LAND ROVER SERIES III PETROL P/U

1981-86

IDENTIFICATION: Introduced **1981:** Available in both petrol and ADE 4 cyl. Diesel versions. Similar in appearance to series II Land Rover, but with changes to front grill which has been broadened and redisigned seats. Cigarette lighter, hazard warning lights & anti-burst door locks have been added as standard fittings.

Year	Sept. New List Price	Number Sold
1981	11 750	484
1982	14 360	478
1983	15 550	472
1984	17 215	326
1985	24 250	80
1986	24 250	1

1981 MODEL

SPECIFICATIONS:

ENGINE:

Type	Petrol (R6) 6 cyl. OHC 2623 cm^3.
Bore and Stroke	76,2 × 95,76 mm
Idling speed	600 r/min
Power (Max)	82 kW (ISO) at 4750 r/min
Torque (Max)	202 N.m (ISO) at 2200 r/min
Compression ratio	8,75:1
Injection order	1-5-3-6-2-4; No. 1 at Front
Radiator Cap Pressure	105 kPa

CARBURETTOR:

Make/Model	Twin SU HIF6 side draught

TRANSMISSION:

Clutch type & dia	Single Dry Plate 241,3 mm
Gearbox	4 speed synchromesh manual, Plus (Hi & Low transfer box),
Rear Axle type	Fully Floating
Final Drive type & ratio	Sprial Bevel 4,7:1

SUSPENSION:

Front	Leaf spring
Rear	Leaf spring

STEERING:

Type	Recirculating ball
Turning circle	14,3

TYRES AND WHEELS:

Size	7,50 × 16 Cross Ply; Rim size 5,50 FX16
Pressures	Front: 176 kPa; Rear (Unladen): 176 kPa Rear (Laden): 310 kPa

BRAKES:

Type	Front: Drum; Rear: Drum
Dia	Front: 279 mm; Rear: 279 mm
Servo Assisted	Yes

CAPACITIES (in litres):

Sump	6,85
Gearbox	Manual: 2,0
Transfer box	2,5
Final Drive	Front: 1,75; Rear: 2,5
Cooling system	8,0
Fuel Tank	90

GENERAL DIMENSIONS:

Overall Length	4450 mm
Width	1690 mm
Height	1920 mm
Wheelbase:	2767 mm
Track	Front: 1395; Rear: 1395 mm
Kerb mass	1594 kg
G.V.M.	2681 kg
Carrying capacity	1000 kg

TUNE UP DATA:

VALVES:

Working Clearance (Hot)	In: 0,40; Exh: 0,46
Timing Clearance:	In.: 0,40/0,45; Exh: 0,51/0,56
Timing:	
In. Opens: 9° 4' BTDC; Closes: 50° 56' ABDC	
Exh. Opens: 48° 56' BBDC; Closes: 11° 4' ATDC	
Spring free length	45,64 mm
Spring rate	231 N.m at fitted length
Seat angle	45° 5'

PISTONS AND RINGS

Piston Clearance (in Bore)	0,203/0,330 mm
Oversizes	0,254; 0,508 mm
No. of Rings:	2 Compression; 1 Oil
Groove clearance:	Compression: 0,038 mm Oil: 0,038 mm
Ring Gap: (in Bore)	Compression: 0,203/0,430 mm Oil.0,203/0,430 mm

CRANKSHAFT:

7 Main bearings	Dia.: 60,353/60,371 mm
Undersizes	0,254; 0,508; 0,766; 1,016 mm
Clearance	0,023/0,063 mm
Crankpin: (Big end)	Dia.: 47,643/47,661 mm
Undersizes	0,254; 0,508 mm
Clearance	0,025/0,063 mm

TORQUE SETTINGS:

Flywheel bolts	81/88 N.m
Cyl. head/Cold	81 N.m
Big ends	42/47 N.m
Main Bearings	95 N.m
O.H.C. Bearing Caps	27 N.m

IGNITION AND ELECTRICAL:

Distributor Type	Lucas 45 D6
Stroboscopic Setting	12° BTDC at 1000 r/min.
Position of timing marks	On flywheel
Contact Breaker gap	0,35/0,40 mm
Dwell angle	33° ± 5°
Spark plug	Champion N 9Y
Spark plug gap	0,58/0,66 mm
Battery	12 v 58 A.h. - Negative earth
Alternator	Lucas 21 ACR
Charging rate	0,66 kW
Regulator type	Integral in alternator

STEERING (Condition for checking — Unladen)

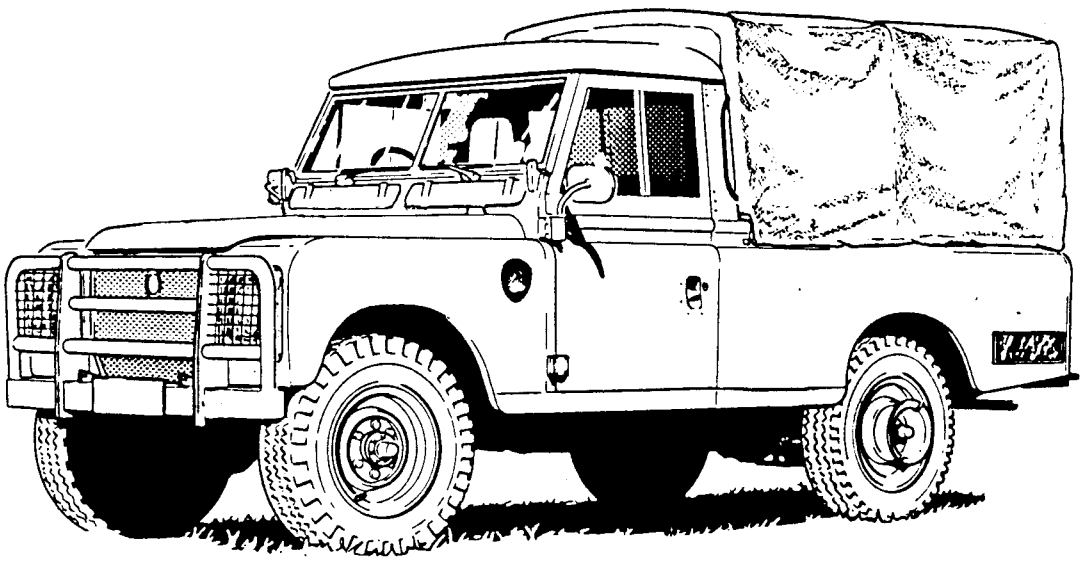
Camber	1,5°
Castor	3°
Toe-in (Front)	1,2/2,4 mm
Kingpin inclination	7°

WORKSHOP REPAIR MANUAL

FOR

LAND ROVER SERIES III S

ALLIED AUTO ELEC. c.c.
REG. No. CK 87/06137/23



VOLUME 1 : SECTIONS

DATA INFORMATION SHEET

Make ..... Land Rover 109"

Model ..... PUPR6 Series IIIS

Engine Type R6

Gearbox/Transfer Box Type ..... M S A

Front Differential Type ..... Salisbury

Rear Differential Type ..... Salisbury 8HA

Fuel Pump Type ..... Facit - Electrical

WORKSHOP REPAIR MANUAL SET PART NO.

PREFACE

GENERAL

1. The manual is intended to provide guidance to workshop personnel carrying out minor and major adjustments and repairs to the Land Rover Series IIIS. The instructions contained herein are set out in a step-by-step format and should enable workshop personnel unfamiliar with the vehicle to carry out all adjustments and repairs necessary to maintain the vehicle in good working order.

2. All necessary information and the correct sequence for carrying out replacement and repair work are detailed in this manual and are in accordance with the correct repair procedures as considered necessary by the manufacturers. It is not advisable to deviate from these instructions.

ARRANGEMENT AND LAYOUT OF THE MANUAL

3. The manual is divided into three volumes. The content of each volume is shown in the main contents page at the front of each volume. The division between volumes is selected so that allied subjects are contained in one complete volume. Typically, the arrangement is as follows:

a. VOLUME 1: Engine and associated systems such as fuel, cooling, ignition and exhaust systems.

b. VOLUME 2: Transmission system from the gearbox through to and including the front and rear axles and hubs.

c. VOLUME 3: All other systems such as brakes, steering, body, electrical etc not covered in Volumes 1 and 2.

INSTRUCTIONS CONTAINED IN THE MANUAL

4. All instructions contained in this manual are arranged in a logical step-by-step format. Where necessary to support the description, an illustration is provided. This illustration is positioned above the relevant steps explaining that part of the procedure.

5. Although in certain instances it is possible to vary the order of removal and replacement, workshop personnel are strongly advised to carry out the procedures in the order given. This will ensure that all components are correctly fitted and that all fasteners are tight.

6. For most removal and replacement procedures it is recommended that these are carried out on a hard surface such as concrete. Where this is not possible due to operational considerations it is essential that whatever improvisation is used, first consideration is given to the safety of personnel and the protection of the vehicle.

DIVISION OF SUBJECTS

7. The manual as a whole is divided into Sections, each Section covering one main subject. For example, Section B deals with the power unit and Section C with the fuel system. Where necessary, each Section is further sub-divided into Sub-sections, Sub-sub-sections or Chapters.

8. Where applicable the content of each Section is arranged in the following sequence:

a. Brief description and specifications including tightening specifications for assembly or component fixings.

b. Fault finding and corrective procedures.

c. Testing procedures.

d. Adjustments.

e. Removal and replacement procedures.

f. Repair, cleaning or overhaul instructions.

g. Maintenance.

h. Special workshop tools.

USE AND PRESENTATION OF THE MANUAL

9. Each sub-division deals with one particular aspect or major component directly related to the main subject. Typically, checks and adjustments, removal and replacement, overhaul and repairs, etc are contained separately in individual sub-divisions. Therefore, to locate instructions for removing the engine for example, the user should refer to the Contents page which precedes Section B (Power Unit). Then, on the page given for removal and replacement procedures, the reader will find that Chapter 1 of Sub-section B4 deals with this subject.

MAIN CONTENTS LIST

SECTION CONTENTS LIST

SECTION A

GENERAL INFORMATION AND SPECIFICATIONS

SECTION A

CHAPTER 1

LOCATION OF IDENTIFICATION PLATES

INTRODUCTION

1. The identification plates fitted to this vehicle are described below:

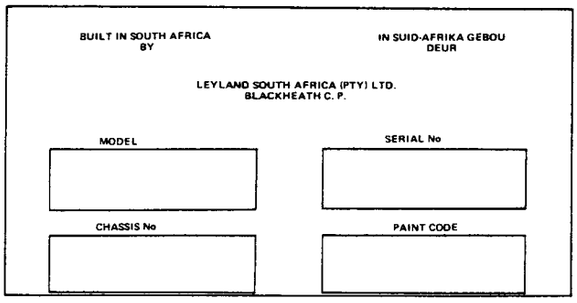


Fig A1

2. Refer to Fig A1. The plate on the right hand wing inside the engine compartment shows:

   Model
   Serial number
   Chassis number
   Paint code

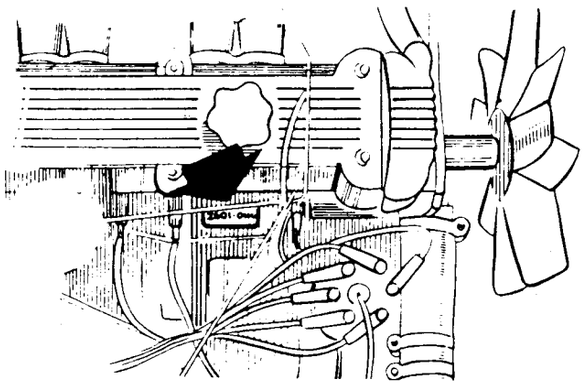


Fig A2

3. Refer to Fig A2. The engine number is stamped onto a machined surface at the right front of the engine.

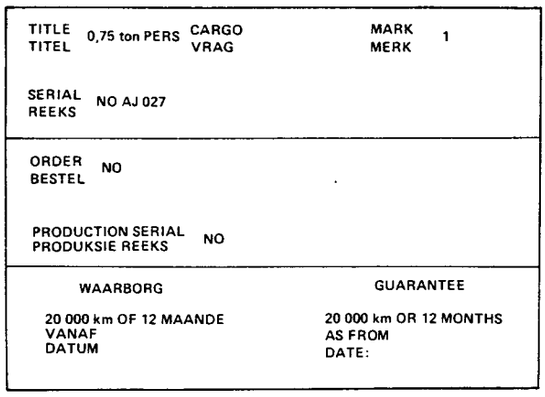


Fig A3

4. Refer to Fig A3. This plate is mounted on the passenger side seat support in the cab. It indicates:

   Title of the vehicle and mark number

   Production serial number
   Guarantee period

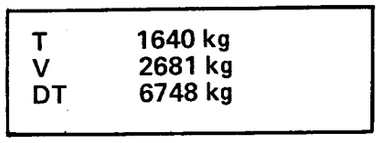


Fig A4

5. Refer to Fig A4. Vehicle masses are shown on a plate behind the left rear wheel arch. They are:

   Vehicle mass (T) : 1640 kg
   Maximum mass of vehicle and load (V) : 2681 kg
   Maximum mass of vehicle, trailer and loads (DT) : 6748 kg

SECTION A

CHAPTER 2

GENERAL INFORMATION

INTRODUCTION

1. The Land Rover is a two or four-wheel drive, general purpose vehicle designed for both on- and off-road use. The power unit is a water cooled, type R6, petrol engine which is coupled via a gearbox and a transfer box, to both the front and rear wheels.

2. The vehicle has a high performance under normal driving conditions. The suspension and overall construction enables the vehicle to reliably traverse rugged terrain with minimum driver discomfort.

POWER UNIT AND TRANSMISSION

3. The power unit is a water cooled, six cylinder petrol engine rated at 82.0 kW at 4750 r/min.

4. Drive is transmitted via a single plate, diaphragm spring clutch to the gearbox. The clutch is hydraulically operated and enclosed within a bell-shaped housing, which is bolted to the front of the gearbox.

5. The gearbox is manually operated and has four forward gears and reverse. All forward gears are of the synchromesh type.

6. The transfer box provides a high and a low range which are selected manually.

AXLES

7. The rear axle and differential assembly is of the spiral bevel type, with fully floating shafts. The ratio to the rear wheels is 4,7:1.

8. The front axle and differential assembly is of the spiral bevel type, with fully encased constant velocity joints transmitting the drive from the differential to the front wheels. The ratio to the front wheels is 4,7:1.

SUSPENSION

9. Leaf springs are fitted longitudinally between the axles and the underside of the chassis. Hydraulic, telescopic shock absorbers are fitted to both axles.

BRAKES

10. The hydraulic braking system is dual line, servo assisted, operating on front and rear wheels. The lockable handbrake acts mechanically on the rear wheels, via a mechanical brake unit mounted on the output shaft from the transfer box.

BODY

11. The body is of solid unitary construction and is mounted on a chassis. The aluminium alloy body panels will not rust or corrode under normal circumstances. Inside the driver's cab, the controls are placed conveniently within reach and vision of the driver.

STEERING

12. The recirculating ball type steering only requires three comma five (3,5) turns from lock to lock. A steering lock is combined with the ignition switch.

ELECTRICAL SYSTEM

13. The electrical system is negative earth, and energised by a 12 V battery. The battery is maintained in a charged state by an alternator. A pre-engaged type starter is fitted for engine starting.

FUEL

14. Twin SU type carburetters fed by an electrically operated fuel pump. A fuel filter unit is fitted to provide additional filtration. The air cleaner is a single element, dry type, fitted with a removable dust cup.

MAINTENANCE REQUIREMENTS

15. The vehicle is designed to minimise maintenance. However, to maintain the vehicle at peak performance, periodic checks and adjustments are necessary. Typically, regular inspections must be made to check oil levels, tightness of fasteners, drive belt tensions, clutch fluid levels, operation of the vehicle, etc. At less frequent intervals it is necessary to repack hubs with grease, check tappet clearances, condition of brake linings, clutch pedal adjustments, specific gravity of battery electrolyte and so on.

16. Maintenance requirements for each assembly or component are detailed at the end of the appropriate Section. It is essential that the maintenance instructions are strictly observed and carried out at the periods indicated.

WORKSHOP REPAIRS TO THE VEHICLE - GENERAL NOTES

17. Many assemblies and components fitted to the vehicles are large and heavy. It is essential, therefore to observe all safety measures when working on the vehicle. Stands and supports should be underrated so that a considerable safety margin is available and to allow for miscalculations of the mass to be supported.

18. Due to the large mass of many assemblies and components, removal and replacement of heavy items should be carried out on a firm surface. Preference should be given to thick concrete floors laid on a well prepared and compact base. If doubt exists or the surface is known to be soft, strong planks should be used if replacement under dangerous conditions cannot be avoided.

19. When recovery vehicles are used in operational areas for removing the engine (for example) it is important that the capacity of the gantry in the extended position is correctly calculated. Once again it is stressed that capacity should be underrated. Preference

should be given to recovery vehicles which are fitted with a gantry which can be extended its length smoothly with the load attached. Recovery vehicles with short gantrys and the need to move the recovery vehicle or the vehicle under repair are not recommended.

20. Dirt, grit, sand, metal filings, etc, cause moving parts to wear quickly. Working areas and parts being repaired must, therefore, be kept clean. Components which are to be refitted must not be placed on dirty surfaces or into dirty containers. Floors and working surfaces should be kept free of oil. When draining oils or disconnecting fuel lines use a suitable container with sufficient size and capacity to avoid spillage. Tools and hands should be kept as clean as is practical and frequent cleaning is recommended. A plentiful supply of clean rags for frequent cleaning of hands and tools is essential. Dirty and oily hands and tools are not only detrimental to good repairs but also prevent safe handling.

SECTION A

CHAPTER 3

VEHICLE SPECIFICATIONS

INTRODUCTION

1. The specifications contained in this Chapter are only intended to provide an overall description of the basic vehicle's content. Detailed specifications of each major component are contained in each Section or Sub-section as appropriate.

ENGINE

2. The main power unit is a normally aspirated, water cooled, petrol engine. The six cylinders are arranged in line, with valve operation via an overhead camshaft.

3. A forced feed lubrication system is employed and a replaceable oil filter filters the oil in the main lubrication circuit.

4. The engine type is as follows:

   a. Type R6
   b. Cylinder capacity 2623 cm^3

FUEL SYSTEM

5. Twin SU type, semi-downdraught carburetters fed by a Facit electric fuel pump. A renewable element type fuel filter is fitted.

6. Petrol is contained in a 90 litre tank under the chassis frame at the rear of the vehicle.

GEARBOX

7. The gearbox is a single helical constant mesh type with synchromesh on all forward gears and the following input/output ratios:

   a. Forward gears: First 3,65:1; Second 2,22:1; Third 1,497:1, Fourth direct

   b. Reverse gear 4,06:1

TRANSFER GEARBOX

8. The transfer gearbox provides a two-speed reduction on the main gearbox output and allows selection of two- or four-wheel drive. The following are the input/output ratios for the transfer box:

   a. High transfer 1,148:1

   b. Low transfer 2,346:1

FRONT AXLE

9. The front axle uses a spiral bevel differential and has enclosed universal joints. Reduction ratio to the wheels is 4,7:1.

REAR AXLE

10. Spiral bevel type with floating shafts. Reduction ratio is 4,7:1.

SUSPENSION

11. Semi-eliptical springs are used for both front and rear suspension and are damped by hydraulic, double acting telescopic shock absorbers.

12. The front of each spring is bolted to brackets fixed to the chassis while the rear is bolted to shackle plates.

WHEELS AND TYRES

13. The wheel size is 550F x 16 and takes cross ply 7.50 x 16 tyres.

BRAKES

14. The following braking systems are fitted to the vehicle:

   a. Footbrake: Hydraulic, dual line, servo assisted system operating drums front and rear.

   b. Handbrake: Drum type, cable operated onto the rear propellor shaft.

HEATING AND VENTILATION

15. Hot engine coolant is switched to a heat exchanger. Fresh air is drawn over the heat exchanger and can be switched to demist the windscreen or through foot level vents to warm the cab. With the coolant switched off, fresh air can be drawn into the cab.

16. Two hand-operated vents below the windscreen can be opened to allow fresh air into the cab.

ELECTRICAL SYSTEM

17. The main components of the electrical system are:

   a. Alternator, 12 V nominal.

   b. Battery, 12 V, 58 Ah.

   c. Starter motor, 12 V, pre-engaged.

STEERING SYSTEM

18. A recirculating ball type operating on the front wheels through a steering relay, track rod and drag link.

DIMENSIONS AND PERMISSIBLE LOADS

19. Principal vehicle dimensions are:

Wheelbase - 109 mm
Overall length - 4450 mm
Maximum width - 1690 mm
Ground clearance - 209 mm
Track - 1395 mm

20. Maximum permissible loads are:

Gross vehicle load - 2681 kg
Gross front axle load - 970 kg
Gross rear axle load - 1905 kg
Maximum trailer load - 4080 kg using trailer with four wheels and independent power brakes

MAXIMUM SPEED

21. Maximum speed for the vehicle is 130 km/h.

SECTION A

CHAPTER 4

DEFINITIONS

INTRODUCTION

1. Terminology in the motor trade varies sometimes from area to area, manufacturer to manufacturer and, therefore, it was decided to include a few defintions of what is meant by certain terms used in this Workshop Repair Manual. It must be borne in mind that the compilers of the list contained herein do not purport that these definitions are the final authority, or in any way exhaustive. This is the work of other bodies and not the purpose of these definitions.

DEFINITIONS

2. The following list of defintions is bounded by the conditions stated in Paragraph 1 :

AXIAL
Forming or belonging to an axis (refer axis).

AXIAL MOVEMENT
Axial movement is a movement of a shaft (or other object) along the line of its axis. Sometimes this is known as end-to-end movement or end play.

AXIS
The axis is an imaginary line about which a body revolves.

BOLT
A bolt is defined in several different ways, one of which includes the length of thread contained on a headed metal pin. However, for the purposes of this manual, a bolt is defined as being a metal pin threaded at one end and a head of any shape at the other end, and used in conjunction with a nut or similar fastener.

BOLTED (-TOGETHER)
The term 'bolted together' is used in this manual to indicate that two or more items are secured to each other by a headed metal pin which is threaded at one end. Nuts may be used to fasten the metal pin or used in conjunction with studs. The actual metal pin may also be a screw (studs and screws are also defined).

BORE (Noun Usage)
The noun bore is used in this manual to indicate that a hole is open at both ends and is circular in shape.

CIRCLIP
A circlip is a small flat strip of springy steel, usually having an oblong-shaped cross section, bent circular but not a complete circle. Some circlips have a hole drilled at each end to facilitate fitment. A circlip may be fitted in a groove around the inside of a bore (hole) or a groove around a shaft or spindle. Little or no side-thrust should be imposed against the circlip.

CLEVIS
A clevis is a U-shaped piece of metal at the end of a metal rod or bar, and used as a linkage. It is not unlike a short-pronged tuning fork in appearance. A hole is drilled near the ends of the two prongs, inside which a clevis pin is fitted. A clevis might be drilled and threaded internally at that part of the U or fork, opposite to the open end, so that a threaded rod can be screwed in. This type of clevis enables the length of the linkage to be adjusted by screwing the threaded rod further in or out.

CLEVIS PIN
A clevis pin fits inside the holes at the end of the two prongs and is used to couple the clevis to its associated linkage. A clevis pin may be headed at one end with a hole drilled through the shank at right angles at the other. In most instances, a split pin is fitted in the hole drilled in the shank.

COTTER
Normally consists of two half moon shaped semi-circular tapered wedges used to hold a spring retainer in position on a stem. eg A valve spring retainer.

DURLOCK BOLTS
Durlock bolts and nuts are a patented design self locking fastener. A locking action is achieved by a specially designed head, which in cross-section is serrated on the gripping face. The Durlock nut is similar in construction. When the nut or bolt is turned in the tightening direction, the sloping edges of the serrations pass normally over the material being fastened together. The peak of the serration bites deep into the material. Movement in the opposite direction (unscrewing) causes the peak of the serration to bite even deeper. Washers of any description must not be used with Durlock bolts and nuts, otherwise the self-locking action will be nullified. All types of self-locking nuts and bolts should not be re-used.

FASTENER

A fastener is a device which is used to secure two or more items together and includes, nuts, bolts, studs, screws, rivets etc. Although in its widest classification, a fastener is often used to describe split pins, circlips etc., it must be remembered that these items are truly retainers, since their inherent strength or method of fitting prohibits significant side thrust or pressure.

LIFTING TACKLE

The term 'lifting tackle' is used in this Workshop Repair Manual, and embraces any device, of sufficient capacity, which raises the item vertically from an overhead position. Block and tackle, handy-billy, endless chain, etc are typical examples of a lifting tackle.

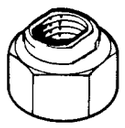
NUTS (Self-locking)

There are several types of self-locking nuts. Usually, the design of the nut is patented.

Nyloc nuts resemble standard type nuts in appearance, except that one end does not have a flat face (rounded). This end is specially designed so that Nyloc material can be inserted during manufacture. Since the hole in the Nyloc is smaller than the bolt diameter, the Nyloc grips the threads and prevents the nut from falling off.

Crimp type nuts resemble standard type nuts in appearance, except that one end does not have a flat face. The shape of this end varies according to design and several types are available. During manufacture, the non-flat face is crimped slightly, and when screwed onto a bolt, it grips the thread and prevents the nut from loosening.

NYLOC NUT



CRIMPED NUT

Durlock nuts are discussed under the heading of Durlock Bolts.

Although design requirements vary from designer to designer and in respect of application, it is not unusual for washers to be omitted when self-locking nuts are used. It is not recommended to re-use self-locking type nuts.

SPLIT PINS

A split pin is a universallv accepted shape, design and application. Its appearance in this list of definitions is only to stress that split pins should not be replaced with pieces of wire, etc. Once used, split pins should be discarded. The application of a split pin should be such that little or no side thrust is exerted against the split pin.

SPRINGS

Springs have a multitude of shapes and applications. Two types are discussed here : compression and tension springs of the coiled variety.

Compression springs are manufactured from coils of spring steel and vary in cross-section shape. The coils may be tighter wound at one end. Usually, the ends are flat and parallel. In its application, the coils of the spring are compressed thus exerting a force in an outwards direction. Springs which are tightly wound at one end should be fitted so that the loosely wound end faces in the direction of movement, ie a poppet valve spring (if tightly wound at one end) is fitted so that the loosely wound end is nearest the cotter (end of valve stem) and at the tightly wound end is nearest the cylinder head (valve seat end).

Tension (return) springs are manufactured from coils of spring steel and vary in cross-section shape. The coils are tightly wound along its entire length. Each end is hooked to enable attachment to the anchoring point and to the component which it is required to return to a desired position. The shape and arrangement of the hooks vary according to application and to suit attachment.

Springs should be replaced when they become unserviceable, such as badly rusted, pitted, cracked, etc. The length of the spring also indicates it's serviceability. A weakened compression becomes shorter and a tension spring becomes longer. Comparison with a new spring will assist in determining original length if this is not known. It should be borne in mind, however, that although of the correct length, the springiness may be insufficient for its application. If this is suspected, the doubtful spring should be compressed or stretched (depending on spring type) using a known force and its length measured. The procedure is repeated with a new spring and the results compared. If a known force is not available, both springs can be fitted end-to-end, then compressed or stretched, as appropriate, and both lengths measured while the force (must be constant) is still applied. It is important to note that whichever method is used, the spring used for comparison purposes must be known to be serviceable. The fact that it is a new spring does not necessarily mean that it is serviceable.

STUDS

The type of stud referred to in this Workshop Repair Manual is threaded at both ends and has a shank similar to a bolt (without a head). In most applications, only one end is secured by a nut, the other end screwed into a threaded hole in one of the items being secured together.

SWIVEL PINS

On a front wheel drive vehicle, drive is imparted from the front axle differential to the front road wheels. The drive is transmitted via a shaft and a constant velocity universal joint. This arrangement prevents the use of a king pin, normally fitted to a standard free-wheeling type front axle, since the king pin would have to pass through the rotating components. Therefore, to overcome this, the pin is manufactured in two halves. One half fits at the top and the other at the bottom of the universal joint housing. These halves are known as swivel pins. The manner in which swivel pins are fitted varies from manufacturer to manufacturer and application to application.

SECTION A

CHAPTER 5

CONVERSION TABLES

INTRODUCTION

1. Throughout the workshop manual, SI (International Metric System) units as approved by the South African Bureau of Standards (SABS) are used. However, since not all countries have adopted the system and others are still in the process of converting to SI units, Workshop personnel will, from time-to-time, encounter measuring devices which are not graduated in SI units.

2. SABS have published a number of very useful booklets which give guidance in these matters, including a comprehensive list of conversions to SI units. However, since these may not be readily to hand at all times, it was considered worthwhile to include a short list of conversion factors covering units of measurement that workshop personnel are likely to meet, when servicing the vehicle.

3. In this respect, two tables are provided. The first, Table A5.1, gives definitions of derived SI units which have special names. The second, Table A5.2, is a short list of useful conversion factors, arranged in alphabetical order. It should be noted that although every reasonable effort has been made to ensure accuracy, the user shall be responsible for verifying that the data given herein is correct, before applying the conversion tables contained in this Sub-section.

TABLE A5.1 DEFINITIONS OF DERIVED UNITS HAVING SPECIAL NAMES

Quantity	SI unit and symbol	Definition
Force	Newton, N	The newton is that force which when applied to a body having a mass of 1 kg, gives it an acceleration of 1 m/s^2.
Pressure, stress	Pascal, Pa	The pascal is the pressure which results when a force of 1 N is applied evenly and perpendicularly to an area of 1 m^2.
Power	Watt, W	The watt is the power which results in the production of energy at the rate of 1 J/s (joule per second).
Electric potential difference (electromotive force)	Volt, V	The volt is the potential difference between two points of a conducting wire carrying a constant current of 1 A, when the power dissipated between these points is equal to 1 W.
Capacitance	Farad, F	The farad is the capacitance of a capacitor between the plates of which there appears a potential difference of 1 V when it is charged with an electric charge equal to 1 C (Coulomb).
Electric resistance	Ohm (Ω)	The ohm is the electric resistance between two points of a conductor when a constant potential difference of 1 V, applied between these two points, produces a current of 1 A, the conductor not being the source of any electronic force.

TABLE A5.2 LIST OF CONVERSION FACTORS TO SI UNITS
(SI SYMBOLS ARE GIVEN IN BRACKETS)

To convert from	To	Multiply by
Abampere (biot)	Ampere (A)	*1 x 10
Abohm	Ohm (Ω)	*1 x 10^{-9}
Abvolt	Volt (V)	*1 x 10^{-8}
Ampere (International, 1948)	Ampere (A)	0,9998 35
Astronomical unit	Metre (m)	1,496 x 10^{11}
Atmosphere (standard)	Pascal (Pa)	*1,013 25 x 10^{5}
Atmosphere (technical) (1 kgf/cm^2)	Pascal (Pa)	9,806 65 x 10^{4}
Atomic mass unit (unified)	Kilogram (kg)	1,660 531 x 10^{-27}
Bar	Pascal (Pa)	*1 x 10^{5}
Biot (abampere)	Ampere (A)	*1 x 10
Cheval vapeur or metric horsepower	Watt (W)	7,354 99 x 10^{2}
Cubic foot	Cubic metre (m^3)	2,831 685 x 10^{-2}
Cubic foot per minute	Cubic metre per second (m^3/s)	4,719 474 x 10^{-4}
Cubic foot per second	Cubic metre per second (m^3/s)	2,831 685 x 10^{-2}
Cubic inch	Cubic metre (m^3)	*1,638 706 4 x 10^{-5}
Cubic inch per minute	Cubic metre per second (m^3/s)	2,731 177 x 10^{-7}
Cubic inch per pound	Cubic metre per kilogram (m^3/kg)	3,612 729 x 10^{-5}
Cubic yard	Cubic metre (m^3)	0,7645 549
Cubic yard per minute	Cubic metre per second (m^3/s)	1,274 258 x 10^{-2}
Degree Celsius (particular temperature)	Kelvin (K)	use $T = t_C + 273,15$
Degree Celsius (temperature interval)	Kelvin (K)	*1
Degree Fahrenheit (particular temperature)	Kelvin (K)	use $T = \frac{(t_F + 459,67)}{1,8}$
Degree Fahrenheit (temperature interval)	Kelvin (K)	0,555 556
Electrostatic unit of potential	Volt (V)	2,997 925 x 10^{2}
Electrostatic unit of resistance	Ohm (Ω)	8,987 554 31 x 10^{11}
Foot pound-force (torque)	Newton metre (N.m)	1,355 818
Foot pound-force per second	Watt (W)	1,355 818
Horsepower (electrical)	Watt (W)	*7,46 x 10^{2}
Horsepower (550 foot pounds-force per second)	Watt (W)	7,456 999 x 10^{2}
Horsepower (metric or cheval vapeur)	Watt (W)	7,345 99 x 10^{2}
Inch	Metre (m)	*2,54 x 10^{-2}
Inch of mercury (32 °F)	Pascal (Pa)	3,386 389 x 10^{3}
Inch of mercury (60 °F)	Pascal (Pa)	3,376 85 x 10^{3}
Inch of water (39,2 °F)	Pascal (Pa)	2,490 82 x 10^{2}
Inch of water (60 °F)	Pascal (Pa)	2,488 4 x 10^{2}
Inch per minute	Metre per second (m/s)	4,233 333 x 10^{-4}
Kilogram-force	Newton (N)	*9,806 65
Kilogram-force metre (torque)	Newton metre (N.m)	*9,806 65
Kilogram-force per square centimetre	Pascal (Pa)	*9,806 65 x 10^{4}
Ohm (international, 1948)	Ohm (Ω)	1,000 495
Ounce-force	Newton (N)	0,2780 139
Ounce-force inch (torque)	Newton metre (N.m)	7,061 552 x 10^{-3}
Torr	Pascal (Pa)	1,333 223 7 x 10^{2}

* Exact values

SUB-SECTION A6

MISCELLANEOUS TIGHTENING RECOMMENDATIONS FOR METRIC THREADS

TABLE A6.1 STANDARD TIGHTENING TORQUE FOR NUTS AND BOLTS

CLASS OF FASTENERS		6,9	8,8	10,9	12,9
NUTS AND BOLTS		TORQUE (N.m)			
Diameter	Thread Pitch				
M4		2,4	2,9	4,1	4,9
M5		5,0	6,0	8,5	10,0
M6		8,5	10,0	14,0	17,0
M8	1	23,0	27,0	38,0	45,0
M8		21,0	25,0	35,0	41,0
M10	1	46,0	55,0	77,0	92,0
M10	1,25	44,0	52,0	73,0	88,0
M10		41,0	49,0	69,0	83,0
M12	1,25	80,0	95,0	135,0	160,0
M12	1,5	76,0	90,0	125,0	150,0
M12		72,0	86,0	120,0	145,0
M14	1,5	125,0	150,0	210,0	250,0
M14		115,0	135,0	190,0	230,0
M16	1,5	190,0	225,0	315,0	380,0
M16		185,0	210,0	295,0	355,0
M18	1,5	295,0	325,0	460,0	550,0
M18	2	265,0	310,0	440,0	530,0
M18		245,0	290,0	405,0	485,0
M20	1,5	385,0	460,0	640,0	770,0
M20	2	370,0	440,0	620,0	740,0
M20		345,0	410,0	580,0	690,0
M22	1,5	520,0	610,0	860,0	1 050,0
M22	2	500,0	600,0	840,0	1 000,0
M22		465,0	550,0	780,0	930,0
M24	1,5	690,0	820,0	1 150,0	1 400,0
M24	2	650,0	780,0	1 100,0	1 300,0
M24		600,0	710,0	1 000,0	1 200,0
M26	1,5	880,0	1 050,0	1 470,0	1 760,0
M27	2	970,0	1 150,0	1 600,0	1 950,0
M27		890,0	1 050,0	1 500,0	1 800,0
M28	1,5	1 070,0	1 270,0	1810,0	2 170,0
M30	1,5	1 400,0	1 650,0	2 300,0	2 750,0
M30	2	1 350,0	1 600,0	2 250,0	2 700,0
M30		1 300,0	1 450,0	2 000,0	2 400,0

NOTES

1. Before using the torque specifications given in Table A6.1 above, the user should verify that special methods of tightening are not applicable. Therefore, refer in the first instance to the tightening tables and instructions in the relevant section.

2. The values given in Table A6.1 apply only to untreated or phosphated bolts (unlubricated) and to instances where the same grade of material is used for both bolt and nut, ie. bolt 8,8, nut 8.

3. Special values based on the waist cross section apply to necked-down bolts (refer Table A6.4).

4. In instances where gaskets, packing, softer grade materials, unclassified fasteners, etc are used, the torque applied should not exceed 75 percent of the specifications given in Table A6.1, left column (Class 6,9). If doubt exists, the manufacturer of the fasteners should be consulted.

TABLE A6.2 TORQUE VALUES FOR PIPE CONNECTIONS

CONNECTION		
Diameter	**Thread Pitch**	**Torque (N.m)**
M10	1,0	16
M12	1,5	28
M14	1,5	33
M16	1,5	38
M18	1,5	46
M20	1,5	56
M22	1,5	68
M24	1,5	87
M26	1,5	91
M27	2,0	102
M30	1,5	105
M32	1,5	110
M35	1,5	125
M38	1,5	130
M40	1,5	160
M42	1,5	175
M45	1,5	175
M48	1,5	190

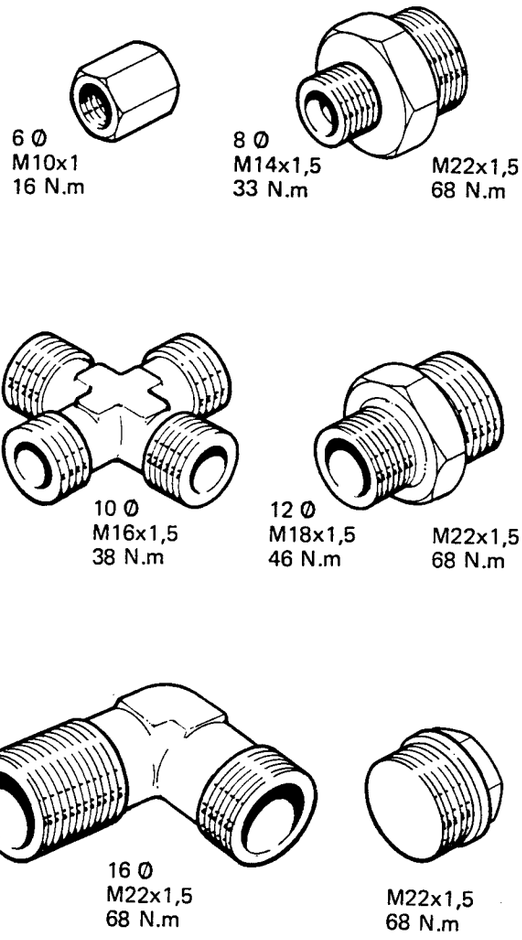
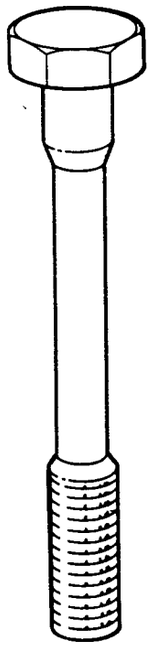


TABLE A6.3 TORQUE VALUES FOR CASTLENUTS ON BALL JOINTS

CASTLE NUT		
Diameter	**Thread Pitch**	**Torque (N.m)**
M16	1,5	100
M18	1,5	150
M20	1,5	200
M24	1,5	250

TABLE A6.4 TORQUE VALUES FOR WAISTED SHANK (NECKED-DOWN) BOLTS

CLASS OF FASTENERS		6,9	8,8	10,9	12,9
Diameter	Thread Pitch	TORQUE (N.m)			
M4		1,2	1,5	2,1	2,6
M5		2,7	3,2	4,5	5,4
M6		4,6	5,4	7,8	9,3
M8		11,7	13,7	19,6	23,5
M8	1	13,7	16,6	22,5	27,4
M10		24,5	28,4	40,2	48,0
M10	1,25	26,4	32,3	45,1	53,9
M12		43,1	51,0	72,5	86,3
M12	1,25	51,0	59,8	84,3	103,0
M12	1,5	47,0	55,9	78,4	94,1
M14		69,6	82,4	117,7	137,3
M14	1,5	79,4	94,1	132,4	156,9
M16		112,8	132,4	186,3	220,7
M16	1,5	122,6	147,1	206,0	250,1
M18		152,0	176,5	250,1	299,2
M18	1,5	186,3	220,7	300,0	372,7
M20		220,7	259,9	367,8	441,4
M20	1,5	259,9	309,0	436,5	519,9
M22		304,0	358,0	510,1	508,2
M22	1,5	358,0	421,8	598,4	716,1
M24		382,5	451,2	637,6	765,1
M24	2	441,4	519,9	735,7	882,9
M27		588,6	686,7	971,1	1 177,2
M27	2	657,2	774,9	1 079,1	1 324,3
M30		784,8	931,9	1 324,4	1 569,6
M30	2	931,9	1 128,2	1 569,6	1 863,9



NOTES

1. Before using the torque specifications given in Table A6.4 above, the user should verify that special methods of tightening are not applicable. Therefore, refer in the first instance to the tightening tables and instructions in the relevant section.

2. The values given in Table A6.4 apply only to untreated or phosphated bolts (unlubricated) and to instances where the same grade of material is used for both bolt and nut, ie. bolt 8,8 nut 8.

SECTION A

CHAPTER 7

LOCTITE USAGE INSTRUCTIONS

PRE-TREATMENT

1. All parts must be free of oil and water; using trichloroethylene, perchloroethylene, chlorothene for cleaning etc would be best, or similar grease solvents. Be sure that the solvents have completely dissipated before applying Loctite. Non-metals, parts with natural or synthetic oxide films, as well as electroplated surface layers must be pretreated with an activator to ensure normal curing. Always use activator for repairs, since this will considerably shorten the curing period. 'Activator T' is recommended.

APPLICATION

2. Apply a few drops on parts or dip parts, then assemble. When using Loctite for blind holes, the tapped hole should also be coated and not only the screw, so that the escaping air will not force the Loctite out.

CURING

3. Curing time is approximately 24 hours; 40 percent of the final hardness is already obtained after 2 to 4 hours. Heating the parts to approximately 120 ^{o}C will provide full shear strength already after approximately 15 minutes.

DISASSEMBLY

4. Connections secured with Loctite can be released again with standard tools. If strongly attached, heat parts to approximately 250 ^{o}C and dismount immediately. The lock will become tight again after cooling down.

REASSEMBLY

5. Parts previously assembled with Loctite may be used again after applying a few drops of Loctite. It is not necessary to remove hardened Loctite, but parts should be dry and free of grease. Remove loose Loctite remainders with a wire brush or compressed air.

SURFACE ROUGHNESS

6. Fixing forces increase with rising surface roughness. The most favourable result is obtained at an average peak-to-valley height of 12 microns (µ) or more.

TEMPERATURE RANGE

7. Loctite products are applicable from –80 ^{o}C to 200 ^{o}C. At temperatures of approximately 260 ^{o}C to 320 ^{o}C Loctite will begin to dissolve. Brittleness will start when temperatures are very low.

STRENGTH

8. Upon curing, Loctite has a shear strength of between 490 kPa to 34 MPa depending on type. Compression strength varies, depending on type, between 340 MPa to 490 MPa without any permanent deformation worth mentioning.

STORAGE

9. Loctite taken from its container should never be poured back, since any contamination entering the container will cure or pre-harden its content. Protect against sunshine and heat. Never store Loctite in metal containers or excluded from air. Loctite products are completely non-toxic.

SECTION A

CHAPTER 8

RECOMMENDED LUBRICANTS AND FLUIDS

INTRODUCTION

These recommendations apply to temperate climates where operation temperatures are above −10°C (14°F). Information on recommended lubricants for under extreme winter conditions can be obtained from Leyland S.A. (Pty.) Limited, Technical Department. Lubricants marked with an asterisk (*) are multi-grade oils suitable for all temperature ranges.

TABLE A8.1 - RECOMMENDED LUBRICANTS AND FLUIDS

COMPONENTS	SAE	BP	CASTROL	DUCKHAM'S	ESSO	MOBIL	CALTEX	SHELL
Engine Carburettor Dash Pots	** 20W	*BP Super Visco-Static 20-500**	*Castrol GTX	Duckham's Q20-50 Motor Oil	Extra 20W-50	Mobiloil Super or Mobiloil Special 20W-50	Supreme 5-Star 20W-50	*Shell Super Oil
Main gearbox Transfer box	90EP GL5	BP Hypo GL 5 EP 90	Castrol Hypoy B90 EP	Duckham's Hypoid 90 GL5	GX 85W-90	HD 80W/90	Multi-purpose Thuban 90 EP	Spirax HD 80W/90
Front differential Rear differential Swivel housing, R.H. Swivel housing, L.H. Steering box Steering relay	90EP	BP Hypo-gear SAE 90EP	Castrol Hypoy B90 EP	Duckham's Hypoid 90	GX 85W-90	Mobilube HD 80W/90	Multi-purpose Thuban EP 90	Spirax HD 80W/90
Drag link ball joint, R.H. Drag link ball joint, L.H. Track rod ball joint, R.H. Track rod ball joint, L.H. Longitudinal arm ball joint, front Longitudinal arm ball joint, rear Front hub, R.H. Front hub, L.H. Rear hub, R.H. Rear hub, L.H. Front propeller shaft Rear propeller shaft		BP Energrease L2	Castrol LM Grease	LB10 Grease	Esso Multi-purpose grease H	Mobil-grease MP or Mobil-grease Super	Marfak All purpose	Retinax or Darina AX
Radiator (anti-freeze solution) Any anti-freeze solution conforming to S.A.B.S.		BP Anti-frost	Castrol Anti-freeze	'Standard' Anti-freeze	Esso Anti-freeze	Mobil Per-mazone	P.I. Anti-freeze	Shell Anti-freeze
Clutch fluid reservoir Brake fluid reservoir	Castrol Girling Brake and Clutch Fluid 'Crimson'. Specification J.1703D or Unipart Brake and Clutch Fluid type 410 (coloured crimson) or type 550 (coloured green).							

NOTE
If SAE 20 grade oil is not available, SAE 30 may be used.

SECTION CONTENTS LIST

SECTION B

POWER UNIT

SUB-SECTION CONTENTS LIST

SUB-SECTION B1

DESCRIPTION AND SPECIFICATIONS

SUB-SECTION B1

CHAPTER 1

DESCRIPTION OF THE ENGINE

INTRODUCTION

1. The power unit fitted to the Land Rover is a type R6 petrol engine. The six in-line cylinders are water cooled and are fed by twin carburetters bolted to the inlet manifold on the left hand side of the engine.

CRANKSHAFT

2. The crankshaft is secured to the underside of the crankcase by seven journal bearings. Bearing shells (two halves per bearing) are fitted between the crankshaft journals and piston connecting rod big end. A timing gear and harmonic balancer/vibration damper are fitted at the front of the crankshaft and a flywheel is fitted at the rear end.

CAMSHAFT

3. An overhead camshaft is used and is chain driven from the crankshaft gear giving a 2:1 reduction. The chain runs over guides, one of which is adjustable, to give initial tension. A spring loaded tensioner is also fitted to take up wear stretch in the chain.

IGNITION

4. The spark plugs are fed from a distributor fitted to the right hand side of the engine. The distributor is driven by a worm gear on the crankshaft through a hollow shaft which also provides the drive for the oil pump.

LUBRICATION

5. The oil pump is fitted in the front of the sump and is driven by a shaft fitted inside the hollow distributor drive shaft. Oil from the pump is circulated through a cooler mounted directly under the radiator and also to various parts of the engine.

COOLING

6. A water pump, belt driven from a pulley on the crankshaft, circulates coolant through the engine and radiator. Cooling is assisted by a viscous drive fan mounted behind the radiator.

SUB-SECTION B1

CHAPTER 2

ENGINE SPECIFICATIONS

INTRODUCTION

1. General data for the engine is given in Table B1.1 and engine torque specifications are shown in Table B1.2.

TABLE B1.1 - GENERAL DATA

ITEM	DESCRIPTION
ENGINE	
Type	R6
Number of cylinders and valve operation	6 cylinder overhead camshaft
Bore	76,2 mm
Stroke	95,76 mm
Cubic capacity	2,623 litre
Firing order	1 - 5 - 3 - 6 - 2 - 4
Compression ratio	8,75 : 1
Torque	201 Nm at 2200 r/min
Maximum output	82 kW at 4750 r/min
Engine idle speed	650 r/min
Fast idle	1200 r/min
Compression pressure - Cranking (hot)	1240 kPa
Oversize bore - first	±0,254 mm
- maximum	±0,508 mm
CRANKSHAFT	
Type	7 main bearing journals
Material	Forged steel, counter balanced
Main journal diameter - standard	60,353 - 60,371 mm
Minimum permissable regrind diameter	59,337 mm
Crankpin journal diameter - standard	47,643 - 47,661 mm
Minimum permissable regrind diameter	47,135 - 47,153 mm
Crankshaft end float	0,1524 mm
Crankpin width	22,50 - 22,55 mm
MAIN BEARINGS	
Type	Replaceable thin wall shell type
Bearing material	Steel backed reticular tin aluminium
Bearing width	20,60 - 20,85 mm
Undersize bearings available	0,254 mm – 0,508 mm –0,7622 mm –1,016 mm
Thrust washer thickness - standard	2,31 - 2,36 mm
Side clearance between thrust washers and crankshaft	0,1524 mm
Thrust taken at	Centre main bearing
Diametral clearance	0,023 - 0,069 mm
Tunnel bore diameter	64,008 - 64,021 mm
BIG END BEARINGS	
Type	Replaceable thin wall shell type
Bearing material	Steel backed reticular tin aluminium
Bearing width	16,8 mm
Diametral clearance	0,025 - 0,063 mm
Undersize bearings	–0,254 mm –0,508 mm
CONNECTING RODS	
Type	Horizontally split big end. Interference fit small end
Length between centres	148,03 - 148,13 mm
Side clearance - rod to crankshaft	0,152 - 0,254 mm
Small end bore diameter	20,60 - 20,612 mm
Big end bore diameter	51,33 - 51,34 mm
Width	22,33 mm

PISTONS		
Type	Aluminium alloy-solid skirt - slotted	
Clearance bottom of skirt	0,203 - 0,033 mm	
Ovality-top of skirt	0,33 - 0,38 mm	
Piston head capacity	10 cc ± 0,25 cc	
Gudgeon pin bore diameter	20,645 - 20,650 mm	
Pistons-oversize available	+ 0,254 mm + 0,508 mm	
Compression height - centre of gudgeon to top of piston	35,63 - 35,84 mm	
PISTON RINGS		
Number per piston	3	
Top ring type	Cast iron-chrome faced	
Second ring type	Cast iron torsional scraper	
Oil control ring type	Slotted segmental	
Width - top ring	1,588 - 1,562 mm	
- second ring	1,588 - 1,562 mm	
Groove clearance - top ring	0,038 mm	
- second ring	0,038 mm	
Ring gap fitted - top ring	0,203 - 0,43 mm	
- second ring	0,203 - 0,43 mm	
GUDGEON PINS		
Type	Interference fit in connecting rod	
Fit in connecting rod (interference)	0,023 - 0,038 mm	
Fit in piston (clearance)	0,0076 - 0,0152 mm	
Outside diameter	20,635 - 20,638 mm	
CAMSHAFT		
Material	Cast iron - 4 bearings	
Journal diameter - first	49,185 - 49,197 mm	
- second	49,975 - 49,987 mm	
- third	50,762 - 50,775 mm	
- fourth	51,534 - 51,569 mm	
Diametrical bearing clearance	0,0254 - 0,0508 mm	
End float (maximum)	0,05 - 0,17 mm	
Chain pitch and number of pitches	9,50 mm x 108	
Timing marks	Sprocket and carrier marks	
TAPPETS		
Material	Forged steel - hardened	
Type	Inverted bucket	
Outside diameter	30,129 - 30,145 mm	
Clearance between tappet and bore	0,018 - 0,053 mm	
Shim adjustment	2,03 - 2,59 mm	
VALVES		
Head diameter - inlet (nominal)	38,10 mm	
- exhaust (nominal)	30,91 mm	
Stem diameter - inlet and exhaust (standard	7,912 - 7,925 mm	
- inlet and exhaust (oversize)	8,039 - 8,052 mm (Service only)	
Stem to guide clearance - inlet and exhaust	0,025 - 0,050 mm	
Seat angle - inlet and exhaust	45,5° (cylinder head 45°)	
Valve seat width - inlet (nominal)	1,72 mm	
- exhaust (nominal)	2,69 mm	
Valve clearance - inlet	0,40 - 0,46 mm	Reset when any clearance has closed
- exhaust	0,51 - 0,56 mm	to 0,31 mm
Valve timing - inlet opens	9°4′ B.T.D.C.	
- inlet closes	50°56′ A.B.D.C.	
- exhaust opens	48°56′ B.B.D.C.	at 0,53 mm valve clearance
- exhaust closes	11°4′ A.T.D.C.	
Valve lift - inlet and exhaust	9,14 mm	
VALVE SPRINGS		
Type	Left hand-single wound	
Free length - inlet and exhaust	45,64 mm	
Number of working coils - inlet and exhaust	5,5	
Fitted length - inlet and exhaust	34,92 mm	
Load at fitted length	231 N	
Length at full lift - inlet and exhaust	25,78 mm	
Load at full lift	427 N	

VALVE GUIDES	
Type	Integral with cylinder head
Inside diameter	7,950 - 7,962 mm
Distance spring seat to top of guide - inlet	28,20 mm
- exhaust	25,40 mm
FLYWHEEL	
Number of teeth - ring gear	156
Outside Diameter	296,275 - 295,199 mm
Ring gear - inside diameter	294,141 - 294,168 mm
Flywheel - Run-out (assembled to crank)	0,203 mm maximum
Flywheel thickness	50 mm
ENGINE LUBRICATION SYSTEM	
Oil pump - make	Concentric
- type	Eccentric rotor
- relief valve	Sealed unit
- relief valve opens	425 kPa
Oil filter - make	G.U.D.Z120
- type	Full flow sealed unit
- by-pass valve opens	48,2-68,8 kPa
Oil pressure - normal running	276-475 kPa at 4000 engine r/min
- minimum idling	138 kPa at 650 engine r/min

TABLE B1.2 - TORQUE SPECIFICATIONS

ITEM	TORQUE (N.m)
Cylinder head bolts	90
Cam carrier to cylinder head	27
Camshaft sprocket	47
Camshaft cover	8
Thermostat housing to cylinder head	10-13
Manifold to cylinder head	24-27
Carburetter studs	8-10
Water pump set screws	24-27
Water pump pulley	24
Crankshaft pulley bolt	81-95
Timing chain guide strips	24-27
Timing cover	24-27
Pivot pin	24-27
Front cover bolts	27
Big end nuts	42-47
Main bearing bolts	95
Flywheel bolts	81-88
Oil pump mounting bolt 1/4 in. UNC	8-10
Oil pump mounting bolt 3/8 in. UNC	27-33
Oil reservoir 1/4 in. UNF bolts	34
Oil reservoir no. 10 screws	17
Oil reservoir drain plug	16-20

SUB-SECTION B2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This sub-section deals with fault diagnosis and suggested action to cure a fault. Table B2.1 gives a list of symptons, the probable cause and necessary remedial action. The Table is not exhaustive and faults may occur which are not listed. In this case the suspected components should be removed for closer inspection and/or overhaul.

TABLE B2.1 - ENGINE FAULT DIAGNOSIS CHART

SYMPTON	POSSIBLE CAUSE	REMEDY
Engine fails to start	Incorrect starting procedure.	See instruction manual.
	Starter motor speed too slow.	Check battery and connections.
	Faulty ignition system.	Rectify or renew.
	Water or dirt in fuel system.	Rectify.
	Carburetter(s) flooding.	Rectify.
	Defective fuel pump system.	Rectify or renew.
	Defective starter motor.	Rectify or renew.
	Starter pinion not engaging.	Remove starter motor and investigate.
Engine stalls	Low idling speed.	Adjust carburetter.
	Faulty sparking plugs.	Clean and test, renew if necessary.
	Faulty coil or condenser.	Renew.
	Faulty distributor points.	Rectify or renew.
	Incorrect mixture.	Adjust carburetter.
	Foreign matter in fuel system.	Rectify.
Lack of power	Poor compression.	If the compression is appreciably less than the correct figure, the piston rings or valves are faulty. Low pressure in adjoining cylinders indicates a faulty cylinder head gasket.
	Badly seating valves.	Rectify or renew.
	Faulty exhaust silencer.	Renew.
	Incorrect ignition timing.	Rectify.
	Leaks or restrictions in fuel system.	Rectify.
	Faulty sparking plugs.	Rectify.
	Excessive carbon deposit.	Decarbonise.
	Brakes binding.	Rectify.
	Faulty coil, condenser or battery.	Rectify or renew.
Engine runs erratically	Faulty electrical connections.	Rectify.
	Defective sparking plugs.	Rectify or renew.
	Low battery charge.	Recharge battery.
	Defective distributor.	Rectify.
	Foreign matter in fuel system.	Rectify.
	Faulty fuel pump.	Renew.
	Sticking valves.	Rectify or renew.
	Defective valve springs.	Renew.
	Incorrect ignition timing.	Rectify.
	Worn valve guides or valves.	Renew.
	Faulty cylinder head gasket.	Renew.
	Damaged exhaust system.	Rectify or renew.
	Vacuum pipes disconnected at inlet manifold or distributor.	Refit pipes.
Engine starts, but stops immediately	Faulty electrical connections.	Check HT leads for cracked insulation: check low tension circuit.

	Foreign matter in fuel system. Faulty fuel pump. Low fuel level in tank.	Rectify. Renew. Replenish.
Engine fails to idle	Incorrect carburetter setting. Faulty fuel pump. Sticking valves. Faulty cylinder head gasket(s).	Rectify. Renew. Rectify or renew. Renew.
Engine misfires on acceleration	Distributor points incorrectly set. Faulty coil or condenser. Faulty sparking plugs. Faulty carburetter. Vacuum pipes disconnected at inlet manifold.	Rectify. Renew. Rectify. Rectify or renew. Check all vacuum connections.
Engine backfires	Ignition defect. Carburetter defect. Sticking valve. Weak valve spring. Badly seating valves. Excessively worn valve stems and guides. Excessive carbon deposit. Incorrect sparking plug gap. Air leak in induction or exhaust systems.	Rectify. Rectify. Rectify. Renew. Rectify or renew. Renew. Decarbonise. Reset. Renew faulty gaskets or components.
Burned valves	Sticking valves. Weak valve springs. Excessive deposit on valve seats. Distorted valves. Excessive mileage between overhauls.	Rectify. Renew. Recut. Renew. Decarbonise.
Noisy valve mechanism	Worn or scored parts in valve operating mechanism. Valves and seats cut down excessively, raising end of valve stem 1,27 mm (0.50 in) above normal position. Sticking valves. Weak valve springs. Worn timing chain or chain-wheels.	Replace faulty parts. Grind off end of valve stem or replace parts. Rectify. Renew. Renew worn parts.
Main bearing rattle	Low oil level. Low oil pressure. Excessive bearing clearance. Burnt-out bearings. Loose bearing caps.	Replenish as necessary. See next sympton. Renew bearings; grind crank-shaft. Renew. Tighten.
Low oil pressure warning light remains on, engine running.	Thin or diluted oil. Low oil level. Choked pump strainer. Faulty release valve. Excessive bearing clearance. Oil pressure switch unserviceable. Electrical fault. Relief valve plunger sticking. Weak relief valve spring. Pump rotors excessively worn. Excessively worn bearings; main connecting rod, big end, camshaft etc.	Drain and refill with correct oil. Replenish. Clean. Rectify. Rectify. Renew. Check circuit. Remove and ascertain cause. Renew. Renew. Ascertain which bearings and rectify.
Rattle in lubrication system	Oil pressure relief valve plunger sticking.	Remove and clean.
Engine overheating	Low coolant level. Faulty cooling system. Faulty thermostat. Incorrect timing. Defective lubrication system.	Check for leaks. Rectify. Renew. Rectify. Rectify.

SUB-SECTION B3

VALVE CLEARANCE - CHECK AND ADJUST

PRELIMINARIES

1. Before the valve clearance can be checked the following should be carried out:

   (1) Remove the cam cover (see Sub-section B4, Chapter 11).

   (2) Remove the spark plugs ((4) on Fig B3.1).

CHECKING CLEARANCES

2. Check as follows:

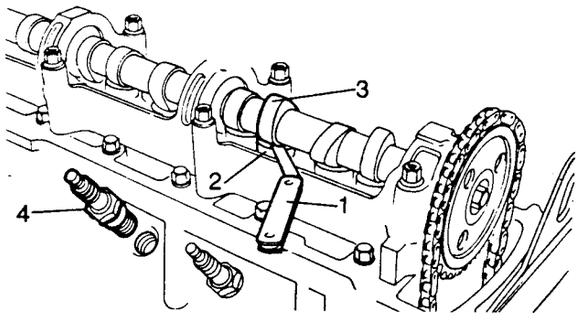


Fig B3.1

(1) Refer to Fig B3.1. To check the clearance use a feeler gauge (1) between the cam lobe (2) and cam follower (3) of each valve and record the clearance measured.

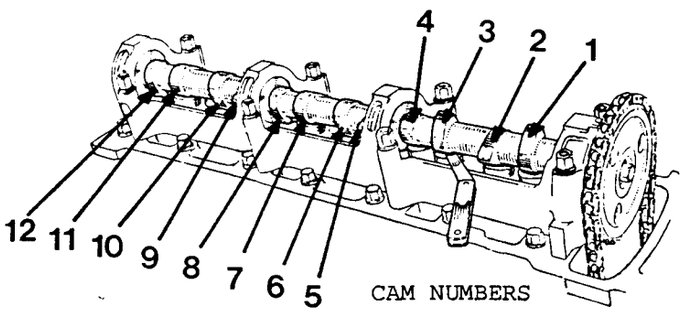


Fig B3.2

(2) Refer to Fig B3.2. Turn the camshaft against the normal direction of rotation and measure the clearance in the following order:

Check cam No	With cam No fully open
1	12
7	6
9	4
2	11
5	8
10	3
12	1
6	7
4	9
11	2
8	5
3	10

3. Under a normal service check, adjustment is only necessary if the clearance (inlet and exhaust) is less than 0,31 mm. When new components have been fitted or valves have been reground, adjust the tappet clearances to the standard settings given in Sub-section B1, Chapter 2.

ADJUSTING

4. All cams which have recorded measurements outside the recommended tolerances should be adjusted at the same time. Make sure which cams are to be adjusted, then:

   (1) Remove the cam followers (see Sub-section B4, Chapter 4, steps (1) to (8).

   (2) On the bench, remove the cam followers of the valves to be adjusted, keeping them separate and referring them to their respective guides.

   (3) Calculate the shim thickness required for each follower in turn by:

      i. Remove the shim from the cam follower and make a note of its thickness.

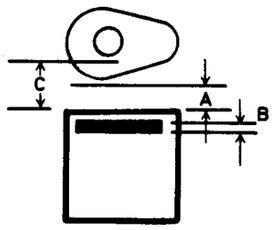


Fig B3.3

      ii. Refer to Fig B3.3. Call the measured clearance A, the shim thickness B and the required clearance C.
      Note that C = 0,40 to 0,46 mm for inlet valves and 0,51 to 0,56 mm for exhaust valves.

iii. Calculate for each follower the shim thickness required, in the following manner:

A + B – C= shim thickness.

Example:
Measured clearance A = 0,24 mm
Shim thickness B = 2,72 mm
Inlet valve clearance C = 0,40 to 0,46 mm
Shim thickness required: A + B – C
= 0,24 + 2,72 – 0,40 to 0,46 mm
= 2,50 to 2,56 mm

(4) Shims available are shown in the table below:

TABLE B3.1 - SHIMS AVAILABLE

REF	THICKNESS	REF	THICKNESS
97	2,47 mm	13	2,87 mm
99	2.52 mm	15	2,93 mm
01	2,56 mm	17	2,98 mm
03	2,62 mm	19	3,03 mm
05	2,67 mm	21	3,08 mm
07	2,72 mm	23	3,13 mm
09	2,77 mm	25	3,18 mm
11	2,83 mm	27	3,23 mm

(5) In the example above it can be calculated that using a shim of 2,52 mm will give a thickness which is between the required limits.

(6) The old shim may be discarded.

(7) Smear the new shim with petroleum jelly and fit it into the cam follower.

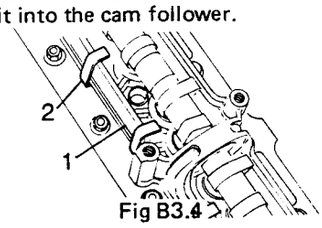


Fig B3.4

(8) Refer to Fig B3.4. Fit the followers (1) into their respective guides and hold them in place with the retaining clips (2) (special tool 18G 1218).

(9) Refit the camshaft carrier (see Sub-section B4, Chapter 4, Para 2, steps (4) to (15)) and re-check valve clearances.

SUB-SECTION CONTENTS LIST

SUB-SECTION B4

REMOVAL AND REPLACEMENT PROCEDURES

SUB-SECTION B4

CHAPTER 1

ENGINE - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the engine as detailed below:

   (1) Drain the engine oil.

   (2) Remove the bonnet (see Sub-section M3, Chapter 1).

   (3) Disconnect the battery earth lead (see Sub-section O5, Chapter 3).

   (4) Remove the radiator (see Sub-section E4, Chapter 1) and grille panel (see Sub-section M3, Chapter 6).

   (5) Remove the gearbox tunnel cover (see Sub-section M3, Chapter 5).

   (6) Disconnect the two exhaust pipes from the manifold (see Sub-section F3, Chapter 2).

   (7) Disconnect the oil cooler pipes from the filter (see Sub-section B4, Chapter 22).

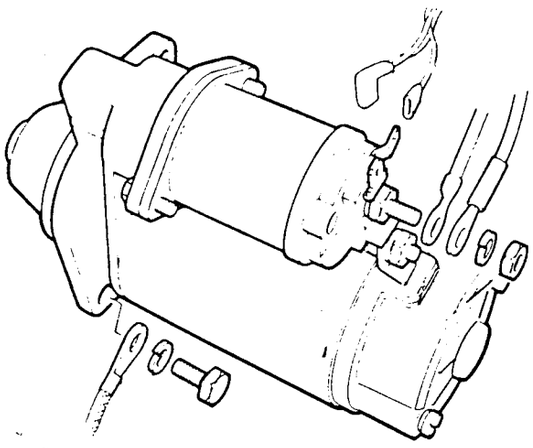


Fig B4.1

(8) Refer to Fig B4.1. Disconnect five electrical leads from the starter motor.

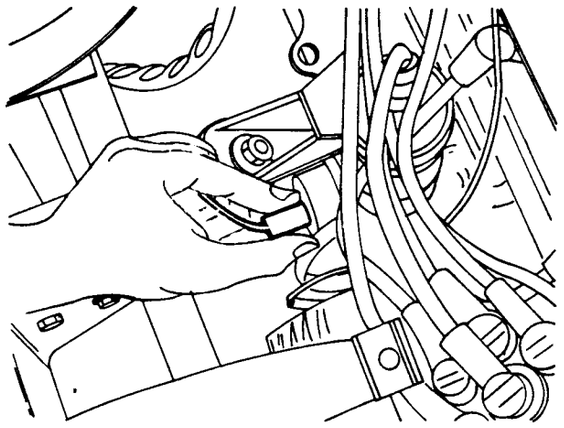


Fig B4.2

(9) Refer to Fig B4.2. Disconnect the oil pressure switch lead.

(10) Disconnect the engine earth cable at the chassis.

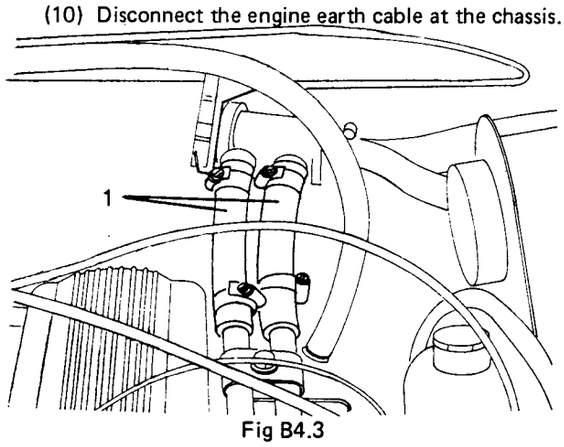


Fig B4.3

(11) Refer to Fig B4.3. Disconnect the heater hoses (1) from the heater water valve.

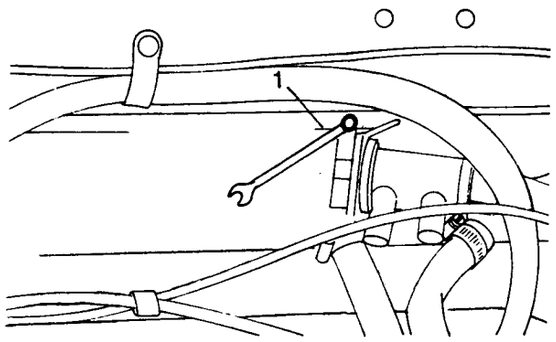


Fig B4.4

(12) Refer to Fig B4.4. Disconnect the control cable (1) at the heater water valve.

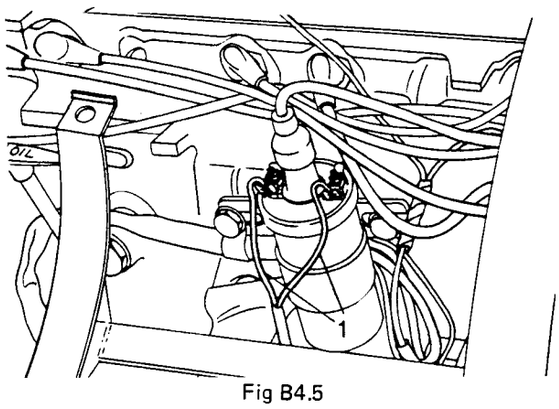


Fig B4.5

(13) Refer to Fig B4.5. Disconnect the switch leads (1) at the ignition coil.

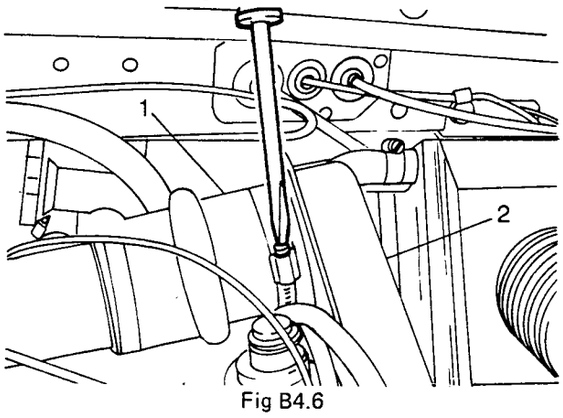


Fig B4.6

(14) Refer to Fig B4.6. Remove the hose (1) between the air cleaner and the air intake box (2) over the carburettors.

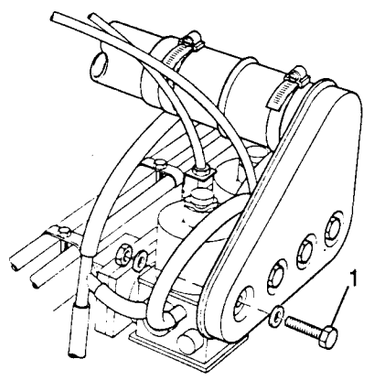


Fig B4.7

(15) Refer to Fig B4.7. Remove the air intake box by removing the four bolts (1) holding the box to the carburettor. Note that the bolts have loose nuts and washers behind the box.

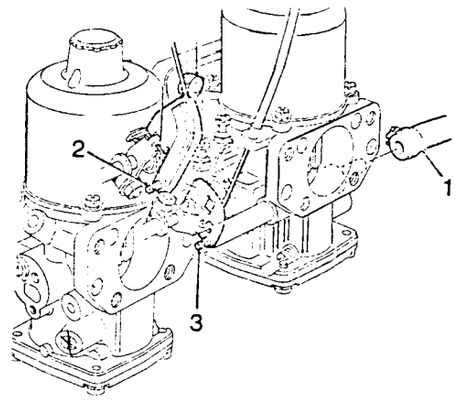


Fig B4.8

(16) Refer to Fig B4.8. Disconnect the fuel feed (1) at the carburettor.

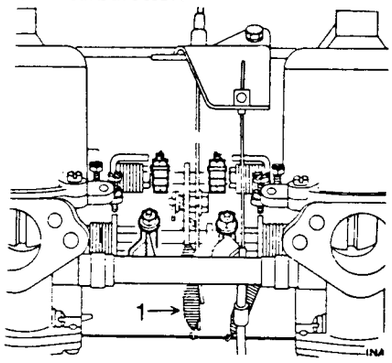


Fig B4.9

(17) Refer to Fig B4.9. Release the accelerator return spring (1).

(18) Disconnect the accelerator cable at the carburettor. (The fixing is (2) on Fig B4.8).

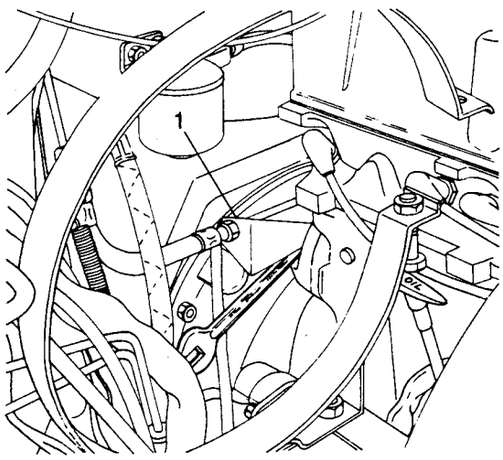


Fig B4.10

(19) Refer to Fig B4.10. Remove the fixings securing the clutch hose and speedometer cable bracket (1) at the flywheel housing.

(20) Disconnect the cold start control cable at the carburettor. (The fixing is (3) on Fig B4.8).

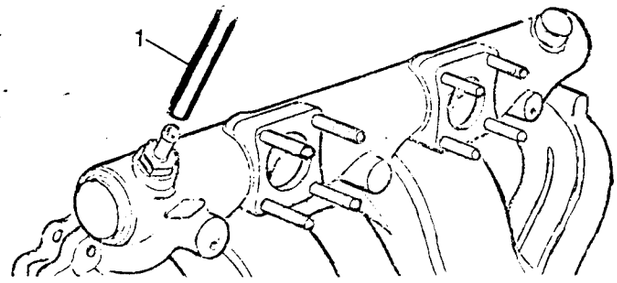


Fig B4.11

(21) Refer to Fig B4.11. Detach the servo hose (1) at the manifold pipe.

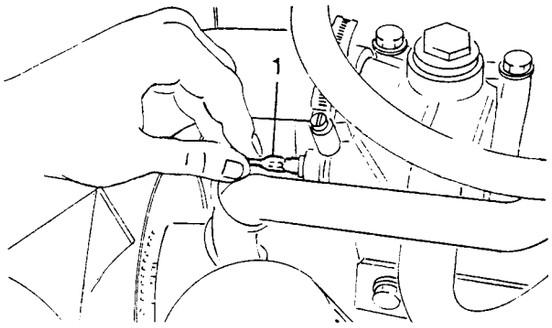


Fig B4.12

(22) Refer to Fig B4.12. Disconnect the electrical lead (1) at the coolant temperature transmitter.

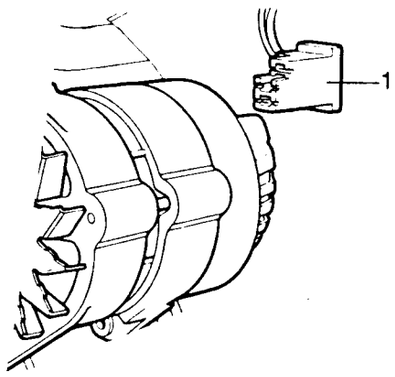


Fig B4.13

(23) Refer to Fig B4.13. Disconnect the electrical leads (1) at the alternator.

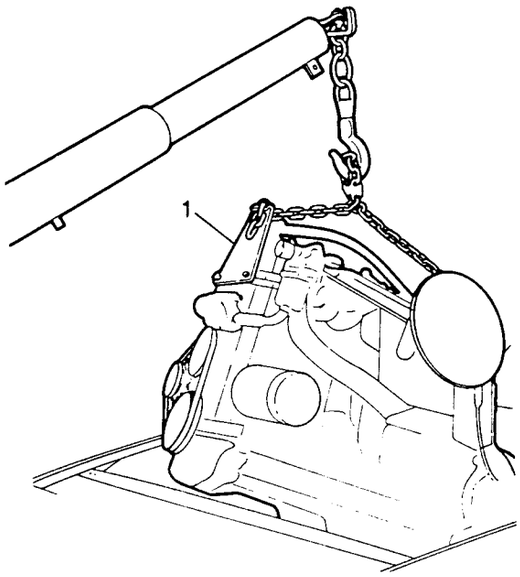


Fig B4.14

(24) Refer to Fig B4.14. Support the engine weight using suitable lifting tackle with engine lifting brackets 18GA041 (1). Note that the figure is only to illustrate the fixings for the lifting brackets. The engine is not lifted clear of the vehicle at this stage.

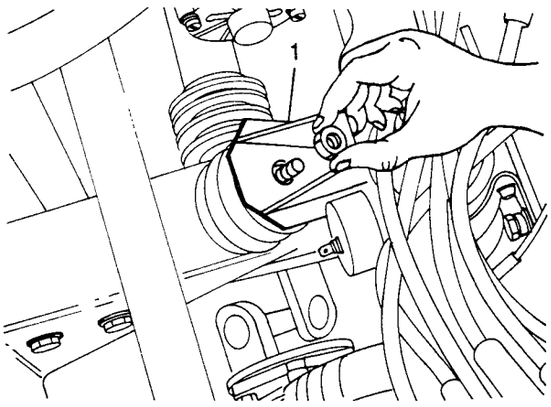


Fig B4.15

(25) Refer to Fig B4.15. Remove the engine front mountings upper (1) and lower fixings.

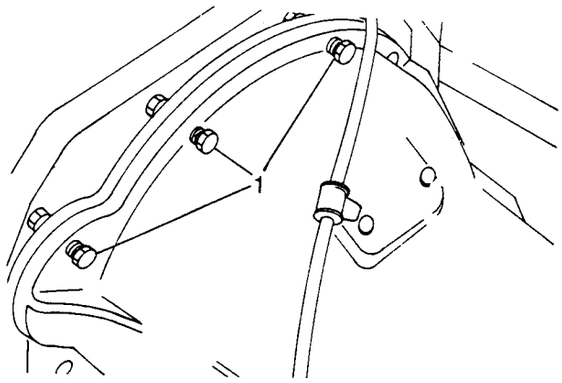


Fig B4.16

(26) Refer to Fig B4.16. Support the gearbox, using suitable packing blocks or a jack, and remove the bell housing to flywheel housing fixings (1).

(27) Pull the engine forward sufficiently to disengage the drive from the gearbox.

(28) Ensure that all cables, pipes etc. are clear then hoist the engine from the vehicle.

REPLACEMENT

2. To replace the engine:

(1) Engage a gear to prevent gearshaft rotation and offer up the engine to the gearbox. If necessary, rotate the engine sufficient to align the gearbox primary pinion with the clutch plate splines.

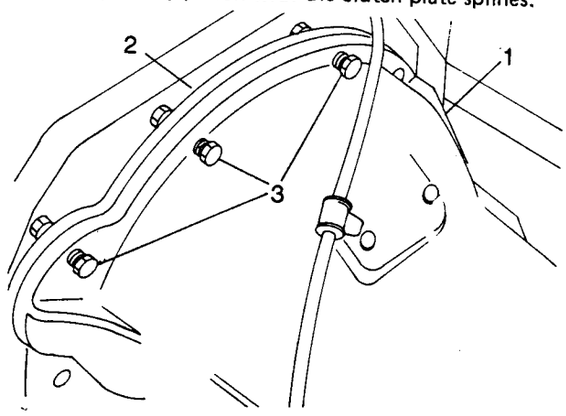


Fig B4.17

(2) Refer to Fig B4.17. When aligned, push the engine fully to the rear and secure the bell housing (1) to the flywheel housing (2), tightening the fixings (3) evenly.

(3) Lift the engine sufficiently to remove the packing or jack from beneath the gearbox.

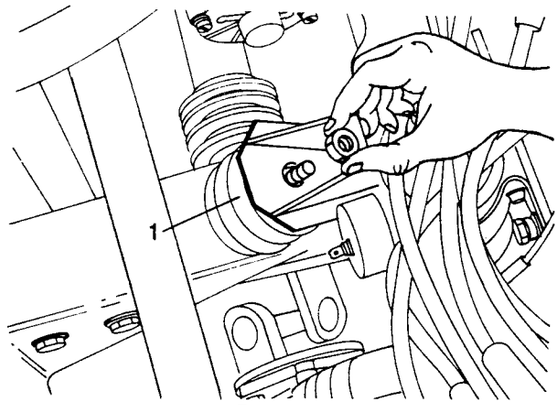


Fig B4.18

(4) Refer to Fig B4.18. Insert and secure the engine front mounting rubbers (1).

(5) Remove the sling and engine lifting brackets.

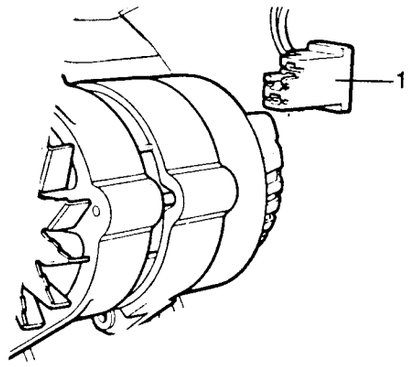
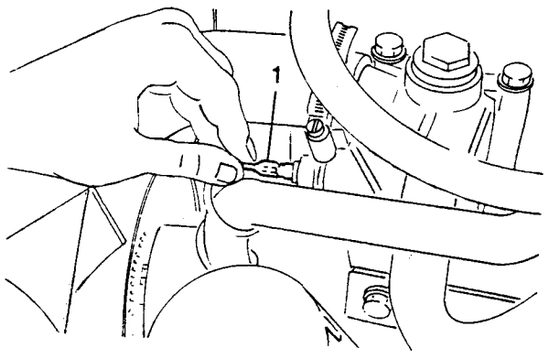


Fig B4.19

(6) Refer to Fig B4.19. Reconnect the electrical plug (1) to the alternator.



(7) Refer to Fig B4.20. Connect the leads (1) to the coolant temperature indicator.

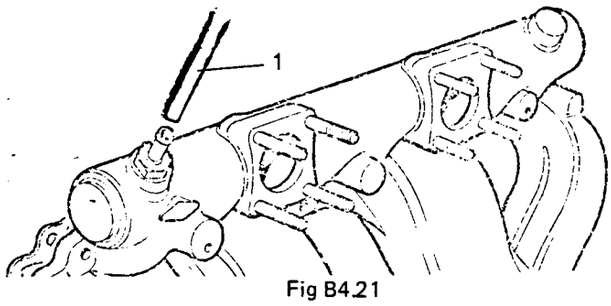


Fig B4.21

(8) Refer to Fig B4.21. Fit the servo hose (1) to the manifold pipe.

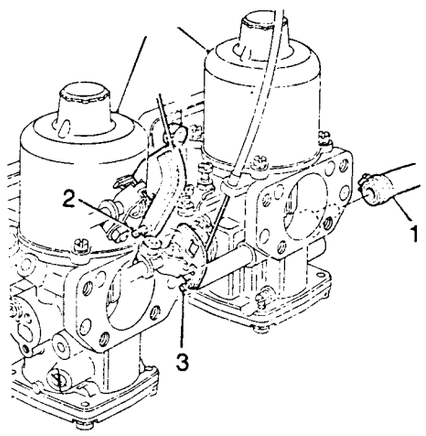


Fig B4.22

(9) Refer to Fig B4.22. Connect the cold start control cable at the carburettor fixing (3).

(10) Refit the accelerator cable to the carburettor fixing (2).

(11) Reconnect the fuel feed pipe (1) to the carburettor.

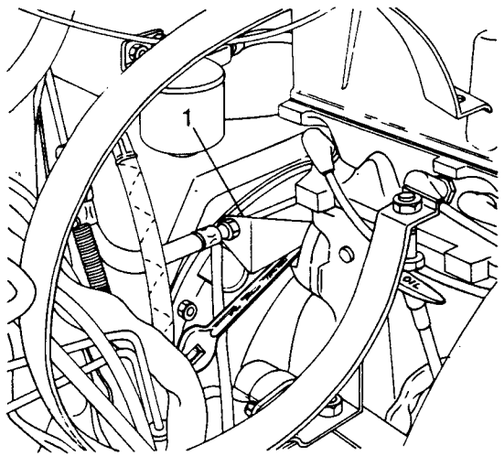


Fig B4.23

(12) Refer to Fig B4.23. Refit the clutch hose and speedometer cable bracket (1) at the flywheel housing.

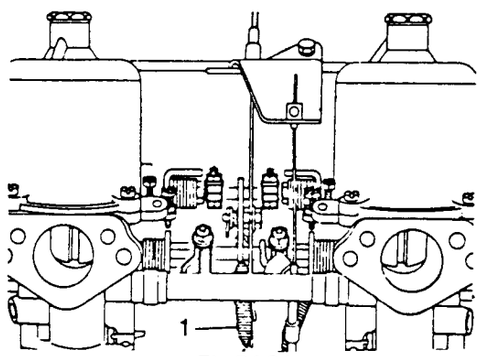


Fig B4.24

(13) Refer to Fig B4.24. Replace the accelerator return spring (1).

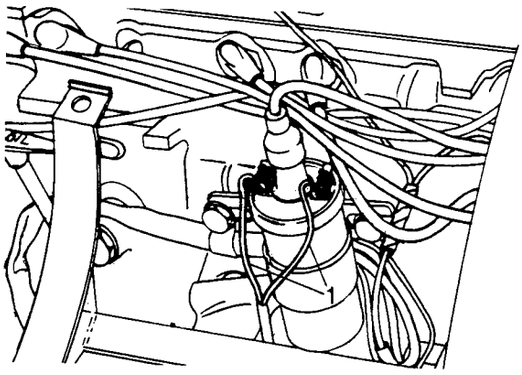


Fig B4.25

(14) Refer to Fig B4.25. Connect the switch lead (1) at the ignition coil.

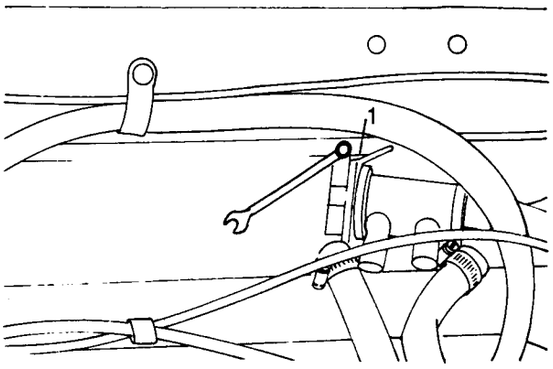


Fig B4.26

(15) Refer to Fig B4.26. Connect the control cable (1) at the heater water valve.

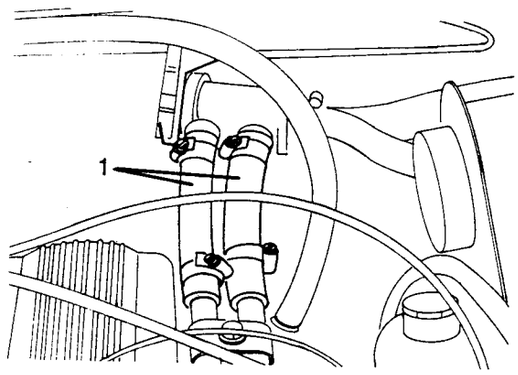


Fig B4.27

(16) Refer to Fig B4.27. Connect the heater hoses (1).

(17) Reconnect the engine earth cable to the chassis side member.

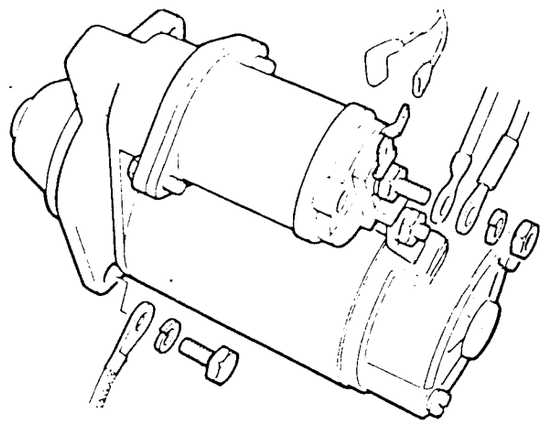


Fig B4.28

(18) Refer to Fig B4.28. Reconnect the five electrical leads to the starter motor and where applicable secure with nuts or bolt and lock washers.

(19) Reconnect the oil cooler pipes to the filter (see Sub-section B4, Chapter 22).

(20) Refit and secure the two exhaust pipes (see Sub-section F3, Chapter 2).

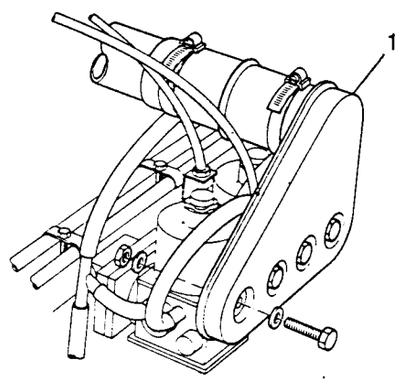


Fig B4.29

(21) Refer to Fig B4.29. Fit the air intake box (1) over the carburettors.

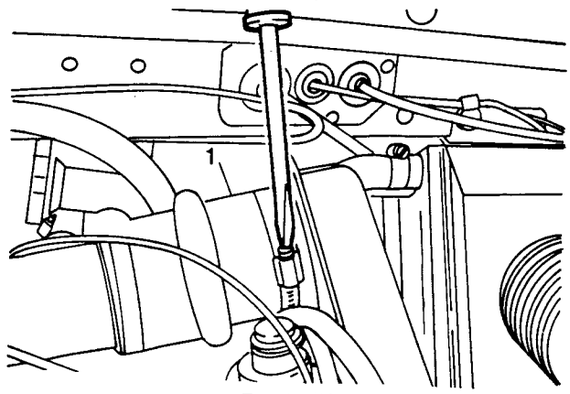


Fig B4.30

(22) Refer to Fig B4.30. Reconnect the hose (1) between the air cleaner and the air intake box.

(23) Refit the gearbox tunnel cover (see Sub-section M3, Chapter 5).

(24) Replace the grille panel (see Sub-section M3, Chapter 6) and radiator (see Sub-section E4, Chapter 1).

(25) Reconnect the battery earth lead (see Sub-section O5, Chapter 3).

(26) Refill the engine with the correct grade of oil.

(27) Replace the bonnet (see Sub-section M3, Chapter 1).

CHAPTER 2

OIL PUMP DRIVE SHAFT - REMOVAL AND REPLACEMENT

REMOVAL

1. The drive shaft is in the tube forming the distributor drive shaft. To remove:

   (1) Remove the distributor (see Sub-section D4, Chapter 2).

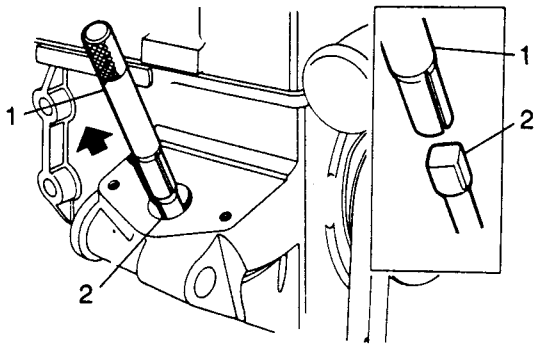


Fig B4.31

   (2) Refer to Fig B4.31. Position tool 18G1147 (1) with the slots diagonally across the square end of the oil pump drive shaft (2).

   (3) Press down on the tool and then withdraw the drive shaft upwards.

REPLACEMENT

2. To replace the oil pump drive shaft:

   (1) Fit the shaft into the distributor drive shaft tube.

   (2) Ensure full engagement. If necessary use the special tool to turn the shaft until it fits into the square hole in the distributor shaft.

   (3) Replace the distributor (see Sub-section D4, Chapter 2).

SUB-SECTION B4

CHAPTER 3

DISTRIBUTOR DRIVE SHAFT - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the drive shaft:

(1) Raise the vehicle on a hoist or stands.

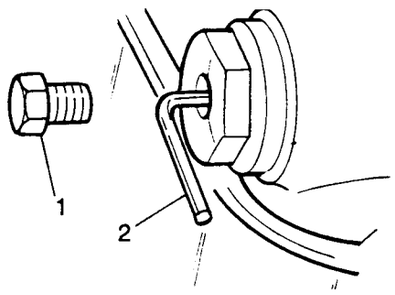


Fig B4.32

(2) Refer to Fig B4.32. Retract the timing chain tensioner by removing the chain tensioner adaptor screw (1), fitting a 3,17 mm allen key (2) and turning the key 90° clockwise.

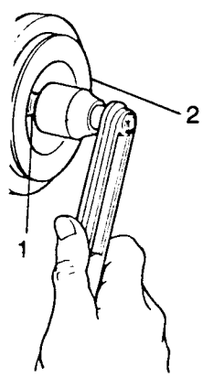


Fig B4.33

(3) Refer to Fig B4.33. Loosen the harmonic balancer bolt (1) using special tool 18G98A (2).

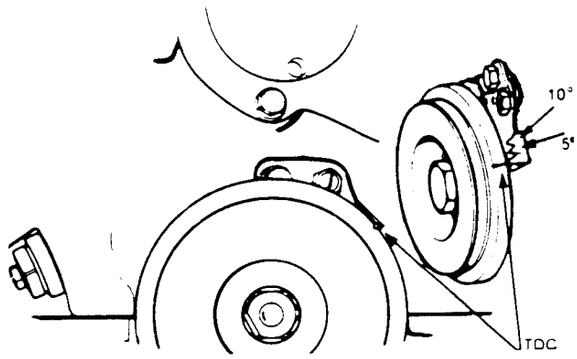


Fig B4.34

(4) Refer to Fig B4.34. Set the timing marks to TDC with No 1 cylinder firing. See Fig B4.35.

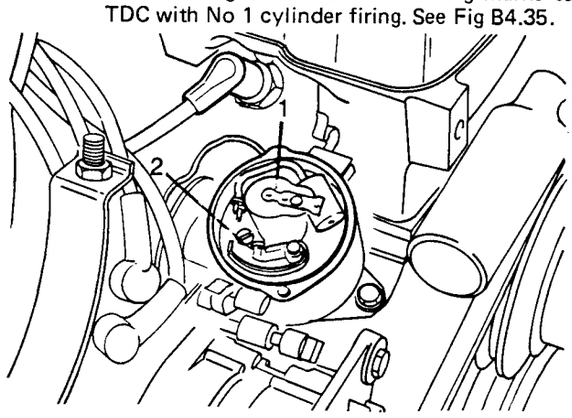


Fig B4.35

(5) Refer to Fig B4.35. The No 1 cylinder firing position is with the distributor rotor (1) pointing to No 1 cylinder take-off (as shown) and the points (2) opening.

(6) Remove the distributor (see Sub-section D4, Chapter 2).

(7) Remove the harmonic balancer ((2) on Fig B4.14).

(8) Remove the crankshaft oil seal (see Sub-section B4, Chapter 7).

(9) Remove the oil pump (see Sub-section B4, Chapter 16) and oil pump drive shaft. Note that this shaft will come out from the bottom of the engine block once the pump is removed.

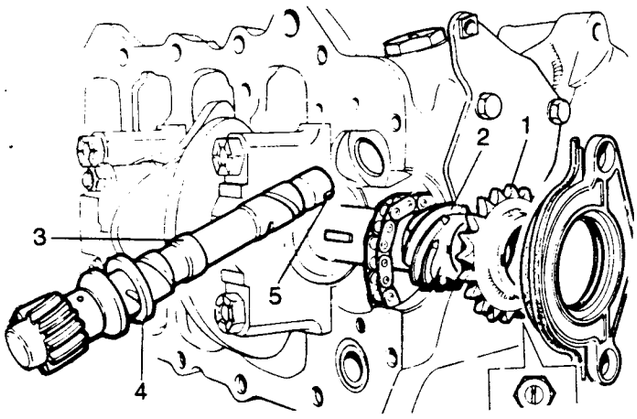


Fig B4.36

(10) Refer to Fig B4.36. Move the sprocket (1) and drive gear (2) forwards.

(11) Pull out the distributor drive shaft (3).

REPLACEMENT

2. Fig B4.36 still refers. Replace the distributor drive shaft as follows:

(1) Fit the thrust washer (4) to the drive shaft.

(2) Check that No 1 piston is at TDC.

Fig B4.37

(3) Refer to Fig B4.37. Fit the drive shaft into the housing with the large slot ((5) on Fig B4.36) running in the 10 o'clock/4 o'clock position (Fig B4.37A, shown looking from the top).

(4) Push the driver gear into position. As the teeth mesh the drive shaft will turn through 90° bring the slot into the 2 o'clock/8 o'clock position (Fig B4.37B). This is the correct position for No 1 cylinder firing.

(5) Refit the distributor (see Sub-section D4, Chapter 2) and check that the rotor arm is set for No 1 cylinder firing with the contact breaker points just opening.

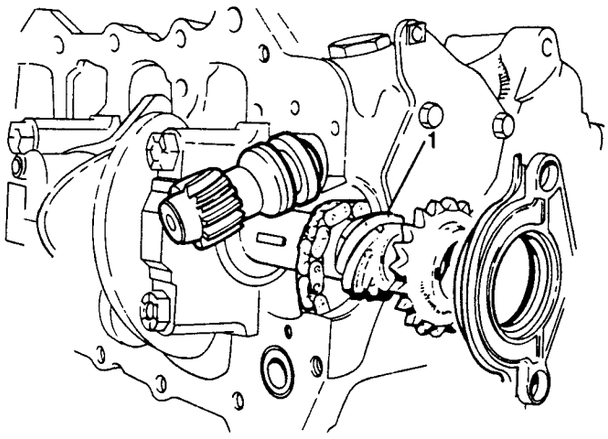


Fig B4.38

(6) Refer to Fig B4.38. Position the sprocket (1) over its woodruff key and replace the chain.

(7) Refit the oil pump drive shaft ensuring that it fits into the square hole at the top of the distributor drive shaft.

(8) Replace the oil pump (see Sub-section B4, Chapter 16).

(9) Replace the crankshaft oil seal (see Sub-section B4, Chapter 7).

(10) Replace the sump (see Sub-section B4, Chapter 17).

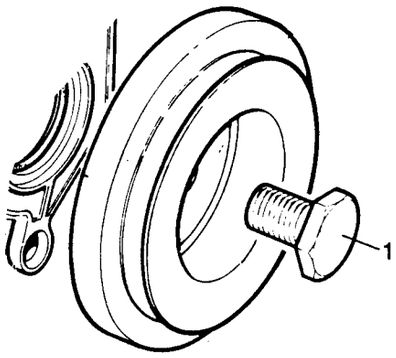


Fig B4.39

(11) Refer to Fig B4.39. Fit the harmonic balancer and pulley and secure with the harmonic balancer bolt (1). Torque the bolt 81 to 92 N.m.

(12) Release the chain tensioner by turning the allen key ((2) on Fig B4.32) 90° counterclockwise.

(13) Remove the allen key and replace the screw ((1) on Fig B4.32).

CHAPTER 4

CAMSHAFT AND FOLLOWERS - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the camshaft and followers:

(1) Remove the camshaft cover and gasket (see Sub-section B4, Chapter 11).

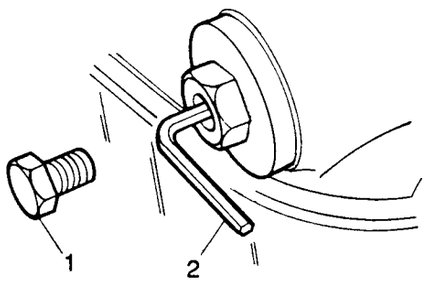


Fig B4.40

(2) Refer to Fig B4.40. Retract the timing chain tensioner by removing the chain tensioner adaptor screw (1), fitting a 3,17 mm allen key (2) and turning the key 90° clockwise.

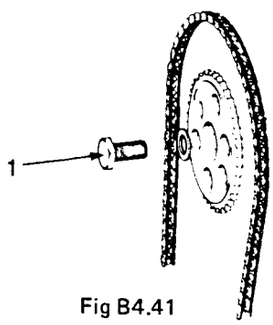


Fig B4.41

(3) Refer to Fig B4.41. Remove the fixing (1) for the camshaft sprocket and remove the sprocket.

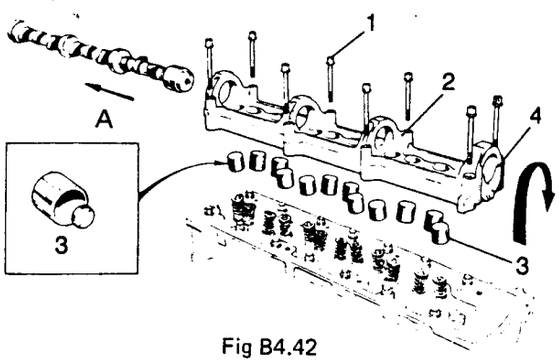


Fig B4.42

(4) Refer to Fig B4.42. Evenly slacken the camshaft carrier bolts (1) in a diagonal sequence until the valve spring pressure is released.

(5) Remove the camshaft carrier bolts.

(6) Raise the camshaft carrier (2) sufficiently to allow the followers (3) to clear the engine valves.

(7) Push the followers into the camshaft carrier until they contact the camshaft.

(8) Continue to remove the carrier assembly by easing it away from the cylinder head and quickly revolve it to prevent the followers from falling out.

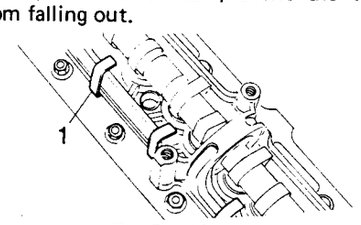


Fig B4.43

NOTE
Refer to Fig B4.43. Special tool 18G1218 (tappet retaining clips) (1) may be used to prevent the followers falling out during this operation.

(9) On the bench remove the cam followers with their adjusting shims, maintaining them in the order in which they were removed.

(10) Remove the camshaft locating plate (4).

(11) Remove the camshaft in the direction of arrow A.

REPLACEMENT

2. Replace the camshaft as detailed below:

(1) Lubricate the cam bearings and fit the camshaft in the opposite direction to arrow A.

(2) Fit and secure the camshaft locating plate.

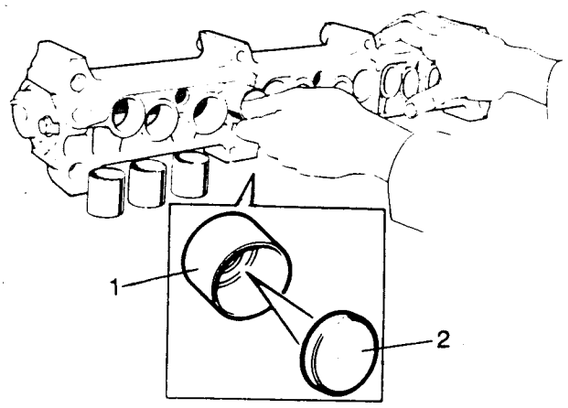


Fig B4.44

(3) Refer to Fig B4.44. Lay the carrier on its side, lubricate the followers (1) and fit them into their respective housings. Smear the shims (2) with grease and replace them.

(4) Check the bottom face of carrier for burrs or damage, as any protrusions will affect valve clearance. Also check that the carrier bolt thread and the respective threads in the cylinder head are free of foreign material.

(5) Position the carrier over the two locating dowels in the cylinder head, taking care not to dislodge the adjusting shims.

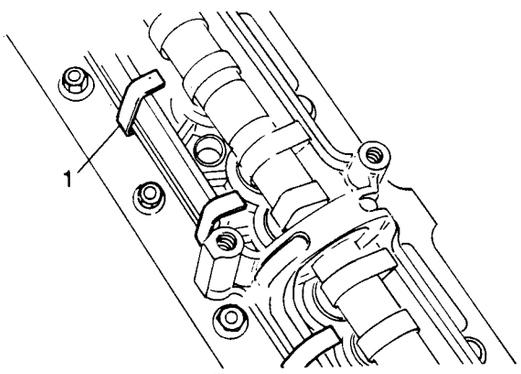


Fig B4.45

(6) Refer to Fig B4.45. If the tappet retaining clips (1) are fitted, remove them at this stage.

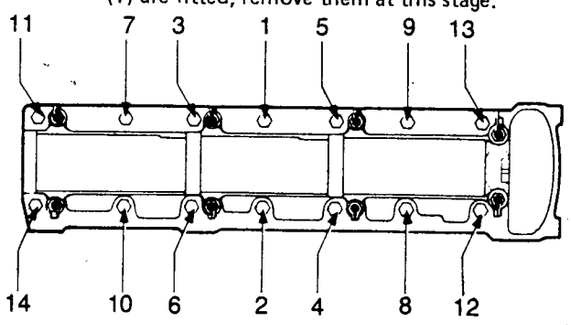


Fig B4.46

(7) Refer to Fig B4.46. Fit the carrier bolts (1 to 14) and gradually tighten them in a diagonal sequence to 27 Nm.

(8) Revolve the camshaft several times.

(9) Check valve clearances and reset if required (see Sub-section B3).

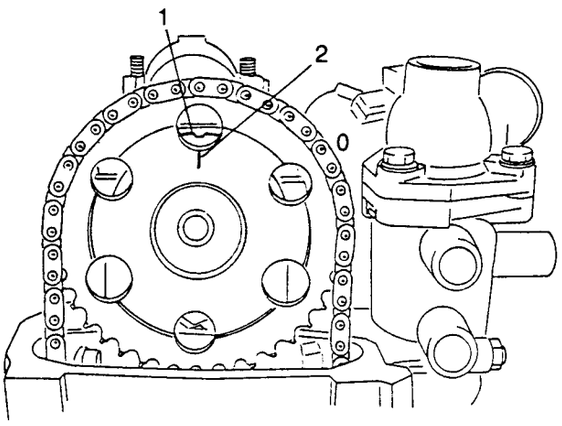


Fig B4.47

(10) Refer to Fig B4.47. Temporarily fit the sprocket to the camshaft and turn the sprocket until the timing mark (1) on the sprocket aligns with the mark (2) on the carrier. Remove the sprocket.

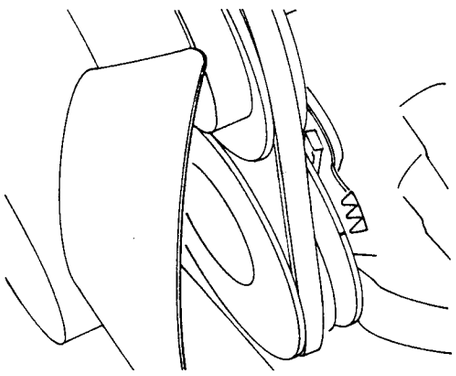


Fig B4.48

(11) Refer to Fig B4.48. Set the crankshaft pulley timing mark to the TDC position with No 1 cylinder firing (rotor pointing to No 1 cylinder take-off and points opening).

(12) Fit the timing chain over the (loose) camshaft sprocket, maintaining the aligning marks.

(13) Fit the camshaft sprocket with the chain, onto the camshaft.

(14) Fit and tighten the securing bolt to 37 N.m.

(15) Release the chain tensioner by turning the Allen key (Fig B4.40) 90° counterclockwise.

(16) Replace the camshaft cover and gasket (see Sub-section B4, Chapter 11).

CHAPTER 5

CONNECTING RODS AND PISTONS - REMOVAL AND REPLACEMENT

REMOVAL

1. First remove the engine from the vehicle (see Sub-section B4, Chapter 1).

2. Remove the connecting rods and pistons as follows:

   (1) Remove the cylinder head (see Sub-section B4, Chapter 10).

   (2) Remove the oil pump (see Sub-section B4, Chapter 16).

   (3) Remove any traces of carbon from around the top of the cylinder bores.

   (4) Check the top of the bores for wear. If a ridge is present it should be removed prior to withdrawing the piston assemblies or damage to the piston could result.

   (5) Carefully remove carbon from the top of the piston.

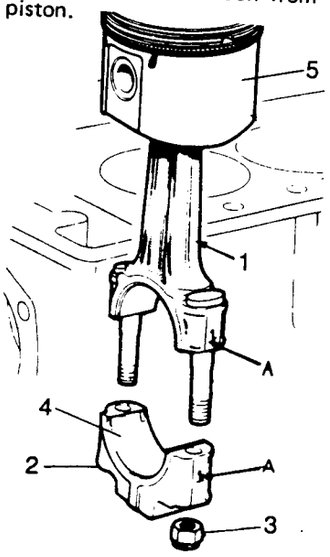


Fig B4.49

   (6) Refer to Fig B4.49. Mark each piston by number in its forward position.

NOTE
The pistons have offset gudgeon pin bosses and can only be fitted one way: The mark "FRONT" or Δ faces the front of the engine.

   (7) Mark the connecting rods (1) and caps (2) so that they may be assembled in their correct order ('A' in Fig B4.49).

   (8) Remove nuts (3).

   (9) Remove the connecting rod caps (2) and bearings (4).

   (10) Remove the pistons (5) and connecting rods (1) out through top.

   (11) Temporarily refit the connecting rod caps and bearing shells to their respective rods.

REPLACEMENT

CAUTION
It is essential that the piston is fitted the correct way round on the connecting rod. The mark "FRONT" or ▲ on the piston crown faces the front of the engine and the cylinder number stamped on the connecting rod and cap faces the distributor side of the engine.

2. To replace the connecting rods and pistons:

   (1) Ensure that the connecting rod big end bores are clean and free from burrs or marks.

   (2) Clean the bearing shells and fit them to the connecting rods and caps. The shells are notched to fit the recesses machined in the rods and caps.

NOTE
Any foreign material between the bearing shells and connecting rod or cap will affect clearance and result in bearing failure.

   (3) Liberally lubricate the cylinder bores, pistons and connecting rod bearings with engine oil.

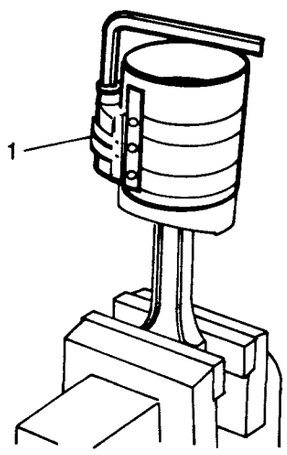


Fig B4.50

   (4) Refer to Fig B4.50. Compress the piston rings using a suitable ring compressor (1).

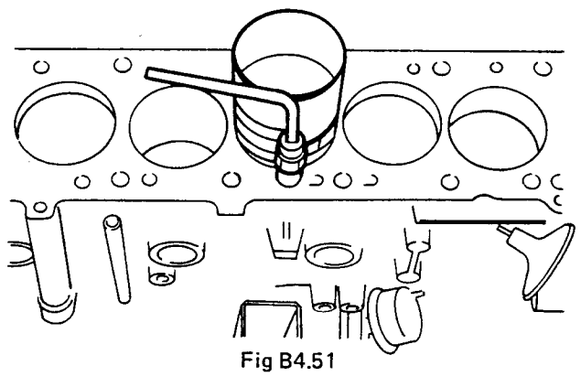


Fig B4.51

(5) Refer to Fig B4.51. Enter the piston and connecting rod assembly to the cylinder bores from the top, ensuring that the oil jet holes in the connecting rods are facing the distributor side of the engine.

(6) Gently tap the piston into the cylinder, at the same time checking that the connecting rods are facing the distributor side of the engine.

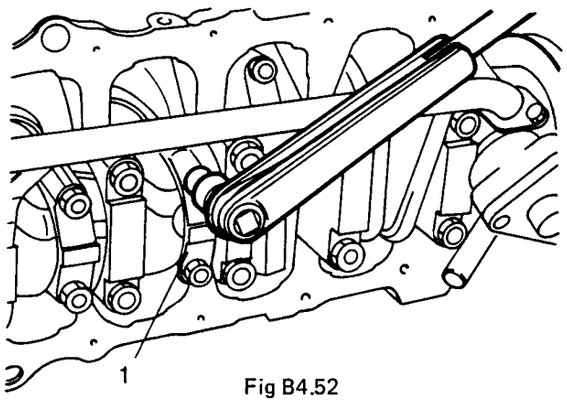


Fig B4.52

(7) Refer to Fig B4.52. With the connecting rod positioned on the crankshaft, fit the connecting rod cap (1) and lower half bearing.

(8) Fit the connecting rod bolts and tighten the nuts to 42 to 47 N.m.

3. Replace the oil pump (see Sub-section B4, Chapter 16), the sump (see Sub-section B4, Chapter 17), the cylinder head (see Sub-section B4, Chapter 10).

CHAPTER 6

CRANKSHAFT PULLEY AND VIBRATION DAMPER ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the crankshaft pulley and vibration damper assembly:

   (1) Remove fan cowling assembly.

   (2) Slacken alternator drive belt and remove (see Sub-section O5, Chapter 1).

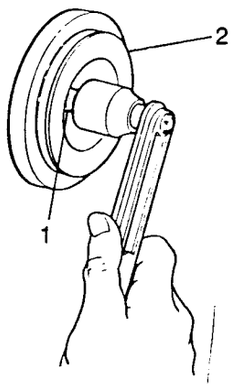


Fig B4.53

   (3) Refer to Fig B4.53. Loosen the retaining bolt (1) with special tool 18G98A and remove bolt.

   (4) Remove the assembly (2) from the shaft using suitable levers.

REPLACEMENT

2. Replace the crankshaft pulley and vibration damper as follows: (Fig B4.53 still applies).

   (1) Lubricate the seal surface with engine oil.

   (2) Replace crankshaft pulley and vibration damper assembly (2).

   (3) Refit retaining bolt (1) and torque to 81 to 95 N.m.

   (4) Replace the alternator drive belt (see Sub-section O5, Chapter 1).

   (5) Replace fan cowl assembly.

CHAPTER 7

SUMP FRONT SEAL, SEAL HOUSING AND CRANKSHAFT OIL SEAL - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the components:

   (1) Remove the sump and gaskets (see Sub-section B4, Chapter 17).

   (2) Remove the crankshaft pulley and vibration damper assembly (see Sub-section B4, Chapter 6).

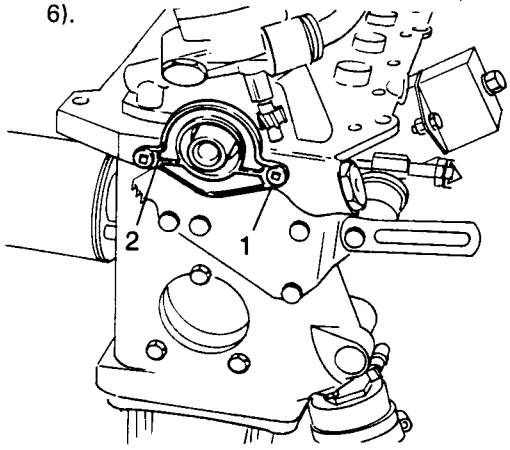


Fig B4.54

   (3) Refer to Fig B4.54. Remove the two counter sunk head screws (1) and washers securing the seal housing (2) to the crankcase and detach the housing.

   (4) Detach the reservoir seal from its groove in the housing.

Fig B4.55

   (5) Refer to Fig B4.55. Carefully drift out the crankshaft oil seal (1) as necessary or alternatively replace the seal and housing as a unit.

REPLACEMENT

2. Refit the seals and housings as detailed below:

   (1) Carefully press a new crankshaft oil seal into the housing as necessary.

   (2) Install the seals and housing assembly over the crankshaft, maintaining fitted horizontal alignment of the countersunk holes and the threaded holes in the crankcase.

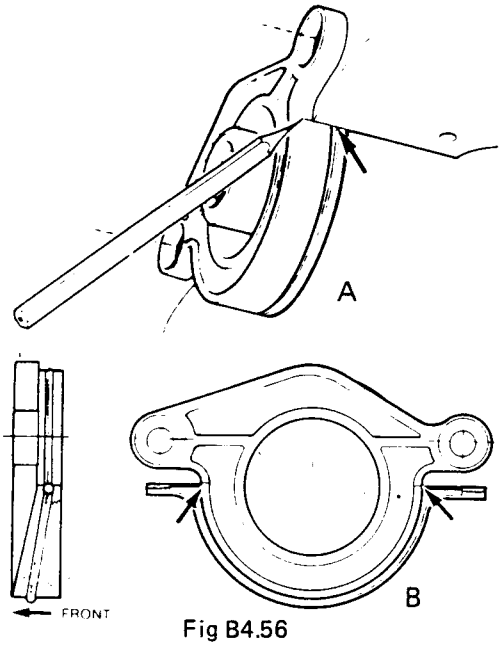


Fig B4.56

   (3) Refer to Fig B4.56. Using a lead pencil mark the position of the crankcase rails on the housing. (Fig B4.56A).

   (4) Remove the housing.

   (5) Fit the seal in the groove in the housing, so that the under side of the lugs align with the pencil lines on the housing, and the hooded part of the seal faces to the front and away from the engine. (Fig B4.56B).

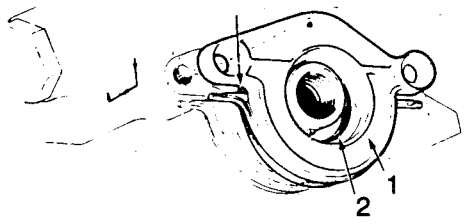


Fig B4.57

   (6) Refer to Fig B4.57. Locate the housing (1) in position on the crankcase and align the attaching screw holes.

   (7) Keeping the housing assembly in the same horizontal alignment, position the whole assembly vertically away from the engine so that the crankshaft oil seal (2) lips are resting on the crankshaft.

CHAPTER 8

CRANKSHAFT REAR OIL SEAL - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the rear oil seal:

(1) Remove the flywheel (see Sub-section B4, Chapter 13).

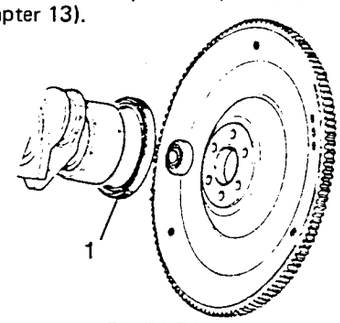


Fig B4.59

(2) Refer to Fig B4.59. Extract the seal (1) from the cylinder block.

REPLACEMENT

2. Replace the seal as follows:

(1) Liberally lubricate the seal lip and the surface of the crankshaft with engine oil.

NOTE
The direction of crankshaft rotation is indicated on the seal by an arrow.

(2) Carefully fit the seal to the crankshaft journal, turning it in the opposite direction to the arrow (clockwise).

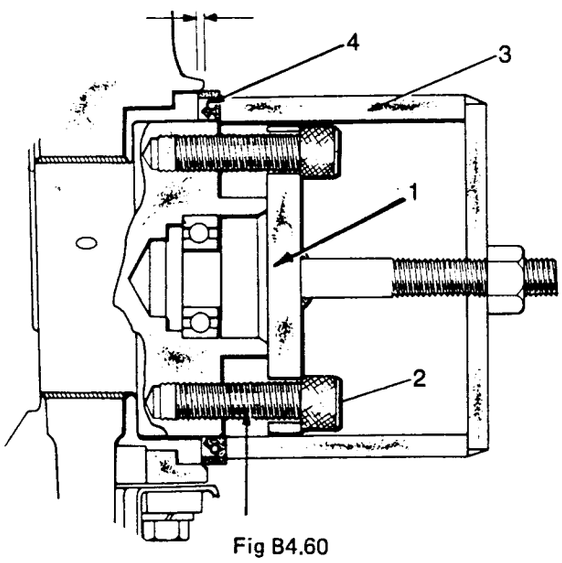


Fig B4.60

(3) Refer to Fig B4.60. Secure the seal replacer adaptor 18GA044 (1) to the end of the crankshaft with the screws (2) as shown.

(4) Lubricate the inside of the seal replacer sleeve (3) 18GA044 and fit it over the crankshaft against the seal (4).

(5) Fit the nut to the adaptor and wind up till the seal enters its housing. Continue to wind in until the seal is flush or just clear of the crankcase face.

NOTE
Clearance must exist between the seal and the flywheel mounting face on the crankshaft.

(6) Refit the flywheel (see Sub-section B4, Chapter 13).

SUB-SECTION B4

CHAPTER 9

CRANKSHAFT - REMOVAL AND REPLACEMENT

REMOVAL

1. For this operation, first carry out the following procedure:

   (1) Remove the engine (see Sub-section B4, Chapter 1).

   (2) Remove the clutch (see Sub-section H3.4, Chapter 1).

   (3) Remove the flywheel (see Sub-section B4, Chapter 13).

   (4) Turn the engine over and remove the sump (see Sub-section B4, Chapter 17).

   (5) Remove the engine back plate and adaptor plate.

   (6) Remove the oil pump (see Sub-section B4, Chapter 16).

   (7) Remove the oil pump drive shaft (see Sub-section B4, Chapter 2).

   (8) Remove the crankshaft pulley and vibration damper assembly (see Sub-section B4, Chapter 6).

   (9) Remove the oil reservoir front seal, seal housing and crankshaft oil seal (see Sub-section B4, Chapter 7).

   (10) Remove the crankshaft rear oil seal (see Sub-section B4, Chapter 8).

   (11) Remove the distributor drive shaft assembly (see Sub-section B4, Chapter 3).

2. To remove the crankshaft:

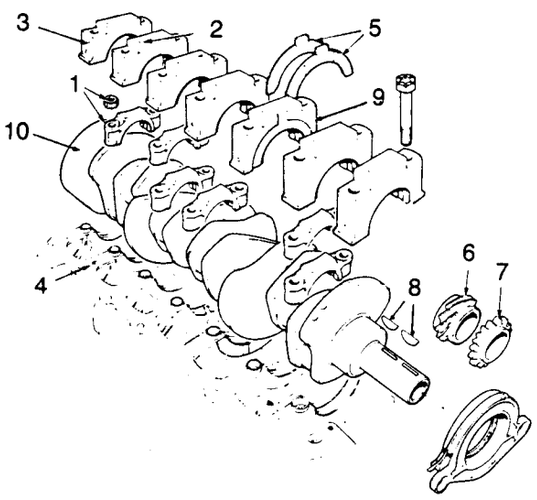


Fig B4.61

   (1) Refer to Fig B4.61. Remove the connecting rod caps (1) maintaining them in their correct order for replacement.

   (2) Remove the main bearing caps (2) noting the location stamping. The caps are number stamped on the LH side (3) and corresponding numbers are stamped on the LH side main bearing webs adjacent to the cap joint (4) to ensure correct replacement.

   (3) Lift the crankshaft from the engine and recover the thrust washers (5) from both sides of No 3 main bearing housing (9).

   (4) Remove the gear (6), sprocket (7) and keys (8) as necessary.

INSPECTING

3. Inspect the crankshaft as follows:

   (1) Thoroughly clean the crankshaft ensuring that there is no foreign material remaining in the oilway.

   (2) Check the main and connecting rod journals for size and wear.

   (3) Check the condition of the thrust faces at No. 3 main journal.

   (4) Check the condition of the spigot bearing (10).

REPLACEMENT

4. Note that Fig B4.61 still applies. To replace the crankshaft:

   (1) Replace the keys (8), gear (6) and sprocket (7) if these have been removed.

   (2) Fit bearing shells to their respective housings.

   (3) Lubricate the crank shaft journals and install shaft in the crankcase.

   (4) Fit the upper half thrust washers in position in the crankcase at No 3 main bearing.

   (5) Install No 3 main bearing cap (9) with its thrust washers (5).

   NOTE
   The oil grooves in the thrust washers face the crankshaft.

   (6) Install the remainder of the main bearing caps (2) and check the bearing clearances.

   (7) Torque the main bearing bolts to 95 N.m.

   (8) Ensure that the crankshaft turns freely.

   (9) Check and adjust as necessary the crankshaft end float.

   (10) Fit the connecting rod bearing shells and assemble the connecting rods to their shaft journals using new self-locking nuts on the bolts. Tighten the nuts to 42 to 47 N.m.

   (11) Ensure that the crankshaft turns freely.

5. Having now replaced the crankshaft, continue:

   (1) Replace the distributor drive shaft assembly (see Sub-section B4, Chapter 3).

   (2) Fit the crankshaft rear oil seal (see Sub-section B4, Chapter 8).

   (3) Replace the oil reservoir front seal, seal housing and crankshaft oil seal (see Sub-section B4, Chapter 7).

   (4) Refit the crankshaft pulley and vibration damper assembly (see Sub-section B4, Chapter 6).

   (5) Replace the oil pump drive shaft (see Sub-section B4, Chapter 2).

   (6) Refit the oil pump, cleaning the oil pump pick-up strainer first (see Sub-section B4, Chapter 16).

   (7) Fit a new oil filter.

   (8) Replace the engine back plate and adaptor to plate.

   (9) Clean and replace the sump (see Sub-section B4, Chapter 17).

   (10) Replace the flywheel (see Sub-section B4, Chapter 13).

   (11) Refit the clutch (see Sub-section H3.4, Chapter 1).

   (12) Replace the engine (see Sub-section B4, Chapter 1).

   (13) Prime the lubrication system prior to starting the engine:

      a. Fill the engine with oil to the level indicated on the dipstick.

      b. Disconnect the main coil lead.

      c. Remove the spark plug.

      d. Crank the engine on the starter until the oil pressure warning light is extinguished.

      e. Replace the plugs and reconnect the main coil lead.

   (14) Start the engine and check for oil leaks.

   (15) Stop the engine and top up the engine oil as necessary.

   (16) Check engine tune.

CHAPTER 10

CYLINDER HEAD AND GASKET - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the cylinder head:

   (1) Disconnect the battery.

   (2) Drain the cooling system (see Sub-section E6).

   (3) Remove the air intake box on the carburetters (see Sub-section C4, Chapter 1).

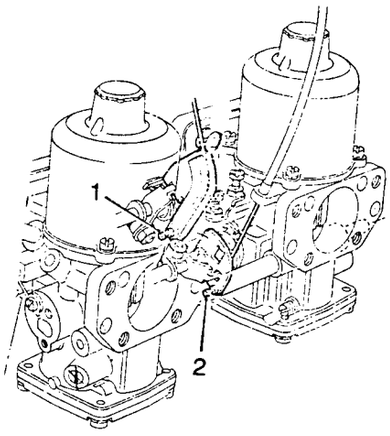


Fig B4.62

   (4) Refer to Fig B4.62. Loosen the fixing (1) and withdraw the accelerator control cable.

   (5) Loosen the fixing (2) and withdraw the mixture (choke) control cable.

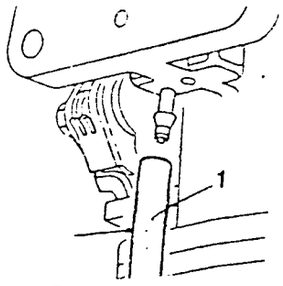


Fig B4.63

   (6) Refer to Fig B4.63. Disconnect the ignition vacuum pipe (1) from the manifold.

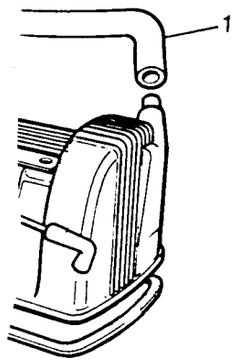


Fig B4.64

   (7) Refer to Fig B4.64. Disconnect the engine breather hose (1) from the cam cover.

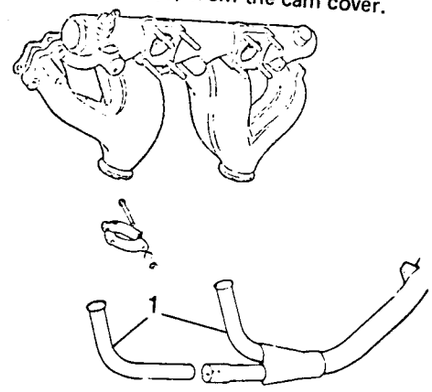


Fig B4.65

   (8) Refer to Fig B4.65. Disconnect the exhaust down pipes (1) from the manifold.

   (9) Disconnect the top radiator hose, the heater hoses and the bypass hose.

   (10) Undo the bolt holding the clamp for the heater hoses on the inlet manifold and lay the hoses to one side.

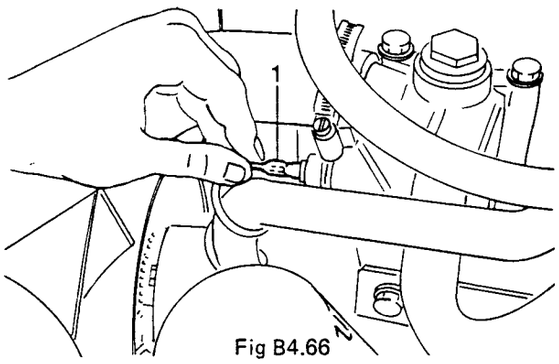


Fig B4.66

(11) Refer to Fig B4.66. Disconnect the wire (1) from the coolant temperature transmitter. The transmitter is located in the thermostat housing on the left hand upper side of the engine just above the water pump and oil filter.

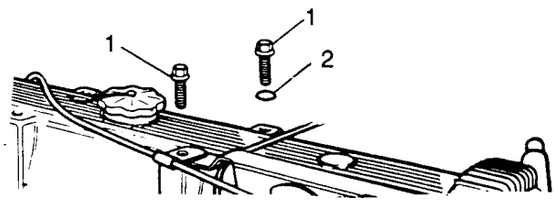


Fig B4.67

(12) Refer to Fig B4.67. Remove the eight flanged bolts (1) and O-rings (2) securing the cam cover and remove the cover and gasket.

(13) Remove the distributor cap and the leads from the spark plugs. It may be necessary to rotate the distributor slightly so that the cap does not foul the head when being removed.

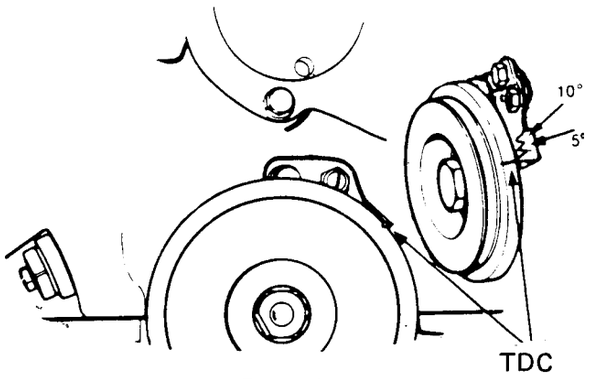


Fig B4.68

(14) Refer to Fig B4.68. Turn the engine until the mark on crankshaft pulley lines up with the TDC mark on the engine block.

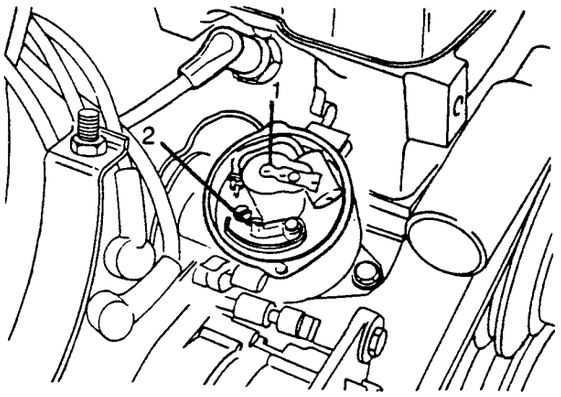


Fig B4.69

(15) Refer to Fig B4.69. Check that No 1 cylinder is in the firing position (rotor (1) pointing to No 1 cylinder take-off and points (2) opening).

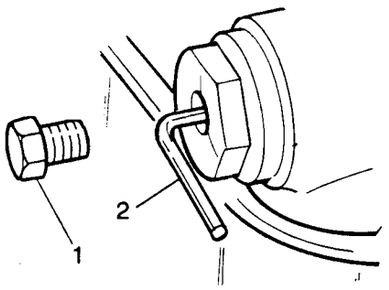


Fig B4.70

(15) Refer to Fig B4.70. Remove the chain tensioner adaptor screw (1).

(16) Insert a 3,17 mm allen key (2) and turn it 90° clockwise to retract the chain tensioner.

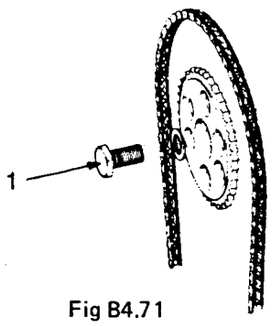


Fig B4.71

(17) Refer to Fig B4.71. Unscrew the camshaft sprocket retaining screw (1), remove the sprocket and allow the chain to hang over the guides.

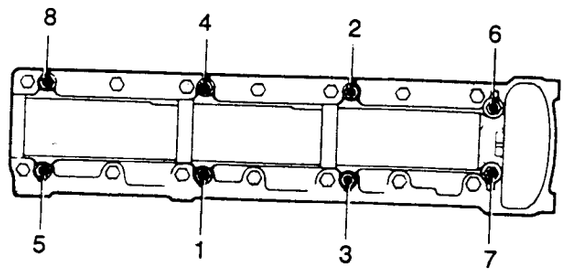


Fig B4.72

(18) Refer to Fig B4.72. Slacken the cylinder head bolts (1 to 8) gradually in a diagonal sequence starting with bolt (8) and ending with bolt (1) and remove the bolts.

(19) Lift off the cylinder head and remove the gasket.

REPLACEMENT

2. Replace the cylinder head as detailed below:

(1) Fit a new cylinder head gasket.

(2) Replace the cylinder head and bolts. Tighten the bolts gradually in the sequence bolt (1) to bolt (8) (Fig B4.72). Final torque figure for the bolts is 90 N.m.

(3) Check that the crankshaft pulley mark is still at TDC.

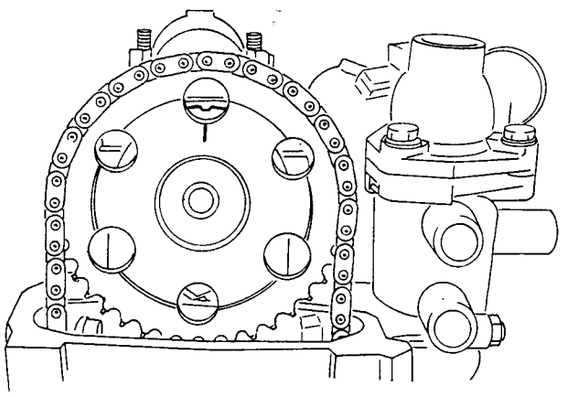


Fig B4.73

(4) Refer to Fig B4.73. Fit the camshaft sprocket and locating pin. Check that the timing marks on the sprocket and cam cover align, then replace the bolt and tighten to 47 N.m.

(5) Replace the chain over the sprocket.

(6) Release the chain tensioner by turning the allen key (Fig B4.70) 90° counterclockwise.

(7) Remove the allen key and replace the adaptor screw.

(8) Refit the distributor cap and the spark plug leads.

(9) Replace the cam cover, using a new gasket and secure with the eight flanged bolts and O-rings. Tighten the bolts to 8 N.m.

NOTE

Do not overtighten the bolts. A bolt flange which touches the alloy cover will promote noise from the valve mechanism.

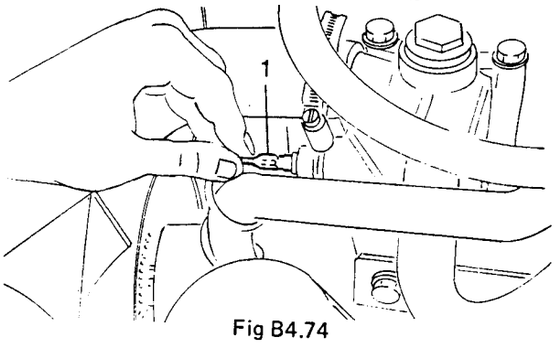


Fig B4.74

(10) Refer to Fig B4.74. Reconnect the wire to the coolant temperature transmitter (1).

(11) Position the heater hoses and secure with the clamp on the inlet manifold.

(12) Reconnect the bypass hose, the heater hoses and the top radiator hose.

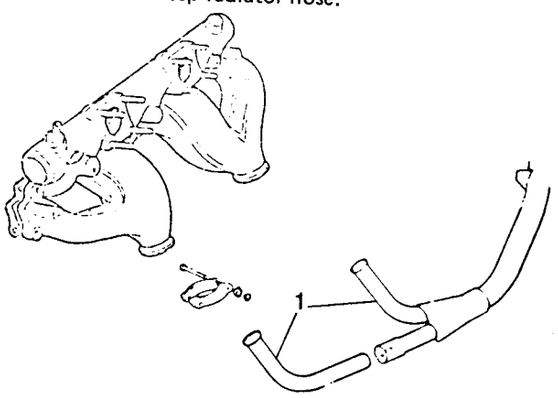


Fig B4.75

(13) Refer to Fig B4.75. Position and connect the exhaust downpipes (1) to the manifold.

(14) Connect the engine breather hose to the cam cover (Fig B4.64).

(15) Connect the ignition vacuum pipe to the manifold (Fig B4.63).

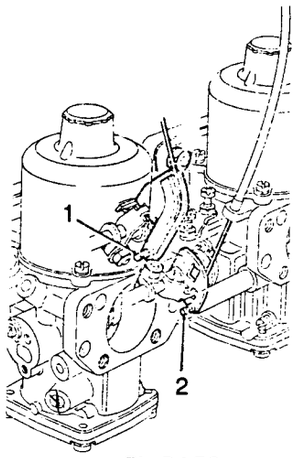


Fig B4.76

(16) Refer to Fig B4.76. Refit the mixture cable and secure with the fixing (2).

(17) Replace the accelerator cable and secure with the fixing (1).

(18) Refit the air intake box over the carburettors (see Sub-section C4, Chapter 1).

(19) Fill the cooling system (see Sub-section E6).

(20) Reconnect the battery.

(21) If the position of the distributor has been disturbed, reset the ignition timing (see Sub-section D3, Chapter 2).

CHAPTER 11

CAMSHAFT COVER - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the camshaft cover:

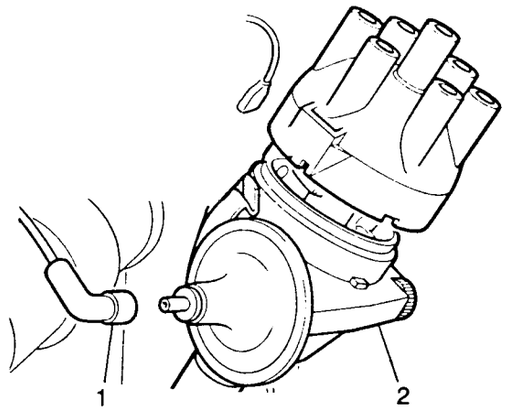


Fig B4.77

(1) Refer to Fig B4.77. Disconnect the vacuum advance pipe (1) at the distributor (2).

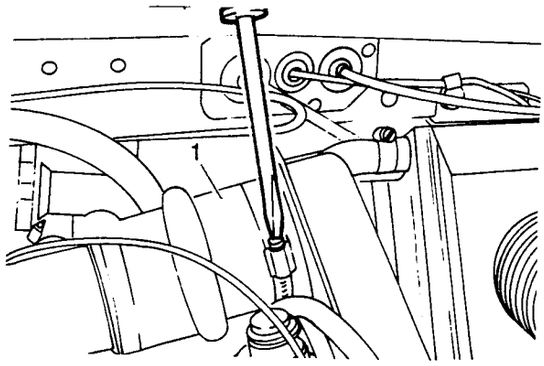


Fig B4.78

(2) Refer to Fig B4.78. Remove the air intake hose (1) between the air cleaner and the air intake box.

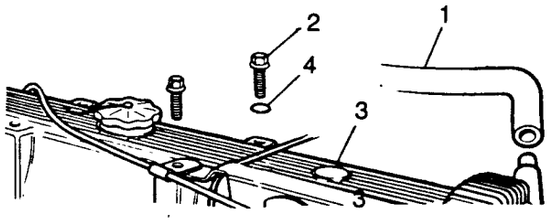


Fig B4.79

(3) Refer to Fig B4.79. Disconnect the breather pipe (1) from the front of the cam cover (3).

(4) Starting from the centre of the cover slacken the eight flanged bolts (2).

(5) Remove the bolts and O-rings (4).

(6) Move the choke and accelerator cables to one side and lift off the cover over the camshaft carrier.

(7) Remove the gasket.

REPLACEMENT

2. Replace the cam cover as follows:

(1) Fit a new cover gasket.

(2) Replace the cam cover, fitting it under the choke and accelerator cables.

(3) Fig B4.79 still applies. Examine the O-ring seals (4) for damage or wear. Replace if necessary.

(4) Fit the flanged bolts (1) and O-rings (2). Tighten the bolts evenly to 8 N.m., working diagonally from the centre. Check that the O-rings (4) stand proud of the bolt flange when the bolts are tightened.

NOTE
Do not overtighten. A bolt flange which touches the alloy cover will promote noise from the valve mechanism.

(5) Refit the air intake hose and tighten the hose clamps.

(6) Reconnect the breather pipe to the front of the cam cover (Fig B4.79,(1)).

(7) Reconnect the vacuum advance pipe to the distributor (Fig B4.77,(1)).

CHAPTER 12

FRONT ENGINE MOUNTINGS - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the front mountings:

   (1) Support the engine with an engine sling.

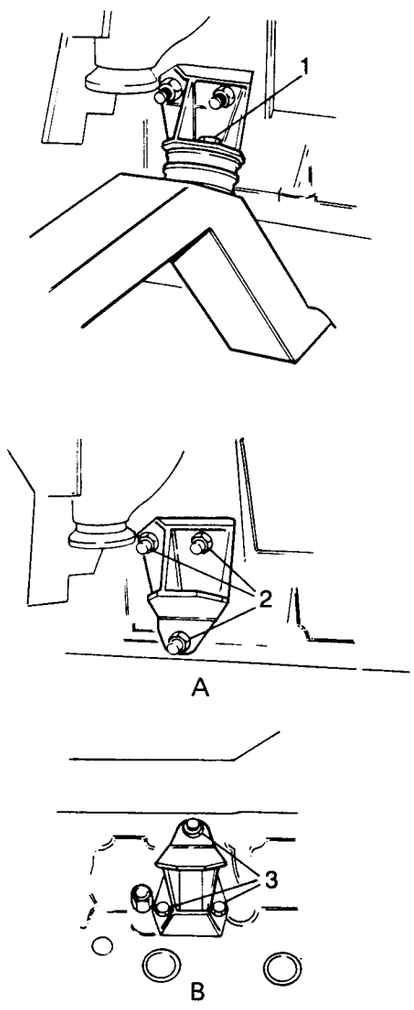


Fig B4.80

   (2) Refer to Fig B4.80. Remove the nuts (1) and spring washers securing the engine mountings to the rubber mountings.

   (3) Remove the nuts (2) and spring washers securing the mountings to the engine brackets (Fig B4.80A - left hand mounting, B4.80B - right hand mounting).

   (4) Remove the mountings.

REPLACEMENT

2. Replace the engine mountings as follows:

   (1) Fit the mounting into position.

   (2) Refit the nuts and spring washer securing the mountings of the engine brackets.

   (3) Replace the spring washers and nuts securing the engine mountings to the rubber mountings.

   (4) Remove the engine sling.

SUB-SECTION B4

CHAPTER 13

FLYWHEEL - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the flywheel:

   (1) Remove the clutch assembly (see Sub-section H3.4, Chapter 1).

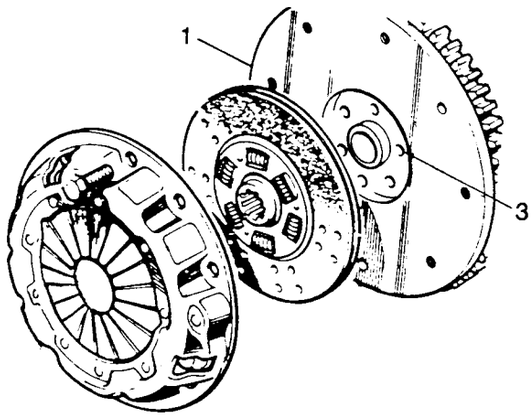


Fig B4.81

   (2) Refer to Fig B4.81. Mark the position of the flywheel (1) in relation of the crankshaft.

