

19 - FUEL SYSTEM

CONTENTS

Page

EFI

DESCRIPTION AND OPERATION

HOT WIRE ELECTRONIC FUEL INJECTION	1
EFI COMPONENTS	2

FAULT DIAGNOSIS

ENGINE TUNING	1
MULTI METER CHECKS	1
FUEL INJECTION - CIRCUIT DIAGRAM - 1990 - 1991	2
BASE IDLE SPEED SETTING	4
FUEL PRESSURE CHECK	5
INJECTOR TESTS	6

REPAIR

AIR CLEANER	1
AIR FLOW SENSOR	1
THROTTLE POTENTIOMETER	2
BY-PASS AIR VALVE (STEPPER MOTOR)	2
SPEED TRANSDUCER	3
ELECTRONIC FUEL INJECTION-RELAYS	3
ELECTRONIC CONTROL UNIT (ECU)-14 CUX	4
INERTIA SWITCH	4
FUEL TEMPERATURE THERMISTOR (SENSOR)	5
COOLANT TEMPERATURE THERMISTOR (SENSOR)	5
DEPRESSURISING FUEL SYSTEM	6
FUEL PRESSURE REGULATOR	6
FUEL RAIL-INJECTORS R/H AND L/H	7
PLENUM CHAMBER	8
RAM HOUSING	13
INTAKE MANIFOLD	13
FUEL FILTER	15
FUEL TANK - PRE 1991	16
FUEL PUMP - PRE 1991	17
FUEL PIPES	18
THROTTLE CABLE	19
THROTTLE PEDAL	20
FUEL SYSTEM - 1991 MODEL YEAR	20
FUEL TANK - 1991 ONWARDS	22



19 - FUEL SYSTEM

CONTENTS

	Page
FUEL FILLER FLAP RELEASE BUTTON.....	23
FUEL FILLER FLAP RELEASE ACTUATOR.....	24
 SPECIFICATIONS, TORQUE	
TORQUE VALUES	1
 SERVICE TOOLS	
DIAGNOSTIC EQUIPMENT	1
FUEL SYSTEM	2

19 - FUEL SYSTEM

CONTENTS

Page

Tdi

REPAIR

FUEL INJECTION PUMP	1
KEY TO DIESEL FUEL SYSTEM LAYOUT	4



19 - FUEL SYSTEM

CONTENTS

Page

CRUISE CONTROL

DESCRIPTION AND OPERATION

CRUISE CONTROL SYSTEM-HELLA GR66	1
CRUISE CONTROL - CIRCUIT DIAGRAM - 1990/92	2
CRUISE CONTROL - CIRCUIT DIAGRAM - AUTOMATIC VEHICLES - 1993 MODEL YEAR	3
CRUISE CONTROL - CIRCUIT DIAGRAM - MANUAL VEHICLES - 1993 MODEL YEAR	4

FAULT DIAGNOSIS

ROAD TEST - PRE 1993 MODELS	1
ROAD TEST - 1993 MODELS	2

REPAIR

BRAKE PEDAL SWITCH/VENT VALVE	1
CLUTCH PEDAL SWITCH/VENT VALVE - 1993 MODEL YEAR ADDITION	1
MAIN CONTROL SWITCH	2
DRIVER OPERATED CRUISE CONTROL SWITCHES-STEERING WHEEL	2
SPIRAL CASSETTE	3
ACTUATOR	4
ACTUATOR LINK-SETTING	4
VACUUM PUMP	5
ELECTRONIC CONTROL UNIT (ECU) - CRUISE CONTROL- Pre 1993	5
ELECTRONIC CONTROL UNIT (ECU) - CRUISE CONTROL - 1993	6
NEUTRAL LOCKOUT RELAY - Pre 1993	6
NEUTRAL LOCKOUT RELAY - AUTOMATIC - SPEED TRIP ECU - MANUAL - 1993	6



HOT WIRE ELECTRONIC FUEL INJECTION

Description

The 'Hot Wire' Electronic Fuel Injection system derives its name from the air flow meter which uses one cold wire and one electrically heated wire to measure the volume of air entering the engine.

The function of the system is to supply the exact amount of fuel directly into the inlet manifold according to the prevailing engine operating conditions.

To monitor these conditions, various sensors are fitted to the engine to measure engine parameters. Data from the sensors is received by the Electronic Control Unit (E.C.U.), the E.C.U. will then determine the exact amount of fuel required at any condition.

The E.C.U. having received data from the sensors produces pulses, the length of which will determine the simultaneous open time of each bank of injectors in turn, which will govern the amount of fuel injected.

Electronic control unit-ECU

The Electronic Fuel Injection system is controlled by the E.C.U. which is located under the front right hand seat. The control unit is a microprocessor with integrated circuits and components mounted on printed circuit boards. The E.C.U. is connected to the main harness by a 40 pin plug.

Injectors

The eight fuel injectors are fitted between the pressurized fuel rail and inlet manifold. Each injector comprises a solenoid operated needle valve with a movable plunger rigidly attached to the nozzle valve. When the solenoid is energized the plunger is attracted off its seat and allows pressurized fuel into the intake manifold.

Engine coolant temperature thermistor (sensor)

The coolant thermistor (sensor) is located by the front left hand branch of the intake manifold. The thermistor provides engine coolant information to the E.C.U. The E.C.U. on receiving the signal from the thermistor will lengthen slightly the time that the injectors are open, and reducing this time as the engine reaches normal operating temperature.

Fuel temperature thermistor (sensor)

The fuel temperature thermistor (sensor) is located in the fuel rail forward of the ram housing. The thermistor sends fuel temperature data to the E.C.U, the E.C.U on receiving the data will adjust the injector open time accordingly to produce good hot starting in high ambient temperatures.

Bypass air valve (stepper motor)

The bypass valve is screwed into a housing attached to the rear of the plenum chamber, between the plenum chamber and bulkhead. The bypass valve has two windings which enable the motor to be energised in both directions thus opening or closing the air valve as required by the E.C.U.

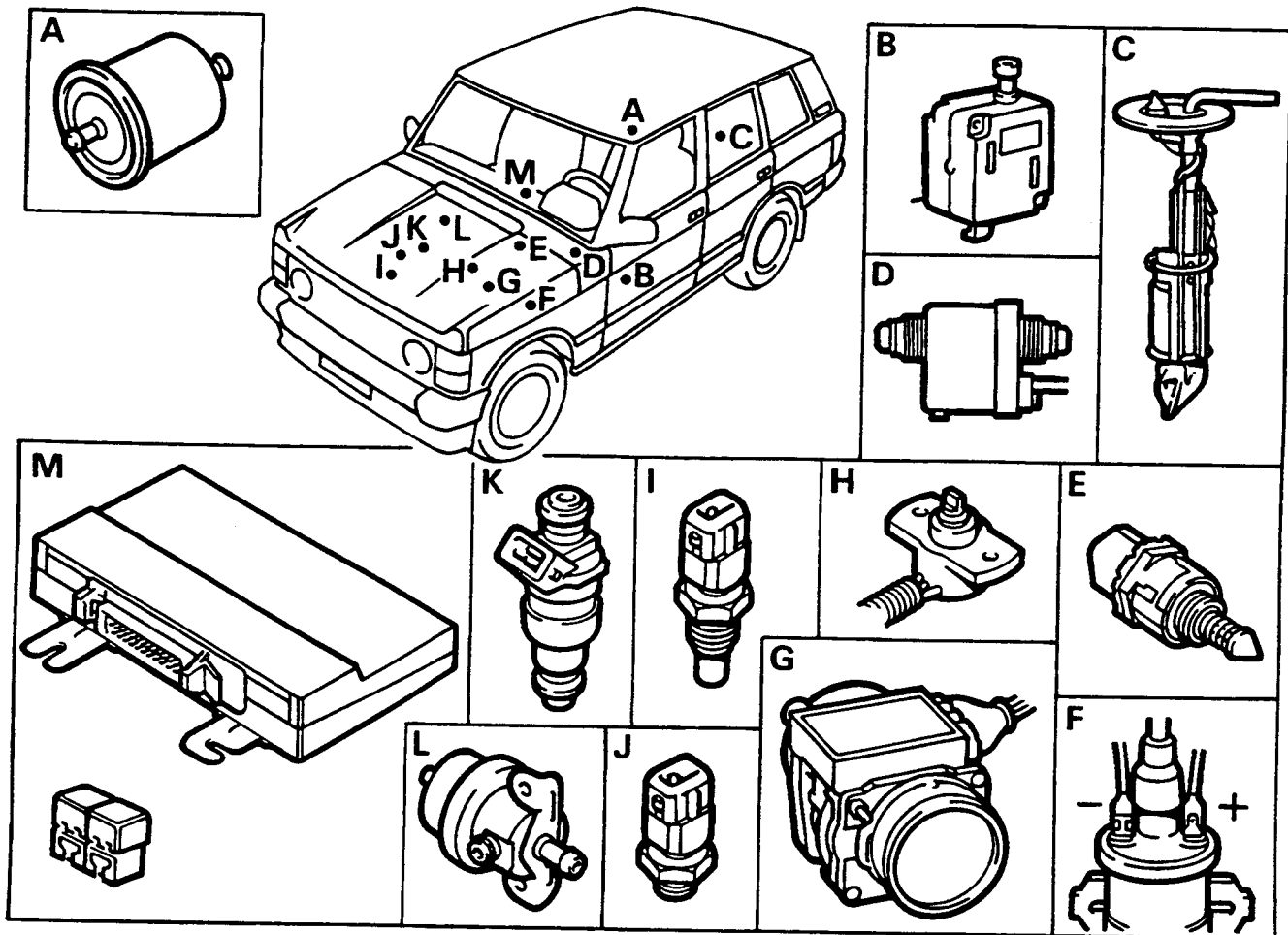
The bypass valve will open and allow extra air into the plenum chamber to maintain engine idle speed when the engine is under increased (Electrical and Mechanical) loads.

The bypass valve will control engine idle speed when the vehicle is stationary.

Lambda sensors (O₂ sensors) - Catalyst vehicles

The two Lambda sensors are located forward of the catalyts mounted in the exhaust downpipes. The sensors monitor the oxygen content of the exhaust gases and provide feedback information of the air/fuel ratio to the E.C.U. Each sensor is heated by an electrical element to improve its response time when the ignition is switched on.

EFI COMPONENTS



RR3831M

- A - Filter - right side rear on chassis.
- B - Inertia switch - under left front seat.
- C - Fuel pump - in fuel tank.
- D - Road speed transducer - left side on chassis.
- E - Bypass air valve - rear of plenum chamber.
- F - Ignition coil - left front inner wing panel.
- G - Air flow sensor - left side of engine.
- H - Throttle potentiometer - secured to throttle housing.
- I - Coolant temperature sensor - front of thermostat housing.
- J - Fuel temperature sensor - injector fuel rail.
- K - Fuel injectors - four to each cylinder head.
- L - Fuel regulator - rear right side of plenum chamber
- M - ECU - under right front seat



Fuel pressure regulator

The fuel pressure regulator is mounted in the fuel rail at the rear of the plenum chamber. The regulator is a mechanical device controlled by plenum chamber vacuum, it ensures that fuel rail pressure is maintained at a constant pressure difference of 2.5 bar above that of the manifold.

When pressure exceeds the regulator setting excess fuel is returned to the fuel tank.

Fuel pump

The electric fuel pump is located in the fuel tank, and is a self priming 'wet' pump, the motor is immersed in the fuel within the tank.

Air flow sensor

The hot-wire air flow sensor is mounted on a bracket attached to the left hand valance, rigidly connected to the air cleaner and by hose to the plenum chamber inlet neck.

The air flow sensor consists of a cast alloy body through which air flows. A proportion of this air flows through a bypass in which two wire elements are situated: one is a sensing wire and the other is a compensating wire. Under the control of an electronic module which is mounted on the air flow sensor body, a small current is passed through the sensing wire to produce a heating effect. The compensating wire is also connected to the module but is not heated, but reacts to the temperature of the air taken in, as engine intake air passes over the wires a cooling effect takes place.

The electronic module monitors the reaction of the wires in proportion to the air stream and provides output signals in proportion to the air mass flow rate which are compatible with the requirements of the E.C.U.

Throttle potentiometer

The throttle potentiometer is mounted on the side of the plenum chamber inlet neck and is directly coupled to the throttle butterfly shaft.

The potentiometer is a resistive device supplied with a voltage from the E.C.U. Movement of the throttle pedal causes the throttle butterfly to open, thus rotating the wiper arm within the potentiometer which in turn varies the resistance in proportion to the valve position. The E.C.U. lengthens the injector open time when it detects a change in output voltage (rising) from the potentiometer.

In addition the E.C.U. will weaken the mixture when it detects the potentiometer output voltage is decreasing under deceleration and will shorten the length of time the injectors are open.

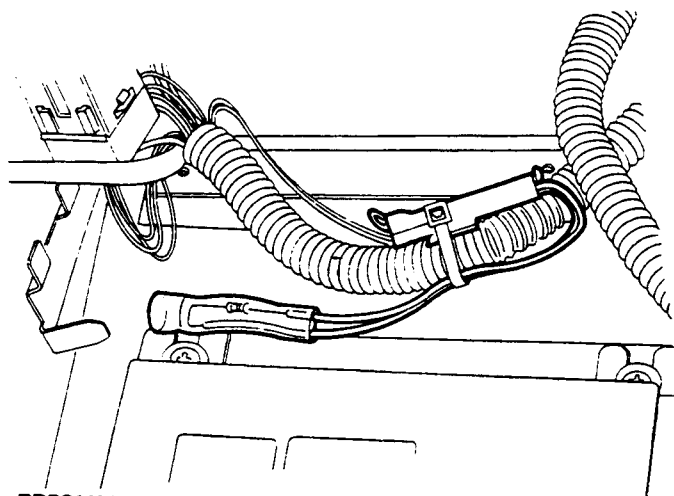
When the throttle is fully open, the E.C.U. will detect the corresponding throttle potentiometer voltage and will apply full load enrichment. This is a fixed percentage and is independent of temperature. Full load enrichment is also achieved by adjusting the length of the injector open time.

When the throttle is closed, overrun fuel cut off or idle speed control may be facilitated dependant on other inputs to the E.C.U.

The potentiometer is 'self adaptive', which means that adjustment is not possible. It also means the potentiometer setting is not lost, for example, when throttle stop wear occurs.



CAUTION: Do not attempt to adjust throttle potentiometer.

Tune select resistor - RR2811M

RR2811M

To suit individual market requirements a tune select resistor is connected across pins 5 and 27 of the ECU. It is located adjacent to the ECU, and strapped to the EFI cable assembly. The value of the resistor is dependent on the market application:

Red wire, 180 ohms, Australia, Rest of world.

Green wire, 470 Ohms, UK and Europe - non catalyst.

Yellow wire 910 Ohms, Saudi non catalyst.

White wire, 3K9 Ohms, European catalyst

Condenser fans

It should be noted that under high coolant temperatures, when the engine is switched off, the condenser fans will be activated and will run for approximately ten minutes.

Road speed transducer

The road speed transducer mounted on a bracket located on the left hand chassis side member adjacent to the rear engine mounting. The transducer provides road speed data to the ECU. The ECU in turn detects vehicle movement from the road speed input and ensures that idle speed control mode is disengaged. Should the speed transducer fail in service the ECU idle speed control would become erratic.

The transducer also provides road speed data to the electric speedometer and, when fitted, air suspension ECU.

Inertia switch

The inertia switch is a mechanically operated switch located under the left hand front seat attached to the seat base rear cross-member.

The switch is normally closed and is in the fuse to fuel pump circuit. In the event of a sudden impact the switch opens, and disconnects the electrical feed to the fuel pump. The switch is reset by pressing down the button.

Relays

The two electronic fuel injection relays are located under the front right hand seat mounted forward of the E.C.U. The main relay is energized via the E.C.U when the ignition is switched on and supplies current to the fuel injection system. The fuel pump relay is energized by the E.C.U. which in turn operates the fuel pump to pressurize the fuel system.



ENGINE TUNING

ECU - EFI circuit diagnosis

Circuit fault diagnosis may be carried out on all EFI vehicles, using a good quality Multi Meter or the hand held tester RTC6834. The tester displays the fault code and guides the operator by visual prompts, through a series of diagnostic checks. Full operational and diagnosis instructions are provided with the unit memory card. *See Service tools, Diagnostic equipment*

Which ever instrument is used to diagnose the problem, the following Preliminary Checks must be carried out first.

Preliminary checks



CAUTION: Catalyst exhaust: If engine is misfiring or fails to start within 12 seconds the cause must be rectified. Failure to do so will result in irreparable damage to the catalysts. After rectification the engine must be run at 1500 rev/min (no load) for 3 minutes to purge any accumulation of fuel in the system.

1. Check that the inertia switch is not tripped.
2. Check fuse C4 in main fuse panel and the fuel pump fuse 10A under the drivers seat.
3. Check for ample fuel in tank.
4. Check air inlet system for possible leaks into the inlet manifold.
5. Check HT cables for correct firing order and routing.
6. Check ignition timing.

Only when the above checks have been carried out, should circuit diagnosis begin.

For diagnosis procedure using a Multi Meter. *See ETM, A1*

The diagnosis procedure using Hand Held Tester is contained in the hand held tester manual. *See Service tools, Diagnostic equipment*

MULTI METER CHECKS

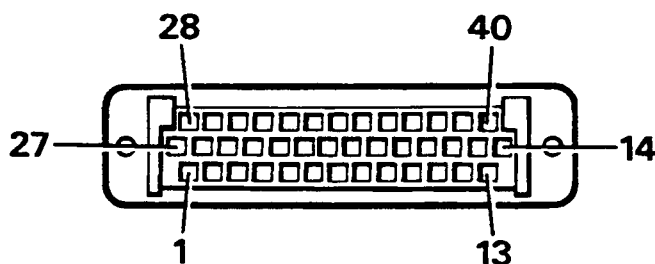
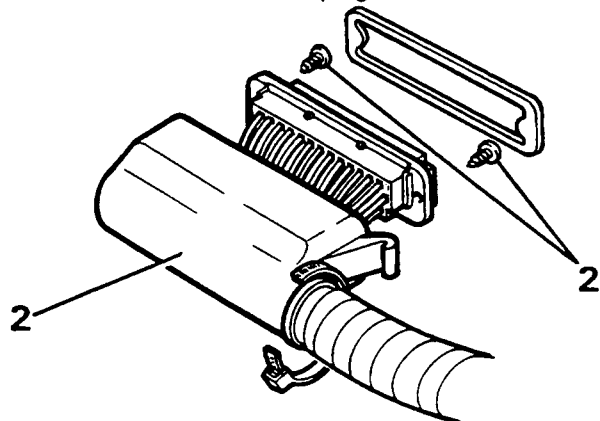
To carry out tests when 40 way multi-plug is connected to the E.C.U., it is necessary to remove the two screws securing the shroud to the plug to enable the multi-meter probes to be inserted into the back of the appropriate pin.



CAUTION: Tests requiring plug to be removed from E.C.U., must have meter probes inserted into back of plug. If probes are inserted into plug sockets, damage will occur to sockets resulting in poor connections when plug is reconnected.

Test

1. Release harness plug from E.C.U. Access is gained by removing front seat base trim of front right hand seat.
2. Remove plug shroud and manoeuvre it along harness to enable meter probes to be inserted into back of plug.
3. Only pin numbers 1, 13, 14, 27, 28 and 40 are moulded onto rear of plug.



RR2800M

View of plug - cover removed.

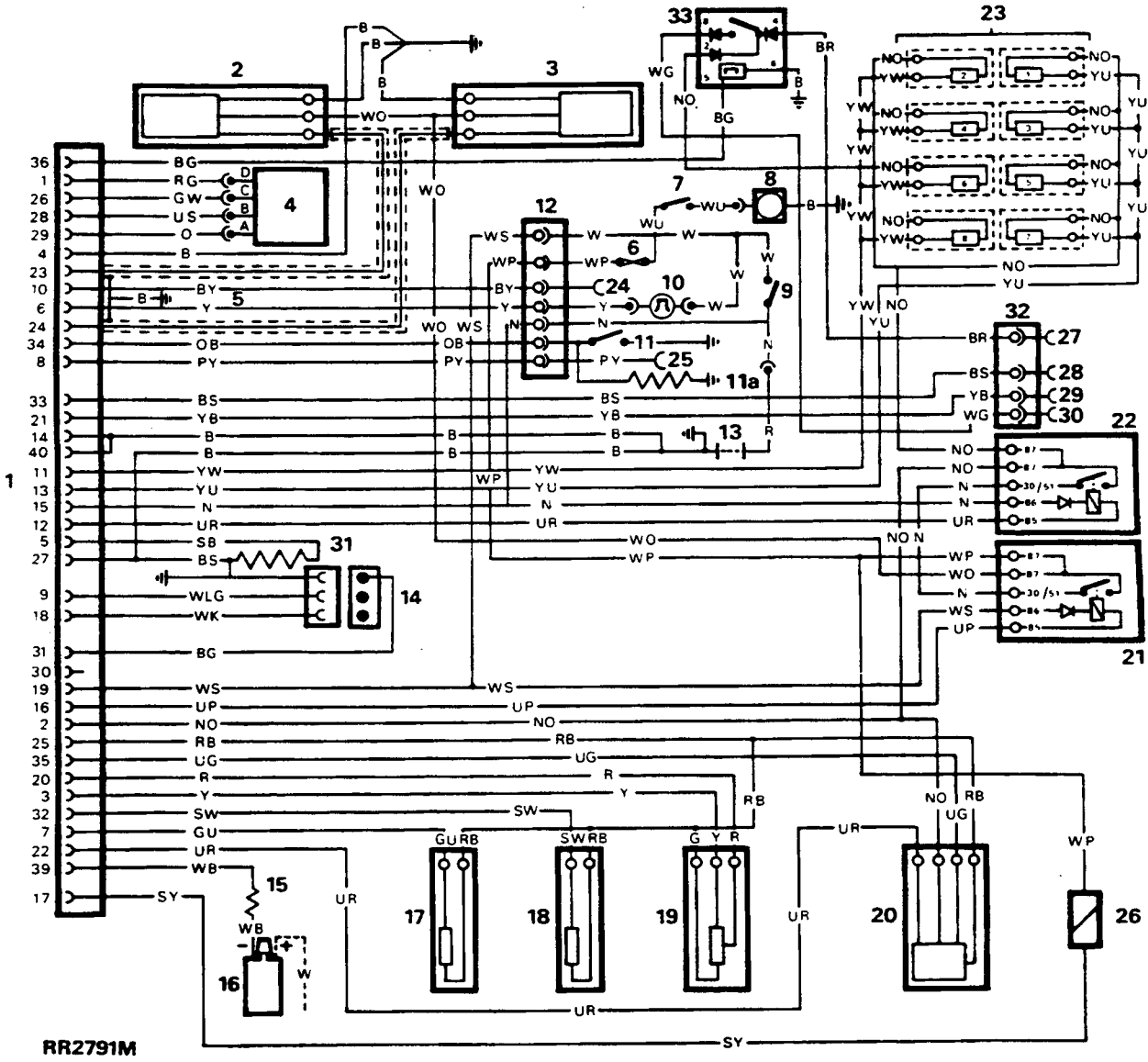
Pins 1 to 13 bottom row.

