THE FRAME

GENERAL

This section has the description and repair procedures for the frame and connected parts. Included in this section are the frame, counterweight, hood, hydraulic and fuel tanks, radiator, exhaust system and cab assembly. Also included are the instructions for removal and installation of the engine.

DESCRIPTION

The frame is a one-piece weldment and has mounts for the counterweight, overhead guard, operator's module, engine and transmission, axles and other parts. The hydraulic tank and fuel tank are part of the frame.

REPAIRS

⚠ WARNING

The lift truck must be put on blocks for some types of maintenance and repair. The removal of the following assemblies will cause large changes in the center of gravity: mast, drive axle, engine and transmission, and the counterweight. When the lift truck is put on blocks, put additional blocks in the following positions to maintain stability:

a. **Before removing the mast and drive axle, put blocks under the counterweight so that the lift truck can not fall backward.**

b. **Before removing the counterweight, put blocks under the mast assembly so that the lift truck can not fall forward.**

The surface must be solid, even, and level when the lift truck is put on blocks. Make sure that any blocks used to support the lift truck are solid, one-piece units.

COUNTERWEIGHT

Removal (See FIGURE 1.)

⚠ WARNING

Make sure that the lifting device used has the correct lift capacity for the counterweight being removed. See TABLE 1.

1. If installed, remove the overhead exhaust pipe from the counterweight.

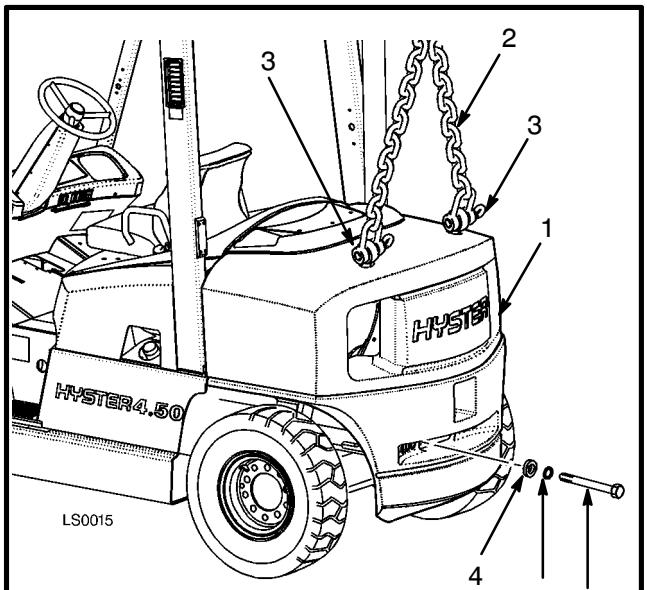
2. Remove cover between counterweight and hood. Remove tow pin.

3. Install two eyebolts into the counterweight lifting holes and attach a lifting device to the eyebolts.

⚠ CAUTION

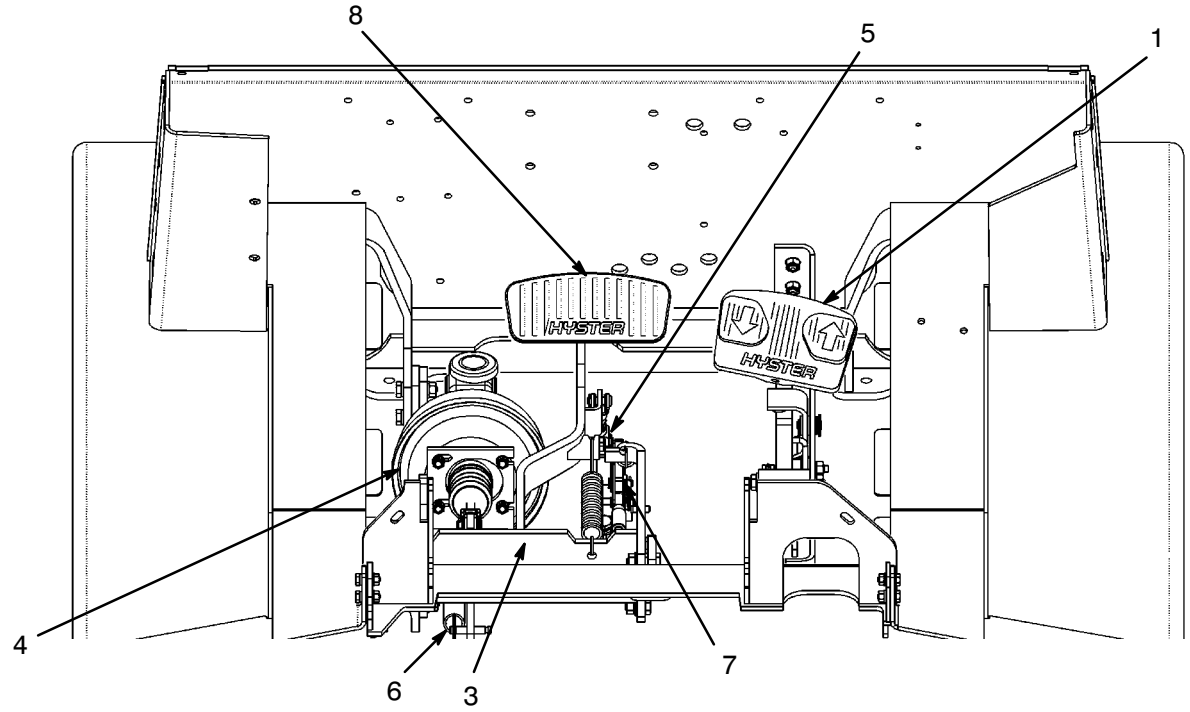
When lifting the counterweight from the lift truck, be careful not to bend the exhaust pipe.

4. Remove two capscrews, washers, and lockwashers. Remove counterweight from lift truck.



1. COUNTERWEIGHT
2. LIFTING DEVICE
3. LIFTING EYE
4. WASHER
5. LOCKWASHER
6. MOUNTING BOLT

FIGURE 1. COUNTERWEIGHT



1. MONOTROL® PEDAL
2. ACCELERATOR PEDAL
3. PEDAL BRACKET
4. BRAKE BOOSTER/MASTER CYLINDER ASSEMBLY
5. INCHING LINKAGE
6. RETURN SPRING
7. INCHING CRANK RETURN SPRING
8. INCH/BRAKE PEDAL

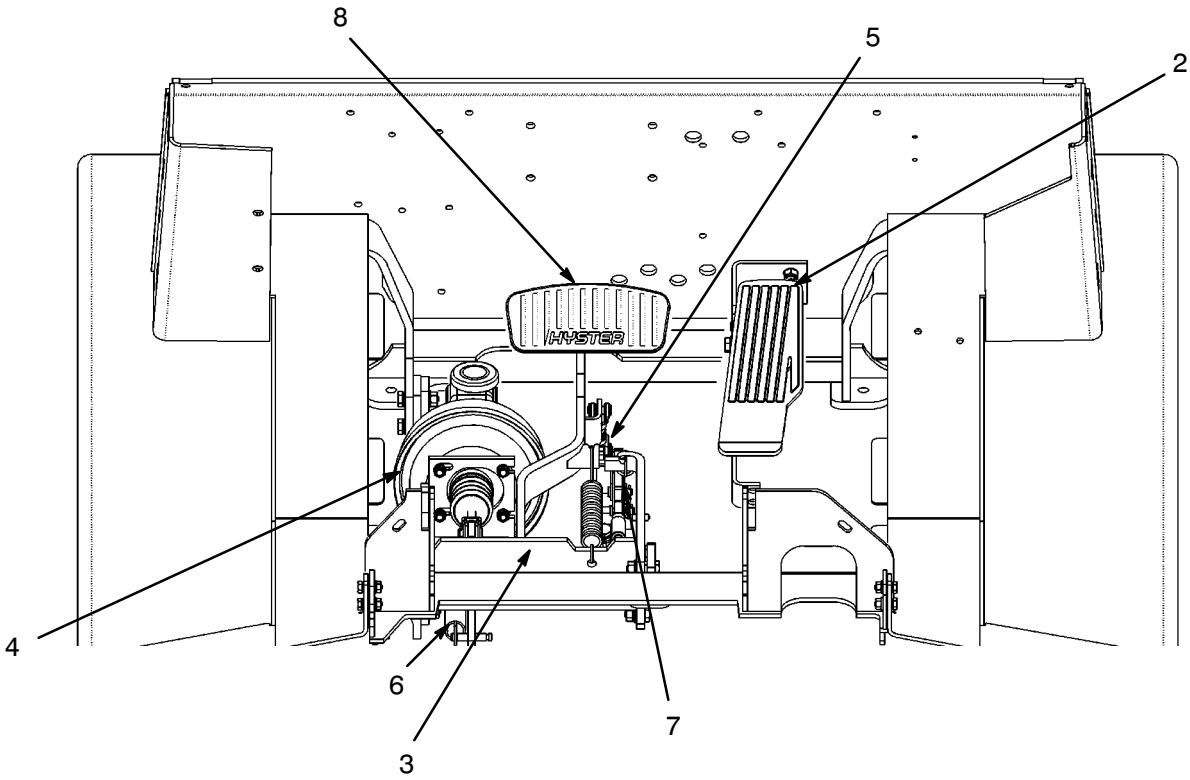
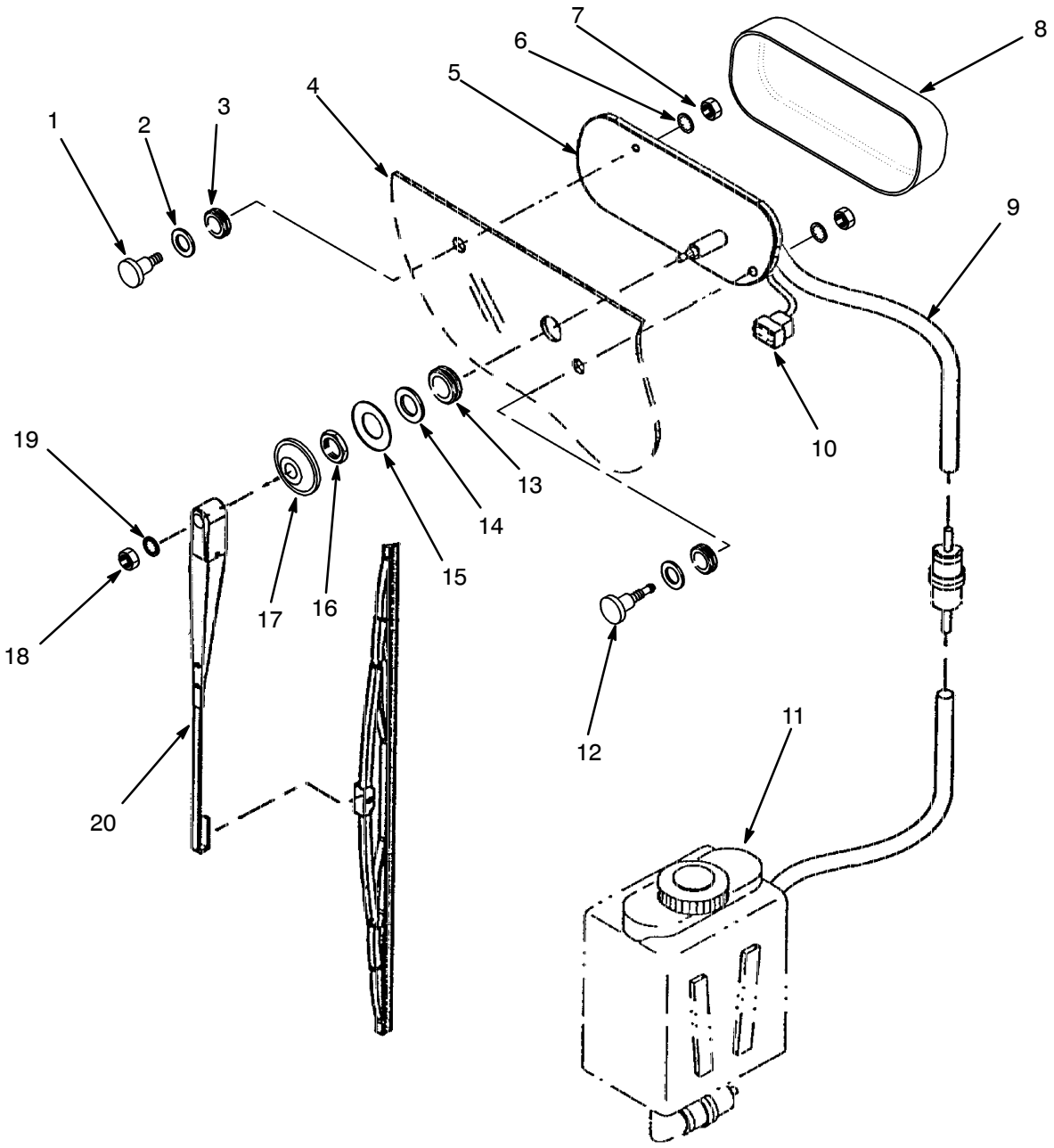


FIGURE 6. PEDAL ASSEMBLY



1. MOUNTING STUD
2. WASHER (2)
3. GROMMET (2)
4. GLASS
5. WIPER MOTOR
6. WASHER (2)
7. NUT (2)
8. COVER
9. WATER TUBE
10. CONNECTOR
11. RESERVOIR
12. SPRAY NOZZLE MOUNTING STUD
13. GROMMET
14. WASHER
15. RETAINER
16. NUT
17. HARDWARE COVER
18. NUT
19. WASHER
20. WIPER ARM

FIGURE 6. REAR WINDOW WIPER SYSTEM

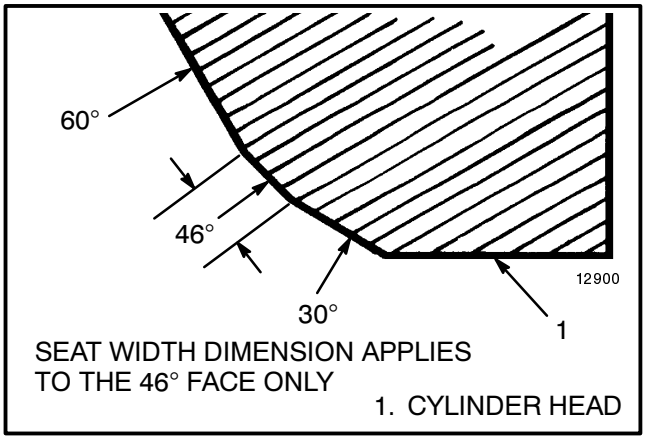


FIGURE 4. VALVE SEAT SPECIFICATIONS FOR INLET AND EXHAUST VALVES

The correct dimensions for the valve seat widths and valve/valve seat overlap are shown in FIGURE 5. The valve seat widths are the dimensions of the 46° face only. The valve/valve seat overlap is the distance from the edge of the seat to the outside edge of the valve.

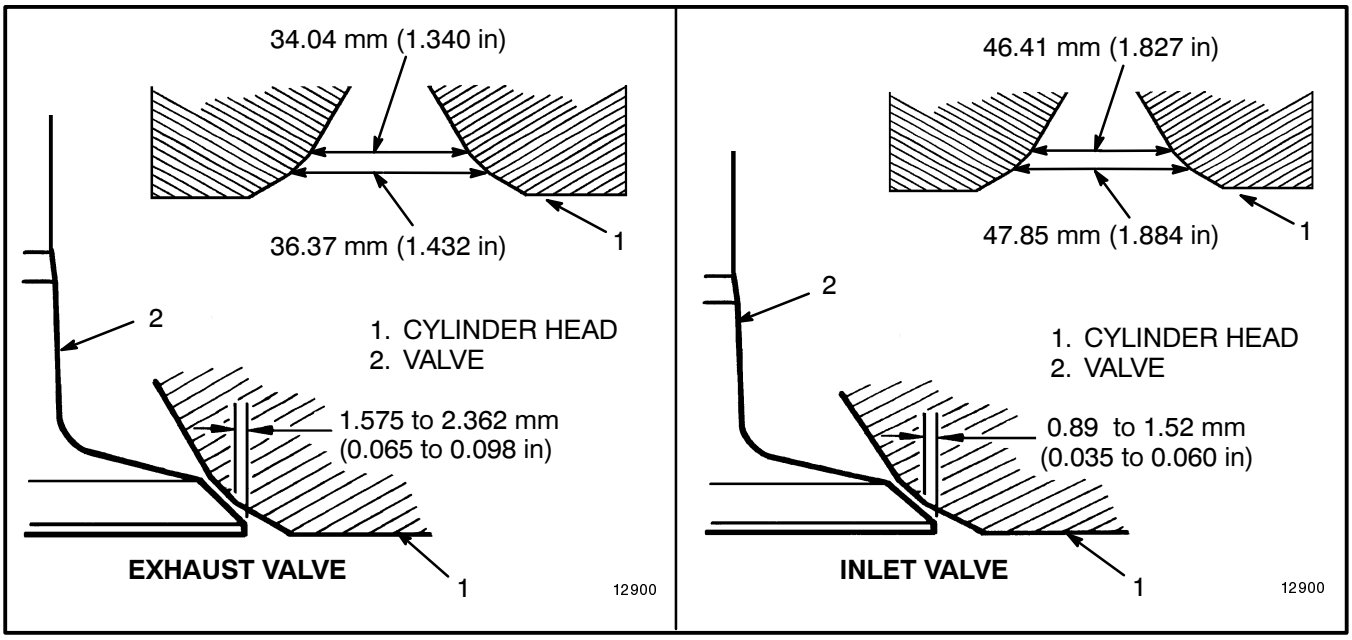


FIGURE 5. VALVE SEAT WIDTHS AND VALVE/VALVE SEAT OVERLAP

Valve Springs (See FIGURE 6.)

Measure the length of the valve springs. The correct length is 51.6 mm (2.03 in).

⚠ WARNING

Be careful when testing the valve springs. These springs can come loose with enough force to cause an injury. Always use equipment that was designed to test springs. Always wear eye and face protection while testing valve springs.

6. Use a special tool to remove the rear bearing.

Balance Shaft, Installation (See FIGURE 27. through FIGURE 29.)

1. Lubricate the rear bearing with new engine oil. Use a special tool to push the rear bearing into the block.

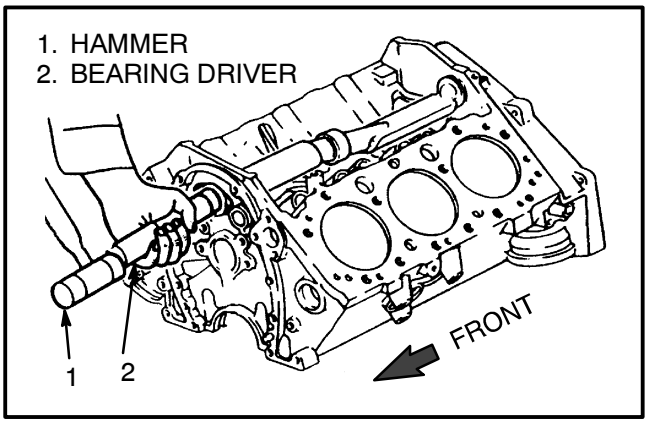


FIGURE 27. BALANCE SHAFT INSTALLATION

2. Lubricate the front bearing with new engine oil. Use a driver to install the balance shaft into the engine block.

3. Install the retainer for the balance shaft. Tighten the screws for the retainer to 14 Nm (125 lbf in).

4. Install the driven gear onto the balance shaft. Tighten the bolt to 20 Nm (178 lbf in) plus an additional 35 degrees of rotation. Rotate the balance shaft by hand to make sure there is clearance between the retainer and the shaft. If the balance shaft does not rotate freely, check that the retaining ring on the front bearing is in its seat.

