

# 57 - STEERING

## CONTENTS

Page

### DESCRIPTION AND OPERATION

DESCRIPTION .....	1
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### FAULT DIAGNOSIS

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

### ADJUSTMENT

POWER STEERING BOX .....	1
CENTRALISE STEERING BOX .....	2
STEERING LOCK STOPS .....	2
FRONT WHEEL ALIGNMENT .....	3
POWER STEERING PUMP DRIVE BELT .....	4

### REPAIR

POWER STEERING FLUID PIPES .....	1
POWER STEERING BOX .....	2
POWER STEERING SYSTEM - BLEED .....	4
POWER STEERING FLUID RESERVOIR .....	4



# 57 - STEERING

## CONTENTS

	Page
POWER STEERING PUMP DRIVE BELT .....	5
STEERING PUMP .....	6
LOWER STEERING SHAFT AND UNIVERSAL JOINTS PRE 1991 .....	7
LOWER STEERING SHAFT AND UNIVERSAL JOINTS 1991 ONWARD .....	8
STEERING WHEEL .....	9
CRUISE CONTROL CASSETTE CENTRALISE .....	10
STEERING COLUMN .....	11
STEERING COLUMN LOCK ASSEMBLY .....	12
DROP ARM .....	13
STEERING DAMPER .....	14
TRACK ROD AND LINKAGE .....	14
DRAG LINK AND DRAG LINK ENDS .....	15
 <b>OVERHAUL</b>	
POWER STEERING BOX .....	1
DROP ARM BALL JOINT .....	10
 <b>SPECIFICATIONS, TORQUE</b>	
STEERING PUMP .....	1
TORQUE VALUES .....	1
 <b>SERVICE TOOLS</b>	
POWER STEERING BOX .....	1
STEERING WHEEL .....	4



## DESCRIPTION

The power assisted steering system incorporates a safety steering column, designed to collapse on impact.

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

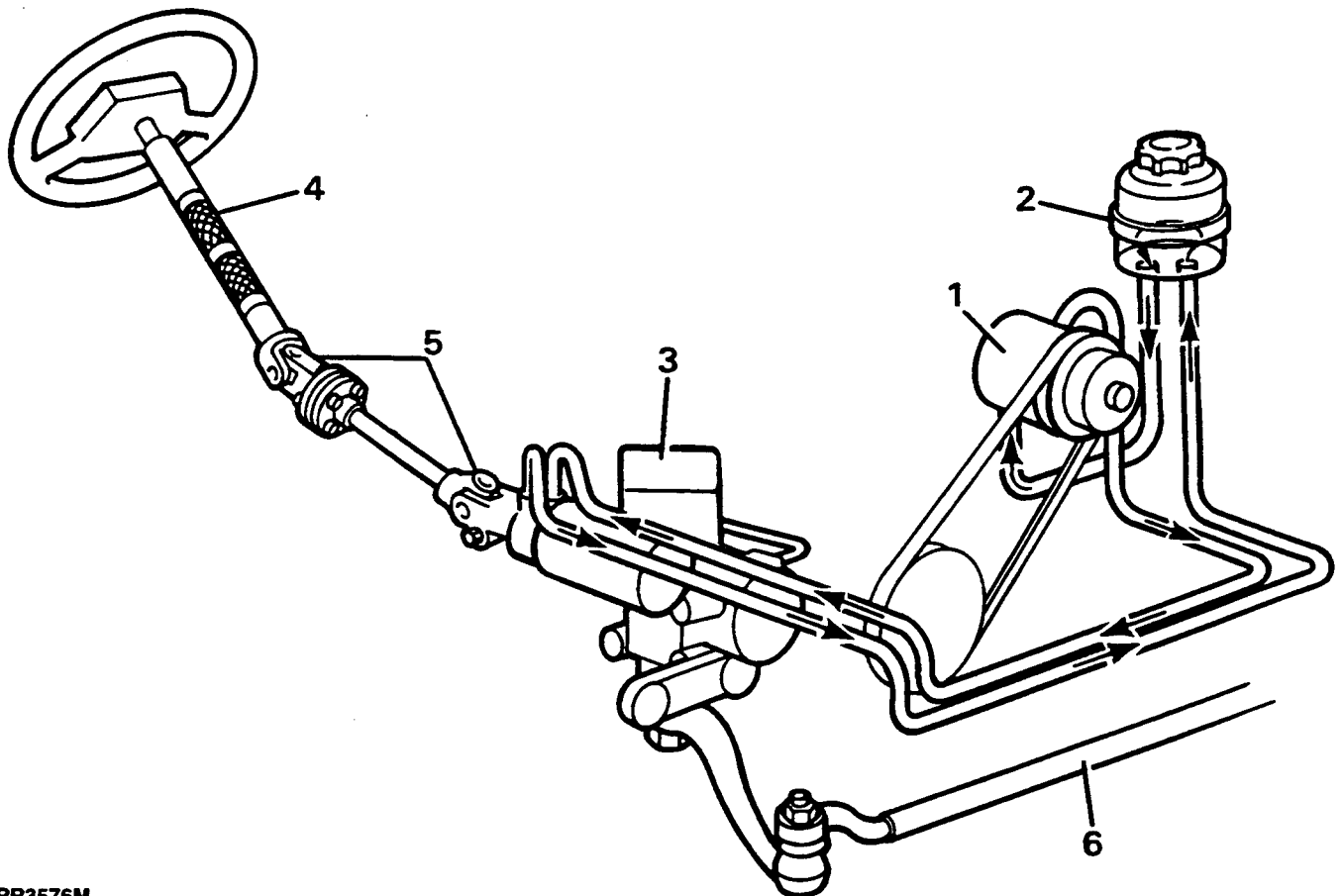
The steering box is located behind the second cross member of the chassis and is connected to the road wheels by the drag link and track rod. A hydraulic damper connected between the differential housing and the track rod absorbs shocks in the steering, caused by road wheel deflections when operating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

## Power steering system

The power steering system comprises an 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 an hydraulic piston/rack to assist the mechanical operation.

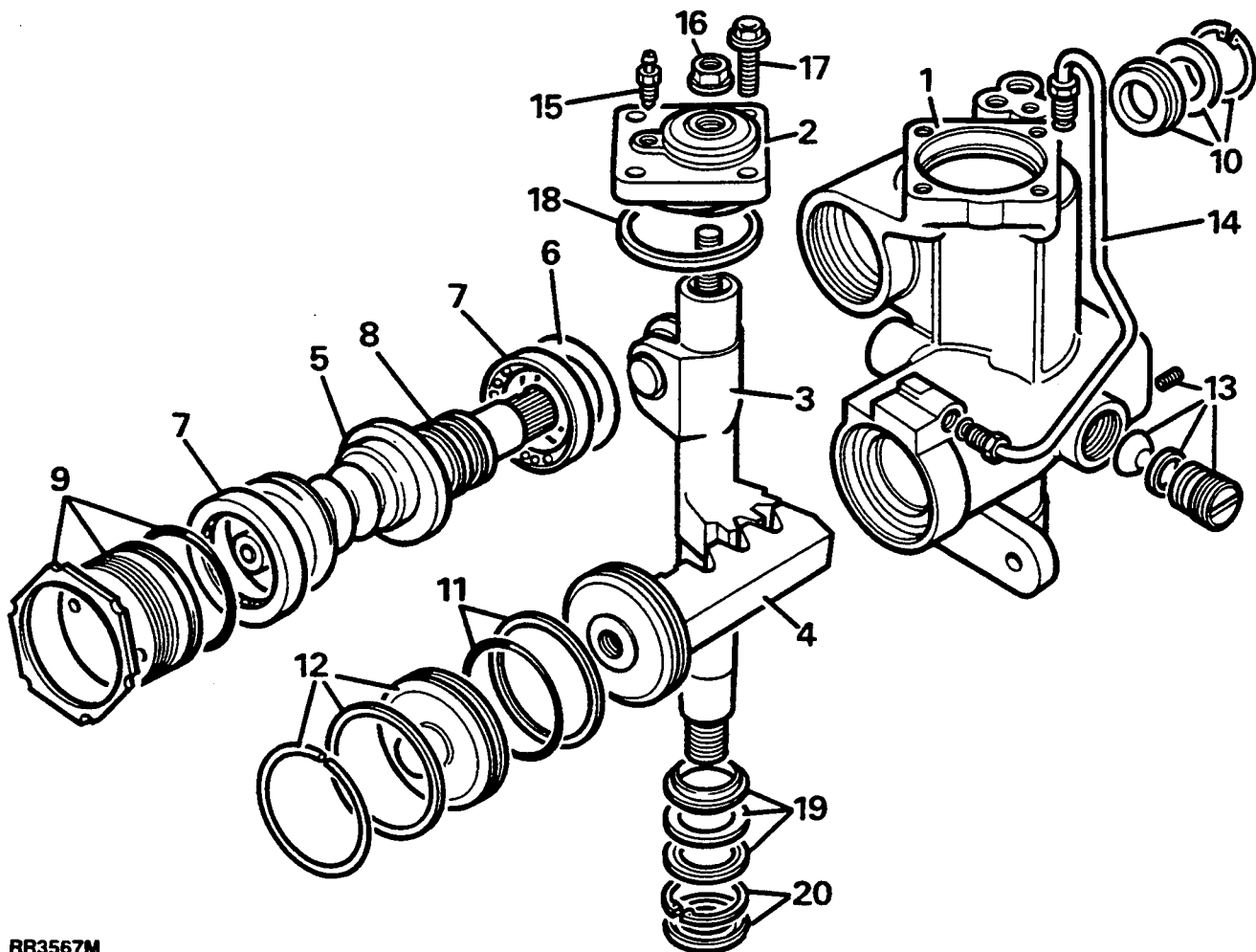
The rotary valve which is operated by movement of the steering wheel, directs fluid pressure to the appropriate side of the hydraulic piston/rack to provide assistance.



RR3576M

## Power steering system

1. Hydraulic pump
2. Fluid reservoir
3. Steering box
4. Collapsable column
5. Universal joints
6. Drag link



RR3567M

### 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                     |



box

**NOTE:** Changes to seal arrangements are described in steering box overhaul procedure, See *Overhaul, Power steering*

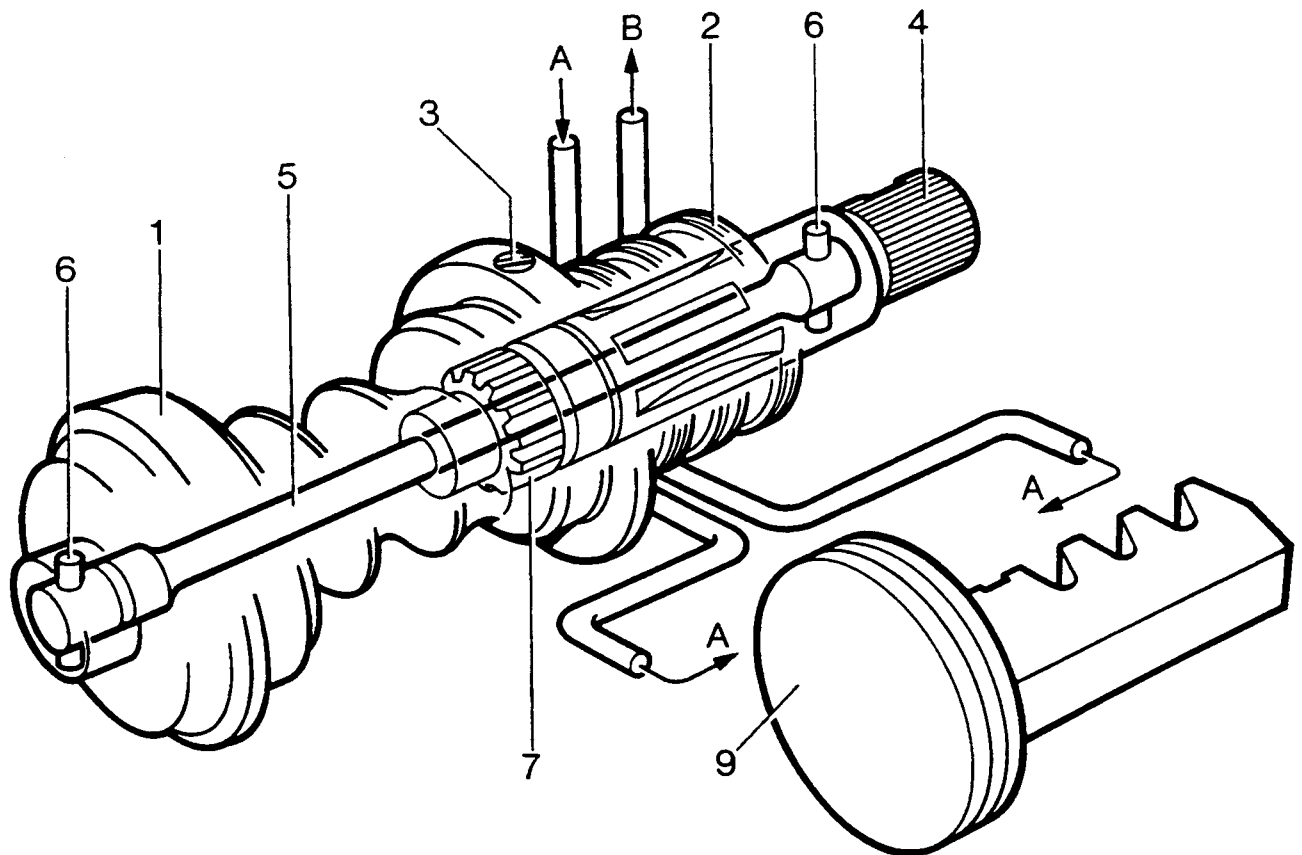


**Rotary valve operation**

The rotary valve assembly seen in RR3620M comprises 1 the worm. 2 the valve sleeve which has valve ports in its inner bore is a snug fit into the worm and is retained with the trim screw 3. The input shaft 4 which is attached to the steering wheel via the steering shaft and steering column, also has valve ports on its outer diameter to align with those in the sleeve. The input shaft and sleeve valve ports are held in neutral alignment by the torsion bar 5 which is secured with pins 6 at each end to the worm and input shaft. Note that only one pin, at input shaft is used on later models

**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 the pump returns to the reservoir via B.



RR3620M

**Rotary valve at neutral**

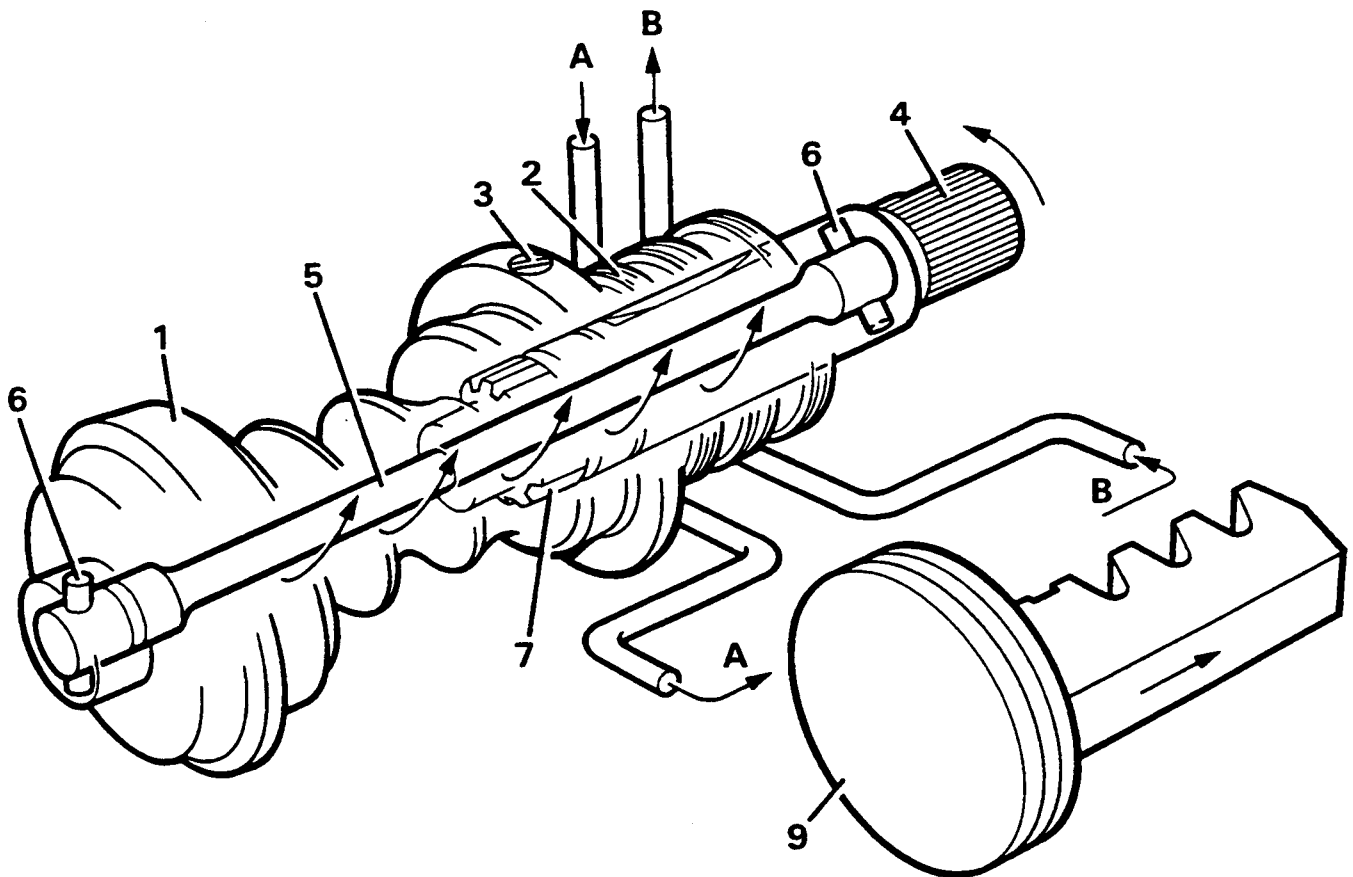
**Demand for assistance (Valve misaligned)**

