TRUCK UTILITY HEAVY (TUH), 4x4

REYNOLDS BOUGHTON - ALL VARIANTS

REPAIR INSTRUCTIONS

This publication contains information covering the requirements of Sub-Category 5-2 at information Levels 2 and 3

BY COMMAND OF THE DEFENCE COUNCIL

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CONTENTS

PREFACE

AMENDMENT IDENTIFICATION

1 Amendments are identified by marginal side lining.

COMMENTS ON THIS PUBLICATION

2 Comments on this publication are to be forwarded in accordance with AESP 0100-P-011-013 to Vehicles & Weapons Branch REME, Chobham Lane, Chertsey, Surrey KT16 0EE.

ASSOCIATED PUBLICATIONS

EMER Wksp N111	Preservation, Identification and Packaging of Assemblies (including engines)
EMER Wksp N345	Split Shell Bearings, Assembly, Techniques using Plastigage Method
EMER T&M A028 Chap 100	Testing Internal Combustion Engines
Equipment Table Scale No - NYK	Reynolds Boughton Special Tools
AESP 2920-C-102	Generator No 16, Mk 1, 28V, 90A (FV 1068364)
AESP 2815-F-641	Engine Diesel, PERKINS PHASER 1000 Series
AESP 2520-C-122	Gearbox, 5 Speed, T5-250 with T5-290 Supplement

Chapter 1

ENGINE

CONTENTS

ENGINE

TABLE 1 SPECIAL TEST EQUIPMENT AND TOOLS

Item No	Tool No	NSN Part No	Designation
(1)	(2)	(3)	(4)
1	PD.1D	6MT2/5120-99-830-9510	Valve guide removal/replacement tool
2	PD.1D-1A	W3/5120-99-214-4096	Valve guide removal/replacement adaptor
3	PD.1C-6	W3/5120-99-789-3674	Valve guide removal/replacement adaptor
4	PD.41D	PD 41D	Gauge for piston height, valve depth and cylinder liner flange
5	PD.208	NOT REQUIRED	Dial gauge
6	MS.67B	6MT2/5120-99-829-5467	Timing gauge
7	PD.67-2	PD 67-2	Timing gauge drive adaptor
8	PD.67-3	PD 67-3	Timing gauge gear adaptor
9	PD.67-4	PD 67-4	Timing gauge pointer
10	PD.67-5	PD 67-5	Timing gauge distance piece
11	PD.145 D	PD 145D	Crankshaft seal replacing tool
12	PD.150B	W3/5120-99-214-4098	Cylinder liner removal/replacement tool
13	PD.150B-17	PD 150B-17	Cylinder liner removal/replacement tool adaptors
14	PD.155B	6MT2/5120-99-719-1213	Crankshaft and fuel pump gear puller
15	PD.155B-5	PD 155B-5	Crankshaft and fuel pump gear puller adaptors
16	PD.163A	W3/2815-99-754-5961	Centralising tool for timing case cover
17	PD.170	PD 170	Timing case cover seal replacing tool
18	PD.170-1	PD 170-1	Timing case cover seal replacing tool pressure plate
19	PD.170-2	PD 170-2	Timing case cover seal replacing tool fastener plate
20	PD.170-3	PD 170-3	Timing case cover seal replacing tool sleeve
21	PD.170-4	PD 170-4	Timing case cover seal replacing tool seal adaptor
22	PD.199	PD 199	Spanner for fuel injection pump flange nuts
23	PD.206	PD 206	Piston replacer tool
24	PD.6118B	6MT2/5120-99-378-4003	Valve spring compressor
25	PD.6118-7	PD 6118-7	Valve spring compressor stud adaptor
26	PD.6118-8	PD 6118-8	Valve spring compressor setscrew adaptor
27	MS.73A	NOT REQUIRED	Set of adjustable cutters for valve seats
28	MS.73B	MS 73B	Handle set for valve set cutters
29	MS.150-9.5	6MT2/5110-99-835-1922	Adjustable pilot for valve seat cutter
30	MS.275	MS 275	Cutter for exhaust valve seats
31	MS.281	MS 641	Cutter for inlet valve seats
32	MS.99	6MT2/5120-99-817-0837	Water pump gear puller
33	MS.107	MS 107	Timing gauge for fuel injection pump
34	MS.1531	NOT REQUIRED	Angle gauge to tighten cylinder head set screws

INTRODUCTION

1 The following paragraphs detail the removal, dismantling, reassembly and installation procedures for the engine sub assemblies. Most tasks may be completed with the engine in-situ, instructions for removing the engine assembly with gearbox complete are provided in paragraph 2. For improved access to the front of the engine, drain the cooling system as detailed in paragraph 2.2 and remove the front grille and radiator assembly as detailed in paragraphs 2.6 to 2.10. For further information refer to AESP 2815-F-641-302.

ENGINE ASSEMBLY

Removal

2 Gain access to the engine by removal of the bonnet, the rear engine cover and the additional access cover. The engine is removed fully dressed, along with the clutch and gearbox, through the front of the vehicle:

Note ...
Identification tags on hoses and electrical connections will assist during re-assembly.

2.1 Disconnect the batteries.

2.2 To minimise the loss of coolant and antifreeze drain the cooling system into a suitable recepticle as follows:

2.2.1 Obtain a suitable threaded union, having the same thread as the cylinder block drain plug tapping and attach a suitable length of plastic piping.

2.2.2 If the engine is cold, the cooling system will be under partial vacuum. Under this condition remove the cylinder block drain plug and immediately fit the adaptor before removing the coolant filler cap. If the engine is warm, relieve the pressure in the system by releasing, but not removing, the coolant filler cap. Retighten when the pressure diminishes. Only then must the cylinder block drain plug be removed and the adaptor fitted, followed by the removal of the coolant filler cap.

2.2.3 When the flow stops disconnect the hoses between the radiator and the engine.

2.3 Remove the hoses from the power steering pump and drain the system into a suitable recepticle.

2.4 Release the front grille and disconnect the electrical connectors to the side and indicator lights (a total of 8 connectors), lift the front grille, including side and indicator lights,clear of the vehicle.

Note...
Removal of the front bumper is a two man task.

2.5 Disconnect the electrical connectors for the head lights (a total of 6 connectors). Remove the 12 bolts securing the front bumper and lift it clear of the vehicle, on vehicles fitted with front winch remove front bumper with front winch.

2.6 Drain the gearbox and engine oils into a suitable recepticle and disconnect the fluid cooling system supply and return lines at the cooling radiator.

2.7 The cable of the bonnet lock release mechanism runs through the radiator cowl. To avoid dismantling this mechanism remove the 16 bolts lift the cowl and cable free and support it on the left wing.

2.8 Disconnect the header tank hoses at the radiator, disconnect the radiator hoses. Some coolant spillage may occur.

2.9 Lift the radiator until the lower mounting spigots disengage from their mountings, remove the radiator taking care not to damage the matrix. Remove the lower mounting rubbers.

2.10 Disconnect the wiring from

2.10.1 the starter motor
2.10.2 the alternator and for FFR vehicles to both alternators
2.10.3 the cold start aid
2.10.4 the engine temperature gauge

2.11 On FFR vehicles remove the 24 Volt alternator see Chapter 13.1.

2.12 Disconnect the 12 Volt alternator harness as it goes through the crossmember.

2.13 Remove the radiator support cross member and the front chassis crossmember.

2.14 Pull the heater air ducting from its location at the cab bulkhead and the right inner wing.

2.15 Remove the air cleaner canister complete with all hoses.

2.16 Disconnect the exhaust system at the turbocharger manifold. Release the exhaust hanger brackets at the gearbox cross member and remove the exhaust system complete.

2.17 Detach the fuel line at the fuel lift pump, plug the line to prevent spillage. Disconnect the fuel return line at the fuel filter. Disconnect the fuel pipe clamps (2) at the gearbox crossmember.

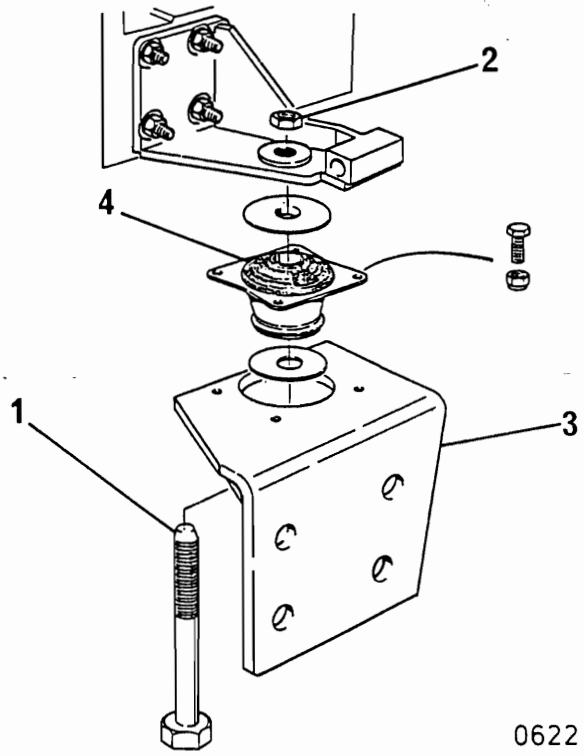
2.18 Disconnect the oil pressure warning sensor and oil pressure gauge supply line.

2.19 Disconnect the pipe connecting the exhaust to the vacuum reservoir.

2.20 Disconnect the throttle and stop control cables at the fuel injection pump. Unclip the cables at the rear of the engine, ensure these cables will not foul the engine or gearbox during removal.

2.21 Match mark and disconnect the propeller shafts, gearbox to transfer box and transfer box to front axle.

2.22 Using a transmission jack EPC02000 or similar with an adaptor plate for the rear of the engine and gearbox and a support strap to the front crankshaft pulley, support the engine and gearbox remove the bell housing mounting bolts (see Chapter 3) and also remove the two front engine mounting bolts (Fig 1).



1 Bolt 2 Locknut 3 Bracket 4 Rubber mounting

Fig 1 Front engine mounting

2.23 Lift the engine slightly and loosen bolts securing rubber mountings, lift and undo bolts securing mounting brackets (Fig 1 (3))

2.24 Withdraw the engine and gearbox complete through the front of the vehicle.

Installation

3 To fit an engine and gearbox reverse the above procedure, noting the following points :-

3.1 Tighten the crossmember and mounting bracket bolts to the torque as quoted in AESP 2320-E-200-522 Chapter 15.

3.2 Tighten the front engine rubber mount bolts (Fig 1 (1)) to a torque of 135Nm (100 lbf ft).

3.3 Tighten the front engine mount locknut (Fig 1 (2)) to a torque 68 Nm (50 lbf ft).

3.4 Bleed the hydraulic steering system as per Chapter 7.

3.5 Bleed the fuel system as described in Chapter 11.

Dismantling and re-assembling

4 For information on dismantling and re-assembling of engine refer to AESP 2815-F-641-302.

Chapter 2

CLUTCH

CONTENTS

TABLE 1 - SPECIAL TOOLS

Item	NSM/Part No.	Description
(1)	(2)	(3)
1	LY6/MT2 5120-99-401 3588	Mandrel clutch alignment Pickewart 37

CLUTCH

1 The clutch consisting of a pressure plate and a driven plate is hydraulically operated and transmits the drive from the engine to the gearbox.

Removal

2 Remove the gearbox from the vehicle as described in Chapter 3 of AESP 2320-E-200-522.

2.1 Remove the clutch pressure plate from the flywheel by undoing the setscrews by diagonal selection. Remove the setscrews and washers.

2.2 Withdraw the pressure plate and driven plate from the flywheel.

Inspection of parts

3.1 Examine the flywheel facing pressure plate and clutch driven plate for oil contamination. If oil contamination is evident the gearbox and crankshaft oil seals should be examined and renewed if necessary.

3.2 Examine the pressure plate and the clutch face of the flywheel for wear or damage. If badly scored the whole surface should be reground to restore a smooth finish.

3.3 Examine the primary shaft spigot bearing in the flywheel and renew if necessary.

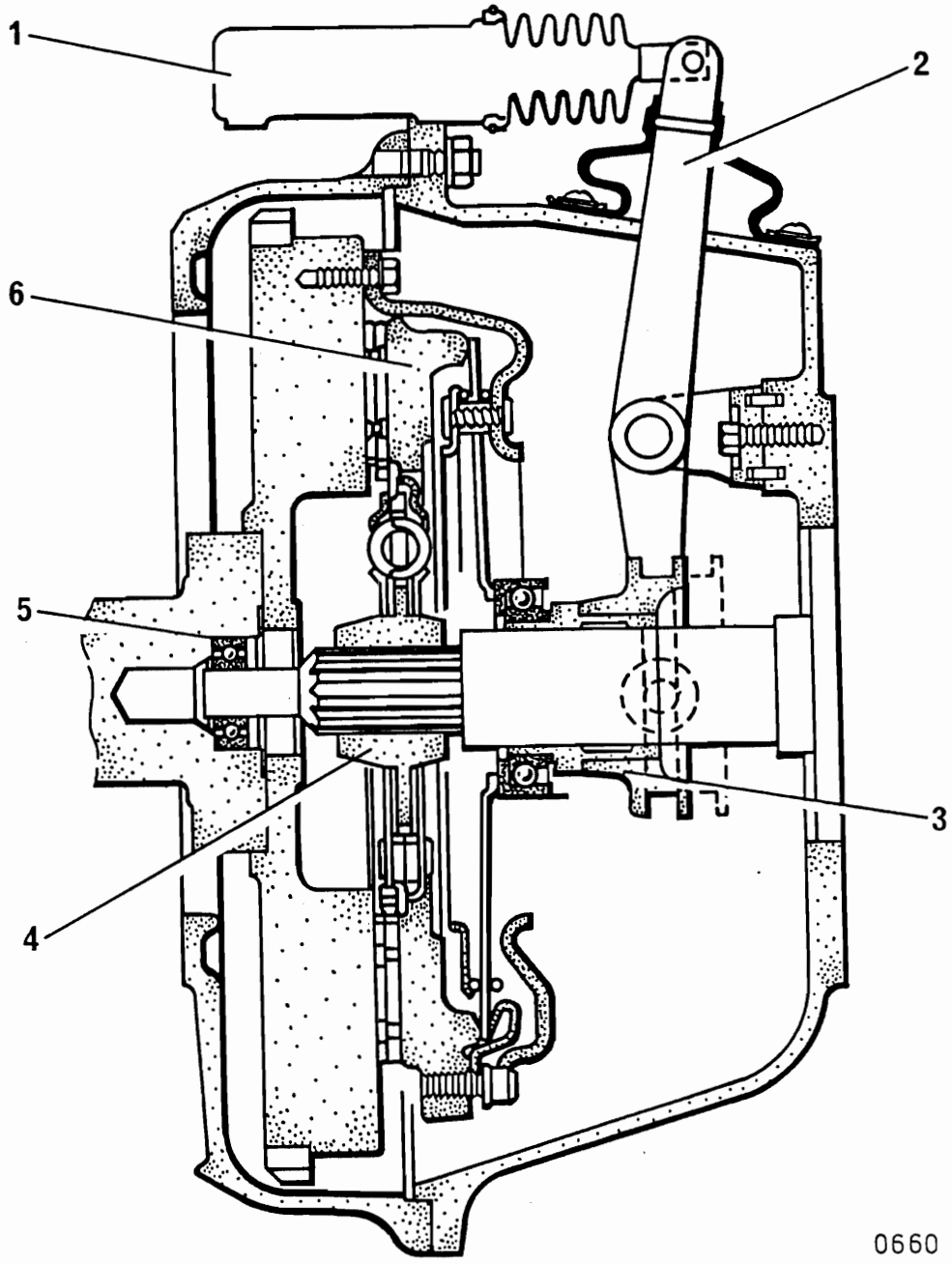
3.4 Apply a light smear of high melting point grease to the spigot bearing.

Note ...
Avoid applying too much grease to prevent contaminating the driven plate linings.

3.5 Examine the driven plate for wear and general condition and renew if necessary.

3.6 Check the driven plate hub splines for wear by placing the driven plate on the primary shaft splines and checking the backlash. If the backlash appears excessive the clutch driven plate must be renewed. Ensure that the plate will move freely backwards and forwards on the spline of the gearbox primary shaft.

3.7 Examine the cover mounting face for damage, check the dowel and mounting holes for wear or elongation. Check the diaphragm spring for damaged fingers, loose rivets or fulcrum rings. Renew parts as necessary.



1 Slave cylinder
2 Withdrawal lever
3 Release bearing assembly
4 Driven plate
5 Spigot bearing
6 Pressure plate

Fig 1 Sectional view of clutch

Installation

4 Refitment is the reversal of the removal instructions noting the following points :

4.1 One driven plate face should be marked "Flywheel side", if no marking is visible the longer bars of the pressure plate hubs should be fitted facing away from the engine flywheel.

4.2 Before tightening the clutch cover setscrews, line up the clutch driven plate with the spigot bearing using the clutch centraliser tool LV6/M2 5120-99-401-3588 (Table 1 item 1).

4.3 Do not remove the centraliser tool until all the pressure plate securing setscrews are fully tightened. Tighten the setscrews a turn at a time by diagonal selection to ensure the assembly fits squarely and evenly on the flywheel. The setscrews should be tightened to a torque of 41 Nm (30 lbf/ft).

4.4 Lightly smear the gearbox primary shaft spline with XG 279 grease.

CLUTCH WITHDRAWAL MECHANISM

5 The clutch withdrawal mechanism consists of a clutch pedal, a master cylinder, a slave cylinder and a clutch withdrawal bearing operated by a withdrawal fork.

Removal

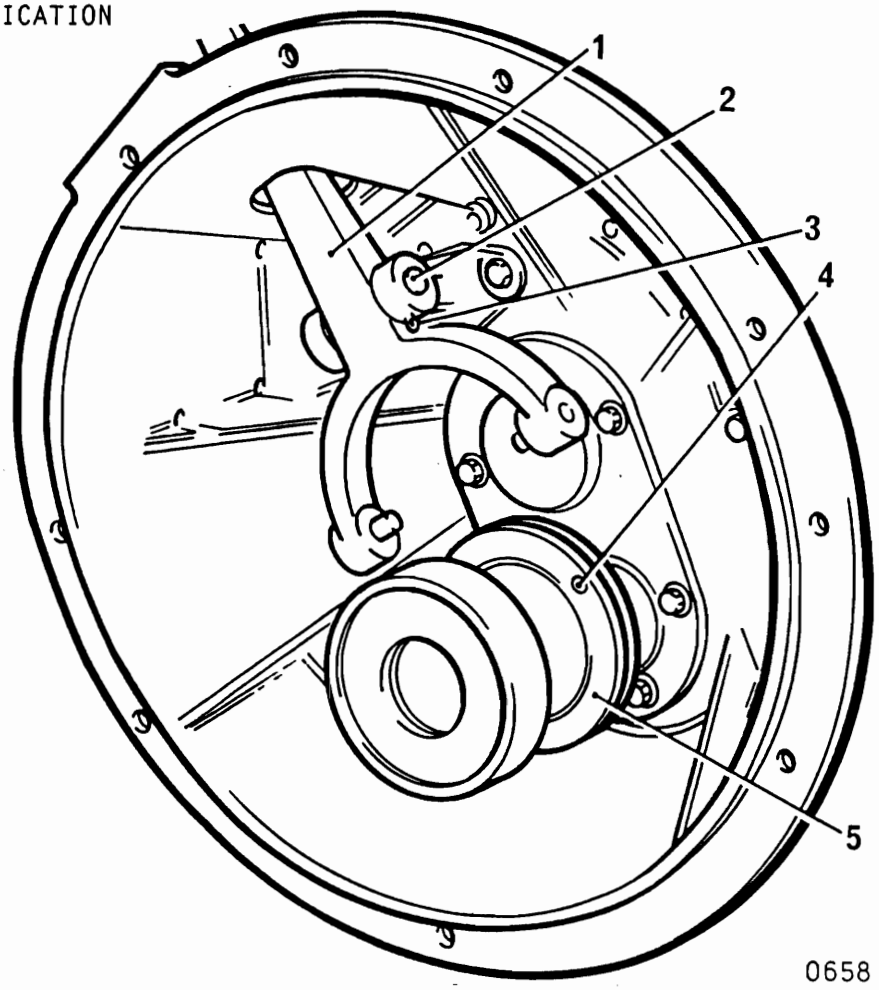
6 Remove the gearbox complete with bell housing from the vehicle as described in Chapter 3 of AESP 2320-E-200-522.

6.1 Undo the spring clip from the slave cylinder push rod clevis pin, remove clevis pin and push rod.

6.2 Release four setscrews and spring washers securing the clamp plate and dust cover to the clutch housing. Remove the clamp plate and dust cover.

6.3 Withdraw the two split pins securing the fork pivot pin. Withdraw pivot pin.

6.4 Remove the withdrawal fork and bearing assembly with torsion pin.



1 Withdrawal fork
2 Pivot pin
3 Split pin
4 Torsion pin
5 Bearing assembly

Fig 2 Clutch withdrawal mechanism

Inspection of parts

7 Examine the withdrawal lever assembly for damage especially in the area of the fulcrum pivot, and renew if necessary.

7.1 Check the fit of the fulcrum pin in the fork and renew the pin or worn.

7.2 Check the withdrawal bearing assembly for wear or damage and renew if necessary.

Installation

8 To refit the clutch withdrawal mechanism reverse removal instruction noting the following points :

8.1 Position the release bearing assembly in the clutch release lever fork with the torsion pin adjacent to the fork.

8.2 Lightly smear the clutch withdrawal lever fork and gearbox primary shaft spline with XG 279 grease.

8.3 Fit new split pins through pivot block and pivot pin.

MASTER HYDRAULIC CYLINDER

Removal

9 To remove the clutch master cylinder from the chassis proceed as follows :

9.1 Open the bonnet and secure in the open position.

9.2 Remove the heater air duct to facilitate access.

9.3 Place a suitable drip tray or similar receptacle under the master cylinder and disconnect the hydraulic pipe from the front of the cylinder.

9.4 Remove the two bolts, spring washers and nuts securing the master cylinder to the mounting bracket.

9.5 Remove the master cylinder from the vehicle leaving the push rod connected to the clutch pedal.

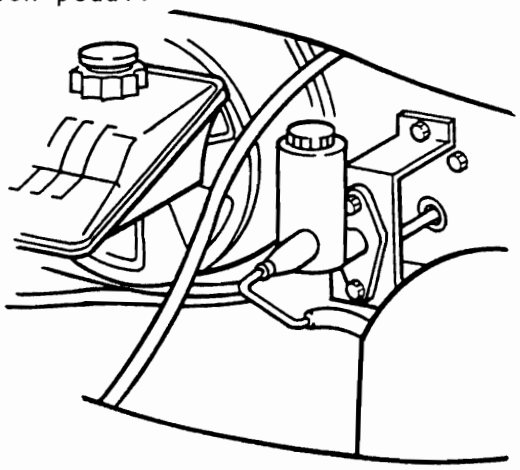


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Fig 3 View of master cylinder

Refitment

10 To refit the master cylinder reverse the removal instructions noting the following points :

10.1 Gently refit the push rod in the master cylinder.

10.2 Tighten the nuts securing the master cylinder to the bracket to a torque of 26 Nm (19 lbf/ft).

10.3 Fill the clutch reservoir with the correct hydraulic fluid as specified in the maintenance schedule.

10.4 Slowly operate the clutch pedal until fluid emerges from the outlet port and refit the pipe to the cylinder.

10.5 Bleed the system as described in para 13.

10.6 Check the system for leaks with the clutch pedal pushed down.

10.7 Test the clutch for correct operation.

SLAVE CYLINDER

Removal

11 To remove the slave cylinder from the vehicle proceed as follows :

11.1 Open the bonnet and secure in the open position.

11.2 Remove the master cylinder reservoir cap, place a clean piece of polythene sheet over the reservoir aperture and refit the cap to seal the system and reduce loss of fluid.

11.3 Remove rear engine cover in cab.

11.4 Remove spring clip from slave cylinder push rod clevis pin and remove clevis pin.

11.5 Disconnect the supply pipe from the slave cylinder. Plug the open end of the pipe and the slave cylinder to prevent ingress of dirt.

11.6 Remove the two setscrews securing the clutch slave cylinder in position and remove the cylinder.

Refitment

12 To refit the slave cylinder reverse the removal instructions noting the following points :

12.1 Secure the slave cylinder in position with two setscrews. Tighten the setscrews to a torque of 57 Nm (42 lbf/ft).

12.2 Before replacing the bleed valve, connect the supply pipe and remove the polythene cover from the master cylinder cap. Refit the bleed valve as soon as fluid emerges from the valve aperture.

12.3 Bleed the system as described in para 13.

12.4 Check the system for leaks with the clutch pedal pushed down.

12.5 Test the clutch for correct operation.

BLEEDING THE HYDRAULIC SYSTEM

13 Remove the master cylinder filler cap and top up the reservoir with the correct fluid as specified in the maintenance schedule. Do not allow the fluid level to drop too low when bleeding the hydraulic system.

13.1 Attach a bleed tube to the bleed screw on the clutch slave cylinder with the free end of the tube in a glass container. Ensure that a quantity of clean brake fluid is in the container and that the end of the bleed tube us immersed into the brake fluid.

13.2 Unscrew the bleed screw one full turn and have an assistant depress the clutch pedal slowly.

13.3 Release the pedal slowly, removing the foot completely at the end of the return stroke. Pause for four seconds before making the next stroke.

13.4 Continue pumping slowly, maintaining the level in the reservoir, until bubbles cease to appear at the end of the bleed tube. Tighten the bleed screw whilst the pedal is on its next down stroke.

13.5 Remove the bleed tube and container. DO NOT RE-USE THE FLUID.

13.6 Top up the fluid reservoir to the required mark and refit the filler cap.

CLUTCH PEDAL

Removal

14 To remove the clutch pedal proceed as follows :

14.1 Disconnect the battery

14.2 Ensure that the road wheels are in the "straight ahead" position and remove the steering lock key.

14.3 Open the bonnet and secure in this position.

14.4 Remove heater air intake duct (RH drive vehicles only).

14.5 Remove the four cheese head and one cross head screws securing the lower cowl, detach the cowl.

14.6 Remove the two screws securing the upper cowl to the steering column support bracket and detach the cowl.

14.7 Disconnect the two multi-plugs from the combination switch housing and multi-plug and Lucar connector at the steering column lock harness.

14.8 Slacken the bolt securing the clamp plate to the lower end of the outer column and remove the three bolts from the clamp plate to the cab floor. Displace the plate and seal.

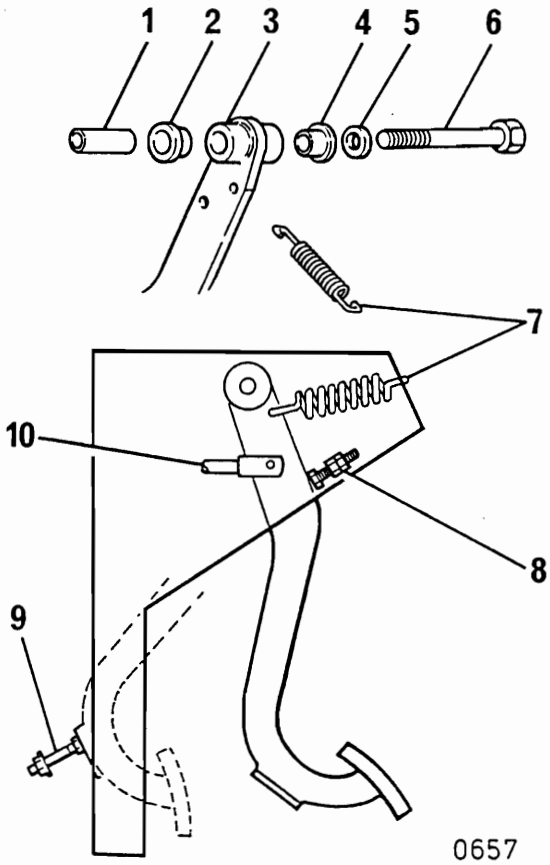
14.9 Remove the universal joint pinch bolt. If the same inner shaft is to be refitted match mark the shaft and universal joint.

14.10 Release the column assembly by removing the two bolts securing the top support bracket, disengage the universal joint and remove the complete assembly from the cab.

14.11 Remove engine rear cover from inside cab.

14.12 Remove the bolts securing the engine front cover and remove cover.

14.13 Remove the clip securing the accelerator push rod to the accelerator pedal and disconnect push rod.



1 Pivot sleeve
2 Bush
3 Clutch pedal
4 Bush
5 Washer
6 Bolt
7 Spring
8 Back stop
9 Forward stop
10 Master cylinder push rod

Fig 4 Clutch pedal

14.14 Remove brake push rod clevis pin clip and withdraw clevis pin.

14.15 Disconnect connector from stop lamp switch and plug from flasher unit.

14.16 Remove buzzer unit securing screw and disconnect connectors from buzzer.

14.17 Disconnect cold air duct, right hand facia outlet for RH drive vehicles and left hand facia outlet for LH drive vehicles, and remove duct from heater casing.

14.18 Remove nuts and bolts securing pedal bracket to instrument panel brackets.

14.19 Remove right hand insulation panel retainers on RH drive vehicles and left hand panel retainers for LH drive vehicles then remove bulkhead insulation panel.

14.20 Raise floor mat and remove the nut and bolt securing the pedal bracket to the floor.

14.21 Raise wheel arch mat and remove nut and bolt securing pedal bracket to bulkhead.

14.22 Remove brake servo retaining nuts and remove servo assembly.

14.23 Remove bolts securing pedal bracket to bulkhead.

14.24 Remove fuseholder and harness earth tag screws and renew fuseholder.

14.25 Move wiring harness clear of the pedal bracket.

14.26 Raise the facia and remove the pedal bracket.

14.27 Remove bolt securing pivot sleeve, collect washer and remove pivot sleeve.

14.28 Move clutch pedal and disconnect return spring.

14.29 Remove pedal assembly and withdraw pivot sleeve bushes. Disconnect push rod.

Inspection of parts

15 Check the fit of the pivot sleeve in the pivot bushes, if excessive, fit new bushes also pivot sleeve if required.

15.1 Check pedal return spring for distortion or deformed coil ends. Renew as neceesary.

15.2 Check clutch pedal push rod clevis pin for wear. Renew as necessary.

15.3 Renew pedal rubber if severely worn.

Refitment

16 Refitting is a reversal of the removal procedure noting the following points :

16.1 The recess between the pivot bushes should be packed with XG 279 grease.

16.2 Check the forward and back stop adjustment after fitting.

16.3 Check for correct drag free clutch operation.

Clutch pedal adjustments

17 Correct adjustment of the clutch pedal back stop is essential to ensure that the master cylinder releases completely and that the clutch release bearing exerts no pressure on the release diaphragm.

17.1 To adjust slacken pedal stop bolt locknut.

17.2 Adjust the pedal back stop bolt until there is a preceptible clearance between the master cylinder push rod and the piston, i.e. free play between the stop and the pedal stem of 0.76 mm (0.030in).

17.3 Tighten stop bolt locknut and re-check clearance.

18 The forward stop adjustment regulates the travel of the master and slave cylinder push rods. Before making any adjustment ensure that the back stop clearance is correct.

18.1 To adjust slacken pedal forward stop bolt locknut.

18.2 The stop is correctly adjusted when the movement of the slave cylinder push rod is 15/17 mm (0.6/0.66 in) with the pedal fully depressed.

18.3 Tighten stop bolt locknut and recheck clearance.

Chapter 3

GEARBOX (MANUAL)

CONTENTS

GEARBOX

Removal

1 To remove the gearbox proceed as follows :

1.1 Apply the handbrake and chock the front wheels.

1.2 Remove the rear engine cover in the cab.

1.3 Remove the gearchange lever gaiter in the cab.

1.4 Remove gearchange lever gaiter under cab floor.

1.5 Turn gearbox lever retainer to release from selector housing taking care as retainer and cap are spring loaded.

1.6 Remove the gearchange lever complete with spring, cap, retainer and gaiters, also remove the locating pins to prevent them falling into the gearbox.

1.7 Drain the gearbox of oil if required.

1.8 Match mark and disconnect the propeller shaft from the gearbox to the transfer box, at both ends.

1.9 Matchmark and disconnect the front axle propeller shaft at the transfer box.

1.10 Move the front axle propeller shaft away from the working area and support so as to avoid putting excessive strain on the universal joints.

1.11 Remove two setscrews securing the slave cylinder to the bell housing, disconnect front push rod and secure clear of the bell housing.

1.12 Disconnect exhaust support brackets, silencer and exhaust downpipe.

1.13 Support the engine underneath the sump.

1.14 Remove the nuts securing the gearbox mountings to the crossmember.

1.15 Undo the clip securing the two cables to the top of the gearbox casing.

1.16 Support the gearbox on a suitable transmission jack.

1.17 Disconnect and remove the gearbox mounting crossmember from the chassis.

1.18 Lower engine and gearbox sufficiently to allow gearbox removal.

1.19 Remove nuts and washers securing bell housing to engine.

1.20 Gently draw the gearbox to the rear taking care to keep it in line until the primary shaft has been withdrawn from the spigot bearing.

Refitment

2 To refit the gearbox reverse the removal instructions noting the following points :

2.1 Engage a gear.

2.2 Lubricate the primary shaft splines with XG279 grease. Do not overgrease as otherwise the clutch facing could be contaminated with lubricant.

2.3 Tighten the bell housing nuts to a torque of 68 Nm (50 lbf/ft).

Dismantling and re-assembling

3 For information on dismantling and re-assembling of the gearbox refer to AESP 2520-C-122.

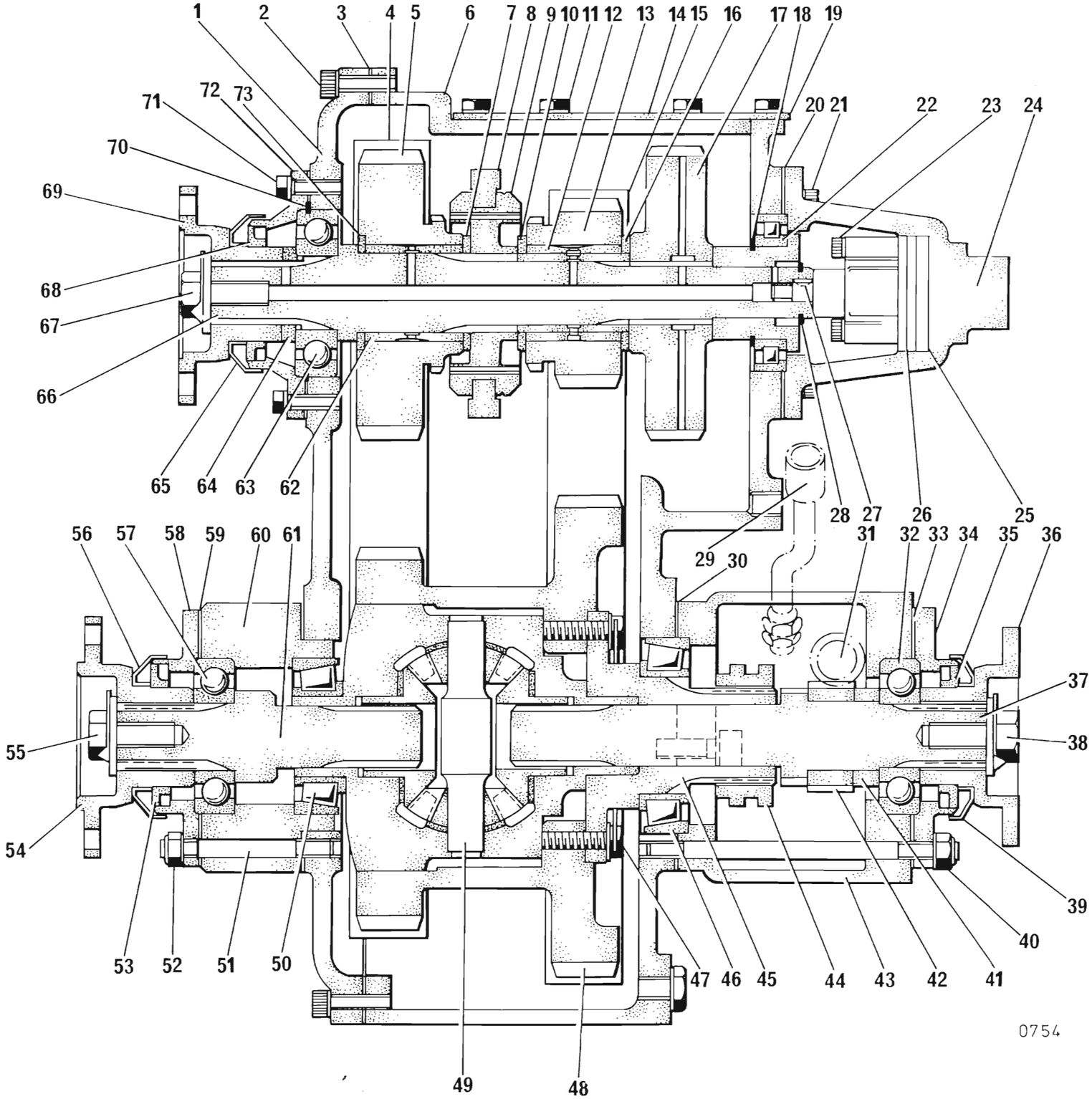


Fig 1 Sectional view of transfer box

Chapter 4

TRANSMISSION
(TRANSFER BOX AND PROPELLER SHAFTS)

CONTENTS

TABLE 1 SPECIAL TOOLS

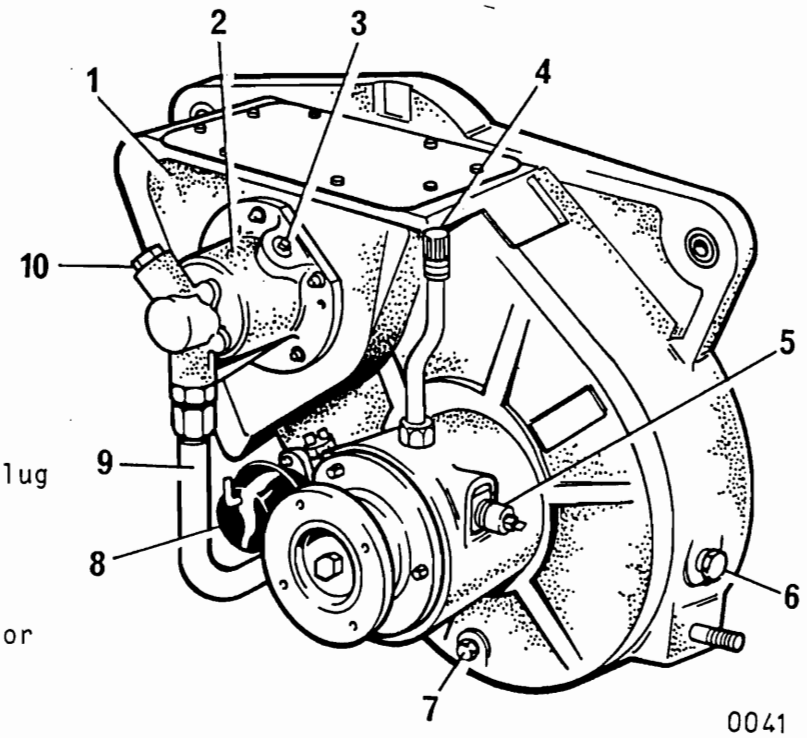
Item	NSM/Part No	Description
(1)	(2)	(3)
1	BW206784	Pressure gauge 0-50 lb/in^2
2	BW77081	Adaptor 3/8in female to 1/2in BSP male

INTRODUCTION

1 All level 2 and 3 repairs except oil pump renewal can be carried out without removing the transfer gearbox from the vehicle. If fluid pressure measuring equipment is available, it should be used to carry out a check on the oil pump pressure whilst the transfer box is in the vehicle and connected to the engine. Removal procedures for the transfer gearbox are given for the purpose of pump renewal and complete transfer gearbox renewal. Whenever nylon diaphragm self-locking nuts are removed, they must be discarded, and new ones fitted on reassembly.

Oil pump pressure checking

2 The following check is intended to ascertain whether or not the oil pump is operating effectively. Under driving conditions, in addition to pump lubrication, oil is transferred to the shafts and bearings by the chains; when the power take-off is being used with the vehicle stationary and neutral selected at the transfer gearbox however (on vehicles fitted with winches), the chains are stationary, and lubrication is dependent solely upon the pump. To check the pump operation, refer to Fig 1 and proceed as follows:



1 Main casing
2 Oil pump housing
3 Pump keyway inspection plug
4 Breather
5 Speedometer drive output
6 Filler plug
7 Drain plug
8 Differential lock actuator
9 Pump suction pipe
10 Pump pressure test plug

Fig 1 Transfer gearbox - rear view

2.1 Remove the hexagonal blanking plug (10) from the top of the oil pump housing.

2.2 Connect a hydraulic pressure gauge (Table 1 item 1) capable of measuring low pressures (up to 10 or 15 lbf/in^2) to the pump housing via an adaptor (Table 1 item 2).

2.3 Set the transfer gear ratio selection lever in the cab to its centre neutral ('N') position.

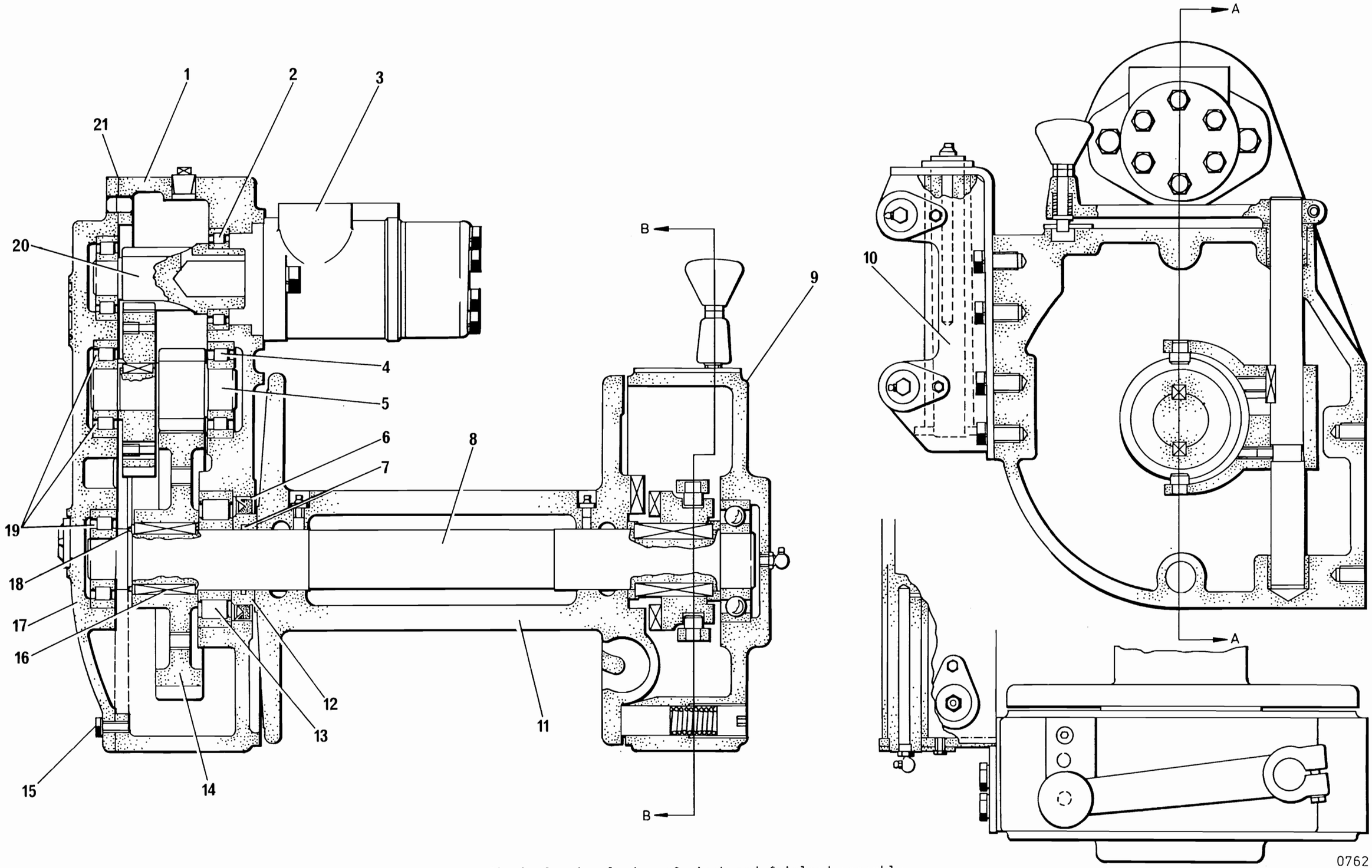


Fig 1 Sectional view of winch and fairlead assembly

2.4 Start the engine, and select manual 2nd gear on the gearbox selector lever; run the engine at a medium speed.

2.5 Check the pressure reading; if it is more than a few lbf/in^2, the pump is working satisfactorily. If there is no reading, or a very low reading, remove the pump and check it for blockages, also check that clamping surfaces between oil pump and oil pump housing are flat and free from dirt and if necessary, renew oil pump as described in Para 17 to 19.

TRANSFER GEARBOX DISMANTLING (in situ operations)

Draining the transfer gearbox

3 Position a receptacle with a capacity of approximately 5 litres beneath the transfer gearbox sump drain plug (Fig 1). Remove the drain plug and sealing washer, and allow the unit to drain.

Input shaft oil seal

Removal

4 To remove the oil seal from the input shaft, refer to Fig 2, and proceed as follows :

4.1 Disconnect the gearbox propeller shaft (10) from the transfer box input flange (four bolts and self-locking nuts); tie the shaft to one side.

4.2 Knock the tab-washer tab away from the side of the coupling-flange nut.

4.3 Grip the coupling flange to prevent it from turning, and remove the coupling-flange bolt and tab-washer.

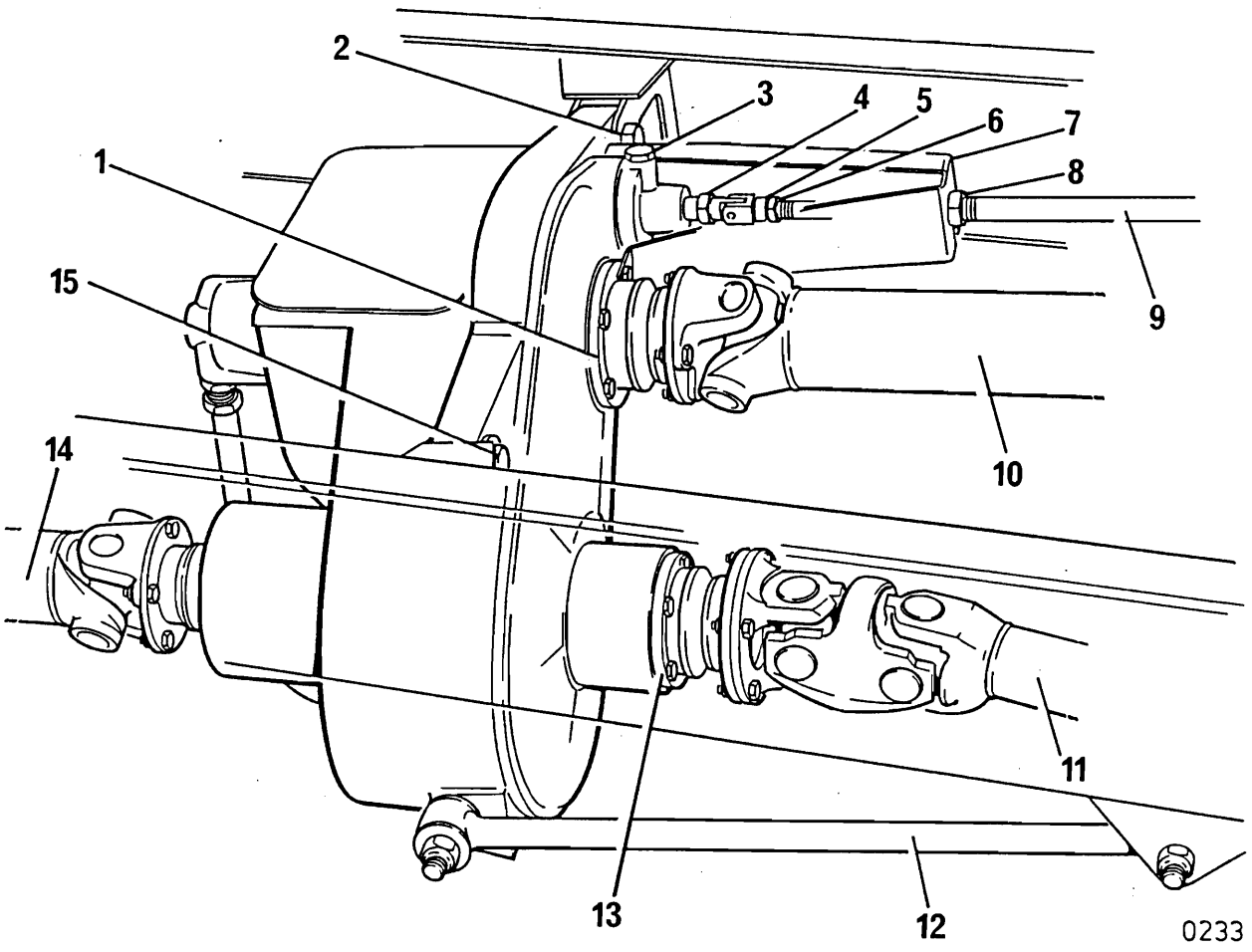
4.4 Pull the flange off the shaft to reveal the outer face of the seal.

4.5 Remove the two bolts and nuts securing the outer flange of the gearchange cable support bracket to the left-hand lug of the unit casing.

4.6 Remove the five screws and spring washers retaining the input shaft bearing retainer/oil seal carrier (one screw also retains the gearchange cable support bracket).

4.7 Place the oil seal carrier with its oil seal downwards on a bench, and support the rim of the carrier.

4.8 Using a drift, tap the oil seal out of the carrier, taking care not to damage the carrier.



1	Input shaft oil seal carrier	9	Selector cable casing
2	Main mounting bolt	10	Gearbox (input) propshaft
3	Selector detent screw	11	Front axle propshaft
4	Selector shaft lug locknut	12	Transfer box support stay rod
5	Selector shaft clevis	13	Front axle output shaft oil seal carrier
6	Selector cable clevis locknut	14	Rear axle propshaft
7	Selector cable support bracket	15	Main mounting bolt
8	Selector cable casing nut		

Fig 2 Transfer gearbox installed - front view

Installation

5 Install a new oil seal as follows:

5.1 Ensure that the oil-seal carrier is free from dirt and debris.

5.2 Smear a new seal with a small amount of oil, and place it into the carrier, ensuring that it is the correct way round (the sealing lip to the shaft should face inboard).

5.3 Using a flat block of hardwood or similar, tap the seal home until its outer edge is flush with the carrier.

5.4 Clean the transfer box casing in the region of the removed seal carrier, then fit a new gasket to the carrier face, and replace it on the casing.

5.5 Replace the five screws and washers, and include the single-hole flange of the gearchange cable support bracket under the top screw nearest the gearchange operating shaft; tighten the screws to a torque of 20-25 Nm (15-18 lbf/ft).

5.6 Replace the coupling flange, and retain it with the bolt and a new tab-washer; tighten the bolt to a torque of 115-122 Nm (85-90 lbf/ft).

5.7 Replace the two bolts and nuts securing the gearchange cable support bracket to the unit casing lug.

5.8 Offer-up and connect the input propeller shaft flange from the gearbox to the transfer box input flange (four bolts and self-locking nuts); tighten the nuts to a torque of 41 Nm (30 lbf/ft).

Front axle output shaft oil seal

Removal

6 To remove the oil seal from the front axle output shaft, refer to Fig 2 and proceed as follows:

6.1 Disconnect the front-axle propeller shaft (11) from the transfer box output flange (four bolts and self-locking nuts); tie the shaft to one side.

6.2 Knock the tab-washer tab away from the side of the coupling-flange nut.

6.3 Grip the coupling flange to prevent it from turning, and remove the coupling-flange bolt and tab-washer.

6.4 Pull the flange off the shaft to reveal the outer face of the seal.

6.5 Remove the five nuts and spring washers retaining the output shaft bearing retainer/oil seal carrier.

6.6 Place the oil seal carrier with its oil seal downwards on a bench, and support the rim of the carrier.

6.7 Using a drift, tap the oil seal out of the carrier, taking care not to damage the carrier.

Installation

7 Install a new oil seal as follows :

7.1 Ensure that the oil-seal carrier is free from dirt and debris.

7.2 Smear a new seal with a small amount of oil, and place it into the carrier, ensuring that it is the correct way round (the sealing lip to the shaft should face inboard).

7.3 Using a flat block of hardwood or similar, tap the seal home until its outer edge is flush with carrier.

7.4 Clean the transfer box casing in the region of the removed seal carrier, then fit a new gasket to the carrier face, and replace it on the casing.

7.5 Replace the five nuts and washers, and tighten the nuts to a torque of 24-30 Nm (18-22 lbf/ft).

7.6 Replace the coupling flange, and retain it with the bolt and a new tab-washer; tighten the bolt to a torque of 115-122 Nm (85-90 lbf/ft).

7.7 Offer-up and connect the front-axle propeller shaft flange to the transfer box output flange (four bolts and self-locking nuts); tighten the nuts to a torque of 41 Nm (30 lbf/ft).

Rear axle output shaft oil seal

Removal

8 To remove the oil seal from the rear axle output shaft, refer to Fig 1 and proceed as follows :

8.1 Disconnect the rear-axle propeller shaft (14) from the transfer box output flange (four bolts and self-locking nuts); tie the shaft to one side.

8.2 Knock the tab-washer tab away from the side of the coupling-flange nut.

8.3 Grip the coupling flange to prevent it from turning, and remove the coupling-flange bolt and tab-washer.

8.4 Pull the flange off the shaft to reveal the outer face of the seal.

8.5 Remove the three nuts and spring washers retaining the output shaft bearing retainer/oil seal carrier.

8.6 Place the oil seal carrier with its oil seal downwards on a bench and support the rim of the carrier.

8.7 Using a drift, tap the oil seal out of the carrier, taking care not to damage the carrier.

Installation

9 Install a new oil seal as follows:

9.1 Ensure that the oil-seal carrier is free from dirt and debris.

9.2 Smear a new seal with a small amount of oil, and place it into the carrier, ensuring that it is the correct way round (the sealing lip to the shaft should face inboard).

9.3 Using a flat block of hardwood or similar, tap the seal home until its outer edge is flush with the carrier.

9.4 Clean the transfer box casing in the region of the removed seal carrier, then fit a new gasket to the carrier face, and replace it on the casing.

9.5 Replace the three nuts and washers, and tighten the nuts to a torque of 24-30 Nm (19-22 lbf/ft).

9.6 Replace the coupling flange, and retain it with the bolt and a new tab-washer; tighten the bolt to a torque of 115-122 Nm (85-90 lbf/ft).

9.7 Offer-up and connect the rear-axle propeller shaft flange to the transfer box output flange (four bolts and self-locking nuts); tighten the nuts to a torque of 41 Nm (30 lbf/ft).

Differential lock engaged switch

Removal

10 To remove the differential lock engaged switch, refer to Fig 3 and proceed as follows :

10.1 Disconnect the two electrical connectors from the switch (7), which is located on the differential lock actuator.

10.2 Unscrew and remove the switch with any washers.

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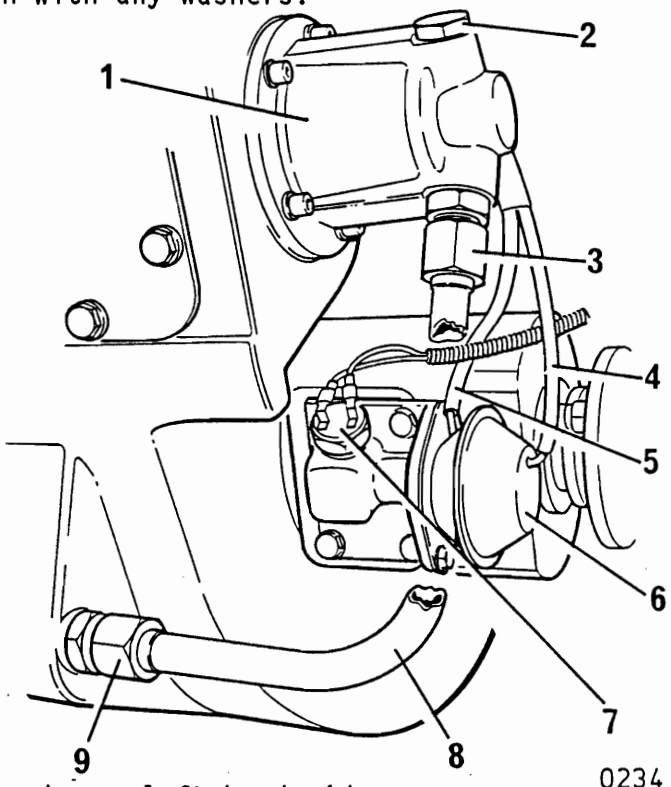


1 Oil pump housing
2 Pump pressure test plug
3 Pump suction pipe union
4 Diff. lock actuator 'engage' line
5 Diff lock actuator 'disengage' line
6 Diff lock actuator vacuum module
7 Diff lock 'engaged' switch
8 Pump suction pipe
9 Pump suction pipe union

0234

Fig 3 Transfer gearbox - left-hand side

Installation

11 Clean the actuator in the vicinity of the switch thread. Installation is the reverse of removal.

Gear selector detent mechanism

Removal

12 Remove the gear selector detent mechanism as follows :

12.1 Knock the tab-washer tab away from the side of the screw at the top of the selector shaft housing (Fig 2).

12.2 Remove the screw (3), which retains the detent spring and plunger, and hook the spring out of the housing. If removal of the detent plunger is necessary, the housing will need to be removed.

12.3 Loosen the locknut (4) on the selector shaft stud, and remove the stud.

12.4 Remove the three screws and plain washers retaining the gear selector shaft housing, then withdraw the housing from the transfer box casing (the selector shaft will stay behind). The detent plunger can now be shaken out of the housing; it it is seized in the retracted position, it will need to be loosened from inside the housing using a made-up 'L'- shaped tool.

Installation

13 Install the gear selector detent mechanism as follows :

13.1 If the gear selector shaft housing has been removed, first remove any gasket material from the face of the housing and the mating face of the main gearbox casing, then remove the 'O' ring from the inner end of the bore, lightly lubricate a new 'O' ring and insert it in its groove in the bore.

13.2 Place a new gasket on the face of the selector shaft housing, then push the housing into the main casing, and retain it with three screws and plain washers.

13.3 Screw the selector cable stud with its locknut into the end of the selector shaft, align the clevis-pin lug with the detent nut (i.e. vertically, so that the clevis pin will lie horizontally), and tighten the locknut.

13.4 Lubricate the detent plunger and its spring, and insert these into their bore; retain them with the screw and a new tab washer.

Refilling and checking the oil level

14 Refill the transfer gearbox, and check the oil level as follows:

14.1 Clean the drain plug, and remove any metal particles sticking to its magnet.

14.2 Clean the drain-plug boss in the casing, and screw the plug in.

14.3 Clean the area around the filler plug boss in the casing, then remove the plug and fill the gearbox with the appropriate oil up to the plug level.

14.4 Screw the plug in and wipe the casing.

TRANSFER GEARBOX

CAUTION ...
When removing the transfer gearbox from the chassis, it must be adequately supported; it weighs approximately 92 kg (202 lb) when empty

Removal

15 Removal of the transfer gearbox is only necessary if the unit is to be renewed as a complete unit, or if the oil pump is to be replaced. Referring to Fig 1, 2 and 3, proceed as follows :

15.1 Unscrew the electrical connector from the speedometer drive output.

15.2 Disconnect the two electrical connectors from the switch, which is on the differential lock actuator.

15.3 Remove the two flexible vacuum lines from the metal pipes on the differential lock actuator.

15.4 Remove the screw which clamps the 'P' clip holding the vacuum lines to the top PTO cover.

15.5 Disconnect the front-axle propeller shaft from the transfer box output flange (four bolts and self-locking nuts); tie the shaft to one side.

15.6 Disconnect the gearbox propeller shaft from the transfer box input flange (four bolts and self-locking nuts); tie the shaft to one side.

15.7 Disconnect the rear-axle propeller shaft from the transfer box output flange (four bolts and self-locking nuts); tie the shaft to one side.

15.8 At the selector cable attachment point, prise the clevis pin spring away from the clevis body, and pull out the pin to release the cable clevis. Loosen the locknut clamping the cable casing to the bracket, and lower the cable from the bracket.

15.9 At the bottom right-hand side of the transfer box, remove the nut and washer securing the longitudinal stay rod; if necessary, slightly loosen the nut and bolt securing the other end of the stay to the chassis bracket, and swing the stay up out of the way.

15.10 Remove the nut from the bolt attaching the transfer box lug to the chassis bracket at each side of the vehicle; do not attempt to remove the bolts, since these are supporting the weight of the unit, and are trapped by it.

15.11 Support the unit on a transmission jack if available, or a normal trolley jack, in either case using blocks, plates and clamps as necessary, in order to accommodate its shape in the upright position, then remove the two loose bolts from the support lugs; the unit can now be lowered out of the chassis.

Cleaning and examination

16 Tape-over the two vacuum pipes on the differential lock actuator, then (preferably using steam) thoroughly clean the exterior of the transfer gearbox, particularly the gear selector cable support bracket, in the region of the gear selector rod where it enters the casing, and also around the three drive flanges and their mud flingers. Examine the transfer gearbox externally as follows :

16.1 Check the casing for cracks or any damage which might render the unit unfit for further service.

16.2 Examine the areas around the three drive couplings for signs of oil leakage; if there are any significant leaks, the appropriate seals should be renewed (see para 4 to 9).

16.3 Check that the breather pipe tip is unobstructed; the plastic breather tip can be unscrewed for checking or renewal if necessary.

Repairs

Oil pump removal

17 To remove the oil pump, refer to Fig 1 and 3 and proceed as follows :

17.1 Unscrew the upper and lower unions, and remove the external pump suction pipe (Fig 1 (9)).

17.2 Remove the five cap screws and plain washers securing the pump housing (Fig 1 (2)) to the main casing, and withdraw the housing with pump. Do not displace the Woodruff key from the pump shaft.

17.3 Remove the three capscrews securing the pump inside the housing, then withdraw the pump.

Oil pump inspection

18 Inspect the oil pump inlet and outlet ports, which are in the base; they should be free from obstructions. Check the drive shaft for excessive end play and 'lift'. A simple check on output pressure as described in Para 2 is the best indication of blockages or unacceptable wear.

Oil pump installation

19 Install the oil pump as follows :

19.1 If the same oil pump as was removed is to be replaced, carefully scrape off any existing sealant from the base of the pump. If a new pump is to be fitted, check that the base and ports are clean and free from damage. Check that clamping surfaces between oil pump and oil pump housing are flat and free from dirt.

19.2 Apply a thin film of any approved general-purpose liquid gasket sealant, ensuring that no excess sealant enters either of the two crescent-shaped ports of the pump, then locate the pump in its correct position in the housing, and secure it with the three capscrews.

19.3 Remove the square-headed plug (Fig 1 (3)) in the side of the pump housing.

19.4 Insert the correct Woodruff key in its slot in the pump drive shaft, then place a new gasket on the flange of the housing.

19.5 Align the pump-shaft keyway approximately with the keyway in the bored end of the input shaft. Whilst offering the housing into position on the main casing, watch the pump shaft through the plug hole in 19.3 and align the pump shaft so that the key enters the input-shaft keyway.

19.6 Move the housing fully up to the main casing, and secure it with the five capscrews and plain washers; tighten the capscrews to a torque of 20-24 Nm (15-18 lbf.ft).

19.7 Replace the square-headed plug in the inspection hole.

TRANSFER GEARBOX INSTALLATION

WARNING ...

When moving the transfer gearbox, a hoist should be used where possible. If moving it manually, a two-man lift is needed, since it weighs about 92 kg (202 lb) when empty.

20 Place the unit on a transmission jack if available, or a normal trolley jack, in either case using blocks, plates and clamps as necessary, in order to accommodate its shape in the upright position, but tilted backwards by a few degrees (its angle in the chassis is 3.5 degrees); proceed as follows :

20.1 Ensure that there is no restriction of access to the chassis area where the transfer gearbox fits, then lift it into position so that its large lugs enter and align with the support brackets on the chassis.

20.2 Insert a bolt into each of the two brackets and lugs from the front, and secure them with self-locking nuts; tighten to a torque of 136 Nm (100 lbf/ft).

20.3 Swing the stay rod down and push the eye of its rubber-mounted bush over the stud at the bottom right-hand side of the transfer gearbox. Secure the stay with a washer and nut, and tighten them to a torque of 102 Nm (75 lbf/ft).

20.4 Tighten the nut and bolt securing the other end of the transfer gearbox stay to the chassis bracket; tighten to a torque of 136 Nm (100 lbf/ft).

20.5 Place the selector cable outer sleeve into the cut-out on the outer end of the cable support bracket, and support it by screwing the two securing nuts together to grip the bracket. It may be necessary to adjust the position of the cable outer sleeve in relation to the bracket in order to set the cab lever correctly; refer to Para 25.

20.6 Slide the cable clevis over the matching hole in the selector shaft lug, and offer the spring clevis pin into the right-hand side of the clevis; move the cable clevis to align its holes with the selector shaft hole, allowing the pin through to enter the other side of the clevis.

20.7 With the pin fully home, snap the spring end over the clevis body.

20.8 Push the two flexible vacuum lines on to the short pipes on the differential lock actuator assembly; the red line goes on the rearward pipe, which is on the end of the actuator.

20.9 Using a 'P' clip, clamp the vacuum lines to the top PTO cover using one of the cover securing screws.

20.10 Push the two spade-type connectors onto the switch terminals on the differential lock actuator.

20.11 Plug-in and screw-up the electrical connector for the speedometer drive output.

20.12 Offer-up and connect the rear-axle propeller shaft flange to the transfer box output flange (four bolts and self-locking nuts); tighten the nuts to a torque of 41 Nm (30 lbf/ft).

20.13 Offer-up and connect the input propeller shaft flange from the gearbox to the transfer box input flange (four bolts and self-locking nuts); tighten the nuts to a torque of 41 Nm (30 lbf/ft).

20.14 Offer-up and connect the front-axle propeller shaft flange to the transfer box output flange (four bolts and self-locking nuts); tighten the nuts to a torque of 41 Nm (30 lbf/ft).

GEAR SELECTOR LEVER

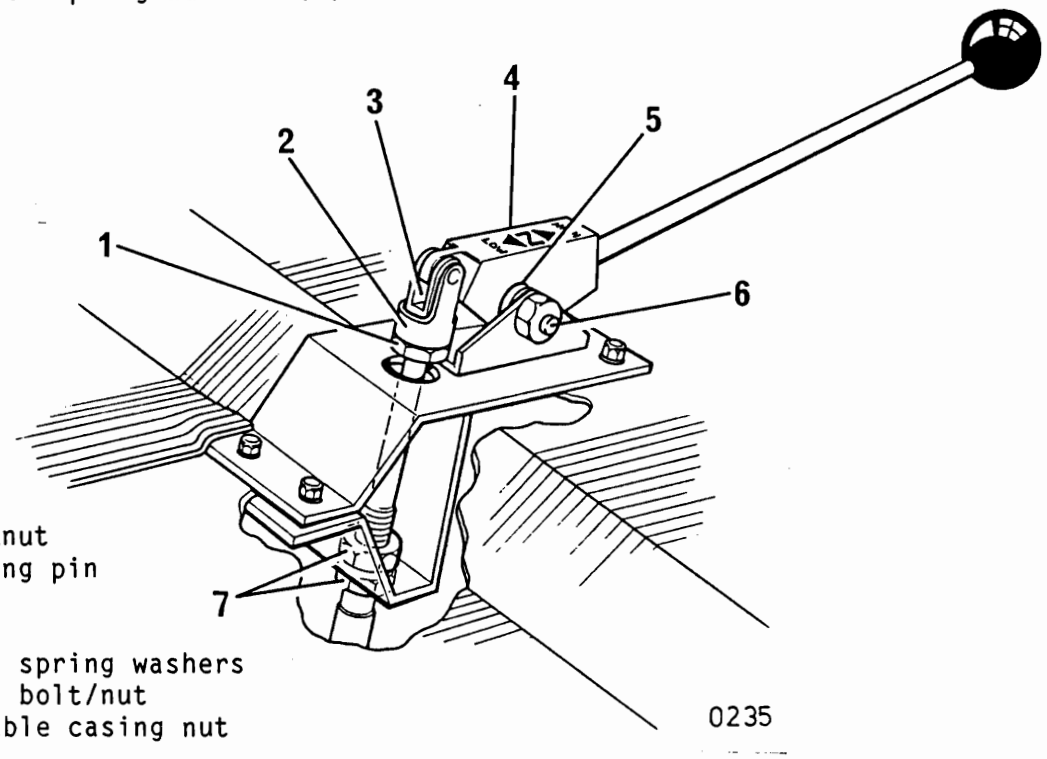
Removal

21 To remove the transfer gear selector lever in the cab, refer to Fig 4 and proceeds as follows :

21.1 Push the lever down to the 'High' positon.

21.2 At the rear of the lever base, prise the spring-clip part of the spring clevis pin away from the clevis body, swivel it clear of the body and then slide it sideways to pull out the pin.

21.3 Remove the lever swivel nut (6) and bolt from the base, and pull the lever with its spring washers (5) out of its bracket.



1 Clevis locknut
2 Clevis spring pin
3 Clevis
4 Lever base
5 Lever pivot spring washers
6 Lever pivot bolt/nut
7 Selector cable casing nut

Fig 4 Gear selector lever and cable

Installation

22 To install the transfer gear selector lever, proceed as follows :

22.1 Place a double-coil spring washer (5) on each side of the lever swivel hole, and push these items into position within the swivel bracket on the floor of the cab.

22.2 Push in the swivel bolt (6) so that it traps the lever and washers, then screw on the nut.

22.3 Push the lever fully downward, and slide the cable clevis over the matching hole in the rear of the lever base.

22.4 Offer the spring clevis pin into the right-hand side of the clevis, and lift the lever to align its hole with the pin, alowing the pin through to enter the other side of the clevis.

22.5 With the pin fully home, snap the spring end over the clevis body.

GEAR SELECTOR CABLE

Removal

23 To remove the transfer gear selector cable, refer to Fig 2 and 4 and proceed as follows :

23.1 In the cab, push the selector lever down to the 'High' position.

23.2 At the rear of the lever base, prise the spring-clip part of the spring clevis pin (Fig 4 (2)) away from the clevis body (Fig 4 (3)), swivel it clear of the body and then slide it sideways to pull out the pin.

23.3 From below the cab floor, at the cable support bracket (Fig 2 (7)), loosen the lower nut on the cable outer casing, then from above the bracket, remove the upper nut; the cable inner core with clevis can now be withdrawn downwards out of the cab and the bracket. If the same cable is to be replaced, retain the upper nut.

23.4 At the selector cable attachment point on the transfer gearbox, prise the clevis pin spring away from the clevis body, and slide out the pin to release the cable clevis.

23.5 Loosen the locknut (Fig 2 (8)) clamping the cable casing to the bracket, and lower the cable from the bracket. The cable can now be removed complete.

Installation

24 To install the transfer gear selector cable, refer to Fig 2 and 4, and proceed as follows :

24.1 At the selector cable attachment point on the transfer gearbox, place the selector cable outer sleeve into the cut-out on the outer end of the cable support bracket, and support it by screwing the two securing nuts together to grip the bracket. It may be necessary to adjust the position of the cable outer sleeve in relation to the bracket in order to set the cab lever correctly. Refer to Para 25.

24.2 Slide the cable clevis (Fig 2 (5)) over the matching hole in the rear of the selector shaft, and offer the spring clevis pin into the right-hand side of the clevis; move the cable clevis to align its holes with the selector shaft hole, allowing the pin through to enter the other side of the clevis.

24.3 With the pin fully home, snap the spring end over the clevis body.

24.4 If a new cable is being fitted, remove the outer nut from the free end of the cable casing. At the cab, and from below, pass the free end of the cable up through the hole in the underfloor bracket, and secure the cable with the outer nut.

24.5 Inside the cab, push the selector lever fully downward and slide the cable clevis (Fig 4 (3)) over the matching hole in the rear of the lever base.

24.6 Offer the spring clevis pin (Fig 4 (2)) into the right-hand side of the clevis, and lift the lever to align its hole with the pin, allowing the pin through to enter the other side of the clevis.

24.7 With the pin fully home, snap the spring end over the clevis body.

Cable/lever adjustment

25 To adjust the cable outer-sleeve anchorage position in order to adjust the position of the selector lever, proceed as follows :

25.1 In the cab, move the selector lever to each of its three indented positions, and check that the lever positions in 'High' and 'Low' are satisfactory from the driver's position. If the lever position is too near the floor in its 'High' position, the cable outer needs to be lenthened; if the lever position generally, particuarly in the 'Low' position, is too upright, the cable outer needs to be shortened.

25.2 To lengthen the cable outer sleeve, at the transfer box cable support bracket (Fig 2 (7)), loosen the end nut on the outer sleeve (i.e. inside the bracket) and screw-in the nut (Fig 2 (8)) which is outside the bracket; before tightening the nuts, check in the cab that the lever position is satisfactory. If there is insufficient adjustment at the transfer box end of the cable, the same procedure can be carried out at the under-cab bracket.

DIFFERENTIAL LOCK SELECTOR CONTROL VALVE

Removal

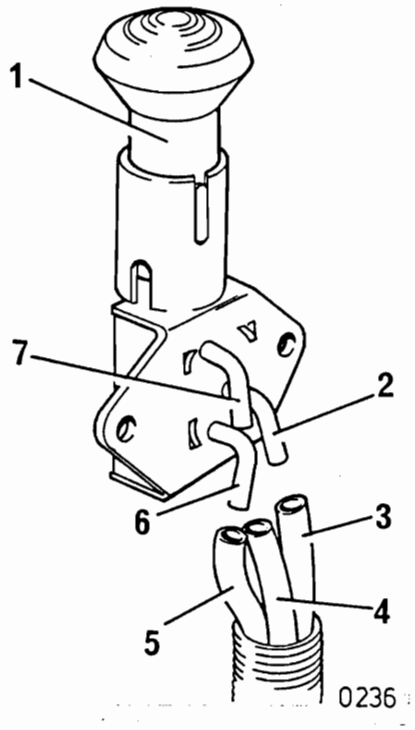
26 To remove the differential lock selector control valve, refer to Fig 5 and proceed as follows :

26.1 Remove the two nuts, screws and washers securing the valve to the bracket on the rear of the gearbox manual selector quadrant.

26.2 Pull off the three vacuum lines (3, 4 & 5) from the rear of the valve.

Installation

27 Installation of the differential lock selector is the reverse of the removal; when replacing the vacuum lines, they should be connected as shown in Fig 5.



1 Diff. lock selector knob
2 Reservoir inlet
3 Reservoir pipe (yellow)
4 'Engage' pipe (red)
5 'Disengage' pipe (black)
6 'Disengage' inlet
7 'Engage' inlet

Fig 5 Differential lock selector control valve

PROPELLER SHAFTS

Removal

28 To remove a propeller shaft complete, remove the four bolts and self-locking nuts from the coupling flange at each end, and lower the shaft out of the vehicle.

Cleaning and examination

29 Clean the complete assembly, including the rubber gaiter, preferably using steam, although any other approved means for the removal of mud, road dirt and oil or grease film may be used. In particular, ensure that no adhesions such as paint or tar etc., which may upset the balance of the shaft, are allowed to remain. Examine the propeller shaft externally as follows :

29.1 Examine the universal joints for excessive leakage of grease and for rotational looseness and end play at the yokes. There is normally some grease exuded from the needle bearings. If any looseness is considered excessive, the appropriate joint should be serviced or the propeller shaft replaced.

29.2 Check the sliding joint for ease of movement without looseness. If movement is sticky or otherwise difficult, the joint should be serviced. If movement is excessively loose, the propeller shaft should be replaced.

29.3 Check the rubber gaiter for holes and general condition; if its condition is considered unsatisfactory, it should be renewed as described in Para 30.

Rubber gaiter removal

30 To remove a rubber gaiter, refer to Fig 6 and proceed as follows:

30.1 Unscrew the wire or worm-drive clip (2 & 7) securing each end of the gaiter, and slide it off the gaiter.

30.2 Pull the joint as far apart as possible, and slide the end of the gaiter nearer the yoke back to reveal the cap on the end of the yoke shaft.

30.3 Unscrew the end cap (9), then withdraw the splined propeller shaft from the yoke shaft, complete with washer and composition seal ring.

30.4 Remove the washer (6) and seal ring (5); they are both split, so that each can be twisted apart for removal from the shaft (over the splines).

30.5 The rubber gaiter (4) can now be removed from the propeller shaft.

Rubber gaiter replacement

31 To replace a rubber gaiter, refer to Fig 6 and proceed as follows :

31.1 Clean the splines on the propeller shaft and the yoke, then lubricate them with grease XG279.

31.2 If removed, place a wire or worm-drive clip on the end of the propeller shaft, and follow this with the rubber gaiter.

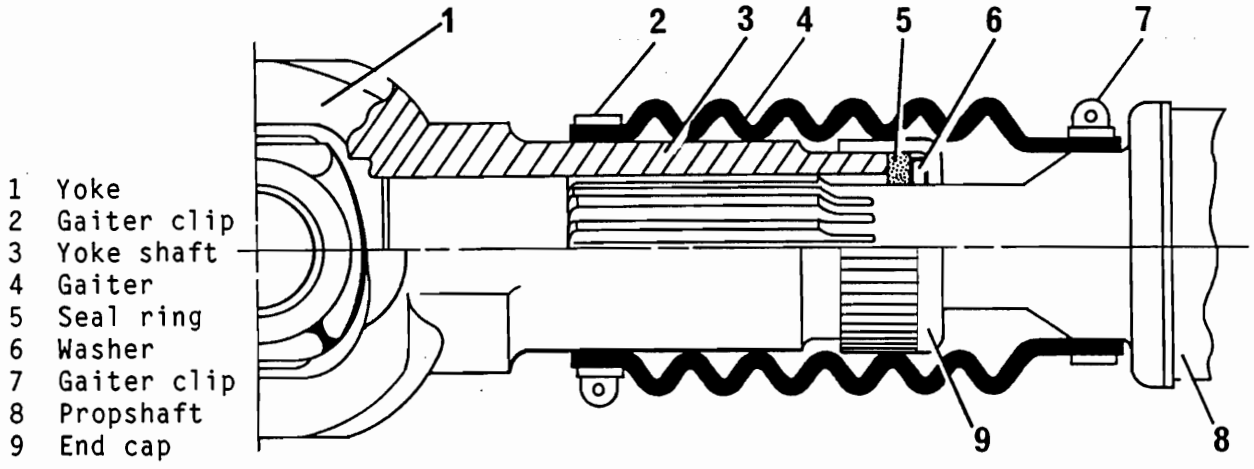


Fig 6 Propeller shaft sliding joint

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31.3 Holding the gaiter back against the tube end, place the end-cap (9) on the end of the propeller shaft, and follow this with the metal washer (6) and then the composition seal (5); these two items are split, and each must be twisted open in order to pass it over the splines and onto the plain part of the shaft.

31.4 Align the marks on the propeller shaft and the yoke (the yokes on each end of the completed propeller shaft must be in the same plane), and push the splines of the propeller-shaft end into the splines of the sliding yoke.

31.5 Push the seal followed by the metal washer up to the yoke tube, and screw on the end cap finger tight.

31.6 Push the free end of the gaiter over the yoke shaft, and place the other clip over the end of the gaiter.

31.7 Positon the gaiter so that when the two halves of the complete propeller shaft are pulled apart to some extent the gaiter is not strained, then position the two clips on the gaiter so that their adjusters are diametrically opposite each other, and tighten them.

Propeller shaft installation

32 To install a propeller shaft complete, proceed as follows:

32.1 Check that the mating flanges on the units connected by the propeller shaft are clean, then lift one end of the shaft into position and support it temporarily with one bolt and self-locking nut.

32.2 Lift the other end of the shaft, and secure it with four bolts and self-locking nuts; tighten the nuts to a torque of 41 Nm (30 lbf/ft).

32.3 Use three further bolts and self-locking nuts to secure the other end of the propeller shaft, along with the bolt and nut originally used; tighten the nuts to a torque of 41 Nm (30 lbf/ft).

Chapter 5

FRONT AXLE

CONTENTS

TABLE 1 SPECIAL TOOLS

Item	Part No	Description
(1)	(2)	(3)
1	D-111	Installer, bearing cup
*2	D-115	Height gauge
*3	D-115-3	Arbor
*4	D-116-1	Pinion height block
*5	D-116-2	Arbor discs (2 off)
*6	D-117	Master bearings, differential (2 off)
*7	D-120	Master pinion block
8	D-128	Dial indicator set
9	D-131	Puller slide hammer
10	D-141	Installer bush
11	D-142	Installer, bearing cup
12	D-158	Remover, bearing cup
13	D-161	Installer, bush
14	D-162	Remover, bearing cup
15	D-163	Installer, oil seal
16	D-167	Spreader, differential carrier
17	C-452	Remover, pinion flange
18	DD-914-P	Puller, press
19	DD-914-7	Extender, press
20	DD-914-8	Ring, reducer
21	DD-914-9	Ring, reducer
22	DD-914-42	Button
23	DD-914-62	Adaptor, bearing cone
24	C-293-37	Adaptor, bearing cone
25	C-3095-A	Installer, bearing cone
26	C-3281	Holder, pinion flange
27	C-4025-A	Installer, differential case bearing
^28	D-195-1	Installer, oil seal
^29	D-195-2	Installer screw
30	C-4171	Handle, universal
31	C-4203	Installer, bearing cup
32	C-3718	Installer, pinion flange
33	BW200353	Hub nut spanner

*Items 2 to 7 inclusive - Setting gauge kit D-116-60
^Items 28 and 29 - Seal installer kit D-195

Front axle identification

1 The serial number is stamped on the top of the shorter tube.

1.1 Dismantling and reassembly of the hub half shaft, and steering knuckles and pinion seal can be carried out in-situ without removing the axle from the vehicle.

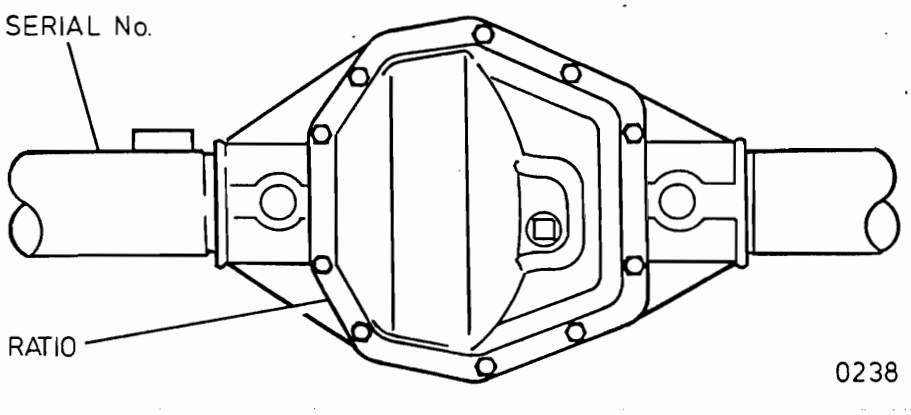

Fig 1 Differential carrier cover plate

Hub bearings removal

2 Slacken the front wheel nuts (left hand thread at left side), then jack up the vehicle and fit chassis supports with the wheels just clear of the ground.

2.1 Remove the wheel.

2.2 Release the auto adjust mechanism using a small screw driver through the aperture in the backplate.

2.3 Remove the drive shaft hub cap and circlip.

2.4 Remove the drive flange (use a hide mallet, if necessary, to break the joint). (Fig 2).

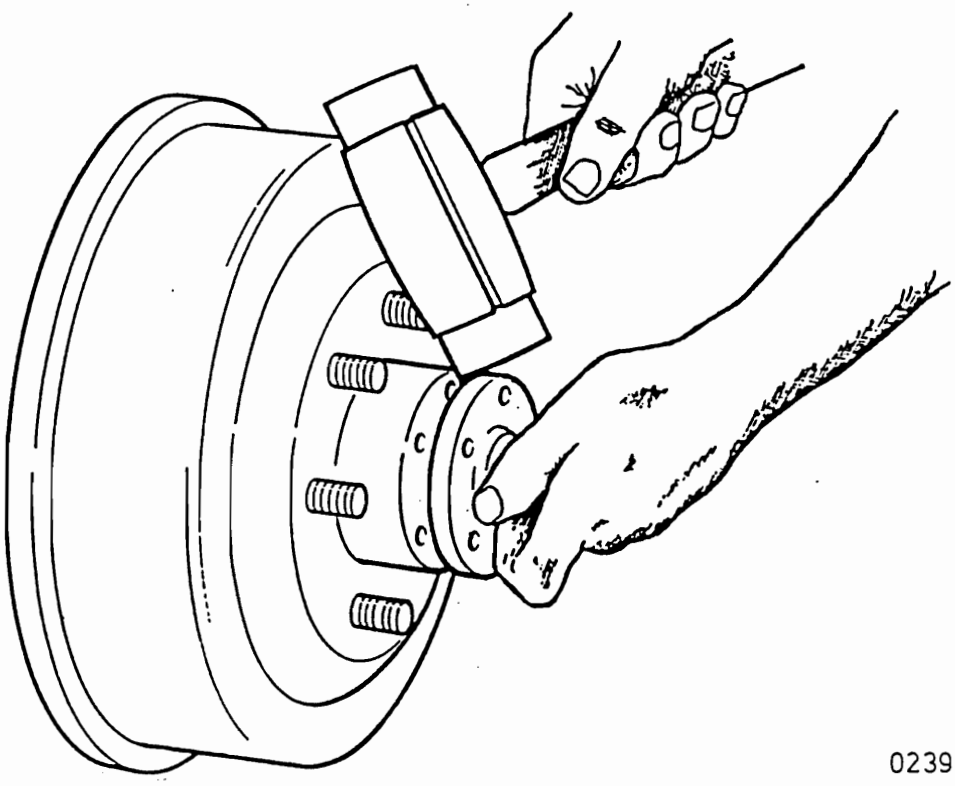

Fig 2 Wheel hub drive flange removal

2.5 Release the lock washer and remove the outer locknut, lockwasher, inner wheel bearing adjusting nut using hub nut spanner BW200353 (Table 1 item 33), and hub bearing washer (Fig 3).

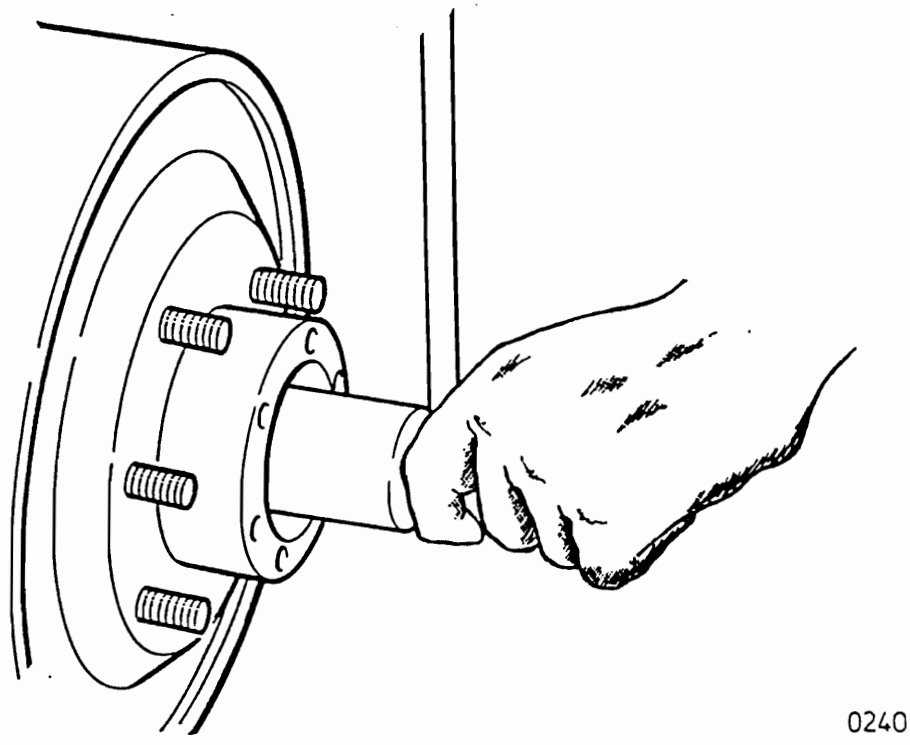

Fig 3 Wheel bearing nut removal

2.6 Remove the outer wheel bearing cone and the wheel hub (brake drum). (Refer to Chapter 10 for brake repair) (Fig 4).

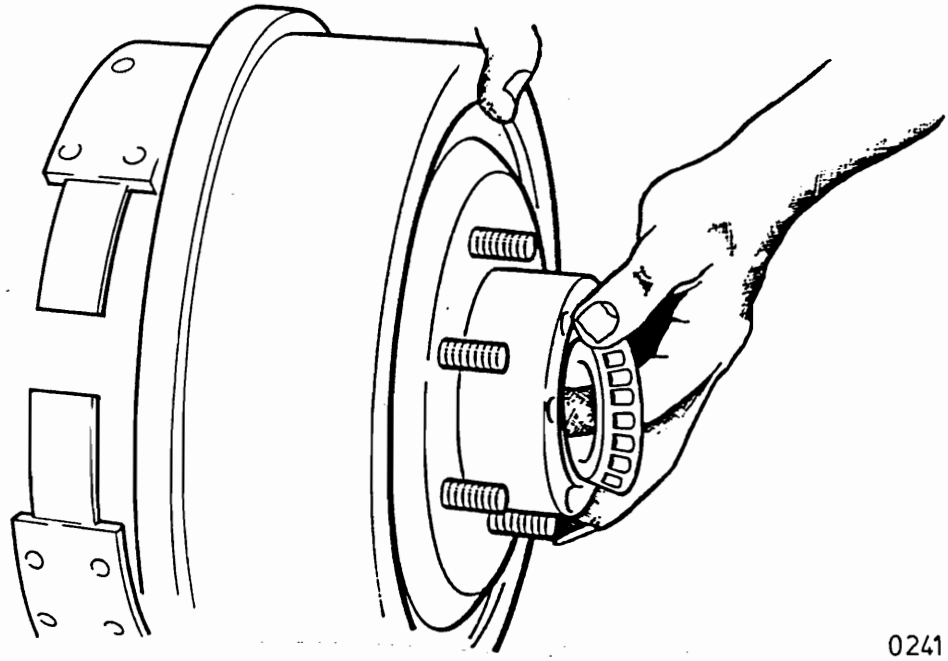

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Fig 4 Wheel hub removal

2.7 Remove the grease seal using a lever or a slide hammer (Fig 5).

2.7.1 Remove the inner bearing cone.

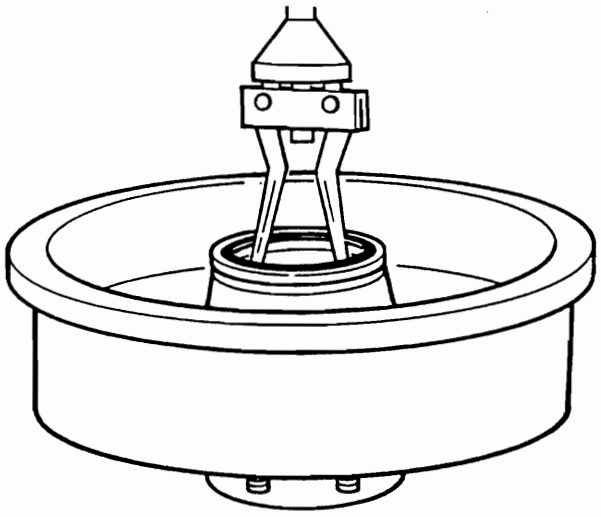

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Fig 5 Hub grease-seal removal

2.8 Remove inner and outer wheel bearing cups using a punch in the machined slots of the wheel hub (Figs 6 & 7).

2.8.1 Clean out the old grease.

2.8.2 Knock out any defective wheel studs using a punch on the threaded end. (Stud head on inside of drum).

2.9 To dismantle steering knuckles refer to Para 4.

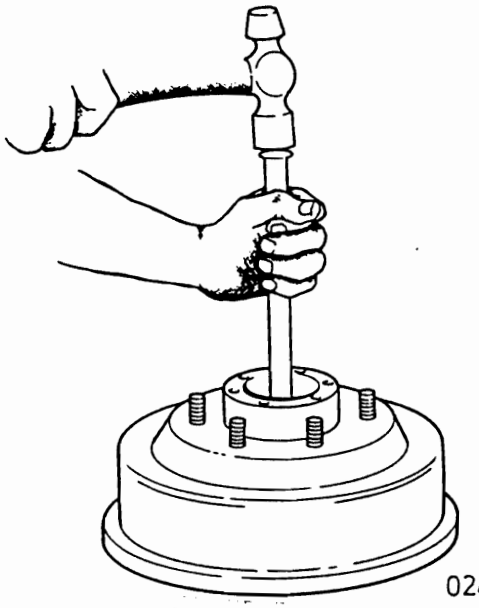

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Fig 6 Inner bearing cup removal

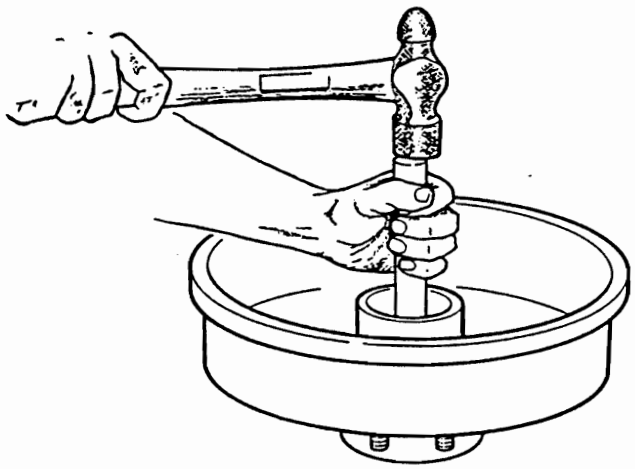

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Fig 7 Outer bearing cup removal

Hub bearings reassembly

3 Assemble the new outer wheel bearing cup using a flat faced installing tool (Fig 8). Ensure that the larger bore is facing outward.

