# Ministry of Defence

Army Equipment Support Publication

# TRUCK UTILITY LIGHT (TUL) HS, TRUCK UTILITY MEDIUM (TUM) HS AND (TUM) BATTLEFIELD AMBULANCE HS, ALL VARIANTS

This publication contains information covering the requirement of Category 523 at levels 3 - 4.

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| 46 | | |
| 47 | | |
| 48 | | |
| 49 | | |
| 50 | | |
| 51 | | |
| 52 | | |
| 53 | | |
| 54 | | |
| 55 | | |
| 56 | | |
| 57 | | |
| 58 | | |
| 59 | | |
| 60 | | |
| 61 | | |
| 62 | | |

## CONTENTS

**PRELIMINARY MATERIAL**

Page

Front cover (title page) ..... (i)
AMENDMENT RECORD ..... (iii)/(iv)
CONTENTS (this list) ..... (v)
PREFACE ..... (v)
Introduction ..... (v)
Vehicle asset codes ..... (vi)
Related and Associated Publications ..... (x)
Related Publications ..... (x)
Associated Publications ..... (xi)
WARNINGS AND CAUTIONS ..... (xi)
Warnings ..... (xi)
Cautions ..... (xi)
ABBREVIATIONS AND SYMBOLS ..... (xiii)/(xiv)
Abbreviations ..... (xiii)/(xiv)
Symbols ..... (xiii)/(xiv)

Table Page

1 Vehicle asset codes ..... (vi)

**OPERATING INFORMATION**

Chapters

1 2.5 Litre 300Tdi direct injected diesel engine
2 Clutch
3 Five speed manual gearbox
4 LT230T Transfer box and propeller shafts

## PREFACE

| | |
|---|---|
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## INTRODUCTION

1 Users should forward any comments on this publication in accordance with Army Equipment Support Publication (AESP) 0100-P-011-013. All comments are only to be submitted using the electronic and interactive Form 10 which can be accessed and downloaded from the Joint Asset Management and Engineering Solutions (JAMES) Portal (via Hot Topic – Forms) or from DR TDOL (F10).

2 All electronic Form 10s are to be completed and forwarded to the Form 10 cell using the instructions accompanying the form in its template location. Security procedures are to be observed in accordance with Joint Services Publication (JSP) 440.

3 The Form 10 procedure is only to be used for the purpose of commenting on the content of an individual AESP and must not be used:

3.1 In place of the Equipment Failure Reporting (EFR) procedure outlined in The Land Equipment Unit Maintenance Standards (LEUMS).

3.2 For subjects which are the concern of the Technical Staff Suggestions outlined in Army General and Administrative Instructions (AGAI):

**VEHICLE ASSET CODES**

4 The vehicle asset code details are listed in Table 1.

**TABLE 1 VEHICLE ASSET CODES**

| Serial (1) | Nomenclature (2) | NSN (3) | Asset Code (4) |
|---|---|---|---|
| 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 Bowman NH | 2310-99-908-6890 | NB 1047 3160 |
| 4 | Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman NH | 2310-99-908-6891 | NB 1047 3161 |
| 5 | Ambulance Battlefield (HS) 4 Stretcher LHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2310-99-893-9970 | NB 1047 8100 |
| 6 | Ambulance Battlefield (HS) 4 Stretcher LHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman NH | 2310-99-908-6892 | NB 1047 8160 |
| 7 | 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 |
| 8 | 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 |
| 9 | Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (EEGR) Tropical | 2310-99-908-5446 | NB 1049 3100 |
| 10 | 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 |
| 11 | 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 |
| 12 | 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 |
| 13 | 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 |

(continued)

**TABLE 1 VEHICLE ASSET CODES (continued)**

| Serial (1) | Nomenclature (2) | NSN (3) | Asset Code (4) |
|---|---|---|---|
| 14 | Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (EEGR) Tropical with Bowman NH | 2310-99-908-6894 | NB 1049 3160 |
| 15 | Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (EEGR) Tropical with Bowman NH & Medical Monitoring IK | 2310-99-908-6895 | NB 1049 3161 |
| 16 | Ambulance Battlefield (HS) 4 Stretcher RHD 4x4 Land Rover 2.5 Tdi (Non EEGR )Tropical With Bowman NH & Medical Monitoring IK | 2310-99-908-6896 | NB 1049 3162 |
| 17 | Truck Utility Light (HS) GS (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Winter/Water | 2320-99-893-9933 | NB 4219 3100 |
| 18 | Truck Utility Light (HS) GS (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9741 | NB 4220 3100 |
| 19 | Truck Utility Light (HS) GS (Soft Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9964 | NB 4220 8100 |
| 20 | Truck Utility Light (HS) GS (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Winter | 2320-99-908-5441 | RB 4224 3100 |
| 21 | Truck Utility Light (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9742 | NB 4225 3100 |
| 22 | Truck Utility Light (HS) FFR (Hard Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9965 | NB 4225 8100 |
| 23 | Truck Utility Light (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Winter/Water | 2320-99-893-9935 | NB 4226 3100 |
| 24 | Truck Utility Light (HS) FFR (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9936 | NB 4228 3100 |
| 25 | Truck Utility Light (HS) FFR (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Air Dropable | 2320-99-908-5442 | NB 4232 3100 |
| 26 | Truck Utility Medium (HS) GS (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Heli Support | 2320-99-908-5449 | RB 5006 3100 |
| 27 | Truck Utility Medium (HS) GS (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Winter/Water | 2320-99-893-9938 | NB 5008 3100 |
| 28 | Truck Utility Medium (HS) GS (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Winter/Water | 2320-99-893-9939 | NB 5009 3100 |
| 29 | Truck Utility Medium (HS) GS (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Winter / Water with Bowman NH | 2320-99-908-6924 | NB 5009 3160 |
| 30 | Truck Utility Medium (HS) GS (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (Non EEGR) | 2320-99-893-9743 | NB 5010 3100 |
| 31 | Truck Utility Medium (HS) GS (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9963 | NB 5010 3101 |
| 32 | Truck Utility Medium (HS) GS (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (Non EEGR) with Bowman NH | 2320-99-908-6904 | NB 5010 3161 |
| 33 | Truck Utility Medium (HS) GS (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (Non EEGR) with BOWMAN SH | 2320-99-908-6905 | NB 5010 3171 |
| 34 | Truck Utility Medium (HS) GS (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (Non EEGR) Trial Vehicle | 2320-99-908-5511 | NB 5010 3199 |

(continued)

**TABLE 1 VEHICLE ASSET CODES (continued)**

| Serial (1) | Nomenclature (2) | NSN (3) | Asset Code (4) |
|---|---|---|---|
| 35 | Truck Utility Medium (HS) GS (Soft Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9966 | NB 5010 8100 |
| 36 | Truck Utility Medium (HS) GS (Soft Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman NH | 2320-99-908-6906 | NB 5010 8160 |
| 37 | Truck Utility Medium (HS) GS (Soft Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman SH | 2320-99-908-6907 | NB 5010 8170 |
| 38 | Truck Utility Medium (HS) GS (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9940 | NB 5017 3100 |
| 39 | Truck Utility Medium (HS) GS (Hard Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9967 | NB 5017 8100 |
| 40 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9744 | NB 5020 3100 |
| 41 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) with ODETTE DF IK | 2320-99-908-5944 | NB 5020 3101 |
| 42 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) with ODETTE IC IK | 2320-99-908-5945 | NB 5020 3102 |
| 43 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) with ODETTE TCAD IK | 2320-99-908-5946 | NB 5020 3103 |
| 44 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) with WILDCAT IK | 2320-99-908-6066 | NB 5020 3104 |
| 45 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) with SPICE IK | 2320-99-908-6417 | NB 5020 3107 |
| 46 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman NH | 2320-99-908-6913 | NB 5020 3160 |
| 47 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman SH | 2320-99-908-6914 | NB 5020 3170 |
| 48 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) with BOWMAN BF LAS | 2320-99-908-6911 | NB 5020 3180 |
| 49 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) with BOWMAN FF LAS | 2320-99-908-6912 | NB 5020 3190 |
| 50 | Truck Utility Medium (HS) FFR (Hard Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9968 | NB 5020 8100 |
| 51 | Truck Utility Medium (HS) FFR (Hard Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) with NBC Support | 2320-99-908-6492 | NB 5020 8104 |
| 52 | Truck Utility Medium (HS) FFR (Hard Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman NH | 2320-99-908-6918 | NB 5020 8160 |
| 53 | Truck Utility Medium (HS) FFR (Hard Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman SH | 2320-99-908-6919 | NB 5020 8170 |
| 54 | Truck Utility Medium (HS) FFR (Hard Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman BF LAS | 2320-99-908-6916 | NB 5020 8180 |

(continued)

**TABLE 1 VEHICLE ASSET CODES (continued)**

| Serial (1) | Nomenclature (2) | NSN (3) | Asset Code (4) |
|---|---|---|---|
| 55 | Truck Utility Medium (HS) FFR (Hard Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman FF LAS | 2320-99-908-6917 | NB 5020 8190 |
| 56 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Winter/Water | 2320-99-893-9941 | NB 5021 3100 |
| 57 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Winter/Water with Bowman NH | 2320-99-908-6926 | NB 5021 3160 |
| 58 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Winter/Water with Bowman SH | 2320-99-908-6927 | NB 5021 3170 |
| 59 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Winter/Water with Bowman BF LAS | 2320-99-908-6928 | NB 5021 3180 |
| 60 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Winter/Water with Bowman FF LAS | 2320-99-908-6920 | NB 5021 3190 |
| 61 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) with Commander's IK | 2320-99-908-5720 | NB 5022 3100 |
| 62 | Truck Utility Medium (HS) FFR (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9745 | NB 5031 3100 |
| 63 | Truck Utility Medium (HS) FFR (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman NH | 2320-99-908-6922 | NB 5031 3160 |
| 64 | Truck Utility Medium (HS) FFR (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) with Bowman SH | 2320-99-908-6923 | NB 5031 3170 |
| 65 | Truck Utility Medium (HS) FFR (Soft Top) LHD 4x4 Land Rover 2.5 Tdi (EEGR) | 2320-99-893-9969 | NB 5031 8100 |
| 66 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) (SIGS) | 2320-99-908-5272 | NB 5035 3100 |
| 67 | Truck Utility Medium (HS) GS (S/Wagon) RHD 4x4 Land Rover 2.5 Tdi (EEGR) 110 Media Operations Support Vehicle | 2320-99-908-6976 | NB 5040 3100 |
| 68 | Truck Utility Medium (HS) FFR (Hard Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) Winter Heli Support vehicle | 2320-99-908-5450 | RB 5042 3100 |
| 69 | Truck Utility Medium (HS) FFR 4x4 Land Rover 2.5 TDi (w/EEGR) Scout | 2320-99-908-7633 | NB 5033 3100 |
| 70 | Truck Utility Medium (HS) GS (Soft Top) RHD 4x4 Land Rover 2.5 Tdi (EEGR) TETHYS IK FES | 2320-99-490-5237 | NB 5037 3100 |
| 71 | Truck Utility Medium (HS) 4x4 GS (Hard Top) Land Rover 130 2.5 Tdi Double Cab Pickup (DCPU) | 2320-99-908-7750 | NB 5045 3100 |
| 72 | Truck Utility Medium (HS) 4x4 GS (Soft Top) Land Rover 130 2.5 Tdi Double Cab Pickup (DCPU) | 2320-99-908-7876 | NB 5046 3100 |

5 Manufacturer:

Rover Group Ltd. Solihull, England

## RELATED AND ASSOCIATED PUBLICATIONS

### Related Publications

6 The AESP Octad for the subject equipment consists of the publications shown below. All references are prefixed with the first eight digits of this publication.

| Category/Sub-category | | | Information Level | | | |
|---|---|---|---|---|---|---|
| | | | 1 User/ Operator | 2 Unit Maintenance | 3 Field Maintenance | 4 Base Maintenance |
| 1 | 0 | Purpose and Planning Information | 101 | 101 | 101 | 101 |
| | 1 | Equipment Support Policy Directives | 111 | 111 | 111 | 111 |
| | 2 | Cancellation Instructions | * | * | * | * |
| 2 | 0 | Operating Information | 201 | 201 | 201 | 201 |
| | 1 | Aide-Memoire | 211 | 211 | * | * |
| | 2 | Training Aids | * | * | * | * |
| 3 | | Technical Description | 302 | * | * | * |
| 4 | 1 | Installation Instructions | 411 | 411 | 411 | 411 |
| | 2 | Preparation for Special Environments | 421 | 421 | 421 | 421 |
| 5 | 1 | Failure Diagnosis | * | 512 | 512 | 512 |
| | 2 | Maintenance Instructions | * | 522 | 523 | 523 |
| | 3 | Inspection Standards | * | 532 | 533 | 533 |
| | 4 | Calibration Procedures | * | * | 524 | 524 |
| 6 | | Maintenance Schedules | 601 | 601 | 601 | 601 |
| 7 | 1 | Illustrated Parts Catalogues | 711 | 711 | 711 | 711 |
| | 2 | Commercial Parts Lists | * | 721 | 721 | 721 |
| | 3 | Complete Equipment Schedule, Production | * | * | * | * |
| | 4 | Complete Equipment Schedule, Service Edition (Simple Equipment) | 741 | 741 | 741 | 741 |
| | 5 | Complete Equipment Schedule, Service Edition (Complex Equipment) | * | * | * | * |
| 8 | 1 | Modification Instructions | 811 | 811 | 811 | 811 |
| | 2 | General Instructions, Special Technical Instructions and Servicing Instructions | 821 | 821 | 821 | 821 |
| | 3 | Service Engineered Modification Instructions (RAF only) | * | * | * | * |

* Category/sub-category not published

**Associated Publications**

7 The following associated publications should be read in conjunction with this category:

| Reference | Title |
|---|---|
| AESP 2610-B-100-013 | Pneumatic, Solid And Cushioned Tyres, Tubes And Associated Road Wheels |
| AP 3260 Book 1 | Mechanical Transport Maintenance Regulations for the Royal Air Force |
| JSP 800 | Road Transport Regulations |

## WARNINGS AND CAUTIONS

8 The following WARNINGS are used in this category:

**WARNINGS**

**(1) ENGINE STAND. WHEN USING AN ENGINE STAND, IT IS ESSENTIAL TO FOLLOW THE STAND MANUFACTURER'S USER INSTRUCTIONS TO ENSURE SAFE AND EFFECTIVE USE OF THE EQUIPMENT.**

**(2) FRAGMENTATION HAZARD. ADEQUATE PRECAUTIONS MUST BE TAKEN AGAINST FLYING FRAGMENTS WHEN SPLITTING THE RING GEAR.**

**(3) PROTECTIVE GOGGLES. WHEN REMOVING VALVE SEAT INSERTS FROM THE CYLINDER HEAD PROTECTIVE GOGGLES MUST BE WORN.**

**CAUTIONS**

9 The following CAUTIONS are used in this category:

**(1) BATTERY LEADS. On 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.**

**(2) BELL HOUSING SEPARATION. The mating faces between the engine and the bell housing are coated with a sealant and will offer resistance during separation.**

**(3) BELTS. Ease the timing belt off the gears using the fingers only. Metal levers may damage the belt and gears. Do not rotate crankshaft, injection pump or camshaft with timing belt removed and cylinder head fitted. Timing belts must be stored and handled with care. Always store a timing belt on its edge with a bend radius greater than 50 mm (2.0 in). Do not use a timing belt that has been twisted or bent double as this will damage the reinforcing fibres. If excessive timing belt debris is evident in the front cover, this is probably due to the misalignment of the front timing cover caused by incorrect assembly of the fuel injection pump bracket. Do not use an oil or coolant contaminated timing belt, cause of contamination must be rectified.**

**(4) DAMAGE TO FACES. Do not insert tools in between the mating faces of the engine and gearbox to aid separation as this will damage the surfaces and ruin the integrity of the waterproof seal.**

**(5) DEBURRING. Remove any burrs and swarf from the pocket. Failure to do so could cause the new insert to crack when fitted.**

(Continued)

CAUTIONS (continued)

(6) ENGINE STARTING. On 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.

(7) HIGH SPRING LOAD. Take care when releasing the retainer bolt as the gear lever ball is spring loaded in its seat by a strong spring and nylon plunger.

(8) Length of the torque meter must not exceed 250 mm (9.8 inches) from centre of square to end of meter.

(9) LOCATION. Ensure end of setscrew locates in hole in selector shaft.

(10) PIN HEAD LOCATION. Ensure that head of pin is on opposite side of quadrant to selector shaft boss

(11) PLUNGER LOCATION. Ensure nylon plunger is facing away from bias spring location.

(12) REAMER. After the cutting edges of the reamer have passed through the guide detach the handle and withdraw the reamer from the combustion side of the head. Under no circumstances should the reamer be withdrawn back through the guide.

(13) SUMP DAMAGE. Ensure care and attention is applied when supporting the engine so there is no damage to the sump.

(14) SURFACE 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 during this operation.

(15) TENSIONING. Failure to carry out accurate belt tensioning could result in belt failure and serious engine damage.

## ABBREVIATIONS AND SYMBOLS

### ABBREVIATIONS

10 The following abbreviations are used in this category:

| Abbreviation | Definition |
|---|---|
| A | Ampere |
| AESP | Army Equipment Support Publication |
| AF | Across Flat |
| ECU | Electronic Control Unit |
| EEGR | Electric Exhaust Gas Recirculation |
| EGR | Exhaust Gas Recirculation |
| FFR | Fitted For Radio |
| ft | Feet |
| HS | High Specification |
| lbf | Pounds foot (Unit of Imperial measurement) |
| LHD | Left Hand Drive |
| mm | millimetre(s) |
| Nm | Newton meter |
| RHD | Right Hand Drive |
| TDC | Top Dead Centre |
| Tdi | Turbo direct injection |
| TUL | Truck Utility Light |
| TUM | Truck Utility Medium |

### SYMBOLS

11 The following symbol is used in this category.

| Symbol | Definition |
|---|---|
| + | Plus |
| °C | Celcius |

# CHAPTER 1

# ENGINES

## CONTENTS

Para

1 Introduction
2 General

## INTRODUCTION

1 This Chapter details the Field repair of the engine systems as fitted to Truck Utility Light (TUL) High Specification (HS) and Truck Utility Medium (TUM) HS and (TUM) Battlefield Ambulance HS vehicles.

### General

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

Chapter 1-1 2.5 litre 300 Tdi direct injected diesel engine.

Chapter 1-2 Winterised/Waterproofed.

Chapter 1-3 Tropicalised.

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## CHAPTER 1-1

# 2.5 LITRE 300 TDI DIRECT INJECTED DIESEL ENGINE

## CONTENTS

Para

1 Introduction
2 Engine
3 Removal (WARNING)
4 Installation (CAUTION)
Cylinder head assembly
5 Removal
6 Cam followers
7 Examination
8 Valve guides (CAUTION)
9 Refacing cylinder head valve seat inserts
10 Renew valve seat inserts (WARNING) (CAUTIONS)
Reassembly
11 Cam followers
Timing belt, gears, timing gear housing and cover (before engine No. 25I01943A)
12 General
13 Dismantling
14 Drive Belt Auto-Tensioner
15 Crankshaft Pulley
16 Timing Gear Front Cover
17 Timing Belt, Gears and Pulleys (CAUTION)
18 Timing Gear Housing
19 Oil Pump
20 Cleaning
21 Examination
Reassembly
22 Oil Pump
23 Timing Gear Housing
24 Timing Gear Housing Crankshaft Seal
25 Timing Gear Housing Camshaft Seal
26 Timing Gears
27 Timing
28 Timing Belt and Tensioner (CAUTION)
29 Timing Gear Front Cover Seal
30 Timing Gear Front Cover
Timing belt, gears, timing gear housing and cover (from engine No. 25I01943A)
31 General
32 Dismantling
33 Drive Belt Auto-Tensioner
34 Crankshaft Pulley
35 Timing Gear Front Cover
36 Timing Belt, Gears and Pulleys (CAUTION)
37 Timing Gear Housing
38 Oil Pump
39 Cleaning
40 Examination
Reassembly
41 Oil pump
42 Timing Gear Housing

(continued)

**CONTENTS (continued)**


43 Timing Gear Housing Crankshaft Seal
44 Timing Gear Housing Camshaft Seal
45 Timing Gears
46 Timing
47 Timing Belt and Tensioner (CAUTIONS)
48 Timing Gear Front Cover Seal
49 Timing Gear Front Cover
50 Drive Belt and Pulleys
51 Radiator
52 Oil Cooler
53 Batteries (CAUTION)
Oil pick-up strainer
56 Removal
57 Refitting
Flywheel and starter ring gear
58 Removal
59 Examination
60 Renewing Starter Ring Gear (WARNING)
61 Refitting

Table Page

1 Special Tools ..... 4
2 Sealants, adhesives and lubricants ..... 4

Fig Page

1 Engine removal disconnection points ..... 9
2 Cam follower removal ..... 12
3 Removing the valves guides ..... 13
4 Fitting the valve guides ..... 13
5 Valve seat replacement ..... 14
6 Timing belt, gears, pulleys and covers ..... 17
7 Timing pin located in flywheel housing ..... 20
8 Removing the crankshaft timing gear ..... 21
9 Removing camshaft gear ..... 22
10 Removing the timing pin and injector pump gear ..... 23
11 Oil pump removal ..... 24
12 Bolt locations for timing gear housing ..... 25
13 Fitting timing gear housing crankshaft seal ..... 26
14 Timing pin located in flywheel housing ..... 27
15 Aligning timing marks on timing gear housing ..... 28
16 Fitting the timing belt tensioner pulley ..... 29
17 Tensioning timing belt using torque meter ..... 30
18 Timing belt, gears, pulleys and covers ..... 35
19 Timing pin located in flywheel housing ..... 37
20 Removing the camshaft gear ..... 38
21 Removing the timing pin and injector pump gear ..... 39
22 Timing pin located in flywheel housing ..... 39
23 Oil pump removal ..... 40
24 Bolt locations for timing gear housing ..... 41
25 Fitting timing gear housing crankshaft seal ..... 42
26 Timing pin located in flywheel housing ..... 43
27 Aligning timing marks on timing gear housing ..... 44


(continued)

**CONTENTS (continued)**


| Fig | | Page |
|---|---|---|
| 28 | Fitting the timing belt tensioner pulley | 45 |
| 29 | Tensioning timing belt using torque meter | 46 |
| 30 | Fitting front timing cover oil seal | 47 |
| 31 | Bolt locations for front timing cover | 48 |
| 32 | Drive belt and pulley location | 49 |
| 33 | Oil strainer and return pipe | 50 |
| 34 | Flywheel removal | 52 |
| 35 | Removing starter ring gear | 53 |
| 36 | Fitting starter ring gear | 54 |

Introduction

1 This Chapter details the Field repairs for Truck Utility Light (TUL) High Specification (HS), Truck Utility Medium (TUM) (HS) and (TUM) Battlefield Ambulance HS vehicles with 2.5 Litre 300 Tdi Turbocharged direct injected (Tdi) diesel engines.

NOTE

When receiving a new engine albeit Electric Exhaust Gas Recirculation (EEGR) or Non-EEGR use the existing ancillaries to dress the new engine to its original configuration (Fitted for Radio (FFR) only).

**ENGINE**

2 The special tools and consumables listed in the following tables will be referred to in the text, where used, by the serial number shown in column 1.

**TABLE 1 SPECIAL TOOLS**

| Serial (1) | Manufacturer's Part Number (2) | NSN/Part Number where applicable (3) | Designation (4) |
|---|---|---|---|
| 1 | LRT-12-036 | 6MT2/5120-99-616-7681 | Drift - valve guide removal tool |
| 2 | LRT-12-515 | 6MT2/5120-99-192-2110 | Distance piece - valve guide fitting |
| 3 | LRT-12-046 | 6MT2/5120-99-062-2206 | Drift - valve guide fitting |
| 4 | LRT-12-031 | 6MT2/5120-99-724-4441 | Crankshaft/camshaft gear remover |
| 5 | LRT-12-044 | 6MT2/5120-99-562-4195 | Flywheel timing pin |
| 6 | LRT-12-045 | 6MT2/5120-99-257-9322 | Injection pump locking pin |
| 7 | LRT-12-080 | 6MT2/5120-99-662-7366 | Crankshaft pulley retainer |
| 8 | LRT-12-049 | 6MT2/5120-99-168-9565 | Pulley extractor |
| 9 | LRT-12-078 | 6MT2/5120-99-147-2271 | Remover adapter |

**TABLE 2 SEALANTS, ADHESIVES AND LUBRICANTS**

| Serial (1) | Manufacturers Part Number (2) | NSN/Part Number where applicable (3) | Designation (4) |
|---|---|---|---|
| 1 | OX-90 | 9150-99-361-7232 | Engine oil |
| 2 | Hylomar universal | 8030-99-762-0064 | Sealing compound |
| 3 | Rocol MTS 1000 | 9150-99-224-5626 | Molybdenum disulphide grease |
| 4 | Loctite 242 | 8030-99-225-0248 | Sealant |

**Removal**

3 To remove the engine from the vehicle proceed as follows:

3.1 Park the vehicle on level ground and apply the park brake.

3.2 Disconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on FFR vehicles the radio batteries (refer to Cat 522 Chap 13-2).

3.3 Disconnect the earth bonding straps and remove the bonnet (refer to Cat 522 Chap 16-1).

3.4 On FFR vehicles remove the 50 Ampere (A) alternator (refer to Cat 522 Chap 13-2).

3.5 Disconnect air cleaner to turbocharger hose (Fig 1 (14)) side air intake and remove air cleaner (13). Refer to Cat 522 Chap 11-1.

3.6 Remove cable ties securing gearbox harness to breather pipes (11).

3.7 Disconnect harness from diff-lock and reverse light switches from under vehicle.

3.8 Manoeuvre harness into engine bay.

3.9 Remove the radiator assembly (7) (refer to Cat 522 Chap 12-1).

3.10 Remove pipe/hoses (4) from turbocharger to intercooler.

3.11 Disconnect heater hoses (10) from cylinder head and heater rails.

3.12 Remove starter motor terminal cover and disconnect positive and fuse box leads (9).

3.13 Remove three retaining nuts and disconnect exhaust down pipe (12).

3.14 Disconnect inlet and outlet hoses (21) from power steering pump.

3.15 Disconnect bypass hose (3) from thermostat housing.

3.16 Release bypass hose from retaining clips on front timing cover.

3.17 Remove split pin securing inner throttle cable (17) to injection pump.

3.18 Depress tags on outer cable adjusting nut, remove cable from mounting bracket and move aside.

3.19 If fitted, release hand throttle cable from mounting bracket and injector pump and move aside.

3.20 Disconnect fuel filter pipe (18) and spill return pipe from injector pump.

3.21 Disconnect both the fuel inlet (15) and fuel filter (16) pipes from fuel lift pump.

3.22 Release fuel feed pipe from retaining clip on air cleaner bracket.

3.23 Disconnect brake servo hose (20) from vacuum pump.

3.24 Blank off pipes, hoses and adapters from which they have been removed to prevent the ingress of dirt or foreign matter.

3.25 Remove engine oil cooler pipes (1) from oil filter adapter.

3.26 Drain the oil sump using a container of suitable capacity.

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

3.28 Remove engine mountings (refer to Cat 522 Chap 1-1).

3.29 Support the gearbox assembly, using a suitable jack or by using packing blocks between the gearbox and the chassis cross member.

3.30 Remove engine to bell housing fixings, leaving starter motor attached to engine.

3.31 Carefully raise engine and pull away from gearbox.

3.32 Ensure all relevant connections to engine have been removed noting their locations for re-fitting.

3.33 Remove the engine.

**WARNING**

**ENGINE STAND. WHEN USING AN ENGINE STAND, IT IS ESSENTIAL TO FOLLOW THE STAND MANUFACTURERS USER INSTRUCTIONS TO ENSURE SAFE AND EFFECTIVE USE OF THE EQUIPMENT.**

3.34 Secure the engine to a suitable mounting stand and remove the lifting chains and hoist.

**Installation**

4 The procedure for installing the engine is as follows:

4.1 Attach a suitable lifting sling and hoist to the engine and remove from mounting stand.

4.2 Clean the flywheel and bell housing mating faces to remove old sealant. Re-coat the faces with sealant (refer to Table 2 Serial 2).

4.3 Smear the splines of the gearbox primary pinion, the clutch centre and the release lever abutment faces with Molybdenum disulphide grease (refer to Table 2 Serial 3).

4.4 Lower the engine into position, locating the primary pinion into the clutch and engaging the flywheel housing studs into the bell housing, secure the housings together with the nuts and washers and tighten to a torque of 45 to 50 Nm (33 to 37 lbf ft).

4.5 Remove the jack or packing blocks from supporting the gearbox.

4.6 Fit engine mountings (refer to Cat 522 Chap 1-1).

4.7 Remove the lifting sling and hoist.

4.8 Reverse the removal procedure to reconnect all pipes, hoses, electrical connections, the radiator assembly, and the exhaust connection to the manifold.

4.9 On FFR vehicles fit the 50 A alternator, fit and tension the drive belt, reconnect all electrical connections (refer to Cat 522 Chap 13-2).

4.10 Refill the cooling system (refer to Cat 522 Chap 12-1).

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

4.12 Check, and if necessary replenish the gearbox lubricating oil (refer to Cat 522 Chap 3-1).

4.13 Reconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on FFR vehicles the radio batteries (refer to Cat 522 Chap 13-2).

**KEY TO FIG 1**

| | | | |
|---|---|---|---|
| 1 | Engine oil cooler pipes | 12 | Exhaust down pipe |
| 2 | Expansion tank pipe | 13 | Air cleaner |
| 3 | Top and bottom hoses | 14 | Air cleaner to turbocharger hose |
| 4 | Intercooler hoses | 15 | Fuel inlet pipe |
| 5 | Viscous coupling | 16 | Fuel filter pipe |
| 6 | Oil cooler pipe bracket | 17 | Throttle cable |
| 7 | Radiator assembly | 18 | Fuel filter to injector pump hose |
| 8 | Alternator connection | 19 | Temperature sensor |
| 9 | Starter motor connections | 20 | Brake servo hose |
| 10 | Heater hoses | 21 | Power steering pump hoses |
| 11 | Breather pipes | 22 | Heater plug connection |

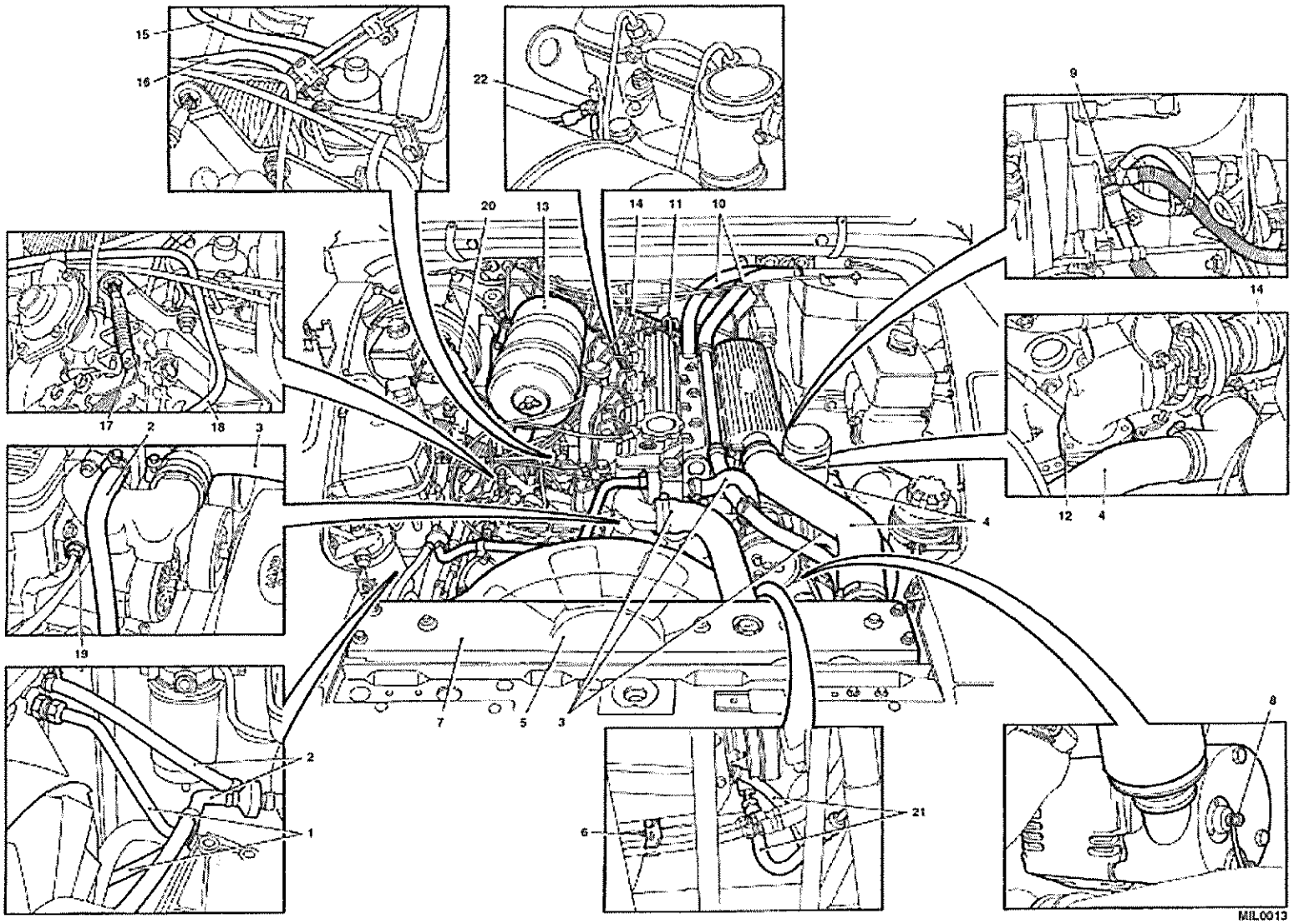


Fig 1 Engine removal disconnection points

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**CAUTION**

**ENGINE STARTING. On 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.**

4.14 Start the engine.

4.15 Check that the oil pressure warning light extinguishes.

4.16 Allow the engine to reach operating temperature and check all fuel, oil and coolant connections for leaks.

4.17 Stop the engine.

4.18 When cool, check coolant and oil levels, top up as necessary (refer to Cat 522 Chap 12-1).

4.19 Refit the bonnet and connect the earth bonding straps (refer to Cat 522 Chap 16-1).

## CYLINDER HEAD ASSEMBLY

### Removal

5 Remove the cylinder head assembly (refer to Cat 522 Chap 1-1).

Cam followers

6 The procedure for removing the cam follower assemblies is as follows:

NOTE

The components from each cam follower assembly must be retained in sets and identified to the location in the cylinder block from which they were removed.

6.1 Remove the eight cam follower guide locating screws (Fig 2 (1)) from the right-hand side of the cylinder block.

6.2 Remove the cam follower slides (2).

6.3 Lift out the rollers (3) and mark the side facing the front of the engine.

6.4 Lift out the guides (4).

Examination

7 Examine the components of each cam follower assembly for wear. Ensure that the slides move freely in the guides and that the oilways are clear to the tappet bearing surface, the cross drilling and the oil feed to the push rod.

Valve guides

8 To renew the valve guides carry out the following:

8.1 Support the cylinder head, combustion face upper most on pieces of timber of sufficient thickness to allow clearance for the valve guides to be driven out.

8.2 Using the special tool (refer to Table 1 Serial 1), drive out the guides from the combustion face (Fig 3).

8.3 Turn the cylinder head over so that the valve seats are face downward.

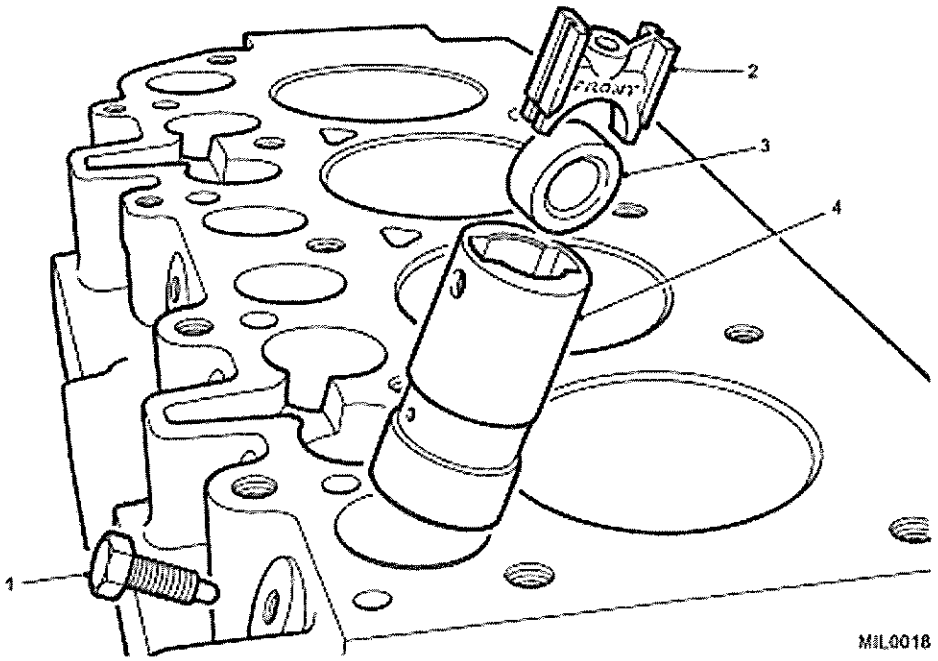
8.4 Clean the guide bores and heat the cylinder head to a temperature of 120 °C.

8.5 Lubricate the new valve guides (Fig 4 (1)) and using special tool (refer to Table 1 Serial 3), and distance piece (refer to Table 1 Serial 2), and a suitable press. Insert the valve guides into the cylinder head.

**CAUTION**

**REAMER. After the cutting edges of the reamer have passed through the guide detach the handle and withdraw the reamer from the combustion side of the head. Under no circumstances should the reamer be withdrawn back through the guide.**

8.6 To ensure that a uniform internal diameter is maintained for the total length of the valve guide, ream the bores from the top of the cylinder head using a hand reamer.