   (3) Remove the six bolts (3) and withdraw the flywheel.

REPLACEMENT

2. Replace the flywheel as follows:

   (1) Fit the flywheel to the crankshaft with the six securing bolts, ensuring the positioning marks are aligned.

   (2) Torque the securing bolts to 81 to 88 N.m.

   (3) Replace the clutch assembly (see Sub-section H3.4, Chapter 1).

   (4) Replace the gearbox (see Sub-section H1.3, Chapter 1).

CHAPTER 14

STARTER RING GEAR - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the starter ring gear:

   (1) Remove the flywheel (see Sub-section B4, Chapter 13).

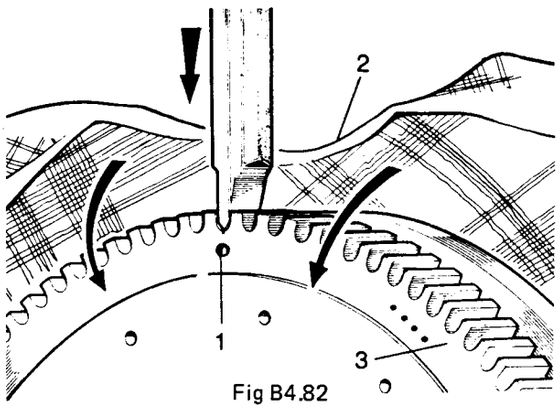


Fig B4.82

   (2) Refer to Fig B4.82. Drill a 10 mm diameter hole (1) axially between the root of any tooth and the inner diameter of the starter ring sufficiently deep to weaken the ring. DO NOT allow the drill to enter the flywheel.

   (3) Secure the flywheel in a vice fitted with soft jaws and place a cloth (2) over the flywheel as protection from flying fragments.

   WARNING
   Take adequate precautions against flying fragments as the starter ring gear may fly to pieces when being split.

   (4) Place a chisel immediately above the drilled hole and strike it sharply to split the starter ring gear (3).

REPLACEMENT

2. Replace the starter ring gear as detailed below:

   (1) Place the flywheel, flanged side down, on a flat surface.

   (2) Heat the starter ring gear uniformly to between 170 and 175 degrees centigrade but do not exceed the higher temperature.

   (3) Locate the heated ring gear in position on the flywheel with the chamfered inner diameter towards the flywheel flange.

   (4) Press the starter ring gear firmly against the flange until the ring contracts sufficiently to grip the flywheel.

   (5) Allow the flywheel to cool gradually. DO NOT hasten the cooling in any way and thereby avoid the setting up of internal stresses in the ring gear which could lead to subsequent fracture or failure.

   (6) Replace the flywheel (see Sub-section B4, Chapter 13).

CHAPTER 15

OIL PICK-UP PIPE AND STRAINER ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove this assembly:

   (1) Remove the sump (see Sub-section B4, Chapter 17).

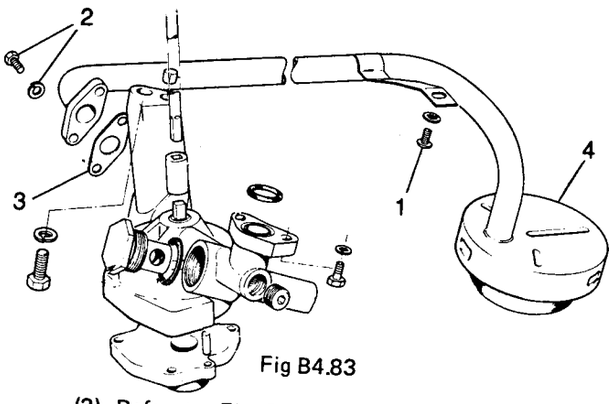


Fig B4.83

   (2) Refer to Fig B4.83. Remove the screw (1) spring, and flat washer securing the support bracket to the main bearing cap. Remove the two screws (2) and spring washers securing the pipe flange to the oil pump. Remove the assembly, detach and discard the flange gasket (3).

REPLACEMENT

2. Replace the assembly as follows:

   (1) Wash the oil strainer (4) in petrol.

   (2) Using a new flange gasket (3), fit the assembly to the oil pump. DO NOT tighten the screws at this stage.

   (3) Check for clearance between the support bracket and the mounting face on the main bearing cap and alignment of the holes. Should clearance or misalignment be present remove the assembly and adjust the bracket.

   (4) Tighten the flange screws and the bracket screw. Ensure that there is no strain on the flange when the three screws are tightened.

   (5) Replace the sump (see Sub-section B4, Chapter 17).

CHAPTER 16

OIL PUMP - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the oil pump:

   (1) Remove the oil pipe pick-up and strainer assembly (see Sub-section B4, Chapter 15).

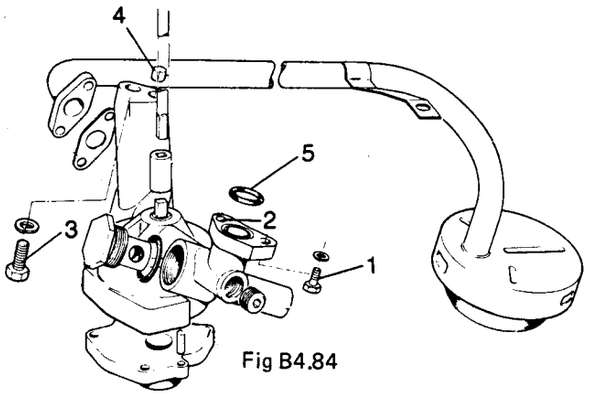


Fig B4.84

   (2) Refer to Fig B4.84. Remove the bolt (1) clamping the oil pump outlet sealing ring flange to the crankcase. Left-hand side of the engine. Note that hole (2) is an alternative mounting used in early models. It is not used on this model.

   (3) Remove the bolt (3) securing the oil pump to the crankcase. Right-hand side of the engine.

   (4) Lift the oil pump assembly off the locating dowels (4) and recover the outlet sealing ring (5).

NOTE

If the pump is removed with the engine in situ, the square ended oil pump drive shaft disengages from its driving square and drops out.

REPLACEMENT

2. To replace the oil pump: (Fig B4.84 still applies).

   (1) Fit a new sealing ring (5) to the outlet flange.

   (2) Ensure that the pump drive shaft is fitted.

   (3) Fit the pump over the locating dowels (4). Should the pump assembly not sit evenly on both mounting faces due to zero end float between the drive square and the distributor drive shaft, check that the shaft has not disengaged from the distributor at the drive tang. Normal shaft end float should be approximately 2,54 mm.

   (4) Secure the pump to the crankcase with the bolt (3) and lockwasher. Tighten to 27 to 33 N.m.

   (5) Replace the bolt (1) and lockwasher holding the pump to the crankcase. Tighten to 8 to 10 N.m.

   (6) Refit the oil pick-up pipe and strainer (see Sub-section B4, Chapter 15).

   (7) Prime the engine before starting by cranking with the starter motor having first removed the coil lead and the spark plugs.

SUB-SECTION B4

CHAPTER 17

SUMP - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the sump:

   (1) Remove the engine oil dipstick.

   (2) Raise the vehicle to a suitable working height and support it with stands.

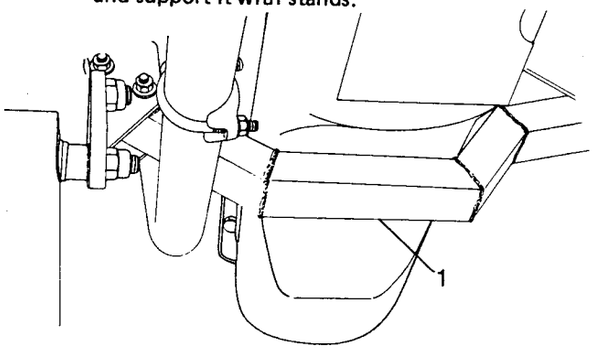


Fig B4.85

   (3) Refer to Fig B4.85. Remove the engine mounting member (1) across the sump (four bolts, washers and locknuts).

   (4) Drain the engine oil (see Sub-section B6).

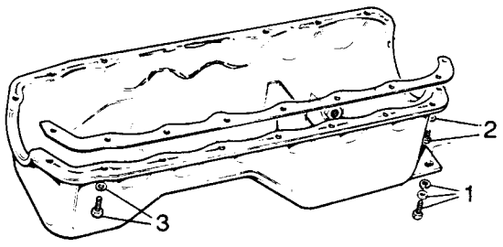


Fig B4.86

   (5) Refer to Fig B4.86. Remove the two bolts, plain and spring washers (1) securing the support plate to the adaptor plate.

   (6) Remove the two 4,76 mm UNC screws (2) and flat washers securing the sump, rear seal and gasket to the adaptor plate.

   (7) Remove the remaining 16 screws and spring washers (3) securing the sump to the cylinder block.

   (8) Lower and remove the sump.

REPLACEMENT

2. Replace the sump as detailed below:

   (1) Check the front and rear sump seals for damage or wear and replace if necessary.

   (2) Fit a new sump gasket as follows:

      i. Apply a thin coat of Permatex No 3 jointing compound to the side rails of the crankcase and allow it to become tacky.

      ii. Apply a thin coat of jointing compound to the underside of each gasket and allow it to become tacky.

      iii. Position the gasket on the side rails so that all holes line up, and the end of the gasket at the front abuts with the lug on the front seal, while at the same time it is positioned on top of the sealing rib.

   NOTE

   It is not necessary to use jointing compound on the rubber seals.

   (3) Offer up the sump to the crankcase.

   (4) Fig B4.86 still applies. Fit the 16 screws and spring washers (3) and torque to 10 to 13 N.m.

   (5) Replace the two bolts, plain and spring washers (1) securing the support plate to the adaptor plate.

   (6) Refit the two 4,76 mm UNC screws and flat washers (2) securing the sump, rear seal and gasket to the adaptor plate.

   (7) Replace the engine cross mounting member.

   (8) Lower the vehicle to the ground.

   (9) Replace the dipstick and fill with the correct grade of oil.

CHAPTER 21

TIMING CHAIN GUIDES - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the timing chain guides:

(1) Raise the vehicle on a hoist or stands.

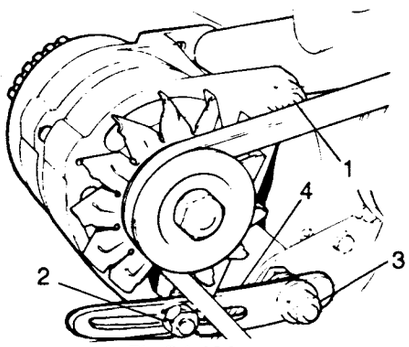


Fig B4.104

(2) Refer to Fig B4.104. Slacken the nuts (1) and (2) and remove the alternator belt.

(3) Remove the nut (3) and take off the alternator adjusting bracket (4).

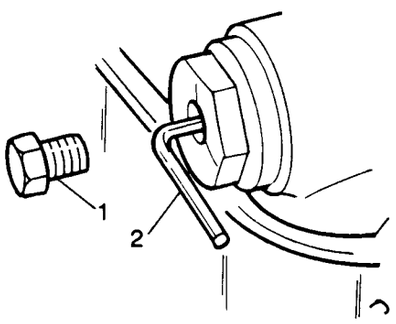


Fig B4.105

(4) Refer to Fig B4.105. Retract the timing chain tensioner by removing the chain tensioner adaptor screw (1), fitting a 3,17 mm allen key (2) and turning the key 90° clockwise.

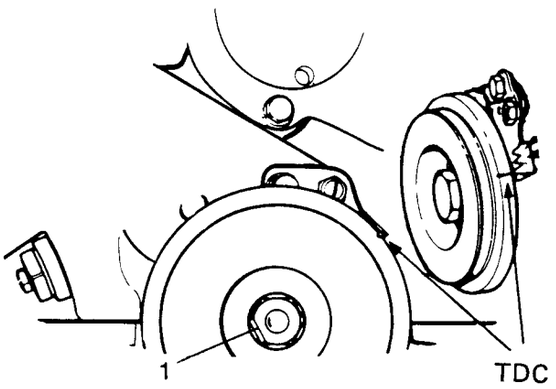


Fig B4.106

(5) Refer to Fig B4.106. Loosen the harmonic balancer bolt (1) using special tool 18G98A.

(6) Set the crankshaft pulley timing mark to the TDC position with No 1 cylinder firing.

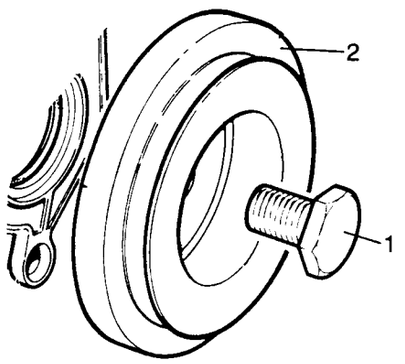


Fig B4.107

(7) Refer to Fig B4.107. Remove the harmonic balancer bolt (1) and pull the crankshaft pulley (2) away.

(8) Remove the camshaft cover (see Sub-section B4, Chapter 11).

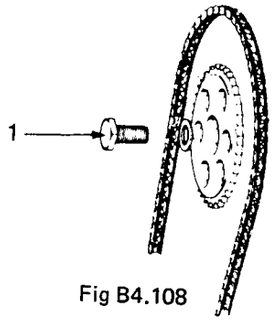


Fig B4.108

(9) Refer to Fig B4.108. Remove the fixing (1) for the camshaft sprocket and remove the sprocket.

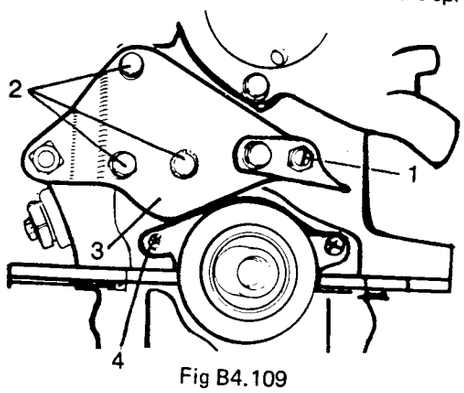


Fig B4.109

(10) Refer to Fig B4.109. Remove the locknut (1) and three bolts (2) and lift away the timing cover (3).

(11) Slacken the sump screws sufficiently to lower the sump by approximately 5 mm.

(12) Remove the two seal housing screws (4). Carefully separate the housing gasket from the sump gasket with a suitable blade or knife and remove the housing.

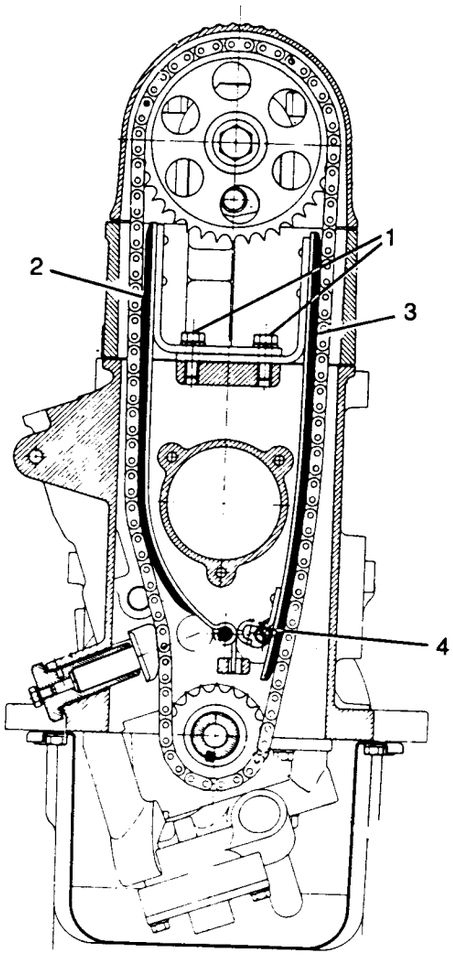


Fig B4.110

(13) Refer to Fig B4.110. Remove the guide retaining bolts (1).

(14) Release the RH guide (2) from the engine.

(15) Release the LH guide (3) from the adjuster (4) at the bottom and remove the guide by lifting and turning through 90° anti-clockwise.

REPLACEMENT

2. Replace the chain guides as follows:

(1) Replace the LH guide first, turning the cam adjuster to ensure that the guide is vertical.

(2) Fit the RH guide.

(3) Replace the guide retaining bolts and tighten to 24 to 27 N.m.

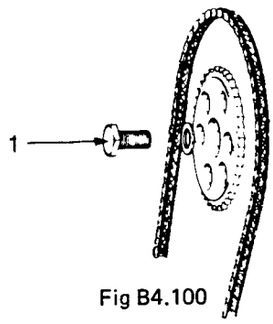


Fig B4.100

(9) Refer to Fig B4.100. Remove the fixing (1) for the camshaft sprocket and remove the sprocket.

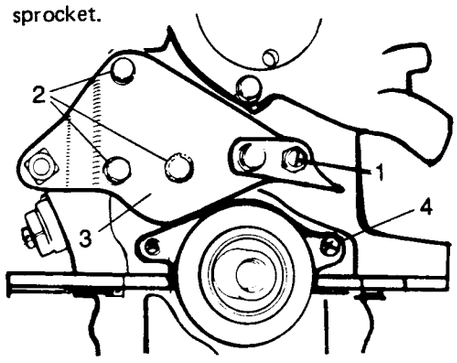


Fig B4.101

(10) Refer to Fig B4.101. Remove the locknut (1) and three bolts (2) and lift away the timing cover (3).

(11) Slacken the sump screws sufficiently to lower the sump by approximately 5 mm.

(12) Remove the two seal housing screws (4). Carefully separate the housing gasket from the sump gasket with suitable blade or knife and remove the housing.

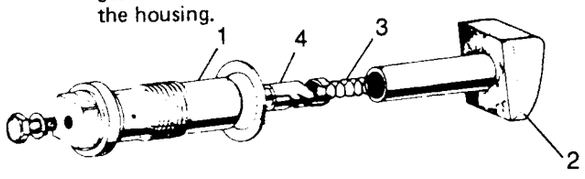


Fig B4.102

(13) Refer to Fig B4.102. Unscrew the tensioner body (1) from the engine block.

(14) Turn the cam adjuster stud ((1) on Fig B4.101) to obtain maximum slack in the chain.

(15) Lever the chain away from the tensioner (2) and turn the tensioner through 180°. Finally push the chain inwards and remove the tensioner through the timing cover aperture.

NOTE
In some cases it may be necessary to remove the camshaft sprocket to obtain sufficient chain movement.

REPLACEMENT

2. To replace the chain tensioner: (Fig B4.102 still applies).

(1) Fit the spring (3) and plunger (4) into the tensioner and lock them in place by fitting the Allen key and turning it 90° clockwise. Remove the Allen key.

(2) Fit the tensioner through the timing hole cover. Push the chain inwards and place the tensioner in position.

(3) Screw in the tensioner body (1) while holding the tensioner against the chain.

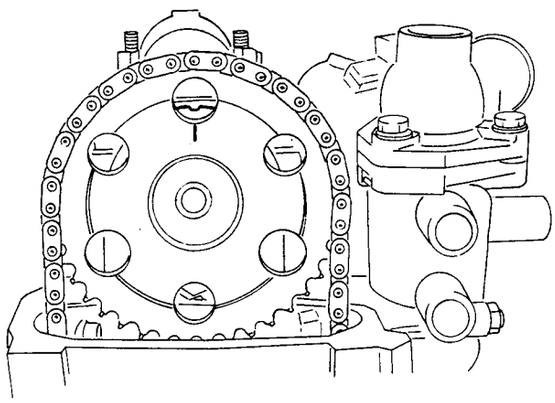


Fig B4.103

(4) Refer to Fig B4.103. Replace the camshaft sprocket. Check that the timing marks on the sprocket and carrier are aligned.

(5) Refit the chain over the sprocket.

(6) Replace the camshaft cover (see Sub-section B4, Chapter 11).

(7) If the crankshaft sprocket has been removed, replace it and refit the chain.

(8) Turn the cam adjuster stud ((1) on Fig B4.101) to the point where the slack in the chain is just taken up. Do not overtighten the chain.

(9) Fit the allen key into the chain tensioner and turn 90° counterclockwise to release the tensioner.

(10) Replace the seal housing, securing it with the two screws.

(11) Retighten the sump screws to 10 to 13 N.m.

(12) Replace the timing cover noting that the dowel bolt goes through the eye at the bottom of the fixed (RH) chain guide. Tighten the other three bolts to 24 to 27 N.m.

(13) Replace and tighten the locknut on the cam adjuster stud. Do not move the stud while tightening the nut.

(14) Refit the crankshaft pulley and tighten the harmonic balancer bolt to 81 to 95 N.m. Check that the timing mark is still at TDC.

(15) Replace the alternator adjusting bracket.

(16) Replace and tension the alternator bolt. Tighten the three nuts (1), (2) and (3) on Fig B4.96.

(17) Lower the vehicle to the ground.

SUB-SECTION B4

CHAPTER 18

OIL PRESSURE RELIEF VALVE - REMOVAL AND REPLACEMENT

INTRODUCTION

1. The oil pressure relief valve is a sealed non-adjustable assembly pressed into the oil pump body. Should a valve be suspect it must be replaced.

REMOVAL

2. To remove the relief valve:

(1) Remove the oil pump assembly (see Sub-section B4, Chapter 16).

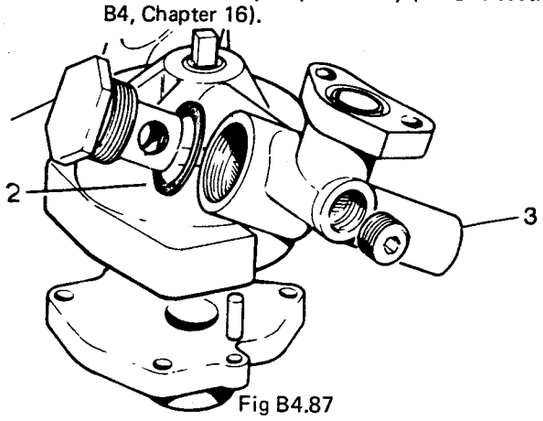


Fig B4.87

(2) Refer to Fig B4.87. Remove the relief valve screw plug (1) and copper washer (2).

(3) Press the valve assembly (3) from the pump body.

REPLACEMENT

3. Replace the valve as follows:

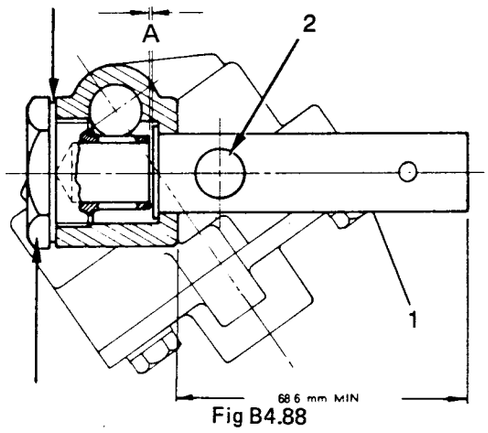


Fig B4.88

(1) Refer to Fig B4.88. Enter the valve (1) into its housing on the oil pump. This press fit valve must be positioned so that the discharge hole (2) is parallel to the pump mounting face.

(2) Ensure the valve is square in the housing and press in until the locating flange bottoms in the housing.

(3) Fit the copper washer and plug assembly and tighten the plug.

(4) Check that a clearance of 0,05 to 0,5 mm exists at dimension A after the plug is tightened.

(5) Replace the oil pump assembly (see Sub-section B4, Chapter 16).

CHAPTER 19

TIMING CHAIN - REMOVAL, FITTING NEW CHAIN AND REPLACEMENT

REMOVAL

1. To remove the timing chain:

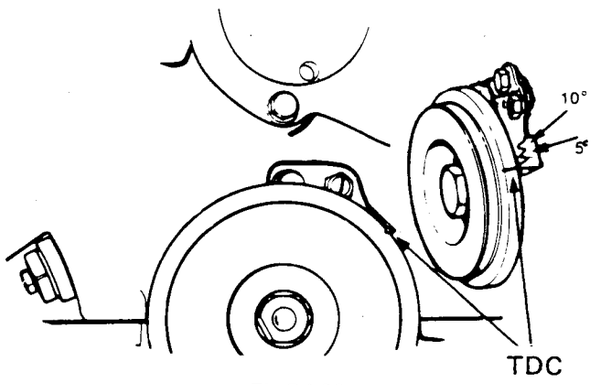


Fig B4.89

(1) Refer to Fig B4.89. Set the timing marks to TDC. With No 1 cylinder firing (distributor rotor pointing to No 1 cylinder take-off and the points opening).

(2) Remove the camshaft cover and gasket (see Sub-section B4, Chapter 11).

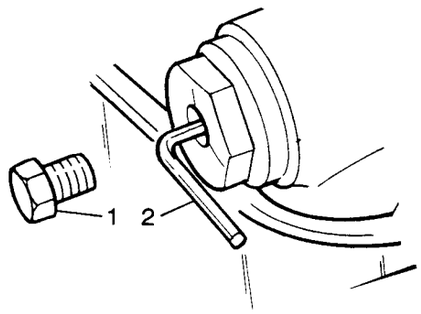


Fig B4.90

(3) Refer to Fig B4.90. Retract the timing chain tensioner by removing the chain tensioner adaptor screw (1), fitting a 3,17 mm allen key (2) and turning the key 90° clockwise.

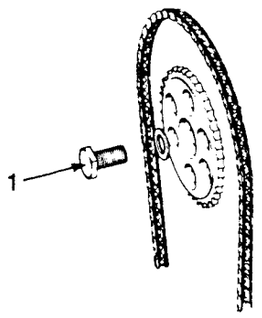


Fig B4.91

(4) Refer to Fig B4.91. Remove the fixing (1) for the camshaft sprocket and remove the sprocket.

FITTING NEW CHAIN

2. The following procedure continues from the removal procedure. To fit a new chain:

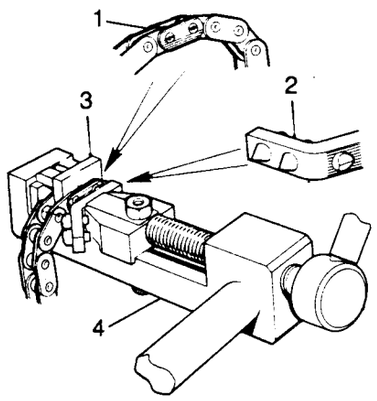


Fig B4.92

(1) Refer to Fig B4.92. Locate the bright link of the chain (1) in special tool 18G1151 (4).

(2) Fit the pointed extractor adaptor (2) into the head of the tool sliding press. Fit the bridge-piece of the tool (3) into the bright link.

(3) Position the link in the front of the tool anvil with the rivet side of the link (link pin heads with horizontal depressions) towards the sliding press of the tool.

(4) Tighten the press until the link pins shear through the link plate.

(5) Retract the press and remove the chain.

(6) Remove the extractor from the press.

(7) Attach the replacement chain to the old chain with a piece of wire so the old chain will act as 'pull through' to locate the new chain around the guides, tensioner and crankshaft sprocket.

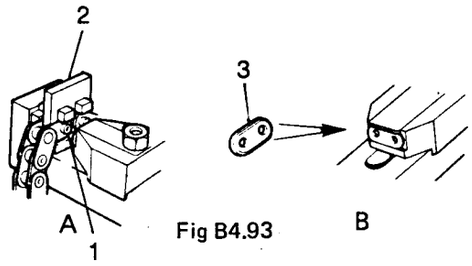


Fig B4.93

(8) Refer to Fig B4.93. Join the ends of the chain with a new link and position the link in the anvil with the head of the pins towards the press.

(9) Fit the locating bridge (2) with its legs centralising the link in the anvil.

(10) Locate the plate of the link (3), chamfered side away from the chain, on the bed of the press.

(11) Press the plate fully onto the link pins, ensuring that the holes and pins are aligned.

(12) Retract the press.

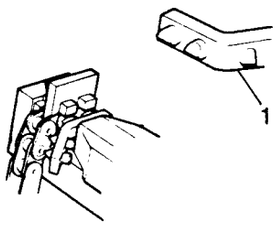


Fig B4.94

(13) Refer to Fig B4.94. Fit the rivet adaptor (1) into the head of the press and tighten the press fully down onto the pins using hand pressure only on the press tommy-bar.

(14) Check that a slight side-play exists on the link with no tight spots.

REPLACEMENT

3. To replace the chain:

(1) Fit the camshaft sprocket. Tighten the bolt to 47 N.m.

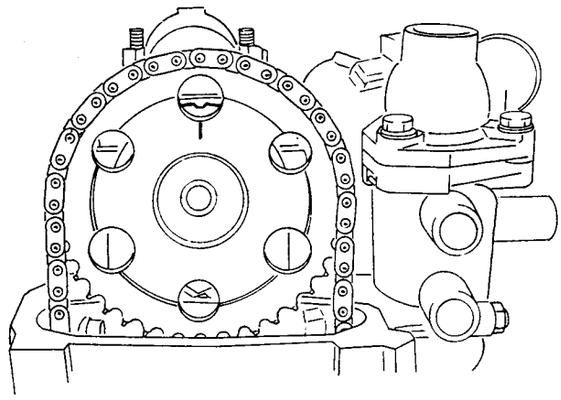


Fig B4.95

(2) Refer to Fig B4.95. Align the timing marks on the camshaft sprocket and carrier.

(3) Check that the crankshaft pulley mark is at the TDC position with No 1 cylinder firing.

(4) Fit the chain over the sprocket, making sure that it is also over the bottom sprocket.

(5) Release the timing chain tension by turning the allen key 90° counterclockwise. Remove the allen key and replace the adaptor screw (Fig B4.90).

(6) Replace the camshaft cover (see Sub-section B4, Chapter 11).

CHAPTER 20

TIMING CHAIN TENSIONER - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the timing chain tensioner:

   (1) Raise the vehicle on a hoist or stands.

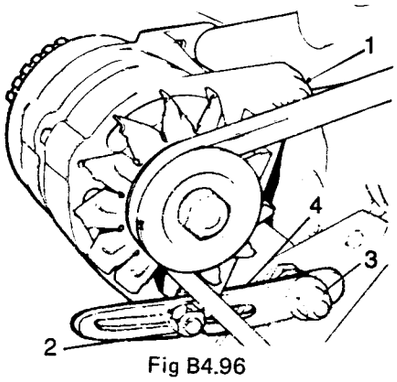


Fig B4.96

   (2) Refer to Fig B4.96. Slacken the nuts (1) and (2) and remove the alternator belt.

   (3) Remove the nut (3) and take off the alternator adjusting bracket (4).

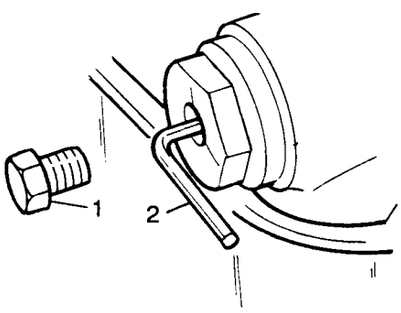


Fig B4.97

   (4) Refer to Fig B4.97. Retract the timing chain tensioner by removing the chain tensioner adaptor screw (1), fitting a 3,17 mm allen key (2) and turning key 90° clockwise. Remove the Allen key.

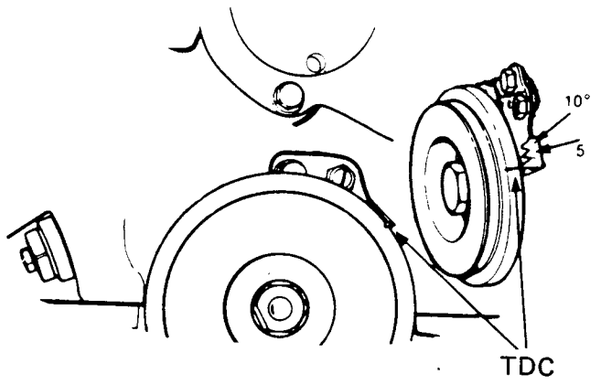


Fig B4.98

   (5) Refer to Fig B4.98. Loosen the harmonic balancer bolt (1) using special tool 18G98A.

   (6) Set the crankshaft pulley timing mark to the TDC position with No 1 cylinder firing.

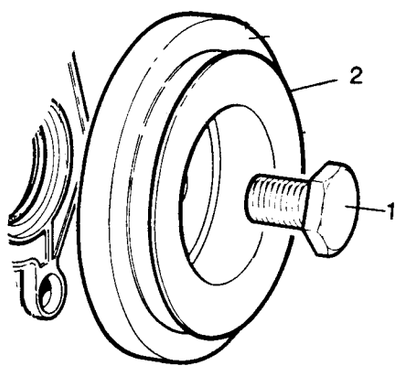


Fig B4.99

   (7) Refer to Fig B4.99. Remove the harmonic balancer bolt (1) and pull the crankshaft pulley (2) away.

   (8) Remove the camshaft cover (see Sub-section B4, Chapter 11).

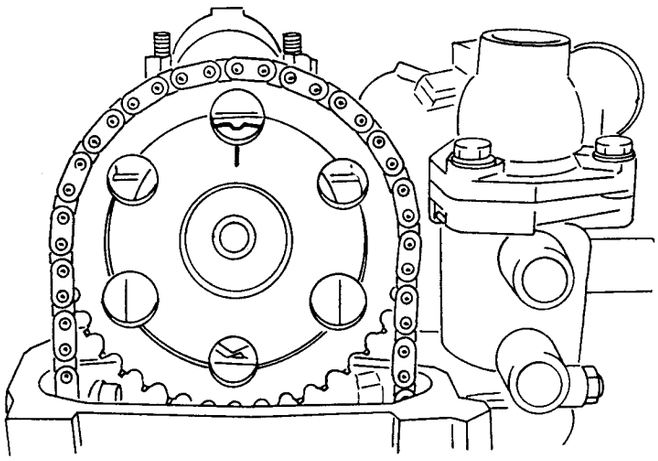


Fig B4.111

(4) Refer to Fig B4.111. Replace the camshaft sprocket. Check that the timing marks on the sprocket and carrier are aligned.

(5) Refit the chain over the sprocket.

(6) Replace the camshaft cover (see Sub-section B4, Chapter 11).

(7) Turn the cam adjuster stud ((4) on Fig B4.110) to the point where the slack in the chain is just taken up. Do not overtighten the chain.

(8) Fit the allen key into the chain tensioner and turn 90° counterclockwise to release the tensioner.

(9) Replace the seal housing, securing it with the two screws.

(10) Retighten the sump screws to 10 to 13 N.m.

(11) Refit the crankshaft pulley and tighten the harmonic balancer bolt to 81 to 95 N.m. Check that the timing mark is still at TDC.

(12) Replace the timing cover noting that the dowel bolt goes through the eye at the bottom of the fixed (RH) chain guide. Tighten the other three bolts to 24 to 27 N.m.

(13) Replace and tighten the locknut on the cam adjuster stud. Do not move the stud while tightening the nut.

(14) Replace the alternator adjusting bracket.

(15) Replace and tension the alternator. Tighten the three nuts (1), (2) and (3) on Fig B4.104.

(16) Lower the vehicle to the ground.

CHAPTER 22

OIL COOLER AND PIPES - REMOVAL AND REPLACEMENT

REMOVAL

1. The oil cooler is located under the radiator. To remove:

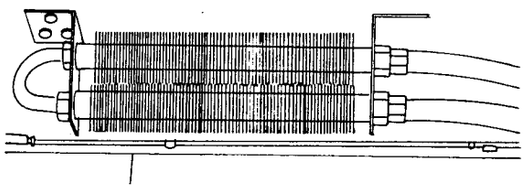


Fig B4.112

(1) Refer to Fig B4.112. Remove the six nuts and bolts securing the oil cooler to the chassis.

(2) Lower the oil cooler from the chassis.

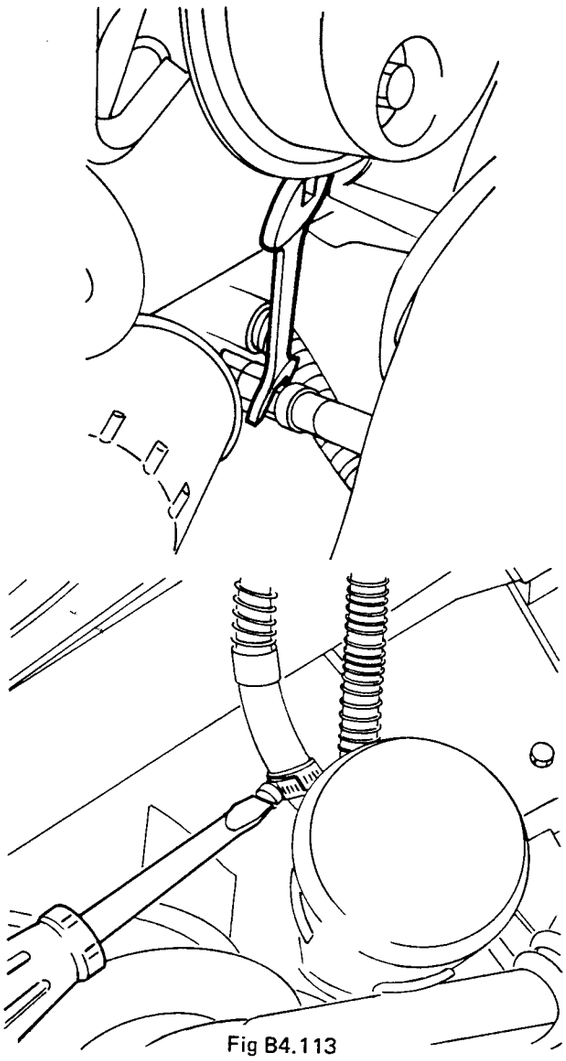


Fig B4.113

(3) Refer to Fig B4.113. Using a suitable container to catch the oil, disconnect the oil cooler pipes from the oil filter adaptor housing and remove the pipes.

REPLACEMENT

2. To replace the oil cooler:

(1) Fig B4.113 still applies. Reconnect the pipes to the oil filter adaptor housing.

(2) Fig B4.112 still applies. Position the oil cooler on the chassis and secure with the six nuts and bolts.

SUB-SECTION CONTENTS LIST

SUB-SECTION B5

ENGINE OVERHAUL PROCEDURES

SUB-SECTION B5

CHAPTER 1

CONNECTING RODS AND PISTONS - DISMANTLING AND REASSEMBLY

DISMANTLING

1. Remove the connecting rod and piston (see Sub-section B4, Chapter 5) then proceed as follows:

(1) Remove the piston rings over the crown of the piston.

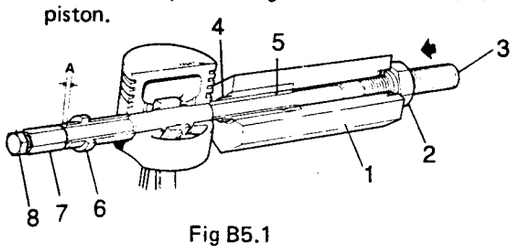


Fig B5.1

(2) Refer to Fig B5.1. Retain the hexagon body (1) of special tool 18G1150 in a vice.

(3) Screw the large nut (2) forward until the nut contacts the thrust race.

(4) Push the screw (3) forward until the nut contacts the thrust race.

(5) Locate the piston adaptor (4) of 18G1150D in the bore of the body with its spigot facing outwards.

(6) Smear the outside diameter of the parallel sleeve (5) with oil and fit the sleeve onto the centre screw, groove end first.

(7) Fit the piston, with the mark "FRONT" or △ etched on the piston crown towards the adaptor, and onto the centre screw of 18G 1150.

CAUTION
The gudgeon pin bore is offset towards the distributor side of the engine. A gudgeon pin counter bore is on the forward side of the piston only (marked "FRONT" or △ on the piston crown).

(8) Fit the remover/replacer bush (6) on the centre screw with the flanged end away from the gudgeon pin.

(9) Screw the stop-nut (7) onto the centre screw and adjust it until approximately 1,0 mm end-play (dimension A) exists on the assembly.

(10) Lock the stop-nut securely with the lock screw (8).

(11) Check that the remover/replacer bush and parallel sleeve are correctly positioned in the bore on both sides of the piston.

(12) Screw the large nut (2) up to the thrust race.

(13) Hold the lock screw (8) and turn the large nut until the gudgeon pin is withdrawn from the piston.

REASSEMBLY

2. To reassemble the connecting rods and pistons:

(1) Check the connecting rod alignment.

(2) Remove the large nut of 18G1150 and pull the centre screw out of the body approximatley 50 mm.

CAUTION
Ensure that the threads of the large nut and screw are lubricated.

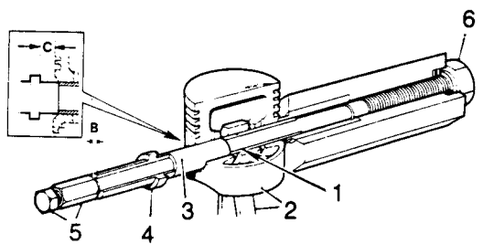


Fig B5.2

(3) Refer to Fig B5.2. Slide the parallel sleeve (1), groove end last onto the centre screw, and up to the shoulder.

(4) Lubricate the gudgeon pin and bores of the connecting rod and piston with graphited oil (Acheson's Colloids 'Oildag').

(5) Fit the connecting rod and piston to the tool (2) with the connecting rod entered on the sleeve up to the groove.

(6) Fit the gudgeon pin (3) into the piston bore up to the connecting rod.

(7) Fit the remover/replacer bush (4) with the flanged end towards the gudgeon pin.

(8) Screw the stop-nut onto the centre screw; adjust the nut to give a 1,0 mm end-play (dimension B) and lock the nut securely with the lock screw (5).

(9) Screw the large nut up to the thrust race (6).

(10) Set the torque wrench to 16 N.m (this represents the minimum load for an acceptable fit).

(11) Using a torque wrench on the large nut, and holding the lock screw, pull the gudgeon pin in until assembly dimension (dimension C) is 8,5

mm. Under no circumstances must the flange of the remover/replacer bush be allowed to contact the piston.

CAUTION

If the torque wrench has not broken throughout the pull, the fit of the gudgeon pin to the connecting rod is not acceptable and necessitates the renewal of components. The large nut and centre screw of the tool must be kept well oiled.

(12) Remove the tool.

(13) Check that the piston pivots freely on the pin, also with sideways movement, and that the gudgeon pin will not foul the bore. If stiffness exists, wash the assembly in fuel or paraffin (kerosene), lubricate the gudgeon pin with Acheson's Colloids 'Oildag' and re-check for ingrained dirt or damage.

(14) Check the piston and connecting rod for alignment.

3. Refit the piston rings:

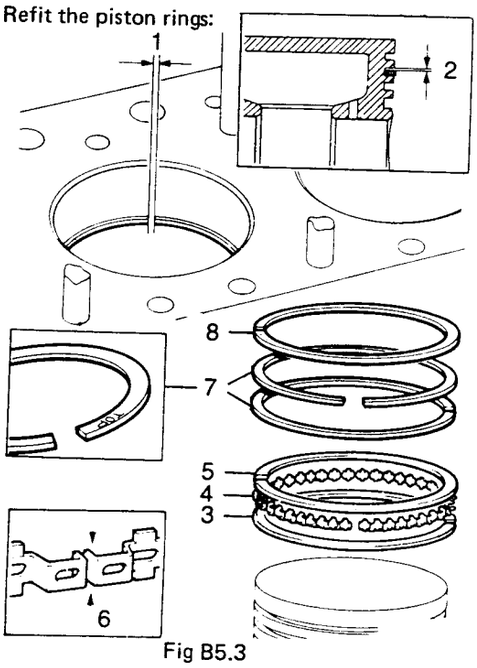


Fig B5.3

(1) Refer to Fig B5.3. Check the piston ring gap in the cylinder bore (1). To be 0,203 to 0,43 mm.

(2) Check the ring to groove clearance (2). To be 0,038 mm.

(3) Fit the bottom rail (3) to the oil control ring to the piston, and position it below the bottom groove.

(4) Fit the oil control expander (4) into the bottom groove.

(5) Move the bottom oil control ring into the bottom groove.

(6) Fit the top control ring rail (5) into the bottom groove.

(7) Check that the ends of the expanders are butting (6) but not overlapping and set the gaps of the rails and expander at 90 degrees to each other.

(8) Fit the tapered compression ring (7) with the face marked 'Top' towards the top of the piston; these rings are thinner than the top compression ring.

(9) Fit the plain compression ring (8) to the top groove.

(10) Position the ring gaps at 90 degrees to each other and away from the thrust side of the piston.

4. Replace the connecting rod and piston assembly (see Sub-section B4, Chapter 5).

mm. Under no circumstances must the flange of the remover/replacer bush be allowed to contact the piston.

CAUTION

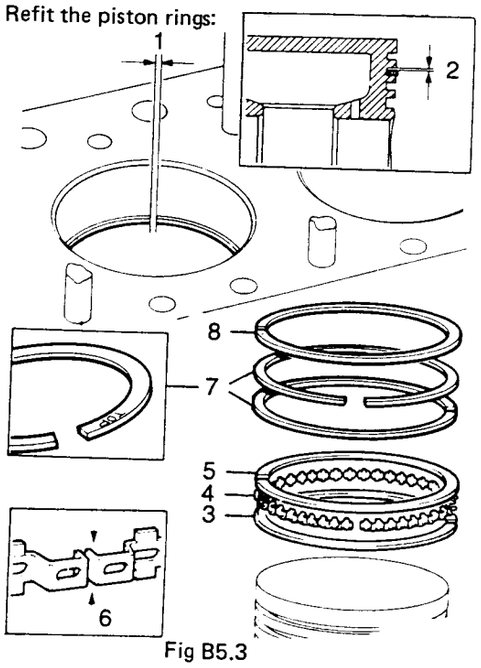
If the torque wrench has not broken throughout the pull, the fit of the gudgeon pin to the connecting rod is not acceptable and necessitates the renewal of components. The large nut and centre screw of the tool must be kept well oiled.

(12) Remove the tool.

(13) Check that the piston pivots freely on the pin, also with sideways movement, and that the gudgeon pin will not foul the bore. If stiffness exists, wash the assembly in fuel or paraffin (kerosene), lubricate the gudgeon pin with Acheson's Colloids 'Oildag' and re-check for ingrained dirt or damage.

(14) Check the piston and connecting rod for alignment.

3. Refit the piston rings:



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(9) Fit the plain compression ring (8) to the top groove.

(10) Position the ring gaps at 90 degrees to each other and away from the thrust side of the piston.

4. Replace the connecting rod and piston assembly (see Sub-section B4, Chapter 5).

CHAPTER 2

FLYWHEEL - OVERHAUL

PROCEDURE

1. Overhaul the flywheel as follows:

   (1) Remove the flywheel (see Sub-section B4, Chapter 13).

   (2) Measure the overall thickness of the flywheel. Fit a new flywheel it is is more than 2 mm below the specified thickness of 50 mm.

   (3) If the flywheel is above the minimum thickness, the clutch face may be refaced as follows:

   (4) Remove the dowels.

   (5) Reface the flywheel over the complete surface.

   (6) Check the overall thickness of the flywheel to ensure that it is still above the minimum thickness.

   (7) Refit the dowels.

   (8) Replace the flywheel (see Sub-section B4, Chapter 13).

SUB-SECTION B5

CHAPTER 3

OIL PUMP - OVERHAUL

DISMANTLING

1. First dismantle the pump as follows:

   (1) Remove the pump (see Sub-section B4, Chapter 16).

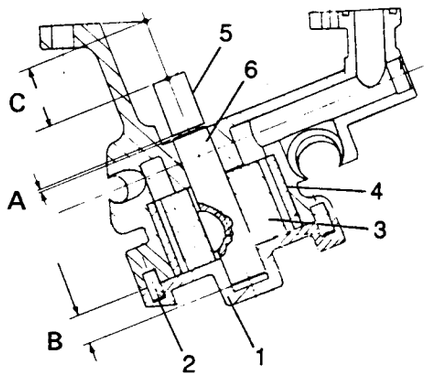


Fig B5.4

   (2) Refer to Fig B5.4. Remove the two screws, spring washers and Allen screw securing the pump cover (1) to the body.

   (3) Remove the cover with O-ring by tapping with a suitable drift on the area adjacent to the dowel bosses (2).

   (4) Identify the rotor lobe (3) with its mating cavity in the outer ring (4) to facilitate correct assembly.

   (5) Remove the outer ring, clean and dry all components.

   (6) Only remove the drive square (5) if it is to be replaced. Grip the square at the driving end and drift out the rotor shaft (6).

INSPECTING

2. Inspect the components as follows:

NOTE

The only serviceable components of the oil pump are the drive square and relief valve assembly. The oil pump must be renewed as an assembly if the rotor lobe clearance is in excess of 0,14 mm.

   (1) Check the drive square for looseness and position on the shaft. A clearance of 0,76 mm must exist between the bottom of the square and the shoulder of the shaft (dimension A).

   (2) Check for indication of flaring or splitting of the square at the drive end.

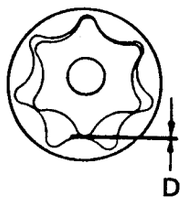


Fig B5.5

   (3) Refer to Fig B5.5. Fit the outer ring in its original running position and check rotor lobe clearance using feeler gauges (dimension D). Clearance to be 0,089 to 0,127 mm.

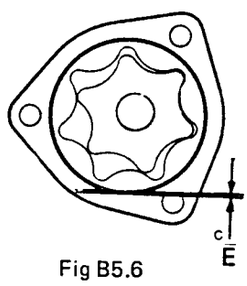


Fig B5.6

   (4) Refer to Fig B5.6. Check outer ring to body clearance (dimension E). Clearance to be 0,28 mm maximum.

NOTE

The outer ring to body clearance (dimension E) will be nil when checking rotor lobe clearance.

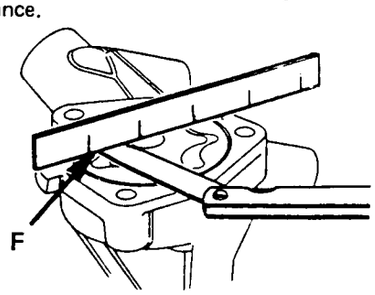


Fig B5.7

   (5) Refer to Fig B5.7. Check the outer ring end float (dimension F). Float to be 0,11 to 0,12 mm.

   (6) Check rotor end float. To be 0,11 to 0,14 mm.

REASSEMBLY

3. To reassemble the pump:

   (1) Lubricate the rotor and shaft assembly if removed.

(2) Mount the pump vertically under a press ram with the rotor shaft end on the press bed.

(3) Locate the square drive and press on until it is 0,6 mm from the shoulder.

NOTE

The chamfer on the shaft at the shoulder should be visible when the rotor assembly is seated in the body. If the chamfer is not visible check the fitted dimensions of the rotor and shaft as shown in Fig B5.4.
These dimensions are:
Dimension A : 0,76 mm
Dimension B : 12,32 to 12,57 mm
Dimension C : 25,65 to 25,90 mm

(4) Refit the outer ring with the chamfer toward the pump body and the correct cavity with its mating rotor lobe.

(5) Fit the bottom cover with O-ring, spring washers, screws and Allen screw.

(6) Tighten the screws and check that the pump shaft turns freely.

SUB-SECTION B6

MAINTENANCE

INTRODUCTION

1. General maintenance on the engine requires a regular inspection for obvious defects including oil and coolant leaks from pipes, hoses and connections.

2. At the intervals specified the sump should be drained and replenished with fresh clean oil of the correct grade. Under severe conditions of mud or dust, the first and subsequent oil changes must be more frequent, even to the extent of a daily change. Under deep wading conditions through water carrying mud and grit, a daily oil change is essential.

ACCELERATOR CABLE

3. At first service (1 500 km) and thereafter every 10 000 km or 6 months:

   (1) Lubricate the accelerator cable using clean engine oil paying particular attention to accelerator cross shaft bearings.

   (2) Check the cable for correct operation and ensure that there is no tendency to stick.

CHECKING ENGINE OIL LEVEL

NOTE

Whenever the oil level is checked, whether the engine is hot or cold, the vehicle must be parked on a level surface.

4. Check engine oil level daily or weekly depending on operating conditions.

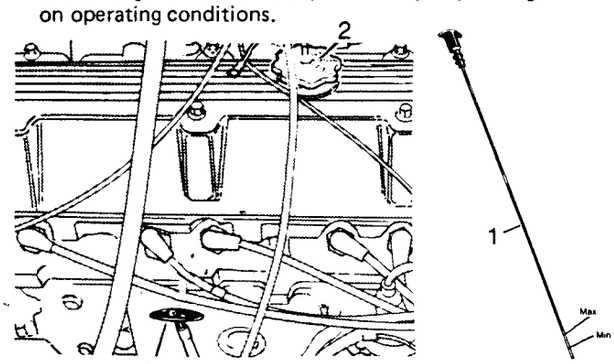


Fig B6.1

   (1) Refer to Fig B6.1. Withdraw the dipstick (1), wipe it with a lint free cloth and reinsert it to its full depth.

   (2) Withdraw the dipstick again and check that the oil level is between the maximum and minimum marks on the dipstick. Reinsert the dipstick.

   (3) If necessary, remove the filler cap (2) and add sufficient oil to take the level close to but not above the maximum mark on the dipstick. Replace the filler cap.

   (4) Under normal circumstances the oil level must never be allowed to fall below the minimum mark on the dipstick.

CHANGING ENGINE OIL

NOTE

Adhere strictly to the oil qualities and grades specified in the service schedule and Technical Specifications.

CAUTION

The engine must be at operating temperature before the oil is drained. Draining must be carried out soon after the engine has stopped so that suspended pollutants do not settle out.

5. Drain and refill the sump at first service (1 500 km) and thereafter every 10 000 km or 6 months.

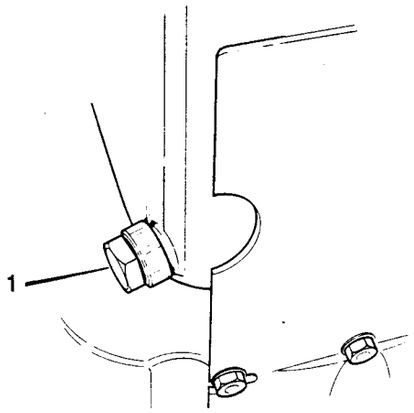


Fig B6.2

   (1) Refer to Fig B6.2. Place a container under the sump drain plug (1). The container must be capable of holding five litres of old oil.

   (2) Remove the oil filter cap ((2) on Fig B6.1).

   (3) Remove the drain plug (1) and allow all oil to drain from the engine.

   (4) Replace the drain plug, using a new copper gasket.

   (5) Change the oil filter (see paragraph below).

   (6) Refill with fresh oil and check the level as described in paragraph 4.

   (7) Run the engine and check for oil leaks at the filter and drain plug.

CHANGING THE FILTER

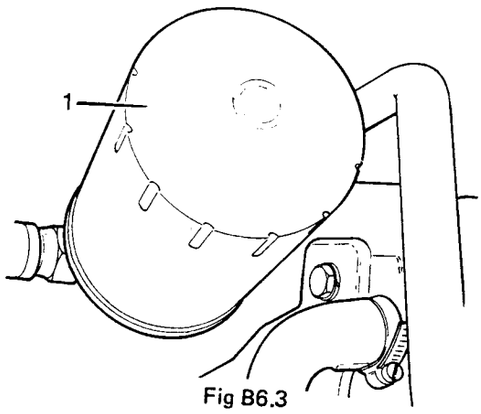


Fig B6.3

6. Refer to Fig B6.3. The filter (1) is located on the left hand side of the engine. Change the filter every 10 000 km or 6 months.

(1) With the sump drained, unscrew the filter cannister.

(2) Remove and discard the used filter.

(3) Thoroughly clean the canister.

(4) Lubricate the sealing washer of the new filter with engine oil.

(5) Fit the new filter into the canister and screw the canister onto the engine.

CARBURETTER HYDRAULIC DAMPERS

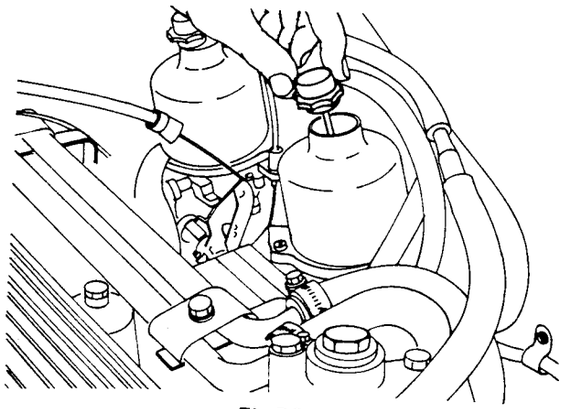


Fig B6.4

7. Refer to Fig B6.4. At first service (1 500 km) and every 10 000 km or 6 months thereafter unscrew the cap on top of the suction chamber and withdraw the hydraulic damper. Replenish the damper reservoir as necessary with SAE 20 oil to within about 12 mm from the top of the tube. Replace the cap and damper.

CLEANING THE ENGINE

8. It is essential that the external parts of the engine are kept clean. Several methods of cleaning can be used and the choice of method depends on the facilities available and the condition of the engine. Dust can be removed with compressed air. The best method of cleaning, especially if oil or grease are present is using a steam jet.

9. Oil and grease can also be removed using a commercial detergent. Allow time for the detergent to loosen the oil and grease and then wash off with water.

NOTE

When washing the engine with water take care to protect the starter motor, alternator and all other electrical devices from water splash.

FLYWHEEL HOUSING DRAIN PLUG

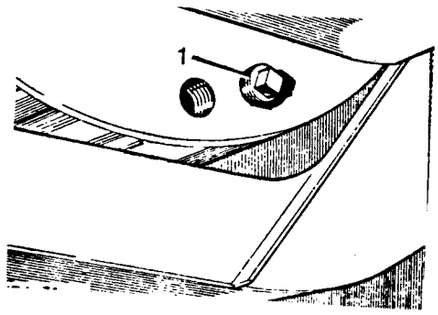


Fig B6.5

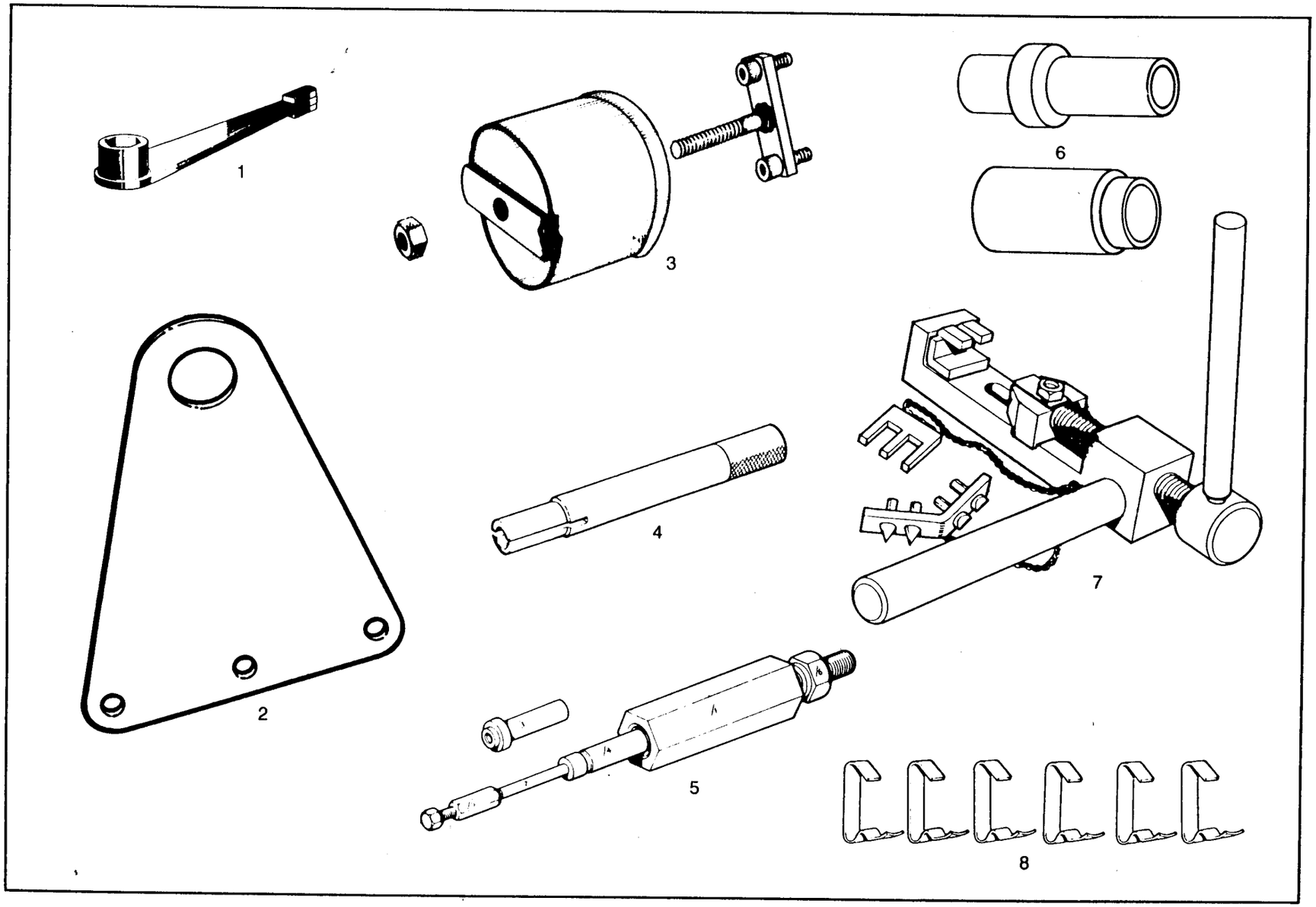
10. Refer to Fig B6.5. The flywheel housing can be completely sealed to exclude mud and water under severe wading conditions, by means of a plug (1) fitted in the bottom of the housing. The plug (1) is screwed into a hole adjacent to the drain hole and should only be fitted when the vehicle is expected to do wading or very muddy work.

11. When the plug is in use it must be removed every 5 000 km or 3 months and all oil allowed to drain off before the plug is replaced.

SUB - SECTION B7

SPECIAL WORKSHOP TOOLS

SPECIAL WORKSHOP TOOLS FOR SECTION B - POWER UNIT



SPECIAL WORKSHOP TOOLS FOR SECTION B - POWER UNIT

Item Ref	Mfr. Part No. & / or Drg.No. &/or Spec. No.	I. C. N.	Item Name and Description	Items/ Unit	Repair Lines
Item Verw.	Verv. Ond. Nr. & / of Tek.Nr. &/of Spes.Nr.	I. B. N.	Itemnaam en Beskrywing	Items/ Eenhd.	Herstel Lyne 1 2 4
1	18G98A		CRANKSHAFT NUT SPANNER for removing cranskshaft nut		
2	18GA041		ENGINE LIFTING BRACKETS for use with double ended chain		
3	18GA044		REAR CRANKSHAFT OIL SEAL REPLACER for fitting oil seal		
4	18G1147		OIL PUMP DRIVE SHAFT remover and replacer		
5	18G1150		GUDGEON PIN remover and replacer		
6	18G1150D		ADAPTOR for use with 18G1150		
7	18G1151		TIMING CHAIN LINK remover and replacer		
8	18G1218		TAPPET RETAINING CLIPS for use when removing camshaft carrier		

SECTION CONTENTS LIST

SECTION C

FUEL SYSTEM

SUB-SECTION CONTENTS LIST

SUB-SECTION C1

DESCRIPTION AND SPECIFICATIONS

SUB-SECTION C1

CHAPTER 1

DESCRIPTION OF THE FUEL SYSTEM

INTRODUCTION

1. The fuel system consists of a fuel tank, an electric fuel pump, a separate filter and the carburetters. The recommended fuel for the system is Premium grade (coast 93 octane, high altitude 98 octane).

TANK

2. The 90 litre fuel tank is mounted at the rear of the vehicle underneath the load area. It incorporates an electrically operated gauge unit connected to an instrument panel meter. The meter gives a constant indication of the amount of fuel in the tank.

3. The filler tube has an anti theft device which prevents removal of fuel by syphoning.

PUMP AND FILTER

4. The tank feeds fuel to a vertically mounted Facit fuel pump. This is an electrically operated type which runs immediately the ignition is switched on.

5. The outlet pipe feeds fuel to a separate filter mounted on the rear wall of the engine compartment. The filter has a reusable element which is accessible when the filter body is removed.

CARBURETTERS

6. Twin SU HIF6 carburetters are fitted to the inlet manifold, each carburetter feeding three cylinders. The carburetters are of the semi downdraught type. They receive fuel from the filter and air from the air cleaner via an intake box.

7. As the throttle is opened, progressively greater amounts of fuel and air are metered into the engine, thereby increasing engine speed. A manually operated choke is fitted which greatly increases the fuel supply to provide a richer mixture for cold starting.

8. The two carburetters must be balanced to ensure an even metering of fuel to all cylinders and optimum performance of the engine.

SUB-SECTION C1

CHAPTER 2

SPECIFICATIONS

INTRODUCTION

1. General data for the fuel system is given in Table C1.1. These are no torque specifications for the fuel system other than for the carburetter fixings to the inlet manifold studs. This specification is given in Table B1.2.

TABLE C1.1 - GENERAL DATA

ITEM	DESCRIPTION
Carburetter — make	S.U. Twin HIF 6
— type	10^{o} semi-downdraught
— choke size	44,45 mm
— needle	BCP
— spring colour	Red
— jet size	2,54 mm
— damper oil	SAE 20 or 20/30 Multigrade
Carburetter — float level	0,5—1,5 mm
Air cleaner-type	Donaldson Cyclopac
Fuel pump-type	Electric-Facit
Recommended octane rating	93 (coast), 98 (highveld)
Maximum C.O. at idle	3-4%

SUB-SECTION C2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This Sub-section deals with fault diagnosis and corrective action for the fuel system. In Table C2.1, a list of symptoms, the probable cause and the necessary action is given. It should be noted that the Table is not exhaustive and faults may occur which are not listed. Should the Table fail to give an indication of a fault, the suspected components should be removed for closer inspection and/or overhaul.

TABLE C2.1 - FUEL SYSTEM FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Difficult starting when cold	Insufficient choke action.	Check action of cold start unit to ensure that the choke is being applied fully - adjust choke cable.
	Fast idle adjustment incorrect.	Check and adjust fast idle setting. Check linkage between choke and throttle for distortion.
	Float chamber level too low.	Check needle valve for sticking-(closed). Check float level setting. Check inlet connection filter for blockage. Check external fuel system in accordance with fuel system fault diagnosis.
	Carburetter flooding.	Check needle valve for sticking - (open). Float punctured. Fuel pump pressure too high. Float level too high.
	No fuel supply to carburetter.	Check filters and pump for blockage. Check fuel tank breather and fuel lines for blockage. Remove fuel pump and check operation. Overhaul or fit new pump.
Difficult starting when hot	Choke sticking 'on'.	Check to ensure choke is returning to fully 'off' position, reset as necessary.
	Blocked air cleaner.	Fit new air cleaner elements, (check indicator).
	Float chamber level too high.	Check float level setting. Check float arms for distortion. Check needle valve for sticking. Punctured float, fuel pump pressure too high.
Lack of engine power	Piston sticking.	Check piston assembly moves freely and returns under spring load - centre jet assembly.
	Water in fuel.	Check diaphragm for cracks or porosity. If water is present in float chamber, the complete fuel system should be drained, fuel components should be

		dismantled, inspected for contamination, paying particular attention to filters.
Erractic slow-running or stalling	Float level too low. Incorrect jet setting. Carburetter air leaks. Manifold air leaks.	Check float chamber level. Check for needle valve sticking. Check and reset jet settings in accordance with carburetter overhaul instructions. Check throttle spindle and bearings for wear. Check inlet manifold gasket for leakage. Check inlet manifold for cracks and distortion of mating faces. Check gasket between carburettor and manifold. Check condition of vacuum servo pipes and connections.
Excessive fuel consumption	Blocked air cleaner. Damper oil too thick. Incorrectly adjusted carburetter. Float level too high. Worn jets and needle. Incorrect needle. Choke sticking 'on'. Engine fault.	Fit new air cleaner elements. Replace with correct grade. Check and reset slow running in accordance with carburetter tune and adjust instructions. Check and reset float level. Check and replace as necessary. Check needle type. Check to ensure choke is returning to fully 'off' position, reset as necessary. See engine fault diagnosis.

SUB-SECTION C3

CARBURETTERS - TUNE AND ADJUST

NOTE

Before servicing or tuning a carburetter in an endeavour to rectify poor engine performance, make sure that the maladjustment or fault is not from another source by first checking:

Valve clearance
Spark plug condition
Contact breaker (dwell angle)
Ignition timing and advance
Presence of air leaks into the induction system

1. To tune the carburetters:

(1) Remove the bonnet (see Sub-section M3, Chapter 1).

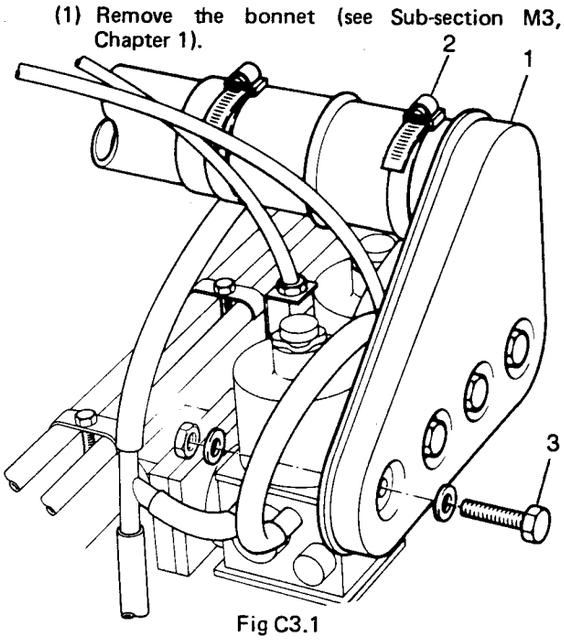


Fig C3.1

(2) Refer to Fig C3.1. Remove the air intake box (1) by disconnecting the air inlet hose (2) and removing the four bolts (3) holding the box to the carburetters. (The bolts have loose nuts and washers behind the box).

(3) Check the throttle for correct operation and free movement with no signs of sticking.

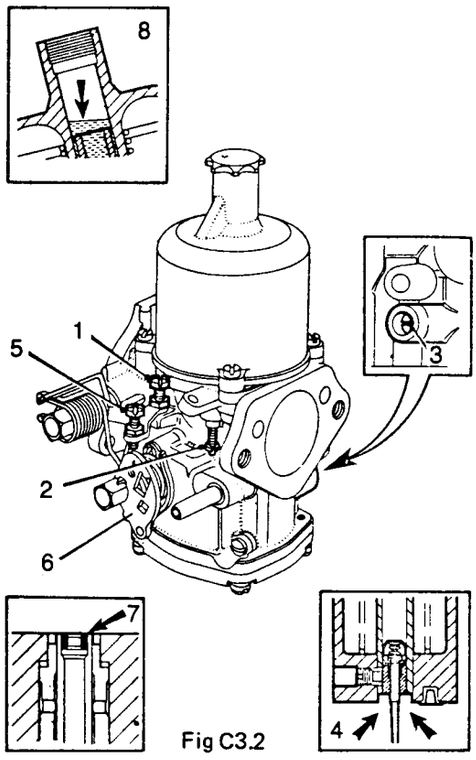


Fig C3.2

(4) Refer to Fig C3.2. Unscrew the throttle adjusting screws (1) until they are just clear of the throttle lever with the throttle closed, then turn the screws (1) clockwise one turn on each.

(5) Raise the piston of each carburetter with the lifting pin (2) and check that it falls freely onto the bridge when the pin is released. If the piston shows any tendency to stick, the carburetter must be serviced.

(6) Lift and support the piston clear of the bridge so that the jet is visible; if this is not possible due to the installed position of the carburetter, remove the sucion chamber assembly.

(7) Turn the jet adjusting screw (3) anti-clockwise until the jet (7) is flush with the bridge without exceeding the bridge height. Ensure that the jets on multi-carburetters are in the same relative position to the bridge of their respective carburetters.

(8) Check that the needle shank is flush with the underside of the piston (4).

(9) Turn the jet adjusting screws (3) clockwise until jet is 2,5 mm below bridge (2 1/4 to 2 1/2 turns).

(10) Turn the fast idle adjusting screws (5) anti-clockwise until they are well clear of the cam.

(11) Refit the suction chamber assembly if it has been removed and, using the lifting pin, check that the piston falls freely onto the bridge.

(12) Check the piston damper oil level: Unscrew the cap and withdraw the damper. Top up with engine oil (preferably SAE 20) until the level is 3 mm above the top of the hollow piston rod (8). Refit the damper and screw the cap firmly into the suction chamber.

(13) Start the engine and run it at a fast idle speed until it attains normal running temperature, then run it for a further five minutes.

(14) Increase the engine speed to 2500 r/min for 30 seconds.

2. Setting can now commence. If the correct setting cannot be obtained within three minutes, increase the engine speed to 2500 r/min for 30 seconds and then re-commence tuning. Repeat this clearing operation at three minute intervals until tuning is completed. Set as follows:

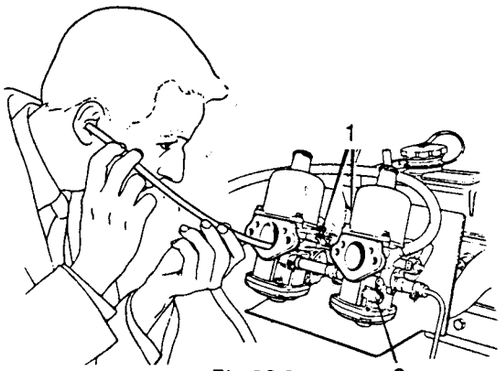


Fig C3.3

(1) Refer to Fig C3.3. Slacken both clamping bolts on the throttle spindle interconnections.

(2) Slacken both clamping bolts (1) on the cold start interconnections.

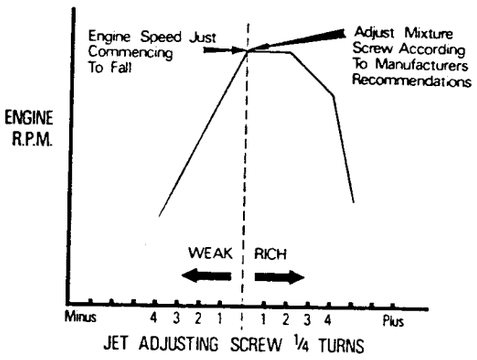


Fig C3.4

(3) Refer to Fig C3.4. Use a listening tube to compare the intensity of the intake hiss on all carburetters and turn the throttle adjusting screws (1) until the hiss is the same.

(4) Turn the jet adjusting screw (3) on each carburetter clockwise to enrich or anti-clockwise to weaken, by the same amount until the fastest speed is indicated. Turn each screw counterclockwise until the engine speed just starts to fall.

(5) Turn each screw very slowly clockwise by the minimum amount until the maximum speed is regained. From this setting adjust the mixture screws according to the graph.

(6) Check the idle speed and re-adjust it as necessary with the throttle adjusting screws (1) turning each by the same amount.

(7) Set the throttle interconnection clamping levers so that a clearance exists between the link pin and the lower edge of the fork. Tighten the clamp bolts, ensuring that there is approximately 0,8 mm end-float on the interconnection rod.

(8) Run the engine at 1500 r/min and check the throttle linkage for correct connection by rechecking the carburetter balance.

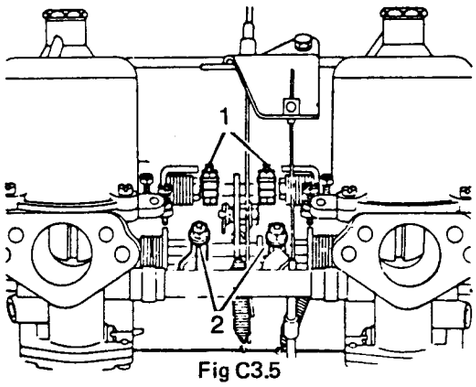


Fig C3.5

(9) Refer to Fig C3.5. With the fast idle cams (2) of each carburetter against their respective stops, set the cold start interconnections so that all cams begin to move simultaneously.

(10) With the fast idle cams against their stops check that a 1,5 mm free movement of the mixture control (choke) cables exists before the cable moves the cams.

(11) Pull out the mixture control (choke) until the arrow marked on the cam is positioned under the fast idle adjusting screw of each carburetter.

(12) Using the listening tube to ensure equal adjustment, turn the fast idle adjusting screws to give the correct fast idle speed.

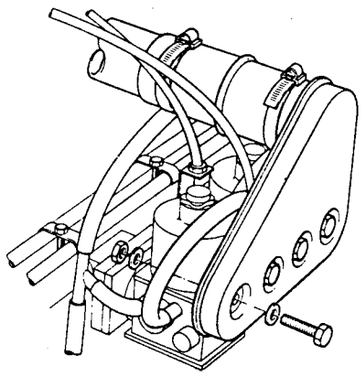


Fig C3.6

(13) Refer to Fig C3.6. Refit the air intake box and hose.

SUB-SECTION CONTENTS LIST

SUB-SECTION C4

REMOVAL AND REPLACEMENT PROCEDURES

CHAPTER 1

CARBURETTERS - REMOVAL AND REPLACEMENT

REMOVAL

1. Both carburetters are removed initially. Separation is carried out after removal. To remove the carburetters:

(1) Disconnect the battery.

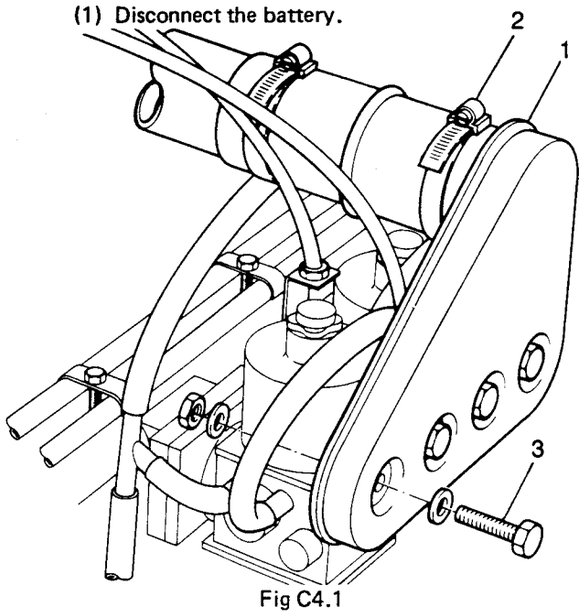


Fig C4.1

(2) Refer to Fig C4.1. Remove the air intake box (1) by disconnecting the air inlet hose (2) and removing the four bolts (3) holding the box to the carburetters. (Note that the bolts have loose nuts and washers behind the box).

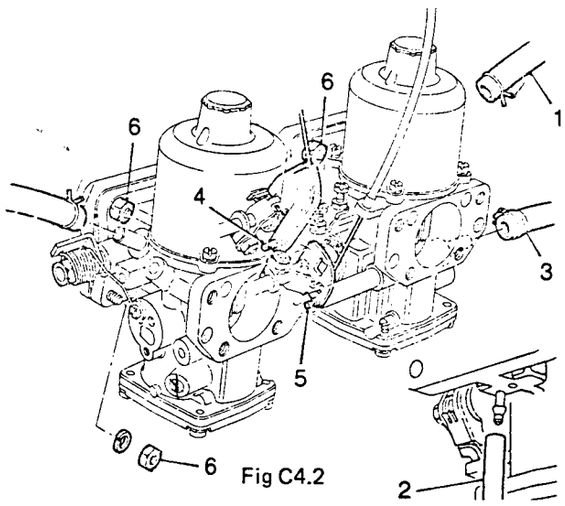


Fig C4.2

(3) Refer to Fig C4.2. Disconnect the engine purge hoses (1) from the carburetters.

(4) Disconnect the ignition vacuum advance pipe (2) from the rear carburetter.

(5) Disconnect the fuel feed pipe (3) to the rear carburetter.

(6) Release the throttle and choke cable fixings (4) and (5) and disconnect the cables.

(7) Remove the eight nuts and spring washers (6) to release the carburetters.

(8) Remove the carburetters, keeping them together so as not to disturb the inter-connecting linkages.

REPLACEMENT

2. Replace the carburetters as follows: (Fig C4.2 still applies).

(1) Using new gaskets fit the carburetters over the studs in the inlet manifold and secure with eight nuts and spring washers (6). Tighten the nuts to 8 to 10 N.m.

(2) Fit the throttle and choke cables and tighten the fixings (4) and (5).

(3) Reconnect the fuel feed pipe (3) to the rear carburetter.

(4) Reconnect the ignition advance pipe (2) to the rear carburetter.

(5) Fit the engine purge hoses (1) to the carburetters.

(6) Reconnect the battery.

NOTE
If the carburetters are to be tuned do so at this stage (see Sub-section C3). If not, continue:

(7) Replace the air intake box over the carburetters (four bolts, nuts and washers).

(8) Refit the air inlet hose and tighten the hose clamp.

SUB-SECTION C4

CHAPTER 2

FUEL PUMP - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the fuel pump as detailed below:

   (1) Disconnect the battery earth lead.

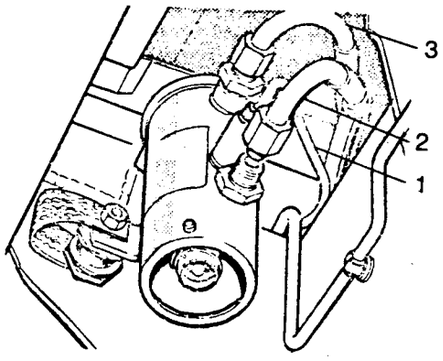


Fig C4.3

   (2) Refer to Fig C4.3. Disconnect the fuel pump electric lead (1) at the snap connector.

   (3) Disconnect the lower fuel pipe (2) (inlet) and cover the end to prevent loss of fuel.

   NOTE
   Do NOT plug the pipe end.

   (4) Disconnect the upper fuel pipe (3) (outlet) and cover the end to prevent fuel loss and the ingress of dirt.

   (5) Remove the two nuts (one at each side of the pump) and remove the pump.

REPLACEMENT

2. To replace the pump:

   (1) Fit the pump over the two studs with the end with the bayonet fixing downwards.

   (2) Ensure that the earth braid is in position and secure the pump with the two nuts.

   (3) Remove the cover over the upper fuel pipe and fit the pipe to the upper union. Tighten the union nut.

   (4) Remove the cover over the lower fuel pipe and fit the pipe to the lower connection on the pump. Tighten the union nut.

   (5) Reconnect the elctrical lead to the snap connector.

   (6) Reconnect the battery earth lead.

CHAPTER 3

FUEL FILTER - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the fuel filter:

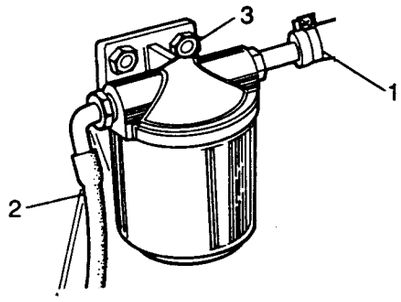


Fig C4.4

(1) Refer to Fig C4.4. Loosen the clamps (4) over the two pipes (1) and (2) and disconnect the two pipes from the filter.

(2) Remove the two nuts (3) securing the filter to the rear wall.

(3) Lift the filter away from the two studs.

REPLACEMENT

2. Replace the filter as follows:

(1) Position the filter on the two studs.

(2) Secure the filter with the two nuts (3).

(3) Replace the inlet (1) and outlet (2) pipes and tighten the clamps (4).

SUB-SECTION C4

CHAPTER 4

FUEL TANK - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the fuel tank:

   (1) Disconnect the battery.

   (2) Drain the fuel into a clean container ((4) on Fig C4.5 is the drain plug).

   (3) Release the clip securing the filler tube hose to the tank.

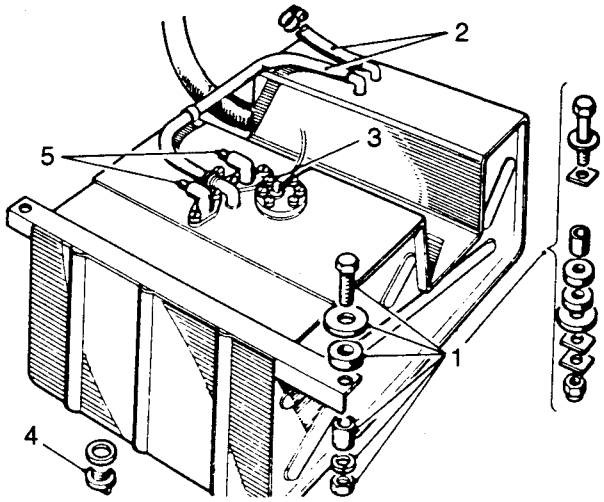


Fig C4.5

   (4) Refer to Fig C4.5. Support the tank and remove the tank securing bolts (1).

   (5) Lower the tank only sufficiently to give access to the leads and pipes on top of the tank.

   (6) Disconnect the breather and air balance pipes (2).

   (7) Disconnect the wires at the gauge unit (3).

   (8) Disconnect the fuel supply pipes (5).

   (9) Lower the tank and remove it from under the vehicle.

REPLACEMENT

2. Replace the fuel tank as follows:

   (1) Fit the tank under the vehicle and raise it sufficiently to allow connection of the various pipes and tubes. Support the tank in this position.

   (2) Reconnect the elctrical leads to the gauge unit.

   (3) Reconnect the breather and air balance pipes.

   (4) Lift the tank into position, fitting the fuel supply pipe into the flexible coupling at the filler cap end.

   (5) Fit the tank securing bolts, washers, spacers (if any) and nuts. Tighten the nuts.

   (6) Reconnect the battery.

SUB-SECTION CONTENTS LIST

SUB-SECTION C5

OVERHAUL PROCEDURES

SUB-SECTION C5

CHAPTER 1

CARBURETTER - OVERHAUL

DISMANTLING

1. First remove the carburetters as detailed in Sub-section C4, Chapter 1.

2. Dismantle a carburetter as follows:

(1) Thoroughly clean the outside of the carburetter.

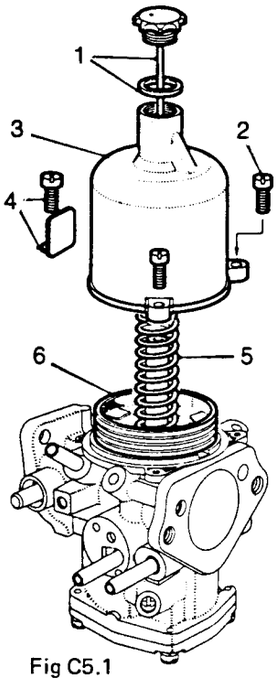


Fig C5.1

(2) Refer to Fig C5.1. Remove the piston damper (1) and its washer.

(3) Unscrew the suction chamber retaining screws (2) and remove the identity tag (4).

(4) Lift the chamber assembly (3) vertically from the body without tilting it.

(5) Remove the piston spring (5). Lift out the piston assembly (6) and empty the oil from the piston rod.

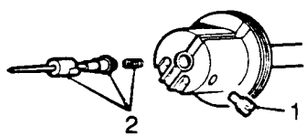


Fig C5.2

(6) Refer to Fig C5.2. Note the position of the needle guide etch mark in relation to the piston transfer holes for correct reassembly and unscrew the needle guide locking screw (1).

(7) Withdraw the needle, guide and spring (2).

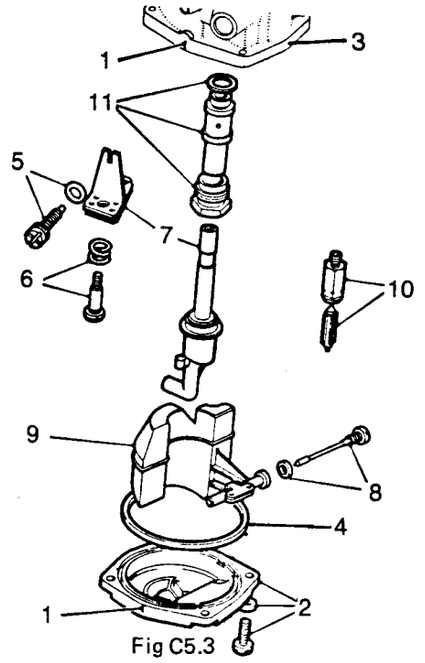


Fig C5.3

(8) Refer to Fig C5.3. Mark the bottom cover-plate and body (1) to ensure correct reassembly. Unscrew the retaining screws (2) and remove the cover (3) complete with sealing ring (4).

(9) Remove the jet adjusting screw (5) complete with O-ring.

(10) Remove the jet adjusting lever retaining screw and spring (6).

(11) Withdraw the jet complete with adjusting lever and disengage the lever (7).

(12) Remove the float pivot spindle and fibre washer (8).

(13) Withdraw the float (9).

(14) Remove the needle valve and unscrew the valve seat (10).

(15) Unscrew the jet bearing locking nut and withdraw the bearing complete with fibre washer (11).

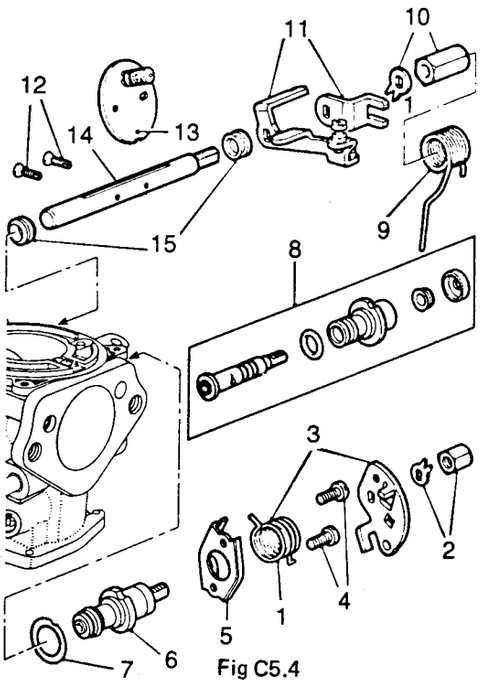


Fig C5.4

(16) Refer to Fig C5.4. Note the location of the ends of the fast idle cam lever return spring (1).

(17) Unlock and remove the cam lever retaining nut and locking washer (2).

(18) With the return spring held toward the carburetter body, prise off the cam lever and remove the return spring (3).

(19) Unscrew the starter unit retaining screws (4) and remove the cover plate (5).

(20) Withdraw the starter unit assembly (6) and remove its gasket (7).

(21) Withdraw the valve spindle and remove the O-rings, seals and dust cap (8).

(22) Note the location and loading of the ends of the throttle lever return spring and remove the spring (9).

(23) Unlock and remove the nut and tab washer (10) and retaining throttle levers.

(24) Remove the throttle lever and throttle actuating lever (11).

(25) Remove the throttle disc retaining screws (12).

(26) Close the throttle and mark the position of the throttle disc (13) in relation to the carburetter flange. Do not mark the disc in the vicinity of the over-run valve. Open the throttle and carefully withdraw the disc from the throttle spindle taking care not to damage the over-run valve.

(27) Withdraw the throttle spindle (14) and remove its seals (15) noting the way the spindle is fitted in relation to the carburetter body to ensure correct reassembly.

INSPECTING

3. Make the following checks on components:

(1) Examine the throttle spindle and its bearings in the carburetter body; check for excessive play, and renew parts as necessary.

(2) Examine the float needle and seating for damage and excessive wear, renew if necessary.

(3) Examine all rubber seals and O-rings for damage or deterioration; renew as necessary. The cover plate sealing ring must be renewed.

(4) Check condition of all fibre washers and gaskets; renew as necessary.

(5) Examine the carburetter body for cracks and damage and for security of the brass connections and the piston key.

(6) Clean the inside of the suction chamber and piston rod guide with fuel or methylated spirit (denatured alcohol) and wipe dry. Abrasives must not be used.

(7) Examine the suction chamber and piston for damage and signs of scoring.

NOTE
The following tuning check need only be carried out if the cause of the carburetter malfunction which necessitated the dismantling has not been located.

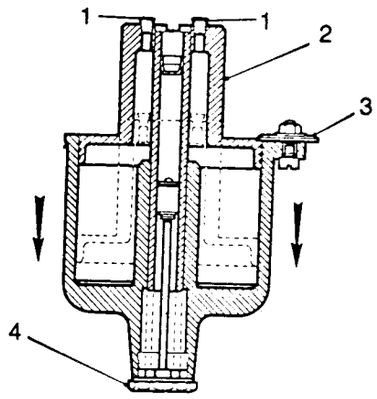


Fig C5.5

(8) Refer to Fig C5.5. Temporarily plug the piston transfer holes (1).

(9) Fit the piston (2) into the chamber without its spring.

(10) Fit a nut and screw, with a large flat washer (3), under the nut, into one of the suction chambers fixing holes, positioning the washer so that it overlaps the chamber bore.

(11) Fit the damper and washer (4).

(12) Check that the piston is fully home in the chamber, invert the assembly to allow the chamber to fall away until the piston contacts the washer.

(13) Check the time taken for the chamber to fall the full extent of the piston travel. For carburetters of 38 mm to 47,6 mm the time taken should be 5 to 7 seconds.

(14) If the times are exceeded check the piston and chamber for presence of oil, foreign matter and damage. If after re-checking the time is still not within these limits, renew the suction chamber assembly.

REASSEMBLING

4. Reassemble the carburetter as follows:

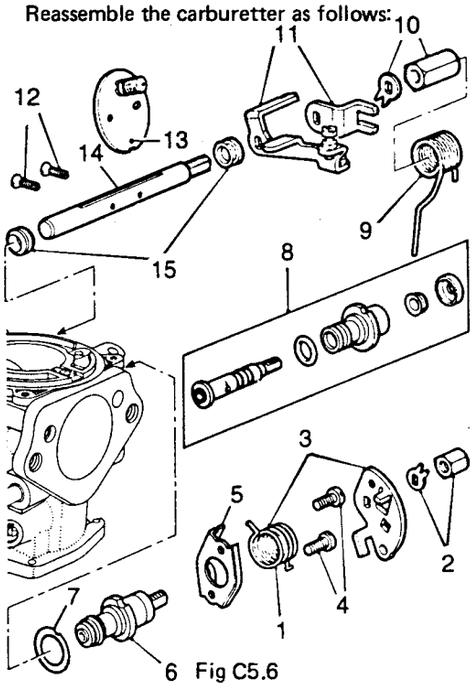


Fig C5.6

(1) Refer to Fig C5.6. Refit the seals (15) to the throttle spindle (14) and replace the spindle. Position the throttle spindle end seals just below the spindle housing flange.

(2) Replace the throttle disc (13) onto the spindle ensuring that the disc is fitted in its original position.

(3) Fit new throttle disc retaining screws (12). Ensure that the throttle disc is correctly positioned and closed correctly before tightening the retaining screws. Spread the split ends of the screws sufficiently to prevent turning.

(4) Refit the throttle level and throttle actuating lever (11).

(5) Replace the tab washer and nut (10) retaining the throttle levers. Lock the washer.

(6) Replace the throttle lever return spring in the position noted in para 2, step (22).

(7) Replace the O-ring, seals and dust cap onto the valve spindle (8) and refit the spindle.

(8) Replace the gasket (7) and starter unit assembly (6). The starter unit valve is fitted with the cut out towards the top retaining screw hole and its retaining plate is positioned with the slotted flange towards the throttle spindle.

(9) Replace the starter unit cover plate (5) and retaining screws (4).

(10) Refit the return spring (3) and the cam lever, locating the ends of the return spring in the position noted in para 2, step (16).

(11) Replace the cam lever washer and retaining nut (2). Lock the washer.

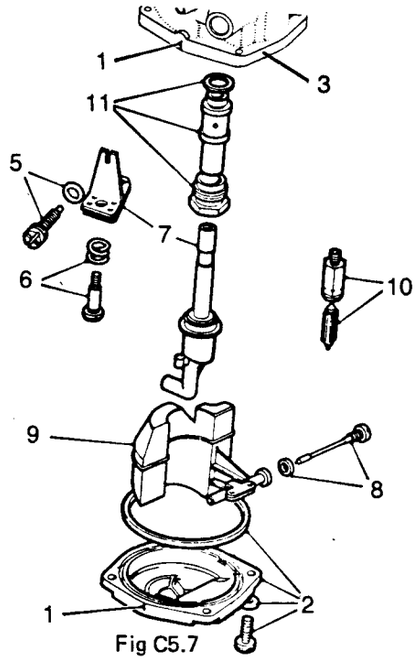


Fig C5.7

(12) Refer to Fig C5.7. Replace the jet bearing (11) and fibre washer. Secure with the locking nut.

(13) Screw in the valve seat and replace the needle valve (10).

(14) Replace the float (9). After fitting the float and valve, insert the carburetter so that the needle valve is held in the shut position by the weight of the float only. Check that the point indicated on the float (see Fig C5.8 opposite) is 1,5 mm to 0,5 mm below the level of the float chamber face. Adjust the float position by carefully bending the brass pad. Check that the float pivots correctly about the spindle.

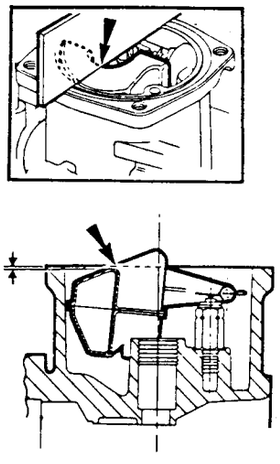


Fig. C5.8

(15) Replace the float pivot spindle and fibre-washer (8).

(16) Fit the jet to the adjusting lever (7) and replace the jet complete. When fitting the jet assembly to the adjusting lever ensure that the jet head moves freely in the bi-metal cut out.

(17) Replace the jet adjusting lever spring and retaining screw (6).

(18) Refit the jet adjusting screw (5) and O-ring. Check that the small diameter of the jet adjusting screws engages the slot in the adjusting lever and set the jet flush with the bridge of the body.

(19) Replace the bottom cover plate (3) and sealing ring (4) aligning the marks made on the cover plate and body in para 2, step (8). Tighten the retaining screws (2).

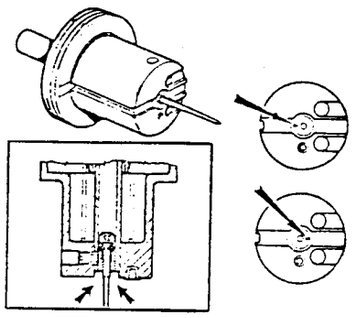


Fig C5.9

(20) Refer to Fig C5.9. Replace the needle guide and spring. Use a new retaining screw when refitting the needle and ensure that the needle guide etch mark aligns correctly with the piston transfer holes (alternative specifications illustrated). After fitting the needle assembly, check that the shoulder of the needle aligns the full face of the piston (see para 2, step (6)).

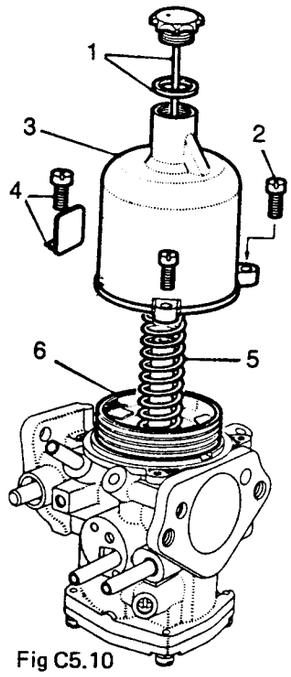


Fig C5.10

(21) Refer to Fig C5.10. Replace the piston assembly (6) and piston spring (5).

(22) Fit the chamber assembly (4) vertically to the body without tilting it.

(23) Secure with the suction chamber retaining screws (2) not forgetting to replace the identity tag (3).

(24) Fill the piston damper housing with the correct grade of oil to the specified level and replace the damper (1) and washer.

5. Fit the carburetter to the engine (see Sub-section C4, Chapter 1).

SUB-SECTION C5

CHAPTER 2

FUEL PUMP - OVERHAUL

NOTE

The electrical components of the pump are sealed and cannot be repaired. For this reason, overhauling is confined to the piston assembly.

1. Overhaul the piston assembly as follows:

(1) Remove the pump from the vehicle (see Sub-section C4, Chapter 2).

(2) Clean the outside surface of the pump before dismantling.

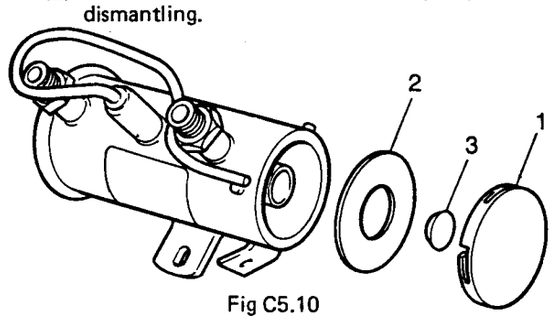


Fig C5.10

(3) Refer to Fig C5.10. Release the end cover (1) from the bayonet fixing and lift out the rubber seal (2) and the magnet (3).

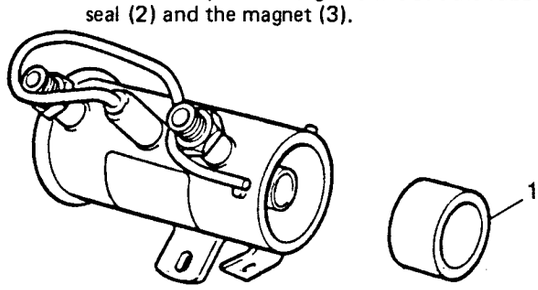


Fig C5.11

(4) Refer to Fig C5.11. Withdraw the filter (1).

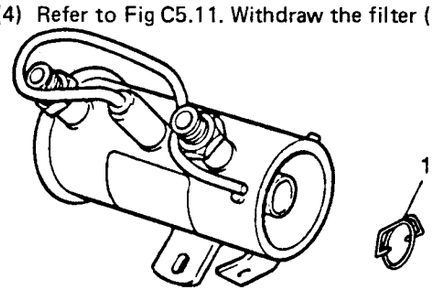


Fig C5.12

(5) Refer to Fig C5.12. Remove the retaining ring (1).

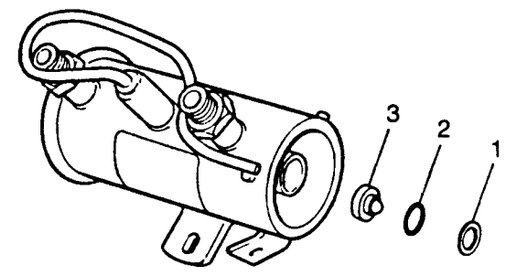


Fig C5.13

(6) Refer to Fig C5.13. Remove the plain washer (1), the rubber seal (2) and the one-way valve (3).

CAUTION

The one-way valve must not be dismantled.

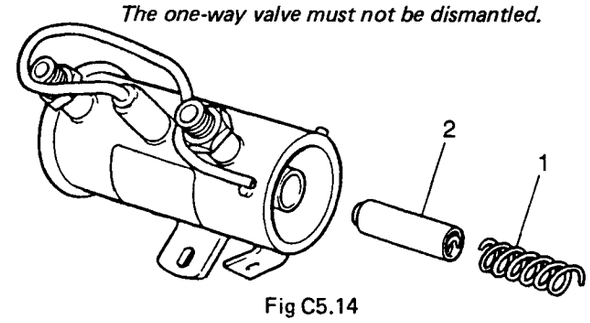


Fig C5.14

(7) Refer to Fig C5.14. Withdraw the piston return spring (1) with the piston (2). If the piston remains in the pump tube, hold the pump body vertically (in the fitted position) and tap the closed end until the piston is released from its magnetic hold and drops out.

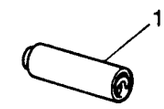


Fig C5.15

(8) Refer to Fig C5.15. Remove the short rebound spring (1) from the piston.

CLEANING

2. To clean the components:

   (1) Clean all components in petrol.

   (2) Immerse the pump body in petrol and clean by using an air line inside the pump tube.

REASSEMBLY

3. Reassemble the pump as detailed below:

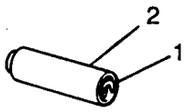


Fig C5.16

(1) Refer to Fig C5.16. Fit the short rebound spring (1) into the end of the piston (2).

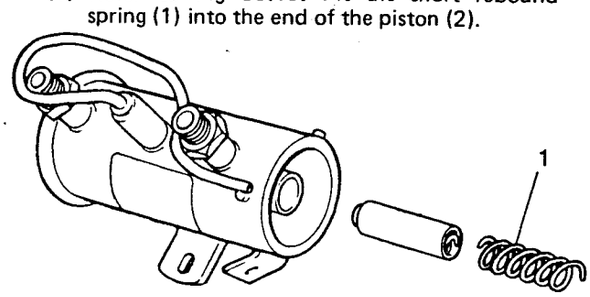


Fig C5.17

(2) Refer to Fig C5.17. Fit the return spring (1) over the piston and insert the complete assembly into the pump body, rebound spring last.

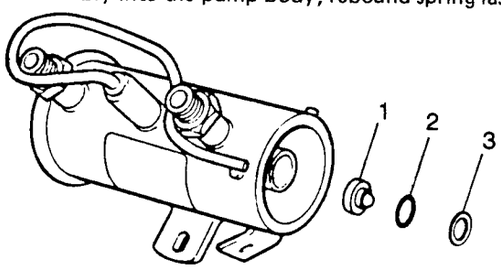


Fig C5.18

(3) Refer to Fig C5.18. Fit the one-way valve (1), rubber seal (2) and plain washer (3) in that order into the pump body.

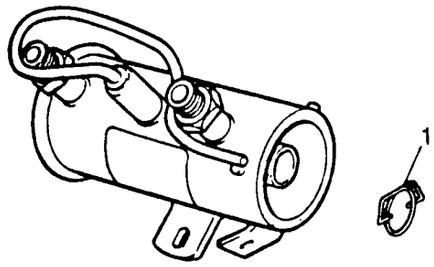


Fig C5.19

(4) Refer to Fig C5.19. Replace the retaining ring (1).

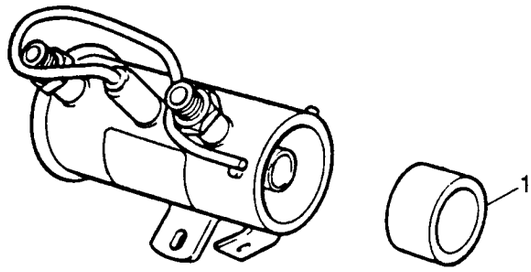


Fig C5.20

(5) Refer to Fig C5.20. Replace the filter (1).

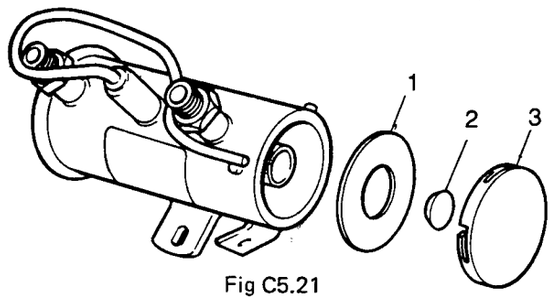


Fig C5.21

(6) Refer to Fig C5.21. Fit the rubber seal (1) and magnet (2) into the end cover (3) and secure to the pump body with the bayonet fixing.

(7) Refit the pump to the vehicle (see Sub-section C4, Chapter 2).

SUB-SECTION C6

MAINTENANCE

INTRODUCTION

1. Little regular maintenance is required on the fuel system other than regular checks for leaks from components and joints. Slow running adjustment of the carburetter is required at regular intervals and cleaning or replacement of the element in the fuel filter and pump should be carried out at the recommended intervals:

CARBURETTOR SLOW RUNNING ADJUSTMENT

2. Carry out the following adjustments at first service (1 500 km) and thereafter at every 10 000 km or six months.

(1) Run the engine until normal operating temperature is obtained.

(2) Remove the air intake box over the carburetters.

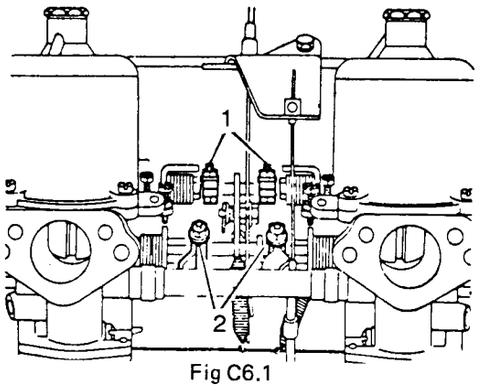
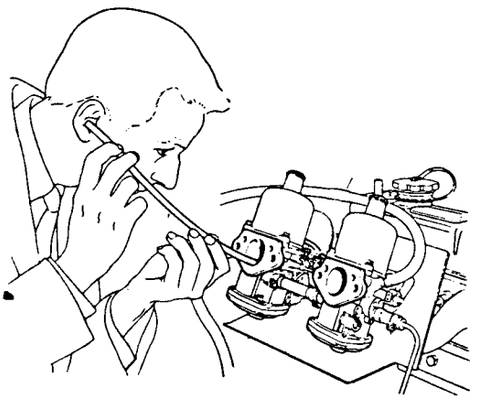


Fig C6.1

(3) Refer to Fig C6.1. Slacken both clamping bolts (1) on the throttle spindle interconnection.

(4) Slacken both clamping bolts (2) on the cold start interconnections.



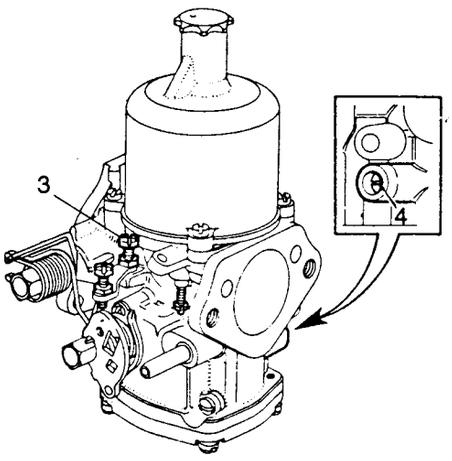


Fig C6.2

(5) Refer to Fig C6.2. Use a listening tube to compare the intensity of the intake hiss on all carburetters and turn the throttle adjusting screws (3) until the hiss is the same. Alternatively use a balancing meter in accordance with makers instructions and balance the carburetters by altering the throttle adjusting screws until the correct idle speed and balance is achieved.

(6) Turn the jet adjusting screw (4) on each carburetter clockwise to enrich or anti-clockwise to weaken, by the same amount until the fastest speed is indicated; turn each screw anti-clockwise until the engine speed just commences to fall. Turn each screw very slowly clockwise by the minimum amount until the maximum speed is regained.

(7) Check the idle speed and re-adjust it as necessary with the throttle adjusting screws, turning each by the same amount.

CHANGING THE FUEL FILTER

3. The fuel filter is located near the dash at the right hand side of the engine compartment. Replace the element every 20 000 km or 12 months.

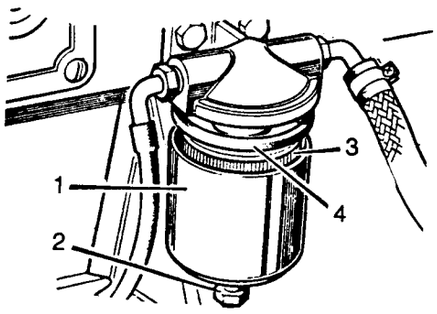


Fig C6.3

(1) Refer to Fig C6.3. Support the element holder (1).

(2) Unscrew the special bolt (2) at the bottom of the holder and remove the holder.

(3) Remove and discard the used element (3).

(4) Thoroughly clean the element holder in petrol.

(5) Check the upper and lower centre seals and the seal for the special bolt (2). Replace with new seals if any show signs of deterioration or damage.

(6) Fit the new element, large hole uppermost, into the holder using the seal (4) supplied with the element.

(7) Place the element holder in position and secure with the special bolt (2).

(8) Start the engine and check for fuel leaks around the filter.

CLEANING THE FUEL PUMP FILTER

4. Clean the filter every 80 000 km or 48 months.

5. The fuel pump must be removed for access to the filter. To remove the fuel pump:

(1) Disconnect the fuel pump electrical lead at the snap connector.

(2) Disconnect the fuel inlet pipe from the pump and plug the end of the pipe to prevent fuel leakage.

(3) Disconnect the fuel outlet pipe.

(4) Remove the two nuts securing the pump, remove the earth braid from the fixing points and remove the pump.

6. To clean the filter:

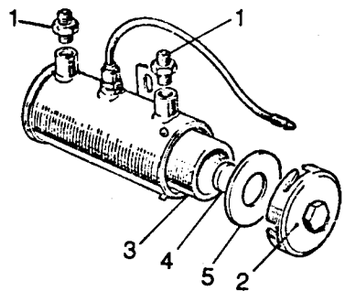


Fig C6.4

(1) Refer to Fig C6.4. Remove the inlet and outlet unions (1).

(2) Release the end cover (2) from the bayonet fixing.

(3) Withdraw the filter (3) from the pump body.

(4) Clean the filter by blowing clean, dry air through the filter from the inside.

(5) Remove the magnet (4) from the end cover and clean with a petrol moistened, lint-free cloth.

7. To reassemble the pump:

(1) Place the filter in the pump body.

(2) Fit the magnet (4) to the end cover (2) using a new gasket (5).

(3) Replace the end cover into its bayonet fixing.

(4) Refit the inlet and outlet unions (1) to the pump body.

8. To refit the pump:

(1) Position the pump to the chassis cross member with the union nearest to the electrical lead towards the front of the vehicle.

(2) Ensure that the earth braid is correctly positioned and tighten the two nuts.

(3) Reconnect the fuel outlet connection.

(4) Remove the temporary plug and reconnect the fuel inlet connection.

(5) Reconnect the electrical lead.

(6) Run the engine to ensure that the pump is operating and is free of leaks.

SECTION CONTENTS LIST

SECTION D

IGNITION SYSTEM

SUB-SECTION CONTENTS LIST

SUB-SECTION D1

DESCRIPTION AND SPECIFICATIONS

SUB-SECTION D1

CHAPTER 1

DESCRIPTION OF THE IGNITION SYSTEM

INTRODUCTION

1. The ignition system comprises a coil, the distributor and the spark plugs, the LT supply to the system being provided by the battery.

COIL

2. The coil has two windings, one of which is fed by the battery and the other one providing the HT to the top of the distributor cap when the contact breaker points open.

DISTRIBUTOR

3. The distributor incorporates automatic timing control by centrifugal mechanism and a vacuum operated unit.

4. The weights of the centrifugal device fly out against the tension of small springs as the engine speed increases. The movement of the weights advances the contact breaker cams in relation to the distributor drive shaft to advance the ignition.

5. The vacuum unit is connected by small bore pipe to the inlet manifold. Reduced pressure in the manifold operates the vacuum unit, the vacuum varying with engine load. At small throttle openings with no load on the engine the high vacuum in the manifold causes the vacuum advance unit to advance the ignition. On hill climbs with a heavy load and large throttle openings the vacuum in the manifold is considerably reduced and the ignition is retarded.

SUB-SECTION D1

CHAPTER 2

IGNITION SYSTEM SPECIFICATIONS

INTRODUCTION

1. Specifications for the ignition system are given in the following tables:

TABLE D1.1 - GENERAL DATA
TABLE D1.2 - TORQUE SPECIFICATIONS

TABLE D1.1 - GENERAL DATA

ITEM	DESCRIPTION	
Coil	Lucas 11C12 - oil filled - 12 V	
Distributor	Lucas 45D6	
- contact point gap	0,35 to 0,40 mm	
- cam dwell angle	33° ± 5°	
- test data (deceleration r/min)	Camshaft r/min	Degrees
	2400	14-18
	2000	9-13
	1600	4-8
	1300	1-5
- vacuum advance - starts	No advance below 800 r/min	
- vacuum advance - ends	76 mm Hg	
Ignition timing (Stroboscopic) - with vacuum advance disconnected	230 mm Hg	
	12° B.T.D.C. at 1000 r/min	
Spark plug - type	Champion N9Y	
Spark plug - gap	0,625 - 0,660 mm	

TABLE D1.2 - TORQUE SPECIFICATIONS

ITEM	TORQUE (N.m)
Distributor flange retaining screws	10 to 13

SUB-SECTION D2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. Fault diagnosis and suggested action to cure a fault on the ignition system is covered in this Sub-section. Table D2.1 gives a list of symptoms, the probable cause and the necessary remedial action. The Table is not exhaustive and faults may occur which are not listed. In this case the suspected components should be removed for closer inspection or overhaul.

TABLE D2.1 - IGNITION SYSTEM FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Engine will not fire	Battery discharged.	Recharge battery.
	Distributor contact points dirty, pitted or maladjusted.	Clean and reset points.
	Distributor cap dirty, cracked or tracking.	Clean or replace cap.
	Carbon brush inside distributor cap not touching rotor.	Replace brush.
	Faulty cable or loose connection in low tension circuit.	Check and remedy.
	Distributor rotor arm cracked.	Replace rotor arm.
	Faulty coil.	Replace coil.
	Broken contact breaker spring.	Replace springset.
	Contact points stuck open.	Replace springset.
Engine misfires	Weak contact breaker spring.	Replace spring.
	High tension plug and coil leads cracked or perished.	Replace leads.
	Spark plug(s) loose.	Tighten plugs.
	Spark plug insulation cracked.	Replace plug.
	Spark plug gap incorrectly set.	Reset gaps.
	Ignition timing too far advanced.	Reset ignition timing.

SUB-SECTION CONTENTS LIST

SUB-SECTION D3

ADJUSTMENTS

SUB-SECTION D3

CHAPTER 1

DISTRIBUTOR CONTACT GAP - ADJUSTING

1. To adjust the contact gap:

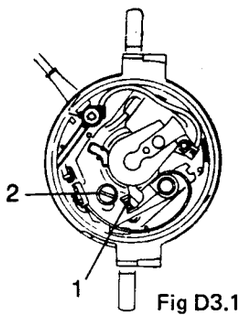


Fig D3.1

(1) Refer to Fig D3.1. Lever the two clips away from the distributor head and lift off the head.

(2) Turn the crankshaft until the contact gap (1) is fully open.

(3) Check the gap with feelers. To be 0,35 to 0,40 mm.

(4) If the gap is more or less than that specified, loosen the screw (2), set the gap to the correct value and tighten the screw.

(5) Recheck the gap and reset if necessary.

CHAPTER 2

IGNITION TIMING - STATIC ADJUSTMENT

1. To adjust the ignition timing without using a stroboscope:

   (1) Adjust the distributor contact gap (see Sub-section D3, Chapter 1).

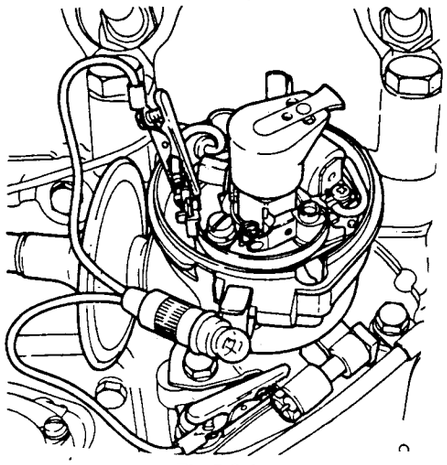


Fig D3.2

   (2) Refer to Fig D3.2. Connect a test lamp to the points indicated.

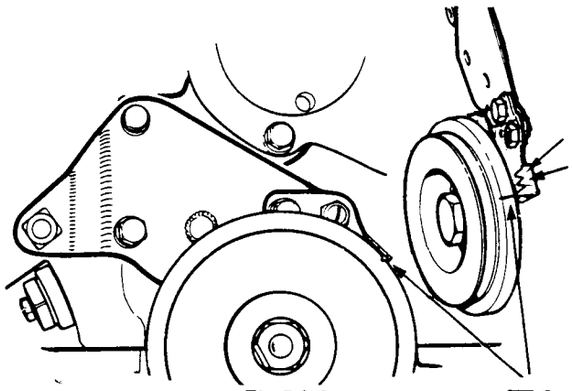


Fig D3.3

   (3) Refer to Fig D3.3. Rotate the crankshaft in the engine run direction until the mark (1) on the crankshaft pulley is approximately 20° before the correct setting for TDC.

   (4) Carefully rotate the crankshaft further until the lamp just comes on. If the timing is correct the crankshaft pulley mark will now be opposite the setting for 12° BTDC.

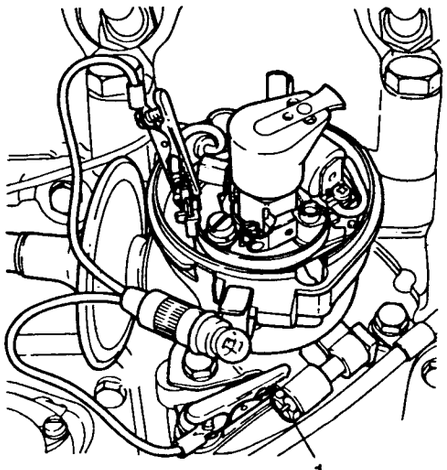


Fig D3.4

   (5) Refer to Fig D3.4. If the pulley mark is not in the correct position, loosen the distributor clamp nut (1).

   (6) Rotate the distributor body counterclockwise past the test lamp illumination position. Carefully rotate clockwise until the lamp just goes out. Tighten the clamp nut (1) with the unit in this position.

   (7) Repeat steps (4) onwards.

   (8) Remove the test lamp circuit.

CHAPTER 3

SPARK PLUGS - CLEANING AND ADJUSTING

REMOVAL

1. To remove a spark plug:

   (1) Withdraw the leads by pulling on the end shrouds. DO NOT PULL THE LEADS.

   (2) Using the special spanner and tommy bar provided with the vehicle, unscrew and remove the spark plug and washer.

CLEANING

2. Clean the plug as follows:

   (1) Fit the plug into a plug cleaning machine.

   (2) Wobble the plug with a circular motion while operating the abrasive blast for a maximum of four seconds.

   CAUTION
   Excessive abrasive blasting will erode the insulator nose.

   (3) Change to air blast only and continue to wobble the plug for a minimum of 30 seconds to remove abrasive grit from the plug cavity.

   (4) Wire-brush the plug threads. Open the gap slightly.

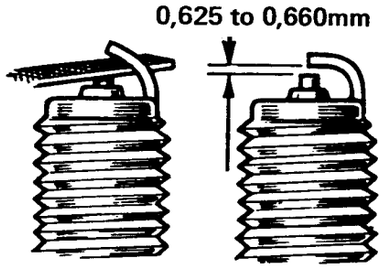


Fig D3.5

   (5) Refer to Fig D3.5. Using a point file (A) square off the electrode surfaces.

   (6) Set the electrode gap (B) to 0,625 to 0,660 mm.

   (7) Test the plug in accordance with the cleaning machine manufacturer's instructions. If satisfactory, fit the plug into the engine.

   (8) Examine the high tension leads, including the coil to distributor lead, for insulation cracking or corrosion at end contacts. Fit new leads as necessary.

   (9) In addition to the correct firing order, the high tension leads must be fitted in correct relation to each other to avoid cross firing.

   (10) When pushing the high tension lead onto the plug, ensure that the end ferrules within the shrouds are firmly seated on the plugs. A guide is that the shroud is within 6 mm of the metal body of the plug.

SUB-SECTION CONTENTS LIST

SUB-SECTION D4

REMOVAL AND REPLACEMENT PROCEDURES

SUB-SECTION D4

CHAPTER 1

COIL - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the ignition coil:

   (1) Disconnect the battery earth lead.

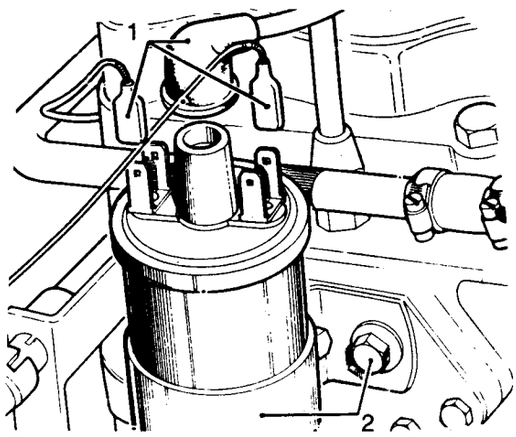


Fig D4.1

   (2) Refer to Fig D4.1. Disconnect the leads (1) from the ignition coil.

   (3) Unscrew the fixings (2) and remove the coil.

REPLACEMENT

2. Replace the coil as follows:

   (1) Place the coil in position and secure with the fixings (2).

   (2) Reconnect the electrical leads (1).

   NOTE
   The electrical leads are fitted with male and female connectors. Ensure that they are fitted to the corresponding blade on the ignition coil.

   (3) Reconnect the battery earth lead.

SUB-SECTION D4

CHAPTER 2

DISTRIBUTOR - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the distributor:

   (1) Disconnect the battery.

   (2) Remove the distributor cap.

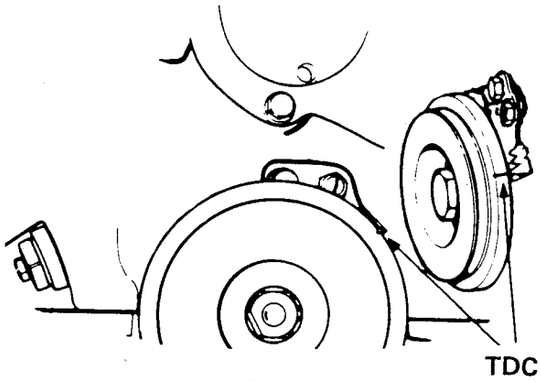


Fig D4.2

   (3) Refer to Fig D4.2. Rotate the crankshaft until the mark (1) on the crankshaft pulley lines up with the TDC point (2) while at the same time the distributor rotor (Fig D4.3) is pointing to the cap segment which is connected to the spark plug of No 1 cylinder (No 1 cylinder is the front cylinder).

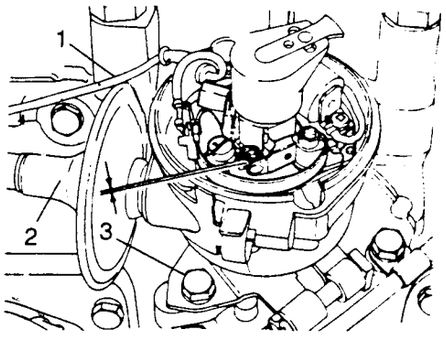


Fig D4.3

   (4) Refer to Fig D4.3. Disconnect the distributor low tension lead (1).

   (5) Disconnect the vacuum pipe from the vacuum advance unit (2).

   (6) Remove the two screws retaining the distributor clamp flange (3) to the cylinder block.

   (7) Withdraw the distributor upwards.

REPLACEMENT

2. Replace the distributor as follows:

   (1) Fit the distributor to the cylinder block with the pinch bolt on the flange outwards.

   (2) Fit the two retaining screws through the flange but do not tighten at this stage.

   (3) Refit the vacuum pipe to the vacuum advance unit.

   (4) Fit the low tension fly lead to the floating connection.

   (5) With the crankshaft and distributor rotor set as in para 1, step (3), rotate the distributor within the limits of the slotted holes in the flange until the contact breaker points are just opening.

   (6) Tighten the flange retaining screws to 10 to 13 N.m.

   (7) Refit the distributor cap.

   (8) Reconnect the battery.

NOTE

For a more accurate setting of the ignition timing see Sub-section D3, Chapter 2.

CHAPTER 3

IGNITION STARTER SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the switch:

   (1) Disconnect the battery earth lead.

   (2) Remove the upper half of the switch shroud from the steering column (four screws).

   (3) Disconnect the leads from the ignition switch.

Models with a Steering Column Lock:

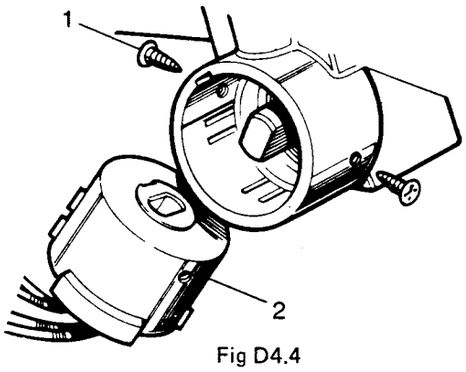


Fig D4.4

   (4) Refer to Fig D4.4. Remove the screws (1) locating the switch in the housing and withdraw the switch (2).

Models without a Steering Column Lock:

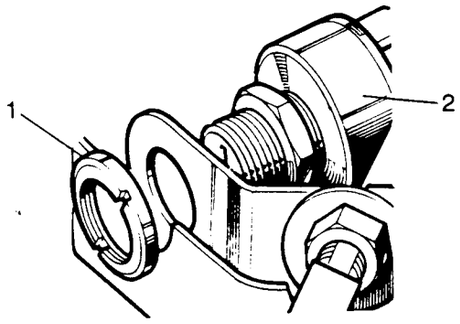


Fig D4.5

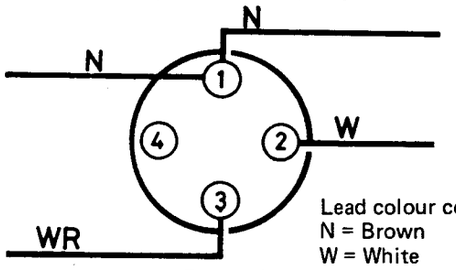
   (5) Refer to Fig D4.5. Unscrew the locking ring (1) and withdraw the switch (2).

REPLACEMENT

2. To replace the ignition starter switch:

   (1) Fit the switch into position with the keyhole vertical and the circular cut-out in the keyhole at the bottom.

   (2) Secure with two screws (models with steering column lock) or the locking ring.



Lead colour code:
N = Brown
W = White
R = Red

Fig D4.6

   (3) Refer to Fig D4.6. Reconnect the leads to the ignition switch.

   (4) Replace the steering column upper shroud (four screws).

   (5) Reconnect the battery earth lead.

SUB-SECTION D5

DISTRIBUTOR - OVERHAUL

DISMANTLING

1. To dismantle the distributor:

(1) Remove the distributor (see Sub-section D4, Chapter 2).

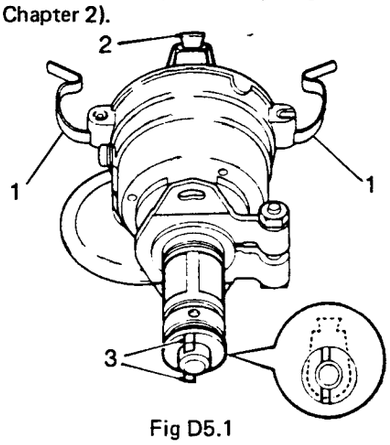


Fig D5.1

(2) Refer to Fig D5.1. Spring back the clips (1) and remove the moulded cover (the dust cap).

(3) Note the relative position of the offset drive dog (3) to the rotor arm lobe (2). The centre line of the drive dog is parallel with and offset to the centre line of the rotor arm.

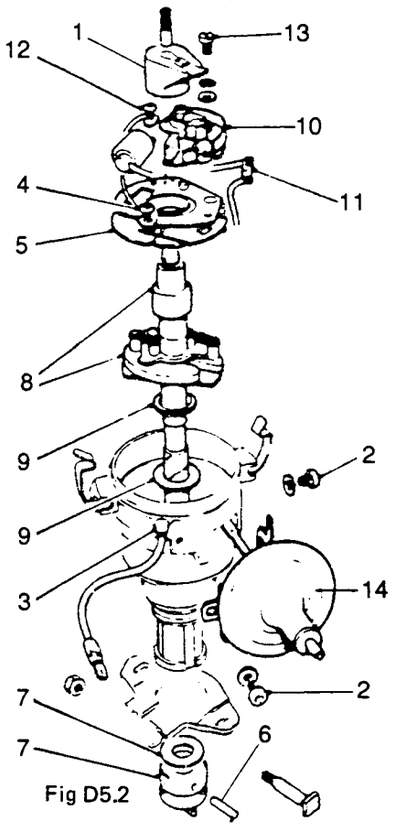


Fig D5.2

(4) Refer to Fig D5.2. Remove the rotor arm (1).

(5) Remove the cam oiling pad.

(6) Remove the two screws (2) retaining the vacuum unit (14), noting that two prongs protrude downwards from the base plate and straddle one of the retaining screws. Disengage the operating arm from the movable plate and remove the assembly.

(7) Push the grommet and low tension lead (3) through the body towards the inside of the housing.

(8) Remove the base plate retaining screw (4).

(9) Lever the base plate (5) from its retaining groove in the body.

(10) Remove the base and bearing plate assembly (5).

(11) Drive out the parallel pin (6) retaining the drive dog.

(12) Remove the drive dog and thrust washer (7) noting that the raised pips on the washer face the drive dog.

(13) Remove the centre spindle complete with the automatic advance weights and springs (8).

(14) Remove the steel washer and nylon spacer from the spindle (9).

(15) Push the moving contact spring (10) towards the centre of the distributor and unclip the low tension lead (11).

(16) Remove the screw (12) retaining the earth lead tag and the capacitor.

(17) Remove the screw (13) spring and plain washer retaining the fixed contact and remove the contact assembly.

INSPECTION

2. Inspect the distributor components:

(1) Examine the fit of the drive spindle in its bush, and the spindle cam for wear. The automatic advance mechanism should not be dismantled other than to remove the control springs. If any of the moving parts are excessively worn or are damaged the complete spindle assembly must be renewed. If the spindle bearing is worn allowing excessive side play, the complete distributor must be replaced.

(2) Check the spring between the fixed and movable plates. Operate the plate and examine for freedom of movement and excessive wear. Renew as an assembly.

(3) Examine the distributor and cap for cracks and signs of tracking. Examine the pick-up brush for wear and freedom of movement in its holder. Renew as necessary.

(4) Check the rotor for damage, electrode security, and burning or tracking. Renew as necessary.

REASSEMBLY

3. Reassemble the distributor as follows:

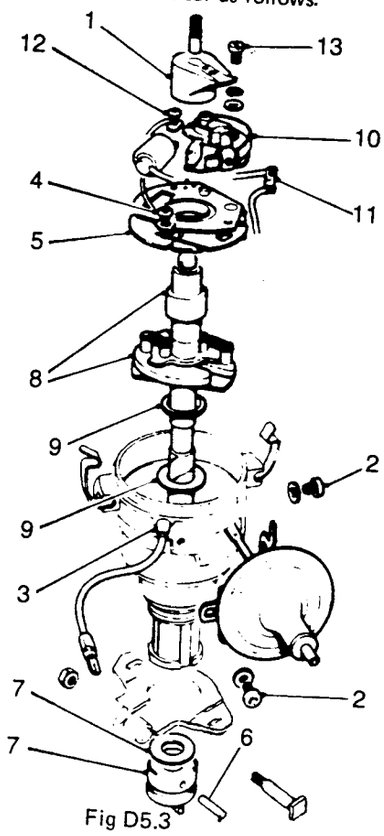


Fig D5.3

(1) Refer to Fig D5.3. Replace the fixed contact assembly and secure with the screw (13), spring and plain washers.

(2) Refit the capacitor and earth lead tag. Secure with the fixing screw (12).

(3) Push the moving contact spring (10) towards the centre and clip in the low tension lead (11). Do not take up the slack at this stage.

(4) Refit the nylon spacer and steel washer (9) to the spindle.

(5) Replace the centre spindle complete with the automatic advance weights and springs (8). During reassembly grease the pivots of the weights and springs and the spindle bearing area with Rocol MP (Molypad).

(6) Replace the drive dog and thrust washer (7) with the raised pips on the washer facing the dog. If a new drive spindle is fitted, tap the drive end of the distributor dog to flatten the 'pips' on the dog washer and ensure the correct amount of end float.

(7) Secure the drive dog with the parallel pin (6).

(8) Refit the base and bearing plate assembly (5). Ensure the base plate is pressed against the register in the body of the distributor so that the chamfered edge engages the undercut.

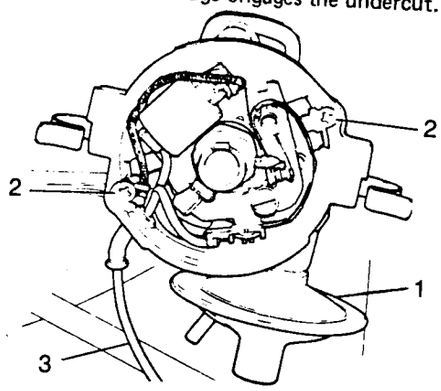


Fig D5.4

(9) Refer to Fig D5.4. Take up the slack in the low tension lead (3) by pulling it and the grommet through the body.

(10) Replace the vacuum unit (1), re-engaging the operating arm to the movable plate. Secure with the two retaining screws (2).

(11) Grease the outside of the contact breaker hollow pivot post and lightly smear the spindle cam, using Retinax 'A' grease.

(12) Replace the cam oiling pad and apply one or two drops of clean engine oil to it.

(13) Replace the rotor arm.

(14) Replace the moulded cover and secure with the clips (Fig D5.1,(1)).

(15) Replace the distributor (see Sub-section D4, Chapter 2).

SUB-SECTION D5

DISTRIBUTOR - OVERHAUL

DISMANTLING

1. To dismantle the distributor:

(1) Remove the distributor (see Sub-section D4, Chapter 2).

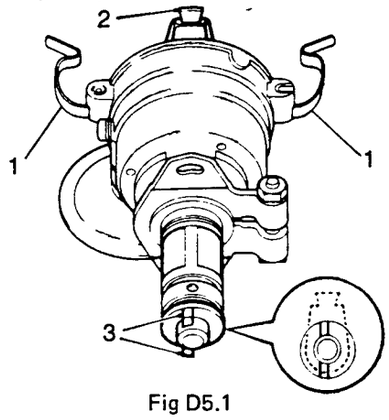


Fig D5.1

(2) Refer to Fig D5.1. Spring back the clips (1) and remove the moulded cover (the dust cap).

(3) Note the relative position of the offset drive dog (3) to the rotor arm lobe (2). The centre line of the drive dog is parallel with and offset to the centre line of the rotor arm.

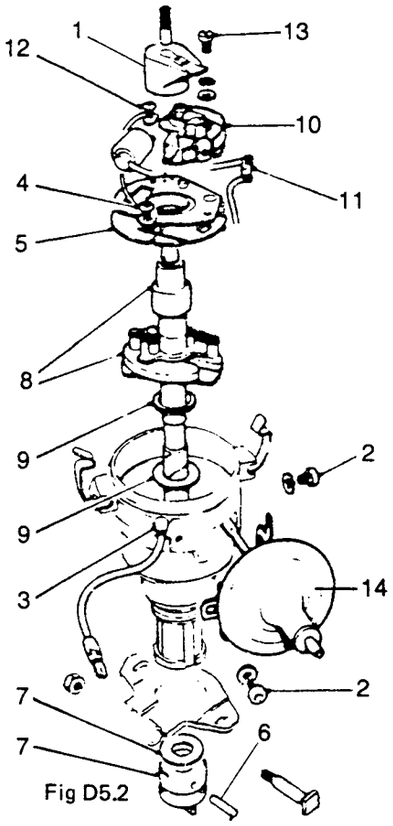


Fig D5.2

(4) Refer to Fig D5.2. Remove the rotor arm (1).

(5) Remove the cam oiling pad.

(6) Remove the two screws (2) retaining the vacuum unit (14), noting that two prongs protrude downwards from the base plate and straddle one of the retaining screws. Disengage the operating arm from the movable plate and remove the assembly.

(7) Push the grommet and low tension lead (3) through the body towards the inside of the housing.

(8) Remove the base plate retaining screw (4).

(9) Lever the base plate (5) from its retaining groove in the body.

(10) Remove the base and bearing plate assembly (5).

(11) Drive out the parallel pin (6) retaining the drive dog.

(12) Remove the drive dog and thrust washer (7) noting that the raised pips on the washer face the drive dog.

(13) Remove the centre spindle complete with the automatic advance weights and springs (8).

(14) Remove the steel washer and nylon spacer from the spindle (9).

(15) Push the moving contact spring (10) towards the centre of the distributor and unclip the low tension lead (11).

(16) Remove the screw (12) retaining the earth lead tag and the capacitor.

(17) Remove the screw (13) spring and plain washer retaining the fixed contact and remove the contact assembly.

INSPECTION

2. Inspect the distributor components:

(1) Examine the fit of the drive spindle in its bush, and the spindle cam for wear. The automatic advance mechanism should not be dismantled other than to remove the control springs. If any of the moving parts are excessively worn or are damaged the complete spindle assembly must be renewed. If the spindle bearing is worn allowing excessive side play, the complete distributor must be replaced.

(2) Check the spring between the fixed and movable plates. Operate the plate and examine for freedom of movement and excessive wear. Renew as an assembly.

SUB-SECTION D6

MAINTENANCE

INTRODUCTION

1. Ignition system maintenance should be confined to regular inspections and setting of the spark plugs and contact breaker gaps. Some lubrication of the distributor is also required.

DISTRIBUTOR CONTACT POINTS

2. Reset the points at first service (1 500 km) and thereafter every 10 000 km or 6 months. Replace every 20 000 km or 12 months.

3. Check and adjust the contact points clearance as follows:

(1) Remove the distributor cap and rotor arm and then turn the engine until the contacts are fully open.

(2) The clearance should be 0,35 to 0,40 mm with the feeler gauge a sliding fit between the contacts.

(3) If necessary slacken the screw securing the adjustable contact, adjust by the adjuster slot until the clearance is correct and then retighten the retaining screw.

(4) Replace the rotor arm and distributor cap.

DISTRIBUTOR MAINTENANCE

4. At first service (1 500 km) and thereafter every 10 000 km or 6 months carry out the following:

(1) Remove the distributor cap and rotor arm.

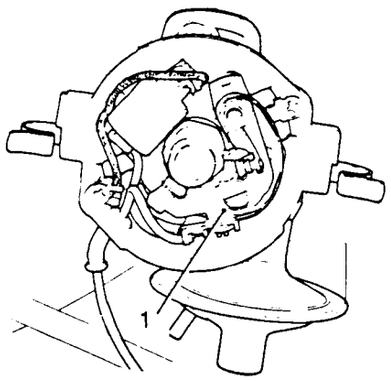


Fig D6.1

(2) Refer to Fig D6.1. Remove the lock screw (1), spring washer and washer.

(3) Lift out the Quikafit contact assembly.

(4) Disengage the contact spring from the insulation pad.

(5) Unclip the terminal plate from the contact spring.

(6) If the contact faces are pitted or cannot be cleaned to a satisfactory condition, renew them. (Ensure that new contact points are free of grease or oil).

(7) If the old contact points are reusable, clean with a fine carborundum stone and wipe with a petrol moistened cloth.

(8) Replace the contacts and adjust as detailed in para 3 above.

(9) Lightly smear the cam with clean engine oil.

(10) Add a few drops of thin machine oil to lubricate the cam bearing and distributor shaft.

(11) Add a few drops of thin machine oil through the side of the contact breaker base plate to lubricate the automatic timing control.

(12) Wipe the inside and outside of the cap with a soft dry cloth. Ensure that the small carbon brush works freely in its holder.

(13) Replace the rotor arm and distributor cap.

SPARK PLUGS

5. Check every 10 000 km or 6 months, replace every 20 000 km or 12 months.

(1) The sparking plugs are fitted with plastic covers.

(2) To gain access to the plugs for cleaning and gap-setting, pull off the plug covers without detaching them from the high tension leads.

(3) Check or replace the sparking plugs as applicable. If the plugs are in good condition, they should be cleaned, preferably using an approved spark plug cleaning machine.

(4) Test the plugs in accordance with the plug cleaning machine manufacturer's recommendations.

(5) If satisfactory set the electrode gap to 0,625 to 0,660 mm and replace.

(6) It is important that only the recommended sparking plugs, Champion N9Y, are used for replacements.

SECTION CONTENTS LIST

SECTION E

COOLING SYSTEM

SUB-SECTION CONTENTS LIST

SUB-SECTION E1

DESCRIPTION AND SPECIFICATIONS

SUB-SECTION E1

CHAPTER 1

DESCRIPTION OF THE COOLING SYSTEM

1. The vehicle has a pressurised, 'no loss' cooling system comprising a radiator, fan, water pump and an expansion tank.

2. The natural thermo syphon action of the water is augmented by a belt-driven pump with centrifugal impeller which is mounted at the cylinder block end of the fan spindle. The impeller receives water from the bottom tank of the radiator and passes it through the cylinder block. From here it rises into the cylinder head and out to a thermostat valve in the top radiator hose. The valve prevents cold water passing to the top tank of the radiator before the engine warms up.