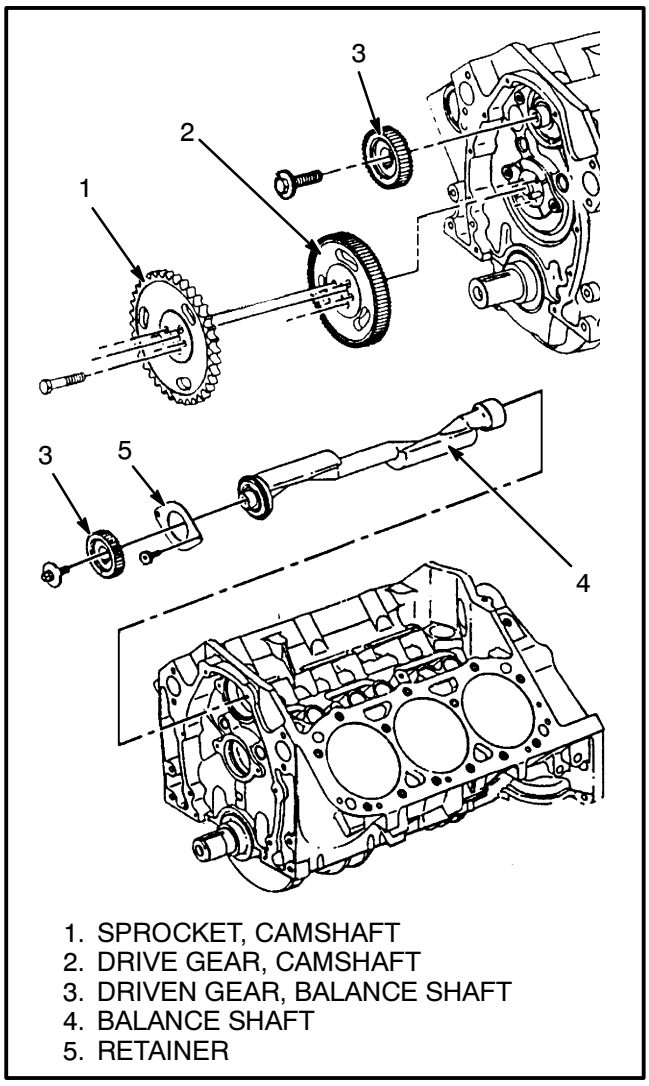


FIGURE 28. BALANCE SHAFT COMPONENTS

5. Temporarily install the drive gear on the camshaft. Turn the camshaft until the timing mark on the drive gear is straight up. Remove the drive gear and rotate the balance shaft until the mark on the driven gear is straight down. Install the drive gear on the camshaft. Make sure the timing marks are in the position shown in FIGURE 29.

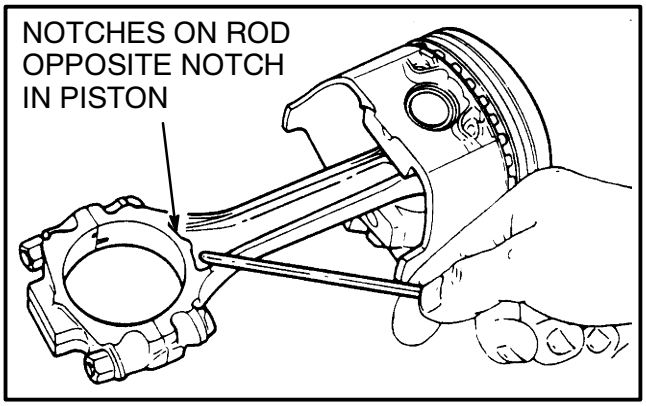


FIGURE 47. CONNECTING ROD IDENTIFICATION

1. Assemble the connecting rod to the piston. Make sure the orientation of the connecting rod and piston are correct as described in the NOTE above. Use a press to install the piston pin into the piston and connecting rod. Lubricate the piston pin with engine oil during installation.

2. Check the clearances of the piston rings as described in "Piston Rings". Install the piston rings on the piston as shown in FIGURE 48.

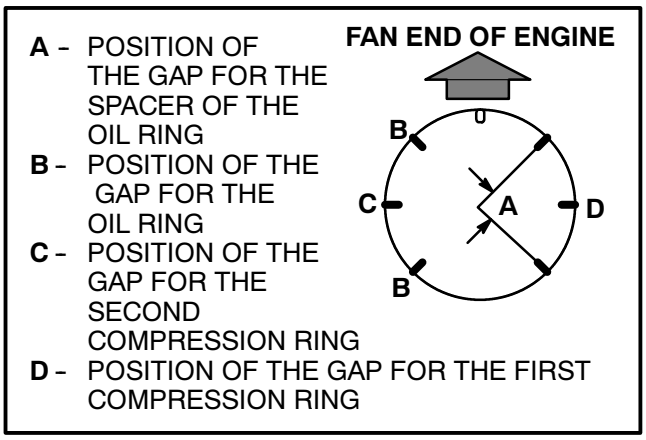


FIGURE 48. ARRANGEMENT OF THE PISTON RINGS ON THE PISTON

Piston And Connecting Rod Assemblies, Installation

1. Lubricate the assembly with engine oil during installation. Arrange the piston rings on the piston as shown in FIGURE 48. Install a ring compressor on the piston.

2. Make sure that the notch in the piston is toward the fan end of the engine. Install the piston and connecting rod assemblies in the cylinder bores.

3. Install the bearings and the caps for the connecting rods. Tighten the nuts. See the procedure in the paragraphs under "Connecting Rod Bearings, Replacement".

4. Check the side clearance of each connecting rod after the bearing cap is installed. See the procedure in the paragraphs under "Connecting Rod Bearings, Replacement".

5. Install the cylinder head as described in "Cylinder Head, Installation".

6. Install the oil pump and the oil sump.

FLYWHEEL AND FLYWHEEL HOUSING

Flywheel Repairs

1. Replace the ring gear (if applicable) on the flywheel. During removal or installation, do not heat the gear to more than 230°C (450°F).

2. During installation, push the ring gear fully against the flywheel.

3. The bearing in the flywheel can be replaced. Push the old bearing from the flywheel and push in a new bearing.

Flywheel, Installation

H3.50-5.00XL (H70-110XL), S3.50-5.50XL (S70-120XL), S6.00-7.00XL (S135-155XL)

NOTE: For model H3.50-5.50XM (H70-120XM) refer to **COOLING SYSTEM 700 SRM 740** for hydraulic pump drive.

When installing the flywheel on these units, refer to the section on the HYDRAULIC PUMP DRIVE ASSEMBLY.

H6.00-7.00XL (H135-155XL)

Make sure the dowel pin is installed in the crankshaft. Install the flywheel.

Units with a manual transmission: make sure the O-ring is installed between the flywheel and the crankshaft. Use a sealant (Hyster Part No. 246108) on the heads of the capscrews. Tighten the capscrews for the flywheel to 79 Nm (58 lbf ft).

Units with a powershift transmission: tighten the capscrews to 79 Nm (58 lbf ft).

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
There is noise inside the engine.	The main bearings are worn or damaged.	Install new main bearings or overhaul engine.
	The bearings for the connecting rods are worn or damaged.	Install new rod bearings or overhaul engine.
	The pistons or rings are worn or damaged.	Install new rings and piston or overhaul engine.
	The engine is too hot.	Check thermostat. Check cooling system (radiator. fan, drive belt, etc.). Clean and repair as required.
	Low oil pressure. Not enough oil in the engine.	Check oil level. Add oil to full mark on the dipstick. Check oil pressure. Repair oil pump. Overhaul engine.
	The flywheel is loose.	Tighten flywheel mounting bolts.
	There is a leak in the exhaust system.	Repair leak.
	A valve mechanism is damaged.	Repair or install new parts as required.
	The valves are not adjusted correctly.	Check and adjust valve clearance.
The engine makes noise during acceleration.	The spark plugs are dirty.	Clean spark plugs and reinstall.
	The spark plugs are the wrong type or heat range.	Install new spark plugs of correct type and heat range.
	The ignition timing is not correct.	Check and adjust ignition timing.
	The fuel is the wrong type or grade.	Drain fuel. Fill with correct fuel.
	There is too much carbon in the combustion chamber (pre-ignition).	Put truck in hard work cycle. Add engine cleaner to fuel. Do top engine overhaul.
	The engine is too hot.	Check thermostat. Check cooling system (radiator. fan, drive belt, etc.). Clean or repair as required.
	The fuel system is not adjusted correctly.	Adjust fuel system.

closed. Check the clearance of the valves of number 1 cylinder and adjust them as necessary.

2. Turn the crankshaft in the normal direction of rotation until the inlet valve of number 2 cylinder has just opened and the exhaust valve of the same cylinder has not fully closed. Check the valve clearances on number 3 cylinder and adjust them as necessary.

3. Turn the crankshaft in the normal direction of rotation until the inlet valve of number 1 cylinder has just opened and the exhaust valve of the same cylinder has not fully closed. Check the valve clearances on number 4 cylinder and adjust them as necessary.

4. Turn the crankshaft in the normal direction of rotation until the inlet valve of number 3 cylinder has just opened and the exhaust valve of the same cylinder has not fully closed. Check the valve clearances on number 2 cylinder and adjust them as necessary.

Six Cylinder Engines

1. Turn the crankshaft in the normal direction of rotation until the inlet valve of number 6 cylinder has just opened and the exhaust valve of the same cylinder has not fully closed. Check the clearance of the valves of number 1 cylinder and adjust them as necessary.

2. Turn the crankshaft in the normal direction of rotation until the inlet valve of number 2 cylinder has just opened and the exhaust valve of the same cylinder has not fully closed. Check the valve clearances on number 5 cylinder and adjust them as necessary.

3. Turn the crankshaft in the normal direction of rotation until the inlet valve of number 4 cylinder has just opened and the exhaust valve of the same cylinder has not fully closed. Check the valve clearances on number 3 cylinder and adjust them as necessary.

4. Turn the crankshaft in the normal direction of rotation until the inlet valve of number 1 cylinder has just opened and the exhaust valve of the same cylinder has not fully closed. Check the valve clearances on number 6 cylinder and adjust them as necessary.

5. Turn the crankshaft in the normal direction of rotation until the inlet valve of number 5 cylinder has just opened and the exhaust valve of the same cylinder has not fully closed. Check the valve clearances on number 2 cylinder and adjust them as necessary.

6. Turn the crankshaft in the normal direction of rotation until the inlet valve of number 3 cylinder has just opened and the exhaust valve of the same cylinder has not fully closed. Check the valve clearances on number 4 cylinder and adjust them as necessary.

VALVE SPRINGS

NOTE: This procedure is normally for changing the valve springs of a single cylinder while the cylinder head is still installed on the engine. If the valves and springs must be removed from the cylinder head for repairs, see the procedures under Valves And Valve Springs later in this section.

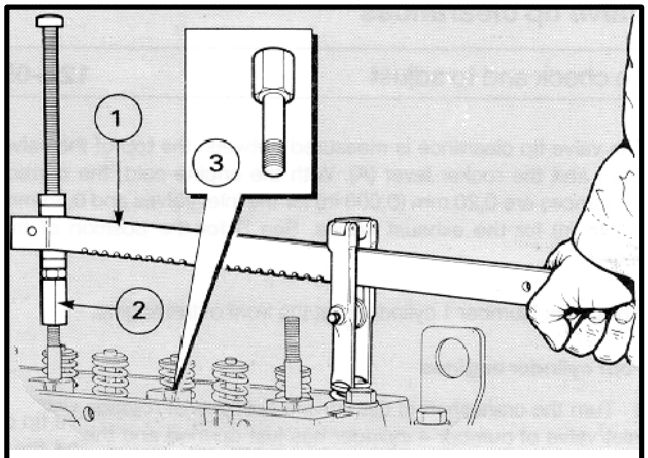
Special Tools: Valve spring compressor
Stud adapter
Setscrew adapter

1. Remove the valve cover.

2. Turn the crankshaft in the normal direction of rotation until the piston for the cylinder is at top dead center (TDC). The inlet valve will just open and the exhaust valve will not be fully closed when the cylinder is at TDC.

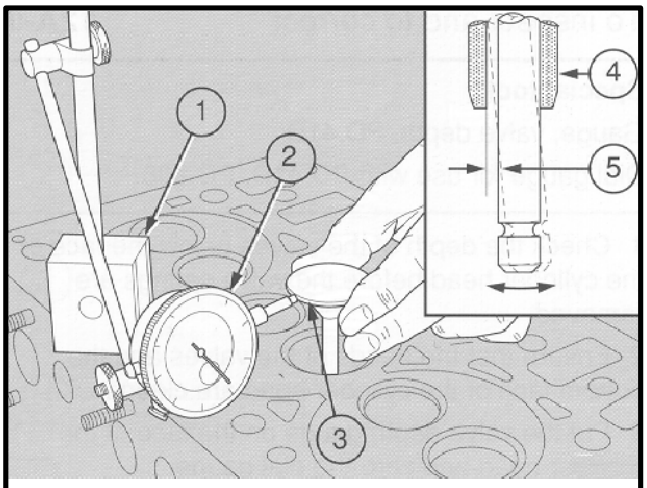
3. Remove the rocker arm assembly.

4. Install the spring compressor and the adapter. See FIGURE 11.



1. VALVE SPRING COMPRESSOR
2. STUD ADAPTER
3. SETSCREW ADAPTER

FIGURE 11. VALVE SPRING COMPRESSOR



1. MAGNETIC BASE
2. DIAL INDICATOR
3. VALVE HEAD
4. VALVE GUIDE
5. MAXIMUM CLEARANCE

FIGURE 32. CHECK THE VALVE GUIDES

Removal

Install the tool for removal and replacement and the adapter on the valve guide. Pull the valve guide from the cylinder head. See FIGURE 33.

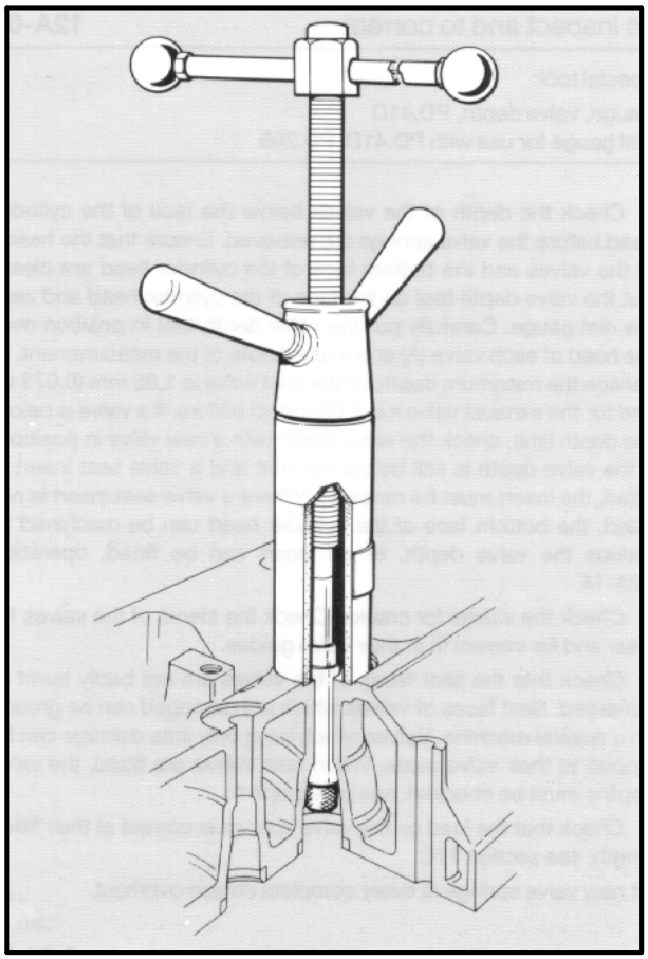


FIGURE 33. REMOVAL OF A VALVE GUIDE

Installation

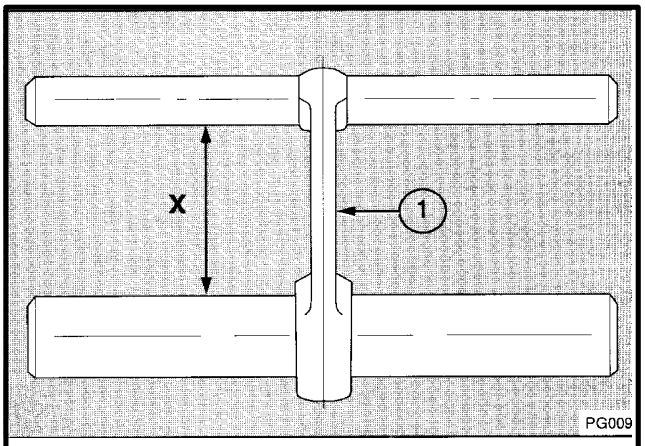
1. Make sure the bore in the cylinder head is clean.

2. Lubricate the outer surface of the new valve guide with engine oil.

3. Install the valve guide on the special tool. See FIGURE 34. Use the special tool to pull the valve guide into the cylinder head. When the valve guide is correctly installed, the valve guide will extend 14.85 to 15.15 mm (0.585 to 0.596 in) above the seat of the valve spring.

small end are square and parallel, see FIGURE 54. The length is checked with the big end bearing removed and the original small end bush fitted. the dimensions for each grade are listed in the table below.

Length Letter	Color Code	Length
F	Red	165.728 to 165.761 mm
G	Orange	165.682 to 165.715 mm
H	White	165.637 to 165.670 mm
J	Green	165.591 to 165.624 mm
K	Purple	165.545 to 165.578 mm
L	Blue	165.499 to 165.532 mm



1. CONNECTING ROD

FIGURE 55. POSITION OF ROD BEARINGS

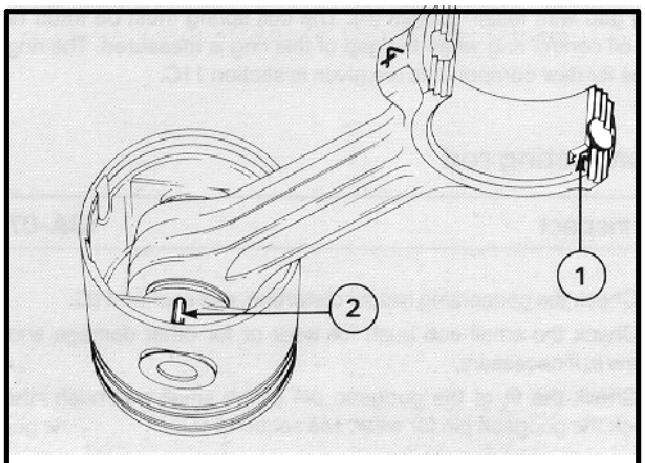
Installation

1. Make sure that the parts are clean. Lubricate the parts with engine oil as they are assembled.

2. Install a new snap ring into one of the grooves to hold the piston pin.

3. Turn the piston for access to install the connecting rod. Install the connecting rod in position in the piston. If the original piston is to installed again, make sure that the mark on the piston is aligned with the mark on the connecting rod as shown in FIGURE 53. Make sure that the piston and connecting rod are installed in the same cylinder again.

If a new piston or connecting rod is being installed, make sure that index slot in the connecting rod for the rod bearing is on the same side of the piston as the boss for the piston pin. See FIGURE 56.



1. INDEX SLOT FOR BEARING
2. IBOSS FOR PISTON PIN

FIGURE 56. ORIENTATION OF PISTON AND CONNECTING ROD

4. Install the piston pin to fasten the connecting rod to the piston. If the piston pin is tight, heat the piston to 40 to 50°C (100 to 120°F) to make installation of the piston pin easier.

5. Install the other snap ring to hold the piston pin in the piston.

6. Install the piston rings as described under Piston Rings, Installation.

PISTON COOLING JETS

Removal

Release the valve assembly and remove the piston cooling jet. The crankshaft has been removed in FIGURE 57. to more clearly show the piston cooling jet. The AR engines have only one cooling jet and installed in the number one cylinder.

Installation

1. Check that the ball assembly moves freely against the spring pressure in the valve assembly and that the jet tube is not damaged. Replace any damaged or worn parts.

are on the same side of the connecting rod as shown in FIGURE 42.

12. Connecting rods with nuts. Install and tighten the nuts evenly to a torque of 125 Nm (92 lbf ft). Make sure that the crankshaft turns freely.

Connecting rods with capscrews. Install and tighten the capscrews evenly to a torque of 155 Nm (114 lbf ft). Make sure that the crankshaft turns freely.

13. Install the oil pump, delivery pipe, and relief valve.

Loosely assemble the bracket of the suction pipe to the main bearing cap. Install a new gasket and fasten the flanges of the suction line to the oil pump. Make sure that the suction pipe is aligned correctly and tighten the capscrew that holds the bracket to the main bearing cap.

14. Install the rear oil seal housing. See Oil Seal.

15. Install the flywheel and the flywheel housing. See Flywheel, Installation.

16. Install the timing gears and the timing case. See Timing Gears And Timing Case, Installation.

17. Install the fuel injection pump. See Fuel Injection Pump, Installation.

18. Install the timing case cover. See Timing Case Cover, Installation.

19. Install the alternator and its mount bracket.

20. Install the crankshaft pulley. See Crankshaft Pulley.

21. Install the coolant pump, fan drive pulley and fan housing, drive belts, and the fan.

22. Install the oil sump. See Oil Sump, Installation.

23. Install the engine into the lift truck. See **THE FRAME** section and the **TRANSMISSION** section for the lift truck.