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**

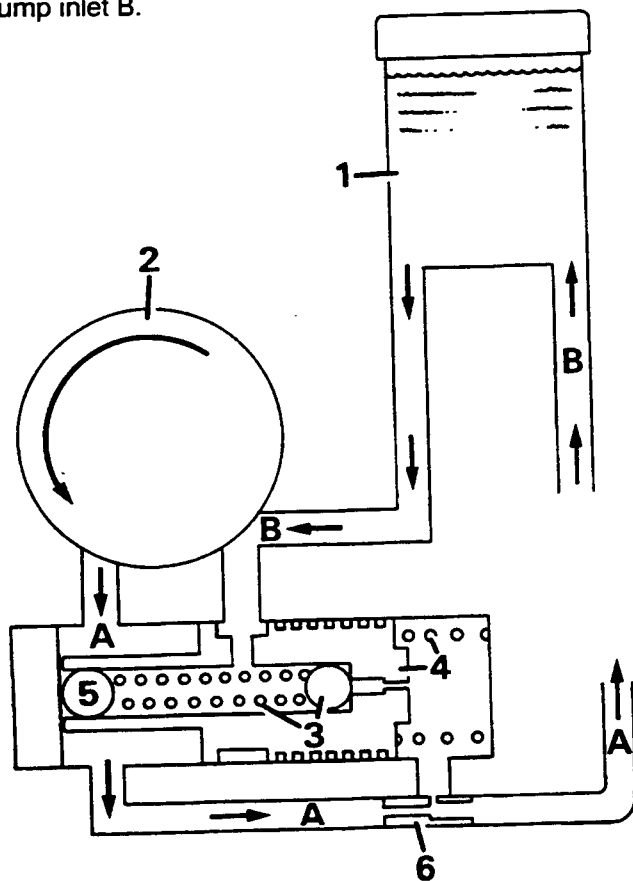


**Pump and regulator valve operation**

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

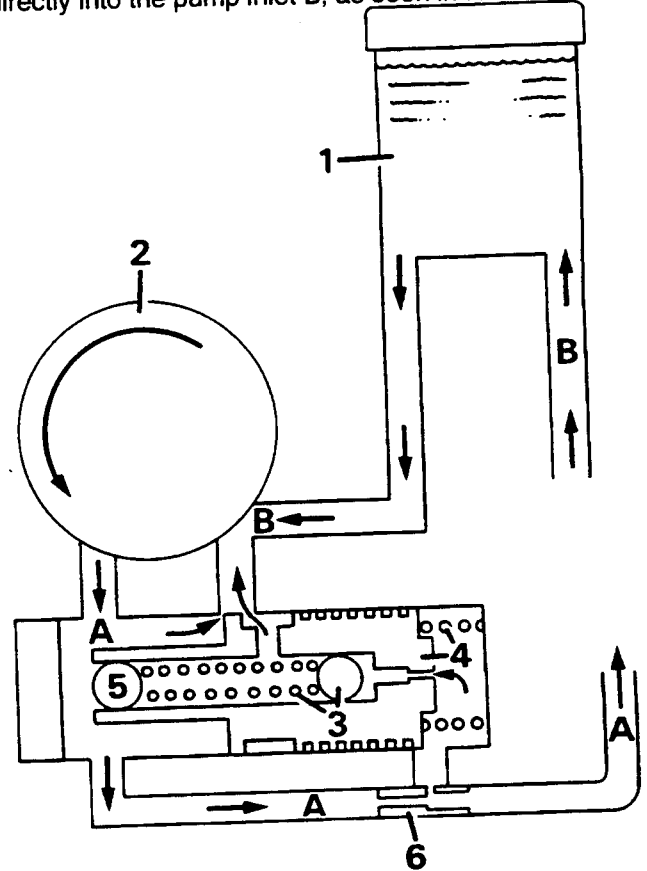
**No demand for assistance**

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.




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**FAULT DIAGNOSIS**


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**INSUFFICIENT POWER ASSISTANCE**


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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 Adjustment, power steering pump 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, *See ENGINE TUNING DATA, Information, ENGINE 3.9 V8*
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.



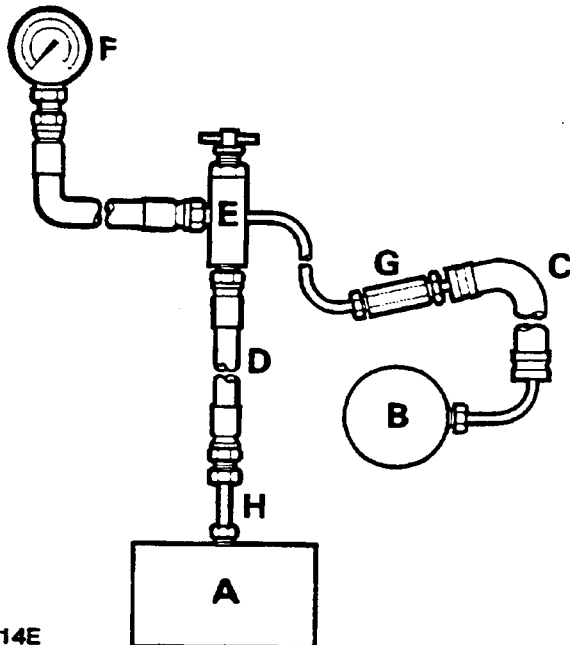
**NOTE: 2.** Insufficient pressure in the system is usually caused by low fluid level or PAS pump drive belt slip, or one of the following: PAS system leaks, faulty PAS pump relief valve, fault in steering box valve and worm assembly, leak at piston in steering box, worn components in PAS pump or box.



## 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.



RR1914E

- A. Steering box.
- B. Steering pump.
- C. Existing hose, steering box to pump.
- D. Hose LRT-57-002.
- E. Test adaptor LRT-57-001.
- F. Pressure gauge LRT-57-005.
- G. Thread adaptor LRT-57-004.
- H. Thread adaptor LRT-57-004.

## Procedure

1. A hydraulic pressure gauge and test adaptor is used to test power steering system. This gauge is able to measure 140 kgf/cm<sup>2</sup>. The maximum power steering system pressure is 77 kgf/cm<sup>2</sup>.
2. Some fault conditions of hydraulic pump may obtain pressures up to 105 kgf/cm<sup>2</sup>. 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 Adjustment, Power steering pump drive belt*
6. Assemble test equipment and fit to vehicle, as shown in RR1914E.
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/cm<sup>2</sup>.
  - (B) Steering wheel held on full lock and engine idling, 28 kgf/cm<sup>2</sup>.

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/cm<sup>2</sup>.
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, Stub Axle, Axle Shaft, Constant Velocity Joint and Swivel Pin, non ABS See FRONT AXLE AND FINAL DRIVE, Overhaul, Front Stub Axle, Constant Velocity Joint and Swivel with 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*
2. Check fluid pressure. *See Power Steering System - Test*
3. Is pressure high?  
YES - Renew pump. *See Repair, 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, 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 column universal joints for seizure and correct alignment. *See Repair, Lower steering shaft and universal joints pre 1991 See Repair, Lower steering shaft and universal joints 1991 onward*

*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 with ABS See FRONT AXLE AND FINAL DRIVE, Overhaul, Stub Axle, Axle Shaft, constant Velocity Joint and Swivel Pin, Non ABS*  
YES - Disconnect the lower steering shaft and check the column and box for stiffness. *See Repair, Lower steering shaft and universal joints pre 1991 See Repair, Lower steering shaft and universal joints 1991 onward*
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 manufacturers. 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 pre 1991 See Repair, Lower steering shaft and universal joints 1991 onward*

**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 pre 1991 See Repair, Lower steering shaft and universal joints 1991 onward*
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 bar. *See FRONT SUSPENSION, Repair, panhard rod See FRONT SUSPENSION, Repair, radius arm See FRONT SUSPENSION, Repair, anti-roll bar front 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 242 (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 abs See FRONT AXLE AND FINAL DRIVE, Repair, Front hub assembly non abs*
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 GENERAL SPECIFICATION DATA, Information, Steering*

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**STEERING STABILITY AND VEER UNDER BRAKING**


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**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, Stub axle, axle shaft, constant velocity joint and swivel pin non ABS** or **See FRONT AXLE AND FINAL DRIVE, Overhaul, Front stub axle, constant velocity joint and swivel with ABS**

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**DIAGNOSTIC CHARTS**


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**1. GENERAL STEERING**


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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 check list**  
NO - Go to 6.
5. Is problem resolved?  
YES - end  
NO - go to 8.
6. Is problem steering niggle  
YES - Replace radius arm bushes, arm and axle  
**See FRONT SUSPENSION, Repair, radius arm**  
Fit NTC 6860 to coil spring Range Rovers. Fit RTC 6860 plus harmonic damper kit 6825 to air suspension Range Rovers.  
NO - go to 8.

7. Is problem resolved?  
YES - end  
NO - continue.
8. Carry out visual check and basic adjustments.  
**See visual check and basic adjustments**
9. Is problem resolved?  
YES - end  
NO - continue.
10. Centralise steering box **See Adjustment, Centralise steering box**
11. Is problem resolved?  
YES - end  
NO - continue.
12. Check, adjust if necessary, steering geometry.
13. Is problem resolved?  
YES - end  
NO - continue.
14. 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**

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**2. STEERING VEER**


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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, Power 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.



**NOTE: Power bleed is recommended.**

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.
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.

### 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. Fit STC 618 axle set if replacing.
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.
1. Is fluid level correct?  
YES - go to 3.  
NO - Refill or drain to correct level. Bleed system, check for leaks.
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 - slacken 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 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.

### POWER STEERING FLUID LEAKS

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.
11. Does moan remain?  
YES - do figure 8 manoeuvres e.g. on car park.  
NO - end.
12. Does moan remain?  
YES - continue  
NO - end.
13. Is noise an intermittent "grunt"?  
YES - *See power steering system "grunt"*  
NO - continue.

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**POWER STEERING SYSTEM - EXCESSIVE NOISE**


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1. Is fluid level correct?  
YES - go to 3.  
NO - Refill or drain to correct level. Bleed system, check for leaks.
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, using tension gauge.  
NO - go to 10.
9. Does squeal remain?  
YES - drive belts contaminated, change belts.  
NO - end.
10. Is noise a continuous moan?  
YES - bleed PAS system.  
NO - go to 13.

14. Is it a clunking noise?  
YES - reset drive belt tension, using tension gauge.  
NO - contact local technical office.
15. Does noise remain?  
YES - Suspect suspension or drive train.  
NO - end.

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**POWER STEERING SYSTEM "GRUNT"**


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**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.
2. Does grunt remain?  
YES - continue  
NO - end.
3. Is correct high pressure hose, pump to box fitted? Diesel NTC 1881, V8 ANR 1887 (Right hand drive only).  
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 with both front wheels free.
2. With engine off, centralise steering wheel. Remove steering wheel cover. 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:

Range Rover with ABS **5.65 Nm.**

Range Rover non-ABS and Discovery **4.40 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 u/j lubrication

## Lower steering shaft universal joint lubrication

1. Check lower steering shaft is correctly phased, *See Repair, Lower steering shaft and universal joints pre 1991 See Repair, Lower steering shaft and universal joints 1991 onward*
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, STUB AXLE, AXLE SHAFT, CONSTANT VELOCITY JOINT AND SWIVEL PIN, 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. 1990 model year ABS vehicles *See FRONT AXLE AND FINAL DRIVE, Overhaul, FRONT STUB AXLE, CONSTANT VELOCITY JOINT AND SWIVEL WITH ABS*  
Note that a torque to turn of 5.1 - 7.3 Nm is required after the axle shaft and swivel housing seal have been removed.
3. 1991 model year ABS vehicles *See FRONT AXLE AND FINAL DRIVE, Overhaul, FRONT STUB AXLE, CONSTANT VELOCITY JOINT AND SWIVEL WITH 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.
4. 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 two screws nearest steering wheel securing lower steering column shroud to upper shroud. Reposition shroud, tighten fixings.
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 spring 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 Adjustment, power steering pump drive belt*  
If using a belt tension gauge the following figures should be obtained:

Run-in belt: 355 - 400 N (80 - 90 lbf)

New belt: 400 - 425 N (90 - 100 lbf)

5. Steering shaft universal joints - check the phasing of the universal joints on vehicles prior to VIN Nos. 601607 (Range Rover) and LJ 002272 (Discovery). Rephase if required, *See Repair, Lower steering shaft and universal joints pre 1991 See Repair, Lower steering shaft and universal joints 1991 onward*
6. Track rod/draglink - 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.
7. 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*

8. Oil leaks - check front and rear axle hubs for leaks. repair as necessary.
9. Brake system - check brake system for leaks, pipe condition, pad wear/contamination, disc wear/condition and ABS sensors for correct fitting.
10. Hub end float - check movement in the hubs by rocking the wheels.
11. Check front wheel alignment, ensuring toe out is between 0 - 2.0 mm. Note that for vehicles displaying a tendency to veer more than considered allowable, it is permissible to set the front track to parallel.
12. 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.

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**STEERING LINKAGE INSPECT**

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**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 manufacturers. 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, *See CHASSIS AND BODY, Repair, Engine undertray*
3. Disconnect drag link from steering drop arm.
4. Check torque to turn, *See Fault diagnosis, Stiff steering check list*
5. Centralise steering box *See Centralise steering box.*



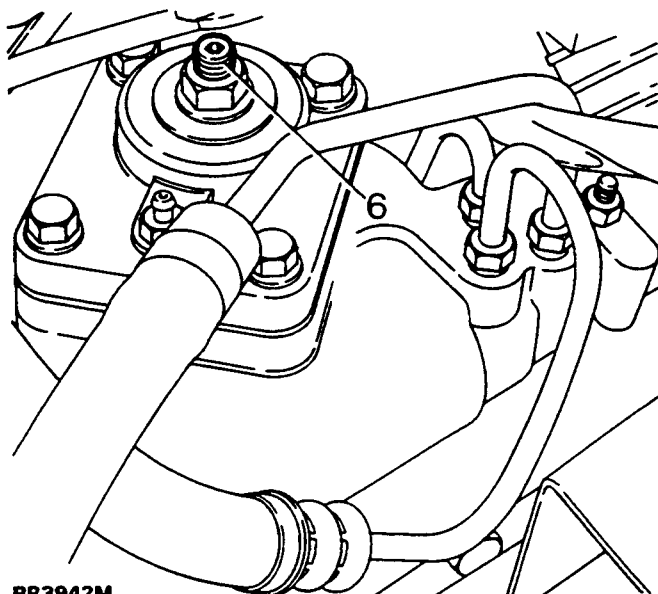
**NOTE:** Only check for no backlash when steering box is in central position.



**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 exist slacken 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 draglink 919 mm between centres if vehicle is prior to November 1991 (drop arm ball joint). Adjust draglink 924 mm between centres if vehicle is post November 1991.
12. Connect drag link and tighten nut to **40Nm fit new split pin.**
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, draglink length is incorrect and is pushing drop arm away from central position.

### Draglink adjust


15. Right hand drive vehicles - if steering wheel is to right, draglink is too long. If steering wheel is to left draglink is too short. Left hand drive vehicles - if steering wheel is to right, draglink is too short. If steering wheel is to left draglink is too long.
16. Adjust draglink until steering wheel points straight ahead when vehicle is travelling in a straight line.
17. If vehicle has cruise control centralise the cassette *See Repair, Cruise control cassette centralise*

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**CENTRALISE STEERING BOX**


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1. Rotate steering wheel to full left hand lock (right hand drive) full right hand lock (left hand drive). Turn steering wheel back towards centre two full turns.

 **NOTE: Steering boxes fitted to Range Rover post VIN 615503 and Discovery post VIN 018110 have a pegging feature to enable the steering box to be positively pegged on centre.**

2. 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.

