

**TRUCK, UTILITY, LTWT AND TRUCK, UTILITY, LTWT, WINCH,
MC2 - LAND ROVER 110 4X4**

MEDIUM GRADE REPAIR

This instruction is authorised for use by command of the Chief of Army. It provides direction, mandatory controls and procedures for the operation, maintenance and support of equipment. Personnel are to carry out any action required by this instruction in accordance with EMEI General A 001.

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INTRODUCTION

1. This EMEI contains procedures for removing, dismantling, repairing, assembling and installing various components of the Truck, Utility, Lightweight, including winch models. Where applicable, instructions for the adjustment, lubrication and minor servicing of these items are included.



Do not use adhesive tapes to seal fuel or oil openings. The adhesive tape is soluble in fuel or oil and can cause contamination. Remove temporary covers before assembling.

2. Prevent dirt and foreign objects from entering any component by placing clean temporary coverings over all exposed openings, including hoses, tubes and lines.



Before removing any electrical system components, disconnect the battery leads. Failure to comply may result in damage to the vehicle electrical system.

3. When disconnecting electrical connectors, hoses and fittings, remove clamps, as required, to gain slack and avoid damage to connectors and fittings.

4. Discard all used gaskets, seals, cotter pins, tab washers, lock pins, key washers and lock-washers. Discard all contaminated fuel and lubricants drained from the truck.

5. Use only those fuels and lubricants specified in the Servicing Instruction, EMEI Vehicle G 109, the User Handbook and this EMEI when replenishing fuel or lubricants.

6. Any fastenings or fittings being tightened to prescribed torques are to have dry, clean threads unless otherwise specified. When specified, thread sealants are to be applied to dry, clean, oil free threads.

7. The engine cooling system contains Nalcool corrosion inhibitor in water at a ratio of 1:12.

Items Previously Known To Have Contained Asbestos



Asbestos is a hazardous material and a carcinogen. Airborne asbestos fibre poses a serious danger to personnel and can lead to acute health concerns and eventual death.

The Land Rover Family of Vehicles (FOV) was originally fitted with a number of gaskets, seals and washers known to have contained asbestos.

Since 2009, all genuine Land Rover Australia supplied repair parts including; gaskets, seals and washers are asbestos free. If it is unknown as to whether the material contains asbestos, such items are to be removed, handled and disposed of IAW Defence WHS Manual.

NOTE

Prior to the disruption, removal or replacement of items contained within Table 1, the vehicle logbook (GM120) should be reviewed. If the item has been replaced since 2009 and noted in Part 4 of the GM120 the item can safely be handled as being asbestos free.

8. The following table provides a list of all known, in-situ, items including; parts, gaskets, seals and washers found in Land Rover 4X4 FOV which may contain asbestos. If an item in Table 1 is to be replaced, the GM120, Part 4 should be reviewed. If the item in question has been replaced after 2009 and noted in Part 4 of the GM120 the item can safely be handled as being asbestos free. If no evidence can be found in Part 4 the item is to be considered contaminated with asbestos. The item is to be replaced IAW Defence WHS Manual Vol 2, Part 3A, Chap 5, Asbestos Management in Defence and recorded in the GM120 Part 4.

Table 1 Items Previously Known To Have Contained Asbestos

Serial	ACM NIIN	NON-ACM NIIN	Item name	Description	RPS: 02188 ISSUE 3 MAR 00	Entry into GM120 Part 4 YES/NO
1	991373054	661566324	Gasket, transmission magnetic plug	Fibre washer for the transmission magnetic plug	FBA 011	
2	991373055	661566325	Gasket, transmission oil strainer plug	Filler plug fibre washer	FBA 016 / FBB 013	
3	661284266	661285409	Gasket, exhaust manifold	Exhaust manifold gasket	ABA 013	
4	998221518	661566345	Gasket, cover plate transfer casing reverse idler access	Transmission side plate gasket	FBA 007	
5	998221519	661566343	Gasket, transfer casing housing dog clutch	Transmission to PTO housing gasket	FBC 016	
6	998221724	661566352	Gasket, transfer casing lower cover plate	Transfer case bottom plate gasket	FBB 010	
7	998221850	661566360	Gasket, transmission pneumatic valve	PTO actuator fibre washer	FEA 019	
8	998240915	661566354	Gasket, transmission oil pump cover	Transmission oil pump cover gasket	FC 012	
9	998498732	661566323	Gasket, transmission oil pump cover	Filler plug gasket for transfer case, front axle housing, rear / intermediate axle housing.	FBA 016 / FBB 013	
10	997980214	994957906	Brake shoe set, transmission handbrake	Handbrake brake shoes	MFB 001	
11	998221517	661566341	Gasket, transmission top cover plate	Transmission top plate gasket	FBA 005	
12	998238297	661568461	Ring oil pick up	Transmission front cover plate oil pickup ring	FC 004	
13	661284264	661586333	Gasket	Oil cooler housing gasket	BE 005	
14	661284450	661446255	Gasket, Pipe, Inlet Manifold	Intake manifold pipe gaskets	ABA 003	
15	661285045	661284582	Gasket inlet manifold	Inlet air manifold gasket	ABA 001	
16	997628209	661566325	Joint washer	Filler plug fibre washer transfer case	FBA 016 / FBB 013	
17	998221722	661566353	Gasket Speedometer case	Speedo drive housing gasket	FBC 005	
18	997920835	661566324	Gasket Magnetic Plug	Filler plug fibre washer transfer case	FBA 011	
19	997472708	661566323	Washer flat, Rear Differential Filler Plug	Rear diff filler plug fibre washer	JA 007	
20	661284268	661450532	Gasket	Thermostat to engine block gasket	BF 007	

Paint

WARNING

This vehicle is painted with polyurethane (PUP). Precautions should be taken prior to carrying out repairs which include painting, sanding, scraping or welding. Fine PUP particles from sanding, filing or welding are eye and lung irritants. Refer to EMEI Workshop D 701 – Repair Policy for Equipment Painted in Polyurethane Paint.

WARNING

The primer used on this vehicle contains chromates. Precautions should be taken prior to carrying out repairs which include painting, sanding, scraping or welding. Fine particles from sanding, filing or welding the primer will contain traces of chromate which are skin, eye and lung irritants. PPE is as for PUP.

WARNING

Do not use compressed air to remove dust from areas which vehicle paint has been sanded, filed or drilled. Fine particles of dust will contain chromates and polyurethane which are skin, eye and lung irritants.

9. This vehicle is painted with polyurethane paint. The primer may contain chromium or zinc chromates. Both PUP and primer are most carcinogenic when in a liquid state but are still harmful if exposed to dust or fumes during repairs which include sanding, filing, welding or drilling through or removing paint layers. Wet sanding methods and / or local extract ventilation will minimise and control exposure from dust or fumes generated.

10. **PPE Requirements.** During repairs that involve sanding, filing, welding or drilling of the paint the following PPE must be worn:

- a. safety glasses,
- b. rubber or PVC gloves,
- c. overalls or full length clothing,
- d. fully enclosed foot wear, and
- e. a Class P1 (Particulate) respirator.

General Safety Warnings

WARNING

All industrial safety, work practices and equipment operating and maintenance instructions pertaining to this EMEI are to be adhered to.

The handling, storage and use of chemical substances are to be in accordance with WHS Manual, ChemAlert and EMEI Workshop E series requirements.

Under no circumstances is compressed air to be used to remove dust from the clutch assembly and flywheel housing or the brake drums/discs and brake linings. Dust from the brake linings can be a health risk if inhaled.

Publications

11. Reference may be necessary to the latest issue of the following documents:
- a. [AS/NZS 1554.1](#):2004 – Structural Steel Welding – Part 1 – Welding of Steel Structures;
 - b. [Defence Road Transport Manual](#) (DRTM);
 - c. [Defence Work Health and Safety Manual](#) (WHSSManual);
 - d. [Electronic Supply Chain Manual \(ESCM\)](#);
 - e. [ChemAlert](#);
 - f. [Technical Regulation of ADF Materiel Manual - Land](#) (TRAMM-L);
 - g. EMEI Workshop E Series;
 - h. Complete Equipment Schedules (CES):
 - (1) Truck, Utility, Lightweight, MC2 – Land Rover 110;
 - (a) [SCES 12035](#); and
 - (b) Equipment Kit [SCES 12036](#).
 - (2) Truck, Utility, Lightweight, W/Winch, MC2 – Land Rover 110;
 - (a) [SCES 12037](#); and
 - (b) Equipment Kit [SCES 12036](#).
 - i. Block Scale [2406/31](#) - Special Tools for RAEME – B Vehicles – Truck, Utility and Trucks, Light, MC2 (Land Rover Model 110);
 - j. [EMEI Vehicle A 029](#) - Vehicles General – Servicing of B Vehicles, Trailers, Motorcycles, Stationary Equipment, Auxiliary and Small Engines;
 - k. [EMEI Vehicle G 100](#) - Truck, Utility, Lightweight, and Truck, Utility, Lightweight, MC2, Winch, Land Rover 110 4x4 – Data Summary;
 - l. [EMEI Vehicle G 102](#) - Truck, Utility, Lightweight, MC2, Land Rover 110 and Truck, Utility Lightweight, W/Winch, MC2, Land Rover 110 – Technical Description;
 - m. [EMEI Vehicle G 103](#) - Truck, Utility, Lightweight, MC2, Land Rover 110 and Truck, Utility, Lightweight, Winch, MC2, Land Rover 110 – Light Grade Repair;
 - n. [EMEI Vehicle G 104-2](#) - Truck, Utility, Lightweight, MC2, Land Rover 110 and Truck, Utility, Lightweight, W/Winch, MC2, Land Rover 110 – Heavy Grade Repair;
 - o. [EMEI Vehicle G 109](#) - Truck, Utility Lightweight, MC2, Land Rover 110 4X4, All Types – Servicing Instruction;
 - p. [RPS 02188](#) - Truck Utility Lightweight, MC2, 4X4, 1 Tonne, 3.9 Litre Diesel Engine, Manual Transmission, 12 V, Landrover Model 110; and
 - q. [RPS 02189](#) - Truck Utility Lightweight, MC2, 4X4, 1 Tonne, 3.9 Litre Diesel Engine, Manual Transmission, 12 V, Landrover Model 110 (W/Winch).
12. A number of modifications and improvements have been made during the service life of the vehicle. Reference to the following publications may be required during repair activities. Any effect of these publications pertaining to the technical content of this document has been included in the text:
- a. [EMEI Vehicle G 008-1](#) - Truck, Lightweight and Light, MC2, All Types – Inspection and repair of Towing Pintle Assembly;
 - b. [EMEI Vehicle G 107-2](#) - Truck, Utility, Lightweight, MC2, Land Rover 110 and Truck, Utility, Lightweight, Winch, MC2, Land Rover 110 – Roll Over Protection and Fitting of Head Restraints;
 - c. [EMEI Vehicle G 107-3](#) - Truck, Utility, Lightweight, MC2, Land Rover 110 4X4, Cargo – Fitting of Stretcher Retaining Clamps;
 - d. [EMEI Vehicle G 187-1](#) - Truck, Utility, Lightweight, MC2, Land Rover 110 4X4 and Truck, Cargo, Light, MC2, Land Rover 110 6X6 – Fitting of Link Cable to the Headlamp Electrical Circuit;

- e. [EMEI Vehicle G 187-2](#) - Truck, Lightweight, MC2, Land Rover 110, All Types and Truck, Light, MC2, Land Rover 110, All Types – Fitting of Mudguard Reinforcement Plates;
- f. [EMEI Vehicle G 187-3](#) - Truck, Utility, Lightweight, MC2, Land Rover 110, All Types and Truck, Cargo, Light, MC2, Land Rover 110, All Types – Fitting of an Extra Earth Strap;
- g. [EMEI Vehicle G 187-4](#) - Truck, Utility, Lightweight, MC2, Land Rover 110, All Types and Truck, Cargo, Light, MC2, Land Rover 110, All Types – Fitting of Spot Mirrors;
- h. [EMEI Vehicle G 187-5](#) - Truck, Utility, Lightweight, MC2, Land Rover 110, All Types and Truck, Cargo, Light, MC2, Land Rover 110, All Types – Fitting of Instrument Blackout Cover;
- i. [EMEI Vehicle G 187-6](#) - Truck, Utility, Lightweight, MC2, All Types, Land Rover 4X4 and Truck, Cargo, Light, MC2, All Types, Land Rover 6X6 – Fitting of External Bonnet Release;
- j. [EMEI Vehicle G 187-7](#) - Truck, Utility, Lightweight, MC2, All Types, Land Rover 4X4 and Truck, Cargo, Light, MC2, All Types, Land Rover 6X6 – Air Cleaner Bracket Mounting;
- k. [EMEI Vehicle G 187-8](#) - Truck, Lightweight, MC2, Land Rover 110 4X4, All Types with Winch and Truck, Light, MC2, All Types, Land Rover 110 6X6, All Types with Winch – Rework of the Winch Drum Grooves and Replacement of the Winch Rope and Chain;
- l. [EMEI Vehicle G 187-9](#) - Truck, Lightweight, MC2, Land Rover 110 4X4, All Types, Not Fitted With Snorkel and Truck, Light, MC2, All Types, Land Rover 110 6X6, All Types, Not Fitted With Snorkel – Repositioning of the Air Inlet Hose and Rear Axle Breather;
- m. [EMEI Vehicle G 187-10](#) - Truck, Lightweight, MC2, All Types, Land Rover 4X4 and Truck, Light, MC2, All Types, Land Rover 6X6 – Fitting of Seat Belt Protector Sleeve;
- n. [EMEI Vehicle G 187-12](#) - Truck, Lightweight and Truck, Light, MC2, Land Rover 110 4X4 and 6X6, All Types – Strengthening of Bonnet Stay;
- o. [EMEI Vehicle G 187-13](#) - Truck, Lightweight and Truck, Light, All Types, Land Rover 110 4X4 and 6X6 – Fitting of Trailer Safety Chain Brackets;
- p. [EMEI Vehicle G 187-14](#) - Truck, Utility, Lightweight, FFR, MC2, Land Rover 110, All Types, Truck, Utility, Light, FFR, Land Rover Series 3, All Types and Truck, Cargo, Light, FFR, MC2, Land Rover 110, All Types – Rewiring of the 28 V Voltmeter Circuit;
- q. [EMEI Vehicle G 187-15](#) - Truck, Lightweight and Truck, Light, All Types, Land Rover 110 4X4 and 6X6 – Replacement of 24 V Power Distribution Box Cables Between Generator Input Plug and Battery Connections;
- r. [EMEI Vehicle G 187-16](#) - Truck, Lightweight, MC2, All Types, Land Rover 110 4X4 and Truck, Light, MC2, All Types, Land Rover 110 6X6 – Conversion From Oil Filled to Grease Filled Swivel Pin Housings;
- s. [EMEI Vehicle G 188-1](#) - Truck, Lightweight, MC2, Land Rover 110 4X4, All Types and Truck, Light, MC2, Land Rover 110 6X6, All Types – Suspension and Steering Inspection Procedure;
- t. [EMEI Vehicle G 189-6](#) - Truck, Utility, Lightweight, MC2, All Variants, Land Rover 110 4X4 and Truck, Cargo, Light, MC2, All Variants, Land Rover 110 6X6 – Reclaiming Broken Indicator Switch;
- u. [EMEI Vehicle G 189-15](#) - Truck, Lightweight and Truck, Light, All Types, Land Rover 110 4X4 and 6X6 – Chassis Repair;
- v. [EMEI Vehicle G 197-1](#) - Truck, Utility, LTWT, MC2, Land Rover (110), All Types – Stowage Bin Drain Holes and Fitting Modification Record Plate;
- w. [EMEI Vehicle G 197-2](#) - Truck, Utility, LTWT, MC2, Land Rover (110), All Types – Dimming of Map Light;
- x. [EMEI Vehicle G 197-3](#) – Truck, Utility, Lightweight, W/Winch, MC2, Land Rover 110 – Fitting of Counter Sunk Screws to Winch Guard;
- y. [EMEI Vehicle G 197-4](#) - Truck, LTWT, MC2, Land Rover (110), All Types – Fitting of Transfer Case Caution Decal;
- z. [EMEI Vehicle G 197-5](#) - Truck, Utility, LTWT, MC2, Land Rover (110), All Types – Fitting of Heater Cable Securing Straps;

- aa. [EMEI Vehicle G 197-6](#) - Truck, Utility, Lightweight, MC2, Land Rover 110, All Types – Fitting of the Steering Protection Plate and Improved Winch Fairlead Plate Mounting Bolts;
- bb. [EMEI Vehicle G 197-7](#) - Truck, Utility, Lightweight, MC2, Land Rover 110, All Types – Fusing of Additional Circuits;
- cc. [EMEI Vehicle G 197-8](#) - Truck, Utility, Lightweight, MC2, Land Rover 110, All Types – Slotting of the Brake Calliper Feed Line Retaining Bracket;
- dd. [EMEI Vehicle G 197-9](#) - Truck, Utility, Lightweight, MC2, Land Rover 110, All Types – Relocation of the Engine Stop Control;
- ee. [EMEI Vehicle G 197-10](#) - Truck, Utility, Lightweight, MC2, Land Rover 110, All Types – Replacement of the Map-light Securing Clip and Securing of the Map-light Wiring;
- ff. [EMEI Vehicle G 197-11](#) - Truck, Utility, Lightweight, MC2, Land Rover 110, All Types – Fitting of Elbow to Transmission Differential Lock Control Valve;
- gg. [EMEI vehicle G197-12](#) - Truck, Utility, Lightweight, MC2, Land Rover 110 4x4 - All Types – Fitting of Lashing Rings;
- hh. [EMEI Vehicle G 197-13](#) - Truck, Lightweight, MC2, Land Rover 110 4X4, All Types – Fitting of Coil Spring Retainers; and
- ii. [EMEI Vehicle G 197-14](#) - Truck, Lightweight, MC2, Land Rover 110 4X4, All Types With Manual Steering Box – Repair of Manual Steering Box Selector Shaft End Float.

Location of Identification Numbers

13. The location of identification numbers on components of the vehicle are described in Table 2.

Table 2 Location of Identification Numbers

Serial	Identification Number	Location
1	Chassis number	Right-hand side of the chassis, forward of the spring mounting turret
2	Chassis nameplate	Left-hand seat box, in the cab
3	Engine number	Left-hand side of the engine block
4	Injection pump identification	Side of the pump
5	Transmission and transfer case	Rear of the transfer case
6	Front axle number	Adjacent to the axle breather
7	Rear axle number	Adjacent to the axle breather

Special Tools and Gauges

Many of the procedures described in this EMEI require the use of special tools, jigs or fixtures. The special tools required are listed in Table 3 and illustrated in Figure 1.

NOTE

Items in Table 3 without an NSN were issued to Units authorised to conduct medium grade repairs as part of the Introduction into Service process.

Table 3 Special Tools

Serial	Part No.	NSN	Item Name	Use
1	EYA3745		Engine lifting sling	Engine lifting
2	9-8521-0063-0		Puller	Removing crankshaft pulley
3	18G092	5120-66-128-4312	Insertor, seal	Installing crankshaft front oil seal
4	EYA3737	2815-66-149-1913	Tool kit seal installation	Installing crankshaft rear oil seal
5	18G134	5120-99-874-1715	Replacer, bearing and oil seal	Installing transmission oil seal
6	18GA134A	5120-66-128-4309	Adaptor, clutch	Installing spigot bush
7	18G134DG	5120-99-825-0833	Replacement adaptor ring	Installing transmission oil seal
8	18G79	5120-99-820-6912	Clutch centraliser	Installing clutch plate
9	RO1001		Transmission lifting bracket	Transmission removal
10	18G1205A	5120-66-128-4300	Wrench adjustable	Transfer case disassembly
11	18G47BB	5120-99-825-0838	Extractor, differential bearing	Bearing removal
12	RO1006		Remover, ball joint	Ball joint remover
13	18G1063	5120-66-128-4304	Separator, ball joint	Ball joint separator
14	18GA085		Puller	Steering wheel puller

List of Lubricants

14. The list of lubricants is detailed in Table 4.

Table 4 List of Lubricants

Serial	Equipment	Lubricant	Capacity (litres)
1	Engine (including filter)	SAE GRADE 40 (OMD-115)	8.5
2	Transmission	SAE GRADE 40 (OMD-115)	2.7
3	Transfer case (with PTO)	SAE GRADE 40 (OMD-115)	5.8
4	Front differential	OEP-220	1.7
5	Rear differential	OEP-220	2.3
6	Steering box	OEP-220	0.45
7	Brake master cylinder	OX-8	Fill to level
8	Clutch master cylinder	OX-8	Fill to level
9	Swivel pin housings	Molytex grease	One EP00 sachet per housing
10	Transmission input shaft	XG-276	As required
11	Clutch pedal trunnion	XG 291	As required
12	Speedometer	XG 291	As required
13	Propeller shaft	XG 291	As required
14	Winch drive line	XG 291	As required
15	Parking brake adjuster	XG 291	As required
16	Windscreen wiper drive cable	XG 291	As required
17	Water pump	XG 291	As required
18	Wheel bearings	XG 291	As required
19	Winch	OEP-220	1.3
20	Winch rope	Rocol wire rope lube	As required
21	Radiator inhibitor	NALCOOL	As required (1:12 ratio)

ENGINE

Engine

15. **Removal.** Remove the engine as follows:
- a. Clean the engine and engine bay with a recommended cleaning agent and blow them dry with compressed air.
 - b. Disconnect the battery.
 - c. Remove the bonnet (Body – Group 17).
 - d. Remove the bumper brushguard in accordance with EMEI Vehicle G 103 – Group 16.
 - e. Remove the grille in accordance with EMEI Vehicle G 103 – Group 17.
 - f. Remove the horn in accordance with EMEI Vehicle G 103 – Group 15.
 - g. Remove the bolts and washers securing the top of the cross-braces to the grille top panel (Figure 2).
 - h. Remove the bonnet catch plate, disconnect the bonnet lock mechanism from the release lever and remove the bonnet lock mechanism from the grille top plate.
 - i. Remove the bolts, washers and nuts securing the bottom of the cross-braces to the chassis and remove the cross-braces.
 - j. Remove the bolts and washers securing the grille panel to the mudguards. Lift the grille panel and the grille top panel from the vehicle.

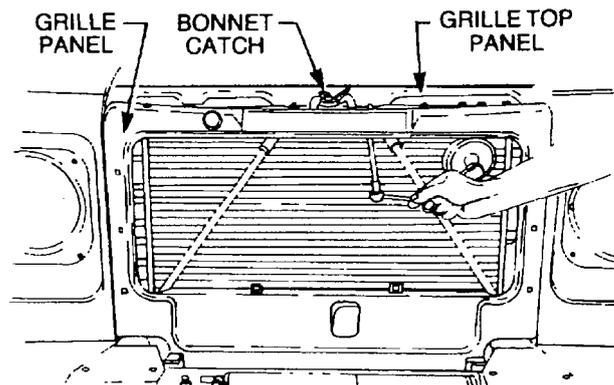


Figure 2 Grille Panel

- k. Remove the radiator in accordance with EMEI Vehicle G 103 – Group 2.
- l. Disconnect the heater hoses at the heater inlet and outlet pipes and plug the hoses with suitable plastic plugs (Figure 3).

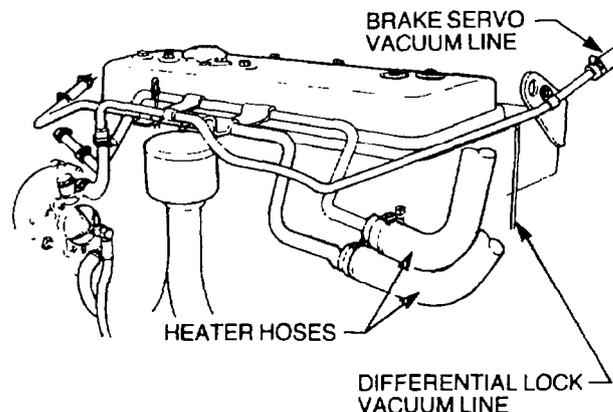


Figure 3 Vacuum Line and Heater Hose Connections

- m. Remove the hose clamps securing the air inlet and outlet hoses to the air cleaner housing and disconnect the hoses. Remove the wing nuts from the clamp bolts and carefully lift the air cleaner out of the mounting bracket (Figure 4).

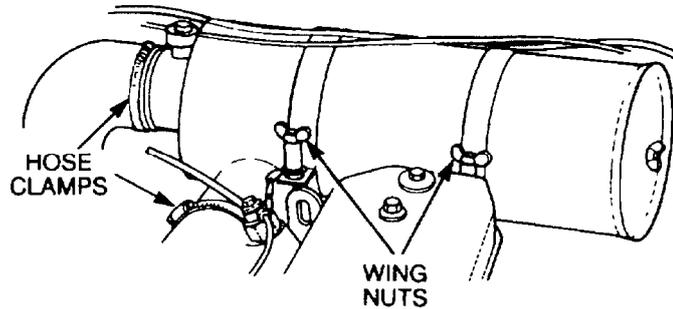


Figure 4 Air Cleaner

- n. Disconnect the differential lock vacuum line and remove the vacuum line to the brake servo.
- o. Disconnect the engine air intake hose at the manifold and remove it.
- p. Remove the nuts securing the front exhaust pipe to the exhaust manifold at the flange. Remove the clamp securing the exhaust pipe support bracket. Discard the sealing ring if it is damaged.
- q. Remove the nuts, washers and bolts securing the front exhaust pipe to the muffler pipe (Figure 5). Remove the front exhaust pipe.

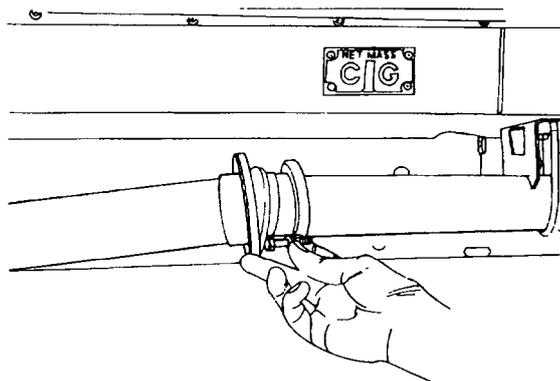


Figure 5 Front Exhaust Pipe

- r. Disconnect the fuel supply and fuel return lines at the rubber hoses on the fuel injection pump (Figure 6).

NOTE

Plug all the apertures with suitable plastic plugs.

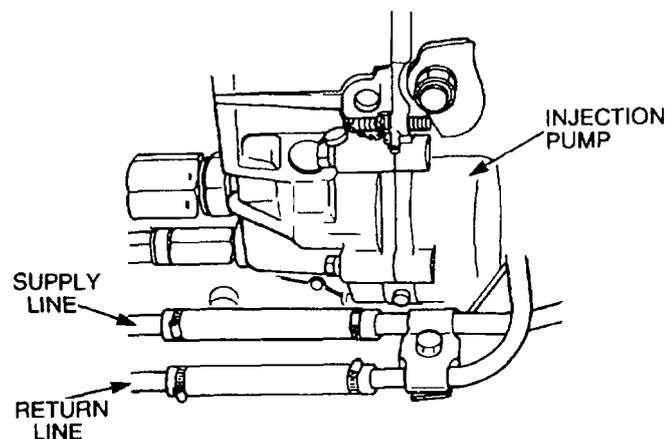


Figure 6 Fuel Lines

- s. Disconnect the engine stop cable end from the injection pump stop lever (Figure 7).

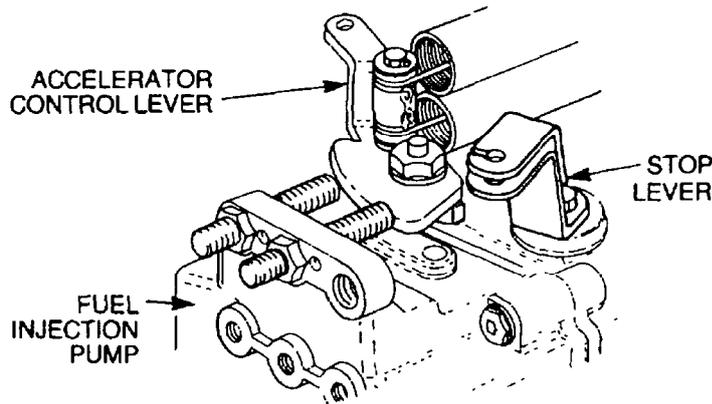


Figure 7 Accelerator Control and Stop Levers

- t. Disconnect the accelerator cable from the fuel injection pump control lever.
- u. Remove the field excitation plug from the alternator (Figure 8). Remove the nut securing the cable to the B-terminal of the alternator, remove the wire from the terminal and install the nut.

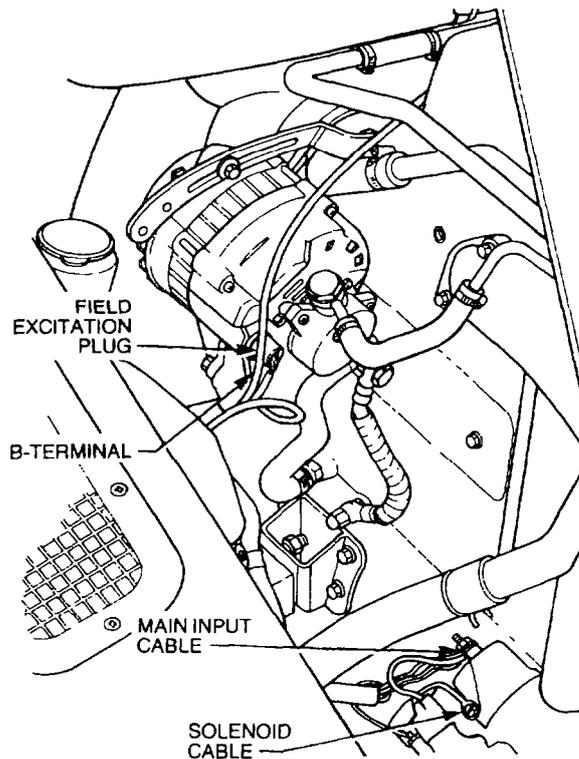


Figure 8 Alternator and Starter Motor Cables

- v. Remove the nut securing the main input cable to the starter motor (Figure 8). Remove the cable and install the nut.
- w. Loosen the screw securing the cable to the starter motor solenoid. Remove the cable and tighten the screw.
- x. Remove the connector from the temperature sender on the thermostat housing.
- y. Remove the connector from the oil pressure sender.
- z. Remove the connectors from the reverse light pressure switch (located towards the rear of the engine block).
- aa. Remove the nut securing the glow plug electrical connection at Number 4 cylinder. Disconnect the wire and install the nut.

- bb.** Remove the bolts securing the clutch slave cylinder to the transmission bell housing. Remove the hydraulic pipe bracket from the starter motor stud and remove the slave cylinder complete with dust cover and backing plate (Figure 9).

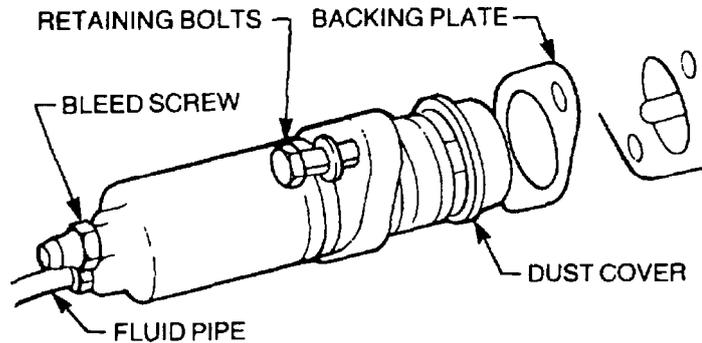


Figure 9 Slave Cylinder

WARNING

The overhead lifting equipment must have a minimum Safe Working Load (SWL) of 500 kg. Lifting equipment with a lower SWL may fail unexpectedly causing injury to personnel and damage to the equipment.

- cc.** Secure special tool EYA3745, to the overhead lifting equipment.
- dd.** Position the overhead lifting equipment over the engine and secure the chains to the engine lifting brackets (Figure 10). Take the weight of the engine with the lifting equipment.

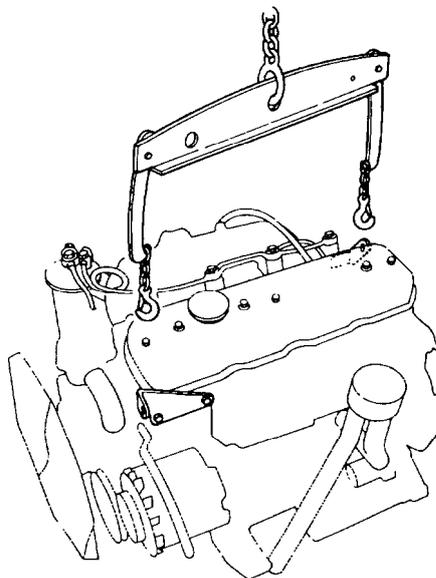


Figure 10 Engine Lifting

NOTE

Ensure the earth strap connected to the left-hand mounting is disconnected.

- ee.** Remove the bolts, nuts and washers securing the engine front mountings to the mounting brackets.
- ff.** Remove the steering coupling cover.
- gg.** Raise the engine approximately 75 mm and insert a suitable piece of wood, between the transmission and the removable cross-member, to support the transmission.

- hh. Remove the bolts securing the transmission bell housing to the flywheel housing. Carefully pull the engine forward until the engine is disconnected from the transmission. Raise the engine, tilting it slightly to allow the transmission input shaft to clear the clutch pressure plate.
- ii. When the oil pan is high enough to clear the front cross-member, withdraw the engine from the vehicle.

16. Installation. Install the engine as follows:

- a. Secure special tool EYA3745, to the overhead lifting equipment.

WARNING

The overhead lifting equipment must have a minimum Safe Working Load (SWL) of 500 kg. Lifting equipment with a lower SWL may fail unexpectedly causing injury to personnel and damage to the equipment.

- b. Position the overhead lifting equipment over the engine and secure the chains to the engine lifting brackets. Raise the engine.
- c. Carefully position the engine in the engine bay, tilting it slightly to allow the transmission input shaft to engage in the clutch pressure plate.

NOTE

Slight rotation of the crankshaft may be necessary to align the splines.

CAUTION

During installation of the engine or transmission, DO NOT use the bell housing bolts to pull the assemblies together if there is a gap evident as this will cause the input bearing retaining plates to bend and allow excess end float of the main shaft.

If the plates are bent, the transmission must be removed and returned for overhaul.

- d. Align the transmission bell housing and flywheel housing bolt holes and secure the housings with the retaining bolts.
- e. Raise the engine sufficiently to remove the piece of wood supporting the transmission.
- f. Lower the engine onto the engine mountings.

NOTE

Ensure the earth strap is reconnected to the left-hand mounting.

- g. Fit the bolts to the chassis bracket and install the washers and nuts to secure the mountings to the engine.
- h. Install the steering coupling cover.
- i. Remove the overhead lifting equipment and lifting bar.
- j. Apply a suitable sealer to both sides of the clutch slave cylinder backing plate and position the plate on the cylinder. Smear the inside of the dust cover with clean hydraulic fluid and install the dust cover on the cylinder.
- k. Install the slave cylinder into the transmission bell housing, ensuring that the push rod is inserted into the dust cover and the bleed screw is uppermost (Figure 11).

