TRUCK, CARGO, MEDIUM, MC2 – UNIMOG
AND TRUCK, CARGO, MEDIUM, MC2, W/WINCH – UNIMOG

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 the procedures for removing, dismantling, repairing, assembling and installing various components of the Truck, Cargo, Medium, and Truck, Cargo, Medium, Winch, MC2 – Unimog (Unimog) and should be read in conjunction with other associated publications. Where applicable, instructions for the adjustment, lubrication and minor servicing of these items are included.

Action Required

2. Actions detailed in this instruction are to be performed by technical maintenance organisations authorised to carry out Light, or Medium Grade Repairs. Inspection and repairs are only to be performed by the following qualified tradespeople:
   a. Vehicle Mechanic – ECN 229,
   b. Technician Electrical – ECN 418-2; or
   c. tri-service/civilian equivalent.

Associated Publications

3. Reference may be necessary to the latest issue of the following documents for maintenance and repair procedures:
   a. Defence Road Transport Instructions;
   b. SCES 010573 – Tool Kit, General, Mechanic, Truck Maintenance (Unimog);
   c. SCES 010599 – Lifting Device, Hydraulic, Cab Tilting, Unimog;
   d. SCES 010613 – Threading Set, Screw, Metric, Tap and Die, Cased, Unimog;
   e. SCES 010788 – Personnel, Stores and Ammunition Module Kit for Fitment to the Unimog Truck Cargo Medium with Twistlocks C/W CES Items;
   f. SCES 011753 – Truck Cargo Medium, Unimog W/O Winch;
   g. SCES 011755 – Truck Cargo Medium, Unimog W/Winch;
   h. SCES 011756 – Truck Cargo Medium, Unimog W/ Crane;
   i. SCES 012072 – Truck Cargo Medium, Unimog W/Twistlocks, W/O Winch;
   j. SCES 012105 – Equipment Kit, Vehicular, Truck, Medium, MC2 – Unimog;
   k. SCES 012216 – Towbar, Motor Vehicle Assembly, Medium Heavy for Mack/Unimog;
   l. EMEI Vehicle A 019-1 – Replacement of Vehicle Speedometers/Hour Meters and Trailer Odometers;
   m. EMEI Vehicle A 049-1 Towing Pintle Hooks – Inspection and Repair;
   p. EMEI Vehicle G 600 – Truck, Cargo, Medium, MC2 – Data Summary;
   q. EMEI Vehicle G 602 – Truck, Cargo, Medium, MC2 and Truck, Cargo, Medium, Winch, MC2 – Technical Description;
   r. EMEI Vehicle G 603 – Truck, Cargo, Medium, MC2 – Light Grade Repair;
   s. EMEI Vehicle G 609 – Truck, Cargo, Medium, MC2, Unimog – Servicing Instruction;
v. **EMEI Vehicle G 619-25** – Truck, Cargo, Medium, MC2, Unimog – All Types – Front and Rear Torque Tube – Partial Removal – Miscellaneous Instruction;

w. **EMEI Workshop D 701** – Painting of Army Equipment – Repair Policy for Equipment Painted in Polyurethane Paint;

x. **EMEI Workshop E 410** – Occupational Health and Safety – Asbestos – General Instruction;

y. RPS 02155 (Base Scale);

z. RPS 02156 (Cargo, w/winch);

aa. RPS 02157 (Cargo, w/crane);

bb. RPS 02158 (Dump);

c. RPS 02202 (Cargo, w/o winch, w/twist locks);

dd. RPS 02204 (Cargo, w/winch, w/twist locks); and

e. RPS 02205 (Cargo, w/crane, w/twist locks).

4. A number of modifications and improvements have been made during the service life of the vehicle. Reference to the following EMEI may be required during repair activities:

**NOTE**

Any effect of these EMEI pertaining to the technical content of this document has been included in the text.

a. EMEI Vehicle G 607-1 – Brushguard;

b. EMEI Vehicle G 607-2 – Horn Relocation;

c. EMEI Vehicle G 607-3 – Hydraulic Jack Stowage Bracket;

d. EMEI Vehicle G 607-4 – Tray Seating Grab Handle;

e. EMEI Vehicle G 607-6 – Centre Seating;

f. EMEI Vehicle G 607-9 – Tie Rod End Locking Nuts;

g. EMEI Vehicle G 617-1 – Engine Emergency Stop Control;

h. EMEI Vehicle G 617-2 – Coolant Header Tank;

i. EMEI Vehicle G 617-3 – Clearance Light Wiring;

j. EMEI Vehicle G 617-4 – Accelerator Pedal Stop Bolt;

k. EMEI Vehicle G 617-6 – Brake Caliper Protection Shrouds;

l. EMEI Vehicle G 617-7 – Change of Engine Shutdown Method;

m. EMEI Vehicle G 617-9 – Fuel Tank Drain Plug;

n. EMEI Vehicle G 617-10 – Accelerator Stop Pedal Cross Shaft;

o. EMEI Vehicle G 617-11 – Lifting and Tie Down Attachments;

p. EMEI Vehicle G 617-12 – Water Pump Jockey Pulley Bracket;

q. EMEI Vehicle G 617-13 – Trays Seat Legs and Stowage Strap;

r. EMEI Vehicle G 617-14 – Brake Airline Chaffing;

s. EMEI Vehicle G 617-15 – Clutch Output Shaft Bearing;

t. EMEI Vehicle G 617-16 – Clutch Master Cylinder Removal;

u. EMEI Vehicle G 617-18 – Tray Floor Headboard Assembly;

v. EMEI Vehicle G 617-20 – Engine Warning Device;

w. EMEI Vehicle G 617-23 – Fitting Additional Blackout Driving Light;
x. EMEI Vehicle G 617-24 – Transmission Oil Distribution Pipe;
y. EMEI Vehicle G 617-25 – Fitting of Austeyr Weapon Brackets;
z. EMEI Vehicle G 617-26 – Handbrake Lever;
aa. EMEI Vehicle G 617-29 – Transmission Shift Mechanism; and
bb. EMEI Vehicle G 617-36 – Fitting of 12.5 Tonne Trailer Safety Chain Mounts.

Safety Precautions

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

**WARNING**

The handling, storage and use of chemical substances are to be in accordance with Safetyman, MSDS and EMEI workshop series requirements.

**WARNING**

Do not work on the vehicle, when raised, without the use of a safety stand beneath the axle. Place the safety 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.

**WARNING**

Compressed air receivers are pressure vessels, Under no instances are they to be heated, brazed or welded. A damaged air receiver can explode when pressurised. Lethal injuries can result from such an explosion.

**WARNING**

Ensure the safety requirements for use of compressed air are strictly adhered to. Inadvertent use of compressed air equipment may result in injury to personnel.

6. Before removing any pneumatic components from the truck, ensure that the relevant compressed air receivers are exhausted through their respective drain cocks/valves.

**WARNING**

Precautions are be taken prior to carrying out repairs which include painting, sanding, scraping or welding. Refer to EMEI Workshop D 701 – Repair Policy for Equipment Painted in Polyurethane Paint.

7. This vehicle is painted in polyurethane paint.
CAUTION

Do not use adhesive tapes to seal fuel and oil drains and openings. Adhesive tapes are soluble when in contact with fuel and oil and can cause contamination. Remove temporary covers before assembling.

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

CAUTION

Before removing any electrical system components, disconnect the battery leads.

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

10. 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.

11. 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.

LIGHT GRADE REPAIR

Special Tools

12. 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 1 and illustrated in Figure 1.

<table>
<thead>
<tr>
<th>Serial</th>
<th>Part No</th>
<th>NSN</th>
<th>Item Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>000 589 68 03 00</td>
<td>5120-12-176-4841</td>
<td>Wrench, injector cap nut</td>
</tr>
<tr>
<td>2</td>
<td>000 589 75 09 00</td>
<td>5120-12-121-1676</td>
<td>Socket</td>
</tr>
<tr>
<td>3</td>
<td>352 589 00 33 00</td>
<td>5120-12-171-0684</td>
<td>Injector remover</td>
</tr>
<tr>
<td>4</td>
<td>312 589 01 31 00</td>
<td>5120-12-139-7594</td>
<td>Lifting handle (Qty 2)</td>
</tr>
<tr>
<td>5</td>
<td>312 589 01 37 00</td>
<td>5120-12-159-5787</td>
<td>Pliers</td>
</tr>
<tr>
<td>6</td>
<td>346 589 00 07 00</td>
<td>5120-12-176-8023</td>
<td>Injector sleeve replacer</td>
</tr>
<tr>
<td>7</td>
<td>000 589 45 31 00</td>
<td>5120-66-135-3296</td>
<td>Spring remover</td>
</tr>
<tr>
<td>8</td>
<td>425 589 00 62 00</td>
<td>4912-12-176-6861</td>
<td>Hoisting beam</td>
</tr>
<tr>
<td>9</td>
<td>435 589 01 62 00</td>
<td>4910-12-176-6848</td>
<td>Hoisting beam</td>
</tr>
<tr>
<td>10</td>
<td>406 589 05 33 00</td>
<td>5120-12-176-6772</td>
<td>Drag link remover</td>
</tr>
<tr>
<td>11</td>
<td>435 589 01 43 00</td>
<td>5120-12-188-7976</td>
<td>Inserter</td>
</tr>
<tr>
<td>12</td>
<td>406 589 04 15 00</td>
<td>5120-12-176-6853</td>
<td>Drift (for use with the inserter – Serial 11)</td>
</tr>
<tr>
<td>13</td>
<td>425 589 00 59 00</td>
<td>5910-12-176-6857</td>
<td>Flange</td>
</tr>
<tr>
<td>14</td>
<td>000 589 01 14 00</td>
<td>5120-12-133-6180</td>
<td>Extension bar (for use with the drift – Serial 12)</td>
</tr>
<tr>
<td>15</td>
<td>406 589 06 33 00</td>
<td>5120-12-176-6859</td>
<td>Puller</td>
</tr>
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Figure 1  Special Tools (Sheet 1 of 2)
Figure 1  Special Tools (Sheet 2 of 2)
Lubrication

13. Table 2 lists lubricant type for assemblies and capacities.

<table>
<thead>
<tr>
<th>Serial</th>
<th>Equipment</th>
<th>Lubricant</th>
<th>Capacity (litres)</th>
</tr>
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<tr>
<td>1</td>
<td>Engine (including filter)</td>
<td>SAE GRADE 40 (OMD-115)</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>Transmission</td>
<td>SAE GRADE 40 (OMD-115)</td>
<td>10.5</td>
</tr>
<tr>
<td>3</td>
<td>Power take-off</td>
<td>SAE GRADE 40 (OMD-115)</td>
<td>5.75</td>
</tr>
<tr>
<td>4</td>
<td>Front axle</td>
<td>OEP-220</td>
<td>2.5</td>
</tr>
<tr>
<td>5</td>
<td>Front wheel hub drives</td>
<td>OEP-220</td>
<td>0.6 each</td>
</tr>
<tr>
<td>6</td>
<td>Rear wheel hub drives</td>
<td>OEP-220</td>
<td>0.6 each</td>
</tr>
<tr>
<td>7</td>
<td>Brake master cylinder</td>
<td>OX-8</td>
<td>Fill to level</td>
</tr>
<tr>
<td>8</td>
<td>Clutch master cylinder</td>
<td>OX-8</td>
<td>Fill to level</td>
</tr>
<tr>
<td>9</td>
<td>Steering system</td>
<td>OEP-220</td>
<td>2.25</td>
</tr>
<tr>
<td>10</td>
<td>Wheel bearings</td>
<td>XG-291</td>
<td>As required</td>
</tr>
<tr>
<td>11</td>
<td>Winch cable</td>
<td>Rocol wire rope lube NSN 9510-99-337-1498</td>
<td>As required</td>
</tr>
<tr>
<td>12</td>
<td>Radiator inhibitor</td>
<td>TEC PG-XL</td>
<td>Fill until the coolant expansion tank is two-thirds full</td>
</tr>
<tr>
<td>13</td>
<td>Winch</td>
<td>OEP-220</td>
<td>2.0</td>
</tr>
</tbody>
</table>

POL Suitability

14. Use only those fuels and lubricants specified in the Servicing Instruction EMEI Vehicle G 609, the User Handbook and this EMEI when replenishing fuel or lubricants.

Access for Repair

15. It may be necessary to remove the bonnet, grille, brushguard or the brushguard mounting bracket. It also may be necessary to raise the cab. These procedures are detailed in EMEI Vehicle G 603.

ENGINE

![WARNING]

Genuine OEM gaskets are asbestos free. If it is not obvious as to whether gasket material contains asbestos or not the gasket is to be disposed of in accordance with EMEI Workshop E 410.

16. Replacement and repair procedures for the engine and engine components are as follows:
   a. engine (Para 17);
   b. flywheel and ring gear assembly (Para 19);
   c. ring gear (Para 19);
   d. cylinder head (Para 21);
   e. valve assembly (Para 25);
   f. oil pump (Para 29);
   g. engine brake actuating cylinder (Para 33); and
   h. engine brake manifold (Para 35).
Engine Removal and Replacement

17. **Removal.** Remove the engine as follows:
   
   a. Raise and secure the cab in accordance with EMEI Vehicle G 603.
   b. Disconnect the batteries (negative terminal first).
   c. Drain the oil from the engine.
   d. Drain the coolant from the system.
   e. Disconnect the electrical cables and the earth strap from the starter motor (Figure 2).

   ![Figure 2 Starter Motor Connections](image2)

   f. Remove the drive belt from the intermediate fan shaft (Figure 3).

   ![Figure 3 Drive Belt Removal](image3)

   g. Remove the clamps holding the exhaust pipe to the chassis and muffler.
   h. Remove the three nuts and bolts holding the exhaust pipe to the flange on the engine brake manifold (Figure 4).

   ![Figure 4 Exhaust Pipe Removal](image4)

   i. Remove the exhaust pipe and gasket from the flange.
j. Discard the gasket.
k. Remove the generator wiring harness from the oil cooler.
l. Disconnect the cables from the oil pressure sensor and the coolant temperature sensor.
m. Disconnect the cable from the tachometer pulse generator (Figure 5).

![Figure 5 Tachometer Pulse Generator Cable Removal](image)

n. Disconnect the fuel lines from the fuel lift pump (Figure 6).

![Figure 6 Fuel Lines](image)
o. Disconnect the fuel return line from the injection pump.
p. Disconnect the fuel lines from the two-stage fuel filter assembly (Figure 7).

![Figure 7 Fuel Filter Assembly](image)
Discard the sealing washers from the banjo bolts.

Remove the air intake line from the air compressor (Figure 8).

Loosen the cap nut and disconnect the compressed air delivery line from the air compressor (Figure 8).

Remove the upper and lower coolant hoses from the radiator.

Detach the coolant vent hose from the radiator.

Remove the two heater hoses from the thermostat housing.

Loosen the cap nut and disconnect the vent line between the timing gear case and the steering fluid reservoir (Figure 9).

Remove the bolt securing the steering pump bracket.

Do not disconnect the hydraulic fluid hoses.

Remove the steering pump bracket and pump from the front engine bearer (Figure 10).
z. Remove the four bolts from the propeller shaft flange (Figure 11).

aa. Remove the propeller shaft.

bb. Remove the two bolts securing the clutch slave cylinder to the transmission (Figure 11).

nn. Do not disconnect the hydraulic hoses.

cc. Remove the clutch slave cylinder.

dd. Remove the starter motor wiring harness from the clutch housing.

ee. Remove the fuel line, cold starting line and leak-off line from the cylinder head.

ff. Remove the centre bolts, nuts and thrust plates from the rear engine mounts (Figure 12).

mm. On vehicles fitted with a winch there will be two rear rubber bumpers installed on each side. On vehicles without a winch one rear rubber bumper is installed on each side.

gg. On vehicles fitted with a winch remove the power take-off (PTO) transmission (Para 46)

hh. Remove the centre bolt, nut, thrust plates and protective cover from the front engine mount (Figure 13).
ii. Remove the housing for the engine breather/filter (Figure 14).

jj. Attach the chain tackle to the lifting brackets on the engine (Figure 15).

kk. Raise the engine until the sump is clear of the chassis.

ll. Manoeuvre the engine and gantry away from the truck and lower the engine.

mm. Block off all open pipes and hoses on the truck.

nn. Thoroughly clean the underside of the cab and the engine bay.

oo. Dry the vehicle with compressed air.

Use a block and tackle, with a capacity greater than 500 kg, fixed to a mobile gantry.
18. **Installation.** Install the engine as follows:

a. Ensure that all components are thoroughly cleaned, correctly located and secured to the crankcase and mounting brackets of the replacement engine.

b. Attach the chain tackle to the lifting brackets on the engine.

c. Raise the engine until the sump is high enough to clear the chassis.

d. Manoeuvre the gantry and engine until the engine is aligned with the mounting points on the chassis.

e. Lower the engine onto the chassis, ensuring correct alignment of the mounting points.

f. Position the deflector plate on the front engine mount (Figure 13).

g. Fit the centre bolt, nut and thrust plates to the front engine mount.

h. Tighten the nut to 140–160 N.m.

i. Fit the centre bolts, nuts and thrust plates to the rear engine rear mounts.

**NOTE**

- On vehicles fitted with a winch install both rear engine rear mount on each side. On vehicles not fitted with a winch install one rear engine mount on each side.

j. Tighten the nut to 140–160 N.m.

k. On vehicles fitted with a winch, install the PTO transmission (Para 46.b).

l. Remove the chain tackle from the engine.

m. Fit and secure the housing for the engine breather/filter (Figure 14).

n. Fit the starter wiring harness to the clutch housing.

o. Fit the fuel line, cold starting line, and the leak-off line to the cylinder head.

p. Fit the propeller shaft to the primary shaft output flange (Figure 11).

q. Secure the shaft with the four bolts.

r. Tighten the bolts to 75 N.m.

s. Coat the sealing surface of the clutch slave cylinder with Loctite 573 (or equivalent).

t. Fit the clutch slave cylinder (Figure 11).

u. Secure the cylinder with the two bolts.

v. Tighten the bolts to 21 N.m.

w. Position the steering pump bracket and pump on the engine front bearer (Figure 10).

x. Secure it with the nut and bolt.

y. Tighten the nut to 75 N.m.

z. Connect the vent line between the timing gear case and steering fluid reservoir (Figure 9).

aa. Connect the two heater hoses to the thermostat housing and tighten the worm drive clamps.

bb. Connect the upper and lower coolant hoses to the radiator and tighten the worm drive clamps.

cc. Connect the coolant vent hose to the radiator and tighten the worm drive clamp (Figure 9).

dd. Connect the air intake hose to the air compressor and tighten the worm drive clamp.
ee. Connect the compressed air delivery hose to the air compressor and tighten the cap nut.

ff. Fit new sealing washers on all banjo bolts and connect the fuel feed and return lines to the two-stage fuel filter assembly (Figure 7).

gg. Connect the fuel return line to the injection pump.

hh. Connect the fuel lines to the fuel lift pump (Figure 6).

ii. Connect the cable to the tachometer pulse generator (Figure 5).

jj. Connect the cables to the oil pressure sensor and the coolant temperature sensor.

kk. Fit a new gasket and install the exhaust pipe against the flange on the engine brake manifold.

ll. Secure it with the three retaining nuts and bolts.

mm. Tighten the nuts to 45 N.m.

nn. Tighten all clamps holding the exhaust pipe to the chassis and muffler.

oo. Fit the drive belt to the intermediate fan shaft, ensuring that the drive belt is correctly tensioned in accordance with EMEI Vehicle G 603.

pp. Connect the electrical cables and earth strap to the starter motor (Figure 2).

qq. Connect the batteries (positive terminal first).