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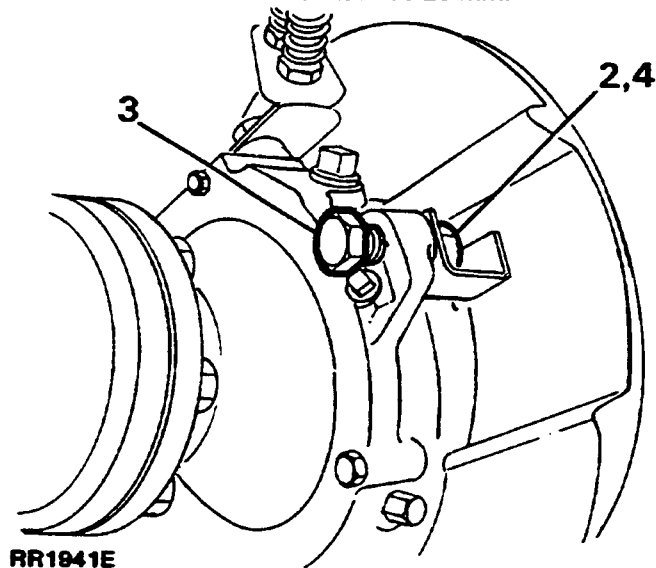
**STEERING LOCK STOPS**


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Service repair no - 57.65.03.

**Check**

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

**Adjust**

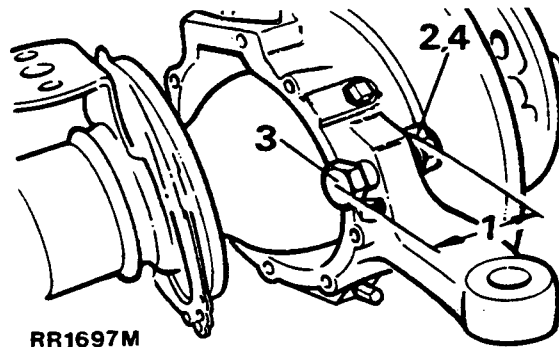
2. Loosen stop bolt locknut.
3. Turn stop bolt as required.
4. Tighten locknut.
5. Check clearance between tyre wall and radius arm on each lock.



**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.

**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.

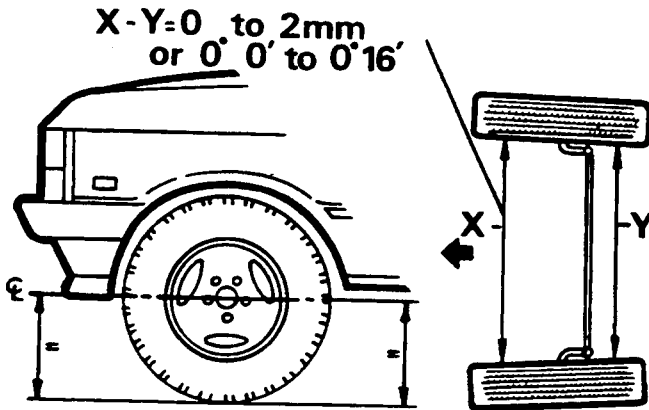
Check and adjust

Checking Toe-out dimensions

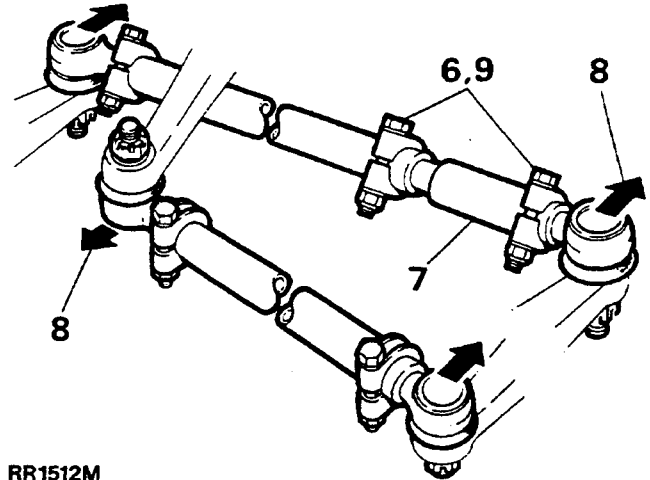


**NOTE: No Adjustment is provided for castor, camber or swivel pin inclinations.**

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.
5. Tighten to **14Nm**.



RR2172E



RR1512M

Adjust

6. Loosen adjuster sleeve clamp.
7. Rotate adjuster to lengthen or shorten track rod.
8. 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.
9. Tighten clamp bolts to **14Nm**.

**POWER STEERING PUMP DRIVE BELT**

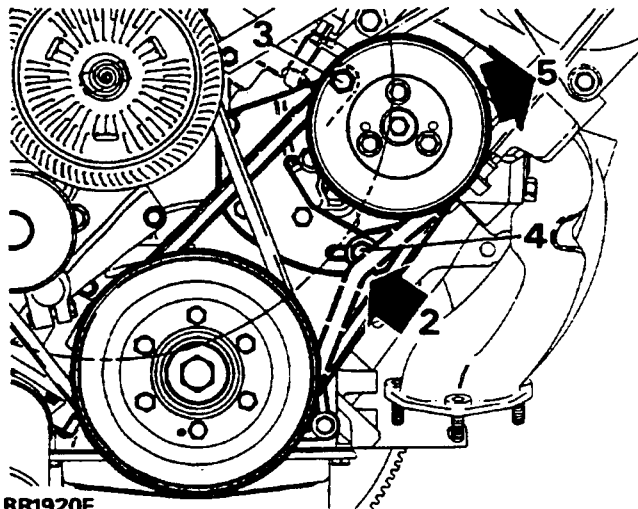
Service repair no - 57.20.01.

**Adjust**

1. Disconnect the battery negative lead.
2. Check belt tension midway between crankshaft and pump pulley. There should be movement of 4 to 6mm.
3. Loosen two nuts at side of pump.
4. Loosen bolt securing lower bracket to slotted adjustment link.
5. Pivot pump until correct belt tension is obtained.



**CAUTION: Do not lever against pump casing. Damage to pump casing may cause fluid leaks.**



RR1920E

6. Hold tension and tighten pump adjusting bolt and two nuts.



**NOTE: Check alternator drive belt tension after adjusting power steering pump belt.**

7. Reconnect the battery negative lead.
8. Recheck belt tension after running engine 3 to 5 minutes, if new belt fitted.



**POWER STEERING FLUID PIPES**

Service repair no - 57.15.21.

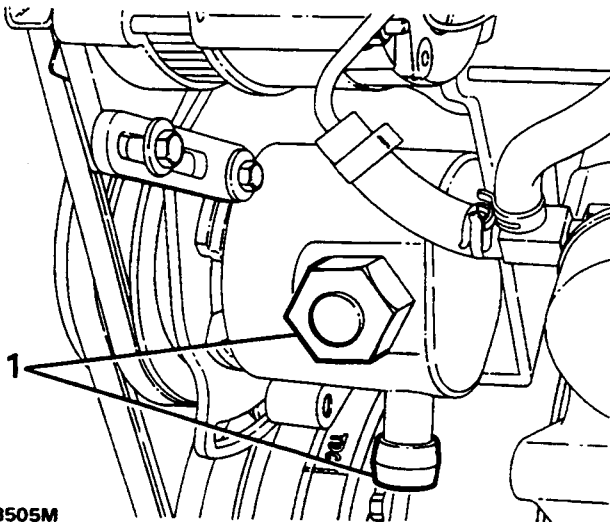


**CAUTION:** If any joints are disconnected, it is essential that open pipe and ports are plugged to prevent ingress of dirt.

The following procedures must be followed when refitting fluid pipes:

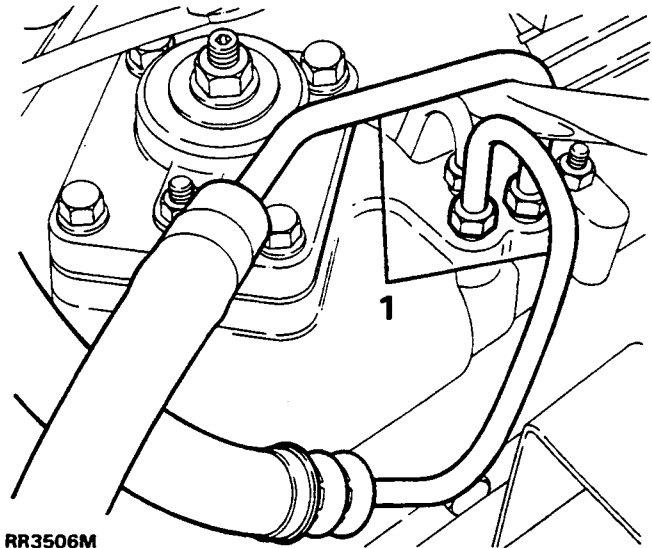
**Power steering pump**

1. Remove plugs, place clamp on feed hose.



RR3505M

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

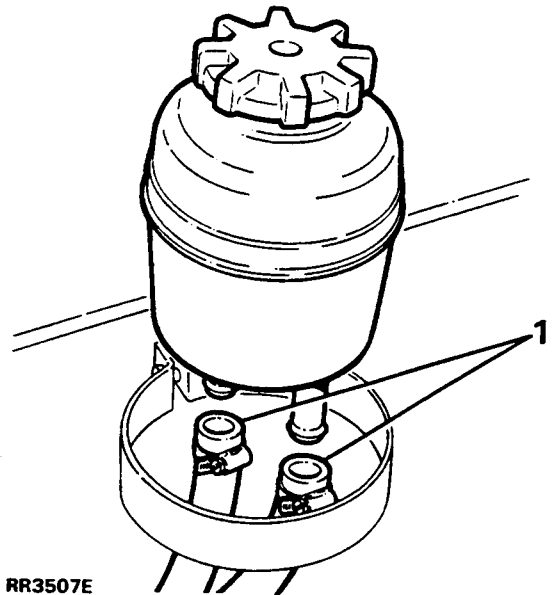


RR3506M

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

**Power steering reservoir**

1. Remove plugs and refit pipes and clamps.



RR3507E

2. Hold clamps. Tighten 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 cruise control spiral cassette 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 cruise control cassette 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 multiplug to cassette, tighten steering wheel securing nut and fit trim.

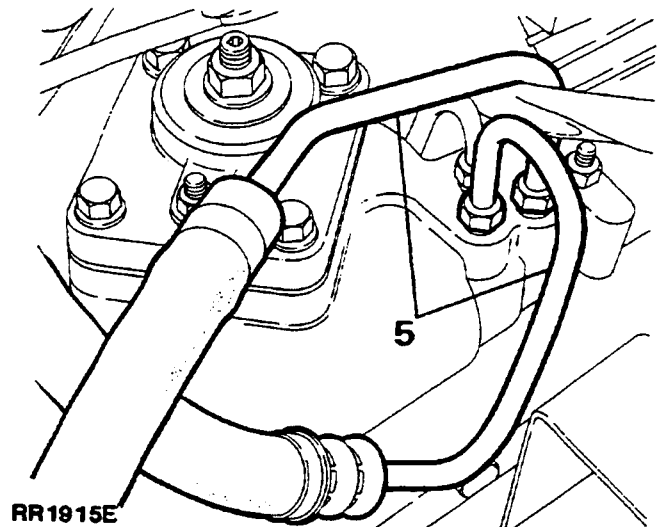


**NOTE:** When drag link is disconnected from steering box, travel available at steering wheel to each full lock is not equal. Steering box is assymetric, to set box on centre follow correct procedure.

### Remove and refit

#### Remove

1. Site vehicle on level surface.
2. Open bonnet.
3. Remove filler cap from power steering fluid reservoir.
4. Disconnect fluid pipes from pump. Drain and discard fluid. Replace filler cap.
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 ramp.

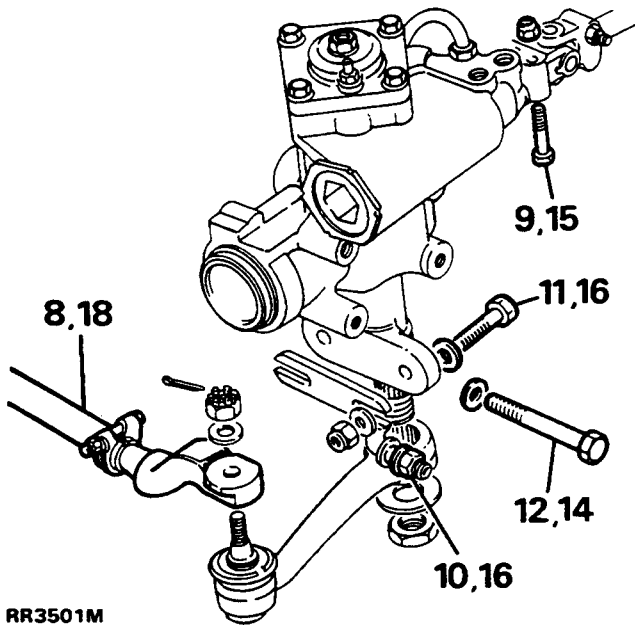


**WARNING:** Ensure wheels are chocked, parking brake is applied, and low range selected.

8. Disconnect drag link from drop arm using a suitable extractor.
9. Remove pinch bolt attaching universal joint to power steering box.



10. Loosen nut, tie bar to panhard rod mounting bracket.
11. Remove bolts securing tie bar to steering box. Move tie bar aside.
12. Remove fixings securing power steering box to chassis side member.
13. Withdraw power steering box.



RR3501M

#### Refit

14. Refit steering box to chassis side member, tighten four bolts to **81Nm**.
  15. Connect pinch bolt securing universal joint to power steering box. Tighten to **35Nm**.
  16. Refit tie bar, tighten three fixings. Starting with tie bar to panhard rod, then loosen all three by one complete turn.
  17. Check steering box, adjust if necessary. See **Adjustment, Power steering box**
  18. Refit drag link and secure.
  19. Lower vehicle to ground.
  20. Remove plugs and refit pipes to steering box. Tighten 16mm thread to **20Nm**.  
14mm thread to **15Nm**.
  21. 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**
  22. Recheck fluid level and replace cap.
  23. With engine running, test steering system for leaks by holding steering in both full lock directions.
- CAUTION:** Do not maintain this pressure for more than 30 seconds in any one minute, to avoid oil overheating and possible seal damage.
24. 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.
25. Drive vehicle in a straight line on level ground and stop.
  26. Tighten tie bar to panhard rod mounting arm to **110Nm**.
  27. Tighten two fixings securing tie bar to steering box to **81Nm**.
  28. Ensure steering wheel is correctly aligned when wheels are positioned straight ahead.
  29. If necessary reposition steering wheel. See **steering wheel**
  30. Road test vehicle.

## POWER STEERING SYSTEM - BLEED

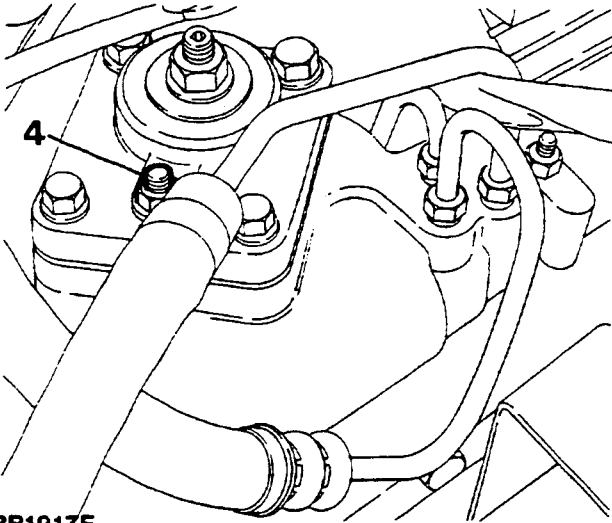
Service repair no - 57.15.02.

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.

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.

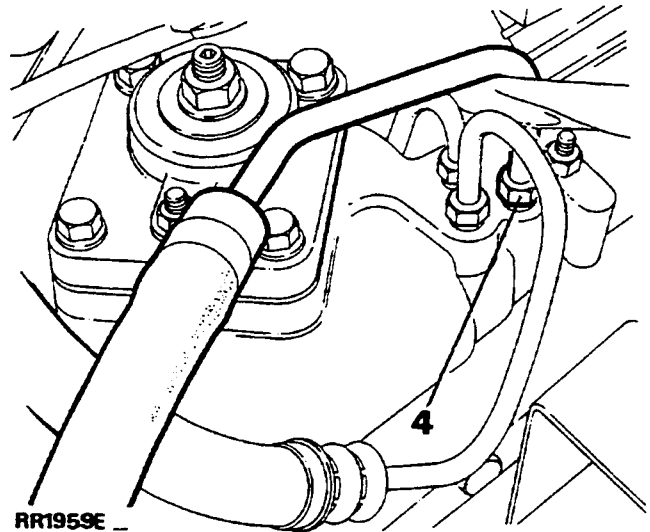
## POWER STEERING FLUID RESERVOIR

Service repair no - 57.15.08.