Note ...
If the facility is available freeze the outer bearing cup to ease assembly.

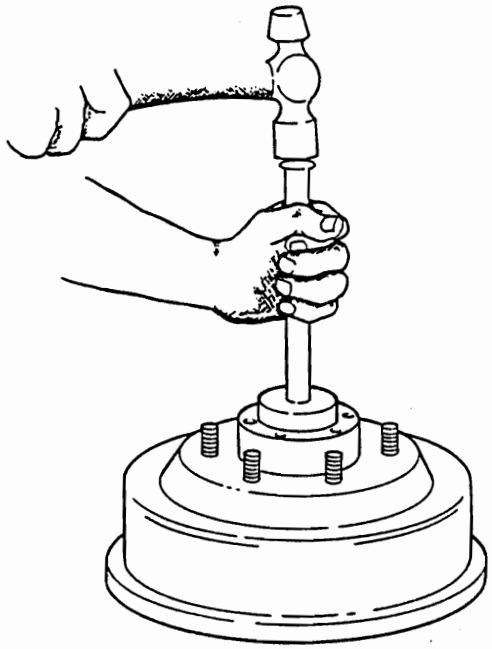

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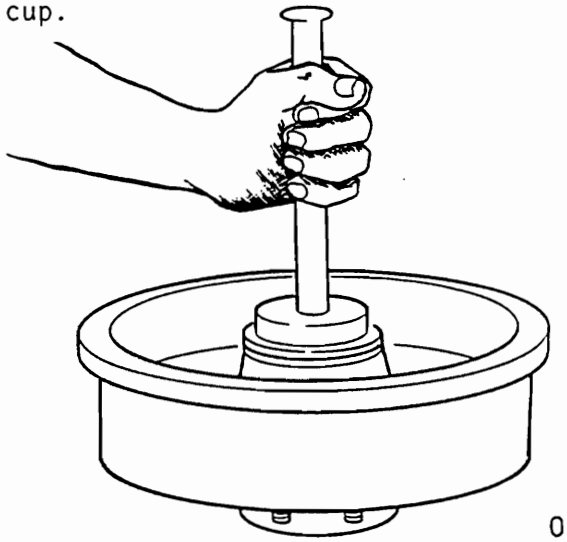
Fig 8 Outer wheel bearing cup assembly

3.1 Assemble the new inner wheel bearing cup using a flat faced installing tool D142 (Table 1 item 11) and handle C4171 (Table 1 item 33) (Fig 9). Ensure that the large bore is facing outward.

Note ...
If the facility is available, freeze the inner bearing cup to ease assembly.

3.2 Refill the hub half full with new grease XG279

3.3 Pack the new inner bearing cone with new grease XG279 and place in the inner wheel bearing cup.



0245

Fig 9 Inner wheel bearing cup assembly

3.4 Assemble a new grease seal to the hub, sealing lip facing the bearing, using a flat faced installer (Fig 10).

3.4.1 Apply a film of grease XG279 around the lip of the seal.

3.5 Replace any defective wheel studs (align the splines carefully).

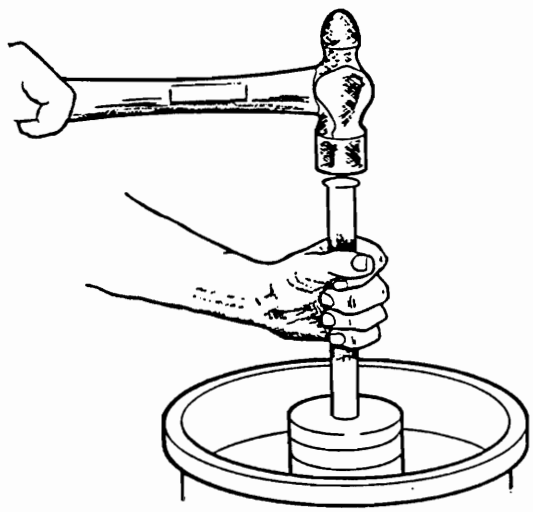


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Fig 10 Hub grease-seal assembly

3.6 Assemble the wheel hub to the spindle, taking care not to damage the grease seal.

3.6.1 Pack the new outer wheel bearing cone with grease XG279 and assemble onto the spindle.

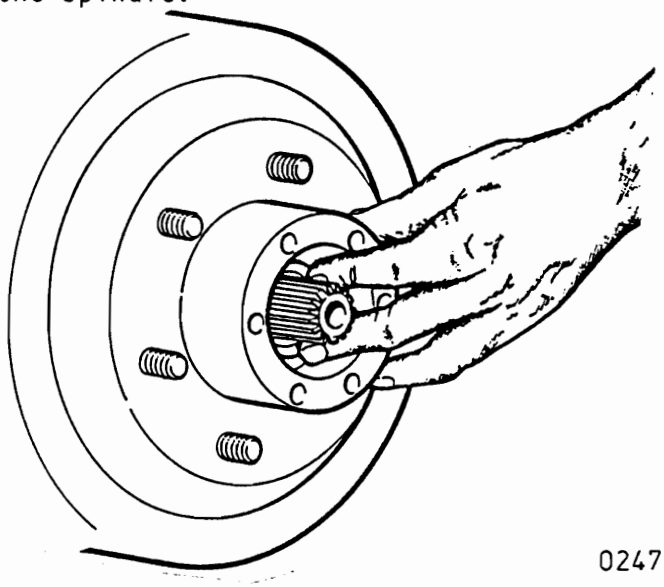

Fig 11 Hub to spindle assembly

3.6.2 Fit the bearing washer and adjustment nut to the spindle (Fig 11).

3.6.3 Tighten the adjustment nut to 150/163 Nm (110/120 lbf.ft) whilst rotating the hub using hub nut spanner BW200353 (Table 1 item 33). Back off the adjustment nut approximately 1/6 turn then fit new locking washer. Align the nut to the nearest tab.

3.6.4 Fit the locknut and tighten to 150/163 Nm (110/120 lbf.ft) (Fig 12). Check that 0.05 to 0.15 mm (0.002 in to 0.006 in) end float is achieved.

3.6.5 Close the locking washer tabs onto the flats of the two nuts.

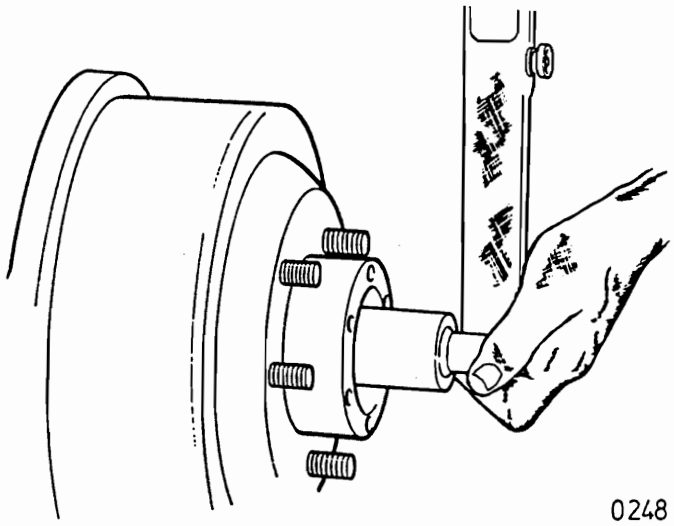

Fig 12 Wheel bearing nut assembly

3.7 Apply silicon sealant (Silastic 732 RTV or Hylomar) to the drive flange and assemble to the hub and drive shaft.

3.7.1 Fit the circlip to the drive shaft (Fig 13).

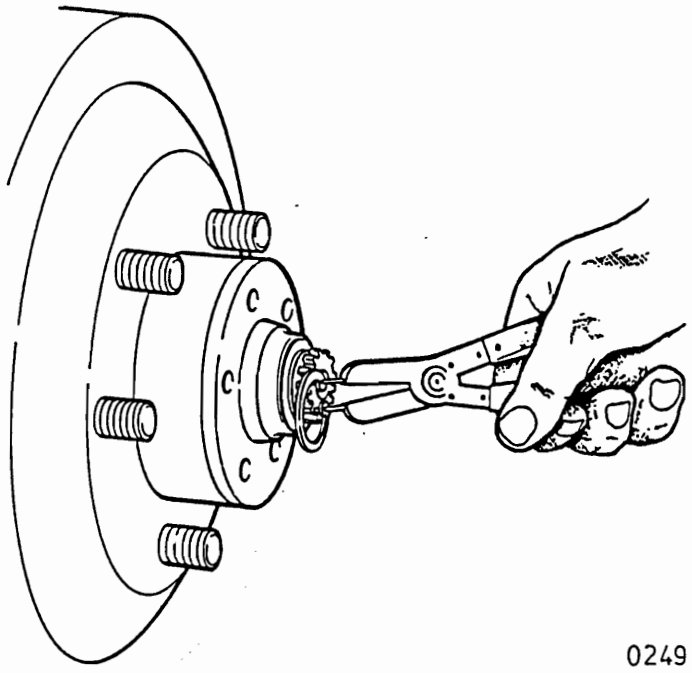

Fig 13 Wheel hub drive flange assembly

3.8 Apply silicon sealant (silastic 732 RTV or Hylomar) to end cap mounting face.

3.8.1 Fit the cap using bolts and new locking straps and tighten to 39/46 Nm (29/34 lbf.ft) (Fig 14).

3.8.2 Close the locking straps on the bolt heads.

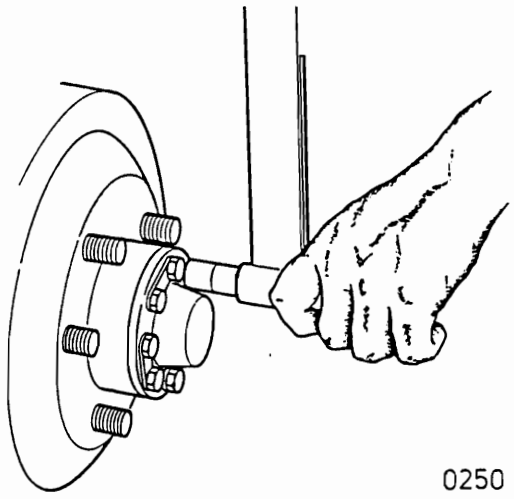

Fig 14 Hub end cap assembly

3.9 Set the brake adjustment (see Chap 10). (Bleed the brakes (see Chap 10)).

3.10 Reassemble the road wheels and nuts. Tighten the wheel nuts to 298 Nm (220 lbf.ft) and remove the chassis supports.

Steering knuckle removal

4 Remove brake backplate (Fig 15).

4.1 Remove wheel hub (para 2).

4.2 Clamp hydraulic brake pipes to prevent loss of brake fluid and then remove pipes from brake backplate. Plug pipes and connector to prevent ingress of dirt.

4.3 Remove brake backplate complete with brake assembly (Chap 10).

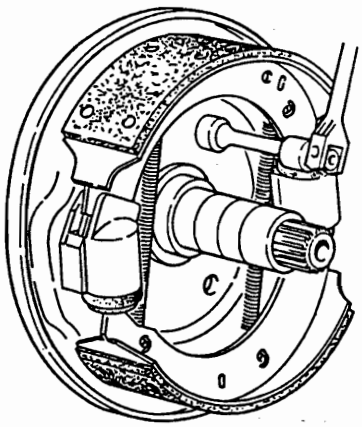

Fig 15 Brake backplate removal

4.4 Drain the steering knuckle oil into suitable container. Observe the condition of the oil and plug for metallic sludge and particles. Clean and refit the plug.

4.5 Remove the hub spindle. Use a hide mallet to ease the spigot free from the steering knuckle (Fig 16).

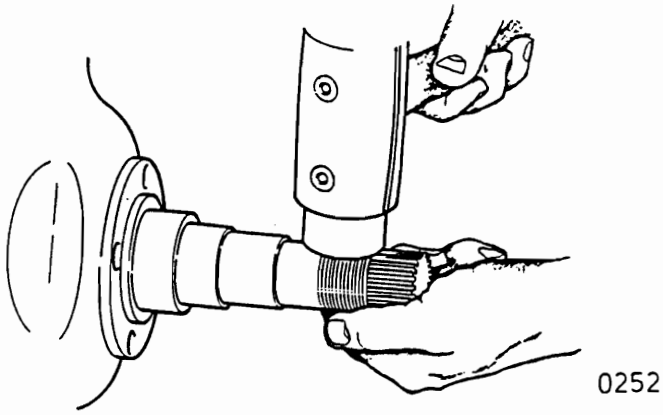

Fig 16 Wheel spindle removal

4.3 If the wheel spindle bush requires replacement, using soft grips in the vice, hold the spindle by the flange, on a non-bearing diameter, and remove the bronze bush with a slide hammer puller D131 (Table 1 item 9) (Fig 17).

4.3.1 The half shaft may now be removed.

4.3.2 Examine the half shaft and constant velocity joint.

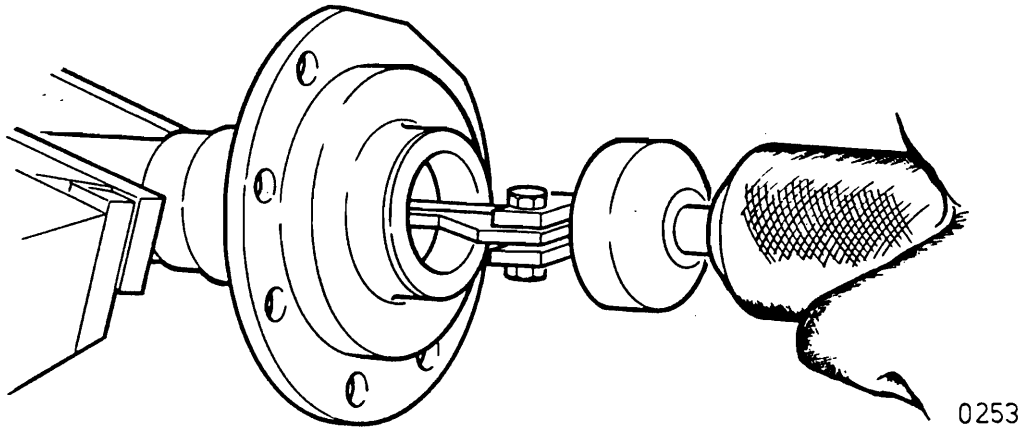

Fig 17 Spindle bush removal

4.4 Remove the tie rod (and drag-link) ball joint split pin and nut. Refit the nut inverted with the upper face just proud of the stud. Strike the nut firmly with a copper faced mallet (Fig 18). Remove the nut and disconnect the tie-rod (and drag-link). (If the stud does not release, use a ball joint splitter).

4.4.1 Disconnect the steering damper ball joint from the track rod arm if working on the left hand side of the axle.

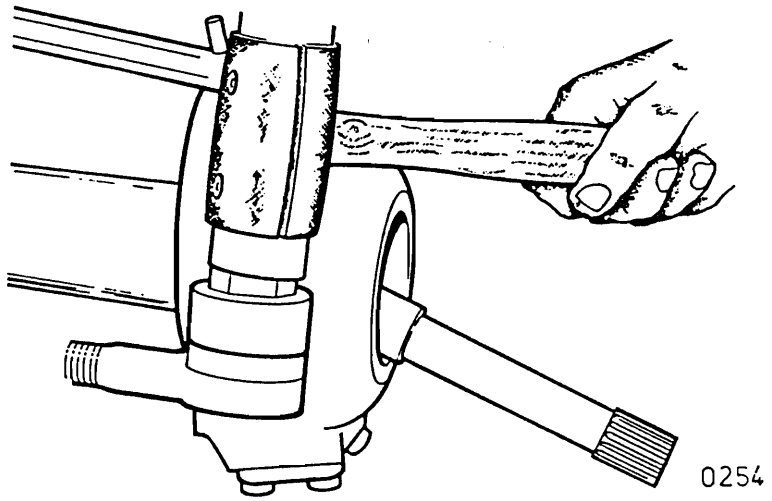

Fig 18 Track rod ball joint removal

4.5 Remove the brake hose bracket from the steering knuckle.

4.5.1 Remove the eight screws and two retainer plates from the knuckle oil seal. Remove and discard the oil seal and two retainer plates.

4.6 Remove the four set screws from the lower king pin cap.

4.6.1 Rotate the king pin cap with a hide mallet and lever it free with a flat bladed screwdriver.

4.7 Swing the bottom of the knuckle out away from the axle and retrieve the lower bearing cone (Fig 19).

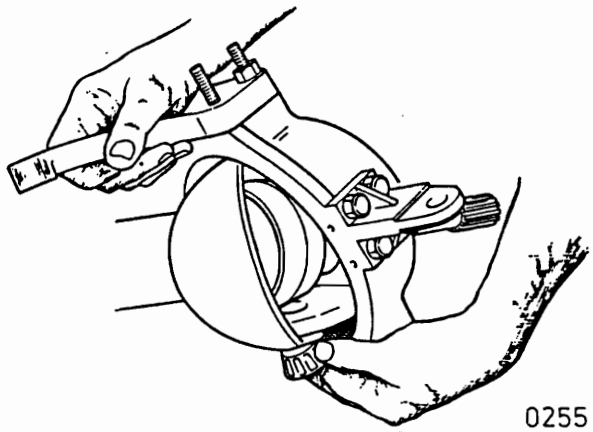

Fig 19 Steering knuckle removal

4.8 Hold the knuckle in a vice using the tie rod arm (Fig 20).

4.8.1 Remove the steering arm nuts, then remove the steering arm with split collets and steering spigot with key from the knuckle Retrieve and identify any shims for re-use.

Note ...
The other end of the axle differs in that an upper king pin bearing cap is fitted in place of the steering arm.

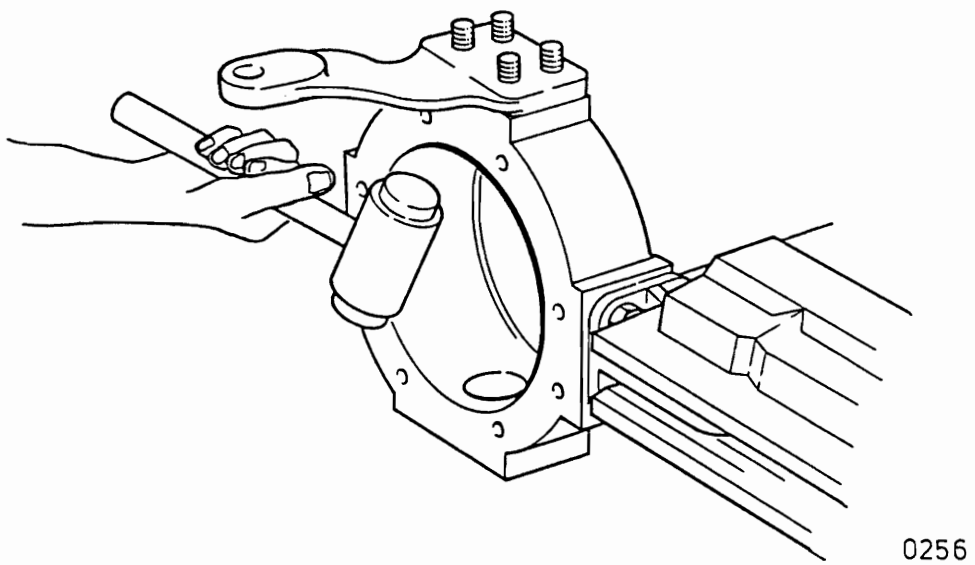

Fig 20 Upper king pin removal

4.9 If it is necessary to replace the king pin bearing cups, remove from the spherical ball yoke using a slide hammer puller D131 (Table 1 item 9) or punch (Fig 21).

4.10 Inspect steering arm studs and replace if necessary. Torque studs to 68/75 (50/55 lbf.ft).

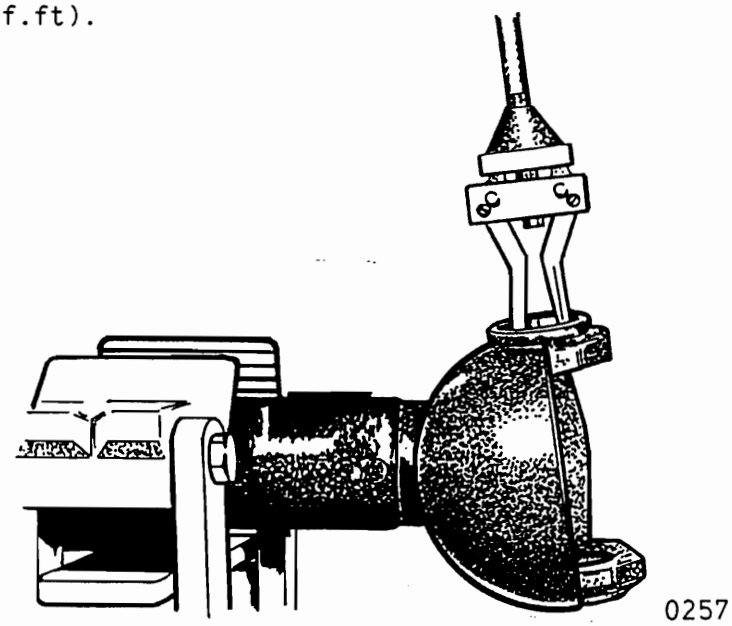

Fig 21 King pin bearing cup removal

Steering knuckle reassembly

5 Assemble new king pin bearing cups to the spherical ball yoke using a flat faced installer D142 and Handle C-4171 (Table 1 items 11 and 30) (Fig 23). Ensure that larger bore is facing outward.

Note ...
If facility is available, freeze king pin bearing cup to ease assembly.

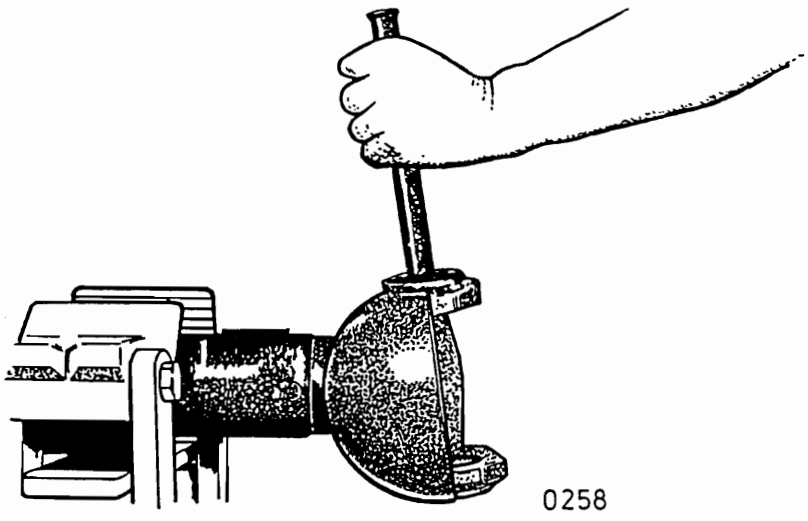

Fig 22 King pin bearing cup assembly

5.1 Clean and examine the lower king pin cap and replace if necessary. Apply silicon sealant (Silastic 732 RTV) to mounting face of king pin cap and assemble to the knuckle housing (Fig 24).

5.2 Hold the steering knuckle in the vice using the track rod arm.

5.2.1 Assemble the four patch bolts and tighten evenly to a torque of 95 Nm (70 lbf.ft).

5.3 Assemble new bearing cone to the lower king pin and pack with XG 279 grease.

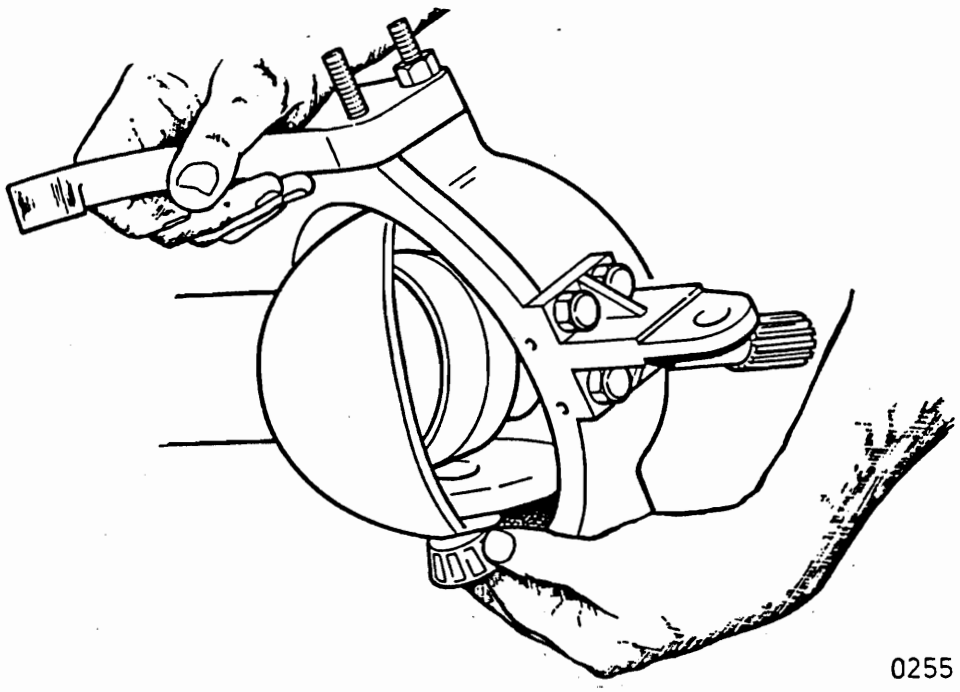

Fig 23 Steering knuckle assembly

5.3.1 Assemble knuckle to spherical ball yoke locating on the lower king pin cap bearing (Fig 23).

5.3.2 Pack the bearing cone for the upper king pin cap (steering pivot) with grease and position in its seat between the spherical ball yoke and the knuckle.

5.3.3 Clean and examine the upper steering pivot and key. Replace if necessary and assemble to the knuckle with any preload shims from 4.8.1. and the steering arm. Fit the collets and nuts and tighten to 156/163 Nm (115/120 lbf.ft).

Note ...
If working on the non-steering side of the axle the upper king pin cap is fitted in place of the steering pivot, key and steering arm.

5.3.4 Using a torque wrench on a steering arm nut, verify the torque required to turn the knuckle is 16/24 Nm (12/18 lbf.ft). (Track rod and knuckle seal should not be fitted at this point).

5.3.5 Add or remove preload shims under the steering arm if necessary. Apply silicon sealant (Silastic 732 RTV) to mounting face on the knuckle housing when making the final assembly. Fit the brake hose bracket and tighten the nuts to a torque of 156/163 Nm (115/120 lbf.ft)

5.4 Assemble new oil seal and retainer plates to knuckle (ensure the oil seal split is uppermost with the closing spring on the outside, and that the retainer plates joint is parallel with the suspension spring seat). Tighten the setscrews to a torque of 24/30 Nm (18/22 lbf.ft) (Fig 24).

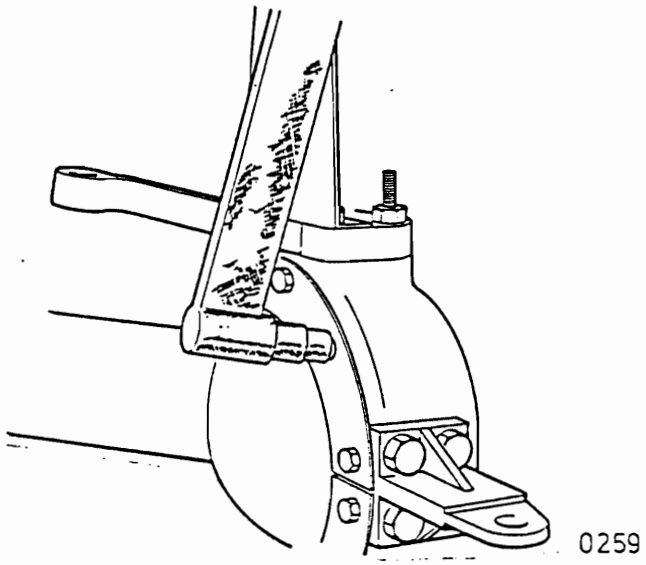

Fig 24 Knuckle oil seal assembly

5.5 Inspect track rod ends and replace if necessary. Tighten clamp bolts to 45/55 Nm (33/40 lbf.ft).

5.6 Fit the track rod (Fig 25), drag-link and steering damper ball joints (refer to Chap 7). Assemble and tighten the track rod and drag link nuts to 95 Nm (70 lbf.ft), steering damper to 48 Nm (35 lbf.ft).

5.6.1 Fit new split pins.

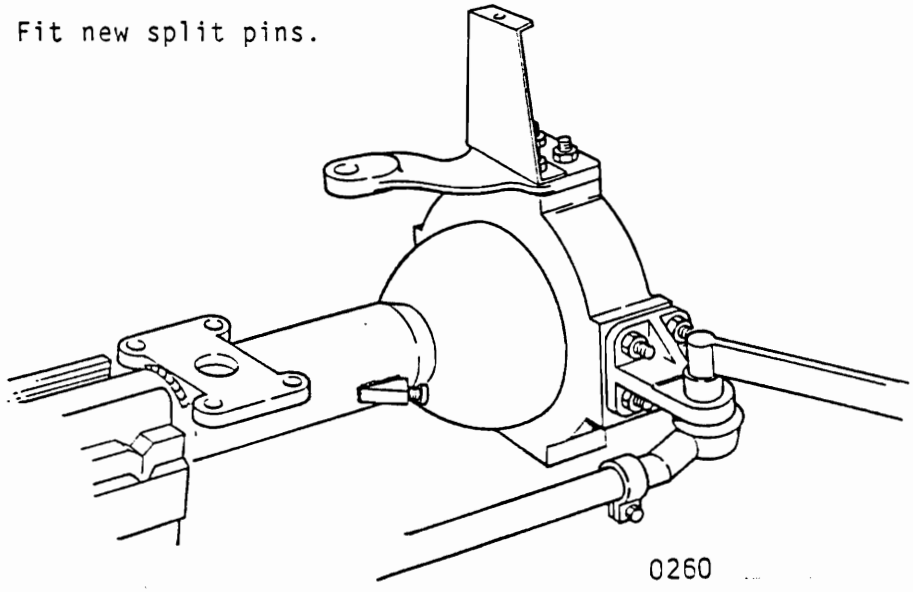

Fig 25 Track rod ball joint assembly

5.7 Fit half shaft complete with constant velocity joint.

5.8 Assemble a new bronze bush if required to the wheel spindle using the flat faced installer D161 and handle C4171 (Table 1 items 13 and 30) (Fig 26).

5.8.1 Grease the bore of the bronze bush and fit spindle to the steering knuckle using Seelastik 732 RTV on mating surface.

5.9 Refill the steering knuckle housing with oil.

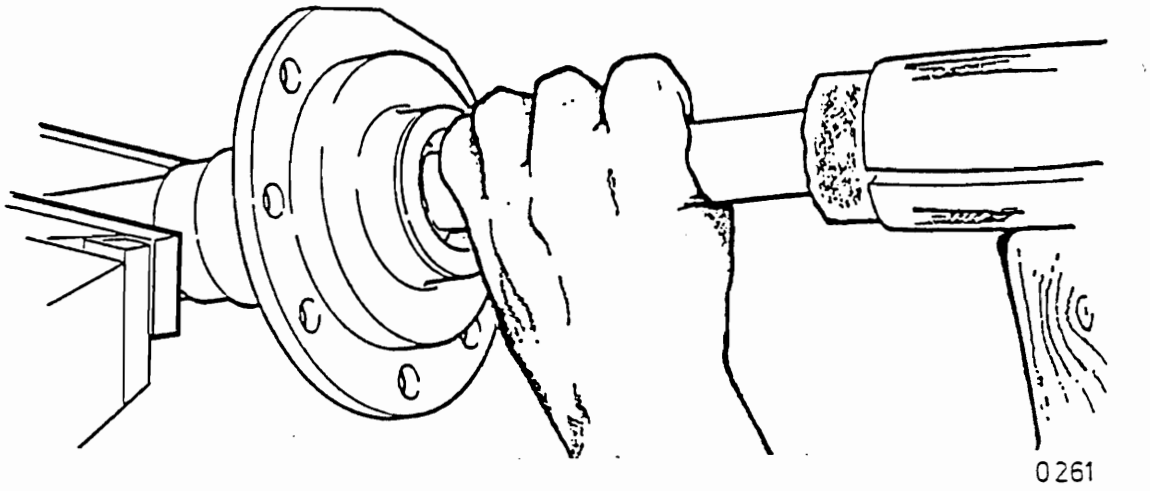

Fig 26 Wheel spindle assembly

5.10 Fit the brake plate assembly, (Fig 27) using new self-locking shoulder bolts and Seelastik 732 RTV on mating surfaces. Tighten the securing bolts to a torque of 150 Nm (110 lbf ft).

5.11 Use the hub bearings reassembly procedures of Para 3 to complete the assembly.

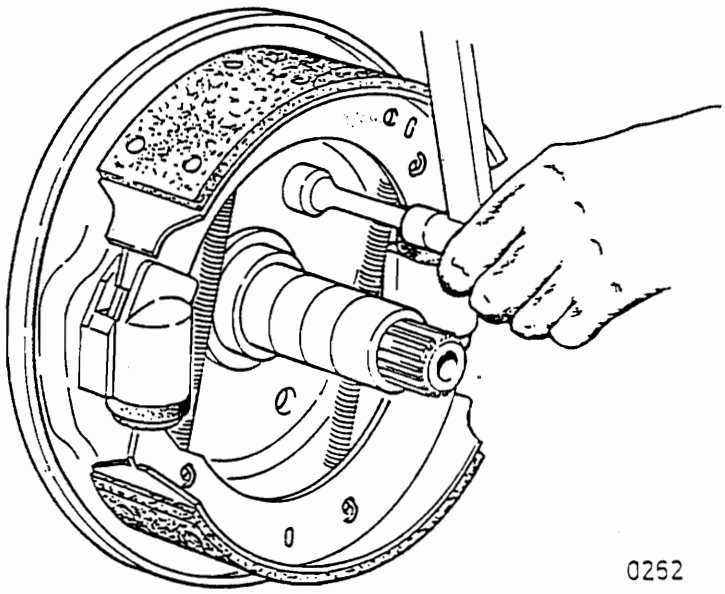

Fig 27 Brakeplate assembly

Breather pipe removal

6 Hold the hose adaptor fitted to the differential housing with a spanner whilst loosening the union nut.

6.1 Disconnect the union from the adaptor. Note the length of hose allowing for the maximum unladen deflection of the road springs.

6.2 Open the engine bonnet and locate the hose which is fed vertically in front of the bulkhead below the vacuum brake servo. Trace the hose behind the air inlet duct, and identify the ties securing the end of the hose to metal pipes. To remove the hose, slide the ties to be within reach then cut the ties using wiremans' side cutting pliers.

6.3 Clean the hose if suitable for re-use or fit a replacement item.

Breather pipe refitment

7 Secure the end of the hose as previously assembled to the metal pipes using plastic cable ties. The ties should not be tightened to cause constriction of the hose bore.

7.1 Refit the hose as previously, adjacent to the bulkhead down to the axle. Check the position of the union compared with that noted in Para 6.1 and verify sufficient length is allowed for axle movement. Adjust the tie point to correspond.

7.2 Fit the breather pipe union to the differential housing breather adaptor, and position the hose to have the maximum bending radius without chafing against other objects during flexure. Hold the adaptor fitted to the differential housing with a spanner and tighten the union nut to 20 Nm (15 lbf.ft). If the adaptor is replaced, tighten it to 48 Nm (35 lbf.ft).

Differential drive flange oil seal removal

8 This can be accomplished with the axle in-situ. Verify the propeller shaft to differential drive flange has an alignment mark on the edge of each flange or make one.

8.1 Remove the four fixing bolts/nuts of the differential drive flange (Fig 32) and separate the joint. Secure the end of the propeller shaft to a suitable place on the chassis.

8.2 Hold the drive flange with yoke holder C-3281 (Table 1 item 26), remove the nut and washer.

8.3 Remove the pinion shaft flange with restraining lever C-3281 (Table 1 item 26) and remover C-452 (Table 1 item 17).

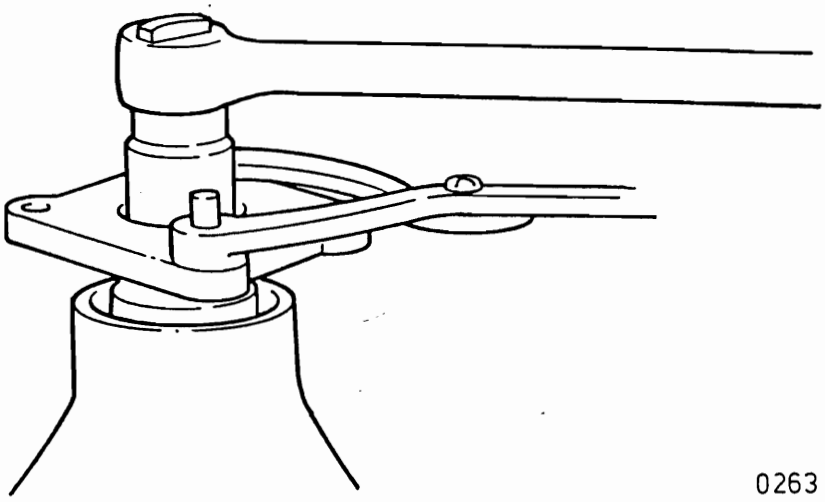

Fig 28 Pinion drive flange nut removal

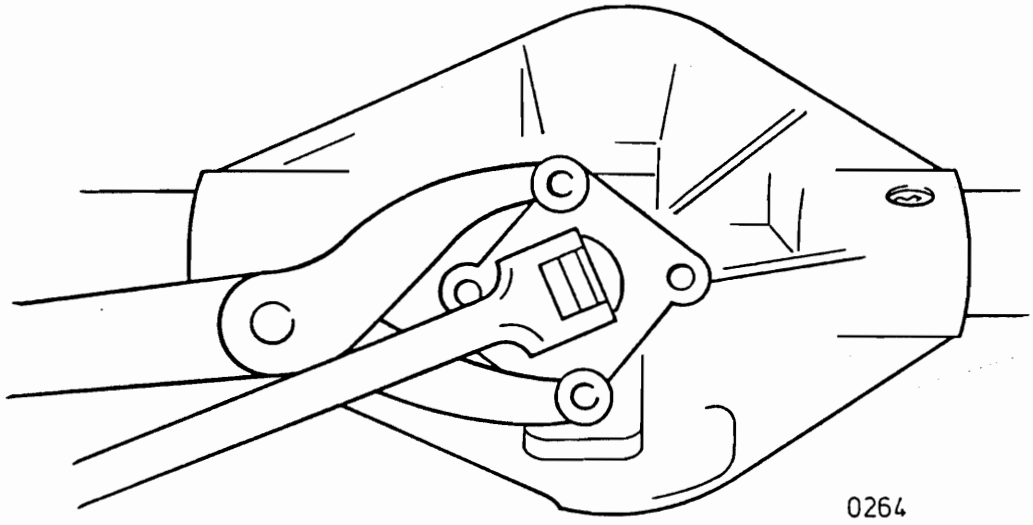

Fig 29 Pinion drive flange removal

8.4 Using a slide hammer D-131 (Table 1 item 9) remove the piston shaft oil seal and discard.

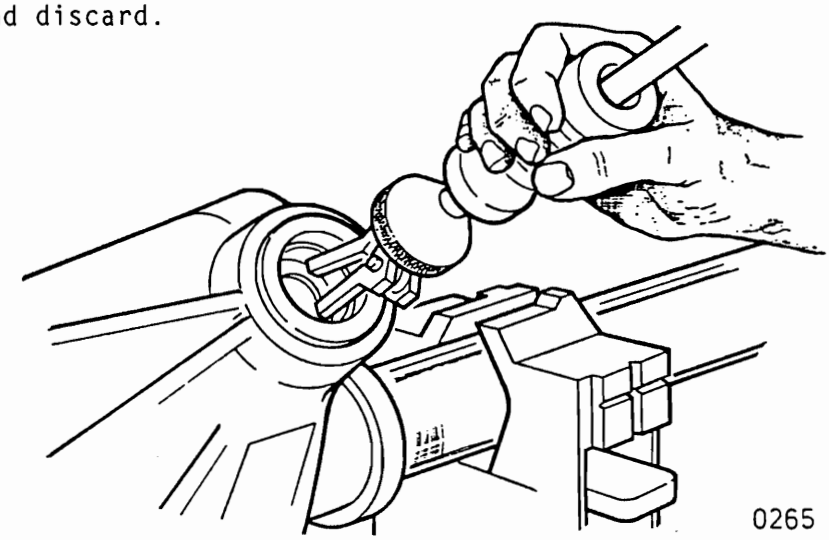

Fig 30 Pinion oil seal removal

8.5 Examine the extent of wear caused by the seal and renew the flange if a groove or scratches are likely to cause damage to the seal.

Differential drive flange oil seal assembly

9 Grease the lip of a new oil seal and fit into its housing with the lip facing the pinion bearings using the installer D-163 and handle C-4171 (Table 1 items 15 and 30).

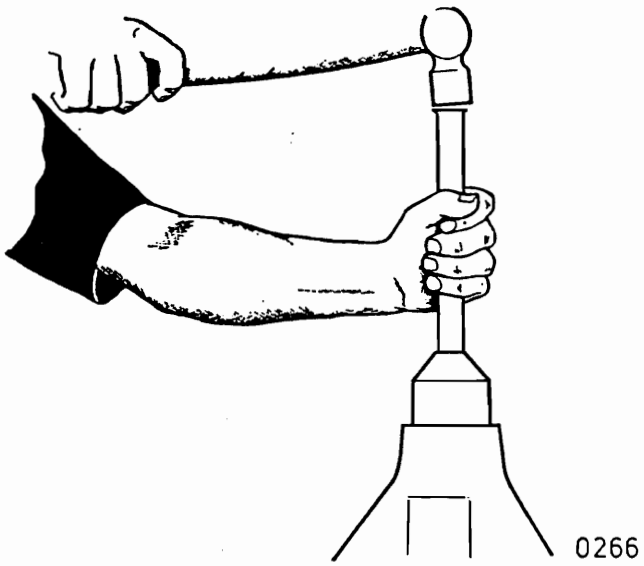

Fig 31 Pinion oil seal assembly

9.1 Refit the differential drive flange. Enter the spigot into the seal carefully.

9.2 Refit the washer and nut. Tighten the nut to a torque of 325-406 Nm (240-300 lbf.ft) using Installer C-3718 and holder C3281 (Table 1 items 26 and 32).

9.3 Refit the propeller shaft flange to the front axle drive flange ensuring that the aligning marks match and secure flange with nuts and bolts. Tighten nuts to a torque of 88-95 Nm (65-70 lbf.ft).

Front axle removal

10 To remove the front axle assembly from the vehicle proceed as follows :

10.1 Apply the handbrake and chock the rear wheels.

10.2 Loosen the front wheel nuts.

10.3 Jack up the front of the vehicle.

10.4 Fit the chassis stands behind the front axle so that the axle can be removed from the front. The front wheel should be clear of the ground.

10.5 Remove the front wheels.

10.6 Disconnect the differential housing breather pipe from the front axle.

10.7 Clamp the hydraulic hoses with pipe clamps to stop fluid escaping, disconnect the hydraulic hoses from the steering knuckle brackets. Seal the ends of the hoses and pipes to prevent ingress of dirt.

10.8 Disconnect the drag link from the steering knuckle arm (Chap 7 refers).

10.9 Disconnect the propeller shaft from the differential drive pinion flange. Ensuring that both flanges are marked for re-assemby.

10.10 Remove the bump stop plates from the two U bolt retainers.

10.11 Using a platform jack with cradle or similar equipment support the axle securely.

10.12 Disconnect the axle from the road springs by removing the "U" bolts. Lower the axle on platform jack and very carefully remove from the vehicle.

Front axle refitment

11 To refit the axle reverse removal sequence instructions noting the following points:

11.1 Support the axle on a jack and position it under the vehicle, drive flange to the rear, long axle tube to the left of the vehicle.

11.2 Raise the axle into contact with the springs locating the spring dowel bolts into the axle bearer pads. Position the axle height to bring the top of the springs into location with the U bolt retainer plates fixed to the strut shock absorbers. Fit new U bolt nuts and tighten to 102 Nm (75 lbf.ft).

11.3 Fit the two bump stop plates to the U bolt retainer plates. Fit new cap screws and tighten to 11 Nm (8 lbf.ft).

11.4 Reassemble the propeller shaft to drive flange coupling. Fit new nuts and tighten to 90 Nm (66 lbf.ft).

11.5 Reconnect the steering drag link to the steering arm (Chap 7 refers).

11.6 Reconnect the hydraulic pipes to the support bracket. Bleed the hydraulic circuits and adjust the brake shoes (Chap 10 refers).

11.7 Reconnect the differential housing breather pipe. (para 7).

11.8 Remove the chassis support stands. Lower the vehicle to the ground and remove the jack.

11.9 Tighten the road wheel nuts to 298 Nm (220 lbf.ft).

11.10 Road test the brakes.

Differential drive dismantling

12 Remove the front axle from the vehicle (para 10).

12.1 Remove the steering damper (Chap 7).

12.2 Clean accummulated road dirt from the axle case. Support the axle on a rigid axle stand. Drain the oil from the differential.

12.3 Remove the hubs (para 2.2 to 2.5 inclusive).

12.3.1 Remove the brake backplates and steering knuckles (para 4 4.3, to 4.9 inclusive).

12.3 Clean accummulated road dirt from the axle case. Support the axle on a rigid axle stand.

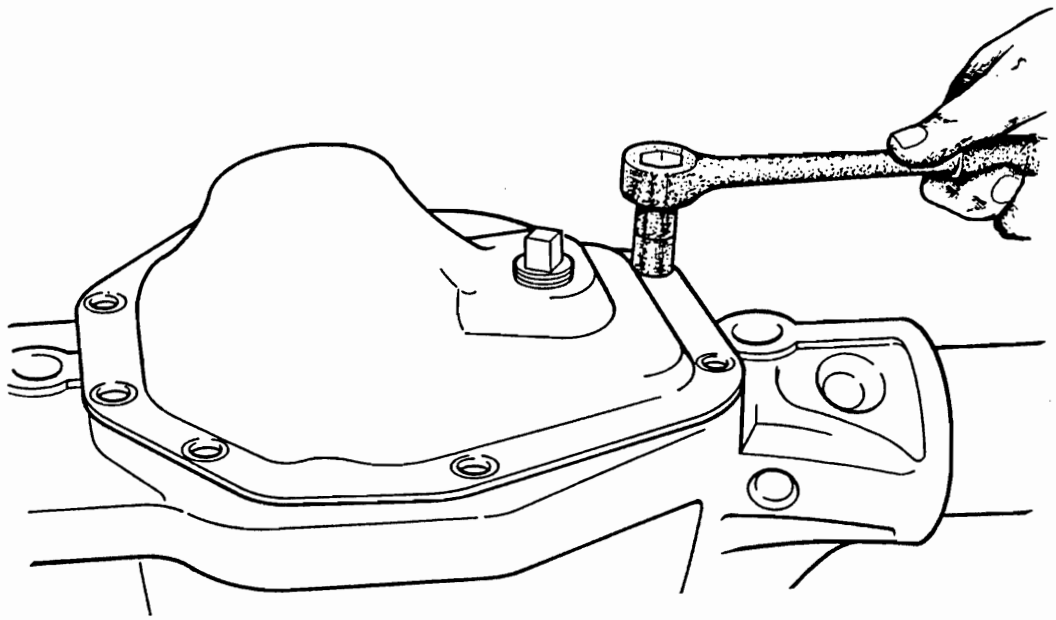

Fig 32 Differential cover plate

12.4 Remove the cover plate, and look for evidence of wear. Examination of the assembly can often reveal the type and extent of repair required, and avoid unnecessary dismantling.

12.5 If the axle is noisy, it is possible that only adjustment of backlash or preload is necessary.

12.6 Examine the contact pattern on the crown wheel teeth. Uneven marking around the crown wheel will show excessive run-out, or uneven wear across the face of the teeth will show whether the pinion is too near or too far away from the crown wheel centre. If the contact pattern is across the width of the tooth flank, check the depth to determine if the marking is too deep or shallow (crown wheel backlash setting). Measure the end float of the differential assembly, and use a torque wrench to measure the torque required to turn the pinion.

12.7 Remove the bolts from a bearing cap then examine the cap for a locating mark. If none is evident repeat for the other bearing cap (kept separate from the first). Make a re-assembly mark if necessary to ensure that the caps are returned to their original position.

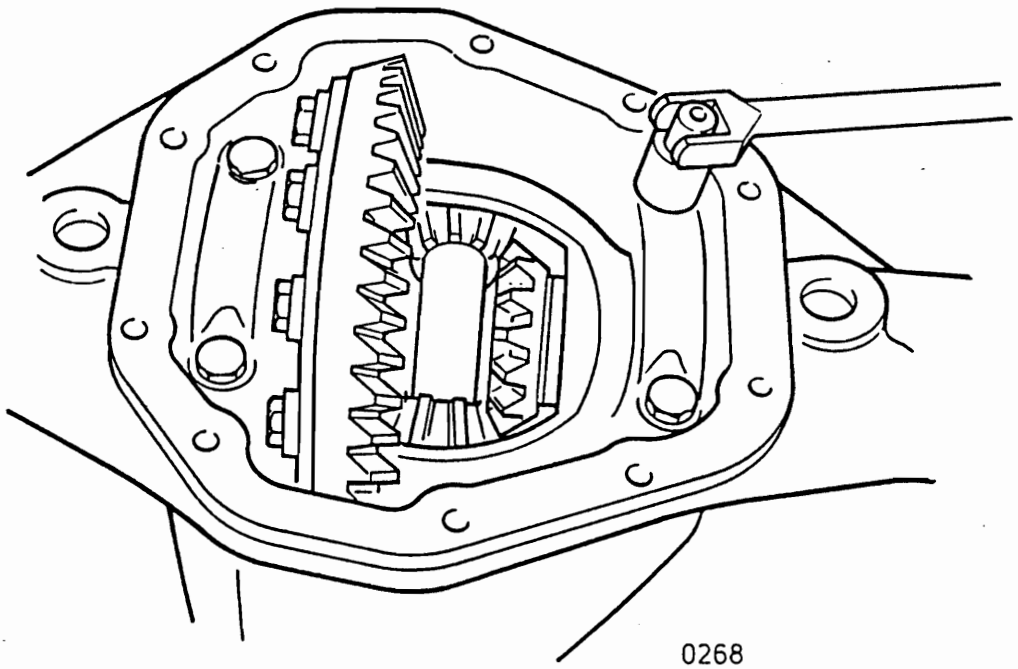

Fig 33 Differential bearing cap removal

12.8 Mount the spreader D-167 (Table 1 item 16) to the carrier. Expand the adjuster to remove the slack without causing tension.

12.8.1 Fit a dial indicator set D-128 (Table 1 item 8) adjusted to show the expansion across the carrier aperture.

12.8.2 Adjust the carrier tensioner to spread the carrier 0.015in (The maximum should be less than 0.020in to avoid distortion).

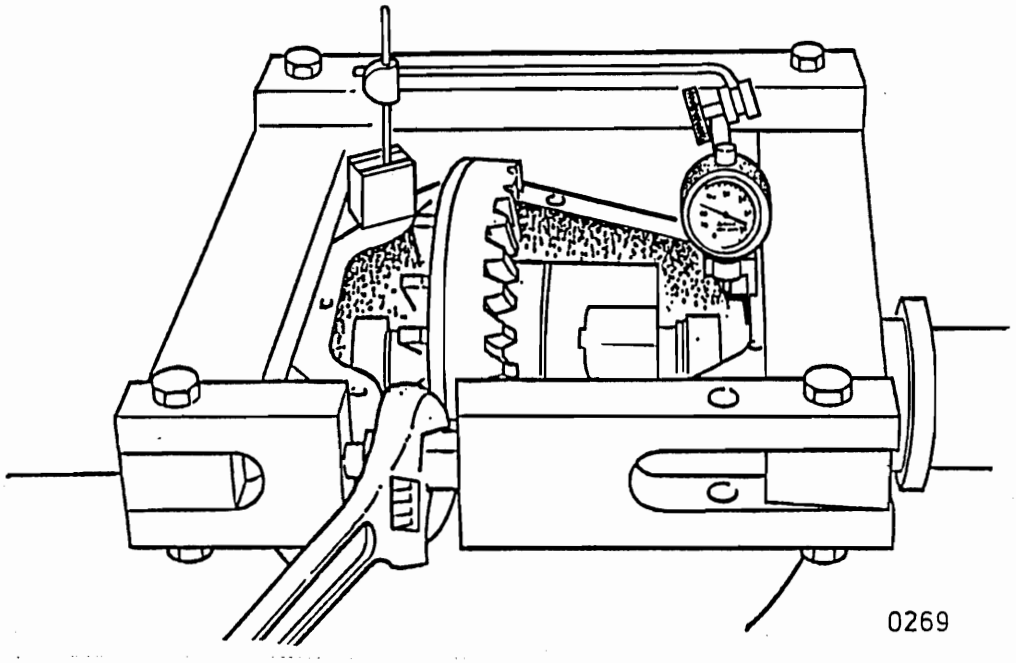

Fig 34 Differential carrier expansion

12.9 Remove the differential assembly from the carrier. Levers may be used, but exercise caution to ensure there is no damage caused to the gears or bearings. Identify the position from which the caps were removed.

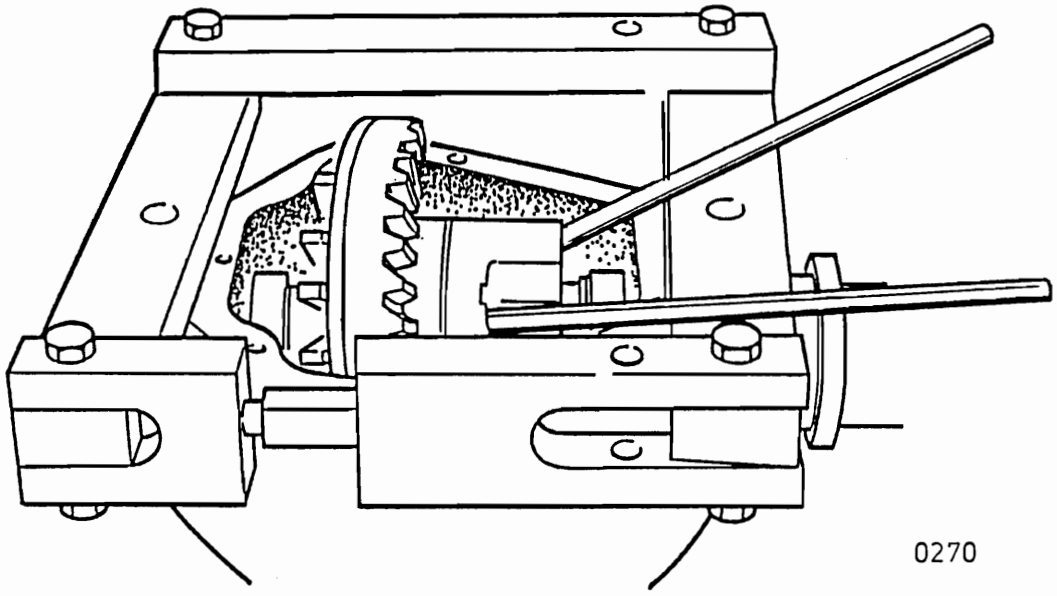

Fig 35 Differential assembly removal

12.10 Using the press DD-914 and adapters (Table 1 items 18,19,20,22,23,), remove the differential bearing cones. Identify their location. Notice in particular the thickness and position of shims behind the bearing cones. Collect the shims with their bearing cone and cup, then wire together.

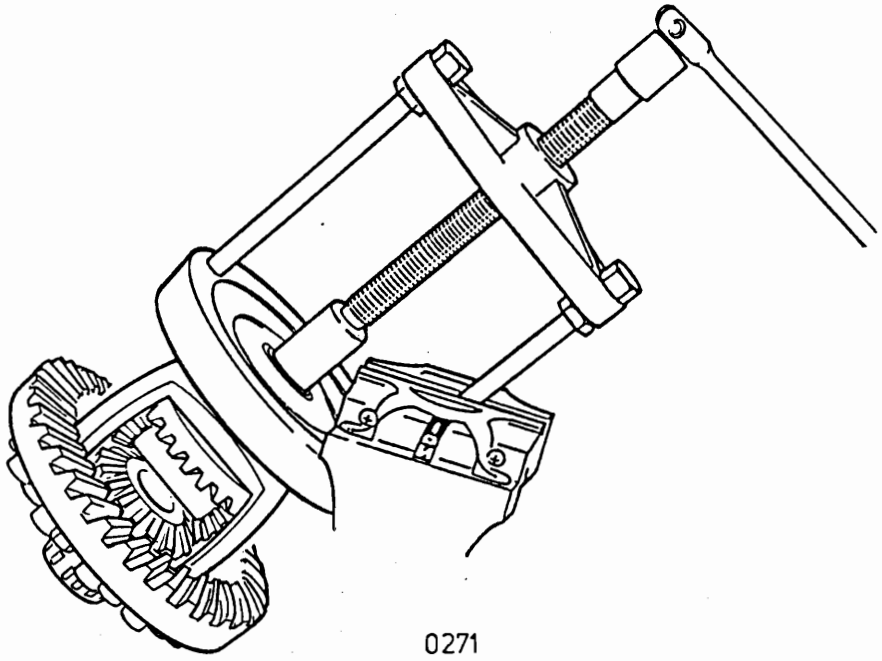

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Fig 36 Differential case bearing removal

12.11 If there was noticeable run-out in the crown wheel prior to dismantling, examine the fitting of the crown wheel to its flange. Examine the casing cross-bores for marks caused by rotation of the bearing cups on material trapped between the bearing and its seat.

12.12 Hold the differential case in the vice using soft jaws. Place protective material on top of the vice to prevent damage to the crown wheel teeth.

12.12.1 Remove the crown wheel flange bolts, observing whether any were excessively tight or loose. Note whether the crown gear is an easy fit on its spigot as the screws are released.

12.12.2 Ease the crown wheel evenly away from the flange and complete removal by hand.

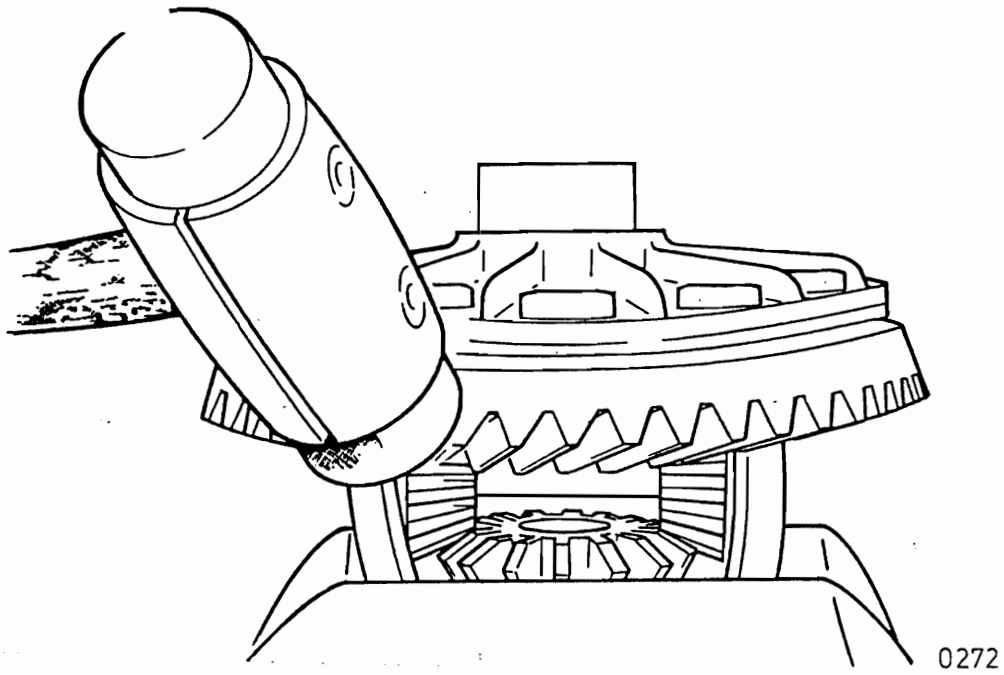

Fig 37 Differential crown wheel removal

12.13 Use a pin punch to remove the differential shaft lock-pin.

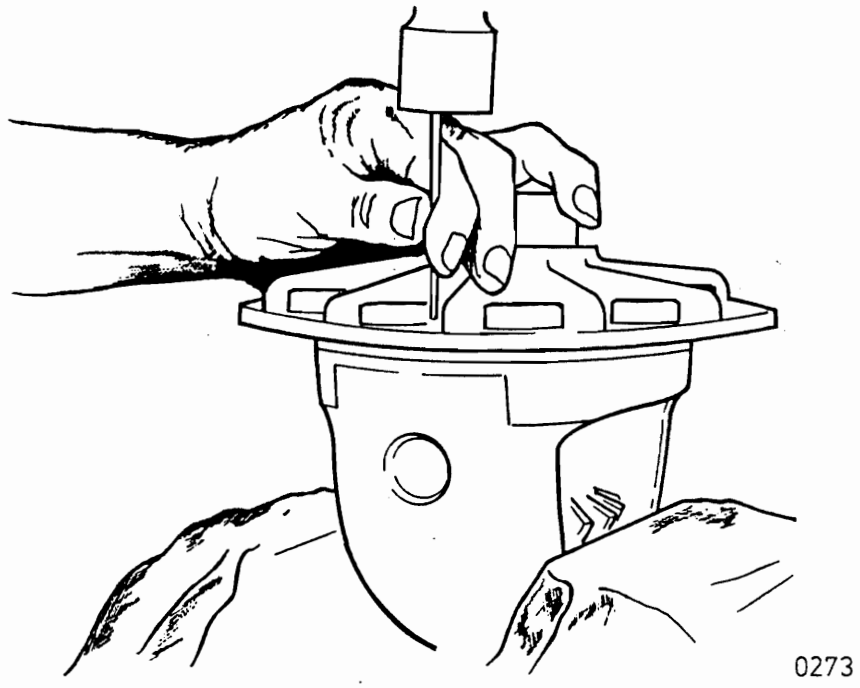

Fig 38 Differential shaft lock-pin removal

12.14 Remove the differential pinion shaft, using a drift if necessary.

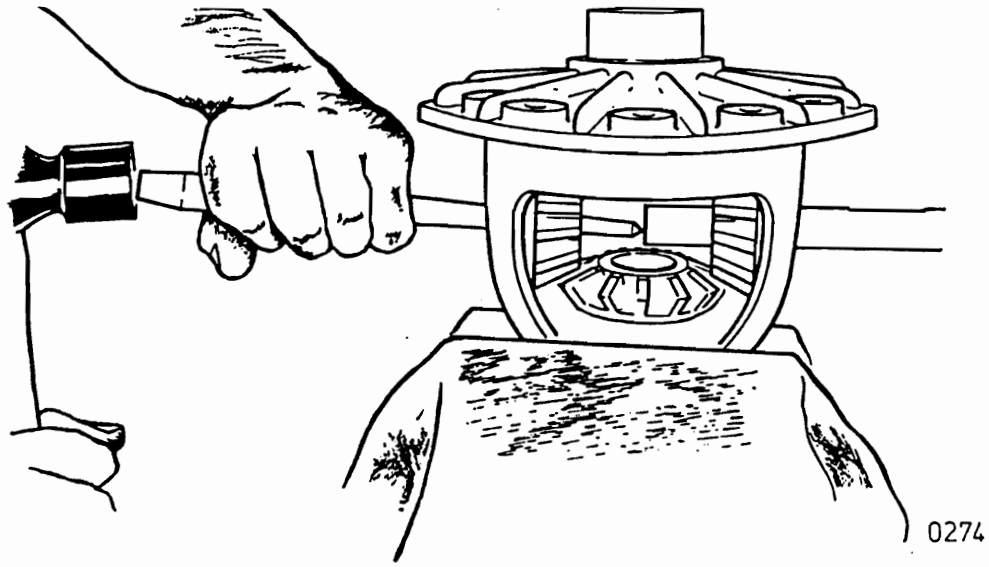

Fig 39 Differential pinion shaft removal

12.15 Rotate the differential pinion together to position the differential gears to the access aperture. Remove the differential gears watching particularly for the spherical seat washers. Remove the differential pinion and their thrust washers.

12.16 Clean and examine all parts noting particularly any localised wear or scuffing marks. Individual parts are not replaced. All parts must be suitable for continued use, or the whole assembly replaced - excepting the crown wheel which is matched to the input pinion.

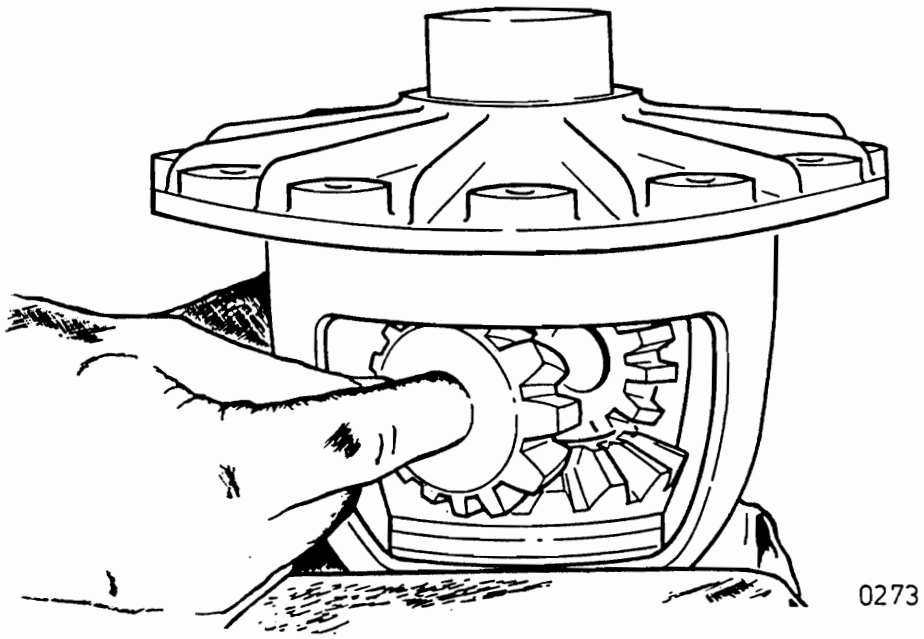

Fig 40 Differential gear removal

12.17 Position the axle case as mounted on the vehicle. Restrain the pinion drive flange with the holder C-3281 (Table 1 item 26) and remove the pinion nut and washer.

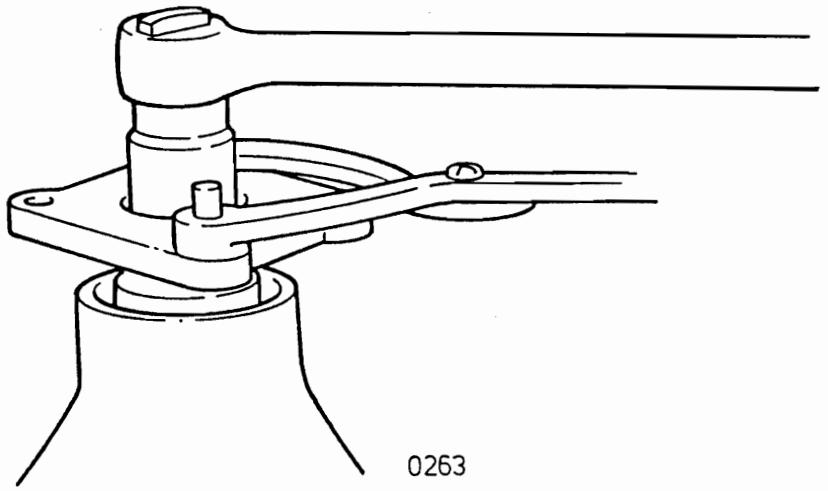

Fig 41 Drive pinion nut removal

12.18 Remove the drive flange using the yoke extractor C-452 with the holder C-3281 (Table 1 items 17 and 26). Examine the oil seal spigot for excessive ridging and replace the flange if there is wear likely to prevent an effective oil seal. Also examine the spline for corrosion wear or fretting.

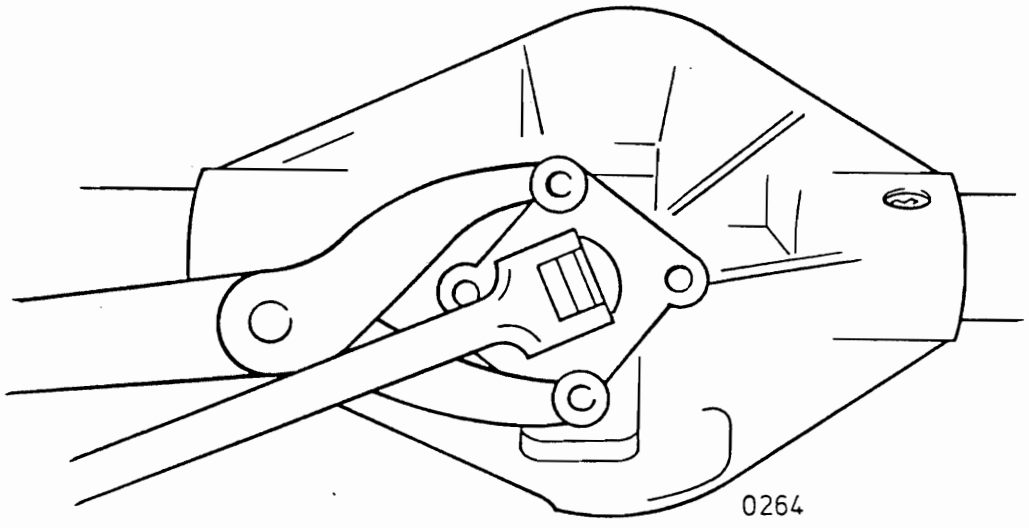

Fig 42 Drive pinion flange removal

12.19 Ease the pinion from its bearings, and remove it carefully from the carrier to prevent damage. Collect any pre-load shims (some may fall free in the carrier).

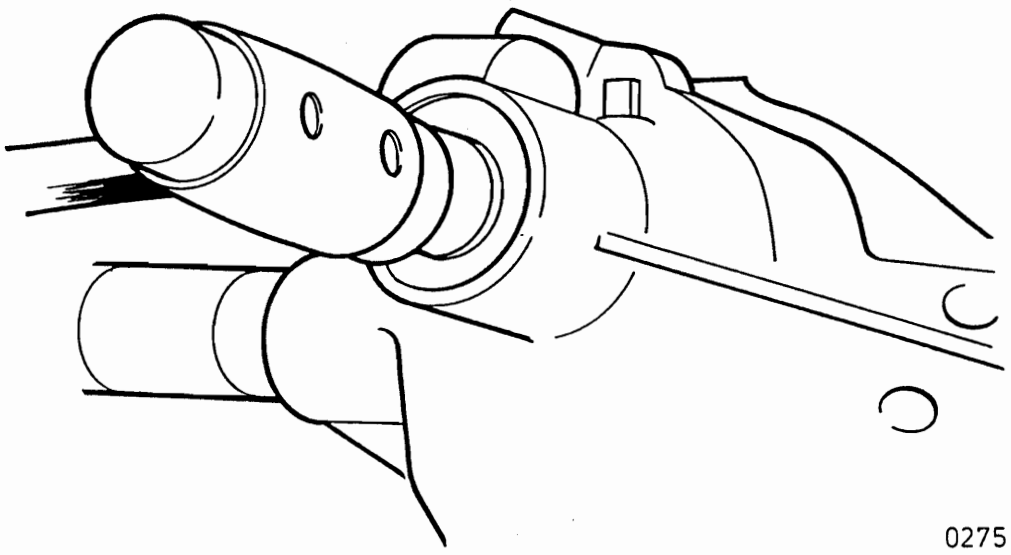

Fig 43 Drive pinion removal

12.20 Remove the oil seal using a slide hammer D-131 (Table 1 item 9). The oil seal should be renewed on re-assembly).

12.21 Remove the bearing cone. Collect all the preload shims and wire them together with the bearing cone.

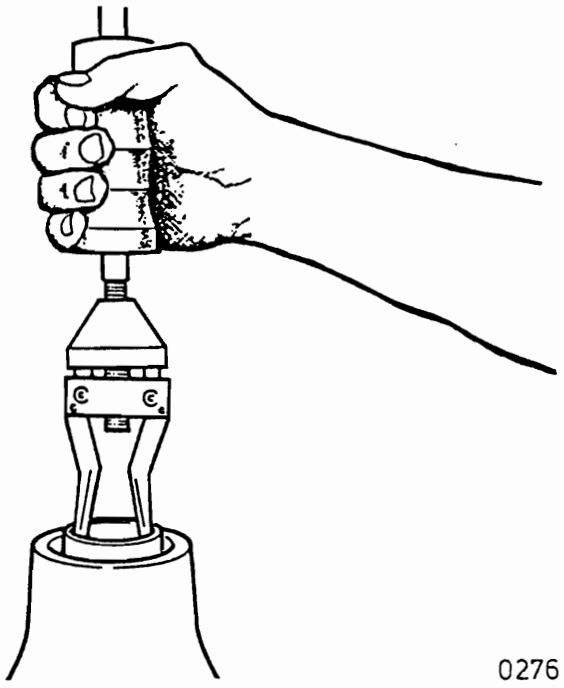

Fig 44 Flange oil seal removal

12.22 Turn the axle case with the carrier aperture uppermost. Using the extractor D-158/C-4171 (Table 1 items 12 and 30), remove the outer pinion bearing cup, taking care not to mark the bearing seat.

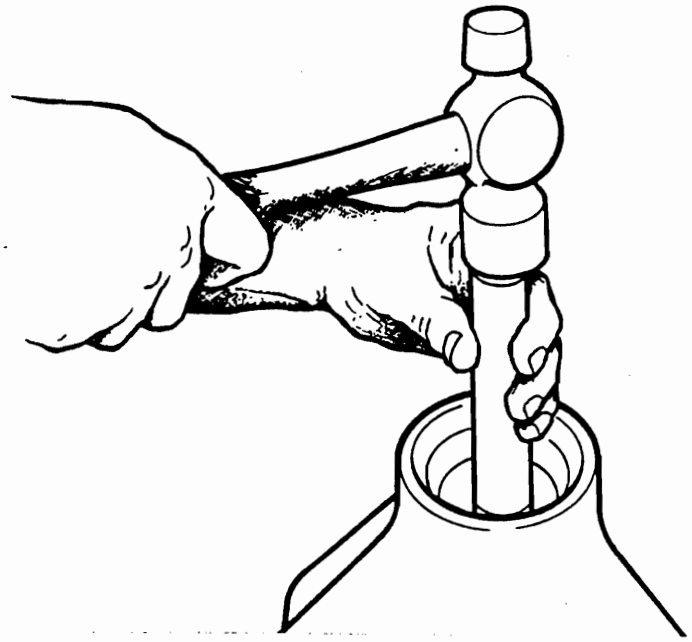

Fig 45 Pinion outer bearing cup removal

12.23 Invert the carrier and use the extractor D-162 (Table 1 item 14)to ease the inner bearing cup from its seat. Remove finally by hand to retrieve the pinion adjustment shims and oil baffle. Collect and wire together.

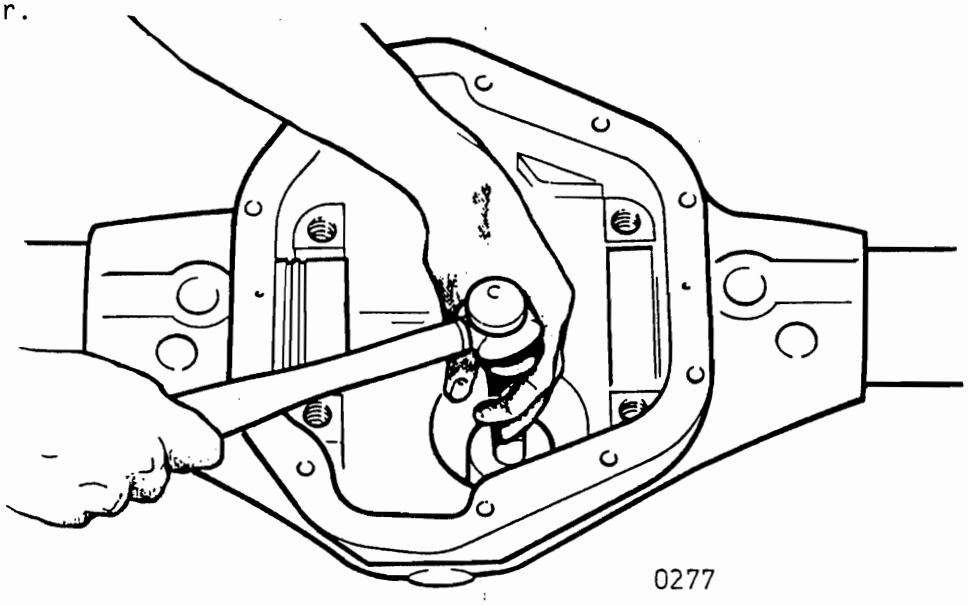

Fig 46 Pinion inner bearing cup removal

12.24 Using press DD-914-P and adapators DD-914-9 and C-293-37 (Table 1 items 18,21,24), remove the pinion bearing cone.

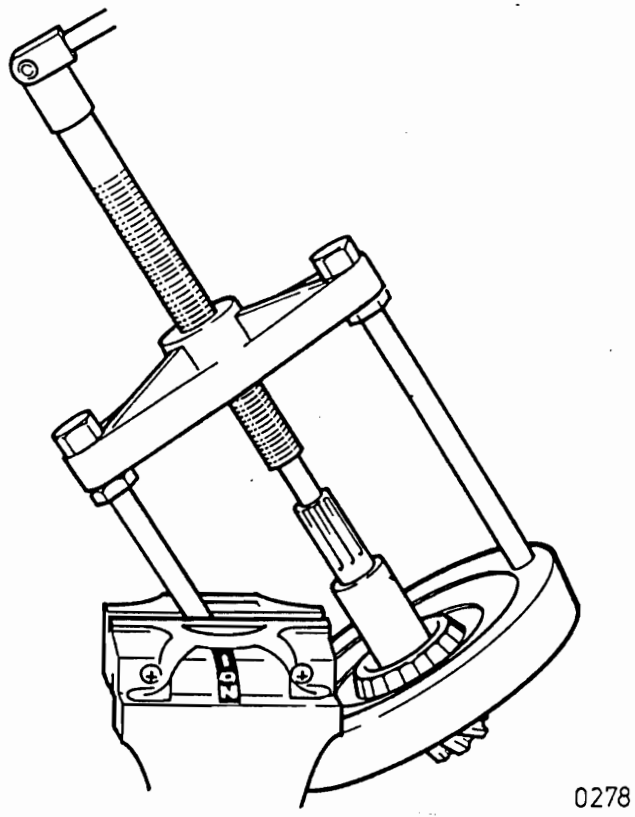

Fig 47 Pinion inner bearing cone removal

12.25 Re-invert the axle casing. Using a long rod through each axle beam, drift out the old oil seal.

Differential gear re-assembly

13 Using the installers D-195 (Table 1 items 28 and 29), assemble the inner axle shaft seals and guides. Enter the seals so that they are correctly aligned and not canted to one side. Extend the adjusting screw until the seals are fully seated. Grease the lips of the seals using XG279 grease.

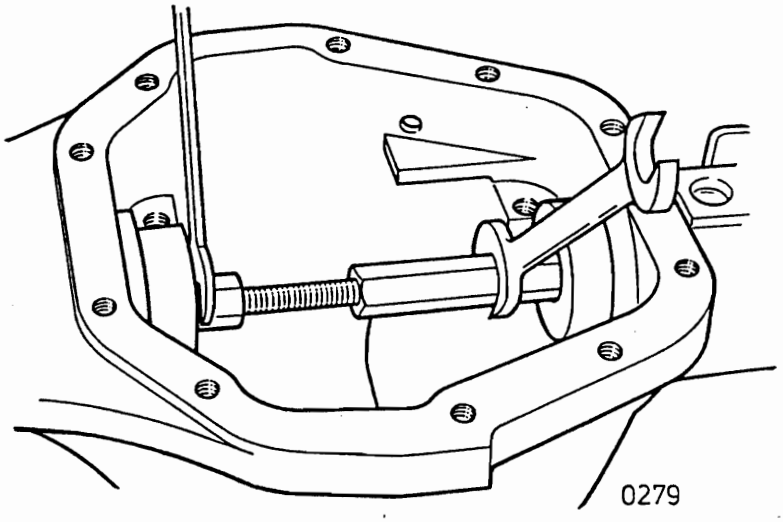

Fig 48 Carrier oil seals assembly

13.1 If the differential is to be replaced as an assembly proceed to Para 13.4.

13.1.1 If the differential assembly has been dismantled, apply a thin film of XG279 grease to the journals of the differential gears and their thrust washers and pair together. Apply a thin film of grease between the mating faces of the differential pinions and their spherical washers and pair together. Grease the spherical thrust faces inside the differential case at the differential shaft holes.

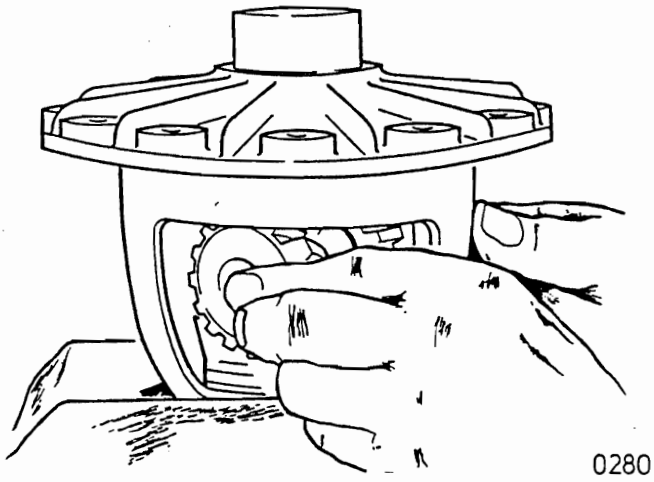

Fig 49 Differential gear assembly

13.1.2 Place the case in a vice fitted with soft jaws. Fit the lower differential gear into the case. Fit the upper differential gear into the case, then holding it in position through one aperture, place a pinion between the two differential gears through the other aperture. Place the other pinion between the two differential gears on the opposite side. Rotate the upper differential gear and manipulate the two pinions into line with their mating shaft holes, ensuring the two spherical thrust washers remain in place.

13.2.3 Align the pinions onto their mating shaft holes. Lightly grease the differential shaft and enter into the shaft hole on the lock-pin side of the case, with the cross-hole in the shaft furthest from the case and aligned with the lock-pin hole in the case.

13.2 Push the differential shaft through the case, making sure the thrust washers and pinions are aligned as they are entered by the shaft.

13.2.1 Before the shaft cross-hole enters the case, make sure it is aligned with its mating hole in the case.

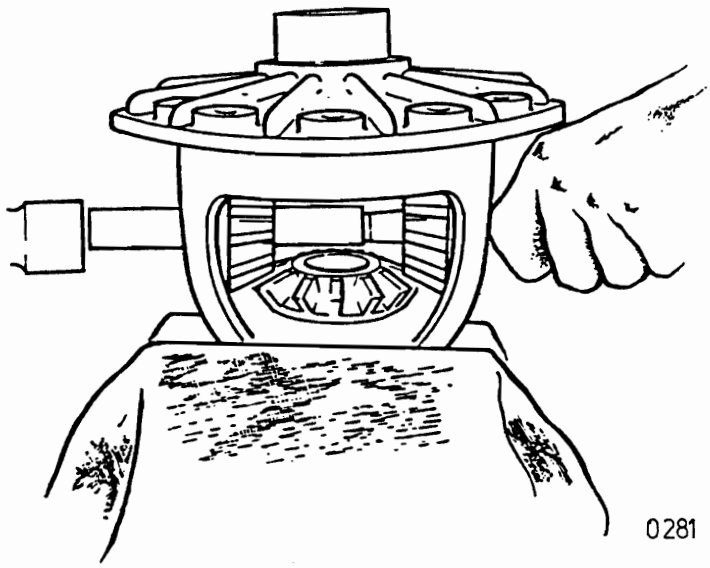

Fig 50 Differential gear shaft assembly

13.3 Invert the differential gear case and assemble the lock pin. Peen over the end of the pin hole sufficient to assist retention.

13.3.1 Assemble the crown wheel onto its spigot, with the fixing holes aligned on the flange. Make sure the mating faces are closed up evenly.

13.3.2 Remove the assembly from the vice and fit two fixing bolts through the crown wheel and close up finger tight.

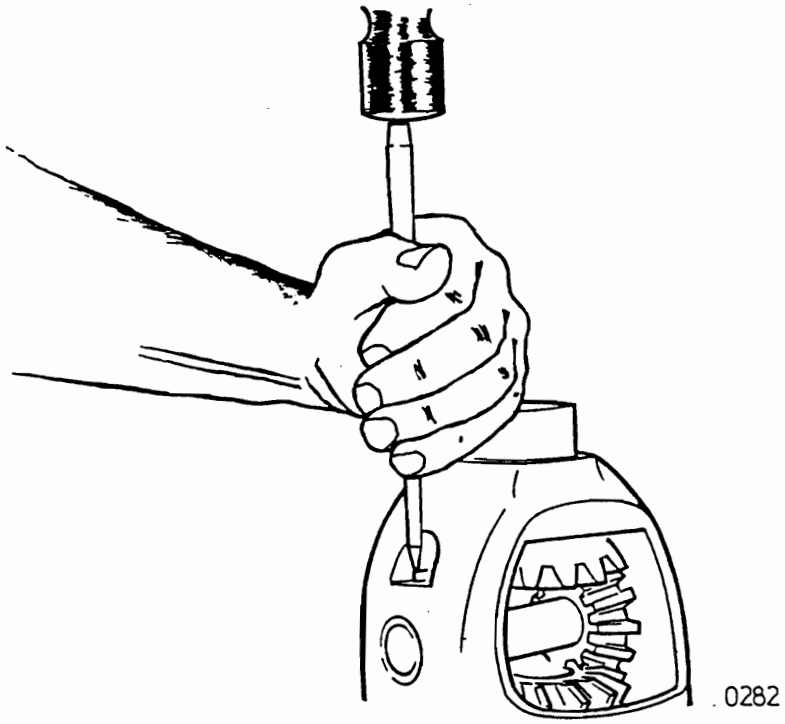

Fig 51 Differential gear shaft lock-pin assembly

13.4 Using soft jaws in the vice, grip the casting of the differential case and fit the remaining fixing bolts of the crown wheel. Tighten the bolts evenly by diagonal selection, to a torque of 136-163 Nm (100-120 lbf.ft).

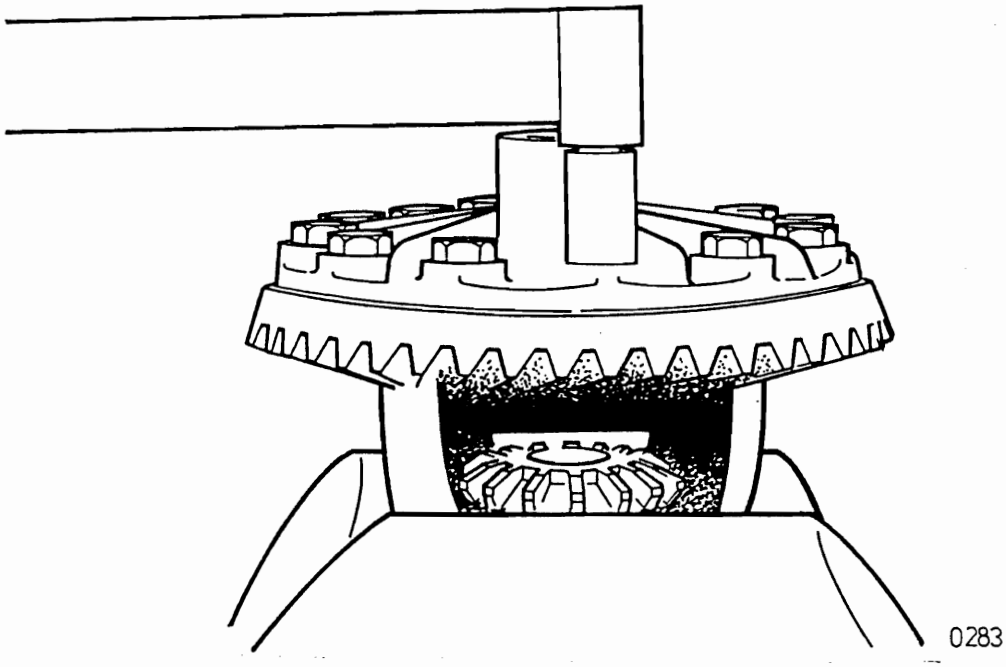

Fig 52 Crown wheel assembly

13.5 Remove the assembly from the vice and examine the differential case trunnions. Ensure they are free of burrs and bruises, then fit the master bearings D-117 (Table 1 item 6).

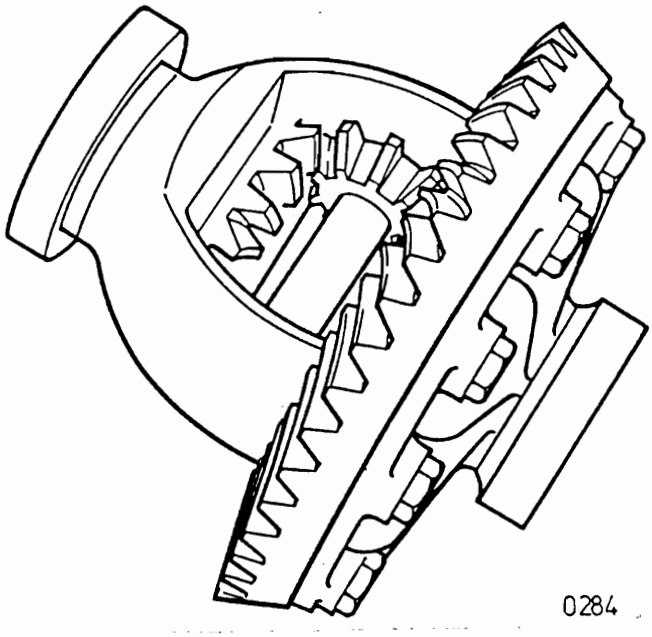

Fig 53 Differential/master bearings assembly

13.6 Fit the differential assembly (less pinion) but with master bearings into the differential casing.

13.6.1 Position magnetic base of the dial indicator D128 (Table 1 item 8) on to the machined face of the carrier aperture (Fig 53).