3. The water is recirculated through the engine until it is hot enough to open the thermostat valve, thus giving a quick warm up.

4. The hot water in the top tank of the radiator flows through the finned core where it is cooled. The passage of air past the core is assisted by the action of a fan.

5. A spring loaded valve in the radiator filler cap pressurises the system and so increases the temperature at which the water boils. The system is pressurised to 105 kPa. As the coolant temperature falls a vacuum is created and at 6,5 kPa a valve opens in the filler cap to allow water from the expansion tank to refill the radiator tank.

SUB-SECTION E1

CHAPTER 2

SPECIFICATIONS

INTRODUCTION

1. General data for the cooling system are given in Table E1.1. There are no torque specifications for the cooling system.

TABLE E1.1 - GENERAL DATA FOR THE COOLING SYSTEM

ITEM	DESCRIPTION
Type	Pressurised, impeller assisted sealed unit with expansion tank.
Expansion tank cap	
- blow-off pressure	105 kPa
Thermostat	
- type	Western Thompson
- crack open temperature	74° C
Water pump	
- type	Centrifugal with sealed bearings
Water pump/alternator belt	
- type	V-wedge
Fan	
- type	Viscous - 7 blade
- diameter	405 mm

SUB-SECTION E2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This Sub-section deals with fault diagnosis and suggested action to cure a fault. Table E2.1 gives a list of symptoms, the probable cause and necessary remedial action. The Table is not exhaustive and faults may occur which are not listed. In this case the suspected components should be removed for closer inspection and/or overhaul.

TABLE E2.1 - COOLING SYSTEM FAULT DIAGNOSIS CHART

SYMPTON	POSSIBLE CAUSE	REMEDY
External leakage	Loose hose clips. Defective rubber hose. Damaged radiator seams. Excessive wear in the water pump. Loose core plugs. Damaged gaskets. Leaks at the heater connections or plugs. Leak at the water temperature gauge plug.	Tighten. Renew. Rectify. Renew. Renew. Renew. Rectify. Tighten.
Internal leakage	Defective cylinder head gasket. Cracked cylinder wall. Loose cylinder head bolts.	Renew. Check engine oil for contamination and refill as necessary. Renew cylinder block. Tighten. Check engine for oil contamination and refill as necessary.
Water loss	Boiling. Internal or external leakage. Restricted radiator or inoperative thermostat.	Ascertain the cause of engine overheating and correct as necessary. See above. Flush radiator or renew the thermostat as necessary.
Poor circulation	Restriction in system. Insufficient coolant. Inoperative water pump. Loose fan belt. Inoperative thermostat.	Check hoses for crimps, reverse flush the radiator, and clear the system of rust or sludge. Replenish. Renew. Adjust. Renew.
Corrosion	Excessive impurity in the water. Infrequent flushing and draining of system. Incorrect anti-freeze mixtures.	Use only soft, clean water together with correct anti-freeze or inhibitor mixture. The cooling system should be drained and flushed thoroughly at least once a year. Certain anti-freeze solutions have a corrosive effect on parts of the cooling system. Only recommended solutions should be used.
Overheating	Poor circulation. Dirty oil and sludge in engine. Radiator fins choked with chaff, mud, etc.	See above. Refill. Use air pressure from the engine side of the radiator and

	Incorrect ignition timing. Insufficient coolant. Low oil level. Tight engine. Choked or damaged exhaust pipe or silencer. Dragging brakes. Overloading vehicle. Driving in heavy sand or mud. Engine labouring on gradients. Low gear work. Excessive engine idling. Inaccurate temperature gauge. Defective thermostat.	clean out passages thoroughly. Rectify. Replenish. Replenish. New engines are very tight during the 'running-in' period and moderate speeds should be maintained for the first 1,000 miles (1,500 km). Rectify or renew. Adjust brakes. In the hands of the operator. In the hands of the operator. In the hands of the operator. In the hands of the operator. In the hands of the operator. Renew. Renew.
Overcooling	Defective thermostat. Inaccurate temperature gauge.	Renew. Renew.

SUB-SECTION E3

TESTING THE THERMOSTAT

1. To test the thermostat:

   (1) Remove the thermostat (see Sub-section E4, Chapter 5).

   (2) Suspend the thermostat in a suitable container of water ensuring that the thermostat is fully immersed and not touching the bottom or sides of the container.

   (3) Heat the water.

   (4) Using a reliable thermometer check the temperature at which the thermostat operates. It should begin to open at 74°C.

2. If the thermostat does not start to open or if the valve sticks in the fully open position, renew the thermostat.

3. Under no circumstances should any attempt be made to repair the thermostat.

4. It is unwise to operate a vehicle for any prolonged period without a thermostat fitted.

SUB-SECTION CONTENTS LIST

SUB-SECTION E4

REMOVAL AND REPLACEMENT PROCEDURES

SUB-SECTION E4

CHAPTER 1

RADIATOR - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the radiator:

WARNING

Do not remove the radiator filler cap while the system is hot unless the expansion tank cap has been removed first.

(1) Remove the fan cowl (see Sub-section E4, Chapter 2).

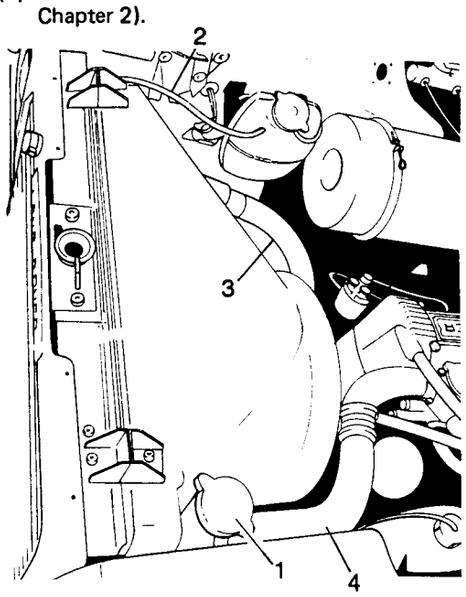


Fig E4.1

(2) Refer to Fig E4.1. Remove the radiator filler cap (1).

(3) Remove the lower radiator hose (3) and drain the radiator.

(4) Disconnect the expansion tank hose (2).

(5) Disconnect the top hose (4) from the radiator.

(6) Lift the radiator clear of the bottom mountings.

REPLACEMENT

2. Replace the radiator as follows:

(1) Fit the radiator into position on the bottom mountings.

(2) Connect the top and bottom hoses to the radiator.

(3) Reconnect the expansion tank hose and replace the expansion tank cap.

(4) Replace the fan cowl (see Sub-section E4, Chapter 2).

(5) Fill the radiator with the required solution of water and inhibitor and, if necessary, anti-freeze solution. Replace the filler cap.

SUB-SECTION E4

CHAPTER 2

FAN COWL - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the fan cowl:

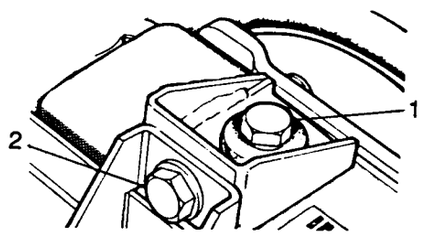


Fig E4.2

(1) Refer to Fig E4.2. Remove the two bolts, nuts and washers (1) and (2) on each bracket. (The other bracket is at the other side of the radiator).

(2) Lift the cowl upwards, keeping the lower part clear of the fan blades.

REPLACEMENT

2. Replace the cowl as follows:

(1) Lower the cowl into position.

(2) Fit and tighten the nuts, washers and bolts in the brackets. The top bolts (1) should only be tightened sufficiently to start compression of the rubber washer. Do not overtighten these bolts.

SUB-SECTION E4

CHAPTER 3

EXPANSION TANK - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the expansion tank as follows:

WARNING

Do not remove the expansion tank filler cap when the engine is hot because the cooling system is pressurised and personal scalding could result.

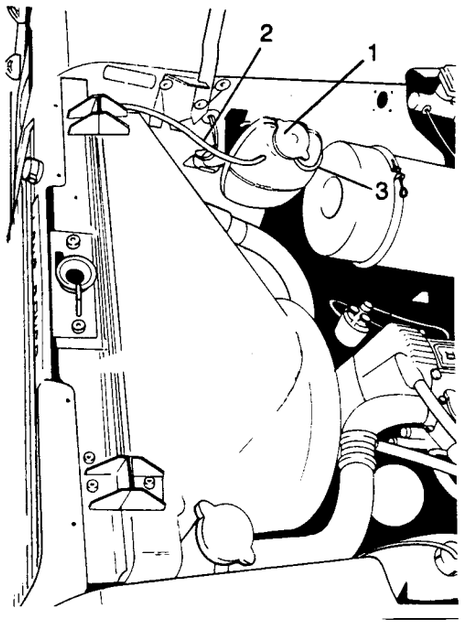


Fig E4.3

(1) Refer to Fig E4.3. Remove the expansion tank filler cap (1) by first turning it counter clockwise a quarter of a turn to allow pressure to escape, then turning it further in the same direction to lift it off.

(2) Disconnect the hose (2) from the radiator.

(3) Disconnect the overflow pipe (3).

(4) Remove the two bolts in the bracket over the tank and take off the bracket.

(5) Remove the expansion tank.

REPLACEMENT

2. To replace the expansion tank:

(1) Place the tank in position, fit the bracket and secure with the two bolts.

(2) Reconnect the overflow pipe and the hose from the radiator.

(3) Fill the tank with water to the level marked on the tank.

SUB-SECTION E4

CHAPTER 4

FAN BLADES - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the fan:

   (1) Remove the fan cowl (see Sub-section E4, Chapter 2).

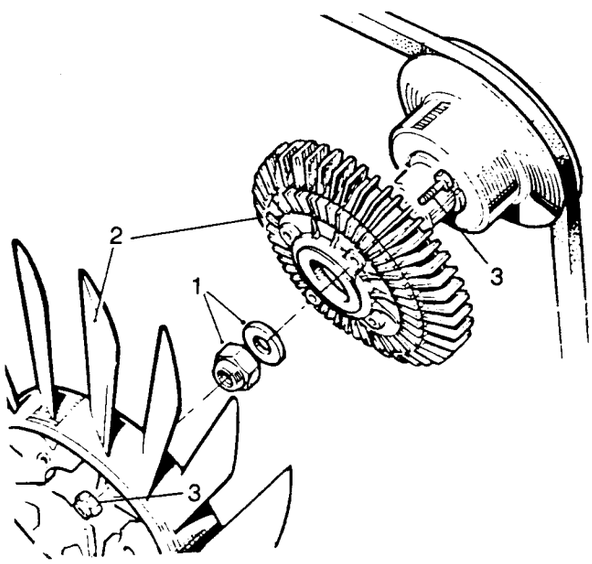


Fig E4.4

   (2) Refer to Fig E4.4. Remove the water pump shaft centre nut and washer (1).

   (3) Pull off the metal coupling and fan blades complete (2).

   (4) To remove the fan blades remove the four bolts and nuts (3) and separate the blades from the metal coupling.

REPLACEMENT

2. Replace the fan blades as follows:

   (1) Reassemble the fan blades to the metal coupling and secure with the four nuts and bolts.

   (2) Fit the fan blade assembly onto the water pump shaft.

   (3) Replace the washer and nut and tighten.

   (4) Replace the fan cowl (see Sub-section E4, Chapter 2).

SUB-SECTION E4

CHAPTER 5

THERMOSTAT - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the thermostat:

   (1) Drain the cooling system.

   (2) Disconnect the top radiator hose.

   (3) Disconnect the water outlet elbow.

   (4) Remove the joint gasket and lift out the thermostat.

   (5) Test the thermostat to the procedure given in Sub-section E3 if required.

REPLACEMENT

2. To replace the thermostat:

   (1) Fit the thermostat into position with the side marked 'Top' uppermost.

   (2) Reconnect the water outlet elbow, using a new gasket.

   (3) Refit the top radiator hose.

   (4) Fill the cooling system with the correct water and inhibitor solution and add anti-freeze if required.

SUB-SECTION E4

CHAPTER 6

WATER PUMP - REMOVAL AND REPLACEMENT

NOTE

The water pump can not be repaired. If it is faulty it must be replaced.

REMOVAL

1. To remove the water pump:

   (1) Remove the fan blades (see Sub-section E4, Chapter 4).

   (2) Slacken the alternator pivot bolts and adjusting link nut.

   (3) Remove the fan belt and water pump pulley.

   (4) Remove the bypass and heater hoses.

   (5) Remove the three bolts securing the pump to the cylinder block and withdraw the pump.

REPLACEMENT

2. Replace the pump as follows:

   (1) Fit the pump with a new sealing gasket to the cylinder block and secure with three bolts and lock washers.

   (2) Refit the bypass and heater hoses.

   (3) Replace the fan belt and water pump pulley.

   (4) Adjust the alternator drive belt (see Sub-section O4).

   (5) Replace the fan blades (see Sub-section E4, Chapter 4).

SUB-SECTION E5

MAINTENANCE

INTRODUCTION

1. Other than checking the water level in the radiator and expansion tank regularly, the only maintenance required is checking the hoses (including the heater hoses) for damage and chafing. Any leaks found must be repaired immediately.

CHECKING WATER LEVEL

2. To check the water level:

(1) If the engine is hot, turn the filler cap counterclockwise to the first stop and allow the pressure to escape.

(2) Press the filler cap down and turn further counterclockwise until the cap can be lifted off.

(3) Check that the water is:

i. Just below or level with the bottom of the filler neck (engine hot).

ii. Between 12 and 19 mm below the bottom of the filler neck (engine cold).

(4) When the engine is cold, remove the cap on the expansion tank and check that there is about 50 mm of water in the tank. If not, fill to this level.

(5) Replace both caps. It is important that they are fully tightened down, not just to the first stop.

CAUTION
Failure to tighten the filler cap properly may result in water loss with possible damage to the engine through overheating.

DRAINING AND REFILLING THE COOLING SYSTEM

3. To drain the system completely:

(1) Remove the filler cap.

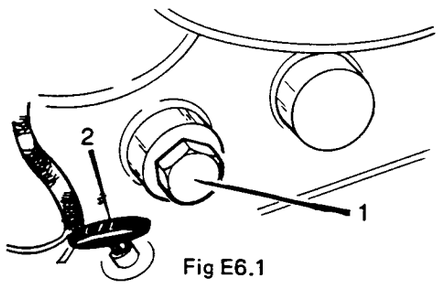


Fig E6.1

(2) Refer to Fig E6.1. Open the cylinder block drain plug (1) (close to the dipstick (2)).

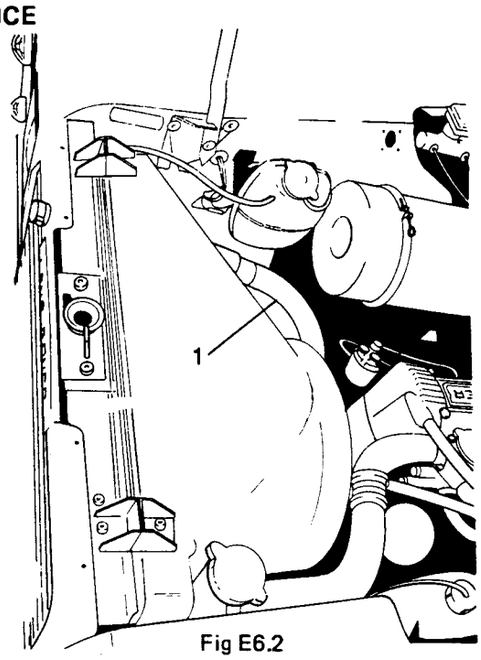


Fig E6.2

(3) Refer to Fig E6.2. Remove the lower radiator hose (1) at the radiator.

(4) Allow all water to drain from the system.

(5) Refit and tighten the drain plug ((1) on Fig E6.1). Refit the lower radiator hose ((1) on Fig E6.2).

(6) Refill the radiator with the correct water and inhibitor solution, add antifreeze if required and replace the filler cap.

(7) Run the engine for a few minutes, then switch off and check the water level. Top up if necessary to 12 to 19 mm below the filler neck.

ADDING ANTIFREEZE SOLUTION

4. When the ambient temperature is expected to fall below 0°C add antifreeze solution in the ratio one part antifreeze to three parts water. For this engine, the quantities will be 2 ℓ antifreeze to 6 ℓ water.

5. To add antifreeze:

(1) Drain the system (para 3).

(2) Fill the radiator with 4,5 ℓ of clean, soft water.

(3) Add the antifreeze solution.

(4) Top up the radiator with water to 12 to 19 mm below the filler neck.

(5) Run the engine for a few minutes to ensure good circulation and then switch off.

(6) Check the water level and if necessary top up.

SECTION CONTENTS LIST

SECTION F

EXHAUST SYSTEM

SUB-SECTION F1

DESCRIPTION OF THE EXHAUST SYSTEM

1. The exhaust system is designed to minimise the noise emitted from the exhaust manifolds and to provide optimum back pressure while carrying exhaust fumes clear of the driver's cab.

2. Two downpipes are used. They run into a single exhaust pipe carrying the gasses to the series connected silencer and expansion box and thence to the tail pipe. The front downpipe can be detached from the pipe junction.

3. The exhaust system is precisely designed; leaks or broken baffles in the silencer tend to reduce engine efficiency and also lead to a high fuel consumption.

SUB-SECTION F2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This Sub-section covers exhaust system faults. Table F2.1 gives a list of symptoms, the possible causes of the fault and the suggested remedial action. The table is not exhaustive and faults may occur which are not listed. Should such a fault be found the suspected components should be removed for a closer inspection.

TABLE F2.1 - EXHAUST SYSTEM FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Leaking exhaust gas	Exhaust couplings misaligned. Holes in exhaust system.	Realign couplings. Replace damaged components.
Engine overheating	Silencer or expansion box blocked. Tail pipe blocked (flattened).	Repair or replace component. Remove blockage or replace tail pipe.
Engine lacks power or stalls	Silencer or expansion box blocked. Tail pipe blocked.	Repair or replace component. Remove blockage or replace tail pipe.

SUB-SECTION CONTENTS LIST

SUB-SECTION F3

REMOVAL AND REPLACEMENT PROCEDURES

SUB-SECTION F3

CHAPTER 1

MANIFOLDS - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the manifolds:

(1) Disconnect the battery.

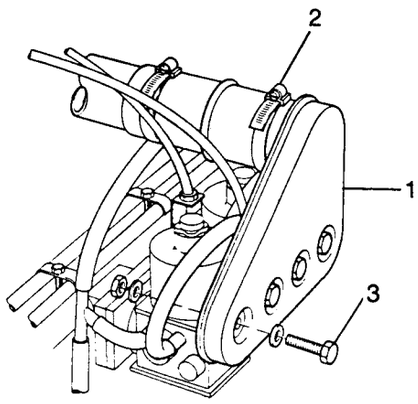


Fig F3.1

(2) Refer to Fig F3.1. Remove the air intake box (1) by disconnecting the air inlet hose (2) and removing the four bolts (3) holding the box to the carburetters. (The bolts have loose nuts and washers behind the box).

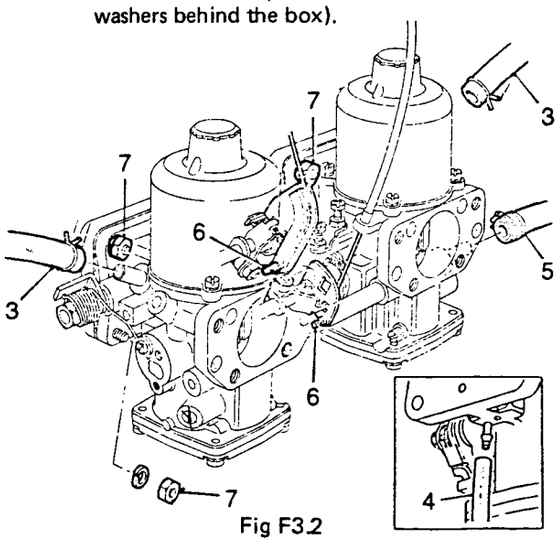


Fig F3.2

(3) Refer to Fig F3.2. Disconnect the engine purge hoses (3) from the carburetters.

(4) Disconnect the ignition vacuum advance pipe (4) from the rear carburetter.

(5) Disconnect the fuel feed pipe (5) to the rear carburetter.

(6) Release the throttle and choke cables (6).

(7) Remove the eight nuts and spring washers (7) to release the carburetters.

(8) Remove the carburetters together with the throttle cable abutment bracket distance plate for the front carburetter, distance pieces and gaskets, keeping the carburetters together so as not to disturb the interconnecting links.

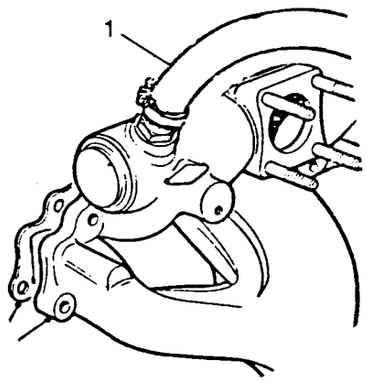


Fig F3.3

(9) Refer to Fig F3.3. Disconnect the brake servo hose (1) from the adapter on the inlet manifold.

(10) Remove the two set bolts to release the heat shield from the exhaust manifold.

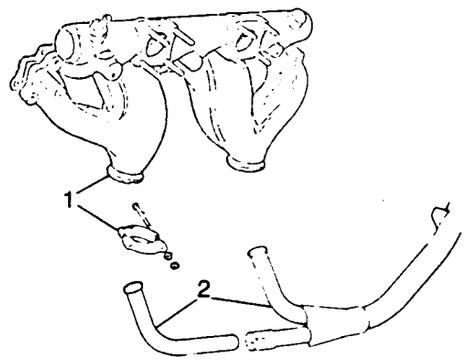


Fig F3.4

(11) Refer to Fig F3.4. Remove the two clamps (1) to release the exhaust downpipes (2) from the exhaust manifold.

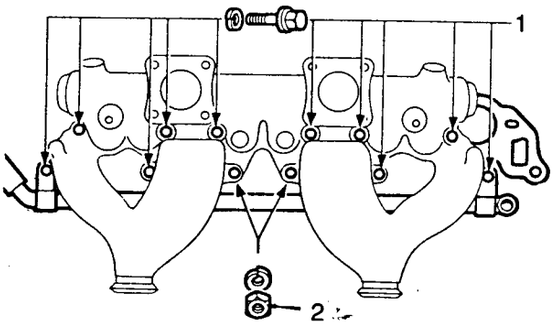


Fig F3.5

(12) Refer to Fig F3.5. Remove the ten set bolts (1) and the two nuts (2) securing the exhaust manifold to the cylinder head.

(13) Remove the manifold and gaskets.

REPLACEMENT

2. Replace the manifold as follows:

(1) Using a new gasket fit the manifold into position and secure with the ten set bolts and two nuts (Fig F3.5). Torque to 20 N.m.

(2) Replace the exhaust downpipes and secure with the two clamps (Fig F3.4).

(3) Replace the heat shield and the two set bolts.

(4) Replace the brake servo hose onto the adaptor on the inlet manifold (Fig F3.3).

(5) Fig F3.2 still applies. Using new gaskets replace the carburetters and fit the eight nuts and spring washers (7) to the studs.

(6) Refit the throttle and choke cables (6).

(7) Reconnect the fuel feed pipe to the rear carburetter (5).

(8) Reconnect the ignition vacuum advance pipe (4) and the engine purge hoses (3).

(9) Replace the air intake box and air inlet hose (Fig F3.1).

(10) Reconnect the battery.

SUB-SECTION F3

CHAPTER 2

EXHAUST SYSTEM - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the exhaust system:

   (1) Disconnect the battery.

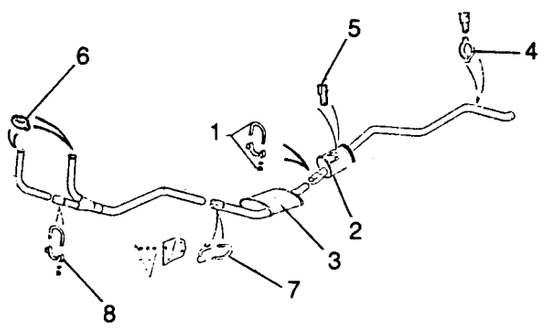


Fig F3.6

   (2) Refer to Fig F3.6. Remove the U-bolt, spring washers and nuts (1) securing the rear silencer assembly (2) to the intermediate silencer (3).

   (3) Remove the tail pipe support bracket (4).

   (4) Disconnect the securing strap (5) and remove the rear silencer and tail pipe.

   (5) Support the remainder of the exhaust system.

   (6) Remove the clamps (6) to release both downpipes from the exhaust manifold.

   (7) Remove the U-bolt (7) securing the downpipe to the mounting bracket.

   (8) Remove the intermediate silencer and downpipes.

   (9) Undo the nuts, remove the U-bolt (8) holding the front downpipe to the intermediate pipe and separate the pipes.

REPLACEMENT

2. Replace the exhaust system as follows:

   (1) Fit the front downpipe to the intermediate pipe but do not tighten the U-bolt (8) at this stage.

   (2) Fit the downpipes into position and lightly secure with the clamps (6).

   (3) Fit the intermediate silencer and lightly clamp into position with the U-bolt (7).

   (4) Place the rear silencer and tail pipe in position and lightly secure with the securing strap (5) and support bracket (4).

   (5) Fit the U-bolt, spring washers and nuts (1) to the junction of the rear and intermediate silencers. Tighten finger tight.

   (6) Starting from the manifold clamps progressively tighten all nuts and bolts while ensuring that there is no strain on any of the components.

   (7) Finally, torque all nuts and bolts to 15 to 18 N.m.

SUB-SECTION F4

MAINTENANCE

1. Regular examinations should be made of the complete exhaust system to ensure that it is intact and that components are not breaking loose. Any fault which allows leakage of exhaust gases, especially into the cab, can be dangerous.

2. Misalignment of components should be rectified immediately. Components with holes in them should be replaced while noisy exhausts should be investigated and the faulty component repaired or replaced without delay.

SECTION CONTENTS LIST

SECTION G

AIR CLEANING SYSTEM

SUB-SECTION G1

DESCRIPTION OF THE CLEANER SYSTEM

INTRODUCTION

1. The air cleaner system is an important part of the engine since a correctly operating system supplies purified air to the combustion chambers. It is essential that the filter element is in good condition and not blocked and that there are no air leaks in the system. Air leaks will result in impure air being drawn into the cylinders and can cause excessive wear to moving parts. A blocked system will starve the cylinders of air and result in poor performance, difficult starting or even stop the engine.

ARRANGEMENT

2. The air intake assembly consists of a Donaldson Cyclopac filter feeding the carburetters through a feed pipe and an intake box. The filter is secured to the right hand wing valance by two straps and is fitted with an indicator which shows red when element efficiency is impaired.

3. A dust cap, fitted to the end of the filter accumulates dust drawn into the air intake system and is designed for easy removal and cleaning.

SUB-SECTION G2

AIR CLEANER - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the air cleaner:

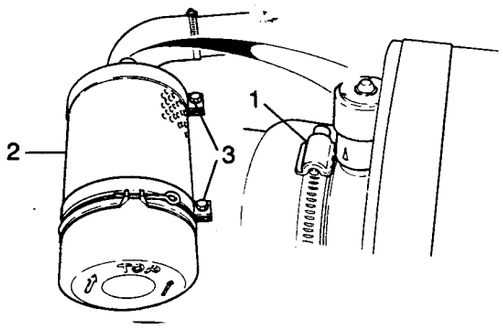


Fig G2.1

(1) Refer to Fig G2.1. Release the hose clamp (1) and pull the flexible pipe away from the air cleaner (2).

(2) Remove the two nuts and bolts (3) in the retaining straps, separate the straps and lift the air cleaner out.

REPLACEMENT

2. Replace the air cleaner as follows:

(1) Fit the air cleaner into the retaining straps with the dust cup to the front of the engine.

(2) Replace the two nuts and bolts into the straps and tighten.

(3) Fit the flexible hose over the end of the cleaner and tighten the hose clamp.

SUB-SECTION G3

MAINTENANCE

INTRODUCTION

1. The air filter is a single element, dry type, fitted with a dust cup. Frequent inspections of the dust cup should be made, especially when operating in dusty off-road conditions. Under such conditions inspection of the dust cup may be necessary as often as once daily.

2. The filter element is so designed that little or no routine maintenance is required. The indicator shows red when the efficiency of the element is impaired and at this stage, or every two years, whichever is the shorter period, the element should be changed.

3. It is essential that the ducting between the filter and the engine has no cracks and all flange joints and clamps are tight. A regular inspection of the ducting should be made to check these points.

DUST CUP CLEANING

4. To remove and clean the dust cup:

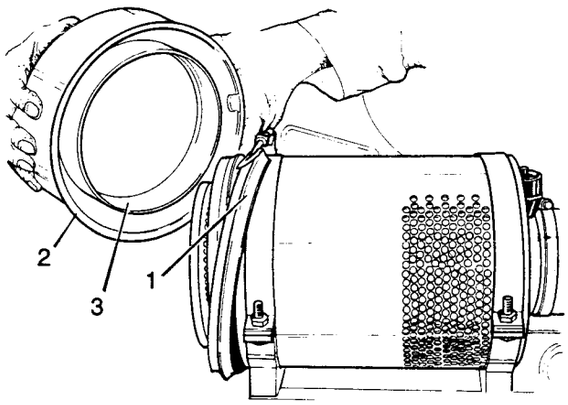


Fig G3.1

(1) Refer to Fig G3.1. Unscrew the bolt in the dust cup clamp (1) and take off the dust cup (2).

(2) Lift out the baffle (3) inside the dust cup.

(3) Empty the dust from the cup and wipe the cup and baffle clean with a dry cloth.

(4) Fit the baffle into the dust cup.

(5) Replace the dust cup with the arrows pointing upwards and secure with the clamp.

ELEMENT REPLACEMENT

CAUTIONS

1. *Do not open any part of the air filter system with the engine running.*

2. *Always ensure that gaskets and seals in the filtration system are in prime condition before fitting/refitting.*

3. *Do not open any part of the air filter system when the ambient air is dusty or gritty.*

4. *Preferably only open the air filter system in a dust free workshop.*

5. *Renew air hoses every two years.*

6. *Do not change or clean the element unnecessarily. Only service if the indicator shows red.*

5. If carefully carried out, the element may be cleaned up to six times before renewing. However, it is recommended that rather than clean a used element, a fresh element is fitted once every two years (or earlier if the indicator shows red). If circumstances are such that the old element must be reused the precautions given in the cautionary notes below must be strictly adhered to.

CAUTIONS

1. *Do not remove dust by knocking the element with or against anything.*

2. *Take care that the element is not accidentally damaged.*

3. *A dented or damaged element must be discarded and not reused.*

4. *Apply low pressure compressed air from inside the element to clear the dust.*

6. To replace an element:

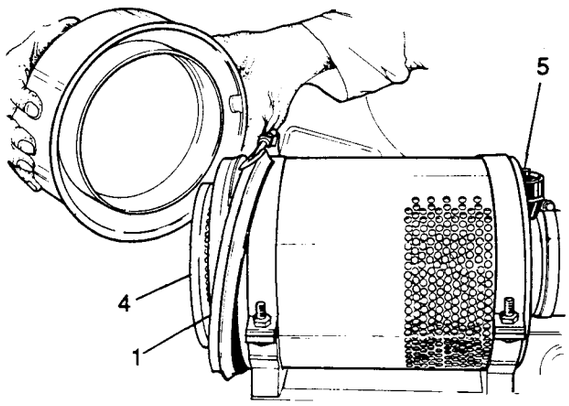


Fig G3.2

(1) Refer to Fig G3.2. Unscrew the bolt holding the dust cup clamp (1). Remove the clamp and the dust cup.

(2) Lift the baffle out of the dust cup.

(3) Unscrew the wing nut and pull the element (4) and its gasket clear of the body assembly.

(4) Inspect the new element for shipping or storage damage. Do not use the element if it has been damaged. Do not use the element without a gasket.

(5) Clean the body with a damp, lint-free cloth. Fit the gasket and element into the body and secure with the wing nut.

(6) Fit the baffle into the dust cup.

(7) Fit the dust cup to the body and secure with the clamp.

(8) Reset the indicator to show green by pressing the button (5) on top of the indicator.

NOTE

Do not attempt to service a faulty indicator - fit a new one.

SECTION CONTENTS LIST

SECTION H

TRANSMISSION SYSTEM

SUB-SECTION CONTENTS LIST

SUB-SECTION H1

GEARBOX

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION H1.1

DESCRIPTION AND SPECIFICATIONS

SUB-SUB-SECTION H1.1

CHAPTER 1

DESCRIPTION OF THE GEARBOX

GENERAL

1. The transmission of power from the engine is achieved by a unique gearbox/transfer box assembly. From the clutch the drive is first taken to the main four speed gearbox. At the near end of the gearbox a transfer box is attached, which transmits the drive through an idler to the propeller shaft drive units. The gearbox/transfer box is fitted between the clutch bell housing and rear axle.

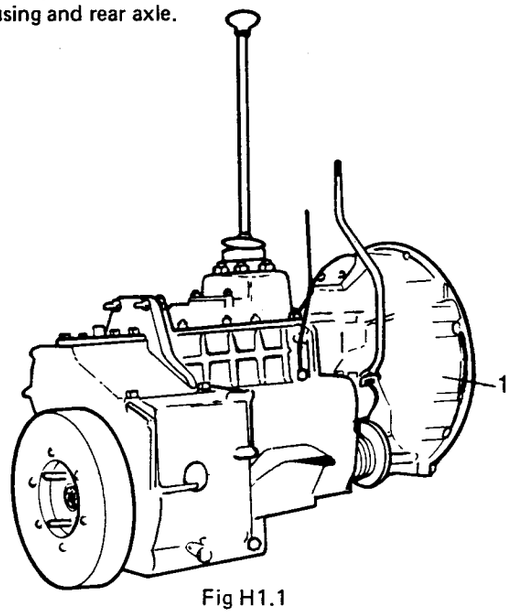


Fig H1.1

2. Refer to Fig H1.1. The gearbox/transfer box is bolted to the bell housing (1) and mounted to the chassis with rubber mountings. The idler wheel has two gears of different diameters and by means of a sliding gear on the output shaft, a high or low ratio can be added to the four speeds of the main gearbox. The forward output shaft drives the front wheels and this can be connected or disconnected by means of a dog clutch on the output shaft, to give 2 and 4 wheel drive.

SUB-SUB-SECTION H1.1

CHAPTER 2

GEARBOX SPECIFICATIONS

INTRODUCTION

1. The specifications for the gearbox are given in the following tables:

TABLE H1.1 - GENERAL DATA
TABLE H1.2 - TORQUE SPECIFICATIONS

TABLE H1.1 - GENERAL DATA

ITEM	DESCRIPTION
Type	Single helical constant mesh with synchro-mesh on all forward speeds
Ratios: Top	Direct
Third	1,497:1
Second	2,22:1
First	3,65:1
Reverse	4,06:1
Adjustments and Measurements:	
On the 1st, 2nd and 3rd mainshaft gears end float should be	0,10 to 0,15 mm
Layshaft bearing nip	0,0 to 0,10 mm
Separation of rear cover to bearing	0,0 to 0,10 mm
Separation of front cover to primary shaft bearing	0,0 to 0,10 mm
End float of bearing fitted on primary shaft	0,0 to 0,5 mm
End float of transfer box double intermediate gear	0,10 to 0,20 mm
End float of high gear in transfer box	0,10 to 0,20 mm
Rolling resistance of output shaft of transfer box, measured with spring balance	0,90 to 1,80 kg
Free length of 4 wheel drive selector shaft spring	70 mm
Free length of high and low selector shaft spring	182 mm

TABLE H1.2 - TORQUE SPECIFICATIONS

ITEM	TORQUE (N.m)
Mainshaft transfer gear nut	130 to 170
Flywheel housing to clutch housing nuts	25 to 30
Fixing screws for register plate to clutch housing	5 to 10
Fixing nuts for power take off cover	12 to 17
Fixing nuts for power take off housing	20 to 30
Fixing nuts for mainshaft rear oil seal housing	20 to 30
Front output shaft casing to transfer box nuts	12 to 17
Speedometer drive housing to transfer box nuts	20 to 30
Clutch housing to gearbox nuts	60 to 75
Gearbox mounting nuts	30 to 45
Fixing screw clutch lever to pivot	7 to 10
Fixing screw clutch housing front cover	20 to 25
Fork retainer cover screws to gearbox	20 to 25
Front and rear output shaft flange nuts	110 to 120
Speedometer drive housing nuts	13 to 18
Fixing nuts for transmission brake drum to flange	20 to 30

SUB-SUB-SECTION H1.2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This Sub-sub-section deals with fault diagnosis and corrective action for the gearbox. In Table H1.3, a list of symptoms, the probable cause and the necessary remedial action is given. It should be noted that the Table is not exhaustive and faults may occur which are not listed. Should the Table fail to give an indication of a fault, the suspected components should be removed for closer inspection and/or overhaul.

TABLE H1.3 - GEARBOX FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Gearbox noisy in neutral	Insufficient oil in gearbox. Incorrect grade of oil. Primary pinion bearing worn. Constant mesh gears worn. Layshaft bearings worn.	Top up as necessary. Drain and replenish. Renew bearing. Renew primary pinion and layshaft. Renew bearings.
Gearbox noisy in all gears except top	Layshaft, mainshaft or primary pinion bearings worn. Constant mesh gears worn.	Renew bearings. Renew primary pinion and layshaft.
Gearbox noisy in one gear only	Worn or damaged gears or bearings.	Renew gears and/or bearings.
Gearbox nosiy in all gears	Worn bearings on primary pinion, mainshaft or layshaft.	Renew bearings.
Oil leaks from gearbox	Gearbox over-filled with lubricating oil. Loose or damaged drain or level plugs. Obstructed breather. Joint washer damaged, incorrectly fitted or missing. Oil seals damaged or incorrectly fitted. Cracked or broken gearbox casings.	Rectify oil level with vehicle standing on level floor. Tighten plugs. If damaged, fit new plugs and joint washer as required. Clean breather. Fit new joint washer with general purpose grease smeared on both sides. Fit new oil seal with 'Hylomar' SQ32M sealing compound smeared on the outside diameter. Fit new casings.
Difficulty in engaging forward gears	Weak springs or worn parts in synchromesh units. Worn selector forks and/or interlock pins. Faulty clutch operation; clutch fluid leakage.	Renew faulty parts. Renew components as necessary. Check clutch master and slave cylinders. Renew clutch components as necessary.
Difficulty in engaging reverse gear	Reverse gear bearings worn or damaged. Faulty clutch operation, clutch fluid leakage.	Renew bearings and shaft as necessary. Check clutch master and slave cylinders. Renew clutch components as necessary.

TABLE H1.3 - GEARBOX FAULT DIAGNOSIS CHART - CONTINUED

SYMPTOM	POSSIBLE CAUSE	REMEDY
Difficulty in disengaging forward gears	Synchromesh cones worn; damaged gear dogs. Distorted or damaged splines.	Renew faulty parts. Renew components as necessary.
Difficulty in disengaging reverse gear	Reverse gear seized on shaft.	Renew parts as necessary.
Gear lever going into reverse too easily and not into first	Weak reverse stop hinge plate spring.	Renew the spring.
Transfer of oil between main gearbox and transfer gearbox	Faulty 'O'-ring seal on reverse idler shaft. Faulty mainshaft oil seal. Obstructed main gearbox breather.	Renew seal. Renew seal. Clean breather.
Oil leakage from gearbox to bell housing	Faulty joint washer/s on gearbox front cover and oil pump. Faulty oil seal, primary pinion to front cover. Damaged or porous gearbox front cover.	Renew joint washer/s. Renew oil seal. Renew front cover.
Transfer gearbox noisy	Insufficient oil in transfer box. Incorrect grade of lubricating oil. Excessive end float on intermediate gears assembly. Worn components in gearbox differential unit. Worn bearings in intermediate gears assembly.	Replenish. Drain and replenish with the correct grade oil. Adjust as required. Renew components. Renew bearings.

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION H1.3

REMOVAL AND REPLACEMENT PROCEDURES

NOTE
For speedometer removal see Sub-section O5

SUB-SUB-SECTION H1.3

CHAPTER 1

GEARBOX - REMOVAL AND REPLACEMENT

NOTE

If the vehicle is not stationed over a pit the gear lever must be removed before the gearbox can be withdrawn (see Sub-sub-section H1.3, Chapter 3 for gear lever removal).

REMOVAL

1. To remove the gearbox from the vehicle:

(1) Remove the floor tunnel (see Sub-section M3, Chapter 5).

(2) Drain the gearbox lubricating oil (see Sub-section H1.5).

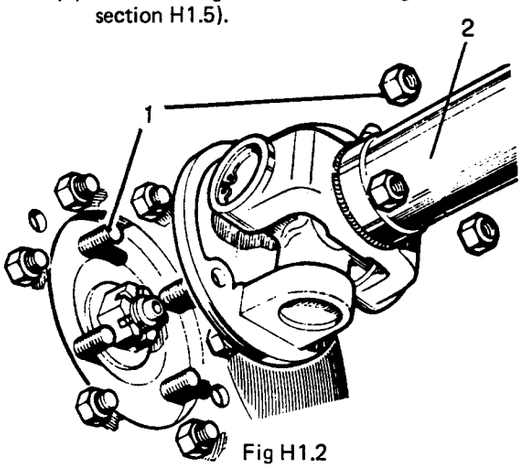


Fig H1.2

(3) Refer to Fig H1.2. Remove the rear propeller shaft fixings (1) at the transmission brake.

(4) Move aside the shaft (2).

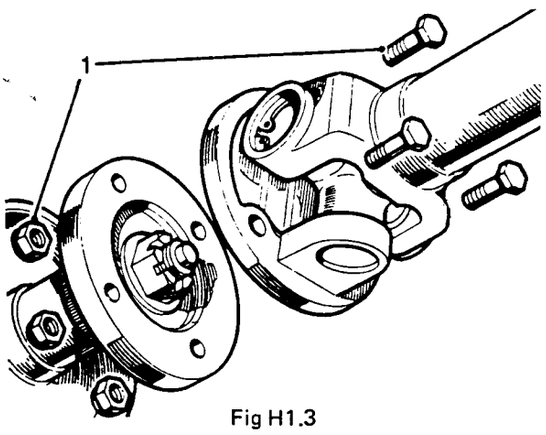


Fig H1.3

(5) Refer to Fig H1.3. Remove the front propeller shaft fixings (1) at the front output coupling.

(6) Move aside the shaft.

NOTE

If the vehicle is fitted with any optional equipment driven from the gearbox, this must be disconnected at the gearbox.

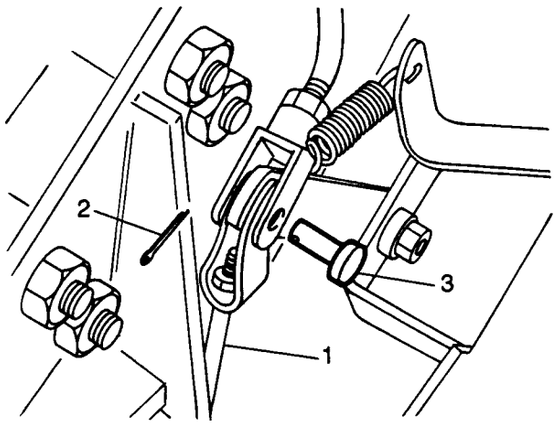


Fig H1.4

(7) Refer to Fig H1.4. Disconnect the handbrake expander rod (1) by removing the split pin (2) and pulling out the clevis pin (3).

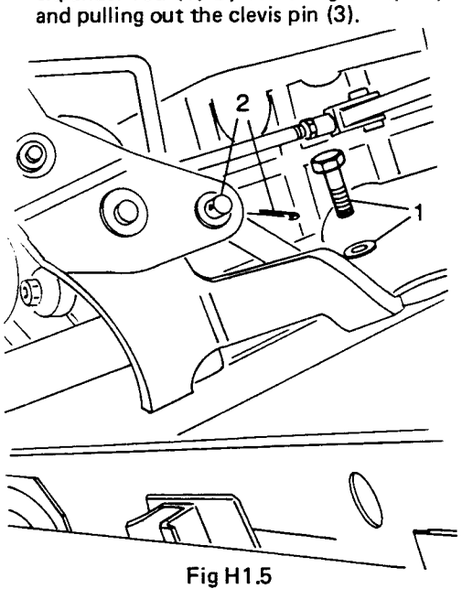


Fig H1.5

(8) Refer to Fig H1.5. Remove the brake lever fixings (1) and the relay fixings (2).

(9) Remove the brake lever and the relay mechanism.

(10) Disconnect the speedometer cable from the gearbox (see Sub-sub-section H1.3, Chapter 19).

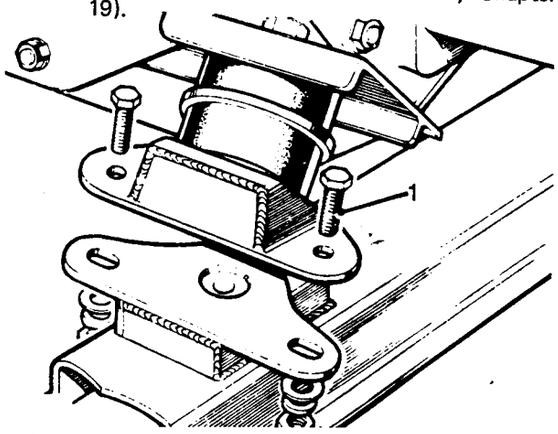


Fig H1.6

(11) Refer to Fig H1.6. Remove the fixings (1) from the two rear mountings for the gearbox.

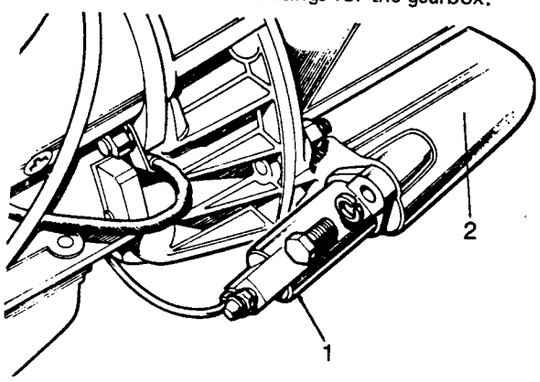


Fig H1.7

(12) Refer to Fig H1.7. Remove the clutch slave cylinder (1) from the bell housing (2) (see Sub-sub-section H3.4, Chapter 3).

(13) Jack up the rear of the engine with a 25 mm thick block of wood between the flywheel housing, to retain the engine in position when the gearbox is removed.

(14) Place a suitable sling around the gearbox and tension it sufficiently to take the weight.

(15) Remove the remaining fixings securing the bell housing to the flywheel housing.

(16) Remove the gearbox rear mounting cross-member fixings to chassis and remove the cross-member.

(17) Carefully withdraw the gearbox rearwards clear of the clutch and lower beneath the vehicle.

REPLACEMENT

2. Replace the gearbox as follows:

(1) Place a suitable sling around the gearbox and raise it to the level of the flywheel housing.

(2) Ease the gearbox towards the flywheel housing ensuring that the splined shaft engages with the splines in the clutch driven plate. It may be necessary to put the gearbox into fourth gear and turn the rear propeller shaft flange to achieve this.

(3) Fit and secure the gearbox rear mounting cross-member.

(4) Replace the fixings securing the bell housing to the flywheel housing.

(5) Replace the clutch slave cylinder (see Sub-sub-section H3.4, Chapter 3).

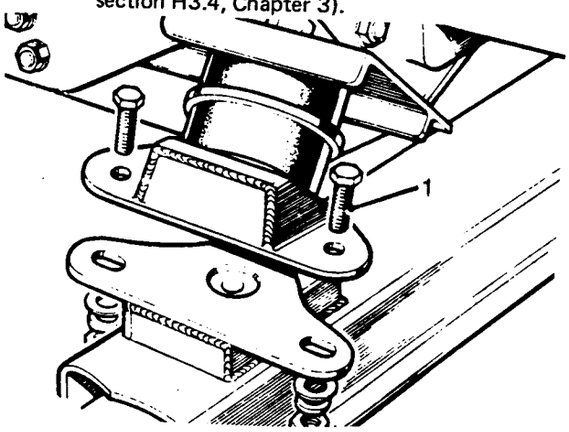


Fig H1.8

(6) Refer to Fig H1.8. Replace the fixings (1) for the two rear mountings for the gearbox.

(7) Reconnect the speedometer cable (see Sub-sub-section H1.3, Chapter 19).

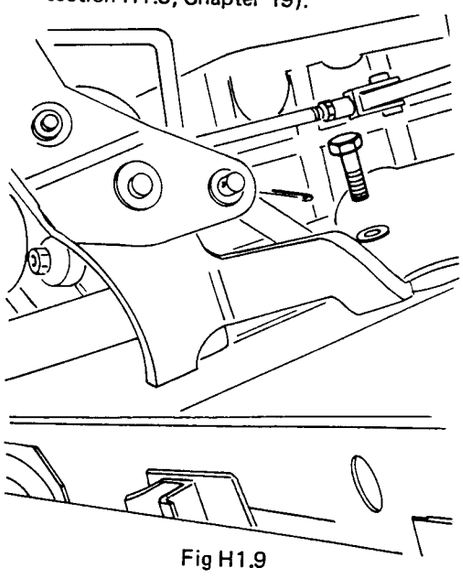


Fig H1.9

(8) Refer to Fig H1.9. Replace the brake lever and relay mechanism.

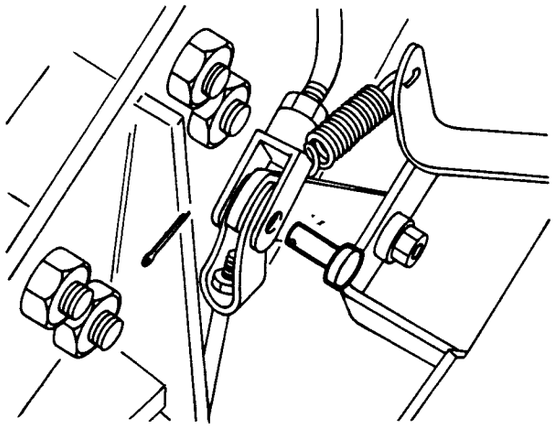


Fig H1.10

(9) Refer to Fig H1.10. Reconnect the handbrake expander rod.

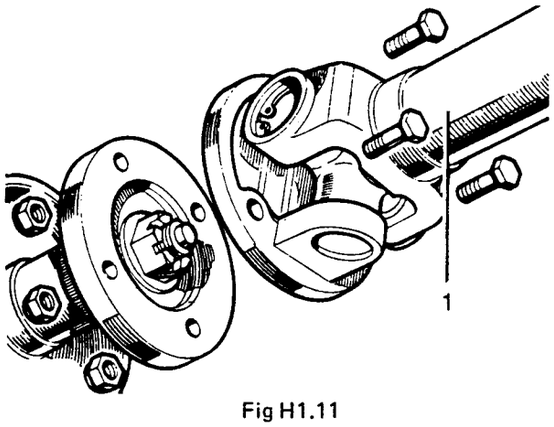


Fig H1.11

(10) Refer to Fig H1.11. Refit the front propeller shaft (1).

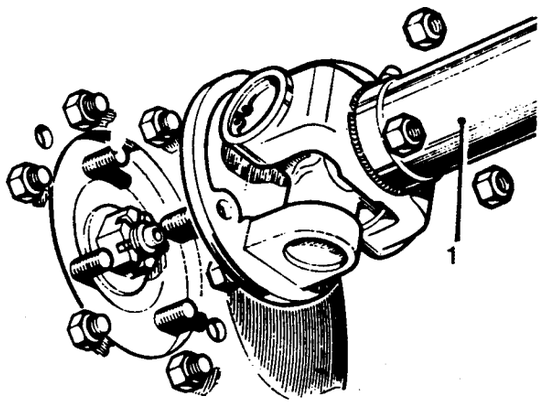


Fig H1.12

(11) Refer to Fig H1.12. Refit the rear propeller shaft (1).

(12) Refill the gearbox with the correct grade of lubricating oil (see Sub-section H1.5).

(13) Replace the floor tunnel (see Sub-section M3, Chapter 5).

SUB-SUB-SECTION H1.3

CHAPTER 2

SPEEDOMETER DRIVE ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the assembly:

(1) Drain the oil from the transfer box (see Sub-section H2.5).

(2) Remove the transmission brake (see Sub-sub-section K2.4, Chapter 2).

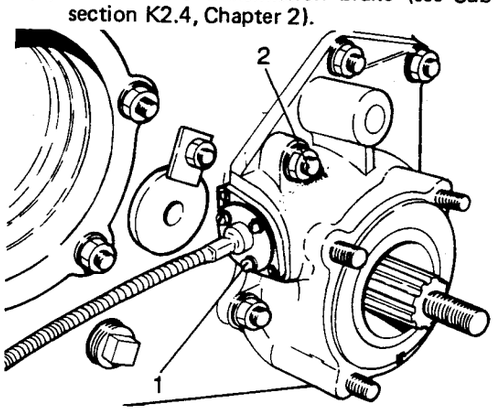


Fig H1.13

(3) Refer to Fig H1.13. Remove the fixing of the speedometer cable plate (1) and disconnect it from the gearbox.

(4) Remove the fixing from the speedometer cover (2).

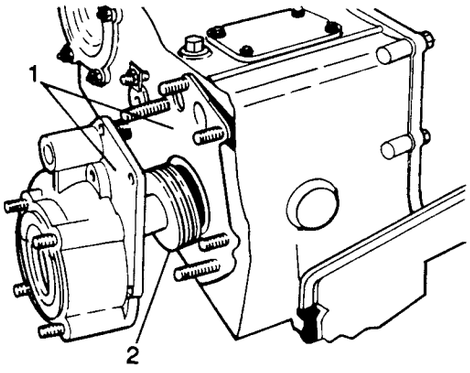


Fig H1.14

(5) Refer to Fig H1.14. Remove the speedometer cover (1) together with the shims.

(6) Remove the speedometer drive (2).

REPLACEMENT

2. To refit the speedometer drive assembly:

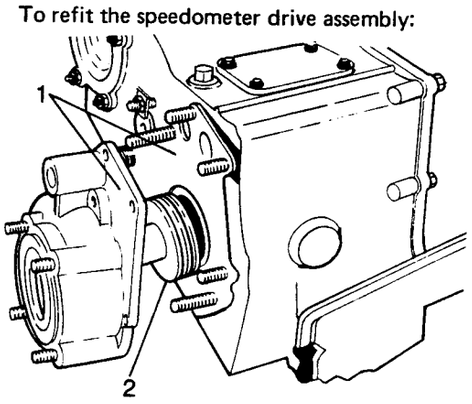


Fig H1.15

(1) Refer to Fig H1.15. Replace the speedometer drive (2).

(2) Fit the speedometer cover together with its shims (1).

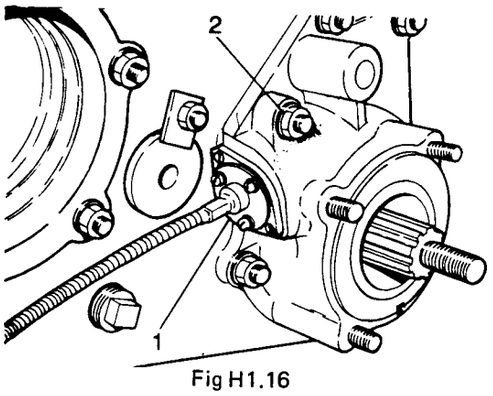


Fig H1.16

(3) Refer to Fig H1.16. Refit the speedometer cover fixings (2).

(4) Refit the speedometer cable plate (1) to the gearbox.

(5) Replace the transmission brake (see Sub-sub-section K2.4, Chapter 2).

(6) Refill the transfer box with the correct grade of oil (see Sub-section H2.5).

SUB-SUB-SECTION H1.3

CHAPTER 3

MAIN GEARBOX LEVER - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the main gearbox lever:

   (1) Set the gear lever to neutral.

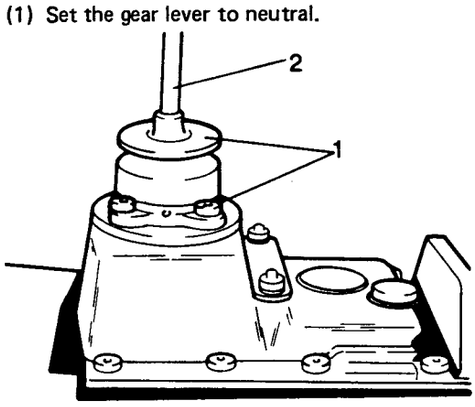


Fig H1.17

   (2) Refer to Fig H1.17. Remove the gear lever dust cover and fixings (1).

   (3) Remove the gear lever (2) together with its support bracket.

REPLACEMENT

2. Replace the gear lever as follows:

   (1) Impregnate the selector finger with general purpose grease.

   (2) Fit the selector finger into fork grooves.

   (3) Apply sealing compound to the support and housing mating faces.

   (4) Fit the support and secure with the four nuts and washers.

   (5) Fit the dust cover.

CHAPTER 4

SELECTOR FORKS AND SHAFTS - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the selector forks and shafts:

   (1) Remove the cab floor and gearbox tunnel (see Sub-section M3, Chapter 5).

   (2) Remove the main gear level (see Sub-sub-section H1.3, Chapter 3).

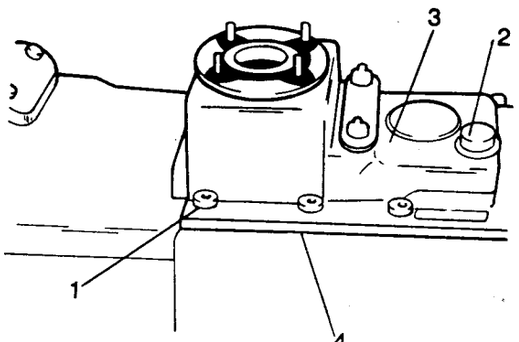


Fig H1.18

   (3) Refer to Fig H1.18. Remove the selector fork and shaft cover fixings (1).

   (4) Remove the plug (2) or reverse switch on special gearboxes.

   (5) Remove the cover (3), shafts and forks.

CLEANING

2. Remove the gasket (4) and carefully clean the rest of the sealing compound from the surfaces of the casing and fork cover.

REPLACEMENT

3. Replace the selector forks and shafts: (Fig H1.18 still applies).

   (1) Fit a new gasket (4), applying a film of sealing compound, Hermetical 600, on both faces.

   (2) Fit the selector forks, shafts and cover (3), taking the precaution of joining the reverse selector fork with the actuating lever.

   (3) Fit the assembly with its nuts and washers (2), tightening them to a torque of 20 to 25 N.m.

   (4) Fit the plug (1) or reverse switch as necessary.

   (5) Fit the main gear lever (see Sub-sub-section H1.3, Chapter 3).

   (6) Start up the engine and check to see that the gears are selected without difficulty.

   (7) Fit the gearbox tunnel and cabin floor (see Sub-section M3, Chapter 5).

SUB-SUB-SECTION H1.3

CHAPTER 5

CLUTCH WITHDRAWAL MECHANISM - REMOVAL AND REPLACEMENT

DISMANTLING

1. First drain all oil from the gearbox (see Sub-sub-section H1.5).

2. To dismantle the clutch withdrawal mechanism:

   (1) Remove the gearbox assembly from the vehicle (see Sub-sub-section H1.3, Chapter 1).

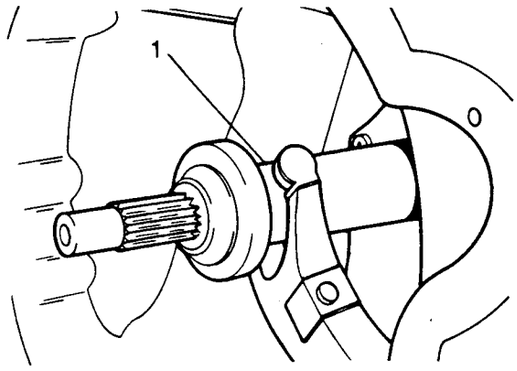


Fig H1.19

   (2) Refer to Fig H1.19. Remove the plastic clip (1) to separate the withdrawal bearing from the clutch mechanism.

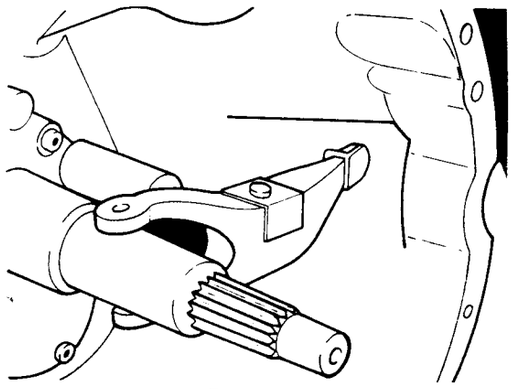


Fig H1.20

   (3) Refer to Fig H1.20. Remove the bolt, washer and clip to separate the clutch lever from its supporting pivot.

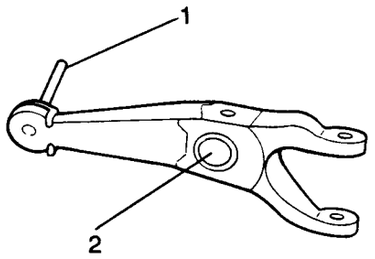


Fig H1.21

   (4) Refer to Fig H1.21. Separate the push rod (1) from the clutch lever by releasing the plastic clip.

   (5) Remove the supporting bush (2) from the pivot.

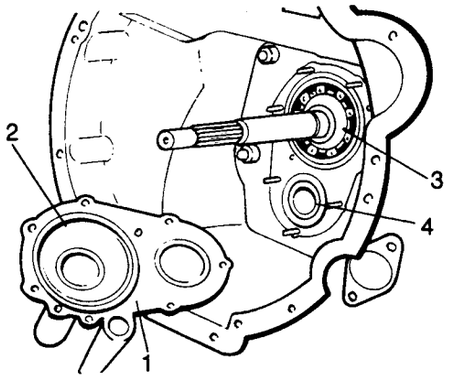


Fig H1.22

   (6) Refer to Fig H1.22. Remove the front cover (1) together with its gasket, removing first the fixing elements.

   (7) Remove the adjusting washers from the bearing of the primary shaft (3) and the front bearing of the layshaft (4) for its ultimate fitting.

NOTE
Washers (3) and (4) may come away with the front cover (1).

INSPECTION

3. Inspect as follows:

   (1) Check all parts to see if there is wear or damage, paying special attention to the cover oil seal and the contact surface of the primary shaft.

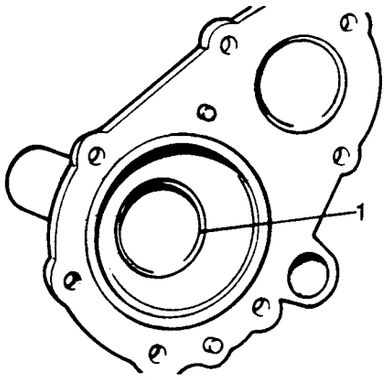


Fig H1.23

(2) Refer to Fig H1.23. Remove the oil seal (1) which is housed in the inside of the cover.

(3) Fit a new oil seal in the cover. The spring must be towards the operator and apply oil SAE 90 EP on the spring lip.

REASSEMBLY

NOTE

If the old cover is to be replaced, proceed as in para 4. If a new cover is to be fitted go to para 5.

4. To reassemble using the original cover:

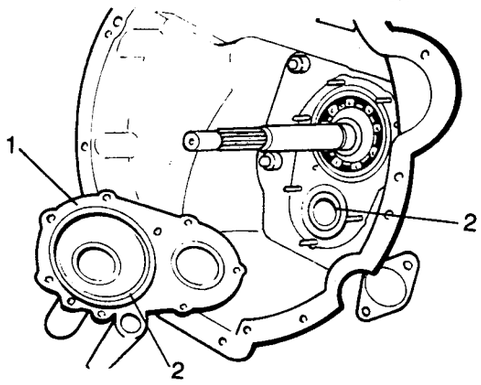


Fig H1.24

(1) Refer to Fig H1.24. Apply a film of Hermetical 600 on both faces of the gasket (1).

(2) Position the bearing adjusting washers of the primary shaft and the front bearing of the lay-shaft (2).

(3) Fit the cover and tighten the nuts to a torque of 20 to 25 N.m.

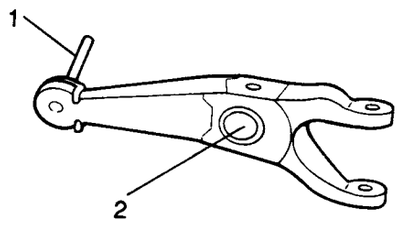


Fig H1.25

(4) Refer to Fig H1.25. Replace the supporting bush (2) in the pivot.

(5) Fit the push rod (1) to the clutch lever and secure with the plastic clip.

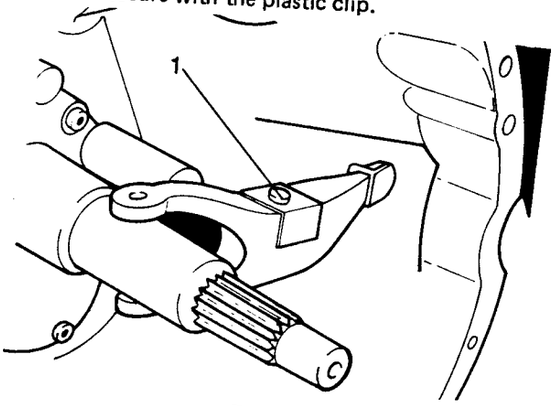


Fig H1.26

(6) Refer to Fig H1.26. Replace the bolt, washer and clip (1) holding the clutch lever to its supporting pivot.

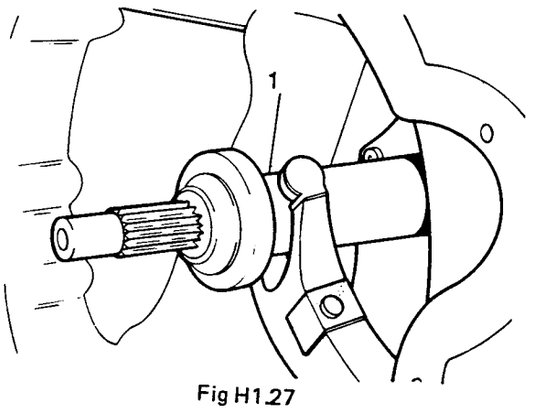


Fig H1.27

(7) Refer to Fig H1.27. Refit the clutch mechansim to the withdrawal bearing and secure with the plastic clip (1).

(8) Refit the gearbox to the vehicle (see Sub-sub-section H1.3, Chapter 1) and refill with the correct grade of oil.

5. When replacing the front cover a new adjustment of the primary shaft bearing must be made. To re-assemble using a new front cover:

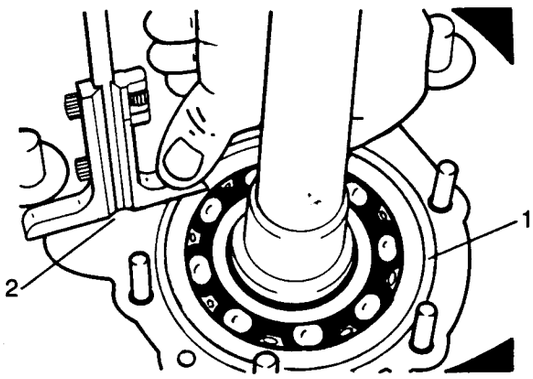


Fig H1.28

(1) Refer to Fig H1.28. Make sure that the spring ring (1) for the primary shaft bearing butts up against the inside frontal face of the clutch housing.

(2) Measure the part that overlaps the exterior track of the bearing, relative to the frontal interior face of the clutch housing (2).

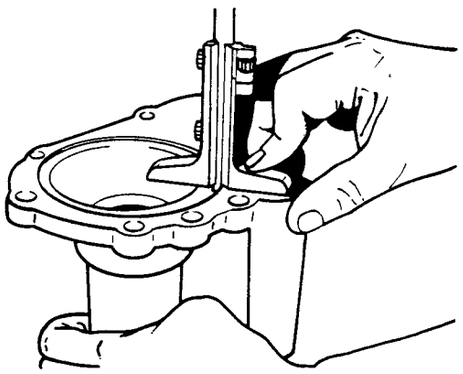


Fig H1.29

(3) Refer to Fig H1.29. Measure the depth of the housing for the exterior track of the bearing, in the front cover, taking into account that this cover must have the gasket fitted.

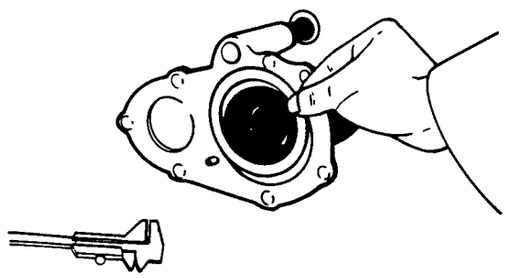


Fig H1.30

(4) Refer to Fig H1.30. The difference between the measurements taken in steps (2) and (3) must be made up by the adjusting washers. The washers' thickness must be the calculated difference plus up to 0,10 mm, this being the maximum load which must be given to the bearing.

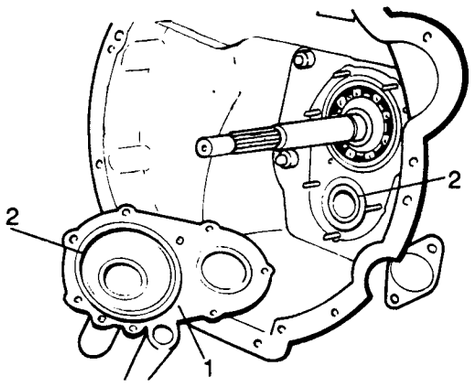


Fig H1.31

(5) Refer to Fig H1.31. Apply a film of Hermetical 600 on both faces of the gasket (1).

(6) Position the bearing adjusting washers (2) of the primary shaft and the front bearing of the layshaft.

(7) Fit the cover and tighten the nuts to a torque of 20 to 25 N.m.

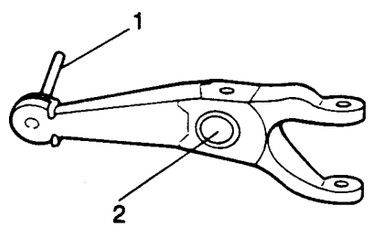


Fig H1.32

(8) Refer to Fig H1.32. Replace the supporting bush (2) in the pivot.

(9) Fit the push rod (1) to the clutch lever and secure with the plastic clip.

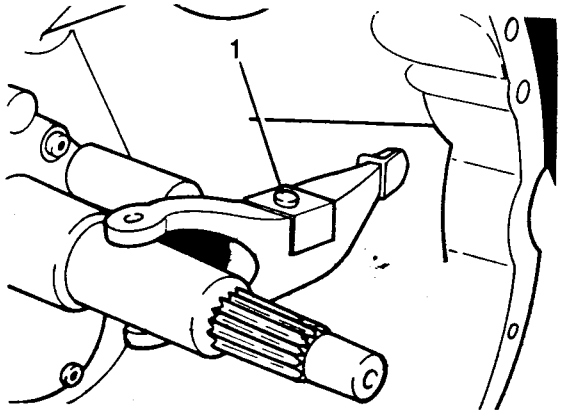


Fig H1.33

(10) Refer to Fig H1.33. Replace the bolt, washer and clip (1) holding the clutch lever to its supporting pivot.

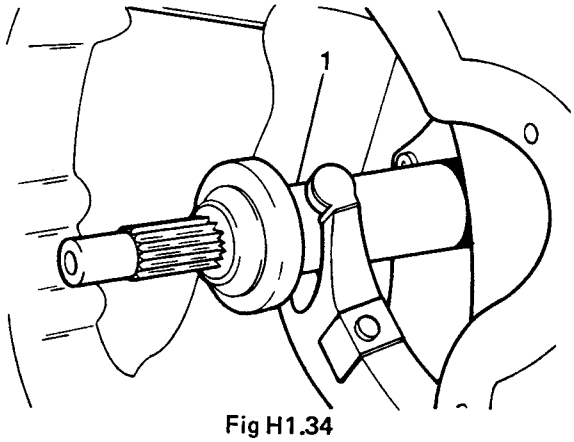


Fig H1.34

(11) Refer to Fig H1.34. Refit the clutch mechanism to the withdrawal bearing and secure with the plastic clip (1).

(12) Refit the gearbox to the vehicle (see Sub-sub-section H1.3, Chapter 1) and refill with the correct grade of oil.

SUB-SUB-SECTION H1.3

CHAPTER 6

CLUTCH BELL HOUSING - REMOVAL AND REPLACEMENT

REMOVAL

1. Before the bell housing is removed:

   (1) Drain the oil from the gearbox (see Sub-sub-section H1.5).

   (2) Remove the gearbox from the vehicle (see Sub-sub-section H1.3, Chapter 1).

   (3) Remove the clutch withdrawal mechanism (see Sub-sub-section H1.3, Chapter 5).

   (4) Remove the adjusting washers of the primary shaft bearing and the front layshaft bearing.

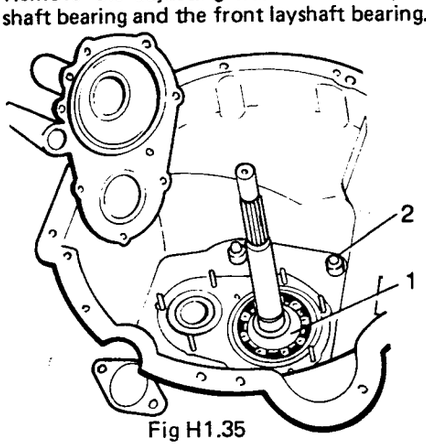


Fig H1.35

   (5) Refer to Fig H1.35. Remove the spring ring and washer (1) that holds the bearing into position on the primary shaft.

   (6) Remove the nuts and washers (2) that retain the clutch bell housing to the gearbox housing.

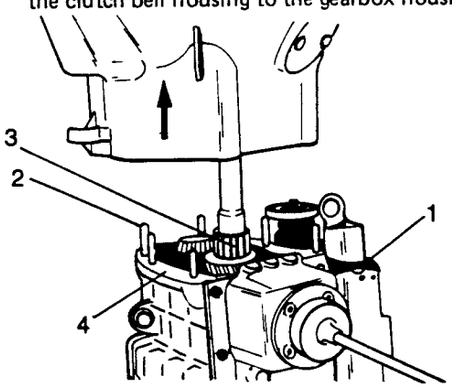


Fig H1.36

   (7) Refer to Fig H1.36. Position the complete gearbox unit (1) perpendicular with the clutch housing upwards.

   (8) Knock upwards with a plastic mallet the clutch housing until the casing together with the primary shaft bearing frees itself from the fixing studs (2).

   (9) The nucleus of gears plus the primary shaft gears (3) will remain perfectly housed in the gearbox housing.

   (10) Replace the gasket (4) if this shows signs of damaged and apply a film of Hermetical 600 on both faces.

REPLACEMENT

2. Replace the clutch bell housing as follows:

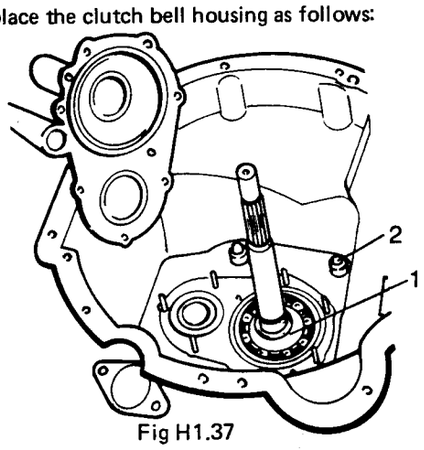


Fig H1.37

   (1) Refer to Fig H1.37. Fit the clutch housing, and tighten the nuts (2) up to a torque of 60 to 75 N.m.

   (2) Fit the washer and spring ring (1) which fixes the bearing to the primary shaft.

   (3) Install the adjusting washers.

   (4) Replace the clutch withdrawal mechanism (see Sub-sub-section H1.3, Chapter 5).

   (5) Refit the gearbox to the vehicle (see Sub-sub-section H1.3, Chapter 1) and refill with the correct grade of oil.

CHAPTER 7

CLUTCH BELL HOUSING - FITTING NEW HOUSING

REMOVAL

1. To replace the bell housing first carry out the following:

   (1) Remove the bell housing (see Sub-sub-section H1.3, Chapter 6).

   (2) Remove the cover, forks and selector shafts (see Sub-sub-section H1.3, Chapter 4).

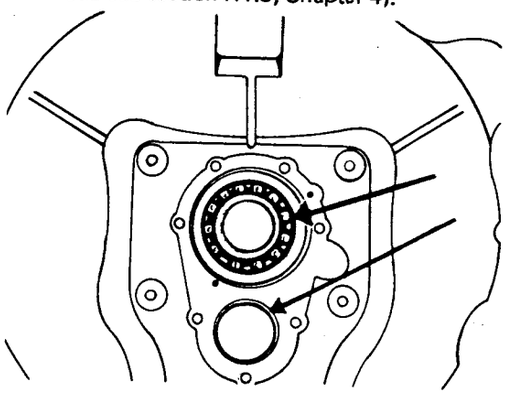


Fig H1.38

   (3) Refer to Fig H1.38. Remove the primary shaft bearing together with its plastic ring and the conical bearing track from the front part of the layshaft.

2. Make ready the new bell housing:

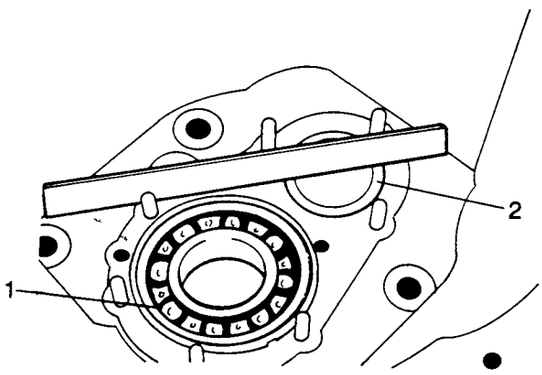


Fig H1.39

   (1) Refer to Fig H1.39. Fit the primary shaft bearing (1) in such a way so that the plastic ring butts against the frontal face of the casing.

   (2) Fit a new outer track of the front conical bearing (2) of the layshaft, in such a way that this is level with the inner front face of the clutch housing.

REPLACEMENT

3. To fit the new clutch bell housing:

   (1) Apply a film of Hermetical 600 to both faces of the gasket.

   (2) Fit the clutch housing to the gearbox casing and tighten the nuts to a torque of 60 to 75 N.m.

NOTE

When the clutch housing is replaced, the adjusting washer for the front layshaft bearing must be calculated as follows:

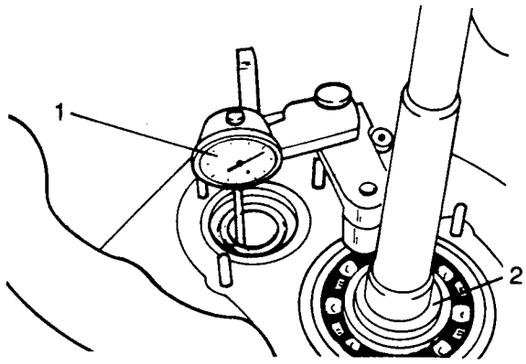


Fig H1.40

   (3) Refer to Fig H1.40. Fit the dial gauge (1) part No. 18G191 on it support so that the needle makes contact with the layshaft.

   (4) Fit the washer and the spring ring (2) that fixes the bearing to primary shaft.

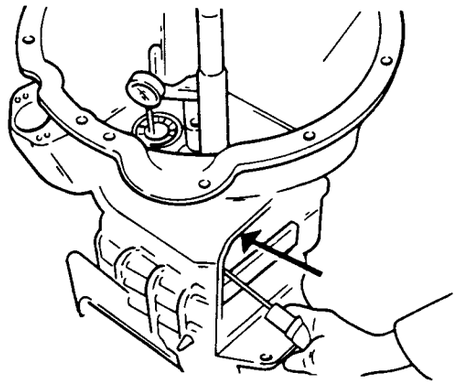


Fig H1.41

   (5) Refer to Fig H1.41. Use a screwdriver to lever the constant gear of the layshaft (1) sliding this upwards and downwards to measure the end play on the dial gauge.

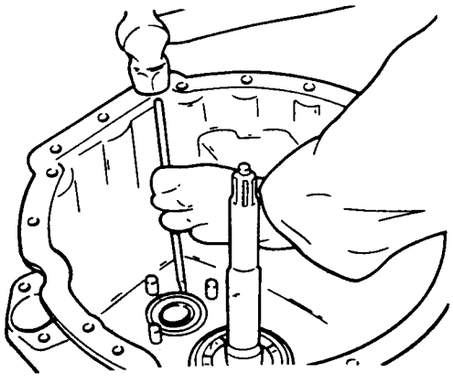


Fig H1.42

(6) Refer to Fig H1.42. The outer track of the front bearing (1) of the primary shaft must be adjusted until there is no play (0) and at the same time check that the shaft turns with no load.

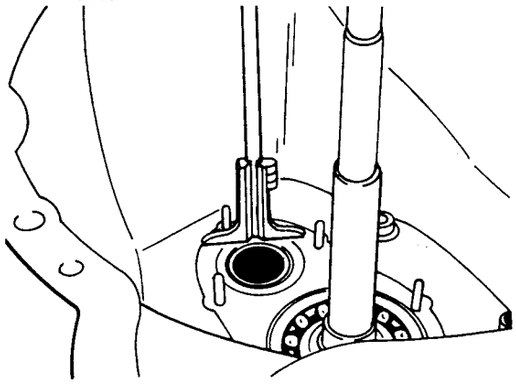


Fig H1.43

(7) Refer to Fig H1.43. Measure the depth of the track relative to the front inner surface of the clutch housing.

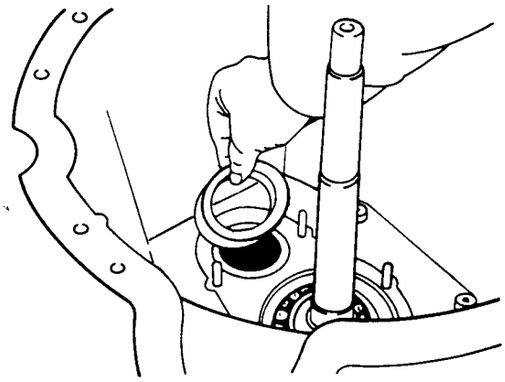


Fig H1.44

(8) Refer to Fig H1.44. Calculate the thickness of washers required according to the measurement obtained in step (7) plus 0,10 mm. This is the load the bearing must have.

(9) Fit the cover assembly, shafts and selector forks (see Sub-sub-section H1.3, Chapter 4).

(10) Fit the bearing washers of the primary shaft, which were removed before, and those of the front bearing of the layshaft which were calculated in step (8).

(11) Fit to the new casing the register plate of the old casing.

(12) Fit the clutch withdrawal mechanism (see Sub-sub-section H1.3, Chapter 5).

(13) Fit the complete gearbox assembly to the vehicle (see Sub-sub-section H1.3, Chapter 1).

(14) Fill the gearbox assembly with oil.

CHAPTER 8

PRIMARY SHAFT BEARING - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the primary shaft bearing:

   (1) Drain the oil from the gearbox (see Sub-section H1.5).

   (2) Remove the gearbox assembly from the vehicle (see Sub-sub-section H1.3, Chapter 1).

   (3) Remove the clutch withdrawal mechanism (see Sub-sub-section H1.3, Chapter 5).

   (4) Remove the clutch housing (see Sub-sub-section H1.3, Chapter 6).

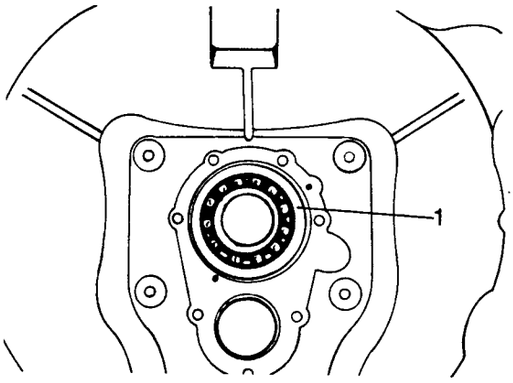


Fig H1.45

   (5) Refer to Fig H1.45. Remove the primary shaft bearing (1).

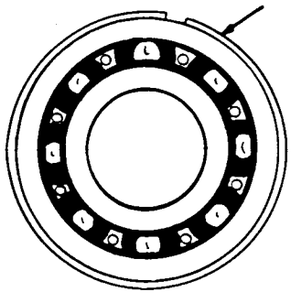


Fig H1.46

   (6) Refer to Fig H1.46. Remove the bearing spring ring.

REPLACEMENT

2. Replace the primary shaft bearing as follows:

   (1) Fit the spring ring onto the new bearing.

   (2) Fit the new bearing into the clutch housing.

   (3) Fit the clutch housing (see Sub-sub-section H1.3, Chapter 6).

   (4) Carry out the adjusting washer calculation for the primary shaft bearing as in Sub-sub-section H1.3, Chapter 5, para 5, steps (1) to (4).

   (5) Fit the calculated adjusting washer in the bearing housing of the primary shaft, in the cover and fit those of the front layshaft bearing.

   (6) Replace the clutch withdrawal mechanism (see Sub-sub-section H1.3, Chapter 5).

   (7) Replace the gearbox assembly (see Sub-sub-section H1.3, Chapter 1) and fill with the correct grade of oil.

CHAPTER 9

PRIMARY SHAFT - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the primary shaft as follows:

(1) Drain the oil from the gearbox (see Sub-sub-section H1.5).

(2) Remove the gearbox assembly from the vehicle (see Sub-sub-section H1.3, Chapter 1).

(3) Remove the clutch withdrawal mechanism (see Sub-sub-section H1.3, Chapter 5).

(4) Remove the clutch housing (see Sub-sub-section H1.3, Chapter 6).

(5) Select 4th gear.

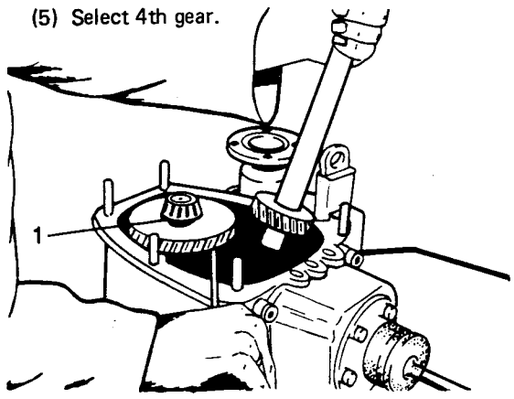


Fig H1.47

(6) Refer to Fig H1.47. Move the layshaft upwards and to one side and remove the primary shaft (1).

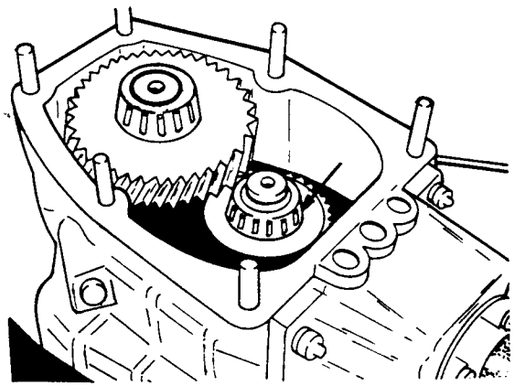


Fig H1.48

(7) Refer to Fig H1.48. Remember that the roller bearing, where the main shaft rests and centres itself, must remain on the end of the above mentioned shaft.

REPLACEMENT

2. To replace the primary shaft:

(1) Fit the new primary shaft in the same manner that the old shaft was removed. Check that it is perfectly housed and that it turns freely.

(2) Fit the clutch housing (see Sub-sub-section H1.3, Chapter 6).

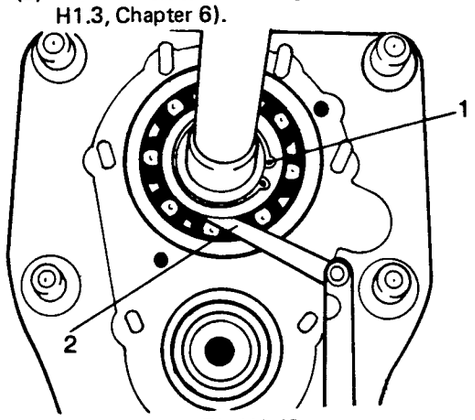


Fig H1.49

(3) Refer to Fig H1.49. Fit the primary bearing adjusting washers and the spring ring (1).

(4) Check the end play of the primary shaft bearing (2) with feeler gauges which should be between 0 and 0,5 mm. If not, select the correct washer.

(5) Fit the clutch withdrawal mechanism (see Sub-sub-section H1.3, Chapter 5).

(6) Refit the gearbox to the vehicle (see Sub-sub-section H1.3, Chapter 1) and fill it and the transfer box with the correct grade of oil.

CHAPTER 10

GEARBOX REAR OIL SEAL RETAINER - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the retainer:

   (1) Drain the oil from the gearbox (see Sub-sub-section H1.5).

   (2) Remove the gearbox assembly from the vehicle (see Sub-sub-section H1.3, Chapter 1).

   (3) Remove the transmission brake (see Sub-sub-section K2.4, Chapter 2)

   (4) Remove the double intermediate pinion from the transfer box (see Sub-sub-section H2.3, Chapter 3).

   (5) Remove the transfer box (see Sub-sub-section H2.3, Chapter 2).

   (6) Remove the selector shafts, forks and cover assembly (see Sub-sub-section H1.3, Chapter 4).

   (7) Select two speeds to stop the main shaft from turning.

   (8) Release the transfer gear nut locking washer.

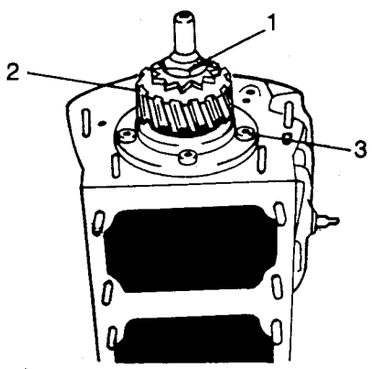


Fig H1.50

   (9) Refer to Fig H1.50. Unscrew the transfer gear nut (1) using special tool 600300.

   (10) Remove the transfer gear (2).

   (11) Remove the oil seal retainer bolts/nuts (3).

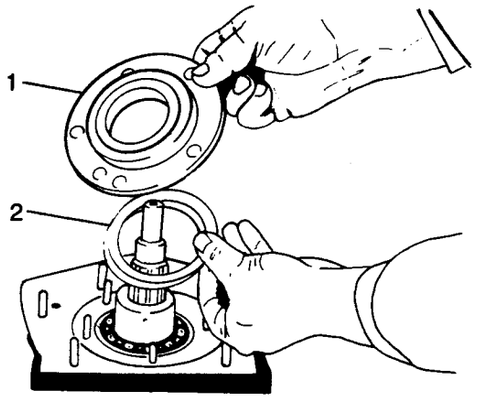


Fig H1.51

   (12) Refer to Fig H1.51. Remove the oil seal retainer (1) and the adjusting washers (2) of the main shaft rear bearing, taking special care not to alter the thickness of these washers.

REPLACEMENT

2. Replace the oil seal retainer as follows:

   (1) Inspect the condition of the gasket, replacing it if necessary and clean off the rest of the sealing compound which could remain on the mating surfaces of the cover and the transfer box casing. Apply a film of Hermetical 600 to both faces of the gasket and locate this in position.

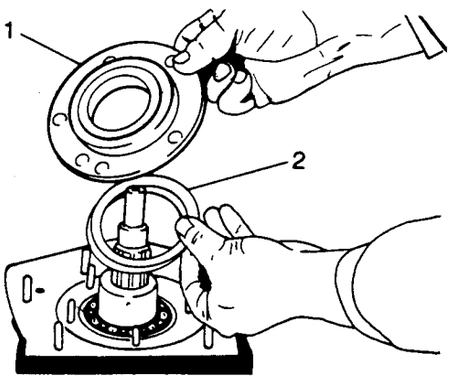


Fig H1.52

   (2) Refer to Fig H1.52. Fit the cover (1) with the adjusting washers (2) for the rear main shaft bearing and put a film of SAE 90 EP oil on the lips of the oil seal.

   (3) Fit the cover fixing nuts and tighten to a torque of 20 to 30 N.m.

   (4) Fit the transfer gear with its nuts and tighten this to a torque of 130 to 170 N.m.

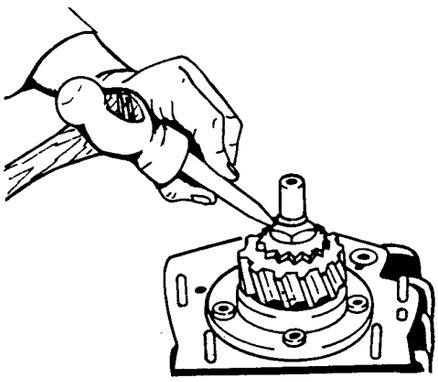


Fig H1.53

(5) Refer to Fig H1.53. Lock the transfer gear nut with the lock washer, bending this over so that it fits into the groove in the threaded portion of the main shaft.

NOTE

If the lockwasher is damaged or does not ensure that it will lock the nut securely, replace it with a new one.

(6) Put the two gears which were selected in para 1, step (7) into neutral.

(7) Replace the selector shafts, forks and cover assembly (see Sub-sub-section H1.3, Chapter 4).

(8) Replace the transfer box (see Sub-sub-section H2.3, Chapter 2).

(9) Replace the double intermediate pinion on the transfer box (see Sub-sub-section H2.3, Chapter 3).

(10) Refit the transmission brake (see Sub-sub-section K2.4, Chapter 2).

(11) Replace the gearbox assembly (see Sub-sub-section H1.3, Chapter 1) and fill with the correct grade of oil.

SUB-SUB-SECTION H1.3

CHAPTER 11

GEARBOX REAR OIL SEAL RETAINER - FITTING NEW RETAINER

REMOVAL

1. Remove the old oil seal retainer as detailed in Sub-sub-section H1.3, Chapter 10).

FITTING THE NEW RETAINER

2. A new seal must be fitted to the new retainer (see Sub-sub-section H1.3, Chapter 12).

3. The thickness of the adjusting washers must be calculated and washers of this thickness must be used when reassembling the unit.

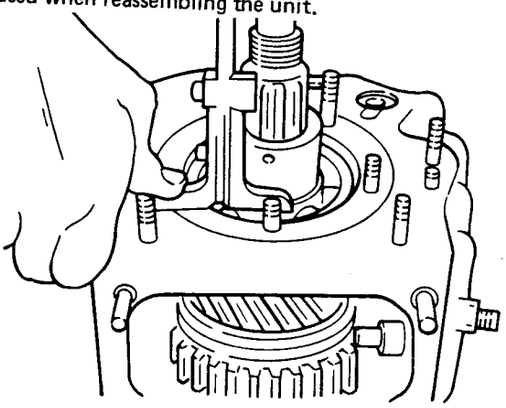


Fig H1.54

(1) Refer to Fig H1.54. Measure the depth of the bearing outer track relative to the plane of the casing, taking into account that the gasket must be fitted.

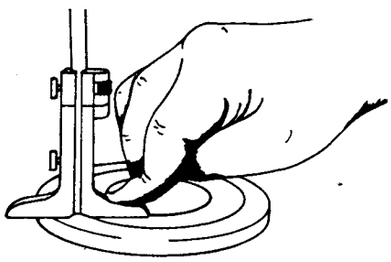


Fig H1.55

(2) Refer to Fig H1.55. Measure the height of the overlap of the cover, which should maintain the bearing in position.

(3) The difference between the measurements taken in steps (1) and (2), plus 0,10 mm (maximum permitted load for this bearing) is the thickness of the required washer(s).

(4) Fit the oil seal retainer (see Sub-sub-section H1.3, Chapter 10) using washers of the thickness calculated above.

SUB-SUB-SECTION H1.3

CHAPTER 12

MAIN SHAFT REAR OIL SEAL - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the oil seal:

(1) Remove the gearbox rear oil seal retainer (see Sub-sub-section H1.3, Chapter 10).

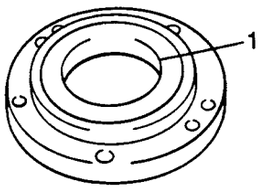


Fig H1.56

(2) Refer to Fig H1.56. Remove the oil seal (1).

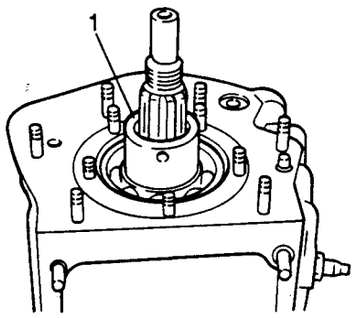


Fig H1.57

(3) Refer to Fig H1.57. Using special tool RO1004 remove the spacer bush (1) and inspect the outer surface for wear produced by the oil seal. If this exists, a new spacer bush must be fitted.

REPLACEMENT

2. Replace the oil seal as detailed below:

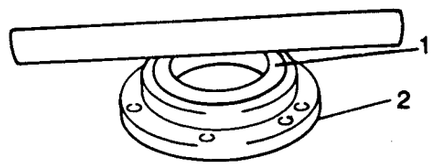


Fig H1.58

(1) Refer to Fig H1.58. Fit the new oil seal (1) in the cover (2) in such a way so that the rear part is level with the rear part of the cover.

(2) Fit the spacer bush, leaving the extractor holes towards the outside.

(3) Apply a film of SAE 90 EP oil on the lips of the oil seal.

(4) Refit the gearbox rear oil seal retainer (see Sub-sub-section H1.3, Chapter 10).

SUB-SUB-SECTION H1.3

CHAPTER 13

GEARBOX HOUSING - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the gearbox housing:

(1) Remove the gearbox rear oil seal retainer (see Sub-sub-section H1.3, Chapter 10).

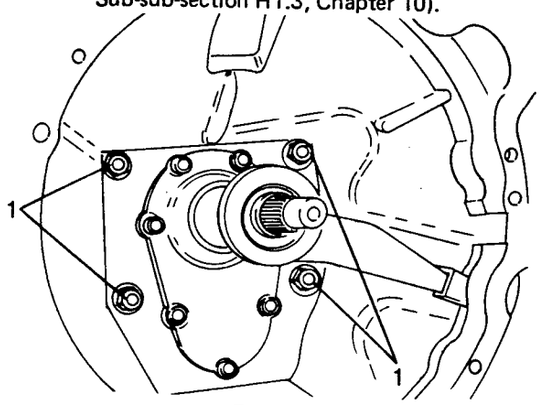


Fig H1.59

(2) Refer to Fig H1.59. Remove the fixing nuts (1) that retain the clutch housing to the gearbox housing.

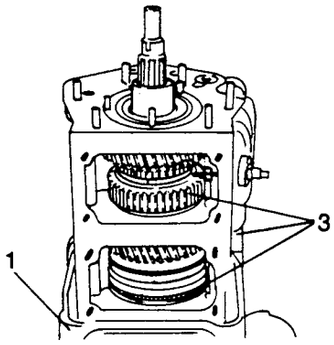


Fig H1.60

(3) Refer to Fig H1.60. Position the gearbox assembly vertically with the clutch housing (1) downwards.

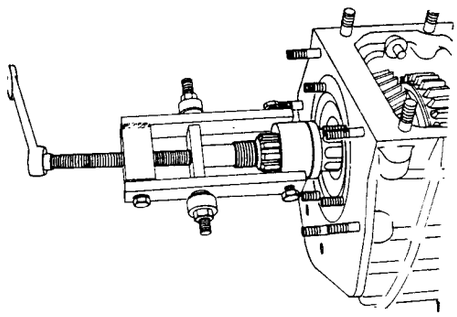


Fig H1.61

(4) Refer to Fig H1.61. Using special tool RO1004 remove the spacer bush (2).

(5) Remove the gearbox, casing, sliding it upwards and taking care not to disturb the 1st, 2nd, 3rd and 4th synchro units ((3) on Fig H1.60).

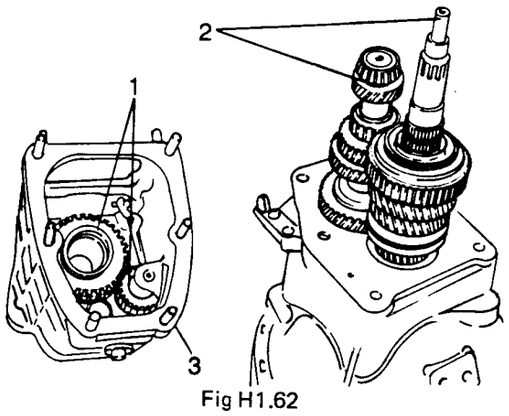


Fig H1.62

(6) Refer to Fig H1.62. On removal of the housing, 1st speed gear (1) will have to be removed at the same time, since this interferes with reverse pinion which also comes out with the housing.

(7) The main shaft and layshaft assemblies (2) will remain positioned on the clutch housing, in their working positions.

REPLACEMENT

2. Replace the gearbox housing as follows:

(1) Inspect the joint washer (3) and if this is damaged fit a new one, applying a film of sealant on both surfaces, after cleaning them thoroughly.

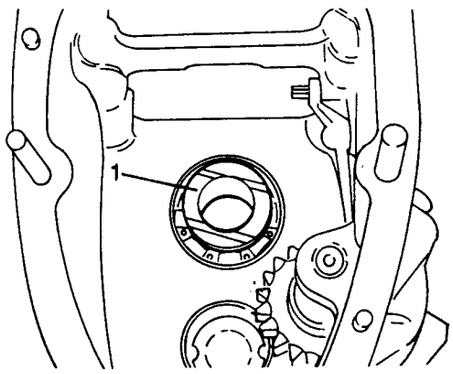


Fig H1.63

(2) Refer to Fig H1.63. Fit the axial adjusting washer (1) on the bearing, in such a way that the oil grooves face inwards.

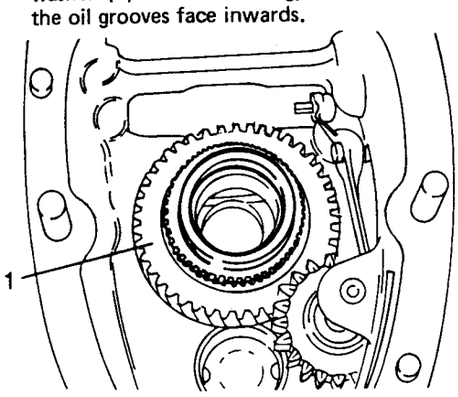


Fig H1.64

(3) Refer to Fig H1.64. Fit 1st speed gear (1) on the washer, and the friction cone facing inwards.

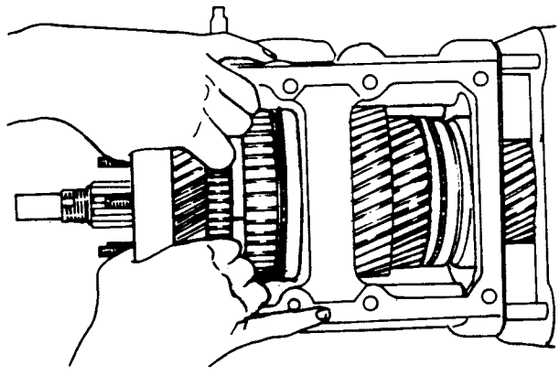


Fig H1.65

(4) Refer to Fig H1.65. Hold the gearbox casing and at the same time maintain the 1st gear in position as well as the adjusting washers. Introduce the casing so that the studs enter in the holes of the clutch housing. The 1st speed gear and the washer should be introduced without difficulty on the main shaft.

(5) Fix the clutch housing to the gearbox casing with nuts, and tighten them to a torque of 60 to 75 N.m.

(6) Replace the gearbox rear oil seal retainer (see Sub-sub-section H1.3, Chapter 10).

SUB-SUB-SECTION H1.3

CHAPTER 14

REAR MAIN SHAFT BEARING - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the main shaft bearing:-

   (1) Remove the gearbox housing (see Sub-sub-section H1.3, Chapter 13).

   (2) Remove the 1st speed pinion and washer.

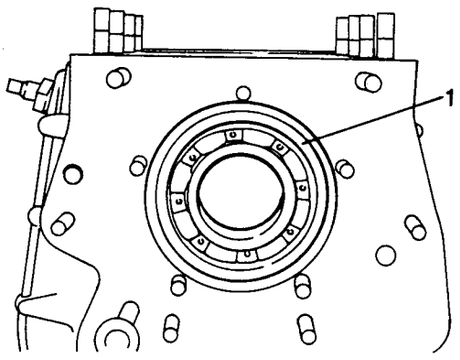


Fig H1.66

   (3) Refer to Fig H1.66. Remove the rear bearing (1) with its spring ring, lightly tapping this bearing towards the rear of the gearbox.

REPLACEMENT

2. If the same bearing is to be replaced:

   (1) Push bearing home until it butts up against the outer part of the casing.

   (2) Replace the gearbox housing (see Sub-sub-section H1.3, Chapter 13).

3. If a new bearing is to be fitted:

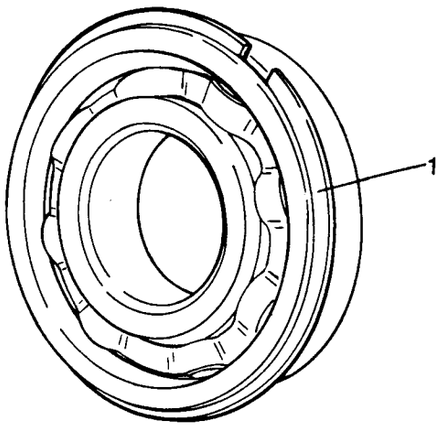


Fig H1.67

   (1) Refer to Fig H1.67. Remove the spring ring (1) from the old bearing and fit it on the new one.

   (2) Push the bearing into the casing, until the spring ring butts up against the casing.

   (3) Replace the gearbox housing (see Sub-sub-section H1.3, Chapter 13).

SUB-SUB-SECTION H1.3

CHAPTER 15.

GEARBOX CASING - FITTING NEW CASING

REMOVAL

1. Remove the casing as follows:

(1) Remove the gearbox housing (see Sub-sub-section H1.3, Chapter 13).

(2) Remove the housing, 1st speed pinion and washer.

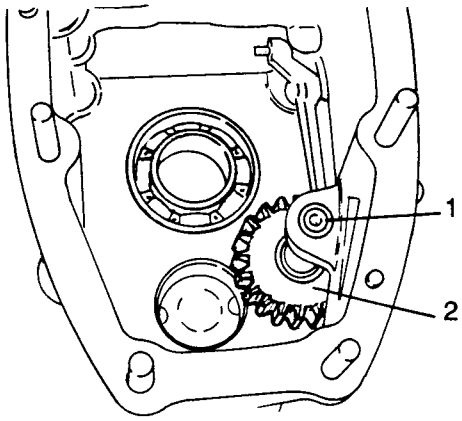


Fig H1.68

(3) Refer to Fig H1.68. Remove reverse pinion shaft (1) towards the rear of the casing, using a press.

(4) Remove the gear (2).

(5) Remove the selector shafts and forks (see Sub-sub-section H1.3, Chapter 4).

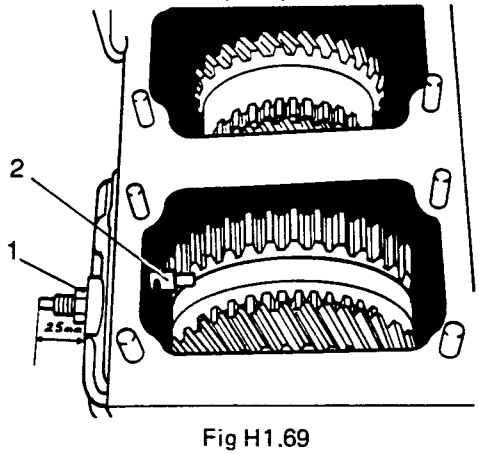


Fig H1.69

(6) Refer to Fig H1.69. Unscrew the nut (1) and extract the lever threaded pivot.

(7) Remove the intermediate lever (2) together with the pad.

(8) Remove the main shaft rear bearing (see Sub-sub-section H1.3, Chapter 14).

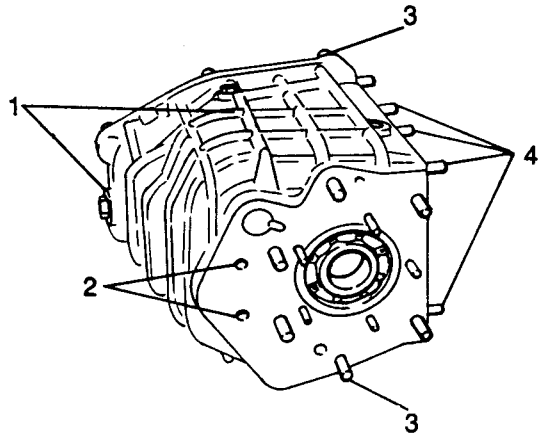


Fig H1.70

(9) Refer to Fig H1.70. Remove the oil filler and drain plugs (1).

(10) Remove the outer track of the rear layshaft bearing lightly tapping this out by means of the holes (2) provided in the casing.

(11) Remove the front and rear studs of the casing (3) and the aligning dowels, as well as the fixing studs (4) for the fork retainer cover.

REPLACEMENT

2. Fit the following to the new casing:

(1) Fit the studs and dowels.

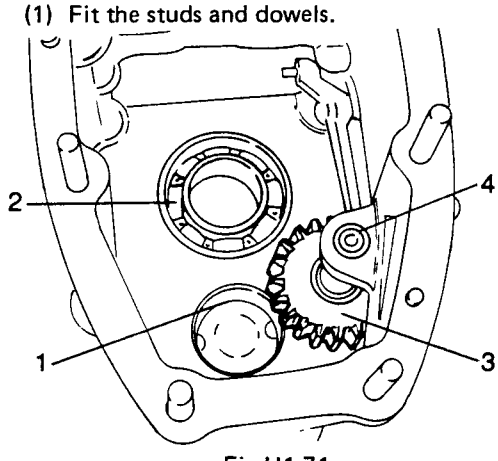


Fig H1.71

(2) Refer to Fig H1.71. Fit the outside track (1) for the layshaft rear bearing until it butts up against the back of its housing.

(3) Fit the mainshaft rear bearing (2) from the outside until the spring ring butts up against the casing (see Sub-sub-section H1.3, Chapter 14).

(4) Fit the gear (3) and reverse shaft (4).

(5) Fit the selector shafts and forks (see Sub-sub-section H1.3, Chapter 4).

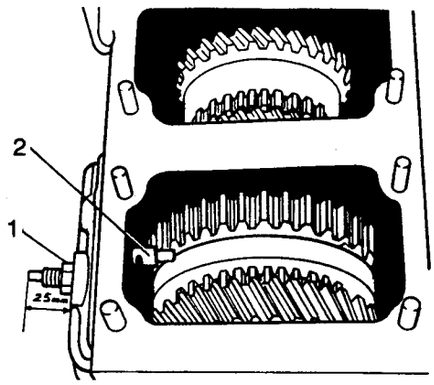


Fig H1.72

(6) Refer to Fig H1.72. Replace the intermediate lever (2) together with the pad.

(7) Replace the lever threaded pivot (1) and tighten the nut.

(8) Replace the gearbox housing (see Sub-sub-section H1.3, Chapter 13).

SUB-SUB-SECTION H1.3

CHAPTER 16

MAINSHAFT AND LAYSHAFT - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the shafts:

   (1) Remove the gearbox housing (see Sub-sub-section H1.3, Chapter 13).

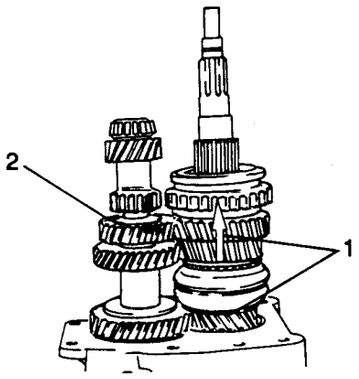


Fig H1.73

   (2) Refer to Fig H1.73. Remove the mainshaft assembly (1) by sliding it upwards, firstly displacing the 4th gear synchro cone from the 4th gear cone.

NOTE
Take care to maintain the gear train together, to avoid the synchro units from coming out of place.

   (3) Once the mainshaft assembly has been removed, take out the layshaft (2).

REPLACEMENT

2. Replace the shafts as follows:

   (1) Position the layshaft supported by its front bearing.

   (2) Fit the mainshaft assembly in such a way so that the gears are perfectly aligned with those of the layshaft and spin freely.

   (3) Replace the gearbox housing (see Sub-sub-section H1.3, Chapter 13).

SUB-SUB-SECTION H1.3

CHAPTER 17

GEARBOX LAYSHAFT - FITTING NEW LAYSHAFT

REMOVAL

1. Carry out the following:

   (1) Remove the layshaft (see Sub-sub-section H1.3, Chapter 16).

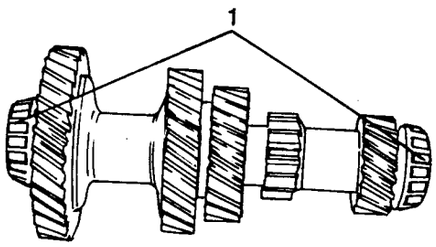


Fig H1.74

   (2) Refer to Fig H1.74. Remove the front and rear layshaft bearings (1) and put them to one side taking care not to interchange them when re-fitted.

FITTING NEW LAYSHAFT

2. Fit the new layshaft as follows:

   (1) Fit the front and rear layshaft bearings until they butt up against the shaft, making sure that they are in the same position as on the old layshaft.

   (2) Position the layshaft, supported by its front bearing. Next, fit the mainshaft in such a way that the gears are perfectly aligned and spin freely.

   (3) Refit the mainshaft (see Sub-sub-section H1.3, Chapter 16).

CHAPTER 18

LAYSHAFT BEARINGS - FITTING NEW BEARINGS

REMOVAL

1. To remove the layshaft bearings:

   (1) Remove the layshaft (see Sub-sub-section H1.3, Chapter 16).

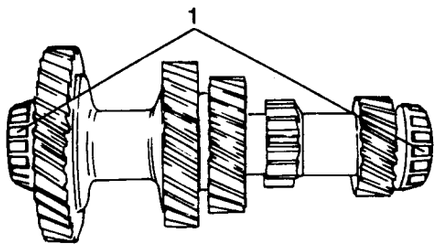


Fig H1.75

   (2) Refer to Fig H1.75. Remove the front and rear bearings (1).

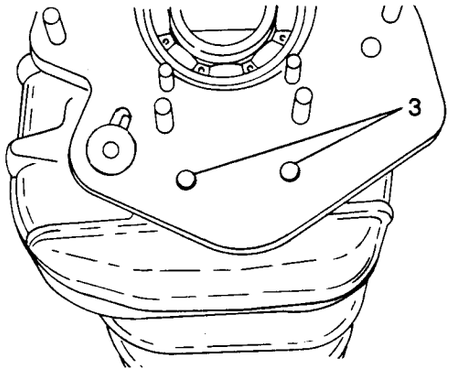


Fig H1.76

   (3) Refer to Fig H1.76. Remove the outer track of the layshaft rear bearing through the holes (3) that are for this in the casing.

   (4) Remove the clutch withdrawal mechanism (see Sub-sub-section H1.3, Chapter 5).

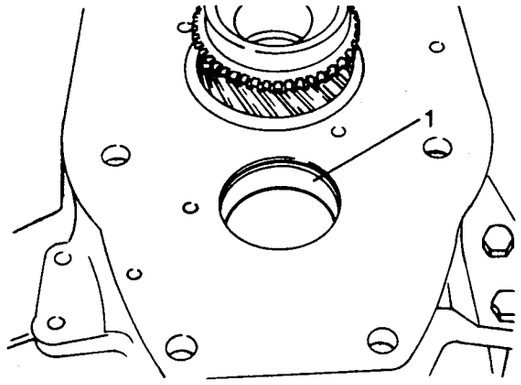


Fig H1.77

   (5) Refer to Fig H1.77. Remove the outer track (1) of the layshaft front bearing.

FITTING NEW BEARINGS

2. Fit the new bearings as follows:

   (1) Fit the new bearings to the layshaft.

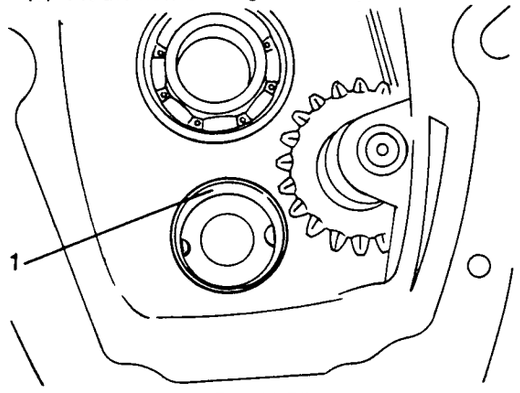


Fig H1.78

   (2) Refer to Fig H1.78. Fit into the gearbox casing the outer rear bearing track (1) of the layshaft, until it butts up against the casing.

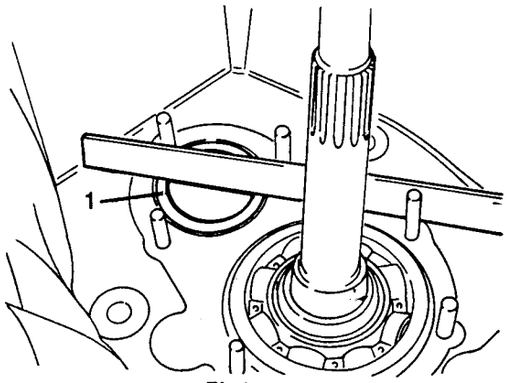


Fig H1.79

(3) Refer to Fig H1.79. Fit the layshaft front bearing outer track (1) in such a way that this is level with the inside front face of the clutch casing.

(4) With the clutch casing in a downward perpendicular position, fit the layshaft supported by its front bearing.

(5) Fit the mainshaft assembly in such a way that the mainshaft gears are perfectly aligned and spin freely.

(6) Fit the gearbox housing (see Sub-sub-section H1.3, Chapter 13) but do not fit the cover assembly, forks and selector shafts.

(7) Position the complete gearbox assembly with the clutch housing upwards.

(8) Calculate the thickness of the required adjusting washers (see Sub-sub-section H1.3, Chapter 7, para 3, steps (3) to (8)).

(9) Fit the clutch mechanism together with the primary pinion washers which were removed when stripping, and fit those that were calculated for the layshaft front bearing outer track.

(10) Fit the complete gearbox assembly to the vehicle (see Sub-sub-section H1.3, Chapter 1).

CHAPTER 19

SPEEDOMETER CABLE - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the cable:

   (1) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

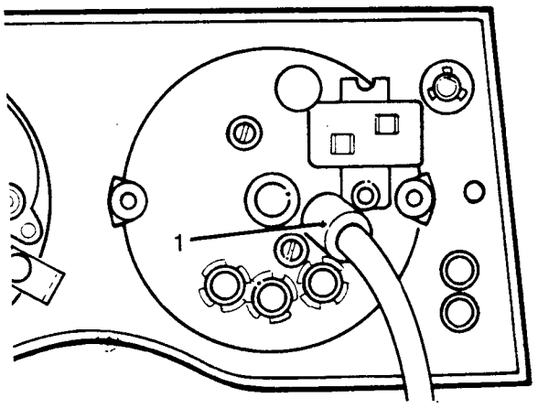


Fig H1.80

   (2) Refer to Fig H1.80. Depress the spring clip (1) and withdraw the cable assembly from the speedometer.

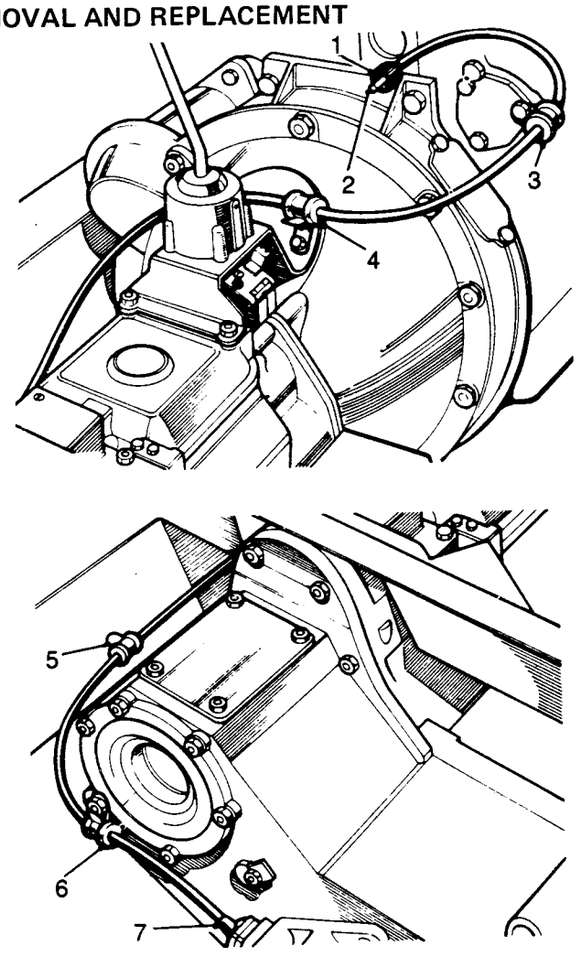


Fig H1.81

   (3) Refer to Fig H1.81. Open the bonnet and withdraw the speedometer cable end (1) into the engine compartment.

   (4) Withdraw the inner cable (2) from the outer.

   (5) Detach the speedometer cable from the securing clips at the engine (3), the flywheel housing (4), the chassis side member (5) and the transfer box (6).

   (6) Disconnect the cable at the gearbox (7).

REPLACEMENT

2. Replace the speedometer cable as follows:

   (1) Connect the cable to the gearbox.

   (2) Run the cable into the engine compartment, fixing the grommets into the securing clips at the transfer box, chassis side member, flywheel housing and engine.

(3) Fit the inner cable, greasing it sparingly with a general purpose grease. Ensure that the inner cable is engaged in the drive slot at the gearbox.

(4) Feed the cable from the engine compartment into the dash.

(5) Refit the cable to the back of the speedometer.

(6) Replace the instrument panel.

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION H1.4

OVERHAUL PROCEDURES

SUB-SUB-SECTION H1.4

CHAPTER 1

SPEEDOMETER DRIVE ASSEMBLY - OVERHAUL

DISMANTLING

1. Dismantle the speedometer-drive assembly as follows:

   (1) Remove the speedometer drive assembly (see Sub-sub-section H1.3, Chapter 2).

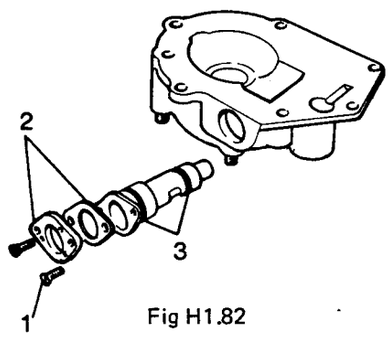


Fig H1.82

   (2) Refer to Fig H1.82. Remove the two screws (1) that fix the retaining plate of the speedometer pinion.

   (3) Remove the fixing plate and washer (2).

   (4) Remove the pinion sleeve and the pinion (3).

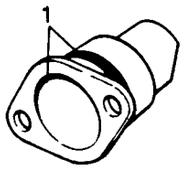


Fig H1.83

   (5) Refer to Fig H1.83. Remove the pinion oil seal and the sleeve ring (1).

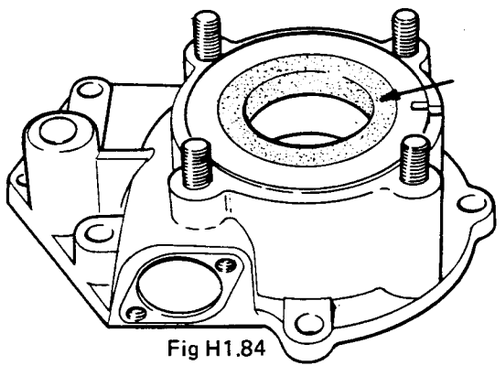


Fig H1.84

   (6) Refer to Fig H1.84. Remove the output shaft oil seal.

INSPECTION

2. Inspect the components as follows:

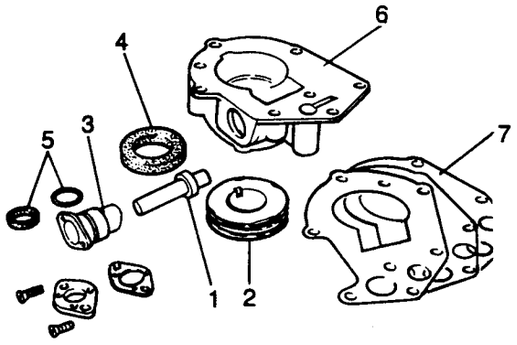


Fig H1.85

   (1) Refer to Fig H1.85. Inspect the teeth of the pinion (1) and worm (2) for damage.

   (2) Check the sleeve (3). This should slide easily over the pinion.

   (3) Use a new oil seal (4) on the output shaft and a new sealing ring and oil seal (5) on the sleeve as well as the plate gasket, if necessary.

   (4) Check that the front surface of the speedometer cover (6) is flat as well as the shims (7), which should not be deformed or damaged.

REASSEMBLY

3. Reassemble the drive assembly as follows:

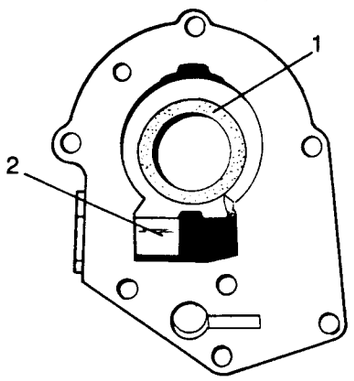


Fig H1.86

   (1) Refer to Fig H1.86. Fit the output shaft oil seal (1) with the sealing lip towards the inside.

      i. If the oil seal is leather, maintain this submerged in SAE 90 EP oil during 4 hours

before fitment, applying a film of Molykote BR2 grease on the lip when fitting it.

ii. If the oil seal is rubber, apply SAE 90 EP oil on the lip when fitting it.

iii. If the oil seal has a metal cage, apply a film of sealing compound Hermetical 600 on the outside so as to avoid possible leaks between the oil seal and the cover.

(2) Fit the sleeve oil seal with the lip inwards and with the sealing ring fitted.

(3) Fit the pinion and sleeve (2) making sure that the plain surface points towards the worm.

(4) Fit the retaining plate and washer, fixing it with its two screws.

(5) Replace the speedometer drive assembly (see Sub-sub-section H1.3, Chapter 2).

SUB-SUB-SECTION H1.4

CHAPTER 2

FRONT OUTPUT SHAFT HOUSING - OVERHAUL

REMOVAL AND DISMANTLING

1. Remove the housing as follows:

(1) Remove the transfer box assembly from the vehicle (see Sub-sub-section H2.3, Chapter 1).

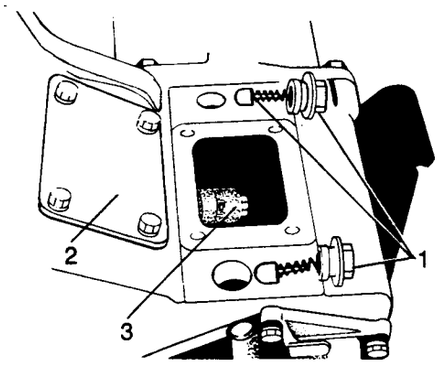


Fig H1.87

(2) Refer to Fig H1.87. Remove the two plugs, springs and dowels (1) from the high and low selector. (Note that only one dowel and spring is fitted on later models).

(3) Remove the fixing elements from the upper access cover (2) to the selector fork and remove the cover together with its washer.

(4) Remove the bolt that fixes the high and low selector fork to the shaft (3).

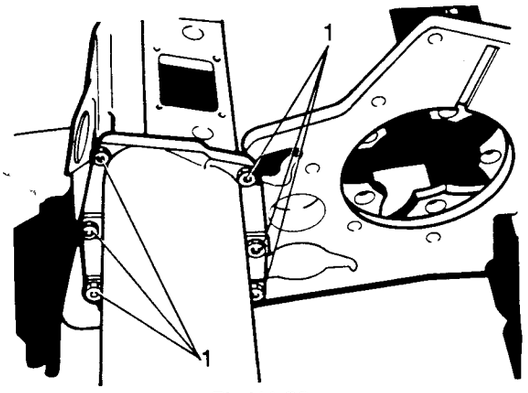


Fig H1.88

(5) Refer to Fig H1.88. Remove the fixing elements (1) of the output shaft cover.

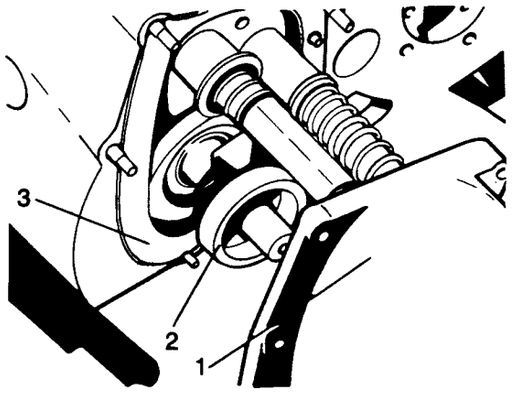


Fig H1.89

(6) Refer to Fig H1.89. Remove the front output shaft cover (1) proceeding with care to catch the four wheel drive dog (2).

(7) Remove the gasket (3) and extract the selector fork for high and low which remained loose in the transfer box casing.

(8) If the selector shafts have been removed, replace as in Sub-sub-section H1.3, Chapter 4.

REASSEMBLY

2. Reassemble and refit the housing as follows:

(1) Fit the high and low selector shaft, with the serrations towards the top of the cover.

(2) Examine the condition of the gasket, replacing it if necessary and applying a film of sealing compound Hermetical 600 on both faces before refitting.

(3) Align the shafts with their respective housings in the transfer box.

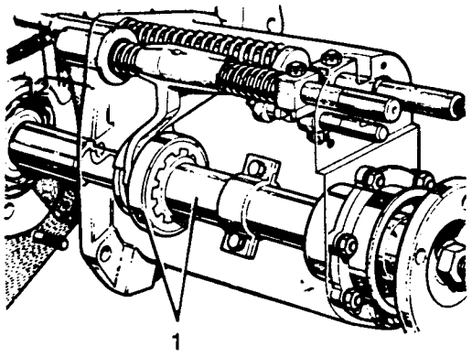


Fig H1.90

(4) Refer to Fig H1.90. Fit the four wheel drive dog (1) joined to its fork and fit to the front output shaft.

(5) Slide the front output shaft cover towards the transfer box casing, engaging the high and low selector shaft with its selector fork.

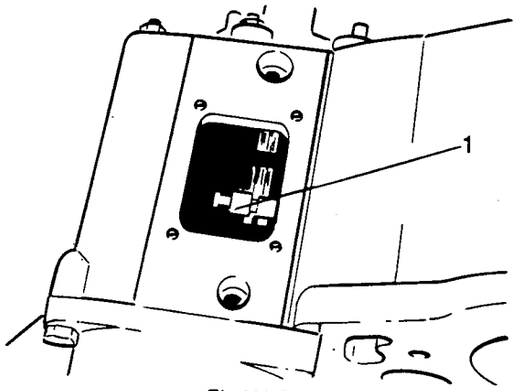


Fig H1.91

(6) Refer to Fig H1.91. Make sure that the pinch bolt (1) of the high and low selector fork, fits into the cut-away provided on the selector shaft.

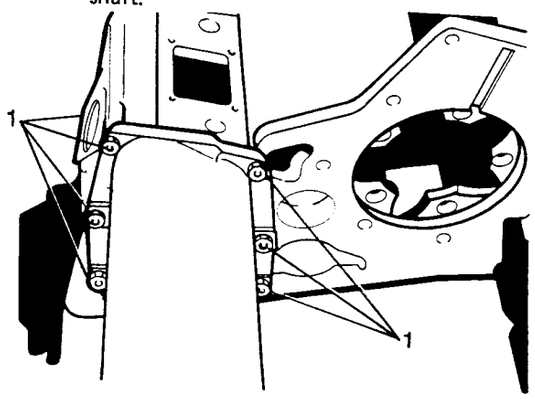


Fig H1.92

(7) Refer to Fig H1.92. Replace the fixings (1) of the output shaft cover. Tighten the nuts to 12 to 17 N.m.

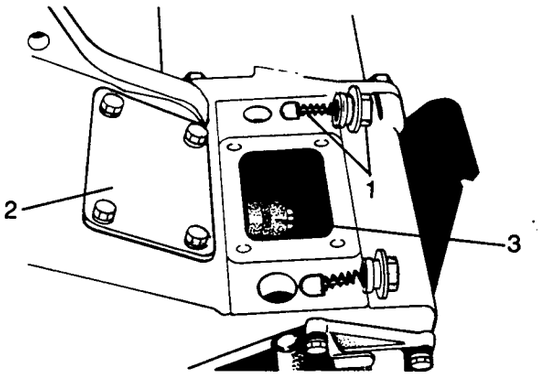


Fig H1.93

(8) Refer to Fig H1.93. Replace the bolt (3) that fixes the high and low selector fork to the shaft.

(9) Replace the upper access cover (2) to the selector fork and its washer. Refit the fixing elements.

(10) Replace the two plug springs and dowels (1) on the high and low selector. (Note that only one spring and dowel is fitted on later models).

(11) Refit the transfer box assembly to the vehicle (see Sub-sub-section H2.3, Chapter 1).

SUB-SUB-SECTION H1.4

CHAPTER 3

FRONT OUTPUT SHAFT COVER - OVERHAUL

DISMANTLING

1. First remove the front output shaft housing (see Sub-sub-section H1.4, Chapter 2).

2. Remove the output shaft cover as follows:

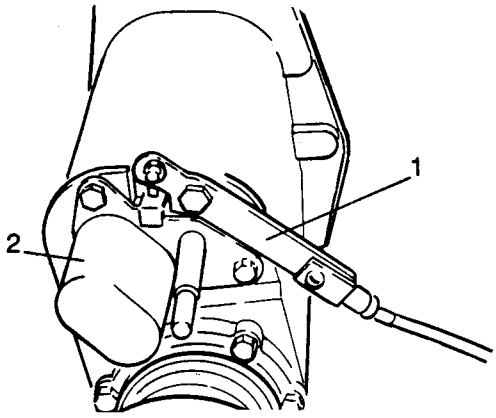


Fig H1.94

(1) Refer to Fig H1.94. Remove the four wheel drive lever (1) together with its pin.

(2) Remove the dust cover (2) from the selector shaft assemblies, together with its gasket.

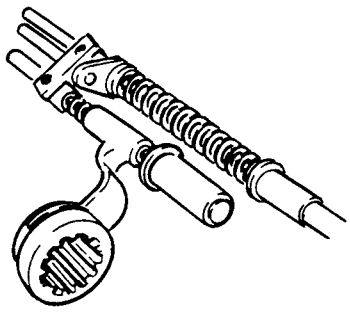


Fig H1.95

(3) Refer to Fig H1.95. Remove the selector shaft assembly and coupling dog of the four wheel drive.

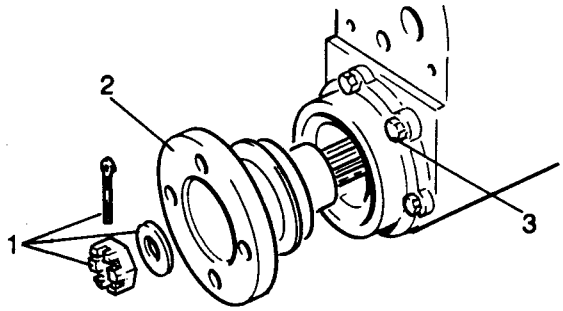


Fig H1.96

(4) Refer to Fig H1.96. Remove the split pin, washer and castle nut (1) that retains the front output shaft flange.

(5) Remove the front output shaft flange (2).

(6) Remove the fixings (3) that retain oil seal housing (4).

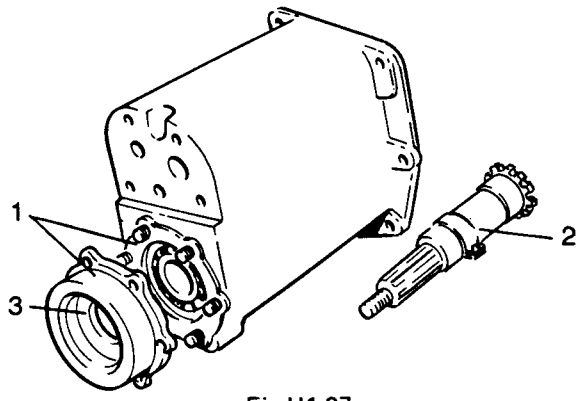


Fig H1.97

(7) Refer to Fig H1.97. Remove the oil seal housing (1) and gasket.

(8) Remove the output shaft (2).

(9) Remove the oil seal (3).

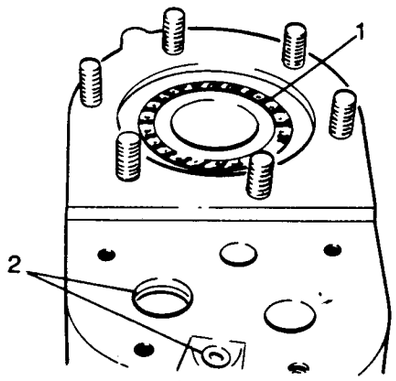


Fig H1.98

(10) Refer to Fig H1.98. Remove the bearing (1) from the housing by lightly tapping the bearing outwards.

(11) Remove the four wheel drive pin sealing ring (2) and the ring for the high and low selector shaft.

3. To strip the four wheel drive selector shaft:

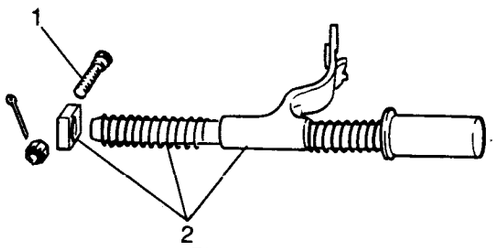


Fig H1.99

(1) Refer to Fig H1.99. Remove the split pin, castle nut and bolt (1) that fixes the retaining plate to the selector shaft.

(2) Remove the retaining plate, springs and selector fork (2).

4. To strip the high and low shaft:

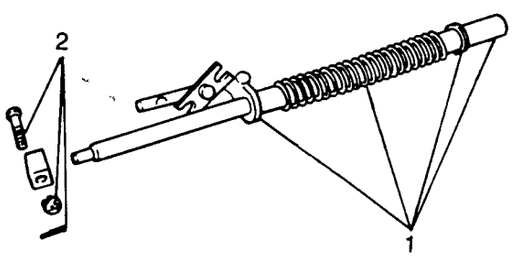


Fig H1.100

(1) Refer to Fig H1.100. Slide off the spacer, bush, spring and pivot assembly (1).

(2) Remove the split pin, castle nut and screw (2) which holds the retaining block, then remove the latter.

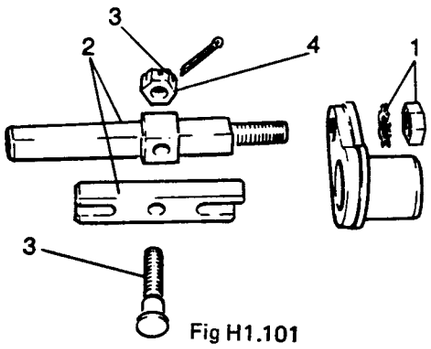


Fig H1.101

(3) Refer to Fig H1.101. Remove the nut and washer (1) that retains the pivot assembly coupling, and remove the latter.

(4) Remove the rocker and pivot assembly shaft (2) removing the split pin (4), castle nut and bolt (3).

5. To strip the output shaft:

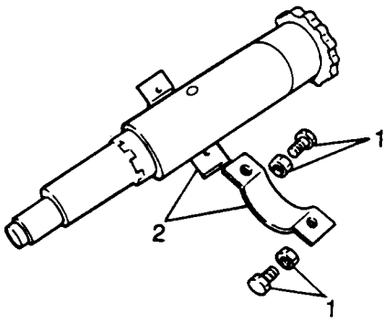


Fig H1.102

(1) Refer to Fig H1.102. Remove the oil deflector fixings (1).

(2) Remove the two halves of the oil deflector (2).

INSPECTION

6. Carry out the following inspection:

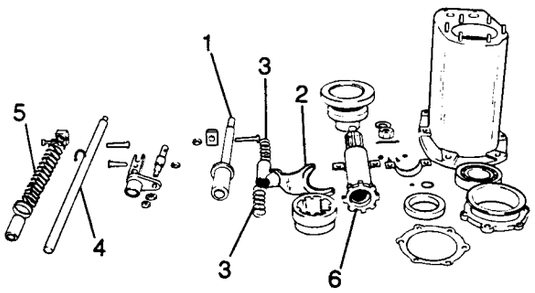


Fig H1.103

(1) Refer to Fig H1.103. Change all components that show signs of wear or damage. Examine the four wheel drive lever bush, replacing if necessary (see Fig H1.94).

(2) Inspect the four wheel drive selector shaft (1) and replace if necessary.

(3) Examine the four wheel drive selector fork (2).

(4) Check the four wheel drive selector fork springs (3) which should have a free length of 69 mm.

(5) Check for wear the high and low selector shaft (4).

(6) Check the high and low selector shaft spring (5) which should have a free length of 182 mm.

(7) Check the front output shaft bush (6) replacing it if necessary.

REASSEMBLY

7. To rebuild the output shaft:

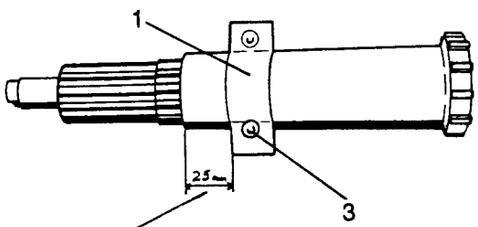


Fig H1.104

(1) Refer to Fig H1.104. Refit the oil deflector (1) on the front output shaft, but do not fully tighten the fixings.

(2) Position the oil deflector at 25 mm (2) from the shoulder of the shaft as shown by the figure.

(3) Tighten up the fixings (3).

8. To reassemble the high and low selector shaft:

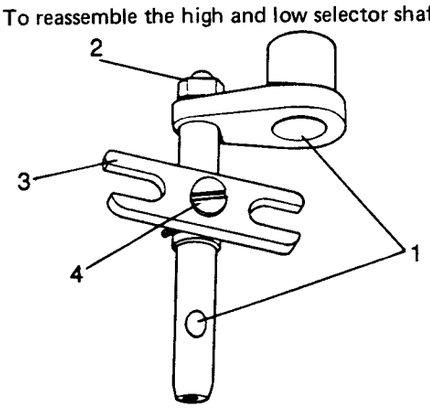


Fig H1.105

(1) Refer to Fig H1.105. Fit the coupling on the pivot assembly shaft (1) taking into account that the hole, on the other end of the shaft, points upwards.

(2) Do not tighten the coupling fixings (2).

(3) Fit the rocker (3) on the pivot assembly shaft, fitting the longer arm as shown in the figure.

(4) Join the rocker and shaft by means of the screw (4), nut and split pin.

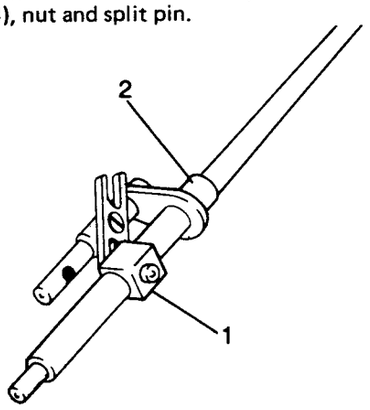


Fig H1.106

(5) Refer to Fig H1.106. Refit the retaining block (1) on the high and low selector shaft, in such a way that the nut and split pin are on the same side of the shaft as the coupling grooves.

(6) Position the pivot assembly (2) on the high and low selector shaft.