### Remove and refit

#### Remove

1. Place tray under power steering box.
2. Prop open bonnet.
3. Remove reservoir filler cap.
4. Disconnect return hose from steering box. Drain fluid from reservoir.



RR1959E

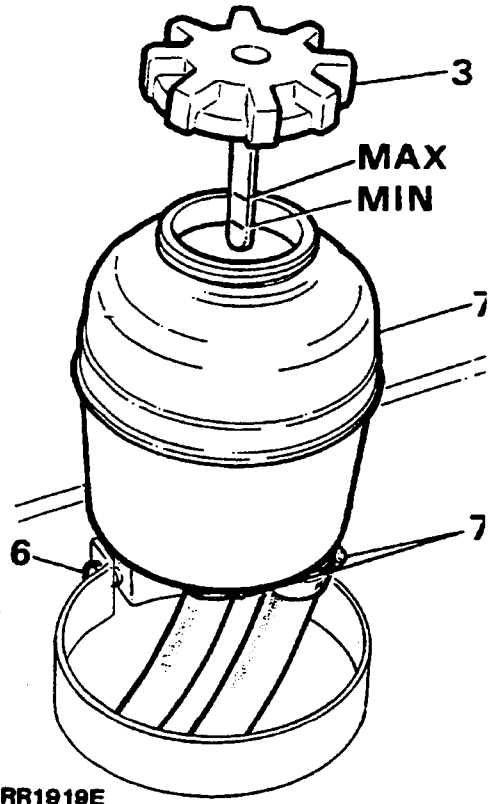


**CAUTION:** Power steering fluid damages paintwork. Clean immediately any spillage. Use only fresh fluid when filling power steering system.

5. Refit return hose to steering box.
6. Release bolt and remove reservoir.
7. Remove flexible hoses from reservoir. See *Power steering fluid pipes*



**NOTE:** The reservoir contains a non serviceable filter. Should power steering fluid prove to be contaminated a new reservoir must be fitted. Vehicles after VIN 629042 have a serviceable filter fitted in the neck of the PAS reservoir.



RR1919E

## Refit

8. Reconnect flexible hoses to reservoir. Tighten hose clamps to **3 Nm**.
9. Refit reservoir and tighten pinch bolt.
10. Fill reservoir to level on dipstick with fluid. See **LUBRICANTS, FLUIDS AND CAPACITIES, Information, Recommended Lubricants and Fluids**
11. Bleed power steering system. See **Power Steering System - bleed**
12. Fit reservoir filler cap.

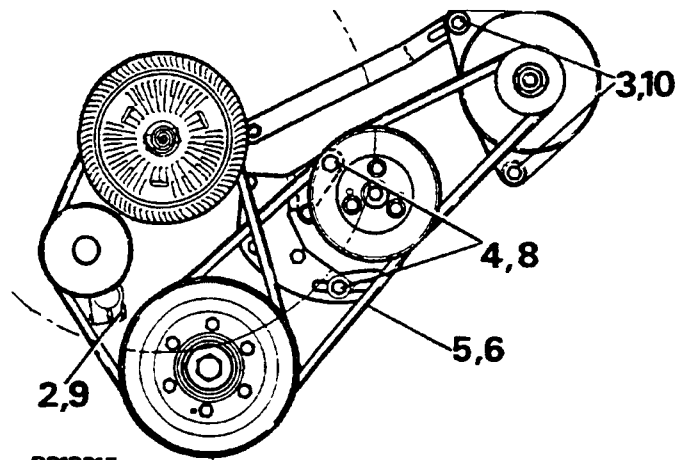
## POWER STEERING PUMP DRIVE BELT

Service repair no - 57.20.02.

## Remove and refit

## Remove

1. Disconnect the battery negative lead.
2. Loosen idler pulley bolt and remove fan belt.
3. Loosen alternator mountings and remove drive belt.
4. Loosen power steering pump mountings.
5. Pivot pump and remove drive belt.



RR1921E

## Refit

6. Fit drive belt onto crankshaft and pump pulleys.
7. Adjust belt tension. See **Adjustment, Power steering pump drive belt**

## STEERING PUMP

Service repair no - 57.20.14.

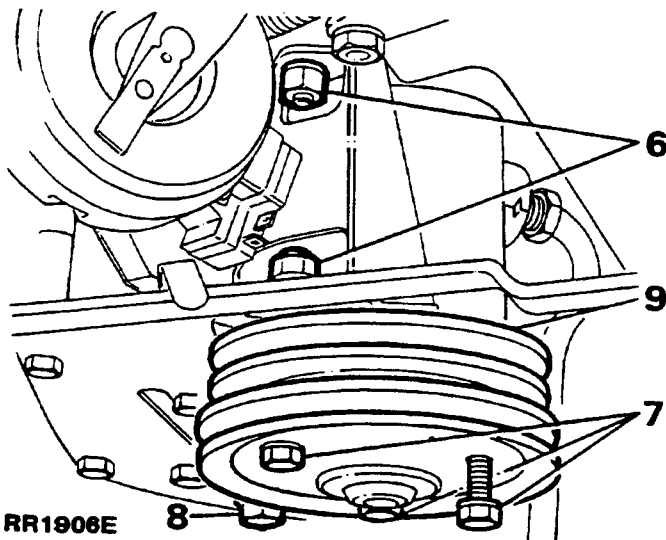
## Remove and refit



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

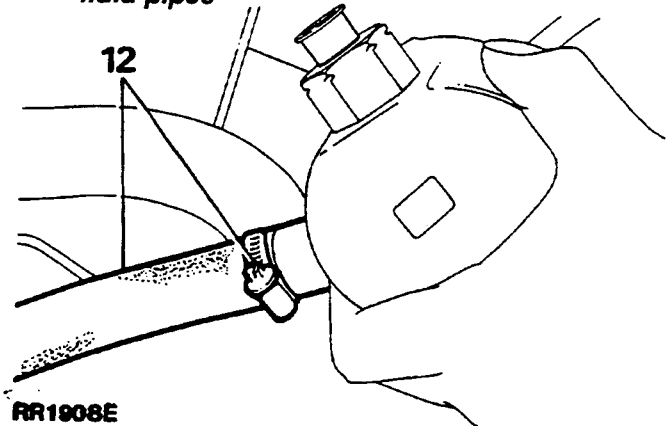
## Remove

1. Disconnect the battery negative lead.
2. Remove alternator drive belt. *See SECTION 10, Maintenance, Under Bonnet Maintenance*
3. Remove water pump drive belt. *See SECTION 10, Maintenance, Under Bonnet Maintenance*
4. Remove left bank spark plug leads and detach distributor cap.
5. Disconnect electrical plug from distributor amplifier unit.
6. Loosen two nuts securing steering pump pivot bracket.



7. Loosen three bolts securing pulley to steering pump.
8. Loosen adjustment bolt, and remove drive belt.
9. Remove three bolts with plain washers and remove pulley.
10. Disconnect fluid pipe from side of pump, *See Power steering fluid pipes*

11. Remove three bolts securing pump to pivot bracket. Remove pump as far as connected hose will permit.
12. Remove hose to pump. *See Power steering fluid pipes*



## Refit

13. Fit feed hose to pump. Tighten hose clamp to **3Nm**.
14. Fit pump into pivot bracket and secure with three bolts. Tighten to **35Nm**.
15. Fit pressure pipe to steering pump. Hold pipe in position. Tighten to **20Nm**.



**CAUTION:** Ensure high pressure fluid pipe is clear of drive belt and top of steering box.

16. Fit pulley to steering pump coat three bolts with Loctite and fit fingertight.
17. Refit and tension steering pump drive belt. *See Adjustment, Power steering pump drive belt*
18. Tighten three steering pump pulley bolts to **10Nm**.
19. Reverse remaining removal instructions.
20. Bleed power steering system. *See Power steering system - Bleed*



## LOWER STEERING SHAFT AND UNIVERSAL JOINTS PRE 1991

Service repair no - 57.40.25.



**NOTE:** Vehicles built before VIN 601607 Range Rover or VIN 002272 Discovery (Jan 1991) require lower steering shaft universal joints checked for alignment and rephased if necessary. The two bolts marked \* in RR3943M must be in line. Vehicles after these VINs have a pre assembled rubber coupling and universal joint, with a further change which eliminates the possibility of misaligned universal joints. See lower steering shaft and universal joints 1991 onwards



**CAUTION:** Before removing any parts of steering linkage, it is imperative that road wheels are positioned straight ahead. Then steering wheel removed to prevent cruise control spiral cassette 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 cruise control cassette 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 multiplug to cassette, tighten steering wheel securing nut and fit trim.

### Remove and refit

#### Remove

1. Ensure road wheels are straight ahead.



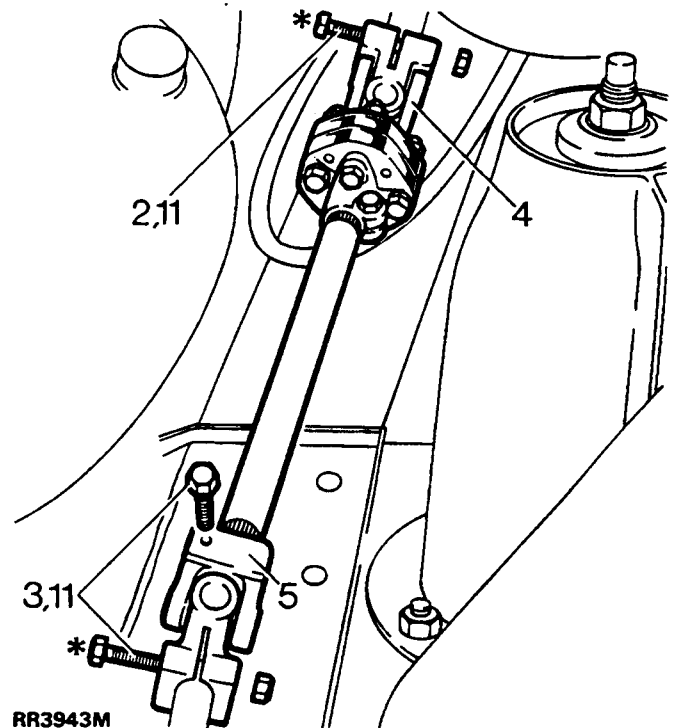
**NOTE:** To access coupling shaft, on left hand drive vehicles, remove air flow sensor and air filter canister.

2. Remove pinch bolt from top universal joint to steering column.
3. Remove two pinch bolts from lower universal joint.
4. Move shaft up to release lower joint from steering box splines. Remove shaft from the steering column splines.

5. Remove lower universal joint from shaft.



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



6. Inspect universal joints for wear and excessive play, renew if necessary.
7. Inspect rubber coupling renew assembly if necessary.
8. Inspect universal joints for stiffness, lubricate if necessary.

#### Refit



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

9. Position lower universal joint on shaft.
10. Position shaft assembly onto steering column. Move assembly up spline to enable lower universal joint to fit onto steering box splines.
11. Align bolt holes with grooves in splines. Fit pinch bolts, and tighten nuts to **35Nm**.

### LOWER STEERING SHAFT AND UNIVERSAL JOINTS 1991 ONWARD



**NOTE:** JAN 1991 introduction at VIN 601607 Range Rover or VIN 002272 Discovery. Where applicable See *Lower steering shaft and universal joints pre 1991*



**CAUTION:** Before removing any parts of steering linkage, it is imperative that road wheels are positioned straight ahead. Then steering wheel removed to prevent cruise control spiral cassette 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 cruise control cassette 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 multiplug to cassette, tighten steering wheel securing nut and fit trim.

#### Remove and refit

#### Remove

1. Ensure road wheels are straight ahead.

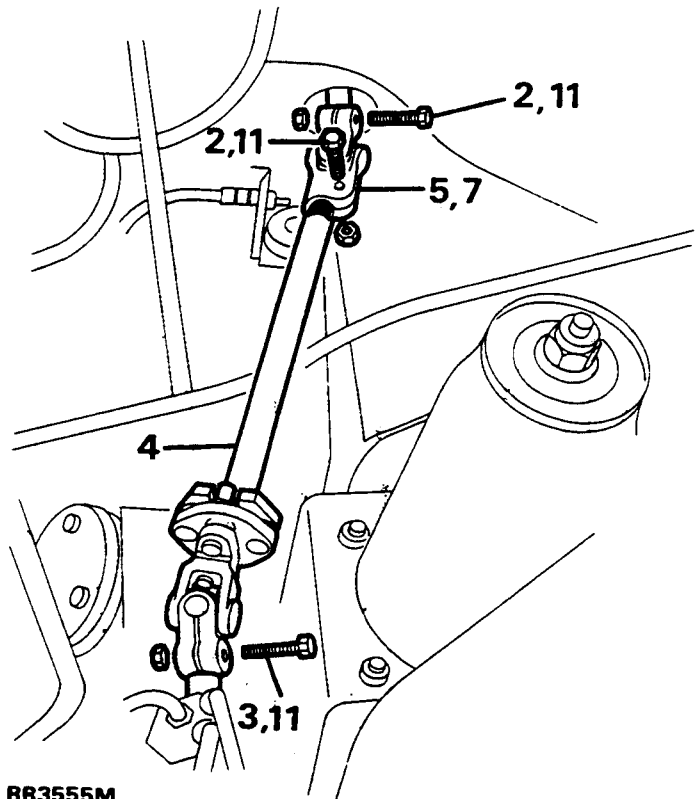


**NOTE:** To access coupling shaft, on left hand drive vehicles, remove air flow sensor and air filter canister.

2. Remove two pinch bolts from top universal joint to steering column.
3. Remove pinch bolt from lower universal joint.
4. Move shaft up to release lower joint from steering box splines. Remove shaft from the steering column splines.
5. Remove top universal joint from shaft.



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



RR3555M

6. Inspect universal joints for wear and excessive play, renew if necessary.
7. Inspect rubber coupling renew assembly if necessary.
8. Inspect universal joints for stiffness, lubricate if necessary.

#### Refit



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

9. Position lower universal joint on shaft.
10. Position shaft assembly onto steering column. Move assembly up spline to enable lower universal joint to fit onto steering box splines.
11. Align bolt holes with grooves in splines. Fit pinch bolts, and tighten nuts to **35Nm**.



## STEERING WHEEL

Service repair no - 57.60.01.



**CAUTION:** Before removing any parts of steering linkage, it is imperative that road wheels are positioned straight ahead. Then remove steering wheel to prevent cruise control spiral cassette 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 cruise control cassette are correctly positioned before steering wheel is replaced. Centralise cruise control cassette See *Cruise control cassette centralise*

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

After final alignment connect multiplug to cassette, tighten steering wheel securing nut and fit trim.

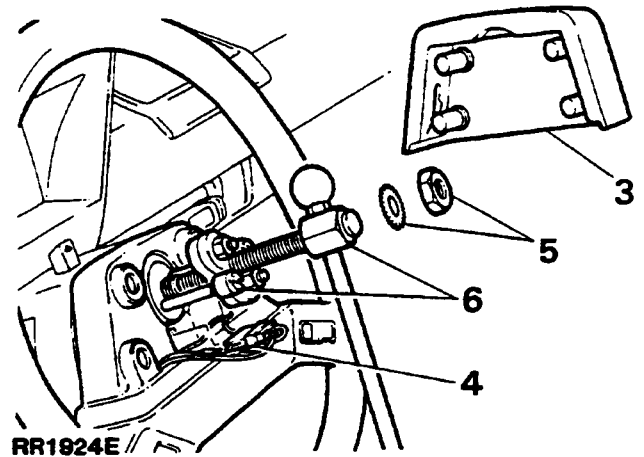
### Remove and refit

#### Remove



**NOTE:** The steering column incorporates shear pins. do not impart shock loads to steering column during remove and refit of steering wheel.

1. Disconnect the battery negative lead.
2. Position road wheels straight ahead so steering wheel can be correctly re-assembled.
3. Remove centre trim pad from steering wheel.
4. Disconnect cruise control multiplug located below centre nut.
5. Remove retaining nut and serrated washer.
6. Remove steering wheel using service tools LRT-57-014 and 015.



**CAUTION:** Prevent rotation of cruise control cassette once steering wheel is removed. Secure cassette in position with adhesive tape.

### Refit

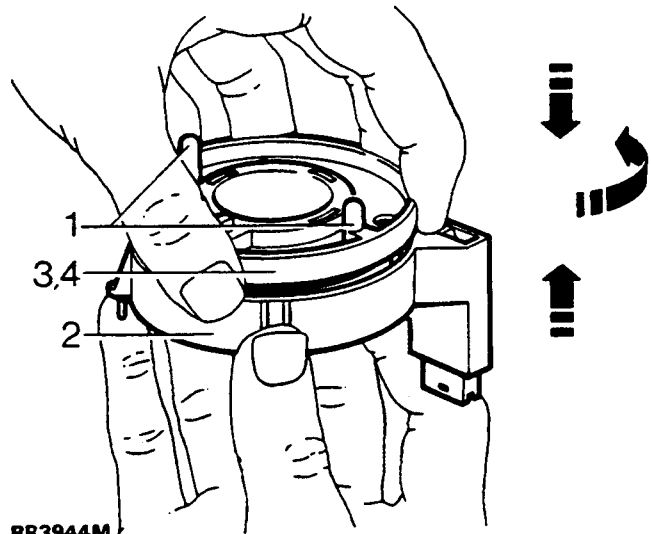
7. Recheck road wheels are positioned straight ahead.
8. Fit steering wheel on column splines. Remove adhesive tape securing cruise control cassette.
9. Fit drive pegs of cassette into holes in steering wheel.
10. Fit washer and nut tighten to **38nm**.
11. Fit cruise control multiplug. fit centre trim pad.
12. Reconnect the battery negative lead.