**NOTE**

Ensure that the coolant expansion tank is two-thirds full.

rr. Fill the cooling system with coolant.

ss. Remove the engine oil filter and fill it with SAE Grade 40 (OMD-115) oil.

tt. Refit the engine oil filter.

uu. Fill the engine with SAE Grade 40 (OMD-115) oil.

vv. Bleed the fuel system in accordance with EMEI Vehicle G 603.

ww. Lower and secure the cab.

---

**CAUTION**

Do not allow the engine to start until the oil pressure has built up; otherwise severe damage can occur to the turbo charger and engine.

xx. Position the hand throttle in the ‘SHUT DOWN’ position.

yy. Crank the engine until oil pressure is registering on the oil pressure gauge.

zz. Start and run the engine for a brief period.

aaa. Check for any leaks (repair where necessary).

bbb. Stop the engine.

ccc. Check the engine oil level (top up if necessary).

ddd. Check the coolant level in the expansion tank (top up if necessary).

eee. Road test the vehicle.

**Flywheel and Ring-gear Assembly**

19. **Removal.** The flywheel and ring-gear assembly can be removed with the engine fitted to the vehicle. Remove the flywheel and ring-gear as follows:

   a. On vehicles fitted with a winch, remove the PTO transmission and clutch bell housing (Para 46).
b. Remove the clutch assembly (Para Error! Reference source not found. or 43).

c. Remove the eight waisted retaining bolts holding the flywheel and ring-gear assembly to the flange on the crankshaft (Figure 16).

![Flywheel and Ring-gear Assembly](image)

1 Flywheel
2 Flywheel housing
3 Flywheel retaining bolts (waisted)
4 Flywheel bearing

**Figure 16  Flywheel and Ring-gear Assembly**

d. Screw two bolts, approximately 100 mm long, into the flywheel.

**NOTE**
If difficulty is experienced in removing the assembly using the bolts, remove the starter motor in accordance with EMEI Vehicle G 603 and use a hammer and soft drift to drive the assembly off the crankshaft. Refit the starter motor.

e. Pull the flywheel and ring-gear assembly off the crankshaft.

f. Clean and inspect all parts.

**CAUTION**
Be sure to grind the fastening surface of the clutch by the same amount as the flywheel contact surface in order to maintain the appropriate dimensions between the clutch fastening surface and the flywheel contact surface. Do not exceed a minimum gap of 13 mm.

**NOTE**
A flywheel with cracks, scorch marks or irregularities is to be replaced.

g. Inspect the ring-gear (if it is damaged, replace it in accordance with sub-para h below).

h. Replace the ring-gear as follows:

**WARNING**
Wear protective gloves when handling the heated ring-gear.

(1) Uniformly heat the ring-gear until it can be removed from the flywheel using a soft drift and a hammer.
(2) Discard the ring-gear.
(3) Allow the flywheel to cool to ambient temperature.
(4) Clean the flywheel.

**CAUTION**

Ensure that the ring-gear does not warp during the fitting process.

(5) Heat the new ring-gear to between 250ºC and 280ºC.
(6) Press the ring-gear onto the flywheel.
(7) Allow the ring-gear and flywheel to cool to ambient temperature.

### 20. Installation

Install the ring-gear and flywheel assembly as follows:

**CAUTION**

The maximum allowable length of the waisted retaining bolts is 26.3 mm. Replace the bolts as a complete set if any bolt is longer than 26.3 mm.

- a. Measure the waisted retaining bolts for excessive elongation (replace with a complete set if any bolt is longer than 26.3 mm).
- b. Coat the ring-gear with a long life lubricating grease (Long-term 2, Olistomoly 2, Molydag 347 or equivalent).
- c. Fit the flywheel to the crankshaft.
- d. Coat the eight waisted bolts with oil.
- e. Secure the flywheel with the eight waisted bolts.

**NOTE**

Tighten the bolts in a diagonal sequence.

- f. Tighten the bolts to an initial setting of 30 + 10 N.m.
- g. Tighten the bolts a further 90º + 20º.
- h. Slowly rotate the engine by hand and using a dial gauge measure the vertical and lateral run-out

**NOTE**

The maximum permissible run-out is 0.1 mm.

- i. Fit the clutch (Para 40.b or 43.b).
- j. On vehicles fitted with a winch, fit the PTO transmission (Para 46).
- k. Adjust the clutch pedal and plunger clearances if necessary in accordance with EMEI Vehicle G 603.
- l. Check the engine oil and coolant levels.
- m. Test drive the vehicle.

### Cylinder Head

#### 21. Removal

Remove the cylinder head as follows:

- a. Raise and secure the cab in accordance with EMEI Vehicle G 603.
- b. Disconnect the batteries.
- c. Clean the engine thoroughly.
d. Drain all the coolant from the cooling system.

e. Remove the coolant expansion tank and its retaining bracket from the cylinder head in accordance with EMEI Vehicle G 603.

f. Unscrew the worm drive clamps and disconnect the heater hoses from the thermostat housing.

g. Remove the two screws securing the coolant manifold to the thermostat housing.

h. Remove the coolant manifold from the thermostat housing.

i. Disconnect the cable from the coolant temperature sensor.

j. Remove the coolant hose from the thermostat body.

**NOTE**

Do not disconnect the cable from the pulse generator.

k. Remove the pulse generator angle-drive (Figure 5).

l. Remove the two brackets holding the cable loom and fuel lines to the cylinder head.

m. Disconnect the external leak-off line and discard the sealing washers on the banjo bolt.

n. Unscrew the cap nuts on the injection pump using the injector cap nut wrench (Table 1, Serial 1) (Figure 17).

![Figure 17 Cap Nut Removal](image)

o. Disconnect the injection pipes from the pump.

p. Remove the exhaust manifold and turbocharger (Ref EMEI Vehicle G 603).

q. Disconnect the breather line from the engine breather/filter housing.

r. Remove the four bolts securing the cylinder head cover.

s. Remove the cylinder head cover and discard the gasket.

**CAUTION**

Note the position of the two nipples on the cylinder head assembly for installation purposes.

t. Compress the nipple assembly using the pliers (Table 1, Serial 5) until the assembly can be removed from between the rocker shafts (Figure 18).
The two rocker shafts have different flanges to accommodate the nipple assembly (Figure 19). Label the two shafts indicating their position on the cylinder head for installation purposes.

To avoid displacing the cam followers, loosen the push rods with short, sharp sideways movements prior to withdrawal.

- Detach the pushrods from the tappets.
- Withdraw the pushrods from the pushrod tunnels.
- Remove the bracket supporting the tachometer angle-drive from the cylinder head (Figure 5).
- Disconnect the leak-off line from the injectors and cylinder head.
- Discard the sealing washers on the banjo bolts.
cc. Remove the coolant manifold from the cylinder head and discard the gaskets.

dd. Remove the cylinder head retaining bolts in the sequence shown in Figure 20.

![Figure 20 Cylinder Head Bolt Removal Sequence](image)

**CAUTION**

Do not damage the injection lines when removing the cylinder head.

ee. Lift and remove the cylinder head from the engine block using the lifting handles (Table 1, Serial 4) (Figure 21).

![Figure 21 Cylinder Head Removal](image)

ff. Discard the cylinder head gasket.

gg. Clean the mating surface of the engine block.

**NOTE**

Ensure that all gasket residues are removed.

hh. Blow dirt, gasket flakes, oil and water from the bolt holes and cylinders with compressed air.

ii. Use a straight-edge and a feeler gauge to check the cylinder head surface for distortion refering to Table 3 for the cylinder head distortion limits.

**NOTE**

If the cylinder head is within limits re-install the cylinder head (Para 24). If the cylinder head is outside limits, replace the cylinder head. Strip the old cylinder head (Para 22) and rebuild the new cylinder head with the items removed from the old cylinder head (Para 23).
Table 3  Cylinder Head Specifications

<table>
<thead>
<tr>
<th>Serial</th>
<th>Measurement</th>
<th>Dimension (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total height of cylinder head (manufactured)</td>
<td>91.9–92.1</td>
</tr>
<tr>
<td>2</td>
<td>Permissible allowance</td>
<td>1.0</td>
</tr>
<tr>
<td>3</td>
<td>Roughness of upper mating surface lengthwise (peak to trough)</td>
<td>Max 0.05</td>
</tr>
<tr>
<td>4</td>
<td>Roughness of upper mating surface crosswise (peak to trough)</td>
<td>Max 0.015</td>
</tr>
<tr>
<td>5</td>
<td>Pressure test (water)</td>
<td>2.5 bar</td>
</tr>
<tr>
<td>6</td>
<td>Nozzle projection from lower mating edge</td>
<td>1.8–2.5</td>
</tr>
<tr>
<td>7</td>
<td>Roughness of lower mating surface (peak to trough)</td>
<td>0.008–0.016</td>
</tr>
</tbody>
</table>

22. **Stripping.** Strip the cylinder head as follows:
   
   a. Unscrew the cap nuts on the injectors using the injector cap nut wrench (Table 1, Serial 1) (Figure 22).
   
   ![Figure 22 Cap Nut Removal](image)
   
   b. Unscrew the gland nuts in the cylinder head.
   c. Remove the two brackets securing the injector lines together.
   d. Remove the injection pipes.
   e. Remove the leak-off line from the injection nozzles.
   f. Discard the seals.
   g. Remove the thrust screws from the injector nozzles using the socket (Table 1, Serial 2) (Figure 23).
   
   ![Figure 23 Injector Thrust Screw Removal](image)
h. Remove the injector nozzles from the injector housings using the injector remover (Table 1, Serial 3) (Figure 24).

![Figure 24 Injector Removal](image)

i. Remove the injector sleeves from the injector housing using the injector sleeve remover (Table 1, Serial 6) (Figure 25).

![Figure 25 Injector Sleeve Removal](image)

As the washers may adhere to the injectors or to the injector sleeves in the cylinder head, ensure that all six sealing washers between the injectors and the injector sleeves are removed and discarded.

j. Remove and discard the sealing washers from both inside and beneath the injector sleeve.

k. Remove any hoses or ancillary equipment.

l. Wipe the cylinder walls and the mating surface of the engine block with a lightly oiled clean cloth.

m. Thoroughly clean all items from the engine that are to be re-used during the installation.

n. Inspect all items that are to be re-used (replace if required).

23. **Rebuilding.** Rebuild the replacement cylinder head as follows:

![CAUTION](image)

Ensure the cleanliness of all injector components.

Ensure that the washers are correctly seated on the base of the injector housings.
26.

**Installation.** Install the cylinder head as follows:

- **a.** Position a new cylinder head gasket on the engine block.
- **b.** Position the cylinder head on the engine block using the lifting handles (Table 1, Serial 4) (Figure 21).

**CAUTION**

The stamped letters OBEN (top) on the gasket must face upwards.

- **a.** Position a new cylinder head gasket on the engine block.
- **b.** Position the cylinder head on the engine block using the lifting handles (Table 1, Serial 4) (Figure 21).

**CAUTION**

The cylinder head retaining bolts are to be tightened in the sequence shown in Figure 26.

- **c.** Fit the cylinder head bolts and tighten them in the sequence shown in Figure 26 in three stages as follows:
  - (1) First tightening stage – 60 N.m;
  - (2) Second tightening stage – 90 N.m; and
  - (3) Third tightening stage – 100 to 110 N.m.
Figure 26  Cylinder Head Bolt Tightening Sequence

Ensure that the pushrods bed home in the cylindrical cam followers.

d. Install the pushrods in the pushrod tunnels.

e. Attach the pushrods to the tappets.

CAUTION

The rocker arm assembly having the shaft with the large diameter flange must be positioned towards the rear of the engine over cylinders 4, 5 and 6.

f. Install the rocker arm assemblies into the cylinder head.

CAUTION

Ensure that the ball-headed bolts in the rocker arms fit exactly into the cupped heads of the pushrods.

g. Install the retaining bolts that secure the rocker assemblies to the cylinder head and hand tighten them.

h. Tighten the retaining bolts to between 100 and 110 N.m.

i. Compress the nipple assembly using the pliers (Table 1, Serial 5) until the assembly can be installed between the rocker shafts (Figure 18).

CAUTION

Ensure the nipple assembly is assembled in the same configuration as when it was removed (the large nipple fits the flange of the rear rocker shaft) (Figure 19).

j. Install the nipple assembly between the rocker shafts.

k. Adjust the valve clearances (Para 28).

l. Fit a new cylinder head cover gasket to the cylinder head.

m. Fit the cylinder head cover.

n. Secure the cylinder head cover with the four bolts.

o. Tighten the bolts to 25 N.m.
Fit the coolant manifold to the cylinder head using a new gasket.

Secure it with the retaining bolts.

Tighten the bolts to 10 to 15 N.m.

Fit the bracket supporting the tachometer angle-drive to the cylinder head (Figure 5).

Tighten the retaining bolts.

Connect the breather line to the engine breather-filter housing and tighten the worm drive clamp (Figure 14).

Fit the exhaust manifold and turbocharger in accordance with EMEI Vehicle G 603.

Fit the two brackets holding the cable loom and fuel lines to the cylinder head.

Tighten the retaining bolts.

Fit the pulse generator to the tachometer angle-drive (Figure 5).

Connect the cab heater lines to the thermostat housing and tighten the worm drive clamps.

Connect the coolant hose to the thermostat body.

Connect the cable to the coolant temperature sensor.

Fit the coolant expansion tank and its retaining bracket.

Tighten the bracket retaining bolts to 30 N.m.

Fit the coolant intake pipe.

Screw the cap nuts on the injection pump using the injector cap nut wrench (Table 1, Serial 1) (Figure 17).

Tighten the cap nuts to 25 N.m.

Close the drain tap at the bottom of the radiator.

Fill the system with coolant.

Ensure that the expansion tank is two-thirds full.

Bleed the fuel system in accordance with EMEI Vehicle G 603.

Connect the batteries (positive terminal first).

Lower and secure the cab.

Raise the bonnet.

Check the engine oil level.

Do not allow the engine to start until the oil pressure has built up; otherwise severe damage can occur to the turbo charger and engine.

Ensure the hand throttle is in the ‘SHUT DOWN’ position.

Crank the engine until an oil pressure indication has registered on the oil pressure gauge.

Start and run the engine for a brief period.

Check for any leaks or unusual noises (repair if necessary).

Stop the engine.

Check both oil and coolant levels.
uu. Lower and secure the bonnet.
vv. Test drive the vehicle.

Valve Assembly

25. Removal. Remove the valve assembly as follows:
a. Remove the cylinder head (Para 21).
b. Place a clean, dry cloth cover over the engine block to prevent the ingress of dirt or foreign material.
c. Compress the valve spring using the spring remover (Table 1, Serial 7) (Figure 27).

d. Remove the split conical cotter (Figure 28, Item 1) from the valve stem.
e. Expand the spring.
f. Remove the spring remover.
g. Remove the valve spring cap, valve spring and valve from the cylinder head (Figure 28, Items 2, 3 and 5).
h. Remove the valve spring seat (Figure 28, Item 4).
i. Clean and inspect all parts (replace as required).
26. **Inspection.** Inspect the valves as follows:

   a. Inspect the valve to ensure it is within the parameters as detailed in Table 4 (Figure 29).

![Figure 29 Engine Valve Measurement](image)

**Table 4 Engine Valve Specifications**

<table>
<thead>
<tr>
<th>Serial</th>
<th>Valves</th>
<th>Item</th>
<th>Intake (mm)</th>
<th>Exhaust (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Valve head diameter</td>
<td>a</td>
<td>44 ±0.1</td>
<td>36 ±0.01</td>
</tr>
<tr>
<td>2</td>
<td>Valve stem diameter</td>
<td></td>
<td>8.935–8.950</td>
<td>9.925–9.940</td>
</tr>
<tr>
<td>3</td>
<td>Valve length</td>
<td></td>
<td>140.5 ±0.2</td>
<td>140.5 ±0.2</td>
</tr>
<tr>
<td>4</td>
<td>Machining tolerances</td>
<td>Diameter (c)</td>
<td>42 ±0.01</td>
<td>34 ±0.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Height (b)</td>
<td>2.8–0.3</td>
<td>2.8–0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Valve seat width (d)</td>
<td>3.5–0.7</td>
<td>4.2–0.7</td>
</tr>
<tr>
<td>5</td>
<td>Valve seat angle</td>
<td></td>
<td>45°–45° 10’</td>
<td>45°–45° 10’</td>
</tr>
<tr>
<td>6</td>
<td>Valve clearance</td>
<td></td>
<td>0.25</td>
<td>0.40</td>
</tr>
<tr>
<td>7</td>
<td>Permissible run-out between</td>
<td>Seat and stem</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Head and stem</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Valve play in guides</td>
<td></td>
<td>0.05–0.087</td>
<td>0.06–0.097</td>
</tr>
</tbody>
</table>

   b. Inspect the valve spring to ensure it is within the tolerances detailed as follows:

   (1) OD........................................................................................................................................33.5 ±0.4 mm
   (2) Wire gauge ....................................................................................................................................4.25 mm
   (3) Length extended........................................................................................................................60.5 mm
   (4) Length under load – preloaded (300 ±15 N.m).........................................................................46.7 mm
   (5) Length under load – final tension (590 ±40 -20 N.m)......................................................35.18 mm

27. **Installation.** Install the valve assembly as follows:

   a. Lightly oil the valve stem and valve guide.
   b. Insert the valves into the valve guide.
Ensure that a uniform and clear lapping/seating pattern is obtained on the valve face and valve seat.

c. Lap the valve to the valve seat using fine lapping paste.
d. Remove the valve.

Ensure that no residue from the lapping process remains on the valve and valve seat.
e. Clean the cylinder head and valve.
f. Fit the valve spring seat into the cylinder head.

Where multiple valves have been removed, ensure that the valves are fitted into the inlet and exhaust ports to which they were lapped.

g. Insert the valve into the valve guide.
h. Compress the valve spring using the spring remover (Table 1, Serial 7) (Figure 27).
i. Fit the valve spring and spring cap.

Ensure that the split conical cotters are correctly seated in the spring cap and grooves in the valve stem.

j. Fit the split conical cotters to the valve stem and spring cap.
k. Slowly expand the valve springs.

NOTE

Allow the cotters to bed home into the spring caps and grooves in the valve stems.

l. Check that the assembly is correctly bedded in by using a nylon/plastic headed hammer to tap the stems of the valves a few times.
m. Fit the cylinder head to the engine (Para 24).

28. Adjustment. Adjust the valve clearance as follows:

Valve clearances shall be checked when the engine temperature is below 50°C.

a. Remove the cylinder head cover in accordance with EMEI Vehicle G 603.
b. Rotate the crankshaft to the right until number one cylinder is at compression top dead center (TDC) (Figure 30).

NOTE

TDC is achieved when the rocker arms of number six cylinder overlap.
c. Check the clearance of the intake valves number two, three and seven and exhaust valves number one, five and nine (Figure 31).

![Figure 30 Rotating the Crankshaft](image)

![Figure 31 Valve Measuring Sequence](image)

d. Table 5 lists the settings.

<table>
<thead>
<tr>
<th>Serial</th>
<th>Valve</th>
<th>Clearance Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intake</td>
<td>0.20 mm</td>
</tr>
<tr>
<td>2</td>
<td>Exhaust</td>
<td>0.30 mm</td>
</tr>
</tbody>
</table>

**NOTE**

Turn the adjustment screw clockwise to reduce valve clearance or anticlockwise to increase valve clearance.

e. Adjust the valve clearance as shown in Figure 32.
f. Turn the crankshaft to the right until number six cylinder is at compression TDC.

NOTE

TDC is achieved when the rocker arms of number one cylinder overlap.

g. Check and adjust the clearance of intake valves six, ten and eleven and of exhaust valves four eight and twelve as shown in Figures 31 and 32 (Table 5 lists the settings).

h. Refit the cylinder head cover.

