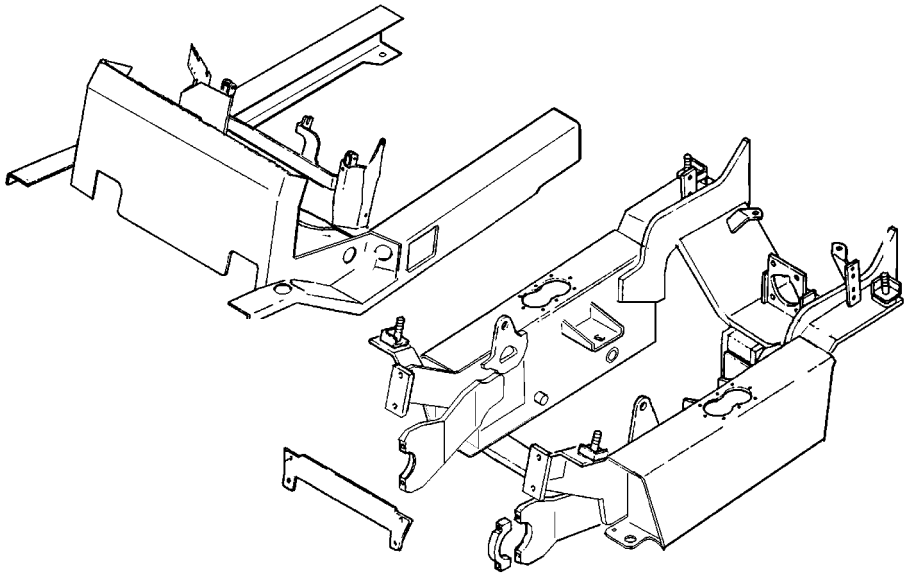
FRAME

H1.50–1.75XM, H2.00XMS
(S/H25–35XM, S/H40XMS)



