

57 - STEERING

CONTENTS

Page

DESCRIPTION AND OPERATION

DESCRIPTION	1
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FAULT DIAGNOSIS

INSUFFICIENT POWER ASSISTANCE	1
POWER STEERING SYSTEM - TEST	2
STEERING DAMPER	3
STEERING FAULTS	3
STEERING STABILITY AND VEER UNDER BRAKING	6
1. GENERAL STEERING	6
2. STEERING VEER	7
3. VEER UNDER BRAKING	7
4. DIRECTIONAL STABILITY	8
POWER STEERING FLUID LEAKS	8
POWER STEERING SYSTEM - EXCESSIVE NOISE	9
POWER STEERING SYSTEM - GRUNT	9
VISUAL AND SAFETY CHECKS	10
ROAD TEST PROCEDURE	10
STIFF STEERING CHECKLIST	11
VISUAL CHECK AND BASIC ADJUSTMENTS	12
STEERING LINKAGE INSPECT	13

ADJUSTMENT

POWER STEERING BOX	1
CENTRALISE STEERING BOX	1
STEERING LOCK STOPS	2
FRONT WHEEL ALIGNMENT	3
POWER STEERING PUMP DRIVE BELT	3

REPAIR

POWER STEERING FLUID PIPES	1
POWER STEERING BOX	2
POWER STEERING SYSTEM - BLEED	5
POWER STEERING FLUID RESERVOIR	5
POWER STEERING PUMP DRIVE BELT	6
POWER STEERING PUMP - V8i	6
POWER STEERING PUMP - Tdi	7
LOWER STEERING SHAFT AND UNIVERSAL JOINTS	9
STEERING COLUMN SHROUD	10



57 - STEERING

CONTENTS

	Page
STEERING WHEEL	10
UPPER STEERING COLUMN	12
STEERING COLUMN LOCK ASSEMBLY	15
DROP ARM	16
STEERING DAMPER.....	17
TRACK ROD AND LINKAGE	18
DRAG LINK AND DRAG LINK ENDS	19
 OVERHAUL	
POWER STEERING BOX	1
 SPECIFICATIONS, TORQUE	
STEERING PUMP	1
TORQUE VALUES	2
 SERVICE TOOLS	
POWER STEERING BOX	1



DESCRIPTION

The power assisted steering system incorporates a compression joint in the lower shaft, designed to collapse on impact and for certain countries, an air bag located in the centre of the steering wheel.

The mis-alignment of the upper steering column with the steering box and the inclusion of two universal joints and a compression joint in the lower shaft, is also designed to prevent frontal impact moving the column toward the driver.

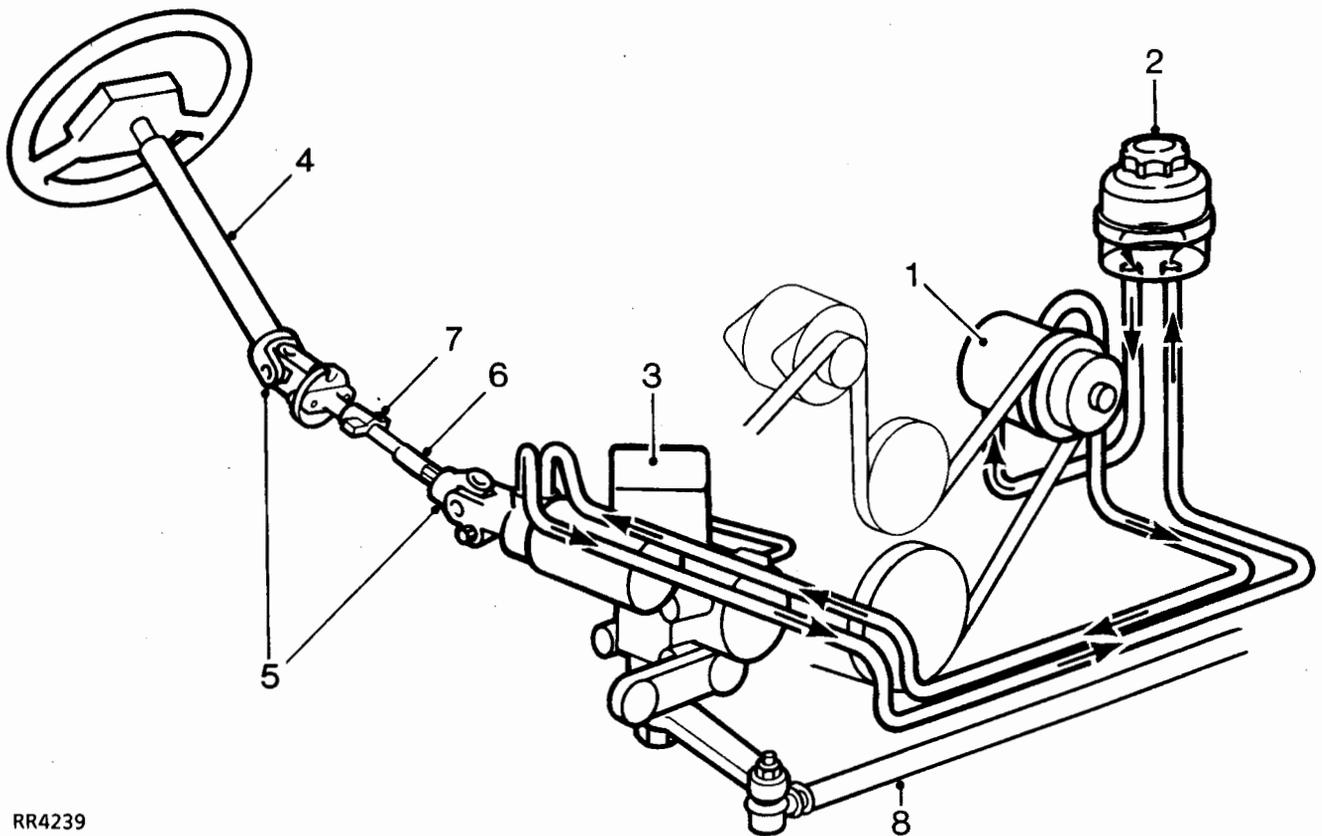
The steering box is located behind the first cross member of the chassis and is connected to the road wheels by the drag link and track rod. An hydraulic damper absorbs shocks in the steering, caused by road wheel deflections when operating on rough terrain.

Power steering system

The power steering system comprises a hydraulic pump which is belt driven from the engine and supplied with fluid from a reservoir that also acts as a cooler.

The steering box houses a self neutralizing rotary valve which is part of the worm/valve assy and a hydraulic piston/rack to assist the mechanical operation.

The rotary valve which is operated by movement of the steering wheel, directs fluid pressure to the appropriate side of the hydraulic piston/rack to provide assistance.



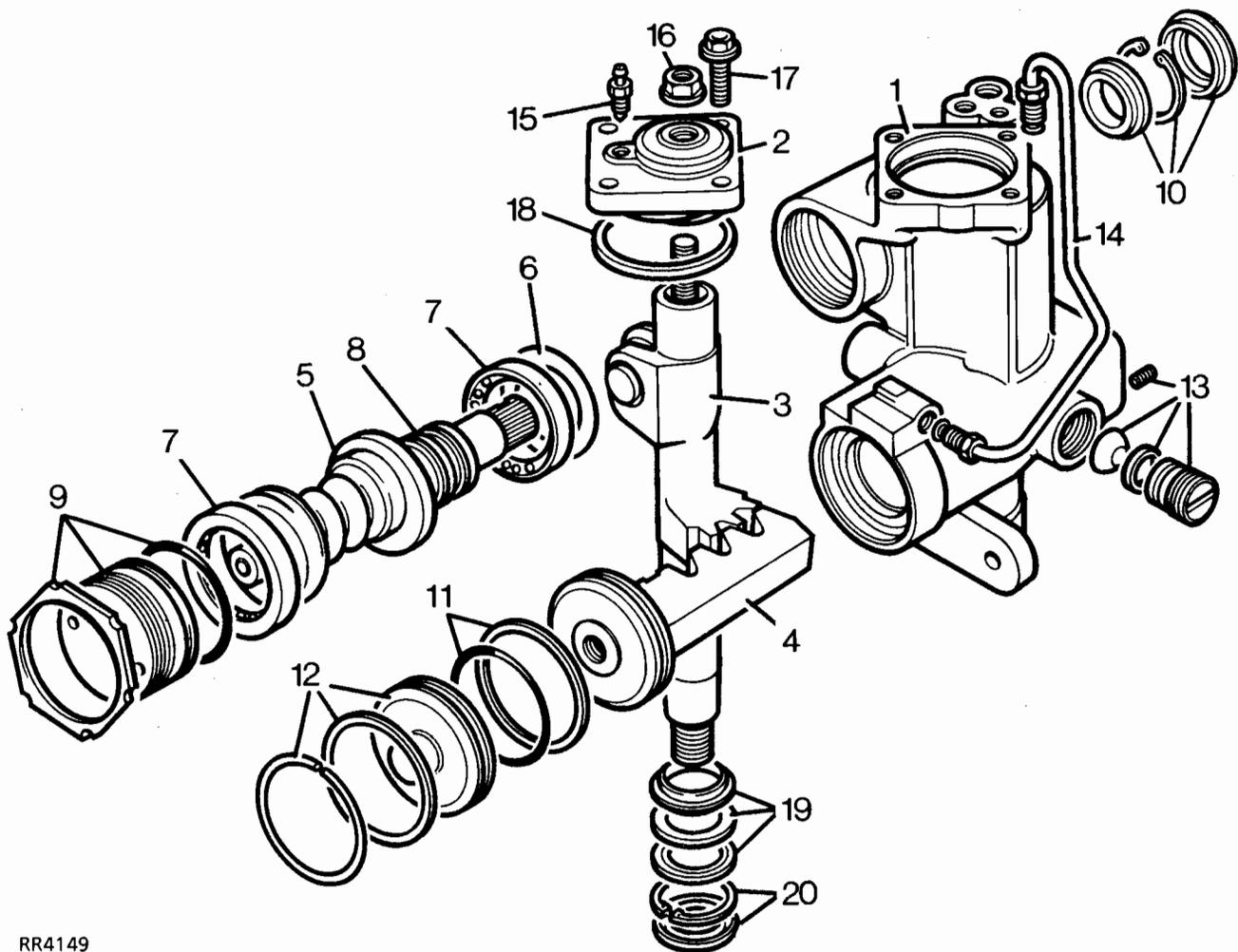
RR4239

Power steering system

1. Hydraulic pump
2. Fluid reservoir
3. Steering box
4. Upper column
5. Universal joints
6. Lower shaft
7. Compression joint
8. Drag link

**Steering column components**

1. Upper shroud
2. Column harness
3. Cruise control switch (if fitted)
4. Steering wheel and nut
5. Rotary coupler
6. Column switch
7. Shear bolts
8. Switch saddle
9. Upper steering column
10. Universal joint
11. Universal joint bolt
12. Steering column lock assembly
13. Lower shroud
14. Column lock/ignition
15. Air bag mounting bracket (if fitted)
16. Air bag module
17. Steering pad (non-airbag)
18. Lower shaft
19. Rubber coupling
20. Compression joint
21. Universal joint
22. Universal joint bolt



RR4149

Power steering box components

- | | |
|---|--|
| 1. Housing complete with sector shaft bearings | 11. 'Teflon' and rubber seal for piston |
| 2. Cover plate complete with bearing | 12. End cover seal and snap ring |
| 3. Sector shaft | 13. Adjustment components for piston/rack |
| 4. Hydraulic piston/rack | 14. Hydraulic pipe |
| 5. Worm/valve and torsion bar assembly | 15. Bleed screw |
| 6. Shims for centralizing worm/valve | 16. Sector shaft adjustment lock nut with seal |
| 7. Ball race (2) | 17. Cover plate bolts (4) |
| 8. 'Teflon' seals for valve sleeve (3) | 18. Cover plate seal |
| 9. Bearing adjuster, locknut and seal | 19. Seal, washer and backup seal |
| 10. Worm shaft pressure seal, circlip and dirt excluder | 20. Circlip and dust cover |



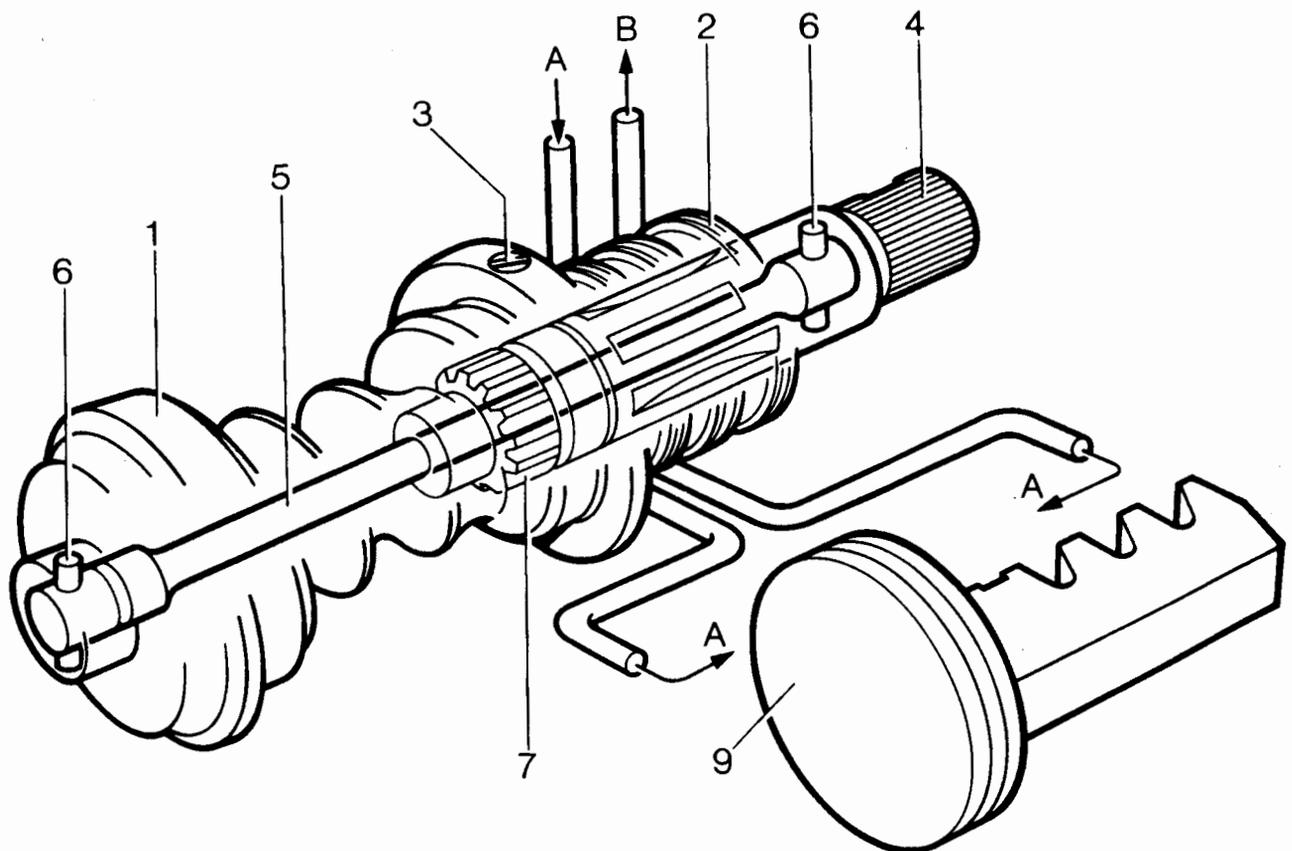
Rotary valve operation

The rotary valve assembly seen in RR3620M comprises the worm (1), the valve sleeve (2), the input shaft (4) and the torsion bar (5).

The valve sleeve is retained inside the worm by the trim screw (3), and incorporates valve ports in its inner bore. The input shaft is attached to the steering wheel via the steering shaft and steering column and incorporates valve ports in its outer diameter to align with those in the sleeve. The torsion bar which is secured to the worm and input shaft with pins (6) at each end (later models use one pin at input shaft end), holds the valve ports in neutral alignment when there is no demand for assistance.

No demand for assistance (Valve at neutral)

When there is no demand for assistance as seen in RR3620M, the torsion bar holds the input shaft and sleeve valve ports in neutral relationship to one another, allowing equal pump pressure A to both sides of the piston/rack (9). Any excess fluid flow from the pump returns to the reservoir via B.



RR3620M

Rotary valve at neutral

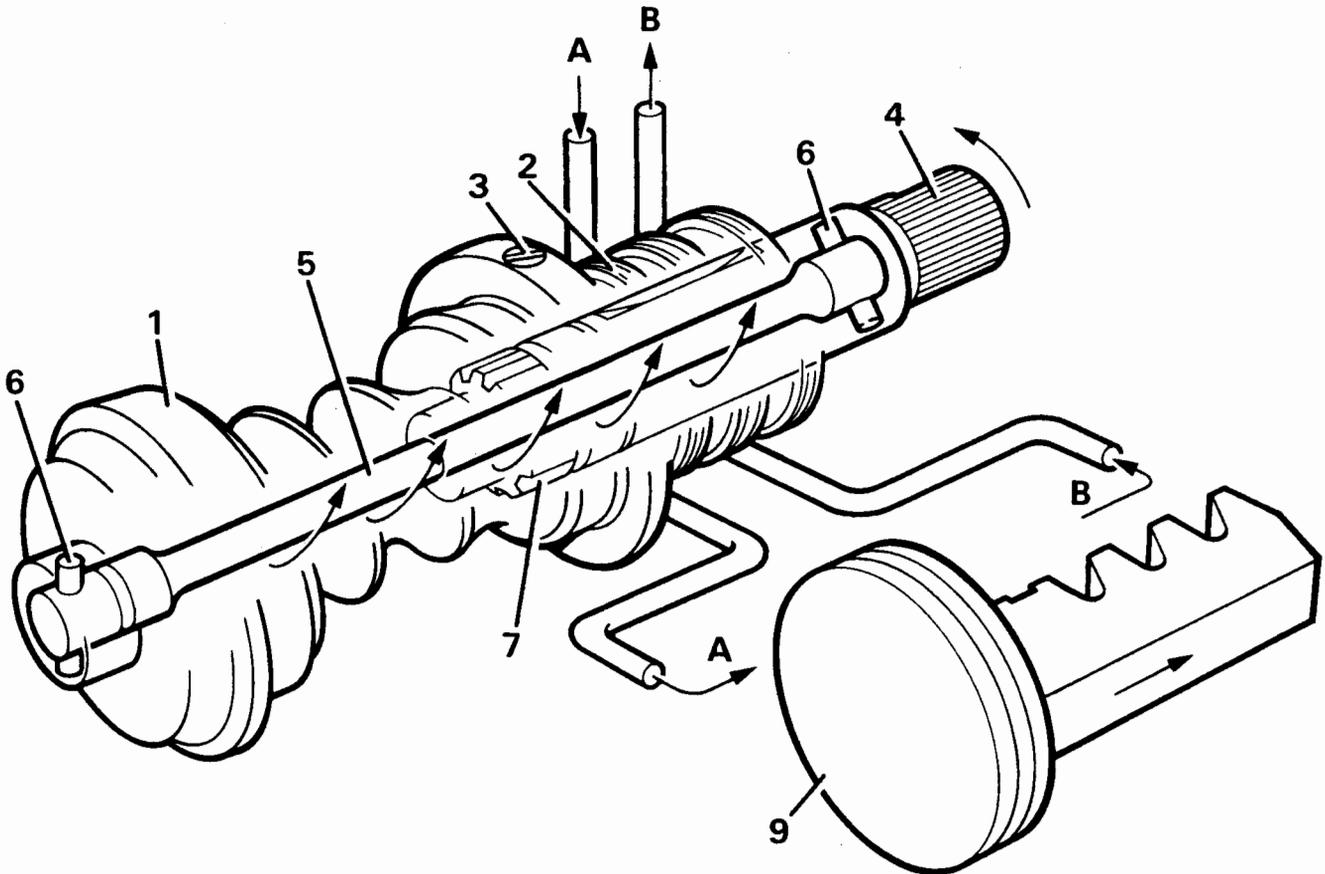
Demand for assistance (Valve misaligned)

When the steering wheel and input shaft is turned, steering resistance transmitted to the worm causes the torsion bar to be twisted and the valve ports to be misaligned for a right or left turn. The misalignment of the valve ports directs all fluid pressure A to one side of the piston only and allows displaced fluid B on the other side.