(7) Couple up one side of the rocker to the special bolt that fixes the retaining block.

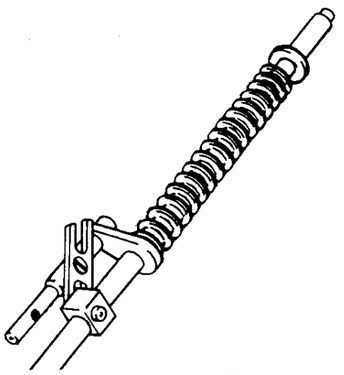


Fig H1.107

(8) Refer to Fig H1.107. Fit the spring, guide bush and spacer tube.

9. To rebuild the four wheel drive selector shaft:

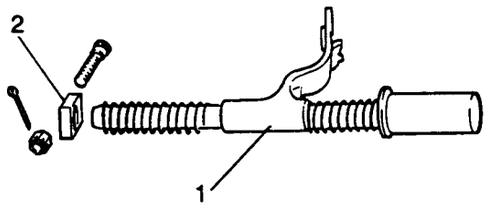


Fig H1.108

(1) Refer to Fig H1.108. Fit the two springs and selector fork (1). Both springs are identical and interchangeable.;

(2) Fit the retaining block (2) on the selector shaft fixing it with the special bolt, castle nut and split pin.

10. To rebuild the assembly:

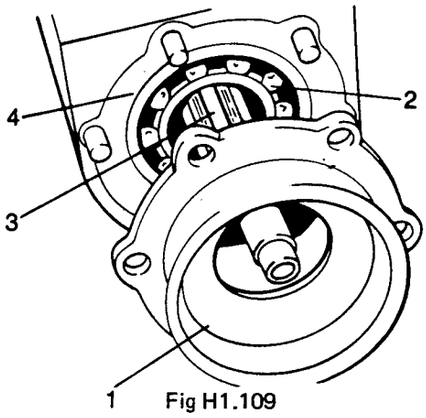


Fig H1.109

(1) Refer to Fig H1.109. Fit the oil seal (1) in its housing, with the lip towards the box. If the oil seal has a metal cage, apply sealing compound to the outside.

(2) Fit the output shaft bearing (2) to the casing until it butts up against the housing.

(3) Introduce the front output shaft (3).

(4) Fit the oil seal housing gasket (4) applying to both faces a film of sealing compound.

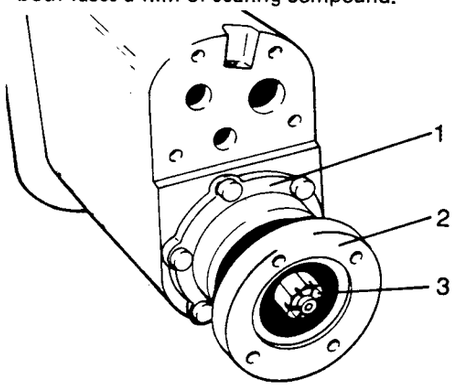


Fig H1.110

(5) Refer to Fig H1.110. Fit the oil seal retainer (1) firstly applying to the oil seal lip a film of SAE 90 EP oil, if the oil seal is cork, and a film of grease, Molykote Baz, if it is of the leather type. The latter type of seal should be submerged in SAE 90 EP oil for four hours, before fitting.

(6) Fit the flange (2).

(7) Install the flange fixing elements (3) and tighten to a torque of 110 to 120 N.m. Afterwards fit the split pin in place.

11. Pre-alignment of the selector shaft:

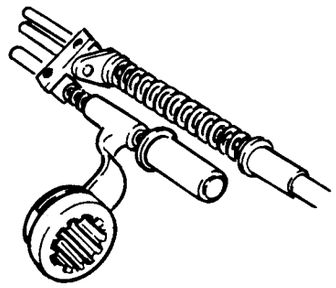


Fig H1.111

(1) Refer to Fig H1.111. Join the two selector shafts, by means of the rocker and special bolts.

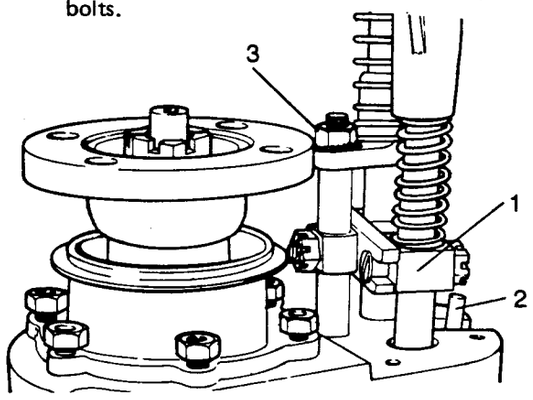


Fig H1.112

(2) Refer to Fig H1.112. Position the selector shaft assembly (1) on the front surface of the front output shaft cover.

(3) The locking pin (2) of the four wheel drive transmission is fitted in its housing and is introduced in the hole of the pivot assembly shaft. This will ensure the correct radial alignment between the pivot assembly shaft and the coupling.

(4) Completely tighten the nut (3) to fix the coupling to the pivot shaft assembly.

(5) Remove the locking pin, and remove the selector shafts, as an assembly.

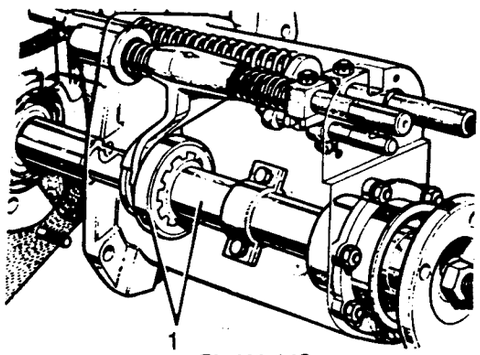


Fig H1.113

(6) Refer to Fig H1.113. Without altering the alignment of the selector shaft assemblies, fit these in position in the front output shaft housing, fitting the four wheel drive dog (1) on the output shaft and selector fork.

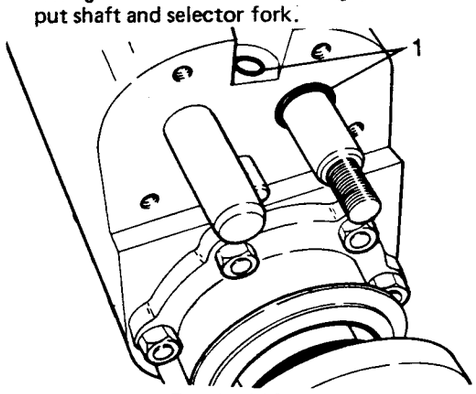


Fig H1.114

(7) Refer to Fig H1.114. Fit the sealing rings (1) of the high and low gears selector shaft and that of the locking pin for four wheel drive.

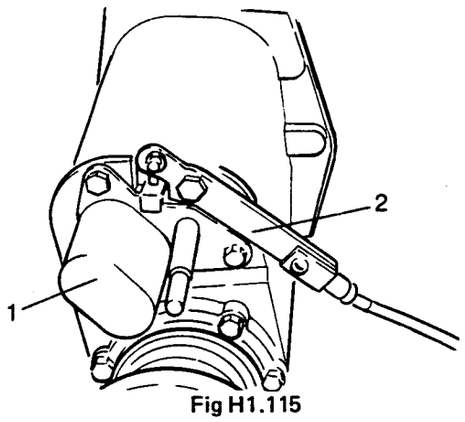


Fig H1.115

(8) Refer to Fig H1.115. Fit the dust cover (1) for the selector shafts, applying a film of sealing compound on the joint washer.

(9) Fit the four wheel drive lever (2) together with the locking pin.

12. Refit the front output shaft housing (see Sub-sub-section H1.4, Chapter 2).

CHAPTER 4

SELECTOR FORKS AND SHAFTS - DISMANTLING AND REASSEMBLY

DISMANTLING

1. To dismantle the selector forks and shafts:

(1) Remove the forks and shafts (see Sub-sub-section H1.3, Chapter 4).

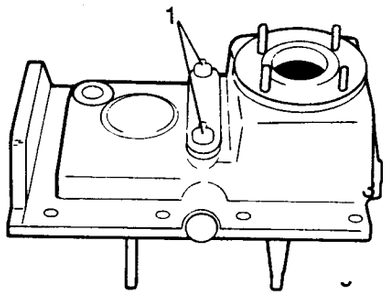


Fig H1.116

(2) Refer to Fig H1.116. Remove the upper plate fixings and release the plate.

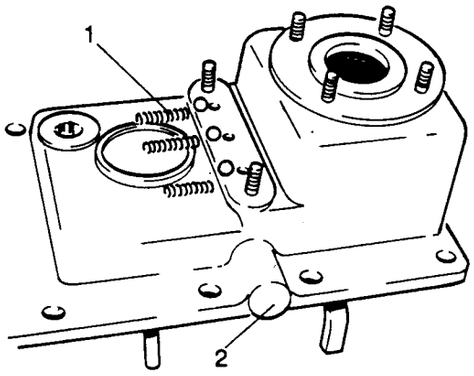


Fig H1.117

(3) Refer to Fig H1.117. Remove the three springs and balls (1) that fix the position of the selector shafts.

(4) Remove the plug (2) from the gallery where the rollers are housed.

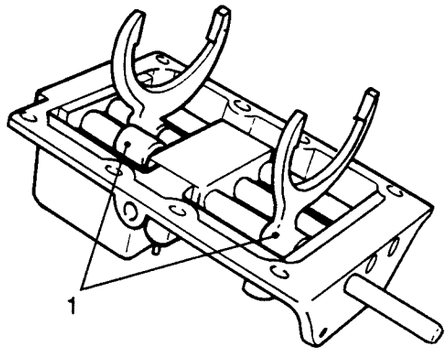


Fig H1.118

(5) Refer to Fig H1.118. Remove the spring pins (1) that hold the selector shaft fork and 1st and 2nd gear fork.

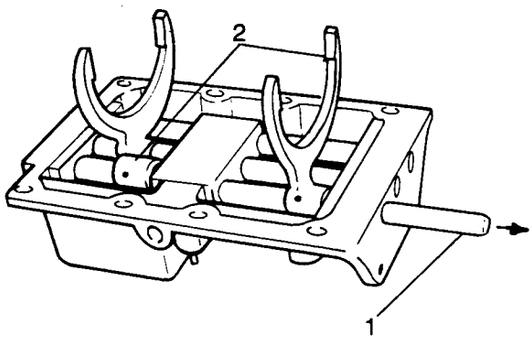


Fig H1.119

(6) Refer to Fig H1.119. Remove the 1st and 2nd gear selector shaft (1) sliding it backwards and then take out the two forks (2).

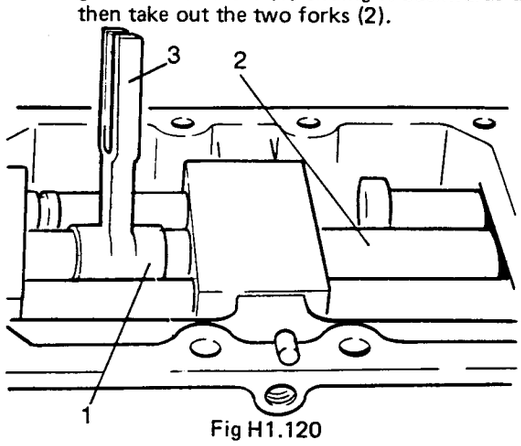


Fig H1.120

(7) Refer to Fig H1.120. Remove the spring pin (1) from the 3rd and 4th speed selector fork, which holds it to its selector shaft and extract the locking roller, through the hole which the cover has for this effect.

(8) Remove the 3rd and 4th selector shaft (2) sliding it backwards and extract the fork (3).

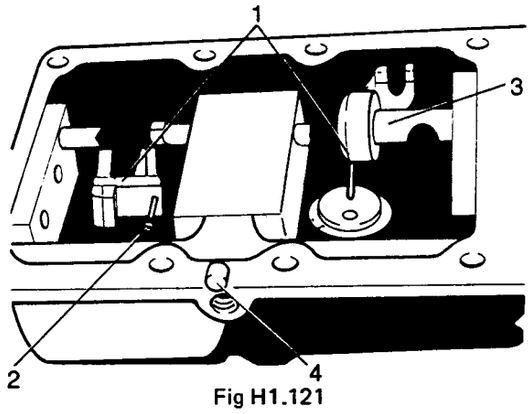


Fig H1.121

(9) Refer to Fig H1.121. Remove the spring pins (1) that retain the selector shaft fork and that of reverse and also remove the locking roller (4).

(10) Loosen off the screw which adjusts the hinge stop for reverse gear (2) so as to be able to slacken off the return spring.

(11) Remove the reverse selector shaft (3) sliding it backwards and remove the forks.

INSPECTING

2. Make the following inspection:

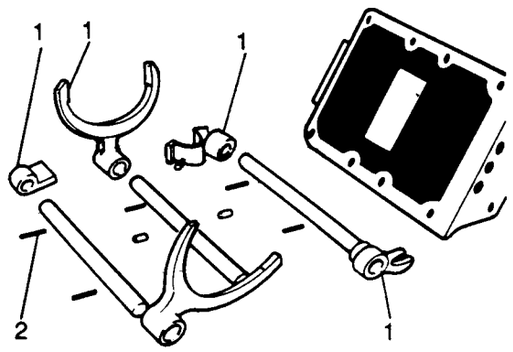


Fig H1.122

(1) Refer to Fig H1.122. Inspect to see that there is no excessive wear in the fork grooves, as well as the contact ends for the gears (1).

(2) Inspect the selector shafts and their housings in the cover. The spring pins (2) must be fitted new as well as any part which is excessively worn.

REASSEMBLY

3. Reassemble the selector forks and shafts:

NOTE

During refitting apply SAE 90 EP oil to all moving parts.

(1) First fit the reverse selector shaft together with its two forks, taking into account that the adjusting screw must be completely loose, so as to be able to couple up the return spring of the shaft.

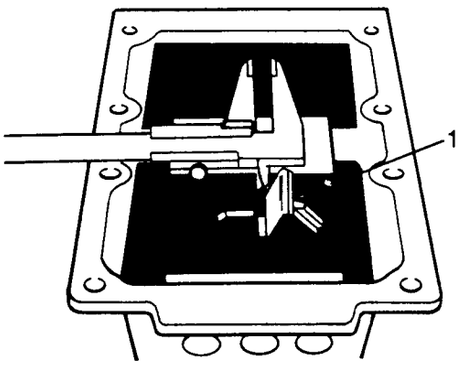


Fig H1.123

(2) Refer to Fig H1.123. Once the spring is hooked onto the shaft, tighten the adjusting screw (1) so that this overlaps some 9 mm.

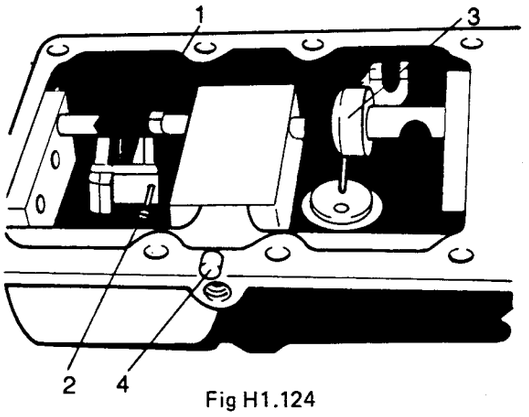


Fig H1.124

(3) Refer to Fig H1.124. Replace the forks for the reverse selector shaft and replace the shaft (3) by sliding it forwards.

(4) Tighten the screw which adjusts the hinge stop for reverse gear (2) to tighten the spring.

(5) Replace the locking roller (4) and replace the spring pin (1) retaining the selector shaft fork.

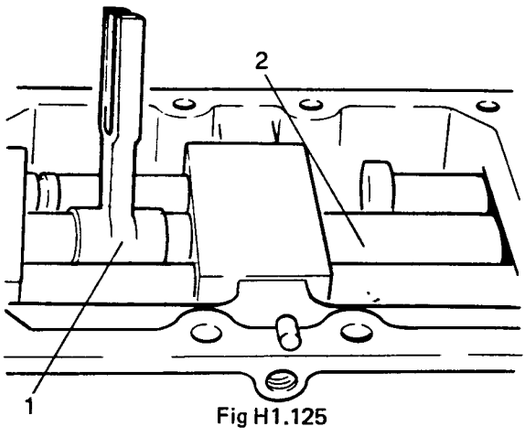


Fig H1.125

(6) Refer to Fig H1.125. Replace the 3rd and 4th selector shaft fork and replace the shaft (2) by sliding it forwards.

(7) Replace the locking roller through the hole in the cover and replace the spring pin (1) in the 3rd and 4th speed selector fork to hold it to the selector shaft.

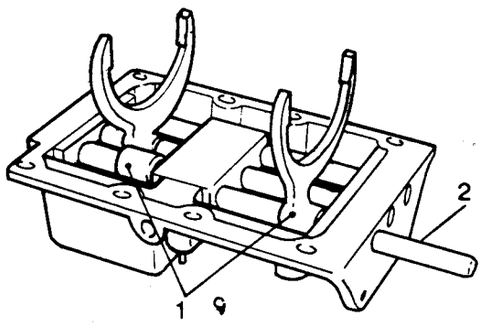


Fig H1.126

(8) Refer to Fig H1.126. Replace the two forks for the 1st and 2nd gear selector shaft (1). Replace the shaft (2) by sliding it forward.

(9) Replace the spring pins that holds the selector shaft fork and the 1st and 2nd gear fork.

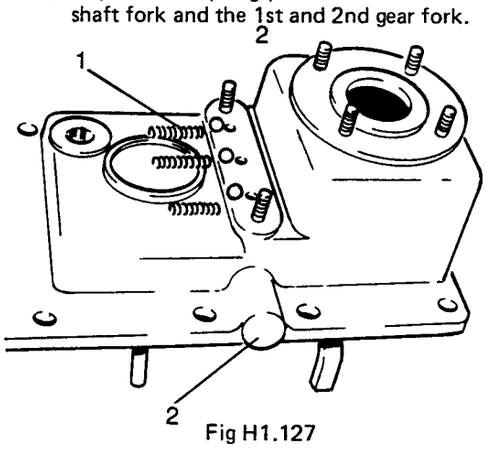


Fig H1.127

(10) Refer to Fig H1.127. Replace the plug (2) in the gallery where the rollers are housed.

(11) Refit the three springs and balls (1) that fix the position of the selector shafts.

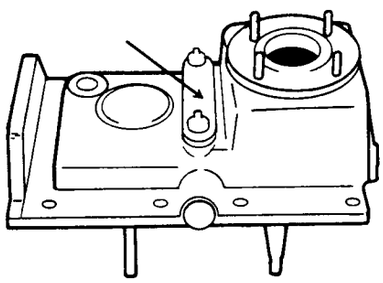


Fig H1.128

(12) Refer to Fig H1.128. Replace the upper plate and secure with the fixings.

4. Replace the forks and shaft (see Sub-sub-section H1.3, Chapter 4).

SUB-SUB-SECTION H1.4

CHAPTER 5

INTERMEDIATE SHAFT FOR REVERSE - OVERHAUL

DISMANTLING

1. To remove the shaft:

   (1) Remove the selector shafts and forks (see Sub-sub-section H1.3, Chapter 4).

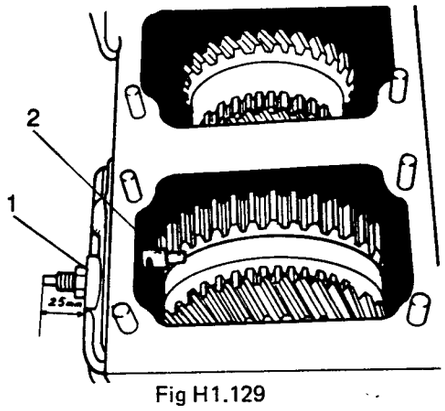


Fig H1.129

   (2) Refer to Fig H1.129. Unscrew the nut (1) and extract the lever threaded pivot.

   (3) Remove the intermediate lever (2) together with the pad.

INSPECTION

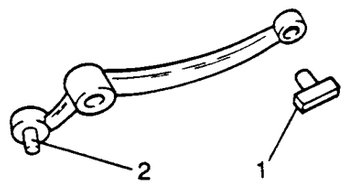


Fig H1.130

2. Refer to Fig H1.130. Examine the wear of the pad (1) and coupling pin (2) which must be changed if found excessive.

REASSEMBLY

3. Reassemble as detailed below:

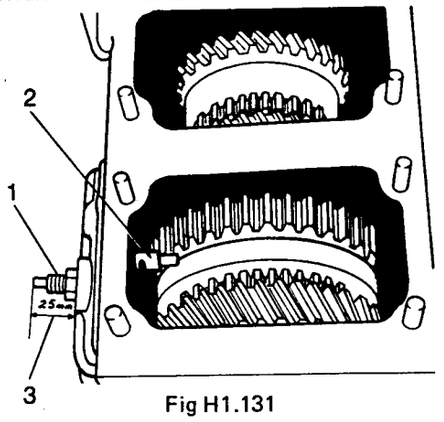


Fig H1.131

   (1) Refer to Fig H1.131. Fit the intermediate lever (2) together with the pad, making sure that the latter fits perfectly into the gear groove.

   (2) Fit the threaded pivot (1) so that this overlaps the casing by 25 mm, then fix the pivot with its nut. The height of the threaded pivot to be 25 mm (3).

4. Replace the shaft (see Sub-sub-section H1.3, Chapter 4).

SUB-SUB-SECTION H1.4

CHAPTER 6

REVERSE PINION - OVERHAUL

DISMANTLING

1. Remove the gear as follows:

   (1) Remove the gearbox housing (see Sub-sub-section H1.3, Chapter 13), the 1st speed gear and washer.

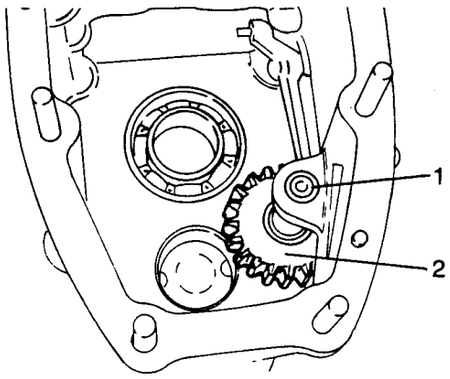


Fig H1.132

   (2) Refer to Fig H1.132. Remove reverse pinion shaft (1) towards the rear of the casing, using a press.

   (3) Remove the gear (2).

2. Strip the gear:

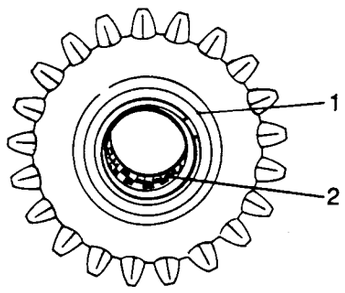


Fig H1.133

   (1) Refer to Fig H1.133. Remove the spring ring (1) from one of its sides.

   (2) Extract the two roller bearings and the two adjusting washers (2).

INSPECTION

3. Inspect the components as follows:

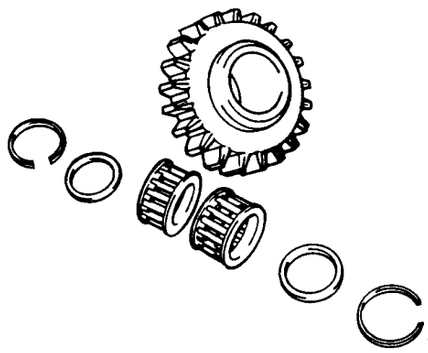


Fig H1.134

   (1) Refer to Fig H1.134. Check the condition of the bearing and wear of all parts.

   (2) Replace worn or damaged components.

REASSEMBLY

4. To reassemble the gear:

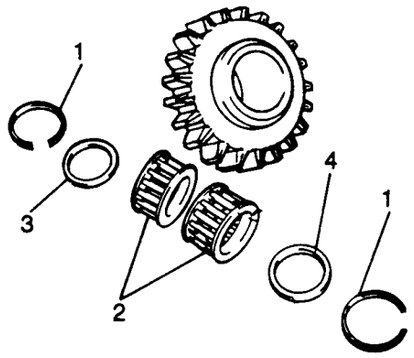


Fig H1.135

   (1) Refer to Fig H1.135. With the spring ring (1) fitted, first introduce the stop washer (3).

   (2) Next fit the two roller bearings (2).

   (3) Fit the other adjusting washer (4) and lastly fit the other spring ring, making sure that it fits perfectly in the gear groove.

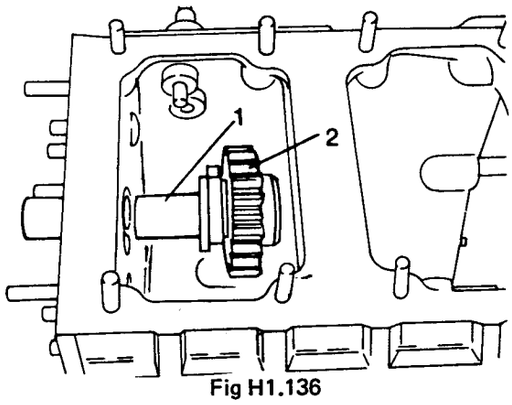


Fig H1.136

(4) Refer to Fig H1.136. Push the shaft (1) into its housing in the casing.

(5) Fit the gear (2) and introduce it on the shaft with the groove on the pad of the intermediate operating lever of the reverse pinion.

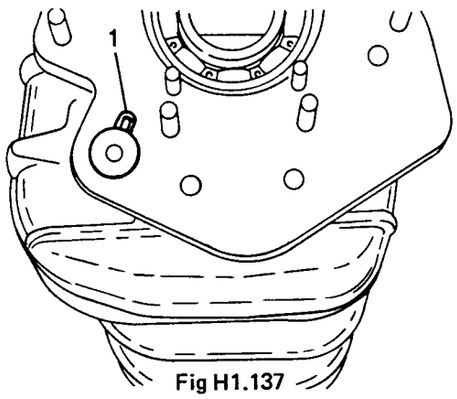


Fig H1.137

(6) Refer to Fig H1.137. Finish pushing home the shaft, by means of a press or plastic hammer, until the rear part of the shaft is level with the rear part of the casing and spring pin (1) must be perfectly housed in the groove of the casing.

(7) Refit the gearbox housing (see Sub-sub-section H1.3, Chapter 13).

SUB-SUB-SECTION H1.4

CHAPTER 7

MAIN SHAFT ASSEMBLY - DISMANTLING AND REASSEMBLY

DISMANTLING

1. First remove the main shaft (see Sub-sub-section H1.3, Chapter 16).

2. To strip the mainshaft assembly:

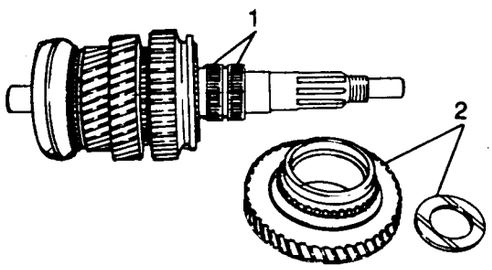


Fig H1.138

(1) Refer to Fig H1.138. Remove the two roller bearings (1) for 1st speed. This pinion and its washers (2) must also be removed from the casing where they remain housed when removing the casing.

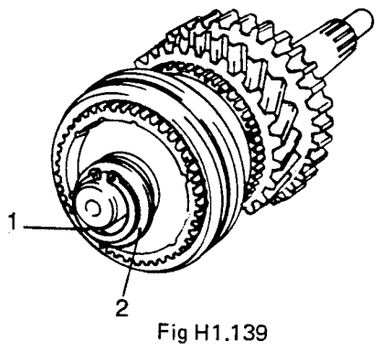


Fig H1.139

(2) Refer to Fig H1.139. Remove the spring ring (1) and the adjusting washer (2) from the mainshaft.

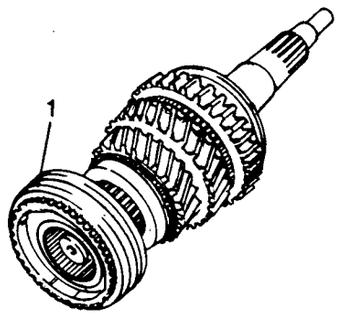


Fig H1.140

(3) Refer to Fig H1.140. Remove the synchro unit (1) for 3rd and 4th speed, taking care that this does not come apart on removal.

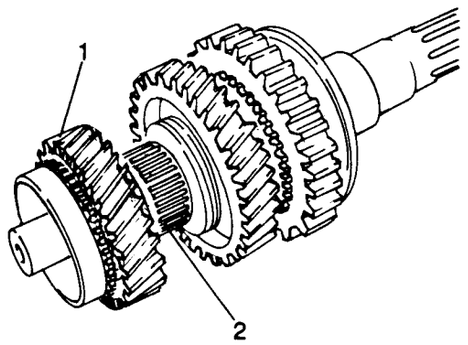


Fig H1.141

(4) Refer to Fig H1.141. Remove the 3rd speed gear (1).

(5) Remove the 3rd speed gear roller bearing (2).

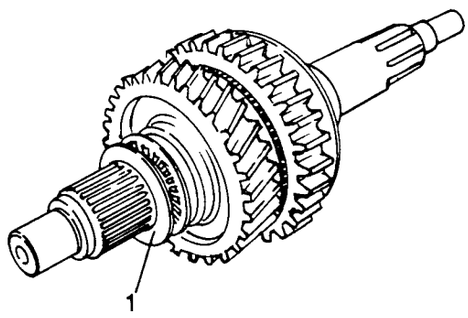


Fig H1.142

(6) Refer to Fig H1.142. Remove the axial bearing and the two thrust washers (1).

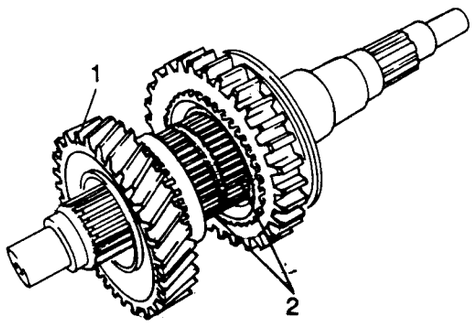


Fig H1.143

(7) Refer to Fig H1.143. Remove 2nd speed gear (1).

(8) Remove the two 2nd speed gear roller bearings (2).

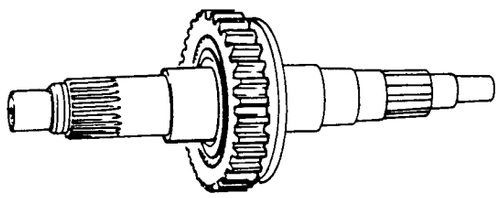


Fig H1.144

(9) Refer to Fig H1.144. The mainshaft is an integral part of the 1st and 2nd speed synchro unit. Since the inner body of the unit and the shaft are machined as a single part, if the mainshaft, synchro unit inner body or outer body are worn, replace the 1st and 2nd synchro unit assembly. Due to the fact that the outer body of the synchro unit is matched with the inner body, these parts are supplied as a matched pair.

SYNCHRO UNITS

3. To strip the 3rd and 4th speed synchro unit:

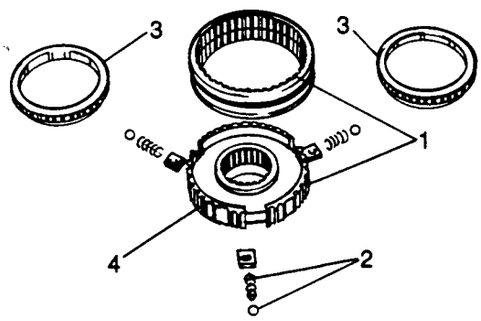


Fig H1.145

(1) Refer to Fig H1.145. To maintain the matched position of the outer and inner bodies (1) of the synchro unit, it is convenient to mark both bodies to ensure maximum slide movement when building the unit.

(2) Before stripping, take care to avoid losing any of the three balls or springs (2).

(3) To facilitate stripping, one of the synchro baulk rings (3) must remain in its working position.

(4) Strip the synchro assembly and push the inner body (4) downwards by means of a synchro cone. The balls and springs will be free from the pressure they make on the outer synchro. It is recommended that the synchro unit be wrapped in a cloth for this operation to avoid the loss of the balls and springs.

4. To strip 1st and 2nd synchro unit:

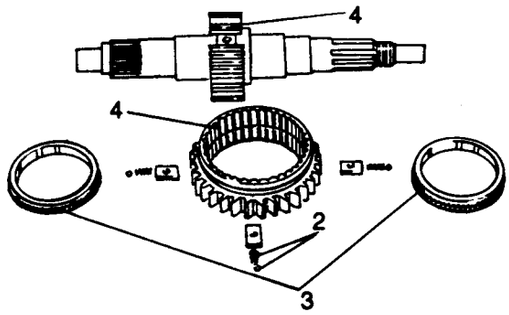


Fig H1.146

(1) Refer to Fig H1.146. Strip the unit in the same manner as that used for the 3rd and 4th speed unit.

(2) The references on Figs H1.145 and H1.146 refer to the same components.

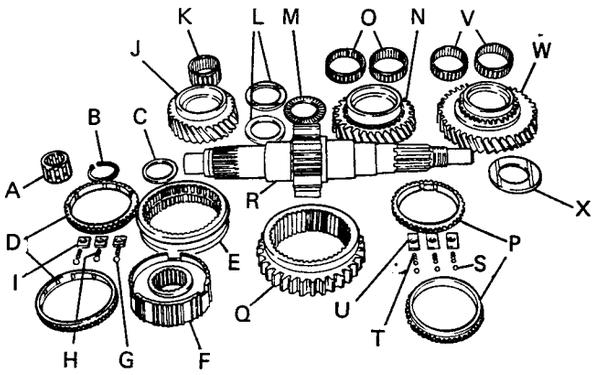


Fig H1.147

A. Mainshaft support bearing
B. Spring ring
C. Mainshaft axial adjusting washer
D. Synchro Cones
E. Synchro outer body for 3rd and 4th speed
F. Synchro inner body for 3rd and 4th speed
G. Synchro unit balls for 3rd and 4th speed
H. Synchro unit springs for 3rd and 4th speed
I. Sliding blocks for 3rd and 4th speed synchro
J. 3rd speed gear
K. Roller bearings for 3rd speed gear
L. Bearing thrust washers
M. Axial bearing
N. 2nd speed gear
O. 2nd speed gear roller bearing
P. Synchro cones
Q. Outer body for 1st and 2nd speed synchro unit
R. Mainshaft and inner body of 1st and 2nd speed synchro
S. 1st and 2nd speed synchro balls
T. 1st and 2nd speed synchro springs
U. Sliding blocks for 1st and 2nd speed synchro
V. 1st speed gear bearings
W. 1st speed gear
X. Thrust washer

INSPECTION

5. Refer to Fig H1.147. Examine all the parts that comprise the mainshaft assembly to see if wear or damage exists, replacing any part if necessary.

REASSEMBLY

6. Rebuilding 1st and 2nd speed synchro unit:

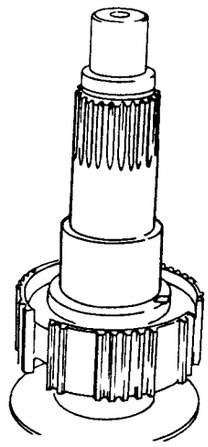
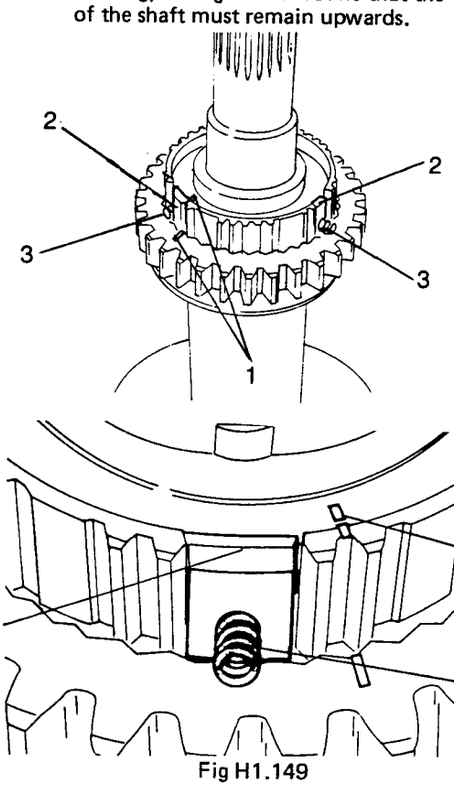


Fig H1.148

(1) Refer to Fig H1.148. Position the mainshaft on a support or in a vice covering the jaws with soft rag, taking into account that the front end of the shaft must remain upwards.



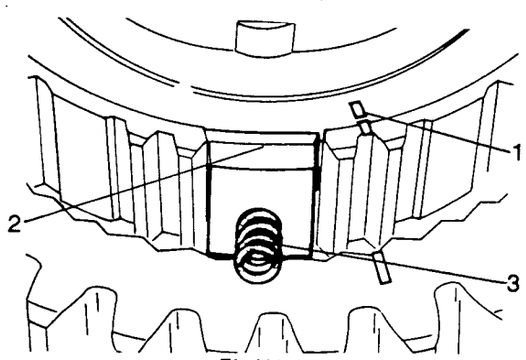


Fig H1.149

(2) Refer to Fig H1.149. Fit the outer body to the inner so that the groove for the selector fork remains towards the rear end of the shaft and the matching marks (1) made in para 3, step (1) coincide.

(3) Fit the sliding blocks (2) in place with the rounded surface (2) facing outwards.

(4) Fit the three springs (3) into the holes of the sliding blocks, in such a way that they are housed in the hollows of the inner body.

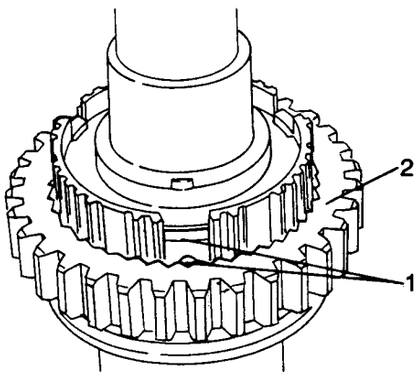


Fig H1.150

(5) Refer to Fig H1.150. House the balls (1) in the ends of the springs, and press them inwards one after another and hold them manually or push the sliding blocks downwards until the balls are retained by the outer body (2).

(6) Lift up the outer body (2) until the balls remain housed in the grooves of the teeth of the outer body.

(7) Finally, fit the two synchro cones and check correct operation of the outer body on the inner body.

7. To rebuild 3rd and 4th synchro unit:

(1) Fit the outer member of the inner member, aligning the marks to maintain them as a pair that were made in para 3, step (1).

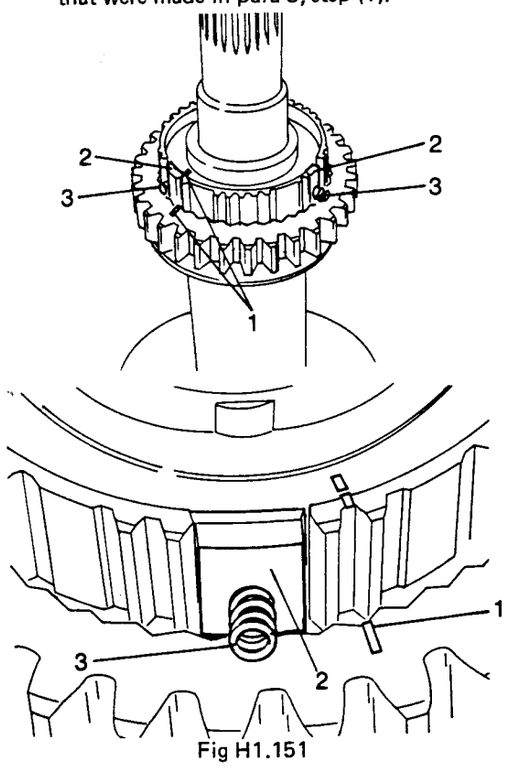


Fig H1.151

(2) Refer to Fig H1.151. Fit the sliding blocks in place with the rounded surface (2) facing outwards.

(3) Fit the three springs (3) into the holes of the sliding block in such a manner that they are housed in the hollows of the inner body.

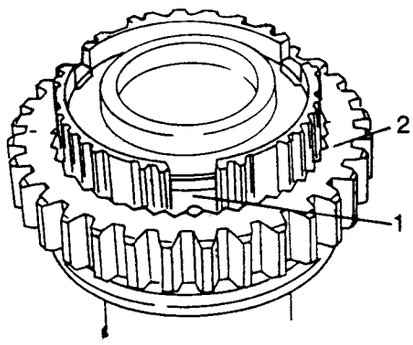


Fig H1.152

(4) Refer to Fig H1.152. House the balls (1) in the ends of the springs and press them inwards one after the other and hold them manually or push the sliding blocks downwards until the balls are retained by the outer body (2).

(5) Lift up the outer body (2) until the balls remain in the grooves of the teeth of the outer body.

(6) Finally fit the two synchro cones and check correct operation of the outer body on the inner body.

8. To rebuild the main shaft:

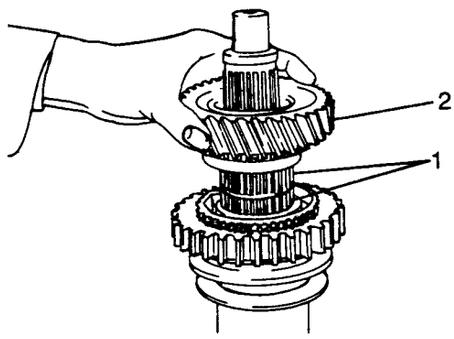


Fig H1.153

(1) Refer to Fig H1.153. With the main shaft and 1st and 2nd synchro unit fitted, fit the 2nd gear bearings (1).

(2) Fit the 2nd speed gear with the conical surface towards the synchro unit.

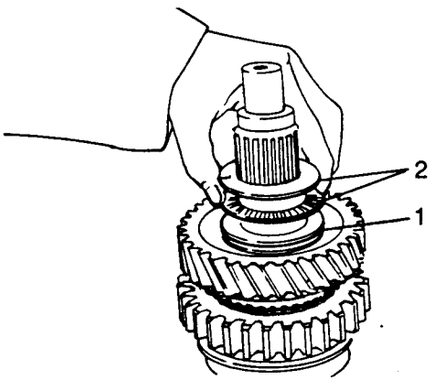


Fig H1.154

(3) Refer to Fig H1.154. Fit thrust washer for the bearing (1) with the grooves towards 2nd speed gear.

(4) Fit the axial bearing and the other thrust washer (2) with the oil grooves towards the front end of the shaft.

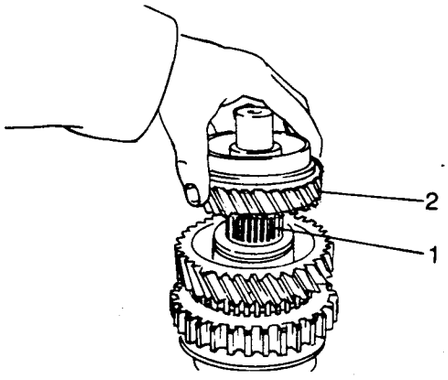


Fig H1.155

(5) Refer to Fig H1.155. Fit the 3rd speed bearing (1).

(6) The 3rd gear (2) should be fitted with the conical surface towards the front end of the main shaft.

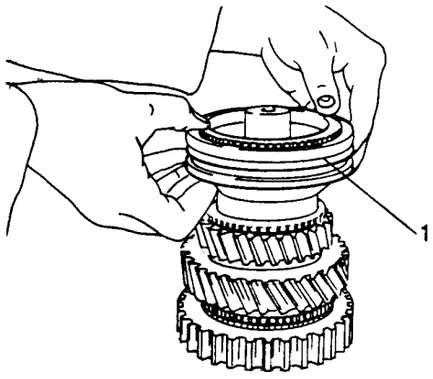


Fig H1.156

(7) Refer to Fig H1.156. Install the synchro assembly (1) of 3rd and 4th speed with the longer hub of the member towards the 3rd speed gear.

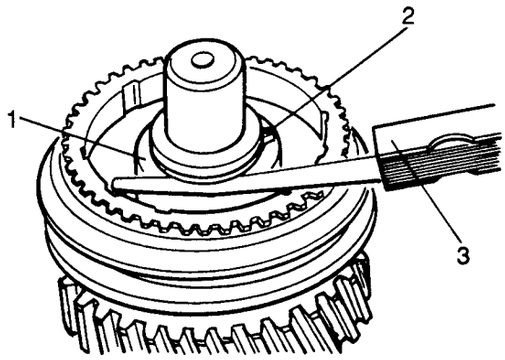


Fig H1.157

(8) Refer to Fig H1.157. Fit the adjusting washer (1) for the complete mainshaft assembly.

(9) Fit the circlip (2) that retains the gears together.

(10) Measure the end float (3) of the gear train which should be between 0,10 to 0,15 mm.

9. To refit the complete mainshaft assembly:

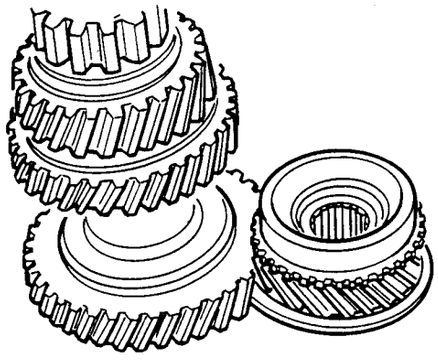


Fig H1.158

(1) Refer to Fig H1.158. With the layshaft in mesh with the primary shaft and supported by the front bearing, fit the roller bearing which serves as a support and centraliser to the mainshaft.

NOTE
This bearing must be perfectly fitted in its primary shaft housing.

(2) Fit the complete mainshaft assembly so that this meshes perfectly with the layshaft and turns freely.

(3) Fit the gearbox housing (see Sub-sub-section H1.3, Chapter 13).

SUB-SUB-SECTION H1.4

CHAPTER 8

MAIN GEAR LEVER - DISMANTLING AND REASSEMBLY

DISMANTLING

1. To strip the gear lever:

   (1) Remove the gear lever (see Sub-sub-section H1.3, Chapter 3).

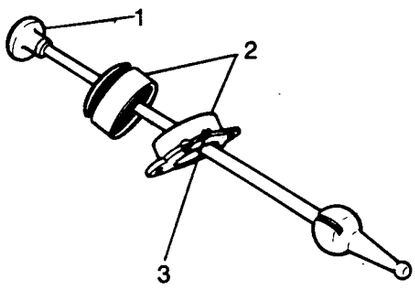


Fig H1.159

   (2) Refer to Fig H1.159. Remove the knob and fixing nut (1).

   (3) Remove the support and dust cover (2) from the ball joint.

   (4) Remove the fixing screw (3).

INSPECTION

2. Inspect as follows:

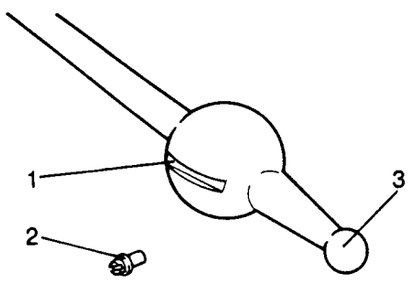


Fig H1.160

   (5) Refer to Fig H1.160. Inspect for wear the fixing groove (1) for the gear lever.

   (6) Inspect the fixing screw (2).

   (7) Inspect the selector finger (3) of the gear lever for wear.

   (8) Replace damaged or worn items.

REASSEMBLY

3. Carry out the following when reassembling the gear lever:

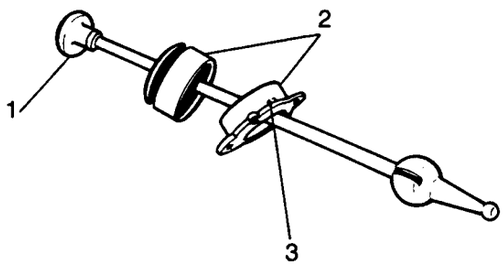


Fig H1.161

   (1) Refer to Fig H1.161. Replace the fixing screw (3).

   (2) Replace the dust cover and support (2) onto the ball joint.

   (3) Replace the fix ring nut and knob (1).

   (4) Refit the gear lever to the gearbox (see Sub-sub-section H1.3, Chapter 3).

SUB-SUB-SECTION H1.5

MAINTENANCE

INTRODUCTION

1. The gearbox is designed for maintenance free operation, requiring only periodic inspections for obvious defects and checking of the oil level. At intervals specified, the oil should be drained and replenished with fresh, clean oil of the correct grade.

2. At frequent intervals, depending on operating conditions, the exterior of the gearbox should be cleaned to prevent the accumulation of dirt, mud and oil, etc.

OIL CHECKING AND CHANGING

Checking Gearbox Oil Level

NOTE

The vehicle must be parked on a completely level surface when checking or changing the oil.

3. To check the oil level:

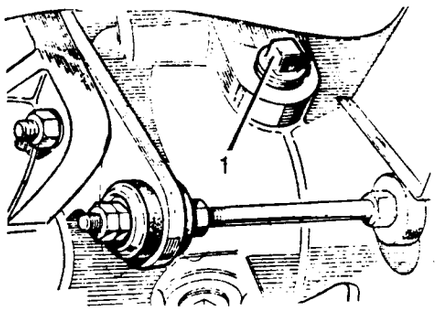


Fig H1.162

(1) Refer to Fig H1.162. Remove the filler level plug (1).

(2) Check that the oil is up to the bottom of the filler plug hole.

(3) If necessary pour oil into the filler plug hole to bring the oil up to this level.

(4) Allow excess oil to drain off through the filler hole.

(5) Replace and tighten the filler level plug.

(6) Wipe off any excess oil around the plug.

NOTE

If significant topping up is required check for oil leaks at the drain and filler plugs, all joint faces and through the drain hole in the bell housing.

Changing Gearbox Oil

NOTE

Before changing the oil the vehicle shall have been driven sufficiently to warm up the oil in the gearbox.

4. To change the oil in the gearbox:

(1) Place a container under the gearbox of sufficient capacity to hold 2 litres of old oil.

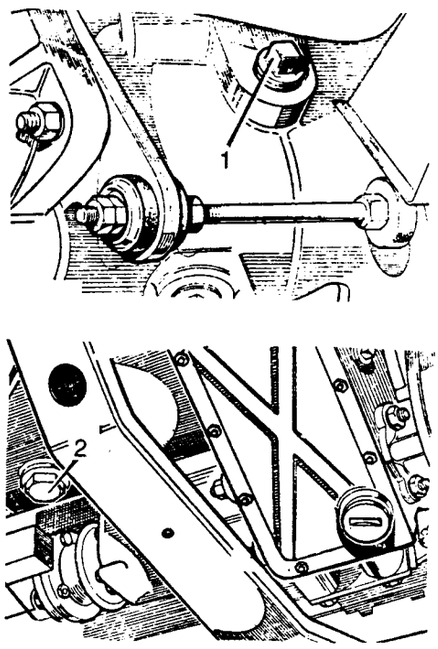


Fig H1.163

(2) Refer to Fig H1.163. Remove the gearbox filler plug (1).

(3) Remove the gearbox drain plug (2) and allow the oil to drain into the container.

(4) Replace and tighten the drain plug using a new gasket.

(5) Fill the gearbox with oil through the filler hole until the oil level is up to the bottom of the filler hole.

(6) Allow excess oil to drain from the filler hole.

(7) Replace and tighten the filler hole plug.

(8) Wipe off excess oil from around the plugs.

SUB-SECTION CONTENTS LIST

SUB-SECTION H2

TRANSFER BOX

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION H2.1

DESCRIPTION AND SPECIFICATIONS

SUB-SUB-SECTION H2.1

CHAPTER 1

DESCRIPTION

1. The transfer box transfers the drive from the gearbox to the front and rear axles and provides high and low ranges to suit a variety of off- and on-road conditions.

SUB-SUB-SECTION H2.1

CHAPTER 2

TRANSFER BOX SPECIFICATIONS

INTRODUCTION

1. Specifications for the transfer box are given in the following Tables:

TABLE H2.1 - GENERAL DATA
TABLE H2.2 - TORQUE SPECIFICATIONS

TABLE H2.1 - GENERAL DATA

ITEM	DESCRIPTION	
Type	Two speed reduction on main gearbox output	
Front wheel drive	Two/four wheel drive control on transfer box output	
Overall ratios (final drive) with helical and spur gear transfer gearbox:		
	High Transfer	Low Transfer
Top	5,4:1	11,1:1
Third	8,05:1	16,5:1
Second	12,0:1	24,6:1
First	19,88:1	40,7:1
Reverse	21,6:1	44,3:1

TABLE H2.2 - TORQUE SPECIFICATIONS

ITEM	TORQUE (N.m)
Transfer box double intermediate gear nut	20 to 25
Front output shaft casing to transfer box nuts	12 to 17
Speedometer drive housing to transfer box nuts	20 to 30
Transfer box lower cover nuts	7,5 to 12,5

SUB-SUB-SECTION H2.2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. Faults on the transfer box are dealt with in this Sub-sub-section. In Table H2.3 a list of symptoms, probable causes and the necessary remedia are given. It should be noted that the Table is not exhaustive and that faults may occur which are not listed. Should the fault not be found by consulting the Table the transfer box should be overhauled.

TABLE H2.3 - TRANSFER BOX FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Noisy transfer box	Excessive end float of intermediate gear. End float on output shaft incorrect. Worn bearings. Low oil level.	Overhaul transfer box. Overhaul transfer box. Replace bearings. Fill transfer box to correct level.
Jumping out of high transfer	Selector spring weak.	Replace spring.
Jumping out of low transfer	Transfer fork assembled wrongly. Excessive end float of intermediate gear. Selector spring weak.	Overhaul transfer box. Overhaul transfer box. Replace spring.
Four-wheel drive will not engage	Return spring below yellow knob wrongly adjusted. Shafts sticking in casing.	Correct the adjustment. Overhaul transfer box.

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION H2.3

REMOVAL AND REPLACEMENT PROCEDURES

SUB-SUB-SECTION H2.3

CHAPTER 1

TRANSFER BOX - REMOVAL AND REPLACEMENT ON THE VEHICLE

REMOVAL

1. The transfer box may be removed without removing the gearbox. To do so:

(1) Drain the oil from the transfer box (see Sub-sub-section H2.5).

(2) Disconnect the front propeller shaft from the output shaft flange (see Sub-sub-section H4.3).

(3) Remove the rear propeller shaft (see Sub-sub-section H4.3).

(4) Remove the speedometer cable (see Sub-sub-section H1.3, Chapter 19).

(5) Remove the transmission brake coupling mechansim.

(6) Remove the fixings of the rear transfer box mountings.

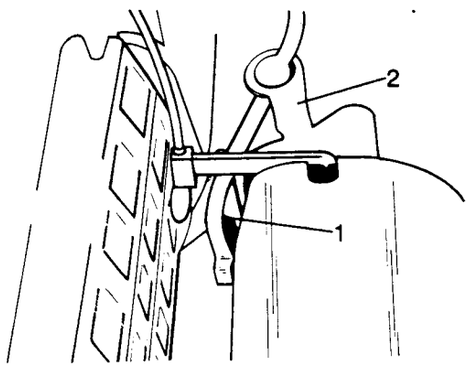


Fig H2.1

(7) Refer to Fig H2.1. Remove the transfer box gear lever (1) from its bracket fixed to the clutch housing.

(8) Remove the link (2) that joins the lever of the transfer box to the high and low gear selector. Take care not to lose the spring.

(9) Remove the yellow knob, nut and spring of the selector lever for four wheel drive.

(10) From inside the vehicle, remove the seat base centre plate, the plate of the RH floor and gearbox tunnel.

(11) Remove the transmission brake assembly (see Sub-sub-section K2.4, Chapter 2).

(12) Remove the double intermediate transfer box gear (see Sub-sub-section H2.3, Chapter 3).

(13) With a hydraulic jack supporting the rear part of the engine, lift this sufficiently so that the transfer box mountings separate from the chassis.

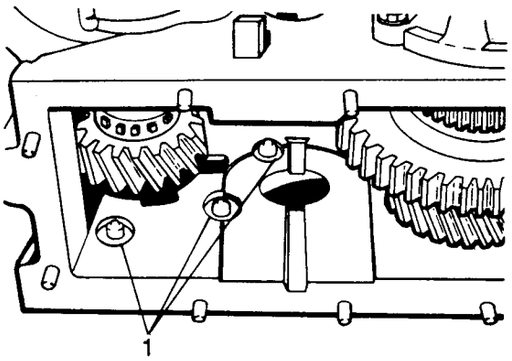


Fig H2.2

(14) Refer to Fig H2.2. Remove the fixing elements (1) that join the transfer box to the gearbox and remove the transfer box and washer.

REPLACEMENT

2. To replace the transfer box:

(1) Apply a film of sealing compound Hermetical 600 on both faces of the washer which is fitted between the transfer box and gearbox.

(2) Fit the washer and transfer box to the gearbox. Tighten the fixing nuts to 20 to 30 N.m.

(3) Lower the hydraulic jack until the transfer box mountings are on the chassis.

(4) Replace the double intermediate transfer box gear (see Sub-sub-section H2.3, Chapter 3).

(5) Refit the transmission brake assembly (see Sub-sub-section K2.4, Chapter 2).

(6) Inside the vehicle replace the gearbox tunnel, the plate of the RH floor and the seat base centre plate.

(7) Replace the yellow knob, nut and spring of the four wheel drive selector lever.

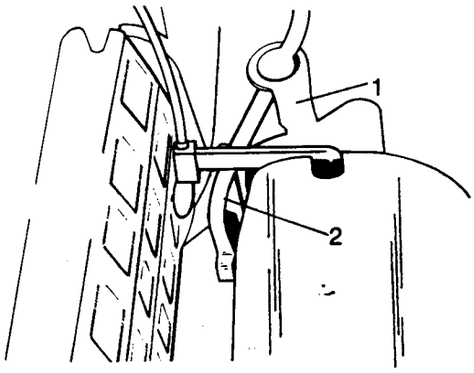


Fig H2.3

(8) Refer to Fig H2.3. Replace the link (2) and spring that join the lever of the transfer box to the high and low gear selector.

(9) Refit the transfer box gear lever (1) into the bracket fixed to the clutch housing.

(10) Replace the fixings of the rear transfer box mountings.

(11) Refit the transmission brake coupling mechanism.

(12) Replace the speedometer cable.

(13) Refit the front and rear propeller shafts (see Sub-sub-section H4.3).

(14) Fill the transfer box with the correct grade of oil (see Sub-sub-section H2.5).

SUB-SUB-SECTION H2.3

CHAPTER 2

TRANSFER BOX - REMOVAL AND REPLACEMENT OUT OF THE VEHICLE

REMOVAL

1. Separate the transfer box from the gearbox as follows:

   (1) Remove the gearbox from the vehicle (see Sub-sub-section H1.3, Chapter 1).

   (2) Remove the double intermediate gear from the transfer box (see Sub-sub-section H2.3, Chapter 3).

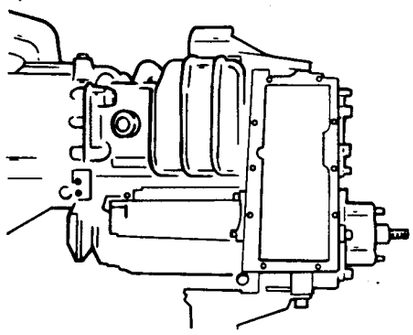


Fig H2.4

   (3) Refer to Fig H2.4. Position the gearbox assembly vertically with the clutch housing downwards. To maintain the assembly in this position, make use of the flywheel housing.

   (4) Remove the screw and nut that holds the selector lever for high and low speeds and extract the lever.

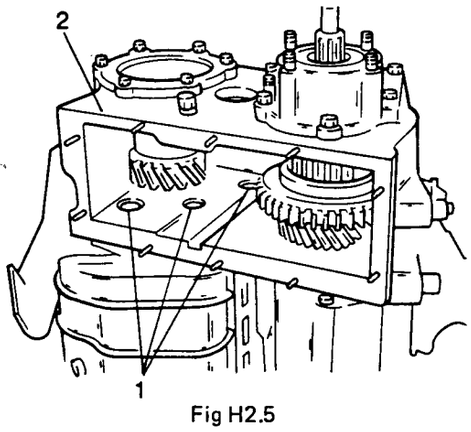


Fig H2.5

   (5) Refer to Fig H2.5. Remove the fixings bolts/nuts (1) that hold the gearbox to the transfer box.

   (6) Separate the transfer box (2) from the gearbox.

REPLACEMENT

2. Replace the transfer box as follows:

   (1) Examine the joint washer and clean off any sealing compound that could exist on the mating surfaces of the casings.

   (2) Apply a film of Hermetical 600 on both faces of the washer and position it on the casing.

   (3) Fit the transfer box assembly and tighten up the nuts to a torque of 20 to 30 N.m.

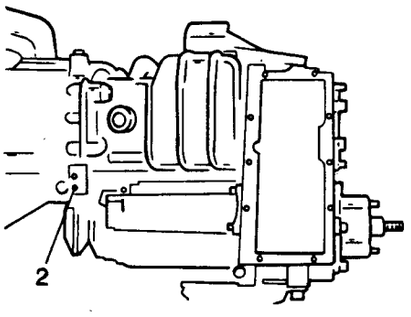


Fig H2.6

   (4) Refer to Fig H2.6. Replace the selector lever (2) for high and low speeds and secure with the screw and nut.

   (5) Replace the double intermediate gear (see Sub-sub-section H2.3, Chapter 3).

   (6) Refit the gearbox to the vehicle (see Sub-sub-section H1.3, Chapter 1).

SUB-SUB-SECTION H2.3

CHAPTER 3

DOUBLE INTERMEDIATE GEAR - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the gear:

(1) Remove the transmission brake (see Sub-sub-section K2.4, Chapter 2).

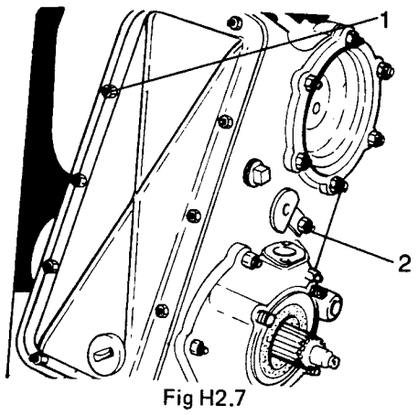


Fig H2.7

(2) Refer to Fig H2.7. Remove the fixings (1) from the transfer box cover, together with its joint washer.

(3) Remove the retaining nut, washer and lock washer (2) from the shaft.

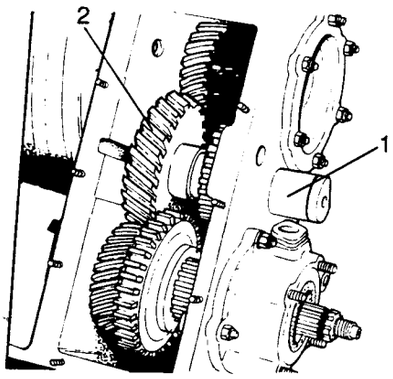


Fig H2.8

(4) Refer to Fig H2.8. Remove the double intermediate gear shaft (1) using special tool 262772.

(5) Remove the gear (2) together with its roller bearings and thrust washers.

INSPECTION

2. Inspect the components as follows:

(1) Change all components that show signs of wear.

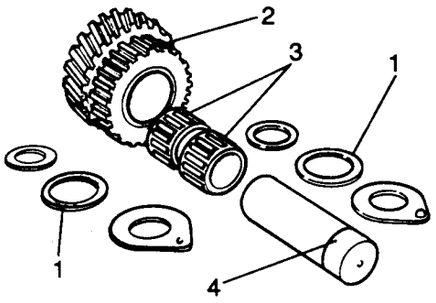


Fig H2.9

(2) Refer to Fig H2.9. It is fundamental that the copper thrust washers (1) are not worn and if they are they must be changed.

(3) Inspect the teeth of the gears (2).

(4) Inspect the roller bearings (3) making sure that the fibre cages are not damaged or worn. Replace if necessary.

(5) Inspect and change, if necessary, the shaft sealing ring (4).

REPLACEMENT

3. To replace the double intermediate gear:

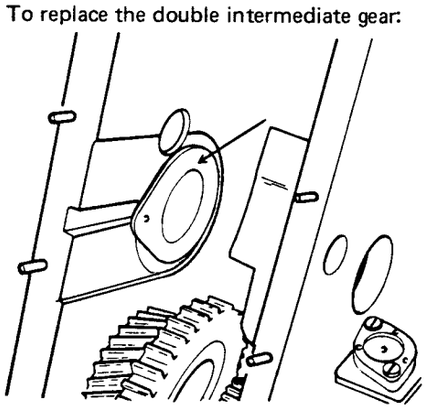


Fig H2.10

(1) Refer to Fig H2.10. First fit the thrust washer on the casing which is fitted with dowels.

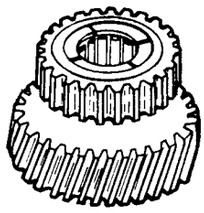


Fig H2.11

(2) Refer to Fig H2.11. Form an assembly with the gear, bearings and thrust washers, taking into account that these have oil grooves which must face outwards. All these parts are held together by grease.

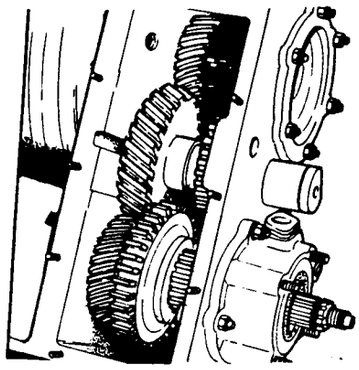


Fig H2.12

(3) Refer to Fig H2.12. Fit the gear, bearings and washer assembly, centring them perfectly with the shaft hole and push the latter in with the hand until it reaches the shaft seal. Continue pushing the shaft home with the aid of a plastic mallet.

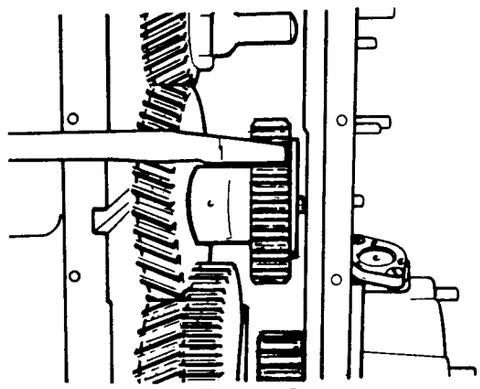


Fig H2.13

(4) Refer to Fig H2.13. Check the end play of the intermediate double gear, which should be between 0,10 to 0,20 mm. The adjustment is carried out by sand papering the thrust washers or adding shims as necessary.

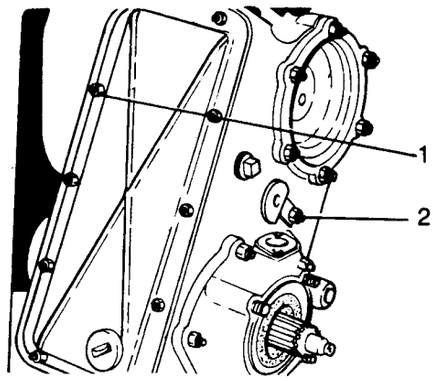


Fig H2.14

(5) Refer to Fig H2.14. Replace the lock washer, washer and retaining nut (2) on the shaft.

(6) Replace the joint washer cover, and the fixings (1).

(7) Replace the transmission brake (see Sub-subsection K2.4, Chapter 2).

SUB-SUB-SECTION H2.4

TRANSFER BOX - OVERHAUL

REMOVAL AND DISMANTLING

1. First, follow the procedure detailed below:

   (1) Remove the transfer box from the vehicle (see Sub-sub-section H2.3, Chapter 1).

   (2) Remove the front output shaft cover (see Sub-sub-section H1.4, Chapter 3).

   (3) Remove the speedometer drive assembly (see Sub-sub-section H1.3, Chapter 2).

2. Strip the transfer box as follows:

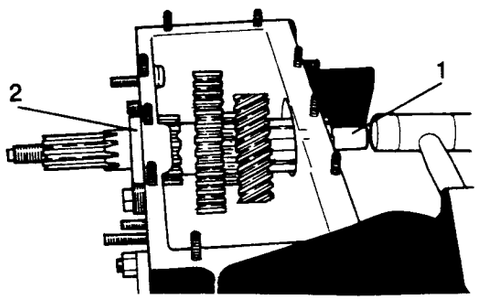


Fig H2.15

(1) Refer to Fig H2.15. Use a plastic hammer to knock the output shaft (1) backwards.

(2) Extract the rear bearing outer track (2) when it moves out of its housing in the casing.

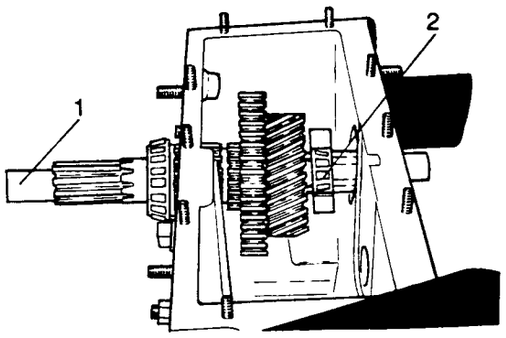


Fig H2.16

(3) Refer to Fig H2.16. Fit special tool 243241 (1) over the threaded portion of the output shaft.

(4) Slide the shaft backwards and between the outer track and the front bearing a second outer track (2) (used one) must be fitted, which has been cut away so that through this the shaft can pass, and slide easily into its housing.

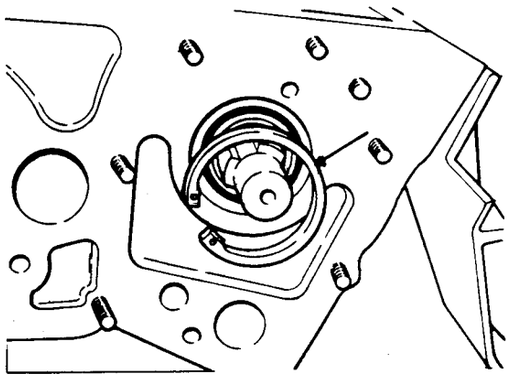


Fig H2.17

(5) Refer to Fig H2.17. Remove the spring clip that retains the front bearing.

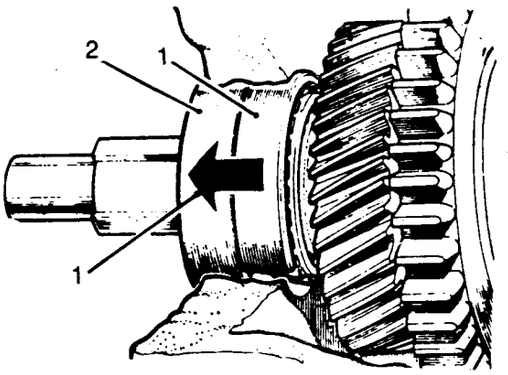


Fig H2.18

(6) Refer to Fig H2.18. With the slave bearing (1) fitted in position, knock the output shaft forward.

(7) Remove the front bearing outer track (2).

(8) Once the front bearing outer track has been removed, remove the slave outer track which was used as an extractor.

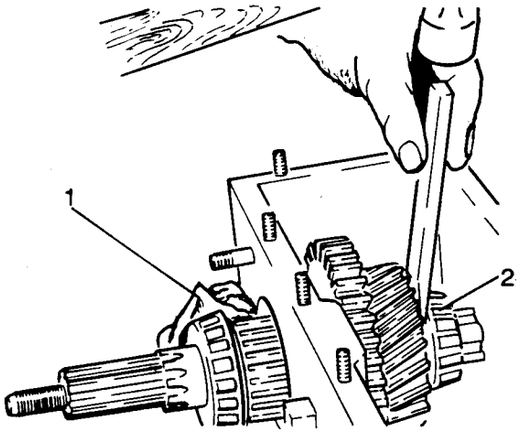


Fig H2.19

(9) Refer to Fig H2.19. Fit rags (1) in position so as to protect the bearing housing during the following operation.

(10) Use a mild steel chisel to remove the output shaft front bearing (2).

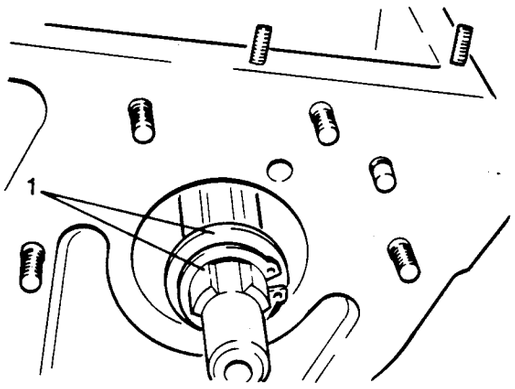


Fig H2.20

(11) Refer to Fig H2.20. Once the bearing has been removed, take off the circlip and thrust washers (1) for the output shaft gears.

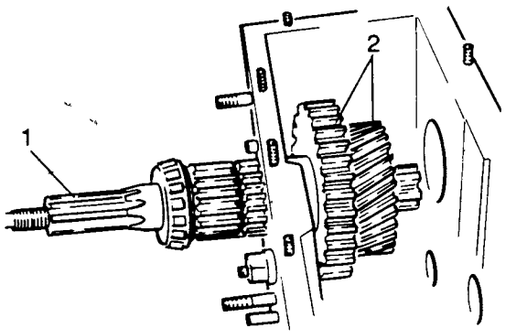


Fig H2.21

(12) Refer to Fig H2.21. Remove the output shaft (1) by sliding it backwards and the gears (2) forward into the casing.

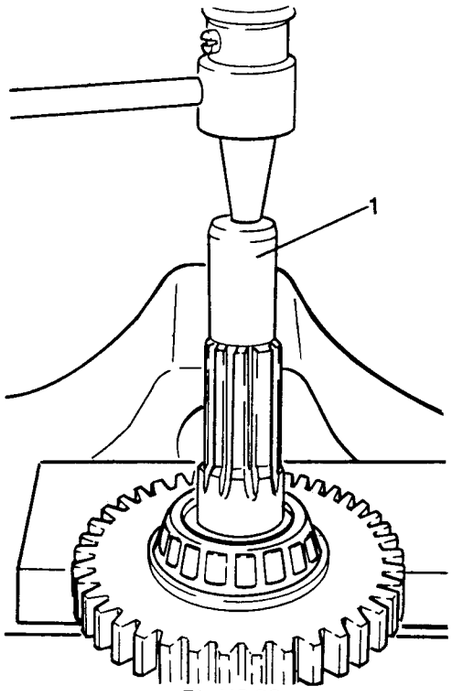


Fig H2.22

(13) Refer to Fig H2.22. Remove the rear bearing by means of a press and employing the low gear as a retaining block for the bearing (as shown).

(14) For this operation the special tool 243241 (1) must be used to protect the thread.

INSPECTION AND CHECK

3. Carry out the following inspection:

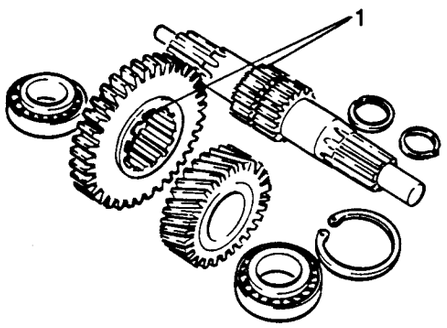


Fig H2.23

(1) Refer to Fig H2.23. Change all components that are worn or damaged. It is of utmost importance that the angles of the low gear splines (1) are not worn.

NOTE

It will be observed that the low gear fits easily over the shaft which permits the shaft to lock when in operation. This makes the output shaft spline edges mesh with the spline edges of the low gear, working in such a way that it is impossible when in low speeds to jump out of gear.

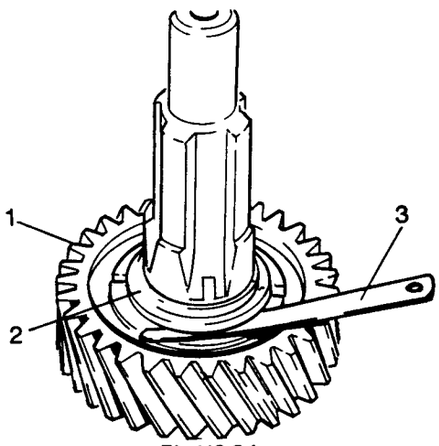


Fig H2.24

(2) Refer to Fig H2.24. Fit the high gear (1) on the output shaft.

(3) Fit the thrust washer and circlip (2).

(4) Position an adequate length of tube over the shaft and push the circlip towards the gear, so as to eliminate any play of this circlip in its groove.

(5) Maintain pressure on the circlip, measure the end float of high gear which should be between 0,10 and 0,20 mm (3).

(6) The end float is adjusted by reducing the thickness of the thrust washer or fitting of a new washer. If the fitting of a new thrust washer does not reduce the end float to the desired limits change the gear and /or shaft.

REASSEMBLY

4. Reassemble the transfer box:

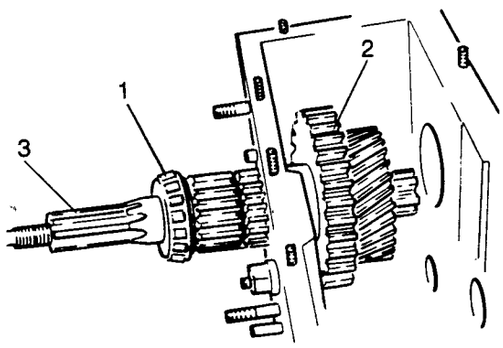


Fig H2.25

(1) Refer to Fig H2.25. Fit the conical roller bearing (1) to the rear of the shaft.

(2) Position the high and low gears (2).

(3) Introduce the shaft (3) through the rear of the casing and fit the high and low gears at the same time.

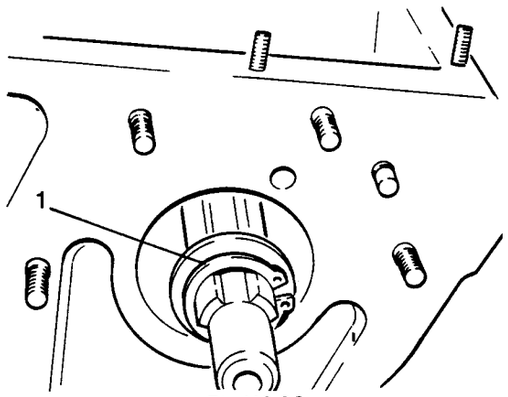


Fig H2.26

(4) Refer to Fig H2.26. Fit the thrust washer and circlip (1).

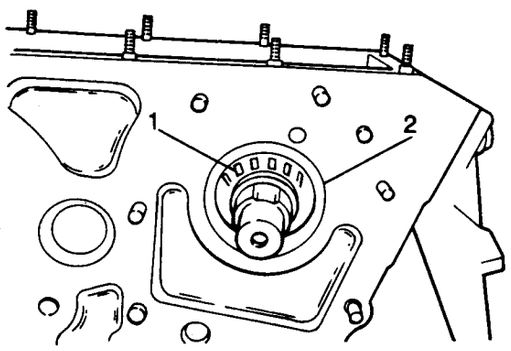


Fig H2.27

(5) Refer to Fig H2.27. Fit the conical roller bearing (1) to the front of the shaft.

(6) Install the front bearing outer track (2) and retain it with the circlip.

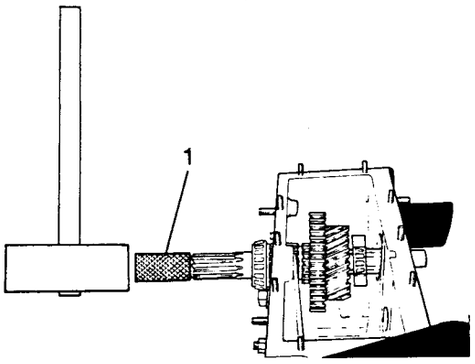


Fig H2.28

(7) Refer to Fig H2.28. Using special tool 243241 (1) knock the shaft forward, until the front bearing remains perfectly seated between the outer track and the circlip which retains gears.

(8) Fit the rear bearing outer track, pushing it home until there is no end float of the shaft, but maintaining the rotation of it without any preload.

5. Adjust preload of the output shaft bearing:

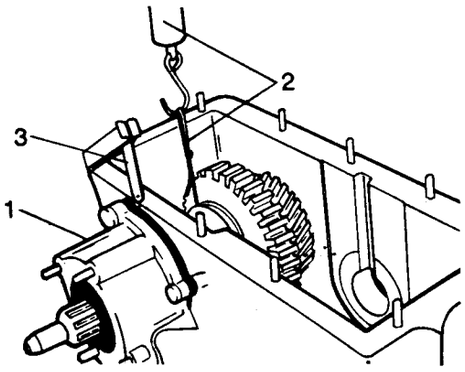


Fig H2.29

(1) Refer to Fig H2.29. Fit the speedometer drive housing (1) without any shims and tighten the nuts with the fingers.

(2) Measure the rolling resistance by means of a string tied around the groove of the selector gear for high and low speeds, and a spring balance. The string must not slip which would give a false reading (2).

(3) The correct preload of the bearings is when a reading of 0,90 to 1,80 kg is achieved on the spring balance. The preload is increased by tightening the speedometer drive housing nuts uniformly.

(4) When the preload is correct, measure the distance with feeler gauges between the speedometer drive housing and the transfer box surfaces (3). The distance is the same as the thickness of the shims to be fitted between the speedometer drive housing and transfer box.

(5) Remove the spring balance, string and speedometer drive housing.

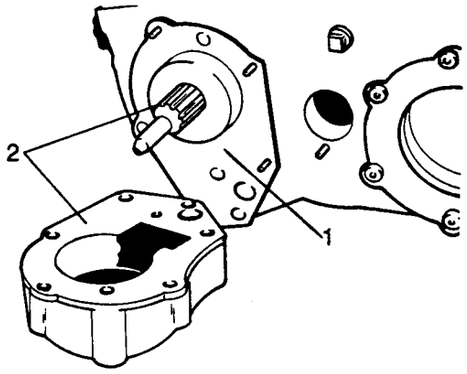


Fig H2.30

(6) Refer to Fig H2.30, Fit the shims (1) calculated in steps (3) and (4) above.

(7) Fit the speedometer drive worm and speedometer drive casing (2) retaining them with the nuts and lock washers. Tighten the nuts to a torque of 13 to 18 N.m.

(8) Replace the front output shaft cover (see Sub-sub-section H1.4, Chapter 3).

(9) Refit the transfer box to the vehicle (see Sub-sub-section H2.3, Chapter 1).

SUB-SUB-SECTION H2.5

MAINTENANCE

INTRODUCTION

1. The transfer box is designed for maintenance free operation, requiring only periodic inspections for obvious defects and checking the oil level. At intervals specified, the oil should be drained and replenished with fresh, clean oil of the correct grade.

2. At frequent intervals, depending on operating conditions, the exterior of the transfer box should be cleaned to prevent the accumulation of dirt, mud and oil, etc.

OIL CHECKING AND CHANGING

Checking Oil Level

NOTES

1. The transfer box and front wheel drive housing are lubricated as one unit.

2. The vehicle must be parked on a completely level surface before checking or changing the oil.

3. To check the oil level:

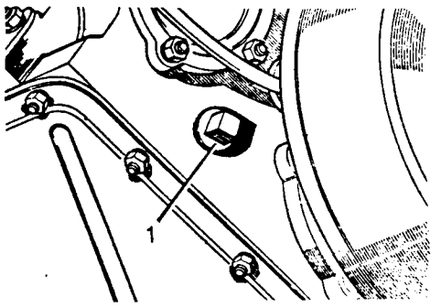


Fig H2.31

(1) Refer to Fig H2.31. Remove the filler level plug (1) on the rear face of the transfer box.

(2) Check that the oil level is up to the bottom of the filler plug hole.

(3) If necessary, pour oil into the filler plug hole to bring the oil up to this level.

(4) Allow excess oil to drain through the filler hole.

(5) Replace and tighten the filler hole plug using a new gasket.

(6) Wipe of excess oil around the filler plug.

NOTE

If significant topping up is required check for oil leaks at the drain and filler plugs, all joint faces and through the drain hole in the bell housing.

Changing the Oil

NOTE

Before changing the oil, the vehicle shall have been driven sufficiently to warm up the oil in the transfer box and front wheel drive housing.

4. To change the oil:

(1) Place a container under the transfer box of sufficient capacity to hold 2,5 litre of old oil.

(2) Remove the transfer box filler plug ((1) on Fig H2.31).

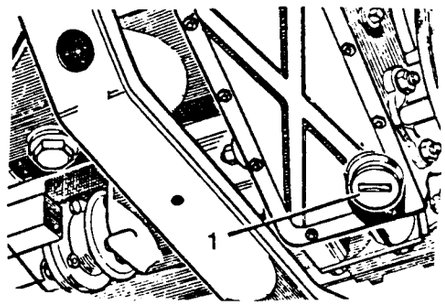


Fig H2.32

(3) Refer to Fig H2.32. Remove the transfer box drain plug (1) and allow the oil to drain into the container.

(4) Replace and tighten the drain plug using a new gasket.

(5) Fill the transfer box with oil through the filler hole until the oil level is up to the bottom of the filler hole.

(6) Allow excess oil to drain from the filler hole.

(7) Replace and tighten the filler hole plug.

(8) Wipe off excess oil from around the plugs.

SUB-SECTION CONTENTS LIST

SUB-SECTION H3

CLUTCH SYSTEM

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION H3.1

SUB-SUB-SECTION H3.1

CHAPTER 1

DESCRIPTION OF THE CLUTCH SYSTEM

GENERAL

1. The clutch is of the single dry-plate, diaphragm spring type. It is hydraulically operated from the clutch pedal through a master cylinder and a slave cylinder. The clutch is fitted between the flywheel and the gearbox, its housing being bolted to the flywheel.

2. The clutch and flywheel are covered by a bell housing to which the slave cylinder is attached. The slave cylinder push rod operates the clutch release lever inside the bell housing.

3. The master cylinder is attached to the rear wall of the engine compartment and incorporates a clutch fluid reservoir with a screw cap. The cylinder push rod is connected directly to the clutch pedal in the driver's cab.

OPERATION

4. Pushing the clutch pedal down pushes a piston in the master cylinder forwards and forces hydraulic fluid to flow through the pipe connecting the master to the slave cylinder. The fluid flow pushes the slave cylinder piston forwards and the rod attached to the piston moves the clutch release lever on its fulcrum to move clutch driven plate away from the flywheel. In this manner the engine is disconnected from the gearbox until the clutch pedal is released. When this occurs the flow of fluid between the master and slave cylinders is reversed and the clutch driven plate again contacts the flywheel to provide a drive to the gearbox.

SUB-SUB-SECTION H3.1

CHAPTER 2

CLUTCH SPECIFICATIONS

INTRODUCTION

1. The specifications for the clutch system are given in the following Tables:

   TABLE H3.1 - GENERAL DATA
   TABLE H3.2 - TORQUE SPECIFICATIONS

TABLE H3.1 - GENERAL DATA

ITEM	DESCRIPTION
Make and type	Girlock S.A., diaphragm spring
Driven plate diameter	241,3 mm
Master cylinder diameter	15,875 mm
Master cylinder push rod free play	1,5 mm
Slave cylinder diameter	22,225 mm
Thrust bearing type	RHP, ball bearing
Clutch pedal pivot bushes, reamed diameter	15,87 ± 0,02 mm
Clutch pedal height setting	140 mm
Clutch pedal free play (minimum)	6 mm

TABLE H3.2 - TORQUE SPECIFICATIONS

ITEM	TORQUE (N.m)
Clutch cover bolts	30 to 35

SUB-SUB-SECTION H3.2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This sub-section deals with fault diagnosis and corrective action on the clutch system. In Table H3.3 a list of symptoms, the probable causes and the necessary remedies are set out. If a fault is suspected, the list of symptoms should be consulted. It should be noted that the Table is not exhaustive and faults may occur which are not listed. Should the Table fail to reveal the fault, the suspected component/s should be removed for closer inspection and/or overhaul.

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

TABLE H3.3 - CLUTCH FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Gear grating and difficult shifting	Lack of clutch pedal reserve total travel. Air in clutch hydraulic system. Lost motion in clutch release fork at pivot point. Cracked release fork. Leaking master or slave cylinder. Excessive idle speed. Clutch binding on input shaft. Excessive clutch plate runout. Oil or grease on clutch lining. Loose linings on clutch plate. Clutch housing or gearbox misaligned.	Check clutch mechanism adjustment. Bleed system. Replace damaged or worn parts. Replace defective part. Repair or replace defective parts. Adjust engine idle rev/min. Check for burrs on splines of clutch and input shaft, remove burrs or replace defective parts. Replace clutch plate. Replace clutch plate and check for leaks on engine, gearbox or release bearing. Replace clutch plate. Check alignment of clutch housing and gearbox.
Clutch slipping	Incorrect adjustment of clutch release mechanism. Worn clutch lining. Damaged or contaminated clutch lining (oil, grease).	Check clutch mechanism adjustment. Replace clutch plate. Replace clutch plate.
Clutch judder	Damaged or contaminated clutch lining. Clutch housing or gearbox misaligned. Driven plate not parallel to flywheel face. Loose, broken or worn engine mountings.	Replace clutch plate. Check alignment of clutch housing and gearbox. Replace driven plate. Tighten or replace engine mountings.
Clutch rattle	Damaged clutch plate. Worn splines. Worn gearbox bearings. Excessive backlash in gearbox.	Replace clutch plate. Replace defective parts. Overhaul gearbox. Overhaul gearbox.
Fractured clutch	Clutch housing or gearbox misaligned. Clutch centre bent during assembly.	Check alignment of clutch housing and gearbox. Fit new clutch plate taking care during assembly.

TABLE H3.3 - CLUTCH FAULT DIAGNOSIS CHART - CONTINUED

SYMPTOM	POSSIBLE CAUSE	REMEDY
Abnormal clutch wear	Overloading vehicle (slipping clutch during pull-off). Too high a gear ratio used when pulling off. Pedal mechanism incorrectly adjusted.	Do not overload vehicle. Educate driver. Check pedal free play and travel.
Clutch grabbing	Dry or rusted spigot shaft spline. Rusted flywheel.	Clean and lubricate with dry graphite based lubricant. Release clutch very slowly until grabbing stops, if it persists, the rust is severe and cleaning after removal of the gearbox and driven plate will be necessary.

SUB-SUB-SECTION H3.3

ADJUSTING THE CLUTCH PEDAL AND MASTER CYLINDER

1. The following is the procedure for setting the clutch pedal height and free play and the free play in the master cylinder push rod:

(1) Remove the bonnet (see Sub-section M3, Chapter 1).

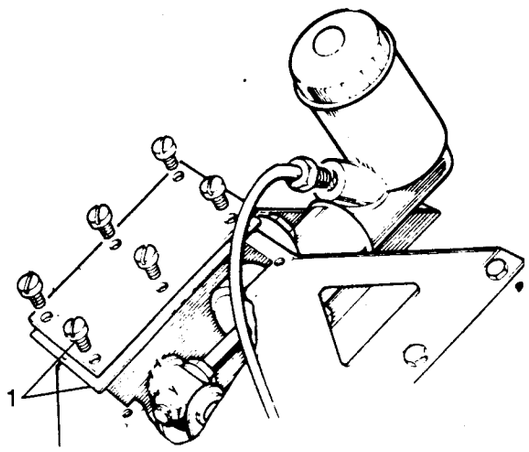


Fig H3.1

(2) Refer to Fig H3.1. Remove the top cover (1) and gasket from the clutch pedal bracket.

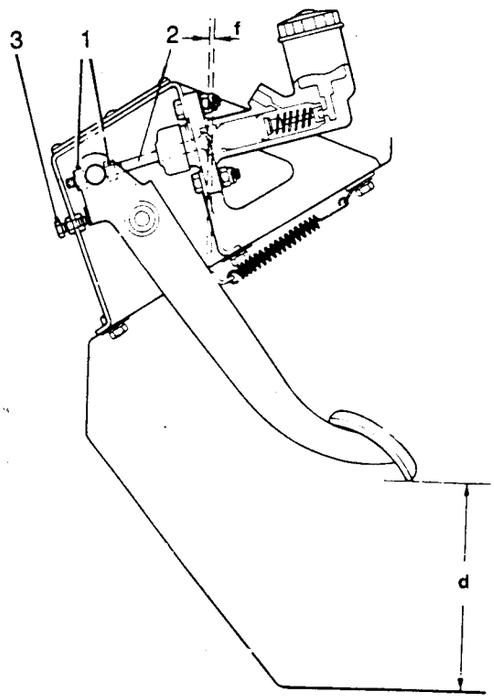


Fig H3.2

(3) Refer to Fig H3.2. Slacken both lock nuts (1) on the master cylinder push rod (2).

(4) Check the distance from the lower edge of the clutch pedal to the floor (distance 'd' in Fig H3.2). The correct distance is 140 mm.

(5) Adjust the pedal stop (3) if necessary to obtain the correct distance.

(6) Adjust the position of the master cylinder push rod (2) until there is approximately 1,5 mm free play between the push rod and the master cylinder piston (distance 'f' on Fig H3.2).

(7) Tighten both lock nuts (1).

(8) Check the clutch pedal for a minimum of 6 mm free movement of the pedal before pressure is felt. Readjust the master cylinder push rod if necessary.

(9) Replace the top cover and gasket. Use a silicon rubber adhesive to retain the gasket if necessary.

(10) Replace the bonnet.

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION H3.4

REMOVAL AND REPLACEMENT PROCEDURES

SUB-SUB-SECTION H3.4

CHAPTER 1

CLUTCH ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the clutch assembly:

   (1) Remove the gearbox assembly (see Sub-sub-section H1.3, Chapter 1).

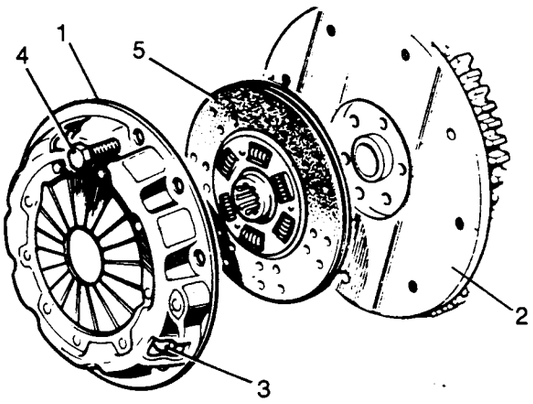


Fig H3.3

   (2) Refer to Fig H3.3. Mark the clutch cover (1) fitted position relative to the flywheel (2).

   (3) Do not disturb the three bolts in the apertures (3) in the clutch cover.

   (4) Remove the bolts (4) holding the clutch cover to the flywheel and remove the cover.

   (5) Withdraw the clutch driven plate (5).

REPLACEMENT

2. To replace the clutch assembly:

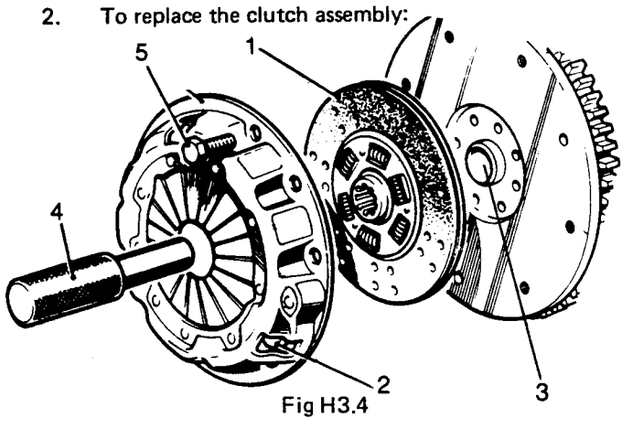


Fig H3.4

   (1) Refer to Fig H3.4. Position the clutch driven plate (1) with the side marked 'flywheel side' towards the flywheel.

   (2) Ensure that the marks on the cover and flywheel are aligned and offer up the cover/driven plate to the flywheel.

   (3) Line up the hole in the cover with the splined hole in the driven plate (2) and the bearing in the crankshaft (3) using special tool 18G79SA (4).

   (4) Secure the cover to the flywheel with the bolts (5) and, using diagonal selection, tighten the bolts evenly to 30 to 35 N.m.

   (5) Remove special tool 18G79SA.

SUB-SUB-SECTION H3.4

CHAPTER 2

MASTER CYLINDER - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the master cylinder:

   (1) Remove the bonnet (see Sub-section M3, Chapter 1).

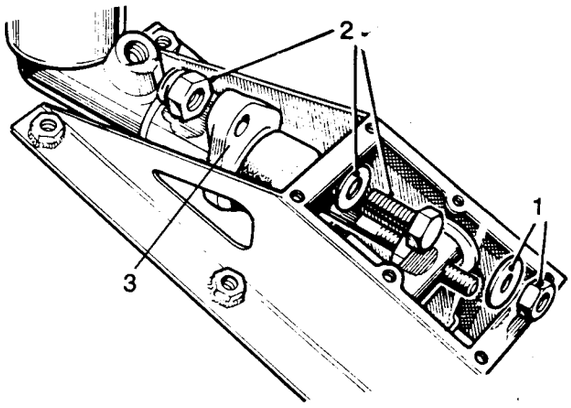


Fig H3.5

   (2) Refer to Fig H3.5. Disconnect the fluid pipe from the master cylinder.

   (3) Remove the top cover and gasket from the clutch pedal bracket.

   (4) Remove the fixing (1) from the end of the master cylinder push rod.

   (5) Remove the master cylinder fixings (2).

   (6) Remove the master cylinder (3) from the pedal bracket.

REPLACEMENT

2. Replace the master cylinder as follows:

   (1) Fit the master cylinder to the pedal bracket, engaging the cylinder push rod through the pedal trunnion (4).

   (2) Fit the plain washer and nut to the end of the push rod.

   (3) Connect the fluid pipe to the master cylinder.

   (4) Bleed the hydraulic system (see Sub-sub-section H3.6).

   (5) Adjust the pedal and master cylinder (see Sub-sub-section H3.3).

SUB-SUB-SECTION H3.4

CHAPTER 3

SLAVE CYLINDER - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the slave cylinder:

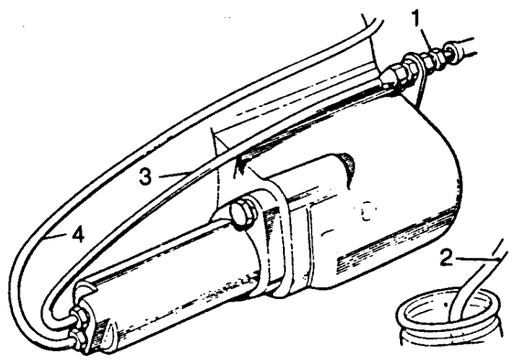


Fig H3.6

(1) Refer to Fig H3.6. Slacken the bleed screw (1) and drain the hydraulic fluid into a suitable container using a bleed tube (2).

(2) Disconnect the bleed pipe (3).

(3) Disconnect the fluid pipe (4).

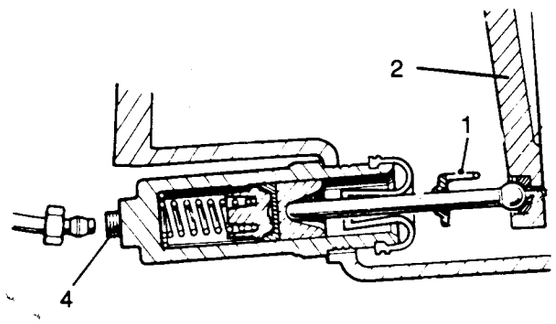


Fig H3.7

(4) Refer to Fig H3.7. Release the plastic clip (1) from the clutch release lever (2) and slide the clip along the push rod (3).

(5) Remove the two retaining bolts and pull the slave cylinder away.

REPLACEMENT

2. Replace the slave cylinder as detailed below:

(1) Partially extend the push rod by applying low pressure air to the fluid connector (4).

(2) Position the push rod central to the body.

(3) Locate the push rod end into the seating in the release lever (2) and retain with the plastic clip (1).

(4) Fit the slave cylinder, bleed valve uppermost and secure with the two bolts and washers.

(5) Fit the fluid pipe (4).

(6) Fit the bleed pipe.

(7) Bleed the system (see Sub-sub-section H3.6).

SUB-SUB-SECTION H3.4

CHAPTER 4

CLUTCH RELEASE ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the clutch release assembly:

   (1) Remove the gearbox assembly (see Sub-sub-section H1.3, Chapter 1).

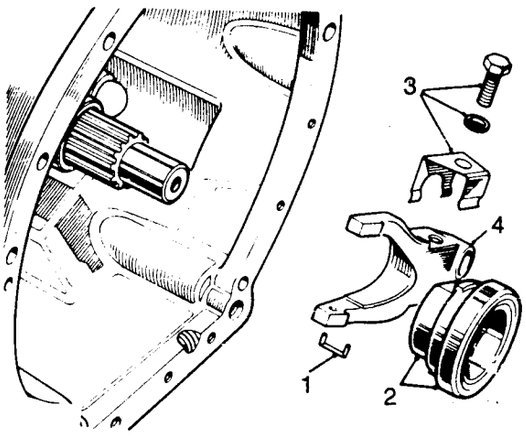


Fig H3.8

   (2) Refer to Fig H3.8. Withdraw the retainer staple (1).

   (3) Withdraw the bearing and sleeve (2). If required, press the bearing off the sleeve.

   (4) Remove the spring clip (3) and fixings.

   (5) Withdraw the release lever (4).

REPLACEMENT

2. Replace the clutch release assembly as follows:

   (1) Fit the release lever (4).

   (2) Replace the spring clip and fixings (3).

   (3) If required, fit a replacement bearing onto the sleeve (2) with the domed face outwards from the sleeve.

   (4) Lubricate the bearing sleeve inner diameter with PBC (Poly Butyl Caprysil) grease.

   (5) Refit the bearing and retainer staple (1).

   (6) Replace the gearbox (see Sub-sub-section H1.3, Chapter 1).

SUB-SUB-SECTION H3.4

CHAPTER 5

CLUTCH PEDAL - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the clutch pedal:

   (1) Remove the bonnet (see Sub-section M3, Chapter 1).

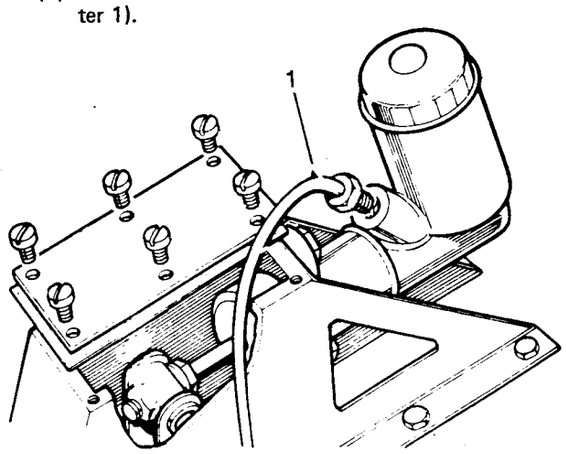


Fig H3.9

   (2) Refer to Fig H3.9. Disconnect the fluid pipe (1) from the clutch master cylinder.

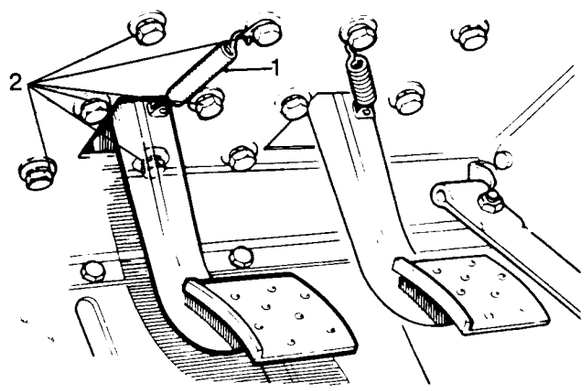


Fig H3.10

   (3) Refer to Fig H3.10. Disconnect the return spring (1) from the pedal.

   (4) From inside the cab remove the six fixing bolts (2) securing the clutch pedal bracket.

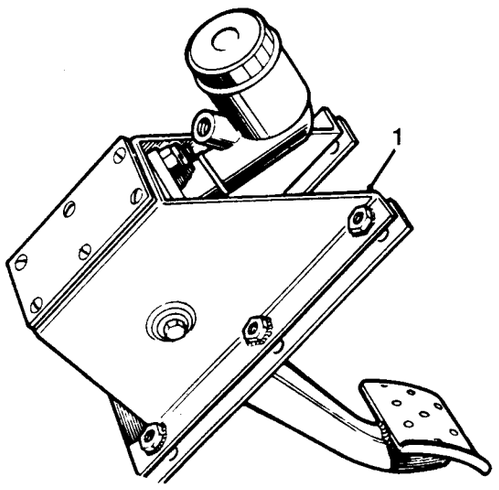


Fig 3.11

   (5) Refer to Fig H3.11. Withdraw the bracket (1) complete with pedal and master cylinder.

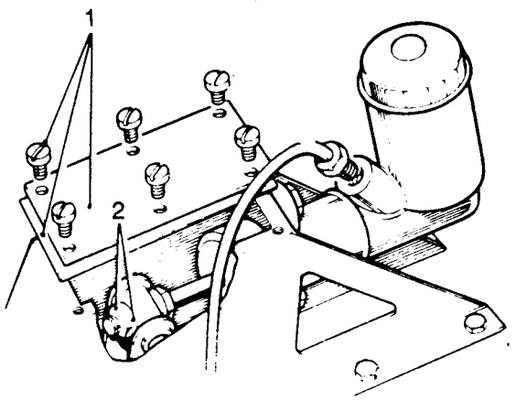


Fig H3.12

   (6) Refer to Fig H3.12. Remove the top cover and gasket (1) from the clutch pedal bracket.

   (7) Remove the nut (2) from the end of the master cylinder push rod and push rod into the master cylinder to clear the pedal trunnion.

SUB-SUB-SECTION H3.4

CHAPTER 5

CLUTCH PEDAL - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the clutch pedal:

   (1) Remove the bonnet (see Sub-section M3, Chapter 1).

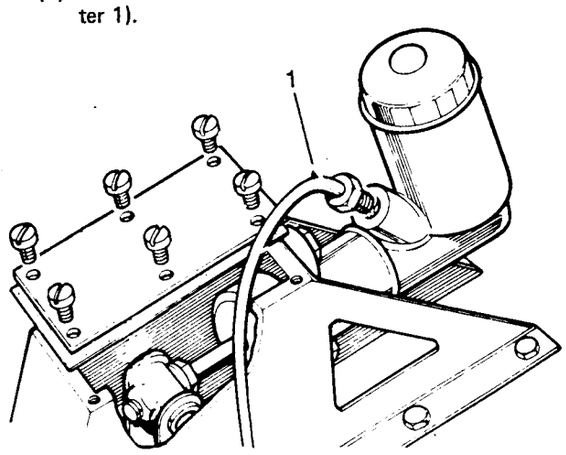


Fig H3.9

   (2) Refer to Fig H3.9. Disconnect the fluid pipe (1) from the clutch master cylinder.

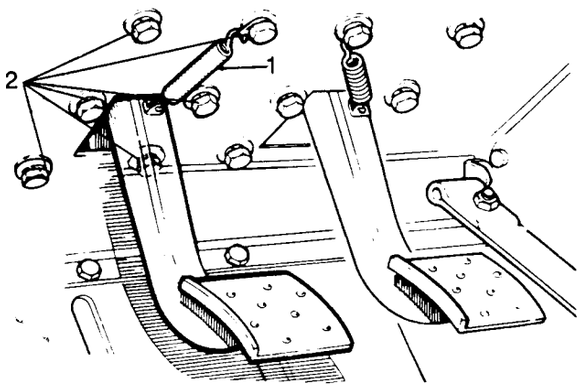


Fig H3.10

   (3) Refer to Fig H3.10. Disconnect the return spring (1) from the pedal.

   (4) From inside the cab remove the six fixing bolts (2) securing the clutch pedal bracket.

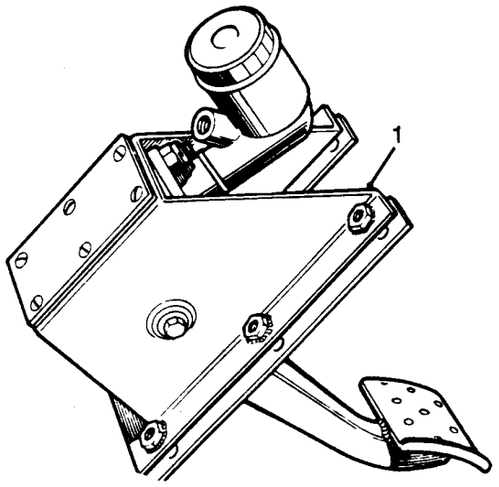


Fig 3.11

   (5) Refer to Fig H3.11. Withdraw the bracket (1) complete with pedal and master cylinder.

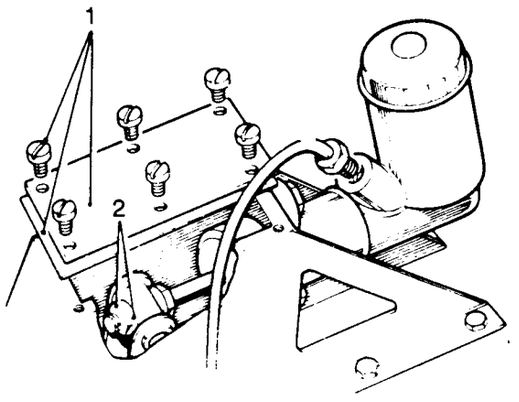


Fig H3.12

   (6) Refer to Fig H3.12. Remove the top cover and gasket (1) from the clutch pedal bracket.

   (7) Remove the nut (2) from the end of the master cylinder push rod and push rod into the master cylinder to clear the pedal trunnion.

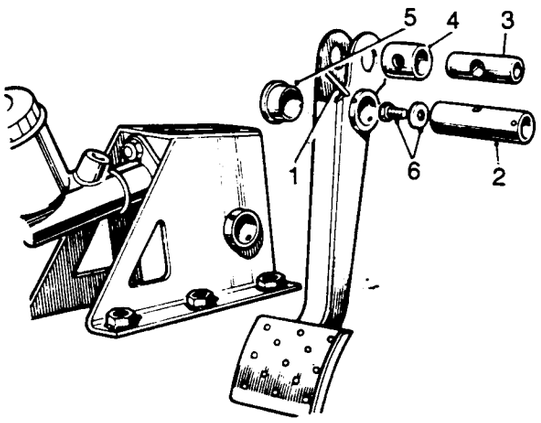


Fig H3.13

(8) Refer to Fig H3.13. Using a suitable punch, drift out the pin (1) from the pedal shaft.

(9) Withdraw the pedal shaft (2).

(10) Withdraw the clutch pedal complete with trunnion (3), bush (4) and distance piece (5).

(11) If required, remove the trunnion, bushes and distance piece from the clutch pedal.

REPLACEMENT

2. To replace the clutch pedal:

(1) If removed, fit the distance piece (5), bush (4) and trunnion (3) to the clutch pedal. Lubricate the trunnion and distance piece with general purpose grease on assembly. New pedal bushes must be reamed to 15,87 mm ± 0,02 mm.

(2) Remove the oil plug (6) and washer from the pedal shaft (2). Fill the shaft bore with clean engine oil and refit the plug and washer.

(3) Replace the pedal shaft into the clutch pedal bracket.

(4) Fit the pedal shaft (2) and replace the pin (1).

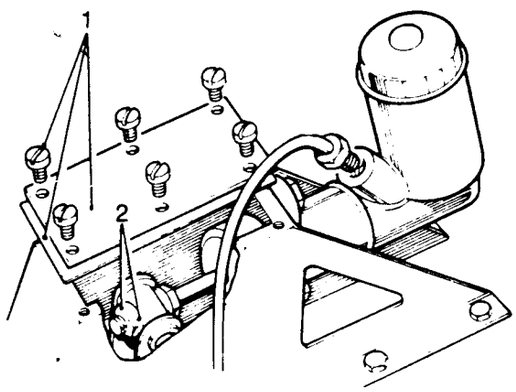


Fig H3.14

(5) Refer to Fig H3.14. Push the master cylinder push rod through the trunnion and fit the nut (2) and washer.

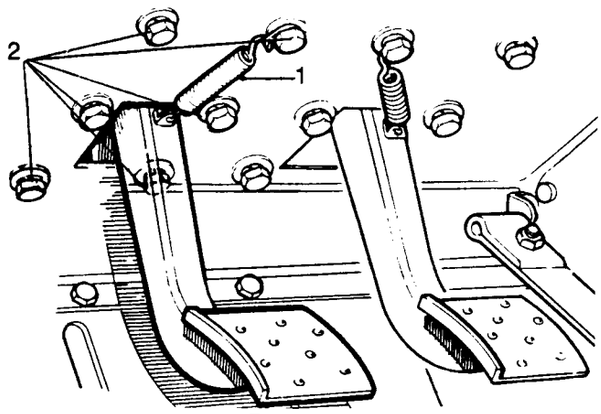


Fig H3.15

(6) Refer to Fig H3.15. Fit the clutch pedal bracket complete with pedal and master cylinder and secure from inside cab with six fixing bolts (2).

(7) Refit the clutch return spring (1).

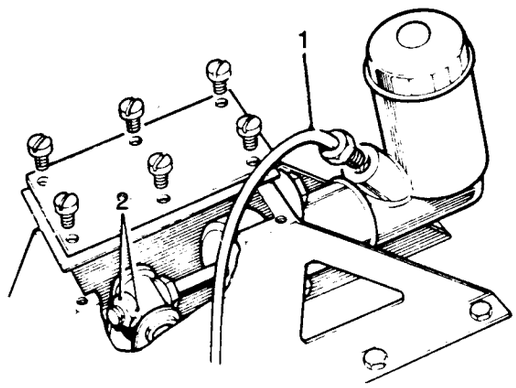


Fig H3.16

(8) Refer to Fig H3.16. Refit the fluid pipe (1) to the clutch master cylinder.

(9) Bleed the system (see Sub-sub-section H3.6).

(10) Set the clutch pedal and master cylinder (see Sub-sub-section H3.3).

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION H3.5

OVERHAUL PROCEDURES

SUB-SUB-SECTION H3.5

CHAPTER 1

MASTER CYLINDER OVERHAUL

DISMANTLING

1. First dismantle the master cylinder:

   (1) Remove the master cylinder (see Sub-sub-section H3.4, Chapter 2).

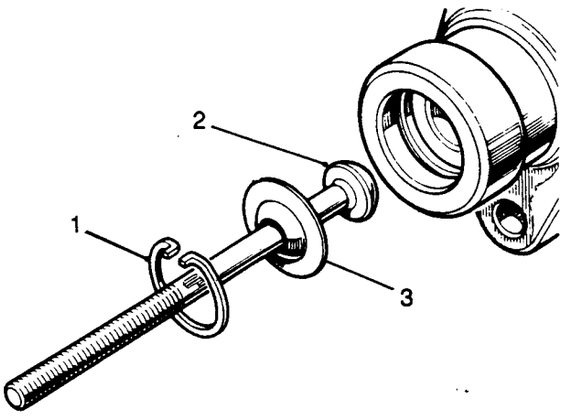


Fig H3.17

   (2) Refer to Fig H3.17. Remove the circlip (1).

   (3) Withdraw the push rod (2) and retaining washer (3).

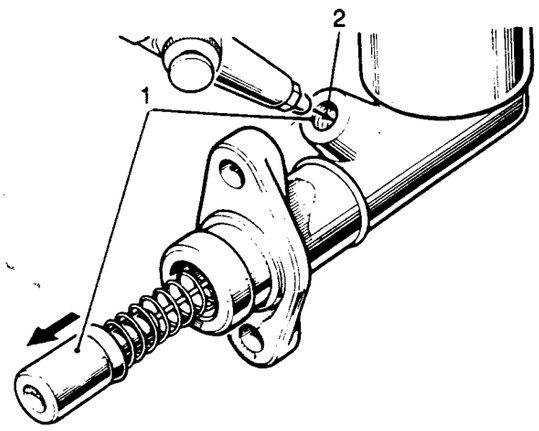


Fig H3.18

   (4) Refer to Fig H3.18. Withdraw the piston assembly (1). If necessary apply a low air pressure to the fluid outlet port (2) to expel the piston.

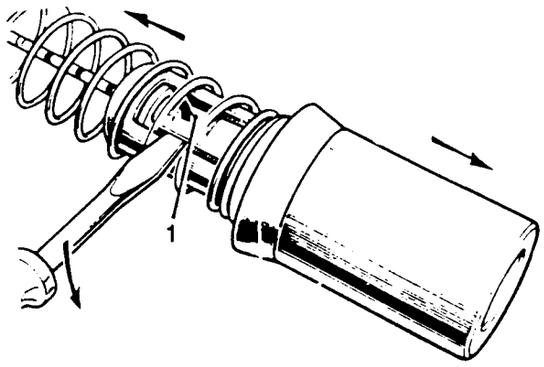


Fig H3.19

   (5) Refer to Fig H3.19. Prise the locking prong (1) of the spring retainer clear of the piston shoulder and withdraw the piston.

   (6) Withdraw the piston seal.

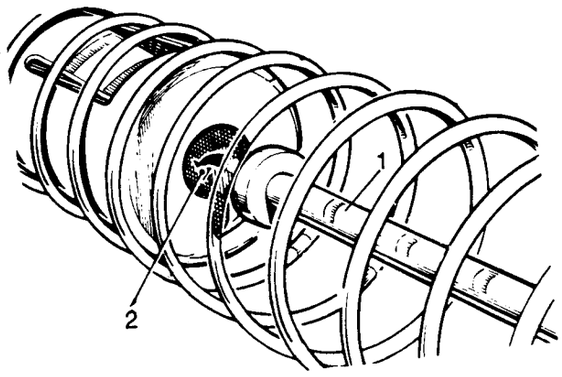


Fig H3.20

   (7) Refer to Fig H3.20. Compress the spring and position the valve stem (1) to align with the larger hole (2) in the spring retainer.

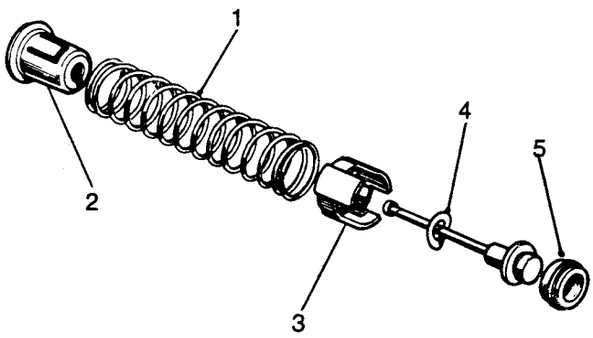


Fig H3.21

(8) Refer to Fig H3.21. Withdraw the spring (1) and retainer (2).

(9) Withdraw the valve spacer (3) and spring washer (4) from the valve stem.

(10) Remove the valve seal (5).

INSPECTING

2. Inspect the master cylinder components:

(1) Clean all components in Girling cleaning fluid and allow to dry.

(2) Examine the cylinder bore and piston. Ensure that they are smooth to the touch with no corrosion, score marks or ridges. If there is any doubt, replace with new components.

(3) Discard all seals and fit new ones.

REASSEMBLY

3. Reassemble the master cylinder as detailed below:

(1) Apply a smear of Castrol-Girling rubber grease to the seals.

(2) Smear the remaining internal components with Castrol-Girling brake and clutch fluid.

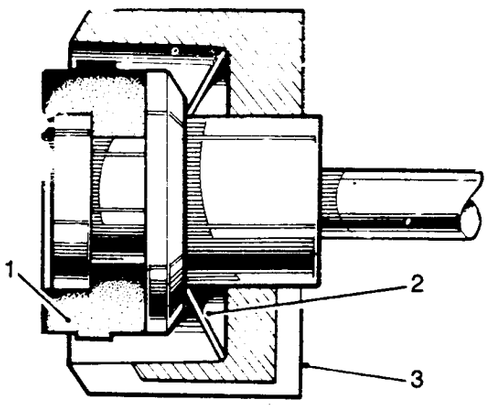


Fig H3.22

(3) Refer to Fig H3.22. Fit the valve seal (1), flat side first, on to the end of the valve stem (2).

(4) Fit the spacer (3), legs first.

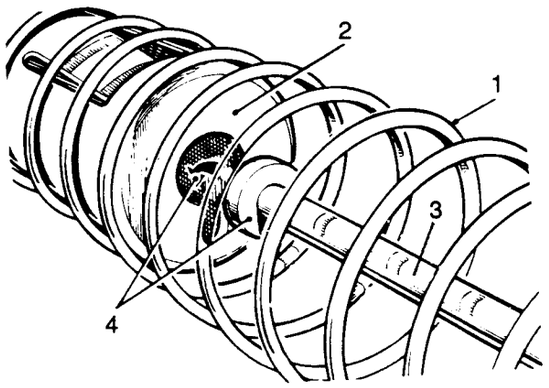


Fig H3.23

(5) Refer to Fig H3.23. Place the coil spring (1) over the valve stem.

(6) Insert the retainer (2) into the spring.

(7) Compress the spring and engage the valve stem (3) in the keyhole slot (4) in the retainer.

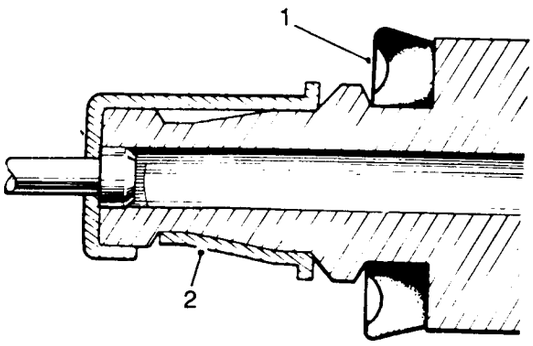


Fig H3.24

(8) Refer to Fig H3.24. Fit the seal (1), large diameter last, to the piston.

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

(10) Smear the piston with Castrol-Girling rubber grease and insert the assembly, valve end first, into the cylinder.

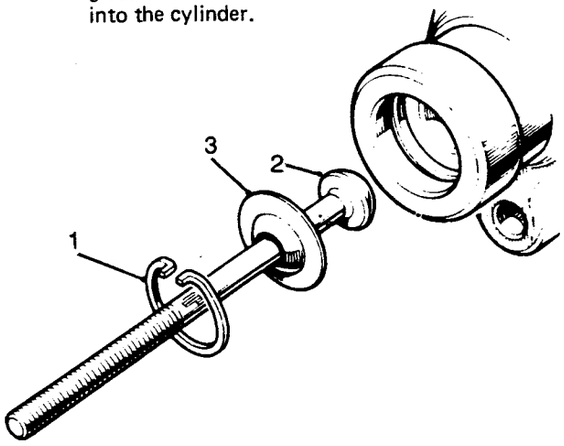


Fig H3.25

(11) Refer to Fig H3.25. Fit the push rod (2) retaining washer (3) and circlip (1).

(12) Replace the master cylinder as detailed in Sub-sub-section H3.4, Chapter 2.

SUB-SUB-SECTION H3.5

CHAPTER 2

SLAVE CYLINDER OVERHAUL

DISMANTLING

1. To dismantle the slave cylinder:-

   (1) Remove the slave cylinder (see Sub-sub-section H3.4, Chapter 3).

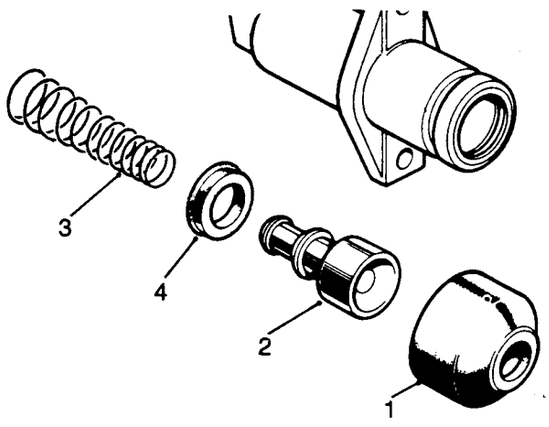


Fig H3.26

   (2) Refer to Fig H3.26. Withdraw the dust cover (1).

   (3) Expel the piston assembly (2) by applying low pressure air to the fluid inlet.

   (4) Withdraw the spring (3).

   (5) Remove the seal (4) from the piston.

INSPECTION

2. Inspect the slave cylinder components:

   (1) Clean all components in Girling cleaning fluid and allow to dry.

   (2) Examine the cylinder bore and the piston. Ensure that they are smooth to the touch with no corrosion, score marks or ridges. If there is any doubt, replace with new components.

   (3) Discard the seal and replace with a new one.

REASSEMBLY

3. Reassemble the slave cylinder as follows:

   (1) Apply a smear of Castrol-Girling rubber grease to the seal.

   (2) Smear the remaining internal components with Castrol-Girling brake and clutch fluid.

   (3) Fit the seal (4), large diameter last, to the piston (2).

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

   (5) Smear the piston with Castrol-Girling rubber grease and insert the assembly, spring end first, into the cylinder.

   (6) Fill the dust cover (1) with Castrol-Girling rubber grease and fit the cover to the cylinder.

   (7) Refit the slave cylinder (see Sub-sub-section H3.4, Chapter 3).

MAINTENANCE

GENERAL

1. The fluid level in the reservoir on the master cylinder must be checked at regular intervals and topped up if necessary. Only use the specified hydraulic fluid in the reservoir.

2. Periodically, check the master and slave cylinders and the hydraulic pipe between the two for leaks. Since leaking components can allow air to enter the system, remedial action must be taken immediately a leak is found.

3. Spongy operation of the clutch is a sign that air has entered the sytem. When the driver becomes aware of a spongy feeling when operating the clutch the system should first be checked for leaks. If there is a leak this should be repaired. If there is no leak or after repair or replacement of any clutch component the hydraulic system must be bled (see below).

BLEEDING THE SYSTEM

4. To bleed the clutch hydraulic system:

NOTE

During the following procedure keep the fluid reservoir topped up to avoid introducing further air into the system. Use only the recommended type of hydraulic fluid.

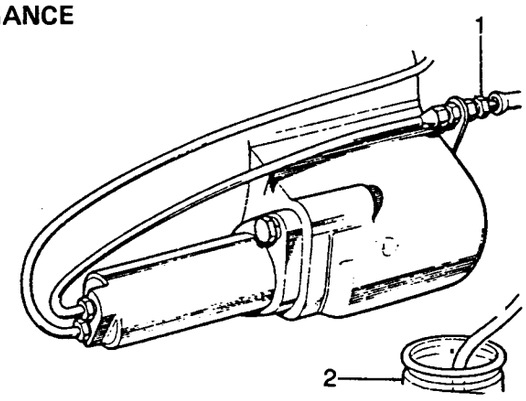


Fig H3.27

(1) Refer to Fig H3.27. Attach a length of suitable tubing to the slave cylinder bleed screw (1).

(2) Place the free end of the tube into a clean glass jar (2) containing clutch fluid.

(3) Slacken the bleed screw.

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

(5) Hold the tube free end immersed and tighten the bleed screw before starting a pedal upstroke.

SUB-SECTION CONTENTS LIST

SUB-SECTION H4

PROPELLER SHAFTS

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION H4.1

DESCRIPTION AND SPECIFICATIONS

SUB-SUB-SECTION H4.1

CHAPTER 1

DESCRIPTION

1. Two propeller shafts are fitted, one between the transfer box and the rear axle differential and the other from the transfer box to the front axle differential.

2. Both propeller shafts incorporate splined sliding portions, the front one being covered by a flexible boot.

3. The shafts are connected to the driving and driven flanges via universal joints.

SUB-SUB-SECTION H4.1

CHAPTER 2

PROPELLER SHAFT SPECIFICATIONS

INTRODUCTION

1. General data for the propeller shafts is given in Table H4.1 below. There are no torque specifications for propeller shaft components.

TABLE H4.1 - GENERAL DATA

ITEM	DESCRIPTION
Type	Hardy-Spicer, needle bearing
Diameter of tubular shaft	50,8 mm

SUB-SUB-SECTION H4.2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This sub-section deals with fault diagnosis and suggested action to cure a fault. Table H4.2 gives a list of symptoms, the probable cause and necessary remedial action. The Table is not exhaustive and faults may occur which are not listed. In this case the suspected components should be removed for closer inspection and/or overhaul.

TABLE H4.2 - PROPELLER SHAFTS FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Vibrating propellor shaft	Fixings loose. Incorrectly assembled propellor shaft. Worn needle roller bearings. Worn splines. Shaft out of balance.	Tighten the fixings evenly and securely. Reassemble propellor shaft correctly aligned. Fit new bearings. Fit new propeller shaft complete. Fit new propellor shaft complete.
Noisy universal joints	Lack of lubrication. Fixing loose. Worn needle roller bearings. Worn splines.	Lubricate propellor shaft. Tighten the fixings evenly and securely. Fit new bearings. Fit new propellor shaft complete.

SUB-SUB-SECTION H4.3

PROPELLER SHAFTS - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove a propeller shaft:

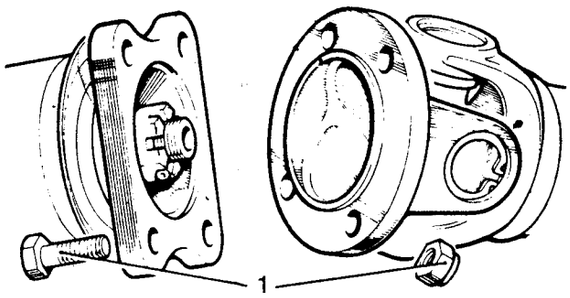


Fig H4.1

(1) Refer to Fig H4.1. Remove the bolts and lock nuts (1) from the coupling flanges at both ends of the shaft.

(2) Withdraw the shaft.

REPLACEMENT

2. Replace a propeller shaft as detailed below:

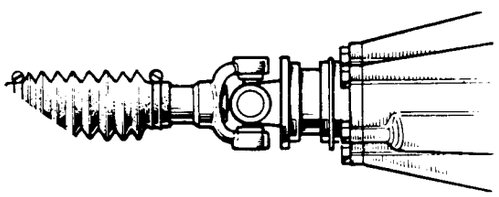


Fig H4.2

(1) **Front propeller shaft:** Refer to Fig H4.2. Locate the shaft in position with the sleeve end towards the front axle.

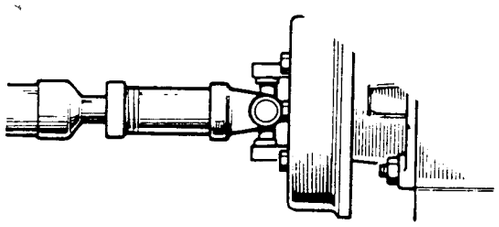


Fig H4.3

(2) **Rear propeller shaft:** Refer to Fig H4.3. Locate the shaft in position with the sleeve end towards the gearbox.

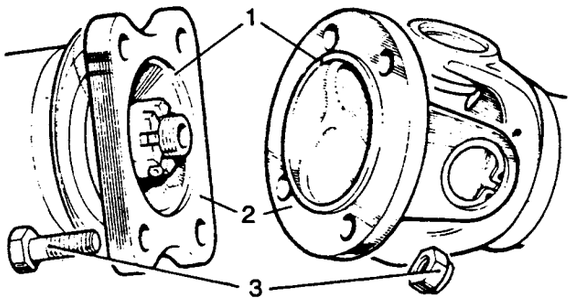


Fig H4.4

(3) **Both shafts:** Refer to Fig H4.4. Ensure that the registers (1) on the coupling flanges (2) engage.

(4) Secure the coupling flanges with the four bolts and locknuts (3).

SUB-SUB-SECTION H4.4

OVERHAUL PROCEDURES

DISMANTLING

1. To dismantle a propeller shaft:

   (1) Remove the propeller shaft (see Sub-sub-section H4.3).

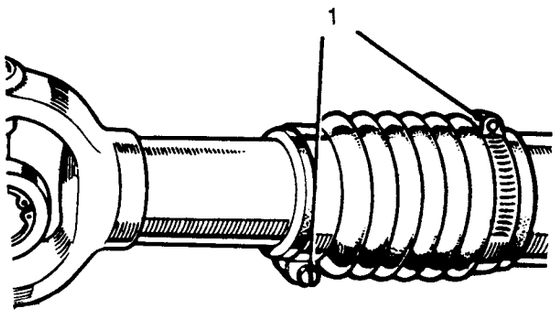


Fig H4.5

   (2) **Front propeller shaft:** Refer to Fig H4.5. Release the two hose clips (1) and slide the rubber boot along the propeller shaft.

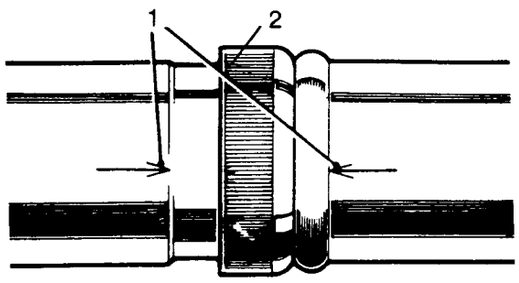


Fig H4.6

   (3) **Both shafts:** Refer to Fig H4.6. Check that the alignment marks (1) on the splined sleeve and the splined shaft are clearly visible. If necessary inscribe new alignment marks.

   (4) Unscrew the dust cap (2).

   (5) Withdraw the splined sleeve.

   (6) Clean the splined shaft and the splined sleeve in a grease solvent.

   (7) Temporarily locate the splined shaft into the sleeve, maintaining the marked alignment.

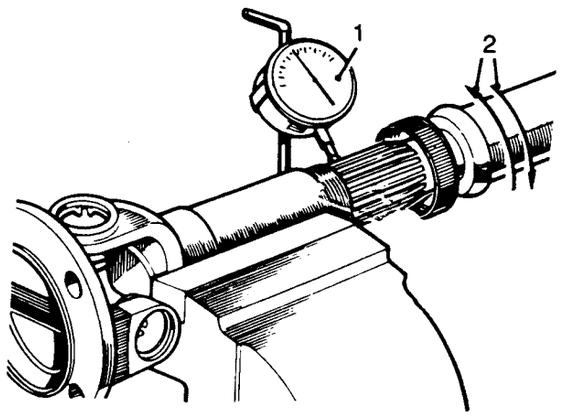


Fig H4.7

   (8) Refer to Fig H4.7. Secure the shaft in a vice.

   (9) Mount a test dial indicator (1) to read off the outside diameter of the shaft splines.

   (10) Check the circumferential movement (2) between the sleeve and shaft. If the movement exceeds 0,1 mm fit a new propeller shaft complete.

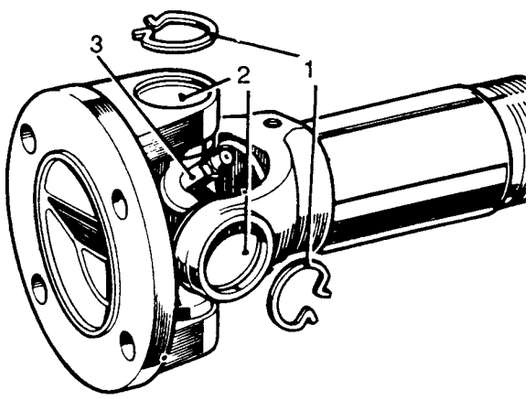


Fig H4.8

   (11) Refer to Fig H4.8. Clean any dirt and enamel from the circlips (1) and the tops of the bearing races (2).

   (12) Remove the circlips.

(13) Remove the grease nipple (3) from the universal joint.

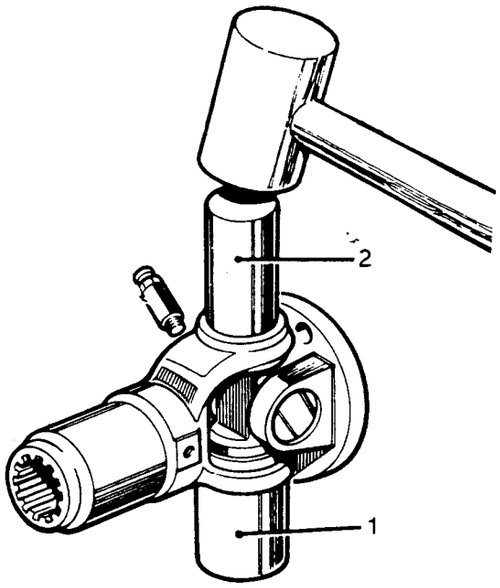


Fig H4.9

(14) Refer to Fig H4.9. Locate the yoke of the splined sleeve onto a suitable piece of tube (1) which has a slightly larger internal diameter than the journal bearing.

(15) Using a brass drift (2) drive the universal joint downwards until it is clear of the lower yoke.

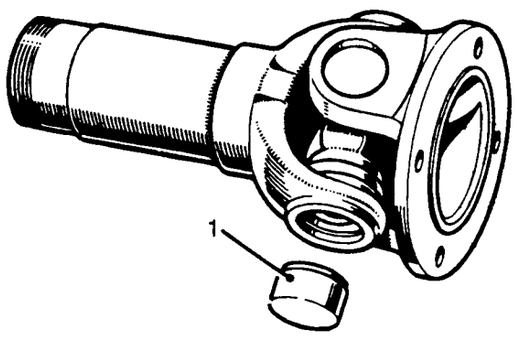


Fig H4.10

(16) Refer to Fig H4.10. Lift the sleeve clear of the tube and withdraw the bearing (1) downwards to avoid dropping the needle rollers.

(17) Repeat steps (14) to (16) for the opposite bearing.

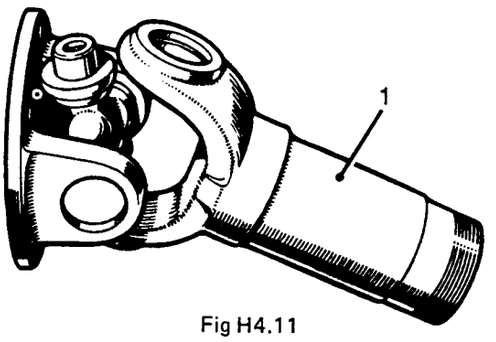


Fig H4.11

(18) Refer to Fig H4.11. Withdraw the splined sleeve (1) from the flanged yoke.

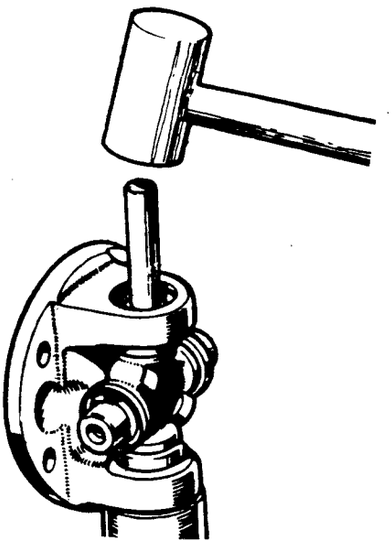


Fig H4.12

(19) Refer to Fig H4.12. Remove the bearings from flanged yoke.

(20) Repeat steps (14) to (19) for the splined shaft.

INSPECTING

2. Clean all components in a grease solvent and allow to dry. Make the following inspection:

(1) Examine all components for obvious wear and damage.

(2) If the journal or bearings for the universal joints show any signs of wear, load markings or distortion they must be replaced complete. Replacement journal assemblies comprise a spider complete with oil seals and bearings.

(3) In the event of wear in any of the eight yoke cross holes, rendering them oval, a new propeller shaft complete must be fitted.

REASSEMBLY

3. Reassemble the propeller shaft as detailed below:

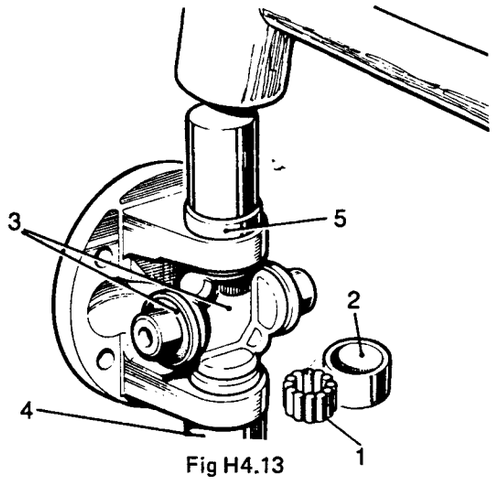


Fig H4.13

(1) Refer to Fig H4.13. Assemble the needle rollers (1) in the bearing races (2). If necessary, use a smear of vaseline to retain them in place.

(2) About half fill the races with a recommended grease.

(3) Insert the journal (3), complete with seals, into the flange yoke holes with the grease nipple tapping pointing away from the flange.

(4) Place the flanged yoke on a suitable flat support (4).

(5) Place the first bearing (5) in position.

(6) Using a brass drift slightly smaller in diameter than the hole in the yoke, tap the bearing into position.

(7) Fit the circlip to retain the bearing.

NOTE
The bearing outer races must be a drive fit, otherwise fit a new propeller shaft complete.

(8) Repeat steps (4) to (7) for the other three bearings comprising the universal joint.

(9) Ensure that all four circlips are firmly located in their grooves. If a joint appears to bind, tap the yoke ears lightly with a soft mallet.

(10) Repeat steps (1) to (9) for the other universal joint.

(11) **Front propeller shaft:** Slide the rubber boot and hose clips over the splined shaft.

(12) **Both propeller shafts:** Liberally smear the splines of the shaft and sleeve with the recommended grease.

(13) Assemble the splined shaft and sleeve, maintaining the marked alignment.

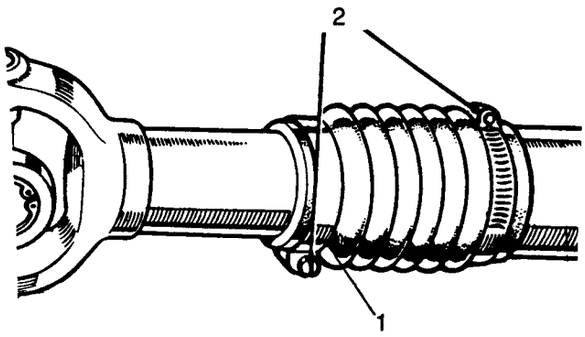


Fig H4.14

(14) **Front propeller shaft:** Refer to Fig H4.14. Place the rubber boot (1) in position and secure the hose clips (2) 180° to each other to maintain balance.

(15) **Both propeller shafts:** Fit the grease nipple to the universal joints and lubricate.

CAUTION
Do not fill the sliding joint with grease, use only sufficient to lubricate the splines otherwise hydraulicking will result.

(16) Refit the propeller shafts (see Sub-sub-section H4.3).