1 Guide locating screw 3 Roller
2 Slide 4 Guide

Fig 2 Cam follower removal

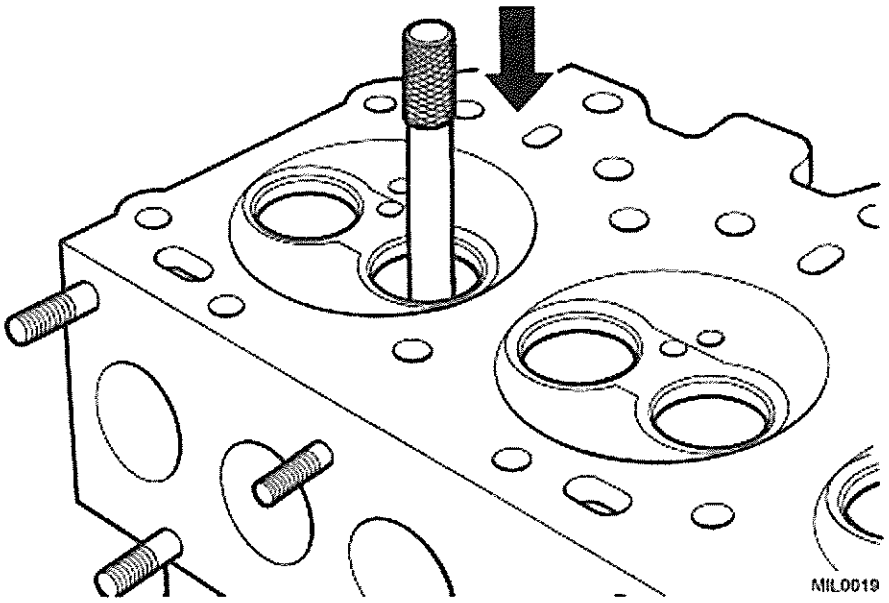
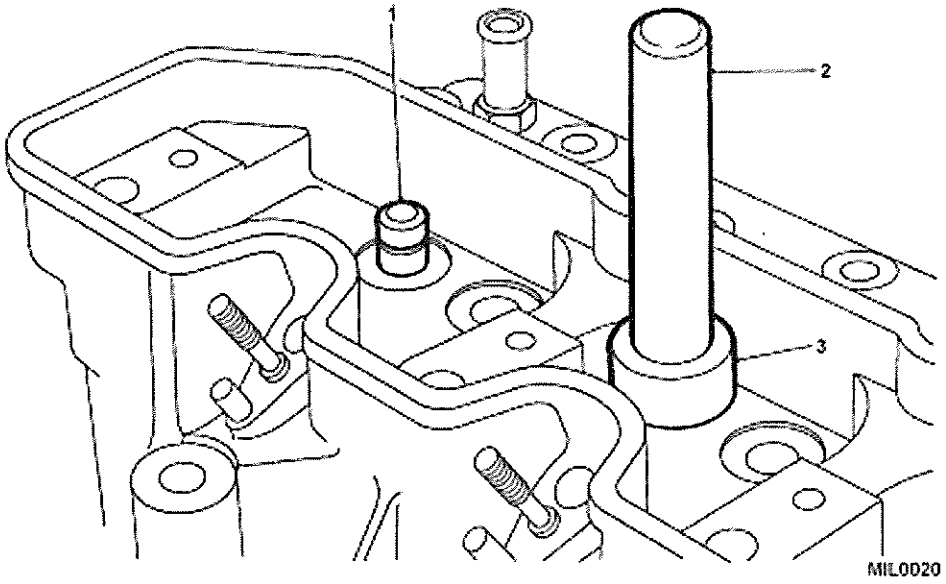



Fig 3 Removing the valves guides




1 Valve guide 2 Special drift 3 Height gauge

Fig 4 Fitting the valve guides

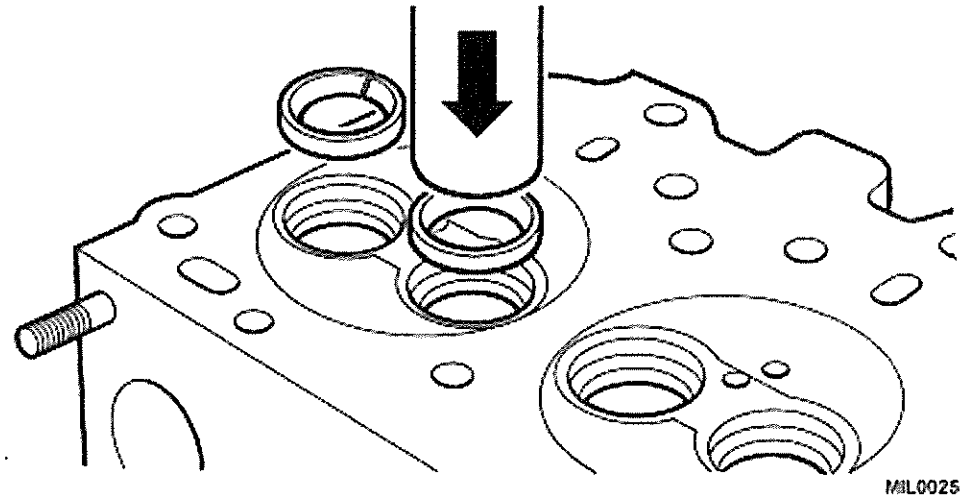



Fig 5 Valve seat replacement

Refacing cylinder head valve seat inserts

9 Reface cylinder head valve seat inserts (refer to Cat 522 Chap 1-1).

Renew valve seat inserts

10 To renew valve seat inserts carry out the following:

**WARNING**

**PROTECTIVE GOGGLES. WHEN REMOVING VALVE SEAT INSERTS FROM THE CYLINDER HEAD PROTECTIVE GOGGLES MUST BE WORN.**

10.1 Secure the cylinder head firmly in a vice with the combustion chamber uppermost.

**CAUTION**

**SURFACE 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 during this operation.**

10.2 Remove the old valve seat inserts by grinding them away until they are thin enough to be cracked and prised out. Care should be taken to avoid damage to the insert pockets.

**CAUTION**

**DEBURRING. Remove any burrs and swarf from the pocket. Failure to do so could cause the new insert to crack when fitted.**

10.3 Heat the cylinder head evenly to approximately 65 °C (149 °F). Using a suitable press insert the new valve seat insert into the recess in the cylinder head (Fig 5), ensuring that it is square and properly seated in pocket. Allow the cylinder head to cool naturally.

10.4 Cut the valve seat using the appropriate cutter; following the procedure for re-facing valve seat inserts (refer to Cat 522 Chap 1-1).

**Reassembly**

Cam followers

11 To fit the cam follower assemblies proceed as follows:

NOTE

If the original cam follower assemblies are being fitted ensure that they are fitted to the locations from which they were removed.

11.1 Insert the cam follower guides (Fig 2 (4)) into the cylinder block and align the locating screw holes.

11.2 Fit the rollers (3) ensuring that they are fitted in accordance with the marks made during removal. New rollers may be fitted either way round.

11.3 Insert the cam follower slides (2) with the word "FRONT" towards the front of the engine.

11.4 Secure the guides with new retaining screws, (1) tighten to 14 Nm (10 lbf ft).

NOTE

The guide retaining screws have a micro encapsulated locking compound applied to the threads to ensure they do not become loose. Once the screw has been used the locking ability is lost.

## TIMING BELT, GEARS, TIMING GEAR HOUSING AND COVER (BEFORE ENGINE NO. 25L01943A)

### General

12 The following paragraphs cover the repair and replacement of parts within and associated with the timing mechanism and the timing gear housing.

### Dismantling

13 Disconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on FFR vehicles the radio batteries (refer to Cat 522 Chap 13-2).

13.1 Disconnect and remove oil cooler pipes (refer to Para 2) and turbo intercooler hoses (refer to Cat 522 Chap 12-1).

13.2 Drain the cooling system, release the viscous coupling, fan and cowl assembly. Remove the radiator complete with top and bottom hoses (refer to Cat 522 Chap 12-1).

**KEY TO FIG 1**

| | | | |
|---|---|---|---|
| 1 | Cylinder block | 19 | Timing gear belt |
| 2 | Gasket-Timing gear housing | 20 | Clamp bolt |
| 3 | Timing gear housing | 21 | Gasket washer |
| 4 | Oil pump | 22 | Front cover gasket |
| 5 | Crankshaft oil seal | 23 | Front cover |
| 6 | Crankshaft "O" ring seal | 24 | Cover bolts |
| 7 | Woodruff keys | 25 | Front cover oil seal |
| 8 | Crankshaft gear | 26 | Front cover seal |
| 9 | Camshaft oil seal | 27 | Crankshaft pulley |
| 10 | Camshaft gear | 28 | Crankshaft pulley bolt |
| 11 | Camshaft retaining bolt | 29 | Serpentine belt |
| 12 | Injection pump gear plate | 30 | Viscous coupling pulley |
| 13 | Injection pump gear | 31 | Viscous coupling |
| 14 | Gear plate location bolts | 32 | Fan |
| 15 | Idler pulley | 33 | Timing cover plug |
| 16 | Belt tensioner | 34 | Pulley retainer bolt |
| 17 | Belt tensioner securing nut | 35 | Viscous coupling bolt |
| 18 | Spacer | | |

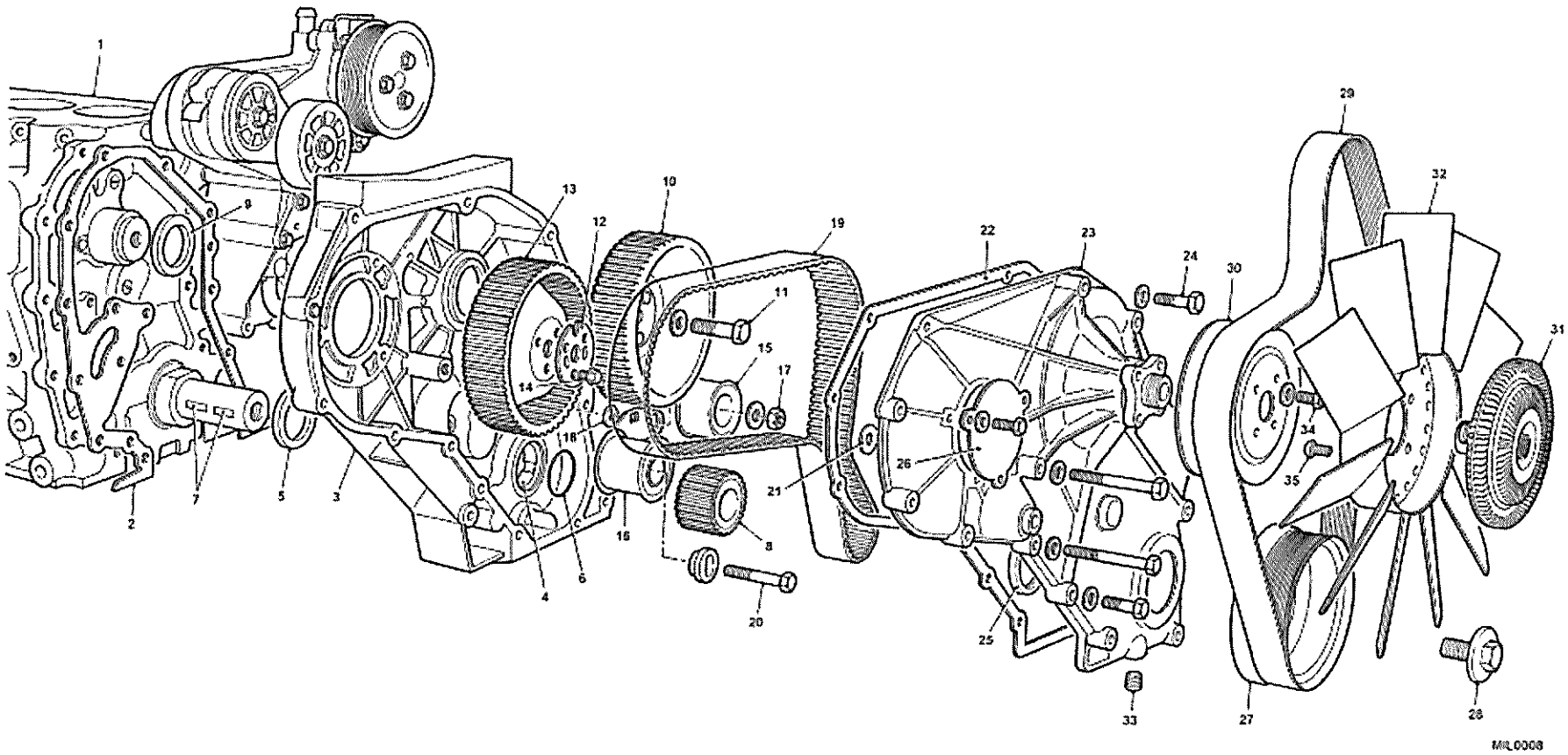



Fig 6 Timing belt, gears, pulleys and covers

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Drive Belt Auto-Tensioner

14 To remove the auto-tensioner proceed as follows:

14.1 Using a hexagonal socket and tommy bar on the pulley nut of the auto-tensioning device, slacken the serpentine drive belt (Fig 6 (29)) and remove.

14.2 Remove the auto-tensioner securing nut and withdraw the complete unit from its locating stud.

Crankshaft Pulley

15 To remove the crankshaft pulley proceed as follows:

15.1 On FFR vehicles remove the drive belt and alternator (refer to Cat 522 Chap 13-2).

15.2 Fit special tool (refer to Table 1 Serial 7), and secure with four bolts.

15.3 Remove crankshaft pulley retaining bolt (28) using a suitable socket and extension bar.

15.4 Remove crankshaft pulley (27). If necessary use special tool (refer to Table 1 Serial 8), with thrust pad from gear remover (refer to Table 1 Serial 4).

Timing Gear Front Cover

16 To remove the timing gear front cover proceed as follows:

NOTE

If the idler pulley is to be removed, slacken the retaining bolts before removing the serpentine belt (Fig 6 (29)).

16.1 Disconnect the banjo bolt securing the front cover pressure pipe assembly (if fitted).

16.2 Remove the bolts (24) securing the front cover (23) noting their length and position. Two of these bolts also retain the thermostat hose clips.

16.3 Remove front cover complete with gasket (22).

16.4 Remove the small gasket (21) from the centre bolt boss.

16.5 Remove the crankshaft front cover oil seal (25) from the cover taking care not to damage the sealing surfaces of the cover.

Timing Belt, Gears and Pulleys

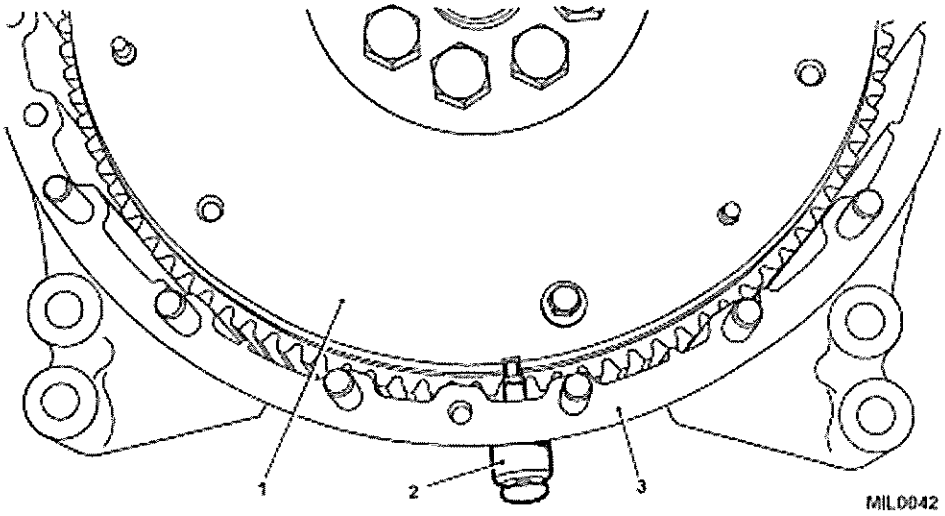
17 To remove the timing belt, gears and pulleys proceed as follows:

17.1 Position the engine at Top Dead Centre (TDC) on no. 1 cylinder.

17.2 Remove the blanking plug from the flywheel housing (Fig 7 (3)) and insert timing tool (refer to Table 1 Serial 5).

17.3 Engage the timing tool pin (2) with the slot in the flywheel (1).

17.4 Check the correct alignment of the timing mark on the camshaft gear and that the crankshaft key aligns with the cast arrow on the timing gear housing.




1 Flywheel 2 Timing pin 3 Flywheel housing

Fig 7 Timing pin located in flywheel housing

17.5 Insert locking pin (refer to Table 1 Serial 6), (Fig 10 (1)) in fuel injection pump gear and through into pump flange.

NOTE

If the camshaft gear is to be removed its retaining bolt should be slackened before the timing belt is removed.

17.6 Slacken the belt tensioner bolt (Fig 6 (20)).

17.7 Remove the idler pulley nut and washer (17) and withdraw the pulley (15).

NOTE

If the timing belt is to be refitted, mark the direction of rotation on the belt using soft chalk.

17.8 Remove the timing belt (19).

**CAUTION**

**BELTS. Ease the timing belt off the gears using the fingers only. Metal levers may damage the belt and gears. Do not rotate crankshaft, injection pump or camshaft with timing belt removed and cylinder head fitted. Timing belts must be stored and handled with care. Always store a timing belt on its edge with a bend radius greater than 50 mm (2.0 in). Do not use a timing belt that has been twisted or bent double as this will damage the reinforcing fibres. If excessive timing belt debris is evident in the front cover, this is probably due to the misalignment of the front timing cover caused by incorrect assembly of the fuel injection pump bracket. Do not use an oil or coolant contaminated timing belt, cause of contamination must be rectified.**

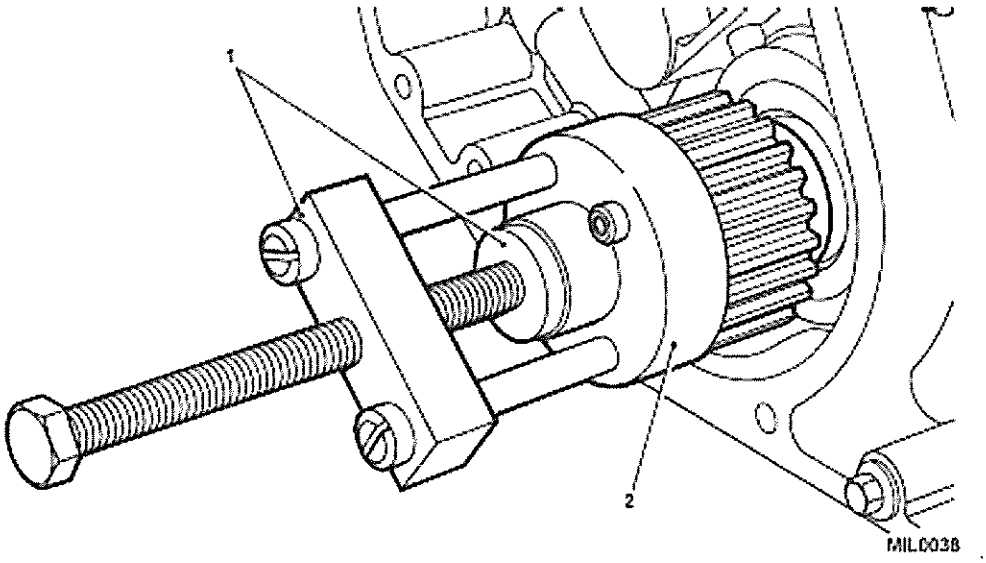
NOTE

During use a belt develops a wear pattern relative to its running direction, if the original belt is to be re-used it must be refitted so that it rotates in the original direction.

17.9 Remove the securing bolt and withdraw the tensioner (16) complete with spacer (18).

17.10 Remove the centre bolt (Fig 9 (1)) from the camshaft gear (2) and withdraw the gear.

17.11 Remove the camshaft oil seal (Fig 6 (9)) from the housing using a suitable tool.




1 Crankshaft/camshaft gear remover 2 Remover adaptor

Fig 8 Removing the crankshaft timing gear

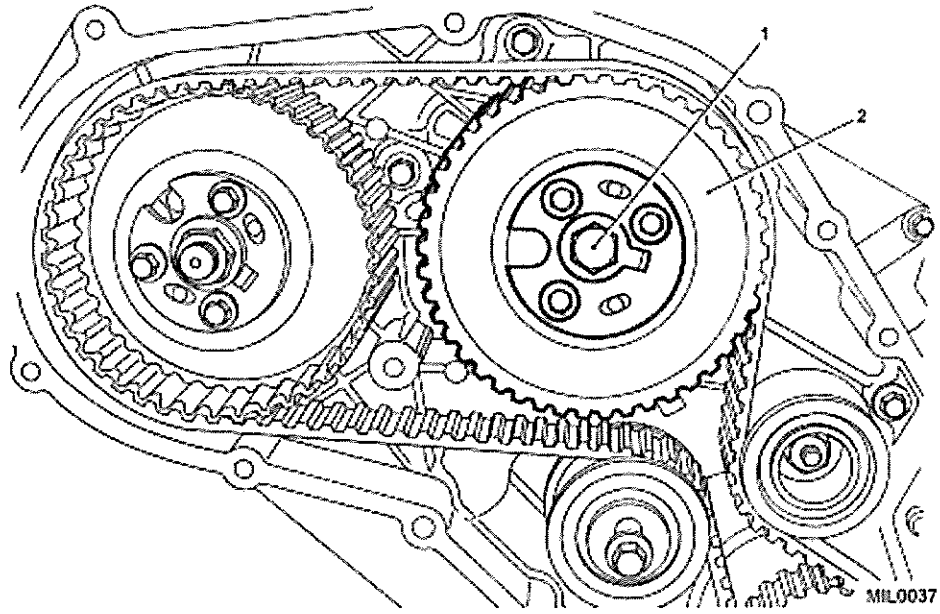
17.12 Slacken the three bolts (Fig 10 (4)) on the front of the injection pump gear.

17.13 Using a 22 mm Across Flats (AF) spanner, (3) carefully rotate the pump hub nut (2) in a clockwise direction sufficiently to release the pump locking pin (1).

17.14 Remove the locking pin (refer to Table 1 Serial 6) from the gear.

17.15 Remove the securing bolts and withdraw the retaining plate (5) and injector pump gear (6).

17.16 Using special tool (refer to Table 1 Serial 4 and 9) remove the crankshaft timing gear (refer to Fig 8 (1) and (2)).




1 Centre bolt 2 Camshaft gear

Fig 9 Removing camshaft gear

**Timing Gear Housing**

18 To remove the timing gear housing carry out the following:

18.1 Disconnect the banjo bolt securing the timing gear housing pressure pipe assembly (if fitted).

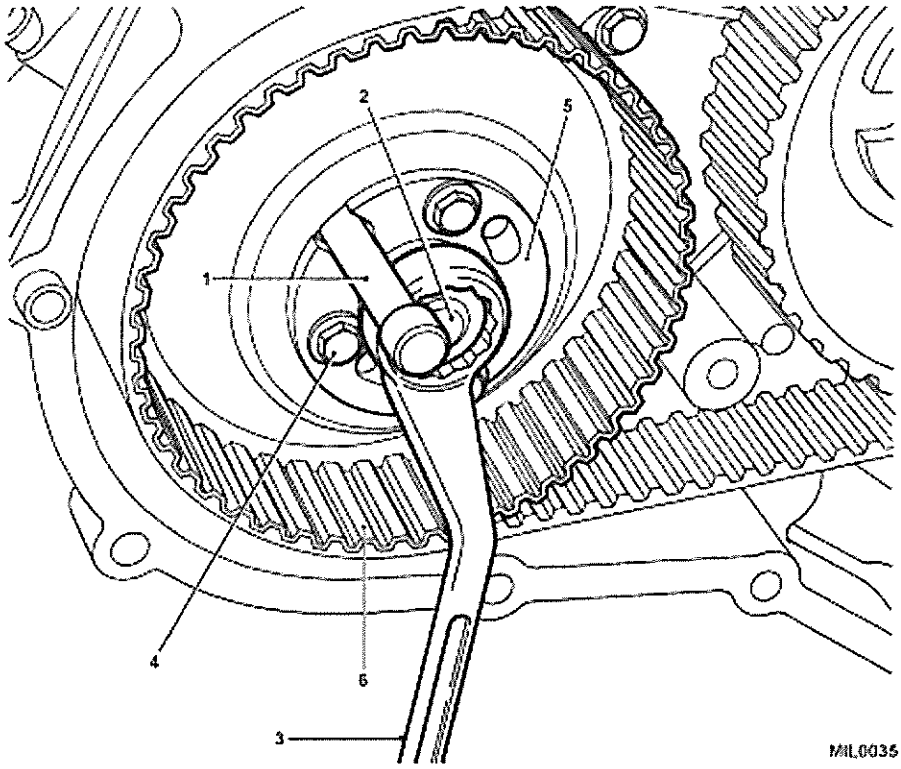
18.2 Remove the fuel injector pump (refer to Cat 522 Chap 11-1).

18.3 Remove the engine oil sump (refer to Cat 522 Chap 1-1).

18.4 Remove the oil pick-up strainer (refer to Para 55).

18.5 Remove the bolts securing the timing gear housing to the cylinder block.

18.6 Withdraw the timing gear housing complete with gasket.




| | | | |
|---|---|---|---|
| 1 | Injection pump timing pin | 4 | Securing bolts |
| 2 | Pump hub nut | 5 | Retaining plate |
| 3 | 22 mm AF spanner | 6 | Injector pump gear |

Fig 10 Removing the timing pin and injector pump gear

**Oil Pump**

19 To remove the oil pump proceed as follows:

19.1 Remove the seven retaining screws (Fig 11 (1)) securing the oil pump backplate (2) to the inner face of the timing gear housing.

19.2 Remove the plate and withdraw the oil pump gear (3).

Cleaning

20 Thoroughly clean and degrease all components ensuring removal of gasket material from joint faces.

Examination

21 Examine all components removed for wear, renew as necessary.

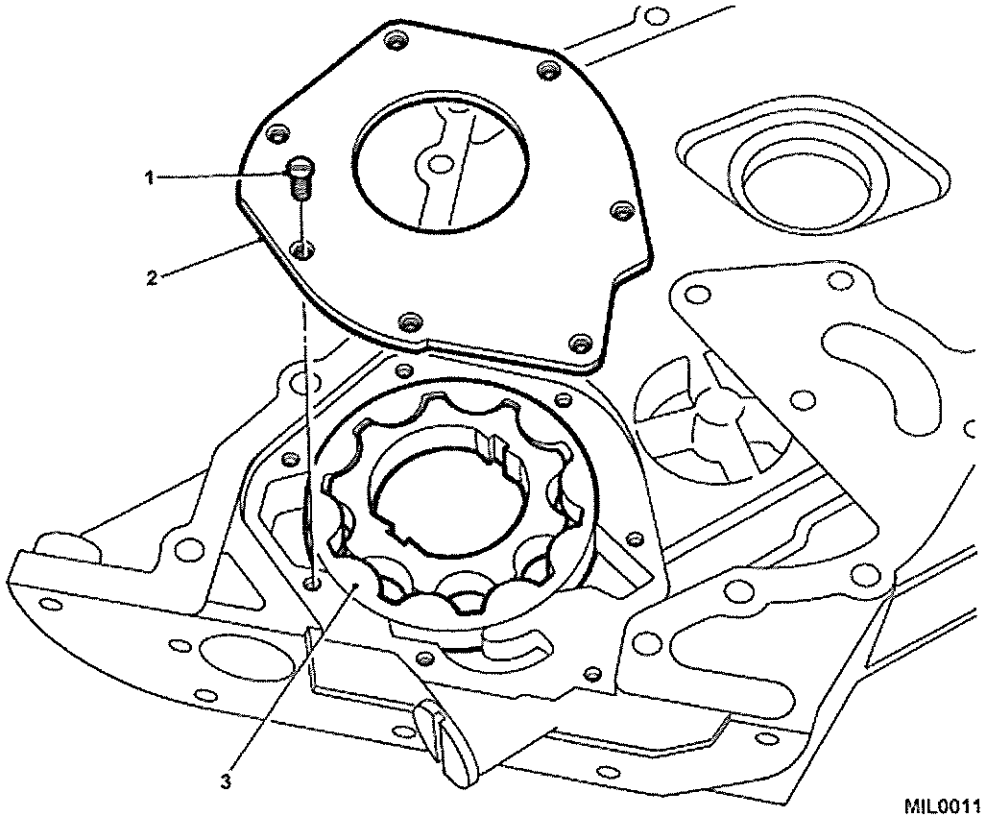
**Reassembly**

Oil Pump

22 To fit the oil pump proceed as follows:

22.1 Fit the oil pump gears to the inner face of the timing gear housing.

22.2 Fit the oil pump backplate and secure with the seven retaining screws (Refer to Fig 11).




1 Retaining screws 2 Back plate 3 Oil pump gear

Fig 11 Oil pump removal

Timing Gear Housing

23 To fit the timing gear housing proceed as follows:

23.1 Using slave guide studs, fit new gasket to cylinder block.

23.2 Align flats on the oil pump with flats on the crankshaft and fit the timing gear housing to the cylinder block.

23.3 Secure the timing gear housing with bolts (Fig 12) of the correct length in the locations where slave studs are not fitted.

23.4 Remove the slave studs and fit the correct length bolts (Fig 12), tighten all securing bolts to a torque of 25 Nm (18 lbf ft).

23.5 Fit the oil pick-up strainer (refer to Para 56).

23.6 Fit the engine oil sump (refer to Cat 522 Chap 1-1).

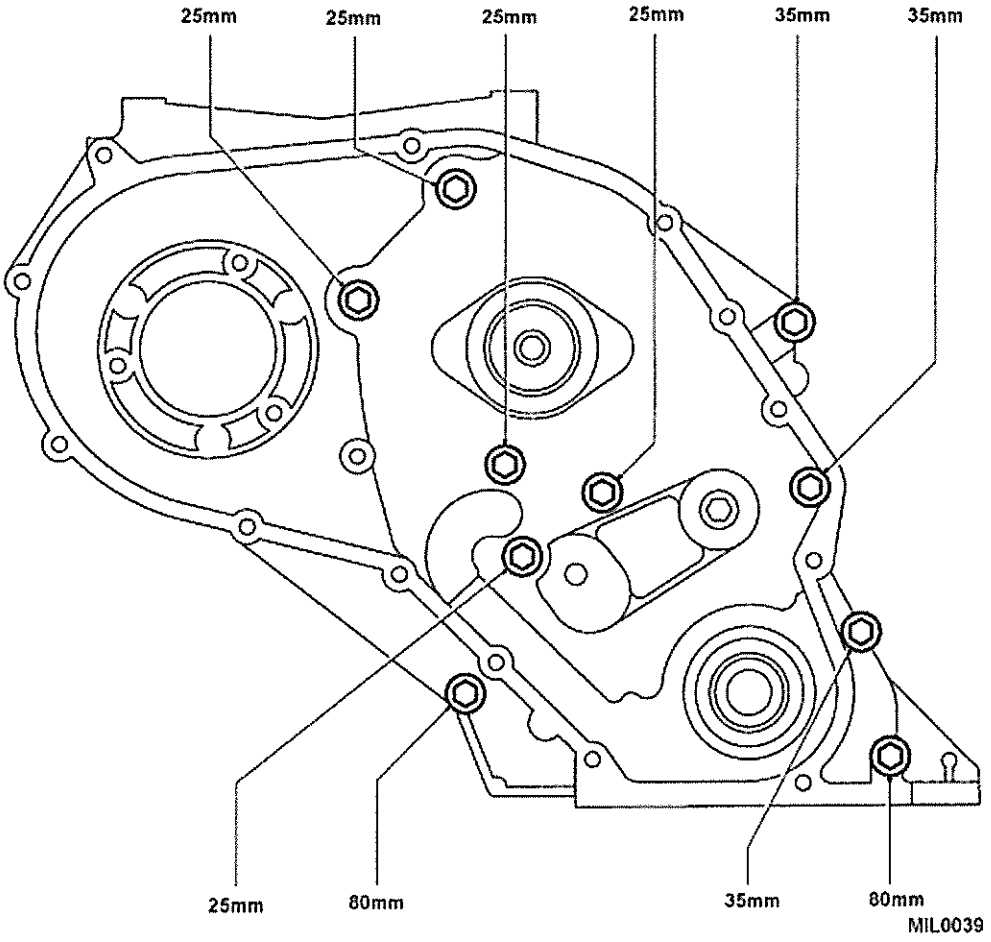



Fig 12 Bolt locations for timing gear housing

Timing Gear Housing Crankshaft Seal

24 To replace the crankshaft seal proceed as follows:

24.1 Lubricate new crankshaft oil seal with clean engine oil (refer to Table 2 Serial 1).

24.2 Locate the seal with the lip side leading, drive the seal squarely into its housing using a suitable tool (Fig 13).

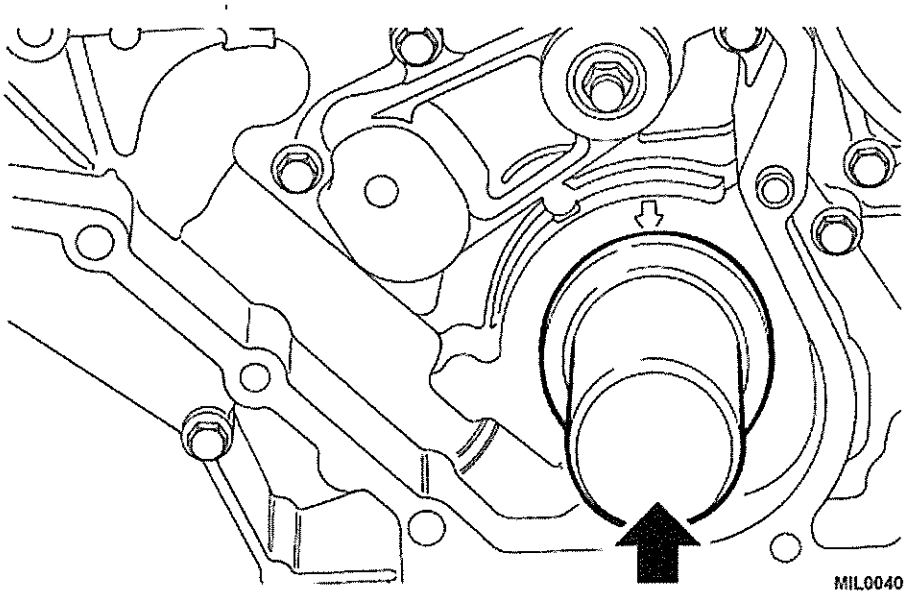



Fig 13 Fitting timing gear housing crankshaft seal

Timing Gear Housing Camshaft Seal

25 To replace the camshaft seal proceed as follows:

25.1 Lubricate new camshaft oil seal with clean engine oil (refer to Table 2 Serial 1).

25.2 Locate the seal on the camshaft with the lip side leading, drive the seal squarely into its housing.

Timing Gears

26 To fit the timing gears carry out the following procedures:

26.1 Fit the fuel injection pump to the timing gear housing (refer to Cat 522 Chap 11-1).

26.2 Using petroleum jelly slide a new "O" ring seal onto the crankshaft, taking care not to damage the seal on the woodruff keys.

26.3 Fit the crankshaft gear to the shaft, tap fully home ensuring that the "O" ring is properly seated.

26.4 Fit the camshaft gear onto its shaft and secure with the centre bolt.

NOTE

Tighten centre bolt to an appropriate torque of 80 Nm (59 lbf ft) after the timing belt has been fitted and tensioned.

26.5 Fit the fuel injection pump gear and plate, secure with the three bolts.

Timing

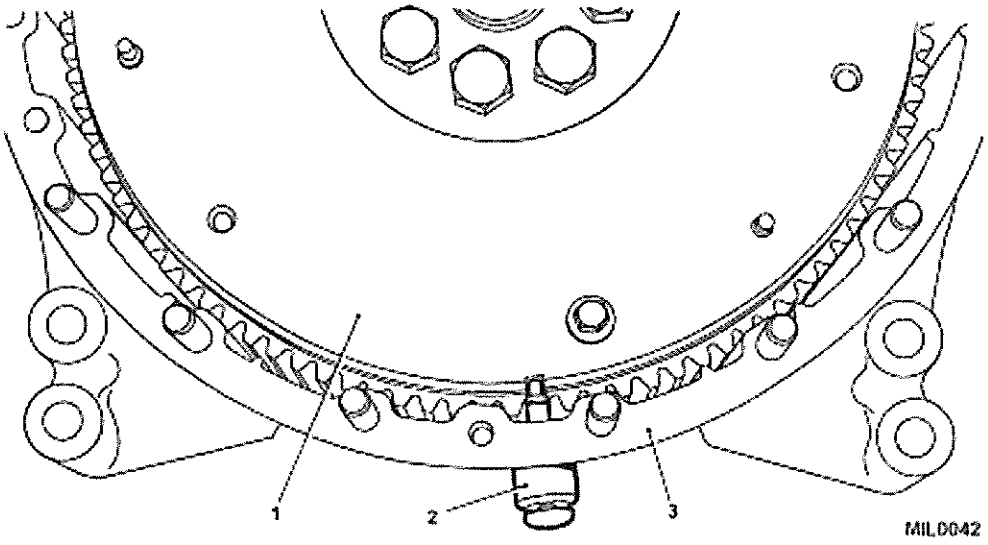
27 The fuel injection pump and valves are timed using the TDC on No. 1 cylinder. This position is determined by the relationship of a slot in the flywheel periphery and a plugged hole in the flywheel housing through which the special tool (refer to Table 1 Serial 5), is inserted to locate in the flywheel slot (Fig 14 (2)).

27.1 Remove the plug from the flywheel housing (3) and fit the body of the tool; at this stage do not engage the pin.

27.2 Turn the crankshaft in a clockwise direction until the slot in the flywheel (1) is in-line with the plughole.

NOTE

If the crankshaft is inadvertently turned beyond the slot, do not turn it back but continue on round in a clockwise direction until the pin of special tool can be fully located in the flywheel slot.




1 Flywheel 2 Timing tool pin 3 Flywheel housing

Fig 14 Timing pin located in flywheel housing

27.3 Using a 22 mm AF spanner on the pump hub nut, rotate the hub nut in a clockwise direction sufficiently to enable the insertion of the special tool (refer to Table 1 Serial 6), into the fuel injection pump gear and through into the pump flange.

27.4 Ensure timing marks on the camshaft gear, the timing gear housing centre boss are correctly aligned and the crankshaft key aligns with the cast arrow on the housing (Fig 15).

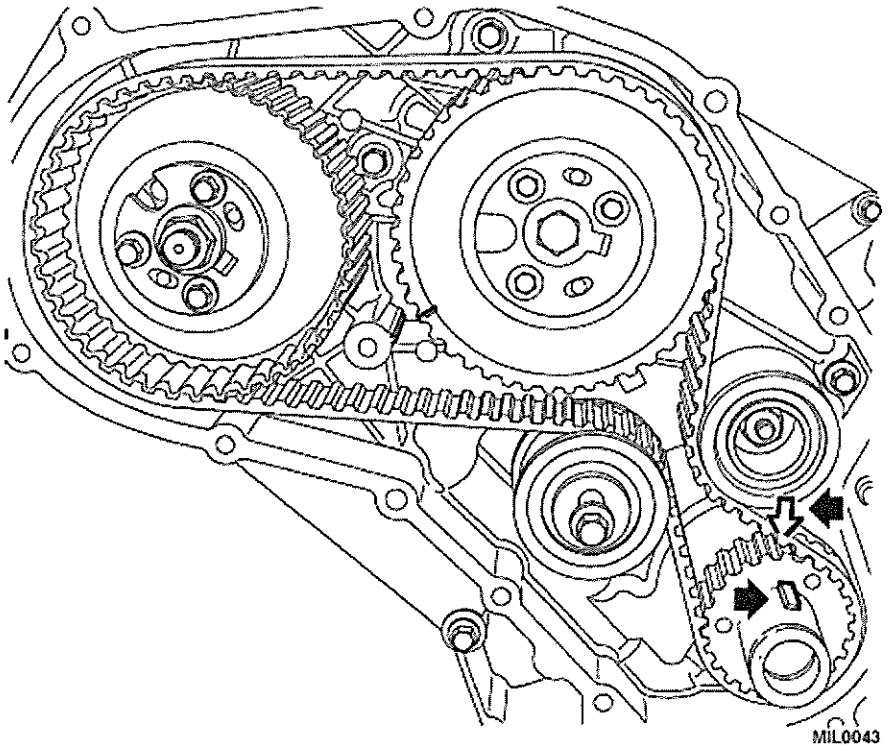



Fig 15 Aligning timing marks on timing gear housing

Timing Belt and Tensioner

28 To fit the timing belt proceed as follows:

28.1 Ensure timing marks are correctly aligned. The pin (Fig 16 (1)) from special tool (refer to Table 1 Serial 6), is correctly inserted in the injection pump gear and timing tool (refer to Table 1 Serial 5), is fitted to the flywheel housing with the pin located in the flywheel slot.