13.6.2 Locate tip of indicator on one of the crown wheel screw spot faces. Mark this position with a piece of chalk.

13.6.3 Push the crown wheel towards the indicator and with the force still applied set the indicator to zero.

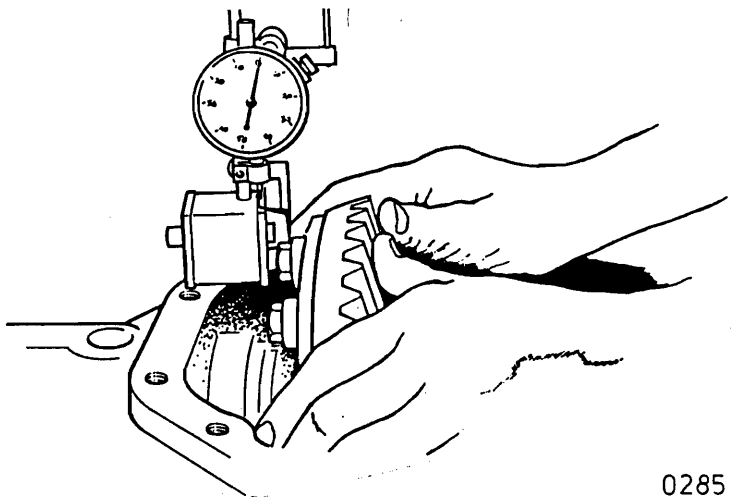

Fig 54 Crown wheel end-float datum

13.7 Push the crown wheel away from the dial indicator and record the reading, which is the dimension of the end-float. Repeat if necessary to ensure a stable and repeatable reading. Record the value. This will be the total amount of shims required (less the preload)

13.7.1 Remove the differential assembly from the carrier but retain the master bearings in-situ.

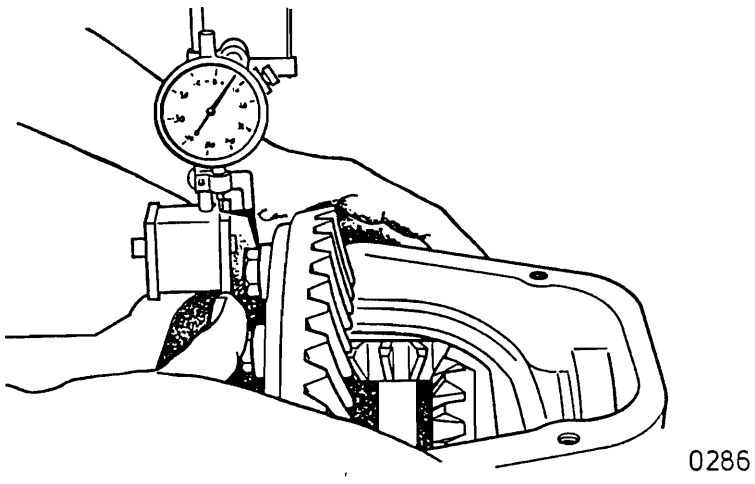

Fig 55 Crown wheel end-float measurement

Differential pinion re-assembly

14 Crown wheels and pinions are only supplied as matched pairs. Matching numbers are etched on both for identification. (This should be verified for every pair).

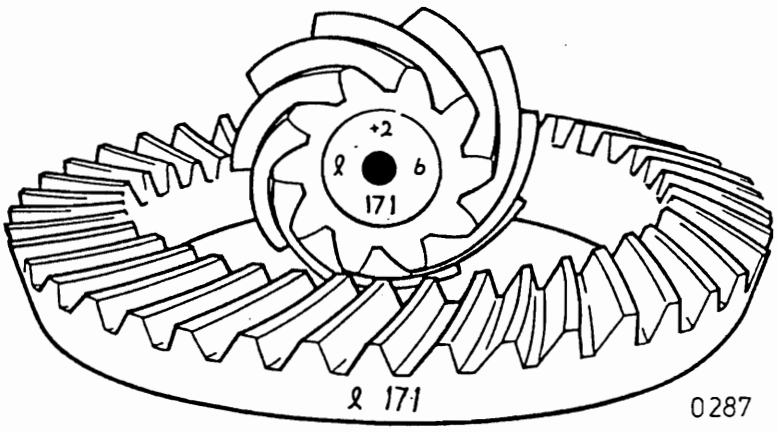

Fig 56 Crown wheel and pinion engraving

14.1 The pinion has a ground face (button) which is used for the engraved marks. When the gear and pinion are properly meshed, with their pitch circles coincident, the dimension from the axial centre line of the crown wheel to the button of the pinion is 3.125in. The + or - number (0 to 4 inclusive) on the button face relates to the manufacturing tolerance with respect to the 3.125in dimension. A pinion which is + 2 should have the button face set to 3.127in from the crown gear centre. Conversely, for -3 it should be set to 3.122in.

14.2 To compensate for manufacturing tolerances which accumulate in the assembly, a four stage compensation technique is used :

14.2.1 Position the pinion correctly.

14.2.2 Preload the pinion bearing.

14.2.3 Position the crown wheel to give correct backlash.

14.2.4 Preload the differential bearings.

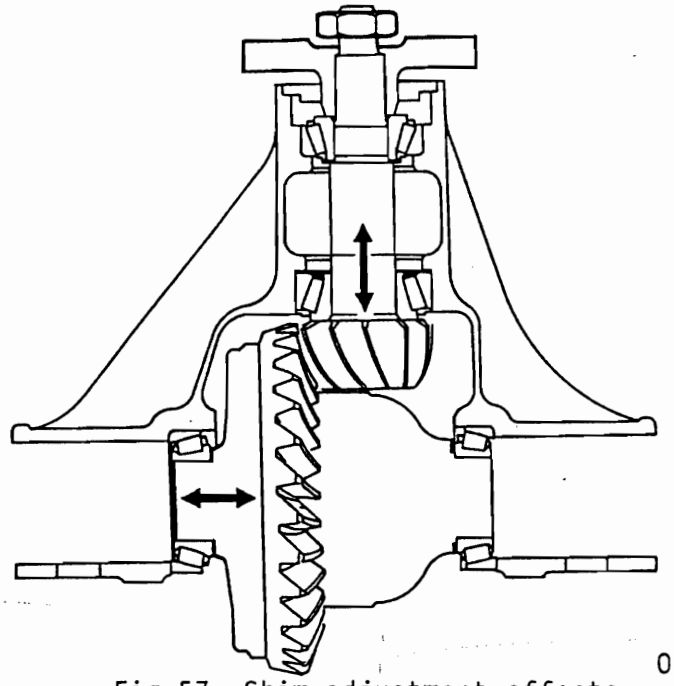

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Fig 57 Shim adjustment effects

14.3 Positioning the pinion relative to its inner bearing determines everything that follows in the assembly sequence. This can be achieved in two ways :

14.3.1 Shim manipulation (see para 14 to para 14.8).

14.3.2 Measurement (see para 14.9 to para 14.13.2).

14.4 To replace a pinion without measurement of its position, it is necessary to know two dimensions.

14.4.1 The thickness of adjustment shims, including the oil baffle, for the old pinion.

14.4.2 The difference between the old and new pinions.

14.5 Clean and visually examine the adjustment shims and baffle removed in Para 12.23, measure and record their individual thickness.

14.6 Examine the engraving on the old and new pinion. If the old pinion is +2 then its dimension is 3.125 + 2 = 3.127in. If the new pinion is -3, its dimension is 3.122in. This means that to move the pinion face from 3.127in to 3.122in it has to move nearer (by 0.005in) therefore a 0.005in shim will have to be added behind the pinion to push it out.

14.7 If the old pinion is -1 (3.125in - 0.001in = 3.124in) and the new pinion is +2 (3.125in + 0.002in = 3.127in), this means that the pinion face must move from 3.124in to 3.127in and 0.003in must be removed from the shims to allow the pinion face to move away to the larger distance from the crown gear centre.

Examples

Old pinion	+ 2 therefore distance	3.127	A
New pinion	- 3 therefore distance	3.122	B
		0.005	(A-B)

Add 0.005in shim to move the new pinion nearer the centre, from old position of 3.127 in to the new distance of 3.122in.

Old pinion	- 1 therefore distance	3.124	A
New pinion	+ 2 therefore distance	3.127	B

Since B is greater

3.127	B
3.124	A
0.003	(B-A)

Remove 0.003in shim to move away from old position of 3.124in to new distance of 3.127in.

14.8 When the shim and oil baffle thickness has been determined, replace any damaged components when making up the set.

14.9 To fit a new pinion by measurement, make sure that all bearing seats are clean and free from damage which would give an incorrect register.

14.9.1 Fit the master pinion block D-120 (Table 1 item 7) into the carrier bore.

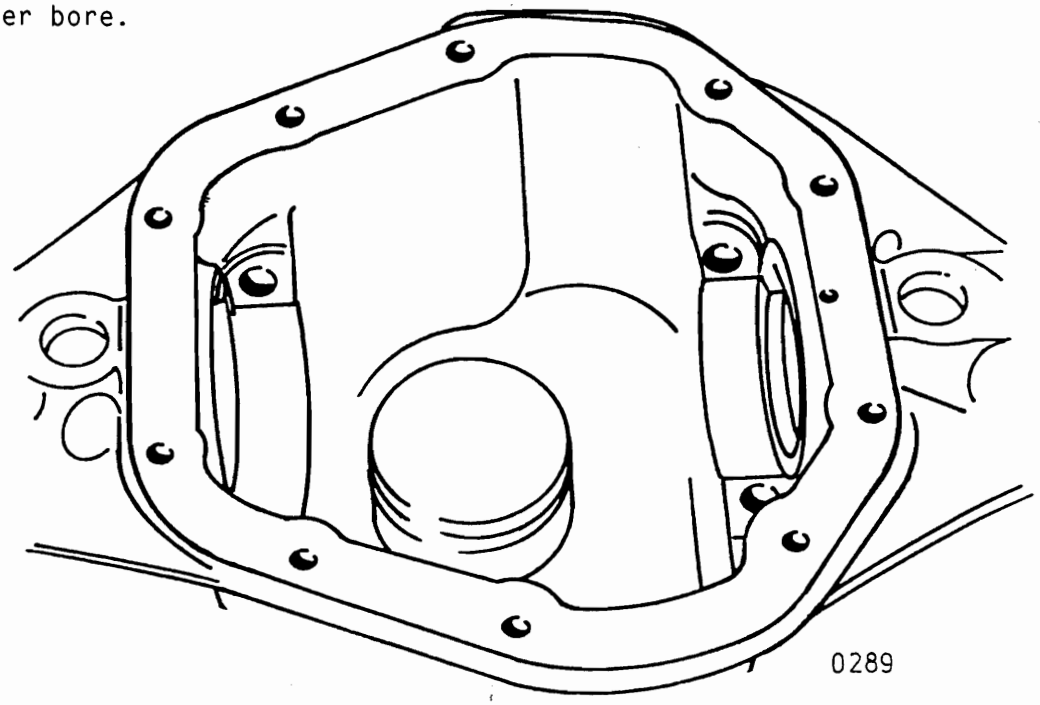

Fig 58 Master pinion gauge block location

14.10 Place the master discs D-116-2 onto the arbor D-115-3 (Table 1 items 3 and 6) and fit them to the carrier cross bores.

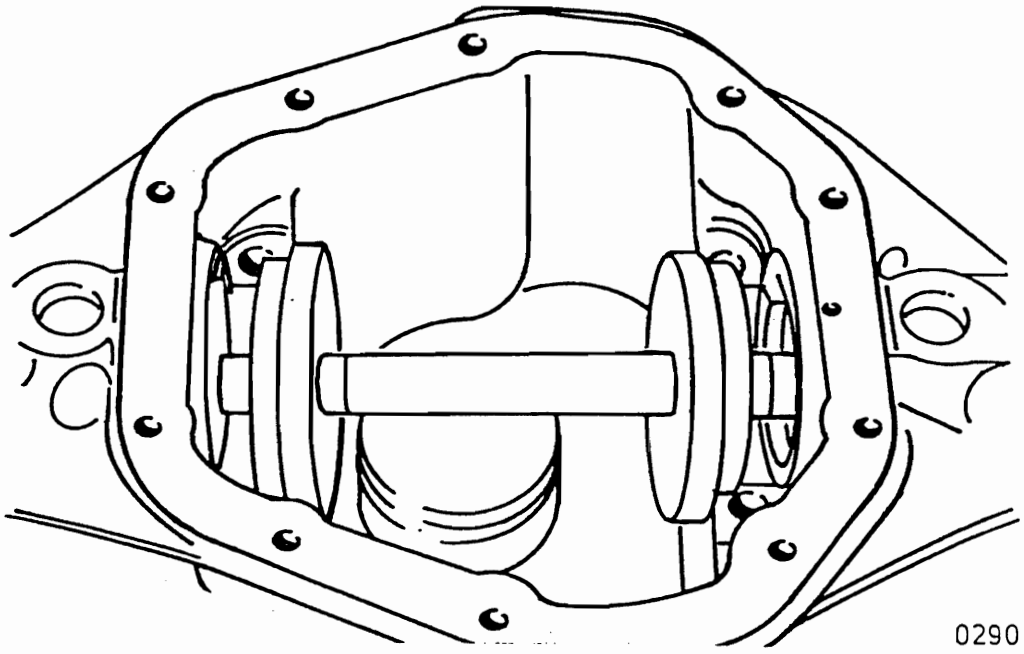

Fig 59 Cross bore bearing discs and arbor location

14.11 Place the pinion height block D-116-1 (Table 1 item 3) on the master pinion block aligned with the arbor.

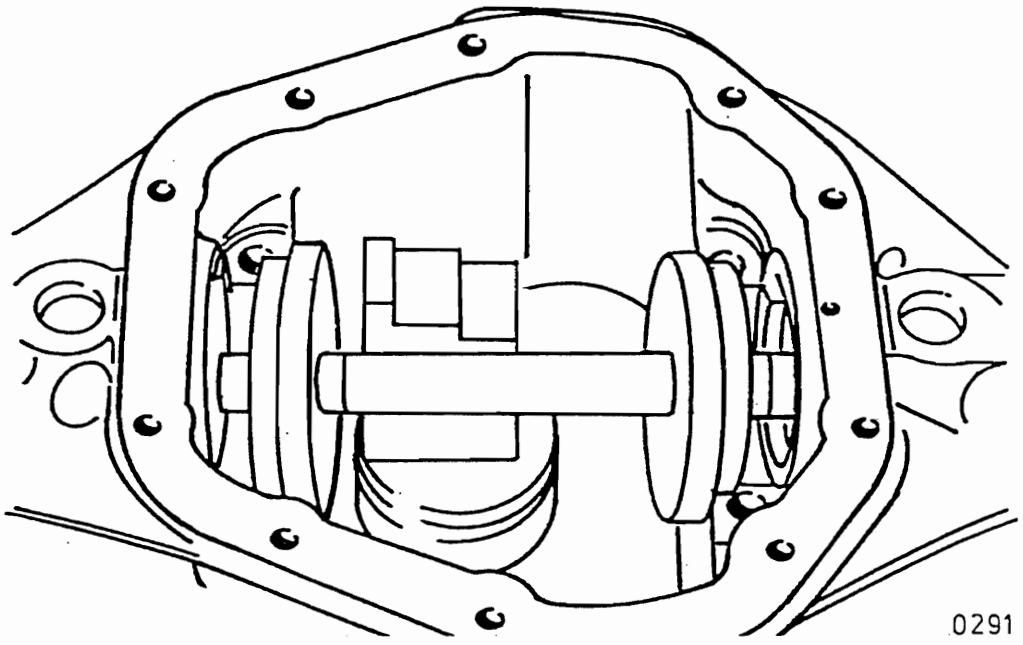

Fig 60 Pinion height block location

14.12 Place the height gauge D-115 (Table 1 item 2) on the lower step of the pinion height block. Press the indicator base and stylus flat against the height block, then set the indicator to zero.

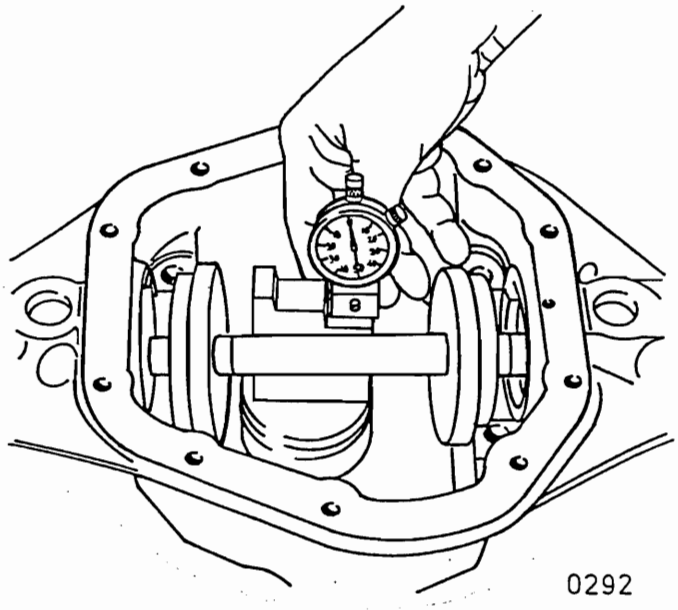

Fig 61 Height gauge datum

14.13 Slide the height gauge over the arbor and find the point of maximum deflection with the height gauge held firmly on the height block.

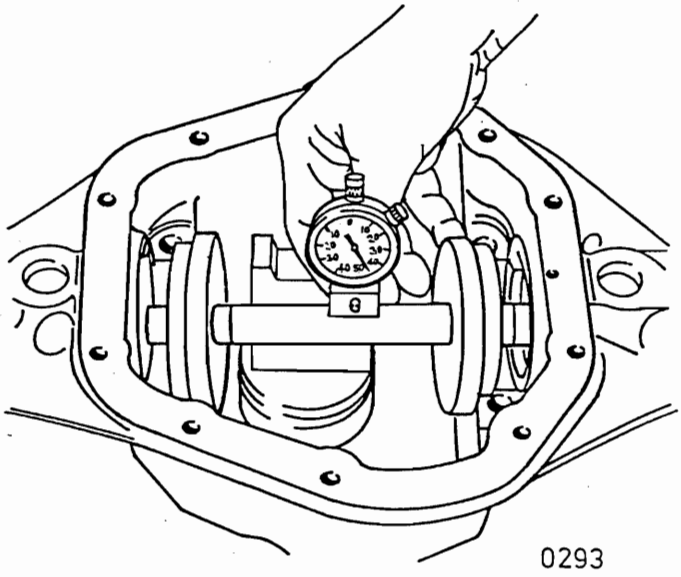

Fig 62 Pinion height datum

14.13.1 The reading indicates the shimpack needed (including baffle) if the pinion engraving is zero. As before, if the pinion is engraved +3, this indicates the gear centre/pinion distance is 3.125in + 0.003in and needs to be 0.003in further away, therefore requiring 0.003in shims to be taken out. Conversely, -2 indicates 0.002in shim to be added to position the pinion 0.002in nearer.

14.13.2 Most shim adjustments will be determined by the thinnest shim being 0.003", hence nearest correction is +/- 0.002" (see Para 14.20.1).

14.13.3 The total shim pack can be determined by micrometer, though the oil baffle has to be included as a shim.

14.14 The oil baffle should be placed in the pinion inner bearing seat (dished side inwards) followed by the pinion shims. Fit the inner bearing cup using the installing tool D-111 and handle C-4171 (Table 1 items 1 and 30). Ensure the cup enters evenly and is fully seated.

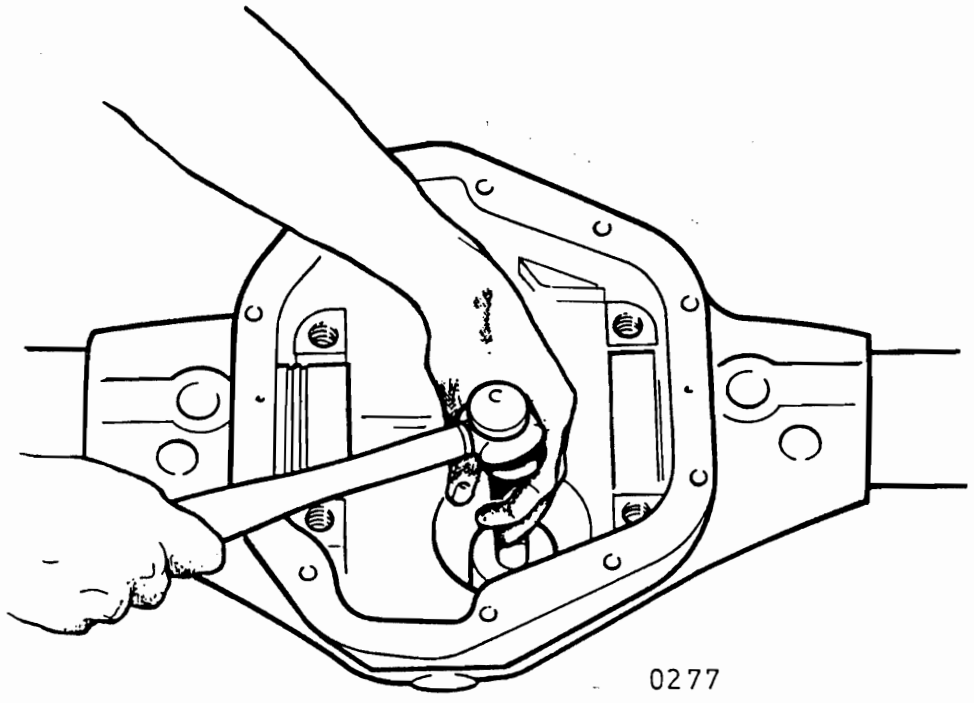

Fig 63 Pinion inner bearing cup assembly

14.15 Invert the carrier and assemble the outer pinion bearing cup using the installing tool C-4203 and handle C-4171 (Table 1 items 30 and 31).

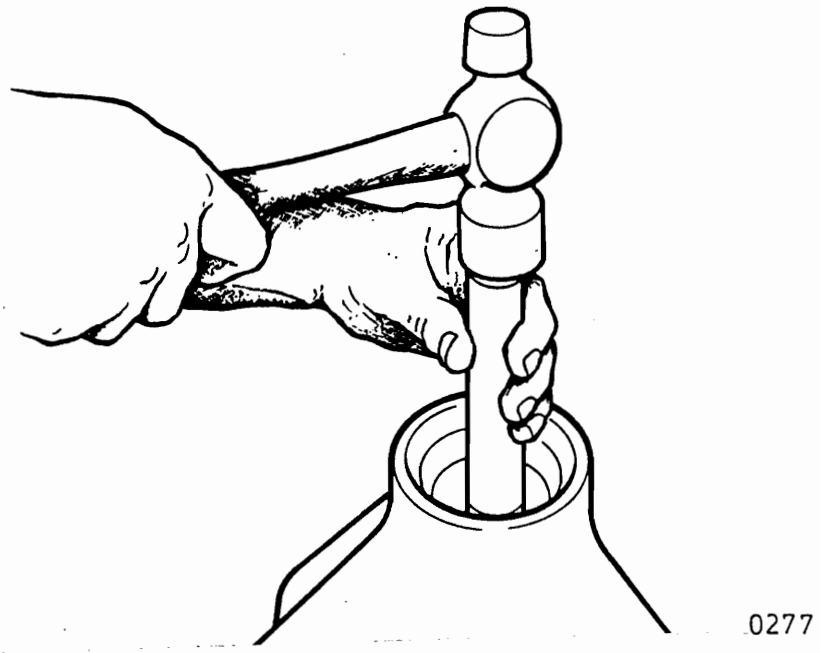

Fig 64 Pinion outer bearing cup assembly

14.16 Use the installer C-3095-A (Table 1 item 25) and fit the inner bearing cone to the pinion shaft, ensuring that it is evenly mated and properly seated.

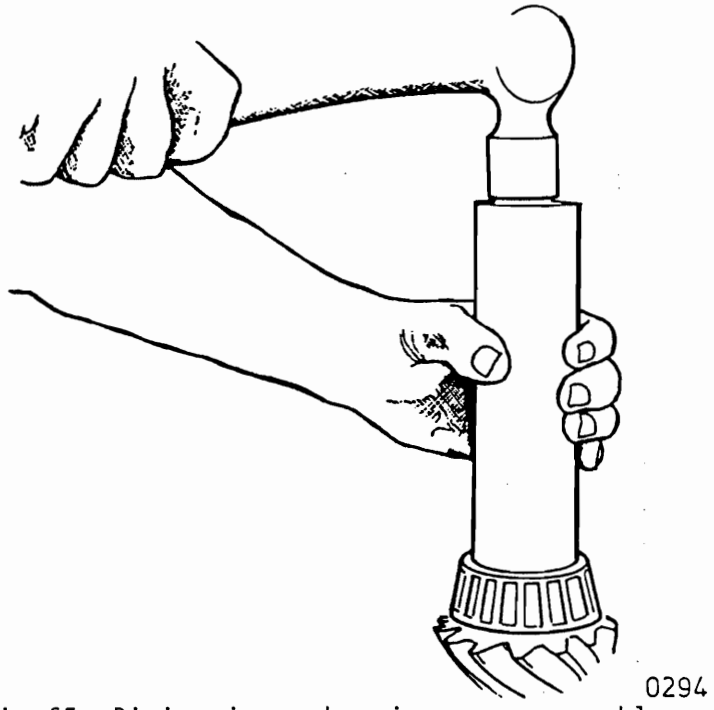

Fig 65 Pinion inner bearing cone assembly

14.17 Assemble the pinion into the carrier with the pinion bearing cone (omit shims etc. at this point). Fit the drive flange, nut and washer, use the installer C-3718 and holder C-3281 (Table 1 items 26 and 32) to tighten the nut.

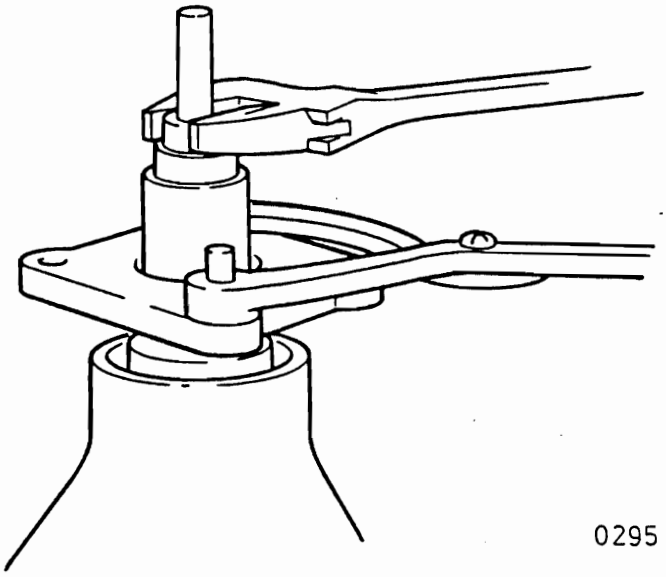

Fig 65 Pinion re-assembly

14.18 Rotate the pinion occasionally during Para 14.17 and tighten the nut until a turning torque of 1.13 Nm (10 lbf.in) is indicated for the pinion using a torque wrench.

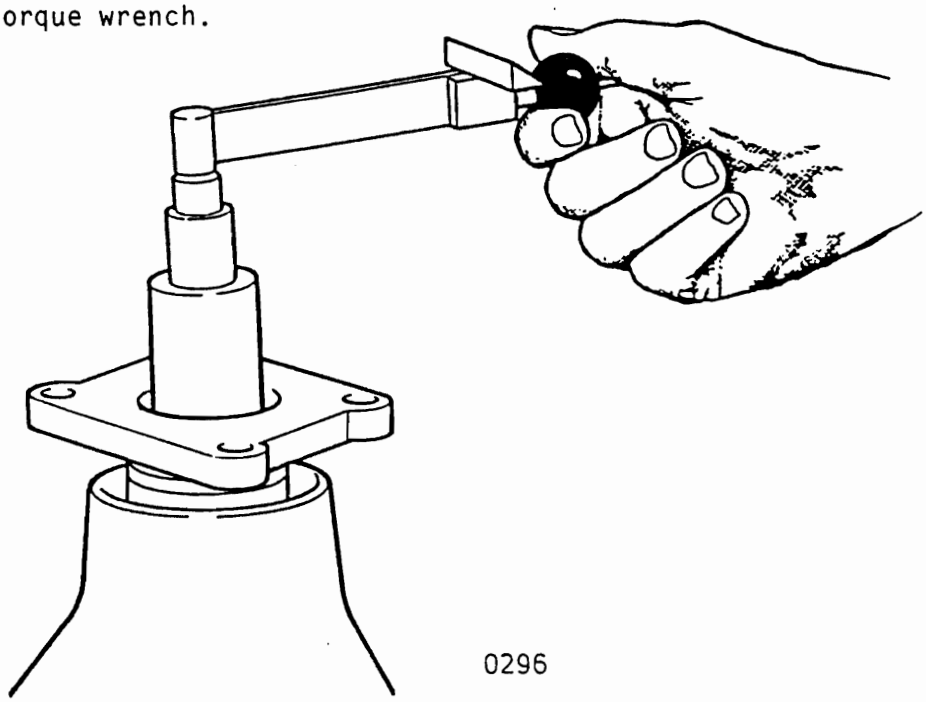

Fig 67 Pinion bearings applied load

14.19 Reposition the carrier and fit the arbor and discs into the carrier cross bore as in Para 14.10. Set the pinion height block on the ground face of the pinion and check the arbor height with respect to the block as in Para 14.12 and 14.13.1. An indicator reading within +/- 0.002in of that etched on the pinion is satisfactory. Otherwise, it is necessary to remove the pinion and inner bearing cup to make the necessary adjustment of the shim pack.

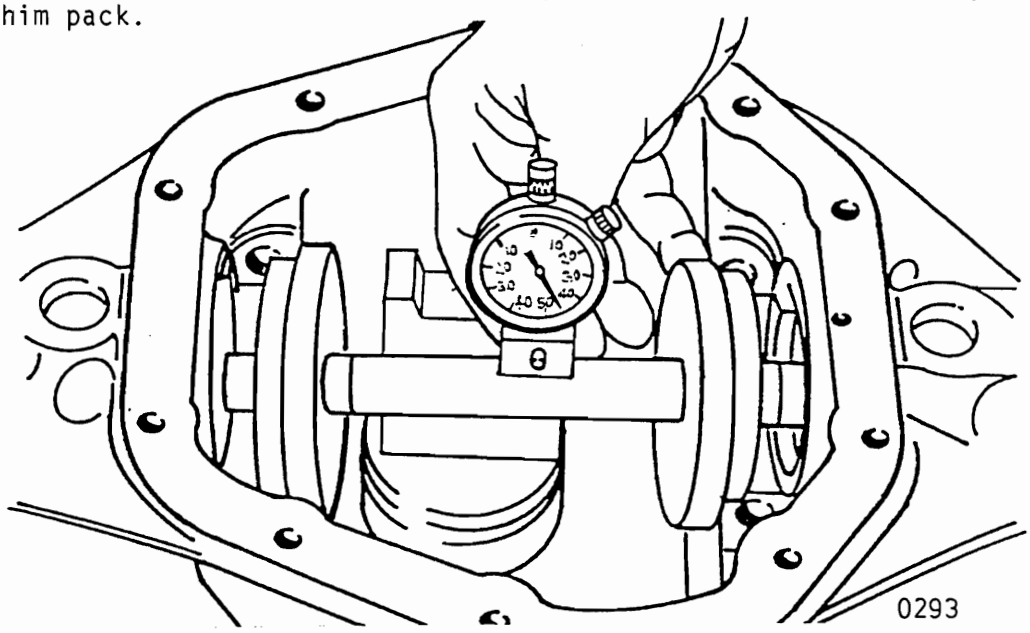

Fig 68 Pinion height adjustment

14.20 Re-invert the carrier and remove the pinion nut, yoke and outer bearing cone. Fit the preload shims (removed in Para 12.19 and 12.21) to the pinion shaft. Assemble the bearing cone, slinger, drive flange and nut. Using a flange holder C-3281 (Table 1 item 26) and torque wrench (see Para 15.1), tighten the flange nut to 325-406 Nm (240-300 lbf.ft). Using the torque wrench, verify the pinion rotation torque is 4 +/-1Nm (30 +/- 10 lbf.in).

14.20.1 Remove shims to increase the preload or add to decrease, and set within the specified torque.

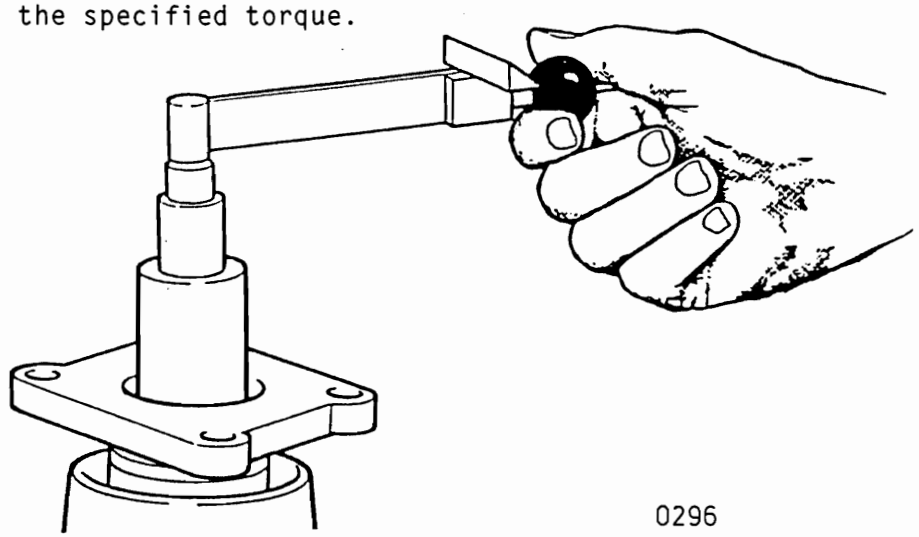

Fig 69 Pinion bearing preload adjustment

14.21 Remove the drive flange. Apply a film of hypoid lubricant to the lip of a new pinion flange oil seal and place in its seat in the carrier. Using a C-4171 installer D-163 and handle C-4171 (Table 1 items 15 and 30), close the seal onto its seat.

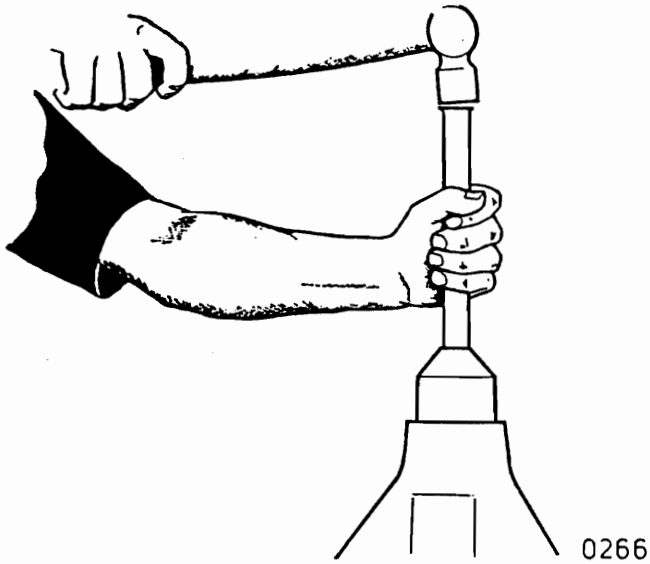

Fig 70 Flange oil seal assembly

14.22 Assemble the drive flange, washer and new pinion nut. Tighten the nut to 325-406 Nm (240-300 lbf.ft) as in Para 14.20

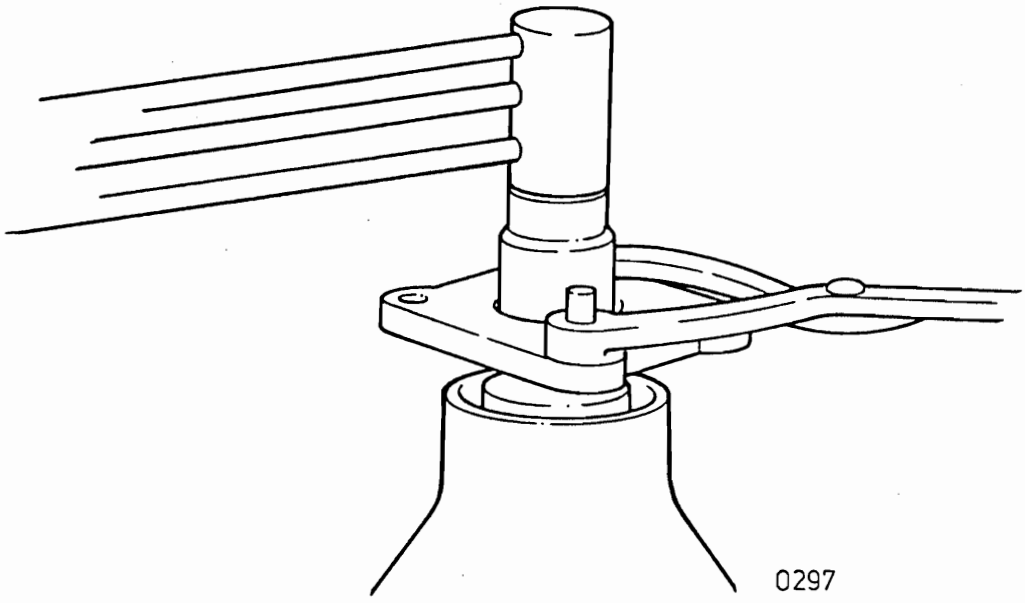

Fig 71 Pinion drive flange assembly

Differential drive assembly

15 Invert the carrier. Place the differential assembly with master bearings (from Para 13.7.1) into the carrier, being careful to mesh the crown wheel and pinion without bruising or scoring the teeth.

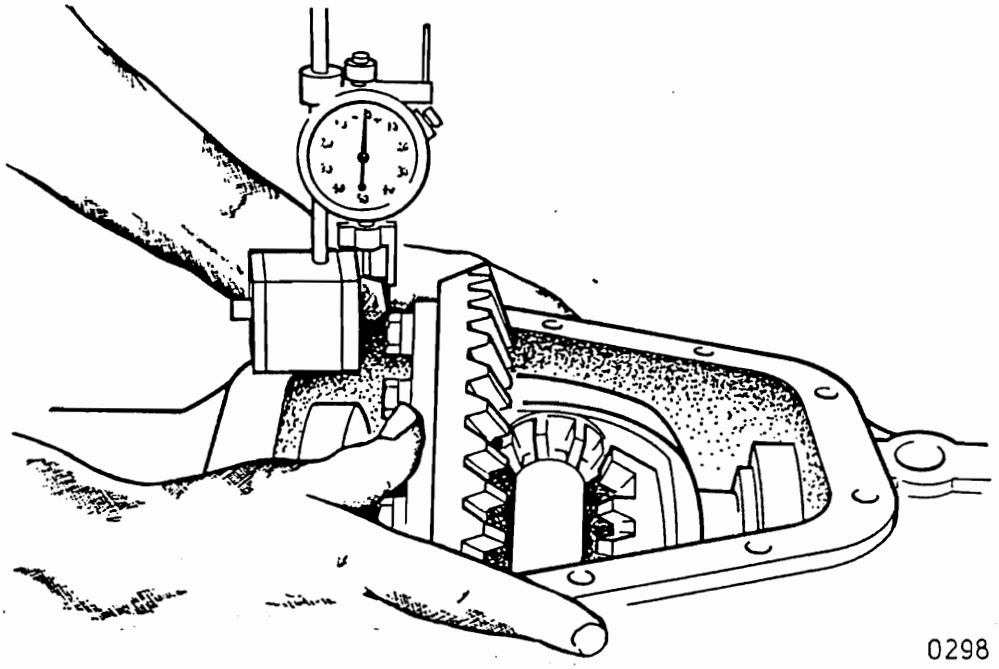

Fig 72 Crown wheel location datum

Set up the dial indicator and measure the backlash as in Para 13.6, making sure the teeth are fully meshed when pressing the crown gear towards the pinion. Using the same measuring position as in Para 13.6, set the D-128 indicator (Table 1 item 8) to zero (Fig 71).

15.1 Press the ring gear away from the pinion and note the deflection from the Para 15 position (Fig 72).

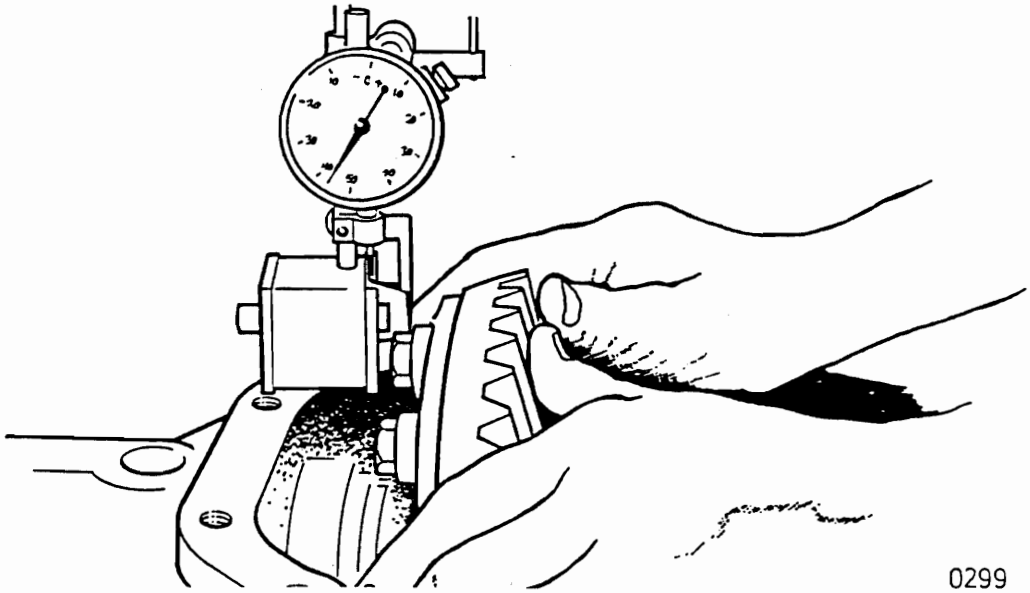

Fig 73 Crown wheel end-float measurement

Repeat if necessary as in Para 13.7 and obtain a confirmed reading. This is the thickness of backlash shim to be used with the differential case bearing. Record its value.

15.2 Remove the dial indicator. Remove the differential assembly from the carrier. Return the master differential case bearings to normal safe keeping. The differential case should be fitted with new bearings. In this event, retrieve the shims collected in Para 12.10 and discard the cups and cones. Select and fit a backlash shim pack, equal to that determined in Para 15.1, under a new bearing cone fitted to the differential case trunnion on the crown wheel side. Using a installer C-4025-A and handle C-4171 (Table 1 items 27 and 30), close the bearing cone evenly onto its seat.

15.3 Using the dimension recorded in Para 13.7.1, add 0.015in to this dimension, then subtract the dimension recorded in Para 15.1. This is the thickness of preload shim. Add shims of this thickness to the other differential case trunnion, then fit a new bearing cone as in Fig.74.

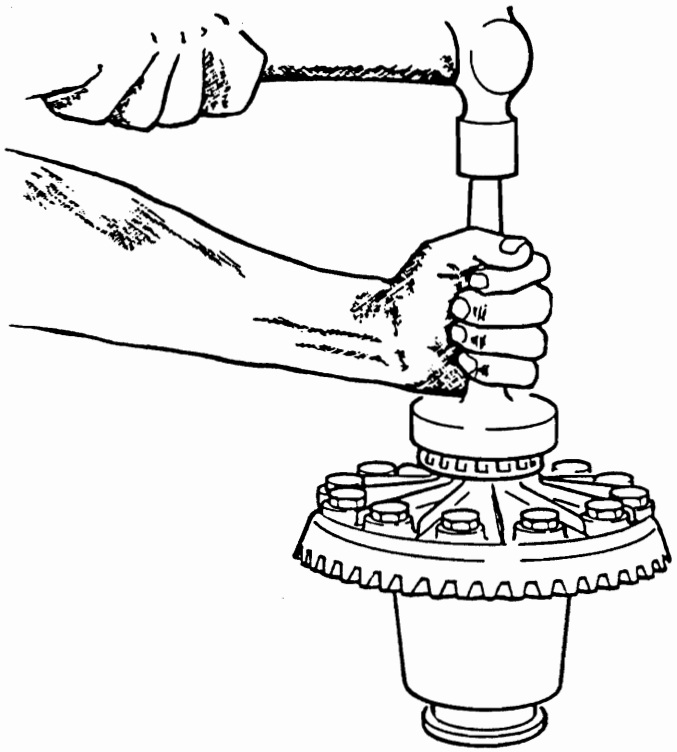

Fig 74 Differential case bearing assembly

15.4 Using the method of Para 12.8, use the spreader D-167 and dial indicator D-128 (Table 1 items 16 and 8) to stretch the carrier aperture. Remove the dial indicator.

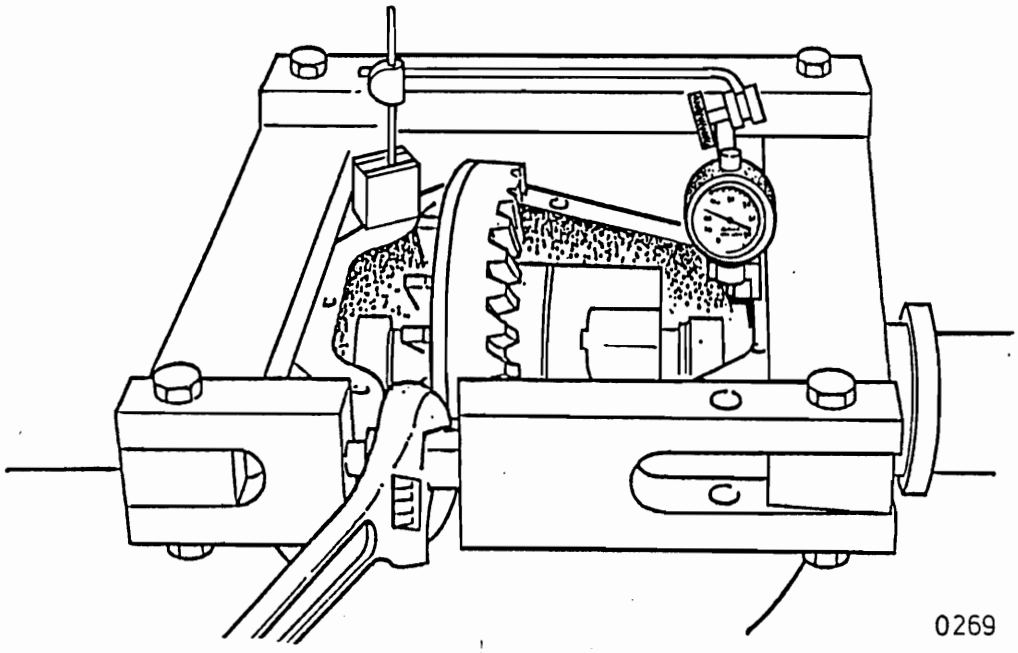

Fig 75 Differential carrier expansion

15.5 Fit the cups to the differential bearing cones and install the differential assembly into the carrier, carefully meshing the crown wheel and pinion. A raw hide mallet may be used to ensure the bearings are properly seated. Remove the spreader.

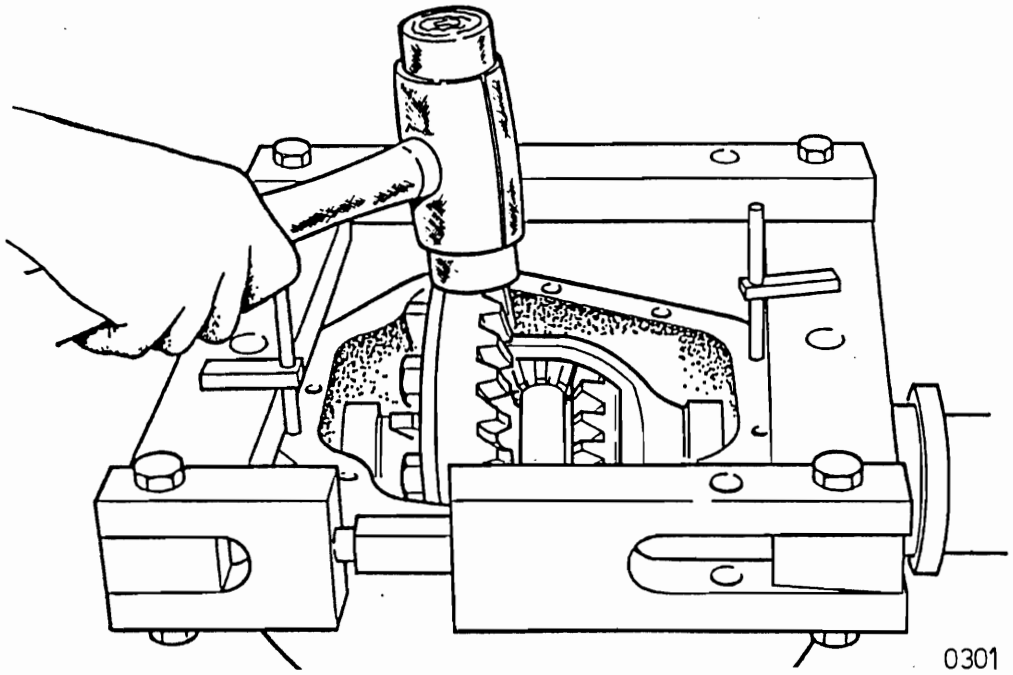

Fig 76 Differential assembly installation

15.6 Install the bearing caps, making sure that they are fitted to the alignments noted in Para 12.7. Using a torque wrench, tighten the cap screws to 95-122 Nm (70-90 lbf.ft).

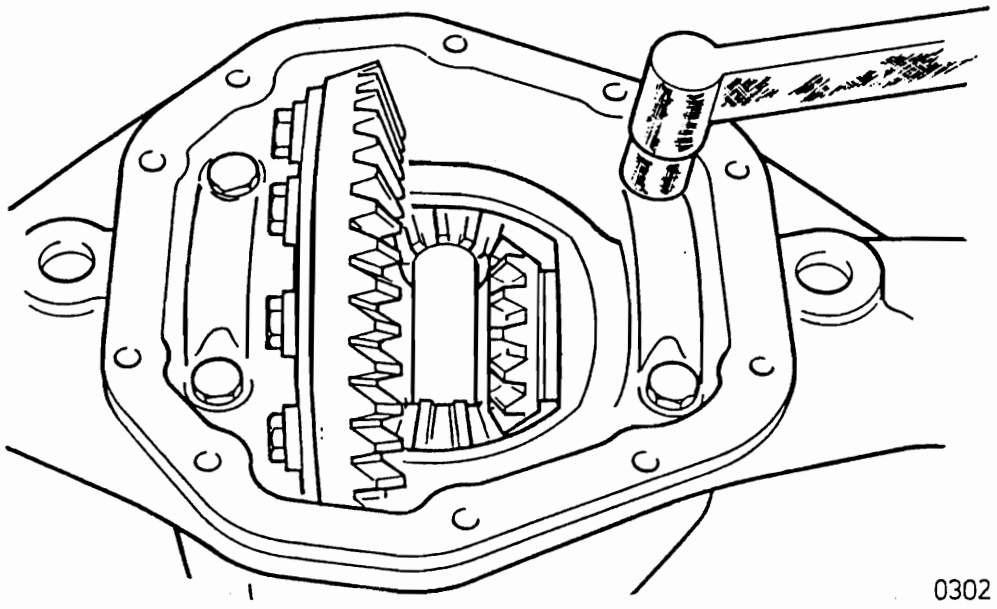

Fig 77 Differential bearing cap assembly

15.7 Verify the setting of Para 15.2 by using a dial indicator to the crown wheel teeth. Using 4 equispaced points around the gear, check that the backlash is between the limits 0.004in min. to 0.009in max. with not greater than 0.002in variation. Transfer shims as in Para 14.20 to correct the backlash, but total shims must remain the same.

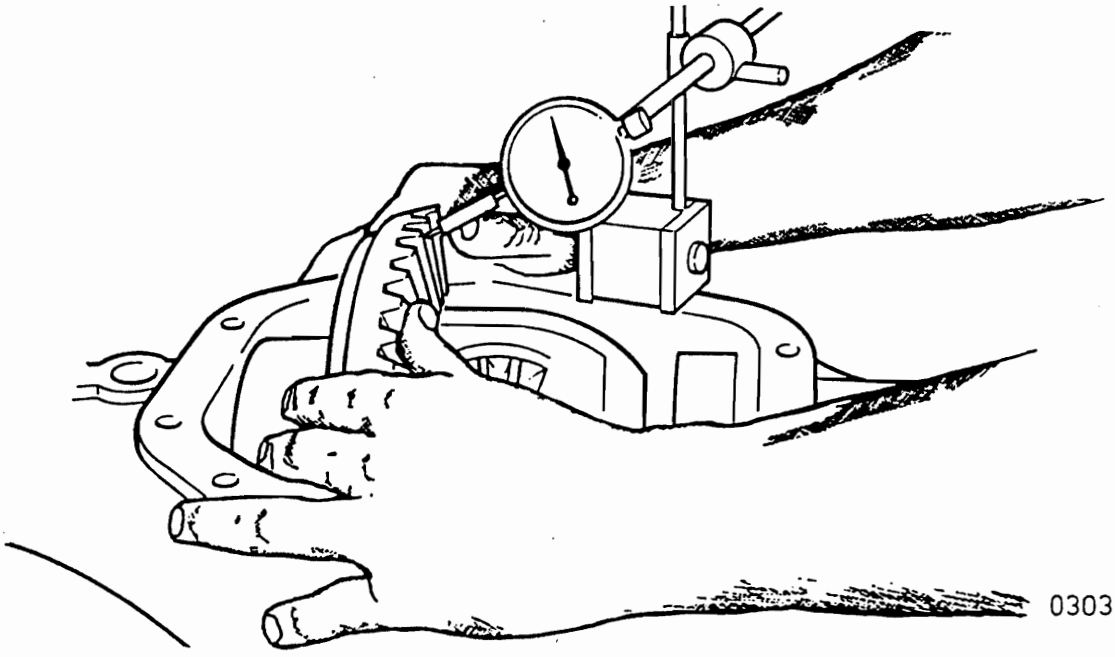

Fig 78 Differential bearing back-lash measurement

15.8 Apply a new gasket to the cover, and fit to the carrier. Tighten the screws using a torque wrench to a torque of 41-54 Nm (30-40 lbf.ft).

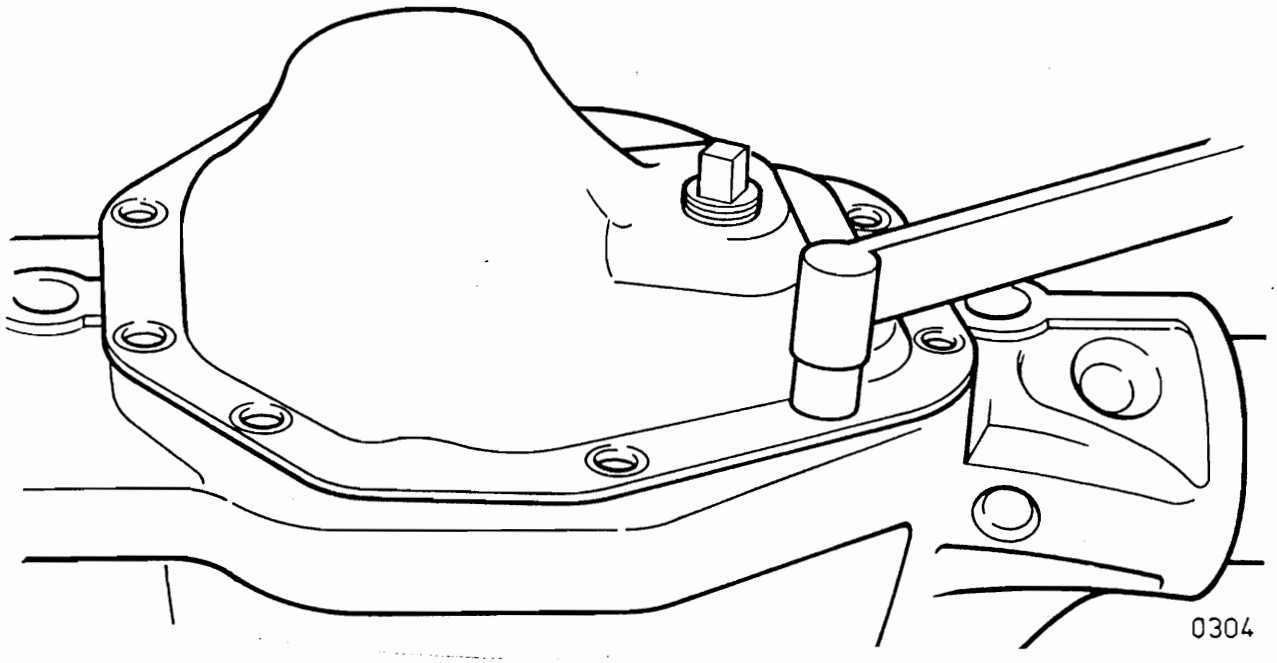

Fig 79 Differential carrier cover installation

Front axle reassembly

16 Assemble the halfshafts and steering knuckles (Para 5.1 to 5.6.1 (inclusive), and 5.7 to 5.8 inclusive).

16.1 Assemble the brake back plate (Chap 10).

16.2 Assemble the hubs (para 3.4 to 3.9 inclusive).

16.3 Assemble the track and rod and steering damper (Chap 7).

16.4 Refit the axle to the vehicle (para 11).

Chapter 6

REAR AXLE

CONTENTS

TABLE 1 SPECIAL TOOLS

Note ...

Items 1 to 5 (inc) + 8 and 9 = pinion setting gauge and master differential bearing kit D-116-70.

Item (1)	Number (2)	Description (3)
*1	D-115-2	Height gauge block
*2	D-115-3	Arbor
*3	D-116-1	Pinion height block
*4	D-116-2	Arbor discs
*5	D-117	Master differential bearings
6	D-128	Dial indicator set
7	D-131	Puller - slide hammer
*8	D-137	Master pinion block
*9	D-158	Extractor - front pinion bearing cup
10	D-159	Extractor - rear pinion bearing cup
11	D-163	Installer - pinion oil seal
12	D-167	Spreader - differential carrier
13	C-452	Remover - flange
14	DD-914-P	Press
15	DD-914-7	Extension
16	DD-914-8	Adaptor - ring
17	DD-914-42	Button
18	DD-914-62	Adaptor - differential bearing cone
19	DD-1241-J	Spanner - wheel bearing nut
20	C-3095-A	Installer - pinion rear bearing cone
21	C-3281	Holder - flange
22	C-3718	Installer - flange
23	C-4025	Installer - differential side bearing cone
24	C-4171	Handle - universal
25	C-4203	Installer - pinion front bearing cup
26	C-4204	Installer - pinion rear bearing cup

AXLE IDENTIFICATION

1 Axles are identified with a manufacturing date and part number stamped on the right hand tube with 1/8in (3.2mm) characters. For example, the code 11-21-6A9 is the manufacturing date November-21-1986 First Shift (A) Assembly Line No. 9. When there are two build dates, the later is the date at which the brake components were assembled. The number stamped next to the manufacturing date is the complete axle assembly part number.

1.1 The entire part number must be obtained to reference the correct build state.

1.2 These routines are written in a progressive sequence, which can be continuous for a complete axle service or selectively applied to subassemblies.

1.3 During dismantling routines, clean and examine all components and isolate any item which is to be replaced.

1.4 Assembly of the drivehead is structured to establish correct mesh of the crown wheel and pinion, and reload the bearings to maintain this during torque transmission.

1.5 Exercise careful control and provide clean workspace conditions throughout assembly procedures.

Axle half-shafts (right or left)

2 Remove the nuts securing the half-shaft flange. Hit centre of axle shaft flange sharply with a mallet to loosen split collets and withdraw collets. It may be necessary to rotate the collets by knocking them with a blunt chisel and a hammer to loosen them taking care not to damage the axle shaft flange. Discard the six nuts and six collets.

2.1 Withdraw the half shaft after all the collets have been removed. It may be necessary to use a thin flat lever or hide mallet to separate the gasket material.

2.2 If the spline has sheared from the half shaft end, it may be possible to retrieve the fragment with a bar magnet tied to a cane. Otherwise the differential assembly will need to be removed.

2.3 When the half shaft is intact, examine for cracks or twist along its length and for worn/distorted splines. If access is available to a new locking differential, a side gear may be used as a gauge if necessary.

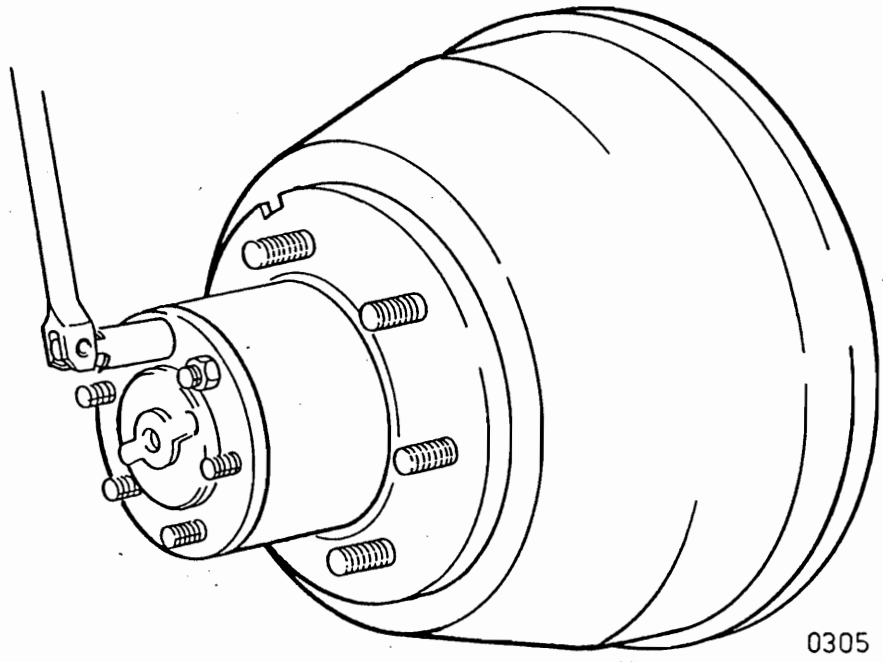

Fig 1 Half shaft flange

2.4 Examine the hub studs for necking and stretched or damaged threads. (Proceed to hub bearings for further dismantling).

2.5 Assemble in reverse order using new nuts and collets. Ensure the flange mating faces are clean and free of burrs or bruises which prevent a good mating fit.

2.6 Fit the half shaft using new gasket material taking care whilst mating the spline coupling to the differential unit, and the drive flange to the hub studs, then close the flange joint.

2.7 Assemble with new washers and collets. Tighten them progressively and evenly, using alternate opposite pairs, to a torque of 100-110 lb ft (136-150 Nm).

Hub bearings dismantling (right or left)

3 Secure the vehicle against uncontrolled movement with chocks to the front wheels. Jack up the rear of the vehicle and support it on chassis stands with the rear wheels clear of the ground.

3.1 Remove the road wheel, then mark the hub/brake drum for reassembly

3.2 Release the handbrake then remove the brake-drum.

3.3 Remove the half-shaft if not carried out in 2.

4 Straighten the hub bearing lock washer tabs. Remove the locknut, lock washers and bearing adjusting nut using tools DD-1241-J (Table 1 items 19). Discard the lock washer.

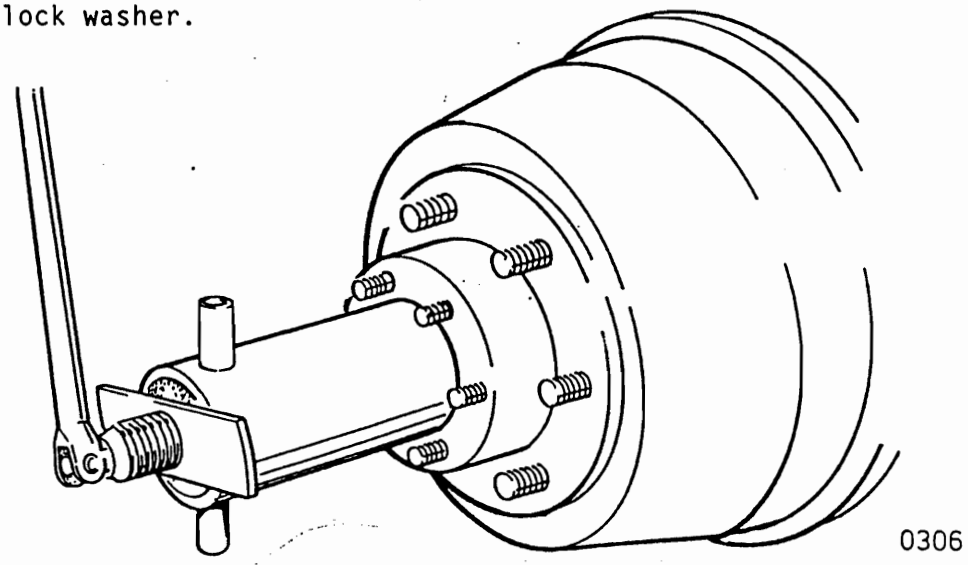

Fig 2 Hub lock-nut removal

5 Ease the hub from the axle until the outer bearing cone is free, then remove it together with the hub from the axle.

5.1 Remove the inner bearing cone and oil seal if retained on the axle. Discard the oil seal and retain the bearing cone with the hub. Clean the mechanical surfaces at the end of the axle tube and examine for wear, particularly at the oil seal and bearing locations. Check that the threads and keyway are not damaged.

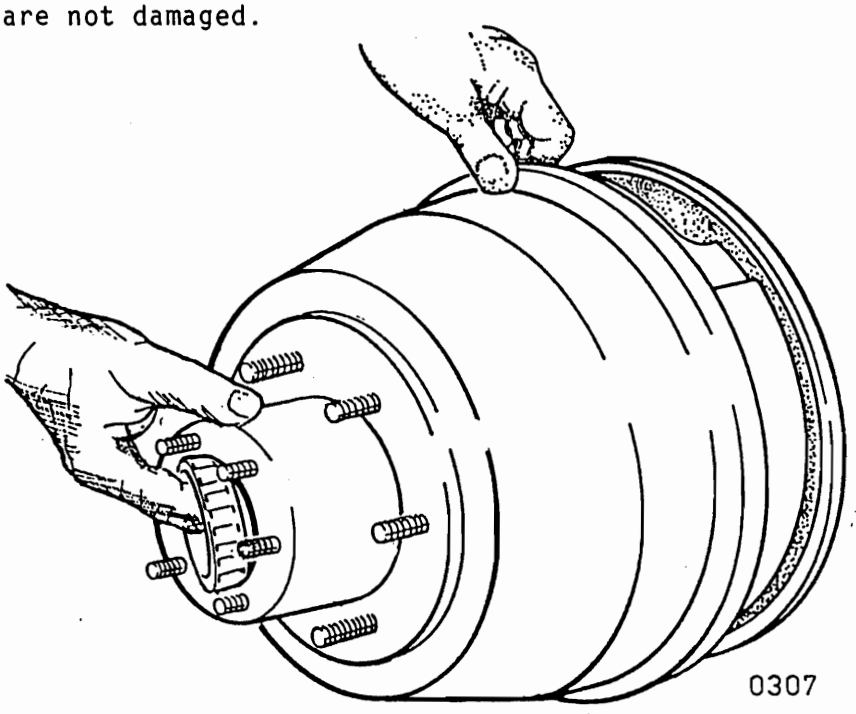

Fig 3 Hub removal

6 Remove the oil seal using a slide hammer (D131) (Table 1 item 7) and discard the seal.

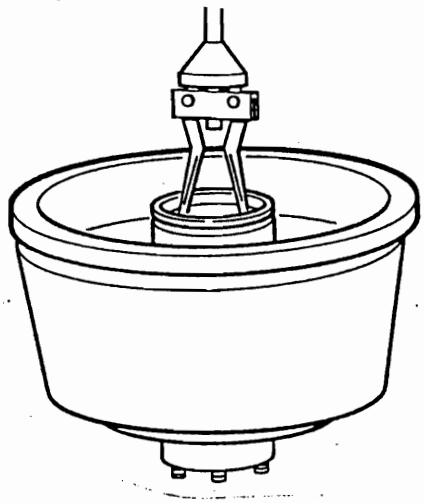

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Fig 4 Oil seal removal

7 Remove the inner and outer bearings cups using C131 slide hammer (Table 1 item 7). Clean the hub and check visually for mechanical damage.

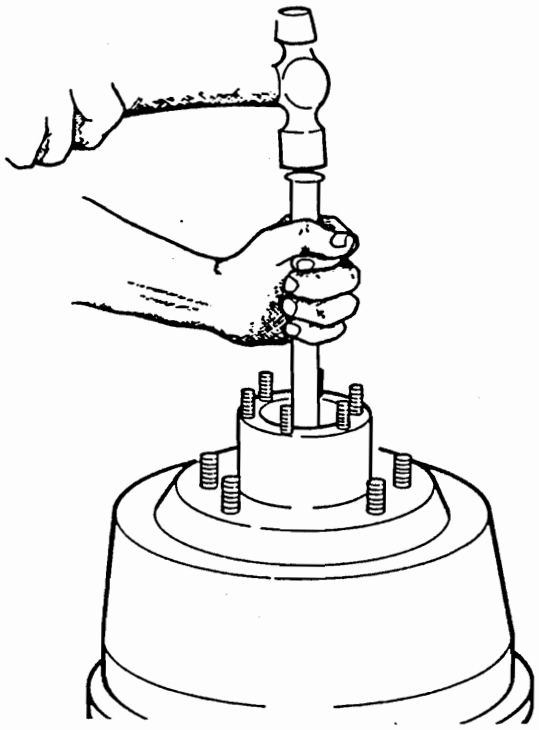

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Fig 5 Bearing cup removal

7.1 It is good practice to rebuild axles with new bearings whenever possible, even when there is little wear. If it is necessary to re-use the bearings previously fitted, clean them with an inhibited solvent and examine for wear. Bearings which are degraded by pitting, flaking, scuffing or corrosion are to be discarded. If the bearing is selected for re-use, dry the solvent by drainage and evaporation, then apply a thin film

of low viscosity, rust inhibiting lubricant and protect the bearing in a dry dust free enclosure. The bearing will be damaged if the solvent is 'turbo-dried' by a compressed air, jetstream.

Hub bearing assembly

8 Assembly is the reverse of the dismantling procedure Para 3 to 7..

8.1 Bearings should not be removed from their trade packs until they are required for assembly.

8.2 Fit the new bearing cups into the hub.

8.3 Place the hub on a clean horizontal surface, resting on the half shaft flange mating face.

8.4 Pack the inner bearing cone with clean fresh, high temperature lithium based grease (XG 279) and fit into its bearing cup in the hub.

8.5 Fit the new oil seal with its outer face flush with the face of the hub, and grease the lip of the seal.

8.6 Pack the outer bearing cone with clean fresh, high temperature lithium based grease (XG 279) and assemble with the hub onto the axle.

8.7 Fit the hub bearing adjusting nut and close up finger tight against the bearing cone.

8.8 Carefully rotate the hub and verify there are no high spots.

8.9 Tighten the adjusting nut to a torque of 68 Nm (50 lbf ft) whilst rotating the hub by the hand using hub nut spanner DD-1241-J and adaptor C4202 (Table 1 items 21 and 30). Release the inner adjusting nut then tighten to a torque of 41-54 Nm (30-40 lbf.ft) while rotating the hub.

8.10 Slacken the inner adjustment nut 135^{o}-150^{o} then fit a new locking washer and position the nut to the nearest locking hole.

8.11 Fit the outer locknut and tighten to a torque of 88-100 Nm (65-75 lbf ft).

8.12 Check that the hub end float on the axle is 0.025 to 0.250 mm (0.001in to 0.010in).

8.13 Close the lock washer tabs onto the nuts or readjust if necessary.

8.14 Assemble the half shaft as in para 2.6 and 2.7.

8.15 Replace the brake drum in its original position marked in 3.1.

8.16 Refit the road wheel. Partly tighten the nuts to 66 Nm (50 lbf ft) and verify operation of the handbrake.

8.17 Remove the chassis support and tighten the road wheel nuts to 298 Nm (220 lbf.ft).

WARNING ...

DO NOT SEPARATE THE TWO DIFFERENTIAL HALVES WITHOUT ENSURING THAT A RETAINING BOLT OR OTHER RESTRAINED IS USED, AS THE DIFFFERENTIAL CONTAINS TWO SPRINGS WHICH COULD CAUSE SERIOUS INJURY

Differential dismantling

9 To dismantle the carrier section:

9.1 To service the crown wheel and pinion or differential assembly, it is advised and assumed that the axle is removed from the vehicle and supported securely on a stand or rack.

9.2 Refer to Chapter 10 for disconnection of the brake links/hoses, and Chapter 8 for dismantling of the axle from the suspension.

9.3 With the axle positioned as on the vehicle, remove the drain plug and drain the oil. Look for the presence of metallic sludge on the plug, oil discolouration, metallic suspensions in the oil and correct viscosity.

9.4 Withdraw the half shafts (Para 2) approximately 10cm (4in) to clear the splines from the differential assemblies.

9.6 Remove the cover-plate set-screws and cover plate. Examine the lower interior surface of the carrier and cover plate and check for the presence of metallic particles. Position the carrier to facilitate complete oil drain-out.

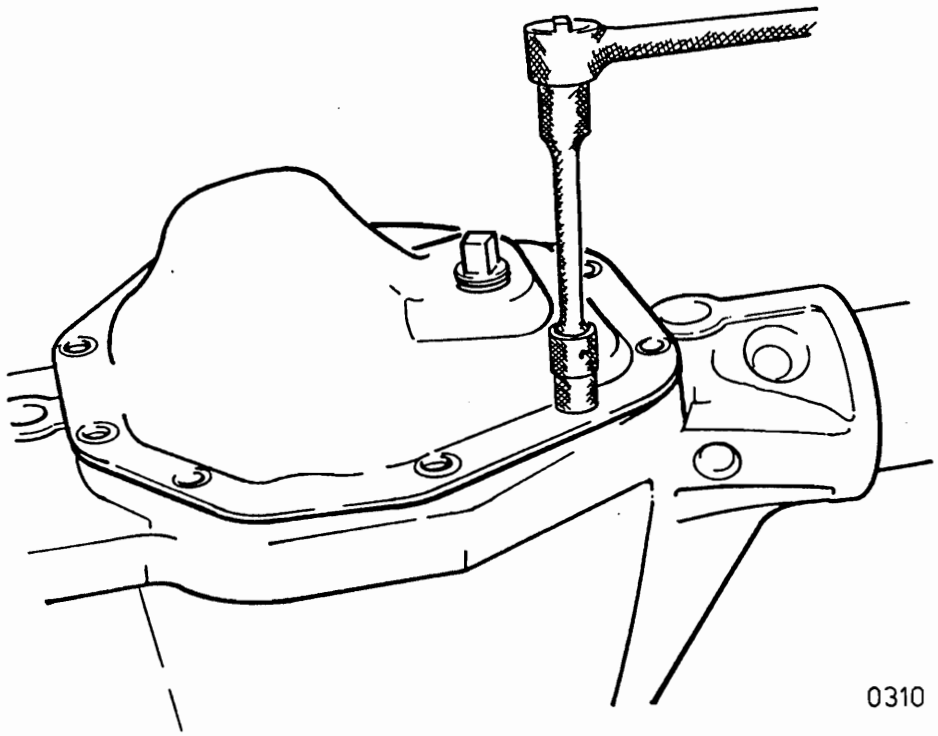


Fig 6 Differential cover removal

14 Place some protective material on top of a bench vice and secure the differential assembly as shown. Remove the crown wheel set screws.

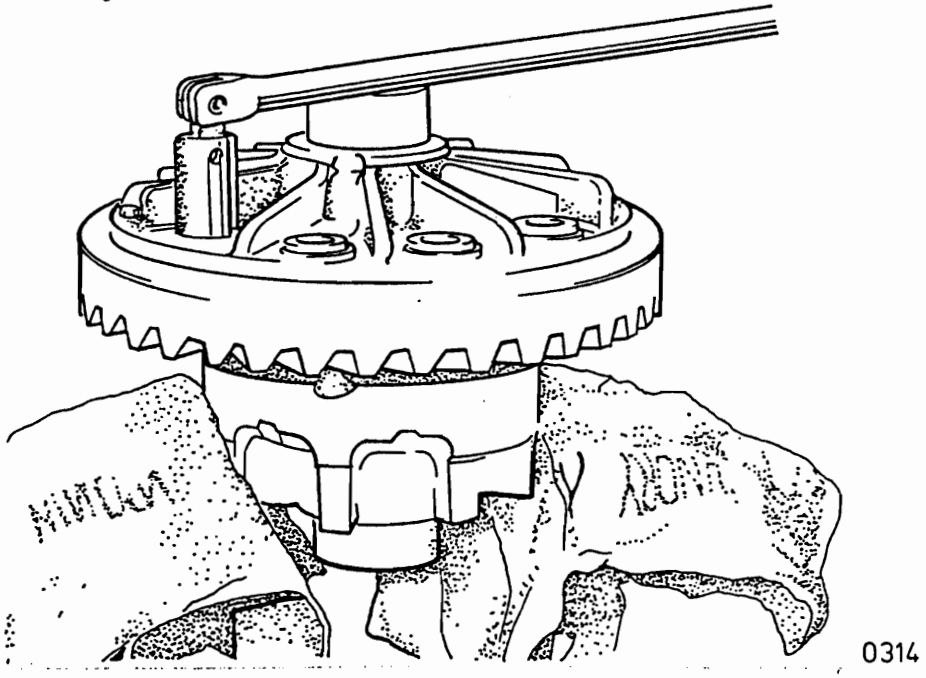


Fig 11 Crown wheel dismantling

15 Free the crown wheel evenly around the flange along the spigot, then ease it carefully from the case avoiding damage to the gear teeth. Discard the crown wheel set screws and replace with new components on reassembly.

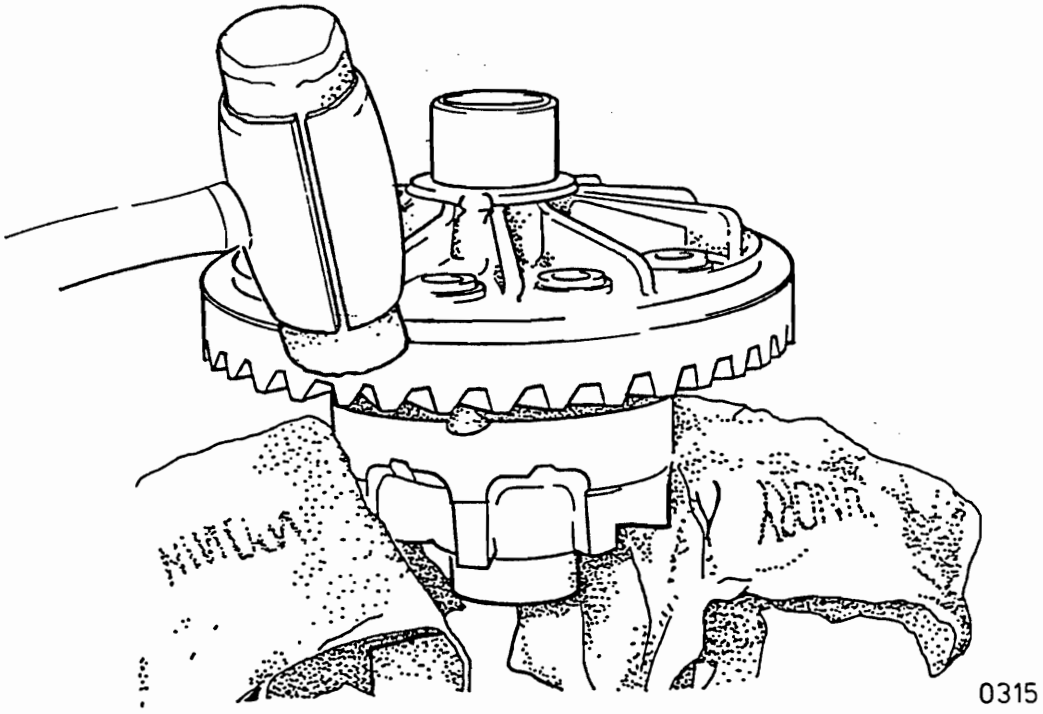


Fig 12 Crown wheel removal

16 The locking differential assembly contains two helical springs in compression with about 30 Kg (65lb) thrust. Their only restraint is through containment within the differential case. Fit a restraining clamp bolt to hold the locking differential together. (Supplied with a new replacement assembly. For local manufacture. 8mm x 15cm bolt requires a 4 cm thread length, wing nut, 5cm washers - 2 off. See Figs 21 and 23).

16.1 Place a holding fixture D-166 (Table 1 item 12) in a bench vice and mount the differential case onto the location pegs. Ensure there is an alignment mating mark on the two differential case halves.

16.2 Release the tension evenly and progressively on the eight case body bolts, then remove the bolts completely. Separate the two case halves and remove the locking differential mechanism.

16.3 Slacken the wing nut on the locking differential restraining bolt and release the operating spring tension.

16.4 Clean and examine all parts and replace any component showing excessive wear. If there is general wear, replace the relevent assembly. The differential case is machined as a pair and the crown wheel and pinion replaced as a set. Service parts can be fitted to the locking differential, but the spider/centre cam and left or right clutch/hold-out ring are sub-assemblies.

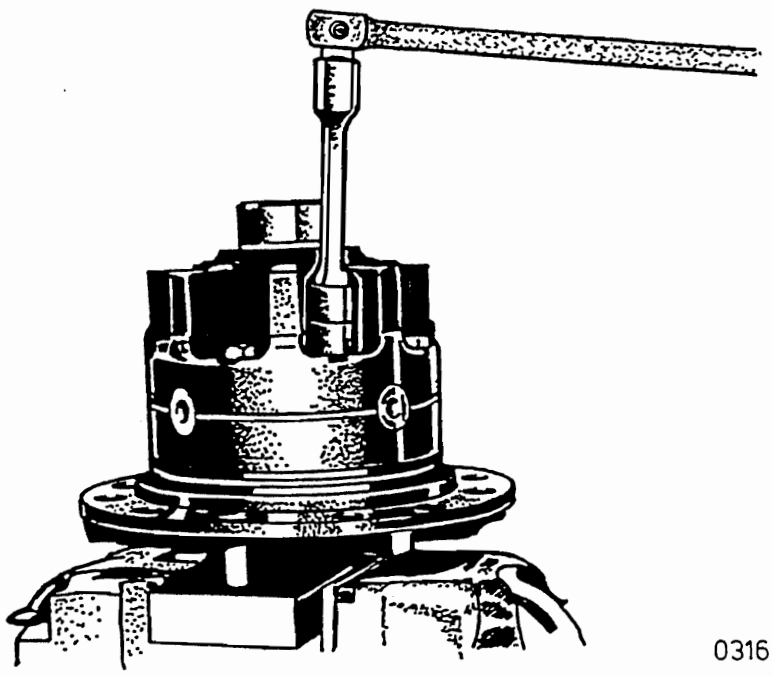


Fig 13 Differential case dismantling

17 Position the carrier with the pinion shaft horizontal. Hold the spline end yoke with a restraining lever (C-3281) (Table 1 item 21) and remove the pinion shaft nut/washer.

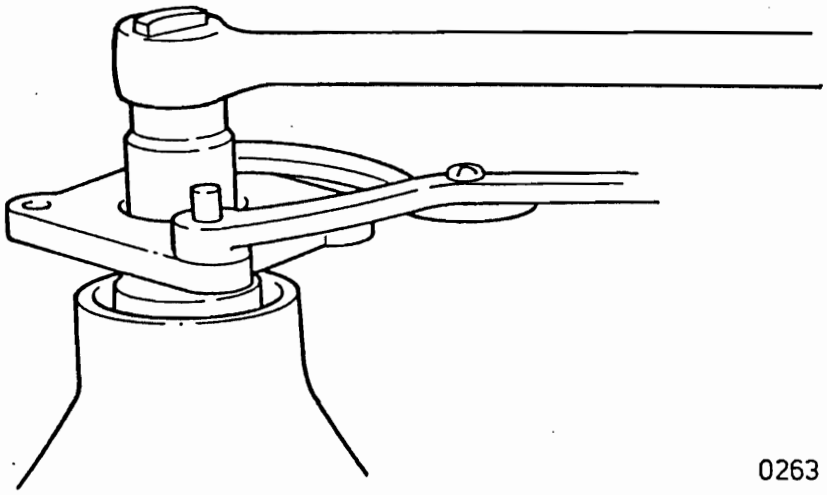


Fig 14 Pinion drive flange dismantling

18 Remove the pinion shaft flange with a C-3281 restraining lever (Table 1 item 21) and C-452 ejector (Table 1 item 13).

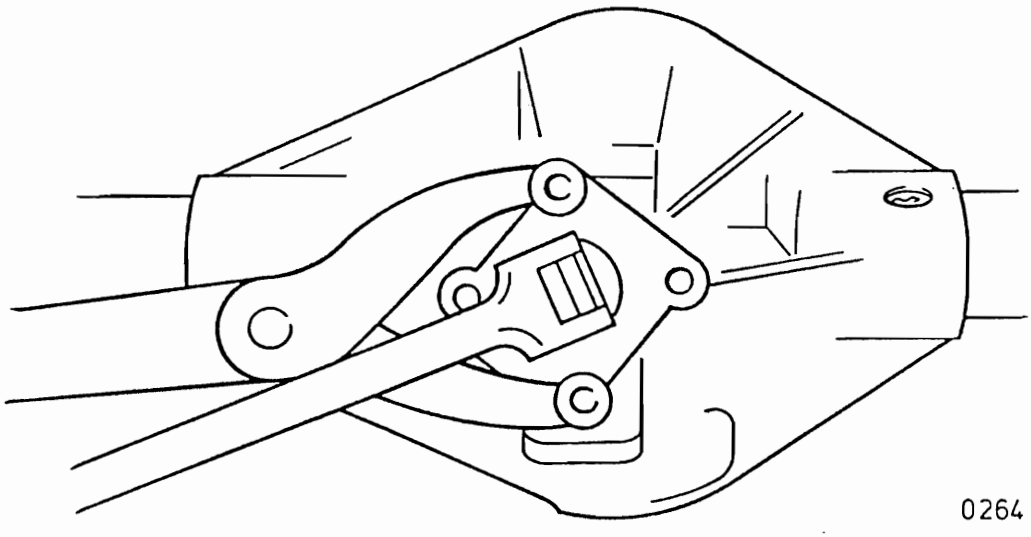


Fig 15 Pinion drive flange removal

19 Ease the pinion from its bearings by tapping the shaft end with a hide mallet. Complete removal by hand as the bearings are released. It is necessary to carefully observe the shims fitted to pre-load the spline - end bearing, some may stick to the bearing, pinion shaft, or fall free. (See Para 21).

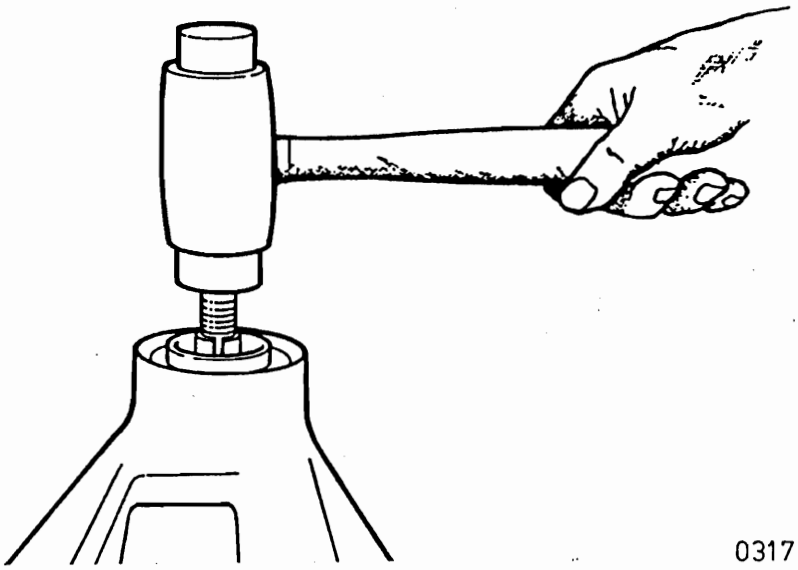


Fig 16 Pinion dismantling

20 Using a slide hammer (D-131) (Table 1 item 7), remove the pinion shaft oil seal and discard. Remove the oil slinger and outer bearing cone.

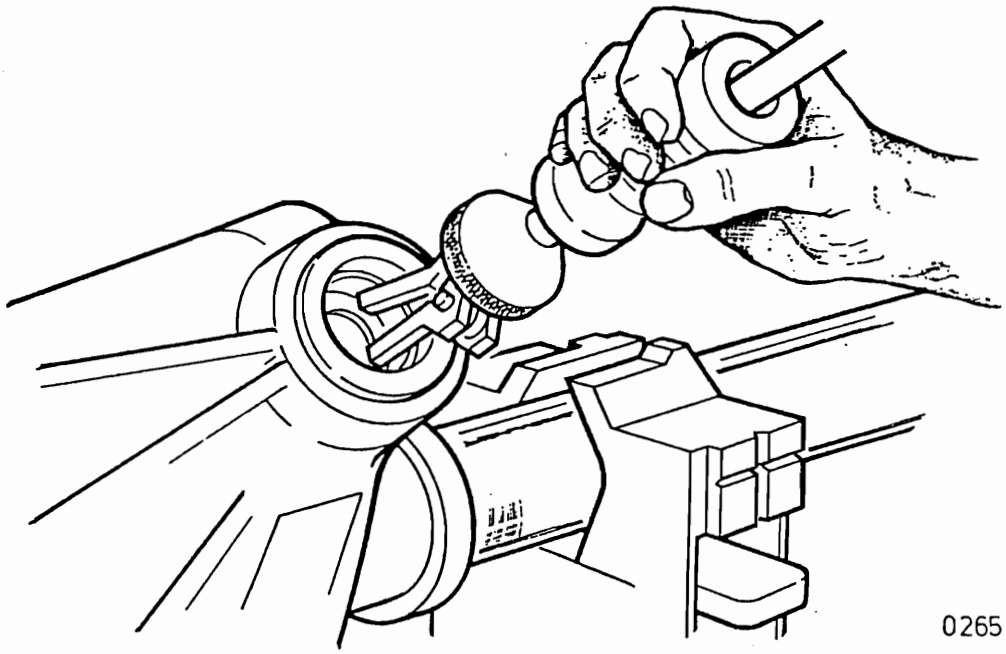


Fig 17 Pinion oil seal removal

21 Position the axle with the carrier access upper-most. Remove outer pinion bearing cup using extractor D-158 (Table 1 item 9) fitted with handle C4171 (Table 1 item 24), taking care to not cause damage to machined bore. Collect the bearing preload shims and wire together.

