

Chapter 7-1

MANUAL STEERING SYSTEM

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INTRODUCTION

1 This Chapter covers the unit and field repairs for steering systems fitted to Land Rover 90 and 110 vehicles having 2.5 litre diesel engines. The information given is applicable to both left and right hand drive vehicles.

STEERING SYSTEM

TABLE 1 SPECIAL TOOLS

| Ser No (1) | Manufacturer's Part No (2) | NSN/Part No where applicable (3) | Designation (4) |
|------------|----------------------------|----------------------------------|--|
| 1 | LRT/57/014 | WTE 5120-99-724-4444 | Steering wheel remover |
| 2 | LRT/57/015 | WTE 5120-99-724-4445 | Adapter pins for use with steering wheel remover |

Collapsible shaft

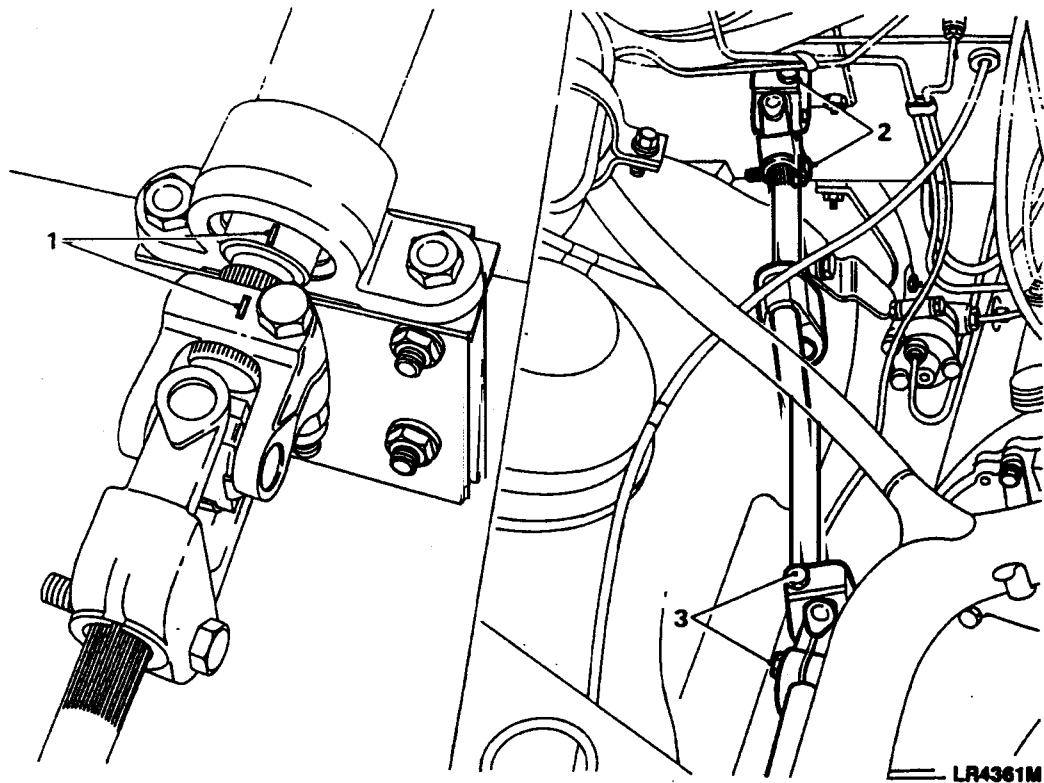
Removal

- 2 To remove the collapsible shaft carry out the following:
 - 2.1 Remove the vehicle bonnet.
 - 2.2 Set the road wheels and steering wheels in the straight ahead position.
 - 2.3 Mark the relationship of the steering column inner shaft to the top universal joint (Fig 1 (1)).

Note ...

The collapsible shaft can be disconnected from the steering column only, if required, by removing the bolts from the top universal joint and slackening the top bolt of the lower universal joint.

- 2.4 Remove the two bolts (2) from the top universal joint and the lower bolt (3) of the bottom universal joint. Slacken the upper bolt of the lower universal joint and withdraw the shaft.



1 Alignment marks

2 Top bolts

3 Bottom bolts

Fig 1 Collapsible shaft

Steering wheel

Removal

- 3 To remove the steering wheel carry out the following:
 - 3.1 Ensure that the front wheels are in the straight ahead position.
 - 3.2 Remove the single screw retaining the steering wheel finisher and remove the finisher.
 - 3.3 Remove the steering wheel retaining nut, make suitable alignment marks on the column and wheel, then using special tools (Serial Nos 1 and 2) remove the steering wheel.

Instrument panel

Removal

- 4 Remove the instrument panel as follows:
 - 4.1 Disconnect the positive and negative leads at the battery terminals and on 12/24 volt vehicles the radio battery leads.
 - 4.2 Remove the four screws securing the instrument panel (Fig 2), ease the panel away from the fascia and disconnect the speedometer cable.
 - 4.3 Disconnect the two block connectors, one multi-plug connector and one white wire then withdraw the panel complete with instruments.

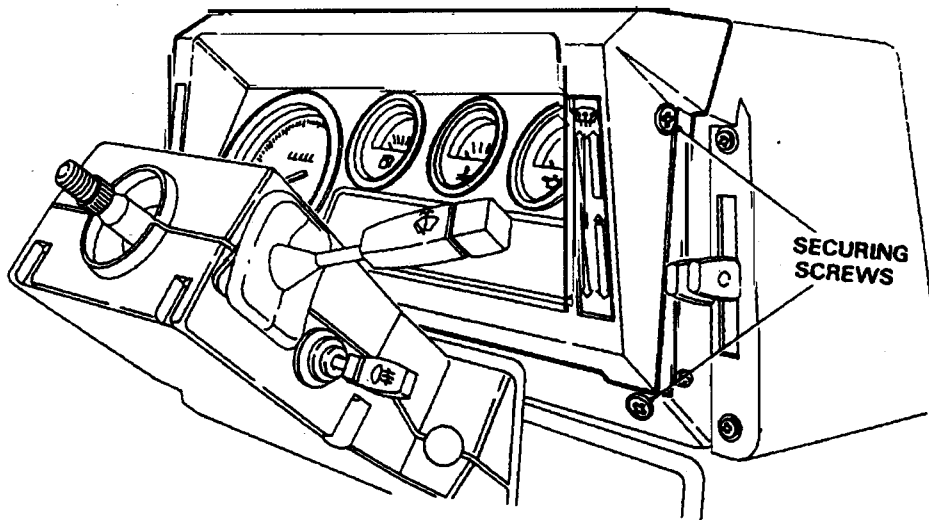


Fig 2 Instrument panel

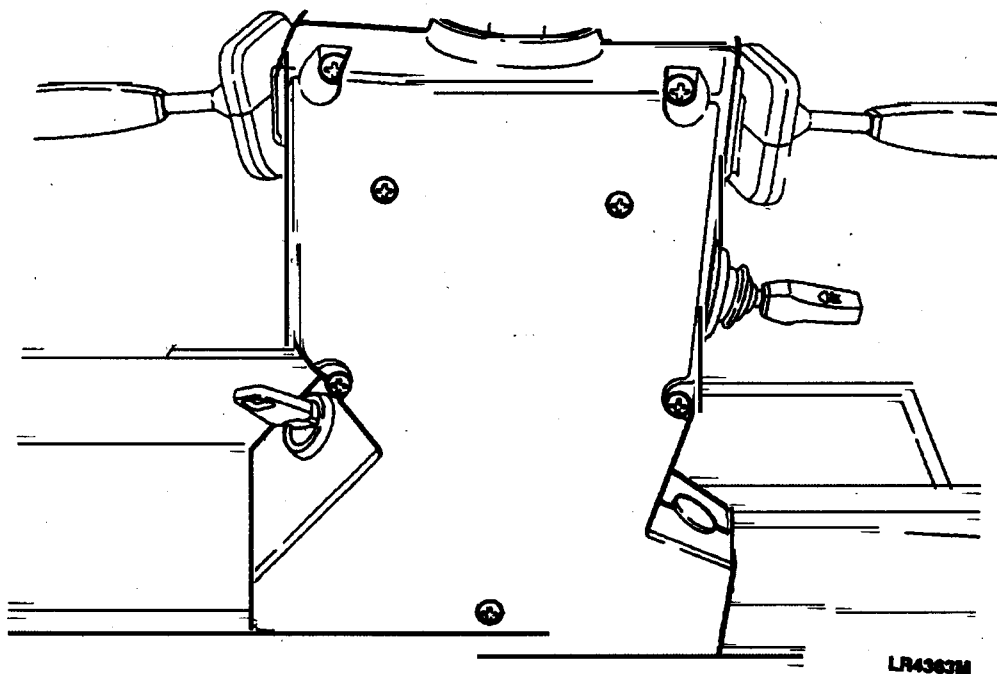


Fig 3 Underside of nacelle showing securing screws

Steering column switches

Removal

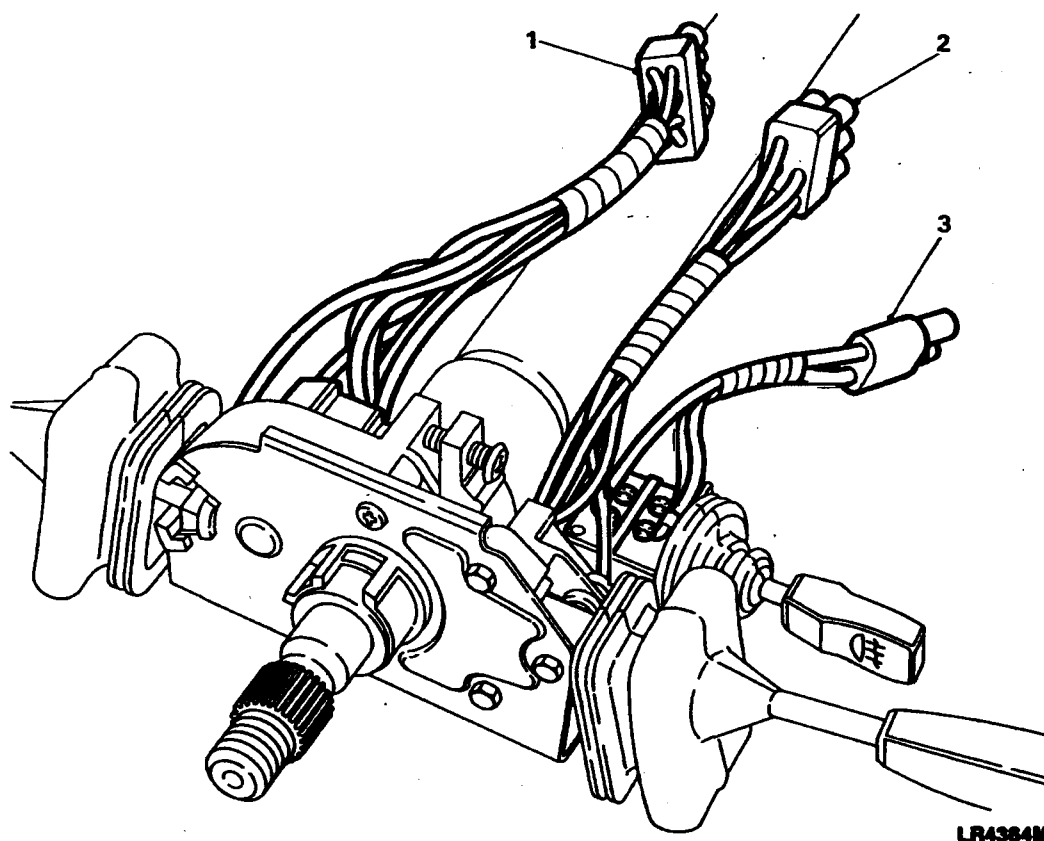
5 Remove the steering column switches as follows:

5.1 Remove the five screws and two self tapping screws to remove the top half of the nacelle (Fig 3).

5.2 Ease the bottom half of the nacelle from the switch grommets and remove.

5.3 Disconnect the multi-plugs making note of the switches to which they are related.

5.4 Remove one clamp screw from the top of the switch cluster and remove the switches (Fig 4).

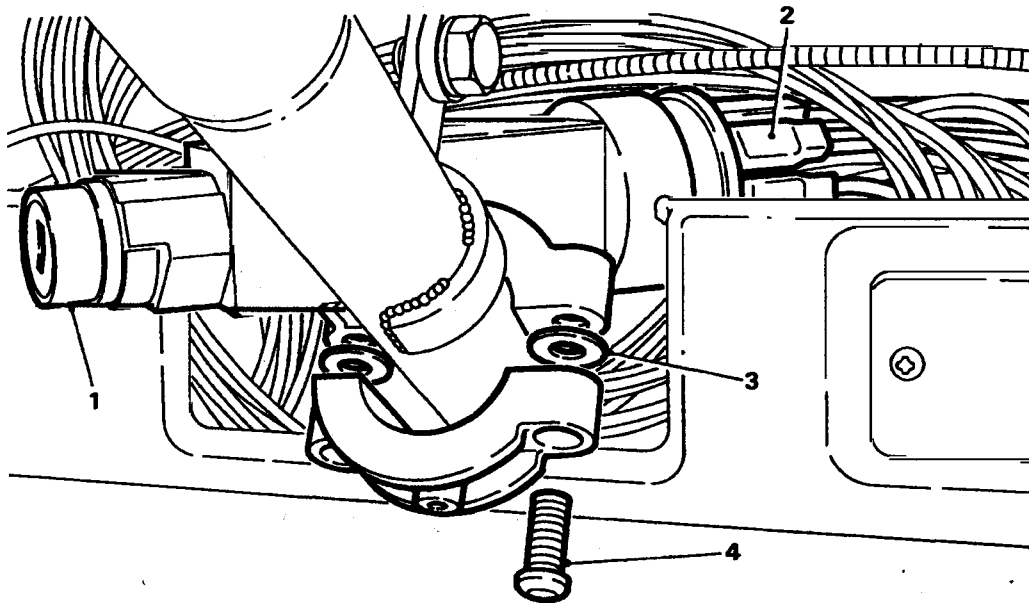


1 Indicator/horn/dipswitch 2 Wash/wipe 3 Rear fog

Fig 4 Steering switch multi-plugs

Steering column heater start/switchRemoval

- 6 Remove the steering column heater start/switch (Fig 5 (1)) as follows:
- 6.1 Note the position of the cables on the back of the switch then , disconnect the lucar connectors (2).
- 6.2 Using a suitable punch or stud extractor remove the two shear bolts (4) securing the switch to the steering column.
- 6.3 Remove the switch (1) and collect the two plain washers (3) from between the switch and clamp.



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- | | | | |
|---|---------------------|---|---------------|
| 1 | Heater/start switch | 3 | Plain washers |
| 2 | Lucar connectors | 4 | Shear bolt |

Fig 5 Steering column heater/start switch removal

Brake pedal boxRemoval

- 7 To remove the brake pedal box refer to Chap 10 Para 25.

Steering column

Removal

8 Remove the steering column as follows:

8.1 Remove the bolt securing the tie-bar to the steering column, behind the steering wheel (Fig 6).

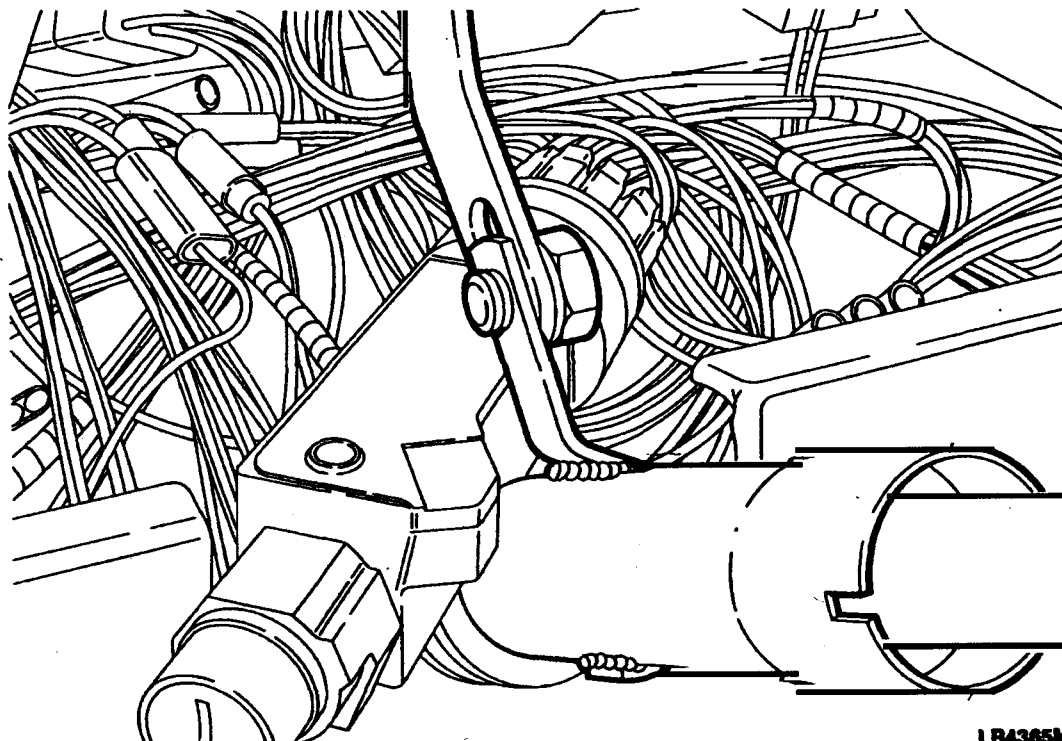
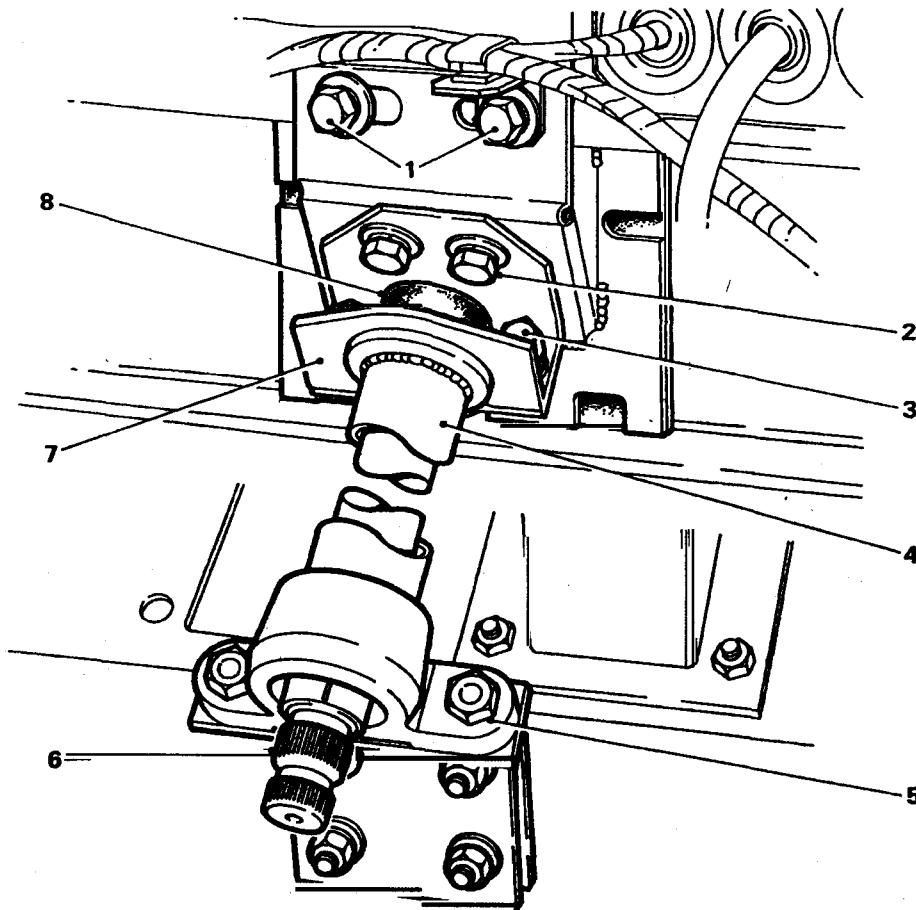


Fig 6 Steering column tie bar

8.2 Remove the two bolts (Fig 7 (5)) securing the lower end of the steering column (4).

8.3 Remove the two bolts (3) securing the two halves of the top clamp and the two bolts (2) that secure the top half of the clamp to the bulkhead and remove the clamp (7) and rubber packing (8).

8.4 Remove the two bolts (1) securing the column main support bracket to the bulkhead and withdraw the steering column and main support bracket from the vehicle. Note that one of the bolts has a harness securing bracket located under the head.



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- | | | | |
|---|------------------------------|---|---------------------|
| 1 | Bolts, main support bracket | 5 | Bolts, lower fixing |
| 2 | Bolts, clamp to bulkhead | 6 | Inner shaft |
| 3 | Bolts, clamp halves together | 7 | Clamp |
| 4 | Steering column | 8 | Rubber packing |

Fig 7 Steering column securing bolts

Dismantling

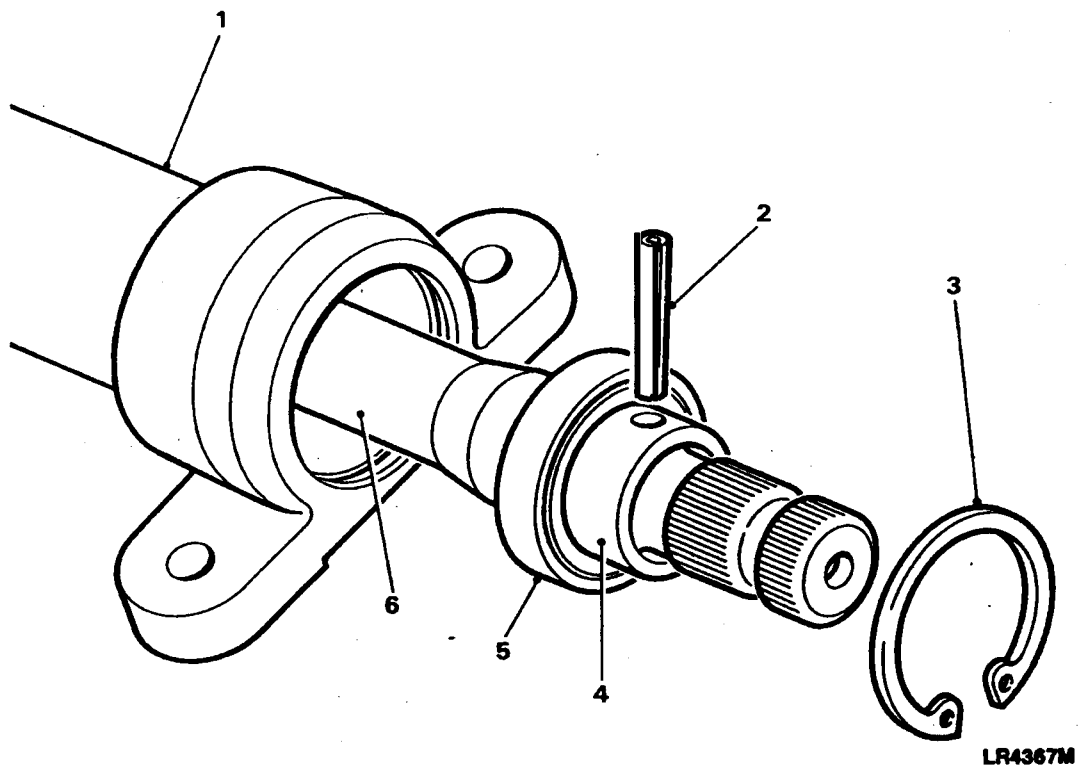
9 Dismantle the steering column as follows:

9.1 Remove the circlip (Fig 8 (3)) from the lower end of the steering column.

9.2 Drift out the inner shaft (6) complete with bearing (5) from the top end of the column.

9.3 Remove the roll pin (2) from the bearing retaining collar (4) and drive the collar and bearing from the inner shaft (6).

9.4 Drive out the needle bearing from the top end of the outer column.



- | | | | |
|---|--------------|---|-------------|
| 1 | Outer column | 4 | Collar |
| 2 | Roll pin | 5 | Bearing |
| 3 | Circlip | 6 | Inner shaft |

Fig 8 Removing/fitting inner shaft

Reassembly

10 Reassemble the steering column as follows:

10.1 Fit a new bearing (Fig 8 (5)) to the lower end of the inner shaft (6).

10.2 Fit the retaining collar (4), ensuring that it butts against the bearing and that the roll pin holes line up. Secure with a new roll pin (2).

10.3 Fit a new roller bearing to the top end of the outer column to a depth of 10mm (3.94 in) (Fig 9).

10.4 Fit the inner shaft and bearing assembly to the outer column and secure with the circlip (3).

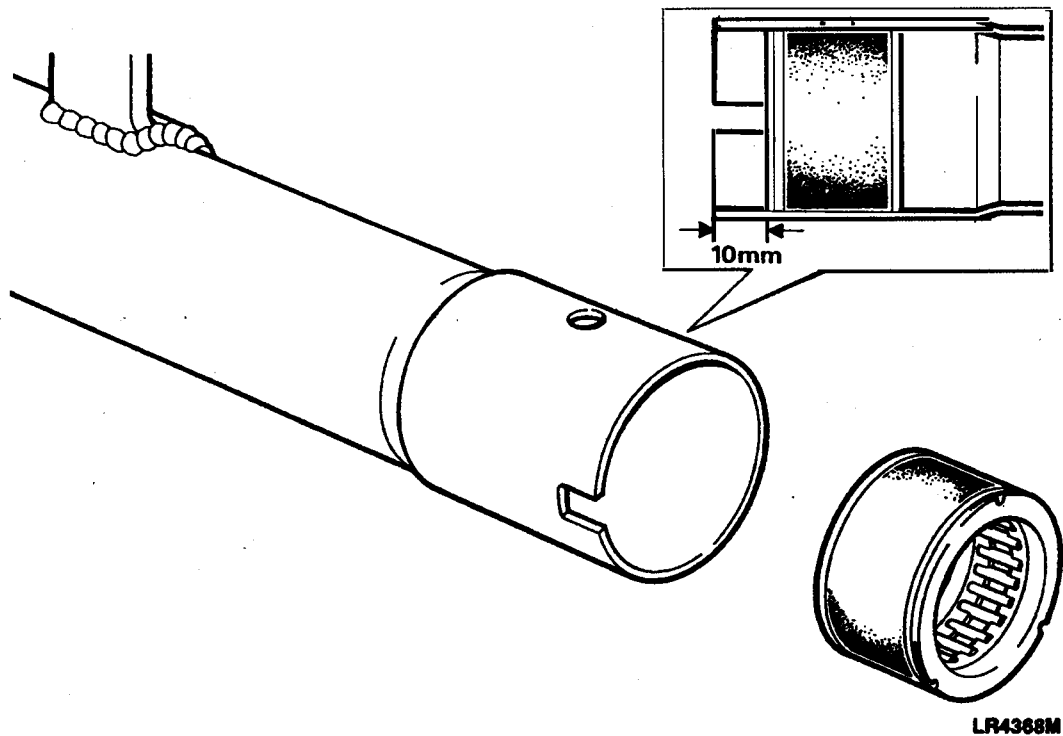


Fig 9 Fitting bearing to outer column

Refitting

11 Refit the steering column as follows:

- 11.1 Fit the main support bracket and packing to the steering column and manoeuvre the column into position in the vehicle.
- 11.2 Loosely secure the main support bracket and harness bracket to the bulkhead with two bolts (Fig 7 (1)).
- 11.3 Loosely fit the clamp and rubber packing strip to the column and retain with two bolts (3).
- 11.4 Loosely secure the lower end of the column to the lower support bracket with two nuts and bolts (5).
- 11.5 Loosely secure the clamp bracket to the main support bracket with two bolts (2).
- 11.6 Working inside the vehicle cab, fit the tie-bar to the column bracket and secure with the single bolt (Fig 6).
- 11.7 Finally tighten the main support bracket bolts, clamp bracket bolts, upper clamp bolts and the lower support bracket nuts and bolts.

Brake pedal box

Refitting

12 To refit the brake pedal box refer to Chap 10 Para 26.

Steering column heater/start switch

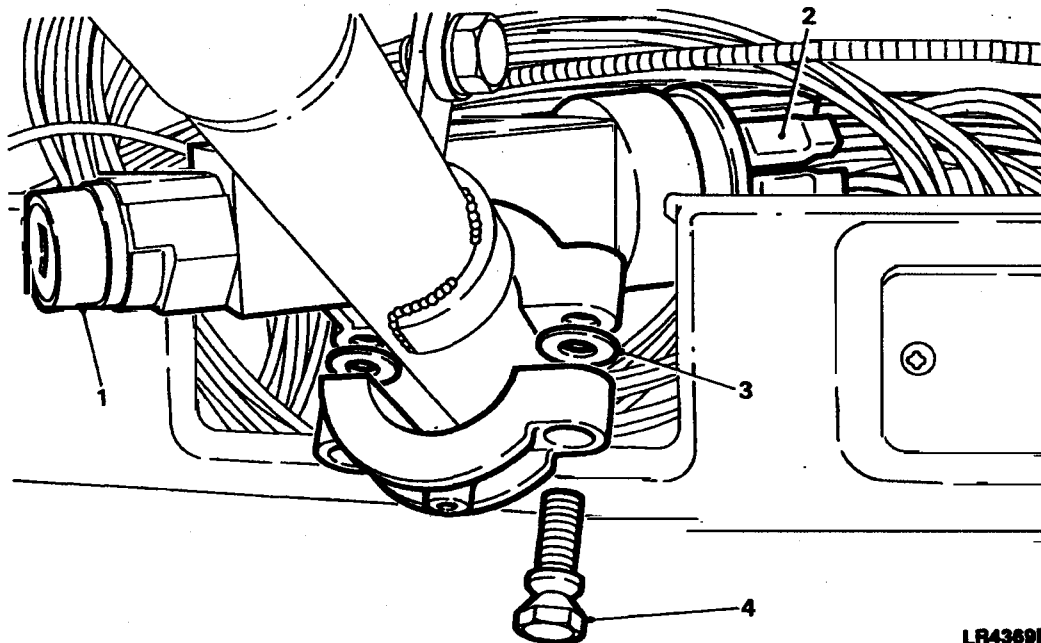
Refitting

13 Refit the steering column heater/start switch as follows:

13.1 Place the heater/start switch (Fig 10 (1)) in position on the steering column and secure with the clamp and shear bolts (4), inserting two plain washers (3) between the switch and clamp.

13.2 Evenly tighten the bolts to secure the switch, then complete the tightening until the heads of the bolts shear.

13.3 Connect the electrical leads (2) to the rear of the switch.



- | | | | |
|---|---------------------|---|---------------|
| 1 | Heater/start switch | 3 | Plain washers |
| 2 | Lucar connectors | 4 | Shear bolt |

Fig 10 Steering column heater/start switch installation

Steering column switches

Refitting

14 Fit the steering column switches assembly, secure with the single screw and connect the multi-plugs (Fig 4).

Instrument panel and nacelleRefitting

15 Refit the instrument panel and nacelle as follows:

15.1 Offer up the instrument panel and connect the speedometer cable, two block connectors, one multi-plug and single white lead to their respective locations at the back of the panel. Locate the panel and secure with the four screws.

15.2 Locate the bottom half of the nacelle in position and fit to the switch grommets, fit the top half and secure with the screws.

Steering wheelRefitting

16 Refit the steering wheel as follows:

16.1 Turn the indicator cancelling ring so that the slots are vertical and the lug with the arrow points to the left, in the direction of the indicator switch.

16.2 Ensure that the front wheels of the vehicle are in the straight ahead position.

16.3 Fit the steering wheel with the finisher attachment lug at the bottom, ensuring that the indicator cancelling forks locate in the cancelling ring slots and aligning the marks made during removal.