HYSTER

PART NO. 897559

100 SRM 545

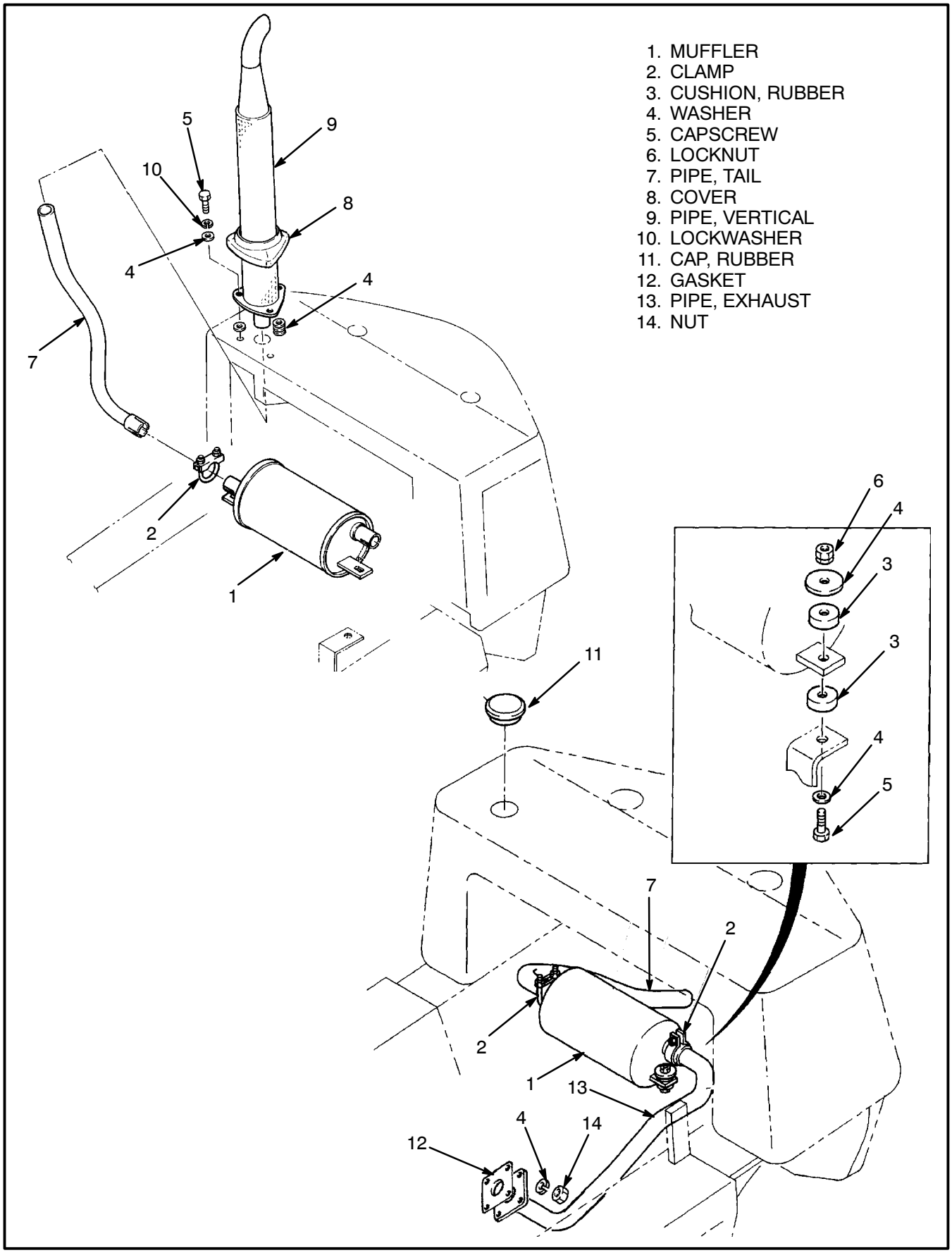


FIGURE 9. EXHAUST SYSTEM, DIESEL

3. Remove the air cleaner, the carburetor linkage, the inlet and exhaust manifolds.

4. Remove the coolant hoses.

5. Remove the bracket for the cooling fan.

6. Remove the upper and lower timing belt covers. See FIGURE 23.

7. Loosen the capscrews for the timing belt tensioner and remove the spring. Remove the capscrews and the timing belt tensioner.

8. Use chalk to mark the direction of rotation of the timing belt. Remove the timing belt. See FIGURE 1.

9. Disconnect the wires at the distributor. Remove the capscrew for the distributor mount and pull the distributor from the front housing.

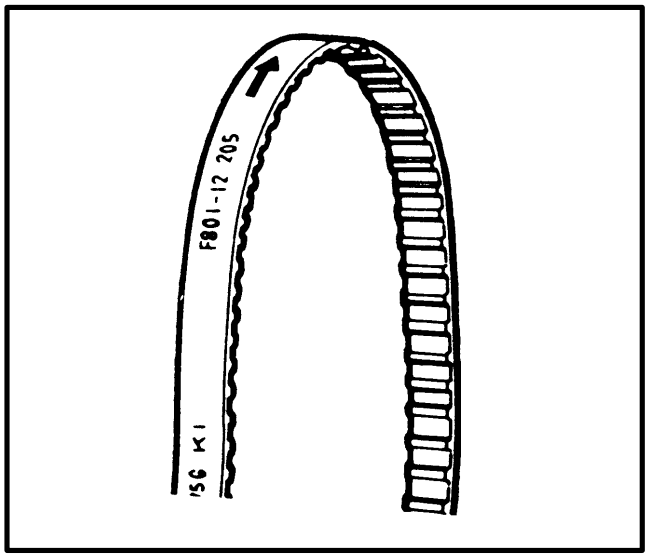


FIGURE 1. TIMING BELT

10. See FIGURE 2. Remove the camshaft pulley. Prevent rotation of the pulley and loosen the capscrew. Remove the capscrew and the pulley.