Oil Pump

29. **Removal.** Remove the oil pump as follows (Figure 33):

![Figure 33 Oil Pump](image)

1. Crankcase
2. Pump mounting bolts
3. Oil pump

a. Drain the oil.

b. Remove the sump in accordance with EMEI Vehicle G 603.
The tang that protrudes above the oil pump drive gear slots into a keyway in the base of the tachometer drive cable. Note the orientation of the tang in relation to the oil pump. Matchmark this position on the oil pump housing immediately below the drive gear for use during installation.

c. Unscrew the three bolts securing the oil pump to the crankcase.
d. Remove the oil pump from the crankcase.

**CAUTION**

Ensure that all gasket residues are removed from the crankcase sealing surfaces and sump sealing surfaces.

e. Clean the mating surfaces on the crankcase and the oil pump.
f. Clean the sump.

30. **Disassembly.** Disassemble the oil pump as follows (Figure 34):

a. Remove the oil pressure relief valve (Item 10) from the oil pump in accordance with EMEI Vehicle G 603.
b. Clamp the oil pump in a vice.
c. Remove the two oil feed pipe retaining bolts (Item 7).
d. Detach the oil feed pipe (Item 8) and gasket (Item 6) from the oil pump.
e. Discard the gasket.
f. Remove the four end cover retaining bolts (Item 11).
g. Detach the end cover (Item 12) from the oil pump.

h. Use a puller to remove the oil pump drive gear (Item 1).

**CAUTION**

Do not to damage or break the drive tang on the drive spindle.

i. Remove the idler shaft (Item 14) and idler gear (Item 13) from the oil pump housing.
j. Remove the idler gear from the idler shaft.
k. Remove the drive spindle (Item 3) and oil displacement gear (Item 5) from the oil pump housing.
l. Remove the Woodruff key (Item 4) from the drive spindle.
m. Remove the oil displacement gear (Item 5).
n. Clean and inspect the oil pump housing.
o. Inspect and measure the drive spindle bore in the oil pump housing.
p. Replace the oil pump if it is damaged or worn beyond the tolerances listed in Table 6.
q. Clean and inspect all the parts removed from the oil pump.
r. Replace any parts which are damaged or worn beyond the tolerances listed in Table 6.

**NOTE**

The idler gear on the idler shaft is a slip fit and can be removed by hand.
i. Remove the idler shaft (Item 14) and idler gear (Item 13) from the oil pump housing.
j. Remove the idler gear from the idler shaft.
k. Remove the drive spindle (Item 3) and oil displacement gear (Item 5) from the oil pump housing.
l. Remove the Woodruff key (Item 4) from the drive spindle.
m. Remove the oil displacement gear (Item 5).
n. Clean and inspect the oil pump housing.
o. Inspect and measure the drive spindle bore in the oil pump housing.
p. Replace the oil pump if it is damaged or worn beyond the tolerances listed in Table 6.
q. Clean and inspect all the parts removed from the oil pump.
r. Replace any parts which are damaged or worn beyond the tolerances listed in Table 6.
### Table 6  Oil Pump Component Tolerances

<table>
<thead>
<tr>
<th>Serial</th>
<th>Component to be Measured</th>
<th>Tolerances (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bore in the oil pump housing for the drive spindle</td>
<td>17.009 ±0.009</td>
</tr>
<tr>
<td>2</td>
<td>Diameter of the drive spindle</td>
<td>16.006 ±0.978</td>
</tr>
<tr>
<td>3</td>
<td>Diameter of the idle shaft</td>
<td>15.034 ±0.006</td>
</tr>
<tr>
<td>4</td>
<td>Height of the oil pump drive gear</td>
<td>39.963 ±0.013</td>
</tr>
<tr>
<td>5</td>
<td>Diameter of the oil pump drive gear</td>
<td>39.960 ±0.015</td>
</tr>
<tr>
<td>6</td>
<td>Backlash of the oil pump drive gear</td>
<td>0.15–0.25</td>
</tr>
<tr>
<td>7</td>
<td>End float of the drive spindle</td>
<td>0.016–0.042</td>
</tr>
<tr>
<td>8</td>
<td>Backlash of the oil displacement gears</td>
<td>0.15–0.25</td>
</tr>
<tr>
<td>9</td>
<td>Axial clearance between the oil displacement gears and the face of the oil pump end cover</td>
<td>0.112 ±0.016</td>
</tr>
<tr>
<td>10</td>
<td>Radial clearance between the oil displacement gears and the oil pump body</td>
<td>0.04</td>
</tr>
</tbody>
</table>

#### 31. Assembly

Assemble the oil pump as follows (Figure 34):

- **a.** Fit the idler shaft (Item 14) into the oil pump housing (Item 2).
- **b.** Heat the oil-displacement gear (Item 5) in oil to approximately 80°C.
- **c.** Fit the oil-displacement gear to the drive spindle (Item 3).
- **d.** Secure the oil-displacement gear with the Woodruff key.
- **e.** Install the drive spindle into the oil pump housing.
- **f.** Fit the idler gear (Item 13) to the idler shaft (Item 14).
- **g.** Heat the drive gear (Item 1) in oil to approximately 80°C.
- **h.** Fit the drive gear to the drive spindle.
- **i.** Check the end play of the drive spindle (Table 6) (adjust as required).
- **j.** Allow the gears to cool to ambient temperature.
- **k.** Re-check the end play of the drive spindle.
- **l.** Use a dial indicator gauge to measure the end float (axial clearance) of the drive spindle (ref Table 6) (adjust as required).
- **m.** Use a dial gauge to measure the backlash of the drive gear (Table 6).
- **n.** Measure the backlash between the oil-displacement gears (Table 6).
- **o.** Fit the end cover to the oil pump housing.
- **p.** Install the four retaining bolts.
- **q.** Tighten the bolts to 35 N.m.
- **r.** Lightly grease a new gasket with grease XG-291.
- **s.** Attach the gasket to the mating surface of the oil feed pipe.
- **t.** Fit the oil feed pipe to the oil pump.
- **u.** Install the two retaining bolts.
- **v.** Tighten the bolts to between 20 and 25 N.m.
- **w.** Fit the oil pressure relief valve (Item 10) to the oil pump in accordance with EMEI Vehicle G 603.
- **x.** Test the oil pump (Table 7).
**Table 7  Oil Pump Test Specification**

<table>
<thead>
<tr>
<th>Serial</th>
<th>Test</th>
<th>Parameters</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Delivery, measured with SAE 10 oil, at 50°C oil temperature, 400 kPa back pressure</td>
<td>300 RPM 1 400 RPM</td>
<td>60.0 L/min 43.0 L/min</td>
</tr>
<tr>
<td>2</td>
<td>Opening pressure of relief valve</td>
<td></td>
<td>520±50 kPa</td>
</tr>
<tr>
<td>3</td>
<td>Oil temperature</td>
<td></td>
<td>120°C (max)</td>
</tr>
<tr>
<td>4</td>
<td>Oil pressure gauge reading for new engine (operating temperature)</td>
<td>Idling at approx 700 RPM  At max speed</td>
<td>120 kPa 500 kPa</td>
</tr>
<tr>
<td>5</td>
<td>Oil pressure gauge reading for used engine (operating temperature)</td>
<td>Idling at about 700 RPM  At max speed</td>
<td>60 kPa 250 kPa</td>
</tr>
</tbody>
</table>
32. **Installation.** Install the oil pump as follows:
   a. Prime the oil pump with SAE Grade 40 (OMD-115) oil.
   b. Align the tang on the drive spindle with the scribed marks on the oil pump housing immediately below the drive gear.
   c. Fit the oil pump to the crankcase.
   d. Install the three retaining bolts.
   e. Tighten the bolts to 35 N.m.
   f. Install the sump in accordance with EMEI Vehicle G 603.
   g. Raise the bonnet.
   h. Fill the engine with SAE Grade 40 (OMD-115) oil.
   
   **CAUTION**
   Do not allow the engine to start until the oil pressure has built up; otherwise severe damage can occur to the turbo charger and engine.
   i. Place the hand throttle lever in the ‘SHUT DOWN’ position.
   j. Crank the engine until the oil pressure registers on the pressure gauge.
   k. Start and run the engine for a brief period checking for any leaks or unusual noises (repair if necessary).
   l. Lower and secure the bonnet.
   m. Test drive the vehicle.

**Engine Brake Actuating Cylinder**

33. **Removal.** Remove the engine brake actuating cylinder as follows (Figure 35).

   a. Raise and secure the cab in accordance with EMEI Vehicle G 603.
   b. Drain all the compressed air from the air tanks.
   c. Disconnect the air line from the cylinder.

![Figure 35 Engine Brake Actuating Cylinder](image_url)
d. Detach the ball socket on the cylinder piston arm from the pivoting lever control.

e. Remove the bolt holding the cylinder to the mounting bracket.

f. Remove the cylinder.

34. **Installation.** Install the engine brake actuating cylinder as follows (Figure 35):

a. Position the cylinder on the mounting bracket.

b. Secure it with the retaining bolt.

c. Tighten the bolt to 35 N.m.

d. Fit the ball socket on the cylinder piston arm to the pivoting lever control.

e. Connect the air line to the actuating cylinder.

f. Tighten the cap nut.

**NOTE**

The engine brake operation can only be tested with the engine under load on a road test.

g. Check the engine oil and coolant levels and top up if necessary.

h. Lower and secure the cab.

i. Test drive the truck and test the operation of the engine brake (adjust if necessary).

**Engine Brake Manifold**

35. **Removal.** Remove the engine brake manifold as follows (Figure 36):

![Figure 36 Engine Brake Manifold](image)

1. Ball-head socket
2. Exhaust pipe securing bolts and nuts
3. Brake manifold securing studs and nuts

a. Raise and secure the cab in accordance with EMEI Vehicle G 603.

b. Disconnect the ball socket (Item 1) on the brake linkage from the engine brake manifold.

c. Remove the nuts and bolts (Item 2) holding the exhaust pipe to the flange on the engine brake manifold.

d. Detach the exhaust pipe and move it to one side.

e. Remove and discard the gasket.

f. Use penetrating oil to lubricate the nuts and studs (Item 3) holding the engine brake manifold to the turbocharger.
g. Remove the nuts.

h. Carefully remove the manifold from the turbocharger.

i. Remove and discard the gasket.

Ensure that no dirt or gasket residue enters the turbocharger.

j. Clean the mating surface on the turbocharger.

36. Repair. Repair the engine brake manifold as follows (Figure 37):

![Figure 37 Engine Brake Components](image-url)
a. Clamp the engine brake manifold in a vice.

b. Hold the butterfly valve (Item 6) fully open and matchmark the position of the actuating lever (Item 10) on the engine brake manifold.

c. Remove the nut (Item 8) and bolt (Item 9) securing the actuating lever to the spindle shaft (Item 5).

d. Remove the actuating lever from the spindle shaft.

e. Remove the nut (Item 1) and bolt (Item 3) securing the pinch clamp (Item 2) to the spindle shaft.

f. Remove the pinch clamp from the spindle shaft.

NOTE

The butterfly valve is machined with chamfered edges, to facilitate sealing when operating. Before removal, fully close the butterfly valve and take note of the position of the chamfered edges against the manifold for use during installation. Take note of the position of the splined portions of the spindle shaft when removing it from the manifold.

g. Remove and discard the spindle shaft, shaft bushes (Items 4, 14 and 16) and the butterfly valve (Item 6) from the engine brake manifold.

h. Clean the holes from which the shaft bushes were removed.

i. Obtain the correct repair kit for the engine brake manifold (RPS 02155 Group ABC, Item 9002).

j. Lubricate the shaft bushes and spindle shaft with SAE Grade 40 (OMD-115) oil.

k. Install the butterfly valve, shaft bushes and spindle shaft into the engine brake manifold.

l. Fully open and close the butterfly valve a few times to check the movement and positioning of the assembled unit (adjust if necessary).

m. Fit the shaft clamp to the spindle shaft.

n. Install and tighten the securing bolt and nut.

o. Fit the actuating lever to the spindle shaft.

p. Install and hand tighten the retaining bolt and nut.

q. Hold the butterfly valve fully open and adjust the position of the actuating lever so that it is aligned with the scribed mark on the engine brake manifold.

r. Tighten the retaining bolt and nut to 10 N.m.

37. Installation. Install the engine brake manifold as follows (Figure 36):

a. Fit the manifold to the turbocharger using a new gasket.

b. Fit the retaining nuts.

c. Tighten the nuts to between 30 N.m and 40 N.m.

d. Fit the exhaust pipe to the flange on the engine brake manifold using a new gasket.

e. Install the retaining nuts.

f. Tighten the nuts to 45 N.m.

g. Connect the ball socket on the brake linkage to the engine brake manifold.

h. Check the engine oil and coolant levels (top up if necessary).
NOTE

The operation of the engine brake can only be tested with the engine under load on a road test.

i. Lower and secure the cab.

j. Test drive the truck and test the operation of the engine brake (adjust if necessary).

FUEL SYSTEM

38. Fuel system components can be replaced or repaired as follows:
   a. fuel injectors (Para 22);
   b. injector sleeves (Para 22); and
   c. fuel lift pump (Para 39).

39. Fuel Lift Pump. Repair the fuel lift pump as follows (Figure 38):

   Figure 38 Fuel Lift Pump
a. Remove the lift pump from the engine (Ref EMEI Vehicle G 603).
b. Clamp the lift pump in a vice.
c. Remove the pre-cleaner (Item 8) from the lift pump (Ref EMEI Vehicle G 603).
d. Remove the U-bolt (Item 13) from the lift pump.
e. Unscrew and discard the hand priming pump (Item 1).
f. Remove and discard the suction valve complete with the spring and spacer (Item 2).
g. Remove the screw plug (Item 7) from the body (Item 14) and discard the gasket (Item 6).
h. Remove and discard the plunger return spring (Item 5).
i. Remove and discard the plunger (Item 4) from the suction chamber.

**NOTE**

The discharge valve (Item 16) is retained in the lift pump body by a screw plug.

j. Remove the screw plug from the lift pump and discard the sealing washer.
k. Remove and discard the discharge valve (Item 16) complete with the spring.
l. Remove and discard the four sealing washers (Item 3) from the body (Item 14).
m. Clean and inspect the lift pump (replace all worn or damaged parts).
n. Install the four sealing washers (Item 3) into the body (Item 14).
o. Install the discharge valve (Item 16) complete with spring into the body.
p. Fit the sealing washer to the body over the discharge valve.
q. Fit and tighten the screw plug.
r. Install the plunger (Item 4) in the suction chamber.
s. Install the plunger return spring (Item 5).
t. Fit the gasket (Item 6) to the body.
u. Fit and tighten the screw plug (Item 7).

**CAUTION**

Do not damage the suction valve.

v. Install the suction valve (Item 2) complete with spring and washer.
w. Fit the hand priming pump (Item 1) to the lift pump body.
x. Tighten the hand priming pump.
y. Fit the U-bolt (Item 13) and pre-cleaner (Item 8) to the lift pump in accordance with EMEI Vehicle G 603.
z. Fit the lift pump to the engine in accordance with EMEI Vehicle G 603.

**CLUTCH – NON-PTO VERSION**

**Clutch Bell Housing**

40. The clutch bell housing can be replaced with the engine and main transmission fitted in the truck. Remove and install the bell housing as follows (Figure 39):
Figure 39  Clutch Bell Housing Components – Non-PTO Version

a. **Removal.** Remove the clutch bell housing as follows:

1. Raise and secure the cab in accordance with EMEI Vehicle G 603.
2. Detach the starter cable, the cable loom and the fuel and vent lines from the bell housing.

**NOTE**

Do not disconnect the hydraulic line.

3. Remove the retaining bolts and detach the clutch slave cylinder from the bell housing.
4. Detach the propeller shaft to the main transmission from the primary shaft flange and move it to one side.
5. Remove the retaining bolts securing the bell housing to the flywheel housing.

**NOTE**

If there is a metal-to-metal bonding between the mating surfaces, a soft headed hammer or a hammer and soft drift may be used to break the bond.

6. Remove the bell housing from the truck.
**WARNING**

Under no circumstances is compressed air to be used to remove dust from the clutch assembly, bell housing or flywheel housing.

(7) Clean all dirt from the clutch and pressure plate assembly and the flywheel housing. Clean the parts that are to be used during installation.

**b. Installation.** Install the clutch bell housing as follows:

(1) Coat the mating surface of the flywheel housing with Loctite 573.

(2) Coat the threads on the retaining bolts with Loctite 241.

(3) Lightly grease the primary shaft with grease XG-276.

(4) Lift and position the clutch bell housing so that the splines on the primary shaft are aligned with the splines in the centre hub of the clutch plate.

(5) Maneuvre the bell housing until it butts fully against the mating surface of the flywheel housing.

(6) Rotate the bell housing until the bolt holes are aligned.

(7) Install the retaining bolts around the bell housing and hand tighten them.

(8) Tighten the retaining bolts in a diagonal sequence to 42 N.m.

(9) Position the propeller shaft against the primary shaft so that the bolt holes are aligned.

(10) Install and tighten the retaining bolts and nuts to 75 N.m.

(11) Coat the mating surface of the clutch slave cylinder with Loctite 573.

(12) Coat the threads on the retaining bolts with Loctite 241.

(13) Fit the slave cylinder to the bell housing.

(14) Install the retaining bolts and tighten them to 21 N.m.

(15) Attach the starter cable, the cable loom and the fuel and vent lines to the bell housing.

(16) Lower and secure the cab in accordance with EMEI Vehicle G 603.

(17) Test drive the truck.

**Clutch Release Bearing**

41. The clutch release bearing is replaced as a separate unit. Remove and install the bearing as follows (Figure 39):

**a. Removal.** Remove the release bearing as follows:

(1) Raise and secure the cab (Ref EMEI Vehicle G 603).

(2) Remove the clutch bell housing from the truck (Para 40).

(3) Remove the release bearing (Item 1) and bearing carrier (Item 20) from the bearing carrier sleeve (Item 3).

(4) Unhook the spring clip (Item 4) from the clutch release fork (Item 2) and remove the release fork from the bearing carrier sleeve.

(5) Remove the release bearing from the carrier.

(6) Discard the release bearing.

(7) Clean the inside of the bell housing and all parts that are to be used during installation.

**b. Installation.** Install the release bearing as follows:

(1) Fit the release bearing (Item 1) to the bearing carrier (Item 20).
(2) Lightly coat the carrier sleeve (Item 3) with grease XG-276.

(3) Fit the clutch release fork (Item 2) over the pivot ball (Item 5) in the bell housing.

(4) Hook the spring clip (Item 4) over the end of the release fork to retain it in position.

(5) Fit the release bearing and carrier to the carrier sleeve.

(6) Fit the clutch bell housing (Para 40).

(7) Lower and secure the cab in accordance with EMEI Vehicle G 603.

(8) Test drive the truck.

Primary Shaft and Bearing

42. The primary shaft and bearing can be replaced as separate items. Remove and install the primary shaft and bearing as follows (Figure 39).

a. Removal. Remove the primary shaft and bearing as follows:
   (1) Raise and secure the cab in accordance with EMEI Vehicle G 603.
   (2) Remove the clutch bell housing (Para 40).
   (3) Remove the clutch release bearing (Para 41).
   (4) Remove the retaining bolts (Item 8) and washers (Item 7) that secure the end cover (Item 10) and the carrier sleeve (Item 3) to the bell housing.
   (5) Remove the carrier sleeve from the bell housing.
   (6) Remove and discard the sealing ring (Item 9) from the carrier sleeve.
   (7) Use a soft-headed hammer to drive the primary shaft (Item 11), primary shaft bearing (Item 17), end cover and flange from the bell housing.
   (8) Remove the circlip from the groove in the primary shaft.
   (9) Use a puller with long reach arms to draw the end cover and bearing off the shaft.
   (10) Discard the shaft and the bearing.
   (11) Remove and discard the sealing ring from the end cover.
   (12) Clean and inspect all those parts that are to be used during installation

b. Installation. Install the primary shaft and bearing as follows:
   (1) Coat the sealing rings with rubber grease.
   (2) Use a suitable soft drift and hammer to install the sealing rings in the end cover and the carrier sleeve.
   (3) Place the end cover into position over the primary shaft and against the shaft flange.
   (4) Pack the shaft bearing with silicon grease.