Pins 14 to 27 centre row.

Pins 28 to 40 top row. For clarity electrical leads omitted.

For diagnostics using a multi meter. *See ETM, A1*

FUEL INJECTION - CIRCUIT DIAGRAM - 1990 - 1991



RR2791M



1. (ECU). 40 Way connector.
 2. Lambda sensor (left bank A).
 3. Lambda sensor (right bank B).
 4. By-pass air valve (stepper motor)(fast idle).
 5. Lambda sensor screened ground.
 6. Fuse C4 - main fuse panel.
 7. Interia switch.
 8. Fuel pump.
 9. Ignition switch.
 10. Speed transducer (road speed input).
 11. Neutral switch (automatic gearbox)(load input).
 12. Main cable connector.
 13. Battery.
 14. Diagnostic plug.
 15. In-line resistor.
 16. Coil/-ve (engine RPM input).
 17. Coolant temperature thermistor (sensor)(input).
 18. Fuel temperature thermistor (sensor)(input).
 19. Throttle potentiometer.
 20. Air flow sensor.
 21. Fuel pump relay.
 22. Main relay.
 23. Injectors-1 to 8.
 24. Pick-up point E.F.I. warning symbol instrument binnacle.
 25. Heated front screen sense.
 26. Purge control valve-if fitted.
 27. 12V from fan relay.
 28. Air conditioning output control.
 29. Air conditioning load input.
 30. Fan relay feed.
 31. Tune resistor.
 32. Heater/air con. cable connector.
 33. Condenser fan timer control.
 34. Resistor (manual gearbox)
- === Denotes screened ground.



NOTE: Lambda sensors fitted to catalyst vehicles only.

BASE IDLE SPEED SETTING



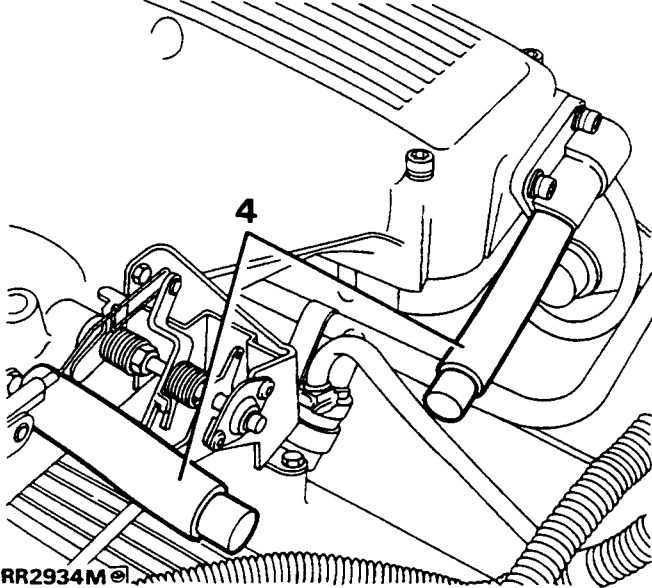
NOTE: Base idle speed is set at factory. It should not require further adjustment unless plenum chamber is changed. The adjustment screw is sealed with a plug to prevent unauthorised alteration. Check ignition timing before attempting following procedure, since this will affect idle speed.

Equipment required

Two blanking hoses. these are manufactured using a new air by-pass valve hose - Part No.ETC7874. Cut two equal pieces 90mm long from hose and seal one end of each, using 13mm diameter bar. Use a suitable clamp to ensure an air tight seal.

Checking procedure

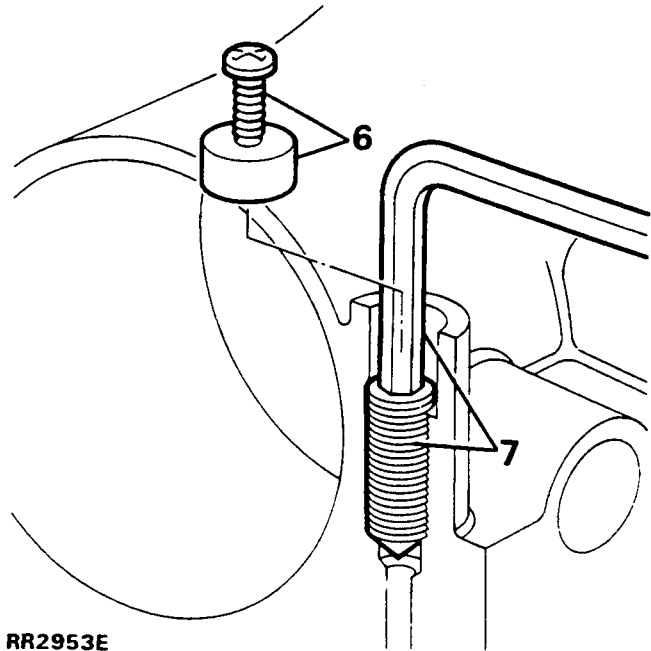
1. Drive vehicle at least two miles until engine and transmission are hot. Switch off engine.
2. Check all electrical loads are OFF, including air conditioning.
3. Remove air by-pass valve hose.
4. Fit blanking hoses to both plenum chamber and air by-pass valve. Ensure hoses are securely fitted to prevent air leaks. Note throttle cable and cruise control actuator have been omitted from illustration.



5. Start engine and check idle speed is within limits. See *ENGINE TUNING DATA, Information, Engine Tuning Data*

Adjusting base idle speed

6. Drill tamper proof plug and insert a self tapping screw to enable plug to be extracted.



RR2953E

7. Start engine, adjust idle screw clockwise to decrease or anti-clockwise to increase idle speed.
8. Stop engine, remove blanking hoses. Reconnect hose to plenum.
9. Fit new tamper proof plug.



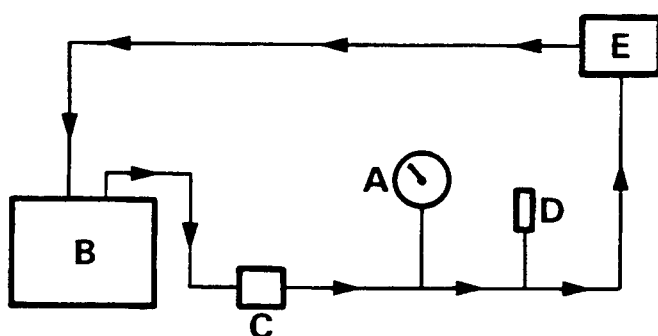
FUEL PRESSURE CHECK

In order to check the fuel pressure it is necessary to first depressurise the fuel system as follows:

WARNING: Under normal operating conditions the fuel injection system is pressurised by a high pressure fuel pump, operating at up to 2.3 to 2.5 bar. When engine is stationary pressure is maintained within system. To prevent pressurised fuel escaping and to avoid personal injury it is necessary to depressurise fuel injection system before any service operations are carried out.

If vehicle has not been run there will be a small amount of residual pressure in fuel line. The depressurising procedure must still be carried out before disconnecting any component within the fuel system.

The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.



RR3834M

- A Pressure gauge 18G1500
- B Fuel tank and pump
- C Fuel filter
- D Fuel injectors x 8
- E Regulator

1. Remove fuel pump relay. *See Repair, Electronic fuel injection-relays*
2. Start and run engine.
3. When sufficient fuel has been used to cause fuel line pressure to drop, injectors will become inoperative, resulting in engine stall. Switch off ignition.
4. Disconnect the battery negative lead.

NOTE: Fuel at low pressure will remain in system. To remove low pressure fuel, place absorbent cloth around fuel pipe at the filter during disconnection.

5. Connect the pressure gauge on the outlet from the filter, located on the chassis under the right rear wheel arch.
 6. Reconnect the battery and turn the ignition to position II while observing the pressure gauge.
- Results**
 Expected reading 2,39-2,672 kgf/cm²
 Pressure drop-max 0.7 kgf/cm² in one minute.
 If pressure is low check that filter is not blocked and pump is operating satisfactorily. Then recheck pressure. If pressure is still low renew regulator. *See Repair, Fuel pressure regulator*

INJECTOR TESTS



NOTE: Before removing any of the injectors, remove and examine the spark plugs, check for consistent colouration of plugs. A leaking injector will result in the appropriate spark plug being 'sooted up'.

The following test may only be carried out using suitable injector test equipment.

Leak Test

Leak test with the injectors closed but pressurise to 2.54 Kg/cm². No injector should leak more than 2 drops of fuel per minute.

Fuel Delivery Test

Fuel delivery test with the injector open and pressurised as above, fuel delivery from each injector should be 160-175 cc per minute using white spirit, or 180-195 cc per minute using petrol at 20°C ± 2°C.



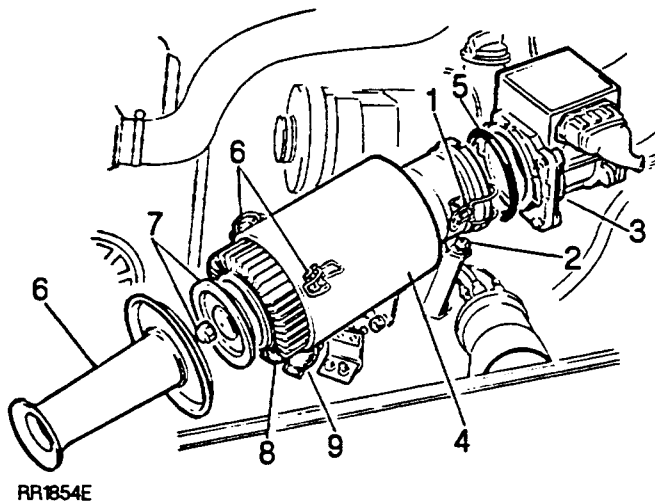
AIR CLEANER

Service repair no - 19.10.30

Remove and refit

Remove

1. Release two clips securing air cleaner to air flow sensor.
2. Release two nuts and bolts securing air cleaner to left hand valance mounting bracket.
3. Detach air flow sensor from air cleaner, and lay carefully to one side.
4. Detach air cleaner from centre mounting bracket and withdraw from engine compartment.
5. Remove large 'O' ring from outlet tube of air cleaner. Fit a new 'O' ring if in poor condition.
6. Unclip three catches and remove inlet tube.
7. Remove nut and end plate securing air cleaner element in position.
8. Withdraw air cleaner element and discard.
9. Inspect dump valve for condition and check it is free of obstructions.



Refit

10. Fit new element and secure in position.
11. Refit inlet tube.
12. Refit air cleaner to mounting bracket and secure.
13. Clip air cleaner to air flow sensor.

AIR FLOW SENSOR

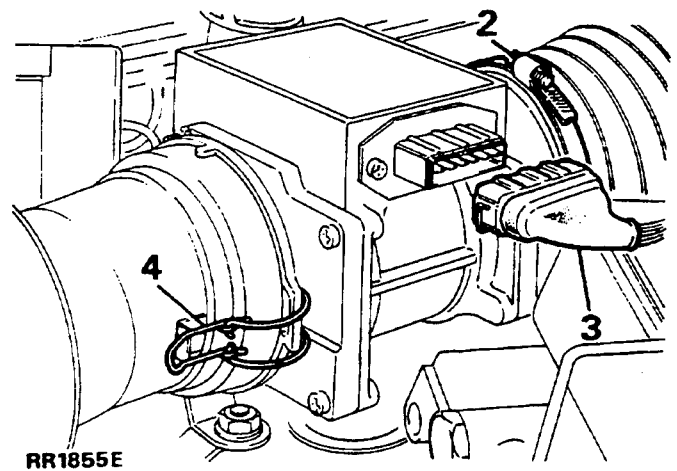
Remove and refit

Remove



NOTE: The air flow sensor is not a serviceable item. In event of failure or damage complete unit must be replaced.

1. Disconnect the battery negative lead.
2. Release intake hose clamp, disconnect from sensor.
3. Disconnect multi-plug.
4. Release two clips securing air cleaner case to air flow sensor. Remove sensor from engine compartment.



Refit

5. Reverse removal procedure. Ensure multi-plug is firmly reconnected, and hose clamp at the rear of sensor is securely tightened, to prevent unmetered air entering engine.

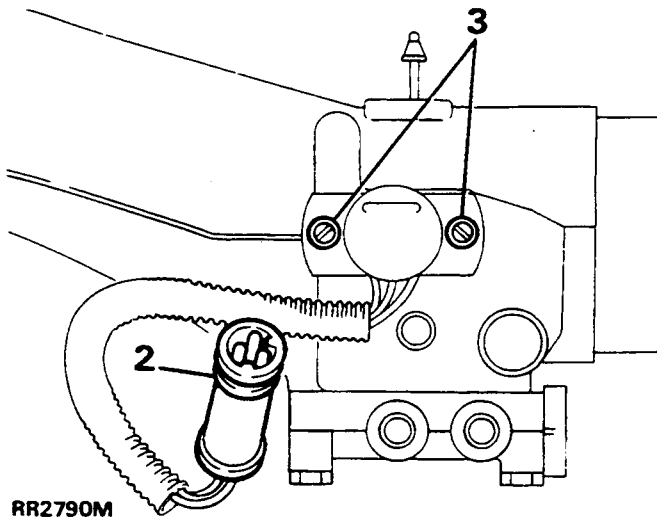
THROTTLE POTENTIOMETER

Service repair no - 19.22.49

Remove and refit

Remove

1. Disconnect the battery negative lead.
2. Disconnect electrical plug.
3. Remove two screws securing switch to plenum chamber and carefully pull switch off throttle shaft.



4. Remove old gasket.

Refit

5. Fit new gasket.
6. Align switch and shaft flats, slide switch on to throttle shaft. Secure switch to plenum chamber.



CAUTION: DO NOT operate throttle mechanism while potentiometer is loosely fitted, damage may be caused to potentiometer wiper track.

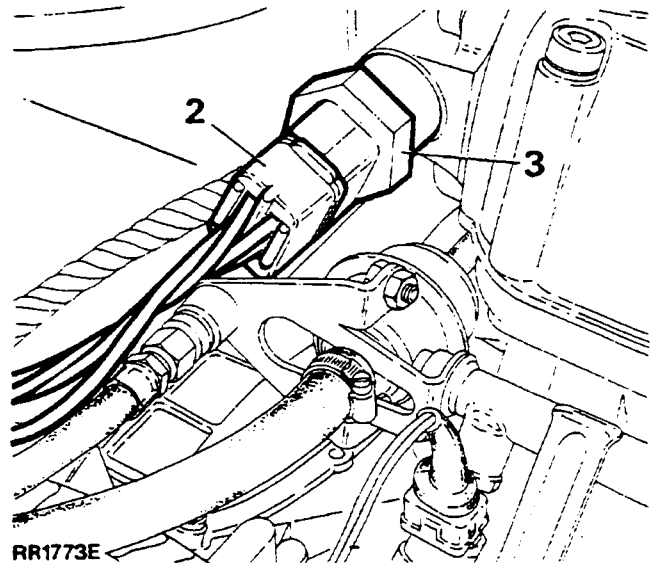
BY-PASS AIR VALVE (STEPPER MOTOR)

Service repair no - 19.22.54

Remove and refit

Remove

1. Disconnect the battery negative lead.
2. Remove multi-plug.
3. Unscrew valve from rear plenum chamber.
4. Remove washer.



Refit

5. Fit **NEW** sealing washer.



NOTE: If same by-pass valve is being refitted clean sealing compounds from threads. Apply Loctite 241 to threads of valve before reassembly.

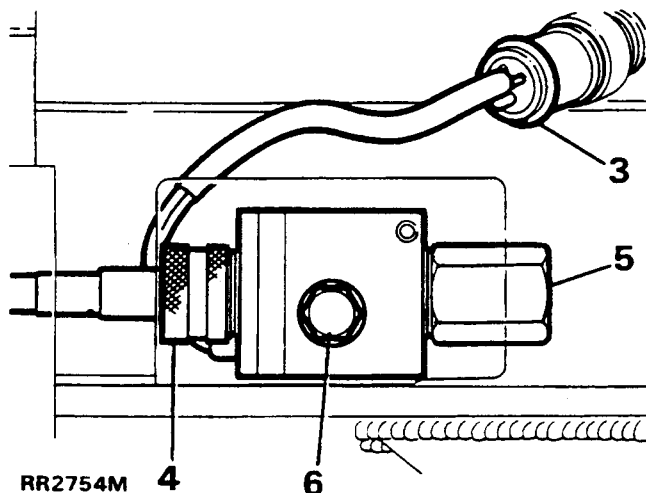
6. Tighten valve to **20 Nm**.
7. Reverse removal procedure.

SPEED TRANSDUCER

Remove and refit

Remove

1. Place vehicle on ramp, apply parking brake.
2. Disconnect the battery negative lead.
3. Raise ramp, disconnect electrical plug.
4. Disconnect speedometer cable.
5. Do not remove blanking cap.
6. Remove single bolt. Remove transducer from mounting bracket.



Refit

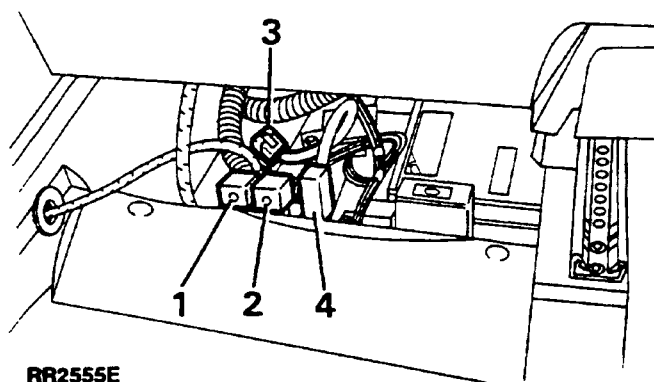
7. Reverse removal procedure.

ELECTRONIC FUEL INJECTION-RELAYS

Service repair no - 19.22.08

Incorporated in fuel injection electrical system are two relays which are located beneath front right hand seat adjacent to cruise control relay and emission maintenance reminder. Access to the relays is gained through the opening at the bottom of the seat when the seat is fully forward.

1. Fuel pump relay - blue base.
2. Main relay - black base.
3. Diagnostic plug.



Remove and refit

Remove

1. Disconnect the battery negative lead.
2. Pull relay(s) from base.

Refit

3. Reverse removal procedure.

ELECTRONIC CONTROL UNIT (ECU)-14 CUX

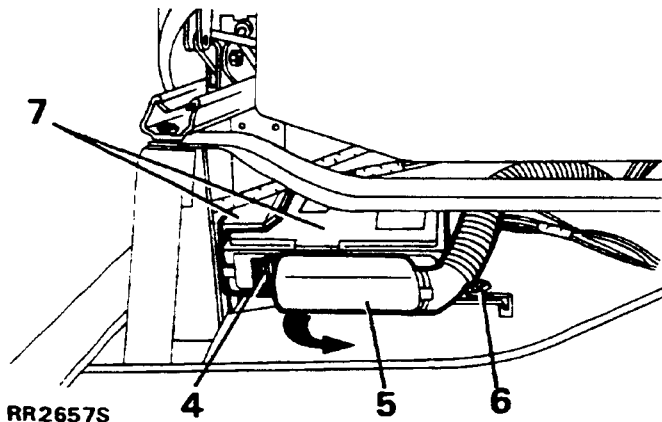
Service repair no - 19.22.34



NOTE: The ECU is not serviceable, in event of unit failure it must be replaced.

Remove and refit**Remove**

1. Remove front and side seat base trim of front right hand seat.
2. Adjust seat to its rearward position, to allow access to ECU.
3. Disconnect the battery negative lead.
4. Release ECU plug retaining clip.
5. Manoeuvre front of plug in the direction of arrow. Detach other end of plug from retaining peg.
6. Release two screws securing ECU.
7. Withdraw ECU from spring clip.

**Refit**

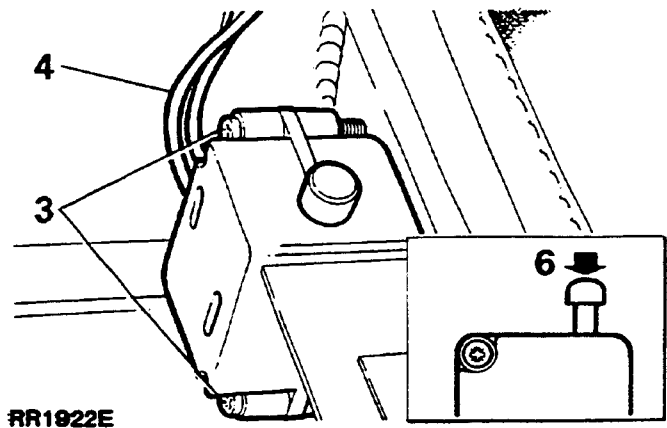
8. Refit ECU securely in spring clip. Fit and tighten 2 securing screws.
9. Reconnect ECU harness plug. Ensure plug is pushed firmly into location and retaining clip secures plug in position.
10. Reverse removal procedure.

INERTIA SWITCH

The inertia switch is located under left hand front seat. Access to switch is gained through opening at rear of seat base.

Remove and refit**Remove**

1. Ensure seat is fully forward.
2. Disconnect the battery negative lead.
3. Remove two screws securing switch to cross member.
4. Withdraw switch and disconnect multi-plug.
5. Remove switch.