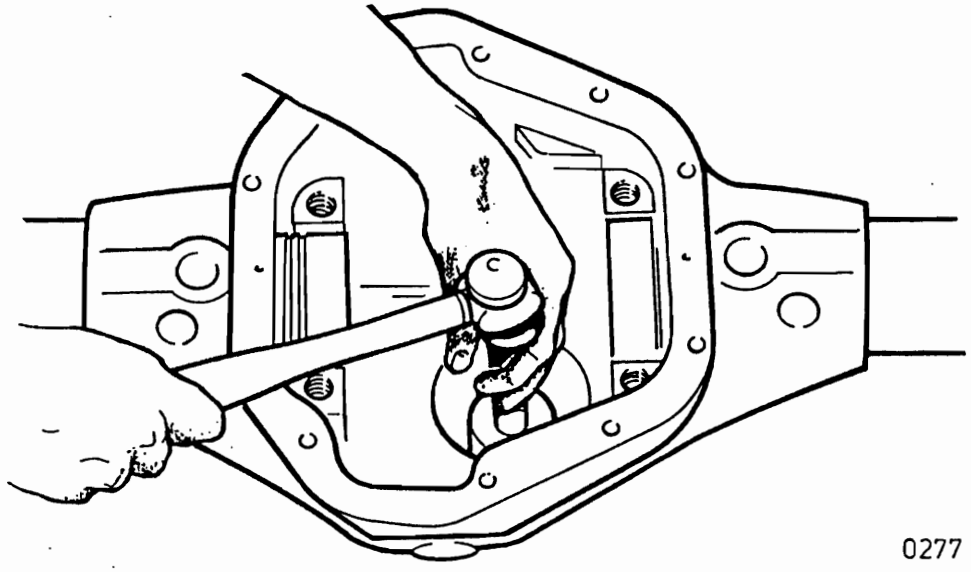


Fig 18 Outer bearing cup removal

22 Invert the carrier if necessary, and using extractor D-159 (Table 1 item 10) remove the inner pinion bearing cup. Note the adjustment shims fitted with the baffle and collect together. Replace any which are damaged at reassembly. A baffle is part of the shim-set and its measured thickness taken into account if replaced (See 32.4).

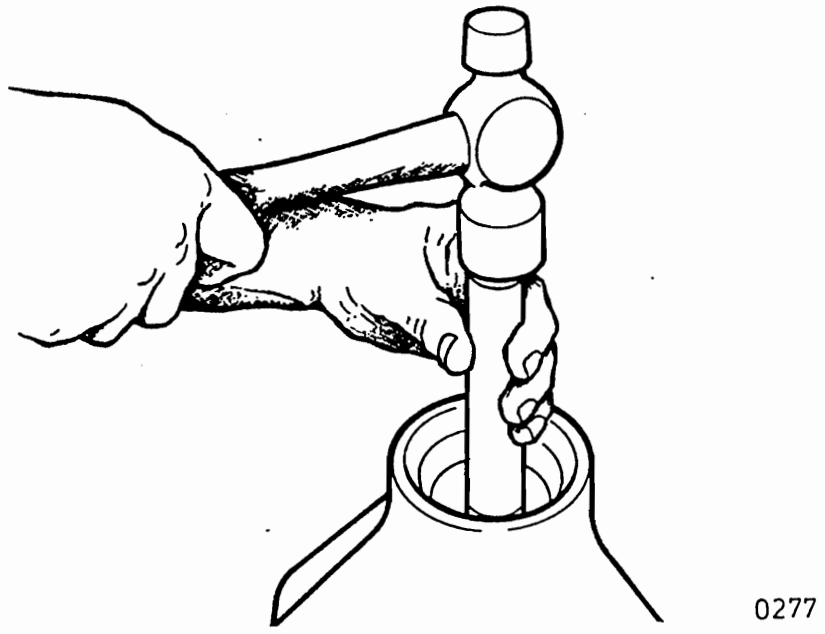


Fig 19 Inner bearing cup removal

23 Using a suitable press set adaptor or drift, remove the inner pinion bearing cone. (This is not necessary in the usual case that both are to be replaced).

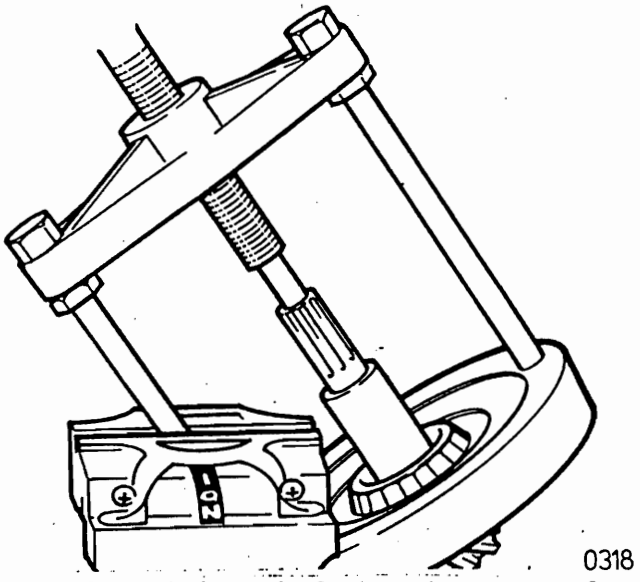


Fig 20 Pinion shaft bearing removal

Crown wheel differential assembly

24 Assemble the locking differential mechanism onto a restaining bolt. (This will be the normal state of a replacement unit). The compressed springs provide an axial thrust of about 30 Kg (65 lb). A restraining bolt can be salvaged from a previous replacement unit or of local manufacture. (8mm screw stock x 15cm + 2 wing nuts + 2 washers of 5cm dia).

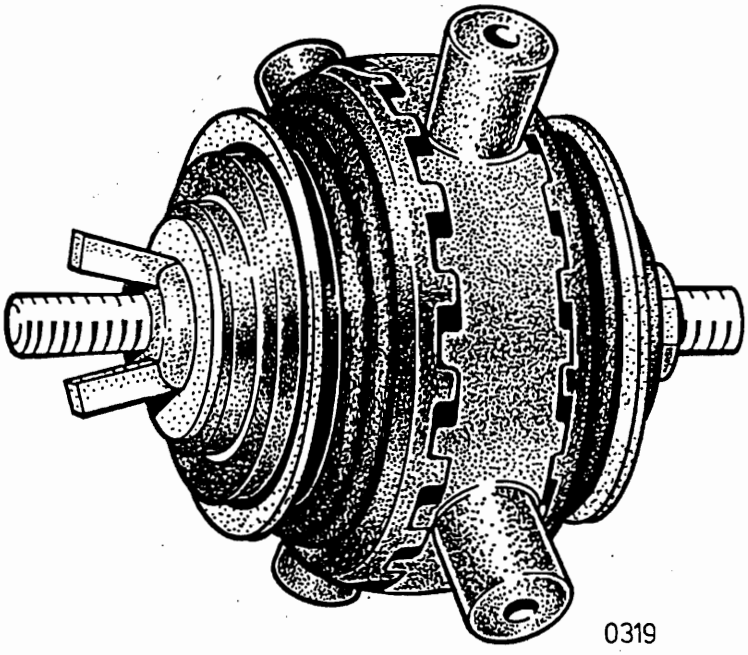


Fig 21 Locking differential assembly

25 Mount the flange half of the differential case on a suitable holding fixture mounted in a vice. Fit the locking differential mechanism to the case, making sure the trunnions are corrctly seated.

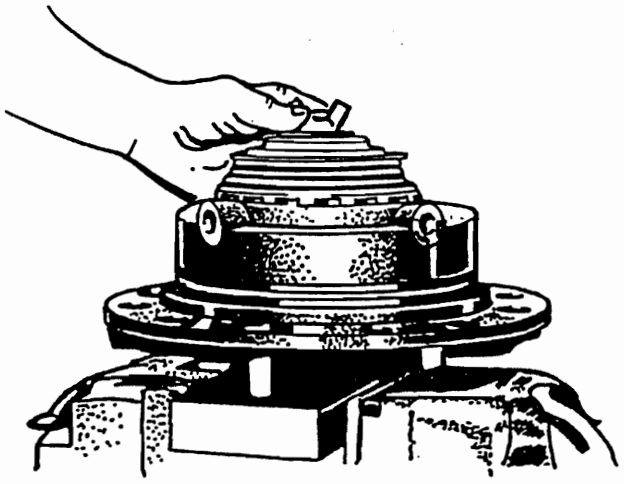


Fig 22 Differential case/locking drive assembly

26 Assemble the cap half of the differential case to the locking differential located on the trunnions. Ensure the locating marks of 16.2 are aligned.

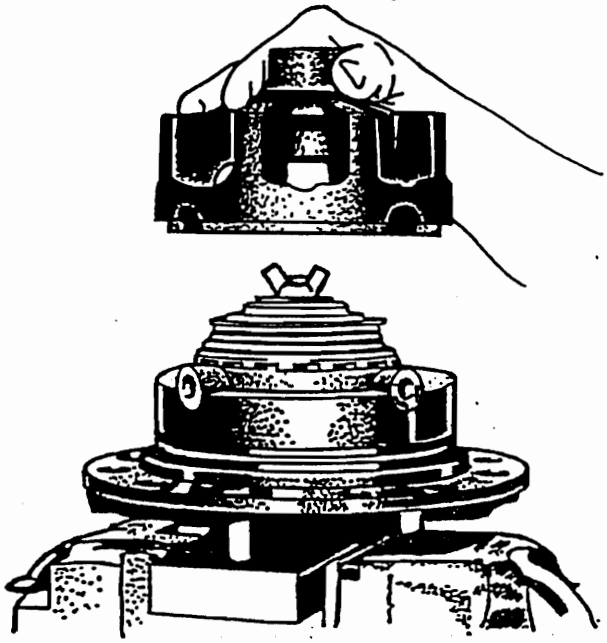


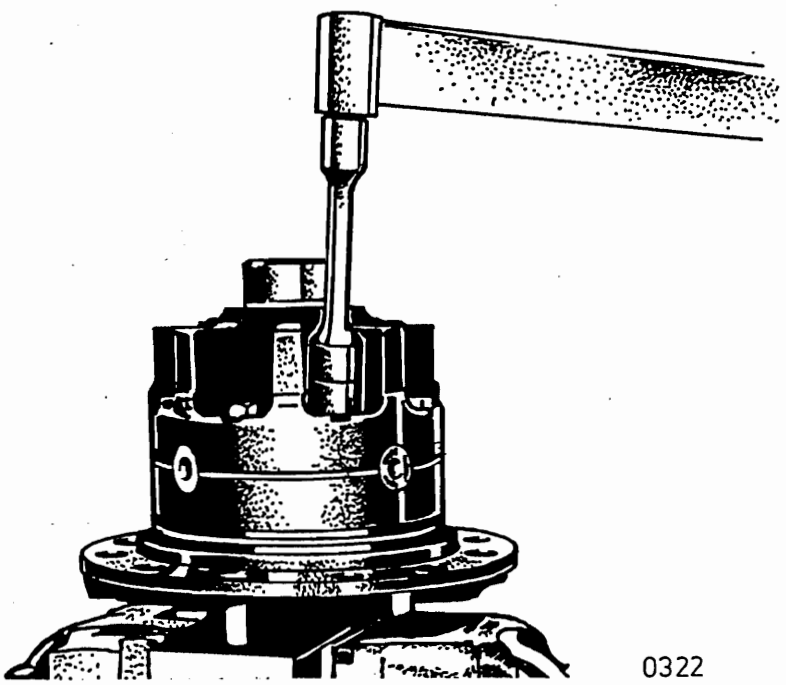
Fig 23 Differential case assembly

27 Assemble the case bolts and close down finger tight, ensuring the two case halves are properly nested together.

27.1 Remove the restraining bolt from the locking differential mechanism.

27.2 Tighten the case bolts evenly using a torque wrench to 90 Nm (65 lbf ft).

27.3 Remove the case from the jig and the jig from the vice.



0322

Fig 24 Differential case bolts assembly

28 Fit the crown wheel to the differential gear case and align the fixing holes. Using new crown wheel bolts, fit two to opposite holes and run-up finger tight.

28.1 With soft jaws fitted to the vice, grip the cap half of the differential case as shown. Tighten the vice no more than is necessary for a stable grip.

28.2 Assemble the remaining crown wheel bolts and run-up finger tight. Tighten the bolts, closing the crown wheel evenly onto the flange, using a torque wrench to 135 Nm (100 lbf ft). Remove the assembly from the vice.

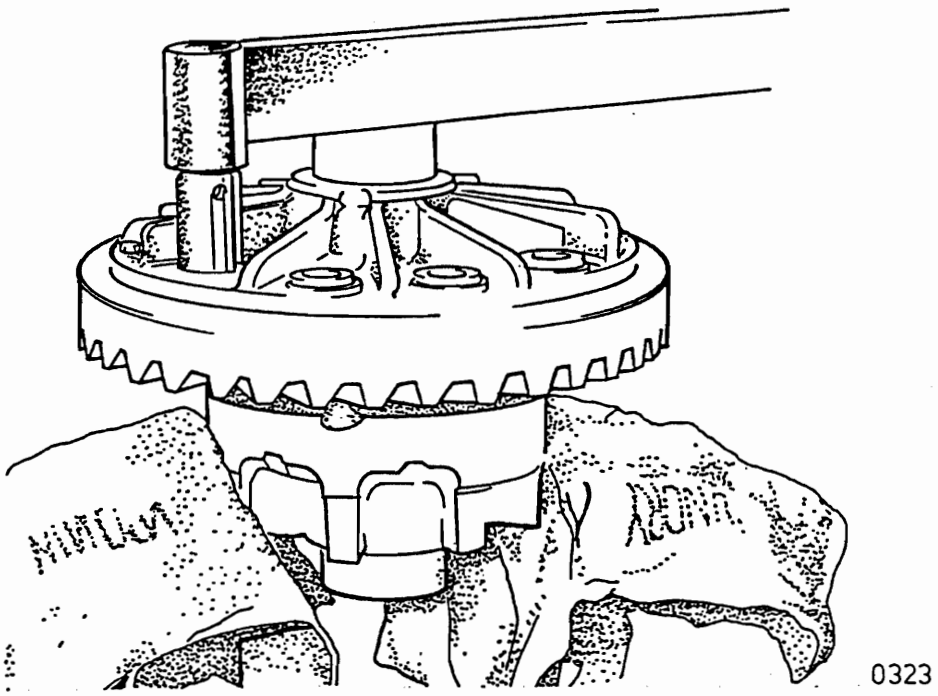


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Fig 25 Differential crown wheel assembly

29 Fit the master differential bearings D-117 (Table 1 item 5) to the differential case. Ensure they rotate freely and mate flush to the trunnion shoulder.

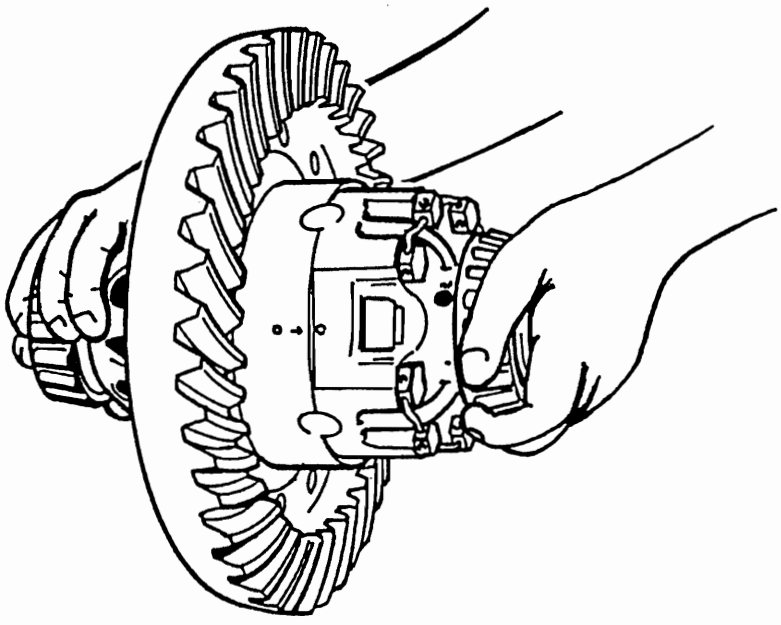

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Fig 26 Master differential bearings assembly

30 Position the axle housing with the carrier aperture uppermost. Ensure the housing bearing seats are clean, then place the crown wheel/differential assembly into its normal position located by the master bearings.

30.1 Mount the magnetic base of the D-128 dial indicator (Table 1 item 6) on the machined face of the carrier aperture, positioned as shown and set to measure the axial float of the differential case and master bearings.

30.2 Select and mark a suitable bolt head as a reference, and position the indicator stylus on it to measure maximum axial displacement away from the indicator.

30.3 Push the crown wheel bolt towards the dial indicator to give maximum deflection, then with the assembly held stable, set the indicator dial '0' to coincide with the pointer. Verify this meter is correctly adjusted.

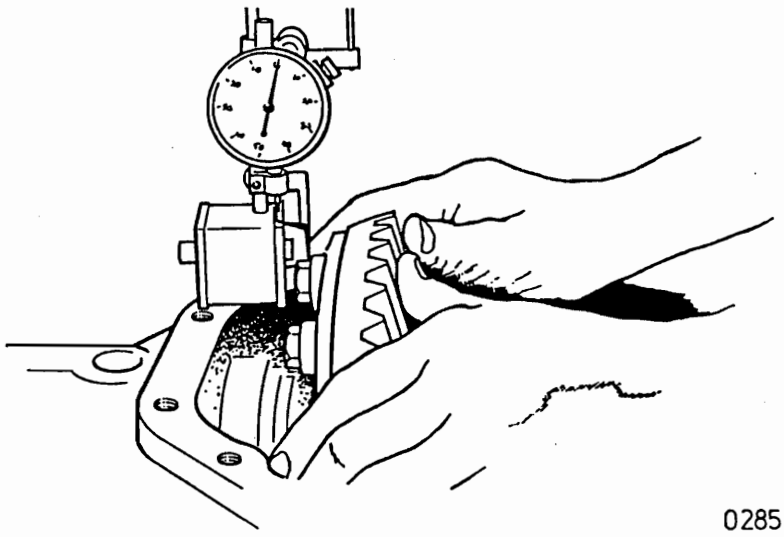

Fig 27 Differential end float setting

31 Push the crown wheel in the opposite direction away from the dial indicator and verify the dial indicator covers the total displacement.

31.1 Repeat if it is necessary to reposition the dial indicator or obtain a confirmed measurement of the end-float.

31.2 Record the reading which will be used at a later stage. The marked bolt will also be used later.

31.3 Remove the dial indicator from the housing. Remove the differential assembly from the housing but retain the master bearings on the case.

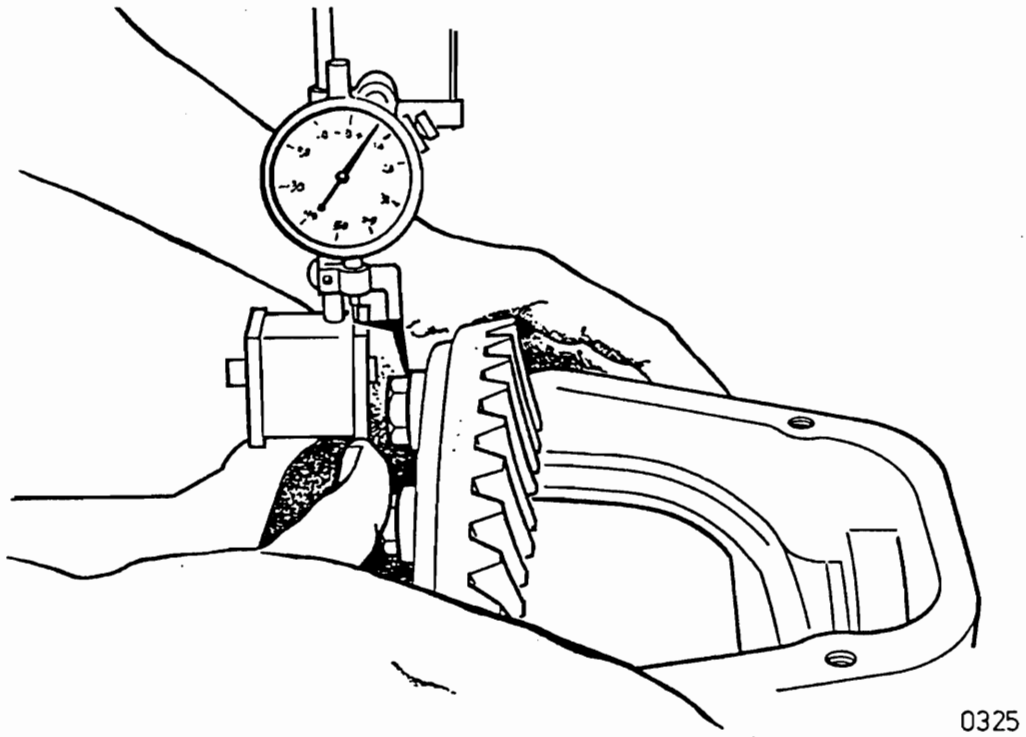

Fig 28 Differential end float measurement

Pinion assembly

32 Crown wheels and pinions are only supplied in matched pairs. Because of this they are etched with an identifying number and both must agree. The ground face of the pinion gear, or 'button', is the datum for measurements and nominally positioned 3.5in from the axial centre line of the crown wheels. This is the distance obtained when a correctly manufactured gear and pinion are properly meshed, with their pitch lines coincident. Manufacturing such gears is not practical, and there are additional inaccuracies in the manufacture of the bearings, and the machined bearing seats in the axle case.

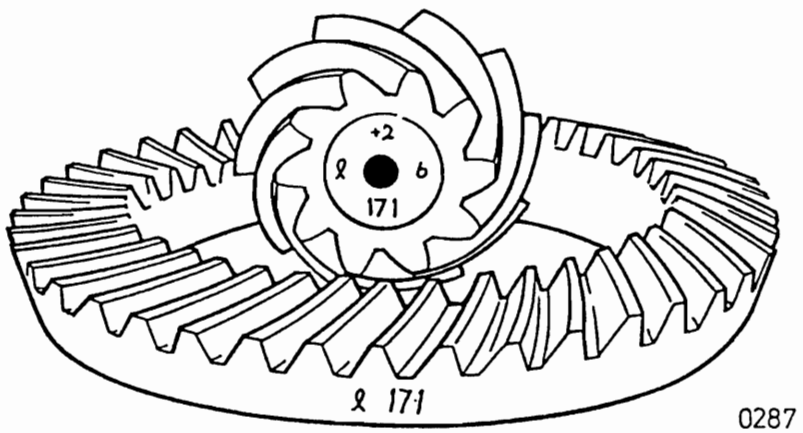

Fig 29 Crown wheel and pinion marking

32.1 The art of building the drive head is to compensate the component tolerances in a progressive manner to provide :

32.1.1 correct position of the pinion gear (Fig 20)

32.1.2 required preload of the pinion bearings

32.1.3 correct backlash of the crown wheel with the pinion (Fig 30)

32.1.4 required preload to the differential case bearings

32.2 Positioning the pinion gear relative to its inner bearing determines everything that follows in the assembly sequence. This can be achieved in two ways :

32.2.1 shim manipulation (see Para 32.3 to 32.4)

32.2.2 measurement (see Para 33 to 37.5).

32.3 To replace a pinion without measurement of its position, it is necessary to know two dimensions:

32.3.1 the thickness of adjustment shims, including the oil baffle, for the old pinion;

32.3.2 the difference between the old and new pinions.

32.3.3 Clean and visually examine the adjustment shims and baffle removed in Para 22, measure and record their individual thickness.

32.3.4 Etched on the pinion button with its identifying number, is its size tolerence in the range 0 to +/-14 (see Fig 32). This number gives the manufacturing difference between the nominal and actual dimension from the pinion pitch circle to the button face, relative to the 3.5in dimension to the centre of the crown wheel. This is important since it is used to correctly position the pinion with its matching crown wheel. If a pinion is etched +3, this means the pinion is +0.003in nearer the crown wheel centre than it should be, therefore a 0.003in shim has to be removed to bring it back to a normal position (This makes the 'crown wheel centre-button face' distance 3.503in). If a pinion is etched -4, this means the pinion is 0.004in farther away from the crown wheel centre than it should be, and a 0.004in shim has to be put in to push it nearer (This makes the 'crown wheel centre - button face' distance now 3.496in).

32.3.5 To replace one pinion with another, proceed as follows. Add (or subtract) the old pinion number with 3.500 (= A). Add (or subtract) the new pinion number with 3.500 (= B).

If A = B, use the same shim-set replacing any damaged components

If A is greater than B, then A-B is the amount of shims to be added. Make up a new shimset replacing any damaged components

If B is greater than A, then B-A is the amount of shims to be taken out. Make up a new shimset replacing any damaged components.

Examples

Old pinion	- - 1	therefore distance	-	3.499	A
New pinion	- - 4	therefore distance	-	3.496	B
				0.003	(A-B)

Add 0.003in shim to move the new pinion nearer the centre, from old position of 3.499in to the new distance of 3.496in.

Old pinion	- - 2	therefore distance	-	3.498	A
New pinion	- + 2	therefore distance	-	3.502	B

Since B is greater	3.502	B
	3.498	A
	0.004	(B-A)

Remove 0.004in shim to move away from old position of 3.498in to new distance of 3.502in

32.4 When making shim adjustments, it will sometimes be necessary to use 'nearest value'. This is due to the fact that shimstock is limited to 3 (or 4) values. The maximum pinion variation is +/-0.004in in 0.001in increments, compared with shim minimum thicknes of 0.003in. Sometimes it may not be possible to adjust to the nearest 0.001in; at other times a new combination may be used, e.g. 2 x 0.003in + 1 x 0.005in in place of 1 x 0.010in.

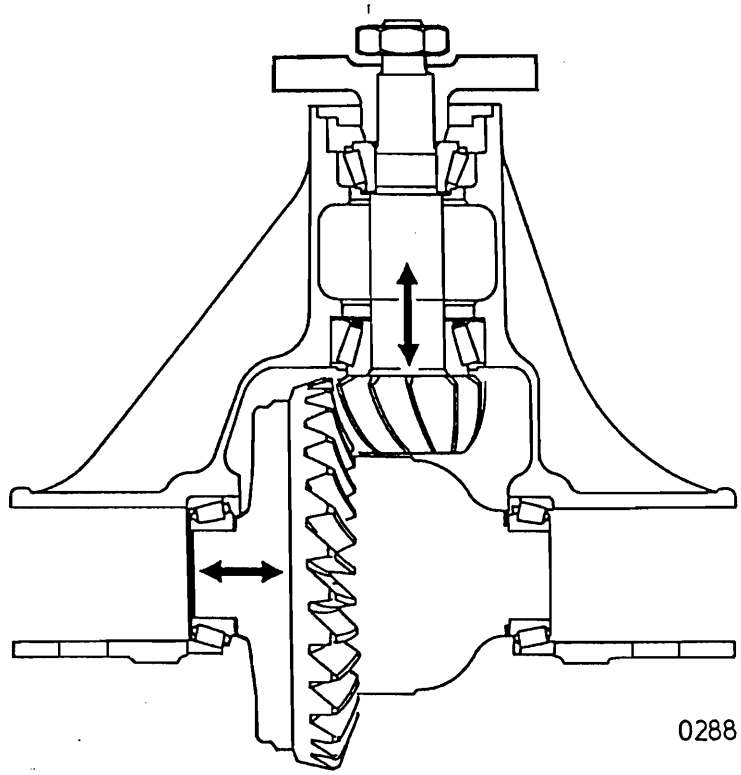

Fig 30 Pinion and crown wheel location

33 With the carrier aperture uppermost (as in Para 21) fit the master pinion block D-137 (Table 1 item 8) into the pinion inner bearing seat.

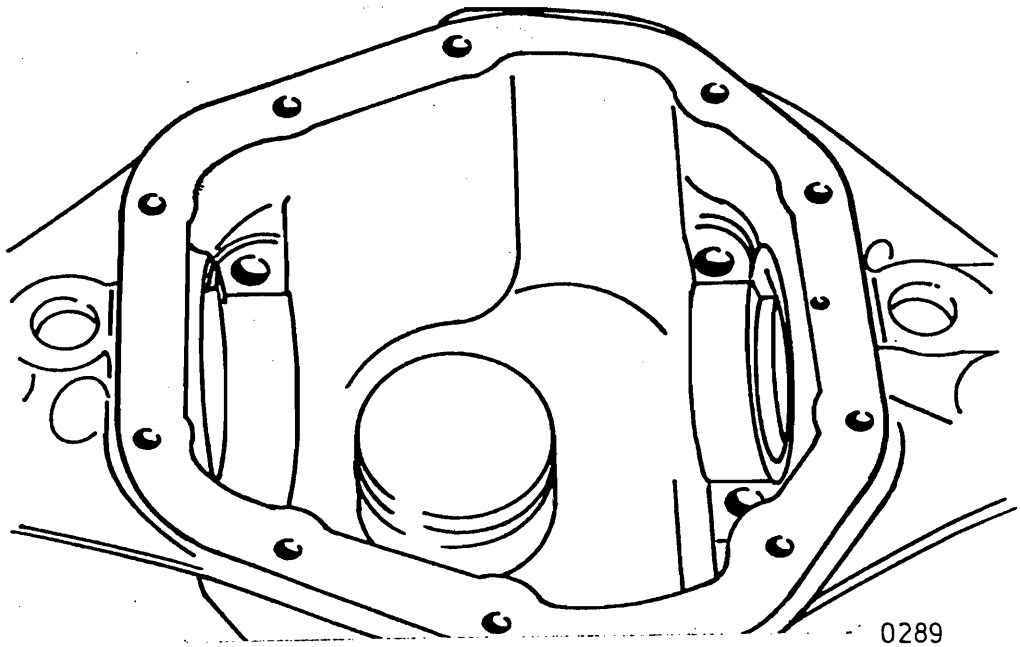

Fig 31 Master pinion block location

34 Fit the D-116-2 arbor discs (Table 1 item 4) to the D-115-3 arbor (Table 1 item 2), and locate the discs in the carrier cross bore.

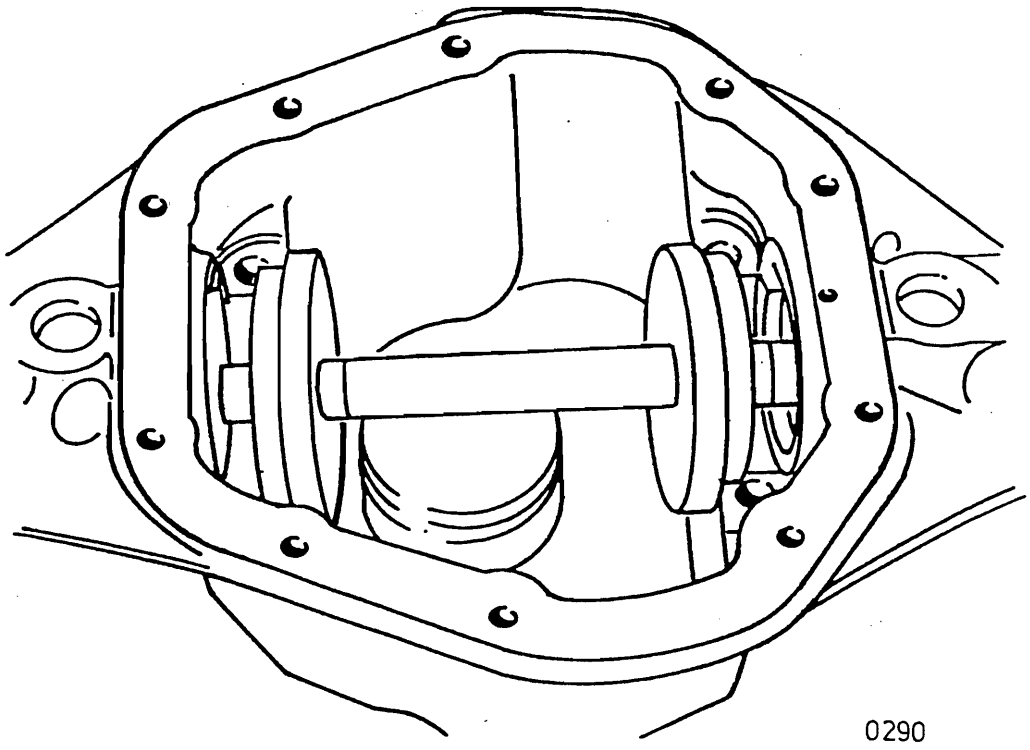

Fig 32 Differential axis arbor

35 Place the pinion height block D-116-1 (Table 1 item 3) on top of the master block with its long side aligned against the arbor.

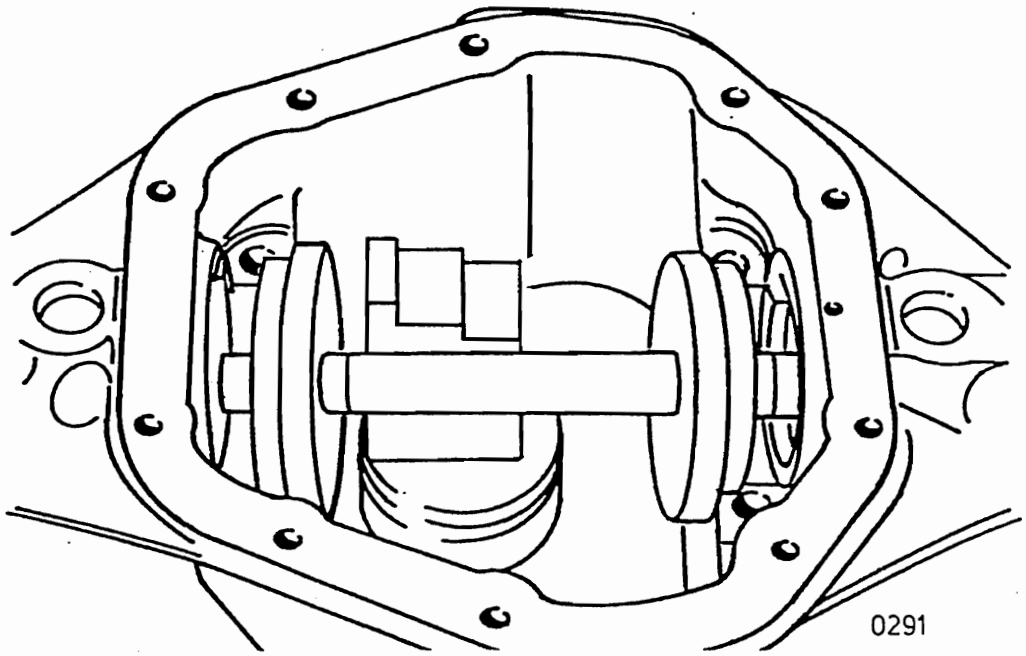

Fig 33 Height setting gauge

36 Position the D-115-2 scooter gauge (Table 1 item 1) on lowest step of pinion height block, with the stylus in contact with the block. Make sure that firm contact is obtained of the scooter on to the block, and set the dial indicator to '0'.

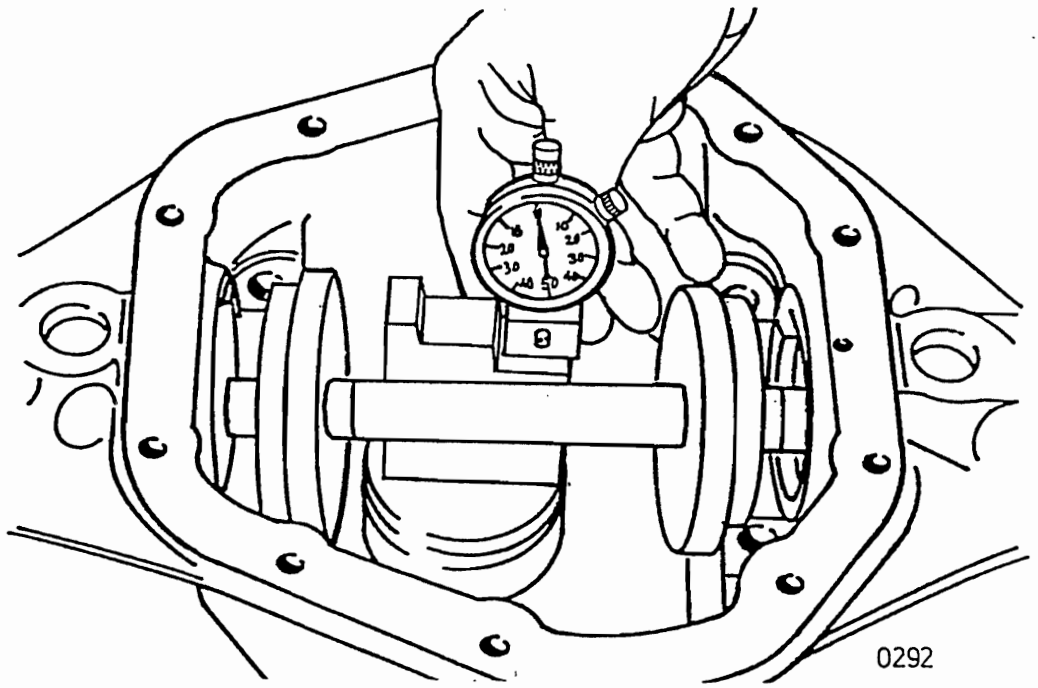

Fig 34 Scooter gauge datum

37 Slide the scooter so that the dial indicator stylus passes over the arbor. Note the indicator reading at the point of maximum deflection over the arbor. This is the shim thickness required, including the baffle, for a nominal pinion (engraved '0' on the button).

37.1 Examine the pinion engraving and note the figure giving the size variation. A + figure means the distance to the crown wheel centre, from the engraved face on the pinion, must be increased by the same number of 1/1000in.

37.2 A pinion button engraving of +2 indicates that the pinion button face must be pushed away from the crown wheel centre, therefore 0.002in must be subtracted from the shim dimension given by the scooter gauge.

37.3 Conversly, with the pinion engraved -3, the pinion must be pushed 0.003in nearer the crown wheel centre, therefore 0.003in shims must be added to the measurement given by the scooter gauge.

37.4 Determine the total of oil baffle plus shims required for the new pinion.

37.5 Clean and examine the components removed in Para 22. Replace any damaged units, then build a new stack to the dimension determined by the measurement.

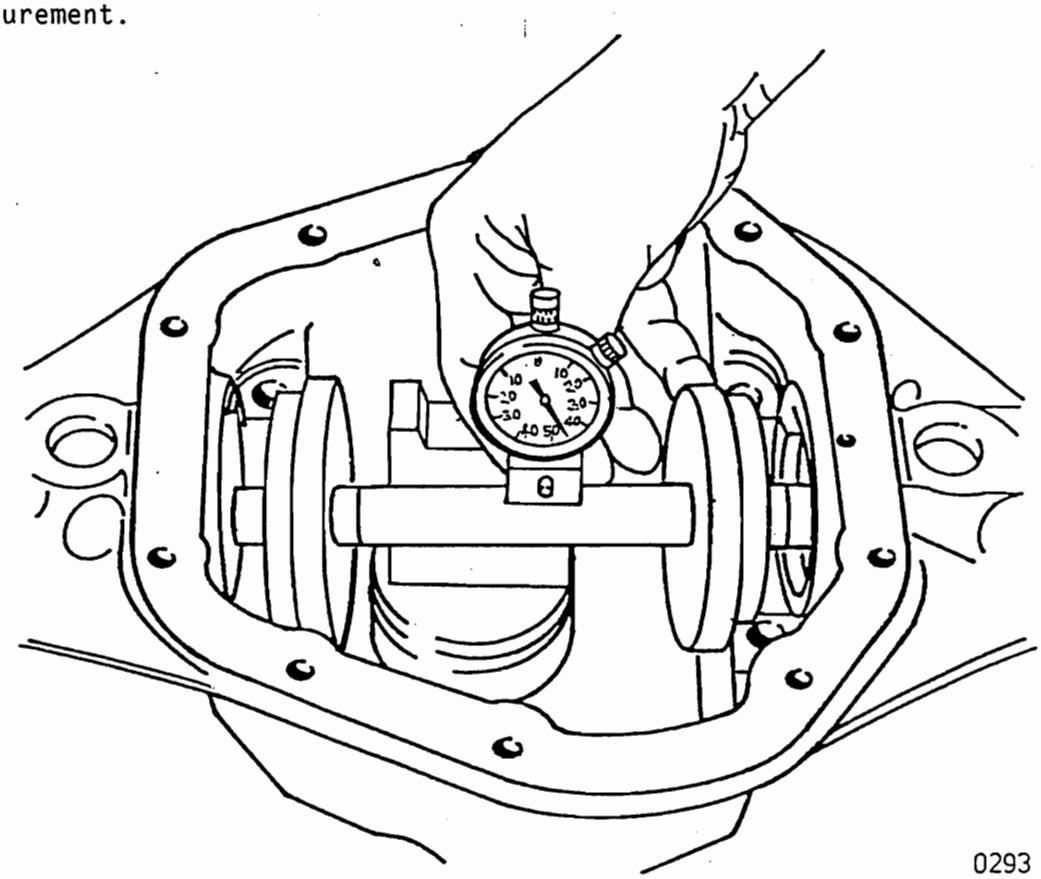

Fig 35 Pinion datum measurement

38 Place the baffle into the pinion inner bearing seat (dished side into the bore) then place the required shim pack onto the baffle. Using the C-4204 installer (Table 1 item 27) and C-4171 handle (Table 1 item 25), fit the pinion inner bearing cup into its seat in the carrier.

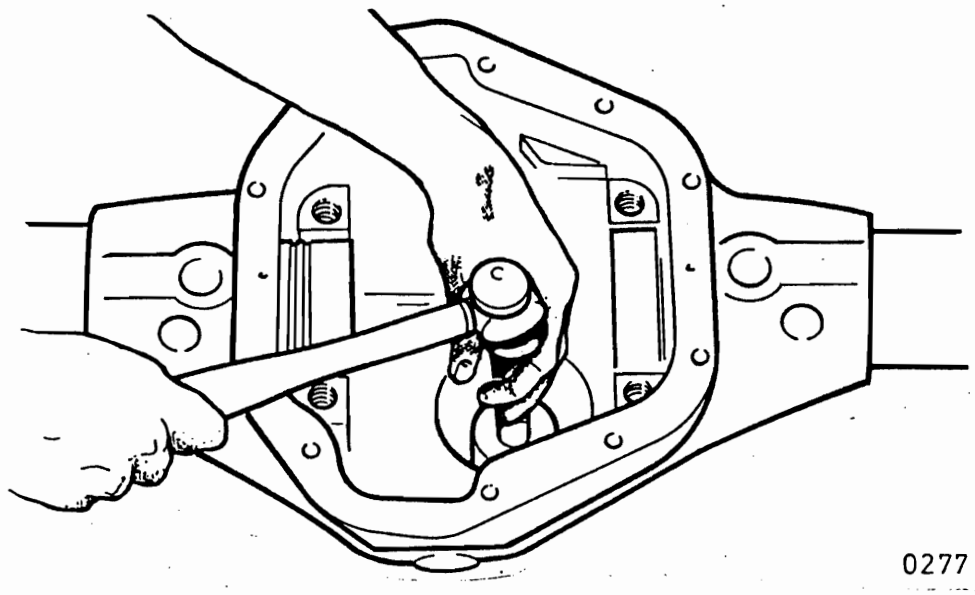

Fig 36 Pinion positioning shims

39 Using the C4203 installer (Table 1 item 25), assemble the outer pinion bearing cup into the carrier.

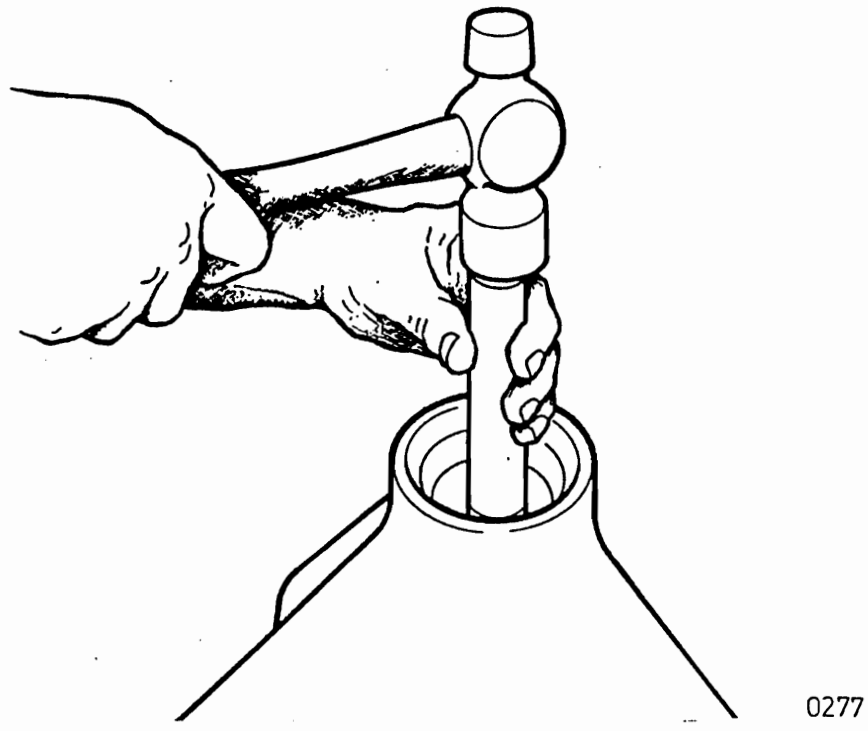

Fig 37 Pinion bearing cup assembly

40 Assemble the inner bearing cone to the pinion, then using C-3095-A (Table 1 item 20) close the bearing cone seat onto the back face of the pinion.

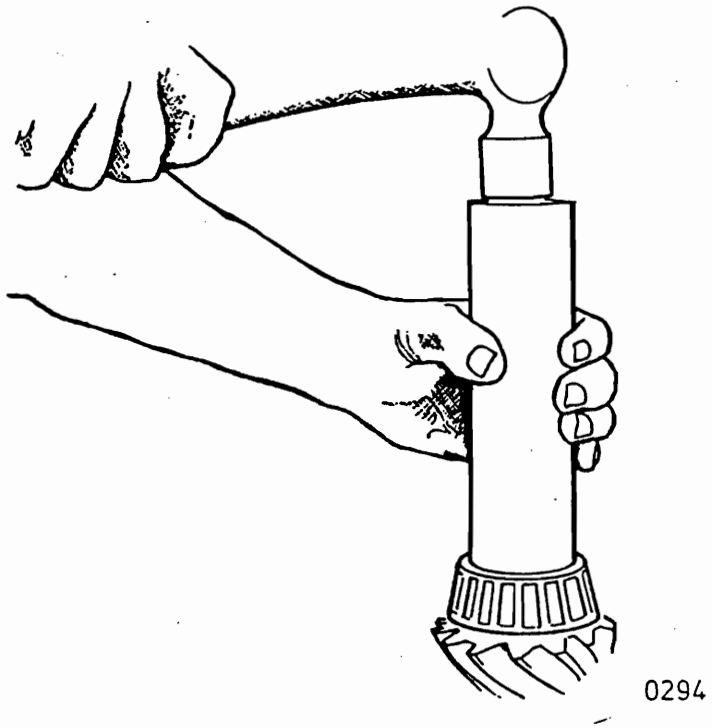

Fig 38 Pinion bearing assembly

41 Place the pinion into the carrier then assemble the outer bearing cone to the shaft (omit shims etc at this stage).

41.1 Fit the end flange onto the spline then assemble the washer and nut using instaler C-3718 (Table 1 item 22) and flange holder C-3281 (Table 1 item 21) (but see Para 42).

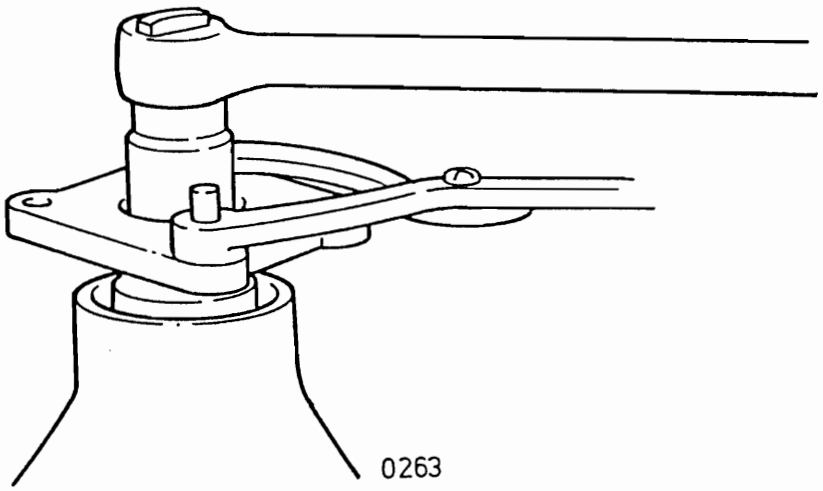

Fig 39 Pinion assembly

42 Tighten the pinion nut, (occasionally rotating the shaft to ensure there are no high spots indicating irregular assembly) until a torque of 1.2 Nm (10 lbf inch) is required to rotate the pinion.

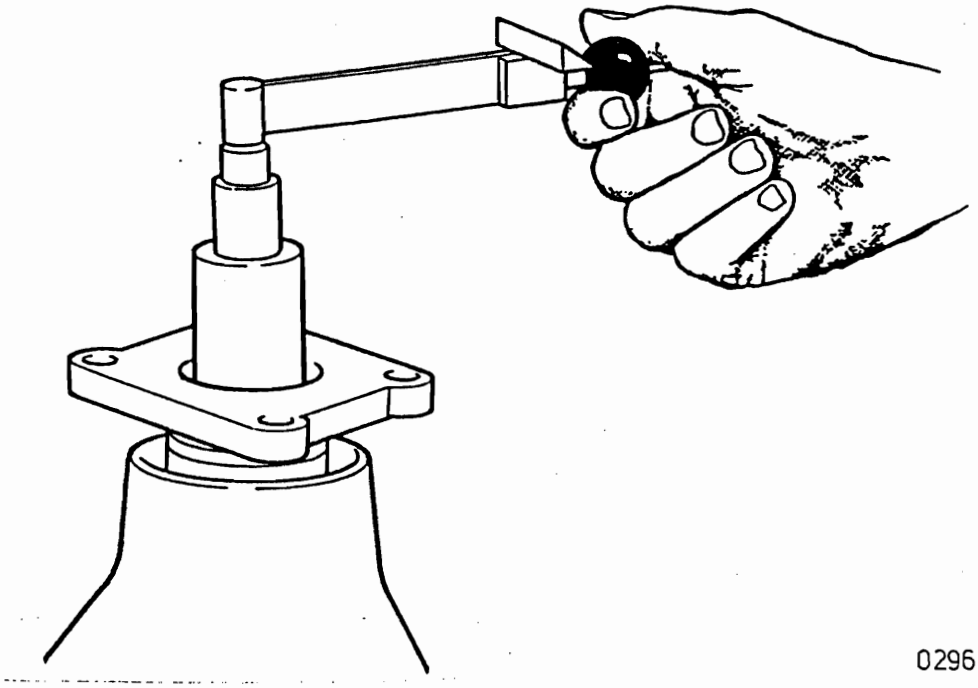

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Fig 40 Pinion torque setting

43 Place the arbor discs into the cross bores of the carrier (see Para 34) and place the height block on the button end of the pinion.

43.1 Place the scooter gauge on the height block and 'zero' the dial indicator.

43.2 Slide the stylus of the scooter gauge over the arbor and check the reading over the highest point. The reading should be within +/-0.002in of the size variance engraved on the pinion button, (e.g. for -1 then a reading in the range +0.001in to -0.003in is acceptable).

43.3 Add/remove shims if necessary using the same setting procedure.

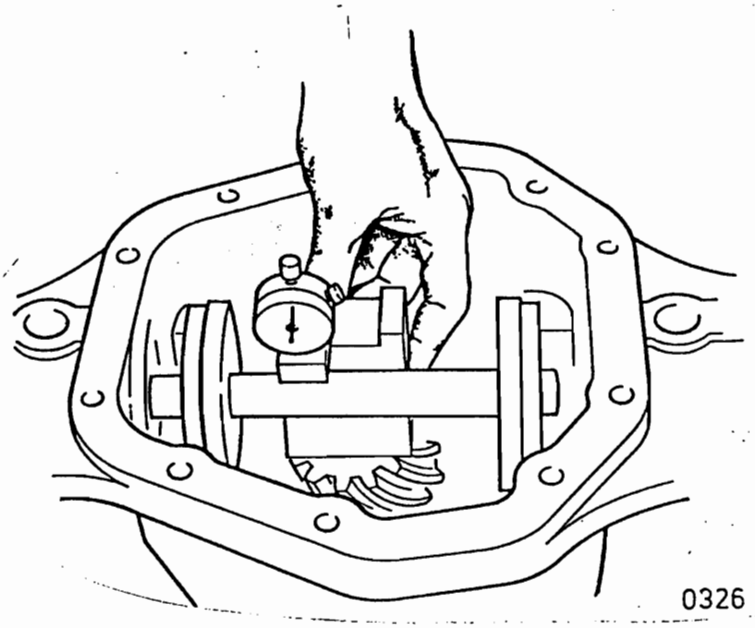


Fig 41 Pinion depth setting

44 Remove the pinion nut, end yoke and inner bearing cone.

44.1 Fit the shims and oil slinger removed during dismantling (replace any damaged components).

44.2 Assemble the inner bearing cone, yoke and nut. Tighten the nut to a torque of 340-350 Nm (250-260 lbf ft) using a torque wrench and C-3281 yoke holder (Table 1 item 21).

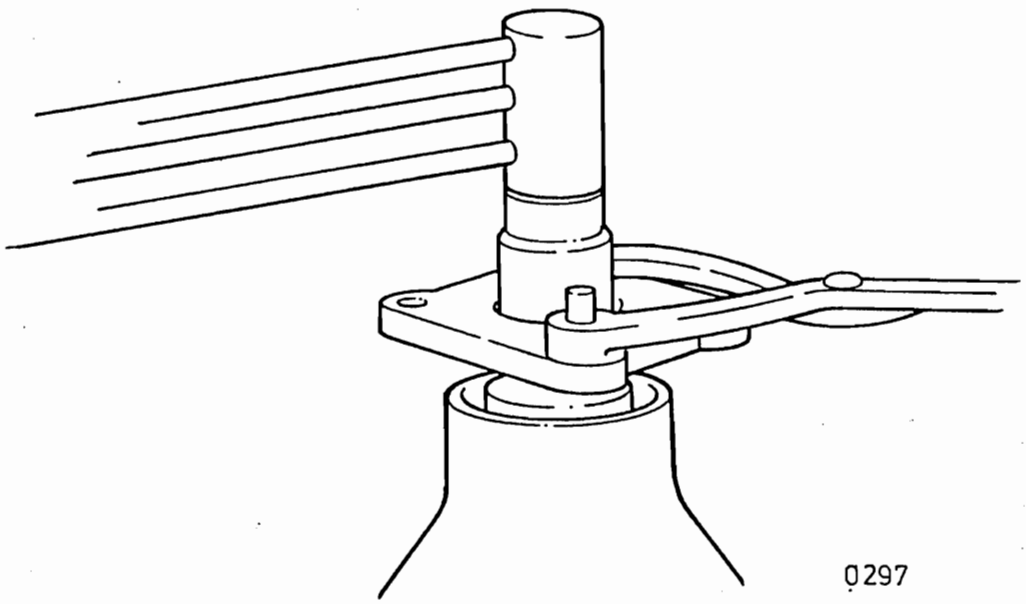


Fig 42 Pinion preload adjustment

45 Using a torque wrench, verify the pinion rotation torque is in the range 2.25-4.5Nm (20-40 lbf in).

45.1 Repeat Para 44, 45 if necessary to add shims (increase preload) or remove shims (decrease preload). (Ref. Fig 30) Note the result obtained.

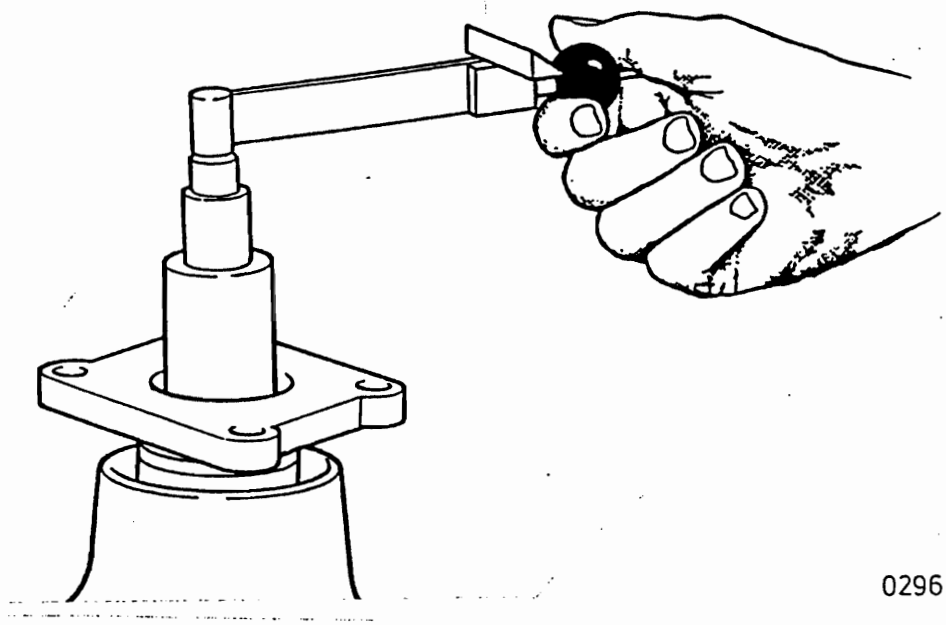


Fig 43 Pinion torque measurement

46 Remove the end yoke.

46.1 Apply a light film of hypoid lubricant to the seal lip of the pinion oil seal, and assemble into the carrier bore using the D-163/C-4171 installer. (Table 1 items 11 and 25).

46.2 Repeat 44 to complete the pinion assembly.

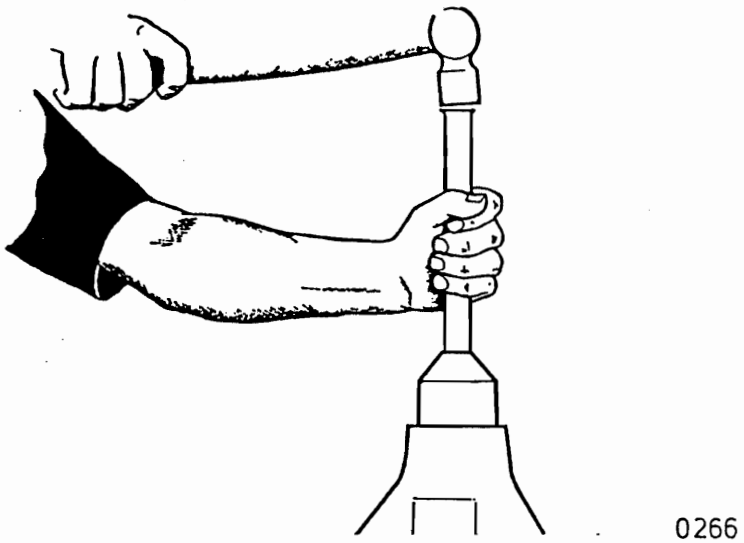


Fig 44 Pinion oil seal assembly

Drivehead assembly

47 Having established the operating position for the pinion, and running preload for its bearings, the same operation can now be carried out for the crown wheel assembly.

48 With the master bearings still fitted to the differential case trunnions, position the crown wheel assembly into the carrier being careful to mesh the crown wheel and pinion without clashing or bruising the teeth.

48.1 Repeat the measurement made in Para 30, except this time ensure the dial indicator datum ('0') is established with the crown wheel fully enmeshed with the pinion (and using the same reference point on the crown wheel).

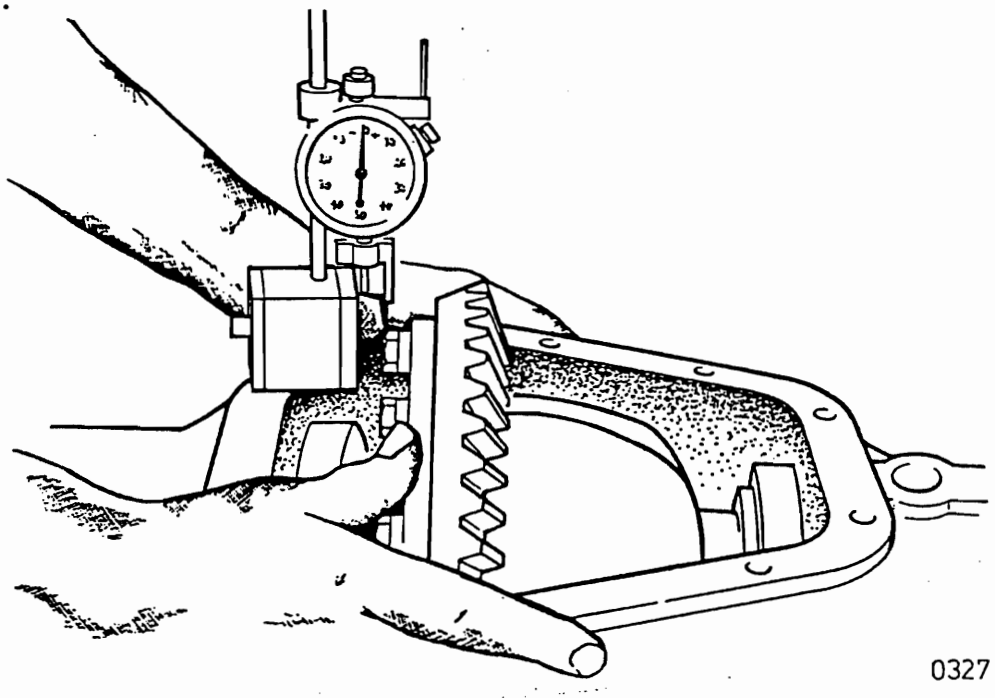


Fig 45 Crown wheel datum

49 Slide the crown wheel in the master bearings away from the pinion to the limit of the movement and note the deflection on the dial indicator. Repeat if necessary to ensure a stable repeatable reading. This dimension is the backlash.

49.1 Using the dimension derived in Para 30, two shimpacks are required to fit on the differential case trunnions.

49.2 Retrieve any re-usable shims from the original assembly.

49.2.1 Assemble a pre-load shimpack equal to the difference between the measurements in Paras 30 and 49 and add 0.015in (i.e. 30-49.1 + 0.015 = pre-load).

49.2.2. Assemble a backlash shimpack equal to the measurement made in Para 49.

49.3 Remove the dial indicator. Carefully extract the crown wheel and differential assembly from the carrier, and remove the master bearings.

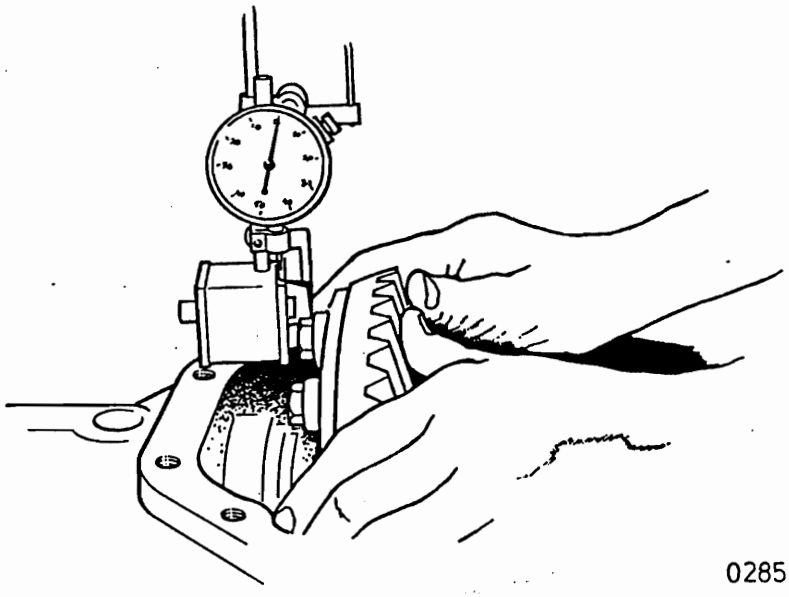


Fig 46 Crown wheel backlash measurement

50 Assemble the pre-load shims to the differential case trunnion, then using the C-4025/C-4171 installer (Table 1 items 23 and 24) fit the bearing cone.

50.1 Invert the differential case with the crown wheel uppermost, then assemble the backlash shims to the differential case trunnion, and fit the bearing cone.

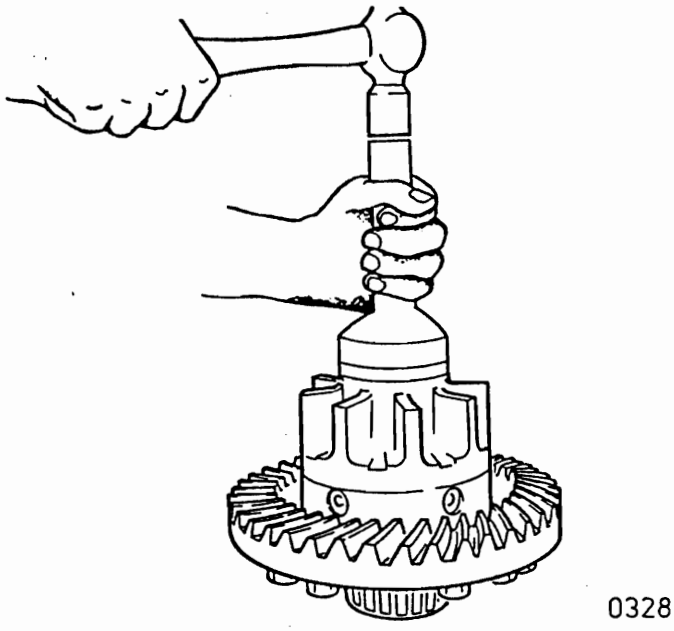


Fig 47 Differential bearing assembly

51 Install the D-167 spreader (Table 1 item 12) to the carrier and adjust it to remove all slackness from the frame without stress in the adjuster.

51.1 Fit the dial indicator base to the carrier face over one of the bearing seats. Position the dial indicator to measure displacement of the spreader over the other bearing seat.

51.2 Adjust the spreader to expand the carrier access aperture 0.015in in the direction of the axle beams. Maximum spread to be less than 0.020in to avoid distortion. Remove the dial indicator.

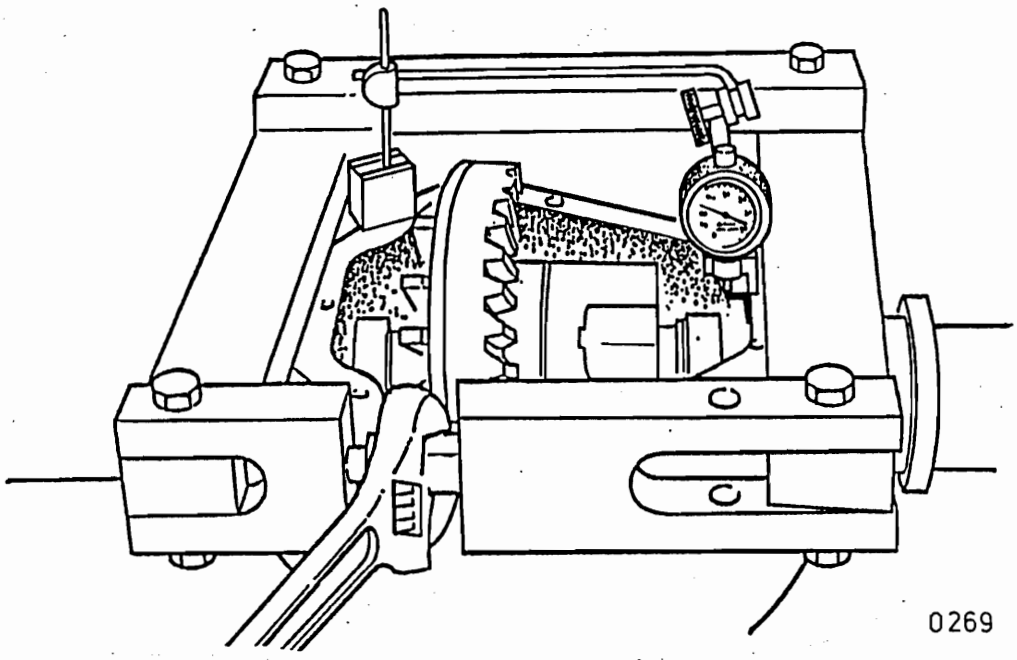


Fig 48 Differential carrier expansion

52 Assemble the bearing cups to the differential bearing cones.

52.1 Install the differential bearing assembly into the carrier, being careful to engage the crown wheel with the pinion without clashing or bruising the teeth.

52.2 Check that the bearing cups are seated in the carrier cross bores.

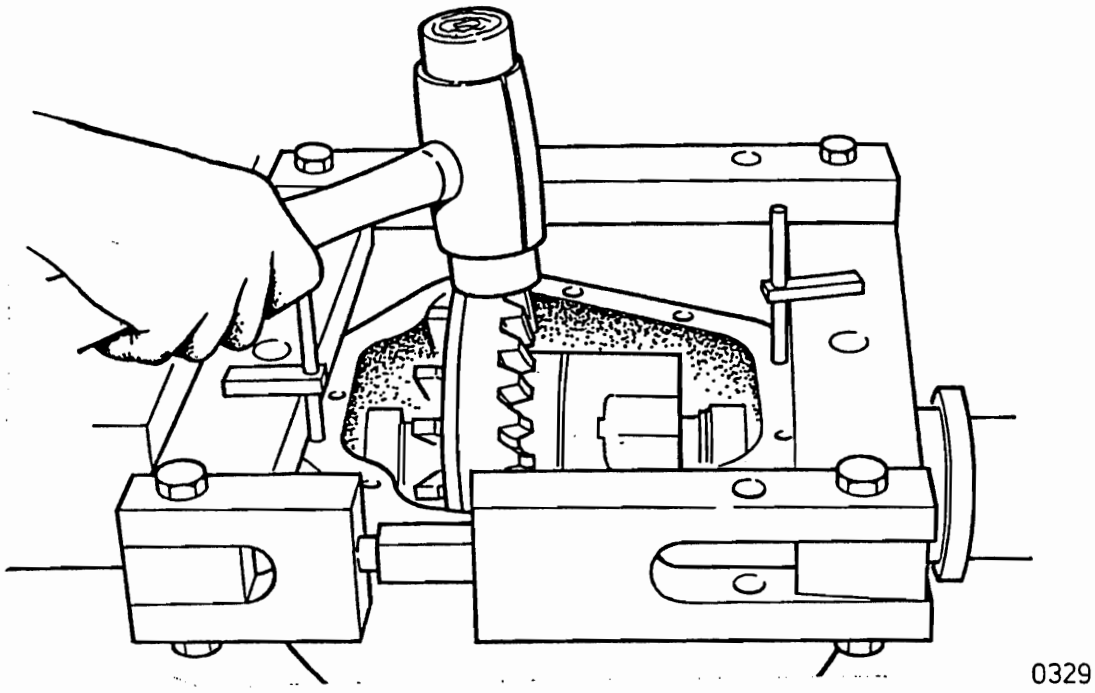


Fig 49 Differential assembly

53 Verify with the dial indicator at four equispaced points, that the crown wheel backlash is in the range 0.005in to 0.01in and the difference between adjacent point is not greater than 0.002in.

53.1 Excess backlash requires shims to be transferred from the preload bearing side to the crown wheel side.

53.2 Insufficient backlash requires shims to be transferred from the crown wheel to the pre-load side.

53.3 In both cases the total shims remain the same.

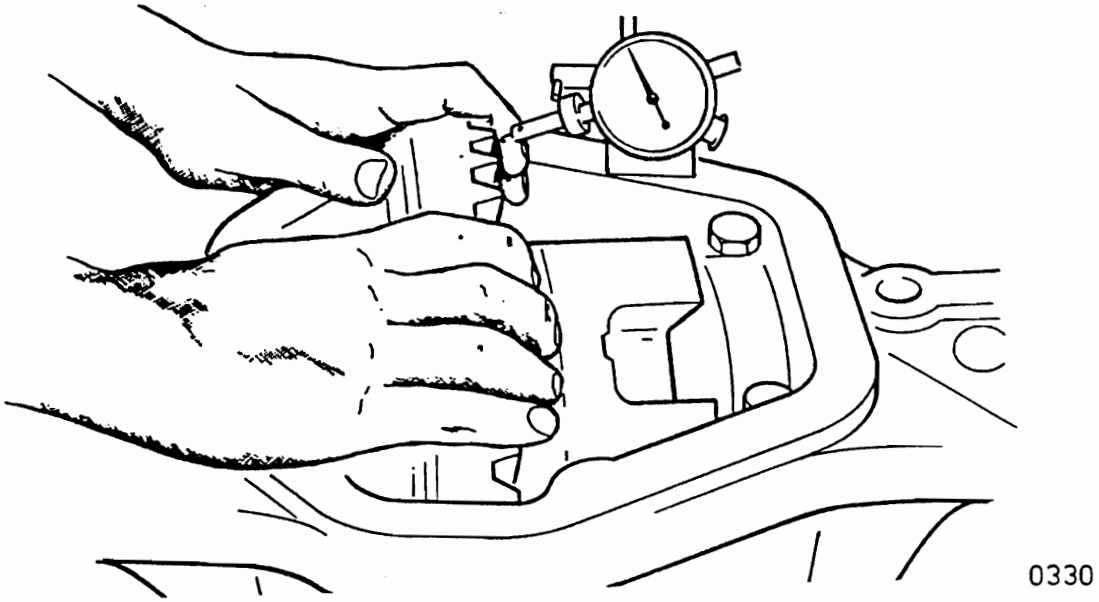


Fig 50 Differential bearing backlash

54 Install the bearing caps ensuring the identification marks of Para 10 are aligned. Tighten the cap bolts to a torque of 95-122 Nm (70-90 lbf ft).

54.1 Apply a thin film of marking grease (engineers blue or pulverised red lead in L.M. grease) to a crown wheel tooth at four equispaced places. Rotate the pinion to give one full turn of the crown wheel and examine the contact marks. They should be evenly impressed around the centre of the gear tooth flank without high spots (which are shown by a total absence of marker grease).

54.2 Exaggerated marks towards the centre of the crown wheel indicate the pinion was set too high (too much adjustment shim).

54.3 Exaggerated marks towards the outside of the crown wheel indicates the pinion was set too low (not enough adjustment shim).

54.4 No marks between the middle and bottom of the teeth indicate not enough backlash shim was fitted, whilst marks down to the roots of the teeth indicate too much backlash shim.

54.5 Any incorrect assembly can only be rectified by total reassembly from the point at which the error occurred.

54.6 The differential case bearings pre-load should be in the range 4.5 to 7.25 Nm (40 to 64 lbf in). With a 4 : 1 advantage through the gear, this is an added load of 1.1 to 1.8 Nm (10 to 16 lbf in) at the pinion. Using the method and value obtained in Para 45, verify this has been increased by 1.1 to 1.8 Nm.

Note ...

If this value is not obtained, differential carrier preload shims would need to be added to increase the value, or removed if the reading is too high.

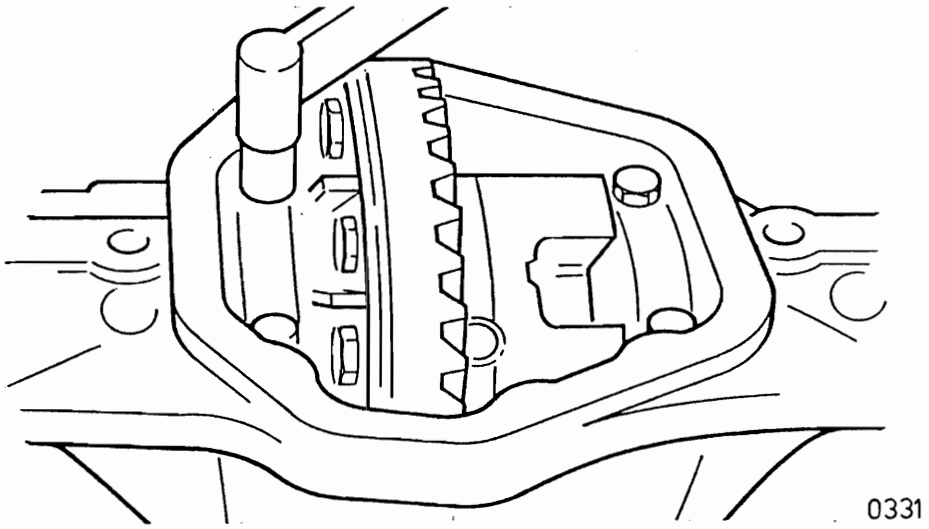


Fig 51 Differential final assembly

55 Install the carrier cover plate using new gasket material. Tighten the setcrews a torque of 41 to 54 Nm (30-40 lbf ft).

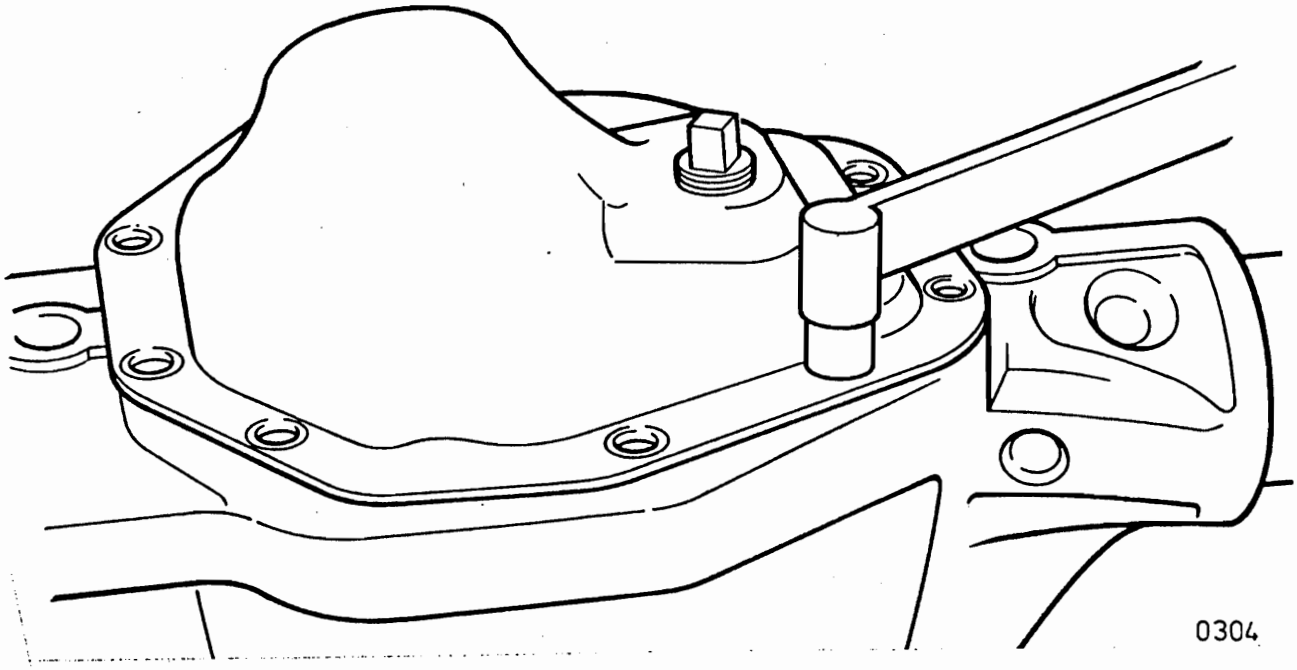


Fig 52 Carrier cover assembly

56 Fitting the axle to the vehicle, and refitting the brakes, hubs and wheels is the reverse of the removal procedure.

Chapter 7

STEERING SYSTEM

CONTENTS

TABLE 1 SPECIAL TOOLS

Item No	NSN/Part No	Tool No	Designation
(1)	(2)	(3)	(4)
1		18G 1133	Ball joint separator
2		RG59A	Adjustable drop arm remover
3		BW85494	Pressure gauge 0-160 bar
4		T.B.A.	Hose and adaptor

BLEEDING THE STEERING HYDRAULIC SYSTEM

1 Prior to bleeding the system ensure that the parking brake is applied, raise the front wheels of the vehicle and support on an appropriate stand.

CAUTION ...

Under no circumstances must the pump be allowed to run in a dry condition as permanent damage will occur.

1.1 Start the engine and run at a fast idle speed. Turn the steering wheel progressively from lock to lock. Check the level of oil in the reservoir, topping up as necessary. Continue until the oil returning to the reservoir is completely clear of air bubbles.

1.2 Top the reservoir up to the indicated level. Remove the supports and lower the vehicle.

STEERING COLUMN

Removal

2 Prior to removal of the steering column ensure the road wheels are in the "straight ahead" position, remove the starter key and disconnect the batteries.

2.1 Remove the four cheese head and one cross head screws securing the lower cowl, detach the cowl.

2.2 Remove the two screws securing the upper cowl to the steering column support bracket and detach the cowl.

2.3 Disconnect the two multi-plugs from the combination switch housing and multi-plug and Lucar connector at the steering column lock harness.

Note ...
If the steering column is to be dismantled following its removal from the vehicle it is advisable to remove the steering wheel at this stage.

2.3.1 To remove the steering wheel prise off the motif assembly and remove the 5/8 in UNF nut, carefully lift the steering wheel free.

2.4 Slacken the bolt securing the clamp plate to the lower end of the outer column and remove the three bolts from the clamp plate to the cab floor. Displace the plate and seal.

2.5 Remove the universal joint pinch bolt. If the same inner shaft is to be refitted match mark the shaft and universal joint.

2.6 Release the column assembly by removing the two bolts securing the top support bracket, disengage the universal joint and remove the complete assembly from the cab.

Installation

3 Installation is the reverse of the removal instructions noting the following:

3.1 Where the original inner shaft is being refitted, align the markings made during removal on the shaft and universal joint. If a new inner shaft is to be fitted proceed as follows:

3.1.1 Ensure that the road wheels are in a straight ahead position. Turn the inner shaft until the turn indicator cancellation drive collar spring is in the 9 'o'clock position as viewed from the driving seat. This will ensure the symmetrical operation of the indicator cancelling mechanism.

3.1.2 If the steering lock assembly has been removed check its operation before fully tightening the shear bolts.

3.1.3 Before finally tightening the outer column upper securing bolts and lower clamp bolt, ensure that the column is raised to achieve dimension "A" Fig 1 i.e. 17mm $\pm$ 1mm gap.

Dismantling

4 To dismantle the steering column assembly secure the column assembly in a vice equipped with soft jaw clamps. Do not distort the outer column.

4.1 Insert the key and unlock the steering lock to allow the inner shaft to rotate freely. Remove the switchgear housing.

4.2 Remove the circlip (10) from the lower end of the inner shaft followed by a washer, lower bearing and further washer. Remove the rivet (1) securing the collar and remove the collar. Using a soft mallet gently tap the inner shaft upwards to permit removal of the upper circlip (2).

4.3 Remove the upper circlip from the inner shaft,and lift off the washers spring and bearing(4). Using a soft mallet drive and drift drive the inner shaft until the lower bush can be removed.

5 To remove the steering lock separate the lock from the column as follows :

5.1 Remove the key from the lock, accurately centre pop both steering lock shear bolts. Pilot drill the bolts using a 0.3mm ($^{1}/_{8}$in) drill.

5.2 Use a 0.7mm ($^{9}/_{32}$in) drill to remove the remains of the secondary heads of the shear bolts from their positions in the lock assembly. Detach the lock and bracket assembly from the outer column.

Reassembly

6 Prior to reassembly inspect all components for damage or excessive wear, renew as necessary.

6.1 Fit the upper bearing to the outer column with the dish of the bearing uppermost, drift into position using a suitable tube, grease with XG275.

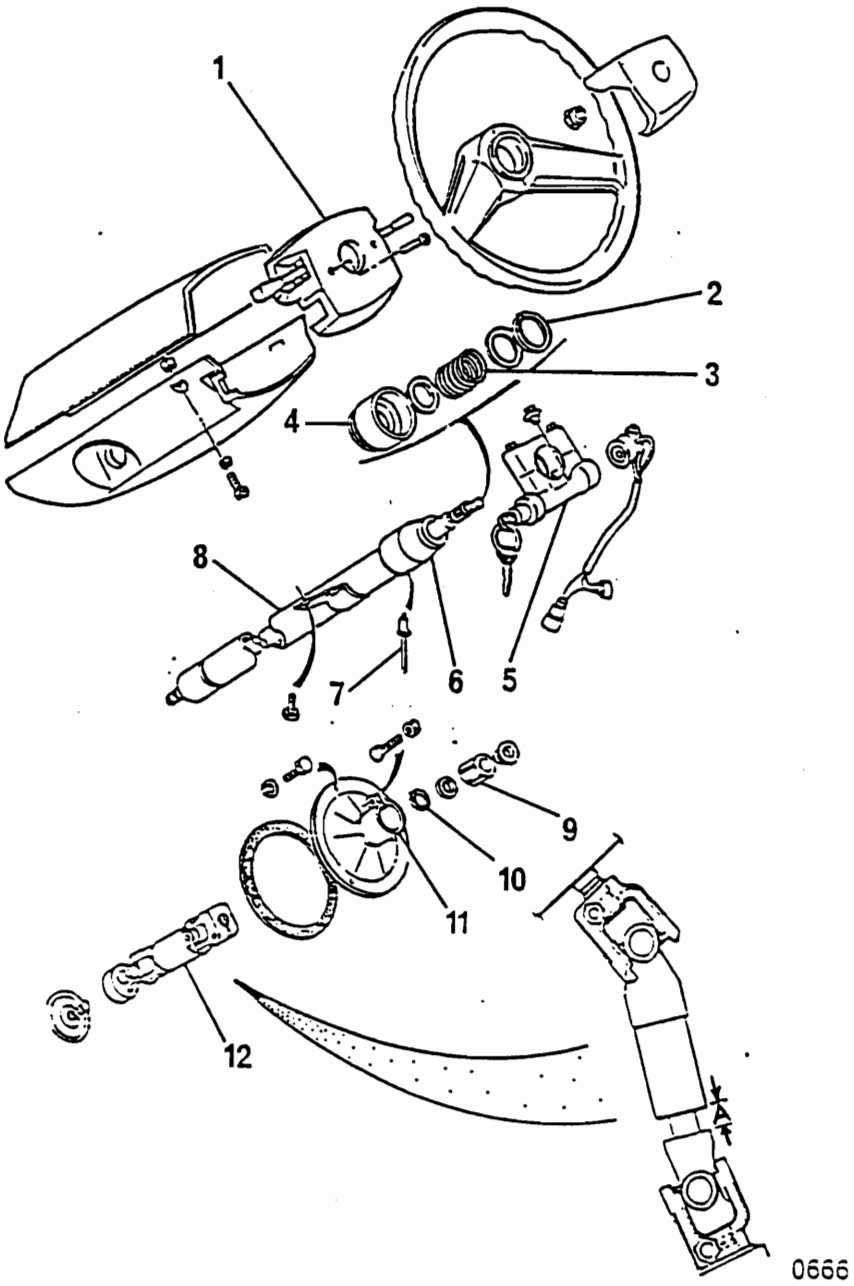
6.2 Grease the lower bush with XG275 assemble onto the inner shaft and enter the shaft into the outer column. Press the lower bush into position in the outer column and push the inner shaft through the top bearing until the circlip locating groove can be seen. Fit the collar, dish uppermost, followed by a washer, spring, second washer and circlip.

6.3 Using a soft mallet tap the inner shaft downwards, fit the collar and secure with new rivet. Fit the washer, to the lower end of the shaft and secure with the circlip.

6.4 Fit the unlocked steering lock assembly on the outer column with the key below and to the left of the column as viewed from the driving seat. Fit the shear bolts finger tight only.

6.5 Check that the inner shaft is free to rotate and also the locking action of the steering lock. Refit the combination switch housing ensuring that the turn indicator switch cancellation spring engages in the key way machined in the innershaft.

6.6 Recheck the operation of the steering lock and check correct operation of associated circuitry before tightening the securing bolts to the point where the heads shear.



1	Combination switch housing	7	Rivet
2	Circlip	8	Outer shaft
3	Spring	9	Lower bush bearing
4	Upper bearing	10	Circlip
5	Steering locking assembly	11	Clamp plate
6	Upper collar	12	Universal joint

A = 17mm ± 1mm

Fig 1 Steering column assembly

STEERING BOX

Removal

7 Prior to removal of the steering box disconnect the batteries, apply the parking brake and chock the rear wheels.

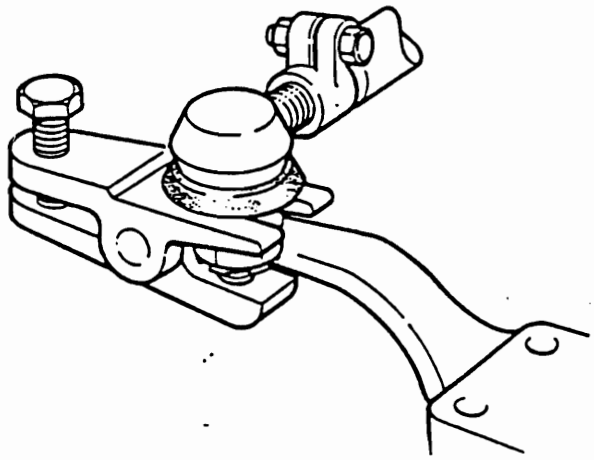
7.1 Raise the front of the vehicle until both front wheels are clear of the ground, support on appropriate stands.

7.2 Place a suitable receptacle beneath the steering box to catch the steering hydraulic oil. Disconnect the union of each pipe from the steering box and allow the oil to drain. Turn the steering wheel from lock to lock until fluid ceases to flow.

7.3 Remove the split pin and securing nut from the drop arm to drag link ball joint. Using a ball joint separator part the joint.

7.4 Remove the steering column.

7.5 Supporting the steering box remove either the 3 bolts securing it to its mounting bracket or the 4 bolts securing the mounting bracket to the chassis sidemember.



0332

Fig 2 Using a ball joint separator

Note ...
If a replacement steering box is to be fitted it will be necessary to remove the universal joint assembly and the drop arm.

7.6 Remove the universal joint by removing the pinch bolt and nut and removing the joint from the splines of the input shaft.

7.7 With the steering box securely mounted in a vice remove the drop arm as follows, after ensuring that the registration marks on the drop arm and sector shaft are clearly visible and aligned :

7.7.1 Obtain a suitable tube to fit over the drop arm and position it so that the drop arm is prevented from moving when the securing nut is unscrewed.

CAUTION

The internal mechanism of the steering box must not be allowed to take the torque reaction as the drop arm securing nut is loosened.

7.7.2 Knock back the tab washer and remove the nut securing the drop arm. Using an adjustable drop arm remover release the drop arm from the shaft.

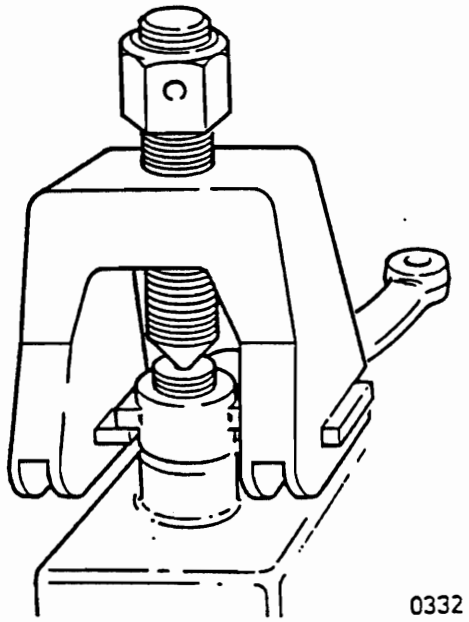


Fig 3 Using a drop arm remover

Installation

8 To install a steering box, reverse the removal procedure. Ensure that the drop arm is positioned correctly on the sector shaft with the registration marks aligned. Bleed the system on completion.

TABLE 2 STEERING BOX INSTALLATION TORQUES

Ser	Connection	Nm	lbf ft
(1)	(2)	(3)	(4)
1	Steering box support bracket to chassis	92	68
2	Steering box to support bracket	460	339
3	Drop arm to rocker shaft nut	249	184
4	Drop arm to drag link ball joint	95	70
5	Lower steering joint - 8 mm	32	24
6	Lower steering joint - 10 mm	80	59

Dismantling and reassembly

9 For instructions on the dismantling and re-assembly of the steering box see AESP 2320-E-200-524 Chapter 7.

POWER STEERING PUMP

Belt adjustment and replacement

10 The procedure for power steering belt adjustment and replacement for both General Service Cargo and FFR variants, is provided in Category 2 Chapter 4.