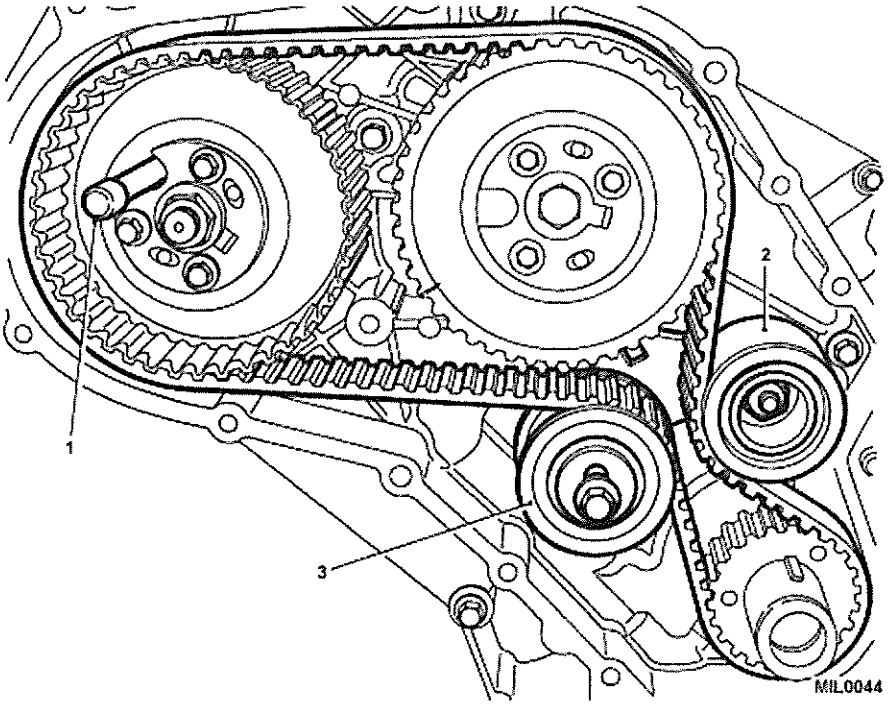
28.2 Fit the belt tensioner (3) and spacer to the idler pulley stud and secure the tensioner pulley with the retaining bolt.

28.3 Fit the belt, observing rotational marks made during removal, by feeding it over the timing gears keeping it tight on the drive side.

28.4 Fit the idler pulley (2) and secure with nut, tighten to a torque of 45 Nm (33 lbf ft).

NOTE

It is important that belt tensioning is carried out carefully and accurately. New and original belts have different tension figures.




1 Locking pin 2 Idler pulley 3 Tensioner pulley

Fig 16 Fitting the timing belt tensioner pulley

28.5 Slacken the injector pump gear retaining bolts and adjust belt so it sits correctly.

28.6 Slacken the belt tensioner (Fig 17 (3)) securing bolt to finger tight, ensure tensioner is free to move.

28.7 Insert a 13 mm square drive (2) and extension bar in the tensioner plate.

**CAUTION**

**Length of the torque meter must not exceed 250 mm (9.8 inches) from centre of square to end of meter.**

NOTES

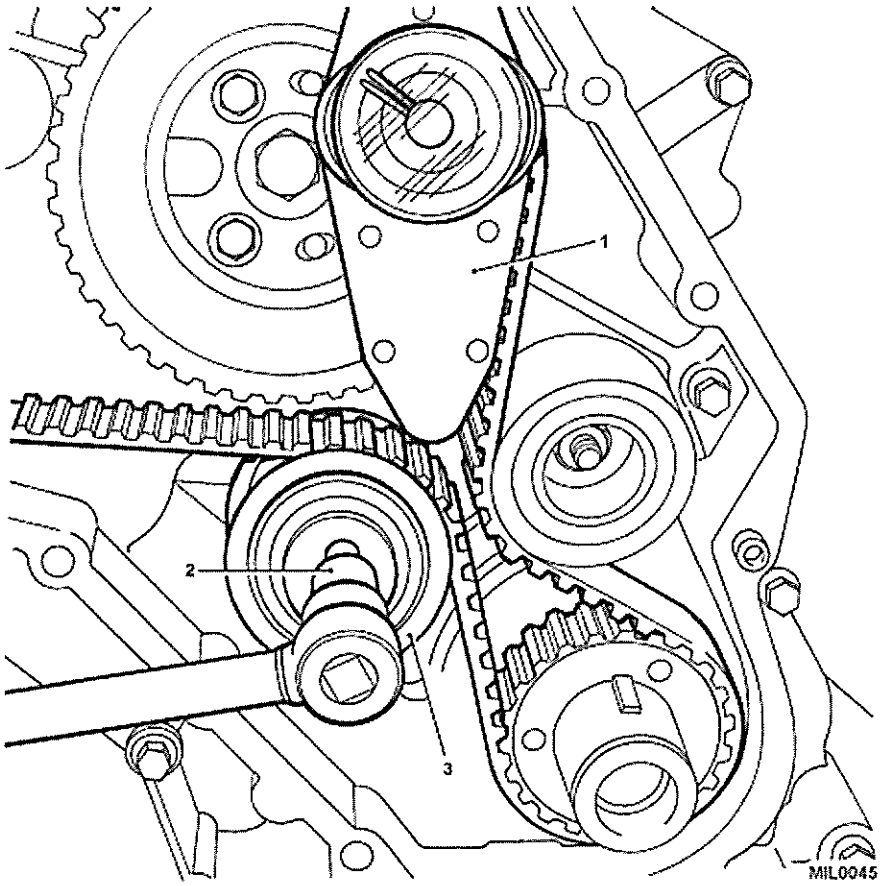
Tensioning of the belt should be carried out using a dial type torque wrench (1) having a range not exceeding 40 Nm (29 lbf ft).

The torque wrench should be used in the as near vertical position as possible.

28.8 Apply a clockwise loading of 11 Nm (8.1 lbf ft) for a new belt or 9 Nm (6.6 lbf ft) for an original belt. When the tension is correct tighten the clamp bolt to a torque of 45 Nm (33 lbf ft) while maintaining the load.

28.9 Remove torque meter and extension bar.

28.10 Tighten the fuel injection pump gear retaining bolts to a torque of 25 Nm (18 lbf ft) and remove the pin from the injection pump gear.




1 Torque meter 2 13 mm socket drive 3 Tensioner pulley

Fig 17 Tensioning timing belt using torque meter

28.11 Disengage timing tool plunger from the slot in the flywheel.

28.12 If removed, tighten the camshaft hub bolt to a torque of 80 Nm (59 lbf ft).

28.13 Remove the timing tool from the flywheel housing and fit the flywheel housing blanking plug torque tighten to 12 Nm (9 lbf ft).

Timing Gear Front Cover Seal

29 To replace the timing gear front cover seal proceed as follows:

29.1 Support the front cover and fit the new seal, open side fitted into the recess.

Timing Gear Front Cover

30 To fit the front cover carry out the following:

30.1 Fit the front cover with a new gasket interposed between the mating faces and a new small gasket on the centre bolt boss.

30.2 Fit the various length bolts to their respective locations (refer to Fig 31), the two top bolts also retain the thermostat hose clips, and evenly tighten to a torque of 25 Nm (18 lbf ft).

## TIMING BELT, GEARS, TIMING GEAR HOUSING AND COVER (FROM ENGINE NO. 25L01943A)

### General

31 The following paragraphs cover the repair and replacement of parts within and associated with the timing mechanism and the timing gear housing.

### Dismantling

32 Disconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on FFR vehicles the radio batteries (refer to Cat 522 Chap 13-2).

32.1 Disconnect and remove oil cooler pipes (refer to Para 2.25) and turbo intercooler hoses (refer to Cat 522 Chap 12-1).

32.2 Drain the cooling system, release the viscous coupling, fan and cowl assembly. Remove the radiator complete with top and bottom hoses (refer to Cat 522 Chap 12-1).

Drive Belt Auto-Tensioner

33 To remove the auto-tensioner proceed as follows:

33.1 Using a hexagonal socket and tommy bar on the pulley nut of the auto-tensioning device, slacken the serpentine drive belt (Fig 18 (30)) and remove.

33.2 Remove the auto-tensioner securing nut and withdraw the complete unit from its locating stud.

Crankshaft Pulley

34 To remove the crankshaft pulley proceed as follows:

34.1 On FFR vehicles remove the drive belt and alternator (refer to Cat 522 Chap 13-2).

34.2 Fit special tool (refer to Table 1 Serial 7), and secure with four bolts.

34.3 Remove crankshaft pulley retaining bolt (29) using a suitable socket and extension bar.

34.4 Remove crankshaft pulley (28). If necessary use special tool (refer to Table 1 Serial 8), with thrust pad from gear remover (refer to Table 1 Serial 4).

Timing Gear Front Cover

35 To remove the timing gear front cover proceed as follows:

NOTE

If the idler pulley is to be removed, slacken the retaining bolts before removing the serpentine belt (Fig 18 (30)).

35.1 Disconnect the banjo bolt (24) securing the front cover pressure pipe assembly.

35.2 Remove the bolts (25) securing the front cover (23) noting there length and position. Two of these bolts also retain the thermostat hose clips.

35.3 Remove front cover (23) complete with gasket (22).

35.4 Remove the small gasket (21) from the centre bolt boss.

35.5 Remove the timing gear front cover oil seal (26) from the cover taking care not to damage the sealing surfaces of the cover.

**KEY TO FIG 18**

| | | | |
|---|---|---|---|
| 1 | Cylinder block | 19 | Timing gear belt |
| 2 | Gasket-Timing gear housing | 20 | Retaining screw |
| 3 | Timing gear housing | 21 | Gasket washer |
| 4 | Oil pump | 22 | Front cover gasket |
| 5 | Crankshaft oil seal | 23 | Front cover |
| 6 | Crankshaft "O" ring seal | 24 | Banjo bolt |
| 7 | Woodruff keys | 25 | Cover bolts |
| 8 | Crankshaft gear | 26 | Front cover oil seal |
| 9 | Camshaft oil seal | 27 | Inspection plate and gasket |
| 10 | Camshaft gear | 28 | Crankshaft pulley |
| 11 | Camshaft retaining bolt | 29 | Crankshaft pulley bolt |
| 12 | Injection pump gear plate | 30 | Serpentine belt |
| 13 | Injection pump gear | 31 | Viscous coupling pulley |
| 14 | Gear plate location bolts | 32 | Viscous coupling |
| 15 | Idler pulley | 33 | Fan |
| 16 | Belt tensioner | 34 | Pulley retainer bolt |
| 17 | Belt tensioner securing nut | 35 | Viscous coupling bolt |
| 18 | Washer | | |

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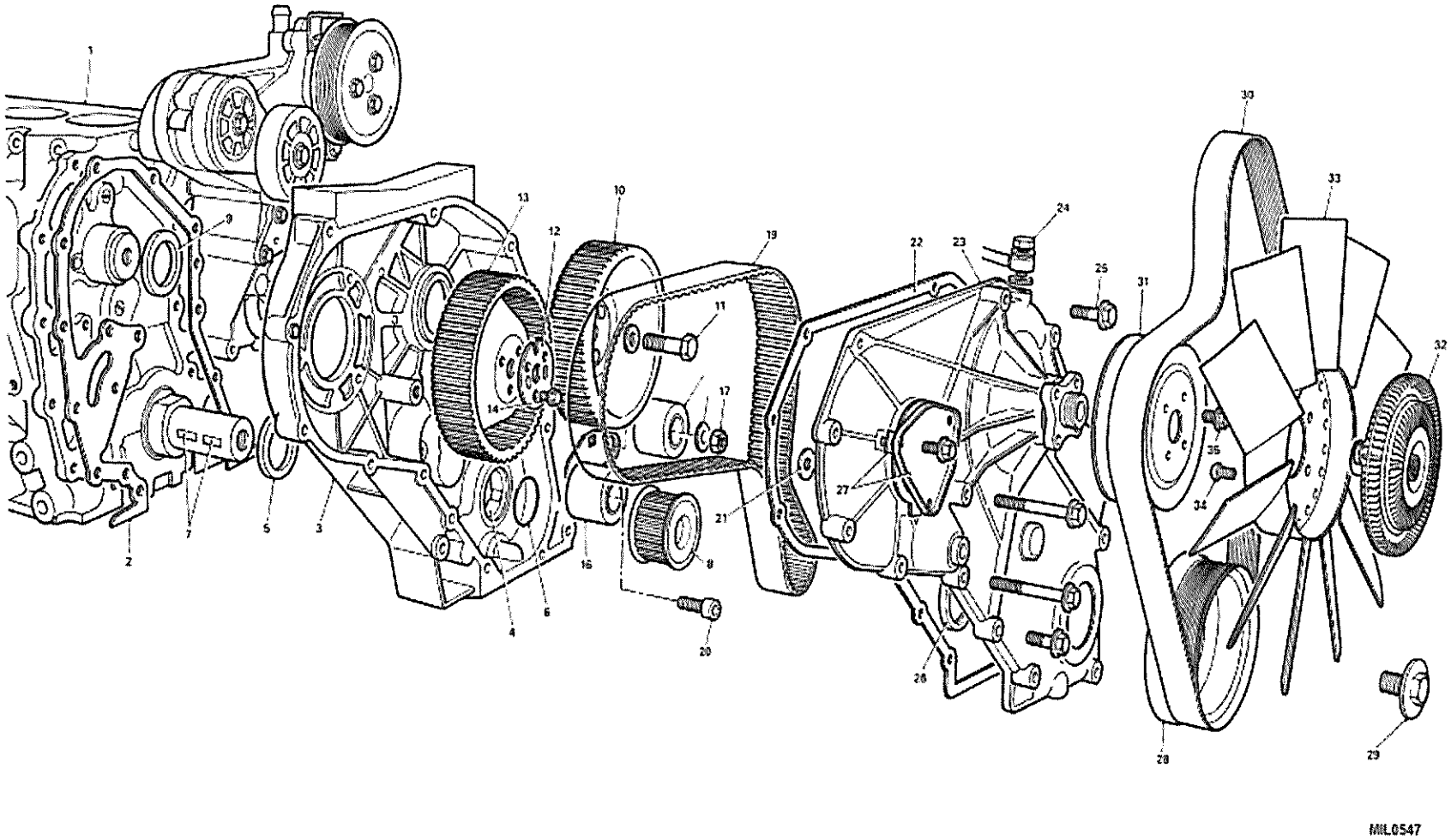


Fig 18 Timing belt, gears, pulleys and covers

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Timing Belt, Gears and Pulleys

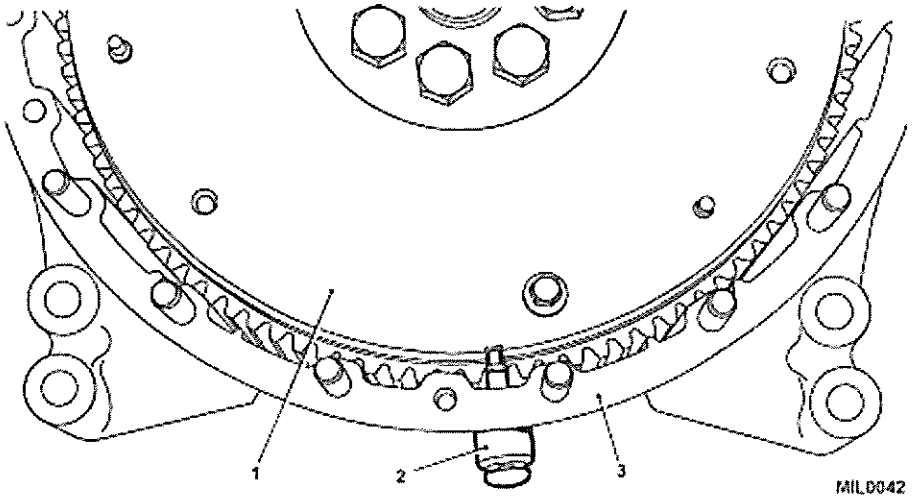
36 To remove the timing belt, gears and pulleys proceed as follows:

36.1 Position the engine at TDC on no. 1 cylinder.

36.2 Remove the blanking plug from the flywheel housing (Fig 19 (3)) and insert timing tool (refer to Table 1 Serial 5).

36.3 Engage the timing tool pin (2) with the slot in the flywheel (1).

36.4 Check the correct alignment of the timing mark on the camshaft gear and that the crankshaft key aligns with the cast arrow on the timing gear housing.




1 Flywheel 2 Timing tool pin 3 Flywheel housing

Fig 19 Timing pin located in flywheel housing

36.5 Insert locking pin (refer to Table 1 Serial 6), (Fig 10 (1)) in fuel injection pump gear and through into pump flange.

NOTE

If the camshaft gear is to be removed its retaining bolt should be slackened before the timing belt is removed.

36.6 Slacken the belt tensioner retaining screw (Fig 18 (20)).

36.7 Remove the idler pulley nut (17) and washer (18) and withdraw the pulley (15).

NOTES

(1) If the timing belt is to be refitted, mark the direction of rotation on the belt using soft chalk.

(2) During use a belt develops a wear pattern relative to its running direction. If the original belt is to be re-used it must be refitted so that it rotates in the original direction.

36.8 Remove the timing belt (19).

**CAUTION**

**BELTS. Ease the timing belt off the gears using the fingers only. Metal levers may damage the belt and gears. Do not rotate crankshaft, injection pump or camshaft with timing belt removed and cylinder head fitted. Timing belts must be stored and handled with care. Always store a timing belt on its edge with a bend radius greater than 50 mm (2.0 in). Do not use a timing belt that has been twisted or bent double as this will damage the reinforcing fibres. If excessive timing belt debris is evident in the front cover, this is probably due to the misalignment of the front timing cover caused by incorrect assembly of the fuel injection pump bracket. Do not use an oil or coolant contaminated timing belt, cause of contamination must be rectified.**

36.9 Remove the retaining screw and withdraw the tensioner (16).

36.10 Remove the centre bolt (Fig 20 (1)) from the camshaft gear (2) and withdraw the gear.

36.11 Remove the camshaft oil seal (Fig 18 (9)) from the housing using a suitable tool.

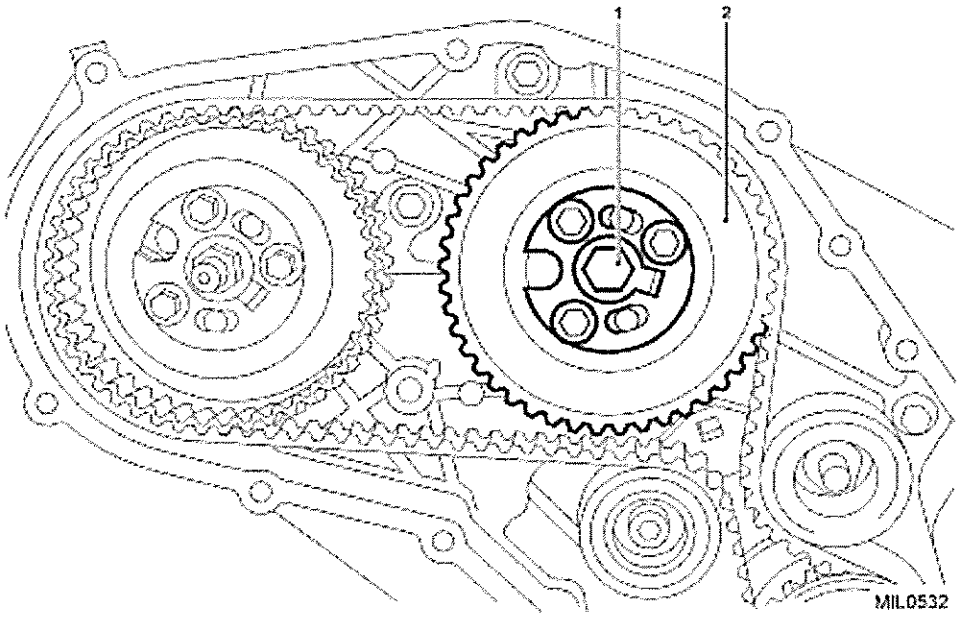
36.12 Slacken the three bolts (Fig 21 (4)) on the front of the injection pump gear.

36.13 Using a 22 mm AF spanner, (3) carefully rotate the pump hub nut (2) in a clockwise direction sufficiently to release the pump locking pin (1).

36.14 Remove the locking pin (refer to Table 1 Serial 6) from the gear.

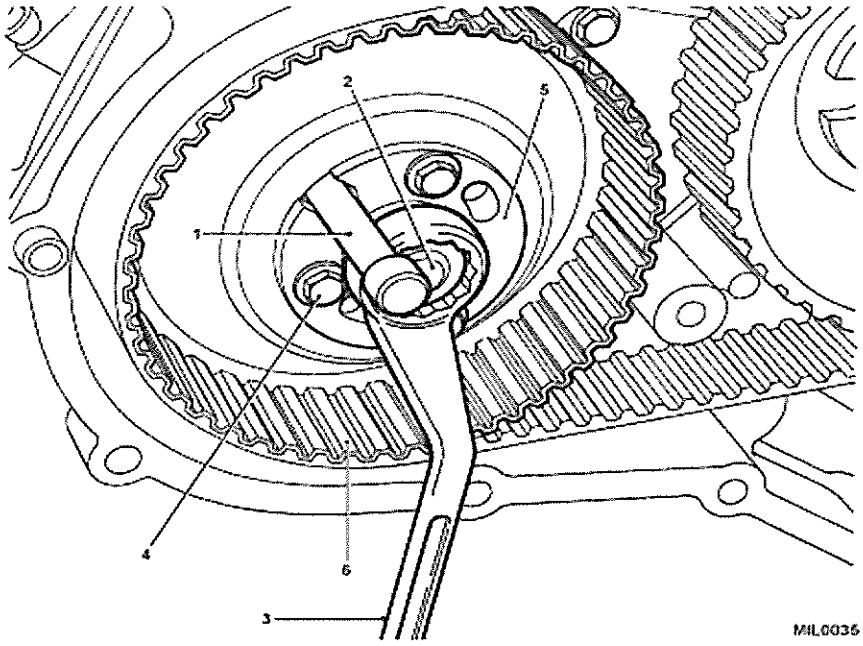
36.15 Remove the securing bolts and withdraw the retaining plate (5) and injector pump gear (6).

36.16 Using special tool (refer to Table 1 Serial 4 and 9) remove the crankshaft timing gear (refer to Fig 22 (1) and (2)).



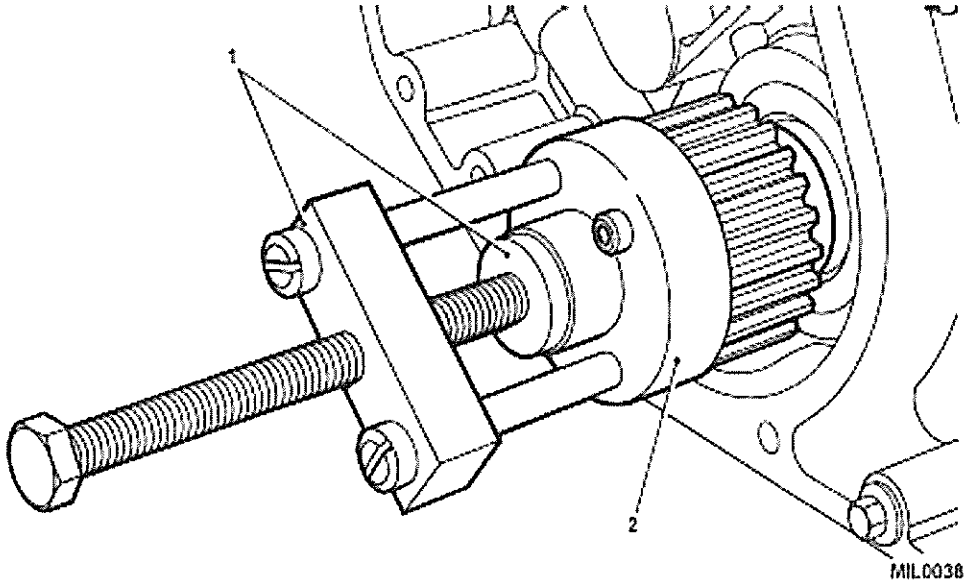

1 Centre bolt 2 Camshaft gear

Fig 20 Removing the camshaft gear




| | | | |
|---|---|---|---|
| 1 | Injection pump timing pin | 4 | Securing bolts |
| 2 | Pump hub nut | 5 | Retaining plate |
| 3 | 22 mm AF spanner | 6 | Injector pump gear |

Fig 21 Removing the timing pin and injector pump gear




1 Crankshaft gear remover 2 Remover adaptor

Fig 22 Timing pin located in flywheel housing

Timing Gear Housing

37 To remove the timing gear housing carry out the following:

37.1 Remove the fuel injector pump (refer to Cat 522 Chap 11-1).

37.2 Remove the engine oil sump (refer to Cat 522 Chap 1-1).

37.3 Remove the oil pick-up strainer (refer to Para 55).

37.4 Remove the bolts securing the timing gear housing to the cylinder block.

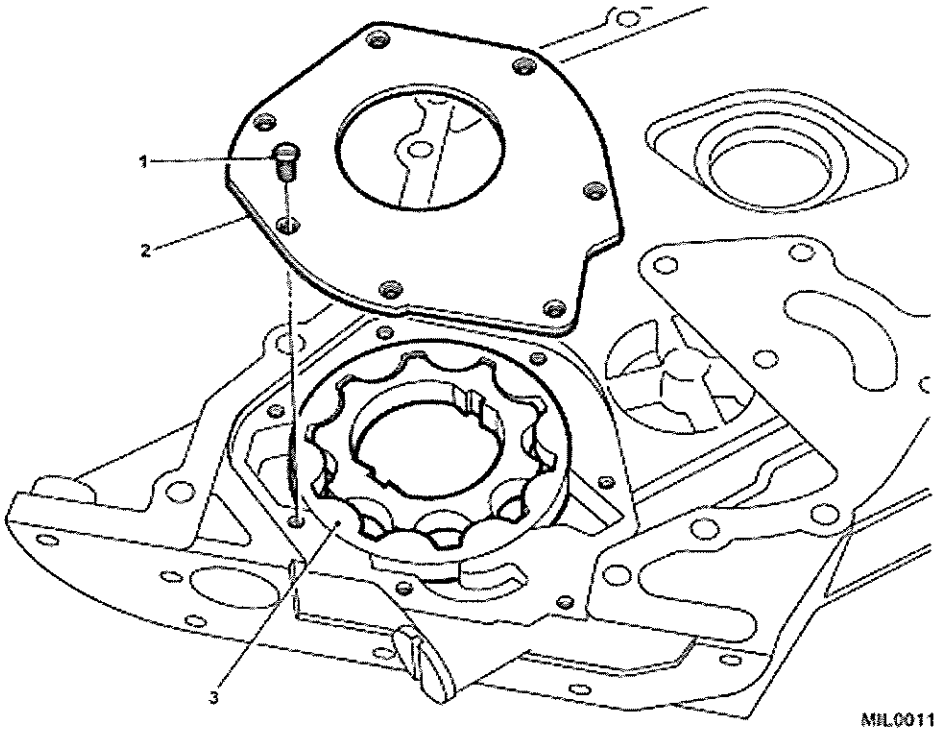
37.5 Withdraw the timing gear housing complete with gasket.

Oil Pump

38 To remove the oil pump proceed as follows:

38.1 Remove the seven retaining screws (Fig 23 (1)) securing the oil pump backplate (2) to the inner face of the timing gear housing.

38.2 Remove the plate and withdraw the oil pump gear (3).




1 Retaining screws 2 Back plate 3 Oil pump gear

Fig 23 Oil pump removal

**Cleaning**

39 Thoroughly clean and degrease all components ensuring removal of gasket material from joint faces.

**Examination**

40 Examine all components removed for wear, renew as necessary.

**Reassembly**

Oil pump

41 To fit the oil pump proceed as follows:

41.1 Fit the oil pump gears to the inner face of the timing gear housing.

41.2 Fit the oil pump backplate and secure with the seven retaining screws.

Timing Gear Housing

42 To fit the timing gear housing proceed as follows:

42.1 Using slave guide studs fit new gasket to cylinder block.

42.2 Align flats on the oil pump with flats on the crankshaft and fit the timing gear housing to the cylinder block.

42.3 Secure the timing gear housing with bolts (Fig 24) of the correct length in the locations where slave studs are not fitted.

42.4 Remove the slave studs and fit the correct length bolts (Fig 24), tighten all securing bolts to a torque of 25 Nm (18 lbf ft).

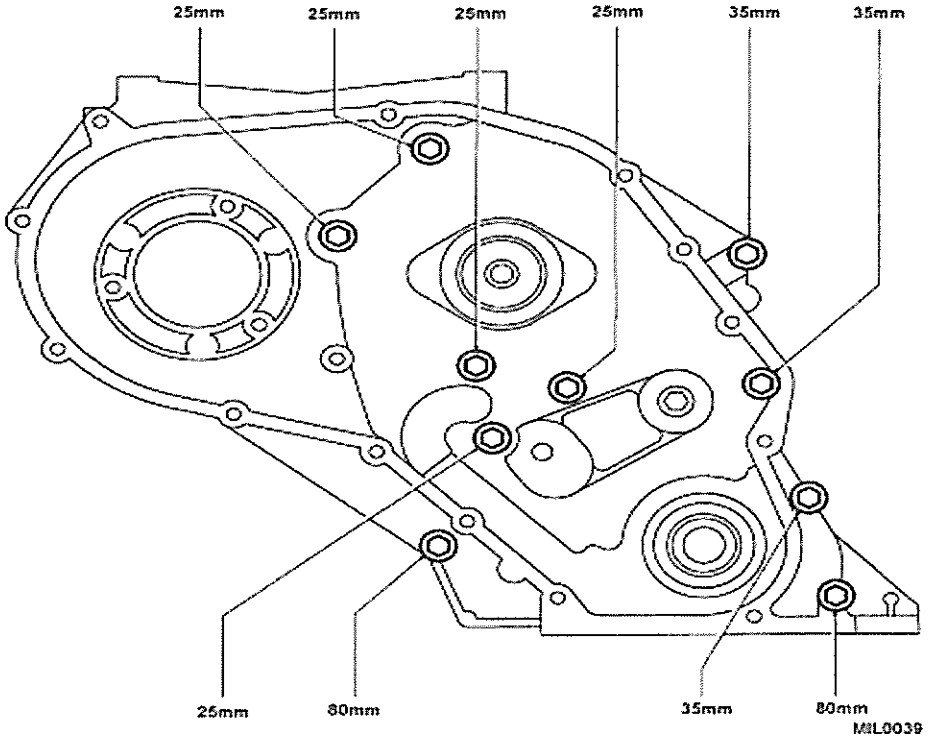



Fig 24 Bolt locations for timing gear housing

42.5 Fit the oil pick-up strainer (refer to Para 56).

42.6 Fit the engine oil sump (refer to Cat 522 Chap 1-1).

Timing Gear Housing Crankshaft Seal

43 To replace the crankshaft seal proceed as follows:

43.1 Lubricate new crankshaft oil seal with clean engine oil (refer to Table 2 Serial 1).

43.2 Locate the seal with the lip side leading, drive the seal squarely into its housing using a suitable tool (Fig 25).

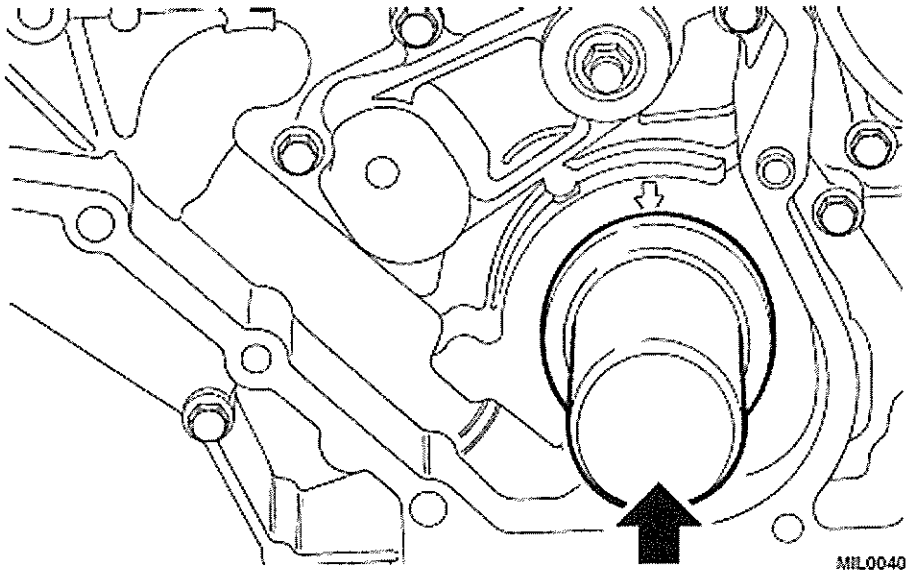



Fig 25 Fitting timing gear housing crankshaft seal

Timing Gear Housing Camshaft Seal

44 To replace the camshaft seal proceed as follows:

44.1 Lubricate new camshaft oil seal with clean engine oil (refer to Table 2 Serial 1).

44.2 Locate the seal on the camshaft with the lip side leading, drive the seal squarely into its housing.

Timing Gears

45 To fit the timing gears carry out the following procedures:

45.1 Fit the fuel injection pump to the timing gear housing (refer to Cat 522 Chap 11-1).

45.2 Using petroleum jelly slide a new "O" ring seal onto the crankshaft, taking care not to damage the seal on the woodruff keys.

45.3 Fit the crankshaft gear to the shaft, tap fully home ensuring that the "O" ring is properly seated.

45.4 Fit the camshaft gear onto its shaft and secure with the centre bolt.

NOTE

Tighten centre bolt to an appropriate torque of 80 Nm (59 lbf ft) after the timing belt has been fitted and tensioned.

45.5 Fit the fuel injection pump gear and plate, secure with the three bolts.

Timing

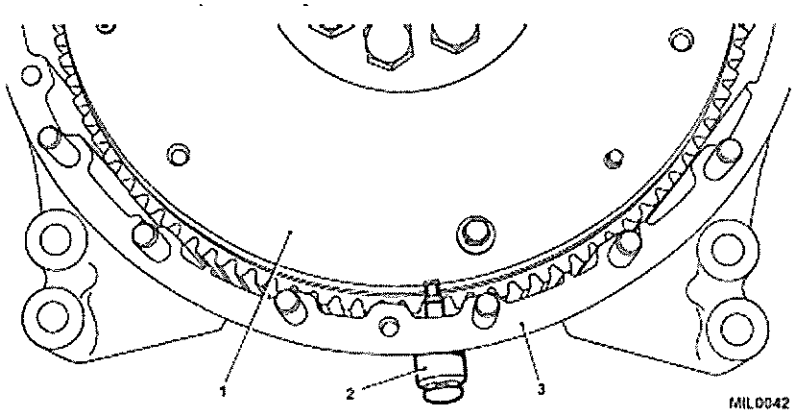
46 The fuel injection pump and valves are timed using the TDC on No. 1 cylinder. This position is determined by the relationship of a slot in the flywheel periphery and a plugged hole in the flywheel housing through which the special tool (refer to Table 1 Serial 5), is inserted to locate in the flywheel slot (Fig 26 (2)).

46.1 Remove the plug from the flywheel housing (3) and fit the body of the tool; at this stage do not engage the pin.

46.2 Turn the crankshaft in a clockwise direction until the slot in the flywheel (1) is in-line with the plughole.

NOTE

If the crankshaft is inadvertently turned beyond the slot, do not turn it back but continue on round in a clockwise direction until the pin of special tool can be fully located in the flywheel slot.




1 Flywheel 2 Timing pin 3 Flywheel housing

Fig 26 Timing pin located in flywheel housing

46.3 Using a 22 mm AF spanner on the pump hub nut, rotate the hub nut in a clockwise direction sufficiently to enable the insertion of the special tool (refer to Table 1 Serial 6), into the fuel injection pump gear and through into the pump flange.

46.4 Ensure timing marks on the camshaft gear, the timing gear housing centre boss are correctly aligned and the crankshaft key aligns with the cast arrow on the housing (Fig 27).

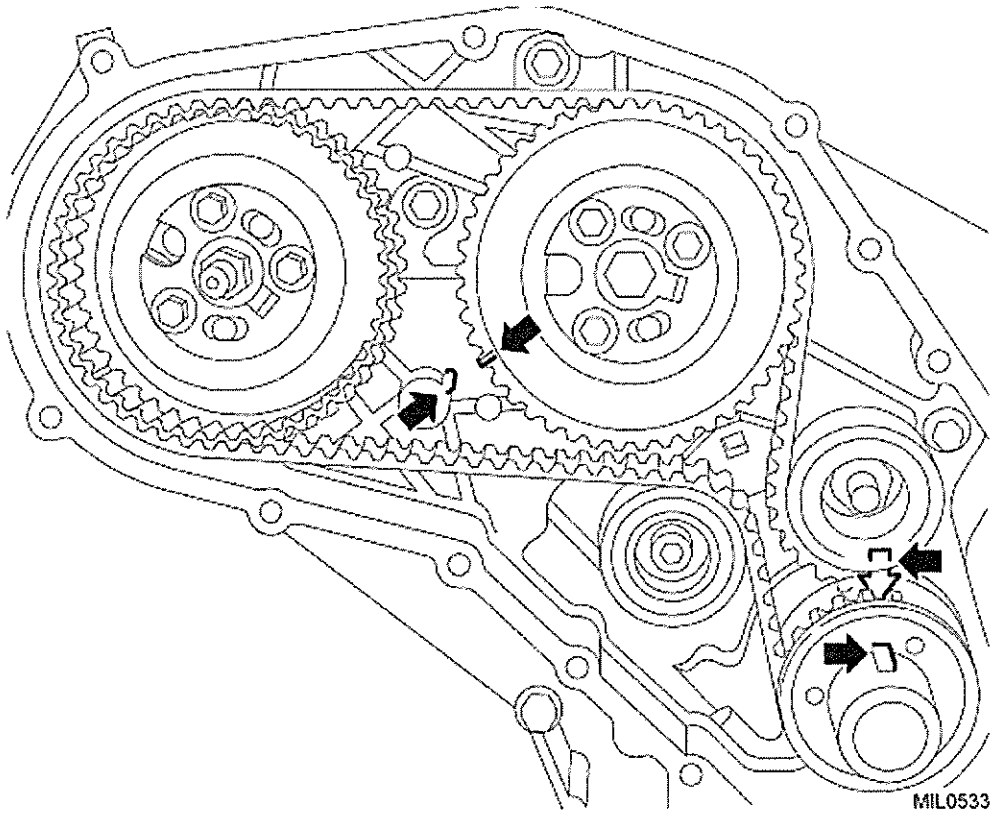



Fig 27 Aligning timing marks on timing gear housing

Timing Belt and Tensioner

47 To fit the timing belt proceed as follows:

47.1 Ensure timing tool (refer to Table 1 Serial 5), is fitted to the flywheel housing with the pin located in the flywheel slot.

47.2 Ensure timing marks are correctly aligned and that the locking pin (Fig 28 (1)) from special tool (refer to Table 1 Serial 6), is inserted through the injection pump gear. (The injection pump gear screws should only be finger tight to allow the gear to rotate in its slots during tensioning).

47.3 Fit the belt tensioner (3) to the idler pulley stud, locate the tensioner pulley with the retaining screw (4) and loosely tighten.