SUB-SUB-SECTION H4.5

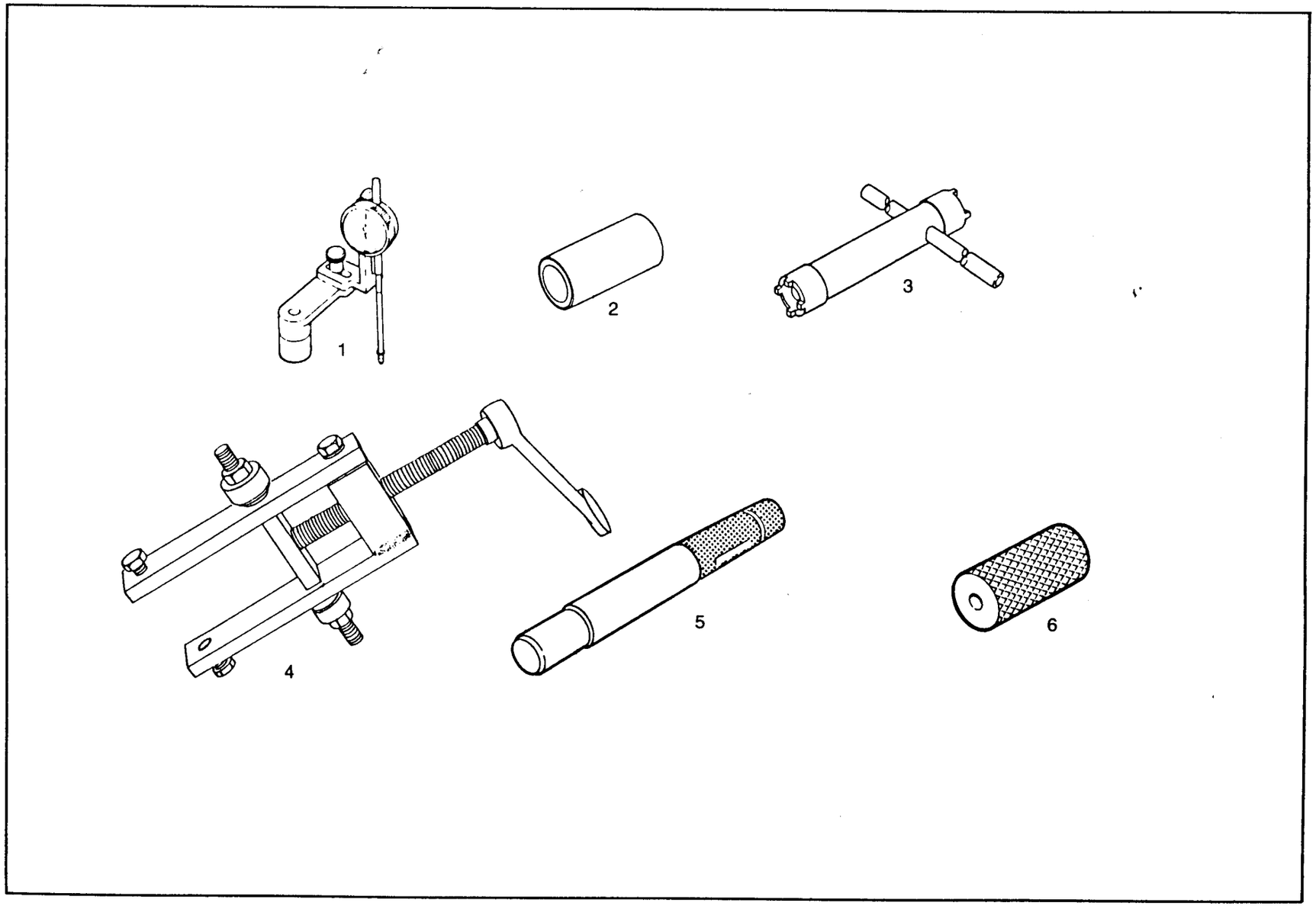
MAINTENANCE

INTRODUCTION

1. The propeller shafts and universal joints fitted to this vehicle are virtually maintenance free. They should be inspected periodically for wear and deterioration and grease should be applied at regular intervals.

2. Note that the cavity between the sliding portion and the universal joint must not be packed with grease since damage may be caused to the shafts or bearings of connected assemblies.

SPECIAL WORKSHOP TOOLS FOR SECTION H - TRANSMISSION



SPECIAL WORKSHOP TOOLS FOR SECTION H - TRANSMISSION

Item Ref	Mfr. Part No. & / or Drg.No. &/or Spec. No.	I. C. N.	Item Name and Description	Items/ Unit	Repair Lines
Item Verw.	Verv. Ond. Nr. & / of Tek.Nr. &/of Spes.Nr.	I. B. N.	Itemnaam en Beskrywing	Items/ Eenhd.	Herstel Lyne 1 2 4
1	18G191		DIAL GAUGE and SUPPORT to measure layshaft constant gear end play		
2	243241		PROTECTION CAP, GEARBOX OUTPUT SHAFT to prevent thread damage		
3	600300		DOUBLE ENDED SPANNER for removing mainshaft shaft nut		
4	RO1004		REMOVER for removing mainshaft spacer		
5	18G79SA		TOOL for centralising clutch		
6	262772		TOOL for removing the intermediate shaft		

SECTION CONTENTS LIST

SECTION I

SUSPENSION SYSTEM

SUB-SECTION CONTENTS LIST

SUB-SECTION I1

DESCRIPTION AND SPECIFICATIONS

SUB-SECTION I1

CHAPTER 1

DESCRIPTION OF THE SUSPENSION SYSTEM

GENERAL

1. The Land Rover is a four wheel drive vehicle, therefore the drive must be transmitted to two axles, front and rear.

2. The front axle combines the function of the steering and driving unit. A differential, similar to that fitted to the rear axle, accepts the power input from the propeller shaft connected to the front of the transfer box and transmits it via a universally jointed shaft to the front wheels. Steering and braking functions are accomplished by swivelling stub axles mounted in housings.

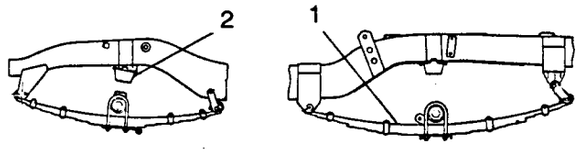


Fig I1.1

3. The suspensions, front and rear, are by semi-elliptical leaf springs (1) damped by hydraulic dampers mounted between axle and chassis frame. Differential units are fitted to both front and rear axles.

4. Rubber shock absorbers (2) prevent excessive upward travel of the axles against the springs.

SUB-SECTION I1

CHAPTER 2

SPECIFICATIONS FOR THE SUSPENSION SYSTEM

INTRODUCTION

1. The specifications are given in the following Tables:

   TABLE I1.1 - GENERAL DATA
   TABLE I1.2 - TORQUE SPECIFICATIONS

TABLE I1.1 - GENERAL DATA

ITEM	DESCRIPTION
Type of springs	Semi eliptical leaf
Number of leaves:	
Front	4
Rear	8
Free camber:	
Front springs	150 mm
Rear springs	170 mm
Shock absorbers	Double acting, hydraulic telescopic type. Non adjustable

TABLE I1.2 - TORQUE SPECIFICATIONS

ITEM	TORQUE (N.m)
Shackle pins	96
'U' bolt nuts	50 to 60

SUB-SECTION I2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This Sub-section deals with fault diagnosis and the corrective action required for the suspension. In Table I2.1, a list of symptoms, the probable cause and the necessary remedies are given. If a fault is suspected, the faults listed in the accompanying Table should be consulted. It should be remembered that the Table is not exhaustive and, therefore, faults may occur which are not listed. Should this fail to reveal the fault, remove the suspect component/s for a closer inspection and/or overhaul of components.

TABLE I2.1 - SUSPENSION FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Vehicle leaning to one side	Broken main leaf spring. Spring/s sagged (collapsed). Heavy load not centralised on load body.	Replace leaf spring. Replace complete spring/s. Educate loading personnel.
Poor directional (stability) control	Leaf clip bolts loose. Shock absorber/s leaking. Shock absorber mounting bracket broken. Broken centre bolt/s.	Replace worn or damaged bolts then torque tighten the bolts. Replace shock absorber/s. Replace mounting bracket. Replace centre bolt/s.
Bumpy (harsh) ride	Shock absorber seized or bent. Vehicle overloaded. Springs sagged (collapsed).	Replace shock absorber. Educate loading personnel. Replace complete spring.
Vehicle leaning excessively during cornering	Spring/s sagged (collapsed). Vehicle overloaded.	Replace complete spring/s. Educate loading personnel.

SUB-SECTION CONTENTS LIST

SUB-SECTION I3

CHECKS AND ADJUSTMENTS

SUB-SECTION I3

CHAPTER 1

CHECKING TRIM HEIGHT

GENERAL

1. The road springs differ in spring rating according to their fitting position and no adjustment is provided. An incorrect replacement spring or incorrect fitting procedure can adversely affect the vehicle trim; check before replacing parts.

CHECKING PROCEDURE

2. Check trim height as follows:

(1) Position the vehicle on firm level ground.

(2) Ensure that the vehicle is in the static, unladen weight condition, that is with a full coolant and lubrication system and 22,5 litres of fuel.

(3) Check and if necessary adjust tyres to recommend pressures.

3. Where the measurements are not within these limits:

(1) Check that the correct springs are fitted. The spring part number is marked on the spring top face and also on the underside of one of the leaves.

(2) If the springs are correct, jack up the vehicle and take the weight off the road springs.

(3) Remove the shackle pins and ensure that they are a free fit in the shackle plate threads and not binding in the shackle pin bushes. Lubricate or polish to achieve this condition.

(4) Deflect the springs and torque the pins as detailed in Sub-section I3, Chapter 2.

(5) Lower the vehicle and recheck trim height.

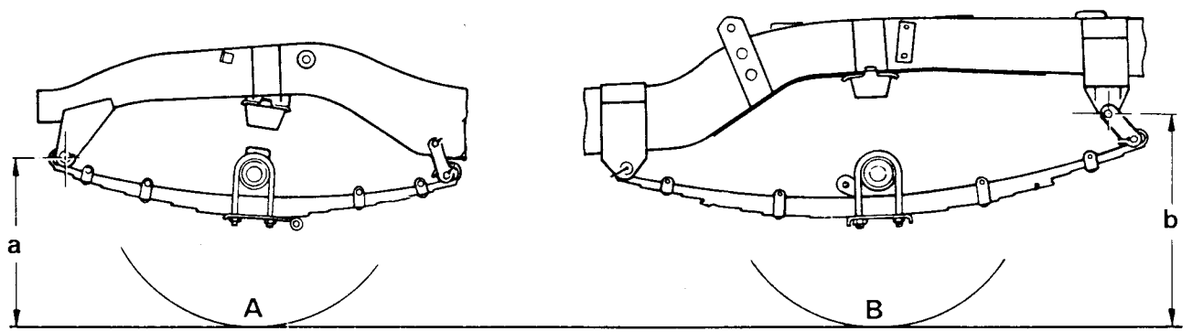


Fig I3.1

(4) Refer to Fig I3.1. Measure the distance from the ground to the shackle pin centres on both front and both rear wheels (measurements 'a' for the front wheels and 'b' for the rear wheels). The two 'a' measurements shall be the same to within 25 mm. The two 'b' measurements shall be the same to within 25 mm.

SUB-SECTION I3

CHAPTER 2

SPRING SETTING PROCEDURE

GENERAL

1. In the following procedure, the spring shackles are tightened onto the shackle bushes whilst in their approximate working positions thus minimising the torque load on the shackle bush rubbers when the vehicle weight is taken on the springs and so prolonging the bush working life.

SETTING

2. This operation should normally be carried out during the replacement of a spring (see Sub-section I4, Chapter 1).

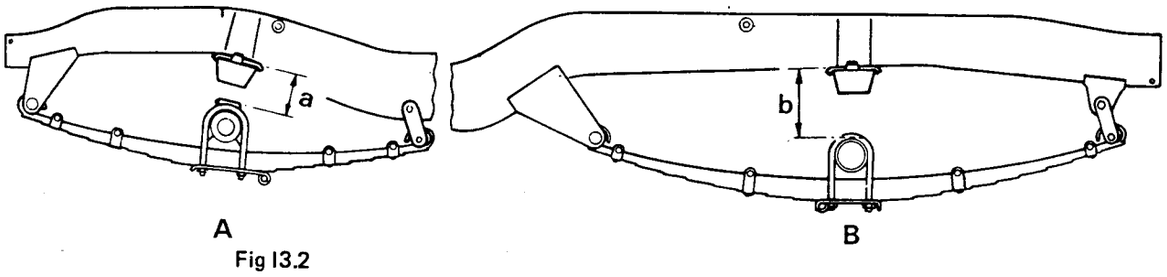


Fig I3.2

(1) Refer to Fig I3.2. Deflect the spring (A front spring, B rear spring) toward the chassis, using a suitable chain and lever, until the following dimensions are obtained.

Front springs - 95 mm (dimension 'a')
Rear springs - 151 mm (dimension 'b')

(2) With the springs held in position, tighten first the shackle pin then the locknut. Torque 96 N.m.

(3) Replace the springs as in Sub-section I4, Chapter 1, para 2, step (8) onwards.

SUB-SECTION I3

CHAPTER 3

CHECKING SHOCK ABSORBER OPERATION

1. To check a shock absorber:

   (1) Remove the shock absorber from the vehicle (see Sub-section I4, Chapter 2).

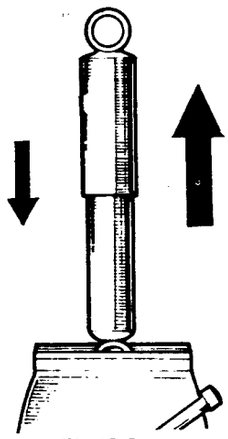


Fig I3.3

   (2) Refer to Fig I3.3. Secure the shock absorber vertically in a vice by holding the bottom fixing between the jaws.

   (3) The shock absorber incorporates differential damping, having greater resistance on the extension stroke. Check the operation by extending and compressing the shock absorber, there must be a uniform resistance throughout the length of the stroke. If the resistance is erratic or weak, fit a new shock absorber.

SUB-SECTION CONTENTS LIST

SUB-SECTION I4

REMOVAL AND REPLACEMENT PROCEDURES

SUB-SECTION I4

CHAPTER 1

ROAD SPRINGS - REMOVAL AND REPLACEMENT

NOTE

The following removal and replacement procedures apply to both the front and rear road springs.

REMOVAL

1. To remove a road spring:

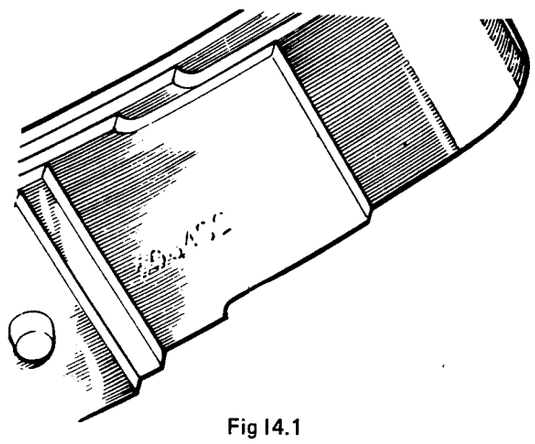


Fig I4.1

(1) Refer to Fig I4.1. The driver side and passenger side road springs are interchangeable. Springs are identified with the part number which is marked on the top face and on the under face of one of the leaves.

(2) Jack up the vehicle and support on stands.

(3) Remove the road wheel.

(4) Support the axle with a jack.

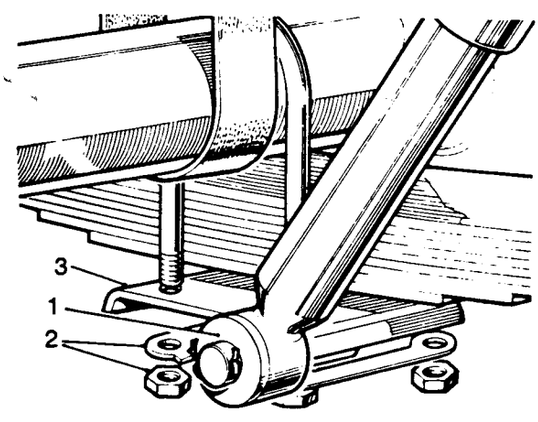


Fig I4.2

(5) Refer to Fig I4.2. Disconnect the shock absorber (1) at the lower fixings.

(6) Remove the fixings (2) and withdraw the spring support plate (3).

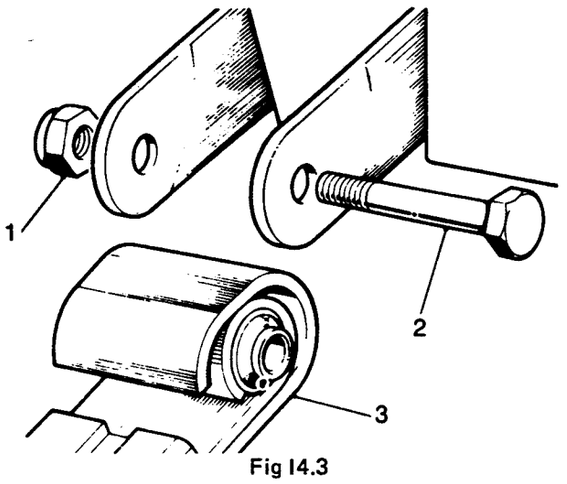


Fig I4.3

(7) Refer to Fig I4.3. Remove the self-locking nut (1) from the shackle pin in each spring eye.

(8) Remove the shackle pin (2) from the rear end of the spring, the pin is threaded into the inner shackle plate.

(9) Remove the shackle pin from the front end of the spring.

(10) Remove the road spring (3) complete.

REPLACEMENT

2. Replace the road spring:

(1) Slacken the shackle pin securing the shackle plates to the chassis.

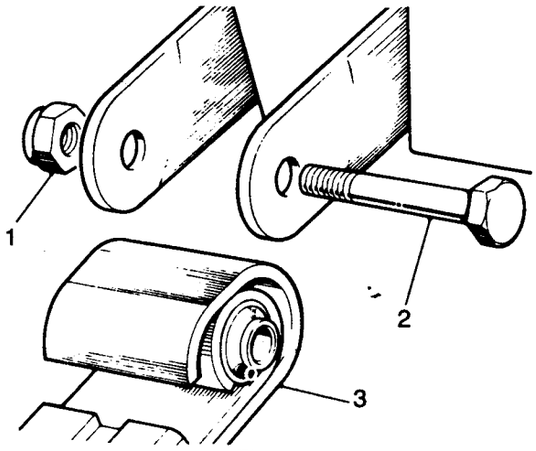


Fig 14.4

(2) Refer to Fig 14.4. Fit the road spring (3) into the shackles.

(3) Replace the shackle pin in the front end of the spring but do not tighten at this stage.

(4) Replace the shackle pin (2) into the rear end of the spring but again do not tighten.

(5) Screw on the self-locking nut (1) finger tight.

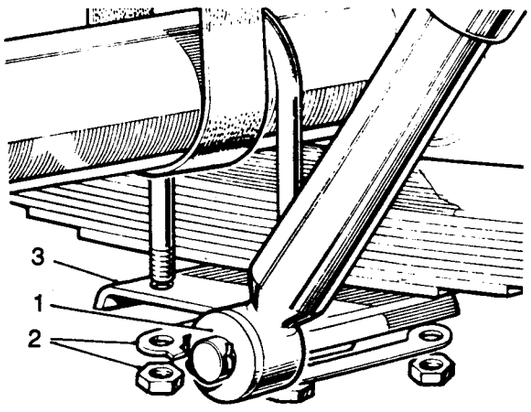


Fig 14.5

(6) Refer to Fig 14.5. Replace the spring support plate (3) and tighten the fixings (2).

(7) Set the springs as in Sub-section 13, Chapter 2.

(8) Reconnect the shock absorber (1) lower fixings.

(9) Refit the road wheel.

(10) Remove the stand and lower the vehicle to the ground.

(11) Check vehicle trim height (see Sub-section 13, Chapter 1).

SUB-SECTION 14

CHAPTER 2

SHOCK ABSORBERS - REMOVAL AND REPLACEMENT

NOTE
Shock absorber fixings for both the front and rear suspension are the same. The following procedure is to be used for either.

REMOVAL

1. To remove a shock absorber:

   (1) Slacken the fixings at the road wheel.

   (2) Jack up the front of the vehicle and support on stands.

   (3) Remove the road wheel.

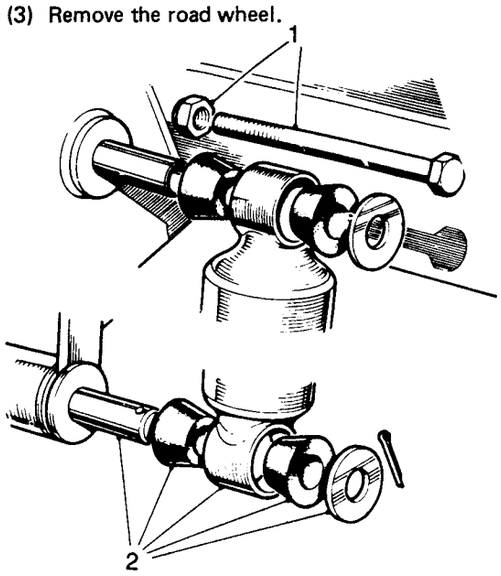


Fig 14.6

   (4) Refer to Fig 14.6. Remove the shock absorber top fixings (1).

   (5) Remove the lower fixings (2).

   (6) Remove the shock absorber.

REPLACEMENT

2. Replace a shock absorber as follows:

   (1) Fit the shock absorber in position and replace the lower fixings.

   (2) Extend or compress the shock absorber as required and replace the top fixings.

   (3) Replace the road wheel.

   (4) Remove the stands and lower the vehicle to the ground.

SUB-SECTION I5

OVERHAUL OF A ROAD SPRING ASSEMBLY

DISMANTLING

1. To dismantle a road spring:

   (1) Remove the spring assembly (see Sub-section I4, Chapter 1).

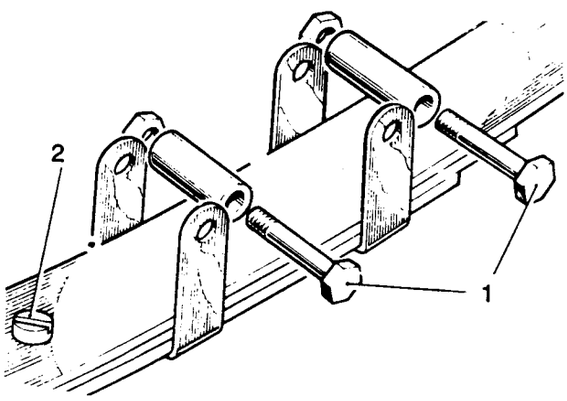


Fig I5.1

   (2) Refer to Fig I5.1. Remove the fixings (1) from the leaf clips, which may be bolts and nuts and/ or long screws threaded into the leaf clips.

   (3) Remove the centre bolt (2) and nut to release the spring leaves.

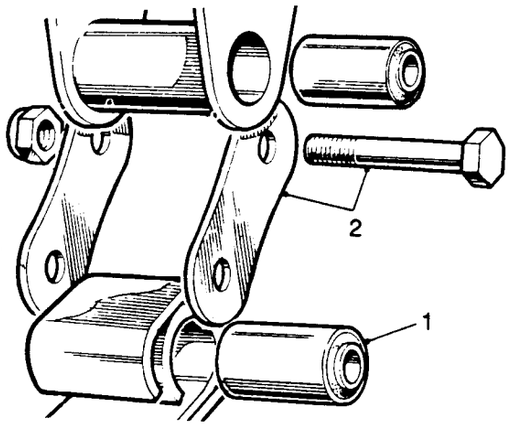


Fig I5.2

   (4) Refer to Fig I5.2. Remove the fixings and withdraw the shackle plates (2) from the chassis frame.

   (5) Press out the bushes (1) from each end of the spring. It is recommended that special tool MF109 is used for this operation.

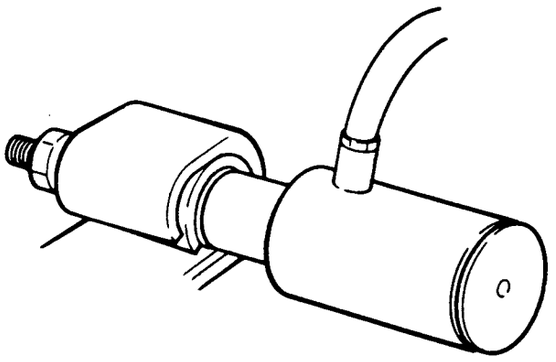


Fig I5.3

   (6) Refer to Fig I5.3 which shows the use of the special tool.

   (7) If necessary, remove the shackle bush from the chassis frame bracket with the aid of a tubular drift or suitable extractor. If the bush disintegrates, leaving the outer casing in the chassis frame bracket, it should be carefully sawn through with a hacksaw to facilitate removal. DO NOT saw the chassis bracket.

INSPECTING

2. Make the following inspection:

   (1) Clean the leaves and examine for cracks. Only the main and second leaves and the spring assembly complete are supplied as a replacement.

   (2) The recambering of road springs is not advised, but if no alternative is possible, the spring should be reset if necessary.

REASSEMBLY

3. Reassemble as follows:

   (1) If removed, fit the shackle bush to the chassis frame bracket. The bush must be a drive fit.

   (2) Grease each leaft with graphite grease and reassemble the spring by fitting the centre bolt and leaf clips. Fit the spring bushes, which must be a press fit.

   (3) Fit the shackle plates to the chassis frame, but do not fully tighten the fixings until the spring is refitted to the vehicle.

SUB-SECTION I6

MAINTENANCE

INTRODUCTION

1. The suspension system is designed for maintenance free operation, requiring only periodic inspections for obvious defects. At intervals specified, the suspension should be inspected and leaf clip bolts checked for tightness.

CLEANING

2. At frequent intervals, depending on operating conditions, the springs and shackles should be cleaned to prevent accumulation of dirt, mud and oil, etc. Dirt and mud must be scraped off with a scraper and then blown off with compressed air. Oil must be wiped off with a dry cloth. Do not use cleaning fluid on springs as it will wash out the lubricant between spring leaves and thus change the characteristics of the spring.

CHECKS AND INSPECTIONS

3. The suspension of a vehicle operating continously on normal smooth roads should be inspected for damage or wear every ten throusand kilometres. Vehicles operating under off-road conditions should be inspected every two thousand kilometres.

4. Visual inspection of suspension. To inspect the suspension the vehicle must be unloaded and parked on a level surface. The following points should be inspected periodically:

(1) Inspect shock absorbers for signs of seals leaking.

(2) Inspect shock absorbers for signs of collapsed or cracked insulator rubber bushes.

(3) Check if shock absorber shafts are bent.

(4) Inspect springs for broken leaves.

(5) Check for sagged (collapsed) springs.

(6) Check for broken centre bolts.

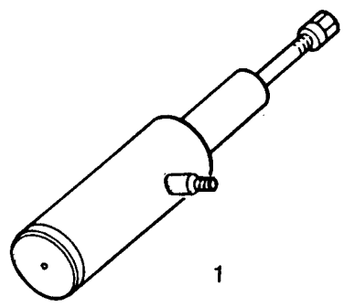
(7) Using a torque wrench check tightness of leaf clip bolts and nuts.

(8) Using a torque wrench check tightness of shackle pins.

(9) Using a torque wrench check tightness of 'U' bolt nuts.

5. If, during the inspection, any defects are noted, they must be corrected before the vehicle is put back into service.

SPECIAL WORKSHOP TOOLS FOR SECTION I - SUSPENSION



1

SECTION CONTENTS LIST

SECTION J

AXLES AND HUBS

SUB-SECTION CONTENTS LIST

SUB-SECTION J1

AXLES AND HUBS

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION J1.1

DESCRIPTION AND SPECIFICATIONS

SUB-SUB-SECTION J1.1

CHAPTER 1

DESCRIPTION OF AXLES AND HUBS

GENERAL

1. The front and rear axles are driving axles, ie the axle drives the road wheels through a differential unit located in the axle housing. The drive is transmitted from the transfer box to the differential unit by propeller shafts.

2. The axles are each secured to two leaf springs by U-bolts. The drive transmitted to the front and rear axles can be considered in two parts:

   a. The centre portion containing the differential unit.

   b. The hub portion containing the brakes on both axles. The front hubs are mounted on swivel housings for steering.

3. The drive to the front axle is not in constant mesh and can be disconnected. The vehicle will then be driven by the rear axle only.

4. The rear axle is in constant mesh and, therefore, is always engaged.

5. The wheel hubs are mounted on the supporting axle tubes, each hub being supported by two lubricated tapered bearings. The drive hub carries the brake drum and road wheel.

SUB-SUB-SECTION J1.1

CHAPTER 2

AXLE AND HUB SPECIFICATIONS

INTRODUCTION

1. The specifications for the axles and hubs are given in the following Tables:

   TABLE J1.1 - GENERAL DATA
   TABLE J1.2 - TORQUE SPECIFICATIONS

TABLE J1.1 - GENERAL DATA

ITEM	DESCRIPTION
Rear axle:	
Type	Salisbury, spiral bevel, floating shafts
Ratio	4,7:1
Front axle:	
Differential	Spiral bevel
Front wheel drive	Enclosed universal joints
Ratio	4,7:1

TABLE J1.2 - TORQUE SPECIFICATIONS

ITEM	TORQUE (N.m)
Rear axle and final drive:	
Hub driving flange bolts	39
Salisbury type axles:	
Differential case bolts	91 to 104
Crownwheel bolts	130 to 145
Differential bearing cap bolts	129 to 145
Differential cover bolts	28 to 35
Front axle and final drive:	
Hub driving flange bolts	39
Hub driving flange nut	14 to 20
Bevel pinion driving flange nut	117,5
Crownwheel bolts (10 mm approx.) diameter	62
(9,5 mm approx.) diameter	48
Differential bearing cap bolts	83

SUB-SUB-SECTION J1.2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This Sub-sub-section deals with faults diagnosis and the corrective action required for the driven front axle. In Table J1.3, a list of symptoms the probable cause and the necessary remedies are given. If a fault is suspected, the faults listed in the accompanying Table should be consulted. It should be remembered that the Table is not exhaustive and, therefore, faults may occur which are not listed. Should this fail to reveal the fault, remove the suspect component/s for a closer inspection and/or overhaul of components.

TABLE J1.3 - DRIVEN FRONT AXLE FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Noisy axle (hub)	Shaft bearings damaged or worn. Damaged or worn wheel bearings. Insufficient grease in hub. Loose wheel bearings.	Replace. Replace. Clean and regrease. Adjust.
Hub overheating	Insufficient grease in hub. Wheel bearings too tight.	Clean and regrease. Adjust.
Hub leaking grease	Inner or outer seals worn or damaged.	Replace.
Steering effort excessive	Seized or damaged swivel pin needle bearings. Lack of lubrication.	Overhaul the swivel pin assemblies. Lubricate with grease and check the steering effort.
Axle leaking oil	Shaft axle seal worn or damaged.	Replace.

SUB-SUB-SECTION J1.3

HUB BEARINGS END FLOAT - CHECK AND ADJUST

NOTE

The following procedure applies to both front and rear hub bearings.

REMOVAL

1. Carry out the procedure in Sub-sub-section J1.4, Chapter 6, para 1, steps (1) to (8) to remove the brake drum and hub driving member.

CHECKS AND ADJUSTMENTS

2. Carry out the following procedure.

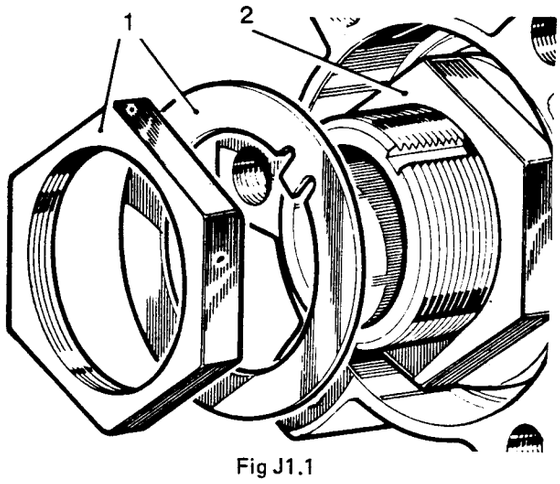


Fig J1.1

(1) Refer to Fig J1.1. Remove the locknut and lockwasher (1) from the hub.

(2) Spin the hub vigrously, causing the bearing roller to settle in the tapered races, producing maximum end-float conditions.

(3) Tighten the adjuster nut (2) sufficient only to take up any obvious end-float. It is necessary to spin the hub every time before checking the end-float, as moving the hub laterally will settle the rollers, affecting the measureable end-float.

(4) Fit the lockwasher and nut, tighten the nut but do not engage the lockwasher.

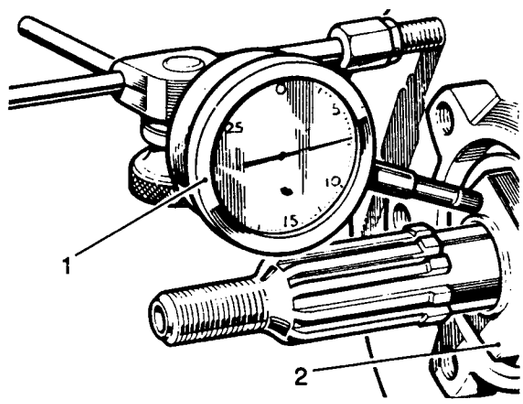


Fig J1.2

(5) Refer to Fig J1.2. Using a dial test indicator (1), check the end-float of the hub, which must be 0,05 to 0,10 mm.

(6) If the hub end-float is not within the permitted limits, remove the locknut and washer (2) and readjust the inner nut. Fit the lockwasher, tighten the locknut and recheck the end-float.

(7) When the end-float is correct, engage the lockwasher.

REPLACEMENT

3. Replace the assembly by carrying out the procedure of Sub-sub-section J1.4, Chapter 6, para 2, steps (5) to (11).

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION J1.4

REMOVAL AND REPLACEMENT PROCEDURES

SUB-SUB-SECTION J1.4

CHAPTER 1

REAR AXLE SHAFTS - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove a rear axle shaft as follows:

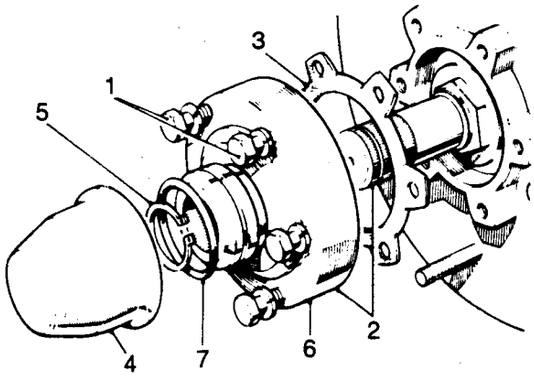


Fig J1.3

(1) Refer to Fig J1.3. Remove the hub driving member fixings (1).

(2) Withdraw the driving member and axle shaft complete (2).

(3) Withdraw the joint washer (3).

(4) Prise off the hub cap (4).

(5) Remove the circlip (5).

(6) Withdraw the driving member (6) from the shaft.

(7) Withdraw the O-ring seal (7).

REPLACEMENT

2. To replace an axle shaft:

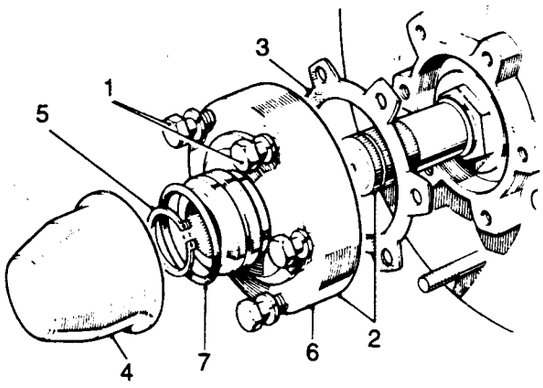


Fig J1.4

(1) Refer to Fig J1.4. Replace the O-ring seal (7).

(2) Fit the driving member (6) to the shaft.

(3) Refit the circlip (5).

(4) Replace the hub cap (4).

(5) Fit a new joint washer (3).

(6) Replace the driving member and axle shaft complete (2).

(7) Tighten the hub driving member fixings (1).

SUB-SUB-SECTION J1.4

CHAPTER 2

REAR AXLE ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the rear axle assembly:-

   (1) Slacken the fixings at both rear wheels.

   (2) Jack up the rear of the vehicle and support on stands.

   (3) Remove both rear road wheels.

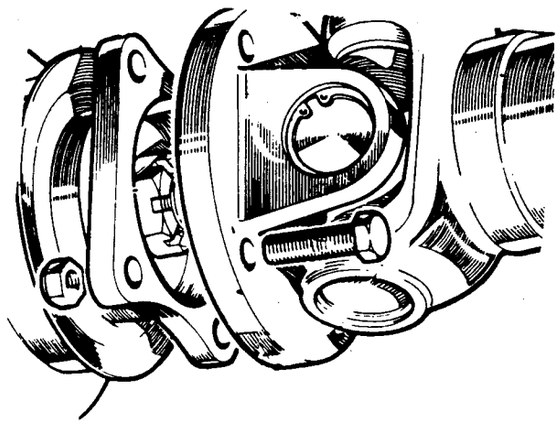


Fig J1.5

   (4) Refer to Fig J1.5. Disconnect the rear propeller shaft and move it clear of the final drive unit.

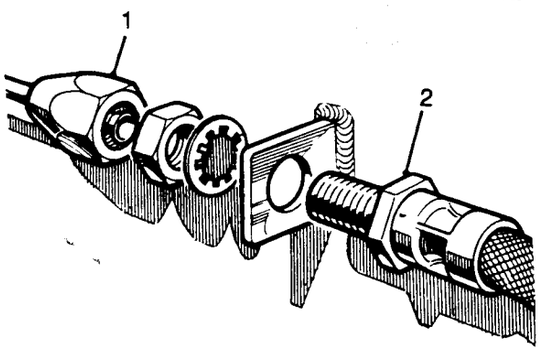


Fig J1.6

   (5) Refer to Fig J1.6. Disconnect the rear brake pipe (1) at the connection with the flexible hose.

   (6) Withdraw the flexible hose (2) from the chassis bracket.

   (7) Depress the brake pedal and wedge in that condition to minimise brake fluid loss.

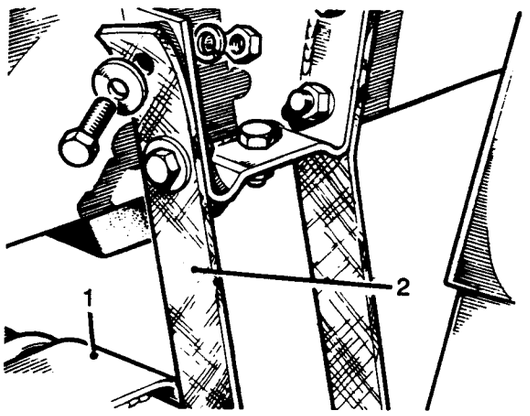


Fig J1.7

   (8) Refer to Fig J1.7. Support the axle, using a jack (1).

   (9) Disconnect one end of each axle check strap (2).

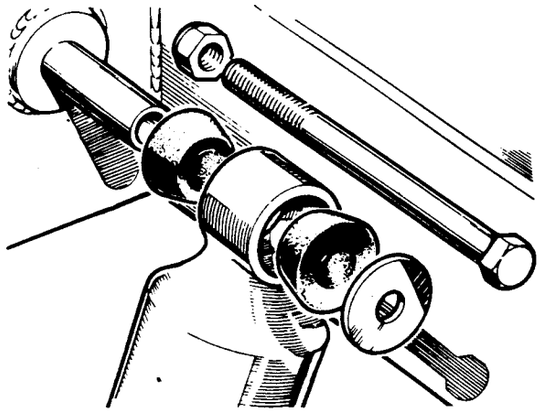


Fig J1.8

   (10) Refer to Fig J1.8. Disconnect the shock absorbers at the upper fixings.

SUB-SUB-SECTION J1.4

CHAPTER 1

REAR AXLE SHAFTS - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove a rear axle shaft as follows:

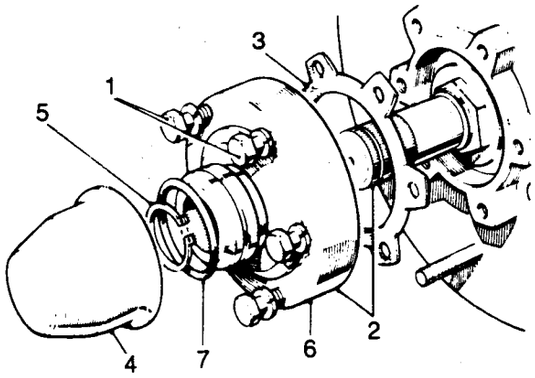


Fig J1.3

(1) Refer to Fig J1.3. Remove the hub driving member fixings (1).

(2) Withdraw the driving member and axle shaft complete (2).

(3) Withdraw the joint washer (3).

(4) Prise off the hub cap (4).

(5) Remove the circlip (5).

(6) Withdraw the driving member (6) from the shaft.

(7) Withdraw the O-ring seal (7).

REPLACEMENT

2. To replace an axle shaft:

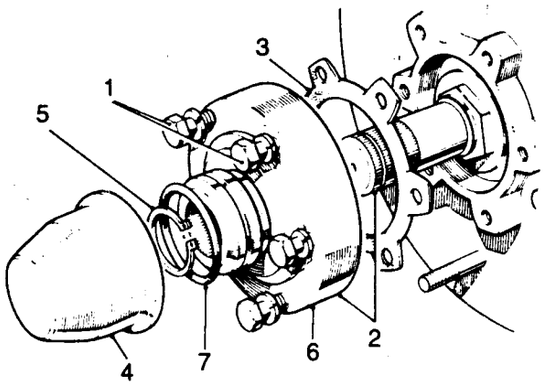


Fig J1.4

(1) Refer to Fig J1.4. Replace the O-ring seal (7).

(2) Fit the driving member (6) to the shaft.

(3) Refit the circlip (5).

(4) Replace the hub cap (4).

(5) Fit a new joint washer (3).

(6) Replace the driving member and axle shaft complete (2).

(7) Tighten the hub driving member fixings (1).

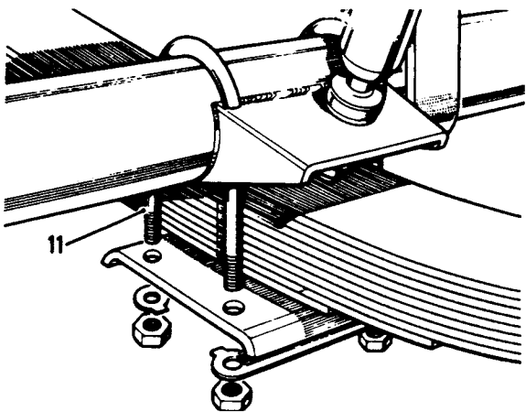


Fig J1.9

(11) Refer to Fig J1.9. Remove the four U-bolts from the axle.

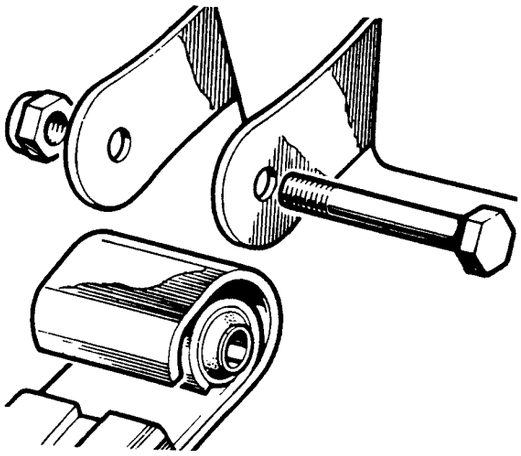


Fig J1.10

(12) Refer to Fig J1.10. Slacken the six shackle pins at the rear road springs, then remove the two rearmost shackle pins.

(13) Lower and withdraw the rear axle.

REPLACEMENT

2. Replace the rear axle assembly as follows:

(1) Lift and position the rear axle.

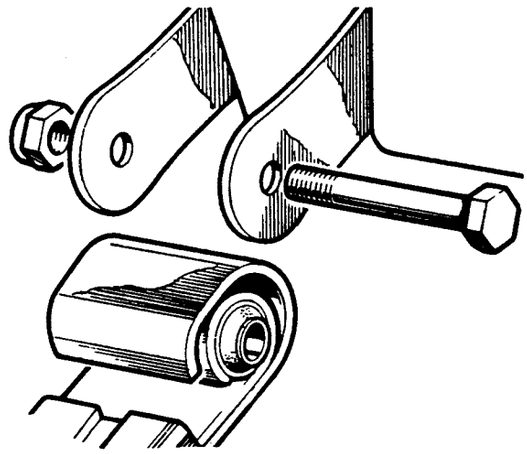


Fig J1.11

(2) Refer to Fig J1.11. Fit the two rearmost shackle pins but do not tighten any of the six shackle pins at this stage.

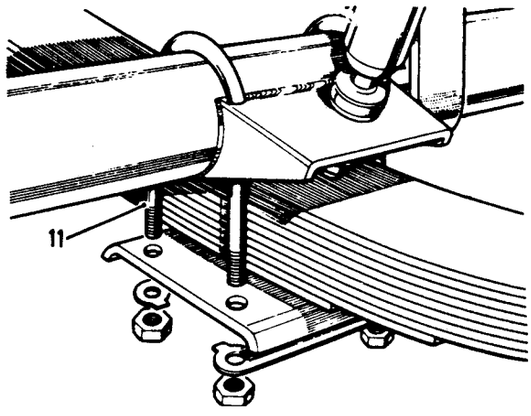


Fig J1.12

(3) Refer to Fig J1.12. Replace the four U-bolts.

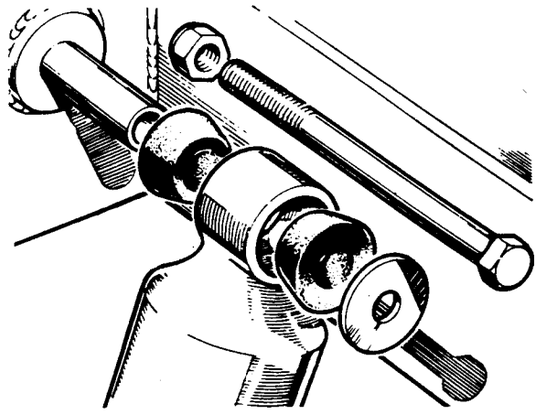


Fig J1.13

(4) Refer to Fig J1.13. Refit the shock absorbers and tighten the fixings.

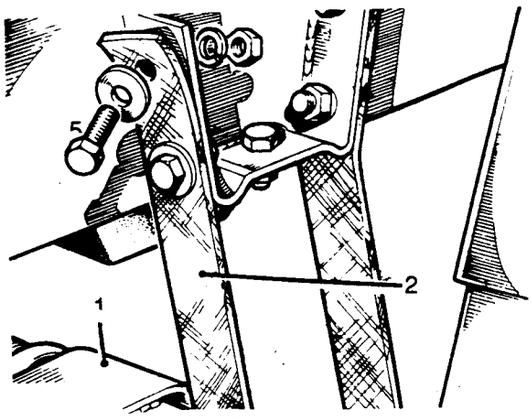


Fig J1.14

(5) Refer to Fig J1.14. Reconnect the axle check straps (2). The jack may now be removed.

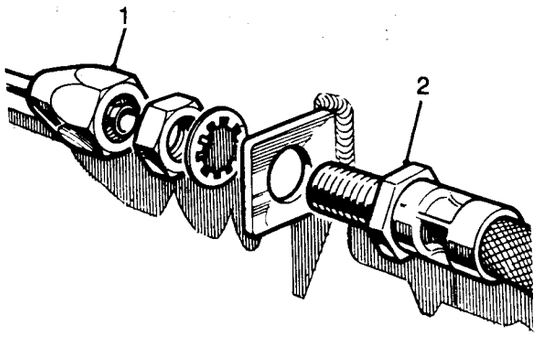


Fig J1.15

(6) Refer to Fig J1.15. Replace the flexible brake hose (2) into the chassis bracket and reconnect the rear brake pipe (1).

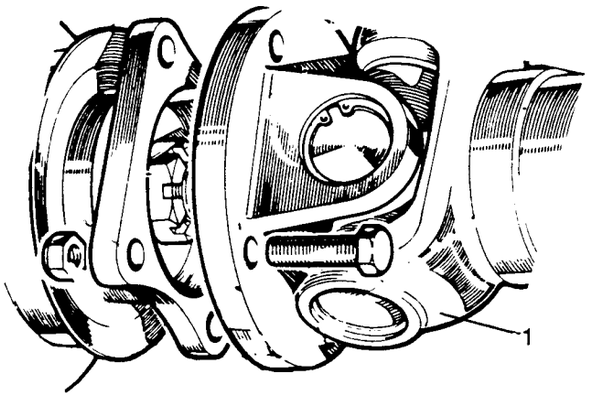


Fig J1.16

(7) Refer to Fig J1.16. Reconnect the rear propeller shaft (1).

(8) Replace the rear road wheels.

(9) Lower the vehicle to the ground and move vehicle bodily backward and forward to settle the springs.

(10) Tighten all six shackle pins and locknuts.

NOTE
If the shackle pins and locknuts are tightened prior to lowering the vehicle to the ground, premature failure of the spring bushes may occur.

(11) Bleed and adjust the brakes (see Sub-section K1.6).

(12) Replenish the front axle lubricating oil if required.

SUB-SUB-SECTION J1.4

CHAPTER 3

FRONT AXLE CASE OIL SEAL - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the oil seal:

   (1) Remove the swivel pin housing, axle half shaft and front hub assembly complete (see Sub-sub-section J2.3, Chapter 3, para 1, steps (1) to (9) only).

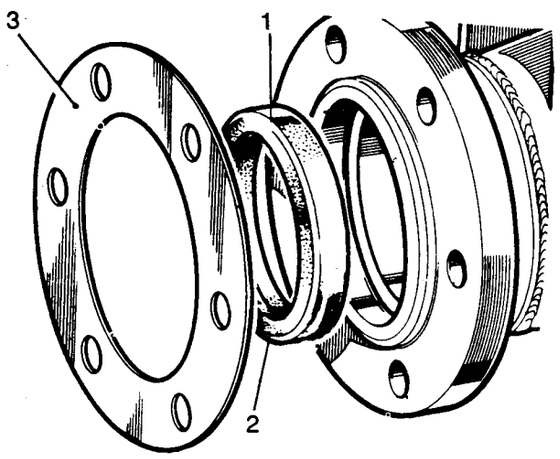


Fig J1.17

   (2) Refer to Fig J1.17. Prise out the axle case oil seal (1).

REPLACEMENT

2. Replace the oil seal as follows (Fig J1.17 still applies):

   (1) Where the oil seal outside diameter (2) is metal and not rubber covered, smear the diameter with suitable jointing compound.

   (2) Fit the oil seal (1) lipped face inward, until flush with the axle recessed end.

   (3) Grease and fit the joint washer (3).

   (4) Refit the items removed in para 1 above (see Sub-sub-section J2.3, Chapter 3, para 2, steps (3) to (10) only).

CHAPTER 4

FRONT AXLE ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the front axle assembly:

   (1) Slacken the fixings at both front road wheels.

   (2) Jack up the front of the vehicle and support on stands.

   (3) Remove both front road wheels.

   (4) Disconnect the front propeller shaft from final drive unit.

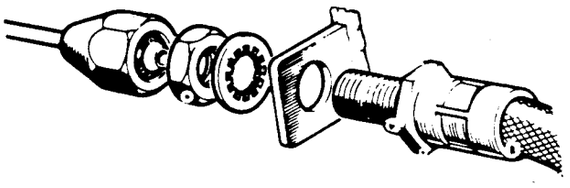


Fig J1.18

   (5) Refer to Fig J1.18. Disconnect the front brake pipes at their connections with the flexible pipes each side of the vehicle and withdraw the flexible pipes from the chassis brackets.

   (6) Depress and wedge the brake pedal to prevent further leakage of brake fluid.

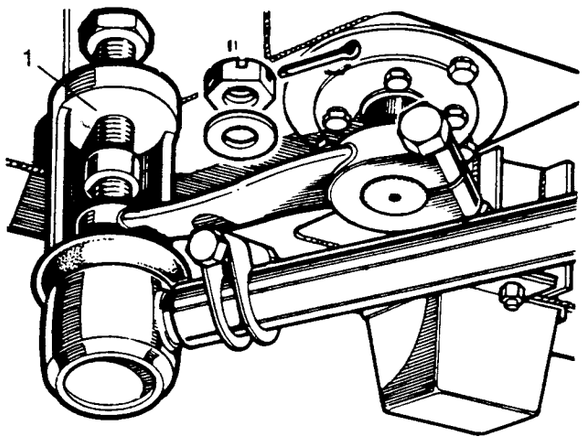


Fig J1.19

   (7) Refer to Fig J1.19. Disconnect the steering drag link from the lower relay lever, using special tool 601763 (1) to extract ball joints.

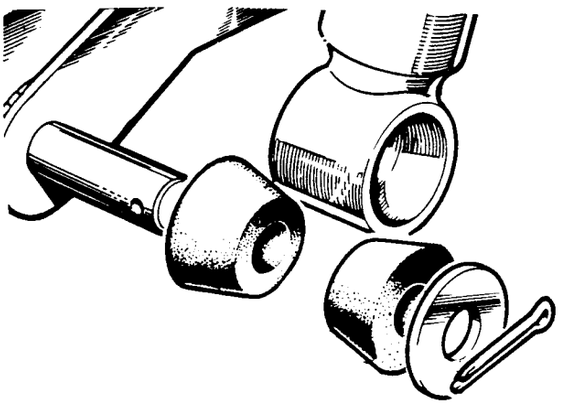


Fig J1.20

   (8) Refer to Fig J1.20. Disconnect the lower ends of the shock absorbers from the road spring bottom plates.

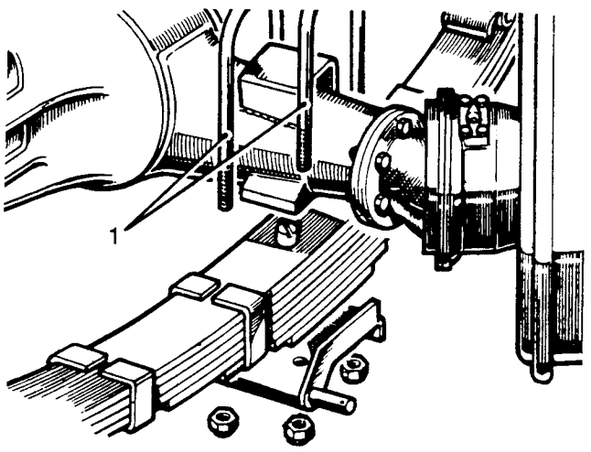


Fig J1.21

   (9) Refer to Fig J1.21. Remove the four U-bolts (1) from the axle.

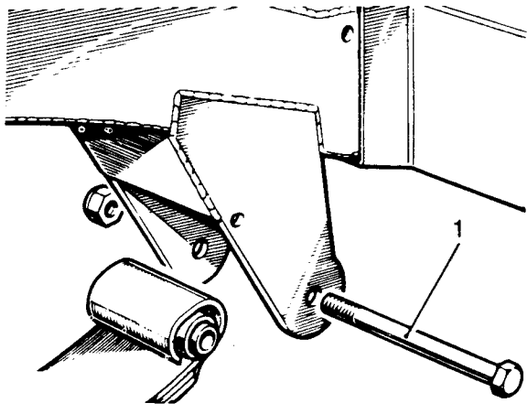


Fig J1.22

(10) Refer to Fig J1.22. Support the front axle with a jack, slacken all six shackle pins (1) at the front road springs, then remove the two front pins.

(11) Lower the jack and withdraw the axle.

REPLACEMENT

2. Replace the front axle assembly as follows:

(1) Place the axle assembly into position and support with a jack.

(2) Using a second jack, raise each road spring in turn and connect the front ends of the springs to the chassis, but DO NOT tighten the shackle pins and locknuts at this stage.

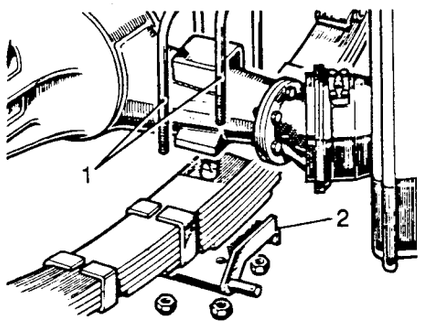


Fig J1.23

(3) Refer to Fig J1.23. Fit the axle U-bolts (1) and engage the lock plates (2).

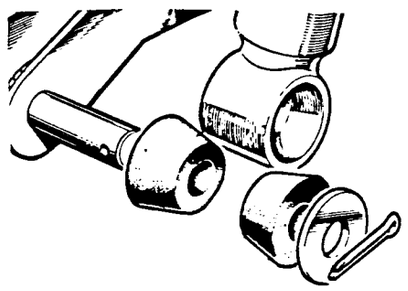


Fig J1.24

(4) Refer to Fig J1.24. Reconnect the lower ends of the shock absorbers to the road spring bottom plate.

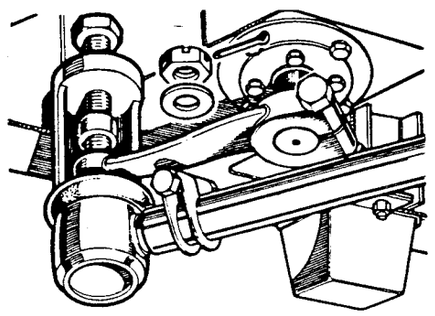


Fig J1.25

(5) Refer to Fig J1.25. Refit the steering drag link to the lower relay lever. Torque the ball joint fixings to 40 N.m.

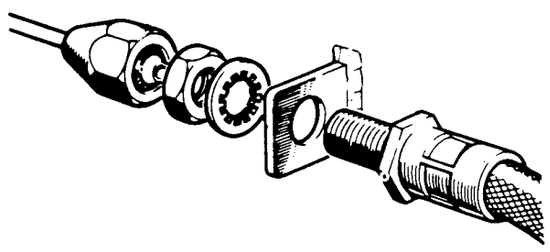


Fig J1.26

(6) Refer to Fig J1.26. Connect the front brake pipes to the flexible pipes on each side of the vehicle, fitting the flexible pipes through the chassis brackets.

(7) Refit the front propeller shaft to the final drive unit.

(8) Replace both front road wheels.

(9) Lower the vehicle to the ground and move vehicle bodily backward and forward to settle the springs, then tighten all six shackle pins and locknuts.

NOTE

If the shackle pins and locknuts are tightened prior to lowering the vehicle to the ground, premature failure of the spring bushes may occur.

(10) Bleed (see Sub-section K1.6) and adjust the brakes (see Sub-section K1.3).

(11) Replenish the front axle lubricating oil if required.

(12) Check, and if necessary, adjust the steering stop (see Sub-section L3, Chapter 3).

SUB-SUB-SECTION J1.4

CHAPTER 5

FRONT HALF SHAFT ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the half shaft:

   (1) Drain the oil from the differential and swivel pin housing.

   (2) Remove the stub axle (see Sub-sub-section J1.4, Chapter 7).

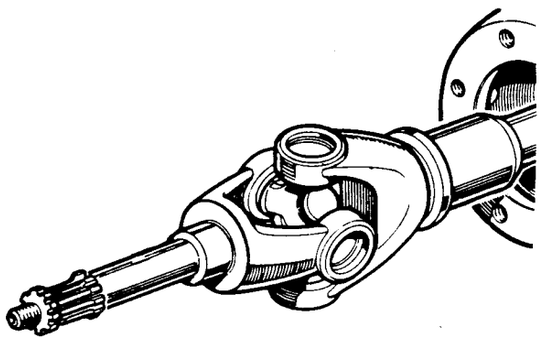


Fig J1.27

   (3) Refer to Fig J1.27. Withdraw the axle half shaft complete.

REPLACEMENT

2. Replace the half shaft as follows:

   (1) Fit the half shaft long end first, taking care to avoid damaging the axle case oil seal.

   (2) Carry out the following check (step 3) at the top and bottom swivel pins with the yokes at the maximum angle with the chamfered radius closest to the swivel pin end face.

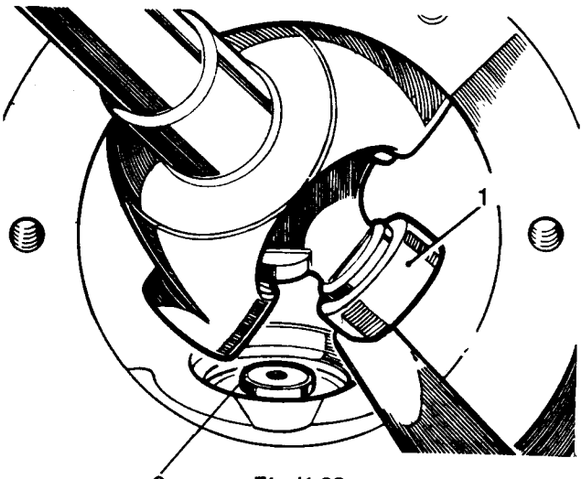


Fig J1.28

   (3) Refer to Fig J1.28. Rotate the half shaft and check that there is a minimum clearance of 1,2 mm between the joint yoke ears (1) and the swivel pin end faces (2).

   (4) If the clearance is insufficient, increase the chamfer on the yoke ears radius.

   (5) Replace the stub axle (see Sub-sub-section J1.4, Chapter 7).

SUB-SUB-SECTION J1.4

CHAPTER 6

HUB ASSEMBLY - REMOVAL AND REPLACEMENT

NOTE

There is little difference in the procedures for removing front and rear hubs and with few exceptions the procedure below is suitable for both hubs. Ignore references to the swivel pin housing when working on the rear hub.

REMOVAL

1. To remove a hub assembly:

   (1) Drain the swivel pin housing lubricating oil.

   (2) Jack up the front or rear of the vehicle.

   (3) Remove the road wheel.

   (4) Slack off the brake shoe adjuster.

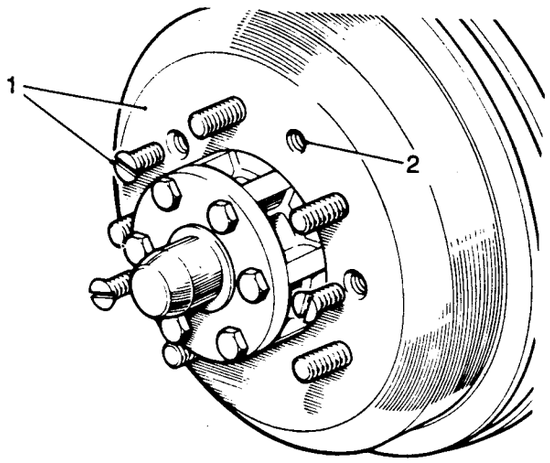
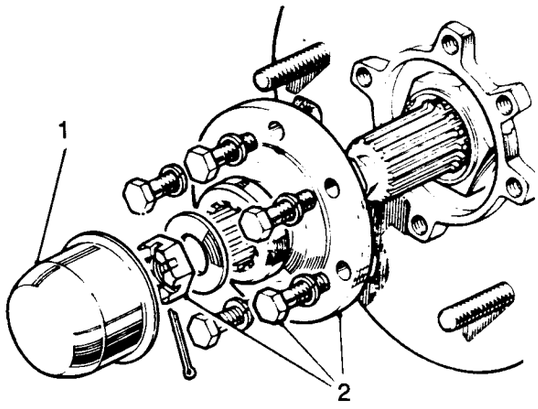


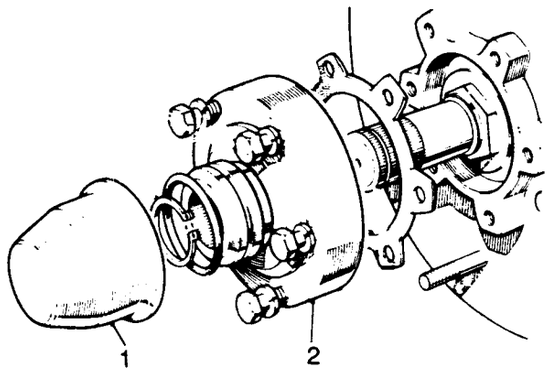
Fig J1.29

   (5) Refer to Fig J1.29. Remove the brake drum (1) noting the provision of an extractor tapping (2).

   (6) If difficulty is experienced in removing the drum, fit one of the drum fixing screws into the extractor tapping provided and turn in the screw whilst using a mallet to dislodge the drum.



FRONT HUB



REAR HUB

Fig J1.30

(7) Refer to Fig J1.30. Prise off the hub cap (1).

(8) Remove the driving member (2) from the axle stub shaft and hub.

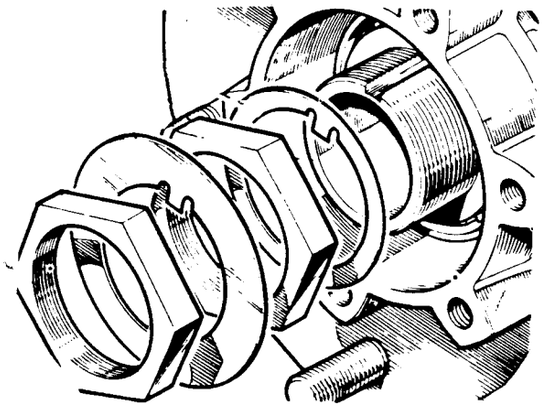


Fig J1.31

(9) Refer to Fig J1.31. Remove the hub fixings.

(10) Hold in position the outer roller bearing.

(11) Withdraw the hub and bearing.

REPLACEMENT

2. Replace the hub assembly as follows:

(1) Lubricate the bearings, using the recommended grease. Do not pack the hub with grease.

(2) Replace the hub and bearing.

(3) Replace the hub fixings.

(4) Adjust hub bearing end float (see Sub-sub-section J3.3).

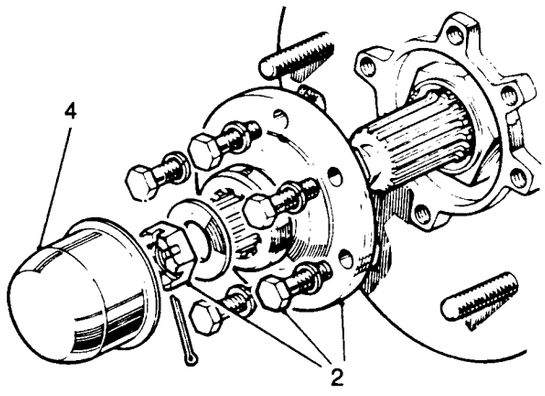


Fig J1.32

(5) Refer to Fig J1.32. Fit the driving member (2) with the felt and rubber oil seal, fitted with the rubber side facing outwards. Torque load for driving member fixing bolts is 39 N.m. Torque load for stub shaft to driving member nut is 14 to 20 N.m using special tool RO1010 on models with the circular castellated nut.

(6) Replace the hub cap (4).

(7) Replace the brake drum and secure with the fixing screws.

(8) Replace the road wheel.

(9) Adjust the brakes (see Sub-section K1.3).

(10) Lower the vehicle to the ground.

(11) Fill the swivel pin housing with the correct grade of lubricating oil.

SUB-SUB-SECTION J1.4

CHAPTER 7

HUB STUB AXLE - REMOVAL AND REPLACEMENT

NOTE

Removal and replacement procedures for front and rear hub axles are the same. The procedures given in this Chapter apply to both.

REMOVAL

1. To remove the stub axle:

   (1) Remove the hub (see Sub-sub-section J1.4, Chapter 6).

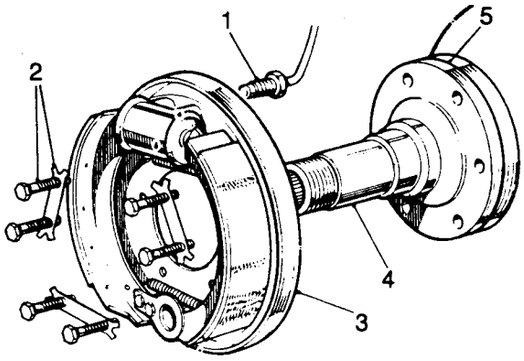


Fig J1.33

   (2) Refer to Fig J1.33. Release the brake pipe (1) from the retaining bracket at the upper swivel pin.

   (3) Remove the brake anchor plate and stub axle fixings (2).

   (4) Suspend aside the anchor plate assembly (3).

   (5) Withdraw the stub axle (4).

   (6) Withdraw the joint washer (5).

REPLACEMENT

2. Replace the stub axle as follows:

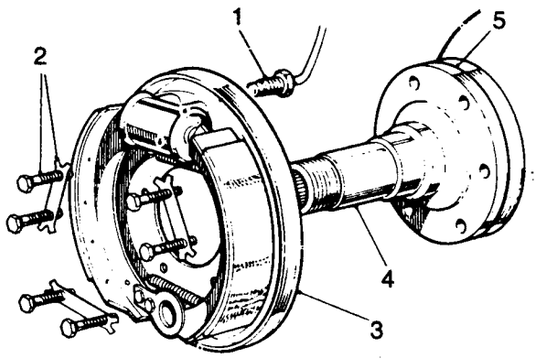


Fig J1.34

   (1) Refer to Fig J1.34. Grease and fit the joint washer (5).

   (2) Refit the stub axle (4).

   (3) Replace the anchor plate assembly (3).

   (4) Replace the brake anchor plate and stub axle fixings (2).

   (5) Refit the brake pipe (1) to the retaining bracket.

   (6) Replace the hub (see Sub-sub-section J1.4, Chapter 6).

SUB-SUB-SECTION J1.4

CHAPTER 8

SWIVEL PIN HOUSING - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the swivel pin housing as detailed below:

(1) Remove the front axle half shaft assembly (see Sub-sub-section J1.4, Chapter 5).

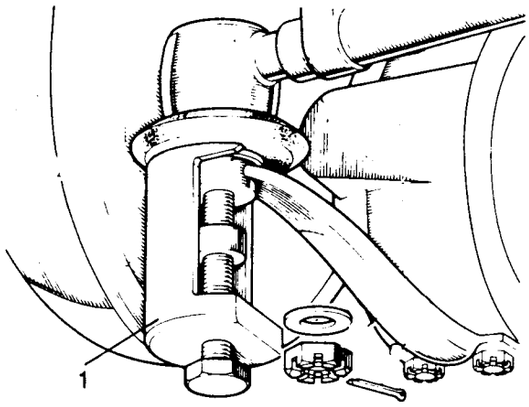


Fig J1.35

(2) Refer to Fig J1.35. Disconnect the track rod at the ball joint, using special tool 601763 (1).

(3) If required, disconnect the drag link at the ball joint, using special tool 601763.

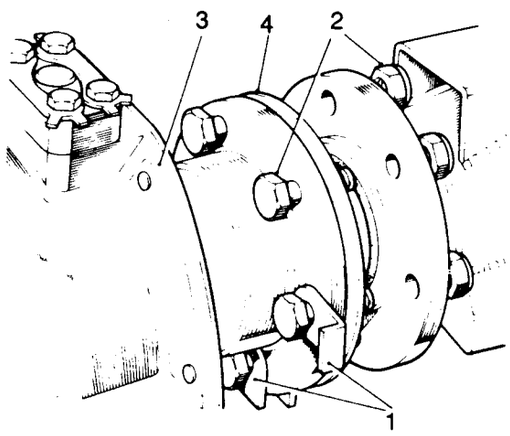


Fig J1.36

(4) Refer to Fig J1.36. Note the fitted position of the steering lock stop plate (1) and on the RH side only, the jack location stop plate.

(5) Remove the fixings (2) swivel pin housing to axle case.

(6) Withdraw the swivel pin housing (3).

(7) Withdraw the joint washer (4).

REPLACEMENT

2. To replace the swivel pin housing:

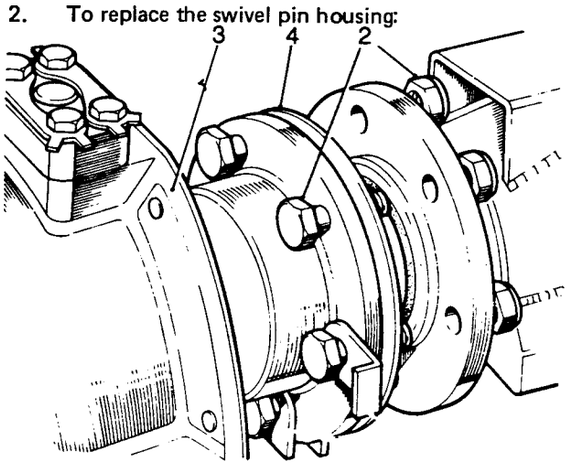


Fig J1.37

(1) Refer to Fig J1.37. Grease and replace the joint washer (4).

(2) Position the swivel pin housing (3) and secure with the fixings (2).

(3) If removed, refit the drag link at the ball joint.

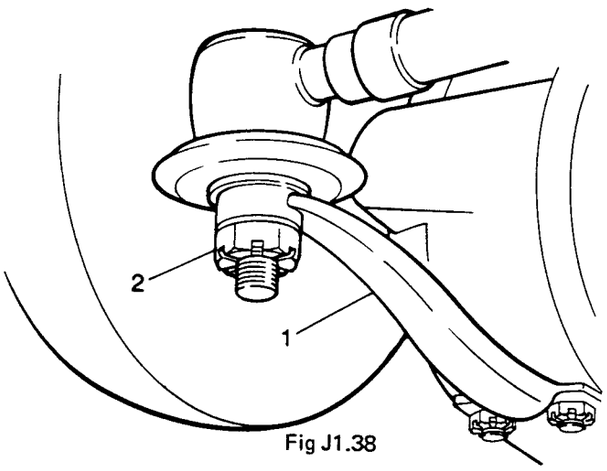


Fig J1.38

(4) Refer to Fig J1.38. Reconnect the track rod (1) at the ball joint. Torque the castellated nut (2) to 40 N.m and fit a new split pin.

(5) Replace the front axle half shaft (see Sub-sub-section J1.4, Chapter 5).

(6) Check and, if necessary reset, the position of the steering lock stop plate.

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION J1.5

OVERHAUL PROCEDURES

SUB-SUB-SECTION J1.5

CHAPTER 1

FRONT HALF SHAFT ASSEMBLY - OVERHAUL

DISMANTLING

1. Dismantle the half shaft assembly as follows:

   (1) Remove the half shaft (see Sub-sub-section J1.4, Chapter 5).

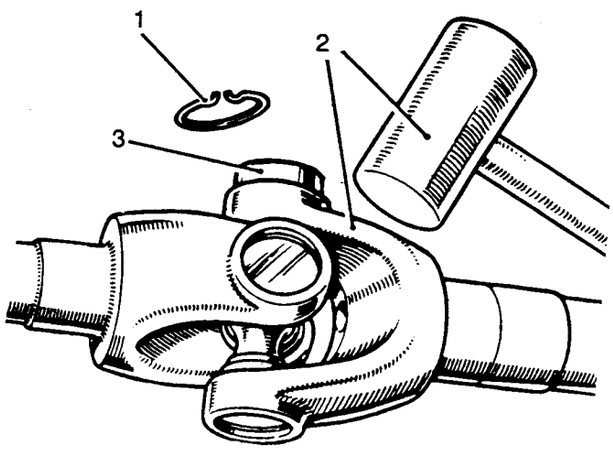


Fig J1.39

   (2) Refer to Fig J1.39. Remove the circlip (1) from the universal joint.

   (3) With one of the stub shaft yoke lugs (2) uppermost tap the radius of the yoke lightly with a soft-nosed mallet.

   (4) The top bearing (3) should then begin to emerge from the yoke.

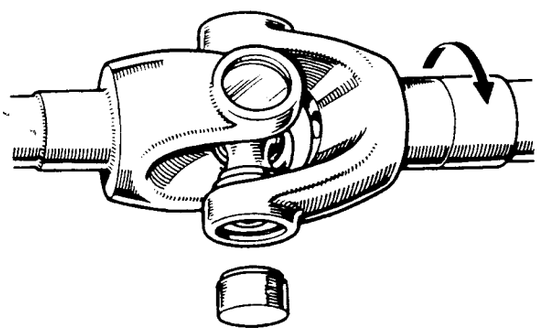


Fig J1.40

   (5) Refer to Fig J1.40. Turn the joint over and withdraw the bearing downwards to retain the needle rollers.

   (6) Repeat steps (2) to (5) to remove the opposite bearing.

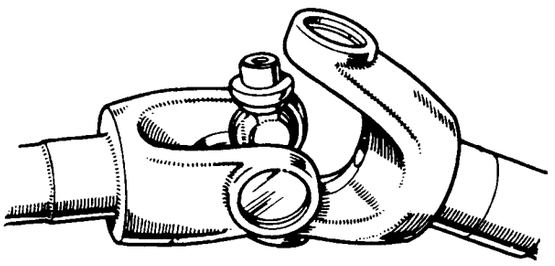


Fig J1.41

   (7) Refer to Fig J1.41. Part the stub shaft from the spider journals.

   (8) Repeat steps (2) to (7) for the half shaft bearings.

2. Dismantle the half shaft as detailed below:

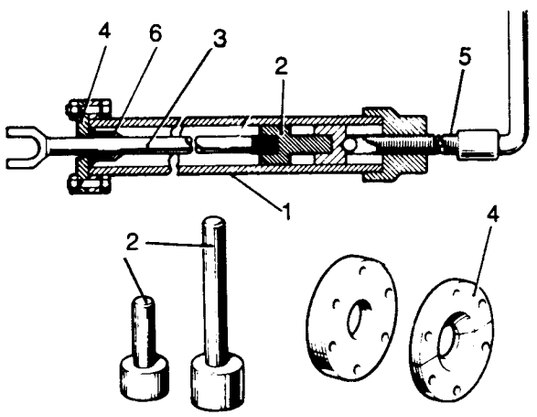


Fig J1.42

   (1) Refer to Fig J1.42. Clamp the extractor tube (1) of special tool 275870 in a vice.

   (2) Position adaptor No. 2 or No. 3 (2), as applicable, onto the shaft (3) and insert the assembly into the extractor tube (1).

   (3) Secure the shaft to the extractor using adaptor No. 5 (4).

   (4) Screw in the ram (5) and press the shaft from the retainer collar, bearing and conical distance piece (6).

   (5) Remove the adaptor; discard the retainer collar.

INSPECTING

3. Inspect the following components:

(1) Examine all components for obvious wear or damage. If the journal or bearings for the universal joint show any signs of wear, load markings or distortion, they must be renewed complete.

(2) The bearing recess should be light drive fit in the yoke trunnions.

(3) In the event of wear taking place in any of the four yoke holes, rendering them oval, a new stub shaft or half shaft must be fitted.

(4) The bearing inner race must be a light press fit on the axle half shaft.

REASSEMBLY

4. Reassemble the half shaft as follows:

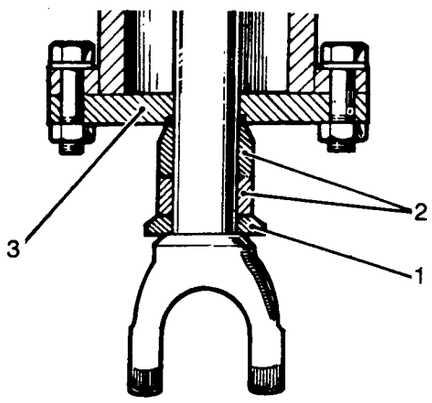


Fig J1.43

(1) Refer to Fig J1.43. Fit the conical distance piece (1) over the half shaft with the internal chamfer to the radius on the shaft.

(2) Place the roller race inner member and a new retaining collar (2) over the half shaft with the chamfer towards the splined end.

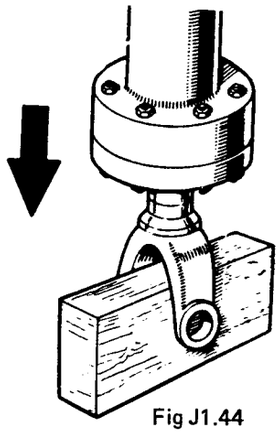


Fig J1.44

(3) Refer to Fig J1.44. Stand the shaft on end on a block of hard wood. Bolt adaptor No. 4 to the tool with the recess towards the collar (see (3) on Fig J1.44).

(4) Drive the collar onto the shaft, using the extractor tube as a ram.

5. Reassemble the universal joint:

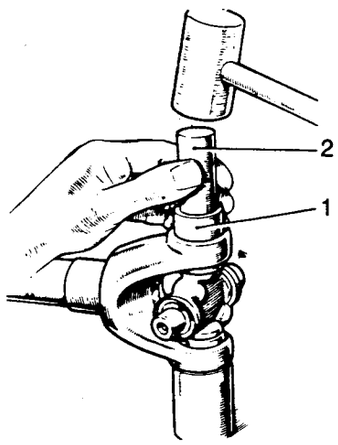


Fig J1.45

(1) Refer to Fig J1.45. Assemble the needle rollers in the bearing races (1), if necessary using a smear of vaseline to retain them in place.

(2) Insert the journal in the stub shaft yoke holes, and using a brass drift (2) slightly smaller in diameter than the hole in the yoke, lightly tap the first bearing into position, and retain with a circlip.

(3) Repeat the foregoing operations for the other three bearings.

(4) Ensure that all four circlips are firmly located in their grooves.

(5) Check that the universal joint moves freely. If the joint appears to bind, hold one shaft so that the joint hangs free and tap the yoke ears lightly with a mallet.

(6) Replace the half shaft (see Sub-sub-section J1.4, Chapter 5).

SUB-SUB-SECTION J1.5

CHAPTER 2

HUB ASSEMBLY - OVERHAUL

NOTE

The following procedure applies to front or rear hubs.

DISMANTLING

1. Dismantle the hub as follows:

   (1) Remove the hub assembly (see Sub-sub-section J1.4, Chapter 6).

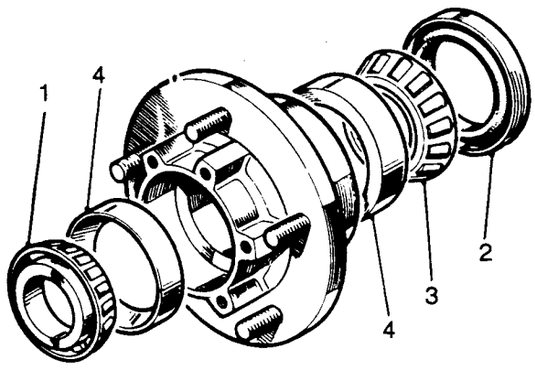


Fig J1.46

   (2) Refer to Fig J1.46. Withdraw the outer roller bearings (1).

   (3) Prise out the oil seal (2).

   (4) Withdraw the inner roller bearing (3).

   (5) Press the bearing outer races from the hub (4).

INSPECTING

2. Carry out the following inspection:

   (1) Examine all components for obvious wear and damage.

   (2) Examine the outside diameter of the inner bearing distance piece which is pressed on to the exposed stub axle. The diameter forms the inner seat for the hub oil seal and must be free from scores, damage and roughness. To replace the distance piece, (see Sub-sub-section J1.5, Chapter 3). The hub bearings must be a sliding fit on the stub axle and a press fit in the hub.

REASSEMBLY

3. To reassemble the hub:

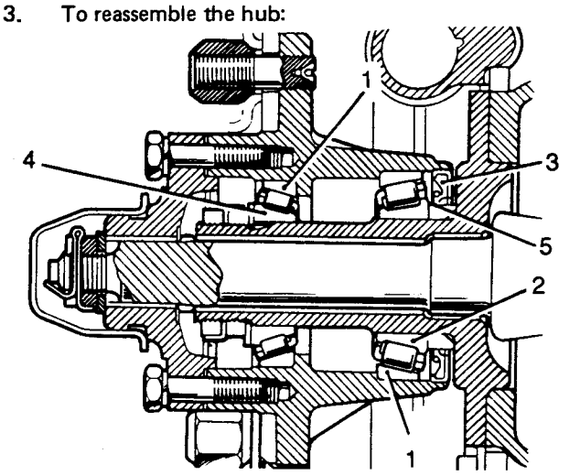


Fig J1.47

   (1) Refer to Fig J1.47. Press the bearing outer races (1) wide side first, into the hub, ensuring that they abut the locating shoulders.

   (2) Grease and fit the inner roller bearings (2). Do not pack the hub centre with grease.

   (3) Refit the oil seal (3) using jointing compound and fitting the seal flush with and not below the rear face of the hub.

   (4) Replace the outer roller bearing (4).

   (5) Replace the hub assembly (see Sub-sub-section J1.4, Chapter 6).

SUB-SUB-SECTION J1.5

CHAPTER 3

HUB STUB AXLE - OVERHAUL

NOTE
The following applies to both front and rear hub stub axles.

REMOVAL

1. Remove the stub axle as detailed in Sub-sub-section J1.4, Chapter 7.

INSPECTION

2. Make the following checks:

(1) Examine the stub axle for obvious wear or damage.

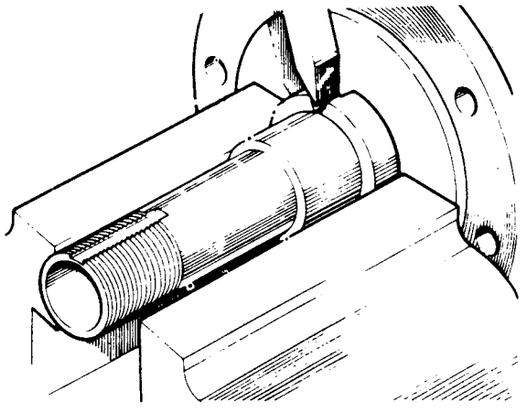


Fig J1.48

(2) Refer to Fig J1.48. Check the outside of the inner bearing distance piece. This must not show any signs of damage or roughness as it forms the inner seat for the oil seal. The distance piece should be a press fit on the stub axle. Any clearance between these two parts will allow oil to leak past on to the brake linings.

(3) If it is required to remove the inner bearing distance piece from the stub axle, it must be shattered, using extreme care to avoid damaging the axle.

(4) Press on the replacement distance piece.

REPLACEMENT

3. To replace the stub axle (see Sub-sub-section J1.4, Chapter 7).

SUB-SUB-SECTION J1.5

CHAPTER 4

SWIVEL PIN HOUSING - OVERHAUL

DISMANTLING

1. First carry out the procedure of Sub-sub-section J2.3, Chapter 3, para 1, steps (1) to (9) to separate the hub assembly, half shaft and swivel pin housing complete from the axle case.

2. Dismantle the assembly as follows:

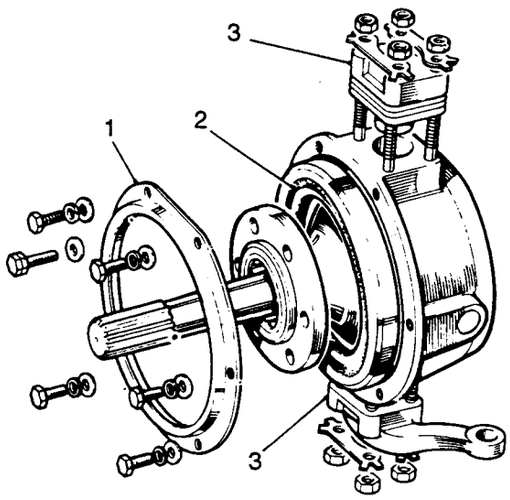


Fig J1.49

(1) Refer to Fig J1.49. Remove the oil seal retainer (1).

(2) Prise out the bearing housing oil seal (2).

(3) Remove the upper and lower swivels (3).

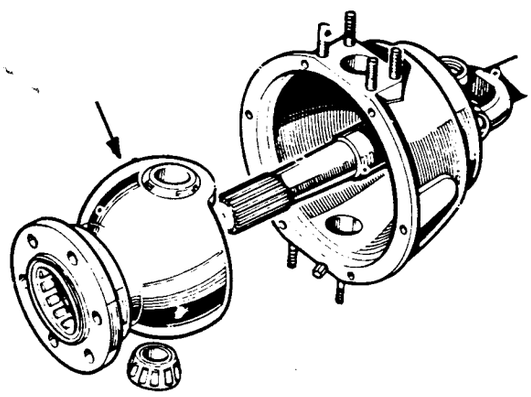


Fig J1.50

(4) Refer to Fig J1.50. Withdraw the bearing housing and bearings.

(5) Press the bush and bearings from the swivel pin bearing housing as required.

INSPECTING

3. Carry out the following inspection:

(1) Examine all components for obvious wear or damage.

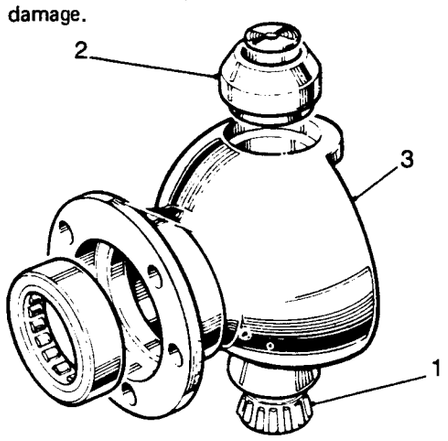


Fig J1.51

(2) Refer to Fig J1.51. The taper roller bearing (1) must be a light push fit on the bottom swivel pin. If a new bearing is a loose fit, the swivel pin assembly must be renewed.

(3) The Railko bush (2) must be a light push fit on the top swivel pin. If a new bush is a loose fit, the swivel pin assembly must be renewed. It is important to note that these bushes and thrust washers should not be washed in any type of cleaning fluid, otherwise there is a danger that the damping characteristics of the material will be adversely affected.

(4) Examine the surface of the swivel pin bearing housing (3) for signs of corrosion or damage; replace the housing if necessary.

REASSEMBLY

4. To reassemble the housing:

(1) Using the same oil as recommended for the swivel pin housing thoroughly lubricate the internal diameter of the Railko bush.

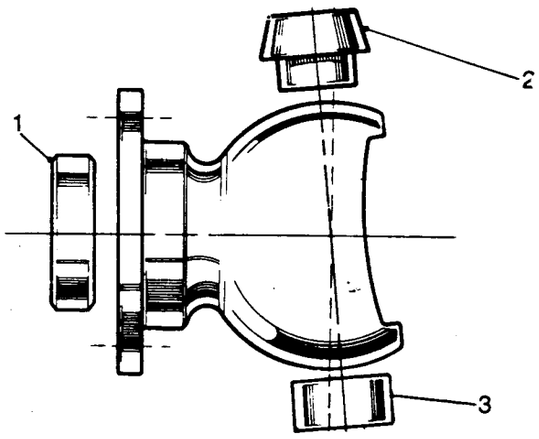


Fig J1.52

(2) Refer to Fig J1.52. Press the roller bearing (1) for the axle half shaft into the swivel pin bearing housing. Press the Railko bush (2) into the top of the bearing housing, and the taper bearing outer race (3), wide edge first, into the bottom of the housing. Take care to correctly identify the bush and bearing locations, noting that the top of the housing is narrower, as illustrated.

(3) Place the taper roller bearing in position in the bottom of the swivel pin bearing housing, and locate the bearing housing into the swivel housing.

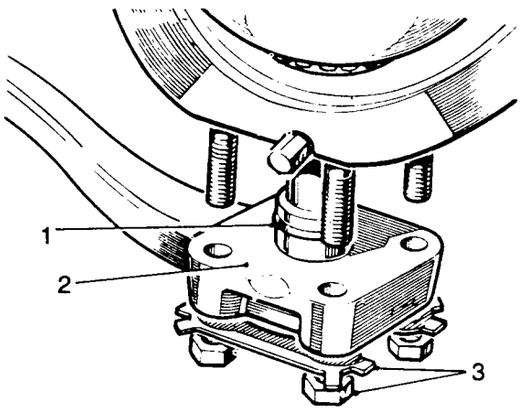


Fig J1.53

(4) Refer to Fig J1.53. Fit a rubber O-ring (1) to the steering lever and swivel pin assembly.

(5) Smear the mating surfaces of the swivel pin and housing with jointing compound.

(6) Fit the steering lever (2) using new replacement nuts, ensuring that it faces forward (away from the oil filler/level plug).

(7) Secure the fixings (3), torque load 70 N.m and engage the lock plates.

(8) Fit the swivel pin and bracket assembly to the top of the swivel pin housing, fitting the shims removed during the dismantling to the value of 1,0 mm.

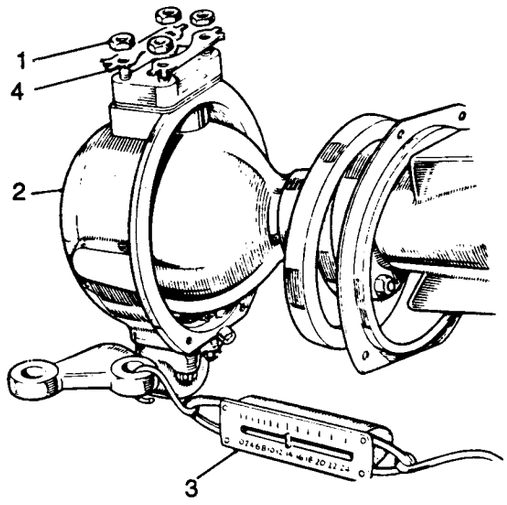


Fig J1.54

(9) Refer to Fig J1.54. Tighten the fixing nuts (1) evenly and securely, but do not engage the lock plates (4) at this stage.

(10) Hold the swivel pin bearing housing (2) by clamping the flange in a vice fitted with soft jaws, or temporarily fit the swivel pin housing to the axle case.

(11) Using a spring balance (3) attached to the steering lever at the track rod connecting eye, measure the resistance to rotation of the swivel pin housing, which must be 5,4 kg to 6,3 kg, after having overcome inertia. Adjust as necessary by adding or subtracting shims under the top swivel pin bracket until the correct resistance figure is obtained.

(12) Engage the lock plates (4) at the swivel pin fixing nuts.

(13) Pack the swivel pin housing oil seal with heavy grease.

(14) Fit the seal and its retainer to the swivel pin housing, locating the steering stop adjustment bolt in the forwardmost hole.

(15) Check that the oil seal wipes the full surface of the bearing housing and adjust the position, if necessary, by slackening off the retainer bolts and resetting the seal.

5. Replace the assembly as detailed in Sub-sub-section J2.3, Chapter 3, para 2, steps (3) to (10).

SUB-SUB-SECTION J1.6

MAINTENANCE

INTRODUCTION

1. The axles and hubs are designed for maintenance-free operation and require only periodic inspections for obvious defects. At intervals the hubs should be cleaned and checked for oil leaks. If any are found they should be rectified as soon as possible.

2. The exterior of the swivel pin housings should be cleaned periodically to prevent the accumulation of dirt, mud and oil etc. The oil should be checked at the intervals specified.

OIL CHECKING

3. The front wheel drive universal joints, the swivel pins and front hub receive their lubrication from the swivel pin housings. To check the oil level in the housings:

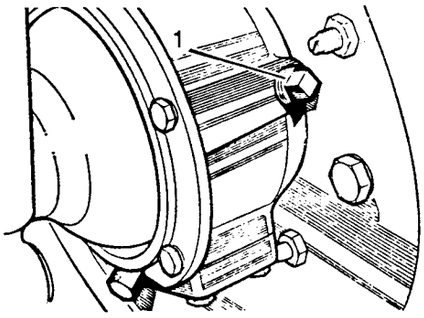


Fig J1.55

(1) Refer to Fig J1.55. Remove the filler hole plug (1).

(2) Check that the oil level is up to the bottom of the filler hole.

(3) If necessary pour oil into the filler hole to bring the oil up to this level.

(4) Allow excess oil to drain from the filler hole.

(5) Replace and tighten the filler hole plug.

(6) Clean off excess oil from around the plug.

NOTE
If significant topping up is required check for oil leaks at the plugs, joint faces and oil seals.

SUB-SECTION CONTENTS LIST

SUB-SECTION J2

DIFFERENTIALS

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION J2.1

DESCRIPTION AND SPECIFICATIONS

SUB-SUB-SECTION J2.1

CHAPTER 1

DESCRIPTION OF THE DIFFERENTIALS

GENERAL

1. Both front and rear differentials are spiral bevel type. Differential units are fitted to both front and rear axles.

2. The rear differential is in constant mesh, therefore always engaged.

3. The front differential, similar to that fitted to the rear, accepts the power input from the propeller shaft connected to the front of the transfer box and transmits it via universally jointed shafts to the front wheels. Steering and braking functions are accomplished by swivelling stub axles mounted in housings. The front axle combines the functions of the steering and driving unit.

4. The drive to the front axle is not in constant mesh, therefore can be disconnected. The vehicle will then be driven by the rear axle only.

SUB-SUB-SECTION J2.1

CHAPTER 2

SPECIFICATIONS

INTRODUCTION

1. The general and torque specifications for the differentials are given in Sub-sub-section J1.1, Chapter 2. The following table gives general data for the two differentials.

TABLE J2.1 - GENERAL DATA

ITEM	DESCRIPTION
FRONT DIFFERENTIAL	
Pinion bearing pre-load	32 to 44 N.m torque resistance
Pinion height setting	0,07 to 0,10 mm using gauges 601998, 262761 or 600299
Clearance between height gauge and slip gauge	0,28 to 0,30 mm using gauge 605004
Crown wheel run-out	0,10 mm
Crown wheel to bevel pinion backlash	0,20 to 0,25 mm
REAR DIFFERENTIAL	
Crown wheel backlash	0,17 to 0,27 mm
Differential bearings pre-load	0,127 mm
Pinion height setting	Set using gauge 18G 191P, gauge length 30,912 mm
Torque Resistance Initial Settings:	
Torque to turn drive pinion and new pinion bearings	34,5 to 46 N.m
Torque to turn drive pinion reusing original bearings	17,3 to 34,5 N.m

SUB-SUB-SECTION J2.2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This Sub-sub-section deals with fault diagnosis and the corrective action required for the differential unit. In Table J2.2, a list of symptoms, the probable cause and the necessary remedies are given. If a fault is suspected, the faults listed in the accompanying table should be consulted. It should be remembered that the Table is not exhaustive and therefore faults may occur which are not listed. Should this fail to reveal the fault, remove the suspect component/s for a closer inspection and/or overhaul of component.

TABLE J2.2 - DIFFERENTIAL FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Pinion seal oil leak	High oil level. Damaged or worn seal.	Drain oil to correct level. Replace.
Differential/housing oil leak	Securing screws loose. Insufficient sealant on screws. Mating surfaces damaged. O-ring collapsed/distorted.	Re-torque screws. Replace screws with new sealant. Repair. Replace with new O-ring.
Differential whine	Incorrect tooth contact pattern.	Re-adjust or overhaul.
Differential noisy	Damaged or worn carrier bearing/s. Damaged or worn crownwheel or pinion teeth.	Overhaul complete differential. Overhaul complete differential.
Axle clonk	Excessive backlash between crownwheel and pinion. Excessive backlash between spider gears.	Re-adjust or overhaul. Replace thrust washers or overhaul.
Differential overheating	Too high or too low oil level.	Replenish to correct level.

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION J2.3

REMOVAL AND REPLACEMENT PROCEDURES

CHAPTER 1

REAR DIFFERENTIAL ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the rear differential assembly:

NOTE
All fixing bolts used on the differential assembly and differential cover have metric threads.

(1) Drain off the differential lubricating oil.

(2) Remove the rear axle assembly (see Sub-sub-section J1.4, Chapter 2).

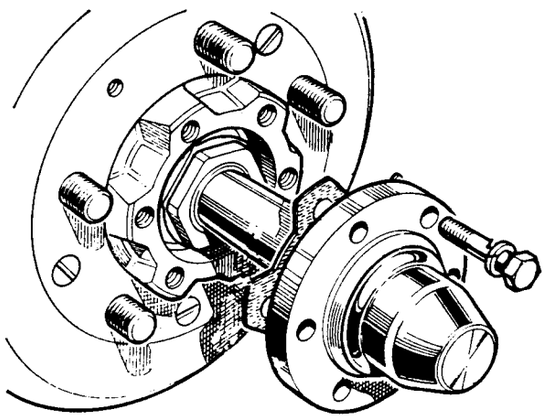


Fig J2.1

(3) Refer to Fig J2.1. Remove the hub driving member fixings.

(4) Withdraw the driving member and attached half shaft sufficiently to disengage the differential.

(5) Carry out steps (3) and (4) for the other half shaft.

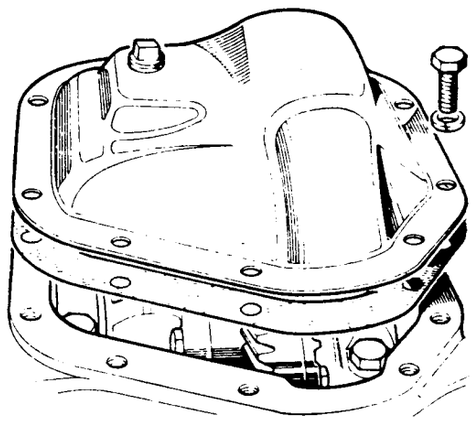


Fig J2.2

(6) Refer to Fig J2.2. Remove the fixings at the differential cover and joint washer.

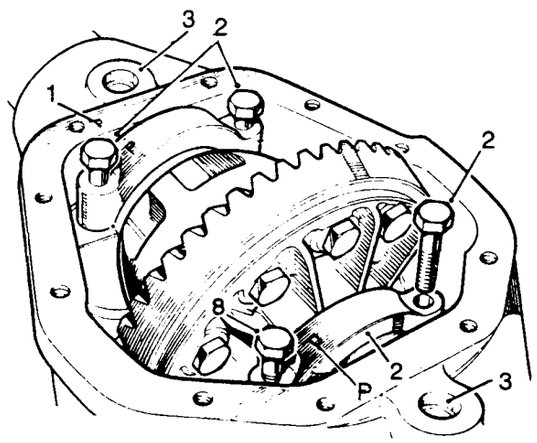


Fig J2.3

(7) Refer to Fig J2.3. Note the relationship marking on the bearing caps and axle casing (1) to ensure correct refitting.

(8) Remove the fixings and withdraw the differential bearing caps (2).

(9) Clean out and examine the spreader tool peg holes (3) provided in the gear casing face; ensure that the holes are free from dirt and burrs and damage.

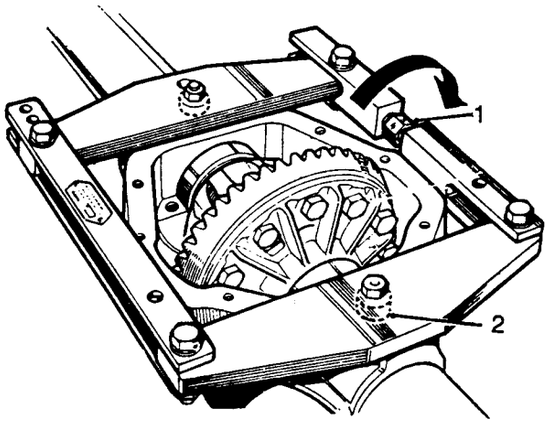


Fig J2.4

(10) Refer to Fig J2.4. Ensure that the turnbuckle adjuster (1) is free to turn.

(11) Fit the axle spreader (2) to engage the peg holes. Spreader 18G131C, Adaptor pegs 18G131F.

(12) Turn the adjuster until all free play between the spreader and casing is taken up, denoted by the adjuster becoming stiff to turn, using a spanner on the adjuster.

(13) Check that the side members of the spreader are clear of the casing.

(14) Stretch the casing, rotating the adjuster by one flat at a time, until the differential assembly can be levered out. Do not lever against the spreader; use suitable packing under the levers to avoid damage to the casing.

CAUTION

To prevent permanent damage to the gear carrier case it must not be over-stretched. Each flat on the turnbuckle is numbered to enable a check to be made on the amount turned. The maximum stretch permitted is 0,30 mm equivalent to three flats.

(15) Ease off the adjuster and remove the spreader.

REPLACEMENT

2. To replace the differential:

NOTE

It is likely that this operation will follow an overhaul of the differential assembly. The shims referred to are those calculated in Sub-sub-section J2.4, Chapter 1, para 10.

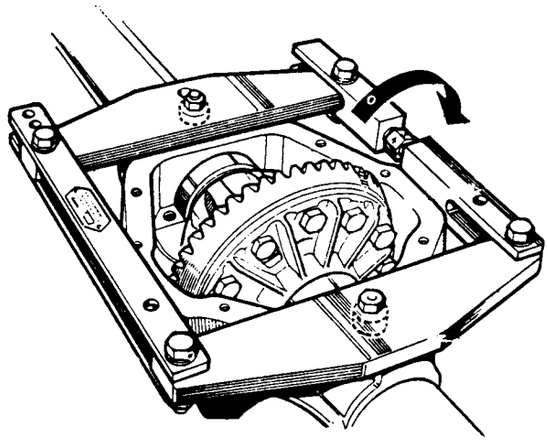


Fig J2.5

(1) Refer to Fig J2.5. Fit the differential unit with shims and bearings to the axle casing, using the axle spreader 18G131C with pegs 18G131F.

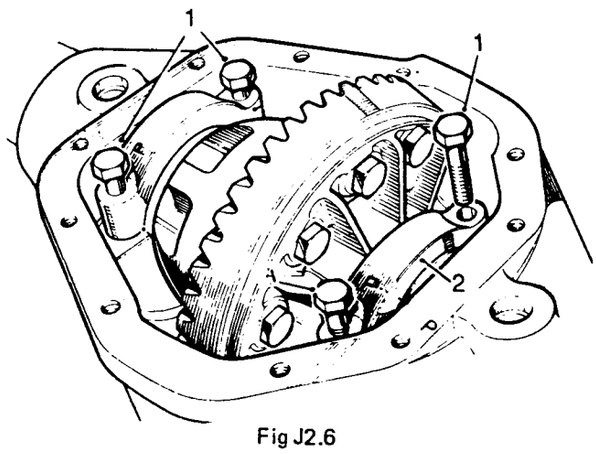


Fig J2.6

(2) Refer to Fig J2.6. Remove the axle spreader.

(3) Fit the bearing caps (2) in their correct position, referring to the relationship markings on the caps and on the axle casing.

(4) Tighten the bearing caps fixings to 129 to 145 N.m. (1).

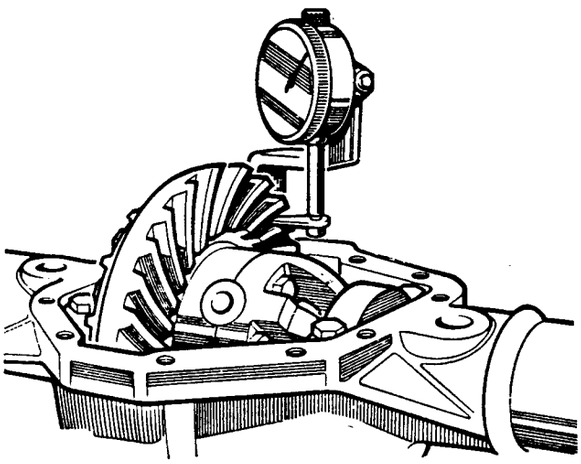


Fig J2.7

(5) Refer to Fig J2.7. Mount a dial gauge on the axle casing with the stylus resting on a crownwheel tooth.

(6) Prevent the drive pinion from rotating and check the crownwheel backlash which must be 0,15 to 0,27 mm.

(7) Fit the differential cover and new gasket. Torque load for fixings is 28 to 35 N.m.

(8) Fit the rear axle assembly (see Sub-sub-section J1.4, Chapter 2).

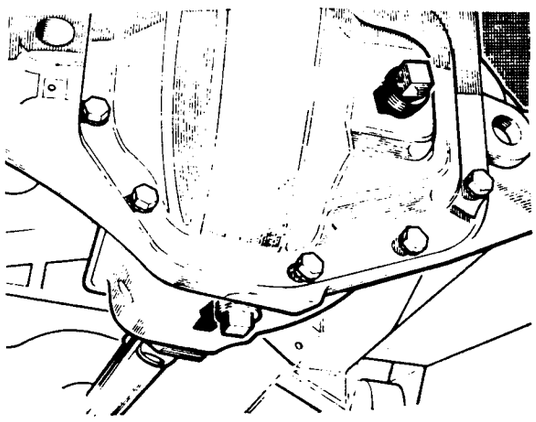


Fig J2.8

(9) Refer to Fig J2.8. Replenish the differential lubricating oil, capacity 2,5 litres, using oil to specification SAE 90 EP. After the initial axle run, check the oil level and replenish as necessary to the filler/level plug hole.

NOTE

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

CHAPTER 2

REAR PINION OIL SEAL - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the oil seal as follows:

(1) Drain the rear axle.

(2) Raise and support the rear of the vehicle.

(3) Remove the hub driving member fixings and disengage the axle shafts from the differential.

(4) Disconnect the propeller shaft (see Sub-sub-section H4.3).

(5) Measure and record the torque required to rotate the pinion.

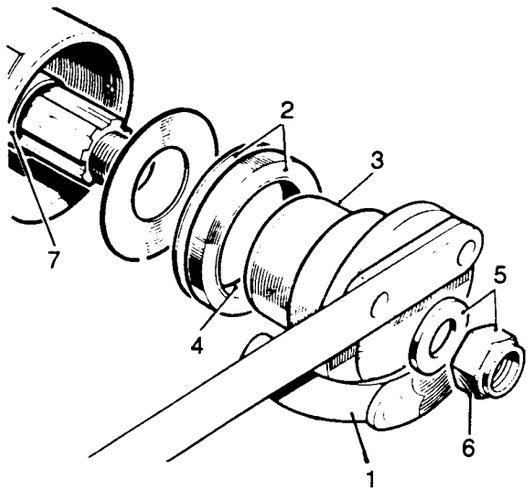


Fig J2.9

(6) Refer to Fig J2.9. Using special tool 18G1205 (1) to prevent the pinion from rotating, remove the flange retaining nut and washer, and withdraw the pinion flange.

(7) Extract and discard the oil seal gasket (2).

(8) Examine the pinion flange (3) for damage, paying particular attention to the oil seal track area.

REPLACEMENT

2. Replace the oil seal (Fig J2.9 still applies):

(1) Grease the sealing lip of the new oil seal (4) using general purpose grease or, if available, grease with a molybdenum disulphide base.

NOTE
Where oil leakage past the seal outer diameter has occurred, coat the metal circumference with Pettman's cement, avoiding contact with the seal rubber.

(2) Fit the gasket and oil seal (2), lipped side first, using special tool RO1008 to drift in the seal.

(3) Refit the pinion flange and washer (5).

(4) Screw on a new retaining nut (6) tightening the nut gradually until resistance is felt.

(5) Rotate the pinion to settle the bearings and measure the torque to rotate the pinion. If the reading obtained is less than that recorded in step (5) before the seal was removed, tighten the nut a very small amount, resettle the bearings and recheck the torque reading. Repeat this procedure until a reading equal to that recorded in step (5) or between 17,2 to 23,0 N.m whichever is the greater, is obtained.

NOTE
Preload build up is rapid, tighten the nut with extreme care. If the required torque reading is exceeded, the axle must be dismantled and a new collapsible spacer fitted, described in Sub-sub-section J2.4, Chapter 1).

(6) Reconnect the propeller shaft (see Sub-sub-section H4.3).

(7) Re-engage the axle shafts to the differential and replace the hub driving member fixings.

(8) Lower the vehicle to the ground.

(9) Fill the rear axle with the correct grade of oil (see Sub-sub-section J2.5).

(10) Check and replenish as necessary to filler/level plug hole after initial axle run.

CHAPTER 3

FRONT DIFFERENTIAL ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the assembly as follows:

   (1) Drain the axle lubricating oil.

   (2) Slacken the front wheel nuts.

   (3) Jack up the front end and support on stands.

   (4) Remove the front road wheels.

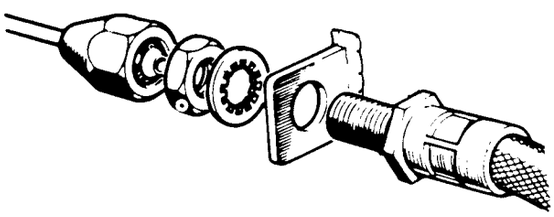


Fig J2.10

   (5) Refer to Fig J2.10. Disconnect the front brake pipes at the connections with the flexible pipes, one each side of the vehicle, and withdraw the flexible pipes from the chassis brackets.

   (6) Depress and wedge the brake pedal to prevent further leakage of brake fluid.

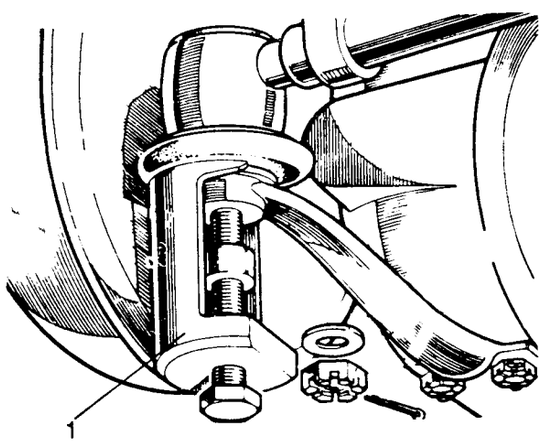


Fig J2.11

   (7) Refer to Fig J2.11. Disconnect the steering track rod and drag link. Use special tool 601763 (1) to extract the ball joints.

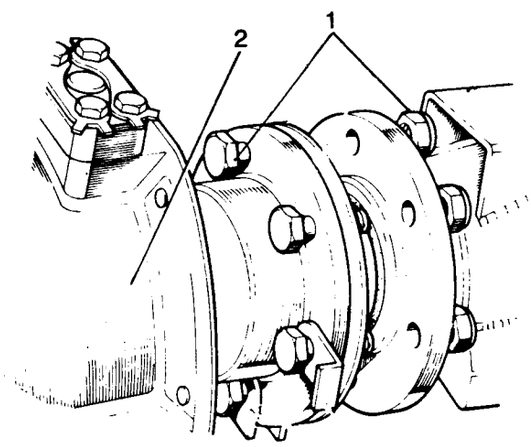


Fig J2.12

   (8) Refer to Fig J2.12. Remove the fixings (1) between the swivel pin housings and the axle case, noting the steering lock stop plate, and on the right hand side only, the jack location stop plate.

   (9) Withdraw the swivel pin housing (2), axle half shaft and front hub assembly complete.

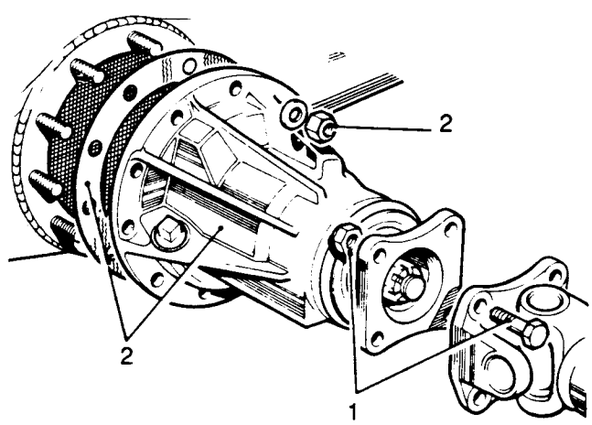


Fig J2.13

   (10) Refer to Fig J2.13. Disconnect the prop shaft (1) and move it clear of the differential.

   (11) Remove the differential assembly fixings (2) and withdraw the assembly.

REPLACEMENT

2. To replace the differential assembly:

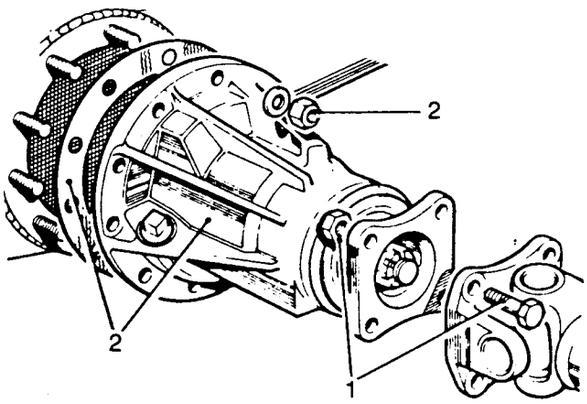


Fig J2.14

(1) Refer to Fig J2.14. Position the differential assembly and secure with the fixings (2).

(2) Refit the propeller shaft and secure with the fixings (1).

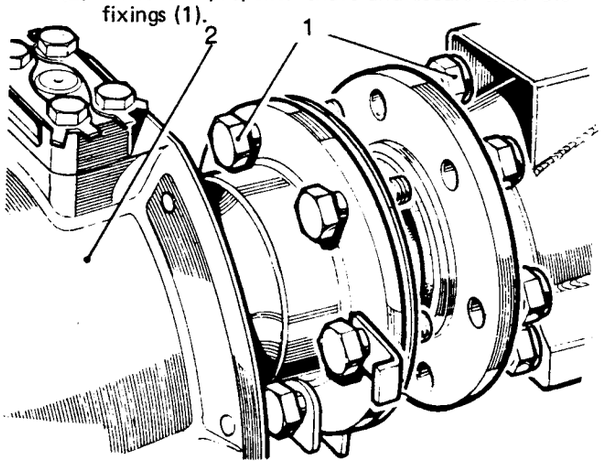


Fig J2.15

(3) Refer to Fig J2.15. Replace the hub assembly complete with axle half shaft and swivel pin housing (2).

(4) Replace the fixings (1) between the swivel pin housings and the axle case noting the steering lock stop plate and on the right hand side only, the jack location stop plate.

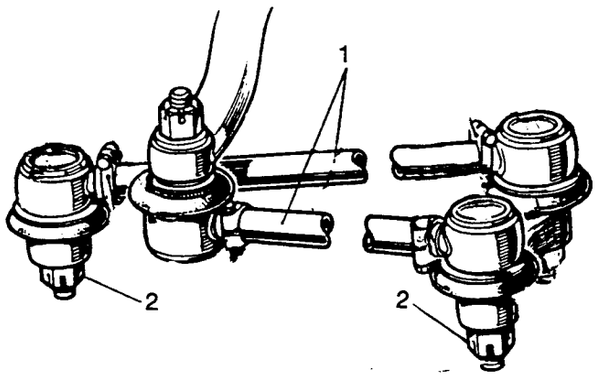


Fig J2.16

(5) Refer to Fig J2.16. Replace the steering track rod and drag link (1). Torque the ball joint fixings (2) to 40 N.m.

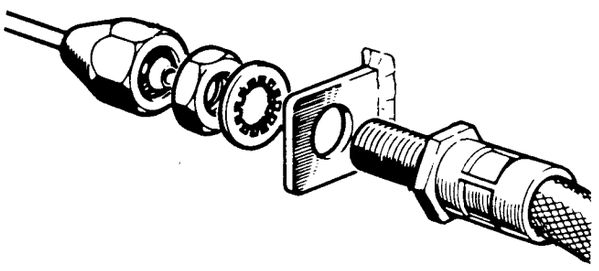


Fig J2.17

(6) Refer to Fig J2.17. Reconnect the front brake pipes at the connections to the flexible pipes, one on each side of the vehicle, fitting the flexible pipes through the chassis brackets.

(7) Replace the front road wheels.

(8) Remove the stands and lower the vehicle to the ground.

(9) Remove the wedge holding the brake pedal.

(10) Bleed the brake system (see Sub-sub-section K1.6).

(11) Replenish the front axle lubricating oil.

SUB-SUB-SECTION J2.3

CHAPTER 4

FRONT PINION OIL SEAL - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the oil seal:

   (1) Drain the lubricating oil from axle case.

   (2) Disconnect the propeller shaft at the differential (see Sub-sub-section H4.3).

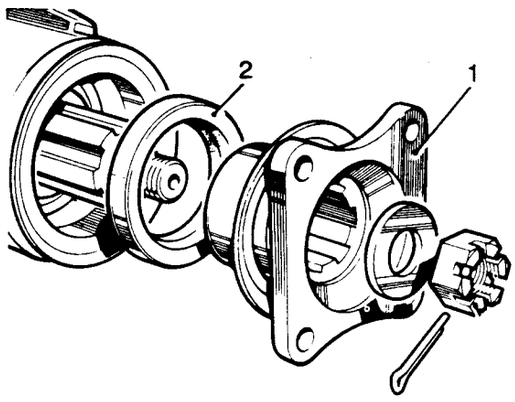


Fig J2.18

   (3) Refer to Fig J2.18. Remove the pinion driving flange (1).

   (4) Prise out the oil seal (2).

REPLACEMENT

2. Replace the oil seal as detailed below:

   (1) Smear the outside diameter of the oil seal (2) with jointing compound.

   (2) Fit the seal, lipped side inward.

   NOTE
   Before fitting the driving flange, examine outside diameter for roughness or damage which may have caused failure of original seal, and rectify or replace as necessary.

   (3) Fit the pinion driving flange (1). Tighten the securing nut. Torque 117 N.m.

   (4) Fit the propeller shaft (see Sub-sub-section H4.3).

   (5) Replenish the differential lubricating oil (see Sub-sub-section J2.5). Ensure the axle case breather is clear. A blocked breather could cause failure of oil seals fitted in the axle assembly.

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION J2.4

OVERHAUL PROCEDURES

SUB-SUB-SECTION J2.4

CHAPTER 1

REAR DIFFERENTIAL - OVERHAUL

DISMANTLING

1. Dismantle the differential as follows:

(1) Remove the differential (see Sub-sub-section J2.3, Chapter 1).

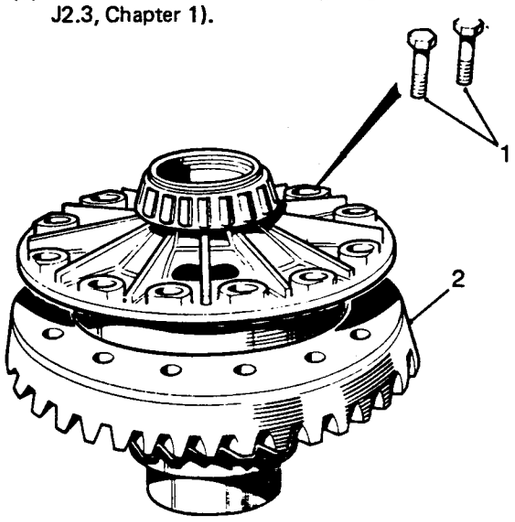


Fig J2.19

(2) Refer to Fig J2.19. Remove the fixings (1) and withdraw the crownwheel (2).

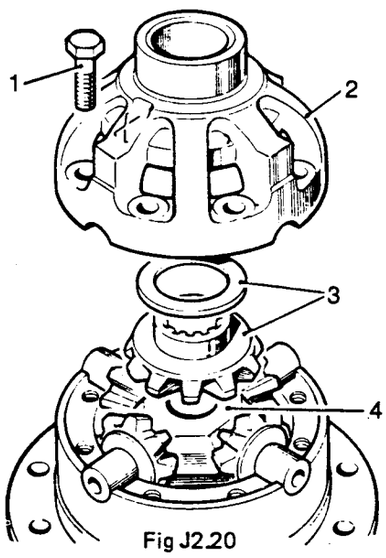


Fig J2.20

(3) Refer to Fig J2.20. Note the alignment markings on the two differential casings to ensure correct refitting, then remove the fixings (1).

(4) Lift off upper case (2).

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

(6) Lift out the cross shaft and pinions (4).

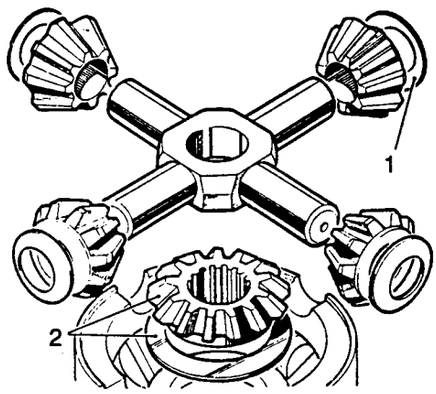


Fig J2.21

(7) Refer to Fig J2.21. Withdraw the dished thrust washers (1).

(8) Withdraw the lower differential wheel and thrust washer (2).

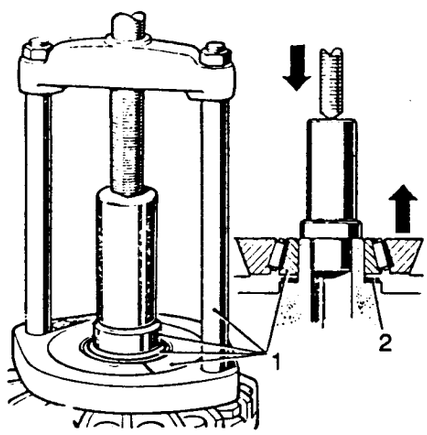


Fig J2.22

(9) Refer to Fig J2.22. Remove the differential bearing cones (1). Remover 18G47BL details 1 and 2, press 18G47C.

(10) Withdraw the shim washers (2) fitted between the bearing cones and the differential casings.

2. Remove the final drive pinion:

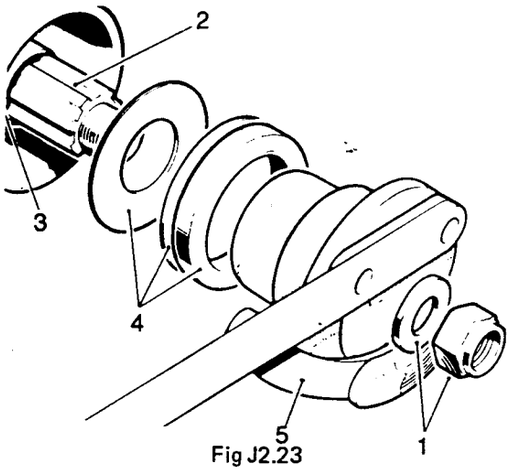


Fig J2.23

(1) Refer to Fig J2.23. Prevent the coupling flange from rotating and remove the flange locknut and plain washer (1), using spanner 18G1205 (5).

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

(3) Withdraw the drive pinion (2) together with the inner bearing cone.

(4) Withdraw and discard the collapsible bearing spacer (3). Withdraw the oil seal, gasket, oil thrower (4) and outer bearing cone.

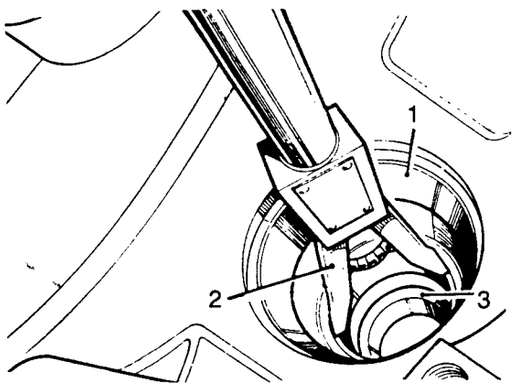


Fig J2.24

(5) Refer to Fig J2.24. Extract the pinion inner bearing cup and shim washers (1) from the casing using special tool S123A (2). Note the shim washer thickness.

(6) Extract the pinion outer bearing cup (3) from the casing using special tool S123A.

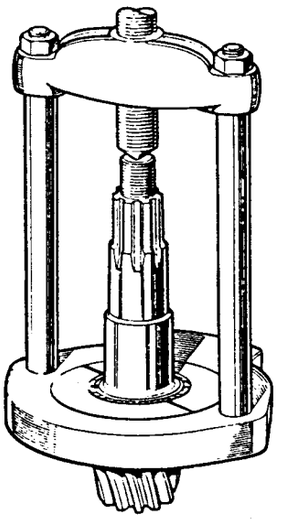


Fig J2.25

(8) Refer to Fig J2.28. Remove the inner bearing cone from the pinion. Remover 18G47BK and press 18G47C.

INSPECTING

3. Carry out the following inspection:

(1) Examine all components for obvious wear and damage.

(2) The bearing cones must be a press fit on their locations.

(3) The crownwheel and pinion are supplied as a matched pair and must not be interchanged separately.

(4) A new crownwheel and pinion matched pair may be fitted to an original gear carrier casing if sound. The original crownwheel and pinion, if sound, may be fitted into a replacement casing.

(5) The two parts of the differential unit casing are matched and must not be replaced separately.

(6) Discard and replace all thrust washers.

(7) Differential housings with worn thrust washer sealings must be replaced as a pair.

(8) Examine the differential case to crownwheel joint face for burrs and damage which could lead to crownwheel run-out when fitted.

REASSEMBLY

4. Reassemble the differential as follows:

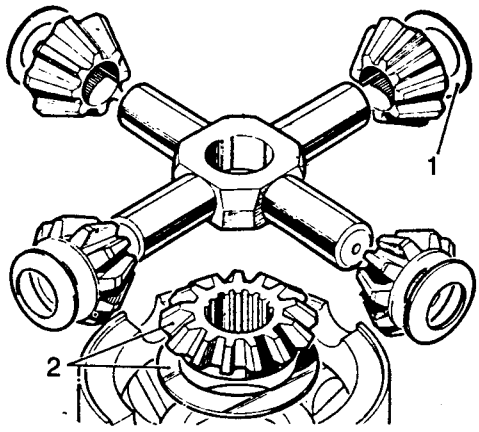


Fig J2.26

(1) Refer to Fig J2.26. Replace the thrust washer and lower differential wheel (2).

(2) Fit the new dished thrust washers (1).

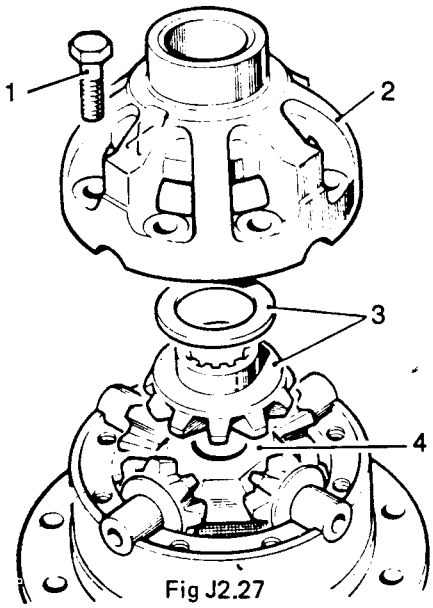


Fig J2.27

(3) Refer to Fig J2.27. Refit the cross shaft and pinions (4).

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

(5) Align the markings on the two differential casings. Place the upper casing (2) in position.

(6) Smear the threads of the fixing bolts (1) with Lockite Studlock. Fit the bolts and tighten diagonally to 91 to 104 N.m.

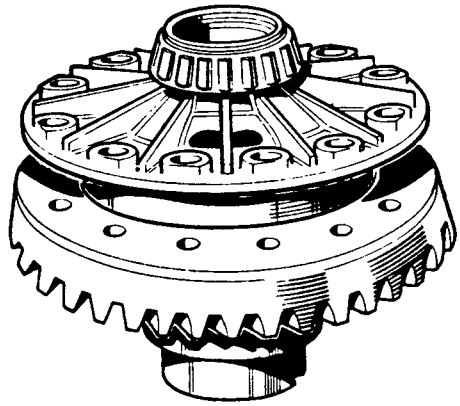


Fig J2.28

(7) Refer to Fig J2.28. Place the differential casing in position on the crownwheel.

(8) Smear the threads of the fixing bolts with Lockite Studlock. Fit the bolts and tighten diagonally to 130 to 145 N.m.

(9) Check the total indicated run-out on the crownwheel back face. This must not exceed 0,05 mm. If run-out is excesssive, check the mating faces for dirt and damage; if necessary select a new radial position for the crownwheel.

(10) Place the differential unit and the bearing cups and cones aside pending the subsequent 'Differential bearing adjustment' checks, (para 5).

5. Carry out the following differential bearing adjustment:

NOTE

This procedure is to establish the correct value of shim washers to be fitted to pre-load the differential bearings. The fitted disposition of the shims, at each side of the differential, is decided during the subsequent 'Differential backlash' checks, (para 9).

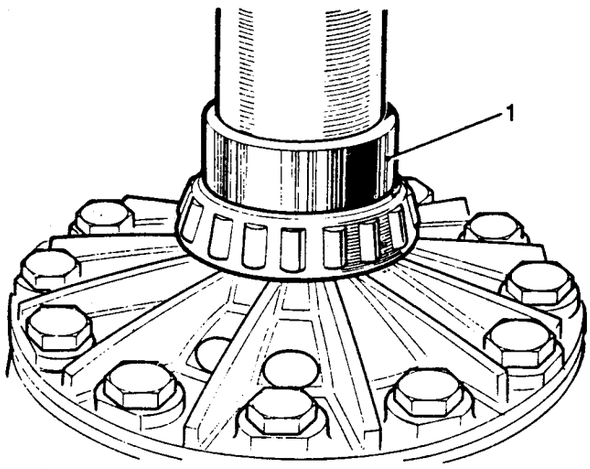


Fig J2.29

(1) Refer to Fig J2.29. Press on the differential bearing cones less shim washer, using special tool 18G134DP (1).

(2) Fit the bearing cups to the differential.

(3) Fit the differential unit and bearing to the gear carrier casing. Do not fit the bearing caps.

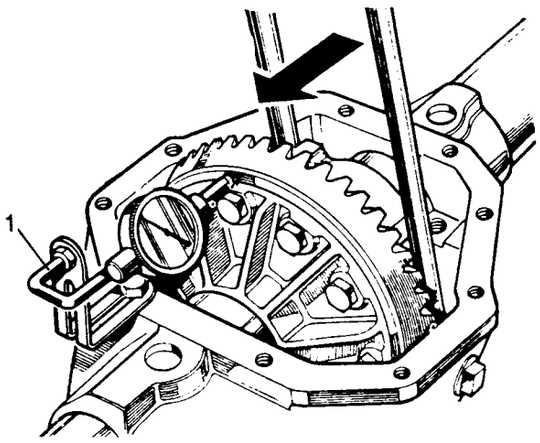


Fig J2.30

(4) Refer to Fig J2.30. Using bracket 530106 (1) position a suitable dial gauge indicator on the casing with the stylus registering on the back face of the crownwheel.

(5) Insert two levers between the casing and the differential unit at one side.

(6) Move the differential unit fully to one side of the casing; do not tilt the unit.

(7) Rotate the differential unit to settle the bearings, continue to lever the differential to the side then zero the dial gauge indicator.

(8) Lever the assembly fully to the other side of the casing, rotate the unit to settle the bearings, then note the total indicator reading.

(9) Add 0,127 mm, for bearing pre-load, to the total noted in step (8). The sum is then equal to the nominal value of shims required for the differential bearings. Shims are available in the range 0,07 mm, 0,12 mm, 0,25 mm and 0,76 mm. Select the total value of shims required.

(10) Remove the differential unit and bearings and place aside. Do not fit the shim washers until the subsequent 'Differential backlash' checks have been made.

6. Fit the drive pinion:

(1) Select shim washers of the same thickness value as those removed from under the pinion inner cup (para 2, step (6)) and place ready for fitting.

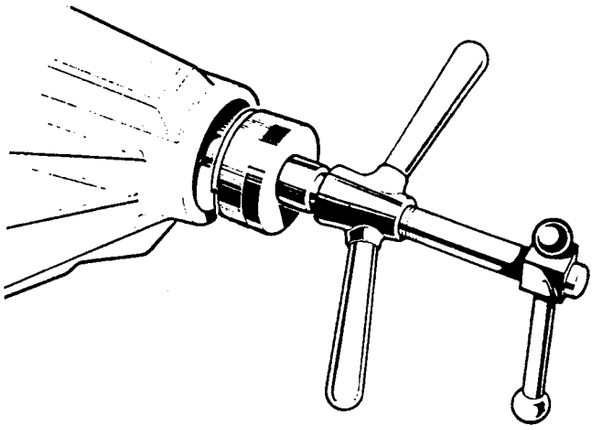


Fig J2.31

(2) Refer to Fig J2.31. Position the outer bearing replacer 18G1122G detail 2, and the outer bearing cup on the press tool 18G1122.

(3) Locate the assembly into the pinion housing nose.

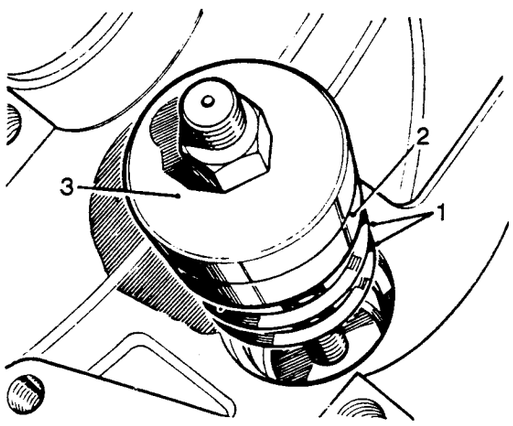


Fig J2.32

(4) Refer to Fig J2.32. Place the selected shim washers (1) on to the inner bearing cup seating.

(5) Position the inner bearing cup (2) in the casing.

(6) Position the inner bearing replacer 18G1122G detail 1, on to 18G1122 and secure with the fixing nut (3).

(7) Hold still the centre screw and turn the butterfly lever to draw in the bearing cups.

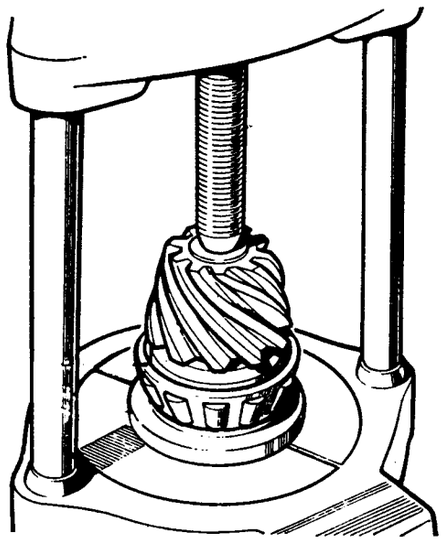


Fig J2.33

(8) Refer to Fig J2.33. Press the inner bearing cone on to the drive pinion 18G47BK details 1 and 2 and 18G47C.

(9) Position the pinion and bearing in the casing; omit the collapsible spacer at this stage.

(10) Fit the outer bearing cone on to the pinion.

(11) Fit the coupling flange and plain washer and loosely fit the flange nut.

(12) Tighten the coupling flange locknut sufficient to remove end-float from the pinion.

(13) Rotate the pinion to settle the bearings and slowly tighten the flange locknut until a torque resistance of 9,25 to 13,8 N.m is required to rotate the pinion.

7. Check the drive pinion markings:

7. Check the drive pinion markings:

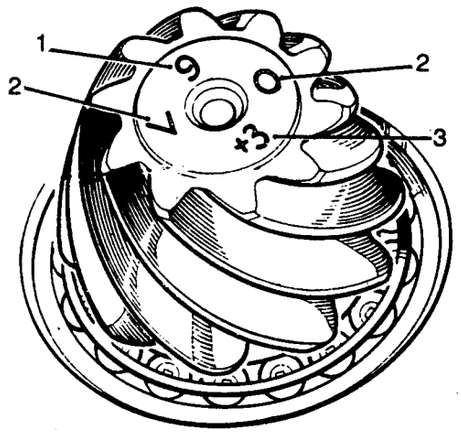


Fig J2.34

(1) Refer to Fig J2.34. Check that the serial number (1) marked on the pinion end face matches that marked on the crownwheel.

(2) The markings on the end face (2) adjacent to the serial number are of no significance during servicing.

(3) The figure marked on the end face (3) opposite to the serial number indicates, in thousandths of an inch, the deviation from nominal required to correctly set the pinion. A pinion marked plus (+) must be deeper than nominal, a minus (–) pinion must be set shallower than nominal.

(4) The nominal setting dimension is represented by the setting gauge block 18G191P (see (1) on Fig J2.35), which is referenced from the pinion end face to the bottom radius of the differential bearing bore.

8. Adjust the drive pinion:

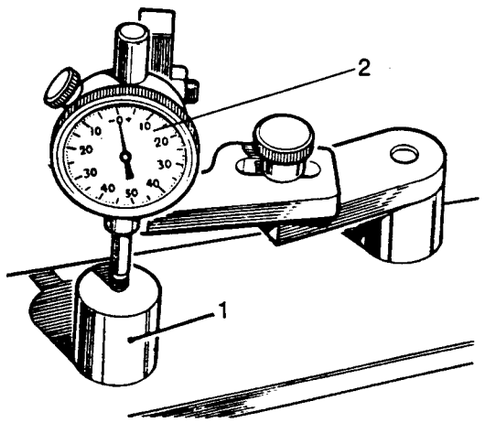


Fig J2.35

(1) Refer to Fig J2.35. Ensure that the pinion end face is free of raised burrs around the etched markings.

(2) Remove the keep disc from the magnetised base of dial gauge tool 18G191.

(3) Place the dial gauge (2) and setting gauge 18G191P (1) on a flat surface and zero the dial gauge stylus on to the setting gauge.

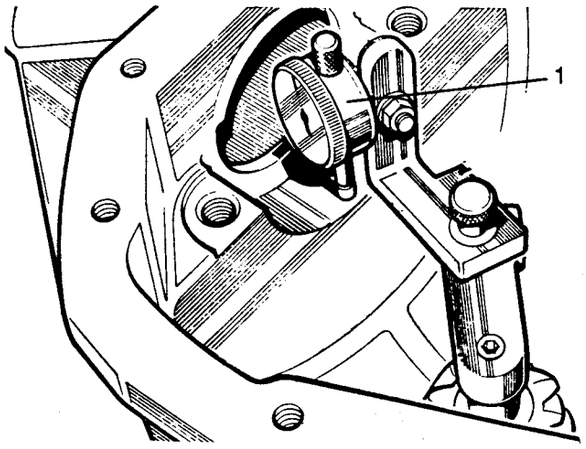


Fig J2.36

(4) Refer to Fig J2.36. Position the dial gauge (1) centrally on the pinion end face with the stylus registering on the lowest point on one differential bearing bore. Note the dial gauge deviation from the zeroed setting.

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

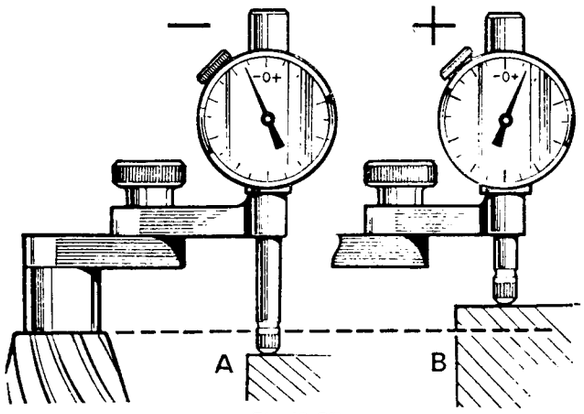


Fig J2.37

(6) Refer to Fig J2.37. Where the stylus has moved down (indicating that the pinion is too high) record as a minus (—) figure (Fig J2.37A).

(7) Where the stylus has moved up (indicating pinion too low) record as a plus (+) figure (Fig J2.37B).

NOTE

For an ideal pinion height setting, the reading on the dial gauge should agree with the figure marked. For a face marking of 3, the dial gauge reading should indicate that the pinion is 0,003 in. lower than nominal (recorded as a plus (+) figure).

(8) Where the figures do not agree, subtract the end face figure from the dial gauge reading; the result is the adjustment required to the thickness of shim washers fitted under the pinion inner bearing cup.
For example:

a. With an end face figure of —3 and a gauge reading of +0,010 inches the adjustment required is
+0,010 inches —(—3) = 0,013 inches

Therefore, add shims to this value to raise the pinion.

b. With an end face figure of +2 and a gauge reading of —0,005 inches the adjustment required is
—0,005 inches —(+ 2) = -0,007 inches

Therefore, subtract shims to this value to lower the pinion.

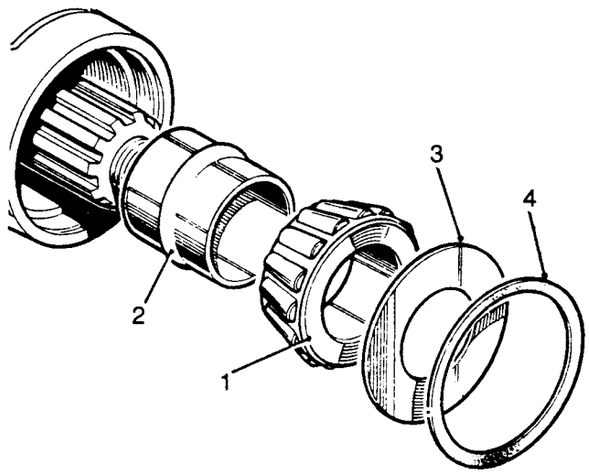


Fig J2.38

(9) Refer to Fig J2.38. When the pinion setting is satisfactory, temporarily remove the pinion outer bearing cone (1).

(10) Fit a new collapsible bearing spacer (2) flared end outward, to the drive pinion and refit the outer bearing cone.

(11) Fit the pinion oil slinger (3).

(12) Fit the oil seal gasket (4).

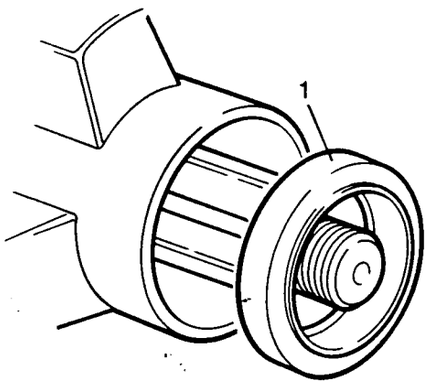


Fig J2.39

(13) Refer to Fig J2.39. Fit the pinion oil seal (1), lipped side first, using a general purpose grease or, where available, a molybdenum disulphide based grease on the lip seal.

