

Chapter 2-1

CLUTCH 2.5 LITRE DIESEL

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INTRODUCTION

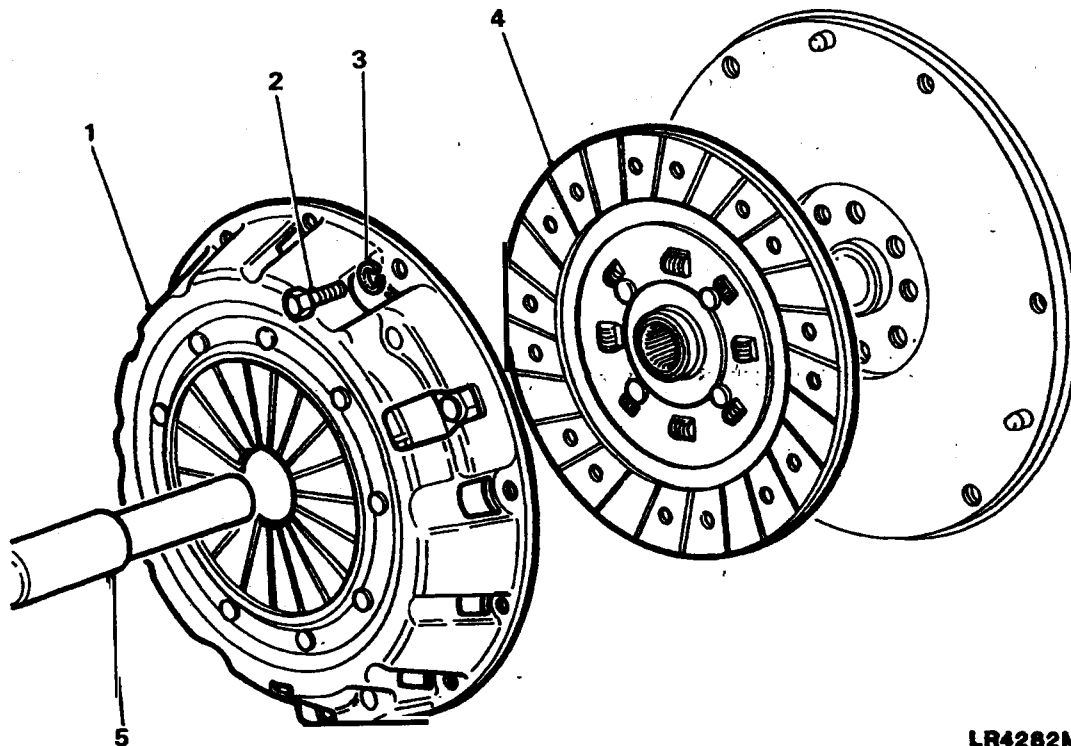
1 This chapter covers the unit and field repairs for clutches fitted to Land Rover 90 and 110 vehicles having 2.5 litre diesel engines.

GENERAL

2 The clutch assembly is of the diaphragm spring type and no overhaul procedures are applicable. Repair is by replacement only.

TABLE 1 SPECIAL TOOLS

Ser No (1)	Manufacturers Part No (2)	NSN/Part No where applicable (3)	Designation (4)
1	RO 605022		Clutch plate mandrel



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- | | | | |
|---|---------------|---|------------------------|
| 1 | Clutch cover | 4 | Clutch plate |
| 2 | Bolt | 5 | Mandrel (special tool) |
| 3 | Spring washer | | |

Fig 1 Clutch assembly

CLUTCH ASSEMBLY

Removal

- 3 To remove the clutch assembly carry out the following:
 - 3.1 Remove the gearbox assembly from the vehicle (AESP 2320-D-122-522 Chap 3-1 Para 4).
 - 3.2 Mark the clutch cover fitted position relative to the flywheel, to ensure correct location at reassembly.
 - 3.3 Remove the six bolts (Fig 1 (2)) and spring washers (3) and withdraw the clutch cover (1).
 - 3.4 Withdraw the clutch plate (4).

Examination

- 4 Examine the clutch components as follows:
 - 4.1 Check the clutch cover diaphragm spring fingers for wear and the pressure plate for signs of wear cracks or burning.
 - 4.2 Check the driven plate for worn, burned or contaminated linings and the centre hub spline for wear.

Reassembly

- 5 Refit the clutch assembly as follows:
 - 5.1 Locate the clutch plate (4) with the side marked 'Flywheel' towards the flywheel.
 - 5.2 Fit the clutch cover (1), using special tool (Serial No 1) ensuring alignment of the marks made during dismantling. Secure the assembly with the bolts and spring washers, tightening the bolts diagonally to a torque of 30 to 38 Nm (22 to 28 lbf ft).

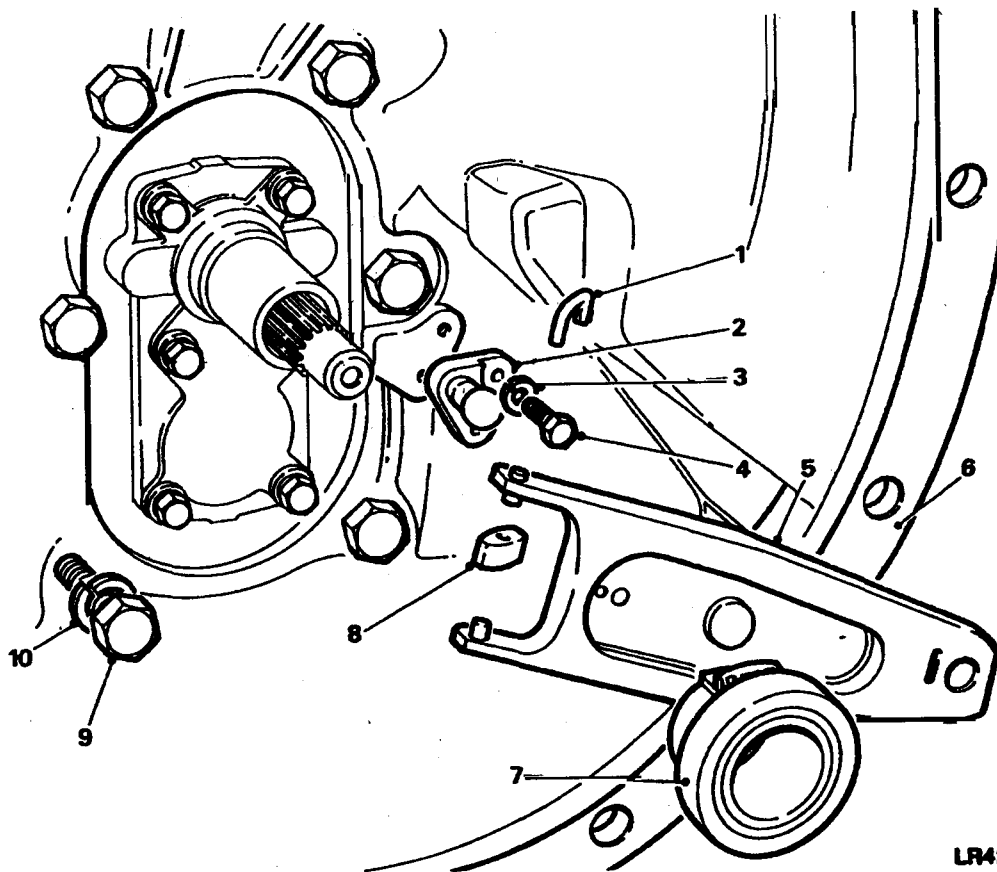
RELEASE MECHANISM

Dismantling

- 6 To dismantle the release mechanism proceed as follows:
 - 6.1 Remove the clutch slave cylinder from the bell housing.
 - 6.2 Remove the clutch release bearing sleeve clip (Fig 2 (1)) and withdraw the release bearing and sleeve (7).
 - 6.3 Detach the clutch release lever (5) from the clutch release lever pivot (2), complete with slipper pads (8). If necessary, remove the bolts (4) and spring washers (3) securing the pivot and detach it from the bell housing (6).

Cleaning

- 7 Thoroughly clean all the components of the release mechanism.



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1	Bearing carrier clip	6	Bell housing
2	Lever pivot	7	Release bearing and carrier
3	Spring washer	8	Slipper pad
4	Bolt	9	Bolt
5	Clutch release lever	10	Spring washer

Fig 2 Clutch release mechanism

Examination

8 Examine all the components for wear or damage paying particular attention to the condition of the release bearing assembly.

Reassembly

9 Reassemble the release mechanism as follows:

9.1 If removed, refit the pivot to the bell housing tightening the bolts to a torque of 22 to 28 Nm (16 to 21 lbf ft).

9.2 Prior to reassembly lubricate the following items with a thin film of molybdenum disulphide grease:

9.2.1 Clutch release lever fulcrum pivot socket.

9.2.2 The clutch release lever slipper pad pins and the faces of each slipper pad.

9.2.3 Ball end of slave cylinder push-rod.

9.3 Fit the slipper pads to the clutch release lever and locate the lever socket on the pivot.

9.4 Lubricate the inner face of the release bearing sleeve with molybdenum disulphide grease and fit to the front cover spigot, locating the slipper pads to the sleeve recesses. Fit a new sleeve clip.

SLAVE CYLINDER

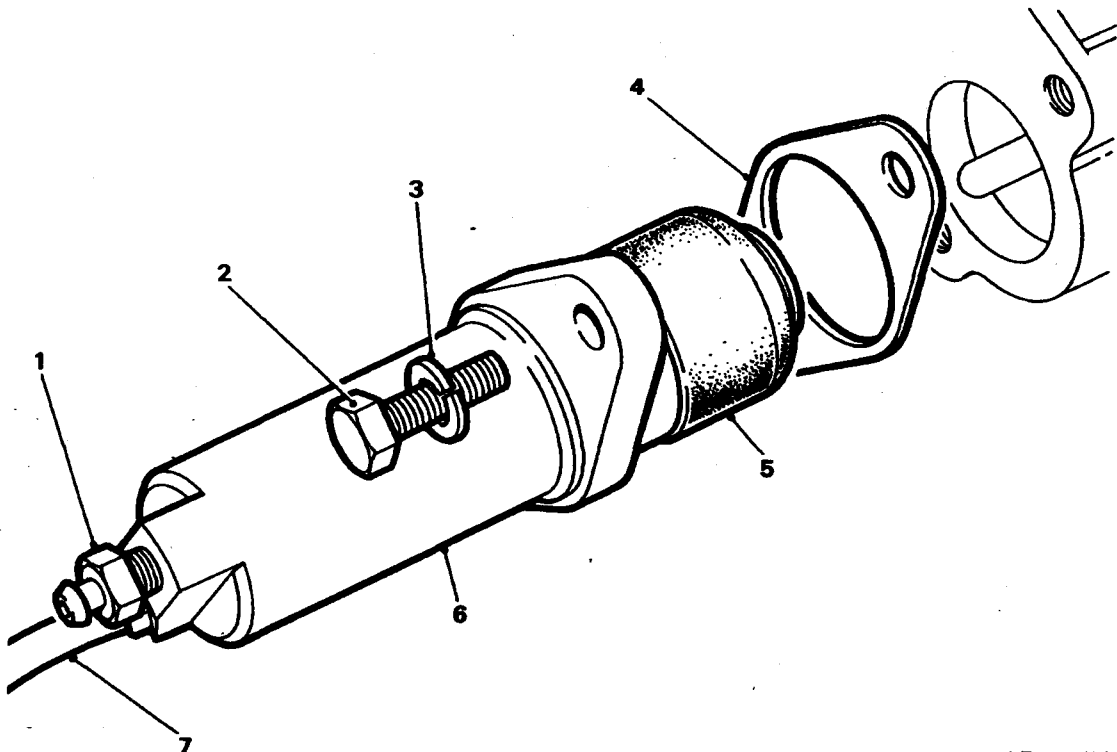
Removal

10 To remove the slave cylinder carry out the following:

10.1 Using a suitable container and a length of tubing drain the clutch fluid system at the slave cylinder bleed valve.

10.2 Disconnect the fluid pipe (Fig 3 (7)), remove the two securing bolts (2) and spring washers (3) and withdraw the slave cylinder (6) and backing plate (4).

10.3 If the dust cover (5) is not withdrawn with the cylinder, withdraw it from the bell housing.



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- | | | | |
|---|---------------|---|----------------|
| 1 | Bleed valve | 5 | Dust cover |
| 2 | Bolt | 6 | Slave cylinder |
| 3 | Spring washer | 7 | Fluid pipe |
| 4 | Backing plate | | |

Fig 3 Slave cylinder removal/installation

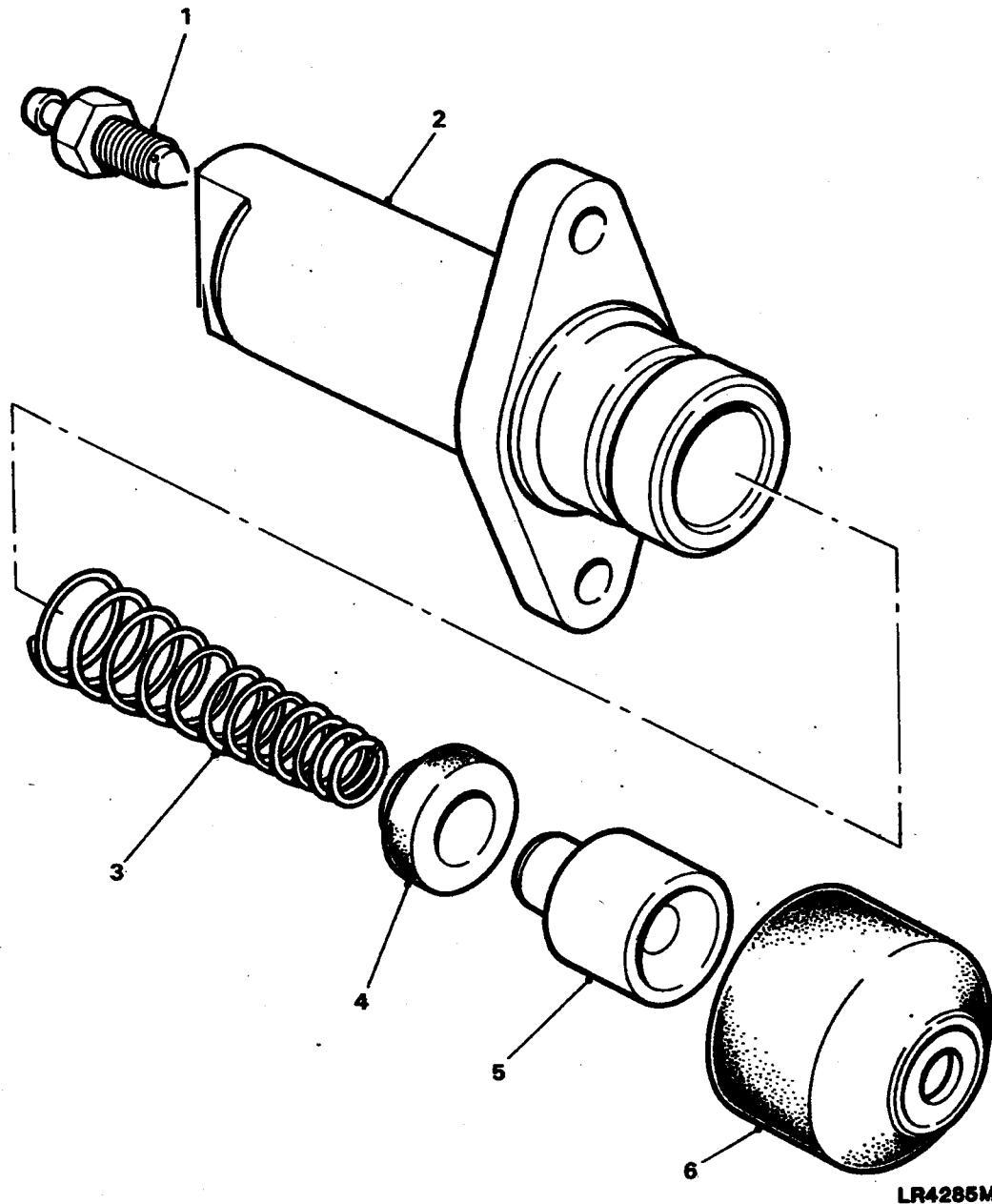
Dismantling

11 Dismantle the slave cylinder as follows:

11.1 Remove the dust cover (Fig 4 (6)).

11.2 Extract the assembled piston (5) and seal (4), applying low pressure air to the fluid inlet if necessary.

11.3 Withdraw the spring (3) from the cylinder body (2).



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- | | | | |
|---|---------------|---|------------|
| 1 | Bleed valve | 4 | Seal |
| 2 | Cylinder body | 5 | Piston |
| 3 | Spring | 6 | Dust cover |

Fig 4 Exploded view of slave cylinder

11.4 Remove the seal from the piston.

11.5 Remove the bleed valve (1) from the cylinder body (2).

Cleaning

12 Thoroughly clean all of the components using new hydraulic fluid and dry off using a lint-free cloth.

Examination

13 Examine the cylinder bore and piston which must be free from corrosion, scores and ridges.

Repairs and replacement

14 Renew the seal and dust cover using the appropriate repair kit.

Reassembly

15 Reassemble the slave cylinder as follows:

Note ...

Cleanliness is essential whilst assembling the slave cylinder, ensure that hands are free from grease or dirt.

15.1 Fit the bleed valve (1), to the cylinder body (2) do not over tighten.

15.2 Lubricate the seals, piston and bore using new hydraulic fluid.

15.3 Fit the seal into the piston groove with the lip of the seal towards the fluid inlet end of the cylinder.

15.4 Locate the conical spring (3), small diameter first, over the front end of the piston (5).

15.5 Fit the assembly, spring first, into the cylinder ensuring that the seal lip does not fold back.

15.6 Fill the dust cover (6) with suitable rubber grease and fit to the cylinder body.

Refitting

16 Refit the slave cylinder as follows:

16.1 Coat both sides of the backing plate (Fig 3 (4)) with Hylomar P232M waterproof jointing compound.

16.2 Locate the backing plate on the cylinder, engage the push-rod through the centre of the dust cover and secure the cylinder to the bell housing, with the bleed screw uppermost.

16.3 Reconnect the fluid pipe.

16.4 Replenish and bleed the hydraulic system (Para 28).

16.5 Check for fluid leaks with the pedal depressed and also with the system at rest.

MASTER CYLINDERRemoval

17 To remove the master cylinder carry out the following:

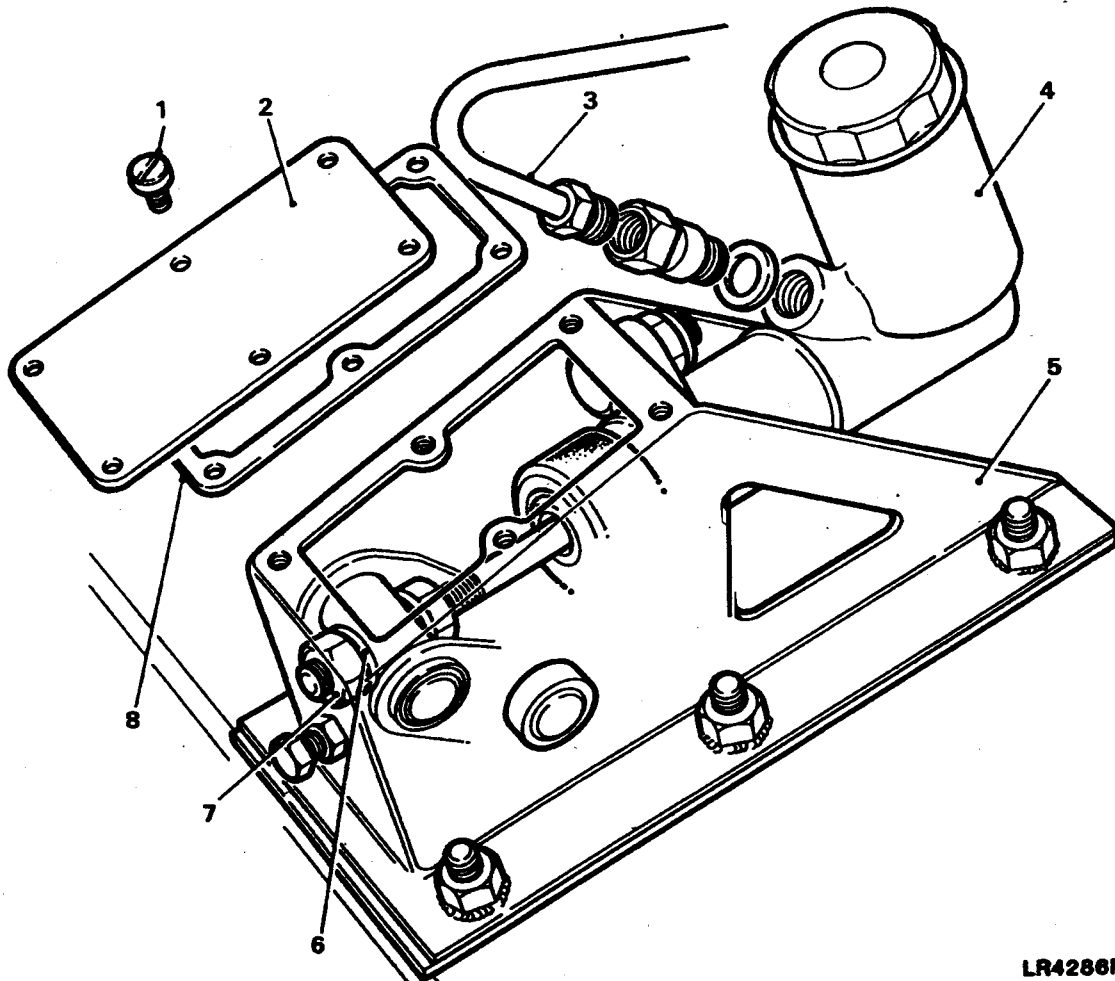
17.1 Drain the hydraulic fluid from the system.

17.2 Disconnect the fluid pipe (Fig 5 (3)) at the master cylinder. Blank off the fluid port and the end of the pipe to prevent the ingress of foreign matter.

17.3 Remove the top cover (2) and gasket (8) from the clutch pedal bracket (5).

17.4 Remove the nut (7) and washer (6) from the end of the master cylinder push-rod and push the rod into the master cylinder to clear the trunnion.

17.5 Remove the master cylinder (4) from the bracket (5).



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- | | | | |
|---|-----------------|---|--------------|
| 1 | Screw | 5 | Bracket |
| 2 | Top cover | 6 | Plain washer |
| 3 | Fluid pipe | 7 | Nut |
| 4 | Master cylinder | 8 | Gasket |

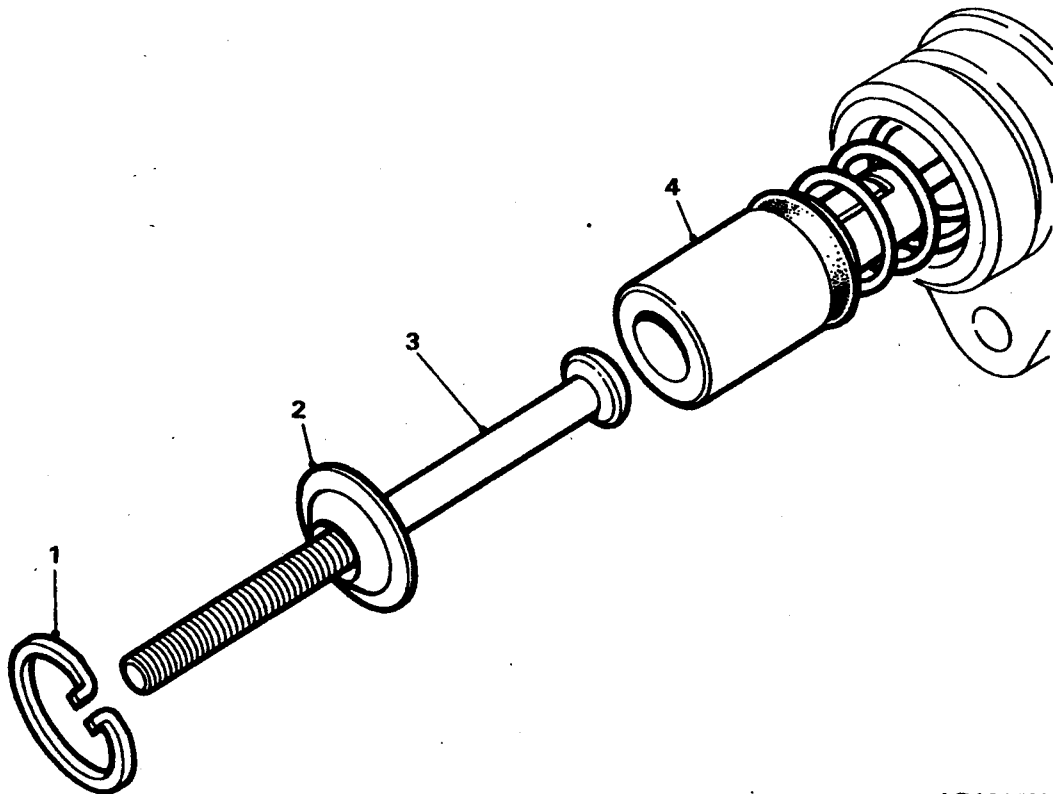
Fig 5 Master cylinder removal

Dismantling

18 Dismantle the master cylinder as follows:

18.1 Remove the circlip (Fig 6 (1)) and withdraw the push-rod (3) and retaining washer (2).

18.2 Withdraw the piston assembly (4). If necessary, apply a low air pressure to the fluid outlet port to expell the piston.



LR4287M

- | | | | |
|---|------------------|---|-----------------|
| 1 | Circlip | 3 | Push-rod |
| 2 | Retaining washer | 4 | Piston assembly |

Fig 6 Push-rod and piston assembly

18.3 Prise the locking prong of the spring retainer clear of the piston shoulder and withdraw the piston (Fig 7).

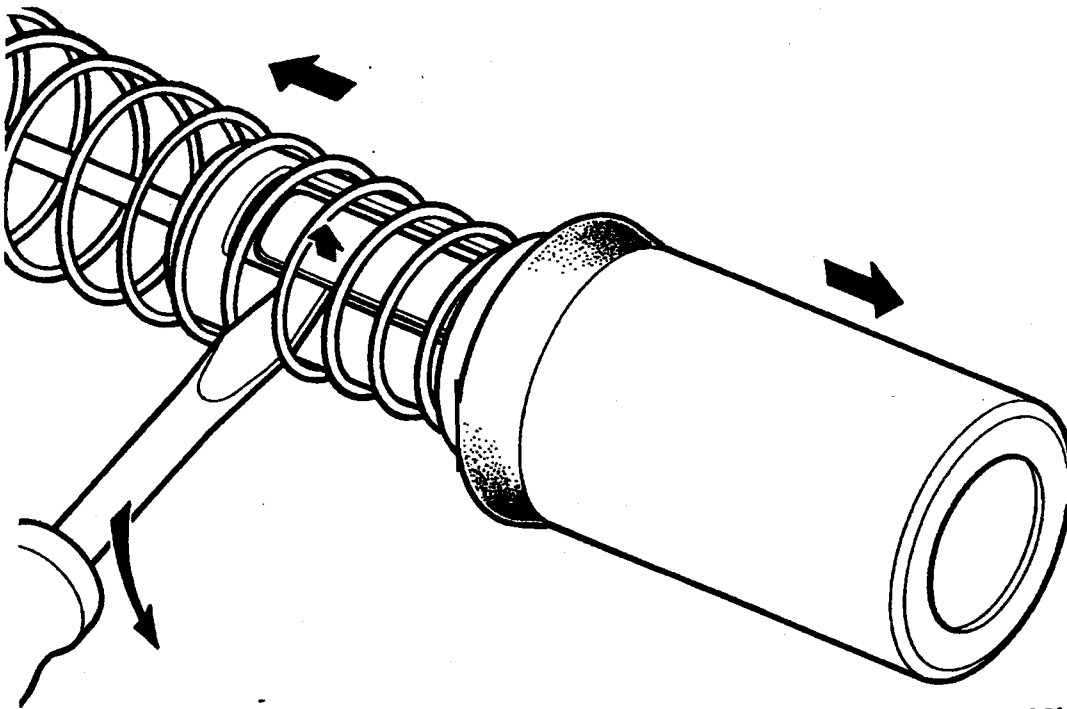
18.4 Remove the seal from the piston.

18.5 Compress the spring (Fig 8 (2)) and position the valve stem (5) to align with the larger hole in the spring retainer (1).

18.6 Withdraw the spring and retainer.

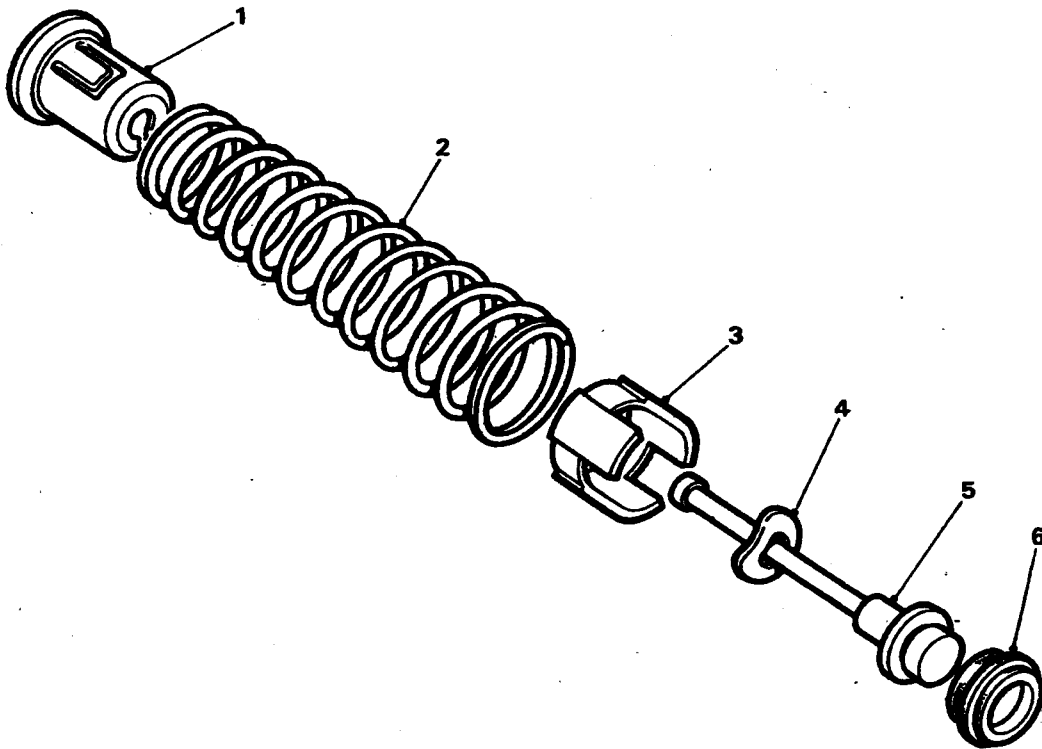
18.7 Withdraw the valve spacer (3) and bowed washer (4) from the valve stem (5).

18.8 Remove the valve seal (6) from the stem.



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Fig 7 Removing piston from spring



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- | | | | |
|---|-----------------|---|--------------|
| 1 | Spring retainer | 4 | Bowed washer |
| 2 | Spring | 5 | Valve stem |
| 3 | Valve spacer | 6 | Valv seal |

Fig 8 Spring and valve assembly

Cleaning

19 Clean all components in clean clutch fluid and allow to dry.

Examination

20 Examine the cylinder bore and piston, ensure that they are smooth to touch and are free from corrosion, score marks or ridges. If there is any doubt fit new replacements.

Repairs and replacement

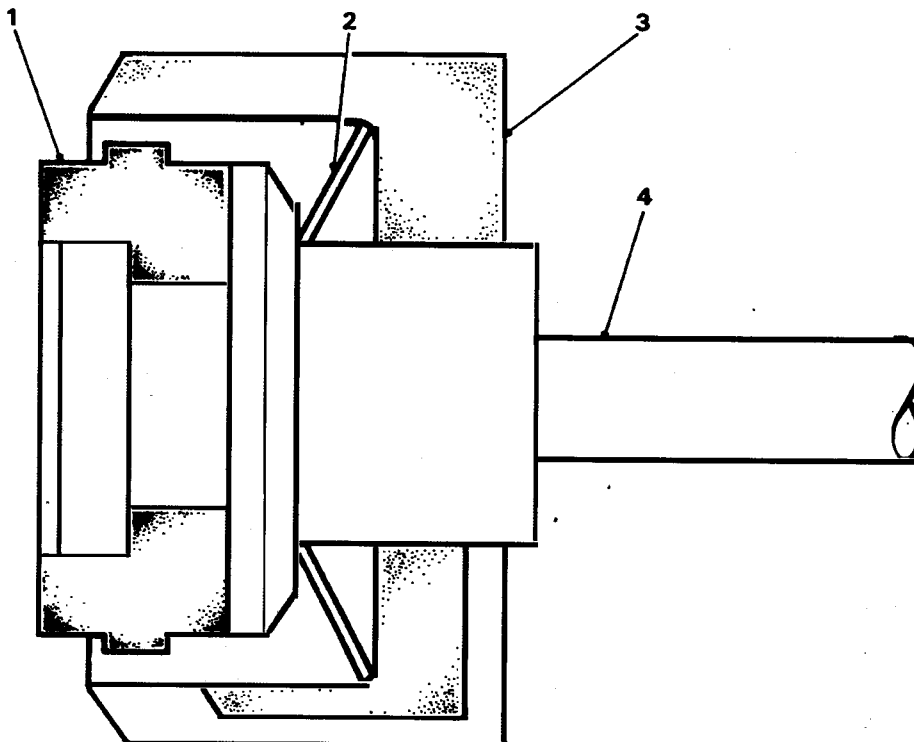
21 The seals should be replaced with new seals from the appropriate master cylinder repair kit (Cat 721).

Reassembly

22 To reassemble the master cylinder proceed as follows:

22.1 Smear the seals with suitable rubber grease and the remaining internal components with clean clutch fluid.

22.3 Fit the new valve seal (Fig 9 (1)), flat side first, on the end of the valve stem (4).



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- | | | | |
|---|--------------|---|--------------|
| 1 | Valve seal | 3 | Valve spacer |
| 2 | Bowed washer | 4 | Valve stem |

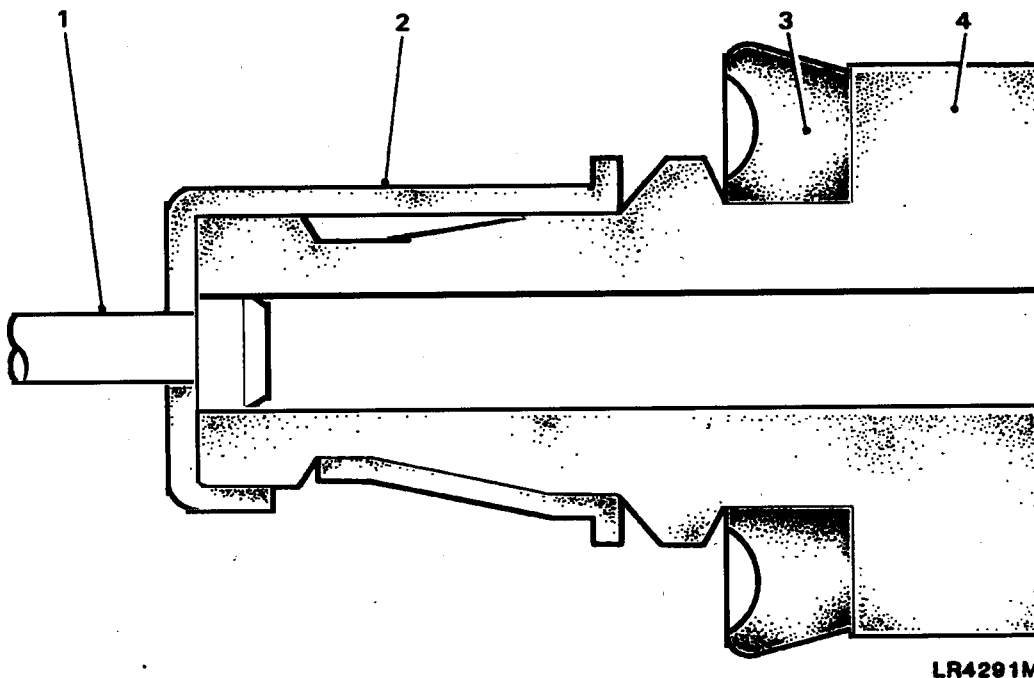
Fig 9 Location of valve seal and bowed washer

- 22.4 Place the bowed washer (2), domed side first, over the small end of the valve stem.
- 22.5 Fit the spacer (3) to the valve stem, legs first.
- 22.6 Insert the retainer (Fig 8 (1)) into the spring (2).
- 22.7 Compress the spring and engage the valve stem in the key hole slot in the retainer.
- 22.8 Fit the new seal, large diameter last, to the piston (Fig 10 (3)).
- 22.9 Insert the piston (4) into the spring retainer (2) and engage the locking prong.
- 22.10 Smear the piston with a suitable rubber grease and insert the assembly, valve end first, into the cylinder.
- 22.11 Fit the push-rod (Fig 6 (3)), retaining washer (2) and circlip (1).

Refitting

23 Refit the master cylinder as follows:

23.1 Fit the master cylinder to the pedal bracket, engaging the cylinder push-rod through the pedal trunnion.



- | | | | |
|---|-----------------|---|-------------|
| 1 | Valve stem | 3 | Piston seal |
| 2 | Spring retainer | 4 | Piston |

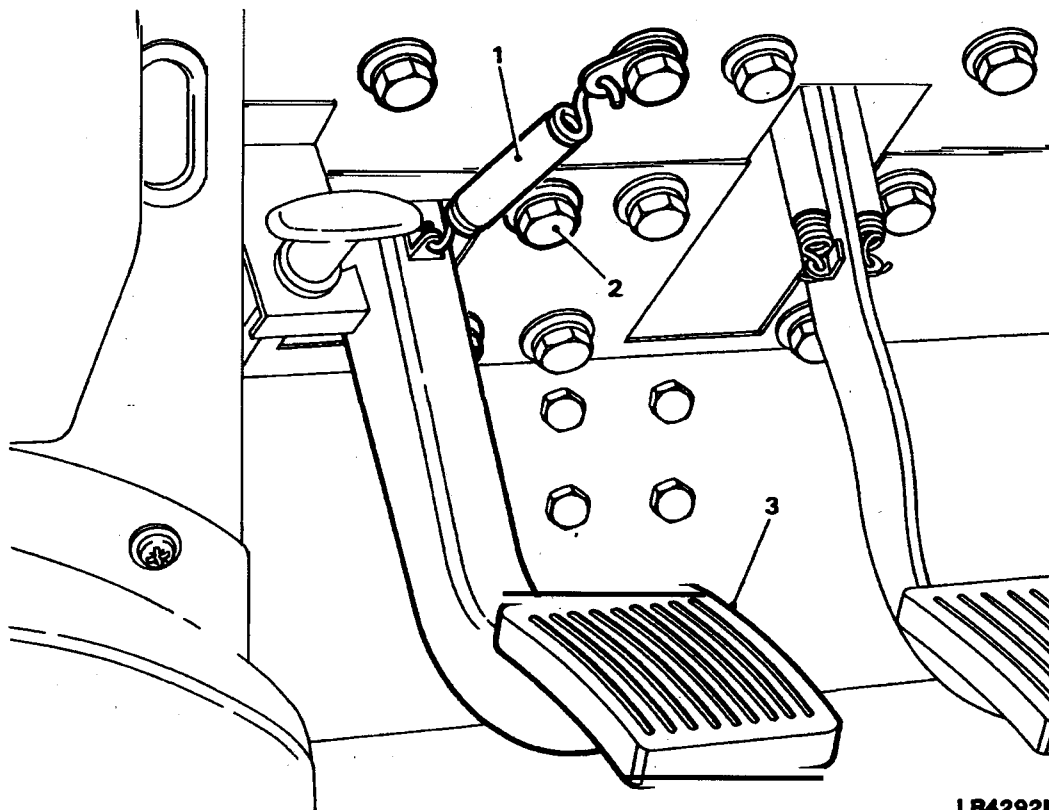
Fig 10 Location of piston seal and spring retainer

- 23.2 Fit the plain washer and nut to the end of the push-rod.
- 23.3 Connect the fluid pipe to the master cylinder.
- 23.4 Bleed the clutch hydraulic system (Para 28).
- 23.5 Carry out the clutch pedal and master cylinder setting procedure (Para 27).

CLUTCH PEDAL

Removal

- 24 To remove the clutch pedal carry out the following:
 - 24.1 Remove the master cylinder from the bracket (Para 17).
 - 24.2 Blank off the fluid port and the end of the pipe to prevent the ingress of foreign matter.
 - 24.3 Disconnect the return spring (Fig 11 (1)) from the clutch pedal (3).
 - 24.4 Remove the fixings (2) securing the clutch pedal bracket.



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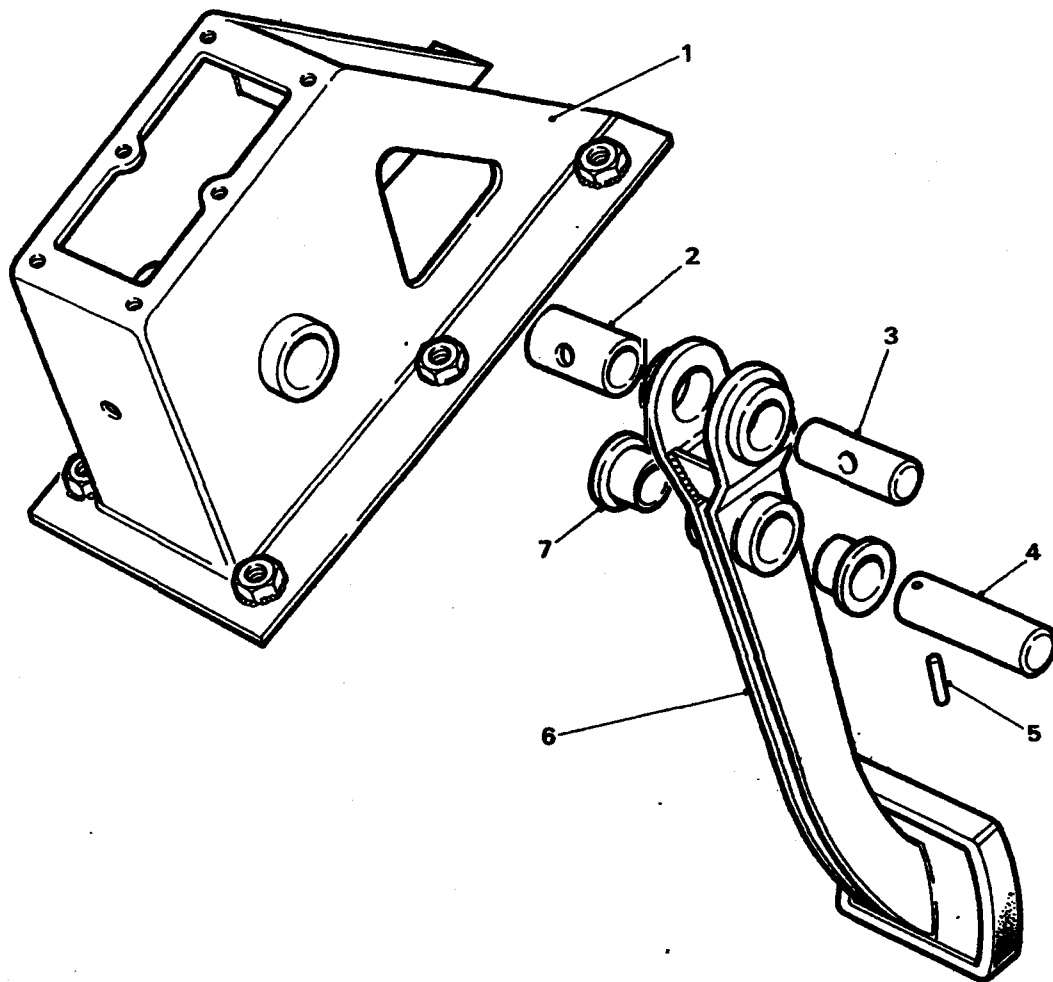
- | | | | | | |
|---|---------------|---|-----------------|---|-------|
| 1 | Return spring | 2 | Bracket fixings | 3 | Pedal |
|---|---------------|---|-----------------|---|-------|

Fig 11 Clutch pedal

24.5 From inside the engine compartment, withdraw the bracket complete with pedal.

24.6 Using a suitable punch, drift out the securing pin (Fig 12 (5)) and withdraw the pedal pivot shaft (4).

24.7 Withdraw the clutch pedal (6) complete with trunnion (3) and bush (2). If necessary remove the trunnion (3), trunnion bush (2) and pivot bushes (7) from the pedal.



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- | | | | |
|---|---------------|---|--------------|
| 1 | Bracket | 5 | Securing pin |
| 2 | Trunnion bush | 6 | Clutch pedal |
| 3 | Trunnion | 7 | Pivot bush |
| 4 | Pivot shaft | | |

Fig 12 Clutch pedal removal/installation

Examination

25 Examine the components for damage and wear, renew as necessary.

Repairs and replacement

26 If it is necessary to fit new pivot bushes to the pedal, after fitment they must be reamed to $15,87 + 0,020$ mm ($0.750 + 0.001$ in).

Refitting

27 Refit the clutch pedal as follows:

27.1 If removed, fit the trunnion bush (2) and trunnion (3) to the clutch pedal (6). Lubricate the trunnion and bush with general purpose grease on assembly.

27.2 Fit the pedal (6) to the bracket (1), insert the pivot shaft (4) and secure with a new pin (5).

27.3 Using a new gasket refit the assembled bracket and pedal to the bulkhead.

27.4 Refit the master cylinder (Para 23).

27.5 Carry out the clutch pedal and master cylinder setting procedure (Para 28).

CLUTCH PEDAL AND MASTER CYLINDER SETTING

28 To set the clutch pedal and master cylinder carry out the following:

28.1 Slacken both locknuts on the master cylinder push-rod.

28.2 Check the distance from the lower edge of the clutch pedal to the floor. The correct distance is 140 mm (5.500 in) without a floor mat (Fig 13).

28.3 Adjust the pedal stop as necessary to obtain the correct distance.

28.4 Adjust the master cylinder push-rod until there is approximately 1,500 mm (0.062 in) free play between the push-rod and the master cylinder piston.

28.5 Tighten both locknuts.

28.6 Check the clutch pedal and ensure that there is a minimum of 6 mm (0.250 in) free movement before pressure is felt. If necessary, readjust the master cylinder push-rod.

28.7 Fit the gasket and top cover to the clutch pedal bracket.

BLEEDING CLUTCH HYDRAULIC SYSTEM

29 To bleed the clutch hydraulic system proceed as follows:

Note ...

During the procedure, keep the fluid reservoir topped-up to avoid introducing air into the system. Use only the recommended fluid (Cat 601).

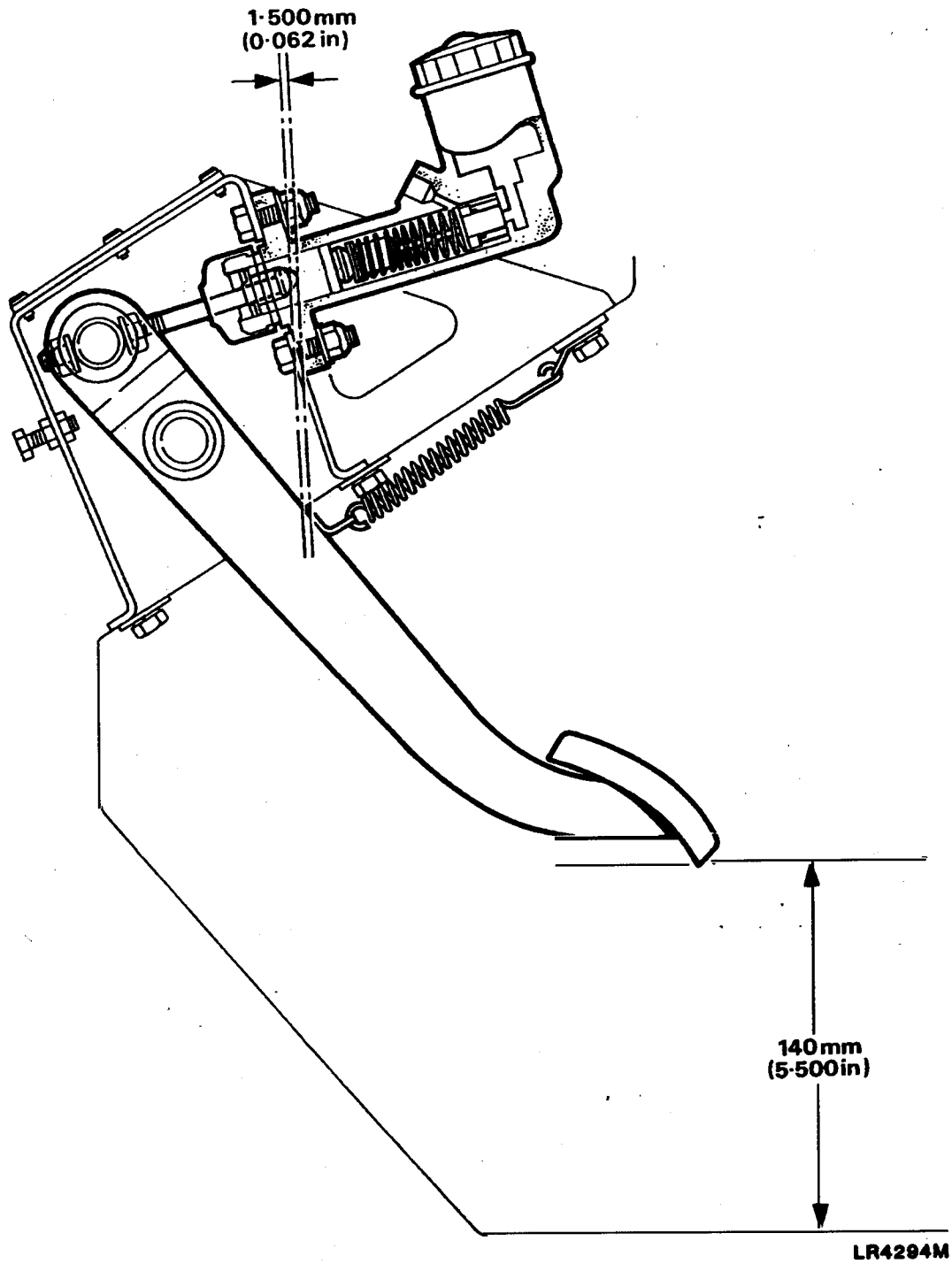


Fig 13 Clutch pedal setting

- 29.1 Attach a length of suitable tubing to the slave cylinder bleed screw.
- 29.2 Place the free end of the tube in a glass jar containing clean clutch fluid.
- 29.3 Slacken the bleed screw.
- 29.4 Pump the clutch pedal, pausing at the end of each stroke, until the fluid issuing from the tubing is free of air with the free end below the surface of the fluid in the jar.
- 29.5 Whilst holding the clutch pedal down and with the free end of the tube below the fluid, tighten the bleed screw.

Chapter 2-2

CLUTCH 3.5 LITRE PETROL 110 AND 127

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INTRODUCTION

1 This Chapter details the Unit and Field repairs for the clutch arrangement fitted to Land Rover 3.5 litre V8 petrol 110 and 127 vehicles.

GENERAL

2 The clutch assembly is of the diaphragm spring type and no overhaul procedures are applicable. Repair is by replacement.