When demanding maximum assistance, any excessive fluid output from the pump due to high pump speed, will circulate through the regulator valve located in the pump unit, causing the temperature of the fluid and the pump to rise rapidly. To avoid excessive fluid temperatures which could damage the oil seals, the steering must not be held on full lock for more that 30 seconds in one minute.

Only when the steering wheel and the demand for assistance is released, will the torsion bar return the valve to neutral, allowing the fluid to circulate through the reservoir where it is cooled.

In the unlikely event of mechanical failure of the torsion bar, a coarse splined connection (7) between the input shaft and worm, ensures steering control is maintained sufficient to allow the vehicle to be recovered.



RR3621M

Rotary valve misaligned

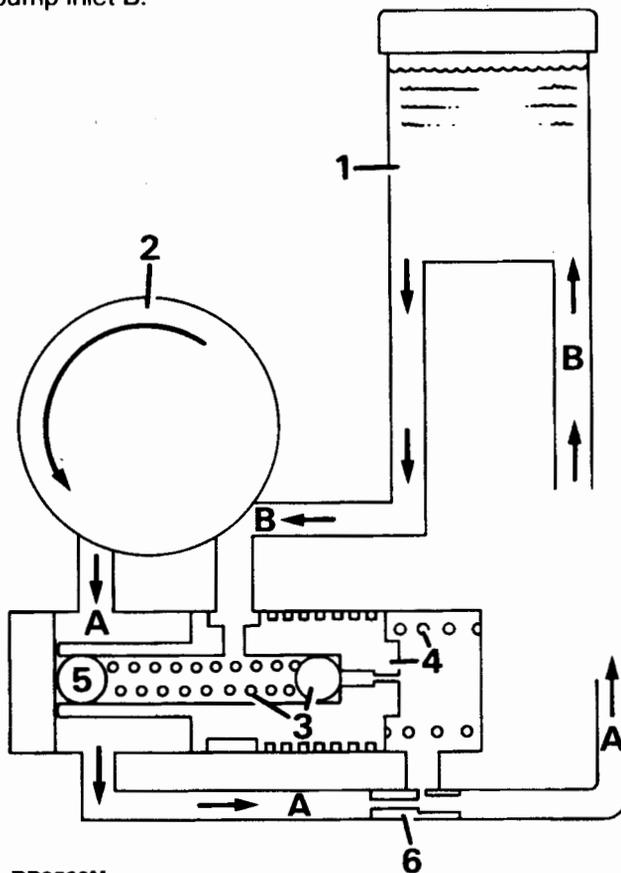


Pump and regulator valve operation

The pump which is belt driven from the engine is an eccentric roller type and also houses the pressure regulator and flow control valve. The pressure is controlled by a spring loaded ball valve 3 which is housed inside the flow control valve piston 4.

No demand for assistance High flow through box - Low pressure

With no demand for assistance as illustrated in RR3568M the rotary valve in the steering box acts as a pressure relief valve, allowing fluid A to flow freely through the steering box and back to the reservoir and pump inlet B.



RR3568M

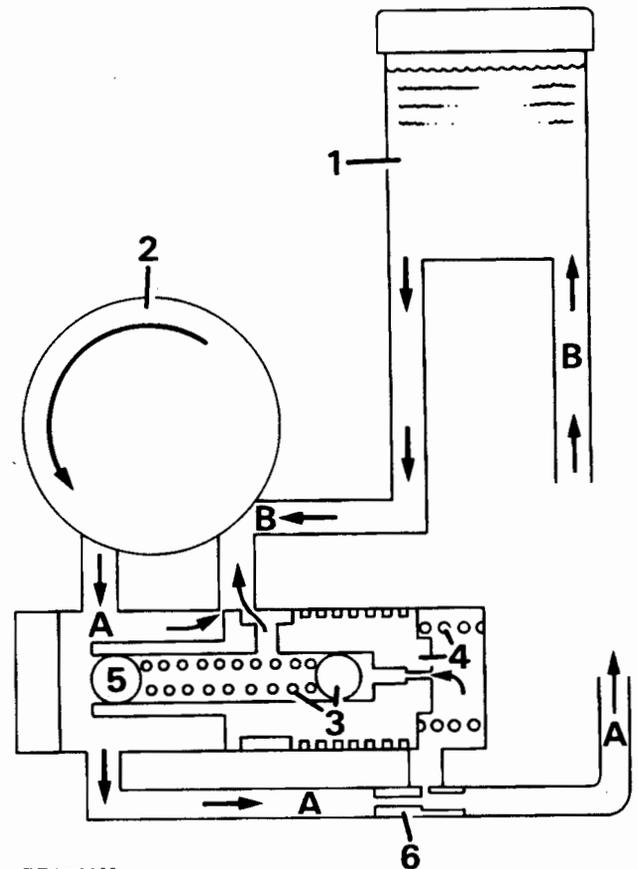
No demand for assistance

1. Reservoir
2. Pump
3. Pressure control ball valve and spring
4. Flow control valve and spring
5. Press fit plug (ball bearing)
6. Restrictor

The ball plug item 5 is pressed into the valve 4 during manufacture and determines the opening pressure of pressure relief valve 3.

No flow, through box - High pressure

When the steering is turned, the rotary valve effectively stops all fluid flow through the steering box, thus causing an increase in pressure A. This increase in pressure is felt in the flow control valve spring chamber where, at a pre-determined pressure the relief valve 3 will open and allow the pressure to escape. The fall in pressure in the flow control spring chamber, allows the flow control valve to move to the right, which in turn allows pump output A to escape directly into the pump inlet B, as seen in RR3569M.



RR3569M

Assistance demanded

As soon as the steering wheel is released after making a turn, the system reverts to the condition seen in RR3568M and the road wheels are returned to the straight ahead position by the mechanical steering geometry.

In the event of any hydraulic failure steering control though heavy, will be maintained through the mechanical components in the steering box.



INSUFFICIENT POWER ASSISTANCE

1. Is fluid level correct?
YES - go to 3.
NO - Fill/bleed system
2. Is problem a leak?
YES - Diagnose. **See Power Steering Fluid Leaks**
NO - continue
3. Is drive belt tension correct?
YES - go to 5.
NO - retension. **See ENGINE, Repair, Drive Belt**
4. Is problem resolved?
YES - end
NO - continue
5. Carry out pressure test at idle and 1000 rev/min.
See Power Steering System - Test
6. Is correct pressure achieved?
YES - steering box defective
Not at any speed go to 9.
Not at idle go to 7.
7. Is idle speed correct?
YES - Go to 8.
NO - Correct idle speed -
If 3.9 **See ENGINE TUNING DATA, Information, Engine 3.9 V8i**
If 4.2 **See ENGINE TUNING DATA, Information, Engine - 4.2 V8i**
If Tdi **See ENGINE TUNING DATA, Information, 300 Tdi Engine**
8. Is problem resolved?
YES - end
NO - go to 9.
9. Bypass steering box using adaptor tap
LRT-57-001
10. Is correct pressure obtained?
YES - defective steering box
NO - defective steering pump



CAUTION: Do not hold steering wheel on full lock for more than 30 seconds in any one minute to avoid overheating fluid and possibly damaging seals.



NOTE: 1. Excessive pressure in the system is almost always caused by a faulty relief valve in the PAS pump.

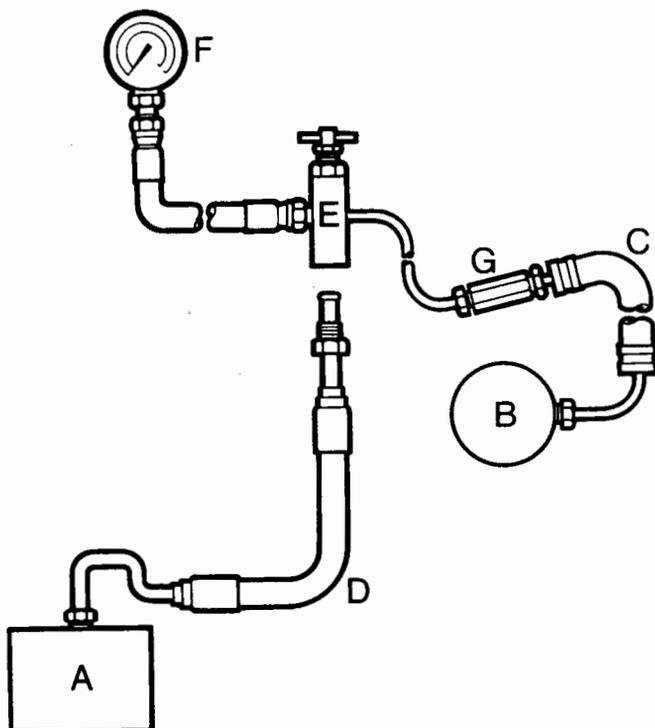


NOTE: 2. Insufficient pressure in the system is usually caused by low fluid level or PAS pump drive belt slip, or one of the following: PAS system leaks, faulty PAS pump relief valve, fault in steering box valve and worm assembly, leak at piston in steering box, worn components in PAS pump or box.

POWER STEERING SYSTEM - TEST



NOTE: If steering lacks power assistance. Check pressure of hydraulic pump before fitting new components. Use fault diagnosis chart to assist in tracing faults.



RR3959M

- A. Steering box.
- B. Steering pump.
- C. Existing hose, steering box to pump.
- D. Hose LRT-57-030.
- E. Test adaptor LRT-57-001.
- F. Pressure gauge LRT-57-005.
- G. Thread adaptor LRT-57-004.
- H. Thread adaptor LRT-57-022.

Procedure

1. A hydraulic pressure gauge and test adaptor is used to test power steering system. This gauge is able to measure 140 kgf/cm². The maximum power steering system pressure is 77 kgf/cm².
2. Some fault conditions of hydraulic pump may obtain pressures up to 105 kgf/cm². Pressure on gauge is same pressure being exerted upon steering wheel. When testing, turn steering wheel gradually while reading pressure gauge.
3. Check and maintain maximum fluid level of reservoir.
4. Examine power steering units and connections for leaks. All leaks must be rectified before attempting to test the system.
5. Check steering pump drive belt tension. **See ENGINE, Repair, Drive Belt**
6. Assemble test equipment and fit to vehicle, as shown in RR3959M.
7. Open tap of adaptor.
8. Bleed system, take care not to overload pressure gauge.
9. With system in good condition, pressures should be:

- (A) Steering wheel held on full lock and engine running at 1,000 rev/min, 70 to 77 kgf/cm².
- (B) Steering wheel held on full lock and engine idling, 28 kgf/cm².

Checks should be carried out on both full lock positions.



CAUTION: Do not maintain this pressure for more than 30 seconds in any one minute to avoid overheating fluid and possibly damaging seals.

10. Release steering wheel and with engine idling. Pressure should read below 7 kgf/cm².
11. If pressures differ to those given a fault exists.
12. To determine if fault is steering box or pump. Close adaptor tap for a maximum five seconds.
13. If gauge does not register specified pressure, pump is faulty.
14. Fit a new pump, bleed system and repeat test. If low pressure or a substantial imbalance exists, fault is in steering box valve and worm assembly.



STEERING DAMPER

The power steering system, as well as reducing the effort required to manoeuvre the vehicle when parking, also helps to dampen any deflections of the road wheels, being transmitted back to the steering wheel.

When operating the vehicle off road, the road wheels are often deflected by ruts and boulders causing the steering wheel to turn left and right. This phenomenon is known as 'steering kickback'. To subdue the effects of 'steering kickback', a hydraulic damper is fitted in the steering linkage between the track rod and the differential casing. The damper, which offers the same resistance in extension and compression, is sealed for life.

Steering damper check

Check the condition operation of the hydraulic steering damper as follows:

Check procedure

1. Inspect damper for casing damage or leaks.
2. Clamp one end of the damper horizontally in a vice using soft jaws. Compress and extend the unit by hand. Resistance should be equal in both directions.
3. If it is felt that the unit is outside acceptable limits, fit a new steering damper

STEERING FAULTS

Symptom:-

Excessive kickback through steering wheel - when driven on rough terrain.

1. Is the steering damper in good working order?
See Steering Damper
NO - Renew unit. **See Repair, Steering Damper**
YES - Continue.
 2. Is there any looseness or free play in the steering ball joints and linkage?
YES - **See Steering Linkage Inspect**
NO - Continue.
 3. Is there any looseness or worn bushes in front suspension?
YES - **See FRONT SUSPENSION, Repair, Radius Arm**
-  **NOTE: When replacing suspension bushes ALL bushes and fixings must be replaced.**
- NO - Continue.
 4. Is the steering exceptionally light/sensitive when driven on good road surface?
YES - See fault symptom - **Steering excessively light/sensitive and freeplay at steering wheel.**
NO - Suspect axle swivel resistance.
 5. Check the resistance of the axle swivels. **See FRONT AXLE AND FINAL DRIVE, Overhaul, Front Stub Axle, Constant Velocity Joint and Swivel Pin Housing Non ABS See FRONT AXLE AND FINAL DRIVE, Overhaul, Front Stub Axle, Constant Velocity Joint and Swivel Pin Housing ABS**

Symptom:-

Fluid leaks from steering box seals.



CAUTION: The steering wheel must not be held on full lock for more than 30 seconds in one minute, as this may overheat the fluid and cause damage to the oil seals.

1. Check fluid level. *See Repair, Power Steering Fluid Reservoir*
Check fluid pressure. *See Power Steering System - Test*
2. Is pressure high?
YES - Renew pump. *See Repair, Power steering Pump*
If oil seal leaks persist after renewing the pump. *See Overhaul, Power Steering Box*
NO - *See Overhaul, Power Steering Box*

Symptom:-

Insufficient power assistance - castor return action normal.

1. Are tyres correct type and pressure?
NO - *See GENERAL SPECIFICATION DATA, Information, Wheels and Tyres*
YES - Continue.
2. Is fluid level correct?
NO - Check fluid level *See Repair, Power Steering Fluid Reservoir*
YES - Check system for air locks. *See Repair, Power Steering System - Bleed*
3. Is pressure correct?
NO - Check fluid pressure. *See Power Steering System - Test*
If pressure is not correct after bleeding the system, renew pump. *See Repair, Power Steering Pump*
YES - *See Overhaul, Power Steering Box*

Symptom:-

Steering heavy - stiff, poor castor return action.

1. Are tyres correct type and pressure?
NO - *See GENERAL SPECIFICATION DATA, Information, Wheels and Tyres*
YES - Check universal joints for seizure and correct alignment. *See Repair, Lower Steering Shaft and Universal Joints*
Check power steering box adjustments. *See Overhaul, Power Steering Box*
2. Is the power assistance satisfactory?
NO - See fault symptom **Insufficient assistance, (castor return action normal)**.
YES - Disconnect drag link from drop arm and check steering column and box for stiffness. *See Repair, Drag Link and Drag Link Ends*
3. Is the steering stiff with the drag link disconnected?
NO - Check steering ball joints for seizure and axle swivels lubrication and resistance. *See Repair, Drag Link and Drag Link Ends See FRONT AXLE AND FINAL DRIVE, Overhaul, Front Stub Axle, Constant Velocity Joint and Swivel Pin Housing Non ABS See FRONT AXLE AND FINAL DRIVE, Overhaul, Front Stub Axle, Constant Velocity Joint and Swivel Pin Housing ABS*
YES - Disconnect the lower steering shaft and check the column and box for stiffness. *See Repair, Lower Steering Shaft and Universal Joints*
4. Is the steering column stiff to turn when disconnected from the box?
NO - Remove and overhaul box. *See Overhaul, Power Steering Box*
YES - Adjust steering column. *See Stiff Steering Checklist*

**Symptom :-**

Steering excessively light/sensitive. Excessive freeplay at steering wheel.

1. Are steering box adjustments correct?
NO - **See Adjustment, Power Steering Box**



WARNING: Adjustments of steering box should not be required while in warranty period. If box is within warranty, it must be returned to manufacturer. No attempt must be made to introduce backlash.

YES - Suspect worn panhard rod or radius arm bushes Check condition of ball joints and the lower steering column shaft universal joints for wear. **See Repair, Lower Steering Shaft and Universal Joints**

Symptom :-

Steering vibration, road wheel shimmy - wobble.

Vibration through the steering linkage powerful enough to induce high frequency oscillation of the steering wheel, is generally caused by out of balance road wheels. However there are a number of other possible causes of this symptom which if severe, may be described as shimmy or wobble. Regardless of the terminology used by the owner/driver to describe the symptoms, the following diagnostic checks should be carried out in the order presented.

1. Check the tyres and balance of the road wheels. **See GENERAL SPECIFICATION DATA, Information, Wheels and Tyres See WHEELS AND TYRES, Fault diagnosis, Fault - Symptoms See WHEELS AND TYRES, Repair, Wheel Balancing**
2. Check the steering hydraulic damper function. **See Steering Damper**
3. Check steering column universal joints for wear and correct alignment. **See Repair, Lower Steering Shaft and Universal Joints**

4. Check steering linkage ball joints for wear, correct alignment and security, including steering box and tie rod. **See Steering Linkage Inspect**
5. Check all front suspension rubbers for wear. Check all fixing torques, including radius arm bushes, panhard rod and anti-roll [sway] bar. **See FRONT SUSPENSION, Repair, Panhard Rod See FRONT SUSPENSION, Repair, Radius Arm See FRONT SUSPENSION, Repair, Anti-Roll[Sway] Bar Assembly See FRONT SUSPENSION, Repair, Front Shock Absorber**
6. Fit new radius arm bushes using NTC 6860. Fit harmonic damper if vehicle has air suspension. Fit new nuts, bolts and washers.
7. **Coil spring vehicles only** - If problem persists fit damper kit STC 241 (2 off front) and STC 1474 (2 off rear). Road test vehicle.
8. Check the power steering box adjustments and operation. **See Overhaul, Power Steering Box**
9. Check the hub bearing end floats and determine the condition of the hub bearings. As applicable. **See FRONT AXLE AND FINAL DRIVE, Repair, Front Hub Assembly**
10. Check the resistance and condition of the swivels. **See FRONT AXLE AND FINAL DRIVE, Description and operation, Description**
If problem is not diagnosed: Repeat checks starting at 1.
11. Carry out a full steering geometry check. **See INTRODUCTION, Information, Steering**

STEERING STABILITY AND VEER UNDER BRAKING

Possible cause:

Incorrectly set, swivel pin bearing preload. There are three different settings for these bearings dependant on model year and if fitted with ABS brakes.

Remedy.

1. Establish model year of vehicle.
2. If fitted with or without antilock brakes.
3. Follow instructions to overhaul front stub axle, constant velocity joint and swivel pin non ABS, or with ABS as appropriate.
See FRONT AXLE AND FINAL DRIVE, Overhaul, Front Stub Axle, Constant Velocity Joint and Swivel Pin Housing Non ABS See FRONT AXLE AND FINAL DRIVE, Overhaul, Front Stub Axle, Constant Velocity Joint and Swivel Pin Housing ABS

1. GENERAL STEERING

1. Carry out visual and safety checks. **See Visual and Safety Checks**
2. Road test vehicle. **See Road Test Procedure**
3. Is problem resolved?
YES - end
NO - continue
4. Is problem stiff steering?
YES - **See Stiff Steering Checklist**
NO - Go to 6.
5. Is problem resolved?
YES - end
NO - go to 8.
6. Is problem steering niggles?
YES - Replace radius arm bushes, arm and axle. **See FRONT SUSPENSION, Repair, Radius Arm**
NO - go to 8.
7. Is problem resolved?
YES - end
NO - continue.
8. Centralise steering box. **See Adjustment, Centralise Steering Box**
9. Is problem resolved?
YES - end
NO - continue.
10. Check, adjust if necessary, steering geometry.
11. Is problem resolved?
YES - end
NO - continue.
12. Categorise the remaining problems into one or more of the following descriptions:
See 2. Steering Veer
See 3. Veer Under Braking
See 4. Directional Stability



2. STEERING VEER

From 1. GENERAL STEERING:

1. Vehicle veers, not under braking, swap front tyres side to side.
2. Is problem resolved?
YES - end
NO - continue.
3. Does vehicle now veer in other direction?
YES - fit new tyres
NO - continue.
4. Recentralise steering box. **See Adjustment, Centralise Steering Box**
5. Is problem resolved?
YES - end
NO - contact local technical office.

3. VEER UNDER BRAKING

From 1. GENERAL STEERING:

1. Vehicle veers under braking, bleed brake system.
2. Is problem resolved?
YES - end
NO - continue.
3. Check brake pads for glazing, and discs, axles etc for contamination.
4. Is problem resolved?
YES - end
NO - continue.
5. Check brake lines and hoses for deterioration. Replace as necessary.
6. Is problem resolved?
YES - end
NO - continue.
7. Contact local technical office.