FLYWHEEL

The steel flywheel has a hardened steel starter ring. The starter ring has 126 teeth.

Removal

1. Remove two opposite capscrews from the flywheel and temporarily install two studs to help control the flywheel when the other capscrews are removed.

2. Remove the other capscrews that fasten the flywheel to the crankshaft. Remove the flywheel.

3. Check the flywheel and ring gear for damage.

Ring Gear (Replacement)

⚠ WARNING

Wear eye protection for this operation to prevent eye injury from metal chips. You will be using a hammer and chisel to break the ring gear.

Before the ring gear is removed, check the position of the chamfer on the teeth.

Use a hammer and chisel to break the ring gear. Make sure that you do not damage the flywheel.

The ring gear must be heated before it can be installed on the flywheel. Use an oven that has a temperature control. Make sure that the ring gear is not heated to more than 250°C (480°F).

Install the ring gear on the flywheel. Make sure that the chamfer on the teeth is in the correct direction.

Installation

1. Make sure the surfaces of the crankshaft and flywheel are clean so that the two parts will fit together correctly.

2. Install the flywheel over the guide studs. Install four capscrews. Remove the two studs and install the remainder of the capscrews. Tighten the capscrews in a cross pattern to 105 Nm (77 lbf ft).

3. Check the flywheel run-out with a dial test indicator. See FIGURE 76. This must be less than 0.30 mm (0.012 in) total indicator reading.

4. Check the alignment of the flywheel face. See FIGURE 77. The error in alignment must not be more than 0.003 mm (0.001 in) total indicator reading for every 25 mm (1.0 in) of the flywheel radius from the crankshaft axis to the indicator plunger. During this check, keep the crankshaft pressed toward the front to remove the effect of crankshaft end-float.

valves are closed when the crankshaft or the camshaft are turned.

1. Make sure that the woodruff key is installed correctly in the end of the camshaft.

2. Remove the idler gear. See Idler Gear Removal.

3. Install the camshaft gear on the shaft with the marked teeth toward the front and the keyway correctly aligned. Use a soft hammer to push the gear onto the camshaft. Make sure that the timing marks are aligned correctly as the gear teeth are engaged. See FIGURE 94.

4. Install the idler gear with the marked teeth correctly aligned. See Idler Gear Installation. If the camshaft has to be turned and a valve hits a piston, disengage the rocker assembly.

5. Install the capscrew and washer and tighten the capscrew to press the gear into position. Tighten the capscrew to 78 Nm (58 lbf ft).

6. If new gears have been installed, check the timing gear clearances as shown in FIGURE 88. The minimum clearances for all gears is 0.08 mm (0.003 in).

7. Install the timing case cover, coolant pump, crankshaft pulley, fan drive pulley, drive belts, and fan. See Timing Case Cover, Installation.

CRANKSHAFT GEAR

Removal

1. Remove the timing case cover. See Timing Case Cover, Removal.

2. Turn the crankshaft until the marked teeth of the crankshaft gear, the camshaft gear, and the gear for the fuel injection pump are aligned as shown in FIGURE 94. The marked teeth on the idler gear will not necessarily be aligned with the marked teeth of the other three gears because of the different speed of rotation of the idler gear.

⚠ CAUTION

Make sure that the crankshaft is not turned while the idler gear or the crankshaft gear is removed. A piston can hit and damage a valve.

3. Remove the idler gear See Idler Gear And Hub, Removal.

4. The crankcase gear is pressed onto the crankshaft. Sometimes a puller will remove the crankcase gear. Sometimes the gear fits so tightly on the crankshaft that the crankshaft must be removed from the engine so that the gear can be removed.

Installation

1. Put the crankshaft gear in a pan of hot oil. Make sure that the temperature can be controlled. **DO NOT** heat the crankshaft gear more than 180°C (226°F). Use boiling water if a container of hot oil and a temperature control is not available. **DO NOT** use an open flame to heat the gear.

2. Align the gear with the key on the crankshaft and with the timing marks on the gear away from the engine. Push the gear onto the crankshaft.

3. Install the idler gear. See Idler Gear, Installation.

4. Check the timing gear clearances as shown in FIGURE 88. The minimum clearances for all gears is 0.08 mm (0.003 in).

5. Install the timing case cover, coolant pump, crankshaft pulley, fan drive pulley, drive belts, and fan. See Timing Case Cover, Installation.

TIMING CASE

Removal

1. Remove the fan.

2. Remove the drive belts.

3. Remove the crankshaft pulley. See Crankshaft Pulley.

4. Remove the fan drive assembly. See Fan And Fan Drive, Removal.

5. Drain the coolant and remove the coolant pump. See Coolant Pump, Removal.

6. Remove the alternator and its mount bracket, and the front support plate.

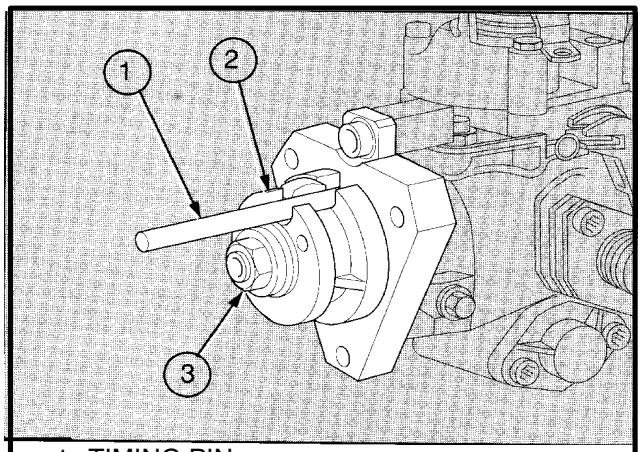
7. Remove the air compressor. See Air Compressor, Removal. Remove the compressor drive. See Air Compressor Drive, Disassembly.

8. Remove the timing case cover. See Timing Case Cover, Removal.

9. Turn the crankshaft until the marked teeth of the crankshaft gear, the camshaft gear, and the gear for the

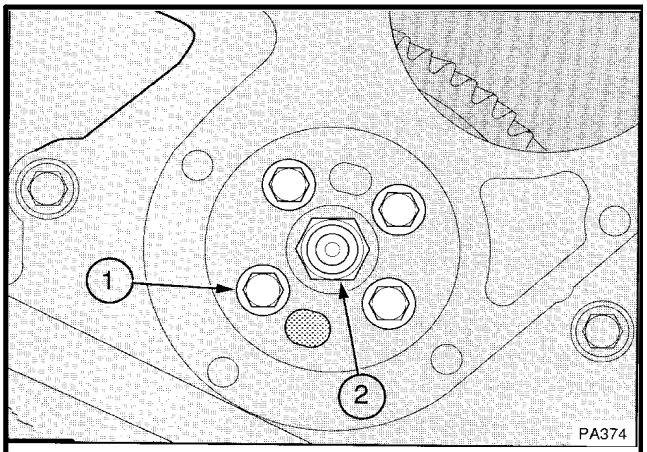
NOTE: On the latest engines with belt driven coolant pumps, four tamper proof fasteners retain the fuel pump gear. Special tools are needed to remove these fasteners, refer to your Perkins distributor.

See FIGURE 107. To remove the fuel injection pump from the engine it is only necessary to remove the four capscrews (1) which secure the fuel pump gear to the hub.



1. TIMING PIN
2. HUB
3. NUT

FIGURE 106. INJECTION PUMP TIMING PIN



1. CAPSCREWS (4)
2. NUT

FIGURE 107. INJECTION PUMP HUB

How To Set Number 1 Piston To TDC On The Compression Stroke

Special tools:

- Valve spring compressor
- Stud adapter
- Setscrew adapter

1. See FIGURE 108. Fasten a temporary pointer (1) to the timing case cover with its tip near to the outer edge of the crankshaft pulley or damper.

2. Loosen the gland nuts that retain the fuel injectors.

3. Remove the rocker cover.

4. Rotate the crankshaft, clockwise from the front, until the push rod for the inlet valve of the rear cylinder just begins to push on the rocker arm.

5. Remove the spring clip and the spacer from the front of the rocker shaft. Release the capscrews of the front two pedestals of the rocker shaft and remove the front rocker lever; tighten the capscrews of the rocker shaft pedestals.

6. Remove the valve springs from the front valve with the valve spring compressor and the adapter, for pedestal studs, or the adapter for pedestal capscrews.

⚠ CAUTION

Fit a suitable collar near the top of the valve to hold the valve if the crankshaft is rotated too far.

7. Allow the valve to be held by the top of the piston.

8. See FIGURE 108. Fasten a dial test indicator (2) with its plunger in contact with the top of the valve stem and with a reading shown on the gage. Rotate slowly the crankshaft, clockwise from the front, until the clockwise movement of the dial gage pointer just stops. Make a mark on the crankshaft pulley or damper to align with the temporary pointer (1). Continue to rotate the crankshaft in the same direction until the guage pointer just begins to move in a counter-clockwise direction. make another mark on the pulley or damper to align with the pointer. Mark the center point between the two marks on the pulley or damper and remove the other two marks.

9. Rotate the crankshaft approximately 45° counter-clockwise from the front and then clockwise until the mark on the pulley or damper is aligned with the pointer. Number 1 piston is now at TDC on the compression stroke.

1. See FIGURE 125. Apply pressure against the end plate (4) of the spring assembly. Remove the snap ring (5). Carefully release the end plate (4) and release the pressure on the compressed spring. Remove the end plate (4), spring (3), and the plunger (2).

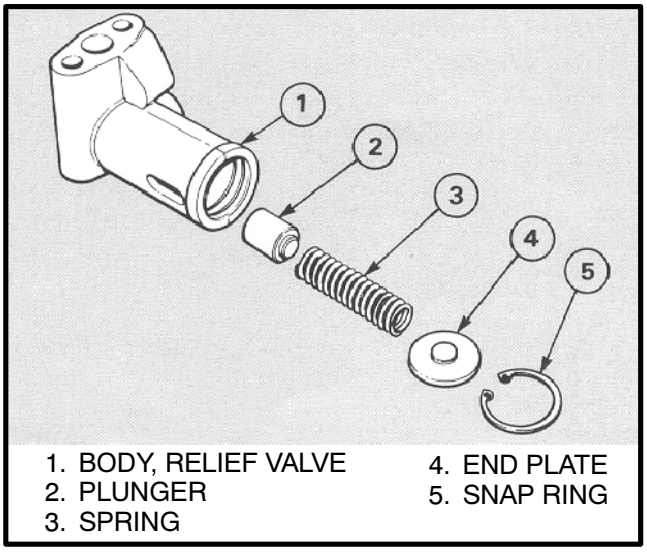
Inspection

1. Clean the parts. Check the parts for wear and damage. Check the load necessary to compress the spring to its fitted length, see Engine Specifications.

2. Check that the seat of the plunger is not damaged and that the plunger moves easily in its bore.

Assembly

1. Lubricate the parts with engine oil during assembly. Install the plunger in the bore as shown in FIGURE 125. Install the spring and end cap. Compress the spring and end cap into the bore so that the snap ring can be installed. Install the snap ring.



1. BODY, RELIEF VALVE
2. PLUNGER
3. SPRING
4. END PLATE
5. SNAP RING

FIGURE 125. RELIEF VALVE ASSEMBLY

Installation

1. Engine AR. Install new O-rings on the connection line. Lubricate the O-rings with engine oil and push the connection line into position in the oil pump.

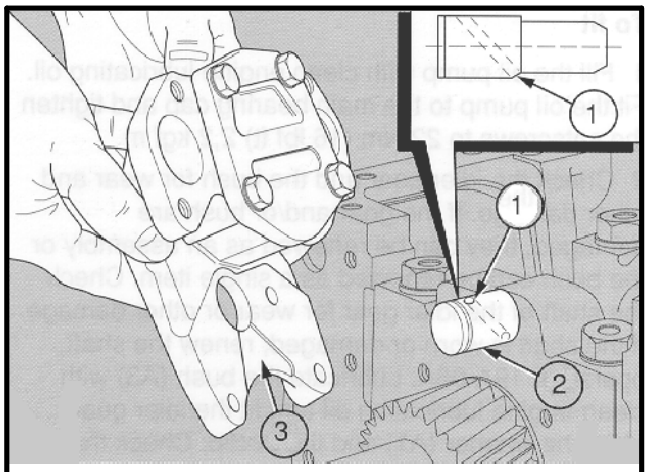
2. Push the relief valve onto the connection line and install the relief valve into position on the engine block. Install and tighten the capscrew.

3. Engines YG and YH. Be sure the faces of the cross flow pipe and the relief valve are clean. Install the relief valve and new gasket to the cylinder block. Install the four capscrews and tighten the flange capscrews and then the valve capscrews.

4. Install the oil sump. See Oil Sump, Installation.

IDLER GEAR SHAFT, REPLACEMENT

The shaft for the idler gear in the oil pump is installed in the front main bearing cap. See FIGURE 126. If this idler gear shaft must be replaced, use the procedures in the following paragraphs. The idler gear shaft has an oil passage (1) for lubrication of the bushing for the idler gear. Engine oil from the front main bearing passes through a channel in the body of the oil pump and then through the oil passage to the idler gear.



1. OIL PASSAGE
2. IDLER GEAR SHAFT
3. CHANNEL IN OIL PUMP

FIGURE 126. IDLER GEAR SHAFT

Removal

The idler gear shaft is fastened in the front main bearing cap with a roll pin. See FIGURE 127. This roll pin is hardened metal. If the following procedure does not remove the roll pin, see Removal Alternative.

⚠ CAUTION

Do not tighten the union nuts of the high pressure pipes more than the recommended torque tension. If there is a leakage from the union nut, ensure that the pipe is correctly aligned with the fuel injector inlet. Do not tighten the fuel injector union nut more, as this can cause a restriction at the end of the pipe. This can affect the fuel delivery.

7. Use new seal washers and install the fuel return line to the connection (2). Tighten the bolt on the banjo fitting to 9.5 Nm (84 lbf in).

8. If the fuel system is empty, remove the air from the fuel system. See Remove Air From The Fuel System.

9. When the engine can be operated, check for fuel leaks.

FUEL PUMP

Removal

1. If a heat shield has been installed, remove the heat shield for the fuel pump. Disconnect the fuel lines to the fuel pump.

2. Remove the capscrews. Remove the fuel pump. If the lobe on the camshaft has moved the internal lever of the fuel pump to the highest point of its lift, the fuel pump can be difficult to remove. The crankshaft must be rotated one revolution to move the lobe on the camshaft.

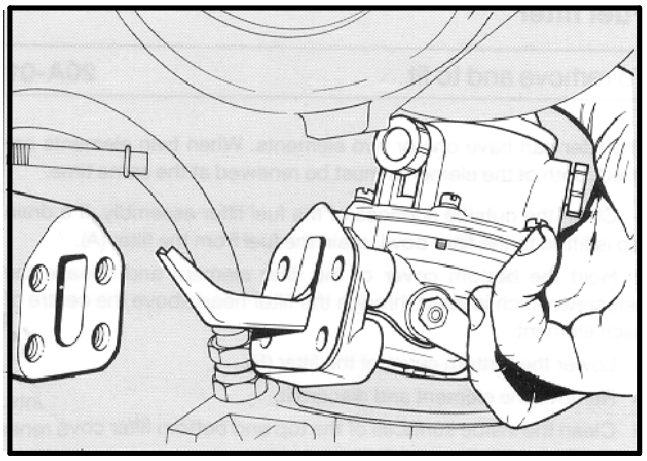


FIGURE 143. FUEL PUMP, REMOVAL AND INSTALLATION

Disassembly

1. Clean the outside surfaces of the fuel pump. Make a mark across the flanges of the two halves of the fuel pump to make sure that it is assembled again in the same positions.

2. See FIGURE 144. Remove the cover (1) and the screen (2). Remove the screws and separate the two halves of the fuel pump.

3. Turn the diaphragm assembly (5) 90° to release the pull rod from the link arm (8) and remove the diaphragm assembly.

4. Remove the stem seal (6), the spring seat washer (7), and the spring (12) from the pull rod. The diaphragm and pull rod assembly must be replaced as a unit.

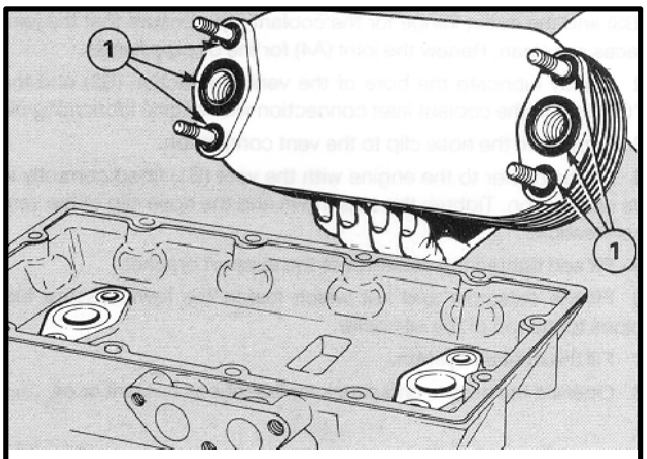
5. The valves (4) are held in their seats by punch marks in the metal. The metal must be made smooth so that valves can be removed.

6. Remove the link arm (8). Hold the rocker lever (11) in a vise and hit the body of the fuel pump with a soft ham-

air at low pressure. Then flush the internal part of the element with clean engine oil.

4. Use new O-rings on the flanges and studs as shown in FIGURE 159.

5. Install the cooler element on the cover and tighten the nuts to 22 Nm (16 lbf ft).



1. O-RINGS

FIGURE 159. JOINTS FOR THE COOLER ELEMENT

Installation

1. If the studs have been removed and will be used again, clean the threads on the studs and on the engine block, Use liquid sealant on the threads before they are installed in the engine block.

2. Use a new gasket and install the oil cooler assembly to the engine block. Tighten the capscrews and nuts to 22 Nm (16 lbf ft).

3. Use a new gasket and connect the oil lines to the flange on the cover and tighten the screws.

4. Fill the coolant system.

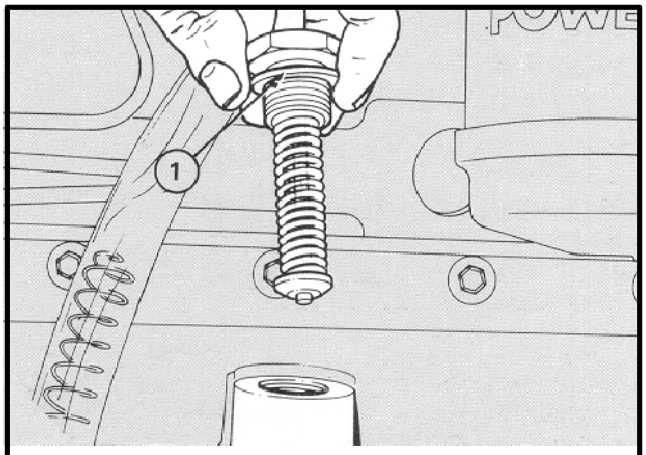
5. When the engine can be operated again, check for leaks.

By-Pass Valve, Oil Cooler

1. See FIGURE 160. Remove the cap and remove the by-pass valve.

2. Check the spring and the valve seat for damage. Replace the parts if they are damaged.

3. Use a new aluminum washer (1). Install the by-pass valve into the oil cooler and tighten the cap to 50 Nm (37 lbf ft).



1. O-RING

FIGURE 160. BY-PASS VALVE, OIL COOLER

ELECTRICAL EQUIPMENT

DRIVE BELTS

Check the drive belts for wear and damage. When a pair of drive belts are used, they must be replaced as a pair. When a pair of drive belts are used, adjust the tension for the tightest belt.

A gauge is available that will indicate the tension in the drive belt. Fit the gauge at the center of the longest length of the drive belt and measure the tension. See FIGURE 161. The correct tension is approximately 355 N (80 lbf)

Main Bearings

Type	Steel back, 20% tin to aluminum bearing material
Width, center bearing (All engines)	36.32 to 36.70 mm (1.430 to 1.445 in)
Width, other bearings (engine AR)	31.62 to 31.88 mm (1.245 to 1.255 in)
Width, other bearings (engines YG and YH)	30.86 to 31.12 mm (1.215 to 1.225 in)
Bearing thickness (All engines)	2.083 to 2.89 mm (0.0820 to 0.0823 in)
Bearing clearance (engine AR)	0.057 to 0.117 mm (0.0022 to 0.0046 in)
Bearing clearance (engines YG and YH)	0.047 to 0.117 mm (0.0018 to 0.0046 in)

Available undersize bearings:

-0.25 mm (-0.010 in)
-0.51 mm (-0.020 in)
-0.76 mm (-0.030 in)

Crankshaft Thrust Washers

Type	Steel back, lead bronze bearing material
Position	each side of the center main bearing
Thickness:	
to Standard	2.26 to 2.31 mm (0.089 to 0.091 in)
to Oversize	2.45 to 2.50 mm (0.096 to 0.098 in)

Crankshaft Heat Treatment

The following part numbers are induction hardened: 3131H024

The following part numbers are nitrocarburized:

3131H022
31315991
31315995
31315681

The following part numbers are 60-hour nitride:

3131H021

Crankshaft Overhaul

Induction hardened crankshafts do not need to be hardened after they have been machined undersize.

