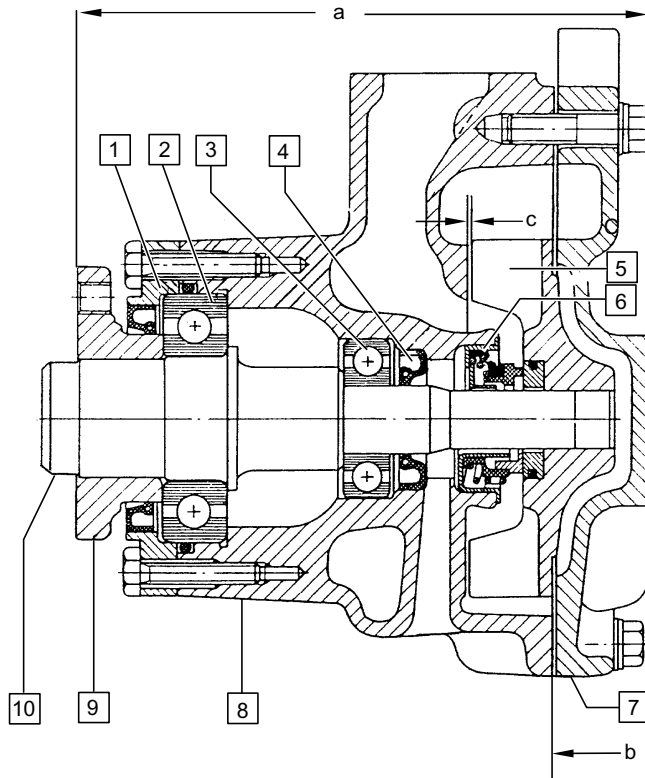


GROUP 2 — COOLING SYSTEM

Coolant Pump



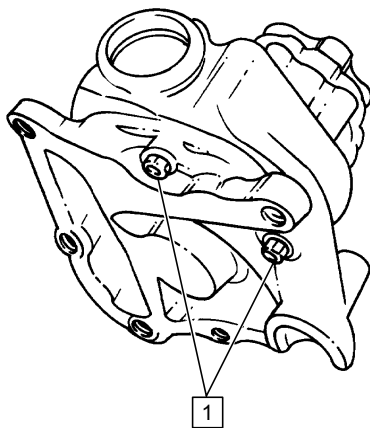
- | | |
|-----------------------|--|
| 1. Seal retainer | 8. Coolant pump housing |
| 2. Large bearing | 9. Pulley mounting flange |
| 3. Small bearing | 10. Coolant pump shaft |
| 4. Rear seal ring | a reference size 143.5 ± 0.5 mm |
| 5. Impeller | b Press impeller onto shaft until area "b" is aligned flush with the flange face of the coolant pump housing. Max allowable deviation ± 0.1 mm |
| 6. Mechanical seal | c Distance; impeller and coolant pump housing $0.6 + 0.5$ mm / $- 0.3$ mm |
| 7. Coolant pump cover | |

Figure 79 - Coolant Pump - Sectional View

49. Disassembly

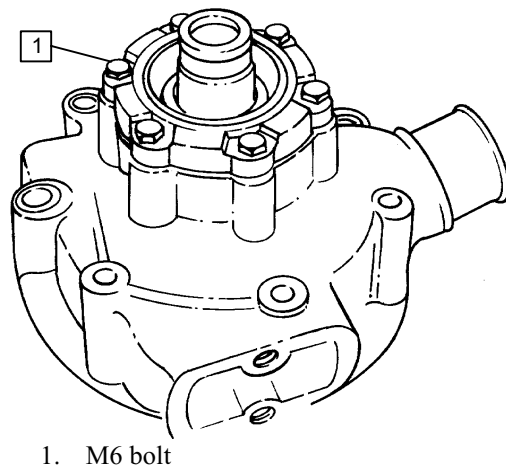
- a. Remove the pulley mounting flange with the puller (Table 2, Item 4).
- b. Remove the two bolts (Fig 80(1)) securing the rear coolant pump housing to the coolant pump and remove the housing.

- c. Remove the six M6 bolts (Fig 81(1)) securing the sealing ring retainer to the coolant pump housing and remove the retainer.



1. Bolt

Figure 80 - Rear Coolant Pump Housing - Removal



1. M6 bolt

Figure 81 - Sealing Ring Retainer - Removal

- d. Remove the sealing ring from the sealing ring retainer using a suitable drift and a hammer (Fig 82).

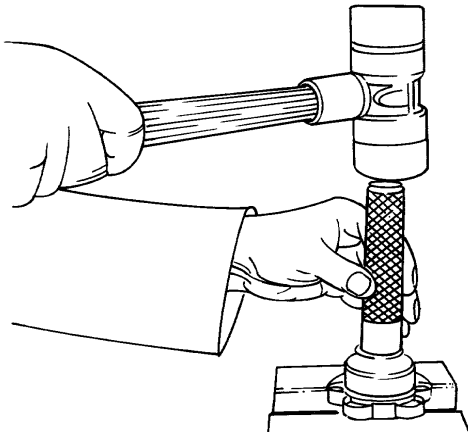


Figure 82 - Retainer Sealing Ring - Removal

- e. Remove the O-ring from the coolant pump housing (Fig 83).

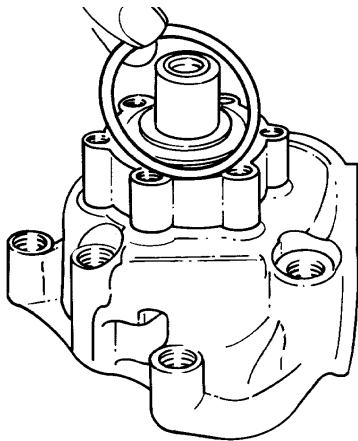


Figure 83 - O-Ring - Removal

- f. Press the coolant pump shaft complete with bearings out of the impeller and the coolant pump housing (Fig 84). Remove the pump impeller from the housing.

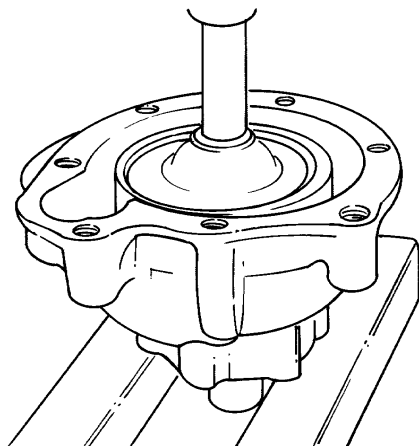


Figure 84 - Coolant Pump Shaft - Removal

- g. Press the large bearing (Fig 79(2)) and small bearing (Fig 79(3)) off the coolant pump shaft (Fig 85).

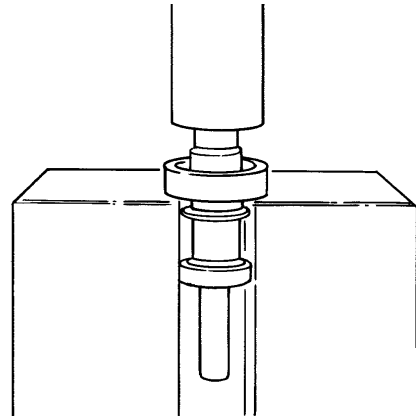


Figure 85 - Large and Small Bearings - Removal

- h. Remove the mechanical seal (Fig 86) and the rear sealing ring from the coolant pump housing using a suitable drift and a hammer.

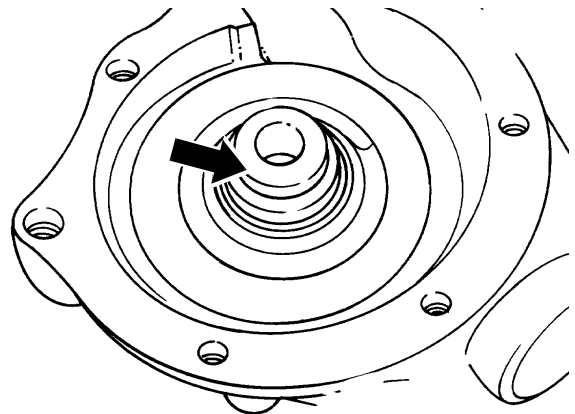


Figure 86 - Mechanical Seal - Removal

50. Cleaning and Inspection

WARNING

ENSURE THE SAFETY REQUIREMENTS FOR USE OF COMPRESSED AIR ARE STRICTLY ADHERED TO. INADVERTANT USE OF COMPRESSED AIR EQUIPMENT MAY RESULT IN INJURY TO PERSONNEL.

- a. Wash the parts in an appropriate cleaning agent and blow dry with compressed air. Clean all mating surfaces.
- b. Inspect all parts for wear or damage. Inspect the impeller and coolant pump shaft (Fig 87), replace if required. Replace all seals and bearings.

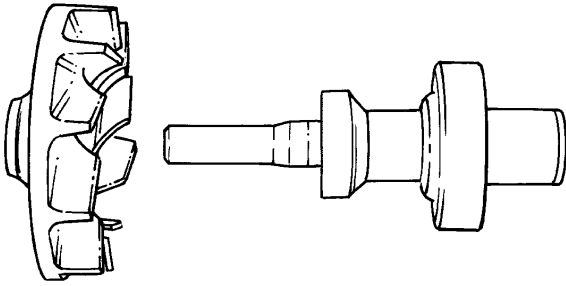


Figure 87 - Impeller and Coolant Pump Shaft - Inspection

51. *Reassembly*

- a. Insert the rear sealing ring (Fig 88) in the coolant pump housing and knock it onto its seat using a suitable drift and a hammer.