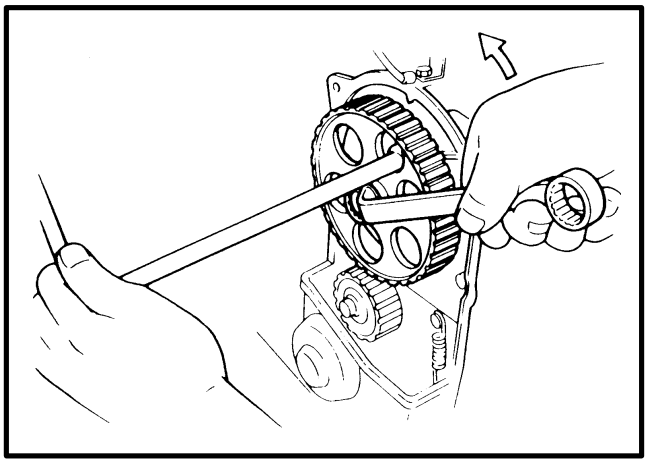


FIGURE 2. REMOVE THE CAMSHAFT GEAR

11. Remove the nuts and capscrews for the front housing, then remove the housing. See FIGURE 19.

12. Remove the valve cover.

13. Loosen the capscrews for the rocker shaft supports in steps. See FIGURE 3. Remove the rocker shaft assembly and the camshaft.

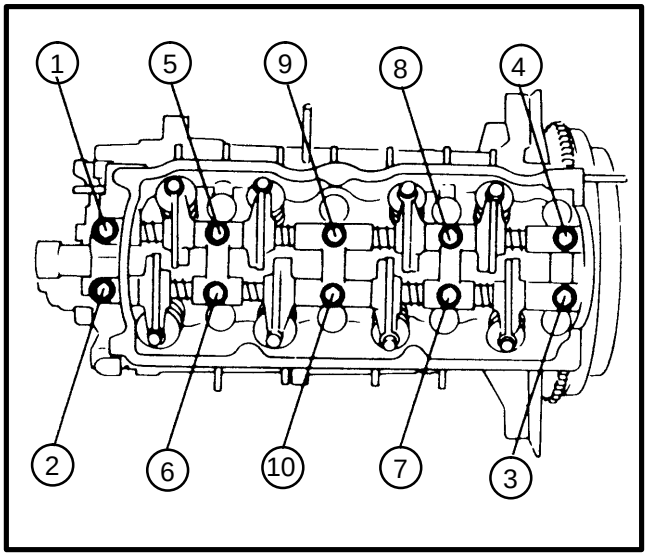


FIGURE 3. SEQUENCE FOR REMOVAL OF THE ROCKER ASSEMBLY

14. Remove the capscrews for the cylinder head in steps. Remove the capscrews in the sequence shown in FIGURE 4.

15. Lift the cylinder head from the block.

CONNECTING RODS AND BEARINGS

1. Use an alignment tool to check the connecting rods for being straight. The maximum amount of distortion per 100 mm (4.0 in) is 0.04 mm (0.0016 in). If the amount of distortion is greater than the specification, install a new rod or use a press to straighten the connecting rod.

2. Check the clearance between the rod bearings and the journals of the crankshaft. Clean the rod bearings and journals. Use a plastic gauge material between the journal and the bearing. Tighten the capscrews for the rod caps to 51 to 56 N.m (37 to 41 lbf ft). Do not rotate the connecting rod. See FIGURE 30. The correct clearance is 0.027 to 0.067 mm (0.0011 to 0.0026 in). If the clearance is greater than the specifications, replace the bearings.