Nitrocarburized crankshafts must be hardened again each time after they have been machined. If nitrocarburized or nitrided hardening methods are not available, the crank shaft must be replaced or exchanged with a crankshaft from the manufacturer.

Crankshafts that have a 60-hour nitride treatment can be machined a maximum of 0.25 mm (0.010 in) without the need to harden them again.

Check the crankshaft for cracks before and after it is machined (ground). Remove any magnetism after the crankshaft has been checked for cracks.

After the crankshaft has been machined, remove any sharp edges from the oil holes for lubrication.

Surface finish and fillet radii must be according to the specifications. The finished sizes for machined crankshafts are shown in FIGURE 171.

When the crankshaft is on mounts at the front and rear main journals, the maximum variation (run-out) (total indicator reading) at the other main journals can not be greater than the following table.

The "run-out" must not be opposite. The difference in "run-out" between one journal and the next one must not be more than 0.10 mm (0.004 in). The "run-out" on the crankshaft pulley diameter, rear oil seal diameter, and the rear flange diameter must not be more than 0.05 mm (0.002 in) total indiactor reading.

Journal	4-cylinder crankshafts	6-cylinder crankshafts
1	Mount	Mount
2	0.08 mm (0.003 in)	0.10 mm (0.004 in)
3	0.15 mm (0.006 in)	0.20 mm (0.008 in)
4	0.08 mm (0.003 in)	0.25 mm (0.010 in)
5	Mount	0.20 mm (0.008 in)
6		0.10 mm (0.004 in)
7		Mount

TORQUE SPECIFICATIONS (CONTINUED)			
Fuel System	**Thread Size**	**Nm**	**lbf ft**
Nuts, high to pressure fuel lines	M12	22	16
Bolt, leak-off connection	M8	9	7
Capscrews, fuel lift pump	M8	22	16
Nut for fuel injector body	-	40	30
Capscrews for the gear of the fuel injection pump	M10	28	20
Special (Torx) screws for gear of the fuel injection pump	M10	22	16
Nuts for flange of fuel injection pump	M8	22	16
Locking screw of Lucas DP 200 fuel injection pump	10A/F	10	7
Cooling System			
Capscrews for fan drive housing to timing case	M10	44	33
Capscrews, fan drive pulley to hub	M8	22	16
Capscrews, fan drive pulley to hub	M10	44	33
Capscrews, fan	M8	22	16
Flywheel	**Thread Size**	**Nm**	**lbf ft**
Capscrews, flywheel to crankshaft	1/2 UNF	105	77
A**uxiliary Equipment**			
Nut, air compressor drive gear to compressor drive shaft	5/8 UNF	120	93
Nut, (30 A/F) air compressor gears	M20	130	101
Capscrew, bracket to idler hub	M10	60	47
Capscrew, bracket to timing case	M8	35	27

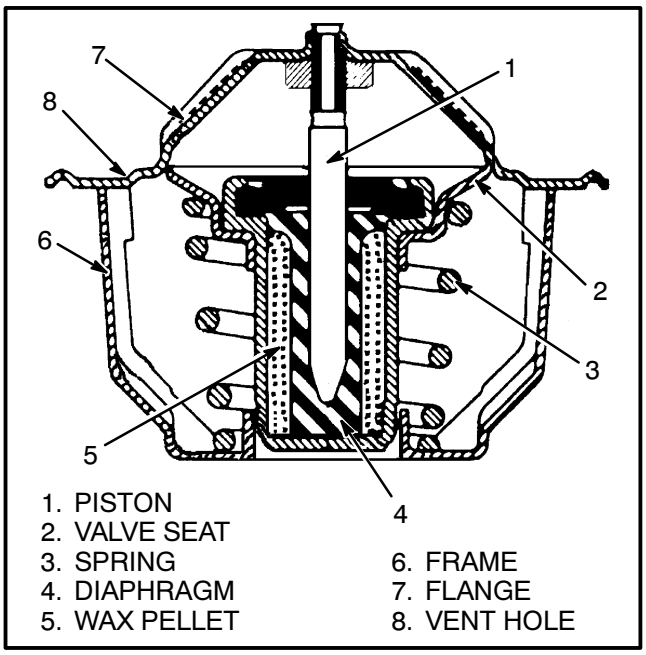


FIGURE 1. TYPICAL THERMOSTAT

The opening and closing of the thermostat helps keep the coolant within the operating limits of the system. The same thermostat is used for summer and winter seasons. Do not operate the engine without a thermostat. The engine will take longer to get warm and then can run improperly.

WATER PUMP

The centrifugal type water pump is installed at the front of the engine block. The inlet for the pump is connected to the bottom of the radiator by a hose. From the pump, coolant passes through the passages in the engine block to the top of the radiator. The thermostat controls the flow of coolant through the engine and radiator.

FAN AND FAN SHROUD

The fan is used to provide air flow through the radiator at all engine speeds. The fan is a puller type and is installed on a separate hub. The fan is driven by a drive belt from the hydraulic assembly drive shaft which is connected to the engine crankshaft.

The fan shroud is used to make sure the air flow from the fan goes through the core of the radiator.

DRIVE SHAFT

The drive shaft is connected to the hydraulic pump at one end and to the crankshaft at the other end. The drive shaft drives the fan pulley.

REPAIRS

⚠ WARNING

During engine operation, be careful not to touch the fan, pulleys or drive belts. Contact with these parts can cause serious personal injury.

COOLING SYSTEM CHECKS

Exhaust Leaks

To check for exhaust leaks into the cooling system, use a kit for this purpose. Follow the manufacturer's instructions when doing the test.

RADIATOR (See FIGURE 2.)

Checks

To check for water flow restrictions in the radiator, run the engine until it is warm. Shut the engine OFF and feel the radiator. The temperature must be even across the radiator. (The radiator will be hotter near the top radiator hose.) Cold spots on the radiator indicate restrictions.

If the radiator has leaks, have it repaired by trained personnel.

NOTE: The Removal and Installation procedures for the radiator are in **THE FRAME, 100SRM726**

Cleaning The Radiator

⚠ CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

1. Drain the cooling system. Fill the cooling system with clean water.

2. Install the radiator cap. Run the engine until the top radiator hose is hot. Stop the engine and let the engine cool.

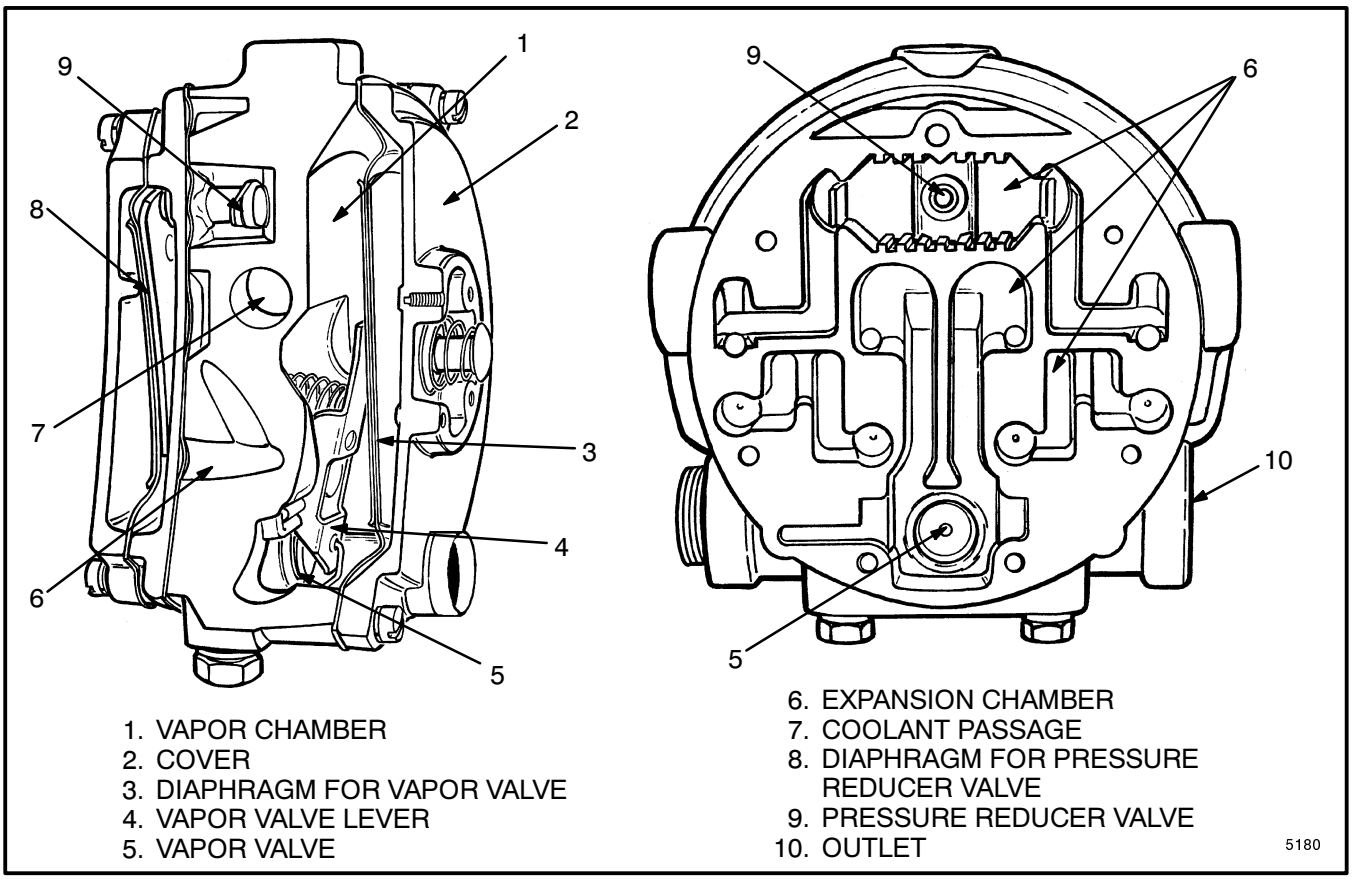


FIGURE 6. INSIDE THE VAPORIZER

The LPG vapor is kept in the expansion chamber by the vapor valve. When the engine starts, the gas in the vapor chamber leaves the vapor chamber to flow through the carburetor. The pressure on the vapor diaphragm then decreases. Air pressure on the other side of the vapor diaphragm pushes on the diaphragm and opens the vapor valve. The gas flows from the expansion chamber to the vapor chamber and then to the carburetor. The pressure in the expansion chamber decreases and again the pressure reducer valve opens to repeat the operation. When the carburetor throttle is closed, the vacuum in the vapor chamber decreases and the vapor valve closes. The pressure in the vapor chamber stays at 10.3 kPa (1.5 psi).

Balance lines connect the air pressure side of the vapor diaphragm to an air inlet port at the carburetor. If the air filter has a restriction, the pressure decreases in the carburetor and in the vapor chamber of the vaporizer. When balance lines are not installed, this decrease can cause the diaphragm to move and open the vapor valve. When balance lines are connected, the restriction causes an equal decrease on both sides of the diaphragm. The balance lines prevent an increase in the fuel mixture in the carburetor. A button in the housing can be used to manually open the vapor valve. LPG vapor then flows to the carburetor for starting the engine.

Carburetor (See FIGURE 7., FIGURE 8. and FIGURE 9.)

The carburetor has one moving part, a diaphragm with the fuel metering valve. The fuel tube in the center of the air tube is the seat for the fuel metering valve.

When the engine starts, the air in the air tube and in the vacuum chamber flows to the engine. Air pressure on the outside of the air tube pushes the diaphragm against the metering spring. The fuel metering valve moves from its seat. Air then flows from the outside of the air tube to the inside of the air tube. The fuel pressure moves the LPG vapor past the fuel metering valve to mix with the air flowing through the air tube. Because the diaphragm causes a restriction, the pressure in the inside of the air tube is always less than on the outside of the tube. The difference in pressure changes when the amount of air flowing through the air tube changes. The diaphragm moves according to the air flow. The amount of fuel that

Installation (See FIGURE 1.)

Install the mount capscrews. Connect all the lines to the fittings. Fill the radiator with coolant. Check for leaks.

CARBURETOR

Removal

1. Remove the hose from the air cleaner to the carburetor inlet. Remove the balance line from the carburetor. Remove the fuel inlet hose and vacuum hose.

2. Remove the carburetor from the governor.

Disassembly (See FIGURE 15.)

Disassemble the carburetor using FIGURE 15. as a reference.

Cleaning

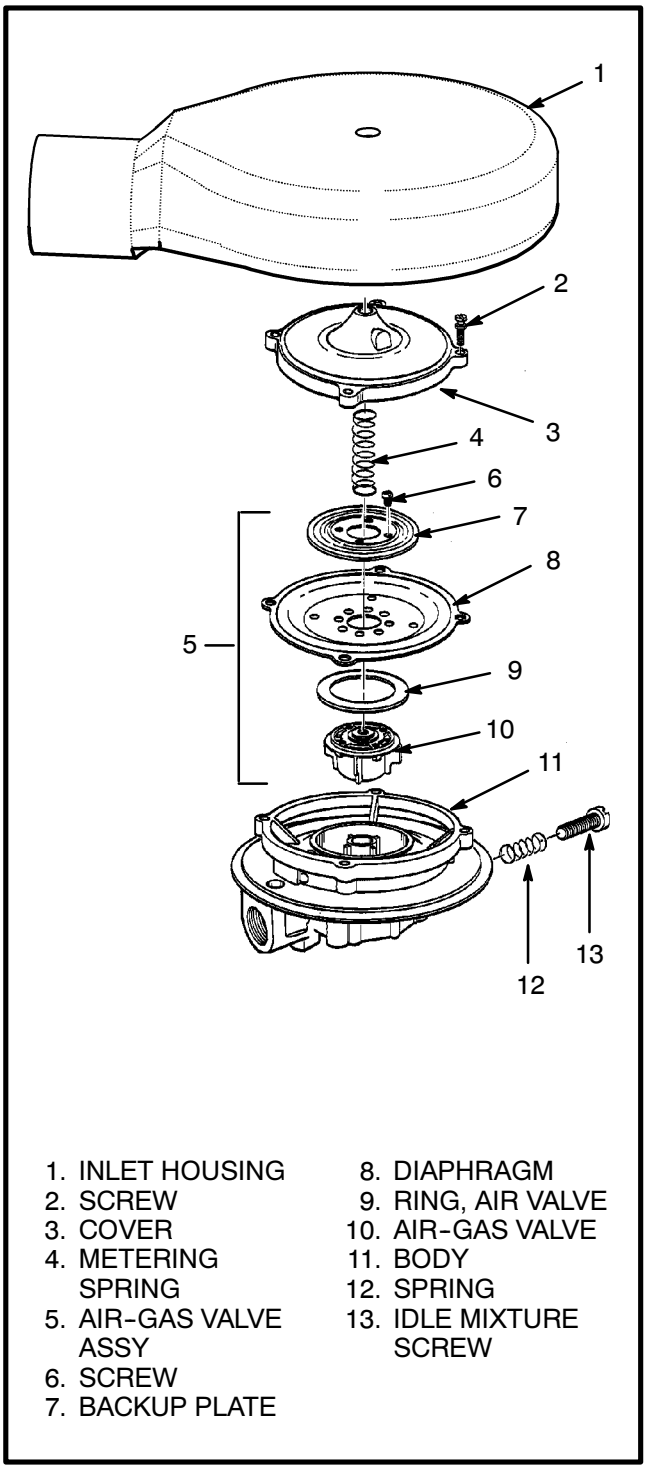
⚠ WARNING

Cleaning solvents can be flammable and toxic, and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety precautions.

⚠ WARNING

Compressed air can move particles so that they cause injury to the user or to other personnel. Make sure that the path of the compressed air is away from all personnel. Wear protective goggles or a face shield to prevent injury to the eyes.

Wash all the parts, except the diaphragm, in solvent. Use compressed air to dry all the parts except the diaphragm. Make sure the air passages in the metering valve are clean.



1. INLET HOUSING
2. SCREW
3. COVER
4. METERING SPRING
5. AIR-GAS VALVE ASSY
6. SCREW
7. BACKUP PLATE
8. DIAPHRAGM
9. RING, AIR VALVE
10. AIR-GAS VALVE
11. BODY
12. SPRING
13. IDLE MIXTURE SCREW

FIGURE 15. CARBURETOR

Assembly

See FIGURE 15. for the procedures for assembling the carburetor. Use only HYSTER Approved repair kits.

DESCRIPTION AND OPERATION

GENERAL

This section has a description and the operating principles of the two-speed powershift transmission. The section is in two parts. The first part describes the mechanical components of the transmission. The second part describes the hydraulic operation of the transmission. See the section, **TWO-SPEED POWERSHIFT TRANSMISSION, Repairs, 1300 SRM 728,** for information on repair and troubleshooting this transmission.

MECHANICAL DESCRIPTION (See FIGURE 1.)

The transmission has a housing assembly, torque converter, transmission pump, control valve and four shaft assemblies.

Torque Converter (See FIGURE 2.)

The torque converter is installed between the engine and the transmission. The torque converter has three main parts: an impeller, a turbine and a stator.

The impeller is connected to the flywheel of the engine by a drive plate. The impeller engages with the transmission pump for the transmission and operates the pump when the engine is running.

The turbine fits inside of the impeller and engages the input shaft of the transmission. The stator also fits inside of the impeller and engages the stator tube on the transmission.