TABLE 1 SPECIAL TOOLS

Ser No (1)	Manufacturers Part No (2)	NSN/Part No where applicable (3)	Designation (4)
1	18G79		Clutch plate mandrel

CLUTCH ASSEMBLYRemoval

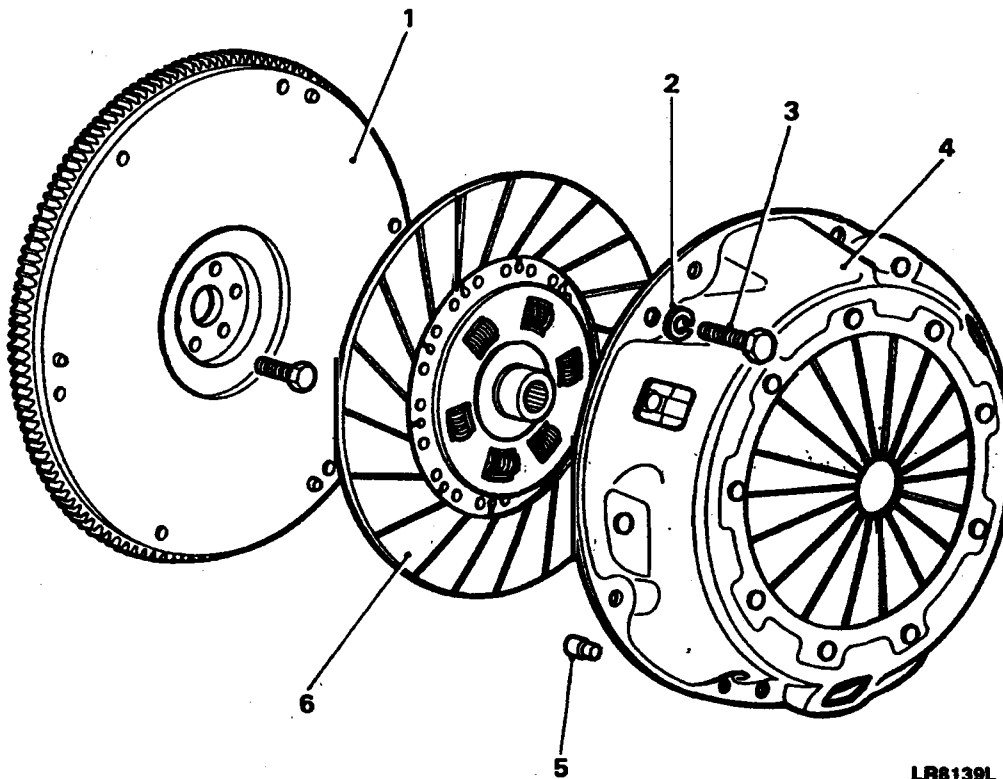
3 To remove the clutch assembly proceed as follows:

3.1 Remove the gearbox assembly (Cat 522 Chap 3-2 or 3-3).

3.2 Mark the clutch cover (Fig 1 (4)) fitted position relative to the flywheel (1), to ensure correct location at reassembly.

3.3 Remove the six bolts (3) and spring washers (2) and withdraw the clutch cover.

3.4 Withdraw the clutch plate (6).



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1 Flywheel
2 Spring washer
3 Bolt

4 Clutch cover
5 Locating dowel
6 Clutch plate

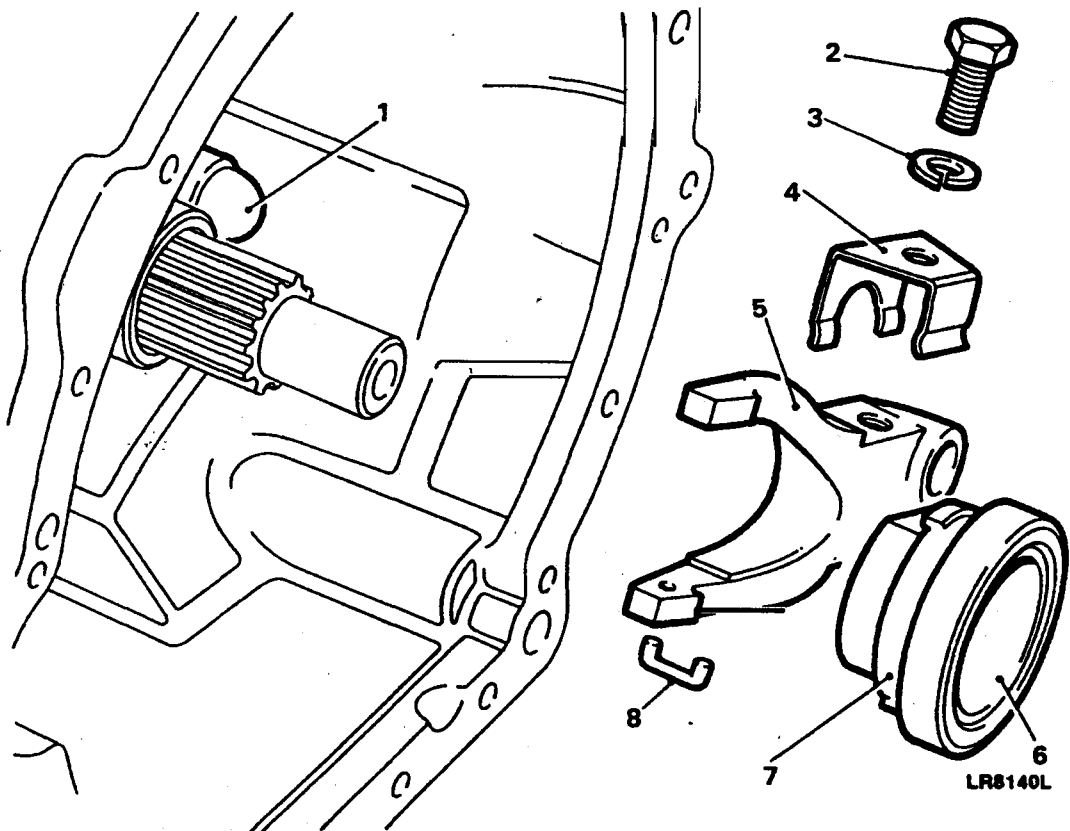
Fig 1 Clutch assembly

Examination

- 4 To examine the clutch components proceed as follows:
- 4.1 Check the clutch cover diaphragm spring fingers for wear and the pressure plate for signs of wear cracks or burning.
- 4.2 Check the driven plate for worn, burned or contaminated linings and the centre hub spline for wear.

Reassembly

- 5 To reassemble the clutch assembly proceed as follows:
- 5.1 Locate the clutch plate (Fig 1 (6)) with the side marked 'Flywheel' towards the flywheel (1).
- 5.2 Fit the clutch cover (4), using special tool Serial No 1 (Table 1) ensuring alignment of dowels (5) and the marks made during dismantling. Secure the assembly with the six bolts (3) and spring washers (2) tightening the bolts diagonally to the correct torque.



- | | |
|-----------------|----------------------------|
| 1 Pivot | 5 Release lever |
| 2 Bolt | 6 Release bearing sleeve |
| 3 Spring washer | 7 Release bearing assembly |
| 4 Spring clip | 8 Retaining staple |

Fig 2 Clutch release mechanism

RELEASE MECHANISMDismantling

- 6 To dismantle the release mechanism proceed as follows:
- 6.1 Remove the clutch slave cylinder from the bell housing (Cat 522 Chap 2-1).
 - 6.2 Withdraw the retaining staple (Fig 2 (8)).
 - 6.3 Remove the release bearing assembly (7).
 - 6.4 Remove the spring clip retaining bolt (2) spring washer (3) and spring clip (4).
 - 6.5 Withdraw the release lever (5).

Cleaning

Thoroughly clean all the components of the release mechanism.

Examination

- 8 Examine all the components for wear or damage paying particular attention to the condition of the release bearing assembly.

Reassembly

- 9 To reassemble the release mechanism proceed as follows:
- 9.1 Smear the pivot (Fig 2 (1)) with grease and fit the release lever (5) and retain with the spring clip (4) bolt (2) and spring washer (3).
 - 9.2 Smear the release bearing sleeve inner diameter (6) with Molybdenum disulphide base grease.
 - 9.3 Fit the release bearing assembly (7) and retain with the staple (8). The staple is to aid assembly and has no other purpose. It may become dislodged in service, without detriment.
 - 9.4 Fit the slave cylinder (Cat 522 Chap 2-1).

SLAVE CYLINDER

- 10 For slave cylinder Unit and Field repair procedures refer to Cat 522 Chap 2-1.

MASTER CYLINDER

- 11 For master cylinder Unit and Field repair procedures refer to Cat 522 Chap 2-1.

CLUTCH PEDAL

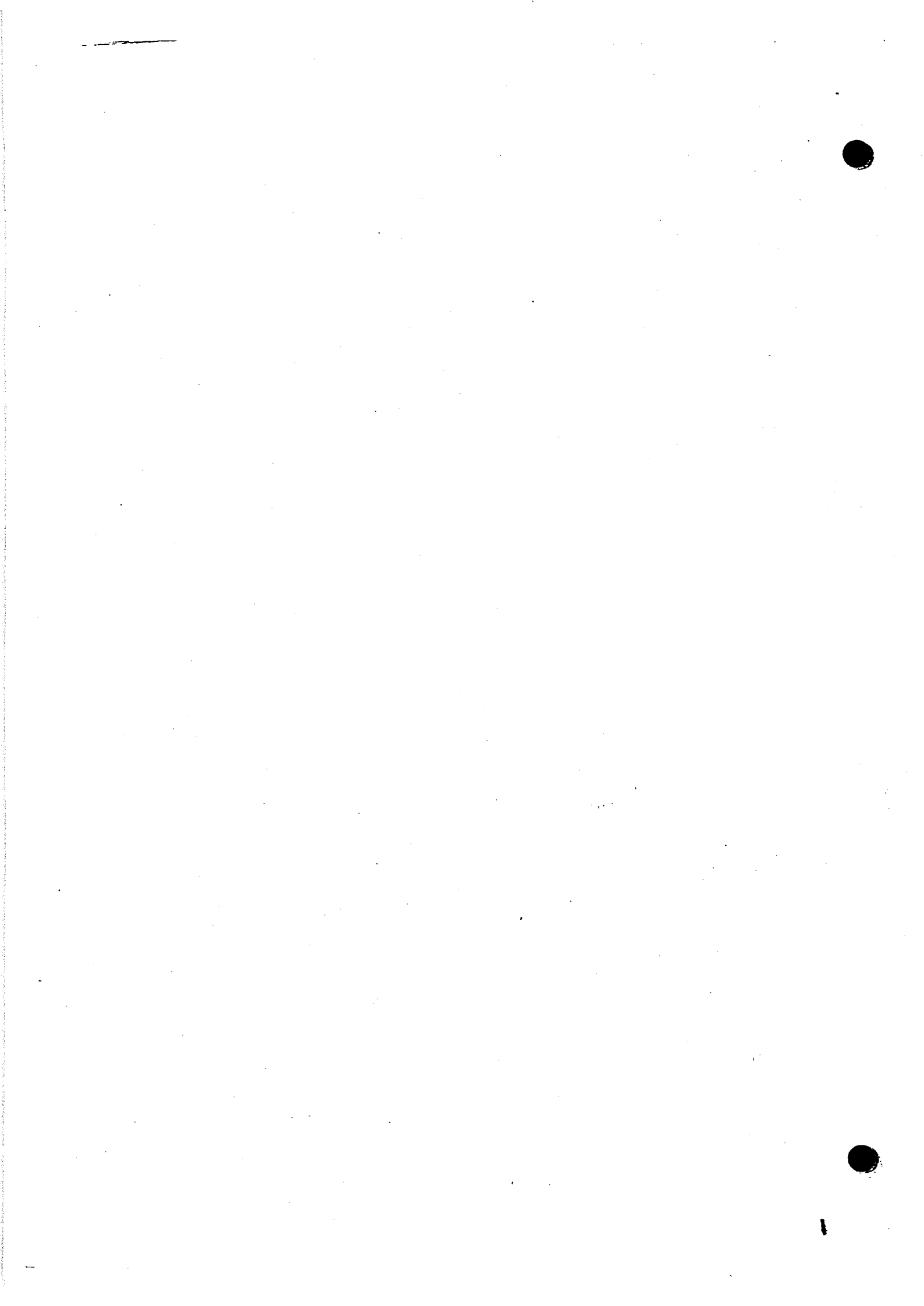
12 For clutch pedal Unit and Field repair procedures refer to Cat 522 Chap 2-1.

CLUTCH PEDAL AND MASTER CYLINDER SETTING

13 For clutch pedal and master cylinder setting refer to Cat 522 Chap 2-1.

BLEEDING CLUTCH HYDRAULIC SYSTEM

14 For bleeding clutch hydraulic system refer to Cat 522 Chap 2-1.



Chapter 3-1

LT77 FIVE SPEED MANUAL GEARBOX

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INTRODUCTION

1 This Chapter details the Unit and Field Repairs for the Land Rover LT77 Five Speed Manual Gearbox.

GENERAL

2 Removal of the gearbox from the vehicle also entails the removal of the LT 230T Transfer Box which is mounted on the rear of the gearbox.

Special tools

3 No special tools are required to carry out the removal but, a locally manufactured cradle (Fig 1) is necessary to support the units during removal.

REMOVAL

4 To remove the units from the vehicle carry out the following:

4.1 Install the vehicle on a ramp.

4.2 Disconnect the battery leads and on 12/24 volt vehicles the leads from the radio batteries.

4.3 Remove the knobs from the transfer and differential lock lever and from the main gearchange lever.

4.4 Remove the gear lever cover.

4.5 Remove the 10 mm nyloc nut and plain washer securing the gearchange lever, mark the gear lever spline setting and detach the lever and gaiter from the splined lower gear lever.

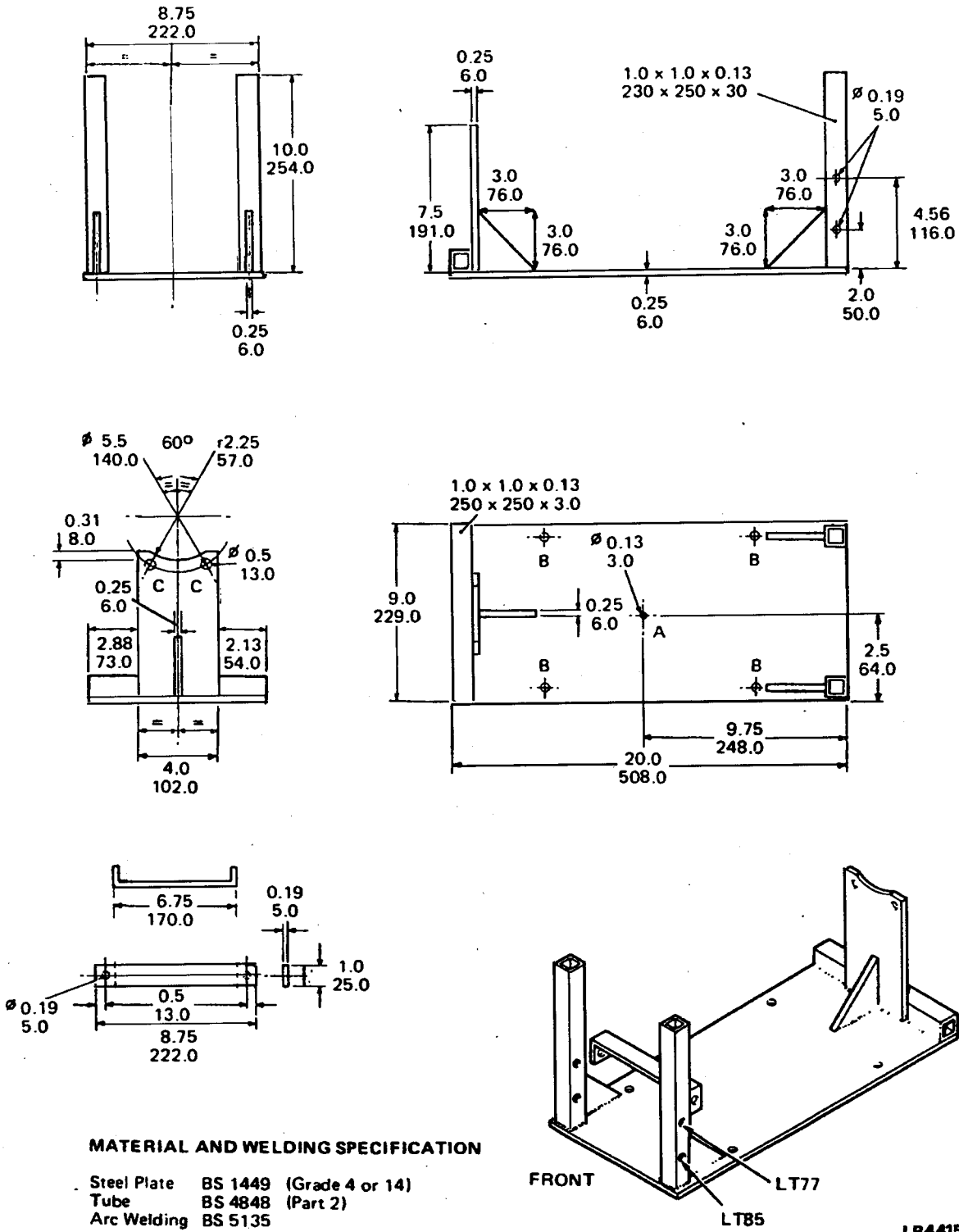


Fig 1 Locally manufactured cradle

- 4.6 Select high range on the transfer gearbox lever to prevent the lever from fouling the tunnel when removing the gearbox.
- 4.7 Remove the spare wheel and vehicle bonnet.
- 4.8 Remove the nuts and bolts retaining the fan cowl to the engine and move the cowling forward, clear of the engine.
- 4.9 Release the transmission breather pipes, speedometer cable and starter motor harness from the clips at the rear of the engine.
- 4.10 Release clamp holding heater pipes on top of engine to prevent heater inlet pipe fouling bulkhead.
- 4.11 Raise the vehicle on the ramp.
- 4.12 Remove the eight bolts securing the chassis cross member and using a suitable means of spreading the chassis, remove the cross member.
- 4.13 Place a container of suitable capacity under the transmission, remove the drain plugs from the main gear casing, extension case and transfer gearbox, allow the oil to drain and refit the plugs.
- 4.14 Remove the intermediate exhaust pipe and silencer section as follows:
 - 4.14.1 Release the connection to the front pipe at the flange .
 - 4.14.2 Release the connection to the rear section at the flange immediately behind the silencer.
 - 4.14.3 Remove the 'U' bolt retaining the pipe to the bracket attached to the transfer box.
- 4.15 Mark the flanges to aid reassembly and disconnect the front propeller shaft from the transfer box.
- 4.16 Similarly, disconnect the rear propeller shaft.
- 4.17 Disconnect the speedometer cable from the rear of the transfer box.
- 4.18 Disconnect the handbrake inner cable by removing the split pin and clevis pin.
- 4.19 Slacken the retaining nuts and release the handbrake outer cable from the bracket.
- 4.20 Remove the two bolts and withdraw the clutch slave cylinder from the bell housing.
- 4.21 Secure the locally manufactured cradle (Fig 1) to a suitable hydraulic transmission hoist. Remove the bottom two bolts from the transfer box rear cover, raise the hoist and secure the rear end of the cradle to the transfer box with the two bolts.
- 4.22 Raise the hoist just sufficiently to take the weight of the transmission.
- 4.23 Remove the three nuts and bolts securing the transfer box LH and RH mounting brackets to the chassis.

- 4.24 Remove the nuts retaining the brackets to the mounting rubbers and withdraw the brackets.
- 4.25 Lower the hoist sufficiently to allow the transfer lever to clear the transmission tunnel aperture.
- 4.26 Disconnect the locked four wheel drive indicator electrical lead (bullet connection) and the reverse light lead.
- 4.27 Support the engine under the sump with a jack, placing timber between the jack pad and sump.
- 4.28 Remove the eleven bell housing nuts, ensure all connections are released and withdraw the transmission from the vehicle.

Separating transfer gearbox from main gearbox

- 5 To separate the transfer box from the gearbox proceed as follows:
 - 5.1 Remove the transmission assembly from the hoist and cradle and install it safely on a bench.
 - 5.2 Remove the four bolts securing the transfer gear change housing to the remote gear change housing.
 - 5.3 Remove the two bolts retaining the cross shaft lever pivot bracket to the extension housing.
 - 5.4 Remove the breather pipes.
 - 5.5 Disconnect the cranked lever from the differential lock lever.
 - 5.6 Place a suitable sling round the transfer box and attach to a hoist.
 - 5.7 Remove the two nuts and four bolts securing the transfer box to the extension casing and withdraw the transfer box.

REFITTING

- 6 Before refitting the gearbox to the vehicle the transfer gearbox must be refitted to the gearbox.

Fitting transfer gearbox to main gearbox

- 7 To fit the transfer box to the main gearbox carry out the following:
 - 7.1 Using a suitable hoist and sling and ensuring that the loose upper dowel is fitted assemble the transfer box to the main gearbox extension casing and secure with the four bolts and two nuts. Tighten the bolts and nuts to a torque of 40 - 50 Nm (29 - 37 lbf ft).
 - 7.2 Fit the transfer selector housing to the main gearbox remote gear change housing with the four bolts, noting that the right hand rear location is fitted with the longer bolt. Tighten the bolts to a torque of 22 - 28 Nm (16 - 21 lbf ft).
 - 7.3 Fit the breather pipes and tighten the banjo bolts to a torque of 14 - 16 Nm (10 - 12 lbf ft).

7.4 Fit the differential lock cross shaft lever pivot bracket to the extension casing with the two bolts. Tighten the bolts to a torque of 22 - 28 Nm (16 - 21 lbf ft).

7.5 Connect the cranked lever to the differential lock lever with a new split pin.

Fitting main gearbox and transfer gearbox to engine

8 To fit the assembled main and transfer gearboxes to the engine carry out the following:

8.1 Fit the locally manufactured cradle (Fig 1) to a suitable hydraulic hoist and secure the transmission assembly to the cradle.

8.2 Smear Hylomar PL 32 on the bell housing face mating with the engine.

8.3 Temporarily fit the gear lever and select any gear in the main gearbox to facilitate entry of the primary shaft.

8.4 Position the hoist under the vehicle and raise to locate the bell housing face with the engine, ensuring that any adjacent pipes or cables are not trapped.

8.5 Secure the transmission to the engine at the bell housing with the eleven nuts, noting that the top right hand nut also retains the speedometer cable clip. Tighten the nuts to a torque of 45 - 50 Nm (29 - 33 lbf ft).

8.6 Connect the differential lock indicator lead (bullet connection).

8.7 Raise the transmission to line up with the engine ensuring that the transfer lever clears the tunnel aperture.

8.8 Fit the transfer box LH and RH mounting brackets to the chassis and loosely secure with the nuts and bolts.

8.9 Loosely fit the rubber mountings and lower the transmission onto the mountings. Tighten the bracket to chassis securing nuts and bolts to a torque of 24 - 29 Nm (18 - 21 lbf ft) and the mounting rubber securing nuts to a torque of 48 - 58 Nm (35 - 42 lbf ft).

8.10 Remove the supporting jack from under the engine sump.

8.11 Remove the two bolts securing the cradle to the transfer box and remove the cradle and hoist. Refit the bolts to the transfer box using Loctite 290 on the threads and fitting the clip for the speedometer cable under the head of the left hand bolt. Tighten the bolts to a torque of 40 - 50 Nm (29 - 37 lbf ft).

8.12 Fit the slave cylinder using Hylosil on the gasket and tighten the bolts evenly to a torque of 22 - 28 Nm (16 - 21 lbf ft).

8.13 Fit the hand brake cable using a new split pin to secure the clevis pin. Grease the clevis and tighten the outer cable locknuts.

8.14 Connect the speedometer cable.

8.15 Check that the drain plugs in the main casing, extension casing and transfer box are fitted and tightened to a torque of 25 - 35 Nm (19 - 26 lbf ft).

8.16 Remove the filler level plug from the main gearbox and fill with the recommended oil (Cat 601) until it begins to run from the filler level plug hole. Apply Hylosil to the threads of the filler plug, then fit and tighten to a torque of 25 - 35 Nm (19 - 26 lbf ft).

8.17 Remove the transfer box filler level plug and fill the transfer box with the recommended oil (Cat 601) until it runs from the filler level plug hole. Apply Hylosil to the threads of the filler plug, then fit and tighten to a torque of 25 - 35 Nm (19 - 26 lbf ft).

8.18 Wipe away surplus oil from the casings.

8.19 Line up the marks (made during removal) and fit the front and rear propeller shafts to the transfer box. Tighten the bolts to a torque of 43 - 51 Nm (32 - 38 lbf ft).

8.20 Fit the exhaust system, and evenly tighten the flange nuts and bolts. Fit the 'U' bolt and secure to the bracket.

8.21 Expand the chassis side members, fit the cross member and secure with the eight nuts and bolts.

8.22 Fit the heater clamp pipe.

8.23 Clip the breather pipes, speedometer cable and starter motor harness to the rear of the engine.

8.24 Correctly position and secure the fan cowl.

8.25 Fit the vehicle bonnet and spare wheel.

8.26 Fit the main gear lever gaiter and lever to the previously marked spline setting, secure with a new 10 mm 'Nyloc' nut and washer, tighten the nut to a torque of 40 - 47 Nm (30 - 35 lbf ft).

8.27 Fit the cover to both gear levers and fit the gear lever knobs.

8.28 Connect the vehicle battery and on 12/24 volt vehicles the radio batteries.

Chapter 3-2

LT85 FIVE SPEED MANUAL GEARBOX

CONTENTS

Frame	Para
	1 Introduction
	2 General
	3 Special tools
	4 Removal
	5 Separating transfer gearbox from main gearbox
	6 Refitting
	7 Fitting transfer gearbox to main gearbox
	8 Fitting assembled main gearbox and transfer gearbox to engine

INTRODUCTION

1 This Chapter details the Unit and Field repair procedures for the LT85 Five speed manual gearbox fitted to Land Rover 127 vehicles.

GENERAL

2 Removal of the gearbox from the vehicle also entails the removal of the LT230T Transfer box which is mounted on the rear of the gearbox.

Special tools

3 No special tools are required to carry out removal, although a locally manufactured cradle is necessary to support the units during removal. Refer to Cat 522 Chap 3-1 Fig 1.

REMOVAL

4 To remove the units from the vehicle proceed as follows:

Note ...

It may be necessary to remove the transmission brake drum to allow removal of the gearbox assembly.

4.1 Install the vehicle on a ramp.

4.2 Disconnect the engine battery leads and on 12/24 volt vehicles the leads from the radio batteries.

4.3 Remove the knobs from the transfer and differential lock lever and from the main gearchange lever.

4.4 Remove the gear lever cover.

4.5 Remove the 10 mm Nyloc nut and plain washer securing the gearchange lever, mark the gear lever spline setting and detach the lever and gaiter from the splined lower gear lever.

- 4.6 Remove the high/low selector housing from the transfer box.
- 4.7 Remove the spare wheel and vehicle bonnet.
- 4.8 Remove the engine air cleaner.
- 4.9 Release the transmission breather pipes, speedometer cable and starter motor harness from the clips at the rear of the engine.
- 4.10 Release clamp holding heater pipes on top of engine to prevent heater inlet pipe fouling bulkhead.
- 4.11 Raise the vehicle ramp.
- 4.12 Remove the eight bolts securing the chassis cross member and using a suitable means of spreading the chassis, remove the cross member.
- 4.13 Place a container of suitable capacity under the transmission, remove the drain plugs from the main gear casing, extension case and transfer gearbox, allow the oil to drain and refit the plugs. Clean the filter on the extension housing plug before refitting.
- 4.14 Remove the intermediate exhaust pipe and silencer section as follows:
 - 4.14.1 Release the connection to the front pipe at the flange.
 - 4.14.2 Release the connection to the rear section at the flange immediately behind the silencer.
 - 4.14.3 Remove the 'U' bolt retaining the pipe to the bracket attached to the transfer box.
- 4.15 Mark the flanges to aid reassembly and disconnect the rear propeller shaft from the transfer box.
- 4.16 Similarly, disconnect the rear propeller shaft.
- 4.17 Disconnect the speedometer cable from the rear of the transfer box.
- 4.18 Disconnect the handbrake inner cable by removing the split pin and clevis pin.
- 4.19 Slacken the retaining nuts and release the handbrake outer cable from the bracket.
- 4.20 Remove the two bolts and withdraw the clutch slave cylinder from the bell housing.

4.21 Secure the locally manufactured cradle (Cat 522 Chap 3-1 Fig 1) to a suitable hydraulic transmission hoist. Remove the bottom two bolts from the transfer box rear cover, raise the hoist and secure the rear end of the cradle to the transfer box with two bolts.

4.22 Raise the hoist just sufficiently to take the weight of the transmission.

4.23 Remove the three nuts and bolts securing the transfer box l.h. and r.h. mounting brackets to the chassis.

4.24 Remove the nuts retaining the brackets to the mounting rubbers and withdraw the brackets.

4.25 Disconnect the locked four wheel drive indicator electrical lead (bullet connection).

4.26 Support the engine under the sump with a jack, placing timber between the jack pad and sump.

4.27 Remove the eleven bell housing nuts, ensure all connections are released and withdraw the transmission from the vehicle.

Separating transfer gearbox from main gearbox

5 For separating transfer gearbox from main gearbox proceed as follows:

5.1 Remove the transmission assembly from the hoist and cradle and install it safely on a bench.

5.2 Remove the two bolts retaining the cross shaft lever pivot bracket to the extension housing.

5.3 Remove the breather pipes.

5.4 Disconnect the cranked lever from the differential lock lever.

5.5 Place a suitable sling around the transfer box and attach to a hoist.

5.6 Remove the two nuts and four bolts securing the transfer box to the extension casing and withdraw the transfer box.

REFITTING

6 Before refitting the gearbox to the vehicle the transfer gearbox must be fitted to the main gearbox.

Fitting transfer gearbox to main gearbox.

7 To fit the transfer box to the main gearbox proceed as follows:

- 7.1 Using a suitable hoist and sling and ensuring that the loose upper dowel is fitted, assemble the transfer box to the main gearbox extension casing and secure with the four bolts and two nuts. Tighten the bolts and nuts to a torque of 40 - 50 Nm (29 - 37 lbf ft).
- 7.2 Fit the breather pipes and tighten the banjo bolts to a torque of 14 - 16 Nm (10 - 12 lbf ft).
- 7.3 Fit the differential lock cross shaft lever pivot bracket to the extension casing with the two bolts. Tighten the bolts to a torque of 22 - 28 Nm (16 - 21 lbf ft).
- 7.4 Connect the cranked lever to the differential lock lever with a new split pin.

Fitting assembled main gearbox and transfer gearbox to engine

8 To fit the assembled main gearbox and transfer gearbox to the engine proceed as follows:

- 8.1 Fit the locally manufactured cradle (Cat 522 Chap 3-1 Fig 1) to a suitable hydraulic hoist and secure the transmission assembly to the cradle.
- 8.2 Smear Hylomar PL32 on the bell housing face mating with the engine.
- 8.3 Temporarily fit the gear lever and select any gear in the main gearbox to facilitate entry of the primary shaft.
- 8.4 Position the hoist under the vehicle and raise to locate the bell housing face with the engine, ensuring that any adjacent pipes or cables are not trapped.
- 8.5 Secure the transmission to the engine at the bell housing with the eleven nuts, noting that the top right hand nut also retains the speedometer cable clip. Tighten the nuts to a torque of 45 - 50 Nm (29 - 33 lbf ft).
- 8.6 Connect the differential lock indicator lead (bullet connection).
- 8.7 Raise the transmission to line up with the engine.
- 8.8 Fit the transfer box LH and RH mounting brackets to the chassis and loosely secure with nuts and bolts.
- 8.9 Loosely fit the rubber mountings and lower the transmission onto the mountings. Tighten the bracket to chassis securing nuts and bolts to a torque of 24 - 29 Nm (18 - 21 lbf ft) and the mounting rubber securing nuts to a torque of 48 - 58 Nm (35 - 42 lbf ft).

- 8.10 Remove the supporting jack from under the engine sump.
- 8.11 Remove the two bolts securing the cradle to the transfer box and remove the cradle and hoist. Refit the bolts to the transfer box using Loctite 290 on the threads, fitting the clip for the speedometer cable under the head of the left hand bolt. Tighten the bolts to a torque of 40 - 50 Nm (29 - 37 lbf ft).
- 8.12 Fit the slave cylinder using Hylosil on the gasket and tighten the bolts evenly to a torque of 22 - 28 Nm (16 - 21 lbf ft).
- 8.13 Fit the hand brake cable using a new split pin to secure the clevis pin. Grease the clevis and tighten the outer cable locknuts.
- 8.14 Connect the speedometer cable.
- 8.15 Check that the drain plugs in the main casing, extension casing and transfer box are fitted and tightened to a torque of 25 - 35 Nm (19 - 26 lbf ft).
- 8.16 Remove the filler level plug from the main gearbox and fill with the recommended oil (Cat 601) until it begins to run from the filler level plug hole. Apply Hylosil to the threads of the filler plug, fit and tighten to a torque of 25 - 35 Nm (19 - 26 lbf ft).
- 8.17 Remove the filler level plug from the transfer box and fill with the recommended oil (Cat 601) until it begins to run from the filler level plug hole. Apply Hylosil to the threads of the filler plug, fit and tighten to a torque of 25 - 35 Nm (19 - 26 lbf ft).
- 8.18 Wipe away surplus oil from the casings.
- 8.19 Line up the marks (made during removal) and fit the front and rear propeller shafts to the transfer box. Tighten the bolts to a torque of 43 - 51 Nm (32 - 38 lbf ft).
- 8.20 Fit the exhaust system, and evenly tighten the flange nuts and bolts. Fit the 'U' bolt and secure to the bracket.
- 8.21 Expand the chassis side members, fit the cross member and secure with the eight nuts and bolts.
- 8.22 Fit the heater clamp pipe.
- 8.23 Clip the breather pipes, speedometer cable and starter motor harness to the rear of the engine.
- 8.24 Fit the engine air cleaner.
- 8.25 Fit the vehicle bonnet and spare wheel.
- 8.26 Fit the high/low selector housing to the transfer box.

8.27 Fit the main gear lever gaiter and lever to the previously marked spline setting, secure with a new 10 mm Nyloc nut and plain washer, and tighten to a torque of 40 - 47 Nm (30 - 35 lbf ft).

8.28 Fit the cover to both gear levers and fit the gear lever knobs.

8.29 Connect the vehicle battery and on 12/24 volt vehicles the radio batteries.

Chapter 3-3

LT85 LIGHTWEIGHT DIVIDED-CASE MANUAL GEARBOX

CONTENTS

Frame	Para
	1 Introduction
	2 General
	5 Special tools

INTRODUCTION

1 This Chapter details the Unit and Field repair procedures for the LT85 Lightweight divided-case manual gearbox fitted to Land Rover 110 vehicles.

GENERAL

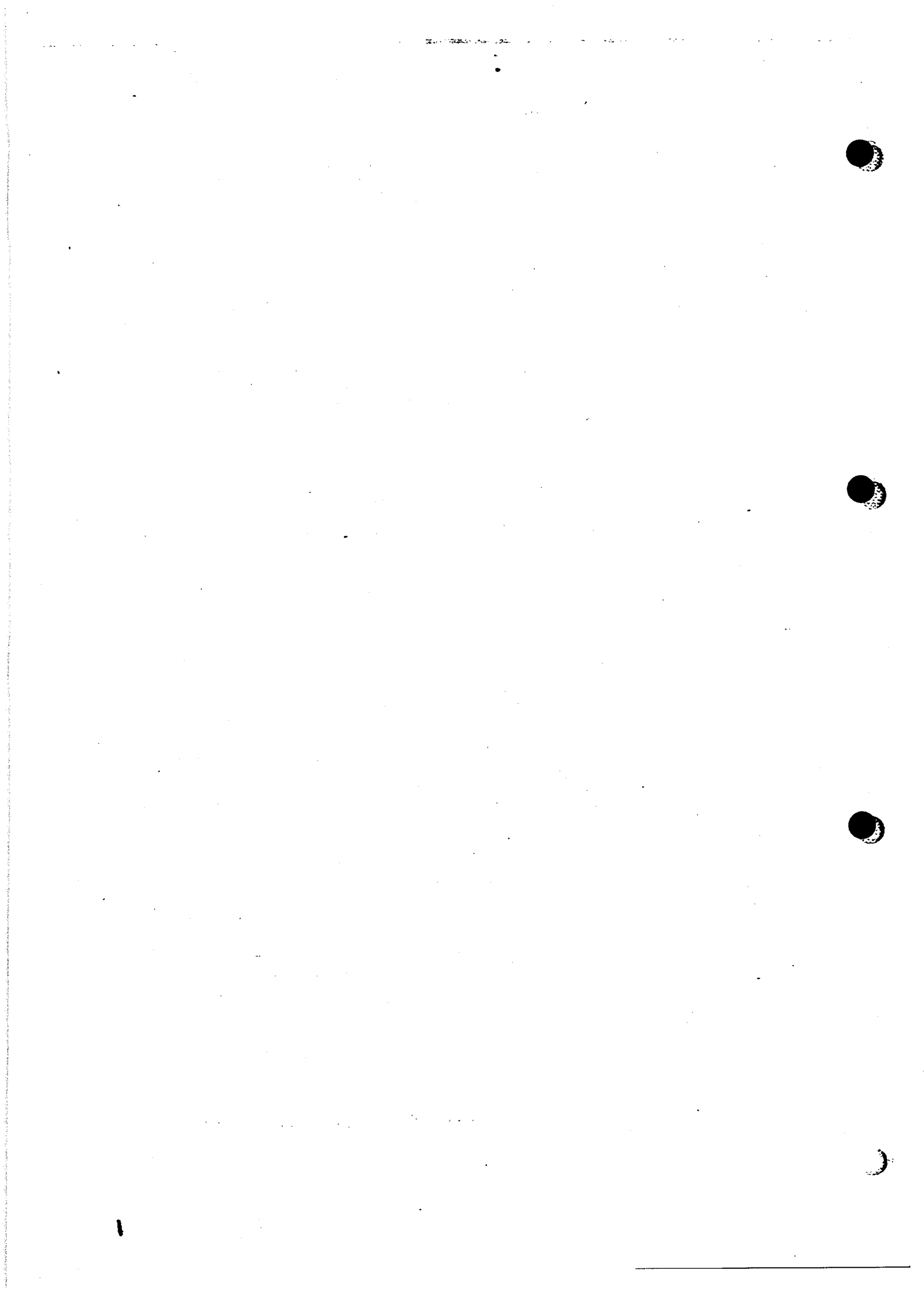
2 Removal of the gearbox from the vehicle also entails the removal of the LT230T Transfer box which is mounted on the rear of the gearbox.

3 For removal/refitting of the assembled main gearbox and transfer gearbox refer to Cat 522 Chap 3-2.

4 For the separation/assembly of the transfer gearbox and main gearbox refer to Cat 522 Chap 3-2.

Special tools

5 No special tools are required to carry out removal, although a locally manufactured cradle is necessary to support the units during removal. Refer to Cat 522 Chap 3-1 Fig 1.



Chapter 4

TRANSMISSION

LT230T TRANSFER BOX AND PROPELLER SHAFTS

CONTENTS

Frame Para

- 1 Introduction
- 2 General
- 3 Removal
- 4 Refitting
- 5 Propeller shafts

Table

- 1 Special tools

Page

1

Fig

- 1 Adaptor plate
- 2 Linkage disconnection points

2

3

INTRODUCTION

1 This Chapter covers the unit and field repairs for the Land Rover LT230T Transfer Gearbox and propeller shafts as fitted to Land Rover 90 and 110 vehicles having 2.5 litre diesel engines.

General

2 The transfer gearbox should be removed from underneath the vehicle, using a suitable hydraulic hoist, and a locally manufactured adaptor plate (Fig 1) for locating the transfer gearbox onto the hoist.

TABLE 1 SPECIAL TOOLS

Ser No (1)	Manufacturers Part No (2)	NSN/Part No where applicable (3)	Designation (4)
1	18G 1425		Guide studs (3)

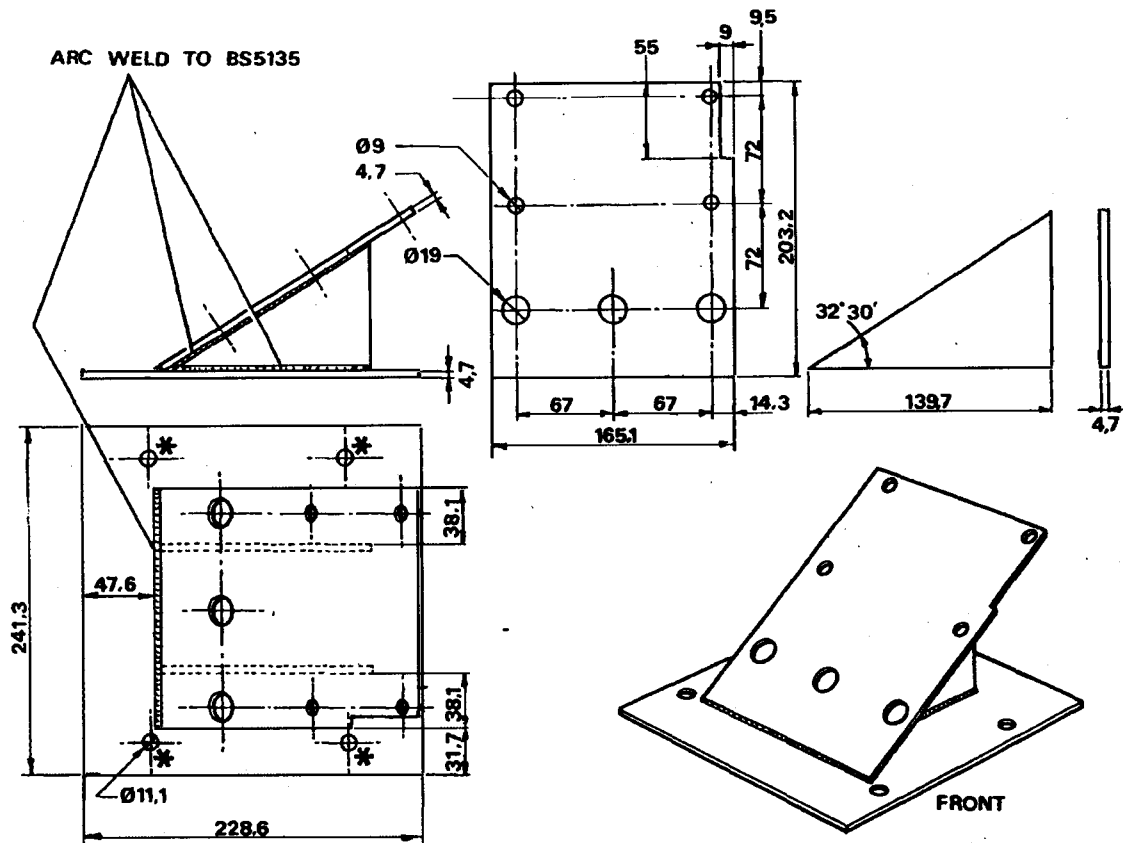
REMOVAL

3 To remove the transfer gearbox from the vehicle carry out the following:

3.1 Install the vehicle on a suitable hydraulic ramp.

3.2. Disconnect the vehicle battery and on 12/24 volt vehicles the radio batteries.

3.3 Remove the cover panel from the right hand seat base.



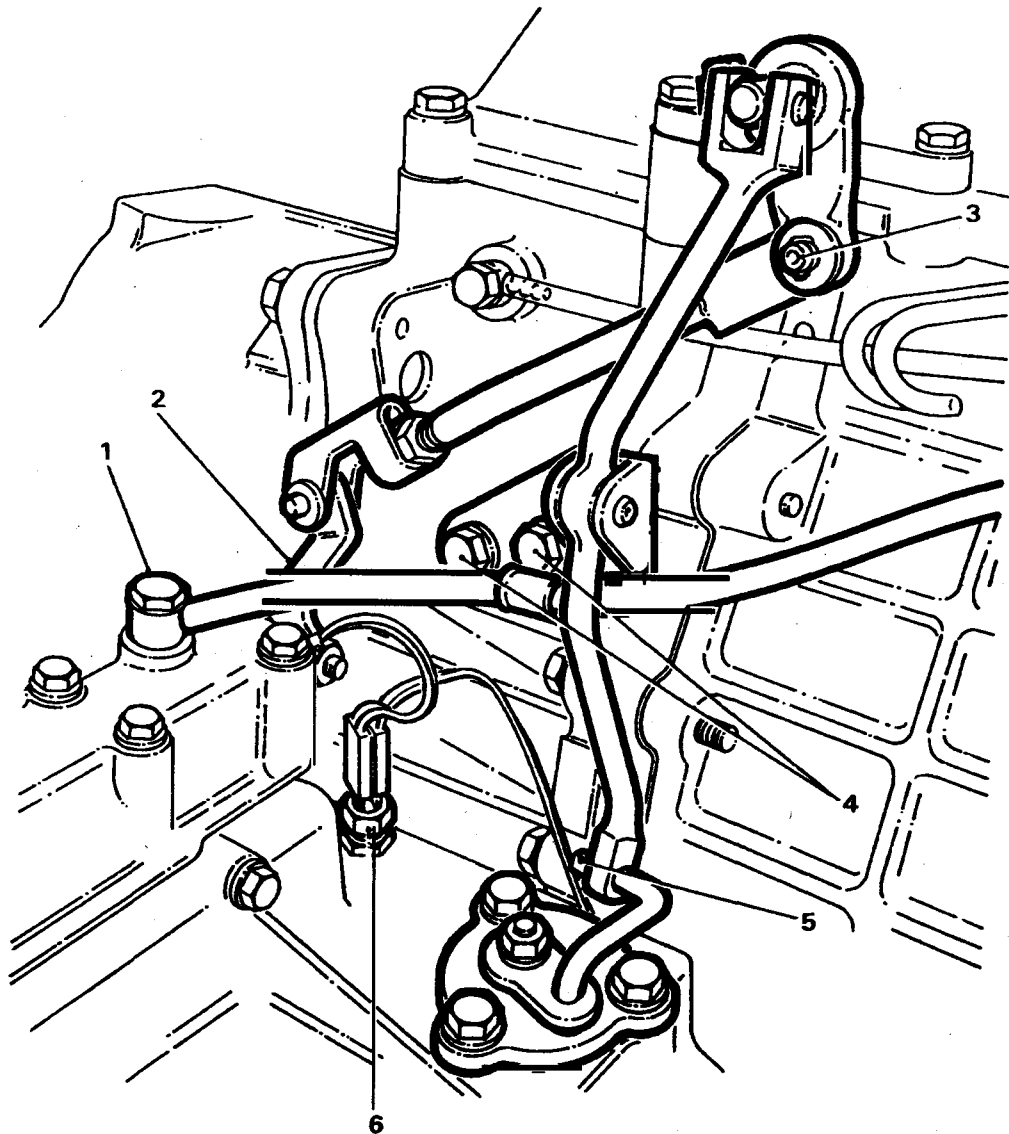
MATERIAL: STEEL PLATE BS1449 GRADE 4 OR 14

*= TO BE DRILLED TO FIT HOIST BEING USED

LR4339M

Fig 1 Adaptor plate

- 3.4 Remove the breather pipe banjo bolt (Fig 2 (1)) from the transfer gearbox high/low cross-shaft housing.
- 3.5 Disconnect the high/low lever (3).
- 3.6 Disconnect the transmission brake cable at the clevis joint.
- 3.7 Raise the vehicle on the ramp and drain the oil from the transfer gearbox.
- 3.8. Remove the centre section of the exhaust system.
- 3.9 Disconnect the front and rear propeller shafts from the transfer gearbox and move them aside (Para 5).
- 3.10 Disconnect the speedometer cable from the transfer gearbox.



LR4281M

Fig 2 Linkage disconnection points

3.11 Remove the split pin (5) at the lower end of the pivot arm for the differential lock control. Then remove the two bolts (4) securing the pivot arm to allow the link to be disconnected.

3.12 Place four, 30mm (1.250 in) long spacers between the top of the hoist and the locally manufactured adaptor plate (Fig 1) at the securing points and secure the adaptor plate to the hoist.

3.13 Remove the four central bolts from the transfer box bottom cover, move the hoist into position and secure the adaptor plate to the transfer gearbox.

3.14 Adjust the hoist to take the weight of the transfer gearbox.

3.15 Remove the three nuts and bolts securing the right hand gearbox mounting bracket to the chassis, remove the nut from the rubber mounting and withdraw the bracket.

- 3.16 Place a suitable wooden block between the main gearbox and chassis cross-member, then lower the hoist until the gearbox contacts the wooden block.
- 3.17 Disconnect the electrical leads from the differential lock switch (6).
- 3.18 Move the small cranked lever (2), for the high/low selector, upward to allow access to the adjacent nut securing the transfer gearbox to the main gearbox extension case.
- 3.19 Remove the two nuts and four bolts securing the transfer gearbox to the main gearbox extension case.
- 3.20 Fit the three guide studs, (special tool Serial No 1), through the transfer gearbox bolt holes to support it during removal.
- 3.21 Lower the hoist and withdraw the transfer gearbox from the vehicle.

REFITTING

- 4 To refit the transfer gearbox to the vehicle carry out the following:
 - 4.1 Ensure that the joint faces of the transfer gearbox and main gearbox extension case are clean and that the three guide studs, (special tool Serial No 1), are fitted to the extension case.
 - 4.2 Lubricate the oil seal in the joint face of transfer box, secure the transfer gearbox to the adaptor plate on the lifting hoist and raise the hoist until the transfer gearbox can be located over the guide studs.
 - 4.3 Remove the guide studs and secure the transfer gearbox to the main gearbox extension case. Tighten the nuts and bolts to a torque of 40 to 50 Nm (29 to 37 lbf ft).
 - 4.4 Complete the refitting procedure by reversing the removal sequence, noting the following important points.
 - 4.5 After removing the lifting hoist and adaptor plate from the transfer box, clean the threads of the four bolts for the transfer gearbox bottom cover; coat with Loctite 290 and fit them together with spring washers. Tighten to a torque of 22 to 28 Nm (16 to 21 lbf ft).
 - 4.6 Refill the transfer box with the correct grade oil to the oil level plug hole (Cat 601).
 - 4.7 Check, and if necessary top-up the oil level in the main gearbox, using the correct grade oil (Cat 601).
 - 4.8 Check the operation of the handbrake and adjust as necessary (Chap 10).

PROPELLER SHAFTS

- 5 The removal and refitting of propeller shafts is self evident, when refitting tighten the flange bolts to a torque of 41 to 52 Nm (30 to 38 lbf ft).

Chapter 5-1

REAR AXLE SALISBURY TYPE - 8HA

CONTENTS

Frame Para

1	Introduction
	Rear axle
2	Removal
3	Installation
	Half shafts
4	Removal
5	Cleaning
6	Examination
7	Installation
	Hub assembly
8	Dismantling
9	Reassembly
	Differential
10	Removal/dismantling
11	Cleaning
12	Examination
13	Reassembly
14	Drive pinion markings
15	Drive pinion adjustment
16	Differential backlash checks
18	Refit axle assembly

Table

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2	Special tools

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Fig

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2	Rear hub assembly	5
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25	Checking crown wheel backlash	29

INTRODUCTION

1 This Chapter covers the Unit and Field Repairs for the Salisbury type rear axle as fitted to Land Rover 110 vehicles.

REAR AXLERemoval

Note ...

The removal and refitting of the axle assembly requires the assistance of two additional personnel to steady the axle, when lowering or positioning the axle.

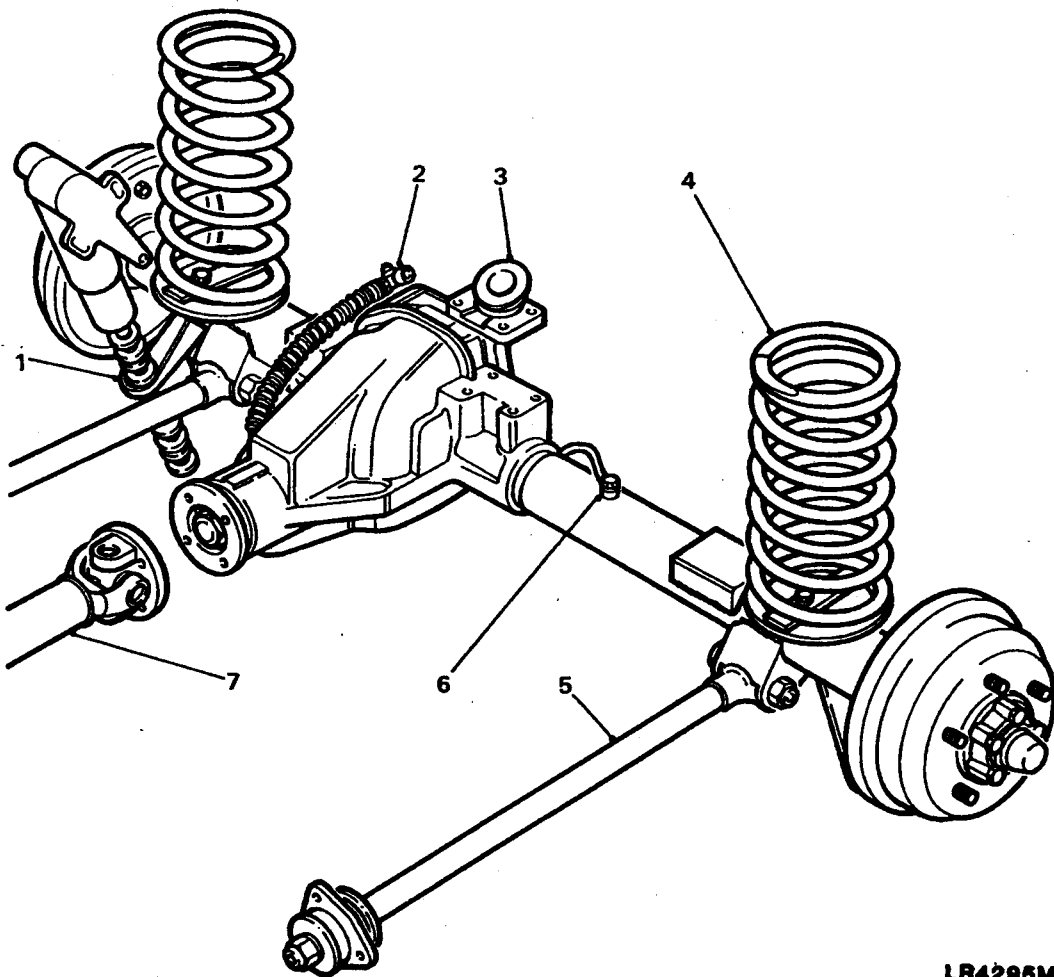
2 To remove the axle proceed as follows:

- 2.1 Jack up the rear of the vehicle and support it with suitable stands located on the chassis.
- 2.2 Remove the rear road wheels.
- 2.3 Support the axle weight with a suitable hydraulic jack.
- 2.4 Disconnect the shock absorbers at the lower fixings (Fig 1 (1)) and remove the rubbers and washers.
- 2.5 Disconnect the flexible brake hose at the three-way connection (2) above and to the right hand side of the differential. Blank off the connections to prevent loss of brake fluid and ingress of foreign matter.
- 2.6 Disconnect the breather hose at the banjo connection (6) on the axle casing.
- 2.7 Disconnect the lower links (5) at the axle.
- 2.8 Mark the differential and propeller shaft flanges with a line, to aid reassembly. Remove the four nuts and bolts, lower the propeller shaft (7) and tie to one side.
- 2.9 Disconnect the pivot bracket ball joint by removing the split pin, castle nut and washer securing the joint to the axle mounted bracket (3).
- 2.10 Lower the axle, release the bolts securing the coil spring retaining plates and remove the springs (4).
- 2.11 If a new or replacement axle assembly is to be fitted, remove the brake pipes from the existing axle assembly, clean and examine them, if they are satisfactory for further use fit to the replacement axle.
- 2.12 Remove the road spring seating plates and fit them to the replacement axle assembly.

