Ministry of Defence

Army Equipment Support Publication

Truck Utility Light (TUL) HS, Truck Utility Medium (TUM) HS and (TUM) Ambulance HS All Variants

2320-D-128-522

3rd Edition January 2009

Sponsored for use in the
United Kingdom Ministry of Defence
and Armed Forces by: Operational Support Vehicle Programme (OSVP)

Publication Authority: Docuneering Ltd.

Business Solutions Team
PO Box 4254
Melksham
SN12 9BL

Service users should send their comments through the channel prescribed for the purpose by the publication sponsor.

AMENDMENT RECORD

Edition No. 1					
Amdt No.	**Chap**	**Page**	**Para**	**Incorporated By (Signature)**	**Date**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

PAGE LEFT INTENTIONALLY BLANK

CONTENTS

PRELIMINARY MATERIAL

PREFACE

Sponsor:	Operational Support Vehicles Programme (OSVP)
File Ref:	D/DGES(A) 548/3/4
Project Number:	ES52c/4356
Publication Authority:	DES-LE-OSP-OSVP

INTRODUCTION

1 Service users should forward any comments on this publication through the channels prescribed in AESP 0100-P-011-013. An AESP Form 10 is provided after the preliminary pages of this publication; it should be photocopied and used for forwarding comments on this AESP.

2 AESPs are issued under Defence Council authority and where AESPs specify action to be taken, the AESP will of itself be sufficient authority for such action and also for demanding of the necessary stores, subject to the provisions of Para 3 below.

3 The subject matter of this publication may be affected by Defence Council Instructions (DCIs), Standing Operating Procedures (SOPs) or by local regulations. When any such instruction, order or regulation contradicts any portion of this publication it is to be taken as the overriding authority.

EQUIPMENT IDENTITY

4 The details are listed in Table 1.

Serial No.	NOMENCLATURE	NSN	ASSET CODE
1.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (Non EEGR)	2310-99-893-9746	NB 1047 3100
2.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (EEGR)	2310-99-893-9971	NB 1047 3101
3.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (Non EEGR) with Medical Monitoring IK	2310-99-908-6496	NB 1047 3102
4.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (Non EEGR with Bowman NH	2310-99-908-6890	NB 1047 3160
5.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman NH	2310-99-908-6891	NB 1047 3161
6.	Ambulance Battlefield (HS) 4 Stretcher LHD 4x4 Land Rover 2.5 Tdi (EEGR)	2310-99-893-9970	NB 1047 8100
7.	Ambulance Battlefield (HS) 4 Stretcher LHD 4x4Land Rover 2.5 Tdi (EEGR) with Bowman NH	2310-99-908-6892	NB 1047 8160
8.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (EEGR) Semi Water (Proofed for 600mm Depth)	2310-99-908-5445	NB 1048 3100
9.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (EEGR) Semi Water (Proofed for 600mm Depth) with Bowman NH	2310-99-908-6893	NB 1048 3160
10.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (EEGR)Tropical	2310-99-908-5446	NB 1049 3100

(continued)

Serial No.	NOMENCLATURE	NSN	ASSET CODE
11.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (EEGR)Tropical with Medical Monitoring IK	2310-99-908-6497	NB 1049 3101
12.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (Non EEGR)Tropical with Medical Monitoring IK	2310-99-908-6550	NB 1049 3102
13.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (EEGR) Desert with Medical Monitoring IK	2310-99-908-6705	NB 1049 3103
14.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (Non EEGR) Desert with Medical Monitoring IK	2310-99-908-6706	NB 1049 3104
15.	Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (EEGR)Tropical with Bowman NH	2310-99-908-6894	NB 1049 3160
16.	Etc.	Etc.	Etc.

5 Manufacturer:

5.1 Land Rover, Solihull, England

RELATED AND ASSOCIATED PUBLICATIONS

Related publications

6 The Octad for the subject equipment consists of the publications shown opposite. All references are prefixed with the first eight digits of this publication. The availability of the publications can be checked by reference to the relevant Group Index (see AESP 0100-A-001-013).

Category/Subcategory			Information Level			
			1 User/ Operator	2 Unit Maintenance	3 Field Maintenance	4 Base Maintenance
1	0	Purpose and Planning Information	101	*	*	*
	1	Equipment Support Policy Directive	111	*	*	*
2	0	Operating Information	201	*	*	*
	1	Aide-Memoir	*	*	*	*
	2	Training Aids	*	*	*	*
3	0	Technical Description	201	302	*	*
4	1	Installation Instructions	*	*	*	*
	2	Preparation for Special Environments	*	*	*	*
5	1	Failure Diagnosis	*	512	512	*
	2	Maintenance Instructions	*	522	523	524
	3	Inspection Standards	*	532	532	533
	4	Calibration Procedures	*	*	*	*
6	0	Maintenance Schedule	601	*	*	*
7	1	Illustrated Parts Catalogue	711	*	*	*
	2	Commercial Parts List	721	*	*	*
	3	Complete Equipment Schedule, Production	731	*	*	*
	4	Complete Equipment Schedule, Service Edition (Simple Equipment)	741	*	*	*
	5	Complete Equipment Schedule, Service Edition (Complex Equipment)	751	*	*	*
8	1	Modification Instructions	*	*	*	*
	2	General Instructions, Special Technical Instructions and Servicing Instructions	*	*	*	*
	3	Service Engineered Modification Instructions (RAF only)	*	*	*	*

*Category / Subcategory not published.

Associated publications

7 The Octad for the subject equipment consists of the publications shown overleaf. All references are prefixed with the first eight digits of this publication. The availability of the publicatians can be checked by reference to the relevant Group Index (see AESP 0100-A-001-013).

Reference	Title
JSP 341	Road Transport Regulations
AP 3260 Book 1	Mechanical Transport Maintenance Regulations for the Royal Air Force
AESP 2610-A-409 Octad	Pneumatic tyres, tubes, associated roadwheels

WARNINGS

(1) HAZARDOUS SUBSTANCES. BEFORE USING ANY HAZARDOUS SUBSTANCE OR MATERIAL, THE USER MUST BE CONVERSANT WITH THE SAFETY PRECAUTIONS AND FIRST AID INSTRUCTIONS DETAILED ON ITS CONTAINER, THE RELEVANT SAFETY DATA SHEET AND IN LOCAL SAFETY ORDERS AND REGULATIONS.

(2) VENTILATION. EXHAUST FUMES ARE HIGHLY TOXIC. WHEN UNDERTAKING REPAIR OPERATIONS THAT REQUIRE THE ENGINE TO BE RUN, ALWAYS ENSURE THAT EXHAUST EXTRACTION EQUIPMENT IS USED, OR THAT THE WORK AREA HAS ADEQUATE VENTILATION.

(3) WORKING UNDER A VEHICLE. WHEN WORKING ON A VEHICLE THAT IS JACKED UP, ALWAYS ENSURE THAT IT IS ADEQUATELY SUPPORTED BY AXLE STANDS OR BLOCKS. NEVER VENTURE UNDER A VEHICLE THAT IS SOLEY SUPPORTED BY JACKS.

PAGE LEFT INTENTIONALLY BLANK

CHAPTER 1

ENGINES

CONTENTS

INTRODUCTION

1 This chapter details the Unit repair of the engine systems as fitted to Truck Utility Light (TUL) HS and Truck Utility Medium (TUM) HS and (TUM) Ambulance HS vehicles.

General

2 This chapter has been sub-chaptered to allow for the various types of vehicle engines as detailed below.

2.1 Chapter 1-1 Engine.

2.2 Chapter 1-2 Winter/water.

2.3 Chapter 1-3 Tropicalised

PAGE LEFT INTENTIONALLY BLANK

CHAPTER 1-1

2.5 LITRE 300TDI DIRECT INJECTED DIESEL ENGINE

CONTENTS

(continued)

CONTENTS (continued)

INTRODUCTION

1 This chapter details the Unit repairs for Truck Utility Light (HS), Truck Utility Medium (HS), and Field Ambulance (HS) vehicles with 2.5 Litre 300 Tdi direct injected turbocharged diesel engines.

ENGINE

TORQUE LIST

Cylinder head bolts	40 Nm/29 lbf ft
Rocker shaft retaining nuts and bolts	25 Nm/18 lbf ft
Tappet adjusting screw locknut	16 Nm/12 lbf ft
Rocker cover nuts	10 Nm/7 lbf ft
Inlet manifold nuts and bolts	25 Nm/18 lbf ft
Exhaust manifold nuts	45 Nm/ lbf ft
Thermostat housing to cylinder head	25 Nm/18 lbf ft
Heater plugs	20 Nm/15 lbf ft
Crankcase ventilator	9 Nm/7 lbf ft
Crankshaft pulley bolt	80 Nm/59 lbf ft +90°
Fan pulley to adaptor on timing cover	25 Nm/18 lbf ft
Auto tensioner to mounting bracket	45 Nm/33 lbf ft
Sump securing bolts	25 Nm/ lbf ft
Sump drain plug	35 Nm/26 lbf ft
Oil filter head	45 Nm/33 lbf ft
Oil temperature control valve	9 Nm/7 lbf ft
Oil drain pipe to cylinder block	25 Nm/18 lbf ft
Fuel injection pump support bracket to cylinder block	25 Nm/18 lbf ft

NOTE

The special tools listed in the following table will be referred to in the text, where used, by the serial number shown in the table.

TABLE 1 SPECIAL TOOLS

Serial (1)	Manufacturers Part Number (2)	NSN/Part Number where applicable (3)	Designation (4)
1	LRT-12-501	6MT2/5120-99-726-2735	Handle set - valve seat cutter
2	LRT-12-505	6MT2/5120-99-808-5919	Valve seat cutter - Inlet
3	LRT-12-007	6MT2/5120-99-301-4247	Cylinder head bolt degree plate
4	LRT-12-080	6MT2/5120-99-662-7366	Crankshaft pulley retainer

TABLE 2 SEALANTS, ADHESIVES AND LUBRICANTS

Serial (1)	Product (2)	NSN/Part Number where applicable (3)	Designation (4)
1	OX90	9510-99-361-7232	Engine oil
2	RTV	8030-99-224-6527	Black sealant

ENGINE MOUNTING BRACKETS

REMOVAL

2 To remove the engine mounting brackets proceed as follows:

2.1 Using a suitable hoist, fit chains to lifting brackets, and support engine.

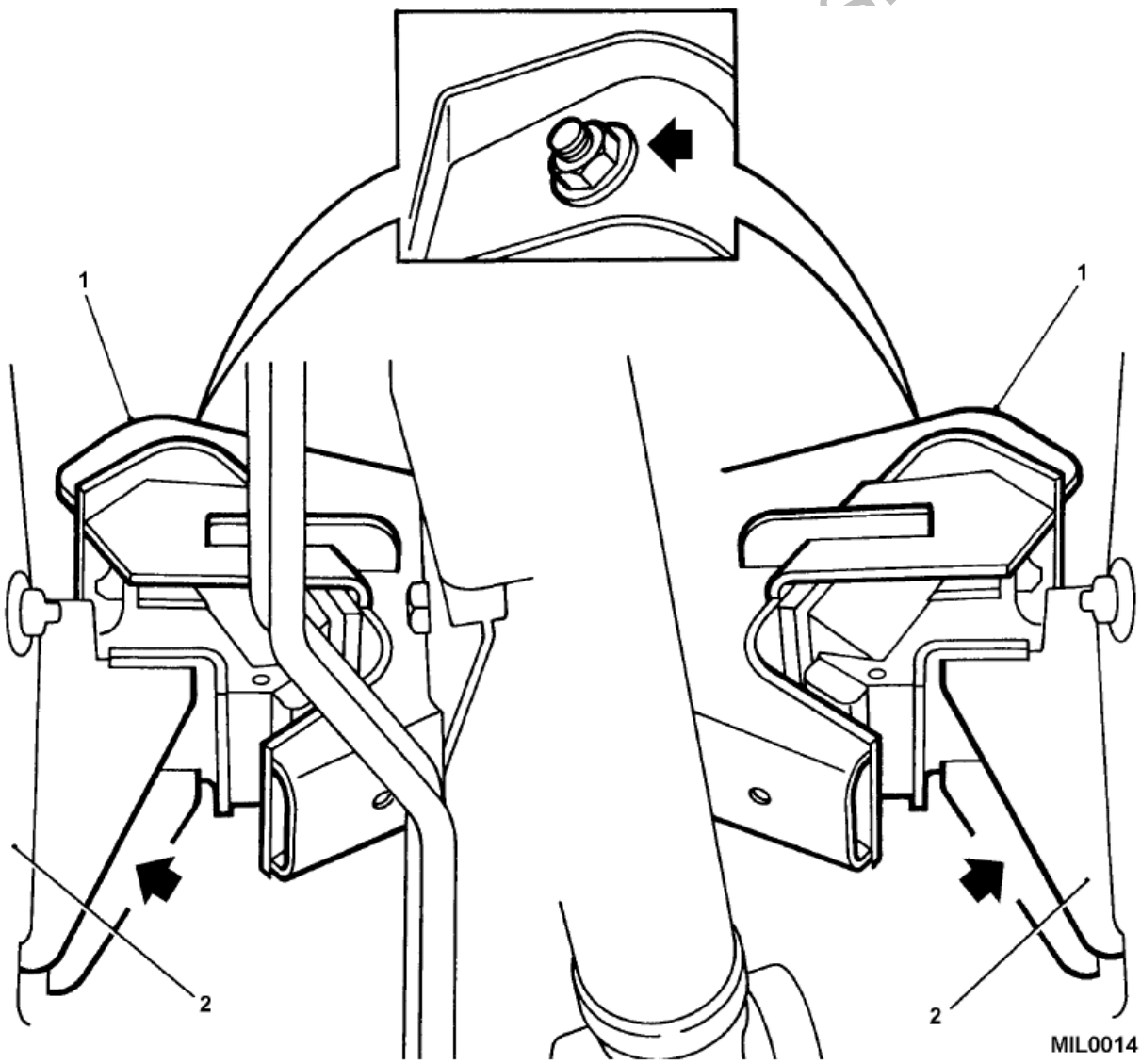
2.2 Remove the fixings securing the front engine mountings (Fig 1 (1)) to the chassis (2).

2.3 Remove the fixings securing the mountings to the engine.

2.4 Remove the mountings.

REFITTING

3 To refit the mounting brackets is the reverse of the removal procedure.



1 Engine mounting 2 Chassis

Fig 1 Engine Mountings

CYLINDER HEAD ASSEMBLY

PREPARATION FOR REMOVAL

4 Before the cylinder head can be removed the following ancillary items must be removed for access and safety:

4.1 Disconnect the vehicle batteries (refer to Chap 13-1) and on Fitted for Radio (FFR) vehicles the radio batteries (refer to Chap 13-2).

4.2 Disconnect the earth bonding straps and remove the bonnet (refer to Chap 16).

4.3 On FFR vehicles remove the 50 amp alternator (refer to Chap 13-2).

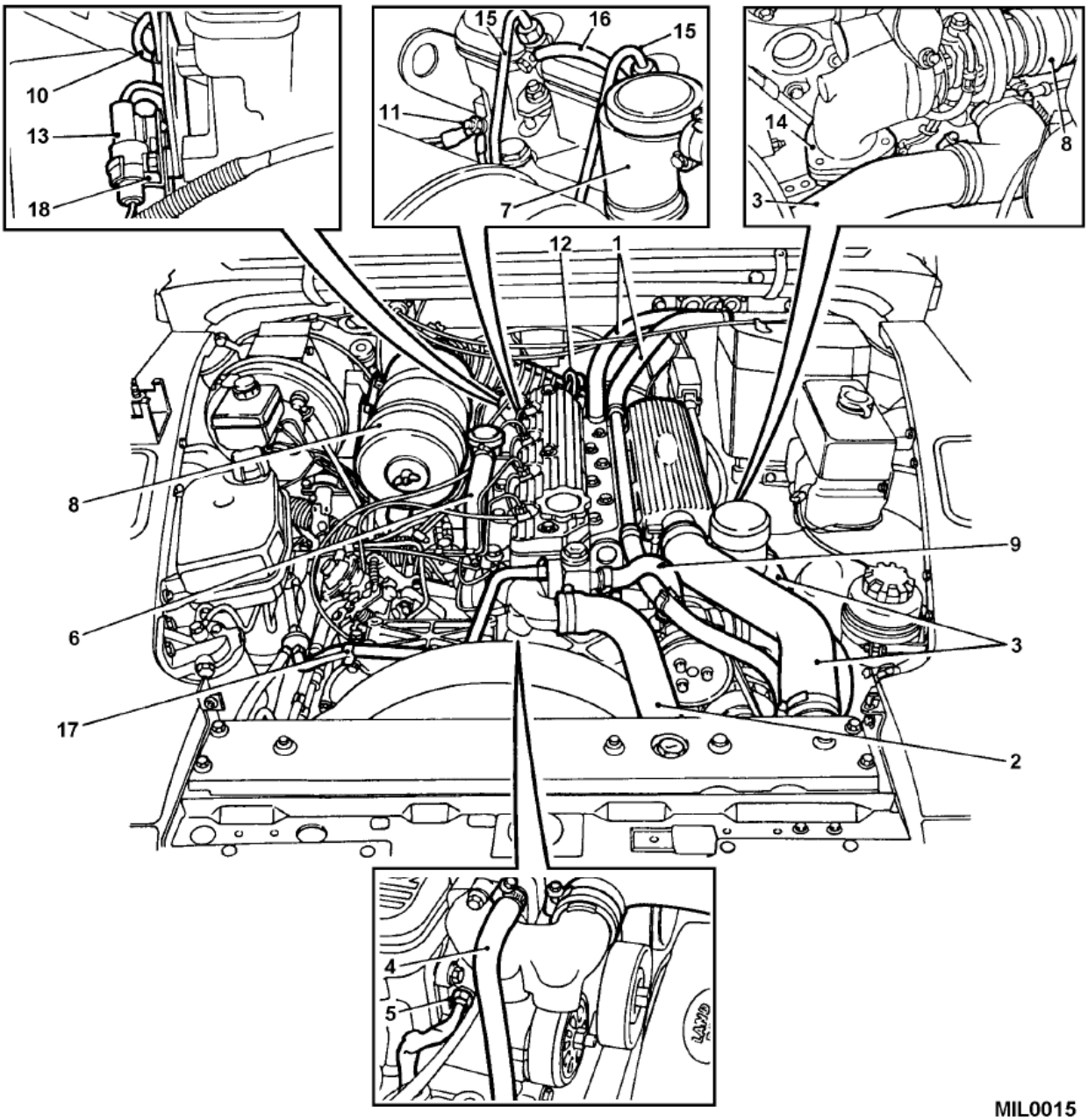
4.4 Drain the cooling system (refer to Chap 12-1).