### CRUISE CONTROL CASSETTE CENTRALISE

On vehicles with cruise control the cruise control cassette is centralised using the following procedure.

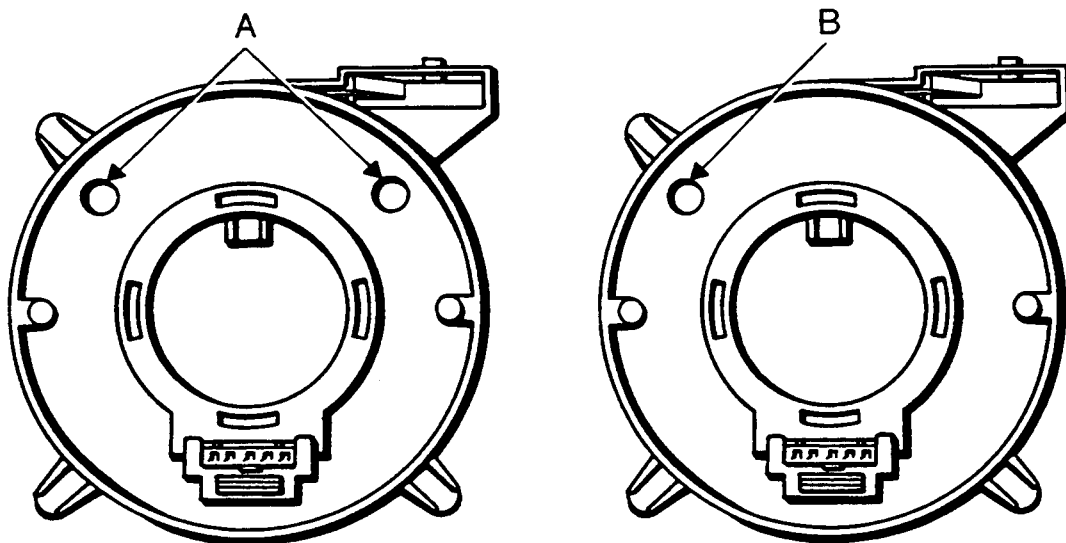
1. Hold spiral cassette with steering wheel location pegs facing forwards, see RR3944M.
2. Hold lower half of cassette.
3. Rotate upper half anti-clockwise as far as tape will allow.



RR3944M

**NOTE:** To disengage ratchet force the two halves together. Do not apply excessive force when limit is reached, as this may result in tape breakage.

4. Rotate the upper half of the cassette approximately 1/4 turn clockwise until holes in cassette upper and lower halves are aligned. Item A in illustration RR3945M, shows two holes aligned with holes in lower half, vehicles before VIN 452004. B shows one hole aligned with hole in lower half, vehicles after VIN 452004.



RR3945M



## STEERING COLUMN

Service repair no - 57.40.01.



**NOTE:** Steering column assembly is not a serviceable component.

### Remove



**CAUTION:** The steering column incorporates shear pins. Do not impart shock loads to steering column during remove and refit of steering wheel.



**CAUTION:** Before removing any parts of steering linkage, it is imperative that road wheels are positioned straight ahead. then steering wheel removed to prevent cruise control spiral cassette 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 cruise control cassette 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 multiplug to cassette, tighten steering wheel securing nut and fit trim.

### Remove and refit

#### Remove

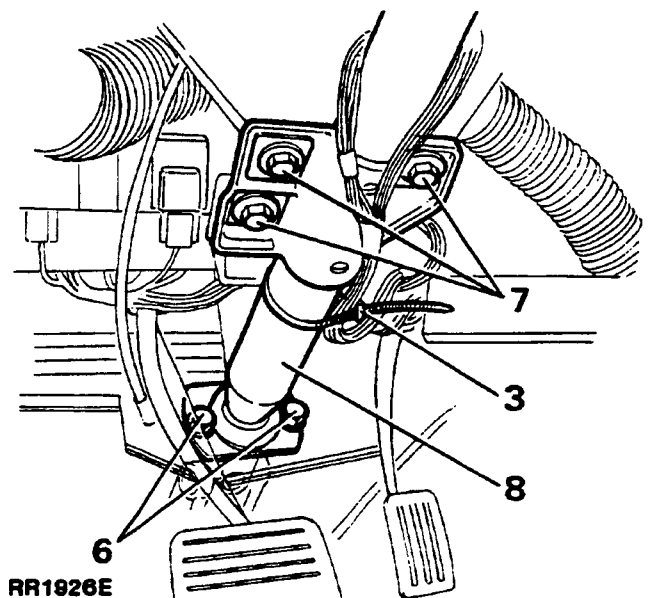
1. Remove steering wheel. *See Steering Wheel*



**CAUTION:** Prevent rotation of cruise control cassette once steering wheel is removed. secure cassette in position with adhesive tape.

2. Remove lower dash panel and unclip lower trim pad.

3. Disconnect electrical multiplugs from steering column switches. Release wire retaining clip from steering column.
4. Remove steering column shroud. *See CHASSIS AND BODY, Repair, Steering column shroud*
5. Remove pinch bolt, from upper universal joint to steering column, *See lower steering shaft and universal joints pre 1991 See lower steering shaft and universal joints 1991 onward*
6. Remove fixings, steering column to floor.
7. Remove fixings, steering column to dash bracket.
8. Remove steering column assembly.



RR1926E

#### Refit

9. Position sealing gasket to end of column assembly.
10. Fit steering column to universal joint.
11. Fit column upper fixings, do not tighten.
12. Fit column lower fixings, do not tighten.
13. Tighten lower fixings to **27 Nm**.
14. Fit universal joint pinch bolt. Tighten to **35 Nm**.
15. Tighten column upper fixings to **27 Nm**.
16. Reverse removal procedure. 1 to 4.

**STEERING COLUMN LOCK ASSEMBLY**

Service repair no - 57.40.31.

**Remove**

For remove and refit of ignition switch. See **ELECTRICAL, Repair, Ignition starter switch**



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



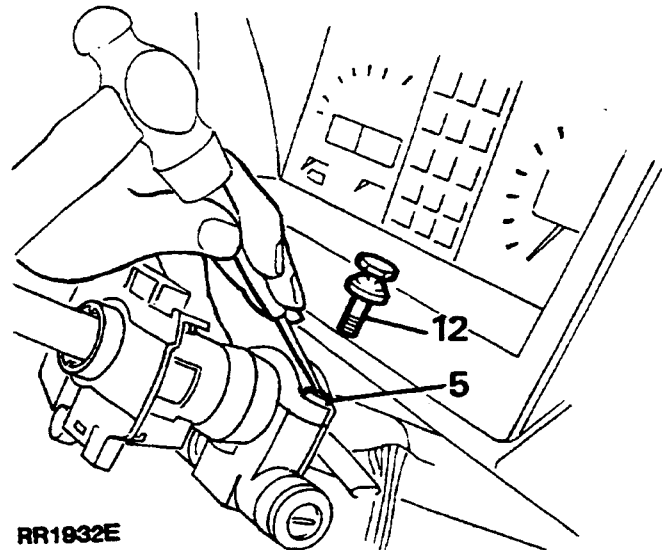
**CAUTION:** After refitting steering linkage parts follow correct procedure to ensure that road wheels, steering box and steering wheel are correctly positioned relative to each other when in straight ahead condition. If steering wheel requires repositioning, ensure that drive pegs on cruise control cassette 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 multiplug to cassette, tighten steering wheel securing nut and fit trim.

**Remove and refit****Remove**

1. Disconnect the battery negative lead.
2. Remove steering wheel. *See Steering wheel*
3. Remove steering column shroud. *See CHASSIS AND BODY, Repair, Steering column shroud*
4. Release column switches from switch housing to access column lock fixings.



RR1932E

5. Tap head of shear pins anti-clockwise to release them.
6. Remove sheared bolts.
7. Detach upper cap.
8. Remove steering column lock assembly.

**Refit**

9. Position steering lock upper cap on outer column, locating spigot in hole provided.
10. Place lower lock assembly into column.
11. Fit shear bolts to retain cap and lock.
12. Tighten bolts sufficient to shear off heads.
13. Reverse removal procedure. 1 to 4.



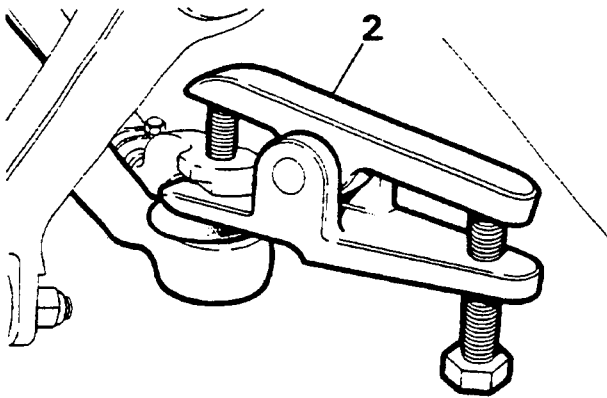
## DROP ARM

Service repair no - 57.50.14.

### Remove and refit

#### Remove

1. Place vehicle on a hoist, or support front axle on axle stands.
2. Disconnect drag link from drop arm ball joint, using extractor LRT-57-018.



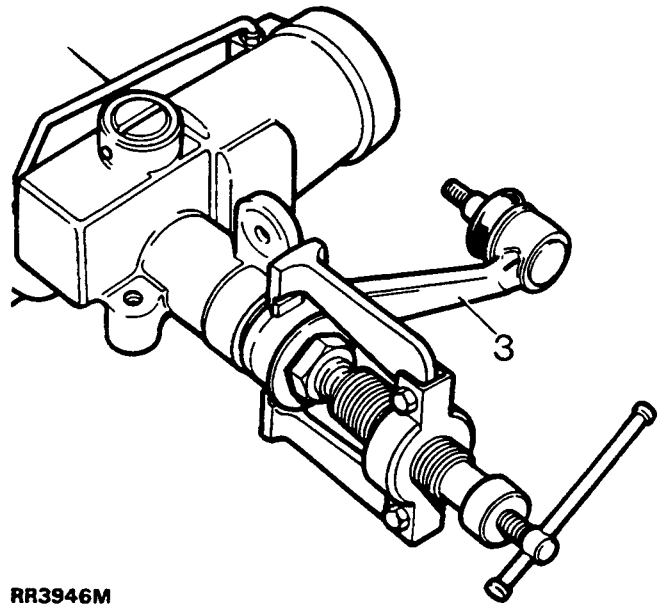
RR1939E

3. Remove drop arm using extractor LRT-57-012. Loosen drop arm securing nut, but do not remove before using extractor.



link.

**NOTE:** The drop arm integral ball joint was deleted in November 1991. Vehicles after this date have the ball joint on the drag



RR3946M

#### Refit

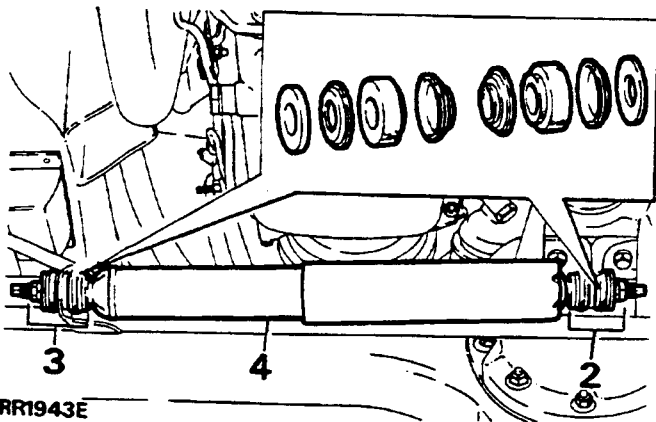
4. Centralise steering box by rotating steering wheel to full inner lock, (full left lock for right drive vehicle or full right lock for left drive vehicle). Turn steering wheel back exactly two full turns.
5. Fit drop arm, align master splines.
6. Fit a new tab washer and drop arm fixing. Tighten to **176 Nm**, bend over tab.
7. Fit drag link. Tighten to **40 Nm**.

**STEERING DAMPER**

Service repair no - 57.55.21.

**Remove and refit****Remove**

1. Place vehicle on a hoist, or support front axle on axle stands.
2. Remove fixings at differential case bracket.
3. Remove fixings at track rod bracket.
4. Remove steering damper.

**Refit**

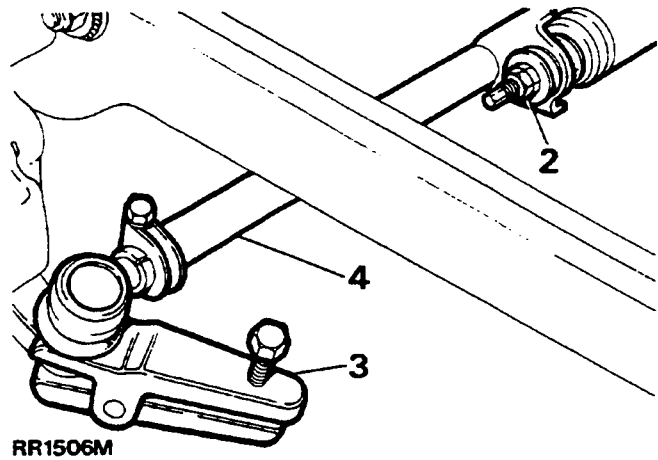
5. Reverse removal procedure. 1 to 4.

**TRACK ROD AND LINKAGE**

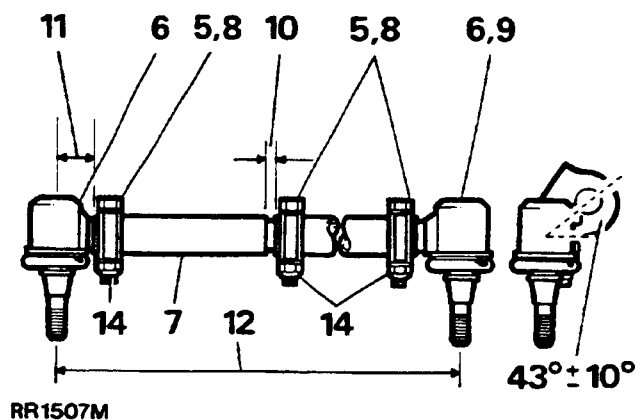
Service repair no - 57.55.09.

**Remove track rod**

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

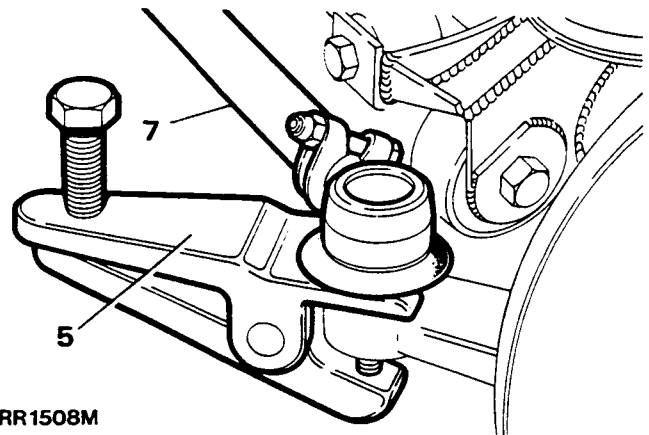
13. Fit track rod and tighten ball joint nuts to **40 Nm**.
14. Check front wheel alignment. *See Adjustment, Front wheel alignment*
15. Connect steering damper to track rod.
16. Remove vehicle from hoist, or axle stands.

### DRAG LINK AND DRAG LINK ENDS

Service repair no - 57.55.17.

#### Remove drag link

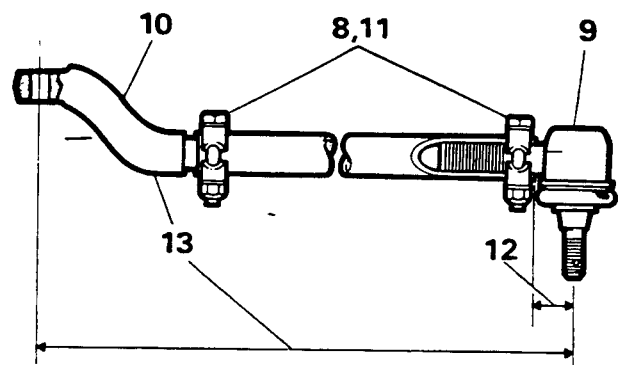
1. Check front wheel alignment. *See Adjustment, Front wheel alignment*
2. Ensure wheels are positioned straight ahead during following procedure.
3. Place vehicle on a hoist, or support front axle on axle stands.
4. Remove right front road wheel.
5. Disconnect drag link ball joint at swivel housing arm, using extractor LRT-57-018.
6. Disconnect drag link end at drop arm ball joint.
7. Remove drag link.