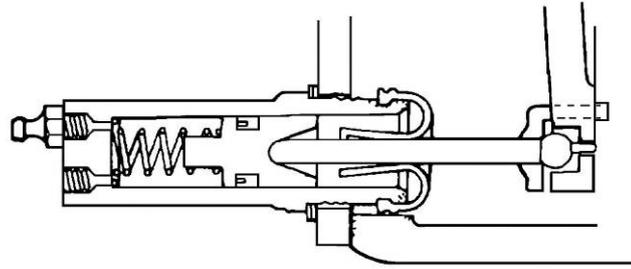


Figure 11 Slave Cylinder

- l.** Install the slave cylinder retaining bolts and washers and torque them to 27 N.m (20 lbf.ft).
- m.** Fit the hydraulic pipe bracket to the starter motor stud and torque the retaining nut to 40 N.m (30 lbf.ft).
- n.** Remove the nut from the glow plug electrical terminal at Number 4 cylinder, connect the electrical wire, install the retaining nut and tighten it securely.
- o.** Connect the electrical connectors to the reverse light pressure switch at the rear of the engine block.
- p.** Connect the electrical terminal to the oil pressure sender.
- q.** Connect the electrical terminal to the temperature sender.
- r.** Connect the main input cable and the solenoid cable to the starter motor (Figure 8).
- s.** Connect the cable to the B-terminal of the alternator (Figure 8). Connect the field excitation plug to the socket at the rear of the alternator.
- t.** Connect the accelerator cable to the fuel injection pump control lever.
- u.** Connect the engine stop cable to the fuel injection pump stop lever.
- v.** Remove the plastic plugs and connect the fuel supply and fuel return lines at the rubber hoses on the fuel injection pump (Figure 6).
- w.** Bleed the fuel system in accordance with EMEI Vehicle G 103 – Group 4.
- x.** Position the front exhaust pipe on the vehicle, secure the pipe to the front mounting bracket with the clamp, but do not tighten the clamp.
- y.** Install the sealing ring and secure the front exhaust pipe to the exhaust manifold. Ensure that the sealing ring is correctly seated in the flange. Install the nuts and washers, but do not tighten them.
- z.** Align the front exhaust pipe with the muffler pipe. Install the sealing ring and secure it with the bolts, washers and nuts.
- aa.** Tighten the exhaust flange nuts and the muffler flange bolts securely.
- bb.** Connect the vacuum lines to the brake servo and the differential lock (Figure 3).
- cc.** Remove the plastic plugs and connect the heater hoses (Figure 3).
- dd.** Carefully position the air cleaner in the mounting bracket and tighten the wing nuts on the clamp bolts.
- ee.** Connect the air inlet and outlet hoses to the air cleaner and tighten the hose clamps. Connect the engine air intake hose at the manifold.
- ff.** Install the radiator in accordance with EMEI Vehicle G 103 – Group 2.
- gg.** Position the grille panel and grille top panel between the mudguards and secure them with the bolts and washers. Position the catch plate on the grille top panel (Figure 12).

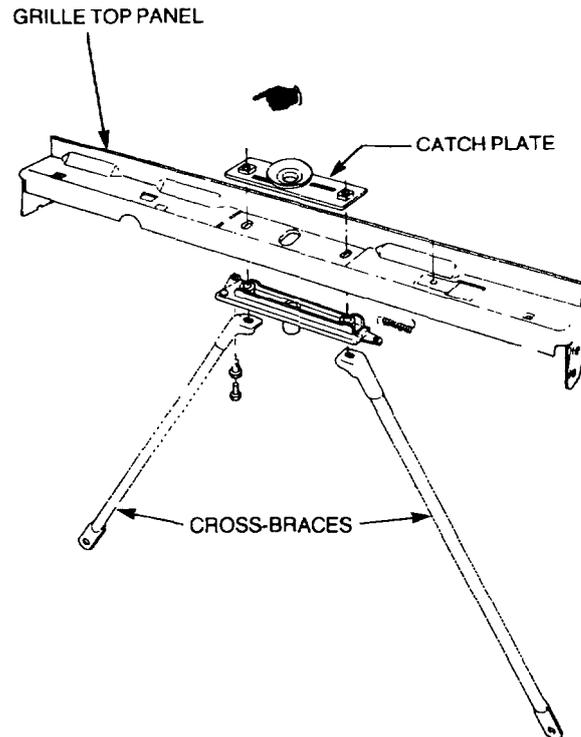


Figure 12 Bonnet Catch

- hh. Position the bonnet lock and one cross-brace under the top panel and secure them with a retaining bolt and washers, but only finger tight.
- ii. Install the second cross-brace and secure the cross-brace and bonnet lock with the retaining bolt and washers, but only finger tight. Position the bottom of each cross-brace in its respective bracket and secure them with the retaining bolt, washers and nut.
- jj. Connect the bonnet release lever to the bonnet locking mechanism.
- kk. Tighten the cross-brace retaining bolts and grille panel retaining bolts securely.
- ll. Operate the bonnet release lever to ensure the bonnet locking mechanism is functioning correctly.
- mm. Install the horn in accordance with EMEI Vehicle G 103 – Group 15.
- nn. Install the grille in accordance with EMEI Vehicle G 103 – Group 17.
- oo. Install the bumper brushguard in accordance with EMEI Vehicle G 103 – Group 16.
- pp. Install the bonnet (Body – Group 17).
- qq. Adjust the bonnet catch in accordance with EMEI Vehicle G 103 – Group 17.
- rr. Connect the battery.
- ss. Fill the engine radiator with coolant in accordance with EMEI Vehicle G 103 – Group 2.
- tt. Replenish the engine with approximately 8.5 litres of new engine oil (if required).
- uu. Start the engine and allow it to warm up to normal operating temperature. Ensure that the engine functions correctly and rectify any faults found.
- vv. Check the engine for leaks and rectify as necessary.
- ww. Check the oil level and top it up if necessary.
- xx. Check the coolant level and top it up if necessary.

Cylinder Head

WARNING

New gaskets provided by Land Rover do not contain asbestos. Older gaskets still fitted to vehicles may contain asbestos. During this task some parts may contain asbestos; refer and comply with procedures and warnings in the introduction section of this EMEI under paragraph heading: **Items Previously Known To Have Contained Asbestos.**

17. **Removal.** Remove the cylinder head as follows:
- a. Remove the bonnet (Body – Group 17).
 - b. Clean the engine with a recommended cleaning agent, paying particular attention to the area around the cylinder head and blow it dry with compressed air.
 - c. Remove the nuts securing the front exhaust pipe to the exhaust manifold (at the flange). Slacken the clamp securing the exhaust pipe support bracket and discard the sealing ring.
 - d. Ensure that the heater temperature control is set to maximum, loosen the bottom radiator hose clamp and drain the coolant into a suitable clean receptacle.
 - e. Remove the top radiator hose when all coolant has drained from the cooling system; fit the bottom radiator hose and secure it with the clamp.
 - f. Remove the hose clamps securing the air inlet and outlet hoses to the air cleaner housing and disconnect the hoses. Remove the wing nuts from the clamp bolts and carefully lift the air cleaner out of the mounting brackets (Figure 4).
 - g. Remove the bolts securing the air cleaner bracket to the engine and remove the bracket.
 - h. Remove the heater hoses at the thermostat housing, water pump and at the heater inlet and outlet pipes (Figure 3). Plug the thermostat housing, water pump and inlet and outlet pipes with suitable plastic plugs.
 - i. Loosen the alternator mounting bolts and the adjusting bolt. Remove the bolt securing the alternator adjustment bracket to the thermostat housing.
 - j. Remove the bolt securing the dipstick top supporting bracket.
 - k. Loosen one of the clamps securing the engine breather pipe to the side cover. Remove the nuts and washers securing the breather to the exhaust manifold (Figure 13).
 - l. Remove the breather and plug the side cover breather hole with a suitable plastic plug.
 - m. Disconnect the differential lock vacuum line from the alternator to the brake servo vacuum line (Figure 3). Remove the vacuum line from the brake servo, the rear engine lifting bracket and the vacuum pump (on the alternator) and plug all the apertures with suitable plastic plugs.
 - n. Remove the bolts securing the heater hose and vacuum line mounting brackets to the engine and remove the complete assembly (Figure 3).

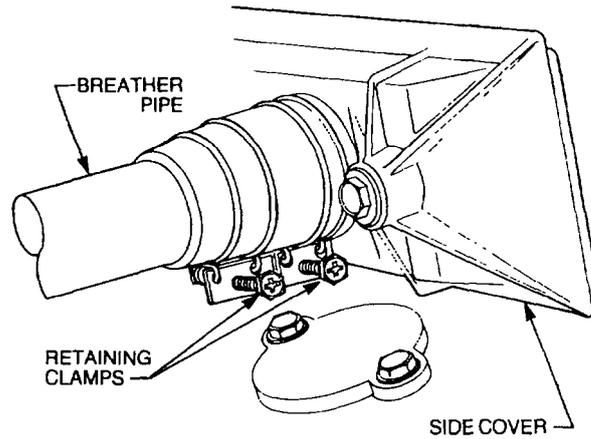


Figure 13 Side Cover Breather Connection

- o.** Remove the coolant by-pass hose (between the thermostat housing and the water pump).
- p.** Remove the breather hose (connecting the valve cover to the air inlet tube).
- q.** Remove the electrical connection from the temperature sensor.
- r.** Remove the electrical strip link from the top of the glow plugs (Figure 14). Remove the electrical feed wire from cylinder Number 4 glow plug and remove the glow plugs.

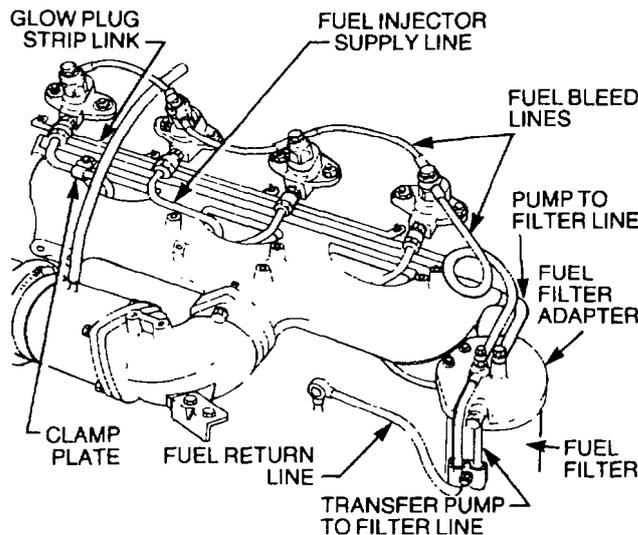


Figure 14 Fuel Lines

- s.** Place a suitable container beneath the engine to catch any fuel spillage and drain the fuel from the fuel filter into a suitable receptacle. Remove the fuel injector bleed lines and plug all the apertures with suitable plastic plugs (Figure 14).
- t.** Disconnect and remove the remaining fuel lines from the fuel filter adapter and plug all apertures with suitable plastic plugs (Figure 14).
- u.** Remove the bolts securing the fuel filter adapter to the air inlet manifold and remove the filter adapter assembly.
- v.** Crack loose the fuel line connection at the fuel injectors and allow any residual fuel which may be under pressure to drain off (Figure 14). Disconnect the fuel lines and plug all the apertures with suitable plastic plugs.
- w.** Remove the clamps securing the fuel lines, remove the fuel lines at the injection pump and plug all the apertures with suitable plastic plugs.

CAUTION

Do not strike the injector tip on the cylinder head or on any other hard surface as this can damage the spray holes.

NOTE

To remove a stuck injector, apply penetrating oil around the injector body and gradually extract the injector by inserting a suitable lever between the cylinder head and the injector body.

- x.** Remove the nuts and spring washers securing each fuel injector to the cylinder head and carefully remove each injector. Remove and discard the injector sealing washers and nozzle gaskets.
- y.** Place the injectors in a suitable rack in numerical sequence so that they can be installed into the cylinders in the order of removal.
- z.** Remove the bolts securing the engine stop cable bracket to the air inlet pipe.
- aa.** Remove the bolts securing the air inlet pipe to the inlet manifold and discard the gasket.
- bb.** Remove the nuts securing the valve cover and remove the valve cover assembly and gasket. Discard the gasket.
- cc.** Slacken and remove the rocker shaft retaining bolts in the sequence shown. Remove the rocker shaft assembly (Figure 15).

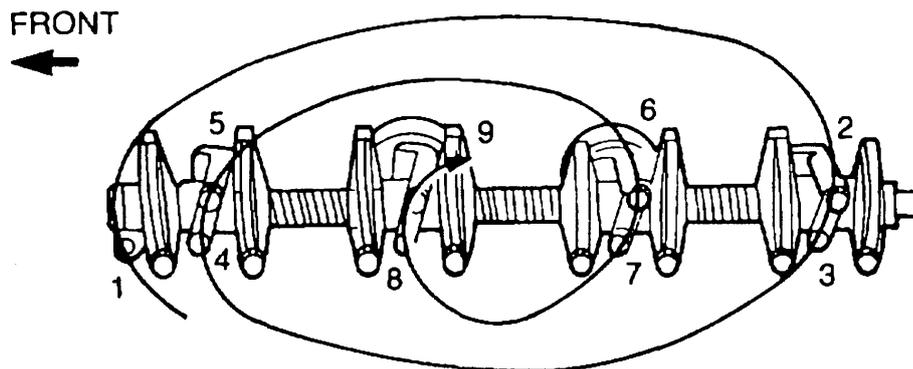


Figure 15 Rocker Shaft - Removal

- dd.** Remove the push rods and mark each rod to ensure correct location during installation.
- ee.** Loosen the cylinder head bolts in the sequence shown (Figure 16).

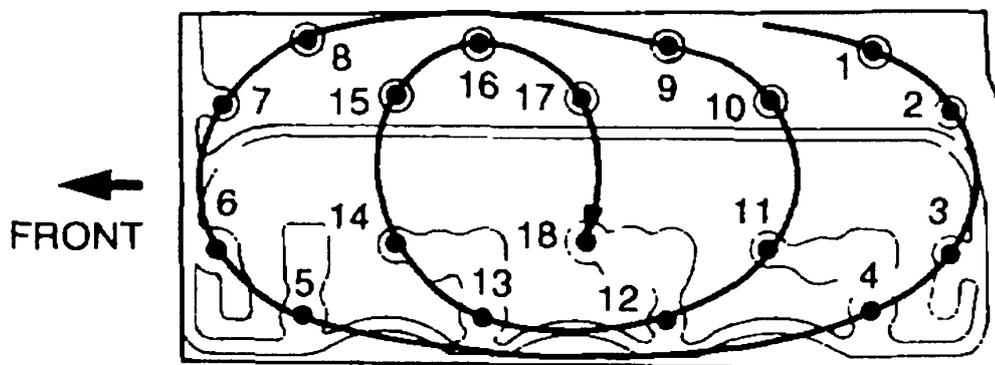


Figure 16 Cylinder Head Bolts - Removal

WARNING

The cylinder head is heavy. Care must be taken on removal or personal injury may result.

- ff. Remove the bolts and remove the cylinder head complete with inlet manifold, exhaust manifold and thermostat housing.
 - gg. Remove the bolts, nuts and washers securing the inlet manifold to the cylinder head. Remove and discard the gasket.
 - hh. Remove the bolts, nuts and washers securing the heat shield and exhaust manifold to the cylinder head. Remove and discard the gaskets.
 - ii. Remove the bolts securing the thermostat housing to the cylinder head. Remove and discard the gasket.
18. **Inspection.** Clean and inspect the cylinder head as follows:

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- a. Clean all trace of gasket material from the engine block, the cylinder head, the inlet and exhaust manifolds and the thermostat housing.
- b. Check the cylinder head for scratches, cracks, gouges and distortion.
- c. Using a straight edge and feeler gauge, check that the cylinder head distortion is less than 0.2 mm (0.008 in), in several directions (Figure 17). Replace the cylinder head as necessary.

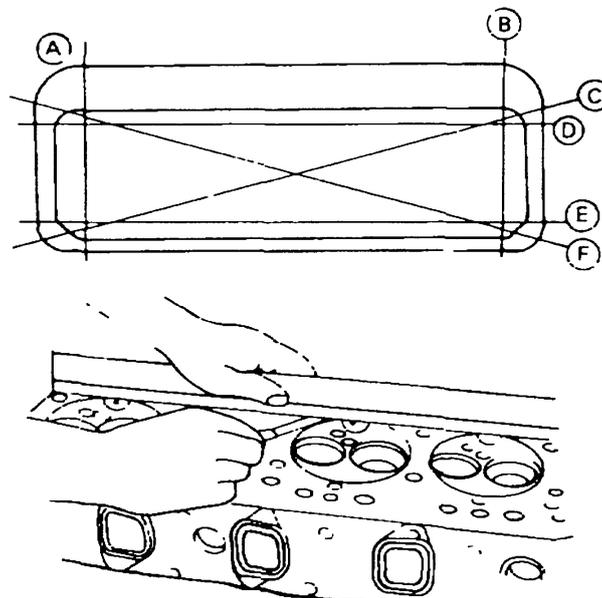


Figure 17 Checking Cylinder Head Distortion

- d. Check the fuel injector cavities for carbon build-up.

NOTE

If a light build-up is noticed, clean it with a wire brush, however, if a heavy carbon build-up is evident, clean it with a suitable reamer.

- e. Remove all trace of carbon build-up from the glow plug cavities and check all threads for cleanliness.
- f. Using taps and dies, clean the threads in the bolt holes and on the studs and replace any damaged or bent studs.
- g. Ensure that all the oil and coolant galleries are free of restrictions.
- h. Check that the push rods are not worn, damaged or bent and replace them as necessary.
- i. Check the rocker arms for contact surface wear and reface or replace them as necessary.
- j. Check that all the oil ports and the passages are free of restrictions.
- k. Check the condition of all the expansion plugs (Para 31) and replace them as necessary.

19. Installation. Install the cylinder head as follows:

- a. Position the cylinder head so that the exhaust ports are uppermost.
- b. Position the new exhaust manifold gaskets on the cylinder head so that the word TOP is toward the manifold (Figure 18).

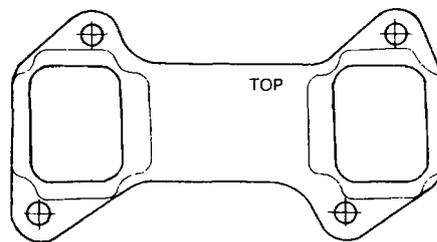


Figure 18 Exhaust Manifold Gasket Installation

- c. Place the exhaust manifold over the gaskets aligning the studs with the corresponding holes in the manifold. Secure the manifold in position with bolts and tighten them finger tight only.
- d. Check that each gasket is correctly positioned and not distorted and install the nuts and washers. Torque the nuts and bolts to 16 to 25 N.m (12 to 19 lbf.ft) using the tightening sequence shown in Figure 19.

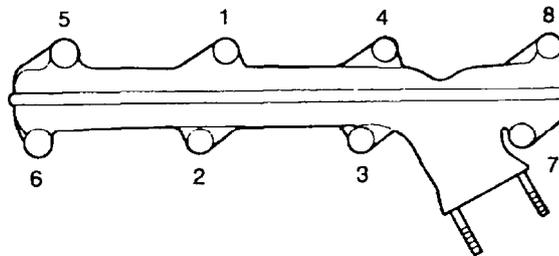


Figure 19 Exhaust Manifold - Tightening Sequence

- e. Position the heat shield on the exhaust manifold and secure it with the retaining nuts and washers.
- f. Position the cylinder head so that the inlet manifold ports are uppermost. Position a new inlet manifold gasket on the cylinder head with the gasket projection uppermost and toward the rear of the engine (Figure 20).

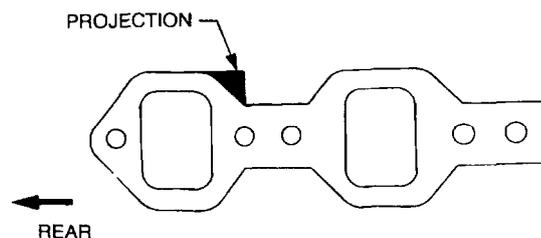


Figure 20 Inlet Manifold Gasket Installation

- g. Place the inlet manifold over the gasket aligning the studs with the corresponding holes in the manifold. Secure the manifold in position with bolts and tighten them finger tight only.
- h. Check that the gasket is correctly positioned and not distorted and install the nuts and washers. Torque the nuts and bolts to 16 to 25 N.m (12 to 19 lbf.ft).
- i. Apply a suitable liquid sealant to both sides of a new thermostat housing gasket and position the gasket and housing on the cylinder head. Secure the housing in position with the bolts and torque the bolts to 42 to 62 N.m (31 to 45 lbf.ft).
- j. Position a new cylinder head gasket on the engine block, ensuring the TOP mark is uppermost and the FRONT mark is toward the front of the engine.
- k. Use two old cylinder head bolts with the heads sawn off to locate the gasket and facilitate the cylinder head installation.

NOTE

A screwdriver slot in the head of the locating bolts will facilitate their removal once the cylinder head is in position.

WARNING

The cylinder head is heavy. Care must be taken on installation or personal injury may result.

- l. Carefully position the cylinder head and manifold assembly over the engine block locating the bolts in the corresponding holes. Lubricate the cylinder head bolts with clean engine oil and install them into the cylinder head.
- m. Remove the locating bolts and replace them with the remaining cylinder head bolts.
- n. Torque the cylinder head bolts in the sequence (Figure 21) in three steps as follows:
 - (1) Step one – torque the bolts to 69 N.m (51 lbf.ft);
 - (2) Step two – torque the bolts to 88 N.m (65 lbf.ft); and
 - (3) Step three – torque the bolts a further 30 degrees.

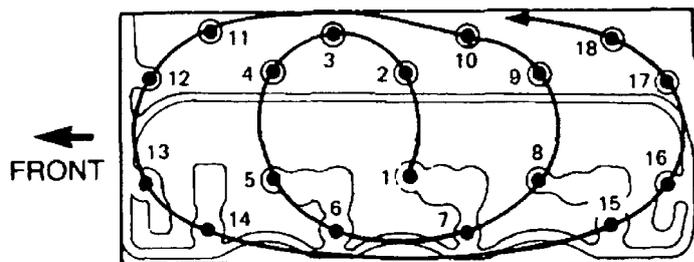


Figure 21 Cylinder Head Bolts Tightening Sequence

- o. Lubricate the push rods with clean engine oil and install them in the cam followers as noted on removal.
- p. Position the rocker shaft assembly on the cylinder head.
- q. Install the nuts, bolts and washers and torque them to 20 to 30 N.m (15 to 22 lbf.ft) in the sequence shown in Figure 22.
- r. Adjust the valve clearance in accordance with EMEI Vehicle G 103 – Group 1.
- s. Fit a new dust cap to each fuel injector, place a small amount of grease on each new nozzle gasket and position the gasket over the nozzle on each injector.

NOTE

The grease will hold the nozzle gasket on the fuel injector during installation.

- t. Install each injector in the cylinder head and secure each injector with the retaining nuts. Torque the nuts to 20 to 30 N.m (15 to 22 lbf.ft).
- u. Install the glow plugs and torque them to 22 to 27 N.m (16 to 20 lbf.ft).

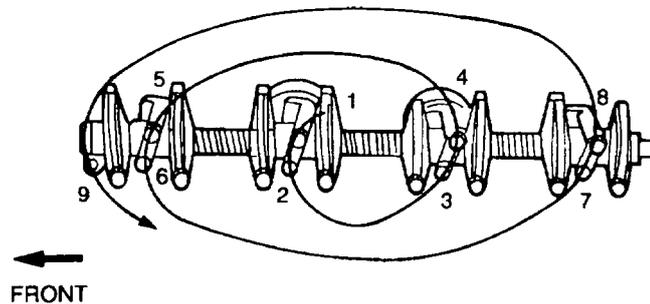


Figure 22 Rocker Shaft Assembly Tightening Sequence

- v. Position the electrical strip link on the glow plugs and secure it with new nuts at cylinders 1, 2 and 3.
- w. Connect the electrical feed wire to cylinder Number 4 glow plug. Secure the feed wire and strip link to the glow plug with a new nut.
- x. Lightly lubricate the rocker arm assembly with clean engine oil.
- y. Fit a new gasket to the valve cover and position the valve cover on the engine. Secure the valve cover in position using a new washer and gasket on each retaining bolt. Torque the bolts to 16 to 26 N.m (12 to 19 lbf.ft).
- z. Install the fuel lines between the injection pump and the fuel injectors and torque the bolts to 28 to 31 N.m (21 to 23 lbf.ft).
- aa. Install the fuel line clamp plates and tighten them securely (Figure 23).

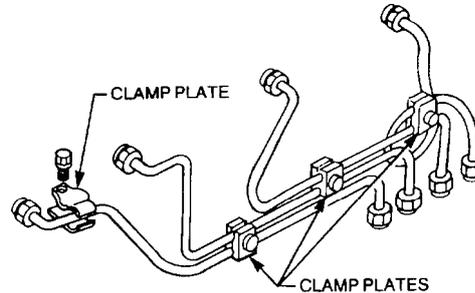


Figure 23 Clamp Plate Location

- bb. Position the fuel filter adapter on the air inlet manifold and secure it with the bolts and new washers.
- cc. Smear a new filter seal with clean fuel and install the new filter. Tighten the filter by hand until the seal contacts the adjuster and then tighten a further half a turn.
- dd. Ensure that the filter drain plug is securely installed (Figure 24).

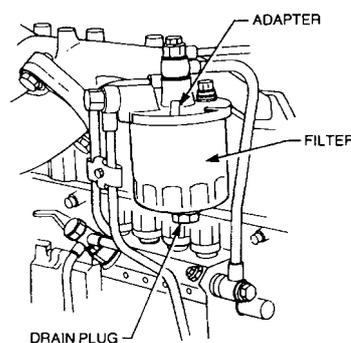


Figure 24 Fuel Filter Installation

- ee.** Connect the fuel bleed lines between each injector using new sealing washers and connect the fuel bleed line between cylinder Number 1 injector and the fuel filter adapter.
- ff.** Connect the remaining fuel lines to the filter adapter and tighten all the bolts securely (Figure 14).
- gg.** Using a new gasket, secure the air inlet pipe to the inlet manifold and tighten the bolts securely.
- hh.** Position the engine stop cable bracket on the air inlet pipe with the bolts and tighten them securely.
- ii.** Connect the electrical connector to the temperature sensor.
- jj.** Install the coolant by-pass between the thermostat housing and the water pump.
- kk.** Position the heater hose and vacuum line assembly on the engine. Insert the retaining bolts through the mounting brackets and tighten the bolts securely.
- ll.** Connect the vacuum line to the brake servo, the rear engine lifting bracket and the vacuum pump on the alternator and tighten all bolts securely.
- mm.** Connect the heater hoses to the thermostat housing, the water pump, the heater inlet and outlet pipes and tighten the hose clamps securely (Figure 3).
- nn.** Secure the engine breather assembly to the exhaust manifold with the retaining nuts and washers.
- oo.** Connect the breather pipe to the side cover outlet and tighten the retaining clamp securely.
- pp.** Install the dipstick top supporting bracket retaining bolt and tighten it securely.
- qq.** Secure the alternator adjustment bracket to the water pump with the retaining bolt.
- rr.** Ensuring that the fanbelt is located in all three drive pulleys, swing the alternator away from the engine and check the tension of the belt by applying moderate thumb pressure to the longest span of the belt. When a belt deflection of 10 to 15 mm has been obtained tighten the alternator mounting and adjusting bolts.
- ss.** Position the air cleaner bracket at the rear of the engine and install the retaining bolts, tighten the bolts securely.
- tt.** Carefully position the air cleaner in the mounting bracket and tighten the wing nuts on the clamp bolts.
- uu.** Connect the air inlet and outlet hoses and tighten the hose clamps securely.
- vv.** Connect the breather hose between the valve cover and the air inlet tube.
- ww.** Secure the front exhaust pipe to the mounting bracket with the clamp, but do not tighten it.
- xx.** Using a new sealing ring secure the front exhaust pipe to the exhaust manifold, ensuring that the sealing ring is correctly seated in the flange. Tighten the exhaust flange nuts and the mounting clamp nuts securely.
- yy.** Install the top radiator hose and tighten the hose clamps securely.
- zz.** Fill the cooling system in accordance with EMEI Vehicle G 103 – Group 2.
- aaa.** Bleed the fuel system in accordance with EMEI Vehicle G103 – Group 4.
- bbb.** Install the bonnet (Body – Group 17).
- ccc.** Start the engine and allow it to warm up to normal operating temperature. Ensure that the engine functions correctly and rectify any faults found.
- ddd.** Check for oil, fuel or coolant leaks and rectify as necessary.

Camshaft Followers

- 20. Removal.** Remove the camshaft followers as follows:
- a.** Clean the engine and engine bay with a recommended cleaning agent, paying particular attention to the area around the valve cover, timing cover and side covers. Blow the area dry with compressed air.
 - b.** Drain the engine oil into a suitable receptacle, install the drain plug together with a new sealing ring and tighten it securely.
 - c.** Disconnect the battery.

- d. Remove the bonnet (Body – Group 17).
- e. Remove the bumper brushguard in accordance with EMEI Vehicle G 103 – Group 16.
- f. Remove the grille in accordance with EMEI Vehicle G 103 – Group 17.
- g. Remove the connector from the spade terminal on the horn.
- h. Disconnect the bonnet release cable.
- i. Remove the bolts and washers securing the top of the cross-braces to the grille top panel.
- j. Remove the bolts, washers and nuts securing the bottom of the cross-braces to the chassis and remove the cross-braces.
- k. Remove the bolts and washers securing the grille panel to the mudguards, lift the grille panel and the grille top panel from the vehicle.
- l. Remove the radiator in accordance with EMEI Vehicle G 103 – Group 2.
- m. Slacken the alternator mounting bolts, remove the adjusting bolt and remove the fanbelt (Figure 25).

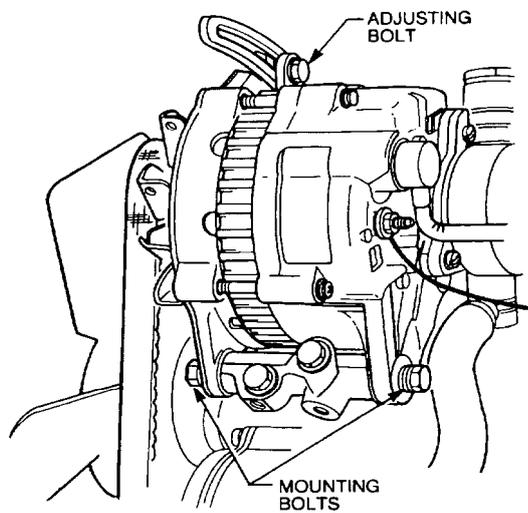


Figure 25 Alternator Adjusting Bolts

- n. Remove the bolts and washers retaining the cooling fan to the water pump drive flange, remove the fan, spacer and drive pulley.
- o. Remove the nut and washer securing the crankshaft pulley to the crankshaft.
- p. Using special tool 9–8521–0063–0, remove the pulley and woodruff keys.
- q. Remove the bolts securing the timing cover to the timing case and remove the cover.
- r. Remove and discard the oil seal.
- s. Remove the nuts securing the valve cover and remove the valve cover assembly and gasket. Discard the gasket.
- t. Slacken the rocker shaft retaining bolts and nuts in the sequence shown in Figure 15.
- u. Remove the bolts, nuts and the rocker shaft assembly.
- v. Remove the push rods and mark each rod to ensure correct location during installation.
- w. Remove the nuts and bolts securing the oil pan to the engine block. Remove the oil pan, the supporting plates and the gaskets. Discard the gaskets.
- x. Remove and discard the sealing sleeves from the retaining bolts and studs.
- y. Remove the oil pump cover from the left-hand side of the engine block. With an Allen key, remove the grub screw locating the oil pump drive pinion thrust bearing and remove the thrust bearing together with the drive pinion.

- z. Loosen one of the clamps securing the engine breather pipe to the side cover. Remove the nuts securing the breather to the exhaust manifold and remove the breather.
- aa. Remove the bolts securing the side covers to the engine block, remove the side covers and discard the gaskets and the bolt sealing washers.
- bb. Lift the camshaft followers from the camshaft lobes and support the followers in the raised position with suitable clips or tape. Ensure that there is sufficient clearance to remove the camshaft.
- cc. Rotate the camshaft drive gear to align the holes in the gear with the thrust plate retaining bolts.
- dd. Remove the retaining bolts and carefully withdraw the camshaft from the engine block. Ensure that the camshaft lobes do not scratch or damage the camshaft bearings.

NOTE

The camshaft followers will drop from the engine when the support is removed.

- ee. Match mark or number the camshaft followers (to ensure correct location at installation), remove the device supporting the followers and remove the followers.
21. **Inspection.** Clean and inspect the camshaft followers as follows:
- a. Clean the camshaft followers with a suitable cleaning agent, using steel wool or a wire brush to remove any carbon build-up.
 - b. Inspect the camshaft followers for cracks pitting or irregular wear and replace them as necessary (Figure 26).

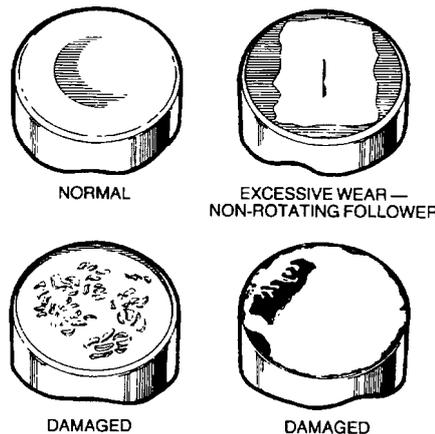


Figure 26 Camshaft Follower Wear Patterns

- c. Clean all trace of gasket material from the engine block and timing cover.
- d. Using a micrometer, check that the camshaft follower O.D. is 27.92 to 27.98 mm (1.1 to 1.1024 in) and replace them as necessary (Figure 27).

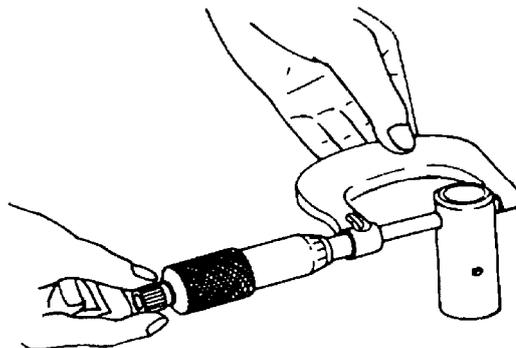


Figure 27 Camshaft Follower Outside Dimensions

- e. Using an internal micrometer, check that the camshaft follower bore is not worn beyond 0.1 mm (0.0039 in) larger than the corresponding camshaft follower.

NOTE

If the bore is beyond the maximum limit, the engine block is to be replaced.

- f. Check that the push rods are not worn, damaged or bent and replace them as necessary.
- g. Check the condition of the side cover expansion plugs (Para 31) and replace them as necessary.

22. Installation. Install the camshaft followers as follows:

- a. Lubricate the camshaft followers and each of the bores with clean engine oil.
- b. Position the camshaft followers in their corresponding bores and ensure that each follower moves freely within the bore. Secure each of the followers in the fully raised position using a suitable clip or tape.
- c. Rotate the crankshaft to align the A mark on the crankshaft gear with the A mark on the idle gear and the C mark on the injection pump gear with the C mark on the idle gear (Figure 28).

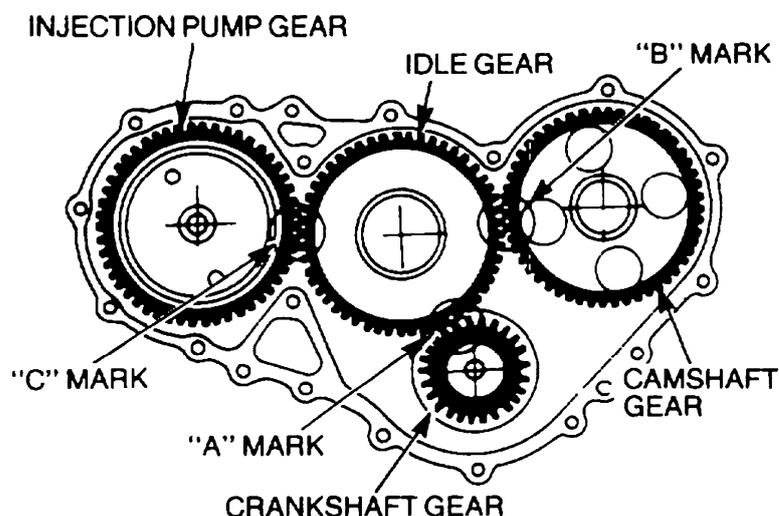


Figure 28 Aligning the Gear Timing Marks

- d. Carefully install the camshaft and align the B mark on the camshaft gear with the B mark on the idle gear.
- e. Rotate the camshaft to align the holes in the gear with the bolt holes in the block and rotate the thrust plate to align with the bolt holes.
- f. Install the retaining bolts and torque them to 21 to 30 N.m (15 to 22 lbf.ft).
- g. Remove the clips or tape securing the followers and allow the followers to drop into the bore.
- h. Fit new sealing sleeves to the oil pan retaining bolts and studs.
- i. Position new gaskets on either side of the supporting plates, then fit the oil pan to the engine block.
- j. Install the retaining bolts and nuts and torque them to 10 to 20 N.m (8 to 15 lbf.ft).
- k. Lubricate the push rods with clean engine oil and install the push rods in the camshaft followers (as noted on removal).
- l. Position a new gasket on the rear side cover and new sealing washers on the retaining bolts.
- m. Install the rear side cover and torque the retaining bolts to 16 to 27 N.m (12 to 20 lbf.ft). Repeat the procedure for the front side cover.
- n. Position the rocker shaft assembly on the cylinder head and install the retaining bolts, washers and nuts.
- o. Torque the bolts and nuts to 20 to 30 N.m (15 to 22 lbf.ft) in the sequence shown in Figure 22.