16.4 Secure the wheel with the nut and a new shake-proof washer and tighten to a torque of 25 Nm (18 lbf ft).

Collapsible shaftRefitting

17 Refit the collapsible shaft as follows:

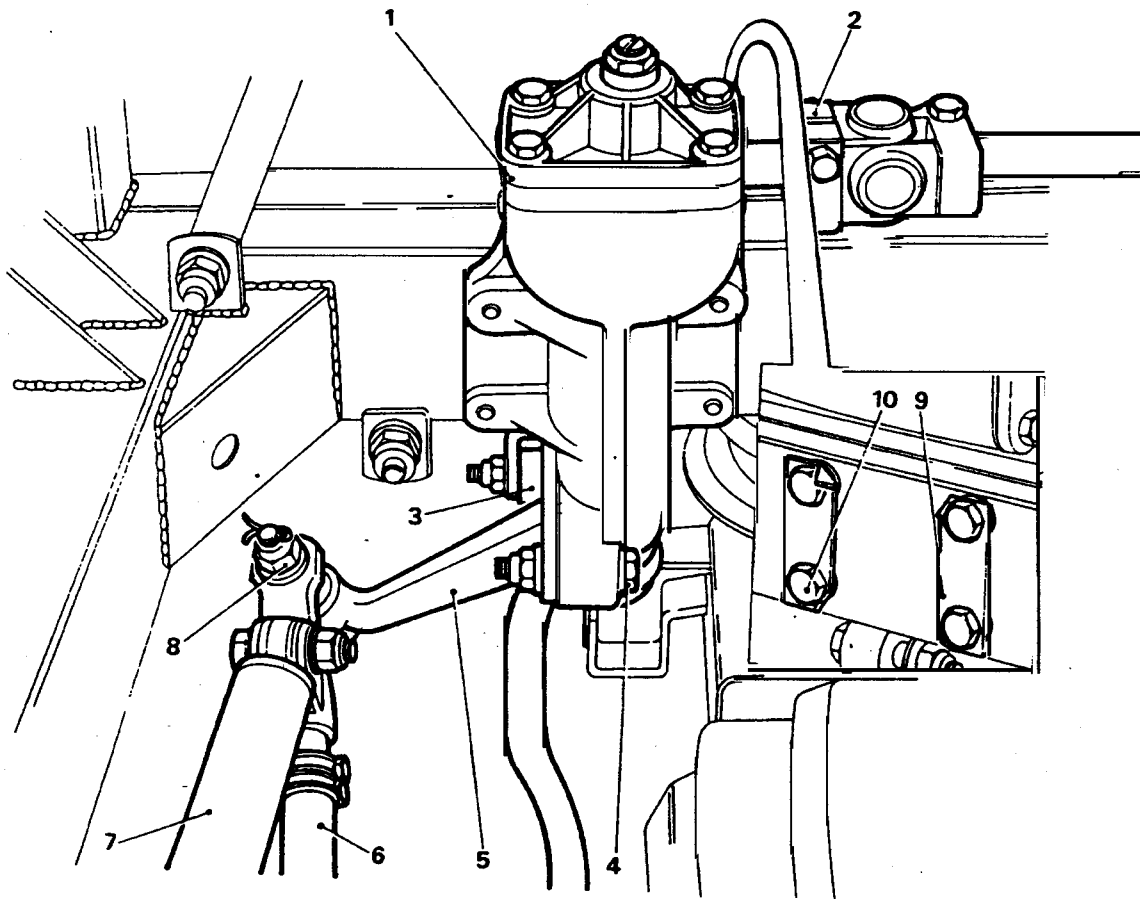
17.1 If necessary fit new universal joints to the support. Note that the long joint is fitted to the short length of shaft and the short joint to the long end. The joints can only be fitted one way to the shaft.

17.2 With the steering lock engaged and the road wheels in the straight ahead position, line-up the marks made during dismantling (Para 2.3) and fit the collapsible shaft assembly with the long leg of the shaft to the steering box. Fit the pinch bolts and nuts and tighten to a torque of 30 Nm (22 lbf ft).

Steering boxRemoval

18 Remove the steering box from the vehicle as follows:

- 18.1 Disconnect the collapsible shaft (Fig 11 (2)) from the steering box (1).
- 18.2 Suitably support the cross rod (7) and steering damper (6) and disconnect the cross rod from the drop arm (5) at the ball joint (8).
- 18.3 Remove the bolts (4), nuts and washers securing the tie bar (3) to the steering box (1).
- 18.4 Turn back the tangs on the locking strips (9) and remove the bolts (10) securing the steering box to the chassis, then withdraw the steering box. Discard locking strips.
- 18.5 Remove the drop arm (5) from the steering box.



- | | | | |
|---|-------------------|----|---------------------|
| 1 | Steering box | 6 | Steering damper |
| 2 | Collapsible shaft | 7 | Cross rod |
| 3 | Tie bar | 8 | Drop arm ball joint |
| 4 | Securing bolt | 9 | Locking strip |
| 5 | Drop arm | 10 | Bolt |

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Fig 11 Steering box removal/installation

Dismantling

- 19 To dismantle the steering box carry out the following:
- 19.1 Remove the adjuster locknut (Fig 1 (7)) from the top of the steering box.
 - 19.2 Remove the four bolts (8) and washers (9) securing the top cover (10).
 - 19.3 Unscrew the top cover from the adjuster (14).
 - 19.4 Lift out the sector shaft (17).
 - 19.5 Remove the four bolts (24) and washers (25) securing the worm shaft cover plate (23), remove the plate complete with shims (21) and gasket (22).
 - 19.6 Remove the outer taper bearing and track (1).
 - 19.7 Withdraw the worm shaft (2) and the shaft end taper bearing (3).
 - 19.8 Remove the dust cover (15) and drift out the worm shaft oil seal (16).
 - 19.9 Drift out the shaft end bearing track and collect the shim (4). Note the thickness of the shim removed for reassembly.
 - 19.10 Prise out the sector shaft oil seal (19).
 - 19.11 Drift out the sector shaft needle roller bearings (13) and (18) from the top cover and from the box.

Cleaning and examination

- 20 Clean and examine the components as follows:
- 20.1 Clean and degrease all parts and examine for wear and damage.
 - 20.2 Renew the bearings (if worn), oil seals, gaskets and any other unsatisfactory parts.
 - 20.3 If the bearing in the top cover is worn renew the complete cover ad bearing.

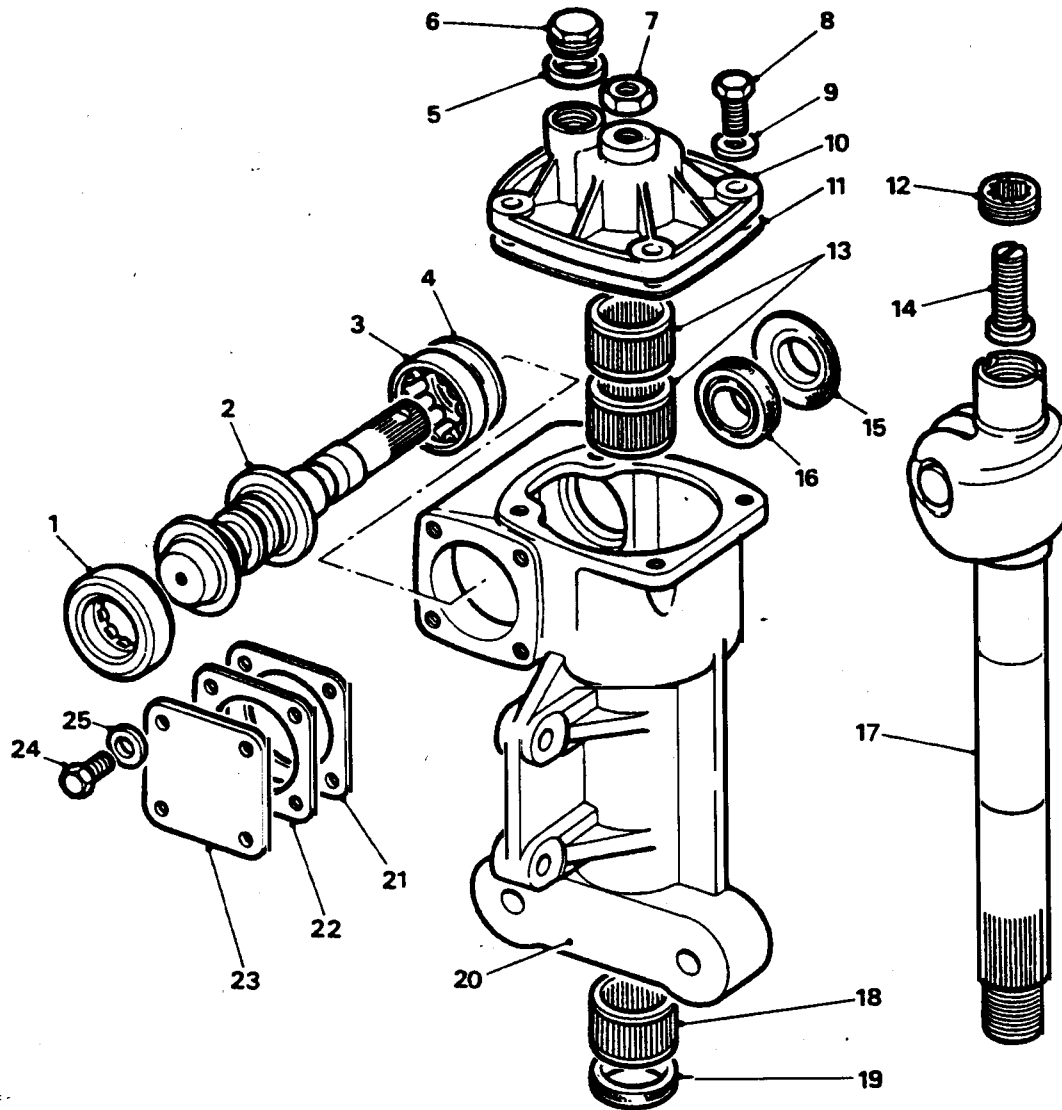
Reassembly

- 21 Reassemble the steering box as follows:

Note ...

During the following operations cleanliness is essential.

- 21.1 Press in the shaft end bearing track with a shim of the same value as that removed (Para 19.9) fitted behind the track, ensuring that the track is fitted squarely and pressed fully home.
- 21.2 Lubricate and fit the bearing (3) to the worm shaft (2) and insert the shaft into the body (20).
- 21.3 Lubricate and fit the bearing and track (1) to the cover end of the worm shaft.
- 21.4 Fit the cover plate (23) gasket (22) and original shim (21), secure with the four bolts and washers and evenly tighten the bolts to a torque of 25 to 30 Nm (18 to 22 lbf ft).



- | | | | |
|----|------------------------|----|-----------------------|
| 1 | Bearing | 14 | Adjuster |
| 2 | Worm shaft | 15 | Dust cover |
| 3 | Bearing | 16 | Oil seal |
| 4 | Shim | 17 | Sector shaft |
| 5 | Washer | 18 | Needle roller bearing |
| 6 | Oil filler plug | 19 | Oil seal |
| 7 | Adjuster locknut | 20 | Body |
| 8 | Bolt | 21 | Shim |
| 9 | Washer | 22 | Gasket |
| 10 | Top cover | 23 | Cover plate |
| 11 | Gasket | 24 | Bolt |
| 12 | Threaded cup | 25 | Washer |
| 13 | Needle roller bearings | | |

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Fig 12 Steering box

21.5 Check the worm shaft bearing pre-load by attaching special tool (Serial No 2) to the worm shaft, wrap a suitable length of string around the tool (Fig 13) and attach a spring balance to one end, with a steady pull note the rolling resistance which should be 2.26 to 2.72 kgf (5 to 6 lbf). Adjust by adding or removing shims.

21.6 When the correct figure is achieved, remove the bolts coat the threads with sealant, refit and evenly tighten to the correct torque (Para 21.4).

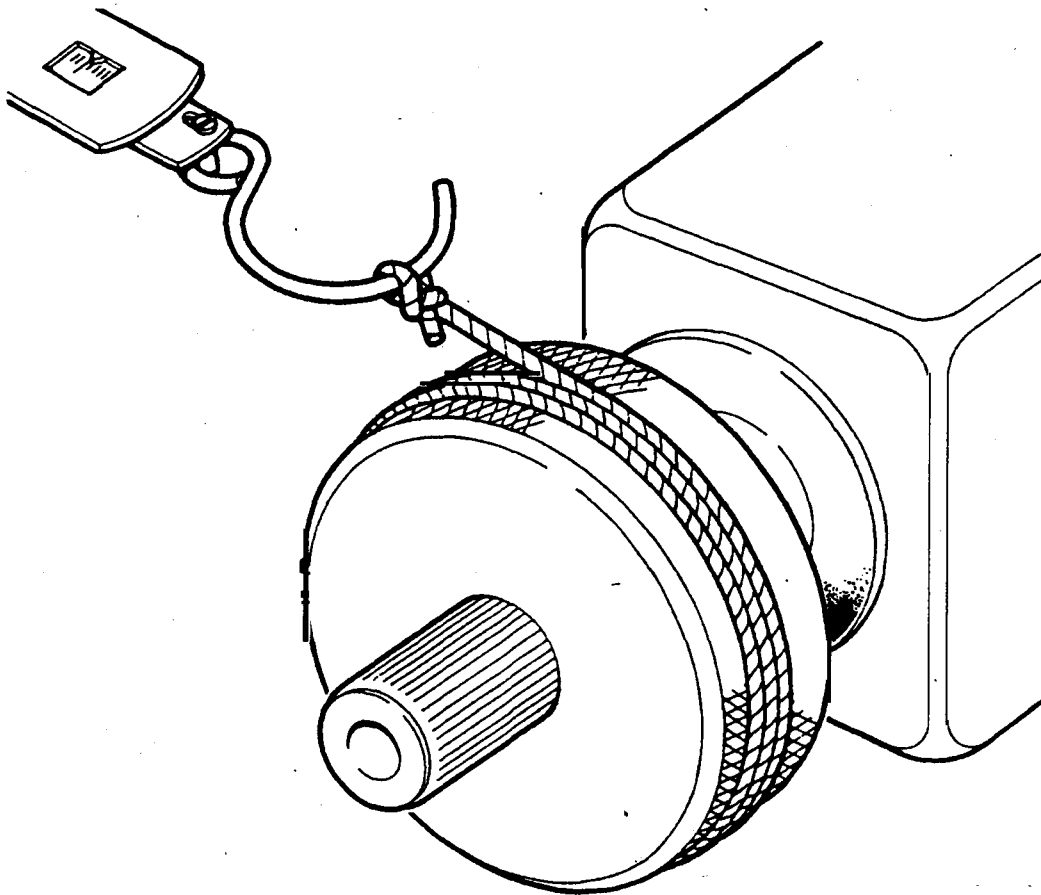


Fig 13 Checking worm shaft pre-load

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21.7 With the lip side leading fit the oil seal (Fig 12 (16)) to the shaft end of the box followed by the dust cover (15).

21.8 Press in the sector shaft upper needle roller bearing (13) to a depth of 83 mm (3.150 in.) from the top of the box.

21.9 Press in the lower bearing 1,00 mm (0.040 in.) below the chamfer.

21.10 Check that no end-play exists in the sector shaft adjuster (14). To reduce end-play unstake the threaded cup (12), turn clockwise until all end-play is removed and restake.

21.11 Fit the sector shaft so that the roller is in the centre of the worm in the straight ahead position.

21.12 Fit the needle roller bearing to the top cover.

21.13 Locate a new gasket (11) over the adjuster onto the box, screw the top cover to the adjuster and to the box with the four bolts and washers evenly tightened to a torque of 25 to 30 Nm (18 to 22 lbf ft).

21.14 Loosely fit the adjuster locknut.

21.15 With the sector shaft in the straight ahead position fit the drop arm and turn the adjuster clockwise until pre-load is applied to the shaft. The amount of pre-load should be such that when the shaft is turned half a turn to the left and then half a turn to the right, the backlash must only just be perceptible. When satisfactory tighten the adjuster locknut.

21.16 Fit the sector shaft oil seal (19).

21.17 Remove the oil filler plug and pour in approximately 0.43 litres (0.75 pints) of approved oil (AESP 2320-D-122-601) to a minimum level of 25 mm (1.0 in.) below the top of the filler hole. Refit the plug and tighten to a torque of 20 Nm (14.75 lbf ft).

Refitting (Fig 11)

22 Refit the steering box as follows:

22.1 Refit the drop arm (5) to the steering box with a new lock washer under the securing nut and tighten the nut to a torque of 176 Nm (130 lbf ft).

22.2 Locate the steering box on the vehicle chassis and secure with the four bolts (10), with new locking strips (9) fitted under the bolt heads. Tighten the bolts to a torque of 81 Nm (60 lbf ft) and lock by turning down the corners of the locking strips.

22.3 Fit the tie bar (3) to the steering box, secure with the nuts, bolts and washers, fitting the smaller washer under the head of the bolt and the large one under the nut. Tighten to a torque of 81 Nm (60 lbf ft).

22.4 Connect the collapsible shaft (2) to the steering box and tighten the pinch bolt to a torque of 30 Nm (22 lbf ft).

22.5 Connect the cross rod (7) to the drop arm ball joint (8), tighten the nut to a torque of 41 Nm (30 lbf ft) and secure with a new split pin.

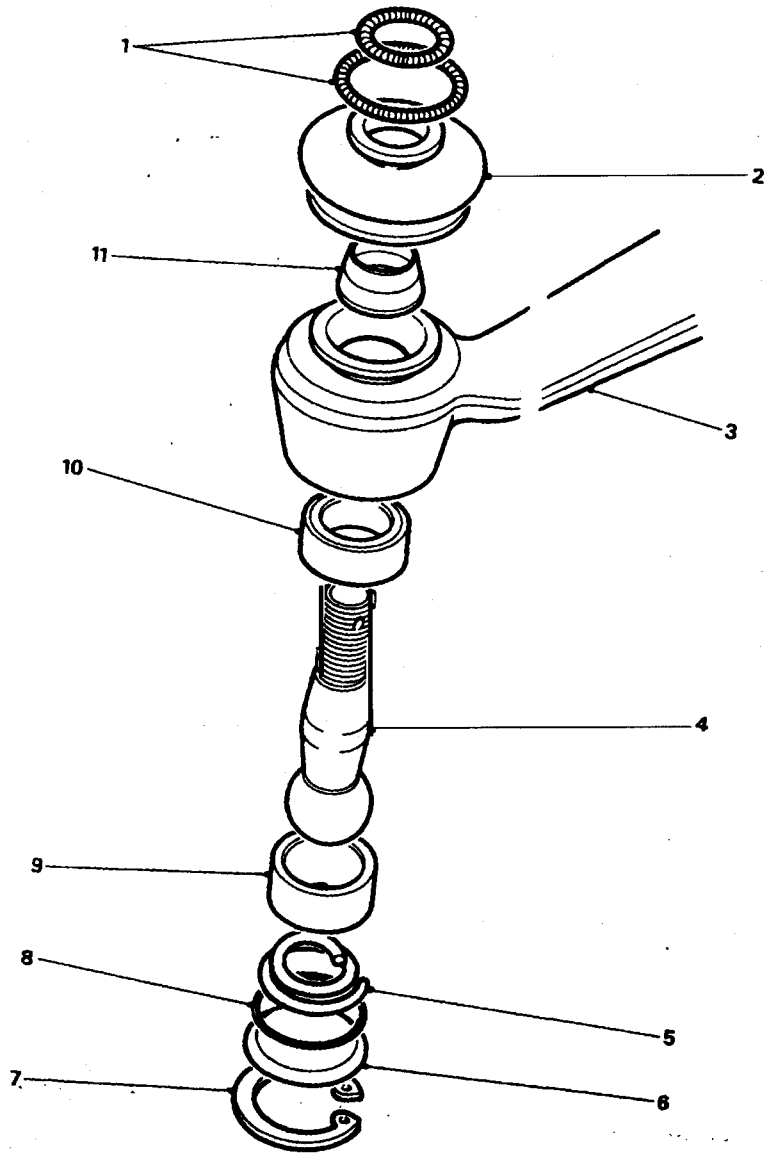
Drop arm ball joint

Removal/dismantling

23 To dismantle and overhaul the drop arm ball joint carry out the following:

23.1 Remove the drop arm from the vehicle and clean the exterior.

23.2 Remove the spring rings (Fig 14 (1)) and prise off the dust cover (2).



- 1 Spring rings
- 2 Dust cover
- 3 Drop arm
- 4 Ball pin
- 5 Spring
- 6 Cover plate

- 7 Circlip
- 8 'O' Ring seal
- 9 Lower ball socket
- 10 Upper ball socket
- 11 Retainer

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Fig 14 Drop arm ball joint

WARNING ...

PERSONAL INJURY COULD RESULT IF THE CIRCLIP IS REMOVED WITHOUT PRESSURE BEING APPLIED AND MAINTAINED TO THE COVER PLATE.

23.3 Position the ball joint under a suitable press to relieve the spring tension and support the drop arm both sides of the ball pin (Fig 15). Apply pressure to the cover plate and remove the circlip (Fig 14 (7)) then slowly release the pressure.

23.4 Remove the cover plate (6), 'O' ring seal (8), spring (5) and lower ball socket (9).

23.5 Using a hide hammer, tap the threaded end of the ball pin (4) to release the retainer (11) and to remove the ball pin from the drop arm (Fig 16).

23.6 Using a sharp-edged punch or chisel, drive the upper ball pin socket from the drop arm (Fig 17).

23.7 Clean the housing in the drop arm ball pin circlip.

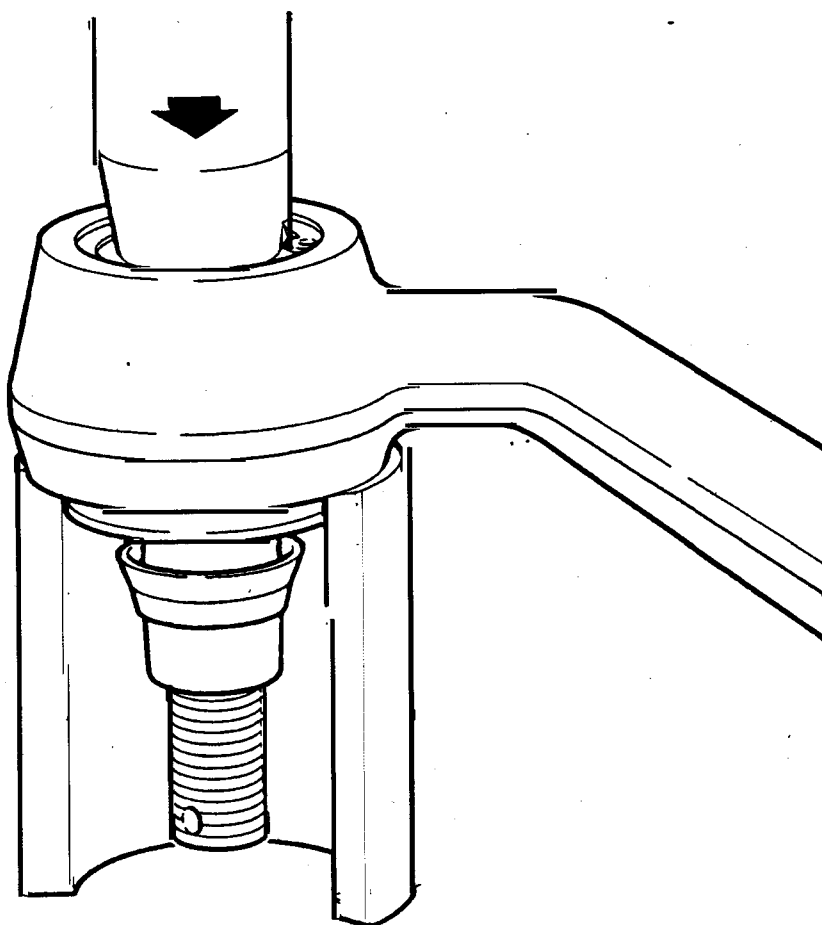


Fig 15 Removing drop arm ball joint circlip

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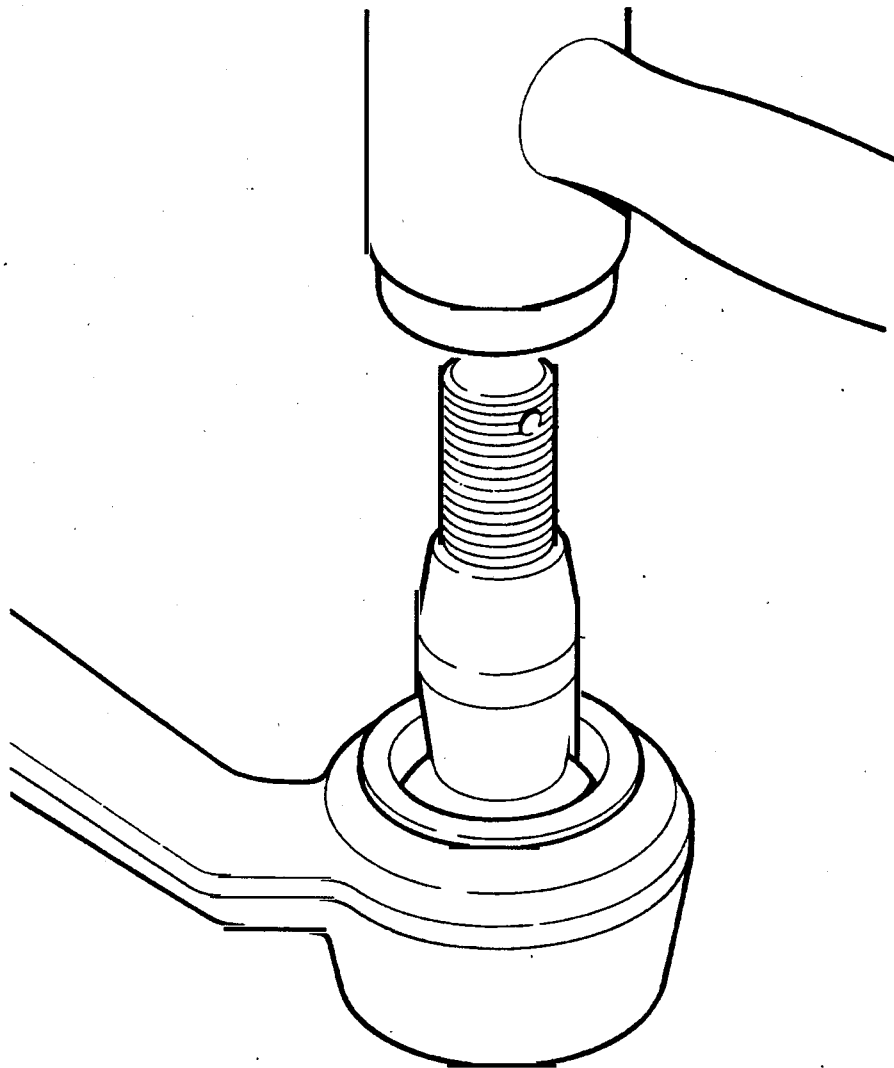


Fig 16 Removing ball pin

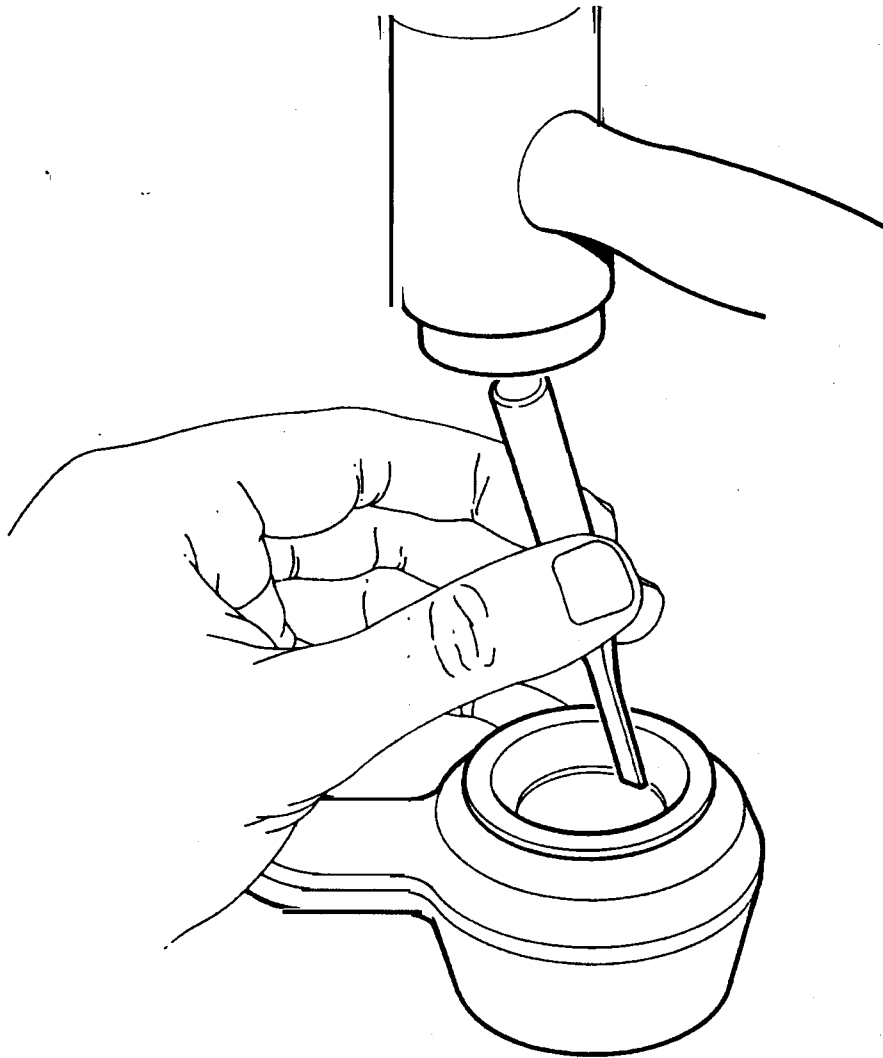
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Repairs and replacement

- 24 A repair kit is available for use when overhauling the drop arm ball joint (AESP 2320-D-122-721).

Reassembly

- 25 To reassemble and refit the drop arm ball joint proceed as follows:
- 25.1 Press the upper ball socket (Fig 14 (10)) into the drop arm (3) up to the shoulder in the housing.
 - 25.2 Dip the ball in BP Energrease L2, (Grease XG 279) or equivalent, fit to the housing and pack with grease.
 - 25.3 Fit the lower ball socket (9) followed by the spring (5) with the small diameter towards the ball.



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Fig 17 Removing ball pin upper socket

25.4 Fit the 'O' ring seal (8) and locate the cover plate (6) on the spring. Compress the spring in the manner used for dismantling (Para 23.3) and fit the circlip (7).

25.5 Press the retainer (11) on to the ball pin (4) so that the top edge is level with the edge of the taper.

25.6 Fit the dust cover (2) and retain with the two springs (1).

25.7 Fit the drop arm to the steering box using a new lock washer under the securing nut, tighten the nut to a torque of 176 Nm (130 lbf ft).

25.8 Fit the cross rod to the drop arm ball joint, tighten the nut to a torque of 41 Nm (30 lbf ft) and secure with a new split pin.

Track rod and cross rod ball joints

26 When adjusting or renewing a track rod or cross rod it is important to ensure that the ball joints are assembled in the same angular plane and that the ball joint pins are central in their respective housings, as example 'A' Fig 18. Premature wear and damage could result if the pins are inclined to one-side as example 'B'.

CAUTION ...

A track rod or cross rod that is damaged or bent must be renewed. No attempt should be made to repair or straighten it.