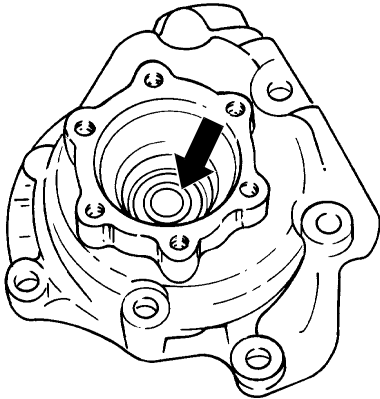


Figure 88 - Rear Sealing Ring

- b. Install the small and large bearings on the coolant pump shaft (Fig 89).

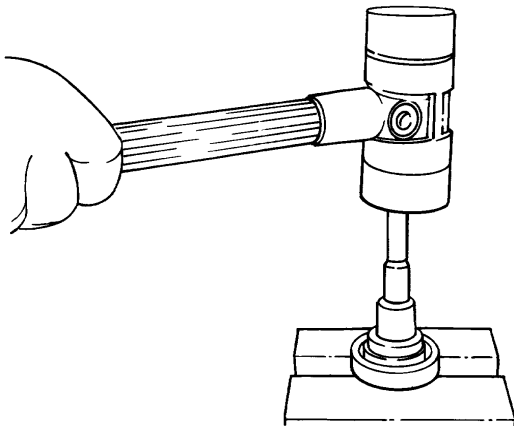


Figure 89 - Small and Large Bearings - Installation

- c. Pack the small bearing (Fig 79(3)), the large bearing (Fig 79(2)) and the space between the bearings with grease (XG-274) and insert the coolant pump shaft into the housing (Fig 90).

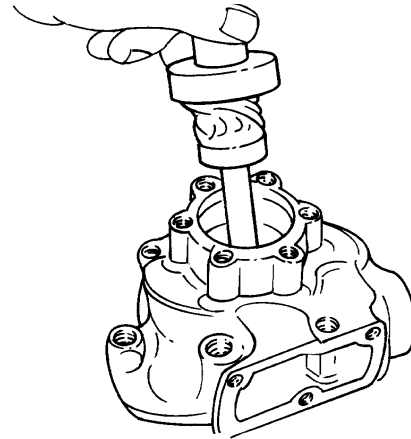


Figure 90 - Coolant Pump Shaft - Installation

- d. Install the mechanical seal (Fig 91) over the shaft onto the coolant pump housing and press it into position using the replacer (Table 2, Item 40).

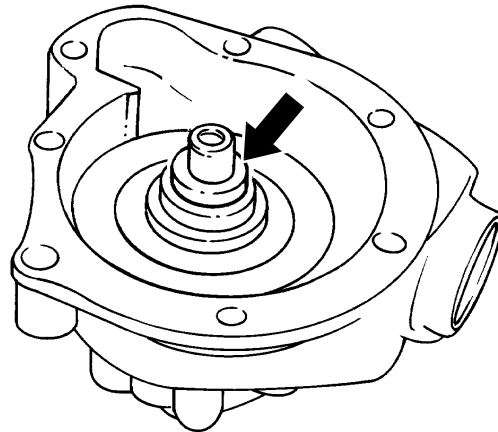


Figure 91 - Mechanical Seal - Installation

- e. Press the sealing ring (Fig 92) into the sealing ring retainer using a replacer (Table 2, Item 41).

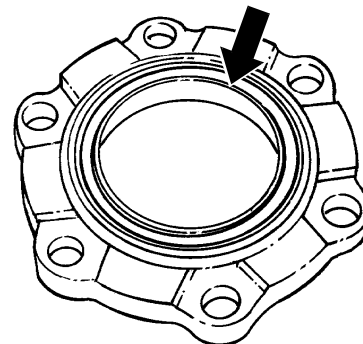


Figure 92 - Sealing Ring - Installation

- f. Install the O-ring in the coolant pump housing (Fig 93).

UNCONTROLLED WHEN PRINTED

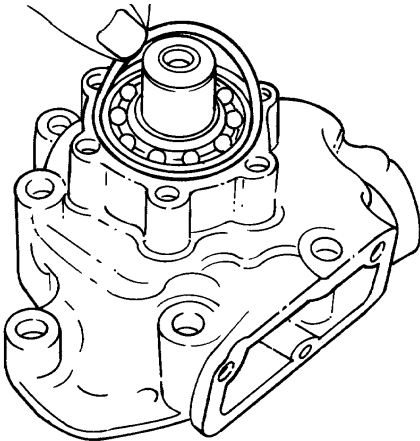


Figure 93 - O-Ring - Installation

- g. Install the sealing ring retainer with seal (Fig 94) and secure with the six M6 bolts. Torque the bolts to 9 Nm.

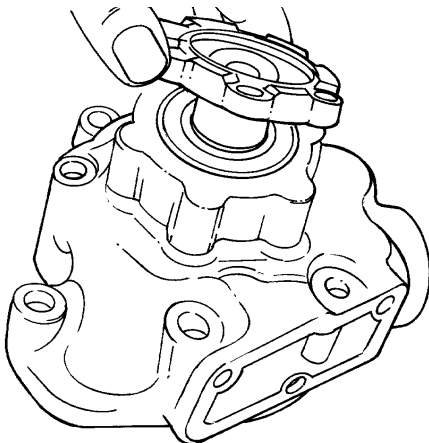


Figure 94 - Sealing Ring Retainer - Installation

- h. Mount the coolant pump impeller over the coolant pump shaft (Fig 95).

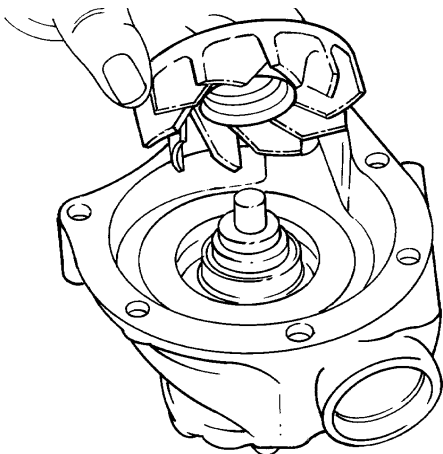


Figure 95 - Coolant Pump Impeller - Installation

- i. Press the coolant pump impeller onto the shaft until the face of the impeller is flush with the face of the coolant pump housing (refer to Figure 79 dimension **b** (± 0.1 mm)) (Fig 96).

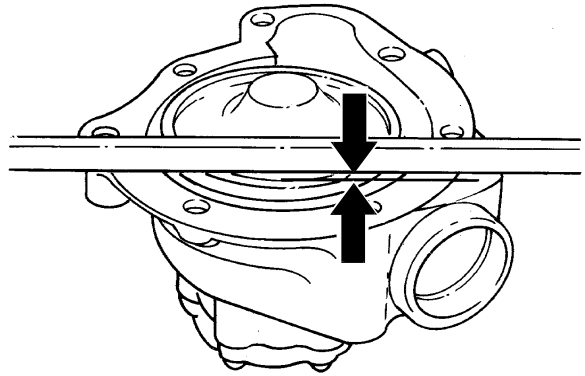


Figure 96 - Coolant Pump Impeller - Installed Position

- j. Press the pulley mounting flange onto the coolant pump (Fig 97).

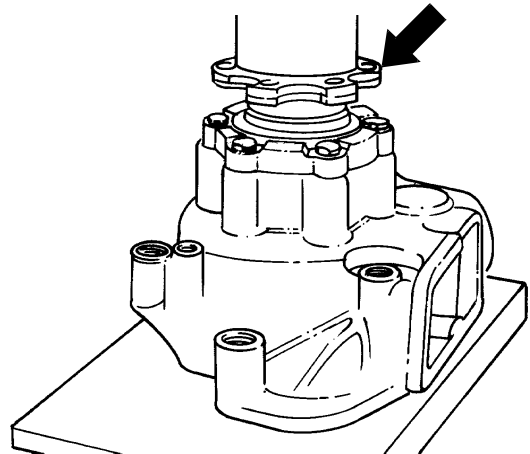


Figure 97 - Pulley Mounting Flange - Installation

- k. Measure the clearance between the impeller and the coolant pump housing (distance **c** = $0.6 + 0.5$ mm / -0.3 mm, refer to Figure 79).
- l. Coat the mating surfaces of the coolant pump and the coolant pump rear housing with a sealing compound (Loctite 573 or equivalent) and install the gasket (Fig 98).

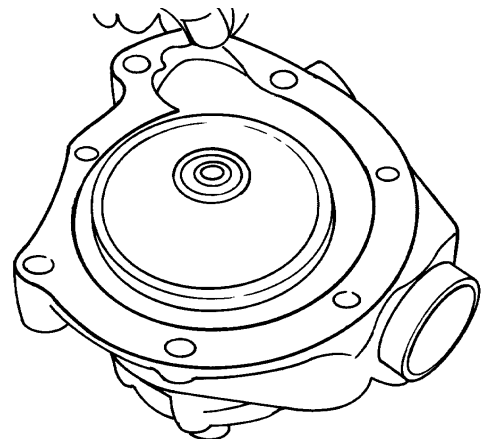
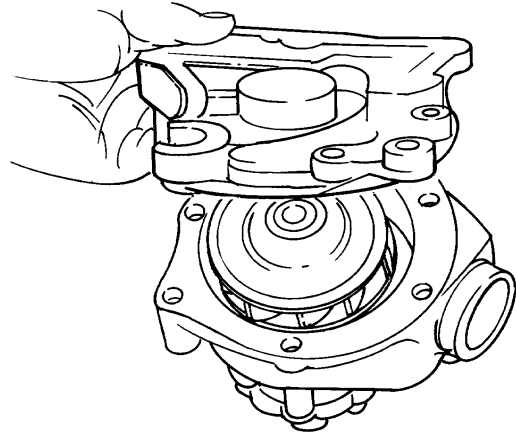


Figure 98 - Coolant Pump Rear Housing Gasket - Installation

- m. Install the coolant pump rear housing (Fig 99) and secure the housing with the M8 mounting bolts. Torque the bolts to 30 Nm.
- n. Measure the reference length **a** (143.5 ± 0.5 mm, refer to Figure 79), rectify as required.