4. DIRECTIONAL STABILITY

From 1. GENERAL STEERING:

1. Is directional stability concern when vehicle is towing?
YES - Check towing/vehicle loading parameters in Owner's Handbook.
NO - go to 3.
2. Is problem resolved?
YES - end
NO - continue.
3. Check condition of rear trailing link/chassis bushes.
4. Is problem resolved?
YES - end
NO - continue.
5. Check condition of front and rear shock absorbers. If in doubt change units in pairs, side to side.
6. Is problem resolved?
YES - end
NO - continue.
7. Check steering damper. **See Steering Damper**
8. Is problem resolved?
YES - end
NO - continue.
9. Check wheel balance
10. Is problem resolved?
YES - end
NO - contact local technical office.

POWER STEERING FLUID LEAKS

1. Is fluid level correct?
YES - go to 3.
NO - Refill or drain to correct level. Bleed system, check for leaks. **See Repair, Power Steering System - Bleed**
2. Is problem resolved?
YES - end
NO - continue.
3. Are hoses or joints leaking? Check on full lock with engine at 2000 rev/min.
YES - loosen and retorque joints.
NO - go to 6.
4. Does leak remain?
YES - change PAS pipe.
NO - end.
5. Does leak remain?
YES - suspect seal in component. Check and replace as necessary.
NO - end.
6. Is oil escaping from filler cap?
YES - bleed system. **See Repair, Power Steering System - Bleed**
NO - go to 8.
7. Is oil still escaping from filler cap?
YES - go back to 1.
NO - end.
8. Is oil leaking from PAS pump?
YES - go to 10.
NO - continue.
9. Is oil leaking from PAS box?
YES - go to 10.
NO - end.
10. Clean unit, add tracer dye to system. Retest
11. Is oil still leaking?
YES - establish leak point. Repair or replace unit as necessary.
NO - end.



POWER STEERING SYSTEM - EXCESSIVE NOISE

1. Is fluid level correct?
YES - go to 3.
NO - Refill or drain to correct level. Bleed system, check for leaks. **See Repair, Power Steering System - Bleed**
2. Is problem resolved?
YES - end
NO - continue.
3. Is pressure hose from pump to box touching body in a hard foul condition?
YES - reroute hose away from body.
NO - go to 5.
4. Does noise remain?
YES - continue.
NO - end.
5. Is noise a whistle or hiss on full lock?
YES - noise is not a fault unless excessive. Compare with other vehicles
NO - go to 8.
6. Is noise excessive?
YES - continue.
NO - end.
7. Change steering box and/or pump.
8. Is noise a squeal on full lock?
YES - check/reset drive belt tension. **See ENGINE, Repair, Drive Belt**
NO - go to 10.
9. Does squeal remain?
YES - drive belt contaminated, change belt.
NO - end.
10. Is noise a continuous moan?
YES - bleed PAS system. **See Repair, Power Steering System - Bleed**
NO - go to 13.
11. Does moan remain?
YES - do figure 8 manoeuvres.
NO - end.
12. Does moan remain?
YES - continue
NO - end.
13. Is noise an intermittent "grunt"?
YES - **See Power Steering System - Grunt**
NO - continue.
14. Is it a clunking noise?
YES - reset drive belt tension. **See ENGINE, Repair, Drive Belt**
NO - contact local technical office.
15. Does noise remain?
YES - Suspect suspension or drive train.
NO - end.

POWER STEERING SYSTEM - GRUNT

Steering box grunts intermittently when turning from lock to lock:

1. Is fluid level correct?
YES - go to 3.
NO - refill or drain to correct level. Bleed system, check for leaks. **See Repair, Power Steering System - Bleed**
2. Does grunt remain?
YES - continue
NO - end.
3. Is correct low pressure hose ANR 3152, steering box to reservoir fitted?
YES - go to 5.
NO - Fit correct hose.
4. Does grunt remain?
YES - continue
NO - end.
5. Purge box by doing figure 8 manoeuvres e.g. on car park, followed by 10 minutes normal road use.
6. Does grunt remain?
YES - Contact local technical office
NO - end.

VISUAL AND SAFETY CHECKS



WARNING: Before taking vehicle out on the public highway for road test, it is important that the following basic visual checks are carried out to ensure that the vehicle complies with legal requirements.

Tyres and wheel rims

1. Check and adjust tyre pressures. **See GENERAL SPECIFICATION DATA, Information, Tyre Pressures**
Note that this information refers to standard tyres fitted as original equipment.
2. Check condition of tyres. Inspect for signs of uneven wear, damage and feathering. Check tread depth.
3. Ensure that the tyre make, type and general condition are common across each axle.
4. Check wheel rims for signs of damage and excessive run out.
5. Carry out road test. **See Road Test Procedure**

ROAD TEST PROCEDURE

General steering/handling problems can usually be classified into one of the categories listed and ARE GENERALLY RELATED TO THE AGE, CONDITION AND USE OF THE VEHICLE.



WARNING: Ensure that all road tests are conducted by suitably qualified drivers in a safe and legal manner, and where local traffic conditions allow.

1. Carry out visual and safety checks. **See Visual and Safety Checks**

Confirm general nature of complaint with customer, simulating where possible the conditions under which the problem occurs. Carry out following road test procedure to establish the problem.

2. Steering load assessment - drive at 16 km/h (10 mph). Put 90° turn input into steering wheel, check self centering. The self centering should be equal on each lock BUT not necessarily return to exactly straight ahead without assistance from the driver.
3. Steering assessment - drive at 64 km/h (40 mph) on a straight FLAT road (no camber), check for steering veer. The vehicle should follow a straight path with NO tendency to follow a curved path. If vehicle veers towards the kerb, vehicle may be 'camber sensitive'. A small amount of veer in direction of camber is acceptable.
4. Directional stability assessment - drive at 112 km/h (70 mph) or maximum legal speed on a straight flat road. Carry out a normal lane change. Vehicle should quickly settle into a new straight path.
5. Braking assessment (medium effort) - drive at 96 km/h (60 mph) on a straight flat road. Apply steady medium braking effort, noting any tendency to veer. Carry out brake test three times, if a veer is consistently noted carry out a braking efficiency test on a rolling road.
6. Braking assessment (full effort) - drive at 96 km/h (60 mph) on a straight flat road. Apply full braking effort, noting any tendency to veer. Carry out brake test three times, if a veer is consistently noted carry out a braking efficiency test on a rolling road.

If the symptom described by the customer is stiff steering or steering niggles, carry out stiff steering procedure. **See Stiff Steering Checklist**

If not proceed with basic checks and adjustments. **See Visual Check and Basic Adjustments**



STIFF STEERING CHECKLIST



NOTE: Having completed visual checks and steering assessment and confirmed that vehicle steering load is incorrect carry out the following procedure in order shown.

Steering wheel 'torque to turn' loads

1. Raise vehicle so both front wheels free.
2. With engine off, centralise steering wheel, and remove air bag, if fitted or steering wheel pad. Using torque wrench on column nut, check torque required to turn the steering wheel one turn in each direction.
3. Record readings obtained in each direction. Compare figures obtained with the specified figures:

Without ABS **4.40 Nm**.

With ABS **4.65 Nm**.



NOTE: If figures are in excess of those specified carry out steering box tie bar reset below. If figures are as specified. See *Visual Check and Basic Adjustments*

Steering box tie bar reset

1. Loosen the three tie bar fixings one complete turn.
2. Drive vehicle carefully a short distance (within the dealership) applying full lock in both directions in order to settle steering components. Drive vehicle over speed bumps and include harsh braking if possible.



WARNING: Do not drive on public highway.

3. Near end of 2. ensure vehicle is driven in a straight line on level ground and halted.
4. Tighten panhard rod mounting arm nut, **110 Nm**.
5. Tighten the two fixings tie bar to steering box, **81 Nm**.
6. Recheck steering wheel torque to turn. If torque reading is still greater than specified, carry out steering shaft universal joint lubrication.

Lower steering shaft universal joint lubrication

1. Check lower steering shaft is correctly phased. See *Repair, Lower Steering Shaft and Universal Joints*
2. Lubricate universal joints with an anti-seizure type penetrating spray. Work the joints to ensure full penetration of the spray by driving vehicle and steering from lock to lock.
3. If steering stiffness still persists carry out swivel pin preload setting.

Swivel pin preload setting

The swivel pin preload setting must be checked and set following the workshop manual procedure.

1. NON ABS vehicles. See *FRONT AXLE AND FINAL DRIVE, Overhaul, Front Stub Axle, Constant Velocity Joint and Swivel Pin Housing Non ABS*
Note that a pull load of 1.16 - 1.46 kg is required after the axle shaft and swivel housing seal have been removed.
2. ABS vehicles. See *FRONT AXLE AND FINAL DRIVE, Overhaul, Front Stub Axle, Constant Velocity Joint and Swivel Pin Housing ABS*
Note that a torque to turn of 2.0 - 2.8 Nm is required after the axle shaft and swivel housing seal have been removed.
3. If steering stiffness still persists carry out steering column alignment.

Steering column alignment

1. Place vehicle on level ground. Measure the angle of lower steering shaft using a Pernumeter placed on the shaft between the universal joints. The angle should measure a minimum of 12°.
2. If necessary, realign the shaft. Release the five fixings securing the steering column. Position column as required. Tighten the fixings evenly, **27 Nm**.
3. Loosen the three screws securing lower steering column shroud to upper shroud ensure lower shroud is clipped to upper shroud. Reposition shroud, tighten screws.
4. Recheck steering column angle.

Steering box adjustment

1. Check steering box adjustment. **See Adjustment, Power Steering Box**

Steering damper check

1. Check condition of steering damper **See Steering Damper**

VISUAL CHECK AND BASIC ADJUSTMENTS



NOTE: It is important that the following instructions are carried out in the sequence shown and the results recorded.

1. Road springs - check that road springs are correctly seated and are to correct specification for vehicle. For spring specification. **See GENERAL SPECIFICATION DATA, Information, Road Springs Data**
2. Ride height - measure trim height from wheel centre to wheelarch eyebrow. Record results on data sheet.
3. Check/top up power steering fluid **See Repair, Power Steering Fluid Reservoir**
4. Check tension and condition of drive belt. **See ENGINE, Repair, Drive Belt**
5. Track rod/drag link - check condition of track rod, drag link and ball joints. **See Repair, Drag Link and Drag Link Ends**
If either component is damaged, check operation of steering damper and steering box for smoothness. Replace all damaged or worn components that impair the operation of the steering system.
6. Suspension bushes - examine all steering and suspension bushes for signs of wear and deterioration. Also check all fixings for torque relaxation. Tighten to correct torque value. **See FRONT SUSPENSION, Specifications, torque, Torque Values**
7. Oil leaks - check front and rear axle hubs for leak and repair as necessary.
8. Brake system - check brake system for leaks, pipe condition, pad wear/contamination, disc wear/condition and ABS sensors for correct fitting.
9. Hub end float - check movement in the hubs by rocking the wheels.
10. Check front wheel alignment. Vehicles displaying a tendency to veer more than considered allowable, it is permissible to set the front track to parallel.
11. Having completed all the above checks and adjustments, road test vehicle. **See Road Test Procedure**
Attempting to reproduce the symptoms established earlier. If symptoms still exist refer to relevant Diagnostic Chart.



STEERING LINKAGE INSPECT



NOTE: When inspecting steering linkages and ball joints for wear the following items must be checked.

Steering ball joints

1. Check ball joint rubber boots for security, signs of cracking or deterioration.
2. Check ball joint assemblies for seizure i.e. no movement on ball joint and associated assemblies.
3. Check for excessive wear. This will be evident as extreme movement on track rod and steering linkages. Renew parts as necessary. **See Repair, Track Rod and Linkage See Repair, Drag Link and Drag Link Ends**

Steering linkages

4. Check all linkages for wear, deterioration and damage. Renew parts as necessary. **See Repair, Track Rod and Linkage See Repair, Drag Link and Drag Link Ends**



POWER STEERING BOX

Service repair no - 57.10.13



WARNING: Adjustments of steering box should not be required while in warranty period. If box is stiff or tight and within warranty, it must be returned to manufacturer. No attempt must be made to introduce backlash.

1. Apply park brake, select 'P' in automatic transmission and chock wheels. Support chassis front on axle stands.
2. Remove engine undertray.
3. Disconnect drag link from steering drop arm.
4. Check torque to turn. *See Fault diagnosis, Stiff Steering Checklist*
5. Centralise steering box. *See Centralise Steering Box*



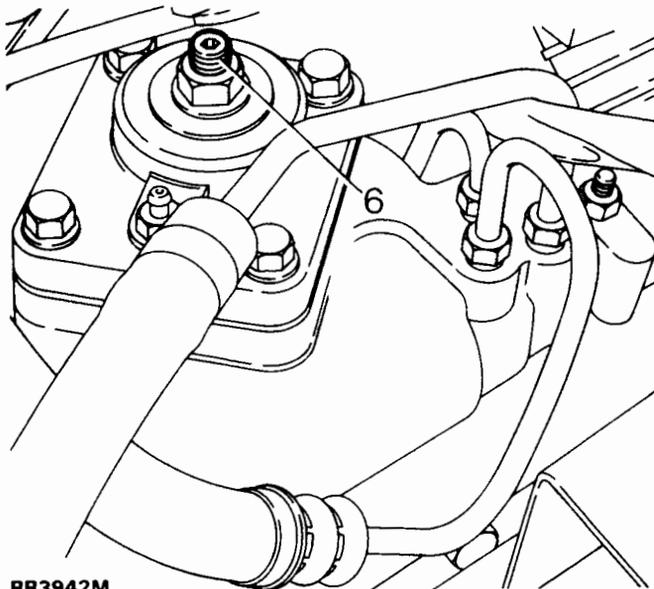
NOTE: Only check for no backlash when steering box is in central position.



NOTE: If steering wheel is not straight, it should be repositioned. *See Repair, Steering Wheel*

The adjustment of the steering box ensures any preload or end float present on centre is removed.

6. The adjustment is obtained by rocking the drop arm about centre whilst an assistant slowly tightens the steering box adjuster screw.



RR3942M

7. Tighten the locknut when all backlash has been removed.
8. Repeat the check for backlash. If backlash exists loosen locknut and repeat adjustment procedure.
9. Turn steering wheel lock to lock and check no tightness exists.
10. Ensure front wheels are aligned and in straight ahead position. *See Front Wheel Alignment*
11. Adjust drag link 924 mm between ball joint centres.
12. Connect drag link. Tighten to **40 Nm**.
13. Lower vehicle to ground level and remove chocks.
14. Road test vehicle. *See Fault diagnosis, Road Test Procedure*



NOTE: If steering wheel is not in straight ahead position when vehicle is travelling in a straight line, drag link length is incorrect and is pushing drop arm away from central position.

Drag link adjust

15. Right hand drive vehicles - if steering wheel is to right, drag link is too long. If steering wheel is to left drag link is too short.
Left hand drive vehicles - if steering wheel is to right, drag link is too short. If steering wheel is to left drag link is too long.
16. Adjust drag link until steering wheel points straight ahead when vehicle is travelling in a straight line.

CENTRALISE STEERING BOX

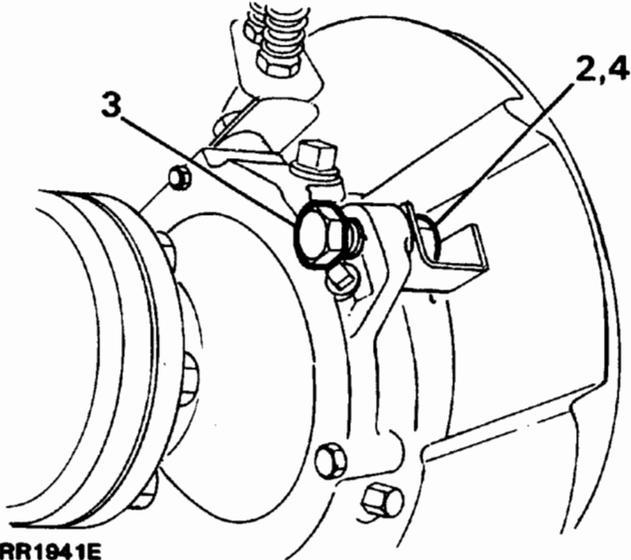
1. To centralise the box, insert a suitable peg (hole size 8.06 mm) into the rear of the drop arm and into the steering box casing to enable rapid and accurate setting on centre.

STEERING LOCK STOPS

Service repair no - 57.65.03

Check

1. Measure clearance between tyre wall and radius arm at full lock. This must be 20 mm.



RR1841E

Adjust

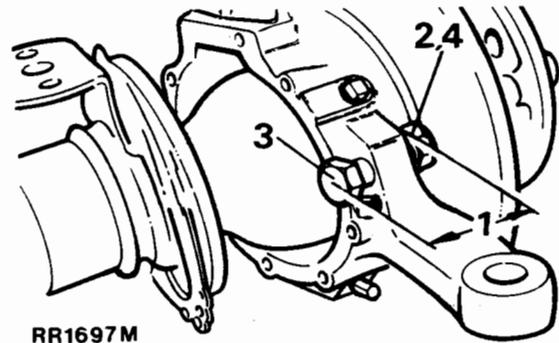
2. Loosen stop bolt locknut.
3. Turn stop bolt as required.
4. Tighten locknut.
5. Check clearance between tyre wall and radius arm on each lock.



NOTE: Alternatively lock stop adjustment may be carried out using following procedure.

Check

1. Measure stop bolt protrusion as shown in RR1697M. This must be 40.5 mm.



RR1697M

Adjust

2. Loosen stop bolt locknut.
3. Turn stop bolt as required.
4. Tighten locknut.
5. Check wheel position at full lock.



FRONT WHEEL ALIGNMENT

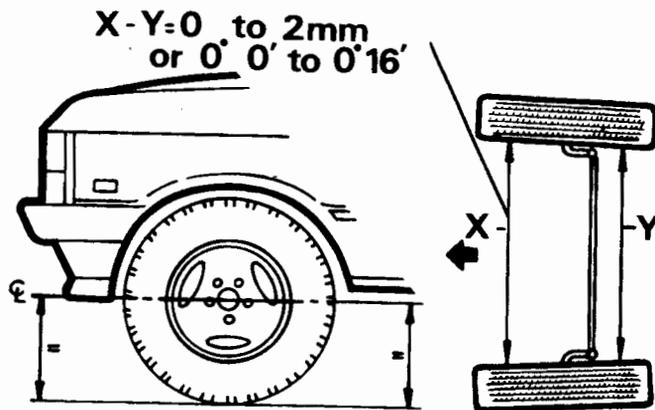
Service repair no - 57.65.01

Checking Toe-out dimensions

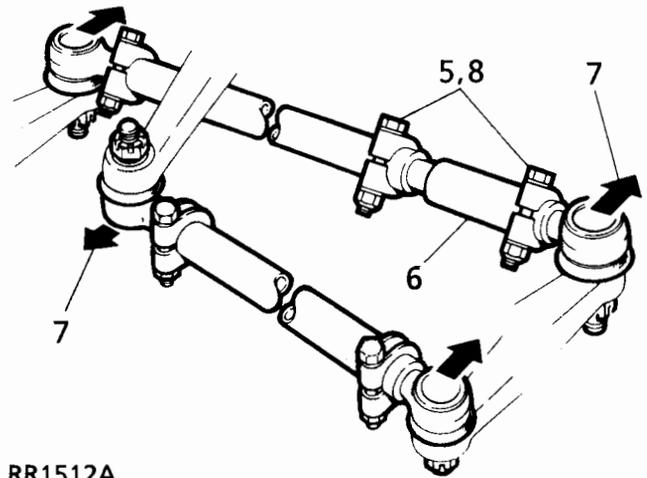


NOTE: No Adjustment is provided for castor, camber or swivel pin inclinations.

1. Set vehicle on level ground with road wheels positioned straight ahead.
2. Push vehicle back and forwards to settle linkage.
3. Measure toe-out at horizontal centre-line of wheels.
4. Check tightness of clamp bolt fixings. Tighten to **14 Nm**.



RR2172E



RR1512A

Adjust

5. Loosen adjuster sleeve clamp.
6. Rotate adjuster to lengthen or shorten track rod.
7. Check toe-out setting as instructions 1 to 4. When toe-out is correct, tap steering linkage ball joint, in directions of arrows shown, to maximum of their travel. This ensures full unrestricted working travel.
8. Tighten clamp bolts to **14 Nm**.