**Refit**

6. Reverse removal procedure. Ensure that switch is reset (plunger in lowest position).



FUEL TEMPERATURE THERMISTOR (SENSOR)

Service repair no - 19.22.08

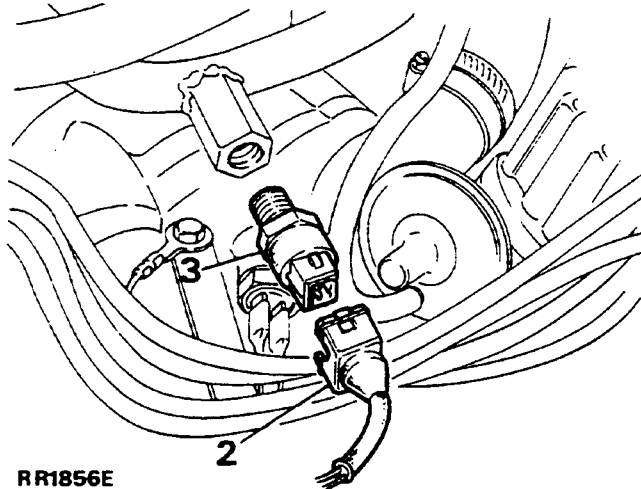
Remove and refit

Remove



NOTE: Fuel leakage will not occur when thermistor is removed from fuel rail, therefore it is not necessary to depressurise the fuel system.

1. Disconnect the battery negative lead.
2. Remove multi - plug from thermistor.
3. Release thermistor from fuel feed rail.



RR1856E

Refit

4. Reverse removal procedure. Ensure thermistor is tightened securely in fuel rail.

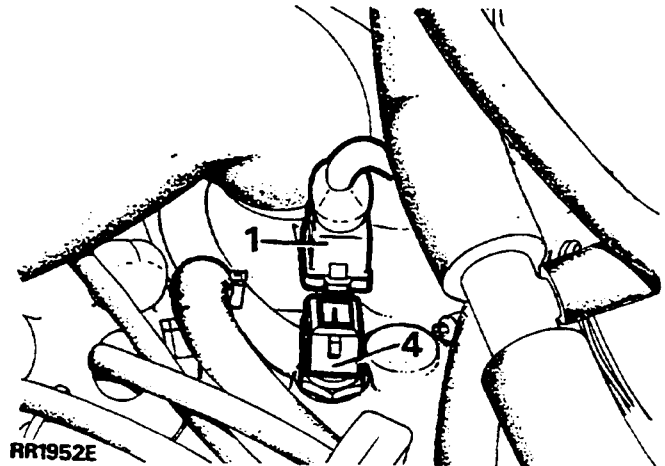
COOLANT TEMPERATURE THERMISTOR (SENSOR)

Service repair no - 19.22.18

Remove and refit

Remove

1. Remove thermistor multi-plug.
2. Release radiator bottom hose, partially drain cooling system.
3. Refit hose and tighten clamp.
4. Remove thermistor from left hand front branch of intake manifold.
5. Remove copper washer.



RR1952E

Refit

6. Fit a NEW copper washer.
7. Fit thermistor and tighten securely.
8. Refill cooling system.
9. Run engine, check for water leaks around thermistor.

DEPRESSURISING FUEL SYSTEM



WARNING: Under normal operating conditions the fuel injection system is pressurised by a high pressure fuel pump, operating at up to 2.3 to 2.5 bar. When engine is stationary pressure is maintained within system. To prevent pressurised fuel escaping and to avoid personal injury it is necessary to depressurise fuel injection system before any service operations are carried out.

If vehicle has not been run there will be a small amount of residual pressure in fuel line. The depressurising procedure must still be carried out before disconnecting any component within the fuel system.

The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

1. Remove fuel pump relay. *See Electronic Fuel Injection-Relays*
2. Start and run engine.
3. When sufficient fuel has been used to cause fuel line pressure to drop, injectors will become inoperative, resulting in engine stall. Switch off ignition.
4. Disconnect the battery negative lead.



NOTE: Fuel at low pressure will remain in system. To remove low pressure fuel, place absorbent cloth around fuel feed hose at fuel rail.

5. Disconnect either:
 - a) Nut and olive at fuel rail
 - OR
 - b) Hose at inlet end of fuel filter.

Refit

6. Refit fuel feed hose.
7. Refit fuel pump relay, reconnect battery.
8. Crank engine (engine will fire in approximately 6 to 8 seconds).

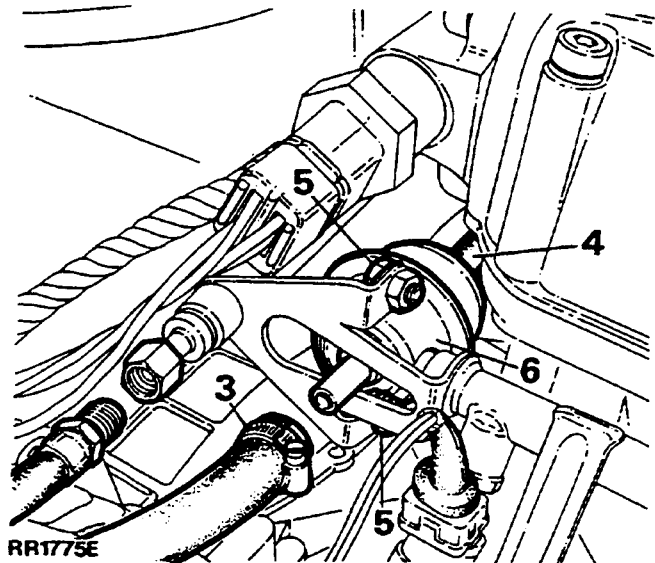
FUEL PRESSURE REGULATOR

Service repair no - 19.45.06

Remove and refit

Remove

1. Depressurise fuel system. *See Depressurising fuel system*
2. Disconnect the battery negative lead.
3. Release hose clamp securing fuel return hose to regulator. Remove the hose.
4. Pull vacuum hose from rear of regulator.
5. Remove two nuts and bolts securing regulator to fuel rail, ease regulator fuel inlet pipe out of fuel rail.
6. Withdraw regulator from engine compartment.



RR1775E



NOTE: Fit a NEW 'O' ring to fuel inlet pipe if original regulator is refitted.

Refit

7. Lightly coat 'O' ring with silicon grease 300 before fitting regulator.
8. Reverse removal procedure.
9. Reconnect battery and pressurise fuel system. Check there are no fuel leaks around regulator connections.



FUEL RAIL-INJECTORS R/H AND L/H

Remove and refit

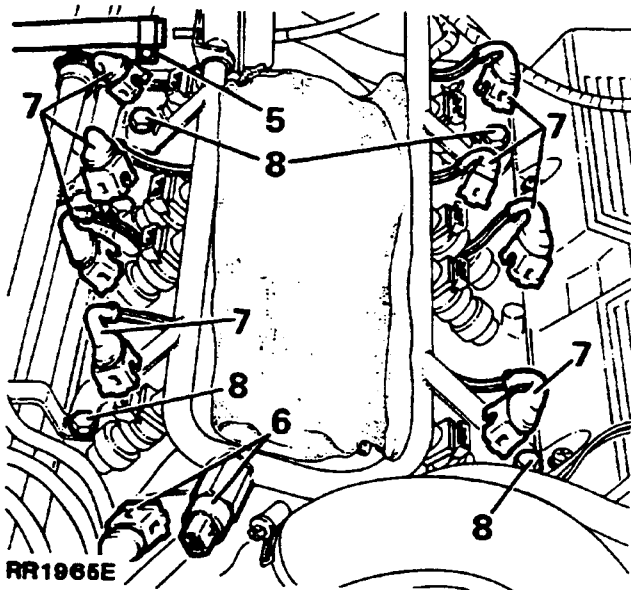
Remove

1. Depressurise fuel system. *See Depressurising fuel system*
2. Disconnect the battery negative lead.
3. Remove plenum chamber. *See Plenum Chamber*
4. Remove ram housing. *See Ram Housing*



NOTE: Place cloth over ram tube openings to prevent ingress of dirt.

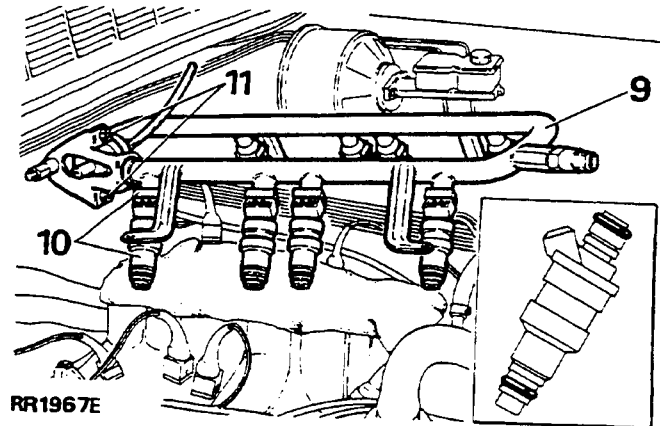
5. Release hose clamp and remove fuel return hose from regulator.
6. Disconnect multi-plug from fuel temperature thermistor (sensor).
7. Disconnect multi-plugs from injectors.
8. Remove five bolts securing fuel rail support brackets to intake manifold. Lay heater pipes to one side.



RR1965E

9. Remove fuel rail and injectors.
10. Remove injector retaining clips, ease injectors from rail.

11. Remove fuel regulator if required.



RR1967E

Refit

12. Fit **NEW** 'O' rings, to injectors. Lightly coat 'O' rings with silicon grease 300. Insert injectors into fuel rail, multi-plug connections facing outwards.
13. Refit retaining clips.



CAUTION: Care must be taken when refitting the fuel rail and injectors to intake manifold to prevent damage to 'O' rings.

14. Fit a **NEW** 'O' ring to pressure regulator lightly coat 'O' ring with silicon grease 300 and secure regulator to the fuel rail.
15. Fit fuel rail and heater pipe assemblies to intake manifold. Secure rail and pipes in position with five bolts.
16. Reverse removal procedure. 2 to 7.
17. Pressurise fuel system and check for fuel leaks around injectors and pressure regulator.

PLENUM CHAMBER

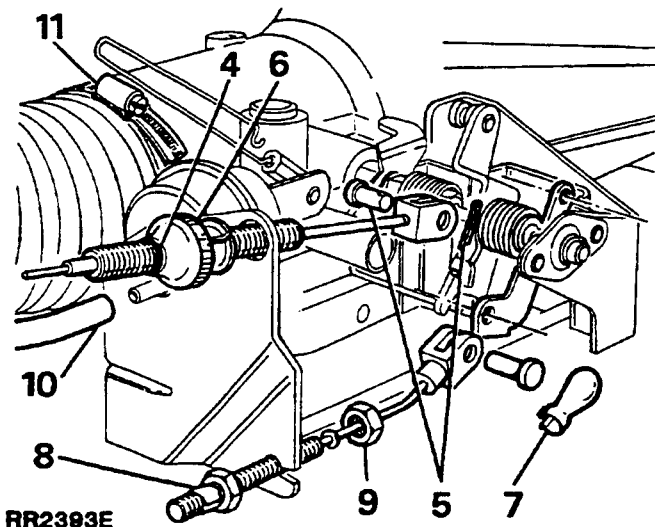
Service repair no - 19.22.46

Includes throttle levers and throttle disc

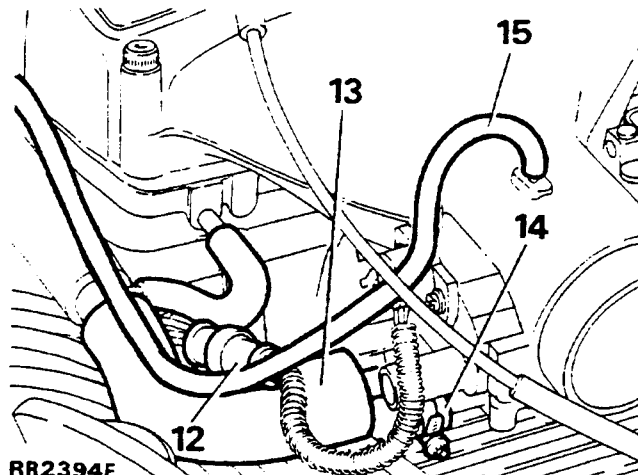
Remove and refit

Remove

1. Disconnect the battery negative lead.
2. Disconnect electrical multi-plug from bypass air valve.
3. Disconnect vacuum hose adjacent to bypass air valve.
4. Mark an identification line on throttle cable outer to assist re-assembly.
5. Remove clevis pin from throttle cable.
6. Pry adjustment thumb wheel from throttle bracket. Lay cable aside.
7. Remove retaining clip and clevis pin from kick down cable (automatic vehicles).
8. Apply adhesive tape behind rear adjustment nut on kick down cable to prevent nut moving.
9. Remove front lock nut. Remove cable and lay aside.
10. Remove cruise control vacuum hose.



11. Remove intake hose from neck of plenum chamber.
12. Disconnect throttle potentiometer multi-plug.
13. Remove PCV breather hose.
14. Disconnect two coolant hoses and plug each hose to prevent excessive loss of coolant. Identify each hose for re-assembly.

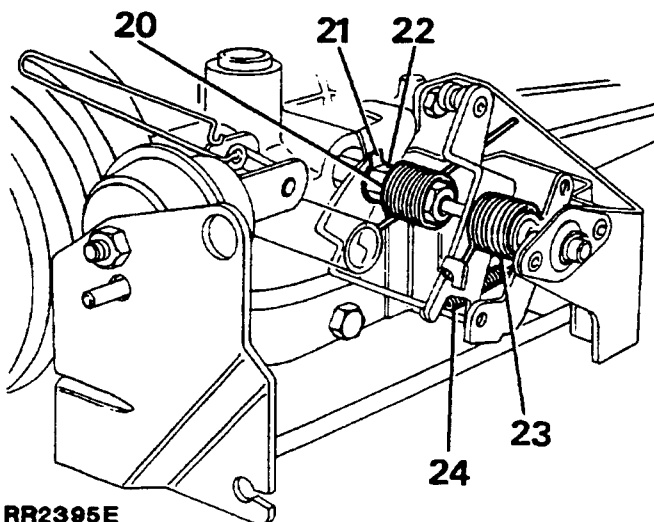


RR2394E

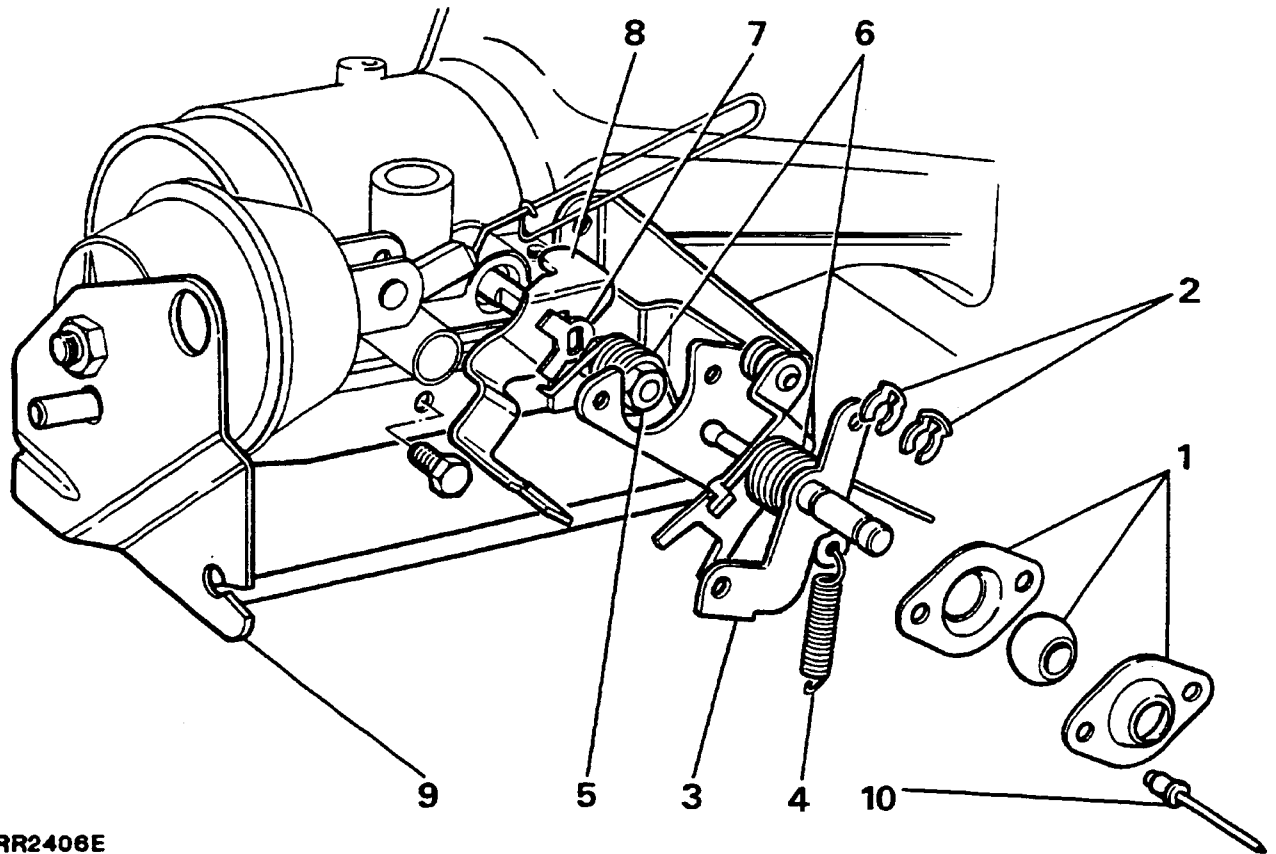
15. Remove distributor vacuum hose.
16. Release two screws and remove potentiometer.
17. Remove six screws securing plenum chamber. Remove plenum chamber.
18. Remove air bypass valve hose.

Throttle lever assembly - remove

19. If fitted - unclip cruise control actuator link. Hold throttle fully open, release link from countershaft assembly. Carefully return lever assembly to close throttle.
20. Release tension on inboard throttle spring.
21. Bend back lock washer tabs.
22. Hold throttle stop lever in closed position, release nut from throttle shaft.
23. Release tension on outboard throttle spring.
24. Remove overtravel spring.



RR2395E

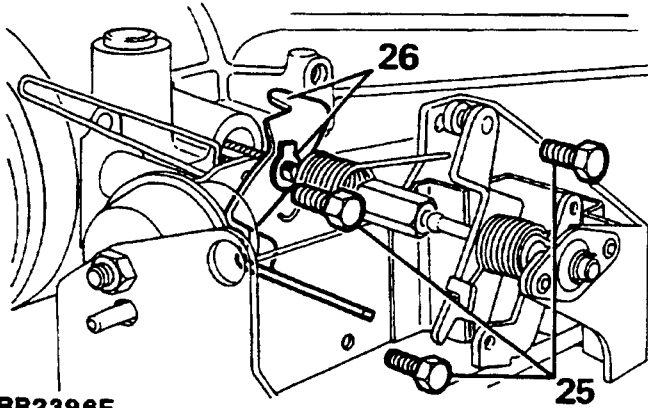


RR2406E

KEY

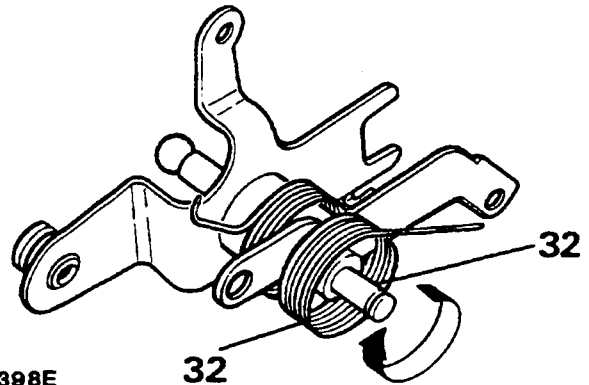
1. Spherical bush/housing
2. Retaining clips (2)
3. Countershaft assembly
4. Overtravel spring
5. Throttle spindle nut
6. Throttle return spring (2)
7. Tab washer
8. Throttle stop lever
9. Throttle bracket assembly
10. Pop rivets (2)

25. Remove three bolts securing throttle bracket to plenum chamber, withdraw bracket assembly.
26. Remove tab washer and throttle stop lever from throttle shaft.



RR2398E

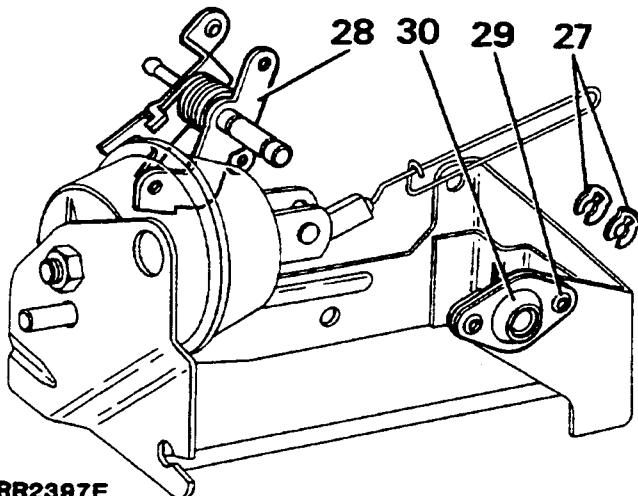
31. Grease new bush with Admax L3 or Energrease LS3. Assemble bush into housing. Assemble to throttle bracket using two 4.7 mm (3/16 in) diameter domed head rivets.
32. Examine bearing surface of countershaft assembly. If worn fit new assembly, otherwise wind throttle return spring off levers.



RR2398E

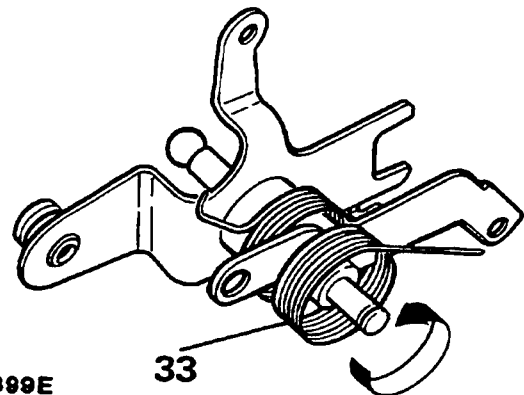
Throttle lever assembly - inspect and overhaul

27. Remove two retaining clips from spherical bush.
28. Remove the countershaft assembly.
29. If spherical bush worn, drill out two securing rivets (4.7 mm, (3/16 in) diameter drill).
30. Split assembly, discard worn bush.