Removal

11 To remove the power steering pump.

11.1 Place a suitable receptacle below the pump to catch the hydraulic system oil when the pipe and hose connections are disconnected. Release the hose from the rear of the pump and allow the system to drain. Plug the end of the hose to prevent ingress of foreign matter.

11.2 Unscrew the union and disconnect the high pressure pipe/hose assembly from the adaptor at the rear of the pump. Drain the residual fluid into the receptacle and plug the end of the pipe.

11.3 Support the pump, remove the adjustment strap pivot bolts, disengage the drive belt from the pulley. Remove the pump.

Installation

12 Installation is the reversal of removal. Adjust the drive belt as detailed in Category 2 Chapter 4. Prime and bleed the system.

TABLE 3 HYDRAULIC PUMP INSTALLATION TORQUES

Ser	Connection	Nm	lbf ft
(1)	(2)	(3)	(4)
1	Pump to adjuster bracket.	9.57	
2	Adjuster bracket to mounting bracket	41	30
3	Pump drive pulley bolt	26	19
4	Pump discharge adaptor	19	14

Testing pump pressure

13 Turn the vehicle steering onto full right lock (on R.H.D.) vehicles) and full left lock (on L.H.D, vehicles).

13.1 Apply handbrake, select "Neutral" on gearbox selector and stop engine.

13.2 Attach a suitable clamp to the lower end of the return line hose from the steering box to the reservoir, to prevent unnecessary spillage of hydraulic fluid when the high pressure supply pipe is disconnected.

13.3 Position a suitable drip tray to catch the hydraulic fluid when the supply pipe is disconnected.

13.4 Unscrew the small union of the high pressure supply pipe from the steering box and allow the fluid to drain into the drip tray.

13.5 Screw in adaptor (Table 1 item 4) and connect pressure gauge No BW85494 (Table 1 item 3). Tighten adaptor.

13.6 Top up reservoir with correct grade of fluid as per maintenance schedule.

13.7 Start the engine and note the pressure registered on the gauge. Stop the engine as soon as the reading has been obtained. The reading should be 130 bar -/+ 10% at or slightly above idling speed.

Caution ...
The MAXIMUM engine running time allowed for this test is 10 seconds as otherwise the pump may be damaged.

13.8 If the pressure is not within the prescribed limits the pump unit is suspect and must be replaced with a new pump.

13.9 On completion of the test, remove the pressure gauge, hose assembly and adaptor.

13.10 Refit the fluid supply pipe to the steering box.

13.11 Remove the clamp from the return hose.

13.12 Top up the reservoir with the correct grade of hydraulic fluid as stated in the maintenance schedule and bleed the system as per para 1.

Dismantling and reassembly

14 This pump is not a serviceable unit.

RESERVOIR

Removal

15 Prior to removing the reservoir thoroughly clean around the area where the hoses secure to the base of the reservoir. Place a suitable receptacle below the reservoir to catch the oil.

15.1 Release the hose clips, remove the hoses and drain the reservoir. Plug both hoses to prevent ingress of dirt and unnecessary fluid loss.

15.2 Remove the three nuts and bolts securing the reservoir to its mounting bracket and remove the reservoir from the vehicle.

Installation

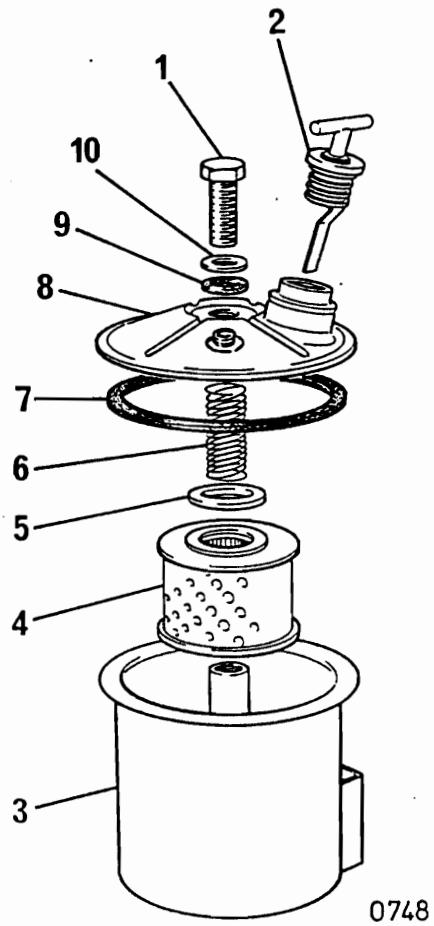
16 Installation is the reverse of removal. Fill the reservoir with the correct fluid as per Maintenance Schedule. Bleed the hydraulic system.

Replacing the filter element

17 To replace the filter element :

17.1 Remove the centre bolt (Fig 4 (1)), washer (10) and sealing washer (9). Lift off the cover (8) and sealing ring (7). Remove the spring (6) and spring seat (5) from the top of the filter element. Lift out the filter element (4).

17.2 Thoroughly clean all components. Position the spring seat on the new filter element, dished face uppermost. Fit the spring above, and concentric with, the dished washer, place the sealing ring in position and fit the reservoir cover. Do not overtighten the cover bolt.



1 Centre bolt
2 Filler cap
3 Bowl
4 Element
5 Spring seat
6 Spring
7 Gasket
8 Cover
9 Sealing washer
10 Washer

Fig 4 Exploded view of hydraulic fluid reservoir

FRONT AXLE STEERING STOPS

Adjustment

18 Adjust the steering stops on the front axle tube so that the front wheels can be moved through an arc of 31^{o} to left and right from the straight ahead position. Lock the steering stop bolts in this position by tightening the locknuts.

Chapter 8

SUSPENSION

CONTENTS

TABLE 1 SPECIAL TOOLS

Serial No	Tool No	NSN/Part No	Designation
(1)	(2)	(3)	(4)
1 2	RG566 RG566-1		Spring bush remover/replacer Spring bush remover/replace adaptor

FRONT SPRINGS

Removal (Fig 1)

1 Slacken the wheelnuts (left hand wheel nuts have left hand threads), raise the front of the vehicle and fit axle stands under the chassis frame, remove the wheel. Place a trolley jack under the front axle and raise sufficiently to take the weight off the axle without loading the spring.

1.1 Remove the two U-bolts (29) securing the axle spring seat to the spring (19). Displace the shock absorber attachment plate.

1.2 Straighten the lock washer (17) on the rear and remove the shackle bolts (18 and 23) and remove both bolts. Remove the spring.

Installation

2 To refit the front springs reverse the above procedure. Use new nuts when refitting the U-bolts.

2.1 Torque tighten U-bolts to 102 Nm (75 lbf ft). Torque tighten the front shackle bolts (14 and 23) to 135 Nm (100 lbf ft) and the rear shackle bolt (18) to 102 Nm (75 lbf ft).

Dismantling

3 Prior to dismantling a spring mark one end of each leaf to ensure that it is replaced in the same position on re-assembly.

3.1 Remove the spring clip bolts and distance tubes from the clips securing the spring leaves. Unscrew the dowel bolt nut and remove the dowel bolt.

Inspection

4 Clean each spring leaf with paraffin, dry thoroughly, and examine each leaf for cracks. Renew all cracked leaves. Grind, or file flat any ridges which may have occurred at the tips of the leaves.

Chapter 8

SUSPENSION

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TABLE 1 SPECIAL TOOLS

Serial No	Tool No	NSN/Part No	Designation
(1)	(2)	(3)	(4)
1 2	RG566 RG566-1		Spring bush remover/replacer Spring bush remover/replace adaptor

FRONT SPRINGS

Removal (Fig 1)

1 Slacken the wheelnuts (left hand wheel nuts have left hand threads), raise the front of the vehicle and fit axle stands under the chassis frame, remove the wheel. Place a trolley jack under the front axle and raise sufficiently to take the weight off the axle without loading the spring.

1.1 Remove the two U-bolts (29) securing the axle spring seat to the spring (19). Displace the shock absorber attachment plate.

1.2 Straighten the lock washer (17) on the rear and remove the shackle bolts (18 and 23) and remove both bolts. Remove the spring.

Installation

2 To refit the front springs reverse the above procedure. Use new nuts when refitting the U-bolts.

2.1 Torque tighten U-bolts to 102 Nm (75 lbf ft). Torque tighten the front shackle bolts (14 and 23) to 135 Nm (100 lbf ft) and the rear shackle bolt (18) to 102 Nm (75 lbf ft).

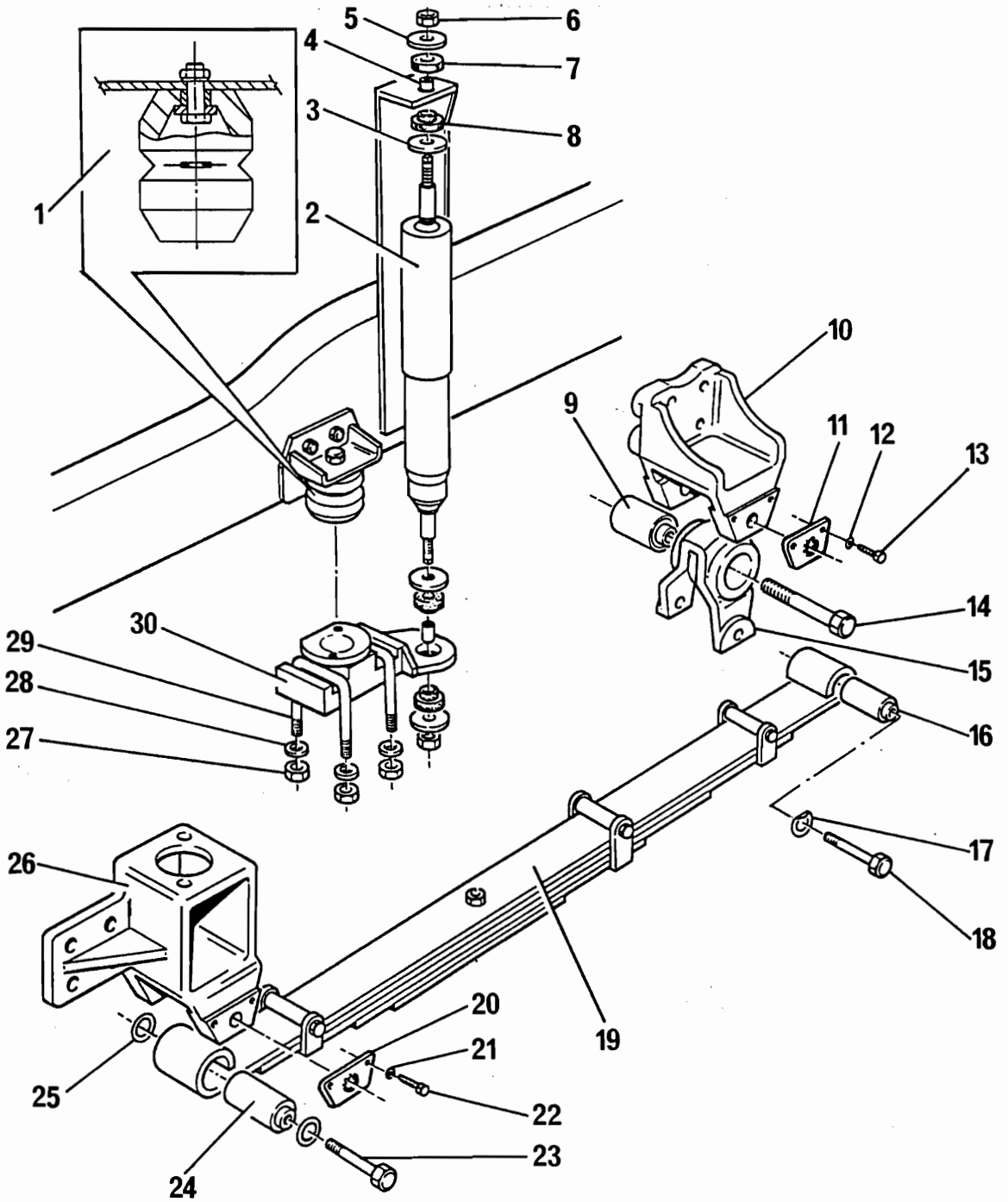
Dismantling

3 Prior to dismantling a spring mark one end of each leaf to ensure that it is replaced in the same position on re-assembly.

3.1 Remove the spring clip bolts and distance tubes from the clips securing the spring leaves. Unscrew the dowel bolt nut and remove the dowel bolt.

Inspection

4 Clean each spring leaf with paraffin, dry thoroughly, and examine each leaf for cracks. Renew all cracked leaves. Grind, or file flat any ridges which may have occurred at the tips of the leaves.



1	Bump stop	11	Lockplate	21	Spring washer
2	Shock absorber	12	Spring washer	22	Setscrew
3	Washer	13	Setscrew	23	Bolt
4	Bush	14	Bolt	24	Bush
5	Washer	15	Shackle	25	Spacer
6	Nut	16	Bush	26	Front hanger bracket
7	Rubber	17	Lockwasher	27	Nut
8	Rubber	18	Bolt	28	Washer
9	Bush	19	Spring	29	'U' Bolt
10	Rear hanger bracket	20	Lockplate	30	Spring seat

Fig 1 Front spring and shock absorber (l.h.side)

4.1 Examine the dowel bolt, renew the bolt if worn or if the threads are damaged.

4.2 Examine the spring bushes (16 and 24) for wear or damage, renew as necessary.

4.3 Check the spring clips, reset any which have become bent. Renew any damaged distance tubes and bolts. Check the U-bolts for stretch or damaged threads, renew if necessary.

Reassembly

5 Reassembly is the reverse of the dismantling procedure, ensure that the leaves are in their original positions. Apply a film of graphite grease (XG 264) to each spring leaf.

Renew spring bushes (in situ)

6 To renew the spring bushes in situ, raise the front of the vehicle and fit axle stands. Place a trolley jack under the front axle, and raise sufficiently to take the weight of the axle without loading the spring.

6.1 Disconnect the shock absorber from the spring attachment plate.

6.2 Straighten the lock washer (17) and remove the rear shackle bolt (18). Lower the spring sufficiently to clear the shackle. To renew the front bush first remove lockplate (20) and then remove the shackle bolt (23).

6.3 Using a spring bush removal/replacement tool RG566 (Table 1 serial No 1) extract the spring front bush. When removing the spring rear bush use the spring bush removal/replacement tool with its adaptor RG566-1 (Table 1 serial No 2).

6.4 To refit a new spring bush reverse the removal procedure and fit a new lock washer (17) if removed.

REAR SPRINGS

Removal (Fig 2)

7 Slacken the wheel nuts (left hand wheel nuts have left hand threads). Raise the rear of the vehicle and support on stands located behind the spring rear hanger brackets. Remove the wheel. Place a trolley jack under the rear axle and raise sufficiently to take the weight of the axle without loading the spring.

7.1 Remove the two U-bolts (11) securing the axle to the spring. Straighten the washer (23) on the rear spring shackle bolt (24), and then remove the lockplate (30) from the front spring shackle bolt (31) and remove the bolts (24 and 31). Lower the axle and remove the spring from the vehicle.

Installation

8 To refit a rear spring reverse the above procedure ensuring that the spring dowel locates in the hole in the spring platform. Use new nuts when refitting the U-bolts.

Note ...
The right hand spring is fitted with an extra distance piece with the exception of the left hand drive TCB FFR carrier NATO Stock Number 2320 99 893 7675 where the extra packing piece is fitted to the left hand spring.

8.1 Torque tighten U-bolt nuts (26) to 142 Nm (105 lbf ft). Torque tighten the spring shackle bolts (24 and 31) to 340 Nm (250 lbf ft).

Dismantling

9 Prior to dismantling a spring mark one end of each leaf to ensure that it it replaced in the same position on re-assembly.

9.1 Secure the spring firmly in clamps or a vice. Remove the spring clip bolts and distance tubes from the clips secured to the spring leaves.

9.2 Unscrew the dowel bolt nut and remove the dowel bolt. Gradually release the vice or clamp pressure so that the leaves do not spring rapidly apart.

Inspection

10 Clean each spring leaf with paraffin, dry thoroughly, and examine each leaf for cracks. Renew all cracked leaves. Grind or file flat any ridging which may have occurred at the tips of leaves.

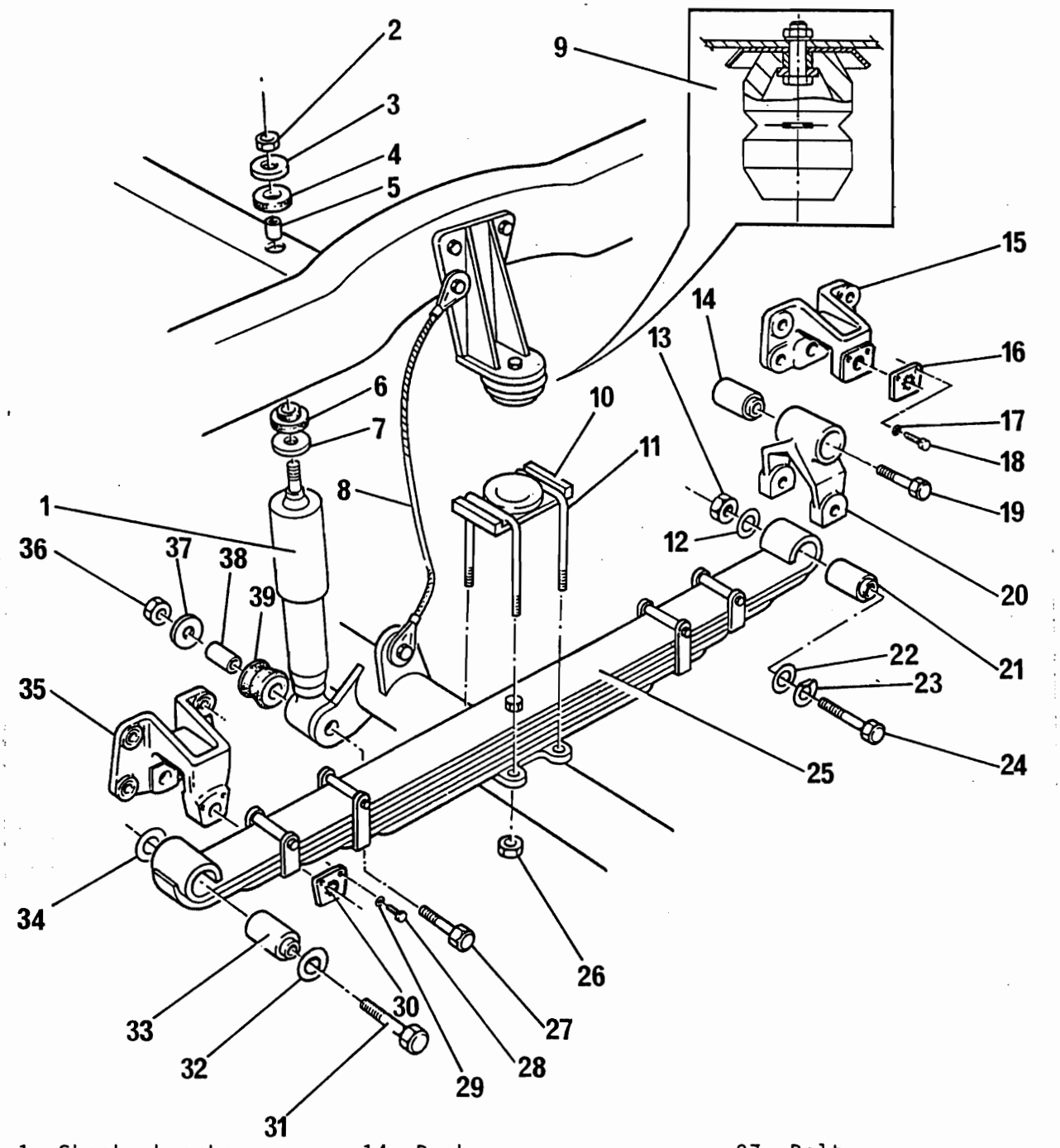
10.1 Examine the centre bolt. Renew the bolt if worn, or the if the threads are damaged. Examine the spring bushes for wear or damage, renew as necessary.

10.2 Check the spring clips, and reset any which have become bent. Renew any damaged distance tubes and bolts.

Re-assembly

11 Re-assembly is the reverse of the dismantling procedure, ensure that the leaves are in their original position. Apply a film of graphite grease (XG 264) to each spring leaf.

Note ...
The right hand spring is fitted with an extra distance piece with the exception of the left hand drive TCB FFR carrier NATO Stock Number 2320 99 893 7675 where the extra packing piece is fitted to the left hand spring.



1	Shock absorber	14	Bush	27	Bolt
2	Nut	15	Rear hanger bracket	28	Setscrew
3	Washer	16	Lockplate	29	Spring washer
4	Rubber	17	Spring washer	30	Lockplate
5	Bush	18	Setscrew	31	Bolt
6	Rubber	19	Bolt	32	Spacer
7	Washer	20	Shackle	33	Bush
8	Check strap	21	Bush	34	Spacer
9	Bump stop	22	Spacer	35	Front hanger bracket
10	Spring seat	23	Lockwasher	36	Nut
11	'U' Bolt	24	Bolt	37	Washer
12	Spacer	25	Spring	38	Bush
13	Nut	26	Nut	39	Rubber

Fig 2 Rear spring and shock absorber (l.h.side)

FRONT SHOCK ABSORBERS

Removal (See Fig 1)

12 Remove the, nut (6) washers (3 and 5) two rubbers (7 amd 8),and bush (4) from the upper and lower ends of the shock absorber. Compress the shock absorber to clear the mounting brackets, and withdraw it from the vehicle.

Installation

13 Reverse the removal procedure, ensuring that the locating spigot of each rubber mounting faces into the hole of each mounting bracket. The rubbers and the steel washers are interchangeable, between the upper and lower mountings.

Inspection

14 The shock absorbers are sealed units which cannot be dismantled or adjusted. In the event of a shock absorber being faulty, a replacement unit must be fitted.

14.1 Some indication of the condition of a shock absorber can be obtained as follows :

14.1.1 Secure the shock absorber in an upright position in a vice, holding it by the fixing stud only - do not grip the body of the shock absorber.

14.1.2 Work the shock absorber up and down through its complete stroke several times to expel any air from the pressure chamber. When the air has been expelled, a uniform resistance should be felt although not necessary a resistance equal to that of the compression stroke, should also be felt throughout the rebound stroke.

14.1.3 If the resistance is erratic, and free movement of the piston can be felt, the shock absorber must be replaced.

14.1.4 Although failure of the support shock absorber to meet the requirements of the above test will confirm that it is faulty, the fact that it may appear to perform satisfactorily during the hand test does not necessarily prove that it is functioning correctly on the vehicle. If in any doubt as to its serviceability replace the shock absorber.

14.2 Check the condition of the rubber mountings and renew if necessary.

REAR SHOCK ABSORBERS

Removal and inspection (See Fig 2)

15 To remove the rear shock absorber.

15.1 Remove the nut (36) and bolt (27) securing the bottom of the shock absorber to the rear axle lug. Collect the washer (37), bush (38) and rubber (39).

15.2 Remove the nut (2), two washers (3 & 7), two rubber mountings (4 & 6) and bush (5) from the upper end of the shock absorber. Remove the shock absorber.

15.3 Inspect the shock absorbers as detailed in Paragraph 14.

Installation

16 To fit a rear shock absorber reverse the above procedure ensuring that the spigot of each rubber mounting locate correctly.

Chapter 9

WHEELS AND TYRES

CONTENTS

TABLE 1 - SPECIAL TEST EQUIPMENT AND TOOLS

Serial No	Tool No	NSN/Part No	Designation
(1)	(2)	(3)	(4)
1	30711		Wheel valve

WHEELS

WARNING ...

THE JACK IS DESIGNED ONLY FOR USE WHEN CHANGING A WHEEL. NEVER GET BENEATH THE VEHICLE WHEN IT IS SUPPORTED SOLELY BY A JACK. DO NOT START OR RUN THE ENGINE WHILST THE VEHICLE IS SOLELY JACK SUPPORTED.

CAUTION ...
This vehicle is fitted with spherical seat wheels. The stud threads are left hand on the left hand side and right hand on the right hand side of the vehicle.

Note :
(1) It is important to note that when a wheel and tyre are to be replaced, the correct direction of the tread pattern is fitted to the appropriate side of the vehicle.

(2) As only one spare wheel is carried on the vehicle, it may not be possible to fit the correct wheel assembly. If this situation arises the spare should be fitted and the tread direction corrected as soon as possible.

Removal

1 Park the vehicle on a firm level surface and apply the handbrake (if removing a rear wheel, chock the front wheels).

1.1 Place jack under the appropriate axle beneath the spring pad and raise jack until it touches the axle.

1.2 Release the wheelnuts half a turn. Raise the jack until the wheel just clears the ground. Remove wheelnuts and wheel. Lightly oil the stud threads to prevent corrosion, this oil must be removed prior to refitting wheel.

Installation

2 Ensure the mating surfaces on the nut and wheel are free of foreign matter, or lubricant.

2.1 Fit the wheel and tighten the wheelnuts to 298Nm (220 lbf.ft)

2.2 Lower and remove the jack then re-check the wheelnut torques.

TYRES

Removal

3 With the wheel removed from the vehicle :

3.1 Remove the dust cap, using a valve key loosen the valve core. Remove valve core completely when the tyre is deflated.

3.2 Remove the spring seal retainer and separate the inner and outer rims.

3.3 Remove the wheel sprat from the inner rim and withdraw the inner rim from tyre.

Installation

4 Prior to fitment of the rims to the tyre, apply a suitable compound to the tyre's rims.

4.1 Place the tyre over the outer rim and fit the wheel sprat.

4.2 Mate the inner and outer rims and fit the spring seal retainer.

4.3 Fit the valve core, using the valve key.

4.4 Connect a compressed air supply to the valve housing and inflate the tyre to 3.5 bar (51 PSI) front or 4.0 bar (58 PSI) rear.

4.5 Remove the compressed air supply and fit dust cap.

CHAPTER 10

BRAKING SYSTEM
(Completely revised)

CONTENTS

(continued)

CONTENTS (continued)

TABLE 1 SPECIAL TOOLS

Item (1)	NSN/Part No. (2)	Description (3)
1	4910-99-813-5415	Shoe horn.
2	5120-99-753-7514	Steady spring tool.

FRONT BRAKES

WARNING

PERSONAL INJURY. IT IS DANGEROUS TO INHALE ASBESTOS DUST FROM BRAKE LININGS. DO NOT USE AIR LINE FOR CLEANING. USE A VACUUM BRUSH WHENEVER POSSIBLE.

Removal

1 To remove the front brake shoes proceed as follows:

1.1 Apply the handbrake and chock the rear wheels. Loosen the appropriate front wheel nuts. (Left hand thread at left side).

1.2 jack up the vehicle and fit axle stands under the front axle tube to service both brakes.

1.3 Remove wheel nuts and wheels. Park the wheels safely.

1.4 Remove the adjuster grommets from the backplate.

1.5 Release the automatic adjust mechanisms using a small screw driver.

1.6 The brake drums are integral with the wheel hubs.

1.7 Remove the hub cap and circlip.

1.8 Remove the drive flange (use a hide mallet if necessary to break the joint).

1.9 Release the lockwasher, and remove the outer locknut, lockwasher, inner wheel bearing adjusting nut and hub bearing washer.

1.10 Slide the combined hub and brake drum from the spindle. Turn the drum downwards to allow dust, etc to fall clear instead of entering the bearings.

1.11 Remove the other hub assembly and keep both sets separate to ensure that they are refitted on the correct side.

1.12 Before proceeding note the relative position of the shoes and springs.

1.13 Depress and rotate the steady pin washers (Fig 1) (24) to release the pins and springs. Extract the steady pins from the backplate.

1.14 Disconnect and remove the shoe to piston tie springs (Fig 1) (6 and 19).

1.15 Using a shoe horn (Table 1, item 1) pull the end of the shoes out of the abutment in the wheel cylinder body.

1.16 To retain the pistons in the wheel cylinders, secure with a strong rubber band or wire, taking care not to damage the rubber boot.

1.17 Clean the inner face of the backplate.

Inspection of parts

2 Inspect all brake parts for wear or damage:

2.1 The brake shoes should be renewed if the linings are worn nearly down to the rivets or if the linings are contaminated with lubricants or hydraulic fluid.

2.2 Remove the adjuster plates (Fig 1) (15) from the old shoes, clean and examine for damage and excessive wear, particularly the teeth of the adjuster plates.

2.3 Examine the adjuster parts attached to backplate.

2.4 Inspect wheel cylinder for signs of leakage.

2.5 Flexible hoses and metal brake pipes must be inspected for wear, damage and corrosion and renewed if necessary.

2.6 Examine the pull-off springs (Fig 1) (26) for damage or overstretching and renew if necessary.

Reassembling

3 To reassemble the front brakes, proceed as follows:

3.1 Lightly smear the adjuster plate pivot pin with copper slip grease (NSN 34B 9510-99-641-9463). Refit the adjuster plates to the brake shoes, also lightly grease the tips of the brake shoes, the areas where the shoe platforms rub against the backplate and the adjuster posts. Keep grease away from linings and rubber parts.

3.2 Position the shoes (Fig 1) (1) in their correct relationship with the pull-off springs (Fig 1) (26), then fit the shoes by reversing the removal instructions.

3.3 Ensure that the adjuster posts (Fig 1) (14) engage in the slots in the adjuster plates (Fig 1) (15).

3.4 Refit the shoe steady pins, springs and washers (Fig 1) (24 and 25).

3.5 Refit the shoe to piston tie springs (Fig 1 (19).

3.6 Refit the two dust covers in the backplate.

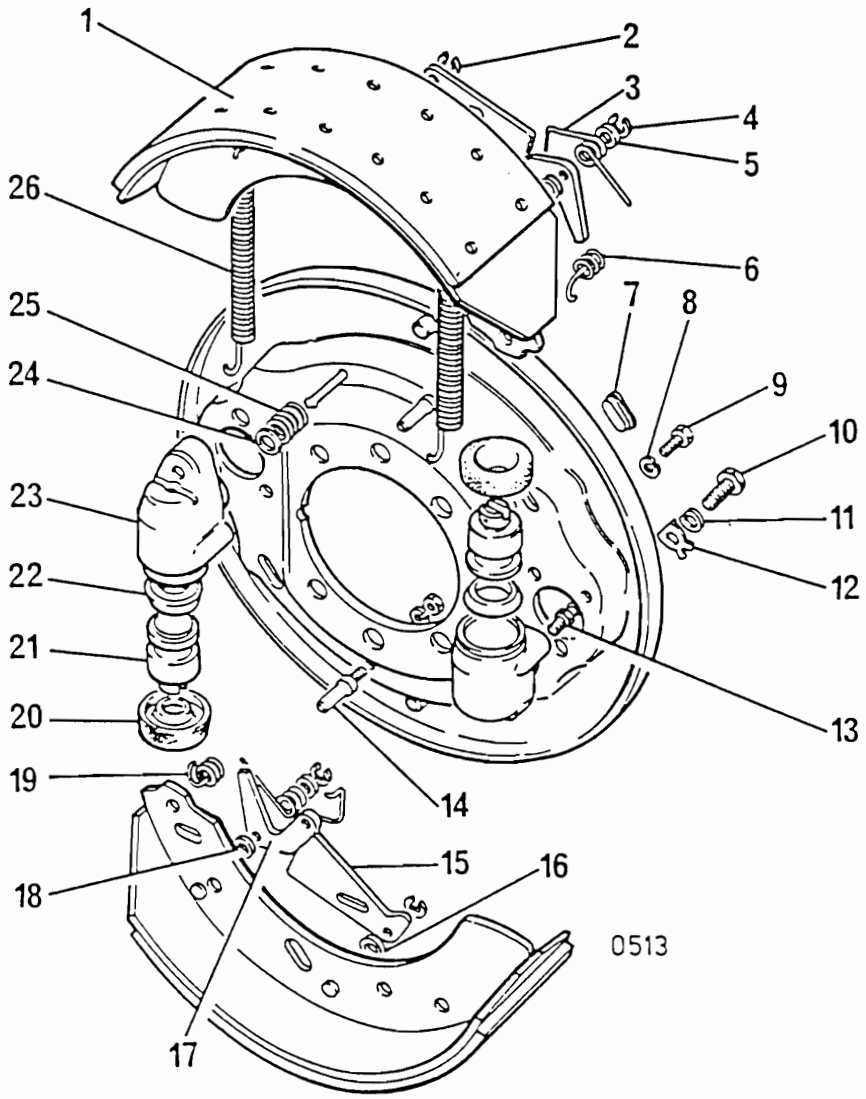
3.7 Manually set the adjuster mechanism on each brake shoe to five clicks on the adjuster plate teeth (Fig 1) (15 and 17).

3.8 Refit the hub/brake drum assembly and apply the foot brake hard several times to centralise the brake shoes.

3.9 Rotate the hub/drum assembly and check there is a light running contact between the brake shoes and hub/drum assembly. Manually adjust, if required as necessary.

3.10 Refit road wheels and remove axle stands and jack.

3.11 Check hydraulic fluid level and top up if necessary.



1	Brake shoe	9	Setscrew	18	Washer
2	Circlip	10	Setscrew	19	Piston tie spring
3	Adjuster spring	11	Washer	20	Rubber boot
4	Circlip	12	Tab washer	21	Piston
5	Washer	13	Bleed screw	22	Seal
6	Piston tie-spring	14	Adjuster post	23	Brake cylinder
7	Grommet	15	Adjuster plate	24	Steady washer
8	Spring washer	16	Washer	25	Steady spring
		17	Adjuster lever	26	Pull-off spring

Fig 1 Front wheel brake details

FRONT WHEEL CYLINDERS

Removal

4 Wheel cylinders should be renewed in pairs as follows:

4.1 Use a hose clamp if available to reduce fluid loss and unnecessary bleeding. If a hose clamp is not available, the complete system should be drained.

4.2 After clamping the hose or draining the system remove the front brake as previously described in Para 1.

4.3 Disconnect bridge pipe between cylinders, the bleed screw and the supply pipe from the rear cylinder plug, the ports and pipe ends to prevent fluid loss, undo cylinder securing bolts and remove bolts.

Dismantling and reassembly

5 To service front wheel cylinder, proceed as follows:

5.1 Thoroughly clean the cylinder.

5.2 Remove the rubber boot (Fig 1) (20) from the cylinder body (Fig 1) (23) and piston (Fig 1) (21).

5.3 Carefully pull the piston out of its bore.

5.4 Remove the piston seal (Fig 1) (22) from the piston and wash all parts in clean brake fluid of the correct grade, as specified in the maintenance schedule.

5.5 Examine the piston bore and piston for signs of corrosion or score marks. If surfaces are clean and free from damage, a new seal may be fitted. If in doubt, about condition fit new cylinder assembly.

5.6 If the piston and cylinder are in satisfactory condition, coat a new piston seal with clean brake fluid as Sub-Para 5.4 and fit the new seal into the groove using the fingers only. The larger diameter of the seal should be facing away from the slotted head of the piston.

5.7 Smear the cylinder bore with clean brake fluid and insert the piston assembly taking care not to bend back the lip of the seal.

5.8 Refit the boot (Fig 1) (21) and cylinder body (Fig 1) (23) grooves.

Refitment

6 To refit the cylinder to the back plate using new tab washers (Fig 1) (12). Tighten the large setscrew to 68 Nm (50 lbf ft) (Fig 1) (10) and small setscrews (Fig 1) (9) to 30.5 Nm (22.5 lbf ft). Close the lock tabs.

6.1 Repeat the above procedure for the second cylinder.

6.2 Reconnect the bridge pipe, bleed screw, and feed pipes ensuring that all connections are secure.

6.3 Fit clips where applicable.

6.4 Remove hose clamp (if used) and bleed each wheel as per Para 15 to 15.11 bleeding the hydraulic system.

6.5 Refit brake shoes and drums and re-adjust brake shoes as previously described in Sub-Para 3.7.

6.6 Ensure that all backplate grommets are replaced.

6.7 Refit the road wheels, lower the vehicle and tighten the wheel nuts to a torque of 298 Nm (220 lbf ft).

6.8 Refit the road wheels, lower the vehicle and tighten the wheel nuts to a torque of 298 Nm (220 lbf ft).

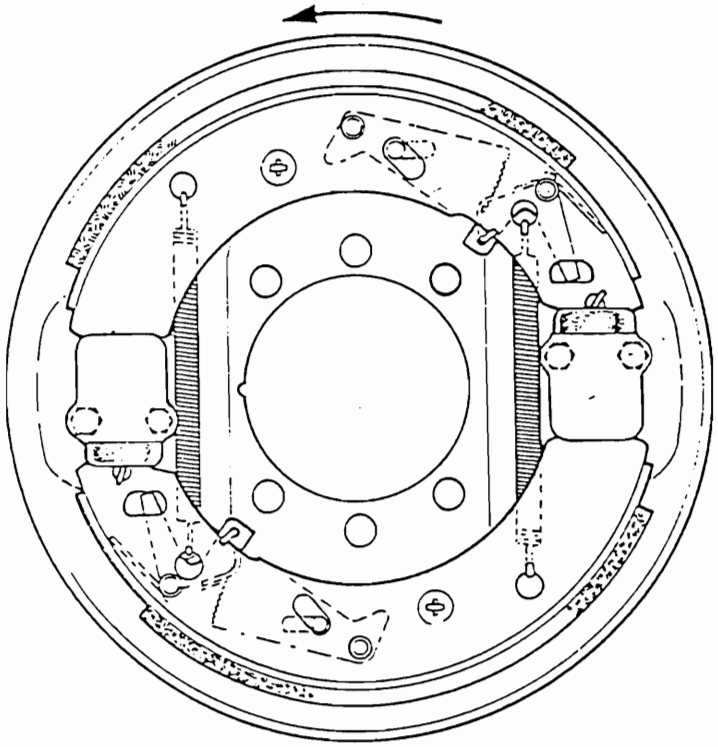


Fig 2 Front wheel brake assembly

FRONT WHEEL BACK PLATE

Removal and refitment

7 If it is necessary to inspect and possibly replace the back plate, proceed as follows:

7.1 Remove the wheels, drum and hub assembly and brake shoes as previously described.

7.2 Remove front wheel cylinder as previously described.

7.3 Remove the backplate securing nuts and remove the backplate.

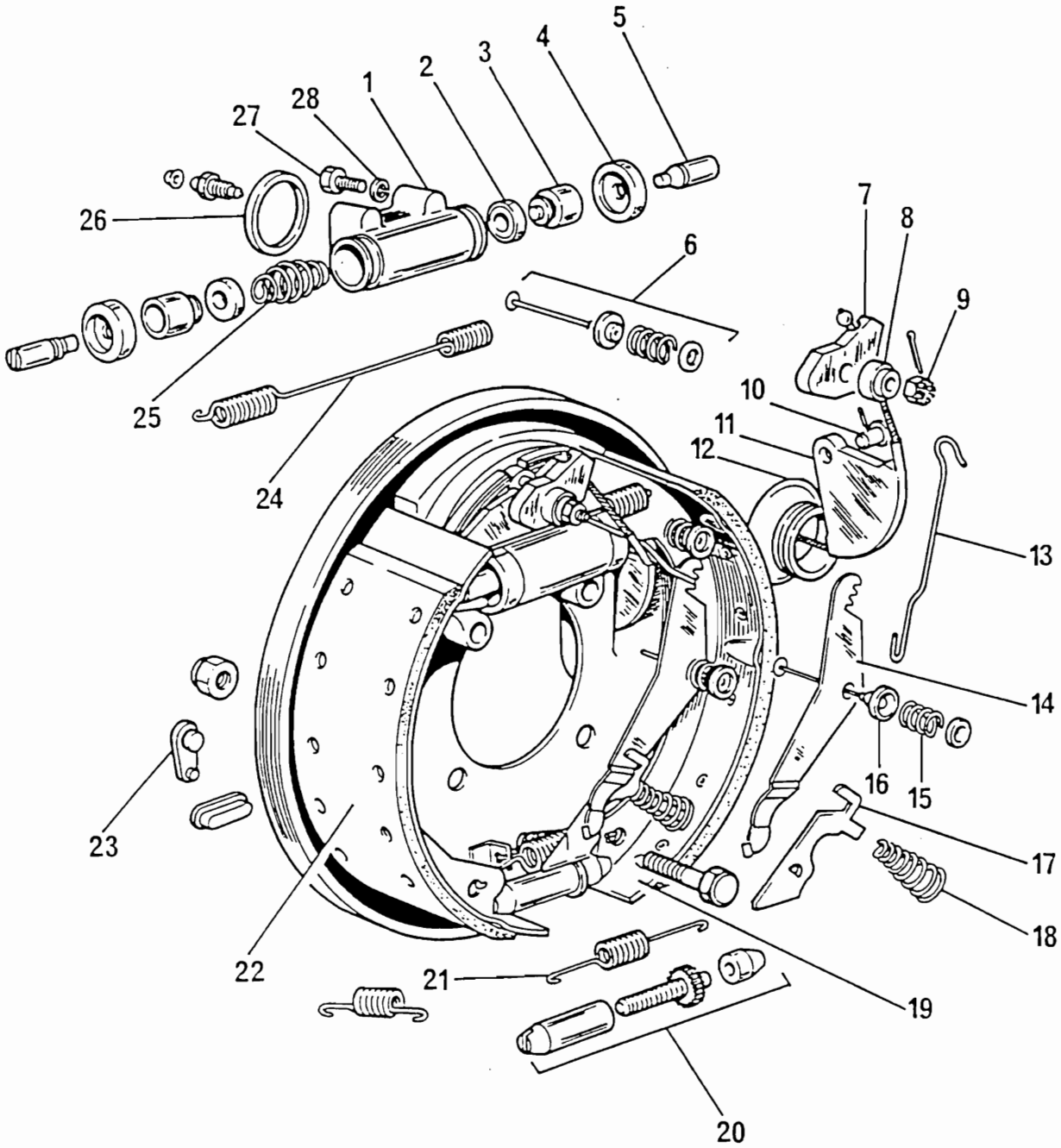
7.4 Clean and refit the backplate using Seelastik 732 RTV on mating surfaces.

7.5 Using new self locking bolts, tighten to a torque of 150 Nm (110 lbf ft).

7.6 Refit the front wheel cylinders as previously described.

7.7 Refit brake shoes, drum and hub assembly and the road wheels as previously described.

7.8 Check operation of brakes.



1	Wheel cylinder	10	Pivot pin	19	Secondary shoe
2	Piston seal	11	Quadrant	20	Adjuster assembly
3	Piston	12	Dust cover	21	Shoe spring
4	Dust cover	13	Wire link	22	Primary shoe
5	Push rod	14	Actuating lever	23	Inspection grommet
6	Hold down assembly	15	Hold down spring	24	Shoe spring
7	Lever cam	16	Sleeve	25	Piston spring
8	Spacer sleeve	17	Pawl	26	Gasket
9	Castellated nut	18	Pawl spring	27	Setscrew
				28	Washer

Fig 3 Rear brake details

REAR BRAKES

Dismantling

8 To remove the rear brake shoes from axle, proceed as follows:

8.1 Place chocks in front and behind the front wheels and then release the handbrake. Check that the vehicle cannot roll backwards or forwards.

8.2 Loosen the rear wheel nuts, jack up the rear axle and position axle stands to hold the rear wheels just clear of the ground.

8.3 Remove the wheel nuts and wheels. Park the wheel securely.

8.4 Mark the relative position of the hub and brake drum for correct reassembly and remove the brake drum.

WARNING

PERSONAL INJURY. IT IS DANGEROUS TO INHALE ASBESTOS DUST FROM BRAKE LININGS. DO NOT USE AIR LINE FOR CLEANING. USE A VACUUM BRUSH WHENEVER POSSIBLE.

8.5 Clean and examine the brake drum for scoring and excessive corrosion.

8.6 Clean and examine the brake linings for excessive wear.

8.7 Use the steady spring hold down tool (Table 1, item 2) to remove the two hold down springs (Fig 3) (15) from the secondary brake shoe.

8.8 Note the relationship of the wire link (Fig 3) (13) and the actuating lever (Fig 3) (14) and remove the lever pawl (Fig 3) (17), spring and wire link (Fig 3) (13).

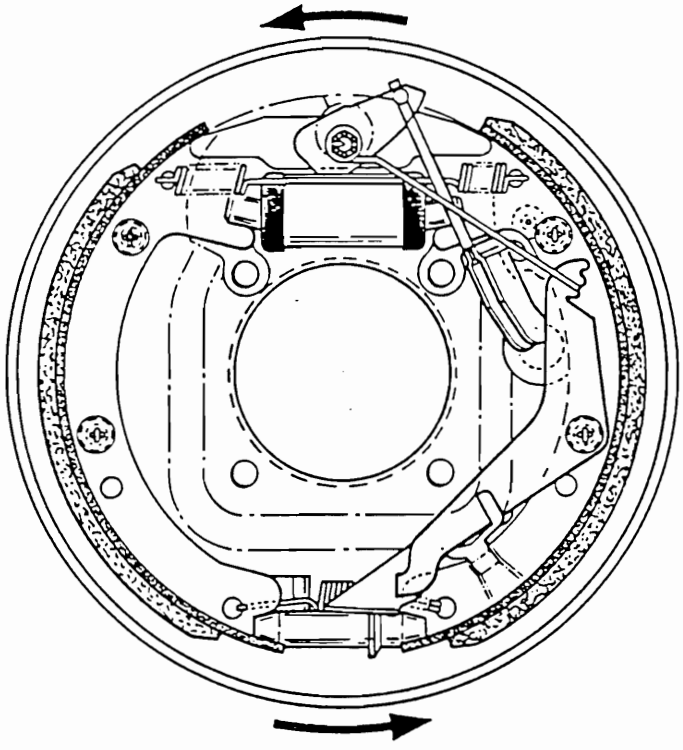


Fig 4 Rear wheel brake assembly

8.9 Remove the split pin and unscrew the castellated nut (Fig 3) (9) from the anchor pin.

8.10 Lift off the spacer sleeve (Fig 3) (8) and handbrake lever cam (Fig 3) (7) after disengaging the cable from the cam.

8.11 Using the shoe horn (Table 1, item 1) on the secondary shoe, prise the shoes apart to remove the adjuster assembly and spring.

8.12 Manipulate the secondary shoe (Fig 3) (19) upwards to enable the shoe and spring to be removed. Note the position of the spring (Fig 3) (13) for refitting.

8.13 Remove the two hold-down springs from the primary shoe using the spring hold down tool (Table 1, item 2) and remove the shoe.

8.14 The anchor should not be removed under any circumstances, it can only be replaced as part of the back plate.

8.15 Inspect the wheel cylinder, if satisfactory, retain piston in position by means of elastic bands.

8.16 If the wheel cylinders are suspect, remove from the backplate by undoing hydraulic feed pipe after clamping with a hose clamp and cover connections to prevent ingress of dirt.

8.17 Undo set screws securing wheel cylinders to backplate and remove cylinders and dismantle as per Para 11.

Reassembling

9 Before commencing reassembly, wash down the backplate with suitable cleaning fluid and allow to dry.

9.1 Wire brush to remove corrosion, taking care not to damage the rubber dust cover on the wheel cylinder if the cylinder has not been removed.

9.2 Check that the adjuster assembly and quadrant pivot are free to move and not corroded.

9.3 Clean and lightly grease moving parts using copperslip grease (NSN 9150-99-641-9463), taking care that the grease does not contact the hydraulic parts or the brake shoe linings.

9.4 Lightly lubricate the shoe platforms, shoe abutments and the anchor pin.

9.5 If the wheel cylinder has been removed, refit to the backplate using a new gasket and securing with washers and setscrews (Fig 3) (27 and 28). Tighten setscrews to a torque of 15 Nm (19 lbf ft). Also refit hydraulic pipe and release pipe clamp.

9.6 Refit the primary shoe (Fig 3) (22) to the backplate with the welded abutment facing outwards, adjacent to the anchor pin.

9.7 Ensure that the shoe web locates in the wheel cylinder push rod slot, and fit hold down spring assemblies (Fig 3) (6).

9.8 Attach the double coil spring (Fig 3) (24) with the side consisting of the greater number of coils to the primary shoe web. The other end is attached to the secondary shoe.

9.9 Manipulate the secondary shoe (Fig 3) (19) so that it abuts the anchor pin at one end and the shoe web locates in the cylinder push rod slot at the other end.

9.10 Secure the shoe in position by fitting the upper steady spring assembly.

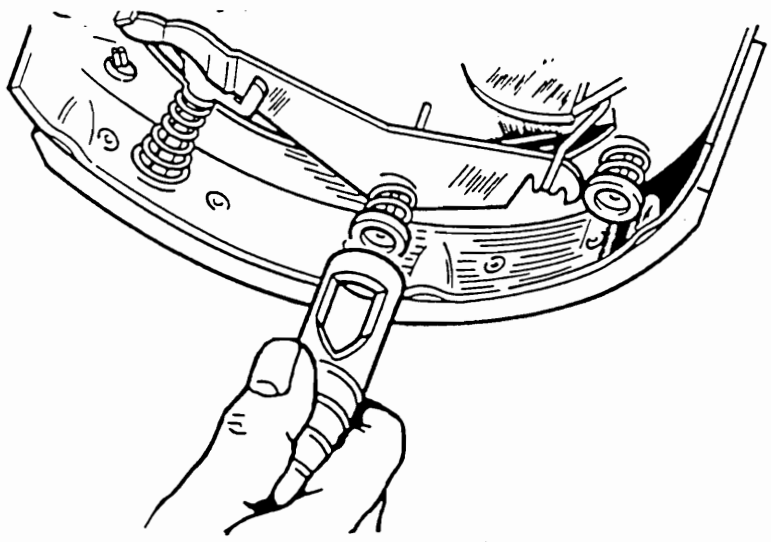


Fig 5 Use of spring hold down tool

9.11 Refit the fully retracted adjuster assembly (Fig 3) (20) and retaining spring between the shoes, ensuring that the adjuster wheel is adjacent to the secondary shoe and adjacent slot in the backplate.

9.12 Attach the pawl (Fig 3) (17) to the actuating lever (Fig 3) (14) and the conical spring (Fig 3) (18) to the pawl.

9.13 Position the assembly on the secondary shoe as illustrated in Fig 3 and secure by sleeve and hold down spring assembly.

9.14 Fit remaining hold down spring.

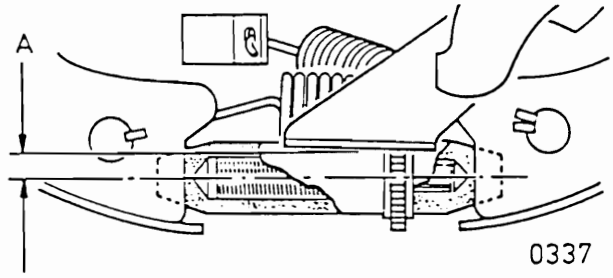
9.15 Fit the brake cable to the handbrake lever cam and fit the cam to the anchor pin. Refit the cable to the cam.

9.16 Locate the wire link (Fig 3) (13) around the spacing sleeve of the anchor pin and in the notch of the actuating lever noted during dismantling.

9.17 Replace the spacing sleeve (Fig 3) (8) and castellated nut and tighten to a torque of 31 Nm (23 lbf ft).

9.18 Slacken off nut slightly if necessary to fit split pin. Ensure that split pin ends do not protrude further than the face of the nut to avoid interference.

9.19 To adjust the auto adjuster setting, check the relationship between the pawl and the adjuster wheel as shown in Fig 6.



A= 6mm +/- 2mm

Fig 6 Auto-adjust setting.

9.20 The distance between the centre line of the adjuster barrel and the operating edge of the pawl at the place where it contacts the wheel should be within the limits stated in Fig 6. If necessary, relocate the link wire into another slot of the actuating lever to obtain the correct dimension.

NOTE

If the lever and pawl are not set correctly, the auto adjust will not work properly.

9.21 Refit the brake drum in the correct relative position to the hub as marked prior to dismantling.

9.22 Refit the wheels, wheel nuts and tighten.

9.23 Rear brakes must be manually adjusted, as per Para 10.

9.24 Remove axle stands and apply handbrake. Torque wheel nuts to 298 Nm (220 lbf ft).

9.25 Check that brakes are operating correctly.

ADJUSTMENT (REAR WHEELS)

10 Whilst rotating the brake drum, manually adjust the brake shoes through the backplate until a light rubbing contact can be heard between the brake drum and shoes.

10.1 Apply the footbrake several times to centralise the brake shoes.

10.2 Re-check the brake adjustment and readjust as necessary.

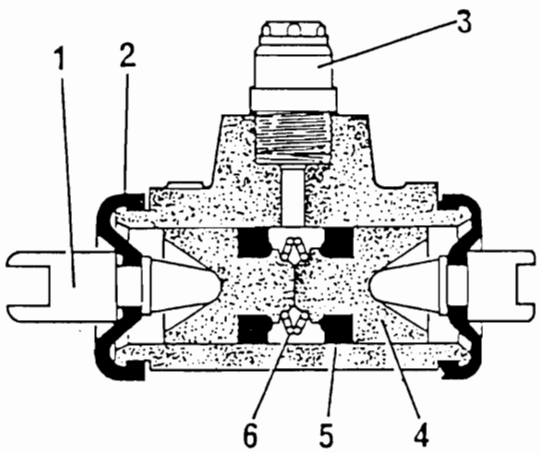
10.3 Refit grommets.

REAR WHEEL CYLINDER

Dismantling and reassembling

11 Always service both rear wheel cylinders at the same time. Keep the cylinders separate so that parts cannot be interchanged.

11.1 Remove the brake as described in Para 8.



1	Push rod	4	Piston
2	Dust cover	5	Piston seal
3	Pipe connection	6	Piston spring

Fig 7 Rear wheel cylinder

11.2 Remove the dust covers, push rods, pistons and spring.

11.3 Remove seals from piston.

11.4 Clean pistons and cylinder in clean brake fluid as per Sub-Para 5.4.

11.5 Examine the cylinder bores, and pistons for signs of corrosion, scoring or other damage. If satisfactory they may be reused.

11.6 Fit the seals with their flat back against the piston shoulder.

11.7 Lubricate the seals and cylinder bore with clean brake fluid and reassemble the cylinder. Ensure that the lips of the seal are not damaged during reassembly.

11.8 Refit the cylinder and assemble the brakes as per Para 9.

MASTER CYLINDER

Dismantling

12 Before disconnecting the master cylinder from the vacuum servo, operate the footbrake several times to exhaust the residual vacuum.

NOTE

Never operate the brake pedal with the master cylinder removed as this will damage the internal components of the vacuum servo.

12.1 Place an oil tray under the master cylinder before commencing removal.

12.2 Remove the hydraulic pipes from the master cylinder and plug the exposed ports to prevent ingress of dirt.

12.3 Disconnect the wires from the fluid level sensor unit.

12.4 Unscrew the three nuts and separate the master cylinder from the vacuum servo.

12.5 If the master cylinder is to be dismantled it is most important to ensure that components do not come into contact with mineral oil or grease.

12.6 Drain the reservoir and refit the cap.

12.7 Mount the master cylinder in a soft jawed vice with the reservoir uppermost.

12.8 Remove the two setscrews securing the reservoir to the cylinder body. Remove the reservoir.

12.9 Remove the two reservoir seal rubbers and the secondary piston stop pin. If the pin cannot be extracted easily push the primary piston and spring assembly down the bore using a soft rod. This will release the head on the pin.

12.10 Hold the primary piston sub-assembly away from the circlip.

12.11 Remove the circlip using internal circlip pliers. Extract circlip from the cylinder body and withdraw the primary piston and spring.

12.12 To remove the secondary piston and return spring from the cylinder body place a clean lint free cloth on the bench and repeatedly tap the open end of the body onto the bench until the secondary piston starts to emerge.

NOTE

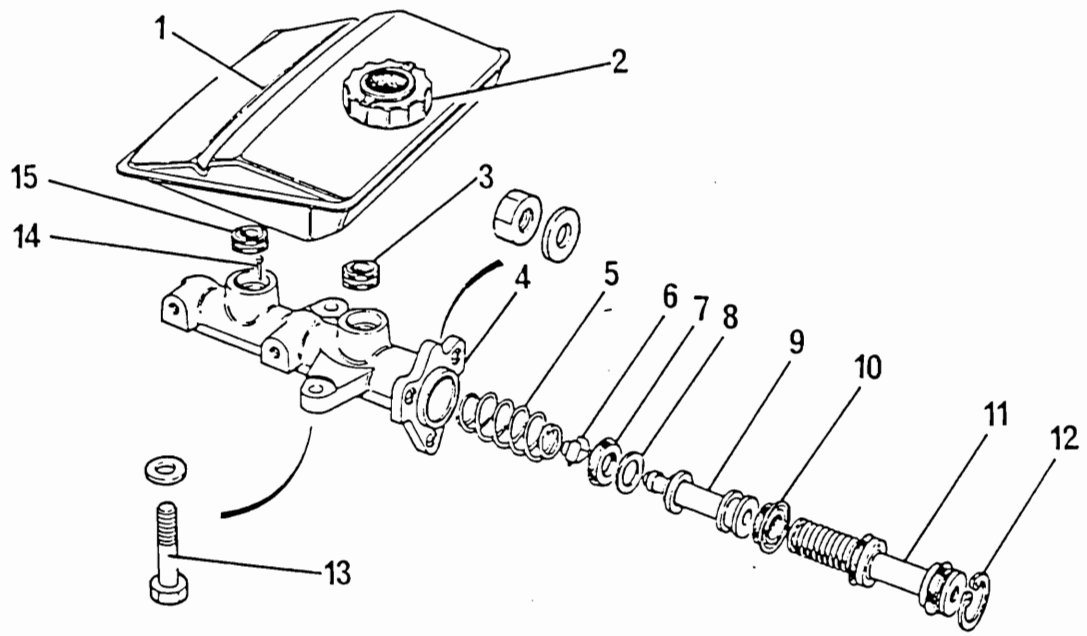
Take careful note of their positions, particularly the seals.

Inspection of parts

13 Clean all parts in hydraulic brake fluid identical to the fluid used to fill the system.

13.1 Carefully dry the component with a lint free cloth and carefully inspect the metal components for damage and wear.

13.2 If the cylinder bore shows the slightest sign of corrosion or scoring, a complete replacement assembly must be fitted.



1 Fluid reservoir
2 Fluid level sensor
3 Reservoir seal
4 Cylinder body
5 Return spring
6 Spring retainer
7 Primary seal
8 Secondary piston washer
9 Secondary piston
10 Reverse seal
11 Primary piston and seal assembly
12 Circlip
13 Setscrew
14 Stop pin
15 Reservoir seal

Fig 8 Exploded view of master cylinder

13.3 If any of the metal internal components are found to be imperfect, a new master cylinder repair kit must be fitted.

13.4 Ensure that the fluid feed and by-pass port drillings in the cylinder body are clear, also the drillings in the head of each piston.

13.5 Check that the vent hole in the fluid level sensor is clear.

Reassembling

14 When reassembling the master cylinder extreme cleanliness is essential and the hands must be free of grease and dirt.

14.1 All components should be lubricated prior to assembly with new hydraulic fluid identical to the fluid used in the system.

14.2 Locate a new piston washer on the head of the secondary piston.

14.3 Gently ease the primary seal over the piston nose with lip facing away from the piston, so that the seal is seated at the piston head holding the piston washer in place.

14.4 Carefully fit the universal seal into the groove at the other end of the piston with the lip facing away from the piston.

14.5 Fit the spring retainer onto the secondary piston nose followed by the return spring.

14.6 Insert the return spring, spring retainer and secondary piston assembly into the bore of the cylinder, taking care not to damage the lip of the leading seal.

14.7 Carefully fit the primary piston and spring assembly, taking care that the seal lip is not being damaged.

14.8 Refit the circlip at the cylinder mouth and check that it is correctly seated in the cylinder.

14.9 Push the primary piston fully into the body, then insert the stop pin into either one of the two secondary feed port holes.

14.10 Place the two reservoir seals into the cylinder body recesses.

14.11 Ensure that the reservoir is clean and insert the two fluid tubes into the rubber seals.

14.12 Fit the two reservoir securing screws and tighten.

14.13 Fit the seal retainer dished side inwards into the end of the vacuum shell, then fit the backing washer and seal. Now refit the master cylinder, secure with three setscrews and tighten setscrews to a torque of 24 Nm (18 lbf ft).

14.14 Reconnect the fluid feed pipes to the master cylinder and reconnect the electrical connections to the fluid level sensor.

14.15 Refill the reservoir with clean hydraulic fluid which is identical to the fluid already in the system.

14.16 Bleed the system as described in Para 15.

14.17 Check the hydraulic system for leaks before road testing the vehicle.

BLEEDING THE HYDRAULIC SYSTEM

15 The system should only be bled if there is air in the system, which will normally give a spongy feel when the brakes are applied.

15.1 The above is mainly caused by either the level of fluid in the reservoir having been allowed to drop too low or worn seals in one of the components.

15.2 Rectify the fault before commencing the bleeding operation.

15.3 Chock the wheels,

15.4 Fill the reservoir above the minimum mark with the recommended brake fluid and **do not** allow the level to drop below a quarter full during the bleeding operation.

NOTE

Fluid bled from the system must not be re-used as it is aerated and will reintroduce air into the system.

15.5 The brakes should be bled in sequence progressing from the bleed point nearest to the master cylinder to the bleed point furthest away from the master cylinder.

15.5.1 First bleed point is at the r.h. front brake.

15.5.2 Second bleed point is at the l.h. front brake.

15.5.3 Third bleed point is at the l.h. rear brake.

15.5.4 Fourth bleed point is at the r.h. rear brake.

15.5.5 Last bleed point is on the top of the load sensing valve.

15.6 Attach a bleed tube to the bleed screw with the free end of the tube in a glass jar containing a small amount of fluid. Ensure that the end of the tube is always immersed in the fluid as otherwise air will enter the system.

15.7 Unscrew the bleed screw one full turn and depress the pedal slowly with a light pressure. Release the pedal slowly and pause before depressing the pedal again.

15.8 Continue pumping slowly, at the same time maintaining the fluid level in the reservoir until bubbles cease to appear at the end of the bleed tube.

15.9 Tighten the bleed screw whilst the pedal is on its next down stroke.

15.10 After all five points have been correctly bled, top up the fluid reservoir to the maximum mark.

15.11 Apply the footbrake several times to ensure that it does not feel spongy.

15.12 Check brake operation.

HANDBRAKE LINKAGE ADJUSTMENT

16 Parts of the mechanical handbrake only require replacement if they are damaged or badly worn.

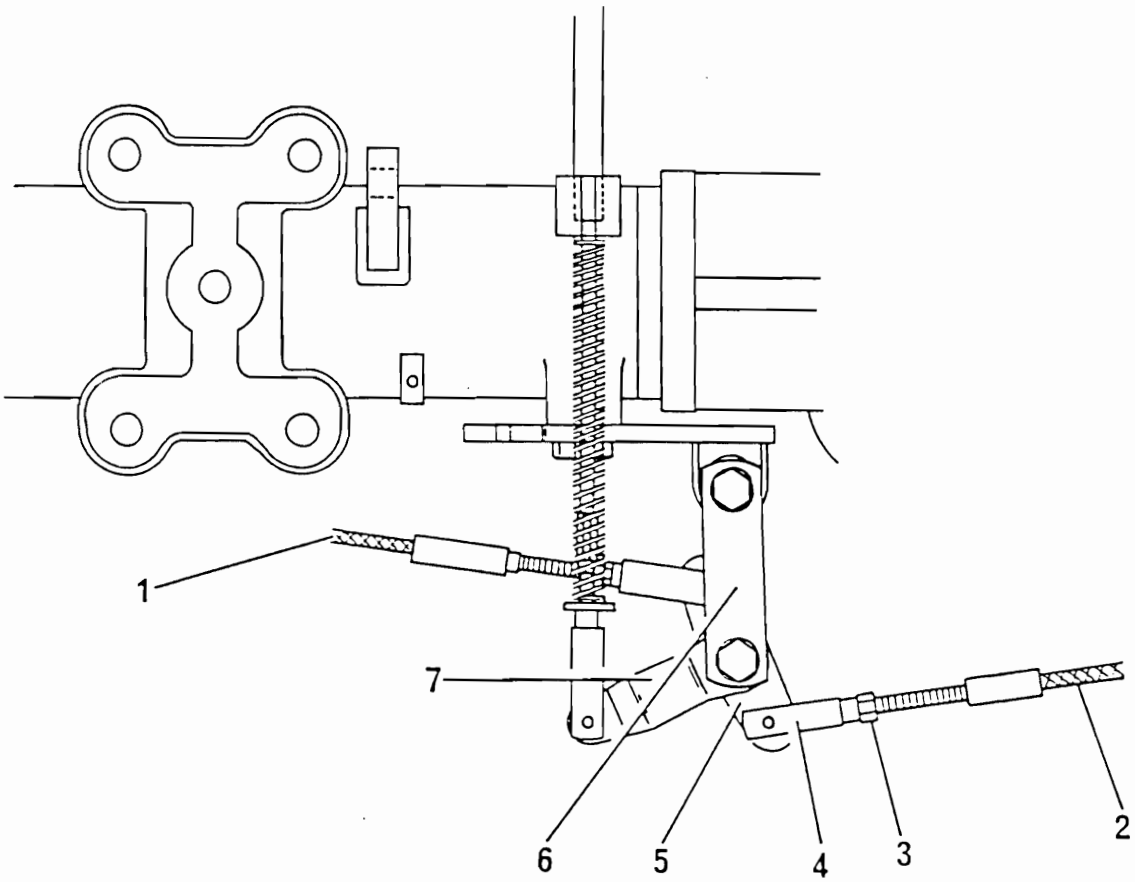
16.1 The handbrake is correctly adjusted when it is possible to apply six to eight notches of the handbrake ratchet between the fully released and the fully applied position.

16.2 The handbrake cables can be readjusted easily by means of the fork ends (Fig 9) (4), ensure that the locknuts (Fig 9) (3) are tightened after adjustment.

16.3 To ensure equal braking on both rear wheels align compensator shackle and actuating levers as shown in Fig 9.

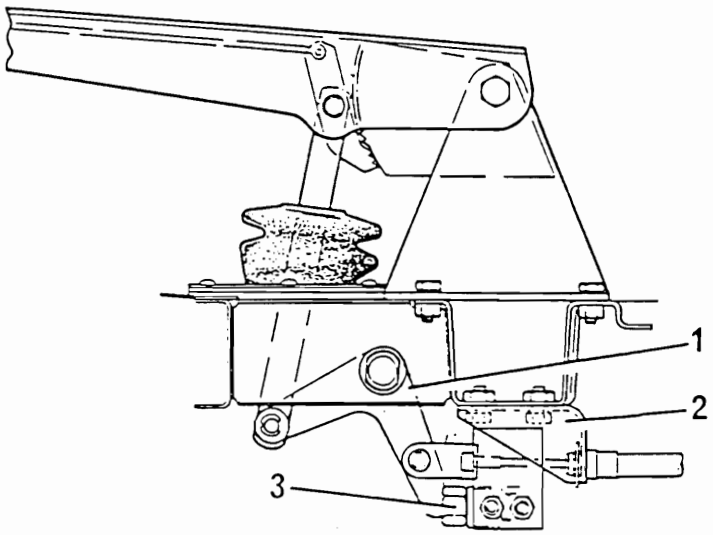
16.4 The handbrake **ON** warning lamp switch is mounted on the bracket under the cab floor.

16.5 With the handbrake lever in the fully **OFF** position, adjust the switch so that the switch retaining nut contacts the relay lever.



1 Cable (l.h.)
2 Cable (r.h.)
3 Lock-nut
4 Fork end
5 Compensator lever
6 Compensator shackle
7 Actuator lever

Fig 9 Handbrake adjustment



1 Relay lever 2 Abutment bracket 3 Switch retaining nut

Fig 10 Handbrake warning light switch adjustment

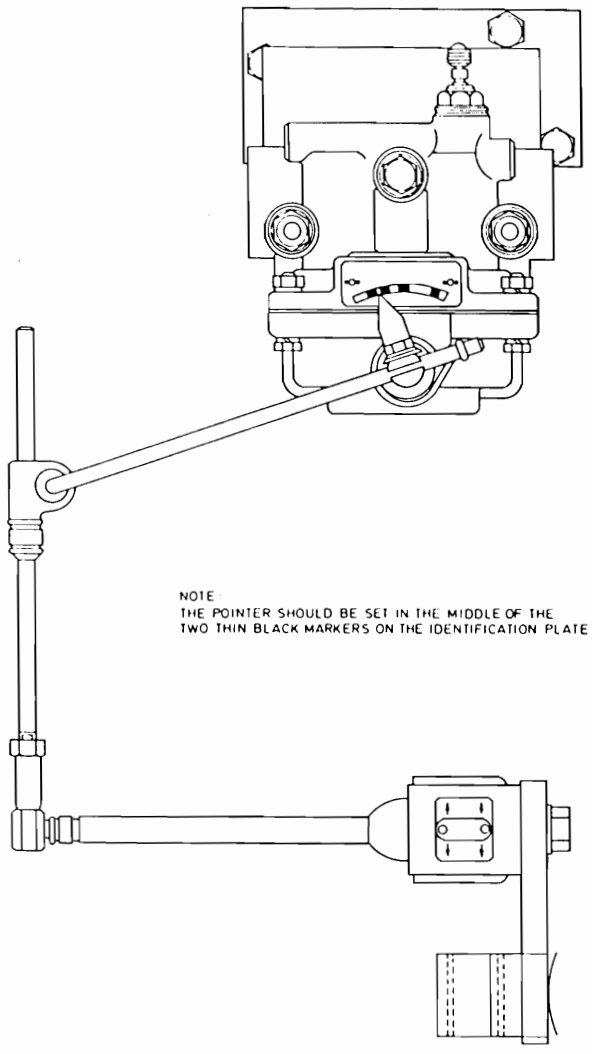


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Fig 11 Load sensing valve setting

LOAD SENSING VALVE SETTING PROCEDURE

17 The load sensing valve is properly set up when it leaves the factory and should only be reset if the valve has been renewed or any other component which could affect the setting has been renewed.

17.1 Set up the load sensing valve linkage in accordance with Fig 11.

17.2 Ascertain the weight of the vehicle in the fully laden condition.

17.3 Ensure that there is no air in the braking system; if necessary bleed the system (see Para 15) including the load sensing valve thoroughly. A bleed screw is fitted on the top of the valve to assist bleeding.

17.4 If the load sensing valve does not appear to be operating correctly, check pressures. With the vehicle in the fully laden condition, apply the footbrake fully and have a second person check the input and output pressures using suitable pressure gauges, fitted into the input and output pipes to the load sensing valve.

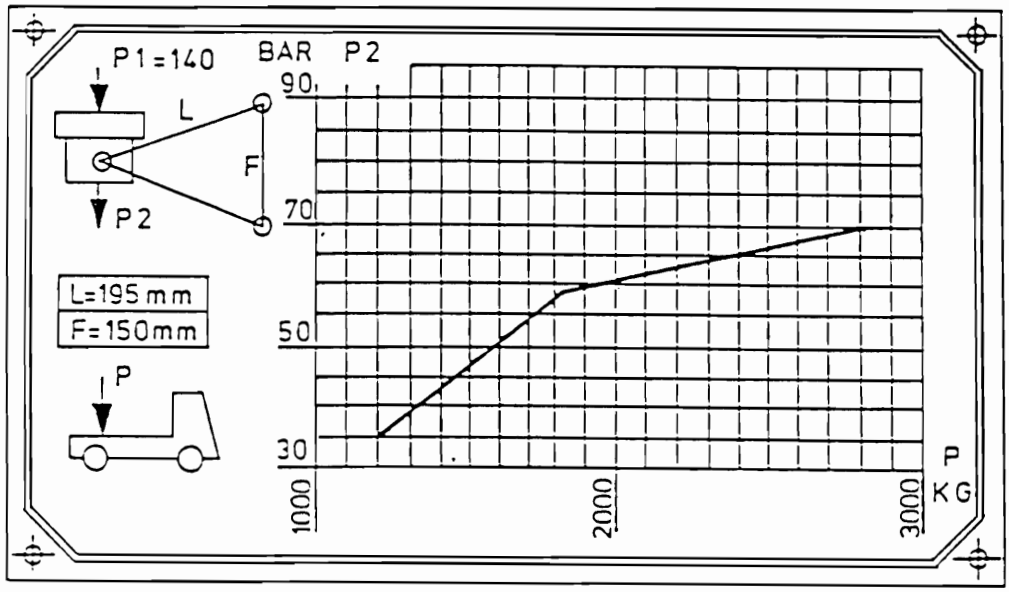


Fig 12 Load sensing valve setting instruction plate

17.5 The input pressure should be 140 bar and the output pressure should be the pressure quoted on the instruction plate graph relative to the load (see Fig 12), ie, if the laden weight is 2800 kg the output pressure should be 70 bar. If necessary, adjust the linkage so that this pressure can be achieved.

17.6 Check the pressure several times to ensure that the result is consistent.

17.7 Remove the pressure gauges on completion of test and reconnect the pipes.

NOTE

It may be necessary to run the engine to recharge the vacuum reservoir to give servo assistance.

WARNING

DO NOT RUN THE ENGINE WITH PERSONNEL UNDER THE VEHICLE.

AIR EXHAUSTER

Removal

18 To remove the exhauster from the vehicle, proceed as follows:

18.1 Disconnect the batteries.

18.2 Position the road wheels on full left-hand lock.

18.3 Working under the left-hand front wheel arch disconnect the oil and vacuum pipes at the exhauster. Plug the pipe ends to prevent ingress of dirt.

18.4 Remove four nuts and spring washers securing exhauster to timing case.

18.5 Withdraw the exhauster, complete with drive gear and joint from the timing case studs.

Dismantling

19 To dismantle the exhauster, proceed as follows:

19.1 Progressively unscrew the four setscrews (Fig 13) (17) securing the thrust plates (Fig 13) (15 and 19) to the drive end clover (Fig 13) (14). The thrust plates locate in a groove around the gear collar.

19.2 Remove the four screws and spring washers and withdraw the thrust plates and drive gear.

19.3 Mark the relative positions of the end covers (Fig 13) (5 and 14) to the body (Fig 13) (3) to assist reassembly.

19.4 Undo the four setscrews and spring washers securing the end cover. Remove the end cover and O-ring.

19.5 Mark the relative position of the rotor blades and the rotor to assist reassembly.

19.6 Withdraw the rotor complete with fibre vanes from the body.

19.7 Undo four socket headed screws and remove drive end cover and joint.

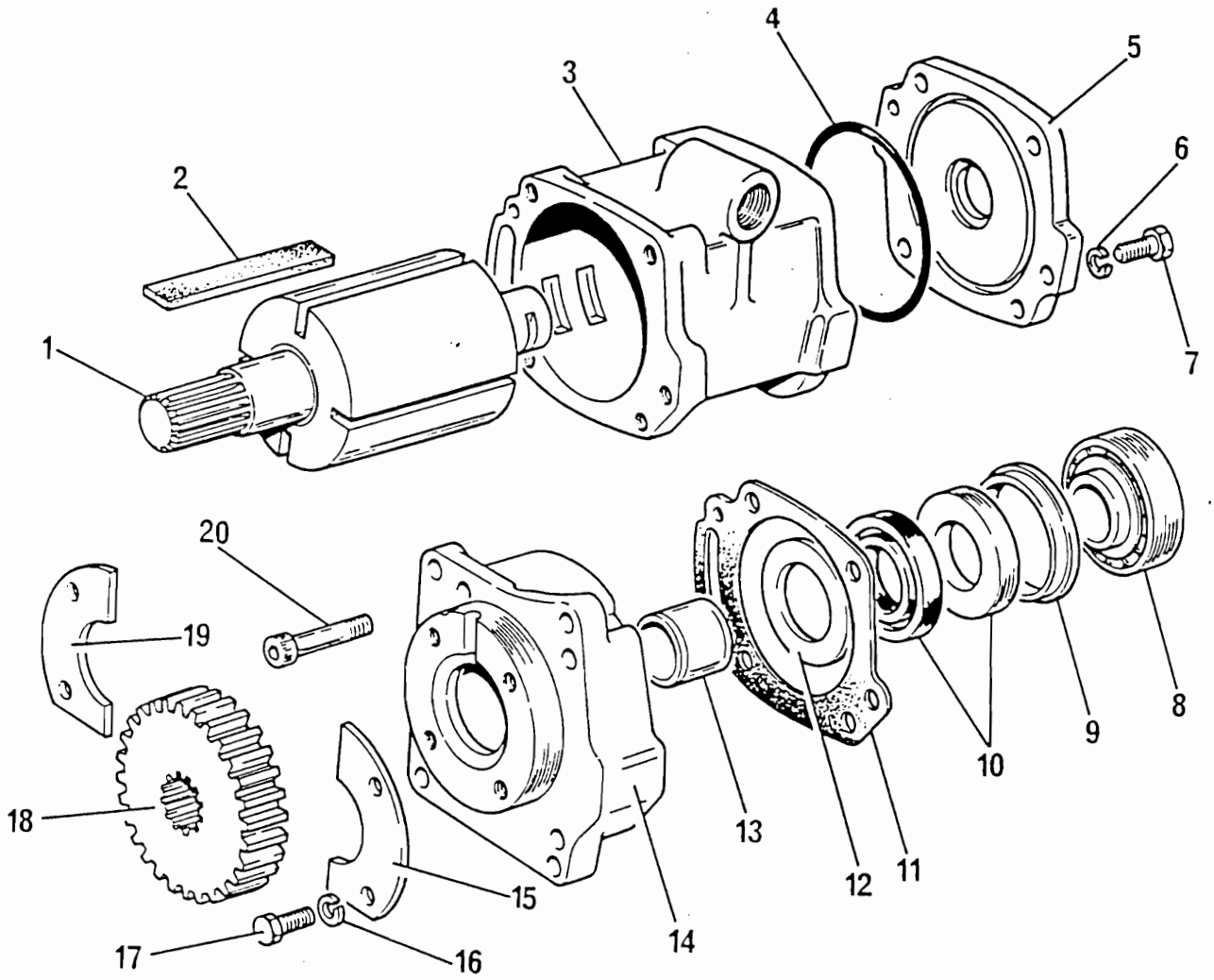
19.8 Further dismantling should only be carried out if, after inspection, it is found that the shaft collar, bearing or seals are defective.

19.9 If roller bearing or shaft collar are defective, withdraw roller bearing inner race and shaft collar.

19.10 Tap drive end cover face several times on to a wooden block, suitably recessed to accommodate the race. Remove outer race.

19.11 Remove inner back plate.

19.12 Press outer back plate and seals from drive end cover using a bar or tube of 33.34 mm (15/16 in.) diameter.



1	Rotor	11	Joint
2	Rotor blade	12	Outer back plate
3	Body	13	Shaft collar
4	O-ring	14	Drive end cover
5	Rear cover	15	Thrust plate
6	Spring washer	16	Spring washer
7	Setscrew	17	Setscrew
8	Roller bearing	18	Drive gear
9	Inner back plate	19	Trust plate
10	Seals	20	Socket headed screw

Fig 13 Exploded view of exhauster

Inspection of parts

20 Wash the roller bearing in thin flushing oil or white spirit and gently blow dry with compressed air. Do not spin the bearing with the compressed air as this might damage the rollers on the race.

20.1 Wash the remaining metal parts in suitable cleaning solvent and clean the rotor and drive end cover with compressed air.

20.2 Examine the roller bearing for signs of overheating, wear or other damage. Rotate slowly to feel any roughness. Renew as necessary.

20.3 Inspect rotor (Fig 13) (1) and shaft for cracks or other damage and examine the shaft seal collar (Fig 13) (13) for wear. Renew as necessary.

20.4 Check the fit of the rotor blades (Fig 13) (2) ion the slots in the rotor and renew worn or damaged blades.

20.5 Clean seals (Fig 13) (10) carefully and examine thoroughly. Check that sealing edge is pliable, sharp and undamaged. Ineffective seals should be renewed.

20.6 Examine the body for cracks or other damage such as scoring in bore. If the scoring is not excessive, the body is still serviceable. Renew if necessary.

20.7 Examine end covers and renew if scored or damaged.

Reassembling

21 Lubricate all moving parts with clean engine oil to prevent possible damage when the engine is started and before oil flow from the engine commences.

21.1 If the bearing, shaft collar or oil seals have been removed, these must first be refitted.

21.2 Lightly grease the rotor shaft and press new bearing inner race on to the shaft. There will be a slight clearance between the bearing and the rotor face.

21.3 Refit outer back plate (Fig 13) (12), press in new seals using a bar or tube of 33.34 mm (1 5/16 in.) diameter, refit inner back plate (Fig 13) (9) and press race into drive end cover.

21.4 Using a new joint, fit the pre-assembled drive end cover on the body, ensuring that the marks align, and secure with four socket head screws (Fig 13) (20).

21.5 Fit the rotor into the body, taking care not to damage the oil seals.

21.6 Hold the body drive end downwards and replace blades in rotor slots, ensuring that the marks made during dismantling correspond.

21.7 Fit a new O-ring (Fig 13) (4) in the rear end cover (Fig 13) (5) and then refit the cover to the body ensuring that the notch marks align. Secure rear end cover with four setscrews and spring washers.

21.8 Check that the rotor turns freely.

21.9 Position the drive gear (Fig 13) (18) on the splines of the rotor shaft.

21.10 Secure the two half round thrust plates in the gear collar groove and then secure thrust plates to drive end cover with four setscrews and spring washers.

Refitment

22 Using a new joint, position the exhauster on the timing case studs and secure with four nuts and spring washers.

22.1 Reconnect the oil and vacuum pipes.

22.2 Reconnect the battery.

22.3 Start the engine and check for oil leaks and correct operation of exhauster. Stop the engine.

VACUUM SERVO

Removal

23 To remove the vacuum servo, proceed as follows:

23.1 Before commencing removal of vacuum servo, operate the brake pedal several times to fully exhaust all residual vacuum from the servo.

NOTE

Never operate the brake pedal with the master cylinder removed, as this will damage the internal components of the vacuum servo.

23.2 Place an oil tray under the master cylinder before starting removal.

23.3 Remove the hydraulic pipes from the master cylinder and plug the exposed parts to prevent ingress of dirt.

23.4 Disconnect the wires from the fluid level sensor unit.

23.5 Unscrew the three nuts securing the master cylinder to the vacuum servo and remove the master cylinder. Disconnect vacuum hose from vacuum servo elbow.

23.6 Remove the clevis pin connecting the vacuum servo fork end to the brake pedal inside the cab and undo the four nuts in the cab securing the vacuum servo to the front bulkhead. Remove vacuum servo.

Refitment

24 To refit the vacuum servo and master cylinder, proceed as follows:

24.1 Carefully refit the vacuum servo onto the bulkhead with the four studs passing through the bulkhead and the pedal bracket.

24.2 Secure the servo studs by nuts and washers. Refit clevis pin, connecting vacuum servo fork to brake pedal and secure pin with securing clip, Reconnect vacuum hose to vacuum servo elbow.

24.3 Lightly grease the outside diameter of the output pushrod with suitable grease, fit the push rod, seal retainer dished side inwards and the backing washer into the end of the vacuum servo.

24.4 Smear the seal with suitable grease, slide over the end of the pushrod and locate into the end of the vacuum servo.

24.5 Check that the groove in the end of the vacuum shell is clean before bolting the master cylinder to the servo assembly. Tighten set screws to a torque of 24 Nm (18 lbf ft).

NOTE

Ensure that the cable clip is refitted under the bottom setscrew.

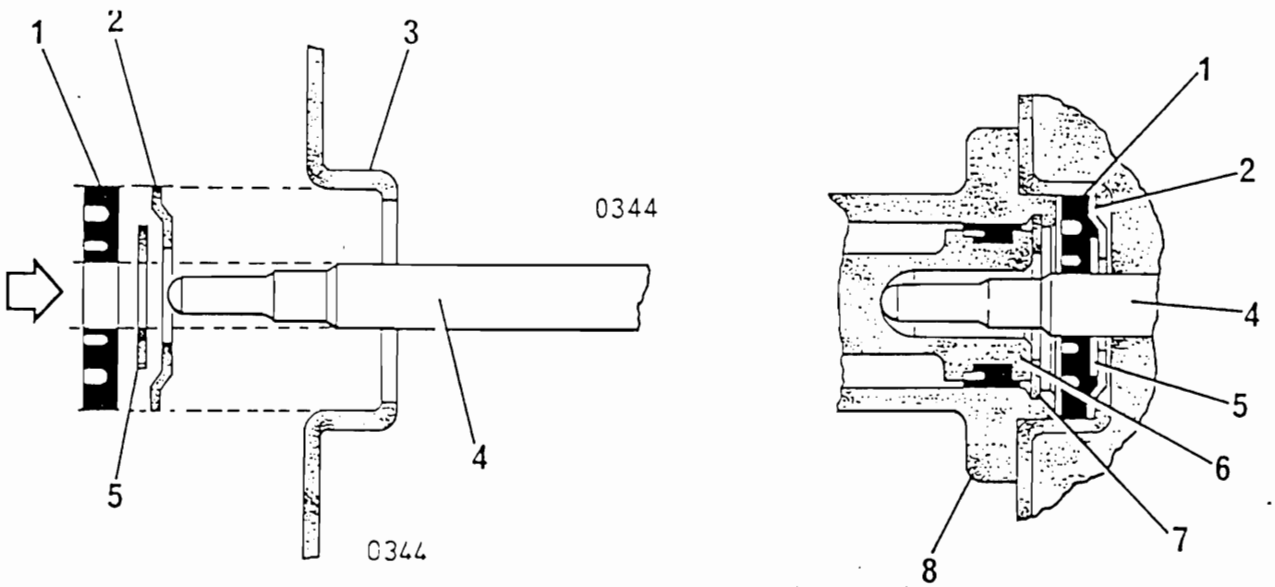
24.6 Reconnect the hydraulic fluid pipes to master cylinder.

24.7 Reconnect the wires to the fluid level sensor unit.

24.8 Refill the reservoir with clean hydraulic fluid as specified in the maintenance schedule.

24.9 Bleed the system as described in Para 15 of this chapter.

24.10 Check the hydraulic system for leaks before road-testing the vehicle.



1	Seal	5	Backing washer
2	Seal retainer	6	Primary piston
3	Servo shell	7	Circlip
4	Output pushrod	8	Master cylinder body

Fig 14 Vacuum seal replacement

Chapter 11

FUEL AND EXHAUST SYSTEMS

CONTENTS

TABLE 1 SPECIAL TOOLS

Item	Tool No	NSN/Part No	Designation
(1)	(2)	(3)	(4)
1	PD199		Spanner, fuel injection pump flange nuts
2	MS.67B	6MT2/5120-99-829-5467	Timing gauge
3	PD.67-3		Timing gauge - gear adaptor
4	PD.67-2		Timing gauge - drive adaptor
5	PD.67-5		Timing gauge - distance piece
6	PD.67-4		Timing gauge - pointer
7	PD.155B		Gear puller for camshaft and fuel pump gears
8	PD.155B-5	6MT2/5120-99-719-1213	Gear puller - adaptors

ELIMINATE AIR FROM THE SYSTEM

1 If air enters the fuel system it must be eliminated from the system before the engine can be started. Air can enter the system if :

1.1 the fuel tank is drained in normal operation,
1.2 the low-pressure fuel pipes are disconnected,
1.3 a part of the low-pressure fuel system leaks during operation.

2 In order to remove air from the fuel system proceed as follows:

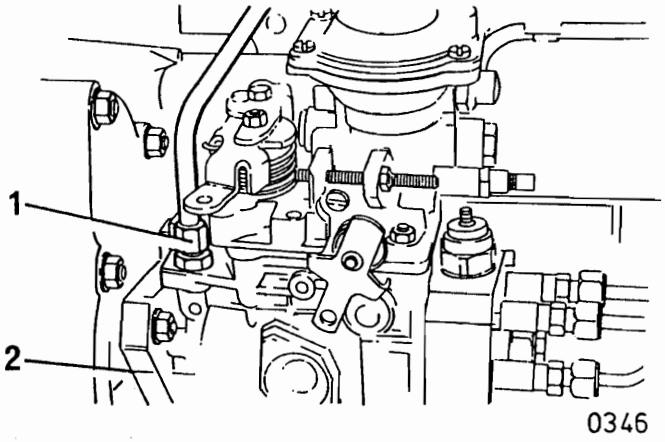
2.1 Loosen the banjo connection bolt which is fitted on top of the filter.

2.2 Operate the priming lever on the fuel lift pump until fuel, free of air, comes from the filter vent point. Tighten the banjo connection bolt. If the drive cam of the fuel lift pump is at the point of maximum lift, it will not be possible to operate the primary lever. In this situation, the crankshaft must be turned one revolution.

2.3 Ensure that the manual stop is in the run position.

2.4 Loosen the union nut of the fuel injection pump fuel inlet pipe. Operate the primary lever of the fuel lift pump until fuel, free from air, comes from the loose connection. Tighten the union nut.

2.5 Loosen the union nut at the fuel starting aid and operate the primary lever of the fuel lift pump until fuel, free from air comes from the loose connection Tighten the union nut.



1 Fuel inlet union nut
2 Alignment timing mark

Fig 1 Inlet pipe union nut.

2.6 Loosen the high-pressure pipe connections at two of the fuel injectors. Operate the starter motor until fuel, free from air, comes from the pipe connections. Tighten the pipe connection.

2.7 The engine is now ready to start. If the engine runs correctly for a short time and then stops, or runs roughly, check for air in the fuel system. If there is air, there is probably a leakage in the suction or low-pressure system.

SEDIMENTER

Dismantling and reassembly

3 Dismantle and reassemble the sedimenter as follows :

3.1 Drain the contents of the bowl into a suitable container.

3.2 Remove the four setscrews securing the bowl clamp ring to the head casting, and remove the clamp ring and plastic bowl.

3.3 Thoroughly clean the bowl and deflector plate.

3.4 Check the sealing ring in the head casting, renew if necessary.

3.5 Fit the deflector plate in the bowl and fill with clean fuel prior to refitting and ensure an airtight joint is obtained.

3.6 Vent the fuel system as detailed above.

FUEL LIFT PUMP

Removal

4 To remove the fuel lift pump :

4.1 Disconnect the fuel pipes from the fuel lift pump.

4.2 Release the setscrews, remove the lockplates and remove the lift pump. The pump may be difficult to remove from the engine. If this occurs the crankshaft must be rotated until the camshaft eccentric, that operates the lift pump, is in a position that will free the rocker lever of the lift pump.

Installation

5 To fit the fuel lift pump:

5.1 Ensure that the camshaft eccentric is in the minimum lift position before the lift pump is fitted, clean the joint face of the lift pump and cylinder block and fit the pump using a new joint. Fit the lockplates and the setscrews and tighten them evenly to 22 Nm (16 lbf ft).

5.2 Connect the fuel pipes.

5.3 Loosen the banjo connection on top of the fuel filter and operate the primary lever on the lift pump to eliminate any air between the lift pump and the fuel filter. Operate the lift pump until fuel, free of air, comes from banjo connection. Tighten the banjo connection.