   NOTE

   As the bearing is a drive fit on the shaft, the use of a power press and suitable hollow drift is recommended to fit the bearing to the shaft.
   (5) Fit the bearing to the shaft.
   (6) Fit the circlip in the groove in the primary shaft.
   (7) Coat the mating surfaces of the end cover carrier sleeve flange with Loctite 573.
   (8) Coat the threads of the retaining bolts with Loctite 241.
   (9) Press the primary shaft and bearing into position in the bell housing.
   (10) Rotate the end cover so that the bolt holes are aligned.
(11) Position the carrier sleeve over the primary shaft so that the bolt holes are aligned.

(12) Install and tighten the retaining bolts to 21 N.m.

(13) Spin the shaft by hand a few times to check the alignment and free spin of the bearing and shaft (adjust or repair as necessary).

(14) Fit the clutch release bearing and carrier (Para 41).

(15) Fit the clutch bell housing (Para 41).

(16) Lower and secure the cab in accordance with EMEI Vehicle G 603.

(17) Test drive the truck.

CLUTCH – PTO VERSION

Clutch and Pressure Plate Assembly

43. The clutch and pressure plate assembly can be replaced with the engine and main transmission fitted in the truck. Remove and install the clutch and pressure plate assembly as follows (Figure 40):

![Figure 40: Clutch and Pressure Plate Assembly](image)

1. Flywheel
2. Clutch plate
3. Retaining bolts
4. Pressure plate
5. Clutch release bearing
6. Release bearing carrier
7. Spring clip
8. Primary shaft
9. Clutch release fork
10. Clutch slave cylinder
11. Bell-housing
12. Flywheel bearing
13. Crankshaft
a. **Removal.** Remove the clutch and pressure plate assembly as follows:

1. Raise and secure the cab in accordance with EMEI Vehicle G 603.
2. Remove the PTO transmission assembly from the truck (Para 46).
3. Remove the bolts securing the assembly to the flywheel.

**WARNING**

The clutch and pressure plate assembly is heavy and requires a two-man lift.

4. Carefully remove the assembly from the truck.
5. Clean and inspect the flywheel housing and assembly.

**NOTE**

Fine emery paper can be used to rub down the face of the flywheel.

6. Inspect the spigot bearing in the flywheel (replace the bearing if necessary using standard workshop practices and procedures).

b. **Installation.** Install the clutch and pressure plate assembly as follows:

**NOTE**

The clutch plate must be installed with the extended portion of the centre hub towards the flywheel. The clutch will not operate if the clutch plate is installed incorrectly.

1. Use a pilot shaft to centre the clutch and pressure plate assembly against the flywheel.
2. Rotate the pressure plate assembly until the bolt holes in the pressure plate cover are aligned with the bolt holes in the flywheel.
3. Install and hand tighten the retaining bolts.
4. Lock up the engine at the flywheel side.
5. With the pilot shaft still installed, tighten the retaining bolts in a diagonal sequence around the assembly to 29 N.m.
6. Remove the pilot shaft and unlock the engine.
7. Fit the PTO transmission assembly to the truck (Para 46).
8. Lower and secure the cab in accordance with EMEI Vehicle G 603.
9. Adjust the free travel of the clutch pedal in accordance with EMEI Vehicle G 603.
10. Check the release movement and pressure plate lift (Table 8 lists the clearances).
11. Test drive the truck.

<table>
<thead>
<tr>
<th>Table 8 Clutch Tolerances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>
Clutch Release Bearing

44. Remove and install the clutch release bearing as follows (Figure 41):

**Figure 41 Release Bearing Components**

### a. Removal
- Remove the clutch release bearing as follows:
  1. Raise and secure the cab in accordance with EMEI Vehicle G 603.
  2. Remove the PTO transmission assembly from the truck (Para 46).
  3. Detach the two spring clips (Item 1) that hold the release bearing carrier (Item 9) to the clutch release fork (Item 7).
  4. Remove the release bearing carrier complete with the release bearing (Item 10) from the transmission assembly.
  5. Remove and discard the release bearing from the carrier.
  6. Clean the inside of the bell housing and all parts that are to be used during installation.

### b. Installation
- Install the clutch release bearing as follows:
  1. Fit the replacement clutch release bearing (Item 10) to the release bearing carrier (Item 9).
  2. Lightly coat the interior surface of the bearing carrier with grease XG-276.
  3. Fit the release bearing carrier complete with the release bearing to the transmission assembly.
  4. Attach the two spring clips (Item 1) that hold the release bearing carrier to the clutch release fork (Item 7).
  5. Install the PTO transmission assembly (Para 46).
  6. Lower and secure the cab in accordance with EMEI vehicle G 603.

**MAIN TRANSMISSION**

45. Remove and install the main transmission assembly as follows (Figure 42):

### a. Removal
- Remove the main transmission as follows:
  1. Raise and secure the cab in accordance with EMEI Vehicle G 603.
(2) Remove the spare wheel.

(3) Remove the bolts and spring washers securing the mounting bracket for the pressurisation valves and the metal cover to the main transmission housing.

(4) Move the mounting bracket and the metal cover clear of the main transmission.

(5) Remove the bolts and spring washers securing the flange of the propeller shaft to the main transmission input flange (Item 12).

(6) Carefully move the input propeller shaft to one side.

(7) Loosen, but do not remove, the bolts securing the shift linkage universal coupling to the shift shaft (Item 11).

(8) Carefully ease the shift linkage universal coupling away from the shift shaft.

(9) Disconnect the cable from the gear-gate indicator switch (Item 4).

(10) Drain the compressed air system.

(11) Disconnect the air supply hose from the shift cylinder (Item 5).

(12) Disconnect the speedometer drive cable from the rear axle drive take-off housing.

(13) Disconnect the cable from the reversing light switch (Item 3).

(14) Remove the shift linkage from the FWD/REV selector lever (Item 2).

(15) Unscrew and remove the banjo-union and breather hose from the main transmission breather hole (Item 1).

(16) Move the hose to one side.

---

**Figure 42  Main Transmission**

1. Breather hole
2. FWD/REV selector lever
3. Reversing-light switch
4. Gear-gate indicator switch
5. Shift cylinder line
6. Rear torque ball housing
7. Front torque ball housing
8. Four-wheel drive switch
9. Four-wheel drive line
10. Special Tool No. 10
11. Shift shaft
12. Input shaft flange
(17) Unscrew the bolt and nut holding the compressor output air line bracket to the chassis.
(18) Remove the bracket and move the air line to one side.
(19) Disconnect the cable from the four-wheel drive indicator switch (Item 8).
(20) Disconnect the four-wheel drive air line (Item 9).
(21) Support the rear torque tube on a stand.
(22) Remove the bolts from the rear torque ball housing (Item 6).
(23) Pull back the torque ball housing and remove the bolts securing the rear axle drive shaft to the transfer box.
(24) Support the front torque tube on a stand.
(25) Remove the bolts from the front torque ball housing (Item 7).
(26) Pull back the torque ball housing and remove the bolts securing the front axle drive shaft to the transfer box.

NOTE
Mount the hoisting beam with the lifting eye towards the rear.

(27) Fit the hoisting beam (Table 1, Serial 8) onto the transfer case in place of the mounting bracket for the pressurisation valves.
(28) Suspend the main transmission with a suitable sling and lifting device.
(29) Remove the drain plugs from the main transmission housing, transfer case and planetary gear case and drain the oil.
(30) Remove and discard the bolts (Figure 43, Item 5) and shims securing the main transmission housing to the mounting on the left-hand side of the chassis.

Figure 43  Main Transmission Mounts

(31) Retain the two intermediate pieces (Figure 43, Item 4).
(32) Remove and discard the bolts (Figure 43, Item 1) securing the main transmission housing to the mounting (Figure 43, Item 2) on the right-hand side of the chassis.
(33) Retain the two spacing pieces (Figure 43, Item 3).
(34) Remove the main transmission assembly out of the chassis.
(35) Clean and check the main transmission mounting brackets on the chassis (replace any worn or damaged parts).
Check that the bolts securing the main transmission mounting brackets to the chassis are tightened to 180 N.m.

b. Installation. Install the main transmission assembly as follows:

**CAUTION**

The transmission securing bolts (Figure 43, Items 1 and 5) must not be reused.

1. Fit the hoisting beam (Table 1, Item 8) onto the transfer case in place of the mounting bracket for the pressurisation valves.
2. Use a suitable sling and lifting device to lift the main transmission housing into position.
3. Align the holes of the main transmission housing with the mating holes in the transmission mounting brackets.
4. Insert the spacing pieces (Figure 43, Item 3) and the bolts (Figure 43, Item 1) and fit the main transmission housing to the right-hand transmission mounting bracket (Figure 43, item 2).
5. Hand tighten the bolts.
6. Insert the intermediate pieces (Figure 43, Item 4) and bolts (Figure 43, Item 5) to secure the transmission housing to the left-hand transmission mounting bracket.
7. Insert shims (Figure 43) as required to pack the space between the main transmission housing and the left-hand transmission mounting bracket.
8. Tighten the bolts to 380 N.m.
9. Tighten the bolts on the right-hand transmission mounting bracket to 150 N.m.
10. Remove the lifting sling and the hoisting beam.
11. Bolt the rear axle drive shaft to the transfer box output flange.
12. Coat the mating surface on the rear torque ball housing with Loctite 573.
13. Bolt the rear torque ball housing to the transfer box (Item 6).
14. Tighten the bolts to 60 N.m.
15. Bolt the front axle drive shaft to the transfer shaft output flange.
16. Coat the mating surface on the front torque ball housing with Loctite 573.
17. Bolt the front torque ball housing to the transfer box (Item 7).
18. Tighten the bolts to 60 N.m.
19. Remove the support stands.
20. Replace the drain plugs and fill the main transmission housing, transfer case and planetary gear case with SAE Grade 40 (OMD-115) oil.
21. Connect the four-wheel drive air line (Item 9).
22. Connect the cable to the four-wheel drive indicator switch (Item 8).
23. Fit the compressed air delivery line to the bracket and fasten the bracket to the chassis.
24. Fit the banjo-union and the breather hose to the main transmission breather hole (Item 1).
25. Fit the shift linkage to the ‘FWD/REV’ selector lever (Item 2).
26. Connect the cable to the reversing light switch (Item 3).
27. Connect the speedometer drive cable to the rear axle drive take-off housing.
28. Connect the air supply hose to the shift-valve (Item 5).
29. Connect the cable to the gear-gate indicator switch (Item 4).
(30) Fit the shift linkage universal coupling to the shift shaft (Item 11).
(31) Adjust the linkage in accordance with EMEI Vehicle G 603.
(32) Align the propeller shaft flange with the main transmission input flange (Item 12).
(33) Insert the bolts and tighten them to 75 N.m.
(34) Position the mounting bracket for the pressurisation valves and the metal cover on the main
transmission housing (Item 10);
(35) Coat the securing bolts with sealant Loctite 241.
(36) Insert the bolts and tighten them to 25 N.m.
(37) Fit the spare wheel.
(38) Lower the cab in accordance with EMEI Vehicle G 603.

PTO TRANSMISSION

PTO Transmission Assembly

46. Remove and install the PTO transmission assembly as follows:

a. Removal. Remove the transmission assembly as follows:

(1) Raise and secure the cab in accordance with EMEI Vehicle G 603.
(2) Remove the drain plugs at the bottom of the transmission casing and drain the oil from the
assembly.
(3) Remove the spare wheel.
(4) Detach the starter cable, the cable loom, and the fuel and vent lines from the bell housing.
(5) Detach the PTO selector linkage from the PTO selector shaft.
(6) Detach the selector linkage for the main transmission from the gear shift lever (Figure 44, Item 1).

![Figure 44 Selector Linkage and Cab Support](image-url)
(7) Detach the selector linkage from the FWD/REV gear selector lever (Figure 44, Item 2).
(8) Remove the tie-wraps and detach the air and vent lines from the cab mounting support.
(9) Remove the retaining bolt (Figure 44, Item 3) from the cab mounting support bracket on the chassis crossmember.
(10) Lift the mounting support (Figure 44, Item 4) out of the bracket and move it backwards.
(11) Remove the propeller shaft to the main transmission (Para 47).
(12) Remove the propeller shaft to the winch (Para 48).

NOTE
Do not detach the hydraulic hose.

(13) Remove the clutch slave cylinder from the assembly housing (Figure 45).

![Figure 45  Clutch Slave Cylinder](image)

(14) Remove the centre bolts and nuts from the four engine rear mountings.
(15) Fit the hoisting beam (Table 1, Item 9) to the transmission housing (Figure 46).

![Figure 46  PTO Transmission Removal](image)

(16) Using a block and tackle fixed to a mobile gantry and with a capacity greater than 750 kg, attach the chain tackle to the hoisting beam and slowly raise the transmission and engine approximately 100 mm.
(17) Fit wooden blocks or supports beneath the rear engine mounts.
(18) Slowly lower the transmission and engine onto the wooden blocks or supports.
**NOTE**

Do not detach the chain tackle from the hoisting beam.

(19) Remove the bolts securing the transmission assembly to the engine.

(20) Move the assembly backwards until the spigot shaft clears the clutch and pressure plate assembly.

(21) Raise and manoeuvre the assembly until it is clear of the truck chassis.

(22) Carefully move the assembly and gantry away from the truck and lower the assembly.

**WARNING**

Under no circumstances is compressed air to be used to remove dust from the clutch assembly, bell housing or flywheel housing.

(23) Clean the clutch assembly and flywheel housing.

(24) Clean all parts that are to be used during installation.

b. **Installation.** Install the transmission assembly as follows:

**NOTE**

Before installing a replacement assembly in the truck, ensure that the correct type of clutch release bearing, release bearing carrier and release bearing fork are fitted.

(1) Fit the hoisting beam (Table 1, Serial 9) to the transmission housing (Figure 46).

(2) Coat the mating surface of the flywheel housing with Loctite 573.

(3) Coat the threads on the retaining bolts with Loctite 241.

(4) Lightly grease the primary shaft with grease XG-276.

(5) Using a block and tackle fixed to a mobile gantry and with a capacity greater than 750 kg, attach the chain tackle to the hoisting beam and slowly raise the assembly until it is high enough to clear the chassis.

(6) Manoeuvre the gantry and assembly into position.

(7) Slowly lower and manoeuvre the assembly until it is aligned for fitting to the engine.

(8) Push the assembly towards the engine and at the same time manoeuvre the assembly so that the splines on the primary shaft align with the splines in the hub of the clutch plate.

(9) Push the assembly until it butts fully against the mating surface of the flywheel housing.

**CAUTION**

If the assembly does not butt fully against the mating surface of the flywheel housing, the assembly has been misaligned. Under no circumstances use longer bolts to pull the assembly up against the flywheel housing as this could result in damage to the truck. The assembly must be correctly aligned by hand.

(10) Rotate the assembly until the bolt holes are aligned.

(11) Install the retaining bolts around the bell housing and hand tighten them.

(12) Tighten the retaining bolts in a diagonal sequence to 42 N.m.

(13) Slowly raise the transmission assembly and engine and remove the wooden blocks or supports.

(14) Slowly lower the assembly and engine onto the engine rear mounting brackets.

(15) Fit the centre bolts and nuts to the rear engine mounts and tighten them to 140 ±20 N.m.
(16) Remove the hoisting beam from the transmission housing and remove the block and tackle.

(17) Coat the mating surface of the clutch slave cylinder with Loctite 573.

(18) Coat the threads on the retaining bolts with Loctite 241.

(19) Fit the slave cylinder to the transmission assembly.

(20) Install the retaining bolts and tighten them to 21 N.m.

(21) Fit the propeller shaft to the main transmission (Para 47).

(22) Fit the propeller shaft to the winch (Para 48).

(23) Fit the cab mounting support to the mounting support bracket on the chassis crossmember.

(24) Install the retaining bolt and nut and tighten to them 410 N.m.

(25) Use tie-wraps to attach the air and vent lines to the cab mounting support.

(26) Attach the selector linkage to the FWD/REV gear selector.

(27) Attach the selector linkage for the main transmission to the gear shift lever.

(28) Attach the PTO selector linkage to the PTO selector shaft (Figure 44).

(29) Attach the fuel and vent lines, the cable loom and starter cable to the bell housing.

(30) Fit the spare wheel.

(31) Refit the drain plug.

(32) Remove the filler plug and fill the assembly with clean SAE Grade 40 (OMD-115) oil (capacity 5.75 litres).

(33) Install and tighten the filler plug.

(34) Lower and secure the cab in accordance with EMEI Vehicle G 603.

(35) Test drive the truck.

(36) Test the operation of the winch.

Propeller Shaft to the Main Transmission

The propeller shaft to the main transmission can be replaced with the PTO transmission and main transmission fitted in the truck. Remove and install the propeller shaft as follows (Figure 47):
**a. Removal.** Remove the propeller shaft as follows:

1. Raise and secure the cab in accordance with EMEI Vehicle G 603.
2. Remove the retaining bolts and detach the metal protective cover (Item 1) over the propeller shaft from the main transmission.
3. Remove the bolts and nuts securing the propeller shaft to the input flange (Item 4) of the main transmission.
4. Detach the propeller shaft from the input flange.
5. Remove the bolts and nuts securing the propeller shaft to the flange of the primary shaft.
6. Detach and remove the propeller shaft from the truck.
7. Clean the flange and propeller shaft well in the casing of the main transmission.
8. Clean the flange and rear portion of the PTO transmission casing.
9. Clean all parts from the transmission that are to be used during installation.

**b. Installation.** Install the propeller shaft as follows:

1. Position the propeller shaft flange against the countershaft flange of the main transmission so that the bolt holes are aligned.
2. Install the retaining bolts and nuts and tighten them to 75 N.m.
3. Position the propeller shaft flange against the flange of the primary shaft so that the bolt holes are aligned.
4. Install the retaining bolts and nuts and tighten to them 75 N.m.
5. Position the metal protective cover on the main transmission and over the propeller shaft.
6. Install and tighten the retaining bolts to 30 N.m.
7. Lower and secure the cab in accordance with EMEI Vehicle G 603.
8. Test drive the truck.

**Propeller Shaft to the Winch**

48. The propeller shaft to the winch can be replaced with the PTO transmission and winch drive shaft fitted in the truck. Remove and install the propeller shaft as follows (Figure 48):

![Figure 48 Propeller Shaft to the Winch](image-url)

**a. Removal.** Remove the propeller shaft as follows:

1. Raise and secure the cab in accordance with EMEI Vehicle G 603.
(2) Remove the bolts and nuts securing the propeller shaft (Item 5) to the flange of the PTO auxiliary shaft (Item 7).
(3) Detach the propeller shaft from the auxiliary shaft flange.
(4) Remove the bolts and nuts (Items 3 and 4) securing the propeller shaft to the flange of the winch drive shaft (Item 2).
(5) Detach and remove the propeller shaft from the truck.
(6) Clean the winch drive shaft flange and housing.
(7) Clean the auxiliary shaft flange and the front portion of the PTO transmission casing.
(8) Clean all parts from the truck that are to be used during installation.

b. Installation. Install the propeller shaft as follows:

**NOTE**

Check that the knuckles on the two universal joints of the propeller shaft are aligned prior to installation. The sliding joint section on the propeller shaft must be positioned towards the winch.