RR1508M

#### Remove drag link ends

8. Loosen clamp bolts.
9. Unscrew ball joint.
10. Unscrew offset end.



RR1509M

**Remove drag link ends**

11. Fit replacement ends. Loosely fit clamp bolts.
12. Set ball joint to drag link distance to 28.5mm as shown.
13. Adjust offset end to nominal length of 919.0mm. this length is adjusted during refit. Adjust to nominal length of 924.00 mm if vehicle is post November 1991.
14. Centralise steering box by rotating steering wheel to full inner lock, (full left lock for right drive vehicle or full right lock for left drive vehicle). Turn steering wheel back exactly two full turns. OR, use centralising feature if possible.
15. Align steering wheel, if necessary. *See steering wheel*

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.



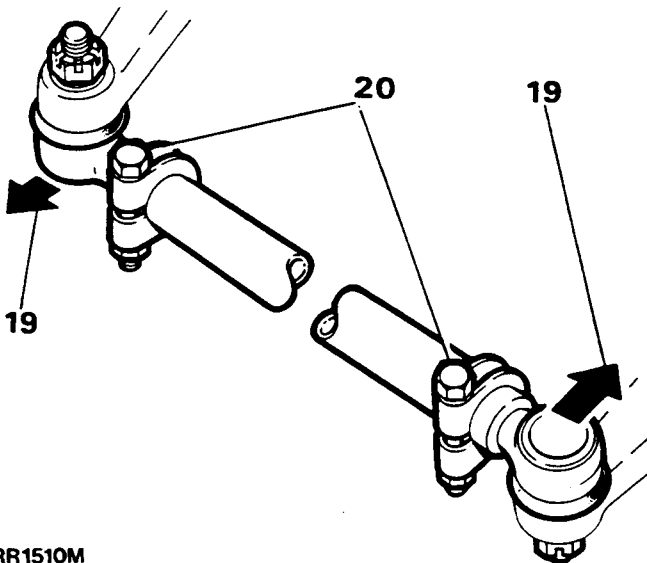
**WARNING:** To correct steering wheel deviations greater than ±5°. Remove and reposition steering wheel, *See steering*

*wheel*

**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 **40nm**.
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**.



RR1510M



**POWER STEERING BOX**

Service repair no - 57.10.07.

**Overhaul**



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

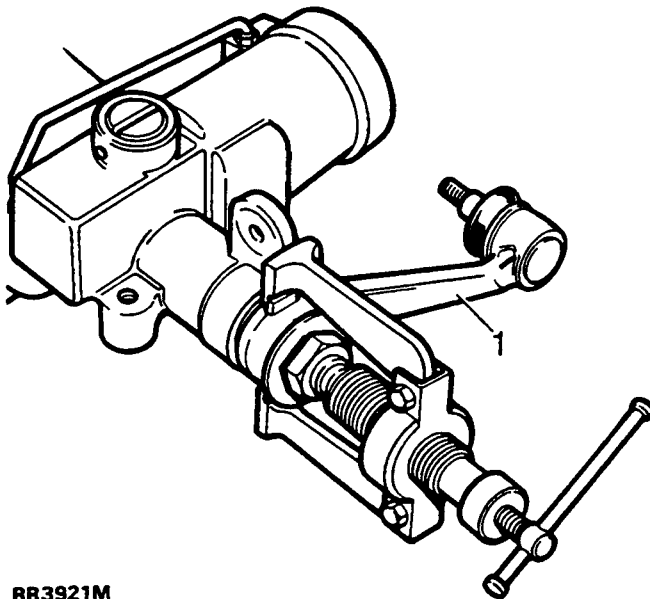


**WARNING:** Wear safety glasses while removing and refitting circlips and retaining ring.

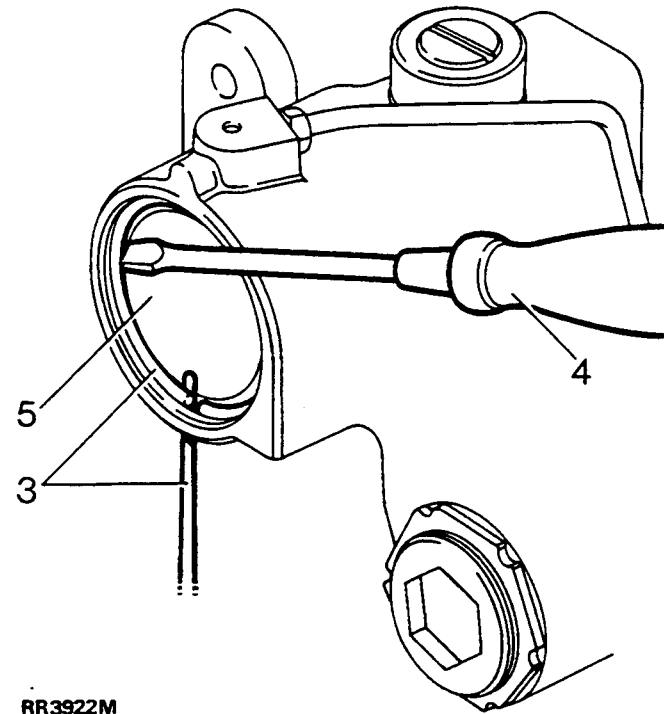


**CAUTION:** Absolute cleanliness is essential when overhauling power steering box.

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.

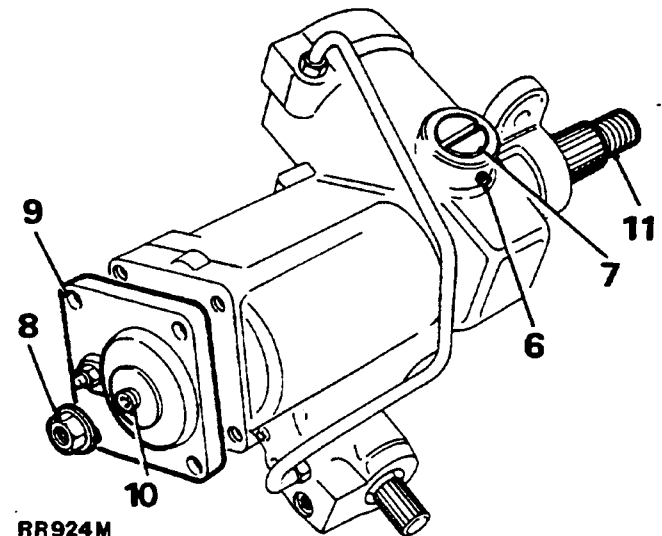


5. Turn input shaft (left lock on left hand drive, right lock on right hand drive) until piston pushes out cover. Turn input shaft fully in opposite direction, applying pressure to piston.
6. Remove set screw retaining rack pad adjuster.
7. Remove rack adjuster and pad.
8. Remove sector shaft adjuster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



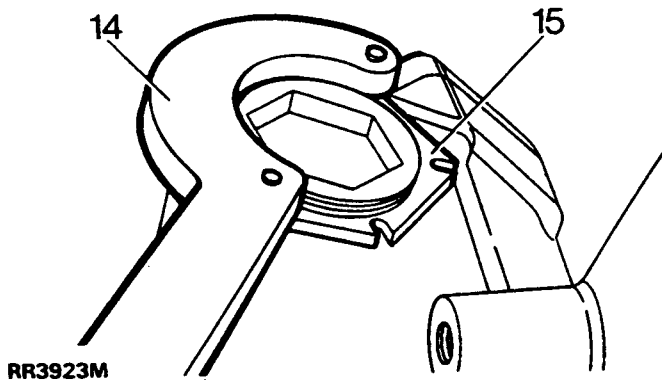
**NOTE:** Steering boxes after serial number 2 M 2166 have sealant applied to hexagon socket to 'tamperproof' sector shaft adjuster.

11. Slide out sector shaft.



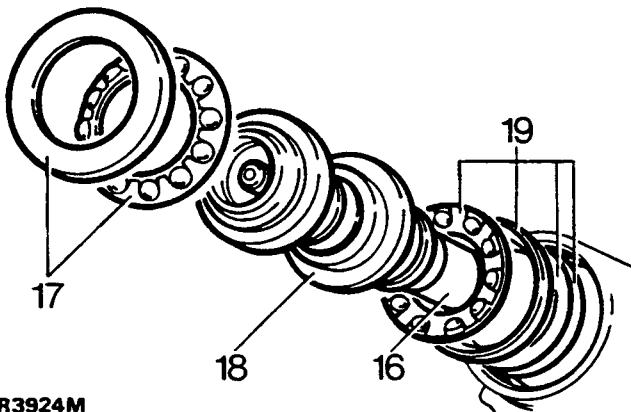


12. Remove piston, a bolt screwed into piston will assist removal.
13. Remove input shaft dirt excluder.
14. Remove worm adjuster locknut using 'C' wrench LRT-57-007.
15. Remove worm adjuster using wrench LRT-57-006.



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.

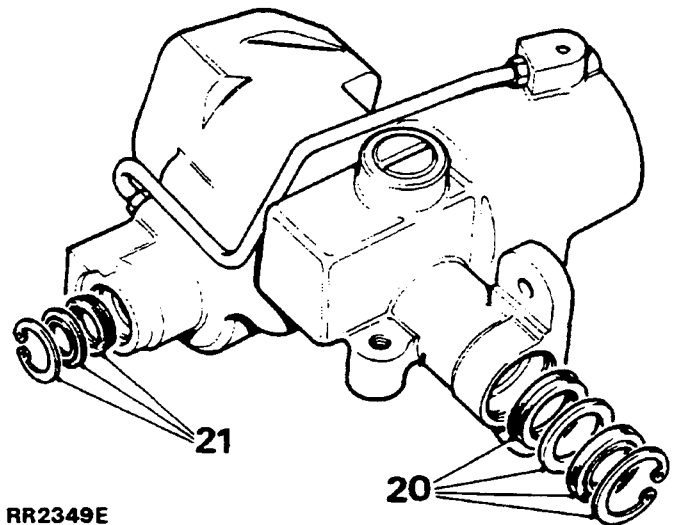


**CAUTION: Do not remove sector shaft bearings from casing. Replacement parts are not available. If sector shaft bearings are worn fit a new steering box.**

21. Remove circlip and seals from input shaft housing bore.



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





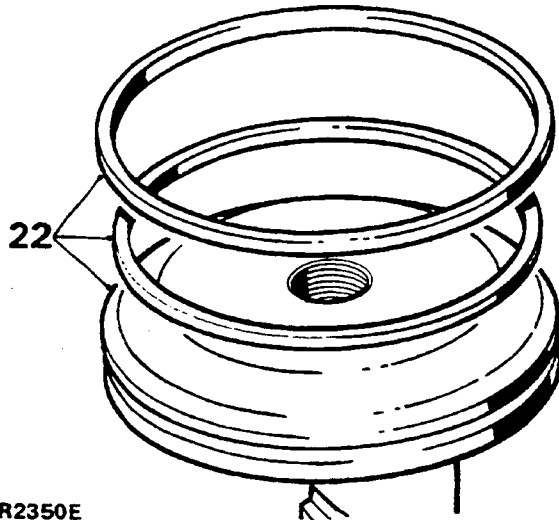
**INSPECTING**

**Piston**

- 22. Discard all rubber seals and provide replacements.



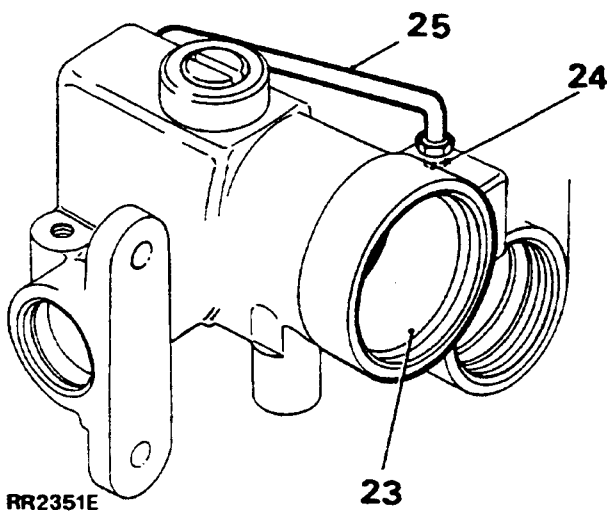
**NOTE: A rubber seal is fitted behind plastic ring on rack piston. Discard seal and plastic ring.**



RR2350E

**Steering box casing**

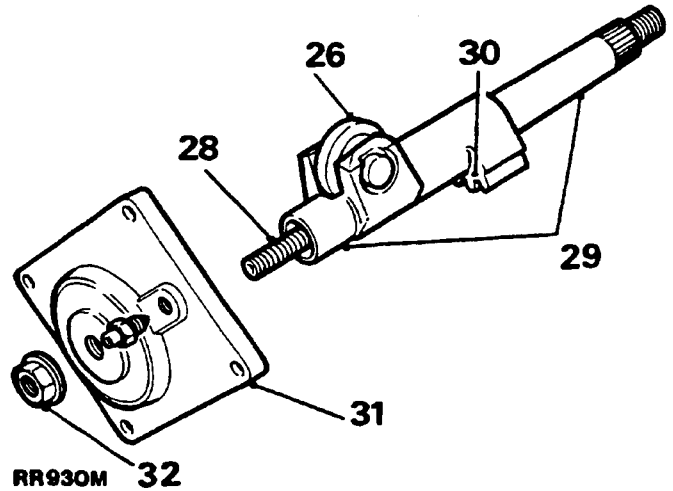
- 23. Examine piston bore for scoring and wear.
- 24. Examine feed tube.
- 25. Fit a new feed tube if damaged. Tighten to 22 Nm.



RR2351E

**Sector shaft assembly**

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



RR930M 32

**Sector shaft cover assembly**

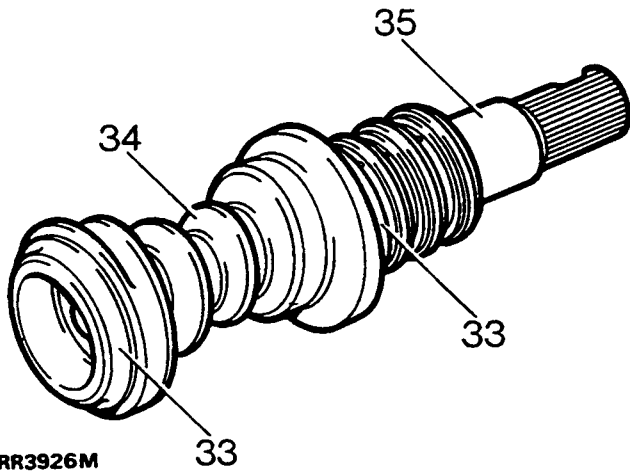
- 31. Inspect cover and bearing. If worn or damaged, replacement parts are not available, fit a new steering box.

**Sector shaft adjuster locknut**

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

**Valve and worm assembly**

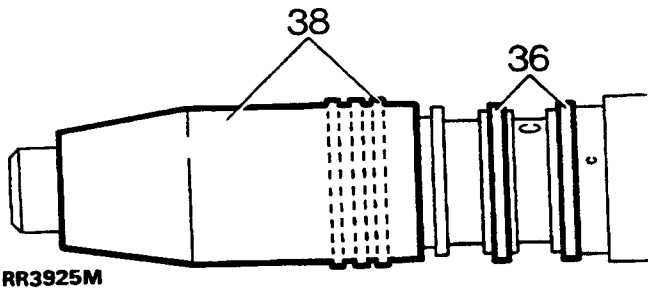
- 33. Examine bearing areas for wear. The areas must be smooth and not indented.
- 34. Examine worm track which must be smooth and not indented.



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.

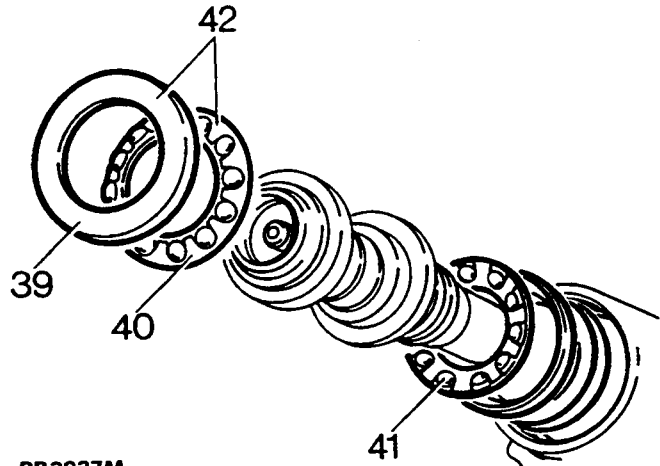
36. Examine valve rings for cuts, scratches and grooves. The valve rings should be free to rotate in grooves.