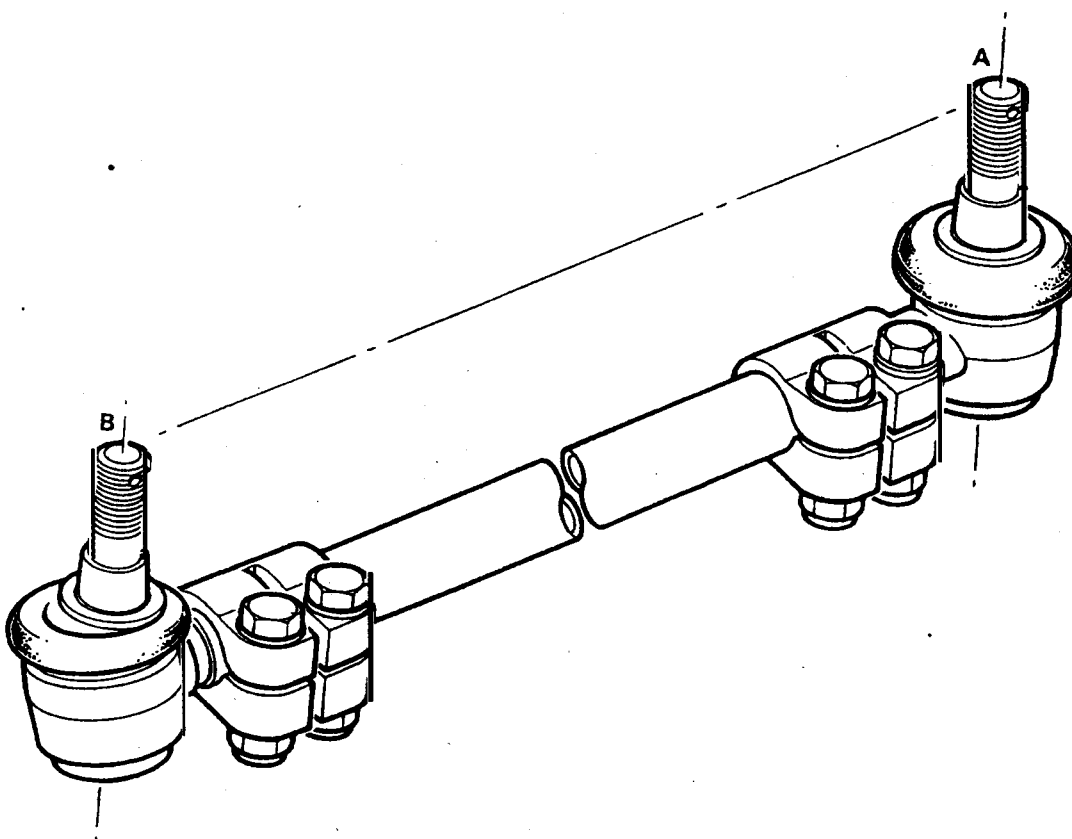


Fig 18 Correct alignment of ball joints

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Chapter 7-2

POWER STEERING SYSTEM LAND ROVER 127 VEHICLES

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INTRODUCTION

1 This chapter details the unit and field repair procedures for the power operated steering components fitted to Land Rover 127 vehicles.

TABLE 1 SPECIAL TOOLS

| Ser No (1) | Manufacturers Part No (2) | NSN/Part No where applicable (3) | Designation (4) |
|---------------|------------------------------|-------------------------------------|-------------------------|
| 1 | MS 252A | | Drop arm extractor |
| 2 | JD10-2/1 | | Test Equipment Assembly |
| 3 | JD10-3A | | |
| 4 | LST 10-11 | | |

STEERING BOXRemoval

2 To remove the steering box proceed as follows:

Cautions ...

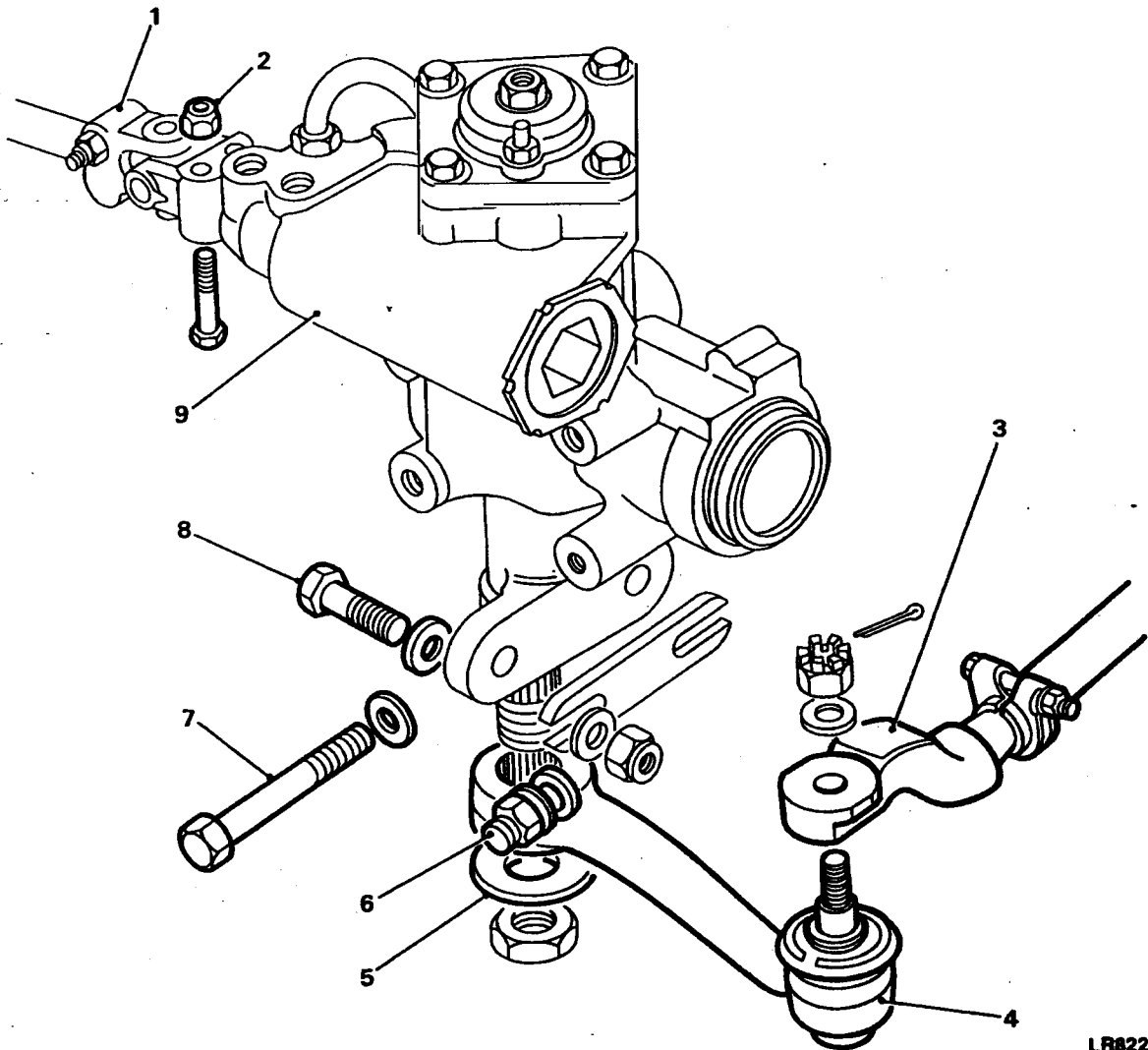
- (1) In order to prevent the power steering system from contamination, it is essential to protect all disconnected hoses and their respective interfaces from the ingress of foreign matter, both during dismantle and until reassembly commences.
- (2) Power steering fluid is harmful to paintwork. Should any fluid seep on to body, chassis or any other components immediately wipe clean. It is most important that fluid drained from the system is not re-used.

- 2.1 Park vehicle on level surface.
- 2.2 Chock rear wheels, raise vehicle and locate axle stands.
- 2.3 Remove road wheel.
- 2.4 Disconnect the drag link (Fig 1 (3)) from the drop arm using a suitable extractor.
- 2.5 Remove the drop arm using special tool (MS 252A).
- 2.6 Remove the filler cap from the power steering fluid reservoir.
- 2.7 Release power steering pipe to chassis fixings and free pipes as necessary.
- 2.8 Place suitable drain can under steering box (2) to contain fluid.
- 2.9 Disconnect return hose union at steering box, drain and discard fluid. Replace reservoir cap.
- 2.10 Disconnect outlet hose union at box.
- 2.11 Disconnect the steering column lower pinch bolt (1).
- 2.12 Position steering wheel to the straight ahead position.

Note ...

To achieve the straight ahead position, turn the steering wheel to the maximum lock and return to the maximum extent of the opposite lock, counting the number of revolutions. Return the steering again, half of the revolutions counted.

- 2.13 Remove the tie bar to box mounting fixings (8) and move the tie bar to the side.



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- | | | | |
|---|-----------|---|--------------|
| 1 | Coupling | 6 | Bolt |
| 2 | Bolt | 7 | Bolt |
| 3 | Drag link | 8 | Bolt |
| 4 | Drop arm | 9 | Steering box |
| 5 | Washer | | |

Fig 1 Steering box removal

- 2.14 Remove steering box to chassis fixings (7).
- 2.15 Remove coupling top pinch bolt slide coupling off steering box withdraw steering box (9).
- 2.16 Clean all mounting faces, unions etc. prior to refitting.

Refitting

3 To refit the steering box to the vehicle proceed as follows:

- 3.1 Offer up steering box, locate coupling to box and push home. Secure with steering box to chassis fixings (7).
- 3.2 Refit tie bar to steering box fixings (8), and tighten to the correct torque.
- 3.3 Locate bottom coupling, secure coupling upper fixings.
- 3.4 Secure bottom coupling fixing.
- 3.5 Remove sealing plugs, locate and secure supply and return hoses, align hoses to chassis and fasten.
- 3.6 Reverse procedures in Para 2.1 to 2.5
- 3.7 Position steering wheel to the straight ahead position.

Note ...

To achieve the straight ahead position, turn the steering wheel to the maximum lock and return to the maximum extent of the opposite lock, counting the number of revolutions. Return the steering again, half of the revolutions counted.

- 3.8 Refill and bleed the system (Refer to Para 4).
- 3.9 Check and if necessary adjust the steering box (Refer to Para 6).
- 3.10 Check hose joints, pump and steering box for any fluid leaks under pressure by holding the steering hard on full lock in both directions.

CAUTION ...

Do not maintain this pressure for more than 30 seconds in any one minute, otherwise the oil may overheat, resulting in damage to the seals.

- 3.11 Check for correct steering characteristics by road testing the vehicle.

Bleeding

4 To bleed the system of air proceed as follows:

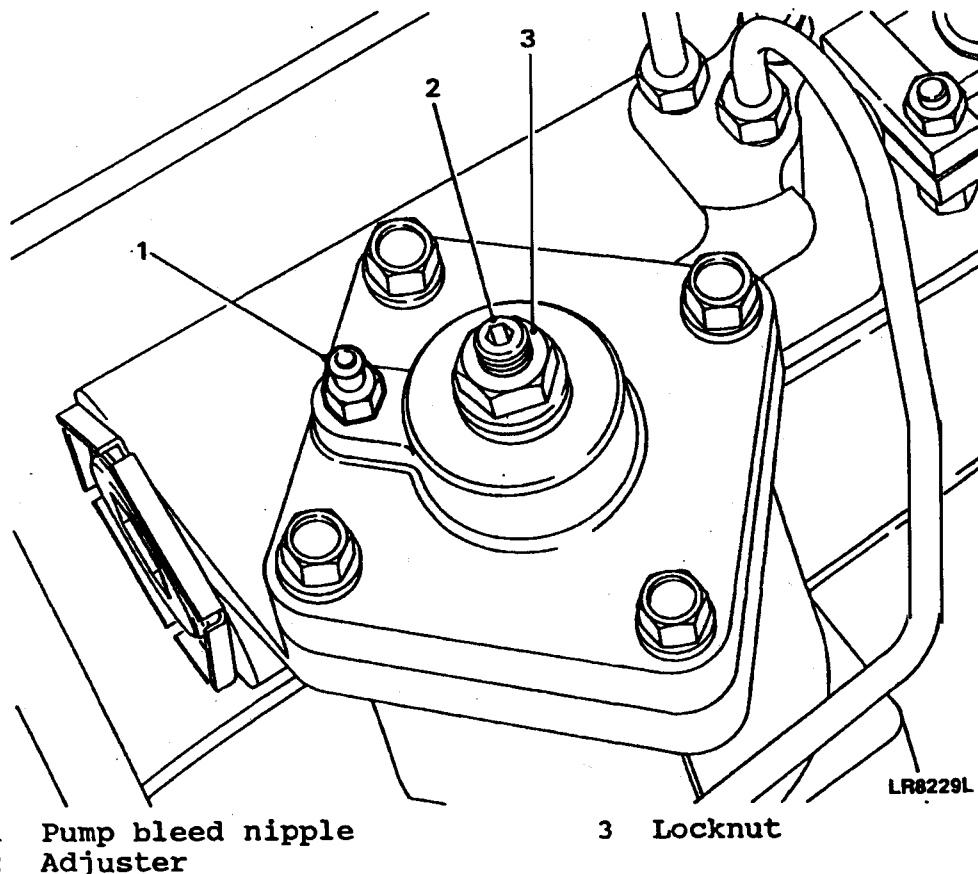


Fig 2 Bleed nipple

Caution ...

Power steering fluid is harmful to paintwork. Should any fluid seep on to body, chassis or any other components immediately wipe clean. It is most important that fluid drained from the system is not re-used.

4.1 Fill the steering fluid reservoir to the mark on the side of the reservoir with a recommended fluid.

4.2 Run the engine until it attains normal operating temperature.

4.3 Check the reservoir fluid level, replenish if necessary.

Note ...

For the following operation (Para 4.4 to 4.6) ensure that the steering reservoir is kept full. Do not increase the engine speed or move the steering wheel.

4.4 With the engine at idle speed, slacken the bleed screw (Fig 2 (1)). When fluid seepage past the bleed screw is observed, re-tighten the screw (1).

Note ...

Ensure that all fluid released during bleeding is wiped clean from the surrounding areas.

4.5 Recheck the the fluid level, replenish if necessary.

4.6 Check hose joints, pump and steering box for any fluid leaks under pressure by holding the steering hard on full lock in both directions.

CAUTION ...

Do not maintain this pressure for more than 30 seconds in any one minute, otherwise the oil may overheat, resulting in damage to the seals.

4.7 If necessary, take the appropriate remedial action to rectify any leaks.

4.8 With the vehicle stationary the steering should be smooth lock-to-lock in both directions, that is, no heavy or light spots when changing direction.

4.9 Check for correct steering characteristics by road testing the vehicle.

Testing the system

5 To test the power steering system proceed as follows:

Note ...

If there is a lack of power assistance for the steering the pressure of the hydraulic pump should be checked first. Refer to the fault diagnosis chart (Cat 512 Chap 7-2) to assist in tracing faults in the power steering.

5.1 The hydraulic pressure test gauge (Fig 3 (1)) is used for testing the power steering system.

Note ...

The gauge is calibrated to read up to 137 bar (2000 lbf/in²). The normal pressure which may be expected in the power steering system is 76 bar (1100 lbf/in²).

5.2 Under certain hydraulic pump fault conditions it is possible to obtain pressures of up to 103 bar (1500 lbf/in²). Therefore, it is important to realise that the pressure upon the gauge is in direct proportion to the pressure being exerted upon the steering wheel. When testing, apply pressure to the steering wheel very gradually while carefully observing the pressure gauge.

5.3 Check the steering fluid level reservoir, replenish if necessary.

5.4 Examine the power steering units and connections for leaks.

Note ...

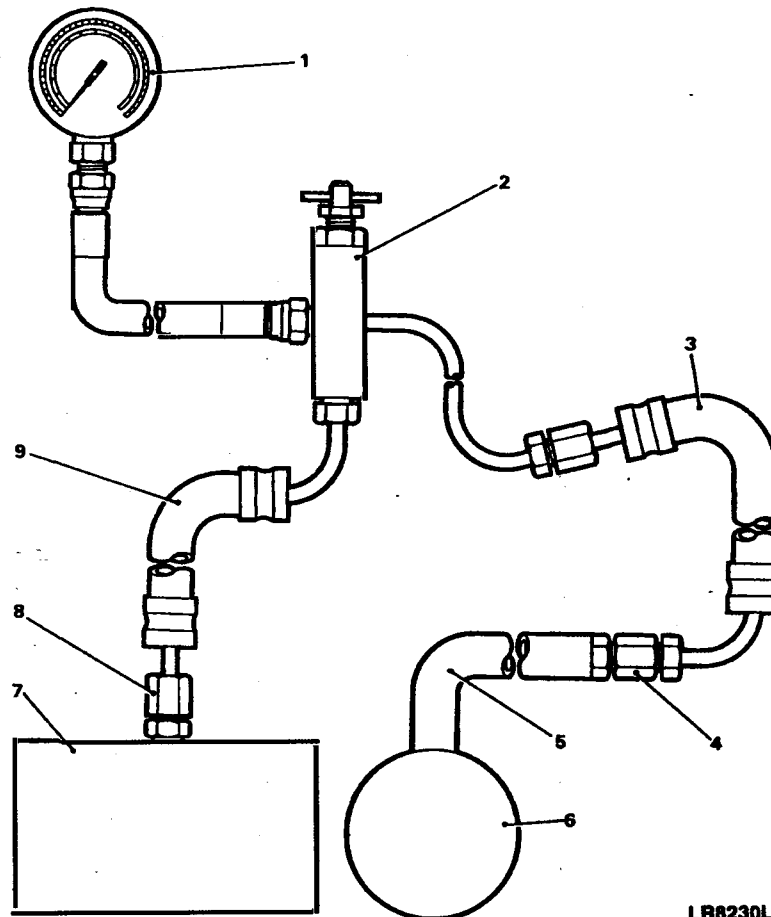
All leaks must be rectified before attempting to test the system.

5.5 Check the steering pump drive belt for condition and tension.

5.6 Assemble the test equipment and fit to the vehicle (Fig 3).

5.7 Open the tap (Fig 3 (2)) in the adaptor.

5.8 Bleed the system but exercise extreme care when carrying out this operation so as not to overload the pressure gauge.



- 1 Gauge
- 2 Test adaptor JD10-2/1
- 3 Hose JD10 - 3A
- 4 Adaptor LST 10-11
- 5 Hose from steering box

- 6 Steering pump
- 7 Steering box
- 8 Adaptor LST 10-11
- 9 Hose JD10 - 3A

Fig 3 Test equipment

5.9 With the system in good condition, momentarily apply lock in one direction until reading is obtained at idle speed, repeat at 1000 rev/min. The pressures should be as follows:

5.9.1 Steering wheel held hard on full lock and engine running at 1,000 rev/min, the pressure should be 68 to 75 bar (1000 to 1100 lbf/in²).

5.9.2 With the engine idling and the steering wheel held hard on full lock, the pressure should be 27 bar (400 lbf/in²) minimum.

CAUTION ...

Under no circumstances must the steering wheel be held on full lock for more than 30 seconds in any one minute, as the oil can overheat and possible damage to the seals may occur.

5.10 Repeat checks for other lock.

5.11 Release the steering wheel and allow the engine to idle. The pressure should be below 7 bar (100 lbf/in²).

5.12 If the pressures recorded above (Para 5.9 to 5.11) are outside the specified range, or pressure imbalance is recorded, a fault exists in the system. To determine if the fault is in the steering box or the pump proceed as follows.

5.13 Close the adaptor tap (2) for a period not exceeding five seconds.

5.14 If the gauge (1) fails to register the specified pressures, the pump is inefficient and should be overhauled or a new unit fitted.

5.15 If pump delivery is satisfactory and low pressure or marked imbalance exists, the fault must be in the steering box valve and worm assembly.

Adjustment

6 To check minimum backlash proceed as follows.

6.1 Jack up the front of the vehicle until the wheels are clear of the ground.

WARNING ...

ENSURE WHEELS ARE CHOCKED AND AXLE SUPPORTS ARE SECURELY SUPPORTING THE VEHICLE PRIOR TO CARRYING OUT THIS PROCEDURE.

6.2 Remove drag link at steering box end (Fig. 1 (3)).

6.3 Position steering wheel in the straight ahead position.

Note ...

To achieve the straight ahead position, turn the steering wheel to the maximum lock and return to the maximum extent of the opposite lock, counting the number of revolutions. Return the steering again, half of the revolutions counted.

- 6.4 Fit the steering wheel clamp taking care to protect the seat.
- 6.5 Mark the drop arm position (4) relative to the steering box (9) body.
- 6.6 Check for steering box backlash by rocking drop arm about centre position.
- 6.3 Slacken off locknut (Fig 2 (3)).
- 6.4 Slacken off adjuster (2) until free play is evident. Continue rocking drop arm, screwing adjuster inwards until backlash is just eliminated. (No preload, no end float)
- 6.5 Tighten the locknut (3) and recheck for backlash.
- 6.6 Turn the steering wheel from lock to lock and check that no excessive tightness exists at any point.
- 6.7 Lower the vehicle to ground level and remove the wheel chocks.
- 6.8 Road test the vehicle.

PUMP

Removal

- 7 To remove the pump proceed as follows:

Cautions ...

- (1) In order to prevent the power steering system from contamination, it is essential to protect all disconnected hoses and their respective interfaces from the ingress of foreign matter, both during dismantle and until reassembly commences.
- (2) Power steering fluid is harmful to paintwork. Should any fluid seep on to body, chassis or any other components immediately wipe clean. It is most important that fluid drained from the system is not re-used.

- 7.1 Disconnect the battery.
- 7.2 Remove alternator drive belt and pump drive belt.
- 7.3 Remove the pump pulley (Fig 4 (5)).
- 7.4 Disconnect the pump to steering box hose connection and allow the steering fluid to drain into a suitable container.

7.5 Remove bolts (5,6) securing pump to bracket and manoeuvre pump from bracket sufficiently to gain access to reservoir hose connection. Disconnect and remove the feed hose.

7.6 Remove pump from the vehicle.

Refitting

8 To refit the power assisted steering pump proceed as follows:

8.1 Refitting the pump is a reversal of removal procedure.

Notes ...

- (1) The feed hose clip should be tightened to 3 Nm and the high pressure union connection to 20 Nm.
- (2) For pump drive belt and alternator belt adjustment refer to Cat 522 Chap 1-2.

8.2 Top up and bleed the system (Para 4).

8.3 Check hose joints and pump for any fluid leaks under pressure by holding the steering hard on full lock in both directions.

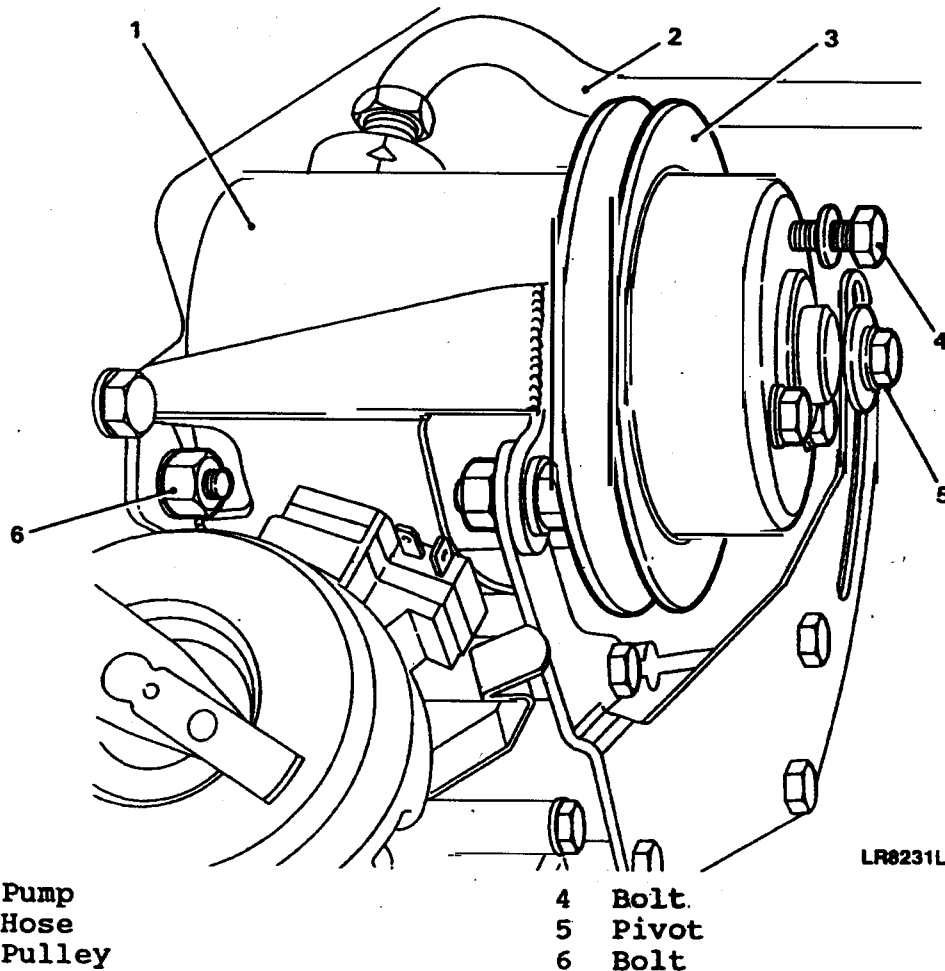


Fig 4 Steering pump

CAUTION ...

Do not maintain this pressure for more than 30 seconds in any one minute, otherwise the oil may overheat, resulting in damage to the seals.

8.4 Check for correct steering characteristics by road testing the vehicle.

Adjustment

9 To adjust the steering pump drive belt for tension proceed as follows.

9.1 Using thumb pressure check the tension of the belt midway between the crankshaft pulley and alternator, the deflection should be between 4 mm and 6 mm. Adjust if necessary.

9.2 Slacken the power steering adjust clamp bolt (Fig 4 (5)).

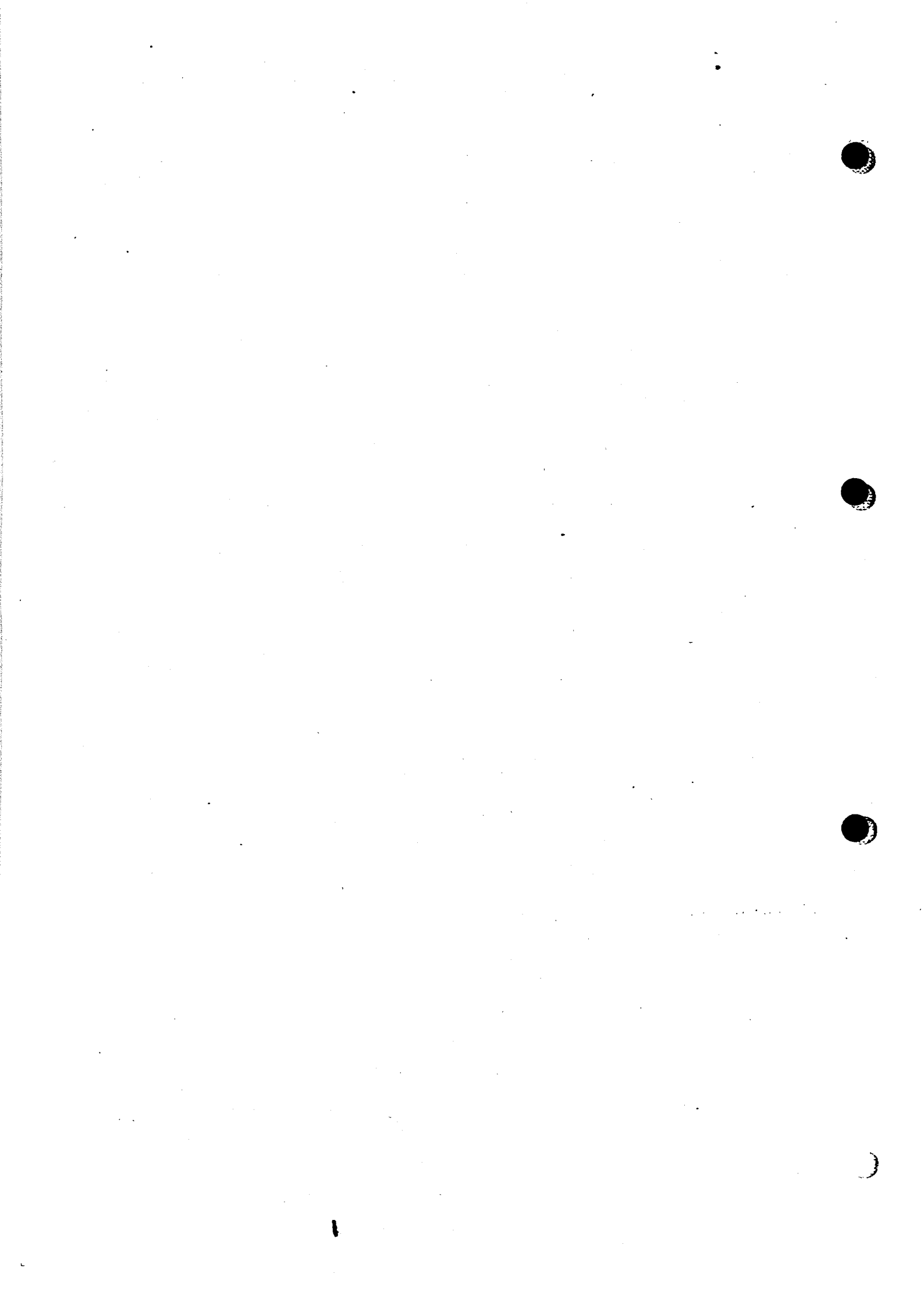
9.3 Slacken the power steering pump two pivot fasteners (6).

9.4 Move the pump in the appropriate direction to achieve the correct tension. Tighten the link clamp (5) and two pivot fasteners (6).

9.5 Recheck for adjustment, repeat procedure if necessary.

CAUTION ...

Do not use a lever or apply pressure to the pump body as this will cause permanent damage to the pump.



Chapter 8-1

SUSPENSION

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INTRODUCTION

1 This Chapter covers the Unit and Field repairs for the suspension system fitted to Land Rover 90 and 110 vehicles.

Note ...

Where suspension components are secured with self locking nuts and they are removed for repair or overhaul purposes, new self locking nuts must be used when refitting the components.

FRONT SUSPENSION

Panhard rod

Removal

2 To remove the panard rod carry out the following:

2.1 Working underneath the vehicle remove the nut (Fig 1 (2)) and bolt (1) securing the panhard rod (4) to the mounting arm (3).