(1) Position the propeller shaft flange against the flange of the winch drive shaft so that the bolt holes are aligned.
(2) Install the retaining bolts and nuts and tighten them to 75 N.m.
(3) Position the propeller shaft flange against the flange of the PTO auxiliary shaft so that the bolt holes are aligned.
(4) Install the retaining bolts and nuts and tighten them to 75 N.m.
(5) Lower and secure the cab in accordance with EMEI Vehicle G 603.
(6) Test drive the truck.
(7) Test the operation of the winch.

**Primary Shaft Bearing**

49. The primary shaft bearings are replaced as separate components of the PTO transmission assembly. Remove and install the bearings as follows (Figure 49):
a. Removal. Remove the primary shaft bearing as follows:

(1) Remove the PTO transmission assembly from the truck (Para 46).
(2) Remove the release bearing carrier from the PTO transmission assembly (Para 44).
(3) Remove the retaining bolts and detach the bearing carrier sleeve (Item 6) and the sealing ring (Item 8) from the assembly.
(4) Discard the sealing ring.
(5) Remove and discard the circlip (Item 9) from the groove in the primary shaft and against the shaft inner bearing (Item 10).
(6) Remove the retaining bolts and detach the transfer casing from the bell housing.
(7) Remove and discard the gasket.
(8) Remove the idler gear assembly from the bell housing.
(9) Clamp the primary shaft so that it cannot rotate.
(10) Remove the flange retaining bolt and washers (Item 16) and remove the flange (Item 15) from the primary shaft.
(11) Remove and discard the flange sealing ring (Item 14).
(12) Use a soft-headed hammer to drive the primary shaft out of the shaft outer bearing (Item 12).
(13) Remove and discard the circlip (Item 11) that retains the shaft outer bearing in position.
(14) Remove and discard the shaft inner bearing (Item 10) from the bell housing.
(15) Remove and discard the shaft outer bearing (Item 12) from the transfer casing.
(16) Clean the transfer casing, bell housing, flywheel housing and all parts that are to be used during installation.

b. Installation. Install the primary shaft bearing as follows:

(1) Install the shift inner bearing in the bell housing.
(2) Install the shaft outer bearing (Item 12) in the transfer casing.
(3) Install the retaining circlip (Item 11) in the transfer casing against the shaft outer bearing.
(4) Fit the primary shaft to the transfer casing.

NOTE

A soft headed hammer may be used to drive the shaft until the step on the shaft butts against the inner race of the bearing.

(5) Coat the flange sealing ring (Item 14) with rubber grease.
(6) Coat the threads of the flange centre bolt (Item 16) with Loctite 241.
(7) Coat the splines in the shaft flange with grease XG-276.
(8) Coat the mating surfaces of the bell housing and transfer casing with Loctite 573.
(9) Install the flange sealing ring into the transfer casing.
(10) Clamp the primary shaft so that it cannot rotate.
(11) Fit the flange (Item 15) to the primary shaft.
(12) Install and tighten the centre bolt to 300 N.m.
(13) Fit the idler gear assembly to the bell housing.
(14) Fit a new gasket to the bell housing.
(15) Position the transfer casing on the bell housing so that the bolt holes are aligned.
(16) Coat the threads of the retaining bolts with Loctite 241.
Install the bolts and tighten them in a diagonal sequence to 21 N.m.

**Primary Shaft Inner Sealing Ring**

50. The primary shaft inner sealing ring is replaced as a separate component of the PTO transmission. Remove and install the sealing ring as follows (Figure 49):

a. **Removal.** Remove the primary shaft inner sealing ring as follows:
   1. Remove the PTO transmission from the truck (Para 46).
   2. Remove the release bearing carrier and release fork from the PTO transmission (Para 44).
   3. Remove the retaining bolts and detach the bearing carrier sleeve (Item 6) and the sealing ring (Item 8) from the assembly.
   4. Remove and discard the sealing ring.
   5. Clean all parts that are to be used during installation.

b. **Installation.** Install the primary shaft inner sealing ring as follows:
   1. Coat the sealing ring with rubber grease.
   2. Coat the mating surfaces of the flywheel housing and bell housing with Loctite 573.
   3. Coat the threads on all the retaining bolts with Loctite 241.
   4. Position the sealing ring (Item 8) in the groove in the carrier sleeve (Item 6).
   5. Take care not to damage the sealing ring lips or shoulder during this process
   6. Use the inserter (Table 1, Serial 11) and drift (Table 1, Serial 12) to drive the sealing ring fully home (Figure 50).

![Figure 50 Inserting the Carrier Sleeve Sealing Ring](image)

(6) Fit the carrier sleeve to the PTO assembly so that the bolt holes are aligned
(7) Install and tighten the retaining bolts.
(8) Fit the release bearing fork and release bearing carrier to the PTO transmission assembly (Para 44).
(9) Fit the PTO transmission assembly to the truck (Para 46).
(10) Test drive the truck.

FRONT AXLE

Front Axle Assembly

51. Remove and install the axle assembly as follows:
   a. Removal. Remove the front axle assembly as follows:
      (1) Remove the spare wheel.
      (2) Remove the split pin and nut securing the ball joint to the pitman arm (Figure 51, Item 1).

![Figure 51 Pitman Arm](image)

(3) Use the drag link remover (Table 1, Serial 10) to remove the drag-link from the pitman arm (Figure 52).

![Figure 52 Removing the Drag Link](image)

(4) Remove the nut and bolt (Figure 51, Item 2) securing the transverse link to the chassis bracket.
(5) Move the transverse link to one side.
(6) Remove the nuts and bolts securing the stabiliser bar to the axle.
(7) Remove the exhaust pipe the manifold.
(8) Remove the cover plate from the muffler.
(9) Remove the muffler support bracket.
(10) Remove the nuts and bolts securing the lower end of the two shock absorbers to the axle.
(11) Remove the nuts and bolts securing the lower end of the two springs to the axle.
(12) Disconnect the brake line, differential lock line and vent line (Figure 53).

![Figure 53 Front Axle Connections](image)

(13) Seal the ends of the brake line.
(14) Disconnect the brake wear indicator cable from the left-hand brake assembly (if fitted).
(15) Drain the oil from the centre axle housing.
(16) Disconnect the vent line to the rubber gaiter.
(17) Remove the clamp (Figure 54, Item 1) securing the rubber gaiter around the torque ball housing and slide back the gaiter.

![Figure 54 Torque Ball Assembly – Front Axle](image)

(18) Remove the bolts (Figure 54, Item 7) securing the torque ball housing to the main transmission.
(19) Use a suitable jack to support the torque tube.
(20) Fit suitable lifting slings to the front lifting points and lift the front of the vehicle.
(21) Remove the front torque ball shell halves (Figure 54, Item 5).
(22) Remove the bolts (Figure 54, Item 3) securing the propeller shaft flange to the main transmission.
(23) Lift the truck until the springs are clear of the axle and withdraw the axle assembly.
(24) Place the truck on suitable stands.
Draw back the torque ball casing (Figure 54, Item 2) and remove the rear torque ball shell halves (Figure 54, Item 6) from the housing.

**b. Installation.** Install the axle as follows:

1. Clean and check all parts (replace any worn or damaged parts).
2. Carefully deburr the torque ball housing and torque ball shell halves.
3. Coat the rear and the front torque ball shell halves with grease XG-276.
4. Fit the shell halves into the torque ball housing.

**NOTE**

To ensure the correct torque setting on the torque ball, shims (Figure 55) are fitted between the torque ball housing and the main transmission (Figure 54, Item 4). The flange (Table 1, Serial 13) is used to measure the torque setting.

![Figure 55 Torque Ball Shims – Front Axle](image)

- a. 0.2 mm, 0.5 mm, 1.0 mm
- b. Dia 148 mm
- c. Dia 194 mm

5. Fit the flange (Table 1, Serial 13) to the torque ball housing and tighten the securing bolts to 60 N.m (Figure 56).

![Figure 56 Adjusting the Torque Ball Housing – Front Axle](image)

6. Measure the force on the extension tube with a spring balance.

7. If the force on the extension tube is below 200 N - insert shims. If the force is above 300 N - remove shims. Repeat the procedure until the force on the extension tube is between 200 N and 300 N.
(8) Remove the flange (Table 1, Serial 13) from the torque ball housing.
(9) Lift the front of the truck and move the axle assembly into position.
(10) Use the bolts (Figure 54, Item 3) to fasten the propeller shaft flange to the main transmission.
(11) Tighten the bolts to 100 N.m.
(12) Use the bolts (Figure 54, Item 7) to fasten the torque ball housing with the shims to the main transmission.
(13) Tighten the bolts to 60 N.m.
(14) Slide the rubber gaiter against the torque ball housing and secure it with the clamp (Figure 54, Item 1).
(15) Connect the vent line to the rubber gaiter.
(16) Connect the differential lock line, bleeder line and brake line (Figure 53).
(17) Connect the brake wear indicator cable (if fitted).
(18) Fit the stabiliser bar to the axle.
(19) Secure the exhaust pipe to the manifold.
(20) Secure the cover plate to the muffler.
(21) Secure the muffler to the support.
(22) Fit the two springs to the axle assembly.
(23) Tighten the bolts to 300 N.m.
(24) Fit the shock absorbers to the axle assembly.
(25) Tighten the bolts to 400 N.m.
(26) Fit the transverse link to the bracket (Figure 51, Item 2).
(27) Tighten the bolt to 300 N.m.
(28) Attach the drag-link (Figure 54, Item 1) to the pitman arm.
(29) Release the clamp on the drag link and adjust the drag link to obtain 165 mm between the centre of the pitman arm and the outer edge of the chassis rail (Figure 51).
(30) Tighten the clamp to 100 N.m.
(31) Fit the nut to the ball joint.
(32) Tighten the nut to 230 N.m and install the split pin.
(33) Fill the centre axle housing with 2.5 litres of oil OEP-220.
(34) Fill the hub drive with 0.6 litres of oil OEP-220 each.
(35) Bleed the brake system in accordance with EMEI Vehicle G 603.
(36) Test drive the truck.
Front Propeller Shaft and Torque Tube

52. Remove and install the propeller shaft and torque tube as follows (Figure 57):

a. Removal. Remove the propeller shaft and torque tube as follows:
   1. Clamp the axle assembly on a suitable stand.
   2. Remove the four bolts securing the axle struts to the torque tube.
   3. Remove the line clamps from the torque tube.
   4. Disconnect the brake line, differential lock line, vent line and brake wear indicator cable (if fitted).
   5. Remove the bolts securing the torque tube to the axle assembly.
   6. Remove the propeller shaft and torque tube.
   7. Keep the plastic end cover on the propeller shaft.
   8. Clean and check all parts.

b. Installation. Install the propeller shaft and torque tube as follows:
   1. Coat the torque arm ball and bearing shell with grease XG-276.
   2. Coat the torque tube flange with sealing compound Terostat 56 (Daimler part number 001.989.58.20).
   3. Fit the torque tube to the axle assembly.
   4. Tighten the bolts to 200 N.m.
   5. Coat the securing bolts with Loctite 421 and fit the axle struts to the torque tube.
   6. Tighten the bolts to 350 N.m.
   7. Connect the brake line, differential lock line, vent line and brake wear indicator cable.
(8) Fit the line clamps around the torque tube.
(9) Clean the inner splines of the propeller shaft.
(10) Fill the cavity behind the profile inside the propeller shaft with 50 grams of grease XG-291.
(11) Fit the propeller shaft with the plastic end cover into the torque tube.

**Front Torque Tube Partial Removal and Installation**

53. When required to access drive line components without needing to fully remove an axle assembly or transmission from the vehicle, partially remove and install the front torque tube in accordance with EMEI Vehicle G 619-25.

**REAR AXLE**

**Rear Axle Assembly**

54. Remove and install the rear axle assembly as follows:

a. **Removal.** Remove the axle assembly as follows:

(1) Remove the spare wheel.
(2) Remove the nut and bolt securing the transverse link to the chassis bracket.
(3) Remove the nuts and bolts securing the lower ends of the shock absorbers to the axle.
(4) Remove the nuts and bolts securing the lower ends of the springs to the axles.
(5) Remove the U-bolts and nuts securing the two stabiliser bar brackets to the axle.
(6) Unhook the lower end of the automatic load-depending brake (ALB) valve pull rod from the torque tube.
(7) Release the line clamp and disconnect the brake line, parking brake line, vent line, differential lock line and the brake wear indicator cable (Figure 58).

![Figure 58 Rear Axle Connections](image)

(8) Drain the oil from the centre axle housing.
(9) Disconnect the vent line to the rubber gaiter.
(10) Remove the clamp (Figure 59, Item 1) securing the rubber gaiter around the torque ball housing and slide back the gaiter.
Figure 59  Torque Ball Assembly – Rear Axle

(11) Remove the casing bolts (Figure 59, Item 7) securing the torque ball housing to the main transmission.

(12) Support the torque tube with a suitable jack.

(13) Fit suitable lifting slings to the rear lifting points and lift the rear of the vehicle.

(14) Remove the front torque ball shell halves (Figure 59, Items 5).

(15) Remove the flange bolts (Figure 59, Item 3) securing the propeller shaft flange to the main transmission.

(16) Manually release the parking brakes in accordance with EMEI Vehicle G 603.

(17) Lift the truck until the springs are clear of the axle and withdraw the axle assembly.

(18) Place the truck on suitable stands.

(19) Draw back the torque ball casing (Figure 59, Item 2) and remove the rear torque ball shell halves (Figure 59, Item 6) from the housing.

b.  Installation. Install the axle assembly as follows:

(1) Clean and check all parts (replace any worn or damaged parts).

(2) Carefully deburr the torque ball housing and torque ball shell halves.

(3) Coat the rear and front torque ball shell halves with grease XG-276 and fit them into the torque ball housing.

NOTE

To ensure the correct torque setting on the torque ball, shims (Figure 60) are fitted between the torque ball housing and the main transmission (Figure 59, Item 4). The flange (Table 1, Serial 13) is used to measure the torque setting.
Figure 60  Torque Ball Shims – Rear Axle

(4) Fit the flange (Table 1, Item 13) to the torque ball housing and tighten the securing bolts to 60 N.m (Figure 61).

Figure 61  Adjusting the Torque Ball Housing – Rear Axle

(5) Measure the force on the extension tube with a spring balance.

(6) If the force on the extension tube is below 200 N, insert shims. If the force is above 300 N, remove shims. Repeat the procedure until the force on the extension tube is between 200 N and 300 N.

(7) Remove the flange from the torque ball housing.

(8) Lift the rear of the truck and move the axle assembly into position.

(9) Use the bolts (Figure 59, Item 3) to fasten the propeller shaft flange to the main transmission.

(10) Tighten the bolts to 100 N.m.

(11) Use the bolts (Figure 59, Item 7) to fasten the torque ball housing with the shims to the main transmission.

(12) Tighten the bolts to 60 N.m.

(13) Slide the rubber gaiter against the torque ball housing.

(14) Secure it with the clamp (Figure 59, Item 1).

(15) Connect the vent line to the rubber gaiter.
(16) Connect the brake line, parking brake line, differential lock line, vent line and brake wear indicator cable (if fitted) (Figure 58).

(17) Fit the two stabiliser bar brackets to the axle.

(18) Fit the springs to the axle assembly.

(19) Tighten the bolts to 300 N.m.

(20) Fit the shock absorbers to the axle assembly.

(21) Tighten the bolts to 400 N.m.

(22) Fit the transverse link to the bracket.

(23) Tighten the bolt to 300 N.m.

(24) Attach and secure the ALB valve pull rod at the torque tube.

(25) Fill the centre axle housing with 2.5 litres of oil OEP-220.

(26) Fill the wheel hubs with 0.6 litres of oil OEP-220 each.

(27) Bleed the brake system (Ref EMEI Vehicle G 603).

(28) Fit the spare wheel.

(29) Road test the truck.

Rear Propeller Shaft and Torque Tube

59. Remove and install the propeller shaft and torque tube as follows (Figure 62):

![Figure 62 Rear Axle Assembly]

**Figure 62 Rear Axle Assembly**

a. **Removal.** Remove the propeller shaft and torque tube as follows:

(1) Clamp the axle assembly on a suitable stand.

(2) Remove the four bolts securing the axle struts to the torque tube.
(3) Disconnect the brake lines, differential lock line and vent lines (Figure 63).

![Figure 63 Rear Axle Connections](image)

(4) Remove the worm drive clamps from the torque tube.

(5) Remove the bolts securing the torque tube to the axle assembly.

(6) Remove the propeller shaft and torque tube.

(7) Keep the plastic end cover on the propeller shaft.

b. Installation. Install the propeller shaft and torque tube as follows:

(1) Coat the torque ball arm housing and bearing shell with grease XG-276.

(2) Coat the torque tube flange with sealing compound Terostat 56 (Daimler part number 001.989.58.20).

(3) Fit the torque tube to the axle assembly.

(4) Tighten the bolts to 200 N.m.

(5) Coat the axle strut securing bolts with Loctite 241.

(6) Fit the axle struts to the torque tube.

(7) Tighten the bolts to 350 N.m.

(8) Connect the brake lines, differential lock line and vent lines.

(9) Fit the worm drive clamps around the torque tube.

(10) Clean the inner splines of the propeller shaft.

(11) Fill the cavity behind the profile inside the propeller shaft with 50 grams of grease XG-274.

(12) Fit the propeller shaft with the plastic end cover into the torque tube.

Rear Torque Tube Partial Removal and Installation

55. When required to access drive line components without needing to fully remove an axle assembly or transmission from the vehicle, partially remove and install the rear torque tube in accordance with EMEI Vehicle G 619-25.

**BRAKE SYSTEM**

Replacement

56. The brake system components replaceable at Medium Grade Repair are as follows:

a. the air compressor;

b. the parking brake valve;

c. the engine brake valve;
d. the pressure regulating valve;
e. the pressure reducing valves;
f. the non-return valve;
g. the brake master cylinder;
h. the spring-loaded pneumatic master cylinder;
i. the four-circuit protection valve;
j. the fording circuit control valve;
k. the pressure switches;
l. the differential pressure switch;
m. the ALB valve; and
n. the trailer brake stretch valve.

Air Compressor

57. The air compressor can be replaced as a separate unit with the engine fitted in the truck. Remove and install the air compressor as follows:

a. **Removal.** Remove the air compressor as follows:
   (1) Open the drain valves on the bottom of the compressed air receivers and exhaust all air from the system.
   (2) Remove the bonnet, brush guard and grille in accordance with EMEI Vehicle G 603.
   (3) Remove the drive belt from the air compressor in accordance with EMEI Vehicle G 603.
   (4) Remove the banjo bolts and disconnect the oil feed and return lines from the air compressor.
   (5) Discard the sealing washers from the banjo bolts.
   (6) Disconnect the air intake line from the air compressor. Unscrew the tube nut and disconnect the compressed air delivery line (Figure 64).

![Figure 64 Air Compressor Lines](image)

(7) Remove the stiffening arm from the base flange on the air compressor (Figure 65).
(8) Detach the compressed air delivery line from the stiffening arm (Figure 65).
(9) Remove the stiffening arm from the bracket that supports the tensioning bolt for the generator drive belt (Figure 65).
Remove the bolts and nuts securing the air compressor to the mounting bracket on the front engine bearer.

Remove the air compressor from the truck.

Clamp the air compressor in a vice.

Lock the drive pulley to prevent it from turning.

Remove the centre bolt from the drive pulley and crankshaft.

Detach the drive pulley from the air compressor crankshaft.