5.4 Operate the engine and check for any fuel or air leakage.

Dismantling and reassembly

6 To dismantle the fuel lift pump :

6.1 Clean the outside surfaces of the fuel lift pump.

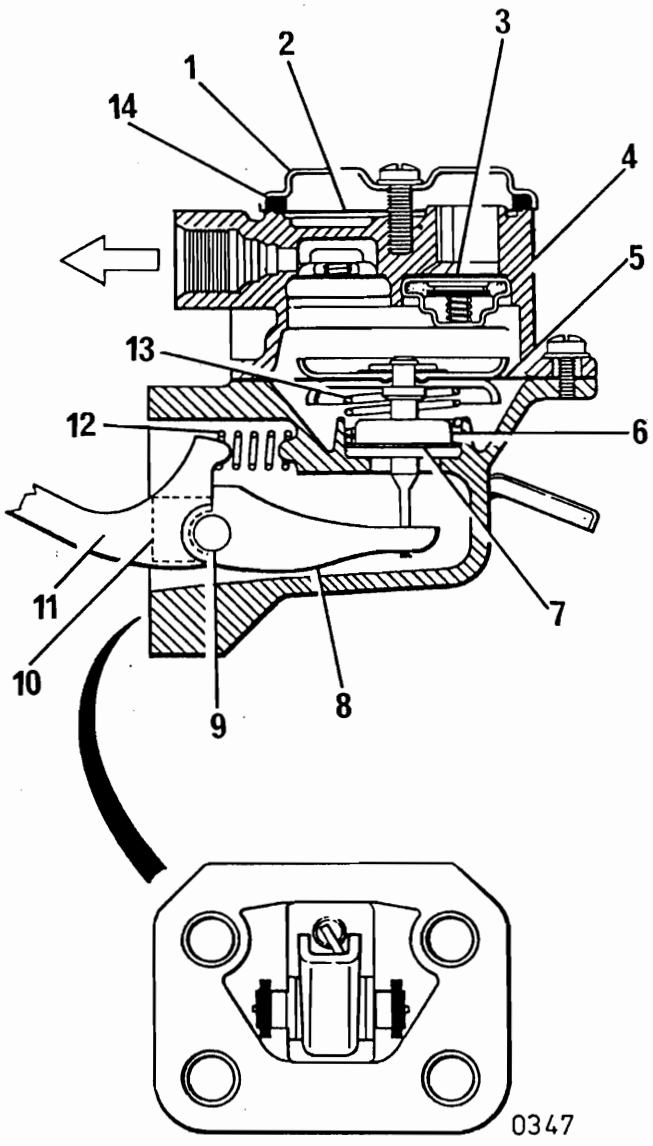
6.2 Make a mark across the flanges of the two halves of the pump to ensure correct relationship when the pump is assembled.

6.3 Remove the cover (1) and the gauze (2). Release the setscrews and separate the two halves of the pump.

6.4 Turn the diaphragm assembly (5) 90 degrees to release the pull rod from the link arm (8) and remove the diaphragm assembly. Remove the stem seal (6), spring seat washer (7) and the spring (12) from the pull rod. The diaphragm and pull rod assembly is renewed as an assembly and no service is possible on the diaphragm.

6.5 The valves (4) are peened in and can be removed with a suitable lever. Some of the peened metal will have to be removed before the valves can be removed.

6.6 To remove the link arm: Hold the rocker lever (11) in a vice and hit the body of the lift pump with a soft face hammer to release the two retainers (10). Be careful not to damage the joint face of the pump body. Remove the rocker lever (11), pin (9), link arm (8) and the return spring (12). Check the components for wear and other damage.



1	Cover	7	Washer
2	Gauze	8	Link arm
3	Seat washer	9	Rocker pin
4	Valve	10	Retainers
5	Diaphragm assembly	11	Rocker lever
6	Stem seal	12	Return spring
		13	Spring
		14	Seal

Fig 2 Fuel lift pump

7 To assemble the fuel lift pump:

7.1 Thoroughly clean the valve housings. Fit new seat washers (3) and push the new valves (4) into position. As the valves are the same, but one valve is fitted in reverse of the other, it is possible to fit the valves

upside down. When the valves are correctly fitted, peen the edge of the valve housings in six places, evenly divided, to keep the valves in position.

7.2 Fit the rocker lever (11), pin (9) and link arm assembly (8) and return spring (12) into the bottom half of the lift pump. Ensuring that the ends of the spring are in their correct location.

7.3 With a light hammer and a suitable adaptor, fit two new retainers (10) in their grooves in the casing until they fasten the pin. Peen the open ends of the grooves to fasten the retainers in position.

7.4 Fit the diaphragm spring (13) into its location under the diaphragm (5) and put the spring seat washer (7) and a new stem seal (6) into position on the pull rod. Ensure that the small diameter at the top of the seal is on the round section of the pull rod.

7.5 Put the diaphragm assembly in position over the lower half of the body with the blade of the pull rod aligned with the slot in the link arm. Press lightly down on the diaphragm until the notch in the pull rod is in the slot in the link arm and turn the diaphragm 90 degrees in either direction. This action will engage and retain the pull rod in the slot of the link arm.

7.6 Push the rocker arm towards the pump body until the diaphragm is level with the body flange and fit the top half of the body in position with the marks on the flanges aligned. Keep the pressure on the rocker arm; fit the spring washers and the screws and tighten them evenly.

7.7 Fit the gauze filter (2) and the cover (1), ensure that the rubber seal (14) is fitted correctly and tighten the screw.

FUEL FILTER

Removal

8 To remove the fuel filter:

8.1 Hold the bottom cover of the filter element and release the setscrew which is fitted through the filter head in the centre of the element.

8.2 Lower the bottom cover, remove the element and discard it.

Installation

9 To fit a fuel filter with new element:

9.1 Clean the inside surfaces of the top and bottom filter covers.

9.2 Fit the new sealing rings.

9.3 Put the bottom cover on the bottom of the new element and assemble it squarely to the filter head, ensure that the element is fitted in the centre against the joint in the filter head.

9.4 Hold the assembly in this position, engage and tighten the setscrews.

9.5 Eliminate all air from the system as detailed above.

FUEL INJECTION PUMP

Removal

10 To remove the fuel injection pump:

10.1 Remove all pipes, disconnect the stop control and the control rod of the fuel injection pump. Use a spanner to prevent movement of the fuel pump outlets when the nuts of the high-pressure pipes are released.

10.2 Remove the gear cover from the cover of the timing case. Remove the gear nut and the spring washer.

10.3 Turn the crankshaft until the keyway in the gear of the fuel pump is in the 1 o'clock position.

10.4 Remove the setscrew and the nut of the support bracket below the fuel pump. Release the flange nut of the fuel pump using special spanner Table 1 item 1.

10.5 Loosen the drive gear of the fuel injection pump using the gear puller (Table 1 item 7) and adaptor (Table 1 item 8).

10.6 Remove the fuel pump; ensure that the key does not fall from the drive shaft.

Installation

11 To fit the fuel injection pump:

11.1 Turn the drive shaft of the fuel injection pump clockwise to align the key with the 1 o'clock position of the keyway in the drive gear. In this position there will be no spring pressure on the drive shaft. Ensure that the key is correctly fitted and fit the fuel pump to the gear.

11.2 Align the mark on the flange of the fuel pump with the mark on the rear face of the timing case, see Figure 1. Fit the flange nuts of the fuel pump and the set screw and nut of the support bracket. Do not apply force to the fuel pump when the support bracket is fitted.

11.3 Fit the spring washer to the drive shaft of the fuel pump and tighten the nut to 80 Nm (59 lbf ft). Fit the gear cover to the cover of the timing case. Fit a new joint if necessary.

11.4 Fit all the pipes, connect the stop control and the control rod of the fuel injection pump. Use a spanner to prevent movement of the pump outlets when the high-pressure pipes are fitted.

11.5 Eliminate all air from the fuel system as detailed above.

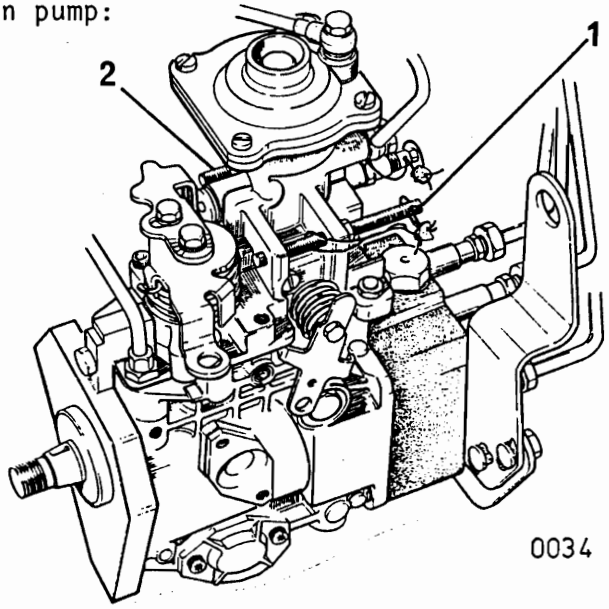
11.6 Operate the engine and check for leakage. With the engine at the normal operating temperature check the idle speed is correct as detailed below.

11.7 If a new fuel injection pump has been fitted, check the maximum no load speed as detailed below.

Idle and maximum speed adjustment

12 To check and adjust the fuel injection pump:

12.1 Operate the engine until it reaches its normal temperature of operation and check the idle speed. If necessary, adjustment can be made by the inner adjustment screw (2). Release the locknut and turn the screw clockwise to increase the speed, or counter-clockwise to decrease the speed. When the speed is correct, tighten the locknut.



1 Max no load adjustment
2 Idle speed adjustment screw

Fig 3 Fuel injection pump adjustment

12.2 With the engine at its normal temperature of operation, check the maximum no load speed. The maximum no load speed is indicated by the last section of the setting code for the fuel injection pump. The setting code can be found on the data plate on the side of the fuel pump. A typical setting code is 2643J000CK/1/2960. In this example, the maximum no load speed is 2960 rev/min. If necessary, this speed can be adjusted by the outer adjustment screw (1). Release the locknut and turn the screw counter-clockwise to increase the speed or clockwise to decrease the speed. When the speed is correct, tighten the locknut and seal the screw. When fitting the pump ensure that the adjustment screw is suitably sealed against interference after it has been set initially.

ENGINE TIMING

Check fuel injection pump timing

13 To set the piston of number 1 cylinder to top dead centre.

13.1 Fasten a temporary pointer to the timing case cover with its tip near to the outer edge of the crankshaft pulley or damper.

13.2 Remove the rocker cover.

13.3 Turn the crankshaft clockwise from the front, until the push rod for the inlet valve of the rear cylinder just tightens.

13.4 Remove the spring clip and the spacer from the front of the rocker shaft. Release the fasteners of the front two pedestals of the rocker shaft and remove the front rocker lever; tighten the fasteners of the rocker shaft pedestals.

13.5 Remove the valve springs from the front valve with the valve spring compressor and adaptor.

13.6 Allow the valve to be held by the top of the piston. Fit a suitable collar near the top of the valve to hold the valve if the crankshaft is turned too far.

13.7 Fasten a dial test indicator with its plunger in contact with the top of the valve stem and with a reading shown on the gauge. Turn slowly the crankshaft, clockwise from the front until the clockwise movement of the dial gauge pointer just stops. Make a suitable mark on the crankshaft pulley to align with the temporary pointer. Continue to turn the crankshaft, in the same direction until the gauge pointer just begins to move in a counter-clockwise direction. Make another mark on the pulley or damper to align with the pointer. Mark the centre point between the two marks on the pulley and remove the other two marks.

13.8 Turn the crankshaft approximately 45^{o} counter-clockwise from the front and then clockwise until the mark on the pulley is aligned with the pointer. Number 1 piston is now at TDC on the compression stroke.

To check valve timing

14 Check the valve timing with number 1 cylinder at TDC on the compression stroke.

14.1 Remove the dial test indicator from number 1 inlet valve and fit the valve springs and the rocker lever. Torque the fasteners for the rocker shaft pedestals to 40 Nm (30 lbf ft) (aluminium) or 75Nm (55 lbf ft) (cast iron bracket).

14.2 Turn the crankshaft, clockwise from the front until the inlet valve of the rear cylinder is fully open.

14.3 Set the valve tip clearance of number 1 cylinder inlet valve to 1.5mm (0.059 in).

14.4 Turn the crankshaft, clockwise from the front, until the push rod of number 1 cylinder inlet valve just tightens. In this position check if the mark on the crankshaft pulley is within 2 $1/2^{o}$ of the pointer.

Note ...
2 $1/2^{o}$ is 4.5 mm (0.18 in) at the circumference of the standard pulley, which has a diameter of 203 mm (8 in).

14.5 If the timing is more than 2 $1/2^{o}$ out of position, the timing gears are probably not in correct mesh.

Note ...
One tooth on the camshaft gear is equivalent to 23.0 mm (0.90 in) of pulley circumference.

14.6 Turn the crankshaft, clockwise from the front, until the inlet valve of the rear cylinder is fully open. Set the valve tip clearance of the inlet valve of number 1 cylinder to 0.20 mm (0.008 in).

14.7 Fit the rocker cover.

14.8 Remove the temporary pointer from the timing case and the timing mark from the pulley.

15 To check the timing of the fuel injection pump

15.1 Set the piston of number 1 cylinder to TDC on the compression stroke. It is not necessary to fit a temporary pointer instead, the dial of the dial test indicator should be set at zero when the clockwise movement of the pointer stops.

15.2 Remove the high pressure pipes from the fuel injection pump. Ensure that a spanner is used to prevent movement of the pump outlets when the high pressure pipes are removed or fitted.

15.3 Remove the plug and washer from the rear of the fuel pump and fit the adaptor and a suitable dial gauge. Set the dial gauge to indicate approximately 3.0 mm.

15.4 Slowly turn the crankshaft, counter-clockwise from the front of the engine, until the dial gauge indicates that the plunger of the fuel injection pump is at the bottom of its stroke. Set the dial to zero.

15.5 Slowly turn the crankshaft clockwise until the dial gauge on the valve stem indicates the correct position of the piston before TDC. The timing of the fuel injection pump is correct if the dial gauge on the pump plunger indicates 1.0 mm (0.039 in).

15.6 If the timing is not correct, disconnect the remainder of the pipes of the fuel injection pump and loosen the setscrew of support bracket for the pump.

15.7 To correct the timing, hold the fuel injection pump and release the flange nuts. If the gauge on the pump plunger indicates more that 1.0 mm (0.039 in), turn the fuel pump counter-clockwise, from the rear of the fuel pump, until the gauge indication is 1.0 mm (0.039 in). If the gauge indication is less than 1.0 mm (0.039 in). Tighten the flange nuts and the setscrew of the support bracket for the pump.

15.8 Turn the crankshaft counter-clockwise approximately 45^{o}, then slowly clockwise and check the TDC position. If the timing and the TDC are correct, remove the dial gauge and the adaptor from the fuel injection pump and fit the washer and the plug.

15.9 Fit all the pipes to the fuel injection pump. Remove the dial test indicator from the cylinder head and fit the valve springs and the rocker lever. Set the valve tip clearance to 0.20 mm (0.008 in). Fit the rocket cover. Eliminate the air from the fuel system.

Check the fuel injection pump timing mark

16 Check the timing mark on the fuel injection pump.

16.1 Remove the fuel injection pump.

16.2 Fit the adaptor (Table 1 item 2) Fig 4 to the drive shaft of the fuel pump and tighten the screw.

Fuel pump code letters	Pump mark angle
BK	314
CK	314
DK	313
EK	315.5
FM	295

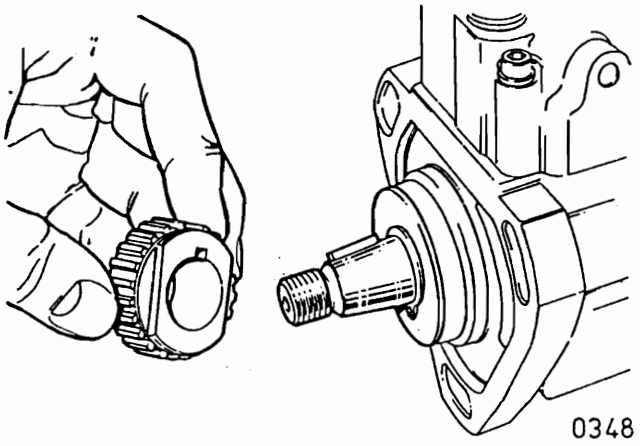


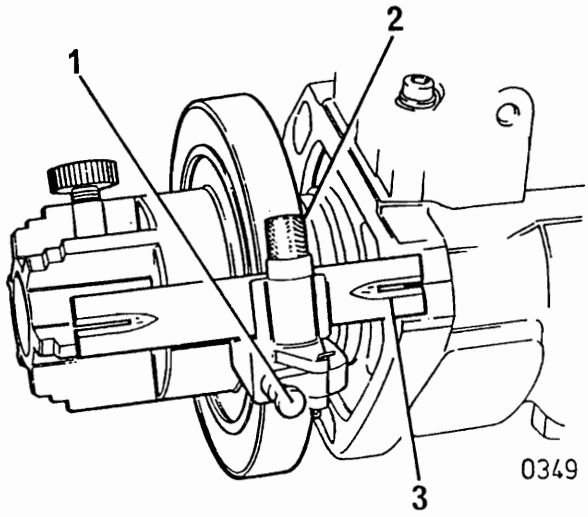
Fig 4 Timing gauge adaptor
Fuel timing mark

16.3 Release the screw (1), set the timing gauge (Table 1 item 2) as appropriate for the fuel pump and tighten the screw.

16.4 Fit the timing gauge to the splined adaptor on the fuel pump drive. Release the screw (2), slide the pointer (3) forward until its over the centre of the fuel pump flange and tighten the screw. Turn the timing tool and the pump shaft to align the master spline with the number 1 outlet of the pump (outlet "C").

16.5 Remove the plug and the washer from the centre of the rear of the fuel pump and fit the adaptor. Fit a dial gauge to the adaptor and set the gauge to indicate approximately 2.0 mm (0.080 in).

16.6 With the fuel injection pump held securely, turn the tool and the drive shaft counter-clockwise, from the drive end, and set the dial gauge to zero when the pump plunger is at its lowest position.



1 Angle adjusting screw
2 Pointer adjusting screw
3 Pointer

Fig 5 Timing gauge
Fuel pump timing mark

16.7 Keep the fuel pump secure and turn the drive shaft clockwise until the gauge indicates 1.0 mm (0.039 in) plunger lift. At this position the slot in the pointer of the timing gauge must align with the mark on the flange of the fuel pump.

16.8 If the mark is not correct, remove the timing tool and eliminate the mark on the flange. Fit the timing gauge and repeat the above operation to obtain 1.0 mm (0.039 in) plunger lift. With the fuel injection pump and timing tool held securely in the correct position, make a new mark on the flange of the fuel pump, within the slot of the pointer. Release the timing tool and repeat the operation to check that the new mark is correct.

16.9 Remove the timing gauge, splined adaptor and the adaptor and dial gauge. Fit the washer and plug to the rear of the fuel pump.

16.10 Fit the fuel injection pump.

16.11 Eliminate air from the fuel system.

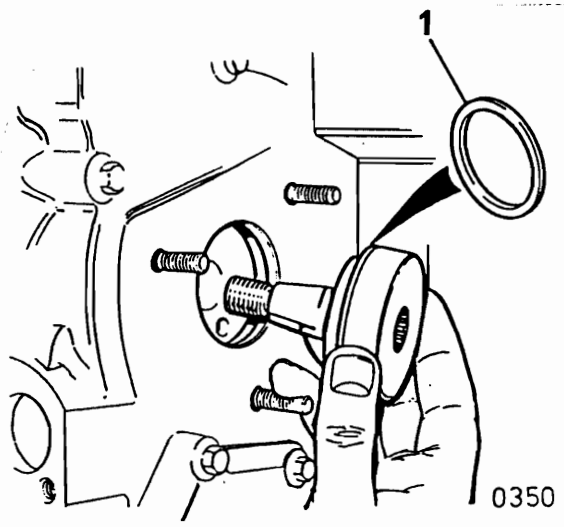
Check the engine timing mark

17 Check the mark on the timing case.

17.1 Set the piston number 1 cylinder to TDC on the compression stroke.

17.2 Remove the fuel injection pump and its joint.

17.3 Fit the distance piece (Table 1 item 5) (1) to the timing gauge adaptor (Table 1 item 4). Align the key in the adaptor with the keyway in the gear of the fuel pump and fit the adaptor to the gear. Ensure that the distance piece is against the rear face of the timing case. Secure the adaptor to the gear with the nut supplied with the adaptor.



1 Distance piece

Fig 6 Timing gauge adaptor - Engine timing mark

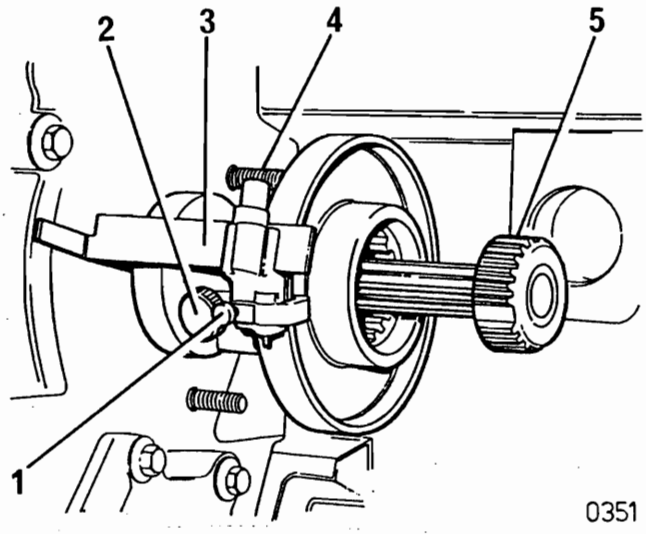
17.4 Loosen the screw (1) on the timing gauge. Set the timing gauge to the correct engine check angle and tighten the screw.

Fuel pump code letters	Engine check angle
BK	308
CK	308
DK	307
EK	308.5
FM	288.75

17.5 Loosen the screw (2) and fit the splined shaft (5) into the timing gauge. Loosen the screw (4). Fit the 90° pointer (3) and tighten the screw.

17.6 Fit the splined shaft of the timing gauge to the adaptor. Slide the timing gauge along the splined shaft until it is against the adaptor and tighten the screw (2).

17.7 Loosen the screw (4). Slide the pointer forward until the flat face is against the rear face of the timing case and tighten the screw. If the mark on the timing case is correct, the mark will align with the top edge of the pointer (3). If the mark is not correct, remove the timing gauge and eliminate the mark on the timing case. Fit the timing gauge. Ensure that the pointer is against the timing case and make a new mark on the timing case along the top straight edge of the pointer.



1 Angle adjusting screw
2 Shaft mounting screw
3 90° Pointer
4 Pointer adjusting screw
5 Splined shaft

Fig 7 Timing gauge - Engine timing mark

17.8 Remove the timing gauge and the adaptor.

17.9 Fit the fuel pump together with a new joint.

17.10 Remove the dial test indicator from the cylinder head and fit the valve springs and the rocker lever. Set the valve tip clearance of number 1 cylinder inlet valve to 0.20 mm (0.008 in). Fit the rocker cover.

17.11 Eliminate air from the fuel system.

INJECTORS

WARNING ...
HIGH PRESSURE SPRAY CAN PENETRATE THE SKIN

Removal

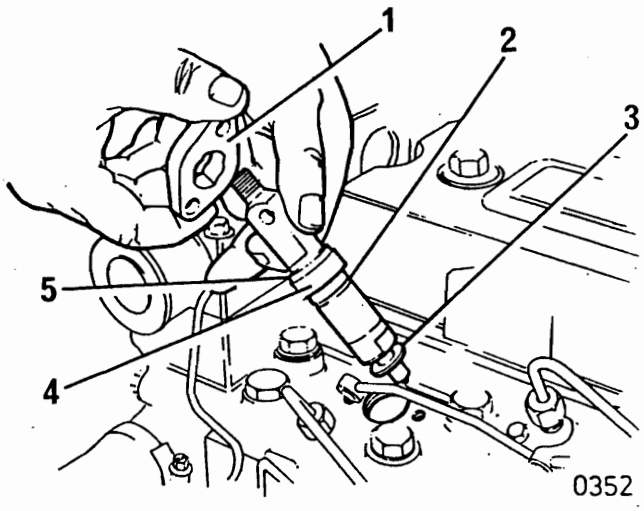
18 An injector fault can be shown by an engine misfire. In order to find which injector is defective, with the engine operating at fast idle speed, loosen and tighten the union nut of the high pressure fuel pipe at each injector. When the union nut of the defective injector is loosened it will have no effect on the engine speed.

19 To remove an injector:

19.1 Remove the fuel leak-off pipes.

19.2 Release the union nuts of the high pressure pipes from the injectors and from the fuel injection pump. Hold the pump outlet to prevent movement while the union nut of the high pressure pipe is released at the pump. Do not bend the pipes if necessary remove the pipe clamps.

19.3 Release the setscrews of the injector flange and remove the flange (1) the injector (2) and its seat washer (3). Remove the dust seal (4) and the spacer (5).



1 Flange
2 Injector
3 Seat washer
4 Dust seal
5 Spacer

Fig 8 Injector assembly

Installation

20 To fit an injector:

20.1 Fit the spacer (5) and a new dust seal (4) to the new injector.

20.2 Put the new injector in position with its spacer, new dust seal and new seat washer. Fit the flange and engage the large setscrews. Ensure that the injector is not tilted and tighten the setscrews evenly to 12 Nm (9 lbf ft).

20.3 Fit the high-pressure pipes and tighten the union nuts to 18 Nm (13 lb ft). Hold the pump outlet with a spanner to prevent movement while the pipe nut is tightened at the pump. If necessary, fit the pipe clamps.

20.4 Renew the seal washers and fit the leak-off pipe.

20.5 Operate the engine and check for fuel leakage.

Note ...
The injectors are marked with code letters on the side of the body just below the connection for the nut of the high pressure pipe. Ensure that the replacement injector has appropriate code letters.

Code	Holder	Nozzle	Set and reset pressure atm	(lbf/in^2)	MPa
HV	LRB67014	JB6801052	250	3675	25.3
HZ	LRB67014	JB6801029	220	3234	22.3
JB	LRB67014	JB6801058	250	3675	25.3
JE	LRB67014	JB6801058	220	3234	22.3
JF	LRB67032	JB6801052	250	3675	25.3
JG	LRB67032	JB6801058	230	3381	23.3
RD	KBEL66S45	DLLA140S1039	250	3675	25.3
RE	KBEL66S47	DLLA150S1055	250	3675	25.3
RF	KBEL66S47	DLLA150S1072	250	3675	25.3
RH	KBEL66S47	DLLA150S1087	250	3675	25.3

EXHAUST SYSTEM

TURBOCHARGER

Removal

21 To remove the turbocharger:

21.1 Thoroughly clean the turbocharger

21.2 Remove the air cleaner hose at the compressor inlet.

21.3 Disconnect the turbocharger support bracket and remove the exhaust elbow and its gasket from the turbocharger.

21.4 Release the hose clips and push the hose of the compressor outlet up the elbow of the induction manifold.

21.5 Release the setscrews from the flange of the oil supply at the top of the bearing housing. Lift of the pipe and remove the flange joint.

21.6 Release the setscrews from the flange of the oil drain pipe at the bottom of the bearing housing. Remove the oil drain pipe and the joint from the flange.

21.7 Release the nuts at the turbocharger to exhaust manifold flange and remove the turbocharger and the gasket. Cover the openings in the manifold and the pipes to ensure that no dirt enters.

21.8 Check the air hoses and the oil drain hose for cracks or other damage and renew if necessary.

Installation

22 To fit the turbocharger:

22.1 Remove the covers from the pipes and manifolds.

22.2 Check that the turbocharger inlets and outlets are clean and free from restrictions and that the turbocharger shaft rotates freely. Check that the openings in the manifolds and the exhaust pipe are clean and free from restriction.

22.3 Fit a new gasket to the exhaust manifold to turbocharger flange (1). Fit the turbocharger. Fit the nuts and tighten them to 44 Nm (33 lbf ft). Use a suitable compound to prevent seizure.

22.4 Lubricate the bearing housing of the turbocharger with clean engine lubricating oil. Fit the oil supply pipe (Figure 10 (1)) together with a new joint and tighten the flange setscrews.

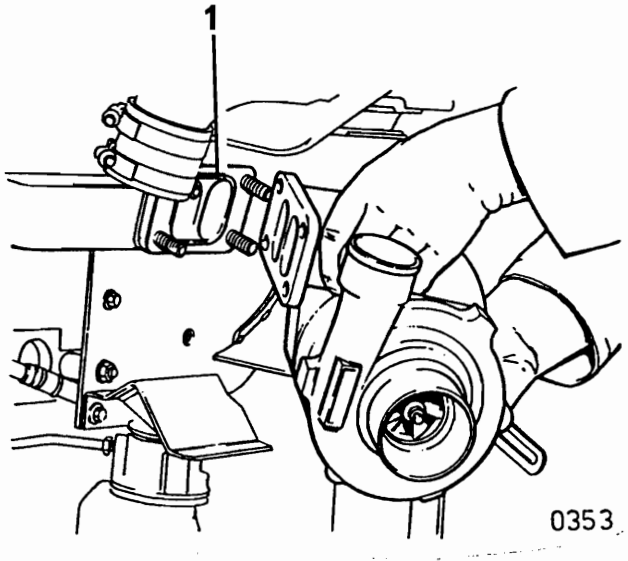
22.5 Fit the oil drain pipe (Figure 10 (2)) together with a new joint and tighten the flange setscrews, but do not connect the hose.

22.6 Using a new gasket fit the exhaust elbow to the turbocharger, fit and tighten the nuts. Fit the turbocharger support bracket.

22.7 Slide the hose on the induction manifold elbow onto the compressor outlet and tighten the hose clips.

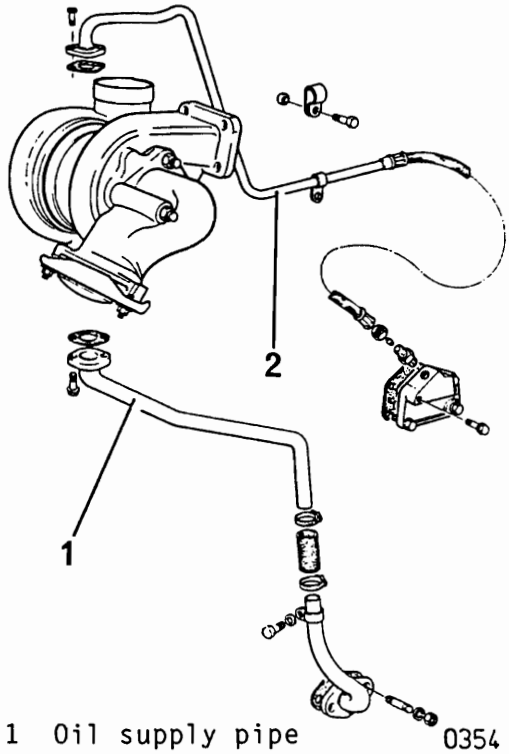
22.8 Check that there is no restriction in the air filter to turbocharger hose. Fit the hose and tighten the clip.

22.9 Operate the starter motor until there is a flow of lubricating oil from the oil drain pipe of the turbocharger. Connect the oil drain pipe.



1 Turbocharger flange

Fig 9 Turbocharger exhaust manifold



1 Oil supply pipe
2 Oil drain pipe

Fig 10 Turbocharger Lubrication

Cleaning the impeller and the compressor casing

23 Remove the turbocharger and make a reference mark on the compressor casing and the bearing housing to ensure correct location on assembly. Clean the impeller and the compressor casing as follows :

23.1 Carefully remove the compressor casing from the turbocharger. If the casing is tight, lightly hit it with a soft faced hammer, if the impeller blades are damaged the turbocharger must be renewed.

23.2 Put the compressor casing in a suitable container that contains a non-corroding solution. Allow the dirt to become soft and then clear the casing with a hard brush and/or soft scraper. Dry the casing with clean, compressed air at low pressure. Clean the impeller with a soft brush.

23.3 Carefully push the compressor impeller towards the bearing housing and turn the impeller by hand. Check that there is no restriction of movement and that there is no noise that might indicate a fault.

23.4 Fit the casing to the turbocharger and align the mark on the casing with the mark on the bearing housing. Fit the lock plates and the setscrews and tighten the setscrews. Refit the turbocharger as detailed above.

EXHAUST SYSTEM

Removal

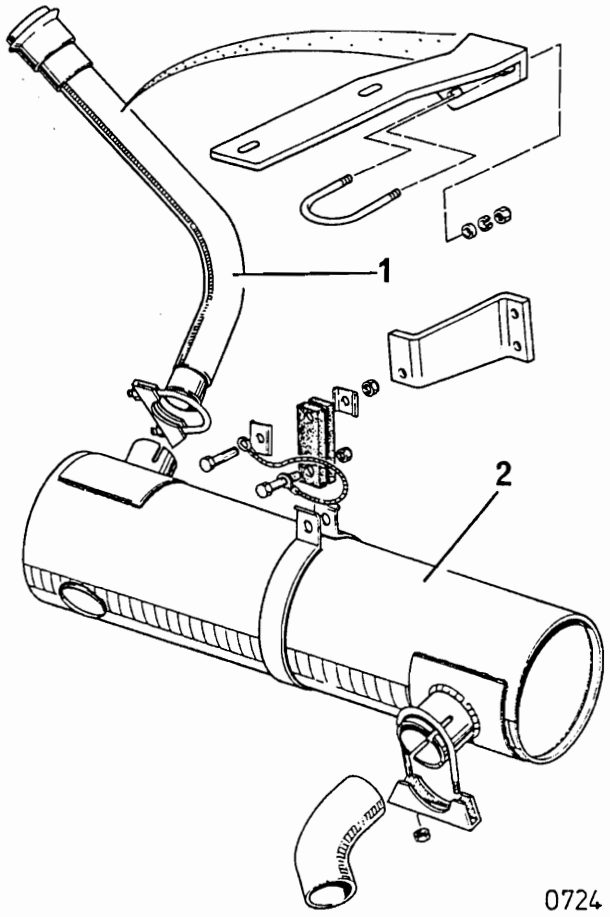
24 To remove the exhaust system complete.

24.1 Remove the three bolts connecting the down pipe flange to the turbocharger exhaust manifold.

24.2 Supporting the silencer, remove the bolt through the rubber hanging strap. Remove the exhaust system complete.

Installation

25 To refit an exhaust system reverse the above procedure. Torque tighten the bolt through the rubber hanging strap to 11 Nm (8 lbf ft). Torque tighten the bolts securing the down pipe flange to the turbocharger exhaust manifold to 40 Nm (30 lbf ft).



1 Downpipe 2 Silencer

Fig 11 Exhaust system

AIR CLEANER ASSEMBLY

Removal

26 To remove the air cleaner complete with filter carry out the following :

26.1 Remove the bolt, washer and nut securing the canister to front mounting bracket.

26.2 Remove the bolt (8), washer, spacer and nut securing canister to rear mounting to bulkhead.

26.3 Loosen hose clips (2 and 9), disconnect flexible hose (3) and venturi hose. Remove canister.

26.4 Loosen hose clip (4) and remove flexible hose (3).

26.5 Remove bolt, washer and nut securing bracket (7).

26.6 Loosen hose clip (5) and remove pipe (6).

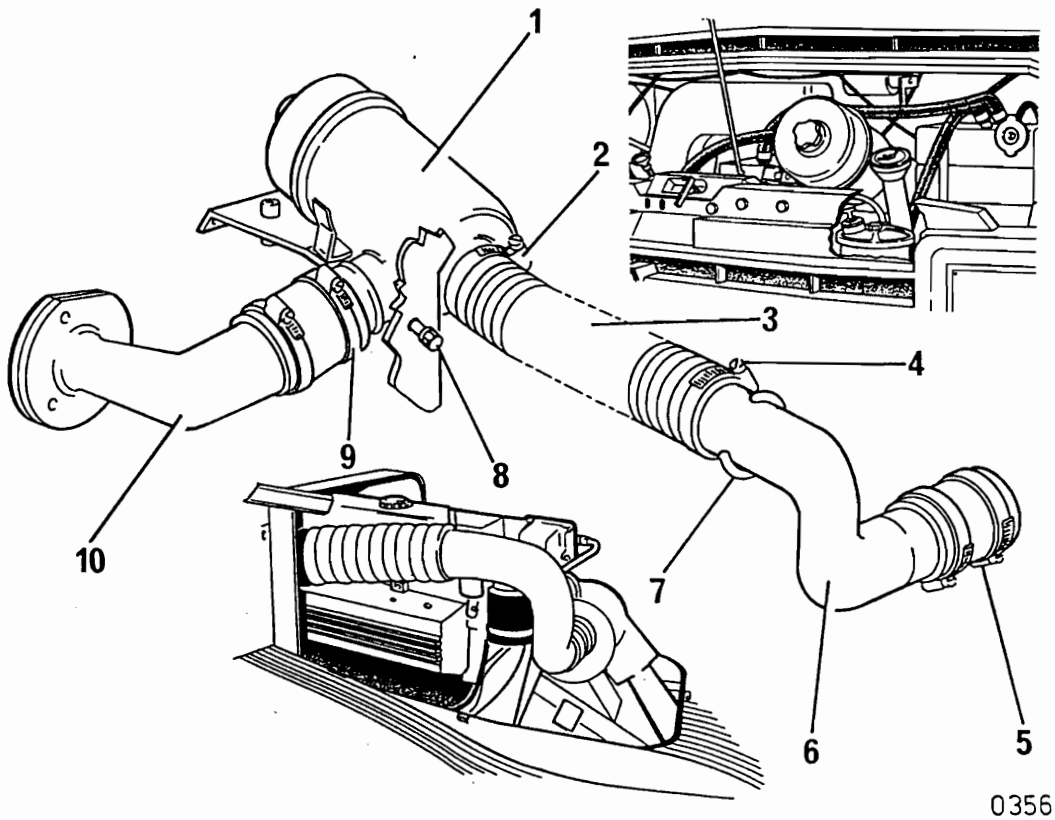
Inspection

27 Remove the filter from canister and inspect for damage, replace as necessary.

27.1 Check the canister and hoses for damage, replace as necessary.

Installation

28 To install the air cleaner assembly is the reverse of the removal procedure.



1	Air cleaner	4	Hose clip	7	Bracket
2	Hose clip	5	Hose clip	8	Bolt
3	Flexible hose	6	Pipe	9	Hose clip
				10	Venturi pipe

Fig 12 Air cleaner assembly

ETHER COLD STARTING AID

WARNING ...
AVOID INHALING ETHER FUMES AS THEY ARE TOXIC. DO NOT SMOKE, USE A NAKED FLAME OR ARC WELDING EQUIPMENT NEAR THIS INSTALLATION AS THE FUMES ARE ALSO HIGHLY INFLAMMABLE. ANY PART OF THE BODY EXPOSED TO ETHER MUST BE WASHED AT ONCE. KEEP ETHER AWAY FROM EYES, MOUTH AND NOSE. GET MEDICAL ADVICE AT ONCE IF AT ALL EFFECTED BY ETHER.

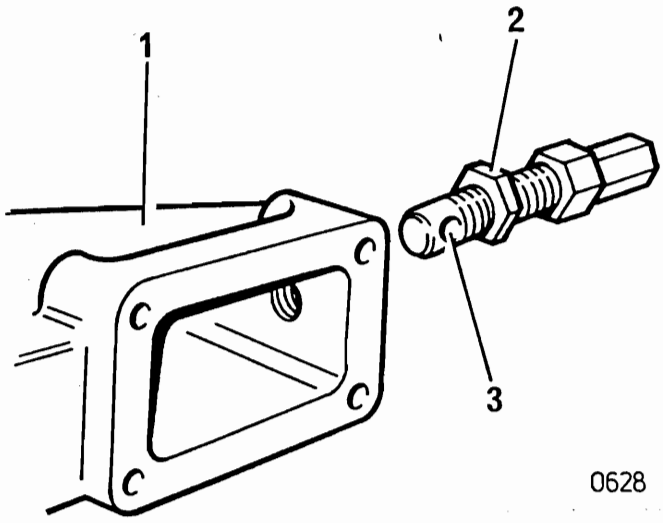
Spray nozzle installation

29 To install the spray nozzle screw the nozzle (3) and adaptor into the inlet manifold, so that the nozzle is central in the opening to the turbo charger and the sprayer faces the turbocharger.

29.1 Lock the nozzle in this position with the locknut (2).

29.2 An arrow on the sprayer nut will give the spray direction.

29.3 Connect the flexible hose securely to the sprayer.



1 Inlet manifold
2 Locknut
3 Nozzle

Fig 13 Installing ether spray nozzle

Chapter 12

COOLING SYSTEM

CONTENTS

DRAINING THE COOLING SYSTEM

1 To minimise the loss of coolant and anti-freeze drain the cooling system as follows :-

1.1 Obtain a suitable threaded union, having the same thread as the cylinder block drain plug tapping, and attach a suitable length of plastic piping.

1.2 If the engine is cold the cooling system will be under partial vacuum. Under this condition remove the cylinder block drain and immediately fit the adaptor before removing the coolant filler cap.
If the engine is warm, relieve the pressure in the system by releasing, but not removing, the coolant filler cap. Re-tighten when the pressure diminishes. Only then must the cylinder block drain plug be removed and the adaptor fitted, followed by the removal of the coolant filler cap.

1.3 When the flow stops disconnect the hoses between the radiator and the engine.

Note ...
The radiator contains 9.4 litres, the header tank 3.35 litres and the engine 4.5 litres. The complete system contains 23 litres of coolant of which 45% is antifreeze AL39.

THERMOSTAT

Removal

2 To remove a thermostat :

2.1 Drain the cooling system so that the coolant level is below the thermostat position and disconnect the top hose from the water outlet connection.

2.2 Release the setscrews and remove the water outlet connection.

2.3 Remove the thermostat.

Installation

3 To fit a thermostat :

3.1 Ensure that the joint faces of the housing and the outlet are clean and that the jiggle pin in the thermostat is free to move.

3.2 Put the new thermostat in position in the housing.

3.3 Fit a new joint and the water outlet connection. Torque tighten the setscrews to 22 Nm (16 lbf ft).

3.4 Connect the top hose and fill the cooling system.

Test

4 To test the operation of the thermostat :

4.1 Hang the thermostat in a suitable container filled with water.

4.2 Heat the water gradually. Use a thermometer to check the temperature at which the valve starts to open, 77 to 85°C (170 to 185°F) and the temperature at which it is fully open 92 to 98°C (198 to 208°F).

4.3 If the thermostat does not operate correctly, it must be renewed. Do not try to adjust the settings.

WATER PUMP

Removal

5 To remove the water pump :

5.1 Drain the cooling system and disconnect the hose at the inlet connection of the water pump.

5.2 Release the setscrews from the flange of the coolant by-pass.

5.3 Release the three setscrews which secure the water pump to the cover of the timing case; two from the front and one from the rear.

5.4 Release the nuts from the rear face of the timing case and remove the water pump. Ensure that the toroidal sealing ring on the cover of the timing case is not lost.

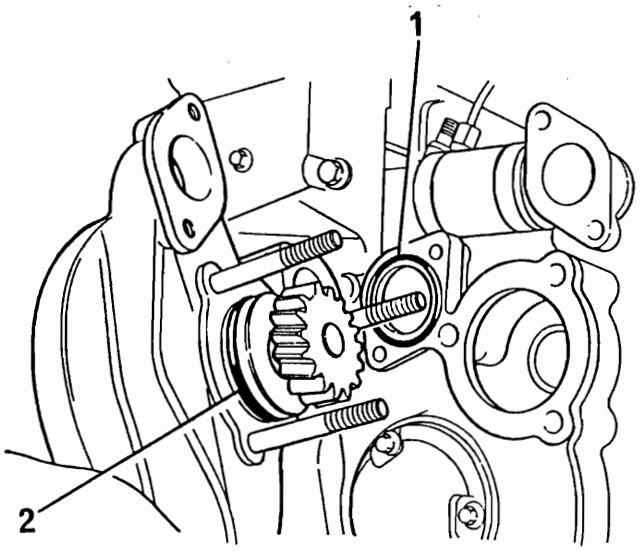
Installation

6 To fit a water pump :

6.1 Check the toroidal sealing rings on the pump body (2) and on the cover of the timing case (1) for damage. If either seal is damaged it must be replaced. Ensure that all joint faces are clean.

6.2 Check the drive gear of the water pump for wear or other damage. Renew if required.

6.3 Lightly lubricate the seal on the pump body with clean engine lubricating oil. Fit the pump



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1 Timing case seal
2 Pump body seal

Fig 1 Water pump

to the timing case cover with its gear in mesh with the gear of the fuel injection pump. The pump is a tight fit in the cover, but can be pulled into position if the nuts for the pump studs are gradually and evenly tightened. Ensure that the seal in the cover remains in position while the pump is fitted.

6.4 Fit and tighten the three setscrews which retain the pump to the cover of the timing case, to 22 Nm (16 lfb ft).

6.5 Fit a new joint to the flange of the coolant by-pass. Fit the by-pass and torque tighten to 50 Nm (37 lfb ft).

6.6 Connect the hose to the inlet connection of the water pump and fill the cooling system. Operate the engine and check for leakage.

Dismantling

7 To dismantle a water pump :

7.1 Remove the three long studs and the toroidal seal (1) from the pump body (4).

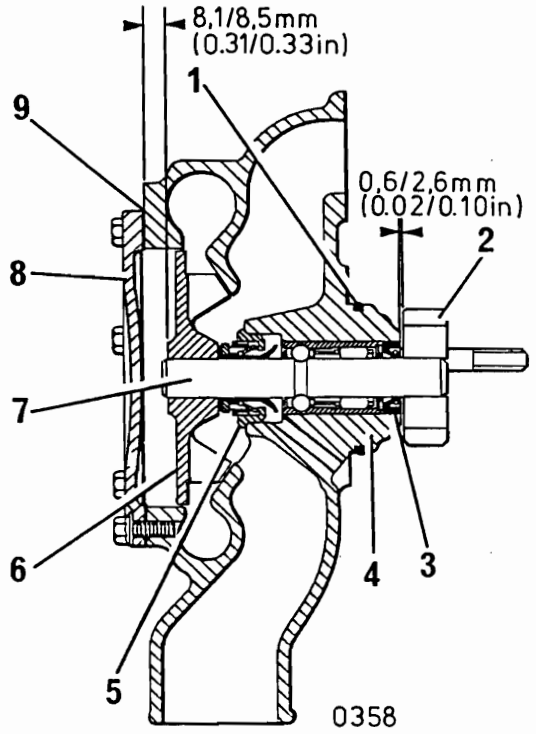
7.2 Remove the front cover (8) and the joint (9).

7.3 Using a gear puller remove gear (2).

7.4 Using a suitable lever remove and discard the seal (3).

7.5 If necessary remove the studs from the pump body. With a suitable support under the impeller end of the body, use a suitable adaptor to press out the shaft and bearing assembly (7) together with the impeller (6) and water seal (5).

7.6 With a suitable support under the impeller, press the shaft out of the impeller. Remove the water seal (5) and discard it.



1	Torodial seal	6	Impeller
2	Gear	7	Shaft and bearing assembly
3	Seal	8	Front cover
4	Pump body	9	Front cover joint
5	Water seal		

Fig 2 Water pump - assembly

Assembly

8 To assemble a water pump :

8.1 Clean thoroughly the inside of the pump body especially the bearing bore and the counter bore for the water seal.

8.2 Apply a thin layer of Loctite 35 to the outer surface of the bearing, but keep the Loctite away from the ends of the bearing. Provide a suitable support under the gear end of the pump body. Put the bearing and shaft assembly (Fig 2 (7)) in position with the bearing square to the pump body and the shortest end of the shaft in the pump body. Use a press and a suitable adaptor, which will apply force to the bearing and not to the shaft, to press in the bearing and shaft assembly. Press the bearing until the end of the bearing is level with the bottom of the counter bore for the water seal. Remove the adaptor and remove all Loctite from the end of the bearing.

8.3 Do not lubricate the water seal (Fig 2 (5)). With the widest end of the water seal towards the bearing, push the seal onto the shaft until it is against the chamfer of the counter bore. Ensure that the seal is square with the bore and press the seal into the counter bore, using a suitable adaptor, until the outer flange is in contact with the pump body. The adaptor must apply force only to the outer flange of the seal. With the seal in position, continue to apply force for approximately 10 seconds to ensure that the seal remains in position.

8.4 Hold the pump with the gear end of the shaft on a suitable support and, with the use of a suitable distance piece and a flat bar, press the impeller (Fig 2 (6)) into the shaft to the dimension indicated. Remove the tool and ensure that the shaft is free to rotate. If the original impeller is to be used again, Loctite 35 must be applied to the bore of the impeller and any excess Loctite removed after the impeller has been fitted.

8.5 Turn the pump over and provide a suitable support for the pump body, remove the studs, if necessary. Lightly lubricate the oil seal (Fig 2 (3)) with clean engine lubricating oil. Put the oil seal into position in the pump body with the flat face of the seal towards the bearing. With a suitable adaptor, press the oil seal into the body until the rear of the seal is level with the end of the pump. When the seal is in position, continue to apply force for approximately ten seconds to ensure that the seal remains in position when the force is released.

8.6 Hold the pump with the impeller end of the shaft on a suitable support. Press the gear (Fig 2 (2)) onto the shaft to the dimension shown. If the original gear is used, Loctite 35 must be applied to the bore of the gear and all excess Loctite removed after the gear has been fitted.

8.7 Fit a new joint (Fig 2 (9)) and the cover (8) and torque tighten the fasteners to 22 Nm (16 lff ft).

FAN

Removal and installation

9 To remove the fan release the setscrews and remove the fan. If necessary, refit the setscrews to retain the fan extension and the pulley to the hub. When fitting a fan tighten the setscrews to 22Nm (16 lbf ft).

FAN DRIVE

Removal

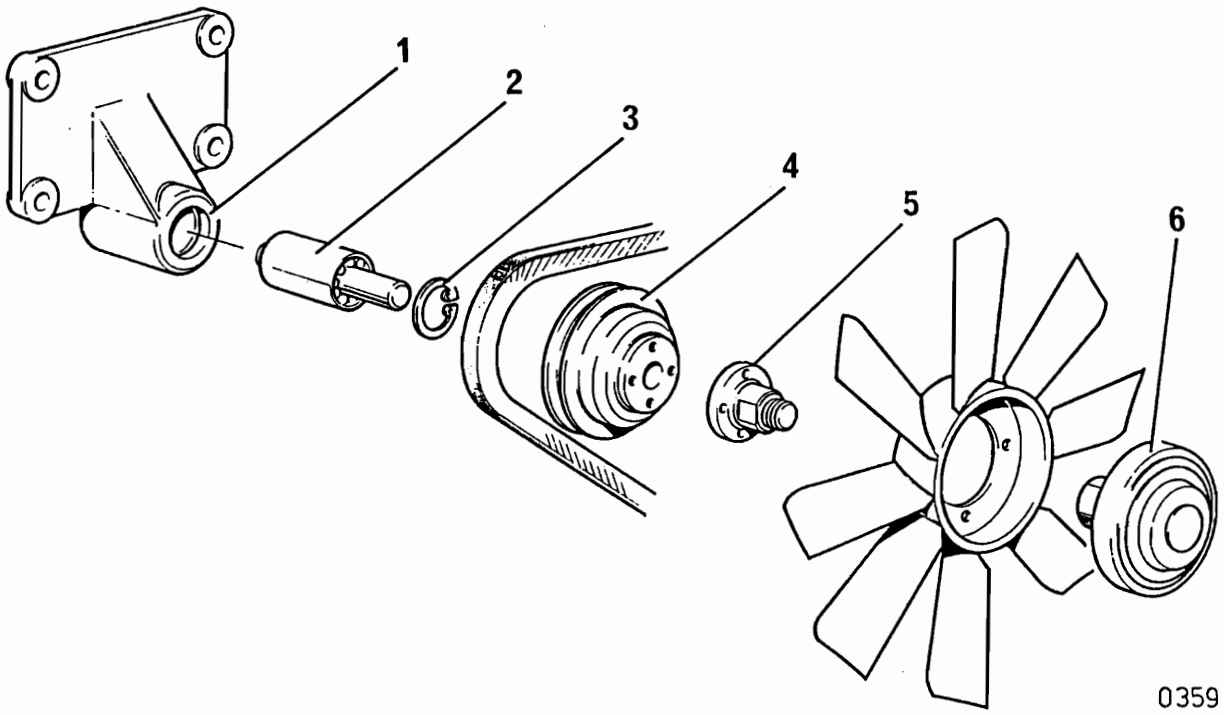
10 To remove the fan drive :

10.1 Loosen the pivot fasteners of the alternator and the fasteners of the adjustment link. Remove the drive belts.

10.2 Release the setscrews and remove the fan. Remove the fan extension and the pulley.

10.3 Check the end-float of the drive shaft. If it is more than 0.25mm (0.010 in), the assembly must be renewed.

10.4 Release the setscrews and remove the fan drive.



1 Fan drive housing
2 Bearing
3 Circlip
4 Pulley
5 Adaptor
6 Fan drive unit

Fig 3 Fan drive - assembly

Installation

11 To fit a fan drive :

11.1 Fit the fan drive and tighten the setscrews to 44 Nm (33 lbf ft)

11.2 Fit the fan as detailed above.

11.3 Fit the belts and adjust the tension (refer to Chapter 13).

Dismantling

12 To dismantle a fan drive :

12.1 Using a suitable puller, remove the hub from the drive shaft.

12.2 Remove the circlip which retains the bearing.

12.3 Provide a suitable support for the front of the bearing housing. Put a suitable adaptor on the rear of the bearing and press the bearing and shaft assembly out through the front of the bearing housing. Do not apply force to the shaft.

Assembly

13 To assemble the fan drive :

13.1 Put the bearing housing on a suitable support with the largest opening uppermost.

13.2 Put the bearing on the housing with the shortest end of the shaft towards the housing. Put a suitable adaptor on the bearing and press the bearing and shaft assembly into the housing. Do not apply force to the shaft.

13.3 Fit the circlip in its groove in the bearing housing.

13.4 With the rear end of the shaft on a suitable support, press on the hub until the distance, measured from the rear of the bearing housing to the front chamfered edge of the hub flange is 115.3 mm (4.54 in).

LUBRICATING OIL COOLER

Removal

14 To remove the lubricating oil cooler :

14.1 Drain the cooling system.

14.2 Release the support bracket at the cooler.

14.3 Release the setscrew and nut which fasten the low pressure fuel pipes to the top of the cooler.

14.4 Release the hose clip at the top rear of the cooler.

14.5 Release the seven setscrews securing the cover. Remove the cooler.

Installation

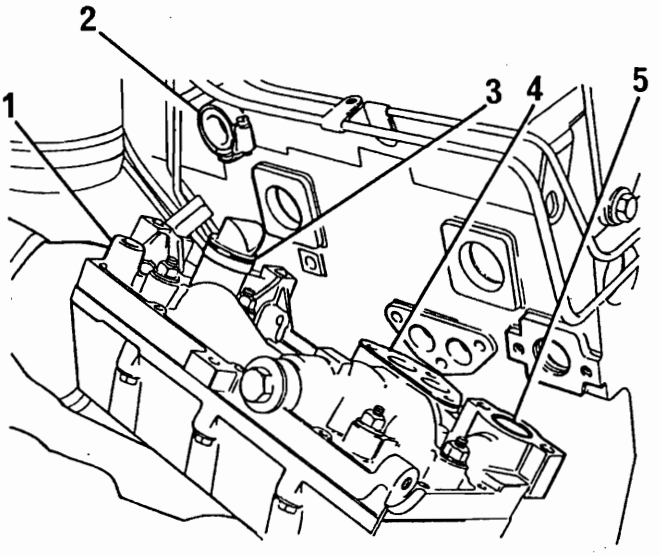
15 To fit a lubricating oil cooler :

15.1 Fit new toroidal sealing rings on the inlet connection for the coolant (3) and the outlet flange for the coolant (5). Ensure that the joint faces are clean. Renew the joint (4) for the oil pipe flange.

15.2 Lightly lubricate the bore of the vent connection (2) and the seal on the coolant inlet connection with engine lubricating oil.

15.3 Loosely fit the hose clip to the vent connection.

15.4 Fit the cooler to the engine ensuring the vent mates correctly with its connection. Tighten the setscrews and the hose clip of the vent connection.



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1 Vent
2 Vent connection
3 Coolant inlet
4 Oilpipe flange
5 Coolant outlet

Fig 4 Lubricating oil cooler

15.5 Fit the supporting bracket.

15.6 Fit the setscrew and nut which fasten the low-pressure fuel pipes to the top of the oil cooler.

15.7 Fill the coolant system.

15.8 Operate the engine and check for leakage of coolant or oil.

Dismantling

16 To dismantle a lubricating oil cooler :

16.1 Remove the oil cooler.

16.2 Release the nuts on the front of the cover and remove the element of the cooler.

16.3 Clean the element and check for cracks. If the inside of the element needs to be cleaned, use a solvent which is suitable for copper. Dry the element with low pressure air and then flush it with clean engine lubricating oil.

Assembly

17 To reassemble the oil cooler :

17.1 Renew all toroidal ring seals.

17.2 Fit the element of the oil cooler to the cover and tighten the nuts to 22 Nm (16 lbf ft).

COOLER BY-PASS VALVE

Removal and installation

18 To remove and fit the cooler by-pass valve :

18.1 Release the hexagonal cap and remove the by-pass valve.

18.2 Check the valve spring and the seal for damages and renew the complete assembly, as necessary.

18.3 Renew the aluminium washer. Fit the by-pass valve into the oil cooler and tighten the cap to 50 Nm (37 lbf ft).

RADIATOR

Removal and installation

19 To remove and refit the radiator proceed as follows :

19.1 Disconnect the batteries.

19.2 Lift the bonnet and safely support in this position.

19.3 Mark the hoses to the radiator to assist during the re-assembly.

19.4 To minimise the loss of coolant and antifreeze drain the cooling system into a suitable recepticle as described in para 1.

19.5 Remove all the other hoses to the radiator ensuring that a suitable recepticle is available into which the fluid can be drained.

19.6 The cable of the bonnet lock release mechanism runs through the radiator cowl. To avoid dismantling this mechanism remove the 16 bolts lift the cowl and cable free and support it on the left hand wing.

19.7 Release the front grille and disconnect the electrical connectors to the side and indicator lights (a total of 8 connectors), lift the front grille, including side and indicator lights clear of the vehicle.

19.8 Lift the radiator until the lower mounting spigots disengage from their mountings, remove the radiator taking care not to damage the matrix.

19.9 To refit the radiator reverse removal instructions.

Chapter 13

ELECTRICAL SYSTEM (12V)

CONTENTS

TABLE 1 WIRING COLOUR CODE

LETTER	COLOUR	LETTER	COLOUR	LETTER	COLOUR
R	RED	P	PURPLE	S	SLATE
B	BLACK	U	BLUE	O	ORANGE
W	WHITE	N	BROWN	LG	LIGHT GREEN
G	GREEN	K	PINK	Y	YELLOW

Note...

A vehicle circuit diagram and full harness wiring details are provided in AESP 2320-E-200-302 Chapter 13

STARTER MOTOR

WARNINGS ...

(1) ALWAYS DISCONNECT THE BATTERIES PRIOR TO WORKING ON ELECTRICAL EQUIPMENT.

(2) BE CAREFUL WHEN USING METAL TOOLS ON OR NEAR LIVE EQUIPMENT. REMOVE ANY METAL JEWELLERY/WATCH STRAPS

(3) NEVER EXPOSE A BATTERY TO A NAKED FLAME.

Removal

1 To remove the starter motor

1.1 Disconnect the batteries. Disconnect the starter motor cables. Remove the three M10 fasteners and carefully lift the starter motor clear of the vehicle.

Installation

2 To fit a starter motor

2.1 Locate the starter motor in the flywheel housing. Torque tighten the fasteners to 44 Nm (33 lbf ft). Connect the starter motor cables. Reconnect the batteries.

Dismantling

3 Remove the starter motor from the vehicle and dismantle as follows. (Fig 1)

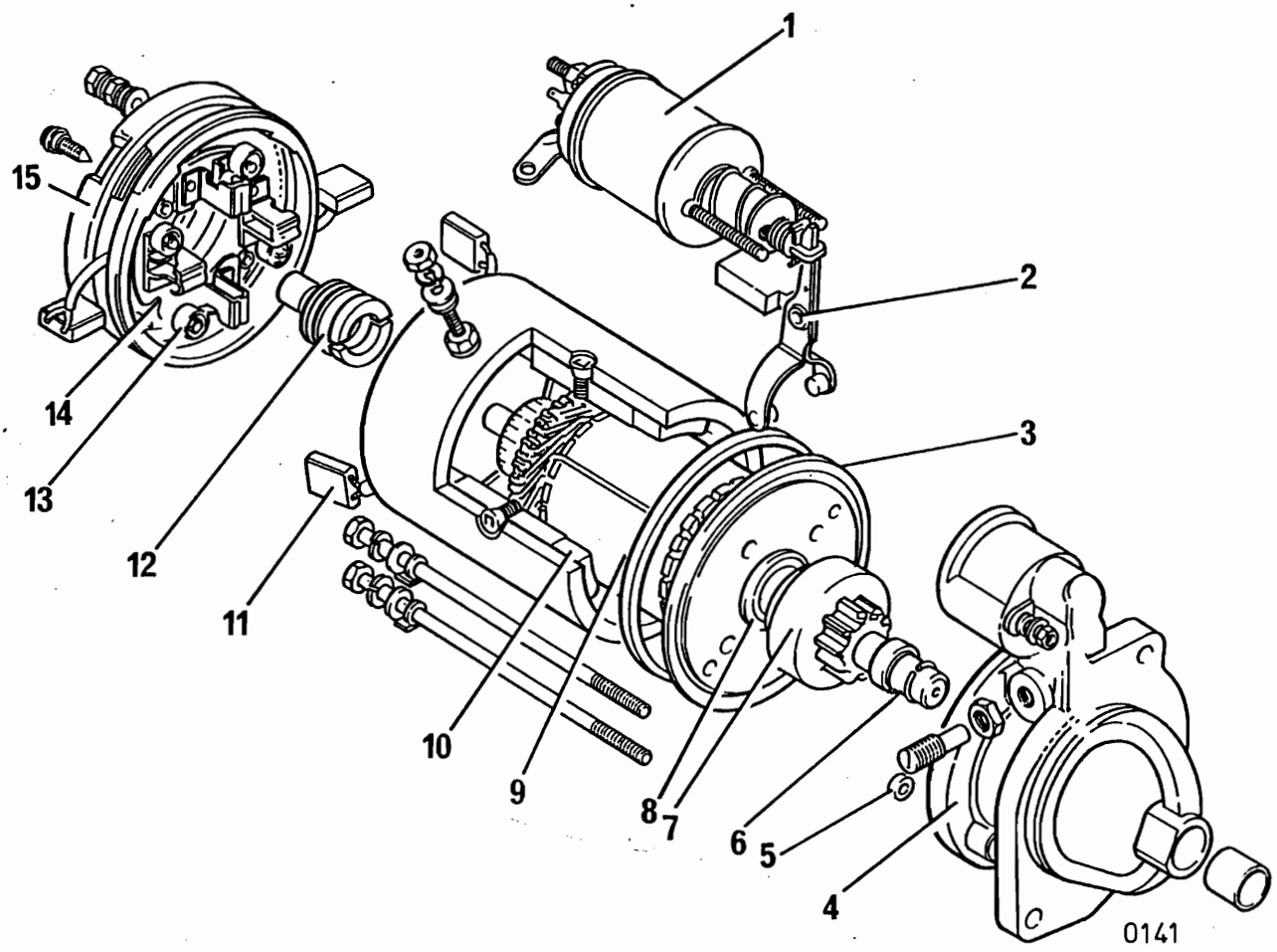
3.1 Disconnect the link from the solenoid unit to the starter motor. Unscrew and remove solenoid securing screws and withdraw the solenoid body. Remove the plunger by lifting the front end of the plunger to release it from the top of the engagement lever. Remove the neoprene grommet and seal.

3.2 Remove the two screws securing the brush plate, remove the two through bolts. Remove the commutator end bracket and seal. If required remove the bearing bush and brake assembly.

3.3 Disengage the brushes and remove the brush plate assembly. Withdraw the yoke assembly complete with field coils and brushes.

3.4 Remove the eccentric pivot pin. Withdraw the drive end bracket by releasing the engagement lever from the drive operating collar as the bracket is being removed.

3.5 Knock the thrust collar from the overjump ring back towards the drive, prize the jump ring from the groove in the shaft. Remove the thrust collar, drive and intermediate bracket complete with seal from the armature.



1	Solenoid	9	Armature
2	Engaging lever assembly	10	Field coil assembly
3	Intermediate bracket assembly	11	Brush set
4	Drive end bracket assembly	12	Brake assembly
5	Eccentric pivot pin	13	Brush springs
6	Retention kit	14	Brush box mounting plate
7	Drive	15	Commutator bracket assembly
8	Bearing bush		

Fig 1 Starter motor assembly

Reassembly

4 Reassembly is the reversal of dismantling, refitting all seals and noting the following :

4.1 Smear the drive shaft splines, the drive operating collar and the bearing surface of the engagement fork with XG279.

4.2 At the armature ensure the brake pin is tight and symmetrically positioned. Ensure the jump ring sits in the groove of the shaft and is covered by the thrust collar.

4.3 Ensure the dowel peg in the drive end bracket aligns with matching location in the intermediate bracket before positioning the yoke.

4.4 When fitting the brush plate wedge the earth brushes in their raised position with the brush springs, offer the plate into position and fit the field coil brushes in their boxes. Release the earth brushes and position their springs. Ensure all brushes move freely.

4.5 When fitting the commutation bracket ensure that armature brake pin aligns with the slot in the brake shoe. Ensure the brush plate fixing holes align with the holes in the commutator end bracket and the through bolts align with the screw holes in the drive end bracket. Torque tighten the through bolts to 11.0 Nm (8.0 lbf.ft) and the earth stud to 8.0 Nm (6.0 lbf ft).

4.6 When refitting the solenoid ensure the plunger mates securely with the operating lever and the curved face of the operating lever faces towards the commutator end of the starter. Torque tighten the solenoid unit fixing bolts to 6.0 Nm (4.5 lbf.ft), the end cover fixing bolts to 2.0 Nm.

Inspection

5 Carry out the following checks on the solenoid and starter motor.

5.1 Check continuity and measure the resistance as per paragraphs 5.1.1 and 5.1.2 of both solenoid windings, if results are unsatisfactory renew the solenoid.

5.1.1 Operating winding resistance, measured between the small unmarked terminal and the main terminal marked STA should be 0.145 - 0.165ohms.

5.1.2 Hold-on winding resistance measured between the small unmarked terminal and the earth point on the solenoid body should be 0.46 - 0.56ohms.

5.2 Check operation of all solenoid springs for freedom of movement, check continuity across the main contacts using an ohmmeter, if results are unsatisfactory, replace the solenoid.

5.2.1 With the solenoid plunger removed the ohmmeter should read infinity.

5.2.2 Operate the plunger by hand to close the contacts the ohmmeter should indicate zero.

5.3 Renew the starter motor brushes if less than 8mm (5/16 inches). If original brushes need cleaning, use a petrol moistened cloth.

5.4 Ensure brushes move freely in their holders. Spring pressure measured in the working position, with new brushes fitted should be between 11.6 N and 15.5 N (42-56 ozs).

5.5 Visually examine the armature, if required clean with a petrol moistened cloth. The commutator may be skimmed to a minimum diameter of 38mm (1.5in). Finish with fine emery cloth. Do not undercut commutator segments.

ALTERNATOR (12 Volt)

WARNINGS ...

(1) ALWAYS DISCONNECT THE BATTERIES PRIOR TO WORKING ON ELECTRICAL EQUIPMENT.

(2) BE CAREFUL WHEN USING METAL TOOLS ON OR NEAR LIVE EQUIPMENT. REMOVE ANY METAL JEWELLERY/WATCH STRAPS

(3) NEVER EXPOSE A BATTERY TO A NAKED FLAME

CAUTIONS ...

(1) The alternator must never be run with the output wire disconnected.

(2) Before disconnecting any wire in the charging system, ensure that the battery is disconnected.

(3) Negative polarity must be observed. Reversed battery connections, however brief, will result in the destruction of the rectifying diodes and possible damage to the wiring harness.

6 The alternator regulator and brush gear assembly may be removed whilst the alternator is on the vehicle.

6.1 Prior to removing the regulator and brush gear assembly disconnect the batteries, disconnect the alternator electrical connections. Using a socket head spanner remove the three bolts securing the regulator. Carefully remove the regulator taking care not to damage the brush gear.

Note ...
Vehicles fitted for radio (FFR) are provided with a screening cowl to contain any RF emissions from the alternator. This cowl is removed after disconnecting the batteries and the alternator electrical connections.

Removal

7 To remove the alternator

7.1 Disconnect the batteries, disconnect the electrical connections to the alternator. Loosen the pivot fasteners of the alternator and the fasteners of the adjustment link. Release the belt tension and remove the belt.

7.2 Remove the adjustment link from the alternator and remove the pivot bolt. Make a note of the position of the washers and distance pieces to ensure that they are fitted correctly. Remove the alternator.

Installation

8 To fit an alternator

8.1 Put the alternator in position and assemble loosely the pivot fasteners and the adjustment link and its fasteners. Ensure that the washers and distance pieces are fitted in their correct positions and that the alternator pulley is aligned to the crankshaft pulley within +/- 2.4 mm ($^3/_{32}$ in).

8.2 Fit the drive belt and adjust the belt tension. Moderate thumb pressure ie 45N (10 lbf) applied to the centre of the longest free length should cause a deflection of approximately 10mm ($^3/_8$ in). Tighten the fasteners and re-check the tension. Connect the alternator wiring. Reconnect the batteries.

Dismantling

9 Before dismantling the alternator match mark the drive end frame and the slip ring end frame to enable correct location when reassembling.

9.1 Using a socket head spanner remove the regulator and brush gear assembly taking care to avoid damage to the brushes.

9.2 Remove the three through bolts. Using a screw driver prise apart the drive end frame and rotor from the stator. To prevent damage to the stator lead terminals keep the stator with the slip ring end frame.

9.3 Remove the three nuts retaining the stator leads to the rectifier assembly and ease the stator from the slip ring end frame. Place the stator on the bench with the leads uppermost.

9.4 Disconnect the rectifier assembly leads noting their position. Remove the two bolts securing the rectifier assembly to the slip ring end frame and lift out the regulator assembly. Note the position of the insulating washers.

9.5 Dismantle the pulley and impeller assembly using M17 spanner and allen key. Note order of spring washer, pulley, impeller and any spacers to ensure correct position of parts when reassembling.

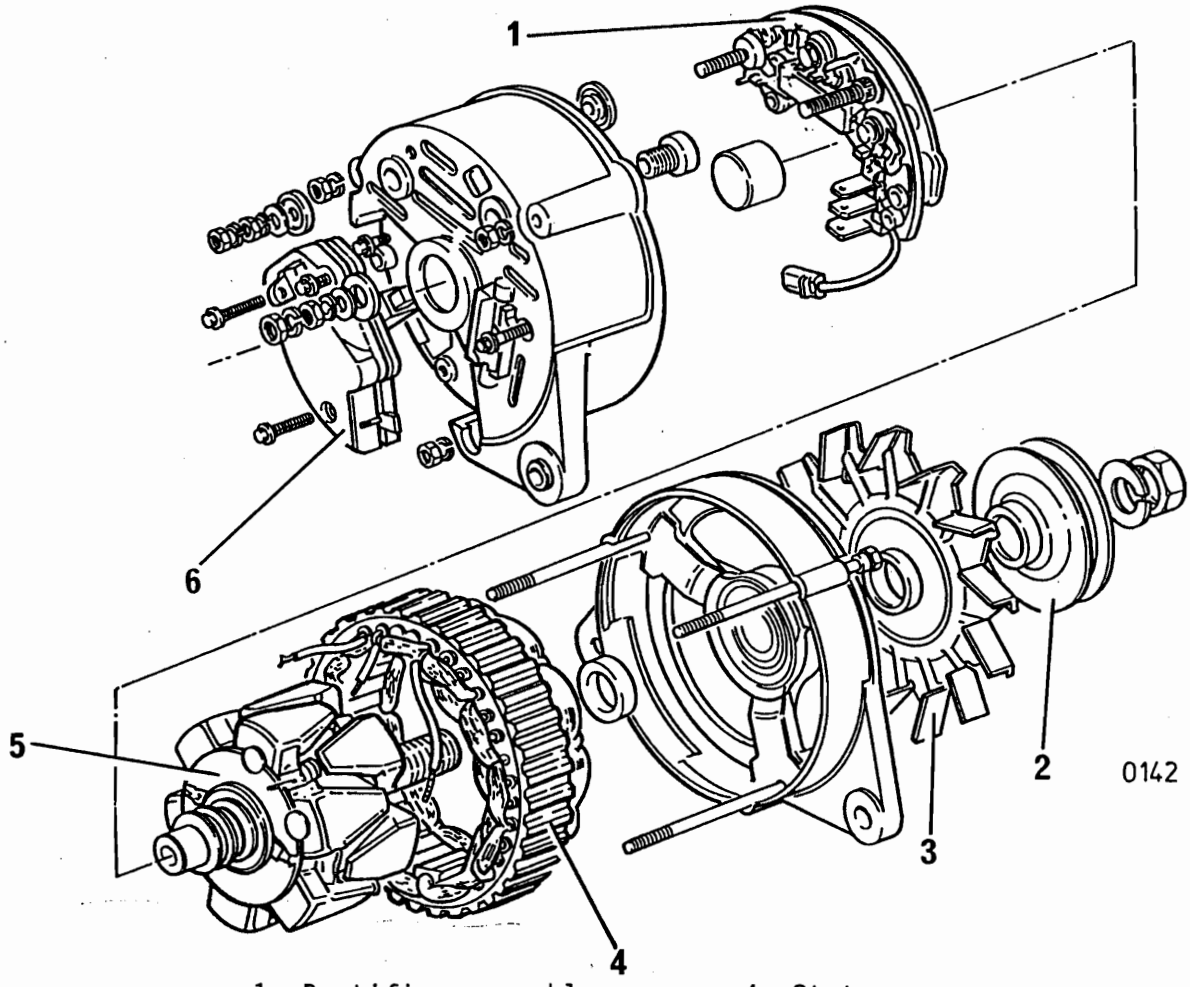
9.6 Slide the rotor out of the drive end frame noting the position and orientation of the spacer.

Reassembly

10 To reassemble the alternator.

10.1 Place the inner spacer on the rotor with the chamfered end towards the drive end frame bearing. Ease the rotor into the frame, fit the outer spacer, fan, pulley, spring washer and the pulley nut. Torque tighten the nut to 60 Nm (45 lbf ft).

10.2 Locate the rectifier assembly in the slip ring end frame, ensure insulating washers are fitted, ensure blade terminals are central when viewed from the outside of the frame. Torque tighten the rectifier assembly fixing bolts to 3.5 Nm (2.5 lbf ft).



1	Rectifier assembly	4	Stator
2	Pulley	5	Rotor
3	Impeller	6	Regulator

Fig 2 Alternator assembly

10.3 Carefully fit the stator and make all electrical connections.

10.4 Thoroughly clean the rotor shaft and slip rings with a soft cloth. Carefully ease the rotor shaft into the slip ring end frame, avoiding damage to the bearing seal. Rotate the drive end frame until the match marks align.

10.5 Fit the through bolts and torque tighten to 5.5 N. (4.0 lbf ft).

10.6 Fit the regulator and brush gear assembly ensuring the brushes make good contact with the slip rings. Torque tighten the regulator fixing bolts to 2.5 Nm (2.0 lbf.ft).

Replacing alternator bearings

11 To replace the drive end bearing, dismantle the alternator;

11.1 Remove the three screws securing the drive end bearing retaining plate, remove the retaining plate. Using an appropriate diameter piece of steel tubing press the bearing from the drive frame.

11.2 Thoroughly clean out all traces of old grease with paraffin. To help prevent bore damage warm the end frame to about 50°C then using the piece of steel, press the new bearing home. Examine the felt seal on the retaining plate for hardening or excessive wear, fit a new retaining plate if necessary.

12 To replace the slip ring end frame bearing, dismantle the alternator;

12.1 Ensure that the inside of the slip ring end frame is supported to prevent damage to the frame when removing the bearing. Using a piece of steel tubing press the bearing out of the frame, from the outside.

12.2 Thoroughly clean out all traces of old grease with paraffin. To help prevent bore damage warm the end frame to about 50°C then using the piece of steel, press the new bearing until it is flush with the end of the frame. Protect the bearing from ingress of dirt.

Inspection

13 When the alternator is dismantled visually inspect all components for signs of damage or wear. Using an Ohmmeter carry out the following :

13.1 Check that the rotor winding resistance is within +/- 5% of 2.9 ohms.

13.2 Check that the rotor winding resistance to earth is infinite.

13.3 Check the stator windings resistance to earth at each phase is 0.14 ohms.

13.4 Visually inspect the stator windings for signs of localised burning. Stator winding resistance measured between phases is 0.14 ohms.

13.5 At the rectifier assembly test each diode in turn, connect one probe of the ohmmeter to the heat sink, the other to a rectifier terminal, note the reading. Reverse the probes, if the ohmmeter reading is the same replace the rectifier assembly.

13.6 Test the diode trio as described above, if readings indicate that any diode is faulty replace the rectifier assembly.

14 When new brushes measure 17mm (0.67 inches) long. Renew the regulator and brush gear assembly before the brush protrusion is less than 5mm (0.02 inches). Before renewing brushes clean the brush guides, check the new brushes move easily in and out of their guides.

15 The regulator is a sealed unit and repair is not possible, if a regulator fault is suspected the regulator and brush gear assembly must be renewed. The regulator controlled voltage is 13.6 to 14.4 volts.

WINDSCREEN WIPERS

WARNINGS ...

(1) ALWAYS DISCONNECT THE BATTERIES PRIOR TO WORKING ON ELECTRICAL EQUIPMENT.

(2) BE CAREFUL WHEN USING METAL TOOLS ON OR NEAR LIVE EQUIPMENT. REMOVE ANY METAL JEWELLERY/WATCH STRAPS

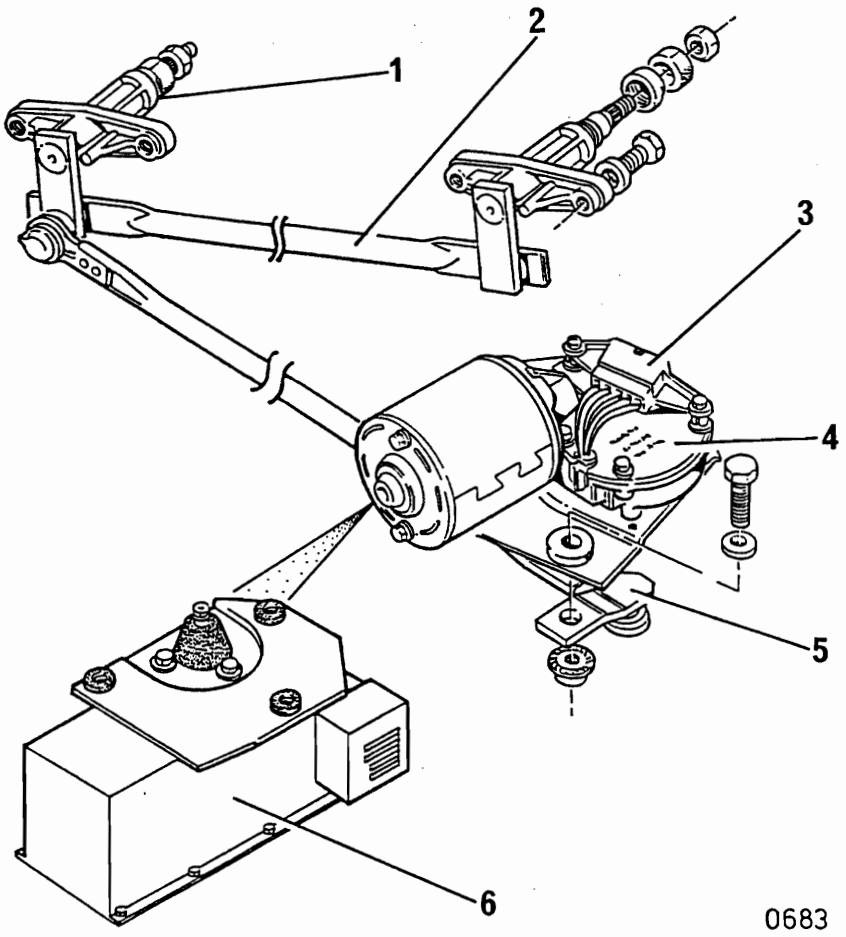
(3) NEVER EXPOSE A BATTERY TO A NAKED FLAME.

Removal

16 To remove the windscreen wiper linkage.

16.1 Disconnect the battery. Disconnect the washer pipes at the wiper arms, remove the wiper arms after removing the securing nuts.

16.2 Remove the bonnet. Remove the seven cross-head screws and washers securing the air intake panel, remove the panel.



1 Spindle and bearing
2 Tandem link
3 Five pin terminal block
4 Gearbox assembly
5 Rotary link
6 Motor in suppression box (FFR only)

Fig 3 Windscreen wiper linkage

Note ...
Always clamp the rotary link with a suitable tool before slackening or tightening the securing nut, otherwise damage to the gear wheel may result.

16.3 Remove the nut securing the rotary link to the wiper drive shaft, ease the link off the drive shaft.

16.4 Remove the two straps securing the washer pipes at the drive boxes. Unscrew the two setscrews and spring washers securing each drive box. Push the drive boxes through the mounting plates and withdraw linkage assembly.

17 To remove the wiper motor

Note ...
Always clamp the rotary link with a suitable tool before slackening or tightening the securing nut, otherwise damage to the gear wheel may result.

On FFR vehicles the wiper motor is enclosed in a box to suppress radio interference, for removal see para 17.3.

17.1 Remove the nut securing the rotary link to the wiper drive shaft, ease the link off the shaft.

17.2 Disconnect the five pin plug. Remove the three setscrews and spring washers securing the wiper motor. Remove the motor.

17.3 On R.H. drive FFR vehicles the air cleaner must be removed and the header tank must be loosened. Remove the nut securing the wiper drive shaft, ease the link off the shaft. Disconnect the lucar connector for the wiring from the filter to the main vehicle harness and also earth connection. Remove the three bolts securing the suppression box to the cab. Remove motor complete with suppression box.

Dismantling the wiper motor (Figure 4)

18 Remove the two short setscrews followed by the two long setscrews and four washers securing the terminal block, remove the gearbox cover and displace the terminal block.

18.1 Pull out the gear and shaft assembly taking care not to lose the dished washer. Match mark the end cover, yoke and body if no alignment marks are evident.

18.2 Unscrew and remove the two through bolts and withdraw the yoke and end cover. Remove the circlip adjacent to the worm gear (gear box side) of the armature shaft.

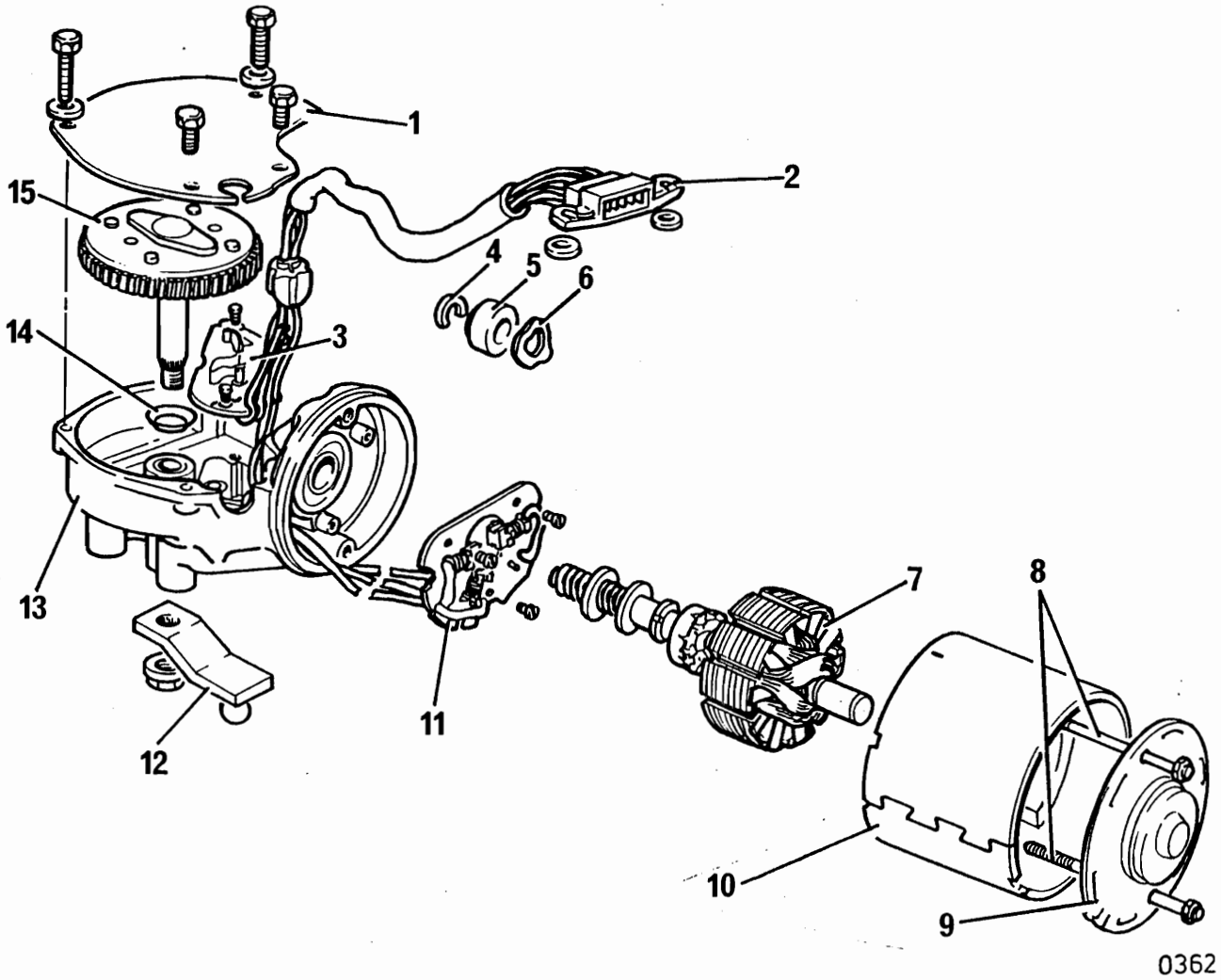
18.3 Withdraw the armature from the gearbox, collect the spacer and wavy washer from the gearbox. Do not remove the brush plate assembly or the parking switch unless they require renewal.

Inspection

19 Examine all components for signs of damage or wear and renew as necessary.

19.1 Clean the brush plate assembly, renew the assembly if the main (opposite) brushes are less than 4.8mm ($^{3}/_{16}$in) long. Check that the narrow section of the stepped brush is worn to the full width of the brush and that all brushes move freely.

19.2 Using a petrol-moistened lint-free cloth, clean the commutator. Check that the surface of the commutator is smooth and free from pitting or burning. The commutator may be skimmed lightly to restore the surface, the minimum acceptable diameter is 17.5mm. Ensure that the intersegment spaces are clear of debris.



1	Gearbox cover	9	End cover
2	Five pin terminal block	10	Yoke
3	Parking switch	11	Brush plate assembly
4	Circlip	12	Rotary link
5	Spacer	13	Gearbox
6	Washer	14	Dished washer
7	Armature	15	Gear
8	Through fixing bolts		

Fig 4 Wiper motor assembly

19.3 Check the armature for short-circuited windings. Using a 12V dc supply with the negative side connected to one test probe and the positive connected, via a suitable range volt meter, to a second probe, check for open-circuited windings. Apply the probes to adjacent commutator segments until all segments have been checked. All voltmeter readings should be similar. A low or zero reading across adjacent segments indicates that one or more adjacent windings are open circuited.

19.4 Check the moulded gear wheel and teeth for wear or damage, renew as necessary.

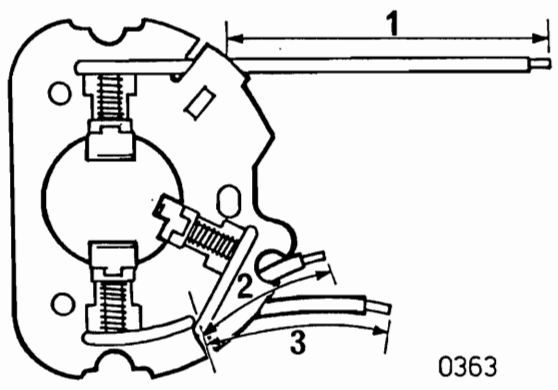
Renew the brush plate assembly

20 To renew the brush plate assembly dismantle the wiper motor, remove the two screws securing the parking switch, and the three screws securing the brush plate assembly.

20.1 Cut the brush leads adjacent to the brush plate and withdraw the parking switch and cables from the gearbox. Discard the original brush plate. Trim the parking switch leads to the dimensions shown in figure 5.

20.2 Position the switch in the gearbox, pushing the brush leads through the aperture in the gearbox housing, slip heat shrink sleeves over the free ends of the leads.

20.3 Join the leads from the new brush plate to the free ends of the original leads (colour to colour) using high temperature resin cored solder. Position the sleeves over the soldered connections and heat shrink to insulate the joints. Re-secure the parking switch and brush plate.



1	Blue	69.85mm	(2.75in)
2	Yellow	38.1mm	(1.5in)
3	Red	38.1mm	(1.5in)

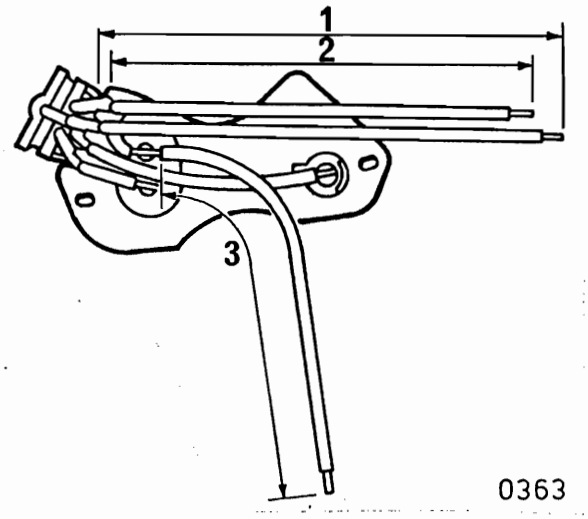
Fig 5 Brush lead dimensions

Renew the parking switch

21 To renew the parking switch dismantle the wiper motor, remove the two screws securing the parking switch and remove the three screws securing the brush plate.

21.1 Cut the leads adjacent to the parking switch and withdraw the brush plate and leads. Discard the original parking switch. Trim the brush gear leads to the dimensions shown in Figure 6.

21.2 Fit the new parking switch, connect the cables and refit the brush plate assembly.



1 Yellow 127mm (5.0 in)
2 Red 120mm.65mm (4.75 in)
3 Blue 82.55mm (3.25 in)

Fig 6 Parking switch lead dimensions

Re-assembling the wiper motor

22 To reassemble the wiper motor reverse the dismantling procedure. Apply XG279 grease to the gear teeth, worm gear on the armature shaft, output shaft, and switch cam. Apply OMD80 oil sparingly to the bearings in the end cover and gearbox housing. Remove any surplus. Ensure that match marks align. Torque tighten wiper motor through bolts to 2.5 Nm (1.8 lbf.ft).

Installation

23 To refit the wiper motor and linkage position the linkage in the cab structure. Push the drive boxes through the mounting plates and secure with setscrews and spring washers.

23.1 Temporarily refit the wiper arms and position the blades in the "parked" position. Position the wiper motor and secure with the three setscrews and spring washers.

23.2 Reconnect the five pin plug. Reconnect the battery. Operate the wipers and switch off, this ensures that the motor is in the parked position.

Note ...
The centre line of the rotary link and the linkage arm must be in a straight line. A clamp should be used on the linkage arm and rotary link to prevent damage to the gear wheel during tightening.

23.3 Fit the rotary link onto the wiper motor spindle and secure with the nut, torque tighten to 30.5 Nm (22.5 lbf.ft).

23.4 Remove the wiper arms. Refit the air intake panel and secure with seven cross-head screws and washers. Secure the washer pipes at each drive box. Refit the wiper arms and connect the washer pipes.

VEHICLE LIGHTING

Lighting switch and lighting switch relay

Lighting switch replacement

24 Remove the switch knob by depressing the spring-loaded retainer through the hole in the knob.

24.1 Using a crosshead screw driver remove the two self tapping screws accessible through the holes in the switch mounting plate. Lift the switch and mounting plate clear of the cab facia and disconnect the six wires.