2.2 Remove the nut and bolt (5) securing the panhard rod to the axle and withdraw the rod.

Cleaning/Examination

3 Thoroughly clean the rod and examine for bends, cracks or any damage that would render it unfit for further service.

Repairs and replacement

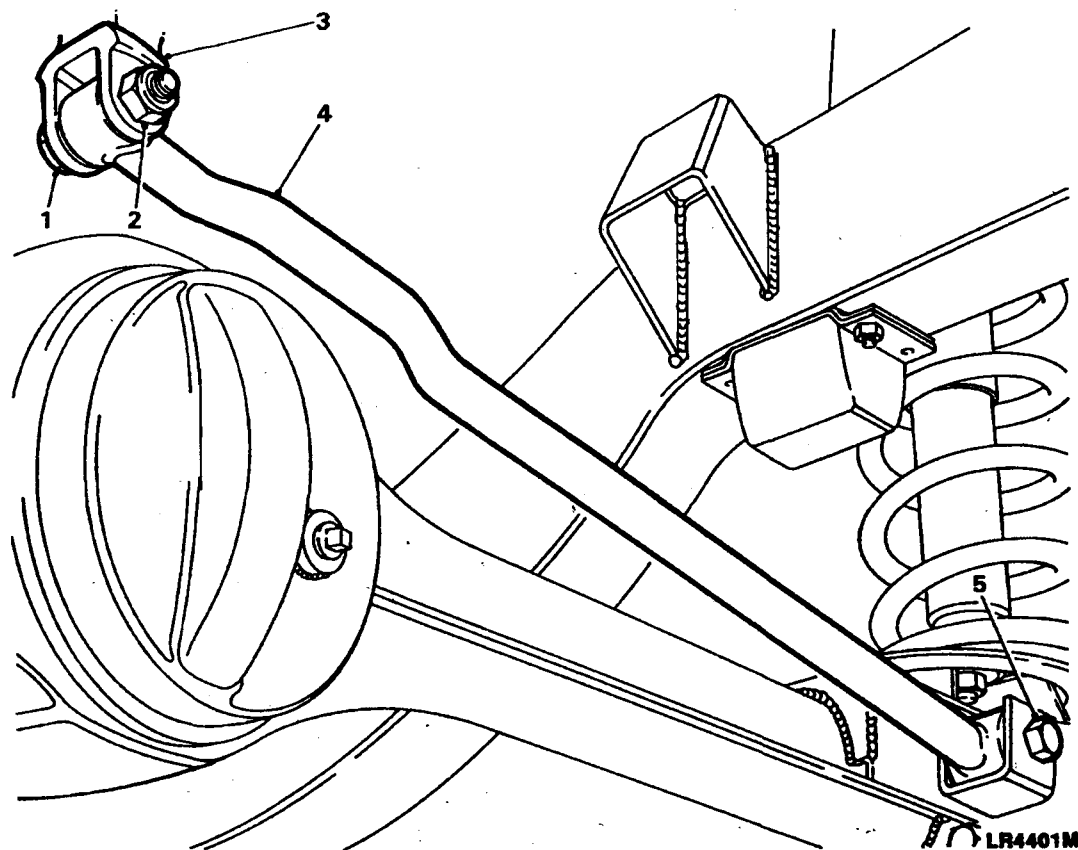
4 The rubber mounted bushes may be renewed by carrying out the following:

4.1 Using a suitable hydraulic or bench press and a length of metal tubing, slightly smaller in diameter than the outside of the bush, press out the rubber mounted bushes. Ensure that the tubing locates on the outer edge of the bush and not on the rubber inner.

4.2 Fit new bushes centrally to their locations in the rod, ensuring that pressure is applied to the outer edge of the bush only.

Refitting

5 Refit the panhard rod in reverse order of removal, with the front suspension at the normal ride height i.e, not jacked up, tighten the securing nuts and bolts to a torque of 88Nm (65 lbf ft).



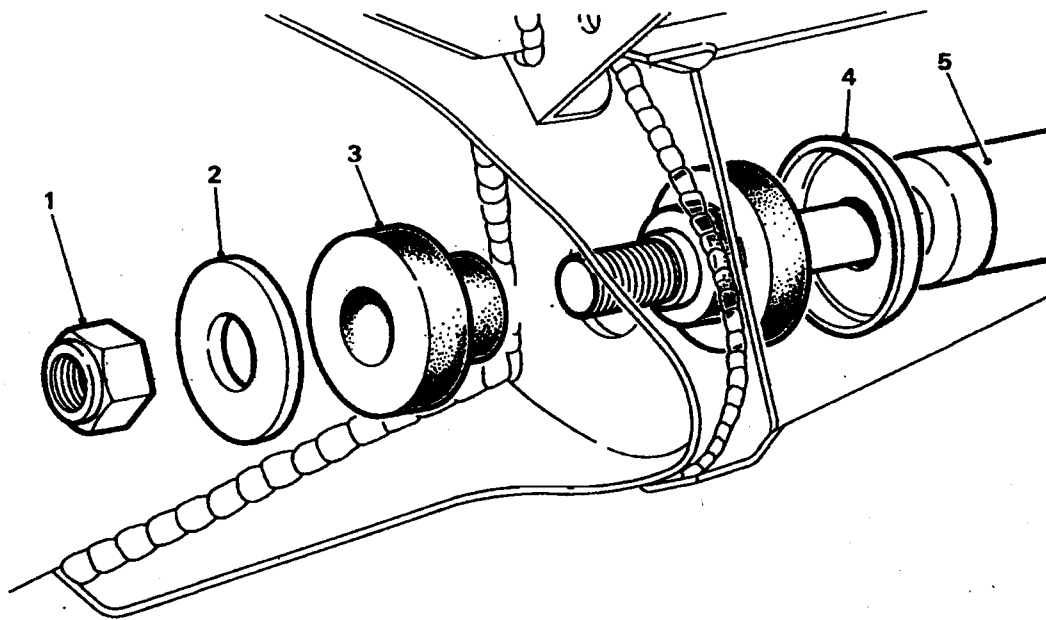
- | | | | |
|---|--------------|---|-------------|
| 1 | Bolt | 4 | Panhard rod |
| 2 | Locknut | 5 | Bolt |
| 3 | Mounting arm | | |

Fig 1 Panhard rod removal/installation

Radius arm

Removal

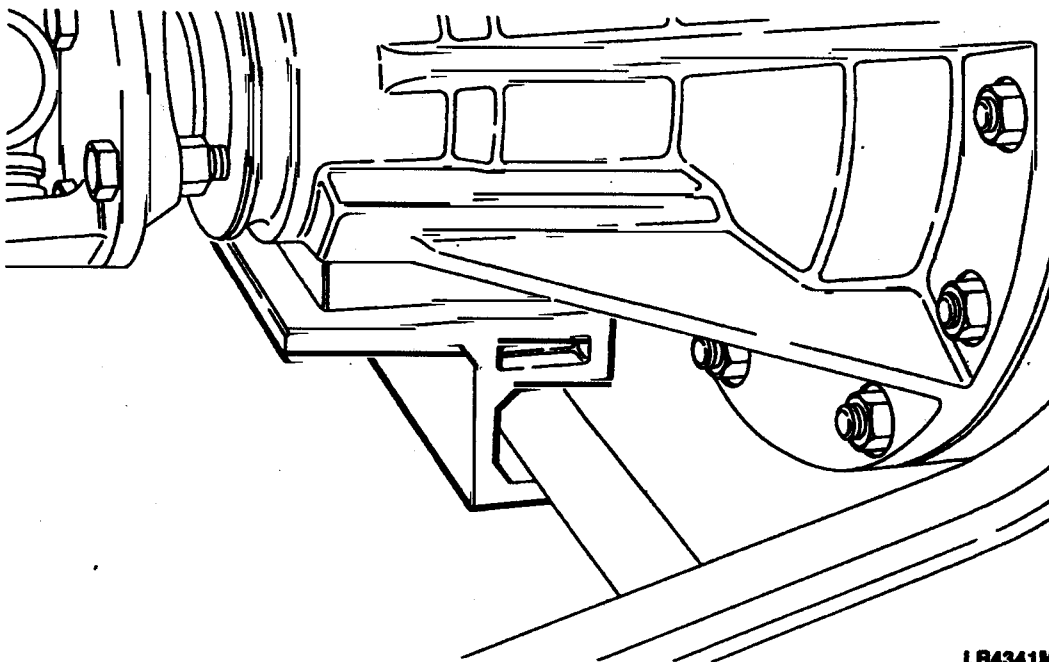
- 6 To remove the radius arms carry out the following:
 - 6.1 Slacken the road wheel retaining nuts.
 - 6.2 Raise the vehicle, support the chassis on suitable axle stands and remove the road wheels (remove both wheels only if removing both radius arms).
 - 6.3 Support the front axle weight using a suitable hydraulic floor jack.
 - 6.4 Remove the nut (Fig 2 (1)) and washer (2) securing the radius arm (5) to the chassis side member.



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- | | | | |
|---|--------------|---|---------------|
| 1 | Locknut | 4 | Dished washer |
| 2 | Plain washer | 5 | Radius arm |
| 3 | Rubber bush | | |

Fig 2 Radius arm chassis mounting removal/installation

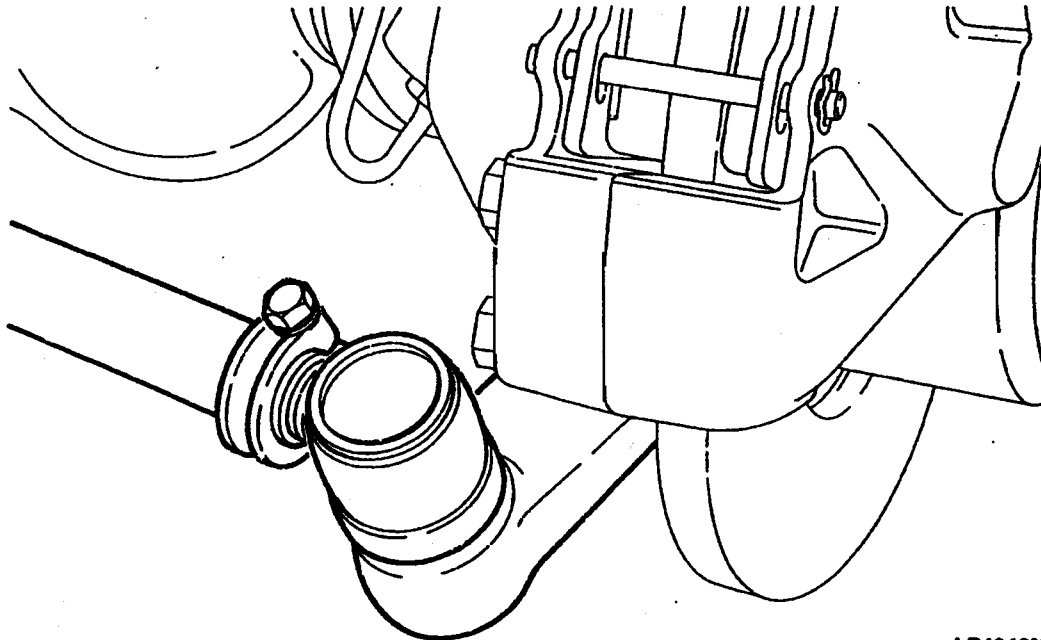


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Fig 3 Track rod protection bracket

6.5 Remove the track rod protection bracket from the underside of the differential assembly (Fig 3).

6.6 Remove the nuts from the track rod ball joints and using a suitable extractor remove the track rod from the swivel housings.



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Fig 4 Track rod to swivel housing ball joint

6.7 Remove the nuts and bolts securing the radius arm to the axl bracket. Release the radius arm from the bracket and withdraw from the chassis side member. Remove the rubber bushes (Fig 2 (3)) and dished washer (4) from the chassis mounting. Discard rubber bushes.

Cleaning/Examination

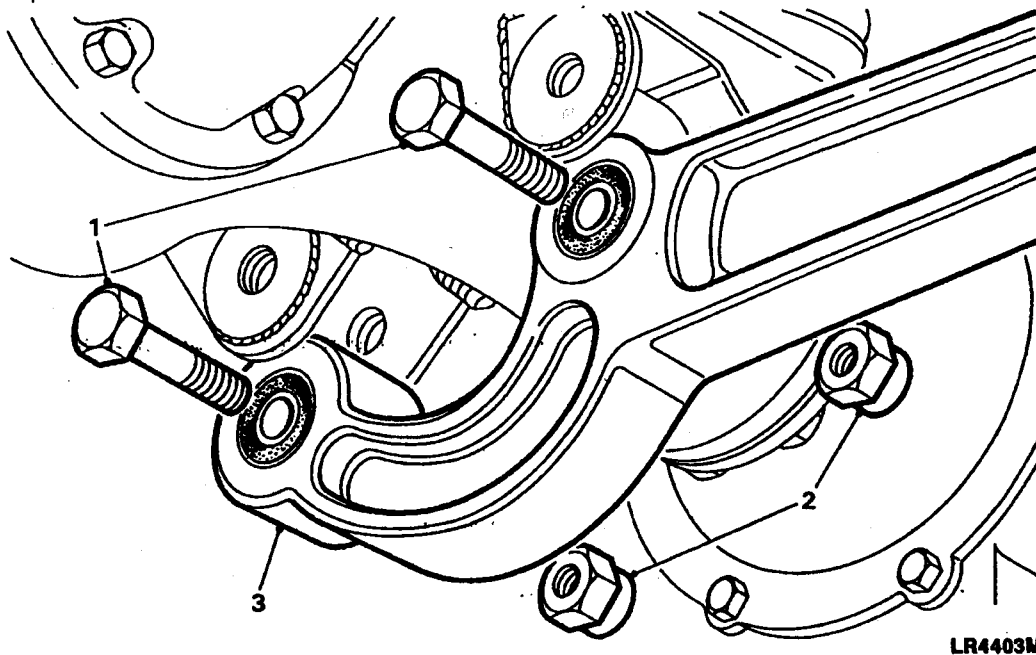
7 Thoroughly clean the radius arms and examine for bends, cracks or any damage that would render them unfit for further service.

Repairs and replacement

8 The rubber mounted bushes may be renewed by carrying out the following:

8.1 Using a suitable hydraulic or bench press and a length of metal tubing, slightly smaller in diameter than the outside diameter of the bush, press out the rubber mounted bushes. Ensure that the tubing locates on the outer edge of the bush and not on the rubber inner.

8.2 Fit new bushes centrally to their locations in the radius arm ensuring that pressure is applied to the outer edge of the bush only.



1 Bolt 2 Locknut 3 Radius arm

Fig 5 Radius arm axle mounting removal/installation

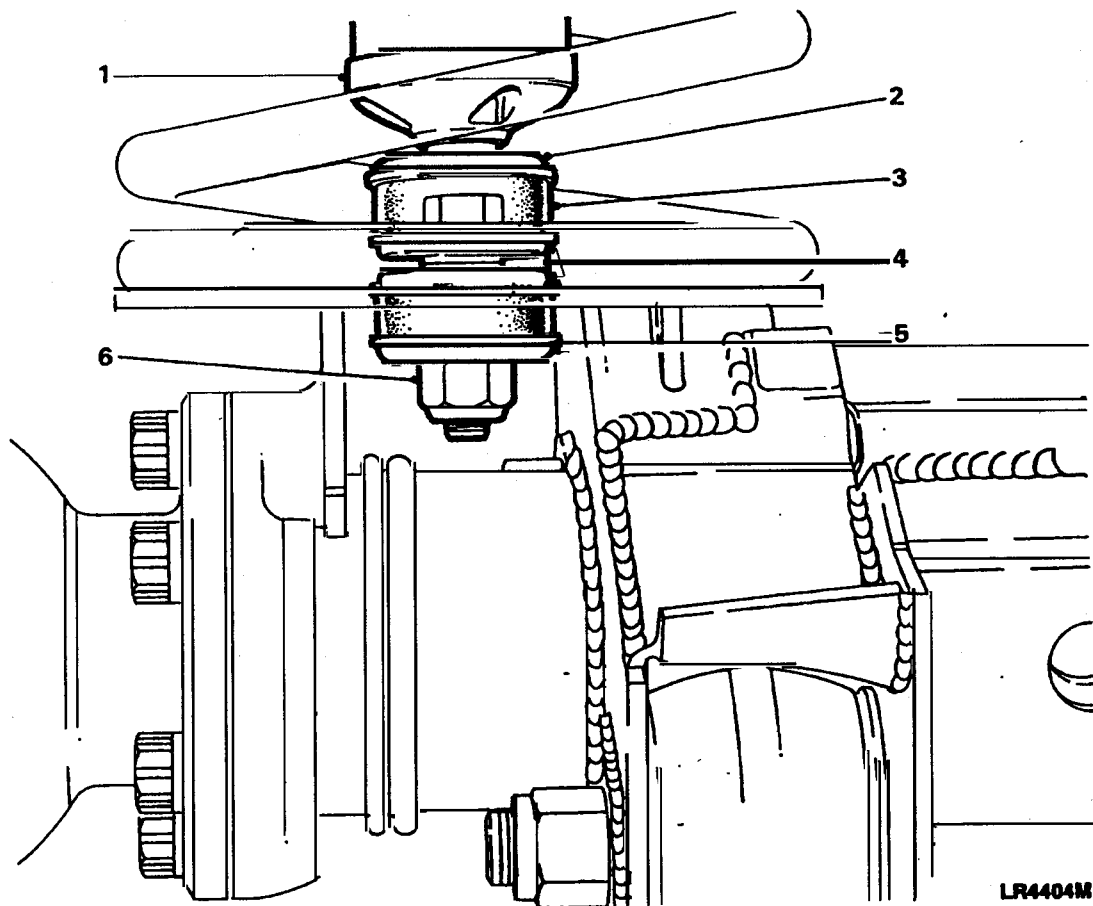
Refitting

9 Refit the radius arms in reverse order of removal fitting new bushes at the chassis side member locations. Tighten the radius arm securing nuts and bolts to a torque of 190 Nm (140 lbf ft) and the track rod ball joint securing nuts to a torque of 40 Nm (30 lbf ft).

Front shock absorbers

Removal

- 10 To remove the front shock absorbers carry out the following:
- 10.1 Slacken the road wheel nuts.
 - 10.2 Raise the front of the vehicle using a suitable hydraulic floor jack. Support the chassis on suitable stands and remove the road wheel. Remove both front wheels only if removing both shock absorbers.
 - 10.3 Support the axle weight using the hydraulic floor jack.
 - 10.4 Remove the locknut (Fig 6 (6)) and lower retaining washer (5) securing the shock absorber (1) to the axle and withdraw the rubber cushion (3) and guide washer (4).



- | | | | |
|---|------------------------|---|------------------------|
| 1 | Shock absorber | 4 | Guide washer |
| 2 | Upper retaining washer | 5 | Lower retaining washer |
| 3 | Rubber cushion | 6 | Locknut |

Fig 6 Front shock absorber lower fixings

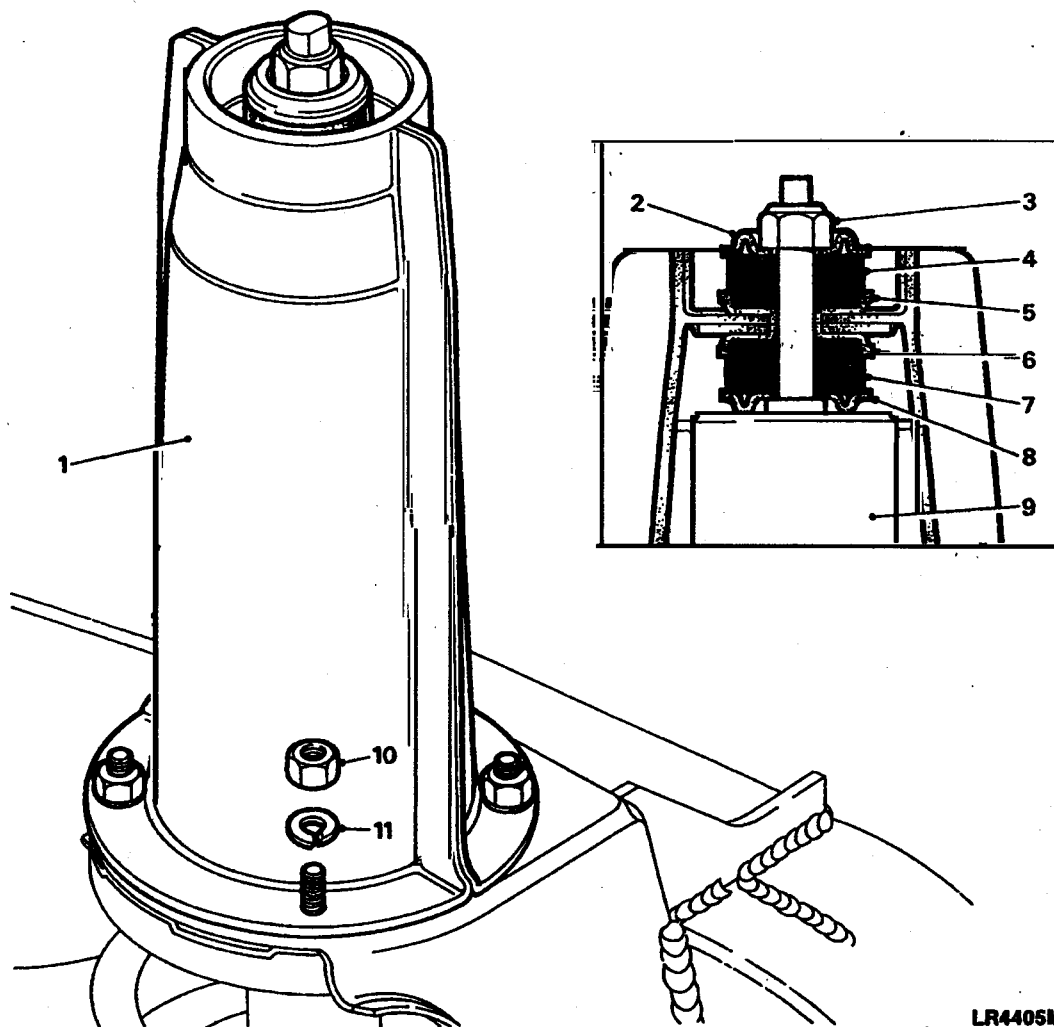
10.5 Remove the four nuts (Fig 7 (10)) and washers (11) securing the shock absorber mounting bracket (1).

10.6 Withdraw the bracket (1) complete with shock absorber (9).

10.7 Remove the lower inner guide washer (Fig 6 (4)), rubber cushion (3) and retaining washer (2) from the shock absorber (1).

10.8 Remove the locknut (Fig 7 (3)) securing the shock absorber (9) to the bracket (1), remove the outer retaining washer (2), rubber cushion (4) and guide washer (5) and withdraw the bracket (1) from the top of the shock absorber.

10.9 Remove the inner guide washer (6), rubber cushion (7) and retaining washer (8) from the shock absorber.



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- | | | | |
|---|------------------------|----|------------------------|
| 1 | Mounting bracket | 7 | Rubber cushion |
| 2 | Outer retaining washer | 8 | Inner retaining washer |
| 3 | Locknut | 9 | Shock absorber |
| 4 | Rubber cushion | 10 | Nut |
| 5 | Outer guide washer | 11 | Spring washer |
| 6 | Inner guide washer | | |

Fig 7 Front shock absorber upper fixings

Cleaning

11 Thoroughly clean the exterior of the shock absorber to remove all road dirt.

Examination

12 Examine the shock absorber as follows:

12.1 Check the exterior for corrosion and oil leaks.

12.2 Check the operation by extending and compressing the shock absorber, resistance should be uniform throughout the length of each stroke. If resistance is erratic or weak renew the shock absorber. When checking resistance a new shock absorber may be used for comparison. To ensure that the new shock absorber is primed, fully extend and compress the unit several times before testing begins. During the tests and when priming, the damper must be kept in the upright position.

Refitting

13 Refit the shock absorbers in reverse order of removal fitting new rubber cushions and locknuts as applicable. Tighten the shock absorber securing nuts to a torque of 75 Nm (55 lbf ft) and the road wheel nuts to a torque of 108 Nm (80 lbf ft).

Front road spring

Removal

CAUTION ...

During the following procedure avoid over stretching the brake hoses. If necessary, slacken the hose connector locknuts to allow the hoses to follow the axle.

14 To remove the front road springs carry out the following:

- 14.1 Remove the front shock absorber (Para 10).
- 14.2 Lower the axle sufficient to free the road spring.
- 14.3 Withdraw the road spring.
- 14.4 Withdraw the shock absorber bracket securing ring.

Refitting

15 Refit the front road spring as follows:

Note ...

When fitting new road springs ensure that the correct type is being fitted, (AESF 2320-D-122-721).

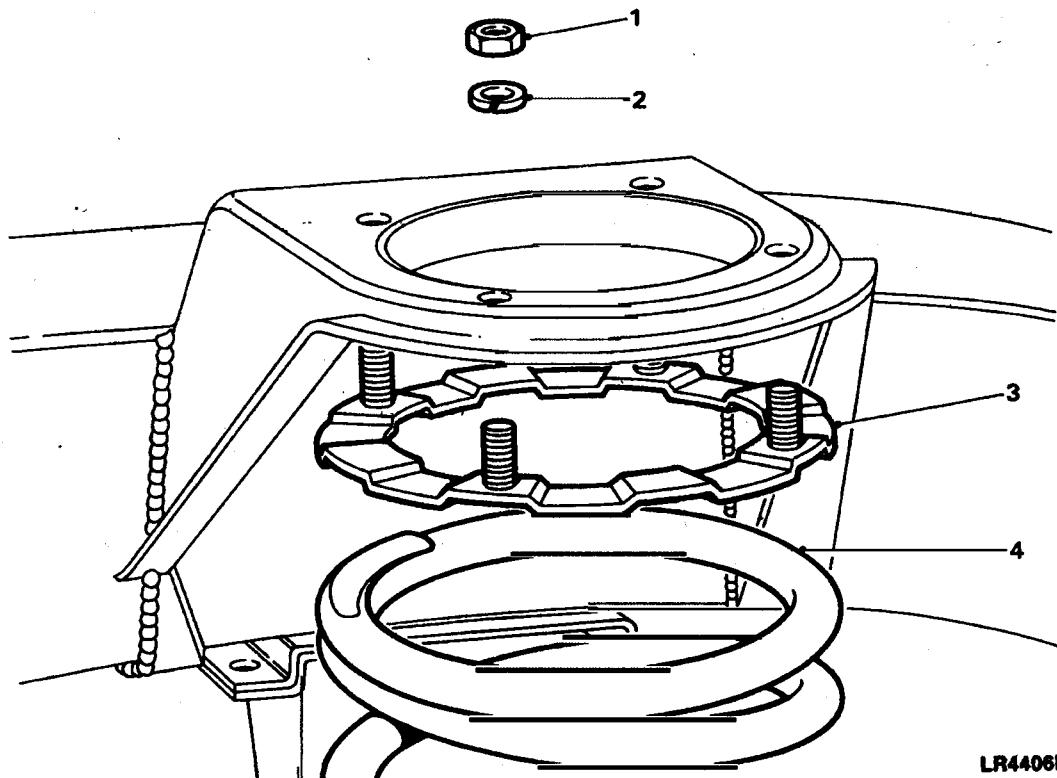
- 15.1 Fit the shock absorber retaining ring (Fig 8 (3)) and temporarily secure with one of the nuts (1).
- 15.2 Position the road spring (4) on the axle seating.

Note ...

On Land Rover 110 vehicles the close coiled end of the road spring must be fitted uppermost.

- 15.3 Raise the axle and ensure that the road spring locates correctly in the upper seating.

- 15.4 Remove the nut temporarily securing the retaining ring.
15.5 Refit the shock absorber (Para 13).



- | | | | |
|---|---------------|---|----------------|
| 1 | Nut | 3 | Retaining ring |
| 2 | Spring washer | 4 | Road spring |

Fig 8 Front road spring upper location

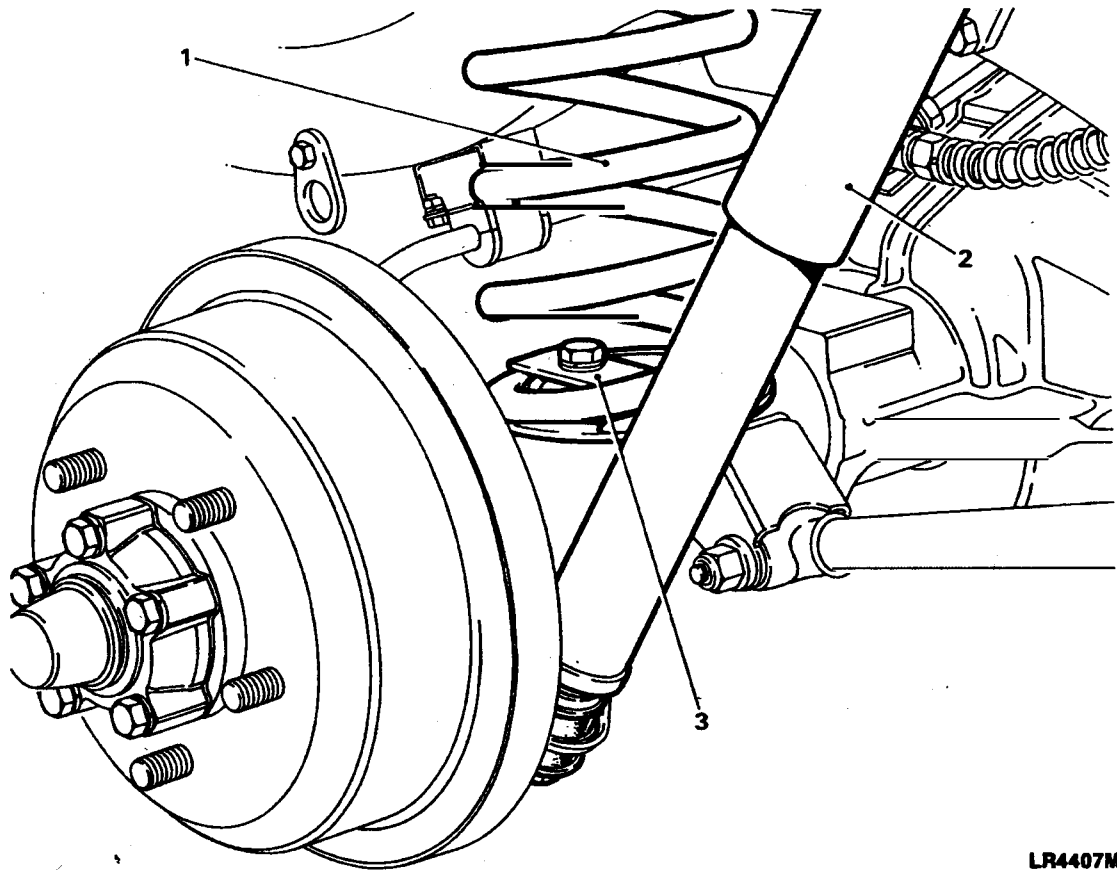
REAR SUSPENSION

Rear road springs

Removal

16 Remove the rear road springs as follows:

- 16.1 Slacken the rear road wheel nuts, raise the rear of the vehicle, lower onto axle stands and remove the road wheels.
- 16.2 Using a suitable hydraulic floor jack support the axle weight.
- 16.3 Disconnect the shock absorber (Fig 9 (2)) at the lower end.
- 16.4 Remove the road spring retaining plate (3).
- 16.5 Lower the axle sufficiently to withdraw the spring, taking care not to stretch the flexible brake hoses by lowering the axle too far.



1 Road spring 2 Shock absorber 3 Retaining plate

Fig 9 Rear road spring and shock absorber lower fixings

Refitting

17 Refit the rear road springs as follows:

Notes ...

- (1) When fitting new road springs ensure that the correct type are being fitted, refer to AESP 2320-D-122-721.
- (2) On Land Rover 90 vehicles the close coiled end of the road spring must be fitted uppermost.
 - 17.1 Fit the spring to the lower spring seat and secure with the retaining plate, raise the axle sufficiently enough to allow correct location of the spring in the upper seat.
 - 17.2 Secure the shock absorber with the rubber bushes correctly located, using a new locknut tightened to a torque of 75 Nm (55 lbf ft).
 - 17.3 Remove the hydraulic jack supporting the axle, fit the road wheels and lower the vehicle to the ground.
 - 17.4 Finally tighten the road wheel nuts to a torque of 108 Nm (80 lbf ft).

Shock absorbers

Removal

18 To remove the rear shock absorbers carry out the following:

18.1 Slacken the rear road wheel nuts, raise the rear of the vehicle, lower onto axle stands and remove the road wheels.

18.2 Using a suitable hydraulic floor jack support the axle weight.

18.3 Remove the shock absorber upper and lower retaining nuts, washers and rubber bushes.

18.4 Remove the shock absorber from the top locating shaft and withdraw it from the vehicle.

Cleaning

19 Thoroughly clean the exterior of the shock absorber to remove all road dirt.

Examination

20 Examine the shock absorber as follows:

20.1 Check the exterior for corrosion and oil leaks.

20.2 Check the operation by extending and compressing the shock absorber, resistance should be uniform throughout the length of each stroke. If resistance is erratic or weak renew the shock absorber. When checking resistance a new shock absorber may be used for comparison. To ensure that the new shock absorber is primed, fully extend and compress the unit several times before testing begins. During the tests and when priming, the damper must be kept in the upright position.

Refitting

21 Refit the shock absorbers in reverse order of removal fitting new rubber bushes and locknuts as applicable and tightening nuts to a torque of 75 Nm (55 lbf ft). Tighten the road wheel nuts to a torque of 108 Nm (80 lbf ft).