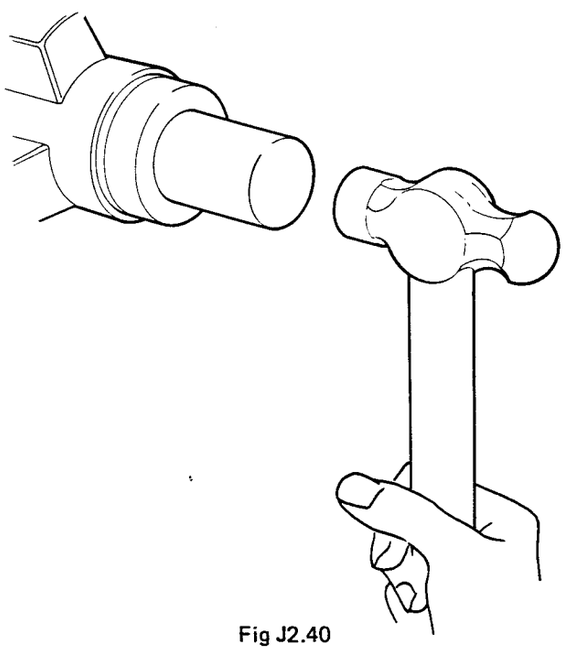


Fig J2.40

(14) Refer to Fig J2.40. Use special tool RO1008 to drift in the seal.

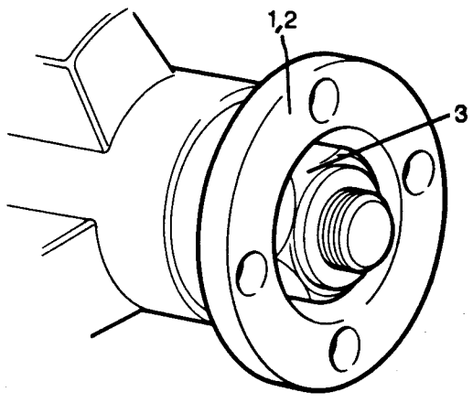


Fig J2.41

(15) Refer to Fig J2.41. Fit the coupling flange (1) and plain washer (2). Loosely fit a new flange nut (3).

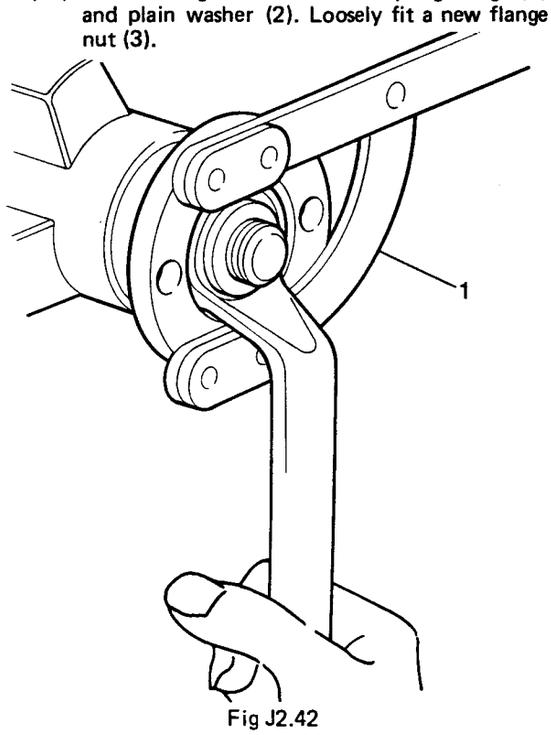


Fig J2.42

(16) Refer to Fig J2.42. Secure special tool 18G-1205 (1) to the coupling flange using slave fixings.

(17) Alternately tighten the flange nut and check the drive pinion resistance to rotation until the following figures are achieved as applicable:

a. Assemblies reusing original pinion bearings:
17,2 to 34,5 N.m. or

b. Assemblies with replacement pinion bearings:
34,5 to 46,0 N.m.

NOTE

A torque load of 345 N.m approximately is required on the coupling flange nut to commence collapsing the bearing spacer. Thereafter torque resistance build-up is rapid, therefore check frequently to ensure the correct figures are not exceeded, otherwise a new collapsible bearing spacer will be required.

9. Check the differential backlash:

(1) Fit the differential unit bearings but omit the shim washers.

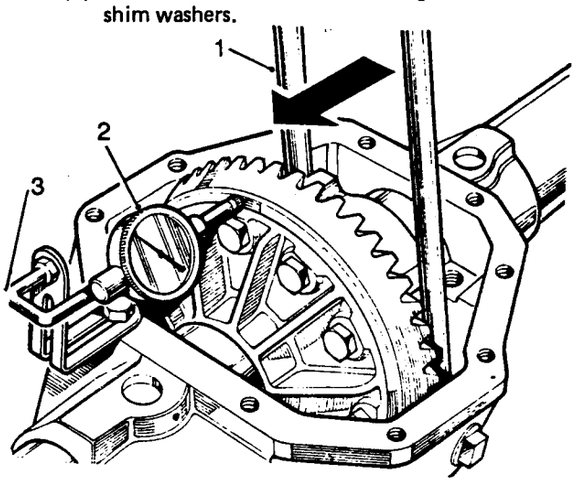


Fig J2.43

(2) Refer to Fig J2.43. Fit the differential unit and lever the unit (1) away from the drive pinion until the opposite bearing cup is seated against the housing. Do not tilt the housing.

(3) Using bracket 530106 (3) install a dial gauge (2) on the casing with its stylus resting on the back face of the crownwheel. Zero the gauge.

(4) Lever the differential unit to engage the crownwheel teeth in full mesh with the drive pinion teeth. Do not tilt the unit.

(5) Note the total reading obtained on the dial gauge.

(6) From this figure subtract 0,25 mm to obtain the correct crownwheel backlash when fitted. The result indicates the value of shimming to be fitted between the differential case and the bearing cone at the crownwheel side of the differential.

(7) Fit the shim value determined in step (6) taking the shims from the pack previously determined during 'Differential bearing adjustment' checks, (para 5). Use special tools 18G47BL details 1 and 2, press 18G47C, 18G134DP.

(8) Fit the remaining shims to the opposite side of the differential using special tools 18G47BL details 1 and 2, press 18G47C and 18G134DP.

CHAPTER 2

FRONT DIFFERENTIAL - OVERHAUL

DISMANTLING

1. Dismantle the front differential assembly as follows:

NOTE
During dismantling it is essential that all components are marked in their original position and relative to other components, so that if original components are refitted, their initial setting is maintained.

(1) Remove the differential assembly (see Sub-sub-section J2.3, Chapter 3).

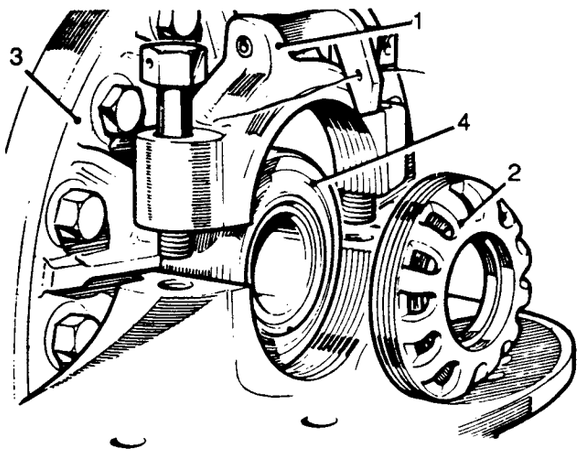


Fig J2.44

(2) Refer to Fig J2.44. Remove the bearing caps (1).

(3) Remove the serrated nuts (2).

(4) Withdraw the crownwheel and differential assembly (3).

(5) Withdraw the differential bearings outer tracks (4).

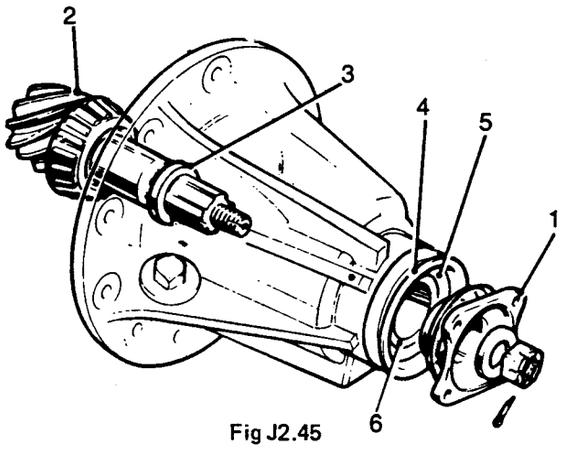


Fig J2.45

(6) Refer to Fig J2.45. Remove the driving flange (1).

(7) Withdraw the pinion (2).

(8) Withdraw the shim washers (3).

(9) Prise out the oil seal (4).

(10) Withdraw the spacer (5).

(11) Withdraw the drive flange roller bearing (6).

(12) Press off the pinion head bearing.

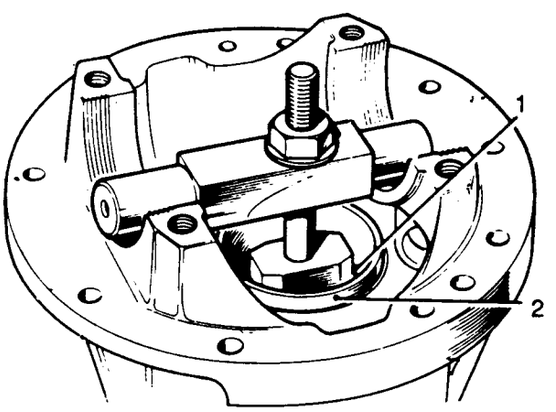


Fig J2.46

(13) Refer to Fig J2.46. Locate the tool 262757 (1) in the pinion housing. Ensure that the projections on the extractor bar fit the cast slots at the rear of the bearing outer race. If necessary, grind the projections until a sliding fit is obtained, otherwise the pinion housing may be damaged.

(14) Extract pinion head bearing outer race (2) together with its shim.

(15) Press out flange end outer race.

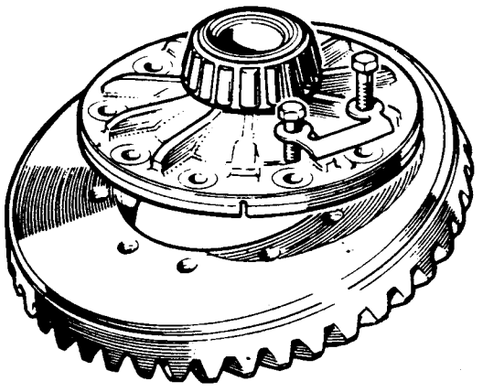


Fig J2.47

(16) Refer to Fig J2.47. Remove the crownwheel from the differential case.

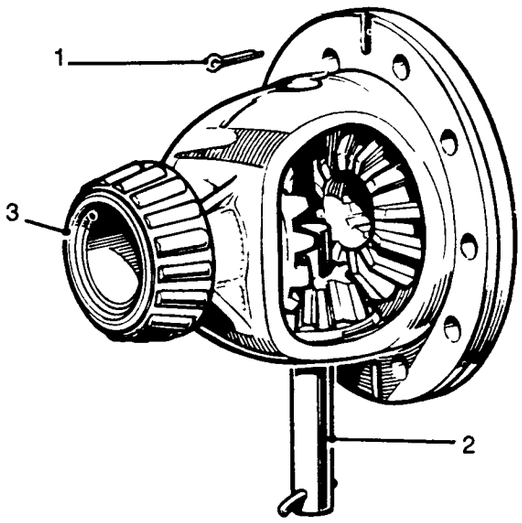


Fig J2.48

(17) Refer to Fig J2.48. Remove the split pin (1) from the differential spindle.

(18) Withdraw the spindle (2).

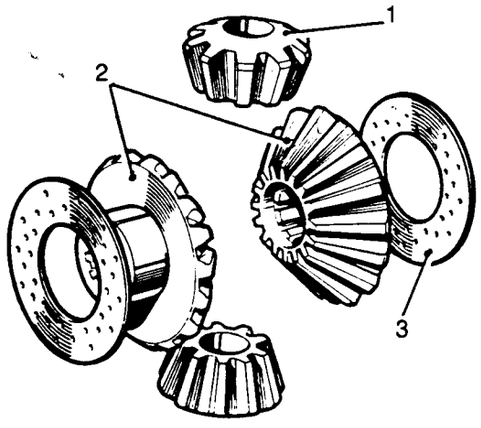


Fig J2.49

(19) Refer to Fig J2.49. Withdraw the pinions (1) by rotating the wheels (2).

(20) Withdraw the wheels (2).

(21) Withdraw thrust washers (3).

(22) Extract the roller bearings ((3) on Fig J2.48).

INSPECTING

2. Carry out the following inspection:

(1) Examine all components for obvious wear or damage.

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

(3) Crownwheel and pinion is only supplied as a matched set and MUST NOT be interchanged separately.

(4) Bevel pinion housing and bearing caps are matched sets, and MUST NOT be interchanged separately.

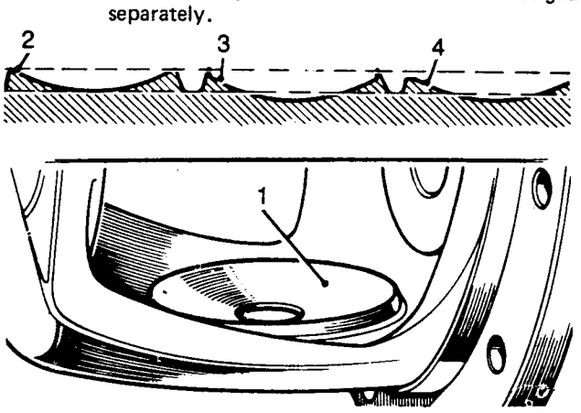


Fig J2.50

(5) Refer to Fig J2.50. Check the differential pinion seatings (1) in the case, as follows:

i. The spherical seats (2) must be finished flush.

ii. The seat must not be stepped or recessed (3).

iii. If a step is present (4) it must be ground away to prevent the pinion teeth rubbing the casing.

REASSEMBLY

3. Reassemble the differential:

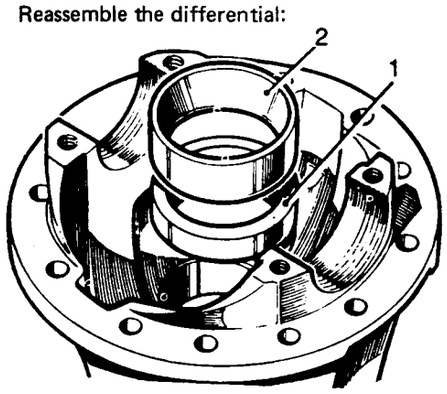


Fig J2.51

(1) Refer to Fig J2.51. Fit shim (1) of same thickness removed during dismantling, in pinion head bearing seat.

NOTE
If original shim has been mislaid, use new shim of at least 1,27 mm thickness.

(2) Press in the pinion head bearing outer race (2). Special tool 262758 used with 262757 ((1) on Fig J2.46).

(3) Press in the flange end bearing outer race.

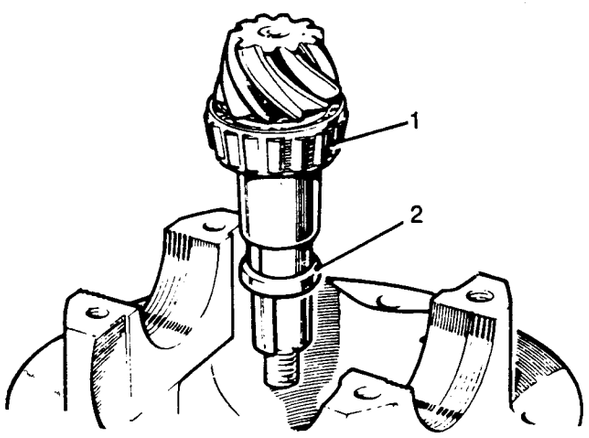


Fig J2.52

(4) Refer to Fig J2.52. Press the pinion head roller bearing (1) onto the pinion.

(5) Locate the pinion shaft into the case together with the bearing pre-load adjustment shim (2) removed during dismantling.

NOTE
If original shim has been mislaid, use new shim of at least 4,06 mm thickness.

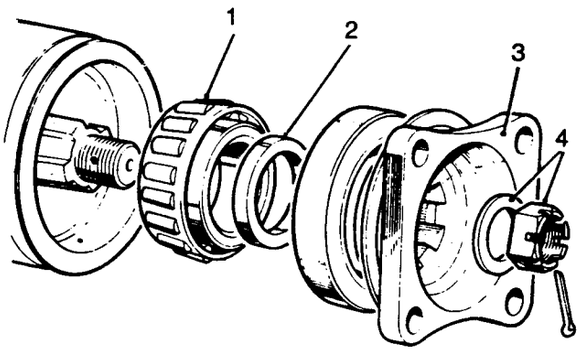


Fig J2.53

(6) Refer to Fig J2.53. Fit the flange end roller bearing (1).

(7) Fit the distance washer (2).

NOTE
Do not fit the oil seal at this stage.

(8) Fit the driving flange (3).

(9) Fit the washer and nut (4). Torque 117 N.m. While tightening the nut, check that the pinion can rotate. If the pinion becomes excessively stiff, use a thicker pre-load adjustment shim.

4. Check and adjust pinion bearing pre-load:

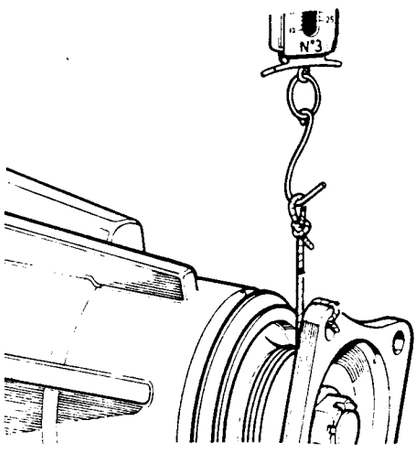


Fig J2.54

(1) Refer to Fig J2.54. Tie a length of cord to the driving flange, then coil it around the flange hub.

(2) Attach a spring balance to the loose end of the cord.

(3) Apply a steady pull on the spring balance and note the force required to rotate the pinion shaft, after having overcome inertia. Bearing pre-load is correct when a figure of 3,2 to 4,5 kg is recorded on the spring balance.

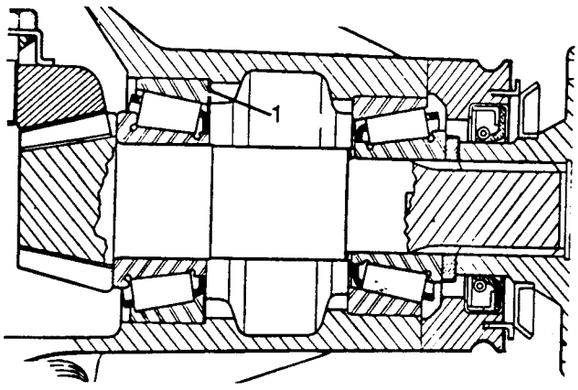


Fig J2.55

(4) Refer to Fig J2.55. Adjustment can be made by changing the shims (1) located on the pinion shaft between the bearings. Shims are avilable in a range of thicknesses. Thicker shimming will reduce bearing pre-load, thinner shimming will increase pre-load.

5. Check and adjust pinion height setting:

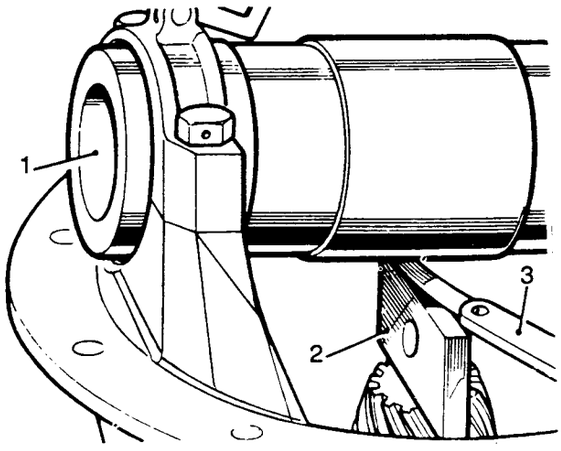


Fig J2.56

(1) Refer to Fig J2.56. Locate pinion height gauge 605004 (1) into the pinion housing and secure with the bearing caps.

(2) Place the slip gauge (2) onto the pinion face and hold firmly in place.

(3) Using a feeler gauge (3) measure the height between the height gauge and the slip gauge. A clearance of 0,28 mm to 0,30 mm must be obtained.

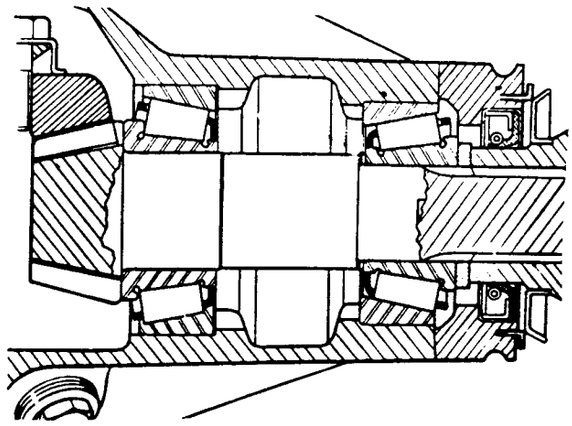


Fig J2.57

(4) Refer to Fig J2.57. If necessary, adjust the thickness of shims between the pinion head bearing outer race and the pinion case to obtain the correct clearance. Use special tool 262757 to remove outer race.

NOTE
Any adjustment of the pinion height will affect the pinion bearing pre-load. When the pinion height is correct, repeat the pinion bearing pre-load check of para 4, steps 1 to 4.

(5) When the pinion height and bearing pre-load is correct, remove the height gauge.

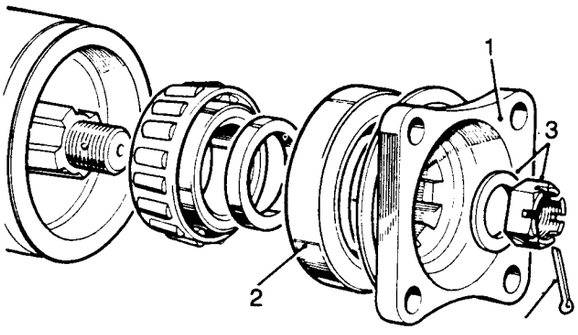


Fig J2.58

(6) Refer to Fig J2.58. Remove the pinion driving flange (1).

(7) Smear the outside diameter of the pinion oil seal (2) with jointing compound.

(8) Fit the seal, lipped side inward.

(9) Fit the driving flange.

(10) Fit the flange securing nut and washer (3). Torque 117 N.m.

(11) Secure nut with split pin.

6. Check differential wheel and pinion backlash:

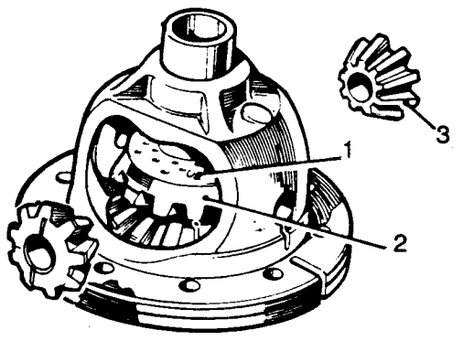


Fig J2.59

(1) Refer to Fig J2.59. Place a thrust washer (1) in position on the rear face of each differential wheel.

(2) Locate the two differential wheels (2) and thrust washers into the differential case.

(3) Insert the differential pinions at exactly opposite points, then rotate the wheel and pinion assembly to align the holes in the pinions and case for the pinion spindle.

NOTE
If original components are being refitted, ensure that the wheel and pinion assembly is in its original position before fitting the spindle.

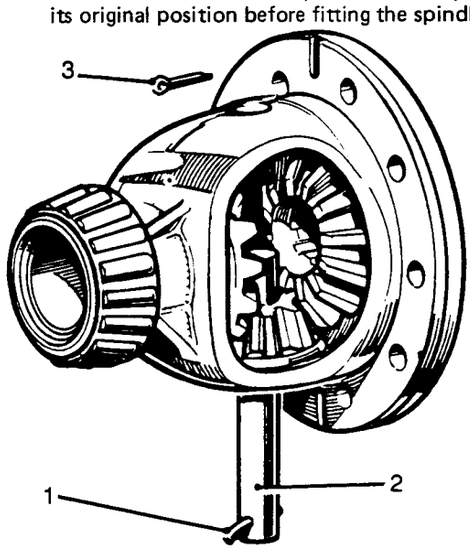


Fig J2.60

(4) Refer to Fig J2.60. Ensure that the plain pin (1) is secure in the pinion spindle.

(5) Fit the spindle (2).

(6) Check for backlash between the differential wheel and pinions, a manual check is sufficient, no actual measuring is necessary. There must be a definite backlash, but this must be the minimum obtainable consistent with smooth running wheels and pinions. Adjustment can be made by changing the thrust washers for the differential wheels, which are available in a range of thicknesses.

(7) Secure the spindle with a split pin (3).

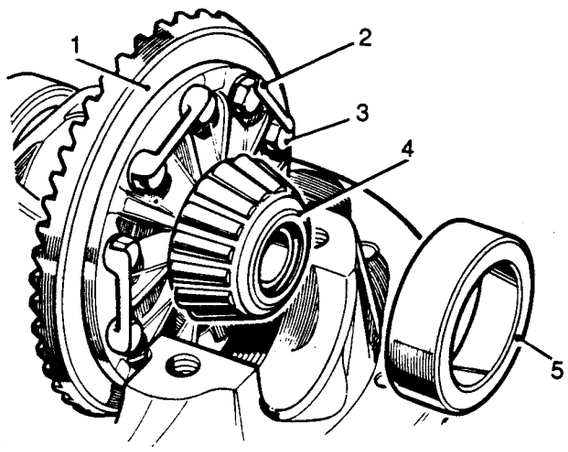


Fig J2.61

(8) Refer to Fig J2.61. Align the crownwheel (1) with the differential case.

(9) Locate lockplates in place (2).

(10) Fit crownwheel securing bolts (3) noting that there are two fitted bolts 10 mm diameter which must be fitted diametrically opposite. The remaining bolts are 9,5 mm diameter. Tighten the bolts evenly to avoid distortion. Torque 48 N.m for all the bolts.

(11) Press on the differential roller bearings (4).

(12) Fit the bearing outer races (5) and locate the differential into the pinion housing.

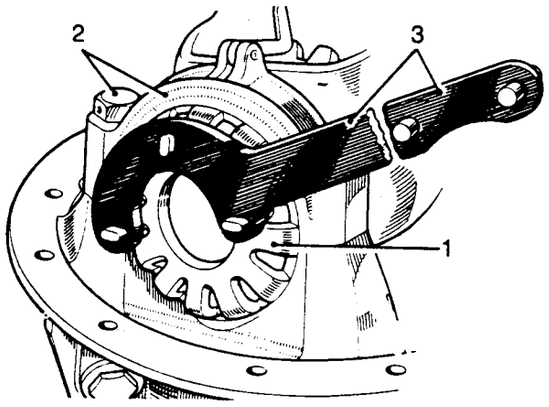


Fig J2.62

(13) Refer to Fig J2.62. Fit the serrated nuts (1).

(14) Fit the bearing caps (2). Tighten the securing bolts firmly but not fully.

(15) Using tool 530105 (3) tighten both serrated nuts to remove all bearing end float without introducing pre-load.

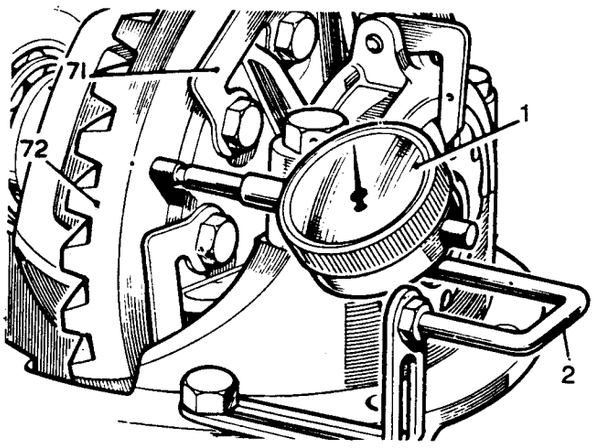


Fig J2.63

(16) Refer to Fig J2.63. Using a test dial (1) indicator with bracket 530106 (2), measure the run-out on the rear face of the crownwheel. This must not exceed 0,10 mm. If excessive run-out is recorded, the crownwheel and differential must be removed from the bevel pinion housing and the crownwheel repositioned on the differential case. Re-assemble and recheck. If necessary, this procedure must be repeated until the run-out is correct.

(17) When the crownwheel run-out is correct, ensure that the lockplates (2) are fully engaged over the crownwheel securing bolts.

(18) Using a dial test indicator, check the crownwheel to bevel pinion backlash. This must be 0,20 mm to 0,25 mm. Where necessary, adjust the crownwheel backlash by alternatively slackening and tightening the serrated nuts until the backlash is correct.

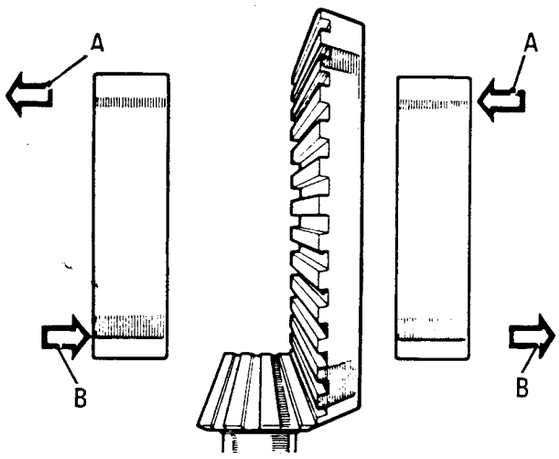


Fig J2.64

(19) Refer to Fig J2.64. Move the serrated nuts in direction A to reduce backlash.

(20) Move the serrated nuts in direction B to increase backlash.

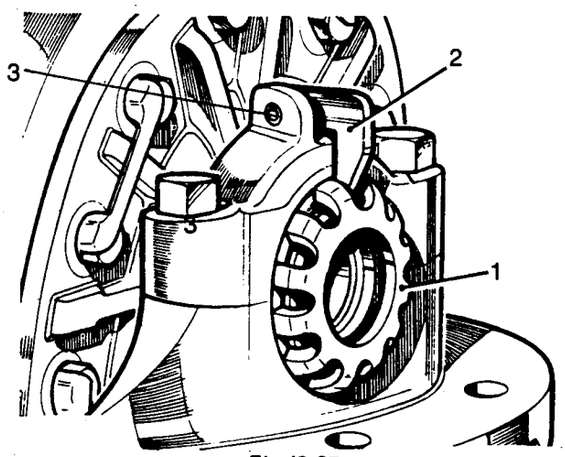


Fig J2.65

(21) Refer to Fig J2.65. With the backlash correct and no bearing end-float or pre-load, tighten both serrated nuts (1) by half a serration only, to pre-load the taper roller bearings.

(22) Engage the lockers (2) into the serrated nuts. If either locker is not opposite a serration, bend it to fit.

(23) Fit the spring pins (3) to retain the lockers.

(24) Tighten the bearing cap bolts. Torque to 83 N.m.

(25) Refit the differential assembly (see Sub-sub-section J2.3, Chapter 3).

SUB-SUB-SECTION J2.5

MAINTENANCE

INTRODUCTION

1. The differential units are designed for maintenance free operation, requiring only periodic inspections for obvious defects and checking the oil level. At intervals specified, the oil should be drained and replenished with fresh, clean oil of the correct grade.

2. At frequent intervals, depending on operating conditions, the exterior of the differential should be cleaned to prevent the accumulation of dirt, mud and oil etc.

OIL CHECKING AND CHANGING - FRONT DIFFERENTIAL

Checking the Oil Level

NOTE
The vehicle shall be parked on a completely level surface before checking or changing the oil.

1. To check the oil level:

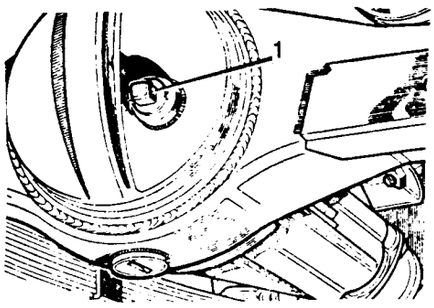


Fig J2.66

(1) Refer to Fig J2.66. Remove the filler plug (1) at the front of the axle casing.

NOTE
A second plug at the rear of the axle casing should be disregarded.

(2) Check that the oil is up to the bottom of the filler plug hole.

(3) If necessary, pour oil through the filler plug hole to bring the oil up to this level.

(4) Allow excess oil to drain from the filler plug hole.

(5) Replace and tighten the filler plug.

(6) Wipe off excess oil from around the filler plug.

NOTE
If significant topping up is required check for oil leaks at the filler and drain plugs, joint faces and oil seals adjacent to axle shaft flanges and the propeller shaft driving flange.

Changing the Oil

NOTE
Before changing the oil, the vehicle shall have been driven sufficiently to warm up the oil in the front differential.

4. To change the oil:

(1) Place a container of sufficient capacity to hold 2 litres of old oil under the front differential.

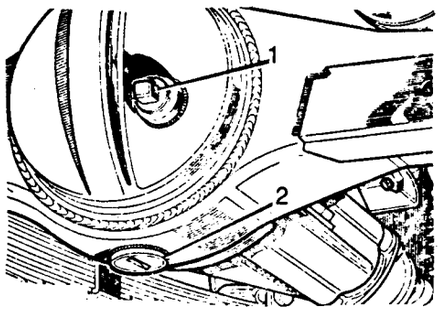


Fig J2.67

(2) Refer to Fig J2.67. Remove the front differential filler plug (1).

(3) Remove the front differential drain plug (2) and allow the oil to drain into the container.

(4) Replace and tighten the drain plug using a new gasket.

(5) Fill the front differential with oil through the filler plug hole until the oil level is up to the bottom of the filler hole.

(6) Allow excess oil to drain from the filler hole.

(7) Replace and tighten the filler hole plug.

(8) Wipe off excess oil from around the two plugs.

OIL CHECKING AND CHANGING - REAR DIFFERENTIAL

Checking the Oil Level

NOTE
The vehicle shall be parked on a completely level surface before checking or changing the oil.

5. To check the oil level:

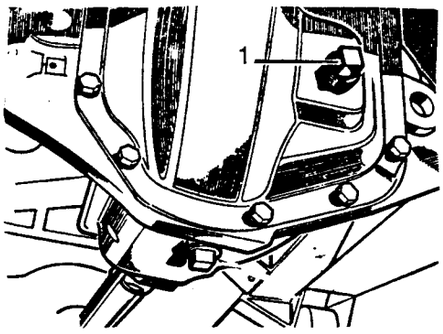


Fig J2.68

(1) Refer to Fig J2.68. Remove the filler level plug (1).

(2) Check that the oil is up to the bottom of the filler plug hole.

(3) If necessary pour oil into the filler plug hole to bring the oil up to this level.

(4) Allow excess oil to drain from the filler hole.

CAUTION
When replacing the filler hole plug do not overtighten. The plug should be just tight to prevent oil leaks.

(5) Replace and tighten the filler hole plug.

(6) Wipe off excess oil from around the plug.

NOTE
If significant topping up is required check for oil leaks from the filler and drain plugs, the joint faces and oil seals adjacent to the axle shaft flanges and the propeller shaft driving flange.

Changing the Oil

NOTE
Before changing the oil the vehicle shall have been driven sufficiently to warm up the oil in the rear differential.

6. To change the oil:

(1) Place a container of sufficient capacity to hold 2,5 litres of old oil under the rear differential.

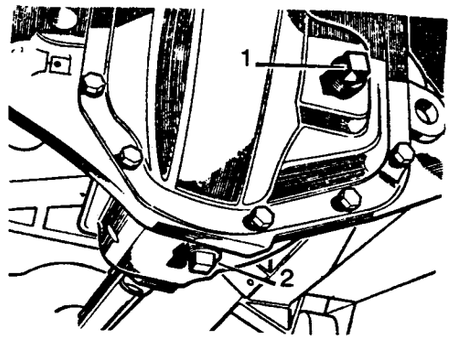


Fig J2.69

(2) Refer to Fig J2.69. Remove the rear differential filler plug (1).

(3) Remove the rear differential drain plug (2) and allow the oil to drain into the container.

(4) Replace and tighten the drain plug using a new gasket.

(5) Fill the differential with oil through the filler hole until the oil level is up to the bottom of the filler hole.

(6) Allow excess oil to drain from the filler hole.

CAUTION
When replacing the filler hole plug do not overtighten. The plug should be just tight enough to prevent oil leaks.

(7) Replace and tighten the filler plug.

(8) Wipe off excess oil from around both plugs.

OIL LEAKS

7. Oil leaks from the differential unit may be due to:

a. A worn oil seal.

b. Too much oil in the differential.

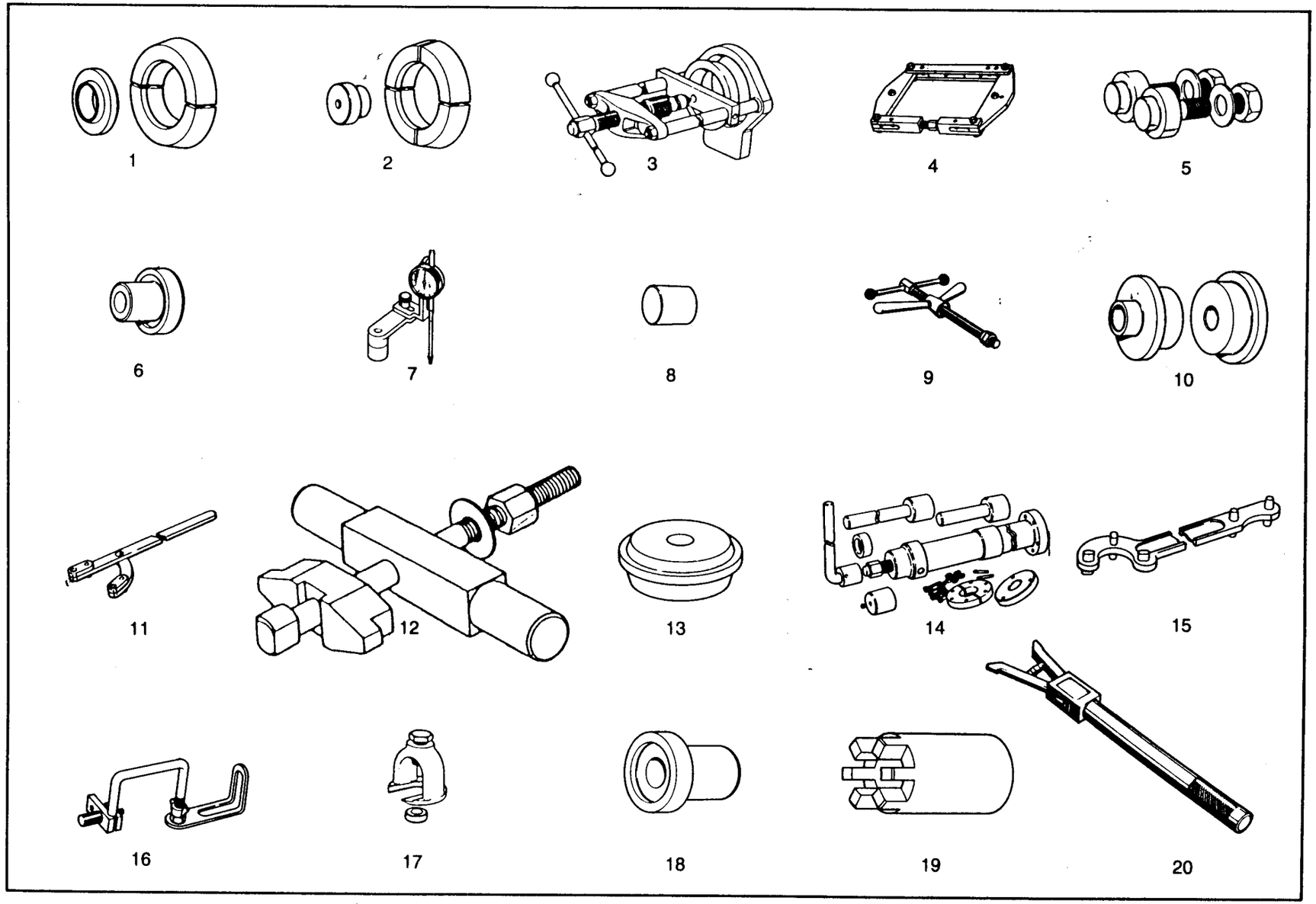
c. A loose cover, or oil leaking past mating faces.

d. Oil leaking into differential from wheel hubs.

8. In time, of course, the oil seals will wear and leak. However, an overfilled differential may cause rapid deterioration of the oil seals, and therefore early detection is essential. For this purpose, regular periodic inspections should be conducted.

9. Oil leaks should be recitified as soon as possible and under no circumstances should the vehicle be used, if the oil in the differential is low. Otherwise, the differential will be severely damaged.

SPECIAL WORKSHOP TOOLS FOR SECTION J - AXLES AND HUBS



SPECIAL WORKSHOP TOOLS FOR SECTION J - AXLES AND HUBS

Item Ref	Mfr. Part No. & / or Drg.No. &/or Spec. No.	I. C. N.	Item Name and Description	Items/ Unit	Repair Lines
Item Verw.	Verv. Ond. Nr. & / of Tek.Nr. &/of Spes.Nr.	I. B. N.	Itemnaam en Beskrywing	Items/ Eenhd.	Herstel Lyne 1 2 4
1	18G47BK		PINION BEARING CONE REMOVER/REPLACER for use on pinion bearings		
2	18G47BL		DIFFERENTIAL BEARING CONE ADAPTOR/REMOVER for use with 18G47C		
3	18G47C		HAND PRESS for removal and replacement of bearings		
4	18G131C		DIFFERENTIAL CASE SPREADER to spread axle case on assembly		
5	18G131F		ADAPTOR PINS for use with 18G131C		
6	18G134DP		DIFFERENTIAL BEARING CONE ADAPTOR/REPLACER for side bearings		
7	18G191		DIAL GAUGE, BRACKET AND BASE for pinion height setting		
8	18G191P		PINION SETTING GAUGE for use with 18G191		
9	18G1122		BEARING CUP REPLACER, basic tool		
10	18G1122G		PINION BEARING CUPS for use with 18G1122		
11	18G1205		PINION FLANGE HOLDING WRENCH, adjustable wrench		
12	262757		EXTRACTOR for differential pinion bearing		
13	262758		PRESS BLOCK for replacing pinion bearing cup		
14	275870		AXLE SHAFT BEARING, removal tool		
15	530105		SPANNER for differential overhaul		
16	530106		BRACKET for dial indicator gauge		
17	601763		BALL JOINT, removal tool		
18	RO1008		PINION OIL SEAL, replacer tool		
19	RO1010		HUB NUT SOCKET for applying correct torque to hub nuts		
20	S123A		PINION BEARING CUP, remover tool		

SECTION CONTENTS LIST

SECTION K

BRAKING SYSTEM

SUB-SECTION CONTENTS LIST

SUB-SECTION K1

ROAD WHEEL BRAKES

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION K1.1

DESCRIPTION AND SPECIFICATIONS

SUB-SUB-SECTION K1.1

CHAPTER 1

DESCRIPTION OF THE BRAKE SYSTEM

GENERAL

1. The Land Rover uses two brake systems: a hydraulic, pedal operated system for the road wheel brakes and a mechanical linkage for the hand or parking brake.

2. The road wheel brakes are dual line, servo assisted, the pedal operating directly on the master cylinder to generate pressure in the hydraulic lines. The dual system is employed so that adequate braking is still available even after a complete failure in the front wheel or the rear wheel hydraulic circuit.

3. The handbrake is mechanically linked to a braking system on the rear propeller shaft. The transfer box output shaft is fitted with an internally splined flange held to the output shaft by a castle nut. The rear face of the flange is fitted with four studs to which the rear propeller shaft universal is clamped. The brake drum, coaxial with the output shaft, is bolted to the flange and so rotates with the propeller shaft. The brake shoes inside the drum are fixed to a back plate attached to the transfer box housing.

BRAKE WARNING LIGHT

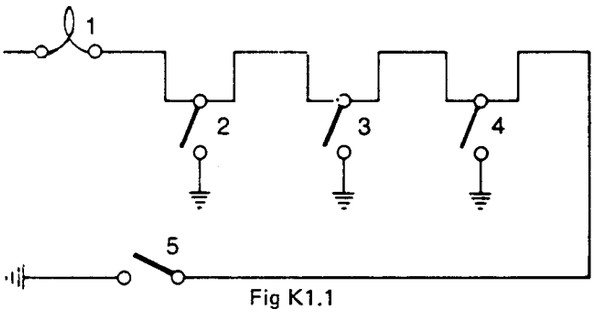


Fig K1.1

4. Refer to Fig K1.1. An amber warning light (1) marked BRAKE is provided on the dash to the left of the instrument panel. The light is in a series circuit with the following warning indicator switches to provided a visual indication of brake hydraulic fluid leakage or servo vacuum loss.

a. A servo mounted vacuum switch (2) indicates lack of vacuum assistance at the brake servo.

b. A pedal mounted switch (3) operates the stop lamps.

c. A chassis mounted differential switch (4) indicates fluid leakage in the front or rear brake hydraulic systems.

5. The brake warning light holder incorporates a test switch (5). The switch is of the push button type and lights when pushed in to show the bulb is OK.

SUB-SUB-SECTION K1.1

CHAPTER 2

BRAKE SYSTEM SPECIFICATIONS

INTRODUCTION

1. Specifications for the wheel brake system are given in the following Tables:

TABLE K1.1 - GENERAL DATA
TABLE K1.2 - TORQUE SPECIFICATIONS

TABLE K1.1 - GENERAL DATA

ITEM	DESCRIPTION
System	Dual line, servo assisted
Master cylinder bore diameter	24,5 mm
FRONT	
Drum diameter	279,4 mm
Reclamation limit	0,75 mm oversize
Wheel cylinder bore diameter	27,57 mm. Twin leading shoe
Lining dimensions	264,66 mm x 76 mm x 4,74 mm
Lining material	Mintex M22
REAR	
Drum diameter	279,4 mm
Reclamation limit	0,75 mm oversize
Wheel cylinder bore diameter	31,75 mm. Single leading shoe
Lining dimensions	264,66 mm x 76 mm x 4,74 mm
Lining material	Mintex M22
Total swept area, foot brakes	2340 cm^2

TABLE K1.2 - TORQUE SPECIFICATIONS

ITEM	TORQUE (N.m)
Wheel cylinder bleed nipple	5 to 8
Master cylinder to servo nuts	22 to 26
Tipping valve retainer (Dual system master cylinder)	49 to 62
Brake failure switch end pipe union	22
Brake failure switch unit to housing	17,0
Fluid reservoir to master cylinder screws (dual line servo models)	3 to 4
Servo assembly securing nuts	12

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION K1.2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

SUB-SUB-SECTION K1.2

CHAPTER 1

GENERAL FAULT FINDING

INTRODUCTION

1. This Sub-sub-section deals with fault diagnosis and corrective action for the wheel brake system. In Table K1.3, a list of symptoms, the probable cause and the necessary remedial action is given. It should be noted that the Table is not exhaustive and faults may occur which are not listed. Should the Table fail to give an indication of a fault, the suspected components should be removed for closer inspection and/or overhaul.

TABLE K1.3 - WHEEL BRAKE FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Spongy pedal action	Air in system. Swollen rubber components (use of incorrect fluid) Incorrect brake shoe adjustment.	Bleed system. Replace swollen components, clean and refill with correct fluid. Adjust shoes.
Loss of pedal pressure	Leak in hydraulic system.	Trace and repair leak.
Hard brake pedal	Incorrect grade of lining. Restriction in master cylinder. Incorrect shoe adjustment.	Reline with correct grade lining. Overhaul cylinder. Adjust shoes.
Poor brakes	Water-soaked linings. Incorrect or glazed linings. Incorrect shoe adjustment. Incorrect master cylinder adjustment.	Dry out linings. Reline with correct grade lining. Adjust shoes. Overhaul master cylinder.
Grabbing brakes	Grease, oil or fluid-soaked linings. Scored or cracked drum. Incorrect shoe adjustment.	Reline. Skim or replace drum. Adjust shoes.
Squealing brakes	Incorrect linings. Distorted brake drum. Bent anchor plate. Damaged brake shoe. Dust in drums. Shoes binding on the steady posts. Loose wheel cylinder.	Replace linings with correct grade. Skim or replace drum. Replace anchor plate. Replace shoes. Clean out dust. Overhaul brake. Tighten cylinder.
Brakes drag	Incorrect shoe adjustment. Distorted rubber boots. Seized shoe. Weak pull-off springs. Loose wheel bearings. Restriction in brake pipe. Distorted drum.	Readjust shoes. Replace boots. Overhaul brakes. Replace springs. Overhaul hub. Trace and clear. Skim or replace drum.
Brake warning lamp lights		See Chapter 2.

NOTE
The brake drums may be skimmed to not greater than 0,75 mm oversize.

CHAPTER 2

BRAKE WARNING LIGHT INDICATIONS

DIAGNOSIS - OVERHAUL

1. When the brake warning light comes on during normal operation it indicates an incipient failure of the road wheel braking system. The vehicle should be driven very carefully to a workshop, or towed if there is a complete brake failure, and the following checks made.

2. Note that the warning indicator switches are normally open circuit. When the switches are closed as a result of fault conditions they short the circuit to earth to illuminate the brake warning light.

SERVO VACUUM SWITCH

3. Make the following checks:

(1) Ensure that a vacuum is available at the switch by checking the hose connections for soundness.

(2) Run the engine for a short period and obtain overrun conditions, that is, open the throttle and then allow it to close quickly.

(3) If the brake warning light stays on disconnect the electrical leads at the vacuum switch and connect them together using a male Lucar connector blade.

(4) If the light is extinguished either the vacuum switch or the servo assembly is faulty. First replace the switch and recheck. If the fault persists change the servo assembly.

(5) If the warning light remains on in step (3) leave the leads connected together and go to the next switch in the circuit.

BRAKE FAILURE SWITCH

4. Check as follows:

(1) Disconnect the switch leads and interconnect them to remake the circuit.

(2) If the brake warning light is extinguished, check for hydraulic system leakage which would cause the differential switch to displace to one end.

(3) Once the fault has been rectified centralise the switch plunger as follows:

i. Set up to bleed a brake line in the system that was not faulty.

ii. Press the brake pedal using very slow pedal travel, observing the brake warning light at the same time.

iii. Immediately the warning light is extinguished keep a light pressure only on the brake pedal and close off the bleed nipple.

(4) If the brake warning light remains on in step (1), check the final switch in the circuit.

STOP LAMP SWITCH

5. This switch lights the stop lights. To check the switch:

(1) Press the brake pedal. If it moves 110 mm the brake stop lights should come on and indicate that the switch is working correctly.

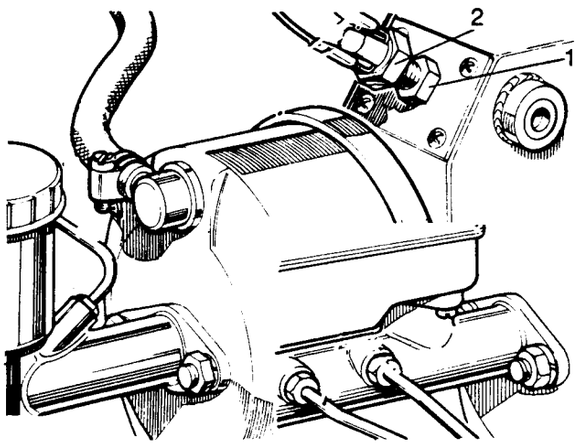


Fig K1.2

(2) Refer to Fig K1.2. If the brake stop lights do not come on after 19 to 25 mm of brake pedal travel, reset the switch by loosening the locknut (1) and screwing the switch (2) out until the correct travel is achieved.

(3) If the stop lights still do not come on after resetting to 19 to 25 mm of predal travel, either the switch or the electrical circuit may be faulty. Check and rectify the fault or replace the switch.

SUB-SUB-SECTION K1.3

ROAD WHEEL BRAKE ADJUSTMENT

NOTE

Two adjusters are provided on each road wheel. Adjust both on each wheel.

PROCEDURE

1. Adjust the brakes as follows:

   (1) Apply the transmission brake for front wheel adjustments. Chock the front wheels for rear brake adjustments.

   (2) Raise the wheel to be adjusted.

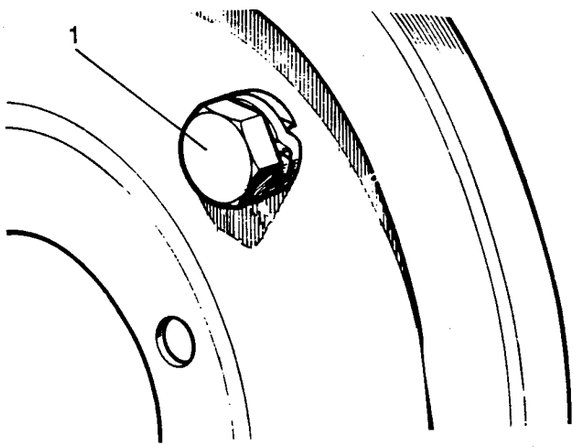


Fig K1.3

   (3) Refer to Fig K1.3. Ensure that the wheel is free to rotate. Back off the adjusters (1) if necessary.

   (4) Turn in the adjusters until the brake shoes contact the wheel drum.

   (5) Back off two serrations on the adjusters (1).

   (6) Lower the wheel to the ground.

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION K1.4

REMOVAL AND REPLACEMENT PROCEDURES

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION K1.4

REMOVAL AND REPLACEMENT PROCEDURES

SUB-SUB-SECTION K1.4

CHAPTER 1

BRAKE FAILURE SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the brake failure switch:

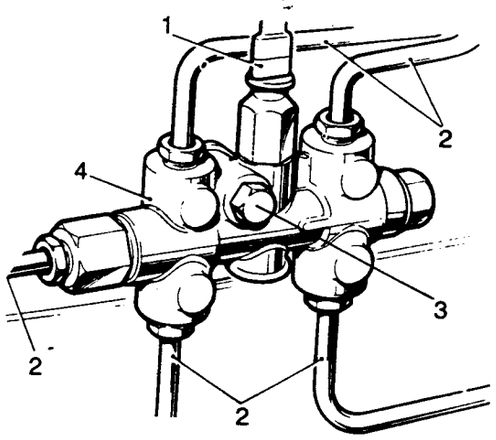


Fig K1.4

(1) Refer to Fig K1.4. Disconnect the electrical leads (1) from the brake failure switch (4), located in the engine compartment at the chassis RH side member.

(2) Disconnect and blank off the five fluid pipes (2).

(3) Remove the central retaining bolt (3).

(4) Remove the brake failure switch (4).

REPLACEMENT

2. Replace the switch as follows:

(1) Secure the brake failure switch in position, with the electrical leads socket uppermost.

(2) Replace the five fluid pipes.

(3) Reconnect the electrical lead.

(4) Bleed the brakes (see Sub-sub-section K1.6).

CHAPTER 2

BRAKE DRUMS - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove a brake drum:

   (1) Jack up the axle and remove the road wheel.

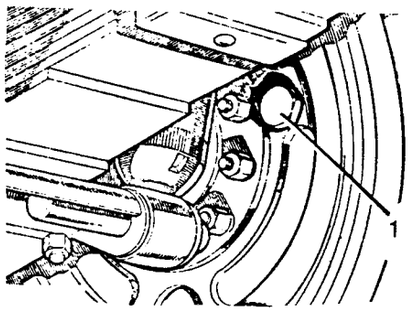


Fig K1.5

   (2) Refer to Fig K1.5. Slacken off the brake adjuster/s (1) at the brake anchor plate.

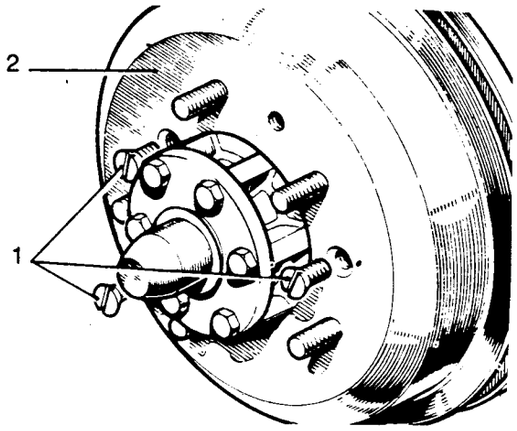


Fig K1.6

   (3) Refer to Fig K1.6. Remove the brake drum fixings (1).

   (4) Withdraw the brake drum (2).

REPLACEMENT

2. Replace a brake drum as follows:

   (1) Fit the drum over the studs, aligning the holes for the fixing screws.

   (2) Fit and tighten the fixings.

   (3) Fit the road wheel and adjust the brakes.

SUB-SUB-SECTION K1.4

CHAPTER 3

MASTER CYLINDER - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the master cylinder:

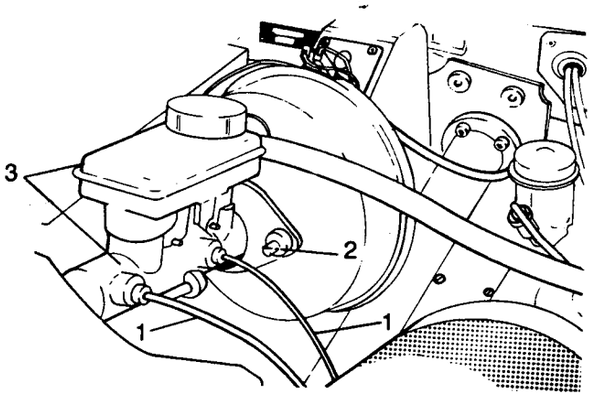


Fig K1.7

(1) Refer to Fig K1.7. Disconnect the brake pipes (1).

(2) Remove the fixings at the flange (2).

(3) Withdraw the master cylinder and fluid reservoir (3).

2. To refit the master cylinder:

(1) Refit master cylinder and fluid reservoir (3).

(2) Replace the fixings (2) and torque to 22 to 26 N.m.

(3) Refit brake pipes (1).

(4) Bleed the brakes (see Sub-sub-section K1.6, paragraph 2).

CHAPTER 4

BRAKE PEDAL - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the brake pedal as follows:

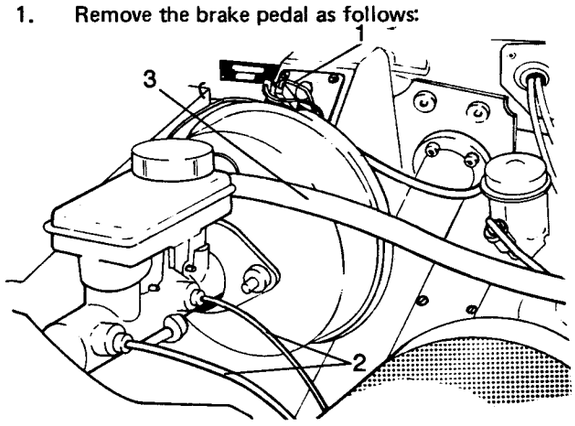


Fig K1.8

(1) Refer to Fig K1.8. Disconnect the stop light electrical leads (1).

(2) Disconnect the outlet pipes (2) from the master cylinder. Fit blanking plugs to the outlet apertures or drain the fluid reservoir, to prevent fluid spillage.

NOTE
The illustration shows the tandem master cylinder.

(3) Disconnect the vacuum pipe (3) from the servo unit.

(4) Remove the toe-board finisher panel.

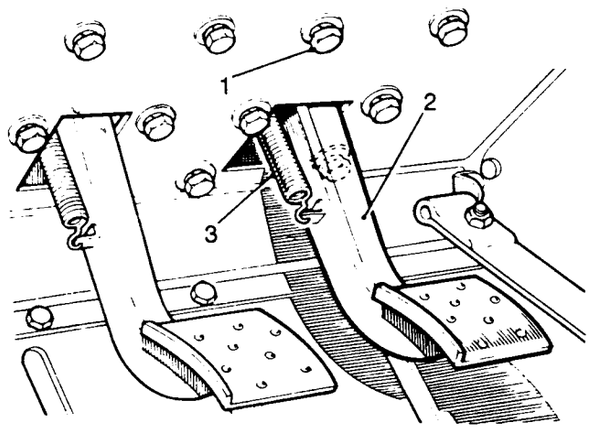


Fig K1.9

(5) Refer to Fig K1.9. Remove the fixings (1) securing the brake pedal bracket to the toe box.

(6) Withdraw the brake pedal and bracket assembly (2) from the engine compartment, manoeuvring the pedal through the aperture in the toe box.

(7) Disconnect the brake pedal return spring (3).

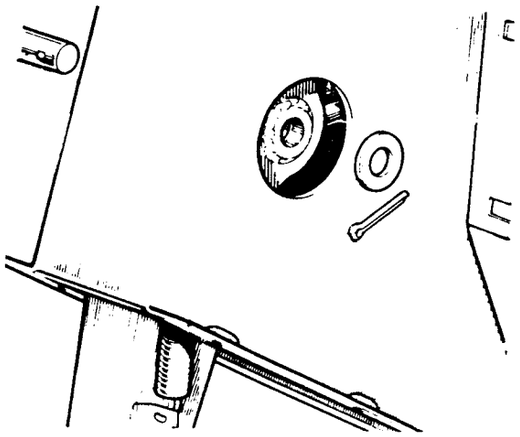


Fig K1.10

(8) Refer to Fig K1.10. Remove the split pin and pivot pin from the brake pedal to servo coupling.

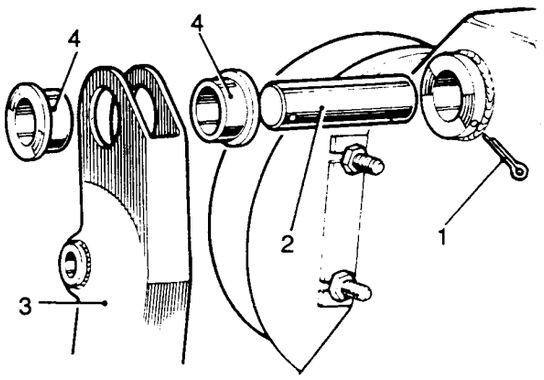


Fig K1.11

(9) Refer to Fig K1.11. Using a suitable punch, drift out pin (1) from the pedal shaft.

(10) Remove pedal shaft (2).

(11) Withdraw the brake pedal complete with bushes (3).

(12) If required, remove the bushes from the pedal (4).

REPLACEMENT

2. To replace the brake pedal:

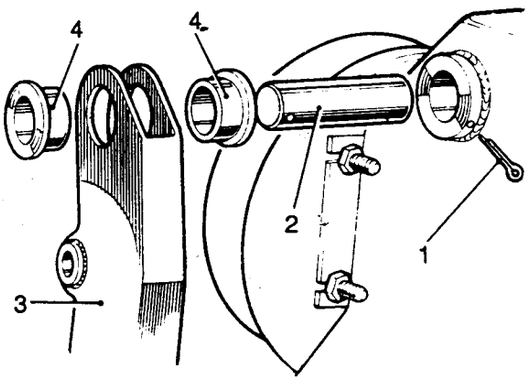


Fig K1.12

(1) Refer to Fig K1.12. If removed, fit the bushes (4) to the brake pedal. New bushes must be reamered to 15,875 mm ± 0,025 mm.

(2) Refit the brake pedal (3) using a general purpose grease to lubricate moving parts.

(3) Replace the pedal shaft (2).

(4) Fit a new split pin (1) into the pedal shaft and spread the ends.

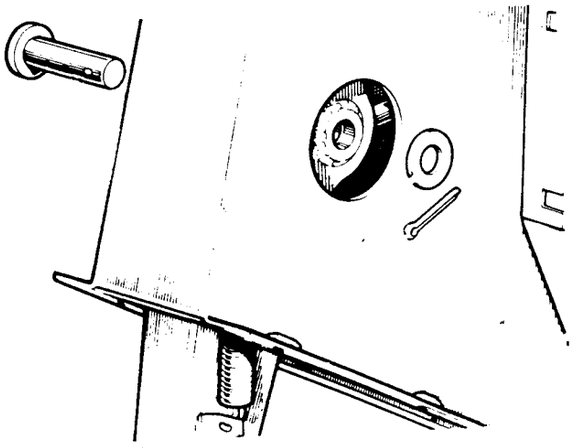


Fig K1.13

(5) Refer to Fig K1.13. Replace the pivot pin and secure with a new split pin.

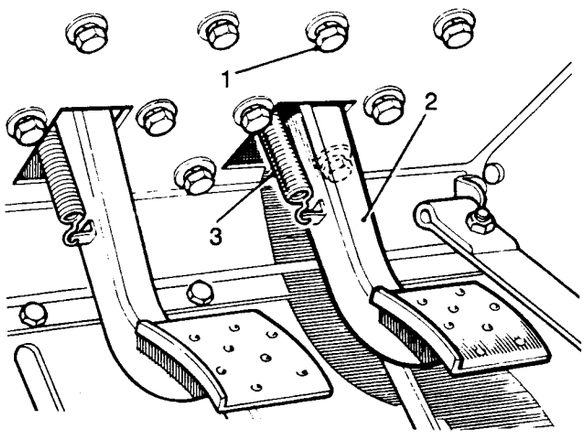


Fig K1.14

(6) Refer to Fig K1.14. Refit the brake return spring (3).

(7) Apply a waterproof sealant between the joint flanges of the pedal bracket and the toe box.

(8) Replace the brake pedal and bracket assembly (2) from the engine compartment, manoeuvring the pedal through the aperture in the toe box.

(9) Secure the brake pedal bracket with the fixings (1).

(10) Replace the toe-board finisher panel:

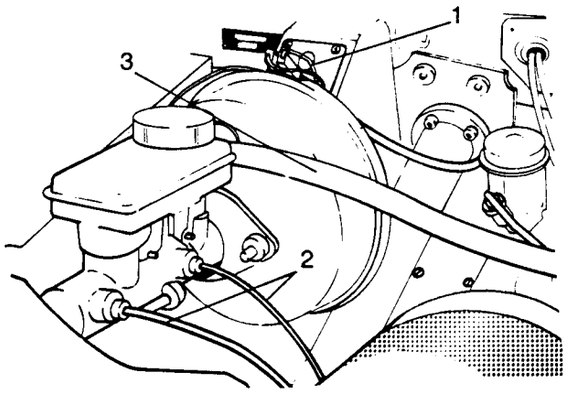


Fig K1.15

(11) Refer to Fig K1.15. Connect the vacuum pipe (3) from the servo unit.

(12) Reconnect the outlet pipes (2) to the master cylinder.

(13) Connect the electrical leads (1) to the stop light switch.

(14) Check, and if necessary, adjust the brake pedal switch located on the pedal box top cover to operate at 19 mm to 25 mm of pedal movement.

(15) Bleed the complete braking system (see Sub-sub-section K1.6).

CHAPTER 5

FRONT BRAKE SHOES - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the brake drum (see Sub-sub-section K1.4, Chapter 2).

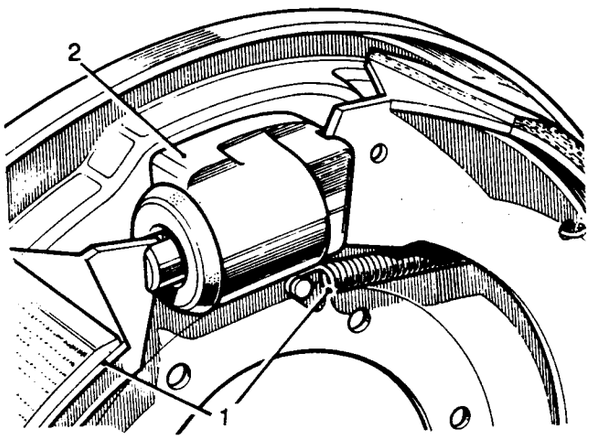


Fig K1.16

(1) Refer to Fig K1.16. Release the brake shoes and pull-off springs (1) by levering the trailing edges away from the wheel cylinders.

(2) Retain the pistons in the wheel cylinders (2) using a rubber band.

(3) If required, reline the brake shoes (see Sub-sub-section K1.5, Chapter 3).

REPLACEMENT

2. To replace the brake shoes:

NOTE

Ensure that the correct width brake shoe is fitted. For this vehicle the shoes must be 76 mm wide.

(1) Using a lever at the trailing edges, replace the brake shoes and pull-off springs.

(2) Remove the rubber band holding the pistons.

(3) Replace the brake drum but not the road wheel at this stage (see Sub-sub-section K1.4, Chapter 2).

(4) Adjust the brakes fully on, then back-off two serrations on the adjusters.

(5) If the brake shoe steady posts have been disturbed, reset as detailed below.

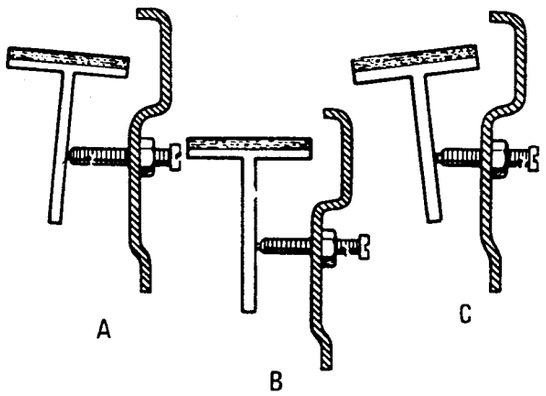


Fig K1.17

(6) Refer to Fig K1.17. Screw the steady posts clear of the brake shoes and apply the brakes (A).

(7) With the brakes applied screw in the steady posts to contact the brake shoes, then secure (B).

(8) Do not tilt the brake shoes by screwing in the steady posts too far (C).

(9) Replace the road wheel and lower the vehicle to the ground.

SUB-SUB-SECTION K1.4

CHAPTER 6

REAR BRAKE SHOES - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the rear brake shoes as follows:

   (1) Remove the brake drum (see Sub-sub-section K1.4, Chapter 2).

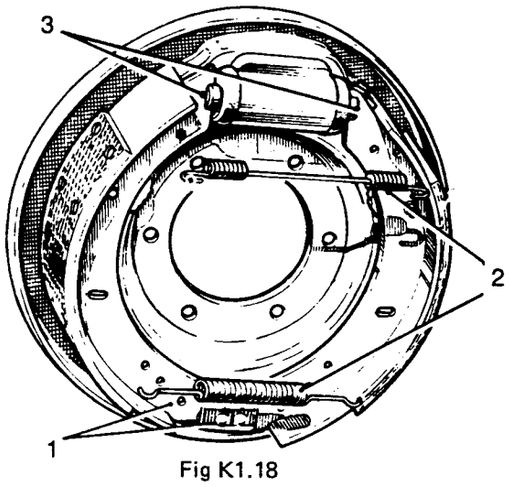


Fig K1.18

   (2) Refer to Fig K1.18. Release the brake shoes by levering the shoes away from the pivot (1).

   (3) Disconnect the springs (2).

   (4) Retain the pistons (3) in the wheel cylinder using a rubber band.

   (5) If required, reline the brake shoes (see Sub-sub-section K1.5, Chapter 3).

REPLACEMENT

2. To replace the brake shoes:

   (1) Reconnect the springs (2).

   (2) Refit the brake shoes using a lever at the pivot.

   (3) Replace the brake drum (see Sub-sub-section K1.4, Chapter 2) but do not replace the road wheel at this stage.

   (4) Adjust the brakes fully on, then back-off two serrations on each adjuster.

   (5) Replace the road wheel.

SUB-SUB-SECTION K1.4

CHAPTER 7

SERVO ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the brake master cylinder (see Sub-sub-section K1.4, Chapter 3).

2. To remove the servo assembly:

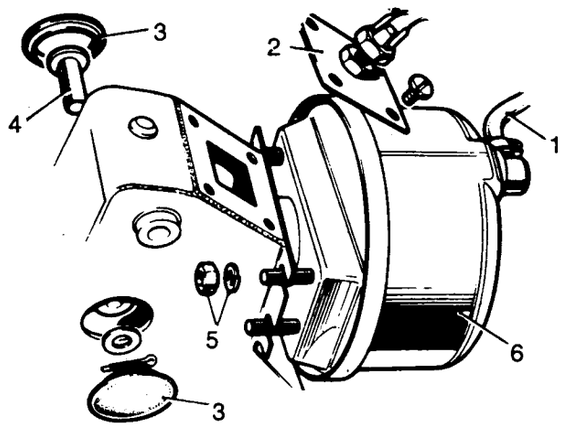


Fig K1.19

(1) Refer to Fig K1.19. Disconnect the vacuum hose (1) from the servo assembly.

(2) Remove the switch plate (2).

(3) Remove the rubber plugs from the pedal box (3).

(4) Remove the split pin and withdraw the clevis pin (4) securing the servo rod to the pedal.

(5) Remove the fixings.

(6) Withdraw the servo assembly (6).

REPLACEMENT

3. Replace the servo unit as follows:

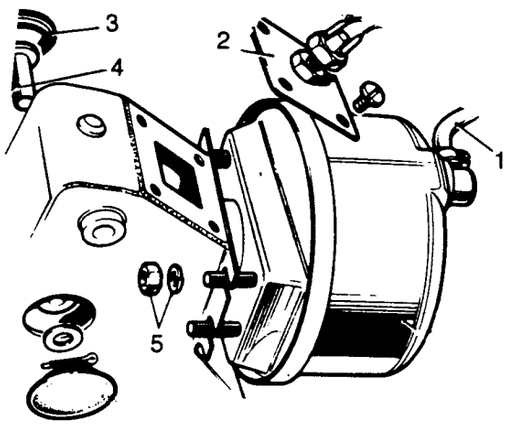


Fig K1.20

(1) Refer to Fig K1.20. Position the servo assembly and tighten the fixings (5) to 12 N.m.

(2) Secure the servo rod to the pedal with the clevis pin (4) and fit a new split pin.

(3) Refit the rubber plugs (3) to the pedal box.

(4) Refit the switch plate (2).

(5) Reconnect the vacuum hose (1) to the assembly.

SUB-SUB-SECTION K1.4

CHAPTER 8

FRONT WHEEL BRAKE CYLINDERS - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the front wheel cylinders:

   (1) Remove the brake shoes (see Sub-sub-section K1.4, Chapter 5).

   (2) Disconnect and seal off the brake fluid pipe.

   (3) Remove the bleed screw (lower cylinder only).

   (4) Remove the wheel cylinder after removing the fixings from the back plate.

REPLACEMENT

2. Replace the cylinder:

   (1) Position the wheel cylinder and secure with the fixings.

   (2) Fit the bleed screw (if removed).

   (3) Reconnect the brake fluid pipe.

   (4) Replace the brake shoes (see Sub-sub-section K1.4, Chapter 5).

   (5) Bleed the brakes (see Sub-sub-section K1.6).

SUB-SUB-SECTION K1.4

CHAPTER 9

REAR WHEEL BRAKE CYLINDER - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the rear brake cylinder:

   (1) Remove the brake shoes (see Sub-sub-section K1.4, Chapter 6).

   (2) Disconnect and seal off the brake fluid pipe.

   (3) Remove the fixings and pull the cylinder away from the back plate.

REPLACEMENT

2. To replace the rear brake cylinder:

   (1) Position the cylinder on the back plate and secure with the fixings.

   (2) Reconnect the brake fluid pipe.

   (3) Refit the brake shoes (see Sub-sub-section K1.4, Chapter 6).

   (4) Bleed the brakes (see Sub-sub-section K1.6).

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION K1.5

REPAIR, CLEANING AND OVERHAUL

SUB-SUB-SECTION K1.5

CHAPTER 1

BRAKE FAILURE SWITCH - OVERHAUL

DISMANTLING

1. Remove the brake failure switch (see Sub-sub-section K1.4, Chapter 1).

2. Dismantle the unit as follows:

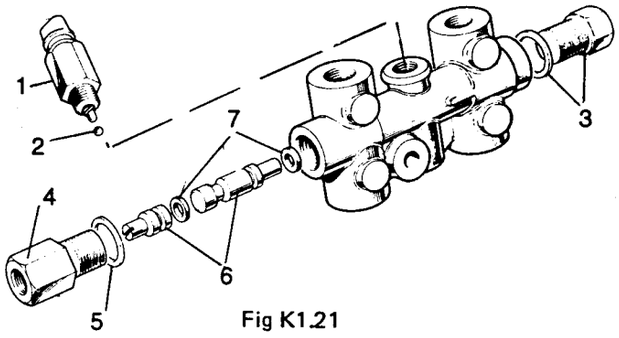


Fig K1.21

(1) Refer to Fig K1.21. Remove the switch unit (1) from the housing.

(2) Withdraw the plunger ball (2).

(3) Remove the end plug and sealing washer (3).

(4) Remove the pipe connector union (4) and sealing washer (5).

(5) Push out the two-part shuttle valve (6) using a soft drift.

(6) Remove and discard the shuttle valve oil seals (7).

INSPECTING

3. Carry out the following inspection on the components:

(1) Clean the shuttle valve, end plug, pipe union and five-way connector, using new brake fluid or ethyl alcohol.

(2) Examine the shuttle valve and its bore in the five-way connector. They must be in perfect condition with no signs of scratches or corrosion, otherwise fit a new switch complete.

(3) To test the electrical switch, reconnect the leads and actuate the switch plunger by pressing it against an earthing point on the vehicle. The BRAKE light should go out.

REASSEMBLY

4. To reassemble the brake failure switch:

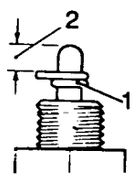


Fig K1.22

(1) Refer to Fig K1.22. If the plunger spring (1) is dislodged, refit with the small coil of the spring toward the switch unit threads.

(2) Position the plunger spring 4 mm approximatley from the plunger end (2).

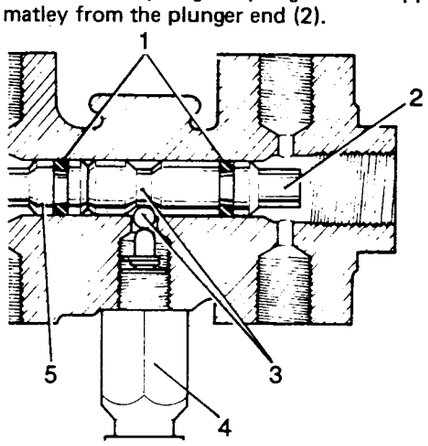


Fig K1.23

(3) Refer to Fig K1.23. Fit new shuttle valve seals (1).

(4) Coat the seals with Girling brake lubricant or clean brake fluid.

(5) Fit the longer shuttle valve (2), slotted end last, to the end plug end of the housing bore.

(6) Position the shuttle valve to align the groove for the plunger ball with the drilling for the ball (3).

(7) Fit the ball and switch unit (4). Torque loading 1,728 N.m.

(8) Fit the shorter shuttle valve (5) slotted end last to the pipe connector end of the housing bore.

(9) Replace the pipe connector union ((4) on Fig K1.21) using a new sealing washer ((5) on Fig K1.21). Torque to 22 N.m.

(10) Replace end plug ((3) on Fig K1.21) using a new sealing washer. Torque to 22 N.m.

5. Replace the switch assembly (see Sub-sub-section K1.4, Chapter 1).

SUB-SUB-SECTION K1.5

CHAPTER 2

MASTER CYLINDER - OVERHAUL

DISMANTLING

1. Remove the master cylinder (see Sub-sub-section K1.4, Chapter 3).

2. Dismantle as follows:

   (1) Withdraw retaining pins and withdraw the fluid reservoir.

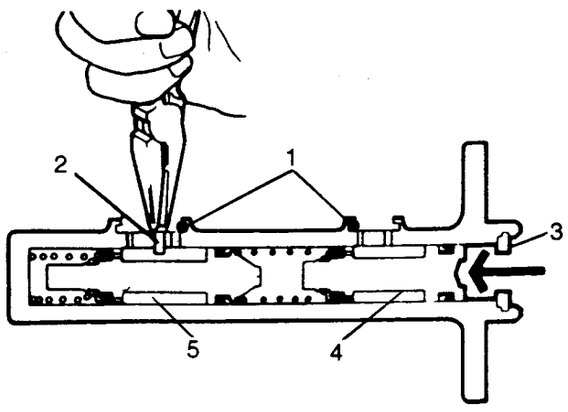


Fig K1.24

   (2) Refer to Fig K1.24. Lever out seals (1).

   (3) Push the plunger fully down the cylinder bore and withdraw secondary plunger stop pin (2).

   (4) Remove the circlip (3) and withdraw the primary plunger assembly (4).

   (5) Tap the cylinder on a soft or wooden surface to remove the secondary plunger assembly (5).

   (6) Remove the secondary plunger spring seal retainer, recuperating seal and washer. Keep the plunger and its spring together at all times.

   (7) Remove seal from the plunger.

   (8) Remove the primary plunger spring, seal retainer, recuperating seal and washer. Keep the plunger and its spring together at all times.

   (9) Remove the seal from the plunger.

INSPECTING

3. Inspect as follows:

   (1) Clean all components in Girling cleaning fluid and allow to dry.

   (2) Examine the cylinder bore and pistons; ensure that they are smooth to the touch with no corrosion, score marks or ridges. If there is doubt, fit new replacements.

   (3) The seals should be replaced. These items are included in the master cylinder overhaul kit.

REASSEMBLY - (USING SERVICE KIT)

4. To reassemble the master cylinder:

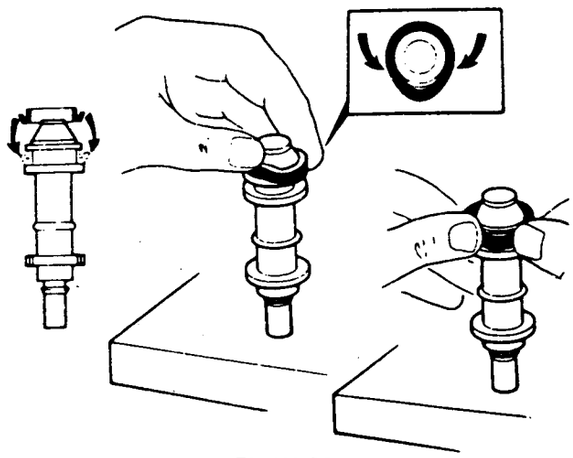


Fig K1.25

   (1) Refer to Fig K1.25. Fit a new seal (1) into the groove in the secondary plunger, as follows: Squeeze the seal into an ellipse then press the raised point of the seal over the flange.

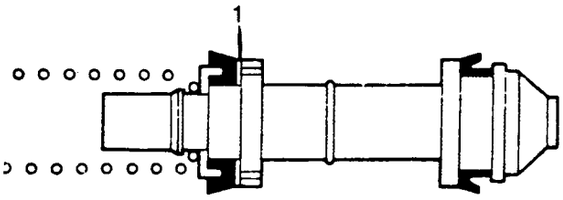


Fig K1.26

   (2) Refer to Fig K1.26. Fit the washer (1), new recuperating seal and spring to the secondary plunger.

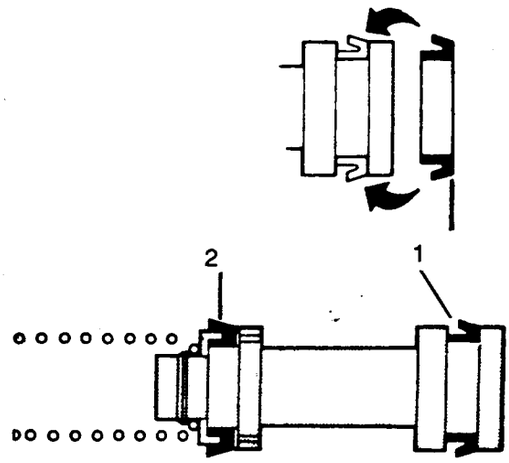


Fig K1.27

(3) Refer to Fig K1.27. Fit the seal into the groove (1) in the primary plunger as described previously.

(4) Fit the washer (2) new recuperating seal, seal retainer and primary spring. Ensure that the seals are fitted as illustrated.

NOTE

It is vital that the following instructions are carried out precisely and that generous amounts of unused brake fluid are used to lubricate the cylinder bore and plunger seals to prevent damage to the seals during assembly.

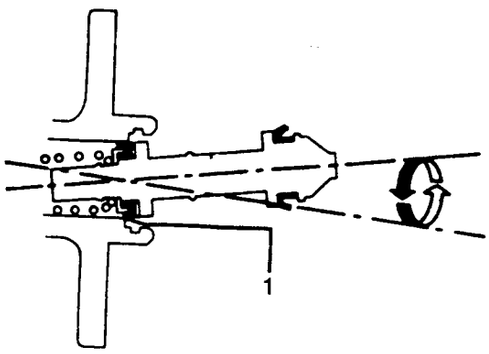


Fig K1.28

(5) Refer to Fig K1.28. Clamp the cylinder in a bench vice, lubricate the secondary plunger seals (1) and the cylinder bore.

(6) Offer the plunger assembly to the cylinder until the recuperation seal is resting centrally in the mouth of the bore. Then, ensuring that the seal does not become trapped, gently introduce the plunger with a circular rocking motion as illustrated to ease in the seal, then slowly push the plunger down the bore in one continuous movement.

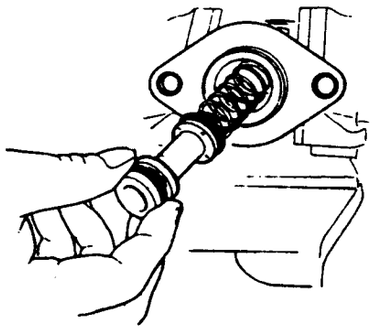


Fig K1.29

(7) Refer to Fig K1.29. Repeat the lubricating and fitting procedure for the primary plunger assembly and fit the retaining circlip.

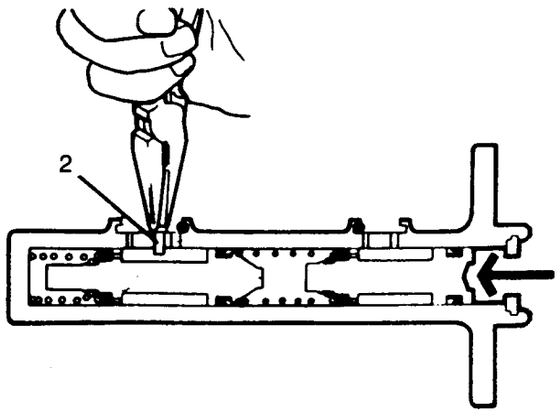


Fig K1.30

(8) Refer to Fig K1.30. Using a clean screw driver, slowly press the plunger (arrowed) fully down the bore to enable the secondary plunger stop-pin (2) to be fitted in its correct position.

(9) Lubricate new seals with unused brake fluid and fit one in each inlet port.

(10) Lubricate the seals and press the fluid reservoir into position on the cylinder and secure with the retaining pins.

(11) Refit the master cylinder (see Sub-section K1.4, Chapter 3).

SUB-SUB-SECTION K1.5

CHAPTER 3

BRAKE LININGS - REFITTING

REMOVAL

1. Remove the old brake linings:

   (1) Remove the brake shoes (see Sub-sub-section K1.4, Chapter 5 or 6).

   (2) Remove the old linings from the shoes by shearing the rivets.

REFITTING

2. To refit new linings:

NOTE

Brake shoes fitting with bonded linings: If the shoes incorporate rivet holes, the bonded linings can be removed and rivetted linings can be fitted in their place. If the shoes are not pre-drilled, replacement shoe and lining assemblies must be fitted.

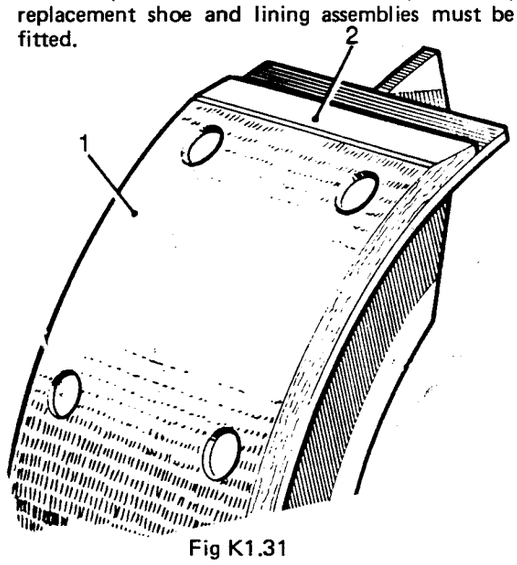


Fig K1.31

(1) Refer to Fig K1.31. Attach the new linings to the shoes (1) commencing at the centre and working outwards, but only peen the rivets sufficiently to locate the linings.

(2) Then with all the rivets loosely fitted, fully secure, start peening from the centre again.

(3) Chamfer both ends of each lining (2).

(4) Replace the brake shoes (see Sub-sub-section K1.4, Chapter 5 or 6).

SUB-SUB-SECTION K1.5

CHAPTER 4

SERVO ASSEMBLY - OVERHAUL

NOTE

The Supervac servo unit can be serviced with a kit that is available without completely dismantling the servo. In the event of the servo developing a major fault, the unit must be renewed.

DISMANTLING

1. First remove the servo assembly (see Sub-sub-section K1.4, Chapter 7).

2. Dismantle as follows:

CAUTION

Do not attempt to remove or adjust the operating rod which is pre-set and locked at the manufacturers (see (6) on Fig K1.32).

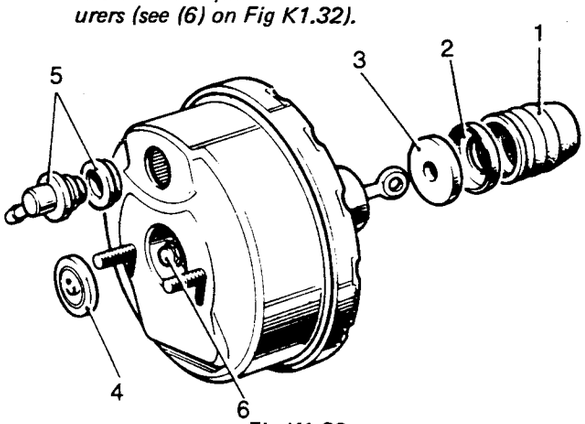


Fig K1.32

(1) Refer to Fig K1.32. Pull back the dust cover (1).

(2) Remove the end cap (2).

(3) Withdraw the filter (3).

(4) Remove the seal plate assembly (4) from the front shell recess.

(5) Remove the non-return valve and grommet (5).

REASSEMBLY - (USING SERVICE KIT)

3. To reassemble the servo assembly:

(1) Lubricate the non-return valve grommet (5) with Girling Grease (64949009) and fit to the front shell.

(2) Fit the new non-return valve into the grommet.

(3) Smear the new seal and plate assembly (4) with Girling Grease (64949009) and press into the front shell, ensuring the plate faces inwards.

(4) Fit the new filter (3) into the neck of the diaphragm plate.

(5) Fit the new end cap (2).

(6) Locate the new dust cover (1) over the lugs of the rear shell.

SUB-SUB-SECTION K1.5

CHAPTER 5

FRONT WHEEL BRAKE CYLINDERS - OVERHAUL

NOTE

A wheel cylinder overhaul kit is available and the components in the kit must be used to replace the old components on overhaul.

DISMANTLING

1. To dismantle the cylinder:

   (1) Remove the brake cylinder (see Sub-sub-section K1.4, Chapter 8).

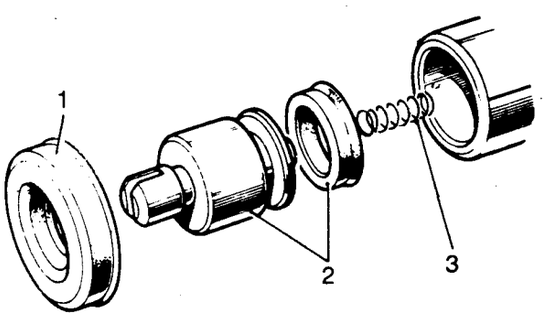


Fig K1.33

   (2) Refer to Fig K1.33. Withdraw the dust cover (1).

   (3) Withdraw the piston and seal (2).

   (4) Withdraw the spring (3).

INSPECTING

2. Inspect as follows:

   (1) Clean all components using Girling cleaning fluid and allow to dry.

   (2) Inspect the cylinder bore and piston for corrosion, scores and wear. If any component is unsatisfactory, replace the wheel cylinder assembly complete.

REASSEMBLY

3. Reassemble the cylinder as follows:

NOTE

Use new seals and dust covers from the wheel cylinder overhaul kit.

   (1) Lubricate the components using the recommended Girling brake fluid.

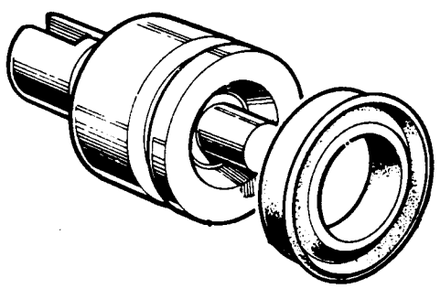


Fig K1.34

   (2) Refer to Fig K1.34. Refit the spring, seal and piston. Fit the piston seal with the lipped side away from the slotted end.

   (3) Fit a new dust cover.

   (4) Replace the brake cylinder (see Sub-sub-section K1.4, Chapter 8).

SUB-SUB-SECTION K1.5

CHAPTER 6

REAR WHEEL BRAKE CYLINDER - OVERHAUL

NOTE

A wheel cylinder overhaul kit is available and the new seals and dust covers contained in the kit must be used in place of the old ones.

DISMANTLING

1. To dismantle a rear wheel brake cylinder:

   (1) Remove the cylinder (see Sub-sub-section K1.4, Chapter 9).

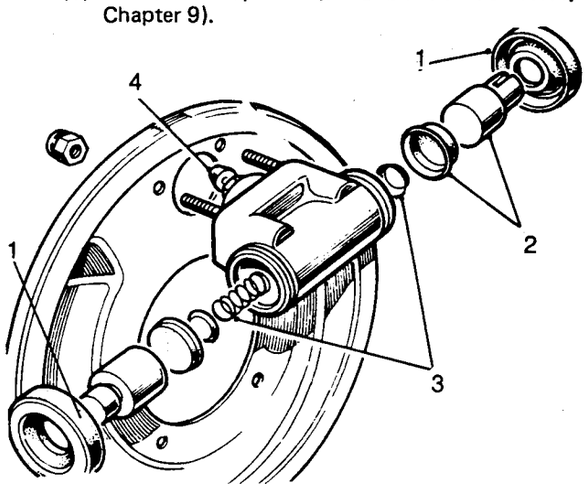


Fig K1.35

   (2) Refer to Fig K1.35. Withdraw the dust covers (1).

   (3) Withdraw the pistons and seals (2).

   (4) Withdraw the spring and seal supports (3).

   (5) Remove the bleed screw (4).

INSPECTING

2. Inspect the components:

   (1) Clean all components using Girling cleaning fluid and allow to dry.

   (2) Inspect the cylinder bore and piston for corrosion, scores and wear. If any components are unsatisfactory, replace the wheel cylinder assembly complete.

REASSEMBLY

3. Reassemble the cylinder as follows:

   (1) Lubricate the components, using the recommended Girling brake fluid.

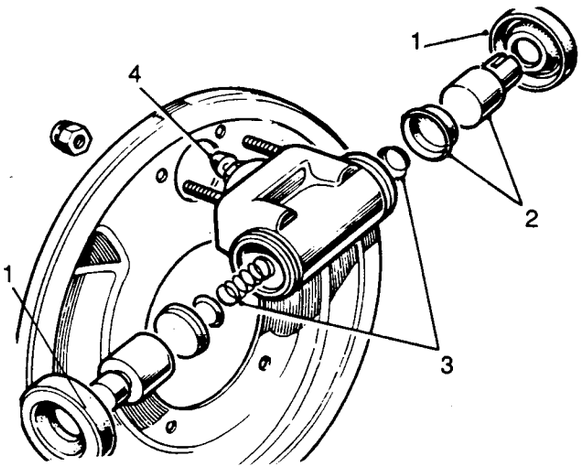


Fig K1.36

   (2) Refer to Fig K1.36. Replace the spring and seal supports (3).

   (3) Refit the pistons and new seals (2). Fit the piston seal with the lipped side away from the slotted end.

   (4) Replace the dust covers (1).

   (5) Fit the bleed screw and tighten to 5 to 8 N.m. Do not overtighten.

   (6) Replace the cylinder (see Sub-sub-section K1.4, Chapter 9).

SUB-SUB-SECTION K1.6

MAINTENANCE

INTRODUCTION

1. Maintenance of the road wheel brakes is only required when operation of the brakes indicates a fault such as spongy action, long pedal travel before the brakes are applied, etc. Periodic checks on the efficiency of the brakes should be made and the brakes adjusted (see Sub-sub-section K1.3) or bled (see below).

2. The back plate should be cleaned and examined at regualr intervals for oil leaks which may indicate oil on the brake linings and impair brake efficiency.

BLEEDING THE BRAKE SYSTEM

NOTES

1. Use only new supplies of the recommended brake hydraulic fluid.

2. Keep the fluid reservoir topped up during bleeding.

3. Where the complete hydraulic system is to be filled, it is advantageous to first charge the system, to each bleed point in turn, before attempting to expel all air from the system.

4. Observe strict cleanliness precautions to prevent foreign matter from entering the hydraulic system.

Isolating Local Air Pockets

3. Use of Girling Brake Service Hose Clamp considerably facilitates the location of air in the system, therefore saving time by locating the hydraulic fault, and saving fluid when servicing the wheel cylinders. To isolate an air pocket:

CAUTION

Providing the brake hose is in reasonable condition, damage cannot be caused using the hose clamp, but the use of other tools to clamp the hoses is not recommended as damage may be caused internally to the hose without it being noticed externally.

(1) With clamps fitted on the two front and one rear hose the pedal action should be perfect with no indication of 'sponginess'. If under these circumstances a spongy pedal is apparent, a new or overhauled master cylinder assembly must be fitted and bled and the test repeated.

(2) If perfect pedal action is obtained with the three hose clamps in position, remove the rear clamp and if the pedal is spongy, the air must be in the rear cylinders. However, if the pedal action is good remove first one then the other of the two front clamps, repeating the test until the air is located.

Bleeding Procedure

4. For wheel cylinder servicing, only the appropriate hose need be clamped. This keeps the loss of fluid to a minimum and after the service is satisfactorily completed, only the affected parts require bleeding. To bleed the brake system:

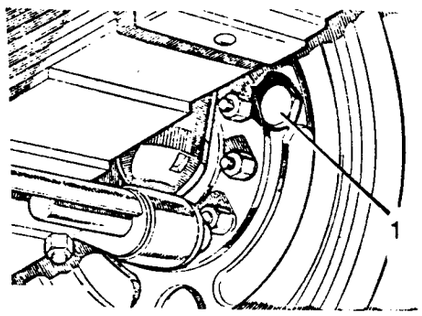


Fig K1.37

(1) Refer to Fig K1.37. Slacken off the brake shoe adjusters (1) on each wheel to minimise wheel cylinder volume.

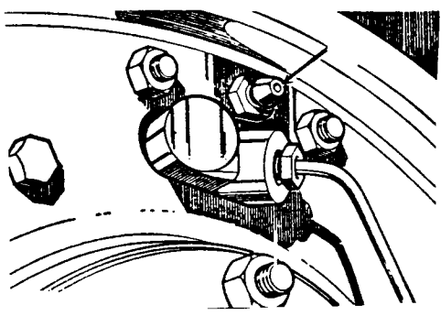


Fig K1.38

(2) Refer to Fig K1.38. Attach a bleed tube to the bleed nipple farthest from the master cylinder. Submerge the tube free end in brake fluid in a transparent container.

(3) Slacken the bleed nipple a half-turn.

NOTE

On dual braking systems only, do not use full pedal travel as this may decentralise the shuttle valve plunger in the brake failure switch. Operate the pedal slowly. If during the bleeding procedure the plunger operates the switch and the warning light is on, the bleedscrew must be closed and the bleedscrew at the other end of the vehicle opened (if bleeding the front brakes, open a bleedscrew on a rear brake and vice versa).

(4) A steady pressure must then be applied to the pedal until the light goes out, then the pressure must be released immediately and the bleed-screw closed, otherwise the piston will move too far in the opposite direction and require resetting again.

(5) Repeat the procedure until fluid discharged from the bleed tube is free of air, then tighten the bleed nipple during a pedal downstroke.

(6) Repeat the procedure on the remaining wheels, commencing and continuing at the next wheel farthest from the master cylinder.

(7) Adjust the brakes (see Sub-sub-section K1.3).

(8) If the system is fitted with servo assistance: hold foot pressure on the brake pedal and start the engine. If the vacuum system is functioning correctly, the pedal will move towards the board. If no movement is felt, the vacuum system is not operating.

SUB-SECTION CONTENTS LIST

SUB-SECTION K.2

TRANSMISSION BRAKE

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION K2.1

DESCRIPTION AND SPECIFICATIONS

SUB-SUB-SECTION K2.1

CHAPTER 1

DESCRIPTION OF THE TRANSMISSION BRAKE

INTRODUCTION

1. The transmission brake is a normal type of drum brake operated only by mechanical linkage between the brake itself and the hand lever in the cab.

2. The brake drum is attached to the rear propeller shaft while the shoes are mounted on a back plate secured to the gearbox housing.

OPERATION

3. The drive from the gearbox passes coaxially through the brake shoes and turns not only the rear propeller shaft but the transmission brake drum as well. When the shoes are expanded by pulling the hand lever, the brake action prevents the propeller shaft and thus the rear wheels from turning. If four wheel drive is engaged the front propeller shaft is indirectly connected to the rear propeller shaft and in effect all four wheels are braked.

SUB-SUB-SECTION K2.1

CHAPTER 2

TRANSMISSION BRAKE SPECIFICATIONS

INTRODUCTION

1. The general data for the transmission brake are given in Table K2.1 below. No torque specifications are available for the transmission brake.

TABLE K2.1 - GENERAL DATA

ITEM	DESCRIPTION
Drum diameter	228,6 mm
Lining dimensions	209,55 mm x 44,45 mm x 4,74 mm

SUB-SUB-SECTION K2.2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This Sub-sub-section covers fault diagnosis and corrective action for the transmission brake. In Table K2.2 a list of symptoms, the probable cause and the recommended remedial action is given. The Table is not exhaustive and faults may occur which are not listed. Should the Table not indicate the fault, the suspected components should be removed for closer inspection and/or overhaul.

TABLE K2.2 - TRANSMISSION BRAKE FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Brake not holding	Water soaked linings. Incorrect or glazed linings. Incorrect shoe adjustment. Incorrect brake lever adjustment.	Dry out. Replace linings. Adjust brake. Adjust lever.
Brake drags	Incorrect shoe adjustment. Seized shoe. Weak pull-off springs. Distorted drum. Scored or cracked drum.	Readjust shoes. Overhaul brake. Overhaul brake. Skim or replace drum. Replace drum.
NOTE: The brake drum may be skimmed to a maximum of 0,75 mm oversize.		

SUB-SUB-SECTION K2.3

TRANSMISSION BRAKE - ADJUSTING

1. To adjust the brake: .

   (1) Turn the adjuster cone fully in and tighten the fixings.

   (2) Slacken off the adjuster cone two 'clicks'; give the brake a firm application to ensure that the shoes have centralised at the expander end. The brake drum should now be free to rotate.

   (3) Set the hand brake linkage so that the hand brake has one or two clicks free movement in the off position.

SUB-SUB-SECTION CONTENTS LIST

SUB-SUB-SECTION K2.4

REMOVAL AND REPLACEMENT PROCEDURES

CHAPTER 1

TRANSMISSION BRAKE HAND LEVER AND LINKAGE - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the lever and linkage:

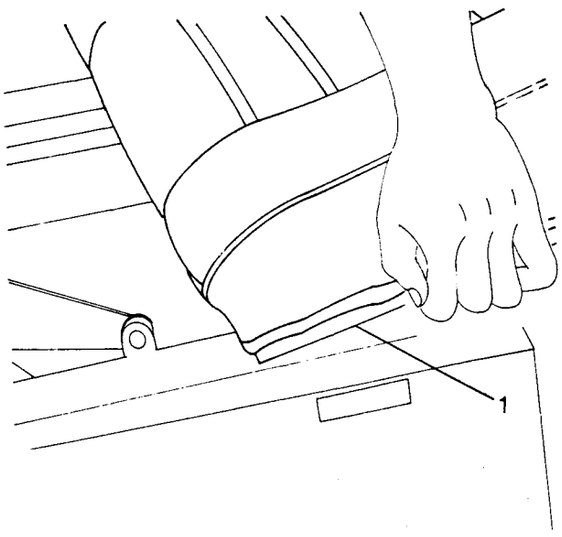


Fig K2.1

(1) Refer to Fig K2.1. Remove the seat cushion and lid panel (1) from the seat base.

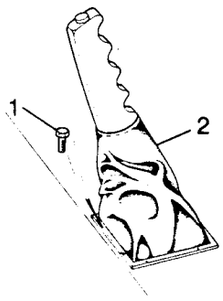


Fig K2.2

(2) Refer to Fig K2.2. Remove the eight screws (1) retaining the leather dust cover (2) on the handbrake lever and remove the cover.

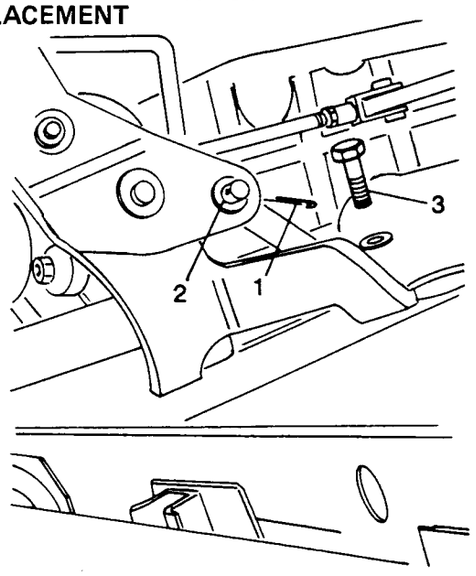


Fig K2.3

(3) Refer to Fig K2.3. Disconnect the cable from the handbrake lever by removing the split pin (1) and clevis pin (2).

(4) Remove the two (3) nuts and bolts holding the handbrake lever mounting to the seat base and remove the handbrake lever.

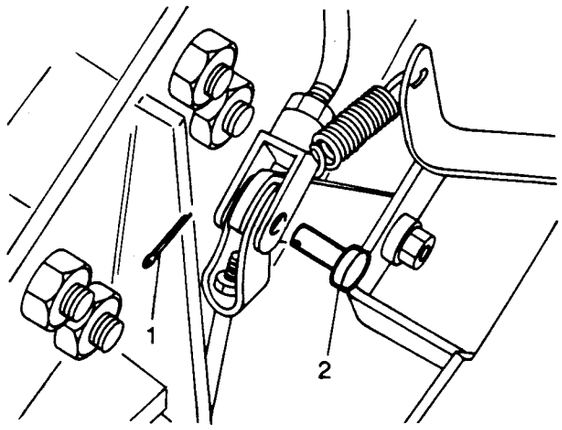


Fig K2.4

(5) Refer to Fig K2.4. From underneath the vehicle disconnect the cable from the relay lever by removing the split pin (1) and clevis pin (2).

(6) Remove the cable.

REPLACEMENT

2. Replace the lever and linkage as follows:

   (1) Fig K2.4 still applies. Under the vehicle, connect the cable to the relay lever and secure with the clevis pin and a new split pin.

   (2) Fig K2.3 still applies. Replace the handbrake lever and secure the lever mounting to the seat base with the two bolts and nuts.

   (3) Connect the cable to the handbrake lever with the clevis pin and a new split pin.

   (4) Adjust the cable to give two clicks on the ratchet when applying the handbrake.

   (5) Fig K2.2 still applies. Replace the leather dust cover and the eight retaining screws.

   (6) Replace the lid panel and the seat cushion.

CHAPTER 2

TRANSMISSION BRAKE ASSEMBLY - REMOVAL AND REPLACEMENT

NOTE

To adjust the assembly or to fit new linings, it is not essential to remove the transmission brake from the vehicle. The brake shoe components are accessible after removing the brake drum which can be detached from the gearbox output flange and pushed back over the propeller shaft.

REMOVAL

1. To remove the transmission brake assembly:

(1) Chock the road wheels.

(2) Disconnect the rear propeller shaft from the transmission brake (see Sub-sub-section H4.3) and move the shaft aside.

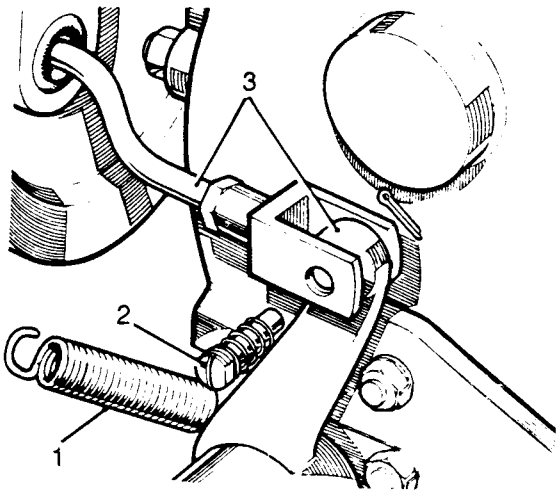


Fig K2.5

(3) Refer to Fig K2.5. Disconnect the brake return spring (1).

(4) Remove the expander rod fork fixings (2).

(5) Disconnect the expander rod from the relay lever (3).

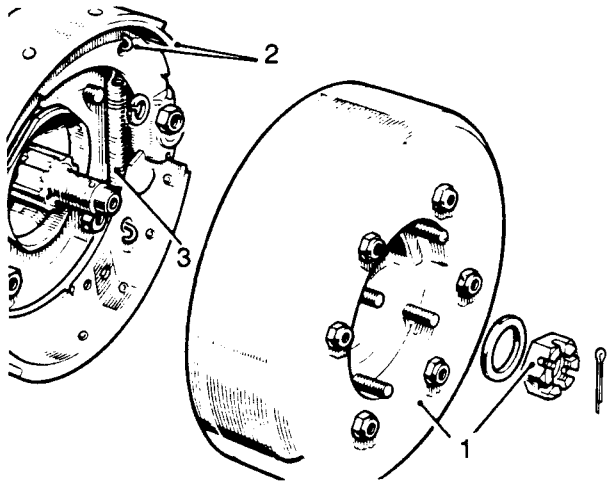


Fig K2.6

(6) Refer to Fig K2.6. Remove the fixings and withdraw the brake drum (1).

(7) Remove the brake shoes together with the pull-off springs (2).

(8) Separate the shoes by detaching the springs (3).

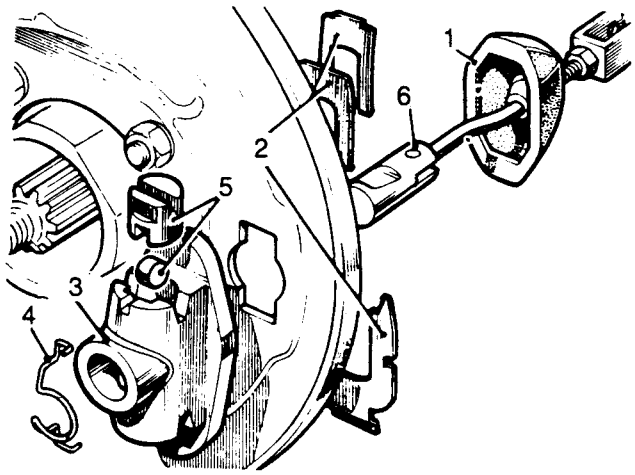


Fig K2.7

(9) Refer to Fig K2.7. Withdraw the dust excluder (1).

(10) Remove the expander unit fixing plates (2).

(11) Withdraw the expander unit (3).

(12) Remove the spring clip from the expander unit (4).

(13) Withdraw the plungers and rollers (5).

(14) Withdraw the operating rod (6).

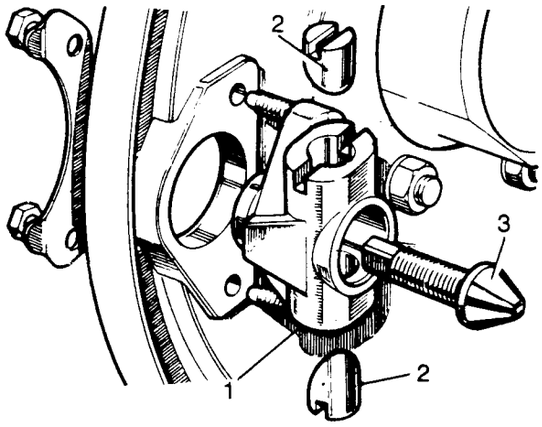


Fig K2.8

(15) Refer to Fig K2.8. Remove the adjuster unit assembly (1).

(16) Pull out the adjuster plungers (2).

(17) Unscrew the adjuster cone (3).

REPLACEMENT

2. To replace the transmission brake assembly:

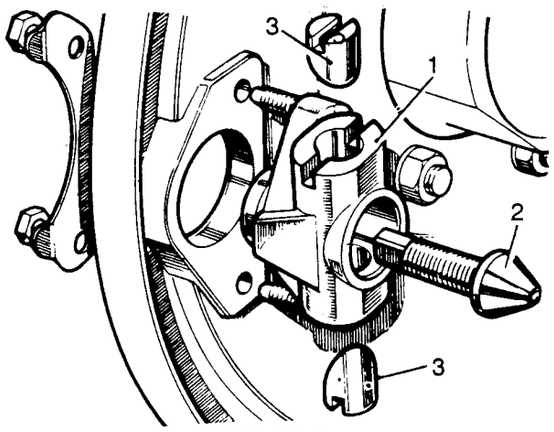


Fig K2.9

(1) Refer to Fig K2.9. Fit the adjuster unit housing (1). Do not tighten the fixings at this stage.

(2) Screw in the adjuster cone (2).

(3) Grease and refit the adjuster plungers (3).

NOTE
The two plungers are identical and may be fitted to either bore. Align the chamfered ends of the plungers with the cone on the adjuster.

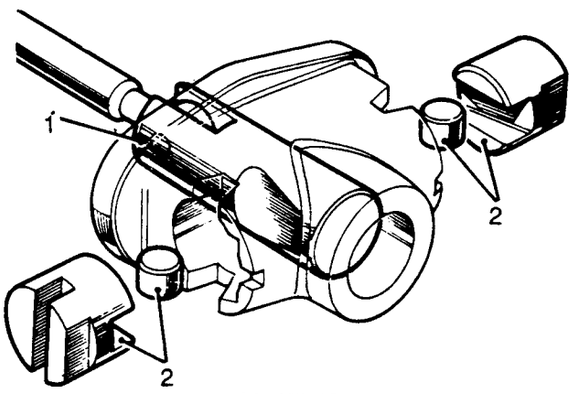


Fig K2.10

(4) Refer to Fig K2.10. Grease and fit the expander rod (1).

(5) Grease and fit the plungers and rollers (2).

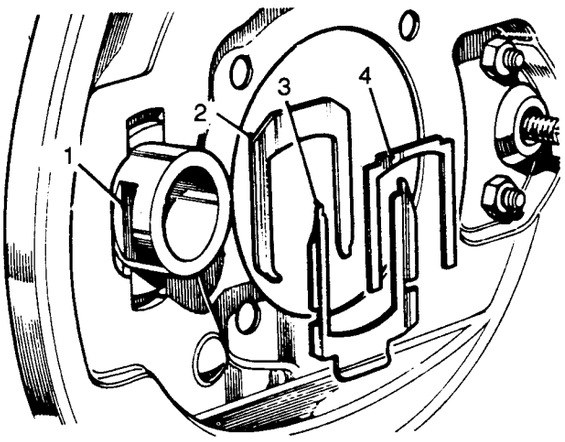


Fig K2.11

(6) Refer to Fig K2.11. Position the adjuster housing (1) on the back plate.

(7) Fit the packing piece (2).

(8) Fit the locking plate (3).

(9) Fit the retainer spring (4).

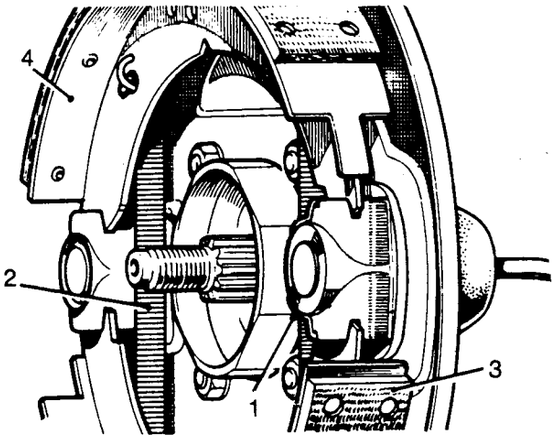


Fig K2.12

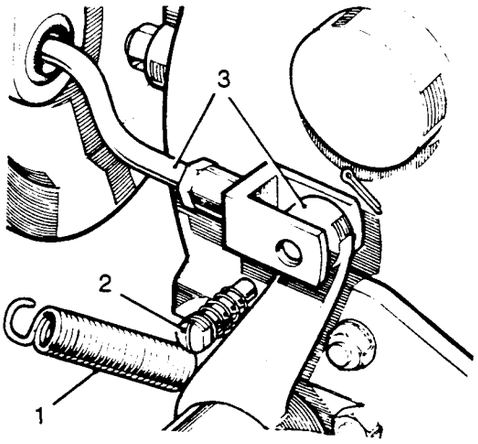


Fig K2.13

(10) Refer to Fig K2.12. Fit the spring clip (1) to the expander unit.

(11) Fit the brake shoes and pull-off springs together (2).

(12) The fully lined end of the lower shoe (3) must be towards the expander housing.

(13) The fully lined end of the upper shoe (4) must be towards the adjuster housing.

(14) Replace the brake drum and secure with the washer and castellated nut. Fit a new split pin and spread the ends.

(15) Refer to Fig K2.13. Fit the expander rod (3) to the relay lever.

(16) Replace the expander rod fork fixings (2).

(17) Connect the brake return spring (1).

(18) Adjust the brake (see Sub-sub-section K2.3).

(19) Remove the chocks under the road wheels.

SUB-SUB-SECTION K2.5

TRANSMISSION BRAKE - CLEANING AND REPAIR

1. Remove the brake assembly (see Sub-sub-section K2.4, Chapter 2).

2. Clean and inspect as follows:

   (1) Clean all components in Girling cleaning fluid and allow to dry.

   (2) Examine all items for obvious wear and replace as necessary.

   (3) Examine the brake for scoring and ovality and skim if required. Standard diameter is 228,6 mm; reclamation limit is 0,75 mm oversize.

   (4) If the brake linings are oily, check and if necessary replace the output shaft oil seal.

   (5) If required, reline the brake shoes (see Sub-sub-section K1.5, Chapter 3).

SUB-SUB-SECTION K2.6

MAINTENANCE

INTRODUCTION

1. The transmission brake has been designed to give maintenance free operation, requiring only periodic inspection for obvious defects. At the specified intervals check the brake operation and adjust the shoes and linkage if necessary.

2. At frequent intervals, depending on operating conditions, the brake assembly should be cleaned to prevent the accumulation of mud, dirt, oil, etc. Oil should be wiped off with a clean cloth and a check made for oil leaks which may indicate a faulty output shaft oil seal.

SECTION CONTENTS LIST

SECTION L

STEERING SYSTEM

SUB-SECTION CONTENTS LIST

SUB-SECTION L1

DESCRIPTION AND SPECIFICATIONS

SUB-SECTION L1

CHAPTER 1

DESCRIPTION

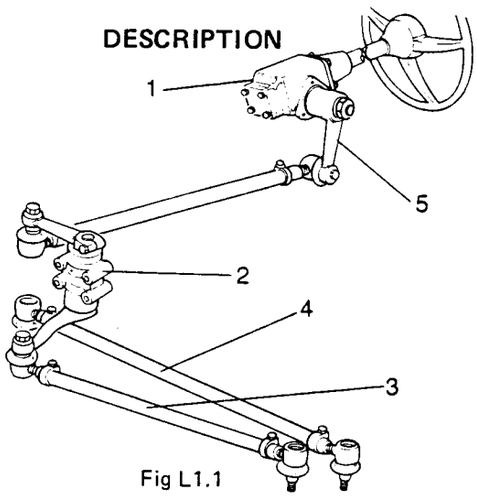


Fig L1.1

1. The steering system is a recirculating ball type operating through the steering box (1), a drop arm (5) and a relay unit (2) to a drag link (3). A track rod (4) connects the two front wheels through ball joints.

2. The steering requires 3,5 turns of the steering wheel from lock to lock.

SUB-SECTION L1

CHAPTER 2

STEERING SYSTEM SPECIFICATIONS

INTRODUCTION

1. The specifications are given in the following Tables:

   TABLE L1.1 - GENERAL DATA
   TABLE L1.2 - TORQUE SPECIFICATIONS

   The specifications in Table L1.1 apply with the vehicle in the static, unladen condition with coolant, oils and 22,7 litres of fuel and with the tyres at the recommended pressures:

TABLE L1.1 - GENERAL DATA

ITEM	DESCRIPTION
Type	Recirculating ball
Ratio: Straight ahead	15,6:1
Full lock	23,8:1
Front wheel toe-in	1,2 to 2,4 mm
Camber angle	1,5° positive
Castor angle	3°
Swivel pin inclination	7°

TABLE L1.2 - TORQUE SPECIFICATIONS

ITEM	TORQUE (N.m)
Steering wheel nut	54
Ball joint nuts	40
Relay lever pinch bolts	76
Steering box support bracket bolts	70 to 85
Steering box support bracket to chassis bolts	20
Steering box drop arm nut	85 to 110

SUB-SUB-SECTION L2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This Sub-sub-section deals with fault diagnosis and corrective action required for the steering system. In Table L2.1 a list of symptoms, the probable cause and the necessary remedies are given. If a fault is suspected, the faults listed in the Table should be consulted. It should be remembered that the Table is not exhaustive and faults may occur which are not listed. Should the Table fail to reveal the fault the suspected component(s) should be removed for a closer inspection and/or overhaul.

TABLE L2.1 - STEERING SYSTEM FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Backlash in steering	Worn or badly adjusted rocker shaft. Worn or loose linkage. Worn swivel hub assembly. Worn or loose front wheel bearings. Steering box loose on chassis.	Replace rocker shaft. Tighten or replace. Overhaul swivel pin housing. Tighten or replace bearings. Tighten box.
Tight steering	Low or unequal tyre pressures. Steering box oil level low. Rocker shaft adjusted too tightly. Inner column binding. Seized ball joint. Relay unit damaged or oil level low.	Check pressures and adjust. Replenish to correct level. Readjust rocker shaft. Clean and lubricate. Replace ball joint. Replenish oil or overhaul relay unit.
Rattle in steering column	Rocker shaft worn or badly adjusted.	Check rocker shaft and replace or readjust.

SUB-SECTION CONTENTS LIST

SUB-SECTION L3

ADJUSTMENTS

SUB-SECTION L3

CHAPTER 1

STEERING BOX ADJUSTMENTS

1. To adjust for steering wheel backlash:

   (1) Set the steering in the straight ahead position.

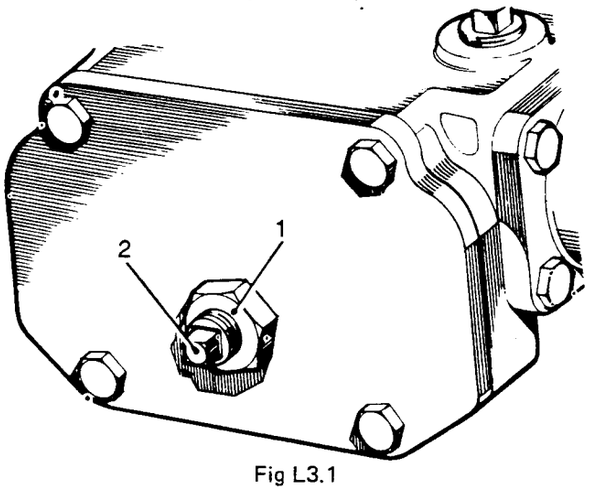


Fig L3.1

   (2) Refer to Fig L3.1. Slacken the lock nut (1) and adjuster (2).

   (3) Screw in the adjuster (2) until steering wheel backlash is taken up.

   (4) Screw in a further one-half flat (maximum) to allow for lock nut (1) tightening.

   (5) Tighten the lock nut without disturbing the adjuster (2).

SUB-SECTION L3

CHAPTER 2

STEERING GEOMETRY

1. No adjustment is provided for castor, camber or swivel pin inclination. However, the following applies to the steering system:

   a. It is essential that there is equal thread engagement of all steering tube ends (ball joints).

   b. With the road wheel in the straight-ahead position and the steering wheel centralised, the steering column lock (if fitted) should engage within ± 20 degrees.

   c. Steering box movement exceeds that required to obtain full lock to lock steering movement. This excess movement must be evenly divided between right-hand and left-hand locks and must not be less than 90 degrees steering wheel movement before the stops in the steering box are operative. This adjustment must be made in the drag link only.

SUB-SECTION L3

CHAPTER 3

LOCKSTOPS

1. To set the lockstops:

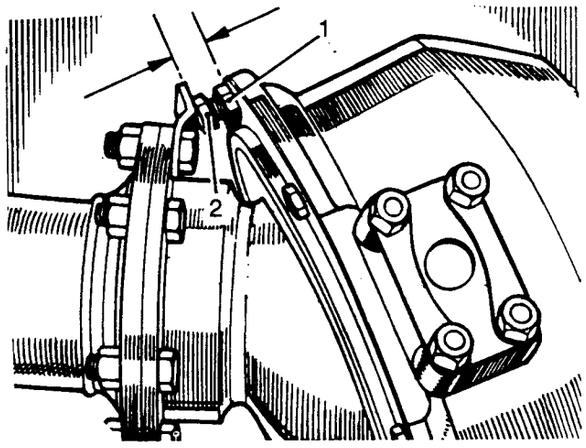


Fig L3.2

(1) Refer to Fig L3.2. Slacken the locknuts (1).

(2) Adjust the stop bolts (2) to obtain 12,5 mm between the bolt head top face and the oil seal retainer face.

(3) Tighten the locknuts (1).

(4) Check the steering at full lock and ensure clearance between the tyres and chassis components.

CHAPTER 4

FRONT WHEEL ALIGNMENT

CHECKING TOE-IN

1. To check toe-in:

(1) Set the vehicle on level ground with the road wheels in the straight-ahead position, and push it forward a short distance.

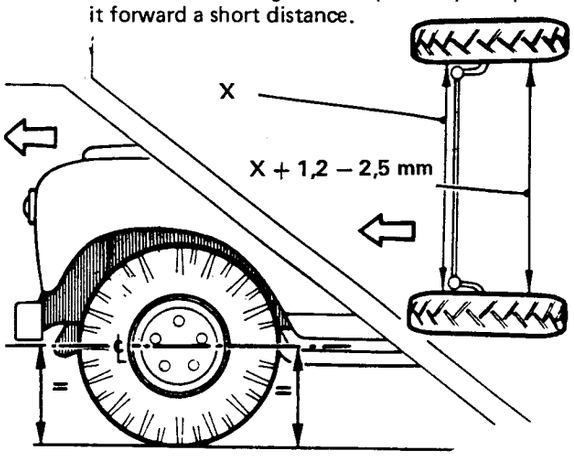


Fig L3.3

(2) Refer to Fig L3.3. Measure the toe-in, with the aid of a tracking stick or suitable proprietary equipment; it should be 1,2 to 2,5 mm measured at the horizontal centre-line of the road wheels.

(3) If necessary, adjust the toe-in as detailed below.

ADJUSTMENT

2. To set toe-in:

(1) Slacken the clamps securing the ball joint at each end of the track rod.

(2) Turn the track rod to decrease or increase its effective length as necessary, until the toe-in is correct.

(3) Push the vehicle rearwards turning the steering wheel from side to side to settle the ball joints. Then, with the road wheels in the straight ahead position, push the vehicle forward a short distance. Re-check the toe-in. If necessary carry out further adjustment.

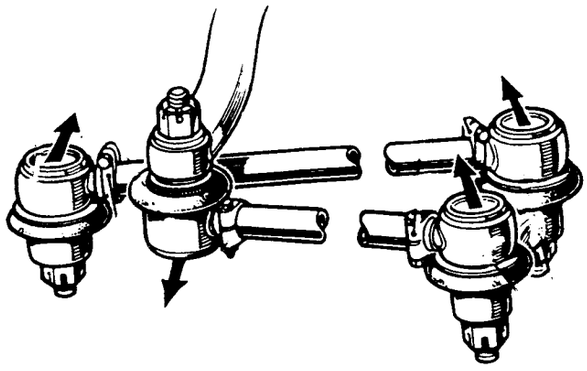


Fig L3.4

(4) Refer to Fig L3.4. When the toe-in is correct, lightly tap the track rod ball joints in the direction indicated to the maximum of their travel, to ensure full unrestricted movement of the track rod.

(5) Secure the ball joint clamps. Torque load 11 to 15 N.m.

SUB-SECTION CONTENTS LIST

SUB-SECTION L4

REMOVAL AND REPLACEMENT PROCEDURES

CHAPTER 1

STEERING COLUMN TOP BEARING - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the steering column top bearing as follows:

(1) Disconnect the battery earth lead.

(2) Remove the steering wheel (see Sub-section L4, Chapter 8).

(3) Release the combined switch from the steering column (see Sub-section L4, Chapter 2).

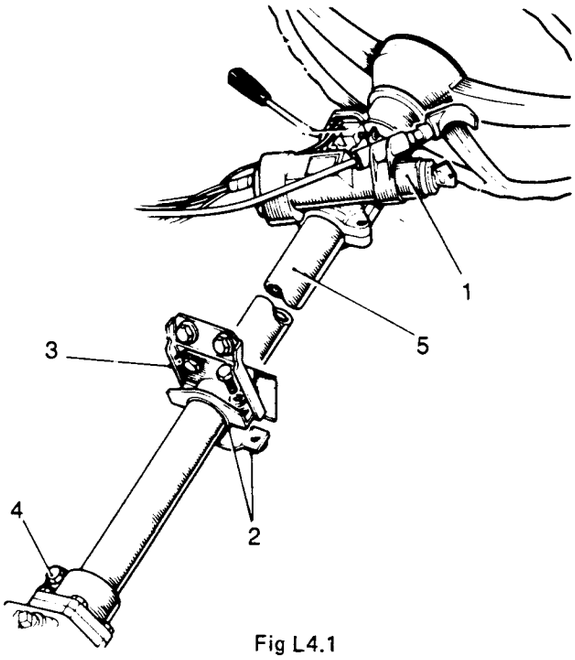


Fig L4.1

(4) Refer to Fig L4.1. On vehicles without a steering column lock, unscrew the lock ring (1) and move aside the ignition/starter switch from the mounting bracket.

(5) Remove the column clamp bracket and seal (2).

(6) Remove the column support bracket (3).

(7) Slacken the pinch bolt (4) outer column to steering box.

(8) Withdraw the outer column (5) from the inner column and steering box.

NOTE
On vehicles fitted with a steering column lock disconnect the cold start control in the engine compartment and disconnect the leads from the ignition/starter switch (see Sub-section L4, Chapter 2), turn the ignition/starter key to unlock steering.

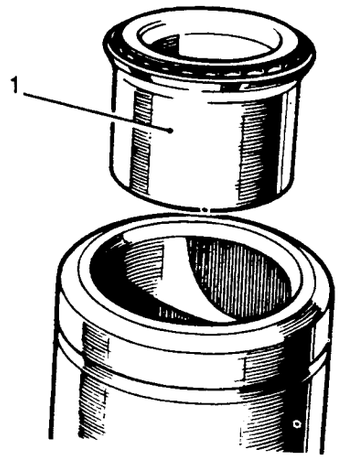


Fig L4.2

(9) Refer to Fig L4.2. Remove the column top bearing (1).

REPLACEMENT

2. To replace the steering column top bearing:

(1) Refit the top bearing (1) to the steering column.

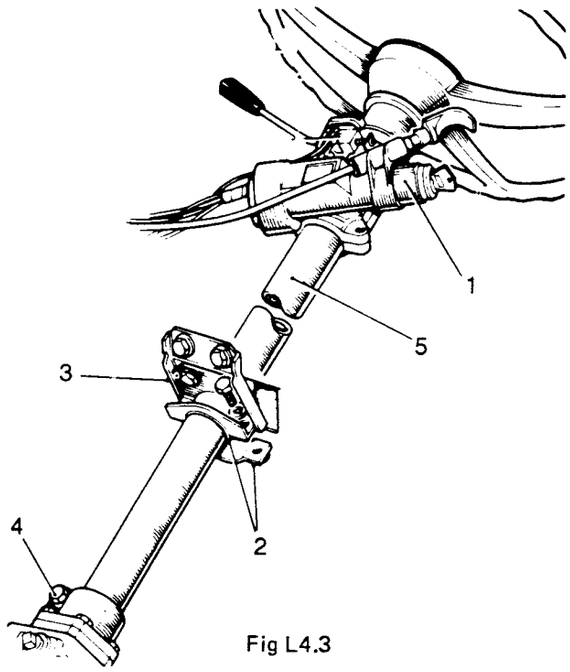


Fig L4.3

(2) Refer to Fig L4.3. Replace the outer column (5) over the inner column.

(3) Tighten the pinch bolt (4), outer column to steering box.

(4) Refit the column support bracket (3).

(5) Replace the column clamp bracket and seal (2).

(6) Replace the ignition/starter switch on the mounting bracket and screw the locking ring (1) tight.

(7) Replace the combined switch onto the steering column (see Sub-section L4, Chapter 2).

(8) Replace the steering wheel (see Sub-section L4, Chapter 8).

(9) Refit the battery negative lead.

CHAPTER 2

STEERING COLUMN LOCK AND IGNITION/STARTER SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the lock and switch:

   (1) Disconnect the battery earth lead.

   (2) Disconnect the cold start control in the engine compartment.

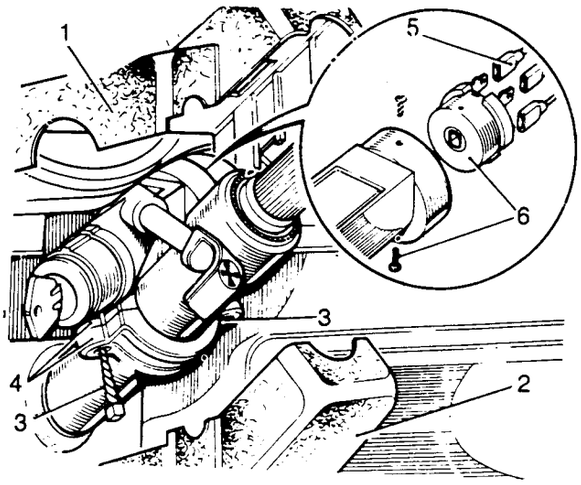


Fig L4.4

   (3) Refer to Fig L4.4. Remove the fixings and withdraw the steering column upper shroud (1).

   (4) Remove the fixings and move aside the lower shroud (2).

   (5) Centre punch and drill a hole in each sheared bolt to accept an extractor (3).

   (6) Remove the sheared bolts using a suitable 'Easy-out' extractor.

   (7) Withdraw the steering column lock and retainer saddle (4).

   (8) Disconnect the electrical leads (5) at the ignition/starter switch.

   (9) If required, remove the fixing screws (6) and withdraw the switch and the cold start control.

REPLACEMENT

2. Replace the lock and switch as detailed below:

   (1) If the switch has been withdrawn, replace it and tighten the fixing screws.

LEAD COLOUR CODE:
N—Brown
R—Red
W—White
O—Orange

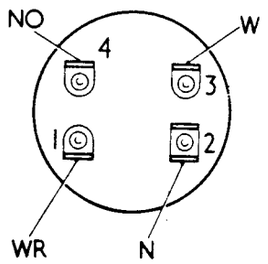


Fig L4.5

   (2) Refer to Fig L4.5. Reconnect the electrical leads to the ignition/starter switch.

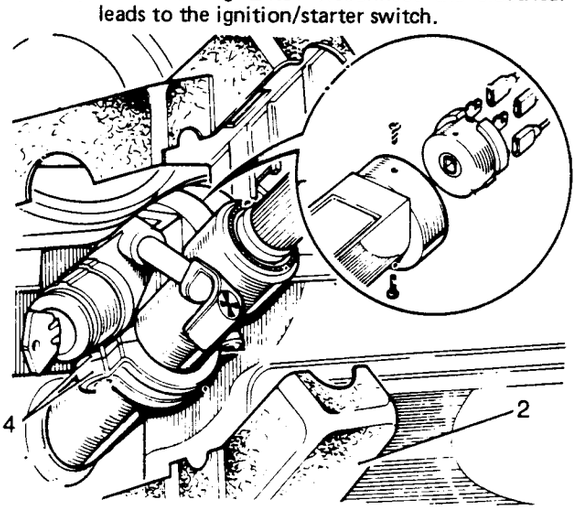


Fig L4.6

   (3) Refer to Fig L4.6. Replace the steering column lock and retainer saddle (4) and secure with new bolts.

   (4) Replace the lower shroud (2).

   (5) Replace the upper shroud (1).

   (6) Reconnect the cold start control in the engine compartment.

   (7) Refit the battery negative lead.

CHAPTER 3

STEERING COLUMN AND BOX ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the column and box:

   (1) Remove the bonnet (see Sub-section M3, Chapter 1).

   (2) Disconnect the battery earth lead.

   (3) Remove the air cleaner (see Sub-section G3).

   (4) Remove the steering wheel (see Sub-section L4, Chapter 8).

   (5) Remove the lock and starter switch (see Sub-section L4, Chapter 2).

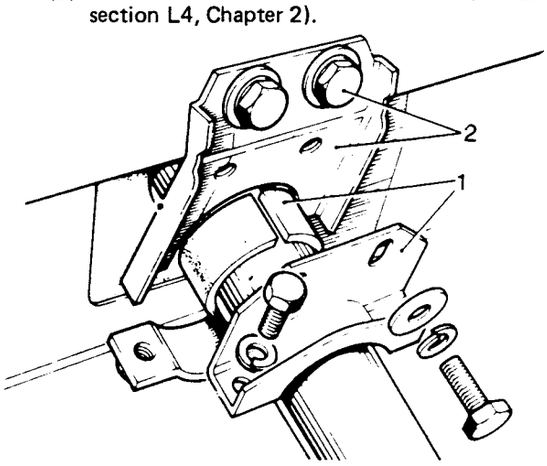


Fig L4.7

   (6) Refer to Fig L4.7. Remove the lower clamp bracket and rubber sleeve (1) from the outer column.

   (7) Remove the upper clamp bracket and support bracket (2) from the bulkhead.

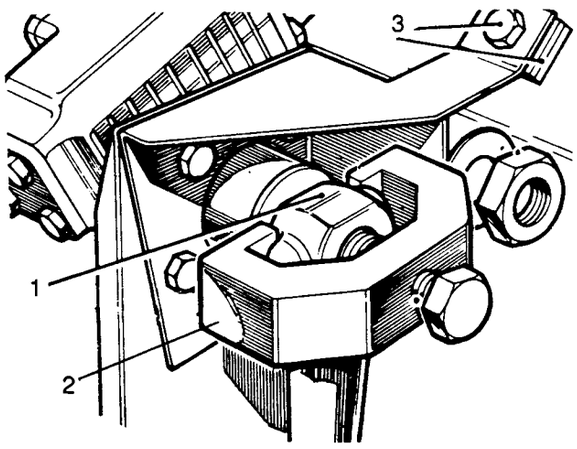


Fig L4.8

   (8) Refer to Fig L4.8. Disconnect the steering drop arm and the attached longitudinal steering tube (1) from the steering box, using special tool 600000 (2).

   (9) Remove the fixings steering box stiffener bracket (3) to the box.

   (10) Raise the front of the vehicle and support on stands.

   (11) Remove the driver's side front road wheel.

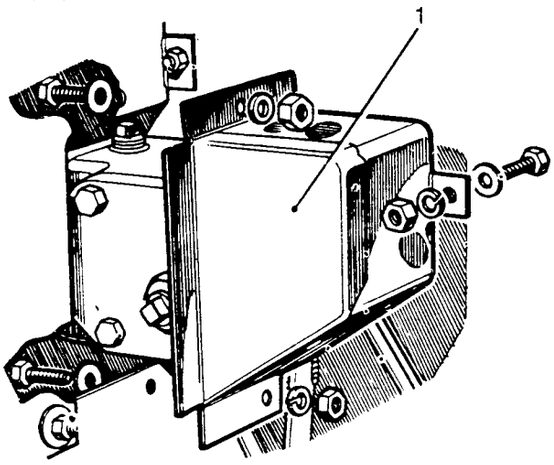


Fig L4.9

   (12) Refer to Fig L4.9. Remove the steering unit box (1) from the wheel arch.

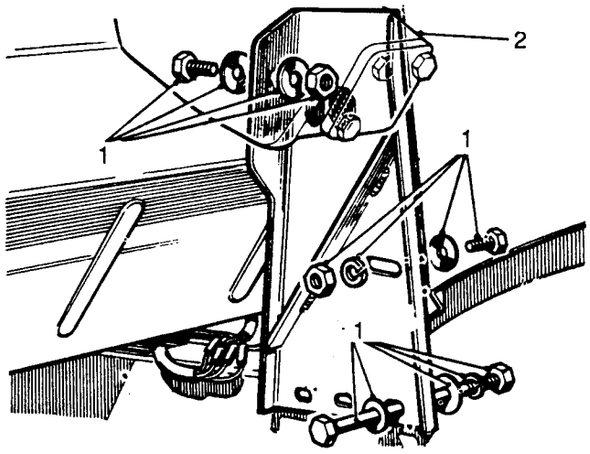


Fig L4.10

(13) Refer to Fig L4.10. Remove the fixings (1), steering box support bracket to toe box, wing valance and chassis.

(14) Withdraw the steering column and box assembly (2) complete with attached brackets from beneath the front wing.

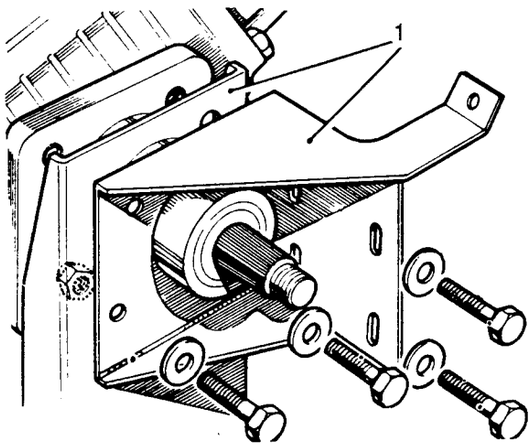


Fig L4.11

(15) Refer to Fig L4.11. If required, remove the stiffener bracket and support bracket (1) from the steering box.

NOTE

The steering box can be overhauled without removing the brackets.

REPLACEMENT

2. Replace the column and box as follows:

(1) If removed, fit the support bracket and stiffener brackets to the steering box. Torque 70 to 85 N.m.

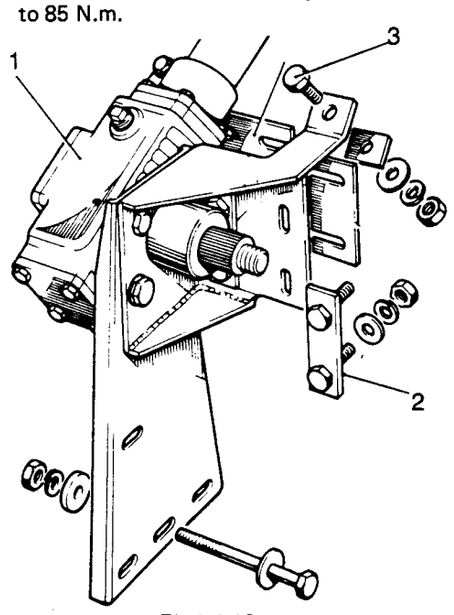


Fig L4.12

(2) Refer to Fig L4.12. Locate the steering box and bracket assembly (1) less drop arm, in position on the vehicle.

(3) Retain the support bracket to the chassis, wing valance and toe box, but do not fully tighten the fixings (2) at this stage.

(4) Retain the steering box stiffener bracket (3) to the toe box, but do not fully tighten the fixings at this stage. If necessary, fit shim washers between the stiffener bracket and the toe box to prevent distorting the toe box or bracket.

CAUTION

During the next steps, do not strain the steering column. If necessary, adjust the steering box position, using the slotted fixing holes in the support and stiffener brackets, to obtain a snug fit between the clamp upper half and the steering column, before securing the clamp halves.