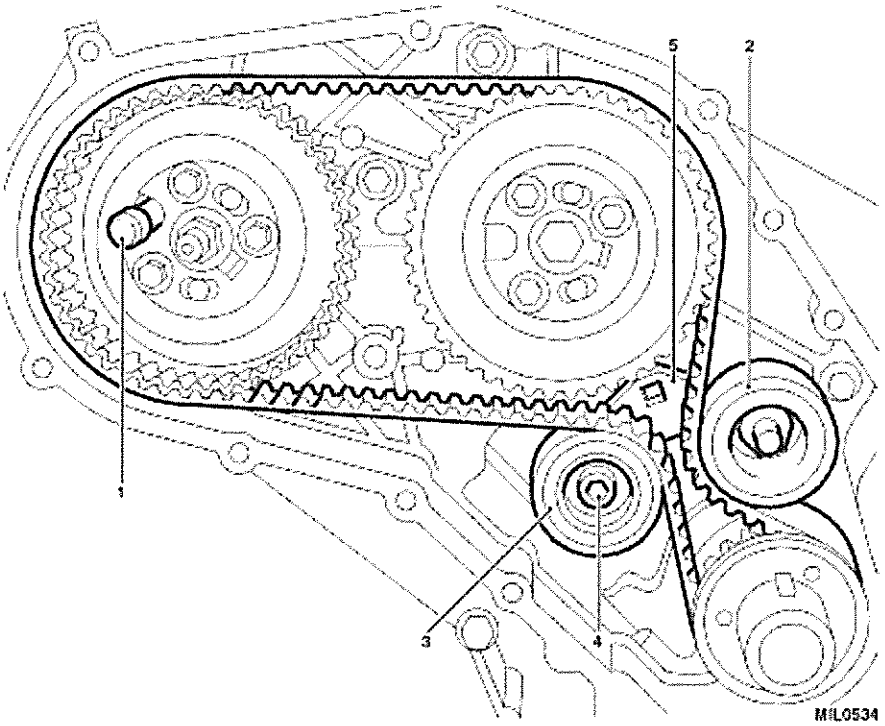
47.4 Fit the idler pulley (2), secure with nut and check tensioner pulley for free movement. Tighten to a torque of 45 Nm (33 lbf ft).

47.5 Fit the belt, observing rotational marks made during removal, by feeding it over the timing gears keeping it tight on the drive side.

**CAUTION**

**TENSIONING. Failure to carry out accurate belt tensioning could result in belt failure and serious engine damage.**

47.6 Back off the belt tensioner securing screw (Fig 1 (4)) approximately one turn and again check the tensioner pulley (3) has free movement.




1 Locking pin
2 Idler pulley
3 Tensioner pulley
4 Retaining screw
5 Tensioner plate

Fig 28 Fitting the timing belt tensioner pulley

47.7 Insert a 13 mm square drive extension bar into the square hole in the tensioner plate (5), attach a torque wrench (Fig 29 (1)) and apply a load of 11 Nm (8 lbf ft).

**CAUTION**

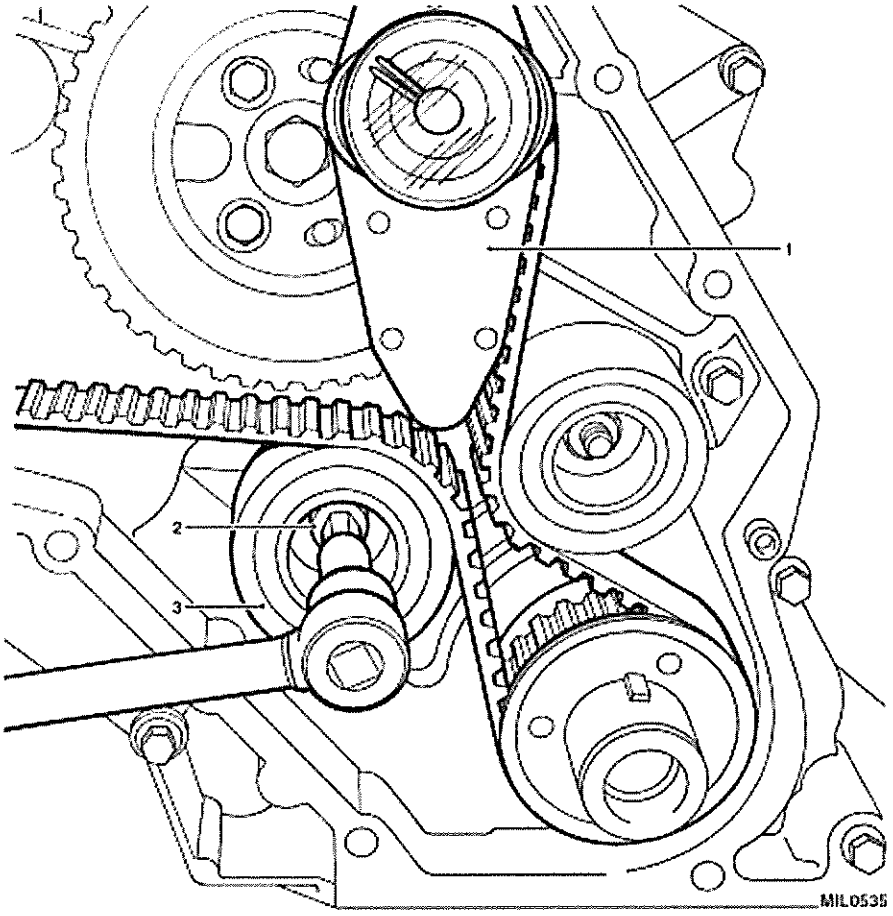
**Length of the torque meter must not exceed 250 mm (9.8 inches) from centre of square to end of meter.**

47.8 Apply a clockwise loading of 11 Nm (8.1 lbf ft) for a new belt or 9 Nm (6.6 lbf ft) for an original belt. When the tension is correct tighten the retaining screw (2) to a torque of 45 Nm (33 lbf ft) while maintaining the load.

NOTES

(1) Tensioning of the belt should be carried out using a dial type torque wrench (1) having a range not exceeding 40 Nm (29 lbf ft).

(2) The torque wrench should be used in the as near vertical position as possible.




1 Torque meter 2 Clamp bolt 3 Tensioner pulley

Fig 29 Tensioning timing belt using torque meter

47.9 After belt tensioning use a spanner on the injection pump hub nut to release any load on the locking pin (refer to Table 1 Serial 6).

47.10 While the locking pin is free, tighten the pump retaining screws to a torque of 25 Nm (18 lbf ft).

47.11 Check locking pin can still slide freely through assembly and remove the locking pin.

47.12 If removed, tighten the camshaft hub bolt to a torque of 80 Nm (59 lbf ft).

47.13 Disengage timing tool plunger from the slot in the flywheel.

47.14 Remove the timing tool from the flywheel housing and fit the flywheel housing blanking plug torque tighten to 12 Nm (9 lbf ft).

Timing Gear Front Cover Seal

48 To replace the timing gear front cover seal proceed as follows:

48.1 Support the front cover and fit the new seal, press into cover so that the flat face of the seal is flush with the back face of the cover (Fig 30).

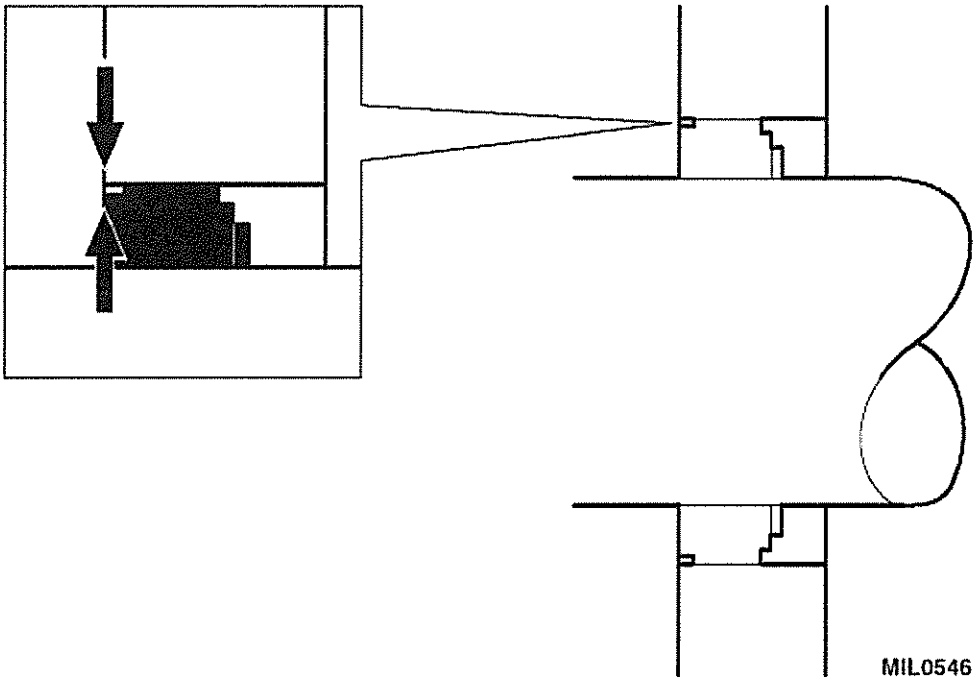



Fig 30 Fitting front timing cover oil seal

Timing Gear Front Cover

49 To fit the front cover carry out the following:

49.1 Fit the front cover with a new gasket interposed between the mating faces and a new small gasket on the centre bolt boss.

49.2 Fit the cover to the engine and fit the various length bolts to their respective locations (Fig 31), (the two top bolts also retain the thermostat hose clips), and evenly tighten to a torque of 25 Nm (18 lbf ft).

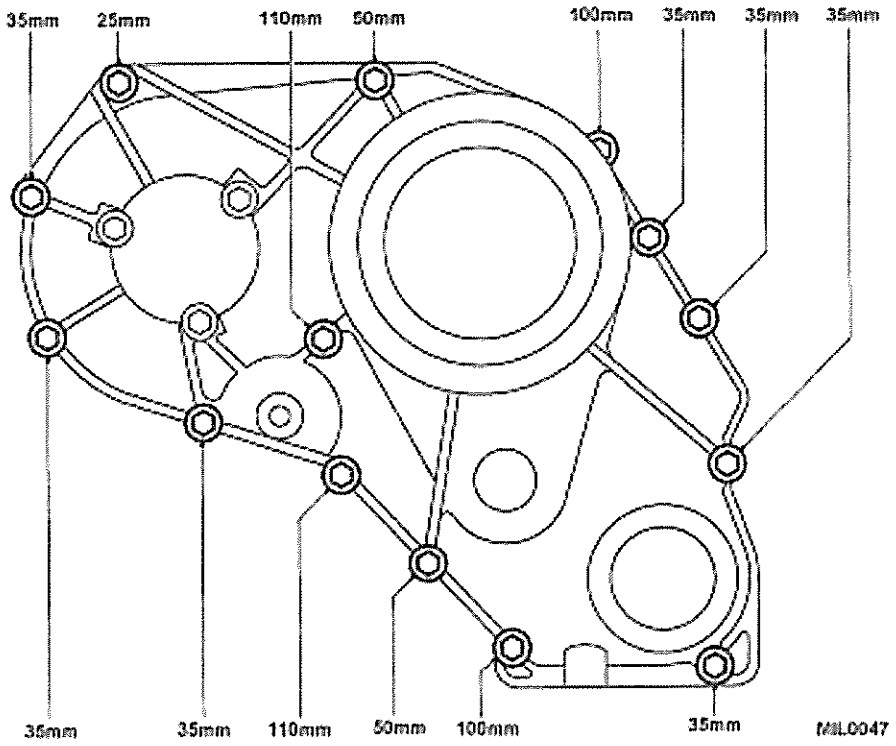



Fig 31 Bolt locations for front timing cover

Drive Belt and Pulleys

50 Fit the drive belt and pulleys (Fig 32) (refer to Cat 522 Chap 1-1).

Radiator

51 Refit the radiator, intercooler, cowling assembly and all respective top and bottom hoses (refer to Cat 522 Chap 12-1).

51.1 Reconnect water pump, thermostat hoses and heater rail hoses (refer to Cat 522 Chap 12-1).

51.2 Refill the cooling system using the correct mix of fluid (refer to Cat 522 Chap 12-1).

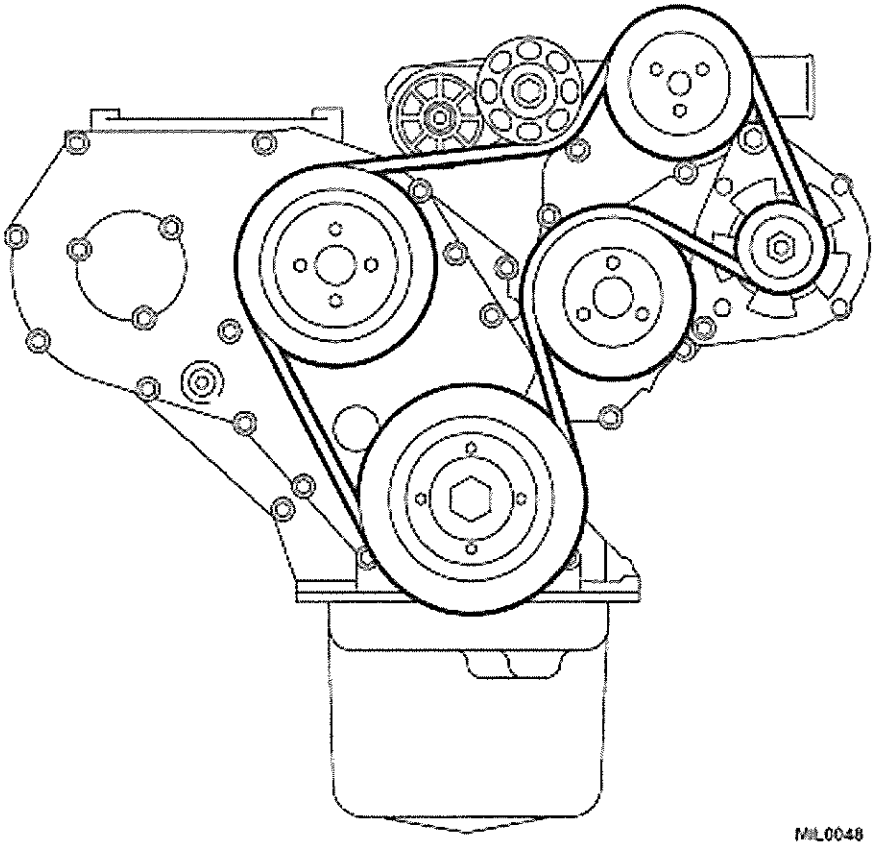
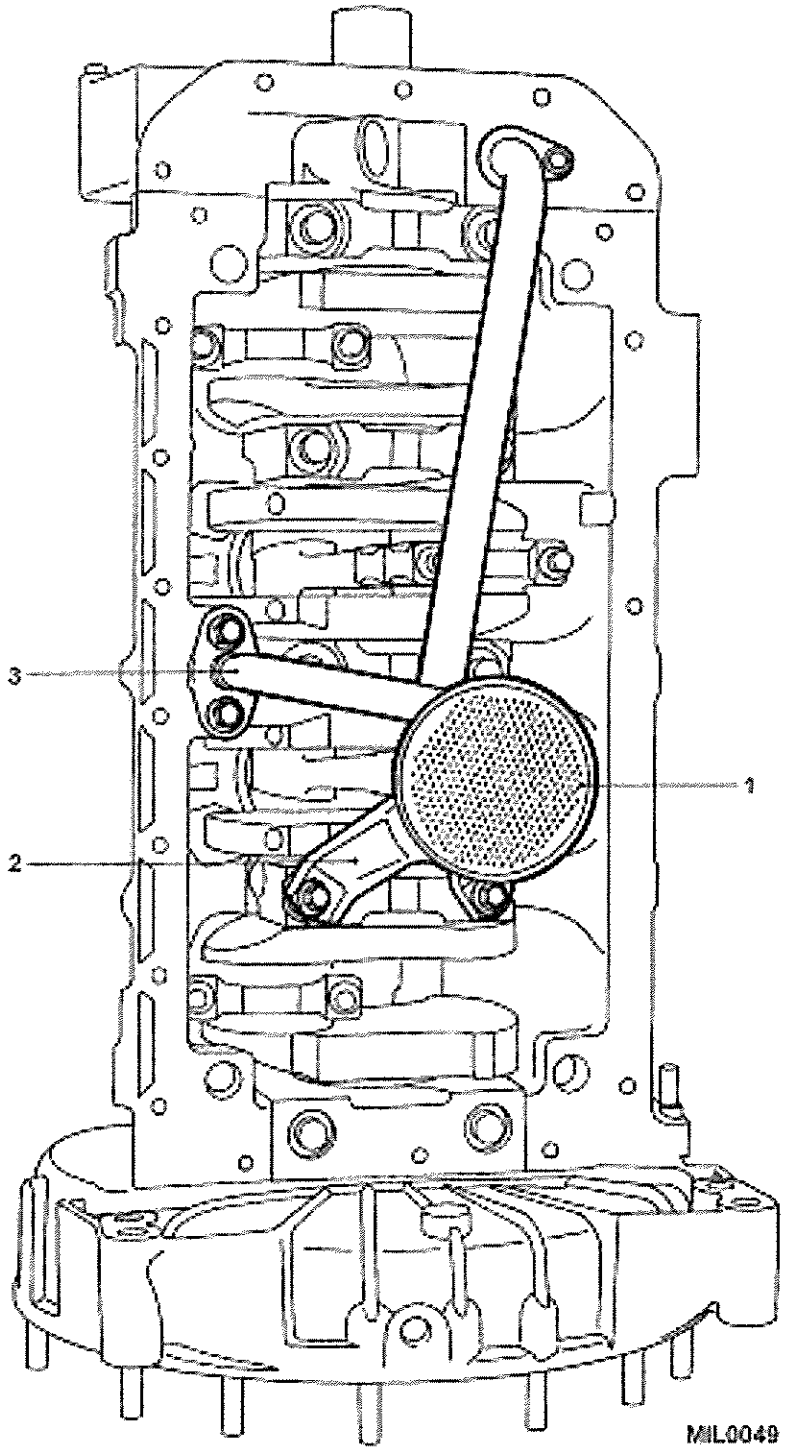



Fig 32 Drive belt and pulley location

Oil Cooler

52 Reconnect the inlet and outlet hoses to their respective adapters (refer to Cat 522 Chap 1-1).




1 Pick up strainer 2 Pipe support bracket 3 Oil return pipe

Fig 33 Oil strainer and return pipe

Batteries

53 Reconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on FFR vehicles the radio batteries (refer to Cat 522 Chap 13-2).

**CAUTION**

**BATTERY LEADS. On 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.**

54 Run the engine and check all oil and coolant connections that have been disturbed for leaks.

55 Stop the engine, when cool check the coolant and oil levels, top up as necessary (refer to Cat 522 Chap 12-1).

**Oil pick-up strainer**

Removal

56 To remove the oil pick-up strainer proceed as follows:

56.1 Remove the sump (refer to Cat 522 Chap 1-1).

56.2 Remove the bolts securing the pipe support bracket (Fig 33 (2)) from the bearing cap bolts.

56.3 Remove the bolt from the pipe flange at the oil pump connection.

56.4 Withdraw the pick-up strainer assembly (1) with 'O' ring.

56.5 Remove and discard the sealing 'O' ring.

56.6 Remove the oil return pipe retaining bolts from the pipe flange and withdraw the pipe (3) from the cylinder block.

56.7 Remove and discard the gasket.

Refitting

57 The procedure for refitting the oil strainer and return pipe is the reverse of the removal procedure, using new "O" ring seal and gaskets as applicable.

57.1 Tighten the return pipe and the strainer pipe flange bolts to 25 Nm (18 lbf ft).

57.2 Fit the pipe support bracket bolts to the bearing cap bolts using a sealant (refer to Table 2 Serial 4) and tighten to 9 Nm (7 lbf ft).

57.3 Refit the engine oil sump (refer to Cat 522 Chap 1-1).

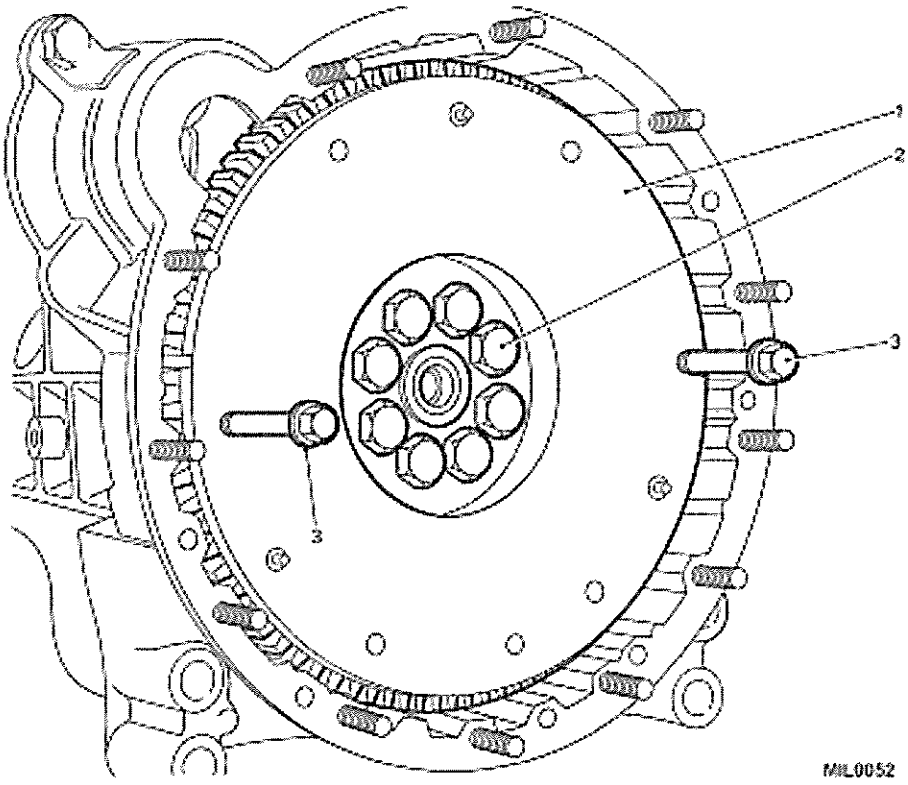
**Flywheel and starter ring gear**

Removal

58 To remove the flywheel proceed as follows:

58.1 In the interests of safety, fit two long 8 mm bolts (Fig 34 (3)) into the clutch bolt holes, diametrically opposite, to use as handles when lifting the flywheel (1) off the crankshaft.

58.2 Temporarily fit the crankshaft pulley and use the pulley retainer tool (refer to Table 1 Serial 7) to restrain the crankshaft while removing the flywheel retaining bolts (2).




1 Flywheel 2 Flywheel retaining bolts 3 8 mm bolts

Fig 34 Flywheel removal

58.3 Remove the flywheel retaining bolts and reinforcing and lift off the flywheel.

Examination

59 To examine the flywheel and starter ring gear proceed as follows:

59.1 Examine the flywheel clutch face for wear or scores, these may be corrected by machining, provided that the overall thickness is not reduced below 36.96 mm (1.45 in.).

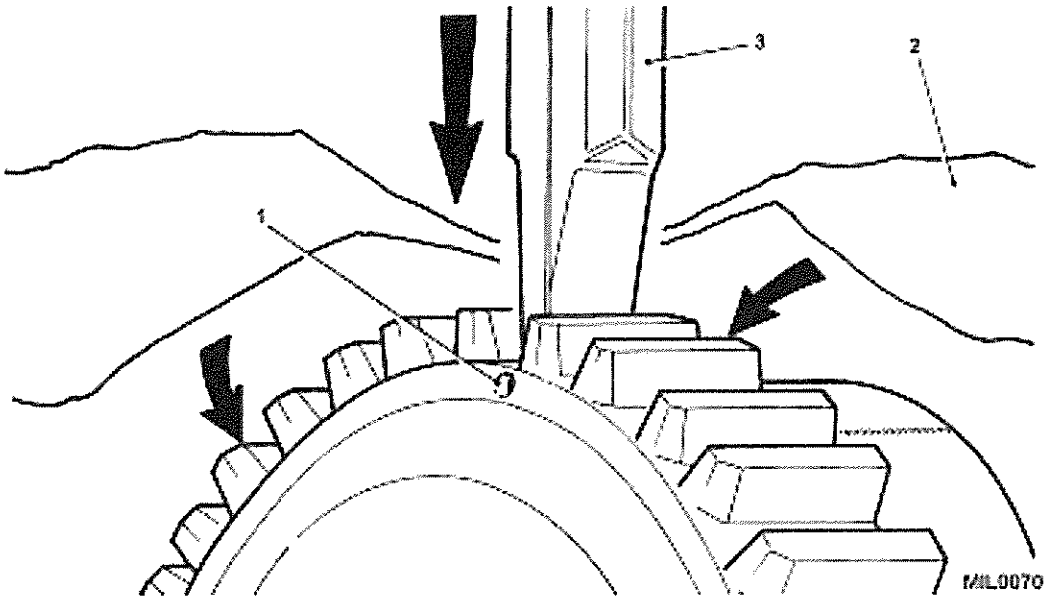
59.2 Examine the starter ring gear teeth, if chipped or worn the gear should be renewed (refer to Para 61).

Renewing Starter Ring Gear

60 To renew the starter ring gear carry out the following:

60.1 Drill an 8 mm hole (Fig 35 (1)) between the root of any two teeth and the inner diameter of the starter ring, deep enough to weaken the ring. Take care not to allow the drill to enter the flywheel.

60.2 Secure the flywheel in a soft jawed vice and cover it with a suitable piece of cloth (2) to protect the operator from flying fragments.




1 8 mm hole 2 Cloth 3 Cold chisel

Fig 35 Removing starter ring gear

**WARNING**

**FRAGMENTATION HAZARD. ADEQUATE PRECAUTIONS MUST BE TAKEN AGAINST FLYING FRAGMENTS WHEN SPLITTING THE RING GEAR.**

60.3 Place a cold chisel (3) above the drilled hole and strike it sharply to split the ring gear.

60.4 Heat the new ring gear uniformly to between 225 °C and 250 °C, do not exceed the higher temperature.

60.5 Place the flywheel, clutch face down, on a flat surface.

60.6 Locate the heated starter ring gear in position with the square edge of the teeth against the flywheel flange (Fig 36).

60.7 Press the starter ring gear firmly against the flange until the ring contracts sufficiently to grip the flywheel. Allow the ring to cool naturally, do not hasten cooling in anyway as distortion may occur.

Refitting

61 Refit the flywheel in the reverse order of the removal ensuring that new patchloc retaining bolts are fitted. Progressively tighten to 147Nm (108 lbf/ft).

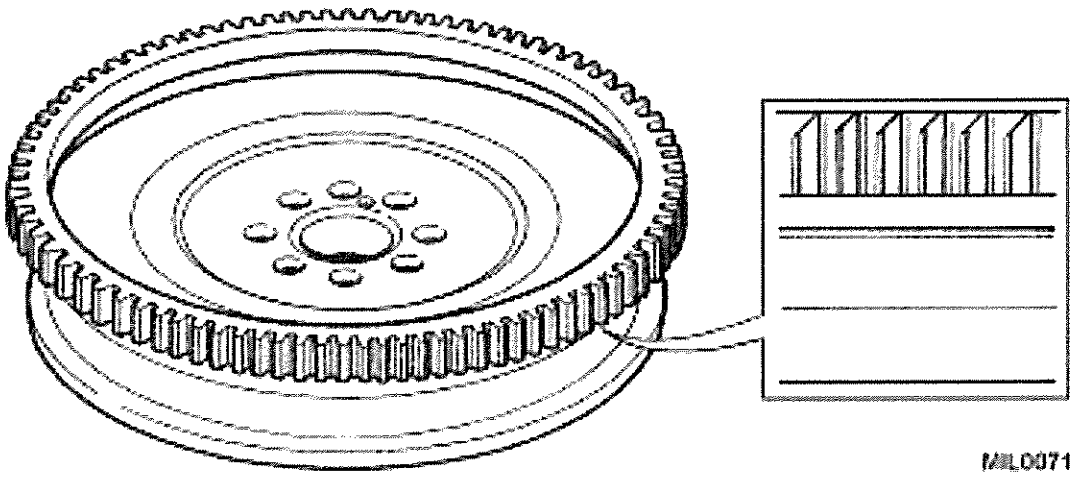



Fig 36 Fitting starter ring gear

# CHAPTER 1-2

# WINTERISED/WATERPROOFED

## CONTENTS

Para

1 Introduction
Engine
3 Removal (WARNING) (CAUTIONS)
4 Installation (CAUTION)

Table Page

1 Sealants, Adhesives and lubricants ..... 1

Fig Page

1 Engine disconnection points ..... 7

## INTRODUCTION

1 This Chapter details the Field repairs for Truck Utility Light (TUL) High Specification (HS), Truck Utility Medium (TUM) HS, Winterised/Waterproofed vehicles with 2.5 Litre 300 Tdi direct injected turbocharged diesel engines.

## ENGINE

2 The consumables listed Table 1 will be referred to in the text, where used, by the serial number shown in column (1).

**TABLE 1 SEALANTS, ADHESIVES AND LUBRICANTS**

| Ser | Product | NSN/Part Number where applicable | Designation |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| 1 | OMD 80 | 9150-99-335-3822 | Engine oil |
| 2 | RTV | 8030-99-224-6527 | Silicon sealant |
| 3 | Rocol MTS 1000 | 9150-99-224-5626 | Molybdenum disulphide grease |

**Removal**

3 To remove the engine from the vehicle proceed as follows:

3.1 Park the vehicle on level ground and apply park brake.

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

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

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

3.5 On FFR vehicles remove the 50 Ampere (A) alternator (refer to Chap 13-2).

3.6 Disconnect the air cleaner (Fig 1 (5)) from the wing mounted raised air intake hose connection (4).

3.7 Disconnect the turbocharger hose (6) from the air intake and remove air cleaner (5) (refer to Chap 11-3). Disconnect the hose from the turbo charger (13).

3.8 Remove cable ties and clips securing breather pipes (7).

3.9 Remove the radiator assembly (21) (refer to Chap 12-1).

3.10 Remove the viscous coupling (20).

3.11 Remove hoses (14) from turbocharger to intercooler and disconnect the Exhaust Gas Recirculation (EGR) flange (12).

3.12 Disconnect heater hoses (8) from cylinder head and heater rails.

3.13 Remove starter motor terminal cover and disconnect positive and fuse box leads (9).

3.14 Remove three retaining nuts and disconnect exhaust down pipe (15).

3.15 Disconnect inlet and outlet hoses (16) from power steering pump.

3.16 Disconnect the top hose and bypass hoses (19) from thermostat housing.

3.17 Release bypass hose from retaining clips on front timing cover.

3.18 Disconnect the bottom hose (18).

3.19 Disconnect the hoses (22, 24) from the expansion tank to the radiator and thermostat housing.

3.20 Remove split pins securing throttle cables (26) to injection pump.

3.21 Depress tags on outer cable adjusting nut, remove cable from mounting bracket and move aside.

3.22 If fitted, release hand throttle cable from mounting bracket and injector pump and move aside.

3.23 Disconnect fuel filter pipe (25) and spill return pipe from injector pump.

3.24 Disconnect both the fuel inlet and fuel outlet pipes (1) from fuel lift pump.

3.25 Release fuel feed pipe from retaining clip on air cleaner bracket.

3.26 Disconnect brake servo hose (3) from vacuum pump.

3.27 Blank off pipes, hoses and adapters from which they have been removed to prevent the ingress of dirt or foreign matter.

3.28 Remove engine oil cooler pipes (23) from oil filter adapter and release the bracket (17) from the sump.

3.29 Drain the oil sump using a container of suitable capacity.

3.30 Remove the water heater Electronic Control Unit (ECU) (10) and move aside (refer to Chap 13-5).

3.31 Disconnect and remove the water heater (11) (refer to Chap 18-3).

3.32 Disconnect the heater plug connection (2) and engine harness connections.

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

3.34 Remove engine mountings (refer to Cat 522 Chap 1-1).

3.35 Support the gearbox assembly, using a suitable jack or by using packing blocks between the gearbox and the chassis cross member.

3.36 Remove engine to bell housing fixings, leaving starter motor attached to engine.

3.37 Carefully raise engine and pull away from gearbox.

**CAUTIONS**

**(1) BELL HOUSING SEPARATION. The mating faces between the engine and the bell housing are coated with a sealant and will offer resistance during separation.**

**(2) DAMAGE TO FACES. Do not insert tools in between the mating faces of the engine and gearbox to aid separation as this will damage the surfaces and ruin the integrity of the waterproof seal.**

NOTE

Use the weight of the engine to help break the seal between the engine and the gearbox. If the seal proves difficult to break, use a hide mallet to tap the area around the joint to assist in the separation.

3.38 Ensure all relevant connections to engine have been removed noting their locations for refitting.

3.39 Remove engine.

**WARNING**

**ENGINE STAND. WHEN USING AN ENGINE STAND, IT IS ESSENTIAL TO FOLLOW THE STAND MANUFACTURERS USER INSTRUCTIONS TO ENSURE SAFE AND EFFECTIVE USE OF THE EQUIPMENT.**

3.40 Secure the engine to a suitable mounting stand and remove the lifting chains and hoist.

**Installation**

4 The procedure for installing the engine is as follows:

4.1 Attach a suitable lifting sling and hoist to the engine and remove from mounting stand.

4.2 Clean the flywheel and bell housing mating faces to remove old sealant. Re-coat the faces with sealant (refer to Table 1 Serial 2).

4.3 Smear the splines of the gearbox primary pinion, the clutch centre and the release lever abutment faces with Molybdenum disulphide grease (refer to Table 1 Serial 3).

4.4 Lower the engine into position, locating the primary pinion into the clutch and engaging the flywheel housing studs into the bell housing, secure the housings together with the nuts and washers and tighten to a torque of 45 to 50 Nm (33 to 37 lbf ft).

4.5 Remove the jack or packing blocks from supporting the gearbox.

4.6 Fit engine mountings (refer to Cat 522 Chap 1-1).

4.7 Remove the lifting sling and hoist.

4.8 Reverse the removal procedure to reconnect all pipes, hoses, electrical connections, the radiator assembly, and the exhaust connection to the manifold.

4.9 On FFR vehicles fit the 50 A alternator, fit and tension the drive belt, reconnect all electrical connections (refer to Chap 13-2).

4.10 Refit the water heater ECU (refer to Chap 13-5) and the Water heater (refer to Chap 18-3).

4.11 Refill the cooling system (refer to Chap 12-2).

4.12 Refill the engine oil system with the correct grade of oil (refer to Table 1 Serial 1).

4.13 Check, and if necessary replenish the gearbox lubricating oil (refer to Chap 3-1).

4.14 Reconnect the vehicle batteries (refer to chap 13-1) and on FFR vehicles the radio batteries (refer to chap 13-2).

**CAUTION**

**ENGINE STARTING. On 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.**

4.15 Start the engine.

4.16 Check that the oil pressure warning light goes out.

4.17 Allow engine to reach operating temperature and check all fuel, oil and coolant connections for leaks.

4.18 Stop the engine.

4.19 When cool check coolant and oil levels, top up as necessary (refer to Chap 12-1).

4.20 Refit the bonnet and connect the earth bonding straps (refer to chap 16-1).

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**KEY TO FIG 1**

1 Fuel pump inlet and outlet pipes
2 Heater plug connection
3 Brake servo hose
4 Raised air intake connection
5 Air cleaner
6 Air cleaner to turbocharger hose
7 Breather pipes
8 Heater hoses
9 Starter motor connections
10 Water heater ECU
11 Water heater
12 EGR connection
13 Turbocharger hose
14 Intercooler hoses
15 Exhaust down pipe
16 Power steering pump hoses
17 Oil cooler pipe bracket
18 Bottom hose
19 Top hose and by-pass hose
20 Viscous coupling
21 Radiator assembly
22 Expansion tank pipe
23 Engine oil cooler pipes
24 Expansion tank pipe
25 Fuel filter to injector pump pipe
26 Throttle cables

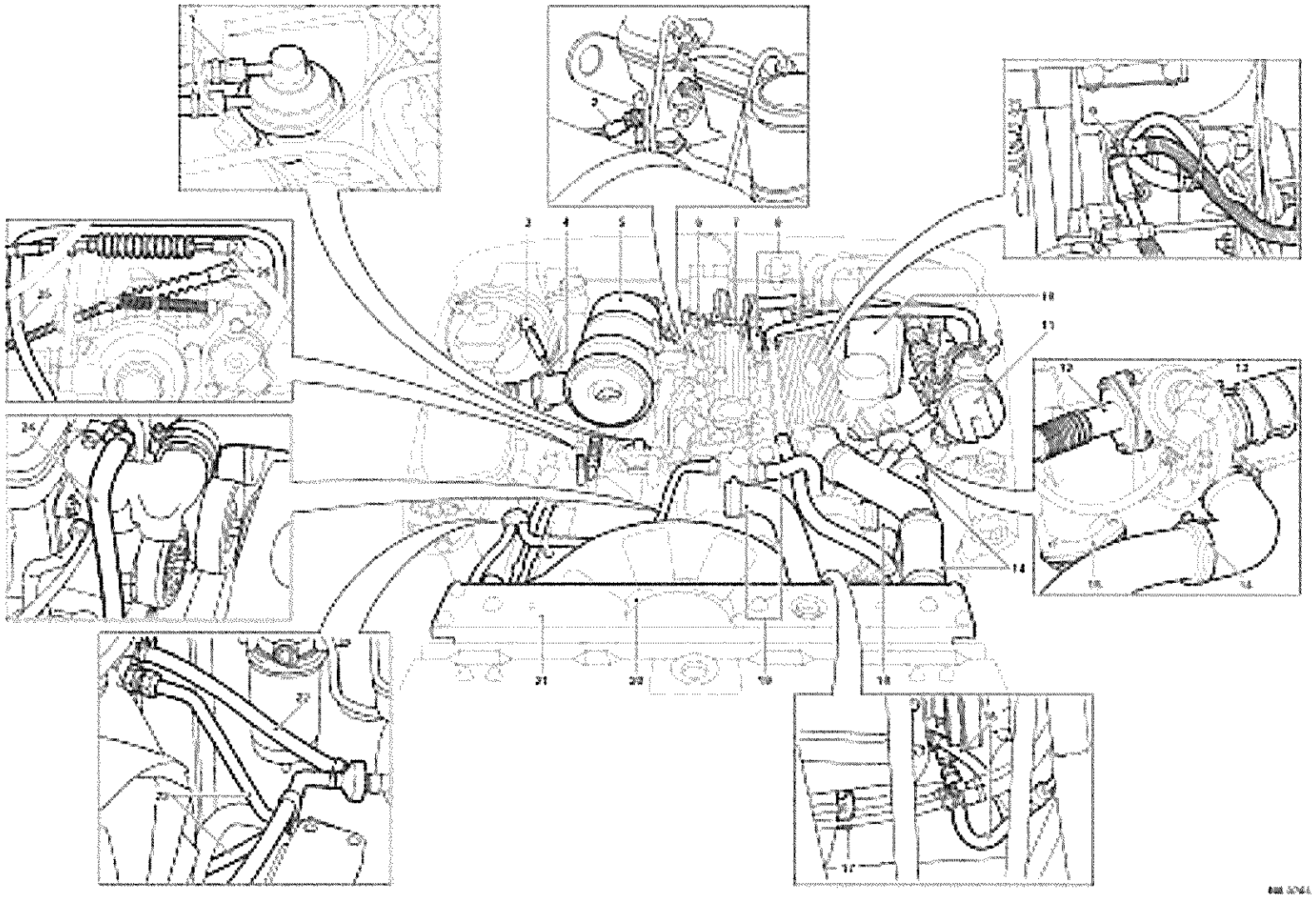

Fig 1 Engine disconnection points

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## CHAPTER 1-3

## TROPICALISED

## CONTENTS

Para

1 Introduction
Engine
3 Removal
4 Installation

Table Page

1 Sealants, Adhesives and lubricants ..... 1

Fig Page

1 Engine disconnection points ..... 7

### INTRODUCTION

1 This Chapter details the Field repairs for (TUM) Battlefield Ambulance High Specification (HS) tropicalised vehicles with 2.5 Litre 300 Tdi direct injected turbocharged diesel engines and air conditioning.