- p.** Adjust the valve clearance in accordance with EMEI Vehicle G 103 – Group 1.
- q.** Fit a new gasket to the valve cover and position the valve cover on the engine.
- r.** Secure the valve cover in position using a new washer and gasket on each retaining bolt. Torque the bolts to 16 to 26 N.m (12 to 19 lbf.ft).
- s.** Connect the breather hose between the valve cover and the air inlet tube.
- t.** Secure the engine breather assembly to the exhaust manifold with the retaining nuts. Torque the nuts to 16 to 26 N.m (12 to 19 lbf.ft).
- u.** Connect the breather pipe to the side cover outlet and tighten the retaining clamp securely.
- v.** Install a new oil seal into the timing cover ensuring that the open side of the seal is facing towards the rear of the cover.
- w.** Smear the timing cover oil seal lip with rubber grease. Position a new gasket on the timing cover using the timing cover retaining bolts to hold the gasket in place.
- x.** Install the timing cover ensuring that the gasket is correctly aligned and the sealing lip on the seal is not distorted. Install the retaining bolts and torque them to 21 to 30 N.m (15 to 22 lbf.ft).
- y.** Install the Woodruff keys onto the crankshaft and the dust thrower onto the back of the crankshaft pulley. Smear the seal rubbing surface on the crankshaft pulley with rubber grease.
- z.** Position the pulley over the end of the crankshaft, align the keyway with the keys and push the pulley onto the crankshaft.
- aa.** Install the retaining nut and washer and torque it to 382 to 480 N.m (282 to 354 lbf.ft).
- bb.** Position the drive pulley spacer and cooling fan on the water pump drive flange.
- cc.** Align the bolt holes, install the retaining bolts and tighten them securely.
- dd.** Position the fanbelt over the pulleys and adjust the tension of the fanbelt by moving the alternator outward. Ensure there is a belt deflection of 10 to 15 mm.
- ee.** When the correct tension is obtained, tighten the alternator adjusting and mounting bolts securely.
- ff.** Install the radiator in accordance with EMEI Vehicle G 103 – Group 2.
- gg.** Install the grille and top panel and secure them to the mudguards using the bolts and washers.
- hh.** Install the cross-braces and bonnet locking mechanism and secure them to the chassis and grille top panel with the bolts washers and nuts.
- ii.** Install the oil pump drive pinion and thrust bearings. Insert and tighten the grub screw (to locate the thrust bearing).
- jj.** Install the oil pump cover together with a new gasket and tighten the bolts securely.
- kk.** Refit the connector to the spade terminal on the horn.
- ll.** Install the front grille, fit the screws and tighten them securely.
- mm.** Install the bumper brushguard in accordance with EMEI Vehicle G 103 – Group 16.
- nn.** Install the bonnet (Body – Group 17).
- oo.** Connect the battery.
- pp.** Fill the engine radiator with coolant in accordance with EMEI Vehicle G 103 – Group 2.
- qq.** Replenish the engine with approximately 7.5 litres of new engine oil, start the engine and allow it to warm up to normal operating temperature.
- rr.** Ensure that the engine functions correctly and rectify any faults found.
- ss.** Check for oil leaks and rectify as necessary.
- tt.** Check the oil level and top it up if necessary.
- uu.** Check the coolant level and top it up if necessary.

Oil Pump

23. **Removal.** Remove the oil pump as follows:
- a. Clean the oil pan and surrounding area with a recommended cleaning agent. Blow the oil pan and surrounding area dry with compressed air.
 - b. Position a suitable receptacle beneath the engine, remove the drain plug from the oil pan and drain the engine oil.
 - c. Install the drain plug together with a new sealing ring and tighten it securely.
 - d. Remove the bolts and nuts securing the oil pan to the engine block and remove the oil pan.
 - e. Discard the sealing sleeves from the retaining bolts and studs.
 - f. Wipe the oil pump with a clean dry cloth and remove the bolts and washers securing the oil pipe to the engine block.
 - g. Remove the bolts securing the oil pump to the engine block and remove the oil pump and pipe assembly. Discard the oil pipe gasket.
24. **Disassembly.** Disassemble the oil pump as follows:
- a. Remove the bolts securing the oil pipe to the oil pump and discard the gasket.
 - b. Remove the gauze strainer from the case (Figure 29).

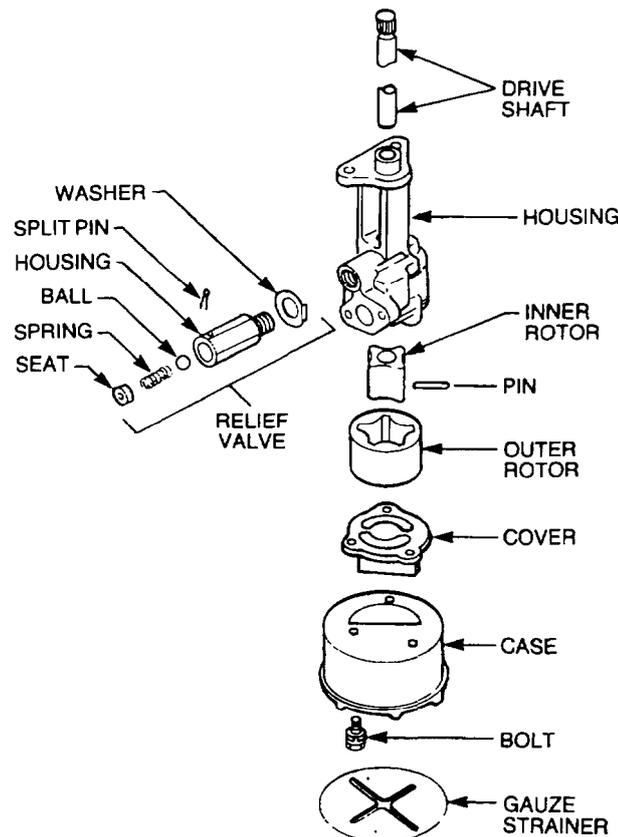


Figure 29 Oil Pump - Exploded View

- c. Remove the bolts securing the case and cover to the housing and remove the case, cover and outer rotor.
- d. Slide the inner rotor and drive shaft assembly from the housing.
- e. Remove the relief valve from the housing.
- f. Carefully remove the split pin from the housing and remove the seat, spring and ball. Discard the split pin.

25. **Inspection.** Clean and inspect the oil pump as follows:
- a. Clean all parts with a recommended cleaning agent, paying particular attention to the gauze strainer. Blow the parts dry with compressed air.
 - b. Clean all trace of gasket material from the oil pan, the engine block, the oil pipe and the oil pump.
 - c. Check the relief valve components for damage or excessive wear and replace them as necessary.
 - d. Check the housing and cover for scoring or damage and replace them as necessary.
 - e. Check the inner rotor, outer rotor, drive shaft and splines on the shaft for damage or excessive wear. Replace parts as necessary.

NOTE

The inner rotor, outer rotor and drive shaft are a matched gear set and must be replaced as a set.

- f. Insert the inner rotor, drive shaft assembly and the outer rotor into the pump housing.
- g. Hold the complete assembly in a soft-jawed vice and using a straight edge and feeler gauge, check the clearance between the inner rotor, the outer rotor and the cover (Figure 30). The clearance should be 0.050 to 0.114 mm (0.0020 to 0.0045 in). If it is outside this limit, replace the gear set.

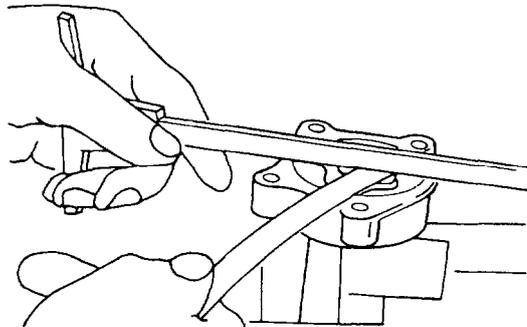


Figure 30 Checking Rotor to Cover Clearance

- h. Using a feeler gauge, check the clearance between the inner rotor and outer rotor (Figure 31). The clearance should be 0.14 mm (0.0055 in) or less. If it is outside this limit, replace the gear set.

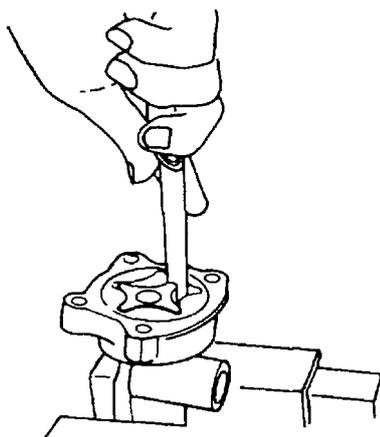


Figure 31 Checking Inner to Outer Rotor Clearance

- i. Using a feeler gauge, check the clearance between the outer rotor and the pump housing (Figure 32). The clearance should be 0.2 to 0.3 mm (0.008 to 0.012 in). If it is outside this limit, replace the oil pump.

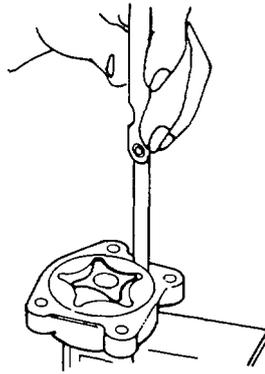


Figure 32 Checking the Outer Rotor to Housing Clearance

- j. Check that the clearance between the drive shaft and the pump housing does not exceed 0.032 to 0.070 mm (0.0013 to 0.0028 in). If it is outside this limit, replace the oil pump.
 - k. Remove the rotors and the drive shaft from the housing.
- 26. Reassembly.** Reassemble the oil pump as follows:
- a. Lubricate the inner rotor, drive shaft assembly, the outer rotor and the housing bore with clean engine oil.
 - b. Insert the inner rotor, drive shaft assembly and outer rotor into the housing.
 - c. Place the cover and case in position and secure them to the housing with the retaining bolts. Tighten the bolts securely.
 - d. Insert the gauze strainer in the lip on the case.
 - e. Insert the ball, spring and seat into the relief valve housing and secure them with a new split pin.
 - f. Fit the washer to the relief valve, screw the valve into the pump housing and tighten it securely.
 - g. Fit the oil pipe to the pump housing together with a new gasket. Ensure the correct orientation of the pipe and tighten the retaining bolts securely.
 - h. Invert the oil pump and pour clean engine oil in through the gauze strainer.
 - i. Turn the drive shaft a few turns to prime the pump.
- 27. Installation.** Install the oil pump as follows:
- a. Position the oil pump on the engine block engaging the splines on the drive shaft with the collar on the driven gear shaft.
 - b. When the oil pump is correctly positioned, install the retaining bolts and tighten them finger tight only.
 - c. Position a new gasket between the oil pipe and the engine block and secure the oil pipe with the retaining bolts.

NOTE

Ensure that the gasket does not distort as the bolts are tightened.

- d. Torque the oil pump retaining bolts to 40 to 59 N.m (31 to 45 lbf.ft).
- e. Fit the new sealing sleeves to the oil pan retaining bolts and studs.
- f. Position a new gasket on the engine block, place the oil pan over the gasket, then position a new gasket and the supporting plates over the rim of the oil pan.
- g. Install the retaining bolts and nuts and torque them to 10 to 20 N.m (8 to 15 lbf.ft).
- h. Fill the engine with clean engine oil, checking the oil level with the dipstick.
- i. Start the engine and allow it to warm up to normal operating temperature.
- j. Check for oil leaks and rectify as necessary.

Oil Cooler

28. **Removal.** Remove the oil cooler as follows:

WARNING

New gaskets provided by Land Rover do not contain asbestos. Older gaskets still fitted to vehicles may contain asbestos. During this task some parts may contain asbestos; refer and comply with procedures and warnings in the introduction section of this EMEI under paragraph heading: Items Previously Known To Have Contained Asbestos.

- a. Clean the engine with a recommended cleaning agent, paying particular attention to the area around the fuel injection pump and the oil cooler. Blow the area dry with compressed air.
- b. Place a suitable receptacle beneath the radiator and loosen the bottom radiator hose.
- c. Drain the coolant into the receptacle, then install the hose and tighten the clamp securely.
- d. Remove the oil filter using an oil filter removing tool.
- e. Remove the fuel injection pump and fuel filter in accordance with EMEI Vehicle G 103 – Group 4.
- f. Remove the bolts securing the oil pipe to the oil cooler and the oil filter adapter and discard the sealing rings.

NOTE

The oil cooler retaining bolts are different sizes. Accordingly, note the position of each bolt on removal to ensure the correct positioning on installation.

- g. Remove the bolts securing the oil cooler to the engine block.
 - h. Remove the oil cooler and discard the gasket.
 - i. Remove the bolts securing the oil cooler element to the housing.
 - j. Remove the oil cooler element from the housing and discard the gaskets.
 - k. Remove the check valve retaining bolt, then remove the spring and valve assembly and discard the washer from the retaining bolt.
29. **Inspection.** Clean and inspect the oil cooler as follows:

WARNING

New gaskets provided by Land Rover do not contain asbestos. Older gaskets still fitted to vehicles may contain asbestos. During this task some parts may contain asbestos; refer and comply with procedures and warnings in the introduction section of this EMEI under paragraph heading: Items Previously Known To Have Contained Asbestos.

- a. Clean all components with a recommended cleaning agent and blow them dry with compressed air.
- b. Remove all trace of gasket material from the oil cooler housing and the engine block.
- c. Inspect the check valve spring for wear, damage or loss of tension and replace as necessary.
- d. Remove any scale build-up on parts with a wire brush.

NOTE

If scale cannot be removed, soak the affected components in a recommended solvent and carefully dry them with compressed air. If scale cannot be removed with a wire brush after soaking, replace the parts as necessary.

- e. Inspect the housing and the element for cracks or pitting and replace them as necessary.

- 30. Installation.** Install the oil cooler as follows:
- a. Position new gaskets on the element studs and install the element in the oil cooler housing.
 - b. Torque the retaining nuts to 20 to 30 N.m (15 to 22 lbf.ft).
 - c. Invert the oil cooler and insert the check valve and spring.
 - d. Position a new washer on the retaining bolt and tighten it securely.
 - e. Install a new gasket on the oil cooler housing holding the gasket in position with retaining bolts at each end.
 - f. Position the oil cooler on the engine block and secure it with the retaining bolts in the positions noted on removal.
 - g. Torque the bolts to 20 to 30 N.m (15 to 22 lbf.ft) in the sequence shown in Figure 33.

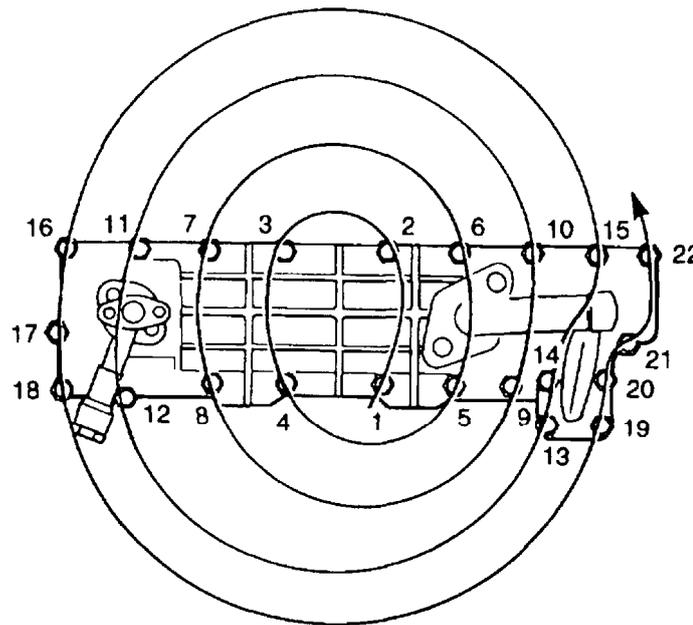


Figure 33 Oil Cooler - Tightening Sequence

- h. Fit new sealing rings, then install the oil pipe between the oil cooler and the oil filter adapter and tighten the retaining bolts securely.
- i. Install the fuel injector pump and fuel filter.
- j. Prime the fuel system in accordance with EMEI Vehicle G 103 – Group 4.
- k. Apply a film of clean engine oil to the oil filter seal and install the oil filter carefully to avoid cross-threading. Tighten the filter a further half a turn after the seal contacts the adapter.
- l. Fill the engine with approximately 8.5 litres of new engine oil.
- m. Check the level on the dipstick and top-up as necessary.
- n. Fill the cooling system in accordance with EMEI Vehicle G 103 – Group 2.
- o. Start the engine and allow it to warm up to normal operating temperature. Check for oil, fuel or coolant leaks and rectify them as necessary. Ensure that the engine functions correctly and rectify any faults found.

Expansion Plugs

31. **Removal.** Remove the expansion plugs as follows:

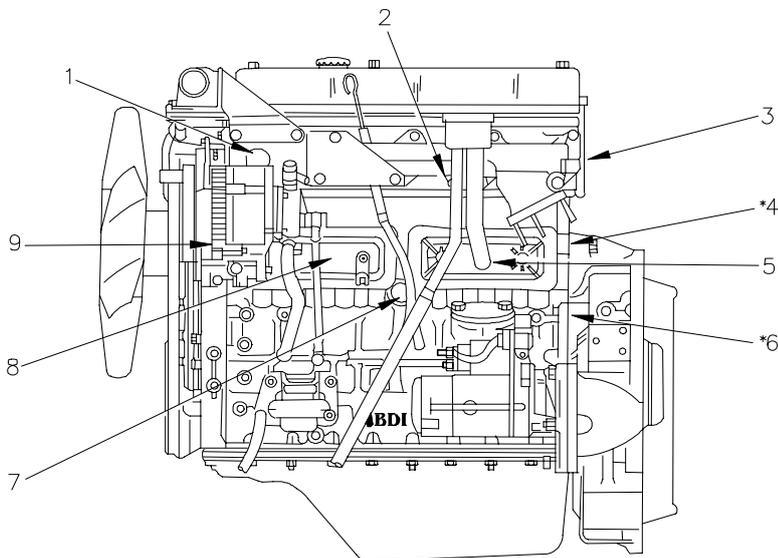
NOTE

Figures 34 and 35 illustrate the location of expansion plugs on the engine assembly. Removal of some engine components will facilitate access to the expansion plug to be removed. Refer to the relevant group in EMEI Vehicle G 103 or this EMEI for the appropriate component removal and installation procedures.

- a. Drain the engine oil or cooling system as necessary.
- b. Using a sharp instrument, pierce a hole in the expansion plug and prise the plug out. Discard the plug.

NOTE

The small expansion plugs may be difficult to remove. If necessary, use a drill, but do not exceed the outer diameter of the expansion plug.

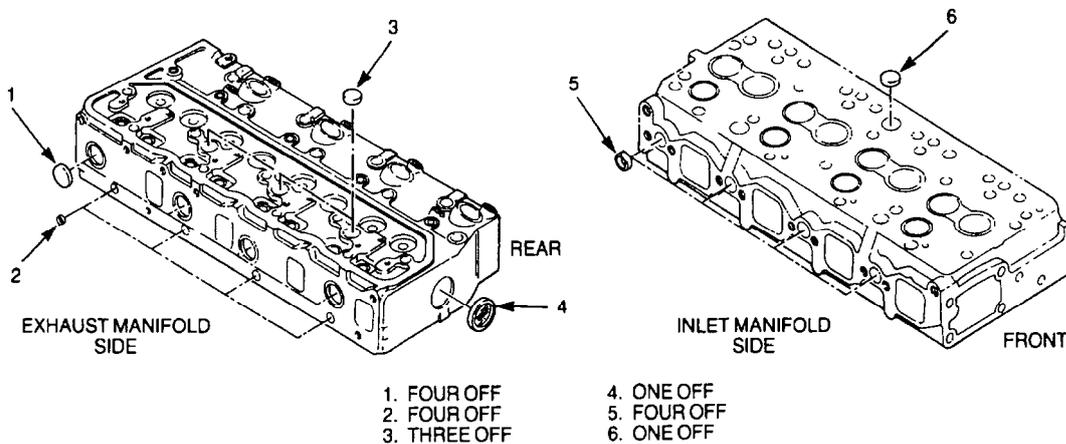


* HEAVY GRADE REPAIR ONLY. DO NOT REMOVE DURING MEDIUM GRADE REPAIR.

- | | |
|------------------------------------|------------------------------------|
| 1. FOUR OFF | 6. ONE OFF, BACK OF ENGINE BLOCK |
| 2. FOUR OFF | 7. ONE OFF. |
| 3. ONE OFF, BACK OF CYLINDER HEAD | 8. ONE OFF, BEHIND FRONT SIDECOVER |
| 4. ONE OFF, BACK OF ENGINE BLOCK | 9. ONE OFF, BEHIND WATER PUMP |
| 5. ONE OFF, BEHIND REAR SIDE COVER | |

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Figure 34 Expansion Plug Location



- | | |
|--------------|-------------|
| 1. FOUR OFF | 4. ONE OFF |
| 2. FOUR OFF | 5. FOUR OFF |
| 3. THREE OFF | 6. ONE OFF |

Figure 35 Expansion Plug Location - Cylinder Head

- 32. Installation.** Install the expansion plugs as follows:
- Ensure that the plug cavity is clean and apply a suitable sealant to the expansion plug.
 - Place the plug in the cavity and tap it into position ensuring that the plug is even and flush with the surround.
 - Install any engine components previously removed and replenish the engine oil and/or cooling system as necessary.

Flywheel and Ring-gear

- 33. Removal.** Remove the flywheel and ring-gear as follows:
- Remove the transmission (Transmission - Group 6).
 - Remove the clutch assembly (Clutch - Group 5).
 - Lock the flywheel to prevent it from rotating and suitably support the flywheel.
 - Remove the retaining bolts and remove the flywheel.
 - Partially cut through the ring-gear with a hacksaw and knock the ring-gear from the flywheel using a hammer and cold chisel.
- 34. Installation.** Install the flywheel and ring-gear as follows:
- Fit a new ring-gear by heating it uniformly and positioning the ring-gear on the flywheel, ensuring that the ring-gear is positioned evenly against the shoulder on the flywheel. Allow the ring-gear to cool.
 - Lubricate the retaining bolts with clean engine oil.
 - Install the flywheel and secure in position with the retaining bolts. Torque the bolts to 142 to 170 N.m (105 to 125 lbf.ft) in sequence (Figure 36).

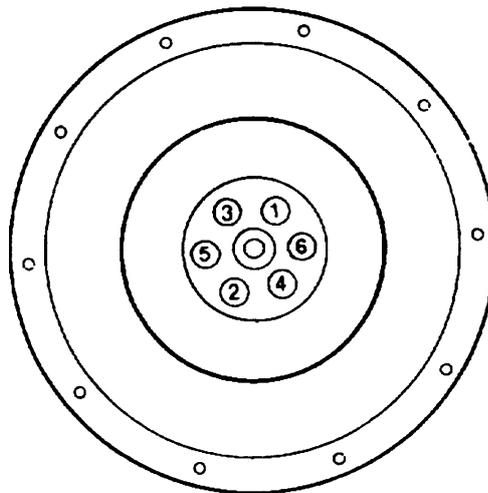


Figure 36 Flywheel - Tightening Sequence

- Install the clutch assembly (Clutch - Group 5).
- Install the transmission (Transmission - Group 6).

Crankshaft Oil Seal - Front

- 35. Removal.** Remove the front crankshaft oil seal as follows:
- Drain the coolant and remove the radiator in accordance with EMEI Vehicle G 103 - Group 2.
 - Clean the crankshaft pulley and surrounding area with a recommended cleaning agent and blow the area dry with compressed air.
 - Loosen the alternator adjusting bolt and mounting bolts and move the alternator toward the engine.
 - Remove the fanbelt.
 - Ensure that the parking brake is applied, low gear is selected, and all wheels are chocked.

- f. Remove the crankshaft front nut and washer (Figure 37).

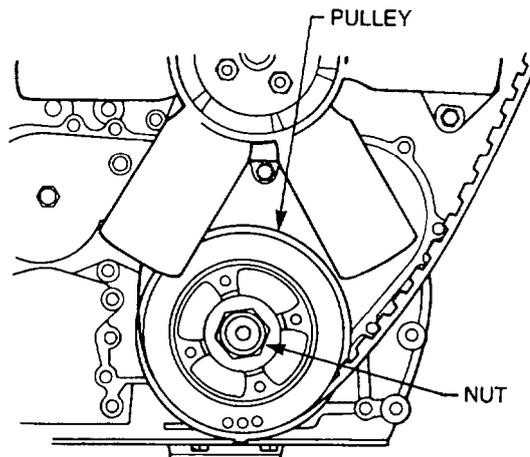


Figure 37 Crankshaft Pulley - Removal

- g. Remove the crankshaft pulley.
 - h. Remove the crankshaft seal using a lever or seal puller as required.
- 36. Installation.** Install the front crankshaft seal as follows:
- a. Lubricate the outer surface of a new seal with clean engine oil and position the seal on the timing case cover.
 - b. Install the seal using special tool 18GA092 (Figure 38).

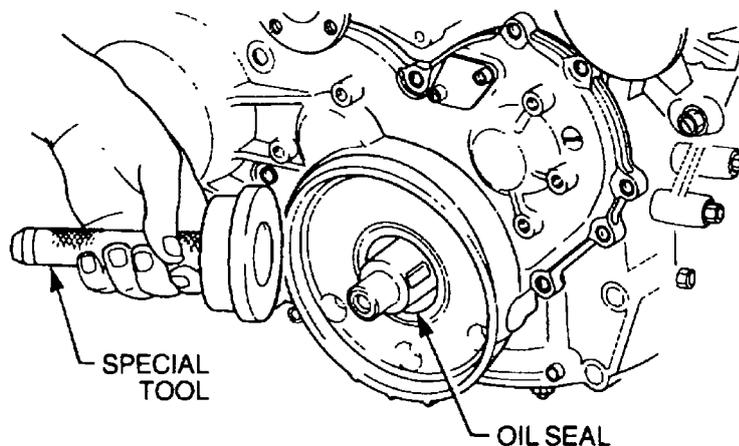


Figure 38 Crankshaft Front Oil Seal Installation

- c. Smear the oil seal lip with rubber grease.
- d. Ensure that the seal rubbing surface on the pulley is not grooved or worn.
- e. Install the pulley, washer and nut. Torque the nut to 382 to 480 N.m (282 to 354 lbf.ft).
- f. Install the fanbelt and adjust the alternator for a 10 to 15 mm deflection on the longest span of the fanbelt when depressed with the thumb.
- g. Install the radiator and refill it with coolant in accordance with EMEI Vehicle G 103 - Group 2.

Crankshaft Oil Seal - Rear

37. The earlier type of rear main crankshaft oil seal, which is currently used on the Land Rover 110 family of vehicles, has a history of marginal sealing performance and short life that has caused an unacceptably high maintenance liability. A new seal has been developed that has significantly improved sealing performance and life expectancy. The new seal incorporates a wear sleeve that can accommodate shaft scoring caused by the earlier type of seal.

38. The following instructions detail the procedures used to:
- a. remove the earlier type of seal and replace it with the new type of seal, and
 - b. remove and replace the new type of seal.
39. **Special Equipment Required.** The new type of seal is to be installed using only the tools contained in Tool, Kit, Seal Installation in Table 5. The special tool previously used to install the superseded seal is not to be used to install the new type of seal.
40. **Identification of Oil Seal Fitted to Engine.** The new type of seal has a green flange with the part number BYG2767 stamped on it that will be visible after the flywheel has been removed and the oil seal has been cleaned.
41. **Removal.** Remove the rear crankshaft oil seal as follows:
- a. Remove the engine (Engine - Group 1).
 - b. Remove and inspect the clutch (Clutch - Group 5).
 - c. Remove the flywheel (Para 33.).
 - d. Determine whether the earlier type of seal remains in the engine or if the new type of seal has been previously fitted. Use the information in Para 40. when identifying which type of seal has been fitted. If the earlier type of seal is present, proceed to Para 41.e. If the new type of seal is present, proceed to Para 41.g.
 - e. Remove the earlier type of seal as follows:



Drill swarf or other foreign matter must not be allowed to enter the engine and must be completely removed before continuing.

- (1) Drill two 3.2 mm diameter holes in the rear of the seal, 180 degrees apart and in line with the centreline of the crankshaft. Smear the drill with grease to assist with collecting the drill swarf. Clean the drill and reapply grease as required.
 - (2) Screw a 4.2 mm diameter, 16 mm long, pan-head, cross-recess head, self-tapping screw into each hole. Use the screws to pull the sleeve out of its housing. Discard the seal and the screws.
 - (3) Thoroughly clean the seal housing and the surrounding area, ensuring that all traces of drill swarf have been removed.
- f. If a Speedi Sleeve has been fitted to the crankshaft oil seal journal, it must be removed. The following procedure may be used:



To prevent filings or other foreign matter entering the engine, a clean rag or other suitable material must be packed into the seal housing before the Speedi Sleeve is removed.

- (1) Gently draw-file a flat spot onto the sleeve to create a weak point, without contacting the journal.
 - (2) Carefully insert a pointed pry bar under the sleeve to break it off the journal.
 - (3) Discard the sleeve and proceed to Para 42.
- g. The new type of oil seal may be removed using the following procedure:
- (1) To remove the seal, a workshop mechanical three-leg puller (external type, suitable for approximately 115 mm opening) must be used.
 - (2) Engage the legs over the green flange; remove and discard the seal (Figure 39).



Figure 39 Removing the New Type of Oil Seal

- 42. Installation.** Install the rear crankshaft oil seal as follows:

CAUTION

The new type of seal must be installed using the tools listed in Table 5. The use of any other tools will cause damage and incorrect installation of the seal resulting in oil leakage.

- a.** Clean and inspect the crankshaft oil seal journal for any abrasion or scoring which may have been caused by previous oil seals.

CAUTION

Emery dust or metal filings must not be allowed to enter the engine and must be completely removed before continuing.

- b.** Carefully remove any burrs or rough areas with emery paper or a fine file. Thoroughly clean away any resulting filings or emery paper dust. If wear is greater than 0.1 mm deep or wide, fill the damaged area with Loctite 3805 in accordance with the manufacturer's instructions, to prevent oil seeping under the seal.

CAUTION

Handle the crank plate and push cone carefully during use to avoid causing burrs or sharp edges that may damage the seal during installation and cause early failure.

- c.** Inspect the crank plate and push cone (Table 5, Items 2 and 3) and carefully remove any burrs or sharp edges, particularly those on the outer diameter of the crank plate.
- d.** Fit the crank plate (Table 5, Item 2) to the crankshaft with one hole positioned at the dowel pin and the other three holes aligned with the flywheel bolt holes (Figure 40).

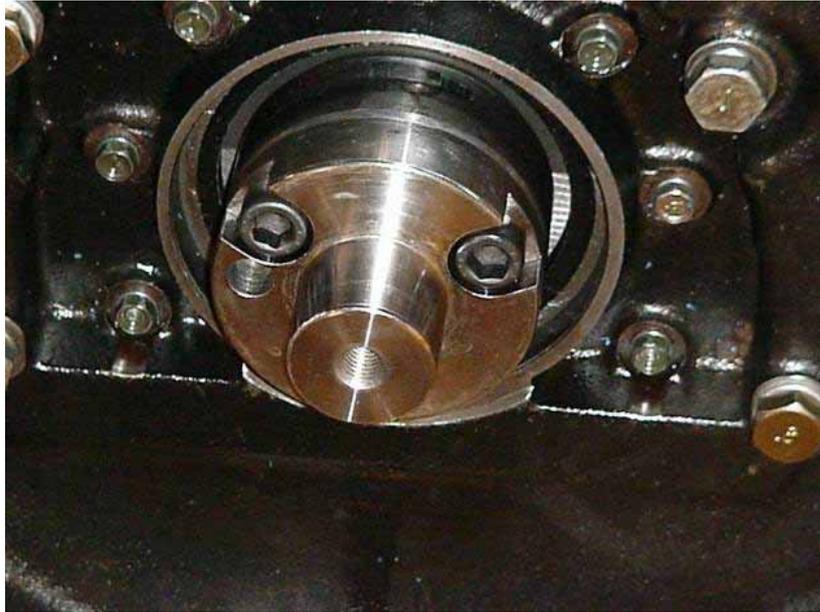


Figure 40 Crank Plate (Secured to Crankshaft)

- e. Secure the crank plate with the short screws (Table 5, Item 4), ensuring the screws are evenly tightened.

NOTE

Before installation, apply only clean engine oil to the outside surface of the new type of seal. Do not apply any type of sealant in an attempt to improve the sealing between the housing and the outer surface of the new seal.

- f. Lubricate the outside surface of the new seal with clean engine oil.
- g. Position the seal over the crank guide so that the part number stamped on the flange of the green inner sleeve is visible.
- h. Push the seal, by hand, along the crank guide until it contacts the crankshaft (Figure 41).

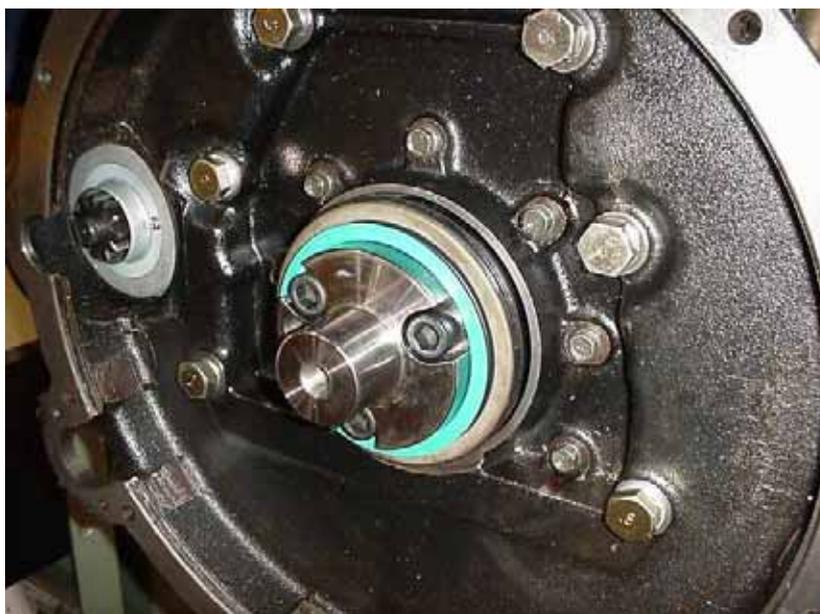


Figure 41 New Type of Seal (Placed on Crank Plate Ready for Installation)

- i. Position the push cone (Table 5, Item 3) over the crank guide, locate it onto the seal and then engage the long screw (Table 5, Item 5) into the crank guide (Figure 42).



Figure 42 Push Cone (Located on Crank Plate and Against the Seal)

CAUTION

To minimise creep back of the seal rubber and to ensure the seal remains in the correct position during service, the push cone must be left tight against the seal for at least two minutes.

- j. Rotate the screw to push the seal into its housing, until hard resistance is felt. Leave the push cone in place for at least two minutes before loosening the screw.
- k. Remove the push cone and crank guide and clean away any green bore sealant that may have been forced from inside the seal.

NOTE

The presence of green bore sealant after the seal has been installed does not indicate there is a fault with the newly installed seal. However, if it does appear, it should be cleaned away using workshop wiping cloths.

- l. Clean away any excess engine oil from the general area.

NOTE

The inner green flange on the seal will stand proud of the housing. This is intentional and no attempt should be made to alter the position of the seal as it is preset by the step on the push cone tool.

- m. Refit the flywheel and secure it in position (Para 34.).
- n. Refit the clutch and pressure plate (Clutch - Group 5).
- o. Refit the engine (Engine - Group 1).