**Figure 99 - Coolant Pump Rear Housing -
Installation**

Table 10 - Coolant Pump Torque Specifications

Designation	Thread strength	Grade	Nm
Pulley to Coolant pump	M 8		30
Coolant pump to crankcase	M 10		50
	M 8		30
Coolant thermostat housing	M 8		30
Coolant pump	M 10		30
Sealing ring holder to coolant pump	M 6		9
End cover to coolant pump	M 8		30
Cover to coolant pump thermostat/bypass element housing	M 8	10.9	25

Table 11 - Coolant Pump Dimensions and Lubricants

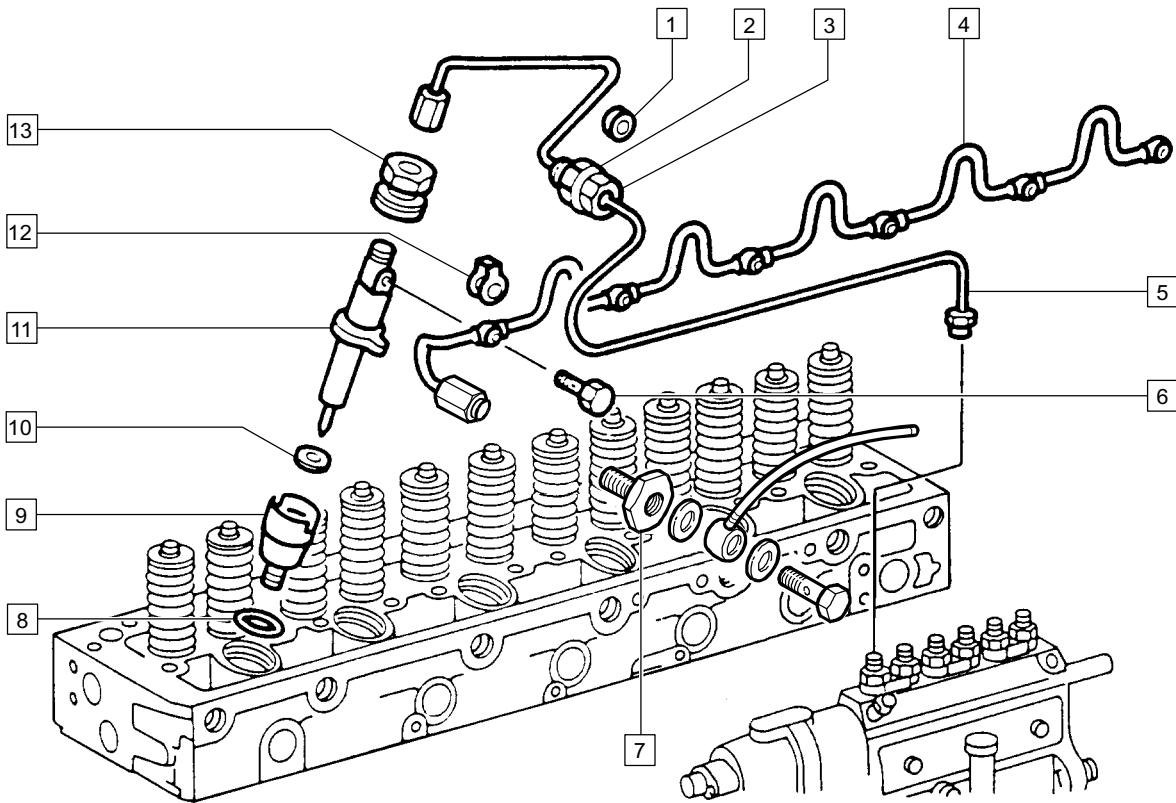
Diameter of coolant pump shaft	at the impeller shaft		mm	<u>15.039</u> 15.028
	bearing seat	Large bearing	mm	<u>30.009</u> 29.996
Small bearing		mm	<u>17.008</u> 16.997	
Shaft diameter for hub			mm	<u>29.054</u> 29.041
Bore diameter in hub			mm	<u>29.021</u> 29.000
Hub diameter for sealing ring in front			mm	<u>42.000</u> 41.840
Shaft diameter for rear sealing ring			mm	<u>17.008</u> 16.997
Bore diameter in impeller			mm	<u>15.008</u> 15.000
Pulley mounting flange mounting face to head of coolant pump cover mounting bolt distance (dimension a)			mm	<u>143</u> 144
Clearance between impeller and coolant pump housing (dimension c)			mm	<u>0.3</u> 1.1
Impeller face and flange face of coolant pump housing clearance (dimension b)	Face of impeller flange flush with housing flange \pm 0.1 mm			

Lubricants

Bearings and cavity Grease, Naval XG-274 (G-450) about 80 g

UNCONTROLLED WHEN PRINTED

GROUP 4 — FUEL SYSTEM



- | | | |
|-----------------------------|----------------------------|------------------------------|
| 1. Rubber grommet | 5. Injection pipe | 9. Protective sleeve |
| 2. Cylinder head gland nut | 6. Banjo bolt | 10. Spacer washer |
| 3. Injection pipe gland nut | 7. Leak-off pipe gland nut | 11. Injector nozzle w/holder |
| 4. Leak-off pipe | 8. Sealing washer | 12. Sealing washer |
| | | 13. Thrust bolt |

Figure 100 - Injector and Injector Leak-off Pipes

Fuel Injectors

52. Removal

- a. Raise and secure the cab (refer to EMEI Veh D 393 Group 01 - Access for Repair).
- b. Operate the battery isolation switch so that the batteries are isolated from the vehicle.
- c. Drain the coolant (refer to EMEI Veh D 393 Group 2 - Cooling System).
- d. Clean the engine around the cylinder head cover thoroughly.
- e. Remove the cylinder head cover (refer to EMEI Veh D 393 Group 1 - Engine).
- f. Remove the fuel injection and leak-off pipes (refer to EMEI Veh D 393 Group 4 - Fuel System).

- g. Remove the thrust bolt from the injector using the tube spanner (Table 2, Item 7), (Fig 101).

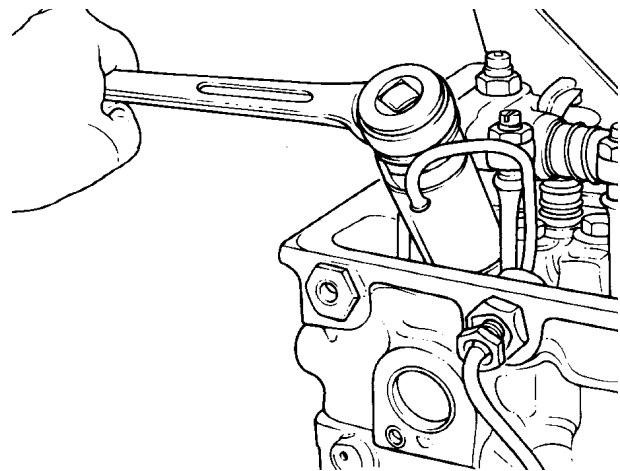


Figure 101 - Injector Thrust Bolt - Removal

UNCONTROLLED WHEN PRINTED

NOTE

The spacer washer (Fig 100(10)) may adhere to the injector or to the injector sleeve in the cylinder head.

NOTE

The spacer washer (Fig 100(10)) determines the distance (1.8 mm to 2.5 mm) that the nozzle projects over the lower edge of the cylinder head. The washers are supplied in two thicknesses (1.0 mm and 1.5 mm). Ensure that the thickness of the old spacer washer is determined before the washer is discarded.

- h. Remove the injector nozzle using the tube spanner (Table 2, Item 8), (Fig 102).
- i. Remove the spacer washer (Fig 100(10)), and measure and record the thickness of the washer.

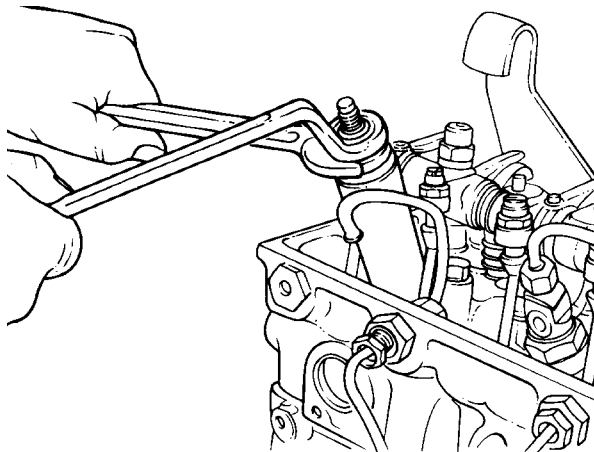


Figure 102 - Injector Nozzle - Removal

- j. Remove the protective sleeve using the tube spanner (Table 2, Item 9), (Fig 103).

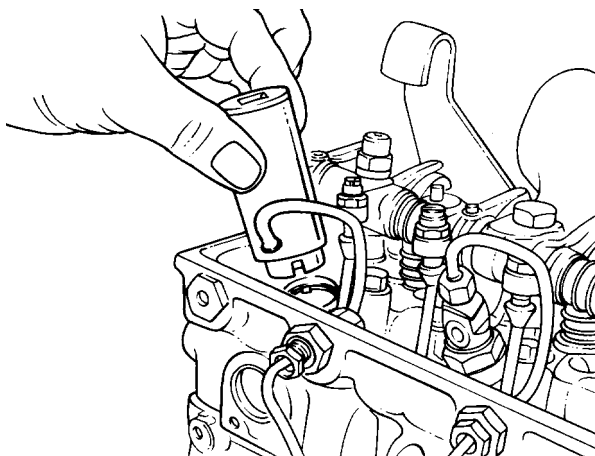


Figure 103 - Protective Sleeve - Removal

- k. Remove the protective sleeve sealing ring from the cylinder head and discard the sealing ring.