4.5 Remove the air cleaner assembly including hoses (Fig 2 (8)) (refer to Chap 11-1).

4.6 Detach the cylinder block ventilation valve (7) and the breather hose (6) from the rocker cover.

CAUTION

INJECTORS. The injectors and heater plugs protrude below the combustion face of the cylinder head. It is important that they are removed before the removal of the cylinder head to avoid the possibility of damage to them.



1	Heater hoses	10	Brackets-transmission breather pipes
2	Radiator top hose	11	Heater plug connection
3	Intercooler hoses	12	Breather pipes
4	Expansion tank pipe	13	Multi-plug
5	Coolant temperature sensor	14	Exhaust down pipe
6	Cylinder block breather hose	15	Fuel injector pipes
7	Cylinder block ventilation valve	16	Spill rail
8	Air cleaner	17	Bracket-vent hose
9	By-pass hose	18	Harness clips

Fig 2 Disconnection points prior to cylinder head removal

4.7 Remove fuel injection pipes (15) (refer to Chap 11-1).

4.8 Disconnect spill rail (16) from fuel injectors (refer to Chap 11-1).

4.9 Remove fuel injectors and sealing washers. Identify each injector to the location from which it is removed (refer to Chap 11-1).

4.10 Remove the inter-connecting harness wiring (Fig 3 (1)) from the heater plugs.

4.11 Remove the heater plugs (2) (refer to Cat 11-1).

4.12 Remove the radiator top hose (Fig 2 (2)).

4.13 Disconnect the by-pass hose (9) from the thermostat.

4.14 Disconnect the expansion tank hose (4).

4.15 Disconnect the coolant temperature sensor lead (5).

4.16 Remove the inter-cooler to induction manifold hose (3) (refer to Cat 11-1).

4.17 Remove the induction manifold rear heat shield and slacken induction manifold lower securing nuts (refer to Cat 11-1).

4.18 Remove upper securing bolts and withdraw induction manifold (refer to Cat 11-1).

4.19 Undo the three nuts to release the down pipe from the exhaust manifold and remove the turbo-charger assembly (refer to Chap 11-1).

4.20 Disconnect heater hose (1) from heater rail and remove heater rail hose from its retaining clip at the water pump.

4.21 Move heater rail aside.

4.22 Disconnect heater hose (1) from rear of cylinder head.

4.23 Remove bolt securing air cleaner mounting bracket to support strut.

4.24 Remove bolt securing harness bracket to cylinder head.

4.25 Remove rear lifting bracket to release engine and transmission breather pipe bracket (10) and multi-plug (13).

REMOVAL

5 The cylinder head assembly removal procedure is as follows:

5.1 Remove the rocker cover (Fig 4 (1)).

5.2 Slacken the tappet adjusting screw locknuts (31) and turn the screws (32) to release them from the push rods (24).

5.3 Remove the rocker shaft retaining nuts (33) and bolts (35), withdraw the rocker shaft assembly.

NOTE

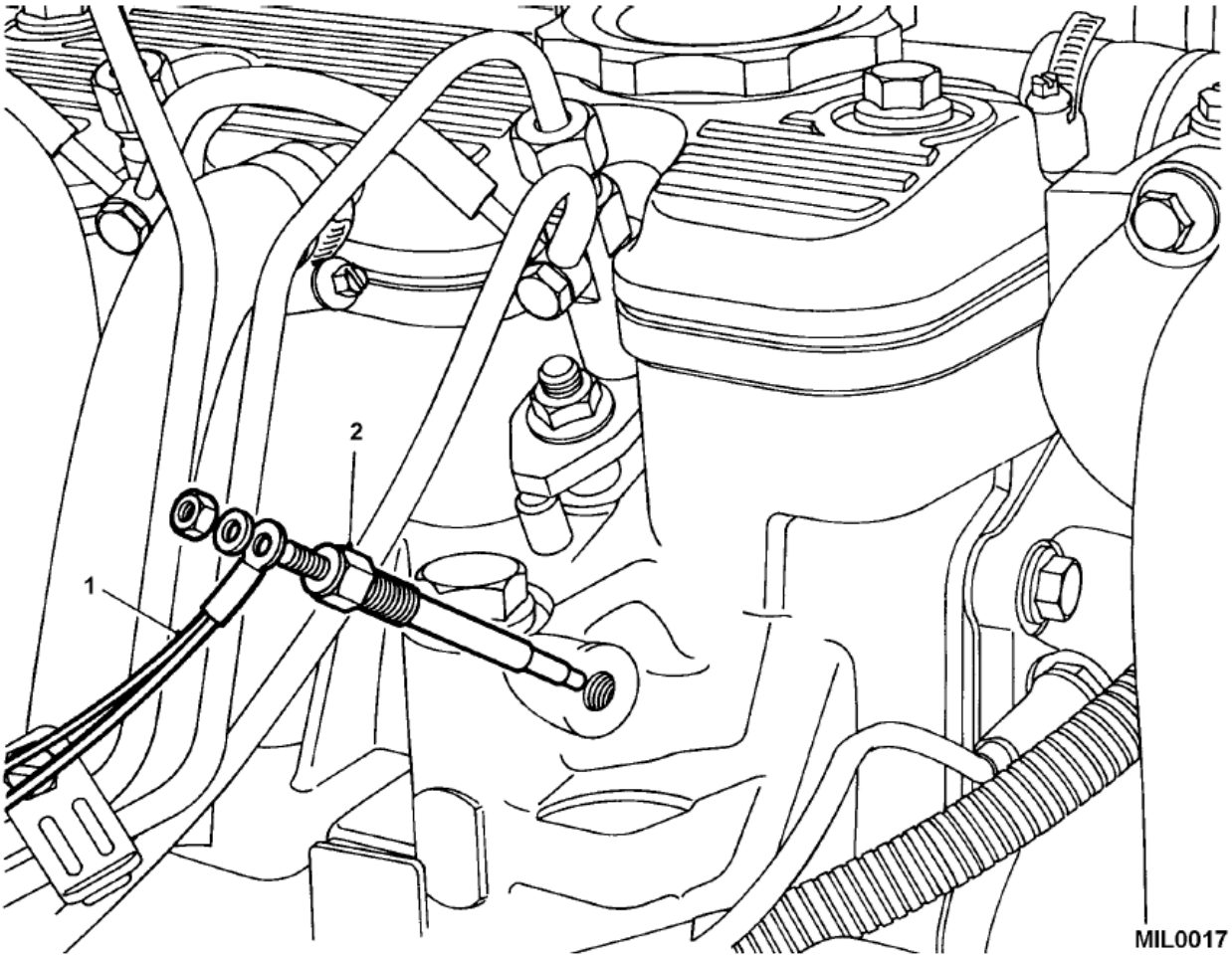
To prevent the rocker shaft assembly from falling apart, prior to dismantling, insert a suitable bolt through each of the rocker retaining end blocks (25) and its corresponding hole in the shaft and secure with nuts.

5.4 Withdraw the push rods and identify them as to the locations from which they were removed.

5.5 Remove the valve stem caps (19).

5.6 Evenly slacken, then remove the cylinder head retaining bolts (41)(42)(58), in the reverse order to the tightening sequence (refer to Fig 9), two of which also secure the air cleaner mounting bracket.

5.7 Remove cylinder head (Fig 4 (10)) and discard the gasket (11).



1 Harness wiring 2 Heater plug

Fig 3 Heater plug removal

DISMANTLING

Cylinder head

6 To dismantle the cylinder head (10) carry out the following:

6.1 Remove the thermostat housing (5) complete with gasket (6).

6.2 Remove the front engine lifting bracket (52).

6.3 Using a valve spring compressor, remove the valves (12)(14) and spring assemblies, keeping them identified with their original locations.

6.4 Discard the oil seals (13)(15).

KEY TO FIG 4

1	Rocker cover
2	Oil filler cap
3	Gasket-rocker cover
4	Inlet manifold
5	Thermostat housing
6	Gasket
7	Thermostat
8	Heater hose adapter
9	Manifold gasket
10	Cylinder head
11	Cylinder head gasket
12	Exhaust valve
13	Exhaust valve seat
14	Inlet valve
15	Inlet valve seat
16	Exhaust manifold
17	Valve guide
18	Valve spring
19	Valve cap
20	Valve spring retainer
21	Split collets
22	Spring protection washer
23	Oil seal- valve guide
24	Push rod
25	Rocker retaining block
26	Rocker shaft
27	Spacer
28	Spring
29	Spacer
30	Rocker lever
31	Locknut
32	Adjusting screw
33	Retaining nut
34	Stud
35	Retaining bolt
36	Cover nut
37	Cover nut sealing washer
38	Rocker lever bush
39	Bolt
40	Oil separator
41	Cylinder head bolt
42	Cylinder head bolt (long)
43	Heater hose adapter
44	Heat shield
45	Heat shield bolt
46	Set screw
47	Blanking plate
48	Gasket
49	Manifold stud
50	Nut
51	Thermostat housing plug
52	Lifting eye (front)
53	Temperature sensor
54	Lifting eye (rear)
55	Blanking plug (rear)
56	Blanking plug (side)
57	Heater plug
58	Cylinder head bolt (short)
59	Fuel injector
60	Fuel injector clamp plate

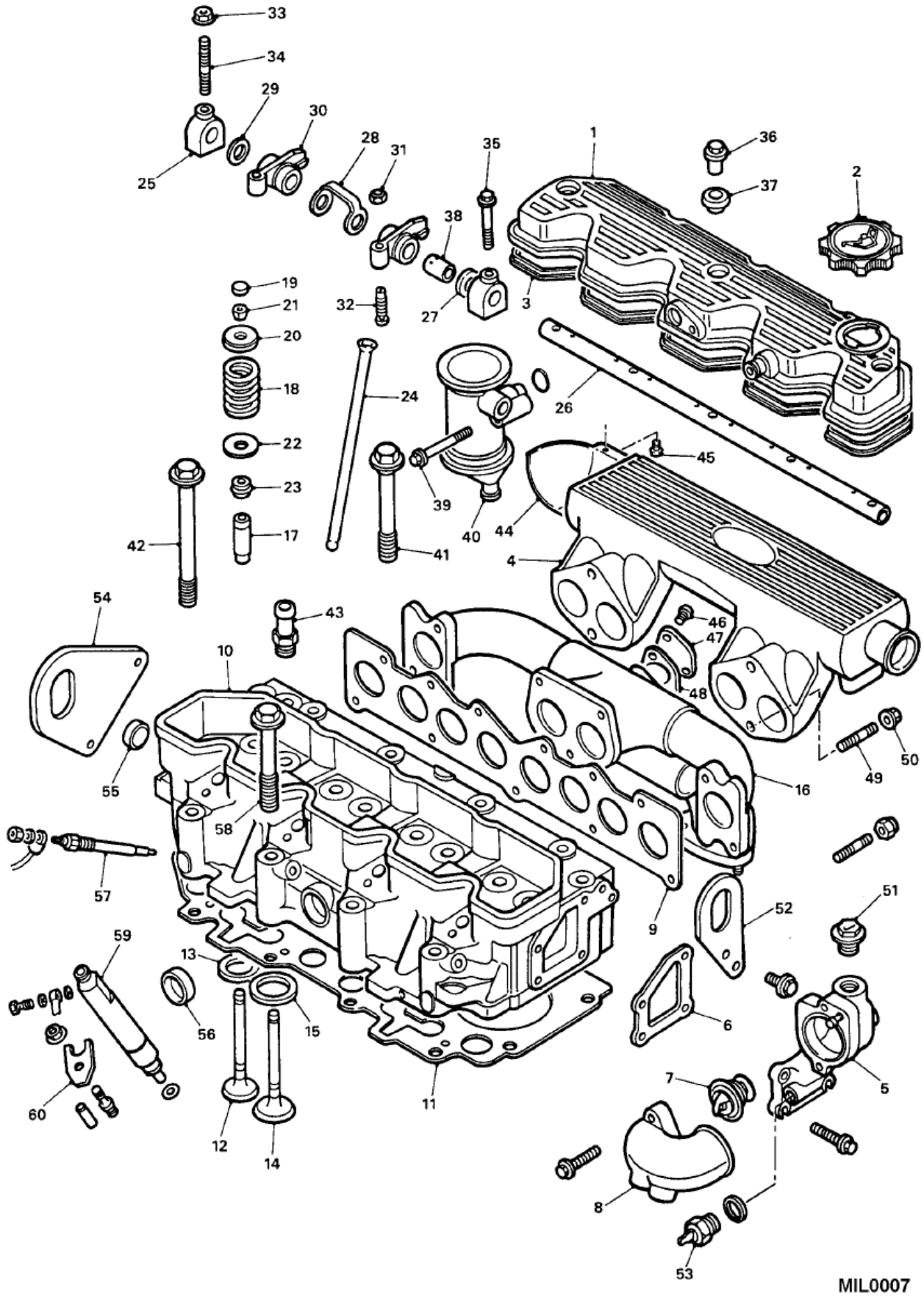


Fig 4 Exploded view of cylinder head

Rocker shaft assembly

7 To dismantle the rocker shaft assembly proceed as follows:

7.1 Withdraw all components from the shaft (Fig 4 (26)) and lay them out on a suitable work surface in the same order as removed.

7.2 Remove the adjusting screws (32) and locknuts (31) from the rockers (30).

Cleaning

8 Remove all carbon deposits from the valves and combustion chambers, degrease all components ready for examination. If scaling is apparent in the cylinder head water passages, remove using a descaling solution in accordance with the manufacturers instructions.

EXAMINATION

Cylinder head

9 The cylinder head should be thoroughly inspected for cracks before repair work is carried out.

CAUTION

CYLINDER HEAD DAMAGE. Since the cylinder head is manufactured from an aluminium alloy care must be taken to ensure that the combustion face, in particular, is not damaged or scratched by placing it on a hard or abrasive surface while carrying out any repair operations.

9.1 Closely examine the cylinder head for cracks particularly between the inlet and exhaust valve seats. Such cracking indicates that the engine has overheated, usually through lack of coolant and the cylinder head should be scrapped.

9.2 Examine the cylinder head for distortion.

9.3 Examine the valve seats for pitting and other damage.

9.4 Check the valve guides for wear by inserting a new valve in the appropriate guide and leaving a gap between the valve face and valve seat of 8.0 mm (0.315 in.). If movement across the head exceeds 0.15 mm (0.006 in.) the guide must be renewed.

Rocker shaft assembly

10 The rocker shaft assembly should be examined as follows:

10.1 Examine the rocker shaft for wear at the bearing surfaces, if the bearing surfaces are worn more than 0.025 mm (0.001 in.) a new shaft must be fitted.

10.2 If the shaft is acceptable for further use ensure that the oil lubrication drillings at the rocker lever locations are not blocked, and that the through bore is clear.

10.3 Examine the rocker levers for wear on the pads, if wear is apparent they must be renewed.

NOTE

It is not permissible to grind the pads, in an attempt to reclaim the rocker levers.

10.4 Check the clearance between the rocker lever bushes and the rocker shaft, if clearance exceeds 0.101 to 0.127 mm (0.004 in. to 0.005 in.) renew the bushes.

10.5 Examine the ball end adjusting screws and discard any that are worn. Check the threads for damage.

Valves and valve springs

11 The valves and valve springs should be examined as follows:

11.1 Examine the valves for cracks, damage and wear. Pitting or slight damage to the valve face can be removed by grinding.

11.2 Check the free length of each spring against the length of a new spring. If the valve springs are to be re-used examine them for squareness of ends.

Push rods

12 Check the push rods for damage and straightness.

REPAIRS AND REPLACEMENT

NOTES

(1) Gaskets, joints and seals are not to be re-used. Renew these items on reassembly. Valve springs, rocker springs and spacers should be renewed at every major overhaul.

(2) The cylinder head cannot be refaced, if there are any signs of distortion the cylinder head must be replaced.

Refacing cylinder head valve seat inserts

13 Cylinder head valve seat inserts can be refaced provided they are not abnormally wide due to repeated refacing operations. If the inserts are considered unsuitable for refacing, new inserts should be fitted.

NOTES

(1) Exhaust valve seat faces should be recut to 45° Inlet valve seat faces should be recut to 60°.

(2) Cutter (refer to Table 1 Serial 1), is a double ended tool having cutters of 30° and 45°. Ensure that the 45° cutter is used in this application.

(3) Cutter (refer to Table 1 Serial 2), is a 60° cutting tool and is for the exhaust valve seat only.