Special Tools for Crankshaft Rear Oil Seal

43. The special tools required for the installation of the crankshaft rear oil seal are listed in Table 5.

Table 5 Special Tools Required for Crankshaft Rear Oil Seal Installation

Item	NSN	Mfr Part No	Designation or Description	Unit of Issue	Qty
1	2815-66-149-1913	EYA3737	Tool kit, seal installation (includes items 2 to 6)	ea	NA
2	NA	EYA3738	Crank plate, seal install tool	ea	1
3	NA	EYA3739	Push cone, seal install tool	ea	1
4	NA	NA	Screw, socket head cap, 14 x 1.5, 35 mm long	ea	3
5	NA	NA	Screw, socket head cap, 14 x 2, 50 mm long	ea	1
6	NA	EYA3740	Case, carry	ea	1

Engine Specifications

44. The engine specifications are detailed in Table 6.

Table 6 Engine Group Specifications

Serial	Item	Specification
	Clutch slave cylinder	
1	Tightening torque	27 N.m (20 lbf.ft)
2	Tightening torque (pipe bracket)	40 N.m (30 lbf.ft)
	Cylinder head	
3	Distortion	Less than 0.2 mm (0.008 in)
4	Tightening torque - First step	68.7 N.m (51 lbf.ft)
5	Second step	88.3 N.m (65 lbf.ft)
6	Third step	30 degrees
7	Exhaust manifold tightening torque	16 to 25 N.m (12 to 19 lbf.ft)
8	Air inlet manifold tightening torque	16 to 25 N.m (12 to 19 lbf.ft)
9	Thermostat housing tightening torque	42 to 62 N.m (31 to 45 lbf.ft)
10	Rocker shaft tightening torque	20 to 30 N.m (15 to 22 lbf.ft)
11	Fuel injectors tightening torque	20 to 30 N.m (15 to 22 lbf.ft)
12	Glow plugs tightening torque	22 to 27 N.m (16 to 20 lbf.ft)
13	Valve cover tightening torque	16 to 26 N.m (12 to 19 lbf.ft)
14	Fuel lines - high pressure tightening torque	28 to 31 N.m (21 to 23 lbf.ft)
15	Fanbelt deflection	10 to 15 mm
16	Cam followers nominal o.d	27.92 to 27.98 mm (1.1 to 1.1024 in)
17	Cam follower-to-bore clearance maximum	0.1 mm (0.0039 in)
18	Engine side covers tightening torque	16 to 27 N.m (12 to 20 lbf.ft)
19	Engine breather tightening torque	16 to 25 N.m (12 to 19 lbf.ft)
20	Oil pump rotor to cover clearance	0.050 to 0.114 mm (0.0020 to 0.0045 in)
21	Inner rotor to outer rotor clearance	0.14 mm (0.0055 in) or less
22	Outer rotor to pump housing clearance	0.2 to 0.3 mm (0.008 to 0.012 in)
23	Drive shaft to pump housing clearance	0.032 to 0.070 mm (0.0013 to 0.0028 in)
24	Tightening torque	40 to 59 N.m (31 to 45 lbf.ft)
25	Engine oil pan (sump) tightening torque	10 to 20 N.m (8 to 15 lbf.ft)
	Oil cooler	
26	Tightening torque (element to cooler)	20 to 30 N.m (15 to 22 lbf.ft)
27	Tightening torque (cooler to engine)	20 to 30 N.m (15 to 22 lbf.ft)
28	Flywheel tightening torque	142 to 170 N.m (105 to 125 lbf.ft)
29	Crankshaft front nut tightening torque	382 to 480 N.m (282 to 354 lbf.ft)
30	Crankshaft rear oil seal retainer tightening torque	20 to 30 N.m (15 to 22 lbf.ft)

Engine Fault Finding

45. The engine fault finding is detailed in Table 7.

Table 7 Engine Group Fault Finding

Serial	Symptom	Probable Cause	Action
1	Engine misfiring	Defective fuel injectors	Replace defective injectors
		Incorrectly adjusted valves	Adjust the valves to the correct clearances
		Worn or broken piston rings	Replace the engine
2	Engine stalls at low speed	Air leaks in the fuel supply	Trace the leak then rectify
		Internal or external fuel leaks	Rectify
		Incorrectly adjusted throttle linkage	Adjust the linkages to the correct specifications
		Governor weights incorrectly adjusted	Replace the fuel injection pump
		Water in fuel	Drain the sedimenter. Drain and flush the fuel tank. Replace the fuel filter then fill the fuel tank with clean fuel
		Incorrect fuel pump calibration	Replace the pump
		Cylinder head gasket blow-by or leakage	Replace the cylinder head gasket
		Blocked in-line filter	Clean or replace the filter
3	Erratic engine speed	Governor weights assembled incorrectly	Replace the fuel injection pump
		Incorrectly calibrated fuel injection pump	Replace the fuel injection pump
4	Low power	Incorrectly calibrated fuel injection pump	Replace the fuel injection pump
		Defective fuel injector(s)	Replace defective injectors
5	Engine will not reach no-load governed speed	Water in the fuel	Drain the sedimenter. Drain and flush the fuel tank. Replace the fuel filter then fill the tank with clean fuel
		Incorrectly calibrated fuel injection pump	Replace the fuel injection pump
		Defective fuel injector(s)	Replace defective injectors
		Blocked in-line filter	Clean or replace the filter
6	Excessive fuel consumption	Defective fuel injector(s)	Replace defective injectors
		Incorrect fuel pump calibration	Replace the fuel injection pump
		Clogged air cleaner elements	Replace the air cleaner elements
		Oil level too high resulting in parasitic drag on crankshaft	Adjust the oil level
7	Engine overheats	Blocked coolant passages	Flush the system
		Incorrectly calibrated fuel injection pump	Replace the fuel injection pump
		Exterior of the engine caked with dirt and grime	Clean the engine
		Blocked radiator	Clean the radiator
		Broken or loose fanbelt	Replace or adjust the fanbelt
		Low coolant level	Fill
		Faulty thermostat	Replace the thermostat
		Faulty expansion tank cap	Replace the expansion tank cap

CLUTCH

Clutch Assembly

46. **Removal.** Remove the clutch assembly as follows:

WARNING

Under no circumstances is compressed air to be used to remove dust from the clutch assembly and flywheel housing. Dust from the brake linings can be a health risk if inhaled.

- a. Remove the engine (Engine - Group 1).
- b. Lock the flywheel to prevent it from turning and matchmark the clutch pressure plate to the flywheel (Figure 43).

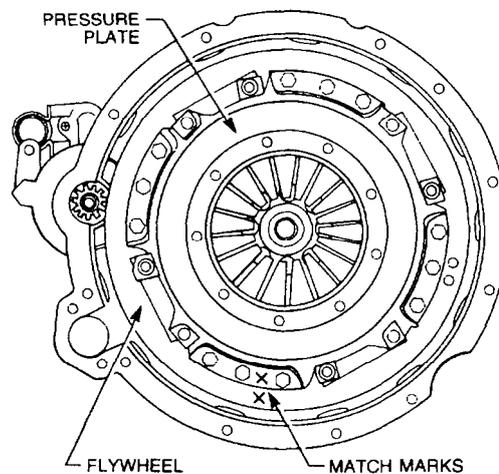


Figure 43 Pressure Plate Removal

- c. Remove the bolts securing the pressure plate to the flywheel by alternately slackening each of the bolts to prevent distortion of the pressure plate housing.
 - d. Discard the lock washers.
 - e. Withdraw the pressure plate and clutch plate.
 - f. Using a slide hammer or similar, remove the spigot bush from the crankshaft extension piece.
 - g. Discard the spigot bush.
47. Clean and inspect the clutch assembly as follows:

WARNING

Under no circumstances is compressed air to be used to remove dust from the clutch assembly and flywheel housing. Dust from the brake linings can be a health risk if inhaled.

- a. Dust off the pressure plate and inspect it for heat cracks and wear. Check the diaphragm spring for wear or damage. Replace the pressure plate as necessary.
- b. Dust off the clutch and check the lining material and the hub spline for excessive wear.
- c. Check for damaged or broken springs.
- d. Replace the clutch plate as necessary.
- e. Inspect the clutch release bearing and replace it if it is worn or damaged.

- 48. Installation.** Install the clutch assembly as follows:
- a. Using special tool 18GA134A, install a new spigot bush in the crankshaft extension piece.
 - b. Apply a small amount of molybdenum disulphide base grease to the bush.



The clamping pressure of the Land Rover 4X4 pressure plate exceeds 540 kg, while the clamping pressure for the Land Rover 6X6 exceeds 800 kg. If a Land Rover 4X4 pressure plate is fitted to a Land Rover 6X6, failure will occur. A Land Rover 6X6 pressure plate fitted to a Land Rover 4X4 will not cause failure.

- c. Install the clutch plate using special tool 18G79 to centralize the clutch plate against the flywheel.
- d. Position the pressure plate on the flywheel, engaging the dowels in the locating holes and ensuring that the matchmarks align.
- e. Install the retaining bolts and new lock washers, and alternately tighten the retaining bolts to prevent distortion of the pressure plate. Torque the bolts to 16 N.m (12 lbf.ft).
- f. Remove the clutch plate aligning tool and the flywheel locking device.
- g. Smear a thin film of molybdenum disulphide base grease on the transmission front cover extension sleeve and input shaft splines.
- h. Install the engine (Engine - Group 1).

Rectification of Jamming Clutch

- 49. Clutch Throw-out Lever Repair.** Repair a loose clutch throw-out lever (or to prevent dislodgement of the clutch throw-out lever from the bell housing) as follows:

- a. Remove the engine (Engine - Group 1).
- b. Remove the throw-out lever pivot and retaining cap from the bell housing.
- c. Clean the lever pivot and housing hole with a Loctite cleaning solvent and allow it to dry.
- d. Apply Loctite 601 to the pivot and refit it and the retaining cap into the bell housing. Allow the Loctite to cure for at least one hour.

NOTE

Due to limited access, a right angle drill is required to drill the hole through the bell housing.

- e. Drill a hole through the bell housing and throw-out pivot lever, suitable to fit a 3 mm diameter x 25 mm long roll pin (Figure 44).



Figure 44 Location of Roll Pin Hole

- f.** Fit the roll pin to prevent dislodgement of the pivot.
- g.** Install the engine (Engine - Group 1).

Clutch Specifications

50. The clutch specifications are detailed in Table 8.

Table 8 Clutch Specifications

Serial	Item	Specification
1	Clutch pressure plate tightening torque	16 N.m (12 lbf.ft)

TRANSMISSION

Transmission Assembly

NOTE

If the transfer of oil between the transmission and the transfer case is suspected, carry out the monitoring procedures detailed at Para 57. prior to changing the transmission assembly.

If the transfer case is suffering continual disengagement (jump out) rectify it in accordance with the procedures detailed in EMEI Vehicle G 103 and procedures detailed at Para 63. prior to changing the transmission assembly.

51. **Removal.** Remove the transmission/transfer case assembly as follows:
- Clean the transmission and surrounding underbody area with a recommended cleaning agent and blow the area dry with compressed air.
 - Disconnect the battery.
 - Remove the floor mats.
 - Remove the bonnet and left-hand door (Body – Group 17).

WARNING

Do not work on the vehicle without the use of an axle stand beneath the axle. Place the axle stand as close to the raised wheel as possible. This procedure is required for all repairs and maintenance activities involving positioning of body parts in potential crush zones of the vehicle. Failure to comply may result in serious injury or death.

- Raise the vehicle and support the vehicle on suitable chassis stands.
- Remove the fuse box cover.
- Remove the screws securing the fuse box to the firewall (Figure 45). Secure the fuse box out of the way.

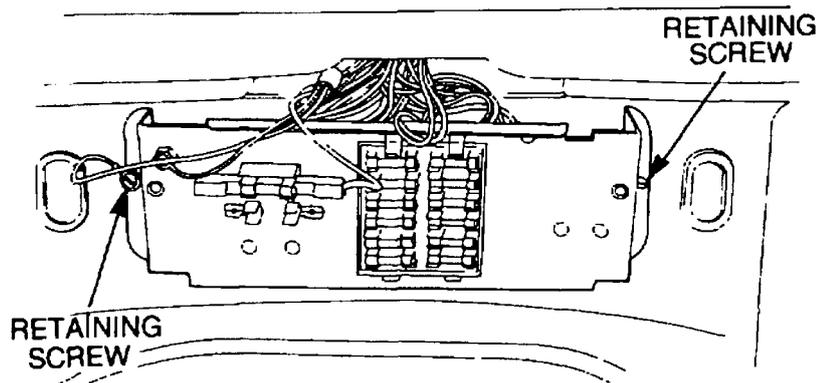


Figure 45 Fuse Box Removal

- Remove the following in accordance with EMEI Vehicle G 103 - Group 6:
 - the gear lever,
 - the top cover, and
 - the transfer case selector lever.
- Remove the push-on connectors from the reverse light switch located on the top of the transmission (Figure 46).

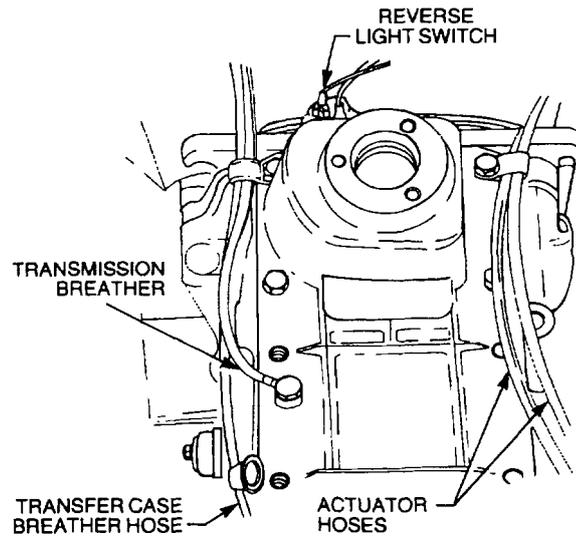


Figure 46 Hose Clamps Removal

- j. Remove the clamps securing the breather and actuator hoses to the transmission (Figure 46).
- k. Remove the transmission breather hose from the top of the transmission.
- l. Secure the special lifting bracket RO1001 to the transmission with the bolts from the transfer case selector lever (Figure 47).

NOTE

The lifting bracket position is determined by the cut-out for the transmission breather.

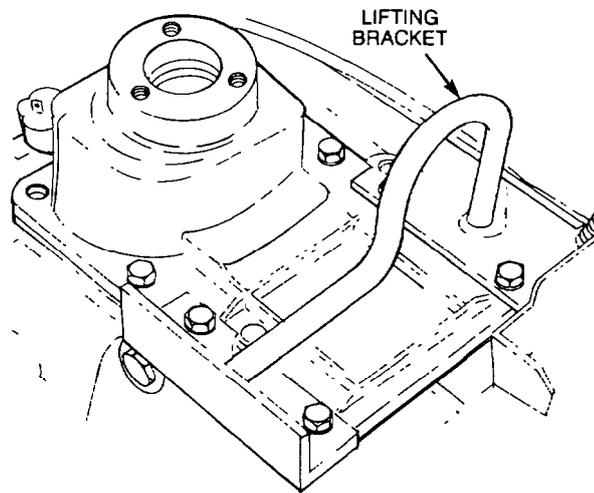


Figure 47 Transmission Lifting Bracket

- m. Remove the hose clamps securing the air inlet and outlet hoses to the air cleaner housing and disconnect the hoses. Cap the hoses.
- n. Remove the wing nuts from the clamp bolts (Figure 4) and carefully lift the air cleaner out of the mounting brackets.
- o. Remove the nuts securing the front exhaust pipe to the exhaust manifold at the flange. Slacken the clamp securing the exhaust pipe support bracket. Discard the sealing ring.
- p. Remove the nuts, washers and bolts securing the front exhaust pipe to the muffler pipe (Figure 5).
- q. Remove the front exhaust pipe.
- r. Disconnect the bullet electrical connector from the differential lock warning light switch (Figure 48).

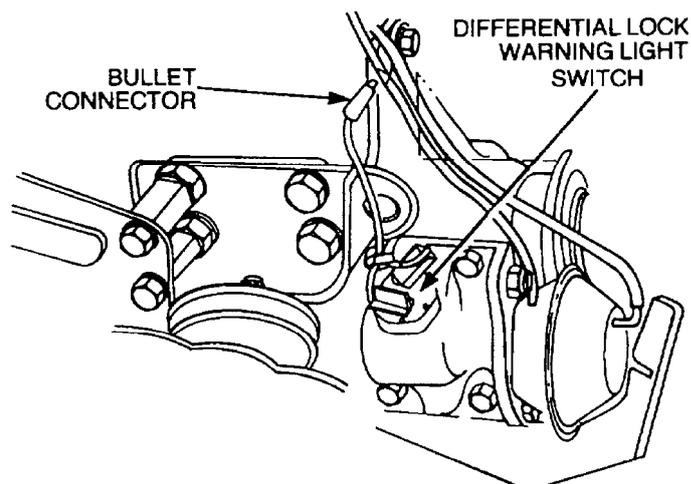


Figure 48 Differential Lock Disconnection

- s. Tag and disconnect the vacuum hoses from the differential lock vacuum chamber.
- t. Remove the split pin and clevis pin securing the parking brake cable to the pivot at the transmission end of the cable (Figure 49).

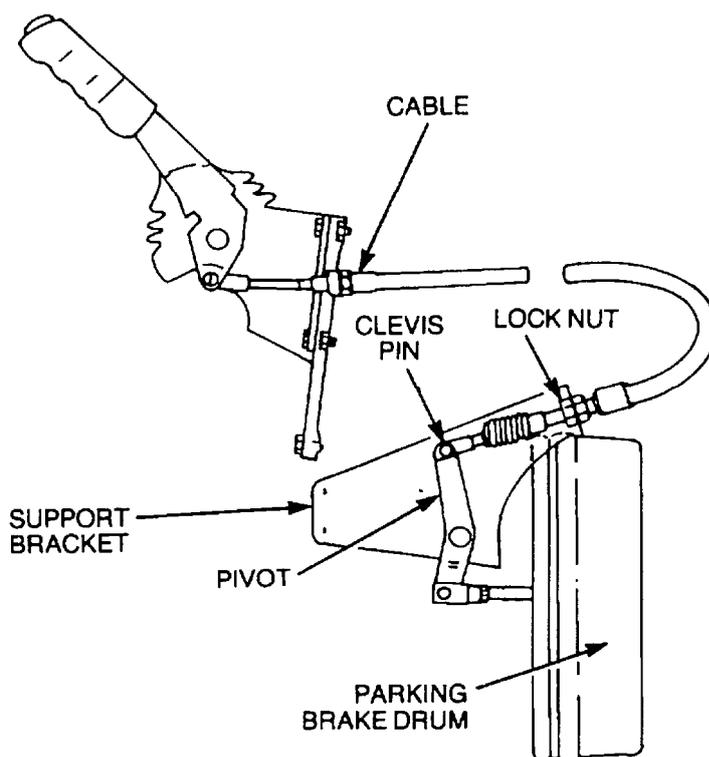


Figure 49 Parking Brake Cable Removal

- u. Loosen the locknuts and remove the end nut from the cable. Withdraw the cable from the bracket.
- v. Remove the locknut and retaining clip securing the speedometer cable to the transmission (Figure 50).

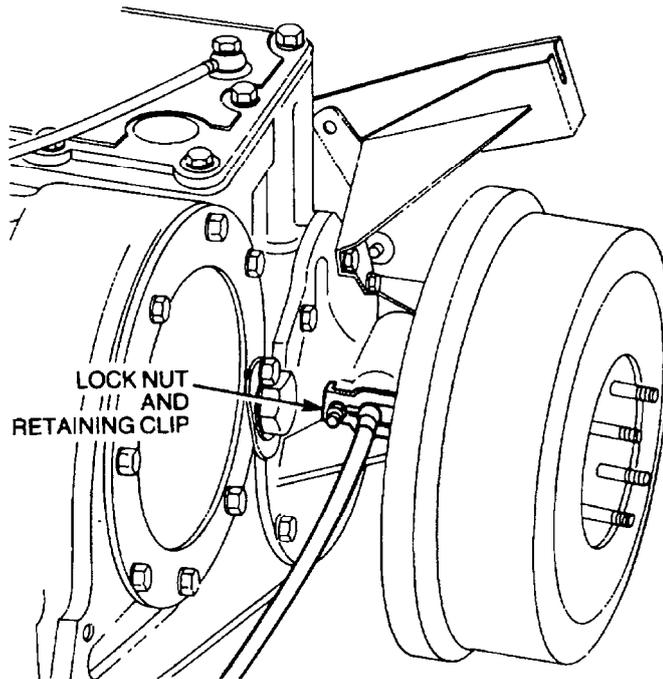


Figure 50 Speedometer Cable Removal

- w. Remove the cable from the transmission.
- x. Remove and discard the locknuts securing the rear propeller shaft flanges to the rear differential and the transmission rear output flange (Figure 51).

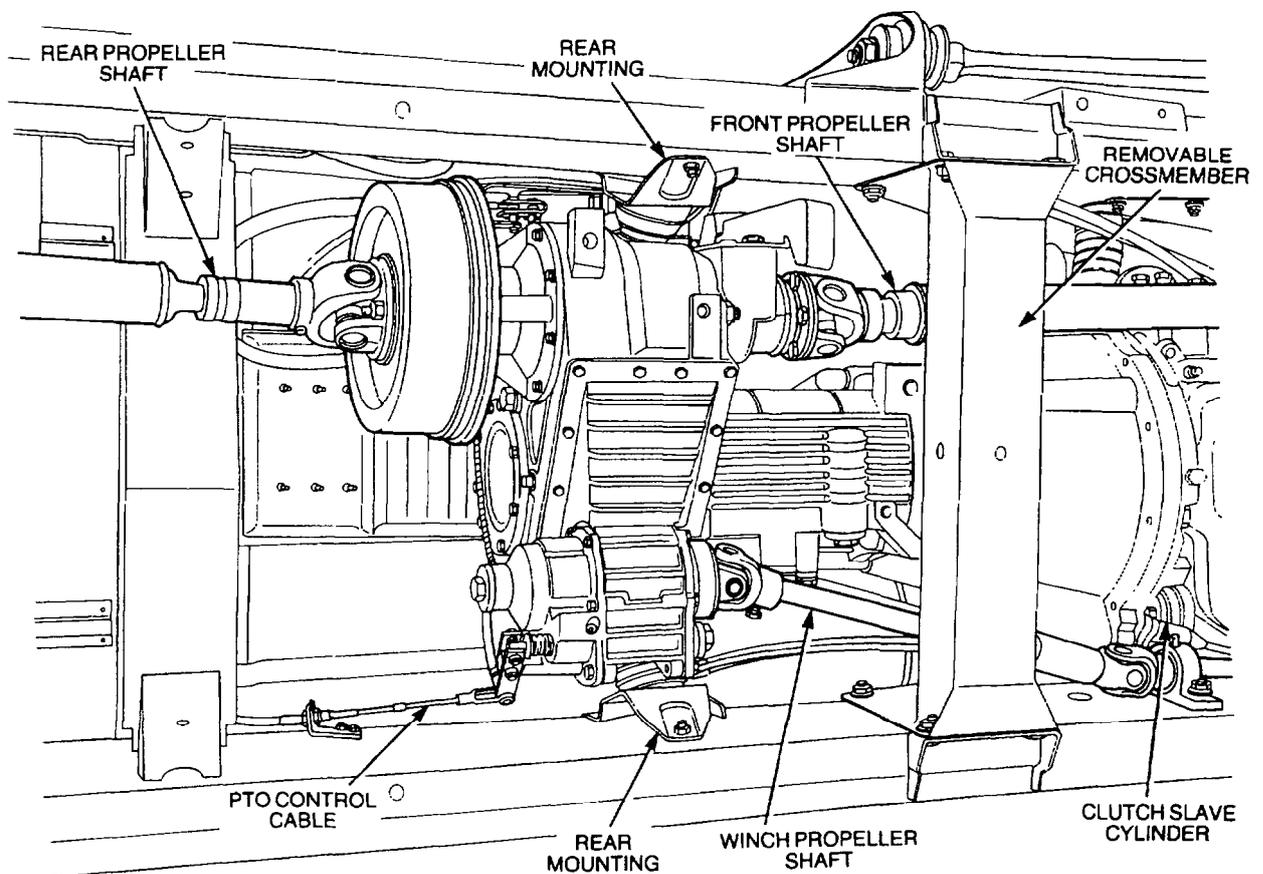


Figure 51 Transmission Removal

- y. Remove the propeller shaft.

NOTE

Ensure the propeller shaft bolts to the transfer case rear output flange (fitted with handbrake drum) are secured in accordance with EMEI Vehicle G 103. If the propeller shaft bolts are not secured, complete the process described in EMEI Vehicle G 103 before installing the transmission.

- z. Remove and discard the locknuts from the front propeller shaft flange at the transmission (Figure 51).
- aa. Lower the propeller shaft.

NOTE

Ensure that the winch and PTO are disengaged.

- bb. Remove the bolts and lock washers securing the winch propeller shaft flange to the PTO (Figure 51). Lower the propeller shaft.
- cc. Remove the split pin and clevis pin securing the PTO control cable to the PTO (Figure 51). Discard the split pin.
- dd. Remove the bolts securing the clutch slave cylinder to the transmission bell housing and then remove the hydraulic pipe bracket from the starter motor stud.
- ee. Remove the slave cylinder complete with dustcover and backing plate.
- ff. Connect suitable overhead lifting equipment to the engine rear lifting bracket.
- gg. Connect suitable overhead lifting equipment, with a minimum safe working load of 350 kg, to the transmission lifting bracket.

NOTE

A suitable length of chain with a D-shackle should be used between the transmission lifting bracket and the lifting equipment.

- hh. Support both the engine and the transmission with the lifting equipment. Remove the bolts securing the transmission bell housing to the flywheel housing.
- ii. Remove the bolts securing the removable crossmember to the chassis rails and remove the crossmember by forcing it downward (Figure 51).
- jj. Remove the bolts and washers securing each rear mounting bracket to the chassis rails (Figure 51). Note the position of the rear earth strap to assist locating the earth strap when the transmission is installed.

NOTE

If the rear earth strap is not fitted refer to EMEI Vehicle G 187-3 for the fitting procedure.

- kk. Lower the transmission and the rear of the engine simultaneously until the transmission lifting bracket clears the seat support.
- ll. Remove the transfer case breather from the top of the transfer case and slide the transmission rearward until the transmission input shaft clears the clutch pressure plate. When the transmission is clear of the clutch, lower the transmission.
- mm. Inspect the transmission and bell housing for oil leaks. Any oil leaks are to be rectified prior to installation.

52. Installation. Install the transmission/transfer case assembly as follows:

- a. Secure the special lifting bracket RO1001 to the transmission with the bolts that normally secure the transfer case selector lever (Figure 47).

NOTE

The lifting bracket position is determined by the cut-out for the transmission breather.

- b. Smear a thin film of molybdenum disulphide grease on the transmission front cover extension sleeve and on the input shaft, including the splines, then position the transmission beneath the vehicle.
- c. Position suitable overhead lifting equipment, with a minimum safe working load of 350 kg in through the cabin door.
- d. Attach a suitable length of chain, with a D-shackle, to the lifting equipment and to the transmission lifting bracket.
- e. Connect suitable overhead lifting equipment to the engine rear lifting bracket.
- f. Slowly raise the transmission to allow the transmission input shaft to engage in the clutch pressure plate. Slight rotation of the crankshaft may be necessary to align the splines.
- g. Connect the transfer case breather to the top of the transfer case before raising the transmission fully.
- h. Carefully raise the transmission and the rear of the engine until the transmission is in place.
- i. Position the rear mounting brackets on the chassis rails, align the bolt holes, then install the retaining bolts and tighten them securely.
- j. Ensure the rear earth strap is installed.



During installation of the engine or transmission, DO NOT use the bell housing bolts to pull the assemblies together, if there is a gap evident. This will cause the input bearing retaining plates to bend, and allow excess end float of the main shaft. If the plates are bent the transmission must be removed and returned for overhaul.

- k. Install the bolts securing the transmission bell housing to the flywheel housing and tighten the bolts securely.
- l. Support the front propeller shaft and the winch propeller shaft, then install the removable crossmember and tighten the retaining bolts securely.
- m. Remove the overhead lifting equipment and the transmission lifting bracket.
- n. Apply a suitable sealer to both sides of the clutch slave cylinder backing plate and position the plate on the cylinder.
- o. Smear the inside of the dust cover with clean hydraulic fluid and install the dust cover on the cylinder.
- p. Install the slave cylinder into the transmission bell housing, ensuring that the push rod is inserted into the dust cover (Figure 11), and the bleed screw is uppermost.
- q. Install the slave cylinder retaining bolts and washers and torque the bolts to 27 N.m (20 lbf.ft).
- r. Fit the hydraulic pipe bracket to the starter motor stud and torque the retaining nut to 40 N.m (30 lbf.ft).
- s. Secure the PTO control cable to the PTO with the clevis pin and a new split pin.
- t. Align the winch propeller shaft flange with the PTO output shaft and, using new lock washers, install the retaining bolts and torque them to 61 N.m (45 lbf.ft).
- u. Align the front propeller shaft flange with the transmission output flange and secure it with new locknuts. Torque the nuts to 41 to 52 N.m (30 to 38 lbf.ft).

- v.** Position the rear propeller shaft between the rear differential and the transmission rear output flange, with the propeller shaft sliding member toward the rear of the vehicle.
- w.** Ensure the propeller shaft bolts to the transfer case rear output flange (fitted with handbrake drum) are secured in accordance with EMEI Vehicle G 103. Fit new locknuts and torque them to 41 to 52 N.m (30 to 38 lbf.ft).
- x.** Secure the speedometer cable to the transmission with the retaining clip and a new locknut.
- y.** Fit the parking brake cable on the support bracket and adjust the locknuts on the cable until the clevis fork aligns with the pivot.
- z.** Install the clevis pin and secure it with a new split pin.
- aa.** Install the bullet electrical connector on the differential lock warning light switch (Figure 48).
- bb.** Connect the vacuum hoses to the differential lock vacuum chamber, ensuring that the red hose is connected to the front fitting.
- cc.** Position the front exhaust pipe on the vehicle, securing the pipe to the front mounting bracket with the clamp, but do not tighten it.
- dd.** Install a new sealing ring and secure the front exhaust pipe to the exhaust manifold ensuring that the sealing ring is correctly seated in the flange.
- ee.** Tighten the exhaust flange nuts and the mounting clamp nuts securely.
- ff.** Align the front exhaust pipe with the muffler pipe then secure it with the bolts, washers and nuts. Tighten the retaining bolts securely.
- gg.** Carefully position the air cleaner in the mounting bracket and tighten the wing nuts on the clamp bolts.
- hh.** Connect the air inlet and outlet hoses to the air cleaner and tighten the hose clamps.
- ii.** Connect the transmission breather hose to the top of the transmission. Secure the breather hose and the actuator hose in position with the respective clamps (Figure 46).
- jj.** Install the push-on electrical connectors on the reverse light switch located on top of the transmission (Figure 46).
- kk.** Install the following in accordance with EMEI Vehicle G 103 - Group 6:
 - (1)** the transfer case selector lever,
 - (2)** the top cover, and
 - (3)** the gear lever.
- ll.** Position the fuse box against the firewall and secure it with the screws.
- mm.** Install the fuse box cover.
- nn.** Install the floor mats.
- oo.** Ensure the transfer case caution decal is fitted in accordance with EMEI Vehicle G 197-4.
- pp.** Check the oil level in both the transmission and transfer case. Top up if necessary.
- qq.** Raise the vehicle and remove the chassis stands. Lower the vehicle and chock the wheels.
- rr.** Install the bonnet and left-hand door (Body - Group 17).
- ss.** Check the application of the parking brake and adjust it if necessary in accordance with EMEI Vehicle G 103 - Group 12.
- tt.** Connect the battery, start the engine and allow it to warm up to normal operating temperature. Check that the transmission, transfer case and PTO function correctly and rectify any faults found.

Power Take Off (PTO)

53. Removal. Remove the PTO as follows:

- a. Clean the transfer case and PTO housing thoroughly with a recommended cleaning agent and blow them dry with compressed air.
- b. Place a suitable receptacle beneath the transfer case, remove the transfer case drain plug and drain the contents into the receptacle.
- c. Install the drain plug securely.
- d. Ensure that the winch and PTO are disengaged. Remove the split pin and clevis pin securing the PTO control cable to the PTO (Figure 52). Discard the split pin.

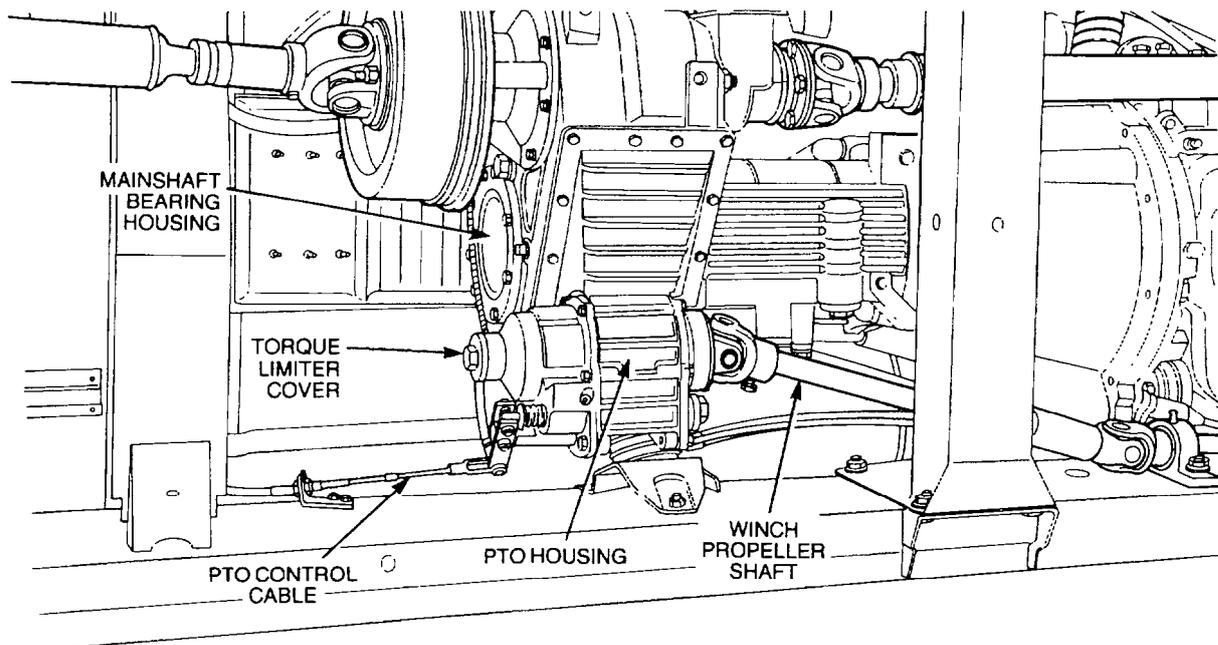


Figure 52 Power Take Off Removal

- e. Remove the bolts and lock washers securing the winch propeller shaft flange to the PTO and lower the propeller shaft.
- f. Using special flange holding wrench 18G1205A, remove the output shaft flange retaining nut and the bolts securing the output shaft end cover to the PTO housing.
- g. Remove the output shaft end cover and discard the gasket.
- h. Remove the bolts securing the mainshaft bearing housing to the transfer case taking care not to dislodge the mainshaft end support bearing (Figure 52).
- i. Remove the housing and discard the gasket.
- j. Remove the bolts securing the torque limiter cover to the PTO housing.
- k. Remove the cover and shaft assembly and discard the gasket.
- l. Lift the lower sprocket up and remove the chain from the sprocket (Figure 53).

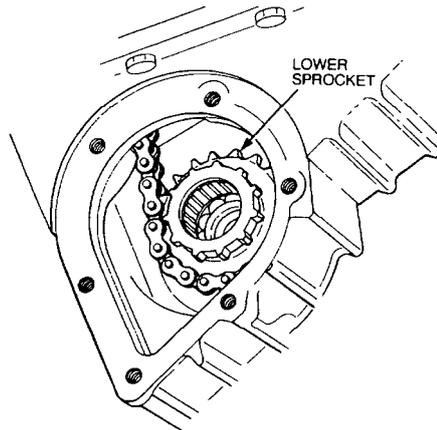


Figure 53 PTO Chain Removal

- m. Remove the chain from the upper sprocket and withdraw the chain through the opening in the transfer case.
- n. Remove the lower sprocket from the PTO housing.
- o. Remove the bolts securing the PTO housing to the transfer case and remove the housing. Discard the gasket.
- p. Remove all trace of gasket material from the PTO housing and the transfer case.