RR2397E

33. Wind new spring onto countershaft assembly, small hooked end of spring is wound on first.



RR2399E

34. Grease shaft with Admax L3 or Energrease LS3, fit countershaft assembly to spherical bearing, secure with two clips.
35. Examine throttle stop lever for wear, fit a new lever if necessary.

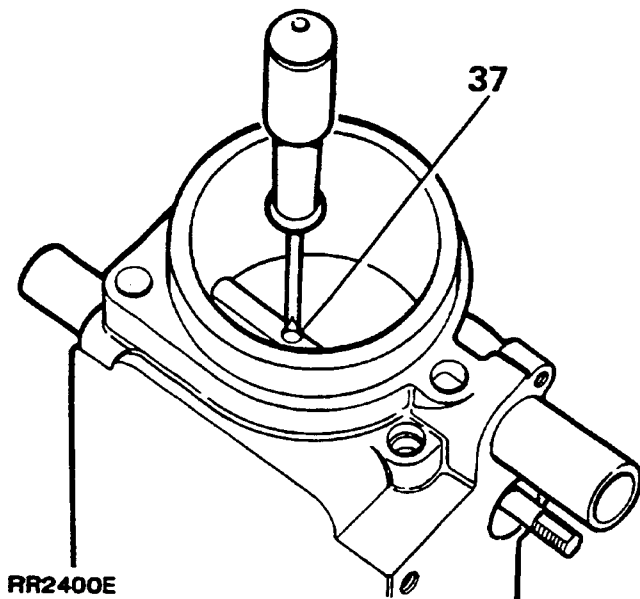


Throttle disc - inspect and overhaul

- 36. Examine throttle shaft for excessive wear between bushes in plenum chamber and shaft. A small amount of clearance is permissible. If excessive wear is evident fit new shaft and bushes as follows.
- 37. Remove two split screws securing throttle disc and withdraw disc.



CAUTION: Take care not to damage shaft.



- 39. Using suitable drift, drive out bushes.

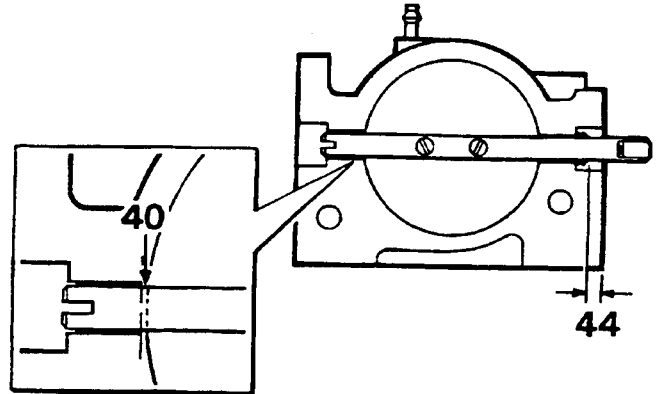


CAUTION: Take care not to damage plenum chamber bores

- 40. Press in new bushes until flush with throttle disc bore.



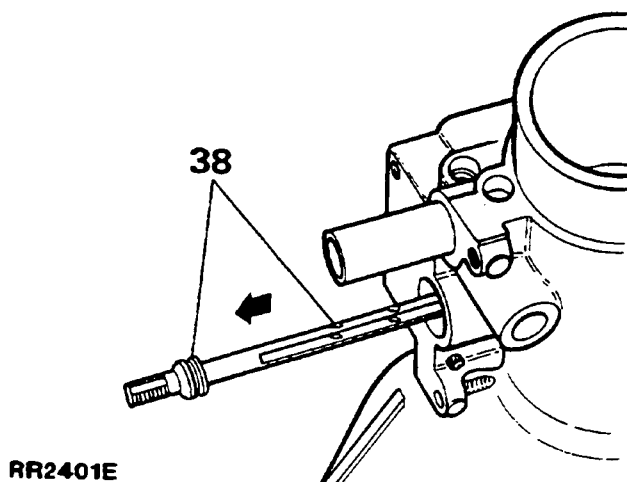
CAUTION: Ensure that bushes do not protrude into bore, as they will interfere with movement of throttle disc.



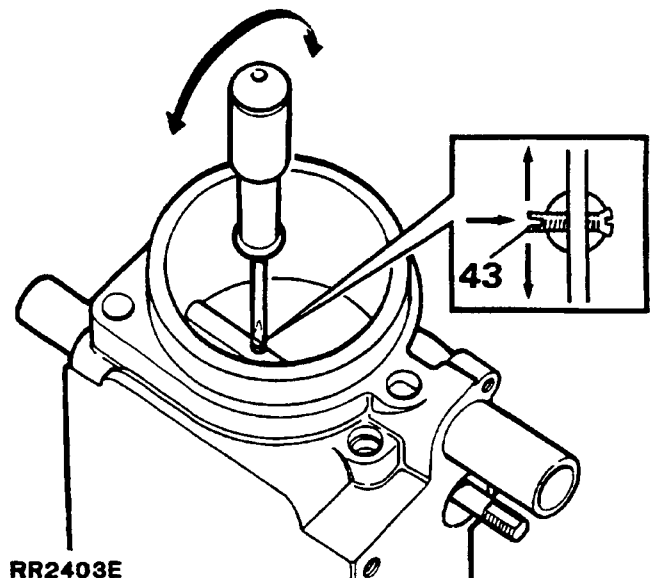
RR2402E

- 41. Fit throttle shaft and disc, secure with two split screws. Do not fully tighten screws.
- 42. Rotate throttle shaft 360° once or twice to centralise disc in bore. Tighten split screws.
- 43. Rotate shaft. Use screw driver to spread split.

- 38. Remove shaft and air seal from plenum chamber.



RR2401E

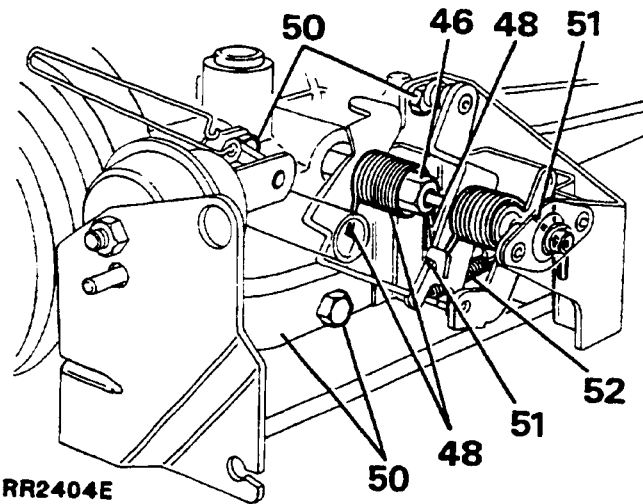


RR2403E

44. Grease new air seal with Admax L3 or Energrease LS3. Push seal down shaft, into counterbore until seal is 6.0 mm (0.236 in) below face of plenum.

Throttle levers and bracket - assemble

45. Fit stop lever to throttle shaft, fit a new tab washer and secure with throttle spindle nut.
46. Holding stop lever on stop, tighten throttle spindle nut securely, bend over tabs to lock nut in position.
47. Fit inboard throttle return spring noting that small hooked end of spring is nearest plenum.
48. Locate hooked end of inboard spring on stop lever. Wind up straight end one full turn and locate in appropriate slot.
49. Fit countershaft to interconnecting nut of throttle valve shaft.
50. Secure throttle bracket assembly to plenum. Secure with three retaining bolts.
51. Ensure hooked end of outboard spring is retained by lever, wind spring up one full turn and locate free end in appropriate slot.
52. Fit overtravel spring. Lightly grease throttle return and overtravel springs with Admax L3 or Energrease LS3.



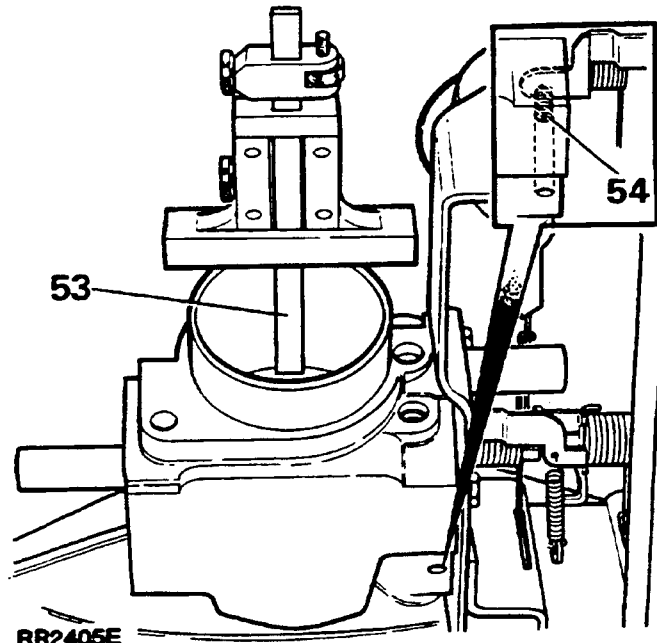
RR2404E



bore.

NOTE: If new throttle levers have been fitted, minimum throttle setting of disc must be checked to ensure it is 90° to

53. Using a depth vernier or depth micrometer, check dimension from mouth of bore to top and bottom of valve disc. Dimension must be within 0.5 mm (0.019 in) total indicator reading across diameter of disc.
54. If dimension is out of limits, adjust small set screw below stop lever.



RR2405E

Refit

55. Reconnect and adjust cruise control actuator link. **See actuator link-setting**
56. Clean joint faces of plenum and ram housing. Apply 'Hylomar' sealant, refit plenum chamber. Tighten to 26 Nm.
57. Reverse removal procedure.



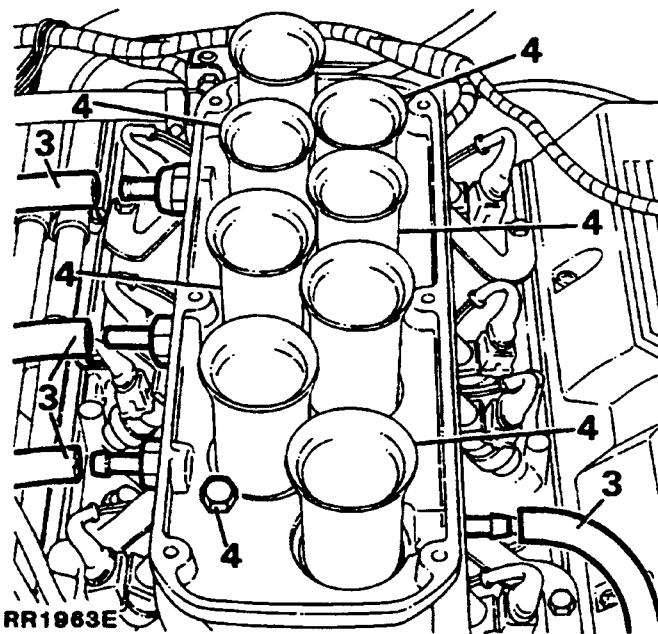
RAM HOUSING

Service repair no - 19.70.04

Remove and refit

Remove

1. Disconnect the battery negative lead.
2. Remove plenum chamber. *See Plenum Chamber*
3. Release hoses from ram housing.
4. Remove six through bolts (with plain washers) securing ram housing to intake manifold.



5. Remove ram housing from intake manifold.
6. Place a protective cover over inlet bores to prevent ingress of dirt.

Refit

7. Clean all mating faces.
8. Apply 'Hylomar' sealant to intake manifold face.
9. Fit ram housing. Tighten bolts, working from two centre bolts, diagonally towards outer four bolts.
10. Tighten to 26 Nm.

INTAKE MANIFOLD

Remove and refit

Remove

1. Depressurise fuel system. *See Depressurising fuel system*
2. Disconnect the battery negative lead.
3. Remove radiator bottom hose, drain coolant until level is below thermostat housing. Refit hose, tighten clamp.
4. Remove plenum chamber. *See Plenum Chamber*
5. Remove ram housing. *See Ram Housing*



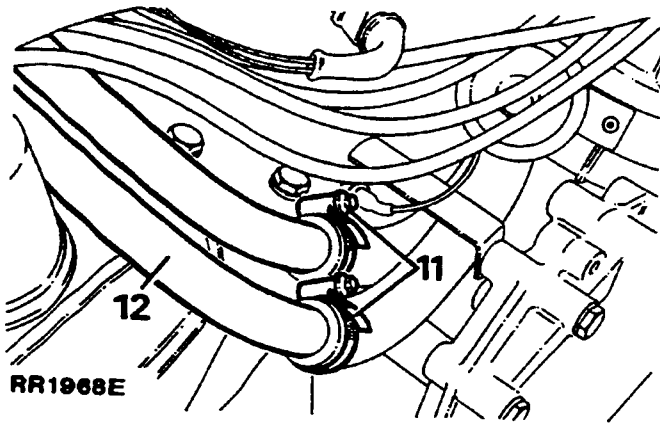
CAUTION: Place a protective cover over intake manifold openings to prevent ingress of dirt.

6. Disconnect electrical multi-plugs to fuel temperature thermistor and injectors.
7. Remove two nuts and bolts securing pressure regulator to fuel rail, ease regulator out of rail. Seal end of fuel rail with plastic plugs to prevent ingress of dirt.



NOTE: Intake manifold can be removed from cylinder block without removing fuel rail and injectors.

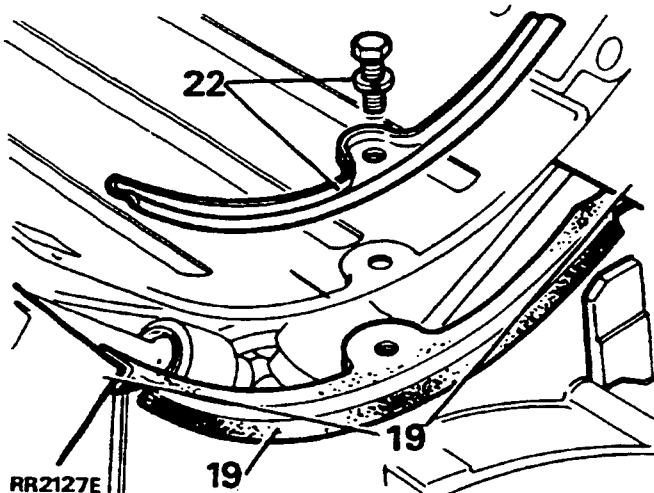
8. Disconnect electrical leads from air-conditioning engine coolant sensor.
9. Disconnect electrical leads to coolant temperature transmitter located at front of intake manifold.
10. Remove injector harnesses from behind fuel rail, lay to one side.
11. Release hose clamps securing two heater hoses behind water pump.
12. Remove two bolts securing rigid heater pipes to intake manifold and ease pipes out of hoses.



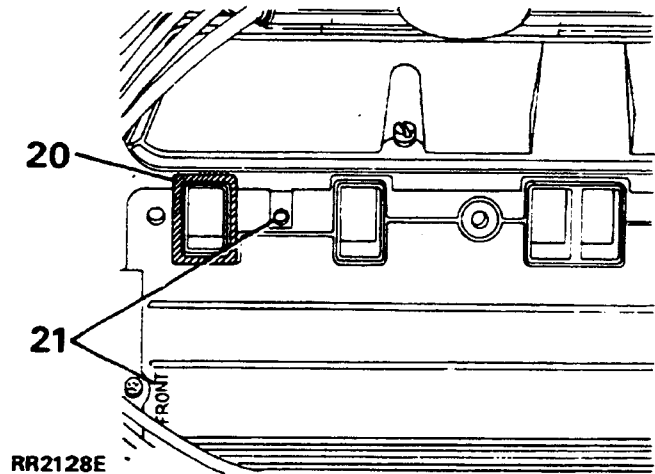
13. Lay heater pipe assembly to one side.
14. Release twelve bolts securing intake manifold.
15. Remove intake manifold.
16. Remove two gasket clamps from cylinder block.
17. Lift off gasket, remove gasket seals.
18. Remove sealing compound from around water passage openings of cylinder heads.

Refit

19. Locate **NEW** seals in position with ends engaged in notches formed between cylinder heads and block.



20. Lightly apply 'Hylomar' sealant around outside of water passage openings on cylinder heads, manifold gasket and intake manifold.



21. Fit manifold gasket with word '**FRONT**' to front and open bolt hole to front right hand side.
22. Fit gasket clamps, **DO NOT** fully tighten bolts.
23. Locate intake manifold onto cylinder heads, clean threads of manifold securing bolts.
24. Fit manifold bolts. Evenly tighten a little at a time, alternating sides, working from centre outwards.
25. Tighten to **38 Nm**.
26. Tighten gasket clamps to **18 Nm**.
27. Reverse removal procedure.
28. Replenish cooling system.
29. Start engine, check for water and fuel leaks.



FUEL FILTER

Service repair no - 19.25.02

Remove and refit

Remove

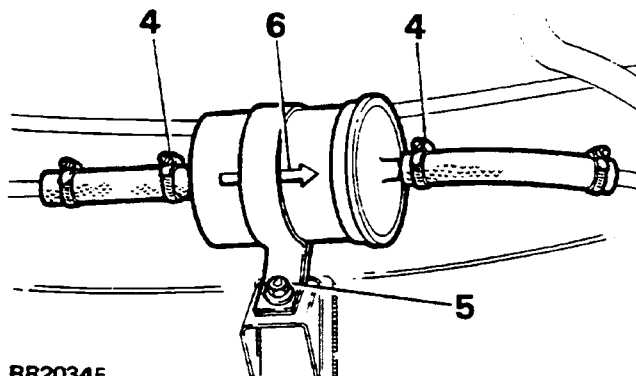


WARNING: Spilling of fuel is unavoidable during this operation. Ensure all necessary precautions are taken to prevent fire and explosion.

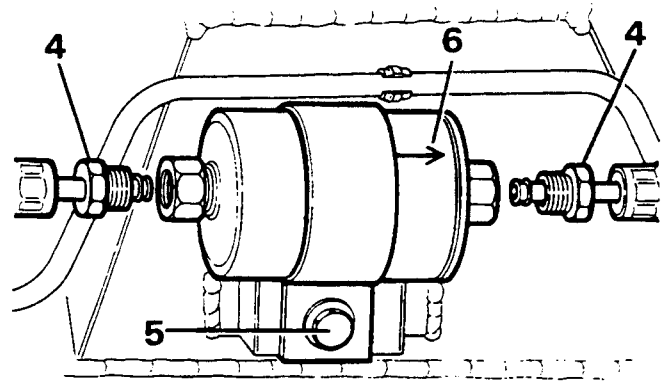


WARNING: Ensure fuel handling precautions given in Section 01 - Introduction are strictly adhered to when carrying out following instructions.

1. Depressurise fuel system. *See Depressurising fuel system*
2. Access to filter is gained through right hand rear wheel arch.
3. Clean area around hose connections to prevent ingress of foreign matter into fuel system. 1991 model year onwards: Clamp inlet and outlet hoses to prevent fuel spillage when disconnecting hoses see RR2966E.
4. Loosen two hose clamps nearest filter to enable hoses to be removed from filter canister. 1991 model: Loosen two fuel line unions and remove hoses. Plug ends of hoses to prevent ingress of dirt.
5. Release securing bolt and bracket and remove filter from chassis side member.



RR2034E



RR2966E

Refit

6. Fit a new filter observing direction of flow arrows stamped on canister.
7. Tighten securing nut and bolt.
8. Fit inlet and outlet hoses. Tighten hose clamps. 1991 models: Tighten to **30 Nm**.
9. Refit fuel pump relay, reconnect battery.
10. Start engine and inspect for fuel leaks around hose connections.

FUEL TANK - PRE 1991

Service repair no - 19.55.08

Remove and refit

Remove



WARNING: Ensure fuel handling precautions given in Section 01 - introduction are strictly adhered to when carrying out following instructions.



CAUTION: Before disconnecting any part of fuel system it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into fuel system.

1. Drive vehicle onto suitable ramp.
2. Depressurise fuel system. *See Depressurising fuel system*
3. Disconnect the battery negative lead.
4. Disconnect electrical leads to fuel tank sender unit. Disconnect fuel pump electrical multiplug.

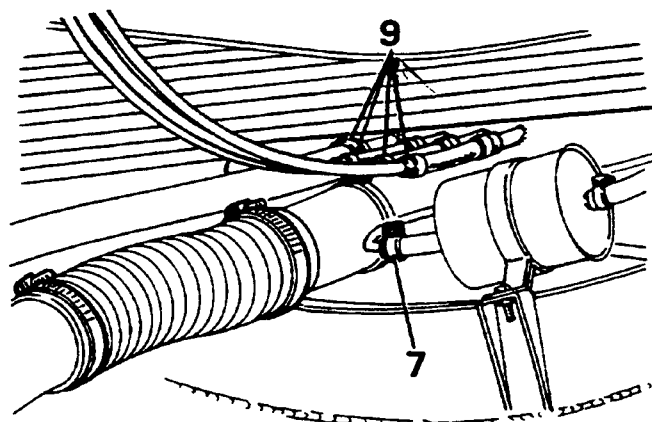


NOTE: Multi-plug is located between underside of body and chassis side member, accessed through left hand rear wheel arch.

5. Raise ramp.
6. Remove drain plug from bottom of fuel tank, drain fuel into a suitable container that can be sealed afterwards.
ENSURE TANK IS DRAINED COMPLETELY. Refit drain plug - refer to WARNING concerning fuel handling at start of procedure.