Lower link

Removal

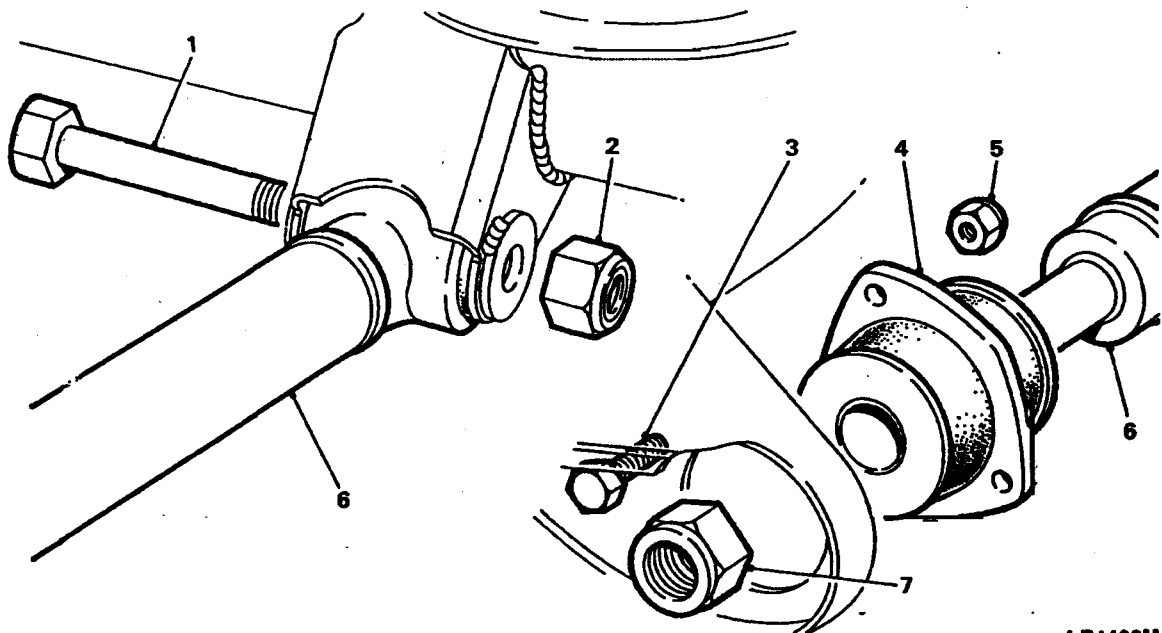
22 To remove the lower link carry out the following:

22.1 Raise the rear of the vehicle using a suitable hydraulic floor jack and support the vehicle using stands placed under the axle.

22.2 Remove the locknut (Fig 10 (2)) and bolt (1) securing the lower link (6) to the axle.

22.3 Remove the three locknuts (5) and bolts (3) securing the flexible mounting rubber (4) to the chassis mounted bracket and withdraw the lower link (6) from the vehicle.

22.4 Remove the locknut (7) and withdraw the flexible mounting rubber (4) from the lower link (6).



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- | | |
|------------------------|---------------------------|
| 1 Bolt, axle fixing | 5 Locknut, chassis fixing |
| 2 Locknut, axle fixing | 6 Lower link |
| 3 Bolt, chassis fixing | 7 Locknut |
| 4 Flexible mounting | |

Fig 10 Lower link fixings

Cleaning/examination

23 Thoroughly clean the link arm and examine for damage and distortion likely to render it unfit for further service. Examine the bush at the axle end of the link and renew as necessary. Examine the flexible mounting rubber for suitability for further service.

Repairs and replacement

24 The rubber mounted bushes at the axle end of the link arm may be renewed by carrying out the following:

24.1 Using a suitable hydraulic or bench press and a length of metal tubing, slightly smaller in diameter than the outside of the bush, press out the rubber mounted bushes. Ensure that the tubing locates on the outer edge of the bush and not on the rubber inner.

24.2 Fit a new bush centrally to the location in the lower link ensuring that pressure is applied to the outer edge of the bush only.

Refitting

25 Refit the lower link as follows:

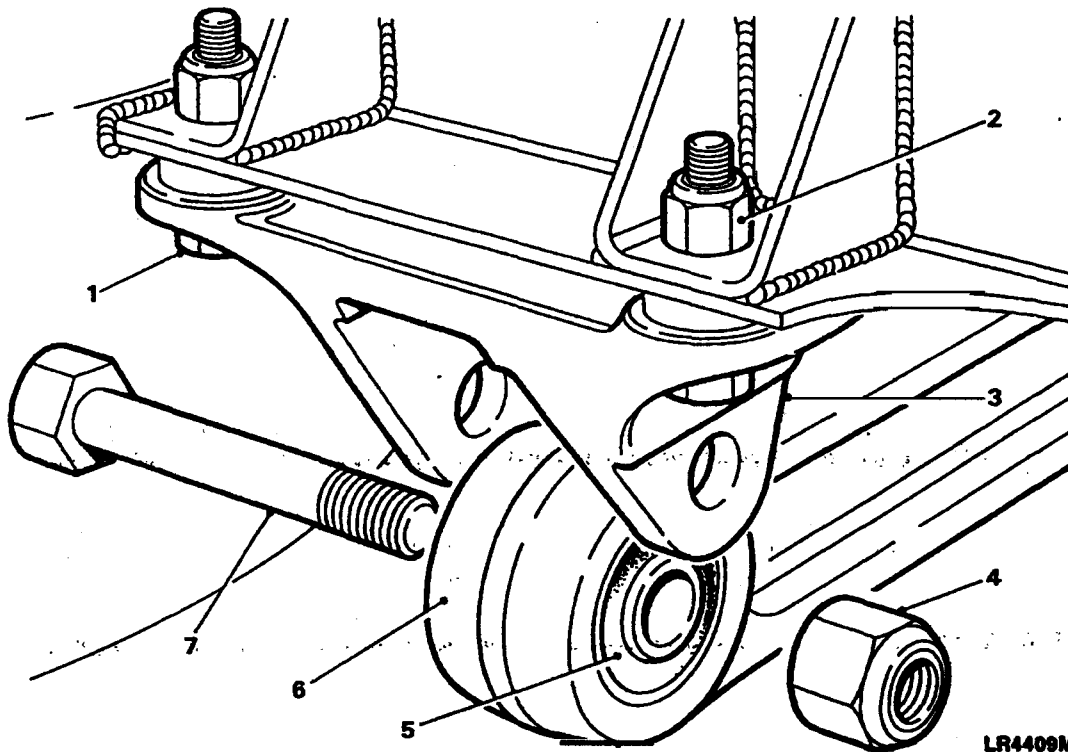
25.1 Fit the flexible mounting (Fig 10 (4)) to the lower link (6), retain with a new locknut (7), do not fully tighten the nut at this stage.

25.2 Locate the flexible mounting (4) in the chassis mounted bracket and secure with the bolts (3) and locknuts (5).

25.3 Locate the bushed end of the lower link (6) in the bracket on the axle and secure with the bolt (1) and a new locknut (2). Tighten the locknut (2) to a torque of 64 Nm (47 lbf ft).

25.4 Lower the vehicle, remove the jack and allow the axle to take up its static laden position.

25.5 Tighten the locknut (7), at the flexible mounting, to a torque of 176 Nm (130 lbf ft).



- | | | | |
|---|------------------|---|------------|
| 1 | Bolt | 5 | Bush |
| 2 | Locknut | 6 | Upper link |
| 3 | Mounting bracket | 7 | Bolt |
| 4 | Locknut | | |

Fig 11 Upper link mounting bracket.

Upper links, pivot bracket and ball joint

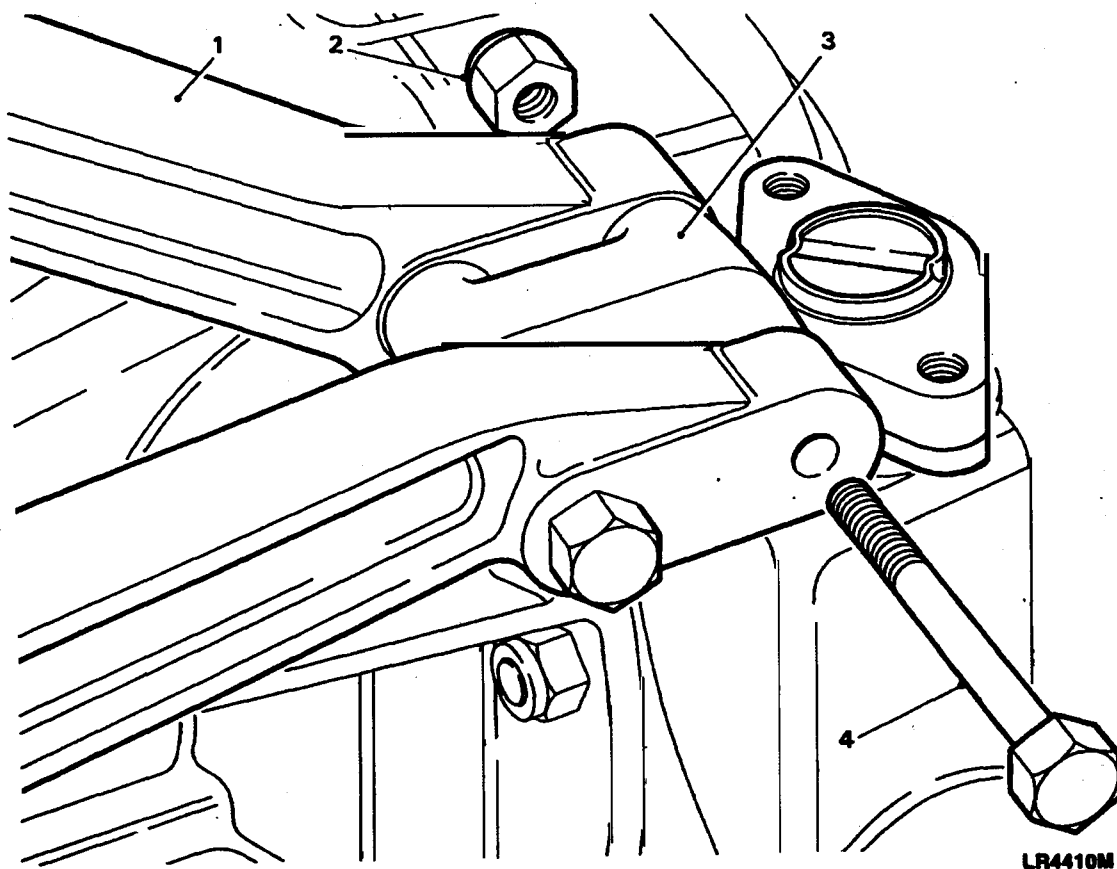
Removal

26 To remove the upper links, pivot bracket and ball joint carry out the following:

26.1 Raise the rear of the vehicle using a suitable hydraulic floor jack. Support the rear of the chassis on stands allowing the axle to be freely suspended.

26.2 Remove the locknuts (Fig 11 (2)) and bolts (1) securing the upper link mounting brackets (3) to the chassis.

26.3 Remove the two locknuts (Fig 12 (4)) and bolts (2) securing the upper links (1) to the pivot bracket (3) and withdraw the upper links complete with the chassis mounting brackets.



1 Upper link
2 Bolt

3 Pivot bracket
4 Locknut

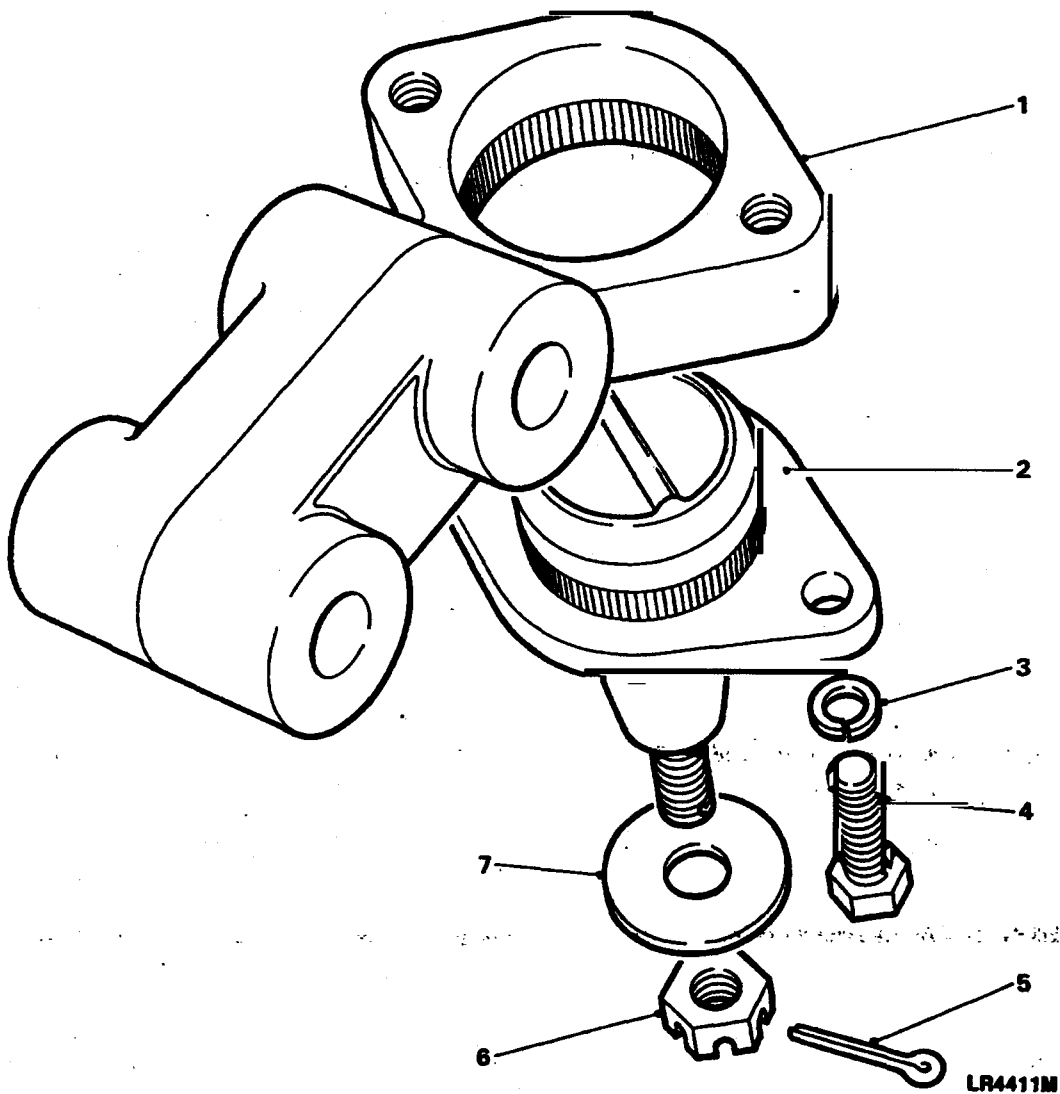
Fig 12 Upper link to pivot bracket

26.4 Remove the locknut (Fig. 11 (4)) and bolt (7) securing the upper links (6) to the brackets (3) and withdraw the brackets from the upper links.

26.5 Remove the split pin (Fig (5)) and the castle nut (6) and washer (7) securing the ball joint (2) at the axle bracket.

26.6 Using a suitable fork type ball joint extractor remove the ball pin from the axle bracket.

26.7 Withdraw the pivot bracket complete with ball joint.



1 Pivot bracket
2 Ball joint
3 Spring washer
4 Screw

5 Split pin
6 Castle nut
7 Plain washer

Fig 13 Pivot bracket and ball joint

Note ...

The ball joint is supplied, pre-packed with grease, as a complete assembly, therefore it must not be dismantled.

26.8 If the ball joint is satisfactory for continued service no further dismantling is necessary. If the ball joint assembly requires replacing remove the two screws (4) and spring washers (3) and withdraw it from the pivot bracket (1).

Cleaning/examination

27 Thoroughly clean the upper links and brackets, examine for damage and distortion likely to render them unfit for further service. Examine the bushes at the chassis end of the links and the pivot bracket ball joint, renew as necessary.

Repairs and replacement

28 The rubber mounted bushes at the mounting bracket end of the link arms may be renewed by carrying out the following:

28.1 Using a suitable hydraulic or bench press and a length of metal tubing, slightly smaller in diameter than the outside of the bush, press out the rubber mounted bushes. Ensure that the tubing locates on the outer edge of the bush and not on the rubber inner.

28.2 Fit a new bush centrally to the location in the upper link ensuring that pressure is applied to the outer edge of the bush only.

Refitting

29 Refit the upper links, pivot bracket and ball joint as follows:

29.1 If a new ball joint is being fitted press the ball joint (2) into the pivot bracket (1), ensuring that the flanges align, secure with the two screws (4) and spring washers (3).

29.2 Fit the assembled pivot bracket and ball joint to the rear axle, secure with the large plain washer (7) and castle nut (6), tighten the nut to a torque of 176 Nm (130 lbf ft) and lock with a new split pin.

29.3 Fit the mounting brackets to the link arms, ensuring that they are fitted to the locations from which they were removed. Secure the bolts with new locknuts but do not fully tighten at this stage.

29.4 Fit the link arms to the pivot bracket, secure with the bolts and new locknuts but do not fully tighten at this stage.

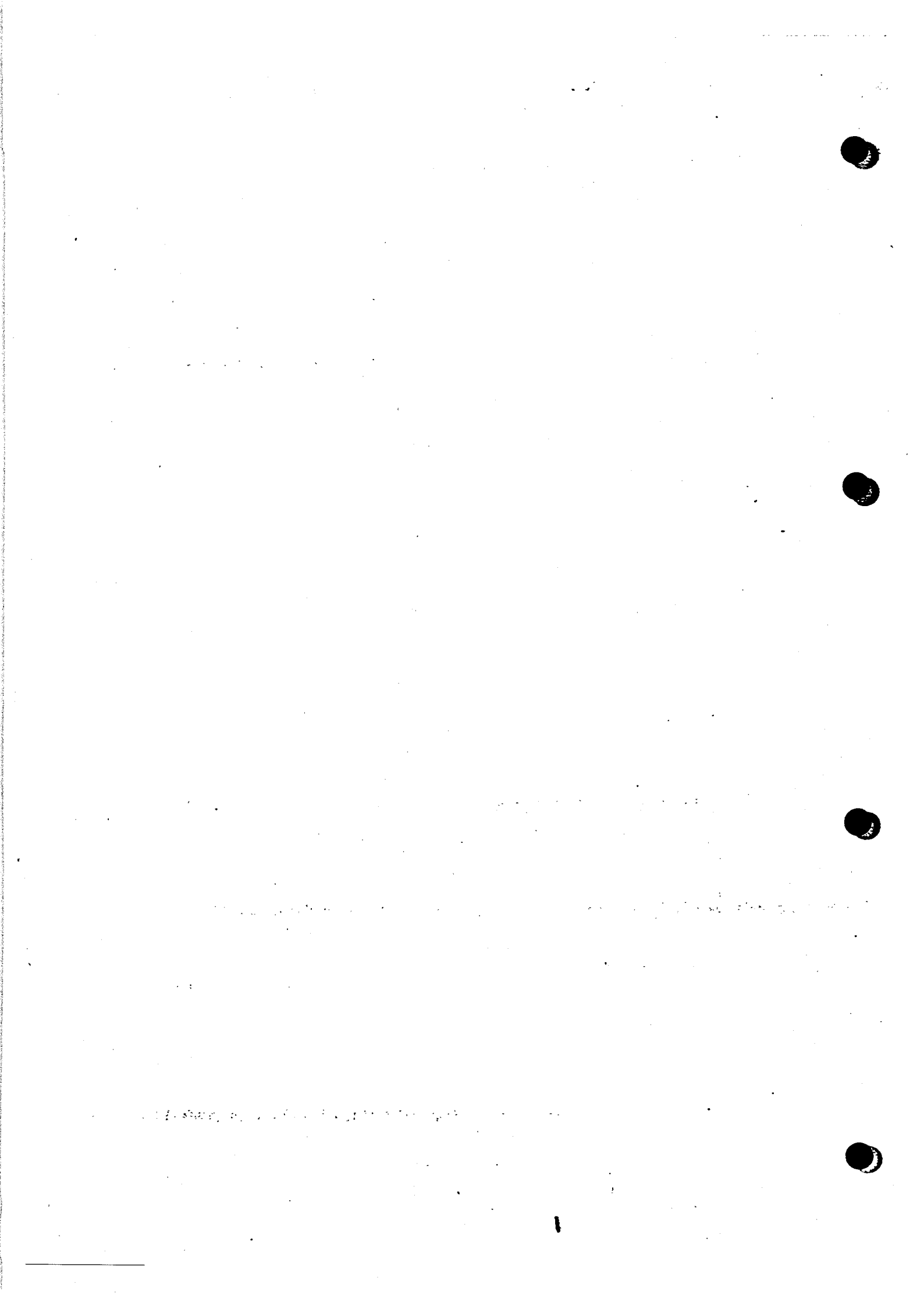
29.5 Fit the mounting brackets to the chassis cross member, secure with bolts, fitted from the bracket side, and new locknuts.

29.6 Evenly tighten all locknuts to the following torque figures:

29.6.1 Mounting bracket to chassis nuts 47 Nm (35 lbf ft).

29.6.2 Upper link arms to mounting bracket nuts 176 Nm (130 lbf ft).

29.6.3 Upper link arms to pivot bracket nuts 115 Nm (85 lbf ft).



Chapter 8-2

SUSPENSION 127 VEHICLES (HEAVY DUTY)

CONTENTS

| Frame | Para | | Page |
|-------|------|----------------------------|------|
| | 1 | Introduction | |
| | 2 | General | |
| | | Removal | |
| | 4 | Coil springs | |
| | 5 | Anti-roll bar | |
| | | Reassembly | |
| | 6 | Coil springs | |
| | 7 | Anti-roll bar | |
| | Fig | | |
| | 1 | Rear heavy duty suspension | 2 |

INTRODUCTION

1 This Chapter details the Unit and Field repairs for the heavy duty suspension fitted to Land Rover 127 vehicles.

GENERAL

2 The front heavy duty suspension is identical to that detailed in Cat 522 Chap 8-1 with the exception that the front coil springs are similar units to those fitted in the Land Rover 110 rear suspension. Refer to Cat 522 Chap 8-1 for overhaul procedures.

3 The rear heavy duty suspension assembly is identical to that detailed in Cat 522 Chap 8-1 with the addition of helper springs fitted inside the existing coil springs and an anti-roll bar.

REMOVAL

Coil springs

4 For removal of rear coil springs refer to Cat 522 Chap 8-1.

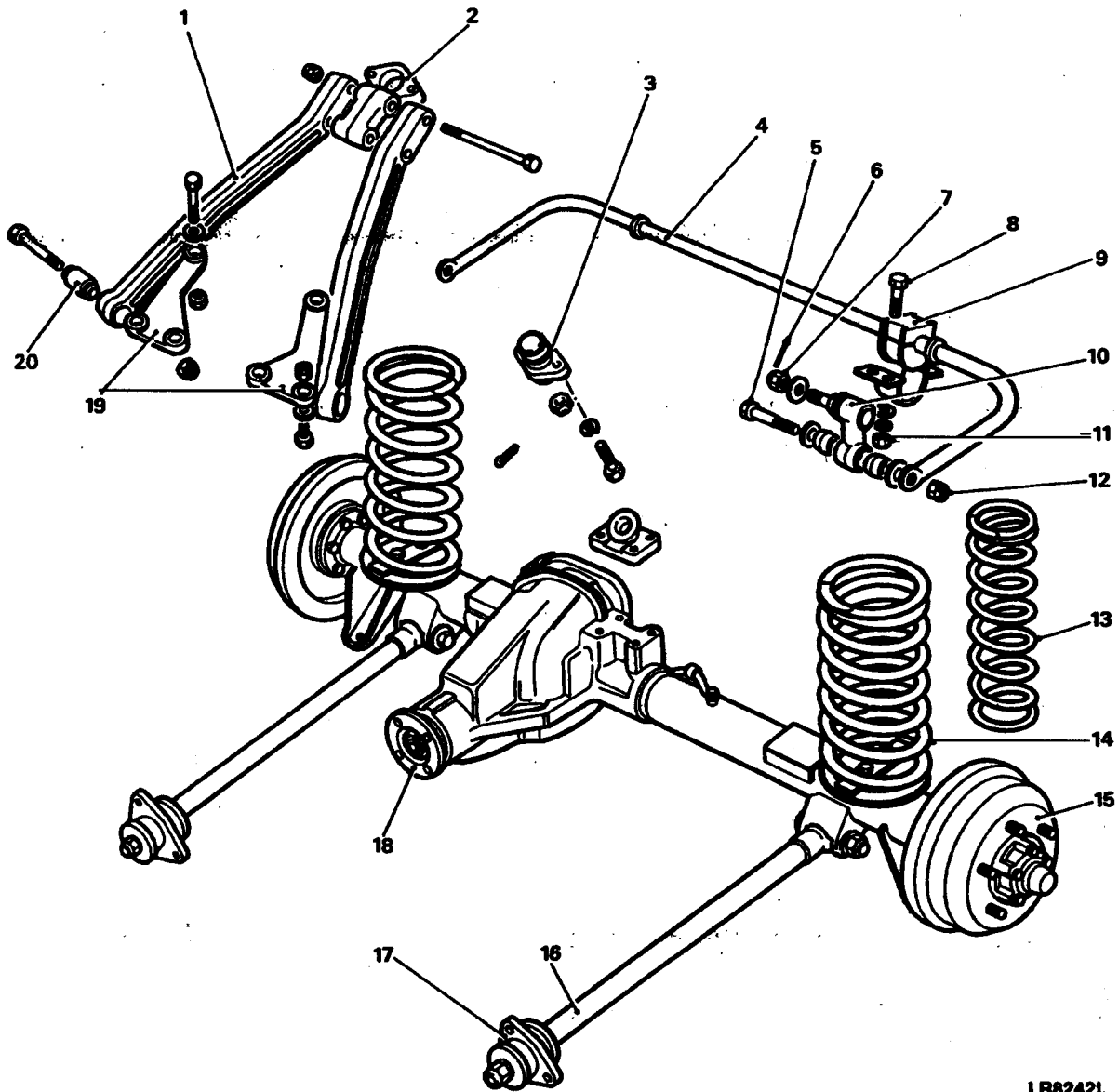
Note ...

The helper springs (Fig 1 (13)) are removed during the rear coil spring removal process.

Anti-roll bar

5 For removal of the anti-roll bar proceed as follows:

5.1 Remove the two nuts (Fig 1 (12)) and bolts (5) securing the anti-roll bar (4) to the axle link (10).



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- | | | | |
|----|--------------------|----|----------------------|
| 1 | Top link | 11 | Nut |
| 2 | Ball joint bracket | 12 | Nut |
| 3 | Ball joint | 13 | Helper coil spring |
| 4 | Anti-roll bar | 14 | Main coil spring |
| 5 | Bolt | 15 | Axle assembly |
| 6 | Split pin | 16 | Lower link |
| 7 | Castle nut | 17 | Lower link mountings |
| 8 | Bolt | 18 | Differential housing |
| 9 | Rubber | 19 | Top link mountings |
| 10 | Link assembly | 20 | Top link bushes |

Fig 1 Rear heavy duty suspension

5.2 Remove the eight nuts (11) and bolts (8), (four each side) retaining the anti-roll bar to the chassis and remove the bar from vehicle.

5.3 Remove the split pin (6) and castle nut (7) and remove the ball joint and link (10) from the axle location.

Reassembly

Coil springs

6 For reassembly of rear coil springs refer to Cat 522 Chap 8-1.

Note ...

The helper springs (Fig 1 (13)) are reassembled during the rear coil spring assembly process.

Anti-roll bar

7 To reassemble the anti-roll bar proceed as follows:

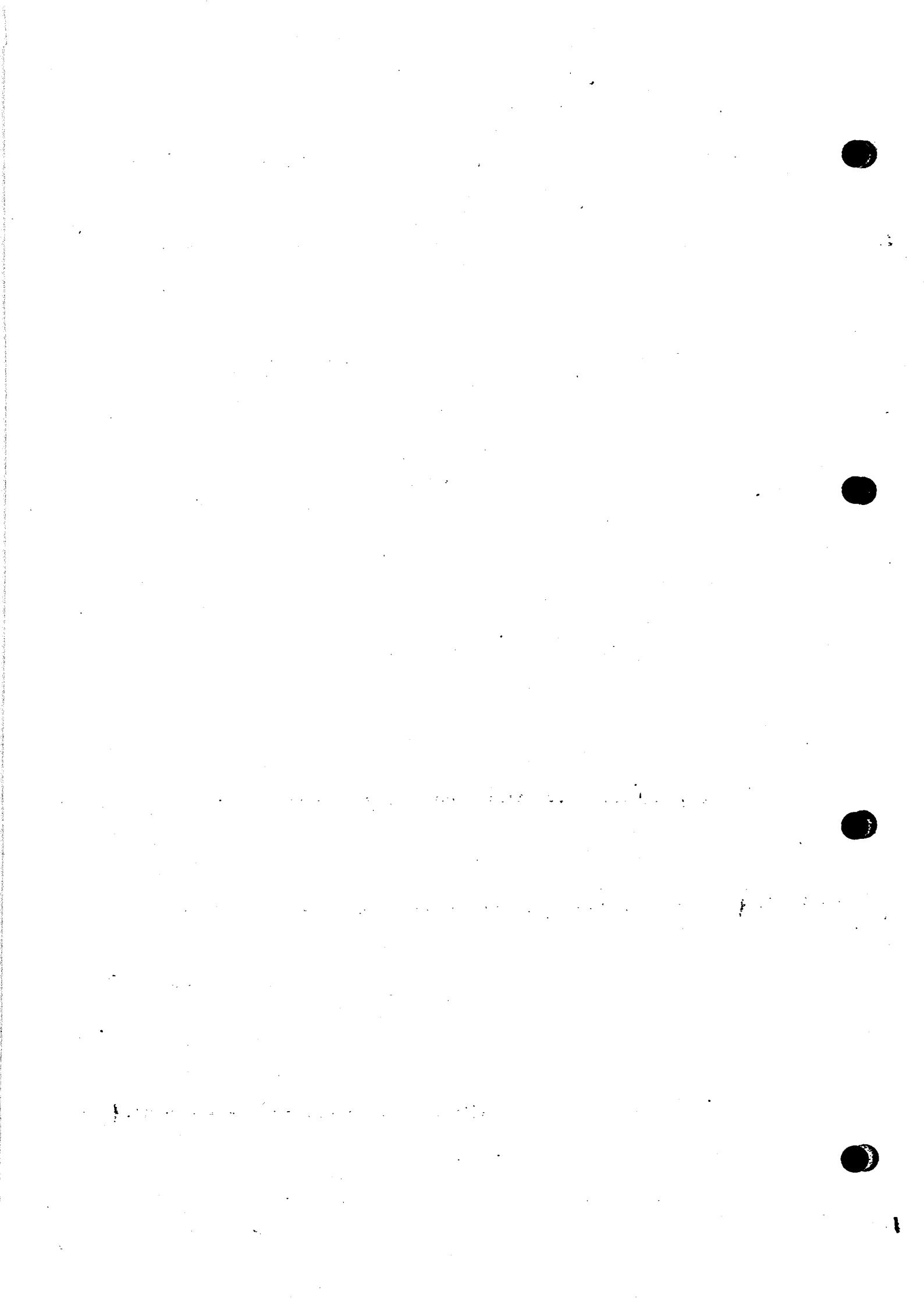
Note ...

If the ball joint requires replacement the complete link must be renewed.

7.1 Renew the rubbers (Fig 1 (9)) and fit the anti-roll bar (4) to the chassis and secure with the eight bolts (8) and nuts (11) tightening to 24 Nm (18 lbf ft).