54. Installation. Install the PTO as follows:

- a. Position a new gasket on the PTO housing and hold it in place with two retaining bolts.
- b. Position the PTO housing on the transfer case and tighten the retaining bolts finger tight. Install the remaining bolts and torque them evenly to 30 N.m (22 lbf.ft).
- c. Insert the sprocket in the PTO housing ensuring that the sprocket is correctly positioned.
- d. Lightly lubricate the PTO chain with engine oil and insert the chain in through the opening in the transfer case.
- e. Fit the chain over the lower sprocket then raise the lower sprocket and install the chain on the upper sprocket.
- f. Position a new gasket on the torque limiter cover and hold it in place with two retaining bolts.
- g. Install the torque limiter cover and shaft assembly ensuring that the lower sprocket is correctly located on the shaft. Secure the cover with the retaining bolts.
- h. Install the remaining bolts and tighten all bolts securely.
- i. Position a new gasket on the output shaft and cover and hold it in place with two retaining bolts.
- j. Install the end cover on the PTO housing and tighten the bolts finger tight. Install the remaining bolts and tighten all bolts securely.
- k. Using special flange holding wrench 18G1205A, install the output shaft flange retaining nut and torque it to 61 N.m (45 lbf.ft).
- l. Position a new gasket on the mainshaft bearing housing and hold it in place with two retaining bolts.
- m. Install the mainshaft bearing housing, ensuring that the mainshaft is correctly located in the bearing and tighten the bolts finger tight.
- n. Install the remaining bolts and torque all bolts to 24 to 30 N.m (18 to 22 lbf.ft).
- o. Align the winch propeller shaft flange with the PTO output shaft and, using new lock washers, install the bolts and torque them to 61 N.m (45 lbf.ft).
- p. Secure the control cable to the PTO with the clevis pin and a new split pin.
- q. Fill the transfer case with approximately 5.8 litres of clean oil.
- r. Start the engine and check the PTO and winch for correct operation. Rectify any faults found.

Transfer Case

55. The transfer case is removed as part of the transmission assembly. For removal and installation instructions, refer to Para 51.



After installation, run the engine for ten minutes with the transmission in fourth gear and the transfer selector in neutral. This procedure will flush out any petroleum jelly used during reassembly and will ensure oil circulation to all bearings.

NOTE

If transfer of oil between the transmission and the transfer case is suspected, carry out the monitoring and rectification procedures (Para 57) prior to changing the transmission.

If the transfer case is suffering continual disengagement (jump out) rectify it in accordance with the procedures detailed in EMEI Vehicle G 103 and Para 63 prior to changing the transmission.

Oil Pump Front Cover and Transmission Input Seal

56. Repair the oil pump front cover and transmission input seal as follows:



New gaskets provided by Land Rover do not contain asbestos. Older gaskets still fitted to vehicles may contain asbestos. During this task some parts may contain asbestos; refer and comply with procedures and warnings in the introduction section of this EMEI under paragraph heading: Items Previously Known To Have Contained Asbestos.

NOTE

If oil tracking is evident between the oil pump cover plate and the transmission housing, the following procedure is an in-service repair.

- a. Remove the transmission assembly (Para 51).
- b. Drain the transmission oil into a suitable container.
- c. Disconnect the clutch throw-out lever from the bell housing pivot.
- d. Remove the lever and throw-out bearing assembly and clean the area around the oil pump cover with a suitable cleaning agent.
- e. Remove the screws and washers securing the front cover and the oil pump to the transmission assembly. Remove the oil pump cover and the front input seal and gasket. Ensure that the countershaft front bearing shim is retained.
- f. Using kerosene and fine emery paper, hand lap the oil pump cover on a suitable flat surface to a flatness of 0.05 mm (0.002 in). There should be a minimum of three millimetres flat width around the plate perimeter.
- g. Remove the relief valve retaining plug from the rear of the oil pump front cover.
- h. Ensure that the relief valve ball and spring are fully functional.
- i. Install the relief valve ball and spring.
- j. Fit the retaining plug until it is approximately one thread or 0.025 mm (0.10 in) below the front cover rear face.

- k. Thoroughly clean the mating surfaces of the cover and the transmission with a suitable cleaning agent.
- l. Using special tools 18G134 and 18G134DG, press in the input oil seal, plain face first into the front cover (Figure 54).

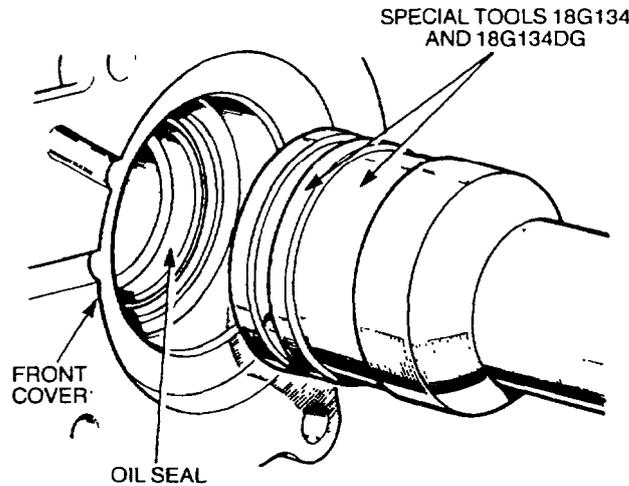


Figure 54 Front Cover Oil Seal Installation



The alignment of the oil feed ring and the oil delivery hole is most important. A restricted oil supply to the mainshaft will result if the holes are not aligned.

- m. Ensure the centre oil hole on the oil feed ring aligns with the oil delivery hole in the front cover, then using special tools 18G134 and 18G134DG, press in the oil feed ring (Figure 55).

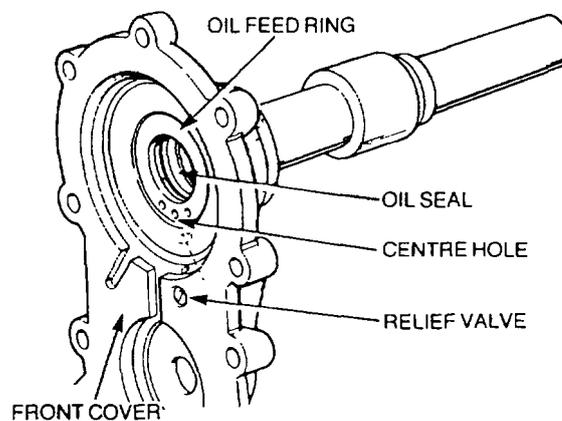


Figure 55 Oil Feed Ring and Relief Valve Installation

- n. Ensure the shim is installed on the counter shaft front bearing; fit the oil pump front cover and a new gasket (Figure 56).
- o. Install the oil pump front cover retaining lock washers, nuts and bolts, but do not tighten them at this stage.
- p. Smear the oil pump drive gear with clean engine oil and carefully insert the drive gear into the oil pump and countershaft drive square.

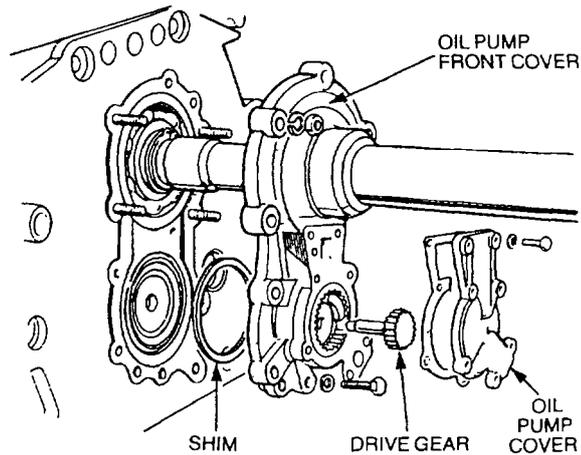


Figure 56 Oil Pump Front Cover Installation

- q. Apply Permatex sealant, or equivalent, to both sides of the oil pump cover gasket.
- r. Install the oil pump cover gasket and oil pump cover.
- s. Fit the lock washers to the bolts and apply Loctite 242 half way along the screw threads. Fit and torque the bolts to 10 N.m (8 lbf.ft), centremost bolt first then the outermost.
- t. Ensure that the oil pump front cover is evenly fitted around the input shaft and torque the bolts and nuts to 30 N.m (22 lbf.ft).
- u. Paint, letter stamp or scratch the letter 'S' on the housing cover to indicate the housing has been lapped.
- v. Lubricate the extension housing sleeve on the transmission front cover.
- w. Ensure the throw-out bearing and the throw-out lever nylon pivot bush are fully functional.
- x. Refit the nylon bush and throw-out lever to the bell housing pivot and secure them using the clip and retaining bolt.
- y. Ensure that the slave cylinder pushrod is properly engaged in the securing clip.
- z. Install the transmission (Para 52.).

Rectification of Oil Transfer Between Transfer Case and Transmission

57. The rectification procedure is to be conducted in three stages as follows:
- a. an oil level check,
 - b. a monitoring period, and
 - c. a repair procedure.
58. **Oil Level Check.** The following procedure is to be carried out when checking or filling the transfer case and transmission to stabilise oil levels prior to monitoring:
- a. Park the vehicle on a flat level surface overnight or for a period of no less than six hours.

NOTE

- Checking of oil levels when the transmission assembly is warm or at operating temperature will cause incorrect readings, with excess oil readings of up to 250 millilitres possible.
- b. Using a suitable container, remove the filler plugs from the transfer case/transmission and allow sufficient time for excess oil to drain off completely.
 - c. Check both the transfer case and transmission breathers to ensure that they are fully functional.
 - d. Fill the transfer case/transmission as required with SAE GRADE 40 (OMD-115) to the bottom of the filler plug hole and allow sufficient time for excess oil to drain off completely.

- e. Refit the filler plugs.
- f. Place a suitable warning decal on the vehicle dashboard and the ST2 (G2) cover, to notify any drivers that the transmission oil levels are being monitored and that all checks, where possible, be conducted by workshop personnel.

59. Monitoring Period. The monitoring period is to be for a minimum of 1000 kilometers with checks conducted monthly. Monitoring should not exceed 3000 kilometers, as the occurrence of oil transfer should have been confirmed during monthly checks.

60. Should oil transfer not be evident during the monitoring period the warning decals are to be removed from the vehicle and the ST2 cover with the results of findings entered in the vehicle's Record Book for Service Equipment (GM 120).

61. If oil transfer is evident during the monitoring period the following repair procedure is to be carried out.

62. Repair Procedure. The following repair procedure can be carried out with the transmission in the chassis:

WARNING

New gaskets provided by Land Rover do not contain asbestos. Older gaskets still fitted to vehicles may contain asbestos. During this task some parts may contain asbestos; refer and comply with procedures and warnings in the introduction section of this EMEI under paragraph heading: Items Previously Known To Have Contained Asbestos.

NOTE

Certain sequences in the following procedure only apply to the winch variant.

- a. Ensure the vehicle handbrake is applied and the wheels are chocked.
- b. Remove the PTO (if fitted) (Para 53.).
- c. If a PTO is not fitted, remove the bolts securing the mainshaft bearing housing to the transfer case, taking care not to dislodge the mainshaft end support bearing. Discard the gasket.

CAUTION

Failure to select third gear in the transmission can result in the dislodgement of a thrust bearing on the mainshaft which would necessitate the removal and overhaul of the transmission assembly to rectify.

- d. Select third gear in the transmission.
- e. Remove the circlip and shim retaining the transfer gear to the mainshaft.
- f. Remove the transfer gear and spacer. If required use special tool 18GA091 (Figure 57).

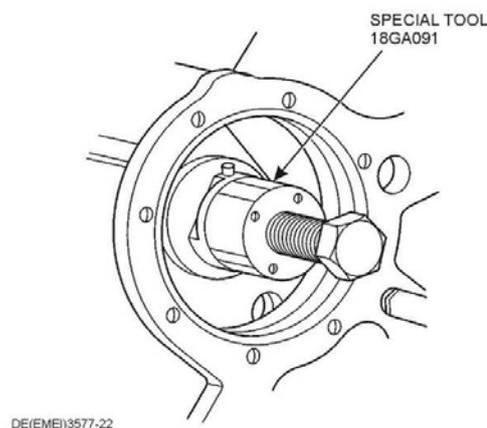


Figure 57 Transfer Gear and Spacer – Removal

- g.** Replace the oil seal and inspect the spacer sealing surface, replace where necessary.
- h.** Install the mainshaft rear spacer on the shaft and position it in the seal (Figure 58).

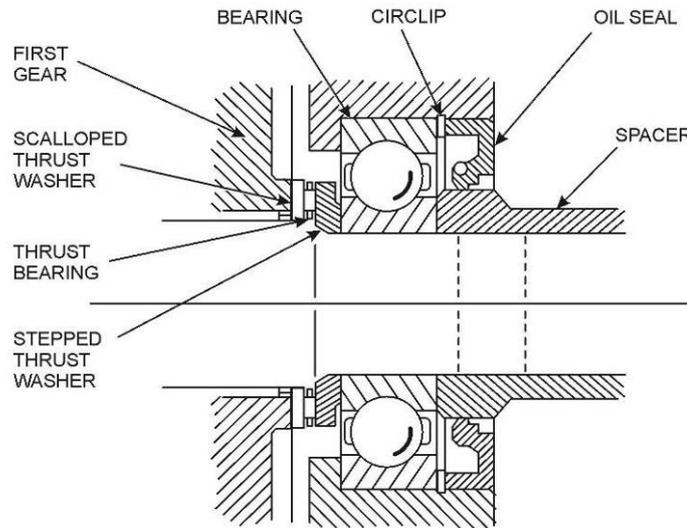


Figure 58 Seal and Rear Spacer – Installation

- i.** Fit the transfer gear.
- j.** Secure the transfer gear to the mainshaft with a new circlip and measure the clearance between the circlip and the transfer gear (Figure 59). The maximum clearance between the circlip and the transfer gear is 0.050 mm (0.002 in). To obtain the correct pre-load on the mainshaft, insert a shim of the correct thickness.

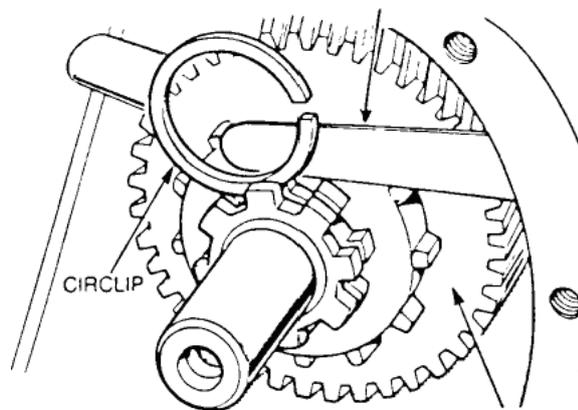


Figure 59 Mainshaft Preload Adjustment

- k.** Remove the circlip, transfer gear and spacer.
- l.** Clean all components and the exposed mainshaft. Apply Loctite Primer 271 to the mainshaft and internal diameter of the spacer.
- m.** Apply a thin coating of Loctite 271 to the exposed area of the mainshaft and push the spacer forward to contact the rear bearing.
- n.** Apply Loctite 271 to the mainshaft rear splines, install the transfer gear, selected shim and secure them with the circlip.
- o.** Install the PTO (where fitted, Para 54.).
- p.** If a PTO is not fitted, using a new gasket install the mainshaft bearing housing and torque the bolts to 24 to 30 N.m (18 to 22 lb ft).
- q.** Fill the transfer case with approximately 3.2 litres of SAE GRADE 40 (OMD-115).
- r.** Ensure the transmission is in neutral, start the engine and check the PTO and winch for correct operation (if fitted).

Transfer Case Repair Procedure to Rectify Disengagement

63. Instructions to conduct in-chassis adjustment and to rectify transfer case disengagement (jump out) are detailed below. The procedures are to be actioned in the order listed.

64. **Repair Procedure.** Prior to repair the vehicle is to be road-tested with the high/low gear selected in the sequence detailed on the caution decal fitted to the windscreen (in accordance with EMEI Vehicle G 197-4). Should the transfer case continue to disengage, then repair should proceed strictly in the following sequence:

- a. selector fork adjustment (EMEI Vehicle G 103 – Light Grade Repair);
- b. lever foul rectification (Light and Medium Grade Repair); and
- c. intermediate gear assembly – inspection and repair (Medium Grade Repair).

65. **Selector Fork Adjustment – Light Grade Repair.** The selector fork adjustment procedure is to be carried out in accordance with EMEI Vehicle G 103.

66. **Lever Fouling Rectification – Light Grade Repair.** To ensure that the transfer case lever is not fouling on the body work, repairs should be carried out in accordance with EMEI Vehicle G 103.

67. **Lever Fouling Rectification – Medium Grade Repair.** Should the transfer case lever still foul after the procedure detailed in EMEI Vehicle G 103 has been carried out, proceed as follows:

- a. Remove the floor mats.
- b. Remove the fuse box cover and rubber moulding around the fuse box.
- c. Remove the rubber around the transmission tunnel, remove the cable ties and lift the gear lever boot.
- d. Remove the screws from the transmission tunnel cover and remove the sound deadening foam from the top of the transmission.
- e. Remove the bolts securing the pivot assemblies to the transmission casing (Figure 60).

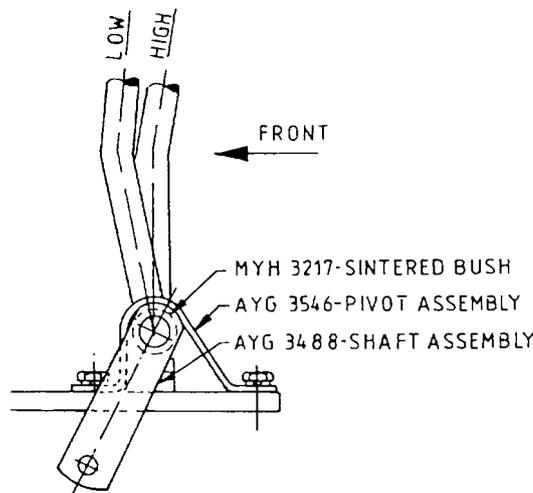


Figure 60 High/Low Range Selector Lever

- f. Lift, but do not fully remove the transmission tunnel cover, and remove the adjustable selector rod from the shaft assembly. Adjust the rod to approx. 160 mm (Figure 61).

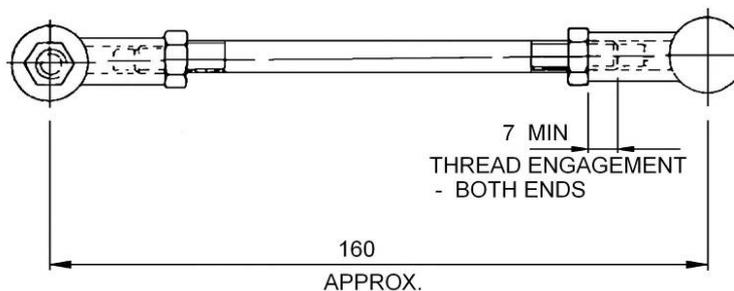


Figure 61 Rod Adjustment

- g.** Remove the transfer case lever assembly from the vehicle.
- h.** Remove the split pin, washer and pivot assembly from the shaft.
- i.** Using a pin punch, remove the roll pin and remove the transfer case lever assembly. Remove the remaining pivot assembly from the shaft.
- j.** Discard the pivot assemblies.
- k.** Install a new pivot assembly on the shaft.
- l.** Position the transfer case lever on the shaft and secure it with a new roll pin.

NOTE

Position of the sintered bush flange is towards the outer ends of the shaft and the orientation of the pivot assembly has the offset towards the front of the vehicle.

- m.** Install the remaining pivot assembly and secure it with the washer and split pin.
- n.** Position the range selector assembly at the transmission and install the selector rod.
- o.** Secure the range selector assembly to the transmission with the four bolts and tighten them securely.
- p.** Install the screws and secure the gearbox transmission tunnel cover.
- q.** Install the gear lever boot and secure it with cable ties. Install the rubber around the transmission cover tunnel.
- r.** Install the fuse box rubber moulding.
- s.** Install the fuse box cover.
- t.** Install the floor mats.
- u.** Fit a new plastic tie to the gear lever boot but do not install the centre seat and transmission access plate/rifle butt box at this stage.
- v.** Road test the vehicle to ascertain if repairs to this stage have rectified the transfer case disengagement.
- w.** If the problem is rectified, install the centre seat and transmission access plate/rifle butt box.
- x.** If the problem continues, proceed with the inspection and repairs detailed in Para 66.

68. Intermediate Gear Assembly - Inspection and Repair. Prior to repairing the intermediate gear assembly, check the GM 120, Record Book for Service Equipment. The following associated repairs and modifications should be carried out, if required:

- a.** rework of the propeller shaft flange in accordance with EMEI Vehicle G 184 - 2;
- b.** fitting of an additional earth strap in accordance with EMEI Vehicle G 187 - 3;
- c.** rectification of oil transfer between the transfer case and the gearbox (Para 57); and
- d.** securing of the rear propeller shaft bolts in accordance with EMEI Vehicle G 103 – Group 8.

69. Proceed with the repair as follows:

WARNING

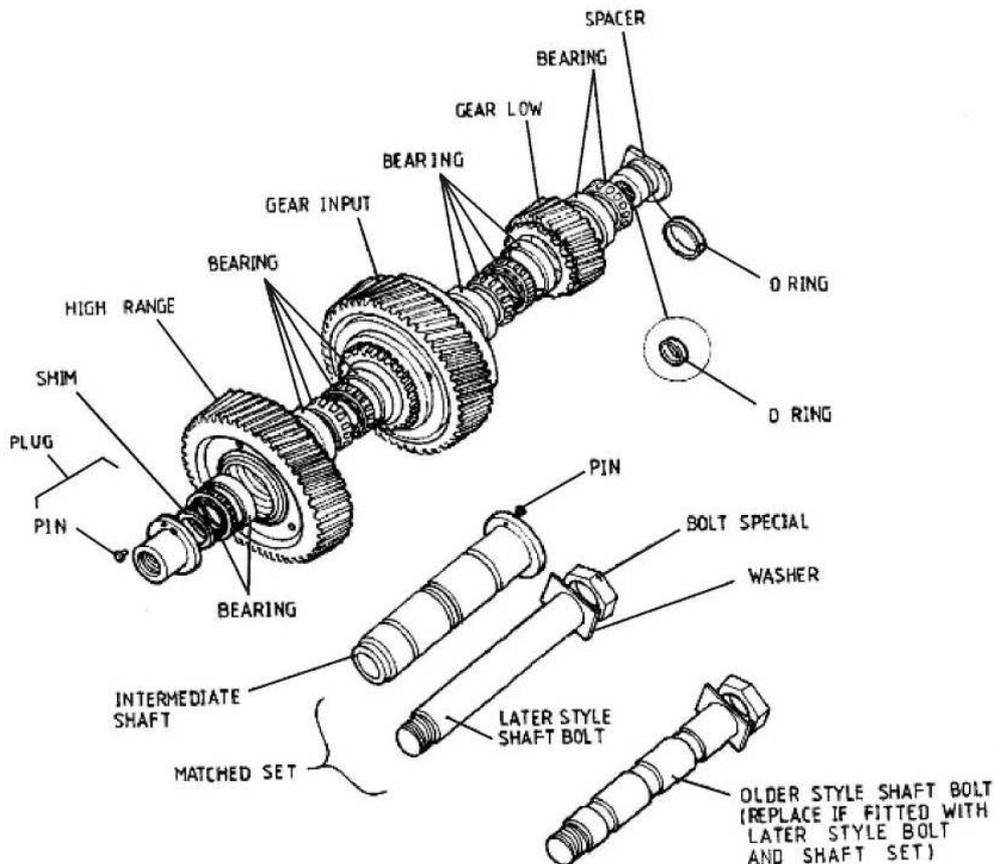
New gaskets provided by Land Rover do not contain asbestos. Older gaskets still fitted to vehicles may contain asbestos. During this task some parts may contain asbestos; refer and comply with procedures and warnings in the introduction section of this EMEI under paragraph heading: Items Previously Known To Have Contained Asbestos.

- a.** Remove the transfer case drain plug and drain the oil into a suitable receptacle.
- b.** Remove the rear propeller shaft and the hand brake drum retaining screws.
- c.** Remove the hand brake drum.

- d. Ensure that the output flange locknut is tight and inspect it for play in the rear output bearing. Replace the bearing if wear is evident.
- e. Using special tool 18G1205A, secure the output flange and remove the locknut, flange, washer and felt seal.
- f. Disconnect the hand brake draw link clevis.
- g. Remove the bolts securing the backing plate to the speedometer cable housing.
- h. Remove the backing plate assembly.
- i. Remove the bolts and washers retaining the bottom cover or remove the PTO if fitted (Para 53.).
- j. Remove the bolt and lock tab securing the intermediate gear assembly shaft bolt.
- k. Whilst supporting the intermediate gear assembly, unscrew and remove the intermediate gear assembly shaft bolt.
- l. Remove the intermediate gear assembly from the transfer case as one unit.

70. Inspection of the Gear Assembly. Inspect the gear assembly as follows:

- a. Remove the shim installed on the end of the intermediate shaft and remove each gear complete with the bearing cups and cones. Inspect the components of the intermediate gear assembly and replace them as detailed below:
 - (1) Inspect the input gear coupling rings and coupling pins (Figure 62). Replace them if that is the only part of the high/low input gear assembly worn. Assemble as detailed (Figure 62).



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Figure 62 Intermediate Gear Assembly

- (2) Manufacture the punch to be used to expand the couplings as detailed in Figure 63.

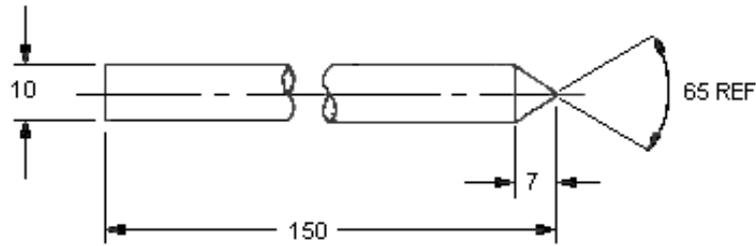


Figure 63 Coupling Pin Punch

- (3) Drill out the coupling pins with a 6.2 mm diameter drill.
- (4) Assemble the new couplings and pins (Figure 64).

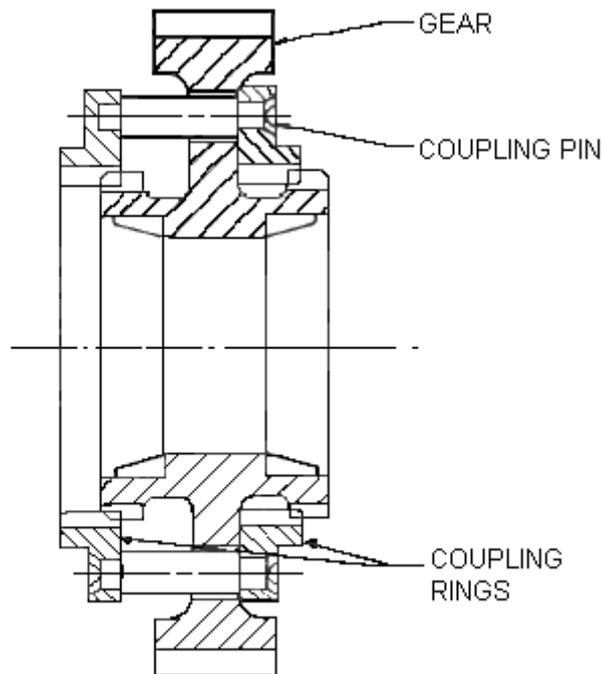


Figure 64 Input Gear Coupling Assembly

- (5) Expand the coupling pins into the couplings using the shaped punch. Invert the gear assembly and expand the opposite ends of the pins.
- (6) Ensure the centre hub is free at all times.
- (7) Replace the input gear assembly complete, if wear is evident on the engaging teeth of the high/low range input gear.
- (8) Replace all the bearings.
- (9) Inspect the intermediate shaft and shaft bolt. Replace it with a new shaft, bolt and lock tab if the bolt is a stepped bolt (this type is prone to breakage), or if the shaft or bolt are worn.
- (10) Replace the low and high range output gears if they are chipped or worn.

NOTE

The Regional Force Surveillance Vehicle has a different high range output gear. Ensure the correct gear is fitted during replacement.

- b. Remove the intermediate gear shaft spacer from the rear of the transmission case. Replace the spacer if it is worn and fit two new O rings.

- c. Remove the threaded plug assembly from inside the transfer case housing and check the security of the locating pins. Replace the plug or pins as necessary.

71. Installation of Transfer Case Gears. Install the transfer gears as follows:

- a. Thoroughly lubricate the gears and the taper roller bearings with clean oil (SAE GRADE 40 (OMD-115)). Install the gears and bearings on the sleeve. Do not fit the shim washer at this stage.



The bearings must be fully seated prior to torquing the nut.

- b. Using an 18 mm bolt, flat washers and nut and with the head of the bolt secured in a vice, place the sleeve on the bolt and gradually tighten the nut to 130 N.m (96 lbf.ft). Do this while rotating and tapping the gears lightly with a soft hammer to ensure the bearings are fully seated (Figure 65).

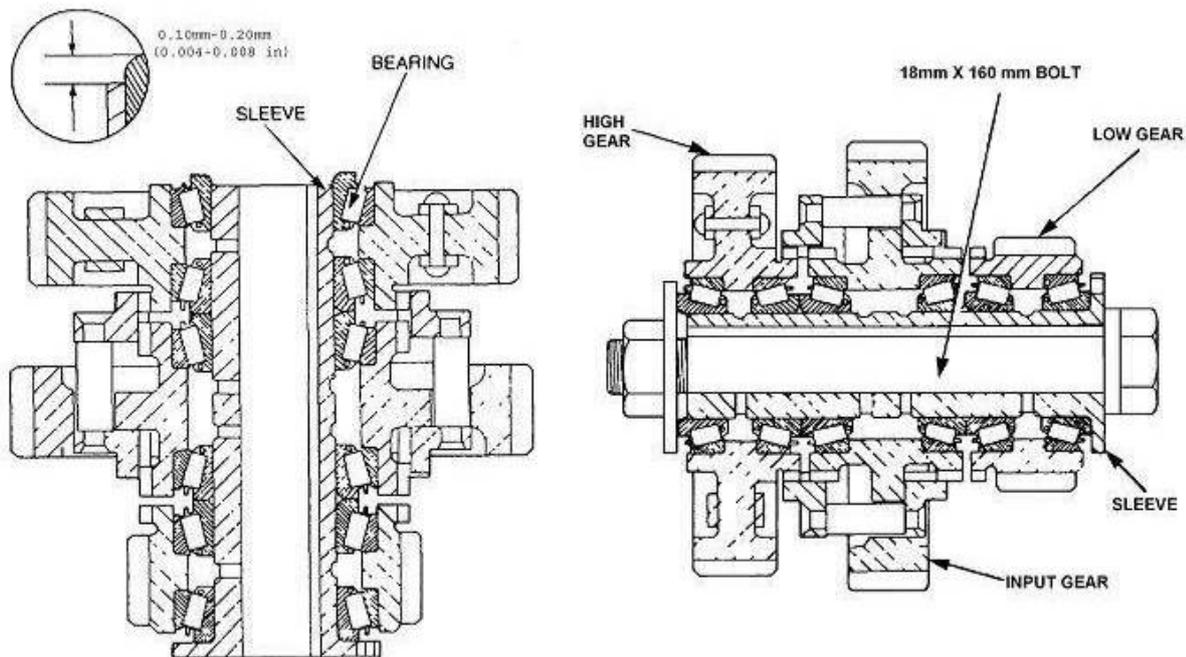


Figure 65 Intermediate Gear Assembly Preload Adjustment and Shim Selection

- c. Remove the nut and flat washers taking care not to disturb the gears and bearings.
- d. Using a dial indicator or micrometer, measure the gap between the shoulder of the sleeve and the face of the bearings (Figure 65). Select a shim washer to obtain a pre-load of 0.10 to 0.20 mm (0.004 to 0.008 in).
- e. Fit the threaded plug to the inside of the transfer case housing and carefully position the intermediate gear assembly and the selected shim washer.
- f. Ensure that the groove in the intermediate shaft is towards the top of the transmission and aligns with the oil hole in the threaded plug and the housing oil passage. Fit new O rings to the end spacer and install it in the transmission case.

NOTE

During the installation of the intermediate gear assembly, pour clean oil (SAE GRADE 40 (OMD-115)) into both cast oil feed holes in the transfer case to ensure the shaft and bearings are adequately lubricated. If the oil hole in the threaded plug does not align with the transfer case housing passage, remove the pin from the plug and rotate the plug to ensure correct alignment. Mark and redrill the pin hole and refit the threaded plug to the casing.

- g.** Insert the intermediate gear shaft special bolt and tension it to 170 to 190 N.m (125 to 140 lbf.ft). Check that the gears rotate freely. The maximum resistance should be 0.5 N.m (0.36 lbf.ft), if the resistance is greater than specified, the pre-load will require resetting.
- h.** Fit the lock tab and bolt to secure the shaft bolt.
- i.** Disconnect the speedometer cable and remove the speedometer cable housing to gain access to the rear of the third differential assembly.

NOTE

Failures of the third differential have been attributed to the bolts working loose. This action is a precautionary measure.

- j.** Remove the securing bolts for the third differential halves and output gear one by one. Apply Loctite 271, refit and torque the bolts as follows:
 - (1)** differential half bolts 54 to 68 N.m (40 to 50 lbf.ft); and
 - (2)** output gear bolts 60 to 64 N.m (44 to 47 lbf.ft).
- k.** Fit a new output bearing, if required, into the speedometer cable housing but do not fit a new output seal at this stage.
- l.** Refit the speedometer cable housing and gasket and speedometer cable.
- m.** With the differential lock disengaged and rear output seal not fitted, check that the rolling resistance of the rear output shaft is 6 to 7 kg (14 to 16 lbs).



The seal must be fully inserted otherwise the chamfer on the output flange will foul the seal and cause leakage.

- n.** Fit a new transfer case rear output seal until the seal plain face just clears the chamfer on the seal housing bore and fit the retainer.
 - o.** After applying a smear of sealing compound (Loctite 515 or equivalent), fit the handbrake backing plate assembly and the oil catcher to the speedometer cable housing using the original mounting bolts. Ensure that the oil drain hole is not blocked by sealant.
 - p.** Clean or replace the hand brake linings as necessary and reconnect the hand brake draw link clevis.
 - q.** Tack weld the propeller shaft bolts in accordance with EMEI Vehicle G 103 – Group 8, if required.
 - r.** Inspect the output flange seal surface. If the surface is worn either replace the flange or fit a speedi sleeve using Loctite 601 in accordance with EMEI Vehicle G 189-12.
 - s.** Fit the output flange, felt seal, washer and a new locknut. Apply Loctite 242 to the threads and tension the locknut to 146 to 180 N.m (108 to 132 lbf.ft).
 - t.** Fit the handbrake drum and propeller shaft. Apply Loctite 242 to the threads and fit new locknuts.
 - u.** Using new gaskets; refit the bottom cover or PTO (Para 54), as applicable.
 - v.** Top up the transmission and transfer case with SAE GRADE 40 (OMD-115).
 - w.** Ensure that an earth strap is fitted to the transmission mount in accordance with EMEI Vehicle G 187-3.
 - x.** Remove the transfer case top cover plate, adjust the selector forks in accordance with EMEI Vehicle G103 – Group 6, and refit the cover plate.
 - y.** Refit the transmission access plate/rifle butt box and centre seat assembly.
- 72. Action After Repair.** Road test the vehicle to ensure the correct selection of high/low range. The selection will feel different to that which has been previously experienced due to the different design of the improved high/low range input gear couplings.
- 73. Recording Action.** Details of the repair are to be entered in the GM 120, Record Book for Service Equipment.