POWER STEERING PUMP DRIVE BELT

Service repair no - 57.20.01

Adjust



NOTE: For details of drive belt adjust procedure See ENGINE, Repair, Drive Belt



POWER STEERING FLUID PIPES

Service repair no - 57.15.21

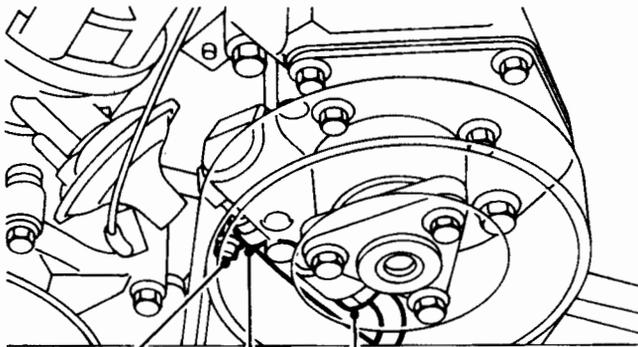


CAUTION: If any joints are disconnected, it is essential that open pipe and ports are plugged to prevent ingress of dirt.

The following procedures must be followed when refitting fluid pipes:

Power steering pump

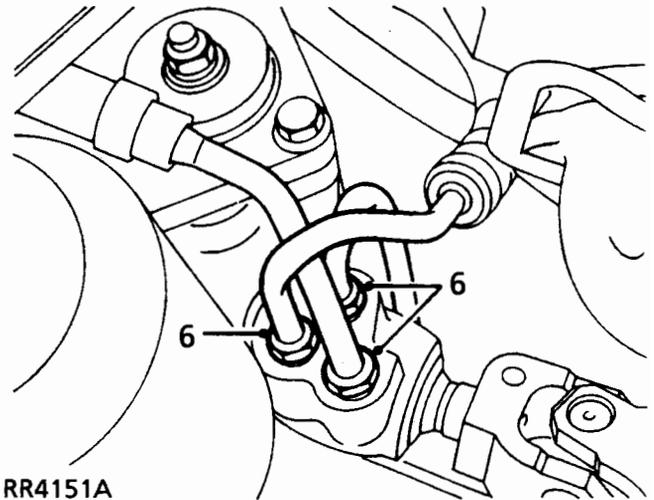
1. Remove plugs, place clamp on feed hose.



RR4150

V8i Steering pump illustrated

2. Push hose onto pump.
3. Hold clamp in position, Tighten to **3 Nm**.
4. Fit high pressure union into pump.
5. Hold pipe in correct position. Tighten to **20 Nm**.

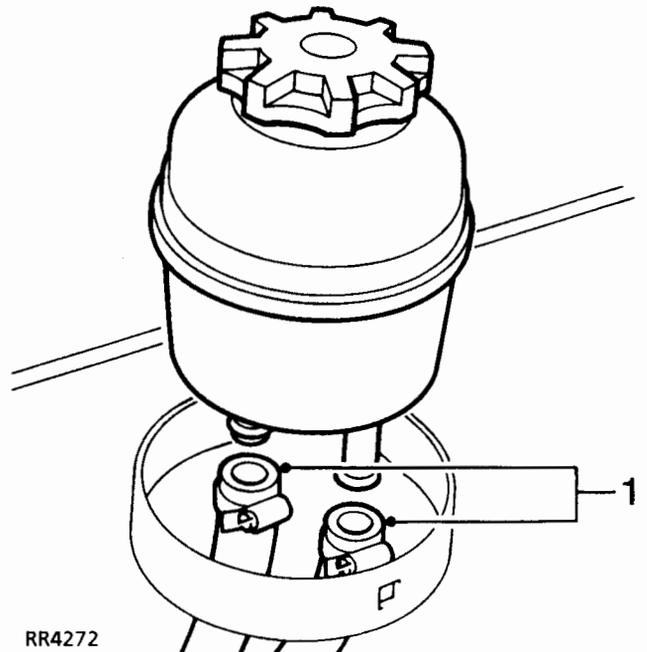


RR4151A

6. Remove plugs and refit pipes to steering box, leave fingertight.
7. Tighten to torque: 16mm thread **20 Nm**.
14mm thread **15 Nm**.

Power steering reservoir

1. Remove plugs and refit pipes and clamps.



RR4272

2. Tighten clamps to **3 Nm**.

POWER STEERING BOX

Service repair no - 57.10.01

General precautions

1. Whenever any part of system, is removed or disconnected, utmost cleanliness must be observed.
2. Disconnected ports and hoses must be plugged to prevent ingress of dirt. If metal sediment is found in system, establish cause rectify and flush system.
3. Do not start engine until reservoir is full as pump will be damaged.
4. Metric pipe fittings are used with 'O' ring pipe ends on fittings to steering box.
5. Follow normal 'O' ring replacement procedure whenever pipes are disconnected.
6. Ensure compatible metric components when fitting replacement pipes.



CAUTION: Before removing any parts of steering linkage, it is imperative that road wheels are positioned straight ahead. Then steering wheel removed to prevent rotary coupler being wound up or damaged.



CAUTION: After refitting steering linkage parts follow correct procedure to ensure that road wheels, steering box and steering wheel are correctly positioned relative to each other when in straight ahead condition. If steering wheel requires repositioning, ensure that drive pegs on rotary coupler are correctly positioned before steering wheel is replaced.

This ensures drive pegs locate in their holes in rear of steering wheel.

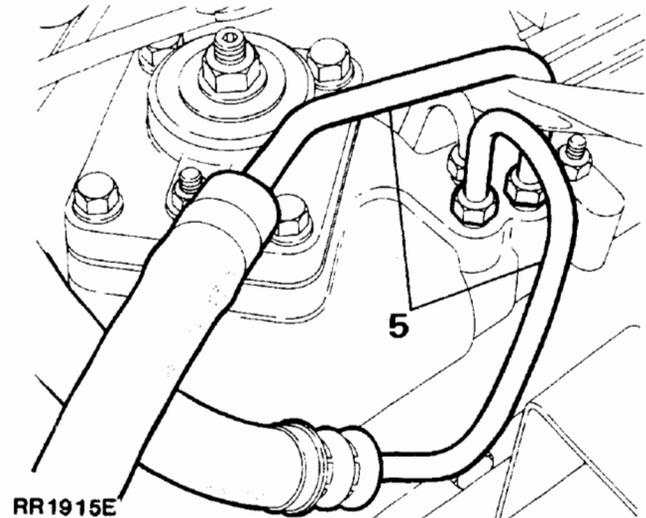
After final alignment connect rotary coupler multiplug, tighten steering wheel securing nut and fit air bag - if fitted or steering wheel trim pad.



NOTE: When drag link is disconnected from steering box, travel available at steering wheel to each full lock is not equal.

Remove

1. Site vehicle on level surface.
2. Open bonnet[hood].
3. Remove filler cap from power steering fluid reservoir.
4. Clean steering box.
5. Disconnect feed and return pipes from steering box.



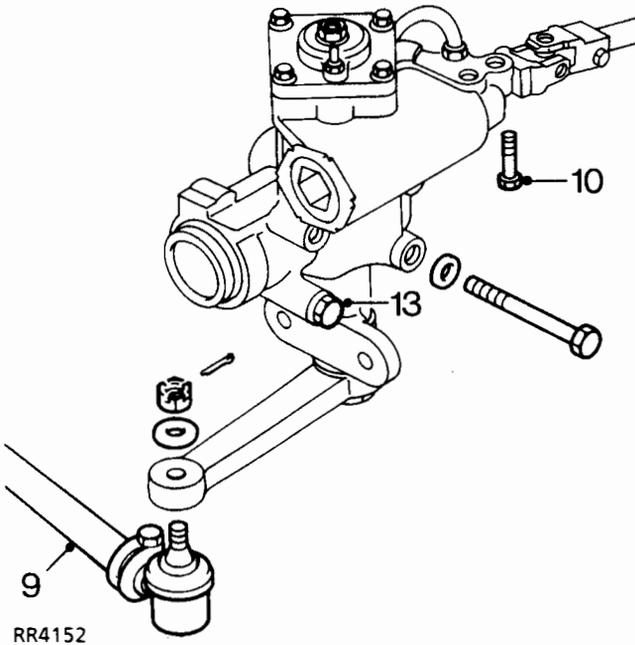
6. Plug open pipes and steering box ports to prevent ingress of dirt.
7. Support chassis front on axle stands. Or raise vehicle on a hoist.



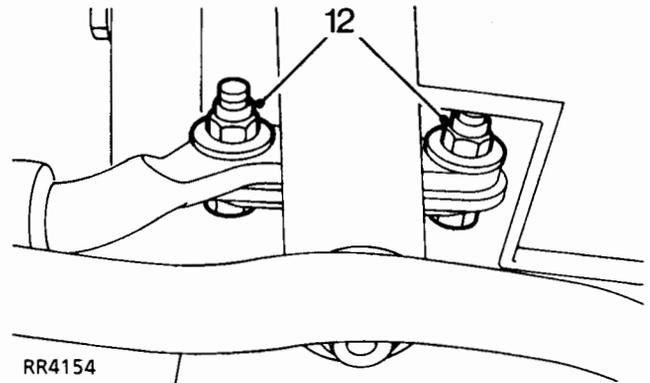
WARNING: Ensure wheels are chocked, parking brake is applied, and low range selected.



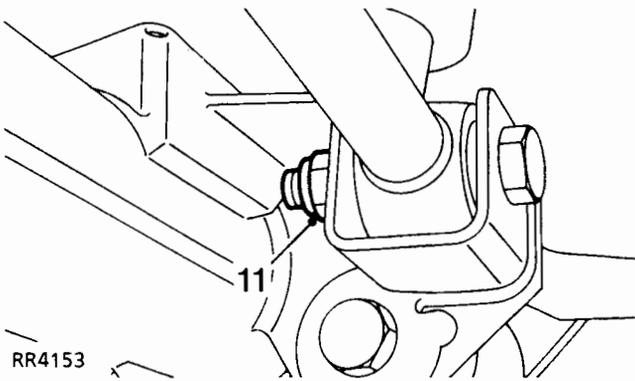
8. Remove undertray



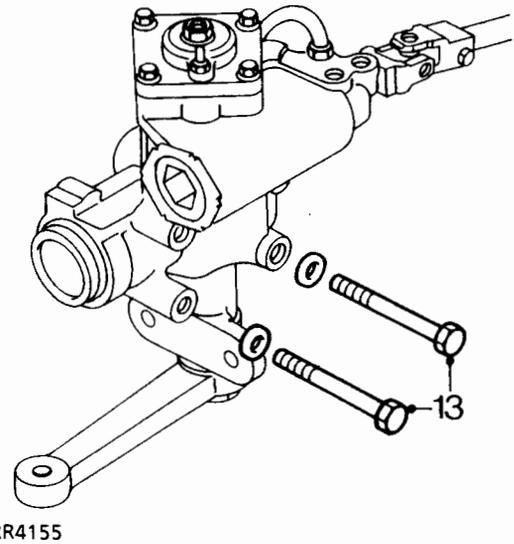
- 9. Disconnect drag link from drop arm using a suitable extractor.
- 10. Remove pinch bolt securing lower shaft universal joint to power steering box.



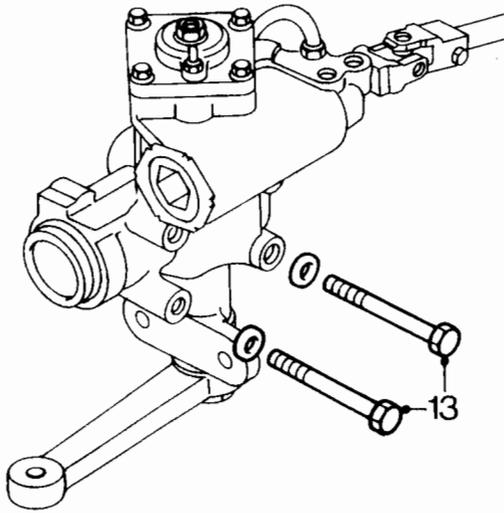
- 12. Remove bolts securing tie bar, move tie bar aside.



- 11. Loosen but do not remove nut securing tie bar to mounting.



- 13. Remove bolts securing power steering box to chassis side member.
- 14. Withdraw power steering box.



RR4155



CAUTION: Do not maintain this pressure for more than 30 seconds in any one minute, to avoid oil overheating and possible seal damage.

26. Test drive vehicle: using both full lock directions, to settle steering components. If possible, drive vehicle over speed bumps and include harsh braking.



WARNING: Do not test drive vehicle on public highway.

27. Drive vehicle in a straight line on level ground and stop.
28. Tighten tie bar to mounting nut to **110 Nm**.
29. Tighten bolts securing tie bar to **81 Nm**.
30. Ensure steering wheel is correctly aligned when wheels are positioned straight ahead.
31. If necessary reposition steering wheel. **See Steering Wheel**
32. Road test vehicle.

Refit

15. Position steering box to chassis side member, ensuring locating peg is engaged. Tighten bolts to **81 Nm**.
16. Fit pinch bolt and nut securing universal joint to power steering box. Tighten to **25 Nm**.
17. Position tie bar, tighten bolts and nut to **81 Nm, starting with tie bar to mounting nut, then loosen nut and bolts by one complete turn.**
18. Check steering box, adjust if necessary. **See Adjustment, Power Steering Box**
19. Refit drag link to drop arm tighten nut to **40 Nm**.
20. Fit undertray.
21. Lower vehicle to ground.
22. Remove plugs and refit pipes to steering box. Tighten 16mm thread to **20 Nm**.
14mm thread to **15 Nm**.
23. Remove filler cap. Fill reservoir to oil level mark on dipstick. Use recommended fluid. **See LUBRICANTS, FLUIDS AND CAPACITIES, Information, Recommended Lubricants and Fluids** and bleed power steering system. **See Power Steering System - Bleed**
24. Recheck fluid level and replace cap.
25. With engine running, test steering system for leaks by holding steering in both full lock directions.



POWER STEERING SYSTEM - BLEED

Service repair no - 57.15.02

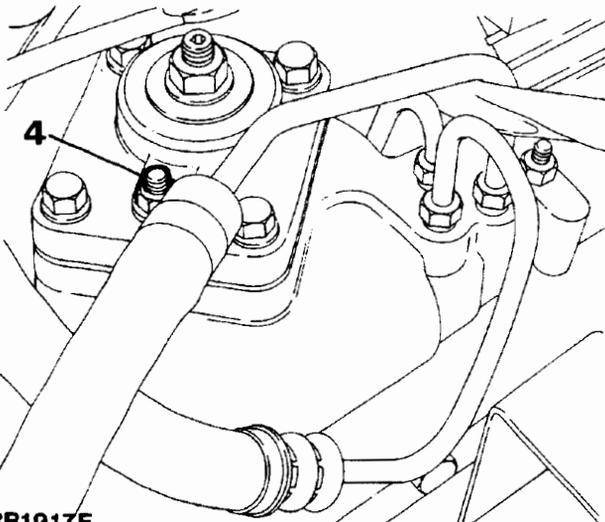
1. Ensure fluid in reservoir reaches dipstick maximum.
2. Run engine to normal operating temperature.
3. Recheck and correct reservoir fluid level.



NOTE: During instructions 4 to 6, maintain maximum fluid level in reservoir. Do not increase engine speed or move steering wheel.

wheel.

4. With engine at idle speed, loosen bleed screw. When fluid seeps past bleed screw retighten screw.



RR1017E

5. Check fluid level.
6. Clean away fluid around bleed screw.
7. Check hose connections, pump and steering box for fluid leaks by holding steering on full lock in both directions.



CAUTION: Do not maintain this pressure for more than 30 seconds in any one minute to avoid overheating fluid and possibly damaging seals.

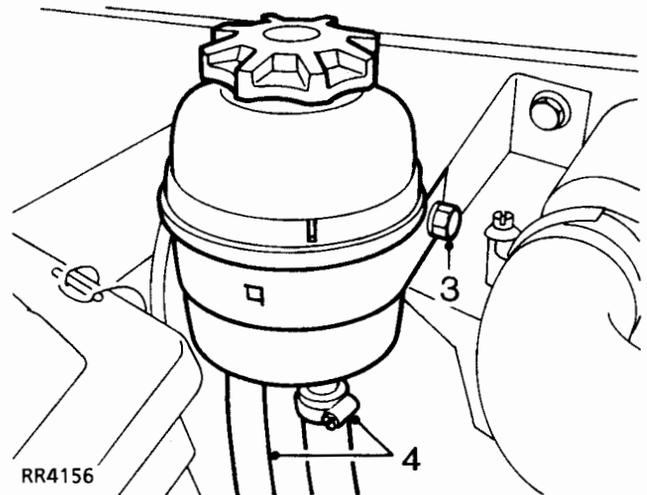
8. Carry out road test.

POWER STEERING FLUID RESERVOIR

Service repair no - 57.15.08

Remove

1. Remove undertray.
2. Position drain tin beneath reservoir.



RR4156

3. Loosen mounting bracket clamp bolt, raise reservoir to gain access to pipe clamps.
4. Loosen clamps, disconnect feed and return hoses from reservoir, allow fluid to drain.

CAUTION: Plug the connections.



5. Remove reservoir.



CAUTION: Discard fluid drained from system. Do not allow fluid to contact paintwork, if spilled, remove fluid and clean area with warm water.

Refit

6. Position reservoir, connect feed and return hoses and tighten clamps to **3 Nm**.
7. Fit reservoir in clamp, tighten clamp bolt.
8. Fill reservoir to 'MAX' mark on dipstick with power steering fluid. **See LUBRICANTS, FLUIDS AND CAPACITIES, Information, Recommended Lubricants and Fluids**
9. Fit undertray.
10. Bleed power steering system. **See Power Steering System - Bleed**

POWER STEERING PUMP DRIVE BELT

Service repair no - 57.20.02



NOTE: For details of drive belt remove and refit. **See ENGINE, Repair, Drive Belt**

POWER STEERING PUMP - V8i

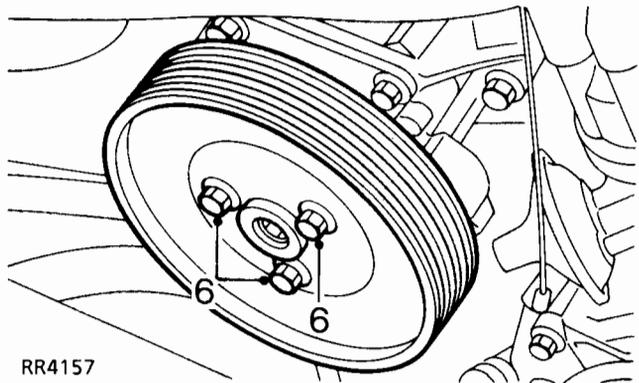
Service repair no - 57.20.14



NOTE: The power steering pump is not serviceable. Fit new pump if worn or damaged.

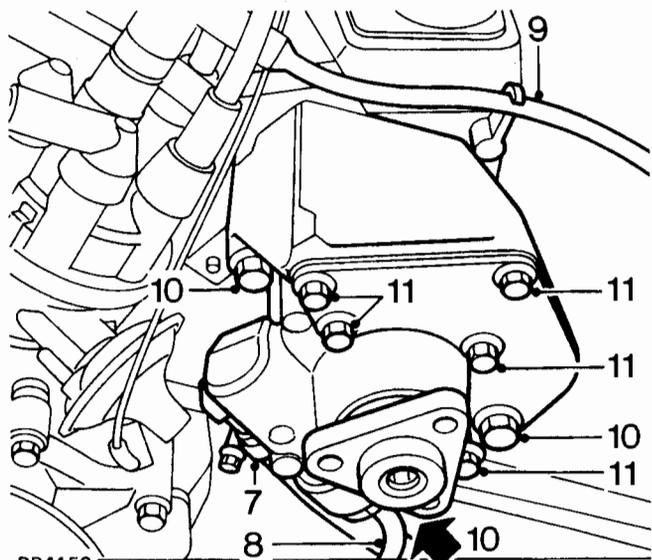
Remove

1. Disconnect battery negative lead.
2. Remove drive belt from steering pump. **See ENGINE, Repair, Drive Belt**
3. Remove undertray.
4. Remove fan blades and viscous coupling. **See COOLING SYSTEM, Repair, Viscous Coupling, Fan Blades, Pulley and Fan Cowl**
5. Position drain tin beneath steering pump.