Installation

3 To install the axle assembly on the vehicle proceed as follows:

- 3.1 Fit the coil springs (4) to the axle and secure with the retaining plates and bolts.



- | | | | |
|---|---------------------------------|---|---------------------|
| 1 | Shock absorber lower fixing | 5 | Lower link |
| 2 | Brake pipe three-way connection | 6 | Breather connection |
| 3 | Pivot ball joint axle bracket | 7 | Propeller shaft |
| 4 | Coil spring | | |

Fig 1 Rear axle removal/installation

- 3.2 Raise the axle with the jack and locate the lower links (5), secure with the bolts and nuts tightened to a torque of 64 Nm (47 lbf ft).
- 3.3 Connect the pivot ball joint to the axle mounted bracket (3) and secure with the castle nut and plain washer, tightening the nut to a torque of 176 Nm (130 lbf ft).
- 3.4 Connect the shock absorbers to the attachment plate (1) on the axle and tighten the securing nuts to a torque of 75 Nm (55 lbf ft).
- 3.5 Connect the propeller shaft (7), aligning the marks made when dismantling, and tighten the securing bolts to a torque of 41 to 52 Nm (30 to 38 lbf ft).
- 3.6 Connect the brake flexible hose at the three-way connector.
- 3.7 Connect the breather hose to the top of the axle casing.

- 3.8 Fit the road wheels and remove the vehicle from the stands.
- 3.9 Fill the axle with the approved oil (Cat 601).
- 3.10 Bleed the brakes and top up the fluid (Cat 201 Chap 4-1 Para 8).
- 3.11 After the initial axle run, check the oil level and replenish as necessary.
- 3.12 Where major running parts have been replaced during overhaul, it is recommended practice to allow the axle assembly to 'run in' by avoiding, where possible, heavy loads and high speeds during initial running.

HALF SHAFTSRemoval

- 4 To remove the half shafts proceed as follows:
- 4.1 Prise off the hub cap (Fig 2 (19)), remove the five securing bolts (20) and spring washers (21) from the driving member (22). Withdraw the driving member complete with the half shaft (1).
- 4.2 If necessary repeat Para 4.1 to remove the other half shaft.
- 4.3 Remove the circlip (18) and withdraw the driving member (22).

Cleaning

- 5 Thoroughly clean the half shaft and driving member.

Examination

- 6 Examine the splines on the half shaft and driving member for damage and wear.

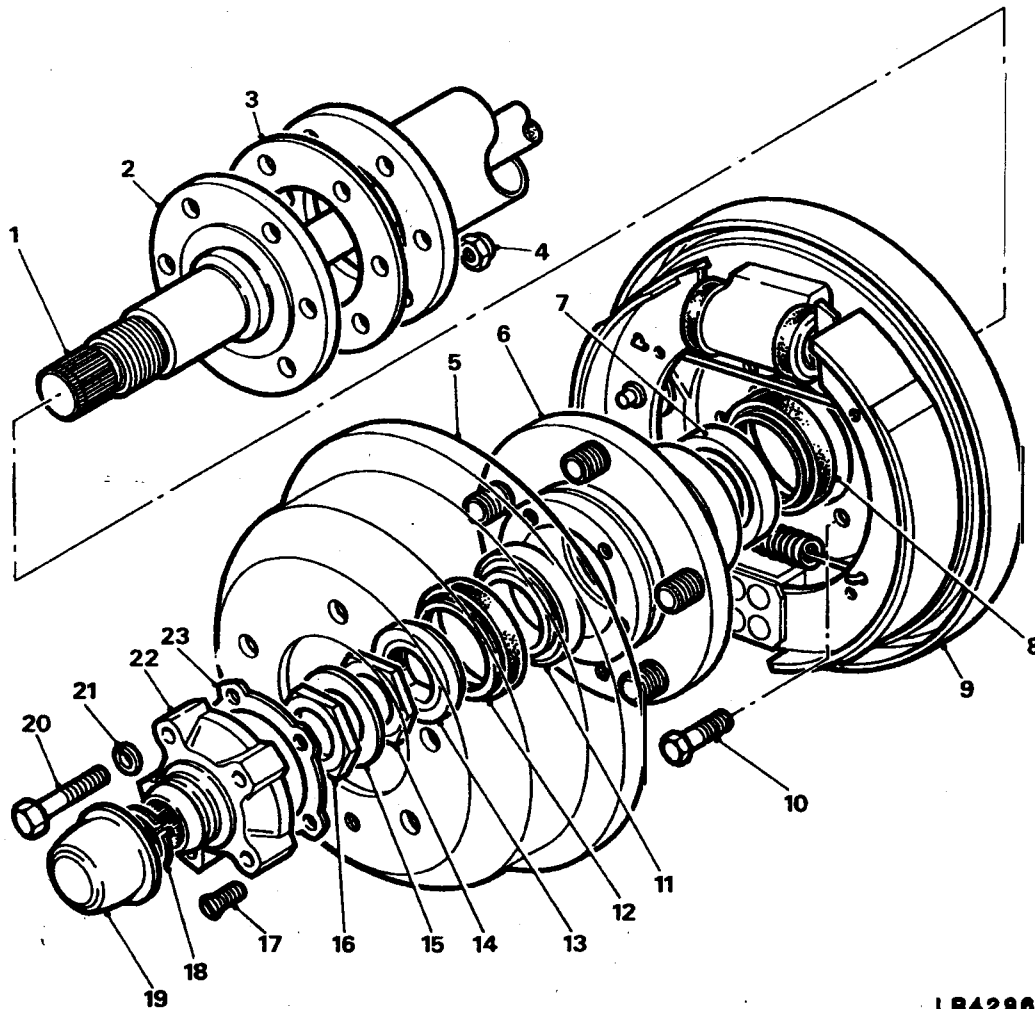
Installation

- 7 To refit the half shafts reverse the removal procedure using a new gasket (23) between the mating faces of the hub (6) and driving member (22) and tightening the bolts (20) to a torque of 60 to 70 Nm (44 to 52 lbf ft).

HUB ASSEMBLY

TABLE 1 SPECIAL TOOLS

Ser No (1)	Manufacturers Part No (2)	NSN/Part No where applicable (3)	Designation (4)
1	LST 550-5		Hub inner and outer oil seal replacer
2	18G 134		Bearing and oil seal replacer (main tool)
3	RO 606435A		Spanner for hub nut adjustment



LR4296M

- | | | | |
|----|-----------------|----|------------------------|
| 1 | Axle half shaft | 13 | Seal track spacer |
| 2 | Stub axle | 14 | Adjusting nut |
| 3 | Gasket | 15 | Lock washer |
| 4 | Locknut | 16 | Locknut |
| 5 | Brake drum | 17 | Screw |
| 6 | Hub | 18 | Circlip |
| 7 | Inner bearing | 19 | Hub cap |
| 8 | Inner oil seal | 20 | Bolt) Hub driving |
| 9 | Brake backplate | 21 | Spring washer) member |
| 10 | Bolt | 22 | Hub driving member |
| 11 | Outer bearing | 23 | Gasket |
| 12 | Outer oil seal | | |

Fig 2 Rear hub assembly

Dismantling

8 To dismantle the hub assemblies carry out the following:

- 8.1 Jack-up the rear of the vehicle, lower onto axle stand and remove the road wheels.
- 8.2 Remove the brake drum retaining screws (17) and withdraw the brake drum (5). if necessary, slacken the brake adjuster to facilitate removal.
- 8.3 Prise-off the hub cap (19) and remove the circlip (18) from the end of the half shaft (1).
- 8.4 Remove the five bolts (20) and spring washers (21) and withdraw the hub driving member (22) complete with gasket (23).
- 8.5 Prise-up the lock washer (15) remove the locknut (16), withdraw the lock washer and remove the adjusting nut (14). Discard lock washer.
- 8.6 Withdraw the hub (6) complete with the inner and outer seals (8) and (12), seal track spacer (13) and inner and outer taper roller bearings (7) and (11).
- 8.7 If the stub axle (2) is damaged or scored, remove complete with gasket (3), and discard it by removing the six brake back plate retaining nuts (4) and bolts (10).
- 8.8 Remove the seal track spacer and outer seal from the hub.
- 8.9 Remove the outer bearing cone.
- 8.10 Remove the inner seal and inner bearing cone.
- 8.11 If new bearings are to be fitted drift or press out the bearing cups from the hubs and discard.
- 8.12 Degrease and examine the hub for cracks and damage, renew if necessary, also if the wheel studs are faulty.

Reassembly

9 To reassemble the hub proceed as follows:

- 9.1 If removed, fit the stub axle (2) and brake back plate (9) to the axle casing with a new gasket (3) interposed between the casing and stub axle mating faces. Secure with the six nuts and bolts (4) and (10) tightening the bolts to a torque of 60 to 70 Nm (44 to 52 lbf ft).
- 9.2 If removed, fit new inner and outer bearing cups to the hub, ensuring that they are pressed squarely into position.
- 9.3 Fit the inner bearing cone and pack with BP Energrease L2 (XG 279 grease) or a suitable alternative.
- 9.4 Fit the inner oil seal as follows:
 - 9.4.1 Clean the hub oil seal housing and ensure that the seal locating surface is smooth and the chamfer on the leading edge is also smooth and free from burrs.

9.4.2 Examine the new seal and ensure that it is clean, undamaged and that the garter spring is properly located even a small scratch on the seal lip could impair its efficiency.

9.4.3 Although the new seal is already pre-greased by the manufacturer, apply BP Energrease L2 (XG279 grease) or a suitable alternative to the outside diameter of the seal, before fitting, taking care not to damage the lip.

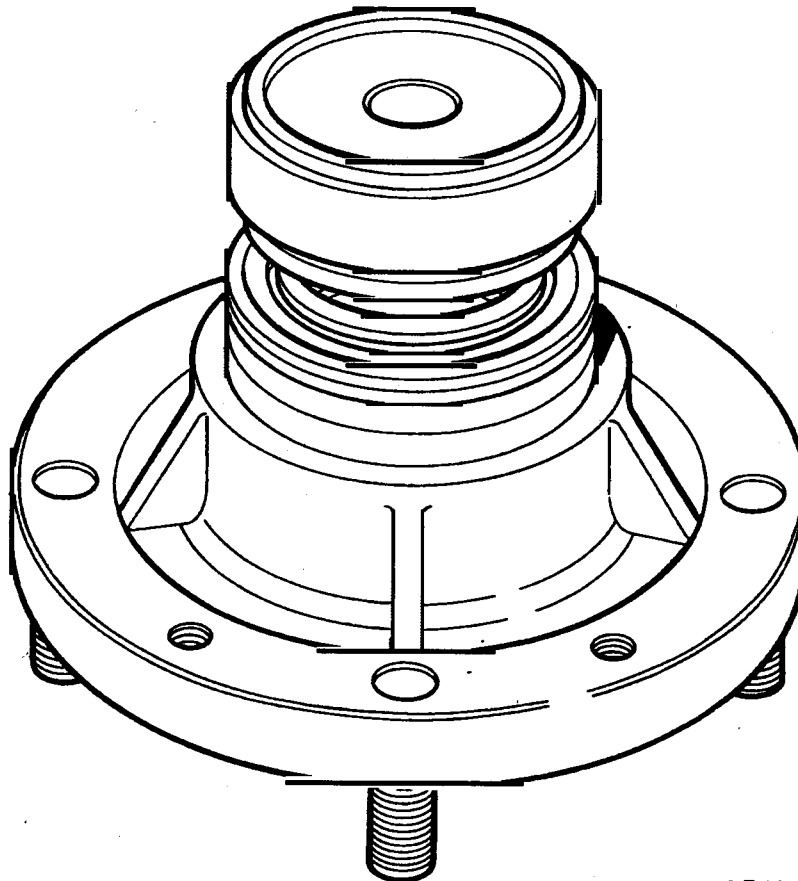
9.4.4 Place the seal, lip side leading, squarely on the hub and using the 76mm end of special tool (Serial No 1) and special tool (Serial No 2) drive the seal into position to the depth determined by the tool (Fig 3).

9.5 Fit the outer oil seal as follows;

9.5.1 Fit the new outer bearing cone and pack with BP Energrease L2 (XG279 grease) or a suitable alternative.

9.5.2 Carry out operations 9.4.1 to 9.4.3.

9.5.3 Carry out operation 9.4.4 but this time use the 72mm end of the special tool.



LR4297M

Fig 3 Fitting oil seals

9.6 Smear the lips of both seals with the above grease. This is important since a dry seal can be destroyed during the first few revolutions of the hub.

9.7 Select a new seal track spacer (Fig 2 (13)) and check that the outer diameter is smooth and free from blemishes and that there are no burrs on the leading edge.

9.8 Taking care not to damage the seal lips fit the hub assembly to the stub axle. Do not allow the weight of the hub to rest, even temporarily, on the outer seal otherwise damage and distortion could occur. Therefore hold the hub clear of the stub axle until the seal track spacer is fitted.

9.9 Carefully fit the seal track spacer, seal lip leading.

9.10 Fit the hub inner nut and using special tool (Serial No 3) tighten the adjusting nut whilst slowly revolving the hub until all end-float is removed, then back-off the nut approximately one half of a turn. Retighten the nut to 1,5 to 1,7 Nm (1.1 to 1.25 lbf ft), this will allow for compression of the rubber on the new seal track spacer and give the required end float of 0,013 to 0,10 mm (0.0005 to 0.004 in).

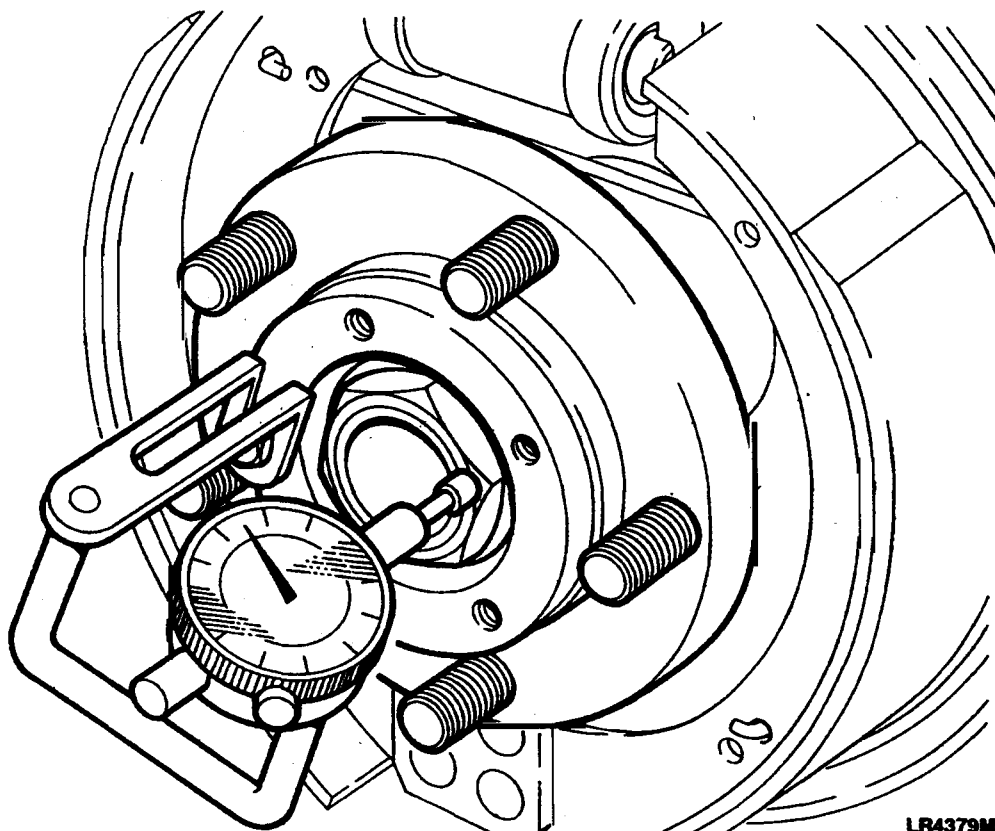


Fig 4 Checking hub end-float using dial test indicator

9.11 If the rubber on the seal track spacer has previously been compressed, the hub end-float can be checked by mounting a dial test indicator and bracket on the hub so that the stylus rests in a loaded condition on the nut (Fig 4). Rotate the hub to settle the bearings and check the end float which must be within the limits shown in para 9.10. Adjust the nut as necessary to achieve the required end-float.

9.12 Fit a new lock washer and the locknut. Whilst restraining the adjustment nut, tighten the locknut to a torque of 95 to 108 Nm (70 to 80 lbf ft).

9.13 If the conditions of para 9.11 apply, rotate the hub several times to settle the bearings then recheck the end-float. adjust as necessary to achieve the required setting.

9.14 Bend one segment of the lock washer over the adjusting nut and the segment diametrically opposite over the locknut (Fig 5).

9.15 Using a new gasket, fit the hub driving member and secure with the five bolts and spring washers, tightening the bolts to a torque of 60 to 70 Nm (44 to 52 lbf ft).

9.16 Fit a new circlip to the axle shaft ensuring that it is properly seated in the groove and refit the hub cap.

9.17 Fit the road wheels, jack-up the vehicle, remove the axle stands and lower the vehicle to the ground. Finally tighten the wheel nuts to a torque of 108 Nm (80 lbf ft).

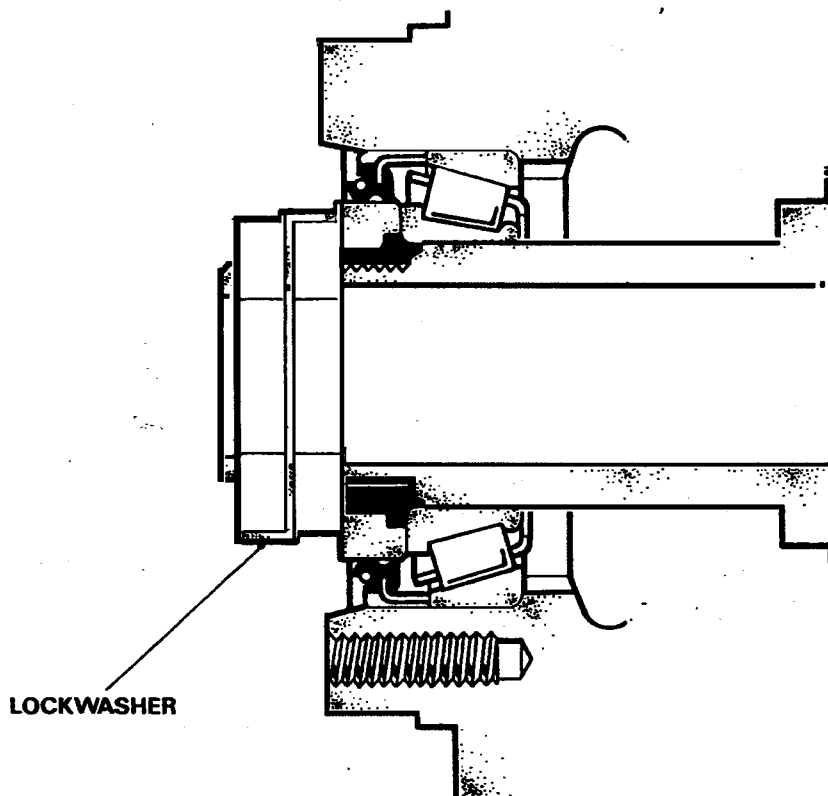


Fig 5 Lock washer location

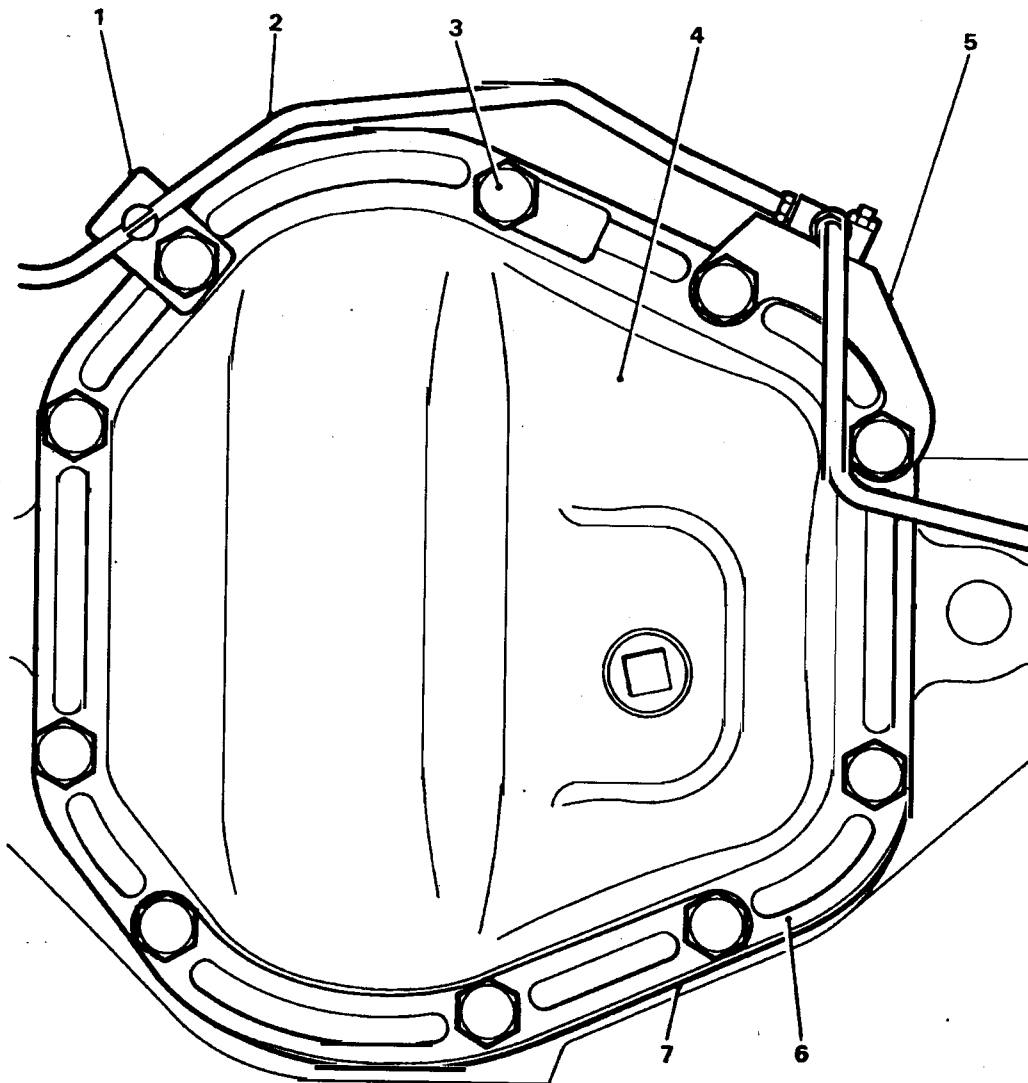
DIFFERENTIAL

TABLE 2 SPECIAL TOOLS

Ser No (1)	Manufacturers Part No (2)	NSN/Part No where applicable (3)	Designation (4)
1	MS 47		Hand press
2	18G 47BK		Pinion bearing cone remover/replacer
3	18G 47BL		Differential bearing cone remover
4	S 123A		Pinion bearing cup remover
5	GKN 131		Axle casing compressor
6	18G 134DP		Differential bearing cone replacer
7	18G 191		Bevel pinion setting gauge
8	18G 191-4		Universal setting block, pinion height
9	R 1008A	LV6MT2/5120-99-825-0849	Pinion oil seal replacer
10	18G 1122		Bearing cup replacer (Main tool)
11	18G 1122G		Replacer pinion bearing cups
12	18G 1205		Adjustable flange holding wrench

Removal/dismantling

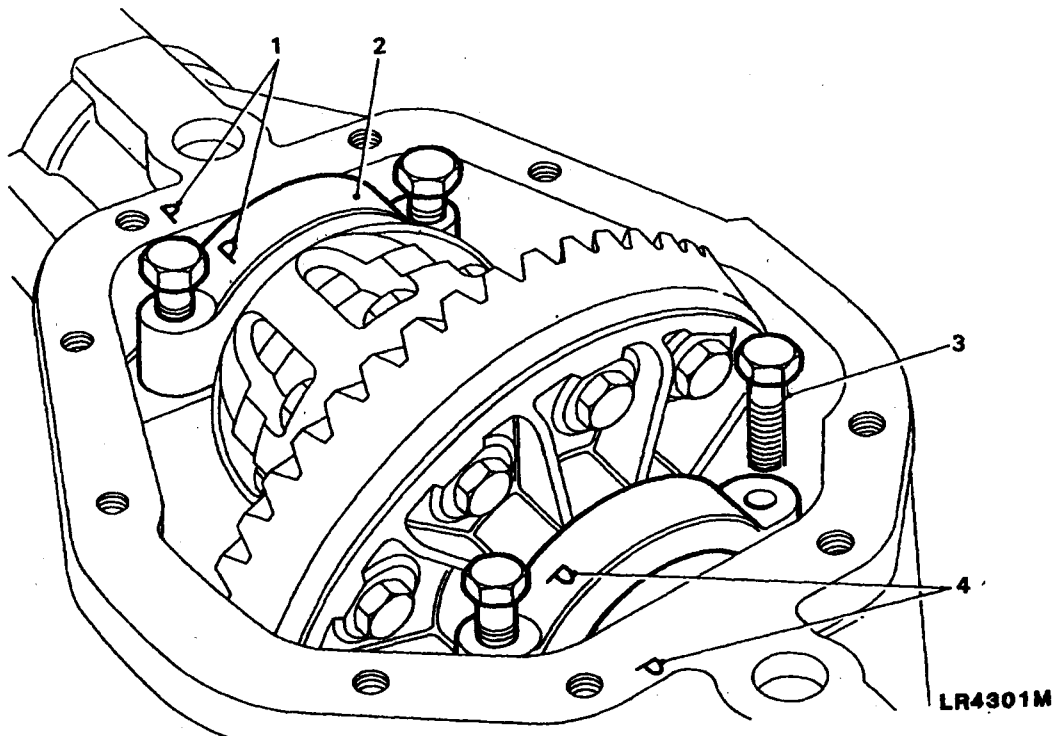
- 10 To remove and dismantle the differential assembly carry out the following:
- 10.1 Using a suitable container drain off the differential lubricating oil, refit drain plug.
- 10.2 Remove the rear axle assembly from the vehicle (Para 2).
- 10.3 Suitably support the axle to allow work to be carried out.
- 10.4 Remove the brake fluid pipes (Fig 6 (1)) to allow the removal of the differential cover (4).
- 10.5 Remove the hub driving member fixings and withdraw the axle shafts sufficiently to disengage from the differential unit (Fig 2).
- 10.6 Remove the bolts (Fig 6 (3)), brake fluid pipe support brackets (1) and (5), the flitch plate (6) and withdraw the differential cover (4) complete with its gasket (7).



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- | | | | |
|---|--------------------|---|--------------|
| 1 | Bracket | 5 | Bracket |
| 2 | Brake fluid pipe | 6 | Flitch plate |
| 3 | Bolt | 7 | Gasket |
| 4 | Differential cover | | |

Fig 6 Removing differential cover



- | | | | |
|---|-----------------|---|-----------------|
| 1 | Location letter | 3 | Bolt |
| 2 | Bearing cap | 4 | Location letter |

Fig 7 Bearing caps removal

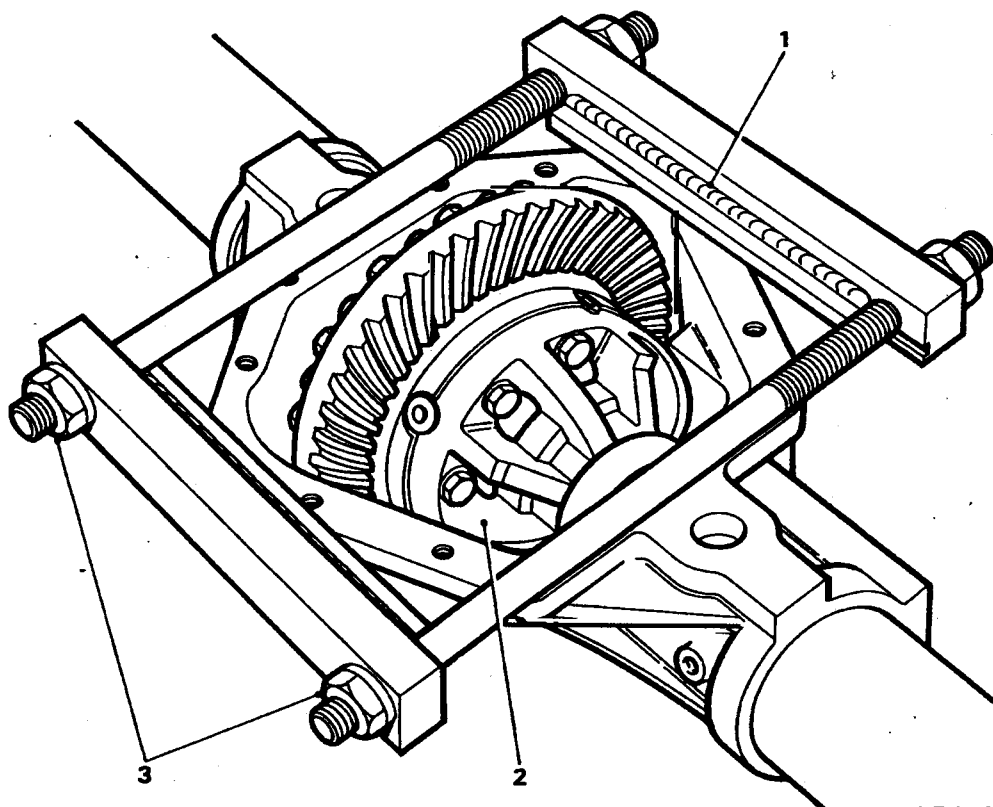
10.7 Note the relationship markings (Fig 7 (1) and (4)) on the bearing caps and axle casing to ensure correct location at reassembly.

10.8 Remove the bolts (3) and withdraw the bearing caps (2).

10.9 Using special tool (Serial No 5) compress the axle casing as follows:

10.9.1 Place the tool on the casing with the weld seam uppermost (Fig 8 (1)). Ensure that the plates rest squarely on the casing machined surface and that the end bars butt against the edges of the casing.

10.9.2 Tighten the adjusting nuts (3) by hand only, until all slack is taken up.



LR4302M

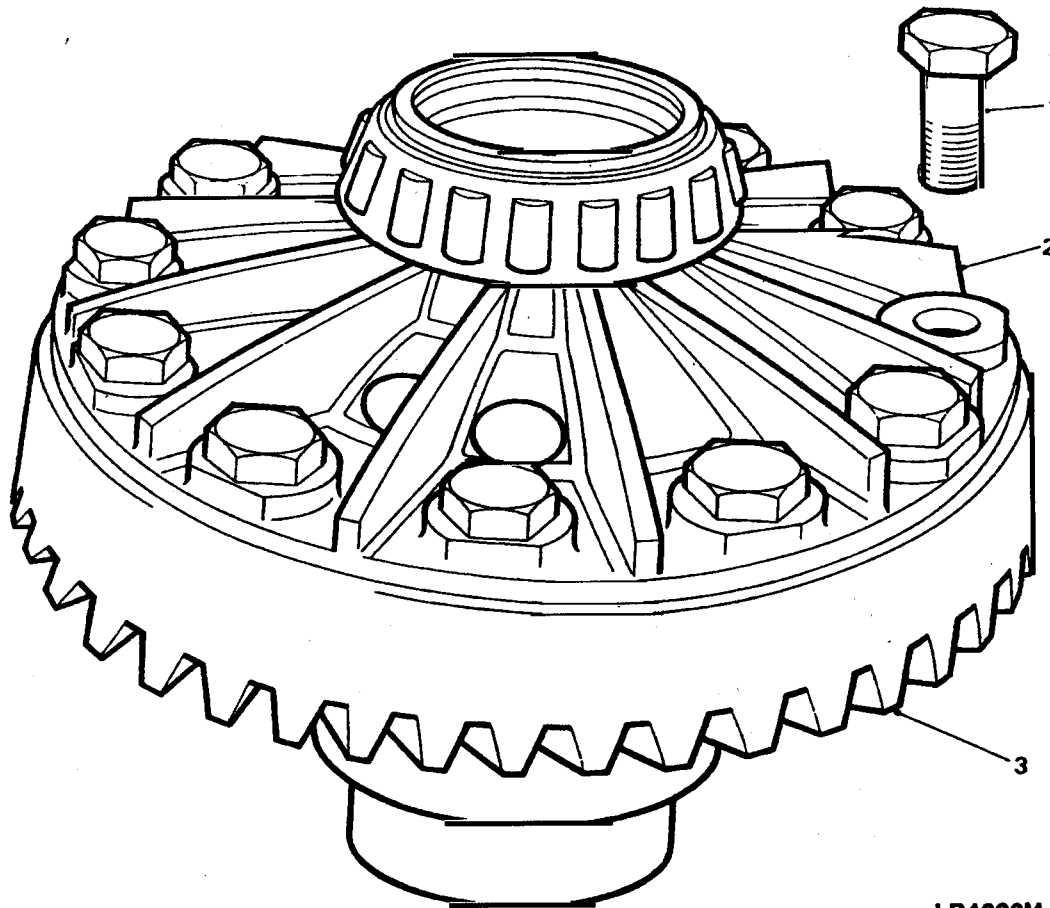
- 1 Welded seam 2 Differential assembly 3 Adjusting nuts

Fig 8 Compressing axle casing

10.9.3 Continue to tighten both nuts alternately with a spanner, one flat at a time, to a maximum of three flats.

10.9.4 Carefully lever the differential assembly (2) out of the casing.

10.10 To facilitate alignment, on reassembly, add alignment marks to the crown wheel and the differential case.



LR4303M

1 Bolt 2 Differential casing 3 Crown wheel

Fig 9 Removing crown wheel

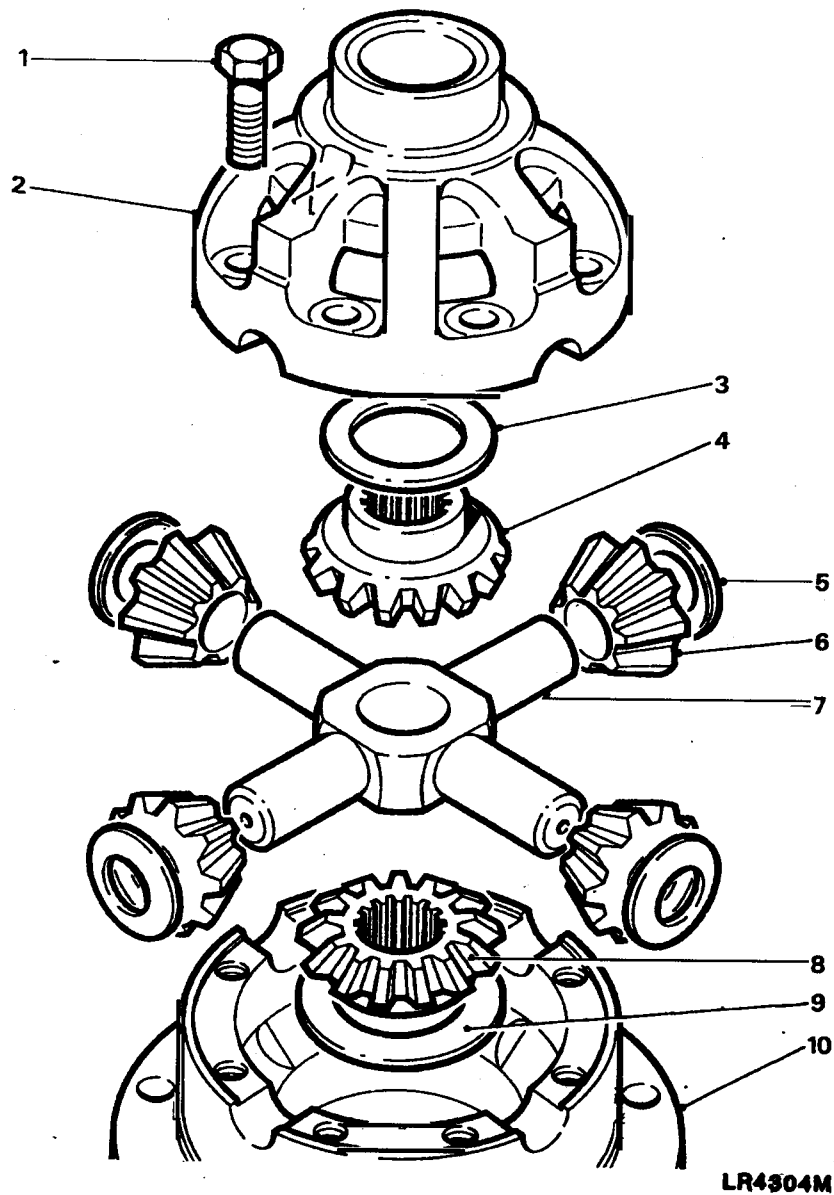
10.11 Remove the securing bolts (Fig 9 (1)) and separate the crown wheel (3) from the differential case (2).

10.12 Note the alignment markings on the differential case halves, if not evident make new ones, then remove the securing bolts (Fig 10 (1)) and lift off the upper case half (2).

10.13 Withdraw the upper differential wheel (4) and thrust washer (3).

10.14 Lift out the cross-shaft (7) and pinions (6) complete with the four dished thrust washers (5), discard the thrust washers.

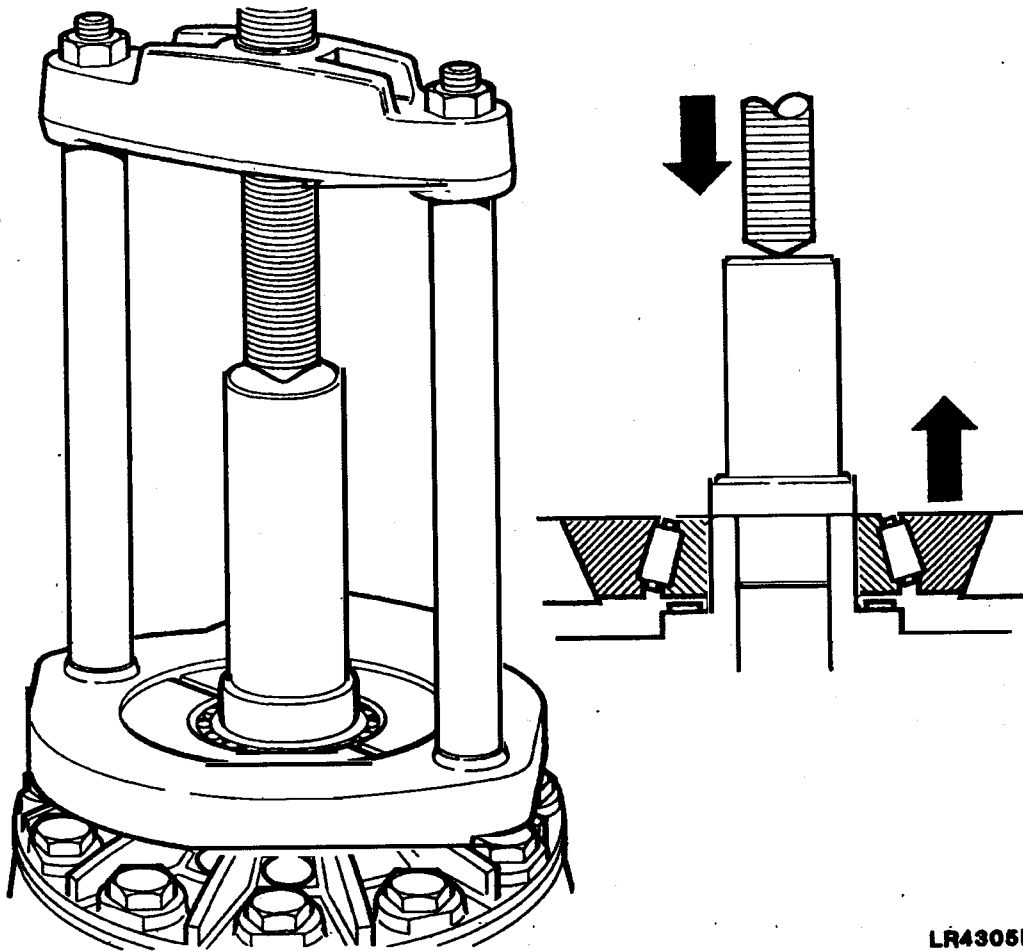
10.15 Withdraw the lower differential wheel (8) and thrust washer (9).



LR4904M

- | | | | |
|---|--------------------------|----|--------------------------|
| 1 | Bolt | 6 | Pinion |
| 2 | Upper case half | 7 | Cross shaft |
| 3 | Thrust washer | 8 | Lower differential wheel |
| 4 | Upper differential wheel | 9 | Thrust washer |
| 5 | Dished thrust washer | 10 | Lower case half |

Fig 10 Differential assembly



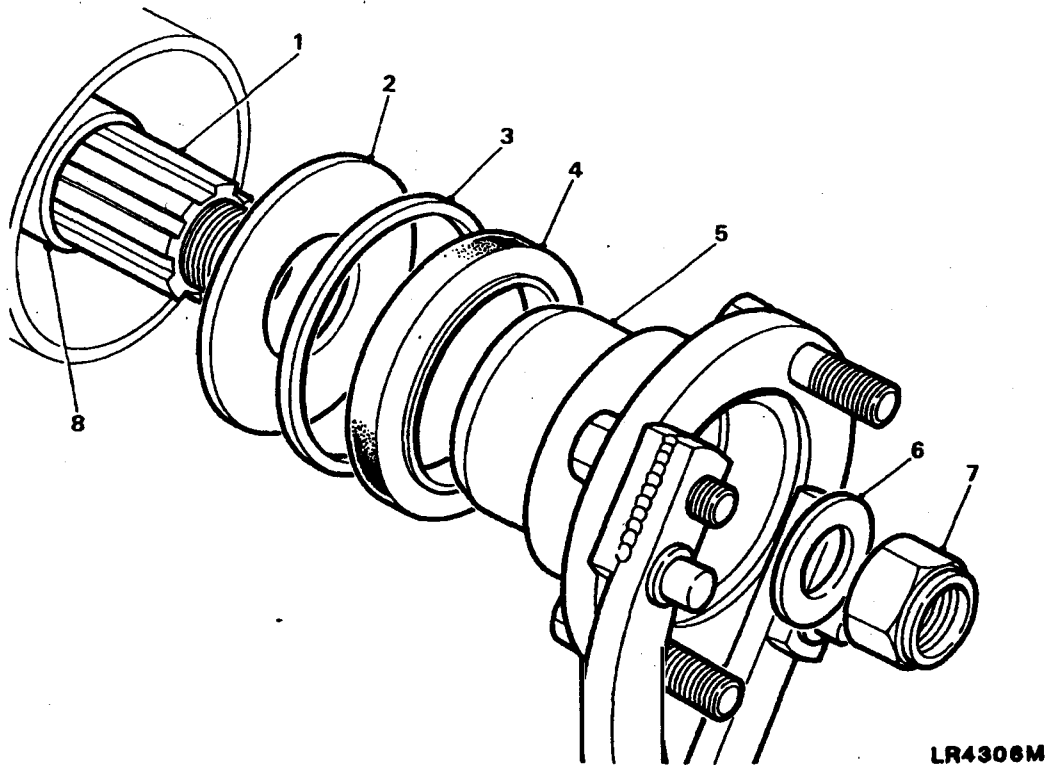
LR4305M

Fig 11 Removing differential bearing cones

10.16 Using special tools (Serial No's 1 and 3) remove the differential bearing cones and withdraw the shim washers fitted under the cones (Fig 11).

10.17 Using special tool (Serial No 12), to prevent the coupling flange (Fig 12 (5)) from rotating, remove the flange locknut (7) and plain washer (6).

10.18 Support the drive pinion (1) and remove the coupling flange by tapping with a hide hammer.



LR4306M

- | | | | |
|---|--------------|---|----------------------------|
| 1 | Drive pinion | 5 | Coupling flange |
| 2 | Oil thrower | 6 | Washer |
| 3 | Gasket | 7 | Nut |
| 4 | Oil seal | 8 | Collapsible bearing spacer |

Fig 12 Coupling flange removal.

10.19 Withdraw the drive pinion (1) together with the inner bearing cone.

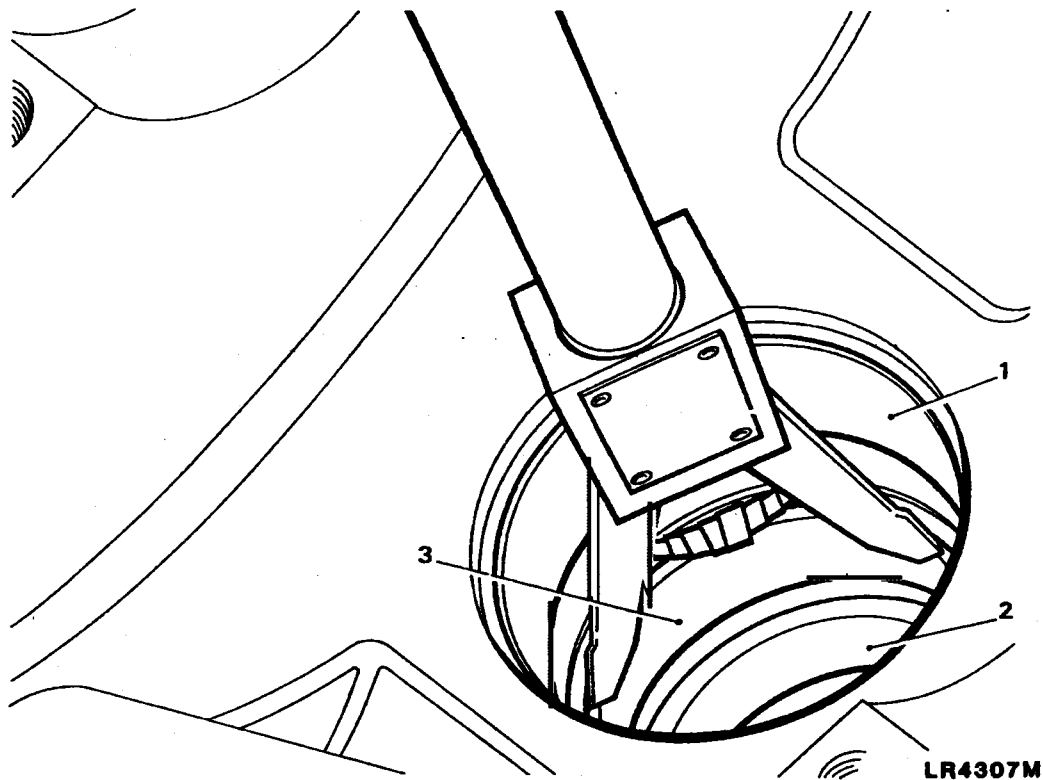
10.20 Withdraw and discard the the collapsible bearing spacer (8).

10.21 Remove the oil seal (4), gasket (3) and oil thrower (2).

10.22 Withdraw the outer bearing cone (Fig 13 (2)).

10.23 Using special tool (Serial No 4), extract the pinion inner bearing cup (1) and shim washers from the casing. Note the thickness of th shim washers removed, to aid reassembly.

10.24 Using special tool (Serial No 4), extract the pinion outer bearing cup (3) from the casing.



1 Inner bearing cup 2 Outer bearing cone 3 Outer bearing cup

Fig 13 Removing bearing tracks

10.25 Using special tools (Serial No's 1 and 2), remove the inner bearing cone from the drive pinion (Fig 14).

Cleaning

11 Thoroughly clean and degrease all of the components.

Examination

12 To examine the components proceed as follows:

12.1 Examine all components for obvious wear or damage.

12.2 The bearing cones must be a press fit on their locations, except for the drive pinion flange and bearing which is a slide fit.

12.3 The crown wheel and pinion are supplied as a matched pair and must not be changed separately.

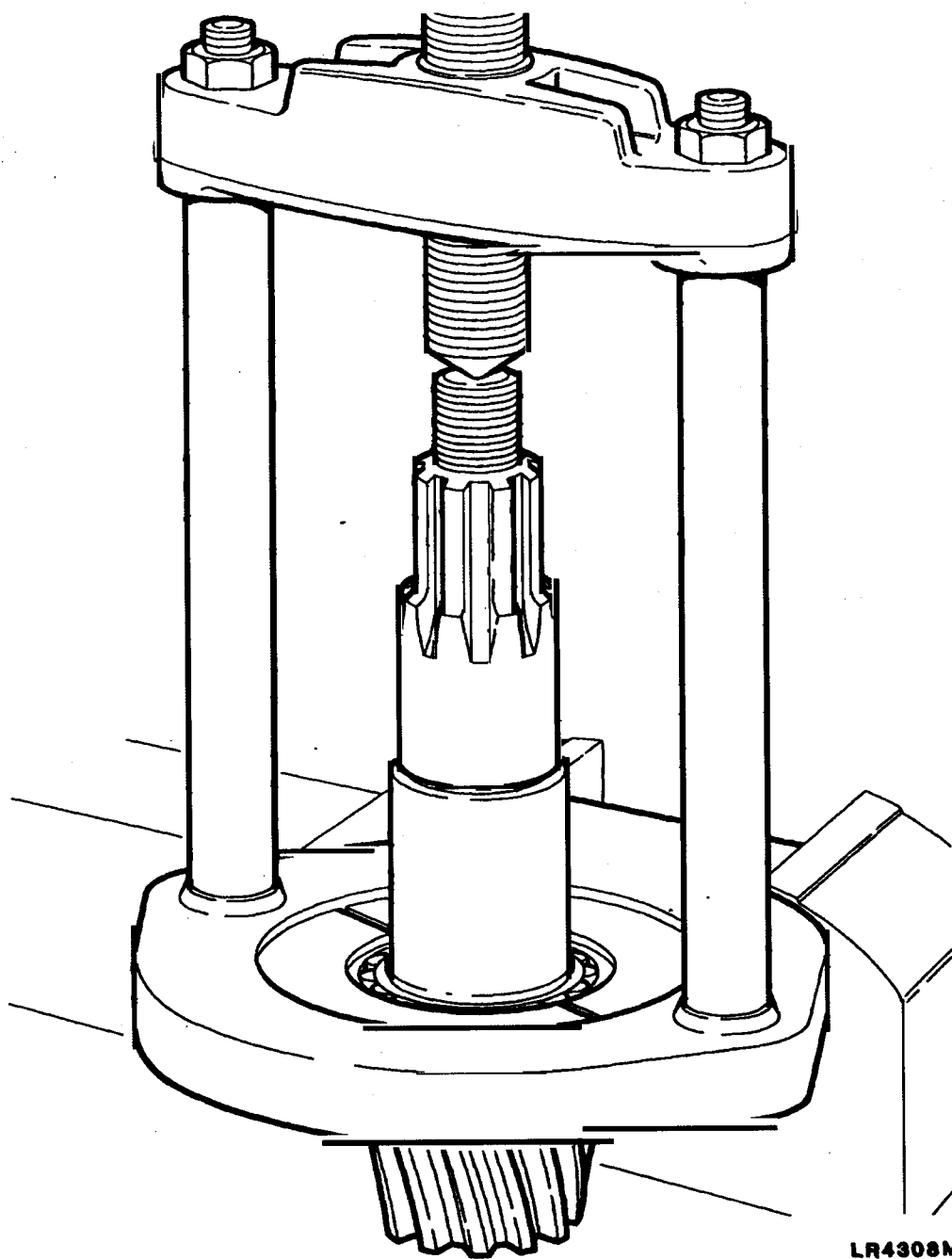


Fig 14 Removing bearing cone from drive pinion

12.4 A new crown wheel and pinion matched pair may be fitted to an existing gear carrier casing, if the casing is satisfactory for continued use, and the original crown wheel and pinion, if satisfactory, may be fitted into a replacement casing.