Transmission Specifications

74. The transmission specifications are detailed in Table 9.

Table 9 Transmission Group Specifications

Serial	Item	Specification
1	Clutch slave cylinder tightening torque	27 N.m (20 lbf.ft)
2	Hydraulic pipe bracket tightening torque	40 N.m (30 lbf.ft)
3	Winch propeller shaft flange tightening torque	61 N.m (45 lbf.ft)
4	Front propeller shaft flange tightening torque	41 to 52 N.m (30 to 38 lbf.ft)
5	Rear propeller shaft flange tightening torque	41 to 52 N.m (30 to 38 lbf.ft)
6	PTO housing tightening torque	30 N.m (22 lbf.ft)
7	PTO output shaft flange nut tightening torque	61 N.m (45 lbf.ft)
8	Mainshaft bearing housing tightening torque	24 to 30 N.m (18 to 22 lbf.ft)
9	Transfer case capacity	3.2 litres
10	Transfer case (with PTO) capacity	5.8 litres
11	Differential casing bolts tightening torque	54 to 68 N.m (40 to 50 lbf.ft)
12	Differential output (low) gear tightening torque	60 to 64 N.m (44 to 47 lbf.ft)
13	Intermediate gear assembly pre-load adjustment torque	130 N.m (96 lbf.ft)
14	Intermediate gear assembly pre-load	0.1 to 0.2 mm (0.003 to 0.007 in)
15	Intermediate gears shaft tightening torque	170 to 190 N.m (125 to 140 lbf.ft)
16	Intermediate gears rolling resistance	0.5 N.m (0.36 lbf.ft)
17	Transfer selector fork clearance	0.12 to 0.25 mm (0.005 to 0.010 in)
18	Front oil pump cover torque	10 N.m (8 lbf.ft)
18	Speedometer drive housing tightening torque	30 N.m (22 lbf.ft)
20	Differential assembly rolling resistance	6 to 7 kg (14 to 16 lbs)
21	Propeller shaft coupling flange (front and rear) tightening torque	146 to 180 N.m (108 to 132 lbf.ft)
22	Front output shaft housing tightening torque	30 N.m (22 lbf.ft)
23	Differential lock vacuum chamber housing tightening torque	30 N.m (22 lbf.ft)

Transmission Fault Finding

75. The transmission fault finding is detailed in Table 10.

Table 10 Transmission Fault Finding

Serial	Symptom	Probable Cause	Action
1	Noisy transmission	Chipped or damaged gears	Replace the transmission
		Excessive mainshaft gear end-play	Replace the transmission
		Bearing failure	Replace the transmission
2	Difficult gear selection	Selector shaft detent balls binding in their holes	Clean the holes and balls
		Loose roll pins in the selectors or selector forks	Replace roll pins or replace the transmission
		Worn selector shaft bores	Replace the transmission
		Worn spigot bush	Replace the bush
		Clutch disc worn into the input shaft	Replace the clutch and transmission
		Worn synchromesh assembly	Replace the transmission
3	Gear disengagement	Weak or broken selector shaft detent ball springs	Replace the springs
		Bent or worn selector forks	Replace the transmission
		Bent selector shaft or worn detents	Replace the transmission
		Excessive mainshaft gear end-play	Replace the transmission
		Worn taper or chipped teeth on the sliding clutch	Replace the transmission
		Worn spigot bush	Replace the bush
		Worn synchromesh assembly	Replace the transmission
4	Oil leaks	Gaskets broken, shifted or squeezed out of position	Replace the gaskets
		Oil seal failure	Replace the oil seal

REAR AXLE

Rear Axle Assembly

76. **Removal.** Remove the rear axle as follows:

WARNING

Do not work on the vehicle without the use of an axle stand beneath the axle. Place the axle stand as close to the raised wheel as possible. This procedure is required for all repairs and maintenance activities involving positioning of body parts in potential crush zones of the vehicle. Failure to comply may result in serious injury or death.

Chock the wheels and engage the transmission differential lock prior to raising the vehicle, to prevent the vehicle from moving.

- a. Chock the front wheels and loosen the wheel nuts on the rear wheels.
- b. Raise the rear of the vehicle and support the vehicle on chassis stands.
- c. Remove the rear wheels.
- d. Remove and discard the locknuts securing the rear propeller shaft flange to the rear differential and lower the propeller shaft.
- e. Remove the banjo bolt securing the breather hose to the rear axle casing and discard the sealing washers (Figure 66).

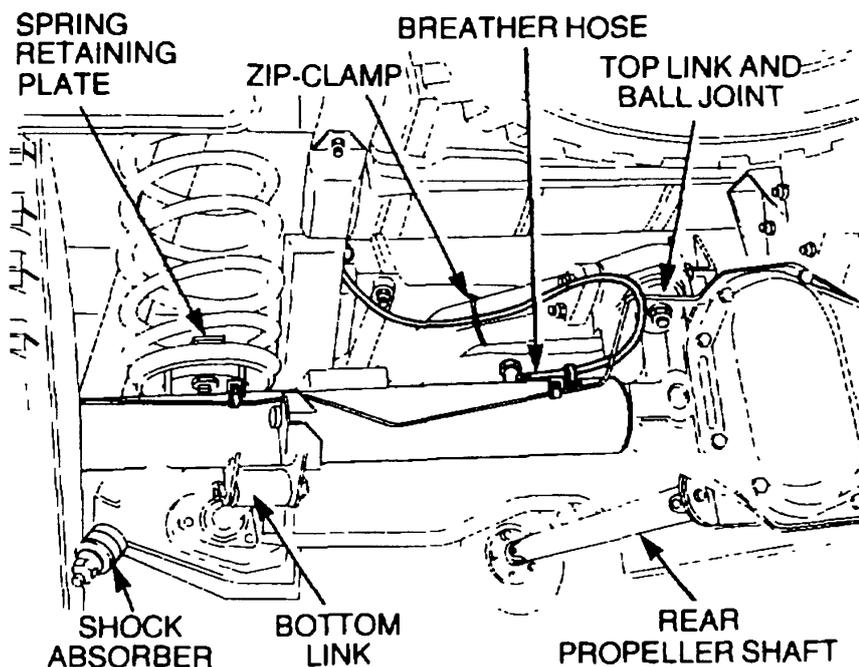


Figure 66 Rear Axle Removal

- f. Remove the zip-clamp securing the hose to the axle and tie the breather hose out of the way. Ensure the breather hose is located in accordance with EMEI Vehicle G 187-9.
- g. Position a suitable trolley jack beneath the rear differential and support the weight of the rear axle assembly.
- h. Remove the nut, cup washer and rubber bush securing each rear shock absorber to the axle casing.
- i. Disconnect the brake hose to the rear wheels at the chassis bracket and plug both hoses with suitable plastic plugs.

- j. Remove the locknuts and bolts securing each bottom link to the axle brackets (Figure 67). Discard the locknuts.

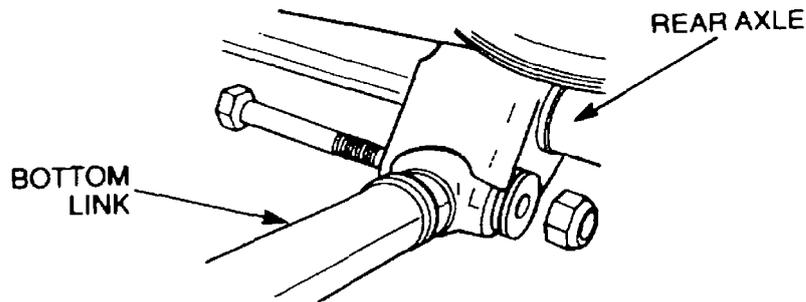


Figure 67 Bottom Link to Axle Bracket

- k. Remove the split pin, castellated nut and washer securing the top link and ball joint to the rear axle casing (Figure 68). Using special tool RO1006, remove the ball joint taking care not to damage the brake pipe. Discard the split pin.

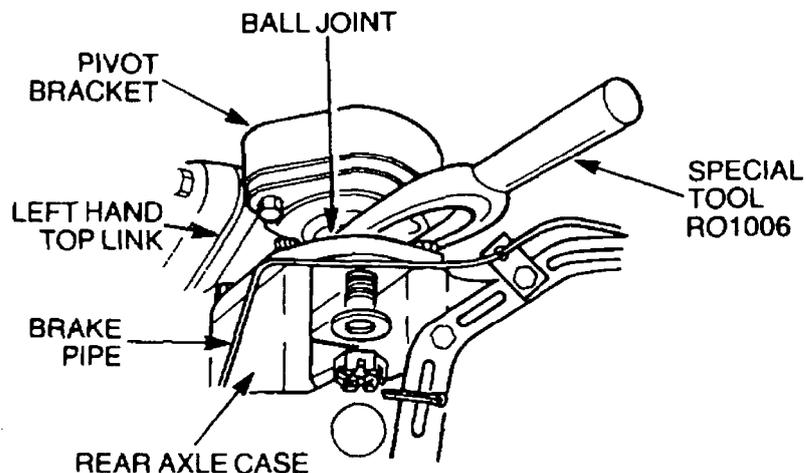


Figure 68 Top Link and Ball Joint Removal

- l. Remove the nuts, washers and bolts securing the spring retaining plates.

NOTE

Ensure that the spring retainers have been fitted in accordance with EMEI Vehicle G 197-13.

- m. Lower the rear axle assembly and withdraw the rear springs.
- n. Remove the axle assembly from beneath the vehicle.

NOTE

Inspect the lower link axle casing mount. Reclaim, if necessary, in accordance with Para 78.

77. Installation. Install the rear axle as follows:

- a. Place the rear axle on a suitable trolley jack and position the axle assembly beneath the vehicle.
- b. Position each bottom link in the axle brackets and secure them with the retaining bolts and new locknuts. Torque each retaining bolt to 168 to 186 N.m (124 to 137 lbf.ft).
- c. Position the rear springs on the axle and secure them with the spring retaining plates. Tighten the retaining bolts securely.

- d. Raise the axle assembly, ensuring that each spring fits correctly in the corresponding upper spring seat, and that the ball joint engages correctly in the axle bracket.
- e. Secure the ball joint with the washer and castellated nut and torque the nut to 176 N.m (130 lbf.ft). Secure the castellated nut with a new split pin.
- f. Insert the end of each shock absorber and rubber bush through the axle casing. Fit the cup washer and nut and tighten each nut securely.
- g. Align the rear propeller shaft flange with the rear differential flange and secure it with new locknuts. Torque the nuts to 41 to 52 N.m (30 to 38 lbf.ft).
- h. Remove the plastic plugs from the brake hoses and connect the brake hoses. Tighten the connection securely.
- i. Using new sealing washers, fit the axle breather hose to the axle case and tighten the banjo bolt securely.
- j. Install the clamps to secure the breather hose to the axle case. Ensure that the hose is still secure in the chassis clips.
- k. Bleed the brake system in accordance with EMEI Vehicle G 103 - Group 12.
- l. Fit the rear wheels and wheel nuts. Raise the vehicle, remove the chassis stands and lower the vehicle to the ground. Remove the jack and tighten the wheel nuts in the correct sequence.



Ensure that the differential oil level plug threads are not stretched. Damaged threads may allow the oil level plug to contact the differential carrier causing severe damage. Rectify stretched threads in accordance with EMEI Vehicle G 103.

- m. Remove the fill plug from the differential rear cover and check the oil level. If necessary, top up with clean oil, install the fill plug and tighten it securely.
- n. Remove the chocks from the front wheels.

Reclamation of Rear Axle Lower Link Mounts

- 78. The rear axle lower link mount reclamation procedures described are to be applied to axle assemblies whenever the holes in the rear axle lower link mounting plates have worn more than 1.5 mm.
- 79. The rear axle lower link casing mount reclamation is carried out as follows:

- a. Disconnect the vehicle battery.



Do not work on the vehicle without the use of an axle stand beneath the axle. Place the axle stand as close to the raised wheel as possible. This procedure is required for all repairs and maintenance activities involving positioning of body parts in potential crush zones of the vehicle. Failure to comply may result in serious injury or death.

- b. Using a suitable hydraulic jack, raise the rear of the vehicle and support it on stands positioned beneath the chassis rails.
- c. Support the axle weight with the jack.
- d. Remove the locknut and bolt securing the rear lower link to the axle bracket.
- e. Remove the locknut and flat washer securing the rear lower link to the chassis bracket and withdraw the link from the bush.
- f. Using a grinder or file, clean the outside surfaces of both the lower link mounts on the axle casing.

- g.** Fit Items 2, 3 and 4 from Table 11 to the axle case mounts (Figure 69), ensuring that the bolt is fitted from inside to out and is parallel to the axle casing centre line. Tighten the bolt firmly.

NOTE

Ensure the mounting bolt is fitted from inside to outside and is parallel to the axle casing centre line before welding the spacer and nut into place.

- h.** Weld the inside spacer and the outside nut to the axle casing mount (Figure 69), with a 3 mm continuous fillet weld, using either:
 - (1)** Manual Metal Arc Welding (MMAW) process using electrodes conforming to AS/NZS 1553.1: E4818 that have been reconditioned prior to use in accordance with the manufacturer’s instructions; or
 - (2)** Gas Metal Arc Welding (GMAW) process using consumables conforming to AS/NZS 2717.1: ES6-GC/M-W503AH and shielding gas conforming to AS 4822:SG-ACO-16/2.75.

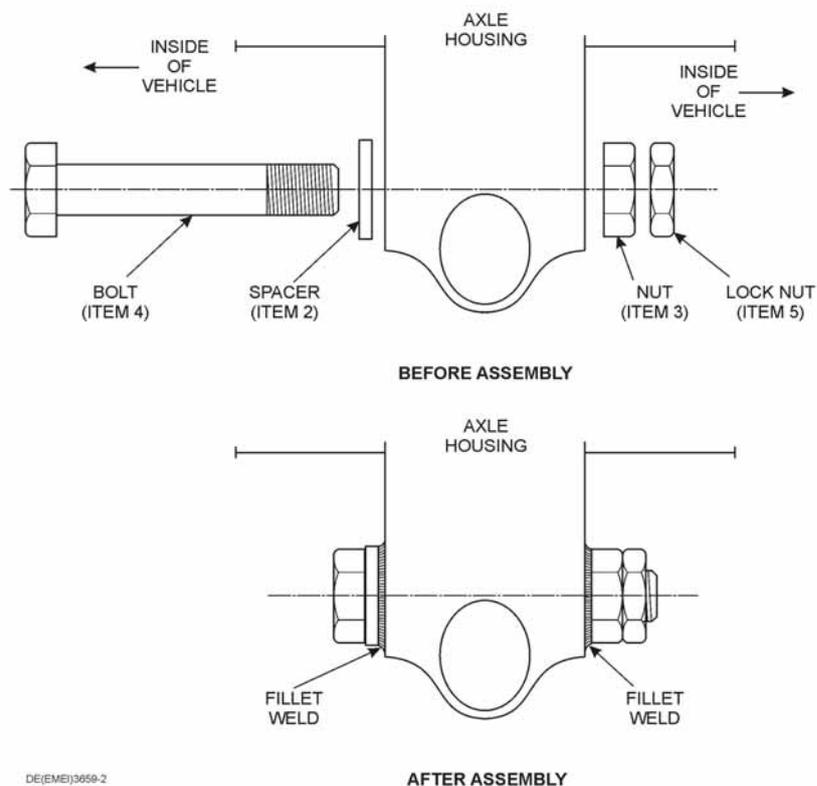


Figure 69 Rear Lower Link

- i.** Remove the bolts and paint all bare metal surfaces.
- j.** Ensure the lower link bushes are fully functional and replace them if required.
- k.** Insert the lower link in the chassis bracket bush, install the flat washer and a new locknut, but do not tighten it.
- l.** Position the lower link into the axle casing mount and install the bolt (Table 11, Item 4) and locknut (Item 5 from Table 11), but do not tighten them.
- m.** Lower the vehicle to the ground and allow the suspension to settle.
- n.** Torque the retaining bolt at the axle end of the link to 168 to 186 N.m (124 to 137 lbf.ft).
- o.** Torque the locknut securing the link to the chassis bracket bush to 176 N.m (130 lbf.ft).
- p.** Connect the vehicle battery.

Radius Arm Reclamation

80. The stores required for the radius arm reclamation are listed in Table 11.

Table 11 Stores Required for Radius Arm Reclamation

Item	NSN	Mfr Part No	Description	Qty Per Kit	Qty Per Equip
1	2590-66-128-8451	AYG 7456	Modification Kit Vehicular Equipment Components, Radius Arm, EMEI Veh G 189-11 (comprising items 2 to 5)		1
2		AYG 7446	Spacer to suit 5/8 inch bolt, 27 mm OD, 6 mm thick	4	
3		NH 610041	Nut, 5/8 inch UNF	4	
4		NH 610321	Bolt, 5/8 inch, 18 TPI, UNF, 4 inch long	4	
5		NT 610041	Locknut, 5/8 inch UNF	4	

Rear Axle Specifications

81. The rear axle specifications are detailed in Table 12.

Table 12 Rear Axle Group Specifications

Serial	Item	Specification
1	Bottom link to axle bracket tightening torque	168 to 186 N.m (124 to 137 lbf.ft)
2	Top link and ball joint to axle bracket tightening torque	176 N.m (130 lbf.ft)
3	Rear propeller shaft flange tightening torque	41 to 52 N.m (30 to 38 lbf.ft)

Rear Axle Fault Finding

82. The rear axle fault finding is detailed in Table 13.

Table 13 Rear Axle Fault Finding

Serial	Symptom	Probable Cause	Action
1	Noisy operation	Improper lubrication	Replace the axle
		Incorrect bearing pre-load	Replace the axle
		Misaligned gears	Replace the axle
		Worn or failed bearings	Replace the axle
		Incorrect tooth contact	Replace the axle
2	Vibration	Worn, damaged or failed flange	Replace the flange
		Failed universal joint	Replace the universal joint
		Worn or failed bearings	Replace the axle

FRONT AXLE

Front Axle Assembly

83. **Removal.** Remove the front axle as follows:

WARNING

Do not work on the vehicle without the use of an axle stand beneath the axle. Place the axle stand as close to the raised wheel as possible. This procedure is required for all repairs and maintenance activities involving positioning of body parts in potential crush zones of the vehicle. Failure to comply may result in serious injury or death.

Chock the wheels and engage the transmission differential lock prior to raising the vehicle, to prevent the vehicle from moving.

- a. Chock the rear wheels and loosen the wheel nuts on the front wheels.
- b. Raise the front of the vehicle and support the vehicle on chassis stands.
- c. Remove the front wheels.
- d. Remove and discard the locknuts securing the front propeller shaft flange to the front differential.
- e. Lower the propeller shaft.
- f. Remove the banjo bolt securing the breather hose to the front axle casing and discard the sealing washers (Figure 70).

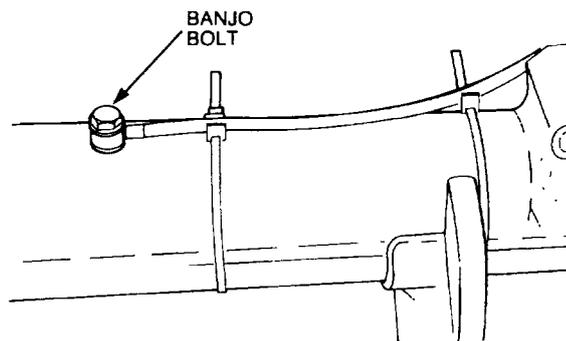


Figure 70 Front Axle Breather Hose Removal

- g. Remove the clamps securing the hose to the axle and radius arm and tie the breather hose out of the way.
- h. Position a suitable trolley jack beneath the front differential and support the weight of the front axle assembly.
- i. Remove the locknut, washers and rubber bushes from the chassis end of each radius arm and discard the locknuts (Figure 71).

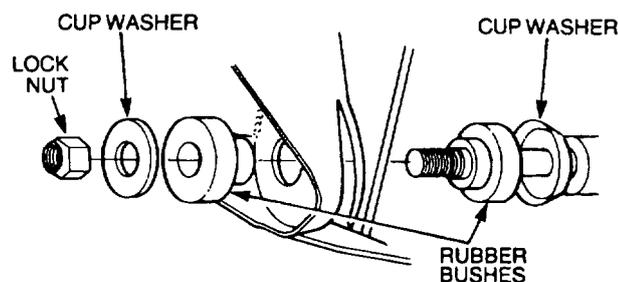


Figure 71 Radius Arm Bush Mounting

- j. Using special tool 18G1063, disconnect the tie rod ball joints at the steering arms (Figure 72).

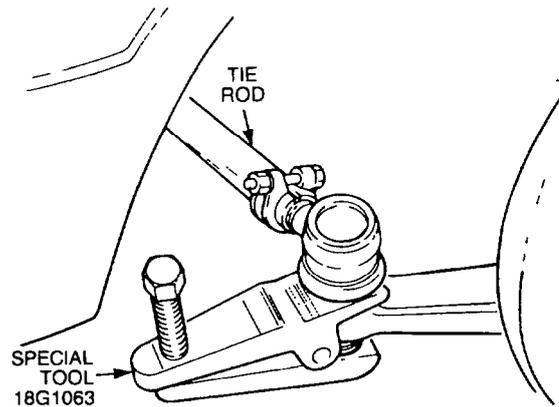


Figure 72 Tie Rod Removal

- k. Remove the locknuts and bolts securing the radius arms to the axle case (Figure 73). Discard the locknuts.

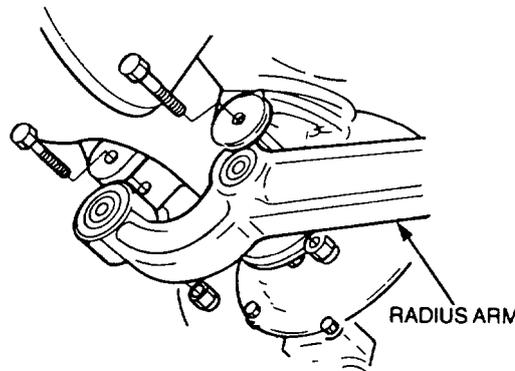


Figure 73 Radius Arm Removal

- l. Lower the front end of the radius arms to clear the axle and withdraw each arm from the chassis brackets.
- m. Remove the nut securing each front shock absorber to the axle casing. Remove the lower cup washer, rubber bush and seating washer from the shock absorbers (Figure 74).

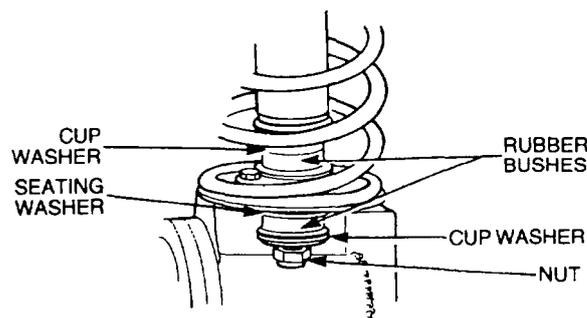


Figure 74 Front Shock Absorber Mounting

- n. Slacken the nut securing the brake hose to the retaining bracket (Figure 76).
- o. Disconnect the brake hoses to both front wheels and plug all hoses with suitable plastic plugs.
- p. Disconnect the brake pad wear indicator cable at the left-hand calliper and tie the cable out of the way.
- q. Remove the split pin, castellated nut and washer securing the drag link to the steering arm. Using special tool 18G1063, disconnect the drag link (Figure 75) and discard the split pin.

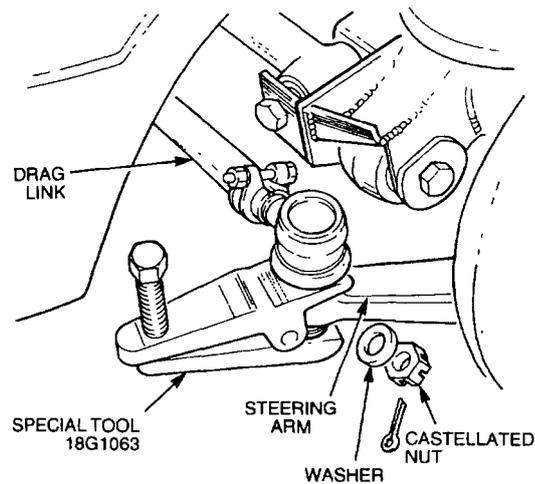


Figure 75 Drag Link Removal

- r. Remove the locknut and bolt securing the Panhard rod to the axle casing and remove the rod from the bracket. Discard the locknut.
- s. Lower the front axle assembly and withdraw the front springs. Ensure the front spring lower retainer has been installed in accordance with EMEI Vehicle G 197-13.
- t. Remove the axle assembly from beneath the vehicle.

NOTE

Inspect the Panhard rod and radius arm mounts for wear. Reclaim the mounts, if necessary (Para 89.).

84. Installation. Install the front axle as follows:

- a. Place the front axle on a suitable trolley jack and position the axle assembly beneath the vehicle.
- b. Position the Panhard rod in the bracket on the axle casing and secure it with the retaining bolt and a new locknut. Torque the bolt to 176 N.m (130 lbf.ft).
- c. Extend the shock absorbers and position the springs over the shock absorbers and onto the spring seat.
- d. Raise the front axle while guiding the shock absorbers into the lower mounting bracket.
- e. Install a cup washer and rubber bush on each radius arm and insert each arm into the corresponding chassis bracket. Install the remaining rubber bush, cup washer and new locknut (Figure 71) but do not tighten it.
- f. Raise the front of each radius arm and locate the bushes in the axle casing. Install the retaining bolts and new locknuts. Torque all radius arm retaining bolts to 176 N.m (130 lbf.ft).
- g. Align the front propeller shaft flange with the front differential flange and secure it with new locknuts. Torque the nuts to 41 to 52 N.m (30 to 38 lbf.ft).
- h. Fit the drag link ball joint on the steering arm and install the washer and castellated nut.
- i. While applying hand pressure to the ball joint, torque the nut to 40 N.m (30 lbf.ft), and install a new split pin.
- j. Remove the plastic plugs from the brake hoses and connect the brake hoses. Tighten each connection securely.
- k. Ensure that the upper cup washer, rubber bush and seating washers are fitted to the shock absorbers threaded rods (Figure 74).
- l. Position the threaded rods in the axle casing bracket and fit the lower seating washer, rubber bush, cup washer and nut to each shock absorber. Tighten the nuts securely.
- m. Using new sealing washers, fit the axle breather hose to the axle case and tighten the banjo bolt securely.

- n.** Install zip-clamps to secure the breather hose to the axle case and radius arm. Ensure that the hose is still secure in the chassis clips.
- o.** Install the tie rod and torque the ball joint nuts to 41 N.m (30 lbf.ft).
- p.** Bleed the brake system in accordance with EMEI VEH G 103 – Group 12.
- q.** Fit the front wheels and secure them with the wheel nuts.
- r.** Raise the vehicle then remove the chassis stands and lower the vehicle to the ground.
- s.** Remove the jack and tighten the wheel nuts in the correct sequence.
- t.** Remove the fill plug from the axle case and check the oil level. If necessary, top-up with clean oil, install the fill plug and tighten it securely.
- u.** Remove the chocks from the rear wheels.
- v.** Carry out the wheel alignment procedure as described in EMEI Vehicle G 103 – Group 14.

Front Axle Specifications

85. The front axle specifications are detailed in Table 14.

Table 14 Front Axle Specifications

Serial	Item	Specification
1	Panhard rod to axle casing tightening torque	176 N.m (130 lbf.ft)
2	Radius arm tightening torque	176 N.m (130 lbf.ft)
3	Front propeller shaft flange tightening torque	44 to 51 N.m (32 to 38 lbf.ft)
4	Drag link to steering arm ball joint tightening torque	40 N.m (30 lbf.ft)
5	Front differential to axle case tightening torque	36 to 46 N.m (26 to 34 lbf.ft)
6	Swivel housing to axle case tightening torque	65 to 80 N.m (48 to 59 lbf.ft)
7	Tie rod to steering arm tightening torque	40 N.m (30 lbf.ft)
8	Front brake calliper retaining bolts tightening torque	82 N.m (60 lbf.ft)

Differential Carrier

86. **Removal.** Remove the differential carrier as follows:

WARNING

Do not work on the vehicle without the use of an axle stand beneath the axle. Place the axle stand as close to the raised wheel as possible. This procedure is required for all repairs and maintenance activities involving positioning of body parts in potential crush zones of the vehicle. Failure to comply may result in serious injury or death.

Chock the wheels and engage the transmission differential lock prior to raising the vehicle, to prevent the vehicle from moving.

- a. Chock the rear wheels.
- b. Loosen the wheel nuts on the front wheels, raise the front of the vehicle and support the vehicle on axle stands.
- c. Remove the front wheels.
- d. Remove and discard the locknuts securing the front propeller shaft flange to the front differential.
- e. Lower the propeller shaft.
- f. Remove the differential drain plug and drain the oil into a suitable receptacle. Refit the drain plug.
- g. Slacken the nut securing the brake hose to the retaining bracket (Figure 76).

NOTE

If the brake pipe needs to be disconnected to be removed from the retaining bracket, carry out the modification detailed in EMEI Vehicle G 197-8.

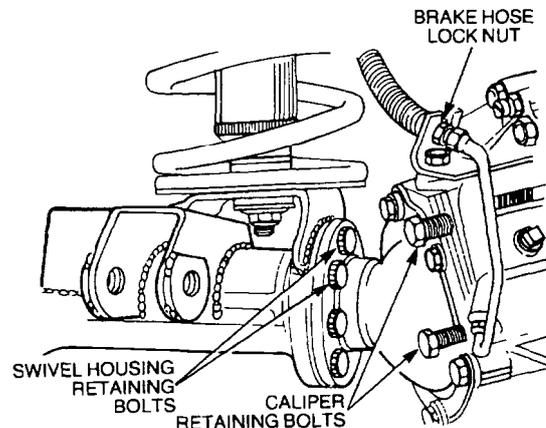


Figure 76 Brake Calliper Removal

- h. Disconnect the wear indicator cable at the left-hand calliper.
- i. Remove the bolts securing the calliper to the swivel housing.
- j. Move the calliper away from the disc and, ensuring that the brake pipes are not bent, secure the calliper to the spring with wire or string.
- k. Remove the split pin, castellated nut and washer securing the tie rod ball joints. Using special tool 18G1063, disconnect the ball joints from the steering arms. Discard the split pin (Figure 77).

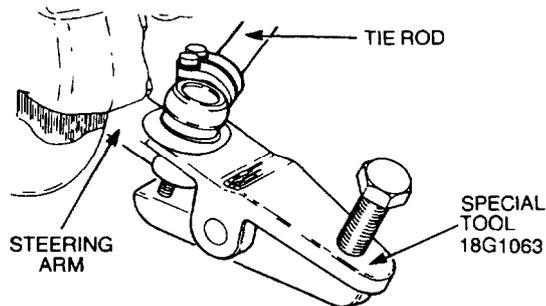


Figure 77 Steering Linkage Removal

- l.** Remove the locknut and washer securing the drag link ball joint to the swivel housing arm. Using special tool 18G1063, disconnect the ball joint.
 - m.** Remove the bolts securing the swivel housing to the axle casing. Remove the hub assembly including the driveshaft.
 - n.** Repeat Paras 83g to j and m for the opposite side of the axle.
 - o.** Remove the locknuts securing the differential carrier to the axle case.
 - p.** Remove the differential carrier and the gasket. Discard the gasket.
 - q.** Remove all trace of gasket material from the axle case and differential carrier.
- 87. Installation.** Install the differential carrier as follows:
- a.** Position a new gasket on the differential carrier and install the differential carrier on the axle case.
 - b.** Secure the carrier to the axle case with new locknuts. Torque the nuts to 36 to 46 N.m (26 to 34 lbf.ft).
 - c.** Ensure that the gasket fitted between the swivel housing and axle case is functional and position the axle shaft in the axle casing. Push the shaft in until the swivel housing flange is hard against the case flange.
 - d.** Using a thin film of Loctite 275, install the bolts and torque them to 65 to 80 N.m (48 to 59 lbf.ft).
 - e.** Position the front propeller shaft flange onto the differential pinion flange, install new locknuts and torque the nuts to 44 to 51 N.m (32 to 38 lbf.ft).
 - f.** Fit the drag link ball joint to the swivel housing arm. Install a flat washer and new locknut and torque the nut to 40 N.m (30 lbf.ft).
 - g.** Position the tie rod ball joint on the steering arms, install the flat washer and castellated nut and torque the nut to 40 N.m (30 lbf.ft). Install a new split pin.
 - h.** Install the brake calliper, then using a thin film of Loctite 271, install the bolts and new lock washers. Torque the bolts to 82 N.m (60 lbf.ft).
 - i.** Tighten the locknut securing the brake hose to the swivel housing bracket and reconnect the wear indicator cable.
 - j.** Repeat Paras 84c and d then h and i for the opposite side of the axle.
 - k.** Remove the differential fill plug and, ensuring that the drain plug is secure, fill the axle with approximately 1.7 litres of oil then install the fill plug.
 - l.** Operate the foot brake several times to centralize the front brake pads.
 - m.** Install the front wheels and tighten the wheel nuts in sequence.
 - n.** Raise the front of the vehicle and remove the axle stands. Lower the vehicle and remove the jack.
 - o.** Tighten the wheel nuts and remove the wheel chocks.
 - p.** Carry out the wheel alignment procedure as described in EMEI Vehicle G103 - Group 14.

Differential Carrier Specifications

88. The differential carrier specifications are detailed in Table 15.

Table 15 Differential Carrier Specifications

Serial	Item	Specification
1	Panhard rod to axle casing tightening torque	176 N.m (130 lbf.ft)
2	Radius arm tightening torque	176 N.m (130 lbf.ft)
3	Front propeller shaft flange tightening torque	44 to 51 N.m (32 to 38 lbf.ft)
4	Drag link to steering arm ball joint tightening torque	40 N.m (30 lbf.ft)
5	Front differential to axle case tightening torque	36 to 46 N.m (26 to 34 lbf.ft)
6	Swivel housing to axle case tightening torque	65 to 80 N.m (48 to 59 lbf.ft)
7	Tie rod to steering arm tightening torque	40 N.m (30 lbf.ft)
8	Front brake calliper retaining bolts tightening torque	82 N.m (60 lbf.ft)

Reclamation of Worn Panhard Rod Mounts

89. The Panhard rod reclamation procedures described below are to be applied to axle assemblies whenever the holes in the Panhard rod mounting plates have worn more than 1.5 mm.

90. Stores Required. The stores required are shown in Table 16 and should be ordered on an ‘as required’ basis.

Table 16 Stores Required for Panhard Rod Mount Reclamation

Item	NSN	Mfr Part No	Description	Qty Per Kit	Qty Per Equip
1	2590-66-128-8450	AYG 7455	Modification Kit Vehicular Equipment Components, Radius Arm, EMEI Veh G 189-11 (comprising items 2 to 5)		1
2		AYG 7488	Spacer, 27 mm OD, 14 mm ID, 6 mm thick	1	
3		NH 114041	Nut, Metric, 14 mm	1	
4		NT 114041	Locknut, Metric, 14 mm	1	
5		AYG 6093	Bolt, M14 mm, Class 8.8, 83 mm long	1	

91. Reclamation. The Panhard rod axle mount reclamation is carried out as follows:

- a. Disconnect the battery.
- b. Remove the locknut and bolt securing the panhard rod to the chassis mounting arm.
- c. Remove the locknut and bolt securing the panhard rod to the axle casing and remove the panhard rod from the vehicle.
- d. Using a grinder or file, clean the outside surfaces of the panhard rod mount.
- e. Fit Items 2, 3 and 5 from Table 16 into the axle case mounts (Figure 78).

NOTE

Ensure the mounting bolt is fitted from front to rear and is parallel to the axle casing centre line before welding the spacer and nut into place.

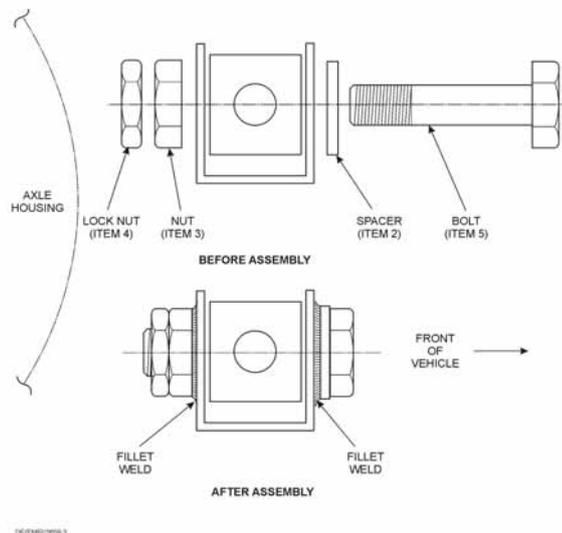


Figure 78 Panhard Rod Mount

- f. Weld the front spacer and the rear nut to the front axle casing mount (Figure 78) with a 3 mm continuous fillet weld, using either:
 - (1) Manual Metal Arc Welding (MMAW) process using electrodes conforming to AS/NZS 1553.1: E4818 that have been reconditioned prior to use in accordance with the manufacturer’s instructions; or

- (2) Gas Metal Arc Welding (GMAW) process using consumables conforming to AS/NZS 2717.1: ES6-GC/M-W503AH and shielding gas conforming to AS 4822:SG-ACO-16/2.75.
- g. Remove the bolt and paint all bare metal surfaces.
 - h. Inspect the panhard rod bushes for useability and replace them if required.
 - i. Install the panhard rod to the chassis mounting arm and refit the bolt and locknut, but do not tighten it.
 - j. Install the panhard rod to the front axle case mount and install the bolt (Table 16, Item 5) and locknut (Table 16, Item 4), but do not tighten it.
 - k. Torque the bolt securing the Panhard rod to the chassis mounting arm to 196 N.m (145 lbf.ft).
 - l. Torque the bolt securing the Panhard rod to the axle casing to 176 N.m (130 lbf.ft) and secure the locknut.
 - m. Connect the battery.
 - n. Carry out the wheel alignment procedure as described in EMEI Vehicle G 103 – Group 14.

Reclamation of Worn Radius Arm Mounts

92. The radius arm reclamation procedures are to be applied to axle assemblies whenever the holes in the radius arm mounting plates, on axle housings with the narrow type mounts (i.e. 49 mm between the locating plates), have worn more than 1.5 mm.