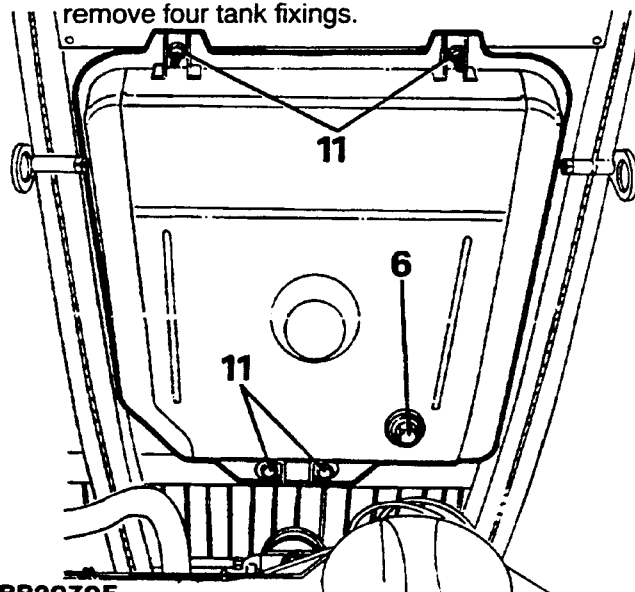
Underneath vehicle

7. Disconnect fuel hose from fuel filter.
8. Disconnect fuel return pipe to fuel tank.
9. Remove breather hose and three evaporative loss hoses from fuel tank. Seal all exposed openings to prevent ingress of foreign matter.



RR2069E

10. Release two hose clamps, securing hose to tank ad filler tube. Manoeuvre hose up filler tube until it is removed from tank filler neck.
11. With a second person supporting fuel tank, remove four tank fixings.



RR2070E

12. Tilt left hand side of tank downwards, manoeuvre tank out of chassis frame. Ensure that fuel feed pipe to filter is not damaged when lowering tank.
13. Place tank in a safe area.
A fuel vapour warning label must be attached to vehicle.
14. If necessary remove fuel pump from tank. *See Fuel Pump - pre 1991*

Refit

15. Refit fuel tank to chassis. Position fuel feed pipe grommets between fuel tank and chassis.
16. Ensure all sealing ring, fuel line and hose connections are secure.
17. Run engine and re-check all connections for fuel leaks. Reverse removal procedure.



FUEL PUMP - PRE 1991

Service repair no - 19.45.03

Remove and refit

Remove



WARNING: Ensure fuel handling precautions given in Section 01 - Introduction are strictly adhered to when carrying out following instructions.

1. Drive vehicle onto a suitable ramp.
2. Depressurise fuel system. *See Depressurise fuel system*
3. Disconnect the battery negative lead.
4. Remove fuel tank. *See Fuel Tank - pre 1991*
5. Disconnect fuel supply hose from pump.
6. Remove sealant from top of pump flange.
7. Remove five screws, remove tank.

Refit

8. Clean area around pump opening in fuel tank.
9. Fit **NEW** pump seal.
10. Secure pump to tank, tighten screws securely.
11. Liberally coat heads of screws and flange of fuel pump with Sikaflex 221 flexible adhesive sealant.
12. Reverse removal procedure. Ensuring that sealing ring, fuel line and hose connections are secure.
13. Run engine and re-check all connections for fuel leaks.

FUEL PIPES

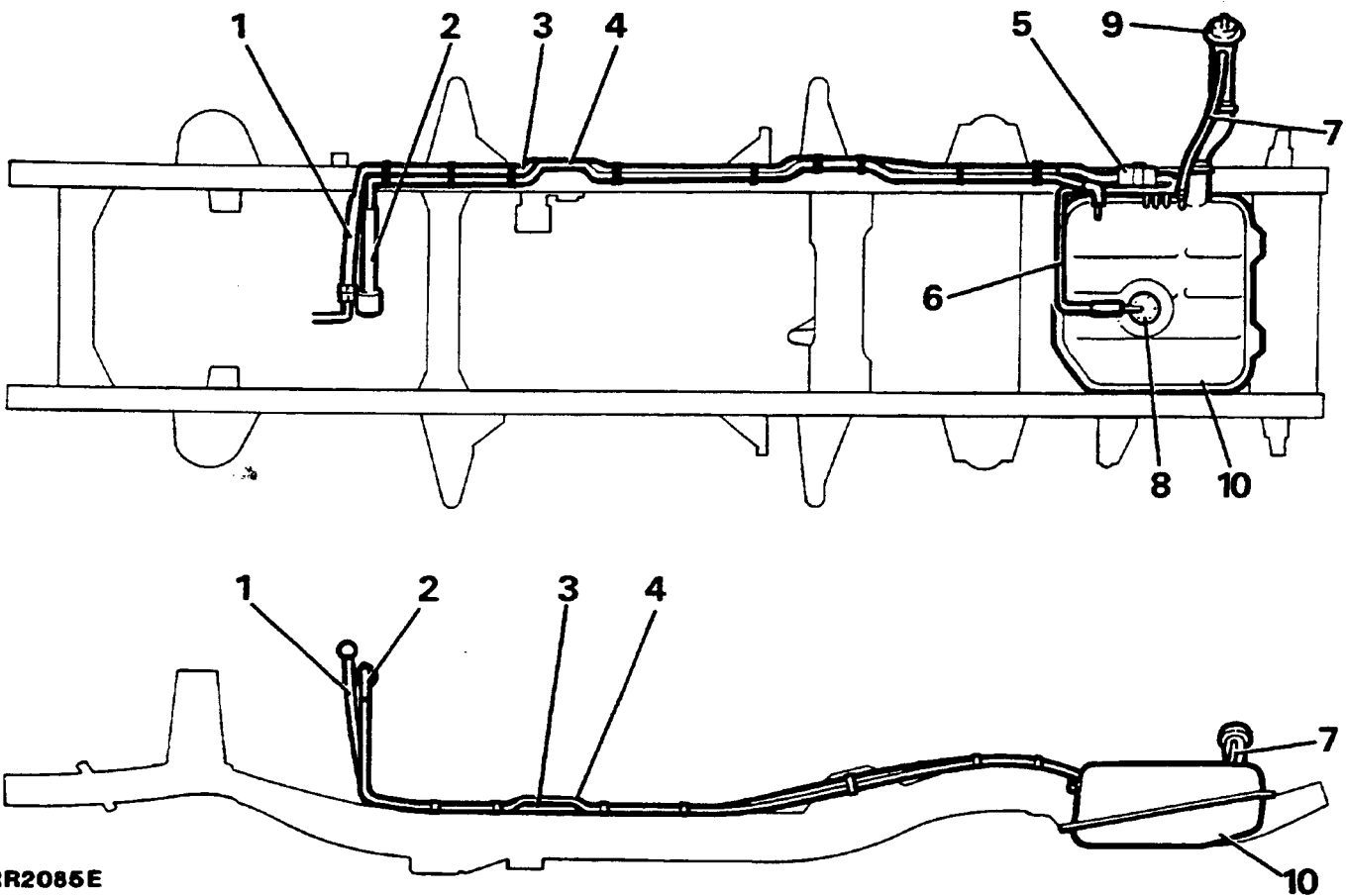
Service repair no - 19.40.92



WARNING: Depressurise fuel system. See *Depressurise fuel system before disconnecting any fuel pipes ensure that all necessary precautions are taken against fuel spillage*



WARNING: Ensure fuel handling precautions given in Section 01 - introduction are strictly adhered to when carrying out following instructions.



RR2085E

KEY

- | | |
|-----------------------------------|------------------------------------|
| 1. Fuel feed hose to fuel rail. | 6. Rigid fuel feed pipe to filter. |
| 2. Fuel return hose to fuel tank. | 7. Breather hose. |
| 3. Rigid fuel feed pipe. | 8. In-tank fuel pump. |
| 4. Rigid fuel return pipe. | 9. Fuel filler neck. |
| 5. Fuel filter. | 10. Fuel tank. |



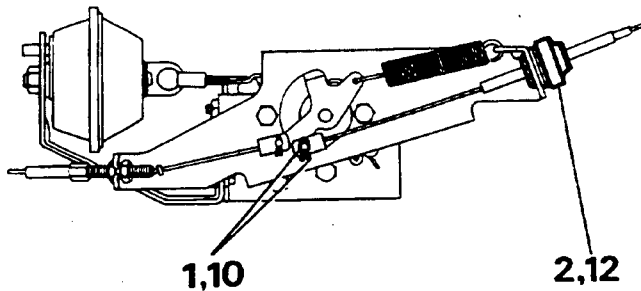
THROTTLE CABLE

Service repair no - 19.20.06

Remove and refit

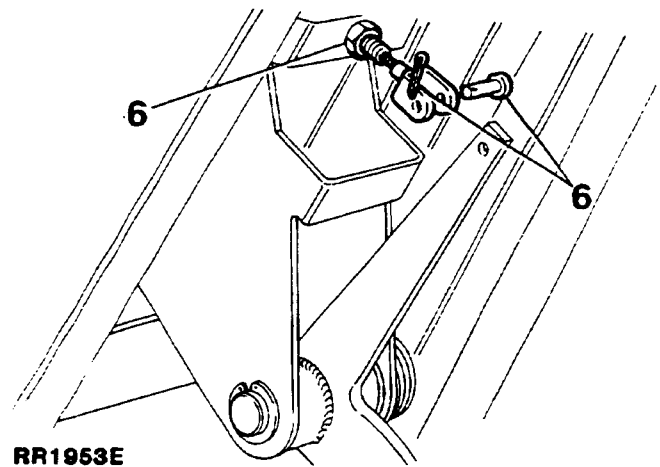
Remove

1. Remove clevis pin securing cable to lever.
2. Carefully pry throttle cable adjustment nut out of mounting bracket.
3. Remove cable from mounting bracket.



RR1954E

4. Release outer cable from retaining clips in engine compartment.
5. Remove lower fascia panel. *See CHASSIS AND BODY, Repair, lower dash panel*
6. Disconnect cable from throttle pedal and release cable locknut.
7. Feed cable through bulkhead grommet into engine compartment.




RR1953E

Refit

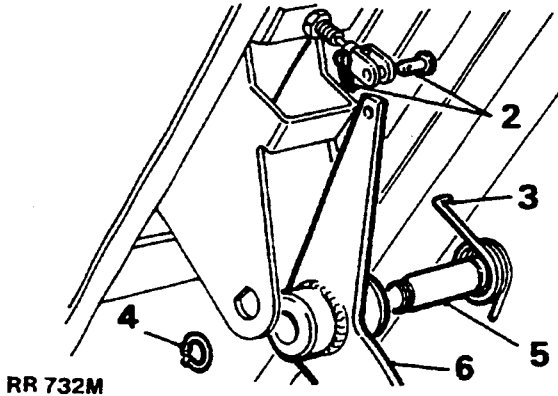
8. Feed new cable from engine compartment through bulkhead grommet.
9. Connect cable to throttle pedal.
10. Connect cable to throttle linkage, using a new split pin.
11. Clip outer cable adjustment nut into mounting bracket.
12. Adjust outer cable to give 1.57 mm (0.062 in) free play in inner cable. Check throttle operation.

THROTTLE PEDAL**Remove and refit****Remove**

1. Remove lower fascia panel. *See CHASSIS AND BODY, Repair, Lower dash panel*
2. Remove clevis pin securing throttle cable to throttle pedal.
3. Release tension from pedal return spring.
4. Remove circlip from pedal pivot pin.
5. Withdraw pivot pin.

 **NOTE:** It may be necessary to lower steering column to gain access to pivot pin circlip.

6. Remove throttle pedal.

**Refit**


7. Lightly grease pivot and clevis pins.
8. Fit clevis pin using a **NEW** split pin.
9. Reverse removal procedure.

FUEL SYSTEM - 1991 MODEL YEAR**Remove and refit**

A revised fuel system was fitted to 1991 model year vehicles. The major change was fitting of a plastic fuel tank with improved breather system. The remote expansion tank is deleted.

A further improvement is use of a combined fuel pump and sender unit. A panel in freight floor of vehicle permits access to fuel pump/sender unit

Fuel pump/sender unit - 1991 Onwards

 **WARNING:** Ensure that fuel handling precautions given in Section 01 - Introduction are strictly adhered to when carrying out following instructions.

 **CAUTION:** Before disconnecting any part of fuel system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into fuel system.

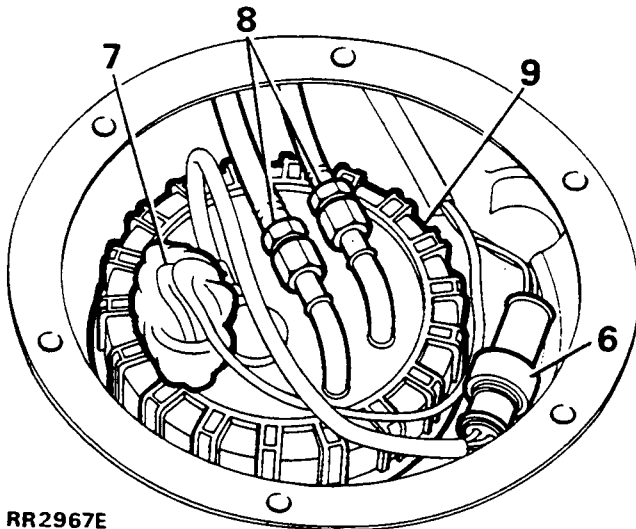
Service Tools:

LRS-19-001 spanner - pump retaining ring

LRS-19-002 'Speedfit' disconnecter

Remove

1. Depressurise fuel system. *See Depressurise fuel system*
2. Disconnect the battery negative lead.
3. Syphon at least 9 litres (2 gallons) of fuel from fuel tank into a suitable container that can be sealed.
4. Remove carpet from loadspace floor and tailgate.
5. Fold back loadspace sound insulation to reveal access panel.

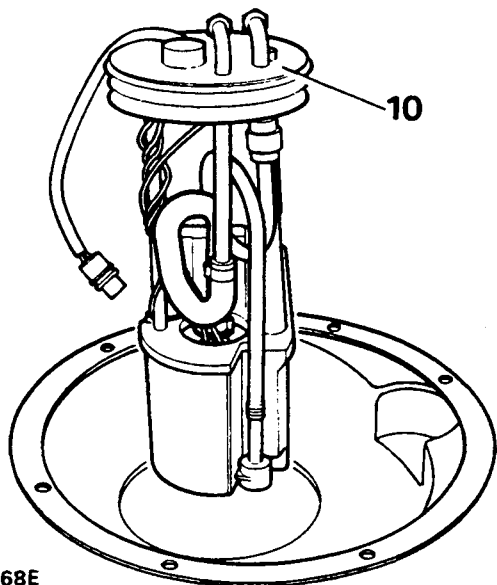


RR2967E

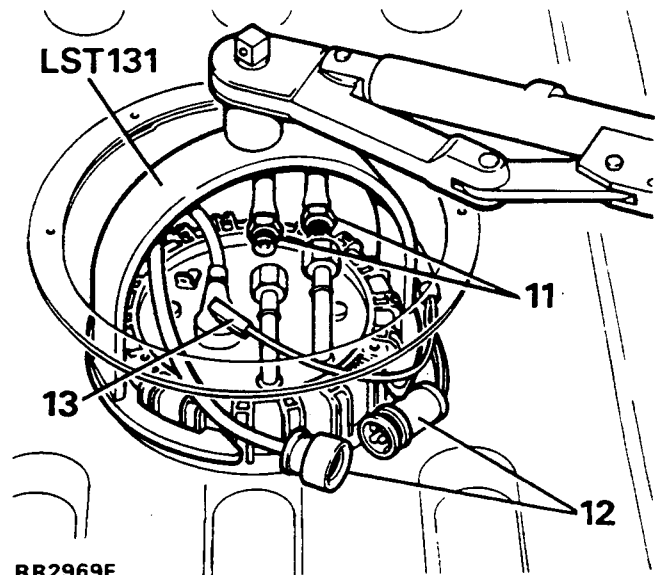
6. Remove access panel from floor.
7. Disconnect electrical connections at multi-plug.
8. Remove insulation sealant from around ground lead, disconnect ground lead.
9. Disconnect two fuel line unions from fuel pump.
10. Using service tool no. LRS-19-001, remove pump unit retaining ring. Withdraw unit from fuel tank.



WARNING: A quantity of fuel will be retained in body of unit, care must be taken to prevent fuel spillage when unit is removed.



RR2968E



RR2969E

Refit

11. Insert fuel pump into tank. Fit retaining ring. Tighten to **48 Nm**.
12. Connect fuel lines to pump.
13. Connect electrical leads at multi-plug.
14. Connect ground lead to pump and insulate with suitable sealant.
15. After assembly, check all fuel pipes, sealing rings and hose connections are secure.
16. Run engine to check for fuel leaks.
17. Inspect access panel seal, fit a new seal if necessary.
18. Fit access panel and tighten screws.
19. Reverse removal procedure. 4 - 5. Fit insulation and carpet.

FUEL TANK - 1991 ONWARDS

Remove and refit



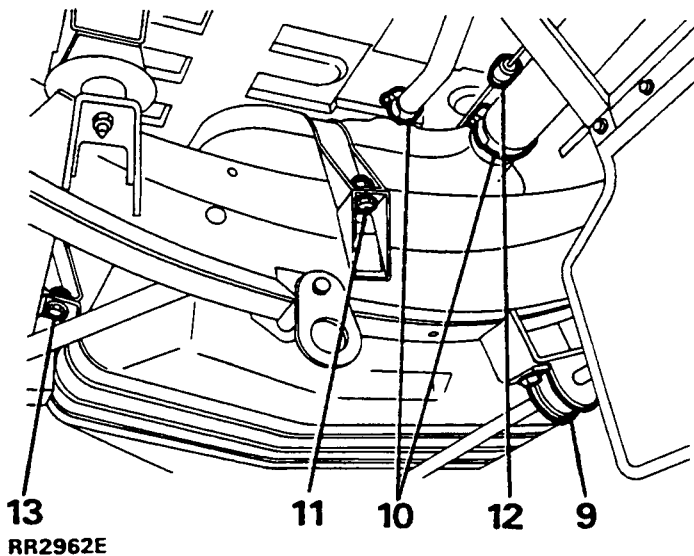
WARNING: Ensure that fuel handling precautions given in Section 01 - introduction are strictly adhered to when carrying out following instructions.



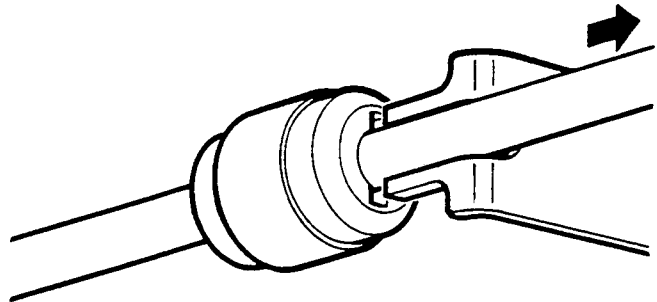
CAUTION: Before disconnecting any part of fuel system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into fuel system.

Remove

1. Depressurise fuel system. Disconnect the battery negative lead.
2. Syphon fuel tank into a suitable container that can be sealed afterwards.
ENSURE TANK IS DRAINED COMPLETELY. (refer to Warning concerning fuel vapor and spillage at start of procedure).
3. Remove carpet loadspace floor and tailgate.
4. Fold back sound insulation to reveal access panel.
5. Remove access panel.
6. Disconnect electrical multi-plug.
7. Remove insulation sealant from around ground lead, and disconnect.
8. Disconnect two fuel line unions from fuel pump.
9. Working underneath vehicle, remove rear anti-roll bar straps, and allow bar to swing down clear of tank.

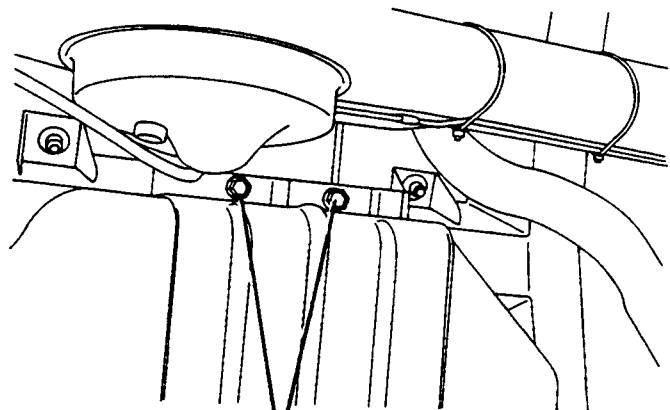


10. Remove tank filler and vent hoses at fuel tank.
11. Remove nut and bolt securing right hand side fuel tank strap.
12. Disconnect evaporative control pipe at green end of 'speedfit' connector.



ST2877M

NOTE: To disconnect 'speedfit' connector, insert forked end of LRS-19-002 into slots of connector see illustration. Press down on collet and simultaneously pull pipe from connector.



RR2963E



13. Remove back two bolts and nut plates securing fuel tank cradle.
14. Remove front nuts, bolts and washers. Remove fuel tank cradle.
15. With assistance, tilt right hand side of tank upwards and manoeuvre tank through chassis to remove.

Refit

16. Reverse removal procedure. Ensuring sealing ring, fuel pipe and hose connections are secure.
17. Run engine, check all connections for fuel leaks. Reverse removal procedure.

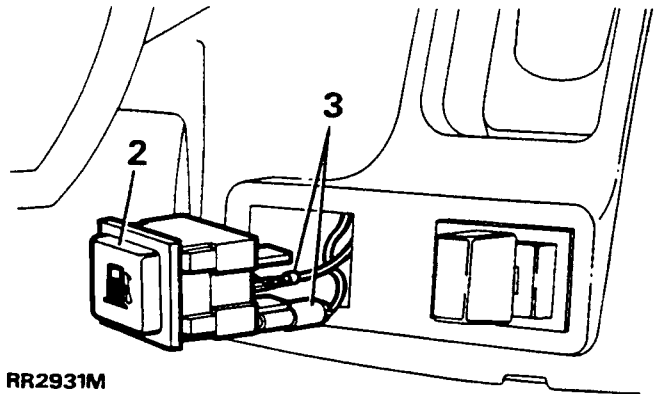
FUEL FILLER FLAP RELEASE BUTTON

Remove and refit

The fuel filler flap is no longer part of central locking system on 1991 model year vehicles. The filler flap is permanently locked. To release flap press button on steering column shroud. On closing, filler flap will be locked automatically. Note that release button will only work with ignition switched to OFF or AUX.