Reface valve seats

14 Valves that are satisfactory for further service can be refaced.

Lap-in valves

15 To ensure a gas tight seal between the valve face and seat it is necessary to lap-in the appropriate valve to its seat. It is essential to keep the valve identified with its seat once the lapping-in operation has been completed

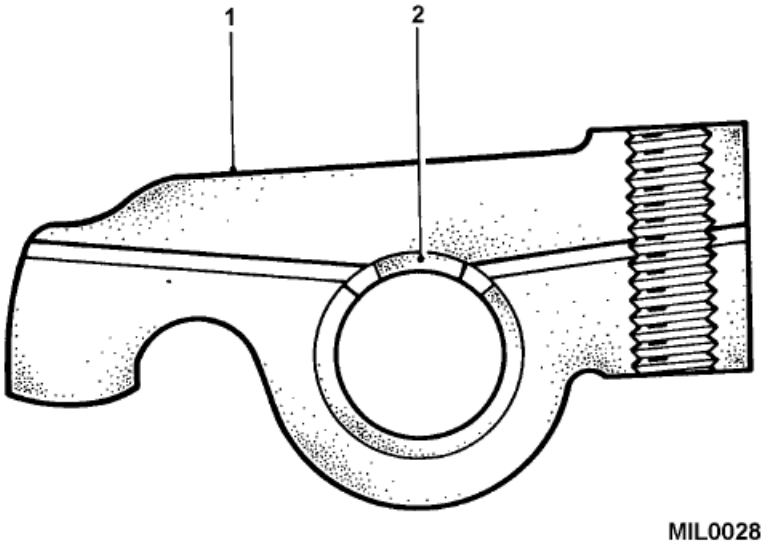
Rocker lever bushes

16 To renew the rocker bushes

16.1 Press out the worn bushes.

16.2 Press in the new bushes (Fig 5 (2)) ensuring that the lubrication drillings in the bushes align with those in the rocker lever (1).

16.3 Clear the swarf and burrs from the lubrication drillings.



1 Rocker lever 2 Bush

Fig 5 Cross-section through rocker lever.

REASSEMBLY

Rocker shaft assembly

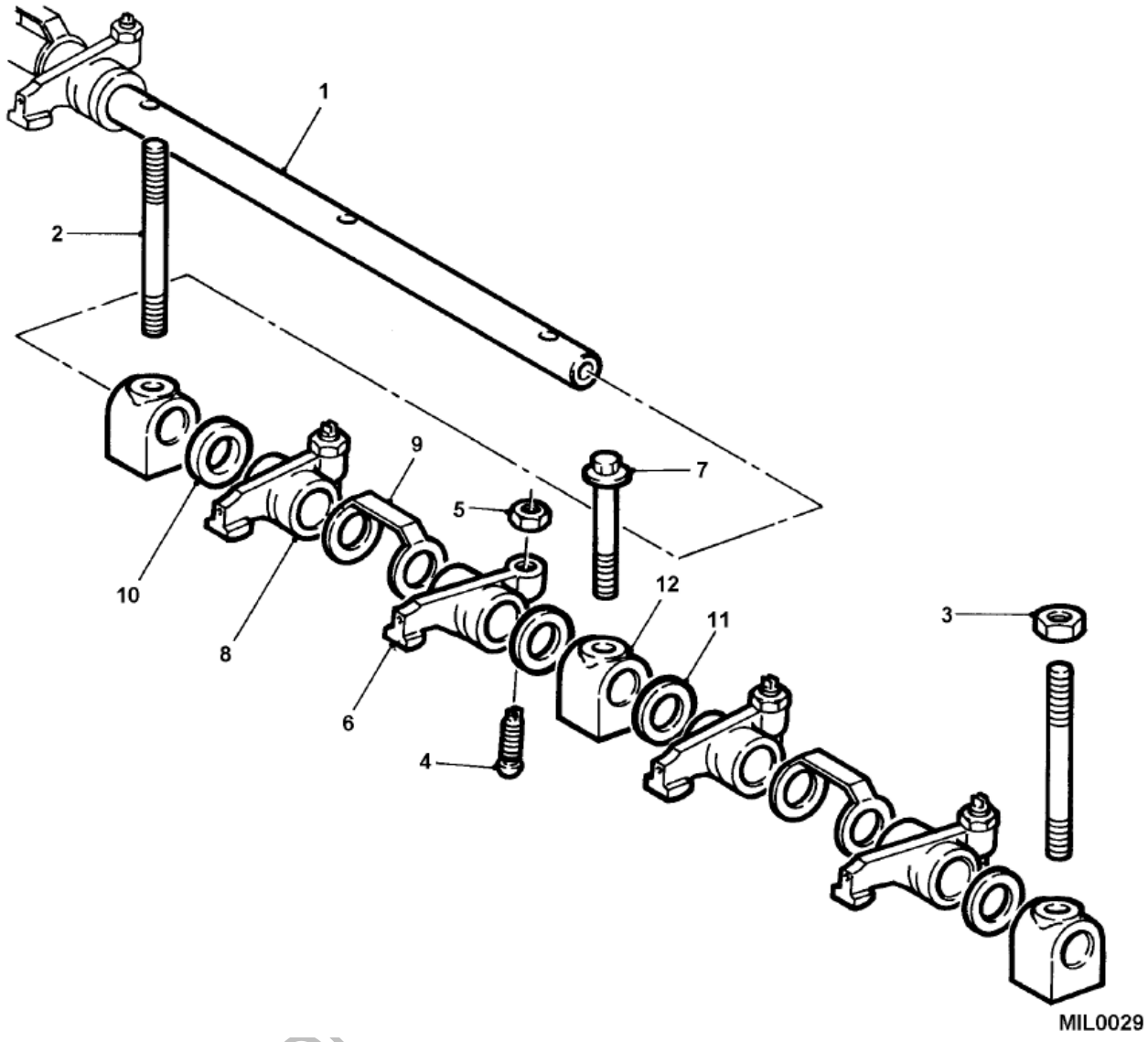
17 To assemble the rocker shaft assembly proceed as follows:

17.1 Assemble the rockers (Fig 6 (6)), retaining blocks (12) new springs (9), washers (11) and spacers (10) onto the rocker shaft (1) in the order from which they were removed.

17.2 Ensure the washers (11) are fitted, one either side of the centre retaining block.

17.3 Loosely assemble the tappet adjustment screws (4) and locknuts (5) to the rocker levers (8).

17.4 Hold the assembly together on the rocker shaft by inserting the retaining studs (2) through the fixing holes of No. 1 and No. 3 retaining blocks.



1	Shaft	7	Securing bolt
2	Stud	8	Rocker
3	Securing nut	9	Spring
4	Adjusting screw	10	Spacer
5	Locknut	11	Washer
6	Locker lever	12	Retaining block

Fig 6 Rocker shaft assembly

Valves to cylinder head

18 To assemble the valves to the cylinder head proceed as follows:

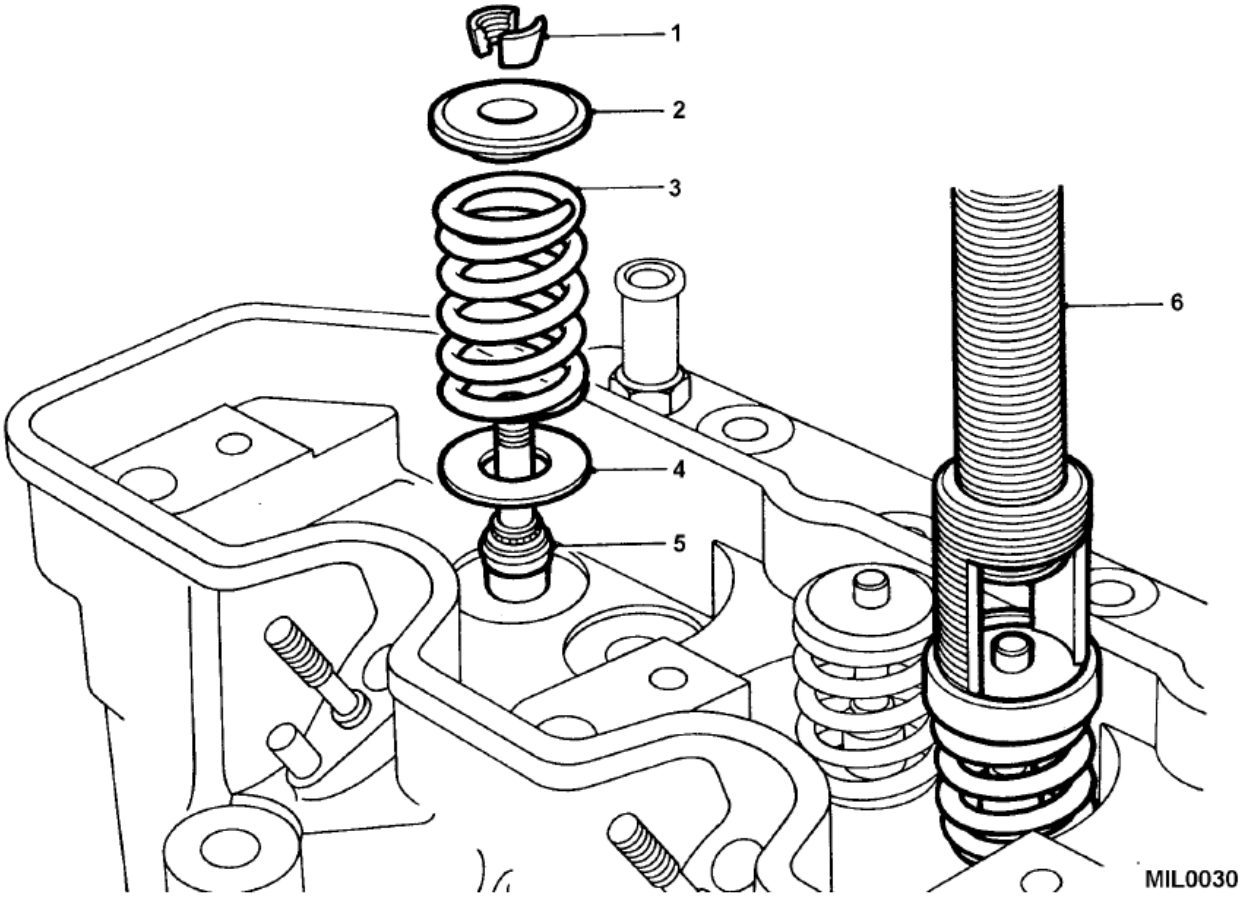
18.1 Insert the valves to their respective guides and locate a spring protection washer (Fig 7 (4)) over each guide.

18.2 Fit new oil seals (5) to all the valve guides with the garter spring uppermost.

18.3 Ensure that the seals fully locate on the valve guides.

18.4 Fit a spring (3) and spring retainer (2) to each valve and compress with a valve spring compressor (6).

18.5 Secure with the multi-groove split collets (1) ensuring that they are fully located in the valve stem and spring retainer.



1	Split collets	4	Spring protection washer
2	Spring retainer	5	Oil seal
3	Valve spring	6	Spring compressor

Fig 7 Valve assemblies

Cylinder head assembly to cylinder block

TABLE 3 GASKET THICKNESSES

Serial (1)	No. of holes (2)	Piston standup dimensions (3)	Gasket Part No. (4)
1	1	0.50 mm to 0.60 mm (0.0019 in. to 0.0023 in.)	ERR5261
2	2	0.61 mm to 0.70 mm (0.0024 in. to 0.0027 in.)	ERR5262
3	3	0.71 mm to 0.80 mm (0.0028 in. to 0.0031 in.)	ERR5263
4	4	0.81 mm to 0.90 mm (0.0032 in. to 0.0035 in.)	ERR7154

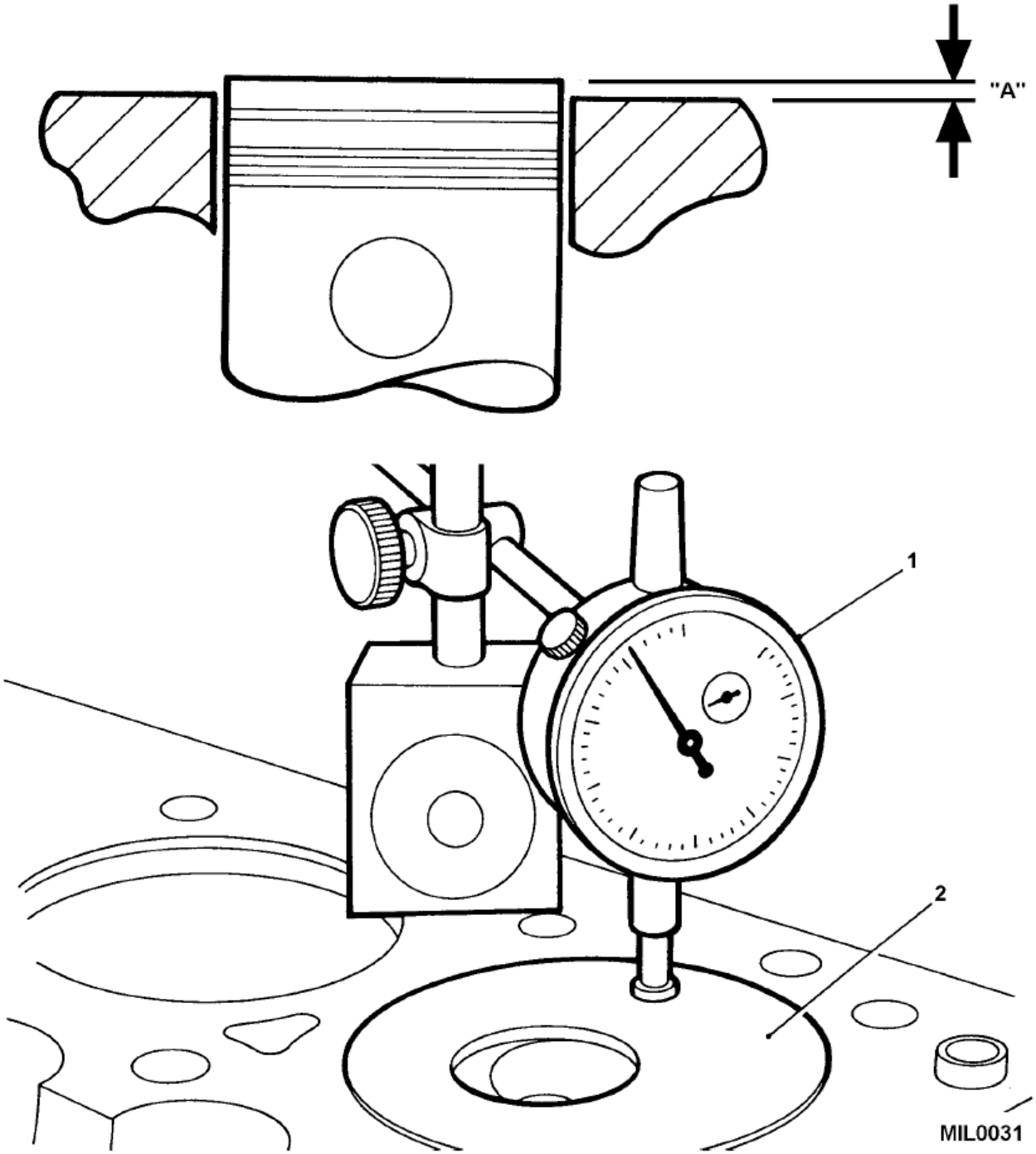
19 To assemble the cylinder head to the cylinder block proceed as follows:

NOTE

Before fitting the cylinder head, the protrusion of the pistons above the block face must be checked in order that the correct thickness gasket may be selected, from the range of four.

19.1 The height of all pistons above the cylinder block must be measured, the thickness of the gasket selected is based upon the largest value of dimension "A" (Fig 8). This dimension, however, must not exceed 0.9 mm (0.0035 in.)

19.2 Four thicknesses of gasket (refer to Table 3) are available and each size can be recognised by the number of identification holes punched in the side of the gasket.



1 Dial test indicator 2 Piston

Fig 8 Piston protrusion for gasket selection

19.3 The thickness of gasket fitted can be seen when the cylinder head is fitted since the identification holes can be seen protruding from the right hand side of the engine towards the rear.

19.4 Clean the cylinder block combustion face and turn the crankshaft so that No. 1 and No. 4 pistons (Fig 8 (2)) are at Top Dead Centre (TDC).

19.5 Use a dial test indicator (1) to determine the highest travel of the piston then zero the gauge and move the stylus over to the cylinder block and note the reading.

19.6 Repeat the procedure on the remaining pistons.

19.7 The highest figure obtained will determine the gasket selected.

19.8 Place the new gasket selected in position on the cylinder block so that the identification holes are towards the rear on the right hand side and the word "TOP" is facing upwards.

19.9 Clean the cylinder head face and lower into position ensuring that the cylinder head locates over the two dowels in the cylinder block.

19.10 Lubricate the threads of new bolts, (refer to Fig 9) with light oil, and fit to their respective positions according to length and diameter.