37. If required, replace all three rings, using ring expander LRT-57-04619. 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.

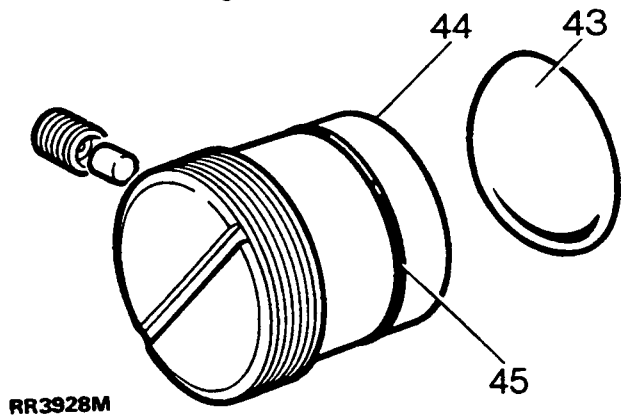
**Ball bearing and cage assemblies**

- 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.



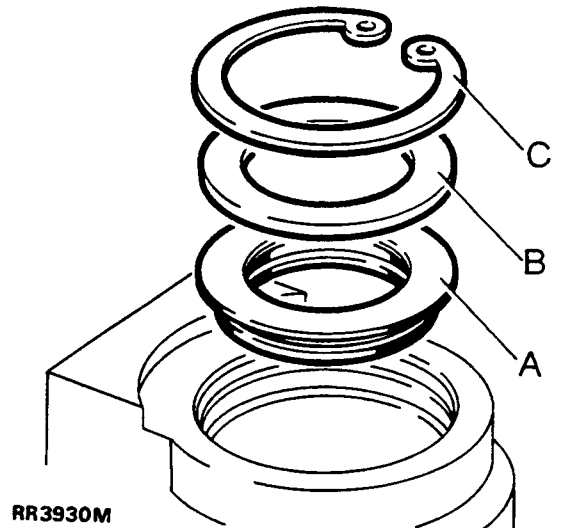
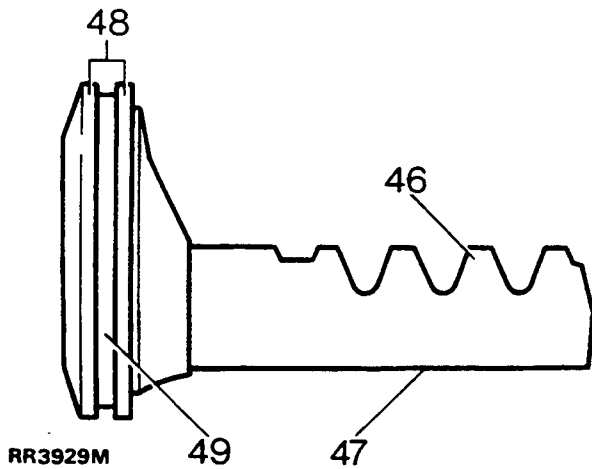
**Rack thrust pad and adjuster**

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




**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.




- 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.

**Input shaft oil seal**

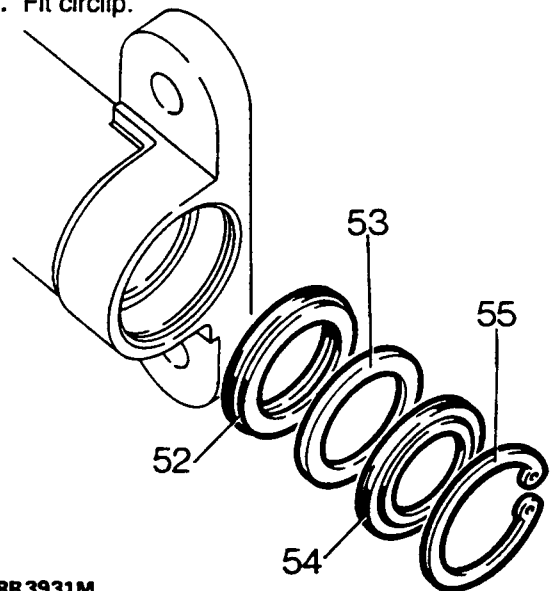
 **NOTE:** Changes to input oil seal. Up to steering box number GBE 51000 00 (see Adwest identity plate) the input shaft oil seal was as shown in RR3930M. This type of seal **MUST** be fitted at this stage.

- a) Fit oil seal, lip side first, into housing. Seal backing to lie flat on bore shoulder.
- b) Fit backing washer.
- c) Fit circlip.

A dirt excluder was added at steering box serial number GBE 51000 00. This is fitted at instruction 94. A revised seal without backing washer was introduced at serial number GBE 51400 00. This seal **MUST** be fitted at instruction 92.


**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.

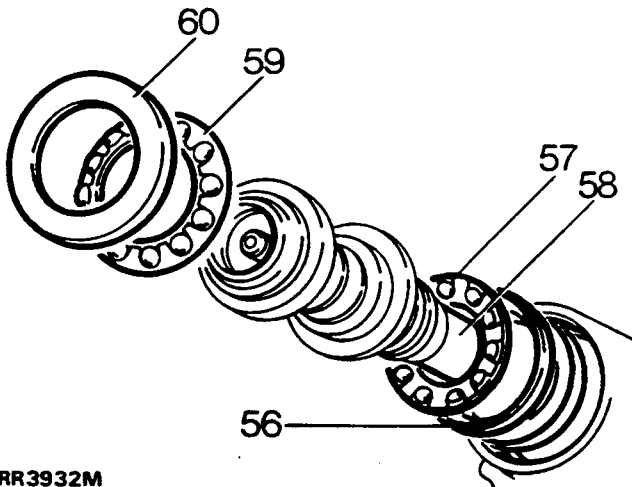


**Fitting valve and worm assembly**

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

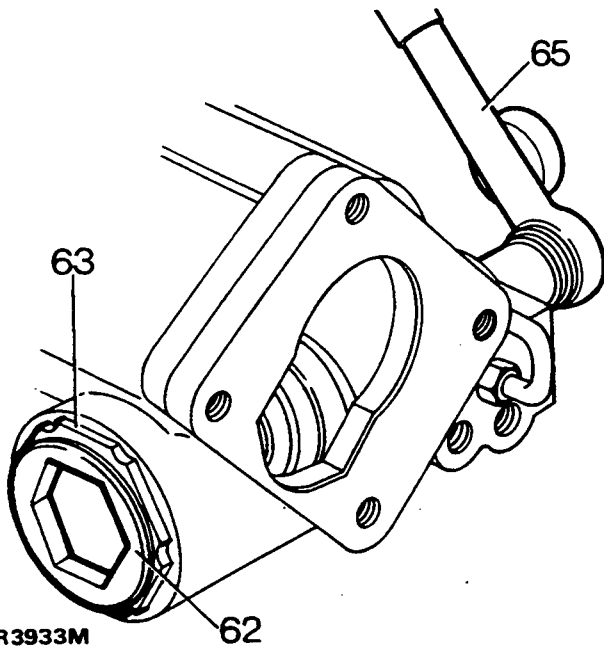
 **NOTE:** If original shims are not used, fit shims of 0.76 mm thickness.

- 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.
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 spanner 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, **100Nm**. Use **worm adjusting wrench LRT-57-006** and **locknut wrench LRT-57-028**.



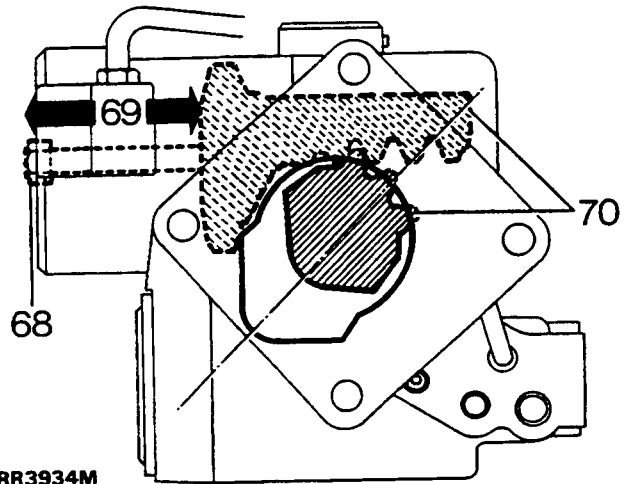
RR3933M

#### 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

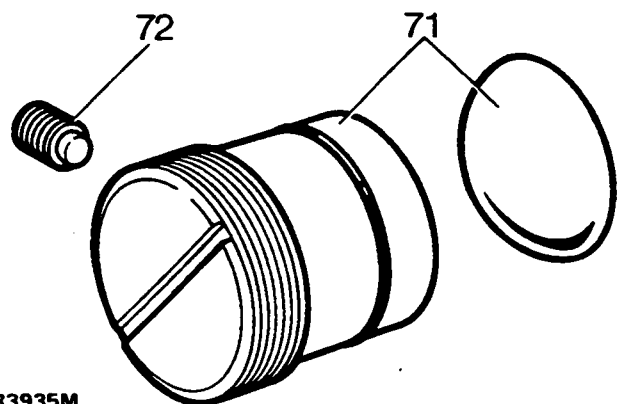
70. Fit sector shaft using seal saver LRT-57-021. Align roller with cut out in casing - see RR3944M. Push in sector shaft while rotating input shaft to allow sector roller to engage worm.



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.

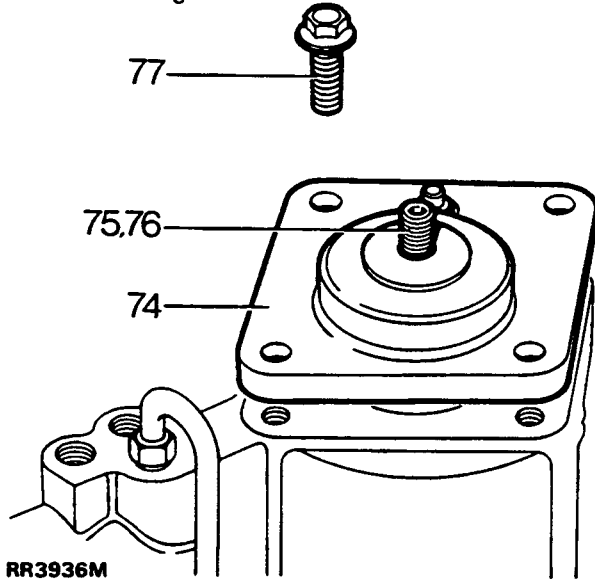


RR3935M



**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.

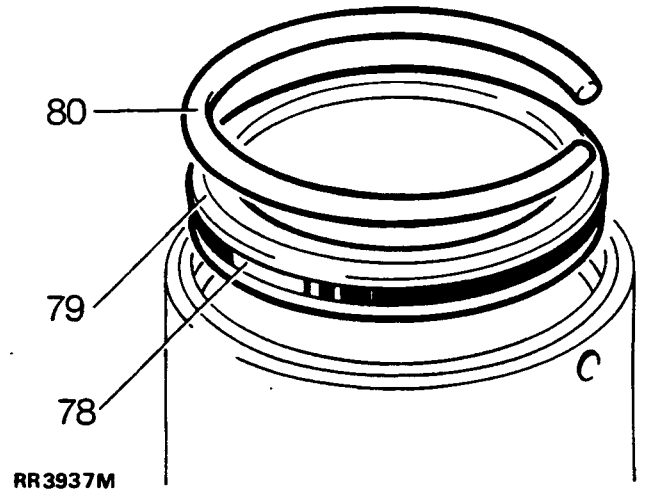


**NOTE:** Before tightening fixings, rotate input shaft to ensure sector shaft roller is free to move in valve worm. If initial resistance is left, turn adjuster screw approximately two turns in a clockwise direction.

- 77. Fit cover bolts. Tighten to **50Nm**. From steering box serial number 1J001. Tighten to **75Nm**.

**Fitting cylinder cover**

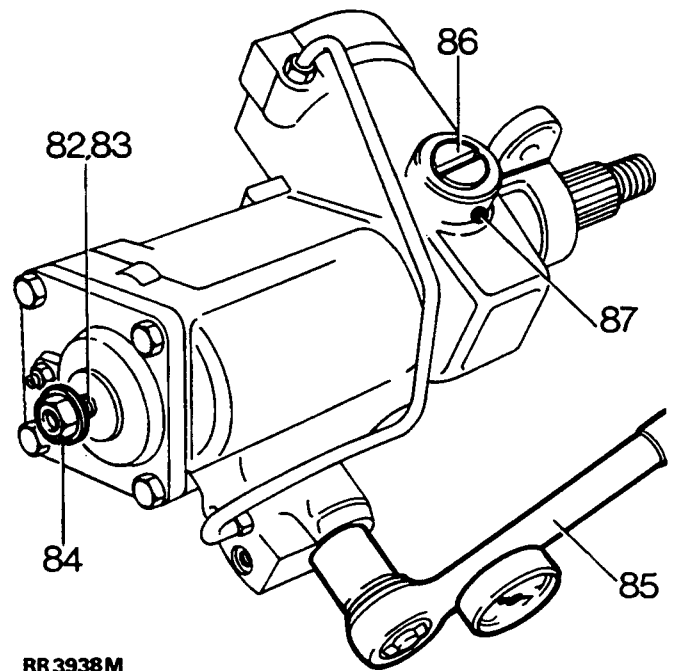
- 78. Fit new square section seal to cover.
- 79. Remove slave bolt fitted at instruction 68. Press cover into cylinder just to clear retainer ring groove.
- 80. Fit retaining ring to groove with one end of ring positioned 12 mm from extractor hole.



**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**.

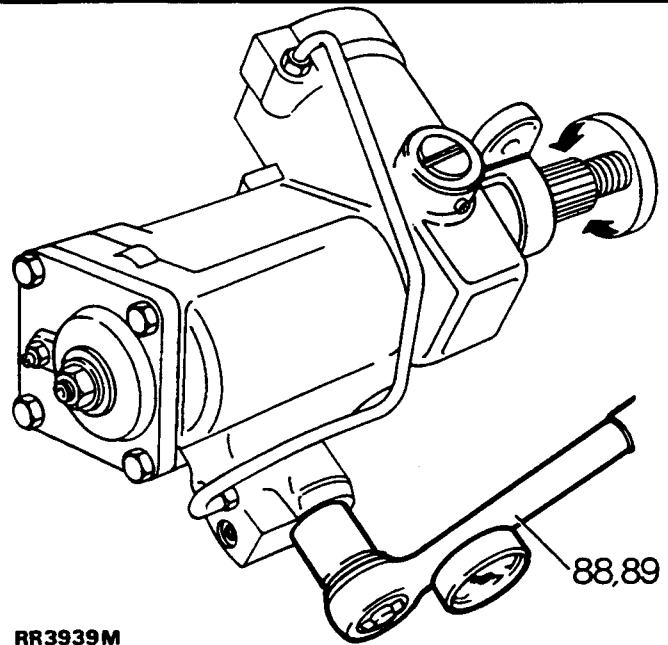
#### Torque peak check

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

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



RR3939M

#### 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, see 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



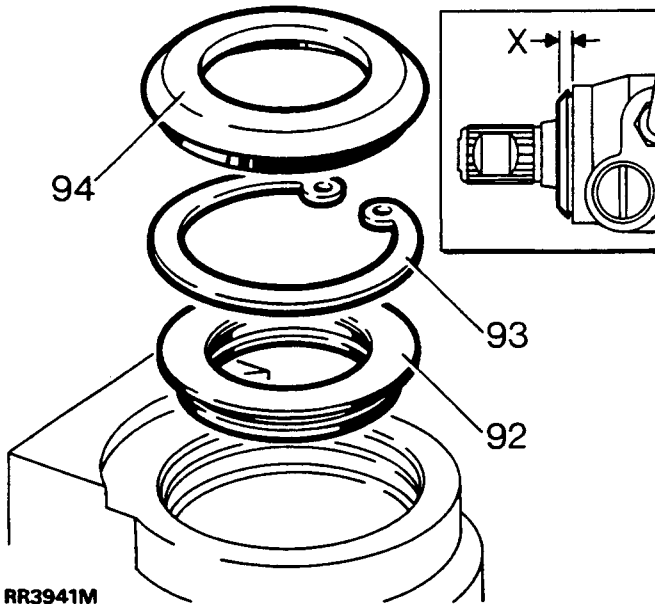
**NOTE:** Instructions 92. and 93. refers to boxes after GBE 51400 00.

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.



**NOTE:** Instruction 84. refers to boxes after GBE 51000 00.

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.

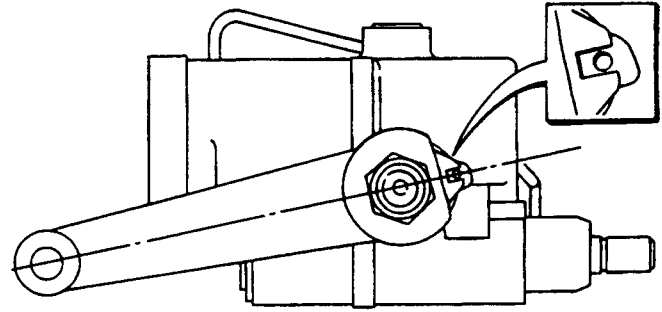


RR3941M

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 (if fitted) in drop arm and steering box see inset in RR3940M. Fit drop arm to steering box using a new tab washer. Tighten to **176Nm**, bend over tab.