12.5 The differential casing halves are a matched pair, if replacement is necessary they must be replaced as such.

12.6 Discard and renew all thrust washers.

12.7 Differential casings with worn thrust washer seatings must be renewed.

12.8 Examine the differential case to crown wheel mating face for burrs and damage which could lead to crown wheel run-out when fitted.

Reassembly

13 To reassemble the differential carry out the following:

13.1 Fit the differential lower wheel (Fig 10 (8)) and new thrust washer (9) to the differential case lower half (10).

13.2 Fit the cross-shaft (7) and pinions (6) complete with new dished thrust washers (5).

13.3 Fit the differential upper wheel (4), in mesh with the pinions (6), with a new thrust washer (3).

13.4 Locate the differential upper casing (2) over assembled pinions and wheels lining up the alignment marks. Secure the assembly with the bolts (1) using Loctite 'Studlock' grade CVX on the threads and tightening evenly and diametrically to a torque of 89 to 101 Nm (66 to 75 lbf ft).

13.5 Fit the crown wheel to the differential casing, lining-up the alignment marks if the existing crown wheel is being used. Use Loctite 'Studlock' CVX on the bolt threads and tighten to a torque of 150 to 170 Nm (111 to 125 lbf ft).

13.6 Using special tool (Serial No 6) press the bearing cones onto the differential casing, then fit the bearing cups to the bearing cones (Fig 15).

13.7 Refer to Para 10.8 and compress the axle casing.

13.8 Fit the differential unit complete with bearings to the axle casing, remove the special tool, then rotate the unit to centralise the bearings. Do not fit the bearing caps at this stage.

13.9 Position a suitable dial gauge indicator on the axle casing with the stylus registering on the back face of the crown wheel (Fig 16).

13.10 Rotate the differential and check the total indicated run-out on the crown wheel back face, this must not exceed 0,05mm (0.002in). If run-out is excessive, check the mating faces for dirt or damage, if necessary, select a new radial position for the crown wheel.

13.11 When satisfactory, carry out the following to obtain the nominal value of shims required for the bearings:

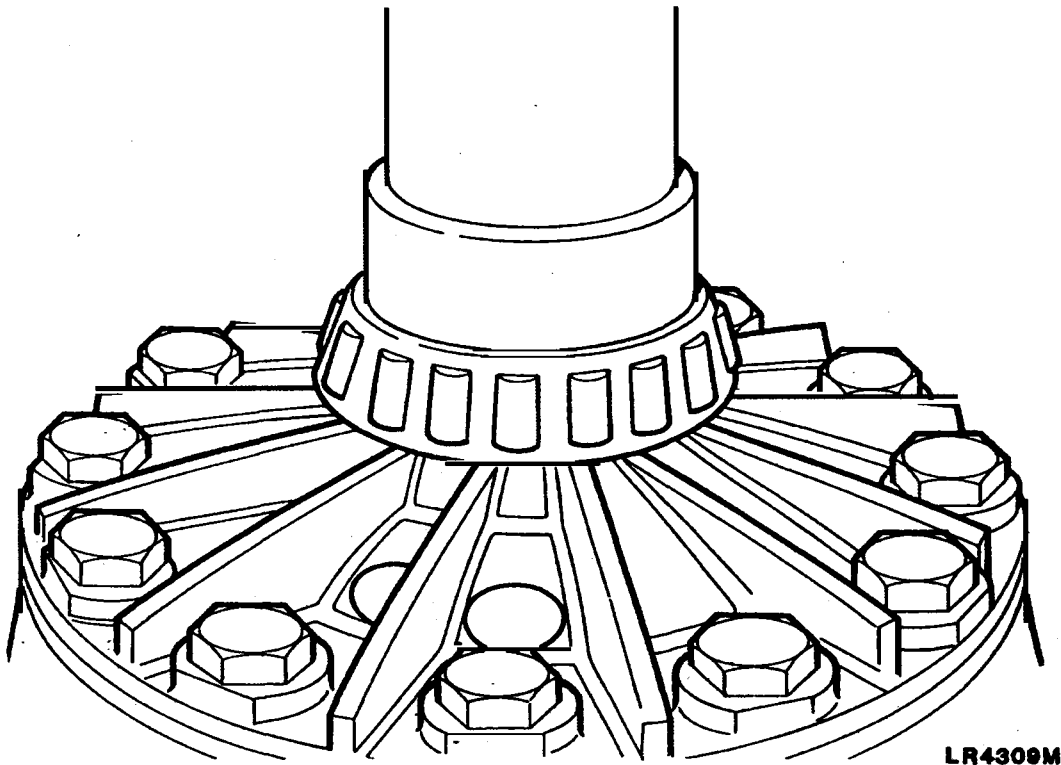


Fig 15 Fitting bearings to differential assembly

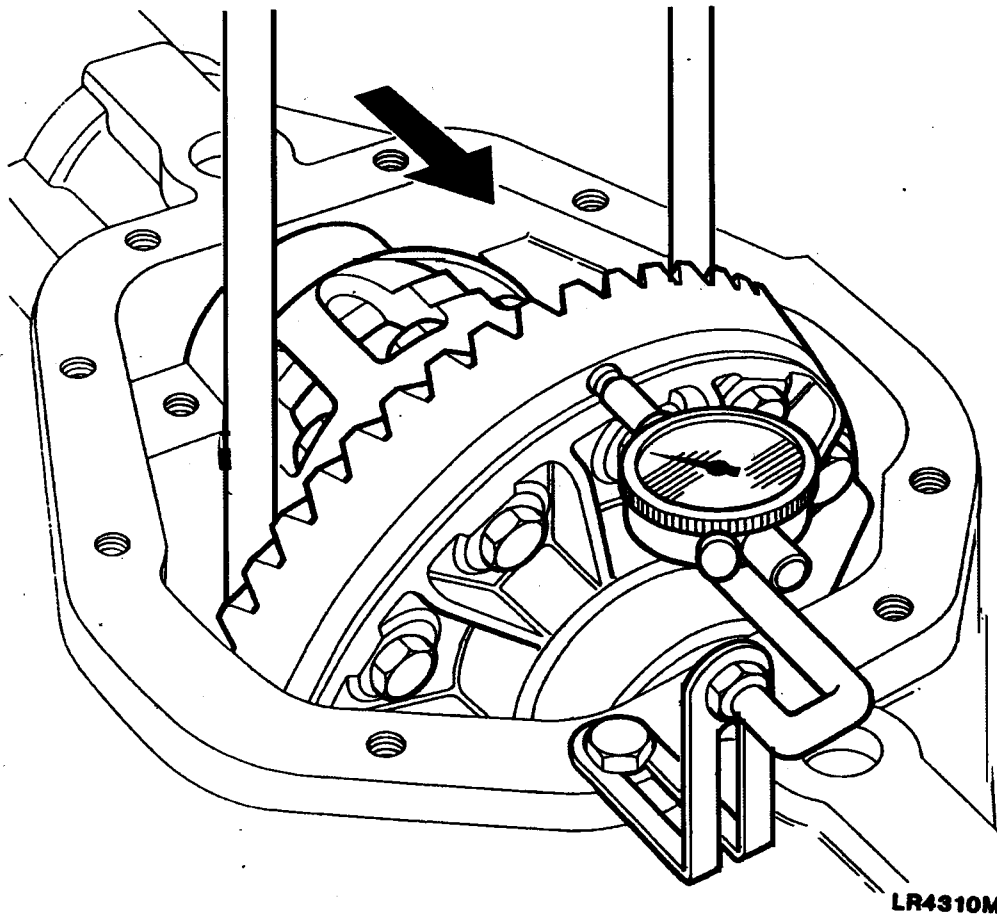
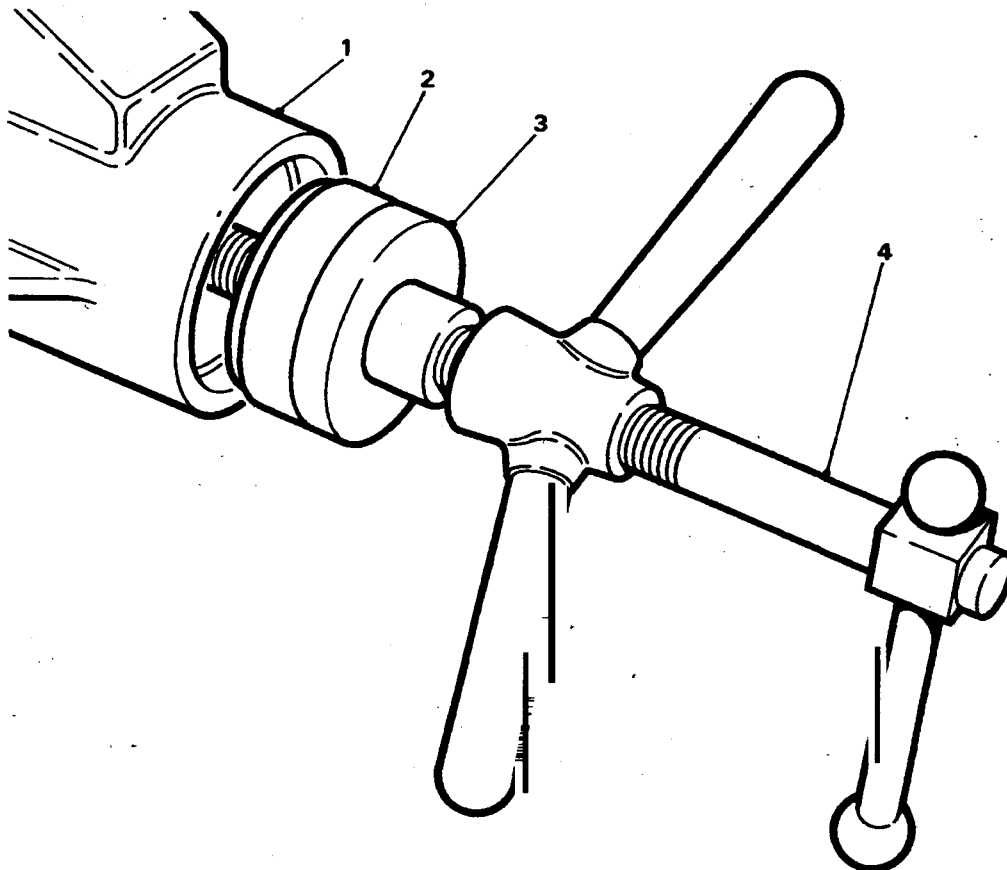


Fig 16 Checking crown wheel run-out and bearing pre-load

- 13.11.1 Insert two levers between the differential unit and the casing (Fig 16).
- 13.11.2 Move the differential unit fully to one side of the casing, do not tilt the unit.
- 13.11.3 Rotate the unit to settle the bearings, continue to lever the unit to one side, then zero the dial gauge indicator.
- 13.11.4 Lever the unit fully to the other side of the casing, rotate the unit to settle the bearings, then note the total indicated reading.
- 13.11.5 To the dimension indicated add 0,127mm (0.005in), for bearing pre-load, the sum is then equal to the nominal value of shims required.
- 13.12 Shims are available in the range 0,07mm (0.003in), 0,12mm (0.005in), 0,25mm (0.010in) and 0,76mm (0.030in). From the range, select the total value of shims required.
- 13.13 Remove the differential unit from the casing. Do not fit the shims until the subsequent differential backlash checks have been carried out.
- 13.14 Lay the differential unit to one side and fit the drive pinion as follows:



LR4311M

- | | |
|---------------------|--------------------------|
| 1 Pinion housing | 3 Outer bearing replacer |
| 2 Outer bearing cup | 4 Main tool |

Fig 17 Fitting outer bearing cup

13.14.1 Select shim washers of the same thickness value as those removed from under the pinion inner cup (Para 10.17.7), and place ready for fitting.

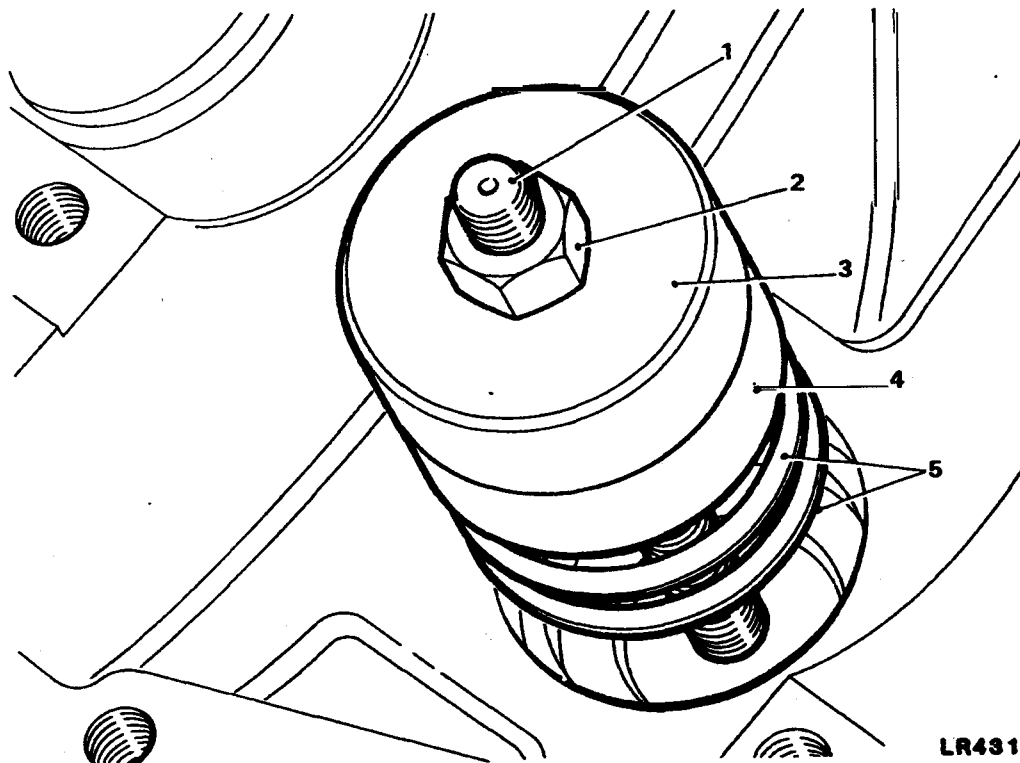
13.14.2 Using special tools (Serial Nos 10 and 11), place the outer bearing replacer (Fig 17 (3)) and the outer bearing cup (2) on the main tool (4) then locate the assembly into the nose of the pinion housing (1).

13.14.3 Place the selected shim washers (Fig 18 (5)) on the inner bearing cup seating and position the bearing cup (4) and shims in the casing with the centre screw of the main tool (1) passing through the bearing cup.

13.14.4 Position the inner bearing (3) replacer on the main tool and secure with the fixing nut. Hold the centre screw still and turn the butterfly lever to draw in the bearing cups.

13.15 Using special tools (Serial Nos 1 and 2) press the inner bearing cone onto the drive pinion (Fig 19).

13.16 Position the pinion and bearing in the casing, omit the collapsible spacer at this stage, and fit the outer bearing cone to the pinion.



- | | | | |
|---|------------------------|---|-------------------|
| 1 | Main tool | 4 | Inner bearing cup |
| 2 | Nut | 5 | Shims |
| 3 | Inner bearing replacer | | |

Fig 18 Fitting inner bearing cup

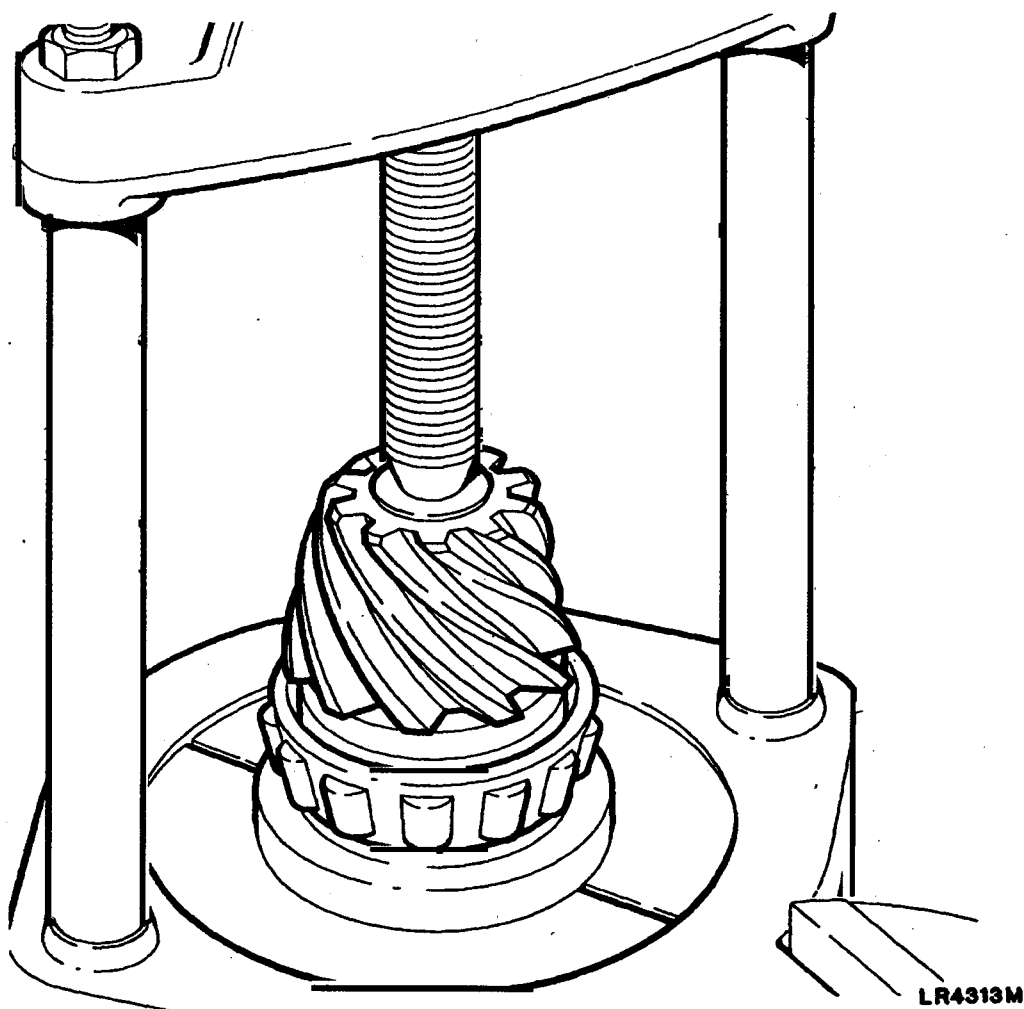


Fig 19 Fitting inner bearing cone to drive pinion

13.17 Fit the coupling flange, with the plain washer and locknut, tightening the locknut until all end-float is removed from the pinion.

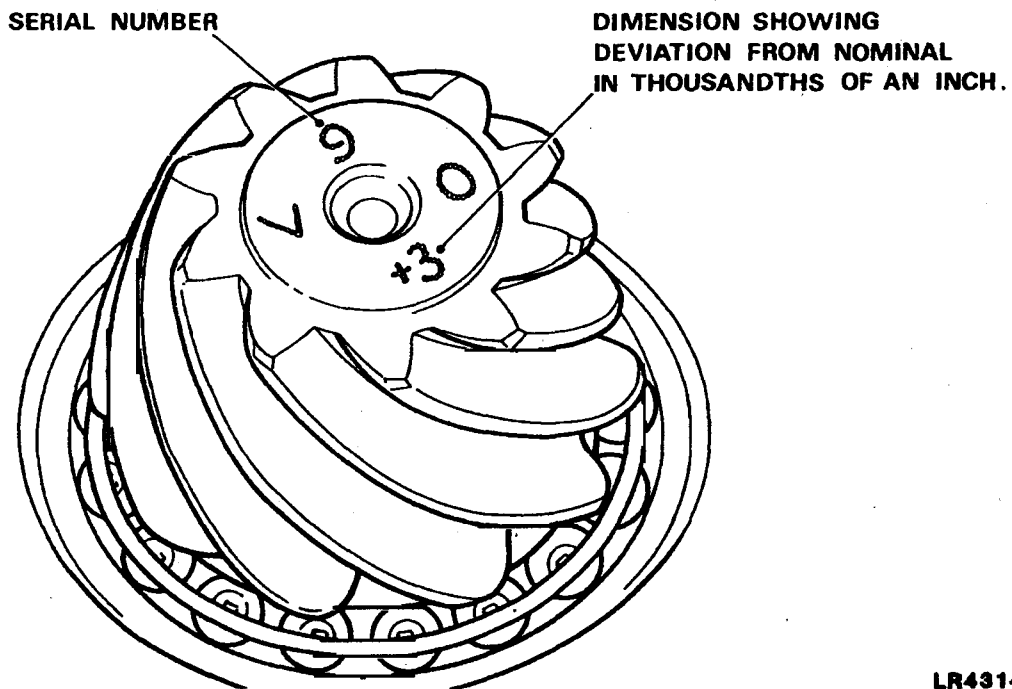
13.18 Rotate the pinion to settle the bearings and slowly tighten the flange locknut until the force required to rotate the pinion is 0,9 to 1,35 Nm (8 to 12 lbf in).

Drive pinion markings

14 Check that the serial number (Fig 20) marked on the pinion end face corresponds with that marked on the crown wheel. The markings on the end face adjacent to the serial number are of no significance during servicing. Note the following when carrying out drive pinion adjustment:

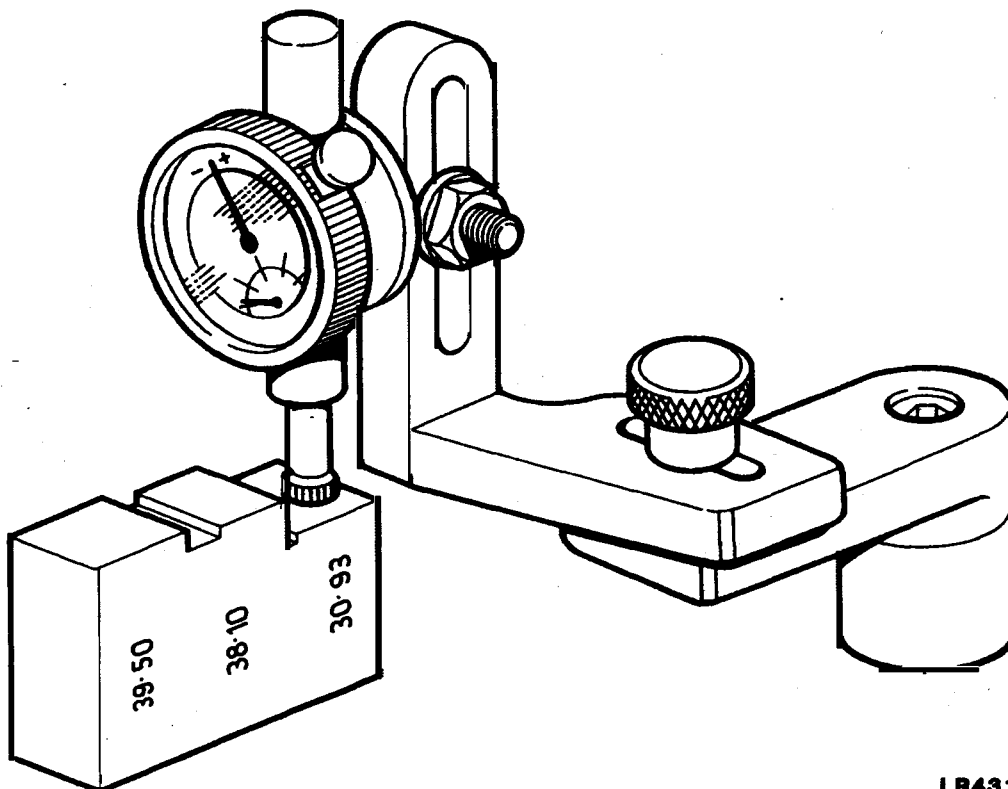
14.1 The figure marked on the end face opposite the serial number indicates, in thousandths of an inch, the deviation from nominal required to correctly set the pinion. A pinion marked plus (+) must be set below nominal, a minus (-) pinion must be set above nominal. An unmarked pinion must be set at nominal.

14.2 The nominal setting dimension is represented by the setting block gauge (Special tool Serial No 8) which is referenced from the pinion end face to the bottom radius of the differential bearing bore.



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Fig 20 Drive pinion markings



LR4315M

Fig 21 Setting dial gauge with setting block

Drive pinion adjustment**15 Adjust the drive pinion as follows:**

15.1 Ensure that the pinion end face is free of raised burrs around the etched markings.

15.2 Remove the keep disc from the magnetized base of dial gauge (Special tool Serial No 7), place the gauge on a flat surface and zero the gauge stylus on the lowest dimension 30,93mm on the setting gauge block (Fig 21).

15.3 Position the dial gauge centrally on the pinion end face with the stylus registering on the lowest point on one differential bearing bore. Note the dial gauge deviation from the zeroed setting.

15.4 Repeat the procedure on the other bearing bore. Add together the readings, then halve the sum to obtain the mean reading. Note whether the stylus has moved up or down from the zeroed setting.

15.5 Where the stylus has moved down, the amount is equivalent to the thickness of shims that must be removed from under the pinion inner cup to bring the pinion down to the nominal position.

15.6 Where the stylus has moved up, the amount is equivalent to the additional thickness of shims required to bring the pinion up to the nominal position.

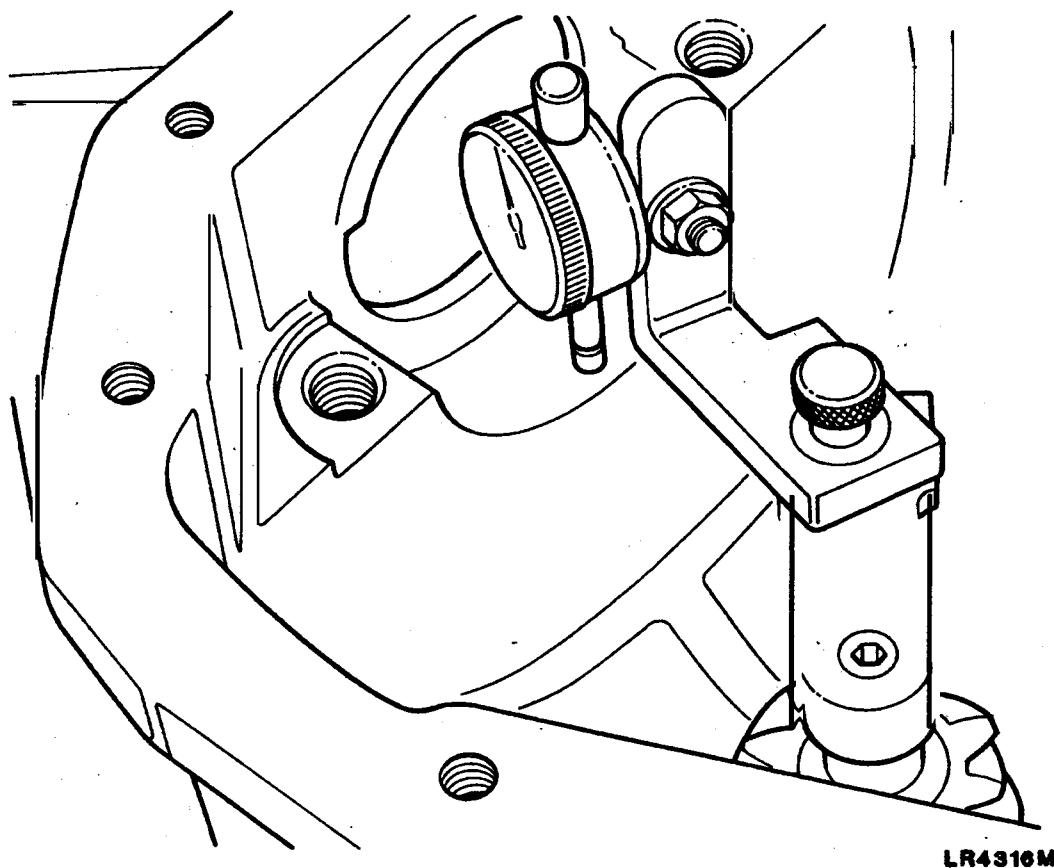


Fig 22 Pinion height setting

15.7 Before adjusting the shim thickness, check the pinion face marking, if it has a plus (+) figure, subtract that amount, in thousandths of an inch, from the shim figure obtained in the previous operations. Alternatively if the pinion has a minus (-) figure, add the amount to the shim thickness figure.

15.8 Having determined the required shim thickness adjust the shims (Fig 23 (1)) under pinion cup as necessary.

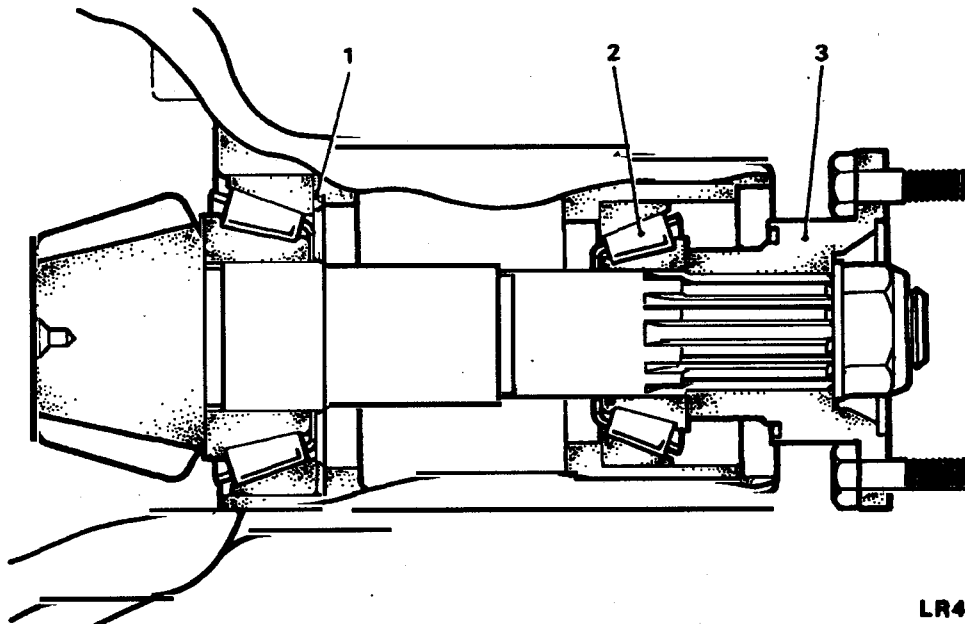
15.9 Recheck the pinion height setting. If the setting is correct, the mean reading on the dial gauge will agree with the figure marked on the pinion end face. For example, with an end face marking of +3, the dial gauge reading should indicate that the pinion is 0.003in below nominal.

15.10 When the pinion setting is satisfactory, temporarily remove the flange (3) and the pinion outer bearing (2).

15.11 Fit a new collapsible bearing spacer (Fig 24 (2)), flared end outward, to the drive pinion (1) and refit the outer bearing (3).

15.12 Fit the oil thrower (4) and a new oil seal gasket (5).

15.13 Fit a new oil seal (6), lipped side first, using a general purpose grease or, where available, a Molybdenum disulphide based grease on the seal lip, using special tool (Serial No 9) to drift in the seal.



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1 Shims 2 Pinion outer bearing 3 Drive flange

Fig 23 Section through drive end

15.14 Fit the drive coupling flange (7) and plain washer (8) to the pinion (1) and loosely fit a new flange nut (9). Use special tool (Serial No 12) to prevent the flange from rotating.

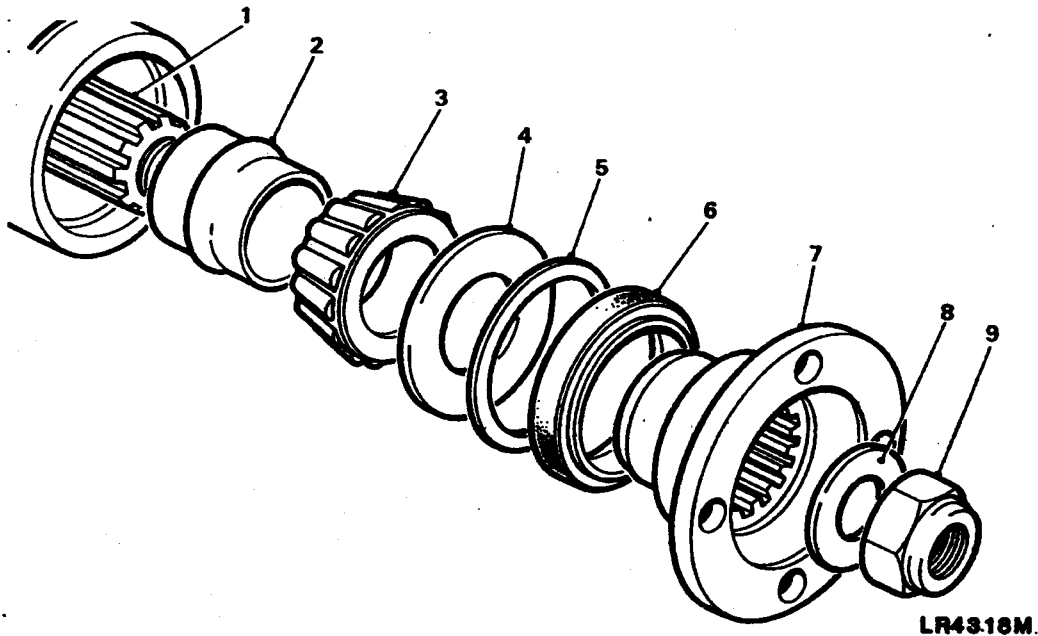
Note ...

When collapsing the bearing spacer. Once it has started to collapse the torque build up is rapid, therefore check the resistance frequently, using a spring balance, to ensure that the correct figures are not exceeded, otherwise a new collapsible bearing spacer will be required.

15.15 Alternately tighten the flange nut and check the drive pinion resistance to rotation until the following figures are achieved, as applicable.

15.15.1 Assemblies re-using their original pinion bearings: 1,7 to 3,4 Nm (1.25 to 2.5 lbf ft).

15.15.2 Assemblies fitted with new pinion bearings: 3,4 to 4,5 Nm to 2.5 to 3.33 lbf ft).



- | | | | |
|---|----------------------------|---|-----------------------|
| 1 | Pinion | 6 | Oil seal |
| 2 | Collapsible bearing spacer | 7 | Drive coupling flange |
| 3 | Outer bearing | 8 | Plain washer |
| 4 | Oil thrower | 9 | Nut |
| 5 | Gasket | | |

Fig 24 Assembling the collapsible bearing spacer

Differential backlash checks

16 Check the differential backlash as follows:

16.1 Refer to Para 10.8 and compress the axle casing.

16.2 Fit the differential unit and lever the unit away from the drive pinion until the opposite bearing cup is seated against the housing. Do not tilt the unit.

16.3 Install a dial gauge on the casing with its stylus resting on the back face of the crown wheel. Zero the gauge (Fig 16).

16.4 Lever the differential unit to engage the crown wheel teeth in full mesh with the drive pinion teeth. Do not tilt the unit.

16.5 Note the total reading obtained on the dial gauge, from this figure subtract 0,25 mm (0.010 in) to obtain the correct crown wheel backlash when fitted. The result indicates the value of shimming to be fitted between the differential case and the bearing cone at the crown wheel side of the differential.

16.6 Remove the differential unit from the casing, fit the shim value determined, taking the shims from the pack previously determined (Para 13.12). Using special tools (Serial Nos 3 and 6) to remove and replace the bearings.

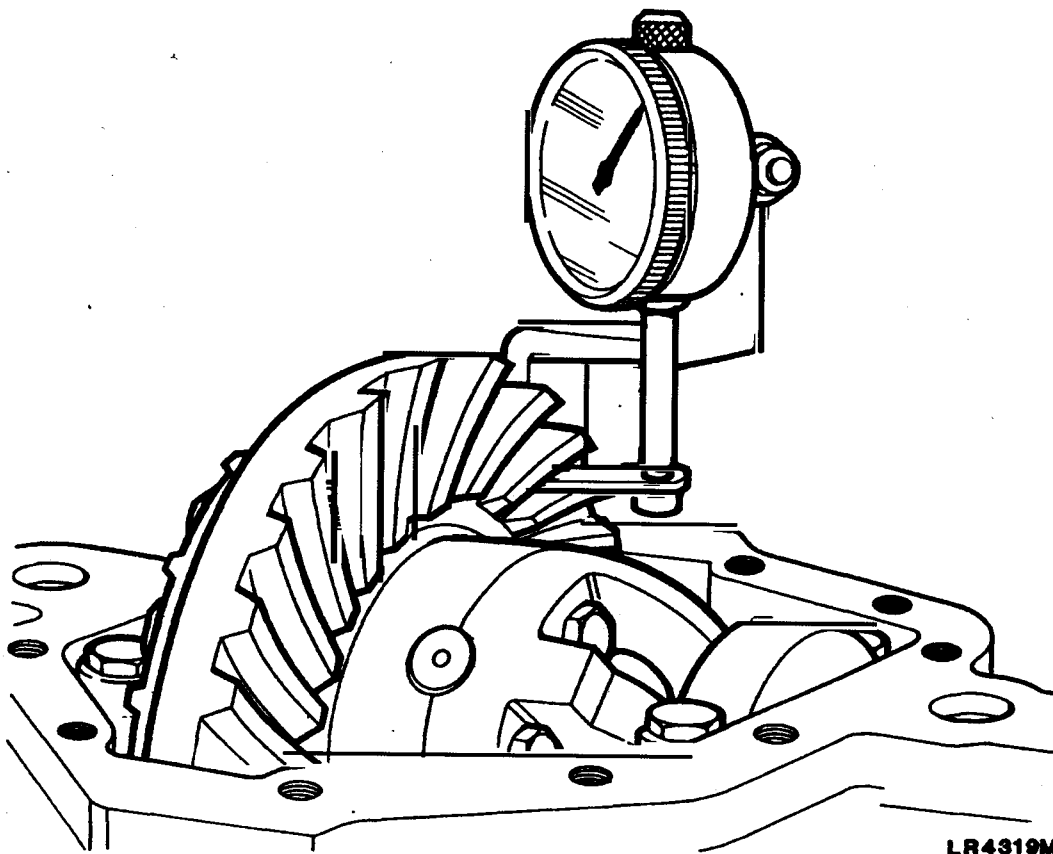


Fig 25 Checking crown wheel backlash

- 16.7 Fit the remaining shims to the opposite side of the differential.
 - 16.8 Refit the differential unit to the axle casing (Para 10.8).
 - 16.9 Remove the axle compressor tool.
 - 16.10 Fit the bearing caps in their correct locations, referring to the relationship markings on the caps and on the axle casing.
 - 16.11 Tighten the securing bolts to a torque of 126 to 142 Nm (93 to 95 lbf ft).
 - 16.12 Mount a dial gauge on the axle casing with the stylus resting on one of the crown wheel teeth (Fig 25).
 - 16.13 Prevent the drive pinion from rotating and check the crown wheel backlash which must be 0,15 to 0,27 mm (0.006 to 0.011 in). If the backlash is not within the specified limits, repeat the backlash checks, looking for possible errors.
 - 16.14 Fit the differential cover and a new gasket, coating both sides of the gasket with Hylomar PL 32M or an equivalent non-setting sealant. Fit the securing bolts with the support strip and two brackets fitted to their respective locations. Tighten the bolts to a torque of 27.5 to 33.8 Nm (20 to 28 lbf ft).
- 17 Refit the axle shafts, coat the threads of the hub driving member bolts with Loctite 'Studlock' grade CVX, fit and tighten the bolts to a torque of 60 to 70 Nm (44 to 52 lbf ft).

Refit axle assembly

- 18 Refit the axle assembly to the vehicle (Para 3).

Chapter 5-2

LAND ROVER HEAVY DUTY REAR AXLE

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Frame Para

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	Rear axle
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	Half shafts
4	Removal
5	Cleaning
6	Examination
7	Installation
	Hub assembly
8	Dismantling
9	Reassembly
	Differential
10	Removal
11	Dismantling (CAUTION)
12	Cleaning
13	Examination
14	Reassembly
15	Drive pinion
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19	Refitting

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2	Special tools

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INTRODUCTION

1 This Chapter covers the Unit and Field Repairs for the Heavy Duty type rear axle as fitted to Land Rover 90 vehicles.

REAR AXLERemoval

Note ...

The removal and refitting of the axle assembly requires the assistance of two additional personnel to steady the axle, when lowering or positioning the axle.

2 To remove the axle proceed as follows:

2.1 Jack up the rear of the vehicle and support it with suitable stands located on the chassis.

2.2 Remove the rear road wheels.

2.3 Support the axle weight with a suitable hydraulic jack.

2.4 Disconnect the shock absorbers (Fig 1(1)) at the lower fixings and remove the rubbers and washers.

2.5 Disconnect the flexible brake hose at the three-way connection (2) above and to the right hand side of the differential. Blank off the connections to prevent loss of brake fluid and ingress of foreign matter.

2.6 Disconnect the breather hose at the banjo connection (6) on the axle casing. Remove the plastic tie straps securing breather hose to axle casing.

2.7 Disconnect the lower links (5) at the axle.

2.8 Mark the differential and propeller shaft flanges with a line, to aid re-assembly. Remove the four nuts and bolts, lower the propshaft (7) and tie to one side.

2.9 Disconnect the pivot bracket ball joint by removing the split pin castle nut and plain washer securing the joint to the axle mounted bracket (3).

2.10 Lower the axle, release the bolts securing the coil spring retaining plates and remove the springs (4).

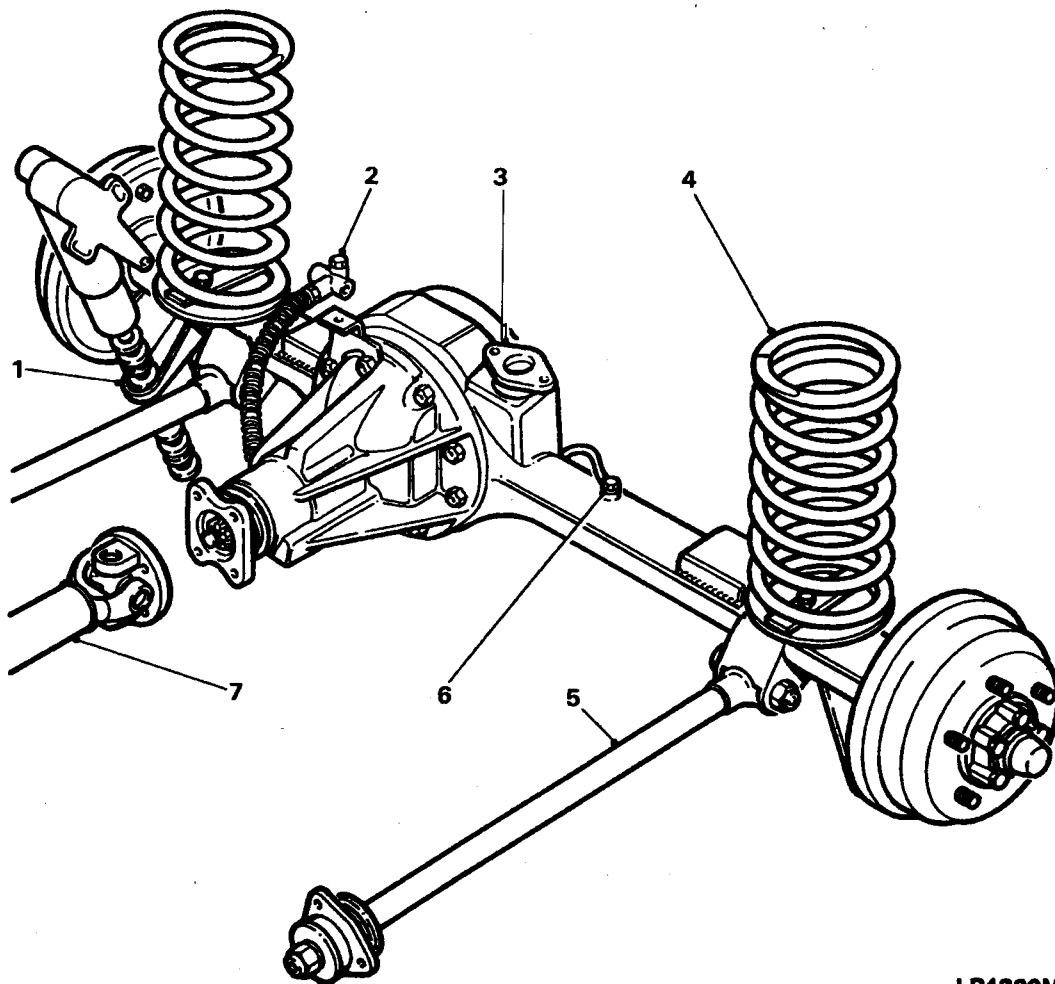
2.11 If a new or replacement axle assembly is to be fitted, remove the brake pipes from the existing axle assembly, clean and examine them, if they are satisfactory for further use fit to the replacement axle.

2.12 Remove the road spring seating plates and fit them to the replacement axle assembly.

Installation

3 To install the axle assembly on the vehicle proceed as follows:

3.1 Fit the coil springs (4) to the axle and secure with the retaining plates and bolts.



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- | | | | |
|---|---------------------------------|---|---------------------|
| 1 | Shock absorber lower fixing | 5 | Lower link |
| 2 | Brake pipe three-way connection | 6 | Breather connection |
| 3 | Pivot ball joint axle bracket | 7 | Propeller shaft |
| 4 | Coil spring | | |

Fig 1 Rear axle removal/installation

3.2 Raise the axle with the jack and locate the lower links (5), secure with the bolts and nuts tightened to a torque of 64 Nm (47 lbf ft).

3.3 Connect the pivot ball joint to the axle mounted bracket (3) and secure with the castle nut and plain washer, tightening the nut to a torque of 176 Nm (130 lbf ft).

3.4 Connect the shock absorbers (1) to the attachment plate on the axle and tighten the securing nuts to a torque of 75 Nm (55 lbf ft).

3.5 Connect the propeller shaft (7), aligning the marks made when dismantling, and tighten the securing bolts to a torque of 41 to 52 Nm (30 to 38 lbf ft).

3.6 Connect the brake pipe flexible hose at the three-way connector (2).

- 3.7 Connect the breather hose (6) to the top of the axle casing.
- 3.8 Fit the road wheels and remove the vehicle from the stands.
- 3.9 Fill the axle with the approved oil (Cat 601).
- 3.10 Bleed the brakes and top up the fluid (Cat 201 Chap 4-1 Para 8).
- 3.11 After the initial axle run, check the oil level and replenish as necessary.
- 3.12 Where major running parts have been replaced during overhaul, it is recommended practice to allow the axle assembly to 'run in' by avoiding, where possible, heavy loads and high speeds during initial running.

HALF SHAFTS

Removal

- 4 To remove the half shafts proceed as follows:
 - 4.1 Prise off the hub cap (Fig 2 (19)), remove the five securing bolts (20) and spring washers (21) from the driving member (22). Withdraw the driving member complete with the half shaft (1).
 - 4.2 If necessary repeat Para 4.1 to remove the other half shaft.
 - 4.3 Remove the circlip (18) and withdraw the driving member (22).

Cleaning

- 5 Thoroughly clean the half shaft and driving member.

Examination

- 6 Examine the splines on the half shaft and driving member for damage and wear.

Installation

- 7 To fit the half shafts reverse the removal procedure using a new gasket (23) between the mating faces of the hub (6) and driving member (22) and tightening the bolts (20) to a torque of 60 to 70 Nm (44 to 52 lbf ft).

HUB ASSEMBLY

TABLE 1 SPECIAL TOOLS

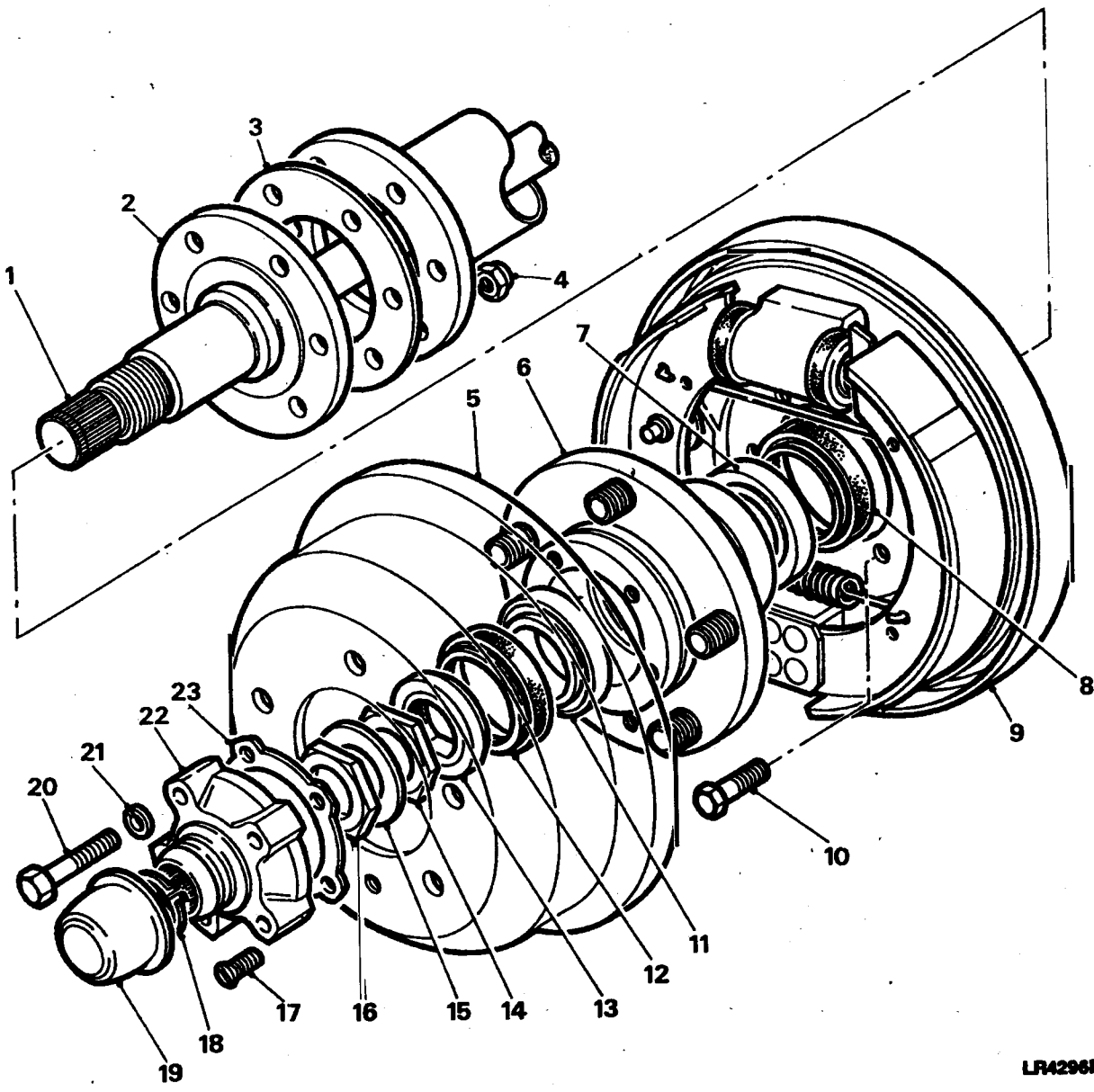
Ser No (1)	Manufacturers Part No (2)	NSN/Part No where applicable (3)	Designation (4)
1	LST 550-5		Hub inner and outer oil seal replacer
2	18G 134		Bearing and oil seal replacer (main tool)
3	RO 606435A		Spanner for hub nut adjustment

Dismantling

- 8 To dismantle the hub assemblies carry out the following:
 - 8.1 Jack-up the rear of the vehicle, lower onto axle stands and remove the road wheels.
 - 8.2 Remove the brake drum retaining screws (17) and withdraw the brake drum (5). If necessary, slacken the brake adjuster to facilitate removal.
 - 8.3 Prise-off the hub cap (19) and remove the circlip (18) from the end of the half shaft (1).
 - 8.4 Remove the five bolts (20) and spring washers (21) and withdraw the hub driving member (22) complete with gasket (23).
 - 8.5 Prise-up the lock washer (15), remove the locknut (16), withdraw the lock washer and remove the adjusting nut (14). Discard lock washer.
 - 8.6 Withdraw the hub (6) complete with the inner and outer seals (8) and (12), seal track spacer (13) and inner and outer taper roller bearings (7) and (11).
 - 8.7 If the stub axle (2) is damaged or scored remove, complete with gasket (3), and discard it by removing the six brake back plate retaining nuts (4) and bolts (10).
 - 8.8 Remove the seal track spacer and outer seal.
 - 8.9 Remove the outer bearing cone.
 - 8.10 Remove the inner seal and inner bearing cone.
 - 8.11 If new bearings are to be fitted drift or press out the bearing cups from the hubs and discard.
 - 8.12 Degrease and examine the hub for cracks and damage, renew if necessary, also if the wheel studs are faulty.