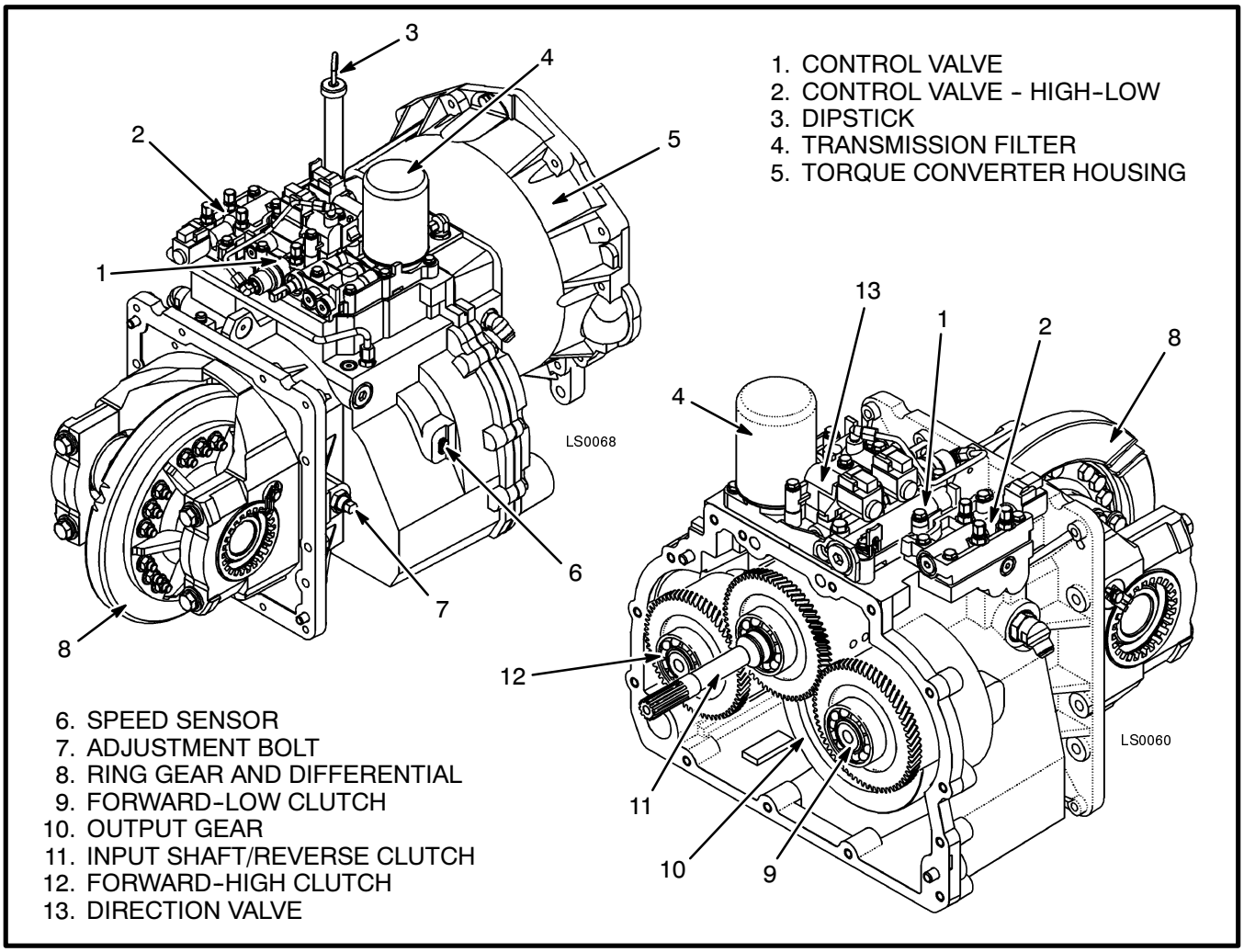
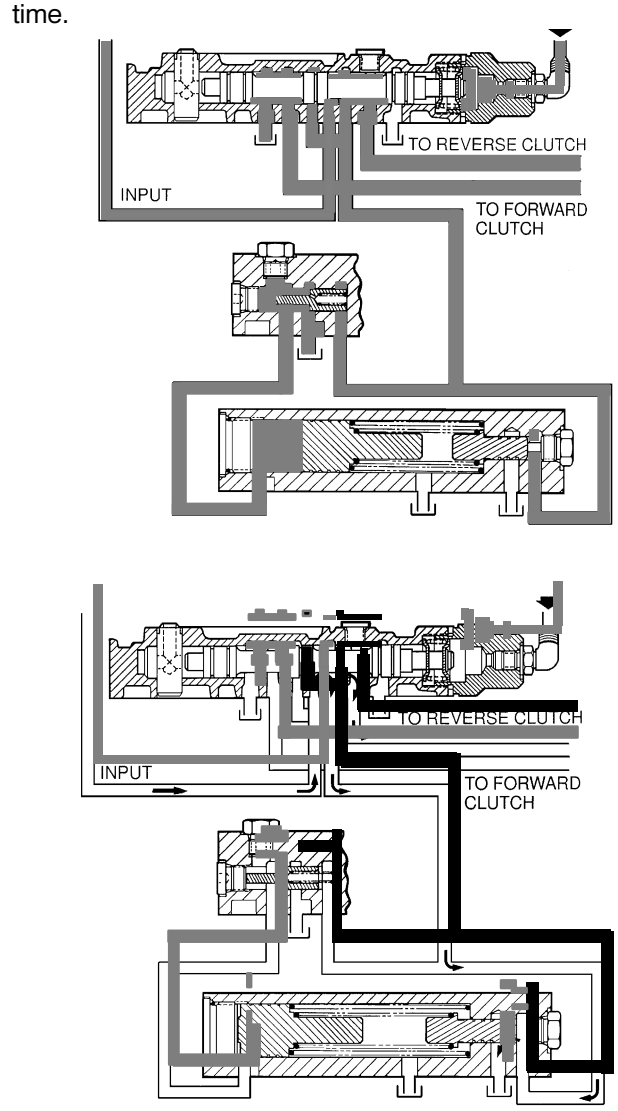
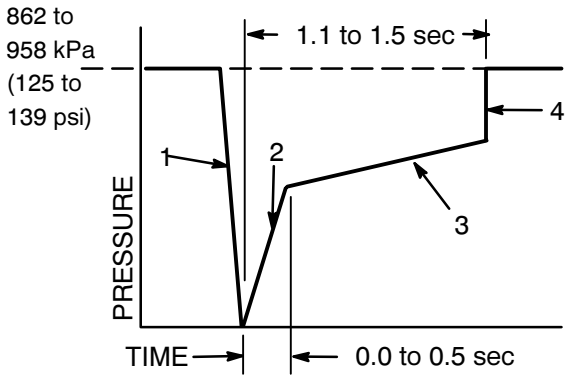


FIGURE 1. TRANSMISSION

The modulator controls the rate of increase in hydraulic pressure to apply a clutch. This delay reduces the shock and stress to the drive train when engaging the transmission or changing the direction of travel. This Figure shows the operation when the direction spool is moved from FORWARD to REVERSE. The operation of the modulator circuit is the same for each movement of the direction spool that causes the application of a clutch.

The graph shows the pressure changes in the modulator circuit (and clutch pressure circuit) when a clutch is being applied. The numbers of the paragraphs refer to the pressure graph and indicate what is happening at that time.





1. CLUTCH DISENGAGES
2. OTHER CLUTCH FILLS WITH OIL
3. MODULATOR CONTROL INCREASE IN PRESSURE
4. OTHER CLUTCH ENGAGED

1. When the direction spool is moved from FORWARD to REVERSE, the direction spool opens a path from the FORWARD clutch to the sump. The oil pressure to the FORWARD clutch decreases rapidly to zero. The oil pressure in the passage to the REVERSE clutch is already zero. An orifice in the clutch piston makes sure that oil does not stay in the clutch because of centrifugal force. Oil pressure in the bore of the modulator piston moves the spool of the modulator valve and opens a path to the sump. The oil in the bore of the modulator piston drains rapidly to the sump.

2. Oil flows through the direction spool and fills the cavity behind the REVERSE clutch piston to apply the clutch. When the pressure increases to approximately 552 kPa (80 psi) to the REVERSE clutch, the pressure causes the modulator regulator to open a path to the sump. This action prevents the pressure from increasing rapidly to apply the clutch.

FIGURE 12. MODULATOR OPERATION (1 of 2)

3. Lubricate the pilot hole in the flywheel and the pilot hub on the torque converter with anti-seize compound.

4. Put lifting straps around the transmission and connect a lifting device to the straps. Align the torque converter housing with the engine adapter. Make sure the pilot on the torque converter engages the flywheel.

5. Install the transmission to the engine. Install the capscrews at the transmission housing. Tighten the capscrews to 38 Nm (28 lbf ft).

6. Install the capscrews that hold the drive plate to the torque converter. Tighten the capscrews to 38 Nm (28 lbf ft). Install the access cover on the torque converter housing.

CLUTCH PACKS

Removal And Disassembly (FIGURE 4.)

1. Remove the oil pump from the housing. Remove the torque converter housing from the transmission being careful that the clutch assemblies do not fall from the housing.

2. Disassemble the clutch assemblies as shown in FIGURE 4. The reverse clutch assembly is shown in the illustrations for this procedure. The procedures are the same for removal and disassembly of the Forward clutch assemblies.

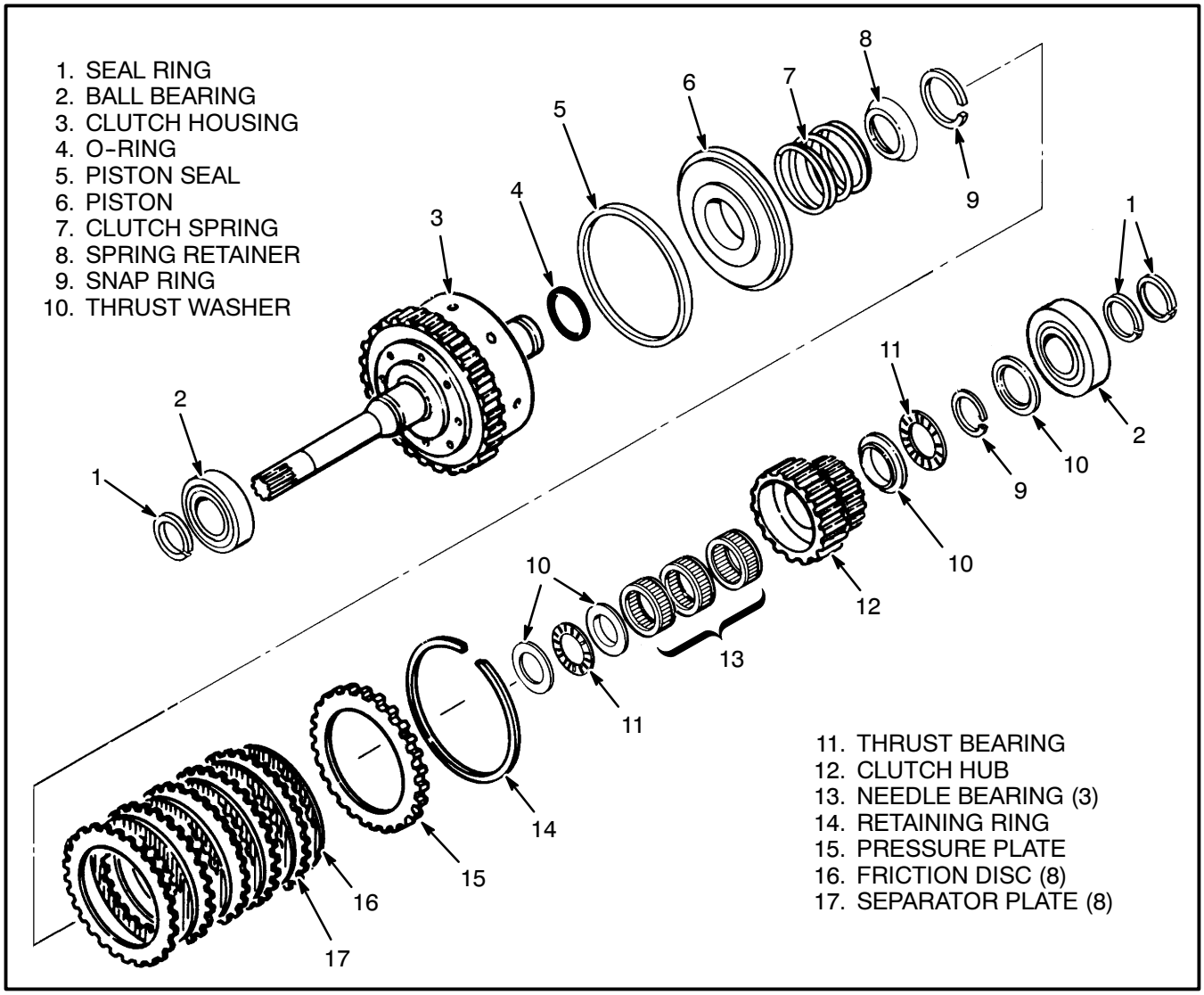


FIGURE 3. REVERSE CLUTCH ARRANGEMENT

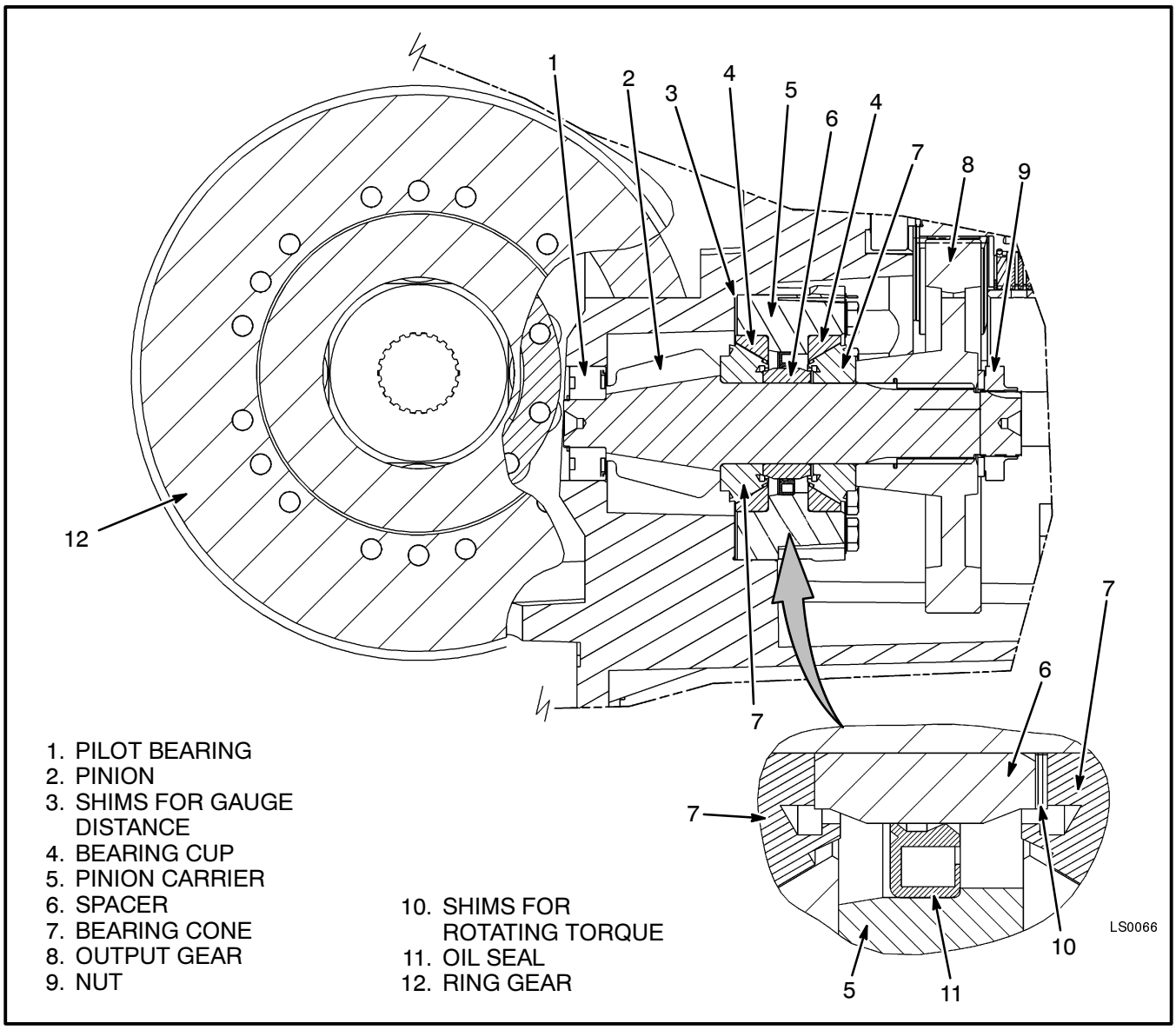


FIGURE 11. RING GEAR AND PINION ARRANGEMENT

Assemble the differential and ring gear assembly:

a. If the ring gear was removed from the differential case, put the ring gear in hot water that is 82 to 105°C (180 to 220°F) for approximately 10 minutes. Remove the ring gear from the water and put it on the differential case. Do not use a press or a hammer to install the ring gear. Tighten the bolts in a cross pattern. Tighten the bolts to 140 Nm (105 lbf ft).

b. Lubricate and install a side gear and thrust washer in the differential case as shown in FIGURE 12.

NOTE: Install bronze side of thrust washers facing the side gear.

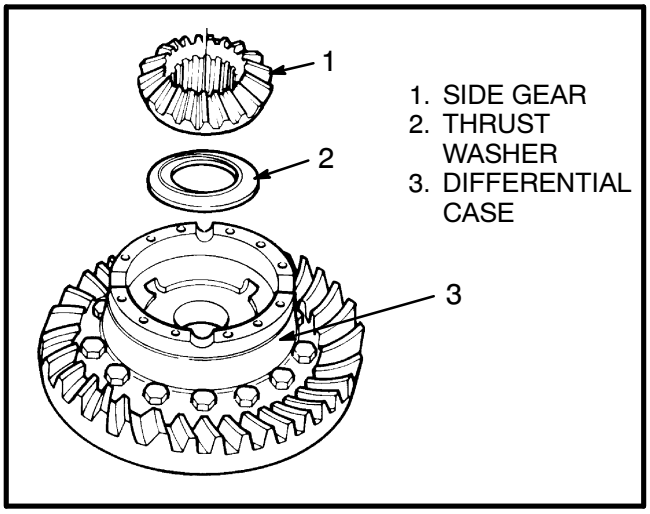


FIGURE 12. INSTALL A THRUST WASHER AND SIDE GEAR

CHECKS AND ADJUSTMENTS

STALL TEST

The stall test checks the condition of the engine, transmission clutches and the stator clutch in the torque converter. If the engine is not operating correctly, the stall speed will be lower than the stall speed shown in the specification. If the stator clutch does not hold, the oil in the torque converter flows into the impeller in the direction opposite to the engine rotation. This reverse flow of oil prevents the engine from reaching the correct rpm. If the engine speed is greater than the stall speed shown in the specification, the transmission clutches are not holding or the wheels are turning. The transmission clutches will not hold if the clutch pressure is not great enough or the clutches are worn.

NOTE: Make sure the governor is adjusted correctly.

Do a stall test to check the operation of the transmission clutches. The engine and hydraulic oil must be at operating temperature. Put a capacity load on the forks to prevent the wheels from turning. Do not apply the inching/brake pedal or the parking brake. These controls will release the clutches in the transmission. Connect a tachometer to the engine. Put the lift truck against an object that cannot move. Start the engine, put the transmission in FORWARD and slowly push the accelerator pedal to full throttle. See2. for stall speeds.

NOTE: The wheels must not turn during the stall speed test.

⚠ CAUTION

Do not hold the throttle open for more than 15 seconds at a time. Permit the engine to operate at idle speed for 2 minutes between tests.

Release the accelerator immediately if the engine speed increases to the speed limit of the governor.

TABLE 2. STALL SPEEDS

STALL SPEEDS (New Engines)	
GM 4.3 V-6, Gasoline	1950 to 2050 rpm
GM 4.3 V-6, LPG	1950 to 2000 rpm
Perkins Diesel	1900 to 1970 rpm

If the stall speed is 50 to 200 rpm below the specification, the engine is not operating at full power. Check the ignition timing, air filter, fuel system and compression.

If the engine speed is 250 to 500 rpm below the specification, the stator clutch is damaged. The torque converter must be replaced as a unit. If the governor is not adjusted correctly (governor speed too low), the results will be wrong.

If the stall speed is greater than the specification, the engaged clutch is not holding or the converter is damaged. Perform the test in REVERSE to test the other clutch assembly. If the engine rpm is greater than the specification in either direction, do the pressure checks to check for the possible cause.

ADJUST THE INCHING/BRAKE PEDAL (See FIGURE 34.)

The following adjustment procedure gives a small amount of transmission "inching" as the brakes are applied (known as inching/brake "overlap"). This overlap makes the "inching" function smooth on a surface that has a minor slope. As the inching/brake pedal is depressed, inching/brake overlap occurs. The brakes start to apply and the transmission clutch packs begin to disengage.

1. Check and adjust the inching/brake pedal if the control valve was removed for repairs.

2. If the lift truck has been operated for more than 25 hours since the brake shoes were installed, and the operation of the brakes is normal, go to Step 5.

3. If the lift truck has new brake shoes, adjust the brake shoes as described in Step 4.

4. Do the following procedure to adjust the brake shoes:

   a. Put blocks at either side of the steer tires to prevent forward or reverse movement of the lift truck. Put the lift truck on solid blocks so that the drive wheels can be removed. Remove the drive wheels.

   b. Use an adjuster tool (or a screwdriver) to expand the brake shoes toward the drums. Tighten the shoes until the brake drums can just be rotated by hand.

   c. Push the automatic adjuster lever away from the adjuster wheel with a small screwdriver. Use the adjuster tool to loosen the adjuster wheel 1 1/2 revolutions. It can help to put a paint mark on the adjuster wheel for reference.

DESCRIPTION AND OPERATION

GENERAL

This section has a description and the operating principles of the powershift transmission. The section is in two parts. The first part describes the mechanical components of the transmission. The second part describes the hydraulic operation of the transmission. See the section, **SINGLE-SPEED POWERSHIFT TRANSMISSION, Repairs, 1300 SRM 752,** for information on repair and troubleshooting this transmission.

MECHANICAL DESCRIPTION

The transmission has a housing assembly, torque converter, transmission pump, control valve and three shaft assemblies.

Torque Converter (See FIGURE 2.)

The torque converter is installed between the engine and the transmission. The torque converter has three main parts: an impeller, a turbine and a stator.

The impeller is connected to the flywheel of the engine by a drive plate. The impeller engages with the transmission pump for the transmission and operates the pump when the engine is running.