Remove

1. Disconnect the battery negative lead.
2. Carefully pry release button from steering column shroud.



RR2931M

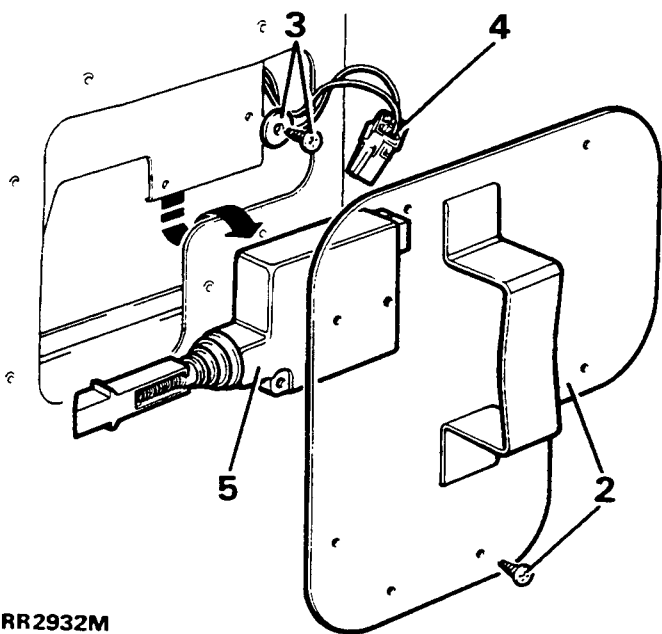
3. Remove release button from shroud and disconnect two wiring connectors. Ensure wires protrude through shroud for reassembly.

Refit

4. Reverse removal procedure.

FUEL FILLER FLAP RELEASE ACTUATOR**Remove and refit****Remove**

1. Release fuel filler flap. Disconnect the battery negative lead.
2. Remove eight screws, withdraw closure panel, in right hand side of load space.
3. Release two screws and manoeuvre actuator clear of its mounting.
4. Disconnect wiring plug.
5. Withdraw actuator.



RR2932M

Refit

6. Reverse removal procedure.



TORQUE VALUES



NOTE: Torque wrenches should be regularly checked for accuracy to ensure that all fixings are tightened to the correct torque.

	Nm
Air-Bypass valve (stepper motor)	20
All flexible hose securing clamps.....	1,3
Fuel feed pipe - hose to fuel rail	22
1991 Model Year	
Fuel filter	31
EVAPORATIVE LOSS CONTROL SYSTEM	
All flexible hose securing clamps.....	1,7

	Nm
METRIC	
M5	6
M6	9
M8	25
M10	45
M12	90
M14	105
M16	180
UNC / UNF	
1/4	9
5/16	24
3/8	39
7/16	78
1/2	90
5/8	136



NOTE: Torque values above are for all screws and bolts used except for those specified.

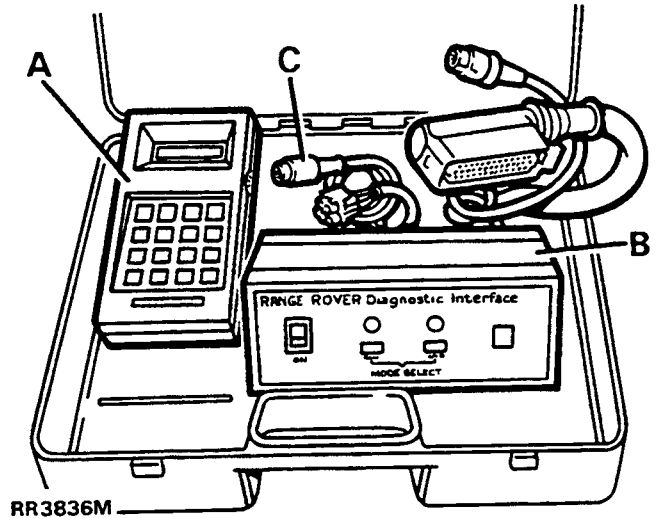
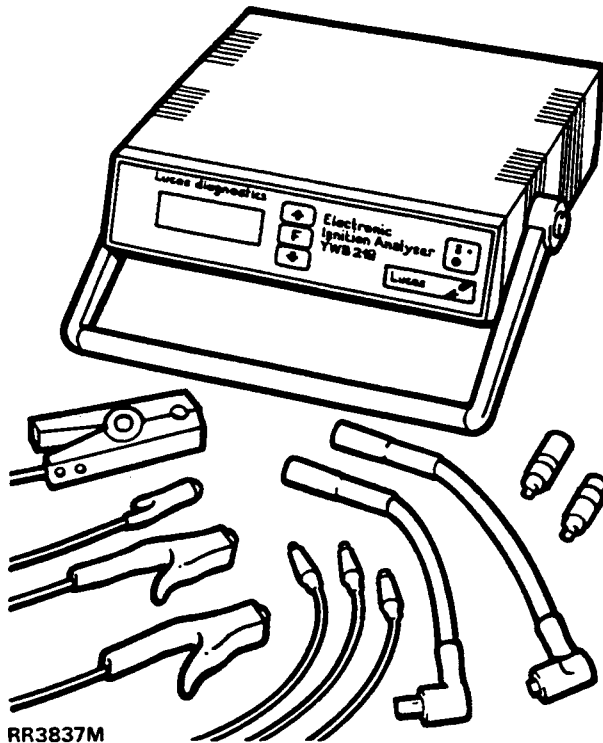


DIAGNOSTIC EQUIPMENT

Electronic Ignition Analyser

Lucas Part No. - YWB 119

Supplied by Lucas with instruction manual.



MEMORY CARDS

Land Rover Part Numbers include two memory cards and instruction manual.

Suitable for 14CUX FUEL SYSTEM

ENGLISH	RTC 6835
USA	RTC 6836
FRENCH	RTC 6837
GERMANY	RTC 6838
ITALIAN	RTC 6839
SPANISH	RTC 6840
DUTCH	RTC 6842
JAPANESE	STC 127

LUCAS EFI DIAGNOSTIC EQUIPMENT

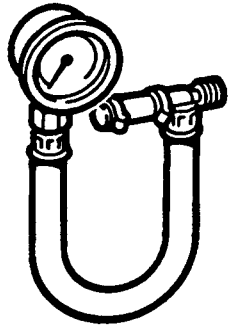
Land Rover Part No. RTC 6834

Comprising:-

- A Hand held tester
 - B Interface unit
 - C Serial link cable
- Foam lined carrying case

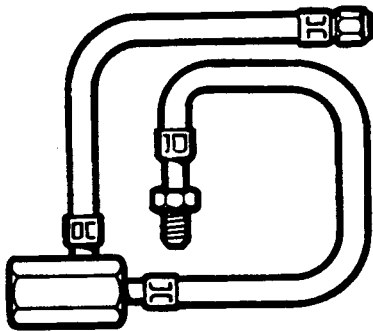


FUEL SYSTEM



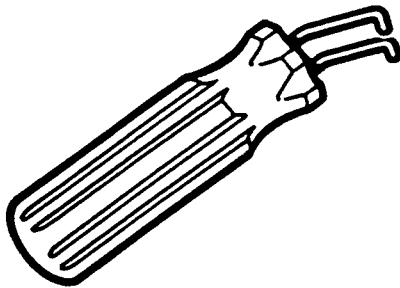
LRT-19-004 Test equipment fuel pressure
18G 500

18G1500



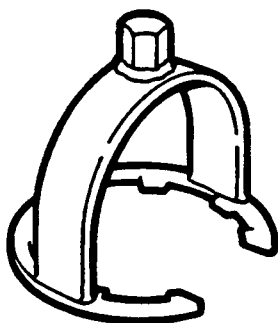
LRT-19-003 EFI pressure test adaptor
LST 143

LST143



LRT-19-002 Connector splitter
LST 144

LST144



LRT-19-001 Fuel pump remover
LST 131

LST131



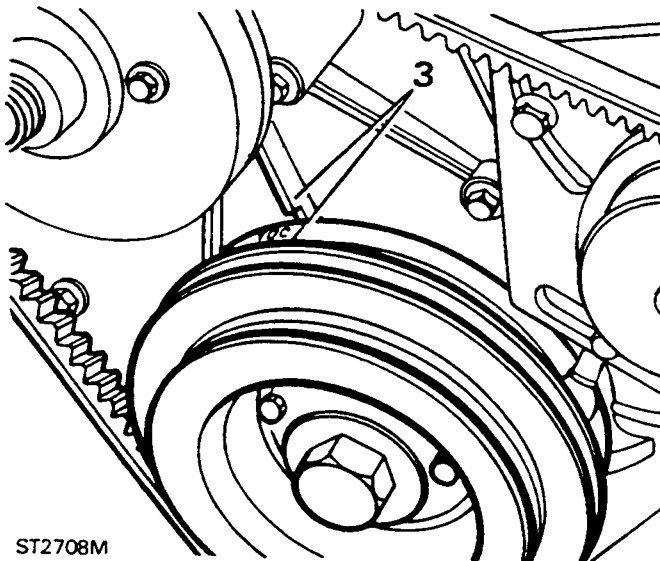
FUEL INJECTION PUMP

Special tools:


Flywheel timing pin	LST 128
Pump gear retaining tool	LST 129

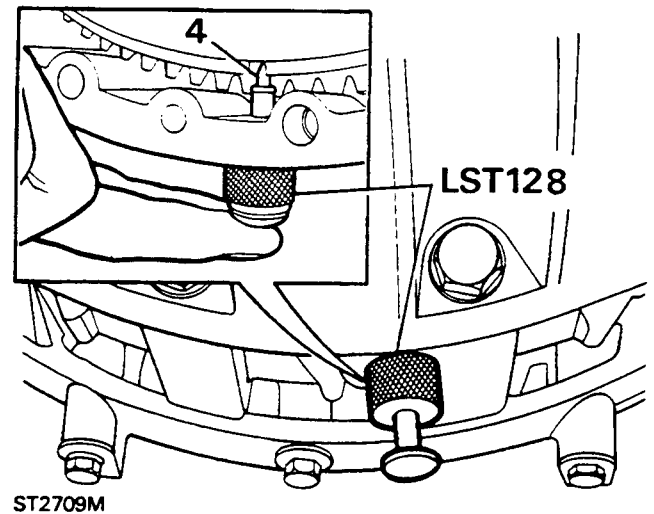
Remove

1. Disconnect the battery negative lead.
2. Remove oil filler cap so that the position of the rockers can be seen to assist in obtaining T.D.C.
3. Turn the crankshaft to align the T.D.C. mark on the crankshaft pulley with the web on the front cover plate. At the same time check that both valves of number one cylinder are closed. Refit filler cap.

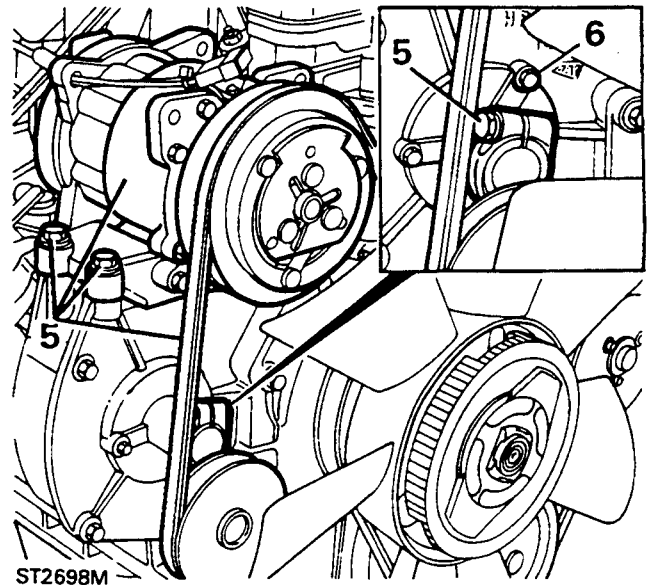


4. Remove blanking plug from bottom of flywheel housing. Fit flywheel timing pin body LST 128. Check that timing pin can be inserted into appropriate slot in the flywheel. Note that there are two slots in the flywheel the narrowest one being that which determines T.D.C. for this direct injection engine.

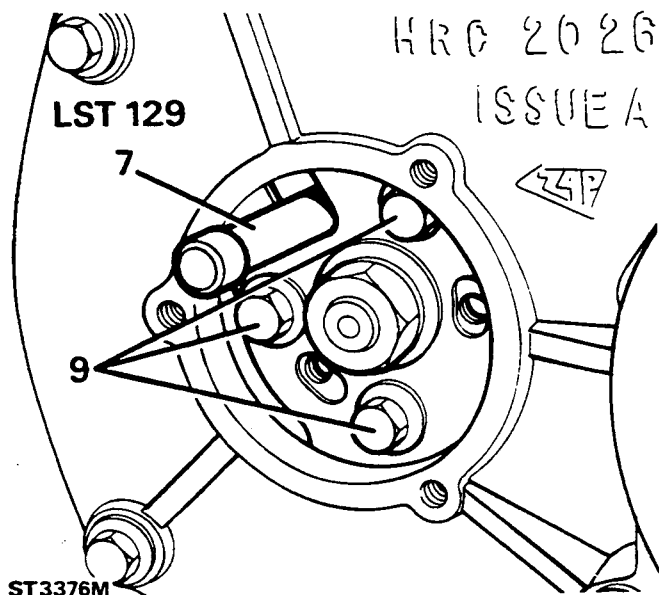
 **NOTE:** If automatic gearbox - The same timing pin fits into a slot in the ring gear. Access is through a hole in engine backplate below the starter motor.



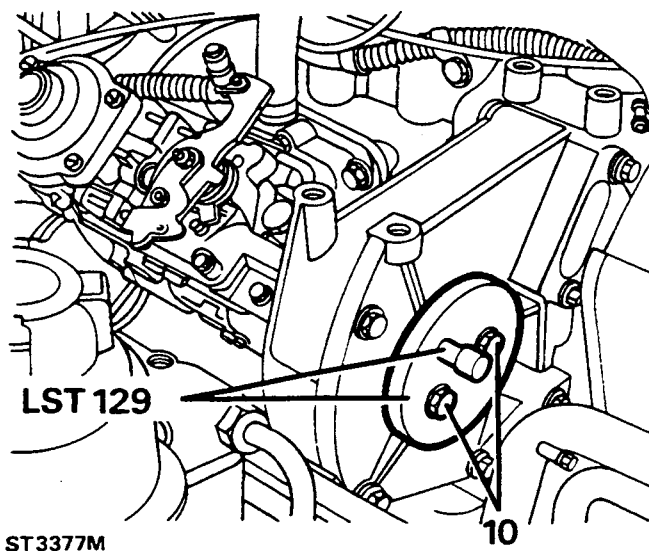
5. Vehicles with air conditioning, slacken and remove compressor drive belt from pulley, remove the four securing bolts and move the compressor aside.
6. Remove three screws to release injection pump hub blanking plate. On air conditioning vehicles this plate also provides a pivot for the compressor drive belt tensioning pulley.



7. Insert the injection pump timing pin LST 129 through the "U" shaped slot in the pump hub into the pump body. Ensure that the pin fits easily and is fully inserted.



9. Remove three bolts retaining the pump drive gear. Remove the locking plate and timing pin.
10. Fit pump gear retaining tool LST129. Align and tighten the two bolts. Reinsert the timing pin through the hole provided in the retaining tool.



8. Loosen pump locking screw, remove keeper plate. Tighten screw to lock pump.

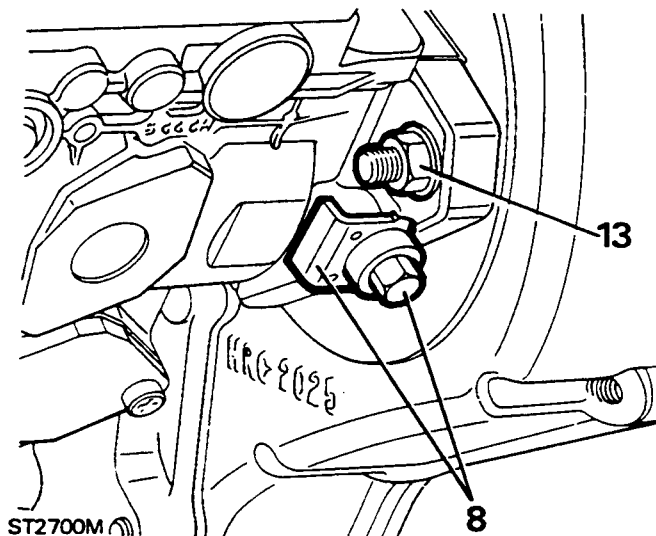


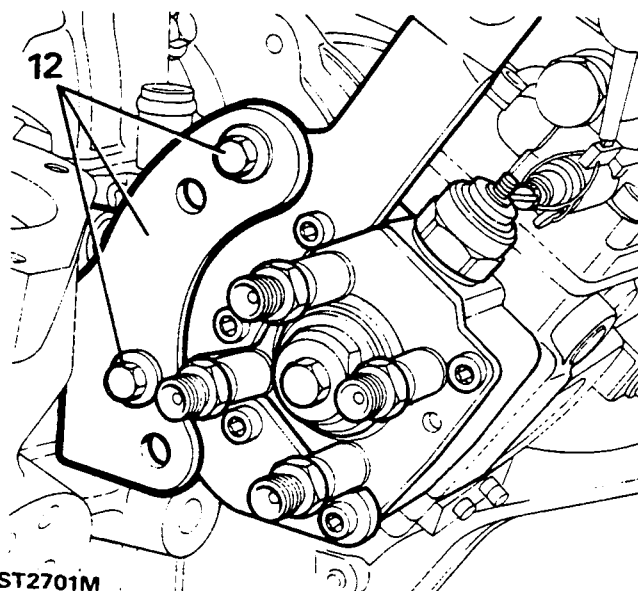
CAUTION: Once timing pin LST 129 has been inserted and the pump shaft locked, **DO NOT TURN** the crankshaft.

11. Remove injector pipes, disconnect following items from injection pump:

- Throttle cable.
- Stop control solenoid lucar.
- Spill return pip.
- Turbo charger boost hose.
- Main fuel supply pipe.

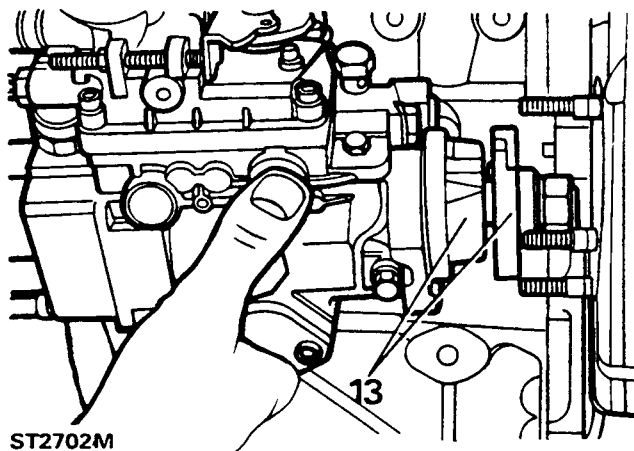
12. Remove two bolts securing pump to rear support bracket and the bolts securing the bracket to cylinder block. Remove the bracket.





ST2701M

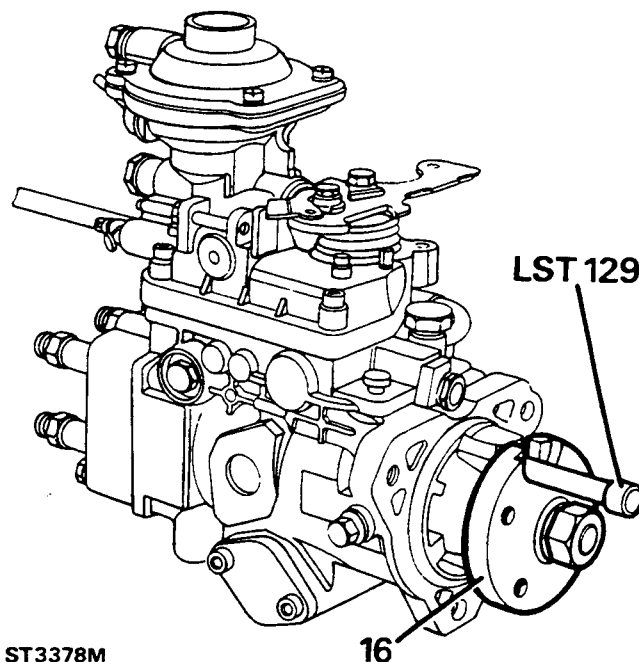
13. Remove flange pump nuts. Remove pump and gasket from the front cover.
14. Fit blanks to fuel pump inlet and outlets to prevent entry of dirt. Loosen the locking screw, fit the keeper plate and tighten the screw.



ST2702M

Refit

15. Clean pump flange and front cover mating face. Place a new gasket in position over the studs.
16. Fit the timing pin LST 129 to the pump. If necessary, rotate pump to enable the pin to locate easily and fully.



ST3378M

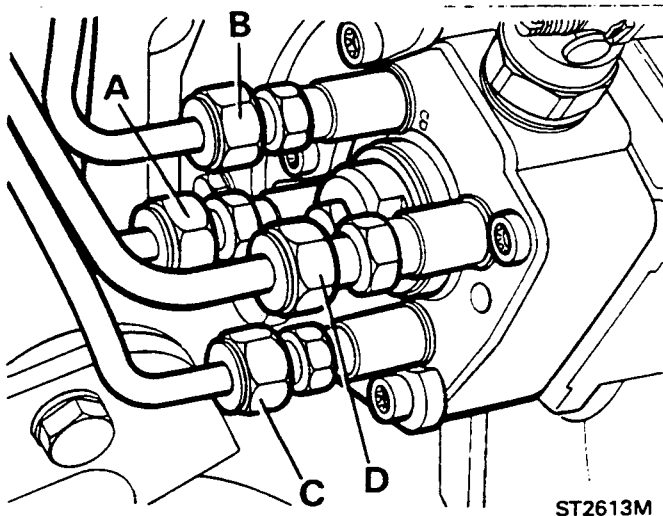
17. Loosen pump locking screw, remove keeper plate, Tighten screw to lock the pump.
18. Fit the pump to the front cover and drive gear. Fit the three nuts, tighten evenly to **24 Nm**.
19. Fit the rear support bracket to the cylinder block and secure the pump to the bracket. Tighten all bolts to **24 Nm**.
20. Connect the following:

Throttle cable.
 Stop control solenoid lucar.
 Spill return pipe.
 Turbo boost hose.
 Main fuel supply pipe.

21. Fit injector fuel supply pipes loosely. Commencing at the front of the engine connect the pipes as follows.

A to number one injector.
 B to number two injector.
 C to number three injector.
 D to number four injector.