Reassembly

- 9 To reassemble the hub proceed as follows:
 - 9.1 If removed, fit the stub axle (2) and brake back plate (9) to the axl casing with a new gasket (3) interposed between the casing and stub axle mating faces. Secure with the six nuts and bolts (4) and (10) tightening the bolts to a torque of 60 to 70 Nm (44 to 52 lbf ft).
 - 9.2 If removed, fit new inner and outer bearing cups to the hub, ensuring that they are pressed squarely into position.
 - 9.3 Fit the inner bearing cone and pack with BP Energrease L2 (XG279 grease) or a suitable alternative.



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- | | | | |
|----|-----------------|----|--------------------|
| 1 | Axle half shaft | 13 | Seal track spacer |
| 2 | Stub axle | 14 | Adjusting nut |
| 3 | Gasket | 15 | Lock washer |
| 4 | Locknut | 16 | Locknut |
| 5 | Brake drum | 17 | Screw |
| 6 | Hub | 18 | Circlip |
| 7 | Inner bearing | 19 | Hub cap |
| 8 | Inner oil seal | 20 | Bolt |
| 9 | Brake backplate | 21 | Spring washer |
| 10 | Bolt | 22 | Hub driving member |
| 11 | Outer bearing | 23 | Gasket |
| 12 | Outer oil seal | | |

Fig 2 Rear hub assembly

9.4 Fit the inner oil seal as follows:

9.4.1 Clean the hub oil seal housing and ensure that the seal locating surface is smooth and the chamfer on the leading edge is also smooth and free from burrs.

9.4.2 Examine the new seal and ensure that it is clean, undamaged and that the garter spring is properly located, even a small scratch on the seal lip could impair its efficiency.

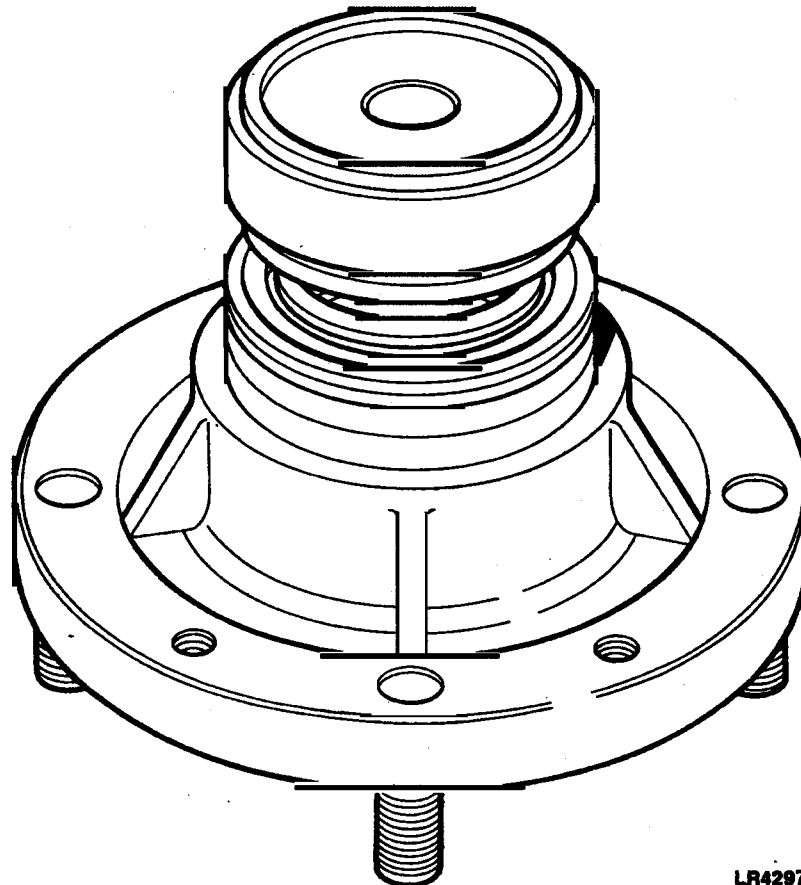
9.4.3 Although the new seal is already pre-greased by the manufacturer, apply BP Energrease L2 (XG279 grease) or a suitable alternative to the outside diameter of the seal, before fitting, taking care not to damage the lip.

9.4.4 Place the seal, lip side leading, squarely on the hub and using the 76mm end of special tool (Serial No 1) and special tool (Serial No 2) drive the seal into position to the depth determined by the tool.

9.5 Fit the outer oil seal as follows;

9.5.1 Fit the new outer bearing cone and pack with BP Energrease L2 (XG279 grease) or a suitable alternative.

9.5.2 Carry out operations 9.4.1 to 9.4.3.



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Fig 3 Fitting oil seals

- 9.5.3 Carry out operation 9.4.4 but this time use the 72mm end of the special tool.
- 9.6 Smear the lips of both seals with the above grease. This is important since a dry seal can be destroyed during the first few revolutions of the hub.
- 9.7 Select a new seal track spacer (Fig 2 (13)) and check that the outer diameter is smooth and free from blemishes and that there are no burrs on the leading edge.
- 9.8 Taking care not to damage the seal lips fit the hub assembly to the stub axle. Do not allow the weight of the hub to rest, even temporarily, on the outer seal otherwise damage and distortion could occur. Therefore hold the hub clear of the stub axle until the seal track spacer is fitted.
- 9.9 Carefully fit the seal track spacer, seal lip leading.
- 9.10 Fit the hub inner nut and using special tool (Serial No 3) tighten the adjusting nut whilst slowly revolving the hub until all end-float is removed, then back-off the nut approximately one half of a turn. Retighten the nut to 1,5 to 1,7 Nm (1.1 to 1.25 lbf ft), this will allow for compression of the rubber on the new seal track spacer and give the required end float of 0,013 to 0,10 mm (0.0005 to 0.004 in).

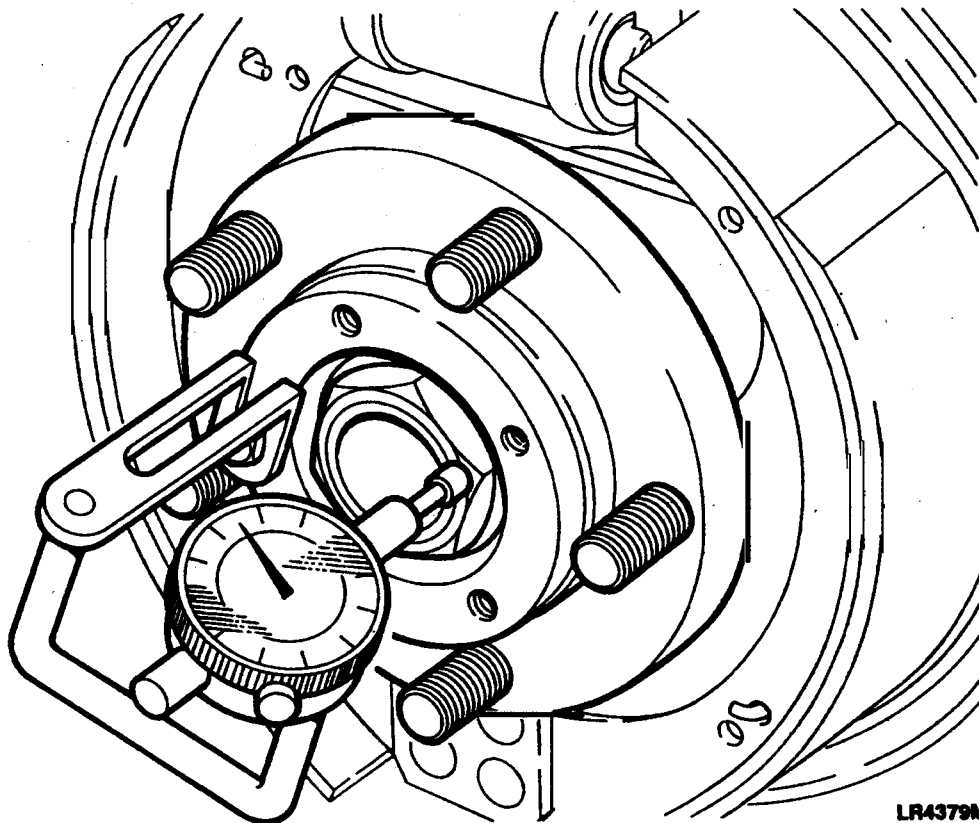


Fig 4 Checking hub end-float using dial test indicator

9.11 If the rubber on the seal track spacer has previously been compressed, the hub end-float can be checked by mounting a dial test indicator and bracket on the hub so that the stylus rests in a loaded condition on the nut (Fig 4). Rotate the hub to settle the bearings and check the end float which must be within the limits shown in para 9.10. Adjust the nut as necessary to achieve the required end-float.

9.12 Fit a new lock washer and the locknut. Whilst restraining the adjustment nut, tighten the locknut to a torque of 95 to 108 Nm (70 to 80 lbf ft).

9.13 If the conditions of para 9.11 apply, rotate the hub several times to settle bearings then recheck the end-float. Adjust as necessary to achieve the required setting.

9.14 Bend one segment of the lock washer over the adjusting nut and the segment diametrically opposite over the locknut.

9.15 Using a new gasket, fit the hub driving member and secure with the five bolts and spring washers, tightening the bolts to a torque of 60 to 70 Nm (44 to 52 lbf ft).

9.16 Fit a new circlip to the axle shaft ensuring that it is properly seated in the groove and refit the hub cap.

9.17 Fit the road wheels, jack-up the vehicle, remove the axle stands and lower the vehicle to the ground. Finally tighten the wheel nuts to a torque of 108 Nm (80 lbf ft).

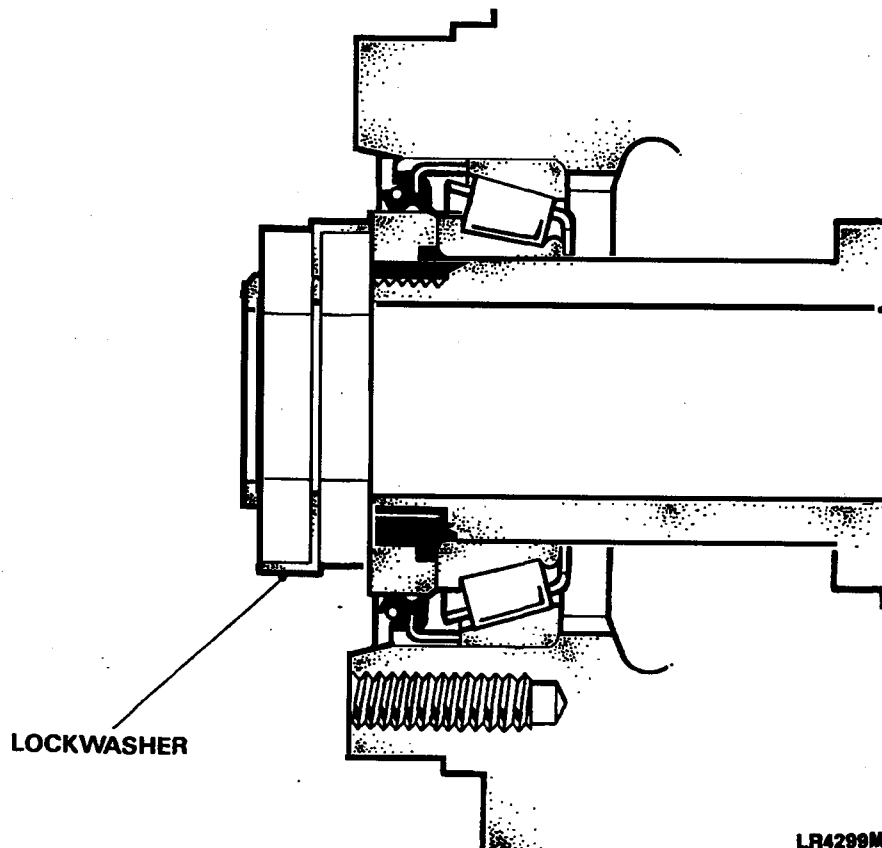


Fig 5 Lock washer location

DIFFERENTIAL

TABLE 2 SPECIAL TOOLS

Ser No (1)	Manufacturers Part No (2)	NSN/Part No where applicable (3)	Designation (4)
1	MS 47		Hand press
2	18G 47-6		Pinion head bearing remover/replacer
3	18G 191		Bevel pinion setting gauge
4	18G 191-4		Universal setting block, pinion height
5	18G 1205		Adjustable flange holding wrench
6	LST 106		Pinion oil seal replacer
7	RO 262757A		Extractor pinion bearing cup
8	RO 262757-1		Replacer pinion bearing cup (use with RO 262757A)
9	RO 262757-2		Adaptor pinion tail bearing cup replacer
10	RO 530105		Spanner carrier bearing nuts
11	RO 530106		Bracket for dial gauge indicator

Removal

10 To remove the differential assembly carry out the following:

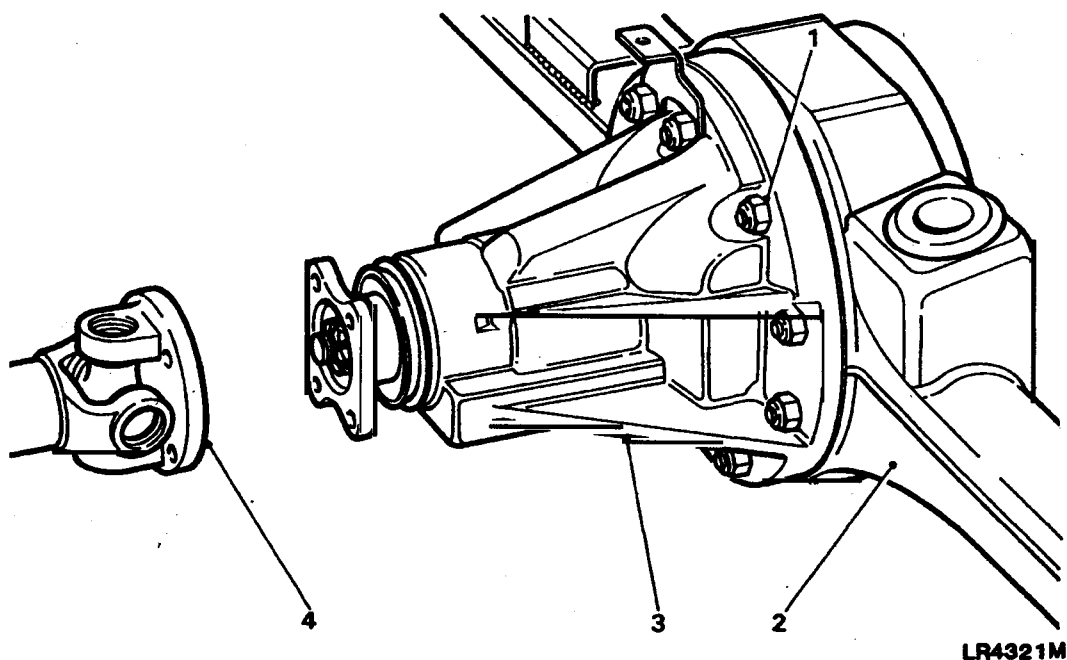
10.1 Using a suitable container drain the oil from the axle. To avoid loss, refit the drain plug.

10.2 Disconnect the propeller shaft (Fig 6 (4)) from the differential flang and secure to one side.

10.3 Remove the hub driving member fixings and withdraw the axle shafts sufficiently to disengage them from the differential unit (Fig 2).

10.4 Suitably support the differential unit whilst removing.

10.5 Remove the self locking nuts (Fig 6 (1)) securing the differential assembly (3) to the axle casing (2) and withdraw the unit from the v hicle.



- | | | | |
|---|------------------|---|-----------------------|
| 1 | Self locking nut | 3 | Differential assembly |
| 2 | Axle casing | 4 | Propeller shaft |

Fig 6 Removing the differential assembly

Dismantling

11 To dismantle the differential assembly, secure the assembly in a suitable work stand and proceed as follows:

Note ...

It is essential that the differential assembly components are marked in their original positions and relative to other components so that, when refitted their original setting is maintained. It should also be noted that the bearing caps are handed and must not be interchanged.

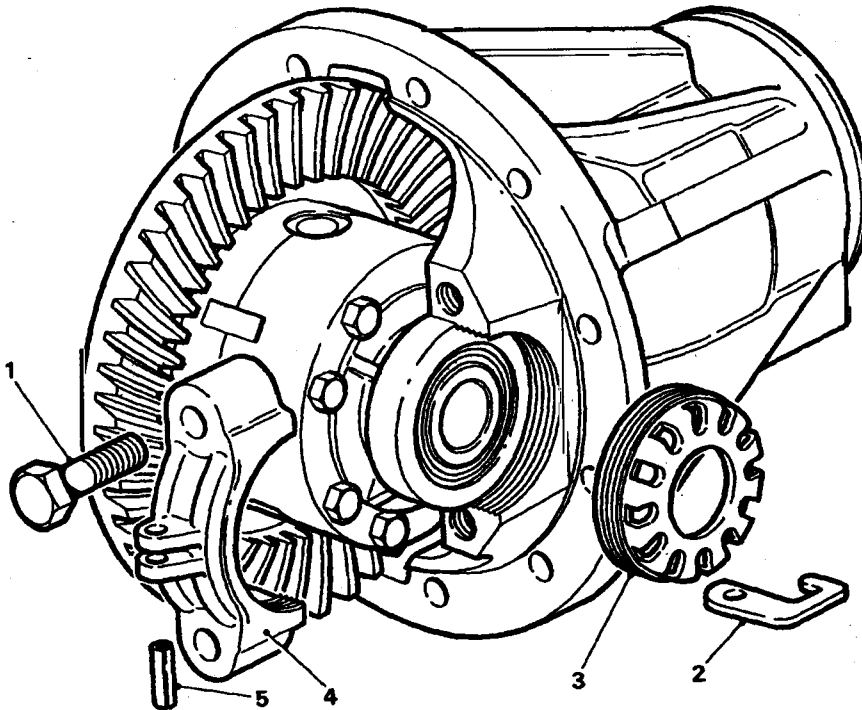
11.1 Drift out the roll pins (Fig 7 (5)) securing the bearing nut locking fingers (2) to the bearing caps (4). Remove the locking fingers.

11.2 Slacken the bearing cap bolts (7) and mark the caps to aid reassembly.

11.3 Using special tool (Serial No 10), remove the bearing adjusting nuts (3).

11.4 Remove the bearing cap bolts (1) and bearing caps (4).

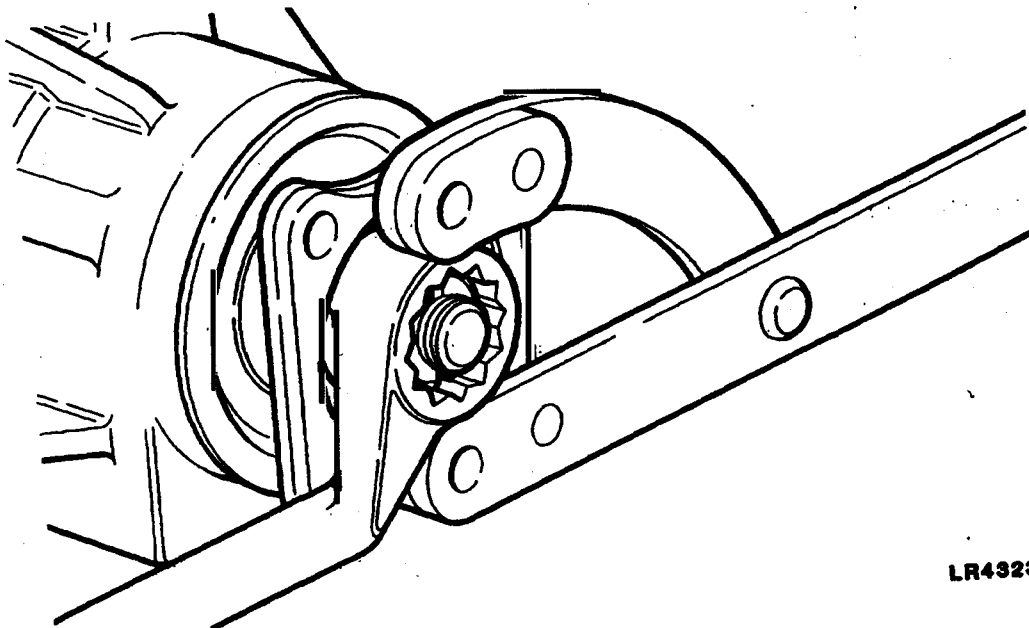
11.5 Lift out the assembled crown wheel, differential unit and bearings.



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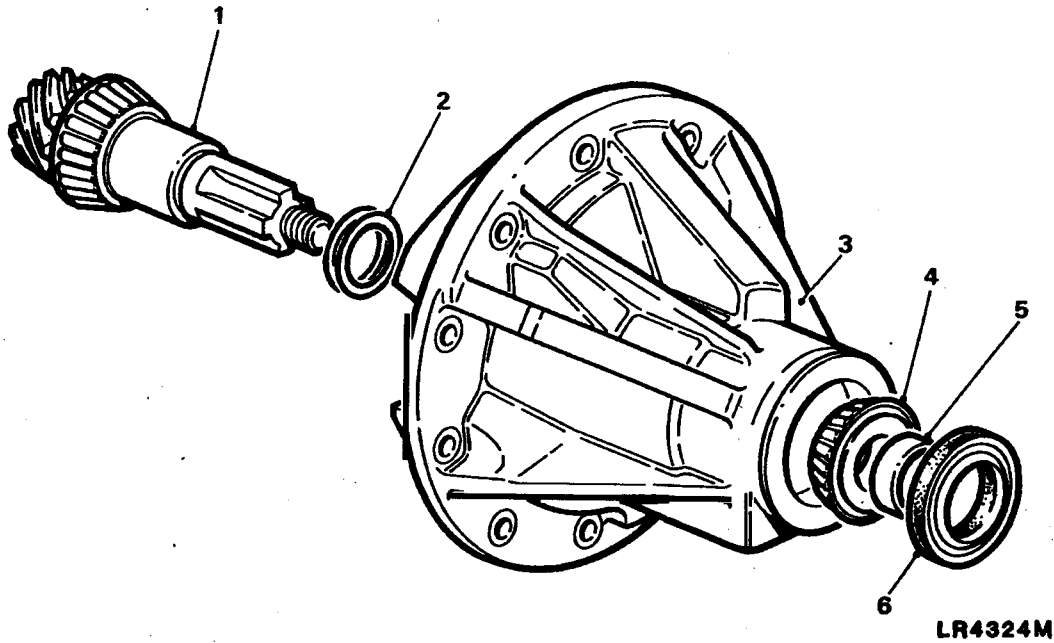
- | | |
|-------------------------|---------------|
| 1 Bolt | 4 Bearing cap |
| 2 Locking finger | 5 Roll pin |
| 3 Bearing adjusting nut | |

Fig 7 Bearing cap removal



LR4323M

Fig 8 Pinion flange nut removal



- | | | | |
|---|---------------------|---|---------------|
| 1 | Pinion and bearing | 4 | Outer bearing |
| 2 | Outer bearing shims | 5 | Spacer |
| 3 | Differential casing | 6 | Oil seal |

Fig 9 Pinion removal

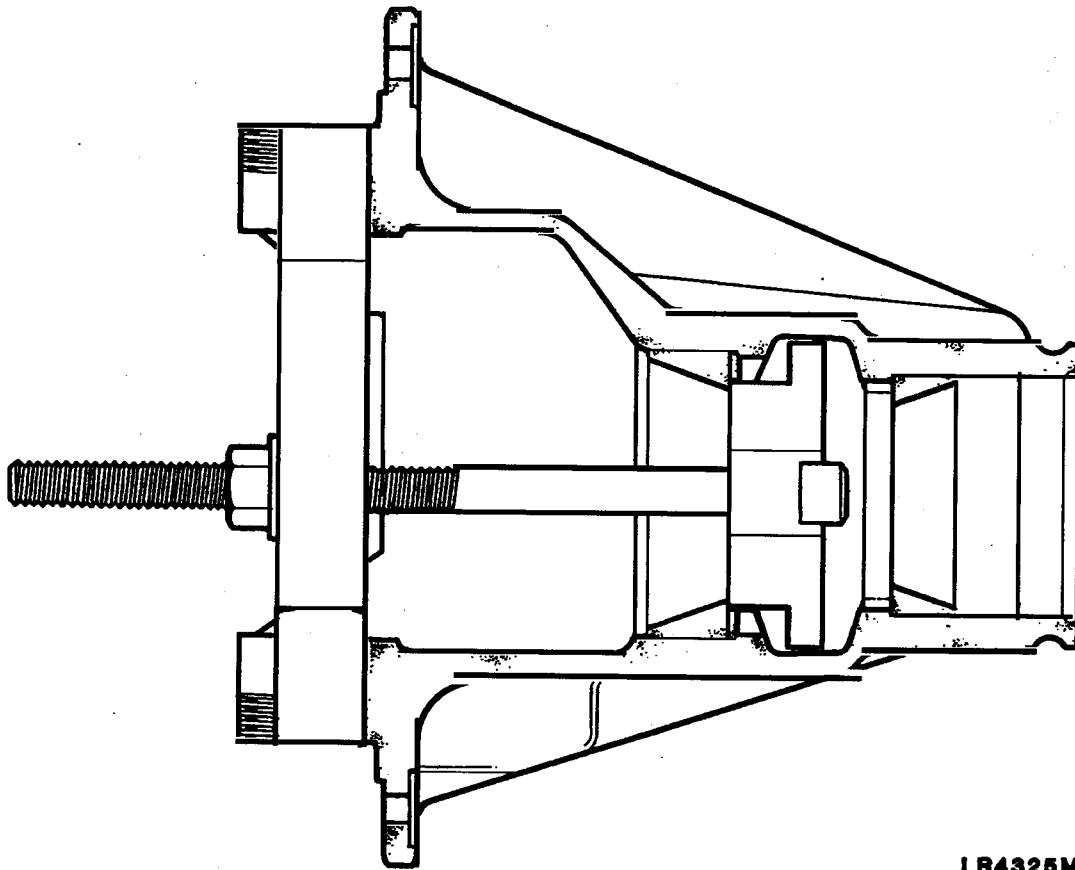
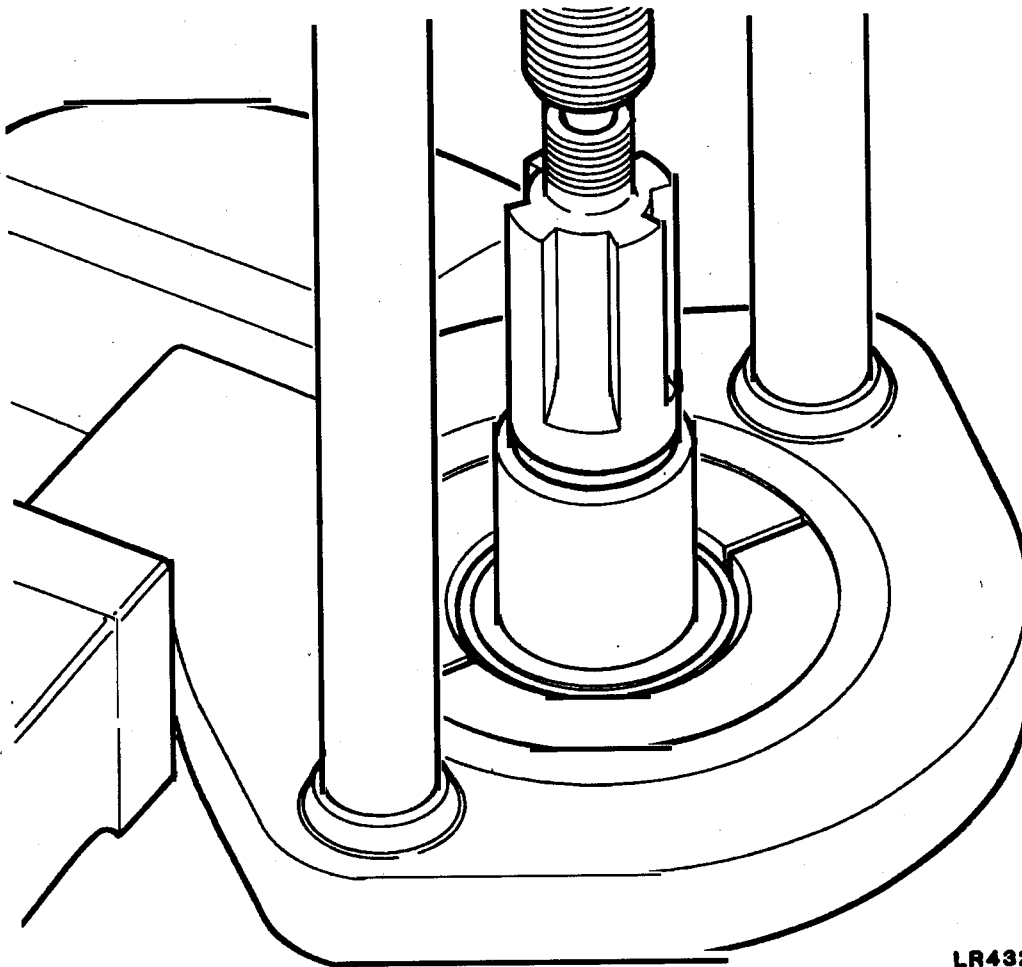


Fig 10 Removing pinion inner bearing track

- 11.6 Remove the split pin securing the pinion flange nut.
- 11.7 Using special tool (Serial No 5) to restrain the flange, remove the pinion flange nut (Fig 8).
- 11.8 Withdraw the pinion (Fig 9 (1) complete with pinion head bearing and outer bearing shims (2). Note thickness of shims to assist with reassembly.
- 11.9 Remove the pinion flange oil seal (6), spacer (5) and outer bearing (4). Discard oil seal.
- 11.10 Using special tool (Serial No 7) remove the pinion inner bearing track and shims (Fig 10). Note thickness of the shim washers removed, to aid reassembly.
- 11.11 Remove special tool and drift out the outer bearing track from the housing.
- 11.12 Using special tools (Serial Nos 1 and 2) remove the pinion inner bearing (Fig 11).



LR4326M

Fig 11 Removing pinion inner bearing

11.13 For reassembly purposes, add alignment marks to the crown wheel and differential and to the differential case halves.

CAUTION ...

To avoid personal injury, the differential unit must be securely retained whilst removing the bolts from the crown wheel and case halves, as these bolts are Loctited and may be difficult to r move.

11.14 Remove the screws (Fig 12 (10)) and washers (9) and detach th crown wheel (2).

11.15 Remove the bolts (3) securing the case halves (4) and (8) together and withdraw the upper half of the casing (8).

11.16 Withdraw the upper differential wheel (13) and if fitted, the thrust washer (12).

11.17 Withdraw the pinions (7), dished thrust washers (5) and the cross shaft (6), noting the relevant position of all the components.

11.18 Remove the lower differential wheel (14) and thrust washer (15).

11.19 Remove the roller bearings (1) and (11) from the casing halves, retain the bearings with their respective outer tracks.

Cleaning

12 Thoroughly clean all of the components.

Examination

13 To examine the components carry out the following:

13.1 Examine all of the components for obvious wear or damage.

13.2 All bearings must be a press fit, except the flange end pinion bearing, which must be a slide fit on the shaft.

13.3 The crown wheel and pinion are a matched assembly and must not be changed separately.

13.4 The bevel pinion housing and the bearing caps are also a matched assembly and must be changed as such.

13.5 The differential casing halves are a matched pair, if replacement is necessary they must be replaced as an assembly.

13.6 Discard and renew all thrust washers.

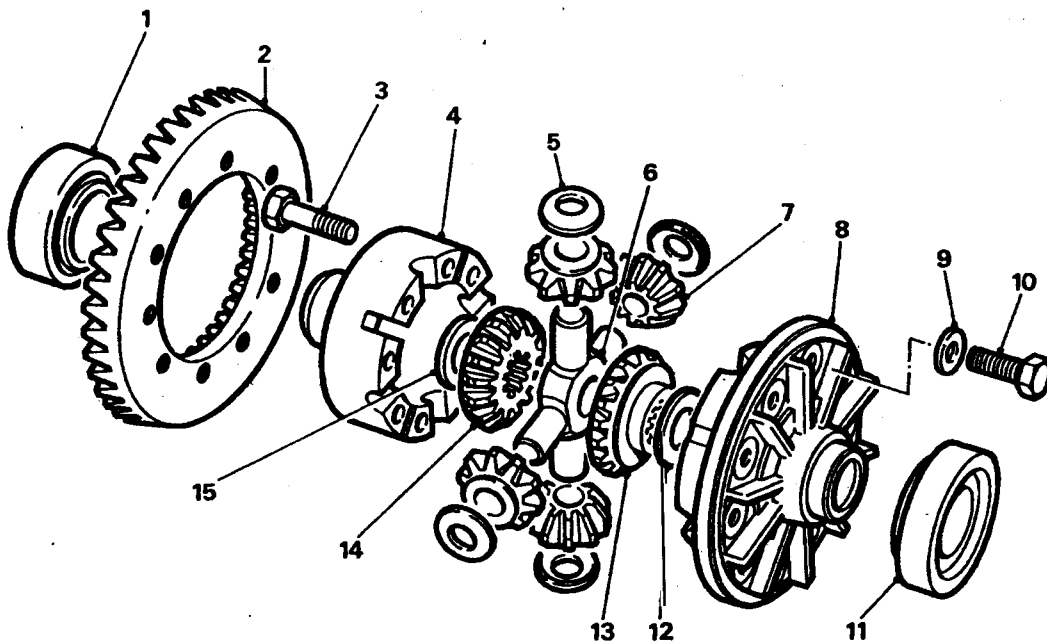
13.7 Differential casings with worn thrust washer seatings must be renewed.

13.8 Examine the differential case to crown wheel mating face for burrs and damage which could lead to crown wheel run-out when fitted.

Reassembly

14 Reassemble the differential as follows:

14.1 Positon the lower case half (Fig 12 (4) with the open side uppermost and fit the lower differential wheel (14) and a thrust washer (15) in the case.



LR4327M

1	Roller bearing	9	Washer
2	Crown wheel	10	Screw
3	Bolt	11	Roller bearing
4	Lower case half	12	Thrust washer
5	Dished thrust washer	13	Upper differential wheel
6	Cross shaft	14	Lower differential wheel
7	Pinion	15	Thrust washer
8	Upper case half		

Fig 12 Differential assembly

14.2 Assemble the cross shaft (6) pinions (7) and dished thrust washers (5), lubricate the thrust washers with EP90 (OEP220) oil.

14.3 Fit the assembled cross shaft in the case half, ensuring correct meshing of the gears.

14.4 Fit the upper differential wheel (13) with a thrust washer (12), again ensuring correct meshing.

14.5 Fit the upper case half (8), maintaining the alignment marking.

Note ...

New screws for securing the case halves are already coated with a dry locking compound and do not require the application of Loctite. If the existing screws are being used the threads must be cleaned and coated with Loctite 'Studlock' CVX.

14.6 Fit the bolts (3), if new bolts are being fitted ensure they are of the correct type. Tighten the bolts evenly to 30 to 36 Nm (22 to 27 lbf ft).

14.7 Check that the serial number on the crown wheel matches that marked on the pinion end face.

14.8 Ensure that the differential housing flange and crown wheel are thoroughly clean. Maintaining the alignment marks fit the crown wheel (2) to the differential case and secure with the screws (10) and washers (9), tighten the screws evenly to a torque of 54 to 61 Nm (40 to 45 lbf ft).

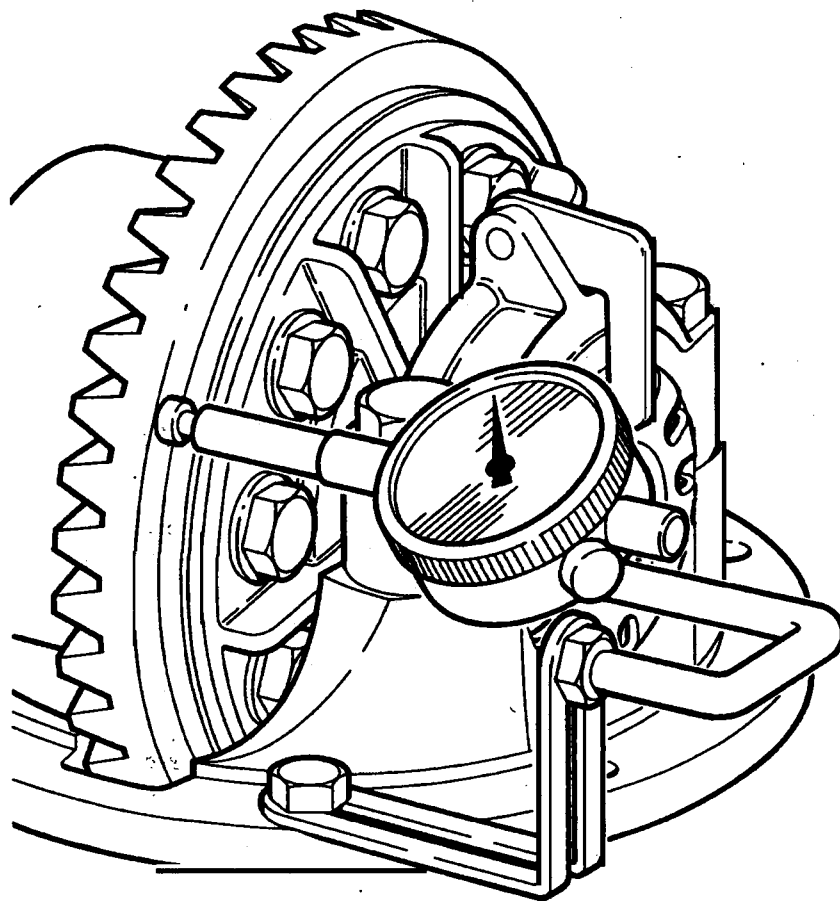
14.9 Press on the differential roller bearings (1) and (11).

14.10 Place the assembled crown wheel and differential unit in the pinion housing, fit the bearing caps, ensuring that they are fitted to the locations from which they were removed, fit the bolts but do not fully tighten at this stage.

14.11 Fit the bearing adjusting nuts and adjust to obtain zero end-float.

14.12 Tighten the bearing cap bolts to a torque of 80 to 100 Nm (59 to 74 lbf ft).

14.13 Using a suitable dial gauge, attached to special tool (Serial No 11) check the crown wheel for run-out (Fig 13), which should not exceed 0,10 mm (0.004 in). If excessive run-out is recorded, remove the crown wheel and examine the mounting flange for burrs, grit etc. Refit the crown wheel and recheck. Run-out attributable to a buckled or damaged differential housing can only be corrected by renewing the differential gear casing.



LR4326M

Fig 13 Checking crown wheel run-out

14.14 When satisfied that run-out is within the specified limits remove the differential assembly from the pinion housing.

14.15 Remove the crown wheel securing screws, coat the threads with Loctite 'Studlock' CVA, refit and evenly tighten to a torque of 54 to 61 Nm (40 to 45 lbf ft).

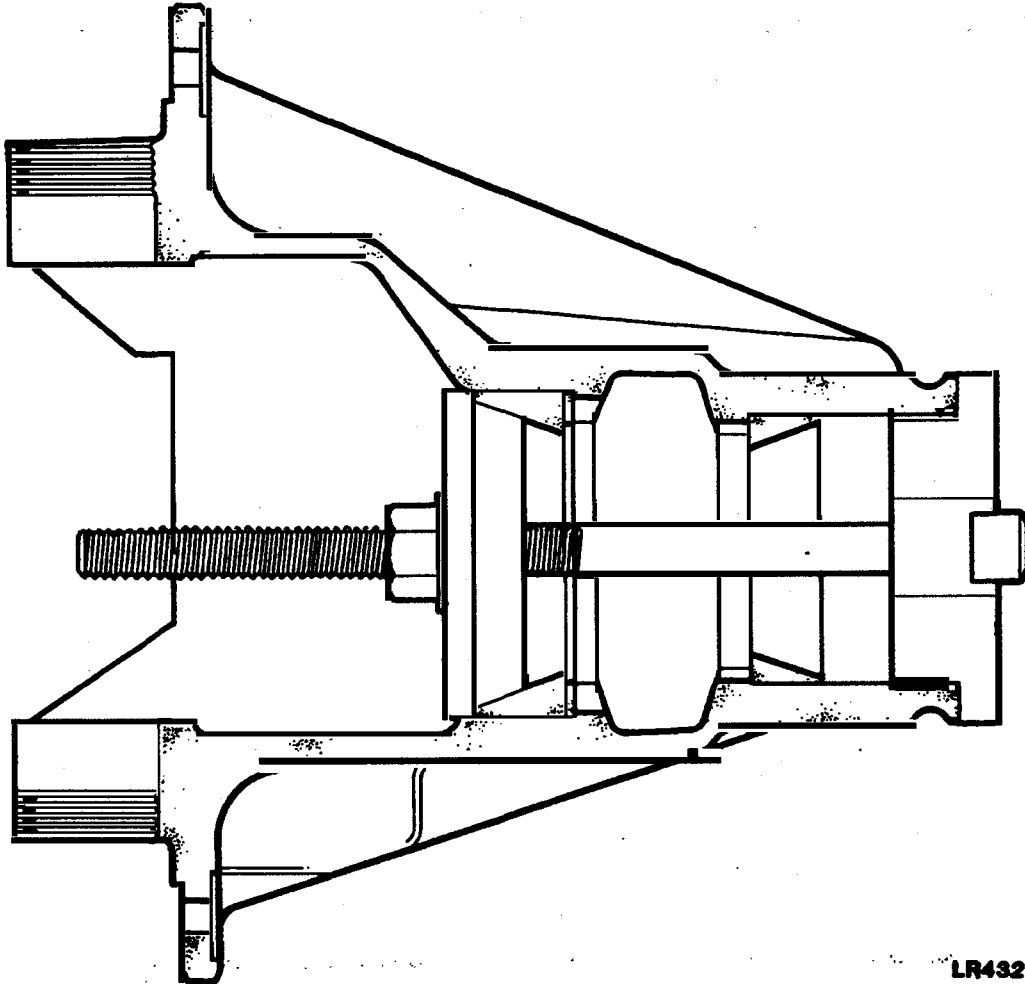


Fig 14 Fitting pinion inner bearing track

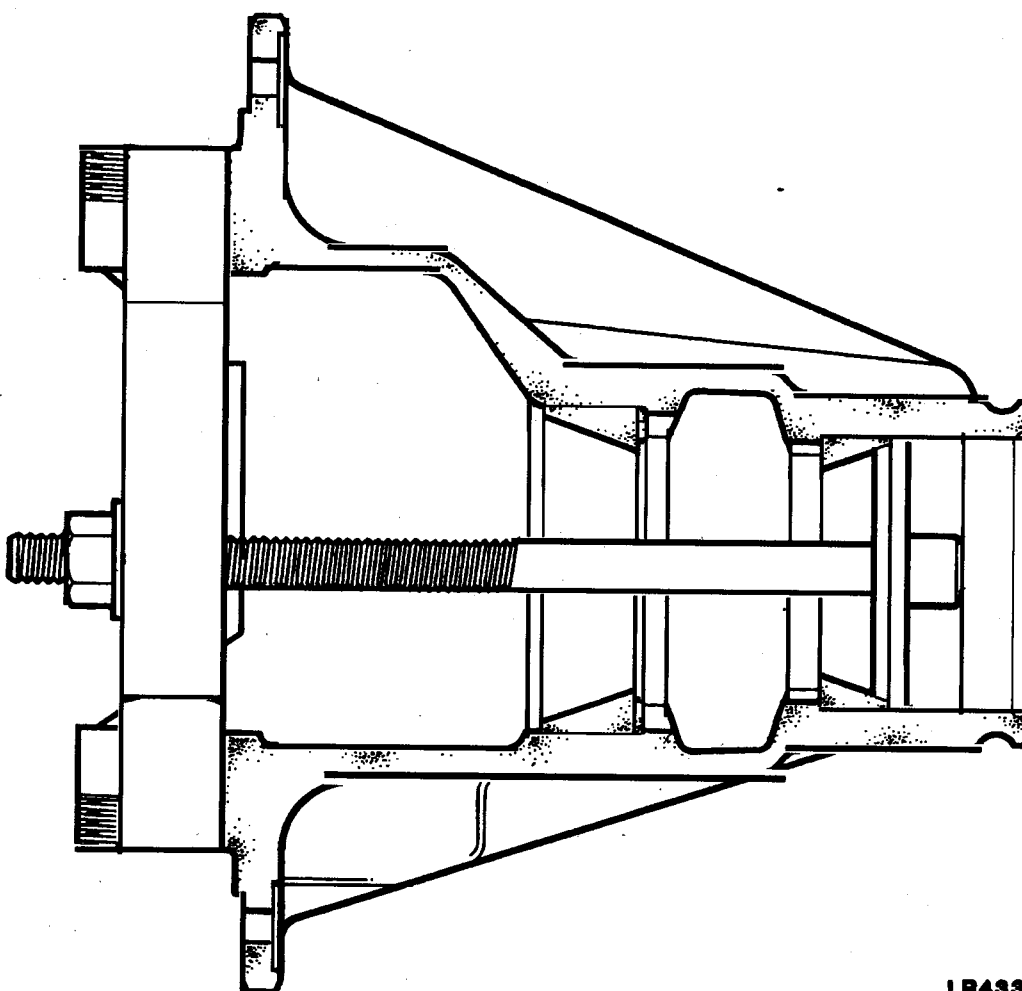
Drive pinion

15 Fit the drive pinion as follows:

15.1 Using special tools (Serial No's 7 and 8), fit the pinion inner bearing track and the original shims or shims to the same value (Para 11.10) to the pinion housing (Fig 14).

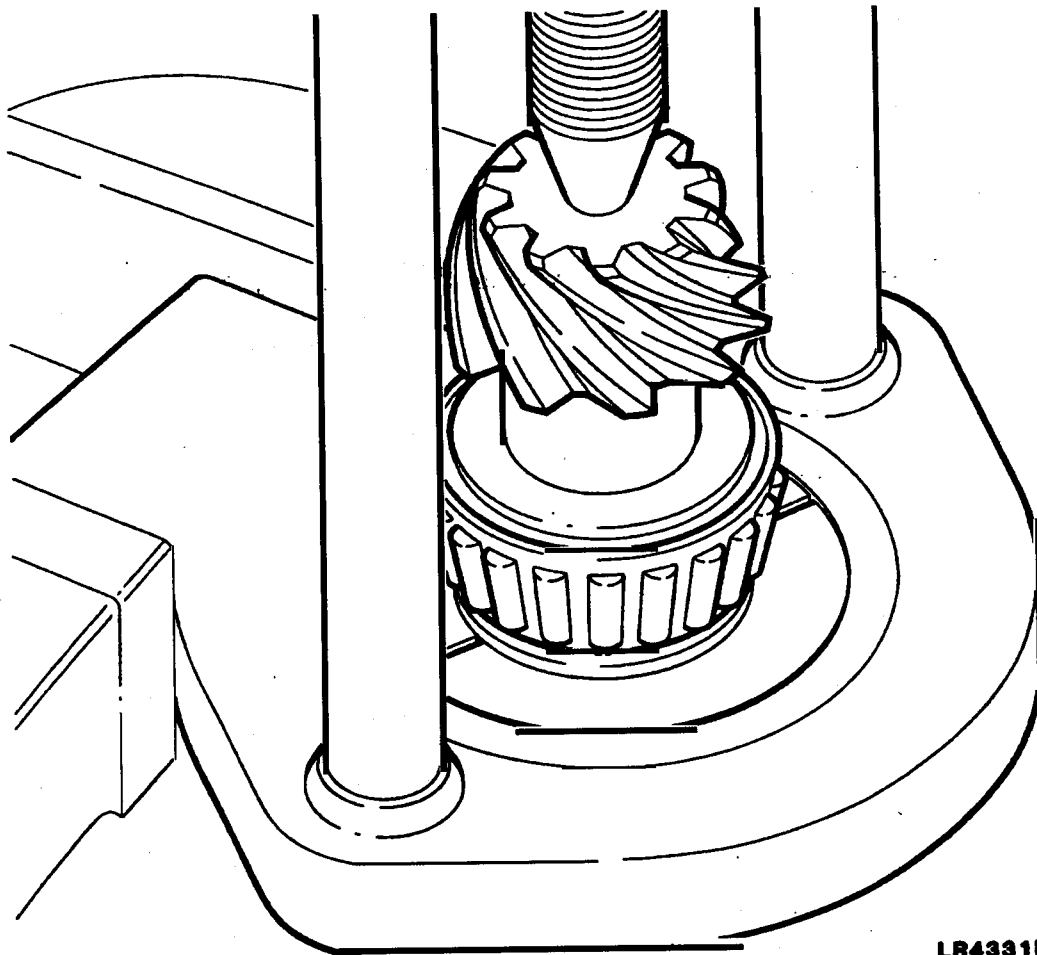
15.2 Using special tools (Serial No's 7 and 9), fit the pinion outer bearing track to the pinion housing (Fig 15).

15.3 Using special tools (Serial No's 1 and 2), fit the pinion inner bearing to the pinion (Fig 16).



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Fig 15 Fitting pinion outer bearing track



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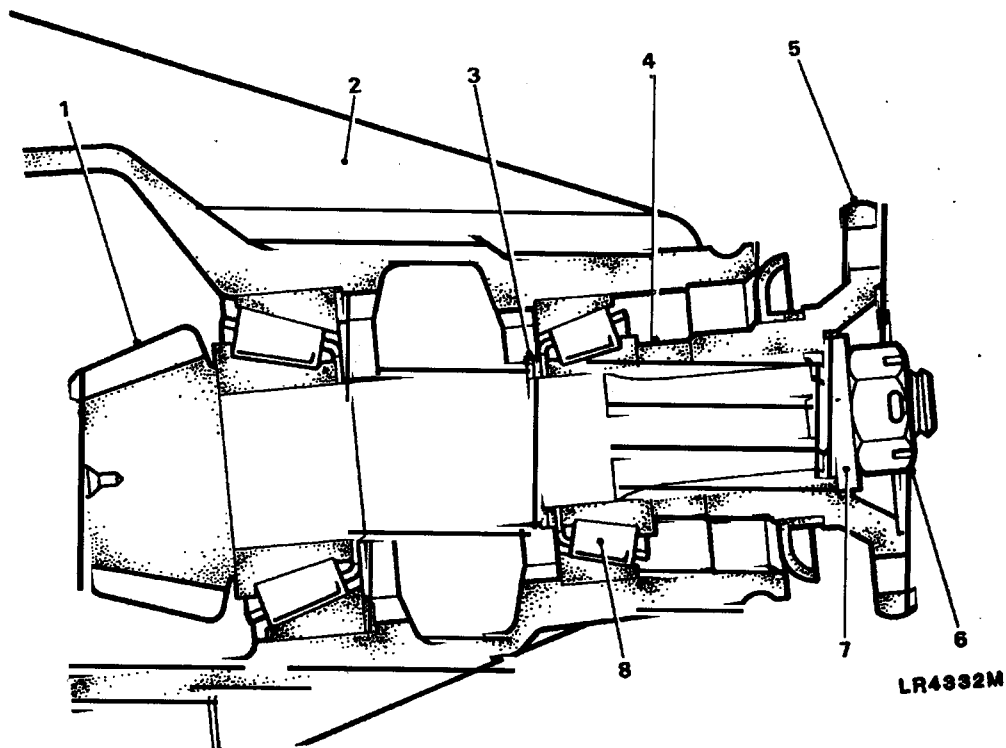
Fig 16 Fitting pinion inner bearing

15.4 Position the assembled pinion and bearing (Fig 16 (1)) in its location in the pinion housing (2). Do not fit the shims (3) for bearing pre-load at this stage.

15.5 Fit the outer bearing (8) and spacer (4) followed by the driving flange (5), washer (7) and nut (6). Do not fit the oil seal at this stage.

15.6 Rotate the pinion to settle the bearings and slowly tighten the flange locknut until the force required to rotate the pinion is 2.25 to 3.97 Nm (1.6 to 2.9 lbf ft) for new bearings and 11.5 to 17.25 kgf cm (10 to 15 lbf in) for original bearings.