53. Cleaning and Inspection

- a. Wash all external dirt, grease and carbon deposits from the injector components using a suitable carbon removing and cleaning agent.
- b. Inspect the injector nozzle spray holes are clear.
- c. Clean the seat for the protective sleeve and the protective sleeve sealing ring groove in the cylinder head.
- d. Clean the inner and outer seats on the protective sleeve.

54. Installation

- a. Install a new protective sleeve sealing ring in the cylinder head (Fig 104). Lubricate the sealing ring with Vaseline prior to installation.

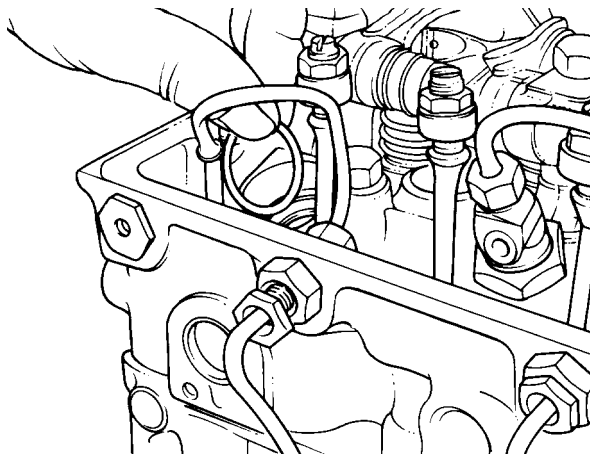


Figure 104 - Protective Sleeve Sealing Ring - Installation

- b. Lubricate the outside of the protective sleeve with Vaseline and install the sleeve in the cylinder head using the tube spanner (Table 2, Item 9). Torque the protective sleeve to 60 Nm (Fig 105).

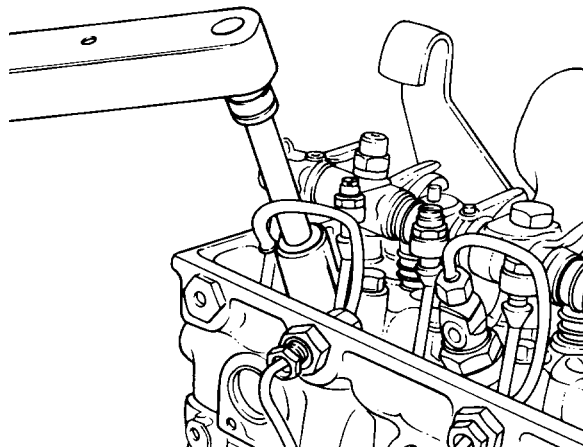


Figure 105 - Protective Sleeve - Installation

NOTE

The spacer washer (Fig 100(10)) determines the distance (1.8 mm to 2.5 mm) that the nozzle projects over the lower edge of the cylinder head. The washers are supplied in two thicknesses (1.0 mm and 1.5 mm). Ensure the washer is the same thickness as the one removed.

- c. Install a new spacer washer, of the same thickness as the one removed, in the cylinder head (Fig 106).

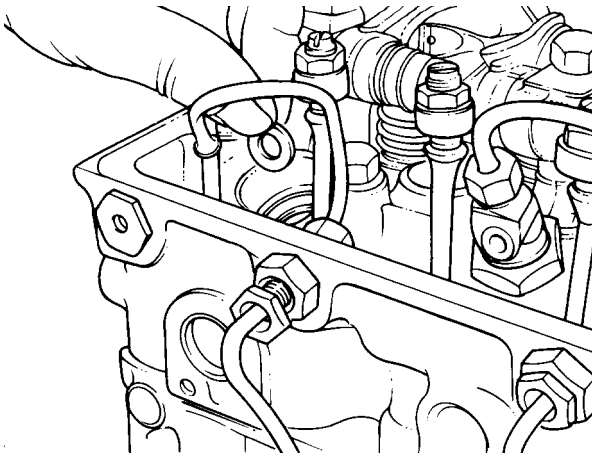


Figure 106 - Spacer Washer - Installation



WHEN INSTALLING THE INJECTOR, THE LOCATING LUG ON THE BARREL OF THE INJECTOR MUST ALIGN WITH THE LOCATING GROOVES IN THE CYLINDER HEAD.

- d. Carefully install the injector into the cylinder head aligning the locating lug on the barrel of the injector with the locating groove in the cylinder head, taking care not to bump the injector nozzle.
- e. Torque the injector thrust bolt to 70 Nm with the tube spanner (Table 2, Item 7), (Fig 107).
- f. Install the leak-off and fuel injection pipes (refer to EMEI Veh D 393 Group 4 - Fuel System).
- g. Install the cylinder head cover (refer to EMEI Veh D 393 Group 1 - Engine).

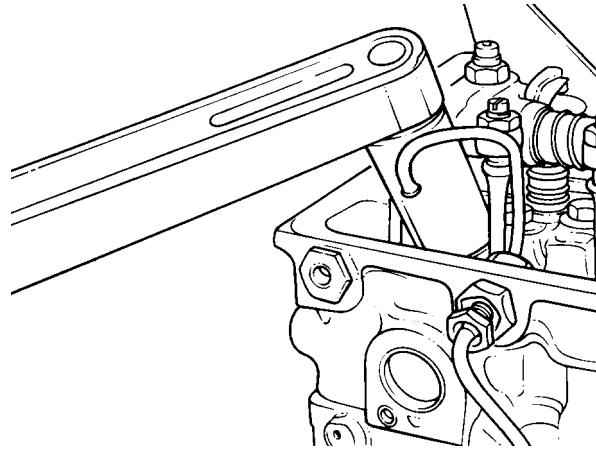


Figure 107 - Injector Thrust Bolt - Installation

- h. Operate the battery isolation switch so that the batteries are connected to the vehicle.
- i. Fill the cooling system with coolant (refer to EMEI Veh D 393 Group 2 - Cooling System).



WHEN THE ENGINE IS RUN WITH THE CABIN RAISED, ENSURE THAT THE ENGINE AIR INTAKE HOSE AND THE AIR COMPRESSOR INTAKE HOSE IS CONNECTED TO THE AIR CLEANER TO PREVENT THE INGRESS OF CONTAMINANTS.



WHEN THE ENGINE IS RUN WITH THE CABIN RAISED ENSURE THE HEATER HOSES AND UPPER STEERING SHAFT ARE CLEAR OF MOVING PARTS TO PREVENT DAMAGE TO COMPONENTS.

- j. Prime the fuel system (refer to EMEI Veh D 393 Group 4 - Fuel System) and run the engine. Check for leaks and check engine performance.
- k. Lower and secure the cab (refer to EMEI Veh D 393 Group 01 - Access for Repair).
- l. Road test the vehicle.

Fuel Injection Pump

55. Removal

- a. Raise and secure the cab (refer to EMEI Veh D 393 Group 01 - Access for Repair).
- b. Operate the battery isolation switch to disconnect the batteries from the vehicle electrical system.
- c. Drain the engine coolant (refer to EMEI Veh D 393 Group 02 - Cooling System).

NOTE

When aligning the start of delivery timing marks, any backlash must be cancelled out. Turn the vibration damper pulley back (anti-clockwise) until the timing mark is past the start of delivery mark (FB) and then turn the pulley in the direction of rotation until the timing marks are aligned.

- d. Rotate the engine with the ring spanner (Table 2, Item 10) until the timing mark (arrow) on the vibration damper pulley is aligned with the start of delivery mark (FB) on the timing pointer (Fig 108).

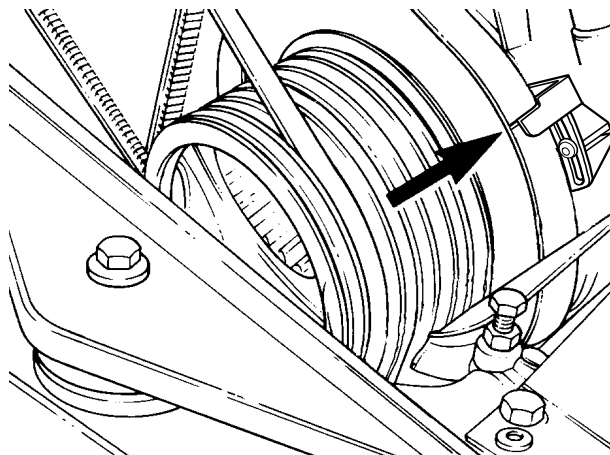


Figure 108 - Timing Mark - Delivery Start

- e. Pull the fuel injection pump timing case plug (with the power steering fluid reservoir breather pipe connected) out of the top of the timing gear case.
- f. Check the alignment of the timing case pointer with the fuel injection pump drive gear timing marks. The timing case pointer must be located between the two timing marks (painted red), (Fig 109). If the marks are not visible, rotate the engine 360° in the direction of rotation.
- g. Disconnect the expansion tank overflow line from the expansion tank.

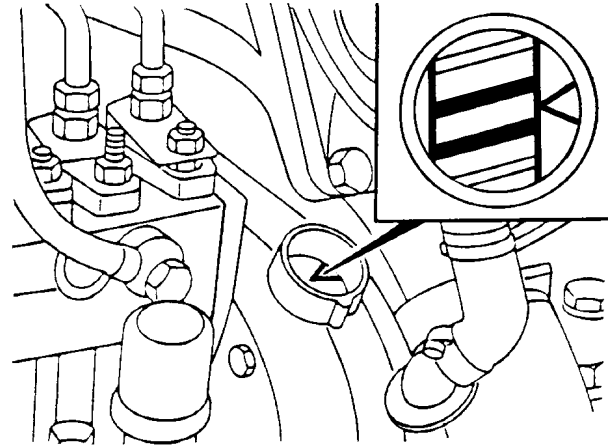


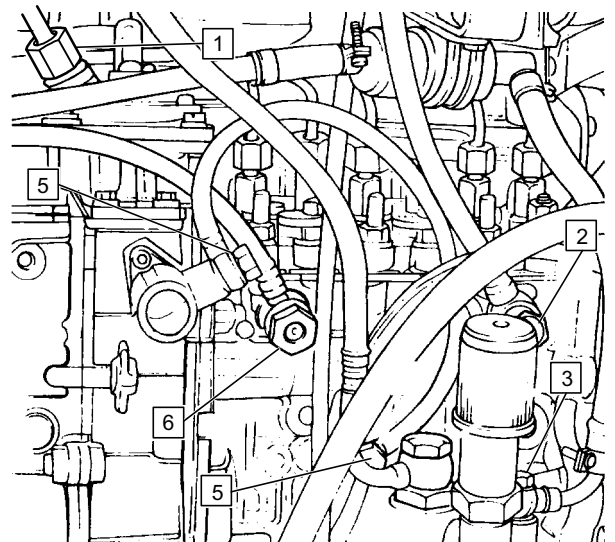
Figure 109 - Fuel Injection Pump Drive Gear - Timing

- h. Cut the cable ties securing the lines, leads and hoses to the fuel injection pump and remove the bolt securing the bracket for the lines, leads and hoses for the fuel injection pump at the rear of the engine.