24.2 Dismantle the switch from the mounting plate by removing the screws securing the escutcheon to the plate.

24.3 Reassemble the switch in the reverse order connecting the wiring to the terminals as follows

Terminal No.	Colour
1	Black
2	Red/brown
3	Blue
4	Red/black
5	Red/slate
6	Yellow/purple

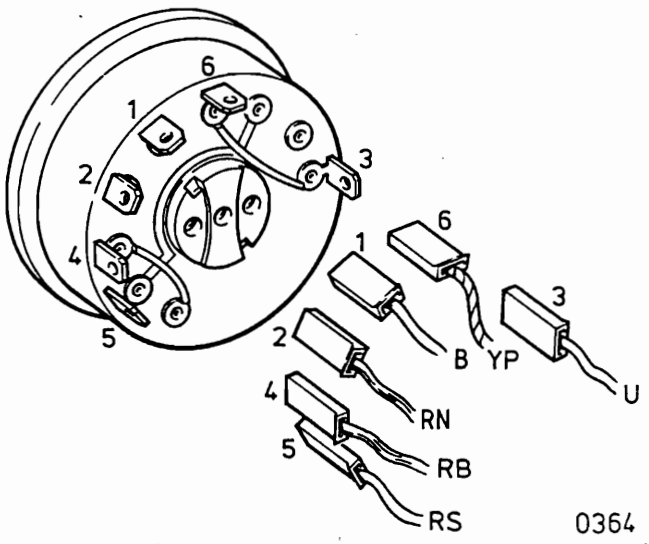


Fig 7 Lighting switch connections

Lighting switch relay

25 The lighting switch relay is repaired by replacement and is located as shown in Fig 8.

Note ...
The lighting switch relay may also be identified by the wiring to it which is predominantly yellow.

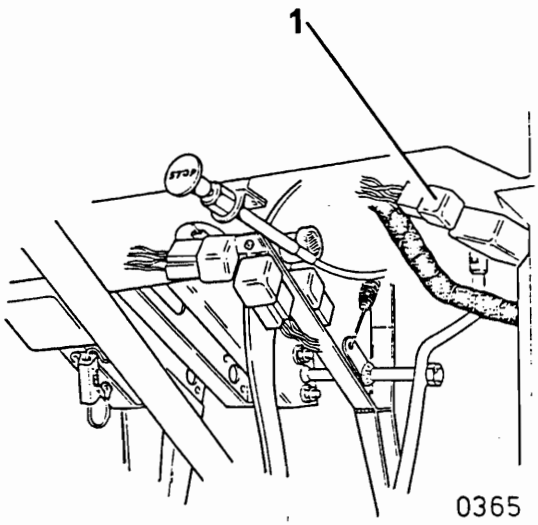


Fig 8 Lighting switch relay -location

Head lamp replacement

CAUTION...
When handling a halogen lamp never touch the lamp glass. Always hold by the base.

26 The head lamps are accessible after removing the glass protection bars. To remove the bars, release the lower bolt lift the bar assembly upwards and withdraw it from the location holes.

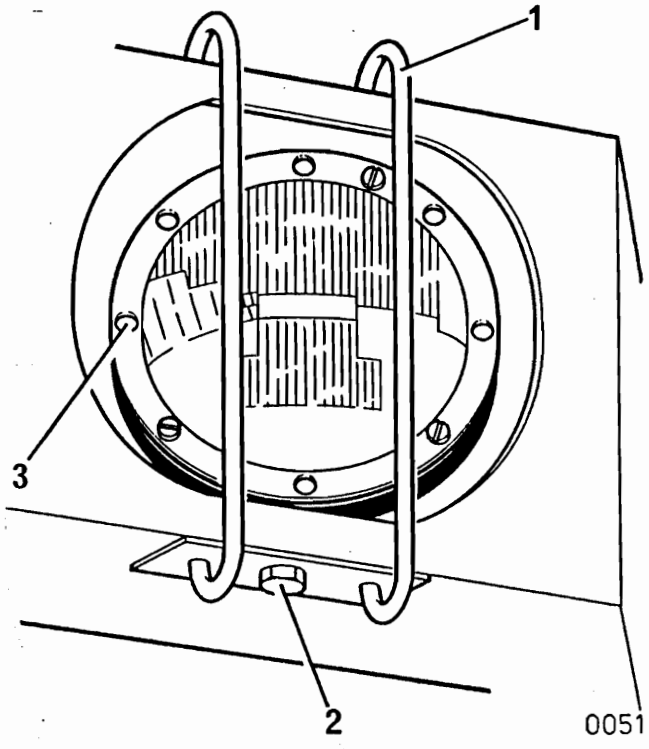
26.1 The light unit can be withdrawn by pressing it firmly inwards and turning it anti-clockwise. Release the lamp connector and remove the lamp. Replace with a double filament 60/55 Watt Halogen lamp.

Head light aiming

27 Before commencing the adjustment the trim screws (3) must be screwed right in.

27.1 Ensure the vehicle is unladen and standing on a level surface with tyres inflated to the correct pressure.

27.2 If beam setting equipment is not available check the beam alignment by parking the vehicle on a level surface 7.6 metres (25 feet) away from a blank wall, with the front part of the vehicle parallel to the wall. When correctly set, the centre of the light spots from the main filaments will be 102mm (4in) below the centre of the head lights and parallel with the vehicle centre line.



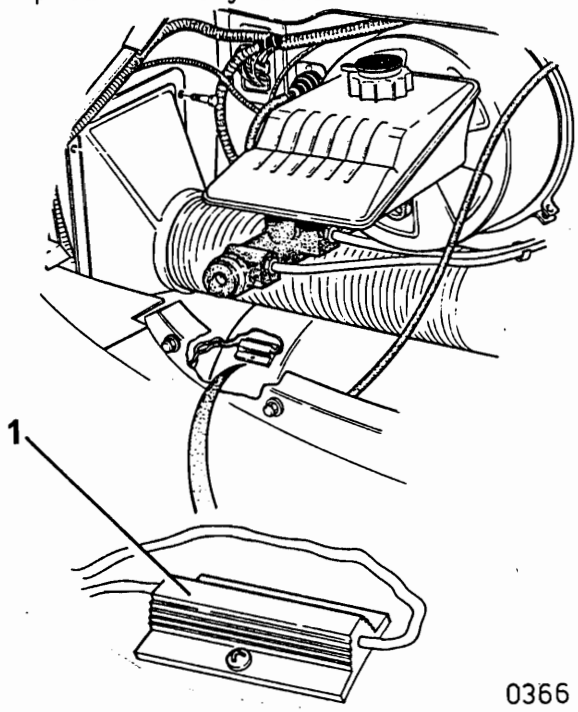
1 Protection bar 2 Bolt
3 Trim screws

Fig 9 Head light alignment

Dim dip relay and resistors

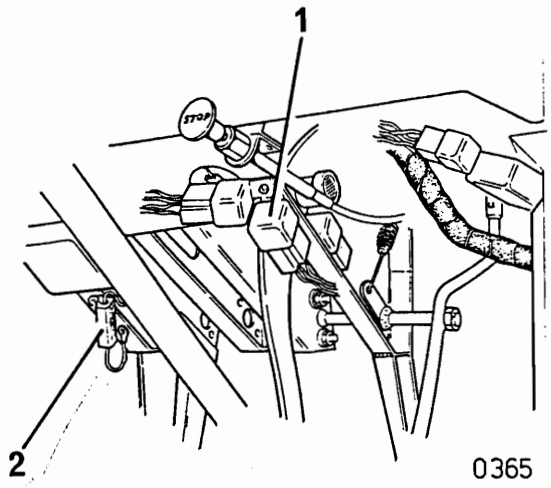
28 When the starter switch is in position II and side lights have been selected at the lighting switch both head light dip beam filaments are lit to 10% normal intensity. The circuit (see Category 3 Chapter 13 Figure 5) comprises, dim dip relay, 50W relay operating resistor and dim dip resistor. Components are repaired by replacement and are located as shown in figures 10 and 11.

Note ...
The dim dip relay may also be identified by the wiring to it which is predominantly blue.



1 Dim dip resistor

Fig 10 Dim dip resistor - location



1 Dim dip relay
2 Dim dip relay operating resistor

Fig 11 Dim dip relay - location

Side lamp replacement

29 Unscrew the threaded lens and remove the lamp by pushing in and turning anti-clockwise. Replace with a 5 Watt small centre contact Type 207 lamp.

Turn indicator/hazard warning lamps

Lamp replacement

30 Unscrew the threaded lens and remove the lamp by pushing in and turning anti-clockwise. Replace with a 21 Watt Type 382 lamp. Side repeaters are fitted with 4 Watt Type 233 lamps which are accessible when the cover is prised off.

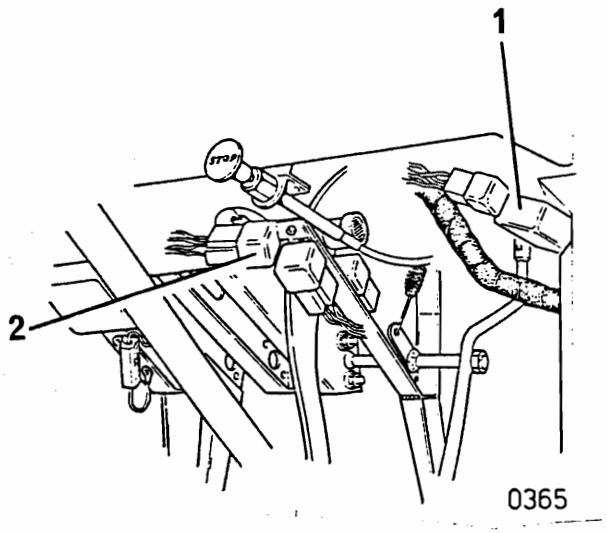
Flasher unit

31 The flasher unit is repaired by replacement and is located as shown in Figure 12.

Flasher inhibitor relay

32 The flasher inhibitor relay is repaired by replacement and is located as shown in Figure 12.

Note ...
The flasher inhibitor relay may also be identified by the wiring to it which is predominantly light green.



1 Flasher unit
2 Flasher inhibitor relay

Fig 12 Flasher unit and inhibitor relay - location

Hazard warning switch

33 Release the six screws securing the instrumentation panel facia. Raise the bonnet and release the speedometer cable from its clip, carefully pull the facia forward to allow access to the rear of the panel.

33.1 Remove the clip holding the switch illumination and force the switch through the front of the facia. Disconnect all wiring. Installation is the reverse of the removal.

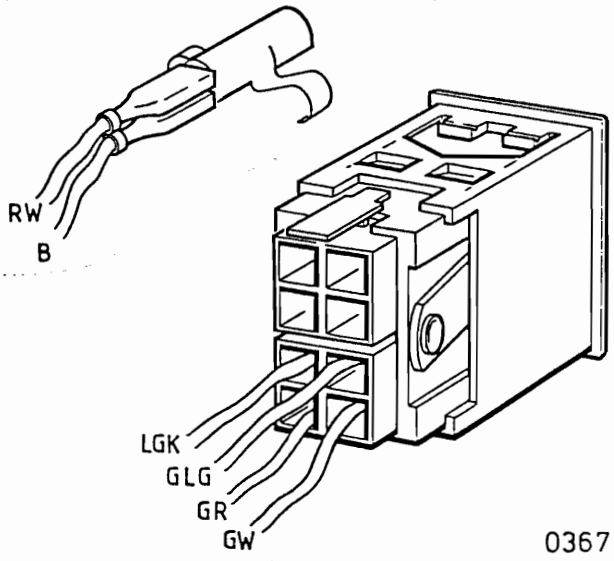


Fig 13 Hazard warning switch

Switch illumination lamp replacement

34 Gain access to the rear of the instrumentation panel as described above. Replace with a 2.2 Watt BA9 type 643 lamp.

Warning lamp replacement

35 Gain access to the rear of the instrumentation panel as described above. Replace with a 2.0 Watt BA7 type 281 lamp.

Stop and tail lamps

Lamp replacement

36 Unscrew threaded lens and remove the lamp by pushing in and turning anti-clockwise. Replace with 21/5 Watt SBC (indexed) 380 type.

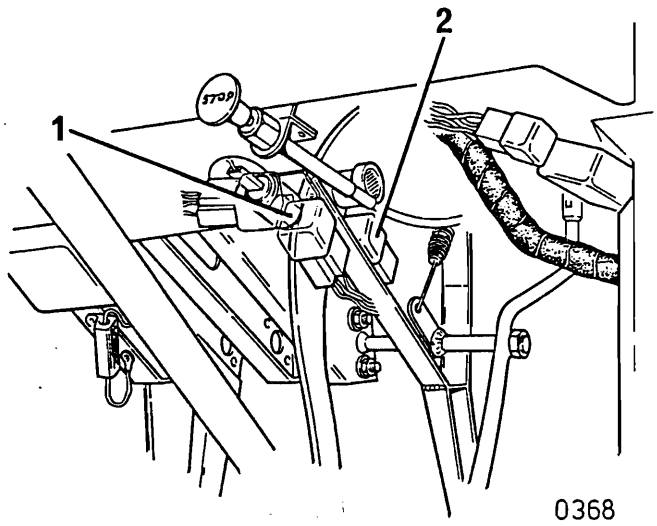
Stop lamp switch

37 The stop lamp switch is repaired by replacement and is located as shown in Figure 14.

Stop lamp relay

38 The stop lamp relay is repaired by replacement and is located as shown in Figure 14.

Note ...
The stop lamp relay may also be identified by the wiring to it which is predominantly green and purple.



1 Stop lamp switch
2 Stop lamp relay

Fig 14 Stop lamp switch and relay - location

Rear guard fog lamps

Lamp replacement

39 Unscrew threaded lens and remove the lamp by pushing in and turning anti-clockwise. Replace with 21 Watt Type 382 lamp.

Switch replacement

40 Release the six screws securing the instrumentation panel facia. Raise the bonnet and release the speedometer cable from its clip, pull the facia forward to allow access to the rear of the panel.

40.1 Remove the clip holding the switch illumination and force the switch through the front of the facia. Disconnect all wiring. Installation is the reverse of removal.

Switch illumination lamp replacement

41 Gain access to the rear of the instrumentation panel as described above. Replace with 2.2 Watt BA9 Type 643 lamp.

Warning lamp replacement

42 Gain access to the rear of the instrumentation panel as described above. Replace with 2.2 Watt BA7 Type 281 lamp.

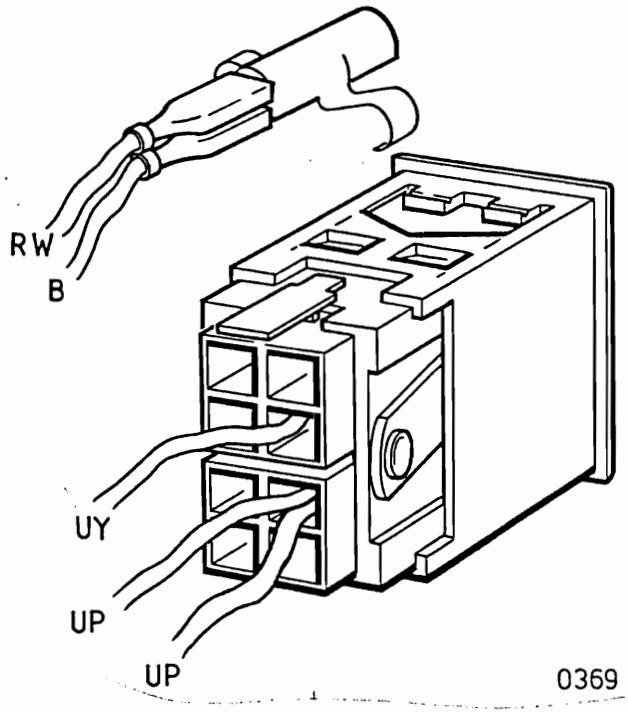


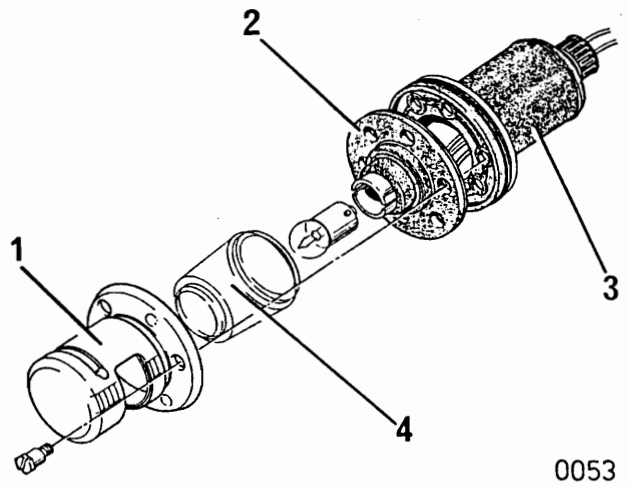
Fig 15 Fog lamps switch

Rear number plate and convoy lamps

43 The number plate light and convoy light are identical in construction.

Lamp replacement

44 Remove lens and capping after releasing the three securing screws. Remove lamp by pushing in and turning anti-clockwise. Replace with 5 Watt SCC Type 207 lamp.



1 Lamp cover
2 Lamp holder
3 Housing
4 Glass

Fig 16 Rear number plate lamp and convoy lamp

INSTRUMENTATION

45 To gain access to the rear of the instrumentation panel release the six screws securing the panel facia, raise the bonnet and release the speedometer cable from its clip, then carefully pull the facia forward.

Speedometer

Meter replacement

46 Gain access to the rear of the instrumentation panel as described in para 45.

46.1 Disconnect the speedometer cable, and release the two knurled nuts clamping the meter and remove the meter through the front of the facia.

46.2 Installation is the reverse of removal.

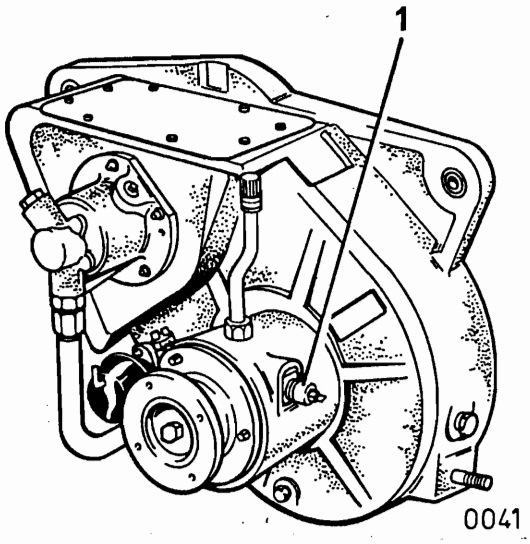


Fig 17 Speedometer drive

Cable replacement

47 Gain access to the rear of the instrumentation panel as described in para 45.

47.1 Disconnect the speedometer cable from the meter and the speedometer drive on the transfer gearbox (Fig 17). Release the cable from its clips and tyraps.

47.2 Installation is the reverse of removal.

Fuel gauge and level sensor

Gauge replacement

48 Gain access to the rear of the instrumentation panel as described in para 45.

48.1 Remove the knurled nut securing the gauge clamp, remove the clamp. Ease the gauge through the facia and remove the wiring.

48.2 Installation is the reverse of removal.

Fuel tank level sender unit replacement

49 To gain access to the fuel tank level sender unit either the body must be lifted as described in Chapter 16 or the fuel tank must be dropped.

49.1 To lower the fuel tank first remove the jerry can housing, to improve access to the supply and return pipe hose clips. Detach the supply and return hose.

49.2 Remove the fuel tank securing straps. Supporting the fuel tank with a hydraulic jack remove the rear tank mounting bracket. Lower the fuel tank first easing it rearwards clear of the forward mounting bracket.

49.3 Using a suitable punch and hammer gently tap the sender unit head anti-clockwise until it is released. Remove the sender unit and seal.

49.4 Repair is by replacement. Installation is the reverse of removal.

Coolant temperature gauge and sensor

Gauge replacement

50 Gain access to the rear of the instrumentation panel as described in para 45.

50.1 Remove the knurled nut securing the gauge clamp, remove the clamp. Ease the gauge through the facia, note the position of all wiring before removal.

50.2 Repair is by replacement. Installation is the reverse of removal.

Sensor replacement

51 Allow the engine to cool before releasing the pressure in the coolant system. The coolant temperature sensor is located behind the thermostat housing on the left hand side, its wire is lead up from the starter motor wiring harness. To improve access remove the air cleaner assembly complete.

51.1 Disconnect the sensor wiring, loosen the sensor and, carefully withdraw, taking care not to damage the fuel injection manifold air pressure compensation line.

51.2 Repair is by replacement. Installation is the reverse of removal. Make up the coolant level as required.

Vacuum gauge, switch and audible alarm

Gauge replacement

52 Gain access to the rear of the instrumentation panel as described in para 45.

52.1 Remove the knurled nut securing the gauge clamp, remove the clamp. Ease the gauge through the facia, note the position of all wiring before removal. Thoroughly clean the surrounding area before removing the vacuum plastic pipe.

52.2 Repair is by replacement. Installation is the reverse of removal.

52.3 The vacuum gauge connects, via a tee piece to an adaptor located as show in Fig 18.

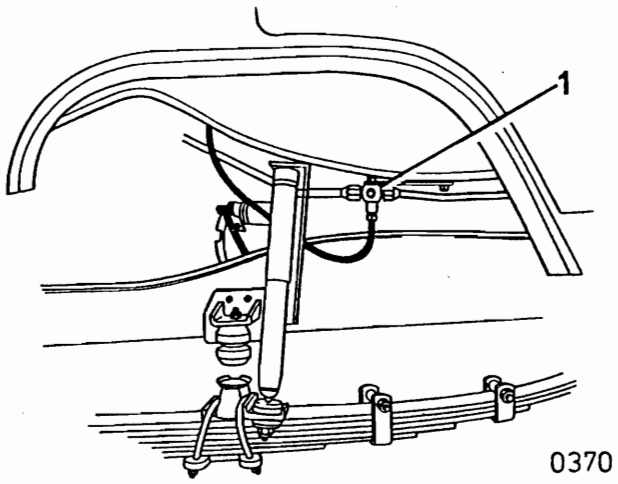


Fig 18 Vacuum sensing adaptor

Switch replacement

53 Gain access to the rear of the instrumentation panel as described in para 45.

53.1 The pressure switch that operates the low vacuum buzzer is housed in an adaptor in the vacuum line to the gauge. Repair is by replacement.

Audible alarm replacement

54 The audible alarm is repaired by replacement and is located as shown in Fig 19.

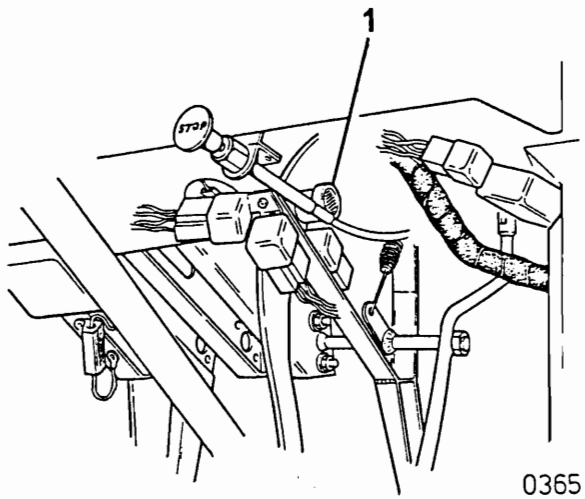


Fig 19 Vacuum audible alarm

Oil gauge, sensor and warning lamp

Gauge replacement

55 Gain access to the rear of the instrumentation panel as described in para 45.

55.1 Remove the knurled nut securing the gauge clamp, remove the clamp. Ease the gauge through the facia, note the position of all wiring before removal. Thoroughly clean the surrounding area before removing the oil pipe.

55.2 Repair is by replacement. Installation is the reverse of removal.

Sensor and oil pressure switch replacement

56 The sender and oil pressure switch are both fitted to the top of the oil filter assembly. Repair is by replacement.

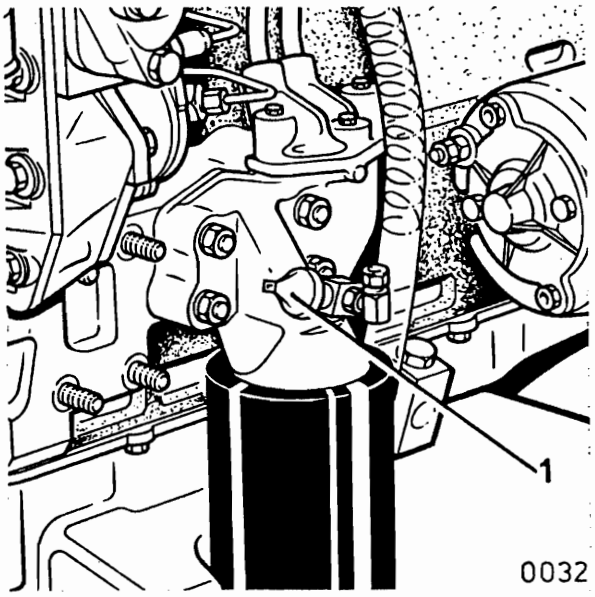


Fig 20 Oil pressure switch

MISCELLANEOUS WARNING CIRCUITS

Brake fluid low level/handbrake on

57 The brake fluid low level and handbrake on switches operate in parallel each switching on the brake failure warning lamp in the instrument panel. The brake fluid low level switch is a float incorporated in the reservoir cap, repair is by replacement. The handbrake switch is secured to the handbrake cable forward bracket, repair is by replacement, an adjustment procedure is provided in Chapter 10.

Differential lock engaged

58 Located on the transfer box as shown in Figure 21 the differential lock engaged switch is repaired by replacement.

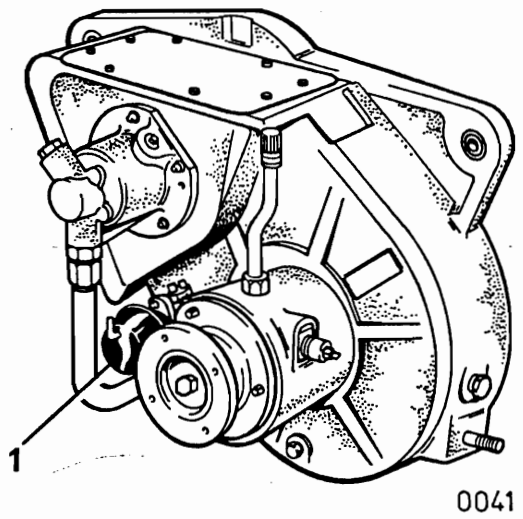


Fig 21 Differential lock engaged switch

MISCELLANEOUS SWITCHES

Steering column combination switch

59 To remove the combination stalk switch :

59.1 Disconnect the batteries prior to removing the steering column cowling. Disconnect the two multi-way connectors.

59.2 Remove the steering wheel centre cover. Remove the steering wheel locknut and spring washer. Carefully lift the steering wheel from the splined head of the column. Remove the combination switch.

60 Repair is by replacement. Installation is the reverse of removal.

Starter switch

61 To remove the starter switch :

61.1 Disconnect the batteries prior to removing the steering column cowling. Disconnect the two starter switch connectors.

61.2 Remove the small crosshead screw in the bottom of the starter switch housing and withdraw the switch from the housing.

62 Repair is by replacement. Installation is the reverse of removal.

MISCELLANEOUS RELAYS

Starter relay

63 The starter relay is mounted to the engine compartment bulkhead behind the screen wash bottle, access to the relay will be improved if this bottle is removed.

63.1 Peel away the black plastic relay cover, disconnect the 4 electrical connections, remove the 2 bolts securing the relay to the bulkhead.

63.2 Repair is by replacement. Installation is the reverse of removal.

Windscreen wiper intermittent wipe relay

64 The windscreen wiper intermittent wipe relay is mounted beneath the passenger side dashboard. Repair is by replacement.

AUXILIARIES

Blower motor and switch

65 Replacement of the blower motor is described in Chapter 16.

Blower motor switch

Gain access to the rear of the instrumentation panel as described in para 45.

65.1 Remove the clip holding the switch illumination and force the switch through the front of the facia. Disconnect all wiring.

65.2 Installation is the reverse of removal.

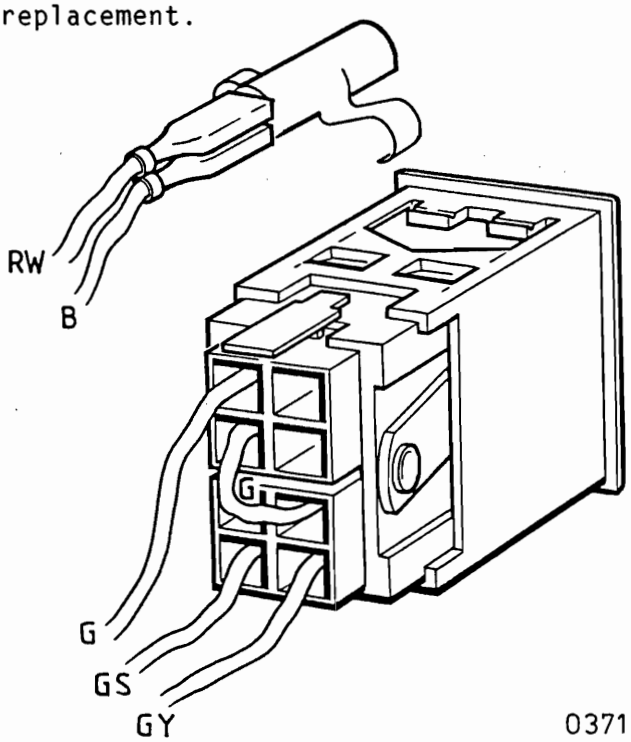


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Fig 22 Blower motor switch

Chapter 13-1

ELECTRICAL SYSTEM (24V)

CONTENTS

INTRODUCTION

1 Repair information for the No 16 Mk1 28 volt 90 amp fused generator FV1068364 will be found in AESP 2920-C-102.

BELT ADJUSTMENT

2 The 24 volt generator is belt driven using twin belts. The belts should never be allowed to become loose enough to slip, which can cause overheating , nor should they be overtightened as this may cause overloading on the generator bearings. Renew a belt if it is worn or damaged, it is recommended that belts are renewed in pairs.

2.1 To check belt tension apply light thumb pressure to the belt midway along the longest unsupported length and measure the deflection. (12mm (0.5in) belt deflection).

Notes...

(1) When fitting a new belt, the adjustment should be checked after a short period of running to allow for initial stretch and bedding in (800 km (500 miles) or 20 hours of operation (whichever occurs first).

(2) The power steering belt will have to be removed before the generator drive belts can be taken off.

2.2 Belt tension is adjusted by altering the position of the idler pulley:

2.2.1 Loosen the idle pulley pivot bolt and adjustment bolt.

2.2.2 Change the idler pulley position to give the correct tension (12mm (0.5 in) belt deflection) and tighten the pivot and adjustment bolts.

2.2.3 Check the belt tension to ensure it is still correct.

24 VOLT GENERATOR

Removal

3 To remove the 24 volt generator:

3.1 Disconnect the 12 volt and the 24 volt batteries, disconnect all electrical wiring to both the 12 volt alternator and the 24 volt generator.

3.2 Loosen the 12 volt alternator pivot and adjusting bolts, release the drive belt from the pulley. Loosen the idler pulley pivot and adjustment bolts and release both belts from the generator pulley.

3.3 Remove the 12 volt alternator complete. Remove the bolt securing the 24 volt generator to the lower mounting bracket. Remove the nuts securing the upper mounting bracket to the studs in the engine block, (only necessary for right hand drive variants). Remove the generator (with the mounting bracket taking care to avoid damage to the lower steering column or steering box).

Installation

4 Installation is the reverse of removal. Adjust belt tension as detailed in paragraph 2.

Chapter 15

CHASSIS FRAME AND FITTINGS

CONTENTS

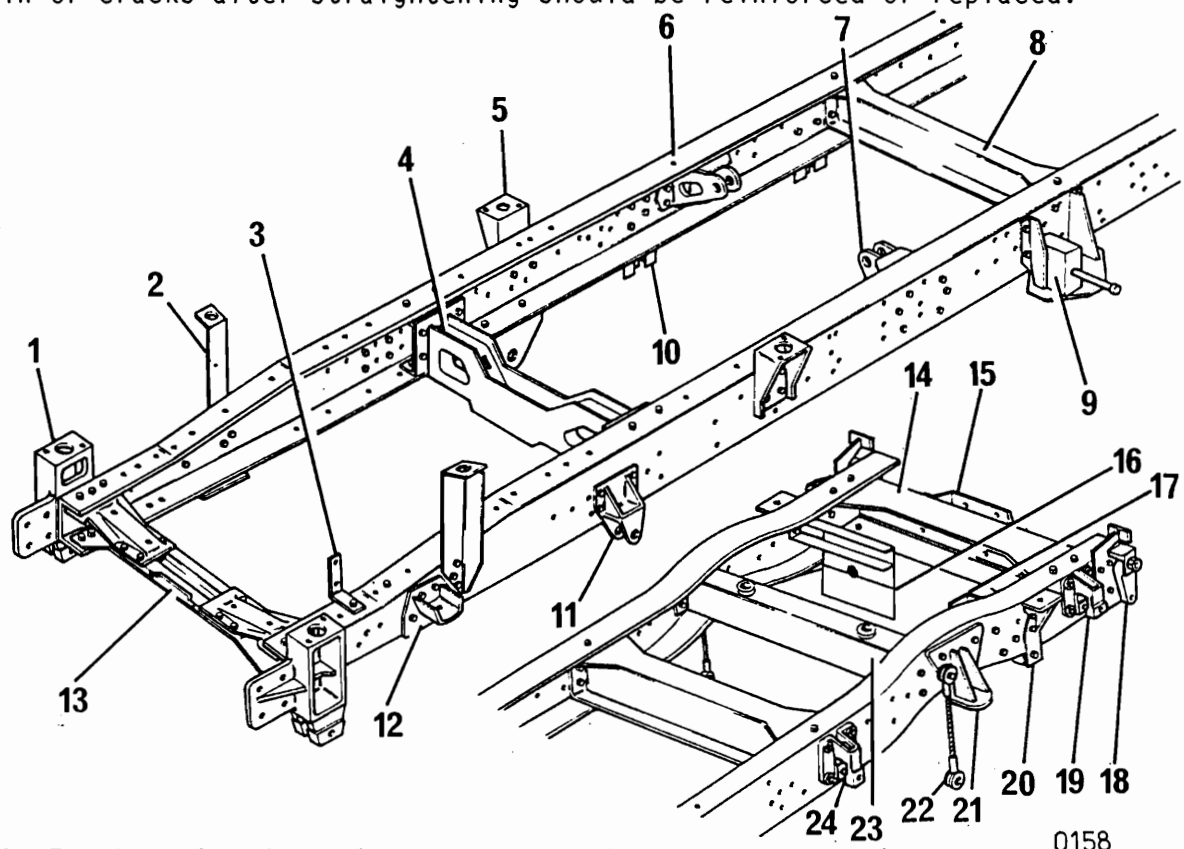
CHASSIS FRAME

CAUTION ...
Under no circumstances should heat be applied to the sidemembers to facilitate straightening as this will affect the strength properties of the material. Should damage to the chassis be sustained, any straightening should be carried out cold

General

1 The chassis sidemembers are of high strength alloy steel to Chrysler UK specification M-030/1000. The crossmembers are of mild steel.

1.1 Any frame crossmember which is bent or buckled sufficiently to show strain or cracks after straightening should be reinforced or replaced.



1	Front spring front hanger	13	Front crossmember
2	Front shock absorber bracket	14	Rear crossmember
3	Oil cooler hose support bracket	15	Tow hook bracket
4	Gearbox crossmember	16	Convoy bracket
5	Rear cab mount bracket	17	Load sensing valve bracket
6	Chassis sidemember	18	Rear recovery eye
7	Transfer box mounting bracket	19	Rear spring rear hanger
8	Intermediate crossmember	20	Body towing stay bracket
9	Spare wheel carrier	21	Rear bump stop bracket
10	Fuel tank bracket	22	Check strap
11	Front spring rear hanger	23	Rear shock absorber crossmember
12	Front bump stop bracket	24	Rear spring front hanger

Fig 1 Chassis frame

1.2 The crossmembers, brackets and spring hangers are fastened to the sidemembers by high tensile bolts and nuts.

1.3 Whenever possible bolts and nuts removed from the chassis frame should be discarded and new items fitted. Ensure that the bolts are fitted to the inside of the sidemember and torque the nuts in accordance with Table 1.

TABLE 1 CHASSIS FASTENING BOLT TORQUES

Bolt size	Grade	Torque Nm	Torque lbf.ft
(1)	(2)	(3)	(4)
M10	8.8	59	43
M12	8.8	143	106
M12	10.9	102	75
M14	8.8	176	130
M16	8.8	252	186

1.4 The grade of the bolts is marked on the head. Fig 2 shows a grade 8.8 bolt.

Fig 2 Bolt grade marking

Repairs

CAUTION ...
No cutting or welding to be carried out, without the written permission from the manufacturers Reynold Boughton Limited as this could invalidate the warrantee.

Cutting

2 Should the frame require cutting due to accidental damage or modifications, under no circumstances must a flame cutter be used.

Welding

CAUTIONS ...
(1) If using electrical welding equipment to repair the frame, it is essential that the battery and alternator are disconnected.

(2) Place earthing strap as close as possible to the point of work, thus avoiding possible arcing across bearings.

3 Any welding on the frame should conform to the following specifications:

3.1 Arc welding to BS5135 (1984) with electrodes to BS639 (1986) Grade E5130B.

3.2 CO^2 welding should be of the semi-automatic MIG/MAG type using wire No 2 to BS2901 Part 1 (1983).

Chapter 16

BODY, CAB AND FITTINGS

CONTENTS

HEATER

Removal

1 Disconnect the battery.

1.1 Disconnect the washer pipes (Fig 1 (1)) at the wipers (Fig 1 (2)) and remove the wipers.

1.2 Remove the bonnet (Fig 1(3)).

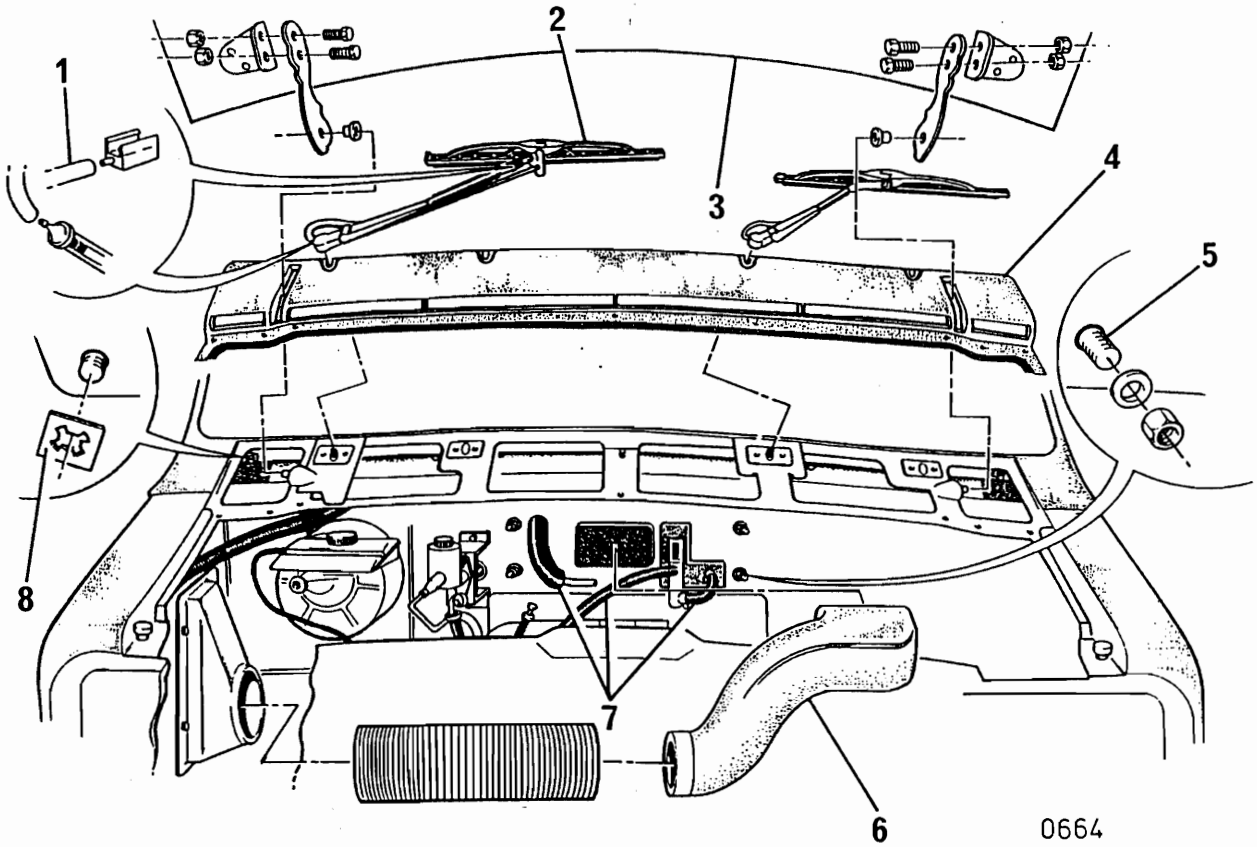
1.3 Remove the seven cross-head screws and washers securing the air intake panel (Fig 1 (4)) and remove the panel.

Note ...

This is to provide access to the spire nuts (Fig 1(8)) securing the facia panel.

1.4 Remove the air intake ducting between the fan and heater (Fig 1 (6)).

1.5 Disconnect the two heater hoses (Fig 1 (7)) at the heater, tie the hose ends above the header tank level to retain the coolant.



1 Pipe connection
2 Wiper
3 Bonnet
4 Intake panel
5 Heater stud
6 Ducting
7 Heater hoses
8 Spire nut

Fig 1 Heater removal (outside cab)

1.6 Remove the four nuts and washers (Fig 1 (5)) securing the heater to the engine bulkhead. Remove any pipe clips or earth connections fitted to these studs and take note of their location.

1.7 Remove the front and rear engine covers inside the cab (Fig 2).

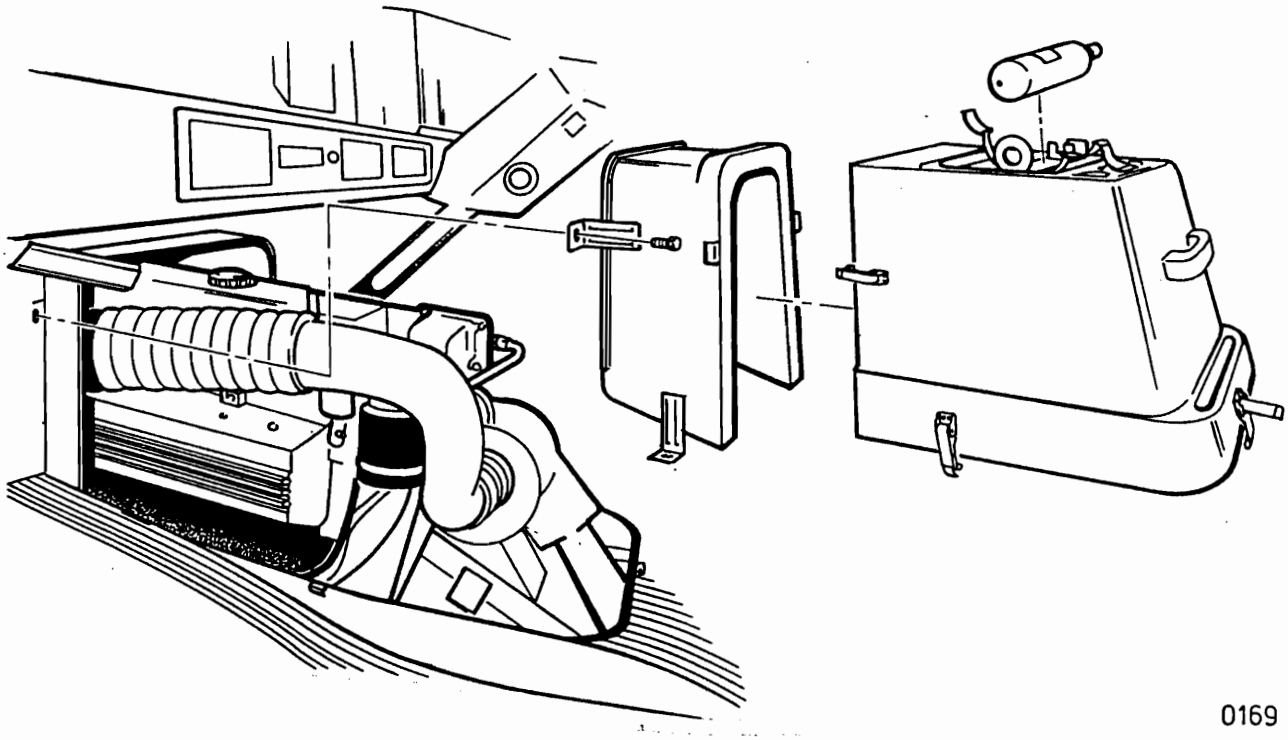


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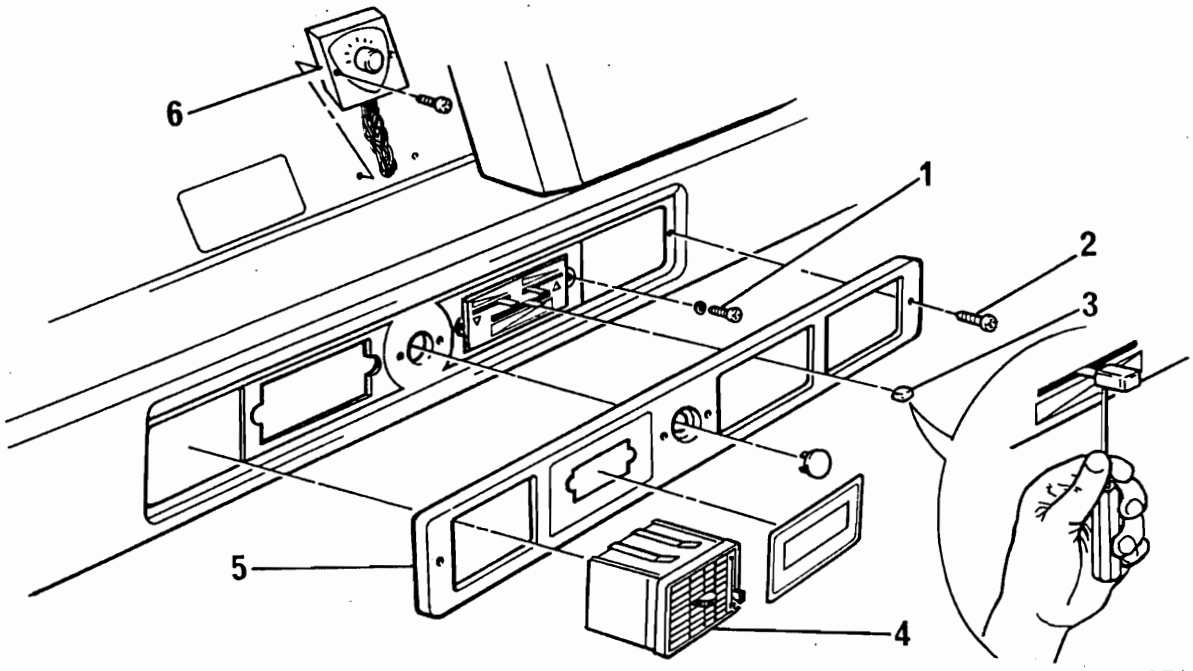
Fig 2 Engine cover removal



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1 Heater screw
2 Trim screw
3 Control knob
4 Air duct
5 Panel trim
6 Lighting switch

Fig 3 Heater control removal

1.8 Remove the two air ducts from the heater to face level vents (Fig 3 (4)).

1.9 Using a small probe, compress the spring retainer and remove the heater control knobs (Fig 3(3)).

1.10 Remove the four cross-head screws (Fig 3(2)) securing the heater control panel trim, and withdraw the trim (Fig 3 (5)).

1.11 Remove the two cross-head screws (Fig 3(1)) securing the heater control unit to the facia panel.

1.12 Remove the steering columm shroud .

1.13 Remove the six cross-head screws securing the instrument panel to the case and disconnect the speedometer cable .

1.14 Withdraw the instrument panel sufficiently to provide access to the four nuts and washers securing the instrument panel case to the facia panel. Remove the nuts and washers .

1.15 Remove the two screws securing the convoy lighting switch (Fig 3 (6)) and disconnect the switch from the wiring after noting the connection details.

1.16 Remove the five cross-head screws securing the facia panel to the vehicle structure, a second person is required to hold the spire nuts (Fig 4(1)).

1.17 Remove the two cross-head screws securing the facia panel to the engine bulkhead bracket (Fig 4 (2)).

1.18 Ease the facia panel upwards and support.

1.19 Withdraw the heater control unit from the facia panel.

1.20 Withdraw the two illumination lights from the control unit.

1.21 Disconnect the demisting ducts from the heater (Fig 5 (1)).

1.22 Withdraw the heater unit and control panel and remove through the passenger door taking care not to spill coolant from the heater matrix.

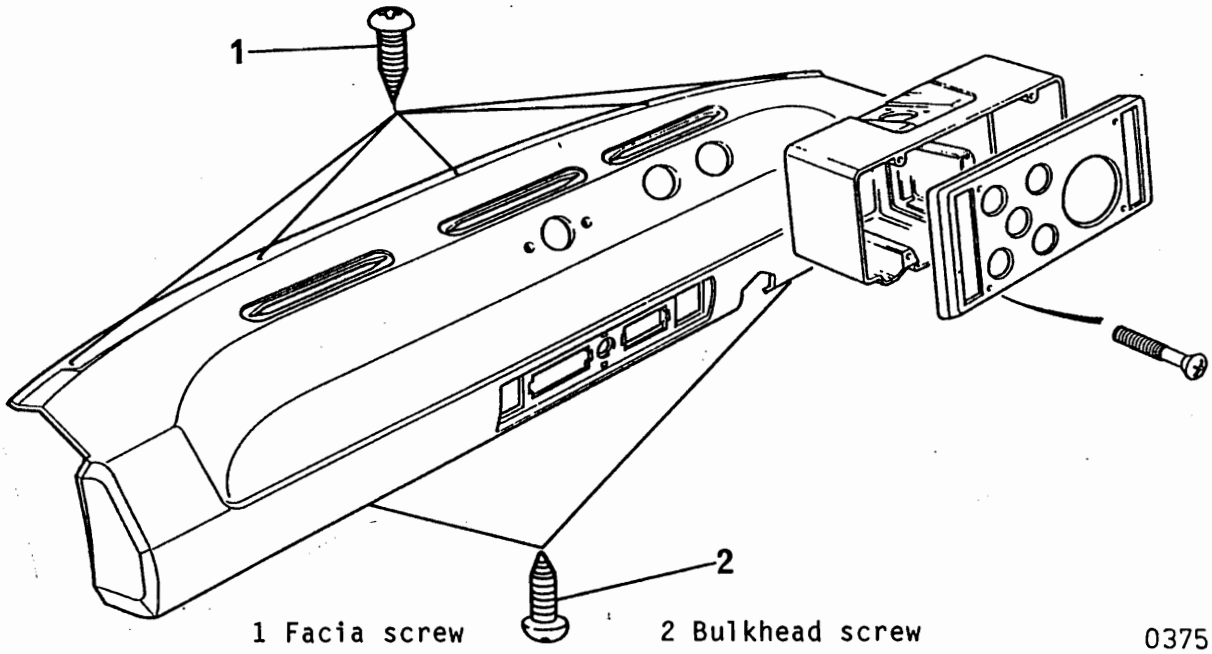


Fig 4 Facia removal

Inspection

2 Check the heater unit for obvious damage.

2.1 Check operating cables and rods for security of attachment and correct operation.

2.2 Check the water valve springs for damage.

2.3 Operate the temperature control lever to open the water valve. Check that there is an unimpeded flow of water through the heater matrix.

Installation

3 Installation is the reverse of the removal procedure.

3.1 Set the heater temperature to maximum and top up the cooling system.

3.2 Run the engine to operating temperature and check for leaks, if necessary top up the cooling system.

Heater matrix and water valve

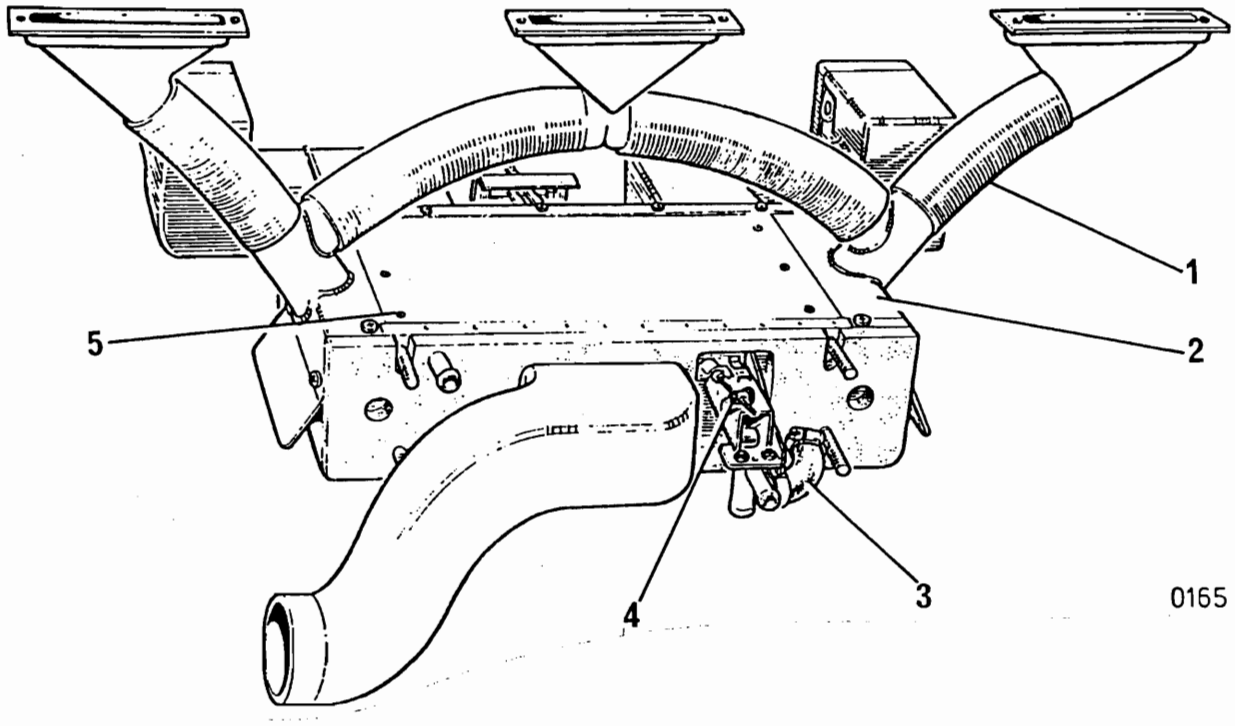
Removal

4 Remove the heater as previously described and place on a workbench.

4.1 Remove the four cross-head screws (Fig 5 (2)) securing each demist outlet assembly, remove the outlets.

4.2 Disconnect the water valve control inner and outer cables Fig 6.

4.3 Remove the connecting hose, water valve to matrix (Fig 6 (3)).



1 Demist duct
2 Demist outlet
3 Connecting hose
4 Matrix screw
5 Control panel screw

Fig 5 Heater assembly

4.4 Remove the four cross-head screws securing the matrix to the heater casing. (Fig 5 (4)).

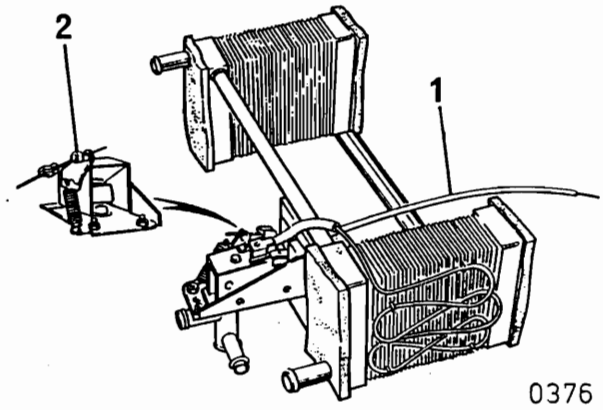
4.5 Remove the sixteen cross-head screws securing the control panel to the casing. Remove the panel complete with flaps (Fig 5 (5)).

4.6 Remove the matrix complete with water valve from the casing.

4.7 Withdraw the capillary tube from the matrix and detach the six clips from the tube.

4.8 Remove the three cross-head screws securing the water valve assembly to the matrix, remove the valve assembly. If a new water valve is fitted the capillary must be formed as shown in Fig 6 and the clips replaced in an identical position to that during removal.

4.9 Remove the setscrews and nuts securing the valve to the mounting bracket.



1 Control cable 2 Cable adjustment

Fig 6 Water valve

Installation

5 Installation is the reverse of the removal procedure.

Control cable adjustment

6 The control cables are correctly adjusted in production, normally adjustment should not be necessary. If adjustment is required proceed as follows :-

6.1 Air distribution to screen

6.1.1 Remove the front and rear engine covers inside the cab.

6.1.2 Operate lever (Fig 7(3) to the closed position.

6.1.3 Slacken the inner cable clamping bolt (Fig 7(4)) on the operating lever.

6.1.4 Switch on the starter switch to position II and operate the blower switch to the high boost position.

6.1.5 Adjust the control inner cable until only a negligible amount of air flows from the screen vents. Tighten the inner cable clamp bolt and check the operation of the control lever.

6.1.6 Switch off the blower and starter switch.

6.1.7 Refit the front and rear engine covers inside the cab.

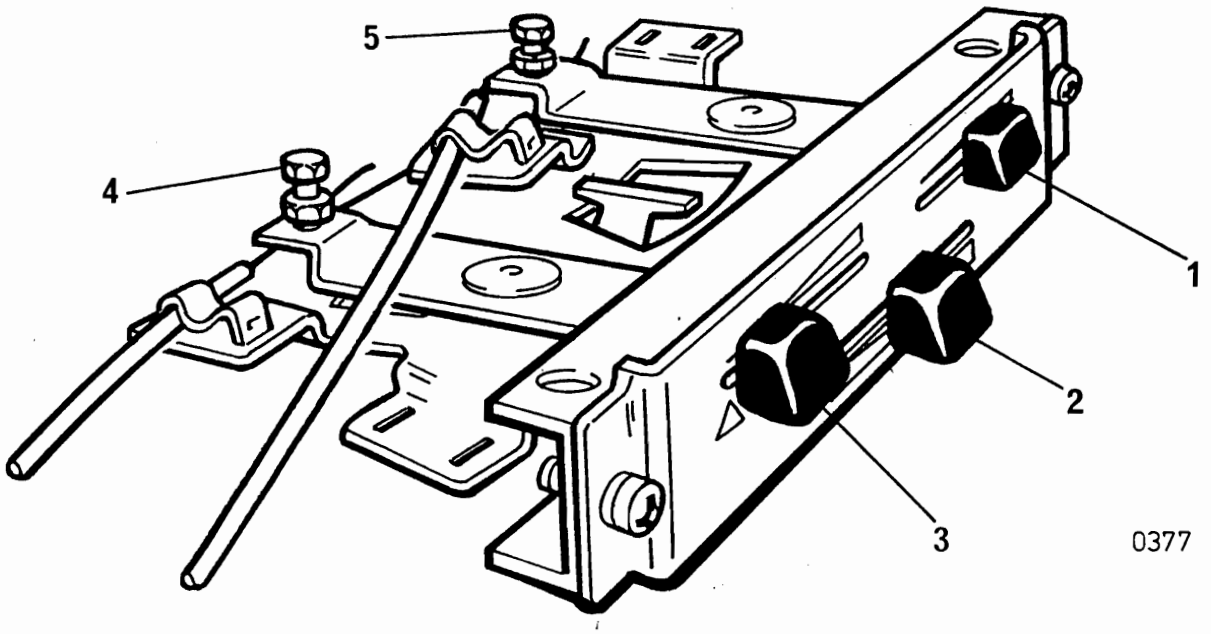


Fig 7 Heater temperature adjustment

6.2 Air distribution to cab interior.

6.2.1 Remove the front and rear engine covers inside the cab.

6.2.2 Operate lever Fig 7(1) to the closed position.

6.2.3 Slacken the inner cable clamping bolt (Fig 7(5)) on the operating lever.

6.2.4 Adjust the control inner cable until the flaps on each side of the heater are fully closed, tighten the inner cable clamp bolt, check the operation of control lever.

6.2.5 Refit the front and rear engine covers inside the cab.

6.3 Air temperature control

6.3.1 Operate lever (Fig 7(2) to the cool or OFF position.

6.3.2 Open and secure the bonnet in the raised position.

6.3.3 Slacken the inner cable clamp screw (Fig 6(2)) on the water valve.

6.3.4 Adjust the control inner cable to fully close the water valve, tighten the inner cable clamp screw and check the operation of the control lever.

6.3.5 Close the bonnet.

Note ...

To ensure efficient operation of the controls the outer cables must be correctly clamped.

Blower motor

Removal

7 The blower motor assembly is mounted in the right hand inner wing valence and is used to induce a forced air flow to the heater, particularly when the vehicle is stationary or operating at low speeds.

7.1 Disconnect the battery.

7.2 Open and secure the bonnet in a raised position.

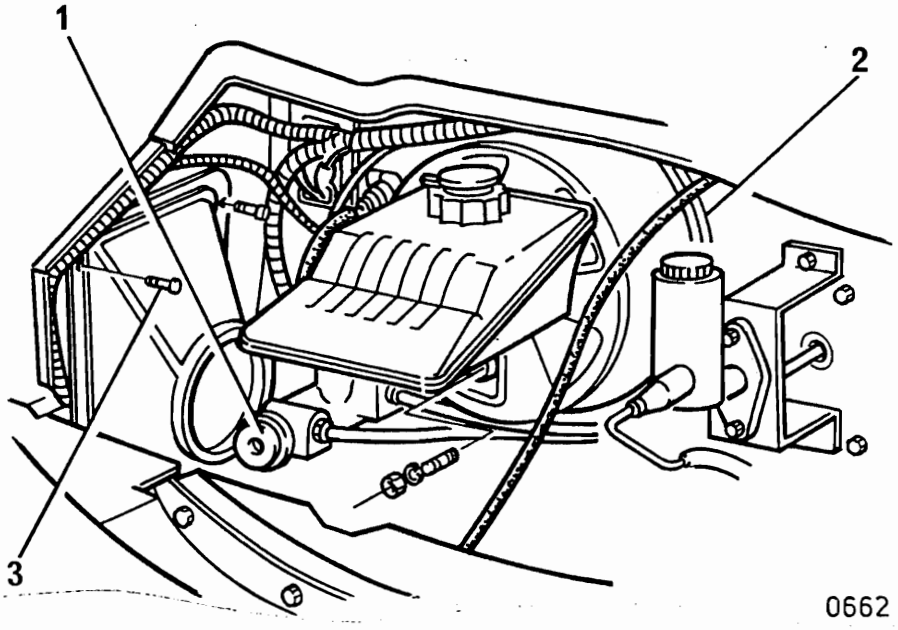
7.3 Remove the motor to heater ducting (Fig 1(7)).

7.4 Pull out brake servo hose adaptor and displace.

7.5 Remove the three nuts securing the brake master cylinder to the servo unit (Fig 8(1)) and displace the master cylinder.

7.6 From inside the cab remove the brake pedal clevis pin (Fig 9) to release the push rod.

7.7 Remove the steel clamp (Fig 8 (2)) securing the servo unit, displace the wiring harness above the servo unit and withdraw the unit.



1 Master cylinder 2 Steel clamp 3 Fan housing bolt

Fig 8 Master cylinder removal

7.8 Remove the four bolts and washers securing the fan housing duct to the inner wing valance (Fig 8 (3)), disconnect the three wires at the snap connectors and displace the two earth wires.

7.9 Withdraw the blower motor assembly taking care not to damage the motor resistor located forward of the motor.

Dismantling

8 Remove the four cross-head screws and washers, displace the rubber grommet.

8.1 Separate the motor from the duct threading the cables through the duct face.

Inspection and overhaul

9 Thoroughly clean the two units, including the sealant from the flange faces.

9.1 The motor is a non serviceable item, and if defective must be renewed.

9.2 Test the motor by connecting the green/yellow and green/slate cables to a 12 or 24 volt battery, whichever is applicable. If the motor is sluggish on initial rotation, or noisy when running, it should be renewed.

Re-assembly

10 Reassembling is the reverse of the dismantling procedure, ensuring the duct face is coated with a suitable sealant.

Installation

11 Refitting is the reverse of the removal procedure.

11.1 Check the operation of the motor.

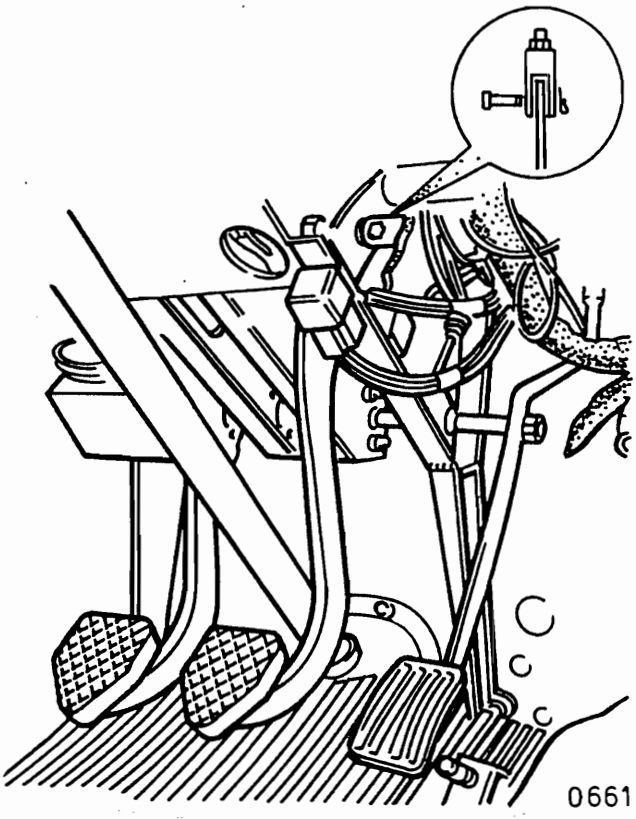
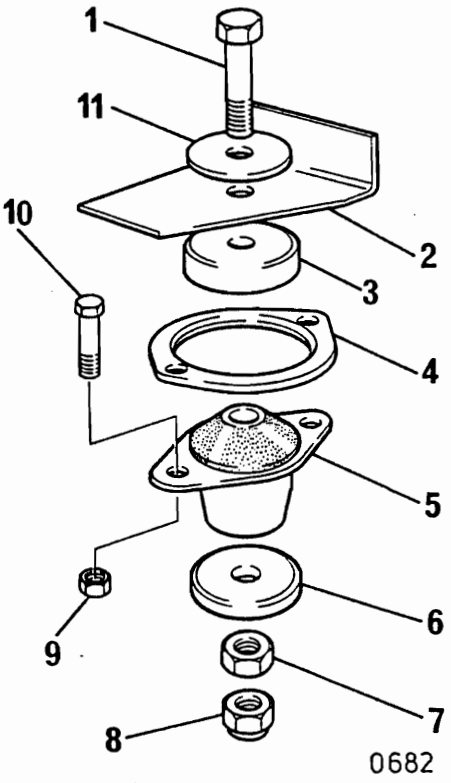


Fig 9 Brake clevis pin removal

CAB MOUNTINGS

12 The cab is mounted onto four oval flange rubber mounts , two situated at the front of the cab and two at the rear. The mounting assembly (Fig 10) is identical for front and rear.



1 Centre bolt
2 Support plate
3 Locating washer
4 Clamp plate
5 Oval flange mount
6 Rebound washer
7 Nut
8 Lock nut
9 Nut
10 Flange bolt
11 Upper washer

Fig 10 Cab mounting assembly

Front mounting removal

13 Remove the 10mm locking bolt from the lower steering column Fig 11. This will free the the steering linkage.

13.1 Remove the centre nut (Fig 10(8)) and washer from beneath the cab.

13.2 Remove the flange nuts from beneath the cab.

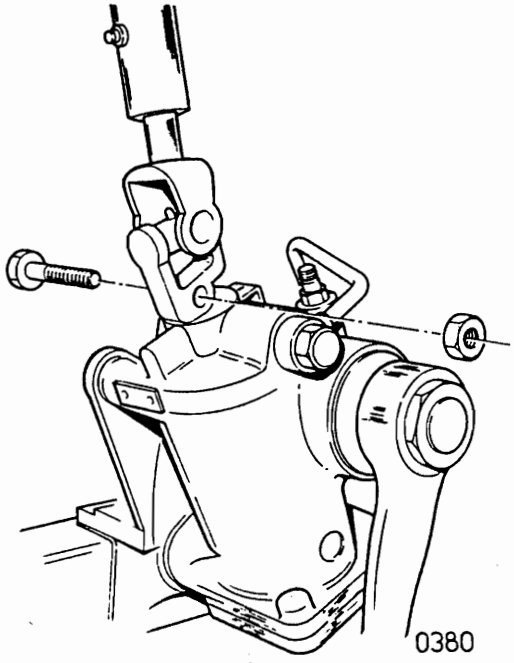


Fig 11 Lower steering joint

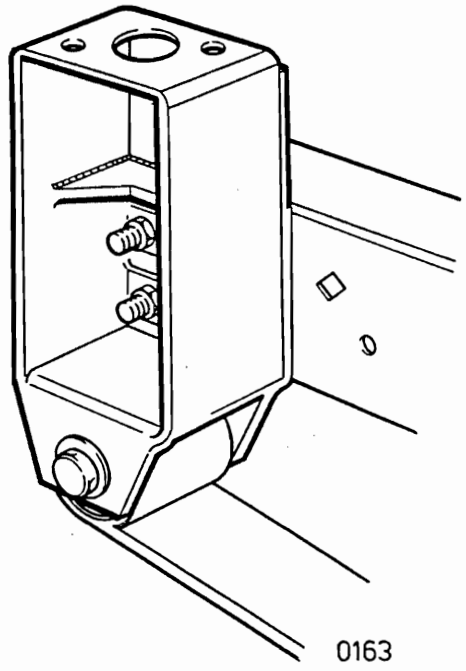


Fig 12 Cab front mounting

13.3 Spreading the load, jack the cab floor up sufficiently to take up the load bearing on the cab mounting and to give clearance for removing the mounting.

13.4 Remove the centre bolt from inside the engine compartment and the two flange bolts from beneath the vehicle.

13.5 Remove the resilient mount.

13.6 Installation is the reverse of removal, the centre nut should be torqued to 74 Nm (55lbf.ft) and the 10mm steering locking bolt to 80 Nm (59lbf. ft).

Rear mounting removal

Note...

The lower steering column bolt does not have to be removed for rear mounting removal.

14 Remove the centre nut (Fig 10 (8)) and washer from beneath the cab.

14.1 Remove both flange nuts from beneath the cab.

14.2 Spreading the load, jack the cab up sufficiently to take up the load bearing on the cab mounting and give clearance for removing the mounting.

14.3 Remove the centre bolt from inside the cab and the two flange bolts from beneath the vehicle.

14.4 Remove the resilient mount.

14.5 Installation is the reverse of removal, the centre bolt should be torqued to 74 Nm (55lbf.ft).

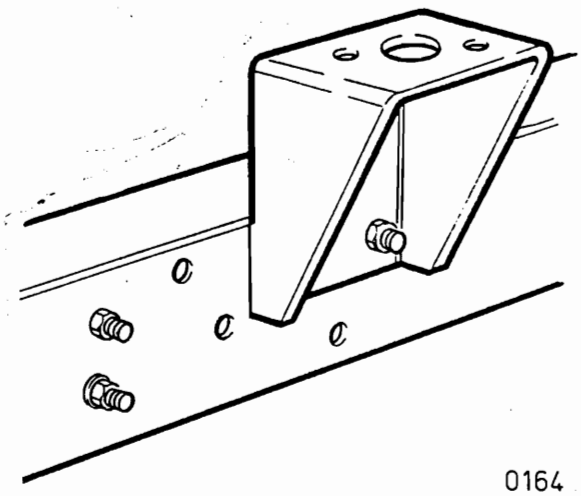


Fig 13 Cab rear mounting

DOOR LOCKS

15 The door lock is mounted inside the door. It incorporates a fork mechanism which engages a striker when the door is closed. The striker is mounted into the cab door pillar. The lock is connected by rods to the interior locking button, the key lock, the door latch (outside) and door latch inside.

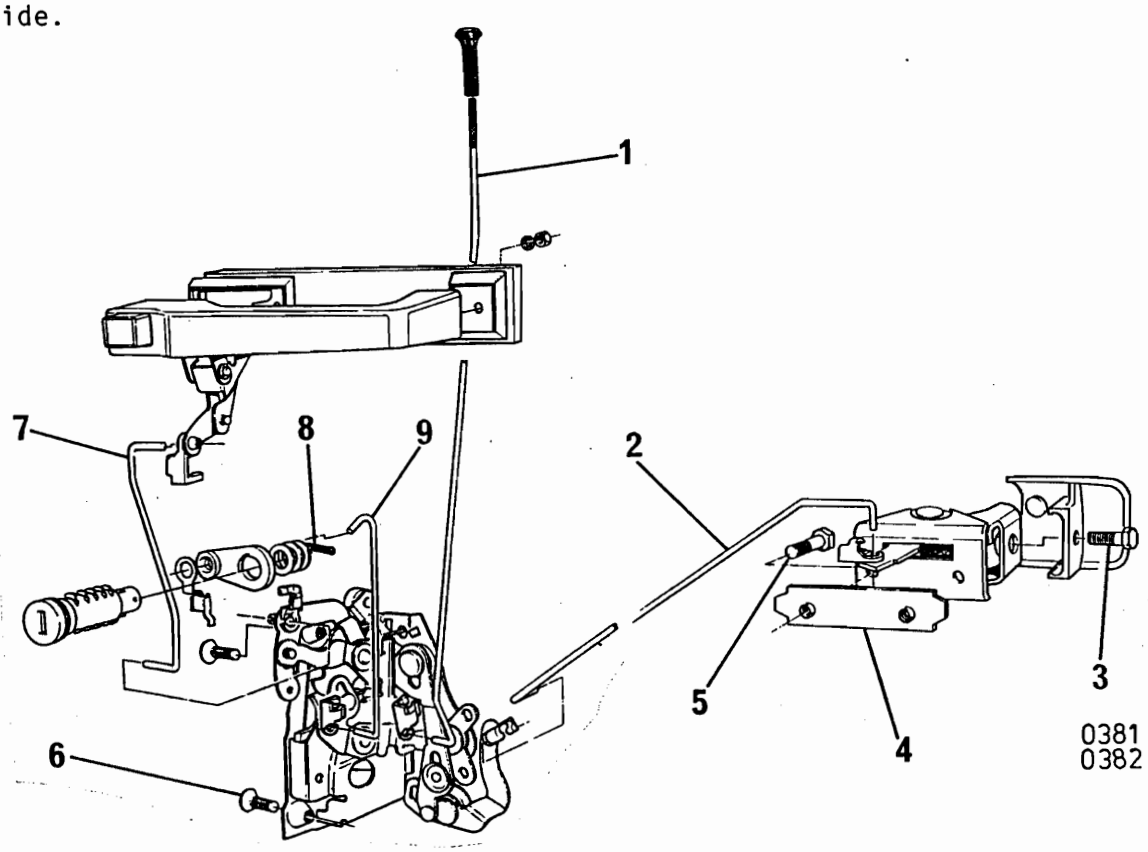


Fig 14 Door lock assemblies

Lock mechanism removal

16 Remove the six self tapping crosshead screws on the door panel and remove the panel.

16.1 From inside the door recess disconnect the plastic clips connecting the lock mechanism to the following rods

16.1.1 Inside locking rod (Fig 14 (1))

16.1.2 Unlatching rod - outside (Fig 14 (7))

16.1.3 Unlatching rod - inside (Fig 14 (2))

16.1.4 Door key lock rod (Fig 14 (9))

16.2 Remove the three crosshead screws retaining the lock mechanism onto the door (Fig 14 (6)) and lift the mechanism out through the door recess.

Installation

17 Installation is the reverse of removal, smear the lock mechanism with XG279 grease prior to installation.

Barrel lock removal

18 Remove the plastic clip connecting the lock mechanism to the door key lock rod.

18.1 Remove the split pin (Fig 14 (8)) and wave washers retaining the barrel. The barrel and connecting rod can then be eased through the lock aperture from outside the cab.

Installation

19 Installation is the reverse of removal, smear the lock with a non greasy lubricant or dry graphite prior to installation.

Door latch - (outside) removal

20 Remove the plastic clips connecting the lock mechanism to the door latch rod and door latch rod to the door handle.

20.1 Remove the two nuts and washers from inside the door recess.

20.2 Ease the door handle off from outside the cab.

Installation

21 Installation is the reverse of removal, smear the latch with XG279 grease prior to installation.

Door latch (inside) removal

22 Remove the plastic clips connecting the door latch to the door lock mechanism.

22.1 Remove the bolt securing the pull handle to the latch (Fig 14 (3)).

22.2 Remove the two self tapping crosshead screws securing the door elbow rest.

22.3 Remove the two bolts securing the latch onto the retention plate (Fig 14 (4) (5).

Installation

23 Installation is the reverse of removal, smear the latch with XG279 grease prior to installation.

DOOR GLASS, REGULATOR AND NO DRAUGHT VENTILATOR

Removal

24 To remove the door glass and regulators carry out the following

24.1 Remove the inner door handle (2 screws), window handle (1 screw) and door trim.

24.2 Remove the trim access panel (6 screws).

24.3 Using an approved method, remove the 3 rivets securing the regulator to the door.

24.4 Support the door glass and disengage the regulator arm from the lower window channel. Withdraw regulator assembly through trim access panel.

24.5 Remove the cross-head screw from underneath door seal securing the quarter light (upper).

24.6 Remove the nut and washer securing the quarter light/door glass channel.

24.7 Holding the door glass, prise the quarter light/door glass channel away from the door structure and lift out complete assembly.

24.8 Withdraw the door glass through the trim panel aperture.

24.9 Remove the no draught ventilator from the quarter light/door glass channel (2 screws).

Inspection

25 Inspection is only required on the regulator assembly.

25.1 Check regulator winding mechanism for damage, renew as necessary.

25.2 Apply XG 279 grease to the winding mechanism and the regulator channel of door glass.

Installation

26 Installation is the reverse of the removal procedure.

26.1 Check for correct operation of the door glass mechanism.

DOOR SURROUND WEATHERSTRIPS

Removal

27 Weatherstrips can be removed from the door by easing the plastic fasteners out of the door frame with a suitable tool.

Installation

28 Position weatherstrip at the top forward corner of the door. Locate and secure plastic fasteners to anchor points in a clockwise direction around the door.

DOORS AND HINGES

Removal

Note ...
The doors can be removed with or without the hinges attached.

29 To gain access to upper and lower hinge bolts remove the cab trim forward of the door.

29.1 Supporting the door, remove the hinge bolts (6 off). Place door on a clean bench.

29.2 Remove the bolts (2 off) securing the upper hinge to the door.

29.3 Remove the bolts (3 off) securing the lower hinge to the door.

Installation

30 Installation is the reverse of the removal procedure.

30.1 Torque hinge bolts to 18 Nm (14 lbf. ft)

WINDSHIELD

Removal

Caution ...
Do not use undue force as this could result in the glass becoming fractured. When lifting hold glass by the top and bottom, as holding from the sides could result in undue stress being applied to the glass.

Note ...
To remove the windshield a minimum of three personnel are required. One inside the cab and two outside supporting the windshield.

31 Remove windshield wiper blades.

31.1 Remove sunvisors

31.2 Using a suitable tool, break the seal between the weather strip and outer face of the windshield aperture.

31.3 With the windshield being supported, starting at the top corner, apply pressure to the inside of windscreen, carefully easing the inner lip of the weather strip over the edge of the aperture. Progressively work out pushing the windshield and weather strip outwards through the aperture.

31.4 Place the windshield on a felt covered bench (to avoid scratching the glass)and remove the weatherstrip.

Inspection

32 Remove all traces of the old sealing compound from aperture, windshield and weatherstrip.

32.1 Check the weatherstrip for cuts and signs of perishing, renew as necessary.

Installation

33 Ensure that all surfaces are free from foreign matter.

33.1 Fit the weatherstrip to the windshield ensuring that it is a good fit.

33.2 Cut a length of cord approximately 24" longer than the periphery of the windshield and insert into inner channel of the weatherstrip.

33.3 To facilitate this operation a 4" length of small diameter pipe can be used to position the cord in the weatherstrip.

33.4 Position the lower edge of the windshield assembly on the aperture flange, ensuring that the cord ends are positioned inside the cab.

33.5 Press the windshield into place, working the lip of the weatherstrip over the aperture flange by pulling evenly on the ends of the cord until the cord is removed

33.6 Using both a suitable pressure gun and sealing compound proceed as follows :

33.6.1 Between the windshield and outer lip of weatherstrip.

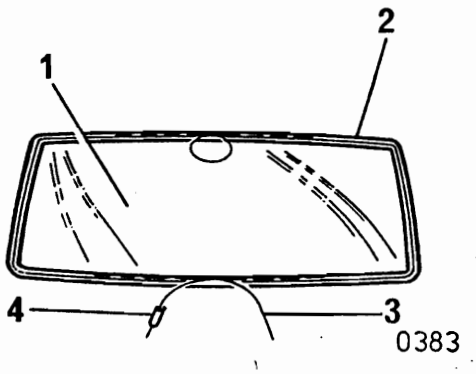
33.6.2 Between external lip of weatherstrip and cab.

33.6.3 Press the weatherstrip firmly to the windshield and aperture to ensure a good seal.

33.7 Remove all surplus sealing compound.

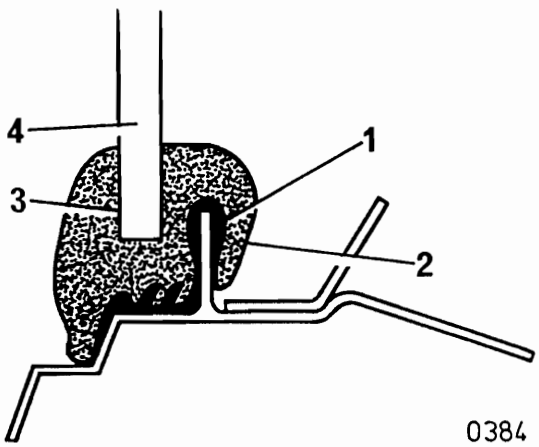
33.8 Refit sunvisors

33.9 Refit windscreen wipers



1 Glass 3 Cord
2 Weatherstip 4 Pipe

Fig 15 Windshield cording



1 Sealer 3 Sealer
2 Weatherstrip 4 Glass

Fig 16 Windshield weatherstrip

SLIDING REAR WINDOW

Removal

34 For removal of the cab sliding rear window refer to windshield removal procedure.

Installation

35 For installation of the cab sliding rear window refer to windshield installation procedure.

SEATS

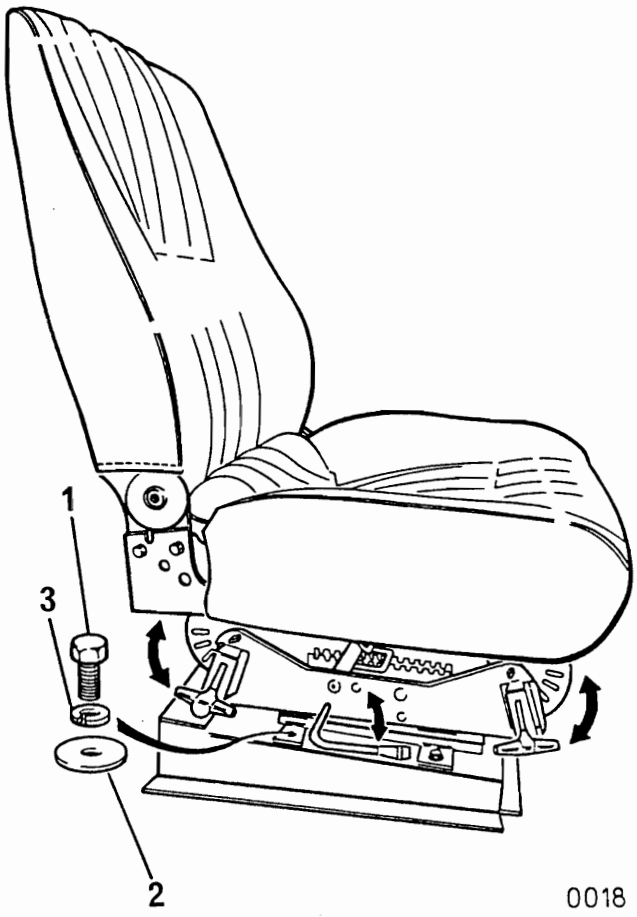
Removal

36 The drivers seat can be removed by removing the four securing bolts (Fig 17).

36.1 The passenger seat can be removed by releasing four securing bolts.

Installation

37 Installation is the reverse of the removal procedure.



1 Bolt 2 Washer
3 Spring washer

Fig 17 Drivers seat

Chapter 17

WINCH (INCLUDING PTO)

CONTENTS

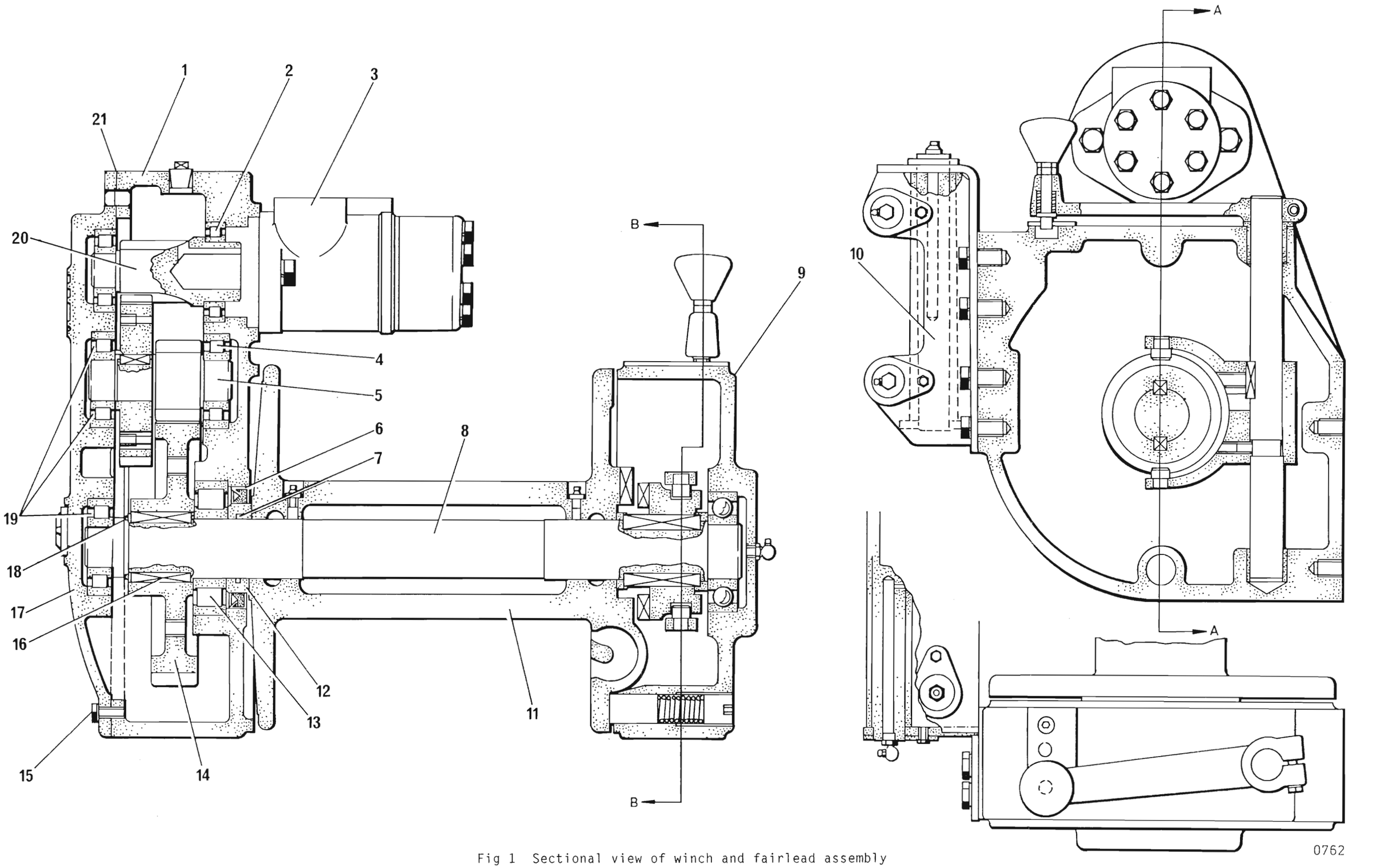


Fig 1 Sectional view of winch and fairlead assembly

WARNING ...

DO NOT ATTEMPT TO DISMANTLE, REPAIR OR REPLACE ANY ITEM ON THE VEHICLE WITH THE ENGINE RUNNING. STOP THE ENGINE AND APPLY THE HANDBRAKE.

CAUTIONS ...

(1) Before removing any hydraulic component from the vehicle wash it down first using water from a high pressure hose and dry it using an air line.

(2) Always observe a high standard of cleanliness when servicing hydraulic components.

TEST EQUIPMENT AND TOOLS

1 The items of special test equipment and tools listed in Table 1 may be required during repair of the winch system. Ancillary items, such as oils and sealants etc, are listed in Table 2.

TABLE 1 SPECIAL TEST EQUIPMENT AND TOOLS

Serial No	NSN/Part No	Designation
(1)	(2)	(3)
1	BW 85494	Dial pressure gauge (range 0-160 bar)

TABLE 2 ANCILLARIES

Serial No	NSN/Part No	Designation
(1)	(2)	(3)
1	8030-99-225 0249	Pipe sealant (loctite 572)
2	8030-99-224-0248	Locking compound (loctite nutlock 242)
3		Hydraulic oil, type OM33
4		Grease, high melting point
5		Grease, type XG279
6		Hydraulic oil, type OMD80
7		Sealing compound (hermetite)
8	8030-99-224-6794	Anti-seize compound (copaslip)

CLEANING AND EXAMINATION

2 Detailed cleaning and examination procedures, where applicable, are provided under the specific dismantling/reassembly and repair/replacement paragraphs. However, as a general rule, comfirm the correct identity and serviceability of the replacement item and examine for damage before fitting. Cleanliness is of the utmost importance where hydraulic systems are concerned, since rapid wear of components may occur as the result of the ingress of dirt. Before removing any hydraulic item, wash it down first and ensure that it is thoroughly cleaned before replacement.

REPAIR AND REPLACEMENT

3 Detailed repair and replacement of most items is also adequately covered by the dismantling/reassembly procedures. In general, ensure that hydraulic hoses and wire control cables are routed as specified, without kinks, and that all fixing bolts etc are tightened to the required torque. In addition, the following salient points should be noted before proceeding:

3.1 Hydraulic hoses. Removal and replacement of hydraulic hoses, after first draining the system, is self-evident. No procedure is given.

3.2 Filler cap. The strainer supplied with a replacement filler cap is not required and should be discarded.

3.3 Hose adaptors. Apply pipe sealant (Table 2, item 1) to the threads of hydraulic hose adaptors before fitting.

3.4 PTO mounting. Withdraw any loose mounting studs at the PTO and clean the threads with a wire brush to remove all traces of the old locking compound. Apply fresh compound (Table 2, item 2) before refitting and then tighten to a torque of 23 to 26 Nm (17-19 lbf.ft).

3.5 PTO indicator switch. The indicator switch is screwed into the shifter cover of the PTO. If fitting a replacement tighten the switch to a torque of 14 to 20 Nm (10-15 lbf.ft) and ensure that the warning lamp wire is reconnected.

3.6 Wire rope. The wire rope is to be examined as detailed in EMER Test and Management A028 Chap 157. Procedures for fitting and coiling the rope are provided in para 64. Cleaning and lubrication is detailed in AESP 2320-E-200-601..

DISMANTLING/REASSEMBLY

4 The dismantling/reassembly instructions provided in this section detail the removal, repair, replacement and refitting of selected items of the winch system (a system diagram is provided in Cat 3). Cross referencing of paragraphs is made to avoid duplication of text. However, there may be some areas of overlap, leading to repetition of instructions, although this has been kept to a minimum.