The turbine fits inside of the impeller and engages the input shaft of the transmission. The stator also fits inside of the impeller and engages the stator tube on the transmission.

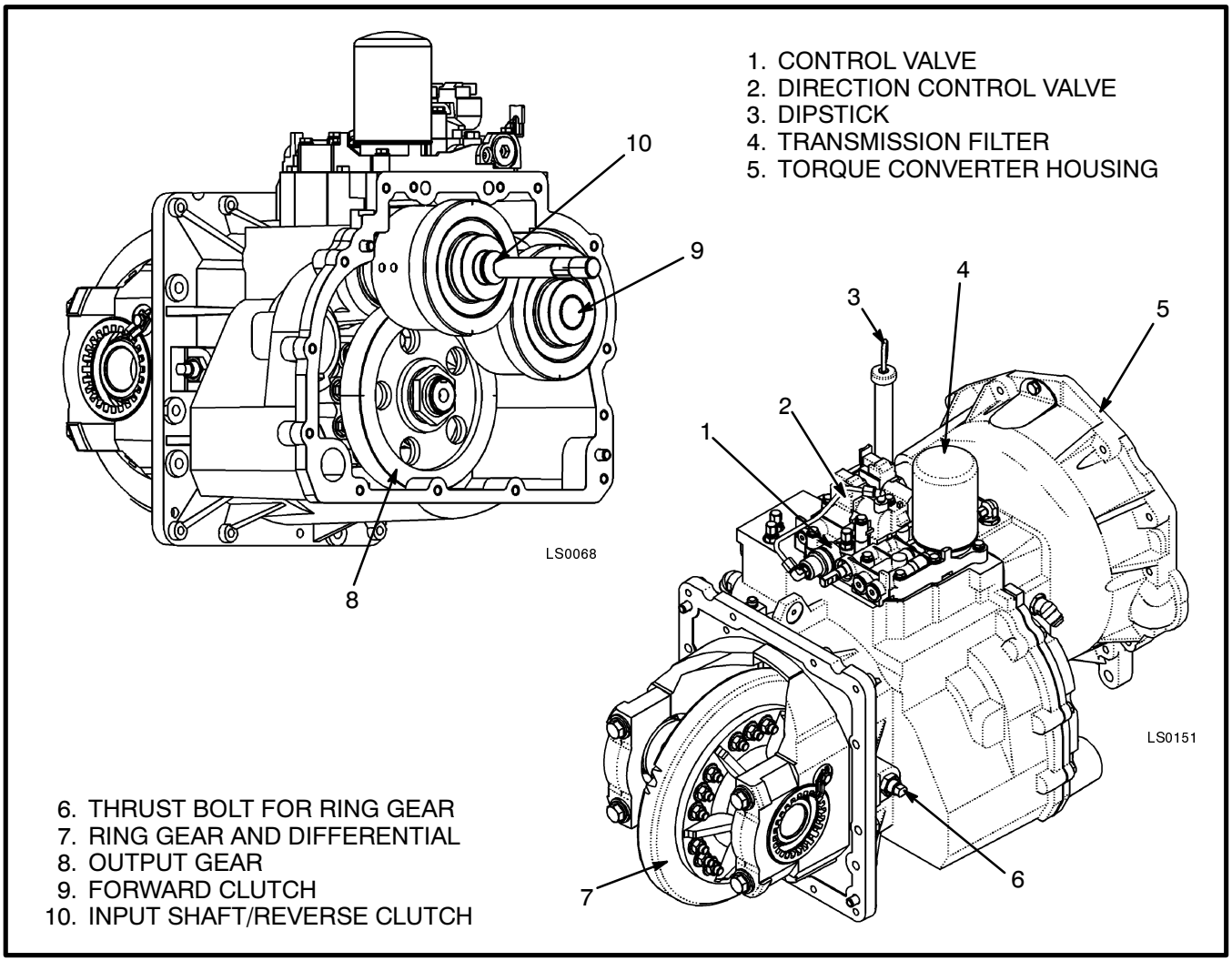
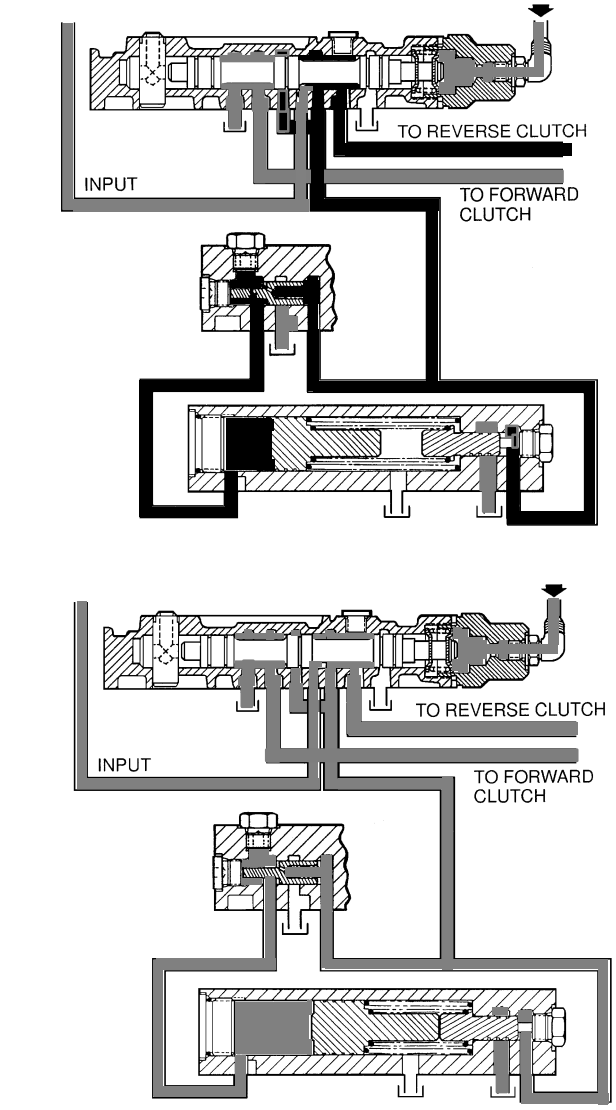


FIGURE 1. TRANSMISSION

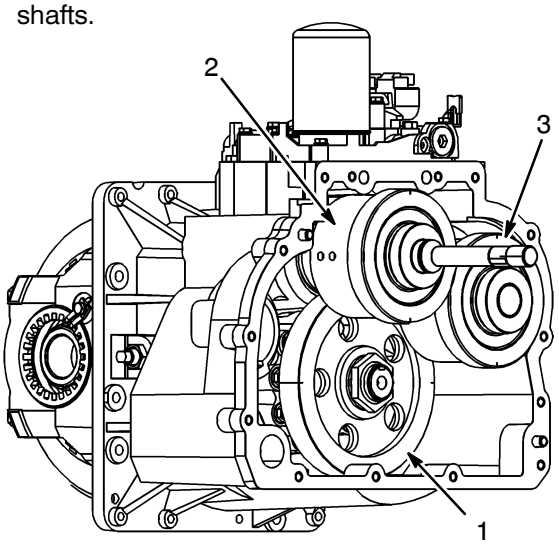


3. When the oil pressure in the circuit between the modulator valve and the modulator piston decreases to zero, the spring at the modulator valve moves the modulator valve to close the path to the sump. The oil must now flow through the orifice in the spool of the modulator valve to the modulator piston. When the pressure in the modulator circuit is approximately 552 kPa (80 psi), the oil pressure begins to push the modulator piston in the bore. As the pressure increases, the movement of the modulator piston increases the force of the spring between the modulator piston and the modulator regulator. The modulator regulator moves to keep a constant difference in pressure of 103 kPa (15 psi) across the orifice in the modulator valve. This constant difference in pressure permits the modulator piston to move at a constant rate and causes the controlled application of the clutch.

4. When the modulator piston pushes the modulator regulator closed [approximately 655 kPa (95 psi)], the path to the sump is completely closed. The oil pressure then increases rapidly to the normal clutch pressure of 862 to 958 kPa (125 to 139 psi). The transmission is engaged to move the lift truck.

FIGURE 11. MODULATOR OPERATION (2 of 2)

STEP 1.
Pull the Forward and Reverse clutch assemblies straight from the transmission housing. Do not damage the seal rings on the end of the clutch shafts.



1. OUTPUT GEAR
2. REVERSE CLUTCH
3. FORWARD CLUTCH

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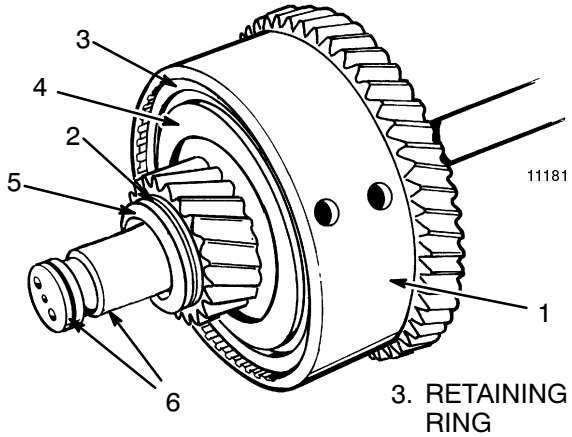
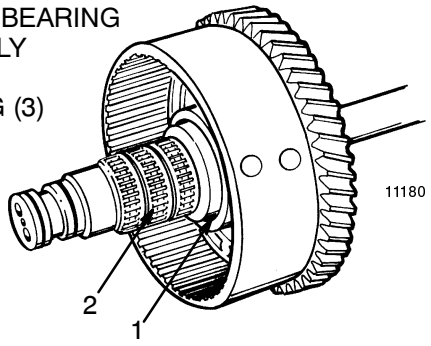
NOTE: Do not remove the output gear from the pinion shaft unless the differential must be repaired.



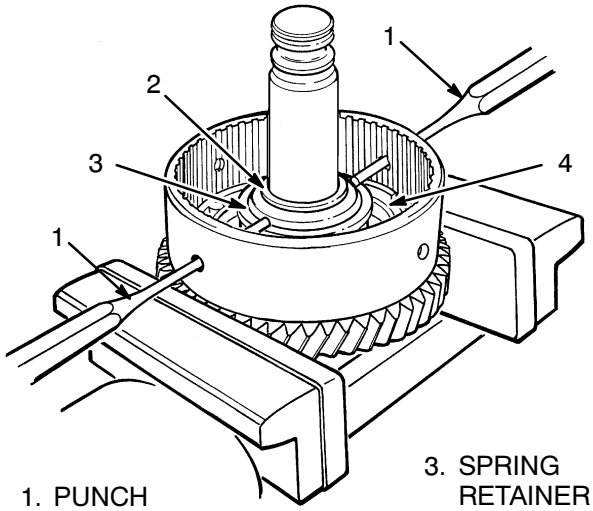
1. HUB AND GEAR
2. THRUST BEARING ASSEMBLY
3. RETAINING RING
4. PRESSURE PLATE
5. SNAP RING
6. SEAL RINGS

STEP 2.
If the ball bearing did not stay in the transmission case, remove it from the clutch shaft. Remove the special thrust washer. Remove the snap ring, thrust washers, and thrust needle bearing. Remove the hub from the clutch assembly. Remove the retaining ring, then remove the pressure plate. Remove the friction discs and separator plates.

1. THRUST BEARING ASSEMBLY
2. NEEDLE BEARING (3)



STEP 3.
Remove the needle bearings from the shaft. Remove the other set of thrust washers and thrust needle bearing.



1. PUNCH
2. SNAP RING
3. SPRING RETAINER
4. PISTON

STEP 4.
Remove the piston only if there is a problem with the piston or seals. Use two punches to push the spring retainer down. Remove the snap ring for the retainer. Remove the retainer, spring and piston. Pull the piston from the clutch housing. Remove the seal from the circumference of the piston and the O-ring from the shaft.

⚠ WARNING

The spring for the clutch is compressed. Make sure the spring and spring retainer can not cause injury when the snap ring is removed.

NOTE: Some technicians make a special bracket so that the spring and retainer can be compressed in a press to remove the snap ring.

FIGURE 4. REMOVAL AND DISASSEMBLY OF CLUTCH ASSEMBLIES

NOTE: Install bronze side of thrust washers facing the side gear.

c. Install the spider, differential pinions and thrust washers into the differential case as shown in FIGURE 13.

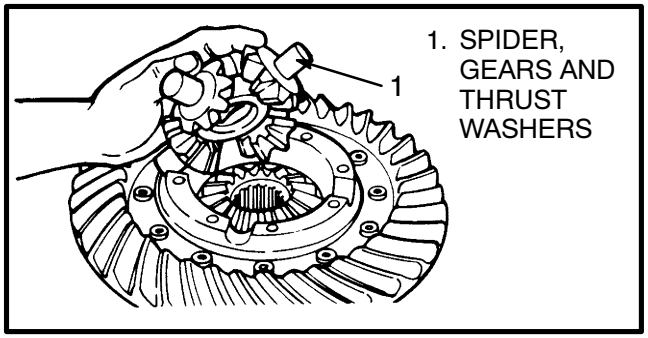


FIGURE 13. INSTALL THE SPIDER, GEARS AND THRUST WASHERS

d. Install the second side gear and thrust washer over the spider and differential pinions as shown in FIGURE 14.

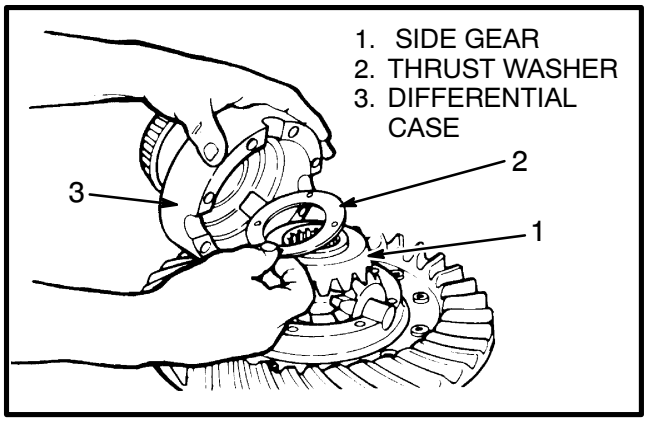


FIGURE 14. INSTALL THE SECOND SIDE GEAR AND THRUST WASHER

e. Put the second half of the differential case over the first half and the gears as shown in FIGURE 15. Make sure the marks are aligned.

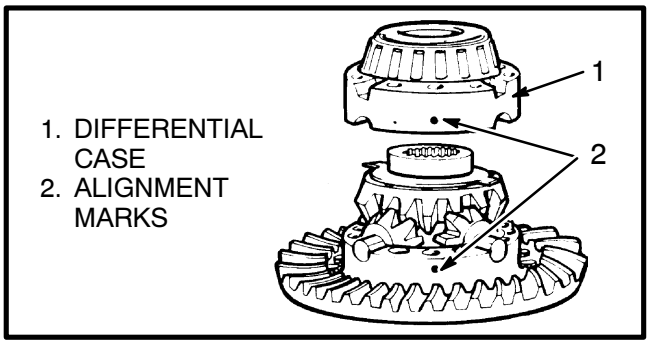


FIGURE 15. INSTALL THE SECOND HALF OF THE DIFFERENTIAL CASE

f. Install the capscrews and tighten them in a cross pattern to 140 Nm (105 lbf ft).

g. Install the bearing cones on the differential case. See FIGURE 16.

h. Apply axle lubricant on the inner diameter of the bearing cups and on both bearing cones that are installed on the differential. Do not permit lubricant on the outer diameter of the bearing cups or the bearing bores of the differential housing.

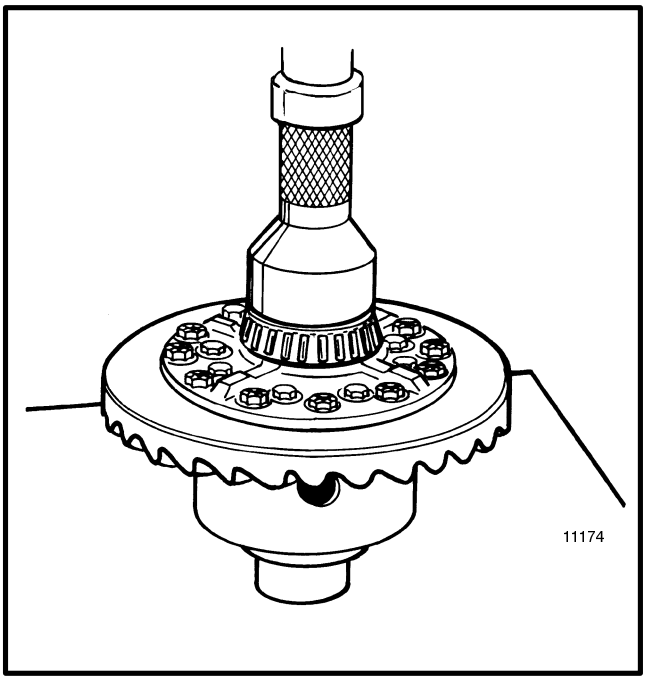


FIGURE 16. INSTALLATION OF THE BEARING CONES

CHECKS AND ADJUSTMENTS

STALL TEST

The stall test checks the condition of the engine, transmission clutches and the stator clutch in the torque converter. If the engine is not operating correctly, the stall speed will be lower than the stall speed shown in the specification. If the stator clutch does not hold, the oil in the torque converter flows into the impeller in the direction opposite to the engine rotation. This reverse flow of oil prevents the engine from reaching the correct rpm. If the engine speed is greater than the stall speed shown in the specification, the transmission clutches are not holding or the wheels are turning. The transmission clutches will not hold if the clutch pressure is not great enough or the clutches are worn.

NOTE: Make sure the governor is adjusted correctly.

Do a stall test to check the operation of the transmission clutches. The engine and hydraulic oil must be at operating temperature. Put a capacity load on the forks to prevent the wheels from turning. Do not apply the inching/brake pedal or the parking brake. These controls will release the clutches in the transmission. Connect a tachometer to the engine. Put the lift truck against an object that cannot move. Start the engine, put the transmission in FORWARD and slowly push the accelerator pedal to full throttle. See TABLE 2 for stall speeds.

NOTE: The wheels must not turn during the stall speed test.

⚠ CAUTION

Do not hold the throttle open for more than 15 seconds at a time. Permit the engine to operate at idle speed for 2 minutes between tests.

Release the accelerator immediately if the engine speed increases to the speed limit of the governor.

TABLE 2. STALL SPEEDS

STALL SPEEDS (Engines with 50+ Hours)	
GM 4.3 V-6, Gasoline	1950 to 2050 rpm
GM 4.3 V-6, LPG	1950 to 2000 rpm
Perkins Diesel	1920 to 1950 rpm

If the stall speed is 50 to 200 rpm below the specification, the engine is not operating at full power. Check the ignition timing, air filter, fuel system and compression.

If the engine speed is 250 to 500 rpm below the specification, the stator clutch is damaged. The torque converter must be replaced as a unit. If the governor is not adjusted correctly (governor speed too low), the results will be wrong.

If the stall speed is greater than the specification, the engaged clutch is not holding or the converter is damaged. Perform the test in REVERSE to test the other clutch assembly. If the engine rpm is greater than the specification in either direction, do the pressure checks to check for the possible cause.

ADJUST THE INCHING/BRAKE PEDAL (See FIGURE 33.)

The following adjustment procedure gives a small amount of transmission "inching" as the brakes are applied (known as inching/brake "overlap"). This overlap makes the "inching" function smooth on a surface that has a minor slope. As the inching/brake pedal is depressed, inching/brake overlap occurs. The brakes start to apply and the transmission clutch packs begin to disengage.

1. Check and adjust the inching/brake pedal if the control valve was removed for repairs.

2. If the lift truck has been operated for more than 25 hours since the brake shoes were installed, and the operation of the brakes is normal, go to Step 5.

3. If the lift truck has new brake shoes, adjust the brake shoes as described in Step 4.

4. Do the following procedure to adjust the brake shoes:

   a. Put blocks at either side of the steer tires to prevent forward or reverse movement of the lift truck. Put the lift truck on solid blocks so that the drive wheels can be removed. Remove the drive wheels.

   b. Use an adjuster tool (or a screwdriver) to expand the brake shoes toward the drums. Tighten the shoes until the brake drums can just be rotated by hand.

   c. Push the automatic adjuster lever away from the adjuster wheel with a small screwdriver. Use the adjuster tool to loosen the adjuster wheel 1 1/2 revolutions. It can help to put a paint mark on the adjuster wheel for reference.

REPAIRS

REMOVAL AND DISASSEMBLY (See FIGURE 1.)