93. **Stores Required.** The stores required are shown in Table 17 and should be ordered on an ‘as required’ basis.

Table 17 Stores Required for Radius Arm Reclamation

Item	NSN	Mfr Part No	Description	Qty Per Kit	Qty Per Equip
1	2590-66-128-8451	AYG 7456	Modification Kit Vehicular Equipment Components, Radius Arm, EMEI Veh G 189-11 (comprising items 2 to 5)		1
2		AYG 7446	Spacer to suit 5/8 inch bolt, 27 mm OD, 6 mm thick	4	
3		NH 610041	Nut, 5/8 inch UNF	4	
4		NH 610321	Bolt, 5/8 inch, 18 TPI, UNF, 4 inch long	4	
5		NT 610041	Locknut, 5/8 inch UNF	4	

94. **Radius Arm Mount Reclamation Procedure.** The radius arm axle assembly mount reclamation is carried out as follows:

- a. Disconnect the battery.

WARNING

Do not work on the vehicle without the use of an axle stand beneath the axle. Place the axle stand as close to the raised wheel as possible. This procedure is required for all repairs and maintenance activities involving positioning of body parts in potential crush zones of the vehicle. Failure to comply may result in serious injury or death.

Chock the wheels and engage the transmission differential lock prior to raising the vehicle, to prevent the vehicle from rolling.

- b. Slacken the front wheel nuts and using a suitable hydraulic jack, raise the front of the vehicle and support it on stands positioned beneath the chassis rails.
- c. Remove the front wheel nuts and wheels. Use the jack to support the axle weight.
- d. Remove the locknuts, washers and rubber bushes from the chassis end of the radius arm.

- e. Using special tool 18G1063, disconnect the tie rod ball joints at the steering arms.
- f. Remove the locknuts and bolts securing the radius arms to the axle case.
- g. Lower the front end of the radius arms to clear the axle and withdraw the arms from the chassis brackets.
- h. Using a grinder or file, clean the outside surfaces of the axle assembly mounts for the radius arms.

NOTE

Ensure the bolts are fitted from inside to outside and are parallel to the axle casing centre line before welding the spacer and nut into place.

- i. Fit Items 2, 3 and 4 from Table 17 to the axle case mounts. Ensure the bolts are fitted from the inside facing out, are parallel to the axle casing and tighten them firmly (Figure 79).

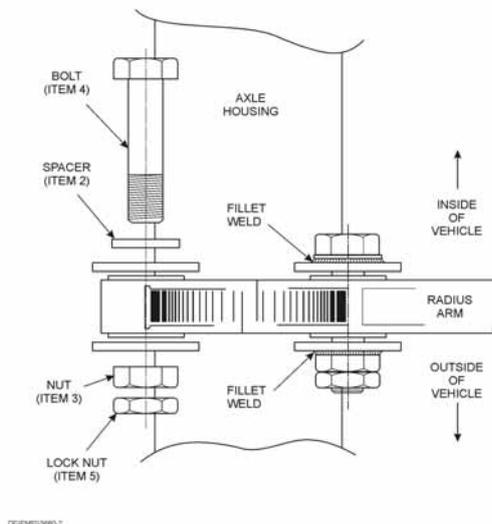


Figure 79 Radius Arm Mounts

- j. Weld the inside spacers and outside nuts to the axle casing mounts (Figure 79), with a 3 mm continuous fillet weld using either:
 - (1) Manual Metal Arc Welding (MMAW) process using electrodes conforming to AS/NZS 1553.1: E4818 that have been reconditioned prior to use in accordance with the manufacturers instructions; or
 - (2) Gas Metal Arc Welding (GMAW) process using consumables conforming to AS/NZS 2717.1: ES6-GC/M-W503AH and shielding gas conforming to AS 4822:SG-ACO-16/2.75.
- k. Remove the bolts and paint all bare metal surfaces.
- l. Inspect the radius arm bushes for useability and replace them as sets, if required.
- m. Install a cup washer and rubber bush on the radius arm and insert the radius arm into the chassis bracket. Install the remaining rubber bush and cup washer. Fit the nut but do not tighten it.
- n. Raise the front end of the radius arm and locate the bushes in the axle casing, install the bolts and nuts (Table 17, Items 4 and 5) but do not tighten them.
- o. Install the front wheels and wheel nuts, lower the vehicle to the ground and allow the suspension to settle.
- p. Tighten the wheel nuts in sequence.
- q. Torque the nuts and bolts securing the radius arms to the axle case and chassis bracket to 176 N.m (130 lbf.ft).
- r. Install the tie rods and torque the ball joint nuts to 41 N.m (30 lbf.ft).
- s. Carry out the wheel alignment procedure as described in EMEI Vehicle G 103 – Group 14.

SUSPENSION

Front Springs

95. **Removal.** Remove the front springs as follows:

WARNING

Do not work on the vehicle without the use of an axle stand beneath the axle. Place the axle stand as close to the raised wheel as possible. This procedure is required for all repairs and maintenance activities involving positioning of body parts in potential crush zones of the vehicle. Failure to comply may result in serious injury or death.

Chock the wheels and engage the transmission differential lock prior to raising the vehicle, to prevent the vehicle from rolling.

- a. Chock the rear wheels.
- b. Loosen the wheel nuts on the front wheels, then raise the front of the vehicle and support the vehicle on axle stands.
- c. Remove the front wheels.
- d. Slacken the nut securing the brake hose to the retaining bracket (Figure 76).
- e. Disconnect the wear indicator cable at the left-hand calliper (if left-hand spring is to be removed).
- f. Remove the bolts securing the calliper to the swivel housing.
- g. Move the calliper away from the disc and, ensuring that the brake pipes are not bent, secure the calliper to the bodywork with wire or string.
- h. Remove the nut cup washer rubber bush, and seating washer securing the shock absorber to the axle case.
- i. Remove the nuts and lock washers securing the shock absorber turret to the chassis.
- j. Remove the shock absorber complete with the turret. Discard the lock washers.
- k. Remove the lower spring seat retaining bracket.

NOTE

If the lower spring seat retaining bracket is not fitted refer to EMEI Vehicle G 197-13.

- l. Lower the axle on the side the spring is to be removed, then remove the spring and bracket securing ring (Figure 80).

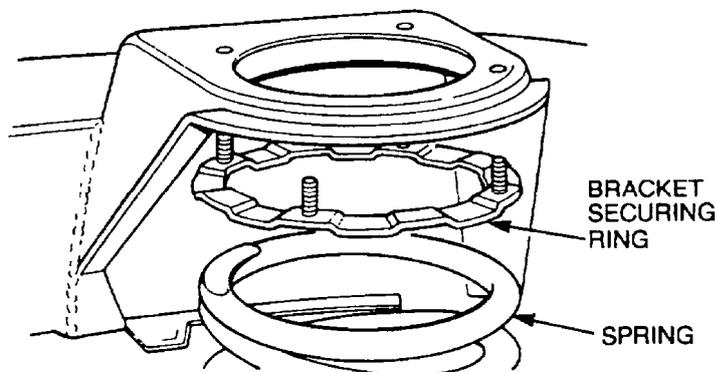


Figure 80 Front Spring Removal

- m. Repeat the procedure for the opposite spring, if necessary.

- 96. Installation.** Install the front springs as follows:
- a. Position the bracket securing ring and retain it in position with two nuts.
 - b. Install the spring and raise the axle to engage the spring in the upper seat.
 - c. Install the lower spring seat retaining bracket.
 - d. Remove the two nuts retaining the bracket securing ring and install the shock absorber and turret.
 - e. Install the nuts and new lock washers and tighten them securely.
 - f. Install the rubber bush, cup washer and seating washer on the shock absorber and secure it to the axle case with a new locknut.
 - g. Install the brake calliper, then using a thin film of Loctite 271, install the two bolts and new lock washers. Torque the bolts to 82 N.m (60 lbf.ft).
 - h. Tighten the locknut securing the brake hose to the swivel housing bracket and reconnect the wear indicator cable.
 - i. Ensure that the axle breather hose is secure.
 - j. Install the front wheels and tighten the wheel nuts.
 - k. Raise the vehicle and remove the axle stands.
 - l. Lower the vehicle and remove the jack and wheel chocks.
 - m. Tighten the front wheel nuts in sequence.
 - n. Disengage the differential lock.
 - o. Operate the foot brake several times to centralize the front brake pads.

Rear Springs

- 97. Removal.** Remove the rear springs as follows:

WARNING

Do not work on the vehicle without the use of an axle stand beneath the axle. Place the axle stand as close to the raised wheel as possible. This procedure is required for all repairs and maintenance activities involving positioning of body parts in potential crush zones of the vehicle. Failure to comply may result in serious injury or death.

Chock the wheels and engage the transmission differential lock prior to raising the vehicle, to prevent the vehicle from rolling.

- a. Disconnect the brake hose at the rear axle. Plug the hose to prevent fluid loss and dirt ingress.
- b. Chock the front wheels.
- c. Raise the rear of the vehicle and support it on chassis stands. Leave the axle supported on the jack.
- d. Remove the nut, cup washer, rubber bush and seating washer securing the shock absorber to the axle case.
- e. Remove the split pin, castellated nut and washer securing the ball joint to the rear axle casing. Using special tool RO1006, remove the ball joint taking care not to damage the brake pipe (Figure 81). Discard the split pin.

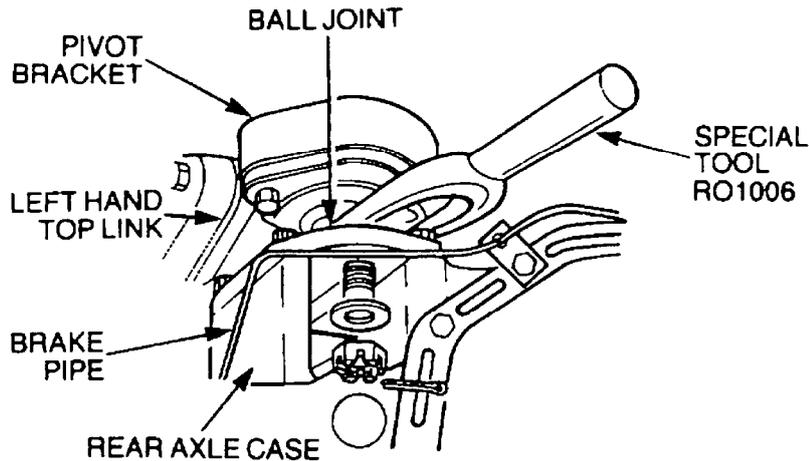


Figure 81 Pivot Bracket Ball Joint Removal

- f. Lower the axle on the side the spring is to be removed, taking care not to stretch the brake hose and axle breather hose.
- g. Remove the nuts and bolts securing the spring retaining plate to the axle case. Remove the spring and spring seat.
- h. Repeat the procedure for the opposite spring if necessary.

98. Installation. Install the rear springs as follows:

NOTE

Ensure the upper and lower spring seats have been modified in accordance with EMEI Vehicle G 197-13.

- a. Install the spring seat and spring.
- b. Fit the spring retaining plate ensuring the retainer clamps on the smallest part of the lower coil. Secure it with the two bolts and new locknuts.
- c. Raise the axle ensuring the spring is positioned correctly in the upper seat.
- d. Install the rubber bush, cup washer and seating washer on the shock absorber and secure it to the axle case with a new locknut.
- e. Insert the ball joint into the axle case and install the flat washer and castellated nut (Figure 81).
- f. Torque the nut to 176 N.m (130 lbf.ft) and install a new split pin.
- g. Connect the brake hose at the rear axle and bleed the brakes in accordance with EMEI Vehicle G 103 – Group 12.
- h. Ensure that the axle breather hose is secure.
- i. Raise the vehicle and remove the jack stands.
- j. Lower the vehicle and remove the wheel chocks.
- k. Disengage the differential lock.

Suspension Specifications

99. The suspension specifications are detailed in Table 18.

Table 18 Suspension Group Specifications

Serial	Item	Specification
1	Rear pivot bracket ball joint to axle bracket tightening torque	176 N.m (130 lbf.ft)

STEERING

Steering Box

NOTE

If the sector shaft end float is excessive, adjust the end float in accordance with EMEI Vehicle G 103 prior to replacing the steering box. This adjustment can only be carried out if the steering box has been modified in accordance with EMEI Vehicle G 197-14.

100. **Removal.** Remove the steering box as follows:

WARNING

Do not work on the vehicle without the use of an axle stand beneath the axle. Place the axle stand as close to the raised wheel as possible. This procedure is required for all repairs and maintenance activities involving positioning of body parts in potential crush zones of the vehicle. Failure to comply may result in serious injury or death.

Chock the wheels and engage the transmission differential lock prior to raising the vehicle, to prevent the vehicle from rolling.

- a. Using a suitable hydraulic jack, raise the front of the vehicle and support it on axle stands.
- b. Ensure the front wheels and the steering wheel are in the straight ahead position and match mark the relationship of the steering column inner shaft to the top universal joint (Figure 82).

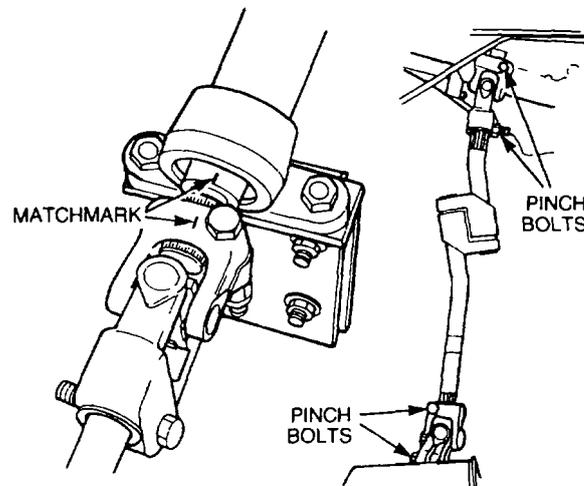


Figure 82 Steering Column Alignment

- c. Remove the bolts securing the steering shaft cover to the inner guard and remove the cover.
- d. Remove the steering protection plate in accordance with EMEI Vehicle G 103 – Group 14.
- e. Using special tool 18G1063, disconnect the drop arm ball joint.
- f. Remove the pinch bolt and locknut securing the universal joint to the steering box worm shaft.
- g. Slacken the pinch bolts securing the upper universal joint and slide the collapsible shaft and lower universal joint off the steering box worm shaft. Discard the locknuts.
- h. Slacken the locknut securing the tie bar to the Panhard rod mounting arm.
- i. Remove the locknuts, washers and bolts securing the tie bar to the steering box then swing the tie bar clear of the steering box (Figure 83). Discard the locknuts.

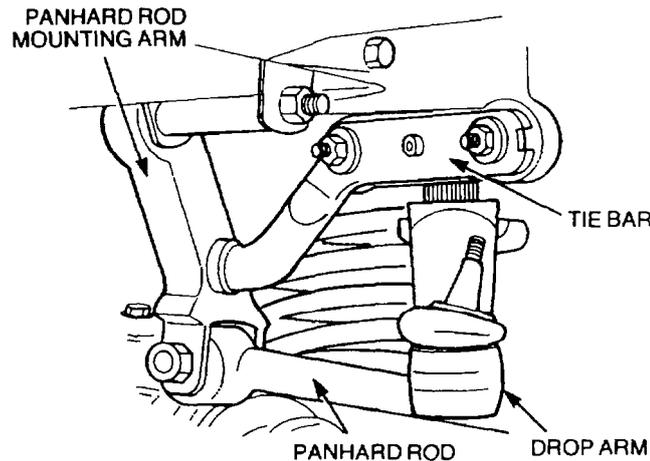


Figure 83 Tie Bar Removal

- j. Remove the locknuts and flat washers securing the steering box to the chassis.
 - k. Remove the steering box. Discard the locknuts.
- 101. Installation.** Install the steering box as follows:
- a. Ensure the mounting bolts and locking plates are positioned through the chassis and install the steering box on the bolts.
 - b. Fit the flat washers and new locknuts and torque the nuts to 80 N.m (60 lbf.ft).
 - c. Check that the steering wheel is in the straight ahead position and set the steering box to the mid way lock-to-lock position.
 - d. Taking care not to turn the steering wheel, install the lower universal joint on the steering box worm shaft and install the pinch bolt.
 - e. Fit new locknuts to all pinch bolts and torque them to 20 to 25 N.m (15 to 18 lbf.ft).
 - f. Fit the steering shaft cover on the inner guard and secure it with the bolts and washers.
 - g. Install the tie bar on the steering box but do not tighten the nuts and bolts.
 - h. Using a new locknut secure the tie bar to the Panhard rod mounting arm.
 - i. Slacken the tie bar retaining bolts then retighten them securely. Torque the locknut securing the tie bar to the panhard rod mounting arm to 80 N.m (60 lbf.ft).
 - j. Connect the drag link to the drop arm and torque the nut to 40 N.m (30 lbf.ft). Insert a new split pin.
 - k. Install the steering protection plate in accordance with EMEI Vehicle G 103 – Group 14.
 - l. Using the hydraulic jack, raise the vehicle off the axle stands, remove the stands and lower the vehicle to the ground.
 - m. Remove the wheel chocks.
 - n. Disengage the transmission differential lock.

Steering Column

- 102. Removal.** Remove the steering column as follows:
- a. Disconnect the battery.
 - b. Ensure the front wheels and steering wheel are in the straight ahead position. Matchmark the relationship of the steering column inner shaft to the top universal joint (Figure 82).
 - c. Remove the pinch bolts from the top universal joint and remove the lower bolt from the bottom universal joint.
 - d. Slacken the top bolt of the lower universal joint and withdraw the shaft.

- e. Remove the screw securing the steering wheel cover and remove the cover.
- f. Remove the steering wheel retaining nut, and using special tool 18GA085, remove the steering wheel from the column.
- g. Remove the screws securing the instrument panel to the fascia and move the panel away slightly to enable the bolt securing the steering column tie bar to be removed (Figure 84).

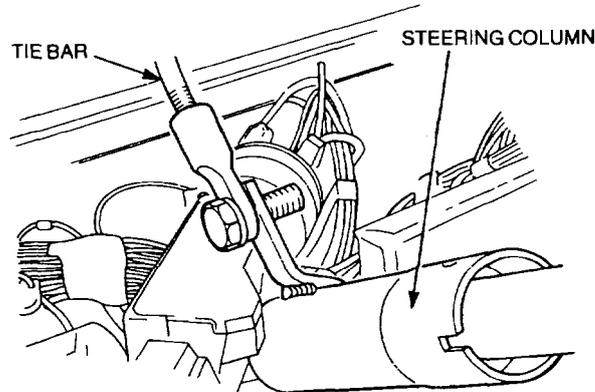


Figure 84 Steering Column Tie Bar Disconnection

- h. Remove the screws securing the shroud and remove the shroud with the hand throttle attached (Figure 85).

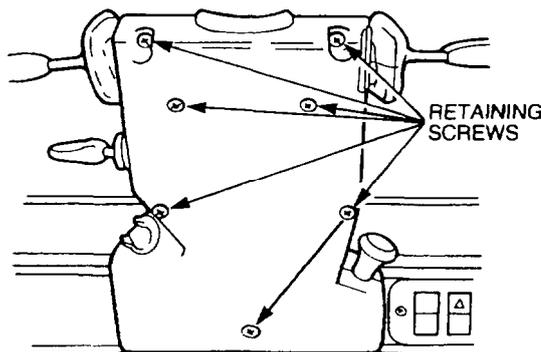


Figure 85 Steering Column Shroud Mounting

- i. Disconnect the multi-plug connectors from the switches.
- j. Remove the clamp screw securing the switch cluster to the steering column (Figure 86).

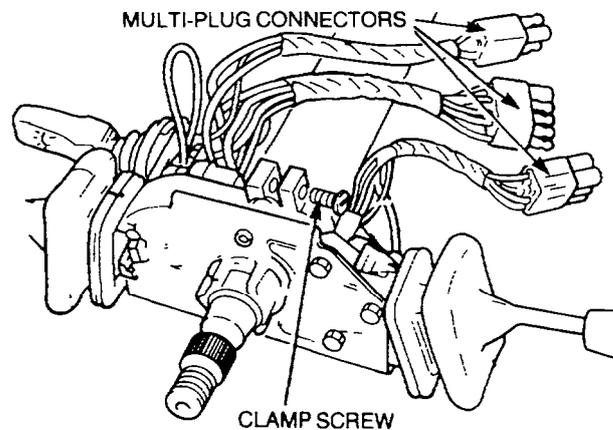


Figure 86 Switch Cluster

- k. Remove the switch cluster.

- l.** Remove the nuts and bolts securing the ignition switch mounting bracket to the column and move the switch and bracket away from the column.
- m.** Remove the brake master cylinder and servo cylinder in accordance with EMEI Vehicle G 103 - Group 12.
- n.** Remove the bolts securing the brake pedal bracket to the firewall and carefully remove the bracket.
- o.** Remove the bolts securing the lower end of the column to the firewall (Figure 87).

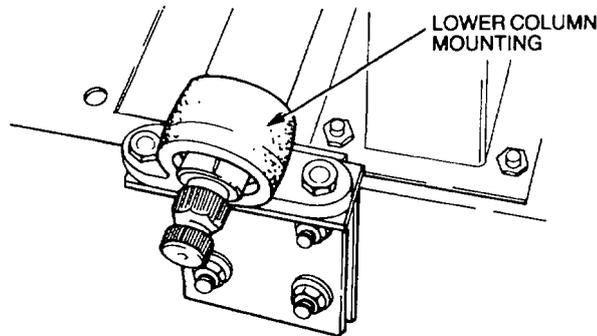


Figure 87 Steering Column Lower Mounting

- p.** Remove the bolts securing the halves of the top clamp and the bolts that secure the top half of the clamp to the firewall. Remove the clamp and rubber packing (Figure 88).

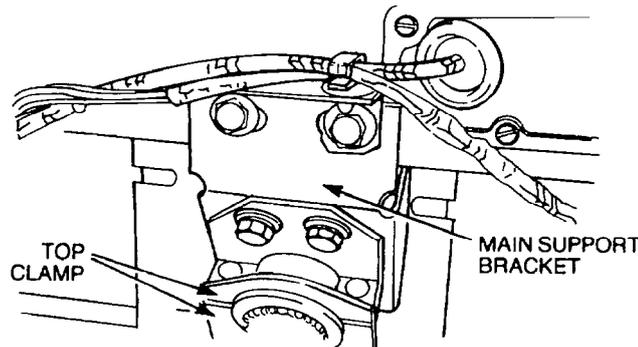


Figure 88 Steering Column Upper Mounting

- q.** Remove the bolts securing the steering column main support bracket to the firewall and remove the column complete with the support bracket.

103. Disassembly. Disassemble the steering column as follows:

- a.** Remove the circlip from the lower end of the steering column.
- b.** Using a suitable drift, remove the inner shaft complete with the bearing from the upper end of the column (Figure 89).

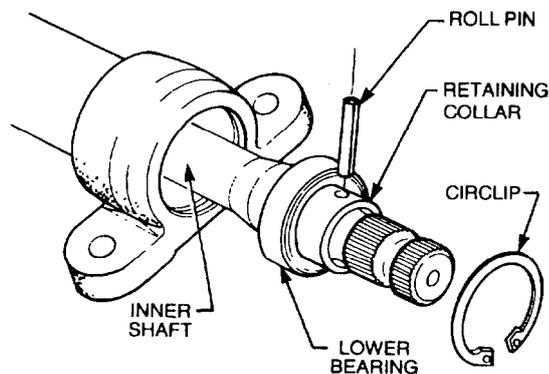


Figure 89 Inner Shaft and Bearing Removal

- c. Remove the roll pin from the lower bearing retaining collar and press the collar and bearing from the inner shaft.
- d. Using a suitable drift, drive the needle roller bearing from the outer column (Figure 90).

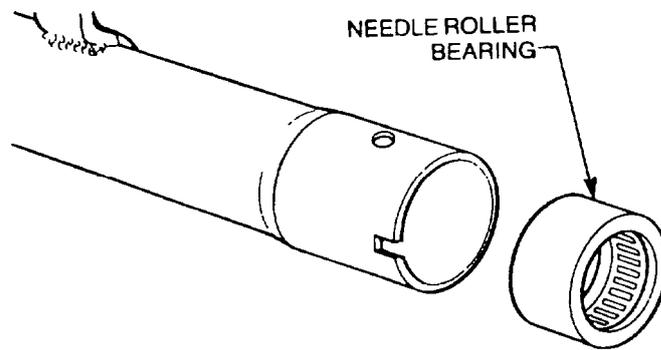


Figure 90 Upper Column Bearing Removal

- 104. Inspection.** Clean and inspect the steering column as follows:
- a. Clean all components of the steering column using a recommended cleaning agent and blow them dry with compressed air.
 - b. Inspect all parts for cracks or excessive wear and replace parts as necessary.
- 105. Reassembly.** Reassemble the steering column as follows:
- a. Press a new lower bearing on the inner shaft and fit the retaining collar. Ensure that the collar fits against the bearing and the roll pin holes are aligned. Install a new roll pin.
 - b. Press in a new needle roller bearing to the top of the steering column ensuring that a gap of 10 mm (0.39 in) is obtained from the bearing to the end of the column (Figure 91).

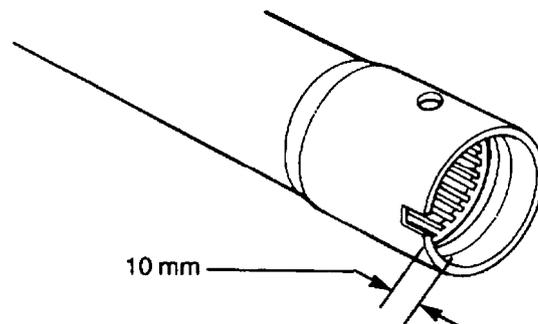


Figure 91 Upper Column Bearing Installation

- c. Ensure that both bearings are adequately lubricated with grease, then insert the inner shaft and lower bearing into the outer column and secure it with the circlip.
- 106. Installation.** Install the steering column as follows:
- a. Install the main support bracket and rubber packing on the steering column and manoeuvre the column into position in the vehicle.
 - b. Loosely secure the main support bracket to the firewall with the bolts (Figure 88).
 - c. Fit the clamp and rubber packing strip to the column and loosely secure it with the bolts.
 - d. Loosely secure the lower end of the column to the lower support bracket with the nuts and bolts (Figure 87).
 - e. Loosely secure the clamp bracket to the main support bracket with the bolts.
 - f. From inside the vehicle, carefully move the instrument panel to one side and secure the tie bar to the column with the bolt. Tighten the bolt securely.

- g.** Check that all electrical connections are secure then install the instrument panel and secure it with the screws.
- h.** Tighten the main support bracket bolts, clamp bracket bolts, upper clamp bolts and the lower support bracket nuts and bolts.
- i.** Install the brake pedal bracket and tighten the bolts securely.
- j.** Install the brake servo and master cylinders.
- k.** Bleed the brake system in accordance with EMEI Vehicle G 103 - Group 12.
- l.** Install the ignition switch mounting bracket on the column and tighten the nuts and bolts securely.
- m.** Install the switch cluster and secure it with the clamp screw. Reconnect the multi-pin connectors.
- n.** Install the steering column shroud and secure it with the screws (Figure 85).

NOTE

When installing the steering wheel, ensure the prongs on the steering wheel hub engage the cut outs in the upper steering column bush. If necessary, rotate the bush to align with the prongs ensuring the arrow on the bush faces the indicator switch.

- o.** Install the steering wheel, shake proof washer and nut. Torque the nut to 38 N.m (28 lbf.ft).
- p.** Fit the steering wheel cover and secure it with the screw.

NOTE

The collapsible shaft has the long joint fitted to the short length of the shaft and the short joint fitted to the long length. The joints can only be fitted to the shaft one way.

- q.** Ensure that the steering wheel and the front wheels are in the straight ahead position, and that the match marks on the top universal joint and the steering column align. Install the collapsible shaft with the long length towards the steering box. Fit the pinch bolts with new locknuts and torque them to 20 to 25 N.m (15 to 18 lbf.ft).
- r.** Connect the battery.

Steering Specifications

107. The steering specifications are detailed in Table 19.

Table 19 Steering Group Specifications

Serial	Item	Specification
1	Steering box to chassis tightening torque	80 N.m (60 lbf.ft)
2	Collapsible shaft universal joint tightening torque	20 to 25 N.m (15 to 18 lbf.ft)
3	Steering wheel tightening torque	38 N.m (28 lbf.ft)
4	Tie bar to Panhard rod mounting arm tightening torque	80 N.m (60 lbf.ft)
5	Drag link to drop arm tightening torque	40 N.m (30 lbf.ft)
6	Upper steering column bearing to column installation distance	10 mm (0.39 in)

FRAME

Towing Pintle

108. Cleaning and Inspection. Clean all parts in a suitable cleaning agent and inspect them for excessive wear (Figure 92). Replace worn parts as necessary.

WARNING

The wear limits shown in Figure 92 are only to be used in conjunction with tow coupling Part No. FV332153. For wear limits of all other towing pintles refer to EMEI Vehicle G 008-1.

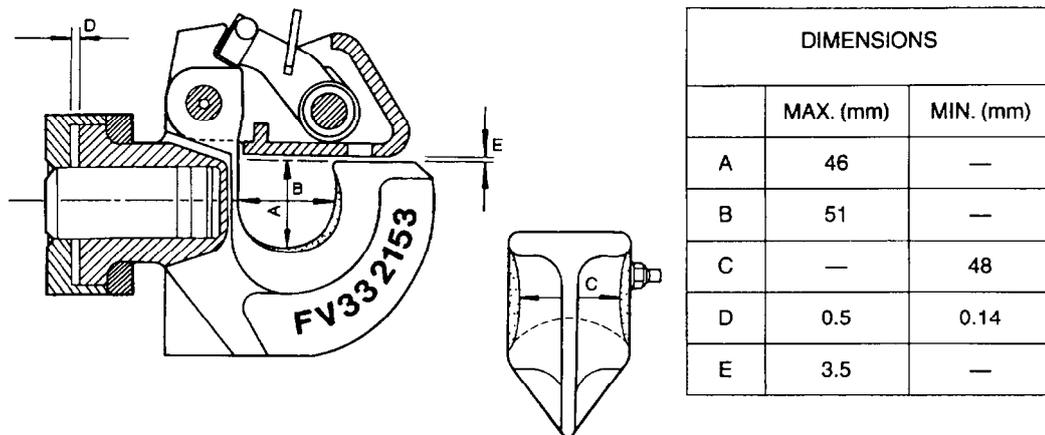


Figure 92 Towing Pintle Wear Limits

BODY

Bonnet

109. Removal. Remove the bonnet as follows:

- a. Remove the de-ditching tools from the bonnet.
- b. Open the bonnet and remove the E-clip securing the clevis pin in the bonnet stay (Figure 93).

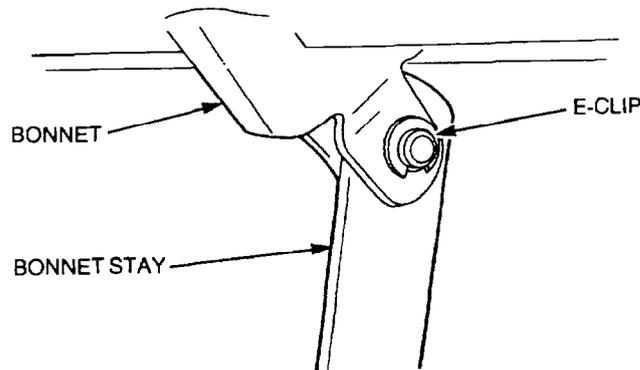


Figure 93 Bonnet Stay Mounting

- c. Remove the clevis pin to allow the stay to be detached.

NOTE

It will be necessary to utilize a second person to assist in lifting off the bonnet.

- d. Raise the bonnet to the vertical position and lift it clear of the hinges.

110. Installation. Install the bonnet as follows:

NOTE

Prior to installing the bonnet ensure that the bonnet stay has been strengthened in accordance with EMEI Vehicle G 187-12.

Inspect the bonnet hinges in accordance with EMEI Vehicle G 103 – Group 17.

Ensure the external bonnet release catch has been fitted to the vehicle as detailed in EMEI Vehicle G 187-6.

It will be necessary to utilize a second person to assist lifting the bonnet into position.

- a. Ensuring the rubber sleeves are positioned with the slots uppermost in the hinges, lower the bonnet vertically to allow the bonnet hinge brackets to engage in the slots.
- b. Position the stay in the bracket and install the clevis pin and E-clip (Figure 93).
- c. Close the bonnet and adjust the catch using the procedure detailed in EMEI Vehicle G 103 – Group 17.
- d. Fit the de-ditching tools.

Mudguard – Front Left

111. Removal. Remove the front left mudguard as follows:

- a. Disconnect the battery.
- b. Remove the bonnet (Para 109.).
- c. Remove the screws and washers securing the windscreen washer container to the inner guard, disconnect the hoses from the washer pump and remove the container.
- d. Remove the screws securing the shock absorber tower cap to the inner guard. Remove the cap.

- e. Remove the screws securing the front grille and remove the grille.
- f. Remove the connector from the spade terminal on the horn.
- g. Remove the bolts and washers securing the grille panel to the mudguard.
- h. Remove the nut, washers and bolt securing the mudguard to the chassis bracket and remove the packing plates if fitted (Figure 94).

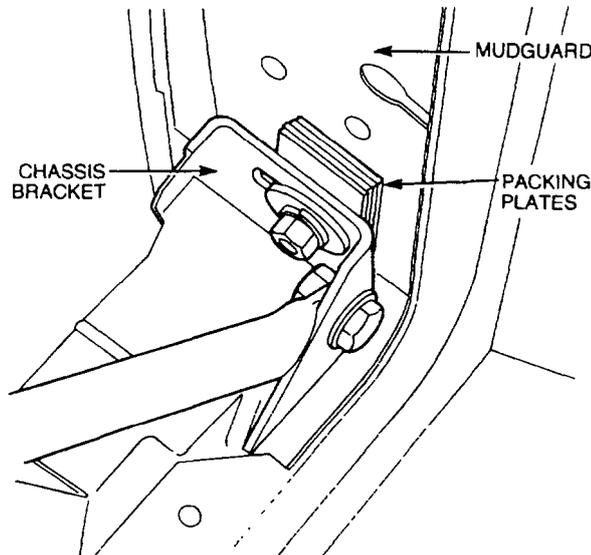


Figure 94 Left Mudguard Mounting

- i. Remove the bolts and washers securing the top left radiator support bracket to the mudguard.
- j. Using a suitable pin punch, remove the pins from the wheel arch trim plastic retaining clips and remove the trim from the mudguard. Retain the pins.
- k. Tag and disconnect the wiring harnesses from the front lighting. Remove the bolt, washer and nut securing the earth leads to the inner guard.
- l. Remove the wiring harnesses from the securing clips.
- m. Remove the bolt and flat washer securing the top of the mudguard to the firewall bracket (Figure 95).

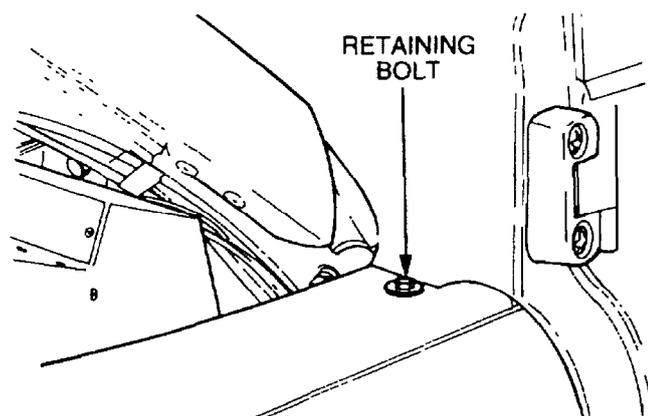


Figure 95 Mudguard-to-firewall Removal

- n. Remove the bolts and washers securing the mudguard to the sill panel.
- o. Remove the screws and washers securing the inner guard to the toe board bracket (Figure 96).

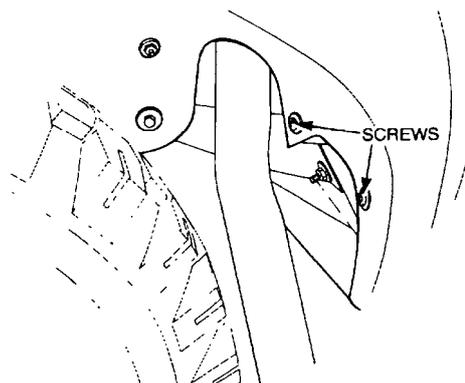


Figure 96 Mudguard-to-toe Board Removal

- p. Remove the bolts and washers securing the mudguard to the A-post.
- q. Remove the bolts and washers securing the inner guard to the chassis mounting.
- r. Carefully remove the mudguard complete with the inner guard by tilting the rear end upwards, then tilting the mudguard outwards to clear the shock absorber tower.