ARMY EQUIPMENT
SUPPORT PUBLICATION



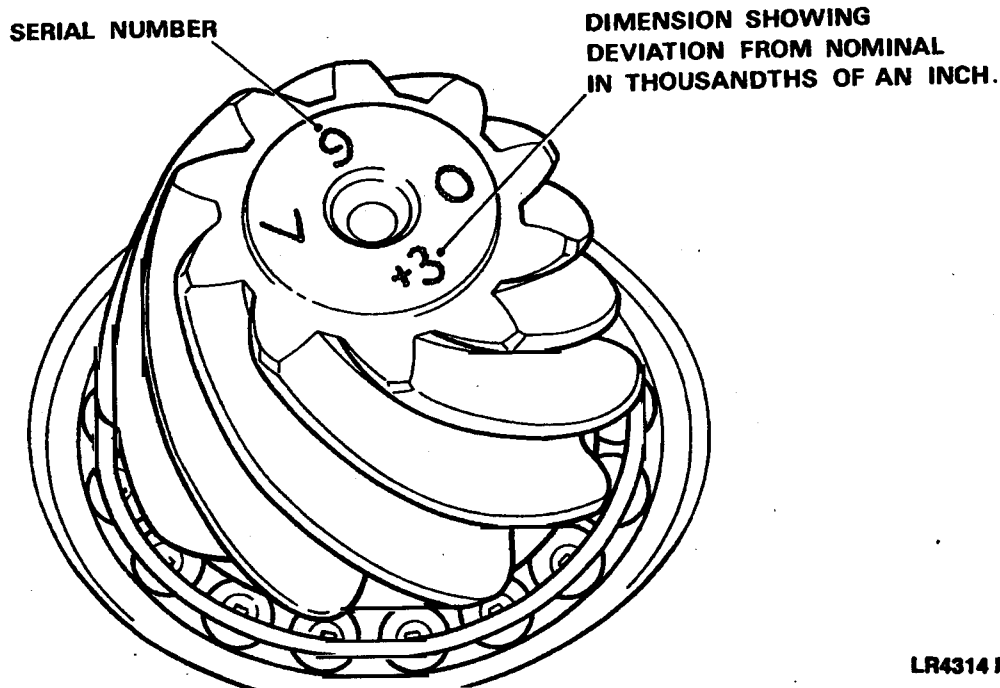
- | | | | |
|---|--------------------------|---|----------------|
| 1 | Pinion and inner bearing | 5 | Drive coupling |
| 2 | Pinion housing | 6 | Nut |
| 3 | Shims | 7 | Washer |
| 4 | Spacer | 8 | Outer bearing |

Fig 17 Fitting pinion to housing

Drive pinion markings

16 Check that the serial number marked on the pinion end face corresponds with that marked on the crown wheel (Fig 18). The markings on the end face adjacent to the serial number are of no significance during servicing. Note the following when carrying out drive pinion adjustment:

16.1 The figure marked on the end face opposite the serial number indicates, in thousandths of an inch, the deviation from nominal required to correctly set the pinion. A pinion marked plus (+) must be set below nominal, a minus (-) pinion must be set above nominal. An unmarked pinion must be set at nominal.



LR4314 M

Fig 18 Drive pinion markings

16.2 The nominal setting dimension is represented by the setting block gauge special tool (Serial No 4) which is referenced from the pinion end face to the bottom radius of the differential bearing bore.

Drive pinion adjustment

17 Adjust the drive pinion as follows:

17.1 Ensure that the pinion end face is free of raised burrs around the etched markings.

17.2 Remove the keep disc from the magnetized base of dial gauge (special tool Serial No 3), place the gauge on a flat surface and zero the gauge stylus on the largest dimension 39,50mm on the setting gauge block (Fig 19).

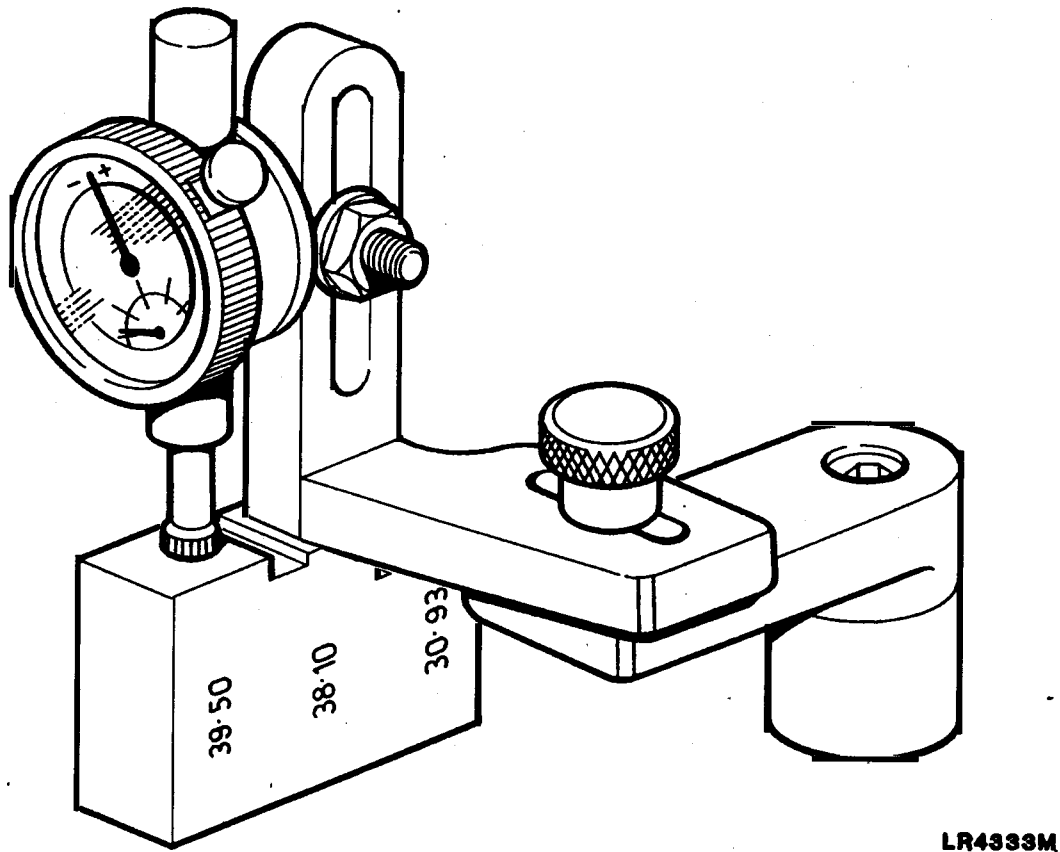


Fig 19 Setting dial gauge using setting block

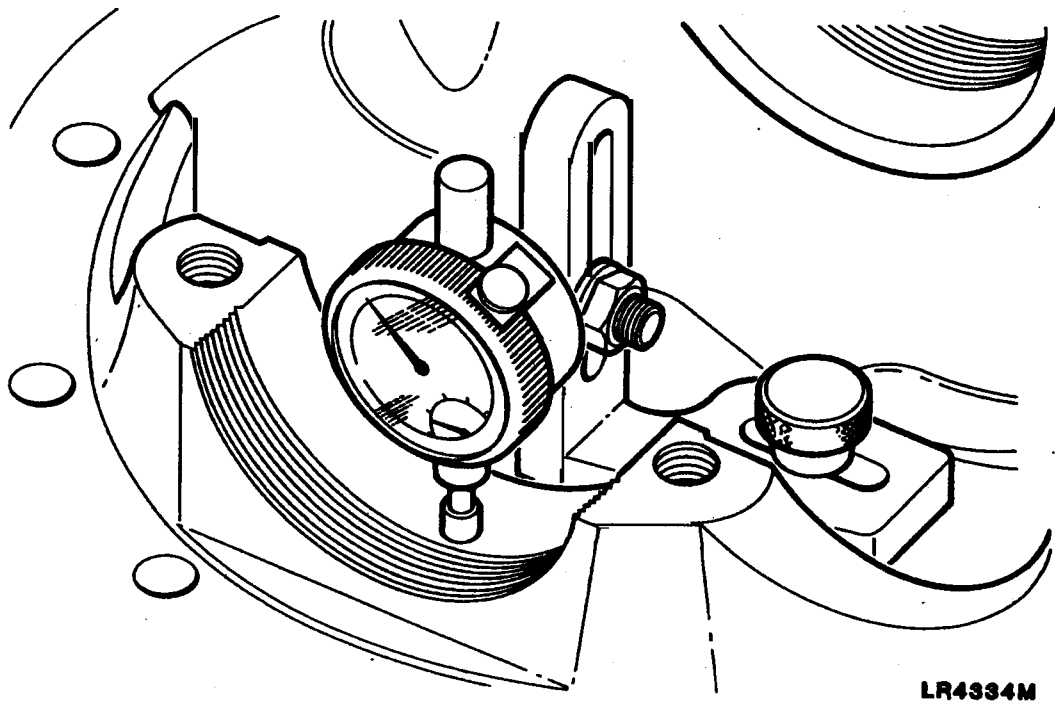


Fig 20 Pinion height setting

17.3 Position the dial gauge centrally on the pinion end face with the stylus registering on the lowest point on one differential bearing bore (Fig 20). Note the dial gauge deviation from the zeroed setting.

17.4 Repeat the procedure on the other bearing bore. Add together the readings, then halve the sum to obtain the mean reading. Note whether the stylus has moved up or down from the zeroed setting.

17.5 Where the stylus has moved down, the amount is equivalent to the thickness of shims that must be removed from under the pinion inner track to bring the pinion down to the nominal position.

17.6 Where the stylus has moved up, the amount is equivalent to the additional thickness of shims required to bring the pinion up to the nominal position.

17.7 Before adjusting the shim thickness, check the pinion face marking, if it has a plus (+) figure, subtract that amount, in thousandths of an inch, from the shim figure obtained in the previous operations. Alternatively if the pinion has a minus (-) figure, add the amount to the shim thickness figure.

17.8 Having determined the required shim thickness adjust the shims under pinion inner bearing track as necessary.

17.9 Recheck the pinion height setting. If the setting is correct, the mean reading on the dial gauge will agree with the figure marked on the pinion end face. For example, with an end face marking of + 3, the dial gauge reading should indicate that the pinion is 0.003in below nominal.

17.10 When the pinion setting is satisfactory, remove the flange and the pinion outer bearing.

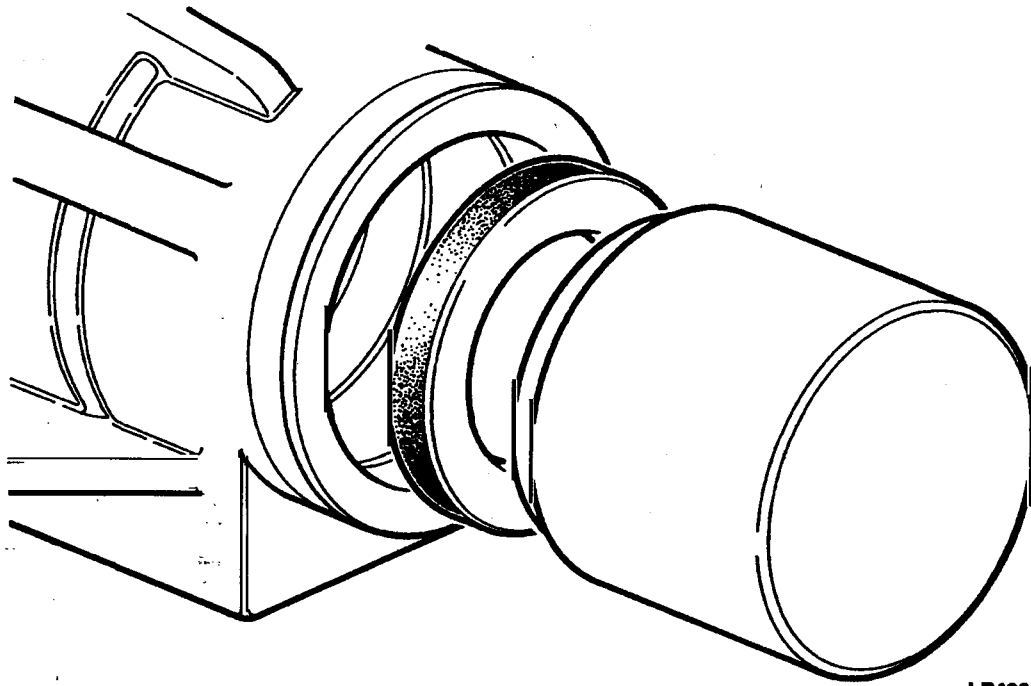
17.11 Fit shims, to the same thickness as those removed (Para 11.8), in position on the pinion shaft.

17.12 Locate the pinion in the housing, fit the outer bearing, spacer and drive flange. Secure with the flange nut and washer, the oil seal should not be fitted at this stage.

17.13 Using special tool (Serial No 5) to restrain the flange, tighten the flange nut to a torque of 95 to 163 Nm (70 to 120 lbf ft), check the force required to rotate the pinion shaft. If new bearings have been fitted the force should be 2.25 to 3.97 Nm (1.6 to 2.9 lbf ft) when initial inertia has been overcome. If the original bearings have been fitted the force should be 11,5 to 17,25 kgf cm (10 to 15 lb in). Add or remove bearing pre-load shims as necessary to obtain the required pre-load. A thicker shim will reduce pre-load and a thinner shim will increase it.

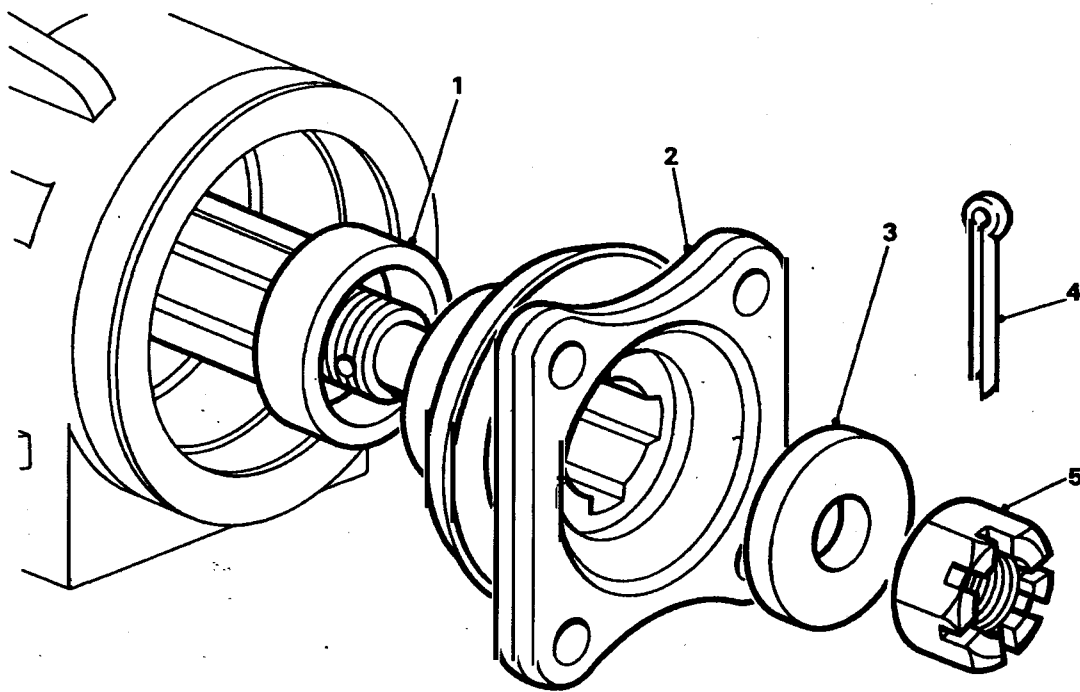
17.14 Remove the pinion flange and using special tool (Serial No 6) fit the oil seal, lips side leading (Fig 21).

17.15 Lubricate the seal lips with EP 90 oil, fit the spacer (Fig 22 (1)) and flange (2) and secure with the washer (3) and nut (5). Tighten the nut to 95 to 163 Nm (70 to 120 lbf ft). Fit a new split pin (4).



LR4936M

Fig 21 Fitting pinion oil seal



LR4936M

- 1 Spacer
- 2 Flange
- 3 Washer

- 4 Split pin
- 5 Nut

Fig 22 Fitting flange and spacer

Differential backlash checks

18 Refit the differential assembly and carry out the following checks:

18.1 Place the differential assembly in the pinion housing and fit the bearing caps (Fig 7 (4)) to their respective locations. Fit the securing bolts (1), do not fully tighten at this stage.

18.2 Loosely assemble the bearing adjustment nuts (3).

18.3 Using special tool (Serial No 10), tighten the adjusting nut on the crown wheel side reducing backlash to zero.

18.4 Tighten the adjustment nut on the pinion side to give 0,10 to 0,17 mm (0.004 to 0.007 in) backlash, using a suitable dial test indicator to check the backlash (Fig 24).

Note ...

Movement of the bearing adjustment nuts in the direction of arrow A (Fig 23) will decrease the backlash and movement in the direction of arrow B will increase the backlash.

18.5 Evenly tighten the bearing cap bolts to a torque of 80 to 100 Nm (59 to 74 lbf ft).

18.6 Recheck the backlash, if satisfactory bend the locking fingers to accommodate the adjusting nut serrations as required. Fit the locking fingers and secure with the roll pins.

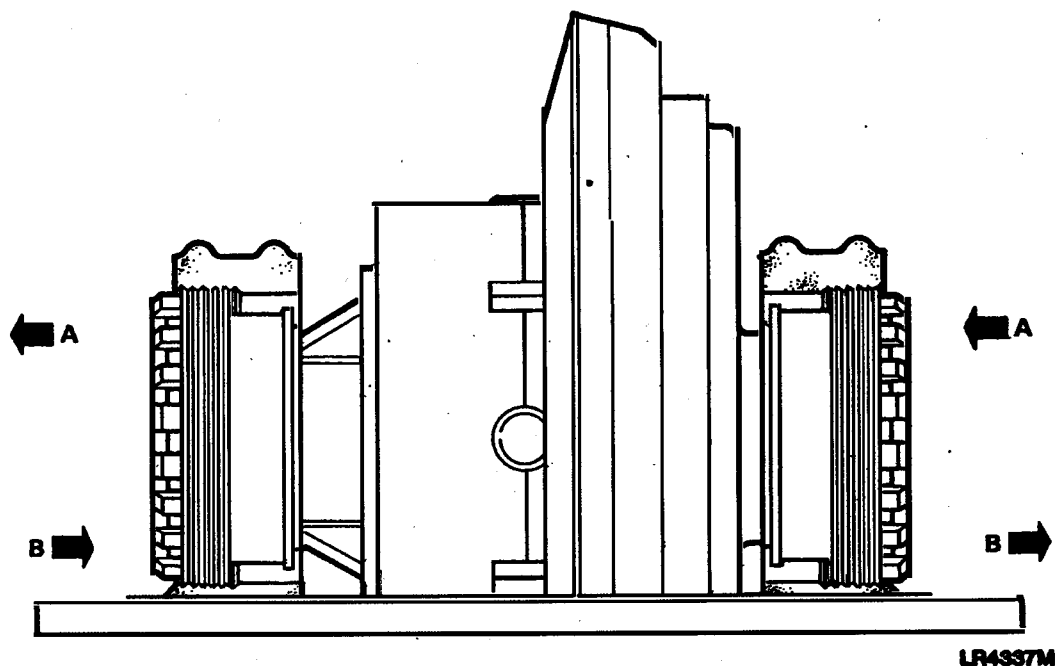
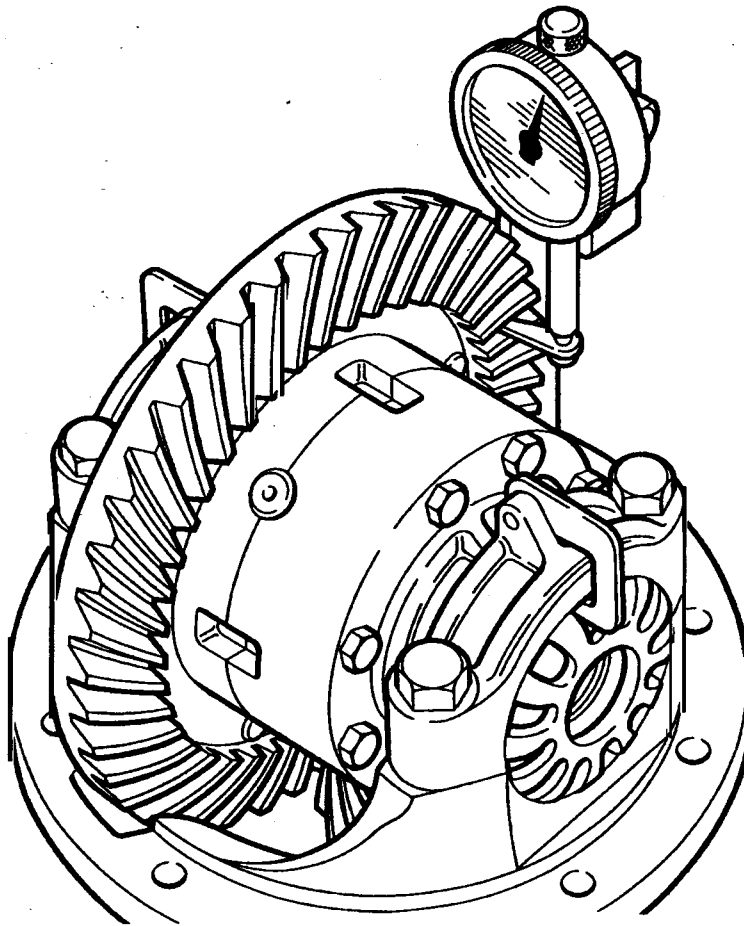


Fig 23 Adjusting crown wheel/pinion backlash



LR4338M

Fig 24 Checking crown wheel backlash

Refitting

19 Refit the assembly to the axle casing as follows:

19.1 Suitably support the differential assembly and position on the axle casing with a new gasket interposed between the mating faces.

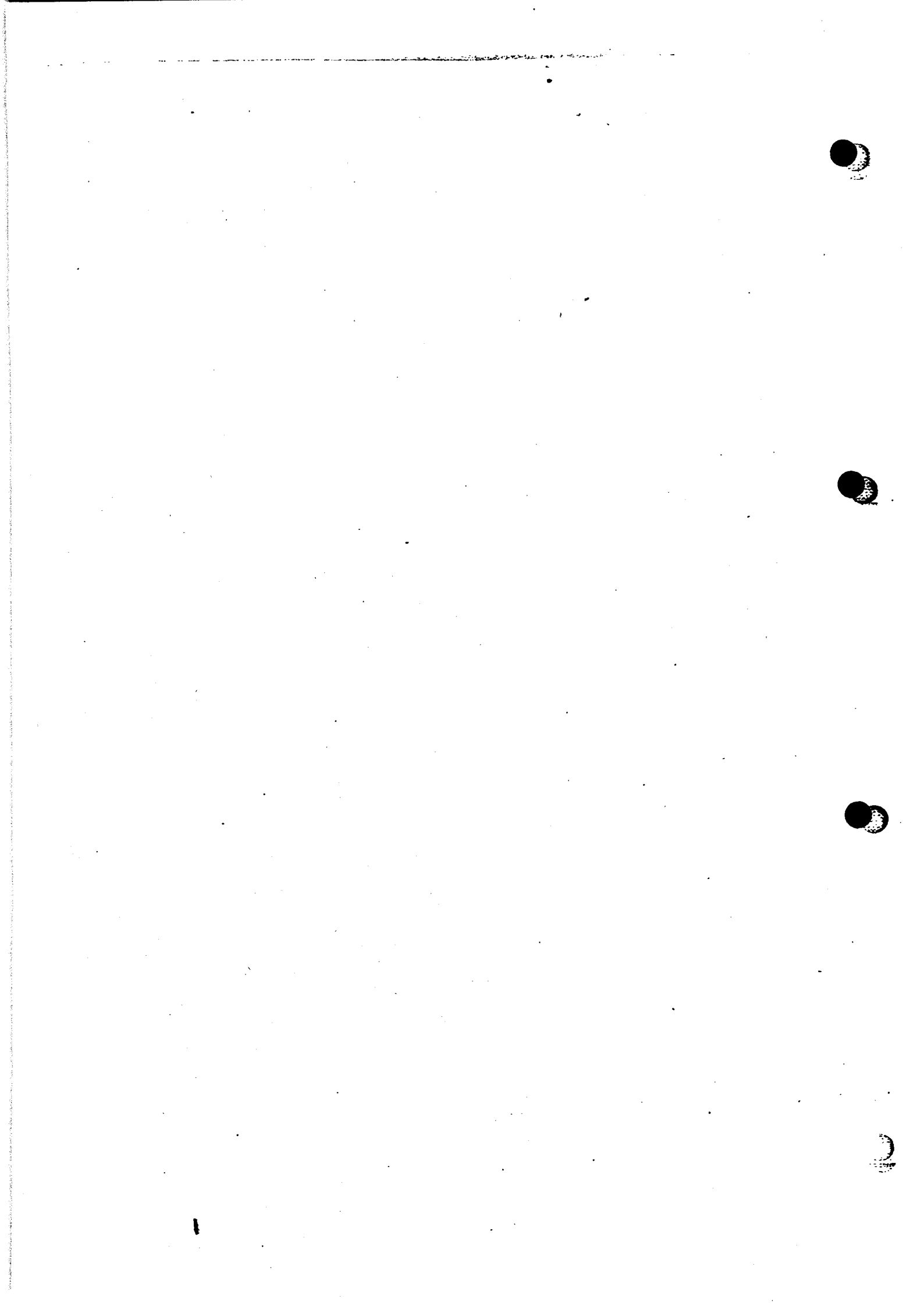
19.2 Secure with new self locking nuts tightened to a torque of 36 to 46 Nm (26 to 34 lbf ft).

19.3 Refit the axle shafts, coat the threads of the hub driving member bolts with Loctite 'Studlock' grade CVX, fit and tighten the bolts to a torque of 60 to 70 Nm (44 to 52 lbf ft).

19.4 Fill the axle with the approved oil (Cat 601).

19.5 After the initial axle run, check the oil level and replenish as necessary.

19.6 Where major running parts have been replaced during overhaul, it is recommended practice to allow the axle assembly to 'run in' by avoiding, where possible, heavy loads and high speeds during initial running.



Chapter 6

FRONT AXLE

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	3	Refitting
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	6	Reassembly
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INTRODUCTION

1 This Chapter details the Unit and Field repairs for front axles fitted to Land Rover 90 and 110 vehicles. The repair instructions detailed are applicable to both left and right hand drive vehicles.

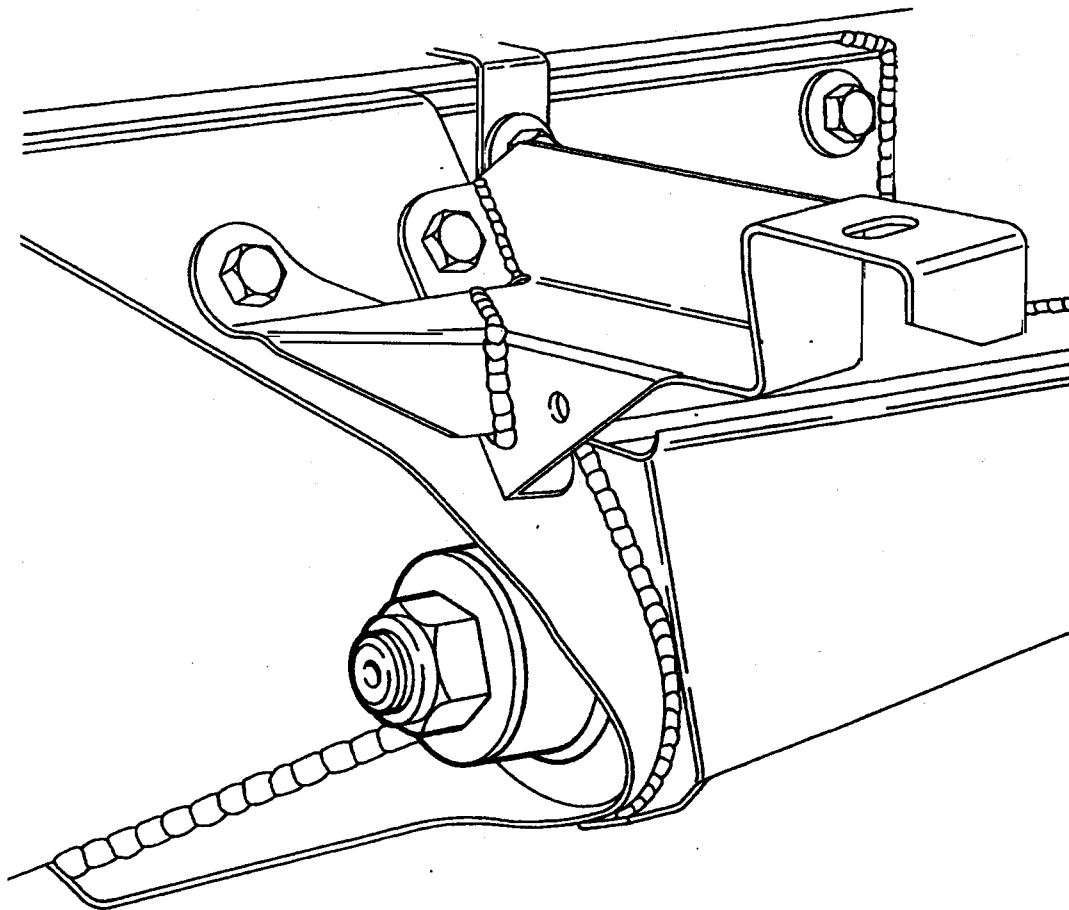
FRONT AXLE ASSEMBLY

Removal

CAUTION ...

The removal of the axle from the vehicle will require the assistance of two further personnel to steady the axle when lowering from the vehicle.

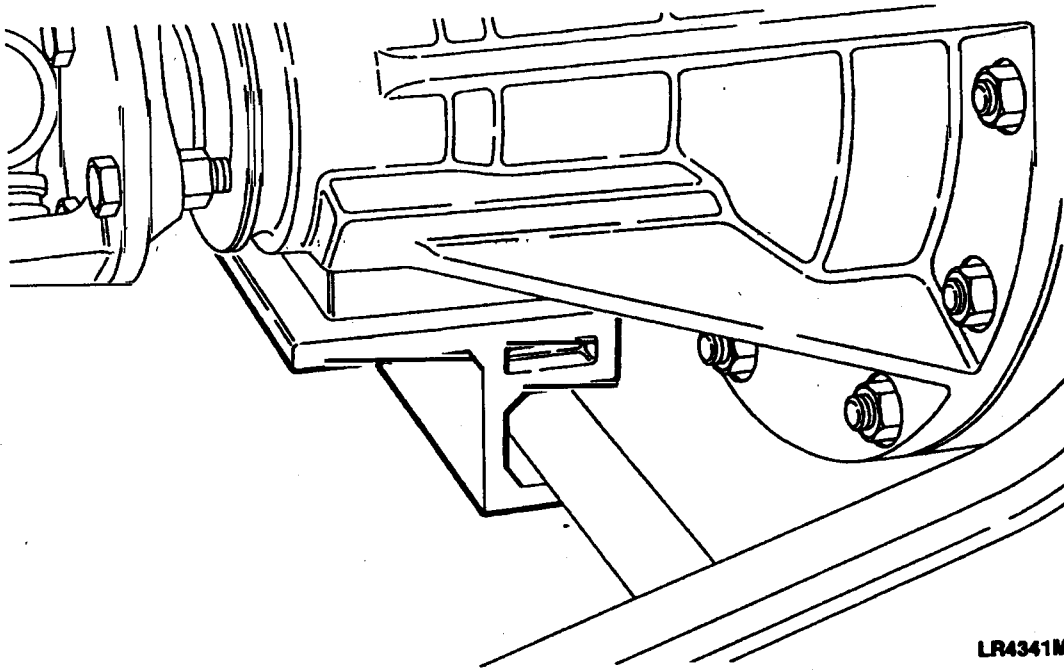
- 2 To remove the axle assembly from the vehicle carry out the following:
 - 2.1 Jack up the front of the vehicle and support the chassis frame.
 - 2.2 Remove the front road wheels.
 - 2.3 Support the axle weight with a suitable hydraulic jack.
 - 2.4 Remove the nuts and washer securing the radius arms to the chassis side members (Fig 1).



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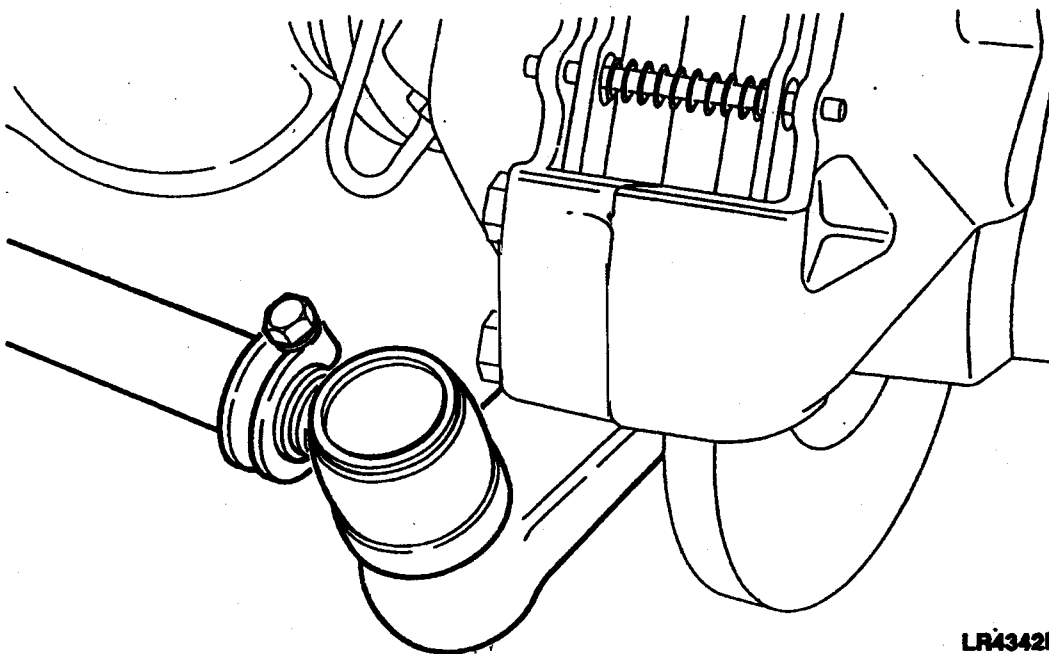
Fig 1 Radius arm fixings at chassis member

2.5. Remove the track rod protection bracket from the underside of the differential assembly (Fig 2).



LR4341M

Fig 2 Track rod protection bracket

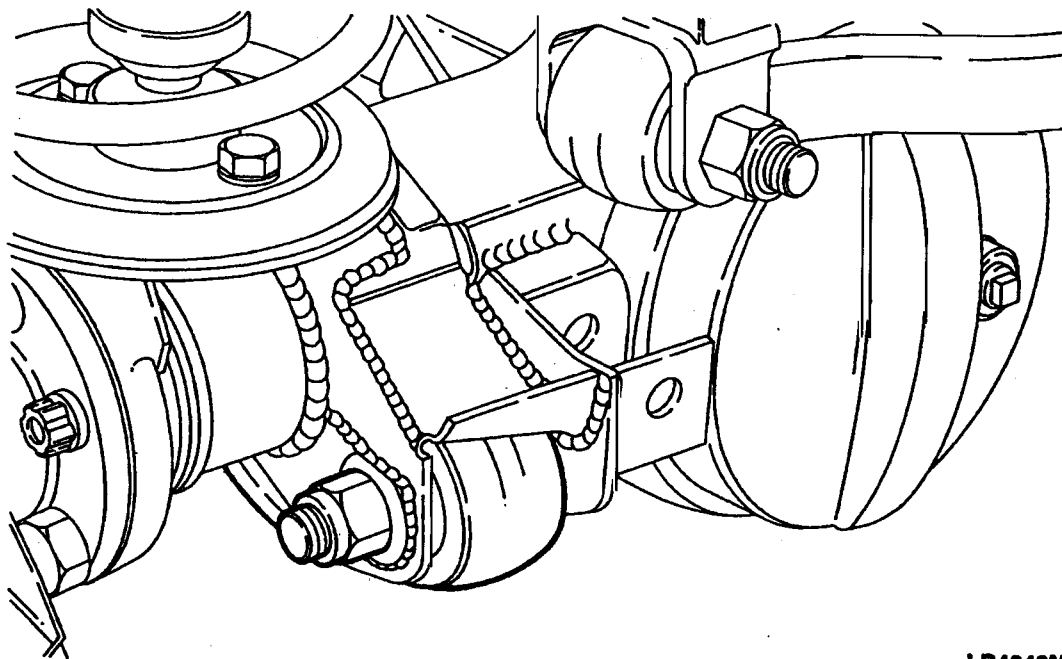


LR4342M

Fig 3 Track rod to swivel housing ball joint

2.6 Remove the nuts from the track rod ball joints and using a suitable extractor remove the track rod from the swivel housings (Fig 3).

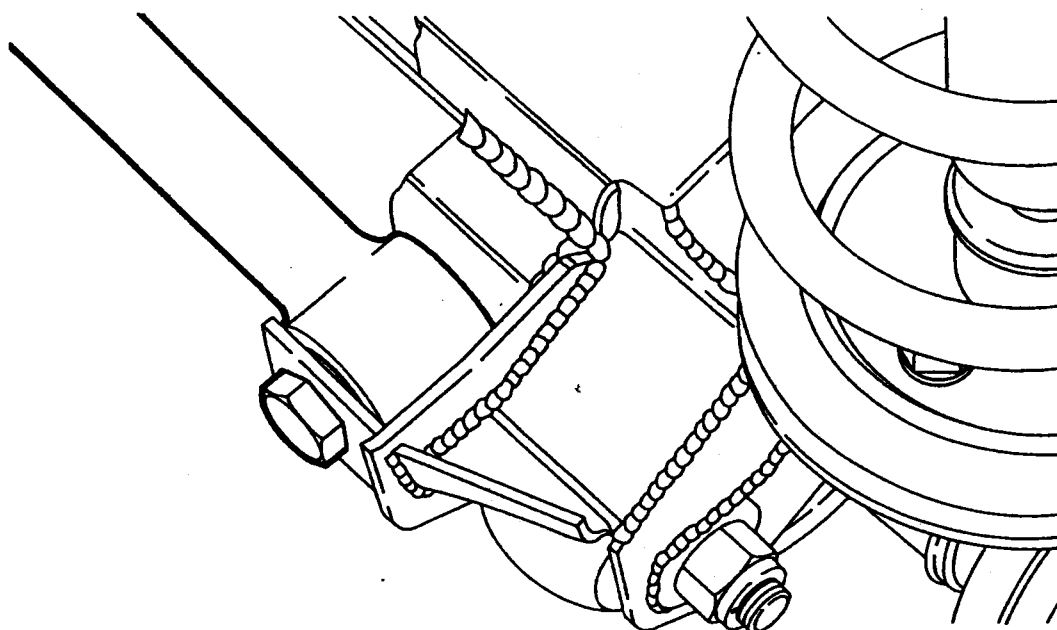
2.7 Remove the four nuts and bolts securing the radius arms to the axle brackets (Fig 4). Release the radius arms from the brackets and withdraw them from the chassis side members.



LR4343M

Fig 4 Radius arm to axle securing bolts

2.8 Remove the nut and bolt securing the panard rod to the axle (Fig 5), tie to the chassis to keep clear of axle.

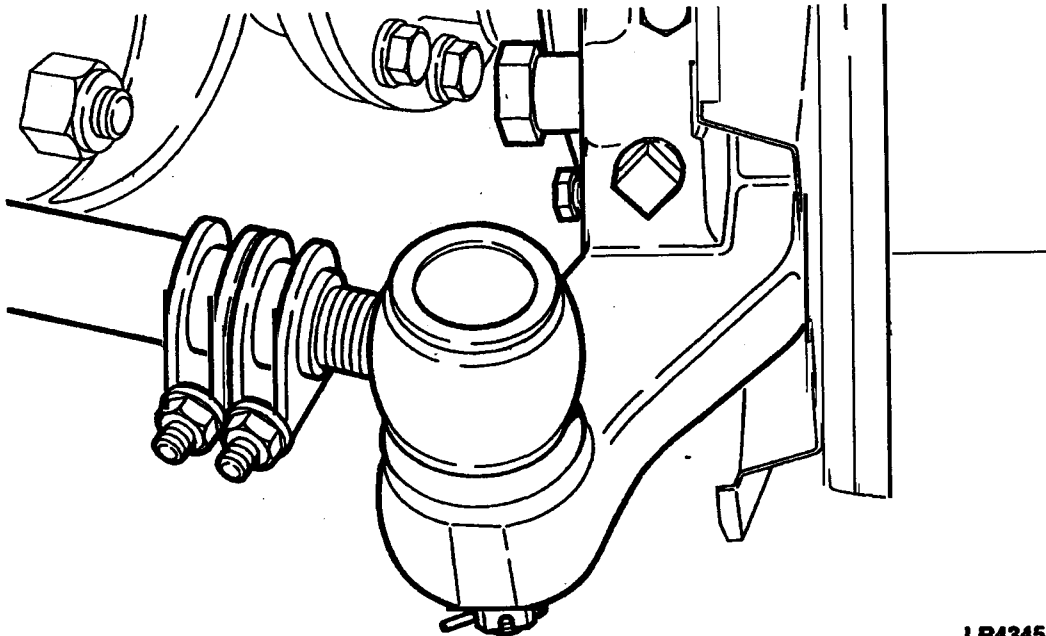


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Fig 5 Panard rod to axle

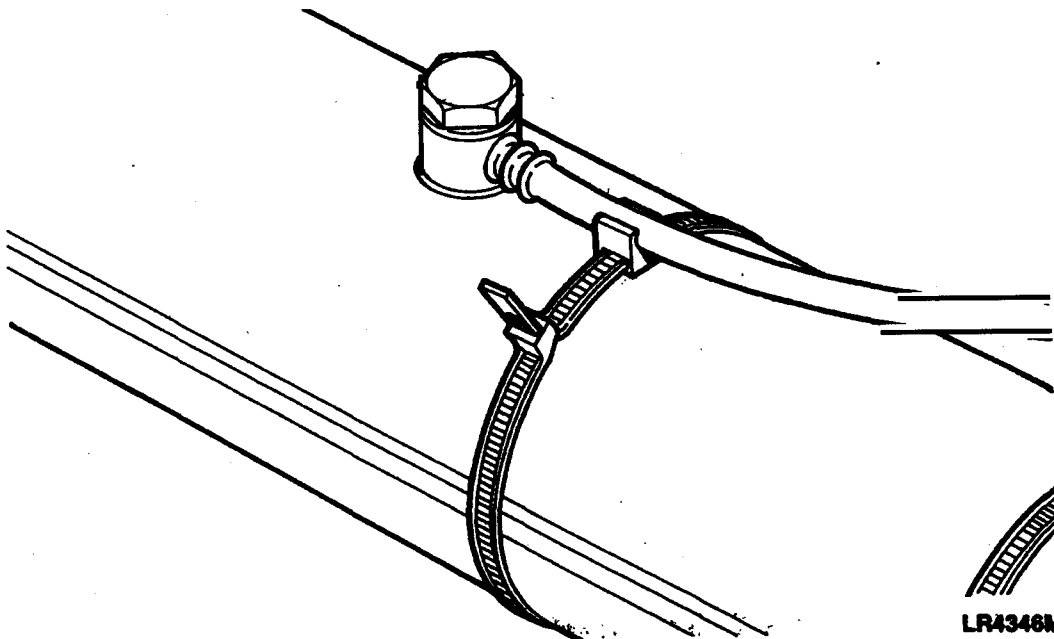
2.9 Remove the nut and washer from the cross rod ball joint at the swivel housing and using a suitable extractor disconnect the cross rod and tie to one side (Fig 6).

2.10 Remove the brake calipers (Chap 10 Para 2).



LR4345M

Fig 6 Cross rod to swivel housing ball joint



LR4346M

Fig 7 Axle breather banjo bolt

2.11 Remove the nuts and washers securing the shock absorbers to the axle (Fig 8).

2.12 Mark the differential and propeller shaft drive flanges with identification marks to aid re-assembly. Remove the four nuts and bolts, tie the propeller shaft to one side.

2.13 Carefully lower the axle assembly and remove the coil springs.

2.14 If the axle assembly is to be replaced remove the spring seats and fit to the replacement axle.

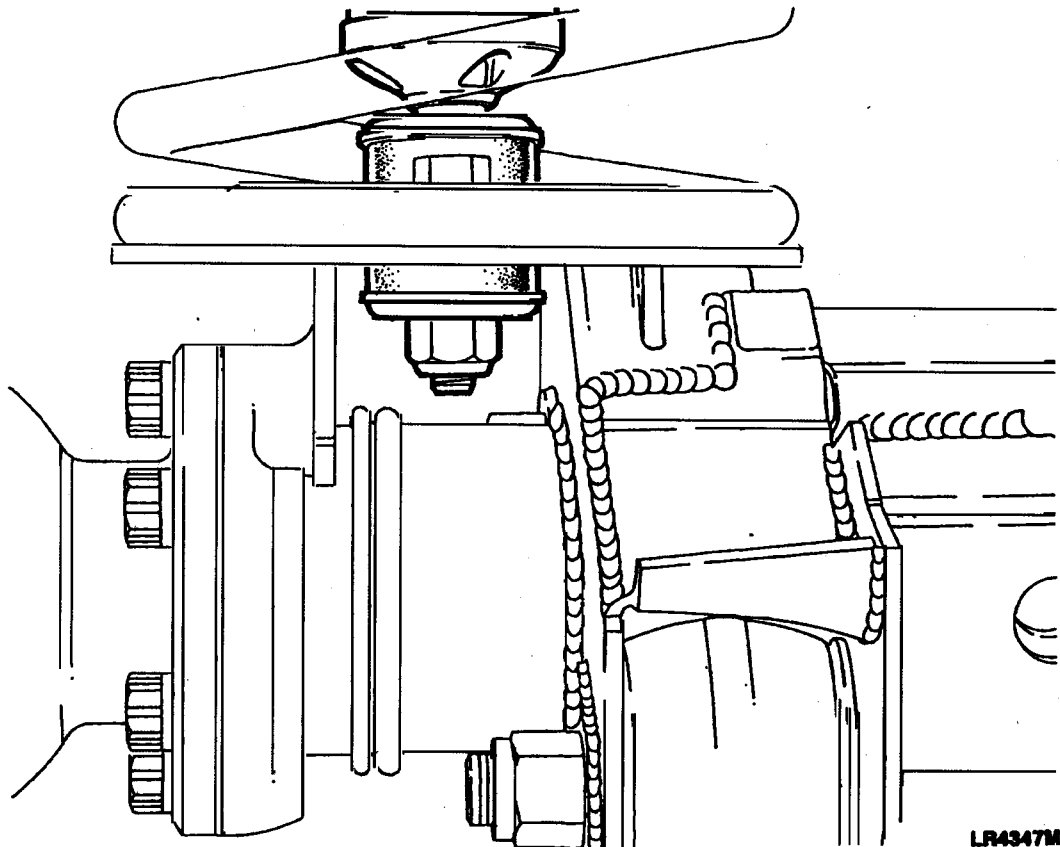


Fig 8 Shock absorber lower securing nuts

Refitting

3 To refit the front axle assembly proceed as follows:

- 3.1 Position the axle under the vehicle, supporting the left hand side of the axle.
- 3.2 Reverse the removal instructions.
- 3.3 Tighten the propeller shaft to differential bolts to a torque of 41 to 52 Nm (30 to 38 lbf ft).
- 3.4 Tighten the panhard rod to axle bracket nuts to a torque of 88 Nm (65 lbf ft).

3.5 Tighten the radius arm to axle and radius arm to chassis side member bolts to a torque of 190 Nm (140 lbf ft).

3.6 Tighten the cross rod and track rod end ball joints to a torque of 40 Nm (30 lbf ft) and fit a new split pin.

3.7 Tighten the shock absorber lower securing nuts to a torque of 75 Nm (55 lbf ft).

HUB ASSEMBLY

TABLE 1 SPECIAL TOOLS

Ser No (1)	Manufacturers Part No (2)	NSN/Part No where applicable (3)	Designation (4)
1	18G 134		Bearing and oil seal replacer (main tool)
2	18G 1349		Oil seal replacer
3	RO 530106		Dial gauge bracket

Removal

4 To remove the front hub assembly proceed as follows:

4.1 Slacken the road wheel nuts.

4.2 Jack up the vehicle and lower onto suitable axle stands.

4.3 Remove the road wheel.

4.4 Slacken the locknuts securing the brake fluid flexible hose to the retaining bracket.

4.5 Remove the brake caliper (Chap 10 Para 2).

4.6 Remove the dust cap (Fig 9 (1)).

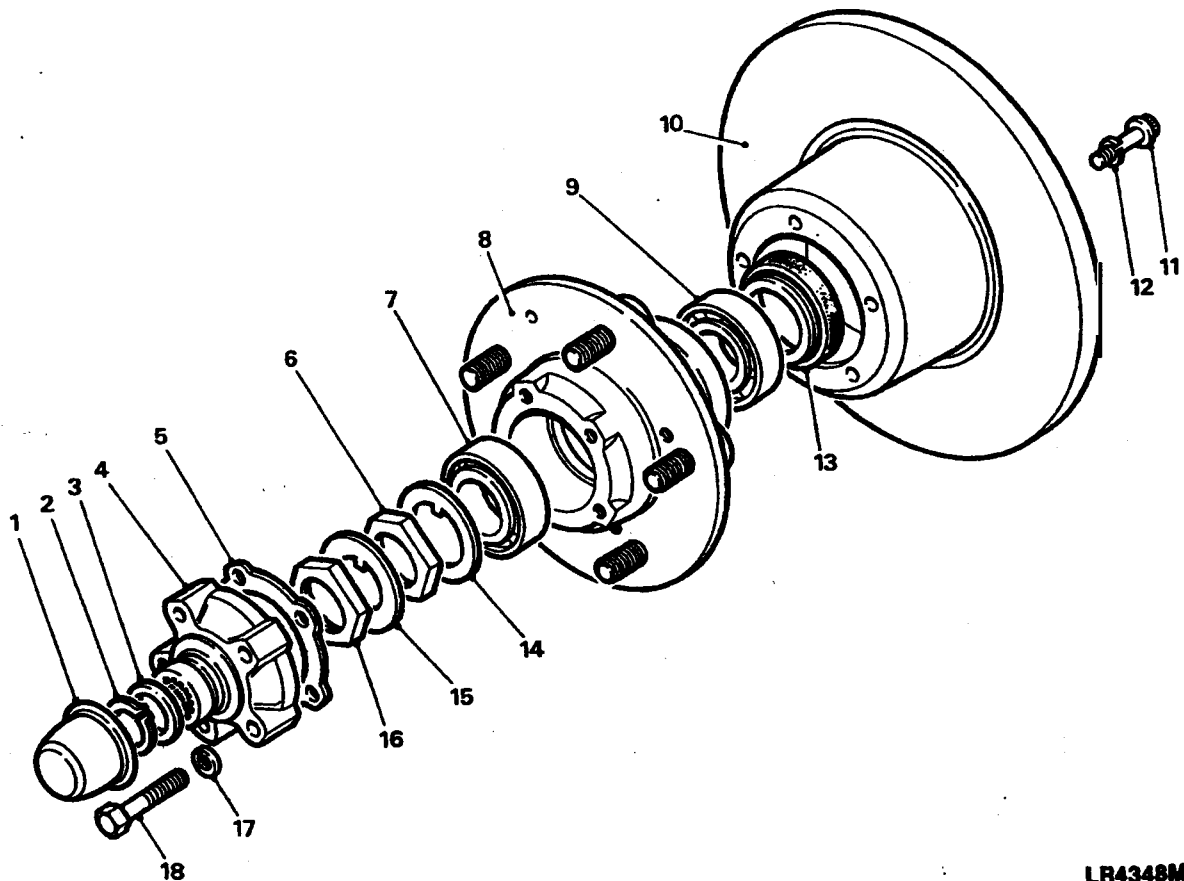
4.7 Remove the circlip (2) and withdraw the drive shaft shim (3).

4.8 Remove the securing bolts (18), spring washers (17) and withdraw the hub driving member (4) complete with gasket (5).