⚠ WARNING

When putting the lift truck on blocks, make sure the surface is solid, even and level. Any blocks used to support the lift truck must be solid, one-piece units.

1. Place blocks on each side (front and rear) of the steering tires to prevent movement of the lift truck.

2. Raise the lift truck and place blocks under the frame, so that the drive wheels are just touching the floor. Place blocks under the counterweight to maintain stability.

3. Remove the mast assembly as directed in **MAST, 4000SRM736**

⚠ WARNING

Deflate pneumatic tires completely before removing them from the lift truck. Air pressure in the tires can cause the tire and rim parts to explode, causing serious injury or death.

4. Remove the wheel assemblies from the drive axle.

NOTE: The following procedure is for one side of the axle assembly. The procedure is the same for both sides.

5. Remove the brake drum. If the brake drum cannot be removed easily, loosen the brake shoes as follows:

a. Make sure the parking brake is released.

NOTE: It may be necessary to push the adjuster pawl away from the adjuster wheel in order to turn the adjuster wheel.

b. Place a screwdriver through the hole in the back plate to turn the adjuster wheel and loosen the brake shoes.

6. Refer to **BRAKE SYSTEM, 1800 SRM 734** for brake system repair.

7. Remove the capscrews from the axle shaft hub.

8. Install two capscrews removed in step 6 into the two holes next to the alignment pins. Alternately tighten each capscrew to remove the axle shafts from the axle assembly.

9. Disconnect the brake lines at the wheel cylinders. Disconnect the parking brake cable at the parking brake lever, and loosen the cable clamps along the frame for the parking brake cable.

10. Drain the oil from the differential.

11. Remove the transmission mounting bolts from the differential housing.

12. Using either a roller jack or forklift, support the axle housing.

13. Place blocks under the transmission housing, and remove pins, bolts and nuts that hold the axle mounts to the frame of the lift truck.

14. Remove the axle assembly from the lift truck.

15. Remove the outer locknut, lockplate inner locknut, outer wheel bearing and hub from the axle assembly.

16. Remove the outer oil seal and inner bearing from the hub. Discard the seal.

17. Remove the brake assembly from the hanger. If the brake assembly is to be repaired, see **BRAKE SYSTEM, 1800 SRM 734.**

18. Remove the hanger and axle bushing from the spindle.

19. Remove the shims only if they are damaged, and note the number of shims removed from each side.

20. Remove the spindle from the differential housing and discard the O-ring.

CLEANING AND INSPECTION

⚠ WARNING

Cleaning solvents can be flammable and toxic, and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety precautions.

1. Clean all the parts of the drive axle with solvent.

2. Inspect the bearings and bearing cups for damage. If either bearing or bearing cup is damaged, replace both bearings and bearing cups. Also replace the inner hub seal.

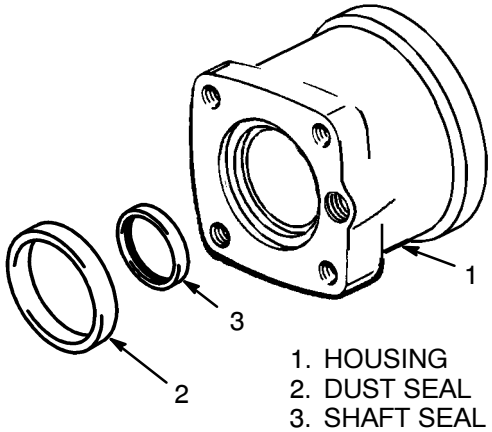
3. Inspect the spindle, axle bushing, and hanger for damage. Replace parts if damaged.

4. Inspect the splines of the axle shaft and replace the axle shaft if the splines are damaged.

Assembly of Steering Control Unit (See FIGURE 4.)

Use new seals, O-rings and neutral position springs during assembly. Lubricate all parts with clean hydraulic oil. Follow the steps of FIGURE 4. to assemble the steering control unit.

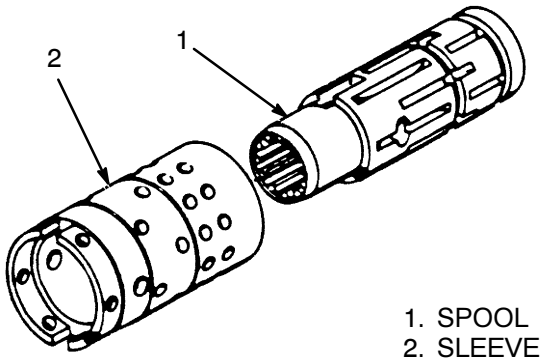
STEP 1. Install dust seal and shaft seal in housing



1. HOUSING
2. DUST SEAL
3. SHAFT SEAL

LS0022

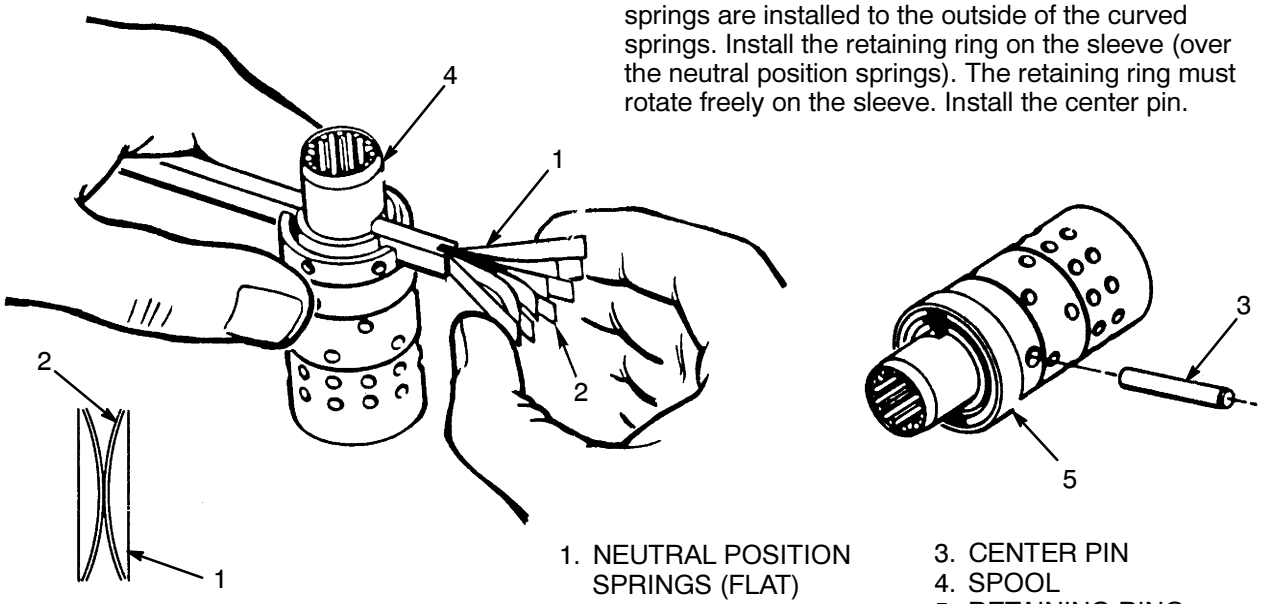
STEP 2. Assemble the spool and sleeve. Make sure the spool rotates freely in the sleeve.



1. SPOOL
2. SLEEVE

12650

STEP 3. Assemble the neutral position spring, and then push them into position in the spool. Make sure the flat springs are installed to the outside of the curved springs. Install the retaining ring on the sleeve (over the neutral position springs). The retaining ring must rotate freely on the sleeve. Install the center pin.



1. NEUTRAL POSITION SPRINGS (FLAT)
2. NEUTRAL POSITION SPRINGS (CURVED)
3. CENTER PIN
4. SPOOL
5. RETAINING RING

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FIGURE 4. ASSEMBLY OF THE STEERING CONTROL UNIT (1 of 3)

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	PROCEDURE
The steer wheels do not move when the steering wheel is turned.	The oil level is low or there is no oil in the tank.	Fill tank. Check for leaks.
	The steering control unit is damaged.	Repair or install new control unit.
	No oil flow from the steering control unit to the steering cylinder.	Repair or install new components. Check for leaks.
Slow or difficult steering.	Relief valve for the steering system needs adjustment.	Adjust or install new relief valve.
	Low oil pressure from the hydraulic pump.	Check for restrictions.
	Seal in the steering cylinder has a leak.	Install new seal.
	Steering control unit is worn or has damage.	Repair or install new control unit.
Steering wheel turns the tires in the wrong direction.	The hydraulic lines are not connected correctly at the steering cylinder or at the steering control unit.	Connect lines properly. Remove air from the system.
Steering function continues after the steering wheel stops.	The steering control unit was assembled wrong or has damage.	Repair or install new control unit.
There is air in the steering system.	The oil level in the tank is low.	Add hydraulic oil as necessary.
	Air was not removed after repair to the hydraulic or steering system.	Remove air from the system.
	The hydraulic pump has an air leak at the inlet.	Check for leaks.

⚠ WARNING

If the brake switches are not adjusted correctly, the engine can be started with the parking brake released. The purpose of the left-hand switch (Monotrol only) is to prevent the starter motor from being energized when the parking brake is not applied. The right-hand switch deenergizes the direction solenoids to put the transmission in Neutral (Monotrol only) when the parking brake is applied.

1. Put the lift truck on blocks so that the drive wheels do not touch the ground or any other object. Put blocks at both sides of the steering tires to prevent movement of the lift truck.

2. Release the parking brake. The right-hand, two-circuit microswitch closes the electric circuit for the Monotrol pedal (energize the solenoids for the powershift transmission). The left-hand switch deenergizes the starting circuit.

3. Turn the ignition switch to the START position. If the parking brake switch operates correctly, the starter will not energize. Turn the ignition switch to the OFF position.

4. Apply the parking brake with the parking brake lever. The right-hand, two-circuit microswitch opens the Monotrol circuit (deenergize the solenoids for the transmission). The starting circuit is energized by the ignition switch through the left-hand switch.

5. Turn the ignition switch to the START position. The starter operates when the parking brake switch operates correctly. Turn the ignition switch to the OFF position.

6. Check the wires for the parking brake switches if the conditions from the results of Steps 2 through 5 are not correct.

7. Apply the parking brake and start the engine. Push the parking brake lever toward the released position, but do not push the release button. The parking brake will stay in the ON position and locked. The transmission must be in NEUTRAL any time the parking brake lever is applied. If the results of the test are not correct, check for wear and damage. Make repairs as necessary and repeat Steps 1 through 7.

ADJUST THE BRAKE SHOES

The brake shoes are automatically adjusted when the brakes are applied while the truck travels in reverse. Use the procedure that follows to manually adjust the brakes after you make repairs.

1. Put the lift truck on blocks so that the drive wheels do not touch the ground. See the section **PERIODIC MAINTENANCE, 8000 SRM 737** for the correct procedures. Make sure that the blocks do not prevent access to the back plates of the brakes.

2. Remove the plugs in the slots in the back plates.

3. Use a tool for brake adjustment in the slot nearest the teeth of the adjuster screw wheel. Push up on the teeth and turn the adjuster screw wheel until the brake shoes touch the brake drum.

4. Put a small screwdriver through the slot in the back plate. Move the automatic adjustment lever away from the adjuster screw wheel.

5. Turn the adjuster screw wheel with the tool for brake adjustment. Push down on the teeth to turn the adjuster screw wheel in the opposite direction. Turn the adjuster screw wheel 1 1/2 revolutions for the necessary clearance between the brake shoes and the drum. Rotate the drive wheel to check for clearance.

6. Repeat Steps 3, 4 and 5 at the other brake assembly. Install the plugs in the back plates.

7. Remove the lift truck from the blocks. Drive the lift truck in Forward and Reverse. Use the brakes to stop ten times in each direction.

NOTE: If the automatic brake adjusters adjust the brake shoes too much or too little, refer to Assembly and Installation in this section for the brake shoes.

REPAIRS

NOTE: Worn or damaged seals are the most common cause of pump repair. The pump bearings, gears and shafts also wear. Many service persons do not repair a worn pump because the cost of repairs can be greater than the cost of a new pump. The seals can be replaced in the hydraulic pump. If the pump is to be rebuilt, the following procedures apply.

REMOVAL

⚠ WARNING

Make sure the carriage is lowered before disconnecting any parts of the hydraulic system.

1. Remove the pump drive shaft, fan belt and pulley as decribed in THE COOLING SYSTEM 700 SRM 740 section.

2. Remove the breather from the hydraulic tank and install a plug. This action prevents the tank from draining too fast when the inlet line is disconnected.

3. Disconnect the hoses from the pump. Install caps and plugs in the hoses and the pump. Be careful so that the inlet hose is not damaged during removal.

4. Remove the nuts and washers holding the pump to the fan mount bracket.

5. Remove the pump from the lift truck.

6. Remove the plate, isolators and hose insulators used for mounting of the pump.

DISASSEMBLY (See FIGURE 2.)

1. Carefully clean the outside of the pump. Before disassembling the pump, make alignment marks on all the housings.

2. Place the pump in a vise with the drive shaft pointing down. Make sure the vise does not hold the pump too tight to cause distortion of the pump body.

NOTE: The position of the seals is important. The holes in the seals must be aligned with the oil passages in the housing sections. The oil passage for the thrust plates is in the outlet chamber.

NOTE: Make sure that you make careful notes of the location and orientation of the parts and seals during disassembly. Some of the parts are similar, but not exactly the same and it can be difficult to make an identification if they are mixed.

3. Remove the capscrews that hold the housings together. Remove the port end cover. Do not damage the machined surfaces. Do not remove the dowel pins that remain in the port end cover or gear housing.

4. Make a note of the positions of the thrust plate, channel seal and gasket seal. Remove the thrust plate. Remove and discard the channel seal and gasket seal.

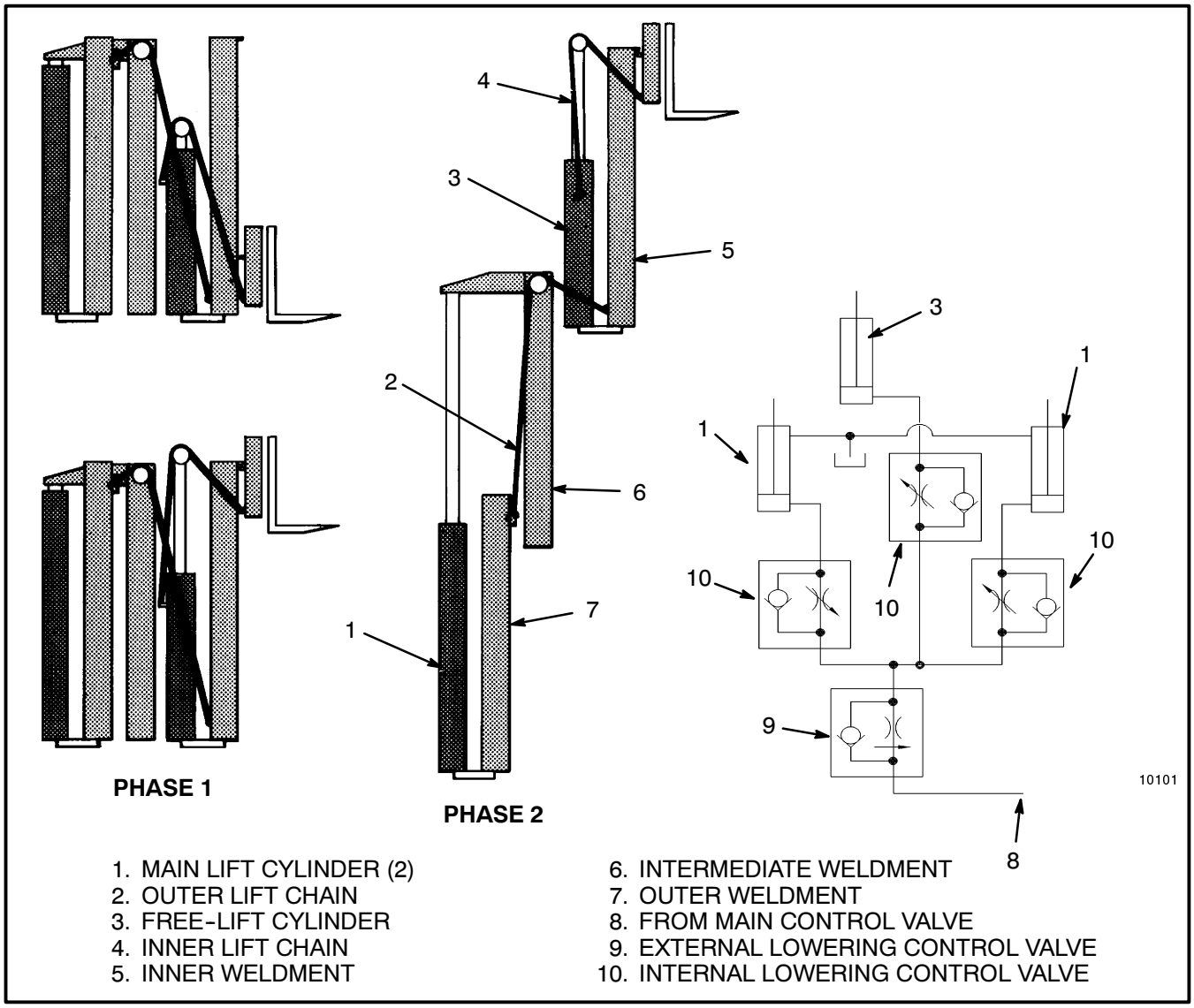
5. Remove the drive and driven gears. Keep gears together as a set. Remove the gear housing. Do not damage the machined surfaces.

6. Make a note of the positions of the thrust plate, channel seal and gasket seal. Remove the thrust plate. Remove and discard the channel seal and gasket seal.

7. Place the shaft end cover in a vise with the mounting face up. Remove the retaining ring and snap ring. Remove the bearing with a bearing puller. Remove and discard the seal.

8. Check all plugs to be sure they are tightly in place. Replacement is necessary only if parts are damaged. Remove with screwdriver.

9. Check all bushings for wear or damage. If necessary, remove bushings using a bushing puller.



1. MAIN LIFT CYLINDER (2)
2. OUTER LIFT CHAIN
3. FREE-LIFT CYLINDER
4. INNER LIFT CHAIN
5. INNER WELDMENT
6. INTERMEDIATE WELDMENT
7. OUTER WELDMENT
8. FROM MAIN CONTROL VALVE
9. EXTERNAL LOWERING CONTROL VALVE
10. INTERNAL LOWERING CONTROL VALVE

FIGURE 3. THREE-STAGE MAST WITH FULL FREE-LIFT

3. Disconnect and remove the lift chains between the outer weldment and the inner weldment. Slide the inner weldment from the intermediate weldment approximately 30 cm (12 in). Remove the strip bearings. Remove the load rollers from the inner and intermediate weldments. Make a note of the shim arrangement. The shim arrangement will be approximately the same during assembly procedures.

4. Slide the inner weldment half-way out of the intermediate weldment. Connect a lifting device to the center of the inner weldment. See FIGURE 11. Slide the inner weldment out of the intermediate weldment.

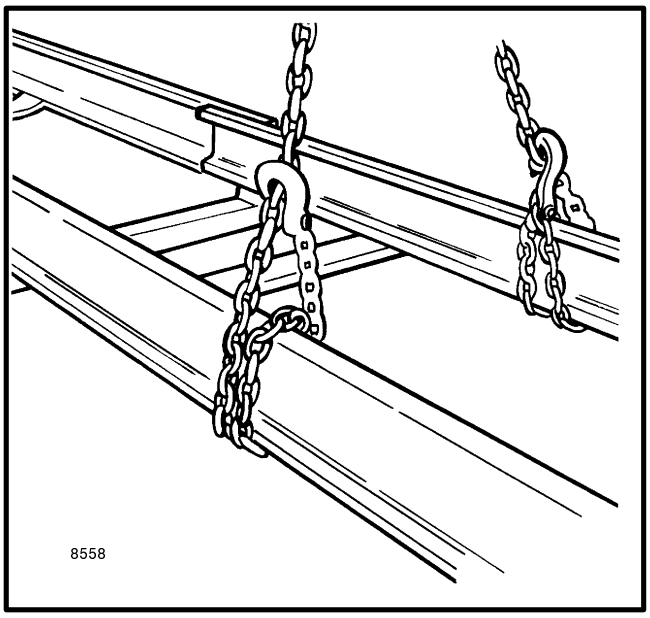


FIGURE 11. INNER WELDMENT

5. Disconnect the hydraulic lines from the lift cylinders. Remove the snap rings and washers from the top of each lift cylinder. Remove the cylinder clamps from the brackets at the top of each lift cylinder.