19.11 Tighten the bolts down so that the heads just make contact with the cylinder head.

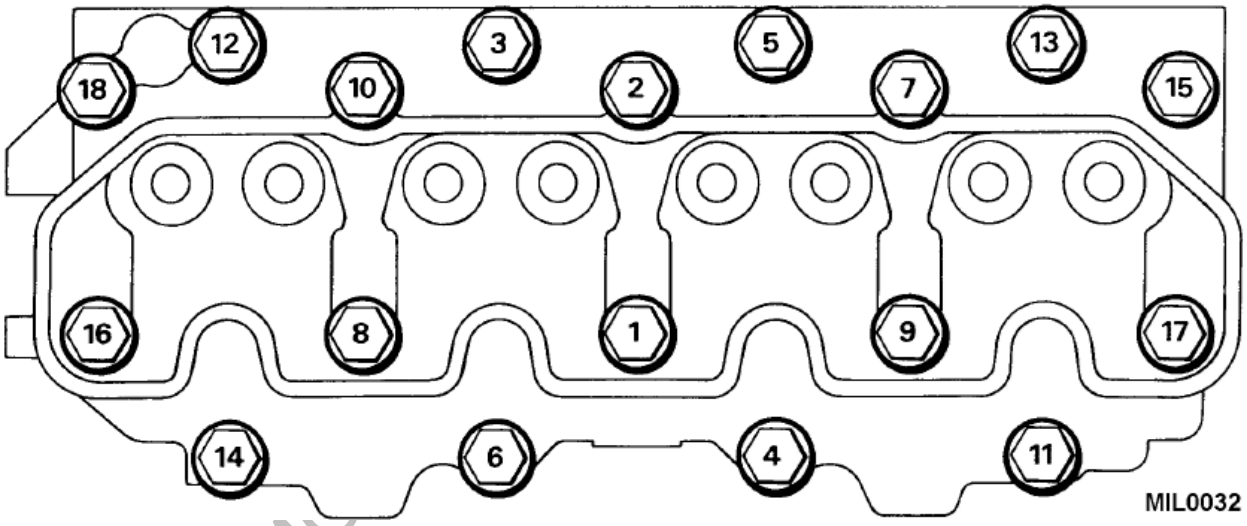


Fig 9 Bolt locations and Tightening sequence for cylinder head.

19.12 Bolt Sizes:

19.12.1 M10 locations 3,5,12 and 13.

19.12.2 M12 locations 1,2,4,6,7,8,9,10,11,14,15,16,17 and 18

19.13 Tighten the bolts to 40 Nm (29 lbf ft) in sequence (refer to Fig 9) using a suitable torque wrench.

19.14 Attach the special tool (refer to Table 1 Serial 3), (Fig 10 (1)) to a suitable socket and extension bar (2).

19.15 Make a suitable pointer from welding rod (3) and attach it to a bolt screwed into a rocker shaft securing bolt hole.

NOTE

Re-positioning of the pointer will be necessary for each bolt.

19.16 Tighten all the bolts down through an angle of 60° in the correct sequence. As each bolt is tightened scribe a line across the head with a piece of chalk or crayon to identify which bolts have been tightened.

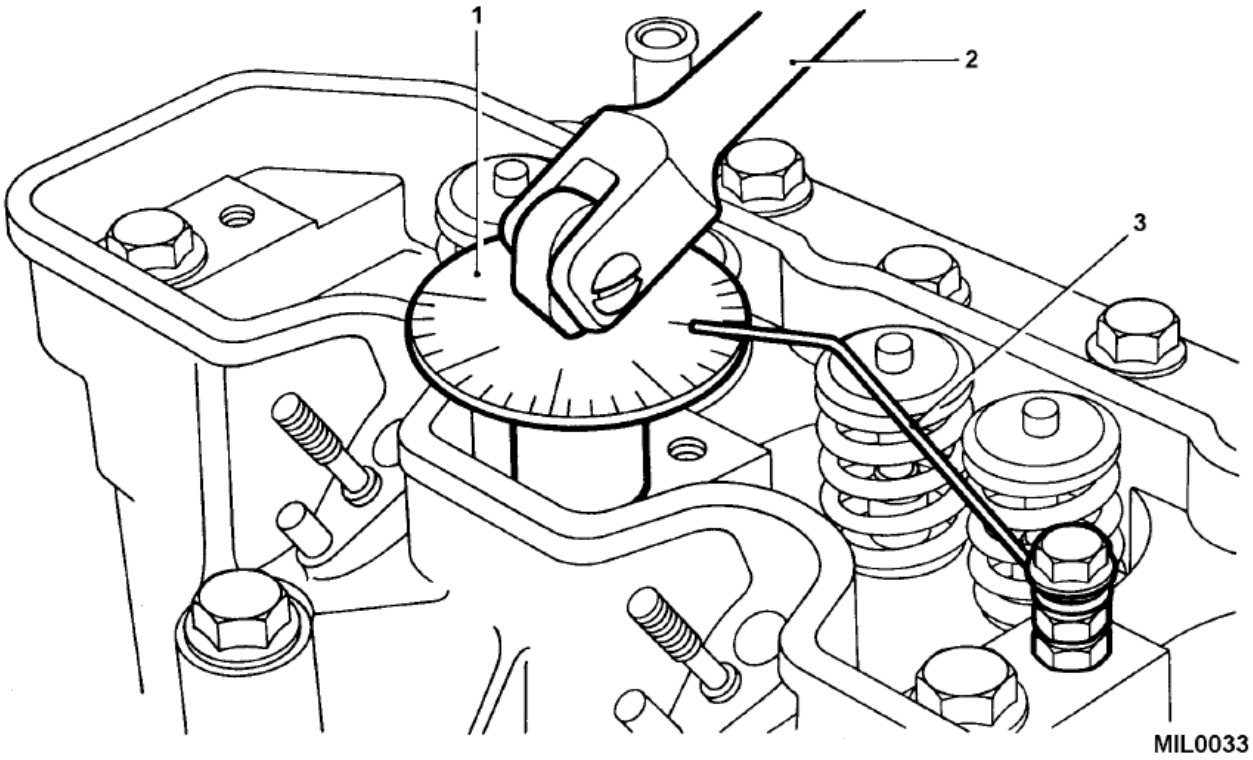
19.17 Tighten each bolt a further 60° again in the correct sequence to complete the tightening procedure.

CAUTION

CYLINDER HEAD DISTORTION. It is important that the double torquing procedure is observed and that on no account should the total angle of 120° be performed in one operation otherwise damage and distortion of the cylinder head may occur.

19.18 Fit the push rods to the engine ensuring that the ball-end locates properly in each cam follower slide.

19.19 Ensure that a new valve stem cap is fitted to each valve stem before fitting the rocker shaft.



1 Degree disc
2 Socket and extension bar
3 Pointer

Fig 10 Torque tightening cylinder head bolts, degree disc

19.20 Fit the rocker shaft to the cylinder head ensuring that the studs, retaining bolts and push rods locate correctly.

19.21 Tighten the rocker shaft retaining nuts and bolts to 25 Nm (18 lbf ft).

Valve clearances

20 To set the valve clearances proceed as follows:

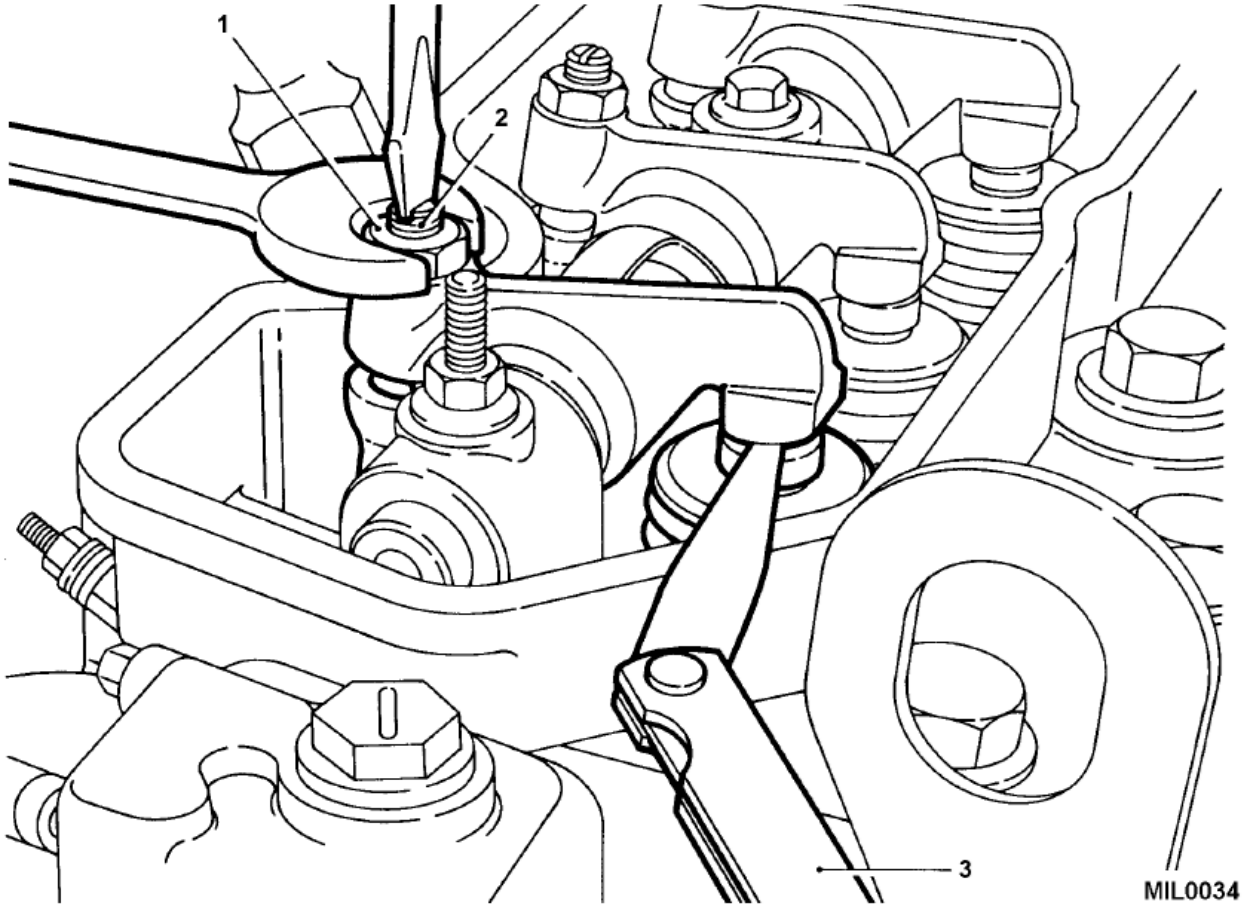
WARNING

VALVE CLEARANCE. IF THE CRANKSHAFT IS ROTATED WITH EXCESSIVE VALVE CLEARANCE, IT IS POSSIBLE THAT THE PUSH RODS MAY BECOME DISLODGED FROM THE CAM FOLLOWER SEATING AND FRACTURE THE CAM FOLLOWER SLIDE.

20.1 To prevent damage, eliminate all clearance from any loose rockers before turning the crankshaft to adjust clearances.

20.2 Turn the engine over until No. 8 valve (counting from the front of the engine) is fully open.

20.3 Using a 0.20 mm (0.008 in.) feeler gauge (Fig 11 (3)) adjust the clearance of No. 1 valve. Slacken the locknut (1) and turn the adjusting screw (2) clockwise to reduce the clearance and anti clockwise to increase.



1 Locknut
2 Adjusting screw
3 Feeler gauge

Fig 11 Tappet clearances

20.4 Tighten the adjusting screw locknut to a torque of 16 Nm (12 lbf ft).

20.5 Continue to adjust the remaining tappets in the following sequence:

20.5.1 Set No. 3 tappet with No. 6 valve fully open.

20.5.2 Set No. 5 tappet with No. 4 valve fully open.

20.5.3 Set No. 2 tappet with No. 7 valve fully open.

20.5.4 Set No. 8 tappet with No. 1 valve fully open.

20.5.5 Set No. 6 tappet with No. 3 valve fully open.

20.5.6 Set No. 4 tappet with No. 5 valve fully open.

20.5.7 Set No. 7 tappet with No. 2 valve fully open.

20.6 Recheck the clearances and adjust as necessary.

Rocker cover

21 Locate a new surround seal on the rocker cover and fit the cover to the cylinder head.

21.1 Secure the rocker cover using the special nuts and washers, tighten to a torque of 10 Nm (7 lbf ft).

Manifolds

22 Using a new gasket, fit the inlet and exhaust manifolds and secure with the retaining nuts and bolts. Tighten the Inlet manifold nuts and bolts to 25 Nm (18 lbf ft) and the exhaust manifold securing nuts to a torque of 45 Nm (33 lbf ft) (refer to Cat 11-1).

Thermostat housing

23 Fit the thermostat housing complete with thermostat to the cylinder head using a new gasket. Tighten the securing bolts to a torque of 25 Nm (18 lbf ft).

Heater plugs

24 Fit the heater plugs and tighten to a torque of 20 Nm (15 lbf ft) (refer to Cat 11-1).

24.1 Connect the electrical harness to the plugs and secure with the single nut and washers (refer to Cat 11-1).

Fuel injectors

25 Fit the fuel injectors (refer to Chap 11-1). Ensure that the injector and seating in the cylinder head is clean and that a new copper sealing washer is fitted to face of each injector (refer to Cat 11-1).

Crankcase ventilator

26 Fit the crankcase ventilator using a new rubber "O" ring, tighten securing bolt to 9 Nm (7 lbf ft).

Reconnection of parts disturbed

27 Reconnect all pipes, hoses and electrical connections disturbed or removed under preparation for removal (refer to Para 4).

Cooling and lubrication systems

28 Refill the cooling system and check the engine oil level as follows:

28.1 Refill the cooling system using the correct mix of coolant, (refer to Chap 12-1).

28.2 Check the engine oil level and top up as necessary with the correct grade of oil, (refer to Table 2 Serial 1).

CAUTION

FFR BATTERY LEADS. On the FFR vehicles if the radio batteries are not fitted ensure that the battery leads are disconnected from the auxiliary terminal box before starting the engine.

28.3 Run the engine checking that the oil pressure warning light goes out. Check all fuel, oil and coolant connections for leaks.

28.4 Stop the engine. When cool check the coolant and oil levels, top up as necessary.

CAUTION

INJECTORS. The injectors and heater plugs protrude below the combustion face of the cylinder head. It is important that they are removed before the removal of the cylinder head to avoid the possibility of damage to them.

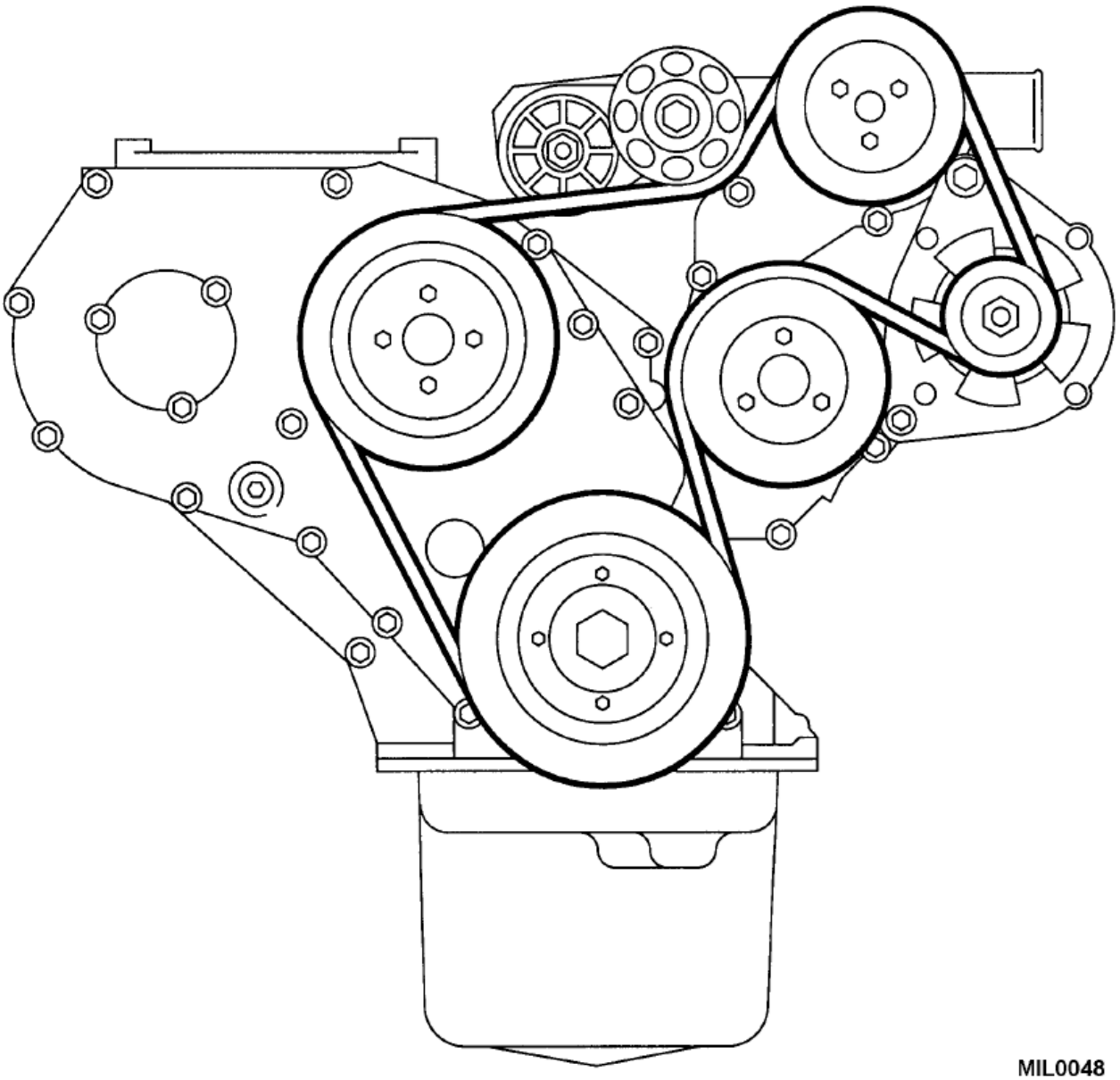


Fig 12 Drive belt and pulley location

DRIVE BELT AND PULLEYS

Removal

29 To remove the drive belt and pulleys proceed as follows:

29.1 Disconnect the vehicle batteries (refer to Chap 13-1) and on Fitted for Radio (FFR) vehicles the radio batteries (refer to Chap 13-2) to prevent the engine being started whilst working on the fan assembly.