4.9 Bend back tab on the lock washer (15) and remove the locknut (16), discard lock washer.

4.10 Remove the adjusting nut (6), withdraw and discard the key washer (14).

4.11 Withdraw the hub and brake disc assembly complete with bearings.



LR4348M

- | | | | |
|---|----------------|----|---------------|
| 1 | Dust cap | 10 | Brake disc |
| 2 | Circlip | 11 | Bolt |
| 3 | Shim | 12 | Spring washer |
| 4 | Driving member | 13 | Oil seal |
| 5 | Gasket | 14 | Key washer |
| 6 | Adjusting nut | 15 | Lock washer |
| 7 | Outer bearing | 16 | Lock nut |
| 8 | Hub | 17 | Spring washer |
| 9 | Inner bearing | 18 | Bolt |

Fig 9 Front hub assembly

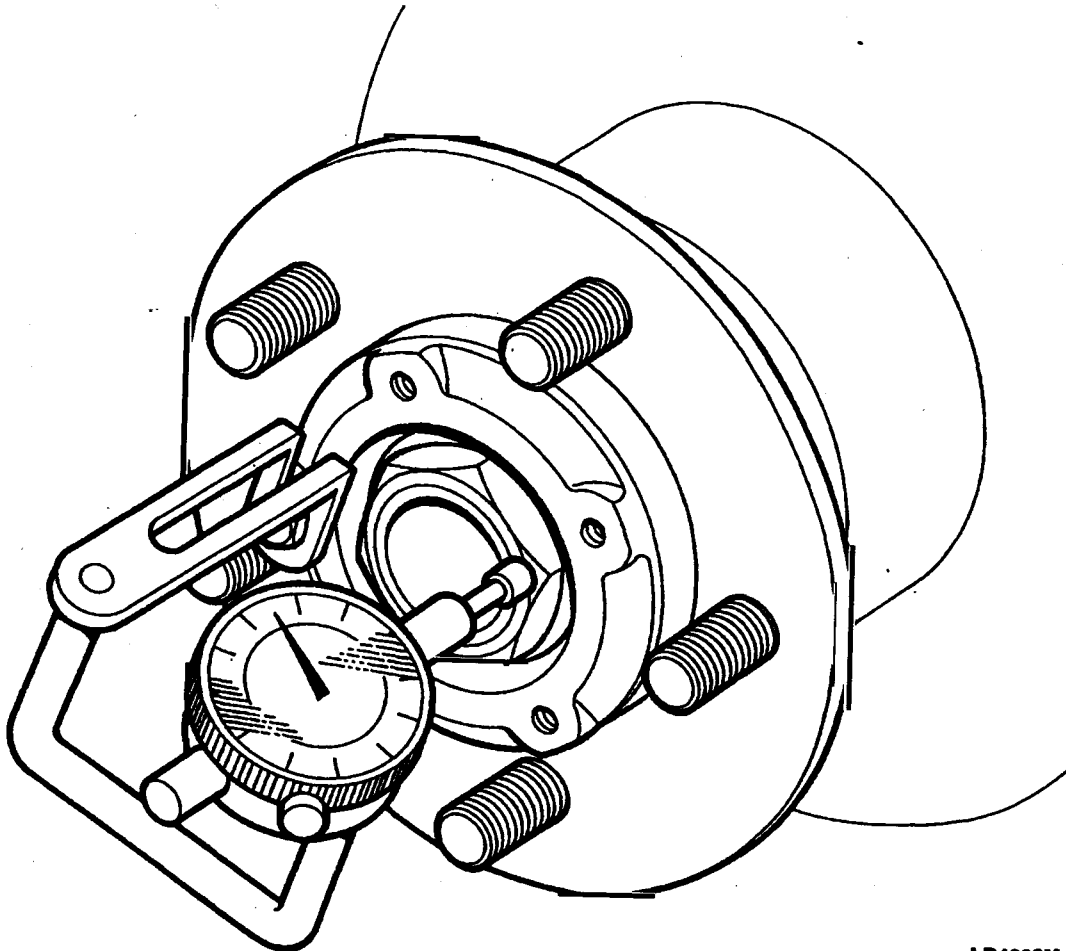
Dismantling

- 5 To dismantle the hub and brake disc assembly proceed as follows:
- 5.1 Remove the outer bearing (7).
 - 5.2 If the existing hub is to be refitted, mark the relationship between the hub and brake disc, to aid reassembly.
 - 5.3 Remove the bolts (11) and spring washers (12), then separate the hub (8) from the brake disc (10).
 - 5.4 Remove the oil seal (13) and the inner bearing (9) from the hub (8) and discard the seal.
 - 5.5 If new bearings are to be fitted remove the inner and outer bearing tracks from the hub.

Reassembly

- 6 Reassemble the hub as follows:
- 6.1 Clean and degrease the hub, if removed fit the inner and outer bearing tracks.
 - 6.2 Pack the hub inner bearing (Fig 9 (9)) with BP Energrease L2 or a suitable alternative, using a minimum of 8,5 grams of grease, and fit to the hub.
 - 6.3 Using special tools (Serial No's 1 and 2) fit a new oil seal (13) to the hub with the lip side leading. Drive in the seal so that it is recessed 4,83 5,33 mm (0.190 to 0.210 in) below the rear face of the hub. Apply grease liberally to the seal lips.
 - 6.4 Assemble the brake disc (10) to the hub (8) aligning the marks made during dismantling. Fit the retaining bolts (11) and spring washers (12) tightening the bolts to a torque of 65 to 80 Nm (48 to 59 lbf ft).
 - 6.5 Grease and fit the outer bearing (7) in the same manner as the inner bearing (Para 6.2).
 - 6.6 Ensure that the stub axle and drive shaft are clean and fit the hub to the axle.
 - 6.7 Locate a new key washer (14) on the stub axle.
 - 6.8 Fit the adjusting nut (6) and tighten by hand, whilst rotating the hub, until all end-float is taken up.
 - 6.9 Mount a dial test indicator, using bracket (Special Tool Serial No 3), on the front face of the hub with the stylus in a loaded condition resting on the adjusting nut (Fig 10).
 - 6.10 Slacken the adjusting nut until an end-float of 0,013 to 0,1016 mm (0.0005 to 0.004 in) is obtained.
 - 6.11 Fit a new lock washer (Fig 9 (15)) and screw on the lock nut (16), tighten the locknut ensuring that no movement of the adjusting nut takes place.

- 6.12 Recheck the end-float, if correct bend over the locking tabs on opposing flats, one tab locking the adjusting nut and one locking the lock nut.



LR4298M

Fig 10 Checking hub end-float

- 6.13 Fit the driving member (Fig 9 (4)), with a new gasket (5), to the hub and evenly tighten the securing bolts (18) to a torque of 60 to 70 Nm (44 to 52 lbf ft).
- 6.14 Fit the original drive shaft shim (3) and secure with a new circlip (2).
- 6.15 Check the drive shaft end-play as follows:
- 6.15.1 Mount a dial test indicator, using bracket (Special Tool Serial No 3), on the front face of the hub with the stylus in a loaded condition resting on the end of the drive shaft.
 - 6.15.2 Fit a suitable bolt to the threaded end of the drive shaft and using a pair of pliers move the drive shaft back and forth noting the dial gauge reading.
 - 6.15.3 From the range of shims available (AESP 2320-D-122-721) fit shims to give an end-play of 0,127 to 0,254 mm (0.005 to 0.010 in).

6.16 Remove the bolt from the drive shaft and the dial test indicator from the hub.

6.17 Fit the dust cap (1).

6.18 Fit the brake caliper (Chap 10 Para 7) and tighten the bolts to a torque of 120 to 150 Nm (88 to 111 lbf ft).

6.19 Locate the brake fluid flexible hose in the bracket and tighten the locknuts.

6.20 Fit the road wheel, remove the axle stand and finally tighten the road wheel nuts.

6.21 Operate the foot brake several times to locate the brake pads before driving the vehicle.

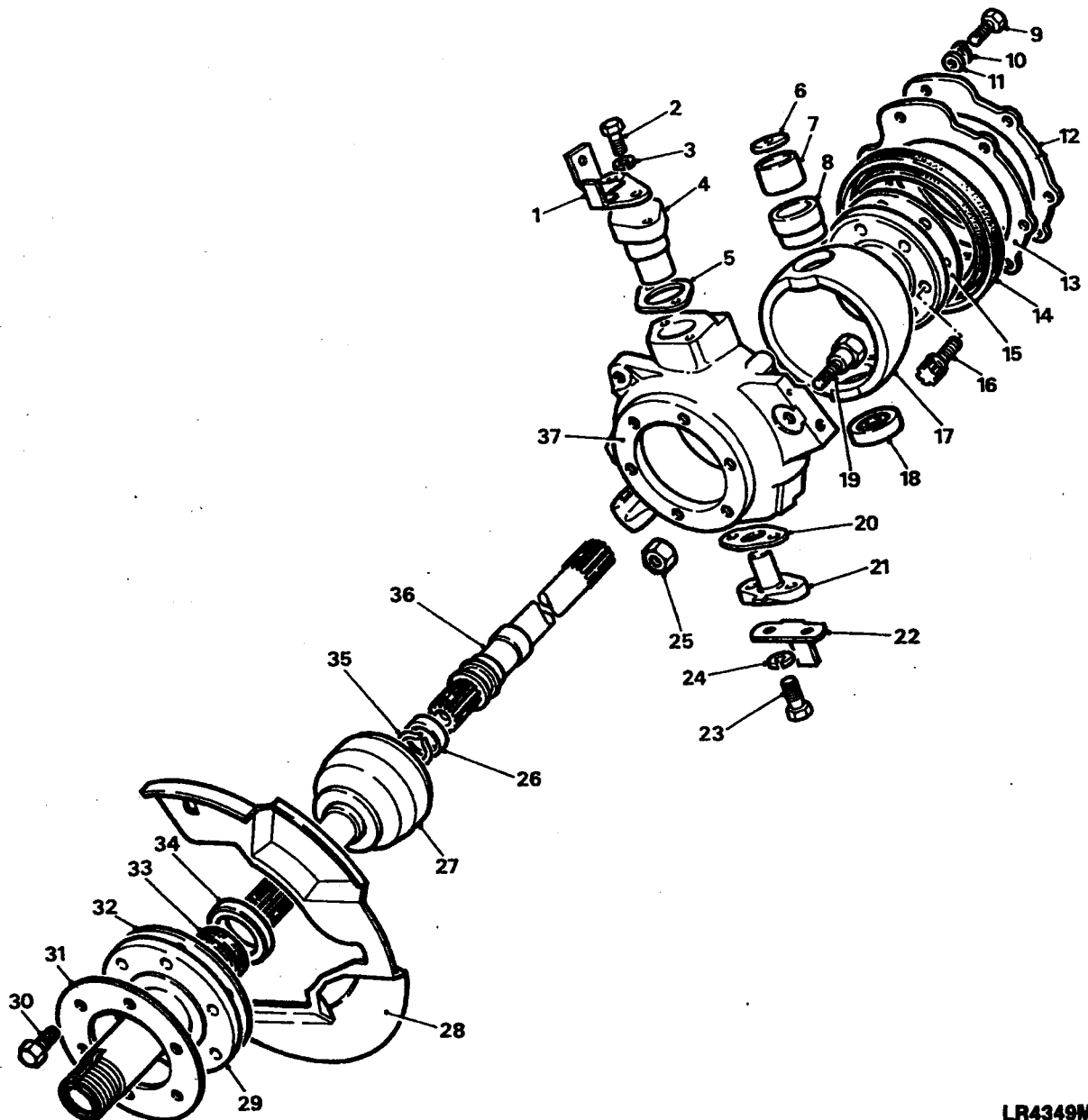
STUB AXLE, AXLE SHAFT, CONSTANT VELOCITY JOINT AND SWIVEL ASSEMBLY

TABLE 2 SPECIAL TOOLS

Ser No (1)	Manufacturers Part No (2)	NSN/Part No where applicable (3)	Designation (4)
1	18G 284		Impulse extractor (Main tool)
2	18G 284AAH		Front stub axle oil seal and bush remover

Key to Fig 11

1	Bracket brake hose	20	Gasket
2	Bolt	21	Lower swivel pin
3	Spring washer	22	Bracket brake disc shield
4	Upper swivel pin	23	Bolt
5	Shim	24	Spring washer
6	Thrust disc	25	Steering lock stop nut
7	Railko bush	26	Collar
8	Railko bush housing	27	Constant velocity joint
9	Bolt	28	Brake disc shield
10	Spring washer	29	Stub axle
11	Plain washer	30	Bolt
12	Oil seal retaining plate	31	Mud shield
13	Gasket	32	Gasket
14	Oil seal	33	Oil seal
15	Gasket	34	Bush
16	Bolt	35	Circlip
17	Swivel pin bearing housing	36	Axle shaft
18	Lower swivel pin bearing	37	Swivel pin housing
19	Steering lock stop bolt		



LR4349M

Fig 11 Stub axle and swivel assembly

Removal/dismantling

7 To remove and dismantle the stub axle, axle shaft, constant velocity joint and swivel assembly carry out the following:

7.1 Stub axle. Remove the stub axle as follows:

7.1.1 Remove the hub assembly (Para 4).

7.1.2 Drain the swivel pin housing and refit the drain plug.

7.1.3 Remove the six bolts (Fig 11 (30)) securing the stub axle (29) to the swivel housing (37), withdraw the stub axle and remove the mud shield (31) and gasket (32).

7.1.4 Using special tools (Serial No's 1 and 2) remove the bronze bush (34) and oil seal (33) from inside the stub axle (Fig 12). Ensure that the fingers of the tool locate behind the oil seal so that the seal and bush are driven out together.

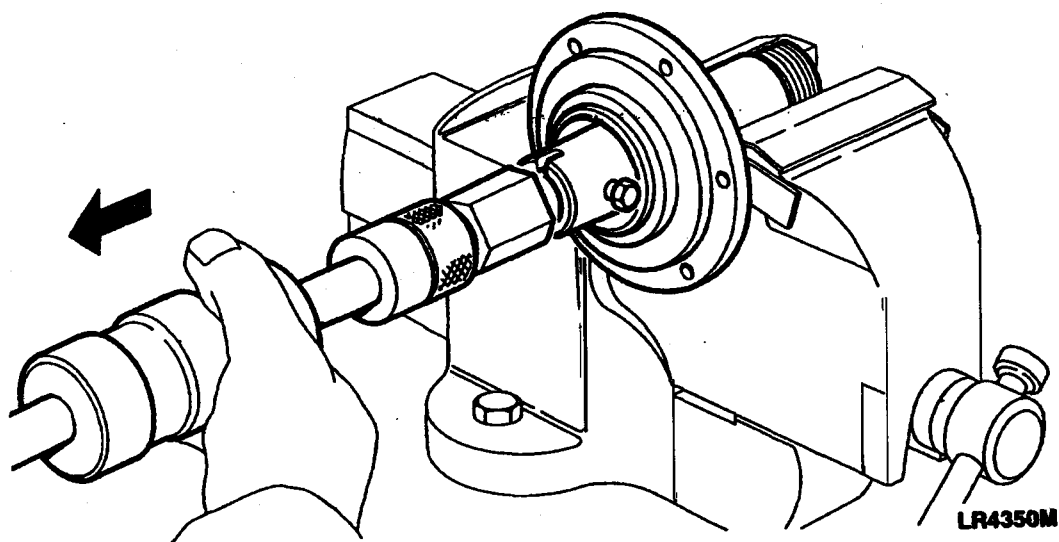


Fig 12 Removing stub axle bush and oil seal

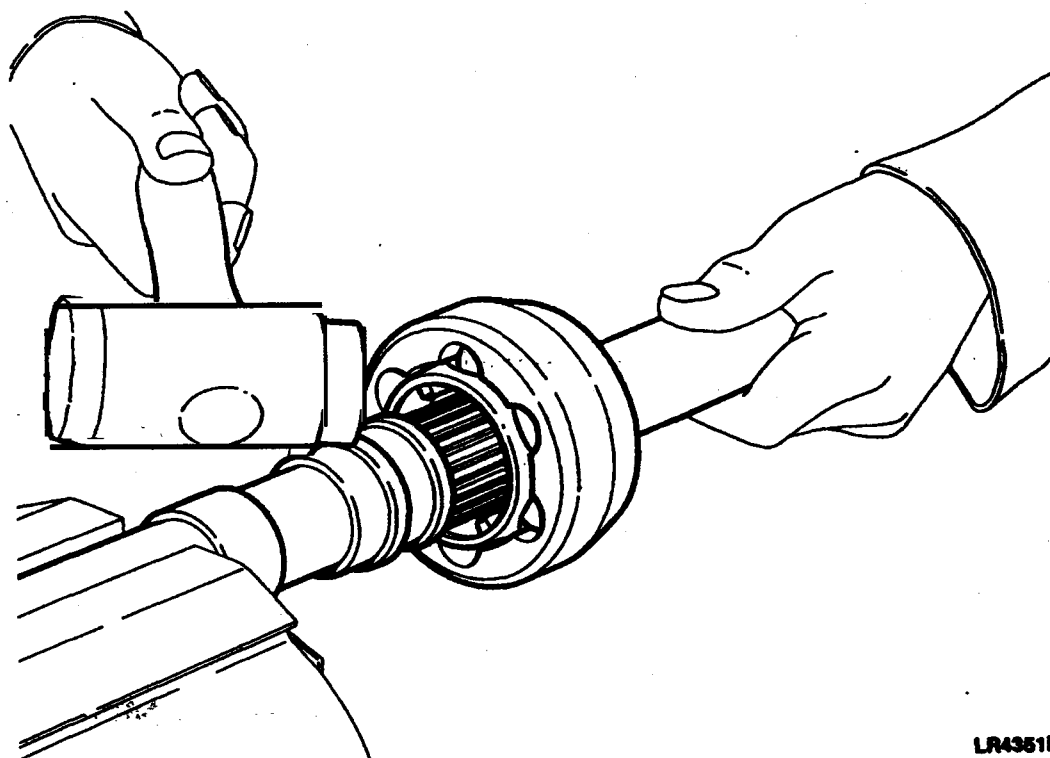


Fig 13 Removing constant velocity joint from axle shaft

7.2 Axle shaft and constant velocity joint. Pull-out the axle shaft and constant velocity joint from the axle casing.

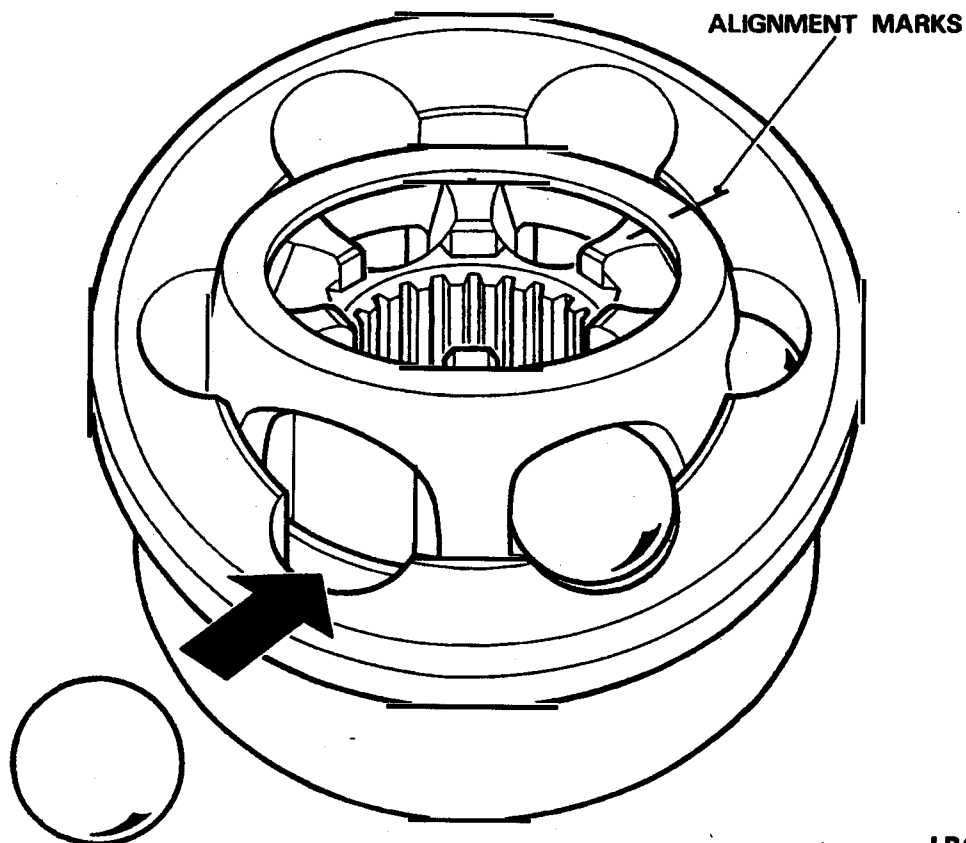
7.3 Constant velocity joint. To remove the constant velocity joint (Fig 11 (27)) from the axle shaft (36) and dismantle it carry out the following:

7.3.1 With the axle shaft firmly held in a soft jawed vice, and using a soft mallet, drive the constant velocity joint from the shaft (Fig 13).

7.3.2 Remove the circlip (Fig 11 (35)) and collar (26) from th axle shaft.

7.3.3 Mark the relative positions of the constant velocity joint inner and outer race and the cage to ensure correct reassembly (Fig 14).

7.3.4 Tilt and swivel the cage and inner race to remove the balls.



LR4352M

Fig 14 Removing steel balls

7.3.5 Swivel the cage into line with the axis of the joint until the two larger opposite apertures coincide with the two lands of the joint housing (Fig 15).

7.3.6 Withdraw the cage.

7.3.7 Turn the inner track at right angles to the cage with two of the lands opposite the cage openings, and withdraw the inner race (Fig 15).

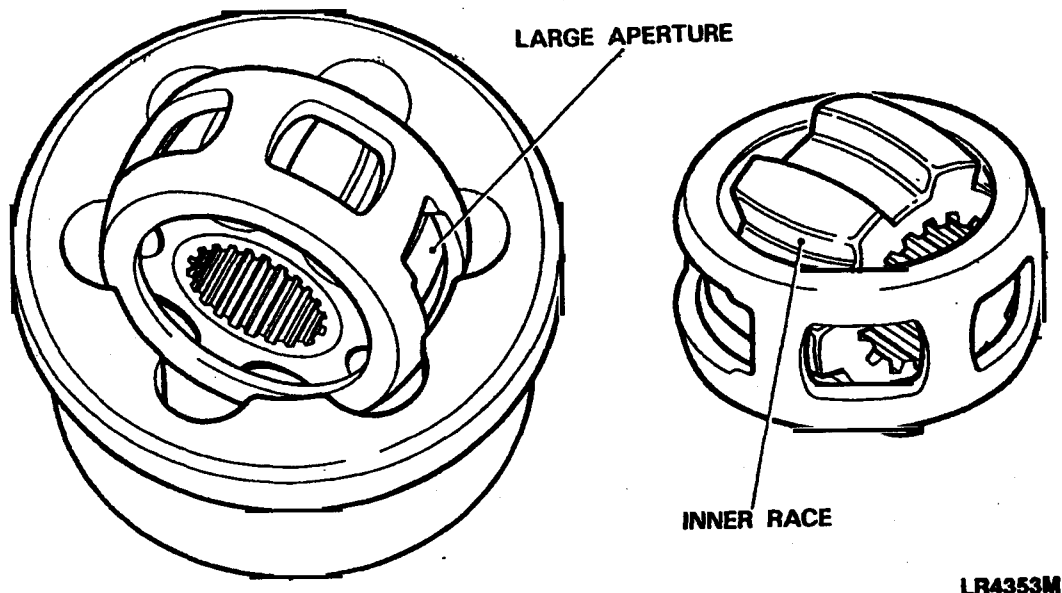


Fig 15 Dismantling constant velocity joint

7.4 Swivel assembly. Remove the swivel assembly as follows:

7.4.1 Remove the brake disc shield (Fig 11 (28)), secured by one nut and bolt at the bottom front, and one single bolt behind the shield, in the swivel housing.

7.4.2 Disconnect the track-rod and if applicable the cross rod ball joints from the swivel housing.

7.4.3 Remove the gaiter (Para 14), then release the oil seal retaining plate (12), gasket (13) and oil seal (14) from the swivel pin housing (37).

Note ...

Whilst the gasket may be removed at this stage the oil seal and retaining plate must remain until the swivel pin bearing housing has been removed.

7.4.4 Remove the two bolts (23), spring washers (24) complete with the brake disc shield bracket (22), securing the lower swivel pin to the housing.

- 7.4.5 Withdraw the lower swivel pin (21) and gasket (20) by tapping the small protruding lug.
- 7.4.6 Remove the top swivel pin retaining bolts (2) and spring washers (3) complete with brake hose bracket (1).
- 7.4.7 Whilst supporting the swivel pin housing (37) withdraw the top swivel pin (4) and shims (5), remove the housing and retrieve the lower taper bearing (18).
- 7.4.8 Remove the seven bolts (16) securing the swivel pin bearing housing (17) to the axle case and remove the housing and gasket (15).
- 7.4.9 Remove the oil seal (14), retaining plate (12) and gasket (13). Discard the oil seal and gasket.
- 7.4.10 Prise out the oil seal from the back of the bearing housing.
- 7.4.11 Drift out the lower swivel pin bearing track.
- 7.4.12 Press out the upper swivel pin 'Railko' bush housing (8).

Cleaning

- 8 Thoroughly clean and degrease all of the components.

Examination

- 9 Examine all components for general wear and condition paying particular attention to seal surfaces, balls, bearing tracks, and splines.

Repairs and replacement

- 10 Renew all seals, gaskets and components considered unfit for further use.

Reassembly

- 11 To reassemble the stub axle, axle shaft, constant velocity joint and swivel assembly carry out the following:

11.1 Swivel assembly. Reassemble the swivel assembly as follows:

- 11.1.1 Press-in the lower swivel pin bearing track to the swivel pin bearing housing.
- 11.1.2 Press-in the 'Railko' bush housing (Fig 11) to the upper swivel pin location with the machined flat on the bush housing facing towards the back of the bearing housing.
- 11.1.3 With the seal lips trailing press the axle shaft oil seal into the rear of the bearing housing, grease the seal lips with a suitable grease.
- 11.1.4 Fit the thrust disc (6) into the bottom of the 'Railko' bush housing.
- 11.1.5 Coat the swivel pin bearing housing to axle casing securing bolts (16) with Loctite 270.
- 11.1.6 Coat both sides of the gasket (15) with sealing compound and place in position on the swivel pin bearing housing to axle mating face.

11.1.7 Place the swivel pin bearing housing oil seal (14), seal retainer (12) and gasket (13) over the back of the housing.

11.1.8 Fit and secure the bearing housing to the axle with the seven bolts, tightening evenly to a torque of 65 to 80 Nm (48 to 59 lbf ft).

11.1.9 Grease and fit the lower swivel pin bearing (18) to the bearing housing.

11.1.10 Place the swivel pin housing over the bearing housing.

11.1.11 Coat both sides of a new lower swivel pin gasket (20) with sealing compound and place over the swivel pin (21). Fit the lower swivel pin with the lug facing outwards, do not secure with the bolts at this stage.

11.1.12 Lubricate the 'Railko' bush (7) with an EP oil and fit the upper swivel pin (4) with the existing shims, ensuring that the thrust disc is not dislodged. Fit the securing bolts (2), washers (3) and brake hose bracket (1). Do not tighten the bolts at this stage.

11.1.13 Coat the threads of the lower swivel pin securing bolts (23) with Loctite 270, fit the bolts together with washers (24) and brake disc shield bracket (22) and tighten to a torque of 22 to 28 Nm (16 to 21 lbf ft).

11.1.14 Tighten the top swivel pin securing bolts to a torque of 60 to 70 Nm (44 to 52 lbf ft).

11.1.15 Check the top swivel pin pre-load by attaching a spring balance to the track-rod ball joint bore, pull the spring balance to determine the effort required to turn the swivel housing (Fig 16). The resistance, once initial inertia has been overcome, should be 3,60 to 4,50 Kg (8 to 10 lb). If necessary, adjust by removing or adding shims, from the range available (AESP 2320-D-122-721), to the top swivel pin as required.

11.1.16 When the correct setting has been achieved, remove the securing bolts, coat the threads with Loctite 270 and refit, tightening to a torque of 60 to 70 Nm (44 to 52 lbf ft).

11.1.17 Liberally apply, but do not pack, a multi purpose grease between the lips of the swivel oil seal (2,5 to 4,0 grams).

11.1.18 Secure the oil seal, gasket and retaining plate. Fit the gaiter (Para 15).

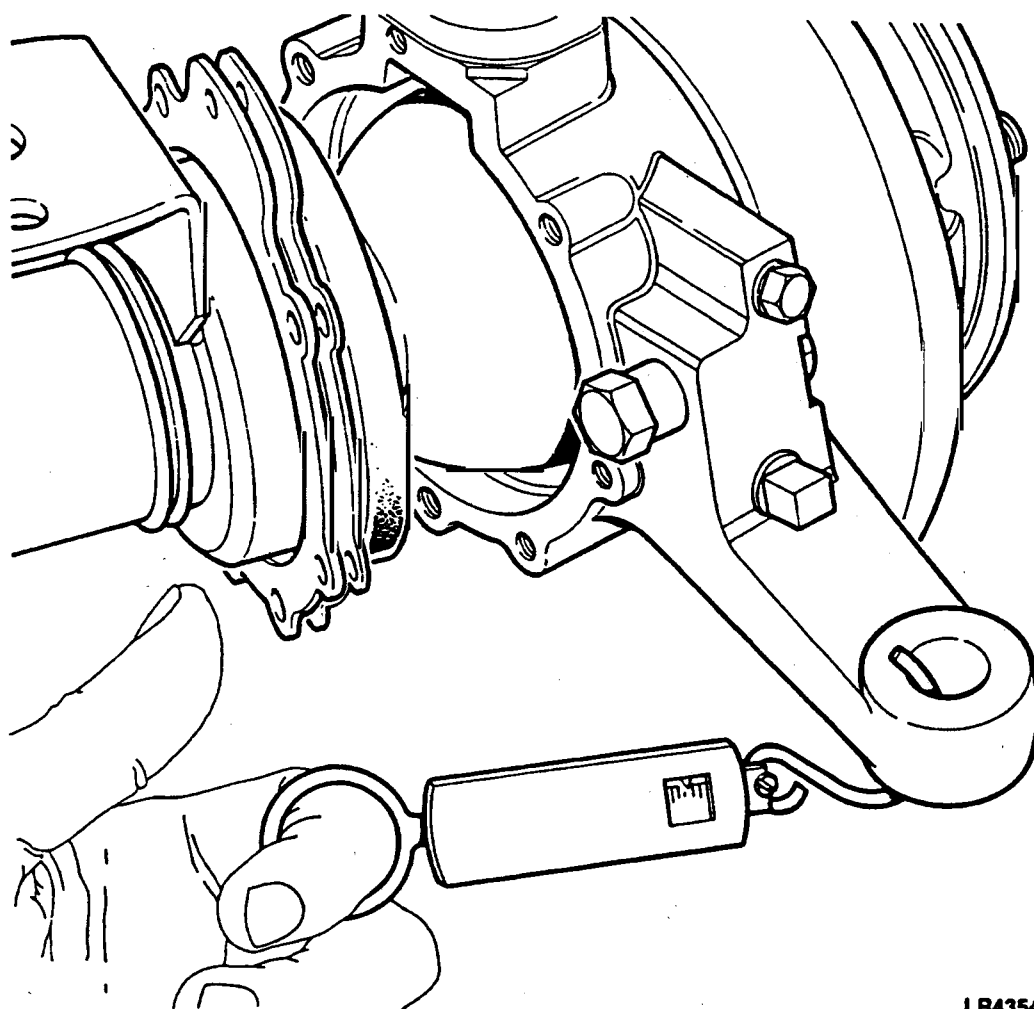
11.1.19 Fit the track rod link and if applicable the cross rod link, tighten the ball joint nuts to a torque of 41 Nm (30 lbf ft) and fit new split pins.

11.1.20 Fit the brake disc mud shield.

11.1.21 loosely fit the lock stop bolt and nut for later adjustment.

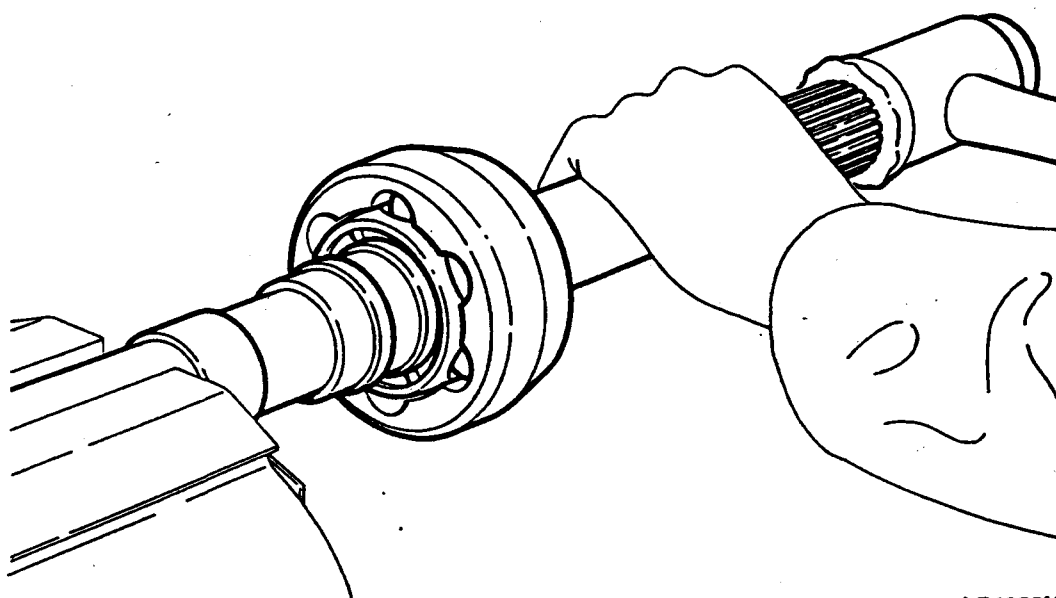
11.2 Constant velocity joint. Reassemble the constant velocity joint in reverse order of dismantling (Para 7.3). Lubricate with an EP 90 oil and carry out the following:

11.2.1 Check that the end float of the assembled joint does not exceed 0,64 mm (0.025 in).



LR4354M

Fig 16 Checking swivel housing resistance



LR4355M

Fig 17 Fitting the constant velocity joint to axle shaft

11.2.2 Fit the collar (Fig 11 (26)) to the axle shaft (36) and retain with the circlip (35), engage the constant velocity joint (27) on the axle shaft splines and using a soft mallet drive the joint home (Fig 17).

11.2.3 Taking care not to damage the axle shaft oil seals, insert the axle shaft through the swivel assembly into the axle casing, when the differential splines are engaged, push the assembly home.

11.3 Stub axle Fit the intermediate oil seal and bush and refit the stub axle as follows:

11.3.1 Lubricate a new intermediate seal (Fig 11 (33)) with OEP 220 oil, ensuring that the lip is well lubricated, then with the lip side leading and using a suitable tube, press the seal into the rear of the stub axle.

11.3.2 Using a suitable block, press-in the bush (34) up to the shoulder.

CAUTION ...

It is most important to ensure that the constant velocity joint bearing journal engages fully with the bronze bush in the rear of the stub axle before the stub axle is secured with bolts. Damage to the bush can occur if this precaution is not observed. The shaft and bush are correctly engaged when the inner end of the axle shaft splines are flush with the end of the stub axle.

11.3.3 Place a new gasket in position on the swivel pin housing to stub axle mounting face. Fit the stub axle, with the keyway uppermost, over the shaft and engage the mating faces, hold the stub axle in position and pull the axle shaft into the bush in the rear of the stub axle.

11.3.4 Place the mud shield (31) in position, coat the threads of the securing bolts (30) with Loctite 270 and secure the stub axle to the swivel pin housing tightening the bolts evenly to a torque of 60 to 70 Nm (44 to 52 lbf ft).

11.4 Refit the hub assembly and road wheel (Para 6).

Refilling swivel assembly

12 Fill the swivel assembly with oil as follows:

12.1 Turn steering onto a full lock.

12.2 Check that the swivel pin housing drain plug is tightly fitted and remove the filler level plug.

12.3 Inject OEP 220 oil, approximately 0,28 litres (0.50 pints), until the oil begins to run out of the filler hole. Fit and tighten the plug and wipe away any surplus oil.

Setting steering lock stop bolts

13 Set the steering lock stop bolts to provide a clearance between the tyre wall and radius arm of 56 mm (2.205 in).

SWIVEL PIN BEARING HOUSING GAITERS

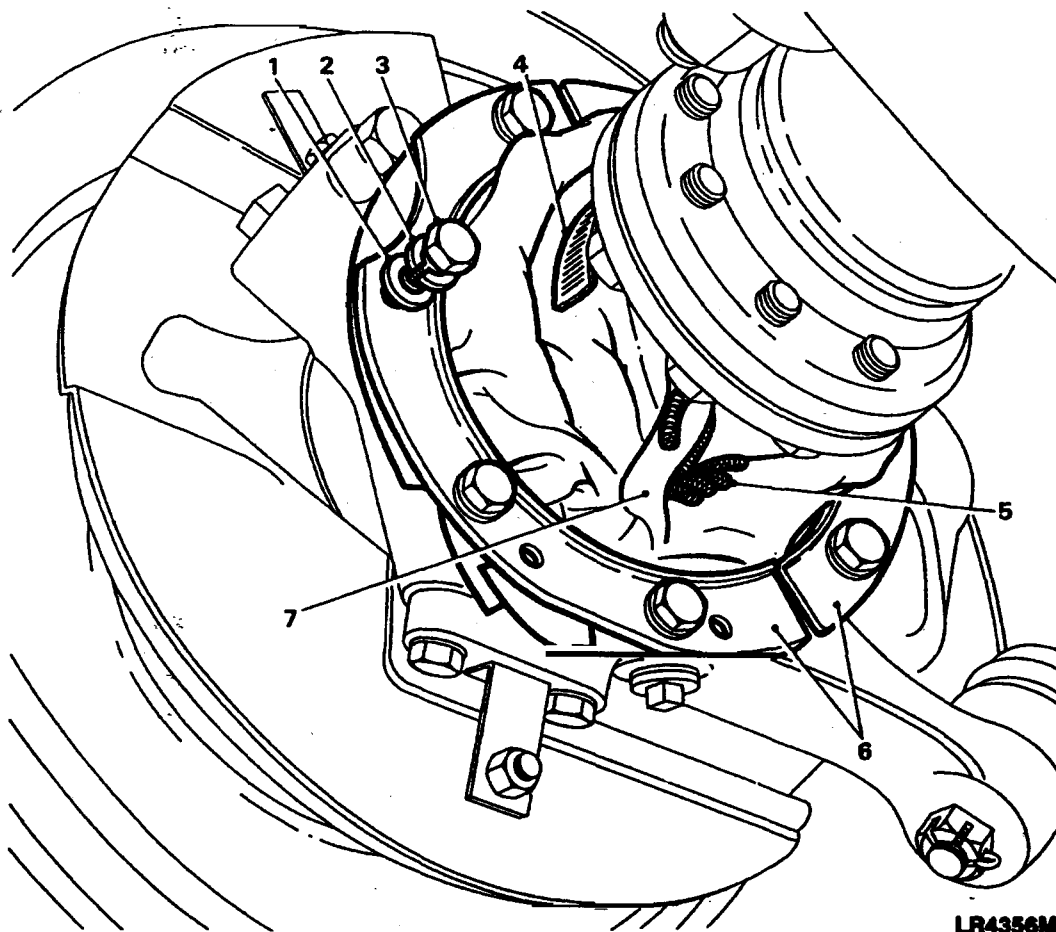
Removal

14 Remove the swivel pin bearing housing gaiters as follows:

14.1 Remove the bolts (Fig 18 (3)), spring (2) and plain washers (1) securing the gaiter retaining halves (6) to the swivel pin housing. Care must be taken, when removing these bolts, not to disturb the large oil seal retaining plate, which is secured by the same bolts.

14.2 Remove the jubilee clip (4) securing the gaiter (7) to the swivel pin bearing housing.

14.3 Unlace the gaiter and remove it from the axle.



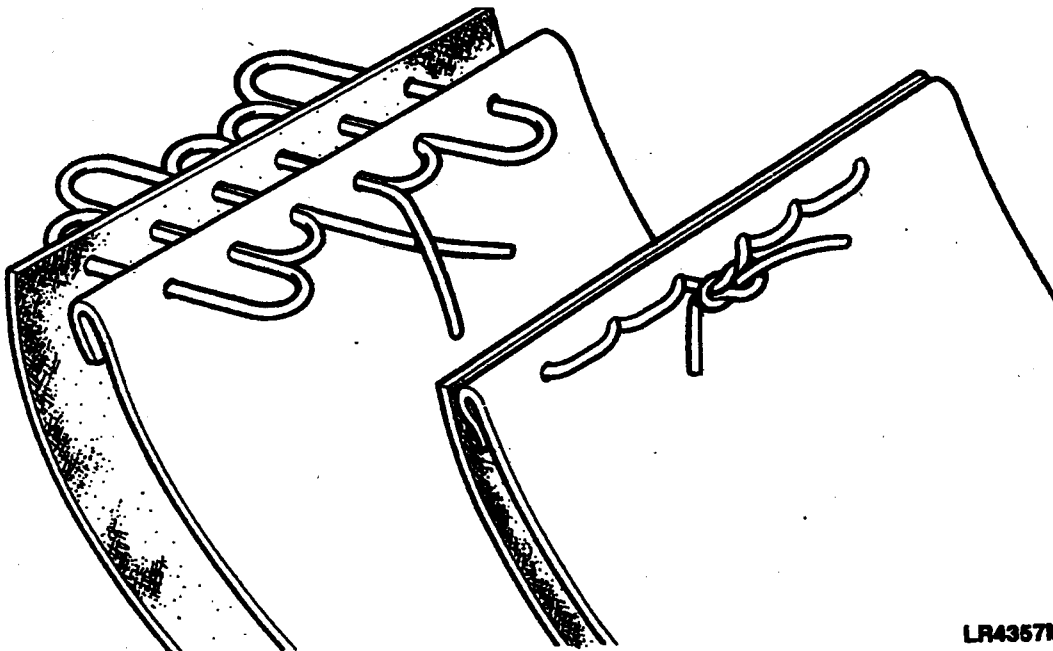
LR4356M

- | | | | |
|---|---------------|---|------------------|
| 1 | Plain washer | 5 | Lace |
| 2 | Spring washer | 6 | Retaining halves |
| 3 | Bolt | 7 | Gaiter |
| 4 | Jubilee clip | | |

Fig 18 Swivel pin bearing housing gaiters

Fitting

- 15 To fit a new swivel pin bearing housing gaiter carry out the following:
- 15.1 Fit the gaiter, smooth side outwards, and lace the two ends together (Fig 19).
- 15.2 Position the gaiter so that the lace is at the bottom of the swivel pin bearing housing.
- 15.3 Secure the gaiter to the swivel pin bearing housing with a new jubilee clip.
- 15.4 Turn the gaiter back and liberally coat the inside with petroleum jelly.
- 15.5 Fit the larger diameter of the gaiter to the swivel pin housing and secure with the retaining halves, bolts, spring and plain washers. Tighten the bolts to a torque of 7 to 10 Nm (5 to 7 lbf ft).
- 15.6 Liberally coat the outside of the gaiter with petroleum jelly.



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Fig 19 Method of lacing gaiters

DIFFERENTIAL

Removal

Note ...

Removal of the differential assembly necessitates the removal of the road wheels, hub assemblies and stub axles to allow access to the axle shafts.

16 To remove the differential assembly carry out the following:

16.1 Using a suitable container drain the oil from the axle. To avoid loss, refit the drain plug.

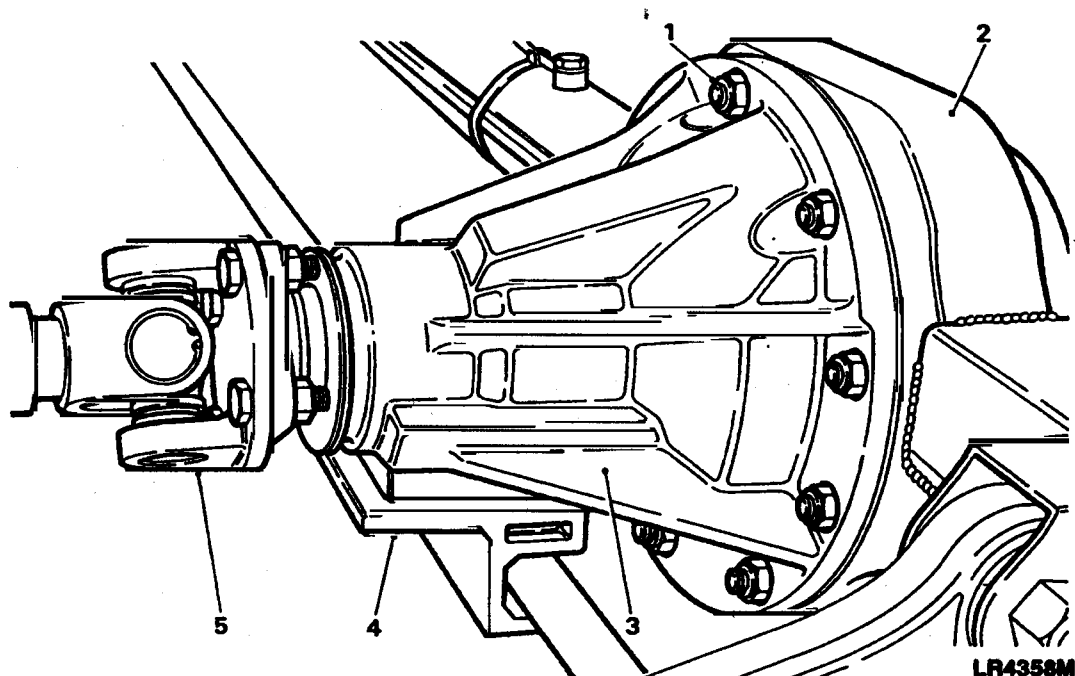
16.2 Mark the propeller shaft and differential flanges to aid reassembly, then disconnect the propeller shaft (Fig 20 (5)) from the differential flange and secure to one side.

16.3 Remove the track rod protection bracket (4) from the underside of the differential unit.

16.4 Withdraw the axle shafts sufficiently to disengage them from the differential unit (Para 7).

16.5 Suitably support the differential unit whilst removing.

16.6 Remove the self locking nuts (1) securing the differential assembly (3) to the axle casing (2) and withdraw the unit from the vehicle.



- | | | | |
|---|-----------------------|---|------------------------------|
| 1 | Self locking nut | 4 | Track rod protection bracket |
| 2 | Axle casing | 5 | Propeller shaft |
| 3 | Differential assembly | | |

Fig 20 Removing the differential assembly

Dismantling

TABLE 3 SPECIAL TOOLS

Ser No. (1)	Manufacturers Part No (2)	NSN/Part No where applicable (3)	Designation (4)
1	MS 47		Hand press
2	18G 47-6		Pinion head bearing remover/replacer
3	18G 191		Bevel pinion setting gauge
4	18G 191-4		Universal setting block, pinion height
5	18G 1205		Adjustable flange holding wrench
6	LST 106		Pinion oil seal replacer
7	RO 262757A		Extractor pinion bearing cup
8	RO 262757-1		Replacer pinion bearing cup (use with RO 262757A)
9	RO 262757-2		Adaptor pinion tail bearing cup replacer
10	RO 530105		Spanner carrier bearing nuts
11	RO 530106		Bracket for dial gauge indicator

17 To dismantle the differential assembly, secure the assembly in a suitable work stand and proceed as follows:

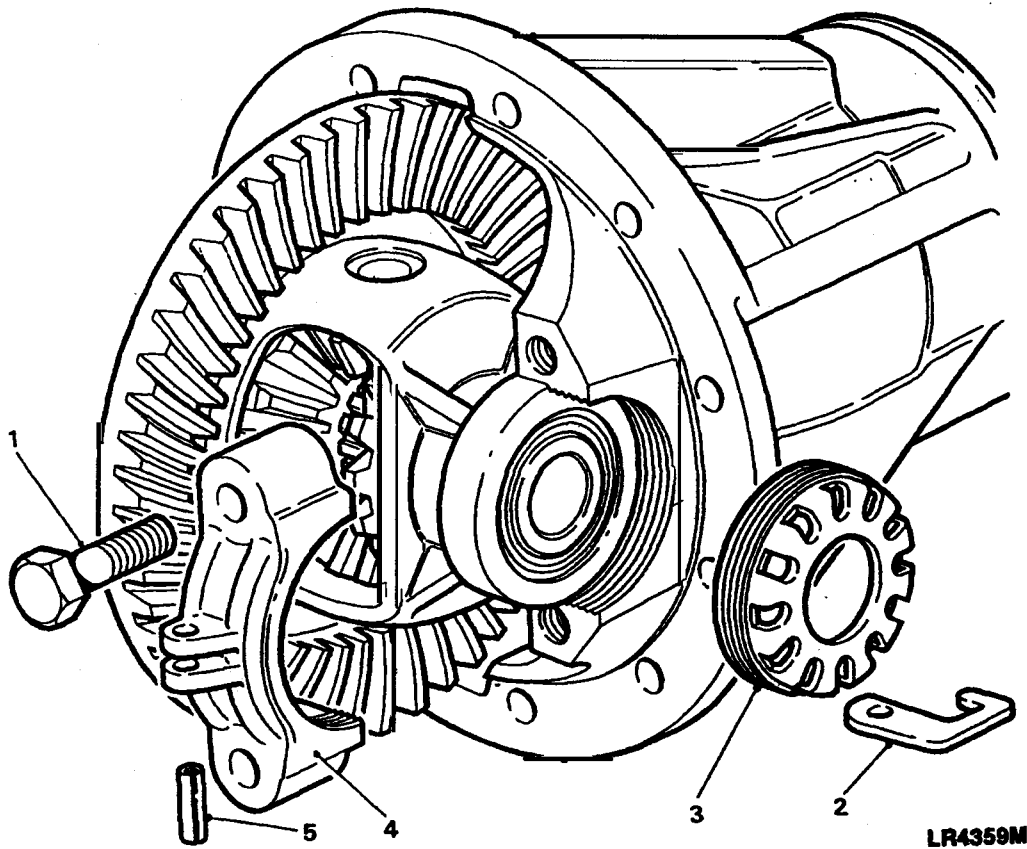
Note ...

It is essential that the differential assembly components are marked in their original positions and relative to other components so that, when refitted their original setting is maintained. It should also be noted that the bearing caps are handed and must not be interchanged.

17.1 Drift out the roll pins (Fig 21 (5)) securing the bearing nut locking fingers (2) to the bearing caps (4). Remove the locking fingers.