6. Remove the capscrews, washers and brackets that mount the bottom of each cylinder.

7. Slide the intermediate weldment from the outer weldment approximately 30 cm (12 in) to disengage the lift cylinders from the intermediate weldment. Remove the lift cylinders from the mounts at the bottom of the outer weldment.

8. Slide the intermediate weldment from the bottom of the outer weldment approximately 30 cm (12 in). Remove the strip bearings. Remove the load rollers. Make a note of the shim arrangement. The shim arrangement will be approximately the same during assembly procedures.

9. Slide the intermediate weldment half-way out of the top of the outer weldment. Connect a lifting device to the center of the intermediate weldment. See FIGURE 11. Slide the intermediate weldment out of the outer weldment until the stub shafts are in the notches of the outer weldment. Remove the intermediate weldment from the outer weldment.

10. Remove the snap rings and bushings at the mast mounts.

11. Remove and disassemble the sheaves and load rollers as necessary for cleaning and repair.

Cleaning and Inspection

Clean and inspect the parts of the three-stage mast using the same procedures as described for the two-stage mast.

Assembly (See FIGURE 12.)

NOTE: The shims for the load rollers keep the weldments parallel and give correct clearance. During assembly, the location of the shims will be approximately the same as they were before disassembly. Check the clearance and adjust the shims for wear or changes because of repairs. The strip bearings are also adjusted by using shims. See the Checks and Adjustments in this section for the instructions to make the necessary adjustments.

1. Connect a lifting device to the center of the intermediate weldment (see FIGURE 11.). Put the stub shafts through the notches in the outer weldment. Slide the intermediate weldment into the outer weldment so that the stub shafts are seen at the top and bottom of the weldments.

2. Install the strip bearings and the shims on the outer weldment. Apply grease to the bearing surface. See FIGURE 10.

3. Install the load rollers and shims on both weldments. Check the clearance of the load rollers and strip bearings as described in Checks and Adjustments.

4. Install the bushings and snap rings into the mast mounts.

5. Install the main lift cylinders. Make sure the spacers, when installed, are in their original positions at the bot-

TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSE	PROCEDURE OR ACTION
No movement of the lift or tilt cylinders.	Pilot line(s) to the control valve are disconnected or leaking.	Tighten or connect fittings.
	No oil or not enough oil in the hydraulic tank.	Fill tank. Check for leaks.
	Relief valve is not set correctly.	Adjust or install new relief valve.
	Hydraulic pump does not operate or has damage.	Repair or install new pump.
	Remote control valve does not operate.	Check and repair valve.
Slow movement of the lift or tilt cylinders.	No oil or not enough oil to the lift or tilt cylinders.	Fill tank. Check for leaks.
	Cylinders have internal or external leaks.	Repair leaks. Install new parts.
	Relief valve is not set correctly.	Adjust or install new relief valve.
	There is a restriction in a hydraulic line.	Remove restriction. Install new parts.
Rough movement of the mast assembly.	There is air in the hydraulic system.	Remove air. Check for loose connections or breaks in lines.
	Lift cylinder(s) is damaged.	Repair or install new lift cylinder.
	Mast weldments are damaged or not aligned.	Align weldments. Install new parts.
	Mast weldments are not lubricated correctly.	Lubricate correctly.
	Load rollers or bearing blocks are damaged or not adjusted correctly.	Repair or adjust the parts.
	Lift chains are damaged.	Replace lift chains.
Lift or tilt cylinders extend or retract when the control valve lever (spool) is in the NEUTRAL position.	Load check valves and spools have damage.	Repair or install new load check valve and spool.
	Cylinder seals have leaks.	Install new seals.
	Hydraulic lines have leaks.	Repair leaks. Install new parts. Remove air from the system.
	Leaks between the spool and the bore.	Install new valve section.
Cylinders at carriage do not operate correctly.	Header hoses are damaged.	Replace header hoses.
	Hydraulic lines at selector valve are damaged or not connected correctly.	Check connections or install new lines.
	Wire harness or wires at selector valve are damaged or not connected correctly.	Check connections or install new wires.
	Solenoid at selector valve does not operate.	Replace solenoid.

NOTES

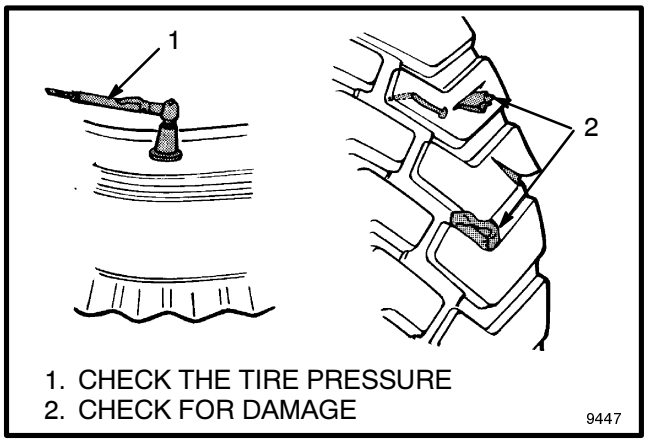


FIGURE 10. CHECK THE TIRES

Check the tires for damage. Check the tread and remove any objects that will cause damage. Check for bent or damaged rims. Check for loose or missing parts. Remove any wire, straps or other material wrapped around the axle.

Make sure the drive wheel nuts are tight. Tighten the wheel nuts in a cross pattern to the correct torque value shown in the MAINTENANCE SCHEDULE.

⚠ CAUTION

When the drive wheels have been installed check all wheel nuts after 2 to 5 hours of operation. Tighten the nuts in a cross pattern to the correct torque value shown in the MAINTENANCE SCHEDULE. When the nuts stay tight for eight hours, the interval for checking the torque can be extended to 350 hours.

Forks (See FIGURE 11.)

The identification of a fork is how the fork is connected to the carriage. The **H3.50-5.50XM (H70-120XM)** series of lift trucks use only hook forks. See FIGURE 11.

Forks, Adjustment (See FIGURE 12.)

Hook forks are connected to the carriage by hooks and lock pins. See These lock pins are installed through the top fork hooks and fit into slots in the top carriage bar. Adjust the forks as far apart as possible for maximum support of the load. Hook forks will slide along the carriage bars to adjust for the load to be lifted. Raise the lock pin in each fork to slide the fork on the carriage bar. Make sure the lock pin is engaged in the carriage bar to lock the fork in position after the width adjustment is made.

Forks, Removal And Installation (See FIGURE 11.)

⚠ WARNING

Do not try to move a fork without a lifting device. Each hook fork for these lift trucks can weigh 66 kg to 183 kg (145 to 402 lb).

A fork can be removed from the carriage for replacement of the fork or other maintenance.

Hook Fork (Removal). Slide a hook fork to the fork removal notch on the carriage. See FIGURE 12. Lower the fork onto blocks so that the bottom hook of the fork moves through the fork removal notch. See FIGURE 11. Lower the carriage further so that the top hook of the fork is disengaged from the top carriage bar. Move the carriage away from the fork, or use a lifting device to move the fork away from the carriage.

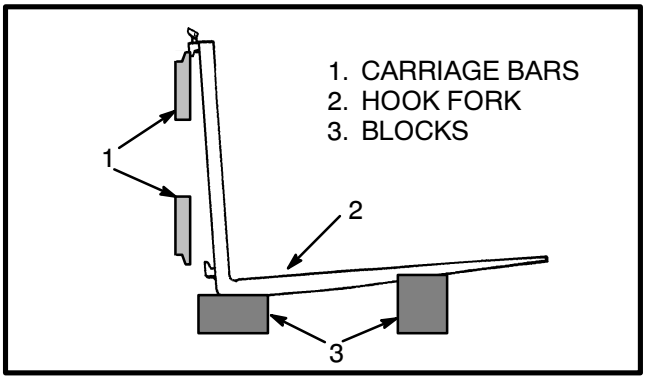


FIGURE 11. REMOVE A HOOK FORK

Hook Fork (Installation). Move the fork and carriage so that the top hook on the fork can engage the upper carriage bar. Raise the carriage to move the lower hook through the fork removal notch. Slide the fork on the carriage so that both upper and lower hooks engage the carriage. Engage the lock pin with a notch in the upper carriage bar.

Inspection Of Forks, Mast, and Lift Chains (See FIGURE 13.)

⚠ WARNING

Never work under a raised carriage or forks. Lower the carriage or use blocks and chains on the mast weldments and carriage so that they can not

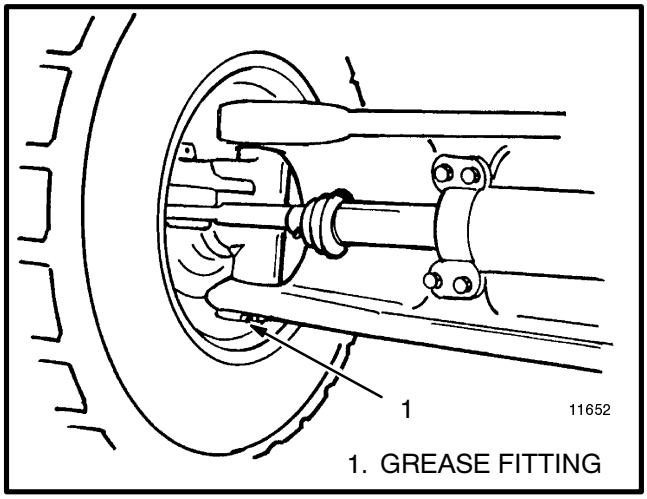


FIGURE 25. STEERING AXLE

FUEL SYSTEM, CHECKS AND ADJUSTMENTS

⚠ CAUTION

The adjustment of the throttle cable must be correct or it can break during operation. The accelerator pedal or the MONOTROL pedal must reach the pedal stop by the time the throttle lever on the fuel injection pump reaches its stop.

LPG Carburetor

Refer to **THE LPG FUEL SYSTEM, 900 SRM 745** for LPG carburetor adjustment procedures.

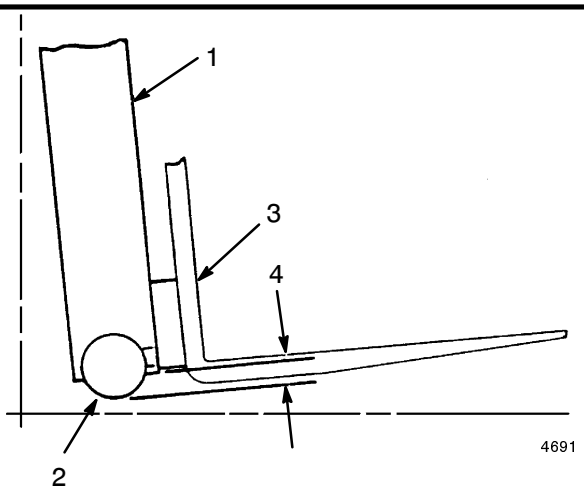
Fuel Injection (Perkins Engine)

Refer to the Fuel System section of the **PERKINS DIESEL ENGINES, 1000 SERIES , 600 SRM 705** for repairs and adjustments to the fuel injection system.

GM V-6 Engine

Refer to the **ELECTRONIC ENGINE CONTROL, 2200 SRM 767** manual for repairs and adjustments to the fuel system.

34 mm (1.3 in) of the roller diameter below the inner channel. If the adjustment is not correct, remove the load and adjust the chain anchors. Make sure that each chain anchor is adjusted the same amount.



1. TILT MAST FULLY BACKWARD
2. CARRIAGE ROLLER
3. FORK
4. CARRIAGE ROLLER MUST NOT EXTEND MORE THAN 34 mm (1.3 in) BELOW THE MAST CHANNEL

FIGURE 33. LIFT CHAIN ADJUSTMENTS

4. Remove the load from the forks. On the two-stage mast, check the clearance of the carriage when the mast is fully extended. On a mast with a free-lift cylinder, make this check after extending the weldments a short distance. The carriage stops must not touch the stop on the top crossmember of the inner weldment. The chains are too tight if the carriage touches the mast stop. Put the mast in a vertical position and lower the carriage completely. If the forks do not just touch the surface, the chains are too tight. If the chains are too tight, adjust the chain anchors. Make sure that each anchor is adjusted the same amount.

NOTE: When the chain adjustments are complete, make sure that the threads on the nuts of the chain anchors are completely engaged. Make sure that all of the adjustment is not removed from the chain anchors. The chain anchors must be able to move in their sockets.

FUEL INJECTORS

⚠ WARNING

Do not put your hands on fuel lines under pressure. Fuel oil can be injected into your body by the hydraulic pressure and cause injury.

NOTE: The inspection and repair of fuel injectors require special tools and training. Most users have a special repair service make repairs on fuel injectors. Fuel injector nozzles that have a problem will cause black smoke in the exhaust, a decrease in engine power, and an increase in engine noise.

NOTE: Additional information on the Perkins diesel engines can be found in the following sections of the **SERVICE MANUAL**:

- **THE PERKINS ENGINE 1004.42, 600 SRM 705**

The engine will run roughly if a fuel injector has a problem. To find which fuel injector has a problem, operate the engine at approximately 1000 rpm. Loosen and tighten the connection to the inlet of each fuel injector in a sequence. When the connection to the bad fuel injector is loosened, there will not be a change in the engine speed.

CHECK FOR LEAKS IN THE LIFT AND TILT SYSTEM

⚠ WARNING

Never allow anyone under a raised carriage. Do not put any part of your body in or through the lift mechanism unless all parts of the mast are completely lowered and the engine is stopped.

Before making any repairs, use blocks and chains on the mast weldments and carriage so that they can not move. Make sure the moving parts are fastened to the parts that can not move.

Do not try to find hydraulic leaks by putting your hand on hydraulic components under pressure. Hydraulic oil can be injected into the body by the pressure.

During test procedures for the hydraulic system, fasten the load to the carriage with chains to prevent it from falling. Keep all personnel away from the lift truck during the tests.

Check the Lift Cylinders for Leaks

1. Operate the hydraulic system. Put a capacity load on the forks and raise and lower the load several times. Lower the load and tilt the mast forward and backward several times. Check for leaks.

LIFT TRUCK WEIGHTS

MODEL	kg	lb
H70XM	5660	12,460
H80XM	5940	13,090
H90XM	6120	13,485
H100XM	6830	15,040
H110XM	7130	15,700
H120XM	7330	16,140
NOTE: Lift trucks equipped with overhead guard, two-stage mast, carriage, load backrest, forks, gas engine, powershift transmission and operator.		

ELECTRICAL SYSTEM

ITEM	GM V-6 4.3	Perkins
All Models	12 volt, negative ground	
Alternator Output (Hot)	45 amps @ 800 rpm	38 amps @ 800 rpm
Alternator Output (Hot)	68 amps @2200 rpm	65 amps @2200 rpm
Ignition Timing Gas @ 800 rpm LPG @ 800 rpm	 0° BTDC 0° BTDC	16° BTDC (Static)
Spark Plugs	AC R48TS	-
Spark Plug Gap	0.89 mm (0.035 in)	-

STALL SPEEDS

ENGINE	NEW ENGINE	ENGINE WITH 50 HOURS
GM V-6 Gas	1920 rpm	1950 to 2050 rpm
GM V-6 LPG	1900 rpm	1950 to 2000 rpm
Perkins	1890 rpm	1920 to1950 rpm

CAPACITIES

ITEM	QUANTITY
ENGINE OIL	
GM V-6	4.7 litre (5.0 qt)
Perkins 1004-42	8.0 litre (8.5 qt)
COOLING SYSTEM	
GM V-6	17.0 litre (18.0 qt)
Perkins 1004-42	17.0 litre (18.0 qt)
HYDRAULIC TANK	
H3.50-4.00XMS (H70-90XM)	44.5 litre (11.7 gal)
H4.00-5.50XM (H100-120XM)	66.0 litre (17.5 gal)
POWERSHIFT TRANSMISSION	14.2 litre (15.0 qt)
DIFFERENTIAL AND DRIVE AXLE	8.5 litre (9.0 qt)
FUEL TANK	
H3.50-4.00XMS (H70-90XM)	69.0 litre (18.2 gal)
H4.00-5.50XM (H100-120XM)	103.0 litre (27.3 gal)
BRAKE FLUID	0.2 litre (0.5 pt)

TIRE PRESSURE

BIAS PLY TIRES		
Tire Size	**kPa**	**psi**
7.00 x 12 - 12 Ply	862	125
300 x 15 - 18 Ply	862	125
250 x 15 -16 Ply	862	125
250 x 15 -18 Ply	965	140
7.00 x 15 -12 Ply	862	125
8.25 x 15 -12 Ply	690	100

This section is for the following models:
H3.50-5.50XM (H70-120XM)(K005)

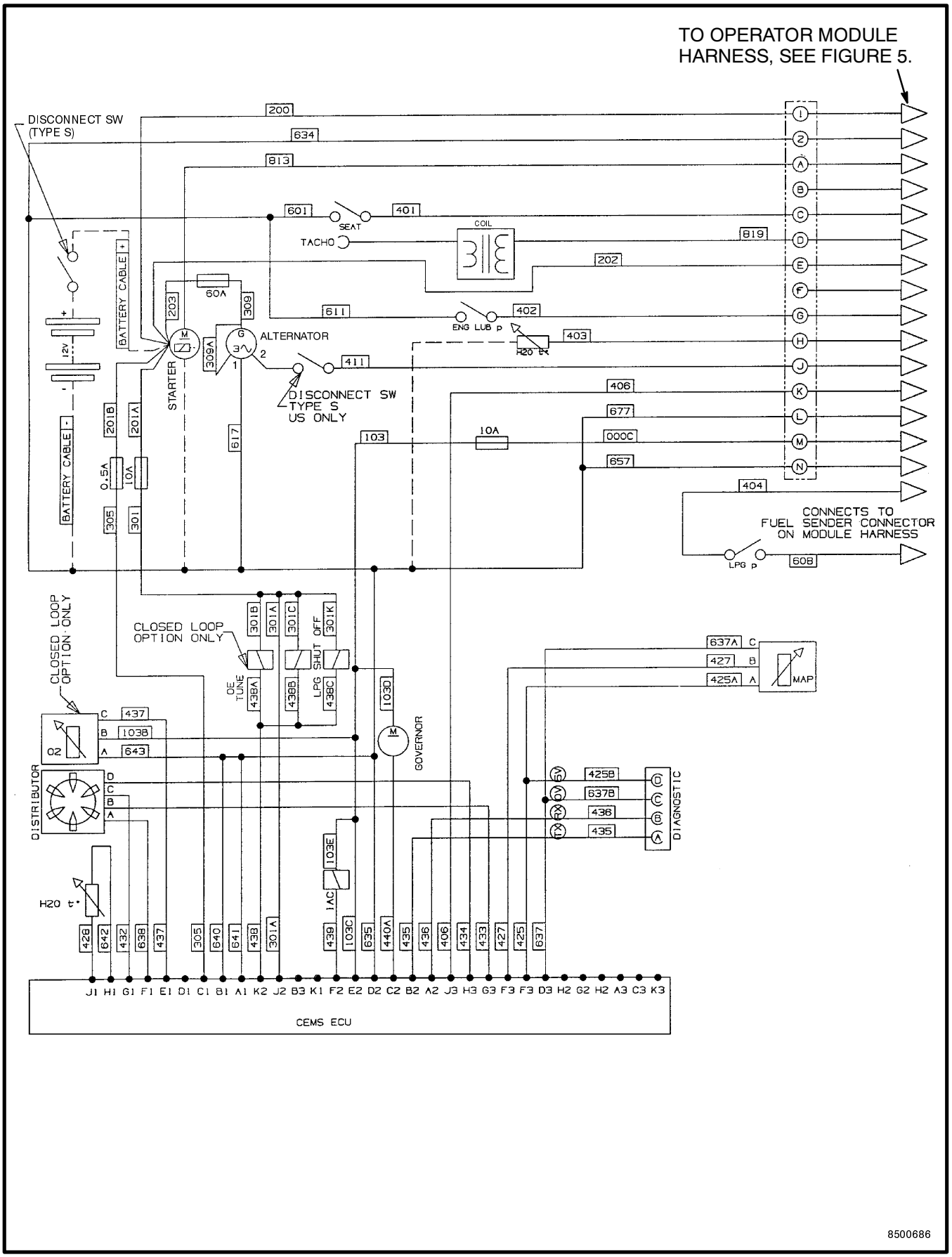


FIGURE 3. ELECTRICAL SCHEMATIC, GM V-6 LPG