CAUTION ...

Ensure that all exposed parts are suitably protected following dismantling, pending repair and reassembly.

Draining the hydraulic system

5 The hydraulic oil tank has a capacity of 16 litres and is filled with hydraulic oil type OM33. The overall system, including hoses etc, has a capacity of approximately 25 litres. To drain the system of oil, proceed as follows :

5.1 Place a clean container under the hydraulic oil tank.

5.2 Remove the magnetic drain plug and allow the oil to drain completely.

Refilling the hydraulic system

6 To refill the hydraulic system, proceed as follows :

CAUTION ...

Use a clean container and clean oil when filling or topping up the hydraulic system

6.1 Ensure that the fibre washer on the magnetic drain plug is in place and intact. If necessary, replace the washer.

6.2 Refit the drain plug to the oil tank.

6.3 Remove the oil tank filler cap and pour in hydraulic oil type OM33 (Table 2, item 3) until it reaches the black line on the sight glass of the level indicator on the side of the tank.

6.4 Replace the filler cap.

6.5 Operate the winch (Cat 2) and visually check for any oil leaks.

6.6 Top up hydraulic oil tank to correct level.

Removal of the oil tank filler

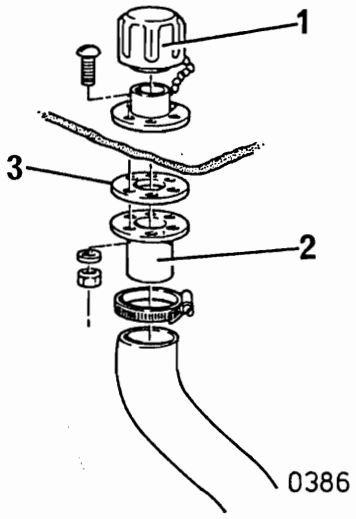
7 To remove the oil tank filler (Fig 1), proceed as follows :

7.1 Remove the cap (1) from the filler neck inside the cab.

7.2 Remove the six screws, locknuts and flat washers securing the filler neck inside the cab to the filler neck (2) beneath the cab.

Note ...
If necessary, disconnect and plug the filler hose at the neck.

7.3 Withdraw the filler neck, complete with cap, from inside the cab and remove the gasket (3) from the filler neck beneath the cab.



1 Cap 2 Neck 3 Gasket

Fig 1 Oil tank filler

Refitting the oil tank filler

8 Refitting is the reverse of removal. If necessary, replace the gasket and/or filler.

Removal of the oil tank level indicator

9 The oil tank level indicator (Fig 2) may be removed with the tank in situ. Proceed as follows :

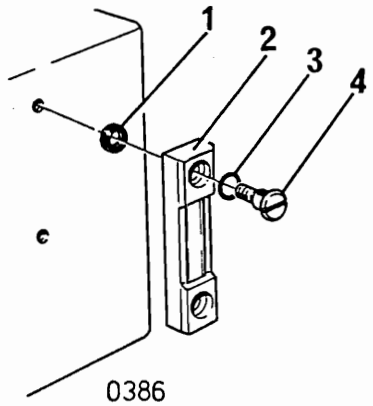
9.1 Drain the hydraulic tank as detailed in para 5.

9.2 Place a clean container under the tank to collect any oil spillage.

9.3 Unscrew and remove the two screws (4) securing the indicator (2) to the rear of the tank.

9.4 Withdraw the level indicator complete with sealing rings (3) and washers (1).

9.5 Plug the holes in the tank to prevent the ingress of dirt.



1 Sealing washer 3 'O'-ring
2 Level indicator 4 Screw

Fig 2 Oil tank level indicator

Refitting the oil tank level indicator

10 To refit the oil tank level indicator, proceed as follows :

10.1 If necessary, replace the sight glass, sealing rings or washers.

10.2 Ensure that the oil pilot holes in the hollow fixing screws are clear and free from obstruction then fit the indicator onto the tank.

10.3 Top up the tank as detailed in Sub paras 6.3, 6.4 and 6.5.

Removal of the hydraulic oil tank

11 To remove the hydraulic oil tank (Fig 3), proceed as follows :

11.1 Drain the hydraulic system as detailed in Para 5.

11.2 Disconnect and plug the three hydraulic hose connections to the tank.

11.3 Remove the four locknuts and bolts from the mounting brackets and withdraw the tank from the vehicle.

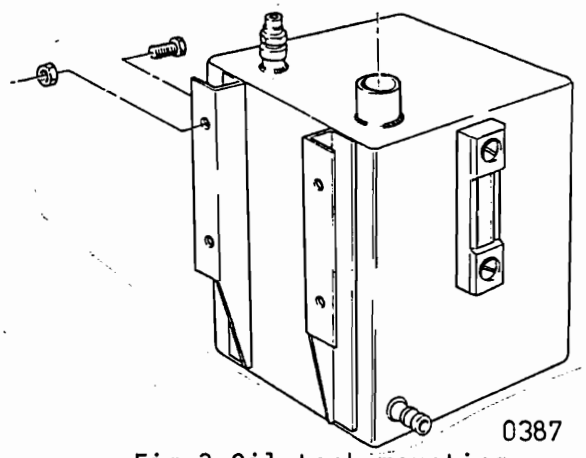


Fig 3 Oil tank mounting

Refitting the hydraulic oil tank

12 To refit the hydraulic oil tank, proceed as follows :

12.1 Feed the four bolts through the holes in the mounting brackets.

12.2 Secure the tank to the chassis with the four locknuts.

12.3 Reconnect the three hydraulic hoses.

12.4 Refill the hydraulic system as detailed in Para 6.

Removal of the suction filter element

13 The filter element (Fig 4) may be removed with the suction filter in situ. Proceed as follows :

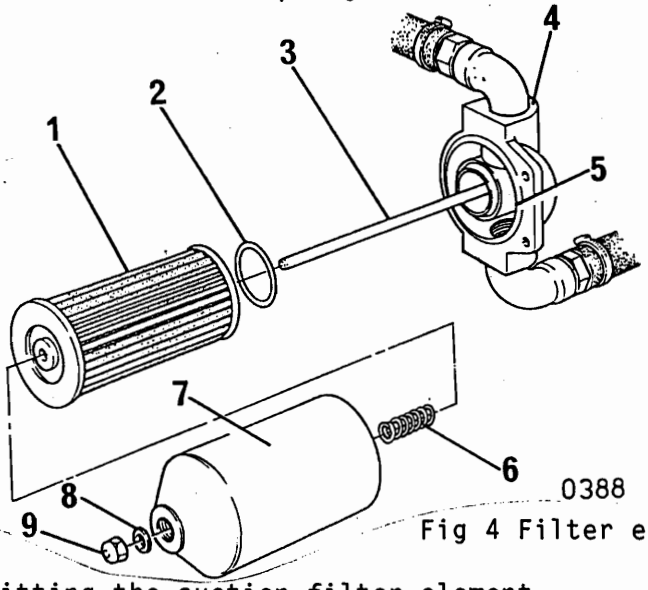
13.1 Wash down and dry the exterior of the suction filter assembly.

13.2 Drain the hydraulic oil tank as detailed in para 5.

13.3 Place a clean container under the filter bowl to collect any oil spillage.

13.4 Remove the domed nut (9) securing the bowl (7) to the stem (3) and withdraw the bowl, complete with bonded seal (5).

13.5 Remove the spring (6) and withdraw the element (1) from the stem.



1 Filter element
2 Gasket
3 Stem
4 Filter head
5 Seal
6 Spring
7 Bowl
8 Seal
9 Domed nut

Fig 4 Filter element

Refitting the suction filter element

14 To refit the suction filter element (Fig 4), proceed as follows :

14.1 Clean or, if necessary, replace the element.

14.2 Clean the filter head (4) and the inside of the bowl.

14.3 If necessary, replace the gasket (2) and the seal (5) on the filter head.

14.4 Lubricate the seal with hydraulic oil type OM33 (Table 2, item 3).

14.5 Renew the element and refit the spring and the bowl, ensuring that the bowl sits squarely on the seal at the head.

14.6 Refit the domed nut to the end of the stem.

14.7 Top up the tank as detailed in Sub paras 6.3, 6.4 and 6.5.

Removal of the suction filter assembly

15 The suction filter and fittings should be removed from the vehicle as one assembly. Proceed as follows :

15.1 Drain the hydraulic system as detailed in Para 5.

15.2 Wash down and dry the exterior of the suction filter assembly.

15.3 Place a clean container under the filter bowl to collect any oil spillage.

15.4 Disconnect and plug the two hydraulic hose connections to the filter.

15.5 Remove the two locknuts and bolts securing the filter mounting bracket to the chassis and withdraw the assembly from the vehicle.

Dismantling of the suction filter and fittings

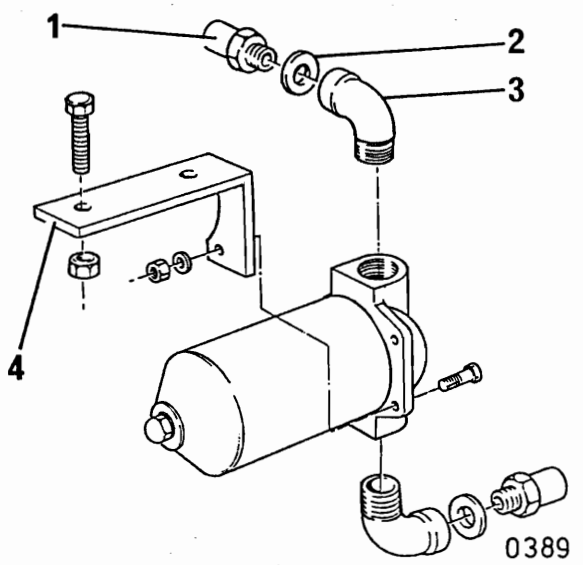
16 To disassemble the suction filter and fittings (Fig 5), proceed as follows:

16.1 Remove the two locknuts, flat washers and bolts securing the filter to the mounting bracket (4).

16.2 Clamp the filter head in a soft-jawed vice and unscrew and remove the two hose adaptors (1), with sealing washers (2), from the elbow connectors (3).

16.3 Unscrew and remove the two elbow connectors from the filter head.

16.4 Unclamp and withdraw the filter complete.



1 Hose adaptor 3 Elbow connector
2 Sealing washer 4 Bracket

Fig 5 Suction filter fittings

Reassembly of the suction filter and fittings

17 To reassemble the suction filter and fittings, proceed as follows :

17.1 If necessary, remove all traces of the old sealing compound from the threads of the elbow connectors and hose adaptors.

17.2 Apply pipe sealant (Table 2, item 1) to the external threads of the two elbow connectors and the hose adaptors.

17.3 Clamp the filter head in a soft jawed vice and screw an elbow connector into each port until the tapered thread begins to bite.

17.4 Continue turning the connectors until the elbows are positioned, relative to the filter head, approximately as shown in Fig 6.

17.5 If necessary, replace the sealing washers, then screw the hose adaptors into the connector elbows.

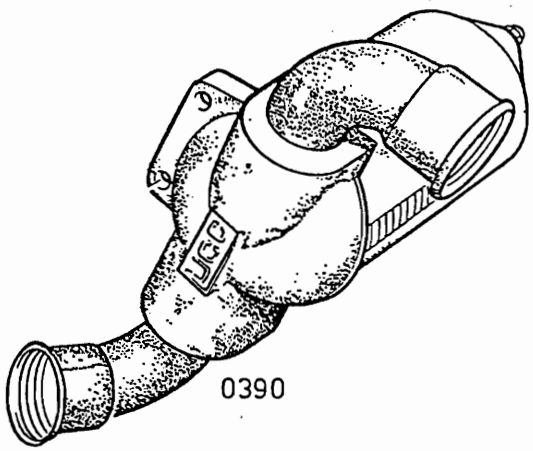


Fig 6 Suction filter connector positioning

17.6 Unclamp the filter and fit it to the mounting bracket using the two bolts, flat washers and locknuts. Tighten to a torque of 12 Nm (9 lbf.ft).

Refitting the suction filter assembly

18 To refit the suction filter assembly, proceed as follows :

18.1 Secure the assembly to the chassis using the two bolts and locknuts. Tighten to a torque of 30 Nm (22 lbf.ft).

18.2 Reconnect the two hydraulic hoses to the adaptors.

18.3 Refill the hydraulic system as detailed in Para 6.

Removal of the PTO control cable

19 To remove the PTO control cable (Fig 7), proceed as follows :

WARNINGS ...

(1) DO NOT ATTEMPT TO WORK ON AN INSTALLED PTO WITH THE ENGINE RUNNING

(2) DO NOT OPERATE THE PTO CONTROL FROM UNDERNEATH THE VEHICLE WITH THE ENGINE RUNNING.

19.1 If necessary, remove the spare wheel for access to the PTO.

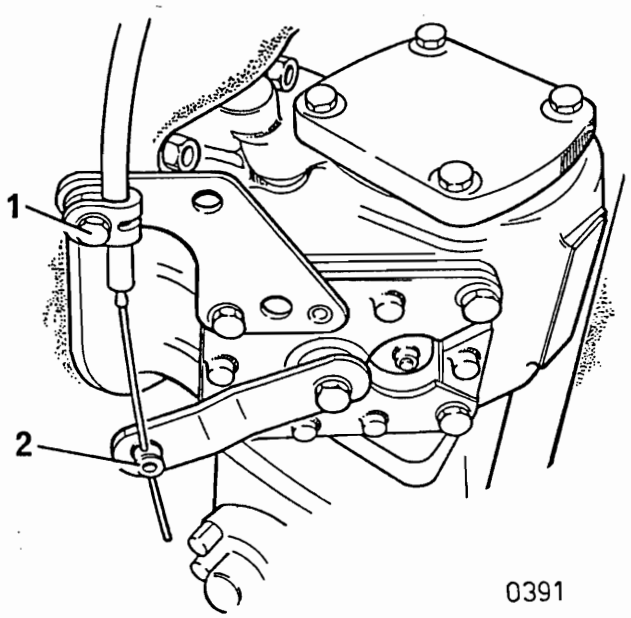
19.2 Disconnect the inner wire of the control cable from the pivot pin (2) in the shifter lever on the underside of the PTO.

19.3 Release the cable from the swivel bracket (1) clamping the outer casing.

19.4 Remove any ties or clips securing the cable to the hydraulic hose routed along the chassis sidemember.

19.5 Unscrew the nut securing the outer casing to the underside of the cab and remove the nut and lockwasher from the cable.

19.6 Withdraw the cable from inside the cab.



1 Swivel bracket 2 Pivot pin

Fig 7 PTO cable connections

Refitting the PTO control cable

20 To refit the PTO control cable, proceed as follows :

CAUTION ...

To ensure the cable will operate properly, avoid kinking the cable or introducing bends of radius less than 150 mm.

20.1 Feed the cable through the hole in the floor of the cab until it reaches the nut on the threaded portion of the outer casing.

20.2 From below the cab, thread the lockwasher and the nut onto the cable. Screw the nut onto the outer casing to secure the cable to the cab.

20.3 Route the cable to the PTO and, if necessary, use ties or clips to attach it to the hydraulic hose routed along the chassis sidemember.

20.4 Ensure that the control knob is pushed all the way in and move the PTO shifter lever to the fully disengaged position (Fig 8).

20.5 Align the cable with the wire control bracket and the shifter lever on the PTO cover assembly. Hold the cable casing in position against the bracket (Fig 9).

20.6 Move the PTO shifter lever to the fully engaged position and determine how much of the cable casing must be cut to allow the lever enough travel to shift in and out completely (Fig 10).

Note ...

The casing need only extend just beyond the bracket, whereas the inner wire must be long enough to pass through the swivel pin in the shifter lever.

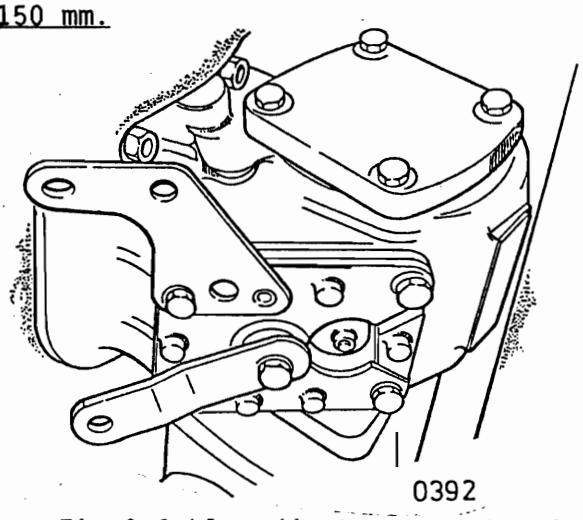


Fig 8 Cable adjustment - step 1

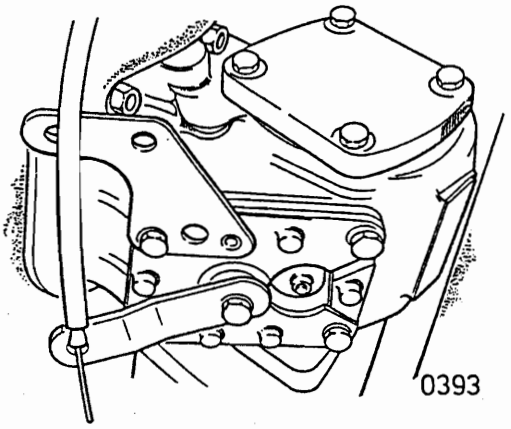


Fig 9 Cable adjustment - step 2

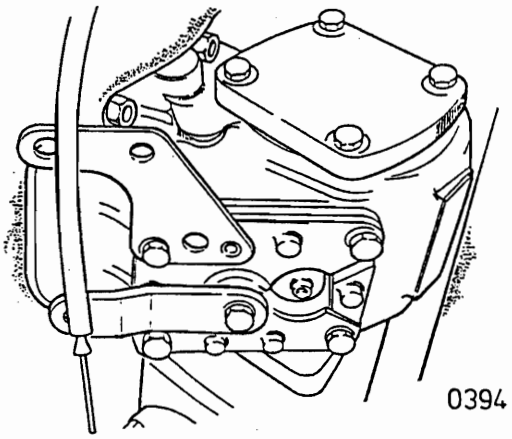
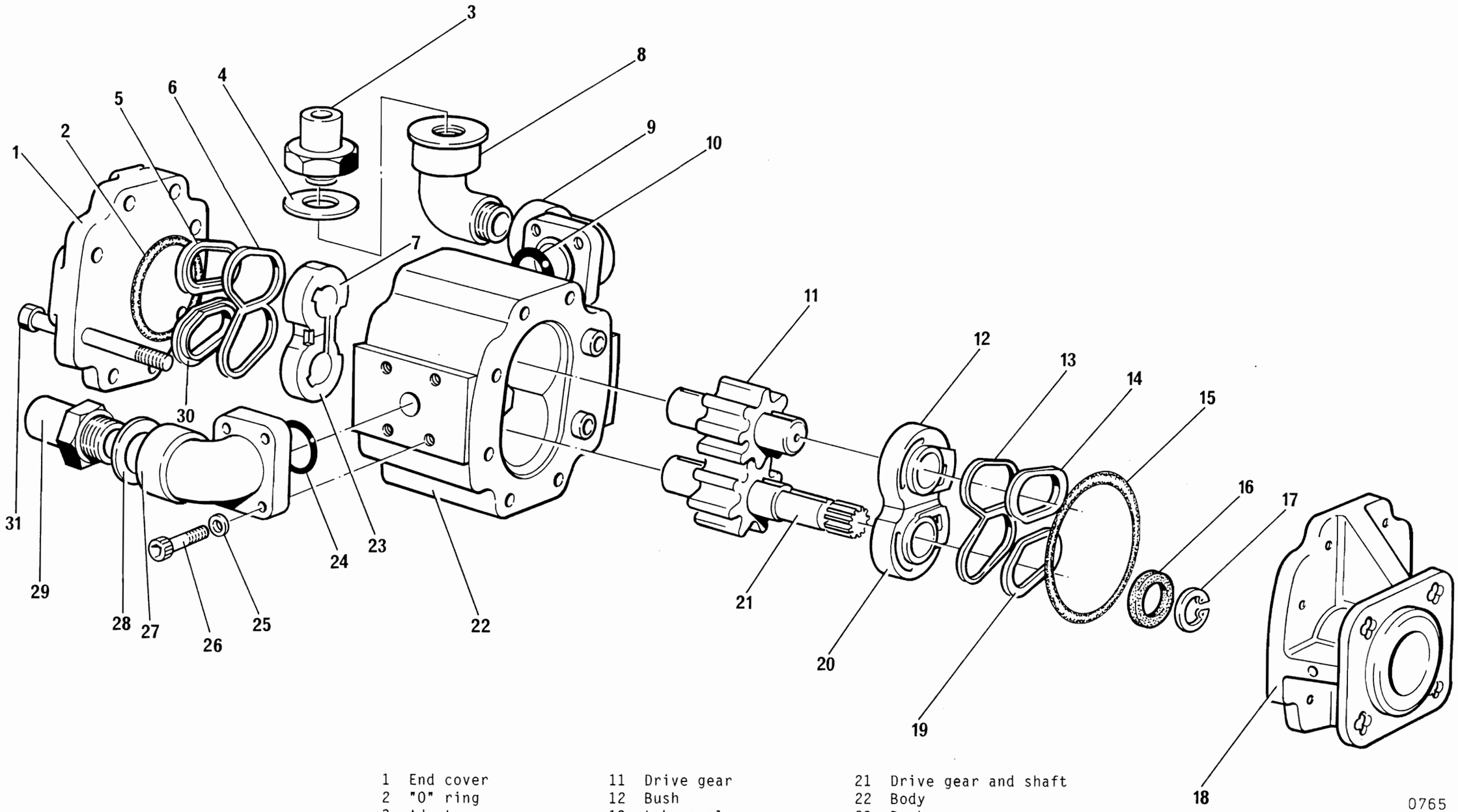


Fig 10 Cable adjustment - step 3



1	End cover	11	Drive gear	21	Drive gear and shaft
2	"O" ring	12	Bush	22	Body
3	Adaptor	13	Lube seal	23	Bush
4	Washer	14	Backing washer	24	"O" ring
5	Backing washer	15	"O" ring	25	Lockwasher
6	Lobe seal	16	Seal	26	Screw
7	Bush	17	Circlip	27	Elbow
8	Elbow	18	Flange	28	Washer
9	Adaptor	19	Backing washer	29	Adaptor
10	"O" ring	20	Bush	30	Backing washer
				31	Setscrew

Fig 4 Exploded view of hydraulic pump

20.7 Using the control knob, pull the inner wire back until the casing can be cut without cutting the wire. Cut the casing using a hacksaw or heavy-duty sidecutters.

20.8 Push the control knob all the way in and move the PTO shifter lever back to the fully disengaged position.

20.9 Feed the casing through the swivel bracket and the inner wire through the pivot pin. Lock the pivot pin and clamp the casing to the bracket (Fig 11). Torque to 1.11 Nm (0.8 lbf.ft) maximum.

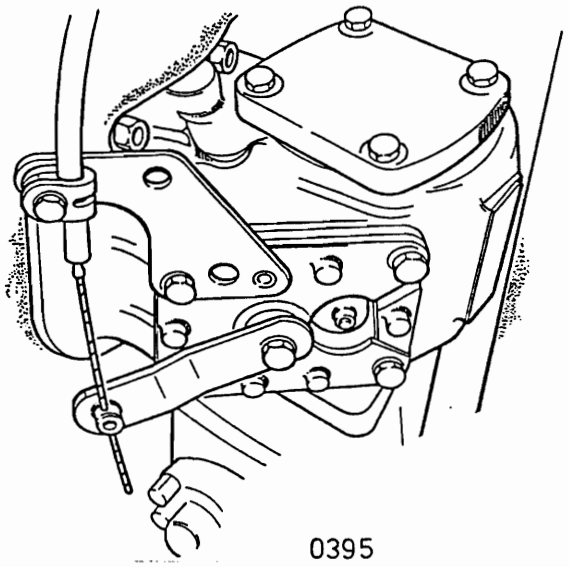


Fig 11 Cable adjustment - step 4

20.10 Cut any excess wire and operate the PTO control knob to ensure enough casing has been removed to allow full gear engagement.

20.11 If necessary, replace the spare wheel.

Removal of the PTO

21 The PTO and its associated close coupled hydraulic pump are fitted to the transfer box. Because of the limited space between the back end of the pump and the adjacent chassis crossmember, it is not possible to remove either the PTO or the pump alone. To remove and separate the PTO and pump assembly, proceed as follows :

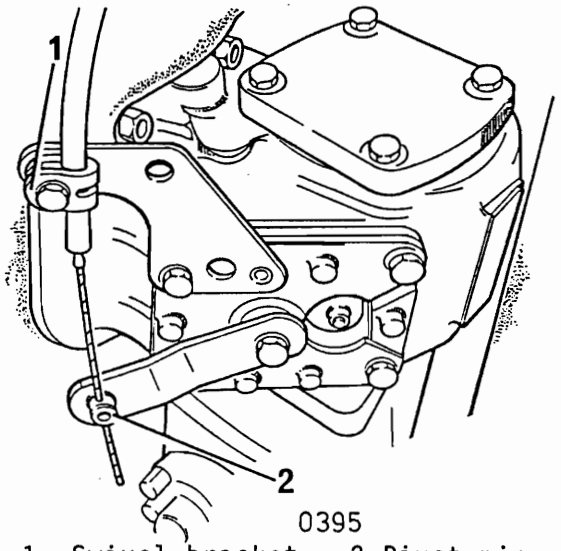
21.1 Drain the hydraulic system as detailed in Para 5.

21.2 Remove the spare wheel for access to the PTO and pump.

21.3 Place a clean container under the pump to collect any oil spillage.

21.4 Disconnect and plug the two hydraulic hose connections to the pump.

21.5 Disconnect the inner wire of the control cable from the pivot pin (Fig 12(2)) in the shifter lever on the underside of the PTO.



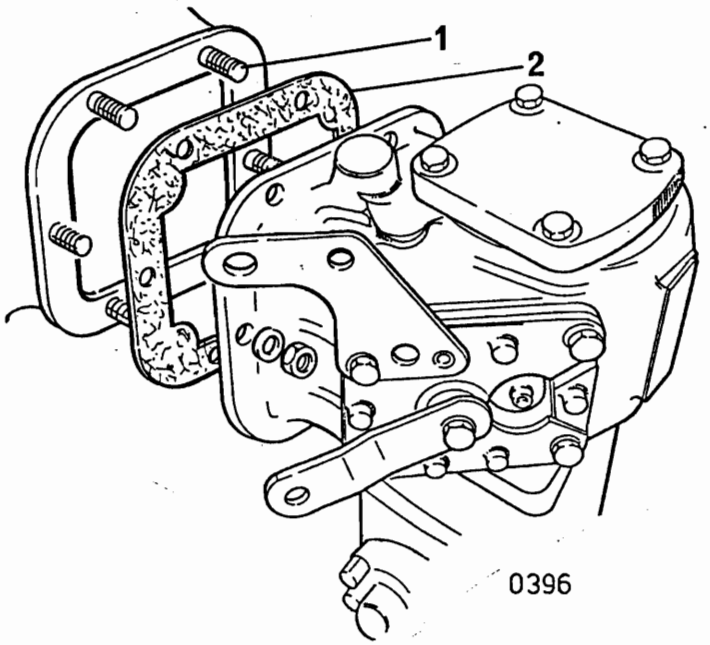
1 Swivel bracket 2 Pivot pin

Fig 12 PTO and control cable

21.6 Release the cable from the swivel bracket (1) clamping the outer casing.

21.7 Disconnect the warning lamp wire from the PTO indicator switch.

21.8 Remove the six nuts and washers securing the PTO to the flange studs (Fig 13(1)) on the transfer box.



1 Flange studs
2 Shimming gaskets

Fig 13 PTO and pump assembly mounting

21.9 Withdraw the PTO and pump assembly, together with the PTO shimming gaskets (2), from the vehicle.

Note ...
Cover the transfer box aperture to prevent dirt entering the transmission.

21.10 Remove the four nuts and washers securing the pump flange to the PTO and then withdraw the pump to separate it from the PTO.

Separation of the shifter cover from the PTO housing

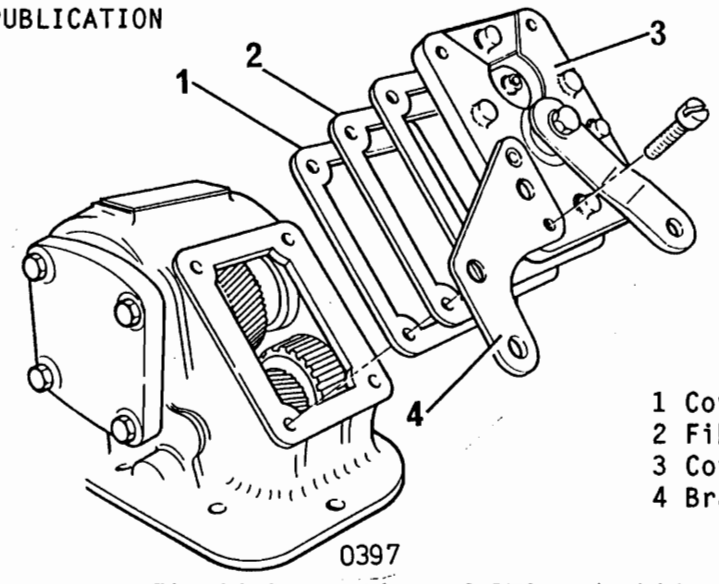
22 To separate the shifter cover (Fig 14) from the PTO housing, proceed as follows :

22.1 Remove the screw securing the bracket (4) to the assembly (via the shifter cover) and withdraw the bracket.

22.2 Remove the remaining three screws securing the shifter cover to the gear housing.

Note ...
It may be necessary to move the shifter lever to the engaged position to expose the screw beneath it.

22.3 Withdraw the cover (3) and shifter post assembly complete with the two cover gaskets (1) and the fibre spacer (2).



1 Cover gasket
2 Fibre spacer
3 Cover and post assembly
4 Bracket

Fig 14 Separation of PTO and shifter cover

Refitting the PTO

23 The PTO and hydraulic pump must be fitted as one assembly. The correct backlash of the cluster gear with the PTO fitted is 0.15 mm - 0.3 mm, achieved by inserting shimming gaskets between the transfer box and the PTO mounting flange. A procedure for approximating the required backlash setting is included in the following. For a more accurate determination, refer to Para 24.

23.1 Assemble the pump to the PTO such that its input port (largest port) is on the opposite side of the assembly to the PTO shifter cover aperture.

23.2 Fit the four washers and nuts to secure the pump flange to the PTO. Ensure that the pump shaft is free to rotate and then fully tighten the nuts to a torque of 41-47Nm (30-35 lbf ft).

23.3 Rock the PTO cluster gear (Fig 15) to determine a feel for the amount of inherent movement or backlash.

23.4 Place a 0.5 mm shimming gasket over the mounting studs on the transfer box. Fit the PTO and pump assembly to the studs and temporarily secure with two nuts and washers.

23.5 Using the shifter cover aperture for access, rock the cluster gear in the PTO to determine the backlash (Fig 16).

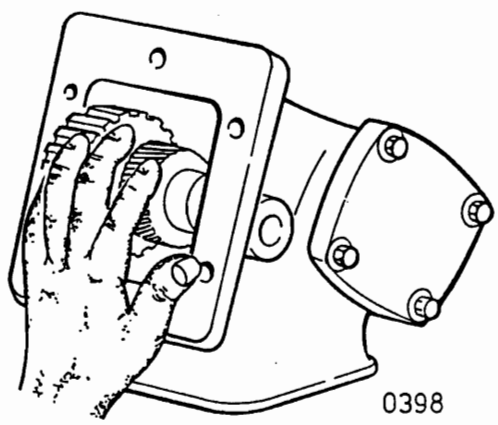


Fig 15 Backlash adjustment - step 1

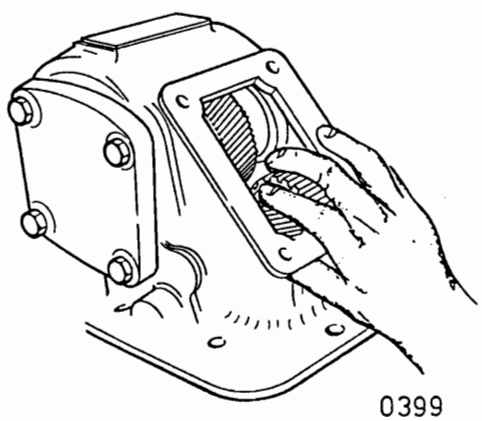


Fig 16 Backlash adjustment - step 2

23.6 If necessary, remove the assembly to increase or decrease the number and/or thickness of the shimming gaskets until the backlash with the PTO mounted feels the same as that established for the unmounted condition (Sub-para 23.3).

Notes ...
(1) Turn the cluster gear so that the backlash is checked at more than one position.

(2) Do not stack more than three shimming gaskets together.

23.7 Fit the four remaining washers and nuts to the mounting studs and tighten all six to a torque of between 41-48 Nm (30-35 lbf.ft).

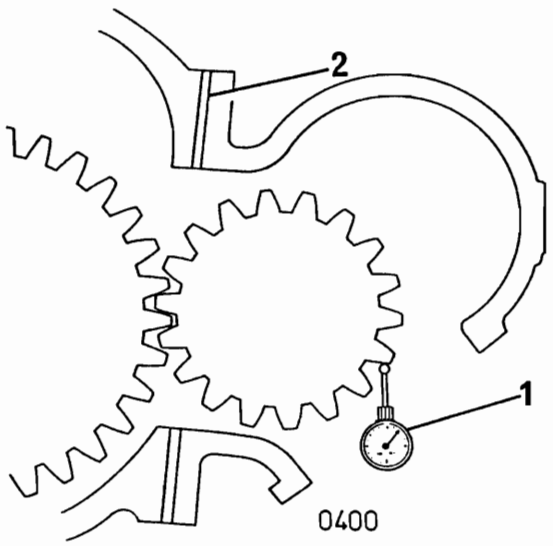
Procedure for checking and adjusting PTO backlash

24 To accurately check for the correct backlash of the cluster gear after refitting the PTO, proceed as follows :

24.1 Mount a dial indicator (Table 1, item 1) so that it registers movement of the cluster gear via the PTO shifter cover aperture (Fig 17).

24.2 Hold the PTO driver gear in the transmission with a screwdriver or bar, and rock the cluster gear back and forth. Note the overall movement on the dial indicator (1).

24.3 If necessary, add or subtract gaskets (2) as required to establish the backlash at 0.15 mm - 0.3 mm.



1 Dial indicator 2 Shimming gasket

Fig 17 Checking backlash

Note ...
As a general rule, a 0.25 mm gasket will change the backlash by approximately 0.15 mm and a 0.5 mm gasket will change the backlash approximately 0.3 mm.

Reassembly of the shifter cover to the PTO gear housing

25 To reassemble the shifter cover to the PTO gear housing, proceed as follows :

25.1 Refit the shifter cover and post assembly, complete with fibre spacer sandwiched between the two cover gaskets. Install the wire control bracket.

Notes ...
(1) It may be necessary to move the shifter lever to allow insertion of the cover screws.

(2) Do not fully tighten the cover screws.

25.2 Operate the shifter lever to ensure that it can move over the full range of travel (between the engaged and disengaged positions) without fouling on the wire control bracket. If necessary, change the position of the lever on the post.

CAUTION ...

If changing the position of the lever on the post, first remove the shifter cover (Fig 18) to prevent the possible loss of the poppet (2) and/or spring (3) into the transmission should the post assembly (1) be accidentally pushed through the cover while reinstating the lever (4).

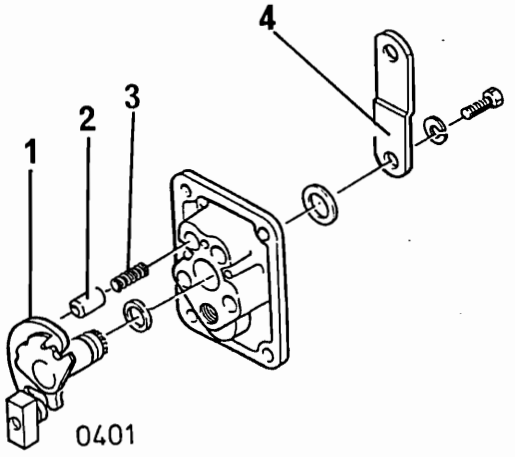
25.3 Tighten the cover screws to a torque of 22-27 Nm (16-20 lbf.ft).

25.4 Refit (and if necessary adjust) the PTO control cable according to the relevant procedures of Para 20.

25.5 Reconnect the warning lamp wire to the PTO indicator switch.

25.6 Reconnect the hydraulic hoses to the pump.

25.7 Refill the hydraulic system as detailed in Para 6.



1 Post and plate assembly
2 Poppet
3 Shifter spring
4 Shifter lever

Fig 18 Shifter cover and lever

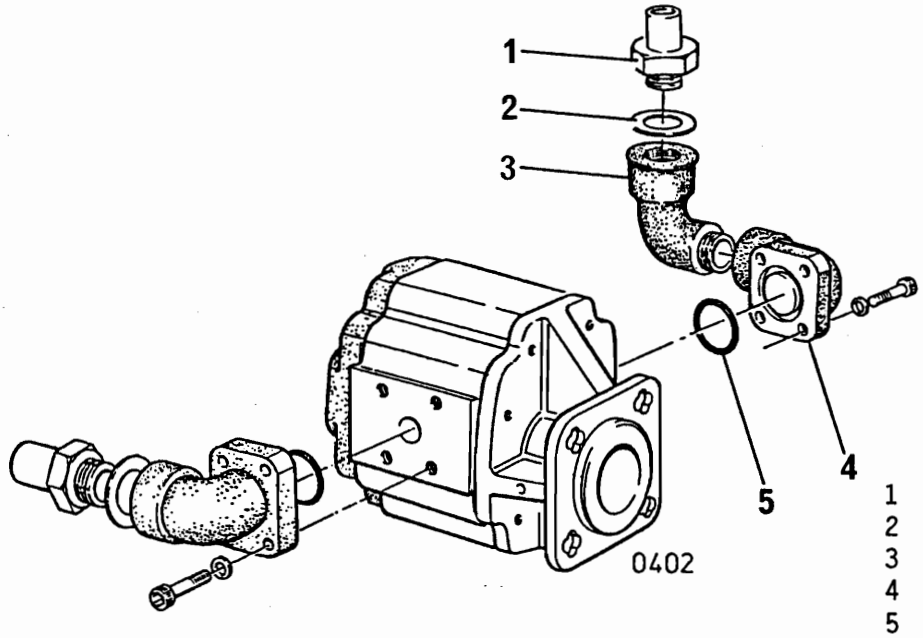
Removal of the hydraulic pump

26 The hydraulic pump is close coupled to the PTO mounted on the transfer box. Because of the limited space between the back end of the pump and the adjacent chassis crossmember, it is not possible to remove either the pump or the PTO alone. To remove and separate the pump and PTO assembly, carry out the procedures of Para 21.

Dismantling of the pump and fittings

27 To dismantle the pump and fittings (Fig 19), proceed as follows:

27.1 Clamp the pump in a soft-jawed vice and unscrew and remove the hose adaptor (1) with sealing washer (2), from the elbow connector (3) at the pump input port.



1 Hose adaptor
2 Sealing washer
3 Elbow connector
4 Straight adaptor
5 'O' ring oil seals

Fig 19 Pump and fittings

27.2 Unscrew and remove the elbow connector from the straight adaptor (4) at the pump input port.

27.3 Unscrew and remove the hose adaptor, with sealing washer, from the straight adaptor at the pump output port.

27.4 Remove the eight cap screws securing the two straight adaptors to the pump and withdraw the adaptors and associated oil seals (5).

27.5 Unclamp and withdraw the pump complete.

Reassembly of the pump and fittings

28 To reassemble the pump and fittings, proceed as follows :

28.1 Fit the straight adaptor oil seals (5) if necessary and ensure that they are seated properly.

28.2 Clamp the pump in a soft-jawed vice, and refit the straight adaptors (4). Tighten the cap screws securing the input and output adaptors to the pump to 25-36 Nm (18-26 lbf.ft).

28.3 If necessary, remove all traces of the old sealing compound from the threads of the elbow connector and hose adaptors.

28.4 Apply pipe sealant (Table 2, item 1) to the external threads of the elbow connector and the two hose adaptors.

28.5 Screw the elbow connector (3) into the input port adaptor (largest port) until the tapered thread begins to bite.

28.6 Continue turning the connector until the elbow is positioned, relative to the pump, approximately as shown in Fig 20.

28.7 Replace the sealing washers (22), then screw the hose adaptors (1) into the appropriate port connectors. Unclamp the pump.

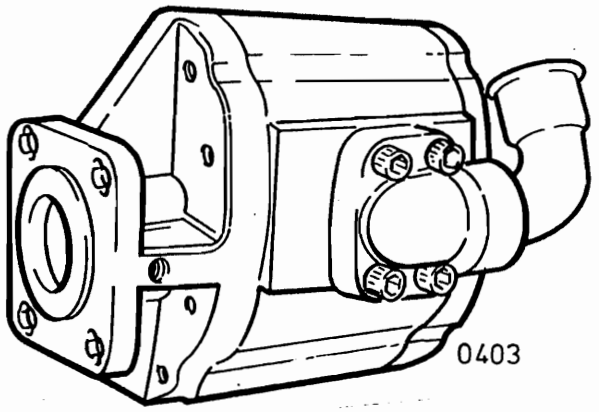


Fig 20 Pump connector positioning

Renewing the pump drive shaft oil seal

29 To renew the pump drive shaft oil seal (Fig 21), proceed as follows :

CAUTION ...

Do not dismantle the pump further than indicated in these instructions. The arrangement of the bushes and gears relative to the body determines the direction of rotation and these items must not be disturbed.

29.1 Remove the hydraulic pump as detailed in Para 26 and lightly mark the body and mounting flange to ensure reassembly in the correct relationship.

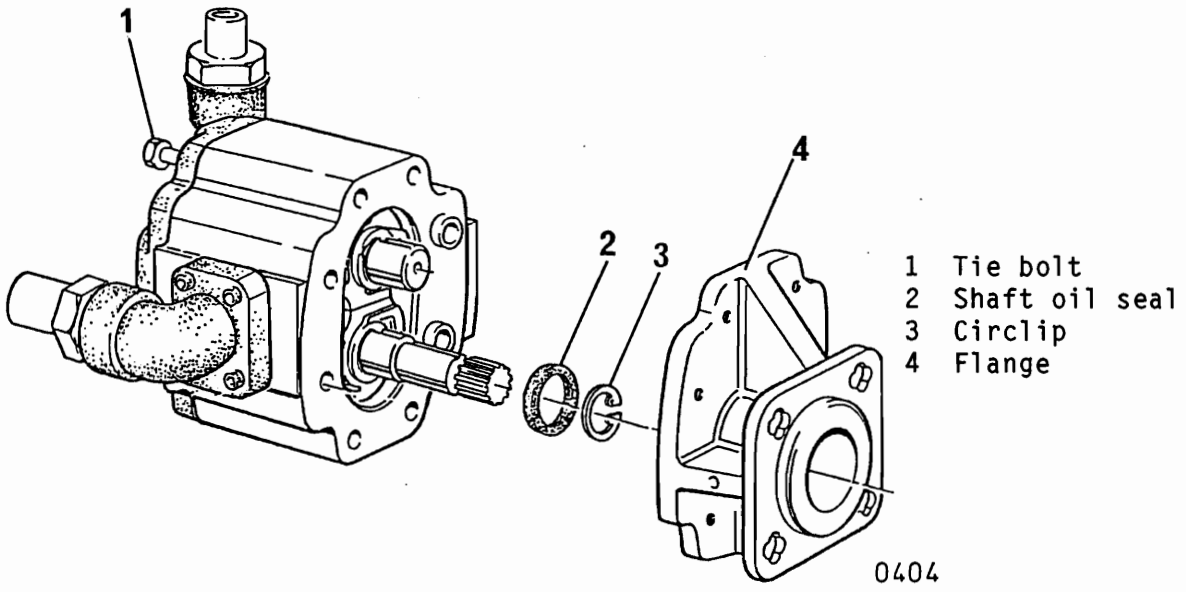


Fig 21 Pump drive shaft oil seal

29.2 Unscrew the eight hexagon headed tie bolts (1) from the threaded holes in the pump mounting flange and slide them out from the end cover.

29.3 Gently tap the mounting flange (4) clear of the two hollow dowels in the pump body and slide it squarely off the drive shaft.

29.4 Clamp the flange securely in a soft-jawed vice, remove the circlip (3) and drift out the seal (2), taking care not to damage the inner edge of the seal housing.

29.5 Clean the housing and remove any burrs. Refit the circlip into the housing recess.

29.6 Pack the space between the lips of the new seal with high melting-point grease (Table 2, item 4) and insert it in to the housing with the garter spring facing inwards. Press the seal into the full depth of the recess.

29.7 Place the flange in position on the pump body and align the marks previously made.

29.8 Feed the hexagon headed tie bolts through the end cover to engage the threads in the flange and screw in until finger tight.

29.9 Tighten the bolts in a diagonal sequence to pull the pump together squarely and finally apply a torque of 47-50 Nm (34-36 lbf.ft).

29.10 Pour a small quantity of hydraulic oil type OM33 (Table 2, item 3) into the ports and check the pump for freedom of rotation.

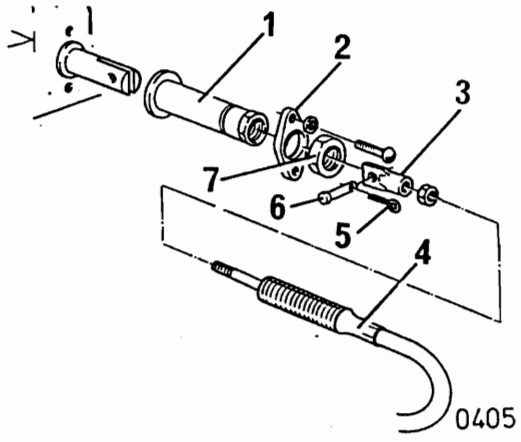
Refitting the hydraulic pump

30 The hydraulic pump and PTO must be fitted as one assembly as detailed in Para 23. Note that it is first necessary to separate the PTO gear housing and shifter cover as detailed in Para 22 in order to check the cluster gear backlash during the refitting process.

Removal of the valve control cable

31 To remove the valve control cable, proceed as follows :

31.1 Centralize the control lever and, at the control valve (Fig 22), release the locknut (7) securing the outer cable (4) to the adaptor (1).



1 Adaptor
2 Fixing plate
3 Cable connector
4 Cable
5 Cotter pin
6 Clevis pin
7 Locking nut

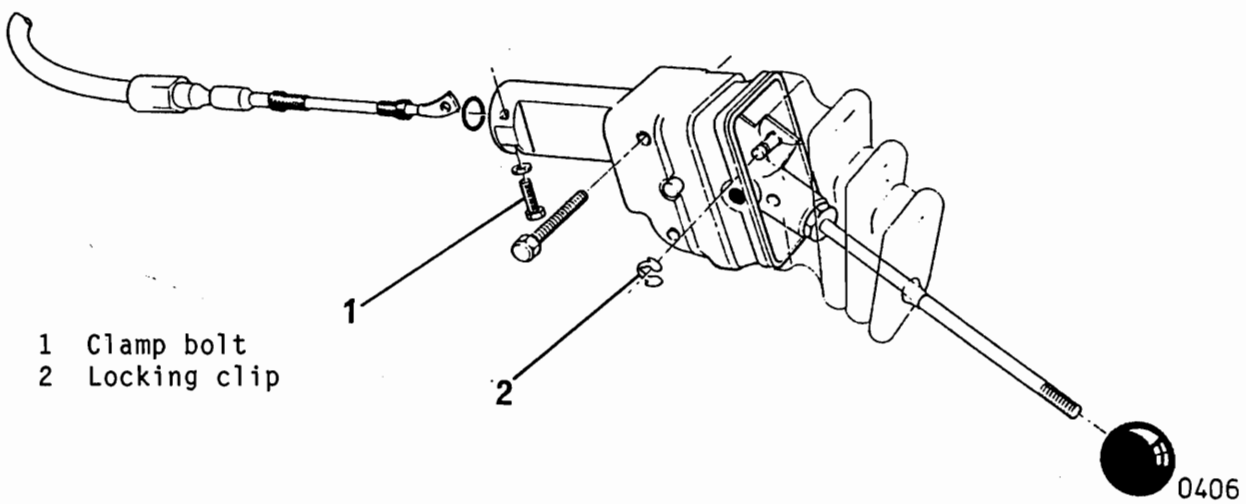
Fig 22 Control valve cable connections

31.2 Remove the two screws securing the adaptor fixing plate (2) to the valve body and screw the locknut and the adaptor along the outer cable to expose the valve spool end.

31.3 Remove the cotter pin (5) from the clevis pin (6) attaching the inner cable connector (3) to the spool end. Withdraw the clevis pin to release the cable from the valve.

31.4 If necessary, remove the adaptor, fixing plate and locknut from the cable assembly.

31.5 At the control lever (Fig 23), remove the knob, release the rubber gaiter from the casing and slide it off over the handle.



1 Clamp bolt
2 Locking clip

Fig 23 Control lever cable connections

31.6 Remove the clamp bolt (1) and plain washer locking the outer cable to the end of the lever casing.

31.7 Push the lever down to expose the cable connector post and remove the locking clip (2). Detach the inner cable from the post and slide it out from the lever casing.

31.8 Withdraw the cable, complete with grommet, through the hole in the floor of the cab.

Refitting the valve control cable

32 To refit the valve control cable, proceed as follows :

32.1 Feed the cable through the hole in the floor of the cab and fit the grommet.

32.2 At the control lever, slide the inner cable through the lever casing, push the lever down to expose the connector post and attach the end of the cable to the post. Insert the locking clip.

32.3 Slide the outer cable into position at the end of the lever casing and lock it using the bolt and plain washer.

32.4 Slide the rubber gaiter over the handle and fit it into position over the lever casing. Screw on the knob and centralize the control lever.

32.5 At the control valve, slide the fixing plate over the adaptor and screw the locknut and the adaptor onto the cable assembly as far as possible.

32.6 Position the inner cable connector in the valve spool end, insert the clevis pin and secure it with the cotter pin.

32.7 Screw the adaptor over the cable connector so that it butts up to the valve body.

32.8 Slide the fixing plate over the adaptor and secure it to the valve body using the two screws. Tighten the screws to a torque of 7-11 Nm (5-8 lbf.ft).

32.9 Lock the outer cable to the adaptor using the locknut.

Removal of the valve control lever

33 To remove the valve control lever, proceed as follows :

33.1 Carry out the procedures of Sub-paras 31.5, 31.6 and 31.7 to detach the cable from the control lever.

33.2 Remove the two M8 bolts (Fig 24) and locknuts securing the control lever to the mounting bracket and withdraw the lever.

33.3 If necessary, remove the four M6 bolts and locknuts securing the mounting bracket to the seat riser and withdraw the bracket.

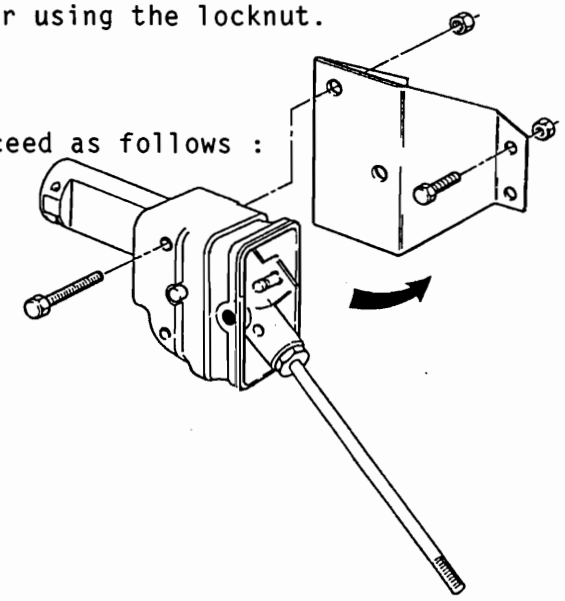


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Fig 24 Control lever mounting

Refitting the valve control lever

34 To refit the valve control lever, proceed as follows :

34.1 If necessary, secure the mounting bracket to the seat riser using the four M6 bolts and locknuts. Torque to 12 Nm (9 lbf.ft).

34.2 Secure the control lever to the mounting bracket with the two M8 bolts and locknuts. Torque to 30 Nm (22 lbf.ft).

34.3 Carry out the procedures of Sub paras 32.2, 32.3 and 32.4 to attach the cable to the control lever.

Removal of the pressure relief valve

35 The main pressure relief valve is part of the hydraulic control valve assembly. The relief valve may be removed with the control valve in situ. Proceed as follows :

35.1 Wash down and dry the exterior of the control valve assembly.

35.2 Place a clean container under the control valve to collect any oil spillage.

35.3 Either unscrew the valve body and withdraw the valve assembly complete (Fig 25) or, if required, dismantle the valve in situ as detailed in Para 36.

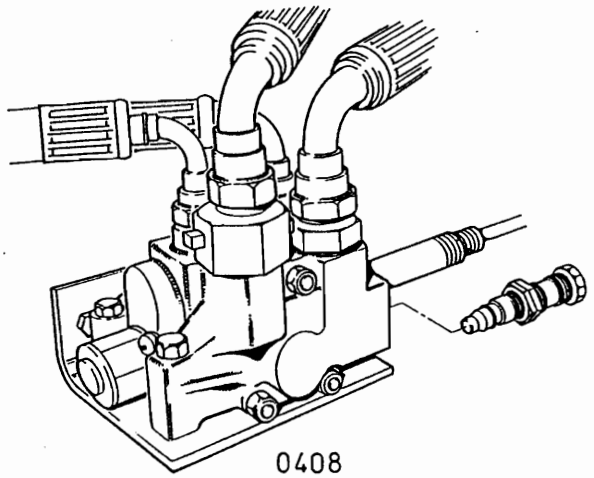

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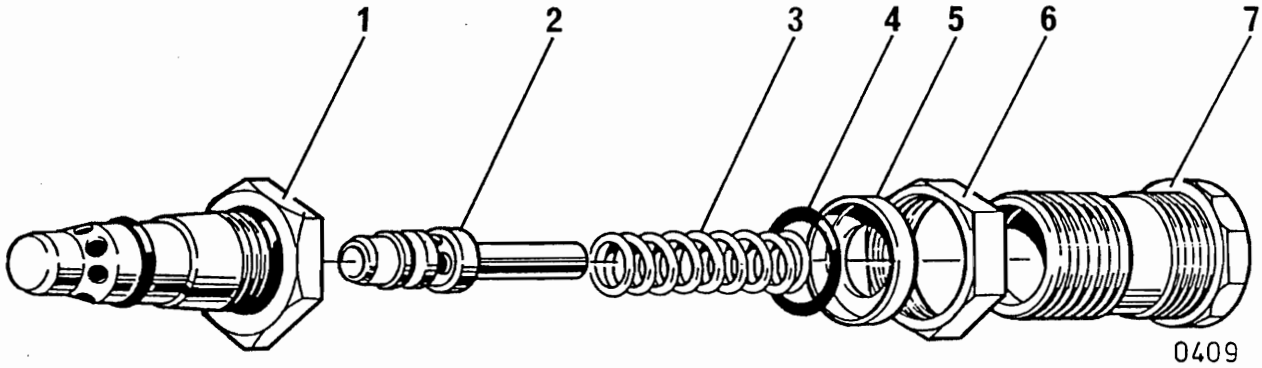
Fig 25 Pressure relief valve

Dismantling of the pressure relief valve

36 The components of the pressure relief valve (Fig 26) may be dismantled either with the complete valve assembly removed or with the valve body left in position. Proceed as follows :

36.1 Securely hold the larger hexagon on the valve body (1) and release the locking nut (6) on the valve spring cap adjuster (7).



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1 Valve body
2 Valve
3 Spring
4 'O' ring
5 Sealing washer
6 Locking nut
7 Cap adjuster

Fig 26 Pressure relief valve components

36.2 Unscrew and remove the cap adjuster complete with 'O' ring (4) and sealing washer (5).

36.3 Take out the poppet valve (2) complete with spring (3) and remove any foreign matter trapped on the valve seat.

Reassembly of the pressure relief valve

37 Reassembly is the reverse of dismantling. Clean and examine the spring, 'O' ring and sealing washer and replace as necessary. Clean and examine the valve poppet and the valve seat and if either is damaged, replace the complete valve assembly. Lubricate all parts with hydraulic oil type OM33 (Table 2, item 3) before reassembly.

Refitting the pressure relief valve

38 Refitting is the reverse of removal. Torque the valve to 14-20 Nm (10-15 lbf.ft) and screw the adjuster out. Set the valve relief pressure as detailed in Para 39.

Setting up the valve relief pressure

39 To set up the hydraulic valve relief pressure, proceed as follows :

39.1 Place a clean container under the hydraulic motor to collect any oil spillage.

39.2 Note their orientation and then disconnect the two hydraulic hoses at the motor. Plug one hose using a 1/2in BSP male plug and terminate the other with a pressure gauge (Table 1, item 1).

39.3 Top up the tank as detailed in Sub paras 6.3, 6.4 and 6.5.

39.4 Ensure that the locking nut on the relief valve spring cap adjuster is released and then start the engine.

39.5 Start the engine and operate the winch controls to register hydraulic pressure at the gauge.

CAUTION ...

Operate at a fast idle speed only. High engine RPM will cause flooding of the control valve and excessive pressure within the hydraulic system.

39.6 Allow the pressure to build up to around 69 bar and then screw in the cap adjuster until the moment the valve blows (ie the pressure registered on the gauge falls to approximately zero momentarily).

39.7 Check the pressure reading at which the valve operates :

39.7.1 If it is less than 69 bar, continue unscrewing the cap adjuster until the valve operates at around 69 bar.

39.7.2 If it is exactly 69 bar, lock the cap adjuster in this position.

39.7.3 If it is greater than 69 bar, reset the winch controls and allow the pressure to fall. Screw the cap adjuster out a little and then repeat the procedures of Sub paras 39.5 through 39.7.

Removal of the pressure relief valve

35 The main pressure relief valve is part of the hydraulic control valve assembly. The relief valve may be removed with the control valve in situ. Proceed as follows :

35.1 Wash down and dry the exterior of the control valve assembly.

35.2 Place a clean container under the control valve to collect any oil spillage.

35.3 Either unscrew the valve body and withdraw the valve assembly complete (Fig 25) or, if required, dismantle the valve in situ as detailed in Para 36.

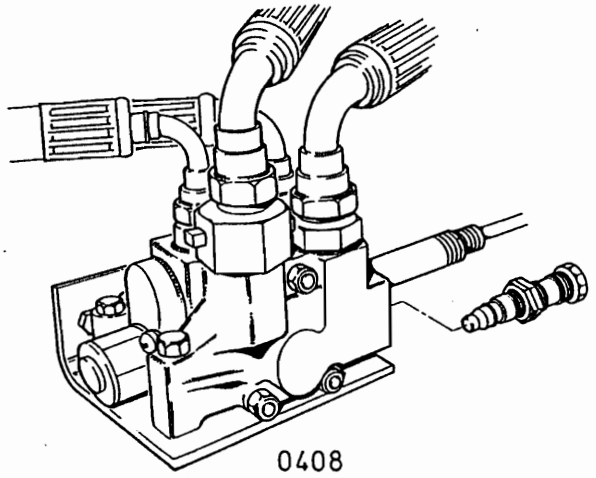

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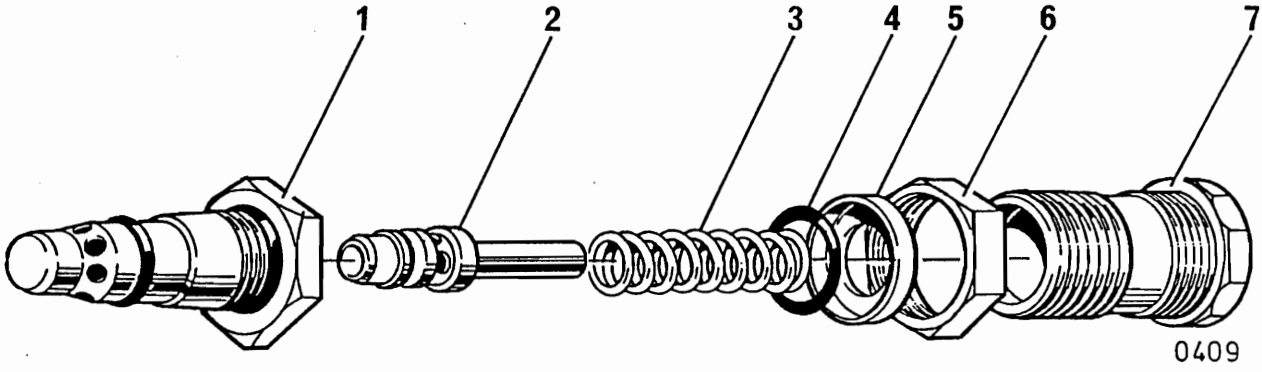
Fig 25 Pressure relief valve

Dismantling of the pressure relief valve

36 The components of the pressure relief valve (Fig 26) may be dismantled either with the complete valve assembly removed or with the valve body left in position. Proceed as follows :

36.1 Securely hold the larger hexagon on the valve body (1) and release the locking nut (6) on the valve spring cap adjuster (7).



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1 Valve body
2 Valve
3 Spring
4 'O' ring
5 Sealing washer
6 Locking nut
7 Cap adjuster

Fig 26 Pressure relief valve components

36.2 Unscrew and remove the cap adjuster complete with 'O' ring (4) and sealing washer (5).

36.3 Take out the poppet valve (2) complete with spring (3) and remove any foreign matter trapped on the valve seat.

Reassembly of the pressure relief valve

37 Reassembly is the reverse of dismantling. Clean and examine the spring, 'O' ring and sealing washer and replace as necessary. Clean and examine the valve poppet and the valve seat and if either is damaged, replace the complete valve assembly. Lubricate all parts with hydraulic oil type OM33 (Table 2, item 3) before reassembly.

Refitting the pressure relief valve

38 Refitting is the reverse of removal. Torque the valve to 14-20 Nm (10-15 lbf.ft) and screw the adjuster out. Set the valve relief pressure as detailed in Para 39.

Setting up the valve relief pressure

39 To set up the hydraulic valve relief pressure, proceed as follows :

39.1 Place a clean container under the hydraulic motor to collect any oil spillage.

39.2 Note their orientation and then disconnect the two hydraulic hoses at the motor. Plug one hose using a 1/2in BSP male plug and terminate the other with a pressure gauge (Table 1, item 1).

39.3 Top up the tank as detailed in Sub paras 6.3, 6.4 and 6.5.

39.4 Ensure that the locking nut on the relief valve spring cap adjuster is released and then start the engine.

39.5 Start the engine and operate the winch controls to register hydraulic pressure at the gauge.

CAUTION ...

Operate at a fast idle speed only. High engine RPM will cause flooding of the control valve and excessive pressure within the hydraulic system.

39.6 Allow the pressure to build up to around 69 bar and then screw in the cap adjuster until the moment the valve blows (ie the pressure registered on the gauge falls to approximately zero momentarily).

39.7 Check the pressure reading at which the valve operates :

39.7.1 If it is less than 69 bar, continue unscrewing the cap adjuster until the valve operates at around 69 bar.

39.7.2 If it is exactly 69 bar, lock the cap adjuster in this position.

39.7.3 If it is greater than 69 bar, reset the winch controls and allow the pressure to fall. Screw the cap adjuster out a little and then repeat the procedures of Sub paras 39.5 through 39.7.

39.8 Reset the winch controls and stop the engine. Remove the pressure gauge and plug and then reconnect the hoses to the hydraulic motor in the correct orientation.

39.9 Top up the tank as detailed in Sub paras 6.3, 6.4 and 6.5.

Removal of the hydraulic control valve assembly

40 To remove the hydraulic control valve, proceed as follows:

40.1 Wash down and dry the exterior of the control valve assembly.

40.2 Place a clean container under the control valve to collect any oil spillage.

40.3 Disconnect and plug the four hydraulic hose connections to the control valve. Note the orientation of the four connections.

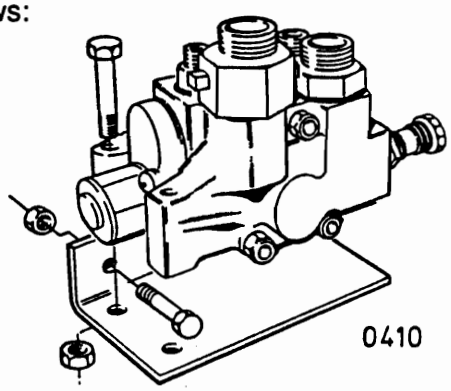


Fig 27 Control valve mounting

40.4 Carry out the procedures of Sub paras 31.1, 31.2 and 31.3 to detach the control cable from the valve.

40.5 Remove the three locknuts and bolts securing the valve to the mounting bracket (Fig 27) and withdraw the assembly from the vehicle.

40.6 If necessary, remove the two bolts and locknuts securing the mounting bracket to the chassis and withdraw the bracket.

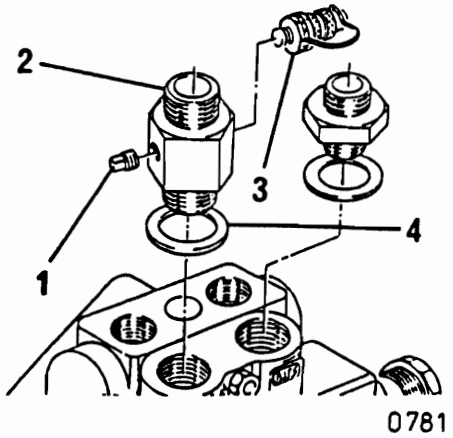
Dismantling of the control valve and fittings

41 To dismantle the control valve and fittings, proceed as follows:

41.1 Clamp the control valve in a soft-jawed vice, and, if necessary unscrew and remove the pressure plug (Fig 28 (1)(and the test point (Fig 28 (3)) from the extended adaptor at the input port.

41.2 Unscrew and remove the four hose adaptors (2), with sealing washers (3), from the valve.

41.3 Unclamp and withdraw the valve complete.



1 Pressure plug
2 Hose adaptor
3 Test point
4 Sealing washer

Fig 28 Control valve fittings

71711(104)
Apr 92 (Amdt 1)

Reassembly of the control valve and fittings

42 Reassembly is the reverse of dismantling. If necessary, remove all traces of the old sealing compound from the threads of the hose adaptors and apply pipe sealant (Table 2, item 1) before reassembly. Replace the sealing washers as necessary.

Refitting the hydraulic control valve assembly

43 To refit the hydraulic control valve assembly, proceed as follows:

43.1 If necessary, secure the mounting bracket to the chassis using the two shorter M10 bolts and locknuts. Torque to 58 Nm (43 lbf ft).

43.2 Secure the control valve to the mounting bracket using the three longer M10 bolts and locknuts. Torque to 58 Nm (43 lbf ft).

43.3 Carry out the procedures of Sub paras 32.5 to 32.9 inclusive to attach the control cable to the valve.

43.4 Reconnect the four hydraulic hoses to the adaptors in the correct orientation.

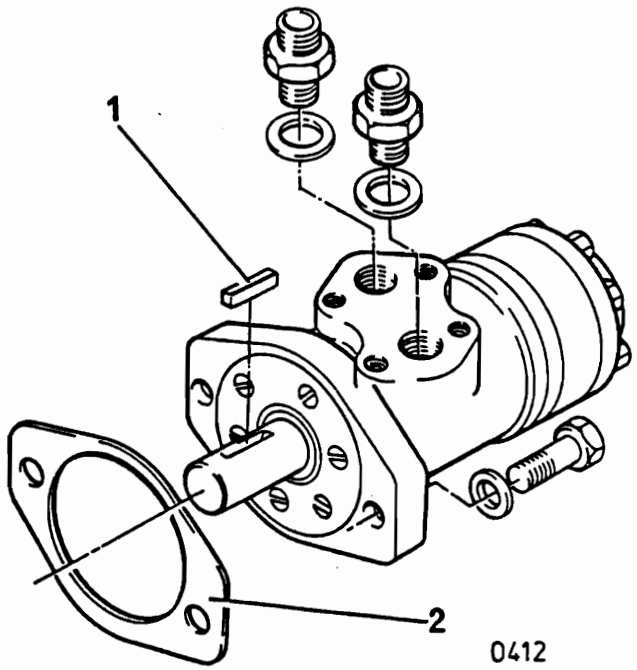
43.5 Top up the tank as detailed in Sub paras 6.3, 6.4 and 6.5.

Removal of the hydraulic motor assembly

44 To remove the hydraulic motor (Fig 29), proceed as follows:

44.1 Place a clean container under the motor to collect any oil spillage.

44.2 Disconnect and blank off the two hydraulic hose connections to the motor. Note the orientation of the connectors.



1 Drive shaft key
2 Flange gasket

Fig 29 Hydraulic motor and fittings

44.3 Remove the two bolts and lockwashers securing the motor flange to the gearcase and withdraw the motor complete with drive shaft key and flange gasket.

Dismantling of the motor and fittings

45 To dismantle the motor and fittings (Fig 29), clamp the motor in a soft-jawed vice and then unscrew and remove the two hose adaptors (1), with sealing washers (2), from the motor ports.

Reassembly of the motor and fittings

46 Reassembly is the reverse of dismantling. If necessary, remove all traces of the old sealing compound from the threads of the hose adaptors and apply pipe sealant (Table 2, item 1) before reassembly. Replace the sealing washers as necessary.

Refitting the hydraulic motor assembly

47 To refit the hydraulic motor assembly, proceed as follows :

47.1 If necessary, renew the flange gasket.

47.2 Ensure that the drive shaft key is in position, fit the gasket and locate the motor on the gearcase with its ports uppermost.

47.3 Secure the motor flange to the gearcase using the two bolts and lockwashers. Torque the mounting bolts to 41-48 Nm (30-35 lbf.ft).

47.4 Reconnect the two hydraulic hoses to the adaptors in the correct orientation.

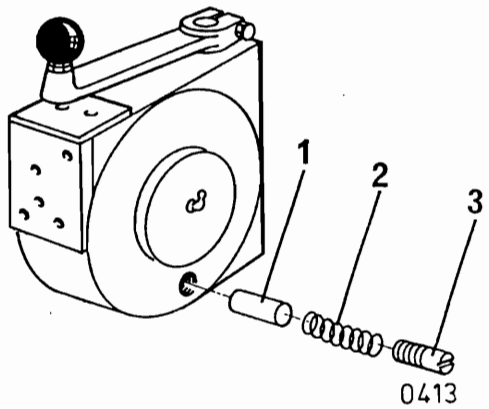
47.5 Top up the tank as detailed in Sub paras 6.3, 6.4 and 6.5.

Removal of the drum brake pad

48 To remove the drum brake pad (Fig 30), unscrew and remove the brake adjusting screw (3) from the clutch end cover and then withdraw the compression spring (2) and brake pad (1)

Note ...

It may be necessary to spike the end of the nylon brake pad, with the end of a screwdriver for example, in order to withdraw it from the cover.



1 Nylon pad
2 Compression spring
3 Adjustment screw

Fig 30 Drum brake pad

Refitting and adjusting the drum brake pad

49 Refitting is the reverse of removal. Replace the brake pad and compression spring as necessary, ensure that the dog clutch is disengaged and then screw in the brake adjuster until resistance is felt when the drum is turned by hand. Check that the drum does not 'overrun' when the rope is paid out manually.

Removal of the dog clutch lever

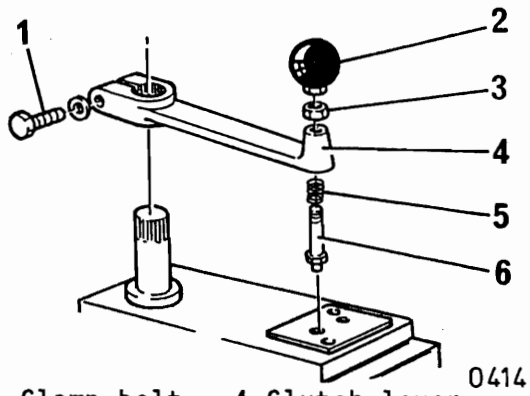
50 To remove the dog clutch lever (Fig 31), proceed as follows :

50.1 Note the position of the lever (engaged or disengaged).

50.2 Release the lever clamping bolt (1) and pull the lever off the selector shaft.

Note ...
It may be necessary to gently prise open the split end of the lever in order to free it from the shaft.

50.3 Grip the locking nut (3) on top of the lever and unscrew and remove the moulded knob (2).



1 Clamp bolt 4 Clutch lever
2 Moulded knob 5 Compression spring
3 Locking nut 6 Selector pin

Fig 31 Dog clutch lever

50.4 Unscrew and remove the selector pin (6) complete with compression spring (5) and withdraw the clutch lever (4).

Refitting the dog clutch lever

51 Refitting is the reverse of removal. Replace parts as necessary. Before locking, adjust the selector pin to give sufficient movement against the spring to clear the detent plate when raised. Ensure that the lever is fitted in the position previously noted in Sub para 50.1.

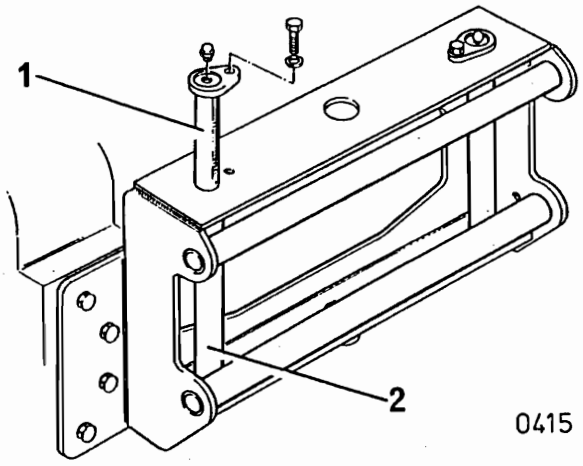
Removal of the fairlead rollers

52 Any one of the four fairlead rollers (Fig 32) may be removed in situ. Proceed as follows :

52.1 Remove the front bumper as detailed in Chapter 15.

52.2 Unscrew and remove the bolt and lockwasher securing the roller pin (1) to the fairlead frame.

52.3 Tap the end of the pin to release it from the frame and then withdraw the pin and remove the roller (2).



1 Pin 2 Roller

Fig 32 Fairlead assembly

Refitting the fairlead rollers

53 Refitting is the reverse of removal. Check the condition of the grease nipples and replace if required. Apply grease (Table 2, item 5) and check that the rollers rotate freely.

Removal of the fairlead assembly

54 To remove the fairlead assembly (Fig 33), proceed as follows :

54.1 Remove the front bumper as detailed in Chapter 15.

54.2 Remove the eight bolts and spring washers securing the fairlead assembly to the winch unit (four at the gearcase and four at the dog clutch).

54.3 Withdraw the fairlead assembly.

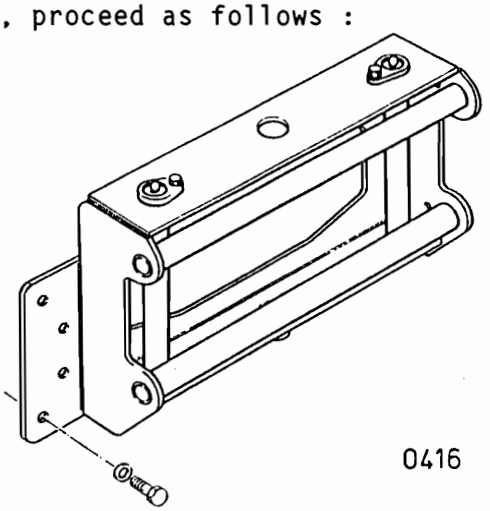


Fig 33 Fairlead assembly mounting

Refitting the fairlead assembly

55 Refitting is the reverse of removal. Torque the mounting bolts to 41-48 Nm (30-35 lbf.ft).

Draining the winch unit gearcase

56 The winch unit gearcase has a capacity of approximately 2.5 litres and is filled with hydraulic oil type OMD80. To drain the gearcase of oil, proceed as follows :

56.1 Place a clean container under the winch unit gearcase.

56.2 Remove the drain plug and allow the oil to drain completely.

Refilling the winch unit gearcase

57 To refill the winch unit gearcase, proceed as follows :

CAUTION ...

Use a clean container and clean oil when filling the gearcase.

57.1 Refit the drain plug. Remove the filler plug from the top of the gearcase and the level plug from the cover.

57.2 Pour in hydraulic oil type OMD80 (Table 2, item 6) until it reaches the level of the hole in the cover.

57.3 Replace the level and filler plugs.

57.4 Operate the winch (Cat 2) and visually check for any oil leaks.

Removal of the gearcase cover and gasket

58 To remove the gearcase cover and gasket (Fig 34), proceed as follows :

58.1 Remove the front bumper as detailed in Chapter 15.

58.2 Drain the gearcase as detailed in Para 56.

58.3 Remove the 15 bolts and spring washers securing the cover to the gearcase.

58.4 Insert two of the bolts into the tapped holes in the cover (one at the top, the other at the bottom) and screw them in evenly, against the gearcase, in order to break the seal and draw off the cover.

58.5 Remove the bolts, withdraw the cover from the dowel pins and remove the gasket.

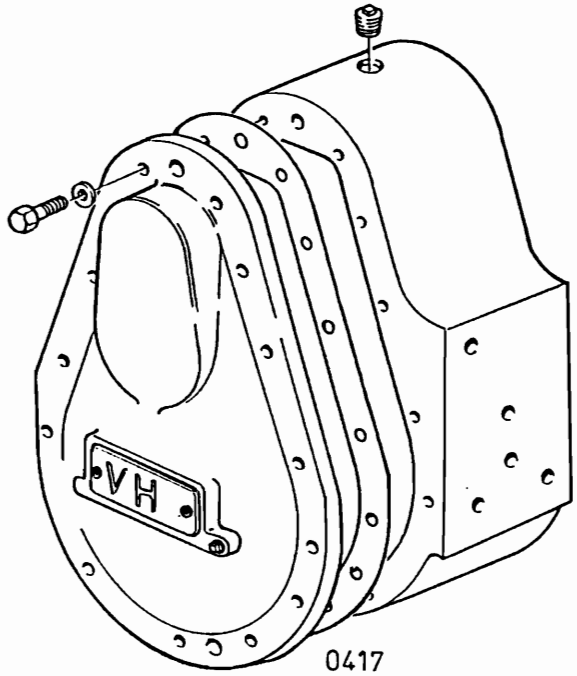


Fig 34 Gearcase cover gasket

Refitting the gearcase cover and gasket

59 To refit the gearcase cover and gasket, proceed as follows :

59.1 Replace the gasket and apply sealing compound (Table 2, item 7) to both sides before fitting. If necessary, remove all traces of old sealing compound from the cover and gearcase.

59.2 Fit the gasket over the dowel pins on the gearcase and then line up the bearing parts in the cover with those in the gearcase. Locate the cover over the dowel pins.

59.3 Fit the bolts and spring washers and tighten in a diagonal sequence to pull the cover on squarely and finally apply a torque of 20-25 Nm (15-18 lbf.ft).

59.4 Refill the gearcase with oil as detailed in Para 57.

Removal of the dog clutch assembly

60 To remove the dog clutch assembly (Fig 35), proceed as follows :

WARNING ...

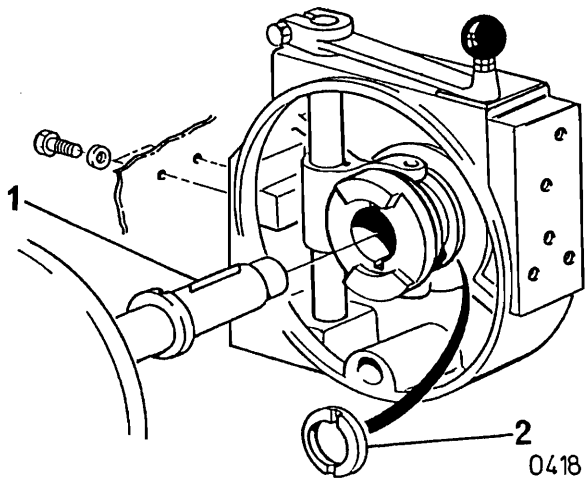
ENSURE THAT PROTECTIVE GLOVES ARE WORN WHEN HANDLING THE WIRE ROPE

60.1 Remove the fairlead assembly as detailed in Para 54.

60.2 Disengage the dog clutch and pay out the rope fully. Release the rope anchor and withdraw the rope from the drum.

60.3 Support the weight of the dog clutch assembly and remove the four bolts, with split washers, securing it to the winch mounting bracket.

60.4 Carefully separate the dog clutch assembly from the drum shaft (1) and retrieve the spacing collar (2). Slide the assembly away from the drum and remove it from the winch unit.



1 Drum shaft 2 Spacing collar

Fig 35 Dog clutch assembly

Renewing the dog clutch

61 To renew the clutch sliding member and ring (Fig 36), proceed as follows :

61.1 Remove the dog clutch assembly as detailed in Para 60 and withdraw the dog clutch (1) from the yoke pins.

61.2 Locate the new dog clutch in the yoke and refit the dog clutch assembly as detailed in Para 63.

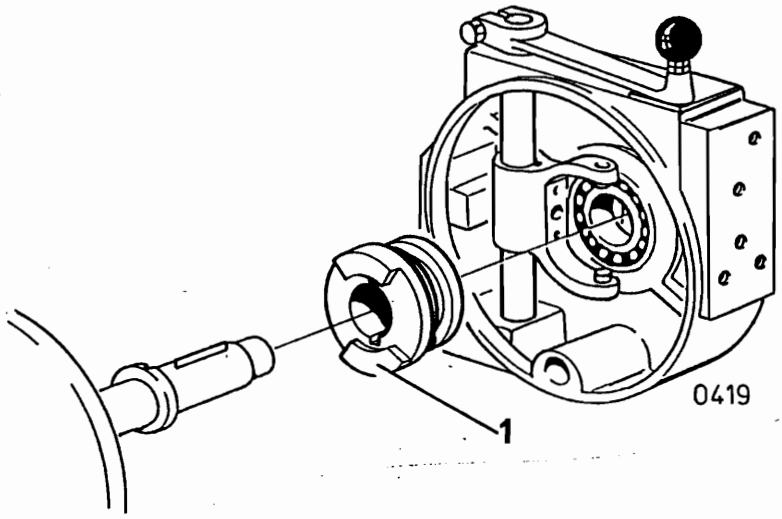


Fig 36 Clutch sliding member and ring

Renewing the gearcase oil seal

62 To renew the gearcase oil seal (Fig 37), proceed as follows :

62.1 Drain the winch unit gearcase as detailed in Para 56.

62.2 Remove the dog clutch assembly as detailed in Para 60.

62.3 Remove the drum shaft key and the remaining spacing collar and then slide the drum off the shaft.

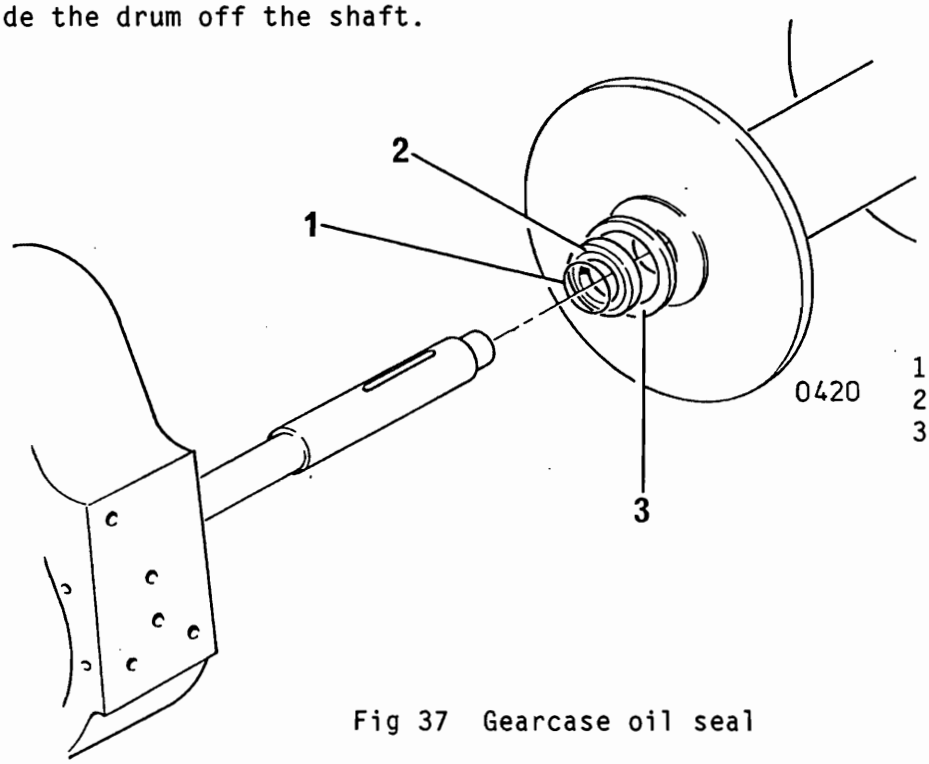


Fig 37 Gearcase oil seal

62.4 Remove the drum spacer (2) and 'O' ring (1) from the shaft and prise out the oil seal (3) from the gearcase, taking care not to damage the seal housing.

62.5 Insert the new oil seal into the gearcase with the garter spring facing inwards. Press the seal in to the full depth of the recess.

62.6 Replace the 'O' ring. Fit the new 'O' ring and the drum spacer over the shaft.

62.7 Slide the drum onto the shaft and check that it rotates freely.

62.8 Fit a spacing collar and then the drum shaft key. Refit the dog clutch assembly as detailed in Para 63.

62.9 Refill the winch unit gearcase as detailed in Para 57.

Refitting the dog clutch assembly

63 To refit the dog clutch assembly, proceed as follows :

63.1 Ensure that the drum shaft key is in position and apply anti-seize compound (Table 2, item 8) to the shaft and the dog clutch.

63.2 Raise the selector pin and move the lever past the engaged position of the detent plate so that the dog clutch extends beyond the clutch cover.

63.3 Lift the assembly up to the shaft and locate the dog clutch over the shaft key. Check that the dog clutch moves freely over the key.

63.4 Fit the spacing collar and then slide the end cover onto the shaft to meet the drum.

Note ...
Raise the selector pin to clear the detent plate as the assembly is pushed into position.

63.5 Fit the four mounting bolts with split washers and torque to 66-72 Nm (48-52 lbf.ft).

63.6 Check the operation of the clutch lever.

63.7 Check the condition of the drum grease nipples and replace if required. Apply grease (Table 2, item 5) and check that the drum rotates freely.

63.8 Refit the fairlead assembly as detailed in Para 55 and coil on the rope (Cat 2).

Removal and refitting the winch rope

WARNING ...

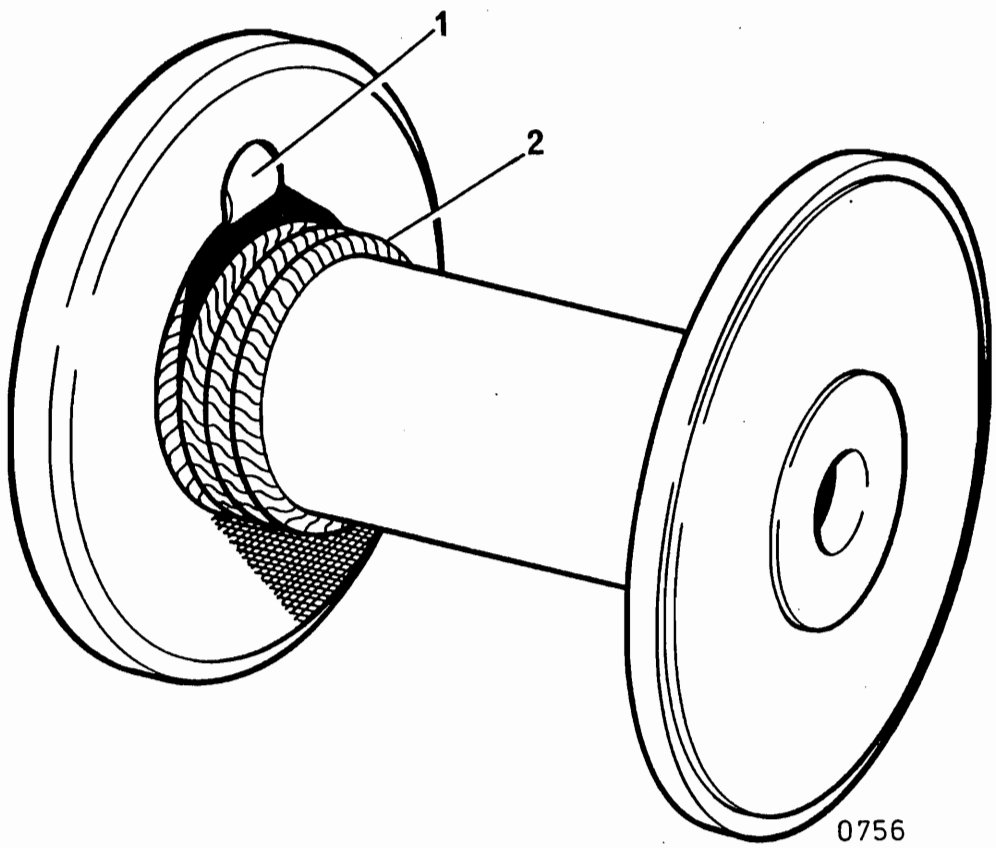
WHEN HANDLING WINCH ROPE WEAR PROTECTIVE GLOVES DURING OPERATIONS. KEEP HANDS CLEAR OF THE DRUM AND FAIRLEAD ROLLERS. ENSURE ALL PERSONNEL ARE CLEAR OF THE WINCH DANGER AREA WHILST THE CABLE IS UNDER TENSION.

64 To remove and refit the winch rope, proceed as follows :-

64.1 Disengage the winch dog clutch and pull the winch rope off the drum. When the rope has been pulled off the drum the ferrule at the end of the rope can be pulled out of the recess in the side the drum.

64.2 Feed the winch rope ferrule end first through the bumper and fairleads and fit the ferrule into the recess in the side of the drum tightly; feed three or four turns of the rope onto the drum to trap the ferrule in the recess.

64.3 Engage the winch dog clutch and carefully feed the rope under tension onto the drum. Ensure that the rope lays evenly from side to side and layer on layer on the drum.



1 Ferrule 2 Winch rope

Fig 38 Fixing winch rope to drum

Removal of the winch unit and fairlead assembly

WARNINGS ...

(1) ENSURE THAT PROTECTIVE GLOVES ARE WORN WHEN HANDLING THE WIRE ROPE.

(2) HEAVY EQUIPMENT. THE WINCH UNIT AND FAIRLEAD ASSEMBLY WEIGHS TBA WITH THE ROPE REMOVED. THEREFORE SUITABLE LIFTING APPARATUS MUST BE USED TO SUPPORT THE UNIT WHILST REMOVING IT FROM THE CHASSIS.

65 To remove the winch unit and fairlead assembly, proceed as follows :

65.1 Remove the front bumper as detailed in Chapter 15.

65.2 Disengage the dog clutch and pay the rope out fully. Release the rope anchor plate and withdraw the rope from the drum.

65.3 Place a clean container under the hydraulic motor to collect any oil spillage.

65.4 Disconnect and plug the two hydraulic hose connections to the motor. Note the orientation of the connectors.

65.5 Use suitable lifting apparatus to support the weight of the winch unit and fairlead assembly and then remove the eight bolts with split washers securing it to the mounting bracket (four on the gearcase and four on the dog clutch).

65.6 Withdraw the winch unit and fairlead assembly.

Refitting the winch unit and fairlead assembly

66 Refitting is the reverse of removal. Torque all mounting bolts to 66-72 Nm (48-52 lbf.ft) and top up the tank as detailed in Sub paras 6.3, 6.4 and 6.5.

TESTING AFTER REPAIR OR REASSEMBLY

67 The winch assembly is to be tested after repair or re-assembly according to EMER Test and Management A028 Chap 157.