29.2 Remove the viscous coupling and fan assembly (refer to Chap 12-1).

29.3 Before removing the serpentine belt, slacken the fan pulley retaining bolts.

29.4 Using a hexagonal socket and tommy bar on the auto tensioner pulley nut, tension the autotensioning unit and remove the drive belt.

29.5 Remove the retaining bolts and detach the pulleys.

Refitting

30 To fit the drive belt and pulleys proceed as follows:

30.1 Lightly grease the crankshaft pulley spigot and fit the pulley onto the crankshaft with the pulley retainer washer and bolt.

30.2 Fit the crankshaft pulley retainer tool (refer to Table 1 Serial 4), and secure with four retaining bolts.

30.3 Using a suitable socket and extension bar tighten the crankshaft pulley bolt to a torque of 80 Nm (59 lbf ft)+ 90°. Remove the pulley retaining tool.

30.4 Fit the fan pulley to the adapter on the timing cover, tighten the retaining bolts to a torque of 25 Nm (18 lbf ft) and refit the auto-tensioner to the auxiliary mounting bracket, tighten the securing nut to 45 Nm (33 lbf ft).

30.5 Fit the drive belt to the fan pulley, crankshaft pulley, power steering pump pulley, alternator pulley, water pump pulley and auto tensioner. Apply a ring spanner to the tensioner pulley retaining bolt, carefully release the belt tension and feed the drive belt over the respective pulleys (refer to Fig 12).

30.6 When all pulleys are connected carefully release the pulley tension, release and remove the ring spanner.

30.7 Reconnect the vehicle batteries (refer to Chap 13-1) and on Fitted for Radio (FFR) vehicles the radio batteries (refer to Chap 13-2).

OIL SUMP

REMOVAL

31 To remove the oil sump proceed as follows:

31.1 Remove the sump drain plug and allow the oil to drain into a container of suitable capacity.

31.2 Remove the bolts securing the sump to the crankcase and withdraw the sump.

31.3 Thoroughly clean all components ensuring removal of sealant from the sump, timing gear housing and cylinder block.

REFITTING

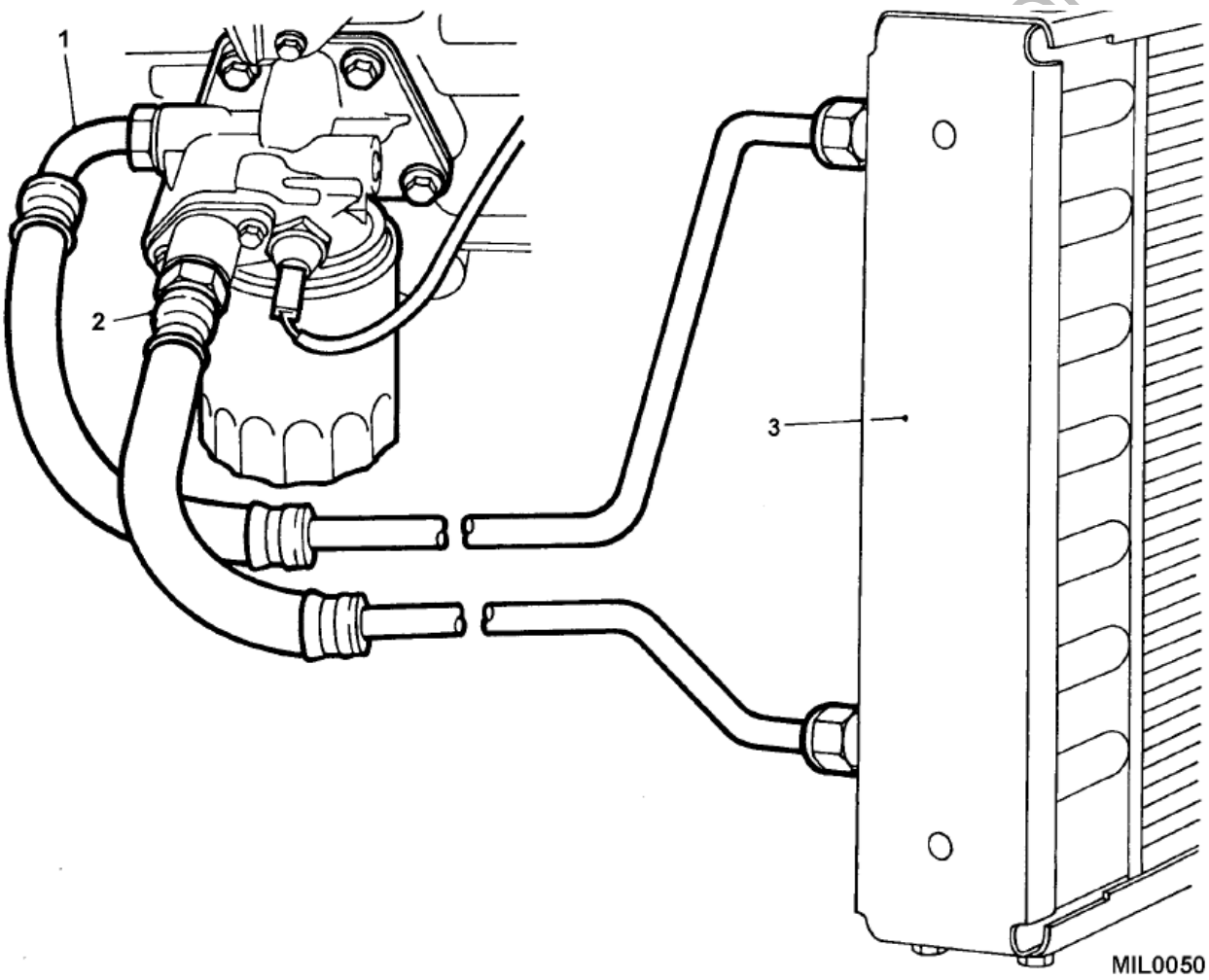
32 To refit the oil sump proceed as follows:

32.1 Apply a 2.0 mm bead of sealant (refer to Table 2 Serial 2) to the sump flange, ensuring the bead is applied in-board of the bolt holes. Fit the sump within 30 minutes of applying the sealant.

32.2 Tighten the sump securing bolts to a torque of 25 Nm (18 lbf ft).

32.3 Fit and tighten the sump drain plug to a torque of 35 Nm (26 lbf ft).

32.4 Refill the engine to the correct level with the correct grade of oil (refer to Table 2 Serial 1).



1 Oil outlet pipe
2 Oil inlet pipe
3 Oil cooler

Fig 13 Oil cooler and hoses

OIL PRESSURE RELIEF VALVE

REMOVAL

33 To remove the oil pressure relief valve proceed as follows:

33.1 Remove the sump (refer to Para 31).

33.2 Remove the relief valve retaining plug from the timing gear housing and withdraw the valve spring and plunger.

REFITTING

34 To refit the oil pressure relief valve proceed as follows:

34.1 Insert the pressure relief valve plunger and spring into the base of the timing gear housing.

34.2 Locate the retaining plug onto the relief valve spring and screw the plug into the timing gear housing.

34.3 Fit the sump (refer to Para 32).

OIL COOLER

REMOVAL

35 To remove the oil cooler, which is part of the radiator assembly, carry out the following:

35.1 Disconnect the inlet (Fig 13 (2)) and outlet (1) oil cooler pipes from the radiator. Tape the ends of the pipes and their respective adapters on the oil cooler (3) to prevent the ingress of dirt.

35.2 Remove the radiator (refer to Chap 12-1).

REFITTING

36 The procedure for refitting the oil cooler is the reverse of the removal procedure.

OIL FILTER HEAD

REMOVAL

37 To remove the oil filter head proceed as follows:

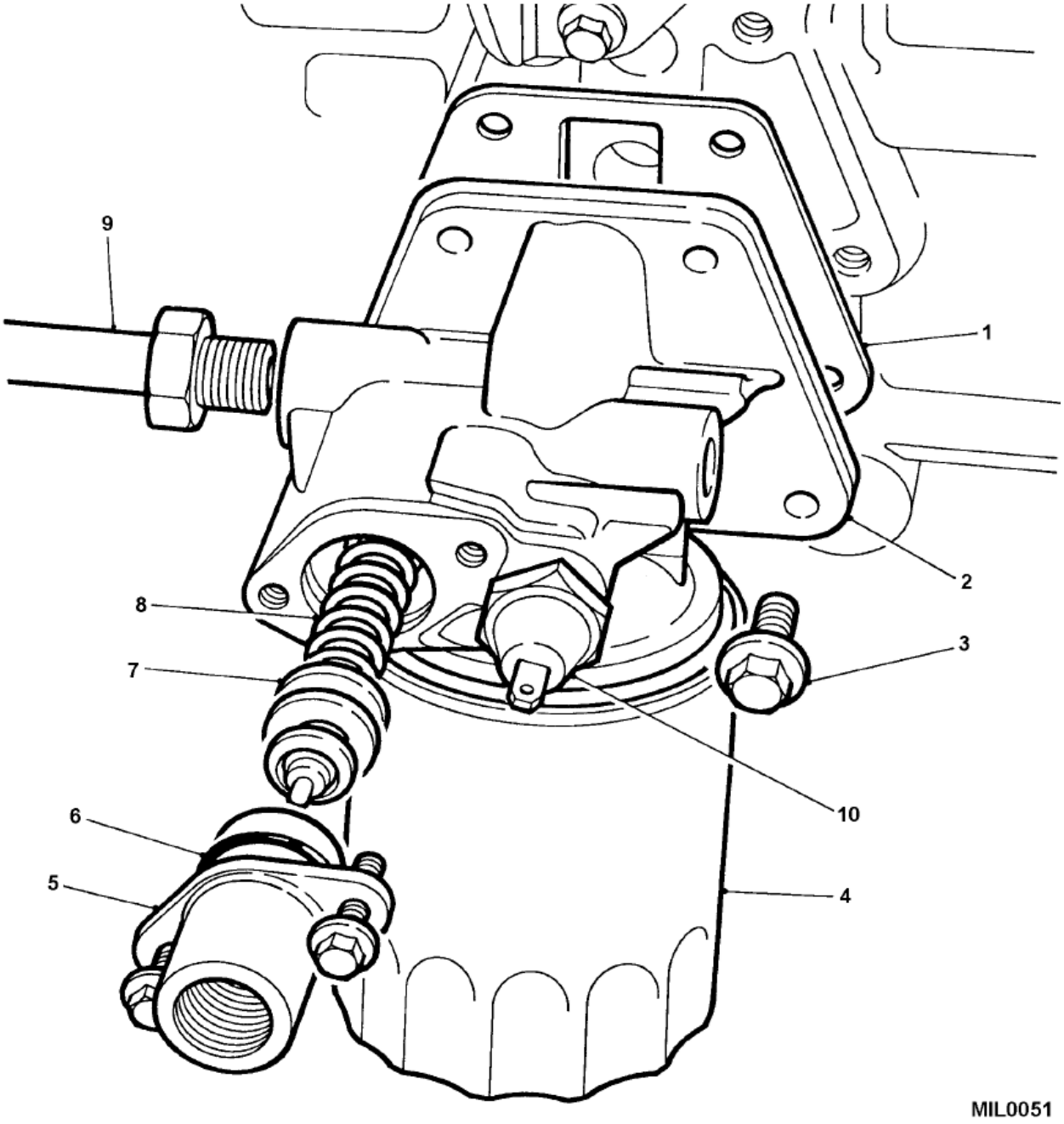
37.1 Disconnect the oil cooler pipes (refer to Para 35).

37.2 Disconnect the pressure switch lead (refer to Fig 14 (10)).

37.3 Remove the securing bolts (3) and withdraw the oil filter head (2) complete with gasket (1).

REFITTING

38 The procedure for refitting the oil filter head is the reverse of the removal procedure. Using a new gasket fit the filter head and tighten the securing bolts to 45 Nm (33 lbf ft).



1	Gasket	6	"O" ring
2	Filter head	7	Thermostat
3	Retaining bolt	8	Spring
4	Oil filter	9	Return pipe
5	Thermostat extension housing	10	Oil pressure switch

Fig 14 Oil temperature control valve

OIL TEMPERATURE CONTROL VALVE

REMOVAL

39 To remove the oil temperature control valve proceed as follows:

39.1 Disconnect oil cooler pipe from the thermostat extension housing (refer to Fig 14 (5)).

39.2 Remove the retaining bolts and carefully withdraw the thermostat extension housing complete with "O" ring seal (6), thermostat (7), two washers and spring (8).

39.3 Thoroughly clean the adapter housing.

39.4 Inspect all components and renew as necessary.

REFITTING

40 The procedure for refitting the oil temperature control valve is the reverse of the removal procedure. Ensure the thermostat pin locates in the extension housing hole, fit new "O" ring seal and tighten securing bolts to 9 Nm (7 lbf ft).

OIL DRAIN PIPE TO BLOCK

REMOVAL

41 To remove the oil drain pipe to cylinder block proceed as follows:

41.1 Remove the hose from the oil drain return pipe.

41.2 Remove the bolts securing the pipe flange to the cylinder block.

41.3 Withdraw the oil drain pipe and discard the gasket.

REFITTING

42 The procedure for refitting the oil drain pipe to the cylinder block is the reverse of the removal procedure.

42.1 Fit a new gasket and tighten the securing bolts to 25 Nm (18 lbf ft).

ENGINE BREATHER SIDE COVER

REMOVAL

43 To remove the engine breather side cover proceed as follows:

43.1 Remove the hose from the engine breather side cover.

43.2 Remove the fuel injection pump rear support bracket nuts and bolts.

43.3 Remove the support bracket retaining bolts to the cylinder block and remove the bracket.

43.4 Remove the remaining engine breather side cover retaining bolts, withdraw the cover and gasket.

43.5 Clean thoroughly and check that the side cover baffle plate is secure.

REFITTING

44 The procedure for refitting the engine breather is the reverse of the removal procedure.

45 Using a new gasket fit the side cover and fuel injection pump support bracket to the cylinder block, tighten securing bolts to 25 Nm (18 lbf ft).

CHAPTER 1-2

WINTER/WATER

CONTENTS

INTRODUCTION

1 This chapter details the Unit repairs for Truck Utility Light (TUL) HS, Truck Utility Medium (TUM), HS winter/water vehicles with 2.5 Litre 300 Tdi direct injected turbocharged diesel engines.

NOTE

This chapter also applies to the winterised vehicles as well.

ENGINE

CYLINDER HEAD ASSEMBLY

Preparation for removal

2 Before the cylinder head can be removed the following ancillary items must be removed for access and safety:

2.1 Disconnect the vehicle batteries (refer to Chap 13-1) and on Fitted for Radio (FFR) vehicles the radio batteries (refer to Chap 13-2).

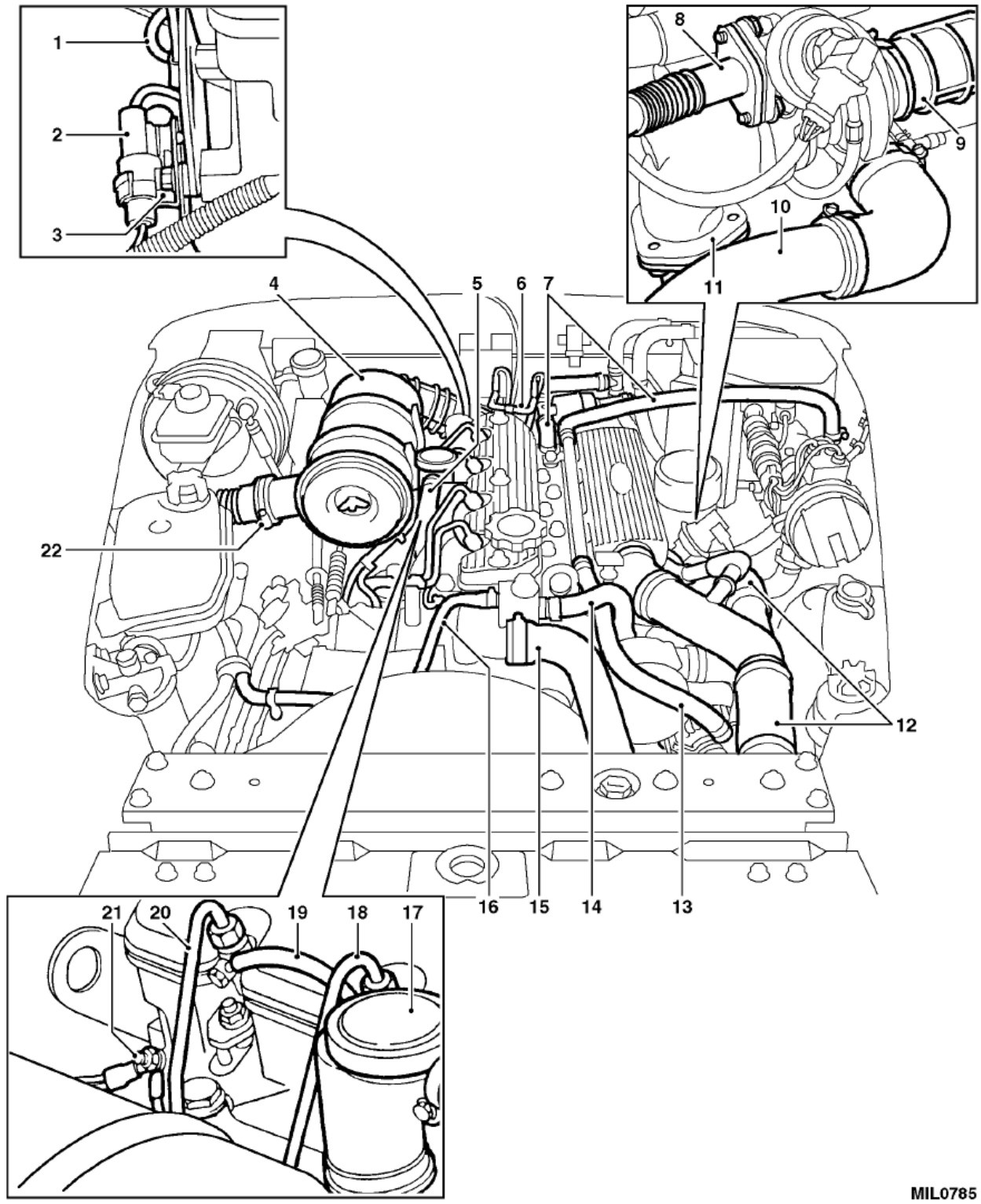


Fig 1 Disconnection points prior to cylinder head removal

KEY TO FIG 1

1	Transmission breather pipes bracket	12	Intercooler hoses
2	Multi-plug	13	Heater hose
3	Harness clips	14	By-pass hose
4	Air cleaner	15	Radiator top hose
5	Cylinder block breather hose	16	Expansion tank pipe
6	Breather pipes	17	Cylinder block ventilation valve
7	Heater hose	18	Fuel injector pipes
8	EGR pipe	19	Spill rail
9	Air cleaner hose	20	Fuel injector pipes
10	Intercooler hose	21	Heater plug connection
11	Exhaust down pipe		

2.2 Disconnect the earth bonding straps and remove the bonnet (refer to Chap 16-1).

2.3 On FFR vehicles remove the 50 amp alternator (refer to Chap 13-2).

2.4 Drain the cooling system (refer to Chap 12-2).

2.5 Remove the air cleaner assembly including hoses (Fig 1 (4)) (refer to Chap 11-3).

2.6 Detach the cylinder block ventilation valve (17) and the breather hose (5) from the rocker cover.

CAUTION

INJECTORS. The injectors and heater plugs protrude below the combustion face of the cylinder head. It is important that they are removed before the removal of the cylinder head to avoid the possibility of damage to them.