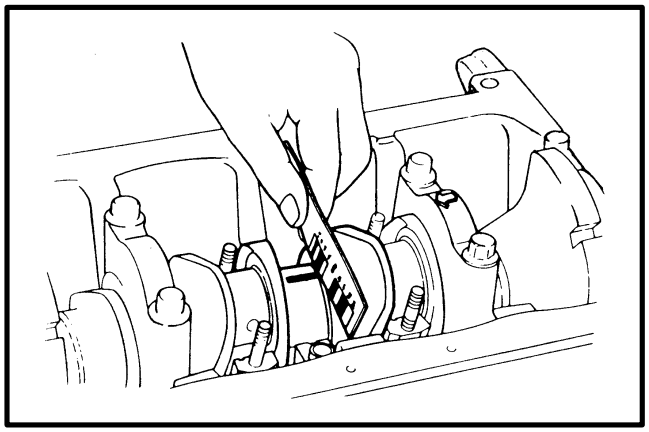


FIGURE 30. CHECK THE CLEARANCE OF THE CONNECTING ROD BEARINGS

Assembly And Installation

PISTONS AND CONNECTING RODS

1. Align the oil port on the large end of the connecting rod with the “F” mark on the piston. See FIGURE 31.

Lubricate the piston pin and bore in the piston with engine oil. Use a press to install the piston pin. The force to push the pin into the piston must be 500 to 1500 kg (1100 to 3300 lb). If the force is not correct, replace the piston pin and/or connecting rod. Use the special tool to make sure the piston pin is installed to the correct depth. After installation, check that the piston moves freely on the piston pin.

2. Install the piston rings on the pistons. During installation, the writing on each piston ring must be toward the top of the piston. Check that the rings rotate freely, then put the ends of the rings in the positions shown in FIGURE 32. Make sure the ends of the upper and lower oil control rings are each 30° from the piston pin. Also make sure that the top and second rings are each 30° from the piston pin. Lubricate the rings with engine oil.

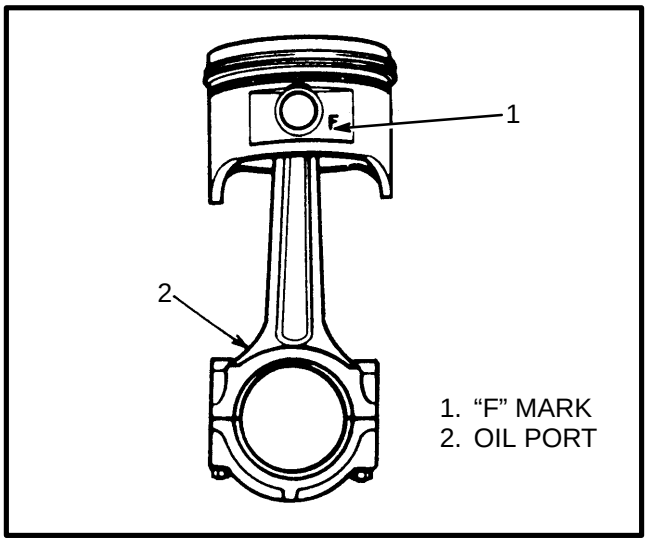


FIGURE 31. CONNECTING ROD AND PISTON

3. Apply clean engine oil to the piston assembly. Install the bearings for the connecting rods. Install the piston into the correct cylinder making sure the “F” is toward the front (timing belt end) of the engine.