RR4157

6. Using a 9 mm Allen key to restrain steering pump pulley, remove 3 bolts securing pulley to pump; remove pulley.



RR4158



7. Loosen clamp securing reservoir hose to steering pump; disconnect hose.
8. Disconnect high pressure pipe from steering pump.



CAUTION: Plug the connections.

9. Release ht lead from clip
10. Remove 3 bolts securing steering pump. Remove pump and recover engine lifting bracket.



NOTE:
Do not carry out further dismantling if component is removed for access only.

11. Remove 5 bolts securing front mounting plate.
12. Fit front mounting plate to replacement steering pump. Tighten bolts to **9 Nm**.

Refit

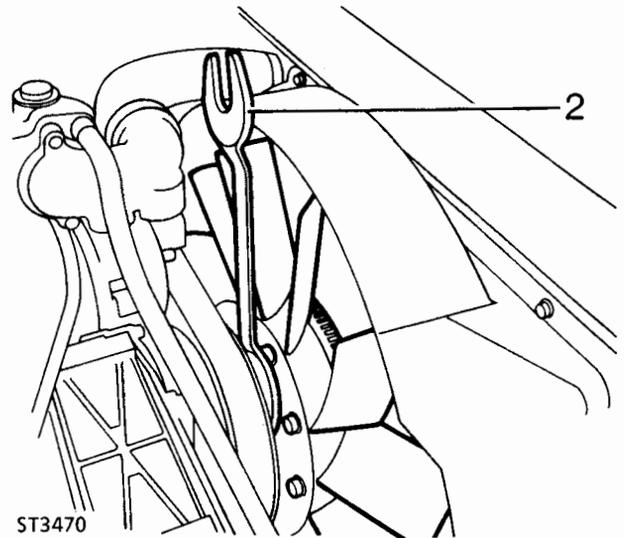
13. Position steering pump and engine lifting plate, fit bolts. Tighten to **35 Nm**. Secure ht lead in clip.
14. Connect high pressure pipe to steering pump, tighten union to **20 Nm**.
15. Connect reservoir hose to steering pump. Tighten clamp to **3 Nm**.
16. Position pulley to pump, coat threads of bolts with Loctite 242.
17. Restrain pulley using a 9 mm Allen key, fit bolts. Tighten to **10 Nm**.
18. Fit drive belt. **See ENGINE, Repair, Drive Belt**
19. Fit fan blades and viscous coupling. **See COOLING SYSTEM, Repair, Viscous Coupling, Fan Blades, Pulley and Fan Cowl**
20. Fit undertray.
21. Reconnect battery negative lead.
22. Bleed power steering system. **See Power Steering System - Bleed**

POWER STEERING PUMP - Tdi

Service repair no - 57.20.14

Remove

1. Remove fan blades and viscous coupling. **See COOLING SYSTEM, Repair, Viscous Coupling, Fan Blades, Pulley and Fan Cowl**



2. Restrain steering pump pulley, loosen but do not remove 3 bolts securing pulley.
3. Remove drive belt. **See ENGINE, Repair, Drive Belt**
4. Remove 3 bolts securing steering pump pulley, remove pulley.
5. Remove undertray.
6. Position drain tin beneath steering pump.

7. Loosen clamp securing reservoir hose to steering pump, disconnect hose.
8. Disconnect high pressure pipe from steering pump.

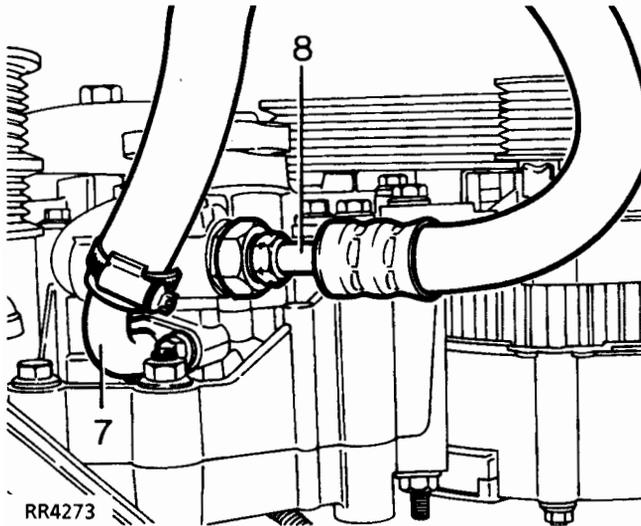


CAUTION: Plug the connections.

9. Remove 4 bolts securing steering pump to mounting bracket, remove pump.



NOTE:
Do not carry out further dismantling if component is removed for access only.



10. Remove 3 bolts securing mounting plate to pump, remove plate.
11. Fit mounting plate to replacement steering pump. Tighten bolts to **9 Nm**.

Refit

12. Position steering pump, fit 3 bolts. Tighten to **35 Nm**.
13. Connect high pressure pipe to steering pump. Tighten to **20 Nm**.
14. Connect reservoir hose to steering pump. Tighten clamp to **3 Nm**.
15. Position pulley to steering pump, coat threads of bolts with Loctite 242; fit but do not fully tighten 3 bolts.
16. Fit drive belt. *See ENGINE, Repair, Drive Belt*
17. Restrain steering pump pulley, tighten bolts to **10 Nm**.
18. Fit fan blades and viscous coupling. *See COOLING SYSTEM, Repair, Viscous Coupling, Fan Blades, Pulley and Fan Cowl*
19. Fit undertray.
20. Bleed power steering system. *See Power Steering System - Bleed*



LOWER STEERING SHAFT AND UNIVERSAL JOINTS

Service repair no - 57.40.25



CAUTION: Before removing any parts of steering linkage, it is imperative that road wheels are positioned straight ahead. Then steering wheel removed to prevent rotary coupler being wound up or damaged.



CAUTION: After refitting steering linkage parts follow correct procedure to ensure that road wheels, steering box and steering wheel are correctly positioned relative to each other when in straight ahead condition. If steering wheel requires repositioning, ensure that drive pegs on rotary coupler are correctly positioned before steering wheel is replaced.

This ensures drive pegs locate in their holes in rear of steering wheel.

After final alignment connect rotary coupler, tighten steering wheel securing nut and fit air bag module - if fitted or steering wheel trim pad.

Remove

1. Ensure road wheels are straight ahead.
2. Remove pinch bolt securing top universal joint to steering column.
3. Remove 2 pinch bolts securing lower universal joint.
4. Move lower shaft up to release lower universal joint from steering box splines. Remove lower shaft.
5. Remove universal joint from lower shaft.



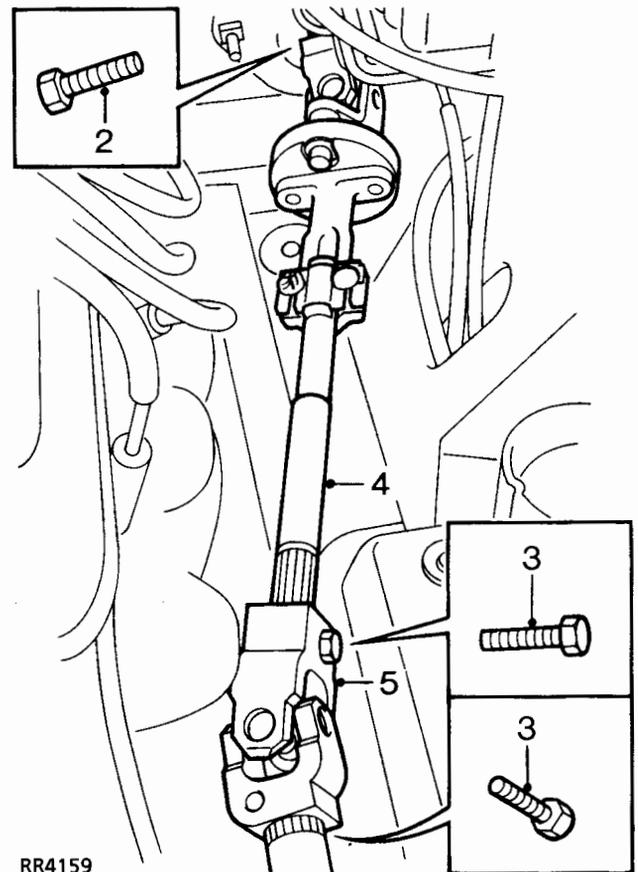
NOTE: Do not dismantle upper coupling joint. Steering shaft, rubber coupling and top universal joint is only available as an assembly.

6. Inspect lower universal joint for wear and excessive play, renew if necessary.
7. Inspect top universal joint and rubber coupling, renew lower shaft as an assembly if necessary.
8. Inspect universal joints for stiffness, lubricate if necessary.



NOTE: Prior to fitting a replacement steering shaft check the following:

9. Release stud fasteners securing heat shield (if fitted).



RR4159

10. Check that indicator clip coloured red is fully inserted under head of compression joint bolt.



WARNING: If clip is displaced, no attempt must be made to drive clip into engagement, a new shaft assembly must be fitted.

11. Secure heat shield stud fasteners (if fitted).

Refit



NOTE: Fit universal joints so pinch bolt holes line up with flat on shaft.

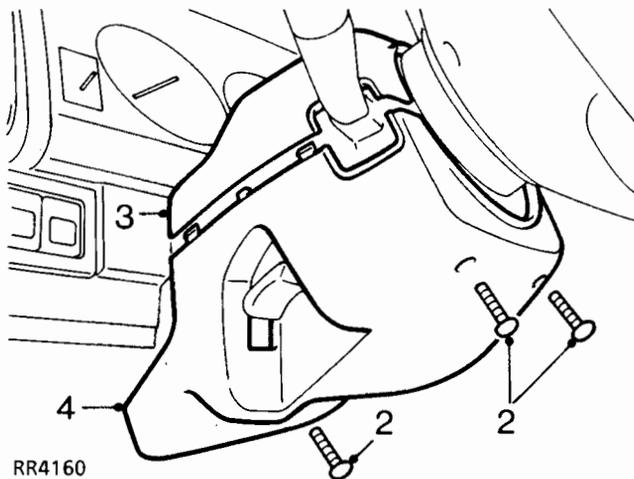
12. Position lower universal joint on shaft.
13. Position shaft assembly onto steering column. Move assembly up spline to enable lower universal joint to fit onto steering box splines.
14. Align bolt holes with grooves in splines. Fit pinch bolts. Tighten to 25 Nm.

STEERING COLUMN SHROUD

Service repair no - 57.40.29

Remove

1. Disconnect battery negative lead.



2. Remove 3 screws securing shroud.
3. Carefully release upper shroud from lower.
4. Manoeuvre lower shroud clear of steering column.

Refit

5. Position upper and lower shrouds to steering column ensuring plastic tags on lower shroud are correctly located. Clip both halves of shroud together.
6. Fit and tighten 3 screws.

STEERING WHEEL

Service repair no - 57.60.01



CAUTION: Prior to commencing work on vehicles fitted with an air bag, See *SUPPLEMENTARY RESTRAINT SYSTEM, Description and operation,*



CAUTION: Before removing any parts of steering linkage, it is imperative that road wheels are positioned straight ahead. Then remove steering wheel to prevent rotary coupler being wound up or damaged.



CAUTION: After refitting steering linkage parts follow correct procedure to ensure that road wheels, steering box and steering wheel are correctly positioned relative to each other when in straight ahead condition. If steering wheel requires repositioning, ensure that drive pegs on rotary coupler are correctly positioned before steering wheel is replaced.

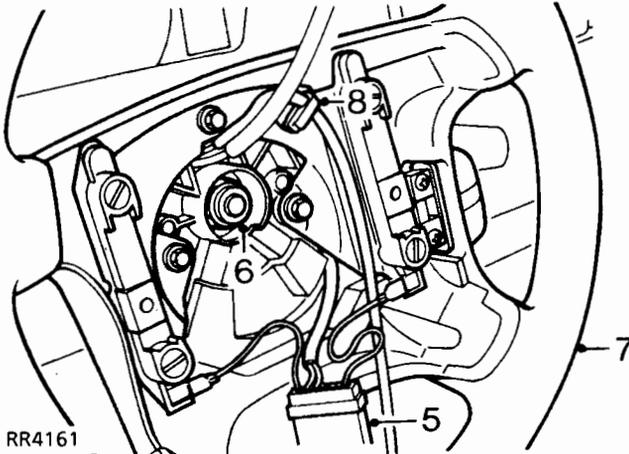
This ensures drive pegs locate in their holes in rear of steering wheel.

After final alignment connect rotary coupler multiplug, tighten steering wheel securing nut and fit air bag - if fitted or steering wheel trim pad.



Remove

1. Disconnect battery negative lead.
2. Position road wheels straight ahead so steering wheel can be correctly re-assembled.
3. **Airbag fitted:** Remove air bag. **See SUPPLEMENTARY RESTRAINT SYSTEM, Repair, Driver's Airbag Module**
4. Remove trim pad from steering wheel, disconnect Lucars from horn button.



RR4161

5. Disconnect rotary coupler multiplug.
6. Loosen but do not remove retaining nut.
7. Release steering wheel from taper, remove retaining nut and washer.
8. Release harness from retaining clip.
9. Withdraw steering wheel whilst at the same time feeding harness through wheel hub.



CAUTION: Prevent rotation of rotary coupler once steering wheel is removed. Secure in position with adhesive tape.



NOTE:
Do not carry out further dismantling if component is removed for access only.

Refit

10. Recheck road wheels are positioned straight ahead.
11. Position steering wheel to column, feed harness through wheel hub.
12. Remove adhesive tape securing rotary coupler.
13. Locate rotary coupler drive pegs and indicator switch self-cancel pegs in steering wheel hub, push wheel fully onto taper.
14. Fit steering wheel nut. Tighten to **50 Nm**.
15. Connect rotary coupler multiplug.
16. Non airbag module: Fit horn push assembly, connect Lucars to horn button, secure harness in clip.
17. Fit airbag module - if fitted. **See SUPPLEMENTARY RESTRAINT SYSTEM, Repair, Driver's Airbag Module**
18. Reconnect battery negative lead.

UPPER STEERING COLUMN

Service repair no - 57.40.01



NOTE: Steering column assembly is not a serviceable component.



CAUTION: Before removing any parts of steering linkage, it is imperative that road wheels are positioned straight ahead. then steering wheel removed to prevent rotary coupler being wound up or damaged.



CAUTION: After refitting steering linkage parts follow correct procedure to ensure that road wheels, steering box and steering wheel are correctly positioned relative to each other when in straight ahead condition. if steering wheel requires repositioning, ensure that drive pegs on rotary coupler are correctly positioned before steering wheel is replaced.

This ensures drive pegs locate in their holes in rear of steering wheel.

After final alignment, connect rotary coupler multiplug, tighten steering wheel securing nut and fit airbag - if fitted or steering wheel trim pad and horn push assembly.

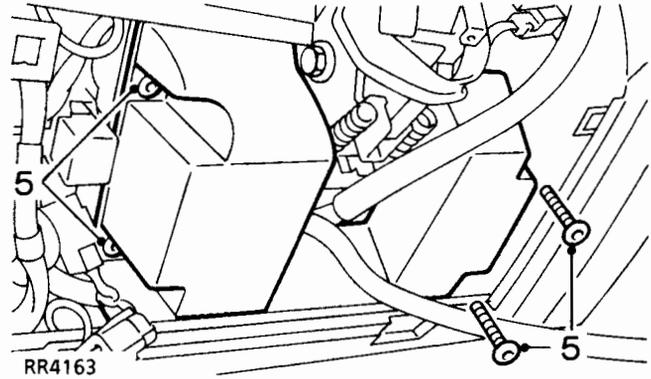
Remove

1. Remove steering wheel. *See Steering Wheel*



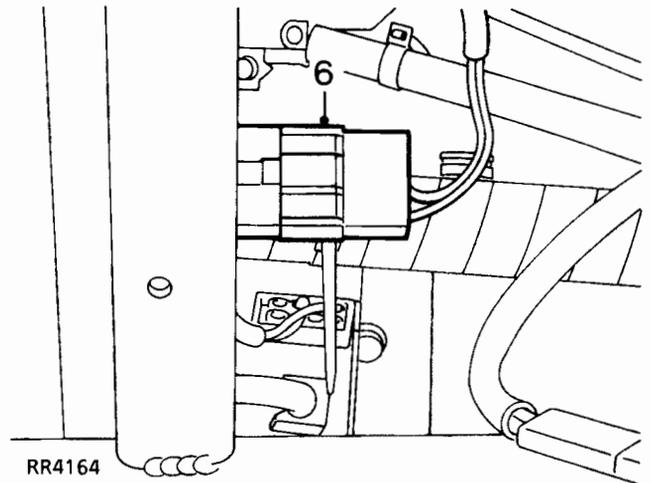
CAUTION: Prevent rotation of rotary coupler once steering wheel is removed. Secure in position with adhesive tape.

2. Remove driver's access panel.
3. Remove steering column shroud. *See Steering Column Shroud*
4. Remove rotary coupler. *See SUPPLEMENTARY RESTRAINT SYSTEM, Repair, Rotary Coupler*



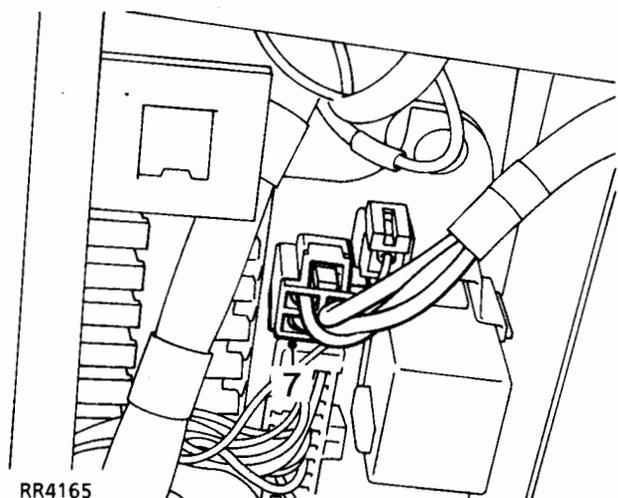
RR4163

5. If fitted - remove 4 screws securing knee bolster, remove knee bolster.



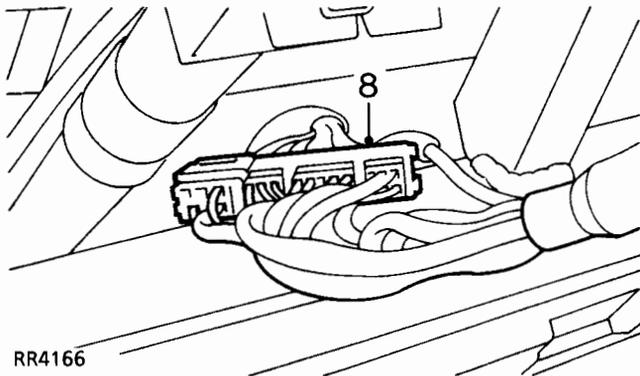
RR4164

6. Disconnect column switch multiplug.



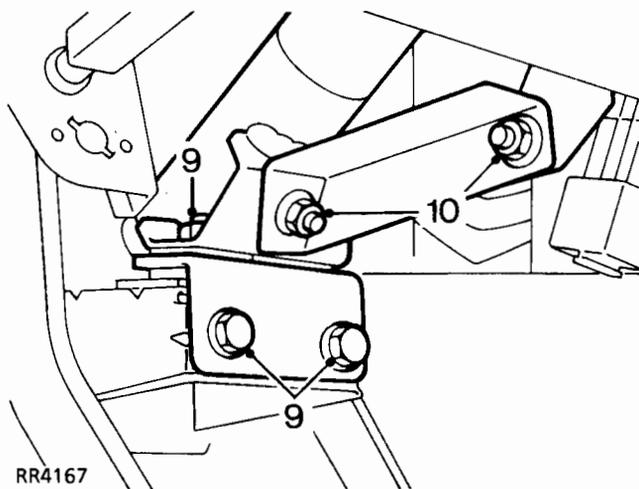
RR4165

7. Disconnect ignition switch multiplug from fuse box.



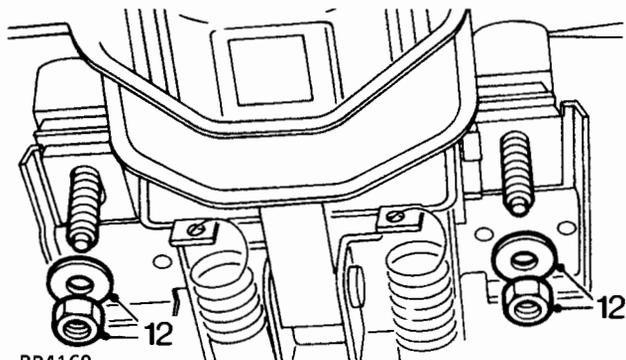
RR4166

8. Disconnect ignition switch main feed multiplug.



RR4167

- 9. Remove 4 nuts securing upper column to lower mounting.
- 10. Remove 2 nuts securing lower mounting steady bracket, remove bracket.
- 11. Remove pinch bolt securing upper column to universal joint.