### ENGINE

2 The consumables listed Table 1 will be referred to in the text, where used, by the serial number shown in column (1).

**TABLE 1 SEALANTS, ADHESIVES AND LUBRICANTS**

| Ser | Product | NSN/Part Number where applicable | Designation |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| 1 | OMD 80 | 9150-99-335-3822 | Engine oil |
| 2 | Hylomar universal | 8030-99-762-0064 | Sealing compound |
| 3 | Rocol MTS 1000 | 9150-99-224-5626 | Molybdenum disulphide grease |

**Removal**

3 To remove the engine from the vehicle proceed as follows:

3.1 Park the vehicle on level ground and apply park brake.

3.2 Disconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on Fitted for Radio (FFR) vehicles the radio batteries (refer to Cat 522 Chap 13-2).

3.3 Disconnect the earth bonding straps and remove the bonnet (refer to Cat 522 Chap 16-1).

3.4 On FFR vehicles remove the 50 Ampere (A) alternator (refer to Cat 522 Chap 13-2).

3.5 Disconnect air cleaner to turbocharger hose (Fig 1 (6)), side air intake and remove air cleaner (5) (refer to Cat 522 Chap 11-1). Disconnect the hose (11) from the turbocharger.

3.6 Remove cable ties securing gearbox harness to breather pipes (7).

3.7 Remove the radiator assembly (19) (refer to Chap 12-1).

3.8 Remove the viscous coupling (18).

3.9 Remove hoses (12) from turbocharger to intercooler and disconnect the Exhaust Gas Recirculation (EGR) flange (10).

3.10 Disconnect heater hoses (8) from cylinder head and heater rails

3.11 Remove starter motor terminal cover and disconnect positive and fuse box leads (9).

3.12 Remove three retaining nuts and disconnect exhaust down pipe (13).

3.13 Disconnect inlet and outlet hoses (14) from power steering pump.

3.14 Disconnect the top hose and bypass hose (17) from thermostat housing.

3.15 Release bypass hose from retaining clips on front timing cover.

3.16 Disconnect the bottom hose (16).

3.17 Disconnect the hoses (20, 22) from the expansion tank to the radiator and thermostat housing

3.18 Remove split pins (24) securing throttle cables to injection pump.

3.19 Depress tags on outer cable adjusting nut, remove cable from mounting bracket and move aside.

3.20 If fitted, release hand throttle cable from mounting bracket and injector pump and move aside.

3.21 Disconnect fuel filter pipe (23) and spill return pipe from injector pump.

3.22 Disconnect both the fuel inlet and outlet pipes (1) from fuel lift pump.

3.23 Release fuel feed pipe from retaining clip on air cleaner bracket.

3.24 Disconnect brake servo hose (3) from vacuum pump.

3.25 Disconnect the high and low pressure pipes (4) to the air conditioning compressor (refer to Cat 522 Chap 18-5).

3.26 Blank off pipes, hoses and adapters from which they have been removed to prevent the ingress of dirt or foreign matter.

3.27 Remove engine oil cooler pipes (21) from oil filter adapter release the bracket (15) from the sump.

3.28 Drain the oil sump using a container of suitable capacity.

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

3.30 Disconnect the heater plug connection (2) and engine harness connections.

3.31 Remove engine mountings (refer to Cat 522 Chap 1-1).

3.32 Support the gearbox assembly, using a suitable jack or by using packing blocks between the gearbox and the chassis cross member.

3.33 Remove engine to bell housing fixings, leaving starter motor attached to engine.

3.34 Carefully raise engine and pull away from gearbox.

3.35 Ensure all relevant connections to engine have been removed noting their locations for refitting.

3.36 Remove engine.

3.37 Secure the engine to a suitable mounting stand and remove the lifting chains and hoist.

**WARNING**

**ENGINE STAND. WHEN USING AN ENGINE STAND, IT IS ESSENTIAL TO FOLLOW THE STAND MANUFACTURERS USER INSTRUCTIONS TO ENSURE SAFE AND EFFECTIVE USE OF THE EQUIPMENT.**

**Installation**

4 The procedure for installing the engine is as follows:

4.1 Attach a suitable lifting sling and hoist to the engine and remove from mounting stand.

4.2 Clean the flywheel and bell housing mating faces to remove old sealant. Re-coat the faces with sealant (refer to Table 1 Serial 2).

4.3 Smear the splines of the gearbox primary pinion, the clutch centre and the release lever abutment faces with Molybdenum disulphide grease (refer to Table 1 Serial 3).

4.4 Lower the engine into position, locating the primary pinion into the clutch and engaging the flywheel housing studs into the bell housing, secure the housings together with the nuts and washers and tighten to a torque of 45 to 50 Nm (33 to 37 lbf ft).

4.5 Remove the jack or packing blocks from supporting the gearbox.

4.6 Fit engine mountings (refer to Cat 522 Chap 1-1).

4.7 Remove the lifting sling and hoist.

4.8 Reverse the removal procedure to reconnect all pipes, hoses, electrical connections, the radiator assembly, and the exhaust connection to the manifold.

4.9 On FFR vehicles fit the 50 A alternator, fit and tension the drive belt, reconnect all electrical connections (refer to Cat 522 Chap 13-2).

4.10 Refill the cooling system (refer to Cat 522 Chap 12-1).

4.11 Refill the engine oil system with the correct grade of oil (refer to Table 1 Serial 1).

4.12 Recharge the air conditioning system (refer to Cat 522 Chap 18-5).

4.13 Check, and if necessary replenish the gearbox lubricating oil (refer to Cat 522 Chap 3-1).

4.14 Reconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on FFR vehicles the radio batteries (refer to Cat 522 Chap 13-2).

**CAUTION**

**ENGINE STARTING. On 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.**

4.15 Start the engine.

4.16 Check that the oil pressure warning light goes out.

4.17 Allow engine to reach operating temperature and check all fuel, oil and coolant connections for leaks.

4.18 Stop the engine.

4.19 When cool check coolant and oil levels, top up as necessary (refer to Chap 12-1).

4.20 Refit the bonnet and connect the earth bonding straps (refer to chap 16-1).

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**KEY TO FIG 1**

| | | | |
|---|---|---|---|
| 1 | Fuel pump inlet and outlet pipes | 13 | Exhaust down pipe |
| 2 | Heater plug connection | 14 | Power steering pump hoses |
| 3 | Brake servo hose | 15 | Oil cooler pipe bracket |
| 4 | Air conditioning compressor connections | 16 | Bottom hose |
| 5 | Air cleaner | 17 | Top hose and by-pass hose |
| 6 | Air cleaner to turbocharger hose | 18 | Viscous coupling |
| 7 | Breather pipes | 19 | Radiator assembly |
| 8 | Heater hoses | 20 | Expansion tank pipe |
| 9 | Starter motor connections | 21 | Engine oil cooler pipes |
| 10 | EGR flange | 22 | Expansion tank pipe |
| 11 | Turbo hose connection | 23 | Fuel filter to injector pump hose |
| 12 | Intercooler hoses | 24 | Throttle cable pins |

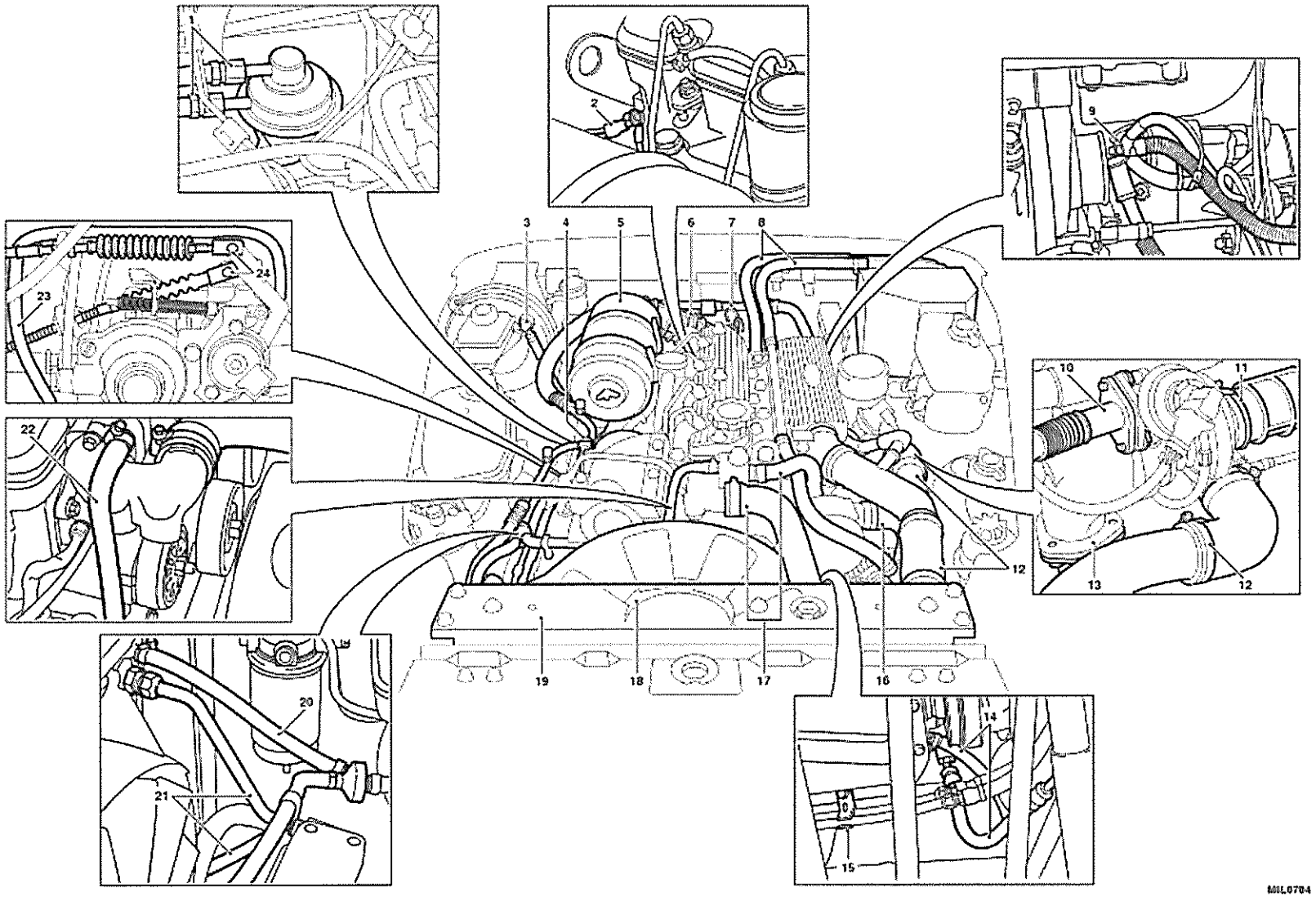


Fig 1 Engine disconnection points

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## CHAPTER 2

## CLUTCH

## CONTENTS

Para

1 Introduction
2 General
Clutch assembly
4 Removal
5 Examination
6 Reassembly
Release mechanism
7 Dismantling
8 Cleaning
9 Examination
10 Reassembly

Table Page

1 Sealants, Adhesives and Lubricants ..... 2
2 Service kits ..... 2

Fig Page

1 Clutch assembly ..... 3
2 Push rod retaining clip ..... 4
3 Clutch release mechanism ..... 5
4 Clutch pedal removal/installation ..... 7

## INTRODUCTION

1 This Chapter covers the Field repairs for clutches fitted to Truck Utility Light (TUL) High Specification (HS), Truck Utility Medium (TUM) HS and (TUM) Battlefield 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.

3 The consumables and service kits listed Table 1 and Table 2 will be referred to in the text, where used, by the serial number shown in column (1).

**TABLE 1 SEALANTS, ADHESIVES AND LUBRICANTS**

| Ser<br>(1) | Product<br>(2) | NSN/Part Number where applicable<br>(3) | Designation<br>(4) |
|---|---|---|---|
| 1 | XG 276 | 9150-99-942-5139 | Molybdenum disulphide grease |
| 2 | XG 279 | 9150-99-220-2418 | General purpose grease |
| 3 | RTV | 8030-99-224-6527 | Sealing compound |

**TABLE 2 SERVICE KITS**

| Ser<br>(1) | NSN/Part Number where applicable<br>(2) | Designation<br>(3) |
|---|---|---|
| 1 | 5340-99-729-9842 | Clip |

NOTE

The clip (Fig 2 (1)) (Table 2 Serial 1) securing the slave cylinder pushrod should be replaced whenever the gearbox is refitted.

## CLUTCH ASSEMBLY

### Removal

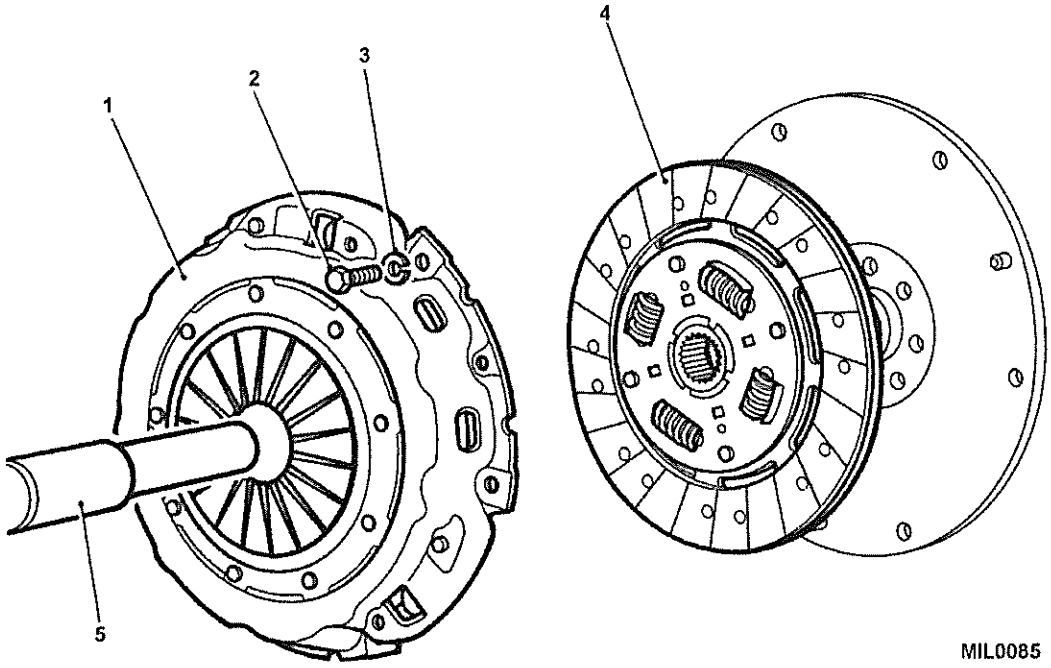
4 To remove the clutch assembly carry out the following:

4.1 Remove the gearbox assembly from the vehicle (refer to Chap 3-1).

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

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

4.4 Withdraw the clutch plate (4).




| | | | |
|---|---|---|---|
| 1 | Clutch cover | 4 | Clutch plate |
| 2 | Bolt | 5 | Mandrel |
| 3 | Spring washer | | |

Fig 1 Clutch assembly

**Examination**

5 Examine the clutch components as follows:

5.1 Check the clutch cover diaphragm spring fingers for wear and the pressure plate for signs of wear cracks or burning.

5.2 Check the driven plate for worn, burned or contaminated linings and the centre hub spline for wear.

5.3 Renew components as necessary.

**Reassembly**

6 Refit the clutch assembly as follows:

6.1 Locate the clutch plate (Fig 1 (4)) with the side marked 'Flywheel' towards the flywheel.

6.2 Fit the clutch cover (1), using a mandrel ensuring alignment of the marks made during dismantling. Secure the assembly with the bolts (2) and spring washers (3), tighten diagonally to a torque of 30 to 38 Nm (22 to 28 lbf ft).

**RELEASE MECHANISM**

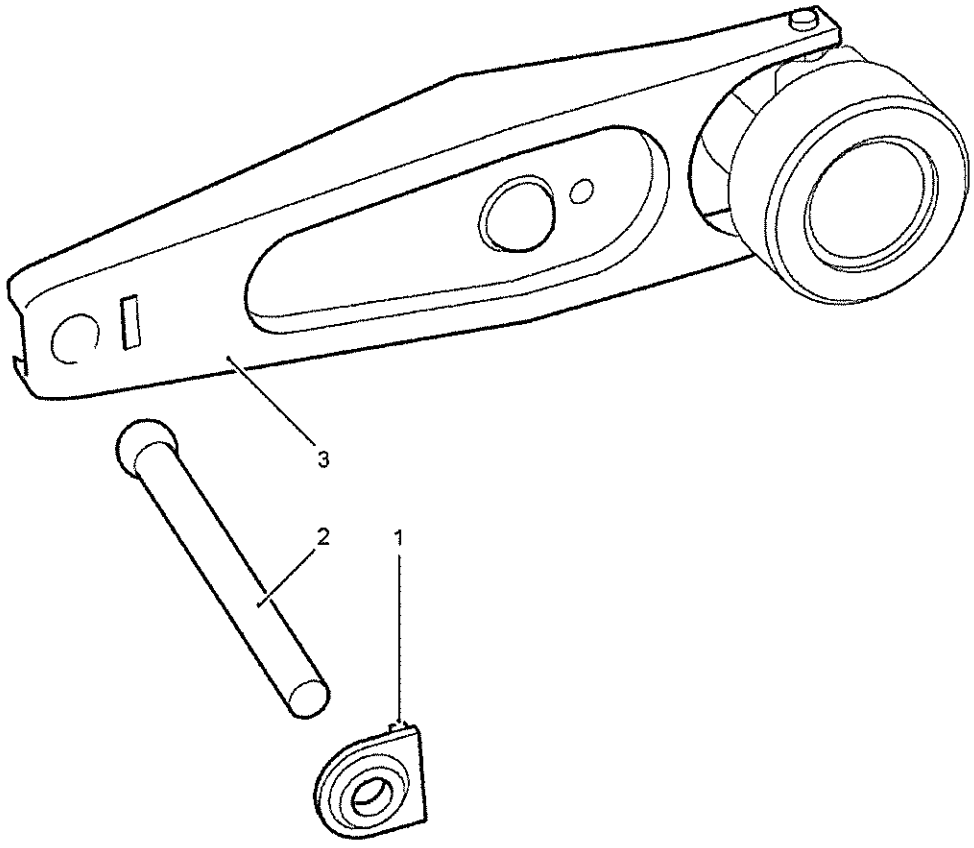
**Dismantling**

7 To dismantle the release mechanism proceed as follows:

7.1 Remove the clutch slave cylinder from the bell housing (refer to Cat 522 Chap 2).

7.2 Remove the clip (Fig 2 (1)) and slave cylinder push rod (2) from the release lever (3).

7.3 Remove the clip from the slave cylinder push rod and discard clip.

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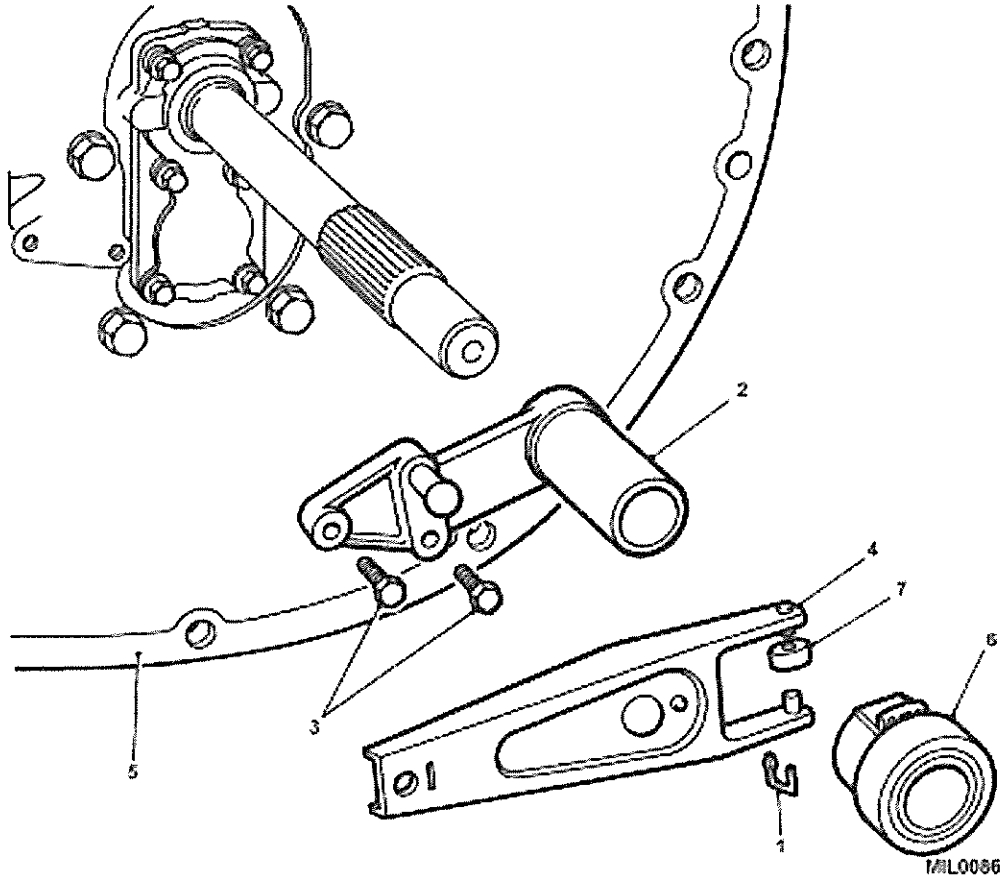
1 Clip
2 Slave cylinder push rod
3 Clutch release level

Fig 2 Push rod retaining clip

7.4 Remove the clutch release bearing carrier clip (Fig 3 (1)) and withdraw the release bearing and carrier (6).

7.5 Detach the clutch release lever (4) from the clutch release lever pivot (2), complete with slipper pads (7). If necessary, remove the bolts (3) securing the pivot and detach it from the bell housing (5).




| | | | |
|---|---|---|---|
| 1 | Bearing carrier clip | 5 | Bell housing |
| 2 | Lever pivot | 6 | Release bearing and carrier |
| 3 | Bolt | 7 | Slipper pad |
| 4 | Clutch release lever | | |

Fig 3 Clutch release mechanism

**Cleaning**

8 Thoroughly clean all the components of the release mechanism.

**Examination**

9 Examine all the components for wear or damage paying particular attention to the condition of the release bearing assembly and slipper pads.

**Reassembly**

10 Reassemble the release mechanism as follows:

10.1 If removed, refit the lever pivot (Fig 3 (2)) to the bell housing (5) tightening the bolts (3) to a torque of 22 to 28 Nm (16 to 21 lbf ft).

10.2 Prior to reassembly lubricate the following items with a thin film of molybdenum disulphide grease (refer to Table 1 Serial 1):

10.2.1 Clutch release lever pivot (2) fulcrum socket.

10.2.2 The clutch release lever slipper pad pins and the faces of each slipper pad (7).

10.2.3 Ball end of slave cylinder push rod.

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

10.4 Lubricate the inner face of the release bearing carrier with molybdenum disulphide grease (refer to Table 1 Serial 1) and fit to the lever pivot, locating the slipper pads to the carrier recesses. Fit a new bearing carrier clip.

10.5 Fit the new clip (refer to Table 2 Serial 1) (Fig 2 (1)) onto the slave cylinder push rod (2).

10.6 Fit the clip and push rod to the release lever (3).

10.7 Refit the clutch slave cylinder to the bell housing (refer to Cat 522 Chap 2).

**CLUTCH PEDAL**

**Removal**

11 To remove the clutch pedal carry out the following:

11.1 Remove the pedal bracket assembly from the vehicle (refer to Cat 522 Chap 2).

11.2 Remove the master cylinder from the bracket (refer to Cat 522 Chap 2).

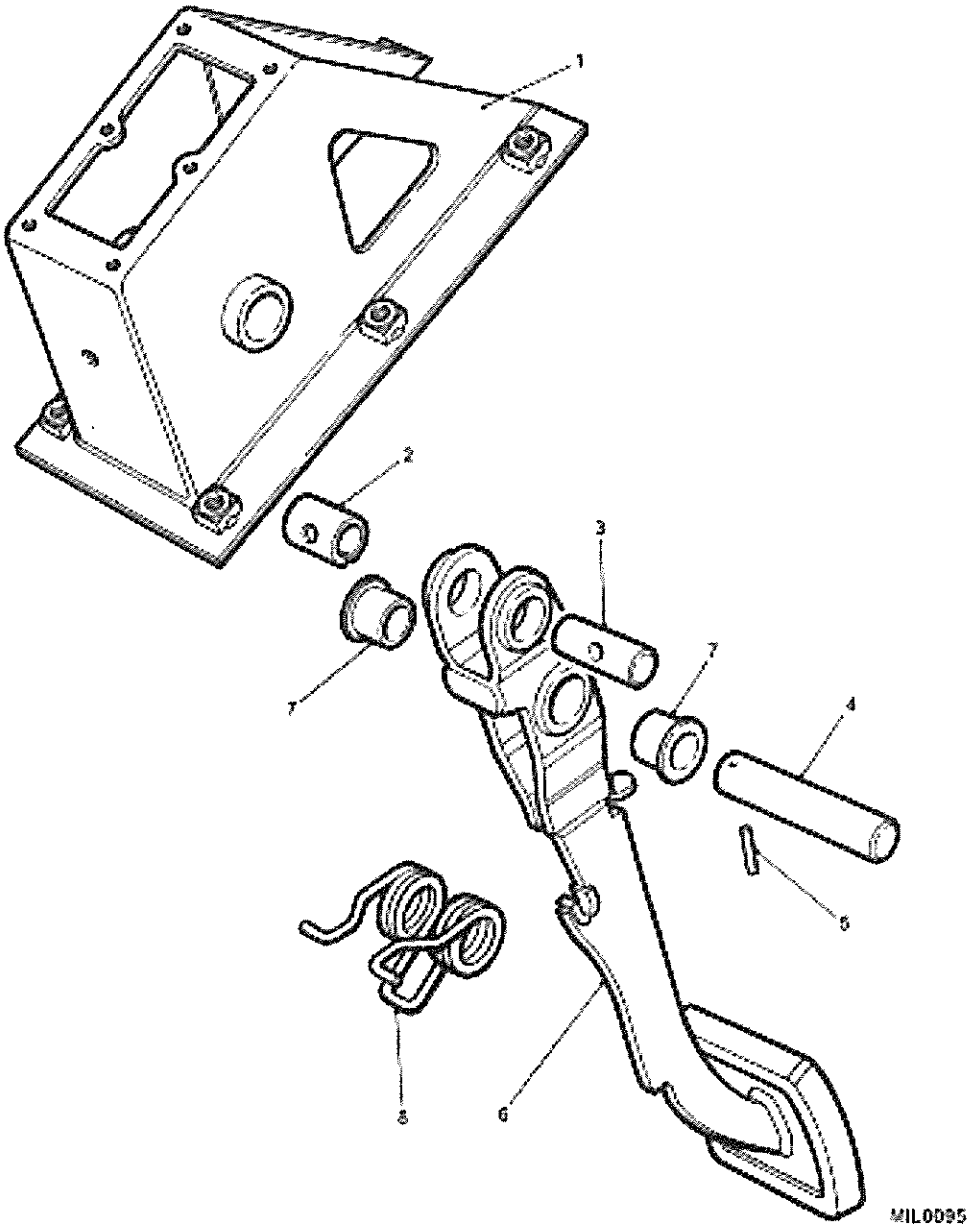
11.3 Blank off the fluid port and the end of the pipe to prevent the ingress of foreign matter.

11.4 Disconnect the return spring (Fig 4 (8)) from the clutch pedal (6).

11.5 Using a suitable punch, drift out the securing pin (5) and withdraw the pedal pivot shaft (4) from the bracket (1).

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

11.7




| | | | |
|---|---|---|---|
| 1 | Bracket | 5 | Securing pin |
| 2 | Trunnion bush | 6 | Clutch pedal |
| 3 | Trunnion | 7 | Pivot bushes |
| 4 | Pivot shaft | 8 | Return spring |

Fig 4 Clutch pedal removal/installation

**Examination**

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

**Repairs and replacement**

13 If it is necessary to fit new pivot bushes to the pedal, after fitment they must be reamed to 15.87 mm (0.62 in.) with a tolerance of + 0.020 mm (0.630 in. + 0.001 in.).

**Refitting**

14 Refit the clutch pedal as follows:

14.1 If removed, fit the trunnion bush (Fig 4 (2)) and trunnion (3) to the clutch pedal (6). Lubricate the trunnion and bush with general purpose grease (refer to Table 1 Serial 2) on assembly.

14.2 Fit the pedal to the bracket, insert the pivot shaft and secure with a new pin.

14.3 Refit the master cylinder (refer to Cat 522 Chap 2).

14.4 Apply sealing compound (refer to Table 1 Serial 3) to the mating surfaces and refit the assembled bracket and pedal to the bulkhead.

14.5 Carry out the clutch pedal and master cylinder setting procedure (refer to Cat 522 Chap 2).

# CHAPTER 3

# FIVE SPEED MANUAL GEARBOX

## CONTENTS

Para

1 Introduction
2 General

## INTRODUCTION

1 This chapter details the Field repair for the manual gearbox systems as fitted to Truck Utility Light (TUL) High Specification (HS), Truck Utility Medium (TUM) HS and (TUM) Battlefield Ambulance HS vehicles.

### General

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

Chapter 3-1 Five speed manual gearbox

Chapter 3-2 Uprated gearbox

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## CHAPTER 3-1

# FIVE SPEED MANUAL GEARBOX

## CONTENTS


Para

1 Introduction
Gearbox and transfer gearbox assembly
2 General
2 Removal (CAUTION)
5 Separating transfer gearbox from gearbox
20 Refitting transfer gearbox to gearbox
7 Clutch housing
8 Transfer gearbox selector housing
9 Gear lever housing and remote housing(CAUTION)
10 Extension housing
11 Dismantling
12 Reassembly
13 Selector quadrant fork (CAUTION)
14 Remote housing (CAUTION)
15 Transfer gearbox selector housing
16 Gear lever housing (CAUTION)
17 5th gear stop screw adjustment.
18 Bias spring adjustment
19 Clutch housing
Refitting
20 Refitting transfer gearbox to gearbox
21 Refitting assembled main and transfer gearboxes to the engine

Table Page

1 Special Tools ..... 2
2 Sealants, adhesives and lubricants ..... 2

Fig Page

1 Gearbox removal ..... 4
2 Transfer gearbox selector housing ..... 7
3 Gear lever and remote housing ..... 9
4 Yoke and selector shaft removal ..... 10
5 Quadrant fork removal from selector rail ..... 11
6 Oil seal collar removal ..... 12
7 Removing the extension housing ..... 13
8 Dismantling the extension housing ..... 14
9 Assembling extension housing ..... 15
10 Fitting extension housing ..... 16
11 Fitting spool retainer ..... 17
12 Fitting remote housing ..... 17
13 Bias spring adjustment ..... 21

## INTRODUCTION

1 This chapter details the Field repairs for Truck Utility Light (TUL) HS, Truck Utility Medium (TUM) HS and (TUM) Battlefield Ambulance HS vehicles fitted with the five speed manual gearbox and the 2.5 litre 300 Tdi direct injected turbocharged diesel engines.

## GEARBOX AND TRANSFER GEARBOX ASSEMBLY

### General

2 Removal of the gearbox from the vehicle also entails the removal of the transfer gearbox which is mounted on the rear of the manual gearbox.

3 The special tools and consumables listed in Table 1 and Table 2 will be referred to in the text, where used, by their serial number shown in the following table.

**TABLE 1 SPECIAL TOOLS**

| Ser | Manufacturers Part Number | NSN/Part Number where applicable | Designation |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| 1 | LRT-12-093 | 6MT2/5120-99-957-3749 | Water pump holding spanner |
| 2 | LRT-12-094 | 6MT2/5120-99-568-5750 | Viscous coupling spanner |
| 3 | LRT-37-021 | 6MT2/5120-99-449-4201 | Replacer, mainshaft rear bearing track |

**TABLE 2 SEALANTS, ADHESIVES AND LUBRICANTS**

| Ser | Manufacturers Part Number | NSN/Part Number where applicable | Designation |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| 1 | Loctite 518 | 8040-99-701-8040 | Sealing compound |
| 2 | Loctite 270 | 8030-99-224-8707 | Sealing compound |
| 3 | OX 75 | 9150-99-869-4114 | Gearbox oil |
| 4 | Loctite 270 | 8030-99-224-8707 | Sealing compound |
| 5 | XG 279 | 9150-99-220-2418 | General purpose grease |
| 6 | OEP 220 | 9150-99-220-1477 | Transfer gearbox oil |

### Removal

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

4.1 Position the vehicle on a ramp.

4.2 Disconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on Fitted For Radio (FFR) vehicles the radio batteries (refer to Cat 522 Chap 13-2).

4.3 Remove the gear change lever (refer to Cat 522 Chap 3).

4.4 Select high range on the transfer gearbox lever to prevent the lever from fouling the tunnel when removing the gearbox.

4.5 Remove the vehicle bonnet.

4.6 Using the water pump holding spanner (refer to Table 1 Serial 1) and the viscous coupling spanner (refer to Table 1 Serial 2), release the viscous coupling.

4.7 Release the transmission breather pipes from the clip at the rear of the engine.

4.8 Raise the vehicle on the ramp.

4.9 Place a suitable container under the transmission. Remove the drain plugs from the main gear casing and transfer gearbox. Allow the oil to drain and refit the drain plugs.

4.10 Remove front exhaust pipe and silencer section as follows:

4.10.1 Undo the connection from the pipe to the exhaust manifold (Fig 1(1)).

4.10.2 Release the connection to the rear section at the flange (2) immediately behind the silencer.

4.10.3 Tie exhaust temporarily aside.

4.10.4 Remove cross member (3) and exhaust bracket.

4.10.5 Untie and remove front and centre exhaust pipe sections.

4.11 Mark for reassembly and disconnect rear propshaft (4) from transmission drum.

4.12 From inside the vehicle, remove the handbrake gaiter and disconnect the cable clevis pin from the handbrake lever (5) (ensure hand brake is off).

4.13 From underneath the vehicle, pull cable through heel board and tie aside.

4.14 Remove centre exhaust bracket (6).

4.15 Remove speedometer cable (7), at the transfer gearbox output housing.

4.16 Disconnect battery earth lead from bolt above left hand mounting bracket.

4.17 Mark for reassembly and disconnect front propeller shaft (8) and tie aside.

4.18 Remove the two bolts and withdraw the clutch slave cylinder (9) from the bell housing and tie aside.

4.19 Remove bolts (10) securing left and right hand mounting brackets to gearbox.

4.20 Using a suitable hydraulic hoist raise and secure to the gearbox.

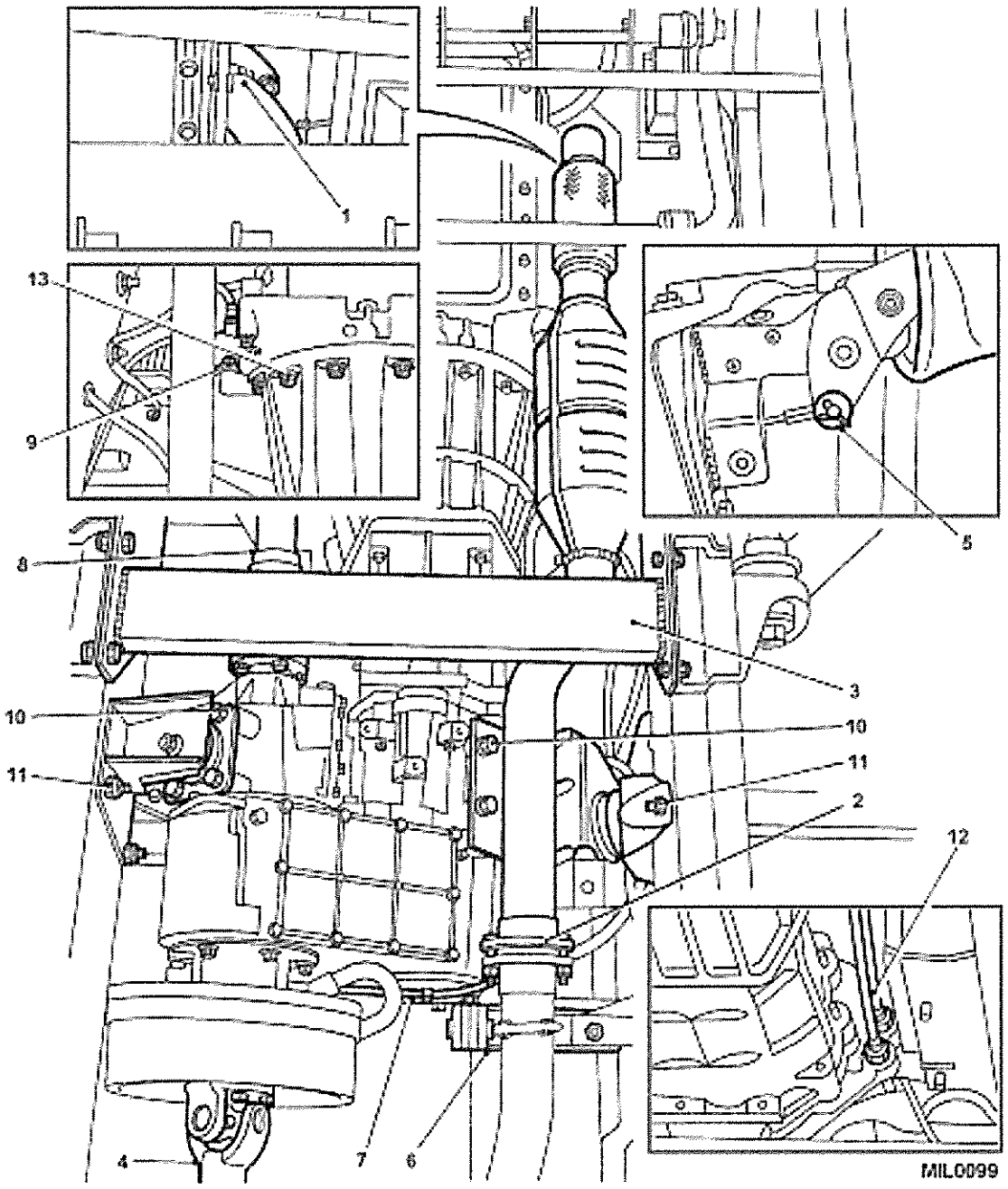
4.21 Raise the hoist sufficiently to take the weight of the transmission.

4.22 Remove the nuts and bolts (11) securing the left and right hand mounting brackets to the chassis.

4.23 Lower the hoist sufficiently to allow the transfer lever to clear the transmission tunnel aperture.

4.24 Disconnect the gearbox oil cooler pipes (12) at the extension housing connections.

4.25 Disconnect the locked four wheel drive indicator and reverse light electrical lead.




1 Exhaust manifold
2 Exhaust flange
3 Cross member
4 Rear propshaft
5 Handbrake lever
6 Exhaust bracket
7 Speedometer cable
8 Front propshaft
9 Clutch slave cylinder
10 Mounting bracket bolts
11 Mounting bracket nuts and bolts
12 Oil cooler pipes
13 Bell housing bolt

Fig 1 Gearbox removal

**CAUTION**

**SUMP DAMAGE. Ensure care and attention is applied when supporting the engine so there is no damage to the sump.**

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

4.27 Remove the bell housing fixings (13), ensure all connections are released and withdraw the transmission from the vehicle.