Finally tighten evenly, do not over tighten. Tighten to **25 Nm**.



22. Remove pump timing pin and pump gear retaining tool LST 129/1.
 23. Reinsert pump timing pin. Fit the gear lock plate, secure with the three bolts, tighten to **25 Nm**.
 24. Remove the timing pin. Unlock the pump, fit the keeper plate and tighten the bolt.

Injection pump timing check

25. To check that pump timing is correct, turn crankshaft two complete revolutions, check that the timing pin LST 129/2 can be inserted easily and fully into the pump. At the same time check that the flywheel timing pin can also be inserted in the flywheel slot.
 26. If, with flywheel timing pin located, the timing pin cannot be inserted cleanly into the pump, carry out the following instructions:
- (1) Turn crankshaft the small amount necessary to enable the timing pin to be inserted into the pump.
 - (2) Remove keeper plate, lock pump.

- (3) Slacken the three pump gear retaining bolts.

- (4) Turn

- (5) Check that timing pin is an easy fit in the pump and that the flywheel timing pin locates.

- (6) Tighten pump gear retaining bolts to **25 Nm**.

- (7) Unlock pump, fit keeper plate, tighten the bolt. Remove timing pin from pump and timing pin tool from flywheel.

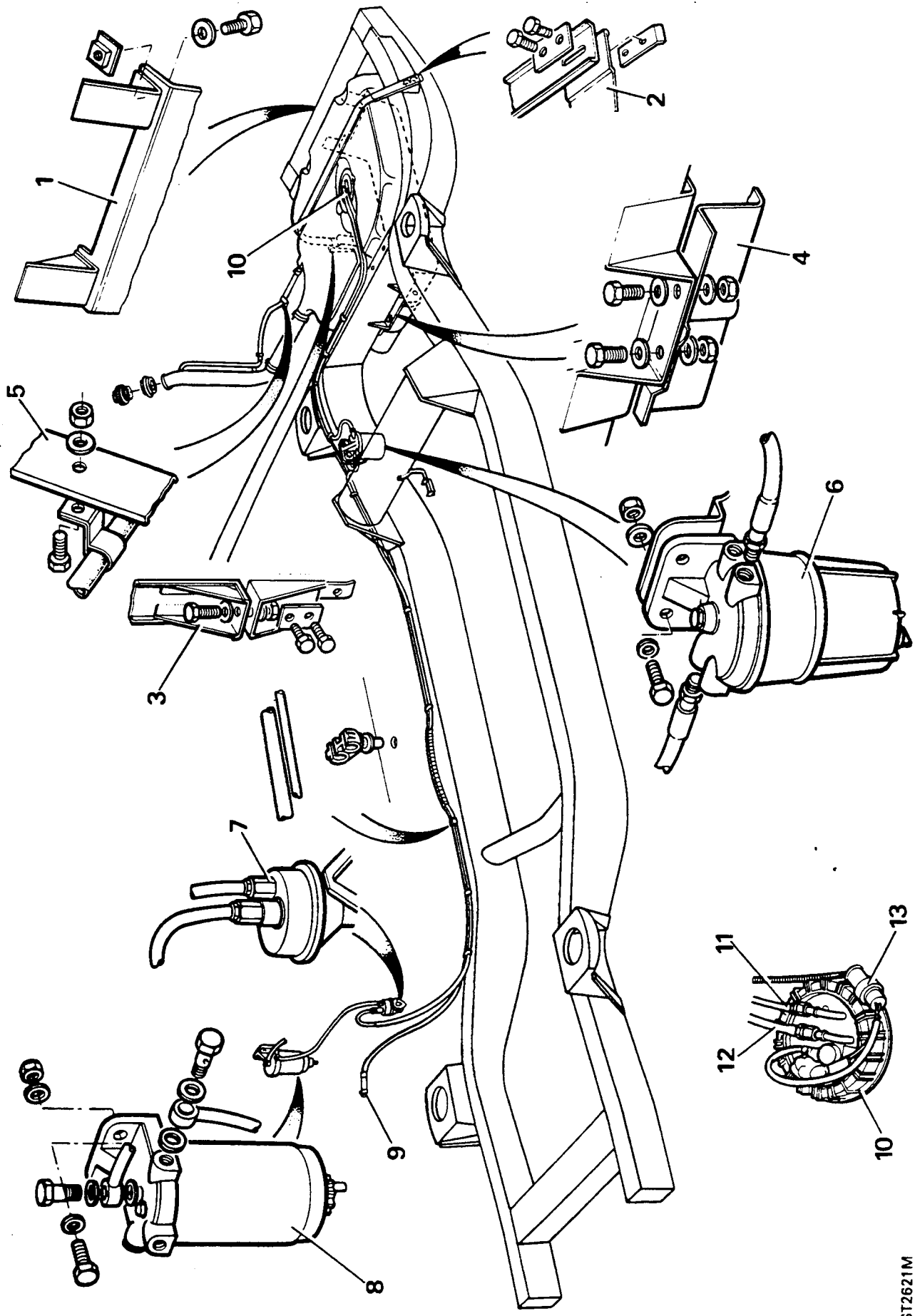
27. Fit the pump aperture cover plate with a new gasket and secure with the three screws.
 28. Where appropriate, fit the air conditioning compressor and tension the drive belt.



NOTE: Pump timing may also be checked by following the procedure in the technical information bulletin number 099/92/EN

KEY TO DIESEL FUEL SYSTEM LAYOUT

1. Fuel tank rear support bracket.
2. Fuel tank retaining strap fixings left hand side.
3. Retaining strap fixing, right hand side.
4. Fuel tank front support bracket.
5. Fuel filler pipe vent hose support.
6. Fuel sedimenter.
7. Engine operated fuel lift pump.
8. Fuel filter located on engine compartment bulk head.
9. Spill return pipe from injectors via fuel injection pump.
10. Fuel tank unit.
11. Spill return pipe to fuel tank.
12. Fuel supply pipe to lift pump via the sedimenter.
13. Multiplug connector for fuel indicator sender unit.



ST2621M



CRUISE CONTROL SYSTEM-HELLA GR66

Description

The cruise control system consists of electro-mechanical devices, and comprises of the following components. A 1993 model year introduction is the inclusion of cruise control on manual vehicles.

Electronic control unit (ECU)

The electronic control unit is located behind the lower dash panel. The microprocessor based ECU evaluates the signals provided by the driver controls, brake pedal switch, clutch pedal switch on 1993 manual models, and the road speed transducer. The ECU activates the vacuum pump as required. The ECU also has a memory function for set speed storage.

Driver operated switches

The main cruise control switch is located in the auxiliary switch panel and activates the cruise control system. The steering wheel switches provide 'set/accelerate' and 'resume/decelerate' features. These switches provide the interface between driver and cruise control system.

Brake pedal switch

The brake pedal switch is located under the lower dash attached to the brake pedal mounting bracket. The switch provides for fast disengagement of the cruise control system and rapid return of the throttle levers to the idle position when the brake pedal is applied.

Clutch pedal switch - 1993 introduction

The clutch pedal switch is located under the lower dash attached to the clutch pedal mounting bracket. The switch provides for fast disengagement of the cruise control system and rapid return of the throttle levers to the idle position when the clutch pedal is applied.

Road speed transducer

The road speed transducer is mounted on a bracket located on the left hand chassis side member adjacent to the rear engine mounting. The transducer provides road speed data to the ECU. The cruise control system cannot be engaged until the road speed exceeds 45 km/h, (28 mph) the system will automatically disengage at a road speed of 42 km/h (26 mph).

Vacuum pump

The vacuum pump is located in the engine compartment, attached to the left hand valance. The vacuum pump is energised when the main cruise control switch is operated, and is actuated by the steering wheel and brake pedal switches. The pump provides a vacuum source to the cruise control actuator at the throttle levers. A control valve in the pump provides for steady increase of road speed or purge of the system when the brake pedal is applied.

Actuator

The actuator is located in the engine compartment and is bolted to the throttle lever bracketry. The actuator provides the servo mechanism link between the cruise control system and throttle linkage and is operated by vacuum from the vacuum pump.

Neutral lockout relay-cruise control - Automatic vehicles

The relay is located under the rear of the front right hand seat. Access is gained through the opening at the bottom of the seat when the seat is in its fully forward position.

1993 models - the relay is located in the right hand side footwell, accessible by removing the trim panel.

The function of the relay is to disengage the cruise control system if neutral, or park, is selected in the main gearbox, when the system is engaged.

Engine speed trip ECU - Manual vehicles

This unit is located in the right hand side footwell, accessible by removing the trim panel.

The function of the unit is to disengage cruise control if engine speed exceeds 5000 rev/min.

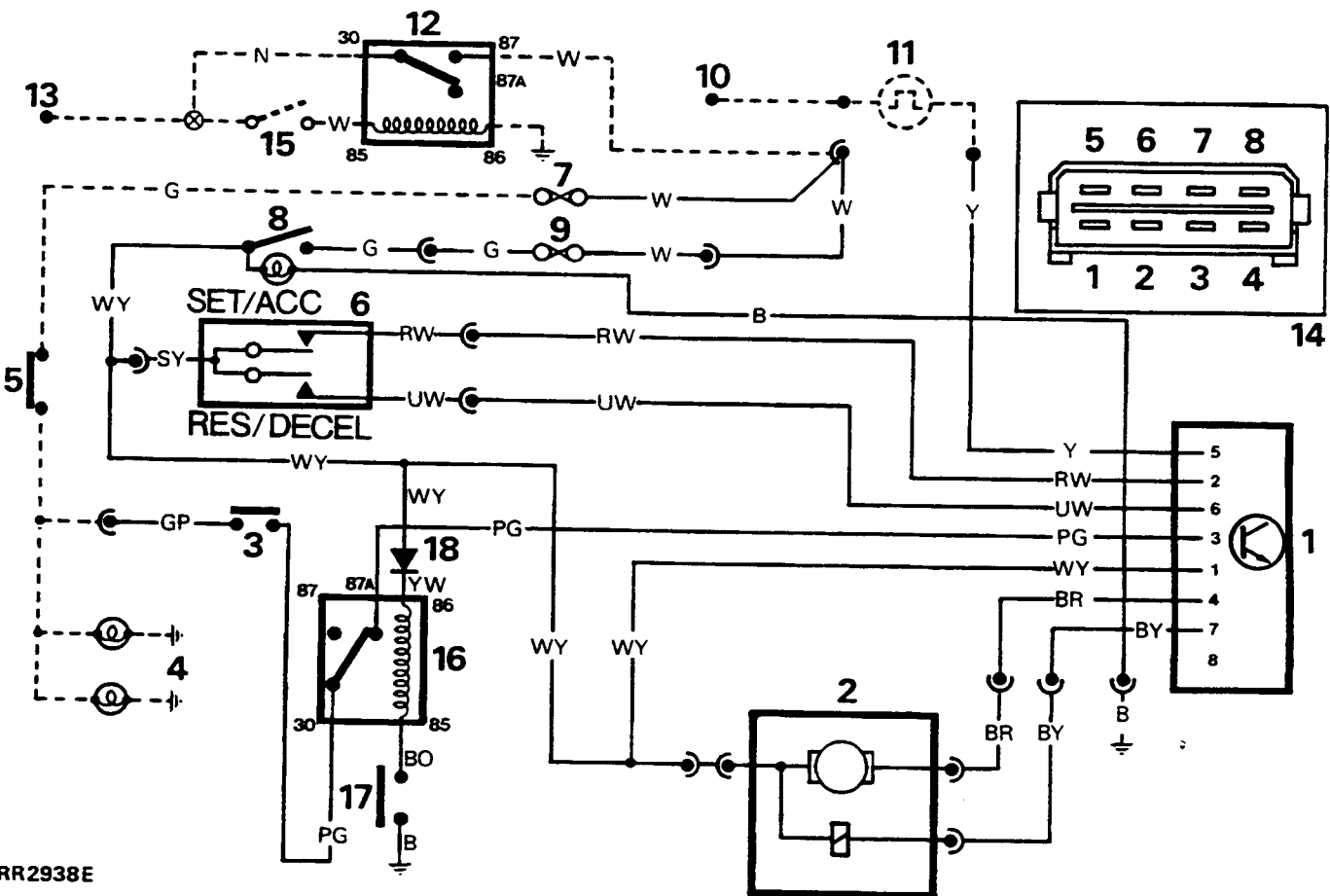
CRUISE CONTROL - CIRCUIT DIAGRAM - 1990/92

- | | |
|---|--|
| 1. Cruise control ECU | 10. 12V + supply to transducer |
| 2. Vacuum pump | 11. Speed transducer |
| 3. Brake switch/vent valve | 12. Ignition load relay-item 1 main circuit diagram |
| 4. Stop lamps | 13. Battery feed |
| 5. Brake switch | 14. Cruise control harness multi-plug identification |
| 6. Steering wheel set and reset switches | 15. Ignition switch-item 8 main circuit diagram |
| 7. Fuse A5 | 16. Relay - neutral lockout |
| 8. Main cruise control switch-auxiliary panel | 17. Start inhibit switch |
| 9. Fuse C5 (10A) | 18. Diode |
| | --- Denotes existing main cable |

Cable colour code

B Black	L Light	P Purple	U Blue
G Green	N Brown	R Red	W White
K Pink	O Orange	S Grey	Y Yellow

The last letter of a colour denotes the tracer colour.



RR2938E



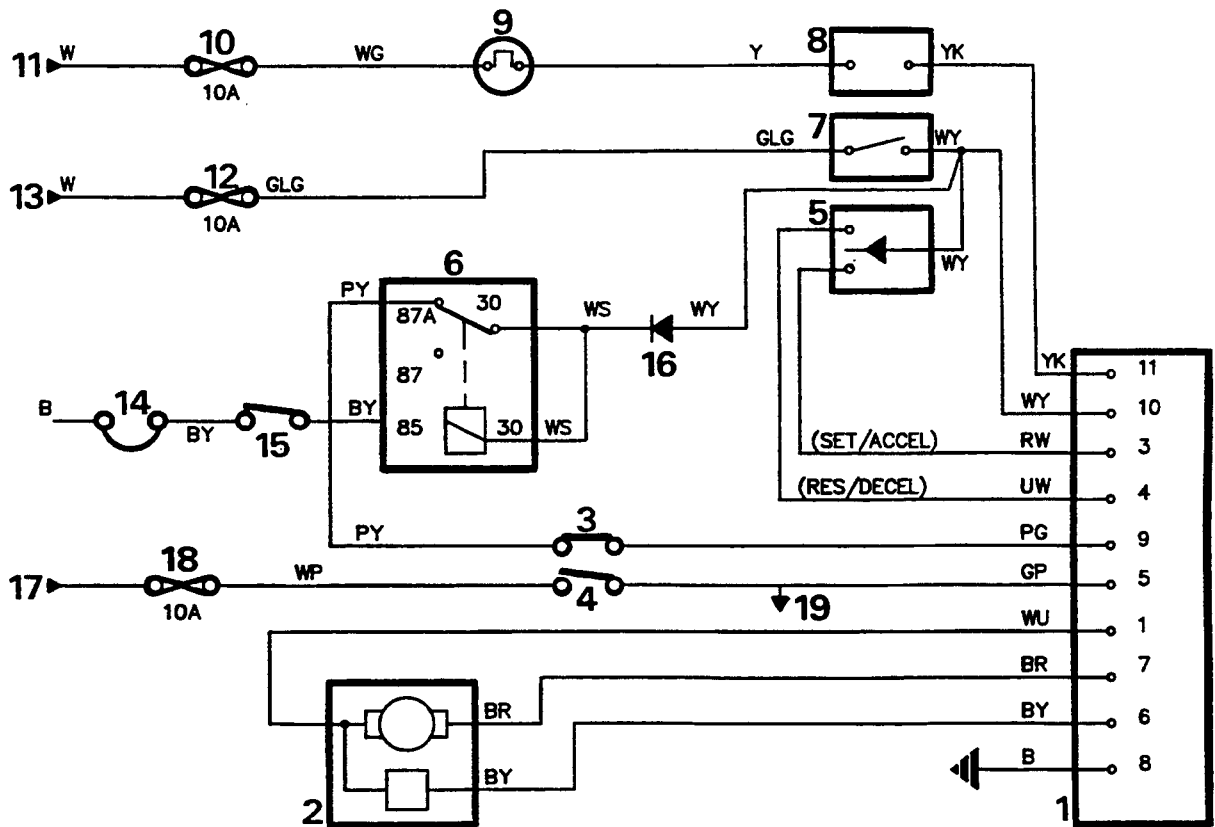
**CRUISE CONTROL - CIRCUIT DIAGRAM -
AUTOMATIC VEHICLES - 1993 MODEL YEAR**

- | | |
|---|-----------------------------------|
| 1. Cruise control ECU | 11. Ignition feed |
| 2. Vacuum pump | 12. Fuse E2 10A |
| 3. Brake switch/vent valve | 13. Ignition feed from load relay |
| 4. Brake light switch | 14. Vehicle alarm |
| 5. Steering wheel set and reset switches | 15. Park/neutral switch |
| 6. Neutral lock out relay | 16. Diode |
| 7. Main cruise control switch-auxiliary panel | 17. Ignition feed |
| 8. Speed buffer | 18. Fuse B1 10A |
| 9. Speed transducer | 19. Stop lamps |
| 10. Fuse B4 10A | --- |
- Denotes existing main cable

Cable colour code

B Black	L Light	P Purple	U Blue
G Green	N Brown	R Red	W White
K Pink	O Orange	S Grey	Y Yellow

The last letter of a colour denotes the tracer colour.



RR3863M

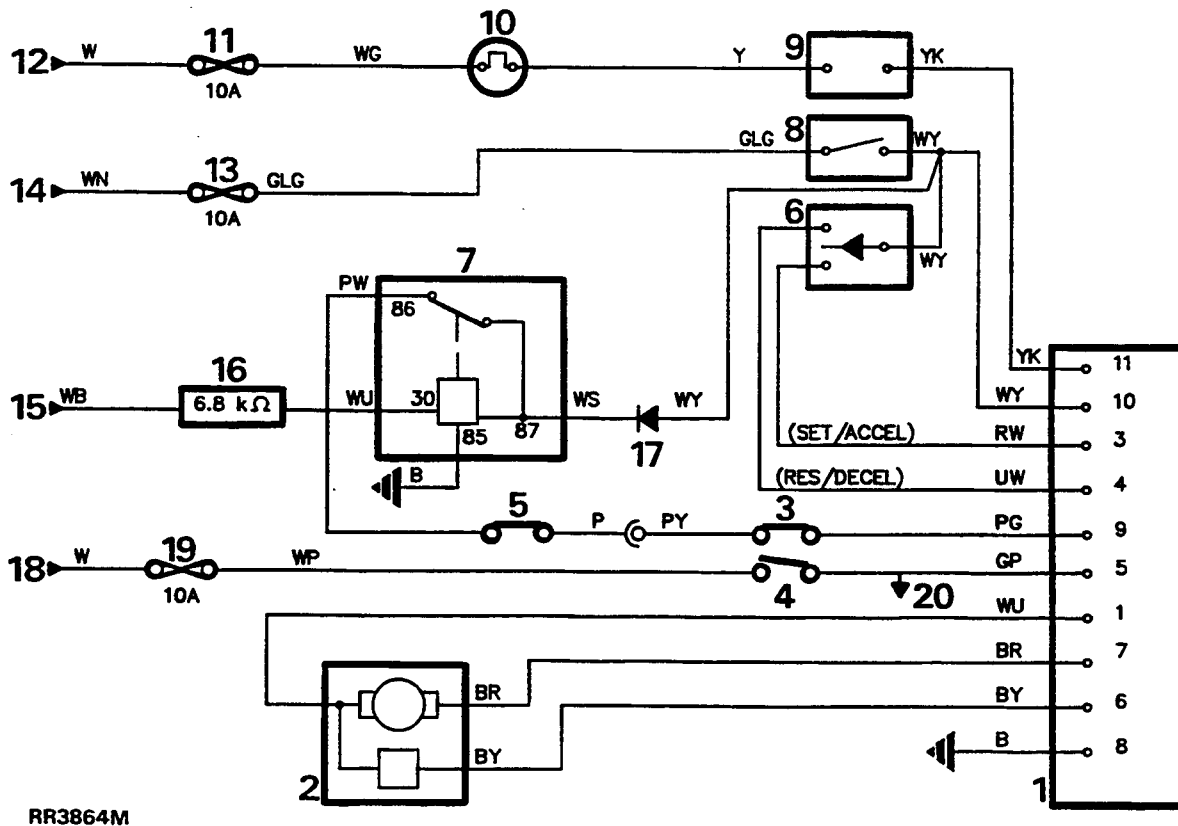
**CRUISE CONTROL - CIRCUIT DIAGRAM -
MANUAL VEHICLES - 1993 MODEL YEAR**

- | | |
|---|---------------------------------------|
| 1. Cruise control ECU | 11. Fuse B4 10A |
| 2. Vacuum pump | 12. Ignition feed |
| 3. Brake switch/vent valve | 13. Fuse E2 10A |
| 4. Brake light switch | 14. Ignition feed from load relay |
| 5. Clutch switch | 15. Speed signal from ignition module |
| 6. Steering wheel set and reset switches | 16. 6.8 Kohm resistor |
| 7. Engine trip ECU | 17. Diode |
| 8. Main cruise control switch-auxiliary panel | 18. Ignition feed |
| 9. Speed buffer | 19. Fuse B1 10A |
| 10. Speed transducer | 20. Stop lamps |
- Denotes existing main cable

Cable colour code

B Black	L Light	P Purple	U Blue
G Green	N Brown	R Red	W White
K Pink	O Orange	S Grey	Y Yellow

The last letter of a colour denotes the tracer colour.



RR3864M



ROAD TEST - PRE 1993 MODELS



CAUTION: Do not engage cruise control when vehicle is being used in low transfer gear or reverse.



WARNING: The use of cruise control is not recommended on winding, snow covered or slippery roads or in heavy traffic conditions where a constant speed cannot be maintained.