7.2 Fit the ball joint and link (10) to the axle location and tighten the castle nut (7) to 176 Nm (130 lbf ft) and fit a new split pin (6).

7.3 Fit the anti-roll bar to the ball joint link and fit new bushes in the sequence illustrated (Fig 1) and tighten the nuts and bolts, to the correct torque.



Chapter 9

WHEELS AND TYRES

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| | 1 General |
| | 2 Tyre pressures |
| | 4 Tyre treads |
| | 5 Tyre wear |
| | 6 Tyre and inner tube repair |
| | 8 Tyre changing |
| | 9 Wheel balancing (WARNING) Wheels (WARNING) |
| | 11 Removal |
| | 12 Refitting |

GENERAL

- 1 The most important factors, among many which have an adverse effect on tyre life are:
 - 1.1 Incorrect tyre pressures.
 - 1.2 High average speeds.
 - 1.3 Harsh acceleration.
 - 1.4 Frequent hard braking.
 - 1.5 Warm, dry climatic conditions.
 - 1.6 Poor road surfaces.
 - 1.7 Impact fractures caused by striking a kerb or brick, etc.
 - 1.8 Incorrect wheel alignment.

TYRE PRESSURES

- 2 To ensure maximum tyre life and performance are obtained careful attention must be given to ensure that correct tyre pressures are maintained. Emergency soft pressures should only be used in extreme conditions where extra flotation is required. Maximum speed should be restricted to 25 mph (40 kph). Return the pressures to normal immediately firm ground is gained.
- 3 Pressures should be checked and adjusted in accordance with the Maintenance Schedule (AESP 2320-D-122-601), paying particular attention to the following points:
 - 3.1 Whenever possible the tyres should be checked cold, as the pressure is approximately 2 lb (0,10 kg) higher at running temperature.
 - 3.2 Valve caps should always be fitted as they form a positive seal on the valves.
 - 3.3 Any unusual pressure loss (in excess of 1 to 3 lb (0,05 to 0,20 kg)) should be investigated and corrected.
 - 3.4 The spare wheel should always be checked, so that it is ready for use at any time.

3.5 When carrying out the tyre pressure checks, also inspect the tyres for cuts abrasions, bulges and for objects embedded in the tread. More frequent inspections are recommended when the vehicle is regularly used in off road conditions. Clean off any oil or grease using petrol sparingly.

TYRE TREADS

4 The tread form of the tyres makes them uni-directional. They must be fitted with the "V" or arrow in the tread pattern pointing forwards when viewed from the top of the wheel, to ensure maximum grip and efficient tread cleaning when operating on soft ground. For this reason it may be necessary to reverse the spare tyre on its wheel (depending on which side of the vehicle it is to be fitted) when putting it into service.

TYRE WEAR

5 Tyres should not be interchanged, e.g. from front to rear, in an attempt to prolong tyre life. Tyre wear produces characteristic patterns depending on their position, if such position is changed after wear has occurred, the performance of the tyre will be adversely affected.

TYRE AND INNER TUBE REPAIR

6 Minor tyre damage, such as from nails, require no attention other than removal of the object, but more severe tread damage will require cold chemical cure repair. Tyres having damaged walls should be replaced. Butyl synthetic inner tube repairs must be vulcanised, the use of cold patches on Butyl tubes is not satisfactory.

6.1 Inner tubes are to be fitted irrespective of whether the tyre is tubed or tubeless. This is to ensure inflation integrity of the cold riveted wheels.

7 Do not attempt to repair a tyre that has sustained damage such as bulges or blisters, ply separation, and broken or cracked beads.

TYRE CHANGING

8 Tyres should only be changed using approved tyre changing equipment to mount or demount the tyres, following the equipment manufacturers instructions.

WHEEL BALANCING

WARNING ...

IT IS ESSENTIAL THAT ALL WHEEL BALANCING IS CARRIED OUT WITH THE WHEELS REMOVED FROM THE VEHICLE. THE USE OF ON THE VEHICLE BALANCING EQUIPMENT COULD CAUSE COMPONENT DAMAGE OR PERSONAL INJURY AND MUST NOT BE ATTEMPTED.

9 Before carrying out wheel balancing clean all mud and dirt deposits from both outside and inside the rims and remove the existing balance weights. Remove stones and chippings from the tyre treads.

10 Inspect the tyres for damage and correct tyre pressures, balance using dynamic balancing equipment, following the equipment manufacturers instructions.

WHEELS

WARNING ...

THE HAND BRAKE ACTS ON THE TRANSMISSION, NOT THE REAR WHEELS, AND MAY NOT HOLD THE VEHICLE WHEN JACKING. IT IS ESSENTIAL WHEN JACKING TO CHOCK THE REMAINING ROAD WHEELS TO PREVENT THE VEHICLE FROM ROLLING.

Removal

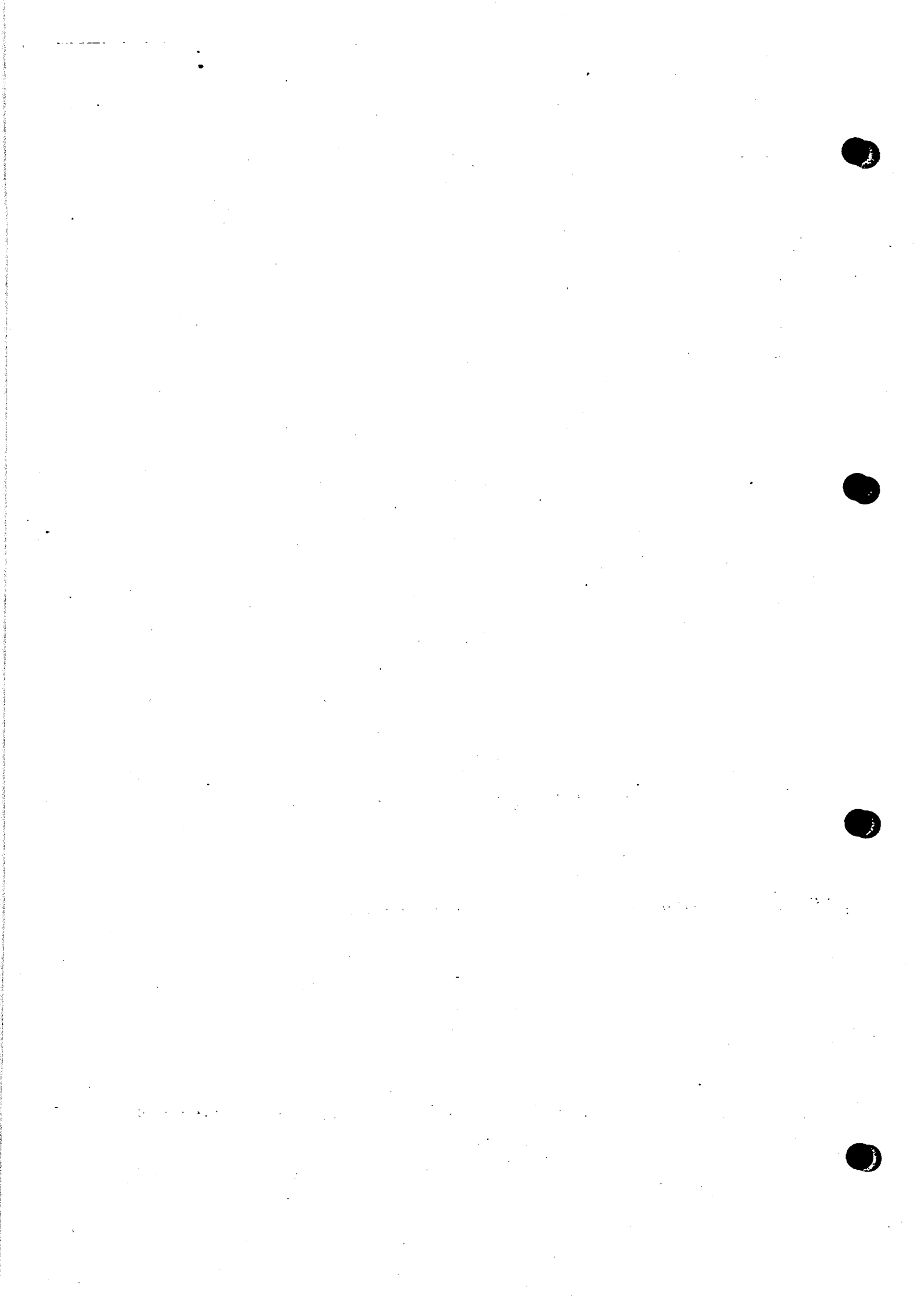
11 To remove the road wheels carry out the following:

- 11.1 With the ignition switched on engage the differential lock, check that the warning light is illuminated.
- 11.2 Select low gear in the transfer box and any gear in the main gearbox.
- 11.3 Chock the road wheels not being removed.
- 11.4 Slacken the wheel nuts on the wheel to be removed.
- 11.5 Using a suitable floor jack raise the vehicle and support with an axle stand.
- 11.6 Remove the wheel nuts and carefully withdraw the wheel over the studs.

Refitting

12 To refit the road wheels carry out the following:

- 12.1 Ensure that the retaining nuts and studs are clean and free from damage.
- 12.2 Lightly coat the wheel mounting spigot face with a suitable anti-seize compound to minimise the possibility of adhesion between the wheel and spigot face.
- 12.3 Apply a drop of lubricating oil to the wheel studs.
- 12.4 Refit the wheel taking care not to damage the stud threads.
- 12.5 Fit the wheel nuts by hand to ensure that they are not cross threaded.
- 12.6 Using a suitable spanner tighten the nuts until the wheel is secure without over-tightening the nuts.
- 12.7 Lower the vehicle and finally tighten the road wheel nuts to a torque of 108 Nm (80 lbf ft).



CHAPTER 10
(Completely revised Incorporating amendment 1 to 5 inclusive)

BRAKING SYSTEMS

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| 6 | Reassembly |
| 7 | Refitting |
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| | Land Rover 90 models |
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| 9 | Examination |
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| 10 | Dismantling |
| 11 | Reassembly |
| 12 | Rear brake reassembly |
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| 20 | Reassembly |
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| 27 | Refitting |
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| 29 | Filter renewal |
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| | Brake pedal box |
| 31 | Removal |
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(continued)

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| 22 | Adjuster assembly | 29 |

INTRODUCTION

1 This chapter covers the Unit and Field repairs for braking systems fitted to Land Rover 90 and 110 vehicles.

FRONT BRAKE CALLIPER

TABLE 1 SPECIAL TOOLS

| Ser No | Manufacturer's Part No | NSN/Part No where applicable | Designation |
|--------|------------------------|------------------------------|------------------------------|
| (1) | (2) | (3) | (4) |
| 1 | 18G 672 | 6NT2/5120-99-737-34-6 | Disc brake piston compressor |

Removal

NOTE

The following procedure is applicable to Land Rover 90 and 110 vehicles. A 110 calliper is illustrated and varies mainly in size and external pipe connection from the 90 version.

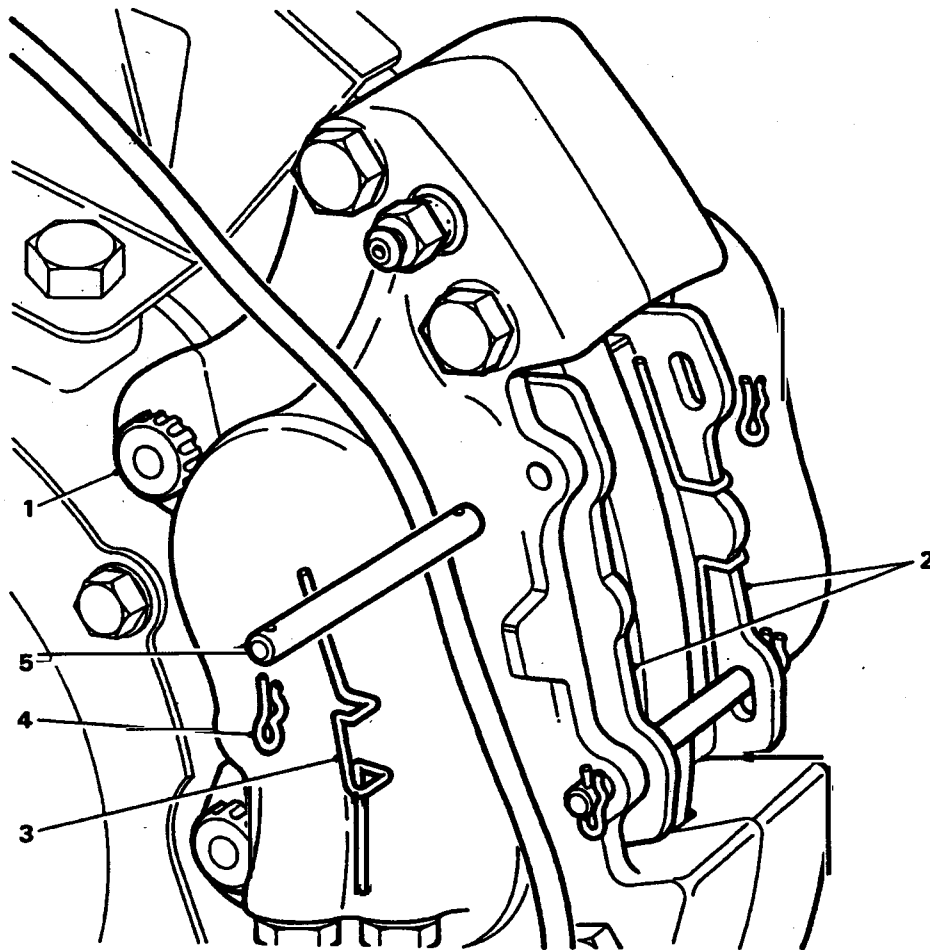
2 To remove the calliper, proceed as follows:

2.1 Slacken the front wheel nuts, jack up the vehicle, lower onto suitable axle stands and remove road wheels.

2.2 Expose the brake flexible hose by pulling back the coiled protective covering and clamp the hose. Disconnect the hose from the calliper.

2.3 Remove the spring clips (Fig 1 (4)), withdraw the retaining pins (5) and the anti-rattle springs (3). Ease out the brake pads (2), if the same pads are to be refitted, identify them to the location from which they were removed.

2.4 Remove the two withdrawing bolts (1) and withdraw the calliper from the vehicle.



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- | | | | |
|---|------------------------|---|----------------|
| 1 | Calliper securing bolt | 4 | Spring clip |
| 2 | Brake pads | 5 | Retaining pins |
| 3 | Anti-rattle spring | | |

Fig 1 Brake pad removal

Dismantling

3 To dismantle the callipers carry out the following:

3.1 Before commencing dismantling thoroughly clean the outer surfaces of the assembly with methylated spirit.

3.2 Using special tool (Table 1, Serial No 1), clamp the pistons in the mounting half of the calliper (Fig 2) and gently, keeping fingers clear, and with CAUTION, apply air pressure to the fluid inlet port to expel the outer pistons. Since it is unlikely that both pistons will expel at the same rate, regulate the rate with a suitable piece of timber between the appropriate piston and calliper.

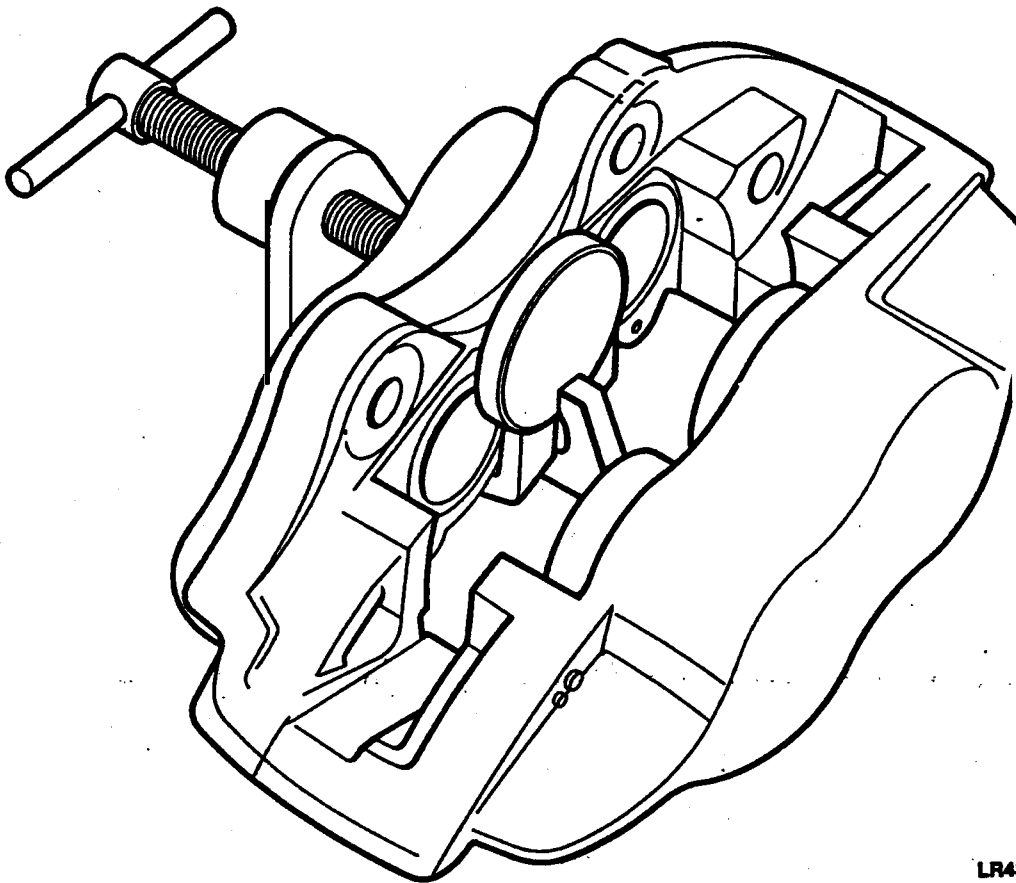


Fig 2 Clamping pistons

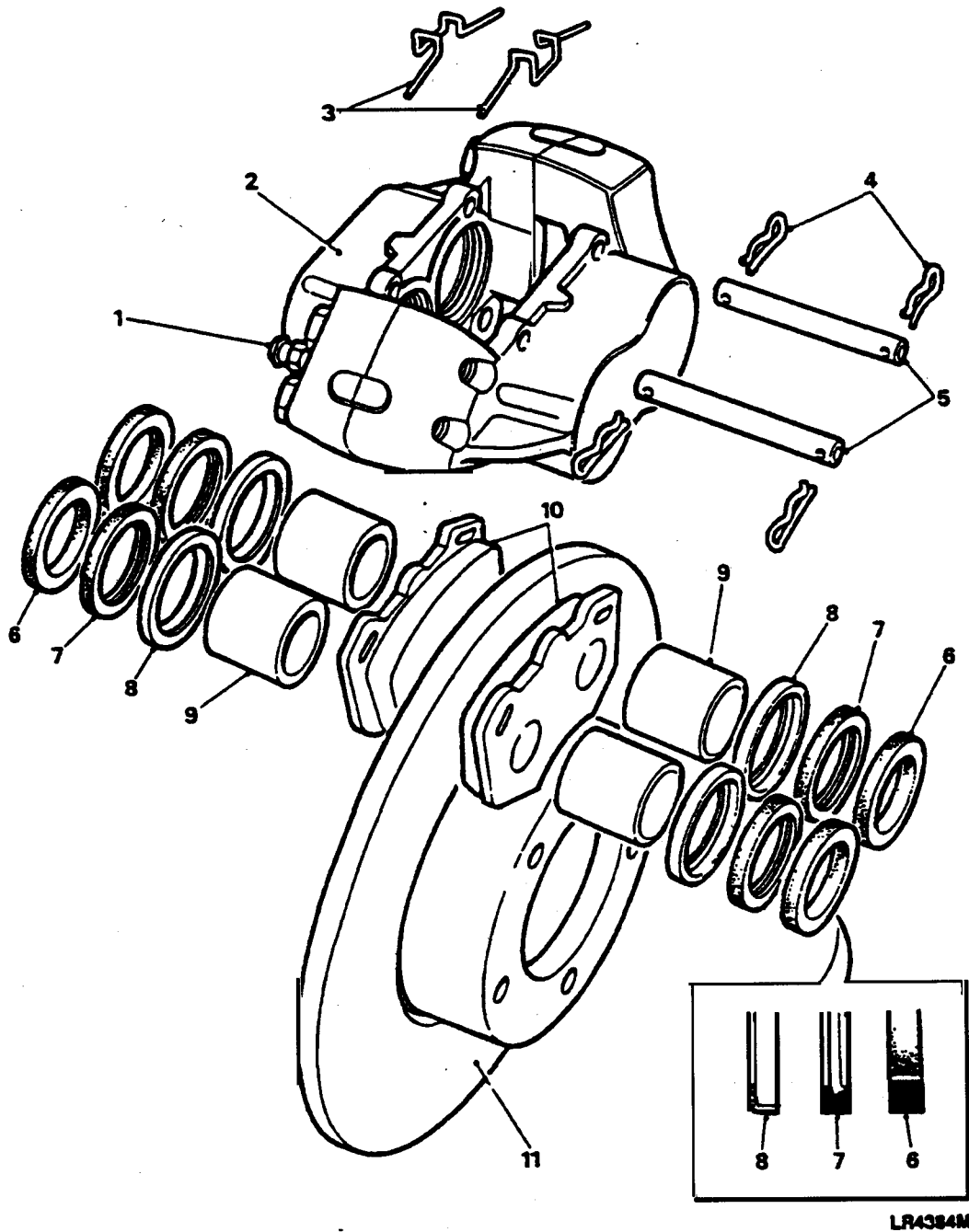
3.3 Remove the pistons (Fig 3 (9)) keeping them identified with their respective bores.

3.4 Remove the clamp and repeat the procedure to remove the opposing pistons.

3.5 Remove the wiper seal retainers (8) by inserting a blunt screwdriver between the retainer and the seal, prise the retainer carefully from the mouth of the bore.

3.6 Taking care not to damage the seal grooves, extract the wiper seals (7) and the fluid seals (6).

3.7 Do not separate the calliper halves.



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- | | | | |
|---|---------------------|----|---------------------|
| 1 | Bleed screw | 7 | Wiper seal |
| 2 | Calliper body | 8 | Wiper seal retainer |
| 3 | Anti-rattle springs | 9 | Pistons |
| 4 | Spring clips | 10 | Brake pads |
| 5 | Retaining pins | 11 | Brake disc |
| 6 | Fluid seal | | |

Fig 3 Front brake calliper

Cleaning

4 Thoroughly clean the bores, pistons and seal grooves with clean brake fluid or methylated spirit only.

Examination

5 Examine the components thoroughly, if the calliper bores or pistons are corroded or if their condition is not perfect a new calliper must be fitted.

Reassembly

6 Fitting the outer pistons first, reassemble the calliper as follows:

6.1 Coat a new fluid seal (Fig 3 (6)) with Lockheed disc brake lubricant. Ease the seal into the bore using only the fingers and ensure that it is properly seated. The fluid seal and the groove are not the same in section, when the seal is seated it feels proud to touch at the edge furthest away from the mouth of the bore.

6.2 Smear the appropriate piston (9) with disc lubricant and insert it squarely into the bore by hand only. Do not tilt the piston during insertion and leave approximately 8 mm (0.315 in) protruding from the bore.

6.3 Coat a new wiper seal (7) with disc brake lubricant and fit it to a new seal retainer (8). Slide the assembly, seal first, over the protruding piston and into the bore recess. Using the piston clamp special tool (Table 1 serial No 1) press home the seal retainer and piston.

6.4 Fit the second piston to the outer side, clamp the pistons and repeat the foregoing to fit the pistons to the inner bores.

Refitting

7 Refit the callipers and pads to the vehicle as follows:

7.1 Fit the calliper to the axle and secure with the two bolts tightening the bolts evenly to a torque of 90 to 110 Nm.

7.2 Connect the brake pipe to the calliper, tighten to a torque of 14 to 16 Nm and remove the hose clamp.

7.3 Lightly smear the back and edges of the pads with disc brake lubricant carefully avoiding the friction material. Fit the pads and secure using new pins, retaining clips and anti-rattle springs.

7.4 Bleed the secondary brake circuit (Para 22).

7.5 When the foregoing instructions have been completed on both callipers, depress the brake pedal firmly several times to locate the friction pads.

7.6 Fit the road wheels, remove the axle stands and finally tighten the wheel nuts to a torque of 108 Nm (80 lbf ft).

7.7 Check the fluid level in the reservoir and top up as necessary.

7.8 Road test the vehicle, remembering that if new friction pads have been fitted they are not bedded in and may take several hundred miles before the brakes are at maximum efficiency.

REAR BRAKE DRUMS

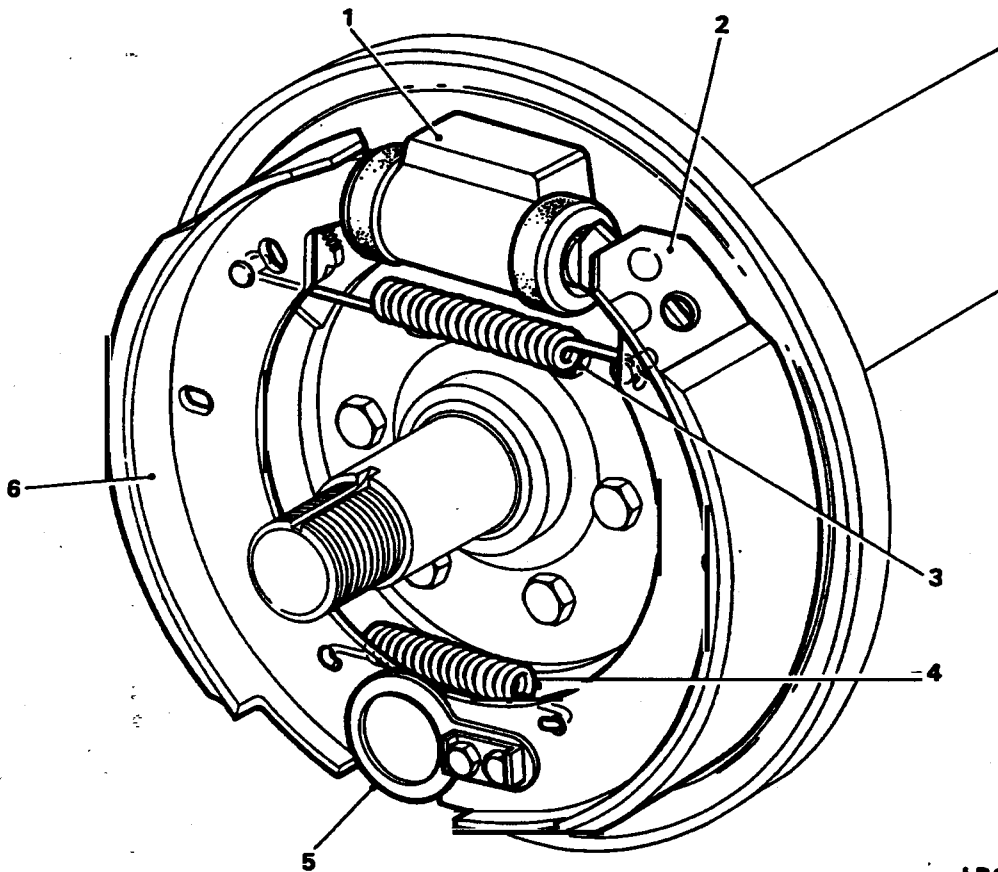
LAND ROVER 90 MODELS

Dismantling

8 To dismantle the rear brakes

WARNING

INHALATION, SERIOUS HEALTH RISK. DO NOT USE AN AIR LINE TO BLOW DUST FROM THE BRAKE ASSEMBLIES, ASBESTOS DUST FROM BRAKE LININGS CAN BE A SERIOUS HEALTH RISK IF INHALED.



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- | | | | |
|---|-----------------------|---|----------------------------|
| 1 | Wheel cylinder | 4 | Lower pull-off spring |
| 2 | Trailing brake shoe | 5 | Trailing shoe anchor plate |
| 3 | Upper pull-off spring | 6 | Leading brake shoe |

Fig 4 Land Rover 90 rear brake l.h. side

- 8.1 Slacken the road wheel nuts, jack-up the vehicle, lower onto axle stands and remove the road wheels.
- 8.2 Slacken the brake shoe adjuster on the rear of the back-plate to assist removal of the brake drum.
- 8.3 Remove the single retaining screw and withdraw the brake drum.
- 8.4 Remove the trailing shoe anchor plate (Fig 4 (5)).
- 8.5 Note the position of the pull-off springs (3) and (4) then lever off the brake shoes and remove the springs.
- 8.6 Clamp the flexible brake hose, disconnect the brake fluid pipe (Fig 5 (5)) at the wheel cylinder and blank-off the pipe end to prevent the ingress of dirt.
- 8.7 Remove the two retaining nuts (6), spring washers (7) and withdraw the wheel cylinder from the back-plate.

Examination

- 9 Examine the components of the rear brake as follows:
 - 9.1 Examine the brake drum for internal scoring and ovality. If required, the interior of the drum can be machined to a maximum diameter of 255.52 mm (10.060 in.).
 - 9.2 Check the operation of the adjuster on the back-plate by turning it.
 - 9.3 Check that the pull-off springs are satisfactory for continued use. If new brake shoes are being fitted the pull-off springs should also be renewed.
 - 9.4 Check that the brake shoes have sufficient lining material for continued use and that they are free from contamination with grease or oil.

Wheel cylinder

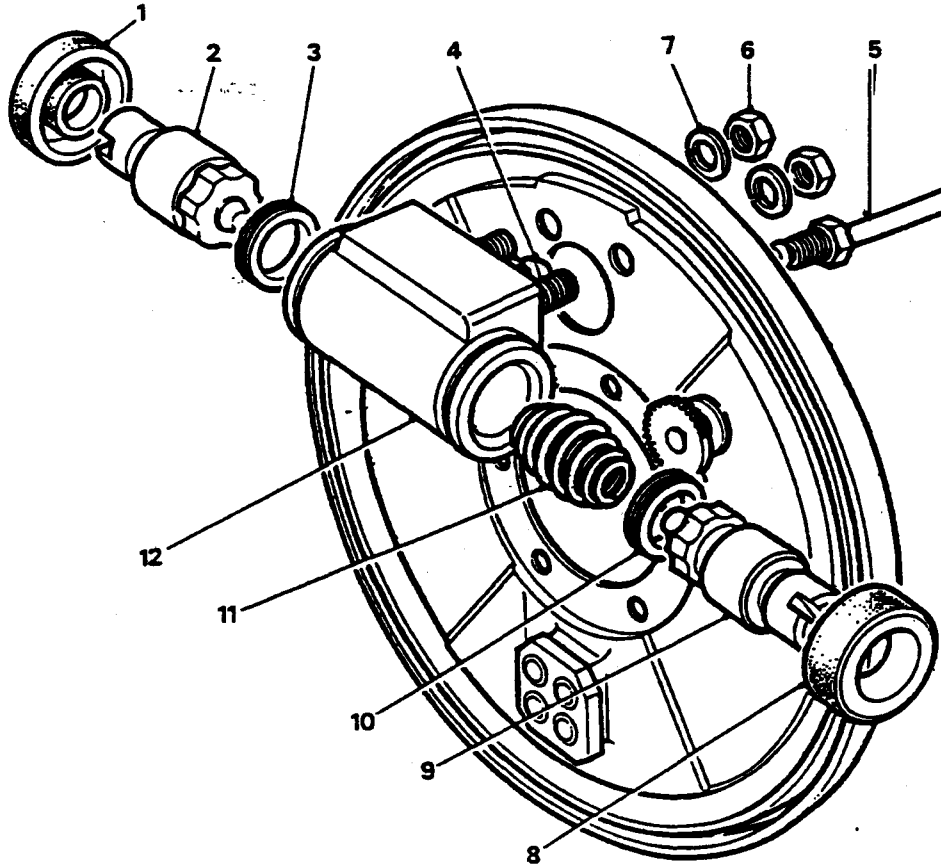
NOTE

The wheel cylinder depicted in Fig 5 is of the type fitted to Land Rover 90 rear brakes. Although larger and pictorially slightly different, the overhaul procedure for the wheel cylinder fitted to the Land Rover 110 rear brakes is the same.