NOTE

Cap all fuel pipes and openings.

- i. Disconnect the fuel return line (Fig 110(6)), the fuel injection pump supply line (Fig 110(2)), the lift pump supply line (Fig 110(3)) and the lift pump outlet line (Fig 110(4)) from the fuel injection pump. Discard the sealing washers from the banjo bolts.

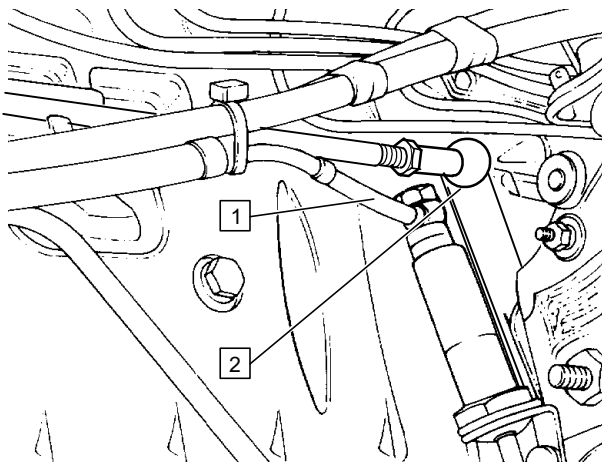


1. Smoke limiter sensing line
2. Fuel injection pump supply line
3. Lift pump supply line
4. Lift pump outlet line
5. Oil supply line
6. Fuel return line

Figure 110 - Supply Lines - Removal

UNCONTROLLED WHEN PRINTED

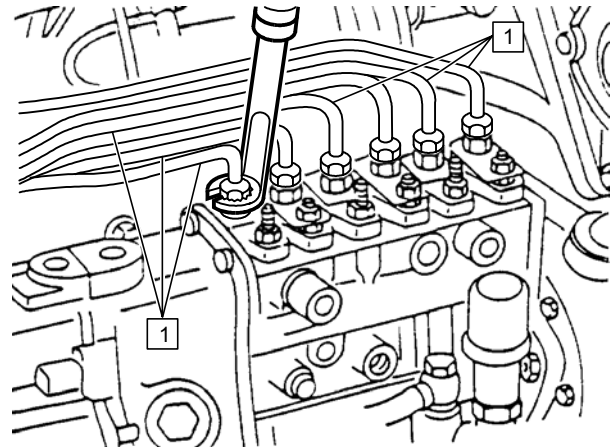
- j. Place a suitable drip tray under the fuel injection pump and disconnect the oil supply line connections (Fig 110(5)). Discard the sealing washers from the banjo bolts.
- k. Disconnect the smoke limiter sensing line (Fig 110(1)) from the smoke limiter.
- l. Remove the air line (Fig 111(1)) from the engine shut-off cylinder. Discard the sealing washers from the banjo bolt.
- m. Remove the locking pin and detach the fuel injection pump connecting linkage socket (Fig 111(2)) from the ball on the pump throttle lever.



- 1. Air line
- 2. Throttle connecting linkage socket

Figure 111 - Operating Linkage - Removal

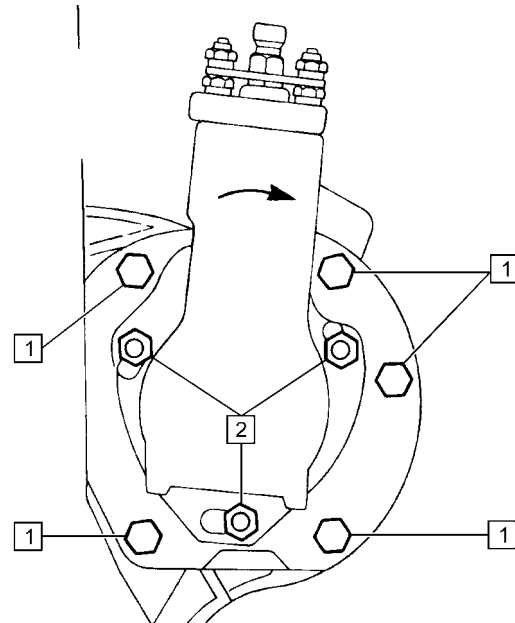
- n. Cut the cable tie securing the leak-off line to the mounting bracket on the engine and remove the banjo bolt securing the leak-off line to the cylinder head. Discard the sealing washers.
- o. Remove the two vertical M12 bolts securing the fuel filter mounting bracket to the air conditioner compressor main mounting bracket.
- p. Remove the fuel injection pump drive gear flange mounting bolt securing the air compressor coolant outlet pipe mounting bracket to the flange.
- q. Loosen the hose clamp securing the rear section of the air compressor coolant outlet pipe to the flexible hose at the compressor and remove the pipe.
- r. Disconnect the air compressor coolant pipe from the right hand rear of the engine.
- s. Undo the cap nuts securing the fuel injection pipes (Fig 112(1)) to the fuel injection pump using the injector cap nut wrench (Table 2, Item 1) and disconnect the pipes from the pump. Cap all open connections.



- 1. Fuel injection pipe

Figure 112 - Fuel Injection Pipes - Removal

- t. Loosen the three nuts (Fig 113(2)) securing the fuel injection pump and rotate the pump away from the engine.
- u. Remove the inner upper mounting bolt (Fig 113(1)) from the fuel injection pump drive gear flange.



- 1. Mounting bolt
- 2. Nut

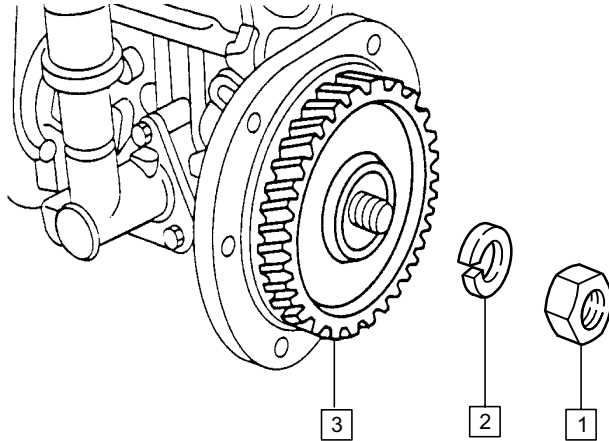
Figure 113 - Fuel Injection Pump - Removal

NOTE

Ensure all the mounting bolts (Fig 113(1)) between the fuel injection pump and the engine block are removed before attempting to remove the fuel injection pump.

- v. Remove the remaining four mounting bolts (Fig 113(1)) from the fuel injection pump drive gear flange.

- w. While supporting the fuel injection pump, remove the pump with drive gear and the drive gear flange outer O-ring. Discard the O-ring.
- x. Remove the nut (Fig 114(1)) and spring washer (Fig 114(2)) from the fuel injection pump drive gear (Fig 114(3)), and remove the gear from the fuel injection pump camshaft with a two-legged universal puller.



- 1. Nut
- 2. Spring washer
- 3. Drive gear

Figure 114 - Fuel Injection Pump Drive Gear - Removal

- y. Remove the woodruff key from the fuel injection pump camshaft.
 - z. Remove the three nuts (Fig 113(2)) and washers securing the fuel injection pump drive gear flange to the fuel injection pump and remove the flange.
 - aa. Remove the fuel injection pump drive gear flange inner O-ring from the drive gear flange. Discard the O-ring.
56. **Cleaning and Inspection**
- a. Clean the mating surfaces on the timing gear case, the fuel injection pump drive gear flange and the fuel injection pump.

WARNING

ENSURE THE SAFETY REQUIREMENTS FOR USE OF COMPRESSED AIR ARE STRICTLY ADHERED TO. INADVERTANT USE OF COMPRESSED AIR EQUIPMENT MAY RESULT IN INJURY TO PERSONNEL.

- b. Ensure that no dirt or foreign material enters the timing gear case or the fuel injection pump. Clean all parts in an appropriate cleaning agent and blow dry with compressed air.

- c. Inspect the fuel injection pump, drive gear and Woodruff key for wear and damage. Replace as required.

57. Installation

- a. Lightly lubricate the new fuel injection pump drive gear flange inner O-ring with grease (XG-274) and install it in the groove in the fuel injection pump housing.
- b. Lightly lubricate the new fuel injection pump drive gear flange outer O-ring with grease (XG-274) and install it on the fuel injection pump drive gear flange.
- c. Fit the drive gear flange to the fuel injection pump and secure with the three nuts and washers.

NOTE

When installing a new fuel injection pump, use the drive gear from the old fuel injection pump, if serviceable.

- d. Fit the woodruff key, drive gear (Fig 114(3)) and spring washer (Fig 114(2)) to the fuel injection pump camshaft and secure the gear with the nut (Fig 114(1)). Torque the nut to 105 Nm.
- e. Loosen the three nuts (Fig 113(2)) securing the fuel injection pump and move the injection pump so the top left mounting bolt (Fig 113(1)) can be accessed.