**NOTE:** If steering box is earlier type without centralising holes, fit drop arm in position shown in RR3940M with input shaft on centre.



RR3940M

97. Refit steering box to vehicle. Tighten chassis fixings to **81Nm**
98. Fill system with power steering fluid. See **LUBRICANTS, FLUIDS AND CAPACITIES, Information, Recommended Lubricants and Fluids**
99. Bleed system. See **Repair, Power steering system - bleed**
100. Test system for leaks, with engine running hold 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.

101. Road test vehicle.



## DROP ARM BALL JOINT



**NOTE:** This procedure relates to steering boxes having the ball joint incorporated in the drop arm. Steering boxes from Adwest serial number GBE 48200 00 have a taper hole in the drop arm. The ball joint is fitted to the drag link. These drop arms also have a cut out which is lined up with the casing for accurately centralising the steering box.

### Overhaul

Overhaul drop arm ball joint with repair kit which consists of following items:

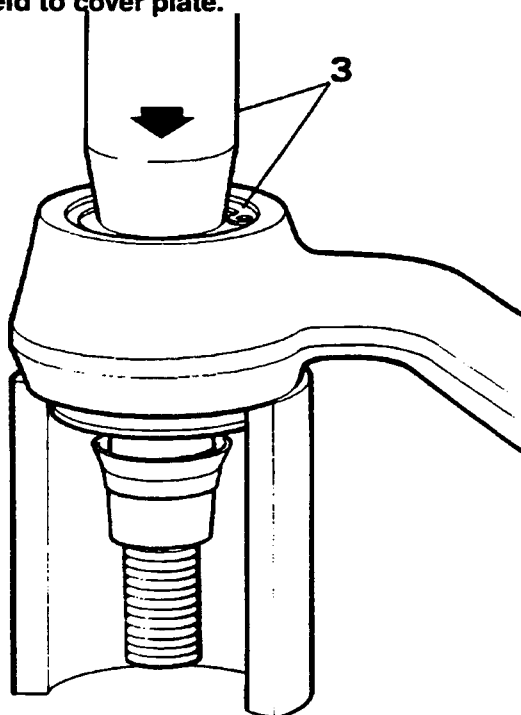
Ball pin	Ball lower socket
Retainer	Spring
Spring rings	'O' ring
Dust cover	Coverplate
Ball top socket	Circlip

### Dismantle

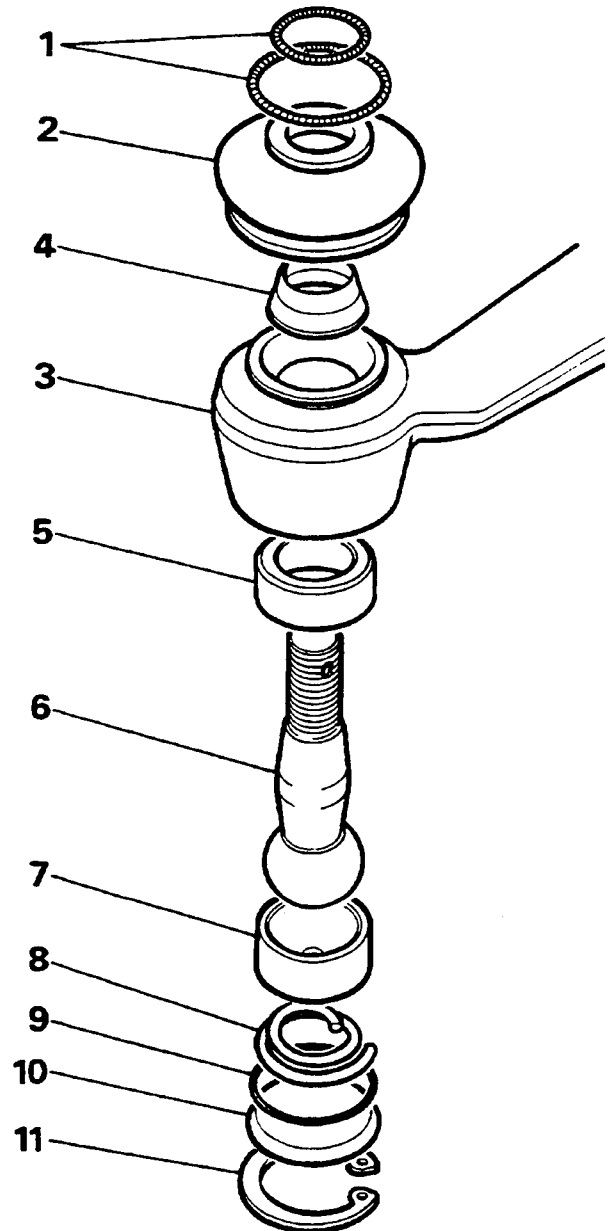
1. Remove drop arm. *See Repair, Drop arm*
2. Remove spring rings and dust cover.
3. Compress ball joint to relieve spring tension while supporting housing as shown. Remove circlip and release pressure.



**WARNING:** Personal injury could result if circlip is removed without pressure being held to cover plate.



ST1382M



ST1381M

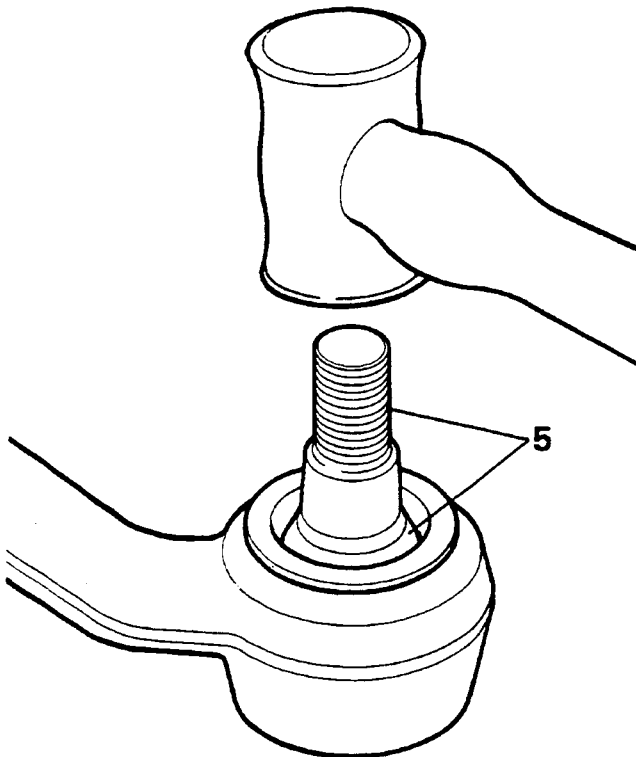
### BALL JOINT COMPONENTS

1. Spring rings
2. Dust cover
3. Ball housing
4. Retainer
5. Bottom socket
6. Ball pin
7. Top socket
8. Spring
9. 'O' ring
10. Cover-plate
11. Circlip

4. Remove spring, top socket and 'O' ring.

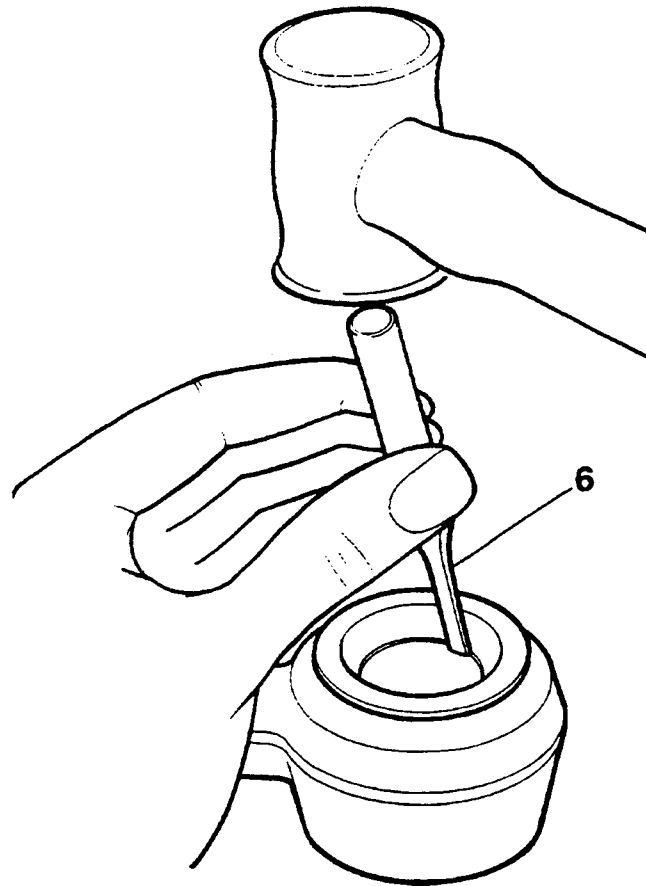


5. Tap threaded end of ball pin to release components, remove retainer and ball pin.



ST1383M

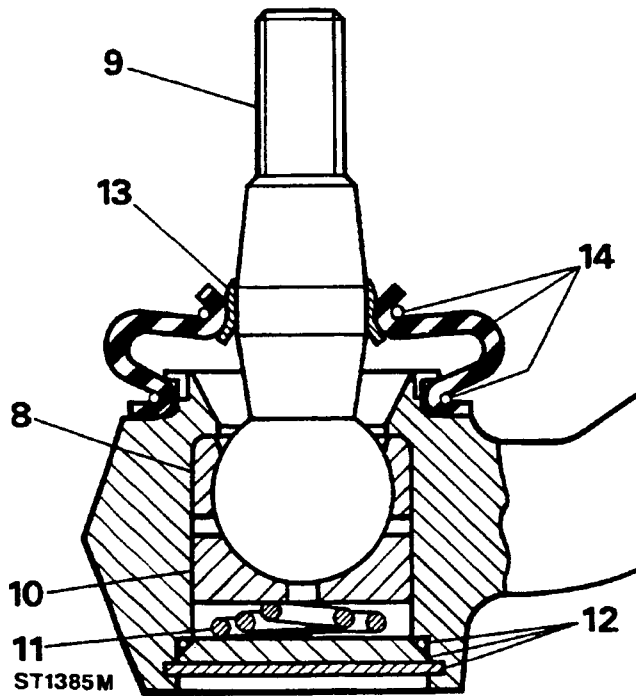
6. Using a punch, drive out ball lower socket.
7. Clean housing and remove any burrs.



ST1384M

**Assemble**

8. Press in lower socket up to shoulder.
9. Dip ball in grease, fit to housing and pack with grease.
10. Fit top socket.
11. Fit spring, small diameter towards ball.
12. Fit 'O' ring. Compress cover plate and fit circlip, ensure circlip is seated.
13. Press retainer onto ball pin until top edge is level with edge of taper.



14. Fit dust cover and retain with two spring rings.
15. Fit drop arm to steering box using new lock washer. Tighten to **176Nm**. **Bend over lock washer.**
16. Fit ball pin to drag link. **See Repair, Drag link and drag link ends**



**STEERING PUMP**

Make/type .....	Hobourn series 200
Operating pressure - straight ahead position - at idle .....	7 kgf/cm <sup>2</sup> maximum
Full lock (left or right) at idle .....	28 kgf/cm <sup>2</sup> minimum
Full lock (left or right) 1000 rev/min.....	70-77 kgf/cm <sup>2</sup>

**TORQUE VALUES**



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

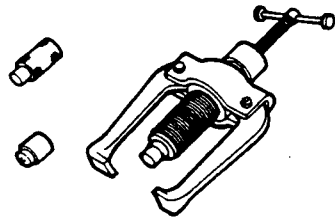
	Nm
Ball joint nuts .....	40
Clamp bolt nuts .....	14
Steering column bracket nuts .....	27
Steering wheel nut .....	38
Universal joint pinch bolt.....	35
<b>PAS box</b>	
Adjuster locknut .....	60
Drop arm nut .....	176
Sector shaft cover to steering box .....	25
Steering box to chassis .....	81
Steering box fluid pipes 14mm thread .....	15
Steering box fluid pipes 16mm thread .....	20
Tie bar to steering box .....	81
<b>PAS pump</b>	
High pressure fluid pipe .....	20
Power steering pump mounting .....	35
Pulley bolts, power steering pump .....	10
Hose clamp .....	3
<b>PAS reservoir</b>	
Hose clamp .....	3

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

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

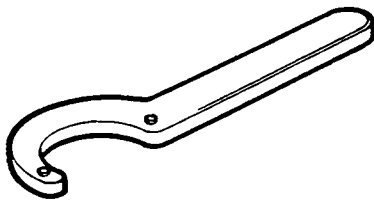


**POWER STEERING BOX**



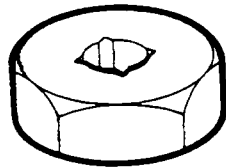
**MS252A**

LRT-57-012 Drop arm extractor  
MS252A



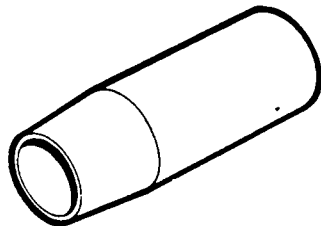
**LST120**

LRT-57-007 'C' Wrench  
LST120



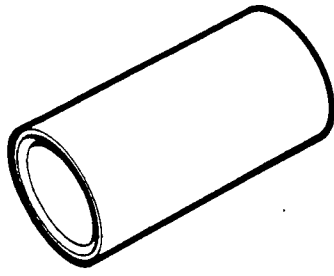
**LST119**

LRT-57-006 Worm adjusting wrench  
LST119



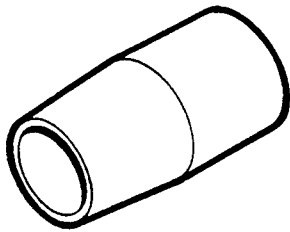
**RO606602**

LRT-57-019 Ring expander  
RO606602



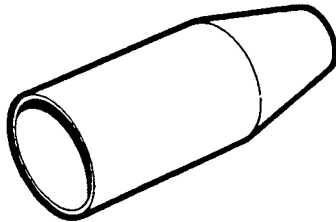
RO606603

LRT-57-020 Ring compressor  
RO606603



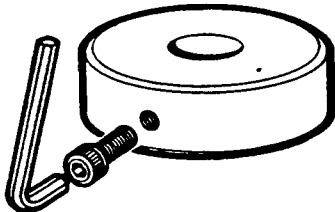
RO606604

LRT-57-021 Seal saver, sector shaft  
RO606604



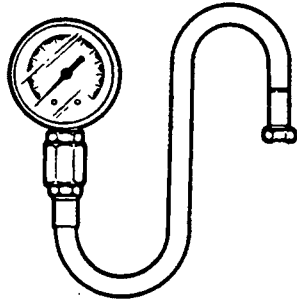
RO1015

LRT-57-016 Seal saver, valve and worm  
RO1015



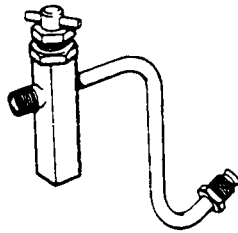
RO1016

LRT-57-017 Torque setting tool  
RO1016



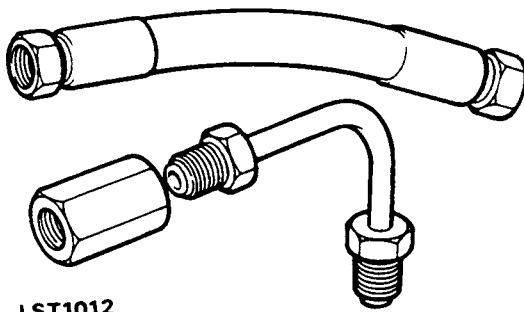
LRT-57-005 Pressure gauge  
HY23

HY23



LRT-57-001 Test adaptor  
JD10-2

JD102



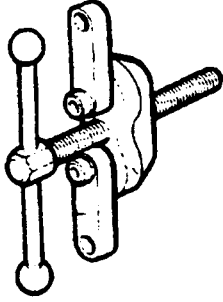
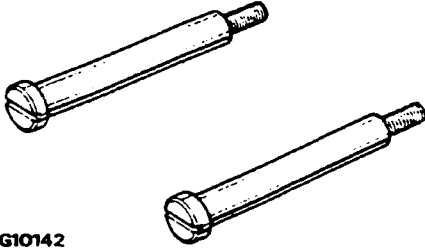
LRT-57-022 Pressure test adaptors  
LST10-12

LST1012

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**STEERING WHEEL**

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**18G1014****LRT-57-014**  
**18G1014****Steering wheel remover****18G10142****LRT-57-015**  
**18G1014-2****Adaptor pins**