Separating transfer gearbox from gearbox

5 To separate the transfer gearbox from the gearbox proceed as follows:

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

5.2 Remove the four bolts securing the transfer gearbox selector housing to the remote housing.

5.3 Remove the nut from the lock up link at the fulcrum lever and disconnect the link from the fulcrum lever.

5.4 Remove the breather pipes.

5.5 Disconnect the cranked lever from the differential lock lever by removing the lower nut from the yoke.

5.6 Place a suitable sling around the transfer gearbox and attach to a hoist.

5.7 Remove the nut and five bolts securing the transfer gearbox to the extension casing and withdraw the transfer gearbox.

**DISMANTLING**

6 Place the gearbox on a suitable workbench with the transfer gearbox removed (refer to Para 5), ensuring that the oil has been drained.

**Clutch housing**

7 Remove the bell housing and clutch release lever (refer to Chap 2).

**Transfer gearbox selector housing**

8 Dismantle the selector housing as follows:

8.1 Slide gaiter (Fig 2 (2)) off gear lever.

8.2 Remove 4 bolts (1) securing gaiter support plate (3) and gasket plate (4).

8.3 Remove gaiter support plate and gasket plate and discard gaskets (5).

8.4 Remove and discard spring clip (6) retaining selector fork clevis pin (7).

8.5 Remove clevis pin from selector fork (17), remove and discard two bushes (14).

8.6 Remove and discard circlip (8) retaining nylon seat (10).

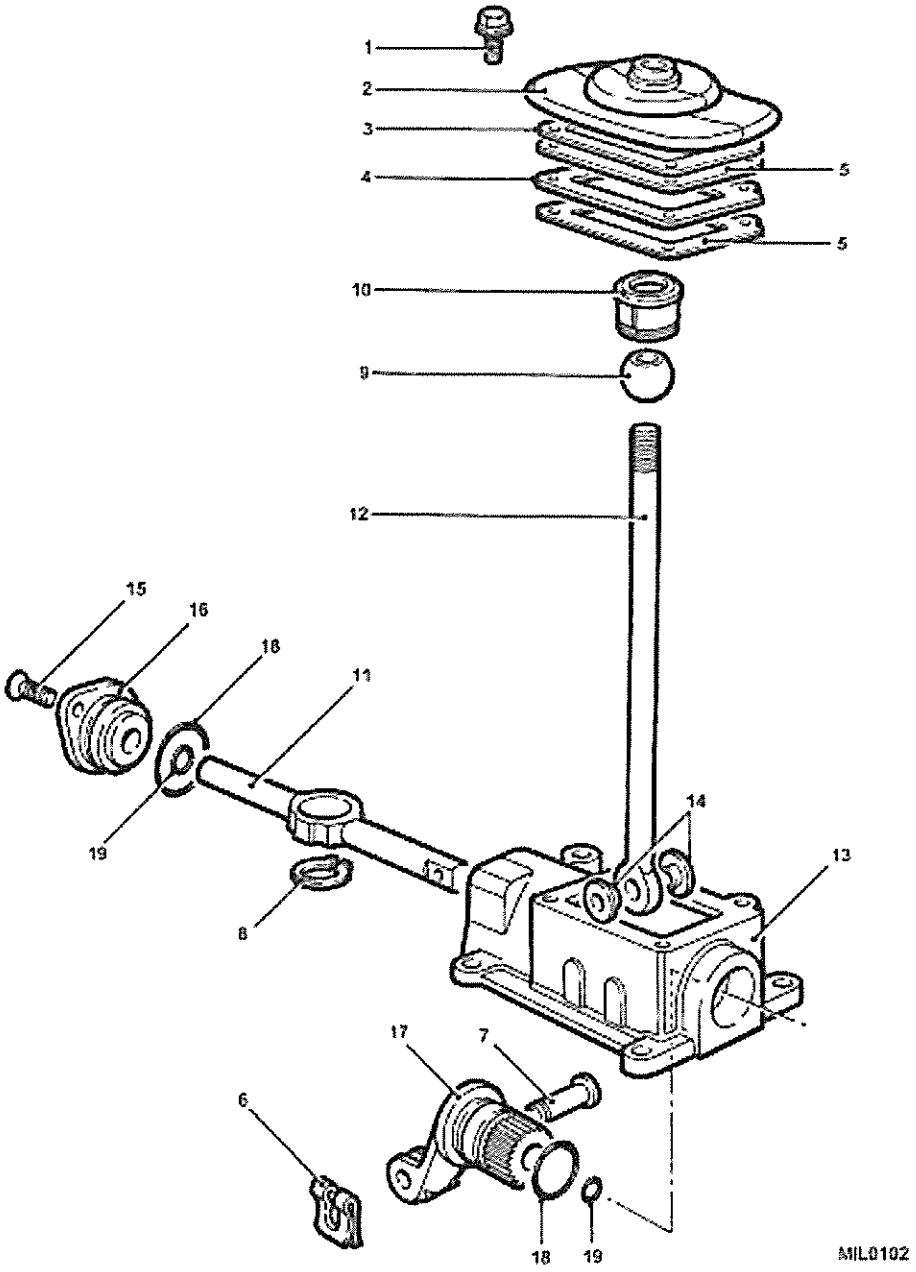
8.7 Remove gear lever (12); recover nylon seating and ball (9).

8.8 Remove the two countersunk head screws (15) securing end cover (16), remove and discard the two 'O' rings (18 and 19).

8.9 Withdraw the cross shaft (11).

8.10 Remove selector fork, remove and discard two 'O' rings (18 and 19).

8.11 Clean all components.




| | | | | | |
|---|---|---|---|---|---|
| 1 | Bolt | 8 | Circlip | 15 | Screw |
| 2 | Gaiter | 9 | Gear lever ball | 16 | End cover |
| 3 | Gaiter support plate | 10 | Nylon seat | 17 | Selector fork |
| 4 | Gasket plate | 11 | Cross shaft | 18 | 'O' ring |
| 5 | Gaskets | 12 | Gear lever | 19 | 'O' ring |
| 6 | Spring clip | 13 | Selector housing | | |
| 7 | Clevis pin | 14 | Bushes | | |

Fig 2 Transfer gearbox selector housing

**Gear lever housing and remote housing**

9 Dismantle the gear lever housing as follows:

9.1 Using a length of suitable tubing dislodge both legs of the bias spring (Fig 3 (2)) from the cross pin on gear lever shaft (21).

**CAUTION**

**HIGH SPRING LOAD. Take care when releasing the retainer bolt as the gear lever ball is spring loaded in its seat by a strong spring and nylon plunger.**

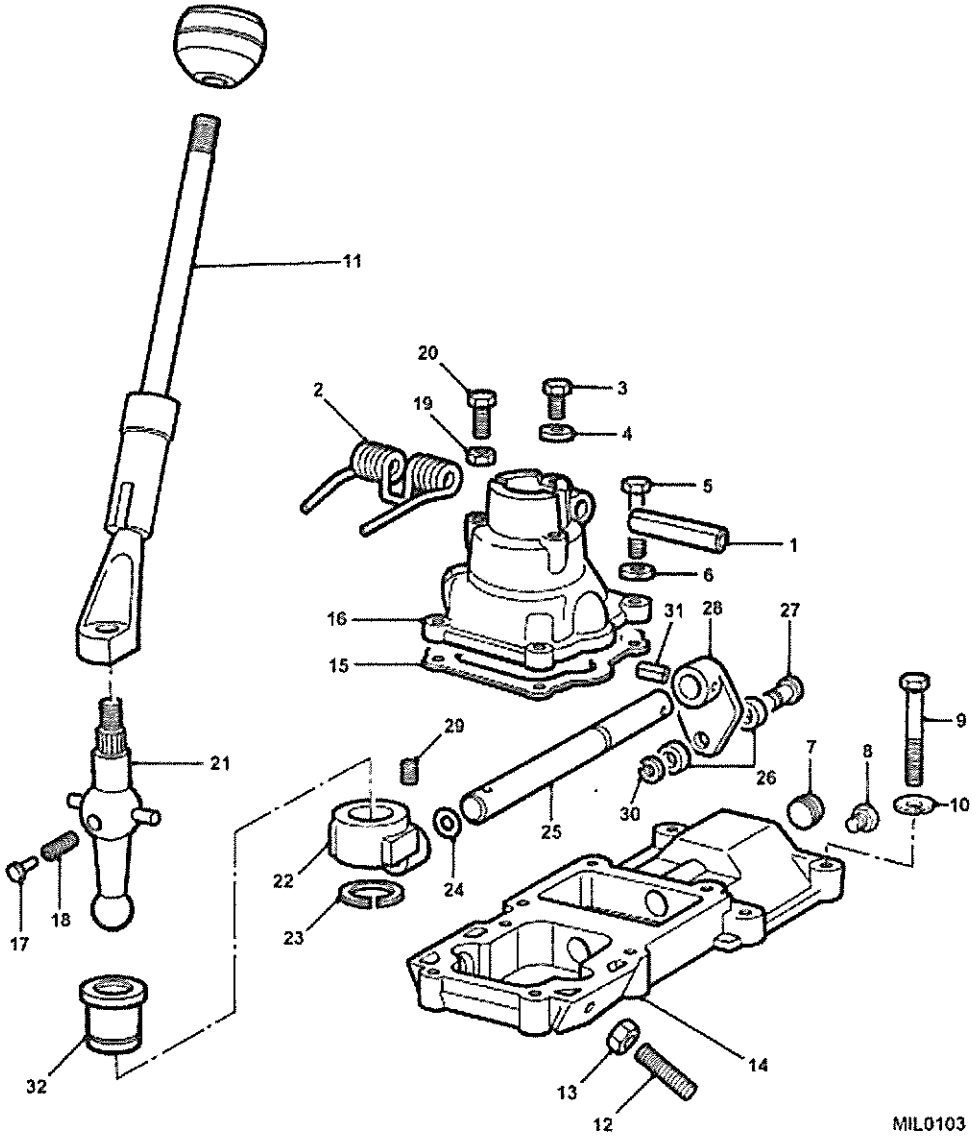
9.2 Remove the screw (3) and special washer (4), to release the gear lever shaft (21), carefully withdraw the shaft from its housing (16) and retrieve the spring (18) and nylon plunger (17).

9.3 Remove the two adjusting screws (20) and locknuts (19).

9.4 Remove the roll pin (1) and detach the bias spring (2).

9.5 Remove the four bolts (5) and spring washers (6) securing the gear lever housing (16) to the remote housing (14). Lift off the housing and discard the gasket (15).

9.6 Remove the bolts (9) and spring washers (10) securing the remote housing (14) to the extension case. Lift off the housing.




| | | | | | |
|---|---|---|---|---|---|
| 1 | Roll pin | 12 | Adjusting screw | 23 | Circlip |
| 2 | Bias spring | 13 | Locknut | 24 | 'O' ring |
| 3 | Screw | 14 | Remote housing | 25 | Selector shaft |
| 4 | Special washer | 15 | Gasket | 26 | Rollers |
| 5 | Bolt | 16 | Gear lever housing | 27 | Pin |
| 6 | Spring washer | 17 | Nylon plunger | 28 | Quadrant |
| 7 | Blanking plug | 18 | Spring | 29 | Screw |
| 8 | Blanking plug | 19 | Locknut | 30 | Circlip |
| 9 | Bolt | 20 | Adjusting screw | 31 | Roll pin |
| 10 | Spring washer | 21 | Gear lever shaft | 32 | Ball pin seating |
| 11 | Gear lever | 22 | Yoke | | |

Fig 3 Gear lever and remote housing

9.7 Remove the locating screw (Fig 4 (1)) from the yoke (2), pull the selector shaft (3) rearwards and remove the yoke from the remote housing.

9.8 Release the circlip (4) and detach the nylon seat (5) from the yoke.

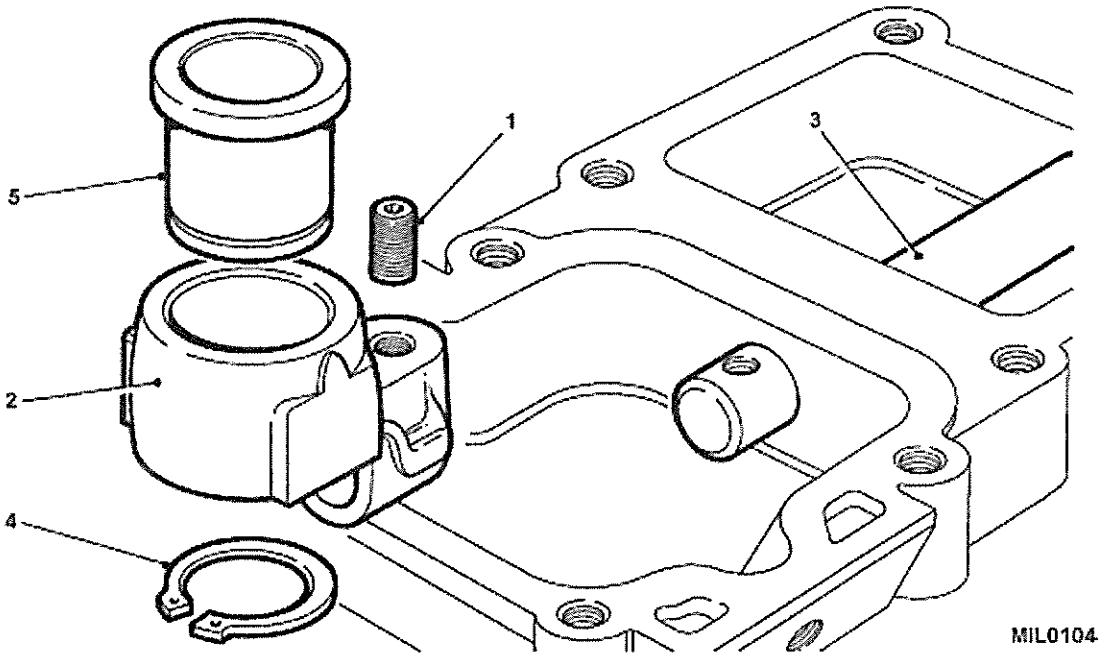
9.9 Invert the remote housing, and remove roll pin (Fig 3 (31)) securing quadrant (28) to selector shaft (25), remove quadrant (28).

9.10 Remove the two blanking plugs (7) and (8) from the rear of the housing.

9.11 Remove selector shaft (25) from remote housing, remove and discard 'O' ring (24).

9.12 Remove and discard circlip (30) retaining rollers (26) and pin (27) to quadrant (28).

9.13 Remove pin and recover rollers.




1 Locating screw
2 Yoke
3 Selector shaft
4 Circlip
5 Nylon seat

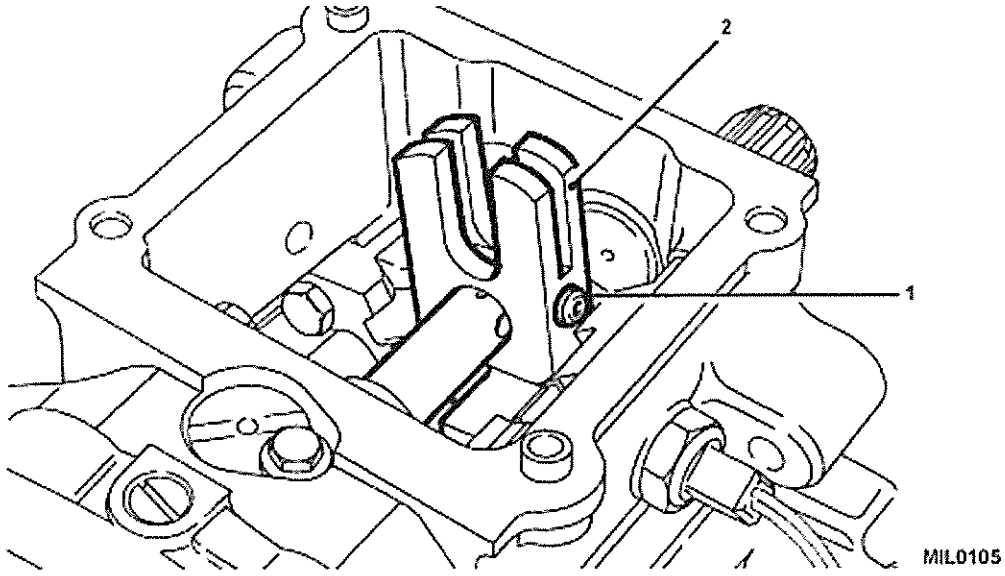
Fig 4 Yoke and selector shaft removal

**Selector quadrant fork**

10 Remove the selector fork as follows:

10.1 Remove and discard the setscrew (Fig 5 (1)) securing the selector quadrant fork (2).

10.2 Move selector shaft forwards and remove quadrant fork.




1 Set screw 2 Quadrant fork

Fig 5 Quadrant fork removal from selector rail

## EXTENSION HOUSING

### Dismantling

11 Dismantle the extension housing as follows:

11.1 Thread a 12 mm bolt into the end of the output shaft and using a suitable tool withdraw oil seal collar (refer to Fig 6).

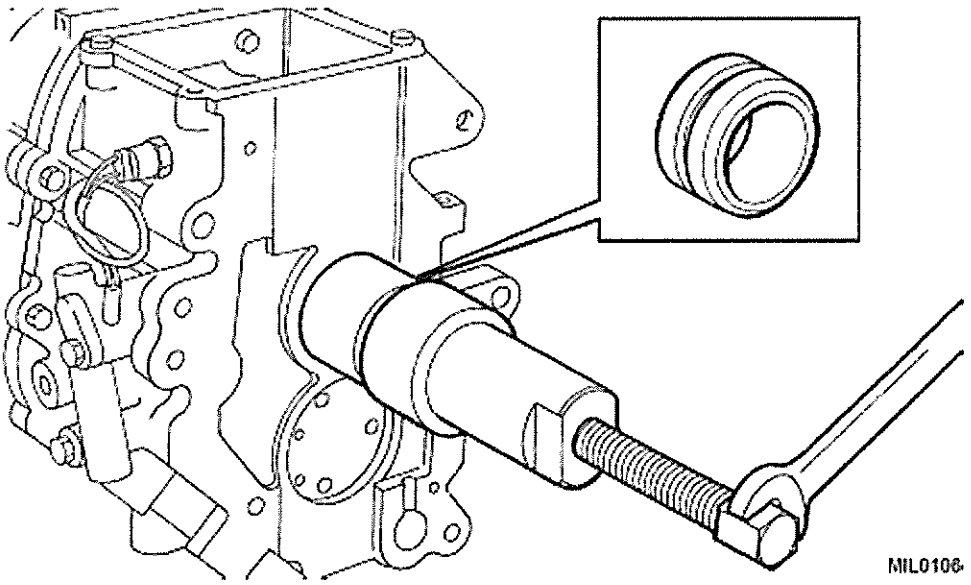



Fig 6 Oil seal collar removal

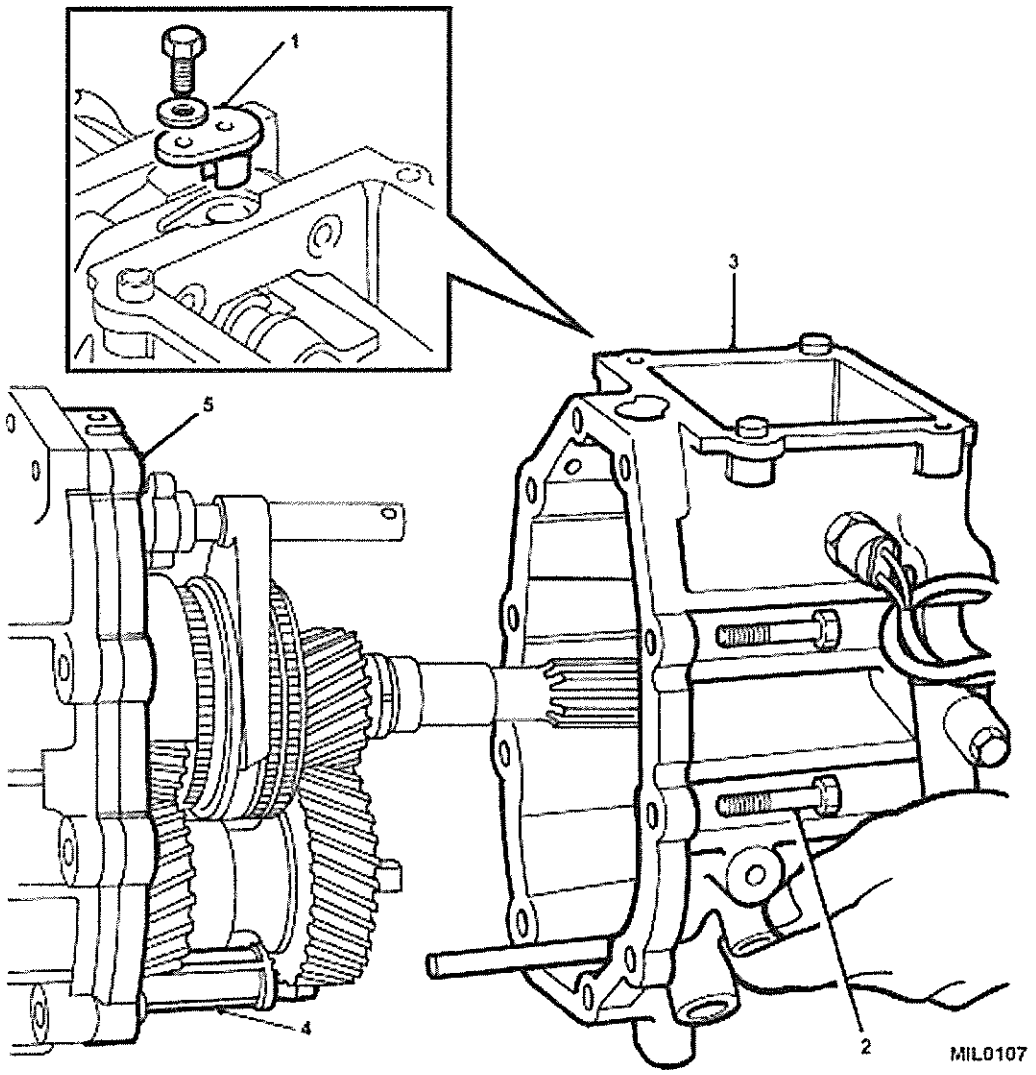
11.2 Remove reverse/5th gear selector spool retainer (Fig 7 (1))

11.3 Remove 10 bolts (2) securing extension casing noting position of longer bolts.

11.4 Place a suitable container underneath the box to catch any oil spillage and remove the extension housing (3).

11.5 Remove oil filter (4).

11.6 Secure centre plate (5) to casing using 'slave' bolts.




1 Spool retainer
2 Bolt
3 Extension housing
4 Oil filter
5 Centre plate

Fig 7 Removing the extension housing

11.7 Remove the three screws (Fig 8 (1)) and remove oil pump (2).

11.8 Remove oil pick-up pipe (3) and check for obstruction.

11.9 Drift out layshaft support bearing (4).

11.10 Remove rear mainshaft oil seal (5).

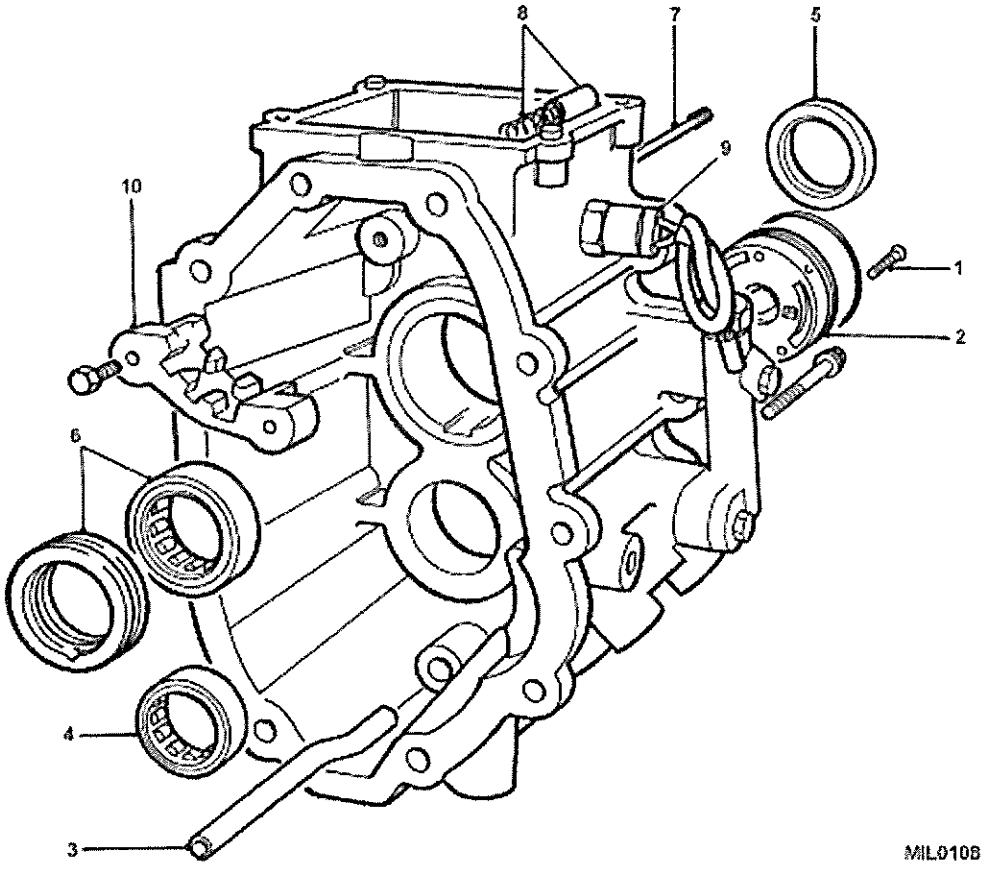
11.11 Drift out mainshaft support bearing and oil pick up ring (6).

11.12 Remove shaft (7) retaining reverse inhibition cam.

11.13 Remove reverse inhibition cam and spring (8).

11.14 Remove reverse light switch (9) and sealing washer.

11.15 Remove gate plate (10).




| | | | |
|---|---|---|---|
| 1 | Screw | 6 | Mainshaft support bearing |
| 2 | Oil pump | 7 | Shaft |
| 3 | Oil pick up pipe | 8 | Reverse inhibition cam and seal spring |
| 4 | Layshaft support bearing | 9 | Reverse light switch |
| 5 | Rear mainshaft oil seal | 10 | Gate plate and oil pick up ring |

Fig 8 Dismantling the extension housing

**Reassembly**

12 To reassemble the extension housing proceed as follows:

12.1 Smear a light coat of grease (refer to Table 1 Serial 5) into the pump recess.

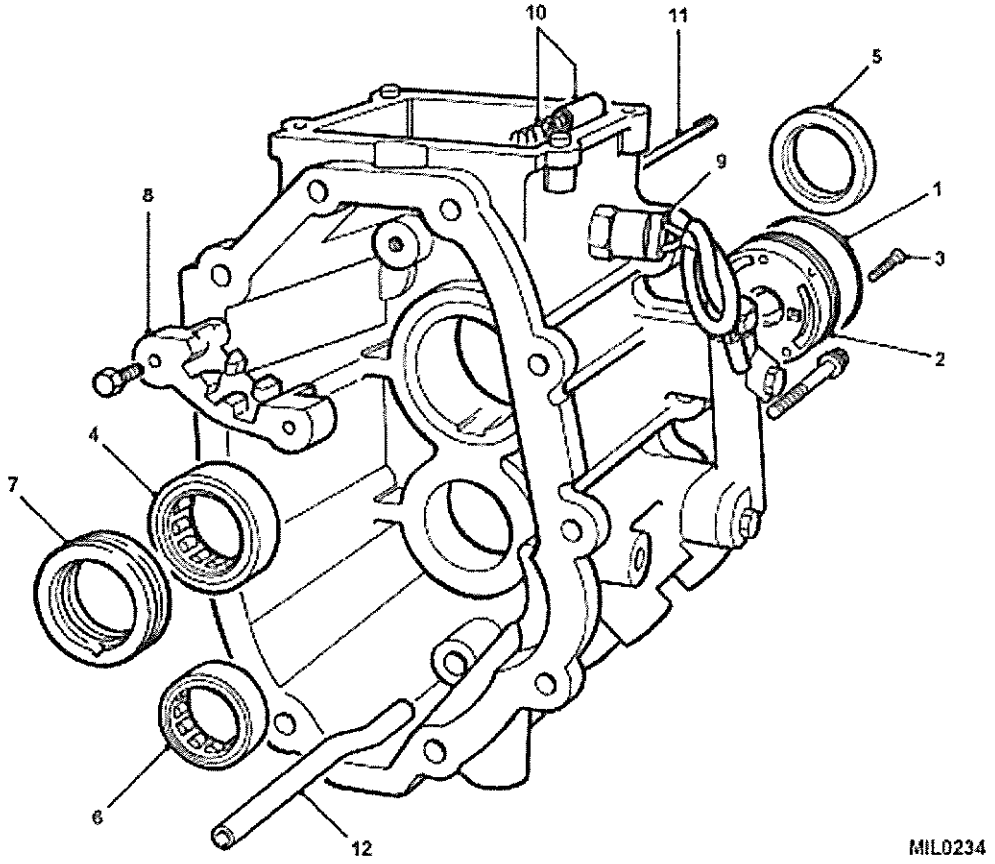
12.2 Renew 'O' ring (Fig 9 (1)) and press pump unit (2) firmly into recess.

NOTE

Ensure 'TOP' marking on pump is to top of casing.

12.3 Tap pump lightly at edges until screws (3) take to threads and pull down pump by tightening screws.

12.4 Fit new mainshaft support bearing (4).




| | | | |
|---|---|---|---|
| 1 | 'O' ring | 7 | Oil pick up ring |
| 2 | Pump | 8 | Gate plate |
| 3 | Screw | 9 | Reverse light switch |
| 4 | Mainshaft support bearing | 10 | Reverse stop cam and spring |
| 5 | Mainshaft rear oil seal | 11 | Shaft |
| 6 | Layshaft support bearing | 12 | Oil pipe |

Fig 9 Assembling extension housing

12.5 Fit new mainshaft rear oil (5) seal using a suitable tool.

12.6 Fit new layshaft support bearing (6).

12.7 Fit new oil pick-up ring (7) (ensure that the blind hole is aligned with centre of drain slot).

12.8 Examine gate plate (8) and renew if worn or damaged.

12.9 Apply sealing compound (refer to Table 2 Serial 2) and refit reverse light switch (9).

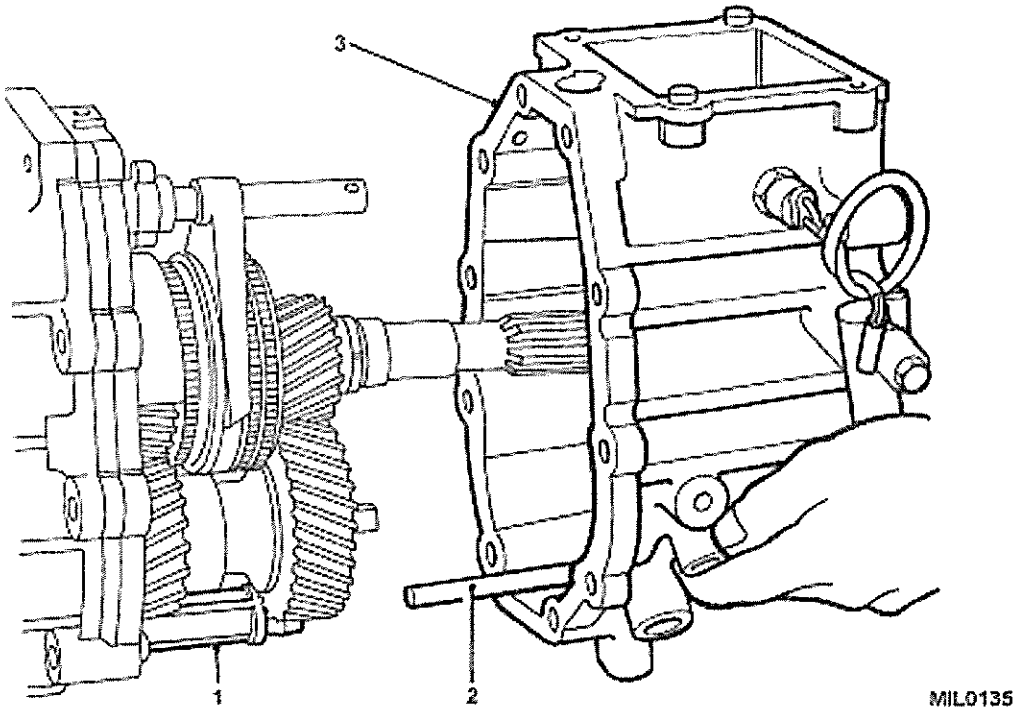
12.10 Refit reverse stop cam and spring (10).

12.11 Apply sealing compound (refer to Table 2 Serial 2) and refit shaft (11).

12.12 Refit oil pipe (12), bend uppermost.

12.13 Remove all 'slave' bolts from centre plate and casing.

12.14 Refit oil filter (Fig 10 (1)).




1 Filter
2 Oil pipe
3 Extension housing

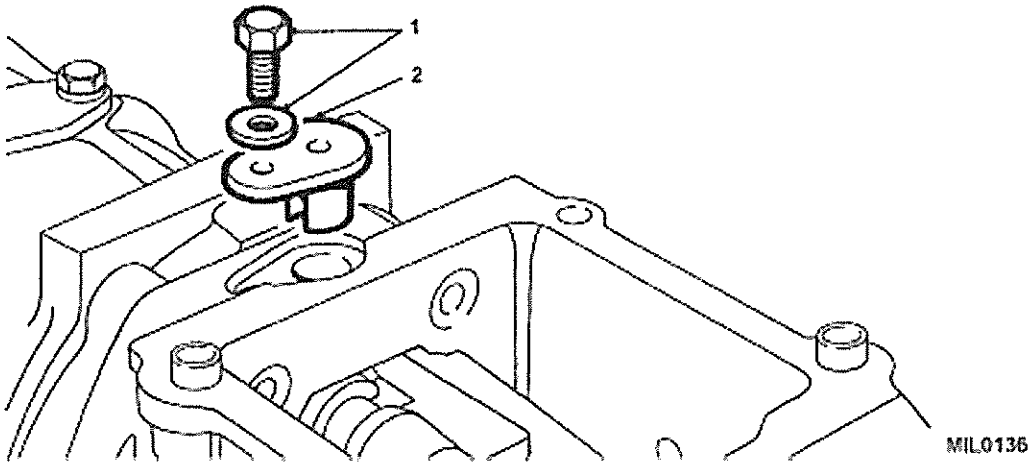
Fig 10 Fitting extension housing

12.15 Apply sealing compound (refer to Table 2, Serial 1) to mating surfaces and fit extension housing (3) ensuring oil pipe (2) locates in filter and roller bearing are not dislodged.

12.16 Bolt extension housing to centre plate and main casing. Tighten to 22-28 Nm (16 - 21 lbf ft).

12.17 Apply sealing compound (refer to Table 2 Serial 1) and fit extension case spool retainer (Fig 11 (2)) with a bolt and washer (1).

12.18 Using a suitable tool with the special tool (refer to Table 1 Serial 3) press on mainshaft oil seal collar.




1 Bolt and washer 2 Spool retainer

Fig 11 Fitting spool retainer

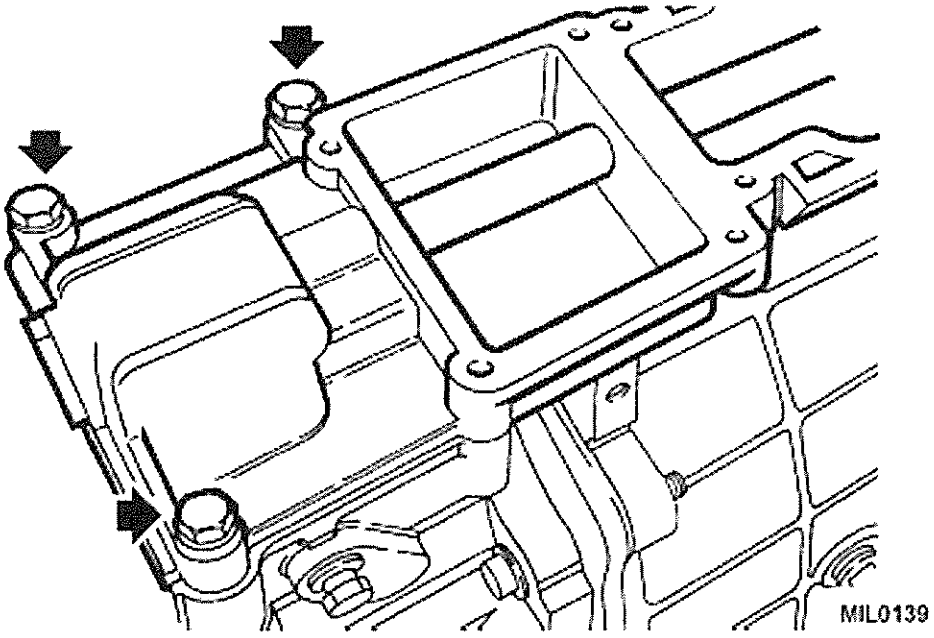



Fig 12 Fitting remote housing

**Selector quadrant fork**

13 Refit the selector quadrant fork as follows:

13.1 Position selector quadrant fork (refer to Fig 5 (2)) to selector shaft.

13.2 Apply sealing compound (refer to Table 2 Serial 4) to thread of a new setscrew (2), fit screw and tighten to 22-28 Nm (16 - 21 lbf ft).

13.3 Move selector shaft to neutral position.

**CAUTION**

**LOCATION. Ensure end of setscrew locates in hole in selector shaft.**

**Remote housing**

14 Assemble the remote housing as follows:

14.1 Lubricate selector shaft (refer to Fig 3 (25)) and new 'O' ring (24) with gearbox oil (refer to Table 2 Serial 3).

14.2 Fit 'O' ring to selector shaft.

14.3 Fit shaft to remote housing.

14.4 Position rollers (26) to quadrant (28) fit pin (27) and secure with new circlip (30).

**CAUTION**

**PIN HEAD LOCATION. Ensure that head of pin is on opposite side of quadrant to selector shaft boss.**

14.5 Fit quadrant (28) to selector shaft (25).

14.6 Fit a new roll pin (31), securing quadrant to sector shaft.

14.7 Apply sealing compound (refer to Table 2 Serial 4) to threads of blanking plug (7), fit and tighten plug.

14.8 Smear ball pin seating (32) with general purpose grease (refer to Table 2 Serial 5).

14.9 Position ball pin seating in yoke (22), secure with a new circlip (23).

14.10 Position yoke on selector shaft (25).

14.11 Apply sealing compound (refer to Table 2 Serial 4) to threads of setscrew, fit and tighten setscrew.

14.12 Fit 5th gear stop screw (12), fit but do not tighten locknut (13).

NOTE

5th gear stop screw adjustment is carried out during gearbox reassembly.

14.13 Apply sealing compound (refer to Table 2 Serial 1) to mating surfaces and position remote housing (14) to extension housing. Ensure rollers locate into the quadrant.

14.14 Fit but do not fully tighten the three bolts (refer to Fig 12) in positions shown.

**TRANSFER GEARBOX SELECTOR HOUSING**

15 Assemble the transfer gearbox selector housing as follows:

15.1 Smear new 'O' rings (refer to Fig 2 (19)) with transmission oil (refer to Table 2 Serial 6) and fit to selector fork (17) in housing (13).

15.2 Smear cross shaft (11) with general purpose grease (refer to Table 2 Serial 5) and locate longest end of shaft in selector fork.