2.7 Remove fuel injection pipes (18, 20) (refer to Chap 11-1).

2.8 Disconnect spill rail (19) from fuel injectors (refer to Chap 11-1).

2.9 Remove fuel injectors and sealing washers. Identify each injector to the location from which it is removed (refer to Chap 11-1).

2.10 Remove the inter-connecting harness wiring (21) from the heater plugs.

2.11 Remove the heater plugs (refer to Chap 11-1).

2.12 Remove the radiator top hose (15).

2.13 Disconnect the by-pass hose (14) from the thermostat.

2.14 Disconnect the EGR pipe (8) from the turbo charger.

2.15 Remove the inter-cooler to induction manifold hose (12).

2.16 Remove the induction manifold rear heat shield and slacken induction manifold lower securing nuts.

2.17 Remove upper securing bolts and withdraw induction manifold.

2.18 Undo the three nuts to release the down pipe (11) from the exhaust manifold and remove the turbo-charger assembly (refer to Chap 11-1).

2.19 Disconnect heater hose (13) from heater rail and remove heater rail hose from its retaining clip at the water pump.

2.20 Move heater rail aside.

2.21 Disconnect heater hoses (7) from rear of cylinder head.

2.22 Remove bolt securing air cleaner mounting bracket to support strut.

2.23 Remove bolt securing harness bracket to cylinder head.

2.24 Remove rear lifting bracket to release engine and transmission breather pipes (1) bracket and multi-plug (2).

2.25 Ensure all ancillary items are disconnected before removing the cylinder head.

Refit

3 Reverse the above procedure when refitting the cylinder head ancillary items.

CYLINDER HEAD

Remove/Refit

4 For remove and refit of the cylinder head assembly (refer to Chapter 1-1).

CHAPTER 1-3

TROPICALISED

CONTENTS

INTRODUCTION

1 This chapter details the Unit repairs for (TUM) Ambulance HS tropicalised vehicle fitted with air conditioning and the 2.5 Litre 300 Tdi direct injected turbocharged diesel engine.

ENGINE

CYLINDER HEAD ASSEMBLY

Preparation for removal

2 Before the cylinder head can be removed the following ancillary items must be removed for access and safety:

2.1 Disconnect the vehicle batteries (refer to Chap 13-1) and on Fitted for Radio (FFR) vehicles the radio batteries (refer to Chap 13-2).

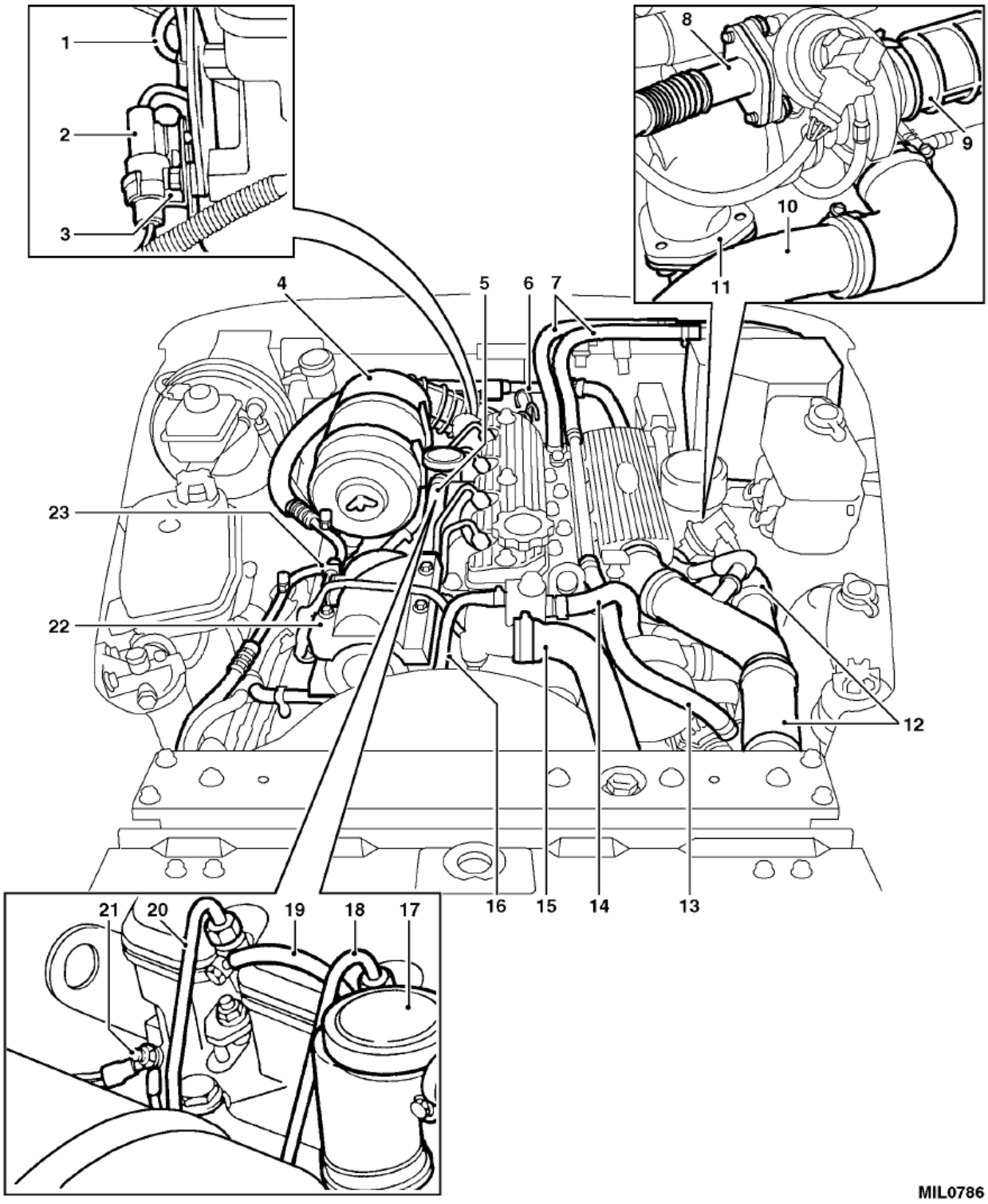


Fig 1 Disconnection points prior to cylinder head removal

KEY TO FIG 1

1	Transmission breather pipes bracket	13	Heater hose
2	Multi-plug	14	By-pass hose
3	Harness clips	15	Radiator top hose
4	Air cleaner	16	Expansion tank pipe
5	Cylinder block breather hose	17	Cylinder block ventilation valve
6	Breather pipes	18	Fuel injector pipes
7	Heater hose	19	Spill rail
8	EGR pipe	20	Fuel injector pipes
9	Air cleaner hose	21	Heater plug connection
10	Intercooler hose	22	Compressor
11	Exhaust down pipe	23	Compressor connections
12	Intercooler hoses		

2.2 Disconnect the earth bonding straps and remove the bonnet (refer to Chap 16-1).

2.3 On FFR vehicles remove the 50 amp alternator (refer to Chap 13-2).

2.4 Drain the cooling system (refer to Chap 12-1).

2.5 Evacuate the air conditioning system and remove the compressor (Fig 1 (22)), (refer to Chap 18-5).

2.6 Remove the air cleaner assembly including hoses (4) (refer to Chap 11-3).

2.7 Detach the cylinder block ventilation valve (17) and the breather hose (5) from the rocker cover.

CAUTION

INJECTORS. The injectors and heater plugs protrude below the combustion face of the cylinder head. It is important that they are removed before the removal of the cylinder head to avoid the possibility of damage to them.

2.8 Remove fuel injection pipes (18, 20) (refer to Chap 11-1).

2.9 Disconnect spill rail (19) from fuel injectors (refer to Chap 11-1).

2.10 Remove fuel injectors and sealing washers. Identify each injector to the location from which it is removed (refer to Chap 11-1).

2.11 Remove the inter-connecting harness wiring (21) from the heater plugs.

2.12 Remove the heater plugs (refer to Chap 11-1).

2.13 Remove the radiator top hose (15).

2.14 Disconnect the by-pass hose (14) from the thermostat.

2.15 Disconnect the EGR pipe (8) from turbo charger.

2.16 Remove the inter-cooler to induction manifold hose (12).

2.17 Remove the induction manifold rear heat shield and slacken induction manifold lower securing nuts.

2.18 Remove upper securing bolts and withdraw induction manifold.

2.19 Undo the three nuts to release the down pipe (11) from the exhaust manifold and remove the turbo-charger assembly (refer to Chap 11-1).

2.20 Disconnect heater hose (13) from heater rail and remove heater rail hose from its retaining clip at the water pump.

2.21 Move heater rail aside.

2.22 Disconnect heater hoses (7) from rear of cylinder head.

2.23 Remove bolt securing air cleaner mounting bracket to support strut.

2.24 Remove bolt securing harness bracket to cylinder head.

2.25 Remove rear lifting bracket to release engine and transmission breather pipe bracket (1) and multi-plug (2).

2.26 Ensure all ancillary items are disconnected before removing the cylinder head.

Refit

3 Reverse the above procedure when refitting the cylinder head ancillary items.

CYLINDER HEAD

Remove/Refit

4 For remove and refit of the cylinder head assembly (refer to Chapter 1-1).

CHAPTER 2

CLUTCH

CONTENTS

INTRODUCTION

1 This chapter details the Unit repairs for clutches fitted to Truck Utility Light (TUL) HS, and Truck Utility Medium (TUM) HS and (TUM) Ambulance HS vehicles having a 2.5 litre 300 Tdi direct injected turbocharged diesel engine and 5 speed manual gearbox.

GENERAL

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

TORQUE LIST

Pressure plate fixings	34 Nm/25 lbf ft	
Hose and pipe connections	15 Nm/11 lbf ft	
Bearing guide to bell housing	25 Nm/18 lbf ft	
Gear selector lever to shaft	25 Nm/18 lbf ft *	* New self locking nut must be used

TABLE 1 SEALANTS, ADHESIVES AND LUBRICANTS

Serial (1)	Product (2)	NSN/Part Number Where applicable (3)	Designation (4)
1	OX 8	9150-99-220-2348	Hydraulic fluid
2	XG 250	6850-99-224-8408	Silicon grease
3	Hylomar Universal	8030-99-220-2370	Waterproof jointing compound

WARNING

CLUTCH REPLACEMENT PARTS. TO AVOID CATASTROPHIC FAILURE AND PERSONAL INJURY ONLY FIT REPLACEMENT CLUTCH PARTS WITH THE CORRECT SUFFIX AS LISTED IN TABLE 2 BELOW.

TABLE 2 REPLACEMENT PARTS

Serial (1)	NSN/Part Number (2)	Part No. (3)	Designation (4)	Gearbox Suffix (5)
1(1)	2520-99-363-2256	FTC2957	Shifter Fork, Vehicular	Suffix - J
1(2)	2520-99-177-7221	UTD100000	Shifter Fork, Vehicular	Suffix - K & L
2(1)	3110-99-313-8019	FTC5200	Bearing, Ball, Annular	Suffix - J
2(2)	3310-99-145-0765	UTJ100210	Bearing, Ball, Annular	Suffix - K & L
3(1)	2520-99-832-3404	FTC5199	Push Rod, Clutch	Suffix - J
3(2)	2520-99-641-7825	UUF100060	Push Rod, Clutch	Suffix - K & L

SLAVE CYLINDER

REMOVAL

CAUTION

SLAVE CYLINDER. If removing the slave cylinder with the gearbox in-situ, DO NOT remove the push rod and clip from the clutch lever.

3 To remove the slave cylinder carry out the following:

3.1 Using a suitable container and a length of tubing drain the clutch fluid system at the slave cylinder bleed valve (Fig 1 (1)).

3.2 Disconnect the fluid pipe (6), remove the two securing bolts (2) and withdraw the slave cylinder (5) and backing plate (3).

3.3 If the dust cover (4) is not withdrawn with the cylinder, withdraw it from the bell housing.

DISMANTLING

4 Dismantle the slave cylinder as follows:

4.1 Remove the dust cover (Fig 2 (6)).

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

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

4.4 Remove the seal from the piston.

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

CLEANING

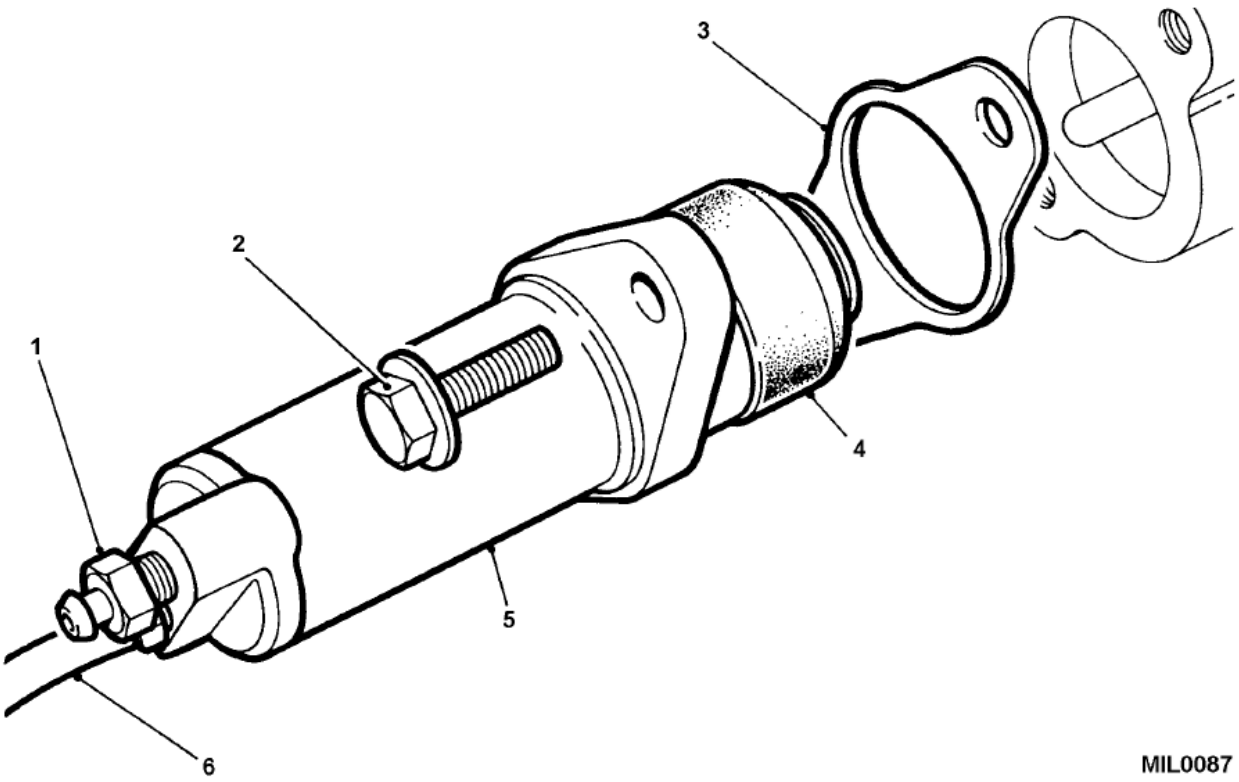
5 Thoroughly clean all of the components using new hydraulic fluid (refer to Table 1 Serial 1) and dry using a lint-free cloth.