NOTE

If the motor has been turned since removing the fuel injection pump, remove the cylinder head cover to ensure the piston of No. 1 cylinder is on compression stroke, at start of delivery. In this position the No. 1 cylinder inlet and outlet valves must be "rocking" and the start of delivery mark (FB), on the timing pointer, must be aligned with the start of delivery mark (FB) on the vibration damper, see para 55.

- f. Rotate the fuel injection pump drive gear so that when the pump is fitted to the engine the timing case pointer is located between the two timing marks (painted red) (Fig 109).

NOTE

Ensure the timing mark on the vibration damper pulley remains aligned with the start of delivery mark (FB) on the timing pointer during the installation of the fuel injection pump (Fig 108).

- g. Install the fuel injection pump to the timing gear case. Ensure the timing case pointer is located between the two timing marks (painted red). If the marks are not aligned remove the fuel injection pump, re-align the pump drive gear and refit the pump.
- h. Install the five mounting bolts (Fig 113(1)) and torque the bolts to 35 Nm. Ensure the compressor coolant outlet pipe mounting bracket is fitted under the head of the middle outer mounting bolt when installing the bolts.
- i. Adjust the fuel injection pump delivery start, see para 58.
- j. Connect the six fuel injection pipes to the fuel injection pump. Torque the pipe cap nuts to 25 Nm using the injector cap nut wrench (Table 2, Item 1).
- k. Connect the air line to the engine shut-off cylinder. Renew the sealing washers on the banjo bolt prior to installation.
- l. Attach the fuel injection pump connecting linkage socket (Fig 111(2)) to the ball on the pump throttle lever and secure with the locking pin. Lubricate the inside of the socket with grease prior to assembly.
- m. Connect the air compressor coolant outlet pipe to the flexible hose at the compressor and to the rear of the engine block. Tighten the connections securely.
- n. Secure the fuel filter mounting bracket to the air conditioner compressor main mounting bracket with the two vertical M12 bolts.
- o. Connect the smoke limiter sensing line (Fig 110(1)) to the smoke limiter.
- p. Connect the leak-off line to the cylinder head. Renew the sealing washers on the banjo bolt prior to installation.
- q. Cable tie the leak-off line and the smoke limiter sensing line to the mounting bracket on the cylinder head.

NOTE

Before installing the oil line, pour 500 ml of engine oil (OMD 115) into the fuel injection pump via the oil feed bore.

- r. Prime the fuel injection pump lubrication system with 500 ml of engine oil (OMD 115) and fit the oil supply line (Fig 110(5)). Renew the washers on the banjo bolts prior to assembly.

- s. Connect the lift pump supply line (Fig 110(3)) and the lift pump outlet line (Fig 110(4)) to the lift pump. Renew the sealing washers on the banjo bolts prior to installation.
- t. Connect the fuel injection pump supply line (Fig 110(2)) and the fuel return line (Fig 110(6)) to the fuel injection pump. Renew the sealing washers on the banjo bolts prior to installation.
- u. Insert the fuel injection pump timing case plug (with the power steering fluid reservoir breather pipe connected) into the top of the timing gear case. Lubricate the O-ring with Vaseline prior to assembly.
- v. Connect the overflow line to the coolant expansion tank. Cable tie the line to the fuel lift pump outlet line to the fuel filter.
- w. Fill the cooling system with coolant (refer to EMEI Veh D 393 Group 2 - Cooling System).
- x. Cable tie the wiring looms, pipes and lines to the fuel injection pump and secure the loom mounting bracket to the rear of the engine.
- y. Bleed the fuel system (refer to EMEI Veh D 393 Group 4 - Fuel System).



WHEN THE ENGINE IS RUN WITH THE CABIN RAISED, ENSURE THAT THE ENGINE AIR INTAKE HOSE AND THE AIR COMPRESSOR INTAKE HOSE IS CONNECTED TO THE AIR CLEANER TO PREVENT THE INGRESS OF CONTAMINANTS.



WHEN THE ENGINE IS RUN WITH THE CABIN RAISED ENSURE THE HEATER HOSES AND UPPER STEERING SHAFT ARE CLEAR OF MOVING PARTS TO PREVENT DAMAGE TO COMPONENTS.

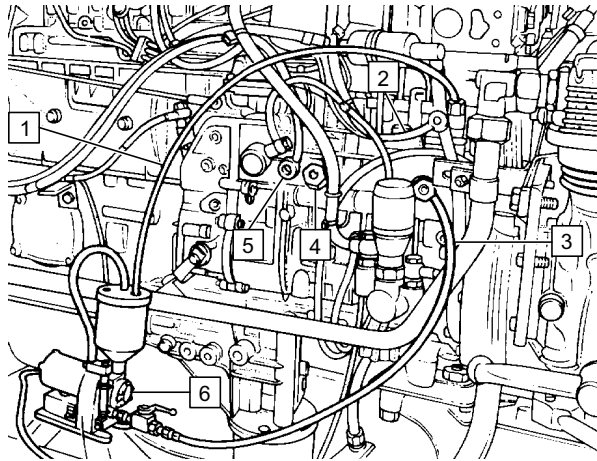
- z. Operate the battery isolation switch to connect the batteries to the vehicle electrical system.
- aa. Start and run the engine. Inspect for oil, water and fuel leaks and the engine for rough idling/hunting. Repair/adjust as required.
- ab. Lower and secure the cab (refer to EMEI Veh D 393 Group 01 - Access for Repair).

- ac. Check the throttle linkage adjustment (refer to EMEI Veh D 393 Group 4 - Fuel System).
- ad. Road test the vehicle and check the engine performance.

Start of Delivery

58. Check and Adjust

- a. Raise and secure the cab (refer to EMEI Veh D 393 Group 01 - Access for Repair).
- b. Operate the battery isolation switch to disconnect the batteries from the vehicle electrical system.
- c. Detach the fuel supply line on the fuel injection pump and connect the pump supply line (Table 2, Item 13), (Fig 115(3)) from the pump unit (Table 2, Item 11), (Fig 115(6)).



- 1. Test line
- 2. Fuel supply line
- 3. Pump supply line
- 4. Screw plug
- 5. Fuel return line and overflow valve
- 6. Pump unit

Figure 115 - Pump Unit Connections

- d. Fill the reservoir of the pump unit (Table 2, Item 11) with clean diesel fuel.
- e. Detach the fuel return line and overflow valve (Fig 115(5)) from the fuel injection pump. Close the openings with the adapter set (Table 2, Item 15) (Fig 115(4)).
- f. Undo the fuel injection pipe cap nuts at the fuel injection pump using the injector cap nut wrench (Table 2, Item 1) and disconnect the fuel injection pipes (Fig 112(1)) from the pump. Cap all open pipe connections.
- g. With the exception of the No. 1 cylinder on the fuel injection pump, fit pressure limiting valves (Table 2, Item 16) to the open pump fuel outlets at cylinders 2 to 6.
- h. Connect the gooseneck pipe (Table 2, Item 14) to No. 1 cylinder on the fuel injection pump.

- i. Turn the crankshaft in the direction of rotation with the ring spanner (Table 2, Item 10) until it is about 1/2 a turn before ignition TDC on No. 1 cylinder.



THE PUMP UNIT OPERATES ON 12 VOLTS. IF THE VEHICLE BATTERIES ARE TO BE USED AS A POWER SOURCE ENSURE THE PUMP IS ONLY CONNECTED ACROSS ONE OF THE 12 VOLT BATTERIES. CONNECT THE RED TERMINAL OF THE PUMP UNIT TO THE POSITIVE TERMINAL ON THE BATTERY.

- j. Connect the pump unit to a 12 volt supply source.

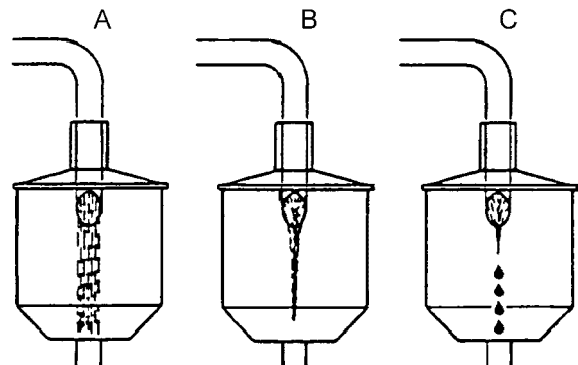


THE PUMP UNIT SHOULD ONLY BE SWITCHED ON DURING THE ACTUAL DELIVERY START CHECK.

NOTE

The pump unit operates at a high pressure. The fuel injection pump throttle linkage is to be locked in the full fuel position and the linkage is not to be moved with the pump unit running.

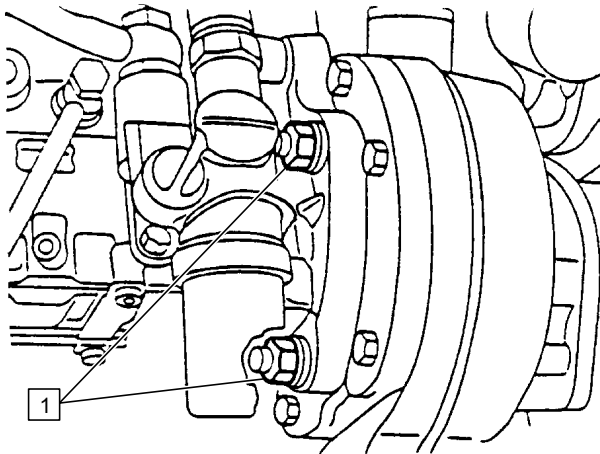
- k. Switch on the pump unit. Slowly turn the crankshaft in the direction of rotation and observe the supply of fuel in the inspection glass on the gooseneck pipe (Table 2, Item 14) until the jet of fuel changes from the constricted form (Fig 116(B)) to the droplet form (Fig 116(C)). At this point, the exact start of delivery is attained.