Dismantling

- 10 Dismantle the wheel cylinder as follows:
 - 10.1 Remove the dust covers (Fig 5 (1) and (8)).
 - 10.2 Withdraw the pistons (2) and (9), keeping the pistons identified with the side of the bore from which they were removed, detach and discard the seals (3) and (10).
 - 10.3 Remove the spring (11).
 - 10.4 Remove the bleed screw (4).
 - 10.5 Clean the components with Girling cleaning fluid and allow to dry.

10.6 Examine the cylinder and pistons for signs of corrosion or wear, if evident a new assembly must be fitted.



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- | | | | |
|---|------------------|----|---------------|
| 1 | Dust cover | 7 | Spring washer |
| 2 | Piston | 8 | Dust cover |
| 3 | Seal | 9 | Piston |
| 4 | Bleed screw | 10 | Seal |
| 5 | Brake fluid pipe | 11 | Spring |
| 6 | Nut | 12 | Cylinder body |

Fig 5 Wheel cylinder

Reassembly

11 Reassemble the wheel cylinder as follows:

11.1 Fit new seals to the pistons with the lip of the seal towards the cylinder.

11.2 Lubricate the pistons with new brake fluid. Fit one of the pistons to the cylinder bore, insert the spring, ensuring correct location with the piston then fit the second piston.

11.3 Fit new dust covers and secure the assembly together with a rubber band until the brake shoes are fitted.

11.4 Fit the bleed screw and tighten to a torque of 5.5 to 8 Nm (4 to 6 lbf ft).

Rear Brake reassembly

12 To reassemble the rear brakes carry out the following:

12.1 Fit the wheel cylinder to the back-plate and secure with the two nuts and spring washers tightened to a torque of 10 to 13 Nm (7.4 to 9.6 lbf ft).

12.2 Reconnect the lower pull-off spring to the brake shoes, refit the shoes locating with the wheel cylinder first.

12.3 Reconnect the upper pull-off spring with its long end hooked over the post on the leading shoe web.

12.4 Refit the trailing shoe anchor plate and secure with the two bolts and tab plate.

12.5 Connect the brake fluid pipe to the wheel cylinder, torque pipe connection to 14 to 16 Nm.

12.6 Fit the brake drum and ensure that it seats correctly on the hub register and secure with the single screw.

12.7 Turn the adjuster until the brake shoe is locked against the drum. Back off approximately two serrations so that the drum revolves freely.

12.8 Repeat the procedure for the opposite brake.

12.9 Bleed the brakes (Para 16).

12.10 Fit the road wheels, remove the axle stands and finally tighten the road wheel nuts to a torque of 108 Nm (80 lbf ft).

LAND ROVER 110 MODELS

Dismantling

13 To dismantle the rear brakes on Land Rover 110 models carry out the following:

WARNING

INHALATION SERIOUS HEALTH RISK. DO NOT USE AN AIR LINE TO BLOW DUST FROM THE BRAKE ASSEMBLIES, ASBESTOS DUST FROM BRAKE LININGS CAN BE A SERIOUS HEALTH RISK IF INHALED.

13.1 Slacken the road wheel nuts, jack up the vehicle, lower onto axle stands and remove the road wheels.

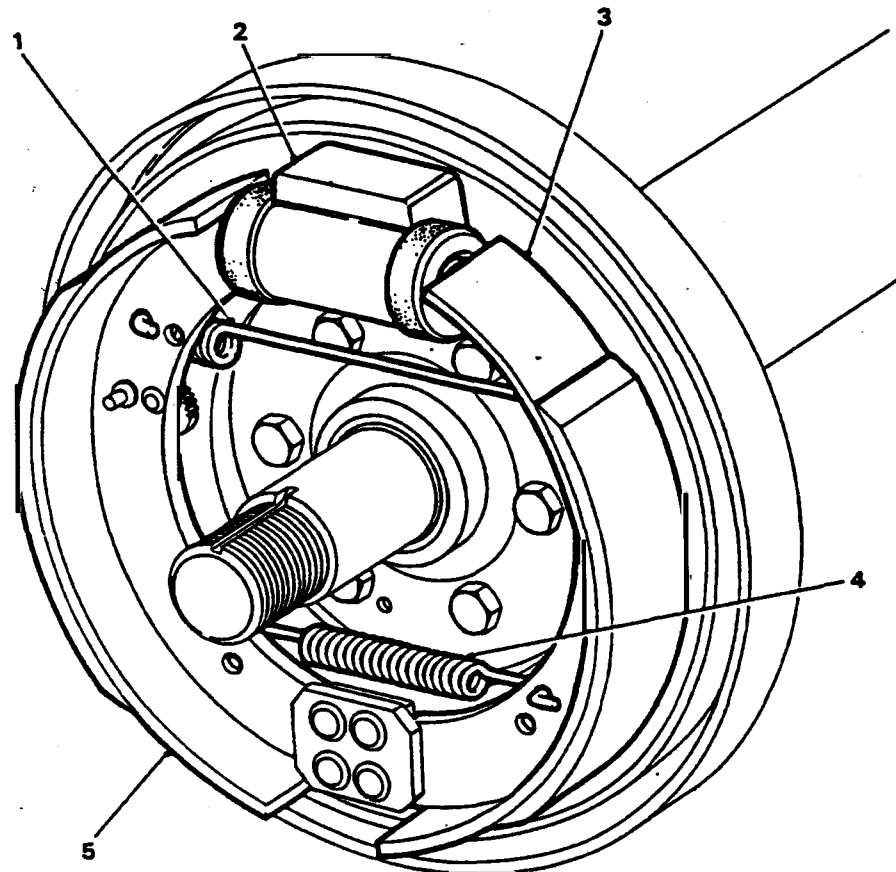
13.2 Slacken the two brake shoe adjusters on the rear of the back-plate to assist removal of the brake drum.

13.3 Remove the single retaining screw and withdraw the brake drum.

13.4 Note the position of the pull-off springs (Fig 6 (1) and (4)) then lever off the brake shoes and remove the springs.

13.5 Clamp the flexible brake hose, disconnect the brake fluid pipe at the wheel cylinder and blank-off the pipe end to prevent the ingress of dirt.

13.6 Remove the two retaining nuts and spring washers and withdraw the wheel cylinder from the back-plate. To dismantle the wheel cylinder refer to Para 10.



- | | | | |
|---|-----------------------|---|-----------------------|
| 1 | Upper pull-off spring | 4 | Lower pull-off spring |
| 2 | Wheel cylinder | 5 | Leading brake shoe |
| 3 | Trailing brake shoe | | |

Fig 6 Land Rover 110 rear brake l.h. side

Examination

14 Examine the components of the rear brake as follows:

14.1 Examine the brake drum for internal scoring and ovality. If required, the interior of the drum can be machined to a maximum diameter of 280.92 mm (11.060 in.).

14.2 Check the operation of the adjusters on the back-plate by turning them.

14.3 Check that the pull-off springs are satisfactory for continued use. If new brake shoes are being fitted the pull-off springs should also be renewed.

14.4 Check that the brake shoes have sufficient lining material for continued use and that they are free from contamination with grease or oil.

Reassembly

15 To reassemble the rear brakes on Land Rover 110 vehicles carry out the following:

15.1 Fit the wheel cylinder to the back-plate and secure with the two nuts and spring washers tightened to a torque of 10 to 13 Nm (7.4 to 9.6 lbf ft).

15.2 Assemble the pull-off springs to the brake shoes (Fig 7), refit the shoes locating with the wheel cylinder first.

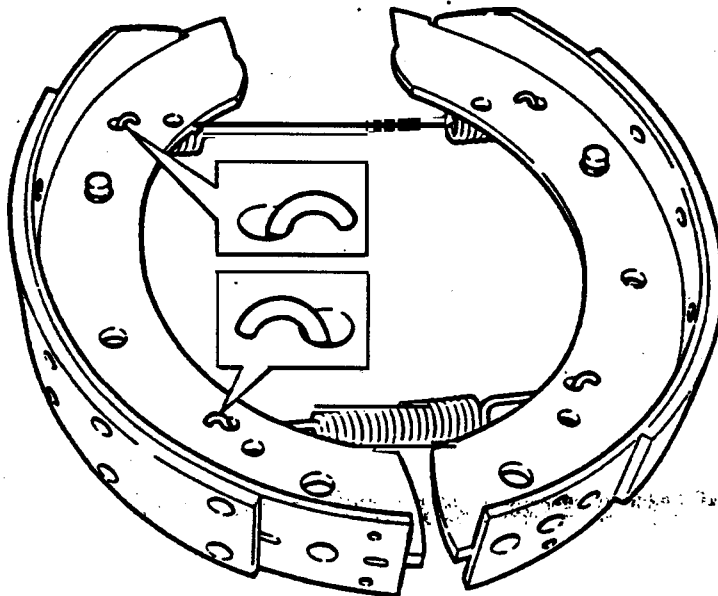


Fig 7 Location of pull-off springs

15.3 Locate the shoes in the wheel cylinder piston slots and lever the opposite ends into the pivot block.

15.4 Operate the brake adjusters to check that the shoes respond.

15.5 Connect the brake fluid pipe to the wheel cylinder, tighten to a torque of 14 to 16 Nm and remove clamp from flexible hose.

15.6 Fit the brake drum ensuring that it seats correctly on the hub and secure with the single screw.

15.7 Adjust each brake shoe independently, turn one of the adjusters in a clockwise direction, when viewed from the rear of the back plate, until the brake shoe is locked against the drum. Back off approximately two serrations so that the drum revolves freely. Repeat the operation on the second shoe also turning the adjuster in a clockwise direction to engage the shoe with the drum.

15.8 Repeat the procedure for the opposite brake.

15.9 Bleed the brakes (Para 29).

15.10 Fit the road wheels, remove the axle stands and finally tighten the road wheel nuts to a torque of 108 Nm (80 lbf ft).

REAR BRAKE CALLIPERS (See Fig 8)

Removal

16 To remove the rear callipers proceed as follows.

16.1 Loosen the rear wheel nuts and jack up the rear of the vehicle, lower the vehicle onto axle stands.

16.2 Remove the wheels.

16.3 Clamp the flexible hose above the rear axle, to prevent loss of fluid.

16.4 Remove the brake pipe (2) from the calliper (1). Seal the end of the pipe to prevent the ingress of dirt.

16.5 Remove the retaining pins (4) and pad retaining spring (5), withdraw the pads (6).

NOTE

If the same pads are being refitted, identify them for reassembly to their original locations.

16.6 Remove the two bolts (3) that secure the calliper to the axle, and withdraw the calliper.

DISMANTLING (Fig 10)

CAUTION

EQUIPMENT DAMAGE. Do not separate the calliper halves.

17 To dismantle the calliper proceed as follows:

17.1 Thoroughly clean the outer surfaces of the calliper (1) with methylated spirits.

17.2 Expel the pistons (3) from their bores by carefully applying air pressure to the fluid inlet port.

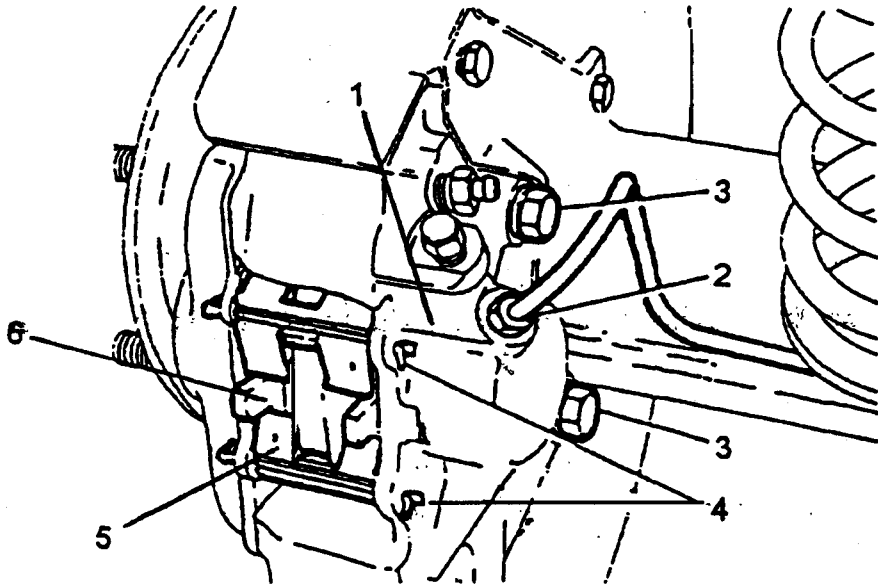
NOTE

Since it is unlikely both pistons will expel at the same rate, control withdrawal of the pistons using a suitable piece of wood as in Fig 9.

17.3 Remove the pistons ensuring they are identified with their respective bores.

17.4 Remove the wiper seal retainers (4) using a blunt screwdriver between the retainer and the seal. Carefully lever the retainer from the mouth of the bore.

17.5 Extract the wiper seal (5) and fluid seal (6), taking care not to damage the seal grooves.



- | | | | |
|---|-------------------------|---|----------------------|
| 1 | Calliper | 4 | Pad retaining pin |
| 2 | Brake pipe | 5 | Pad retaining spring |
| 3 | Calliper retaining bolt | 6 | Pads |

Fig 8 Rear calliper

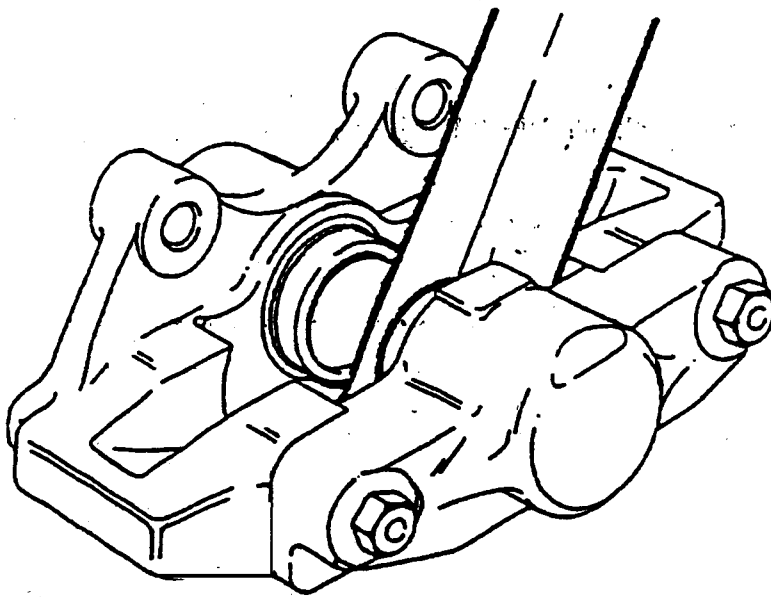
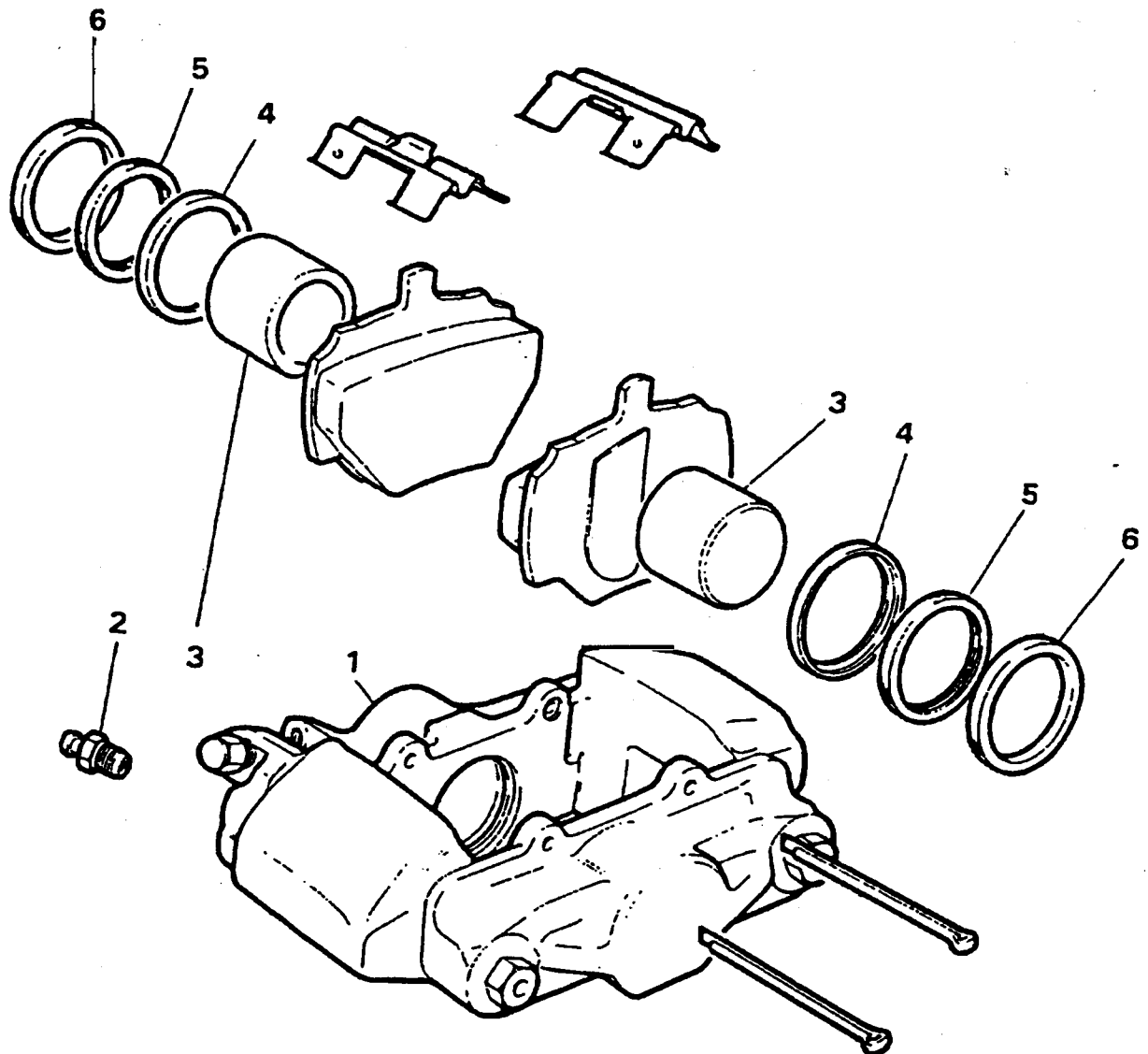


Fig 9 Removing pistons



- | | | | |
|---|-------------|---|---------------------|
| 1 | Calliper | 4 | Wiper seal retainer |
| 2 | Bleed screw | 5 | Wiper seal |
| 3 | Piston | 6 | Fluid seal |

Fig 10 Rear brake calliper assembly

Cleaning

18 Thoroughly clean the bores, piston and seal grooves with clean brake fluid or methylated spirit only.

Examination

19 Examine the components thoroughly. If the calliper bores or pistons are corroded or if their condition is not perfect a new calliper must be fitted.

Reassembly

20 Reassemble the calliper as follows:

20.1 Coat a new fluid seal (6) with Lockheed disc brake lubricant. Ease the seal into the bore using fingers only and ensure that it is properly seated.

NOTE

The fluid seal and groove are not the same in section, when the seal is seated it feels proud to touch at the edge furthest from the mouth of the bore.

20.2 Smear the appropriate piston (3) with disc brake lubricant and insert squarely into the bore, by hand. Do not tilt the piston during insertion and leave approximately 8 mm (0.315 in) protruding from the bore.

20.3 Coat a new wiper seal (5) with disc brake lubricant and fit to a new seal retainer (4).

20.4 Slide the wiper seal and retainer, seal first, over the protruding piston and into the bore recess.

20.5 Using the clamp (Table 1 Ser No 1) press home the seal retainer and piston.

20.6 Repeat Paras 20.1 to 20.5 on the other side of the calliper.

Refitting (Fig 8)

21 To refit the calliper to the axle, proceed as follows:

21.1 Fit the calliper (1) to the axle and secure with the two bolts (3), tighten evenly to a torque of 120 - 150 Nm (88 - 111 lbf ft).

21.2 Connect the brake pipe (2) to the calliper.

21.3 Remove the clamp from the flexible hose.

21.4 Lightly coat the back and edges of the pads (6) with brake grease, carefully avoiding the friction material.

21.5 Insert the pads and retaining springs (5), secure in position with new retaining pins (4) and spread the ends. Ensure that the retaining springs are in the correct position.

21.6 Bleed the brakes.

21.7 Refit the road wheels, jack up the vehicle and remove the axle stands. Lower the vehicle to the ground.

21.8 Tighten wheel nut, evenly, to a torque of 129 Nm (95 lbf ft).

BLEEDING THE BRAKES

Primed system

22 To bleed the brakes on a primed system carry out the following:

22.1 Attach a length of clear plastic or rubber hose to the bleed screw, first starting at the front of the vehicle on the bleed screw furthest away from the master cylinder, immerse the other end of the tube in a glass jar containing a quantity of clean new brake fluid.

22.2 Check that the fluid reservoir is full to the maximum mark and keep the reservoir topped up during the bleeding operation.

22.3 Unscrew the bleed screw approximately one half of a turn, enough to allow fluid to be pumped out. Opening the bleed screw too far will allow air to be drawn back into the system around the threads.

22.4 Smartly depress the foot pedal, pause and then allow the pedal to rapidly return, pause again before repeating the procedure.

22.5 Continue with the above sequence until fluid free from air bubbles flows. Close the bleed screw immediately after the last down stroke, whilst the pedal is depressed.

22.6 Bleed the opposite front brake following the above procedure.

22.7 Bleed the rear brakes commencing with the brake furthest away from the master cylinder.

22.8 On completion of the bleeding operation fit the dust caps to the bleed screws.

Unprimed system

23 To bleed a replacement master cylinder or a fully drained system carry out the following:

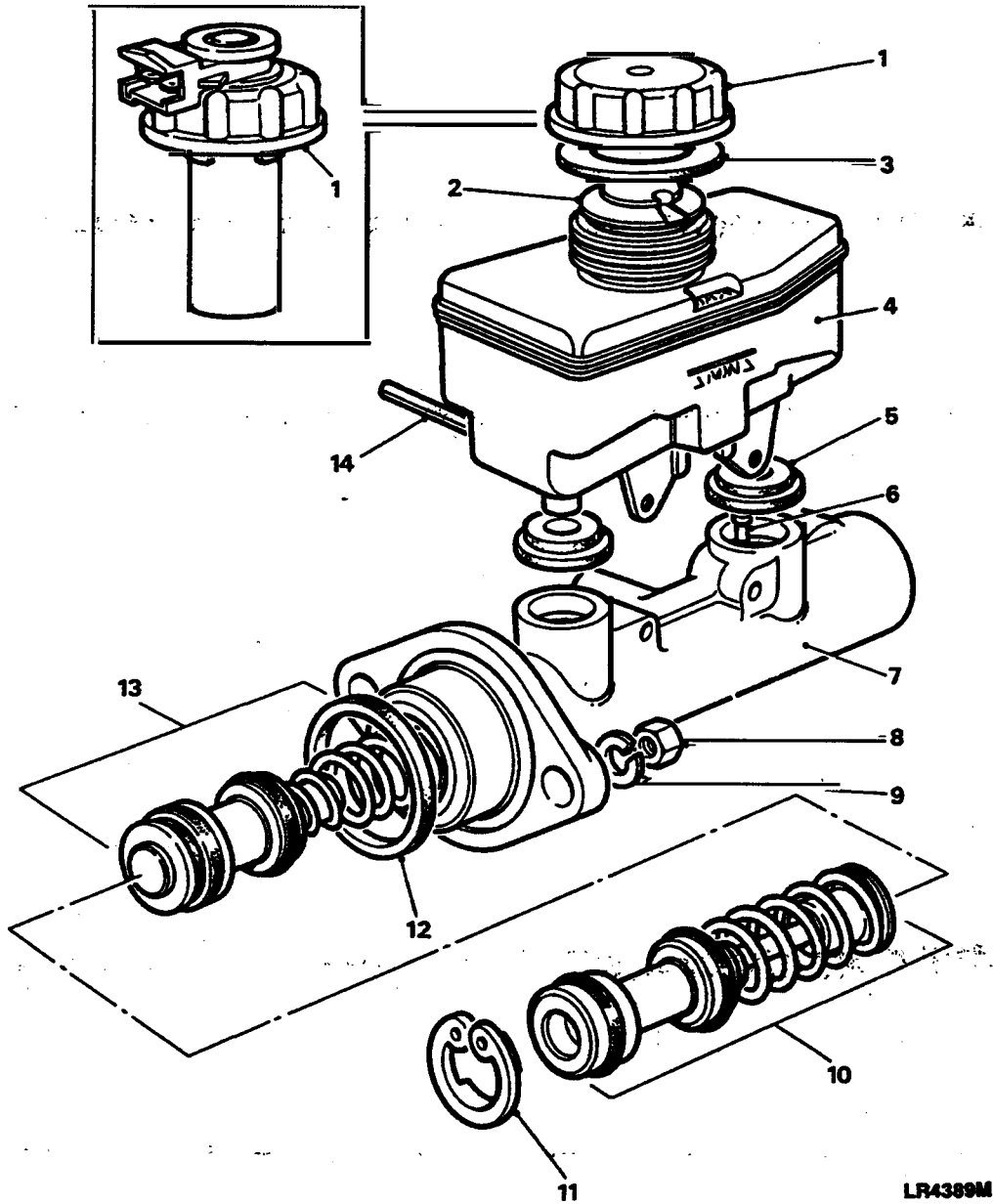
23.1 Top up the fluid reservoir to the maximum mark.

23.2 Open a bleed screw in both circuits and allow fluid to prime both circuits of the master cylinder by gravity for approximately five minutes, then bleed the system as for a primed system (Para 22).

MASTER CYLINDER

CAUTION

CORROSIVE FLUID. Brake fluid is corrosive, if any fluid comes into contact with th paintwork, immediately wash down with a large quantity of clean fresh water and wip cl an with a soft cloth.



- | | |
|-------------------|------------------------------|
| 1 Filler cap | 8 Nut |
| 2 Baffle | 9 Spring washer |
| 3 Seal | 10 Primary piston assembly |
| 4 Reservoir | 11 Circlip |
| 5 Sealing rubbers | 12 Seal |
| 6 Stop pin | 13 Secondary piston assembly |
| 7 Cylinder body | 14 Roll pin |

Fig 11 Master cylinder assembly

Removal

24 To remove the master cylinder from the brake system carry out the following:

24.1 Disconnect the warning lamp electrical connector from the top of the master cylinder filler cap, Land Rover 90 models only.

24.2 Disconnect the two pipe connections at the side of the master cylinder. Blank off the pipes to prevent the ingress of dirt.

24.3 Remove the nuts (Fig 11 (8)) and washers (9) securing the master cylinder to the servo unit and withdraw the cylinder complete with fluid reservoir (4) and seal (12).

Dismantling

25 Dismantle the master cylinder as follows:

25.1 Remove the filler cap (Fig 11 (1)) and pour off the fluid in the reservoir. Remove the baffle (2) (110 vehicles only) and seal (3) from the filler cap.

25.2 Using a suitable punch drive out the two roll pins (14) and remove the reservoir (4) from the master cylinder body (7).

25.3 From the master cylinder body prise out the two reservoir sealing rubbers (5) the primary piston (Fig 14 (3)) and withdraw the spring retainer (1), spring (7), seal retainer (6), recuperating seal (5) and washer (2).

25.4 Secure the master cylinder in a soft jawed vice and push the primary piston down the bore and withdraw the secondary piston stop pin (Fig 9).

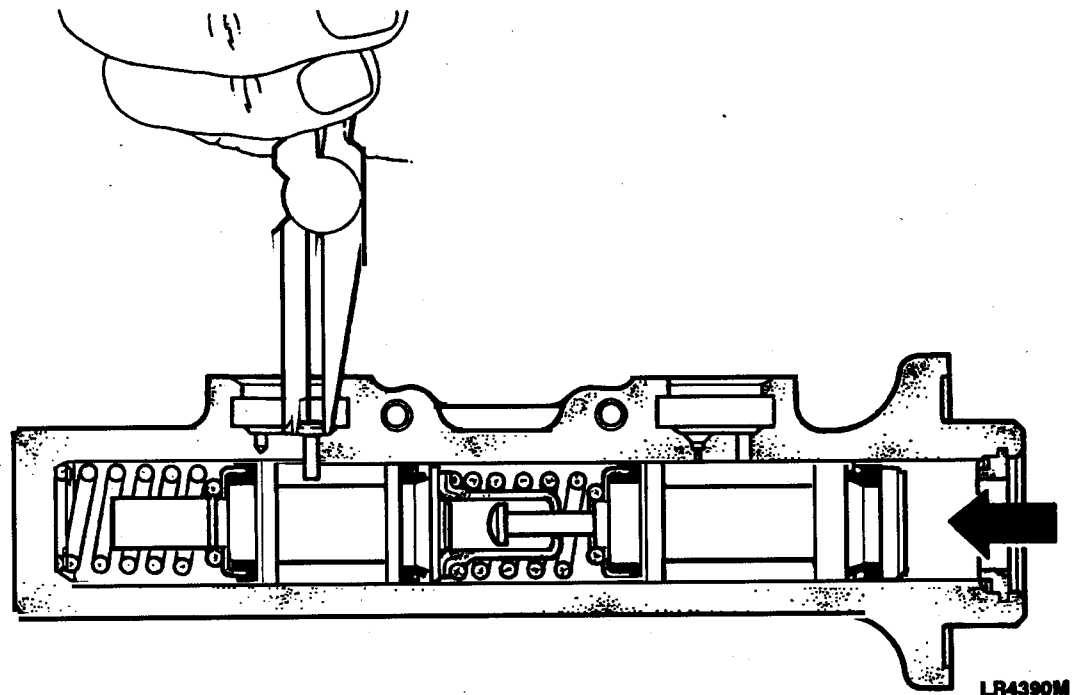
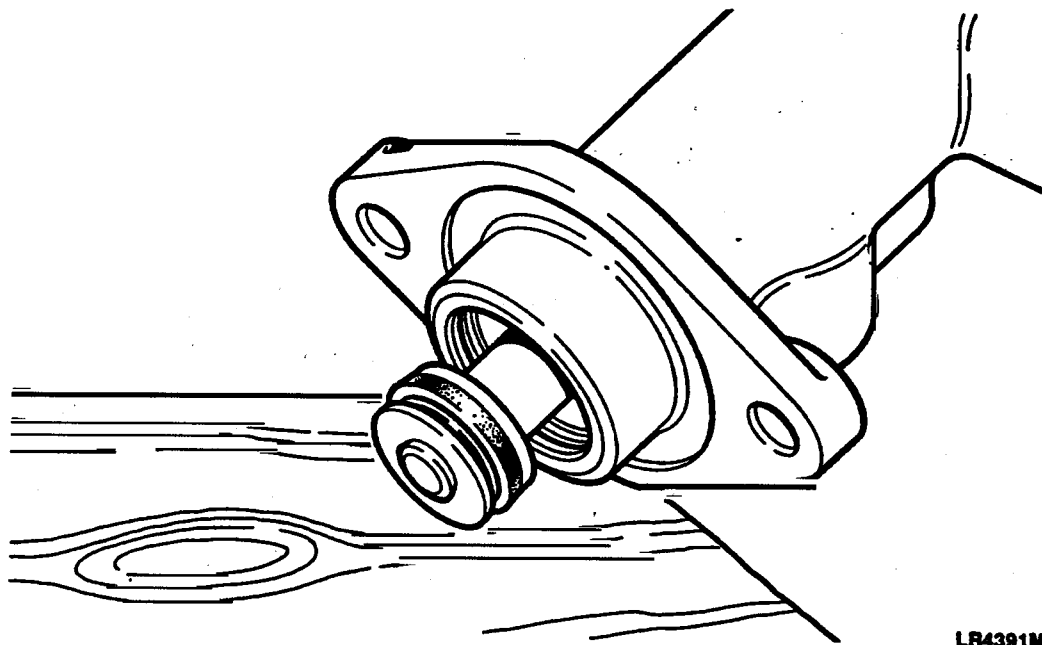


Fig 12 Removing secondary piston stop pin

25.5. Press down the primary piston, remove the circlip (Fig. 11 (11)) and withdraw the primary piston assembly (10).

25.6 Tap the cylinder body (7) sharply on a soft or wooden surface to expel the secondary piston assembly. (Fig 13).



LR4391M

Fig 13 Removing secondary piston assembly

25.7 Using a 2.5 mm Allen key, unscrew the retaining bolt (Fig 14 (8)) from the primary piston (3) and withdraw the spring retainer (1), spring (7), seal retainer (6), recuperating seal (5) and washer (2).