ENGINE SPECIFICATIONS

ITEM	SPECIFICATION
Valve Mechanism	
Spring Free Length (Outer)	52.4 mm (2.063 in)
Service Limit	50.8 mm (2.00 in)
Spring Free Length (Inner)	45.7 mm (1.799 in)
Service Limit	44.3 mm (1.744 in)
Rocker Arm Shaft Diameter	15.966–15.984 mm (0.6286– 0.6293 in)
Rocker Arm Bore Diameter	16.000 –16.027 mm (0.6299 to 0.6311 in)
Clearance Between Rocker Arm and Shaft	0.016–0.061 mm (0.0006–0.0024 in)
Camshaft	
Cam Lobes – Production Limit	37.102 mm (1.4607 in)
Cam Lobes – Service Limit	36.902 mm (1.4528 in)
Bearing Journals, 1 and 5	31.940–31.965 mm (1.2575 to 1.2585 in)
Bearing Journals, 2, 3 and 4	31.910–31.935 mm (1.2563 to 1.2573 in)
Bearing Journal Wear Limit	0.05 mm (0.002 in)
Clearance Between Journals and Bore, 1 and 5	0.035–0.085 mm (0.0014–0.0033 in)
Clearance Between Journals and Bore, 2, 3 and 4	0.065–0.115 mm (0.0026–0.0045 in)
End Clearance	0.08–0.16 mm (0.003–0.006 in)
End Clearance (Service Limit)	0.20 mm (0.008 in)
Crankshaft	
Distortion	less than 0.03 mm (0.0012 in)
Main Bearing Journal Diameter	59.937–59.955 mm (2.3597–2.3604 in)
Service Limit	0.05 mm (0.002in)
Grinding Limit	0.75 mm (0.030 in)
Clearance Between Journals and Main Bearings	0.031–0.049 mm (0.0012–0.0019 in)
Service Limit	0.08 mm (0.003 in)
Connecting Rod Journal Diameter	50.940–50.955 mm (2.0055–2.0061 in)
Service Limit	0.05 mm (0.002 in)
Grinding Limit	0.75 mm (0.030 in)
Thrust Bearing Clearance	0.08–0.18 mm (0.003–0.007 in)
Service Limit	0.30 mm (0.012 in)
Connecting Rods	
Small End Bore	21.943–21.961 mm (0.8639–0.8646 in)
Clearance Between Piston Pin and Bore	0.015–0.040 mm (0.0006–0.0016 in)
Clearance Between Crankshaft Journals and Rod Bearings	0.027–0.067 mm (0.0011–0.0026 in)
Service Limit	0.10 mm (0.004 in)
Cylinder Block	
Distortion at Top Surface	0.15 mm (0.0059 in)
Bore Diameter	86.00– 86.019 mm (3.3858–3.3866 in)
Wear Limit	0.15 mm (0.0059 in)

valve seat is too deep and the cylinder head must be replaced.

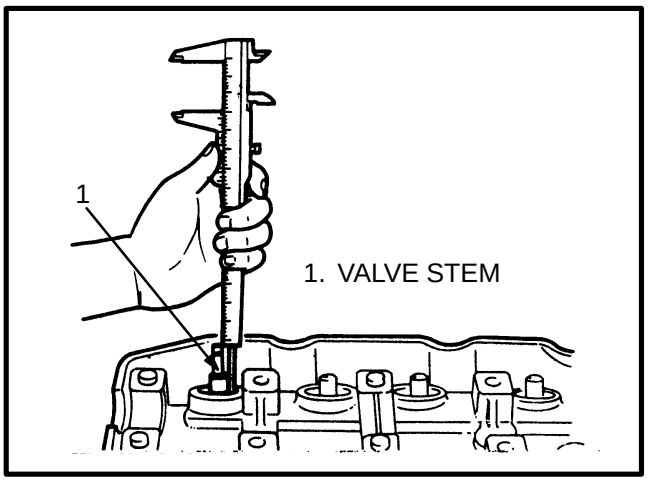


FIGURE 14. VALVE GUIDE

VALVES

1. See FIGURE 15. Inspect the stem of each valve for wear. Use a micrometer to measure the outside diameter of the stem. The minimum dimension for an intake valve is 7.980 mm (0.3142 in). The minimum dimension for an exhaust valve is 7.975 mm (0.3140 in).