- A. Fuel jet "Full"
- B. Fuel jet constricted "shortly before start of delivery"
- C. Chain of drops "start of delivery"

Figure 116 - Fuel Delivery Characteristics

- l. Switch the pump unit off. Check the alignment of the timing marks on the vibration damper pulley (Fig 108).
- m. If the timing marks are not aligned, turn the crankshaft in the direction of rotation until the marks are aligned.
- n. Loosen the three injector pump securing nuts (Fig 117(1)) and rotate the fuel injection pump towards the engine block.



1. Securing nut

Figure 117 - Fuel Injection Pump - Adjustment

NOTE

The pump unit operates at a high pressure. The fuel injector pump throttle linkage is to be locked in the full fuel position and the linkage is not to be moved with the pump unit running.

CAUTION

THE PUMP UNIT SHOULD ONLY BE SWITCHED ON DURING THE ACTUAL DELIVERY START CHECK.

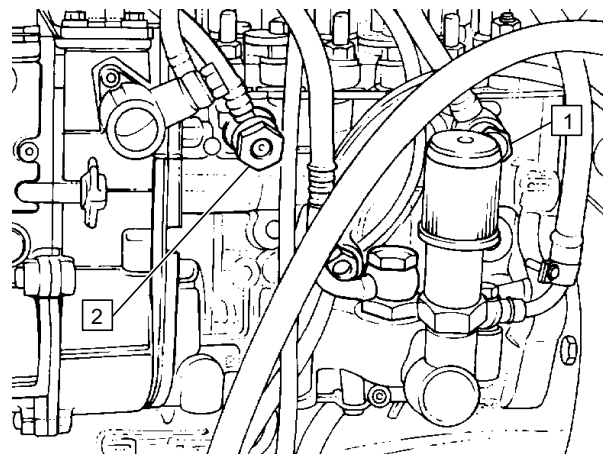
- o. Switch on the pump unit. Slowly rotate the fuel injection pump outwards at the top and observe the supply of fuel in the inspection glass until the jet of fuel changes from the constricted form (Fig 116(B)) to the droplet form (Fig 116(C)). At this point, the exact start of delivery is attained.
- p. Tighten the three injector pump securing nuts (Fig 117(1)).
- q. Turn the pump unit off.
- r. Torque the injector pump securing nuts to 45 Nm.

- s. Recheck the start of delivery; refer to sub-para i to l; adjust if required.
- t. Reset the fuel injection pump throttle linkage to the idle position.
- u. Remove the pump unit connections, the pressure limiting valves and adaptors from the fuel injection pump.
- v. Remove the gooseneck pipe (Table 2, Item 14) from the No. 1 cylinder on the fuel injection pump.

NOTE

Replace all sealing washers prior to connecting the fuel lines and the overflow valve.

- w. Connect the overflow valve and the fuel return line (Fig 118(2)) to the fuel injection pump.
- x. Connect the fuel supply line (Fig 118(1)) to the fuel injection pump.



1. Fuel supply line
2. Overflow valve and the fuel return pipe

Figure 118 - Fuel Injection Pump - Connections

- y. Connect the six fuel injection pipes to the fuel injection pump. Torque the pipe cap nuts to 25 Nm using the injector cap nut wrench (Table 2, Item 1).
- z. Operate the battery isolation switch to connect the batteries to the vehicle electrical system.
- aa. Lower and secure the cab (refer to EMEI Veh D 393 Group 01 - Access for Repair).
- ab. Start and run the engine. Inspect the fuel injection pump for leaks and the engine for rough idling/hunting. Repair/adjust as required.

NOTE

The recommended engine idle speed is 700 RPM and must be checked and adjusted if required, when repairs of the following nature are carried out: replacement of the fuel injection pump, adjusting delivery start, replacement or repairs to the throttle linkages, and any repairs that may cause an alteration to the engine idle speed.

- a. Check/adjust the engine idling speed, the accelerator linkage and the hand throttle linkage (refer to EMEI Veh D 393 Group 4 - Fuel System).
- ad. Road test the vehicle. Check the engine performance and for leaks on completion of the road test, rectify as required.

Engine Shut-Off Cylinder

59. Removal

- a. Raise and secure the cab (refer to EMEI Veh D 393 Group 01 - Access for Repair).
- b. Remove the banjo bolt and sealing washers securing the air line to the engine shut-off cylinder. Discard the sealing washers.
- c. Slacken the 32 mm lock nut securing the engine shut-off cylinder to the mounting bracket on the fuel injection pump.
- d. Unscrew the engine shut-off cylinder from the mounting bracket using a 14 mm open end spanner.

60. Installation

- a. Screw the engine shut-off cylinder into the mounting bracket on the fuel injection pump using a 14 mm open end spanner.
- b. Depress the fuel injection pump stop lever fully down and forward until the stop lever engages the positive stop mechanism and is held in the engine stop (no fuel) position.

WARNING

ENSURE THE SAFETY REQUIREMENTS FOR USE OF COMPRESSED AIR ARE STRICTLY ADHERED TO. INADVERTANT USE OF COMPRESSED AIR EQUIPMENT MAY RESULT IN INJURY TO PERSONNEL.

CAUTION

DO NOT EXCEED SEVEN (7) BAR WHEN ACTUATING THE ENGINE SHUT-OFF CYLINDER WITH COMPRESSED AIR. EXCESSIVE AIR PRESSURE WILL DAMAGE THE CYLINDER.

- c. Using a suitable nozzle on a compressed air hose actuate the engine shut-off cylinder with compressed air (maximum pressure 7 bar) until the engine shut-off cylinder piston is fully extended.
- d. Screw the engine shut-off cylinder down until the cylinder piston contacts the fuel injection pump stop lever and tighten the 32 mm lock nut securely.
- e. Secure the air line to the engine shut-off cylinder with the banjo bolt and sealing washers. Renew the sealing washers on the banjo bolt prior to installation.

CAUTION

WHEN THE ENGINE IS RUN WITH THE CABIN RAISED, ENSURE THAT THE ENGINE AIR INTAKE HOSE AND THE AIR COMPRESSOR INTAKE HOSE IS CONNECTED TO THE AIR CLEANER TO PREVENT THE INGRESS OF CONTAMINANTS.

CAUTION

WHEN THE ENGINE IS RUN WITH THE CABIN RAISED ENSURE THE HEATER HOSES AND UPPER STEERING SHAFT ARE CLEAR OF MOVING PARTS TO PREVENT DAMAGE TO COMPONENTS.

- f. Run the engine and test the operation of the engine shut-off cylinder, adjust as required.
- g. Check the throttle linkage adjustment (refer to EMEI Veh D 393 Group 4 - Fuel System).
- h. Lower and secure the cab (refer to EMEI Veh D 393 Group 01 - Access for Repair).

GROUP 5 — CLUTCH SYSTEM

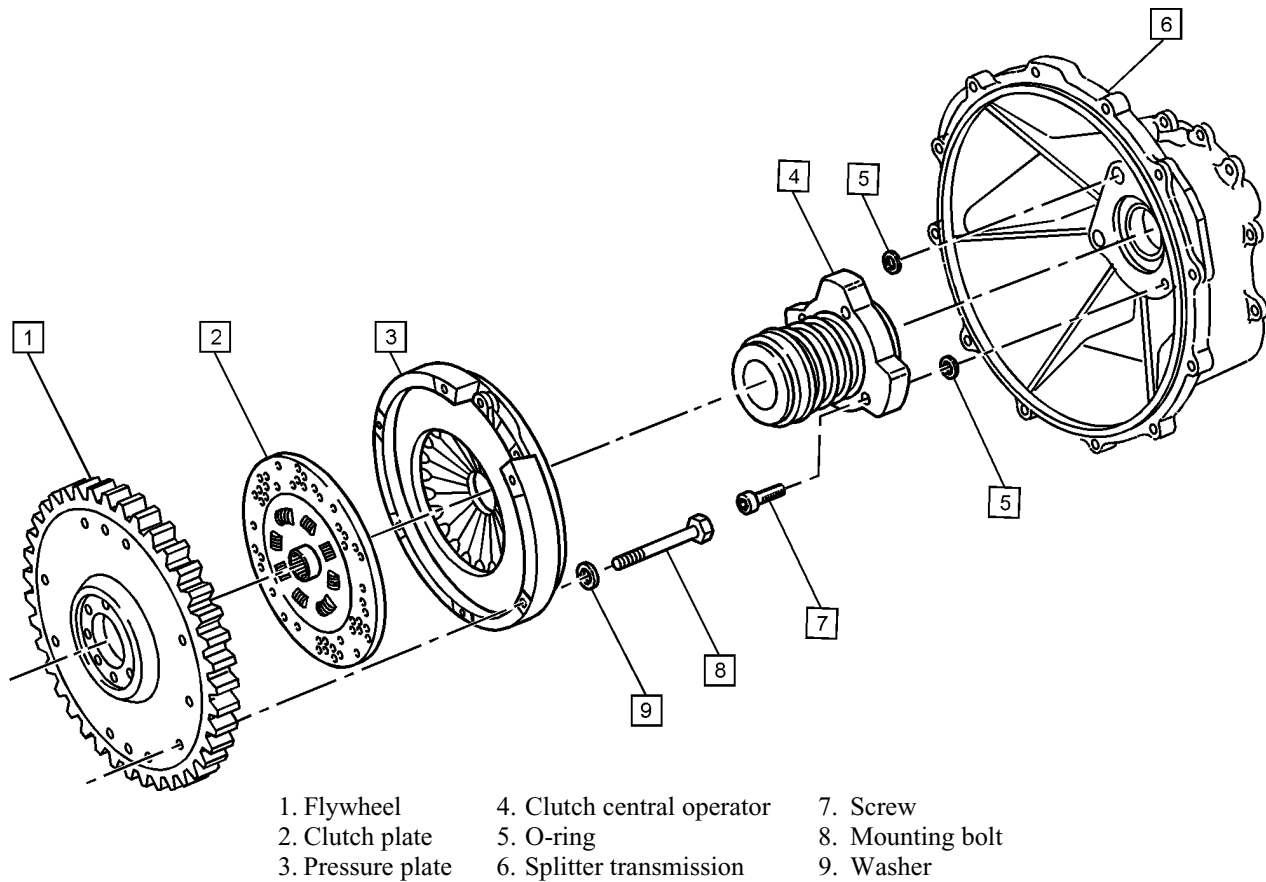


Figure 119 - Clutch Components - Exploded View

Clutch

61. Removal

- a. Raise and secure the cab (refer to EMEI Veh D 393 Group 01 - Access for Repair).
- b. Remove the splitter transmission with clutch housing (refer to Group 6 – Transmission Group, para 67).