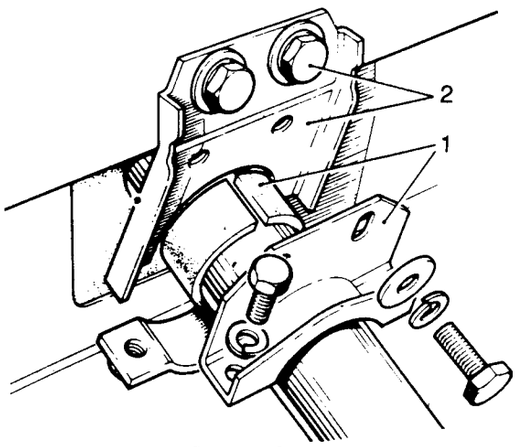


Fig L4.13

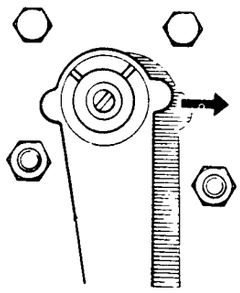
(5) Refer to Fig L4.13. Refit the upper clamp bracket and support bracket (2) to the bulkhead.

(6) Fit the rubber sleeve and lower clamp bracket (1) to the outer column.

(7) Insert slotted packing pieces as required to take up clearance between the support bracket, stiffener bracket and toe box.

(8) Secure the support bracket and stiffener bracket fixings. Torque load for support bracket to chassis fixings is 20 N.m.

(9) Lower the front of the vehicle to the ground.



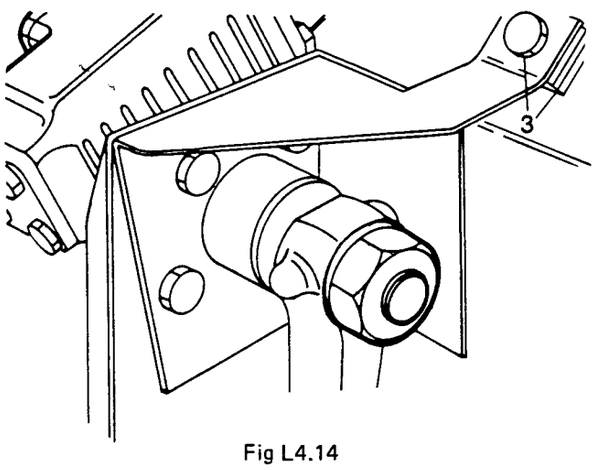


Fig L4.14

(10) Refer to Fig L4.14. Replace the fixings (3), steering box stiffener bracket to the box.

(11) Fit the drop arm to the steering box, aligning the mark on the steering rocker arm with the forward mark of the two on the drop arm.

NOTE

Where a replacement steering box and drop arm complete is being fitted, remove and discard the original drop arm from the longitudinal steering tube, using special tool 601763 (see Fig L4.15), and fit the new drop arm. Torque load for ball joint fixings is 40 N.m.

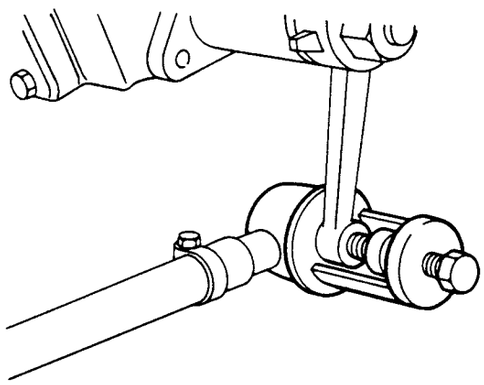


Fig L4.15

(12) Tighten the drop arm fixing to 85 to 110 N.m.

(13) Replace the lock and starter switch (see Sub-section L4, Chapter 2).

(14) Replace the steering wheel (see Sub-section L4, Chapter 8).

(15) Replace the air cleaner (see Sub-section G3).

(16) Reconnect the battery earth lead.

(17) Refit the bonnet (see Sub-section M3, Chapter 1).

SUB-SECTION L4

CHAPTER 4

STEERING RELAY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the steering relay:

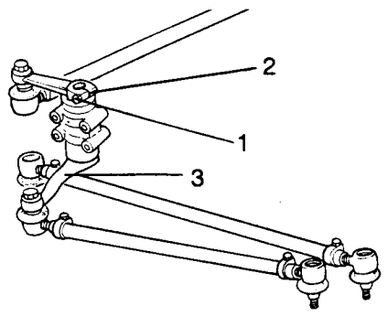


Fig L4.16

(1) Refer to Fig L4.16. From under the bonnet, remove the pinch bolt (1) and withdraw the upper lever (2) from the relay shaft.

(2) Remove the two upper nuts and bolts securing the relay to the chassis.

(3) From under the vehicle, remove the pinch bolt and withdraw the lower lever (3) from the relay shaft.

(4) Support the relay and remove the two lower nuts and bolts securing the relay to the chassis.

(5) Withdraw the steering relay.

REPLACEMENT

2. Replace the steering relay as follows:

(1) Ensure that the relay unit is filled with the correct oil.

(2) Locate the relay in position on the chassis and secure the assembly with the four nuts and bolts.

(3) Fit the upper and lower relay levers and their respective securing bolts and nuts.

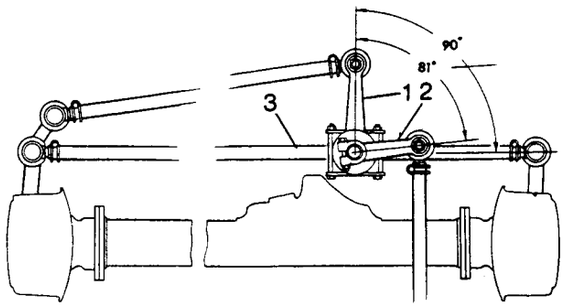


Fig L4.17

(4) Refer to Fig L4.17. The angular relationship of the upper and lower relay levers should be 81 degrees. Check by setting the road wheels in the straight ahead position, at which point the relay lower lever (1) should be at 90 degrees to the track rod. The relay upper lever (2) should be inclined forward of the track rod, 9 degrees out of alignment with the track rod (3).

3. Refit the ball joints to the track rod as follows:

(1) Screw the ball joints equally until the overall dimension between the ball joint centres is 1157 to 1160 mm (dimension A on Fig L4.19).

(2) Position the ball joint clamps 1,6 to 3,2 mm from the track rod ends (dimension B). Do not tighten the clamp bolts at this stage.

4. Refit the track rod:

(1) Fit the ball joints into their housings and secure with the washer and castellated nut. Torque to 40 N.m. Fit new split pins.

(2) Replace the front road wheels.

(3) Lower the front end of the vehicle to the ground.

(4) Check and if necessary adjust wheel alignment leaving the clamp fixings slackened.

(5) Tighten the ball joint clamps. Torque to 11 to 15 N.m.

CHAPTER 5

TRACK ROD BALL AND JOINTS - REMOVAL AND REPLACEMENT

REMOVAL

1. First remove the track rod:

   (1) Jack up the vehicle front end and support on stands.

   (2) Remove the front road wheels.

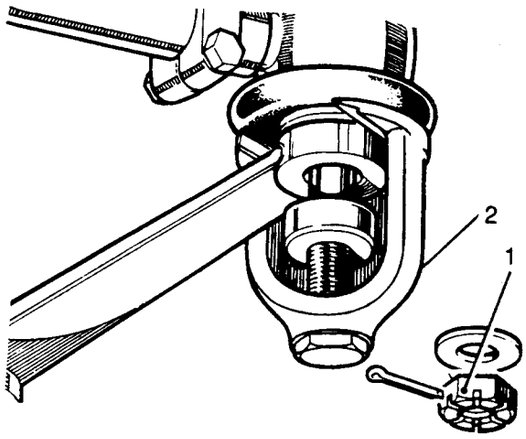


Fig L4.18

   (3) Refer to Fig L4.18. Remove the fixings (1) from both ball joints.

   (4) Extract the ball joint, using special tool 601763 (2).

   (5) Withdraw the track rod and ball joints.

2. Now remove the ball joints from the track rod:

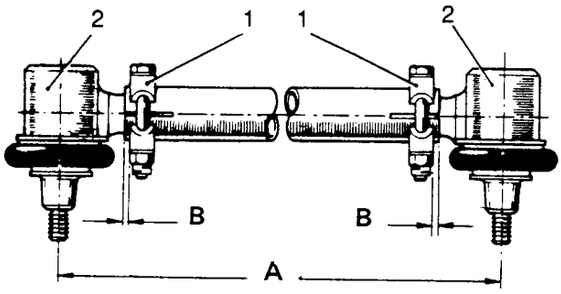


Fig L4.19

   (1) Refer to Fig L4.19. Slacken the ball joints clamp fixings (1).

   (2) Unscrew the ball joints (2) (LH and RH thread).

REPLACEMENT

3. Refit the ball joints to the track rods as follows:

   (1) Screw on the ball joints equally until the overall dimension between the ball joint centres is 1157 to 1160 mm (dimension A on Fig L4.19).

   (2) Position the ball joint clamps 1,6 to 3,2 mm from the track rod ends (dimension B). Do not tighten the clamp bolts at this stage.

4. Refit the track rod:

   (1) Fit the ball joints into their housings and secure with the washer and castellated nut. Torque to 40 N.m. Fit new split pins.

   (2) Replace the front road wheels.

   (3) Lower the front end of the vehicle to the ground.

   (4) Check, and if necessary adjust, wheel alignment, leaving the clamp fixings slackened.

   (5) Tighten the ball joint clamps. Torque to 11 to 15 N.m.

SUB-SECTION L4

CHAPTER 6

LONGITUDINAL STEERING TUBE AND BALL JOINTS - REMOVAL AND REPLACEMENT

REMOVAL

1. First remove the longitudinal steering tube as detailed below:

   (1) Prop open the bonnet.

   (2) Remove the fixings (split pin, castellated nut and washer) from the ball joint connecting the longitudinal tube to the steering box drop arm.

   (3) Using special tool 601763 extract the ball joint from the steering box drop arm (see Fig L4.18 for use of special tool).

   (4) Remove the fixings from the ball joint connecting the longitudinal tube to the relay lever.

   (5) Using special tool 601763 (see Fig L4.18) extract the ball joint from the relay lever and withdraw the longitudinal steering tube from the vehicle.

2. The ball joints may now be removed as follows:

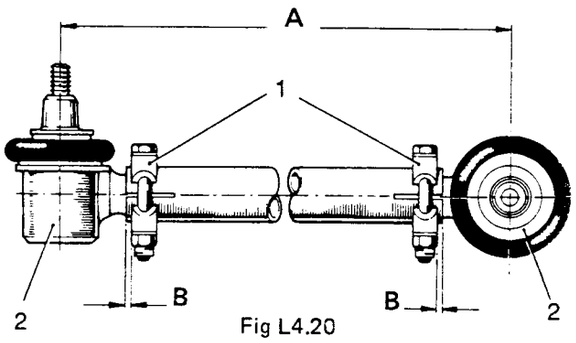


Fig L4.20

   (1) Refer to Fig L4.20. Slacken the ball joint clamp fixings (1).

   (2) Unscrew the ball joints (2) (LH and RH thread).

REPLACEMENT

3. To replace the ball joints onto the longitudinal steering tube:

   (1) Screw in the ball joint equally until the overall dimension between ball joint centres is 621,4 to 624,6 mm (dimension A). Position the clamps 1,58 to 3,17 mm from the longitudinal tube ends (dimension B). Do not tighten the clamp fixings at this stage.

4. To refit the longitudinal steering tube:

   (1) Insert the ball joint ends into their housings on the steering relay lever and the steering box arm.

   (2) Secure the ball joints with washers and castellated nuts. Torque the ball joint fixings to 40 N.m and fit new split pins.

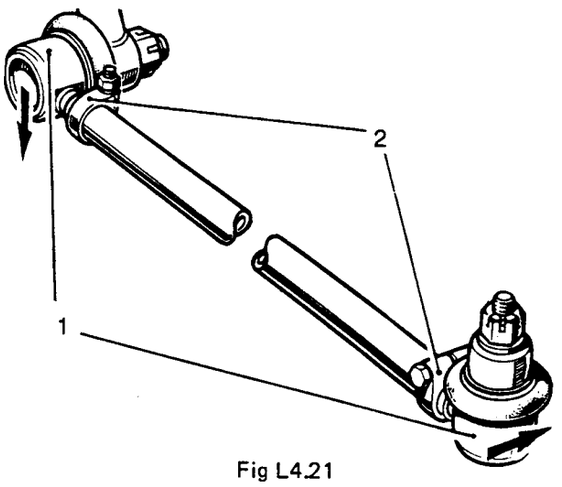


Fig L4.21

   (3) Refer to Fig L4.21. Using a mallet, lightly tap the ball joint cups (1) in the direction indicated to the maximum of their travel, to ensure full unrestricted movement of the longitudinal arm.

   (4) Tighten both ball joint clamps (2) to 11 to 15 N.m.

   (5) Check the steering lockstops setting (see Subsection L3, Chapter 3).

   (6) Check the steering, lock to lock, for correct functioning. If necessary, adjust the overall length of the longitudinal arm by slackening the ball joint clamps and screwing the arm in or out, as required, then resecure the clamps.

CHAPTER 7

DRAG LINK AND BALL JOINTS - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the drag link first as detailed below:

   (1) Jack up the vehicle front end.

   (2) Remove the front road wheel from the side where the drag link is connected to the swivel pin steering lever.

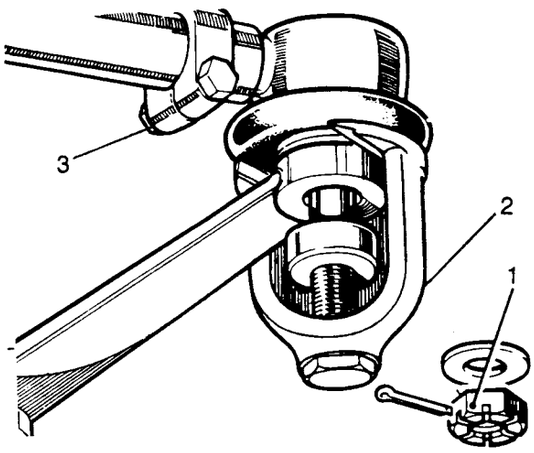


Fig L4.22

   (3) Refer to Fig L4.22. Remove both ball joint fixings (1).

   (4) Extract the ball joints, using special tool 601763 (2).

   (5) Withdraw the drag link.

2. Now remove the ball joints:

   (1) Slacken the clamp fixings (3) on Fig L4.2 .

   (2) Unscrew the ball joints, LH and RH thread.

REPLACEMENT

3. Replace the ball joints as follows:

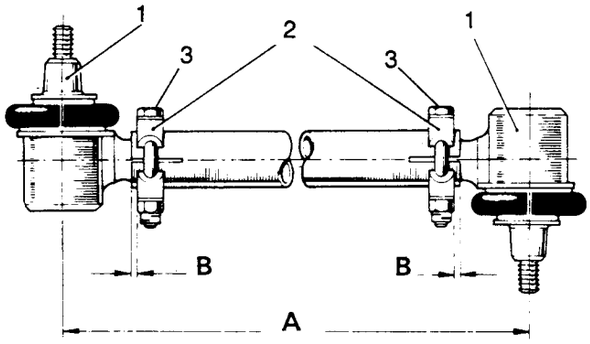


Fig L4.23

   (1) Refer to Fig L4.23. Screw in the ball joints (1) equally until the overall dimension between ball joint centres is 782,62 to 785,79 mm (dimension A).

   (2) Position the clamps (2) 1,58 to 3,17 mm from the drag link ends (dimension B) with the clamp jaws situated over the slot in the tube; the relay lever ball joint is in the pendant position when fitted. Do not tighten the clamp fixings (3) at this stage.

4. Now refit the drag link:

   (1) Fit the drag link ball joints into their housings and secure with a washer and castellated nut. Tighten the nuts to 40 N.m. Fit new split pins.

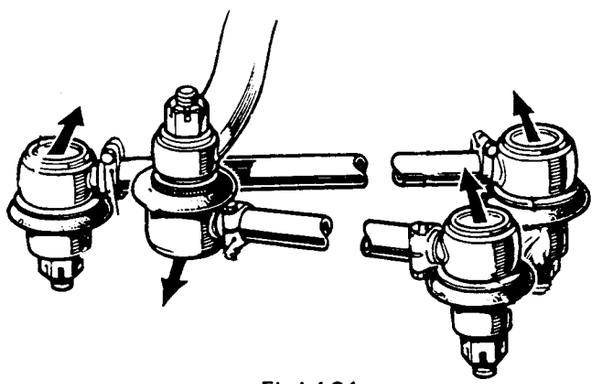


Fig L4.24

   (2) Refer to Fig L4.24. If the clamps were previously slackened, lightly tap the ball joint cups with a mallet in the direction indicated to the maximum of their travel, to ensure full unrestricted movement of the drag link.

(3) Tighten the ball joint clamps to 11 to 15 N.m.

(4) Replace the front road wheel.

(5) Lower the vehicle front end to the ground.

CHAPTER 8·

STEERING WHEEL - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the steering wheel:

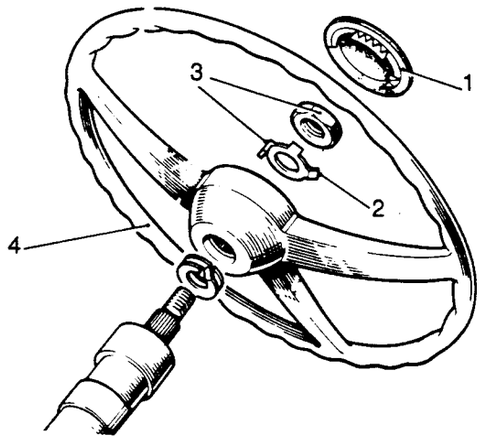


Fig L4.25

(1) Refer to Fig L4.25. Prise off the wheel centre cover (1).

(2) Release the locking tab (2).

(3) Remove the tab washer and fixing nut (3).

(4) Withdraw the steering wheel (4). Take care not to lose the spring washer below the wheel.

REPLACEMENT

2. To replace the steering wheel:

(1) Position the road wheels in the straight ahead position.

(2) Fit the steering wheel with the centre spoke pointing downwards.

(3) Fit the tab washer and fixing nut. Torque the nut to 54 N.m.

(4) Tap the locking tab into position against the nut.

(5) Refit the wheel centre cover.

SUB-SECTION CONTENTS LIST

SUB-SECTION L5

OVERHAUL AND CLEANING PROCEDURES

SUB-SECTION L6

MAINTENANCE

INTRODUCTION

1. The steering system is relatively trouble free and requires little regular maintenance other than periodic cleaning and checking the connecting links for wear and damage.

2. The ball joints should be examined periodically to see that the rubber covers are undamaged. If cuts or abrasions are noted the covers should be replaced immediately.

CHECKING OIL LEVEL IN THE STEERING RELAY

3. At the specified intervals, check the oil level as follows:

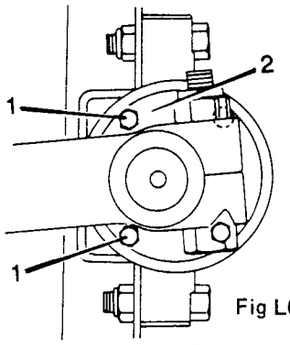


Fig L6.1

(1) Refer to Fig L6.1. Remove two of the bolts (1) securing the relay top cover (2).

(2) Check that the oil level is up to the bottom of the holes.

(3) If it is not, pour oil into one of the holes (the other acts as a breather) until the oil is at the correct level.

NOTE

1. While filling, it is probable that oil will eject from the breather hole. If this occurs do not assume that the relay unit is full. Allow time for the oil to find its way to the main chamber. Wait a few moments until the breather hole is clear of oil, then continue pouring.

2. As the unit fills up, air is forced out of the breather hole in the form of an air bubble again giving the impression that the unit is full. Wait until the bubble subsides and then continue filling until the oil is clearly visible at the base of the filler and breather holes.

(4) Replace the two top cover bolts.

SUB-SECTION L5

CHAPTER 1

STEERING COLUMN AND BOX ASSEMBLY - OVERHAUL

DISMANTLING

1. To dismantle the assembly:

(1) Remove the steering column and box assembly (see Sub-section L4, Chapter 3).

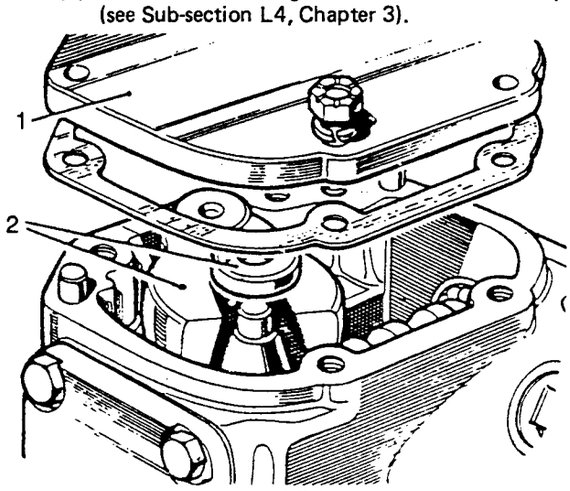


Fig L5.1

(2) Refer to Fig L5.1. Remove the side cover (1) and drain the oil from the steering box.

(3) Lift out the roller for the main nut and withdraw the rocker shaft (2).

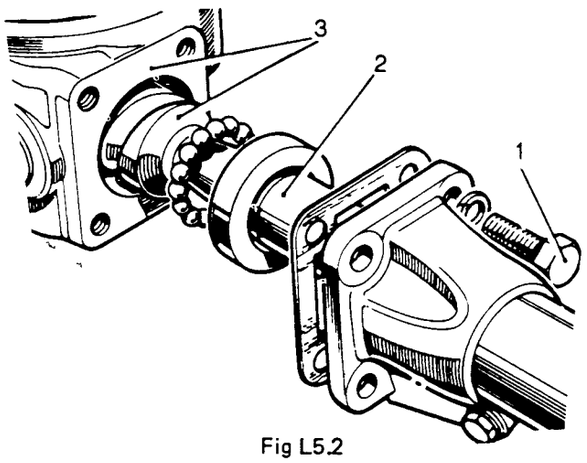


Fig L5.2

(4) Refer to Fig L5.2. Hold the outer column in a vice and remove the fixings (1) securing the steering box.

(5) Using a mallet, tap the inner column (2) at the steering wheel end to partially remove the box.

(6) Withdraw the box and inner column (3) complete. Take care not to lose any of the steel balls from the steering box bearings.

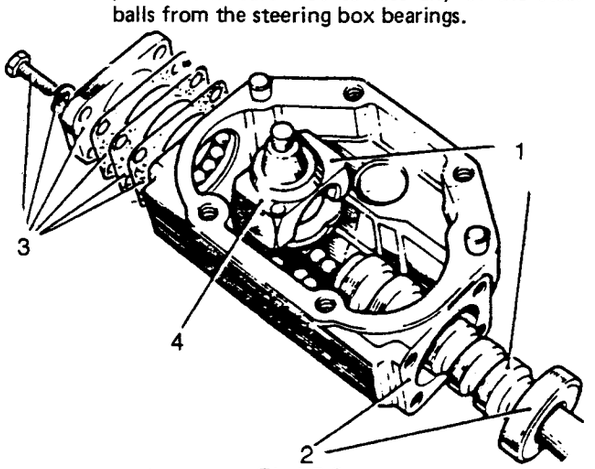


Fig L5.3

(7) Refer to Fig L5.3. Rotate the inner column to locate the main nut in the mid-way position on the worm shaft (1).

(8) Using a mallet, gently tap the box away from the inner column sufficient to remove the upper ball race (2). Take care not to lose the steel balls which will be released from the bearings.

(9) Wind the worm shaft through the main nut and remove the shaft, main nut and any loose steel balls.

(10) Remove the end cover, shims and lower ball race (3).

(11) Dislodge and remove the twelve 9,52 mm diameter ball bearings from the main nut and recirculating tube (4).

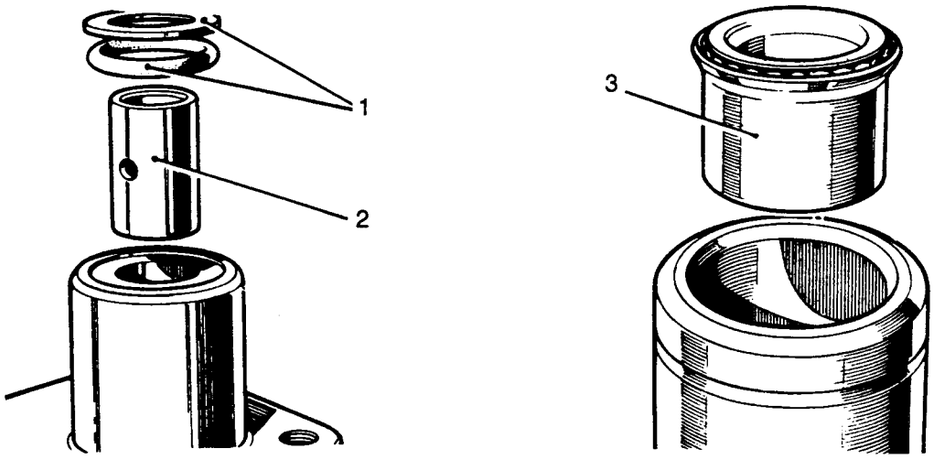


Fig L5.4

(12) Refer to Fig L5.4. Remove the retaining washer and oil seal (1).

(13) If required, press out the rocker shaft bush (2).

(14) If required, remove the outer column top bearing (3).

INSPECTING

2. Carry out the following inspection:

(1) Clean all components in a grease solvent and dry out.

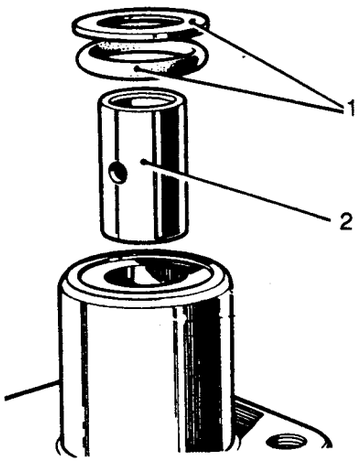
(2) Examine all components for obvious signs of wear or damage.

(3) Examine the main nut ball bearing track for evidence of indentations or scaling.

(4) Examine the worm shaft for similar markings. Slight indentations at the extreme end of the shaft can be disregarded as this is a normal wear condition, but if indentations have spread to the middle of the shaft, a replacement must be fitted.

REASSEMBLING

3. Reassemble the steering box and column as follows:



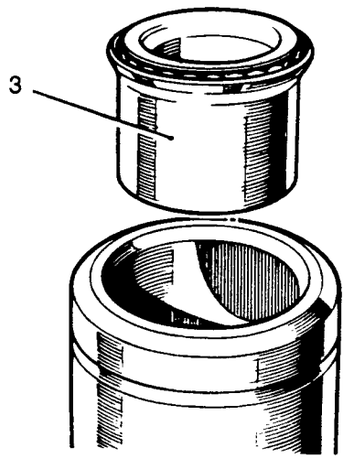


Fig L5.5

(1) Refer to Fig L5.5. If it has been removed, replace the outer column top bearing (3).

(2) If necessary, refit the rocker shaft bush (2). Use a press if required.

(3) Replace the retaining washer and oil seal (1).

NOTE
In the following procedures use a general purpose grease to retain ball bearings and to coat all joint washers while assembling.

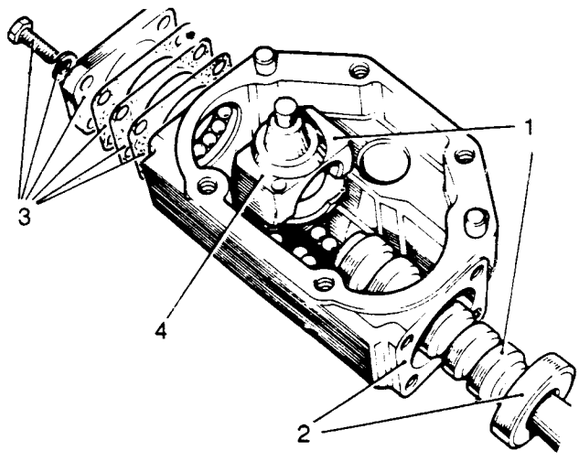


Fig L5.6

(4) Refer to Fig L5.6. Fit the twelve 9,52 mm diameter ball bearings to the main nut and recirculating tube (4).

(5) Replace the lower ball race, shims and end cover (3).

(6) Wind the worm shaft through the main nut.

(7) Refit the upper ball race and fit the box to the inner column (2).

(8) Rotate the inner column to locate the main nut in the midway position on the worm shaft (1).

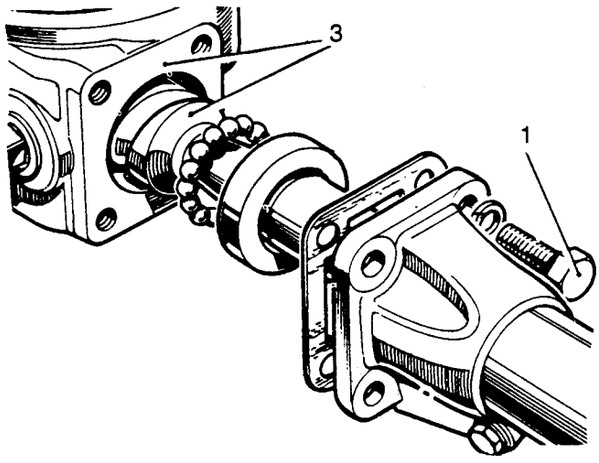


Fig L5.7

(9) Refer to Fig L5.7. Refit the box and inner column (3) complete to the outer column.

(10) With the outer column held in a vice, replace the fixings (1) securing the steering box.

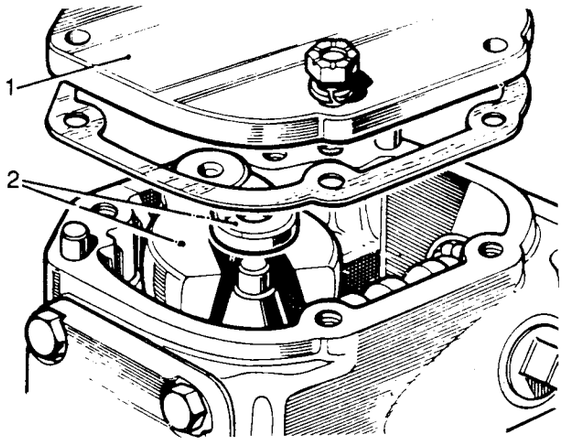


Fig L5.8

(11) Refer to Fig L5.8. Replace the rocker shaft (2) and refit the roller for the main nut.

(12) Replace the side cover (1). Coat all cover plate fixing nuts with 'Wellseal' or suitable equivalent sealing compound and tighten to 23 to 28 N.m.

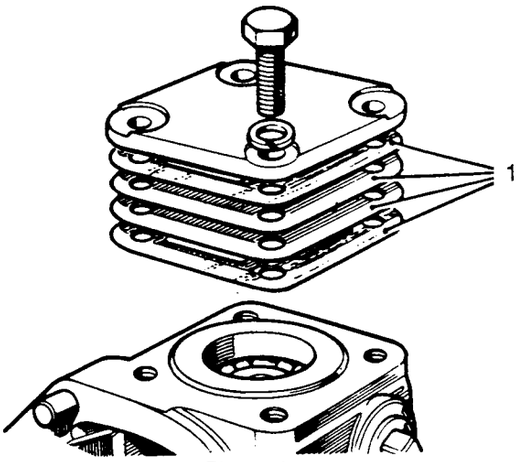


Fig L5.9

(13) Refer to Fig L5.9. Check for end-float on the steering column. Adjust the shim washer (1) thickness between the end cover and the steering box to obtain a 'free to rotate but no end-float' condition on the inner column.

(14) Set the steering in the straight ahead position (midway lock to lock).

(15) Screw the steering box adjuster by hand until there is no end-float between the adjuster and the rocker shaft. Screw in a further one half flat (maximum) to allow for locknut tightening.

(16) Tighten the adjuster locknut ensuring that the adjuster does not move.

(17) Fill the steering box with the correct grade of lubricating oil.

(18) Replace the steering column and box assembly (see Sub-section L4, Chapter 3).

SUB-SECTION L5

CHAPTER 2

STEERING RELAY - OVERHAUL

DISMANTLING

1. Dismantling the relay assembly as follows:

(1) Remove the relay assembly (see Sub-section L4, Chapter 4).

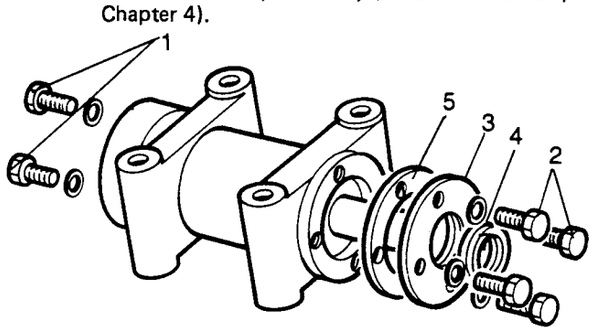


Fig L5.10

(2) Refer to Fig L5.10. Remove the two of the securing bolts (1) from the relay top cover. Invert the relay and allow the oil to drain.

(3) Locate the relay assembly horizontally in a vice.

(4) Remove the four bolts (2) securing the relay lower cover (3).

(5) Remove the lower cover complete with oil seal (4) gasket (5) and thrust washer. Discard the gasket.

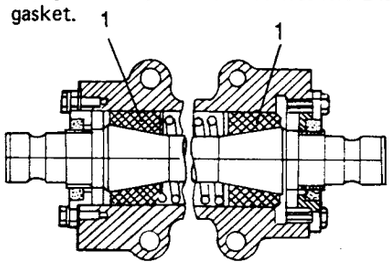


Fig L5.11

(6) Refer to Fig L5.11. The relay shaft now has to be drifted through the lower end of the relay housing. In the sectioned illustration of the relay assembly, note that items (1) are split bushes with internal tapered faces, against which they are held by a compression spring.

WARNING

The relay split bushes and spring will fly apart when released from the housing. Protection must be provided to prevent injury.

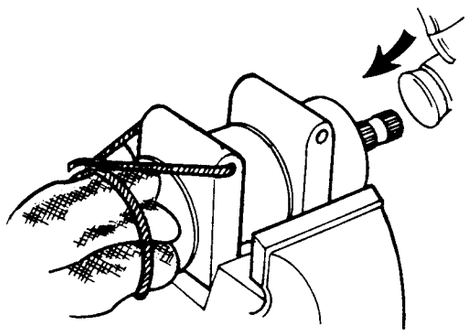


Fig L5.12

(7) Refer to Fig L5.12. Enclose the lower end of the relay assembly with stout material, leaving within the material sufficient space to accommodate the relay shaft. Secure the material to the relay housing to form a safety sheath.

(8) Gently tap the relay shaft into the safety sheath.

(9) Remove the safety sheath and collect the relay shaft, split bushes, spring and washers.

(10) Remove the bolts securing the relay upper cover and remove the upper cover complete with oil seal, gasket and thrust washer. Discard the gasket, remove the oil seal.

(11) Remove the oil seal from the relay lower cover.

INSPECTING

2. Thoroughly clean all components and examine for wear and damage. Renew components as necessary.

REASSEMBLY

3. To reassemble the relay:

(1) Apply jointing compound to the outer periphery of the new oil seals. Fit the oil seals to the relay upper and lower covers (seal lips towards the relay housing).

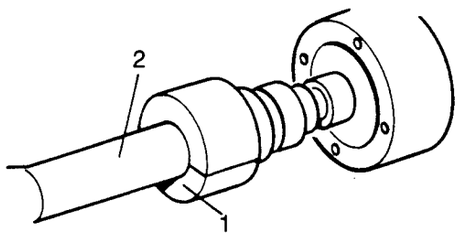


Fig L5.13

(2) Refer to Fig L5.13. Locate the two halves of the split bush (1) on the top cone of the shaft (2).

(3) Insert the assembly of shaft and bush into the housing from the bottom.

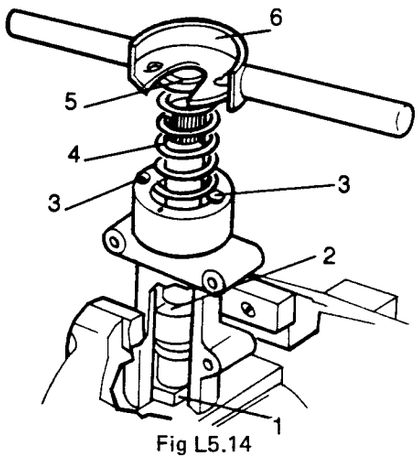


Fig L5.14

(4) Refer to Fig L5.14. Secure the housing and shaft assembly, bottom end uppermost, in a vice with a 19 mm support block (1) under the bottom end of the shaft.

(5) Insert the washer (2) for the spring into the housing and fit two of the oil seal retainer fixing bolts (3) into the housing diametrically opposite each other.

(6) Fit the spring (4) and washer (5).

(7) Using special tool 600536 (6) carefully compress the spring.

(8) Turn the tool to lock in position with the keyhole slots under the heads of the bolts.

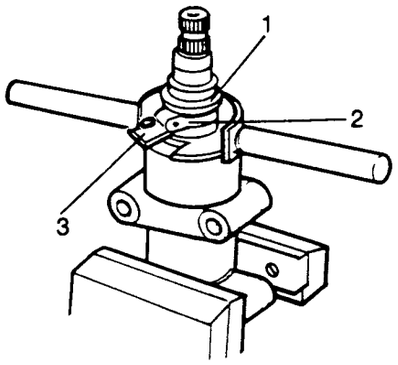


Fig L5.15

(9) Refer to Fig L5.15. Locate the other split bush (1) in position on the bottom cone of the shaft and secure with a 50 mm hose clip (2).

(10) Remove the special tool and the seal retainer fixing bolts (3).

(11) Remove the assembly from the vice and gently tap the shaft into position until the split bush has entered the housing for at least half its length.

(12) Remove the hose clip and continue to tap the shaft into the housing until the bushes are correctly located in the housing.

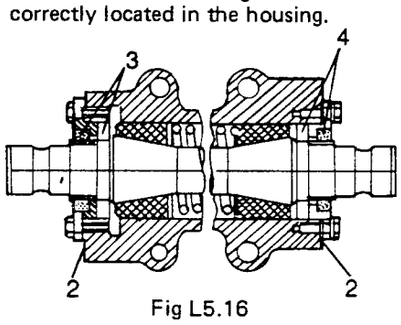


Fig L5.16

(13) Refer to Fig L5.16. Smear general purpose grease on both sides of the joint washers (2) and fit one to each end of the housing.

(14) Fit the thrust washer and end cover (3) complete with seal to the bottom end of the housing only. Use 'Wellseal' or a suitable equivalent sealing compound on the threads of the bolt fitted to the breather hole.

(15) Fill the housing with the correct grade of oil.

(16) Fit the thrust washer and end cover (4), complete with seal to the top of the housing, using sealing compound on the threads of the four securing bolts.

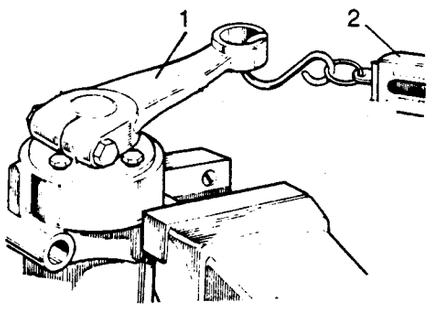


Fig L5.17

(17) Refer to Fig L5.17. Hold the relay in a vice.

(18) Temporarily attach the upper relay lever (1) and use a suitable spring balance (2) to check resistance to rotation of the relay shaft. The resistance, measured on the spring balance, must not be less than 5,4 kg and should not exceed 7,3 kg.

(19) If the resistance is less than 5,4 kg, fit a new spring.

(20) If the resistance is excessive, remove the oil seal retainers and thrust washers, then use a suitable piece of tube to push each split bush in turn clear of its cone and inject lubricating oil. Reassemble and recheck.

(21) Fit the assembly to the vehicle (see Sub-section L4, Chapter 4).

CHAPTER 3

STEERING BALL JOINTS - CLEANING AND REGREASING

GENERAL

1. The steering ball joints have been designed in such a way as to retain the initial filling of grease for the normal life of the ball joint; however, this applies only if the rubber boot remains in position on the joint. The rubber boots should be checked at the maintenance intervals to ensure that they have not become dislodged or the joint damaged. Should any of the rubber boots be dislodged, proceed as follows:

DISMANTLING

2. To dismantle a ball joint:

(1) Remove the ball joint from the longitudinal arm, track rod or drag link (see Sub-section L4, Chapter 5, 6 or 7).

NOTE
If only one ball joint requires attention, it is only necessary to disconnect the applicable end of the steering arm.

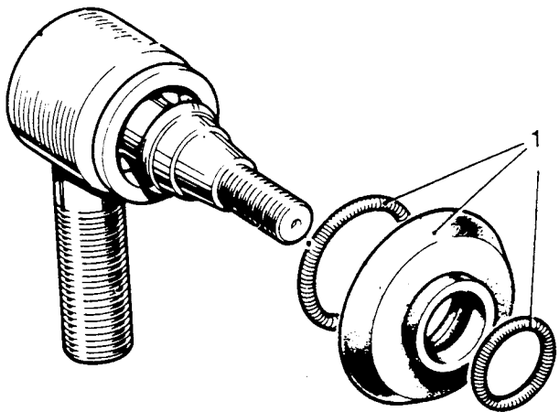


Fig L5.18

(2) Refer to Fig L5.18. Remove the rubber cover and spring rings (1).

(3) Thoroughly clean all parts.

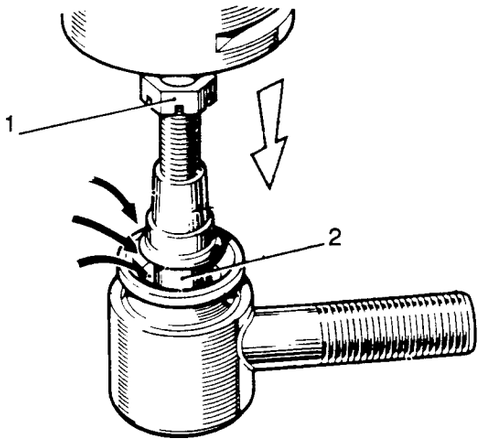


Fig L5.19

(4) Refer to Fig L5.19. Place the castle nut (1) upside down on the pin and screw on a few threads.

(5) Place the ball joint under a press or between the jaws of a vice and carefully force the pin and ball down against the spring. In this position the interior of the ball joint can be cleaned and lubricated.

(6) Apply grease around the taper (2) and fill the replacement rubber boot.

REASSEMBLY

3. Reassemble the ball joint:

(1) Discard the spring rings and fit new rings.

(2) Take off the castle nut.

(3) Replace the ball joint onto the longitudinal arm, track rod or drag link (see Sub-section L4, Chapter 5, 6 or 7).

SUB-SECTION M1

DESCRIPTION OF THE BODY

1. The Land Rover bodywork, with the exception of a steel radiator grille and tailboard frames is made from 'Birmabright' alloy. This is a magnesium-aluminium alloy which will not rust or corrode under normal circumstances. It is work hardening and so becomes brittle when hammered. It is, however, easily annealed.

2. Birmabright has the property of forming a hard oxide skin when exposed to air so care and special preparation is necessary when painting is undertaken.

SUB-SECTION M2

CHASSIS FRAME ALIGNMENT

PROCEDURE

1. With the vehicle assembled, a check for chassis 'squareness' can be made as follows:

   (1) Place the vehicle on a level floor.

   NOTE
   The measuring points referred to below are the fixed spring shackle locations.

   (2) Hold a plumb line against one of the measuring points.

   (3) Mark the floor directly beneath the plum bob.

   (4) Carry out steps (2) and (3) for the three other measuring points.

   (5) Move the vehicle and measure diagonally between the front and rear marks. The chassis is square if the two measurements agree to within 9,5 mm.

   (6) Using a suitable trammel, make comparative side-to-side checks between the front suspension front shackle pin and the rear wheel hub centre.

   (7) With the vehicle upper structure removed, comparative side-to-side checks for chassis frame malalignment can be made, using as datums the 9,5 mm diameter holes provided in the No. 2 and in the rearmost cross-members.

   NOTE
   The vehicle front bumper is regarded as the No. 1 cross-member.

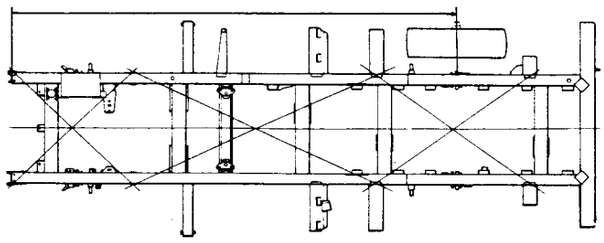


Fig M2.1

SUB-SECTION CONTENTS LIST

SUB-SECTION M3

REMOVAL AND REPLACEMENT PROCEDURES

SUB-SECTION M3

CHAPTER 1

BONNET - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the bonnet:

   (1) Remove the spare wheel if this is fitted to the bonnet.

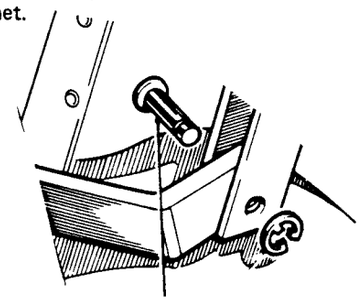


Fig M3.1

   (2) Refer to Fig M3.1. Disconnect the prop rod.

   (3) Raise the bonnet to the vertical position.

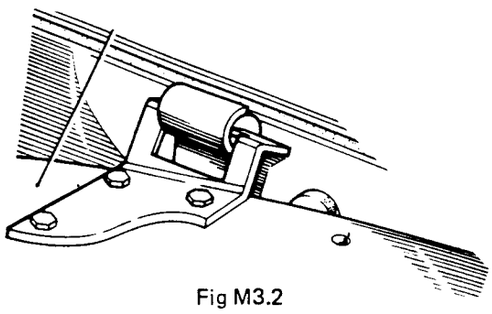


Fig M3.2

   (4) Refer to Fig M3.2. Lift the bonnet clear from the hinges.

REPLACEMENT

2. Replace the bonnet as follows:

   (1) With the bonnet in the vertical position engage it with the hinges.

   (2) Lower the bonnet sufficiently to reconnect the prop rod.

   (3) Lower the bonnet fully and ensure that it engages with the lock.

CHAPTER 2

DOORS - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove a side door as follows:

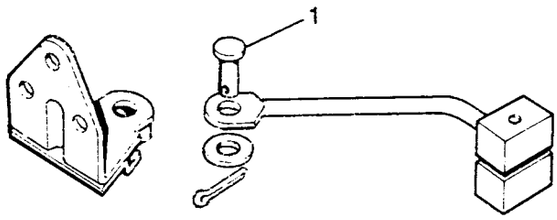


Fig M3.3

(1) Refer to Fig M3.3. Disconnect the door check strap (1).

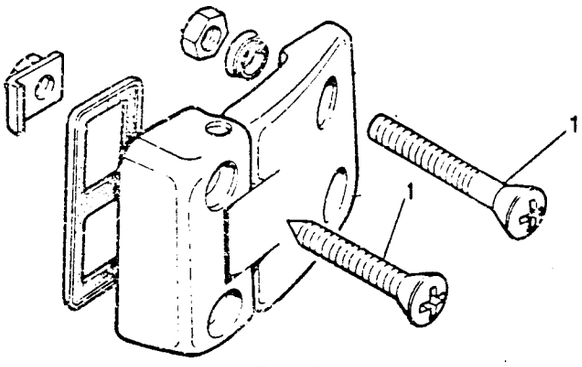


Fig M3.4

(2) Refer to Fig M3.4. Remove the fixings (1) securing the hinges.

(3) Withdraw the door.

REPLACEMENT

2. To replace the door:

(1) Examine the weather seals for deterioration or damage. Replace if necessary.

(2) Place the door into position. Swing the hinges into position and secure with the fixings.

(3) Reconnect the door check strap.

CHAPTER 3

DOOR GLASS - REMOVAL AND REPLACEMENT

REMOVAL

Sliding Glass

1. The sliding glass must be removed before the fixed glass can be taken out. Proceed as follows:

   (1) Move the sliding window to allow access to the screws securing glass run channel, top and bottom.

   (2) Remove the screws from inside the channel.

   (3) Withdraw the top run channel and sliding window.

   (4) Remove the bottom run channel if necessary.

Fixed Glass

2. Once the sliding glass is removed the fixed glass may be taken out as follows:

   (1) Remove the screws securing the front retainer.

   (2) Ease the fixed glass clear of the frame.

REPLACEMENT

3. First replace the fixed glass:

   (1) Apply new Prestik sealing strip to the window frame.

   (2) Fit the glass into the frame.

   (3) Replace the screw securing the front retainer.

4. The sliding glass may now be replaced:

   (1) Replace the bottom run channel if this has been removed.

   (2) Place the top run channel onto the sliding glass top and fit both into the frame.

   (3) Replace and tighten the securing screws inside the channel.

   (4) Check that the sliding glass moves freely in the channels.

CHAPTER 4

DOOR LOCK - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove a door lock:

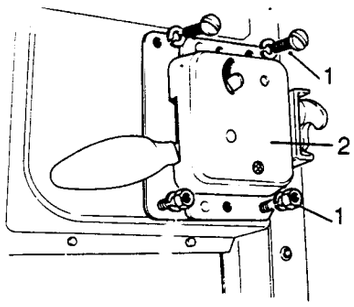


Fig M3.5

(1) Refer to Fig M3.5. Remove the fixings (1).

(2) Withdraw the door lock (2).

(3) If required, remove the striker plate from its support bracket (2 screws).

REPLACEMENT

2. Replace the door lock as follows:

(1) Fit the lock into position, engaging the square rod of the outer door handle into the square hole in the lock.

(2) Secure the lock with the fixings.

(3) Check movement of the catch.

(4) Replace the striker plate if this has been removed.

(5) Adjust the striker plate so that the door draught excluders are slightly compressed with the door closed.

CHAPTER 5

FRONT FLOOR - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the front floor:

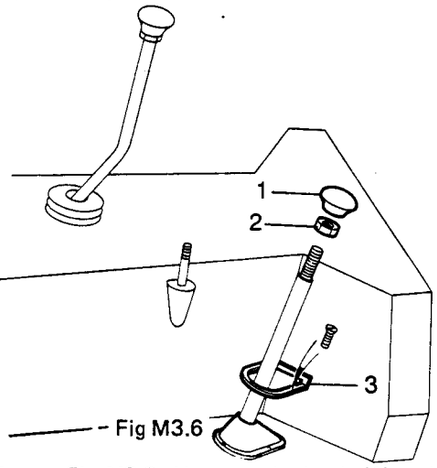


Fig M3.6

(1) Refer to Fig M3.6. Unscrew the knob (1) and locknut (2) from the transfer gear lever.

(2) Remove the fixings and withdraw the dust cover (3) from the transfer gear lever.

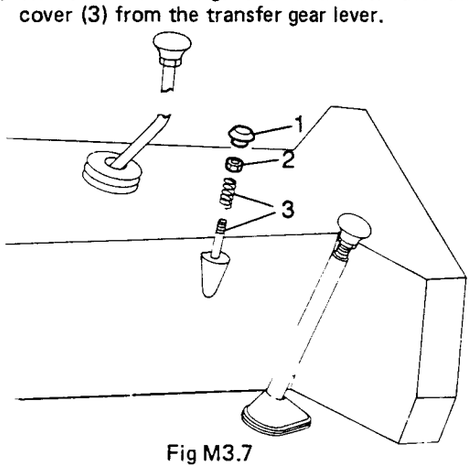


Fig M3.7

(3) Refer to Fig M3.7. Unscrew the knob (1) and locknut (2) from the four-wheel drive lever.

(4) Withdraw the spring and ferrule (3).

(5) Remove the floor mats.

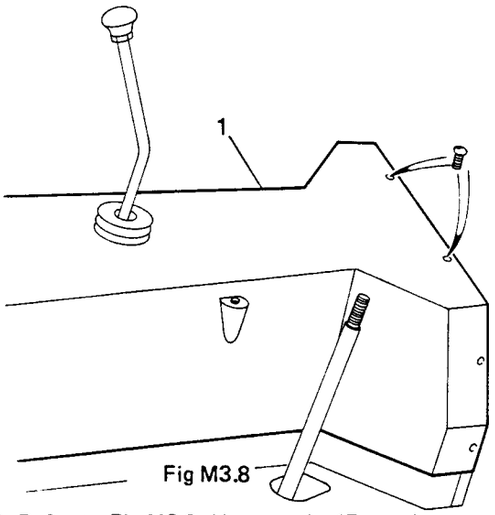


Fig M3.8

(6) Refer to Fig M3.8. Unscrew the 17 speed screws and remove the gearbox tunnel cover (1).

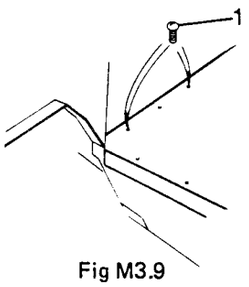


Fig M3.9

(7) Refer to Fig M3.9. Remove the securing bolts in the floor (1) and remove both halves of the floor.

REPLACEMENT

2. To replace the floor:

(1) Using a waterproof sealant between the joint flanges (a suitable sealant is Sealastrip), fit the floor halves and secure with the fixing bolts.

(2) Replace the gearbox tunnel cover, again using a waterproof sealant, and secure with the 17 speed screws.

(3) Fit the ferrule, spring and locknut to the four-wheel drive lever. Depress the lever and adjust the locknut until the compressed spring length is 58 mm. Fit the knob and tighten the locknut.

(4) Replace the dust cover over the transfer gear lever.

(5) Replace the knob and locknut on the lever.

CHAPTER 6

RADIATOR GRILLE AND GRILLE PANEL - REMOVAL AND REPLACEMENT

REMOVAL

1. Two grilles are fitted to the Land Rover: a fine mesh grille at the front secured by wing nuts and behind this, a coarse mesh grille. To remove both grilles and the grille panel:

(1) Remove the bonnet (see Sub-section M3, Chapter 1).

(2) Disconnect the battery earth lead.

(3) Unscrew the wing nuts and lift off the fine mesh grille.

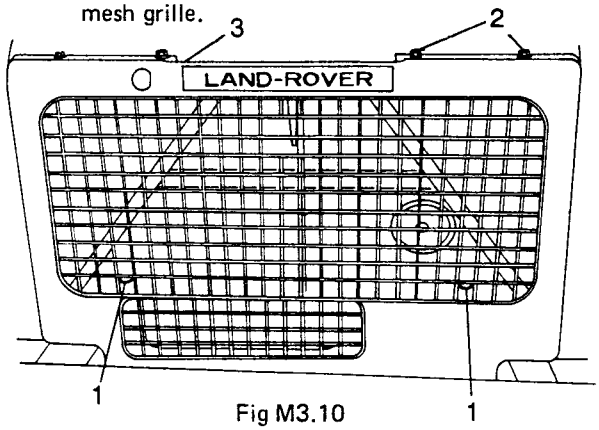


Fig M3.10

(4) Refer to Fig M3.10. Remove the two screws (1) securing the coarse mesh grille and lift off the grille.

(5) Remove the four screws (2) holding the grille panel (3) and lift off the panel.

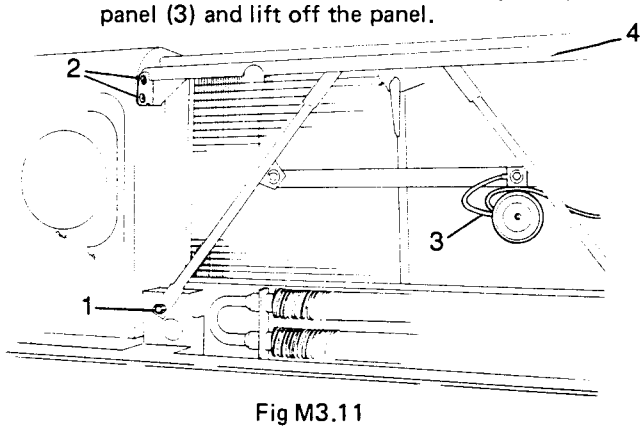


Fig M3.11

(6) Refer to Fig M3.11. Remove the two bolts (1) at the bottom of the support tubes.

(7) Remove the four screws (2) securing the grill panel frame to the wings. These screws have loose nuts inside the wings.

(8) Disconnect the electrical connector (3) from the horn.

(9) Lift off the complete grille panel framework (4).

REPLACEMENT

2. To replace the grille and grille panel:

(1) Fig M3.11 still applies. Fit the grille panel framework into position and secure with the screws (2), nuts and washers through the wings.

(2) Refit the two bolts (1) to the bottom of the support tubes.

(3) Remake the electrical connection to the horn.

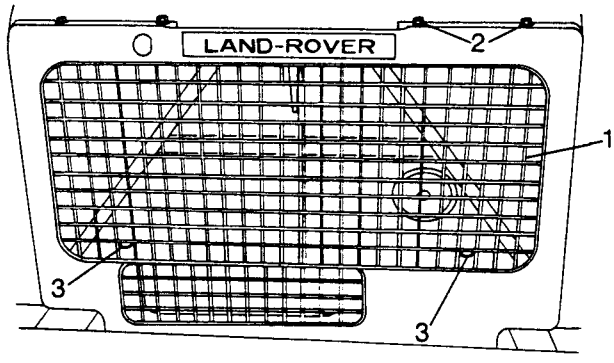


Fig M3.12

(4) Refer to Fig M3.12. Place the grille panel (1) into position and secure with the four screws (2) at the top.

(5) Fit the coarse mesh grille and replace the two screws (3) securing this to the grille panel.

(6) Replace the fine mesh grille and secure with the wing nuts.

CHAPTER 7

WINDSCREEN - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the windscreen:

   (1) Remove the bolts securing the roof to the windscreen.

   (2) Slacken or remove the remaining roof fixings.

   (3) Remove the windscreen wiper arms and blades.

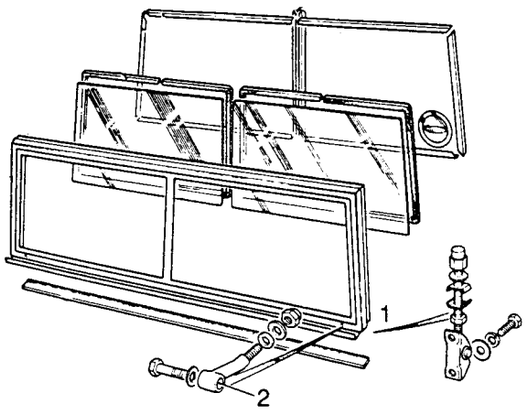


Fig M3.13

   (4) Refer to Fig M3.13. Slacken the nuts on the windscreen clamp bolts (1). Swing the clamp bolts clear of the windscreen.

   (5) Disconnect the wiper motor earth lead from the windscreen frame.

   (6) Remove the bolts securing the windscreen to the hinges (2).

   (7) Remove the windscreen.

REPLACEMENT

2. Replace the windscreen as follows:

   (1) Refit the windscreen.

   (2) Replace the bolts securing the windscreen to the hinges.

   (3) Reconnect the wiper motor earth lead to the windscreen frame.

   (4) Refit the clamp bolts to the windscreen and tighten the nuts.

   (5) Replace the windscreen wiper arms.

   (6) Ensure that the windscreen top and bottom sealing strips are in good condition. Replace and tighten the roof fixings.

CHAPTER 8

WINDSCREEN GLASS - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the windscreen glass:

   (1) Remove the windscreen wiper arms and blades.

   (2) Remove the sun visors and the rear view mirror from the interior of the cab.

   (3) Remove the headlining strip from above the windscreen.

   (4) Remove the fascia top rail.

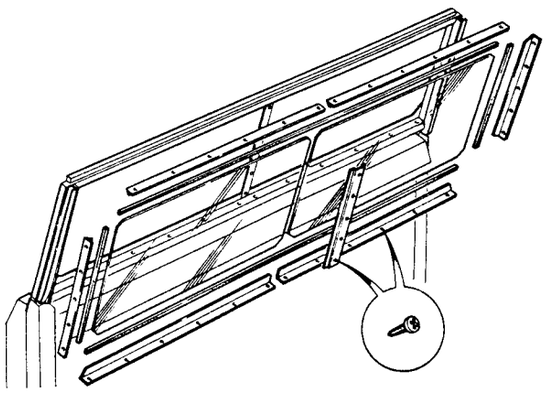


Fig M3.14

   (5) Refer to Fig M3.14. Remove the screws securing the glass retaining angle strips.

   (6) Carefully ease the glass clear of the screen.

   (7) Remove all traces of sealant from the windscreen frame and glass retaining strips.

REPLACEMENT

2. To replace the glass:

   (1) Line the interior of the windscreen frame with 'Sealastrip'.

   (2) Locate the glass in the windscreen frame and press firmly into the Sealastrip.

   (3) Place Sealastrip round the edges of the glass to seal the angle strips when fitted.

   (4) Fit the angle strips to retain the glass and secure with the retaining screws.

   (5) Remove surplus Sealastrip.

   (6) Fit the fascia top rail.

   (7) Fit the headlining strip.

   (8) Fit the sun visors and rear view mirror.

   (9) Refit windscreen wiper arms and blades.

SUB-SECTION M4

BODY REPAIRS

INTRODUCTION

1. Land Rover body panels are manufactured from a special aluminium alloy known as 'Birmabright'.

2. 'Birmabright' melts at a slightly lower temperature than pure aluminium and will not rust nor corrode under normal circumstances. It is work-hardening, but is easily annealed. Exposed to the atmosphere, a hard oxide skin forms on the surface.

3. 'Birmabright' panels and wings can be beaten out after accidental damage, then must be annealed by the application of heat, followed by slow air-cooling. As the melting point is low, heat must be applied slowly and carefully.

4. A practical temperature control is to apply oil to the cleaned surface to be annealed. Play the welding torch on the underside of the cleaned surface and watch for the oil to clear, leaving the surface clean and unmarked; then allow to cool naturally in the air when the area so treated will again be soft and workable. Do not quench with oil or water.

5. Another method is to clean the surface to be annealed and then rub it with a piece of soap. Apply heat beneath the area, as described above, and watch for the soap stain to clear. Then allow to cool, as for the oil method.

6. When applying the heat for annealing, always hold the torch some little distance from the metal, and move it about, so as to avoid any risk of melting it locally.

GAS WELDING BIRMABRIGHT

General

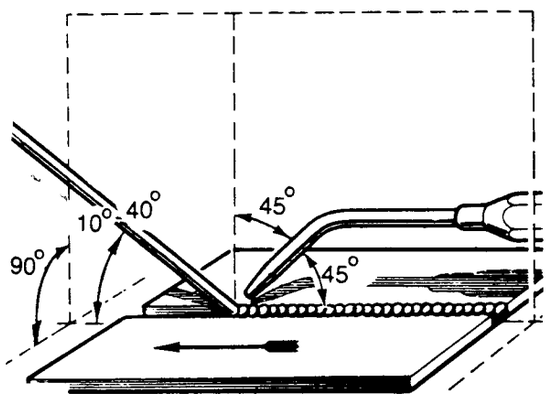


Fig M4.1

7. Refer to Fig M4.1. A small jet must be used, one or two sizes smaller than would be used for welding sheet steel of comparable thickness. For instance, use a No. 2 nozzle for welding 18 SWG sheet, and a No. 3 for 16 SWG sheet.

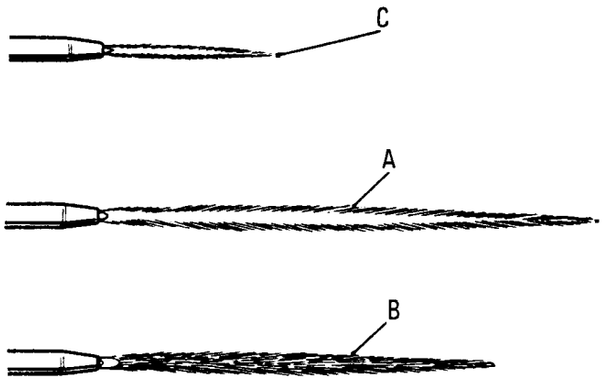


Fig M4.2

8. The flame should be smooth, quiet and neutral and have a brilliant inner core with a well-defined, rounded end as in (A). The hottest point of the flame is close to the jet, and the flame should have a blue to orange envelope becoming nearly colourless at the end.

9. A slightly reducing flame (B) may also be used, that is, there may be a slight excess of acetylene. Such a flame will have a brilliant inner core with a feathery white flame and a blue or orange envelope.

10. Do not use an oxydising flame (C) which has a short pointed inner core bluish white with a bluish envelope.

11. Use only 5 percent magnesium/aluminium welding rod (5Mg/A). Sifalumin No. 27 (MG.5 Alloy) (Use Sifbronze Special flux with this rod) or a 'Birmabright' offcut sheet. Do not use too wide or thick an offcut or trouble may be experienced in making it melt before the material which is being welded.

12. Clean off all grease and paint, dry thoroughly then clean the edges to be welded and an area at least 12,5 mm on either side of the weld with a stiff wire scratch brush or wire wool. Cleanliness is essential. Also clean the welding rod or strip with wire wool.

13. A special acid flux must be used, and we recommend 'Hari-Kari' which is obtainable from Afrox (South Africa).

14. A small quantity of 'Hari-Kari' may be made into a paste with water, following the directions on the tin, and the paste must be applied to both surfaces to be welded and also to the rod. In case of Sifbronze Special Flux, use in powder form as directed.

15. Remember that aluminium and its alloys do not show 'red-hot' before melting, and so there is nothing about the appearance of the metal to indicate that it has reached welding temperature. A little experience will enable the operator to gauge this point, but a useful guide is to sprinkle a little sawdust over the work; this will sparkle and char when the right temperature is approached; a piece of dry wood rubbed over the hot metal will sparkle at the point of contact.

16. As the flux used is highly acid, it is essential to wash it off thoroughly immediately after a weld is completed. The hottest possible water should be used, with wire wool or a scratch brush. Very hot soapy water is good, because of the alkaline nature of the soap, which will tend to 'kill' the acid.

17. It is strongly recommended that a few welds are made on scrap metal before the actual repair is undertaken if the operator is not already experienced in welding aluminium and its alloys.

18. The heat of welding will have softened the metal in the area of the repair, and it may be hardened again by peening with a light hammer. Many light blows are preferable to fewer heavy ones. Use a 'dolly' or anvil behind the work to avoid denting and deformation, and to make the hammering more effective. Filing of surplus metal from the weld will also help to harden the work again.

Welding Tears and Patches

19. If a tear extends to the edge of a panel, start the weld from the end away from the edge and also at this point drill a small hole to prevent the crack spreading, then work towards the edge.

20. When welding a long tear, or making a long welded joint, tack the edges to be welded at intervals of from 50 to 100 mm with spots. This is done by melting the metal at the starting end and fusing into it a small amount of the filler rod, repeating the process at the suggested intervals. After this, weld continuously along the joint from right to left, increasing the speed of the weld as the material heats up.

21. After the work has cooled, wash off all traces of flux as described previously, and file off any excess of build-up metal.

22. When patching, cut the patch to the correct shape for the hole to be filled, but of such size as to leave a gap of 0,8 mm between it and the panel, and then weld as described above. Never apply an 'overlay' patch.

23. For all body repairs work the gas welding method is sufficient and quite satisfactory.

ELECTRIC WELDING

CAUTION

The battery earth lead must be disconnected before commencing electric welding, otherwise the alternator will be damaged.

24. At the Rover factory the 'Argon-Arc' process is used, all atmospheric oxygen being excluded from the weld by the Argon gas shield.

SPOT WELDING

25. Spot-welding is largely used in the manufacture of Land Rover bodies, but this is a process which can only be carried out satisfactorily by the use of the proper apparatus.

26. Aluminium and its alloys are very good conductors of heat and electricity, and thus it is most important to maintain the right conditions for successful spot-welding. The correct current density must be maintained, and so must the 'dwell' of the electrodes. Special spot-welding machines have been developed, but they are expensive, and though the actual work can be carried out by comparatively unskilled labour, supervision and machine maintenance must be in the hands of properly qualified persons.

RIVETING

27. Where both sides of the metal are accessible and it is possible to use an anvil or dolly, solid aluminium rivets may be used, with a suitable punch or pop to ensure clean, rounded heads on the work. For riveting blind holes, pop-rivets must be used. These are inserted and closed by special 'Lazy-Tong' pop-rivet pliers.

SUB-SECTION M5

PAINTING THE BODY

GENERAL

1. Land Rover body panels are manufactured from a special aluminium-alloy known as 'Birmabright' and the following paintwork procedure should be followed on these panels.

PREPARATION

2. The area to be painted must be flatted to remove the hard oxide skin which forms on the surface of the alloy when exposed to the atmosphere. Degrease and dry the area, then apply a suitable etch-primer.

3. Unless an etch-primer is used, paint is liable to come away as it cannot 'key' into the hard oxide of an untreated alloy surface. The use of AECI Dulux Corrocote Twin Pack base and catalyst (reference 193-0821 and 115-0895) is recommended. It is quick and easy to apply, and it prolongs the life of the paint film by ensuring excellent adhesion.

4. The activated Etching Primer has a limited pot-life of about 8 hours at normal temperatures and should not be used after this time, as it may have inferior adhesion and corrosion resistance. Any Etching Primer which has been mixed for more than 8 hours must be thrown away, and not returned to the can.

APPLICATION

5. Apply Etching Primer as soon as possible after cleaning, and paint as soon as the pre-treatment is completed. Undue delay may cause the surface to be contaminated again and thus nullify the treatment. Do not leave pre-treated work overnight before it is painted.

6. Etching Primer, when followed by a suitable paint system, gives a film which is very resistant to moisture, but the Etching Primer itself is water sensitive. It should therefore be coated with paint as soon as possible when it is dry.

7. Activate the Etching Primer by mixing it with an equal volume of Activator P273-5021 and allow to stand for 10 minutes.

8. Adjust the spraying viscosity of the mixture if necessary to 22-25 sec. BSB4 Cup by adding small quantities of Thinner 851-565; never add more Activator.

9. Apply by spray to clean, dry surface in a thin uniform coat, rather than a thick heavy one which may impair adhesion.

10. Air dry for at least 15 minutes before applying undercoat by spray or for 2 hours before brush application. If required, these times can be shortened by force drying, this also gives increased hardness to the film.

11. Subsequent painting follows normal paintshop practice.

12. When wet flatting the subsequent paint layers take care not to rub through to the Etching Primer. If this does occur allow to dry out thoroughly, dry flat the area and spot in with Etching Primer.

SECTION CONTENTS LIST

SECTION N

HEATING AND VENTILATION

SUB-SECTION N1

DESCRIPTION OF THE HEATING AND VENTILATION SYSTEM

1. Fresh air is drawn through a grille on the left hand wing by an electrically driven fan. The fan feeds a heat exchanger through which engine coolant is fed when heating is required or is shut off when heating is not selected.

2. The air from the heat exchanger is ducted to the cab for demisting purposes or to foot level vents under the control of a selector lever in the cab.

3. A separate lever in the cab controls a valve in the engine coolant system. Progressively opening the valve regulates the quantity of hot coolant fed to the heat exchanger.

4. Two hand operated vents under the windscreen are provided. Either or both of these may be opened to allow a direct flow of air into the cab.

SUB-SECTION N2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This Sub-section deals with fault diagnosis and corrective action for the heating and ventilation system. Table N2.1 lists symptoms, probable causes and suggested remedial action in the event of a system fault developing. The Table is not exhaustive and should a fault occur which is not listed, the suspected component should be removed for closer examination.

TABLE N2.1 - HEATING AND VENTILATION FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Inefficient or no heating or demisting	Water valve cable broken. Water valve inoperative. Hot water pipes blocked.	Replace cable. Replace valve. Replace pipes.
Fan not turning	Electrical fault. Fan faulty.	Check circuit and repair. Replace fan.
System will not switch on (or off)	Cable disconnected or broken.	Reconnect or replace cable.

SUB-SECTION CONTENTS LIST

SUB-SECTION N3

REMOVAL AND REPLACEMENT PROCEDURES

CHAPTER 1

HEATER CONTROLS - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the heater controls in the cab:

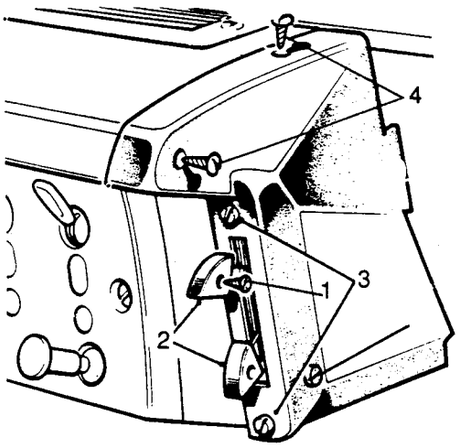


Fig N3.1

(1) Refer to Fig N3.1. Remove the fixings (1) and withdraw the finger grips (2).

(2) Remove the fixings, control lever assembly to end panel (3).

(3) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

(4) Remove the end panel fixings (4). The lower screw at the side has a loose nut behind the instrument panel.

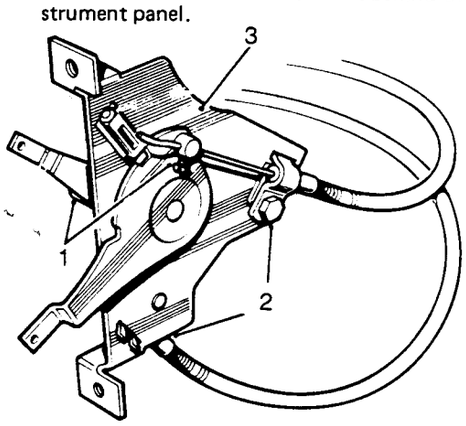


Fig N3.2

(5) Refer to Fig N3.2. Slacken the inner cables grub screws (1).

(6) Slacken the outer cables clamp screws (2).

(7) Withdraw the heater control assembly (3).

REPLACEMENT

2. To replace the heater controls:

(1) Refit the control cables outers under the clamps and tighten the clamp screws. Note that the cable from the left hand lever is connected to the water valve in the engine compartment.

(2) Fit the cable inners to the levers and temporarily tighten the grub screws.

(3) Operate each lever and check that the left hand lever causes the water valve push rod to operate over the full range. The right hand lever should operate the air distribution flaps from fully open to fully closed.

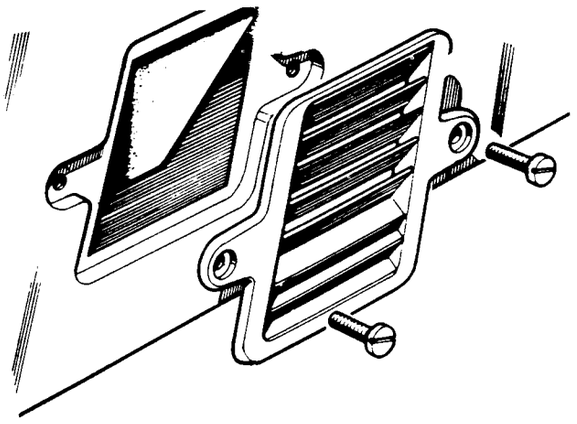


Fig N3.3

NOTE
Refer to Fig N3.3. The operation of the flaps can be checked by removing the air outlet grilles in the lower facia.

(4) Slacken the grub screws and adjust the cable inners if necessary until the water valve and flaps operate over the correct range. Tighten the grub screws.

(5) Offer up the control assembly to the end plate and secure with the two fixing screws ((3) on Fig N3.1).

(6) Replace the end panel and secure with the three screws. The lower screw has a loose nut behind the dash.

(7) Replace the finger grips: HOT/COLD to the left hand lever and DEF/CAR to the right hand lever.

(8) Refit the instrument panel into the dash.

CHAPTER 2

AIRFLOW CONTROL CABLE - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the heater/ventilator air flow control cable:

   (1) Remove the heater controls up to step (4) in Sub-section N3, Chapter 1.

   (2) Remove the lower facia.

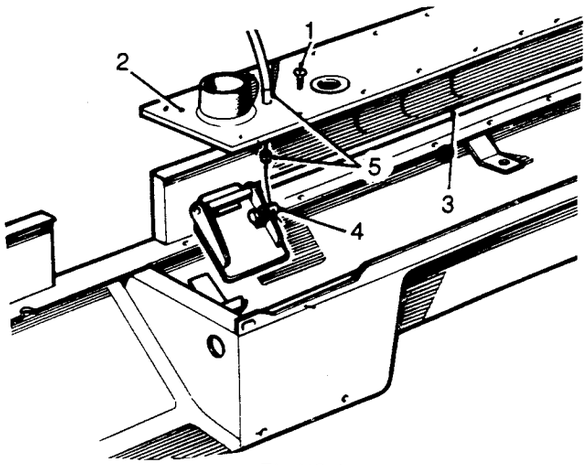


Fig N3.4

   (3) Refer to Fig N3.4. Remove the heater ducting cover fixings (1).

   (4) Withdraw the ducting cover (2) to gain access to the air distribution flaps.

   (5) Withdraw the distribution flaps from the facia (3).

   (6) Disconnect the inner cable at the flaps (4).

   (7) Withdraw the outer cable (5) retained at the ducting cover by a tubular clip.

REPLACEMENT

2. Replace the air flow control cable as follows:

   (1) Refit the outer cable (5) and secure.

   (2) Connect the inner cable to the flaps (4).

   (3) Fit the distribution flaps to the facia (3).

   (4) Replace the ducting cover (2) and secure with the fixings (1).

   (5) Replace the lower facia.

   (6) Refit the heater controls (see Sub-section N3, Chapter 1).

SUB-SECTION N3

CHAPTER 3

HEATER WATER VALVE CONTROL CABLES - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the cable:

   (1) Remove the heater controls (see Sub-section N3, Chapter 1).

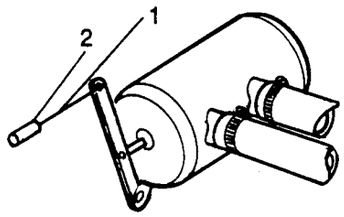


Fig N3.5

   (2) Refer to Fig N3.5. Disconnect the inner (1) and outer (2) cables at the water valve control lever (3).

   (3) Withdraw the cable through the dash grommet.

REPLACEMENT

2. Replace the cable as follows:

   (1) Feed the cable end through the grommet in the dash.

   (2) Connect the inner and outer of the cable to the water valve control lever. Do not tighten the inner fixing at this stage.

   (3) Replace the heater controls (see Sub-section N3, Chapter 1).

   (4) Set the water valve in the closed position (push rod fully in).

   (5) Set the cable control lever in the fully up 'cold' position.

   (6) Take up all slack in the inner cable then tighten the inner cable fixing at the water control valve lever.

CHAPTER 4

HEATER WATER VALVE - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the water valve:

   (1) Partially drain the coolant from the radiator.

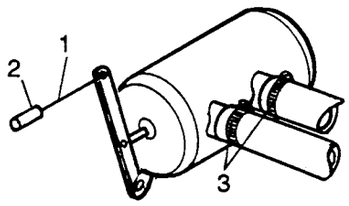


Fig N3.6

   (2) Refer to Fig N3.6. Slacken the inner (1) and outer (2) cable fixings.

   (3) Free the inner cable and withdraw from the valve.

   (4) Release the heater hose clips (3) and slide the hoses away from the valve.

   (5) Remove the fixings and lift out the valve.

REPLACEMENT

2. Replace the valve as follows:

   (1) Fit the valve into position and secure with the fixings.

   (2) Slide the heater hose out the valve and tighten the hose clips.

   (3) Replace the inner and outer cables and tighten the outer cable clamp. Do not tighten the inner cable fixing at this stage.

   (4) Set the water valve in the closed position (push rod fully in).

   (5) Set the control lever in the cab to cold (up).

   (6) Take up all the slack in the inner cable and tighten the fixing.

   (7) Refill the radiator.

CHAPTER 5

HEATER FAN SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the switch as follows:

   (1) Disconnect the battery earth lead.

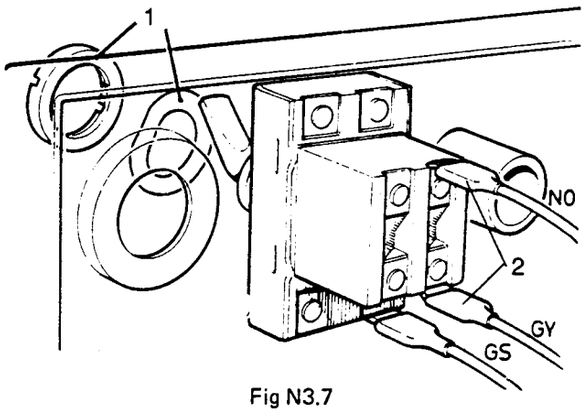


Fig N3.7

   (2) Refer to Fig N3.7. Unscrew the lockring (1) and withdraw the wave washer from the switch knob.

   (3) Withdraw the instrument panel from the dash (see Sub-section O5, Chapter 27).

   (4) Disconnect the leads from the switch.

   (5) Withdraw the switch.

REPLACEMENT

2. To replace the switch:

   (1) Fit the switch into the instrument panel. Orientate with the two inner terminals (2) on the right looking at the back of the switch.

   (2) Secure the switch with the wave washer and lockring.

   (3) Reconnect the leads to the switch terminals as shown in the illustration above.

   (4) Replace the instrument panel into the dash.

   (5) Reconnect the battery earth lead.

Lead colours:

N - Brown
O - Orange
G - Green
Y - Yellow
S - Slate

CHAPTER 6

DEMISTER HOSE - REMOVAL AND REPLACEMENT

REMOVAL

Passenger's Side Hose

1. To remove the hose on the passenger side:

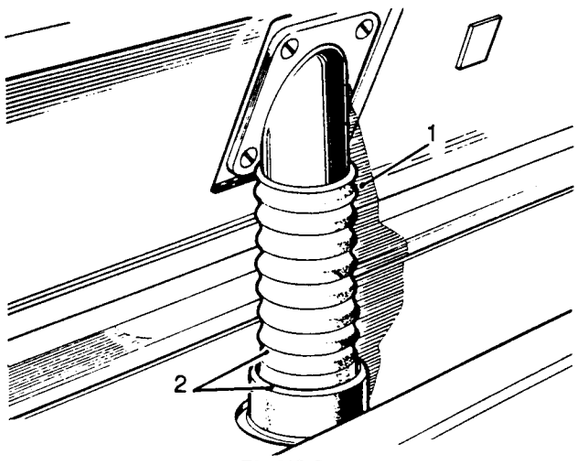


Fig N3.8

(1) Refer to Fig N3.8. Pull the hose upper end (1) off the nozzle adaptor.

(2) Withdraw the hose from the rubber connector (2).

Driver's Side Hose

2. To remove the hose on the driver's side:

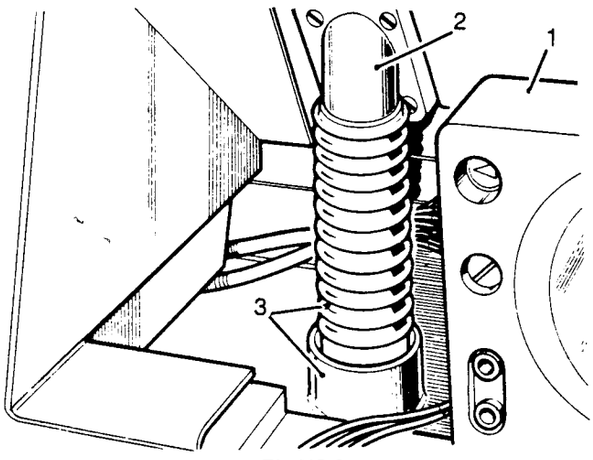


Fig N3.9

(1) Refer to Fig N3.9. Withdraw the instrument panel (1) sufficiently to gain access to the hose (see Sub-section O5, Chapter 27).

(2) Pull the upper end of the hose downwards off the nozzle adaptor (2).

(3) Withdraw the hose from the rubber connector (3).

REPLACEMENT

Passenger Side Hose

3. To replace the passenger side hose:

(1) Fit the hose, either way up, into the rubber connector.

(2) Slide the upper end of the hose over the nozzle adaptor.

Driver's Side Hose

4. Replace the hose as follows:

(1) Fit the hose, either way up, into the rubber connector.

(2) Slide the upper end of the hose over the nozzle adaptor.

(3) Replace the instrument panel.

CHAPTER 7

DEMISTER NOZZLES - REMOVAL AND REPLACEMENT

REMOVAL

Passenger's Side Nozzle

1. To remove the nozzle:

   (1) Remove the demister hose (see Sub-section N3, Chapter 6).

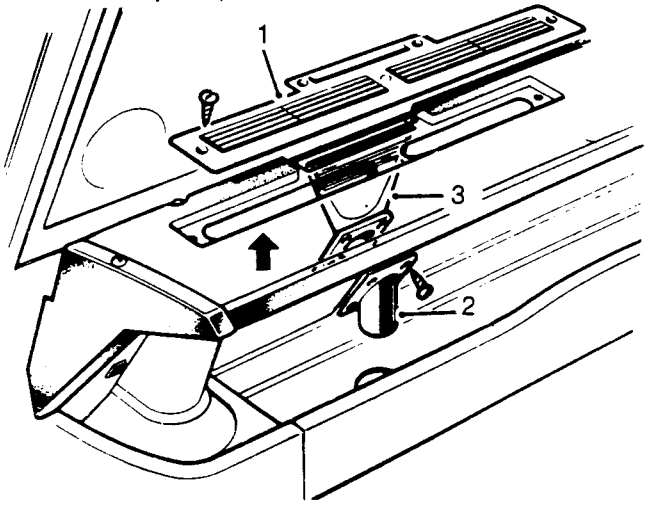


Fig N3.10

   (2) Refer to Fig N3.10. Remove the fresh air grille (1) (two screws).

   (3) Remove the nozzle adaptor fixings and withdraw the adaptor (2).

   (4) Manoeuvre the nozzle (3) out through the fresh air grille aperture.

Driver's Side Nozzle

2. Remove the nozzle as follows:

   (1) Disconnect the battery earth lead.

   (2) Remove the upper and lower shrouds from the steering column (6 screws). Note that the large screws in the bottom shroud holds the fuse box. Do not remove these screws.

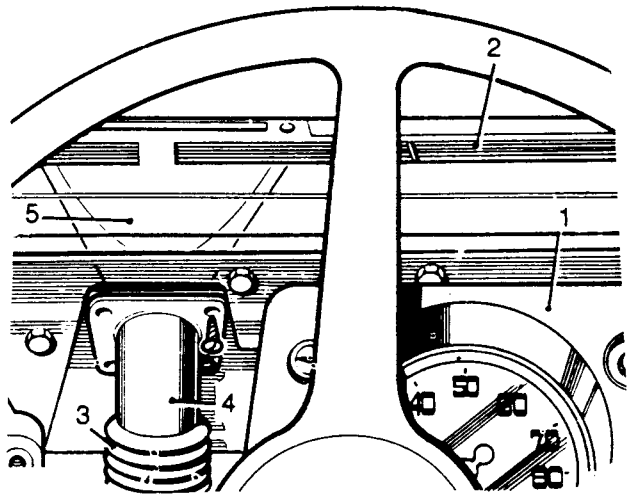


Fig N3.11

   (3) Refer to Fig N3.11. Withdraw the instrument panel (1) clear of the dash (see Sub-section O5, Chapter 27).

   (4) Remove the fresh air grille (2) (two screws).

   (5) Withdraw the demister hose (3) (see Sub-section N3, Chapter 6).

   (6) Remove the fixings from the nozzle adaptor (4) and remove the adaptor.

   (7) Manoeuvre the nozzle (5) out through the fresh air grille aperture.

REPLACEMENT

Passenger's Side Nozzle

3. To replace the nozzle:

   (1) Manoeuvre the nozzle in through the fresh air grille aperture.

   (2) Fit the nozzle adaptor and secure with the four screws.

   (3) Replace the fresh air grille.

   (4) Replace the demister hose (see Sub-section N3, Chapter 6).

Driver's Side Nozzle

4. Replace the driver's side nozzle as follows:

   (1) Manoeuvre the nozzle into position through the fresh air grille aperture.

   (2) Fit the nozzle adaptor and secure with the four screws.

   (3) Replace the demister hose (see Sub-section N3, Chapter 6).

   (4) Refit the fresh air grille (two screws).

   (5) Replace the instrument panel in the dash.

   (6) Refit the upper and lower shrouds to the steering column.

   (7) Reconnect the battery earth lead.

CHAPTER 8

VENTILATOR GRILLE PANEL AND QUADRANT ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the grille panel and quadrant assembly:

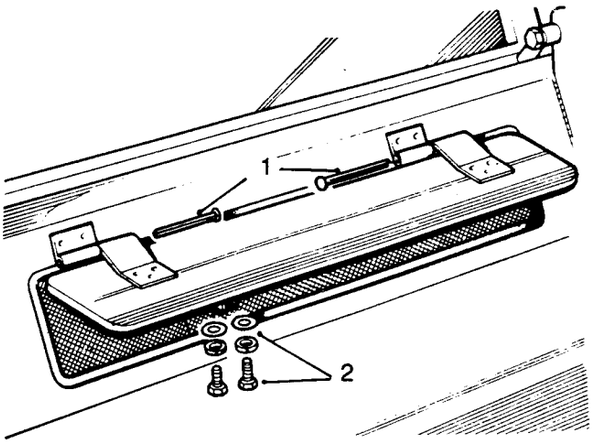


Fig N3.12

(1) Refer to Fig N3.12. Remove the hinge pins (1) and grille panel.

(2) Remove the control lever fixings (2).

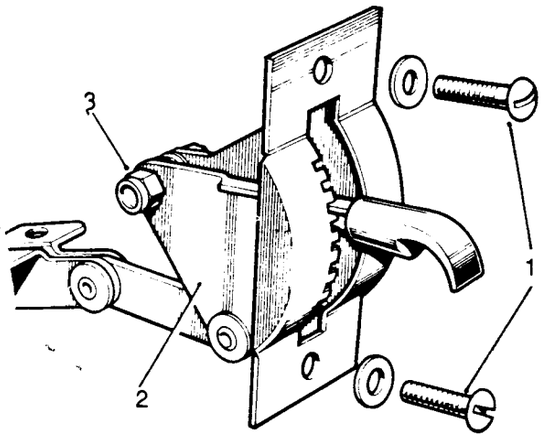


Fig N3.13

(3) Refer to Fig N3.13. Remove the ventilator to dash fixings (1) and withdraw the ventilator control and quadrant assembly (2).

REPLACEMENT

2. Replace the grille panel and quadrant as follows:

(1) Check lever operation in the quadrant. If required adjust the special locknut (3) to alter the spring loading on the lever.

(2) Replace the ventilator control and quadrant assembly and secure with the ventilator to dash fixings.

(3) Refit the control lever fixings.

(4) Replace the grille and hinge pins.

CHAPTER 9

FRESH AIR INTAKE - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the fresh air intake on the left hand side fender just in front of the passenger door as follows:

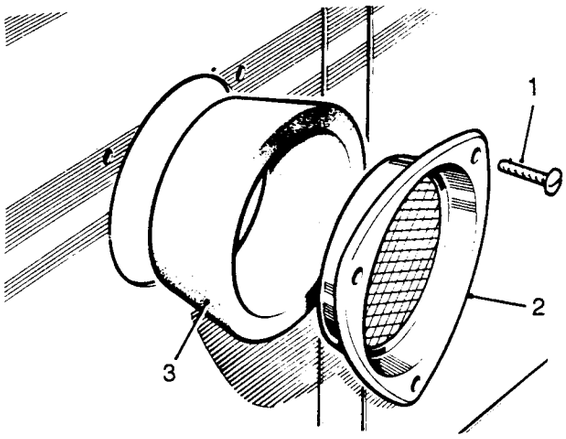


Fig N3.14

(1) Refer to Fig N3.14. Remove the fixings (1).

(2) Withdraw the intake grille assembly (2).

(3) If required, withdraw the air inlet seal (3).

REPLACEMENT

2. To replace the fresh air intake:

(1) Refit the air inlet seal (3).

(2) Replace the intake grille assembly (2) and secure with the fixings (1).

CHAPTER 10

HEATER BOX COMPLETE - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the heater box:

   (1) From inside the cab remove the trim stuck to the bulkhead panel.

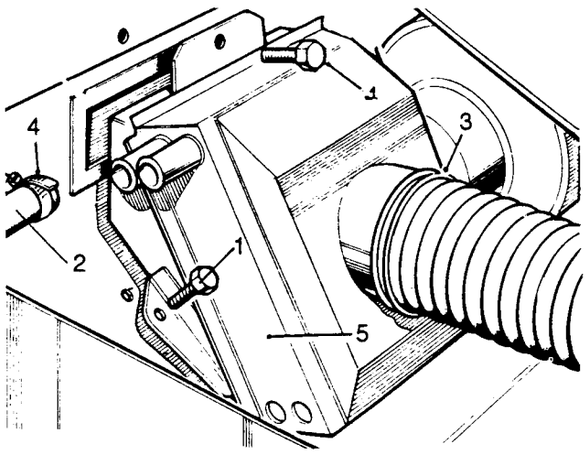


Fig N3.15

c

   (2) Refer to Fig N3.15. Open the bonnet and remove the heater box lower fixings (1).

   (3) Disconnect the heater water hoses (2).

   (4) Disconnect the air inlet hose (3).

   (5) Remove the heater box upper fixing (4).

   (6) Withdraw the heater box (5).

2. If radiator removal is required for inspection purposes, continue as follows:

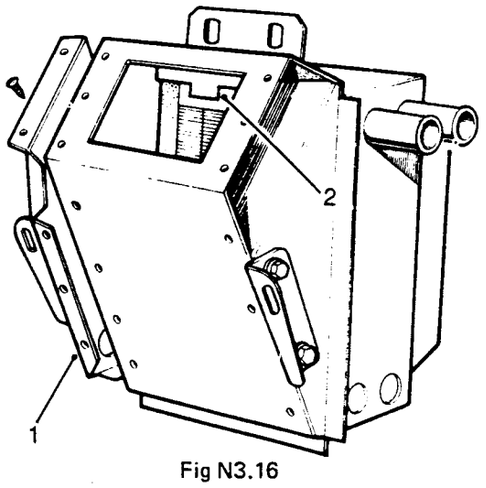


Fig N3.16

   (1) Refer to Fig N3.16. Remove the fixings and withdraw the detachable side panel (1).

   (2) Withdraw the radiator and pipes assembly. (2)

REPLACEMENT

3. Fit the radiator if it has been removed:

   (1) Replace the radiator and pipes assembly.

   (2) Refit the side panel and secure with the fixings.

4. Replace the heater box:

   (1) Fit the heater box into position and secure with the upper and lower fixings.

   (2) Refit the air inlet hose.

   (3) Restick the trim to the bulkhead panel.

CHAPTER 11

HEATER/BLOWER FAN MOTOR - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the motor:

(1) Disconnect the battery earth lead.

(2) Disconnect the blower motor leads ((1) on Fig N3.18).

(3) From inside the cab, remove the trim stuck to the bulkhead panel.

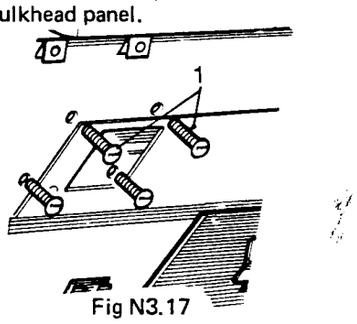


Fig N3.17

(4) Refer to Fig N3.17. Still inside the cab, remove the blower motor fixings (1).

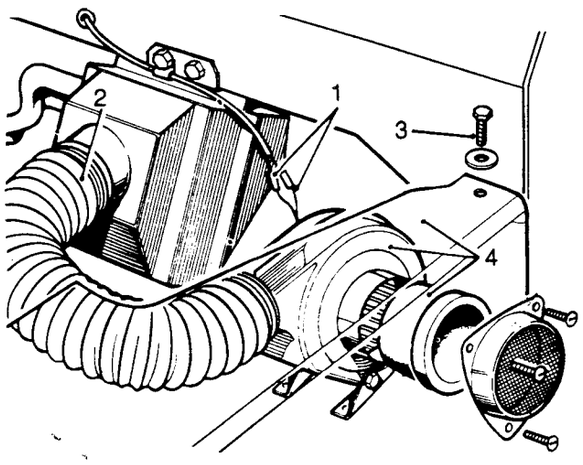


Fig N3.18

(5) Refer to Fig N3.18. Lift the bonnet and disconnect the air hose at the matrix inlet (2).

(6) Remove the wing panel rear top fixing bolt (3).

(7) Manoeuvre the blower motor assembly clear, lifting the wing panel sufficiently to allow passage. (4)

(8) Remove the air inlet seal (see Sub-section N3, Chapter 9).

REPLACEMENT

2. To replace the blower motor:

(1) Place the motor in position.

(2) Fit the air inlet seal and replace the intake grille (see Sub-section N3, Chapter 9).

(3) Replace the wing panel rear top fixing bolt.

(4) Reconnect the air hose to the matrix inlet.

(5) In the cab, replace the blower motor fixings ((1) on Fig N3.17).

(6) Restick the trim to the bulkhead panel.

(7) Back in the engine compartment, reconnect the blower motor leads: The brown lead with the green marker band connects to the green/slate lead. The green lead connects to the green/yellow lead.

(8) Reconnect the battery earth lead.

SUB-SECTION N4

MAINTENANCE

1. The heating and ventilating system is relatively trouble free, requiring only periodic inspection for obvious defects.

2. At intervals, check for water leaks from the joints in the hoses to the water valve. Check for smooth operation of the water valve rod and cable.

3. Keep the electrical leads to the blower motor clean and ensure that the connections are tight. Wipe off accumulated dust and dirt with a clean, dry cloth and clean the air inlet grille occasionally.

SECTION CONTENTS LIST

SECTION O

ELECTRICAL SYSTEM

CAUTION
Before working on the electrical system read the cautionary notes at the beginning of Sub-section O1, Chapter 1.

SUB-SECTION CONTENTS LIST

SUB-SECTION O1

DESCRIPTION AND SPECIFICATIONS

CHAPTER 1

DESCRIPTION OF THE ELECTRICAL SYSTEM

CAUTIONS

1. *Before carrying out any repairs or maintenance to an electrical component, always disconnect the battery.*

2. *The V-drive fan belt used with alternators is not the same as that used with d.c. machines. Use only the correct replacement fan belt. Occasionally check that the engine and alternator pulleys are accurately aligned.*

3. *It is essential that good electrical connections are maintained at all times. Of particular importance are those in the charging circuit (including those at the battery) which should be occasionally inspected to see that they are clean and tight. In this way any significant increase in circuit resistance can be prevented.*

4. *Do not disconnect battery cables while the engine is running or damage to the semiconductor devices may occur. It is also inadvisable to break or make any connections in the alternator charging and control circuits while the engine is running.*

5. *When using rapid charge equipment to recharge the battery, the battery must be disconnected from the vehicle.*

6. *When using electric arc welding equipment in the vicinity of the engine take the following precautions to avoid damage to the semiconductor devices used in the alternator and control unit and also to the ignition system:*

   (1) Disconnect battery earthed lead.

   (2) Disconnect alternator output cables.

7. *Alternator testing and repairs must only be undertaken by a qualified auto electrician or the local agents.*

INTRODUCTION

1. The main components of the electrical system are a 12 V battery charged by an engine-driven alternator. The battery drives the fuel pump, road and cab lights via switches, the ignition system, the starter motor and solenoid, and various warning and indicator lamps in the cab. Four fuses, rated at 17A continuous and 35A blow, are fitted to protect the battery from overloads in the low current circuits.

2. The electrical system is negative earth and it is most important to ensure correct polarity of all electrical connections. Incorrect connections made when reconnecting cables may cause irreparable damage to the semiconductor devices used in the alternator and regulator.

3. The electronic voltage regulator employs micro-circuit techniques resulting in improved performance under difficult service conditions. The whole assembly is encapsulated in silicone rubber and housed in an aluminium heat sink, ensuring complete protection against the adverse affects of temperature, dust, moisture, etc.

ALTERNATOR

4. The Lucas alternator type 21 ACR fitted to the vehicle is a high output three-phase machine which produces current at idling speed.

5. The heatsink-rectifier, terminal block assembly can be removed complete. There are six silicone diodes connected to form a full wave rectifier bridge circuit, and three silicone diodes which supply current to the rotor winding. Individual diodes cannot be removed from the heatsink assemblies. Regulation is by a Lucas type 8TRD control unit mounted in the slip-ring end bracket. There is no provision for adjustment in service.

6. Individual connectors are used to connect external wiring to the alternator. The alternator's main negative terminals are connected internally to the body of the machine. Provision is made for the connection of external negative wiring if required.

SURGE PROTECTION DEVICE

7. The surge protection device is a special avalanche-diode, fitted to the outer face of the slip-ring end bracket (not to be confused with a suppression capacitor, similarly fitted in the end bracket). The avalanche-diode is connected between terminal 'IND' and frame and its purpose is to protect the regulator from damage by absorbing high transient voltages which occur in the charging system due to faulty cable connections, or if the cables are temporarily disconnected at the battery whilst the engine is running. The surge protection device is intended to provide limited protection for the regulator under normal working conditions and therefore the service precaution not to disconnect any of the charging system cables, particularly those at the battery, whilst the engine is running, should still be observed.

STARTER MOTOR

General

8. The 2M100 pre-engaged starter motor is a four pole, four brush machine, 100 mm in diameter, with a series connected field, an armature with a face type commutator and a solenoid operated roller clutch drive.

Commutator

9. The face type commutator on the end face of the armature works in conjunction with a fully insulated brush-gear assembly comprising two pairs of wedge shaped brushes and coil type springs assembled into a brushbox moulding. The moulding is riveted to the inside of the commutator end cover. The brushes are provided with a keywayto ensure correct fitting and the springs are held captive in the brushbox moulding.

Coil Connections

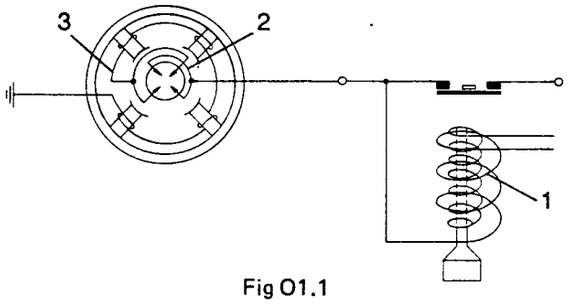


Fig O1.1

10. Refer to Fig O1.1. The field coils are of conventional design but the method of connection is different to that usually employed. The supply voltage to the starter motor is applied via the solenoid (1) direct to one pair of brushes (2). The start of the field winding (3) is connected to the other pair of brushes and the winding terminates at earth (the frame of the starter motor) via a riveted connection to the yoke.

Armature Movement

11. End float and axial movement of the armature is determined by the position in which a special type of 'Spire' retaining ring is fixed to the armature shaft, where it extends through the commutator end bracket.

Drive Engagement Lever

12. There is no need to set the drive pinion and therefore the operating position of the drive engagement lever is non-adjustable. The plain type pivot pin on which the lever swivels is retained in the fixing bracket by a small special type of 'Spire' retaining ring.

Roller Clutch

13. The roller clutch prevents the armature from rotating excessively if the drive remains in mesh after the engine has started.

SUB-SECTION O1

CHAPTER 2

SPECIFICATIONS

INTRODUCTION

1. The specifications for the electrical system are given in the following Tables:

TABLE O1.1 - GENERAL DATA
TABLE O1.2 - TORQUE SPECIFICATIONS

TABLE O1.1 - GENERAL DATA

ITEM	DESCRIPTION
ALTERNATOR	
Type	Lucas 21 ACR battery sensed with transistorised current-voltage regulator
Nominal voltage	12 volts
Regulating voltage	13,6 to 14,4 volts
Cut-in voltage	13,5 volts at 2100 rev/min
Polarity	Negative earth
Maximum output current	55 amperes at 6000 alternator rev/min
Maximum output speed	12400 rev/min
Rotor winding resistance	3,2 ohms at 20°C (68°F)
Brush spring pressure	225 to 368 gf (9 to 13 ozf)
Minimum brush length	8 mm (0,312 in)
BATTERY	
Type	Lucas C9
Capacity	58 Ah at 20 hour rate
STARTER MOTOR	
Type	Lucas 2M100 pre-engaged
*Lock torque	19,52 N.m with 463 A
*Torque at 1 000 r/min	9,9 N.m with 300 A
*Light running current	40 A at 6 000 r/min (approx)
BULB AND SEALED BEAM	
Headlamps with bulbs	Lucas 411, 12 V, 45/50 W, clear
Headlamps with sealed beam units	Lucas 54521872, 60/45 W
Sidelamps	Lucas 207, 12 V, 4 W
Stop/Tail lamps	Lucas 380, 12 V, 21/5 W
Flasher lamps	Lucas 382, 12 V, 21 W
Rear number plate lamp	Lucas 233, 12 V, 4 W
Instrument panel lights	Lucas 987, 12 V, 2,2 W MES
Warning lights	Lucas 987, 12 V, 2,2 W MES
Warning light, brakes	Lucas 280, 12 V, 1,5 W
Warning light, flashers	Lucas 281, 12 V, 2 W
Interior light	Lucas 382, 12 V, 21 W
Hazard switch (on dash)	Lucas 12 V, 2 W
All blackout lights	Lucas 12 V, 5 W

*Typical performance figures obtained with a 12 V, 60 Ah battery in a 70% charged condition at 20° C.

TABLE O1.2 - TORQUE SPECIFICATIONS

ITEM	TORQUE (N.m)
Alternator shaft nut	35 to 42

SUB-SECTION O2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This Sub-section deals with fault diagnosis and the corrective action required for the electrical system. In the Table below a list of symptoms, the probable cause and the suggested remedies are shown. The Table is not exhaustive and does not indicate faulty bulbs. Should a fault occur in a circuit containing a bulb the first action should be to check the bulb by replacement. If the fault is still present, check wiring and connections between the lamp and the switch or battery.

2. Each of the four fuses protects several circuits, thus if more than one bulb fails, the fuses should be checked first.

TABLE O2.1 - ELECTRICAL SYSTEM FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Battery in low state of charge	Broken or loose connection in alternator circuit. Current voltage regulator not functioning correctly. Slip rings greasy or dirty. Brushes worn not fitted correctly or wrong type.	Examine the charging and field circuit wiring. Tighten any loose connections and renew any broken leads. Examine the battery connection. Adjust or renew. Clean. Renew.
Battery over-charging, leading to burnt-out bulbs and frequent need for topping-up	Current voltage regulator not functioning correctly.	Renew.
Lamps giving insufficient lumination	Battery discharged. Bulbs discoloured through prolonged use.	Charge the battery from an independent supply or by a long period of daylight running. Renew.
Lamps light when switched on but gradually fade out	Battery discharged.	Charge the battery from an independent supply or by a long period of daylight runnings.
Lights flicker	Loose connection.	Tighten.
Failure of lights	Battery discharged. Loose or broken connection.	Charge the battery from an independent supply or by a long period of daylight running. Locate and rectify.
Starter motor lacks power or fails to turn engine	Stiff engine. Battery discharged.	Locate cause and rectify. Charge the battery either by a long period of daytime running or from independent electrical supply.

TABLE O2.1 - ELECTRICAL SYSTEM FAULT DIAGNOSIS - Continued

SYMPTOM	POSSIBLE CAUSE	REMEDY
	Broken or loose connection in starter circuit.	Check and tighten all battery, starter and switch connections and check the cables connecting these units for damage.
	Greasy or dirty slip rings.	Clean.
	Brushes worn, not fitted correctly or wrong type.	Renew.
	Brushes sticking in holders or incorrectly tensioned.	Rectify.
	Starter pinion jammed in mesh with flywheel.	Remove starter motor and investigate.
Starter noisy	Starter pinion or flywheel teeth chipped or damaged.	Renew.
	Starter motor loose on engine.	Rectify, checking pinion and the flywheel for damage.
	Armature shaft bearing.	Renew.
Starter operates but does not crank the engine	Pinion of starter does not engage with the flywheel.	Check operation of starter solenoid. If correct, remove starter motor and investigate.
Starter pinion will not disengage from the flywheel when the engine is running	Starter pinion jammed in mesh with the flywheel.	Remove starter motor and investigate.
Engine will not fire	The starter will not turn the engine due to a discharged battery.	The battery should be recharged by running the car for a long period during daylight or from an independent electrical supply.
	Sparking plugs faulty, dirty or incorrect plug gaps.	Rectify or renew.
	Defective coil or distributor.	Remove the lead from the centre distributor terminal and hold it approximately 6 mm from some metal part of the engine while the engine is being turned over. If the sparks jump the gap regularly, the coil and distributor are functioning correctly. Renew a defective coil or distributor.
	A fault in the low tension wiring is indicated when no spark ocurrs between the contacts when separated quickly with an insulated screwdriver with the ignition on.	Examine all the ignition cables and check that the bottom terminals are secure and not corroded.
	Dirty or pitted contacts.	Clean or renew.
	Contact breaker out of adjustment.	Adjust.
	Controls not set correctly or trouble other than ignition.	See Starting Procedure in the OMM.
Engine misfires	Distributor points incorrectly set.	Adjust.
	Faulty coil or condenser.	Renew.
	Faulty sparking plugs.	Rectify.
	Faulty carburetter.	Check and rectify.

TABLE 02.1 - ELECTRICAL SYSTEM FAULT DIAGNOSIS - Continued

SYMPTOM	POSSIBLE CAUSE	REMEDY
Frequent recharging of the battery necessary	Alternator inoperative.	Check the brushes, cables and connections or renew the alternator.
	Loose or corroded connections.	Examine all connections, especially the battery terminals and earthing straps.
	Slipping fan belt.	Adjust.
	Voltage control out of adjustment.	Renew.
	Excessive use of the starter motor.	In the hands of the operator.
	Vehicle operation confined largely to night driving.	In the hands of the operator.
	Abnormal accessory load.	Superfluous electrical fittings such as extra lamps etc.
	Internal discharge of the battery.	Renew.
Alternator not charging correctly	Slipping fan belt.	Adjust.
	Voltage control not operating correctly.	Rectify or renew.
	Greasy, charred or glazed slip rings.	Clean.
	Brushes worn, sticking or oily.	Rectify or renew.
	Shorted, open or burnt-out field coils.	Renew.
Alternator noisy	Worn, damaged or defective bearings.	Renew.
	Cracked or damaged pulley.	Renew.
	Alternator out of alignment.	Rectify.
	Alternator loose in mounting.	Rectify.
	Excessive brush noise.	Check for rough or dirty slip rings, badly seating brushes, incorrect brush tension, loose brushes and loose field magnets. Rectify or renew.
Defective distributor	Contact breaker gap incorrect or points burned and pitted.	Clean and adjust.
	Distributor cap cracked.	Renew.
	Weak or broken contact breaker spring.	Renew.
	Excessive wear in distributor shaft brushes, etc.	Renew.
	Rotor arm pitted or burned.	Clean or renew.
	If the engine lacks power, or misfires, it may de due to a faulty condenser.	Renew the condenser.
Poor performance of horns	Low voltage due to discharged battery.	Recharge.
	Bad connections in wiring.	Carefully inspect all connection and horn push.
	Loose fixing bolt.	Rectify.
	A faulty horn.	Adjust or renew.

SUB-SECTION O3

TESTING THE ALTERNATOR IN SITU

EQUIPMENT REQUIRED

1. The following test metres will be required for the tests:

   a. A moving coil ammeter or multimeter with a range of 0-75 amps.

   b. A moving coil voltmeter or multimeter with a range of 0-30 volts.

OUTPUT TEST

2. This test should be carried out with the alternator at normal temperatures. Run a cold engine at 3000 rev/min for three to four minutes before testing.

   (1) Disconnect the battery earth lead.

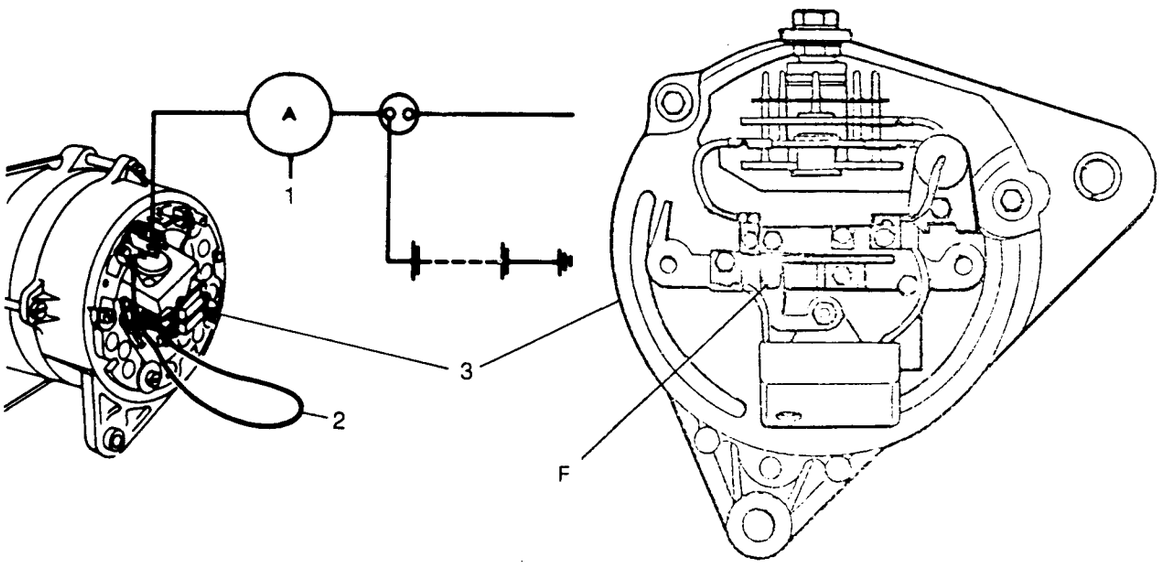


Fig O3.1

   (2) Refer to Fig O3.1. Connect ammeter (1) in series with alternator (3) main output cable and starter solenoid.

   (3) Remove connectors from alternator. Remove moulded end cover and re-make connectors.

   (4) Connect jumper lead (2) to short out the 'F' terminal to earth. (This makes regulator inoperative by effectively linking 'F' green lead to alternator frame).

   (5) Reconnect battery earth lead.

(6) Switch on all vehicle lighting, headlights on main beam. Switch on ignition and check warning light is on.

(7) Start engine, slowly increase speed to 3000 rev/min. Ammeter reading should equal maximum output of 55 ampres.

VOLTAGE DROP TEST

3. This test checks for an unwanted high resistance in the charging circuit.

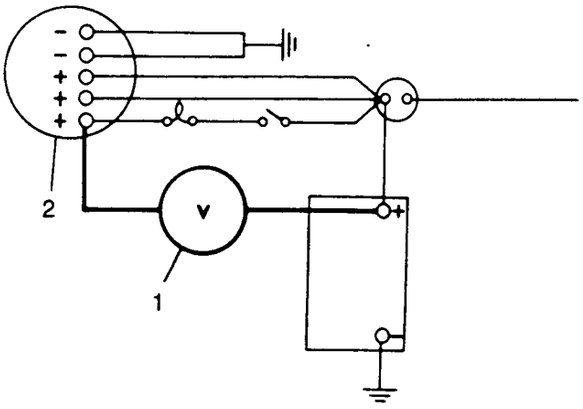


Fig O3.2

(1) Refer to Fig O3.2. Connect voltmeter (1) between battery +ve terminal and alternator main output terminal (2).

(2) Switch on all vehicle lighting, headlights on main beam.

(3) Start engine and run at 3000 rev/min. Note voltmeter reading. Stop engine and switch off the lights.

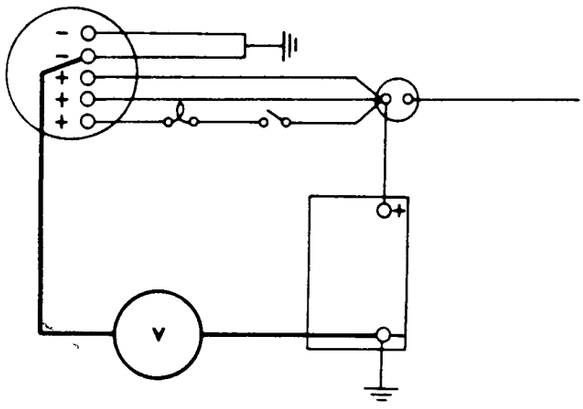


Fig O3.3

(4) Refer to Fig O3.3. Transfer voltmeter connections to battery earth and alternator negative terminal.

(5) Switch on all vehicle lighting, headlights on main beam.

(6) Start the engine and run at 3000 rev/min. Note the voltmeter reading. Stop the engine.

(7) The voltmeter readings in steps (3) and (6) should not be greater than 0,5 volts. Higher readings indicate an unwanted high resistance in the circuit.

CONTROL UNIT TEST

4. Circuit wiring must be in good condition and all connections clean and secure. The battery must be in a well charged condition or be temporarily replaced by a charged unit. Test the control unit as follows:

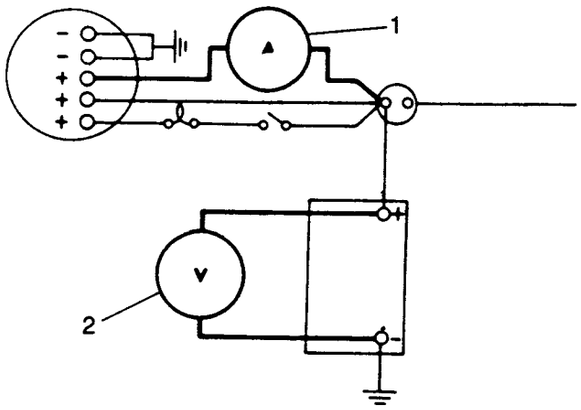


Fig O3.4

(1) Refer to Fig O3.4. Connect ammeter (1) in series with starter solenoid and alternator main output cable.

(2) Connect voltmeter (2) between battery terminals.

(3) Start engine and run at 3000 rev/min until the ammeter reads less than 10 amperes. Voltmeter reading should be between 13,6 volts and 14,4 volts.

(4) An unstable reading or a reading outside the specified limits indicates a faulty control unit.

ALTERNATOR DRIVE BELT - ADJUSTING

CHECKING BELT TENSION

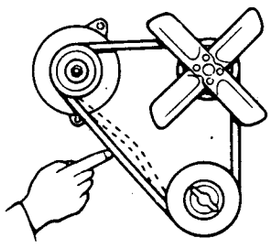


Fig O4.1

(1) Refer to Fig O4.1. To check belt tension depress the belt at the midway point of its longest run with moderate finger pressure. Deflection is to be 12 mm. If it is more or less than this, retension the belt.

TENSIONING THE BELT

CAUTION

Do not use leverage across the alternator body when tensioning the belt.

2. To tension the belt:

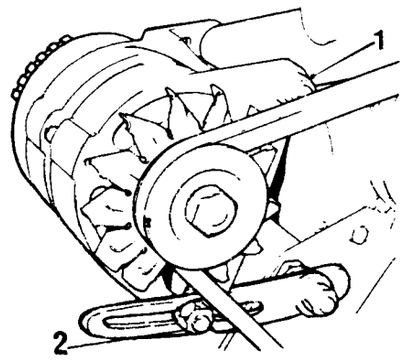


Fig O4.2

(1) Refer to Fig O4.2. Slacken the nuts (1) securing the alternator to the mounting bracket.

(2) Slacken the fixings (2) at the adjustment link.

(3) Pivot the alternator inwards or outwards as necessary and adjust until the correct tension is obtained. Tighten the bolt on the top of the adjustment link.

(4) Tighten the remaining fixings.

(5) Recheck tension and readjust if necessary.

SUB-SECTION CONTENTS LIST

SUB-SECTION O5

REMOVAL AND REPLACEMENT

CHAPTER 1

ALTERNATOR - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the alternator:

(1) Disconnect the battery earth lead.

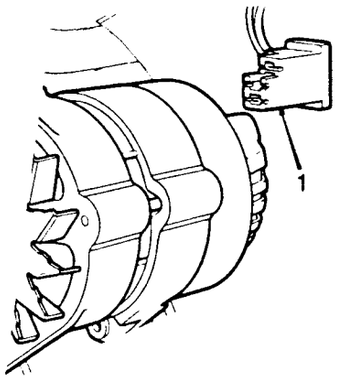


Fig O5.1

(2) Refer to Fig O5.1. Disconnect the leads from the alternator.

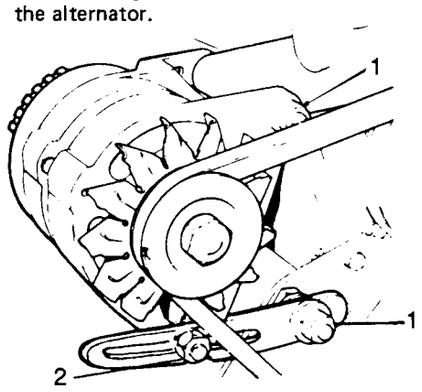


Fig O5.2

(3) Refer to Fig O5.2. Slacken the alternator fixings (1) and (2). Pivot the alternator inwards towards the engine and remove the drive belt.

(4) Remove all fixings and lift out the alternator.

REPLACEMENT

2. To replace the alternator:

(1) Refer to Fig O5.2. Fit the alternator into position and secure with finger tight fixings (1) and (2).

(2) Fit the drive belt and adjust belt tension (see Sub-section O4, Chapter 3).

(3) Refer to Fig O5.1. Connect the leads (1) to the alternator.

(4) Reconnect the battery.

CHAPTER 2

CONTROL UNIT - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the control unit:

   (1) Disconnect the battery.

   (2) Remove the alternator (see Sub-sub-section O5, Chapter 1).

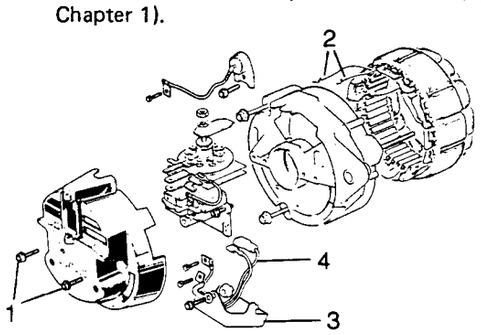


Fig O5.3

   (3) Refer to Fig O5.3. Remove alternator end cover by withdrawing two retaining screws (1).

   (4) Unsolder stator winding connections (2) at rectifier diodes.

   CAUTION
   It is essential to use a thermal shunt and a lightweight soldering iron.

   (5) Note position of cables (4) at rectifier plates and disconnect.

   (6) Remove three hexagon headed screws securing brush moulding and regulator (3) to slip-ring end bracket.

   (7) Remove brush gear and regulator from alternator.

REPLACEMENT

2. Replace the control unit as follows:

   (1) Refer to Fig O5.3. Replace the brush gear and regulator (3) and secure with the three screws.

   (2) Reconnect the cables (4) to the rectifier plate.

   (3) Solder the stator winding connections (2) to the rectifier diodes.

   (4) Replace the end cover (1) and secure with the two retaining screws.

CHAPTER 3

BATTERY - REMOVAL AND REPLACEMENT

REMOVAL

1. The battery is in the cab, under the driver's seat. To remove:

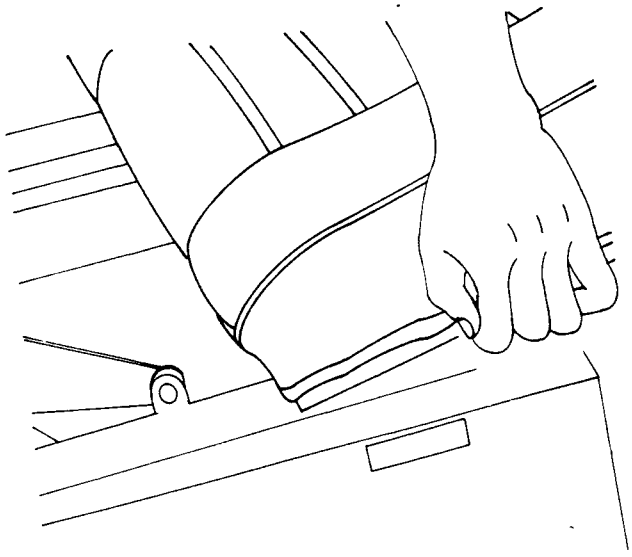


Fig O5.4

(1) Refer to Fig O5.4. Lift off the seat.

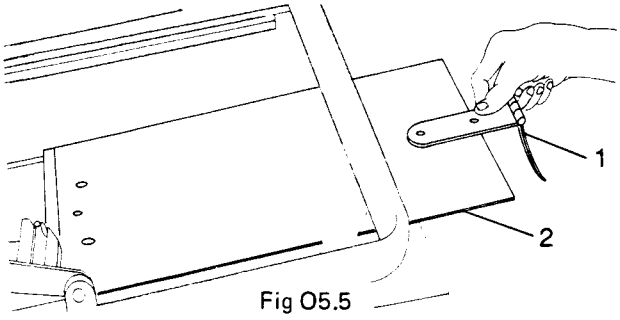


Fig O5.5

(2) Refer to Fig O5.5. Undo the antiluce fastener (1) in front of the seat frame, lift the plate (2) slightly and pull forward to remove.

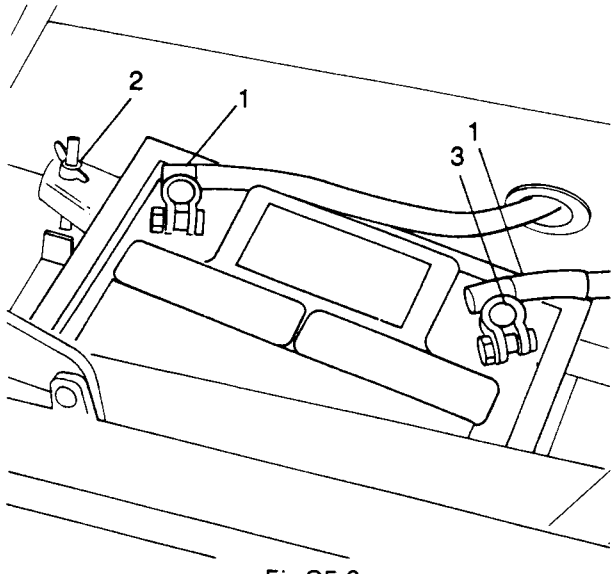


Fig O5.6

(3) Refer to Fig O5.6. Disconnect the two battery leads (1).

(4) Remove the two wing nuts (2) and lift off the battery retaining frame.

(5) Lift out the battery.

REPLACEMENT

2. To replace the battery:

(1) Fig O5.6 still applies. Place the battery into the box with the positive terminal (3) adjacent to the positive (red) lead.

(2) Refit the battery frame, carefully avoiding contact with the terminals, and secure with the wing nuts (2).

(3) Remove any oxydization from the leads and terminals with a clean cloth. Fit the leads and secure. Apply a smear of acid resistant grease around the terminals.

(4) Fig O5.5 still applies. Replace the plate over the battery box and clip the antiluce device into position.

(5) Replace the seat.

CHAPTER 4

HORN - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the horn:

   (1) Disconnect the battery earth lead.

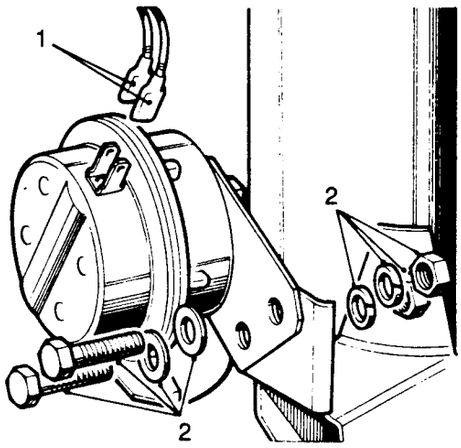


Fig O5.7

   (2) Refer to Fig O5.7. Disconnect the leads (1) from the horn.

   (3) Remove the fixings (2) and lift the horn out.

REPLACEMENT

2. Replace the horn as follows:

   (1) Offer up the horn to the bracket.

   (2) Secure with the fixings (2).

   (3) Replace the horn leads (1). It is immaterial which lead fits to each terminal.

CHAPTER 5

STARTER MOTOR - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the starter motor:

   (1) Drive the vehicle onto a ramp.

   (2) Disconnect both battery leads.

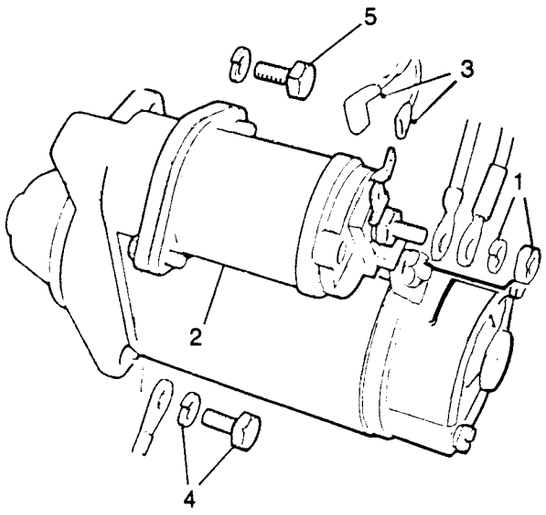


Fig O5.8

   (3) Refer to Fig O5.8. Remove the nut and spring washer (1) and remove the battery lead from the solenoid (2).

   (4) Disconnect the brown and the brown/red leads from their respective connections (3).

   (5) Remove the lower mounting bolt (4), nut and spring washer.

   (6) Remove the upper mounting bolt (5), nut and spring washer, and manoeuvre the starter motor downwards from the vehicle.

REPLACEMENT

2. Replace the starter motor as detailed below:

   (1) Manoeuvre the starter motor upwards into the vehicle and secure with the upper mounting bolt (5) nut and spring washer.

   (2) Refit the lower mounting bolt (4) nut and spring washer.

   (3) Reconnect the brown and brown/red leads (3) to their respective connections.

   (4) Reconnect the battery lead to the solenoid (2) and secure with the nut (1) and spring washer.

   (5) Reconnect the battery leads.

CHAPTER 6

HEADLAMP ASSEMBLY - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the headlamp assembly:

(1) Disconnect the battery earth lead.

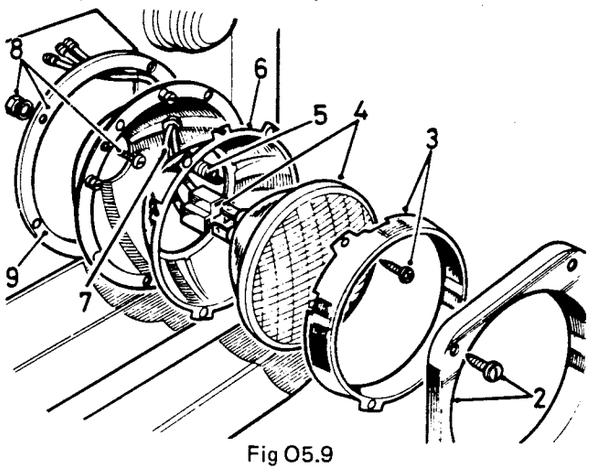


Fig O5.9

(2) Refer to Fig O5.9. Remove the headlamp Bezel (2).

(3) Remove the headlamp rim (3).

(4) Disconnect the headlamp leads at the plug connector and withdraw the light unit (4).

(5) Disconnect the spring from the headlamp shell (5).

(6) Withdraw the headlamp shell (6) by rotating it clear of the slotted locations.

(7) Disconnect the headlamp leads (7) at the snap connectors behind the radiator grille.

(8) Remove the headlamp mounting shell (8).

(9) Withdraw the gasket (9).

REPLACEMENT

2. Replace the headlamp assembly as follows:

(1) Replace the gasket (9).

(2) Replace the headlamp mounting shell (8) and secure with the bolts, nuts and washers.

(3) Reconnect the headlamp leads to the snap connectors behind the radiator grille. The connections are:

Blue/Red - dip beam positive.
Blue/White - main beam positive.
Black - earth.

(4) Refit the headlamp shell (6) by rotating it into the slotted locations.

(5) Reconnect the spring to the headlamp shell (5).

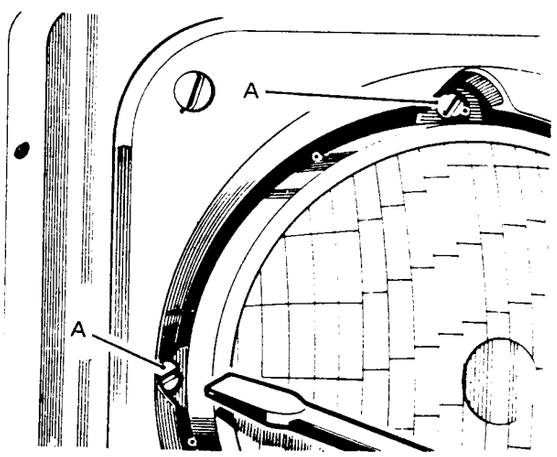
(6) Refit the light unit (4) and connect the leads to the plug connector.

(7) Replace the headlamp rim (3) and secure with the self tapping screws.

(8) Refit the headlamp bezel (2) and secure with the fixing screws.

(9) Reconnect the battery earth lead.

(10) Check and if necessary adjust the headlamp using suitable beam setting equipment. The beam setting screws and beam position diagram are given in Fig O5.10 below:



BEAM SETTING SCREWS (A)

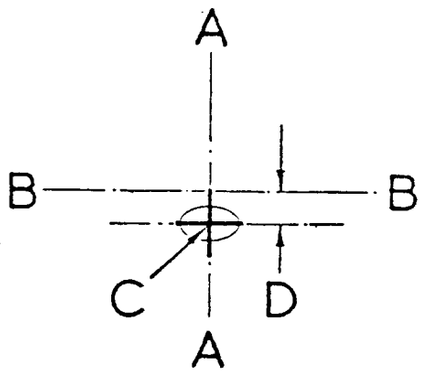


Fig O5.10

BEAM SETTING MARKS

AA = Vertical centre line of headlamp

BB = Horizontal centre line of headlamp measured from level floor

C = Centre of concentrated area of light

D = 50 mm ± 25 mm

CHAPTER 7

FRONT FLASHER LAMP - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove either the flasher or side lamp assembly:

(1) Disconnect the battery earth lead.

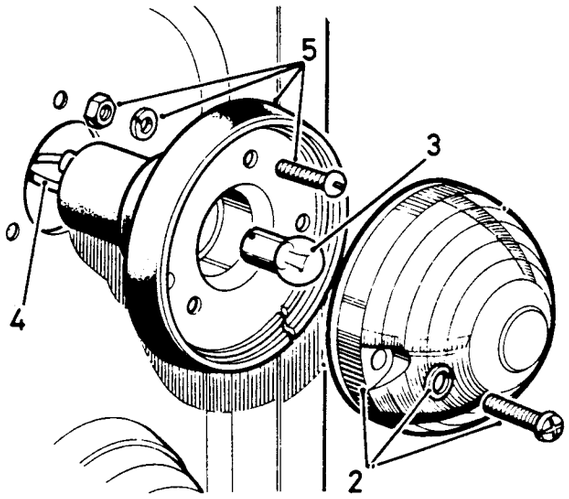


Fig O5.11

(2) Refer to Fig O5.11. Remove the lamp lens (2) after removing the two cross-head bolts and washers.

(3) If required, remove the bulb (3).

(4) Disconnect the lamp leads at the snap connectors (4) in the engine compartment.

(5) Remove the fixings (5) and pull out the lamp body.

REPLACEMENT

2. Replace the assembly as follows:

(1) Fit the lamp body into position and secure with the bolts, nuts and washers (5).

(2) Connect the lamp leads at the snap connectors in the engine compartment: Red lead - positive; Black lead - earth.

(3) Replace the bulb (3).

(4) Refit the lamp lens (2) and secure with the cross head bolts and washers.

(5) Reconnect the battery earth lead.

CHAPTER 8

COMBINED REAR, FLASHER, STOP AND BL/ LAMPS - REMOVAL AND REPLACEI

REMOVAL

1. To remove the lamp:

(1) Disconnect the battery earth lead.

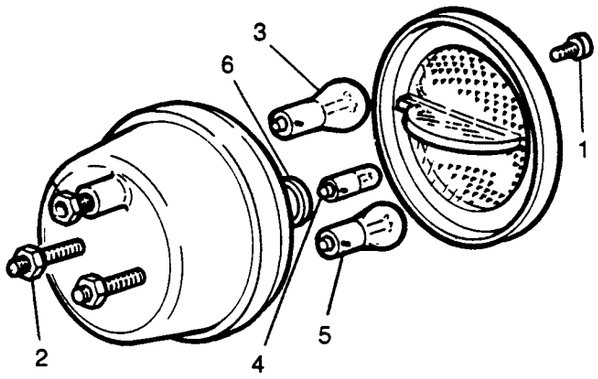


Fig O5.12

(2) Refer to Fig O5.12. Remove the lens fixings (two screws) (1) and pull off the lens.

(3) Remove the bulbs if required.

(4) Remove the fixings for the cover in the rear of the load area behind the lamp (two self tapping screws and one nut) and lift the cover away.

(5) Disconnect the lamp leads at the snap connectors, making a note of the socket each connector comes from.

(6) Remove the two bolts (2) holding the lamp to the wall and pull the lamp body away.

REPLACEMENT

2. Replace th

(1) Position secure w

(2) Reconn nectors.

(3) Replace the bulbs:

18 W at the top (3).
4 W in the centre (4).
21/5 W at the bottom (5).

(4) Replace the red tube (6) over the centre bulb.

(5) Refit the lens with amber at the top and secure with the fixings.

(6) Reconnect the battery earth lead and check that the bulbs operate correctly:

In the amber sector - flasher.
In the red sector - normal tail light.
- normal stop light.
- blackout tail light.

(7) Replace the cover in the load area and secure with the two self tapping screws and the screw, two washers and nut.

CHAPTER 9

INSPECTION SOCKETS - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the inspection sockets:

   (1) Disconnect the battery earth lead.

   (2) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

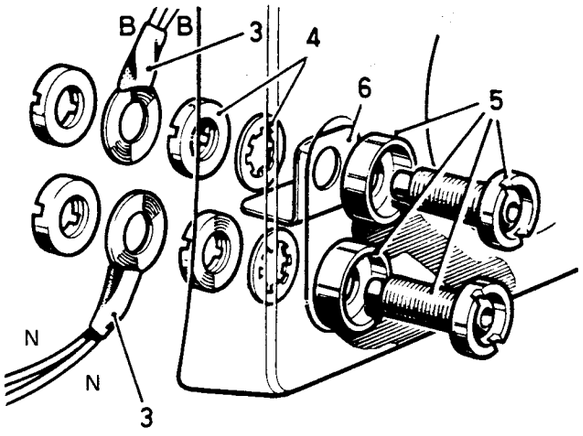


Fig O5.13

   (3) Refer to Fig O5.13. Disconnect the electrical leads (3) from the sockets.

   (4) Remove the screw lock rings, shakeproof washers (4) and insulation tab (6).

   (5) Withdraw the sockets (5).

REPLACEMENT

2. Replace the sockets as follows:

   (1) Fit the sockets into the holes (red on top) with the insulation tab (6) central between the two sockets. Secure with the shakeproof washers and lock rings (4).

   (2) Connect the leads to the sockets, black leads to the black socket and the remaining leads to the red socket, and secure with the screws.

   (3) Reconnect the battery earth lead.

CHAPTER 10

PANEL ILLUMINATION OR WARNING LAMP BULB - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove a lamp bulb:

   (1) Disconnect the battery earth lead.

   (2) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

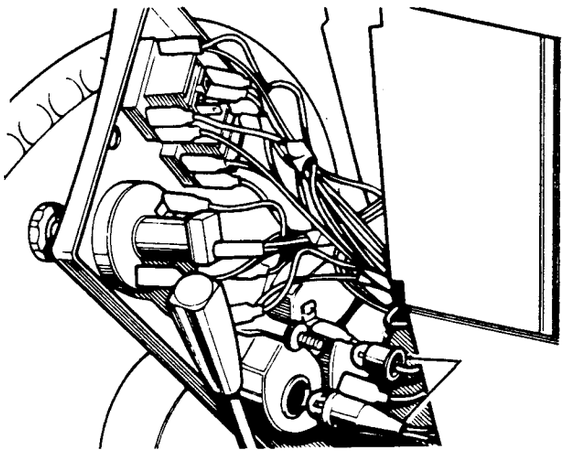


Fig O5.14

   (3) Refer to Fig O5.14. Withdraw the bulb holder and change the bulb as necessary.

REPLACEMENT

2. Replace the instrument panel as detailed in Sub-section O5, Chapter 27.

CHAPTER 11

FLASHER UNIT - REMOVAL AND REPLACEMENT

REMOVAL

1. The flasher unit is located on the bulkhead behind the instrument panel. To remove the unit:

   (1) Disconnect the battery earth lead.

   (2) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

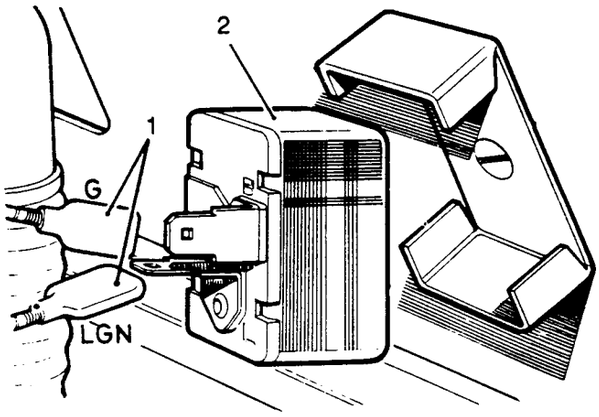


Fig O5.15

   (3) Refer to Fig O5.15. Disconnect the two leads (1) from the flasher unit.

   (4) Pull the flasher unit (2) foward out of its clip.

REPLACEMENT

2. To replace the flasher unit:

   (1) Fit the flasher unit into the clip.

   (2) Connect the leads to the flasher unit terminals:

   Green lead to the vertical terminal.
   Light green/brown lead to the horizontal terminal.

   (3) Replace the instrument panel (see Sub-section O5, Chapter 27).

Lead colours:

G - Green
L - Light
N - Brown

CHAPTER 12

LIGHTING SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the switch:

   (1) Disconnect the battery earth lead.

   (2) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

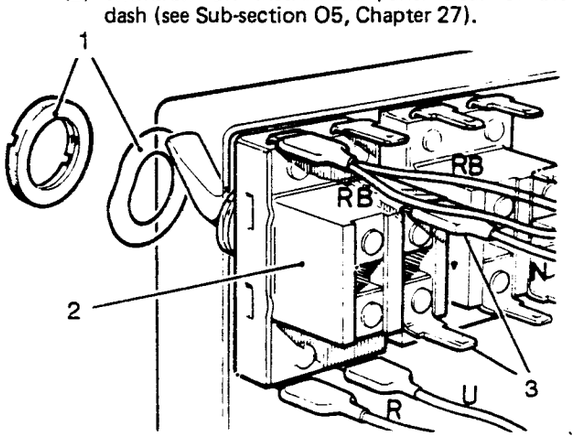


Fig O5.16

   (3) Refer to Fig O5.16. Unscrew the lock ring and wave washer (1) from the switch knob.

   (4) Disconnect the leads from the back of the switch.

   (5) Withdraw the switch (2).

REPLACEMENT

2. Replace the switch as follows:

   (1) Orientate the switch by looking at the back and keeping the two inner terminals (3) to the right.

   (2) Fit the switch this way up into its mounting hole and secure with the wave washer and lock ring.

   (3) Connect the leads to the back of the switch in the positions shown on illustration above.

   (4) Replace the instrument panel.

   (5) Reconnect the battery earth lead.

Lead colours:

R - Red
B - Black
N - Brown
U - Blue

CHAPTER 13

PANEL LIGHT SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. The following instructions apply to the panel light switch and to a combined panel and interior light switch. The latter has more leads to the back of the switch. To remove:

(1) Disconnect the battery earth lead.

(2) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

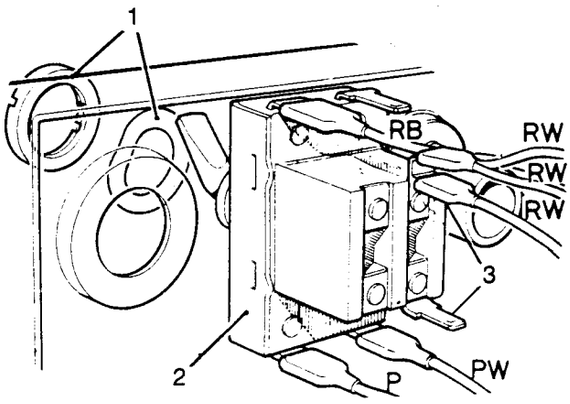


Fig O5.17

(3) Refer to Fig O5.17. Unscrew the lock ring (1) and remove it and the wave washer (1) from the switch knob.