Clean and inspect the air compressor mounting bracket, the drive pulley and centre bolt (replace as required).

b. Installation. Install the air compressor as follows:

Clamp the air compressor in a vice.

Lock the drive pulley to prevent it from turning.

Fit the drive pulley to the air compressor crankshaft.

Install the centre bolt.

Tighten the centre bolt to 90 ±10 N.m.

Position the air compressor on the mounting bracket so that the bolt holes are aligned.

Install and hand tighten the securing bolts and nuts.

Fit the stiffening arm to the base flange on the air compressor cylinder head and tighten the securing bolts.

Attach the compressed air delivery line to the stiffening arm and tighten the securing clamp.

Attach the stiffening arm to the bracket that supports the tensioning bolt for the generator drive belt and hand tighten the bolts (Figure 65).

Connect the compressed air delivery line to the air compressor and tighten the tube nut (Figure 64).

Connect the air intake line to the air compressor and tighten the worm drive clamp (Figure 64).
(13) Using new sealing washers on the banjo bolts, connect the oil feed and return lines to the air compressor.

(14) Fit and correctly tension the generator drive belt in accordance with EMEI Vehicle G 603.

(15) Tighten the air compressor mounting bolts and nuts to 22 N.m.

(16) Tighten the securing bolts on the stiffening arm and bracket that supports the tensioning bolt for the generator drive belt.

(17) Start and run the engine until the air pressure has built up to within the correct operating range (check the system for any leaks and repair as necessary).

(18) Fit the bonnet, grille and brush guard in accordance with EMEI Vehicle G 603.

(19) Test drive the truck.

Parking Brake Valve

64. Remove and install the parking brake valve as follows (Figure 66):

Figure 66 Parking Brake Valve

a. **Removal.** Remove the parking brake valve as follows:

(1) Raise and secure the cab in accordance with EMEI Vehicle G 603.

(2) Drain the air from the three compressed air receivers.

(3) Disconnect the vent line (Item 3).

(4) Label the four lines.

(5) Remove the three banjo bolts (Item 2) and remove the air lines.

(6) Support the brake valve assembly and remove the two securing bolts (Item 1).

(7) Remove the brake valve assembly.
(8) Remove the securing pin (Item 6) and detach the lever mechanism (Item 5) from the brake valve.

b. **Installation.** Install the parking brake valve as follows:
   
   (1) Fit the lever mechanism to a new brake valve and insert the securing pin.
   (2) Fit the brake valve assembly.
   (3) Insert and tighten the securing bolts.

   **NOTE**

   Ensure that the lines are connected to the correct ports.
   
   (4) Fit the air lines.
   (5) Insert and tighten the banjo bolts.
   (6) Fit the vent line.
   (7) Run the engine until the pressure in the compressed air receivers is at the operating level.
   (8) Check for leaks (rectify as necessary).
   (9) Check the operation of the parking brake valve (Para 77).

**Engine Brake Valve**

65. Remove and install the engine brake valve as follows (Figure 67):

   ![Engine Brake Valve Diagram]

   **Figure 67** Engine Brake Valve

a. **Removal.** Remove the engine brake valve as follows:

   (1) Raise and secure the cab in accordance with EMEI Vehicle G 603.
   (2) Drain the air from the three compressed air receivers.
   (3) Remove the two banjo bolts (Item 2).
   (4) Support the brake valve and remove the securing nut (Item 1).
   (5) Remove the brake valve.

b. **Installation.** Install the engine brake valve as follows:

   (1) Fit a new brake valve and secure it with the nut (Item 1).
   (2) Connect the air lines using the banjo bolts (Item 2).
(3) Lower and secure the cab in accordance with EMEI Vehicle G 603.
(4) Run the engine until the pressure in the compressed air receivers is at the operating level.
(5) Check for air leaks (rectify as necessary).
(6) Check the operation of the engine brake valve.

Pressure Regulating Valve

66. Remove and install the pressure regulating valve as follows (Figure 68):

![Figure 68 Pressure Regulating Valve](image)

a. **Removal.** Remove the pressure regulating valve as follows:
   (1) Drain the air from the three compressed air receivers.
   (2) Disconnect the input line (Item 3) and output line (Item 1) from the pressure regulating valve.
   (3) Remove the locknuts (Item 2) and securing bolts (Item 4).
   (4) Remove the valve.

b. **Installation.** Install the pressure regulating valve as follows:
   (1) Fit a new pressure regulating valve.
   (2) Insert and tighten the locknuts and bolts.
   (3) Connect the input and output lines.
   (4) Run the engine.
   (5) Check for leaks (rectify as necessary).
   (6) Check on the dual-pressure gauge in the cab that the pressure in the compressed air receivers builds up to the correct operating level (17.5 bar to 18 bar).
   (7) Test drive the truck.

Pressure Reducing Valves

67. There are three types of pressure reducing valve fitted to the truck. The replacement procedures are as follows:

a. **Single-pressure Reducing Valve (Brake Circuit 2).** Replace the single-pressure reducing valve (Brake Circuit 2) as follows (Figure 69):
(1) Drain the air from the three compressed air receivers.
(2) Disconnect the two lines from the T-piece (Item 1) on the pressure reducing valve.
(3) Unscrew and remove the T-piece.
(4) Unscrew and remove the pressure reducing valve from the connector (Item 2) to the compressed air receiver.
(5) Screw a new pressure reducing valve onto the connector.
(6) Fit the T-piece to the new valve.
(7) Connect the two lines to the T-piece.
(8) Run the engine until the pressure in the compressed air receivers is at operating level.
(9) Check for leaks (rectify as necessary).
(10) Check the operation of the pressure reducing valve (Para 77).

b. **Dual-pressure Reducing Valve (Brake Circuit 1).** Replace the dual-pressure reducing valve (Brake Circuit 1) as follows (Figure 70):

(1) Drain the air from the three compressed air receivers.
(2) Disconnect the control line (Item 1) from the top of the pressure reducing valve.
(3) Disconnect the two lines from the T-piece (Item 2) on the pressure reducing valve.
(4) Unscrew and remove the T-piece.
(5) Unscrew and remove the pressure reducing valve from the connector (Item 3) to the compressed air receiver.
(6) Screw a new pressure reducing valve onto the connector.
(7) Fit the T-piece to the new valve.

(8) Connect the two lines to the T-piece.

(9) Connect the control line to the top of the valve.

(10) Run the engine until the pressure in the compressed air receivers is at operating level.

(11) Check for air leaks (rectify as necessary).

(12) Check the operation of the pressure reducing valve (Para 77).

**c. Single-pressure Reducing Valve (Fording Circuit).** Replace the single-pressure reducing valve (fording circuit) as follows (Figure 71):

![Figure 71 Single-pressure Reducing Valve (Fording Circuit)]

(1) Select two-wheel drive.

(2) Drain the air from the three compressed air receivers.

(3) Remove the banjo bolt (Item 3) from the valve.

(4) Remove the banjo bolt (Item 1) from the valve.

(5) Remove the securing nuts and bolts (Item 2).

(6) Remove the valve.

(7) Fit a new valve.

(8) Insert and tighten the securing nuts and bolts.

(9) Fit the banjo bolt (Item 1) through the two banjo unions.

(10) Insert the banjo bolt into the valve and tighten the bolt.

(11) Fit the banjo bolt (Item 3) through the banjo union.

(12) Insert the banjo bolt into the valve and tighten the bolt.

(13) Run the engine until the pressure in the compressed air receivers is at operating level.

(14) Check for air leaks (rectify as necessary).

(15) Check the operation of the pressure reducing valve (Para 77).
Non-return Valve

68. Remove and install the non-return valve as follows (Figure 72):

![Figure 72 Non-return Valve](image)

- **Removal.** Remove the non-return valve as follows:
  1. Remove the spare wheel.
  2. Drain the air from the three compressed air receivers.
  3. Disconnect the two lines from the T-piece (Item 3).
  4. Remove the T-piece.
  5. Disconnect the input line (Item 1) from the valve.
  6. Note the direction of the flow arrow on the valve.
  7. Unscrew the securing nut (Item 2) and remove the valve.

- **Installation.** Install the non-return valve as follows:
  1. Install a new valve with the flow arrow in the correct direction.
  2. Fit and tighten the securing nut.
  3. Connect the input line to the valve.
  4. Fit the T-piece to the valve.
  5. Connect the two lines to the T-piece.
  6. Run the engine until the pressure in the compressed air receivers reaches the operating level.
  7. Check for air leaks (rectify as necessary).
  8. Chock the truck wheels.
  9. Apply and release the parking brake and check that the spring-loaded parking brake cylinders operate correctly.
  10. Drain the air from the two main compressed air cylinders.
  11. Apply and release the parking brake and check that the spring-loaded parking brake cylinders operate correctly.
  12. Fit the spare wheel.

Brake Master Cylinder

69. Remove and install the brake master cylinder as follows (Figure 73):

- **Removal.** Remove the brake master cylinder as follows:
  1. Disconnect the output lines (Items 1 and 2) from the master cylinder.
  2. Seal the end of the lines.
  3. Remove the securing bolts (Item 6).
NOTE
Drain the hydraulic oil into a suitable container.

4 Remove the master cylinder.

Figure 73  Brake Master Cylinder

b. Installation. Install the brake master cylinder as follows:

1 Fit a new master cylinder.
2 Insert and tighten the securing bolts.
3 Connect the output lines.
4 Fill the master cylinder reservoirs.
5 Bleed the brake system in accordance with EMEI Vehicle G 603.
6 Test drive the truck.
7 Check for leaks (rectify where necessary).

Spring-loaded Pneumatic Master Cylinder

70. Remove and install the spring-loaded pneumatic master cylinder as follows (Figure 73):

a. Removal. Remove the spring-loaded pneumatic master cylinder as follows:

1 Remove the brake master cylinder (Para 69).
2 Remove the securing nut and bolt from the hydraulic test points (Item 4).
3 Disconnect the master cylinder vent line.
4 Remove the input line T-pieces from the rear of the booster assembly.
5 Remove the securing bolts (Item 5).
6 Remove the pneumatic master cylinder.

b. Installation. Install the spring-loaded pneumatic master cylinder as follows:

1 Fit a new spring-loaded pneumatic master cylinder.
2 Install and tighten the bolts (Item 5).
3 Fit the input line T-pieces to the rear of the pneumatic master cylinder.
4 Connect the master cylinder vent line.
5 Fit the securing bolt through the hydraulic test points.
6 Fit and tighten the nut.
7 Fit the brake master cylinder (Para 69).
8 Test drive the truck.
9 Check for leaks (rectify as required).
Four-circuit Protection Valve

71. Remove and install the four-circuit protection valve as follows (Figure 74):

![Four-circuit Protection Valve](image)

**Figure 74  Four-circuit Protection Valve**

a. **Removal.** Remove the valve as follows:

1. Drain the three compressed air receivers.
2. Remove the banjo bolts (Item 2).
3. Disconnect the lines (Items 1 and 3).
4. Disconnect the input line (Item 6).
5. Remove the securing nut (Item 5).
6. Remove the valve.
7. Remove the mounting union (Item 4) from the valve.

**NOTE**
Retain the mounting union for use during the installation of the new valve.

b. **Installation.** Install the valve as follows:

1. Fit the mounting union (Item 4) to the valve.
2. Install the new valve.
3. Fit and tighten the securing nut.
4. Connect the input line (Item 6).
5. Connect the lines (Items 1 and 3).
6. Fit the banjo bolts through the banjo unions and connect the remaining lines.
7. Run the engine until the pressure in the compressed air receivers is at the operating level.
8. Check the operation of the four-circuit protection valve (Para 77).
Fording Circuit Control Valve

72. Remove and install the fording circuit control valve as follows (Figure 75):

![Figure 75 Fording Circuit Control Valve](image)

**a. Removal.** Remove the fording circuit control valve as follows:

1. Select two-wheel drive.
2. Drain the three compressed air receivers.
3. Raise the cab in accordance with EMEI Vehicle G 603.
4. Remove the banjo bolts (Items 1 and 5).
5. Disconnect the line (Item 6).
6. Remove the securing nut and bolt (Item 2).
7. Unscrew the mounting union (Item 3).
8. Remove the valve.

**b. Installation.** Install the fording circuit control valve as follows:

1. Fit a new valve using the mounting union.
2. Fit and tighten the securing nut and bolt.
3. Connect the line (Item 6).
4. Fit the banjo bolts through the banjo unions and connect the remaining lines.
5. Lower the cab in accordance with EMEI Vehicle G 603.
6. Run the engine until the pressure in the compressed air receivers is at operating level.
7. Check for leaks (rectify as necessary).
8. Check the operation of the control valve (Para 77).

Pressure Switches

73. There are four pressure switches fitted to the truck in the following circuits:

a. engine brake;

b. park brake;
c. differential lock; and
d. four-wheel drive.

To replace the switches, first check that the particular circuit is vented, disconnect the cable and unscrew and replace the pressure switch.

**Differential Pressure Switch**

74. Remove and install the differential pressure switch as follows (Figure 76):

![Figure 76 Differential Pressure Switch](image)

- **a. Removal.** Remove the differential pressure switch as follows:
  1. Disconnect the cable (Item 1) from the switch.
  2. Disconnect the four lines and seal the ends of the lines.
  3. Remove the securing nut and bolt (Item 2).
  4. Remove the switch.

- **b. Installation.** Install the differential pressure switch as follows:
  1. Install a new switch.
  2. Fit and tighten the securing nut and bolt.
  3. Connect the four lines to the switch.
  4. Connect the cable to the switch.
  5. Bleed the brake system in accordance with EMEI Vehicle G 603.

**ALB Valve**

75. Remove, install and adjust the ALB valve as follows (Figure 77):

![Figure 77 ALB Valve](image)
a. **Removal.** Remove the ALB valve as follows:
   
   (1) Detach the operating linkage at the torque tube (Item 6).
   (2) Detach the spring from the valve (Item 4).
   (3) Remove the banjo bolt (Item 1) and seal the double banjo union.
   (4) Disconnect the two lines (Item 2) and seal the ends of the lines.
   (5) Remove the two bolts securing the valve to the mounting bracket.
   (6) Remove the valve.

b. **Installation.** Install the ALB valve as follows:
   
   (1) Install a new valve.
   (2) Fit and tighten the securing bolts.
   (3) Connect the two lines.
   (4) Insert the banjo bolt into the double banjo union and fit the double banjo union to the valve.
   (5) Attach the spring to the valve.
   (6) Attach the operating linkage at the torque tube.
   (7) Bleed the brake system in accordance with EMEI Vehicle G 603 and the ALB valve through the bleed point (Item 5).

c. **Adjustment.** Adjust the ALB valve as follows:
   
   (1) Detach the operating linkage at the torque tube.
   (2) Connect pressure gauges to the test points before and after the ALB valve.

   **NOTE**

   The test points are located above the pneumatic master cylinder.

   (3) Slowly depress the brake pedal.

   (4) Both pressure gauges should rise evenly to a maximum setting of between 26 bar and 30 bar.

   **NOTE**

   At this level the pressure in the modulated circuit stops rising.

   (5) If necessary, adjust the pressure to between 26 bar and 30 bar with the adjusting screw (Item 3).

   (6) Attach the operating linkage at the torque tube.

   (7) Determine the rear axle load by weighing the truck in the travel configuration.

   (8) Fully depress the brake pedal (up to approximately 140 bar).

   (9) The pressure in the modulated circuit must remain within the range specified on the calibration chart (Figure 78) within a tolerance of ±5 bar.

   (10) If necessary, adjust the modulated pressure by adjusting the length of the operating linkage.

   **NOTE**

   Shortening the linkage reduces the pressure. Lengthening the linkage increases the pressure.

   (11) Disconnect the pressure gauges.

   (12) Fit and hand tighten the test point caps.
Figure 78  ALB Valve Load Modulation

Trailer Brake Stretch Valve

76. Remove and install the stretch valve as follows (Figure 79):

a. Removal. Remove the stretch valve as follows:
   (1) Raise and secure the cab in accordance with EMEI Vehicle G 603.
   (2) Drain the air from the three compressed air receivers.
   (3) Disconnect the air lines from the valve.
   (4) Remove the securing nut (Item 1) from the through-floor stud (Item 2).
   (5) Remove the valve.
   (6) Remove and retain the through-floor stud from the valve.

b. Installation. Install the stretch valve as follows:
   (1) Fit the through-floor stud to the replacement valve.
   (2) Fit the valve into position and secure it with the nut.
   (3) Connect the air lines to the valve.
   (4) Lower and secure the cab in accordance with EMEI Vehicle G 603.
   (5) Run the engine until the pressure in the compressed air receivers is at operating level.
   (6) Check for leaks (rectify as necessary).
   (7) Check the operation of the stretch valve.
Testing

77. To carry out the tests on the brake system two pressure gauges, dummy trailer connections and various pressure gauge input adapters are required.

**WARNING**

Chock the truck during any test which requires the release of the park brakes.

Regulated Pressure

78. Check that the pressure of circuits 1 and 2 on the dual-pressure gauge in the cab is between 17.5 bar and 18 bar.

Four-circuit Protection Valve

79. Drop the pressure in either circuit 1 or circuit 2 to zero by draining the appropriate compressed air receiver. Check that a pressure of at least 4.5 bar is maintained in the other circuit. The pressure may be checked on the dual pressure gauge in the cab.

Circuits 1 and 2 without a Trailer

80. Connect pressure gauges to the circuit 1 test point (outer test point) and the circuit 2 test point (inner test point). At maximum pressure circuit 1 reads 9.5 bar and circuit 2 reads 7.3 bar. Circuit 2 lags circuit 1 by approximately 0.5 bar.

Circuits 1 and 2 with a Trailer

81. Connect a pressure gauge to the circuit 1 test point (outer test point). Connect a pressure gauge to the trailer brake control coupling. Close the trailer brake supply line with a dummy coupling. The following readings should be obtained:

   a. At maximum brake pressure circuit 1 should read 7.3 bar and the trailer control line should read 7.3 bar.
   b. With the handbrake applied the trailer control line should read 6.8 bar.
   c. With the handbrake in the ‘TEST’ position the trailer control line should fall to zero.

Non-return Valve

82. Connect a pressure gauge to the test connection for the parking brake circuit. Fit dummy couplings to both the trailer lines. Drain the two main compressed air receivers. With a trailer connected, the pressure should read 7.3 bar. Without a trailer connected, the pressure should read 9.5 bar.

Trailer Protection Valve

83. Connect a pressure gauge to the trailer brake supply coupling. Leave the control coupling open. At maximum brake pressure the pressure in the supply lines should drop to 1.5 bar or less within 2 seconds.

Fording Pressurisation Circuit

84. Test the fording pressurisation circuit as follows:

   a. Disconnect the pressurisation line at the rear axle.
   b. Connect a pressure gauge in the pressurisation line at the back axle using a T-piece.
   c. Ensure that the regulated pressure is above 12 bar.
   d. Select four-wheel drive.
   e. Check that the pressure in the circuit is 0.35 bar (35 kPa). If necessary, adjust the regulating screw on the fording circuit pressure reducing valve to obtain the correct pressure.
   f. Select two-wheel drive.
g. The pressure should drop to zero.

h. Remove the pressure gauge and connect the pressurisation line to the rear axle.

SUSPENSION

Front and Rear Transverse Links

85. Remove and replace the front and rear transverse links as follows (Figure 80):

![Figure 80 Transverse Links](image)

**a. Removal.** Remove the transverse links as follows:

1. Use penetrating oil to lubricate the bolts in both ends of the transverse link.
2. Remove the locknut from the bolt that secures the transverse link to the chassis bracket.
3. Remove the bolt.
4. Discard the bolt and locknut.
5. Remove and discard the bolt that secures the transverse link in the bracket on the axle casing.
6. Remove the transverse link from the truck.
7. Clean and inspect the chassis bracket and the bracket on the axle casing.