WARNING

THE CLUTCH AND PRESSURE PLATE ASSEMBLY WEIGHS ABOUT 24 KGS.

CAUTION

UNDO THE PRESSURE PLATE MOUNTING BOLTS EVENLY TO PREVENT DAMAGE TO THE PRESSURE PLATE DIAPHRAGM.

- c. Remove the clutch pressure plate M8 (Grade 10.9) mounting bolts and washers (Fig 119(8) and (9)) then remove the pressure plate (Fig 119(3)) and clutch plate (Fig 119(2)).

62. Cleaning and Inspection

NOTE

The throw-out bearing is pre-packed and is not to be washed out.

- a. Inspect the clutch plate for lubricating oil and hydraulic oil on the linings and for mechanical damage. Inspect the vibrational and dampening springs for wear and the linings for cracks and for thickness.

NOTE

Minor imperfections on the clutch pressure plate and the flywheel surfaces can be removed with coarse emery cloth.

- b. Inspect the clutch pressure plate for heat cracks and scoring. Inspect the diaphragm for cracks.

CAUTION

DO NOT ATTEMPT TO OPERATE THE DIAPHRAGM SPRING IN A PRESS OR SIMILAR.

UNCONTROLLED WHEN PRINTED

- c. Inspect the diaphragm levers for wear and even height (Fig 120).

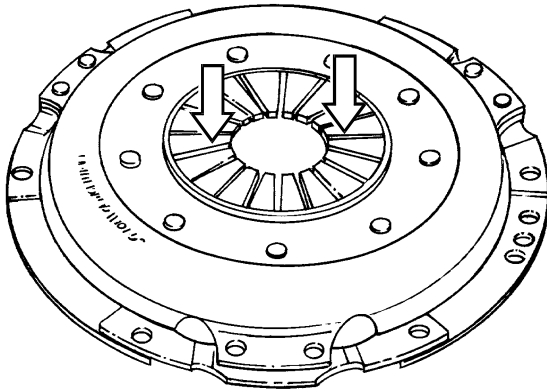


Figure 120 - Diaphragm Levers - Inspection

- d. Inspect the flywheel (refer to Group 1 - Engine, para 18).
e. Inspect the spigot bearing in the flywheel and the spigot bearing seat on splitter transmission input shaft, replace if required.
f. Inspect the clutch throw-out bearing (Fig 121); replace if required, refer to para 65.

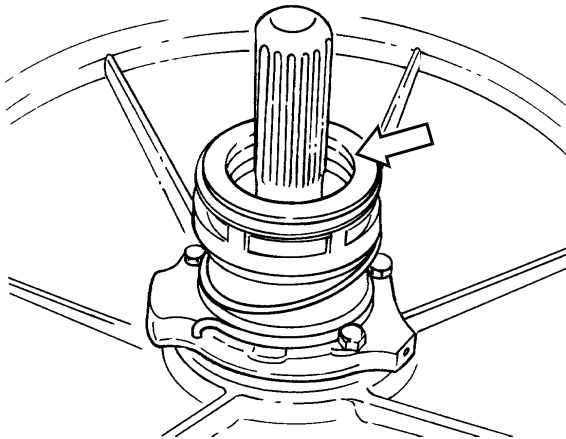


Figure 121 - Clutch Throw-Out Bearing

63. **Installation**

NOTE

The clutch plate must be installed with the extended portion of the centre hub towards the flywheel.

WARNING

THE CLUTCH AND PRESSURE PLATE ASSEMBLY WEIGHS ABOUT 24 KGS.

- a. Centre the clutch pressure plate and clutch disk using the pilot shaft (Table 2, Item 17), (Fig 122). Install the M8 (Grade 10.9) mounting bolts and washers (Fig 119(8) and (9)) and hand tighten the bolts.

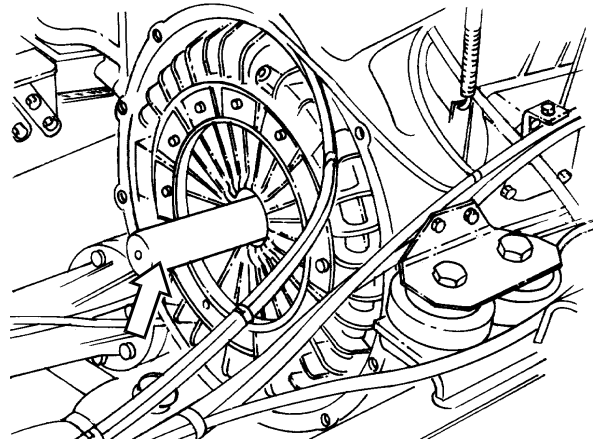


Figure 122 - Clutch and Pressure Plate - Installation

- b. Lock up the engine at the flywheel side, and (with the pilot shaft still installed) torque the clutch pressure plate M8 (Grade 10.9) mounting bolts, in a diagonal sequence, in increasing stages, to 29 Nm. Remove the pilot shaft and free the engine.

NOTE

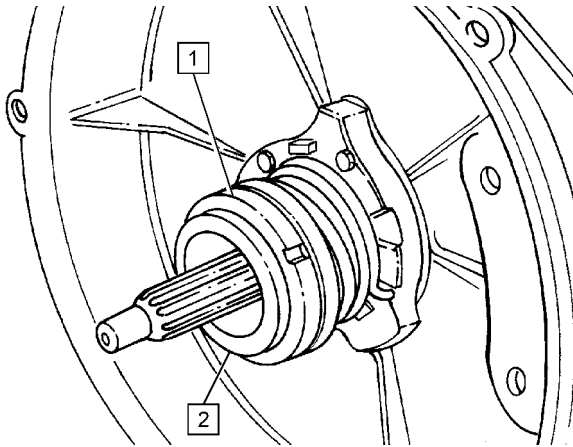
Coat the mating surface of the flywheel housing with a sealant (Loctite 573) and lightly lubricate the drive shaft splines with a molybdenum disulphide based grease (XG-276) prior to installing the splitter transmission.

- c. Install the splitter transmission with clutch housing (refer to Group 6 – Transmission Group, para 69).
d. Lower and secure the cab (refer to EMEI Veh D 393 Group 01 - Access for Repair).
e. Bleed the clutch (refer to EMEI Veh D 393 Group 5 - Clutch System).
f. Road test the vehicle, inspect for leaks and check the performance of the clutch.

Clutch Central Operator

64. **Removal**

- a. Raise and secure the cab (refer to EMEI Veh D 393 Group 01 - Access for Repair).
b. Remove the splitter transmission with clutch housing (refer to Group 6 – Transmission Group, para 67).
c. Remove the three M8 clutch central operator mounting bolts and remove the clutch central operator (Fig 123(1)) from the clutch housing. Discard the two O-rings (Fig 124(2)).



- 1. Clutch central operator
- 2. Throw-out bearing

Figure 123 - Clutch Central Operator - Removal

d. Detach the clip retainers from the clutch throw-out bearing mount and remove the throw-out bearing (Fig 123(2)).

65. Inspection

a. Inspect the clutch central operator for leaks and wear, replace if required.

NOTE

The throw-out bearing is pre-packed and is not to be washed out.

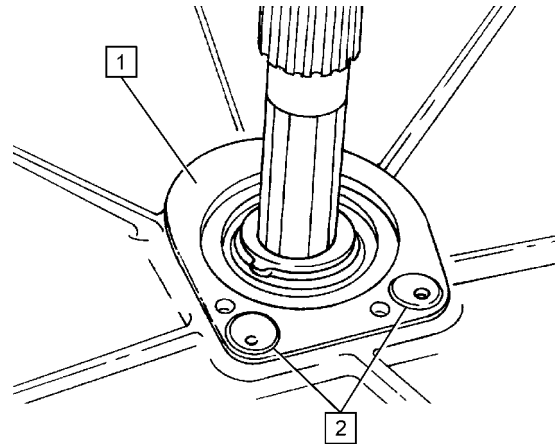
b. Inspect the throw-out bearing for wear, replace if required.

66. Installation

NOTE

The flange surface (Fig 124(1)) of the clutch central operator and the clutch housing are not to be coated with sealing compound or lubricant containing mineral oil. If required lubricate the O-rings with ATE brake cylinder grease.

a. Install the two O-rings (Fig 124(2)) that seal the clutch central operator and clutch housing hydraulic fluid channels in their grooves on the clutch housing.



- 1. Flange surface
- 2. O-ring

Figure 124 - Clutch Bearing Flange

b. Install the clutch central operator (Fig 123(1)) on the clutch housing and secure with the four M8 mounting bolts. Torque the bolts to 21 Nm.

c. Install the throw-out bearing (Fig 123(2)) on the bearing mount and secure with the clip retainers.

NOTE

Coat the mating surface of the flywheel housing with sealant (Loctite 573) and lightly lubricate the drive shaft splines with a molybdenum disulphide based grease (XG-276) prior to installing the splitter transmission.

d. Install the splitter transmission with clutch housing (refer to Group 6 - Transmission, para 69).

e. Lower and secure the cab (refer to EMEI Veh D 393 Group 01 - Access for Repair).

f. Bleed the clutch (refer to EMEI Veh D 393 Group 5 - Clutch System).

g. Road test the vehicle, inspect for leaks and check the performance of the clutch central operator.