(4) Disconnect the leads from the back of the switch.

(5) Withdraw the switch (2).

REPLACEMENT

2. Replace the switch as follows:

(1) Orientate the switch by looking at the back and keeping the two inner terminals (3) on the right.

(2) Fit the switch this way up into the instrument panel mounting hole and secure with the wave washer and lock ring.

(3) Connect the leads to the back of the switch as shown in the illustration above.

(4) Replace the instrument panel.

(5) Reconnect the battery earth lead.

Lead colours:

R - Red
B - Black
W - White
P - Purple

CHAPTER 14

WINDSCREEN WIPER/WASHER SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the switch:

   (1) Disconnect the battery earth lead.

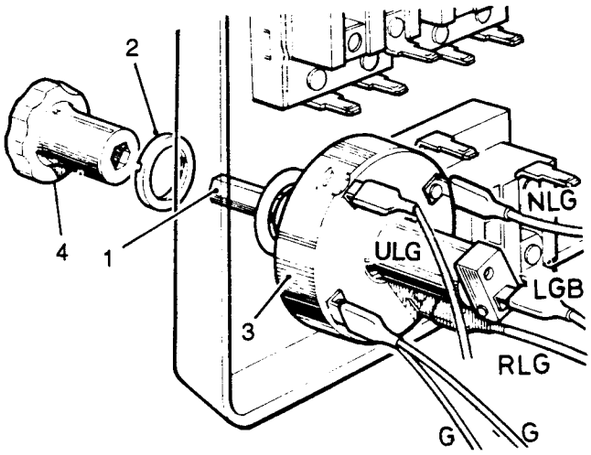


Fig O5.18

   (2) Refer to Fig O5.18. Depress the plunger (use a matchstick or similar pointed instrument) and withdraw the switch knob (4).

   (3) Unscrew the lock ring (2).

   (4) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

   (5) Disconnect the leads from the back of the switch and withdraw the switch (3).

REPLACEMENT

2. Replace the switch as follows:

   (1) Fit the switch through the mounting hole with the centre terminal at the bottom of the block and secure with the lock ring.

   (2) Connect the leads to the terminals on the back of the switch as shown in the above Figure.

   (3) Refit the instrument panel to the dash.

   (4) Push in the plunger and push the switch knob onto the hex rod (1).

   (5) Reconnnect the battery earth lead.

Lead colours:

N - Brown
G - Green
R - Red
B - Black
U - Blue
L - Light

CHAPTER 15

STOP LIGHT SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. The stop light switch is mounted on a panel behind the servo unit. To remove the switch:

   (1) Disconnect the battery earth lead.

   (2) Raise the bonnet.

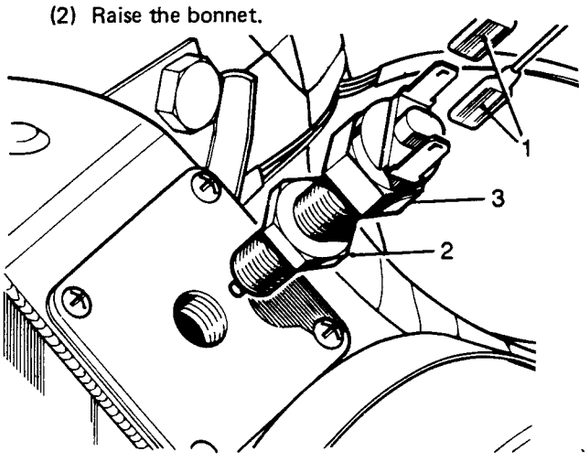


Fig O5.19

   (3) Refer to Fig O5.19. Disconnect the leads (1) from the stop switch.

   (4) Release the lock nut (2) and unscrew the switch (3) from the brake pedal bracket.

REPLACEMENT

2. To replace the stop switch:

   (1) Screw the switch into the brake pedal bracket but do not tighten the lock nut at this stage.

   (2) Connect the leads to the switch terminals. It is immaterial which lead goes to which terminal.

   (3) With the ignition on, check that the stop lamp lights at 19 to 25 mm brake pedal travel. If necessary, disconnect the leads and screw the stop switch into or out of the bracket. Reconnect the leads and recheck.

   (4) Carry out step (3) until the correct pedal travel is established.

   (5) Tighten the lock nut without moving the switch.

   (6) Lower the bonnet and reconnect the battery earth lead.

CHAPTER 16

CHOKE WARNING LIGHT SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. The choke warning light switch is clamped to the choke cable at the rear of the engine compartment. To remove the switch:

(1) Disconnect the battery earth lead.

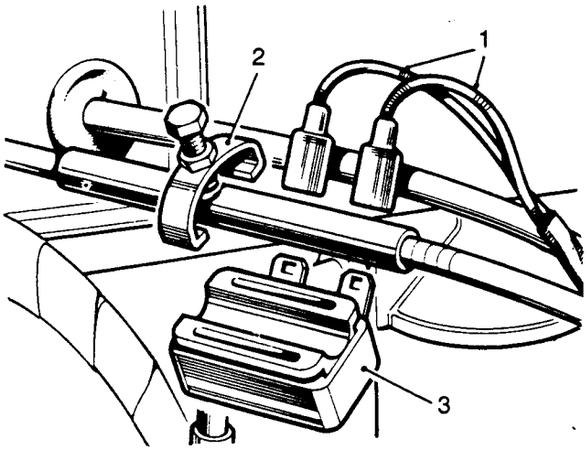


Fig O5.20.

(2) Refer to Fig O5.20. Disconnect the leads (1) from the switch.

(3) Remove the clip (2) securing the switch to the choke cable.

(4) Remove the switch.

REPLACEMENT

2. Replace the switch as follows:

(1) Offer up the switch to the choke cable.

(2) Fit the clip and tighten the bolt and lock nut holding it to the choke cable.

(3) Replace the leads. It is immaterial which lead goes to which terminal.

(4) Reconnect the battery earth lead.

CHAPTER 17

COMBINED DIRECTION INDICATOR, HEADLIGHT AND HORN SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the combined switch:

   (1) Disconnect the battery earth lead.

   (2) Remove both halves of the switch shroud from the steering column (six screws in all. The seventh (larger) screw is for the fuse box. Do not remove).

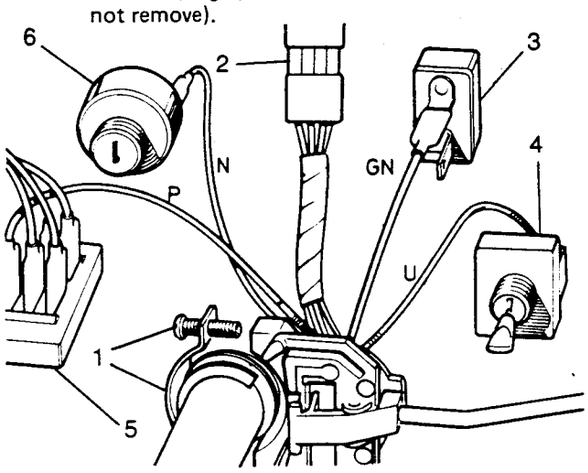


Fig O5.21

   (3) Refer to Fig O5.21. Unscrew the bolt (1) to release the switch from the steering column.

   (4) Withdraw the combined switch sufficient to disconnect the main harness (2) at the plug connector.

   (5) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

   (6) Disconnect the switch leads from the flasher unit (3), lighting switch (4), fuse box (5) and ignition switch (6). Note that only the leads connected to the switch unit are to be disconnected at the other units.

   (7) Withdraw the combined switch.

REPLACEMENT

2. Replace the combined switch unit as follows:

   (1) Connect the leads from the switch unit to the flasher unit (3), lighting switch (4), fuse box (5) and ignition switch (6) as shown in the illustration above.

   (2) Fit the switch unit into position.

   (3) Refit the instrument panel to the dash.

   (4) Connect the main harness (2) to the plug connector.

   (5) Secure the switch unit with the clamp and bolt (1).

   (6) Replace the two halves of the shroud.

   (7) Reconnect the battery earth lead.

Lead colours:

G - Green
N - Brown
P - Purple
U - Blue

CHAPTER 18

FUSE BOX - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the fuse box:

   (1) Disconnect the battery earth lead.

   (2) Remove the upper half of the switch shroud from the steering column (four screws).

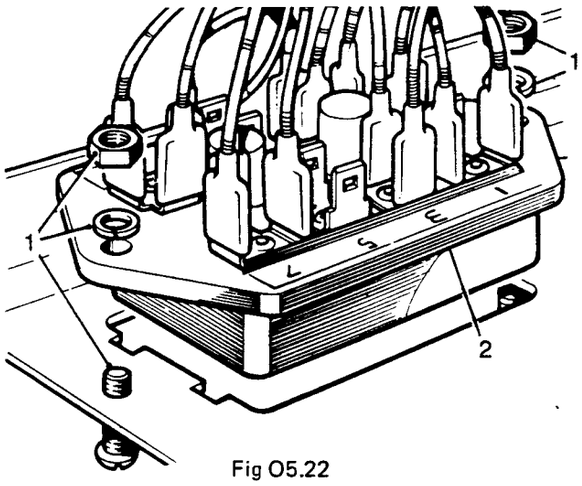


Fig O5.22

   (3) Refer to Fig O5.22. Disconnect all leads from the fuse box.

   (4) Remove the fuse box fixings (1) and (2) and lift the fuse box out of the lower shroud.

REPLACEMENT

2. To replace the fuse box:

   (1) Fit the fuse box into the lower shroud and secure with the screws, lockwashers and nuts (1) and (2).

   (2) Connect the leads to the fuse box:

Terminal	Lead Colour
1	Brown
2	Purple
3	Brown
4	Brown*
5	White
6	3 x Green
7	White
8	2 x Green

   (3) Replace the upper shroud.

   (4) Check that the four fuses and two spares are all 17 amps with a 35 amp blow rate.

   (5) Reconnect the battery earth lead.

**NOTE*
It is important that the brown lead to terminal 4 is the lead from the hazard unit (see wiring diagram).

SUB-SECTION O5

CHAPTER 19

SPEEDOMETER - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the speedometer from the instrument panel:

   (1) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

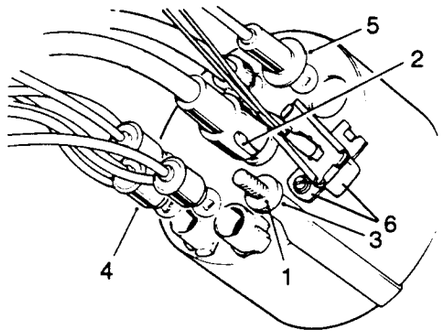


Fig O5.23

   (2) Refer to Fig O5.23. Remove the knurled nuts (1) at the speedometer clamp brackets.

   (3) Withdraw the earth lead eyelets (3) and shakeproof washers from the clamp studs.

   (4) Depress the spring clip and withdraw the speedometer cable (2).

   (5) Withdraw the speedometer clear of the instrument panel.

   (6) Withdraw the warning lamp (4) and illumination lamp (5) bulb holders.

   (7) Disconnect the leads from the instrument voltage stabiliser (6).

   (8) Remove the speedometer.

REPLACEMENT

2. To replace the speedometer:

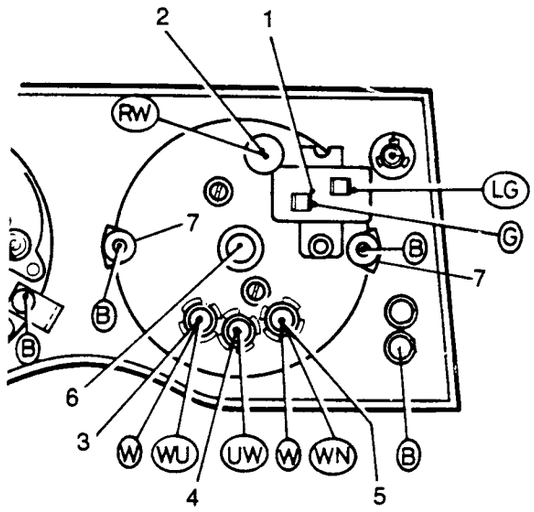


Fig O5.24

   (1) Refer to Fig O5.24. Hold the speedometer in front of the instrument panel, refit the warning and illumination lamp holders and leads to the following:

      a. The voltage stabiliser (1).

      b. The illumination hole (2).

      c. The cold start warning lamp mounting (3).

      d. The headlamp main beam warning lamp mounting (4).

      e. The oil pressure warning lamp mounting (5).

   (2) Fit the speedometer into the instrument panel and reconnect the speedometer drive cable into its fitting (6).

   (3) Replace the earth lead eyelets, shakeproof washers and clamp brackets. Secure with the knurled nuts (7).

   (4) Refit the instrument panel to the dash.

Lead colours:

W - White
B - Black
U - Blue
N - Brown
G - Green
R - Red
L - Light

CHAPTER 20

OIL PRESSURE WARNING SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. The oil pressure warning switch is attached to the right hand lower side of the engine, below the ignition coil and adjacent to the engine mounting. Remove the switch as detailed below:

   (1) Disconnect the battery earth lead.

   (2) Disconnect the electrical lead from the switch.

   (3) Unscrew the switch.

   (4) Remove the switch and sealing washer.

REPLACEMENT

2. To replace the switch:

   (1) Fit the switch into position using a new sealing washer.

   (2) Screw the switch home.

   (3) Connect the electrical lead to the switch unit.

   (4) Reconnect the battery earth lead.

CHAPTER 21

COOLANT TEMPERATURE TRANSMITTER - REMOVAL AND REPLACEMENT

REMOVAL

1. The coolant temperature transmitter is fitted to the thermostat housing on the left hand upper side of the engine just above the water pump and oil filter. To remove the transmitter:

   (1) Drain the cooling system.

   (2) Disconnect the electrical lead from the transmitter.

   (3) Remove the transmitter from the thermostat housing.

REPLACEMENT

2. Replace the transmitter as follows:

   (1) Fit the transmitter into position using a new sealing washer.

   (2) Connect the electrical lead to the transmitter.

   (3) Refill the cooling system with the correct water and inhibitor solution and add antifreeze if required.

CHAPTER 22

FUEL CONTENTS GAUGE - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the fuel contents gauge:

(1) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

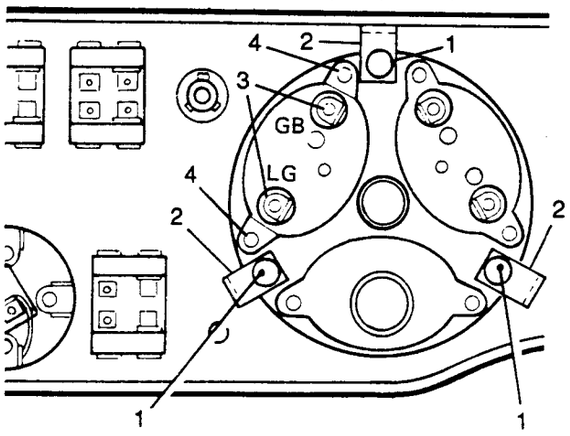


Fig O5.25

(2) Refer to Fig O5.25. Remove the three knurled nuts (1) at the grouped instruments clamp brackets (2).

(3) Withdraw the three earth lead eyelets and shakeproof washers.

(4) Withdraw the grouped instrument clear of the instrument panel.

(5) Disconnect the 'Lucar' connectors (3).

(6) Remove the fixing screws (4) and withdraw the gauge.

REPLACEMENT

2. To replace the fuel contents gauge:

(1) Fit the gauge into the grouped instrument and secure with the fixing screws (4).

(2) Reconnect the Lucar connectors as illustrated.

(3) Fit the grouped instrument into the instrument panel.

(4) Refit the shakeproof washers and earth lead eyelets.

(5) Replace the clamp brackets (2) and secure with the three knurled nuts (1).

(6) Fit the instrument panel to the dash.

Lead colours:

G - Green
B - Black
L - Light

CHAPTER 23

FUEL TANK GAUGE UNIT - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the unit:

   (1) Disconnect the battery earth lead.

   (2) Remove the inspection cover in the rear floor.

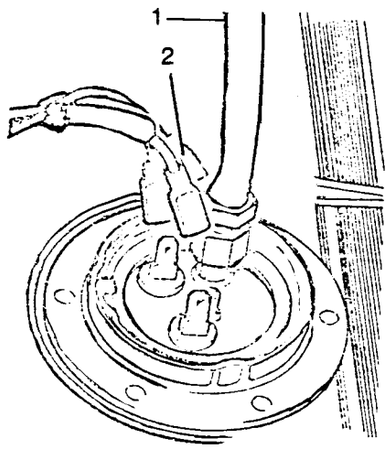
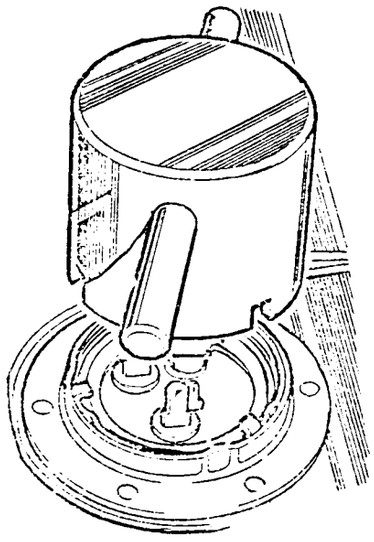


Fig O5.26

   (3) Refer to Fig O5.26. Disconnect the fuel pipe (1) at the fuel tank gauge unit.

   (4) Note the position of the electrical leads (2) and disconnect them from the unit.



   (5) Refer to Fig O5.27. Using special tool 600964 turn the gauge unit locking ring counterclockwise until the indents in the locking ring align with the lugs on the tank.

   (6) Withdraw the locking ring.

   (7) Withdraw the complete fuel gauge unit.

   (8) Remove the rubber seating ring.

REPLACEMENT

2. Replace the gauge unit as follows:

   (1) Lightly smear the joint faces on the gauge unit, the sealing washer and the fuel tank with Bostik adhesive No 772 or a suitable alternative.

   (2) Insert the gauge unit and seating washer into the tank and engage the two lugs in the gauge unit base plate into the cutouts in the fuel tank flange.

   (3) Fit the locking ring and using special tool 600964 turn the ring clockwise until it is locked.

   (4) Connect the fuel pipe to the unit.

   (5) Reconnect the electrical leads.

   (6) Reconnect the battery earth lead.

CHAPTER 24

BLACKOUT STOP LAMP - REMOVAL AND REPLACEME...

REMOVAL

1. To remove the lamp:

   (1) Disconnect the battery earth lead.

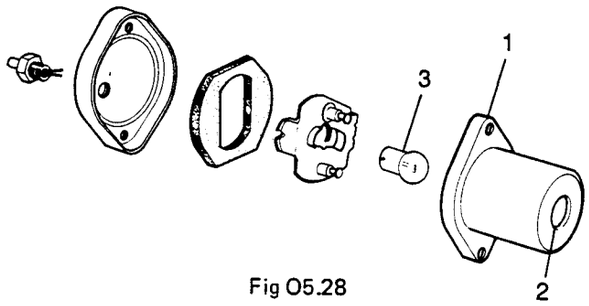


Fig O5.28

   (2) Refer to Fig O5.28. Remove the lens cover fixings (1) and pull off the lens.

   (3) Remove the bulb (3) if required.

   (4) Remove the fixings for the cover in the rear of the load area behind the lamp (two self tapping screws and one nut) and lift the cover away.

   (5) Disconnect the lamp leads at the snap connectors making a note of which socket each lead comes from.

   (6) Remove the two nuts holding the lamp to the wall and pull the lamp body away.

REPLACEMENT

2. Replace the lamp as follows:

   (1) Position the lamp on the rear wall and secure with the two nuts and washers.

   (2) Reconnect the lamp leads at the snap connectors.

   (3) Replace the bulb.

   (4) If removed, replace the lens (2) into the cover, locating the grooves in the lens over the protrusions inside the cover.

   (5) Fit the lens cover and secure with the two screws (1).

   (6) Replace the cover in the load area and secure with the two self tapping screws and the screw, washers and nut.

   (7) Reconnect the battery earth lead.

CHAPTER 25

NUMBER PLATE LAMP - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the lamp:

   (1) Disconnect the battery earth lead.

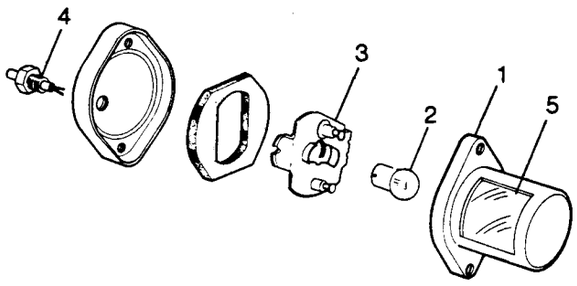


Fig O5.29

   (2) Refer to Fig O5.29. Remove the lens cover fixings (1).

   (3) Remove the bulb (2).

   (4) Disconnect the lamp leads at the connectors on the carrier (3) making a note of which connector each lead comes from.

   (5) Unscrew the hollow bolt (4) through which the leads are routed.

   (6) Remove the two nuts holding the lamp to the wall and pull the lamp body away.

REPLACEMENT

2. Replace the lamp as follows:

   (1) Position the lamp on the rear wall and secure with the two nuts and washers.

   (2) Feed the leads through the rear body of the lamp and tighten the hollow bolt (4).

   (3) Reconnect the leads to their connectors on the carrier (3).

   (4) Replace the bulb (2).

   (5) If removed, replace the lens (5) into the cover, locating the grooves in the lens over the protrusions in the cover.

   (6) Fit the lens cover and secure with the two screws (1).

   (7) Reconnect the battery earth lead.

CHAPTER 26

BLACKOUT SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the blackout switch:

   (1) Disconnect the battery earth lead.

   (2) Withdraw the instrument panel clear of the dash (see Sub-section O5, Chapter 27).

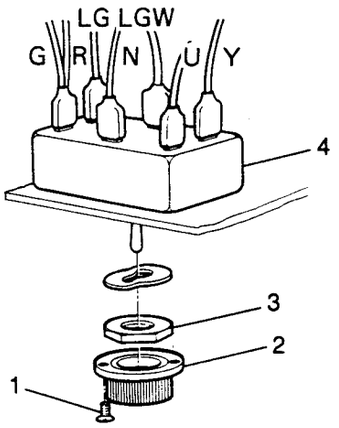


Fig O5.30

   (3) Refer to Fig O5.30. Remove the fixings (1) for the switch safety housing (2) and remove the housing.

   (4) Remove the nut (3) and wave washer from the switch knob.

   (5) Disconnect the leads from the back of the switch (4).

   (6) Withdraw the switch.

REPLACEMENT

2. Replace the switch as follows:

   (1) The switch is symmetrical and may be fitted either way round. Place the switch in position and secure with the wave washer and nut.

   (2) Connect the leads to the switch as shown in Fig O5.28.

   (3) Refit the switch safety housing (2) and secure with the two self tapping screws (1).

   (4) Replace the instrument panel.

   (5) Reconnect the battery earth lead.

Lead colours:

G - Green
R - Red
N - Brown
W - White
U - Blue
Y - Yellow
L - Light

CHAPTER 27

INSTRUMENT PANEL - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the instrument panel as follows:

(1) Disconnect the battery earth lead.

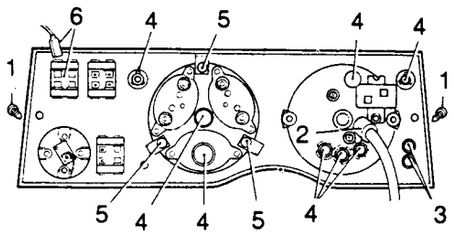


Fig O5.31

(2) Refer to Fig O5.31. Remove the instrument panel fixings (1).

(3) Withdraw the instrument panel clear of the dash. If necessary, remove the steering wheel. At this stage the panel is in a position where individual lamps, switches and instruments can be removed. Continue if the complete panel is to be withdrawn.

(4) Depress the spring clip and withdraw the cable assembly from the speedometer (2).

(5) Withdraw the instrument panel sufficient to gain access to the wiring connections.

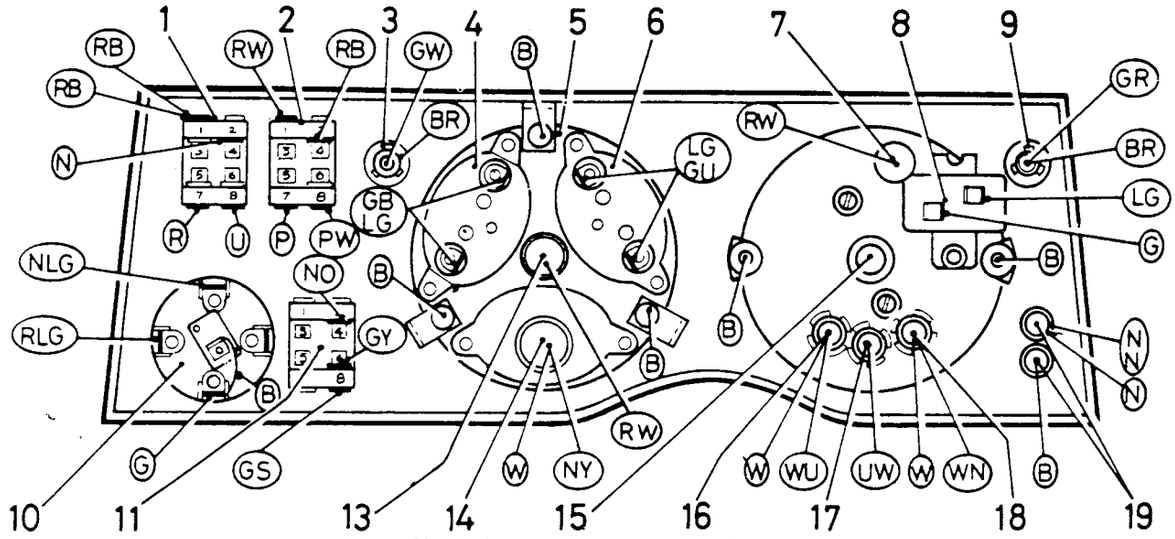
(6) Remove the inspection lamp socket leads (3).

(7) Withdraw all warning and illumination lamp leads and bulbs complete with holders (4).

(8) Disconnect the earth lead terminals at the knurled nuts (5) on the grouped instrument.

(9) Disconnect all 'Lucar' connectors (6).

(10) Withdraw the instrument panel and instruments complete.



Key to instrument panel and wiring

1. Lighting switch
2. Panel light switch
3. RH turn indicator warning light
4. Fuel contents gauge
5. Grouped instruments
6. Coolant temperature gauge
7. Panel illumination light
8. Instruments voltage stablizer
9. LH turn indicator warning light
10. Wiper/washer switch
11. Heater switch
13. Panel illumination light
14. Battery charge warning light
15. Speedometer drive head
16. Cold start warning light
17. Headlamp mainbeam warning light
18. Oil pressure warning light
19. Inspection lamp sockets

Lead colours:

S - Slate
B - Black
G - Green
N - Brown
P - Purple
R - Red
U - Blue
W - White
Y - Yellow
L - Light

REPLACEMENT

2. To replace the instrument panel:

   (1) Refer to Fig 05.32. Reconnect the Lucar connectors with the lead colours in the positions indicated.

   (2) Refit the warning and illumination lamps and holders. The positions and lamp lead colours are also shown in the illustration above.

   (3) Reconnect the inspection lamp socket leads.

   (4) Refit the speedometer cable assembly.

   (5) Replace the instrument panel in the dash and secure with the two fixing screws.

   (6) Reconnect the battery earth lead.

CHAPTER 28

HAZARD WARNING SWITCH - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the switch:

(1) Disconnect the battery.

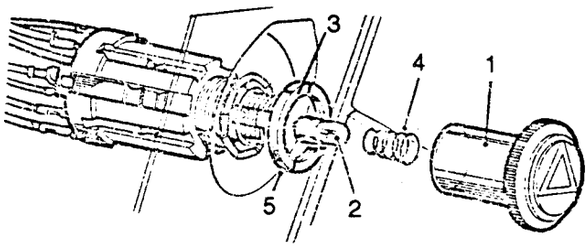


Fig O5.33

(2) Refer to Fig O5.33. Unscrew the hazard warning switch knob (1) taking care not to lose the bulb and spring (4).

(3) Pull out the warning lamp bulb (2).

(4) Remove the self tapping screws holding the panel on which the hazard warning lamp switch and test switch are mounted. Ease the panel forward away from the dash.

(5) Unscrew the locking ring (3) holding the switch to the panel and remove, together with the wave washer.

(6) Pull out the switch from the rear of the panel.

(7) Disconnect the electrical leads round the periphery of the switch.

(8) Disconnect the black centre lead.

REPLACEMENT

2. Replace the switch as follows:

(1) Connect the black lead through the centre of the switch.

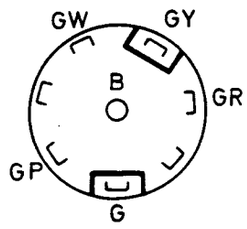


Fig O5.34

(2) Refer to Fig O5.34. Reconnect the electrical leads to the periphery of the switch.

(3) Fit the switch into the panel and secure with the wave washer and lock ring.

(4) Fit the hazard warning switch bulb and screw on the knob.

(5) Replace the panel and secure with the self tapping screws.

(6) Reconnect the battery.

Lead colours:

G - Green
W - White
Y - Yellow
R - Red
P - Purple

SUB-SECTION CONTENTS LIST

SUB-SECTION O6

CLEANING, REPAIR AND OVERHAUL PROCEDURES

CHAPTER 1

OVERHAULING THE ALTERNATOR

DISMANTLING

1. To dismantle the alternator:

(1) Remove the alternator (see Sub-section O5, Chapter 1).

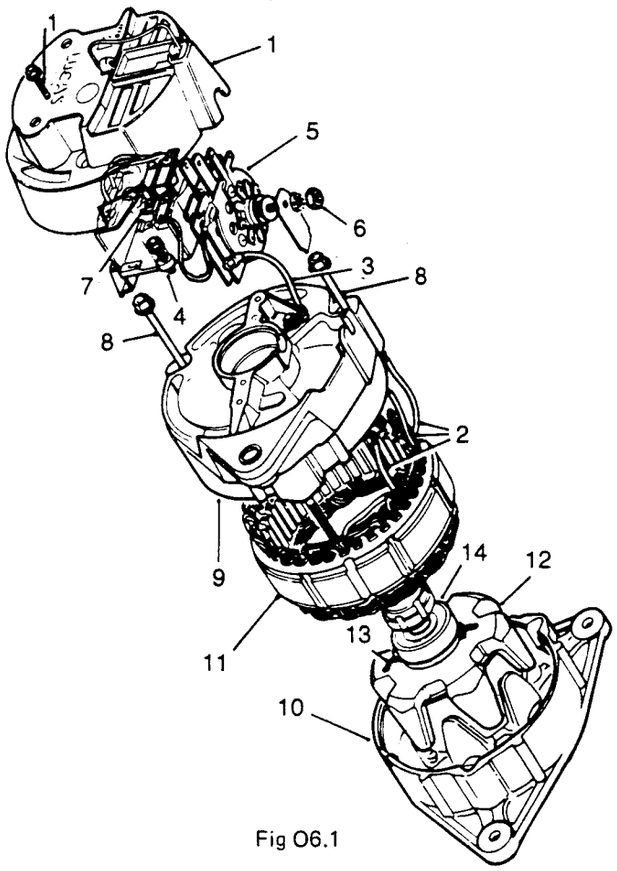


Fig O6.1

(2) Refer to Fig O6.1. Withdraw two retaining screws and remove moulded slip-ring end cover (1).

(3) Note positions of stator winding connections (2) to rectifier connecting pins.

(4) Using thermal shunt and lightweight soldering iron (25 watt), unsolder the connections.

(5) Note position of cable connectors to rectifier plates. Disconnect the cables (3).

(6) Withdraw three hexagon headed screws (4) securing brushbox and regulator to slip-ring end bracket.

(7) Remove brushbox moulding and regulator assembly (5).

(8) Slacken rectifier securing nut (6) and remove rectifier.

BRUSHGEAR INSPECTION

2. The serviceability of the brushes is gauged by the length protruding beyond the brush moulding in the free position. This amount should exceed (8 mm). If renewal is necessary care must be taken to replace the leaf spring at the side of the inner brush.

3. Renew brush and spring assemblies ((7) on Fig O6.1) if brushes are worn to 8 mm. To replace a brush:

(1) Remove the small screws securing the brush retaining plates and regulator cables.

(2) Replace brushes with new units and refit brush retaining plates and regulator cables.

4. Check brush spring pressure with push-type spring gauge to end of brush. Spring pressure should be 225 to 368 gf when brush is flush with moulding.

SLIP-RING INSPECTION

5. The surface of the slip-ring should be smooth and free from grease or dirt. Servicing is confined to cleaning with a petrol-moistened cloth or finest grade glass-paper.

CAUTIONS

1. Emery cloth or similar abrasive must not be used.

2. The slip-rings cannot be machined.

FURTHER DISMANTLING

6. Continue dismantling the alternator. Note that Fig O6.1 still applies.

(1) Withdraw three through-bolts (8).

(2) Separate the alternator into its major components:

a. Slip-ring and bracket (9).

b. Drive end bracket, rotor, fan and pulley (10).

c. Stator laminations and windings (11).

(3) Separate the rotor (12) from the drive end bracket by removing the pulley, fan and shaft key.

(4) Press the rotor shaft from the bearing.

7. Remove the slip-ring end bearing: (Fig O6.1 still applies).

(1) Unsolder the field wind rings (13) from the slip-ring moulding.

(2) Remove the slip-ring moulding (14).

(3) Press the bearing from the shaft.

8. Remove the drive end bearing:

(1) Remove the circlip and retaining slate from the drive end bearing.

(2) Press out the bearing.

BEARING INSPECTION

9. Inspect the bearings for wear, flat spots or other damage and replace if necessary.

10. Pack the bearing with Shell Alvania RA grease.

ROTOR TESTING

11. To test the rotor an ohmmeter, a 110 volt ac supply and a 15 watt test lamp are required. If an ohmmeter is not available a 12 volt battery and an ammeter may be used as an alternative. Test the rotor as follows:

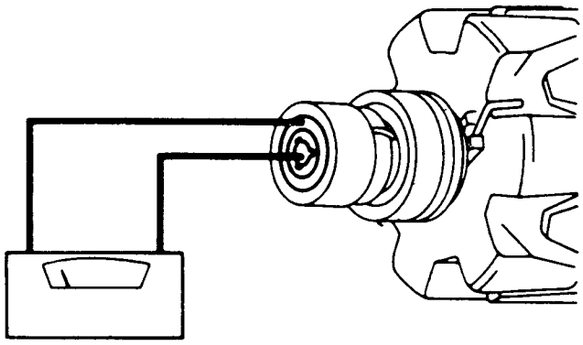


Fig O6.2

(1) Refer to Fig O6.2. Connect the ohmmeter between the slip-rings.

(2) Check that the resistance is 3,2 ohms at 20°C.

ALTERNATIVE METHOD

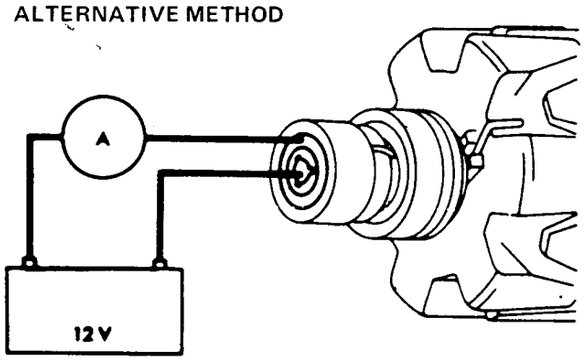


Fig O6.3

(3) Refer to Fig O6.3. Connect an ammeter and battery between the slip-rings.

(4) Check that the ammeter reads approximately 3 amps.

12. To test for defective insulation between the slip-rings and rotor poles:

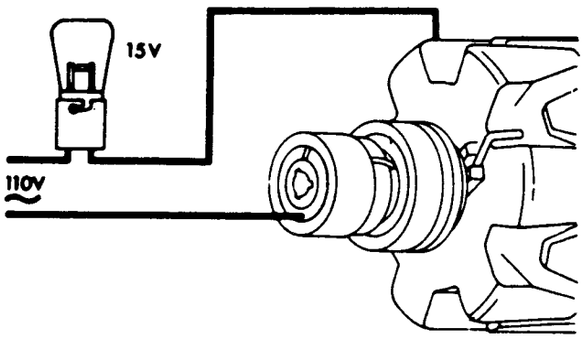


Fig O6.4

(1) Refer to Fig O6.4. Connect a 110 volt ac supply between each slip-ring and the rotor poles in turn.

(2) If the lamp lights, the coil is earthed to the rotor core and a replacement rotor and slip-ring assembly should be fitted.

STATOR TESTING

13. For this test, a 12 volt battery with a 36 watt test lamp and a 110 volt ac supply with a 15 watt test lamp are required.

To test the stator:

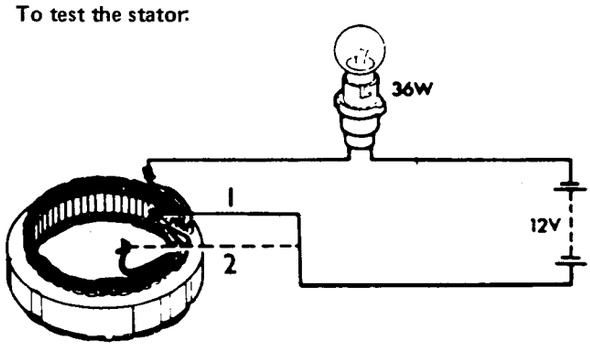


Fig O6.5

(1) Refer to Fig O6.5. Check continuity of stator windings between any pair of wires by connecting in series a 12-volt battery and test lamp of not less than 36 watts. Failure of the test lamp to light means that part of the stator winding is open circuit and a replacement stator must be fitted.

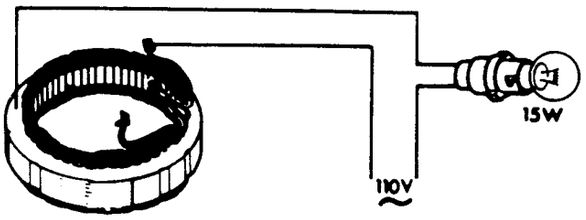


Fig O6.6

(2) Refer to Fig O6.6. Test stator insulation with 110-volt test lamp. Connect test leads to laminated yoke and any one of the three stator cables. If the lamp lights, the stator coils are earthed. A replacement stator must be fitted.

DIODE TESTING

14. To test the diodes a 12-volt battery and a 1,5 watt test lamp are required. Test as follows:

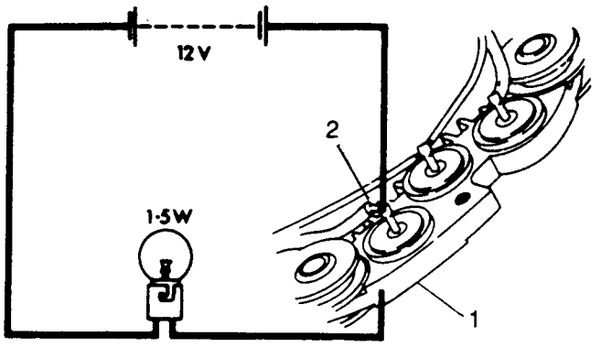


Fig O6.7

(1) Refer to Fig O6.7. Connect one battery terminal to the heatsink under test (1).

(2) Connect the other battery terminal in series with the test lamp and each diode pin (2) in turn.

(3) Reverse connections to heatsink and diode pins. The lamp should light in one direction only. Should the lamp light in both tests, or not light at all the diode is defective and a new rectifier heatsink must be fitted.

NOTES

1. To prevent damage to diode assemblies during soldering operations it is important that a thermal shunt is used.

2. Only 'M' grade 45-55 tin-lead solder should be used.

REASSEMBLY

15. To reassemble the alternator:

(1) Replace the drive end bearing, retaining plate and circlip.

(2) Replace the slip-ring end bearing onto the shaft.

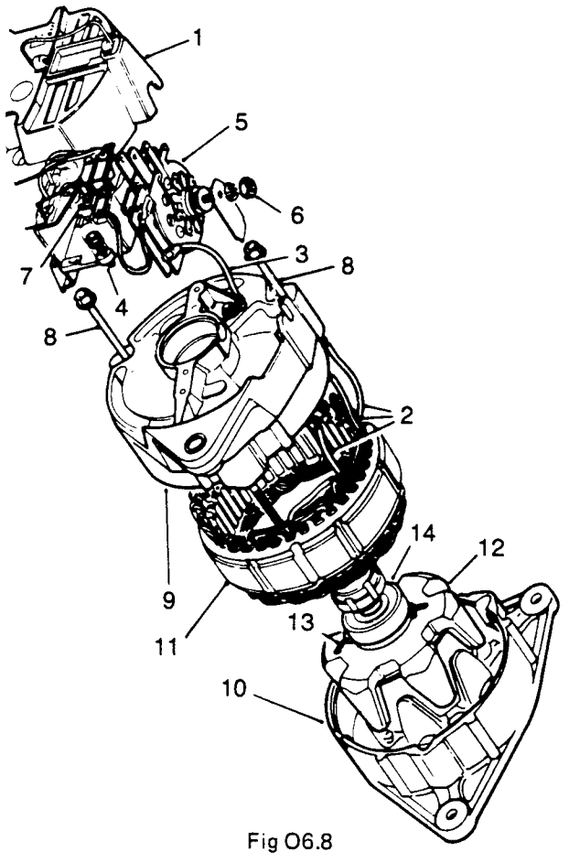


Fig O6.8

(3) Refer to Fig O6.8. Replace the slip-ring moulding (14).

(4) Resolder the field windings (13) to the slip-ring moulding.

(5) Press the rotor shaft into the slip-ring end bearing.

(6) Reconnect the rotor (12) to the drive end bracket, fitting the pulley, fan and shaft key.

(7) Fit together the slip-ring end bracket (9), the drive end bracket (10) and the stator (11). Secure with the through bolts (8).

(8) Replace the rectifier and tighten the securing nut (6).

(9) Replace the brush box moulding and regulator assembly (5) and secure to the slip-ring end bracket with the three box head screws (4).

(10) Reconnect the cables (3) to the rectifier plates in the position noted in paragraph 1, step (4).

(11) Using a thermal shunt and 25 watt soldering iron solder the stator winding connection (2) to the rectifier connecting pins. The positions of the connectors were noted in paragraph 1, step (2).

(12) Replace the moulded slip-ring end cover (1) and secure with the two retaining screws.

(13) Replace the alternator (see Sub-section O5, Chapter 1).

CHAPTER 2

OVERHAULING THE STARTER MOTOR

DISMANTLING

1. First, remove the starter motor (see Sub-section O5, Chapter 5).

2. Remove the solenoid as follows:

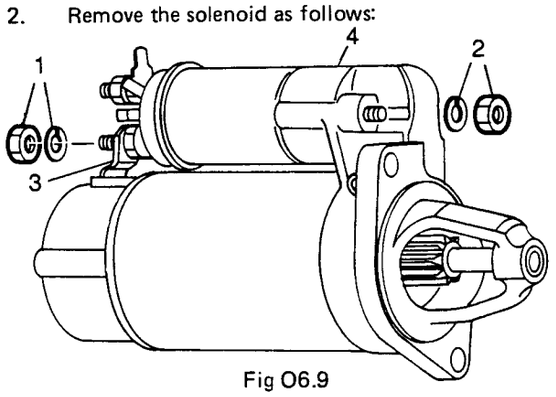


Fig O6.9

(1) Refer to Fig O6.9. Remove the nut and washer (1) which secures the solenoid-to-starter connecting link to solenoid terminal STA.

(2) Remove the two nuts (2) and washers securing the solenoid to the fixing bracket.

(3) Pull back the connecting link (3) from the solenoid terminal and at the same time lift the terminal end of the solenoid clear of the connecting link and withdraw the major part of the solenoid from the fixing bracket (4).

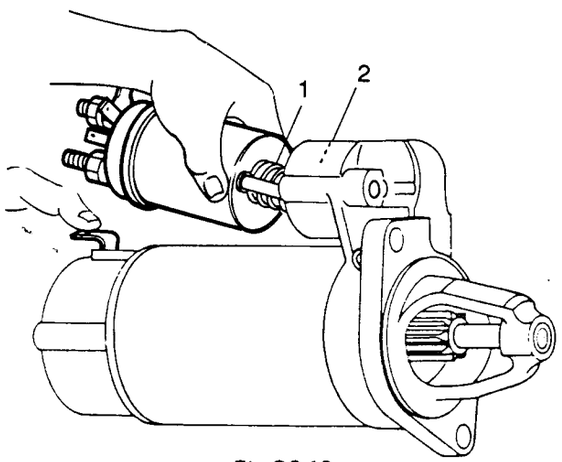


Fig O6.10

(4) Refer to Fig O6.10. Remove the plunger (1) from the drive engagement lever (2) by gripping the plunger in the hand and applying an upward lift at the front of the plunger.

3. Remove the commutator end cover:

NOTE

Before removing the end cover ensure that a replacement Spire retaining ring is available for use during reassembly. This is necessary because this type of retaining ring is a press fit on the armature shaft and if the original fitting of the ring is disturbed, it becomes unsatisfactory for further use.

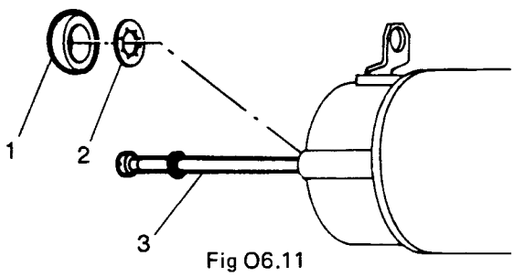


Fig O6.11

(1) Refer to Fig O6.11. Remove the end cap (1) to gain access to the retaining ring (2).

(2) Using an engineer's chisel cut through a number of the retaining ring claws until the grip on the armature shaft is sufficiently relieved to allow the ring to be removed. Remove the ring.

(3) Remove the two through bolts (3).

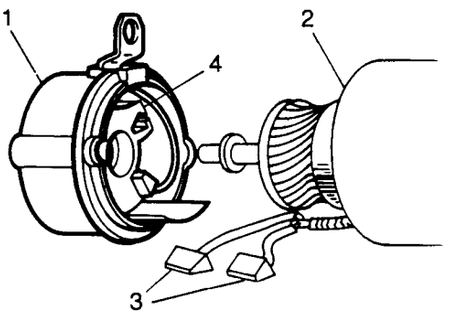


Fig O6.12

(4) Refer to Fig O6.12. Partially withdraw the commutator end cover (1) from the yoke (2) and disengage the two field coil brushes (3) from the brush box moulding (4).

(5) Withdraw the commutator end cover.

4. Remove the armature and roller clutch:

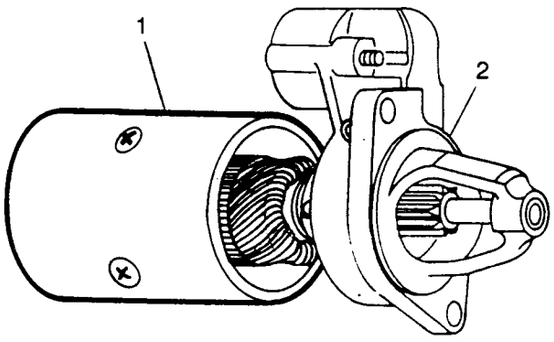


Fig O6.13

(1) Refer to Fig O6.13. Withdraw the yoke (1) from the armature assembly (2).

NOTE
Do not disturb the field coil assembly in the yoke.

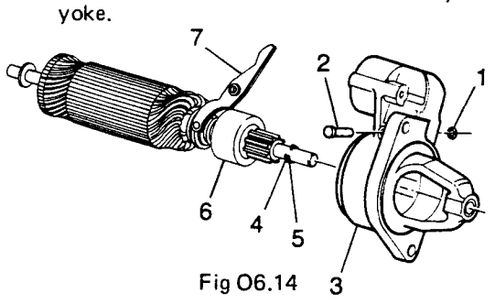


Fig O6.14

(2) Refer to Fig O6.14. Remove the Spire retaining ring (1) from the drive engagement lever pivot pin (2).

NOTE
Ensure that a new Spire retaining ring is available for reassembly.

(3) Withdraw the pivot pin (2).

(4) Withdraw the fixing bracket (3) from the armature assembly.

(5) Using a tubular tool (a box spanner for instance) drive the thrust collar (4) squarely off the jump ring (5).

(6) Remove the jump ring from the groove in the armature shaft and slide the ring off the shaft.

(7) Slide the thrust collar and the roller clutch drive (6) and lever assembly (7) off the shaft.

INSPECTION - ARMATURE

5. Check that the commutator face is clean and free from burn spots and grooving. If either or both of these are found, use a flat surface of very fine glass paper to remove the spots or grooving. Clean the commutator with a petrol moistened cloth.

6. If the burn spots or grooves are too deep to be removed with glass paper the commutator may be skimmed. The minimum thickness to which the commutator copper may be skimmed before the armature must be replaced is 3,5 mm. Terminate any skimming operation by polishing the commutator surface with a flat pad of very fine glass paper and then wiping it clean with a petrol moistened cloth.

CAUTION
Do not undercut the insulation slots.

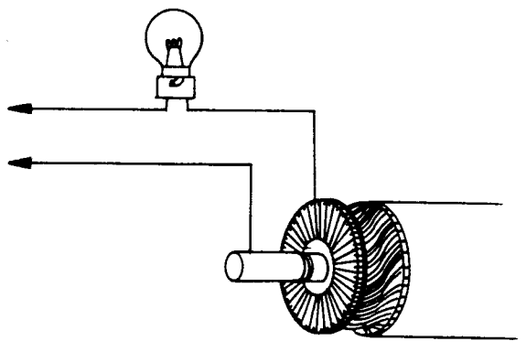


Fig O6.15

7. Refer to Fig O6.15. Check armature insulation by connecting a 110 V ac supply in series with a 15 W test lamp between the armature shaft and each commutator segment in turn. For satisfactory insulation the lamp should not light.

8. If the armature shows signs of 'thrown' solder or lifted conductors, overspeeding of the armature is indicated and the operation of the roller clutch drive should be checked (see para 19).

9. Short circuited armature windings (indicated by a high current consumption, low light running speed and low lock torque performance) can only be detected by the use of specialised armature testing 'Growler' equipment. If this equipment is not available, the only alternative is to check the armature by substitution.

10. If the armature laminations have been in contact with the pole shoes the armature bearings are probably excessively worn. First, check that the pole shoes are tight and that the armature runs true in a lathe. Then, check the inner diameter of the bearings. The bearings must be changed when the diameter exceeds 11,20 mm for the commutator end cover bearing, and 12,09 mm for the drive end fixing bracket bearing. (See para 26 for changing the bearings).

INSPECTION - BRUSHGEAR

11. Check that the brushes move freely in the brush box moulding. Sticking brushes should be cleaned with a petrol moistened cloth. Brushes which are worn down to approximately 9,5 mm in length must be renewed (See para 31).

12. Measure brush spring pressure:

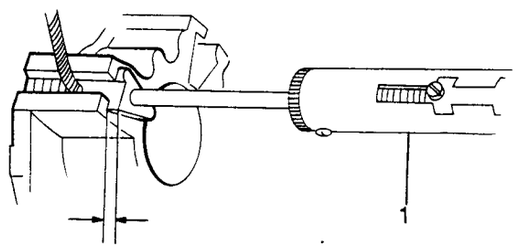


Fig O6.16

(1) Refer to Fig O6.16. Position a new brush in each of the brush boxes in turn.

(2) Press on top of the brush with a push-type spring gauge (1) until the top of the brush protrudes by about 1,5 mm from the brush moulding (dimension A).

(3) Check that the spring gauge reading is 10,0 N.

13. Check the insulation of the brush springs by connecting a 110 V, 15 W test lamp between a clean part of the end cover and each of the springs in turn. The lamp should not light.

14. Check that the connecting link grommet is in good condition.

INSPECTION - YOKE AND FIELD COIL ASSEMBLY

15. Inspect the field coils in situ for signs of obvious faults. Check the inter-connecting joints between coils, the earthed connection of the field winding where it is reiveted to the yoke and look for discolouration (due to burning) of the winding insulation tape, which could indicate short-circuited windings or a short-circuit between the windings and the yoke. A visible fault will eliminate the need for testing and in such cases if necessary the field coil assembly should be removed from the yoke to enable it to be repaired or renewed.

16. If there are no obvious signs of a fault, the field coil continuity and the insulation between the field coils and yoke can be checked without removing the field coil assembly from the yoke.

17. Check field coil continuity by connecting a 12 V battery operated test lamp between either of the field coil brushes and a clean part of the yoke. The lamp should light.

18. **Field coil insulation:** Before being able to check the insulation between the field coils and yoke, it will first be necessary to disconnect the earthed end of the winding from the yoke. Before disconnecting the windings (See para 32) determine whether it is justified. Consider the light running and lock torque or alternatively consider the fault symptoms. If the speed and torque were low, and the current consumption high, or the fault symptom was low cranking speed, faulty field winding insulation could be the cause and this interpretation of the starting motor performance would justify disconnecting the earthed end of the field winding to enable a positive check to be carried out.

19. The field winding insulation can be checked (after disconnecting the winding at the yoke) by connecting a 110 V, 15 W test lamp between the disconnected end of the winding and a clean part of the yoke. **The lamp should not light.** Ensure that neither of the brushes, or bare parts of their flexible leads contact the yoke during the test.

20. **Field coil resistance:** Due to the very low resistance of the field coil conductors, the presence of a short-circuit between the field coil windings can only be determined by specialised equipment. If the results of all previous testing has been satisfactory, short-circuited field coil windings could be the cause of the fault and the field coil assembly should now be further proved by substitution. To change the field coils see para 32.

INSPECTION - ROLLER CLUTCH DRIVE ASSEMBLY

21. Check the clutch action. The pinion should have instantaneous take-up of the drive in one direction and be free to rotate in the other.

22. Check that the assembly moves freely along the armature shaft splines. The armature shaft splines and moving parts of the engagement lever should be liberally smeared with Shell SB.2628 (cold climates) or Retinax 'A' (hot climates). The roller clutch mechansim is a sealed unit, which is pre-packed with sufficient grease to last the life of the starter motor. In the unlikely event of the clutch action becoming faulty, it will not be possible to rectify the fault and the whole of the drive assembly will have to be renewed.

INSPECTION - SOLENOID

23. Check solenoid winding resistance by connecting a good quality ohmmeter between solenoid terminal STA and a good earth point on the solenoid body. A reading of 1,01 to 1,07 ohms indicates that the windings are in a satisfactory state.

24. An alternative method of carrying out the above test is to connect a 0 to 20 A moving coil ammeter in series with a 12 V battery, solenoid terminal STA and a good earth point on the solenoid body. A reading of 11,2 to 11,8 amps should be obtained.

25. Associated with the solenoid plunger are three springs: the plunger and drive return spring, the drive engagement spring which is incorporated inside the plunger to overcome the difficulty of engaging the pinion on occasions of tooth-to-tooth abutment, and the 'lost motion' spring which is assembled to the connecting part of the solenoid plunger to provide a measure of lost motion in the drive operating mechanism as the drive commences to disengage. It is sufficient to check only that the springs are not broken. In the case of the drive engagement spring (inside the plunger), to check the spring it will be necessary to ensure that a spring-loaded pull action exists between the plunger body and the connecting part of the plunger.

26. The solenoid incorporates a very small additional Lucar terminal blade (marked IGN), which is for use in conjunction with ballast ignition systems. It is sufficient to check that this terminal becomes electrically connected to the solenoid main input terminal, when the solenoid is energised.

27. Should the above tests give satisfactory results the only other fault would be the solenoid contacts and these should be changed (See para 33).

REPLACING THE BEARINGS

28. The armature bearings, fitted in the commutator end cover and the drive end fixing bracket, are self-lubricating porous-bronze bushes.

29. New bushes must be completely immersed in Shell 'Turbo 41' oil, or in clean engine oil, for 24 hours at room temperature, before they are fitted. Alternatively, if the lubricant is heated to a temperature of 100°C, 2-hours immersion of the bushes is sufficient, providing the lubricant is allowed to cool before the bushes are removed.

30. The bushes must **not** be reamed after fitting otherwise the self-lubricating qualities will be impaired.

31. Worn bushes should be removed by using a wheel-operated press. Alternatively, support the bearing housing and then with a mandrel carefully tap the bush out of the cover or bracket.

32. New bushes should be pressed into position by means of a shouldered polished mandrel with dimensions as follows:- commutator end cover bush 11,117 mm, drive end fixing bracket bush 12,011 mm.

RENEWING THE BRUSHES

33. Renew the brushes as follows:

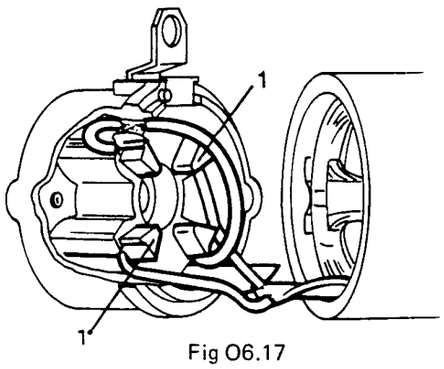


Fig O6.17

(1) Refer to Fig O6.17. For the field coil brushes (1) cut the brush flexible leads leaving approximately 6 mm of lead each side of the coil end.

(2) Solder the new brushes to the remaining ends of the old leads.

NOTE
Use only resin-cored type solder.

(3) For the other two brushes, replace them complete with terminal link and moulded rubber grommet.

(4) Check that the brushes are in the positions shown in the figure.

RENEWING THE FIELD COILS

34. Fit new field coils as follows:

(1) Disconnect the end of the field winding where it is riveted to the yoke. To do so, file away the riveted-over end of the connecting eyelet securing rivet sufficiently to enable the rivet to be tapped out of the yoke.

(2) Remove the four pole shoe screws with a wheel-or-power-operated screwdriver.

(3) Withdraw the field coil from the yoke.

(4) Wipe clean the inside of the yoke and the insulating pieces through which the through-bolts locate.

(5) Loosely fit the new field coil assembly (with pole shoes) into the yoke, with the threads of the pole shoe fixing screws only partially engaged.

(6) Assemble the through bolt insulating pieces into the yoke by sliding the shoulders of the insulating pieces between the field coils and the yoke in a position 180° apart and 90° each side of the field coil brush connection point.

(7) Tighten the pole shoes progressively to a torque of 40 N.m.

(8) Make a good earth connection between the end of the field winding and the yoke.

RENEWING THE SOLENOID CONTACTS

35. To renew the contacts:

(1) Remove the two screws securing the terminal and base assembly to the solenoid.

(2) Apply a hot soldering iron alternately to each of the two soldered terminal connections and wait for the solder to run free.

(3) Shake most of the melted solder out of the joints by tapping the solenoid terminal ends sharply down on the bench.

(4) Clamp the solenoid body in a vice (terminals uppermost) and while applying a constant pull on the moulded cover, apply the soldering iron alternatley to the two soldered connections until the terminal and base assembly is freed.

(5) When remaking the soldered connections avoid dry-soldered joints by ensuring that the parts are clean and adequately heated before applying the solder.

(6) Tighten the terminal and base fixing screws to a torque of 2,44 N.m.

REASSEMBLY

36. Reassemble the starter motor as follows:

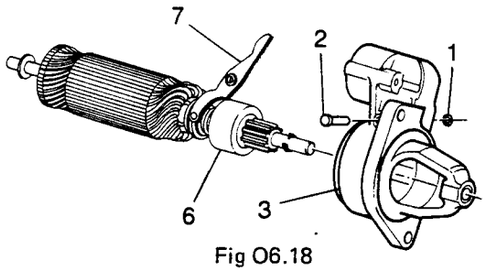


Fig O6.18

(1) Refer to Fig O6.18. Slide the roller clutch drive (6) and lever assembly (7) and the thrust washer onto the armature shaft.

(2) Fit the jump ring into the groove in the armature shaft and drive the thrust washer squarely onto the jump ring.

(3) Refit the fixing bracket (3) to the armature assembly and secure with the pivot pin (2) through the bracket and the bore in the drive engagement lever.

(4) Fit a new Spire retaining ring (1).

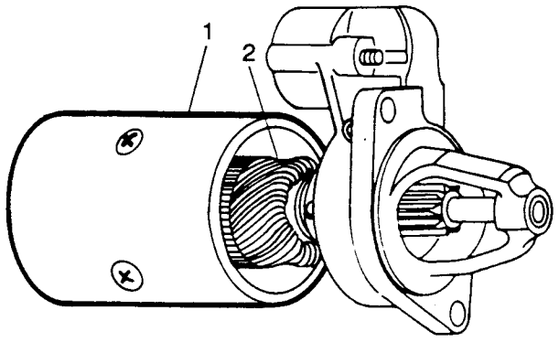


Fig O6.19

(5) Refer to Fig O6.19. If it has been removed, fit the internal thrust washer (3) to the commutator end of the armature shaft.

(6) Fit the yoke (1) over the armature assembly (2).

37. Fit the commutator end cover:

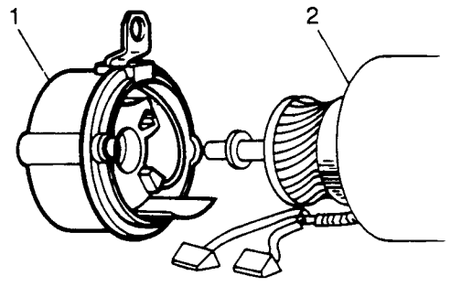


Fig O6.20

(1) Refer to Fig O6.20. Hold the commutator end cover (1) close to the yoke (2) and fit the brushes into their correct housings in the brush box moulding.

(2) Fit the commutator end cover to the yoke and align the holes for the through bolts.

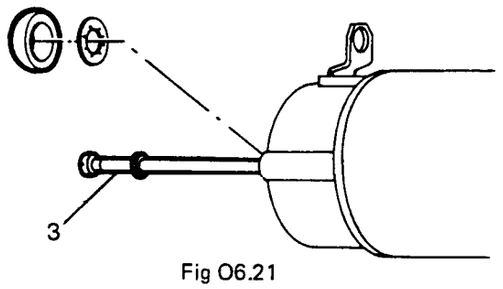


Fig O6.21

(3) Refer to Fig O6.21. Fit the two through bolts (3) and tighten to a torque of 10,84 N.m.

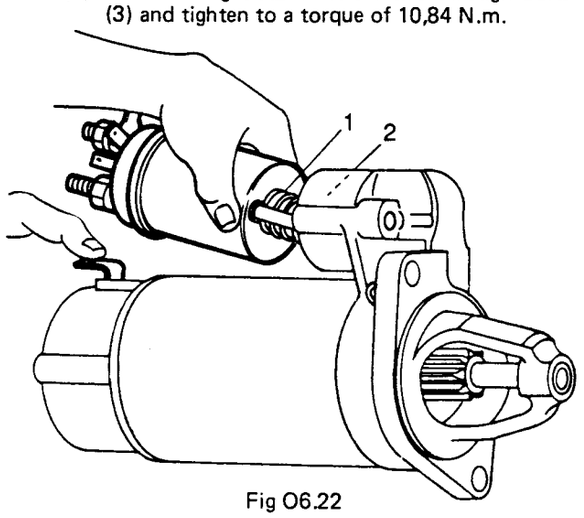


Fig O6.22

(4) Refer to Fig O6.22. Fit the solenoid plunger into the fixing bracket. Hold the plunger (1) and use a downward push to engage the drive engagement lever (2).

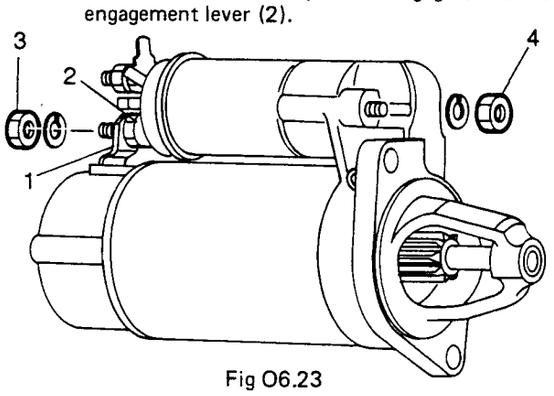


Fig O6.23

(5) Refer to Fig O6.23. Pull back the connecting link (1) and lower the solenoid into position on top of the starter motor.

(6) Engage the solenoid terminal STA over the connecting link (2).

(7) Replace the nut and washer (3) on terminal STA.

(8) Fit the two nuts and washers (4) securing the solenoid to the fixing bracket and tighten to 6,1 N.m.

(9) Drive a new Spire retaining ring onto the armature shaft into a position which provides a maximum of 0,25 mm clearance between the retaining ring and the bearing bush shoulder.

(10) Replace the end cap to the commutator end cover.

SUB-SECTION O7

MAINTENANCE

INTRODUCTION

1. The electrical system is relatively trouble free if maintained in good condition. However, regular inspections are needed to keep the system in this condition.

BATTERY

2. Check electrolyte level at least once per week and if necessary, top up with distilled water until the electrolyte is about 10 mm above the top of the plates.

3. The battery terminals should be kept free of oxyidation products (a white powdery substance). Whenever this is found it should be wiped off with a clean, dry cloth and a smear of acid resistant grease (vaseline for example) should be applied to the terminals. Note that good contact must be maintained between the battery terminal and the connecting lead; grease must not be applied to the mating surfaces.

LIGHTS

4. Bulbs are liable to failure at any time without warning. Because of this, frequent checks of lamp operation should be made and faulty bulbs replaced immediately.

5. Lenses should at all times be kept free of mud and dirt. They should be wiped with a clean, damp cloth whenever practical.

WIRING

6. The leads between the various electrical circuits are an important part of the system. Where clips or grommets are used the wires should be firmly held in position. Wires trapped between metal parts, especially where they pass across sharp edges should be suitably protected against chafing. Mud or moisture on leads, especially close to terminals, can cause short circuits and failure of circuits.

7. The wiring should be checked for the points made above at regular intervals and immediate remedial action taken where required. Disconnect and reconnect terminals occasionally to ensure good contact is maintained between mating surfaces.

FUSE CHANGING

8. If more than one lamp or service fails at the same time the fuses should be examined and a blown fuse replaced. If the same fuse blows again immediately on switching on, check the circuits concerned for a short circuit to earth.

9. To change a fuse:

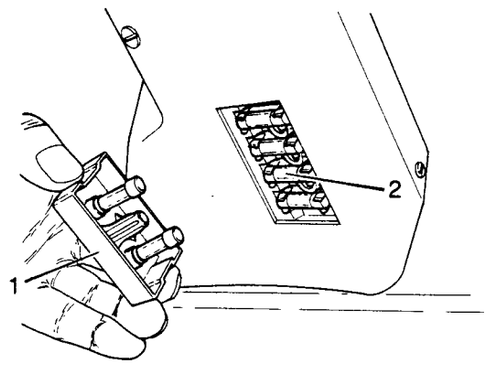


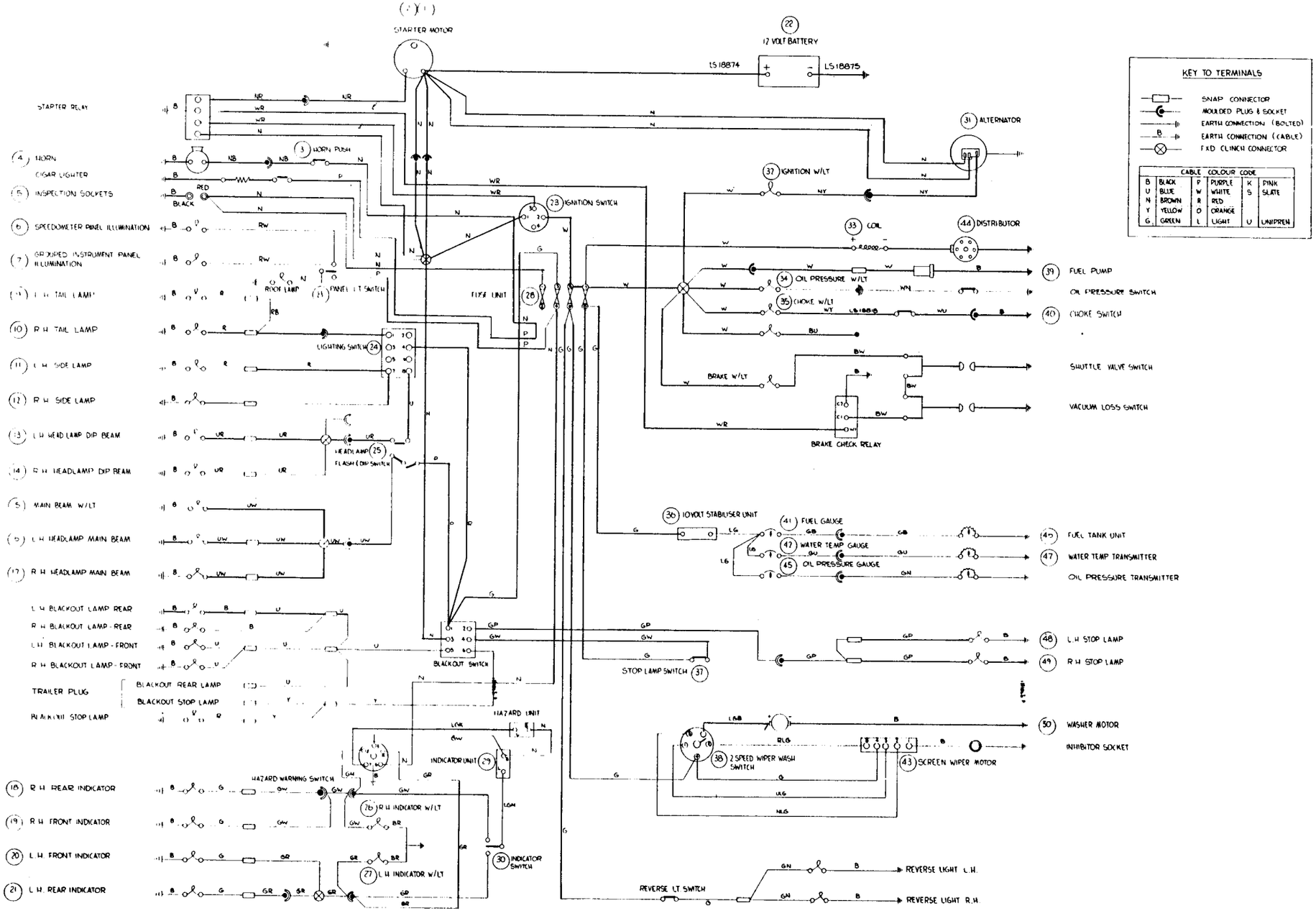
Fig O7.1

(1) Refer to Fig O7.1. Pull off the fuse box cover (1).

(2) Pull the ruptured fuse (2) out of its clips and discard.

(3) Clip a fresh fuse into position.

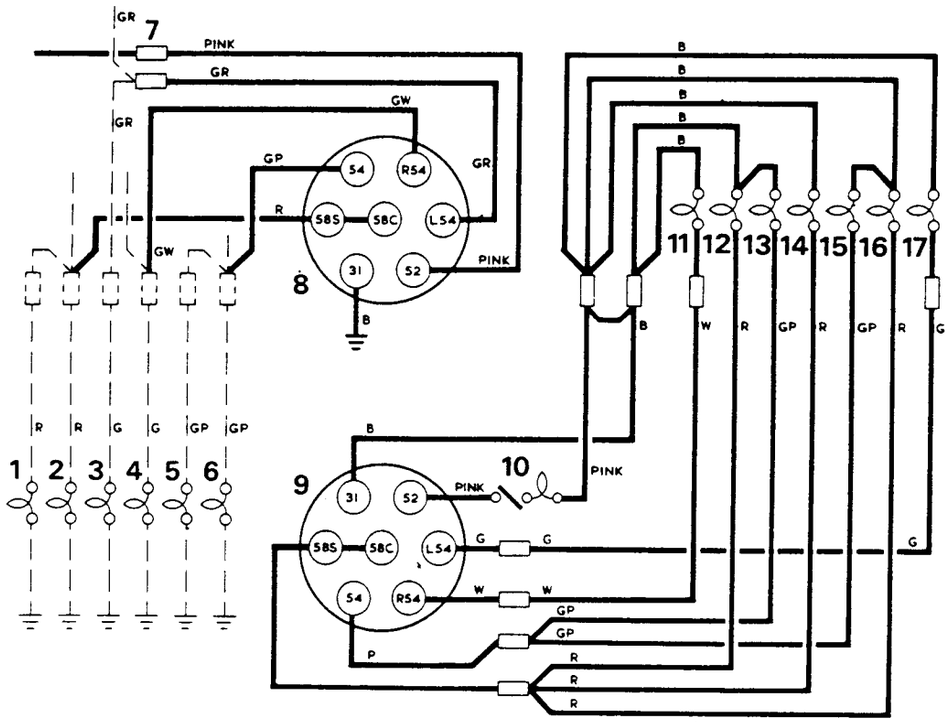
(4) Replace the fuse box cover.


STARTER MOTOR
22 12 VOLT BATTERY
LS18874
LS18875
KEY TO TERMINALS
SNAP CONNECTOR
MOULDED PLUG & SOCKET
EARTH CONNECTION (BOLTED)
EARTH CONNECTION (CABLE)
FXD CLINCH CONNECTOR
CABLE COLOUR CODE
B BLACK
U BLUE
N BROWN
Y YELLOW
G GREEN
P PURPLE
W WHITE
R RED
O ORANGE
L LIGHT
K PINK
S SLATE
U UNIPREN
STARTER RELAY
4 HORN
CIGAR LIGHTER
5 INSPECTION SOCKETS
6 SPEEDOMETER PANEL ILLUMINATION
7 GROUPED INSTRUMENT PANEL ILLUMINATION
9 L.H. TAIL LAMP
10 R.H. TAIL LAMP
11 L.H. SIDE LAMP
12 R.H. SIDE LAMP
13 L.H. HEAD LAMP DIP BEAM
14 R.H. HEADLAMP DIP BEAM
15 MAIN BEAM W/LT
16 L.H. HEADLAMP MAIN BEAM
17 R.H. HEADLAMP MAIN BEAM
3 HORN PUSH
ROOF LAMP
21 PANEL LT SWITCH
LIGHTING SWITCH 24
HEADLAMP 25
FLASH/DIP SWITCH
23 IGNITION SWITCH
FUSE UNIT 28
31 ALTERNATOR
37 IGNITION W/LT
33 COIL
44 DISTRIBUTOR
34 OIL PRESSURE W/LT
35 CHOKE W/LT
BRAKE W/LT
BRAKE CHECK RELAY
39 FUEL PUMP
OIL PRESSURE SWITCH
40 CHOKE SWITCH
SHUTTLE VALVE SWITCH
VACUUM LOSS SWITCH
36 10VOLT STABILISER UNIT
41 FUEL GAUGE
42 WATER TEMP GAUGE
45 OIL PRESSURE GAUGE
45 FUEL TANK UNIT
47 WATER TEMP TRANSMITTER
OIL PRESSURE TRANSMITTER
L.H. BLACKOUT LAMP REAR
R.H. BLACKOUT LAMP - REAR
L.H. BLACKOUT LAMP - FRONT
R.H. BLACKOUT LAMP - FRONT
TRAILER PLUG
BLACKOUT REAR LAMP
BLACKOUT STOP LAMP
BLANKING STOP LAMP
BLACKOUT SWITCH
STOP LAMP SWITCH 37
48 L.H. STOP LAMP
49 R.H. STOP LAMP
HAZARD UNIT
INDICATOR UNIT 29
HAZARD WARNING SWITCH
18 R.H. REAR INDICATOR
19 R.H. FRONT INDICATOR
20 L.H. FRONT INDICATOR
21 L.H. REAR INDICATOR
76 R.H. INDICATOR W/LT
27 L.H. INDICATOR W/LT
30 INDICATOR SWITCH
38 2 SPEED WIPER WASH SWITCH
43 SCREEN WIPER MOTOR
50 WASHER MOTOR
INHIBITOR SOCKET
REVERSE LT SWITCH
REVERSE LIGHT L.H.
REVERSE LIGHT R.H.

08.2

1. Starter motor
2. Solenoid, Starter motor
3. Switch for horns
4. Horn
5. Inspection sockets
6. Speedometer panel illumination
7. Grouped instrument panel illumination
8. Switch panel, lights
9. Tail lamp, LH
10. Tail lamp, RH
11. Side lamp, LH
12. Side lamp, RH
13. Headlamp, LH dipped beam
14. Headlamp, RH dipped beam
15. Warning light, headlamp main beam
16. Headlamp, LH main beam
17. Headlamp, RH main beam
18. Direction indicator lamp, rear RH
19. Direction indicator lamp, front RH
20. Direction indicator lamp, front LH
21. Direction indicator lamp, rear LH
22. Battery
23. Switch, ignition and starter
24. Switch, lights
25. Switch, headlamp flash and dip
26. Warning light, indicator RH
27. Warning light, indicator LH
28. Fuses, 1 to 4, 35 amp, blow, 17 A normal working
29. Indicator unit, flasher
30. Switch, direction indicators
31. Alternator, lucas 16 ACR
32. Warning light, ignition
33. Ignition coil
34. Warning light, oil pressure
35. Warning light, choke
36. Voltage stabiliser, fuel-, water-, and temperature gauge
37. Switch, stop lamp
38. Switch, windscreen wiper
39. Fuel pump
40. Switch, cold start, warning light
41. Fuel gauge
42. Water temperature gauge
43. Screenwiper motor
44. Distributor
45. Switch, oil pressure
46. Fuel tank unit
47. Water temperature transmitter unit
48. Stop lamp, LH
49. Stop lamp, RH
50. Screenwasher motor

KEY FOR VEHICLE WIRING DIAGRAM



CIRCUIT DIAGRAM, TRAILER LIGHTING, NEGATIVE EARTH

Vehicle

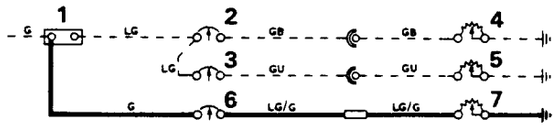
1. Tail lamp, R.H.
2. Tail lamp, L.H.
3. Flasher lamp, L.H.
4. Flasher lamp, R.H.
5. Stop lamp, R.H.
6. Stop lamp, L.H.
7. To fuse box
8. Socket on vehicle

Trailer

9. Socket on trailer
10. Interior lamp & switch
11. Flasher lamp, R.H.
12. Tail lamp, R.H.
13. Stop lamp, R.H.
14. Number-plate illumination
15. Stop lamp, L.H.
16. Tail lamp, L.H.
17. Flasher lamp, L.H.

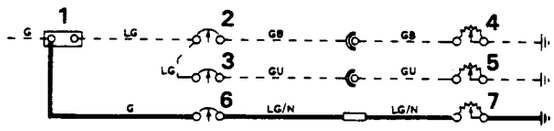
KEY TO CABLE COLOURS

B.	Black	P.	Purple
N.	Brown	V.	Blue
W.	White	R.	Red
G.	Green	L.	Light



Oil Temperature Gauge

1. Stabilizer unit
2. Fuel gauge
3. Water temperature gauge
4. Fuel tank unit
5. Water temperature transmitter
6. Oil temperature gauge
7. Oil temperature transmitter



Oil Pressure Gauge

1. Stabilizer unit
2. Fuel gauge
3. Water temperature gauge
4. Fuel tank unit
5. Water temperature transmitter
6. Oil pressure gauge
7. Oil pressure transducer

KEY TO CABLE COLOURS

B.	Black	P.	Purple
N.	Brown	U.	Blue
W.	White	R.	Red
G.	Green	L.	Light
S.	Slate		

SECTION CONTENTS LIST

SECTION P

WHEELS AND TYRES

SUB-SECTION P1

DESCRIPTION AND SPECIFICATIONS

DESCRIPTION OF THE WHEELS

1. Five wheels are provided, four in use and a spare wheel which is stored in the load area immediately behind the cab. The spare wheel may be fastened on top of the bonnet if additional load area space is required.

2. The two rear wheels are fitted with drums secured by the normal wheel nuts. These drums may be used with ropes to extract the vehicle from a bogged down situation. One end of the ropes is attached to some secure object on solid ground and the other end is secured in the slot in the drums. As the rear wheels rotate the ropes wind themselves round the drums and in doing so, pull the vehicle clear.

SPECIFICATIONS

3. The specification for the wheels and tyres is given in Table P1.1 while the tyre pressures are shown in Table P1.2.

TABLE P1.1 - WHEEL AND TYRE DATA

ITEM	DESCRIPTION
Wheels	5,50F x 16
Tyres	Cross ply 7,50 x 16
Wheel nut torque	100 to 115 N.m

TABLE P1.2 - TYRE PRESSURES

LOAD	PRESSURE kPa
Normal	
with load under 250 kg	
front	176
rear	176
with load over 250 kg	
front	176
rear	310
Minimum pressure in mud or sandy terrain	
with load under 250 kg	
front	110
rear	110
with load over 250 kg	
front	110
rear	179

SUB-SECTION P2

MAINTENANCE

TYRE WEAR EQUALISATION

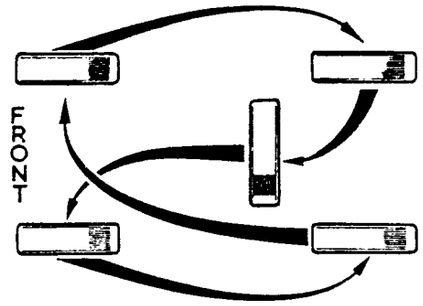


Fig P2.1

1. Refer to Fig P2.1. The road and spare wheels shall be changed round as illustrated to equalise tyre wear.

2. When cross country tyres are fitted the point of the V in the tread should be directed to the front at the top.

JACKING PROCEDURE

WARNING

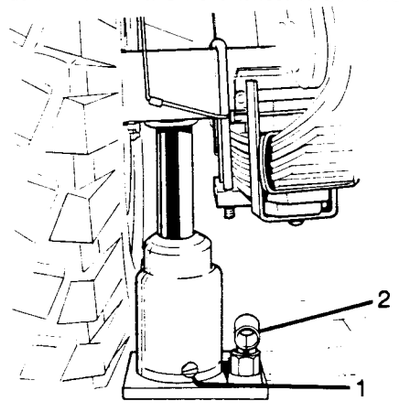
It is unsafe to work under the vehicle using only the jack to support it. Always use stands or other suitable supports to provide an adequate safety factor.

3. To jack up a wheel:

(1) Park the vehicle on level ground.

(2) Apply the handbrake and engage four wheel drive (yellow knob down). This ensures that the handbrake is operative on all four wheels.

(3) Loosen the nuts on the wheel to be removed.



(4) Refer to Fig P2.2. Place the jack beneath the axle tube on the corner of the wheel to be raised.

(5) Insert the jack rod on the jack release valve (1) and turn clockwise to close the valve.

(6) Fit the rod into the hydraulic pump socket (2).

(7) Pump the rod up and down to lift the vehicle.

(8) When the wheel is clear of the ground remove the wheel nuts and lift off the wheel.

(9) Fit the replacement wheel and tighten the nuts finger tight.

(10) Lower the wheel by inserting the jack rod on the release valve (1) and turning counterclockwise to open the valve.

(11) When the wheel is on the ground tighten the wheel nuts diagonally to a torque of between 100 and 115 N.m.

GENERAL

4. Examine the tyres at regular intervals for tread wear, cuts and abrasions. The tyre should be changed when the tread is less than 1 mm high over 75% of the surface. Cuts in the tyre side wall can be damgerous, resulting in a blow-out when least expected. Tyres with cuts should be changed as soon as possible.

5. Light abrasions are not necessarily serious enough to warrant changing the tyre. However, if the canvas is visible the tyre must be changed immediately.

6. Under- or over-inflation of the tyre can cause excesive tyre wear and damage. Always maintain correct tyre pressures.

SECTION CONTENTS LIST

SECTION V

WINDSCREEN WIPER AND WASHER SYSTEM

SUB-SECTION CONTENTS LIST

SUB-SECTION V1

DESCRIPTION AND SPECIFICATIONS

SUB-SECTION V1

CHAPTER 1

DESCRIPTION OF THE WINDSCREEN WASHER AND WIPER SYSTEM

WINDSCREEN WASHER

1. The fluid for washing the windscreen is contained in a reservoir on the left hand wing valance. A feed tube which passes through the reservoir cap is taken to the pump which is driven by a small electric motor. The pump sucks fluid from the reservoir and feeds it through tubes to two washer jets positioned below and in the centre of each half of the windscreen. The jets spray the fluid onto the windscreen.

2. The pump motor is controlled by a switch on the dash in the vehicle cab.

WINDSCREEN WIPERS

3. The wiper system consists of an electric motor located behind the facia on the left of the cab, and a step-down gearbox integral with the motor. The two wiper arms are connected to the motor through individual drive boxes and a flexible cable running in a sheath.

4. Control of the motor is by means of a switch on the right hand side of the dash in the cab.

SUB-SECTION V1

CHAPTER 2

SPECIFICATIONS

INTRODUCTION

1. General data for the windscreen wiper motor is given in Table V1.1. Torque specifications for the windscreen wiper and washer system are shown in Table V1.2.

TABLE V1.1 - GENERAL DATA, WINDSCREEN WIPER MOTOR

ITEM	DESCRIPTION
Make/type	Lucas 14 W, two speed
Armature end float	0,1 to 0,2 mm
Brush minimum length	4,8 mm
Brush spring tension	140 to 200 g
Resistance of armature winding at 16°C measured between adjacent commutator segments	0,23 to 0,35 ohms
Light running, rack disconnected:	
Current at 13,5 V	2,0 A
Speed 60 seconds from cold	60 to 70 r/min

TABLE V1.2 - TORQUE SPECIFICATIONS

ITEM	TORQUE (N.m)
Drive adaptor screws on wheel boxes	3,45
Windscreen wiper motor yoke fixing bolts	2,3

SUB-SECTION V2

FAULT DIAGNOSIS AND CORRECTIVE ACTION

INTRODUCTION

1. This Sub-section deals with fault diagnosis and corrective action required for the windscreen washer and wiper system. Table V2.1 below lists the symptoms, the probable cause and suggested remedies. Should a fault occur which is not listed the suspected component should be removed for inspection and/or overhaul.

TABLE V2.1 - WINDSCREEN WIPER AND WASHER SYSTEM FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
One wiper inoperative	Wheel box failure. Drive cable broken.	Replace wheelbox. Replace cable.
Both wipers inoperative	Drive cable broken. Motor failure. Electrical fault.	Replace cable. Replace motor. Check connections (see wiring diagram) and repair.
Smeared windscreen	Wiper blades worn.	Replace blades.
Washing fluid not available	Reservoir empty. Pump failure. Electrical fault. Tubes disconnected. Tubes blocked. Washer jets blocked.	Refill. Replace motor and pump. Check connections (see wiring diagram) and repair. Reconnect tubes. Replace tubes. Clean or replace jets.

SUB-SECTION CONTENTS LIST

SUB-SECTION V3

REMOVAL AND REPLACEMENT PROCEDURES

SUB-SECTION V3

CHAPTER 1

WASHER RESERVOIR - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the reservoir as follows:

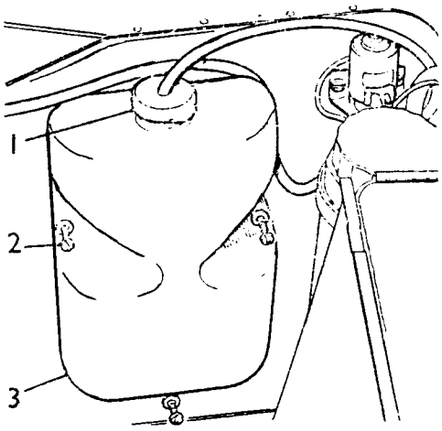


Fig V3.1

(1) Refer to Fig V3.1. Remove the reservoir filler cap (1) complete with suction tube and filter.

(2) Remove the three screws, washers and nuts (2) securing the reservoir to the wing valance.

(3) Remove the reservoir (3).

REPLACEMENT

2. To replace the reservoir:

(1) Fit the reservoir into position and secure with the three screws, nuts and washers.

(2) Replace the filter, suction tube and cap.

SUB-SECTION V3

CHAPTER 2

WASHER JETS - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the washer jets:

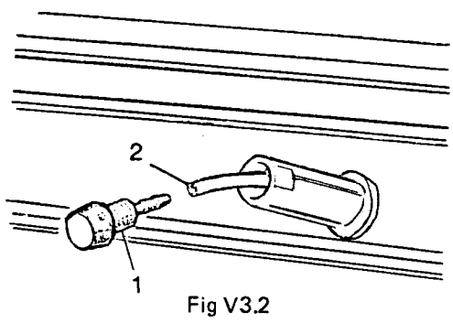


Fig V3.2

(1) Refer to Fig V3.2. Unscrew the washer jet (1).

(2) Withdraw the jet and washer tube from the jet holder.

(3) Detach the jet from the washer tube (2).

REPLACEMENT

2. Replace the jet as follows:

(1) Engage the jet in the washer tube.

(2) Wind the jet and tube counterclockwise approximately the number of turns required to secure the jet in the jet holder.

(3) Push the jet and tube into the jet holder and screw the jet into position. The washer tube will unwind to its normal free position.

CHAPTER 3

WASHER TUBES - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the washer tubes:

(1) Disconnect the battery.

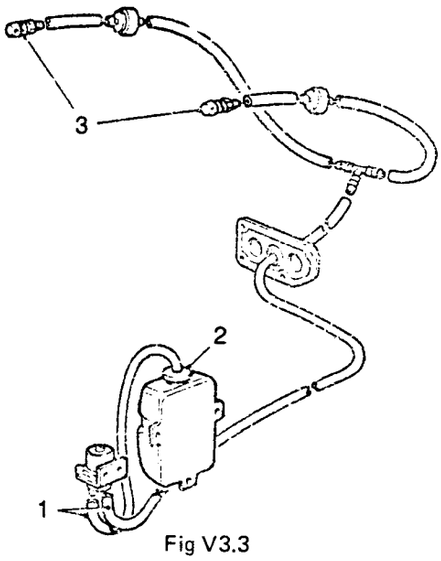


Fig V3.3

(2) Refer to Fig V3.3. Disconnect the washer tubes (1) from the washer pump.

(3) Remove the washer reservoir cap (2) and withdraw the pump inlet tube complete with filter.

(4) Release the delivery tube (pump to cab) from its retaining clips.

(5) Unscrew the windscreen washer jets (3) and remove the jets from the washer tubes.

(6) Ease back the panel tray trim edging from the top of the wiper motor cover.

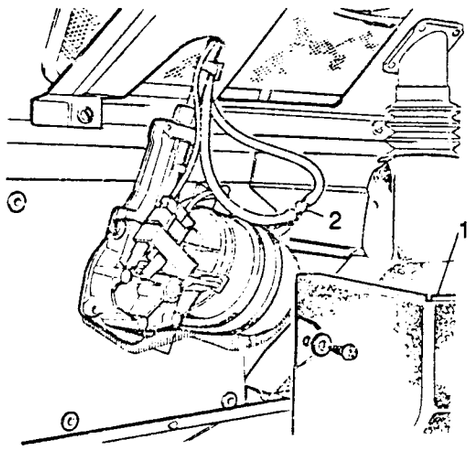


Fig V3.4

(7) Refer to Fig V3.4. Remove the screws securing the wiper motor cover and withdraw the cover (1).

(8) Remove the two screws securing the instrument panel and ease the panel towards the steering wheel.

(9) Release the demister tubes from the upper fascia vents.

(10) Remove the upper fascia.

(11) Remove the retaining clips from the washer tubes.

(12) Withdraw the washer tubes and their connecting T piece (2).

REPLACEMENT

2. Replace the washer tubes as follows:

(1) Fit the tubes into the T piece and position the tubes. Note that when threading the tube from the T piece to the washer pump through the bulkhead it will be found advantageous to unscrew the plate holding the washer tube grommet to the front of the bulkhead.

(2) Fit the retaining clips to the washer tubes.

(3) Replace the upper fascia.

(4) Connect the demister tubes to the upper fascia vents.

(5) Replace the cover over the wiper motor and reposition the panel tray trim edging.

(6) Replace the jets in the washer tubes (see Subsection V3, Chapter 2).

(7) Fit the delivery tube from the pump into its retaining clips.

(8) Replace the washer reservoir cap and filter.

(9) Reconnect the washer tubes to the pump.

(10) Refit the instrument panel into the dash.

(11) Reconnect the battery.

SUB-SECTION V3

CHAPTER 4

WASHER PUMP - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the pump as follows:

   (1) Disconnect the battery.

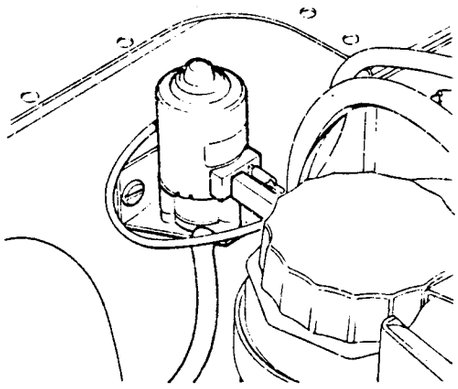


Fig V3.5

   (2) Refer to Fig V3.5. Disconnect the washer tubes from the washer pump. Note that the suction tube (washer reservoir tube) is fitted to the pump union adjacent to the radiator.

   (3) Detach the electrical feed wire and earth wire from the pump.

   (4) Remove the two bolts and washers securing the pump, pump bracket and earth wire to the wing valance.

   (5) Remove the pump, pump bracket and earth wire.

REPLACEMENT

2. To replace the pump:

   (1) Fit the pump, pump bracket and earth wire into position and secure to the wing valance with the two bolts and washers.

   (2) Reconnect the electrical feed wire and the earth wire.

   (3) Reconnect the washer tubes to the washer pump.

   (4) Reconnect the battery.

CHAPTER 5

WIPER ARMS - REMOVAL AND REPLACEMENT

REMOVAL

1. Remove the windscreen wiper arms as follows:

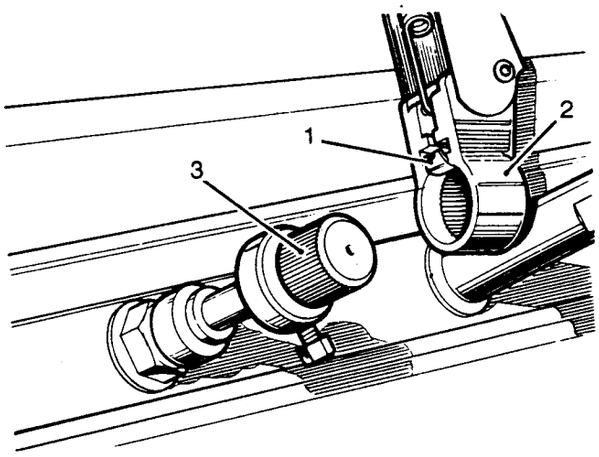


Fig V3.6

(1) Refer to Fig V3.6. Using a small screwdriver, hold back the spring clip (1) which retains the wiper arm on the spindle.

(2) Withdraw the wiper arm (2) from the spindle boss (3).

REPLACEMENT

2. To replace the wiper arm:

(1) Switch on the ignition. Switch the wipers on and off and allow the motor to move the boss to the 'park' position. Switch off the ignition.

(2) Push the arm onto the boss, locating it on the splines so that the wiper blade is just clear of the screen rail.

(3) Ensure that the spring retaining clip is located in the retaining groove on the boss.

CHAPTER 6

WIPER MOTOR AND DRIVE - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the motor and drive:

   (1) Disconnect the battery earth lead.

   (2) Remove the wiper arms (see Sub-section V3, Chapter 5).

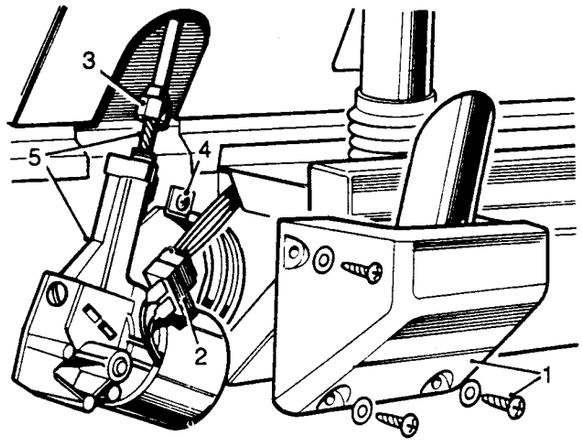


Fig V3.7

   (3) Refer to Fig V3.7. Remove the left hand end cover from the lower fascia (1).

   (4) Disconnect the electrical plug from the wiper motor (2).

   (5) Disconnect the drive cover tube (3) from the wiper motor.

   (6) Slacken the clamp (4) securing the wiper motor.

   (7) Remove the wiper motor, withdrawing the drive from the cover tube (5).

REPLACEMENT

2. Replace the motor and drive as follows:

   (1) Feed the drive through the cover tube. Rotating the wheel box spindle will assist in this operation.

   (2) Fit the motor into position and tighten the clamp (4).

   (3) Connect the drive cover tube (3) to the wiper motor.

   (4) Reconnect the electrical plug (2) to the motor.

   (5) Replace the end cover (1) on the lower fascia.

   (6) Replace the wiper arms (see Sub-section V3, Chapter 5).

   (7) Reconnect the battery earth lead.

SUB-SECTION V3

CHAPTER 7

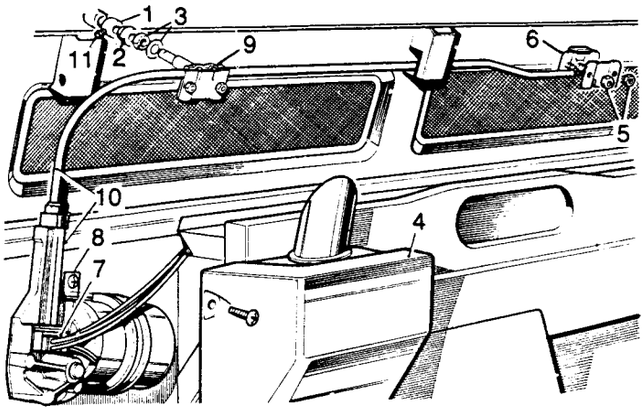
WIPER MOTOR, DRIVE AND WHEEL BOXES - REMOVAL AND REPLACEMENT

REMOVAL

1. To remove the drive and wheel boxes:

(1) Disconnect the battery earth lead.

(2) Remove the wiper arms (see Sub-section V3, Chapter 5).



(3) Refer to Fig V3.8. Loosen the screws (11) and remove the drive adaptor from the wheel box spindles (1).

(4) Withdraw the grommet (2) from the wheel box spindles.

(5) Remove the locknuts (3) from the wheel boxes.

(6) Remove the fascia top rail.

(7) Remove the fascia support panel.

(8) Remove the end cover (4) from lower fascia.

(9) Remove the backplate from the RH wheel box (5).

(10) Withdraw the RH wheel box (6).

(11) Disconnect the electrical plug (7) from the wiper motor.

(12) Slacken the clamp (8) securing the wiper motor.

(13) Withdraw the LH wheel box (9) clear of the dash.

(14) Withdraw the wiper motor complete with drive cable (10), LH wheel box and drive to the RH wheel box.

REPLACEMENT

2. Replace the drive and wheel boxes as follows: (Fig V3.8 still applies).

(1) Fit the motor, drive cable, LH wheel box and RH drive into position with the wheel box into dash.

(2) With the motor correctly positioned tighten the clamp screw (8).

(3) Reconnect the electrical plug to the wiper motor (7).

(4) Replace the RH wheel box (6) and backplate. Tighten the nuts (5).

(5) Refit the end cover (4) to the lower fascia.

(6) Replace the fascia support panel.

(7) Replace the fascia top rail.

(8) Refit the locknuts (3) to the wheel boxes and tighten.

(9) Fit the grommet (2) to the wheel box spindles.

(10) Replace the drive adaptor on the wheel box spindles and tighten the screws (11) to 3,45 N.m.

(11) Replace the wiper arms (see Sub-section V3, Chapter 5).

(12) Reconnect the battery earth lead.

SUB-SECTION V4

WINDSCREEN WIPER MOTOR - OVERHAUL

DISMANTLING

1. First remove the windscreen wiper motor and drive (see Sub-section V3, Chapter 6).

2. Dismantle the motor as follows:

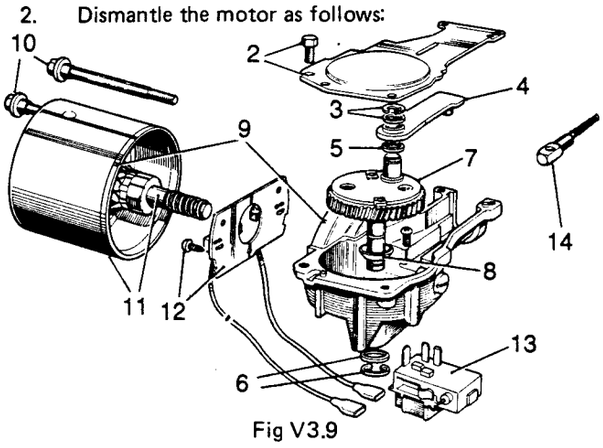


Fig V3.9

(1) Refer to Fig V3.9. Remove the gearbox cover (2).

(2) Remove the circlip and plain washer (3) securing the connecting rod.

(3) Withdraw the connecting rod (4).

(4) Withdraw the flat washer (5).

(5) Remove the circlip and washer (6) securing the shaft and gear.

(6) Clean any burrs from the gear shaft and withdraw the gear (7).

(7) Withdraw the dished washer (8).

(8) Add alignment to the yoke and gearbox for reassembly (9).

(9) Remove the yoke securing bolts (10).

(10) Withdraw the yoke and armature (11).

(11) Remove the brush gear assembly (12).

(12) Remove the limit switch (13).

INSPECTING

3. Inspect the following components:

(1) Check the brushes for excessive wear, if they are worn to 4,8 mm in length, fit a new brush gear assembly.

(2) Using a push type gauge, check that the brush spring pressure is 140 to 200 g when the bottom of the brush is level with the bottom of the slot in the brush box. Fit a new brush gear assembly if the springs are not satisfactory.

(3) Test the armature for insulation and open or short circuits. Use a test lamp (110 V, 15 W). Fit a new armature if faulty.

(4) Examine the gear wheel for damage or excessive wear.

REASSEMBLY

4. To reassemble the motor: (Fig V3.9 still applies).

(1) Refit the limit switch (13).

(2) Replace the brush gear assembly (12).

(3) Connect the leads between the motor and the limit switch: Blue lead to terminal 1, red lead to terminal 5.

(4) Use Shell Turbo 41 oil sparingly to lubricate the bearing bushes, armature shaft bearing journals, gear wheel shaft and wheel box spindles. Thoroughly soak the felt washer in the yoke bearing with oil.

(5) If a replacement armature is to be fitted, slacken the thrust screw (1) (See Fig V3.10), to provide end float for fitting the yoke.

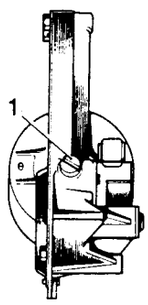


Fig. V3.10

(6) Fit the yoke and gearbox together aligning the marks made in Paragraph 2 step (8).

(7) Fit the yoke securing bolts (10) and tighten to 2,3 N.m.

(8) Set armature end float: Hold the yoke vertical with the adjuster screw (1) uppermost (See Fig V3.10). Carefully screw in the adjuster until resistance is felt. Screw back the adjuster one quarter turn. This gives the required end float.

(9) Fit the dished washer beneath the gear wheel with its concave side towards the gear wheel.

(10) Replace the gear (7) and secure with the circlip and washer (6).

(11) Use Ragosine Listate Grease to lubricate the gear wheel teeth, armature shaft worm gear, connecting rod and pin, cable rack and wheel box gear wheels.

(12) Replace the flat washer (5). Ensure that the larger of the two washers is fitted to the crank-pin beneath the connecting rod.

(13) Refit the connecting rod (4), fitting the pin underneath into the hole in the lug (14) on the operating cable. Hold in position and replace plain washer and circlip.

(14) Fit the gearbox cover and secure with the fixing screws (2).

SUB-SECTION V5

MAINTENANCE

INTRODUCTION

1. The windscreen washer and wiper system is relatively trouble free and requires little regular maintenance other than maintaining sufficient fluid in the reservoir and examining the wiper blades frequently for deterioration and damage. Efficient clearing of the windscreen is essential for safe driving so worn or damaged wipers should be replaced immediately a fault is detected.

FILLING WASHER RESERVOIR

2. The windscreen washer reservoir is located on the left hand front wing valance. To top up or fill the reservoir:

(1) Remove the reservoir cap.

(2) Fill the reservoir with clean water to within about 25 mm below the bottom of the filler neck.

(3) Use a windscreen washer solvent in the reservoir.

(4) In cold weather add Isopropyl Alcohol to prevent the water freezing.

SECTION CONTENTS LIST

SECTION Y

GENERAL FAULT FINDING

SECTION Y

CHAPTER 1

FAULT FINDING FOR SECTION B - ENGINE

INTRODUCTION

1. This Chapter deals with fault diagnosis and suggested action to cure a fault. Table Y1 gives a list of symptoms, the probable cause and necessary remedial action. The Table is not exhaustive and faults may occur which are not listed. In this case the suspected components should be removed for closer inspection and/or overhaul.

TABLE Y1 - ENGINE FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Engine fails to start	Incorrect starting procedure.	See instruction manual.
	Starter motor speed too slow.	Check battery and connections.
	Faulty ignition system.	Rectify or renew.
	Water or dirt in fuel system.	Rectify.
	Carburetter(s) flooding.	Rectify.
	Defective fuel pump system.	Rectify or renew.
	Defective starter motor.	Rectify or renew.
	Starter pinion not engaging.	Remove starter motor and investigate.
Engine stalls	Low idling speed.	Adjust carburetter.
	Faulty sparking plugs.	Clean and test, renew if necessary.
	Faulty coil or condenser.	Renew.
	Faulty distributor points.	Rectify or renew.
	Incorrect mixture.	Adjust carburetter.
	Foreign matter in fuel system.	Rectify.
Lack of power	Poor compression.	If the compression is appreciably less than the correct figure, the piston rings or valves are faulty. Low pressure in adjoining cylinders indicates a faulty cylinder head gasket.
	Badly seating valves.	Rectify or renew.
	Faulty exhaust silencer.	Renew.
	Incorrect ignition timing.	Rectify.
	Leaks or restrictions in fuel system.	Rectify.
	Faulty sparking plugs.	Rectify.
	Excessive carbon deposit.	Decarbonise.
	Brakes binding.	Rectify.
	Faulty coil, condenser or battery.	Rectify or renew.
Engine runs erractically	Faulty electrical connections.	Rectify.
	Defective sparking plugs.	Renew or rectify.
	Low battery charge.	Recharge battery.
	Defective distributor.	Rectify.
	Foreign matter in fuel system.	Rectify.
	Faulty fuel pump.	Renew.
	Sticking valves.	Rectify or renew.
	Defective valve springs.	Renew.
	Incorrect ignition timing.	Rectify.
	Worn valve guides or valves.	Renew.
	Faulty cylinder head gasket.	Renew.
	Damaged exhaust system.	Rectify or renew.
	Vacuum pipes disconnected at inlet manifold or distributor.	Refit pipes.

TABLE Y1 - ENGINE FAULT DIAGNOSIS CHART - Continued

SYMPTOM	POSSIBLE CAUSE	REMEDY
Engine starts, but stops immediately	Faulty electrical connections. Foreign matter in fuel system. Faulty fuel pump. Low fuel level in tank.	Check HT leads for cracked insulation: check low tension circuit. Rectify. Renew. Replenish.
Engine fails to idle	Incorrect carburetter setting. Faulty fuel pump. Sticking valves. Faulty cylinder head gasket(s).	Rectify. Renew. Rectify or renew. Renew.
Engine misfires on acceleration	Distributor points incorrectly set. Faulty coil or condenser. Faulty sparking plugs. Faulty carburetter. Vacuum pipes disconnected at inlet manifold.	Rectify. Renew. Rectify. Rectify or renew. Check all vacuum connections.
Engine backfires	Ignition defect. Carburetter defect. Sticking valve. Weak valve spring. Badly seating valves. Excessively worn valve stems and guides. Excessive carbon deposit. Incorrect sparking plug gap. Air leak in induction or exhaust systems.	Rectify. Rectify. Rectify. Renew. Rectify or renew. Renew. Decarbonise. Reset. Renew faulty gaskets or components.
Burned valves	Sticking valves. Weak valve springs. Excessive deposit on valve seats. Distorted valves. Excessive mileage between overhauls.	Rectify. Renew. Recut. Renew. Decarbonise.
Noisy valve mechanism	Worn or scored parts in valve operating mechanism. Valves and seats cut down excessively raising end of valve stem 1,27 mm (0.050 in) above normal position. Sticking valves. Weak valve springs. Worn timing chain or chainwheels.	Replace faulty parts. Grind off end of valve stem or replace parts. Rectify. Renew. Renew worn parts.
Main bearing rattle.	Low oil level. Low oil pressure. Excessive bearing clearance. Burnt-out bearings. Loose bearing caps.	Replenish as necessary. See next symptom. Renew bearings; grind crankshaft. Renew. Tighten.
Low oil pressure warning light remains on, engine running	Thin or diluted oil. Low oil level. Choked pump strainer. Faulty release valve. Excessive bearing clearance. Oil pressure switch unserviceable. Electrical fault. Relief valve plunger sticking. Weak relief valve spring. Pump rotors excessively worn. Excessively worn bearings; main, connecting rod, big end, camshaft etc.	Drain and refill with correct oil. Replenish. Clean. Rectify. Rectify. Renew. Check circuit. Remove and ascertain cause. Renew. Renew. Ascertain which bearings and rectify.

TABLE Y1 - ENGINE FAULT DIAGNOSIS CHART - Continued

SYMPTOM	POSSIBLE CAUSE	REMEDY
Rattle in lubrication system.	Oil pressure relief valve plunger sticking.	Remove and clean.
Engine overheating	Low coolant level. Faulty cooling system. Faulty thermostat. Incorrect timing. Defective lubrication system.	Check for leaks. Rectify. Renew. Rectify. Rectify.

TABLE Y2 - FUEL SYSTEM FAULT DIAGNOSIS CHART - Continued

SYMPTOM	POSSIBLE CAUSE	REMEDY
	Water in fuel.	If water is present in float chamber, the complete fuel system should be drained, fuel components should be dismantled, inspected for contamination, paying particular attention to filters.
Erratic slow-running or stalling	Float level too low. Incorrect jet setting. Carburetter air leaks. Manifold air leaks.	Check float chamber level. Check for needle valve sticking. Check and reset jet settings in accordance with carburetter overhaul instructions. Check throttle spindle and bearings for wear. Check inlet manifold gasket for leakage. Check inlet manifold for cracks and distortion of mating faces. Check gasket between carburetter and manifold. Check condition of vacuum servo pipes and connections.
Excessive fuel consumption	Blocked air cleaner. Damper oil too thick. Incorrectly adjusted carburetter. Float level too high. Worn jets and needle. Incorrect needle. Choke sticking 'on'. Engine fault.	Fit new air cleaner elements. Replace with correct grade. Check and reset slow-running in accordance with carburetter tune and adjust instructions. Check and reset float level. Check and replace as necessary. Check needle type. Check to ensure choke is returning to fully 'off' position, reset as necessary. See engine fault diagnosis.

SECTION Y

CHAPTER 3.

FAULT FINDING FOR SECTION D - IGNITION SYSTEM

INTRODUCTION

1. Fault diagnosis and suggested action to cure a fault on the ignition system is covered in this Chapter. Table Y3 gives a list of symptoms, the probable cause and the necessary remedial action. The Table is not exhaustive and faults may occur which are not listed. In this case the suspected components should be removed for closer inspection or overhaul.

TABLE Y3 - IGNITION SYSTEM FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Engine will not fire	Battery discharged.	Recharge battery.
	Distributor contact points dirty, pitted or maladjusted.	Clean and reset points.
	Distributor cap dirty, cracked or tracking.	Clean and replace cap.
	Carbon brush inside distributor cap not touching rotor.	Replace brush.
	Faulty cable or loose connection in low tension circuit.	Check and remedy.
	Distributor rotor arm cracked.	Replace rotor arm.
	Faulty coil.	Replace coil.
	Broken contact breaker spring.	Replace springset.
	Contact points stuck open.	Replace springset.
Engine misfires	Weak contact breaker spring.	Replace spring.
	High tension plug and coil leads cracked or perished.	Replace leads.
	Spark plug(s) loose.	Tighten plugs.
	Spark plug insulation cracked.	Replace plug.
	Spark plug gap incorrectly set.	Reset gaps.
	Ignition timing too far advanced.	Reset ignition timing.

SECTION Y

CHAPTER 4

FAULT FINDING FOR SECTION E - COOLING SYSTEM

INTRODUCTION

1. This Chapter deals with fault diagnosis and suggested action to cure a fault. Table Y4 gives a list of symptoms, the probable cause and necessary remedial action. The Table is not exhaustive and faults may occur which are not listed. In this case the suspected components should be removed for closer inspection and/or overhaul.

TABLE Y4 - COOLING SYSTEM FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
External leakage.	Loose hose clips. Defective rubber hose. Damaged radiator seams. Excessive wear in the water pump. Loose core plugs. Damaged gaskets. Leaks at the heater connections or plugs. Leak at the water temperature gauge plug.	Tighten. Renew. Rectify. Renew. Renew. Renew. Rectify. Tighten.
Internal leakage	Defective cylinder head gasket. Cracked cylinder wall. Loose cylinder head bolts.	Renew. Check engine oil for contamination and refill as necessary. Renew cylinder block. Tighten. Check engine for oil contamination and refill as necessary.
Water loss	Boiling. Internal or external leakage. Restricted radiator or inoperative thermostat.	Ascertain the cause of engine overheating and correct as necessary. SEE ABOVE. Flush radiator or renew the thermostat as necessary.
Poor circulation	Restriction in system. Insufficient coolant. Inoperative water pump. Loose fan belt. Inoperative thermostat.	Check hoses for crimps, reverse flush the radiator, and clear the system of rust or sludge. Replenish. Renew. Adjust. Renew.
Corrosion	Excessive impurity in the water. Infrequent flushing and draining of system. Incorrect anti-freeze mixtures.	Use only soft, clean water together with correct anti-freeze or inhibitor mixture. The cooling system should be drained and flushed thoroughly at least once a year. Certain anti-freeze solutions have a corrosive effect on parts of the cooling system. Only recommended solutions should be used.

TABLE Y4 - COOLING SYSTEM FAULT DIAGNOSIS CHART - Continued

SYMPTOM	POSSIBLE CAUSE	REMEDY
Overheating	Poor circulation.	SEE ABOVE.
	Dirty oil and sludge in engine.	Refill.
	Radiator fins choked with chaff, mud, etc.	Use air pressure from the engine side of the radiator and clean out passages thoroughly.
	Incorrect ignition timing.	Rectify.
	Insufficient coolant.	See item D.
	Low oil level.	Replenish.
	Tight engine.	New engines are very tight during the 'running-in' period and moderate speeds should be maintained for the first 1 000 miles (1 500 km).
	Choked or damaged exhaust pipe or silencer.	Rectify or renew.
	Dragging brakes.	Adjust brakes.
	Overloading vehicle.	In the hands of the operator.
	Driving in heavy sand or mud.	In the hands of the operator.
	Engine labouring on gradients.	In the hands of the operator.
	Low gear work.	In the hands of the operator.
	Excessive engine idling.	In the hands of the operator.
	Inaccurate temperature gauge.	Renew.
	Defective thermostat.	Renew.
Overcooling	Defective thermostat.	Renew.
	Inaccurate temperature gauge.	Renew.

SECTION Y

CHAPTER 5

FAULT FINDING FOR SECTION F - EXHAUST SYSTEM

INTRODUCTION

1. This Chapter covers exhaust system faults. Table Y5 gives a list of symptoms, the possible cause of the fault and the suggested remedial action. The table is not exhaustive and faults may occur which are not listed. Should such a fault be found the suspected components should be removed for a closer inspection.

TABLE Y5 - EXHAUST SYSTEM FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Leaking exhaust gas	Exhaust couplings misaligned. Holes in exhaust system.	Realign couplings. Replace damaged components.
Engine overheating	Silencer or expansion box blocked. Tail pipe blocked (flattened).	Repair or replace component. Remove blockage or replace tail pipe.
Engine lacks power or stalls	Silencer or expansion box blocked. Tail pipe blocked.	Repair or replace component. Remove blockage or replace tail pipe.

SECTION Y

CHAPTER 6

FAULT FINDING FOR SUB-SECTION H1 - GEARBOX

INTRODUCTION

1. This Chapter deals with fault diagnosis and corrective action for the wheel brake system. In Table Y6, a list of symptoms, the probable cause and the necessary action is given. It should be noted that the Table is not exhaustive and faults may occur which are not listed. Should the Table fail to give an indication of a fault, the suspected components should be removed for closer inspection and/or overhaul.

TABLE Y6 - GEARBOX FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Gearbox noisy in neutral	Insufficient oil in gearbox. Incorrect grade of oil. Primary pinion bearing worn. Constant mesh gears worn. Layshaft bearings worn.	Top up as necessary. Drain and replenish. Renew bearing. Renew primary pinion and layshaft. Renew bearings.
Gearbox noisy in all gears except top	Layshaft, mainshaft or primary pinion bearings worn. Constant mesh gears worn.	Renew bearings. Renew primary pinion and layshaft.
Gearbox noisy in one gear only	Worn or damaged gears or bearings.	Renew gears and/or bearings.
Gearbox noisy in all gears	Worn bearings on primary pinion, mainshaft or layshaft.	Renew bearings.
Oil leaks from gearbox	Gearbox over-filled with lubricating oil. Loose or damaged drain or level plugs. Obstructed breather. Joint washer damaged, incorrectly fitted or missing. Oil seals damaged or incorrectly fitted. Cracked or broken gearbox casings.	Rectify oil level with vehicle standing on level floor. Tighten plugs. If damaged, fit new plugs and joint washer as required. Clean breather. Fit new joint washer with general purpose grease smeared on both sides. Fit new oil seal with 'Hylomar' SQ32M sealing compound smeared on the outside diameter. Fit new casings.
Difficulty in engaging forward gears	Weak springs or worn parts in synchromesh units. Worn selector forks and/or interlock pins. Faulty clutch operation; clutch fluid leakage.	Renew faulty parts. Renew components as necessary. Check clutch master and slave cylinders. Renew clutch components as necessary.
Difficulty in engaging reverse gear	Reverse gear bearings worn or damaged. Faulty clutch operation, clutch fluid leakage.	Renew bearings and shaft as necessary. Check clutch master and slave cylinders. Renew clutch components as necessary.

TABLE Y6 - GEARBOX FAULT DIAGNOSIS CHART - Continued

SYMPTOM	POSSIBLE CAUSE	REMEDY
Difficulty in disengaging forward gears	Synchromesh cones worn; damaged gear dogs. Distorted or damaged splines.	Renew faulty parts. Renew components as necessary.
Difficulty in disengaging reverse gear	Reverse gear seized on shaft.	Renew parts as necessary.
Gear lever going into reverse too easily and not into first	Weak reverse stop hinge plate spring.	Renew the spring.
Transfer of oil between main gearbox and transfer gearbox	Faulty O-ring seal on reverse idler shaft. Faulty mainshaft oil seal. Obstructed main gearbox breather.	Renew seal. Renew seal. Clean breather.
Oil leakage from gearbox to bell housing	Faulty joint washer/s on gearbox front cover and oil pump. Faulty oil seal, primary pinion to front cover. Damaged or porous gearbox front cover.	Renew joint washer/s. Renew oil seal. Renew front cover.
Transfer gearbox noisy	Insufficient oil in transfer box. Incorrect grade of lubricating oil. Excessive end float on intermediate gears assembly. Worn components in gearbox differential unit. Worn bearings in intermediate gears assembly.	Replenish. Drain and replenish with the correct grade oil. Adjust as required. Renew components. Renew bearings.

SECTION Y

CHAPTER 7

FAULT FINDING FOR SUB-SECTION H2 - TRANSFER BOX

INTRODUCTION

1. Faults on the transfer box are dealt with in this Chapter. In Table Y7 a list of symptoms, probable causes and the necessary remedia are given. It should be noted that the Table is not exhaustive and that faults may occur which are not listed. Should the fault not be found by consulting the Table the transfer box should be overhauled.

TABLE Y7 - TRANSFER BOX FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Noisy transfer box	Excessive end float of intermediate gear. End float on output shaft incorrect. Worn bearings. Low oil level.	Overhaul transfer box. Overhaul transfer box. Replace bearings. Fill transfer box to correct level.
Jumping out of high transfer	Selector spring weak.	Replace spring.
Jumping out of low transfer	Transfer fork assembled wrongly. Excessive end float of intermediate gear. Selector spring weak.	Overhaul transfer box. Overhaul transfer box. Replace spring.
Four-wheel drive will not engage	Return spring below yellow knob wrongly adjusted. Shafts sticking in casing.	Correct the adjustment. Overhaul transfer box.

SECTION Y

CHAPTER 8

FAULT FINDING FOR SUB-SECTION H3 - CLUTCH

INTRODUCTION

1. This Chapter deals with fault diagnosis and corrective action on the clutch system. In Table Y8 a list of symptoms, the probable causes and the necessary remedies are set out. If a fault is suspected, the list of symptoms should be consulted. It should be noted that the Table is not exhaustive and faults may occur which are not listed. Should the Table fail to reveal the fault, the suspected component(s) should be removed for closer inspection and/or overhaul.

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

TABLE Y8 - CLUTCH FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Gear grating and difficult shifting	Lack of clutch pedal reserve total travel. Air in clutch hydraulic system. Lost motion in clutch release fork at pivot point. Cracked release fork. Leaking master or slave cylinder. Excessive idle speed. Clutch binding on input shaft. Excessive clutch plate runout. Oil or grease on clutch lining. Loose linings on clutch plate. Clutch housing or gearbox misaligned.	Check clutch mechanism adjustment. Bleed system. Replace damaged or worn parts. Replace defective part. Repair or replace defective parts. Adjust engine idle rev/min. Check for burrs on splines of clutch and input shaft, remove burrs or replace defective parts. Replace clutch plate. Replace clutch plate and check for leaks on engine, gearbox or release bearing. Replace clutch plate. Check alignment of clutch housing and gearbox.
Clutch slipping	Incorrect adjustment of clutch release mechanism. Worn clutch lining. Damaged or contaminated clutch lining (oil, grease).	Check clutch mechanism adjustment. Replace clutch plate. Replace clutch plate.
Clutch judder	Damaged or contaminated clutch lining. Clutch housing or gearbox misaligned. Driven plate not parallel to flywheel face. Loose, broken or worn engine mountings.	Replace clutch plate. Check alignment of clutch housing and gearbox. Replace driven plate. Tighten or replace engine mountings.
Clutch rattle	Damaged clutch plate. Worn splines. Worn gearbox bearings. Excessive backlash in gearbox.	Replace clutch plate. Replace defective parts. Overhaul gearbox. Overhaul gearbox.

TABLE Y8 - CLUTCH FAULT DIAGNOSIS CHART - Continued

SYMPTOM	POSSIBLE CAUSE	REMEDY
Fractured clutch	Clutch housing or gearbox mis-aligned. Clutch centre bent during assembly.	Check alignment of clutch housing and gearbox. Fit new clutch plate taking care during assembly.
Abnormal clutch wear	Overloading vehicle (slipping clutch during pull-off). Too high a gear ratio used when pulling off. Pedal mechanism incorrectly adjusted.	Do not overload vehicle. Educate driver. Check pedal free play and travel.
Clutch grabbing	Dry or rusted spigot shaft spline. Rusted flywheel.	Clean and lubricate with dry graphite based lubricant. Release clutch very slowly until grabbing stops, if it persists, the rust is severe and cleaning after removal of the gearbox and driven plate will be necessary.

SECTION Y

CHAPTER 9

FAULT FINDING FOR SUB-SECTION H4 - PROPELLER SHAFTS

INTRODUCTION

1. This Chapter deals with fault diagnosis and suggested action to cure a fault. Table Y9 gives a list of symptoms, the probable cause and necessary remedial action. The Table is not exhaustive and faults may occur which are not listed. In this case the suspected components should be removed for closer inspection and/or overhaul.

TABLE Y9 - PROPELLER SHAFTS FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Vibrating propeller shaft	Fixings loose. Incorrectly assembled propeller shaft. Worn needle roller bearings. Worn splines. Shaft out of balance.	Tighten the fixings evenly and securely. Reassemble propeller shaft correctly aligned. Fit new bearings. Fit new propeller shaft complete. Fit new propeller shaft complete.
Noisy universal joints	Lack of lubrication. Fixing loose. Worn needle roller bearings. Worn splines.	Lubricate propeller shaft. Tighten the fixings evenly and securely. Fit new bearings. Fit new propeller shaft complete.

SECTION Y

CHAPTER 10

FAULT FINDING FOR SECTION I - SUSPENSION

INTRODUCTION

1. This Chapter deals with fault diagnosis and the corrective action required for the suspension. In Table Y10, a list of symptoms, the probable cause and the necessary remedies are given. If a fault is suspected, the faults listed in the accompanying Table should be consulted. It should be remembered that the Table is not exhaustive and, therefore, faults may occur which are not listed. Should this fail to reveal the fault, remove the suspect component/s for a closer inspection and/or overhaul of components.

TABLE Y10 - SUSPENSION FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Vehicle leaning to one side	Broken main leaf spring. Spring/s sagged (collapsed). Heavy load not centralised on load body.	Replace leaf spring. Replace complete spring/s. Educate loading personnel.
Poor directional (stability) control	Leaf clip bolts loose. Shock absorber/s leaking. Shock absorber mounting bracket broken. Broken centre bolt/s.	Replace worn or damaged bolts then torque tighten the bolts. Replace shock absorber/s. Replace mounting bracket. Replace centre bolt/s.
Bumpy (harsh) ride	Shock absorber seized or bent. Vehicle overloaded. Spring sagged (collapsed).	Replace shock absorber. Educate loading personnel. Replace complete spring.
Vehicle leaning excessively during cornering	Spring/s sagged (collapsed). Vehicle overloaded.	Replace complete spring/s. Educate loading personnel.

SECTION Y

CHAPTER 11

FAULT FINDING FOR SUB-SECTION J1 - AXLES AND HUBS

INTRODUCTION

1. This Chapter deals with fault diagnosis and the corrective action required for the driven front axle. In Table Y11, a list of symptoms the probable cause and the necessary remedies are given. If a fault is suspected, the faults listed in the accompanying Table should be consulted. It should be remembered that the Table is not exhaustive and, therefore, faults may occur which are not listed. Should this fail to reveal the fault, remove the suspect component/s for a closer inspection and/or overhaul of components.

TABLE Y11 - DRIVEN FRONT AXLE FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Noisy axle (hub)	Shaft bearings damaged or worn. Damaged or worn wheel bearings. Insufficient grease in hub. Loose wheel bearings.	Replace. Replace. Clean and regrease. Adjust.
Hub overheating	Insufficient grease in hub. Wheel bearings too tight.	Clean and regrease. Adjust.
Hub leaking grease	Inner or outer seals worn or damaged.	Replace.
Steering effort excessive	Seized or damaged swivel pin needle bearings. Lack of lubrication.	Overhaul the swivel pin assemblies. Lubricate with grease and check the steering effort.
Axle leaking oil	Shaft axle seal worn or damaged.	Replace.

SECTION Y

CHAPTER 12

FAULT FINDING FOR SUB-SECTION J2 - DIFFERENTIALS

INTRODUCTION

1. This Chapter deals with fault diagnosis and the corrective action, required for the differential unit. In Table Y12, a list of symptoms, the probable cause and the necessary remedies are given. If a fault is suspected, the faults listed in the accompanying table should be consulted. It should be remembered that the Table is not exhaustive and therefore faults may occur which are not listed. Should this fail to reveal the fault, remove the suspect component/s for a closer inspection and/or overhaul of component.

TABLE Y12 - DIFFERENTIAL FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Pinion seal oil leak	High oil level. Damaged or worn seal.	Drain oil to correct level. Replace.
Differential/housing oil leak	Securing screws loose. Insufficient sealant on screws. Mating surfaces damaged. O-ring collapsed/distorted.	Re-torque screws. Replace screws with new sealant. Repair. Replace with new O-ring.
Differential whine	Incorrect tooth contact pattern.	Re-adjust or overhaul.
Differential noisy	Damaged or worn carrier bearing/s. Damaged or worn crownwheel or pinion teeth.	Overhaul complete differential. Overhaul complete differential.
Axle clonk	Excessive backlash between crownwheel and pinion. Excessive backlash between spider gears.	Re-adjust or overhaul. Replace thrust washers or overhaul.
Differential overheating	Too high or too low oil level.	Replenish to correct level.

SECTION Y

CHAPTER 13

FAULT FINDING FOR SUB-SECTION K1 - BRAKING SYSTEM

INTRODUCTION

1. This Chapter deals with fault diagnosis and corrective action for the wheel brake system. In Table Y13, a list of symptoms, the probable cause and the necessary remedial action is given. It should be noted that the Table is not exhaustive and faults may occur which are not listed. Should the Table fail to give an indication of a fault, the suspected component/s should be removed for closer inspection and/or overhaul.

TABLE Y13 - WHEEL BRAKE FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Spongy pedal action	Air in system. Swollen rubber components (use of incorrect fluid). Incorrect brake shoe adjustment.	Bleed system. Replace swollen components, clean and refill with correct fluid. Adjust shoes.
Loss of pedal pressure	Leak in hydraulic system.	Trace and repair leak.
Hard brake pedal	Incorrect grade of lining. Restriction in master cylinder. Incorrect shoe adjustment.	Reline with correct grade lining. Overhaul cylinder. Adjust shoes.
Poor brakes	Water-soaked linings. Incorrect or glazed linings. Incorrect shoe adjustment. Incorrect master cylinder adjustment.	Dry out linings. Reline with correct grade lining. Adjust shoes. Overhaul master cylinder.
Grabbing brakes	Grease oil or fluid-soaked linings. Scored or cracked drum. Incorrect shoe adjustment.	Reline. Skim or replace drum. Adjust shoes.
Squealing brakes	Incorrect linings. Distorted brake drum. Bent anchor plate. Damaged brake shoe. Dust in drums. Shoes binding on the steady posts. Loose wheel cylinder.	Replace linings with correct grade. Skim or replace drum. Replace anchor plate. Replace shoes. Clean out dust. Overhaul brake. Tighten cylinder.
Brakes drag	Incorrect shoe adjustment. Distorted rubber boots. Seized shoe. Weak pull-off springs. Loose wheel bearings. Restriction in brake pipe. Distorted drum.	Readjust shoes. Replace boots. Overhaul brakes. Replace springs. Overhaul hub. Trace and clear. Skim or replace drum.
Brake warning lamp lights		SEE NEXT PAGE

NOTE
The brake drums may be skimmed to not greater than 0,75 mm oversize.

BRAKE WARNING LIGHT INDICATIONS

DIAGNOSIS - GENERAL

1. When the brake warning light comes on during normal operation it indicates an incipient failure of the road wheel braking system. The vehicle should be driven very carefully to a workshop or towed if there is a complete brake failure and the following checks made.

2. Note that the warning indicator switches are normally open circuit. When the switches are closed as a result of fault conditions they short the circuit to earth to illuminate the brake warning light.

SERVO VACUUM SWITCH

3. Make the following checks:

(1) Ensure that a vacuum is available at the switch by checking the hose connections for soundness.

(2) Run the engine for a short period and obtain overrun conditions, that is, open the throttle and then allow it to close quickly.

(3) If the brake warning light stays on disconnect the electrical leads at the vacuum switch and connect them together using a male Lucar connector blade.

(4) If the light is extinguished either the vacuum switch or the servo assembly is faulty. First replace the switch and recheck. If the fault persists change the servo assembly.

(5) If the warning light remains on in step (3) leave the leads connected together and go to the next switch in the circuit.

BRAKE FAILURE SWITCH

4. Check as follows:

(1) Disconnect the switch leads and interconnect them to remake the circuit.

(2) If the brake warning light is extinguished, check for hydraulic system leakage which would cause the differential switch to displace to one end.

(3) Once the fault has been rectified centralise the switch plunger as follows:

i. Set up to bleed a brake line in the system that was not faulty.

ii. Press the brake pedal using very slow pedal travel, observing the brake warning light at the same time.

iii. Immediately the warning light is extinguished keep a light pressure only on the brake pedal and close off the bleed nipple.

(4) If the brake warning light remains on in step (1), check the final switch in the circuit.

STOP LAMP SWITCH

5. This switch lights the stop lights. To check the switch:

(1) Press the brake pedal. If it moves 110 mm the brake stop lights should come on and indicate that the switch is working correctly.

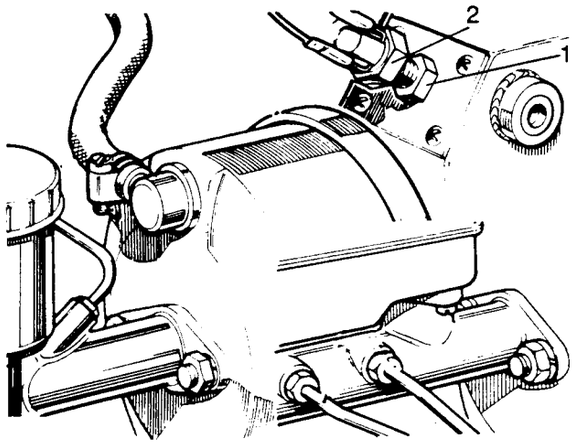


Fig K1.2

(2) Refer to Fig K1.2. If the brake stop lights do not come on after 19 to 25 mm of brake pedal travel, reset the switch by loosening the locknut (1) and screwing the switch (2) out until the correct travel is achieved.

(3) If the stop lights still do not come on after resetting to 19 to 25 mm of pedal travel, either the switch or the electrical circuit may be faulty. Check and rectify the fault or replace the switch.

SECTION Y

CHAPTER 14

FAULT FINDING FOR SUB-SECTION K2 - TRANSMISSION BRAKE

INTRODUCTION

1. This Chapter covers fault diagnosis and corrective action for the transmission brake. In Table Y14 a list of symptoms, the probable cause and the recommended action is given. The Table is not exhaustive and faults may occur which are not listed. Should the Table not indicate the fault, the suspected components should be removed for closer inspection and/or overhaul.

TABLE Y14 - TRANSMISSION BRAKE FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Brake not holding	Water soaked linings. Incorrect or glazed linings. Incorrect shoe adjustment. Incorrect brake lever adjustment.	Dry out. Replace linings. Adjust brake. Adjust lever.
Brake drags	Incorrect shoe adjustment. Seized shoe. Weak pull-off springs. Distorted drum. Scored or cracked drum.	Readjust shoes. Overhaul brake. Overhaul brake. Skim or replace drum. Replace drum.
NOTE The brake drum may be skimmed to a maximum of 0,75 mm oversize.		

SECTION Y

CHAPTER 15.

FAULT FINDING FOR SECTION L - STEERING SYSTEM

INTRODUCTION

1. This Chapter deals with fault diagnosis and corrective action required for the steering system. In Table Y15, a list of symptoms, the probable cause and the necessary remedies are given. If a fault is suspected, the faults listed in the Table should be consulted. It should be remembered that the Table is not exhaustive and faults may occur which are not listed. Should the Table fail to reveal the fault the suspected component(s) should be removed for a closer inspection and/or overhaul.

TABLE Y15 - STEERING SYSTEM FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Backlash in steering	Worn or badly adjusted rocker shaft. Worn or loose linkage. Worn swivel hub assembly. Worn or loose front wheel bearings. Steering box loose on chassis.	Replace rocker shaft. Tighten or replace. Overhaul swivel pin housing. Tighten or replace bearings. Tighten box.
Tight steering	Low or unequal tyre pressures. Steering box oil level low. Rocker shaft adjusted too tightly. Inner column binding. Seized ball joint. Relay unit damaged or oil level low.	Check pressures and adjust. Replenish to correct level. Readjust rocker shaft. Clean and lubricate. Replace ball joint. Replenish oil or overhaul relay unit.
Rattle in steering column	Rocker shaft worn or badly adjusted.	Check rocker shaft and replace or readjust.

SECTION Y

CHAPTER 16

FAULT FINDING FOR SECTION N - HEATING AND VENTILATION

INTRODUCTION

1. This Chapter deals with fault diagnosis and corrective action for the heating and ventilation system. Table Y16 lists symptoms, probable causes and suggested remedial action in the event of a system fault developing. The Table is not exhaustive and should a fault occur which is not listed, the suspected component/s should be removed for closer examination.

TABLE Y16 - HEATING AND VENTILATION FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Inefficient or no heating or demisting	Water valve cable broken. Water valve inoperative. Hot water pipes blocked.	Replace cable. Replace valve. Replace pipes.
Fan not turning	Electrical fault. Fan faulty.	Check circuit and repair. Replace fan.
System will not switch on (or off)	Cable disconnected or broken.	Reconnect or replace cable.

SECTION Y

CHAPTER 17.

FAULT FINDING FOR SECTION O - ELECTRICAL SYSTEM

INTRODUCTION

1. This Chapter deals with fault diagnosis and the corrective action required for the electrical system. In the Table below a list of symptoms, the probable cause and the suggested remedies are shown. The Table is not exhaustive and does not indicate faulty bulbs. Should a fault occur in a circuit containing a bulb the first action should be to check the bulb by replacement. If the fault is still present, check wiring and connections between the lamp and the switch or battery.

2. Each of the four fuses protects several circuits, thus if more than one bulb fails, the fuses should be checked first.

TABLE Y17 - ELECTRICAL SYSTEM FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
Battery in low state of charge	Broken or loose connection in alternator circuit.	Examine the charging and field circuit wiring. Tighten any loose connections and renew any broken leads. Examine the battery connection.
	Current voltage regulator not functioning correctly.	Adjust or renew.
	Slip rings greasy or dirty.	Clean.
	Brushes worn not fitted correctly or wrong type.	Renew.
Battery overcharging, leading to burnt-out bulbs and frequent need for topping-up	Current voltage regulator not functioning correctly.	Renew.
Lamps giving insufficient lumination	Battery discharged.	Charge the battery from an independent supply or by a long period of daylight running.
	Bulbs discoloured through prolonged use.	Renew.
Lamps light when switched on but gradually fade out	Battery discharged.	Charge the battery from an independent supply or by a long period of daylight runnings.
Lights flicker	Loose connection.	Tighten.
Failure of lights	Battery discharged.	Charge the battery from an independent supply or by a long period of daylight running.
	Loose or broken connection.	Locate and rectify.
Starter motor lacks power or fails to turn engine	Stiff engine.	Locate cause and remedy.
	Battery discharged.	Charge the battery either by a long period of daytime running or from independent electrical supply.

TABLE Y17 - ELECTRICAL SYSTEM FAULT DIAGNOSIS CHART - Continued

SYMPTOM	POSSIBLE CAUSE	REMEDY
	Broken or loose connection in starter circuit.	Check and tighten all battery, starter and switch connections and check the cables connecting these units for damage.
	Greasy or dirty slip rings.	Clean.
	Brushes worn not fitted correctly or wrong type.	Renew.
	Brushes sticking in holders or incorrectly tensioned.	Rectify.
	Starter motor jammed in mesh with flywheel.	Remove starter motor and investigate.
Starter noisy	Starter pinion or flywheel teeth chipped or damaged.	Renew.
	Starter motor loose on engine.	Rectify, checking pinion and the flywheel for damage.
	Armature shaft bearing.	Renew.
Starter operates but does not crank the engine	Pinion of starter does not engage with the flywheel.	Check operation of starter solenoid. If correct, remove starter motor and investigate.
Starter pinion will not disengage from the flywheel when the engine is running	Starter pinion jammed in mesh with the flywheel.	Remove starter motor and investigate.
Engine will not fire	The starter will not turn the engine due to a discharged battery.	The battery should be recharged by running the car for a long period during daylight or from an independent electrical supply.
	Sparking plugs faulty, dirty or incorrect plug gaps.	Rectify or renew.
	Defective coil or distributor.	Remove the lead from the centre distributor terminal and hold it approximately 6 mm from some metal part of the engine while the engine is being turned over. If the sparks jump the gap regularly, the coil and distributor are functioning correctly. Renew a defective coil or distributor.
	A fault in the low tension wiring is indicated when no spark occurs between the contacts when separated quickly with an insulated screwdriver with the ignition on.	Examine all the ignition cables and check that the bottom terminals are secure and not corroded.
	Dirty or pitted contacts.	Clean.
	Contact breaker out of adjustment.	Adjust.
	Controls not set correctly or trouble other than ignition.	See Starting Procedure in the OMM.
Engine misfires	Distributor points incorrectly set.	Adjust.
	Faulty coil or condenser.	Renew.
	Faulty sparking plugs.	Rectify.
	Faulty carburetter.	Check and rectify.

TABLE Y17 - ELECTRICAL SYSTEM FAULT DIAGNOSIS CHART - Continued

SYMPTOM	POSSIBLE CAUSE	REMEDY
Frequent recharging of the battery necessary	Alternator inoperative.	Check the brushes, cables and connections or renew the alternator.
	Loose or corroded connections.	Examine all connections especially the battery terminals and earthing straps.
	Slipping fan belt.	Adjust.
	Voltage control out of adjustment.	Renew.
	Excessive use of the starter motor.	In the hands of the operator.
	Vehicle operation confined largely to night driving.	In the hands of the operator.
	Abnormal accessory load.	Superfluous electrical fittings such as extra lamps etc.
	Internal discharge of the battery.	Renew.
Alternator not charging correctly	Slipping fan belt.	Adjust.
	Voltage control not operating correctly.	Rectify or renew.
	Greasy, charred or glazed slip rings.	Clean.
	Brushes worn, sticking or oily.	Rectify or renew.
	Shorted, open or burnt-out field coils.	Renew.
Alternator noisy	Worn, damaged or defective bearings.	Renew.
	Cracked or damaged pulley.	Renew.
	Alternator out of alignment.	Rectify.
	Aternator loose in mounting.	Rectify.
	Excessive brush noise.	Check for rough or dirty slip rings, badly seating brushes, incorrect brush tension, loose brushes and loose field magnets. Rectify or renew.
Defective distributor	Contact breaker gap incorrect or points burned and pitted.	Clean and adjust.
	Distributor cap cracked.	Renew.
	Weak or broken contact breaker spring.	Renew.
	Excessive wear in distributor shaft bushes, etc.	Renew.
	Rotor arm pitted or burned.	Clean or renew.
	If the engine lacks power, or misfires, it may be due to a faulty condenser.	Renew the condenser.
Poor performance of horns	Low voltage due to discharged battery.	Recharge.
	Bad connections in wiring.	Carefully inspect all connection and horn push.
	Loose fixing bolt.	Rectify.
	A faulty horn.	Adjust or renew.

SECTION Y

CHAPTER 18

FAULT FINDING FOR SECTION V - WINDSCREEN WASHER AND WIPER

INTRODUCTION

1. This Chapter deals with fault diagnosis and corrective action required for the windscreen washer and wiper system. Table Y18 below lists the symptoms, the probable cause and suggested remedies. Should a fault occur which is not listed the suspected component/s should be removed for inspection and/or overhaul.

TABLE Y18 - WINDSCREEN WIPER AND WASHER SYSTEM FAULT DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE	REMEDY
One wiper inoperative	Wheel box failure. Drive cable broken.	Replace wheel box. Replace cable.
Both wipers inoperative	Drive cable broken. Motor failure. Electrical fault.	Replace cable. Replace motor. Check connections (see wiring diagram) and repair.
Smeared windscreen	Wiper blades worn.	Replace blades.
Washing fluid not available	Reservoir empty. Pump failure. Electrical fault. Tubes disconnected. Tubes blocked. Washer jets blocked.	Refill. Replace motor and pump. Check connections (see wiring diagram) and repair. Reconnect tubes. Replace tubes. Clean or replace jets.