**b. Installation.** Install the transverse links as follows:

1. Position the transverse link in the bracket on the axle casing so that the bolt holes are aligned.
2. Install the bolt and hand tighten it.
3. Position the transverse link in the chassis bracket so that the bolt holes are aligned.
4. Install the bolt and locknut and hand tighten it.
5. Tighten both centre bolts to 300 N.m.
Front Stabiliser Bar

86. Remove and install the front stabiliser bar as follows (Figure 81):

Figure 81  Front Stabiliser Bar

a. Removal. Remove the front stabiliser bar as follows:

(1) Raise and secure the cab in accordance with EMEI Vehicle G 603.
(2) Remove the spare wheel.
(3) Remove and discard the locknuts and thrust plates from the centre pins securing the stabiliser bar to the right-hand side and left-hand side swinging shackles.
(4) Drive the centre pins from the swinging shackles and stabiliser bar using a soft drift and hammer.
(5) Remove the bolts and nuts securing the fixed brackets to the left and right-hand side chassis rails.
(6) Detach the brackets from the chassis.
(7) Remove the stabiliser bar and brackets from the truck.
(8) Remove the circlips that secure the bushes in the brackets.
(9) Remove the bushes from the brackets.
(10) Remove the brackets from the stabiliser bar.
(11) Lever the bushes open and remove the bushes from the stabiliser bar.
(12) Discard the bushes.
(13) Clean and inspect all those parts to be used during installation.

b. Installation. Install the front stabiliser bar as follows:

(1) Coat the bracket bushes with rubber grease.
(2) Lever the bushes open and fit them to the stabiliser bar.
(3) Fit the brackets to the stabiliser bar.
(4) Press the bushes into the brackets so that they bed fully home.
(5) Fit the retaining circlips.
(6) Position the stabiliser bar so that the ends of the bar are aligned with the swinging shackles and raise the swinging shackles into position over the bar ends.
(7) Install the retaining pins, thrust plates and locknuts.
(8) Hand tighten the locknuts.
(9) Raise the stabiliser bar and at the same time move the brackets into position against the chassis rails so that the bolt holes are aligned.

(10) Install and tighten the retaining bolts and locknuts.

(11) Tighten the locknuts on the retaining pins in the swinging shackles.

(12) Fit the spare wheel.

(13) Lower and secure the cab in accordance with EMEI Vehicle G 603.

(14) Test drive the truck.

Rear Stabiliser Bar

87. Remove and install the rear stabiliser bar as follows (Figure 82):

![Figure 82 Rear Stabiliser Bar](image)

**Figure 82** Rear Stabiliser Bar

a. **Removal.** Remove the rear stabiliser bar as follows:

(1) Remove and discard the locknuts and thrust plates from the centre pins securing the stabiliser bar to the right and left-hand side swinging shackles.

(2) Drive the centre pins from the swinging shackles and stabiliser bar with a soft drift and hammer.

(3) Remove and discard the locknuts from the U-bolts securing the fixed brackets to the rear axle casing.

(4) Detach the brackets from the axle casing.

(5) Remove the stabiliser bar and brackets from the truck.

(6) Remove the circlips that secure the bushes in the brackets.

(7) Remove the bushes from the brackets.

(8) Remove the brackets from the stabiliser bar.

(9) Lever the bushes open and remove the bushes from the stabiliser bar.

(10) Discard the bushes.

(11) Clean and inspect all those parts to be used during installation.

b. **Installation.** Install the rear stabiliser bar as follows:

(1) Coat the bracket bushes with rubber grease.

(2) Lever the bushes open and fit them to the stabiliser bar.

(3) Fit the brackets to the stabiliser bar.

(4) Press the bushes into the brackets so that they bed fully home.

(5) Fit the retaining circlips.

(6) Position the fixed brackets on the axle casing so that the locating dowels slot into the centring holes in the brackets.
(7) Install the U-bolts around the axle casing and through the brackets.
(8) Fit and tighten the locknuts.
(9) Position the ends of the stabiliser bar in the clevis forks of the swinging shackles so that the pin holes are aligned.
(10) Install the retaining pins, thrust plates and locknuts.
(11) Tighten the locknuts.
(12) Test drive the truck.

Swinging Shackles

88. Remove and install the front and rear swinging shackles as follows (Figure 83):

![Figure 83  Swinging Shackles](image)

a. **Removal.** Remove the swinging shackles as follows:
   (1) For ease of access when replacing the front swinging shackles, raise and secure the cab in accordance with EMEI Vehicle G 603.
   (2) Remove and discard the locknut and thrust plate from the centre pin securing the stabiliser bar to the swinging shackle.
   (3) Drive the centre pin from the swinging shackle and bar with a soft drift and hammer.
   (4) Move the shackle clear of the stabiliser bar.
   (5) For the front swinging shackles proceed as follows:
      (a) Remove the circlip from the lower centre pin.
      (b) Drive the centre pin from the mounting bracket and shackle with a soft drift and hammer.
      (c) Remove the shackle from the truck.
   (6) For the rear swinging shackles proceed as follows:
      (a) Remove the centre bolt and thrust plate securing the shackle to the mounting bracket on the chassis rail.
      (b) Pull the shackle off the mounting bracket.
(c) Remove and discard the spacer ring.

(7) Clean and inspect the mounting brackets (replace if necessary).

b. Installation. Install the swinging shackles as follows:

(1) For the rear swinging shackles proceed as follows:
  (a) Fit the spacer ring over the bar on the mounting bracket
  (b) Fit the swinging shackle to the mounting bracket.
  (c) Fit the thrust plate and centre bolt.
  (d) Tighten the centre bolt.

(2) For the front swinging shackles proceed as follows:
  (a) Install the swinging shackle into the mounting bracket so that the pin holes are aligned.
  (b) Install the centre pins.
  (c) Fit the retaining circlips to the centre pins.

(3) Move the swinging shackles into position over the ends of the stabiliser bar.

(4) Install the retaining pins, thrust plates and locknuts.

(5) Tighten the locknuts.

(6) Lower and secure the cab if required in accordance with EMEI Vehicle G 603.

(7) Test drive the truck.

Front Springs

89. Remove and install the front springs as follows (Figure 84):

a. Removal. Remove the front springs as follows:

(1) Raise and secure the cab in accordance with EMEI Vehicle G 603.

(2) Remove the lower centre bolts and nuts securing the shock absorbers to the brackets on the axle casing.

(3) Detach the shock absorbers from the axle casing and fully compress them.

(4) Remove the centre bolt and nut securing the front transverse link to the bracket on the chassis rail.

(5) Detach the transverse link from the bracket.

(6) Remove the locknuts from the lower centre pins that secure the swinging shackles to their respective brackets on the axle casing.

(7) Remove the centre pins and detach the swinging shackles from the brackets.

(8) Remove the locknut from the centre bolt securing the retaining plate and main spring to the lower spring bracket on the axle casing.

(9) Rotate the plate anticlockwise until the lip on the retaining plate is clear of the lowest coil of the main spring.

(10) Move a block and tackle into position above the truck.

(11) Attach the chain tackle to the two lifting eyes on the front of the chassis.

(12) Raise the truck until there is about 200 mm clearance between the base of the main spring and the lower spring bracket on the axle casing.
Place heavy duty axle stands beneath the chassis rails as additional supports and a safety measure.

(13) Remove the lower retaining plate.
(14) Remove the centre bolt and nut securing the main spring and rubber spring assembly to the upper spring bracket.
(15) Remove the spring and components from the truck.
(16) Clean and inspect the spring brackets and all parts to be used during installation.
b. **Installation.** Install the front springs as follows:

1. Position the retaining plate on the lower spring bracket on the axle casing.
2. Insert the centre bolt through the retaining plate and bracket.
3. Fit the locknut to the centre bolt and tighten two to three turns.
4. Insert the centre bolt through the spring sleeve.
5. Insert the centre bolt in the rubber spring and fit the spacing collar over the centre bolt against the rubber spring.
6. Fit the retaining plate over the centre bolt against the spacing collar.
7. Hold this sub-assembly together and fit it inside the main spring and then centre the entire assembly on the retaining plate and centre bolt.
8. Lift the assembly into position against the upper spring bracket.
9. Insert the centre bolt through the hole in the spring bracket.
10. Fit the locknut to the centre bolt.
11. Tighten the locknut to 300 N.m.
12. Remove the axle stands from beneath the truck and slowly lower the truck until the main springs are resting on the lower spring brackets.
13. Rotate the retaining plate in a clockwise direction until the lip on the retaining plate locks over the lowest coil of the main spring.
14. Tighten the centre bolt and nut to 300 N.m.
15. Detach the chain tackle from the lifting eyes and remove the tackle from the truck.
16. Fit the swinging shackles into their respective mounting brackets on the axle casing.
17. Align the pin holes and install the centre pins.
18. Fit the locknuts to the centre pins.
19. Tighten the locknuts.
20. Attach the transverse link to the bracket on the chassis rail.
21. Install the centre bolt and nut.
22. Tighten the nut to 300 N.m.
23. Extend the front shock absorbers so that the lower eyes fit into the mounting bracket on the axle casing.
25. Install the centre bolt and nut.
26. Tighten the nut to 400 N.m.
27. Lower and secure the cab in accordance with EMEI Vehicle G 603.
28. Test drive the truck.

**Rear Springs**

**90.** Remove and install the rear springs as follows (Figure 85):

a. **Removal.** Remove the rear springs as follows:

1. If the vehicle is fitted with a canopy, remove and store the canopy and canopy frame.
2. Remove the two rectangular plates from the floor of the cargo tray.
3. Remove the rear shock absorbers in accordance with EMEI Vehicle G 603.
(4) Remove the centre bolt and nut securing the rear transverse link to the bracket on the chassis rail.

(5) Detach the transverse link from the bracket.

(6) Remove the locknuts from the U-bolts that secure the fixed brackets to the axle casing.

---

Figure 85  Rear Spring Assembly

1. Retaining bolt  
2. Upper spring bracket  
3. Main spring retaining plate  
4. Helper spring retaining plate  
5. Washer  
6. Retaining nut  
7. Main spring  
8. Helper spring  
9. Retaining bolt  
10. Lower retaining plate  
11. Washer  
12. Retaining nut  
13. Lower spring bracket  
14. Axle casing
NOTE

Do not remove the brackets from the stabiliser bar.

(7) Remove the U-bolts and detach the brackets from the axle casing.
(8) Detach the ALB valve linkage from the bracket on the torque tube (Figure 86).
(9) Remove the nut from the centre bolt securing the retaining plate and main spring to the lower spring bracket on the axle casing.
(10) Rotate the plate anticlockwise until the lip on the retaining plate is clear of the lowest coil of the main spring.
(11) Move a block and tackle into position above the truck.
(12) Feed the chain tackle through the two holes in the floor of the cargo tray and attach the tackle to the two lifting eyes on the rear of the chassis.

(13) Raise the truck until there is about 200 mm clearance between the base of the main spring and lower spring bracket on the axle casing.

---

Figure 86   ALB Valve Linkage

**WARNING**

*Place heavy duty axle stands beneath the chassis rails as additional supports and a safety measure.*

(14) Remove the lower retaining plate.
(15) Remove the centre bolt and nut securing the main spring, helper spring and retaining plates to the upper spring bracket.
(16) Remove the springs and components from the truck.
(17) Clean and inspect the spring brackets and all parts to be used during installation.

**b. Installation.** Install the rear springs as follows:

(1) Position the retaining plate on the lower spring bracket on the axle casing.
(2) Insert the centre bolt through the retaining plate and bracket.
(3) Fit the locknut to the centre bolt and tighten it two to three turns.
(4) Fit the retaining plate for the helper spring to the centre bolt.
(5) Place the helper spring over the centre bolt and retaining plate.
(6) Fit the retaining plate for the main spring to the centre bolt.
(7) Hold this subassembly together and fit it inside the main spring and then centre the entire assembly on the retaining plates and centre bolt.
(8) Lift the assembly into position against the upper spring bracket.
(9) Insert the centre bolt through the hole in the spring bracket.
(10) Fit the locknut to the centre bolt.
(11) Tighten the nut to 300 N.m.
(12) Remove the axle stands from beneath the truck and slowly lower the truck until the main springs are resting on the lower spring brackets.
(13) Rotate the retaining plate in a clockwise direction until the lip on the retaining plate locks over the lowest coil of the main spring.
(14) Tighten the centre bolt and locknut to 300 N.m.
(15) Detach the chain tackle from the lifting eyes and remove the tackle from the truck.
(16) Attach the ALB valve linkage to the bracket on the torque tube (Figure 86).
(17) Position the fixed brackets on the axle casing so that the locating dowels slot into the centring holes in the brackets.
(18) Install the U-bolts around the axle casing and through the brackets.
(19) Fit and tighten the locknuts.
(20) Attach the transverse link to the bracket on the chassis rail.
(21) Install the centre bolt and nut.
(22) Tighten the nut to 300 N.m.
(23) Fit the rear shock absorbers to the truck in accordance with EMEI Vehicle G 603.
(24) Fit the two rectangular plates to the floor of the cargo tray.
(25) Fit the canopy frame and canopy if necessary.
(26) Test drive the truck.

STEERING

Steering Box

91. Remove and install the steering box as follows:
   a. Removal. Remove the steering box as follows:
      (1) Park the vehicle so that the front wheels are in the straight ahead position.
      (2) Remove the brush guard, bonnet and grille in accordance with EMEI Vehicle G 603.
      (3) Drain the oil from steering box.
      (4) Disconnect the oil feed and return lines from the steering box and blank off the pipes to prevent dirt entering.
      (5) Discard the sealing washers from the banjo unions.
      (6) Remove the split pin and castellated nut from the taper shaft on the end of the drag-link.
      (7) Detach the end of the drag-link from the pitman arm using the drag-link remover (Table 1, Serial 10) (Figure 87).
      (8) Detach the lower portion of the rubber gaiter covering the steering shaft.
      (9) Remove the bolt and nut securing the lower steering shaft to the steering box worm shaft.
      (10) Detach the steering shaft.
Figure 87  Removing the Drag Link

(11) Remove the bolts securing the steering box to the chassis rail.

**NOTE**

Do not discard the conical spacers.

(12) Remove the steering box from the truck.

(13) Clamp the steering box in a vice.

(14) Remove the split pin and castellated nut securing the pitman arm to the steering box output shaft.

(15) Remove the pitman arm from the steering box using the puller (Table 1, Serial 15) (Figure 88).

**NOTE**

When removing the pitman arm in the field, the tapered joint should be soaked with a rust penetrating lubricant and the correct puller attached (Table 1, Serial 15) for its removal. In addition to this, the pitman arm can be warmed slightly and the boss of the pitman arm on the steering box struck on its radius using a copper hammer and solid drift as this will help release the pitman arm.

Figure 88  Removing the Pitman Arm

(16) Clean all parts that are to be used during installation and the area of the chassis rail from which the steering box was removed.

b. **Installation.** Install the steering box as follows:

(1) Clamp the steering box in a vice.
The mark on the pitman arm must point towards the mark on the steering shaft (Figure 89).

Figure 89  Locating the Pitman Arm

(2) Fit the pitman arm to the output shaft of the steering box, ensuring the marks are aligned.
(3) Fit a new castellated nut to the output shaft.
(4) Tighten the nut to 530 N.m.
(5) Install a new split-pin.
(6) Remove the steering box from the vice.
(7) Insert the retaining bolts for the steering box through the chassis rail.
(8) Fit the conical spacers over the bolts with the conical faces towards the chassis rail.
(9) Position the steering box so that the bolt holes align with the retaining bolts (do not dislodge the spacers).
(10) Screw the retaining bolts into the steering box by hand.
(11) Tighten the retaining bolts to 420 N.m.
(12) Centre the pitman arm.
(13) Attach the end of the drag-link to the pitman arm.
(14) Fit a new castellated nut to the end of the drag-link and hand tighten the nut.
(15) Pack the support ring (Figure 90, Item 1) with grease XG-276 so that the grease spaces (Figure 90, Item 4) are filled when the support ring is fitted.
(16) Position the support ring on the steering box.
(17) Attach the lower steering shaft to the steering box worm shaft.
(18) Check the position of the steering wheel in relation to the position of the front wheels (adjust if necessary).
The distance between the supporting ring and the steering box end cover must not exceed 8 mm. The distance between the end face of the universal joint and the supporting ring must not exceed 2 mm (Figure 90).

**NOTE**

Ensure that the retaining bolt slots into the annular groove around the worm shaft of the steering box.

1. Install the retaining bolt and nut that secures the lower steering shaft to the steering box worm shaft.
2. Tighten the nut and bolt to 64 N.m.
3. Secure the rubber gaiter in position on the steering shaft.
4. Release the clamp on the drag-link and adjust the drag-link to obtain 165 mm between the centre of the pitman arm and the outer edge of the chassis rail (Figure 51).
5. Tighten the clamp to between 87 N.m and 93 N.m.
6. Tighten the castellated nut securing the end of the drag-link to the pitman arm to 420 N.m.
7. Fit a new split-pin to the castellated nut.
8. Check the drag link and adjust if necessary in accordance with EMEI Vehicle G 603.
9. Fit new sealing washers to the banjo unions.
10. Connect the oil feed and return lines to the steering box and tighten the banjo bolts.
11. Fill the power steering system with OX-47 (Grade 10) oil (capacity 2.25 litres).
12. Attach a V-configuration chain tackle to the two lifting eyes on the front chassis of the truck and slowly raise the truck until the front wheels are just clear of the ground.
13. Start and run the engine at high idle.
14. Bleed the power steering system by turning the steering wheel from lock to lock several times until no air bubbles are observed in the oil in the steering pump reservoir.
(33) Stop the engine.

(34) Check the wheel lock stops and adjust if necessary (Para 102).

(35) Check the steering limiters and adjust if necessary (Para 103).

(36) Slowly lower the truck to the ground.

(37) Remove the chain tackle from the lifting eyes and from the truck.

(38) Fit the brush guard, bonnet and grille in accordance with EMEI Vehicle G 603.

(39) Test drive the truck.

Steering Pump

92. Remove and install the steering pump as follows (Figure 91):

   a. **Removal.** Remove the steering pump as follows:

   (1) Disconnect and blank off the oil feed and return lines from the steering pump.

   (2) Remove the drive belt (Figure 92, Item 2) from the drive pulley (Figure 92, Item 3) on the steering pump.

   (3) Remove the bolt (Figure 92, Item 4) and the locknut (Figure 92, Item 6) securing the steering pump and mounting bracket to the engine front bearer.

   (4) Remove the steering pump from the truck (if necessary a soft drift and hammer may be used).

   (5) Clamp the steering pump in a vice.

   (6) Remove the locknut (Figure 92, Item 1) securing the drive pulley to the pump rotor shaft.

   (7) Use a puller to remove the drive pulley.
(8) Remove the Woodruff key from the rotor shaft.

(9) Remove the retaining bolts (Figure 92, Item 9) securing the mounting bracket to the flange on the steering pump.

(10) Remove the mounting bracket from the steering pump.

(11) Clean all parts to be used during the installation and that portion of the engine bearer from which the steering pump was removed.

b. **Installation.** Install the steering pump as follows:

(1) Fit the mounting bracket to the steering pump.

(2) Install and tighten the retaining bolts.

(3) Clamp the drive pulley in a vice.

(4) Fit the Woodruff key to the pump rotor shaft.

(5) Fit the drive pulley to the pump rotor shaft.

(6) Fit a new locknut to the rotor shaft and tighten the locknut.

(7) Position the steering pump against the engine front bearer so that the bolt holes are aligned.

(8) Install and tighten the retaining bolt and nut.