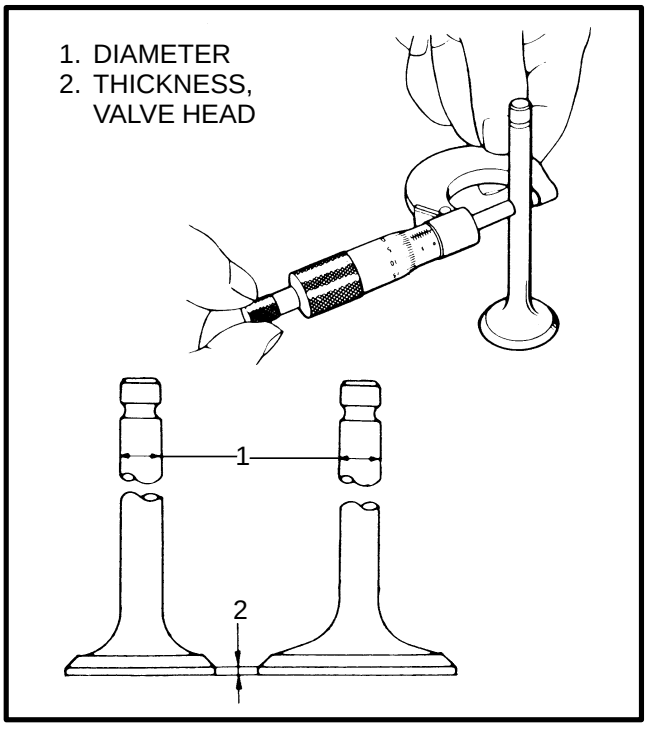


FIGURE 15. INSPECT THE VALVES

2. Inspect the valves for cracks, burned faces and distortion. Inspect the seat face of the valves for wear and damage. Measure the thickness of the valve head. See The minimum thickness for an intake valve is 0.5 mm (0.020 in). The minimum thickness for an exhaust valve is 1.0 mm (0.040 in).

3. If the valves need grinding the correct surface angle is 45° for both intake and exhaust valves.

VALVE SPRINGS

Check the valve springs for damage. See FIGURE 16. Measure the free length of the valve springs. The minimum length is 42.0 mm (1.65 in). Check the valve springs for being square. See FIGURE 16. If the measurement is more than 1.52 mm (0.059 in), replace the valve spring(s).

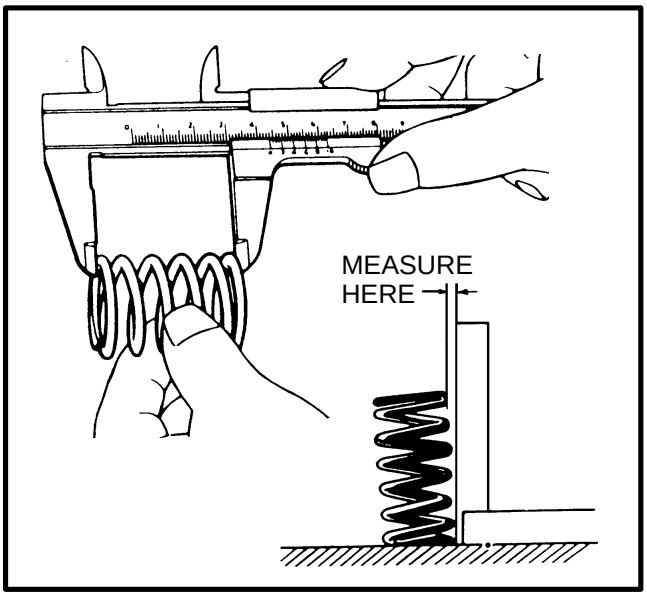


FIGURE 16. INSPECT THE VALVE SPRINGS

Installation

1. Clean the surface of the cylinder head and the surface of the block.

2. Install the valves and valve springs.

3. If the timing chain was removed, do the following:

a. Install the guides for the timing chain on the cylinder block. See FIGURE 17.

5. If the readings are lower than the minimum reading, there is a problem with the valves, piston rings or cylinder head gasket. Do the following tests to find the problem:

a. Add approximately 30 ml (1.0 oz) of engine oil to each cylinder at the spark plug hole.

b. Crank the engine approximately ten revolutions to distribute the oil.

c. Install the compression gauge and do the same tests as described in step 3.

d. If the compression pressure increases to a normal reading, the low pressure was caused by worn or damaged piston rings. The cylinder bore can also be damaged.

e. If the compression reading does not increase, the low pressure was caused by worn valves, valve seats or valve guides.

f. If the low pressure readings are in two cylinders next to each other, the cylinder head can be leaking.