1. Start engine, depress main control switch to actuate cruise control system. Accelerate to approximately 50 km/h, (30 mph), operate 'set/acc' switch, immediately release switch, remove foot from accelerator pedal. Vehicle should maintain speed at which 'set/acc' switch was operated.
2. Operate 'set/acc' switch and hold at that position, vehicle should accelerate smoothly until switch is released. Vehicle should now maintain new speed at which 'set/acc' switch was released.
3. Apply 'res/decel' switch while vehicle is in cruise control mode, cruise control should disengage. Slow to approximately 55 km/h, (35 mph) operate 'res/decel' switch, immediately release switch and remove foot from accelerator, vehicle should smoothly accelerate to previously set speed. Increase speed using accelerator pedal, release pedal, vehicle should return to previously set speed.
4. Operate brake pedal, cruise control system should immediately disengage returning vehicle to driver control at accelerator pedal. Operate 'res/decel' switch, vehicle should accelerate to previously set speed without driver operation of accelerator pedal.
5. Operate 'res/decel' switch and allow vehicle to decelerate to below 42 km/h, (26 mph). Operate 'res/decel' switch, cruise control system should remain disengaged.
6. Operate 'set/acc' switch below 45 km/h, (28 mph), cruise control system should remain disengaged. Accelerate, using accelerator pedal to above 45 km/h, (28 mph), operate 'res/decel' switch, and remove foot from accelerator pedal, vehicle should smoothly adjust to previously memorised speed.
7. Depress main control switch in control system should immediately disengage and erase previously set speed from E.C.U. memory **See ETM, B5**

ROAD TEST - 1993 MODELS



CAUTION: Do not engage cruise control when vehicle is being used in low transfer gear or reverse.



WARNING: The use of cruise control is not recommended on winding, snow covered or slippery roads or in heavy traffic conditions where a constant speed cannot be maintained.

1. Start engine, depress main control switch to actuate cruise control system. Accelerate to approximately 50 km/h, (30 mph), operate 'set/acc' switch, immediately release switch, remove foot from accelerator pedal. Vehicle should maintain speed at which 'set/acc' switch was operated.
2. Operate 'set/acc' switch and hold at that position, vehicle should accelerate smoothly until switch is released. Vehicle should now maintain new speed at which 'set/acc' switch was released.
3. Momentarily touch and release 'set/acc' switch, vehicle speed should increase 1.6 km/h (1 mph) for each touch. Note that five touches will increase speed 8 km/h (5 mph).
4. Apply 'res/decel' switch while vehicle is in cruise control mode, cruise control should disengage. Slow to approximately 55 km/h, (35 mph) operate 'res/decel' switch, immediately release switch and remove foot from accelerator, vehicle should smoothly accelerate to previously set speed. Increase speed using accelerator pedal, release pedal, vehicle should return to previously set speed.
5. Operate brake pedal, cruise control system should immediately disengage returning vehicle to driver control at accelerator pedal. Operate 'res/decel' switch, vehicle should accelerate to previously set speed without driver operation of accelerator pedal.
6. Operate 'res/decel' switch and allow vehicle to decelerate to below 42 km/h, (26 mph). Operate 'res/decel' switch, cruise control system should remain disengaged.
7. Operate 'set/acc' switch below 40 km/h, (28 mph), cruise control system should remain disengaged. Accelerate, using accelerator pedal to above 45 km/h, (28 mph), operate 'res/decel' switch, and remove foot from accelerator pedal, vehicle should smoothly adjust to previously memorised speed.
8. **Automatic vehicles** - select neutral, system should disengage. **Manual vehicles** - depress clutch, system should disengage.
9. Cruise at 80 km/h (50 mph), declutch, select neutral, remove foot from clutch. Operate 'res/decel' switch. Engine should rev to 5000 rev/min, cruise control disengages, engine returns to idle.
10. Engage forward gear. Operate 'res/decel' switch. Remove foot from accelerator. Speed should accelerate to previous set speed.
11. Depress main control switch in control system should immediately disengage and erase previously set speed from E.C.U. memory See **ETM, B5**



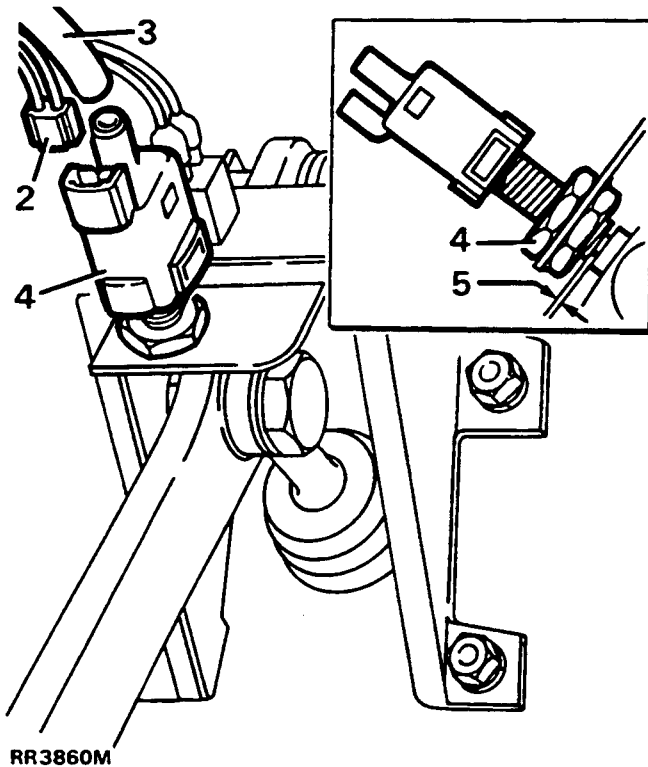
BRAKE PEDAL SWITCH/VENT VALVE

Service repair no - 19.75.35

Remove and refit

Remove

1. Remove lower dash panel, *See CHASSIS AND BODY, Repair, Lower dash panel*
2. Disconnect electrical multi-plug from brake pedal switch.
3. Pull vent hose from switch.
4. Loosen locknut, unscrew switch from bracket.



Refit

5. Fit switch. Adjust switch to provide a clearance of 1.0 mm between switch body and contact button.
6. Tighten locknut.
7. Fit hose and multi-plug securely.
8. Reverse removal procedure.

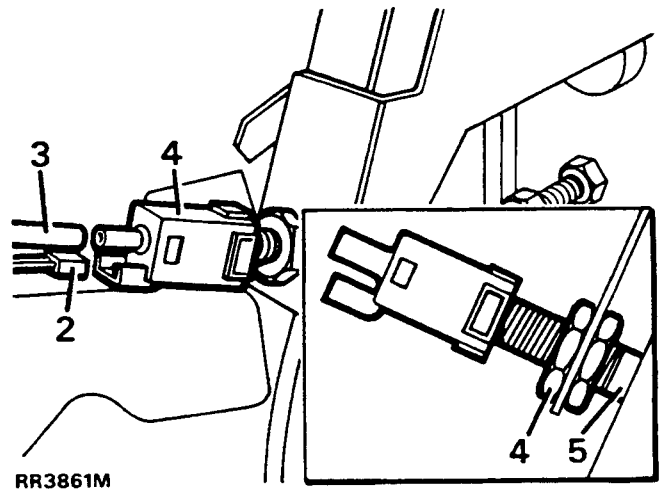
CLUTCH PEDAL SWITCH/VENT VALVE - 1993 MODEL YEAR ADDITION

Service repair no - 19.75.34

Remove and refit

Remove

1. Remove lower dash panel, *See CHASSIS AND BODY, Repair, Lower dash panel*
2. Disconnect electrical multi-plug from clutch pedal switch.
3. Pull vent hose from switch.
4. Unscrew adjusting nut, remove switch.



Refit

5. Refit switch, fit adjusting nut. Adjust valve to provide zero clearance between valve body and inside shoulder of contact button.
6. Tighten adjusting nut
7. Fit hose and multi-plug securely.
8. Reverse removal procedure.

MAIN CONTROL SWITCH

Service repair no - 19.75.30

Remove and refit of main control switch and bulb replacement is included in Electrical Section 86, **See ELECTRICAL, Repair, auxiliary switch panel**

DRIVER OPERATED CRUISE CONTROL SWITCHES-STEERING WHEEL

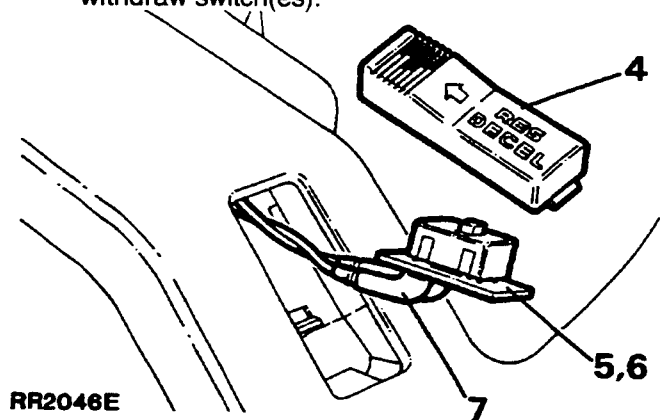
Service repair no - Set - 19.75.36

Service repair no - Resume - 19.75.37

Remove and refit

Remove

1. Disconnect the battery negative lead.
2. Pry centre trim pad off steering wheel.
3. Disconnect electrical multi-plug located in small opening below steering wheel retaining nut.
4. Carefully pry switch(es) out of steering wheel spoke(s).
5. Release small switch button from opening within spoke(s).
6. Carefully pull switch and electrical leads through spoke until access is gained to electrical connections beneath switch.
7. Disconnect electrical leads from switch and withdraw switch(es).

**Refit**

8. Reverse removal procedure. Ensuring electrical leads are fitted securely.



SPIRAL CASSETTE

Service repair no - 19.75.54

Remove and refit

The spiral cassette is located behind steering wheel. Access to unit is gained by removing steering wheel and steering column shroud.



NOTE: To enable steering wheel to be refitted in correct radial position, ensure front road wheels are in straight ahead position.

Remove

Service Tools:

LRT-57-014 Steering wheel remover

LRT-57-015 Adaptor pins

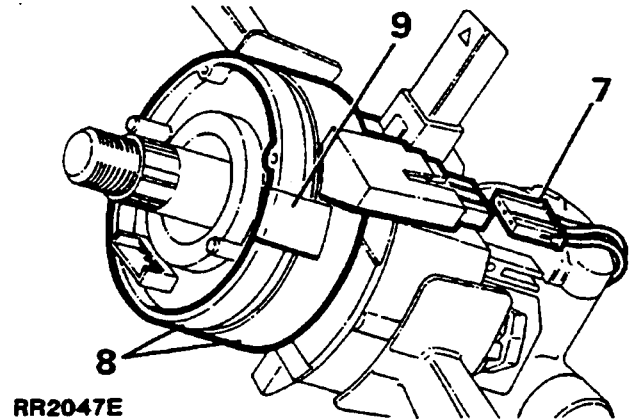
1. Disconnect the battery negative lead.
2. Remove steering wheel centre trim panel.
3. Disconnect electrical multi-plug located in small opening in centre of steering wheel.
4. Remove steering wheel securing nut and serrated washer, using service tool LRT-57-014 and adaptor pins, withdraw steering wheel.



CAUTION: Apply adhesive tape to upper and lower halves of spiral cassette to prevent upper half rotating after steering wheel is removed. Failure to do this will result in damage to flexible tape inside cassette.

5. Remove six lower fixings securing steering column shroud.
6. Release either left hand or right hand fixing securing top of shroud.

7. Ease halves of shroud apart until access is gained to electrical multi-plug on cassette. Disconnect multi-plug.
8. Remove cassette from steering column.



Refit

9. Remove adhesive tape retaining halves of spiral cassette.



NOTE: Ensure that two pegs on spiral cassette locate in two holes on underside of steering wheel before securing steering wheel.

10. Reverse removal procedure. Ensuring that electrical leads within steering column shroud are not trapped between shroud mating faces.

ACTUATOR

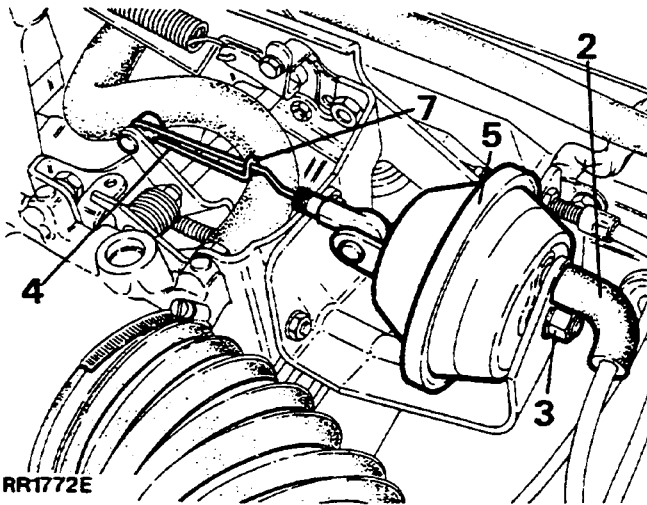
Service repair no - 19.75.12

Remove and refit

NOTE: The actuator is non serviceable, fit a new unit if failure or damage occurs.

Remove

1. Disconnect the battery negative lead.
2. Pull rubber elbow from actuator.
3. Remove nut securing actuator to throttle bracket.
4. Remove actuator, and manoeuvre actuator operating link off throttle lever.
5. Withdraw actuator.

**Refit**

6. Inspect rubber diaphragm. Fit a new actuator assembly if diaphragm is damaged.
7. Reverse removal procedure. Fitting hook uppermost

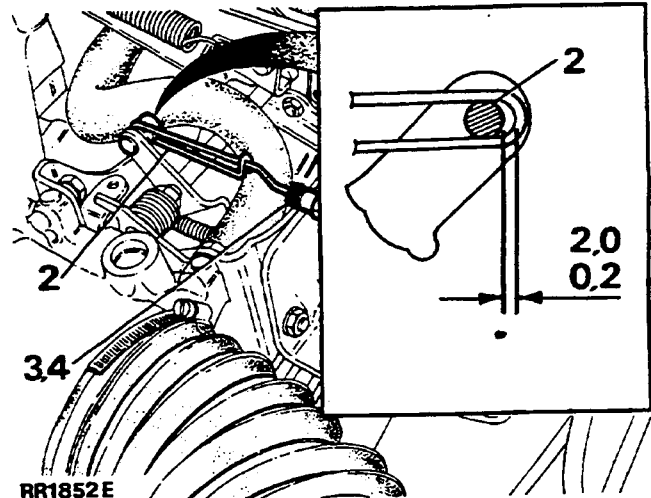
ACTUATOR LINK-SETTING

Service repair no - 19.75.21

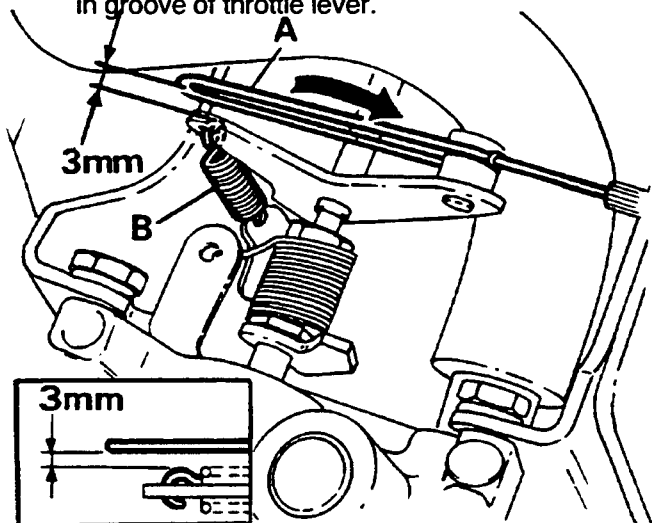


NOTE: Setting procedure is carried out at minimum throttle condition only.

1. Ensure ignition is switched 'OFF'.
2. Check clearance between inside edge of actuator link and recessed diameter of throttle lever. Clearance should be 0.2 to 2.0 mm.

**Link - adjust**

3. Remove link from actuator.
4. Rotate socket joint adjuster as necessary.
5. Refit link to actuator and recheck clearance between link and lever.
6. With throttle fully open, check a gap of at least 3mm exists between side of link ("A" in illustration) and side of small spring ("B" in illustration). Realign link by bending to achieve correct gap. Recheck clearance at closed throttle/open throttle. Check link slides smoothly in groove of throttle lever.





VACUUM PUMP

Service repair no - 19.75.06

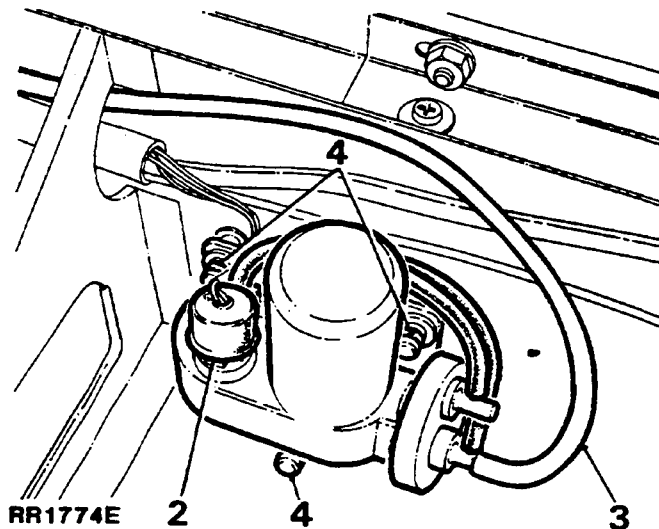
Remove and refit



NOTE: The vacuum pump is non serviceable, fit a new unit if failure or damage occurs.

Remove

1. Disconnect the battery negative lead.
2. Disconnect multi-plug from top of vacuum pump.
3. Disconnect vacuum feed hose from vacuum pump.
4. Withdraw three vacuum pump rubber mountings.



5. Remove vacuum pump.

Refit

6. Reverse removal procedure. Ensuring all hose and electrical connections are secure.

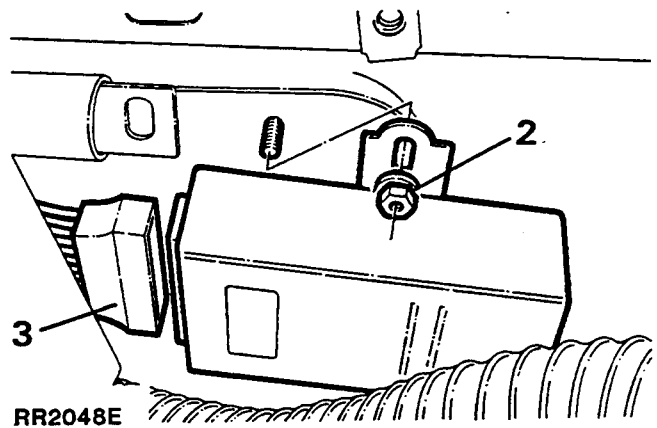
ELECTRONIC CONTROL UNIT (ECU) - CRUISE CONTROL- Pre 1993

Service repair no - 19.75.49

Remove and refit

Remove

1. Remove lower dash panel, *See CHASSIS AND BODY, Repair, Lower dash panel*
2. Remove two fixings, lower ECU to access multi-plug.
3. Disconnect ECU multi-plug, remove unit from vehicle.



Refit

4. Reverse removal procedure. Ensuring that electrical multi-plug is securely reconnected.

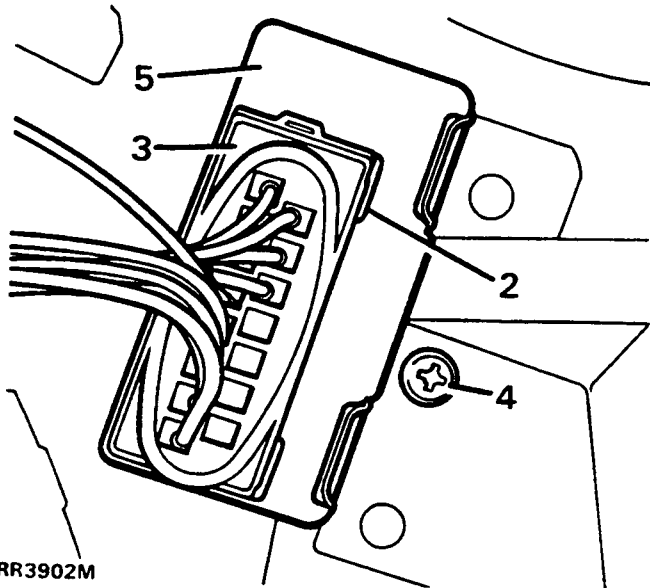
ELECTRONIC CONTROL UNIT (ECU) - CRUISE CONTROL - 1993

Service repair no - 19.75.49

Remove and refit

Remove

1. Remove lower dash panel, *See CHASSIS AND BODY, Repair, Lower dash panel*
2. Release wire clip.
3. Disconnect ECU multi-plug.
4. Remove ECU fixing.
5. Remove ECU.



RR3902M

Refit

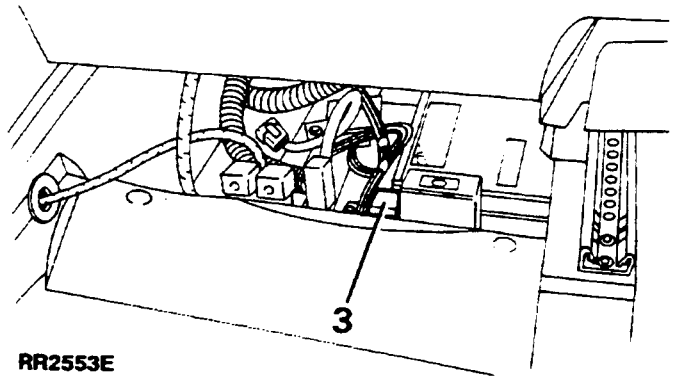
6. Reverse removal procedure. Ensuring that electrical multi-plug is securely reconnected.

NEUTRAL LOCKOUT RELAY - Pre 1993

Remove and refit

Remove

1. Adjust seat fully forward.
2. Disconnect the battery negative lead.
3. Pull relay from terminal block.



RR2553E

Refit

4. Reverse removal procedure.

NEUTRAL LOCKOUT RELAY - AUTOMATIC - SPEED TRIP ECU - MANUAL - 1993



NOTE: The neutral lock out relay/speed trip ECU is mounted in the right hand side footwell. To identify components, see 1993 Range Rover Electrical Troubleshooting Manual.