EXAMINATION

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

REPAIRS AND REPLACEMENT

7 Renew the seal and dust cover using a repair kit.



1	Bleed valve	4	Dust cover
2	Bolt	5	Slave cylinder
3	Backing plate	6	Fluid pipe

Fig 1 Slave cylinder removal/installation

REASSEMBLY

CAUTION

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

8 Reassemble the slave cylinder as follows:

8.1 Fit the bleed valve (1); to the cylinder body (2) do not over-tighten.

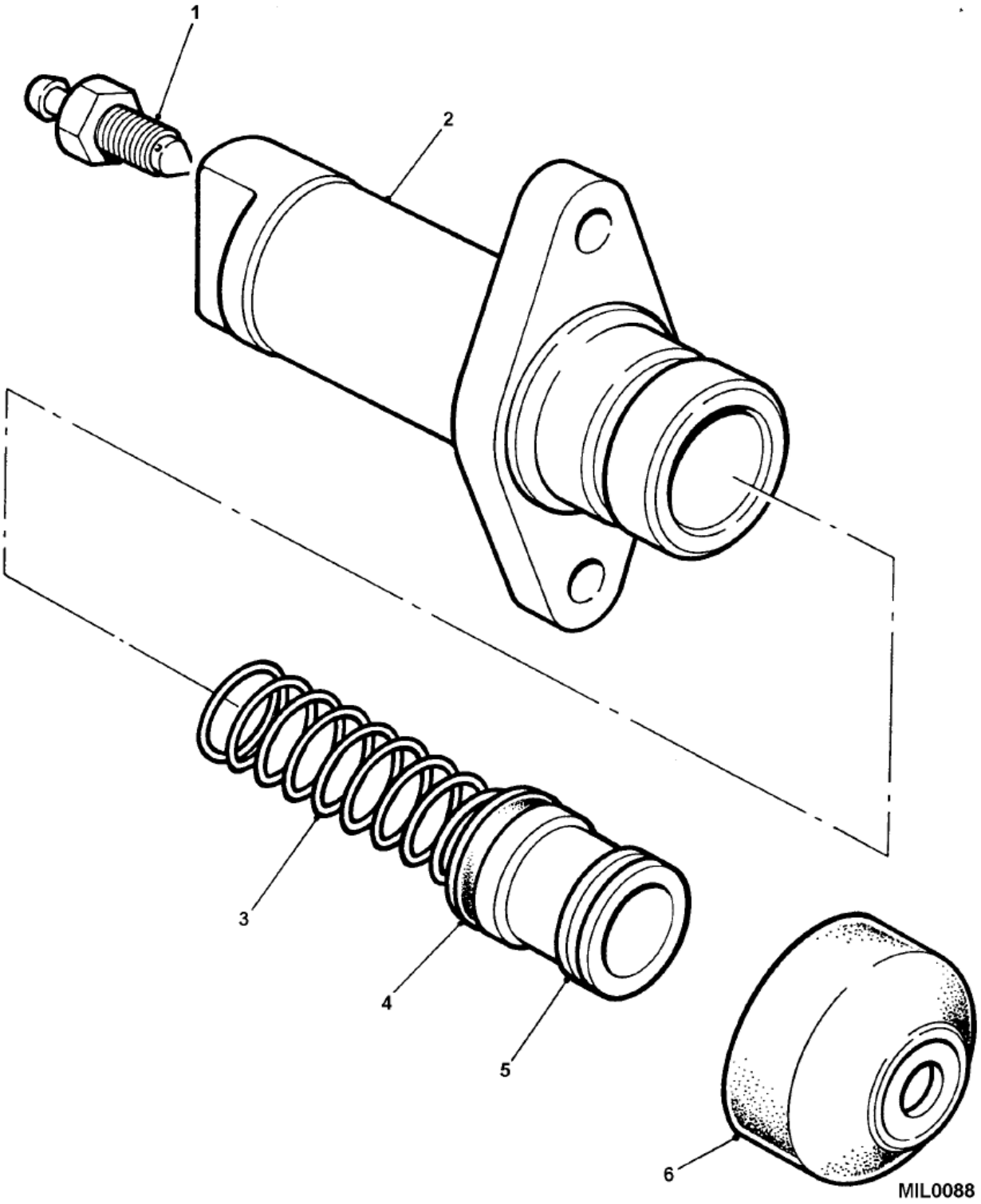
8.2 Lubricate the seals, piston and bore using new hydraulic fluid.

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

8.4 Locate the spring (3) over the front end of the piston (5).

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

8.6 Fill the dust cover (6) with silicon grease (refer to Table 1 Serial 2) and fit to the cylinder body.



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

Fig 2 Exploded view of slave cylinder

REFITTING

9 Refit the slave cylinder as follows:

9.1 Coat both sides of the backing plate (Fig 1 (3)) with waterproof jointing compound (refer to Table 1 Serial 3).

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

9.3 Reconnect the fluid pipe.

9.4 Replenish and bleed the hydraulic system (refer to Para 17).

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

MASTER CYLINDER

REMOVAL

10 To remove the master cylinder carry out the following:

10.1 Drain the hydraulic fluid from the system.

10.2 Disconnect the fluid pipe (Fig 3 (3)) at the master cylinder (4). Blank off the fluid port and the end of the pipe to prevent the ingress of foreign matter.

10.3 Unclip the air cleaner, disconnect the bottom hose and move the assembly aside.

10.4 From inside the vehicle remove the fibre board closing panel above the pedals.

10.5 Remove the six bolts (9) securing pedal bracket (5) to the bulkhead.

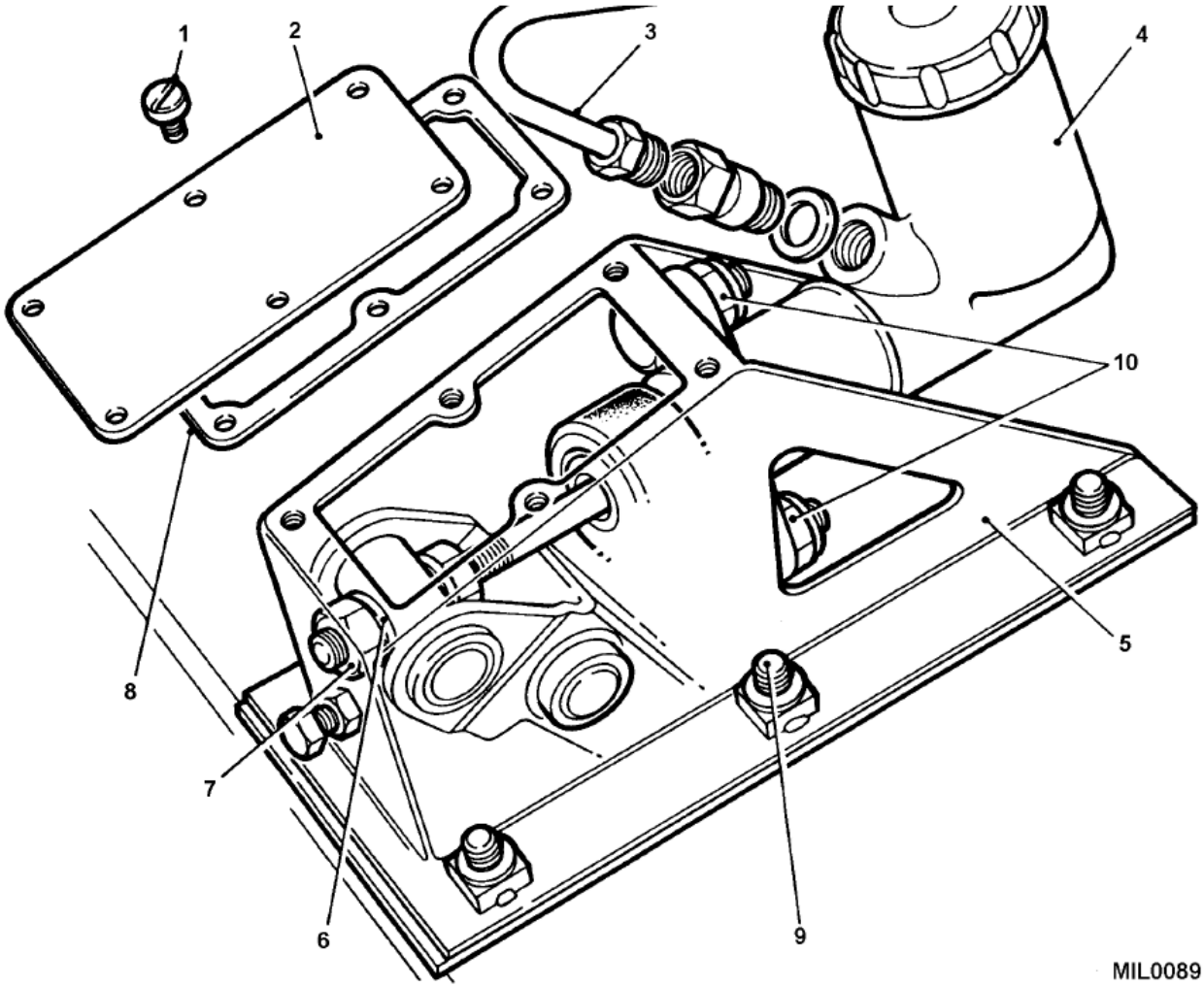
10.6 From inside the engine compartment remove the screw securing the speedometer cable to the top of the pedal bracket.

10.7 Move pipework and cables aside and lift out the pedal bracket complete, turn through 90° to ensure pedal clears hole in bulkhead.

10.8 With the assembly on a workbench, remove the six screws (1) securing the top cover (2) and gasket (8).

10.9 Remove the nut (7) and washer (6) from the end of the master cylinder push rod.

10.10 Remove the nuts and bolts (10) securing the master cylinder to the pedal bracket and remove the master cylinder.



1	Screw	6	Plain washer
2	Top cover	7	Nut
3	Fluid pipe	8	Gasket
4	Master cylinder	9	Bolt
5	Bracket	10	Nut, bolt and washer

Fig 3 Master cylinder removal

DISMANTLING

11 Dismantle the master cylinder as follows:

11.1 Remove the circlip (Fig 4 (1)) and withdraw the push-rod (3) and retaining washer (2).

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

11.3 Prise the locking prong of the spring retainer clear of the piston shoulder and withdraw the piston (Fig 5).

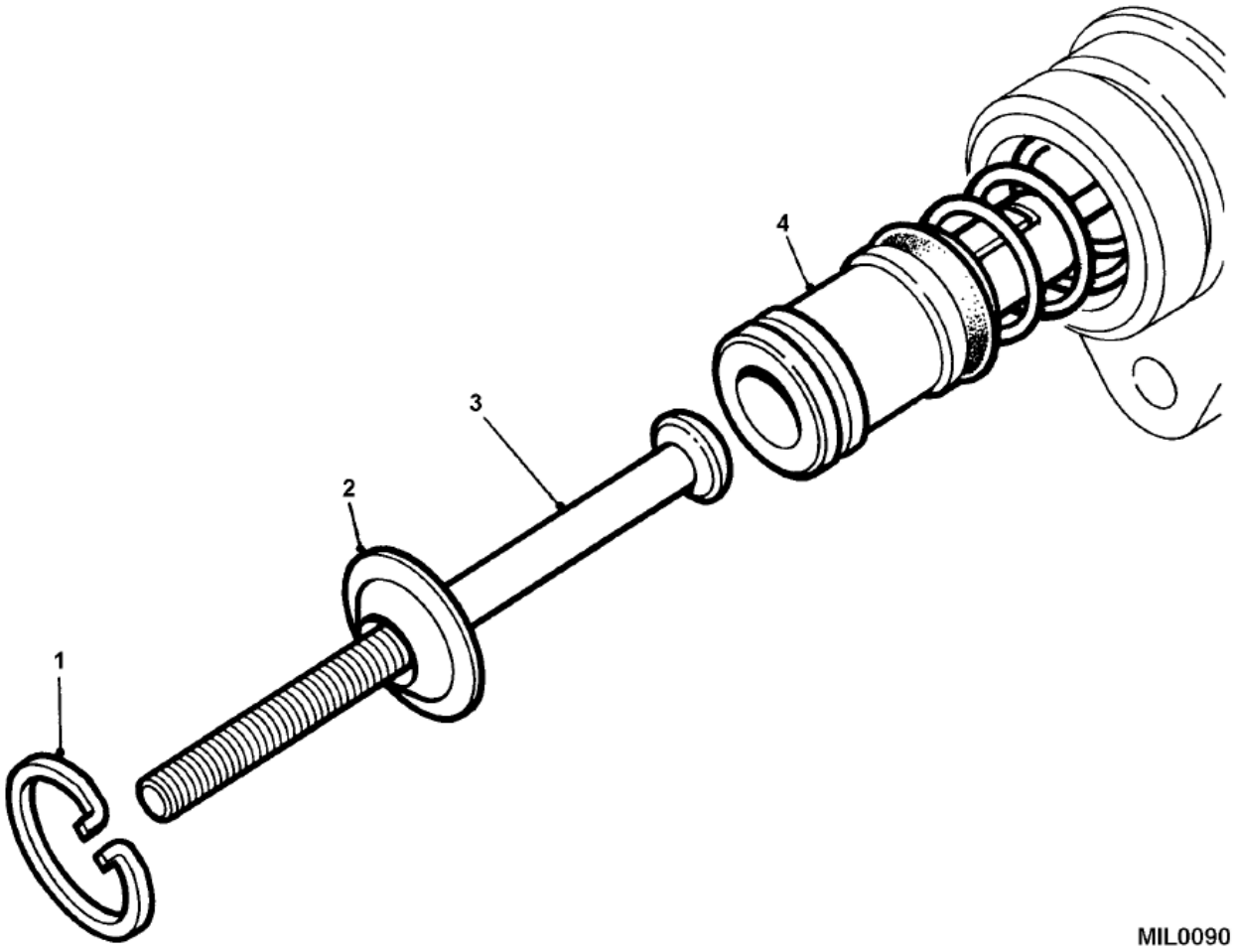
11.4 Remove the seal from the piston.

11.5 Compress the spring (Fig 6 (2)) and position the valve stem (5) to align with the larger hole in the spring retainer (1).

11.6 Withdraw the spring and retainer.

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

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



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

Fig 4 Push-rod and piston assembly

CLEANING

12 Thoroughly clean all of the components using new hydraulic fluid (refer to Table 1 Serial 1) and dry using a lint free cloth.

EXAMINATION

13 Examine the cylinder bore and piston, ensuring that they are free from corrosion, score marks or ridges. If there is any doubt, then renew.