(9) Fit and adjust the drive belt in accordance with EMEI Vehicle G 603.

(10) Connect the oil feed and return lines to the steering pump.

(11) Fill the power steering system with 2.25 litres of OX-47 (Grade 10) oil.

(12) Bleed the power steering system ((Para 91.b(32)).

(13) Test drive the truck.

**Steering Pump Reservoir**

93. Remove and install the steering pump reservoir as follows (Figure 93):

![Figure 93 Steering Pump Reservoir](image)

**Figure 93** Steering Pump Reservoir

a. **Removal.** Remove the steering pump reservoir as follows:

(1) Remove the bonnet from the truck in accordance with EMEI Vehicle G 603.

(2) Loosen the worm-drive clamps and disconnect the oil feed and return lines from the reservoir.
(3) Drain the oil from the reservoir.
(4) Blank off the oil lines.
(5) Disconnect the timing case vent line from the lid of the reservoir.

**NOTE**

The reservoir is mounted in a circular mounting bracket bolted to the front inner fender. Two bolts and nuts clamp the bracket around the reservoir to secure it in place.

(6) Loosen the bolts and nuts sufficiently to allow the reservoir to be removed.
(7) Remove the reservoir from the truck.
(8) Clean the mounting bracket and the front inner fender.

b. **Installation.** Install the steering pump reservoir as follows:

(1) Fit the reservoir into the mounting bracket.
(2) Tighten the two retaining bolts and nuts to secure the reservoir in place.
(3) Connect the timing case vent line to the lid of the reservoir.
(4) Connect the oil feed and return lines to the reservoir and tighten the worm-drive clamps.
(5) Fit a new oil filter in the reservoir.
(6) Fill the power steering system with 2.25 litres of OX-47 (Grade 10) oil.

**NOTE**

With the engine running, the oil level in the reservoir must be at the upper mark on the dipstick. With the engine stopped, the oil level must be 1 to 2 cm above the upper mark on the dipstick.

(7) Check the oil level on the dipstick.
(8) Bleed the power steering system ((Para 91.b(32)).
(9) Fit and secure the bonnet in accordance with EMEI Vehicle G 603.
(10) Test drive the truck.

**Steering Box Repair**

94. The repair procedures for the steering box components are listed in functional groups as follows (Figure 94):

a. the sector shaft; and
b. the valve spool.
Do not dismantle or attempt to repair the wormshaft (Item 33) or piston (Item 5).

A strict standard must be applied when inspecting and repairing steering box components. In cases of doubt, the components in question shall always be replaced.

When repairing the steering system, the teflon sealing rings and O rings involved shall always be replaced. If any bearings are worn or damaged in any way, they must be replaced.

As the valve spool is a lapped fit in the steering box housing, it is not possible to fit a replacement valve spool. A new steering box housing and valve spool must be obtained if the valve spool is scored or damaged in any way. The valve spool must only be removed for cleaning purposes.
Sector Shaft Repair

95. Repair the sector shaft as follows:
   a. Clamp the steering box in a vice.
   b. Centre the steering box components.
   c. Hold the adjusting bolt (Item 34) to prevent it from turning and remove the check nut (Item 45) from the adjusting bolt (Figure 95).
   d. Remove the bolts (Item 46) securing the sector shaft (Item 33) and cover (Item 44) to the steering box housing.
   e. Use a soft-headed hammer to drive the sector shaft and end cover from the steering box.
   f. Remove the end cover from the sector shaft by rotating the adjusting bolt clockwise until the end cover can be detached.
   g. Remove the needle bearing (Item 40) from the end cover.
   h. Remove the teflon sealing ring (Item 41) and nitrile O ring (Item 43) from inside the end cover.
   i. Remove the O rings from the end cover flange (Item 39) and oil channels (Item 42).
   j. Discard all the sealing rings and O rings.
   k. Remove the outer circlip (Item 38) from the adjusting bolt in the end of the sector shaft.
   l. Remove the inner circlip (Item 36) from the groove in the shaft.
   m. Remove the adjusting bolt, thrust ring (Item 37) and spacer (Item 35) from the sector shaft.
   n. Remove the needle bearing retaining circlip (Item 19) from inside the sector shaft housing.
   o. Remove the sector shaft sealing ring (Item 32).
   p. Use a puller to remove the needle bearing from the sector shaft housing (Figure 96).
q. Clean the steering box and all parts to be used during assembly and installation.

r. Replace all worn or damaged components and all sealing rings and O rings.

s. Fit the adjusting bolt into the end of the sector shaft.

t. Install the spacer and thrust ring.


CAUTION

Ensure that both circlips are correctly seated.

u. Fit the inner circlip to the groove in the sector shaft.

v. Fit the outer circlip to the adjusting bolt.


NOTE
To assist in installing the teflon sealing ring, soak the sealing ring for a short time in a mixture of warm water and a few drops of oil.

w. Install the nitrile O ring first, then install the teflon sealing ring in the groove inside the sector shaft end cover.


CAUTION

Ensure that the O rings are not twisted in the grooves.

x. Fit the O rings to the end cover flange and the oil channels.

y. Install the needle bearing into the sector shaft end cover and press it fully home.

z. Fit the end cover to the sector shaft and adjusting bolt.

aa. Rotate the adjusting bolt anticlockwise to pull the end cover against the sector shaft.


CAUTION

Ensure that the O rings are not twisted in the grooves.


NOTE
To assist in installing the teflon sealing ring, soak the sealing ring for a short time in a mixture of warm water and a few drops of oil.

bb. Install the nitrile O ring first, then install the teflon sealing ring in the groove inside the sector shaft housing.

cc. Fit the needle bearing into the sector shaft housing.

dd. Coat the sector shaft sealing ring with rubber grease.

ee. Install the sealing ring in the shaft housing.


CAUTION

Ensure the circlip seats correctly in the groove.

ff. Fit the retaining circlip.

gg. Centre the working piston in the steering box.
hh. Check that the centring marks on the end cover and worm (input) shaft are aligned. (adjust if necessary until correctly centred).

![CAUTION]

*Do not damage the teflon sealing rings and O rings.*

ii. Carefully insert the sector shaft into the housing.

**NOTE**

If difficulty is experienced, drive the sector shaft fully home by lightly tapping the adjusting bolt with a soft-headed hammer.

jj. Install the end cover retaining bolts.

kk. Tighten them to between 60 N.m and 65 N.m.

**Valve Spool**

96. Repair the valve spool as follows:

a. Remove the circlip (Item 12) that retains the valve spool cover (Item 11) in position in the housing.

b. Carefully lever the cover out of the housing.

c. Remove the O ring (Item 10) from the cover.

![CAUTION]

*Take great care when withdrawing the valve spool, as it is a lapped fit in the housing.*

d. Carefully withdraw the valve spool from the housing.

e. Clean and inspect the valve spool.

**NOTE**

If the helixes on the valve spool are scored or damaged in any way, a new steering box housing and valve spool must be obtained.

![CAUTION]

*Press the valve spool gently until it beds fully home in the housing.*

f. Install the valve spool in the housing.

![CAUTION]

*Ensure that the O ring is not twisted in the groove.*

g. Fit a new O ring to the valve spool cover.

h. Insert the cover into the housing and press it inwards until the circlip groove is clear.
Ensure that the circlip seats correctly in the groove.

   i. Install the retaining circlip.

Steering Pump Repair

97. The repair procedures for the steering pump are listed in functional groups as follows (Figure 97):

   a. the pumping elements;
   b. the drive shaft and bearings; and
   c. the flow limiting valve assembly.

---

Figure 97  Steering Pump
Pumping Elements

The procedure to repair the pumping elements is as follows:

a. Remove the hooked snap-ring (Item 24) that secures the end cover (Item 23) in position in the pump body.

b. Remove the end cover from the pump body.

c. Note the positioning of the O rings (Items 21 and 22) for later installation purposes and remove the O rings from the outer radial groove in the pump body.

**CAUTION**

Do not damage the spring attached to the pressure plate during removal.

d. Use pump pliers or a similar tool to withdraw the pressure plate (Item 19) from the pump body.

**CAUTION**

Ensure that the cam ring and rotor do not drop out of the pump and fall onto a hard surface.

e. Tilt the steering pump and shake it a few times to dislodge the cam ring and rotor (Item 16) and withdraw them from the pump body.

**NOTE**

If the face plate (Item 15) does not dislodge and come away with the cam ring and rotor, use long nosed pliers to withdraw the face plate from the pump.

f. Remove the locating dowel (Item 9) from the pump.

g. Note the positioning of the O rings (Items 17 and 18) for later installation purposes and remove the O rings from the inner radial groove in the pump body.

**CAUTION**

A strict standard must be applied when inspecting steering pump components. In cases of doubt the components must always be replaced.

h. Clean and inspect the pump and all components for wear or damage (replace worn or damaged components).

**CAUTION**

Fit the white nylon O ring first and then fit the black nitrile O ring.

Ensure that the O rings are not twisted in the groove.

i. Fit the two new O rings to the inner radial groove in the pump body.

j. Install the locating dowel in the pump.

k. Position the face plate in the pump so that the drilled hole is aligned with the locating dowel.

l. Press the face plate fully home in the pump.
The cam ring, rotor and rotor vanes must be replaced as matched components and not separately.

Ensure that the single small hole encompasses the locating dowel. The two larger holes are oil passages.

Ensure that the half arrow cast into the side of the cam ring points in the direction of rotation of the pump ie clockwise when viewed from the front of the truck.

m. Install the cam ring in the pump.

n. Fit the rotor to the drive shaft with the smooth machined surface towards the face plate.

o. Press the rotor fully home.

p. Install the rotor vanes into the slots in the rotor.

q. Install the pressure plate in the pump and press it fully home.

r. Fit the compression spring to the pressure plate.

s. Fit the two O rings to the outer radial groove in the pump body.

t. Fit the end cover to the pump with the recess facing inwards.

u. Press the end cover into the body bore until the hooked snap-ring can be fitted.

v. Fit the snap-ring to retain the end cover in position.

w. Rotate the pump shaft a few times by hand to check the free movement of the internal components.

Drive Shaft and Bearings

99. The procedure for repairing the drive shaft and bearings is as follows (Figure 97):

a. To gain access to the drive shaft and bearings for repair purposes, carry out the procedures detailed in Para 98 steps a. to g.

b. Remove the seal ring (Item 3) and the circlip (Item 4) from the drive shaft (Item 2).

c. Use a soft headed hammer to remove the drive shaft and ball bearing (Item 5) from the pump through the drive end.

d. Remove the retaining circlip (Item 6) from the drive shaft.

e. Remove the ball bearing from the drive shaft.

f. Knock the needle bearing (Item 7) out of the body.

g. Clean and inspect all components for wear or damage (replace worn or damaged components).

h. Lightly lubricate all replacement components with clean OX-47 (Grade 10) oil.

i. Apply a coating of grease XG-276 to the lips of the shaft sealing ring.
j. Fit the inner needle bearing into the pump (Figure 98).

![Figure 98 Fitting the Needle Bearing](image)

k. Press the needle bearing in until a distance of between 37.0 mm and 37.2 mm is obtained between the edge of the bearing and the end face of the pump drive end (Figure 99). Use a depth gauge or vernier to measure the distance.

![Figure 99 Measuring the Inner Needle Bearing Depth](image)

l. Press the ball bearing onto the drive shaft.

m. Fit the retaining circlip to the drive shaft.

n. Press the drive shaft and ball bearing into the pump until the ball bearing outer race butts fully home against the collar in the pump drive end.

o. Install the retaining circlip.

p. To complete the assembly of the pump carry out the procedures detailed in Para 98 steps h to w.

**Flow Limiting Valve Assembly**

100. The procedure for repairing the flow limiting valve assembly is as follows (Figure 97):

a. Remove the retaining plug (Item 14) from the housing.

b. Withdraw the limiting valve assembly (Items 11, 12 and 13) from the housing.

c. Clean and inspect the limiting valve housing.

d. Clean and inspect the valve assembly for wear or damage (replace the assembly if required).

**CAUTION**

Tolerance group numbers are stamped on the valve housing end face and on the valve piston body. These numbers must match exactly to ensure the correct operation of the pump (Figure 100).
e. Lightly lubricate the valve assembly and housing bore with OX-47 (Grade 10) oil.

The valve piston must not stick in the bore.

f. Install the valve piston (Item 11) in the housing.

g. Insert the valve spring (Item 12) into the housing so that it butts onto the collar on the piston.

h. Fit the sealing washer (Item 13) to the retaining plug.

i. Install and tighten the retaining plug.

Adjustments

101. The steering system components that can be adjusted are as follows:

a. wheel alignment in accordance with EMEI Vehicle G 603;

b. the steering lock; and

c. the steering limiters.

Steering Lock

102. Adjust the steering lock as follows:

a. Park the truck on a level horizontal surface with the front wheels resting on rotary plate scales which are graduated in degrees.

b. Set the front wheels to the straight ahead position.

c. Set the scale on the rotary plates to the 0° position.

d. Turn the steering to the full left lock position.

NOTE

The angle at full lock should read 40°.

e. Note the angle of the left front wheel on the plate scale.

f. Loosen the locknut on the wheel lock adjusting bolt.

g. Screw the adjusting bolt inwards or outwards against the wheel stop until the correct angle is obtained.

h. Tighten the locknut.

i. Turn the steering to the full right lock position.

j. Repeat the procedure given in steps d to h to obtain the correct angle of 40° for the right front wheel.

k. Test drive the truck.
Steering Limiters

103. Adjust the steering limiters as follows (Figure 101):

For safety reasons do not unscrew the limiting valves more than two-and-a-half turns out of the steering housing while the engine is running, as the valves are pressurised.

The complete valve may only be removed from the housing after the engine is stopped.

The adjusting range of the steering limiter extends from the point at which the limiting valves are screwed fully home to approximately two turns outwards. The steering limiter can be correctly set only if the straight ahead position of the front wheels coincides with the aligned centring marks on the worm shaft and the worm shaft end cover.

a. Move a block and tackle into position above the truck.

b. Attach a V-configuration chain tackle to the two lifting eyes on the front of the chassis.

c. Raise the front of the truck until the front wheels are just clear of the ground.

d. Place heavy duty axle stands beneath the truck.

e. Unscrew the securing bolt (Item 1).

f. Remove the locking plates (Item 2) from both limiting valves (Item 3).

g. Screw the valves into the steering housing as far as possible.

h. Remove the cap from the centre boss of the steering wheel.

i. Start and run the engine at fast idle speed (approximately 800 RPM.).

j. Turn the steering wheel to full left lock.

NOTE

The cast markings on the steering housing indicate the limiting valves to be adjusted for left and right limiting lock.

The following procedures require two people.

k. Unscrew the left limiting valve to between two and two and one half turns out of the steering housing.

l. Fit a spring scale torque wrench to the steering wheel centre nut.

m. Apply pressure to the torque wrench in a anticlockwise direction until a reading of 30 N.m is obtained on the scale.
n. Hold at this reading whilst the limiting valve is adjusted.
o. Slowly screw the limiting valve into the steering housing until the reading on the torque wrench scale starts to drop.
p. Stop turning the valve at this point.

NOTE
The limiting valve may be screwed in marginally further to align the valve with the locking plate.

q. Fit the locking plate over the limiting valve and lock it in position.
r. To adjust the right limiting lock, turn the steering wheel to full right lock and apply pressure to the torque wrench in a clockwise direction. Adjust the right limiting valve carrying out the procedures detailed in steps k to q.
s. After adjusting both limiting valves, lower the front of the truck and remove the chain tackle from the truck.
t. Fit the cap to the centre boss of the steering wheel.
u. Test drive the truck.

BODY

Cab Doors Replacement

104. Remove and install the cab doors as follows:

a. Removal. Remove the cab doors as follows:
   (1) Open the cab door.
   (2) Remove the snap-ring from the retaining pin in the door check arm.
   (3) Remove the retaining pin from the check arm.
   (4) Remove the plugs from the top of the upper and lower door hinges
   (5) Lubricate the hinge pins and hinges with machine oil or penetrating oil.

   NOTE
   Remove the pin from the lower door hinge first.
   (6) Remove the hinge pins from the door hinges using a pin drift and hammer.
   (7) Remove the door from the truck.
   (8) Clean the hinge brackets on the door pillars and the door rubbers and frame.

b. Installation. Install the cab door as follows:
   (1) Position the door so that the hinge brackets and the check-arm on the door are aligned with the brackets on the door pillar.
   (2) Install the hinge pin in the upper door hinge.
   (3) Install the hinge pin in the lower door hinge.
   (4) Drive the hinge pins fully home using a pin drift and hammer.
   (5) Install the retaining pin in the door check arm and pillar bracket.
   (6) Fit the snap-ring to the retaining pin.
   (7) Fit the plugs into the top of the upper and lower door hinges.
   (8) Check the alignment of the door in the door frame (adjust as necessary).
(9) Check the action of the door catch against the striker plate (adjust the position of the striker plate in relation to the door catch if necessary).

Repairs

105. Repairs to the truck body/panels are to be carried out using standard workshop practices.

WINCH

Winch Assembly Replacement

106. Remove and install the winch assembly as follows (Figure 102):

![Figure 102 Winch](image)

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

1. Remove the brushguard and the brushguard mounting brackets in accordance with EMEI Vehicle G 603.

   **WARNING**

   Use a block and tackle with a lifting capacity of at least 200 kg attached to a mobile gantry to raise and move the winch assembly from the truck.

2. Move the gantry with the block and tackle into position over the front of the truck and attach a wire rope or ropes to the winch assembly so that it does not drop to the ground when detached from the truck.

3. Take the weight of the winch on the sling ropes.

4. Remove the spring clips from the retaining pins on both sides of the winch assembly.

5. Remove the spring clip from the drive shaft in the winch housing.

6. Remove the retaining pins from the mounting brackets.

7. Pull the winch assembly off the winch drive shaft and mounting brackets.

8. Move the winch assembly clear of the truck and lower it to the ground.

9. Clean and inspect the winch drive shaft, mounting peg and mounting brackets.

10. Clean all parts to be used during installation.

b. **Installation.** Install the winch as follows:

1. Position the winch assembly against the truck so that the drive boss in the winch is aligned with the winch drive shaft and the hole for the mounting peg is aligned with the peg.

2. Manoeuvre the winch assembly onto and over the winch drive shaft.
(3) Push the winch assembly onto the drive shaft and mounting peg until the pin holes in the assembly align with the pin holes in the mounting brackets.

(4) Install the retaining pins.

(5) Install the spring clips to lock the pins in position.

(6) Remove the sling from the winch assembly and move the gantry away from the truck.

(7) Fit the brush guard mounting bracket and the brush guard to the truck in accordance with EMEI Vehicle G 603.

(8) Test the operation of the winch (rectify as necessary).

Winch Mounting Brackets Replacement

107. Remove and install the winch mounting brackets as follows:

   a. **Removal.** Remove the winch mounting brackets as follows:

      (1) Remove the winch assembly from the truck (Para 106).

      (2) Remove the nuts and bolts securing one of the mounting brackets to the chassis.

      (3) Remove the mounting bracket.

      (4) Remove the nuts and bolts securing the other mounting bracket to the chassis.

      (5) Remove the mounting bracket.

      (6) Clean and inspect the winch assembly and that area of the truck from which the winch and brackets were removed.

   b. **Installation.** Install the winch as follows:

      (1) Position one of the mounting brackets on the chassis.

      (2) Install and tighten the retaining bolts and nuts.

      (3) Position the other mounting bracket on the chassis.

      (4) Install and tighten the retaining bolts and nuts.

      (5) Lightly coat the winch drive shaft and peg on the left-hand side bracket with grease XG-274.

      (6) Fit the winch assembly to the truck (Para 106).