112. Installation. Install the front left mudguard as follows:

NOTE

Ensure the mudguard is fitted with a reinforcement plate in accordance with EMEI Vehicle G 187-2.

- a. Position the mudguard complete with the inner guard on the vehicle and secure the inner guard to the chassis mounting with the bolts and washers. Do not tighten them at this stage.
- b. Secure the mudguard to the A-post with the bolts and washers, but do not tighten them.
- c. Secure the inner guard to the toe board bracket with the screws and washers, but do not tighten them.
- d. Install the bolts and washers that secure the mudguard to the sill panel, but do not tighten them.
- e. Secure the top rear of the mudguard to the firewall bracket with the bolt and washer.
- f. Position the mudguard on the grille panel and install the bolts and washers.
- g. Install the packing plates (if required) between the mudguard and chassis bracket (Figure 94), and fit the bolt, washers and nut.
- h. Install the bolts and washers that secure the left side top radiator support bracket to the mudguard and tighten the bolts securely.
- i. Tighten all bolts and screws securing the mudguard and inner guard to the vehicle.
- j. Connect the wiring harnesses to the front lights and horn.
- k. Secure the wiring harnesses to the inner guard with the clips.
- l. Secure the earth leads to the inner guard with the bolt, washer and nut. Tighten the nut securely.
- m. Position the wheel arch trim on the mudguard and secure it with the plastic clips and pins.
- n. Install the windscreen washer container on the inner guard and secure it with the screws and washers.
- o. Connect the hoses to the washer pump.
- p. Install the bonnet (Para 110.).

Mudguard – Front Right

113. Removal. Remove the front right mudguard as follows:

- a. Disconnect the battery.
- b. Remove the bonnet (Para 109.).

- c. Remove the screw securing the expansion tank strap and remove the tank from the bracket. Secure the tank away from the mudguard.
- d. Remove the screws securing the shock absorber tower cap to the inner guard. Remove the cap.
- e. Remove the screws securing the front grille and remove the grille.
- f. Remove the bolt, washer and nut securing the air intake clamp to the inner guard. Remove the bolts and washers securing the steering shaft cover to the inner guard.
- g. Remove the steering shaft cover.
- h. Remove the bolts and washers securing the grille panel to the mudguard.
- i. Remove the nut, washers and bolt securing the mudguard to the chassis bracket and remove the packing plates, if fitted (Figure 97).

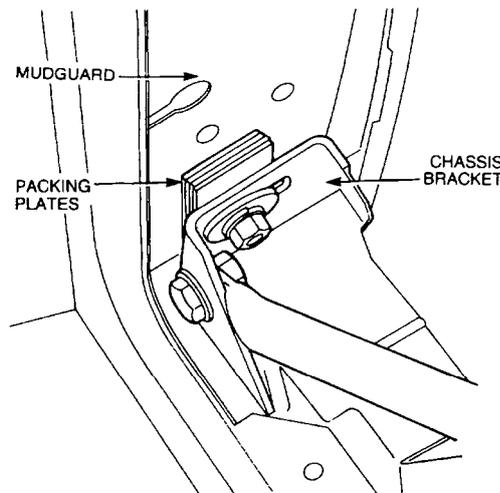


Figure 97 Right Mudguard Mounting

- j. Remove the bolts and washers securing the top right radiator support bracket to the mudguard.
- k. Using a suitable pin punch, remove the pins from the wheel arch trim plastic retaining clips and remove the trim from the mudguard. Retain the pins.
- l. Tag and disconnect the wiring harnesses from the front lighting. Remove the bolt, washer and nut securing the earth leads to the inner guard.
- m. Remove the wiring harnesses from the securing clips.
- n. Remove the bolt and flat washer securing the top of the mudguard to the firewall bracket (Figure 98).

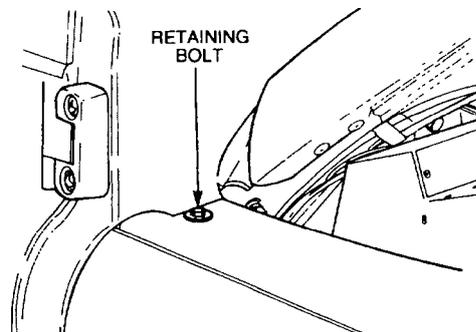


Figure 98 Mudguard to Firewall Removal

- o. Remove the bolts and washers securing the mudguard to the sill panel.
- p. Remove the screws and washers securing the inner guard to the toe board bracket (Figure 99).

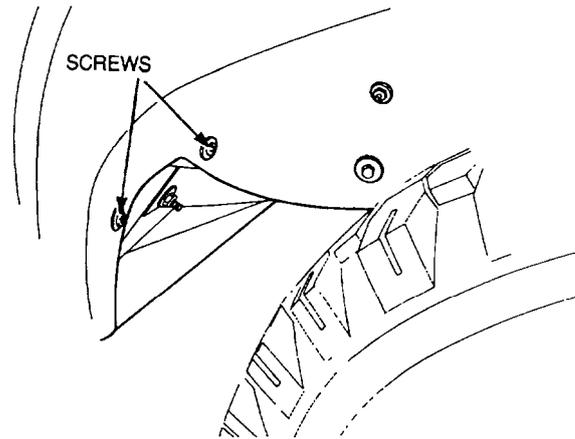


Figure 99 Mudguard to Toe Board Removal

- q. Remove the bolts and washers securing the mudguard to the A-post.
- r. Remove the bolts and washers securing the inner guard to the chassis mounting.
- s. Carefully remove the mudguard complete with the inner guard by tilting the rear end upwards and then tilting the mudguard outwards to clear the shock absorber tower.

114. Installation. Install the front right mudguard as follows:

NOTE

Ensure the mudguard is fitted with a reinforcement plate in accordance with EMEI Vehicle G 187-2.

- a. Position the mudguard complete with the inner guard on the vehicle and secure the inner guard to the chassis mounting with the bolts and washers. Do not tighten them at this stage.
- b. Secure the mudguard to the A-post with the bolts and washers, but do not tighten them.
- c. Secure the inner guard to the toe board bracket with the screws and washers, but do not tighten them.
- d. Install the bolts and washers that secure the mudguard to the sill panel, do not tighten them.
- e. Secure the top rear of the mudguard to the firewall bracket with the bolt and washer.
- f. Position the mudguard on the grille panel and install the bolts and washers.
- g. Install the packing plates (if required) between the mudguard and chassis bracket (Figure 97), and fit the bolt, washer and nut.
- h. Install the bolts and washers that secure the right side top radiator support bracket to the mudguard and tighten the bolts securely.
- i. Tighten all bolts and screws securing the mudguard and inner guard to the vehicle.
- j. Connect the wiring harnesses to the front lights and secure them to the inner guard with the clips.
- k. Secure the earth leads to the inner guard with the bolt, washer and nut, then tighten them securely.
- l. Position the wheel arch trim on the mudguard and secure it with the plastic clips and pins.
- m. Secure the air intake clamp to the inner guard with the bolt, washer and nut and tighten it securely.
- n. Install the steering shaft cover to the inner guard and tighten the bolts securely.
- o. Install the expansion tank and the retaining strap and secure it with the screw.
- p. Install the bonnet (Para 110.).
- q. Connect the battery.

Doors

115. **Removal.** Remove the doors as follows:

- a. Remove the split pin securing the door check strap clevis pin and remove the clevis pin and flat washer (Figure 100).

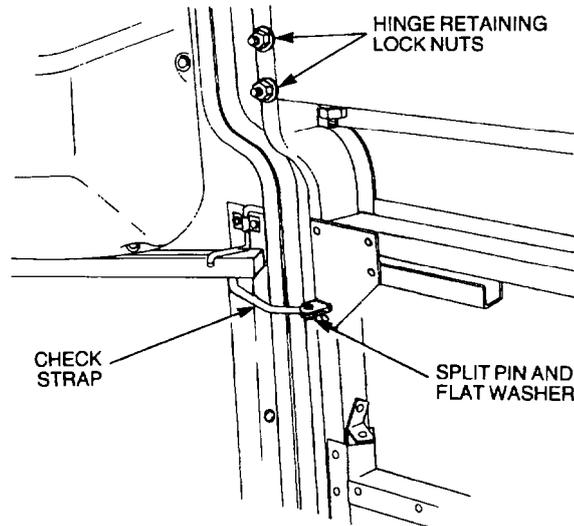


Figure 100 Door Removal

- b. Support the door and remove the locknuts, special plastic washers and bolts that secure the hinges to the door.
- c. Remove the door.

116. **Installation.** Install the doors as follows:

- a. Support the door and position the hinges, then install the bolts.

NOTE

The special plastic washers must be fitted with the taper towards the door.

- b. Fit the special plastic washers with the taper towards the door frame and install the locknuts.
- c. Tighten the locknuts securely.
- d. Ensure the door lock aligns with the striker plate. If necessary slacken the bolts that secure the hinges to the A-post and then retighten them.
- e. Install the check strap into the firewall bracket and insert the clevis pin and flat washer.
- f. Secure the clevis pin with a new split pin.

Windscreen Glass

117. **Replacement.** Replace the windscreen glass as follows:

- a. Remove the windscreen and frame assembly from the vehicle in accordance with EMEI Vehicle G 103 - Group 17.

NOTE

It will be necessary to utilize a second person to assist in the replacement of the windscreen glass.

- b. Apply even pressure to the inside face of the glass and push the glass and rubber surround out of the frame.
- c. Remove all trace of hardened sealer from the frame.

- d. Lay the windscreen glass on a flat, soft surface ensuring that the inside face of the windscreen is facing uppermost.
- e. Install the windscreen rubber on the glass with the inside face of the rubber uppermost (Figure 101).

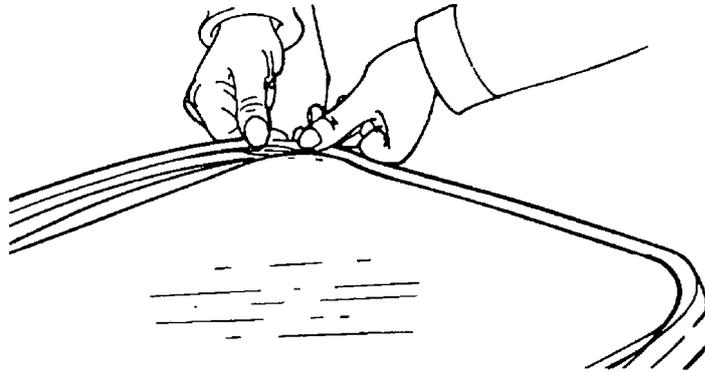


Figure 101 Windscreen Rubber Seal Installation

NOTE

The inside face of the glass can be determined by the etched motif.

- f. Using approximately 4 metres of rope with a diameter of 7 mm, insert the rope into the groove of the rubber (Figure 102) starting at the bottom centre of the glass and leaving enough rope at the start to enable it to be pulled on during installation.

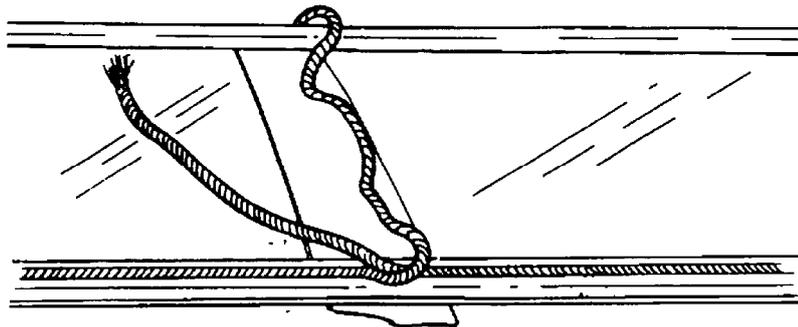


Figure 102 Rubber Seal Installing Rope

- g. Using a solution of soap and water, lubricate the rope and rubber thoroughly (Figure 103).

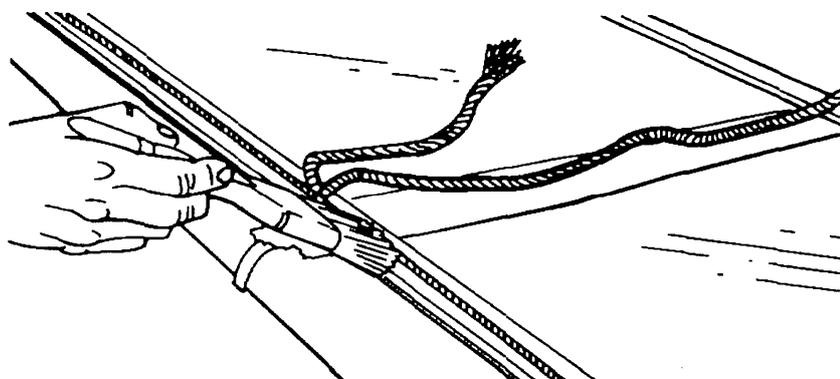


Figure 103 Rubber Seal Applying Soap Solution

- h. Apply a thin bead of suitable sealant to the front face of the windscreen frame flange (Figure 104).

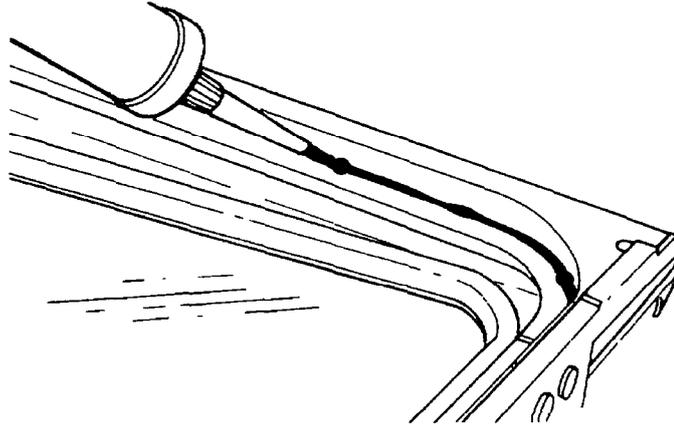


Figure 104 Windscreen Frame Applying Sealant

- i. Position the windscreen frame over the glass and rubber assembly, ensuring that the front face of the frame is facing downwards and the etched motif on the glass is towards the bottom of the frame (Figure 105).

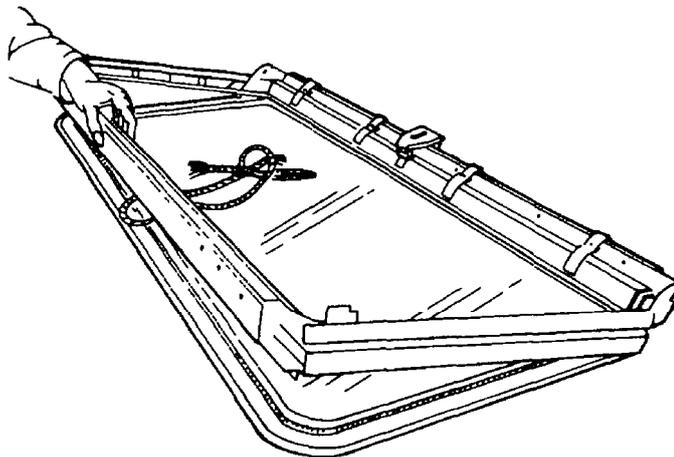


Figure 105 Windscreen Frame Installation

- j. Push down on the frame continuously and pull one end of the rope around the rubber until the frame flange is correctly located. If the corners are not fitting correctly, remove the frame, install the rope and repeat sub paragraphs h and i until the windscreen is installed.
- k. Press the inside face of the rubber seal to ensure that the glass is seating correctly.
- l. Replace the windscreen and frame assembly in accordance with EMEI Vehicle G 103 - Group 17.

Roll Over Protection

118. The vehicle is fitted with a roll over protection structure (ROPS). Refer to EMEI Vehicle G 107-2 for fitting instructions.

WARNING

The roll over protection assembly is to be replaced if the vehicle has been involved in a roll over accident.

The roll over protection assembly is to be replaced where distortion has occurred to the roll over structure or capping rails.

The roll over protection assembly is to be replaced if any welds are cracked or have failed.

CAUTION

The roll over protection is **NOT** to be modified or repaired by drilling, grinding or welding the structure unless specified within authorised documentation. The ROPS is to be repaired by replacement.

Fitting of Camouflage Net Carrier

119. Inspection. Prior to installation, inspect as follows:

- a. Inspect the mounting rivnuts fitted to the front and rear roll cage tubes or rear canopy bows as appropriate to ensure they are firm and serviceable (Qty Two per tube).

NOTE

If required, refer to Rivnut Replacement Procedure (Para 122. or 123.) depending on the size of the mounting holes.

- b. Inspect the canopy for rips or tears around the access holes for the rivnuts (approximately 10mm size holes required).
- c. Repair as necessary.

120. Stores Required. The stores required to install the camouflage net carrier are listed in Table 20.

Table 20 Stores Required to Install Camouflage Net Carrier (Using Rivnuts)

Item	NSN	Designation	Qty per Equip
1	NIC	Frame camouflage stowage	1
2	5340-66-128-5936	Mount rubber	4
3	5310-99-122-6475	Washer plain	4
4	5306-99-122-5258	Bolt 8 mm x 65 mm	2
5	5305-99-122-5255	Bolt 8 mm x 45 mm	2
6	5305-66-150-2533	Coach bolt M8 x 120 mm	2
7	5305-66-150-2532	Coach bolt M8 x 90 mm	2
8	5310-66-128-4918	Nyloc nut	4

121. Installation. Install the camouflage net carrier as follows:

- a. Position items 1 and 2 from Table 20 on the roll cage tubes (Figure106).

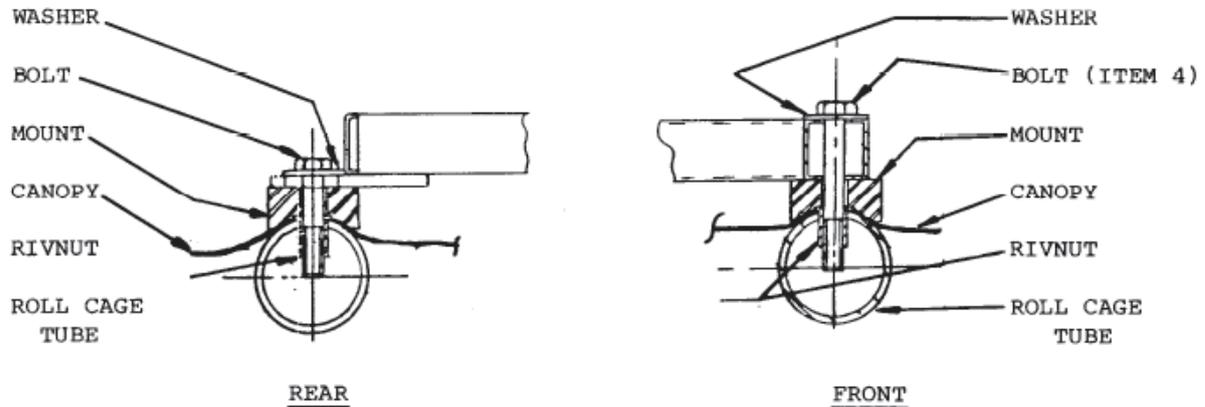


Figure 106 Location of Fixing Components (Using rivnuts)

- b. Assemble item 3 from Table 20 onto items 4 and 5.
- c. Apply Loctite 242, NSN 8030-66-079-8891, to the threads of the bolts and fit the bolts (Figure106) ensuring item 4 (longer bolts) is fitted to the front roll tube.
- d. Tighten the bolts until the rubber mounts are compressed a minimum of 1/3 their normal height.

Rivnut Replacement Procedure

122. If any of the rivnuts fitted to the front and rear roll cage tubes are found to be damaged or missing and the rivnut mounting hole is less than 11.5 mm diameter, proceed as follows:

- a. Remove the canopy (refer vehicle user manual).
- b. Prepare for welding ensuring seats and seat belts are adequately protected to prevent any damage from the welding processes.
- c. Disconnect the battery.
- d. Prepare the rivnut mounting hole area for welding by removing paint etc.
- e. Weld the rivnut (NSN 5310-99-772-5133) into position in two places by using Gas Metal Arc Welding (GMAW) using LW1 wire with Argoshield 51 gas or Manual Metallic Arc Welding (MMAW) using low hydrogen electrodes.
- f. After completion of the repair, remove any sharp or rough edges by grinding, ensuring the weld is flush with the rivnut top surface.
- g. Prime and patch paint the finished repair as required.
- h. Refit the vehicle canopy (refer vehicle user manual), ensuring correct alignment between the access holes in the canopy and the rivnuts.
- i. Install the camouflage net carrier (Para 121.).

123. If the rivnut mounting holes are greater than 11.5 mm but less than 16 mm, or if the ROPS or Rear Canopy Bow (RCB) has been drilled through proceed as follows:

NOTE

The procedure is to be applied to both sides of the ROPS or RCB even if only one side mounting hole diameter is between 11.5 mm and 16 mm or has been drilled through.

- a. Remove the canopy (Ref user handbook).

- b. Drill out the affected rivnut mounting holes to 16 mm diameter on the top and bottom of the tube.
- c. Prepare the vehicle for welding ensuring seats and seat belts are adequately protected to prevent any damage from the welding or grinding processes.
- d. Disconnect the battery leads.
- e. The rivnut mounting hole area is to be prepared for welding by removing the paint etc.
- f. Insert prefabricated reinforcement box tube (13 mm x 13 mm RHS square section, 60 mm long and 1.8 mm wall thickness, primed) into the 16 mm holes and weld it into position. Weld land is to be at least 3 mm and no greater than 4 mm.

NOTE

The tube is initially longer than required to aid the welding process. The tube is to be fully welded top and bottom in position using GMAW with LW1 wire and Argoshield 51 gas or MMAW using low hydrogen electrodes. Welding is to comply with AS 1554 Structural Steel Welding Code.

- g. Remove any rough or sharp edges by grinding, ensuring the reinforcement tube is flush with the weld and the finished top surface is between 3 mm and 4 mm proud of the ROPS or RCB tube.
- h. Prime and patch paint the finished repair as required.
- i. Refit the vehicle canopy (Ref user manual).
- j. Mount the camouflage net carrier (Table 20 Item 1) using items 2 and 3.
- k. Secure the camouflage net carrier using M8 coach bolts (Table 20 Item 6 for front ROPS and 7 for rear ROPS or RCB) and Nyloc nuts (Table 20 Item 8) inserted from the bottom of the ROPS or RCB (Figure 107), so that no thread or sharp edges are protruding into the vehicle interior etc.
- l. Tighten the bolts until the rubber mounts are compressed a minimum of 1/3 their normal height.

NOTE

As the front coach bolt will protrude approx 15 mm above the nut in the tightened position, a maximum of 10 mm may be cut from the end of the bolt prior to assembly to prevent excessive snagging of the camouflage net.

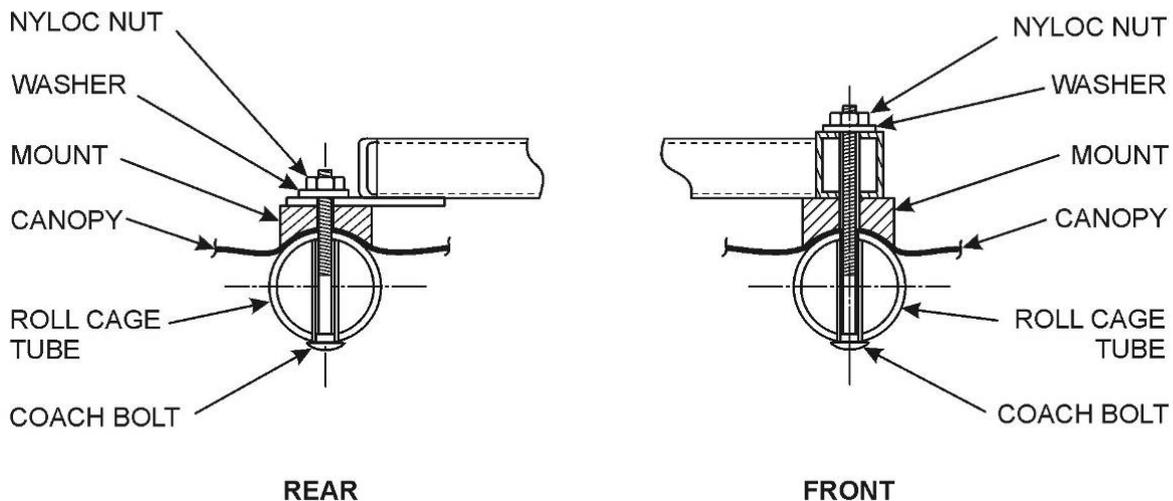


Figure 107 ROPS / RCB Repair Procedure

CAB HEATING/COOLING

Heater Assembly

124. Removal. Remove the heater assembly as follows:

- a. Using a suitable container, drain the engine cooling system. If necessary open the heater controls to allow the heater to be completely drained.
- b. Remove the screws securing the ducting and grille to the left side front mudguard and remove the ducting.
- c. Disconnect the securing clip and cable from the air directional control lever (Figure 108).

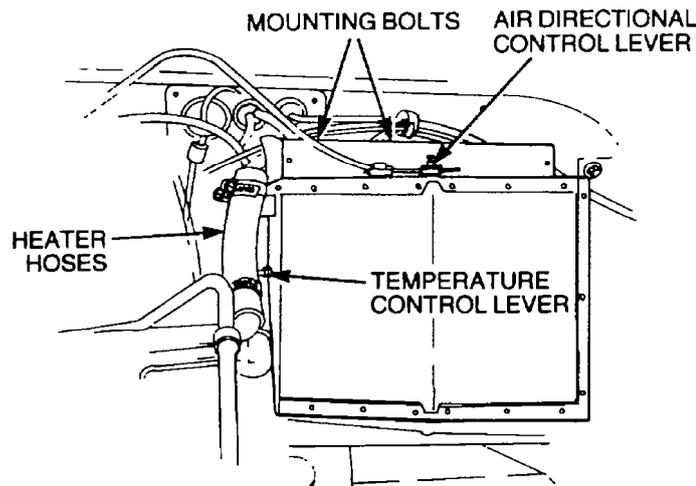


Figure 108 Heater Assembly Removal

- d. Slacken the hose clamps securing the inlet and outlet hoses to the pipes and disconnect the hoses.
 - e. Disconnect the securing clip and cable from the temperature control lever.
 - f. Remove the bolts that secure the top of the heater assembly to the firewall.
 - g. Disconnect the wiring harness at the three-pin connector.
 - h. Remove the bolts that secure the lower mounting bracket to the firewall and remove the heater assembly.
- 125. Disassembly.** Disassemble the heater assembly as follows:
- a. Using a suitable drill, remove the rivets securing the resistor plate to the case and withdraw the resistor and plate assembly (Figure 109).

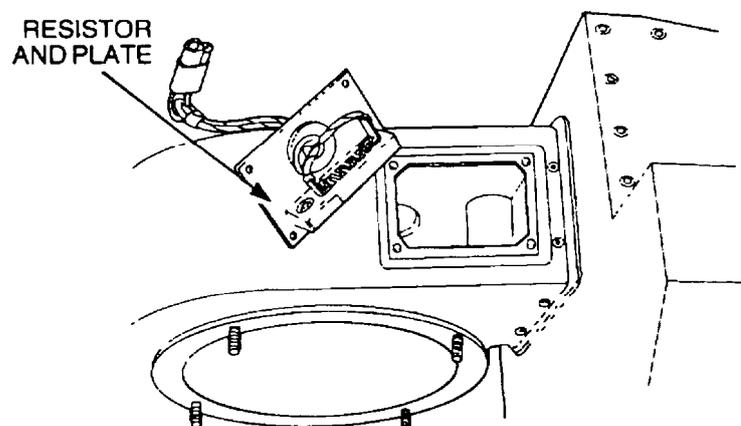


Figure 109 Resistor and Plate Removal

- b. Using a suitable drill, remove the twenty-four rivets securing the panel to the heater case noting that three of the rivets are located beneath the foam seal.
- c. Remove the panel and heater radiator (Figure 110).

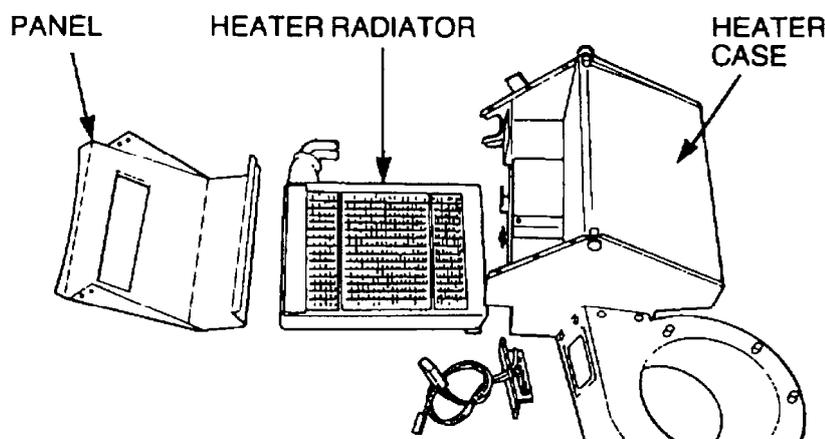


Figure 110 Heater Assembly Exploded View

126. **Inspection.** Clean and inspect the heater assembly as follows:
 - a. Inspect the radiator for damaged seams, choked or damaged fins, corrosion and restrictions in the core. Replace the radiator as necessary.
 - b. Remove all traces of sealing compound from the case and panel.
127. **Reassembly.** Reassemble the heater assembly as follows:
 - a. Install the heater radiator in the case. Apply a suitable sealing compound around the rivet faces and install the panel. Secure the cover with pop rivets.
 - b. Apply a suitable sealing compound to the resistor plate and install the plate on the case. Secure the plate with pop rivets.
128. **Installation.** Install the heater assembly as follows:

NOTE

Prior to installing the heater assembly ensure the heater cable securing straps have been fitted in accordance with EMEI Vehicle G 197-5.

- a. Position the heater assembly on the firewall and install the mounting bolts. Tighten the bolts securely.
- b. Install both the temperature and air directional cables and secure them with the clip and grub screw. Ensure that when the dash mounted levers are operated, full travel is obtained at the heater assembly.
- c. Install the inlet and outlet heater hoses and secure them with the hose clamps.
- d. Refill the cooling system in accordance with EMEI Vehicle G 103 - Group 2.
- e. Install the ducting and mudguard grille and secure them with the screws.

WINCH

Winch Assembly

129. **Removal.** Remove the winch assembly as follows:

- a. Remove the 3/8 in UNC Allen screw securing the winch drive line universal joint to the winch input shaft (Figure 111).

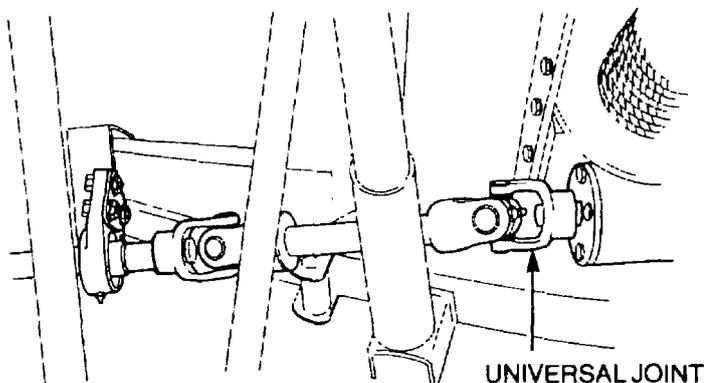


Figure 111 Winch Input Shaft Universal Joint Disconnection

- b. Remove the chain from the towing eyes.
- c. Remove the bolts securing the winch rear support bracket to the lugs attached to the chassis rails.
- d. Using a suitable jack, support the weight of the winch and remove the bolts securing the fairlead frame to the chassis (Figure 112).

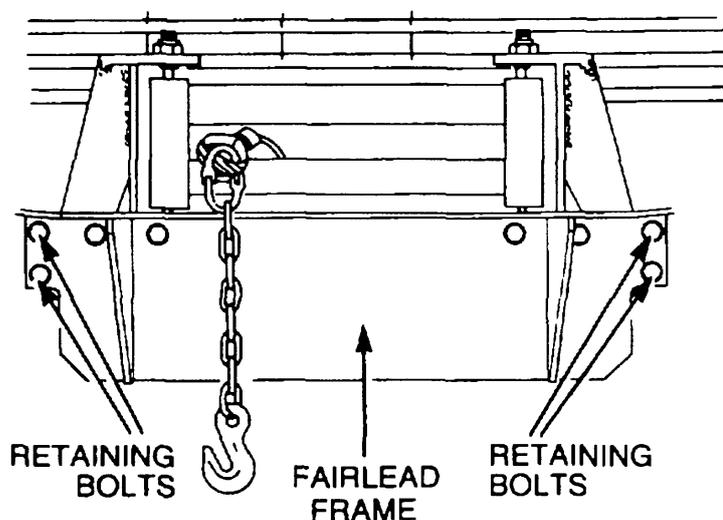


Figure 112 Winch and Fairlead Frame Removal

NOTE

The universal joint may need to be prised off the shaft. Take care not to lose the key fitted to the shaft.

- e. Carefully pull the winch and fairlead frame forward to allow the universal joint to slide off the input shaft and to clear the chassis ends.
- f. Remove the bolts securing the fairlead frame to the winch housing and remove the frame (Figure 113).

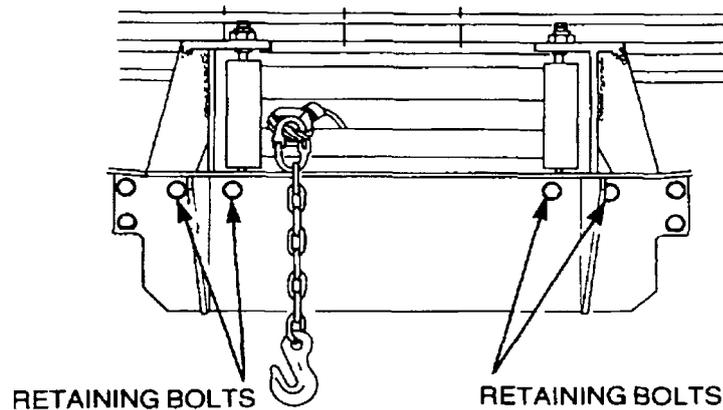


Figure 113 Fairlead Frame Removal

- g.** Feed the winch rope and chain through the fairlead rollers.
- h.** Remove the bolts securing the winch rear support bracket to the housing.
- i.** Remove the bracket and discard the washers.
- j.** Remove the winch assembly from the supporting jack.

130. Installation. Install the winch assembly as follows:

NOTE

Use a suitable sealing compound on all bolts installed into the winch gear housing to prevent oil leakage. Prior to installing the winch assembly, ensure that the winch guard screws and mounting holes are countersunk in accordance with EMEI Vehicle G 197-3. Ensure the winch drum, winch rope and chain comply with EMEI Vehicle G 187-8.

- a.** Position the winch rear support bracket on the winch housing, install the bolts and washers and torque them to 77 N.m (57 lbf.ft).
- b.** Position the fairlead frame on the winch housing and install the bolts and washers. Do not tighten them fully.
- c.** Support the weight of the winch assembly on the jack. Position the winch in between the chassis rails and at the same time, fit the universal joint onto the input shaft ensuring the key is correctly located.
- d.** Secure the rear support bracket to the chassis rail lugs and tighten the bolts securely.
- e.** Install the retaining bolts (Figure 112) and torque them to 77 N.m (57 lbf.ft).
- f.** Torque the bolts securing the fairlead frame to the winch housing to 77 N.m (57 lbf.ft).
- g.** Ensure that the drive line universal joint is fully installed on the input shaft and tighten the Allen screw.
- h.** Secure the chain to the front towing eyes and remove the jack.
- i.** Functionally test the operation of the winch.

Winch Specifications

131. The winch specifications are detailed in Table 21.

Table 21 Winch Assembly Specifications

Serial	Item	Specification
1	Winch to rear support bracket tightening torque	77 N.m (57 lbf.ft)
2	Winch frame to chassis tightening torque	77 N.m (57 lbf.ft)
3	Fairlead frame to winch tightening torque	77 N.m (57 lbf.ft)

END

Distribution List: **VEH G 16.0 – Code 2** (Maint Level)
(Sponsor: CGSVSPO, Light B Vehicles)
(Authority: EC-006633)