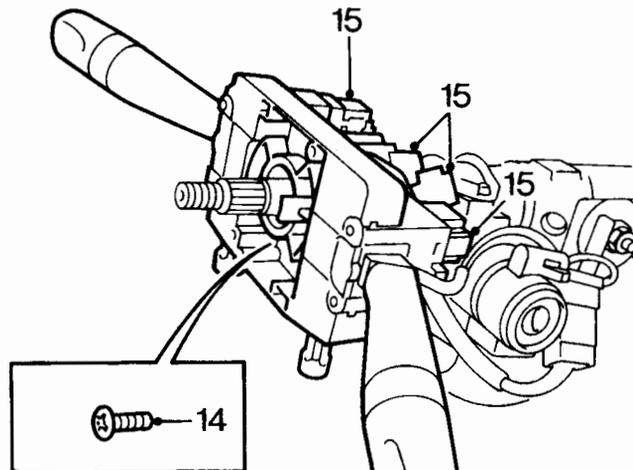
RR4168

12. Remove 2 nuts and washers securing upper column to upper mounting bracket.

13. Carefully manoeuvre upper column out of footwell, recover rubber boot.

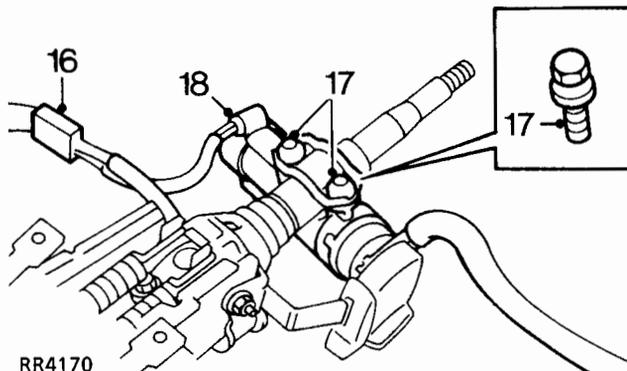


NOTE: Do not carry out further dismantling if upper column is removed for access only.



RR4169

- 14. Loosen but, do not remove screw securing column switch assembly, withdraw assembly to gain access to multiplugs.
- 15. Disconnect column switch multiplugs, remove column switch assembly.



RR4170

- 16. Disconnect ignition switch multiplug.
- 17. Remove shear bolts securing steering column lock, remove lock and saddle; discard shear bolts.
- 18. Withdraw bulb holder from column lock shroud.
- 19. Transfer components to new upper column, connect multiplug.



NOTE: Do not shear column lock bolts at this stage.

Refit

20. Manoeuvre upper column to position in footwell, ensure splines in column and universal joint are correctly engaged and rubber boot is fitted.
21. Fit but do not tighten universal joint pinch bolt.
22. Position upper column to upper mounting, fit washers and nuts, do not tighten nuts.
23. Fit but do not tighten nuts and bolts securing upper column to lower mounting.
24. Fit lower mounting steady bracket, fit but do not tighten nuts and bolts.
25. Ensure upper column is aligned to mountings.
26. Tighten all nuts and bolts to **22 Nm**.
27. Tighten universal joint pinch bolt to **25 Nm**.
28. Connect column switch multiplug.
29. Connect ignition switch multiplugs.
30. Fit rotary coupler. **See SUPPLEMENTARY RESTRAINT SYSTEM, Repair, Rotary Coupler**
31. Fit steering wheel. **See Steering Wheel**
32. Reconnect battery negative lead.
33. Check steering column lock for correct operation, tighten shear bolts until heads shear off.
34. If fitted - position knee bolster, fit and tighten screws.
35. Fit steering column shroud. **See Steering Column Shroud**
36. Fit driver's access panel.



STEERING COLUMN LOCK ASSEMBLY

Service repair no - 57.40.31

Remove



CAUTION: Before removing any parts of steering linkage, it is imperative that road wheels are positioned straight ahead. Then steering wheel removed to prevent rotary coupler being wound up or damaged.

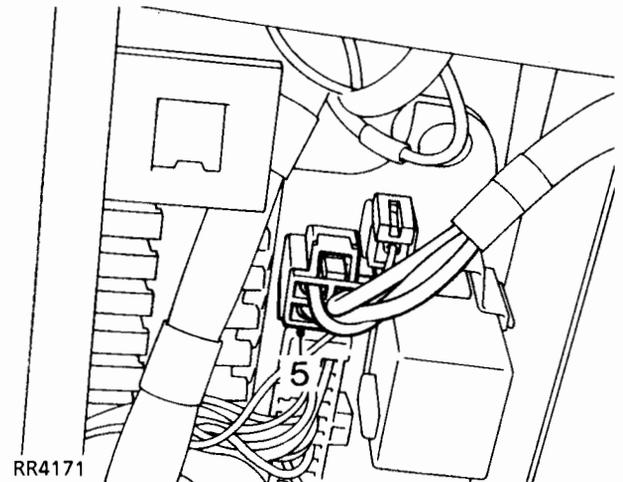


CAUTION: After refitting steering linkage parts follow correct procedure to ensure that road wheels, steering box and steering wheel are correctly positioned relative to each other when in straight ahead condition. If steering wheel requires repositioning, ensure that drive pegs on rotary coupler are correctly positioned before steering wheel is replaced.

This ensures drive pegs locate in their holes in rear of steering wheel.

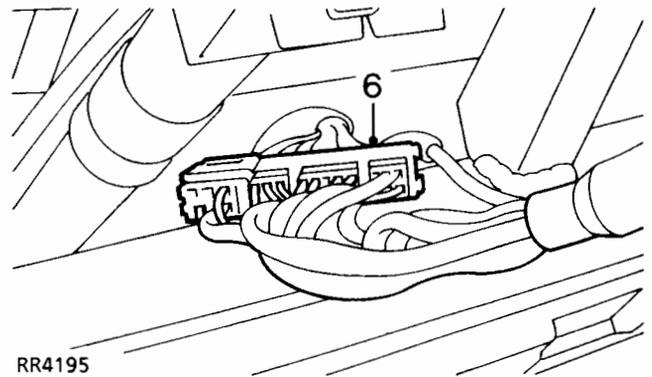
After final alignment connect rotary coupler multiplug, tighten steering wheel securing nut and fit airbag module - if fitted.

1. Disconnect battery negative lead.
2. Remove steering column shroud. *See Steering Column Shroud*
3. Release turnbuckles, lower driver's access panel.
4. If fitted, remove 4 screws securing knee pad, remove bolster.



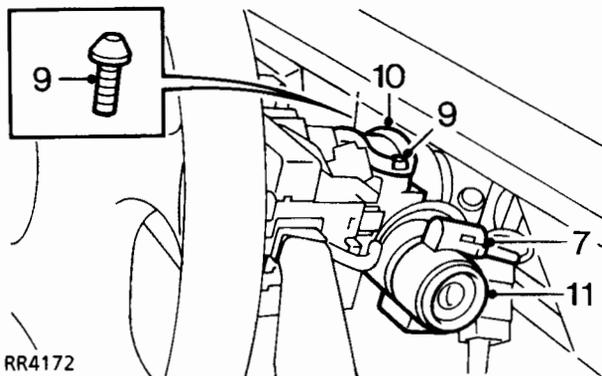
RR4171

5. Disconnect ignition switch multiplug from fuse box.



RR4195

6. Disconnect ignition switch main feed multiplug.



7. Remove bulb holder from steering column lock shroud.
8. Tap head of shear bolts anti-clockwise to release them.
9. Remove and discard shear bolts.
10. Detach saddle.
11. Remove steering column lock assembly.

Refit

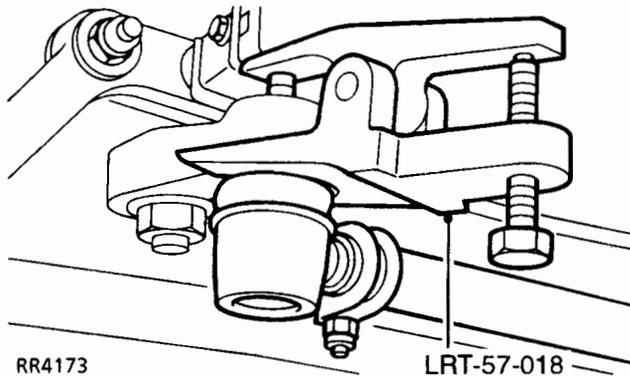
12. Position steering lock saddle on column, locating spigot in hole provided.
13. Place lower lock assembly into column.
14. Fit but do not fully tighten new shear bolts.
15. Connect multiplugs.
16. Insert bulb holder into steering column lock shroud.
17. Reconnect battery negative lead.
18. Check steering column lock for correct operation, tighten shear bolts until heads shear off.
19. Fit steering column shroud. **See Steering Column Shroud**
20. If fitted - fit knee bolster, fit and tighten screws.
21. Raise driver's access panel, secure turnbuckles.

DROP ARM

Service repair no - 57.50.14

Remove

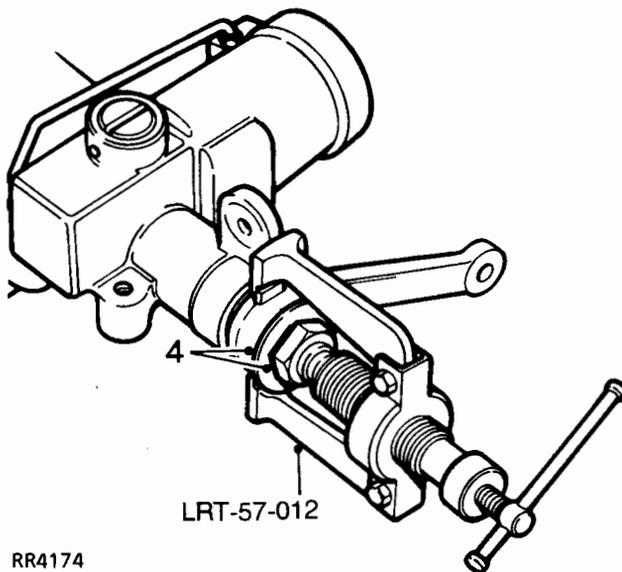
1. Place vehicle on a hoist, or support front axle on axle stands.



2. Disconnect drag link ball joint from drop arm, using extractor LRT-57-018.



3. Bend back tabs on locking washer and remove drop arm using extractor LRT-57-012. Loosen drop arm securing nut, but do not remove before using extractor.
4. Remove nut, discard locking washer.



Refit

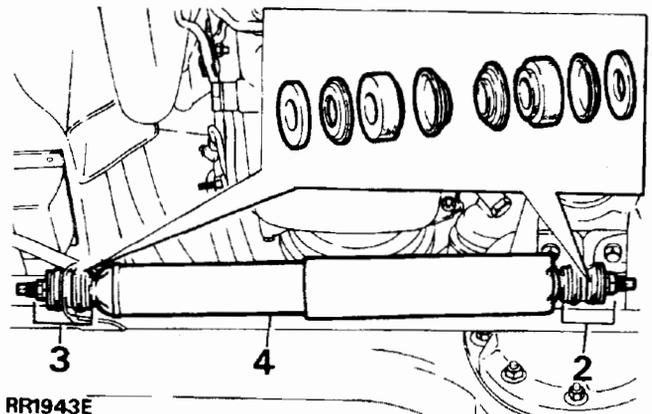
5. Centralise steering box. **See Adjustment, Centralise Steering Box**
6. Fit drop arm, align master splines.
7. Fit a new tab washer and drop arm fixing nut. Tighten to **176 Nm**, bend over tab.
8. Fit drag link. Tighten ball joint nut **40 Nm**.

STEERING DAMPER

Service repair no - 57.55.21

Remove

1. Site vehicle on a ramp [hoist].
2. Remove fixings at differential case bracket.
3. Remove fixings at track rod bracket.
4. Remove steering damper.



Refit

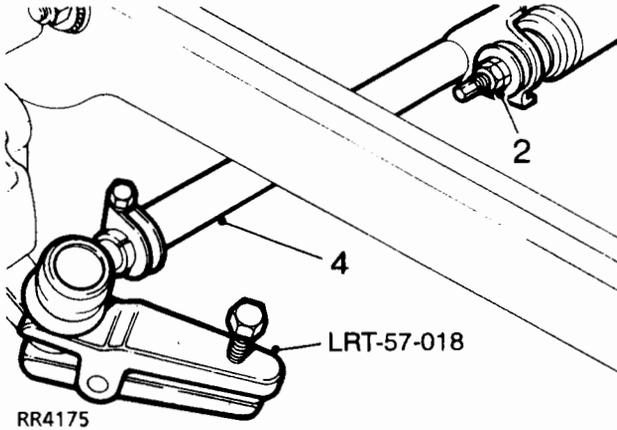
5. Reverse removal procedure. 1 to 4.

TRACK ROD AND LINKAGE

Service repair no - 57.55.09

Remove track rod

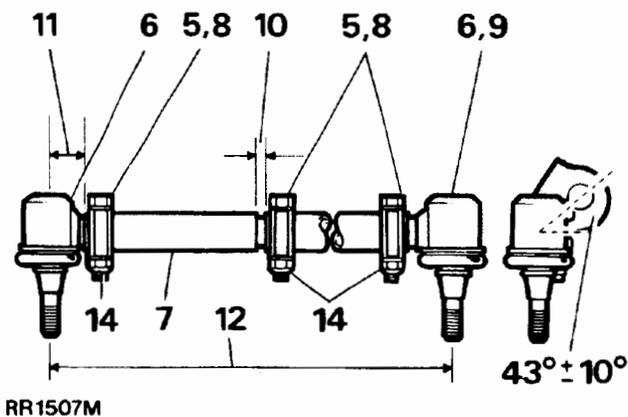
1. Site vehicle on a ramp [hoist].



2. Disconnect steering damper at track rod.
3. Disconnect track rod at ball joints, using extractor LRT-57-018.
4. Remove track rod.

Remove linkage

5. Loosen clamp bolts.
6. Unscrew ball joints.
7. Unscrew track rod adjuster. (left hand thread).



Refit linkage

8. Fit replacement parts. Loosely fit clamp pinch bolts.
9. Screw in ball joint to full extent of threads.
10. Set adjuster to track rod distance to 9mm as shown.
11. Set adjuster end ball joint distance to 28.5mm as shown.
12. Track rod effective length of 1230.0mm is subject to adjustment during wheel alignment check.

Refit track rod



CAUTION: Fit a new track rod if existing is damaged or bent. No attempt should be made to repair it.

13. Fit track rod and tighten ball joint nuts to **40 Nm**.
14. Check front wheel alignment. **See Adjustment, Front Wheel Alignment**
15. Connect steering damper to track rod.
16. Remove vehicle from hoist, or axle stands.

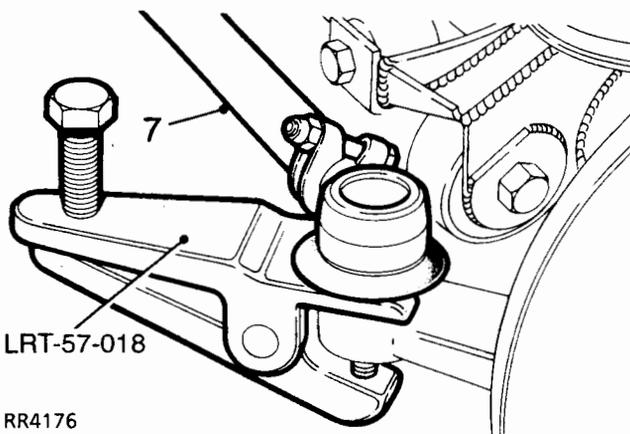


DRAG LINK AND DRAG LINK ENDS

Service repair no - 57.55.17

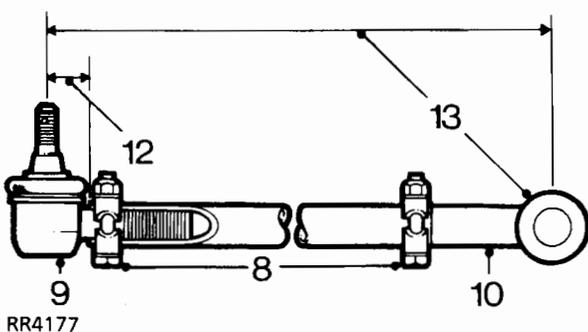
Remove drag link

1. Check front wheel alignment. **See Adjustment, Front Wheel Alignment**
2. Ensure wheels are positioned straight ahead during following procedure.
3. Place vehicle on a hoist, or support front axle on axle stands.
4. Remove right front road wheel.



5. Disconnect drag link ball joint at swivel housing arm, using extractor LRT-57-018.
6. Disconnect drag link ball joint at drop arm using LRT-57-018.
7. Remove drag link.

Remove drag link ends



8. Loosen clamp bolts.
9. Unscrew ball joints.
10. Clean internal threads in drag link.

Refit drag link ends

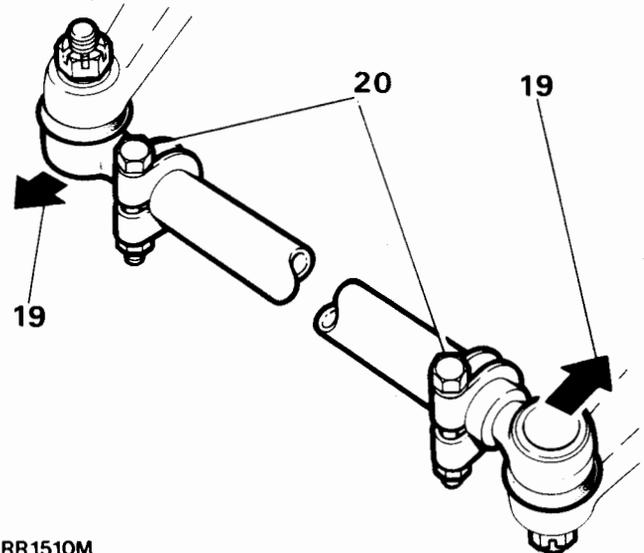
11. Fit replacement ends. Loosely fit clamp bolts.
12. Set ball joints to drag link distance to 28.5mm as shown.
13. Adjust ball pin centres to nominal length of 924.0mm. this length is adjusted during refit.
14. Centralise steering box. **See Adjustment, Centralise Steering Box**
15. Align steering wheel, if necessary. **See Steering Wheel**

Refit drag link



CAUTION: Fit new drag link if existing drag link is damaged or bent. No attempt should be made to repair it.

16. Fit drag link. Tighten ball-joint nuts to **40 Nm**.
17. Check steering lock stops. **See Adjustment, Steering Lock Stops**
18. Ensure full steering travel is obtained between lock stops. Adjust drag link length to suit.
19. Tap ball joints in direction shown, so both pins are in same angular plane.
20. Tighten clamp bolts to **14 Nm**.



21. Reverse removal procedure. 3 and 4.
22. Road test vehicle.
23. If driving straight ahead and steering wheel is offset by 0° to ± 5° in either direction. Remedy by adjusting drag link length.