25.8 Taking care not to damage the piston remove the outer seal (4).

25.9 From the secondary piston (Fig 15 (4)) remove the spring (1), seal retainer (2), recuperating seal (6) and washer (3).

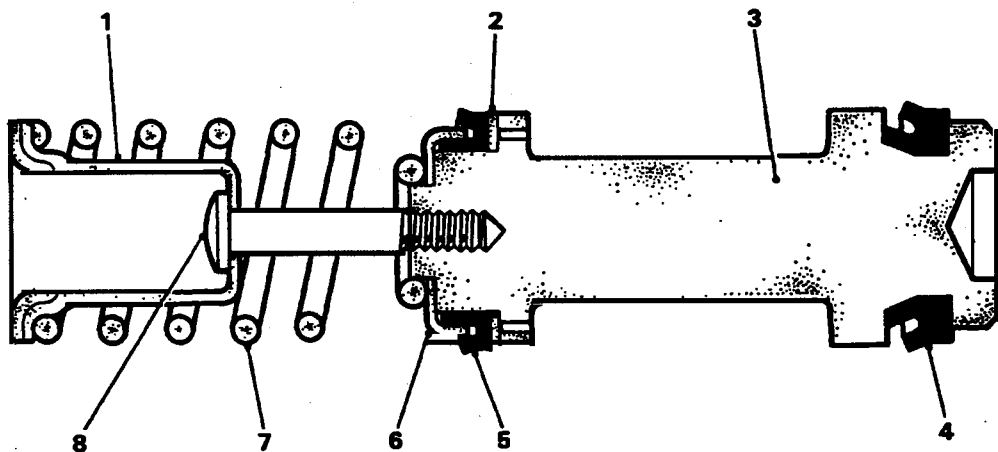
25.10 Taking care not to damage the piston remove the outer seal (5).

25.11 Discard all seals removed.

Reassembly

NOTE

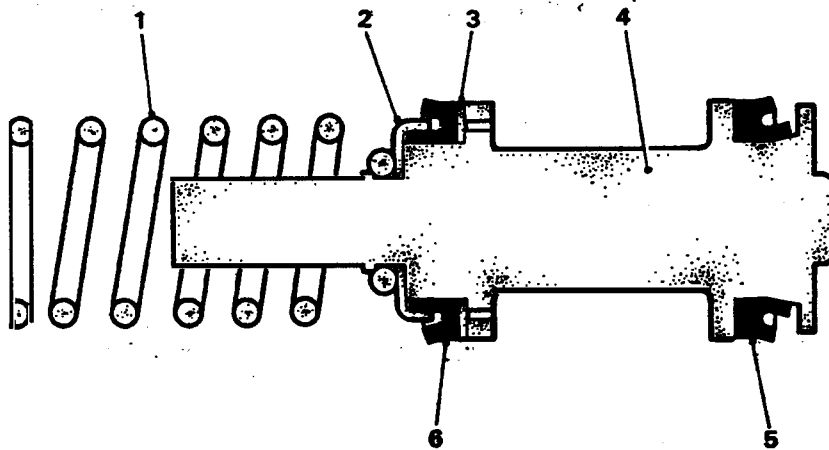
It is important the following instructions are carried out precisely, otherwise damage could be caused to the new seals when inserting the plungers into the cylinder bore. Generous amounts of new brake fluid should be used to lubricate the parts during assembly. Never use old fluid or any other form of lubricating material. Cleanliness throughout is essential.



LR4392M

- | | |
|-------------------|---------------------|
| 1 Spring retainer | 5 Recuperating seal |
| 2 Washer | 6 Seal retainer |
| 3 Piston | 7 Spring |
| 4 Outer seal | 8 Retaining bolt |

Fig 14 Primary piston assembly



- 1 Spring
2 Seal retainer
3 Washer

- 4 Piston.
5 Outer seal
6 Recuperating seal

LR4393M

Fig 15 Secondary piston assembly

26 To reassemble the master cylinder carry out the following:

26.1 Fit a new outer seal to the groove in the secondary piston by squeezing the seal between the finger and thumb and forming an ellipse, press the raised part of the seal over the flange using the fingers of the other hand (Fig 13).

26.2 Fit the recuperating seal and its associated components in reverse order of removal (Para 25.8).

26.3 Fit a new outer seal to the groove in the primary piston using the same procedure as for the secondary piston.

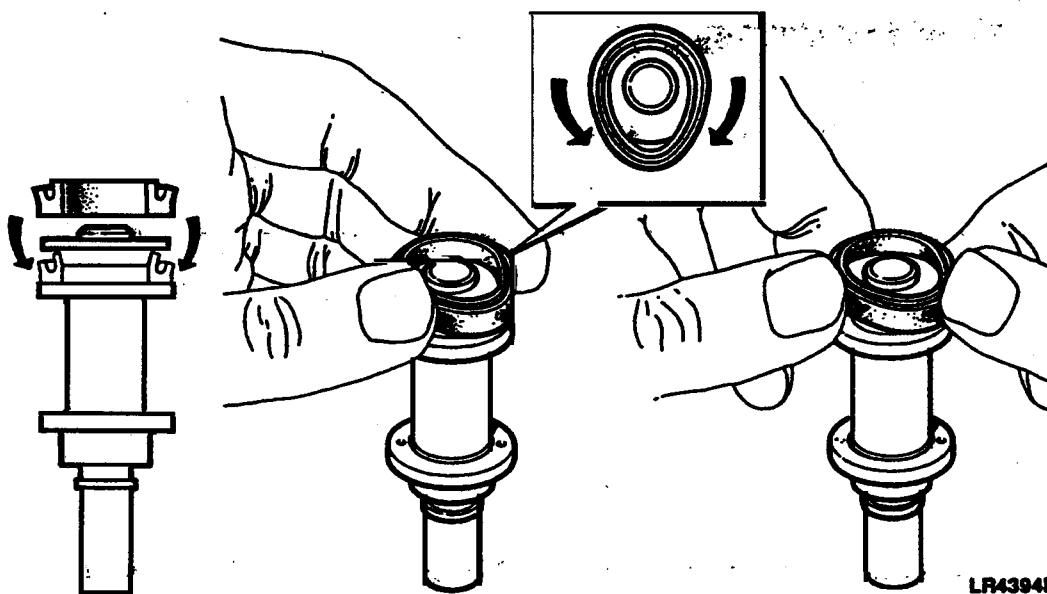


Fig 16 Fitting piston outer seals

26.4 Fit the recuperating seal and its associated components in reverse order of removal (Para 26.6). Compress the spring and secure the components with the bolt, tighten the bolt to a torque of 2 to 3 Nm (1.5 to 2.2 lbf ft). Do not overtighten.

26.5 Clamp the cylinder body in a soft jawed vice and lubricate the secondary piston seals and the cylinder bore. Offer the piston assembly to the cylinder until the recuperation seal is resting centrally in the mouth of the bore. Gently introduce the plunger with a circular rocking motion (Fig 17). Whilst ensuring that the seal does not become trapped, ease the seal into the bore and slowly push the piston down in one continuous movement.

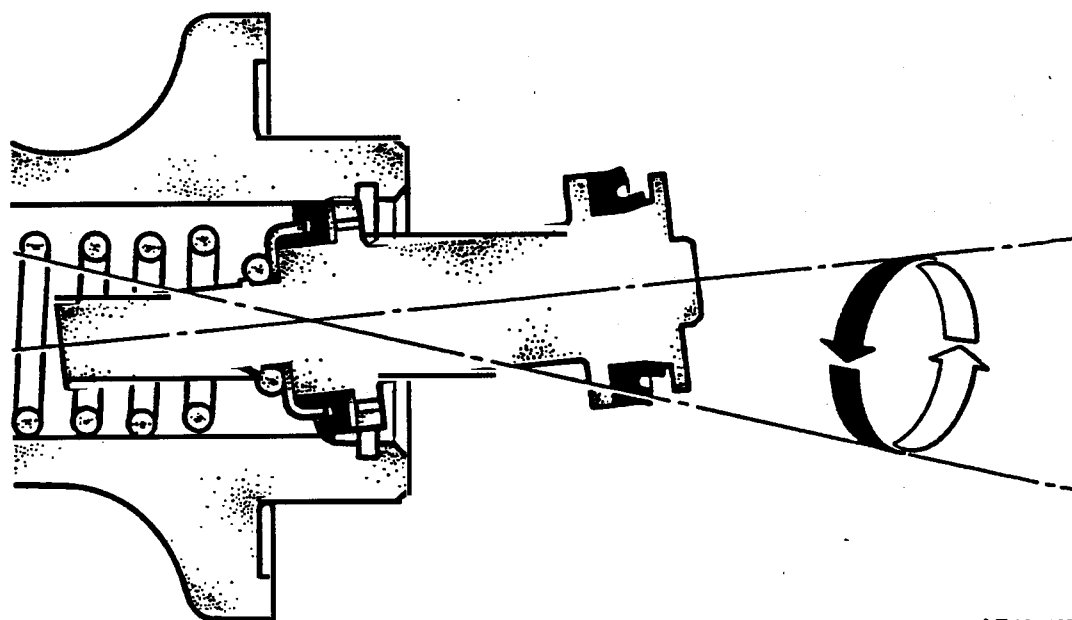


Fig 17 Fitting secondary piston assembly to body

26.6 Fit the primary piston assembly, using the same method as for the secondary piston assembly. When fitted press the piston down and secure with the circlip (Fig 11 (11)).

26.7 Slowly press the piston down the bore and fit the secondary piston stop pin (6).

Refitting

27 To refit the master cylinder carry out the following:

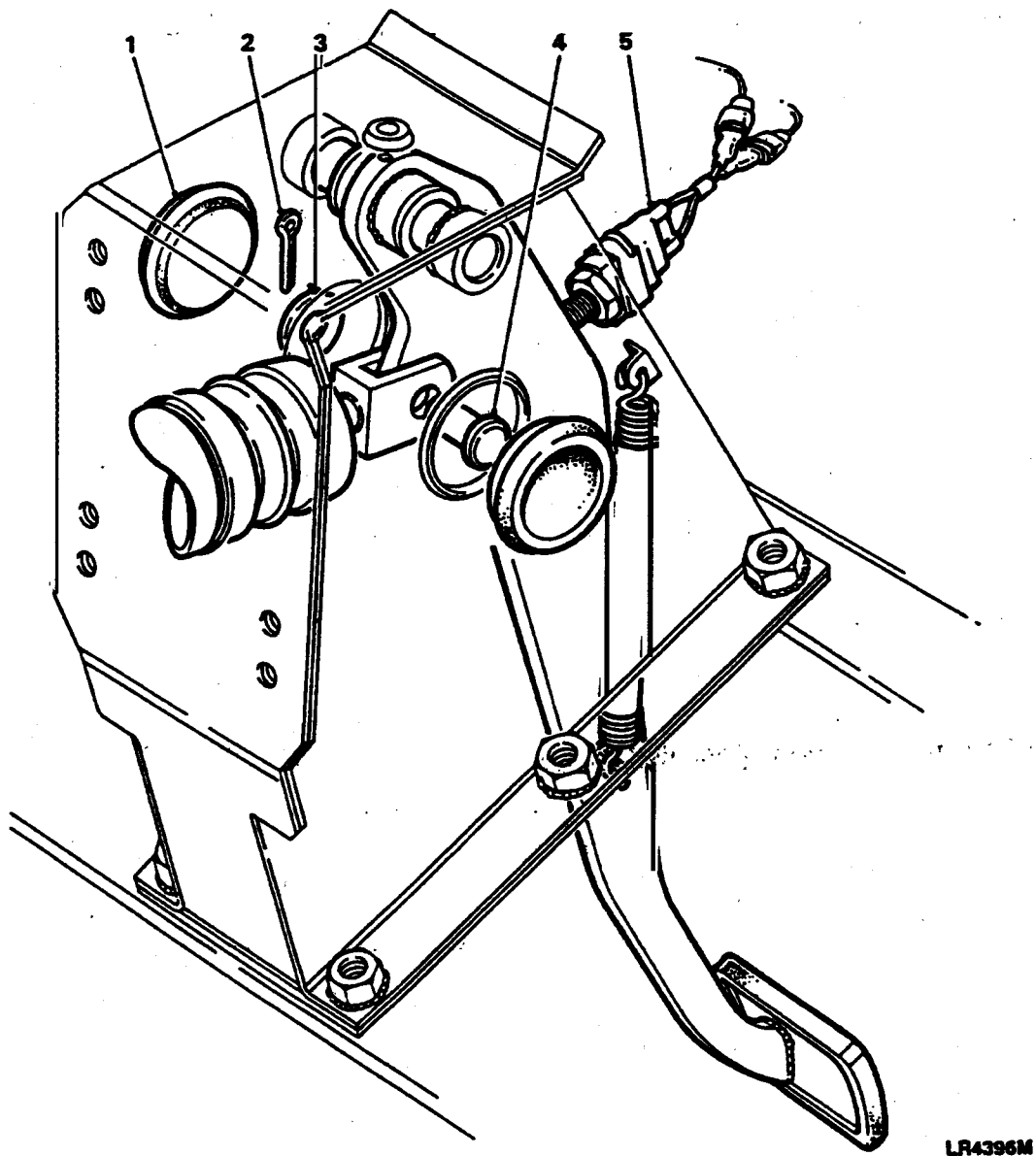
27.1 Lubricate new seals (Fig 11 (5)) and fit to the inlet ports in the master cylinder body, with the large diameter downwards.

27.2 Press the reservoir (4) into position and secure with the two roll pins (14).

27.3 Fit a new seal (3) and baffle (2) (110 vehicles only) to the reservoir cap and screw on the cap (1).

27.4 Fit a new seal (12) to the cylinder flange, fit the master cylinder to the servo and secure with the two nuts (8) and spring washers (9). Tighten the nuts to a torque of 21 to 29 Nm (15 to 22 lbf ft).

27.5 Reconnect the brake pipes and tighten to a torque of 14 to 16 Nm (10 to 11 lbf ft). On Land Rover 90 vehicles reconnect the warning lamp electrical connector to the reservoir cap.



LR4396M

- | | | | |
|---|------------------|---|--------------------|
| 1 | Blanking grommet | 4 | Clevis pin |
| 2 | Split pin | 5 | Brake light switch |
| 3 | Washer | | |

Fig 18 Servo unit to pedal connections

SERVO ASSEMBLY

Removal

28 To remove the servo assembly carry out the following:

- 28.1 Remove the master cylinder from the servo unit (Para 24).
- 28.2 Disconnect the vacuum hose from the servo unit.
- 28.3 Disconnect the electrical connectors from the brake light switch (Fig 18 (5)) at the rear of the pedal box.
- 28.4 Remove the blanking grommets (1) from the pedal box.
- 28.5 Remove the split pin (2) from the clevis and withdraw the clevis pin (4) and the washer (3).
- 28.6 Remove the four nuts securing the servo unit to the pedal box and remove the servo.

Filter renewal

29 To renew the brake servo filters carry out the following:

- 29.1 Pull back the dust cover (Fig 19 (1)) and release the end cap (2).
- 29.2 Cut the filters and remove them from the shaft.
- 29.3 Clean the filter seating and fit the new filters noting that they must be cut to fit over the shaft.
- 29.4 Refit the end cap and dust cover.

Refitting

30 To refit the servo assembly reverse the removal procedure using a new split pin to secure the clevis pin.

BRAKE PEDAL BOX

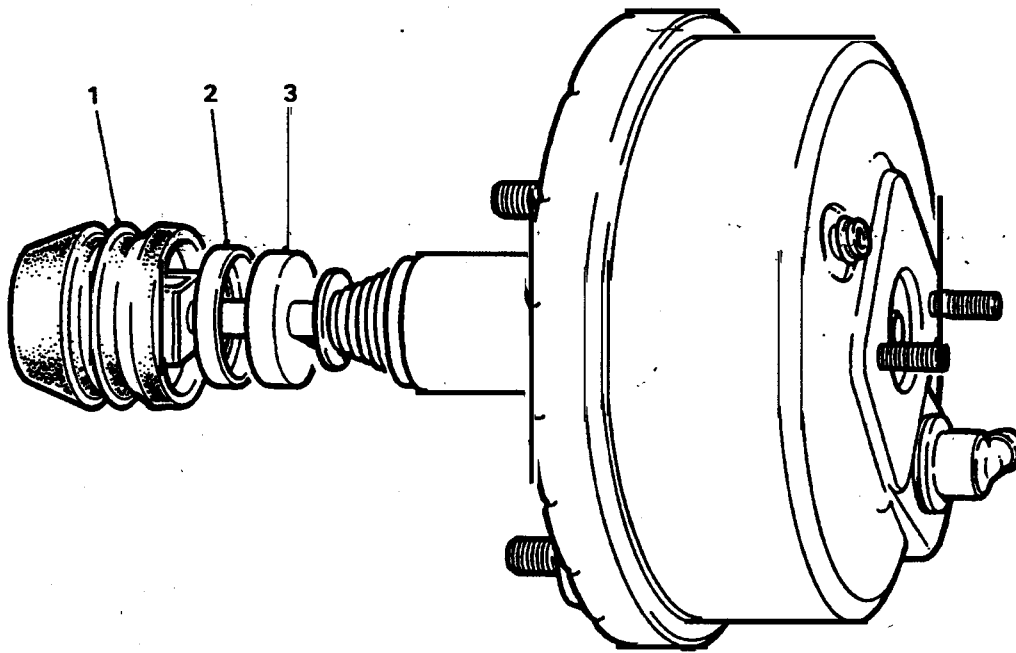
Removal

31 Remove the brake pedal box as follows:

- 31.1 Remove the servo assembly (Para 28).
- 31.2 Remove the six bolts securing the pedal box to the bulkhead.
- 31.3 Taking care not to damage the brake fluid pipes remove the pedal box from the bulkhead complete with the brake pedal assembly and gasket.

Refitting

32 Refit brake pedal box in reverse order of removal using a new gasket between the pedal box flange and the bulkhead.



LR4397M

1 Dust cover

2 End cap

3 Filter

Fig 19 Servo unit filter replacement

TRANSMISSION BRAKE**WARNING**

ASBESTOS. DO NOT USE AN AIR LINE TO BLOW DUST FROM THE BRAKE ASSEMBLIES, ASBESTOS DUST FROM BRAKE LININGS CAN BE A SERIOUS HEALTH RISK IF INHALED.

Dismantling

33 To dismantle the transmission brake carry out the following:

33.1 Disconnect the battery, chock the road wheels for safety and release the hand brake.

33.2 Disconnect the propeller shaft from the output flange.

33.3 Slacken the brake adjuster (Fig 20 (2)), remove the two countersunk screws (17) and withdraw the brake drum (1).

33.4 Remove the split pin and clevis pin connecting the brake cable to the brake actuating lever.

33.5 Note the position of the pull-off springs (15) in relation to the brake shoes. Remove the brake shoes complete with pull-off springs.

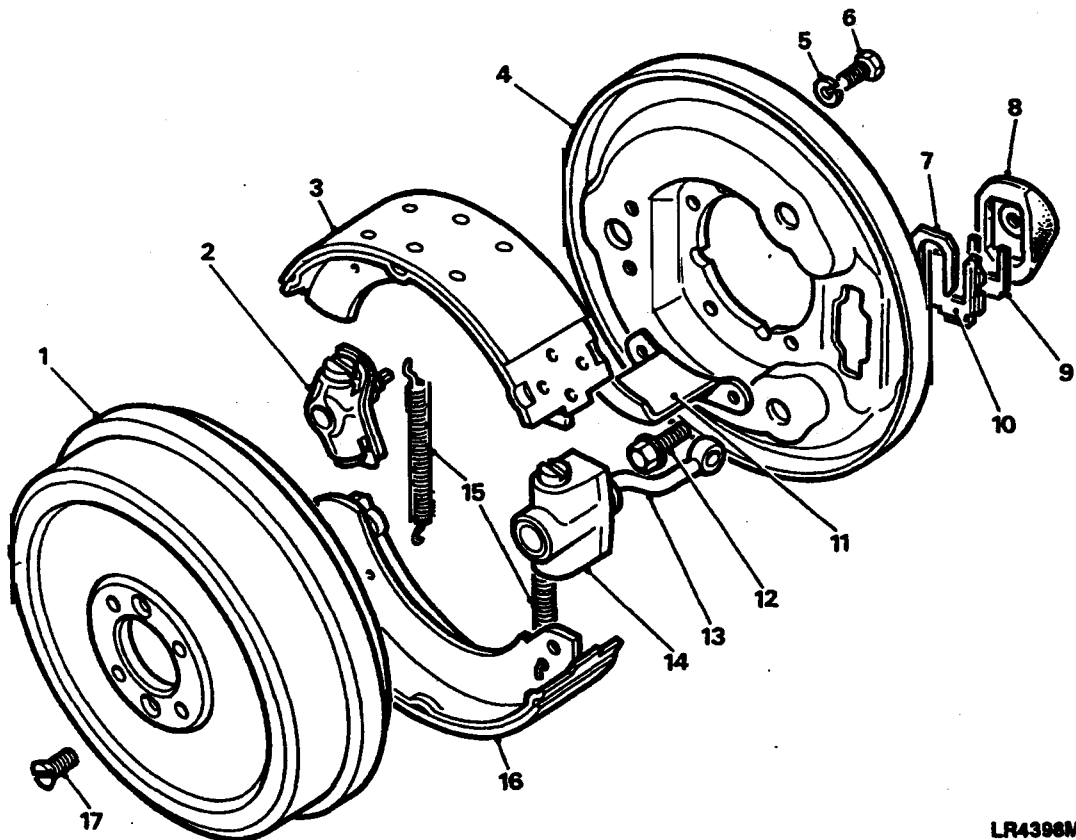
33.6 Remove the four bolts (12) securing the back plate (4) to the transfer box and withdraw the back plate complete with oil catcher (11).

33.7 Expander assembly. Remove and overhaul as follows:

33.7.1 Remove the rubber dust cover (8).

33.7.2 Remove the expander and drawlink (13).

33.7.3 Remove the spring plate (7) and the locking plate (10).



LR4398M

- | | | | |
|---|-------------------|----|-------------------|
| 1 | Brake drum | 10 | Locking plate |
| 2 | Adjuster assembly | 11 | Oil catcher |
| 3 | Upper brake shoe | 12 | Bolt, back plate |
| 4 | Back plate | 13 | Draw link |
| 5 | Spring washer | 14 | Expander assembly |
| 6 | Bolt, adjuster | 15 | Pull-off springs |
| 7 | Spring plate | 16 | Lower brake shoe |
| 8 | Dust cover | 17 | Countersunk screw |
| 9 | Packing plate | | |

Fig 20 Transmission brake assembly

33.8 Adjuster assembly. Remove and overhaul as follows:

33.8.1 Remove the two bolts (Fig 22 (1)) and spring washers (2) withdraw the adjuster assembly from the back plate.

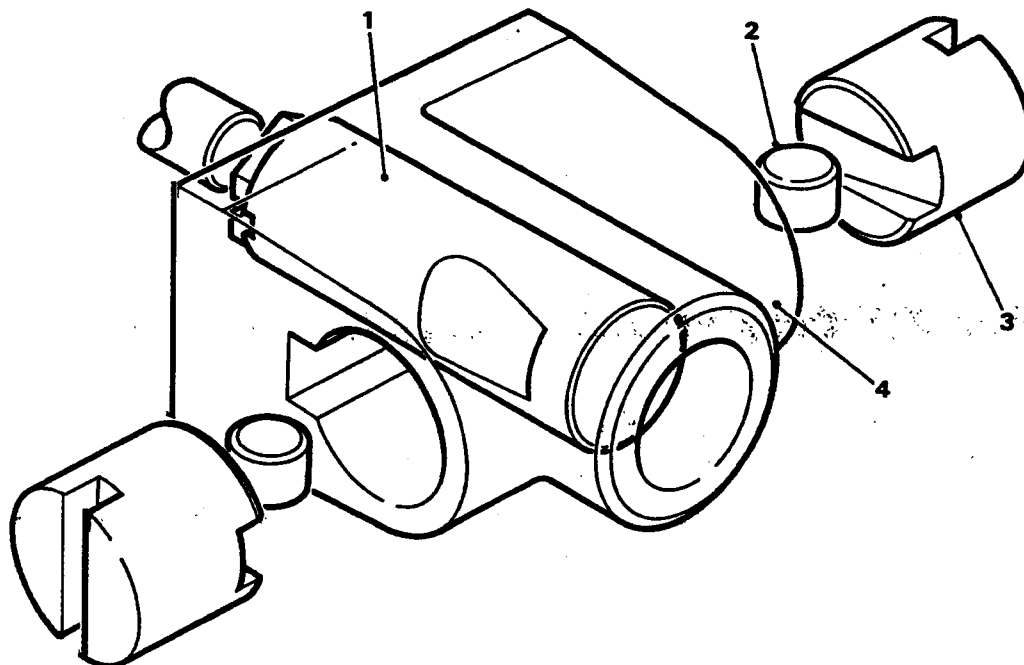
33.8.2 Remove the plungers (3).

33.8.3 Screw the adjuster cone (4) inwards to remove from the housing.

33.8.4 Clean the parts in brake cleaning fluid and allow to dry. Examine and discard components considered unfit for further service.

33.8.5 Grease the adjuster cone and screw into the housing.

33.8.6 Grease and fit the adjuster plungers, aligning the chamfered ends with the adjuster cone. The two plungers are identical and can be fitted to either bore. Secure the assembly with a rubber band to prevent the plungers from falling out prior to fitment to the back plate.



LR4399M

- | | | | |
|---|------------------------|---|---------|
| 1 | Expander and drawlink. | 3 | Plunger |
| 2 | Roller | 4 | Body |

Fig 21 Expander assembly

Examination

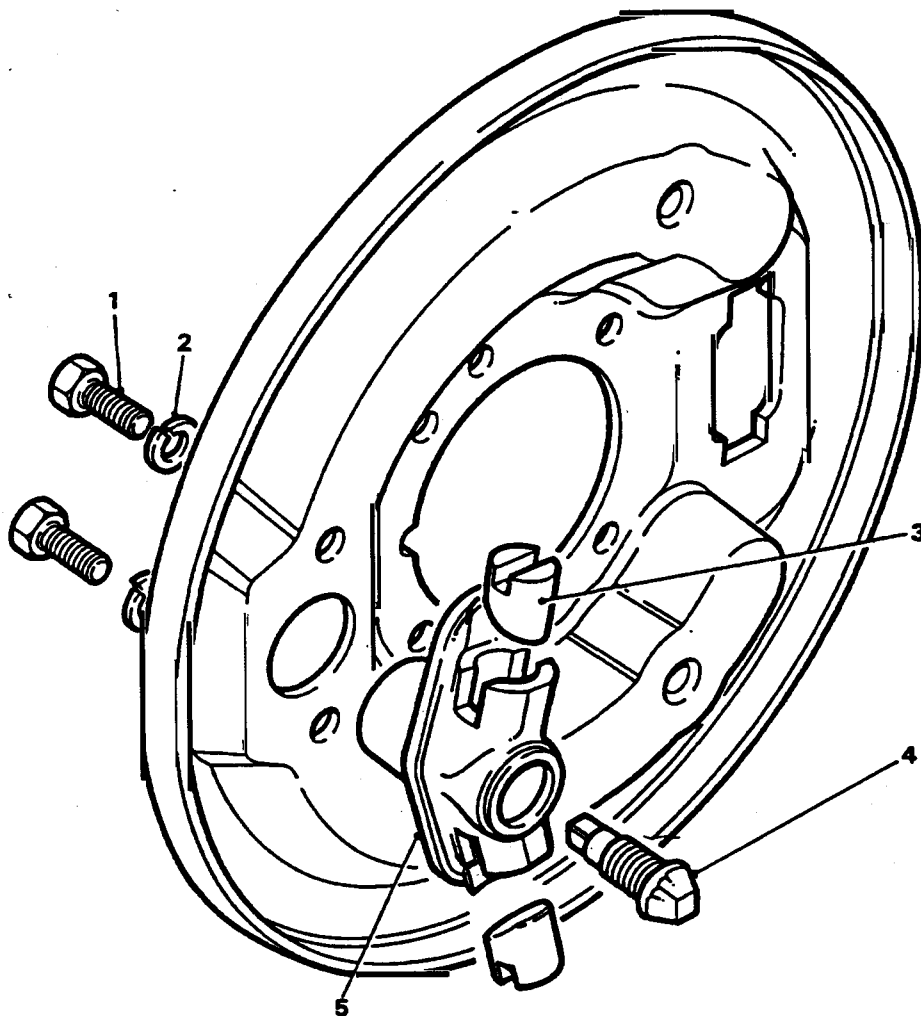
34 Examine the remainder of the transmission brake components as follows:

34.1 Examine the brake drum for internal scoring and ovality. If required, the interior of the drum can be machined to a maximum diameter of 255.65 mm (10.064 in.).

34.2 Check that the pull-off springs are satisfactory for continued use. If new brake shoes are being fitted the pull-off springs should also be renewed.

34.3 Check that the brake shoes have sufficient lining material for continued use and that they are free from contamination with grease or oil.

34.4 If the brake linings are oil contaminated check and if necessary renew the output shaft oil seal.



LR4400M

- | | |
|-----------------|-----------------|
| 1 Bolt | 4 Adjuster cone |
| 2 Spring washer | 5 Adjuster body |
| 3 Plunger | |

Fig 22 Adjuster assembly

Reassembly

35 To reassembly the transmission brake carry out the following:

35.1 Position the expander assembly (Fig 20 (14)) on the inside of the brake back plate (4) and secure with the spring plate (7), locking plate (10) and packing plate (9).

35.2 Fit the rubber dust cover (8).

35.3 Fit the adjuster assembly (2) to the back plate (4), secure with the two bolts (6) and washers (5), do not fully tighten the bolts at this stage.

35.4 Fit the back plate assembly and oil catcher (11) to the transfer box and secure with the four bolts (12), tighten the bolts to a torque of 65 to 80 Nm (48 to 59 lbf ft).

35.5 Fit the brake shoes and pull-off springs (15) to the back plate, fitting the brake shoes with the fully lined end of the lower shoe (16) toward the expander assembly and the fully lined end of the upper shoe (3) toward the adjuster assembly.

35.6 Fit the brake drum (1) and secure with the two countersunk screws (17), tighten the screws to a torque of 22 to 28 Nm (16 to 21 lbf ft).

35.7 Connect the expander draw link to the actuating lever with a new clevis pin, washer and split pin.

35.8 Turn the adjuster cone fully in and tighten the two retaining screws left slack in 35.3.

35.9 Slacken off the adjuster two 'clicks', firmly apply and then release the hand brake lever to centralise the shoes. The drum should then rotate freely.

35.10 Adjust the hand brake cable to give the pawl two 'clicks' free movement on the ratchet before the third 'click' fully expands the shoes against the drum.

35.11 Connect the propeller shaft and evenly tighten the retaining nuts to a torque of 41 to 52 Nm (30 to 38 lbf ft).

36 Reconnect the battery and remove the chocks from the road wheels.