15.3 Smear new 'O' rings (18) with transmission oil (refer to Table 2 Serial 6) and fit to end cover (16).

15.4 Position end cover on cross shaft, fit and tighten with countersunk screws (15).

15.5 Assemble ball (9) and nylon seating (10) to gear lever (12) ensuring that groove in seating is towards cross shaft.

15.6 Smear ball and nylon seating with general purpose grease (refer to Table 2 Serial 5) and locate in cross shaft; retain with a new circlip (8).

15.7 Place new bushes (14) on to gear lever, locate in selector fork (17) and fit clevis pin (7).

NOTE

Ensure the head of the clevis pin points towards the front of the vehicle.

15.8 Fit new spring clip (6) to retain clevis pin.

15.9 Place gasket plate (4) and gaiter support plate (3) on to housing, using new gaskets (5).

15.10 Fit retaining bolts and tighten to 15 Nm (11 lbf ft).

15.11 Fit gaiter (2).

15.12 Smear a new gasket with general purpose grease (refer to Table 2 Serial 5) and fit to remote housing.

15.13 Position transfer gearbox selector housing to remote housing.

15.14 Fit but do not fully tighten four bolts (1).

**GEAR LEVER HOUSING**

16 Assemble the gear lever housing as follows:

16.1 Smear ball pin of the gear lever shaft (refer to Fig 3 (21)) with general purpose grease (refer to Table 2 Serial 5) and fit spring (18) and nylon plunger (17).

16.2 Depress nylon plunger against spring pressure, position gear lever shaft (21) into ball pin seating (32).

**CAUTION**

**PLUNGER LOCATION. Ensure nylon plunger is facing away from bias spring location.**

16.3 Fit gear lever shaft retaining screw (3) and special washer (4), tighten screw to 10 Nm (7 lbf ft).

16.4 Fit gear lever (11) to gear lever shaft.

16.5 Position roll pin (1) to housing (16), fit roll pin.

16.6 17.6 Fit bias spring adjusting screws (20) and locknuts

16.7 Using a suitable piece of tubing, locate both ends of bias spring (2) cross pin on gear lever shaft.

NOTE

Do not adjust bias spring at this stage.

16.8 Smear a new gasket (15) with general purpose grease (refer to Table 2 Serial 5) and fit to remote housing (14).

16.9 Position gear lever to remote housing ensuring lever ball is correctly located.

16.10 Fit but do not tighten the four bolts (5).

16.11 Tighten remote housing, transfer gearbox selector housing and gear lever housing bolts to 25 Nm (18 lbf ft).

**5th gear stop screw adjustment.**

17 Adjust the 5th gear stop screw (Fig 3 (12)) as follows:

17.1 Select reverse gear. While applying light pressure to gear lever towards right, turn screw clockwise until it contacts yoke.

17.2 Turn screw anti-clockwise until 25 mm (0.98 in.) free play is felt at knob, ensure 5th gear can be engaged then tighten locknut (13).

17.3 Check all other gears are selectable.

**Bias spring adjustment**

18 Adjust the bias spring as follows:

NOTE

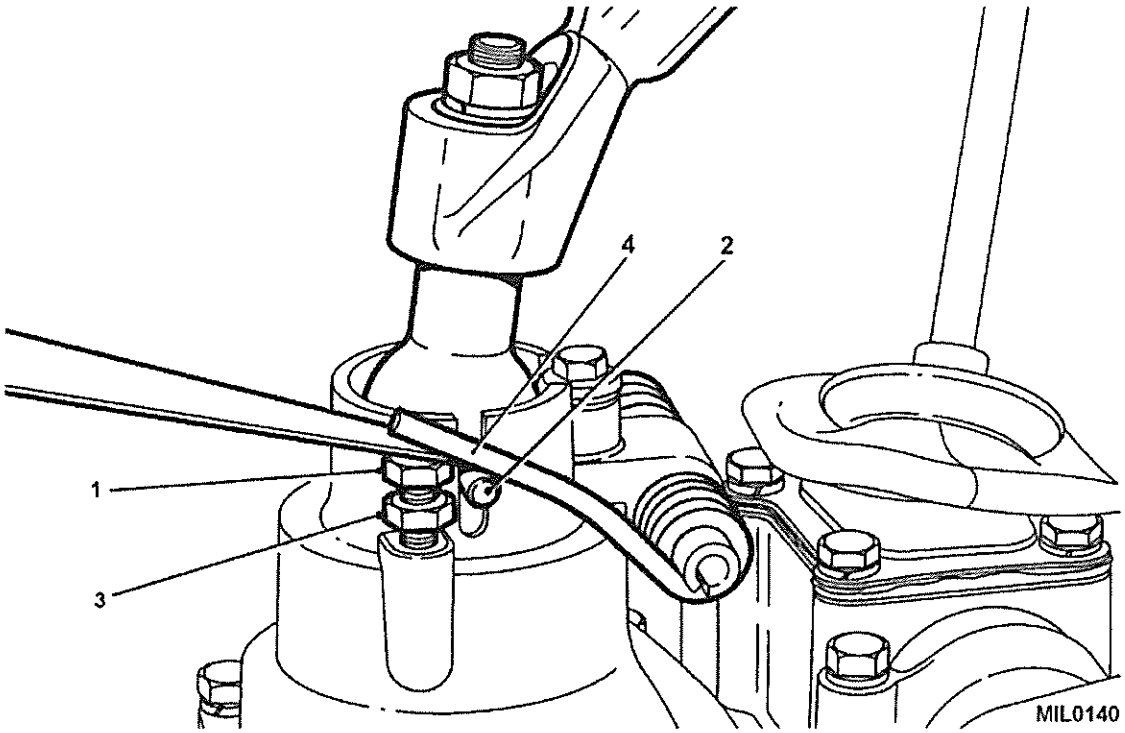
The purpose of this adjustment is to set both bolts so that the bias spring legs apply equal pressure on both ends of the gear lever cross pin when third or fourth gear is engaged. This will ensure that when the lever is in neutral, the gear change mechanism is automatically aligned for third or fourth gear.

18.1 Select third or fourth gear.

18.2 Adjust the two adjusting screws (Fig 13 (1)) until both legs (4) of the spring are approximately 0.5 mm (0.02 in.) clear of the cross pin (2) in the gear lever.

18.3 Apply a light load to the gear lever in a left hand direction and adjust the right hand adjusting screw downward until the right hand spring leg just makes contact with the cross pin.

18.4 Repeat the same procedure for the left hand adjusting screw.




1 Adjusting screw
2 Cross pin
3 Locknut
4 Spring leg

Fig 13 Bias spring adjustment

18.5 Lower both adjusting screws equal amounts until the radial play is just eliminated.

18.6 Tighten locknuts (3).

18.7 Return gear lever to neutral position and rock across the gate several times. The gear lever should return to the third and fourth gate.

## CLUTCH HOUSING

19 Fit the bell housing and clutch release lever (refer to Chap 2).

## REFITTING

### Refitting transfer gearbox to gearbox

20 To fit the transfer gearbox to the main gearbox carry out the following:

20.1 Using a suitable hoist and sling, and ensuring that the loose upper dowel is fitted, assemble the transfer gearbox to the main gearbox extension casing. Secure with the four fixings, and tighten to a torque of 40 to 50 Nm (29 to 37 lbf ft).

20.2 Fit the transfer gearbox selector housing to the main gearbox remote housing noting that the right hand rear location is fitted with the longer bolt. Tighten to a torque of 22 to 28 Nm (16 to 21 lbf ft).

20.3 Fit the differential lock up link at the fulcrum lever.

20.4 Connect the cranked lever to the differential lock lever.

**Refitting assembled main and transfer gearboxes to the engine**

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

NOTE

Before fitting the gearbox to the vehicle the transfer gearbox must be refitted to the gearbox (refer to Para 20).

21.1 Fit the transmission to a suitable hydraulic hoist and secure.

21.2 Smear sealing compound (refer to Table 2 Serial 1) on the bell housing face mating with the engine.

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

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

21.5 Secure the transmission to the engine at the bell housing noting the position of the brackets for the oil cooler and air cleaner pipes. Tighten the fixings to a torque of 45 to 50 Nm (33 to 37 lbf ft).

21.6 Connect the differential lock indicator and reversing light leads.

21.7 Raise the transmission to line up with the gearbox mountings ensuring the transfer lever clears the tunnel aperture.

21.8 Fit the transfer gearbox left and right hand mounting brackets to the chassis and loosely secure with the bolts.

21.9 Locate the bolts and secure the mounting brackets to the transfer gearbox and tighten. Tighten chassis fixings to a torque of 80 - 90 Nm (59 - 66 lbf ft).

21.10 Remove cradle and hoist.

21.11 Remove the supporting jack from under the engine sump.

21.12 Reconnect battery earth lead to gearbox.

21.13 Reconnect speedo cable.

21.14 Refit transmission handbrake cable.

21.15 Reconnect rear propeller shaft noting the markings made previously (refer to Para 4.11). Tighten to a torque of 43 to 51 Nm (32 to 38 lbf ft).

21.16 Reconnect front propeller shaft noting the markings made previously (refer to Para 4.17). Tighten to a torque of 43 to 51 Nm (32 to 38 lbf ft).

21.17 Position front and centre exhaust sections and secure at the rear connection only, locate front section to exhaust flange and leave loose.

21.18 Refit chassis cross member and exhaust support bracket.

21.19 Secure front exhaust section and tighten flange bolts.

21.20 Check drain plugs in main casing, extension casing and transfer gearbox are fitted and tighten to a torque of 25 to 35 Nm (18 to 26 lbf ft).

21.21 Remove the filler level plug from the main gearbox and fill with oil (refer to Table 2 Serial 3) until it begins to run from the plughole. Apply sealing compound (refer to Table 2 Serial 1) to the threads of the filler plug, fit and tighten to a torque of 25 to 35 Nm (18 to 26 lbf ft).

21.22 Remove the transfer gearbox filler level plug and fill with oil (refer to Table 2 Serial 6) until it runs out of the plughole. Apply sealing compound (refer to Table 2 Serial 1) to the threads of the filler plug, fit and tighten to a torque of 25 to 35 Nm (18 to 26 lbf ft).

21.23 Wipe away any surplus oil from the casings.

21.24 Refit bracket retaining breather pipes to the rear of the engine.

21.25 Refit the viscous coupling.

21.26 Fit the vehicle bonnet.

21.27 Fit the main gear lever (refer to Cat 522 Chap 3).

NOTE

Detached earth leads should be refitted after the chassis earth point has been cleaned. After fitting, apply a protective grease.

21.28 Reconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on FFR vehicles the radio batteries (refer to Cat 522 Chap 13-2).

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## CHAPTER 3-2

## UPRATED GEARBOX

### CONTENTS

Para


1 Introduction
2 Gearbox and transfer box assembly
General
4 Remove (CAUTION)
5 Separating transfer gearbox from gearbox
6 Dismantling
7 Clutch housing
8 Transfer gearbox selector housing
9 Gear lever housing and remote housing (CAUTION)
10 Selector quadrant fork
Extension housing
11 Dismantling
12 Reassembly
13 Selector quadrant fork (CAUTION)
14 Remote housing (CAUTION)
15 Transfer gearbox selector housing
16 Gear lever housing (CAUTION)
17 5th gear stop screw adjustment
18 Bias spring adjustment
19 Clutch housing
Refitting
20 Refitting transfer gearbox to gearbox
21 Refitting assembled main and transfer gearboxes to the engine


Table Page


1 Special tools ..... 2
2 Sealants, adhesives and lubricants ..... 2


Fig Page


1 Gearbox removal ..... 4
2 Transfer gearbox selector housing ..... 7
3 Gear lever and remote housing ..... 9
4 Yoke and selector shaft removal ..... 10
5 Quadrant fork removal from selector rail ..... 11
6 Oil seal collar removal ..... 11
7 Removing the extension housing ..... 12
8 Dismantling the extension housing ..... 13
9 Assembling the extension housing ..... 15
10 Fitting the extension housing ..... 16
11 Fitting spool retainer ..... 16
12 Fitting remote housing ..... 18
13 Bias spring adjustment ..... 20

## INTRODUCTION

1 This Chapter details the Field repairs for Truck Utility Light (TUL) High Specification (HS), and Truck Utility Medium (TUM) HS and (TUM) Battlefield Ambulance HS vehicles fitted with the uprated five speed manual gearbox and the 2.5 litre 300 Tdi direct injected turbocharged diesel engines.

## GEARBOX AND TRANSFER BOX ASSEMBLY

2 Removal of the gearbox from the vehicle also entails the removal of the transfer gearbox, which is mounted on the rear of the manual gearbox.

## GENERAL

3 The special tools and consumables listed in Table 1 and Table 2 will be referred to in the text, where used, by their serial number shown in the table.

**TABLE 1 SPECIAL TOOLS**

| Ser<br>(1) | Manufacturers Part Number<br>(2) | NSN/Part Number where applicable<br>(3) | Designation<br>(4) |
|---|---|---|---|
| 1 | LRT-12-093 | 6MT2/5120-99-957-3749 | Water pump holding spanner |
| 2 | LRT-12-094 | 6MT2/5120-99-568-5750 | Viscous coupling spanner |
| 3 | LRT-37-021 | 6MT2/5120-99-449-4201 | Replacer, mainshaft rear bearing track |

**TABLE 2 SEALANTS, ADHESIVES AND LUBRICANTS**

| Ser<br>(1) | Product<br>(2) | NSN/Part Number where applicable<br>(3) | Designation<br>(4) |
|---|---|---|---|
| 1 | RTV | 8030-99-224-6527 | Silicon sealant |
| 2 | Hylogrip 640I | 8030-12-194-4484 | Sealing compound |
| 3 | OX 75 | 9150-99-869-4114 | Gearbox oil |
| 4 | Loctite 270 | 8030-99-224-8707 | Sealing compound |
| 5 | XG 279 | 9150-99-220-2418 | General purpose grease |
| 6 | OEP 220 | 9150-99-220-1477 | Transfer gearbox oil |
| 7 | Orange hylomar | TBA | Sealant |

### Remove

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

4.1 Position the vehicle on a ramp.

4.2 Disconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on Fitted For Radio (FFR) vehicles the radio batteries (refer to Cat 522 Chap 13-2).

4.3 Remove the gear change lever (refer to Cat 522 Chap 3).

4.4 Select high range on the transfer gearbox lever to prevent the lever from fouling the tunnel when removing the gearbox.

4.5 Remove the vehicle bonnet.

4.6 Using the water pump holding spanner (refer to Table 1 Serial 1) and the viscous coupling spanner (refer to Table 1 Serial 2), release the viscous coupling.

4.7 Release the transmission breather pipes from the clip at the rear of the engine.

4.8 Raise the vehicle on the ramp.

4.9 Place a suitable container under the transmission. Remove the drain plugs from the main gear casing and transfer gearbox. Allow the oil to drain and refit the drain plugs.

4.10 Remove front exhaust pipe and silencer section as follows:

4.10.1 Undo the connection from the pipe to the exhaust manifold (Fig 1 (1)).

4.10.2 Release the connection to the rear section at the flange (2) immediately behind the silencer.

4.10.3 Tie exhaust temporarily aside.

4.10.4 Remove cross member (3) and exhaust bracket.

4.10.5 Untie and remove front and centre exhaust pipe sections.

4.11 Mark for reassembly and disconnect rear propshaft (4) from transmission drum.

4.12 From inside the vehicle, remove the handbrake gaiter and disconnect the cable clevis pin from the handbrake lever (5) (ensure hand brake is off).

4.13 From underneath the vehicle, pull cable through heel board and tie aside.

4.14 Remove centre exhaust bracket (6).

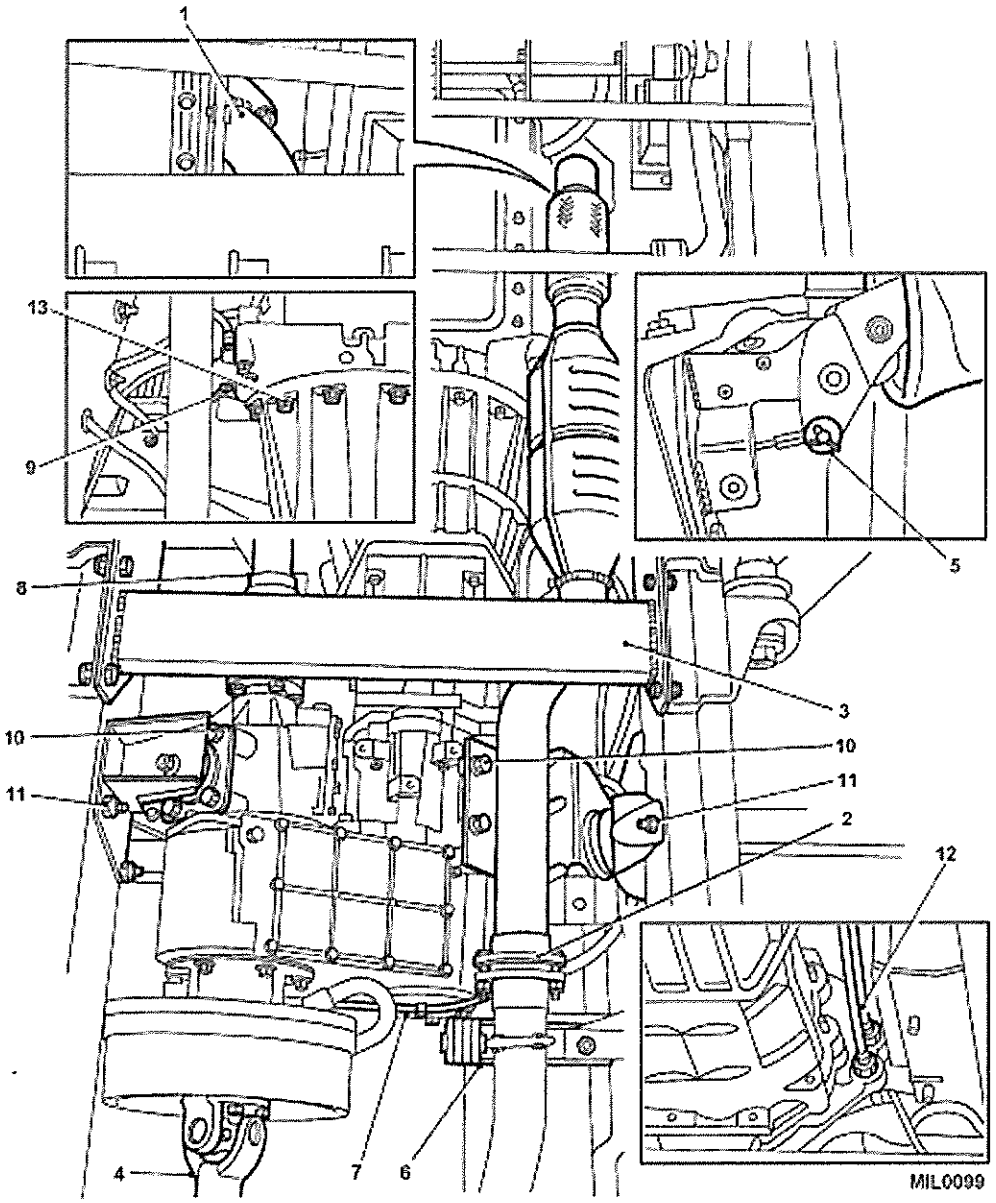
4.15 Remove speedometer cable (7), at the transfer gearbox output housing.

4.16 Disconnect battery earth lead from bolt above left hand mounting bracket.

4.17 Mark for reassembly and disconnect front propeller shaft (8) and tie aside.

4.18 Remove the two bolts and withdraw the clutch slave cylinder (9) from the bell housing and tie aside.

4.19 Remove bolts (10) securing left and right hand mounting brackets to gearbox.




1 Exhaust manifold
2 Exhaust flange
3 Cross member
4 Rear propshaft
5 Handbrake lever
6 Exhaust bracket
7 Speedometer cable
8 Front propshaft
9 Clutch slave cylinder bolt
10 Mounting bracket bolts
11 Mounting bracket nuts and bolts
12 Oil cooler pipes
13 Bell housing bolts

Fig 1 Gearbox removal

4.20 Using a suitable hydraulic hoist raise and secure to the gearbox.

4.21 Raise the hoist sufficiently to take the weight of the transmission.

4.22 Remove the nuts and bolts (11) securing the left and right hand mounting brackets to the chassis.

4.23 Lower the hoist sufficiently to allow the transfer lever to clear the transmission tunnel aperture.

4.24 Disconnect the gearbox oil cooler pipes (12) at the extension housing connections.

4.25 Disconnect the locked four wheel drive indicator and reverse light electrical lead.

**CAUTION**

**SUMP DAMAGE. Ensure care and attention is applied when supporting the engine so there is no damage to the sump.**

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

4.27 Remove the bell housing fixings (13), ensure all connections are released and withdraw the transmission from the vehicle.

Separating transfer gearbox from gearbox

5 To separate the transfer gearbox from the gearbox proceed as follows:

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

5.2 Remove the four bolts securing the transfer gearbox selector housing to the remote housing.

5.3 Remove the nut from the lock up link at the fulcrum lever and disconnect the link from the fulcrum lever.

5.4 Remove the breather pipes.

5.5 Disconnect the cranked lever from the differential lock lever by removing the lower nut from the yoke.

5.6 Place a suitable sling around the transfer gearbox and attach to a hoist.

5.7 Remove the nut and five bolts securing the transfer gearbox to the extension casing and withdraw the transfer gearbox.

**Dismantling**

6 Place the gearbox on a suitable workbench with the transfer gearbox removed (refer to Para 5), ensuring that the oil has been drained.

Clutch housing

7 Remove the clutch housing and clutch release lever (refer to Chap 2).

Transfer gearbox selector housing

8 Dismantle the selector housing as follows:

8.1 Slide gaiter (Fig 2 (2)) off gear lever.

8.2 Remove four bolts (1) securing gaiter support plate (3) and gasket plate (4).

8.3 Remove gaiter support plate and gasket plate and discard gaskets (5).

8.4 Remove and discard spring clip (6) retaining selector fork clevis pin (7).

8.5 Remove clevis pin from selector fork (17), remove and discard two bushes (14).

8.6 Remove and discard circlip (8) retaining nylon seat (10).

8.7 Remove gear lever (12), recover nylon seating and ball (9).

8.8 Remove the two countersunk head screws (15) securing end cover (16), remove and discard the two 'O' rings (18 and 19).

8.9 Withdraw the cross shaft (11).

8.10 Remove selector fork, remove and discard two 'O' rings (18 and 19).

8.11 Clean all components.

Gear lever housing and remote housing

9 Dismantle the gear lever housing as follows:

9.1 Using a length of suitable tubing dislodge both legs of the bias spring (Fig 3 (2)) from the cross pin on gear lever shaft (21).

**CAUTION**

**HIGH SPRING LOAD. Take care when releasing the retainer bolt as the gear lever ball is spring loaded in its seat by a strong spring and nylon plunger.**

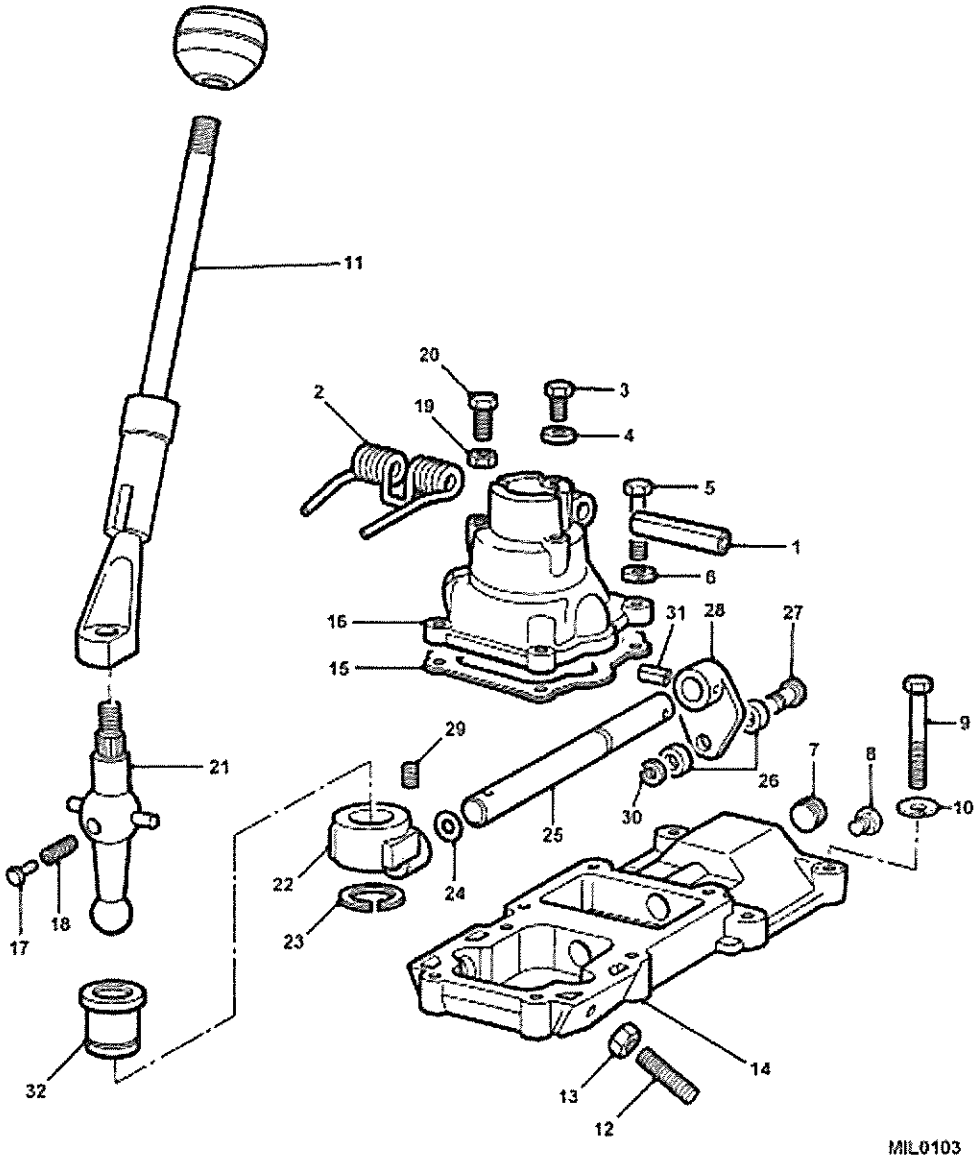
9.2 Remove the screw (3) and special washer (4), to release the gear lever shaft (21), carefully withdraw the shaft from its housing (16) and retrieve the spring (18) and nylon plunger (17).

9.3 Remove the two adjusting screws (20) and locknuts (19).

9.4 Remove the roll pin (1) and detach the bias spring (2).

9.5 Remove the four bolts (5) and spring washers (6) securing the gear lever housing (16) to the remote housing (14). Lift off the housing and discard the gasket (15).

9.6 Remove the bolts (9) and spring washers (10) securing the remote housing (14) to the extension case. Lift off the housing.




| | | | | | |
|---|---|---|---|---|---|
| 1 | Roll pin | 12 | Adjusting screw | 23 | Circlip |
| 2 | Bias spring | 13 | Locknut | 24 | 'O' ring |
| 3 | Screw | 14 | Remote housing | 25 | Selector shaft |
| 4 | Special washer | 15 | Gasket | 26 | Rollers |
| 5 | Bolt | 16 | Gear lever housing | 27 | Pin |
| 6 | Spring washer | 17 | Nylon plunger | 28 | Quadrant |
| 7 | Blanking plug | 18 | Spring | 29 | Screw |
| 8 | Blanking plug | 19 | Locknut | 30 | Circlip |
| 9 | Bolt | 20 | Adjusting screw | 31 | Roll pin |
| 10 | Spring washer | 21 | Gear lever shaft | 32 | Ball pin seating |
| 11 | Gear lever | 22 | Yoke | | |

Fig 3 Gear lever and remote housing

9.7 Remove the locating screw (Fig 4 (1)) from the yoke (2), pull the selector shaft (3) rearwards and remove the yoke from the remote housing.

9.8 Release the circlip (4) and detach the nylon seat (5) from the yoke.

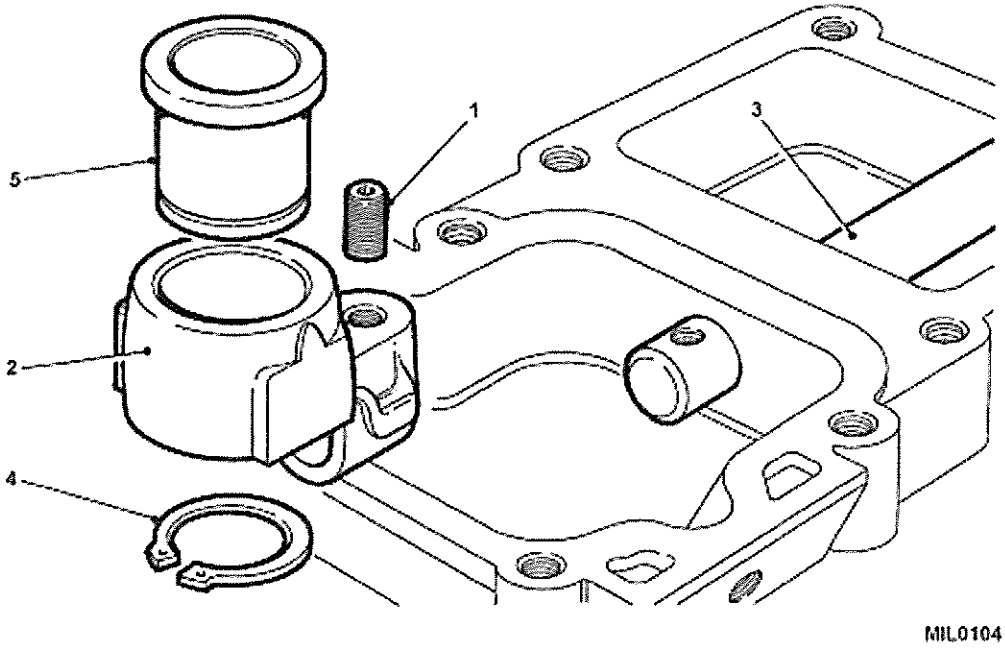
9.9 Invert the remote housing, and remove roll pin (Fig 3 (31)) securing quadrant (28) to selector shaft (25), remove quadrant (28).

9.10 Remove the two blanking plugs (7) and (8) from the rear of the housing.

9.11 Remove selector shaft (25) from remote housing, remove and discard 'O' ring (24).

9.12 Remove and discard circlip (30) retaining rollers (26) and pin (27) to quadrant (28).

9.13 Remove pin and recover rollers.




1 Locating screw
2 Yoke
3 Selector shaft
4 Circlip
5 Nylon seat

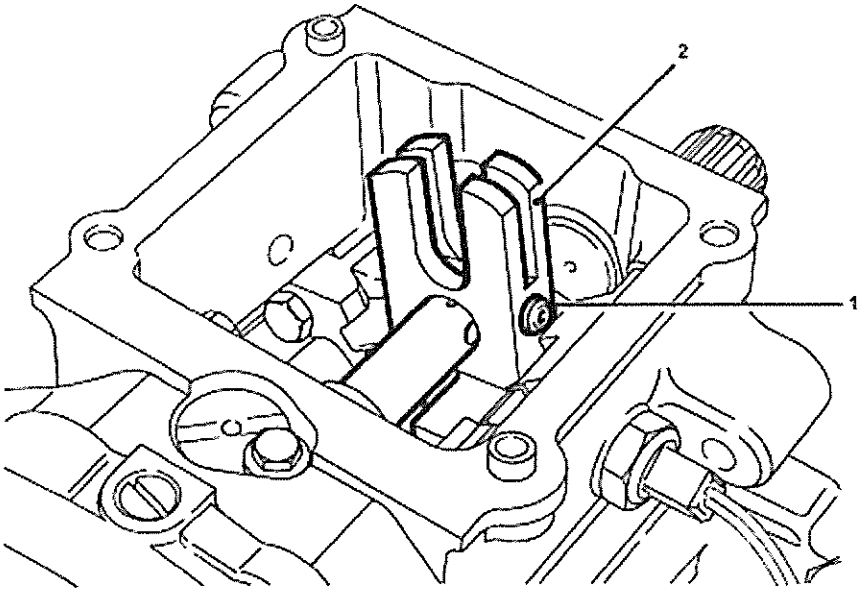
Fig 4 Yoke and selector shaft removal

Selector quadrant fork

10 Remove the selector fork as follows:

10.1 Remove and discard the setscrew (Fig 5 (1)) securing the selector quadrant fork (2).

10.2 Move selector shaft forwards and remove quadrant fork.




1 Set screw 2 Quadrant fork

Fig 5 Quadrant fork removal from selector rail

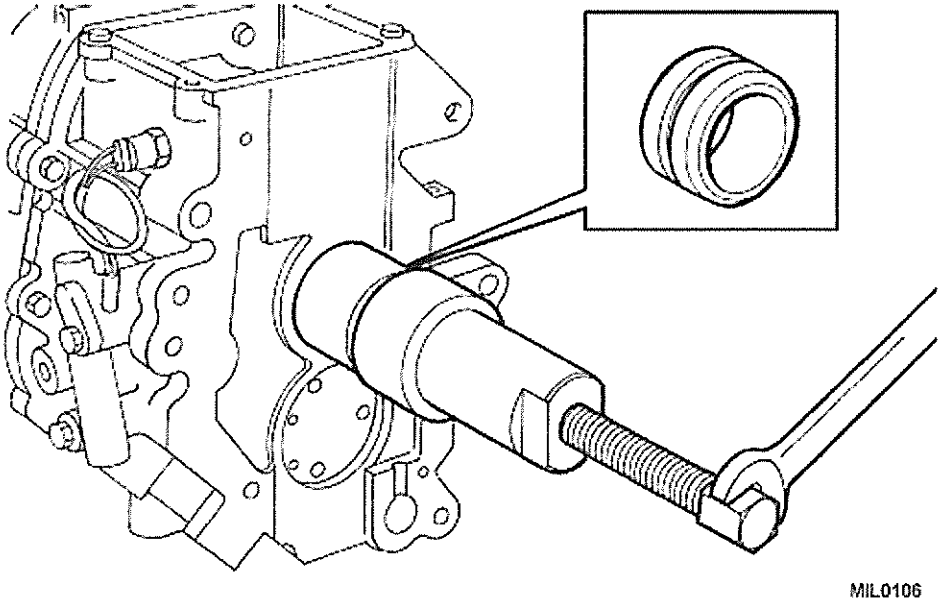


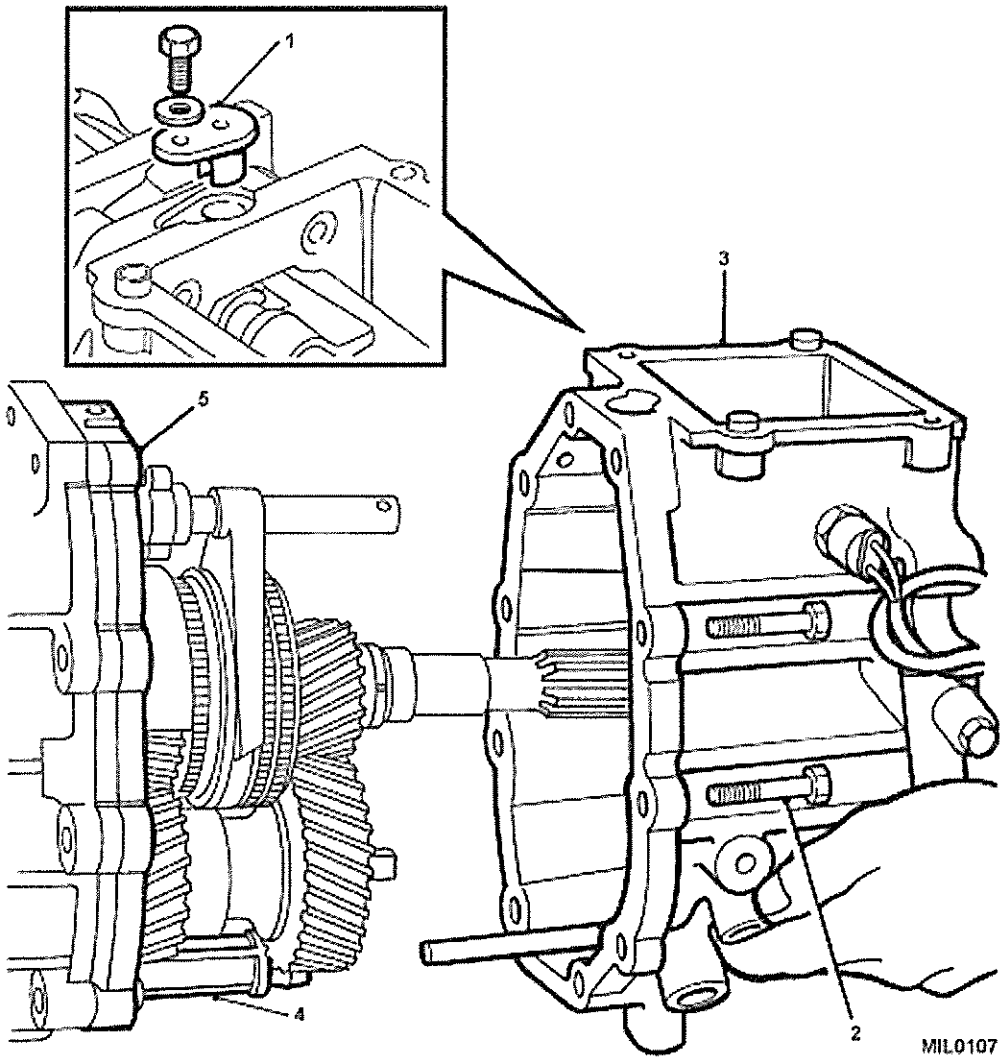

Fig 6 Oil seal collar removal

## EXTENSION HOUSING

### Dismantling

11 Dismantle the extension housing as follows.

11.1 Thread a 12 mm bolt into the end of the output shaft and using a suitable tool withdraw oil seal collar (refer to Fig 6).