WARNING: To correct steering wheel deviations greater than ± 5°. Remove and reposition steering wheel. See Steering

Wheel



POWER STEERING BOX

Service repair no - 57.10.07

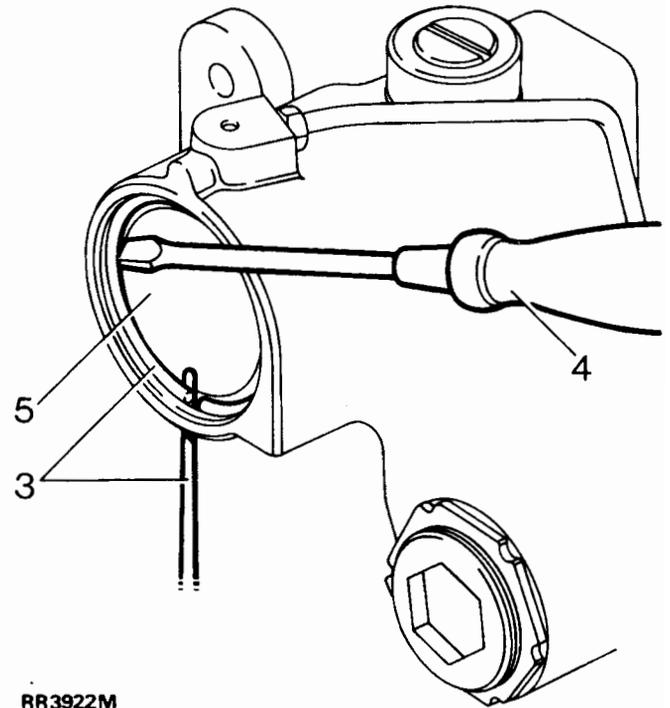
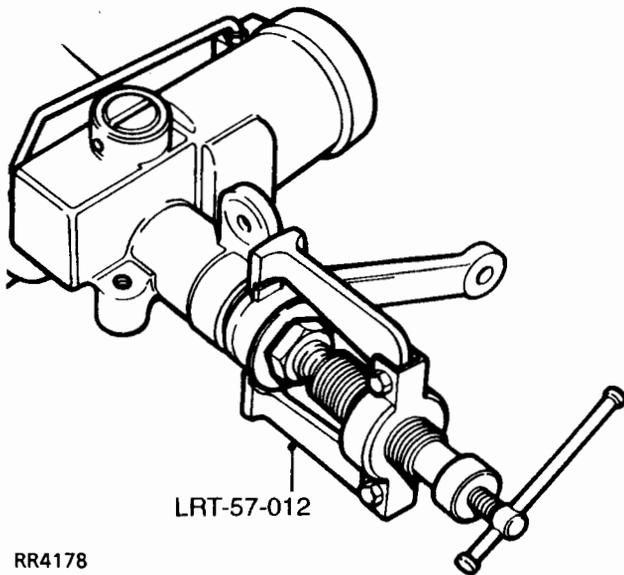
Overhaul

- 

NOTE: Overhaul of steering box should not be carried out during the warranty period.
- 

WARNING: Wear safety glasses while removing and refitting circlips and retaining ring.
- 

CAUTION: Absolute cleanliness is essential when overhauling power steering box.

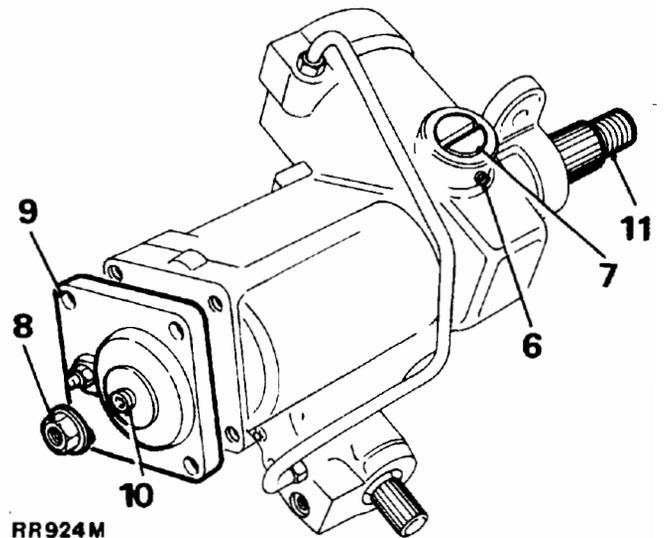


1. Remove steering box from vehicle. **See Repair, Power Steering Box**
Remove drop arm using extractor LRT-57-012. Loosen drop arm securing nut, but do not remove before using extractor. Remove dirt excluder from output shaft.
2. Drain oil, remove blanking plugs and bleed screw. Hold steering box over suitable container, turn input shaft from lock to lock, until oil is drained. Refit bleed screw.
3. Rotate retainer ring until one end is 12 mm from extractor hole. Using a drift through hole in cylinder, lift retaining ring from groove in cylinder bore.
4. Remove retainer ring, using a screwdriver.

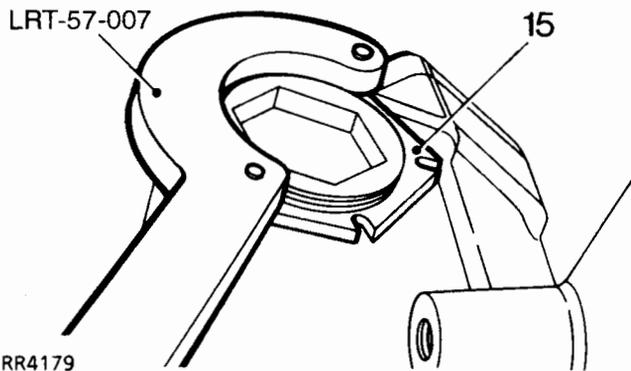
5. Turn input shaft (left lock on left hand drive, right lock on right hand drive) until piston pushes out cover. Turn input shaft fully in opposite direction, applying pressure to piston.
6. Remove set screw retaining rack pad adjuster.
7. Remove rack adjuster and pad.
8. Remove sector shaft adjuster locknut.
9. Remove four bolts from sector shaft cover.
10. Screw in sector shaft adjuster until cover is removed.

 **NOTE:** Sealant is applied to hexagon socket to 'tamperproof' sector shaft adjuster

11. Slide out sector shaft.

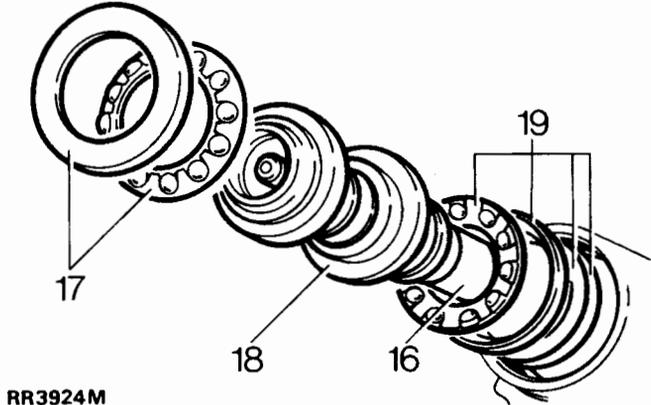


12. Remove piston, a bolt screwed into piston will assist removal.
13. Remove input shaft dirt excluder.

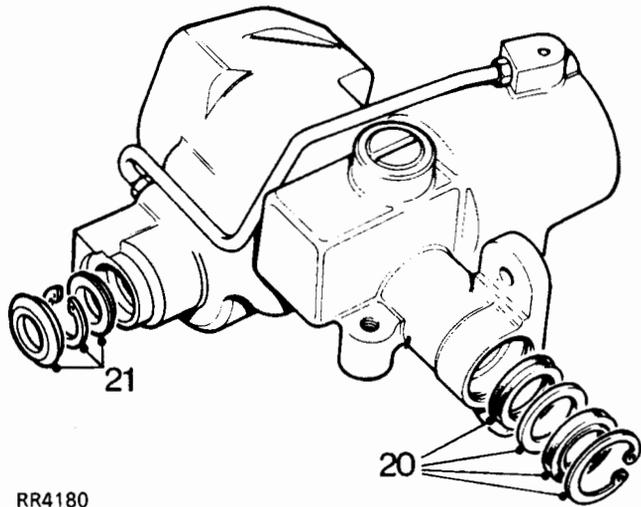


14. Remove worm adjuster locknut using 'C' wrench LRT-57-007.
15. Remove worm adjuster using wrench LRT-57-006.
16. Tap splined end of shaft to free bearing.
17. Remove bearing cup and caged ball bearing assembly.
18. Remove valve and worm assembly.
19. Remove inner bearing cage, cup and shim washers. Retain shims for reassembly.

NOTE: Should difficulty be experienced warm casing and bearing assembly. Cool bearing cup using a mandrel and tap steering box on a bench.



Steering box seals



20. Remove circlip and seal from sector shaft housing bore.



CAUTION: Do not remove sector shaft bearings from casing. Replacement parts are not available. If sector shaft bearings are worn fit a new steering box.

- Remove dirt excluder, circlip and seal from input shaft housing bore.



CAUTION: The use of a seal puller is recommended to prevent damage to casing, and possible oil leaks.

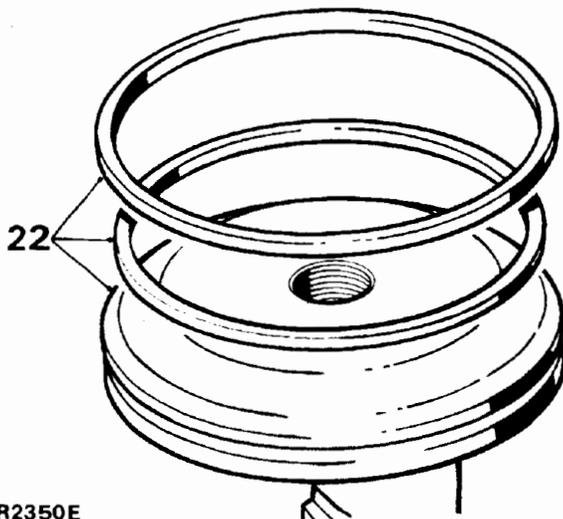
INSPECTING

Piston

- Discard all rubber seals and provide replacements.



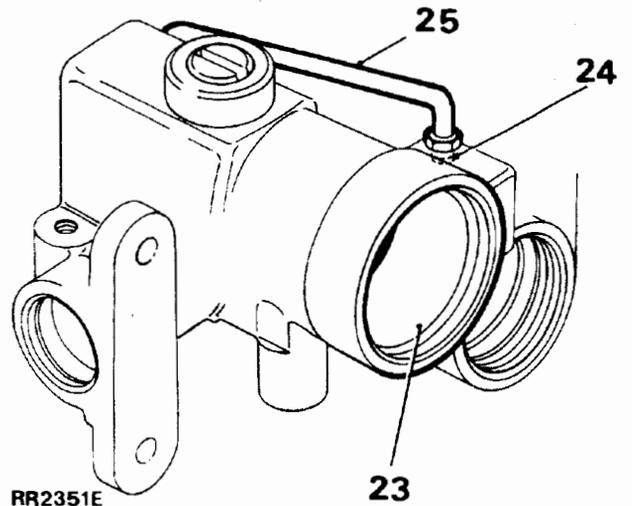
NOTE: A rubber seal is fitted behind plastic ring on rack piston. Discard seal and plastic ring.



RR2350E

Steering box casing

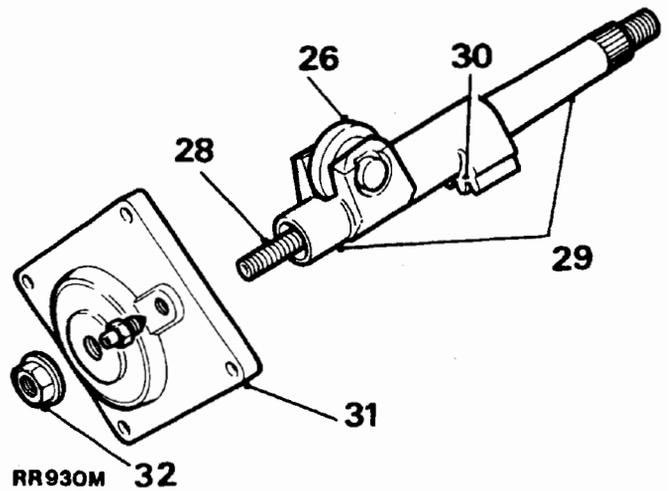
- Examine piston bore for scoring and wear.
- Examine feed tube.
- Fit a new feed tube if damaged. Tighten to 22 Nm.



RR2351E

Sector shaft assembly

- Check there is no side play on roller.
- If side play on roller exists fit a new sector shaft.
- Check condition of adjuster screw threads. Check adjuster end float. Fit new adjuster if end float exceeds 0.15 mm.
- Examine bearing areas on shaft for excessive wear.
- Examine gear teeth for uneven or excessive wear.



RR930M 32

Sector shaft cover assembly

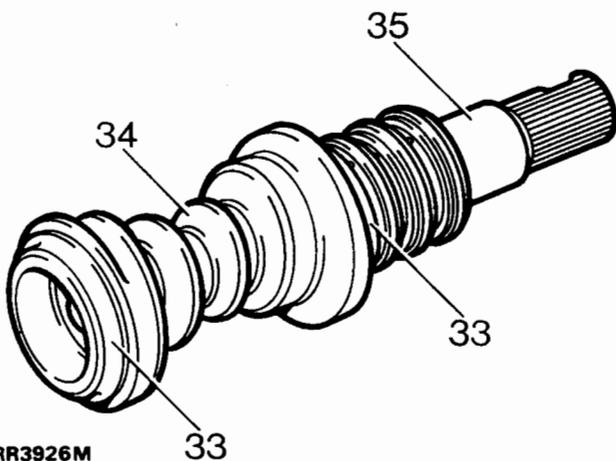
31. Inspect cover and bearing. If worn or damaged, replacement parts are not available, fit a new steering box.

Sector shaft adjuster locknut

32. The locknut is also a fluid seal. Fit new nut at overhaul.

Valve and worm assembly

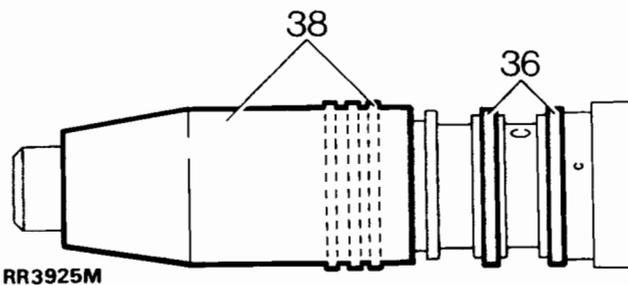
33. Examine bearing areas for wear. The areas must be smooth and not indented.
34. Examine worm track which must be smooth and not indented.



35. Check for wear on torsion bar assembly pin. No free movement should exist between input shaft and torsion bar or between torsion bar and worm.

NOTE: Any sign of wear makes it essential to fit new valve and worm assembly.

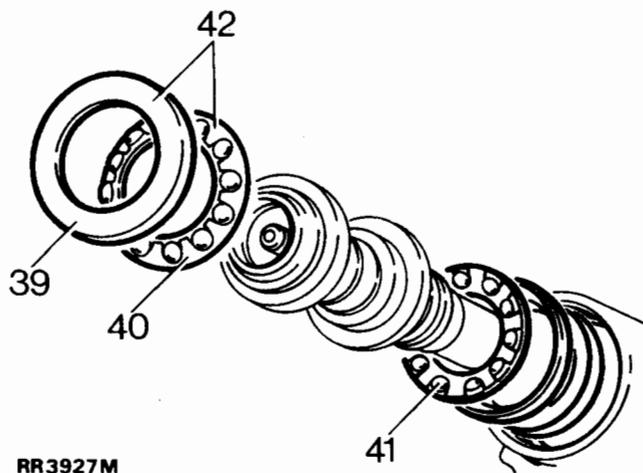
36. Examine valve rings for cuts, scratches and grooves. The valve rings should be free to rotate in grooves.



37. If required, replace all three rings, using ring expander LRT-57-019. The expander will not pass over rings already fitted. Remove rings to allow access without damaging seal grooves.
38. Warm rings and expander tool to aid assembly. Fit rings to expander, slide expander over valve and worm assembly. In turn fit rings to their grooves. Remove expander, slide valve and worm assembly into ring compressor LRT-57-020 and allow to cool.

Ball bearing and cage assemblies

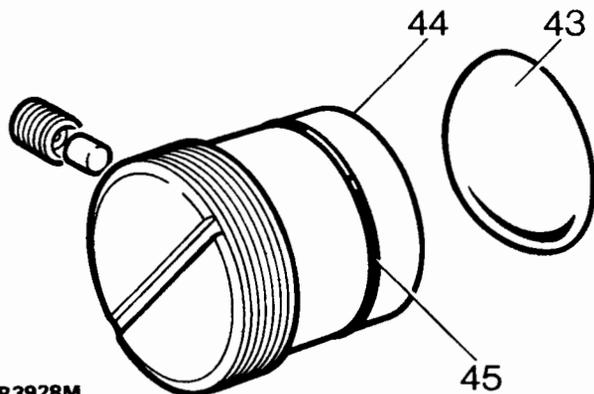
39. Examine ball races and cups for wear and general condition.
40. If ball cage has worn against bearing cup, fit replacements.
41. Bearing balls must be retained by cage.
42. Bearing and cage repair is carried out by complete replacement of assembly.





Rack thrust pad and adjuster

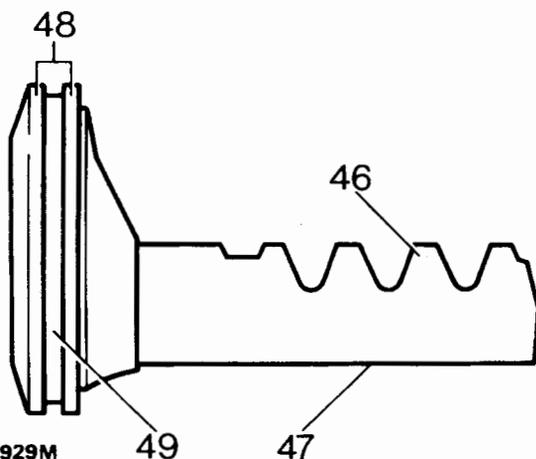
- 43. Examine thrust pad for scores.
- 44. Examine adjuster for wear in pad seat.
- 45. Fit new sealing ring to rack adjuster.



RR3928M

Rack and piston

- 46. Examine for excessive wear on rack teeth.
- 47. Ensure thrust pad bearing surface is free from scores and wear.
- 48. Ensure piston outer diameters are free from burrs and damage.



RR3929M

- 49. Examine seal and ring groove for scores and damage.
- 50. Fit new ring to piston. Warm nylon seal and fit to piston.
- 51. Slide piston assembly into cylinder with rack tube outwards.

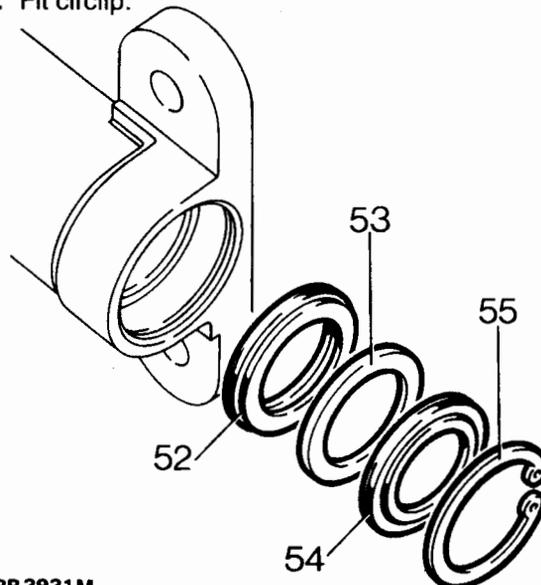
Reassemble



NOTE: When fitting replacement oil seals lubricate with recommended fluid and ensure absolute cleanliness.

Sector shaft oil seal

- 52. Fit oil seal, lip side first.
- 53. Fit extrusion washer.
- 54. Fit dust seal, lipped side last.
- 55. Fit circlip.



RR3931M

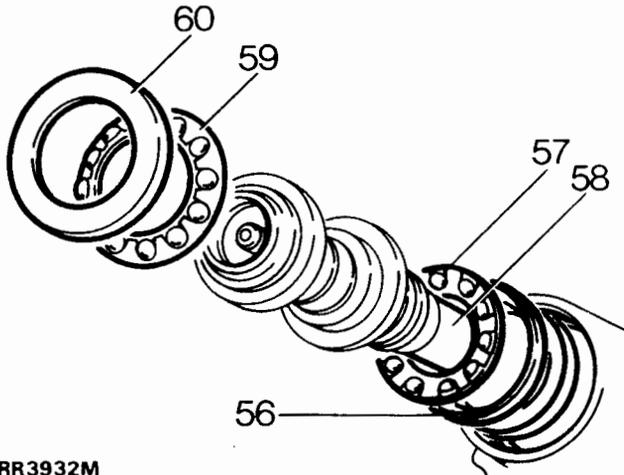
Fitting valve and worm assembly

- 56. Refit original shims and inner bearing cup. Use Petroleum Jelly to aid assembly.