17.2 Slacken the bearing cap bolts (1) and mark the caps to aid reassembly.

17.3 Using special tool (Serial No 10), remove the bearing adjusting nuts (3).



- | | |
|-------------------------|---------------|
| 1 Bolt | 4 Bearing cap |
| 2 Locking finger | 5 Roll pin |
| 3 Bearing adjusting nut | |

Fig 21 Bearing caps removal

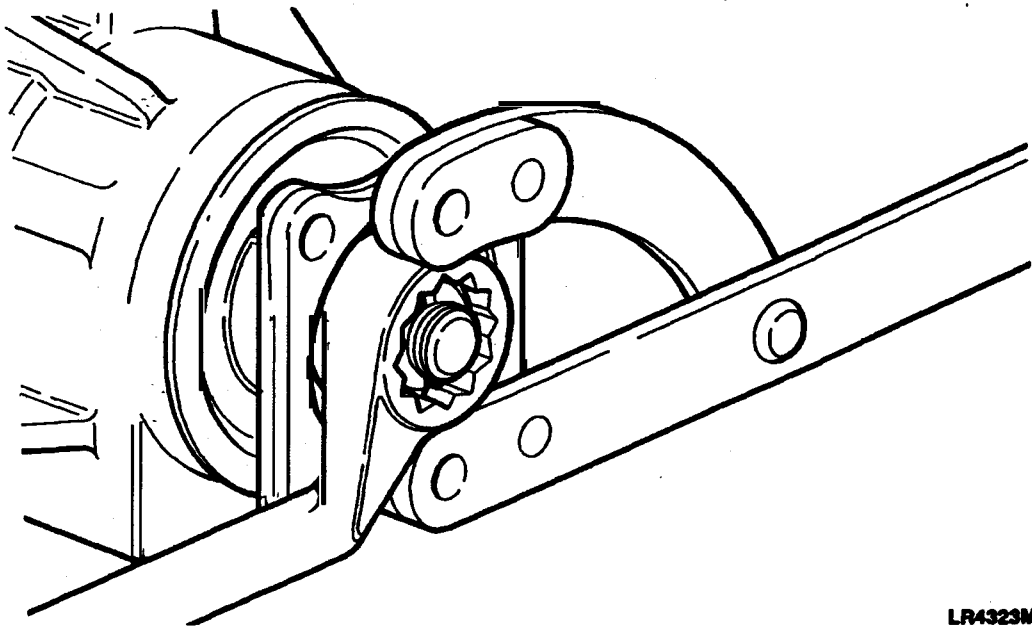
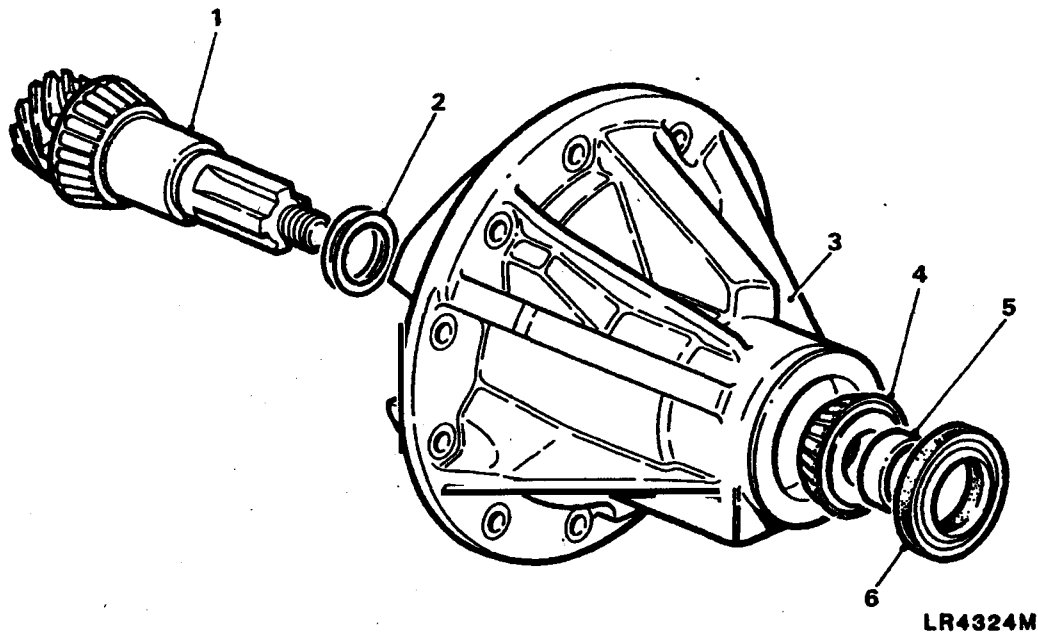


Fig 22 Pinion flange nut removal

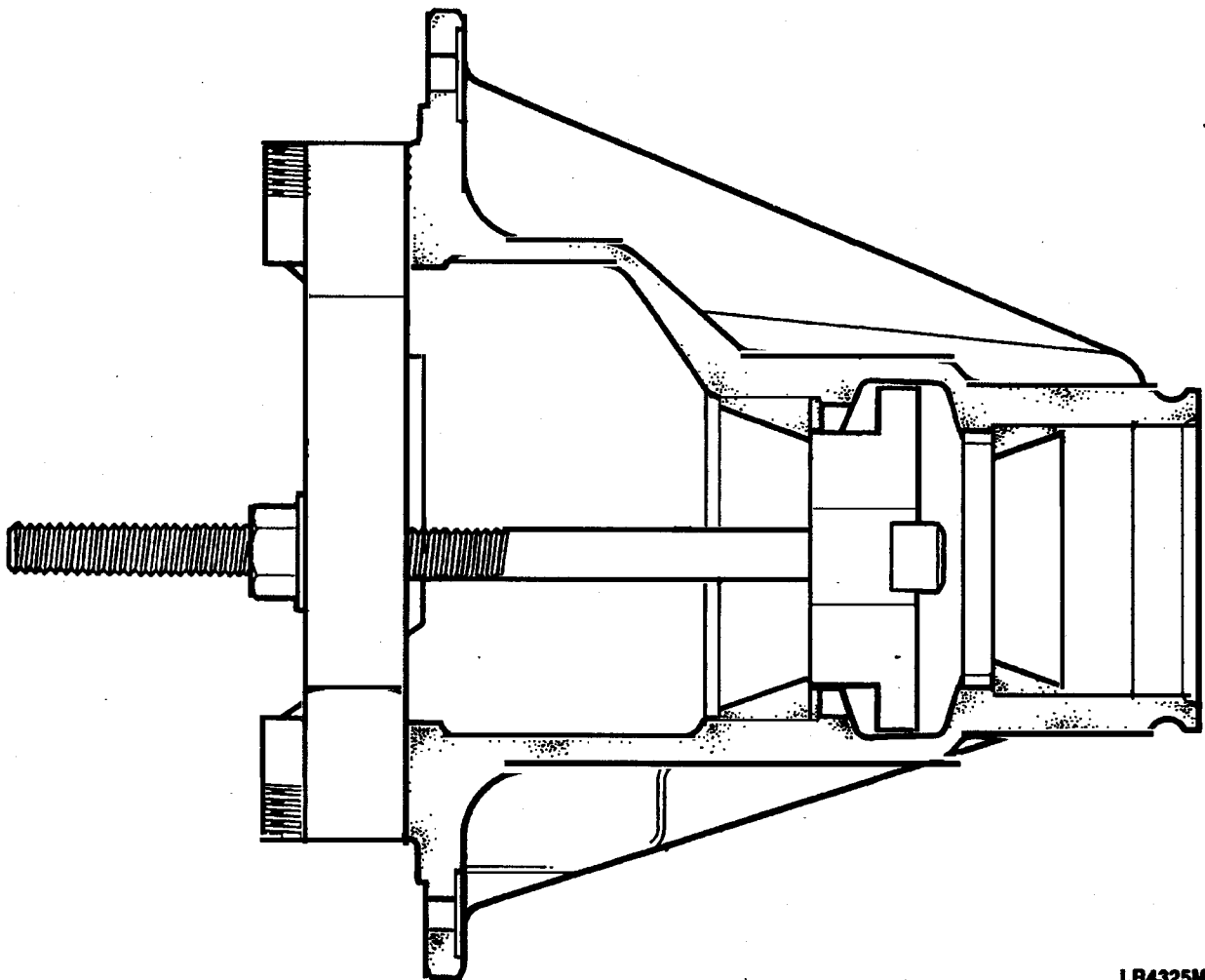
- 17.4 Remove the bearing cap bolts (1) and bearing caps (4).
- 17.5 Lift out the assembled crown wheel, differential unit and bearings.
- 17.6 Remove the split pin securing the pinion flange nut.
- 17.7 Using special tool (Serial No 5) to restrain the flange, remove the pinion flange nut (Fig 22).



1	Pinion and bearing	4	Outer bearing
2	Outer bearing shims	5	Spacer
3	Differential casing	6	Oil seal

Fig 23 Pinion removal

- 17.8 Withdraw the pinion (Fig 23 (1)) complete with pinion head bearing and outer bearing shims (2). Note thickness of shims to assist with reassembly.
- 17.9 Remove the pinion flange oil seal (6), spacer (5) and outer bearing (4). Discard oil seal.
- 17.10 Using special tool (Serial No 7) remove the pinion inner bearing track and shims (Fig 24). Note thickness of the shim washers removed, to aid reassembly.
- 17.11 Remove special tool and drift out the outer bearing track from the housing.
- 17.12 Using special tools (Serial Nos 1 and 2) remove the pinion inner bearing (Fig 25).



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Fig 24 Removing pinion inner bearing track

17.13 For reassembly purposes, add alignment marks to the crown wheel and differential flange.

17.14 Remove the bolts (Fig 26 (1)) and washers (2) and detach the crown wheel (7).

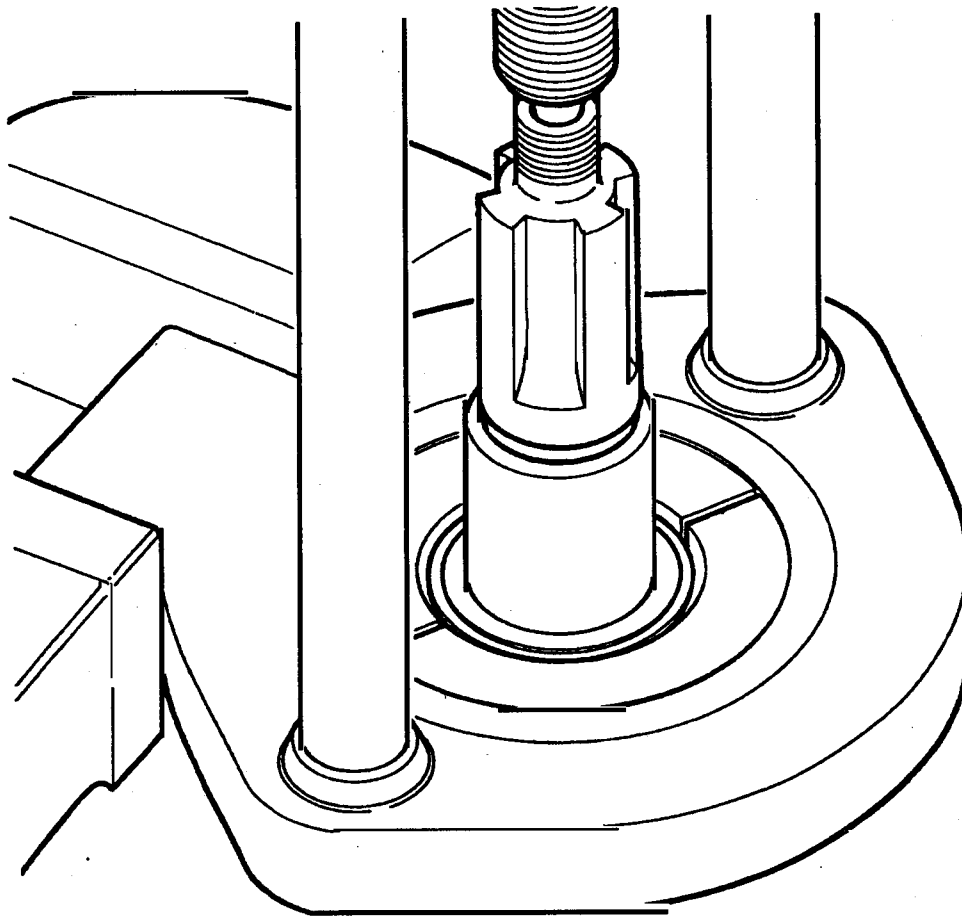
17.15 Remove the differential carrier bearings (6).

17.16 Remove the circlips (3) securing the cross shaft (4) and withdraw the shaft.

17.17 Withdraw the gears (8) and pinions (9).

Cleaning

18 Thoroughly clean all of the components.



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Fig 25 Removing pinion inner bearing

Examination

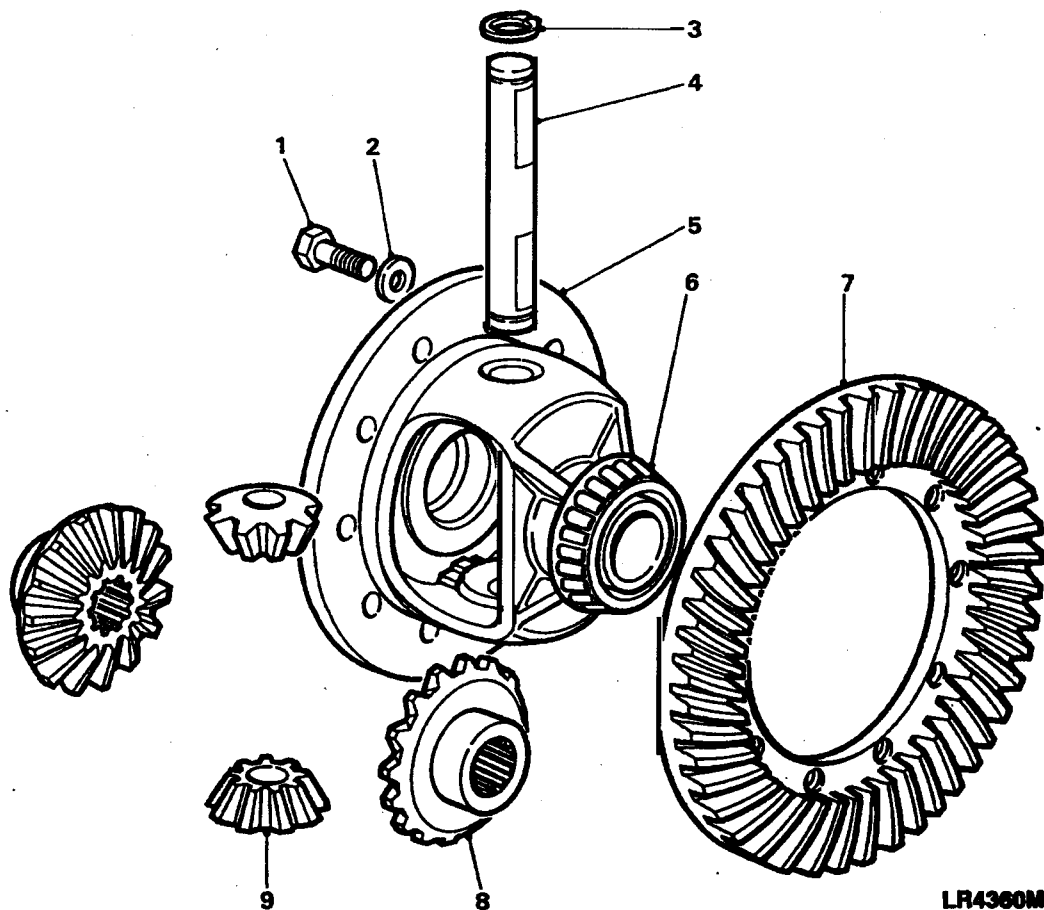
19 To examine the components carry out the following:

- 19.1 Examine all of bearings for obvious wear, damage and pitting.
- 19.2 Check all gears for wear, scuffing, pitting and damaged teeth.
- 19.3 The crown wheel and pinion are a matched assembly and must not be changed separately.
- 19.4 Examine the differential flange to crown wheel mating face for burrs and damage which could lead to crown wheel run-out when fitted.

Reassembly

20 Reassemble the differential as follows:

- 20.1 Fit the differential gears (Fig 26 (8)) and pinions (9) to the housing (5), insert the cross shaft (4) and secure with the circlips (3).



- | | | | |
|---|----------------------|---|-------------------|
| 1 | Bolt | 6 | Carrier bearing |
| 2 | Washer | 7 | Crown wheel |
| 3 | Circlip | 8 | Differential gear |
| 4 | Cross shaft | 9 | Pinion gears |
| 5 | Differential housing | | |

Fig 26 Differential assembly

20.2 Check the gears for freedom of rotation and backlash. Nominal backlash should be present, excessive backlash will necessitate the renewal of the gears and/or the differential housing. No provision is mad for backlash adjustment.

20.3 Check that the serial number on the crown wheel matches that marked on the pinion end face.

20.4 Ensure that the differential housing flange (5) and crown whe l (7) are thoroughly clean. Maintaining the alignment marks fit the crown wheel to the differential housing and secure with the bolts (1) and washers (2), tighten the screws evenly to a torque of 54 to 61 Nm (40 to 45 lbf ft).

20.5 Fit the carrier bearings (6), using a suitable press and assemble the tracks to the bearings.

20.6 Place the assembled differ ntial unit in the pinion housing, fit the bearing caps, ensuring that they are fitted to the locations from which they were removed, fit the bolts but do not fully tighten at this stage.

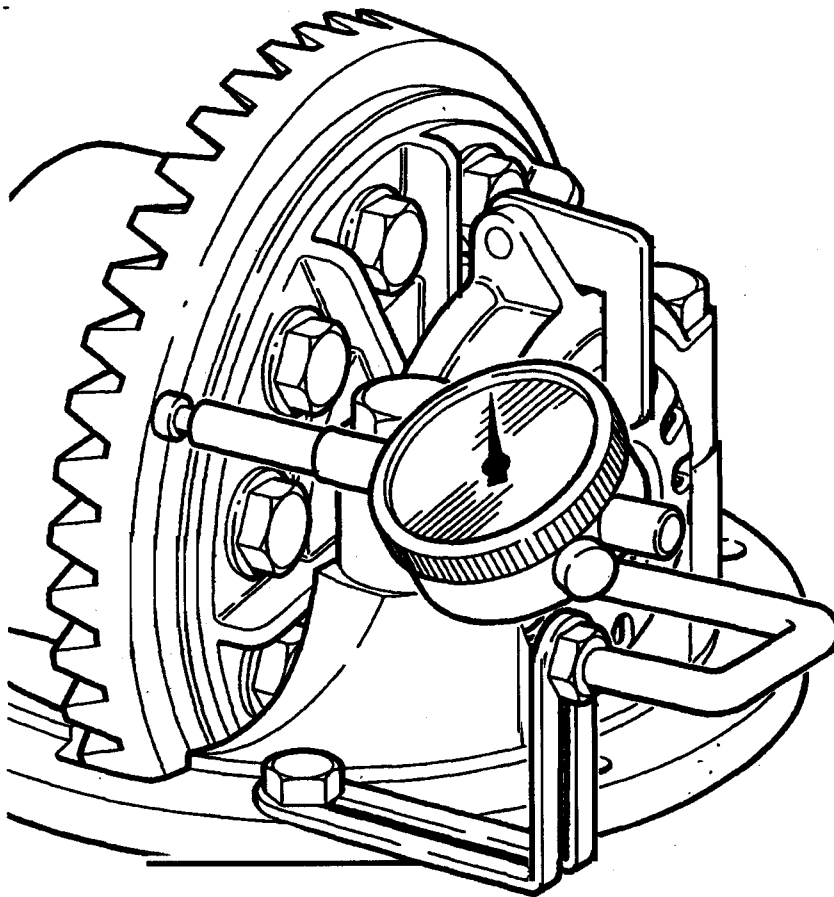
20.7 Fit the bearing adjusting nuts and adjust to obtain zero end-float.

20.8 Tighten the bearing cap bolts to a torque of 82 Nm (60 lbf ft).

20.9 Using a suitable dial gauge, attached to special tool (Serial No 11) check the crown wheel for run-out (Fig 27), which should not exceed 0,10 mm (0.004 in). If excessive run-out is recorded, remove the crown wheel and examine the mounting flange for burrs, grit etc. Refit the crown wheel and recheck. Run-out attributable to a buckled or damaged differential housing can only be corrected by renewing the casing.

20.10 When satisfied that run-out is within the specified limits remove the differential assembly from the pinion housing.

20.11 Remove the crown wheel securing screws, coat the threads with Loctite 'Studlock' CVA, refit and evenly tighten to a torque of 54 to 61 Nm (40 to 45 lbf ft).



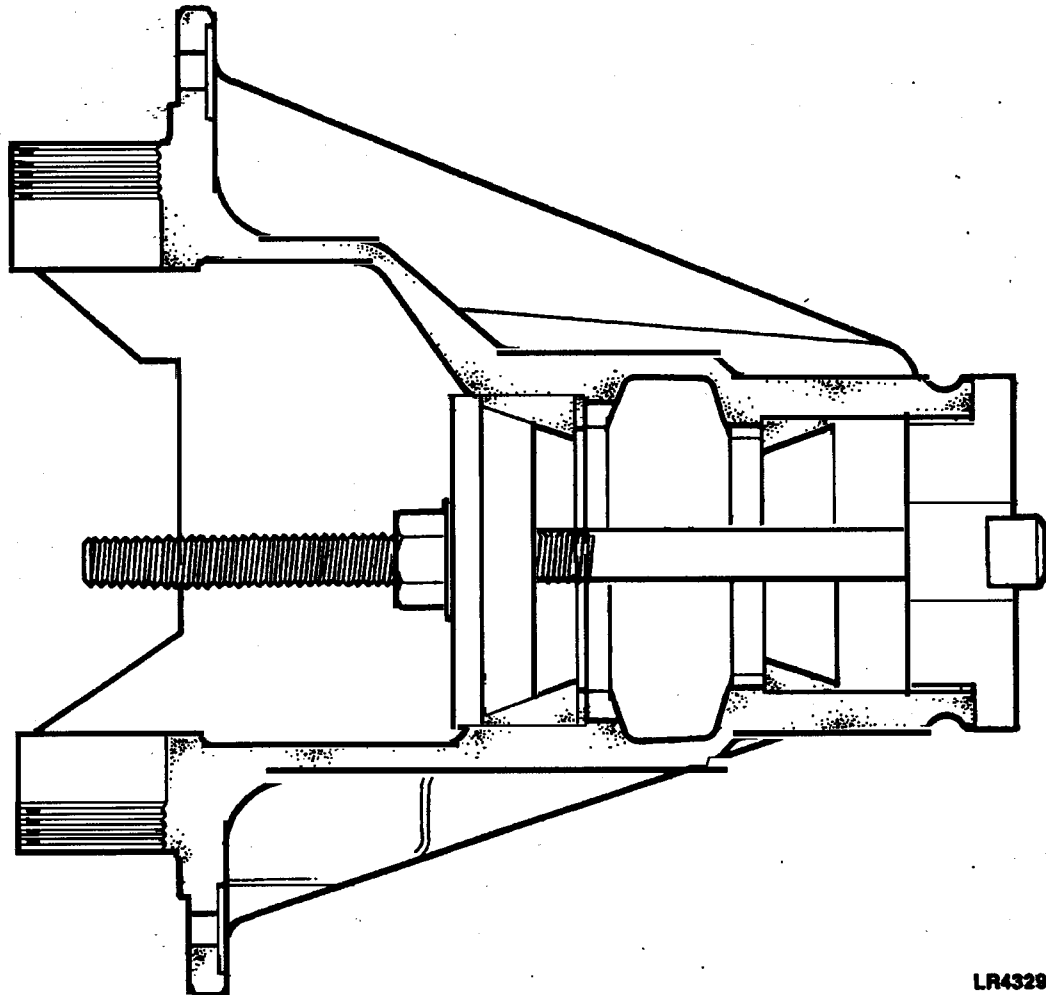
LR4328M

Fig 27 Checking crown wheel run-out

Drive pinion

21 Fit the drive pinion as follows:

21.1 Using special tools (Serial No's 7 and 8), fit the pinion inner bearing track and the original shims, to the pinion housing (Fig 28).

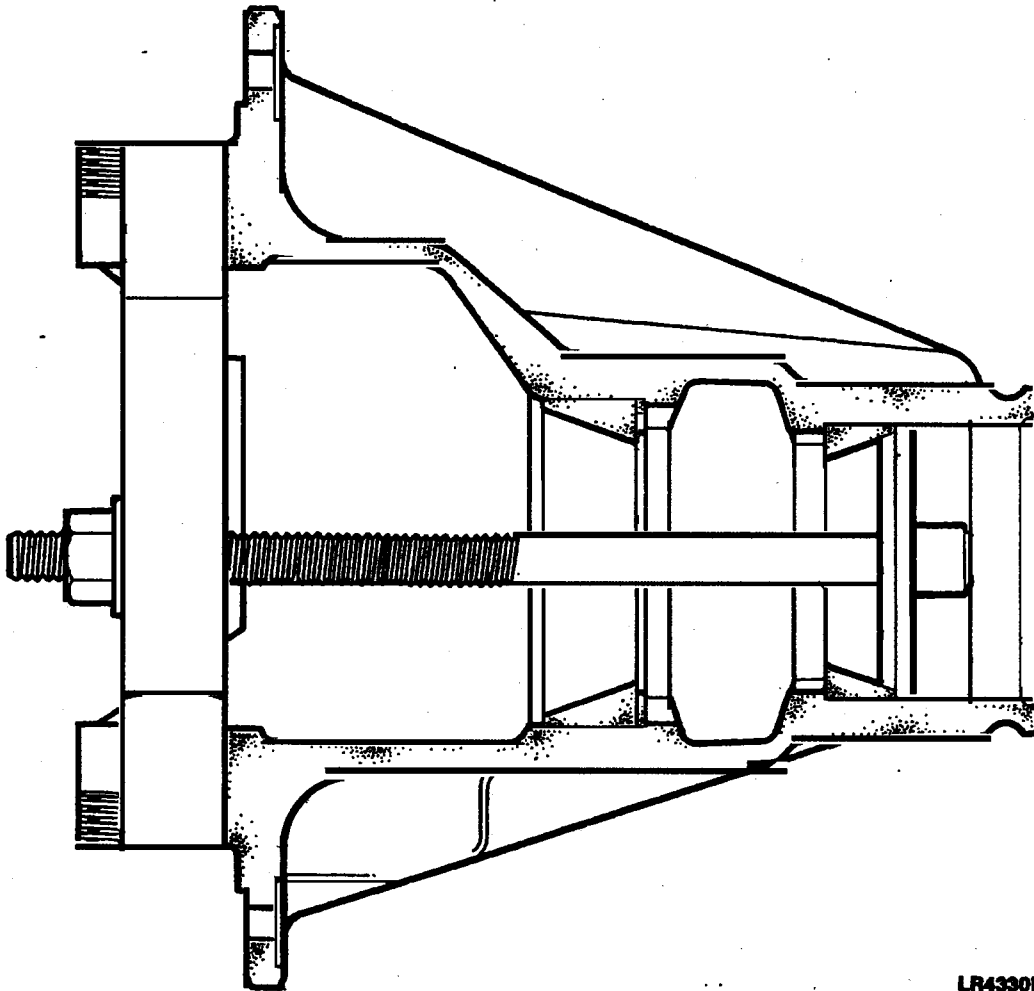


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Fig 28 Fitting pinion inner bearing track

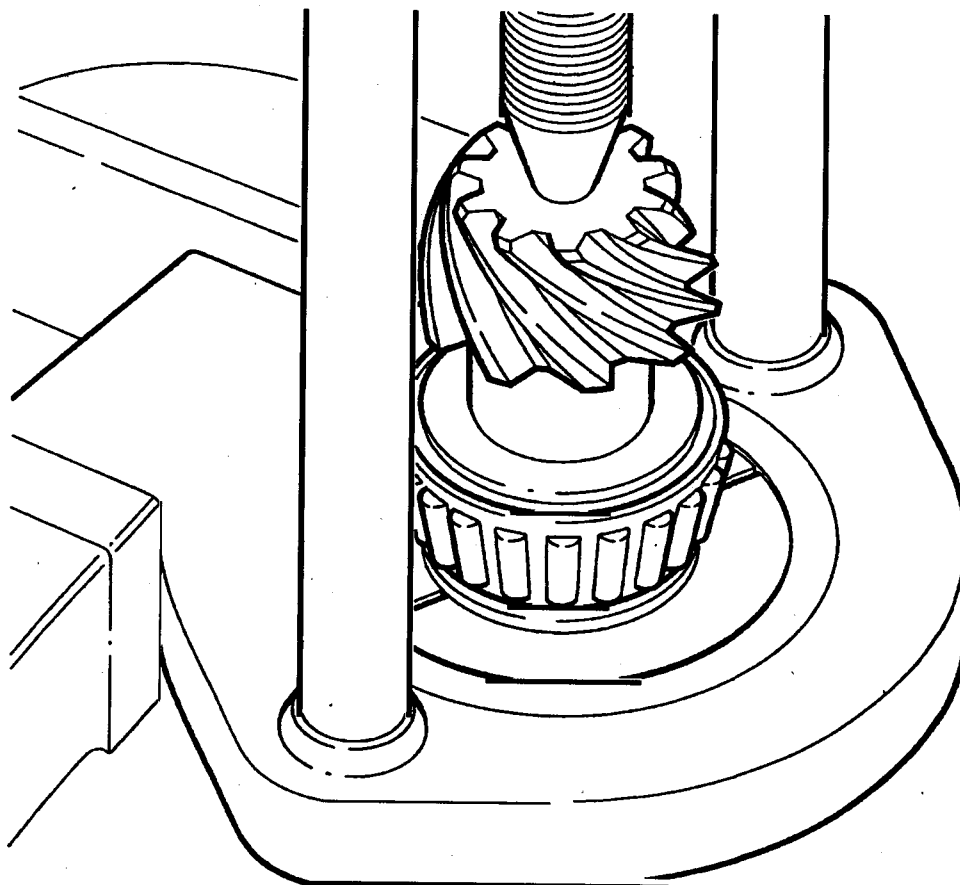
21.2 Using special tools (Serial No's 7 and 9), fit the pinion outer bearing track to the pinion housing (Fig 29).

21.3 Using special tools (Serial No's 1 and 2), fit the pinion inner bearing to the pinion (Fig 30).



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Fig 29 Fitting pinion outer bearing track



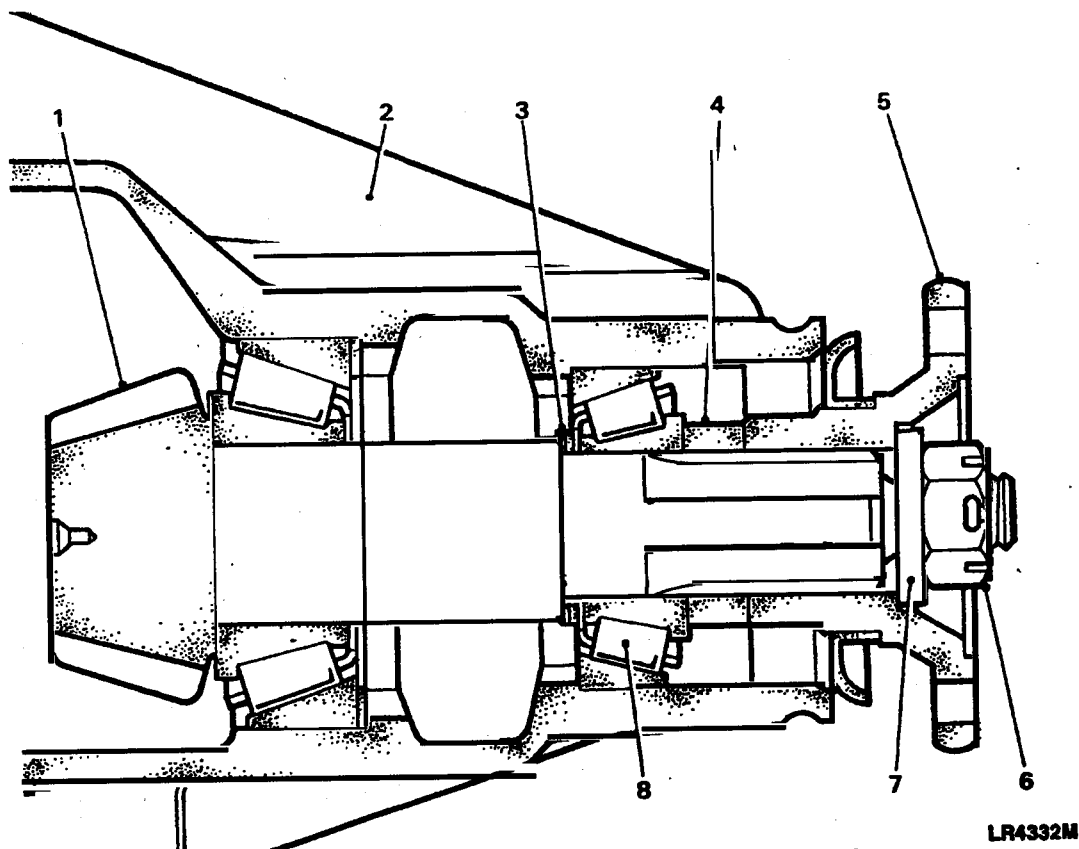
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Fig 30 Fitting pinion inner bearing

21.4 Position the assembled pinion and bearing (Fig 31 (1)) in its location in the pinion housing (2). Do not fit the shims (3) for bearing pre-load at this stage.

21.5 Fit the outer bearing (8) and spacer (4) followed by the driving flange (5), washer (7) and nut (6). Do not fit the oil seal at this stage.

21.6 Rotate the pinion to settle the bearings and slowly tighten the flange nut until the force required to rotate the pinion is 23 to 40,5 kgf cm (20 to 35 lbf in) for new bearings and 11.5 to 17.25 kgf cm (10 to 15 lbf in) for original bearings.



- | | | | |
|---|--------------------------|---|----------------|
| 1 | Pinion and inner bearing | 5 | Drive coupling |
| 2 | Pinion housing | 6 | Nut |
| 3 | Shims | 7 | Washer |
| 4 | Spacer | 8 | Outer bearing |

Fig 31 Fitting pinion to housing

Drive pinion markings

22 The markings on the end face of the drive pinion, adjacent to the serial number, are of no significance during servicing. Note the following when carrying out drive pinion adjustment:

22.1 The figure marked on the end face opposite the serial number (Fig 32) indicates, in thousandths of an inch, the deviation from nominal required to correctly set the pinion. A pinion marked plus (+) must be set below nominal, a minus (-) pinion must be set above nominal. An unmarked pinion must be set at nominal.

22.2 The nominal setting dimension is represented by the setting block gauge special tool (Serial No 4) which is referenced from the pinion end face to the bottom radius of the differential bearing bore.

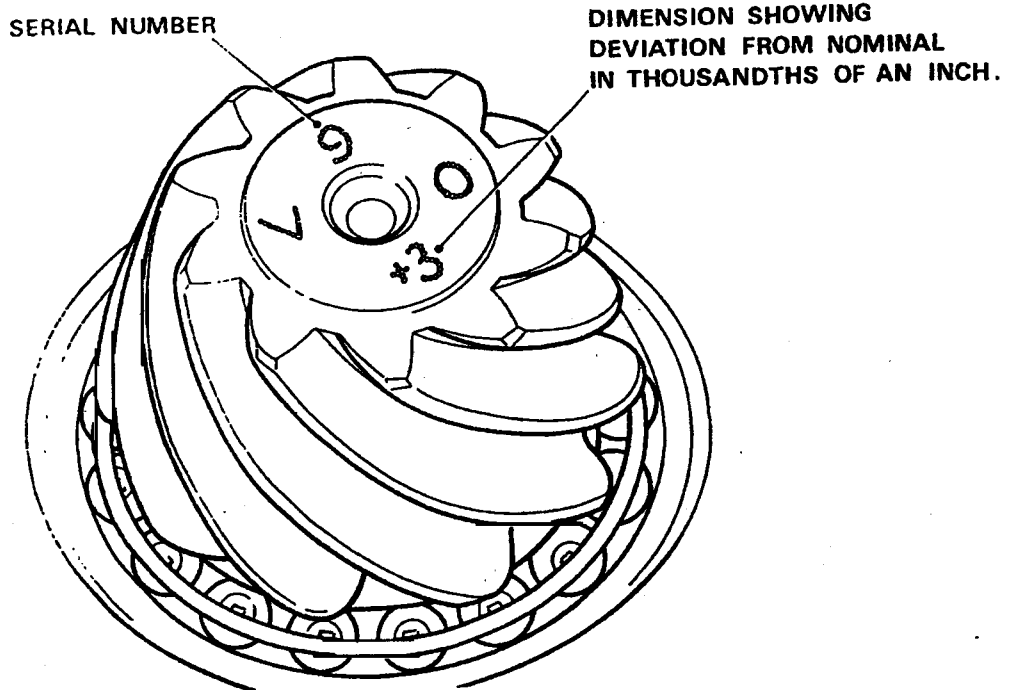
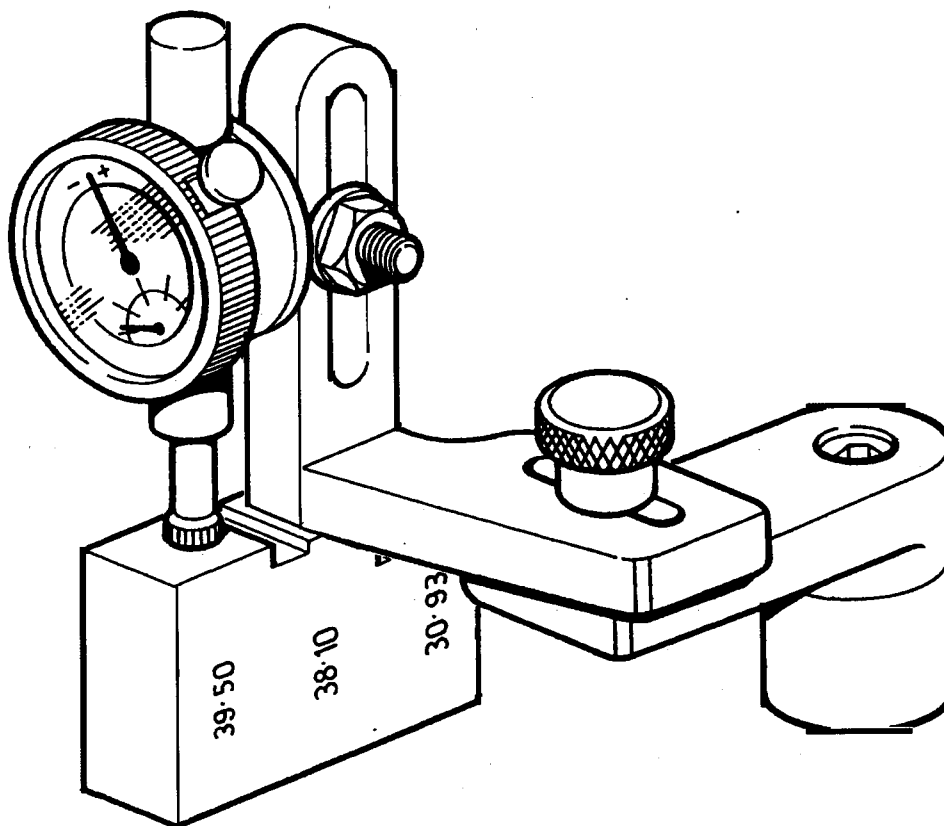


Fig 32 Drive pinion markings

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Fig 33 Setting dial gauge with setting block

Drive pinion adjustment

23 Adjust the drive pinion as follows:

23.1 Ensure that the pinion end face is free of raised burrs around the etched markings.

23.2 Remove the keep disc from the magnetized base of dial gauge special tool (Serial No 3), place the gauge on a flat surface and zero the gauge stylus on the largest dimension 39,50mm on the setting gauge block (Fig 33).

23.3 Position the dial gauge centrally on the pinion end face with the stylus registering on the lowest point on one differential bearing bore (Fig 34). Note the dial gauge deviation from the zeroed setting.

23.4 Repeat the procedure on the other bearing bore. Add together the readings, then halve the sum to obtain the mean reading. Note whether the stylus has moved up or down from the zeroed setting.

23.5 Where the stylus has moved down, the amount is equivalent to the thickness of shims that must be removed from under the pinion inner track to bring the pinion down to the nominal position.

23.6 Where the stylus has moved up, the amount is equivalent to the additional thickness of shims required to bring the pinion up to the nominal position.

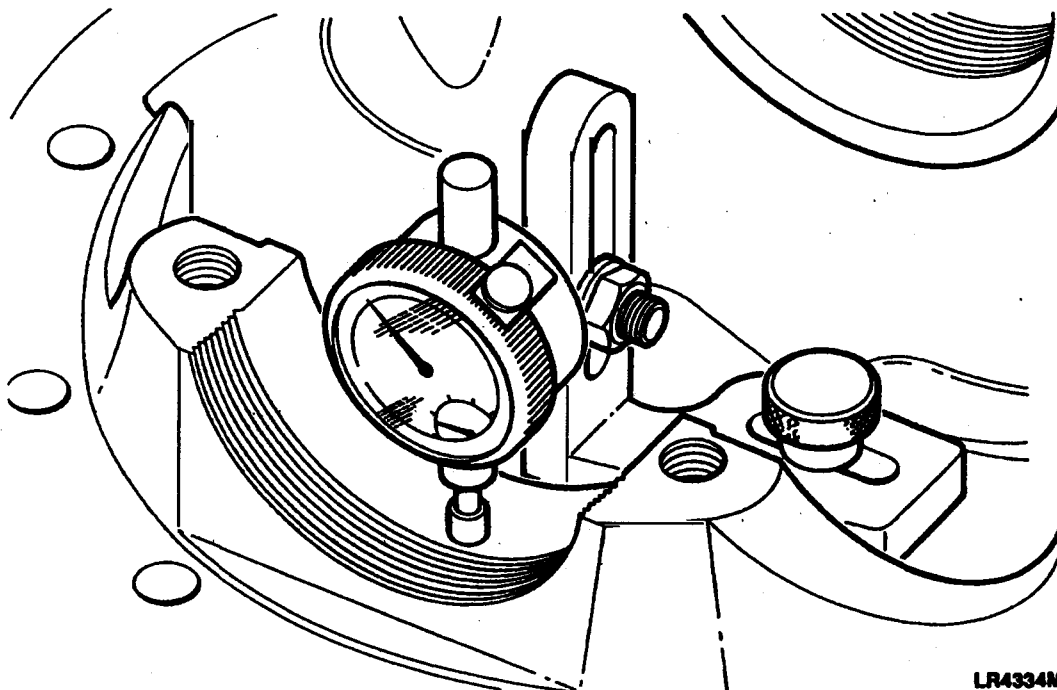


Fig 34 Pinion height setting

23.7 Before adjusting the shim thickness, check the pinion face marking, if it has a plus (+) figure, subtract that amount, in thousandths of an inch, from the shim figure obtained in the previous operations. Alternatively if the pinion has a minus (-) figure, add the amount to the shim thickness figure.

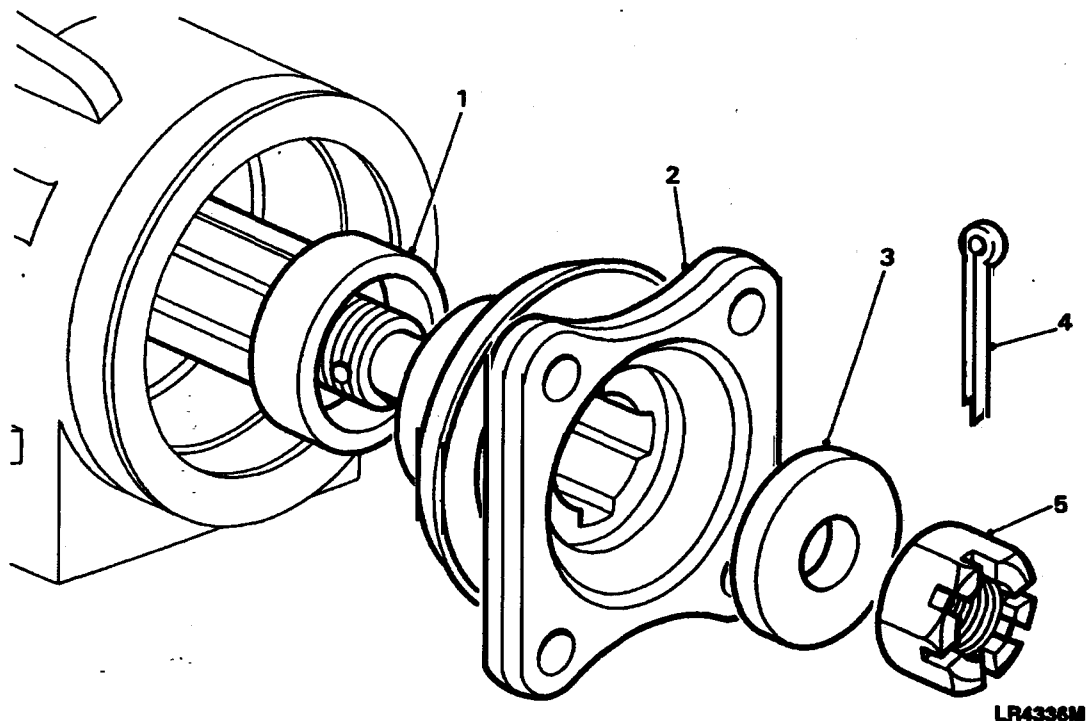
23.8 Having determined the required shim thickness adjust the shims under pinion inner bearing track as necessary.

23.9 Recheck the pinion height setting. If the setting is correct, the mean reading on the dial gauge will agree with the figure marked on the pinion end face. For example, with an end face marking of +3, the dial gauge reading should indicate that the pinion is 0.003in below nominal.

23.10 When the pinion setting is satisfactory, remove the flange and the pinion outer bearing.

23.11 Fit shims, to the same thickness as those removed, in position on the pinion shaft.

23.12 Locate the pinion in the housing, fit the outer bearing, spacer and drive flange. Secure with the flange nut and washer, the oil seal should not be fitted at this stage.



- | | | | |
|---|--------|---|-----------|
| 1 | Spacer | 4 | Split pin |
| 2 | Flange | 5 | Nut |
| 3 | Washer | | |

Fig 35 Fitting flange and spacer

23.13 Using special tool (Serial No 5) to restrain the flange, tighten the flange nut to a torque of 95 to 163 Nm (70 to 120 lbf ft), check the force required to rotate the pinion shaft. If new bearings have been fitted the force should be 23 to 40,25 kgf cm (20 to 35 lbf in) when initial inertia has been overcome. If the original bearings have been fitted the force should be 11,5 to 17,25 kgf cm (10 to 15 lb in). Add or remove bearing pre-load shims as necessary to obtain the required pre-load. A thicker shim will reduce pre-load and a thinner shim will increase it.

23.14 Remove the pinion flange and using special tool (Serial No 6) fit the oil seal (Fig 36).

23.15 Lubricate the seal lips with EP 90 oil, fit the spacer (Fig 35 (1)) and flange (2) and secure with the washer (3) and nut (5). Tighten the nut to 95 to 163 Nm (70 to 120 lbf ft), fit a new split pin (4).

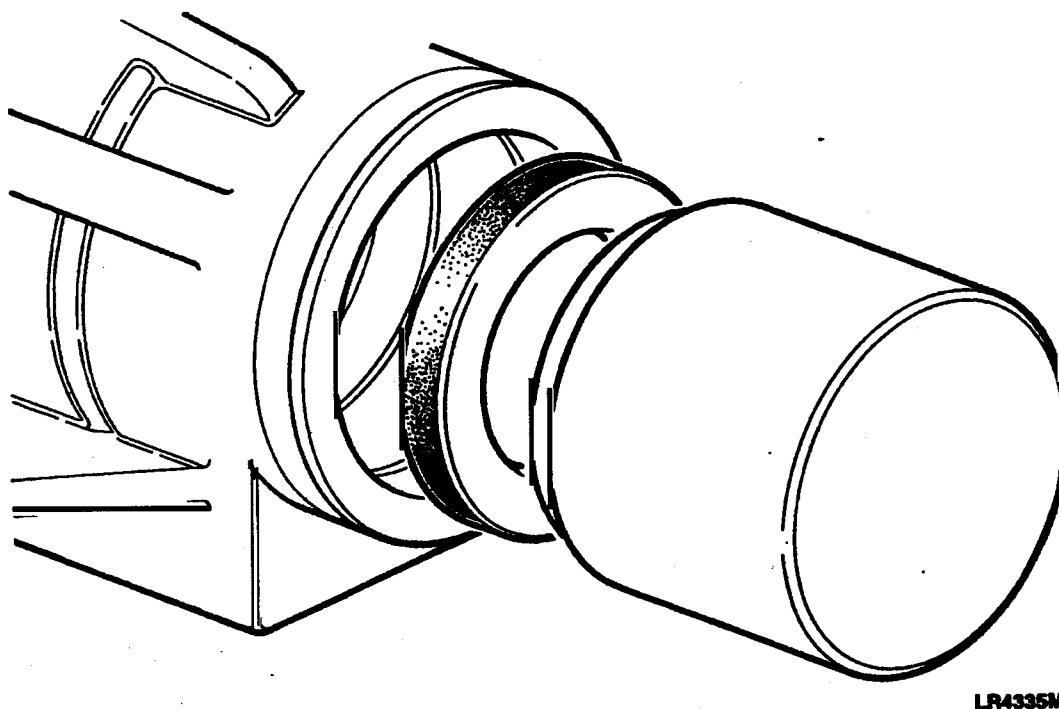


Fig 36 Fitting pinion oil seal

Differential backlash checks

24 Refit the differential assembly and carry out the following checks:

24.1 Place the differential assembly in the pinion housing and fit the bearing caps (Fig 21 (4)) to their respective locations. Fit the securing bolts (1), do not fully tighten at this stage.

24.2 Loosely assemble the bearing adjustment nuts (3):

24.3 Using special tool (Serial No 10), tighten the adjusting nut on the crown wheel side reducing backlash to zero.

24.4 Tighten the adjustment nut on the pinion side to give 0,10 to 0,17 crown wheel backlash, using a suitable dial test indicator to check the backlash (Fig 38).

Note ...

Movement of the bearing adjustment nuts in the direction of arrow A (Fig 37) will decrease the backlash and movement in the direction of arrow B will increase the backlash.

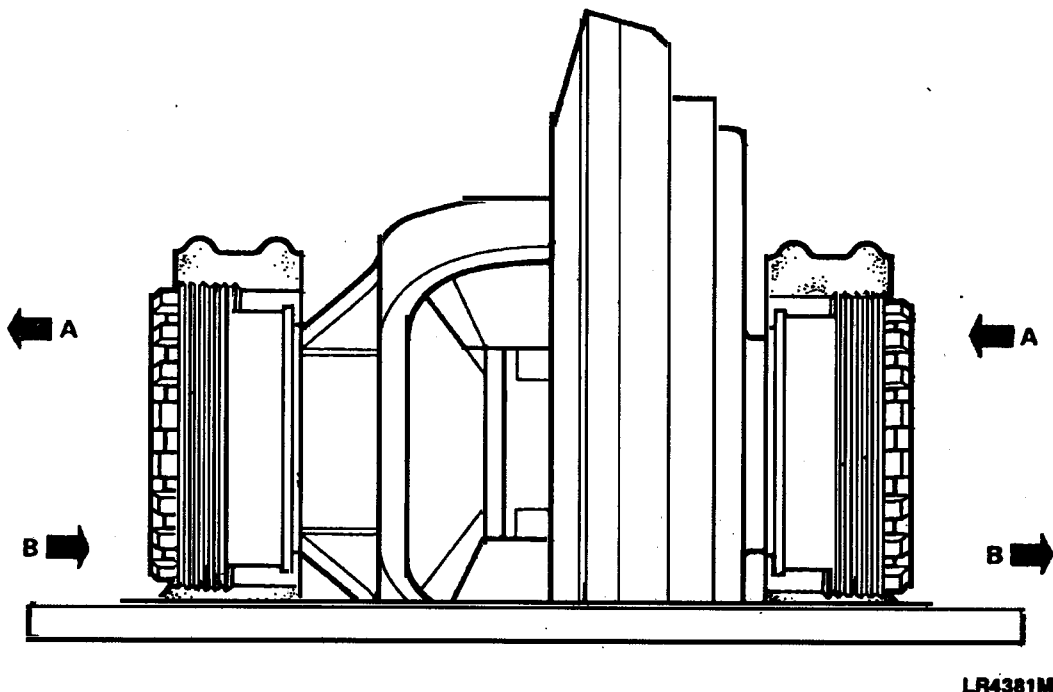


Fig 37 Adjusting crown wheel/pinion backlash

24.5 Evenly tighten the bearing cap bolts to a torque of 80 to 100 Nm (59 to 74 lbf ft).

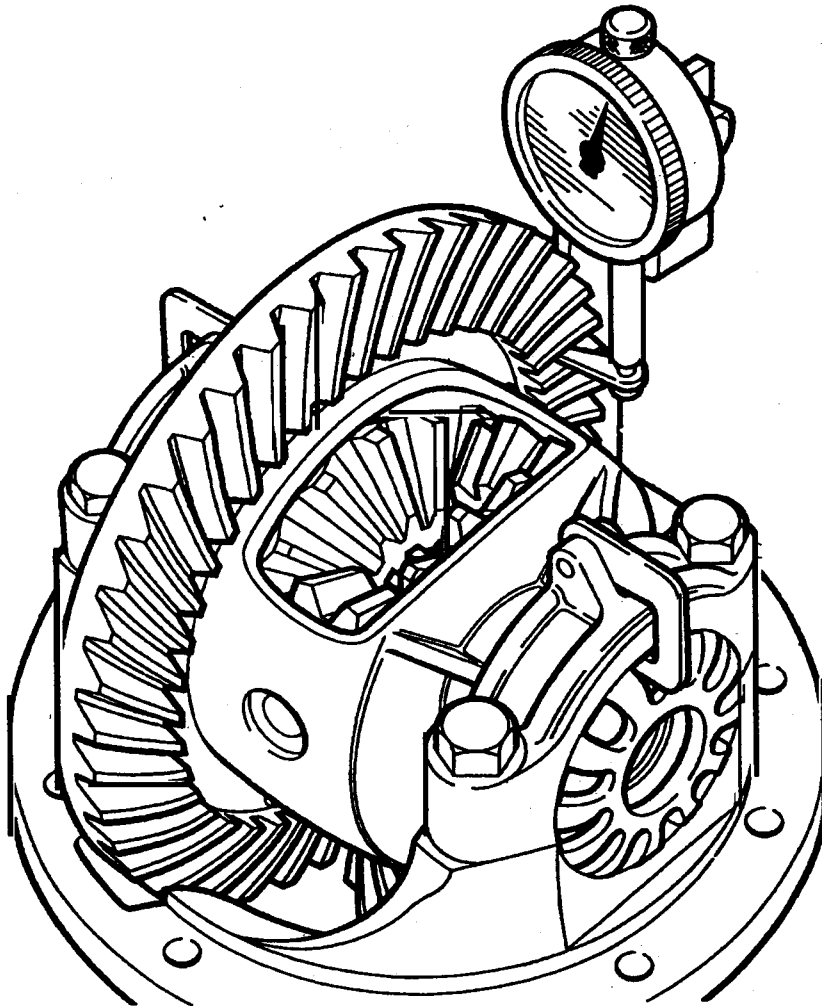
24.6 Recheck the backlash, if satisfactory bend the locking fingers to accommodate the adjusting nut serrations as required. Fit the locking fingers and secure with the roll pins.

Refitting

25 Refit the differential assembly to the axle casing as follows:

25.1 Suitably support the differential assembly and position on the axle casing with a new gasket interposed between the mating faces.

25.2 Secure with new self locking nuts tightened to a torque of 36 to 46 Nm (26 to 34 lbf ft).



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Fig 38 Checking crown wheel backlash

- 25.3 Fit the track rod protection bracket to the underside of the differential unit.
- 25.4 Re-engage the axle shafts and refit the stub axle (Para 11.3.3).
- 25.5 Refit the hubs and road wheels (Para 6).
- 25.6 Refill the swivel assemblies (Para 12).
- 25.7 Fill the axle with the approved oil (AESP 2320-122-201 Chap 4-1 Para 14).
- 25.8 After the initial axle run, check the oil level and replenish as necessary.
- 25.9 Where major running parts have been replaced, it is recommended practice to allow the axle assembly to 'run in' by avoiding, where possible, heavy loads and high speeds during initial running.