1 Spool retainer
2 Bolt
3 Extension housing
4 Oil filter
5 Centre plate

Fig 7 Removing the extension housing

11.2 Remove reverse/5th gear selector spool retainer (Fig 7 (1))

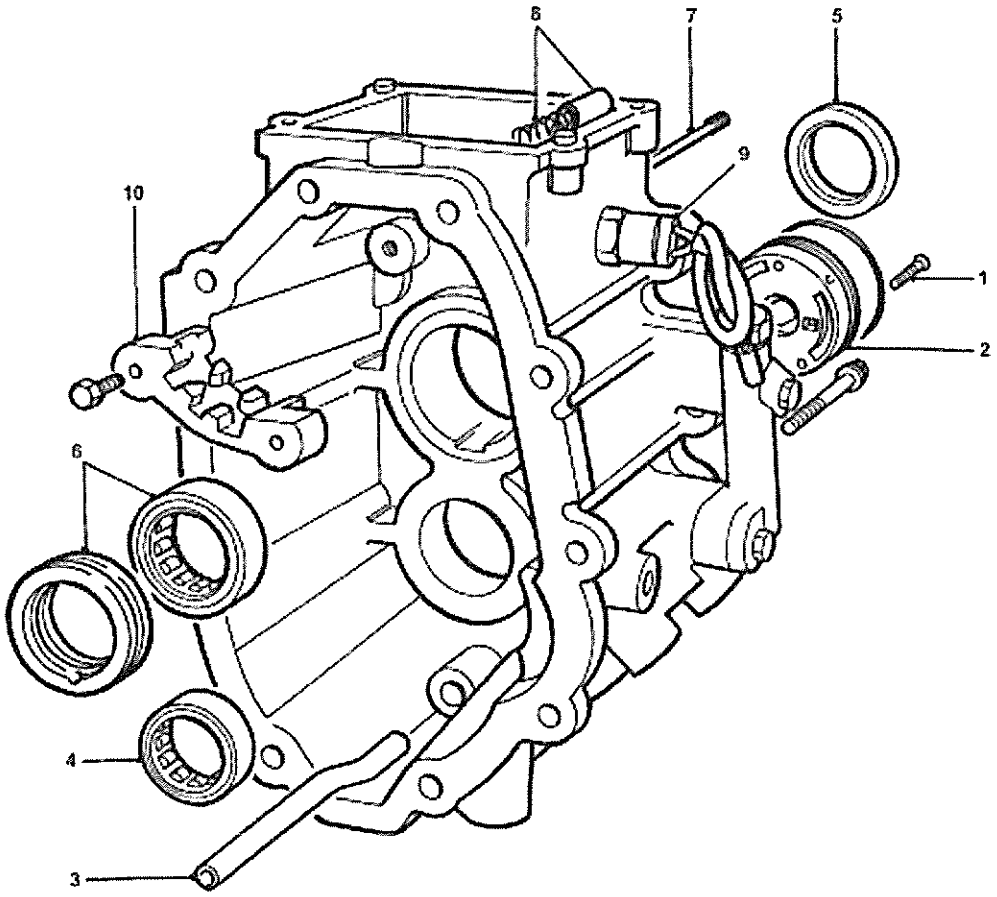
11.3 Remove 10 bolts (2) securing extension casing noting position of longer bolts.

11.4 Place a suitable container underneath the box to catch any oil spillage and remove the extension housing (3).

11.5 Remove oil filter (4).

11.6 Secure centre plate (5) to casing using 'slave' bolts.

11.7 Remove the three screws (Fig 8 (1)) and remove oil pump (2).




| | | | |
|---|---|---|---|
| 1 | Screw | 6 | Mainshaft support bearing and oil pick up ring |
| 2 | Oil pump | 7 | Shaft |
| 3 | Oil pick up pipe | 8 | Reverse inhibition cam and seal spring |
| 4 | Layshaft support bearing | 9 | Reverse light switch |
| 5 | Rear mainshaft oil seal | 10 | Gate plate |

Fig 8 Dismantling the extension housing

11.8 Remove oil pick-up pipe (3) and check for obstruction.

11.9 Drift out layshaft support bearing (4).

11.10 Remove rear mainshaft oil seal (5).

11.11 Drift out mainshaft support bearing and oil pick up ring (6).

11.12 Remove shaft (7) retaining reverse inhibition cam.

11.13 Remove reverse inhibition cam and spring (8).

11.14 Remove reverse light switch (9) and sealing washer.

11.15 Remove gate plate (10).

**Reassembly**

12 To reassemble the extension housing proceed as follows:

12.1 Smear a light coat of grease (refer to Table 2 Serial 5) into the pump recess.

12.2 Renew 'O' ring (Fig 9 (1)) and press pump unit (2) firmly into recess.

NOTE

Ensure 'TOP' marking on pump is to top of casing.

12.3 Tap pump lightly at edges until screws (3) take to threads and pull down pump by tightening screws.

12.4 Fit new mainshaft support bearing (4).

12.5 Fit new mainshaft rear oil (5) seal using special tool (refer to Table 1 Serial 6).

12.6 Fit new layshaft support bearing (6).

12.7 Fit new oil pick-up ring (7) (ensure that the blind hole is aligned with centre of drain slot).

12.8 Examine gate plate (8) and renew if worn or damaged.

12.9 Apply sealing compound (refer to Table 2 Serial 2) and refit reverse light switch (9).

12.10 Refit reverse stop cam and spring (10).

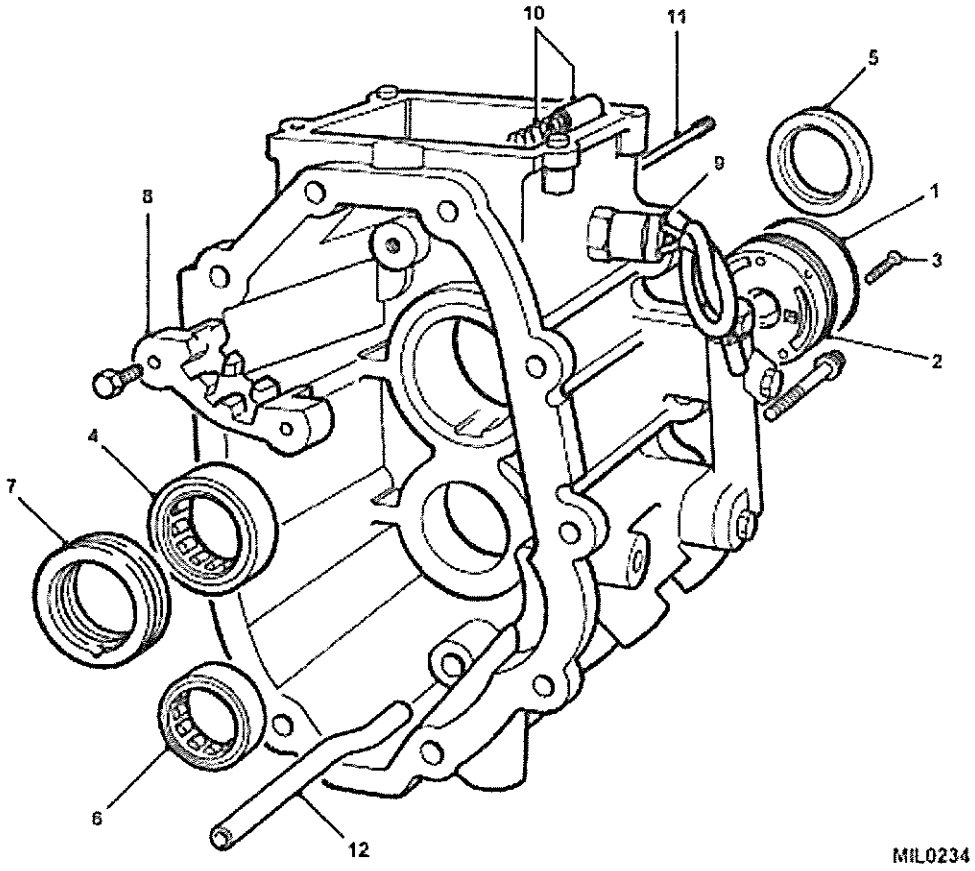
12.11 Apply sealing compound (refer to Table 2 Serial 2) and refit shaft (11).

12.12 Refit oil pipe (12), bend uppermost.

12.13 Remove all 'slave' bolts from centre plate and casing.

12.14 Refit oil filter (Fig 10 (1)).

12.15 Apply sealant (refer to Table 2 Serial 1) to mating surfaces and fit extension housing (3) ensuring oil pipe (2) locates in filter and roller bearing are not dislodged.



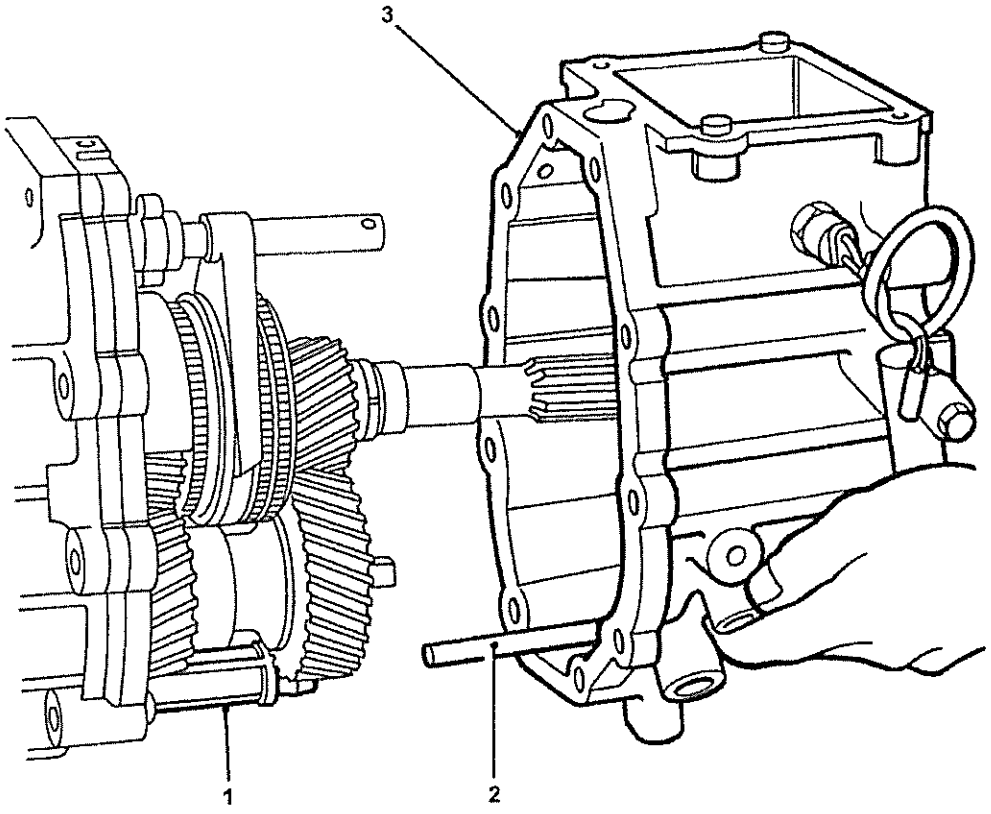

| | | | |
|---|---|---|---|
| 1 | 'O' ring | 7 | Oil pick up ring |
| 2 | Pump | 8 | Gate plate |
| 3 | Screw | 9 | Reverse light switch |
| 4 | Mainshaft support bearing | 10 | Reverse stop cam and spring |
| 5 | Mainshaft rear oil seal | 11 | Shaft |
| 6 | Layshaft support bearing | 12 | Oil pipe |

Fig 9 Assembling the extension housing

12.16 Bolt extension housing to centre plate and main casing. Tighten to 22 to 28 Nm (16 to 21 lbf ft).

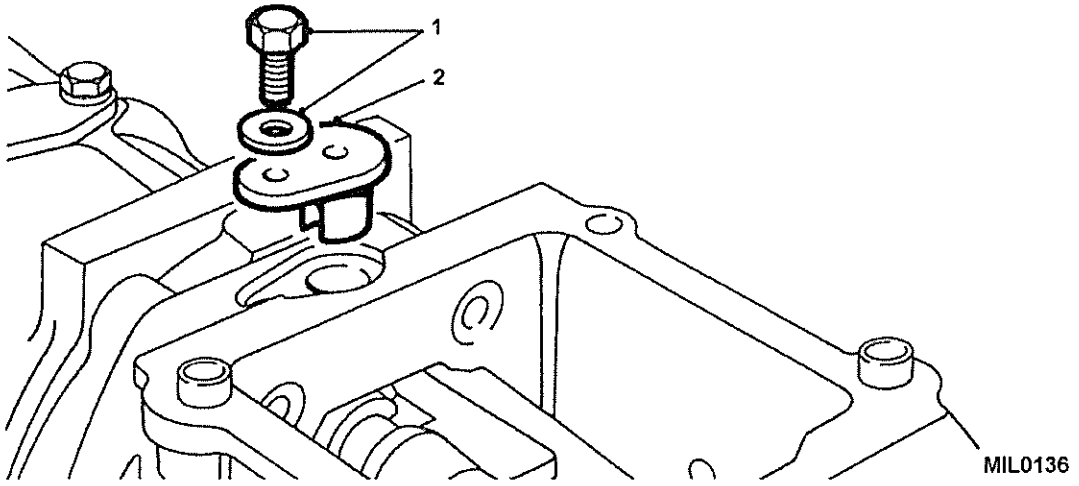
12.17 Apply sealant (refer to Table 2 Serial 1) and fit extension case spool retainer (Fig 11 (2)) with a bolt and washer (1).

12.18 Using a suitable tool with the special tool (refer to Table 1 Serial 6) press on mainshaft oil seal collar (refer to Fig 12).




1 Filter 3 Extension housing
2 Oil pipe

Fig 10 Fitting the extension housing




1 Bolt and washer 2 Spool retainer

Fig 11 Fitting spool retainer

**Selector quadrant fork**

13 Refit the selector quadrant fork as follows:

13.1 Position selector quadrant fork (refer to Fig 5 (2)) to selector shaft.

13.2 Apply sealing compound (refer to Table 2 Serial 4) to thread of a new set screw (2), fit screw and tighten to 22 to 28 Nm (16 to 21 lbf ft).

13.3 Move selector shaft to neutral position.

**CAUTION**

**LOCATION. Ensure end of setscrew locates in hole in selector shaft.**

**Remote housing**

14 Assemble the remote housing as follows:

14.1 Lubricate selector shaft (refer to Fig 3 (25)) and new 'O' ring (24) with gearbox oil (refer to Table 2 Serial 3).

14.2 Fit 'O' ring to selector shaft.

14.3 Fit shaft to remote housing.

14.4 Position rollers (26) to quadrant (28), fit pin (27) and secure with new circlip (30).

**CAUTION**

**PIN HEAD LOCATION. Ensure that head of pin is on opposite side of quadrant to selector shaft boss.**

14.5 Fit quadrant (28) to selector shaft (25).

14.6 Fit a new roll pin (31), securing quadrant to sector shaft.

14.7 Apply sealing compound (refer to Table 2 Serial 4) to threads of blanking plug (7), fit and tighten plug.

14.8 Smear ball pin seating (32) with general purpose grease (refer to Table 2 Serial 5).

14.9 Position ball pin seating in yoke (22), secure with a new circlip (23).

14.10 Position yoke on selector shaft (25).

14.11 Apply sealing compound (refer to Table 2 Serial 4) to threads of setscrew, fit and tighten setscrew.

14.12 Fit 5th gear stop screw (12), fit but do not tighten locknut (13).

NOTE

5th gear stop screw adjustment is carried out during gearbox reassembly.

14.13 Apply sealant (refer to Table 2 Serial 1) to mating surfaces and position remote housing (14) to extension housing. Ensure rollers locate into the quadrant.

14.14 Fit but do not fully tighten the three bolts (refer to Fig 12) in positions shown.

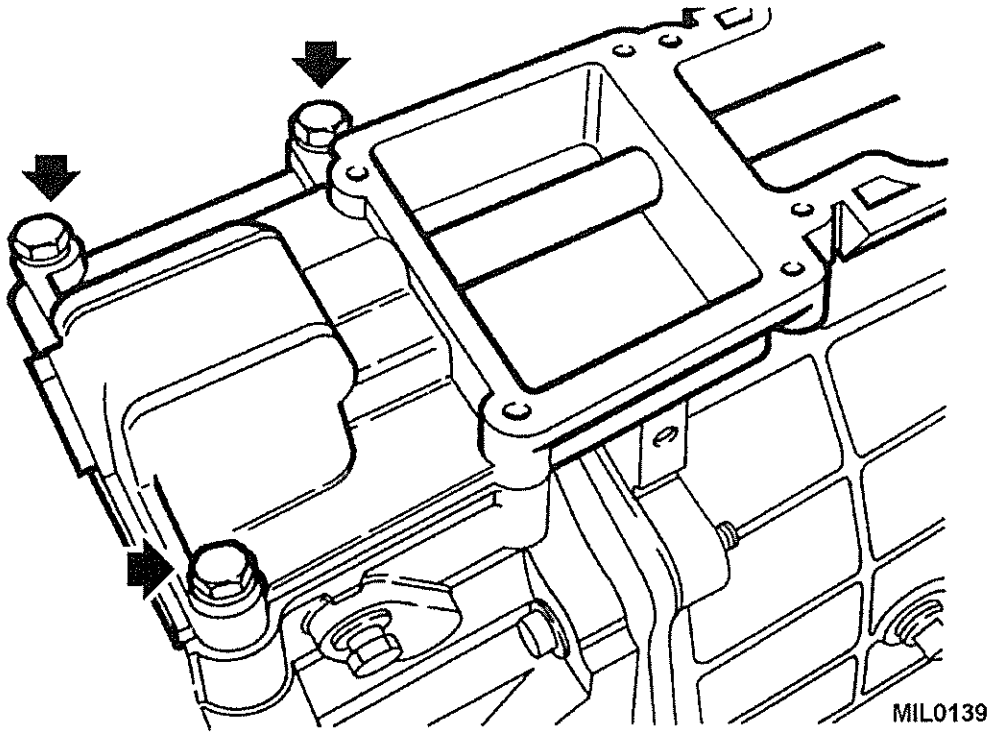



Fig 12 Fitting remote housing

**TRANSFER GEARBOX SELECTOR HOUSING**

15 Assemble the transfer gearbox selector housing as follows:

15.1 Smear new 'O' rings (refer to Fig 2 (19)) with transmission oil (refer to Table 2 Serial 6) and fit to selector fork (17) in housing (13).

15.2 Smear cross shaft (11) with general purpose grease (refer to Table 2 Serial 5) and locate longest end of shaft in selector fork.

15.3 Smear new 'O' rings (18) with transmission oil (refer to Table 2 Serial 6) and fit to end cover (16).

15.4 Position end cover on cross shaft, fit and tighten with countersunk screws (15).

15.5 Assemble ball (9) and nylon seating (10) to gear lever (12) ensuring that groove in seating is towards cross shaft.

15.6 Smear ball and nylon seating with general purpose grease (refer to Table 2 Serial 5) and locate in cross shaft; retain with a new circlip (8).

15.7 Place new bushes (14) on to gear lever, locate in selector fork (17) and fit clevis pin (7).

NOTE

Ensure the head of the clevis pin (7) points towards the front of the vehicle.

15.8 Fit new spring clip (6) to retain clevis pin.

15.9 Place gasket plate (4) and gaiter support plate (3) on to housing, using new gaskets (5).

15.10 Fit retaining bolts and tighten to 15 Nm (11 lbf ft).

15.11 Fit gaiter (2).

15.12 Smear a new gasket with general purpose grease (refer to Table 2 Serial 5) and fit to remote housing.

15.13 Position transfer gearbox selector housing to remote housing.

15.14 Fit but do not fully tighten four bolts (1).

**GEAR LEVER HOUSING**

16 Assemble the gear lever housing as follows:

16.1 Smear ball pin of the gear lever shaft (refer to Fig 3 (21)) with general purpose grease (refer to Table 2 Serial 5) and fit spring (18) and nylon plunger (17).

16.2 Depress nylon plunger against spring pressure, position gear lever shaft (21) into ball pin seating (32).

**CAUTION**

**PLUNGER LOCATION. Ensure nylon plunger is facing away from bias spring location.**

16.3 Fit gear lever shaft retaining screw (3) and special washer (4), tighten screw to 10 Nm (7 lbf ft).

16.4 Fit gear lever (11) to gear lever shaft.

16.5 Position roll pin (1) to housing (16), fit roll pin.

16.6 Fit bias spring adjusting screws (20) and locknuts (19).

16.7 Using a suitable piece of tubing, locate both ends of bias spring (2) cross pin on gear lever shaft.

NOTE

Do not adjust bias spring at this stage.

16.8 Smear a new gasket (15) with general purpose grease (refer to Table 2 Serial 5) and fit to remote housing (14).

16.9 Position gear lever to remote housing ensuring lever ball is correctly located.

16.10 Fit but do not tighten the four bolts (5).

16.11 Tighten remote housing, transfer gearbox selector housing and gear change housing bolts to 25 Nm (18 lbf ft).

**5th gear stop screw adjustment**

17 Adjust the 5th gear stop screw (12) as follows:

17.1 Select reverse gear. While applying light pressure to gear lever towards right, turn screw clockwise until it contacts yoke.

17.2 Turn screw anti-clockwise until 25 mm (0.98 in.) free play is felt at knob, ensure 5th gear can be engaged then tighten locknut (13).

17.3 Check all other gears are selectable.

**Bias spring adjustment**

18 Adjust the bias spring as follows:

NOTE

The purpose of this adjustment is to set both bolts so that the bias spring legs apply equal pressure on both ends of the gear lever cross pin when third or fourth gear is engaged. This will ensure that when the lever is in neutral, the gear change mechanism is automatically aligned for third or fourth gear.

18.1 Select third or fourth gear.

18.2 Adjust the two adjusting screws (Fig 13 (1)) until both legs (4) of the spring are approximately 0.5 mm (0.02 in.) clear of the cross pin (2) in the gear lever.

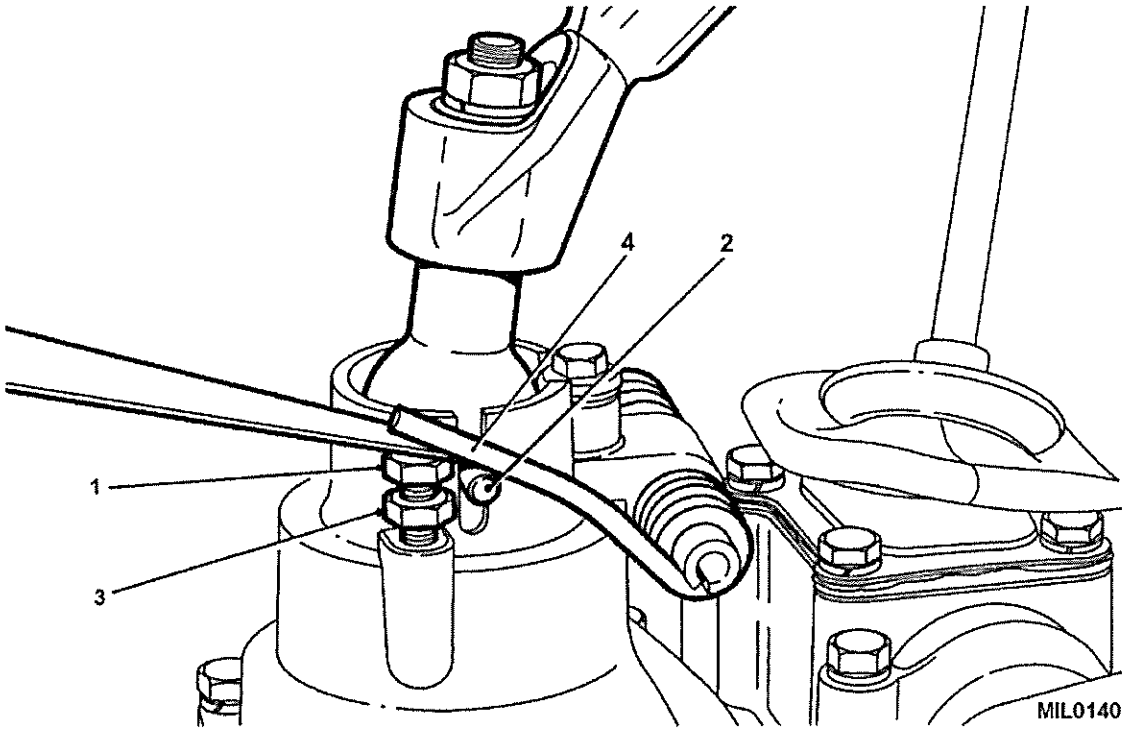
18.3 Apply a light load to the gear lever in a left hand direction and adjust the right hand adjusting screw downward until the right hand spring leg just makes contact with the cross pin.

18.4 Repeat the same procedure for the left hand adjusting screw.

18.5 Lower both adjusting screws equal amounts until the radial play is just eliminated.

18.6 Tighten locknuts (3).

18.7 Return gear lever to neutral position and rock across the gate several times. The gear lever should return to the third and fourth gate.




1 Adjusting screw 3 Locknut
2 Cross pin 4 Spring leg

Fig 13 Bias spring adjustment

**CLUTCH HOUSING**

19 Fit the clutch housing and clutch release lever (refer to Chap 2).

**REFITTING**

**Refitting transfer gearbox to gearbox**

20 To fit the transfer gearbox to the main gearbox carry out the following:

20.1 Using a suitable hoist and sling, and ensuring that the loose upper dowel is fitted, assemble the transfer gearbox to the main gearbox extension casing. Secure with the four fixings, and tighten to a torque of 40 to 50 Nm (29 to 37 lbf ft).

20.2 Apply sealant (refer to Table 2 Serial 1) to the mating faces and fit the transfer gearbox selector housing to the main gearbox remote housing noting that the right hand rear location is fitted with the longer bolt. Tighten to a torque of 22 to 28 Nm (16 to 21 lbf ft).

20.3 Fit the differential lock up link at the fulcrum lever.

20.4 Connect the cranked lever to the differential lock lever.

**Refitting assembled main and transfer gearboxes to the engine**

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

NOTE

Before fitting the gearbox to the vehicle the transfer gearbox must be refitted to the gearbox (refer to Para 5).

21.1 Fit the transmission to a suitable hydraulic hoist and secure.

21.2 Apply sealant (refer to Table 2 Serial 1) on the bell housing face mating with the engine.

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

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

21.5 Secure the transmission to the engine at the bell housing noting the position of the brackets for the oil cooler and air cleaner pipes. Tighten the fixings to a torque of 45 to 50 Nm (33 to 37 lbf ft).

21.6 Connect the differential lock indicator and reversing light leads.

21.7 Raise the transmission to line up with the gearbox mountings ensuring the transfer lever clears the tunnel aperture.

21.8 Fit the transfer gearbox left and right hand mounting brackets to the chassis and loosely secure with the bolts.

21.9 Locate the bolts and secure the mounting brackets to the transfer gearbox and tighten. Tighten chassis fixings to a torque of 80 to 90 Nm (59 to 66 lbf ft).

21.10 Remove cradle and hoist.

21.11 Remove the supporting jack from under the engine sump.

21.12 Reconnect battery earth lead to gearbox.

21.13 Apply sealant (refer to Table 2 Serial 7) and reconnect speedo cable.

21.14 Refit transmission handbrake cable.

21.15 Reconnect rear propeller shaft noting the markings made previously (refer to Para 4.11). Tighten to a torque of 43 to 51 Nm (32 to 38 lbf ft).

21.16 Reconnect front propeller shaft noting the markings made previously (refer to Para 4.17). Tighten to a torque of 43 to 51 Nm (32 to 38 lbf ft).

21.17 Position front and centre exhaust sections and secure at the rear connection only, locate front section to exhaust flange and leave loose.

21.18 Secure front exhaust section and tighten flange bolts.

21.19 Check drain plugs in main casing, extension casing and transfer gearbox are fitted and tighten to a torque of 25 to 35 Nm (18 to 26 lbf ft).

21.20 Remove the filler level plug from the main gearbox and fill with oil (refer to Table 2 Serial 3) until it begins to run from the plughole. Apply sealing compound (refer to Table 2 Serial 1) to the threads of the filler plug, fit and tighten to a torque of 25 to 35 Nm (18 to 26 lbf ft).

21.21 Remove the transfer gearbox filler level plug and fill with oil (refer to Table 2 Serial 6) until it runs out of the plughole. Apply sealing compound (refer to Table 2 Serial 1) to the threads of the filler plug, fit and tighten to a torque of 25 to 35 Nm (18 to 26 lbf ft).

21.22 Wipe away any surplus oil from the casings.

21.23 Refit bracket retaining breather pipes to the rear of the engine.

21.24 Refit the viscous coupling.

21.25 Fit the vehicle bonnet.

21.26 Fit the main gear lever (refer to Cat 522 Chap 3).

21.27 Reconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on Fitted For Radio (FFR) vehicles the radio batteries (refer to Cat 522 Chap 13-2).

## CHAPTER 4

## LT230T TRANSFER BOX AND PROPELLER SHAFTS

### CONTENTS

Para

1 Introduction
2 General
Transfer gearbox
4 Removal
5 Refitting
Speedometer housing
6 Removal
7 Refitting

Table Page

1 Sealants, adhesives and lubricants ..... 1

Fig Page

1 Linkage disconnection points ..... 3
2 Speedometer drive housing and driven gear ..... 5

### INTRODUCTION

1 This Chapter covers the Field repairs for Truck Utility Light (TUL) High Specification (HS) and Truck Utility Medium (TUM) HS and (TUM) Battlefield Ambulance HS vehicles fitted with the LT230T transfer gearbox and propeller shafts. However, there are no repairs applicable to the propeller shafts at this level of repair.

### GENERAL

2 The transfer gearbox, which is mounted on the rear of the manual gearbox, can be removed independently of the gearbox.

3 The consumables listed Table 1 will be referred to in the text, where used, by the serial number shown in column (1).

**TABLE 1 SEALANTS, ADHESIVES AND LUBRICANTS**

| Ser | Product | NSN/Part Number where applicable | Designation |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| 1 | Loctite 270 | 8030-99-224-9318 | Sealing compound |
| 2 | OEP 220 | 9150-99-220-1477 | Transfer gearbox oil |

**TRANSFER GEARBOX**

**Removal**

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

4.1 Position the vehicle on a suitable hydraulic ramp.

4.2 Disconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on Fitted For Radio (FFR) vehicles the radio batteries (refer to Cat 522 Chap 13-2).

4.3 Remove the kit retention bar, matting and centre cover panel.

4.4 Remove the breather pipe banjo bolt (Fig 1 (1)) from the transfer gearbox high/low cross-shaft housing.

4.5 Disconnect the high/low lever (2).

4.6 Remove handbrake gaiter and disconnect the transmission brake cable at the clevis joint (refer to Cat 522 Chap 10-1).

4.7 Raise the vehicle on the ramp and drain the oil from the transfer gearbox into a suitable container.

4.8 Remove the centre section of the exhaust system, including the front mounting rubber support bracket.

4.9 Disconnect the front and rear propeller shafts from the transfer gearbox (refer to Cat 522 Chap 4) and move them aside.

4.10 Disconnect the speedometer cable from the transfer gearbox.

4.11 Remove the retaining clip (3) at the lower end of the pivot arm (4) and disconnect the differential lock control operating rod (5).

4.12 Support the box using a suitable hoist.

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

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

4.15 Place a suitable wooden block between the main gearbox and chassis crossmember, then lower the hoist until the gearbox contacts the wooden block.

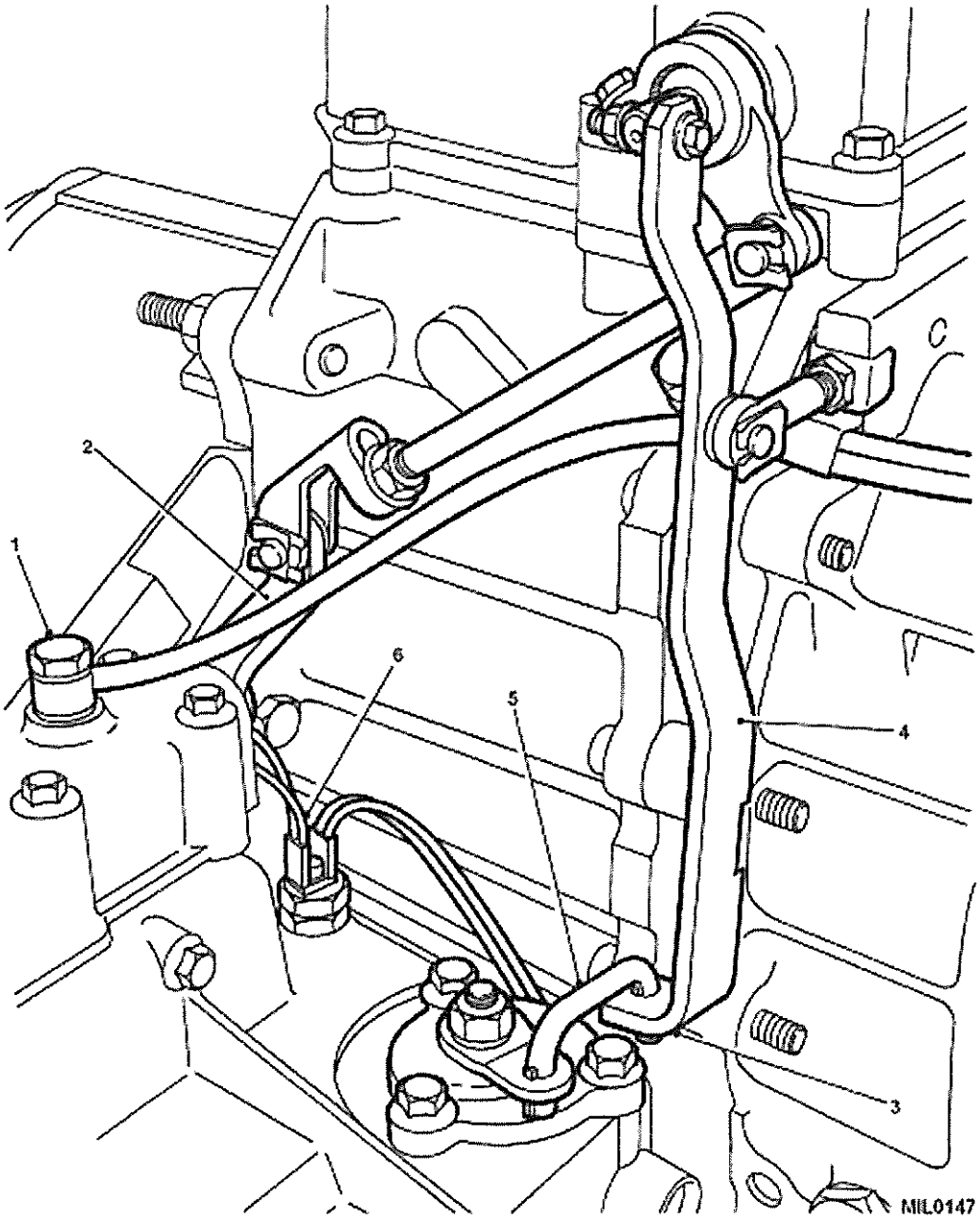
4.16 Disconnect the electrical leads (6) from the differential lock switch.

4.17 Move the cranked lever (2), for the high/low selector, upward to allow access to the adjacent nut securing the transfer gearbox to the main gearbox extension case.

4.18 Remove the retaining nut securing the earth leads to the right hand side of the transfer box case.

4.19 Remove the battery earth strap retaining nut and the two nuts and four bolts securing the transfer gearbox to the main gearbox extension case.

4.20 Lower the hoist and withdraw the transfer gearbox from the vehicle.




| | | | |
|---|---|---|---|
| 1 | Breather pipe banjo bolt | 4 | Pivot arm |
| 2 | High/low lever | 5 | Operating rod |
| 3 | Retaining clip | 6 | Differential lock switch leads |

Fig 1 Linkage disconnection points

**Refitting**

5 To refit the transfer gearbox to the vehicle carry out the following:

5.1 Ensure that the joint faces of the transfer gearbox and main gearbox extension case are clean.

5.2 Lubricate the oil seal in the joint face of transfer box, secure the transfer gearbox to the lifting hoist and raise the hoist until the transfer gearbox can be located to the main gearbox.

5.3 Fit the battery earth strap, and secure the transfer gearbox to the main gearbox extension case. Tighten the nuts and bolts to a torque of 40 to 50 Nm (29 to 37 lbf ft).

5.4 Complete the refitting procedure by reversing the removal sequence, noting the following important points:

5.4.1 After removing the lifting hoist from the transfer gearbox, clean the threads of the four bolts for the transfer gearbox bottom cover, coat with sealing compound (refer to Table 1 Serial 1) and fit them together. Tighten to a torque of 22 to 28 Nm (16 to 21 lbf ft).

5.4.2 Refill the transfer box with oil (refer to Table 1 Serial 2) to the oil level plug hole.

5.4.3 Check, and if necessary, top up the oil level in the main gearbox, using the correct grade oil (refer to Chap 3-1).

5.4.4 Check the operation of the handbrake and adjust as necessary (refer to Cat 522 Chap 10-1).

## SPEEDOMETER HOUSING

### Removal

6 To remove the speedometer housing proceed as follows:

6.1 Position the vehicle on a suitable hydraulic ramp.

6.2 Disconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on FFR vehicles the radio batteries (refer to Cat 522 Chap 13-2).

6.3 Locate and remove the nut, washer and retaining plate securing the speedometer cable to the drive.

6.4 Remove the speedometer housing (Fig 2 (2)). If necessary ease out with a flat bladed screwdriver.

6.5 Remove speedometer gear (4) from its housing (2).

6.6 Remove the 'O' ring (3) and oil seal (1) and discard.

### Refitting

7 To refit the speedometer housing proceed as follows:

7.1 Fit the 'O' ring (Fig 2 (3)) and oil seal (1), open side inwards, to the speedometer drive housing (2).

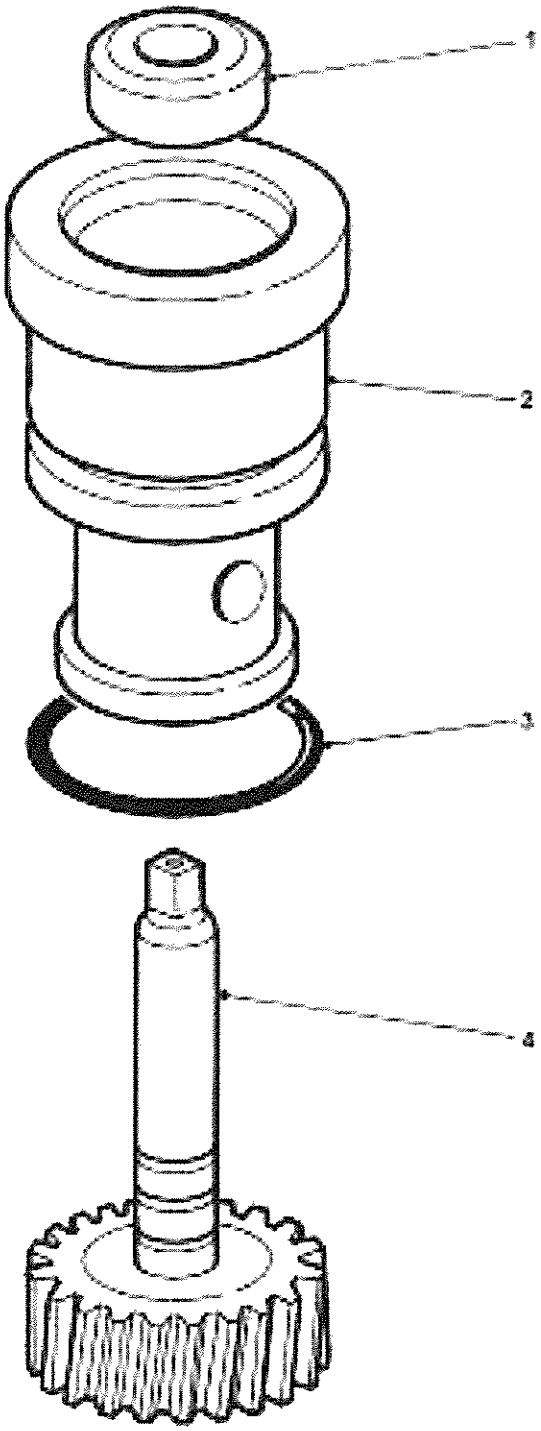
7.2 Lubricate the 'O' ring and seal with oil (refer to Table 1 Serial 2).

7.3 Locate the shaft of the speedometer driven gear (4) in the speedometer drive housing (2) and press into position.

7.4 Fit the assembled speedometer housing in the output housing and press in until flush with the housing face.

7.5 Fit the speedometer cable and secure with the retaining plate, nut and washer.

7.6 Reconnect the vehicle batteries (refer to Cat 522 Chap 13-1) and on FFR vehicles the radio batteries (refer to Cat 522 Chap 13-2).




| | | | |
|---|---|---|---|
| 1 | Oil seal | 3 | 'O' ring |
| 2 | Speedometer housing | 4 | Speedometer gear |

Fig 2 Speedometer drive housing and driven gear

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