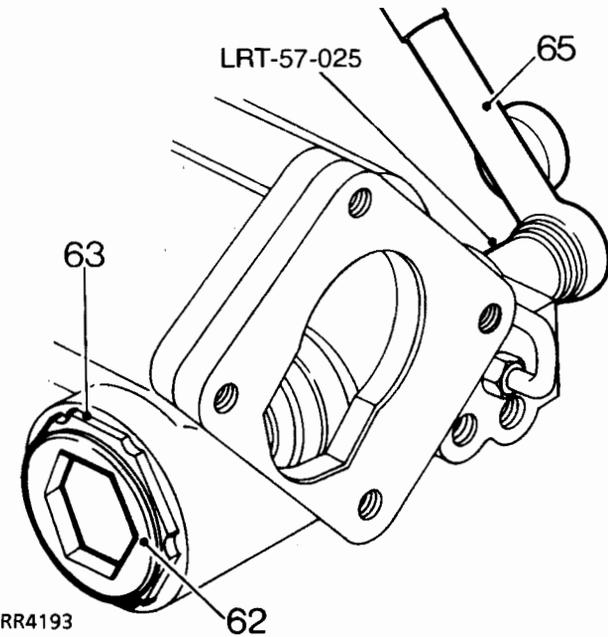
NOTE: If original shims are not used, fit shims of 0.76 mm thickness.

- 57. Fit inner cage and bearings assembly.
- 58. Fit valve and worm assembly.
- 59. Fit outer cage and bearings assembly.
- 60. Fit outer bearing cup.



RR3932M

61. Fit new worm adjuster sealing ring.



RR4193

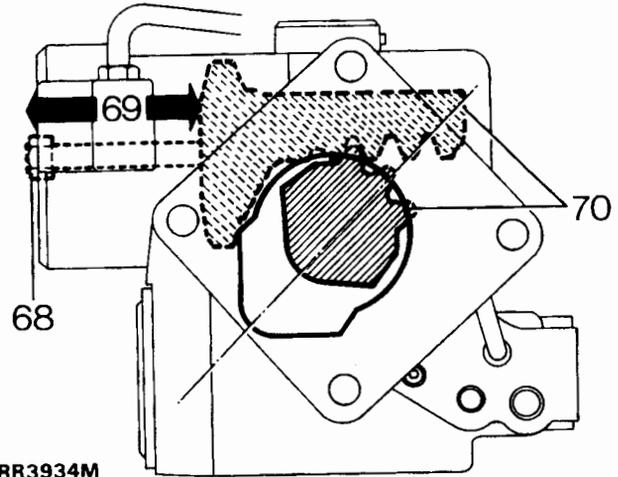
- 62. Loosely screw adjuster into casing.
- 63. Fit locknut, do not tighten.
- 64. Turn in worm adjuster until end float is almost eliminated. Ensure bearing cages are seated correctly.
- 65. Measure maximum rolling torque of valve and worm assembly, using a torque wrench and spline socket LRT-57-025.
- 66. Turn in worm adjuster while rotating shaft to increase figure measured in instruction 65. to 0.56 Nm.
- 67. Back off worm adjuster 1/4 turn. Turn in worm adjuster to increase reading at 65. by 0.21 - 0.34 Nm with locknut tight, **100 Nm**. Use worm adjusting wrench LRT-57-006 and locknut wrench LRT-57-028.

Fitting rack and piston

- 68. Screw slave bolt into piston to aid assembly.
- 69. Fit piston and rack so piston is 70 mm from outer end of bore.

Fitting sector shaft

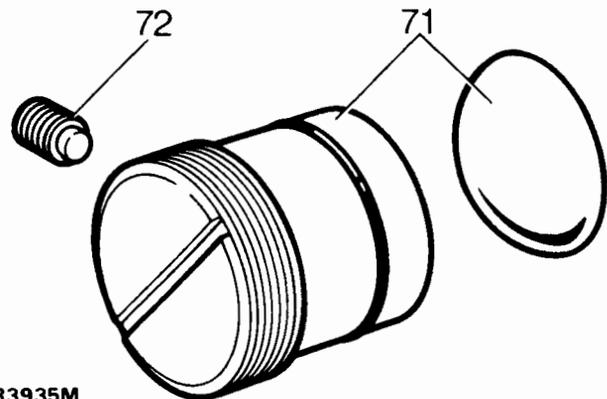
- 70. Fit sector shaft using seal saver LRT-57-021. Align roller with cut out in casing - see RR3934M. Push in sector shaft while rotating input shaft to allow sector roller to engage worm.



RR3934M

Fitting rack adjuster

- 71. Fit rack adjuster and thrust pad to engage rack. Back off half turn on adjuster.
- 72. Loosely fit new nylon pad and adjuster set screw assembly.

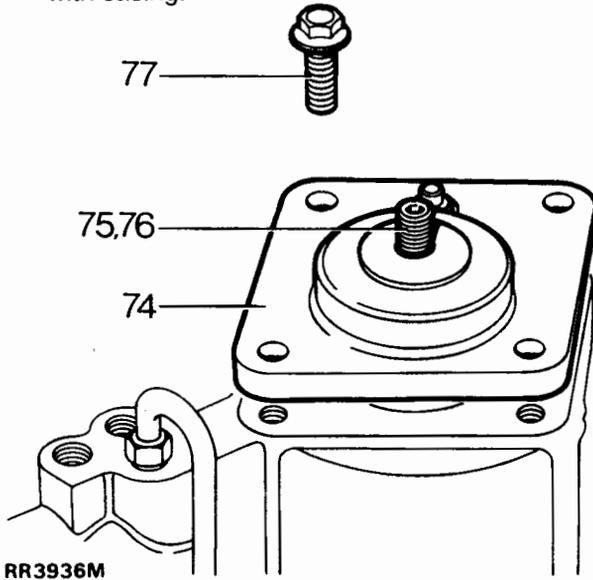


RR3935M



Fitting sector shaft cover

- 73. Fit new sealing ring to cover.
- 74. Align cover with casing.
- 75. Screw cover assembly fully on to sector shaft adjuster screw.
- 76. If necessary back off sector shaft adjuster screw. Tap cover in place to allow cover to joint fully with casing.

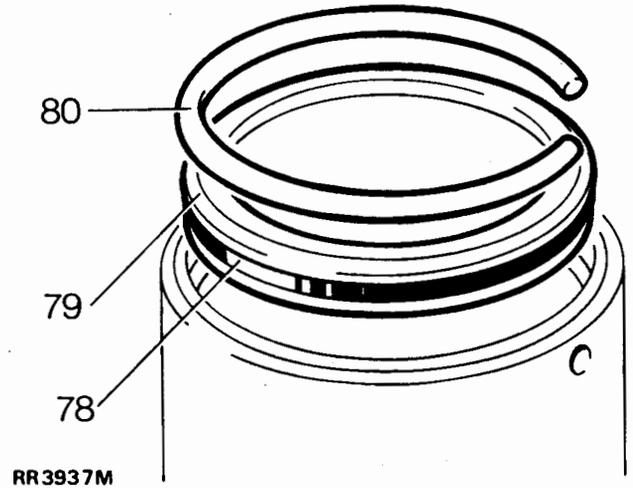


△ **NOTE:** Before tightening fixings, rotate input shaft to ensure sector shaft roller is free to move in valve worm. If initial resistance is left, turn adjuster screw approximately two turns in a clockwise direction.

77. Fit cover bolts. Tighten to 75 Nm.

Fitting cylinder cover

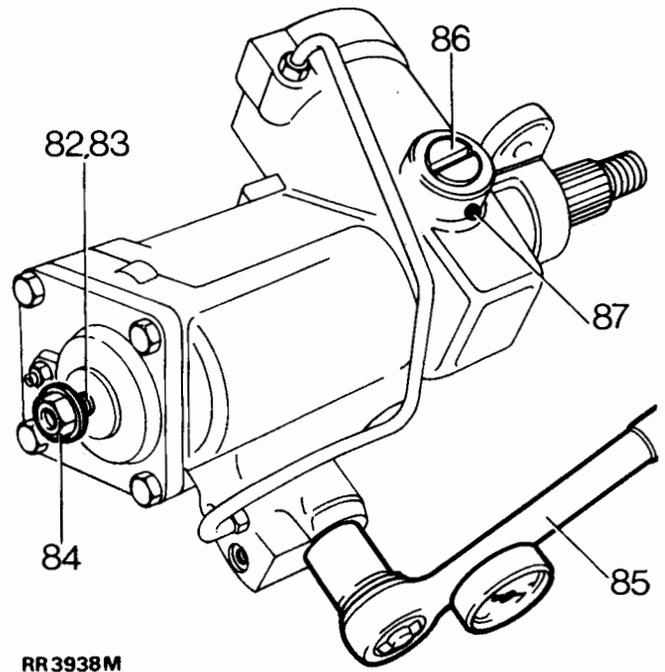
- 78. Fit new square section seal to cover.
- 79. Remove slave bolt fitted at instruction 68. Press cover into cylinder just to clear retainer ring groove.
- 80. Fit retaining ring to groove with one end of ring positioned 12 mm from extractor hole.



Adjusting sector shaft

△ **NOTE:** Refit drop arm and tighten nut sufficiently to ensure that no backlash exists between drop arm and sector shaft.

- 81. To set worm on centre, rotate input shaft to full inner-lock (full right lock for a left hand drive vehicle, full left lock for a right hand drive vehicle). Rotate input shaft back towards centre two full turns.
- 82. The box is now on centre and can be adjusted.



83. Hold input shaft and rock drop arm to establish backlash is present. Continue rocking and slowly turn sector shaft adjusting screw clockwise. Continue rotating adjuster screw until backlash has almost been eliminated.
84. Refit locknut and tighten.



NOTE: It is important steering box is centralised before any adjustments are made.

85. Check maximum rolling torque one and a quarter turns either side of centre position, using a torque wrench and spline socket LRT-57-025. Rotate adjuster screw to obtain across centre torque of 0.34 Nm plus torque figure at one and a quarter turns. Tighten adjuster locknut to **60 Nm**.

Adjusting rack adjuster.

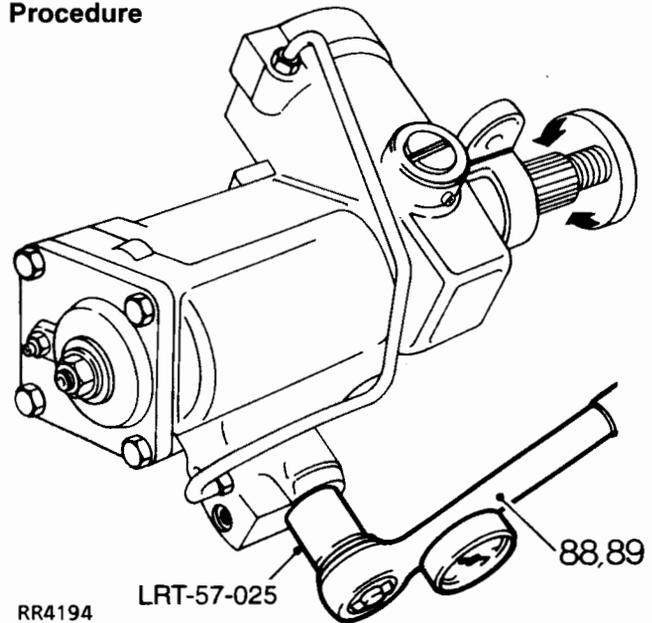
86. Turn in rack adjuster to increase figure measured in instruction 85. by 0.23 - 0.34 Nm. **The final figure may be less, but must not exceed 1.35 Nm.**
87. Lock rack adjuster in position with grub screw. Tighten to **5 Nm**.

Torque peak check

With input shaft rotated from lock to lock, rolling torque figures should be greatest across centre position and equally disposed about centre position.

The condition depends on value of shimming fitted between valve and worm assembly inner bearing cup and casing. The original shim washer value will give correct torque peak position unless major components have been replaced.

Procedure



RR4194

LRT-57-025

88,89

88. With input coupling shaft toward the operator, turn shaft fully counter-clockwise.
89. Check torque figures obtained from lock to lock using torque wrench and spline socket LRT-57-025.
90. Check also for equal engagement either side of centre.

Adjustments

91. Note where greatest figures are recorded relative to steering position. If greatest figures are not recorded across centre of travel (steering straight-ahead), adjust as follows:

If torque peak occurs **before** centre position, **add** to shim washer value; if torque peak occurs **after** centre position, **subtract** from shim washer value, **refer to fitting valve and worm assembly**.

Shim washers are available as follows:
0.03mm, 0.07mm, 0.12mm and 0.24mm.



NOTE: Adjustment of 0.07mm to shim value will move torque peak area by 1/4 turn on the shaft.

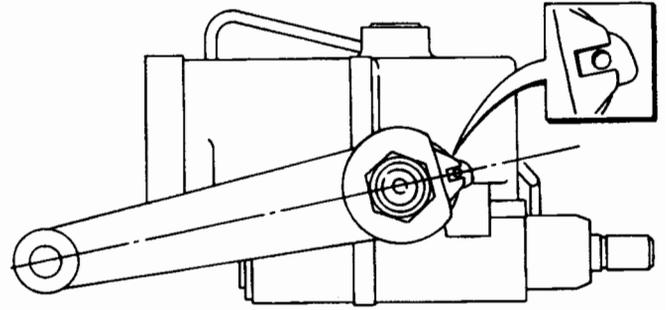
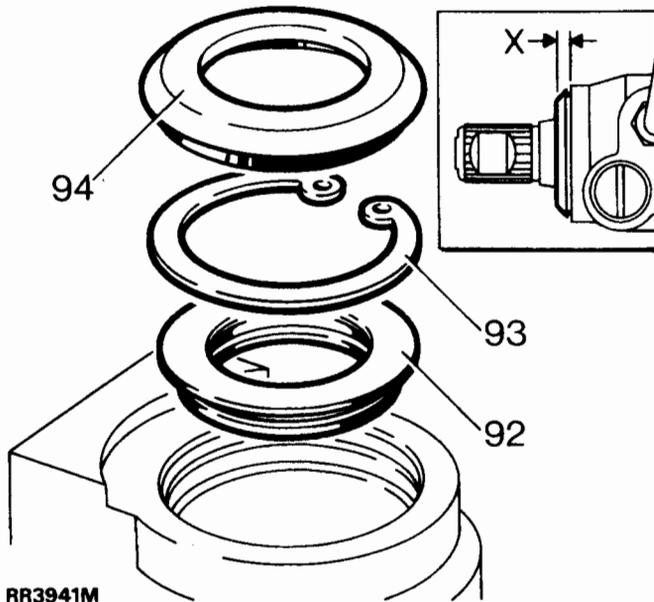


CAUTION: When reshimming valve and worm, extreme caution must be exercised to prevent seal damage during reassembly.



Input shaft oil seal

92. Fit seal, lip side first, into housing. Use seal saver LRT-57-016 and seal installer LRT-57-026. Note that seal is fitted to a depth of 4.75 - 5.00 mm from face of box.
93. Secure seal with circlip.
94. Smear inner lip of dirt excluder with PTFE grease. Fit dirt excluder using LRT-57-027. When fitted correctly outer shoulder of excluder is 4.00 - 4.50 mm from face of box, dimension X in RR3941M.



97. Fit steering box. See *Repair, Power Steering Box*

95. Remove drop arm. Smear inner lip of dirt excluder with PTFE grease and refit, ensuring outer lip is flush with casing.
96. With input shaft on centre, line up centralising holes in drop arm and steering box see inset in RR3940M. Fit drop arm to steering box using a new tab washer. Tighten to **176 Nm**, bend over tab.



STEERING PUMP

Make/type - V8i	ZF 'Unicorn'
Make/type - Tdi	Hobourn Eaton 500 series
Operating pressure - straight ahead position - at idle	7 bar, 100 lbf/in ² maximum
Full lock (left or right) at idle	28 bar, 400 lbf/in ² minimum
Full lock (left or right) 1000 rev/min.....	70-77 bar, 1000-1100 lbf/in ²

TORQUE VALUES

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

	Nm
Ball joint nuts	40
Clamp bolt nuts	14
Steering column bracket nuts	22
Steering wheel nut	50
Tie bar to mounting nut	110
Universal joint pinch bolt	25
PAS box	
Adjuster locknut	60
Drop arm nut	176
Sector shaft cover to steering box	75
Steering box to chassis	81
Steering box fluid pipes 14mm thread	15
Steering box fluid pipes 16mm thread	20
Tie bar	81
PAS pump	
High pressure fluid pipe	20
Power steering pump mounting	35
Pulley bolts, power steering pump	10
Hose clamp	3
Front mounting plate bolts	9
PAS reservoir	
Hose clamp	3

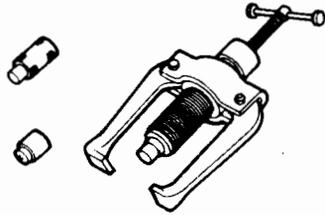
* Torque values below are for all screws and bolts used except for those that are specified otherwise.

METRIC	Nm
M5	6
M6	9
M8	25
M10	45
M12	90
M14	105
M16	180

UNC / UNF	Nm
1/4	9
5/16	24
3/8	39
7/16	78
1/2	90
5/8	136



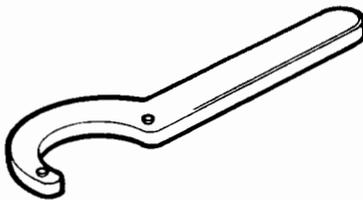
POWER STEERING BOX



MS252A

LRT-57-012

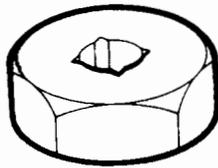
Drop arm extractor



LST120

LRT-57-007

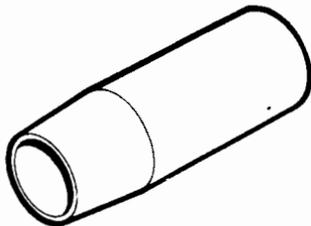
'C' Wrench



LST119

LRT-57-006

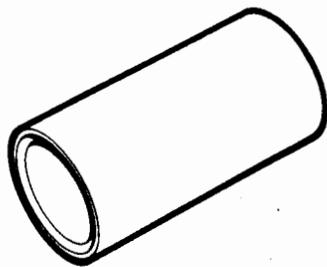
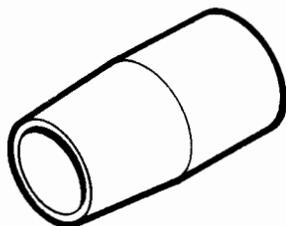
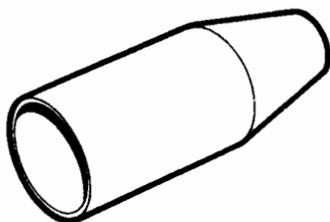
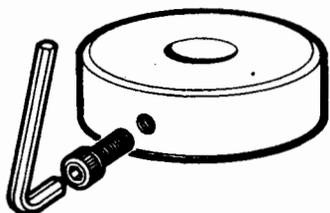
Worm adjusting wrench

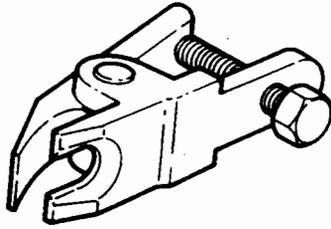


RO606602

LRT-57-019

Ring expander

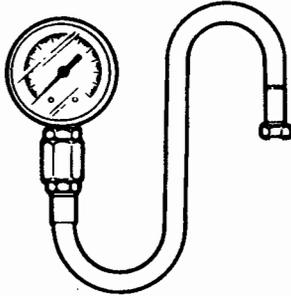
**RO606603****LRT-57-020****Ring compressor****RO606604****LRT-57-021****Seal saver, sector shaft****RO1015****LRT-57-016****Seal saver, valve and worm****ROI 016****LRT-57-017****Torque setting tool**



18G1036A

LRT-57-018

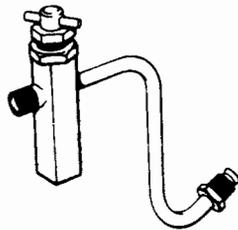
Ball joint remover



HY23

LRT-57-005

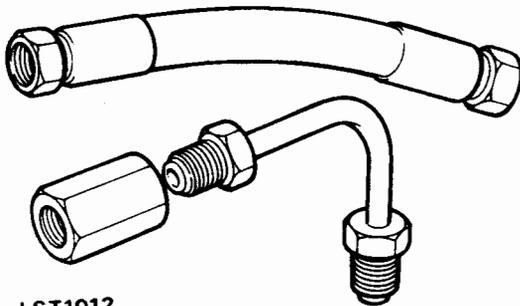
Pressure gauge



JD102

LRT-57-001

Test adaptor



LST1012

LRT-57-022

Pressure test adaptors