REPAIRS AND REPLACEMENT

14 The seals should be replaced with new seals from a master cylinder repair kit.

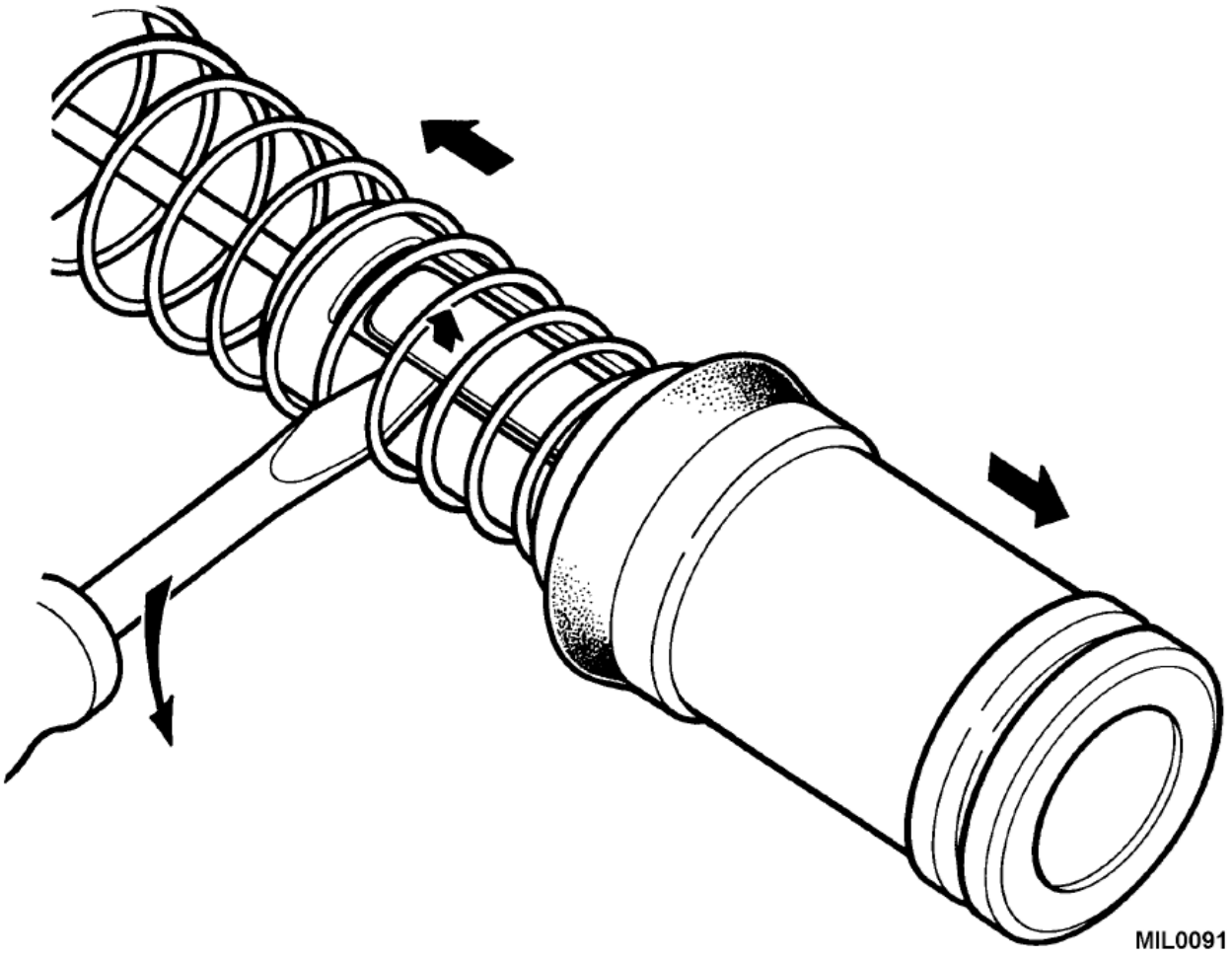
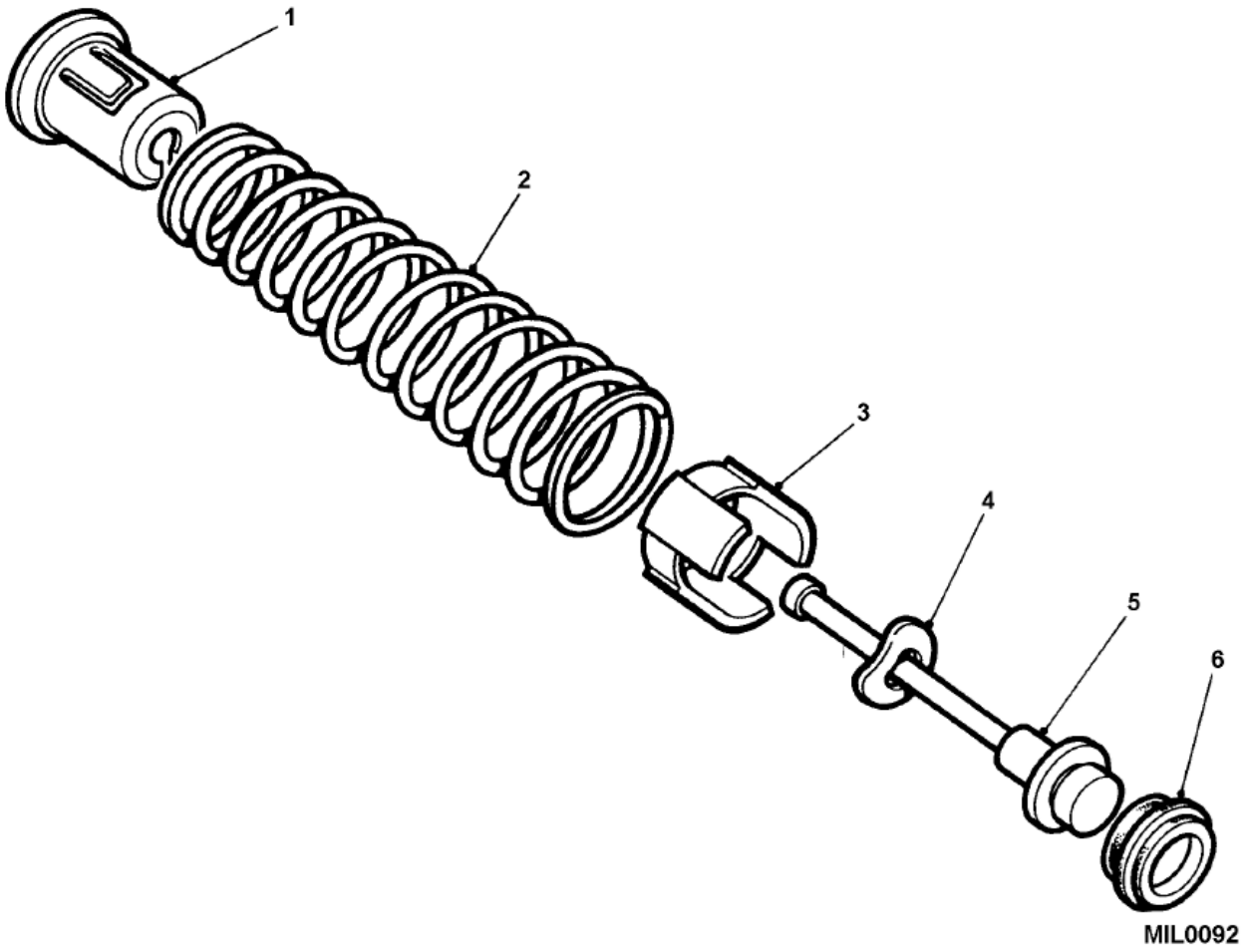


Fig 5 Removing piston from spring



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

Fig 6 Spring and valve assembly

REASSEMBLY

15 To reassemble the master cylinder proceed as follows:

15.1 Smear the seals with silicon grease (refer to Table 1 Serial 2) and the remaining internal components with clean hydraulic fluid (refer to Table 1 Serial 1).

15.2 Fit the new valve seal (Fig 7 (1)), flat side first, on the end of the valve stem (4).

15.3 Place the bowed washer (2), domed side first, over the small end of the valve stem.

15.4 Fit the spacer (3) to the valve stem, legs first.

15.5 Insert the retainer (Fig 6 (1)) into the spring (2).

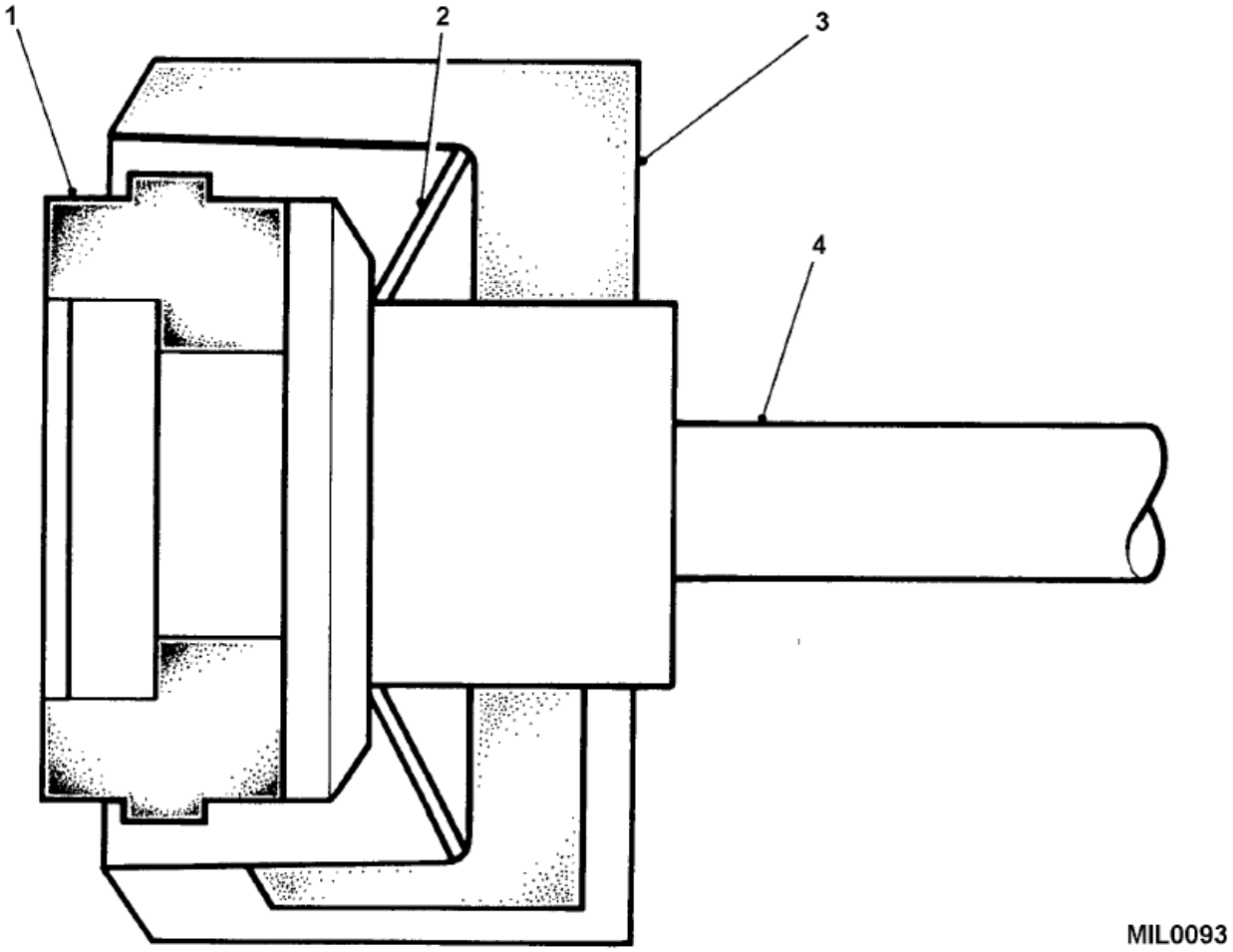
15.6 Compress the spring and engage the valve stem (5) in the key hole slot in the retainer.

15.7 Fit the new seal, large diameter last, to the piston (Fig 8 (3)).

15.8 Insert the piston (4) into the spring retainer (2) and engage the locking prong.

15.9 Smear the piston with a silicon grease (refer to Table 1 Serial 2) and insert the assembly, valve end first, into the cylinder.

15.10 Fit the push-rod (Fig 4 (3)), retaining washer (2) and circlip (1).



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

Fig 7 Location of valve seal and bowed washer

REFITTING

16 Refit the master cylinder as follows:

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

16.2 Fit the plain washer and nut to the end of the push rod.

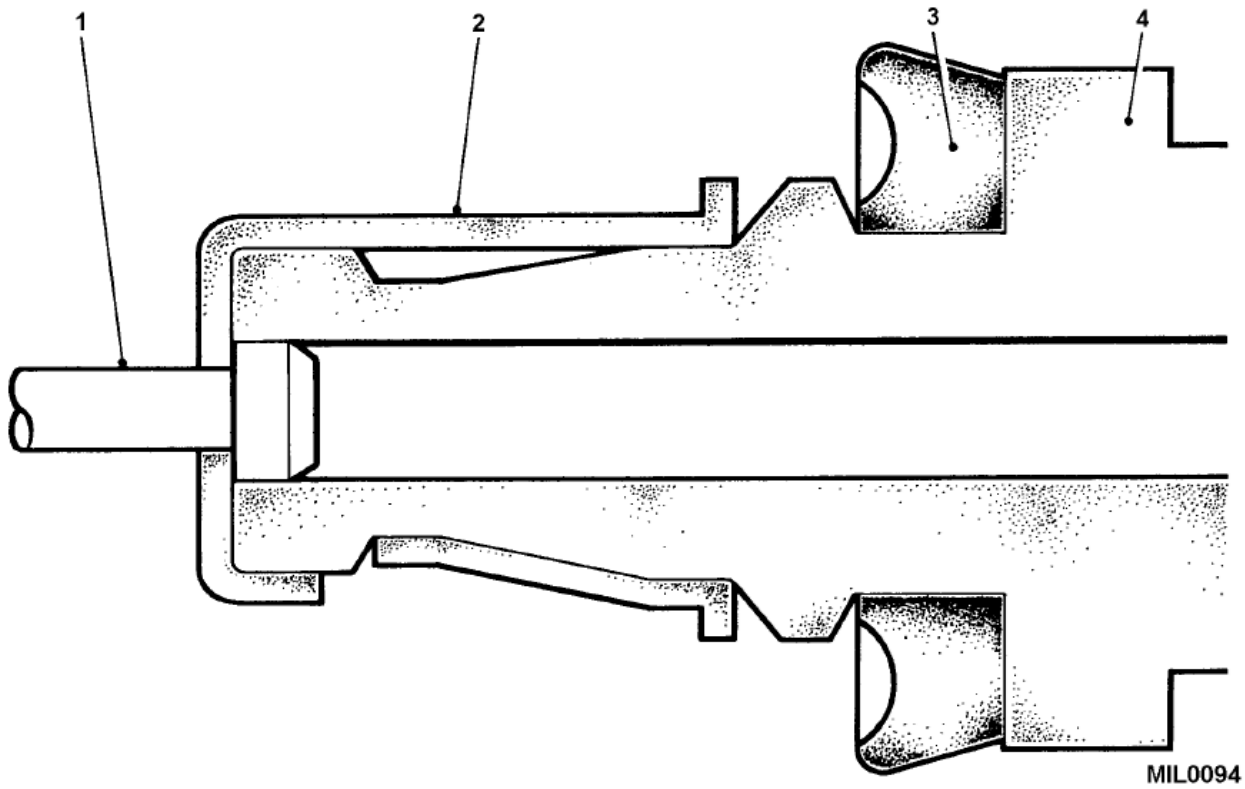
16.3 Fit the pedal bracket assembly onto the engine compartment bulkhead and secure.

16.4 Connect the fluid pipe to the master cylinder.

16.5 Bleed the clutch hydraulic system (refer to Para 17).

16.6 Carry out the clutch pedal and master cylinder setting procedure (refer to Para 18).

16.7 Fit the top cover and gasket to the to the pedal bracket and secure.



1	Valve stem	3	Piston seal
2	Spring retainer	4	Piston

Fig 8 Location of piston seal and spring retainer

16.8 Refit the air cleaner and hose and secure with the clips.

BLEEDING CLUTCH HYDRAULIC SYSTEM

CAUTION

HYDRAULIC FLUID. Use only the recommended hydraulic fluid (refer to Table 1 Serial 1).

NOTE

During the procedure, keep the fluid reservoir topped-up to avoid introducing air into the system.

17 To bleed the clutch hydraulic system proceed as follows:

17.1 Attach a length of suitable tubing to the slave cylinder bleed screw.

17.2 Place the free end of the tube in a glass jar containing clean clutch fluid.

17.3 Slacken the bleed screw.

17.4 Pump the clutch pedal, pausing at the end of each stroke, until the fluid issuing from the tubing is free of air with the free end below the surface of the fluid in the jar.

17.5 Whilst holding the clutch pedal down and with the free end of the tube below the fluid, tighten the bleed screw.

CLUTCH PEDAL AND MASTER CYLINDER SETTING

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

18.1 Slacken both locknuts on the master cylinder push rod.

18.2 Check the distance from the lower edge of the clutch pedal to the floor. The correct distance is 140 mm (5.500 in.) without a floor mat (Fig 9).

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

18.4 Adjust the master cylinder push-rod until there is approximately 1.500 mm (0.062 in.) free play between the push rod and the master cylinder piston.

18.5 Tighten both locknuts.

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

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

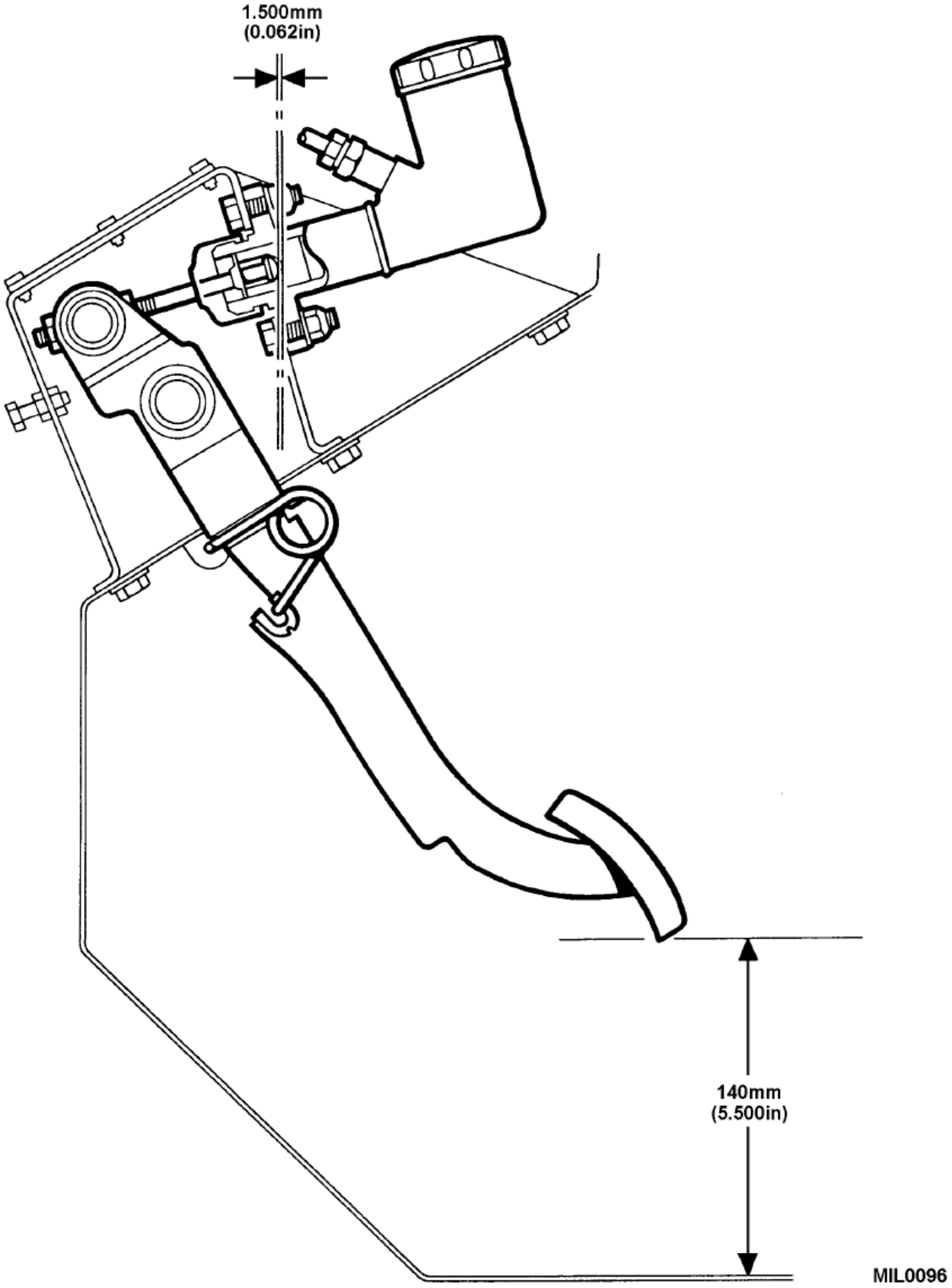


Fig 9 Clutch pedal setting