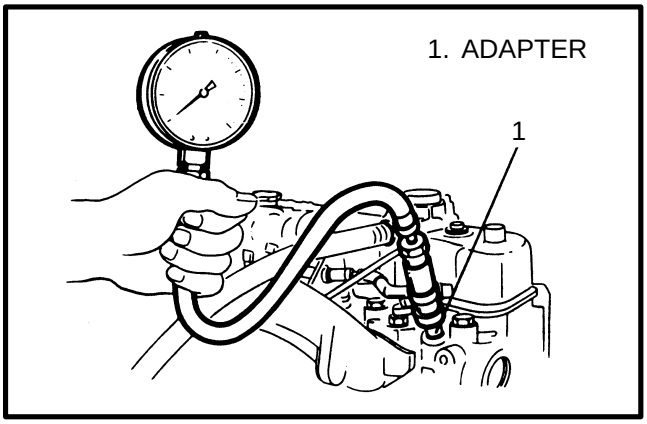


FIGURE 37. CHECK THE COMPRESSION PRESSURE

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 airflow through the radiator at all engine speeds. The fan is a pusher-type or puller-type and can be installed on the water pump or on a separate hub. The fan is driven by a drive belt from the engine crankshaft.

The fan shroud ensures the air flow from the fan goes through the core of the radiator.

Cooling System Checks

RADIATOR

WARNING

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

NOTE: The Repair procedures for the radiator are in the **Frame** section of the **Service Manual**.

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.

THERMOSTAT

WARNING

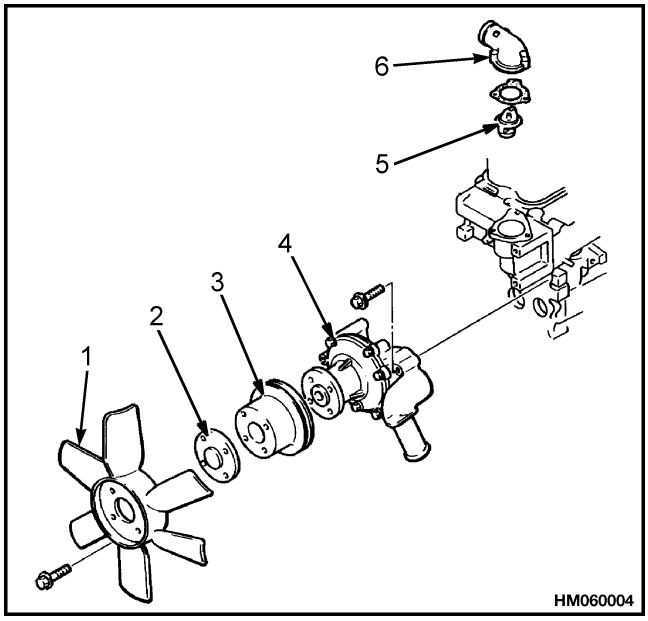
During engine operation, be careful not to touch the fan, pulleys, or drive belts. Contact with these parts can cause serious injury.

CAUTION

DO NOT operate the engine without a thermostat. The engine and cooling system can be damaged.

NOTE: Repair procedures for the thermostat are in the **Engine** section of the **Service Manual**.

1. Remove thermostat from cooling system. See Figure 3.
2. Mix solution of water with 33% antifreeze. Heat solution to 14°C (57°F) above temperature on thermostat.
3. Hold thermostat with wire and put it in solution. Stir solution. If operating correctly, thermostat will open.
4. Remove thermostat and put in same solution at –12°C (10°F) below temperature on thermostat. Valve must close completely.



1. FAN
2. SPACER
3. HUB/PULLEY
4. WATER PUMP
5. THERMOSTAT
6. THERMOSTAT HOUSING

Figure 3. Cooling System Components Typical Arrangement

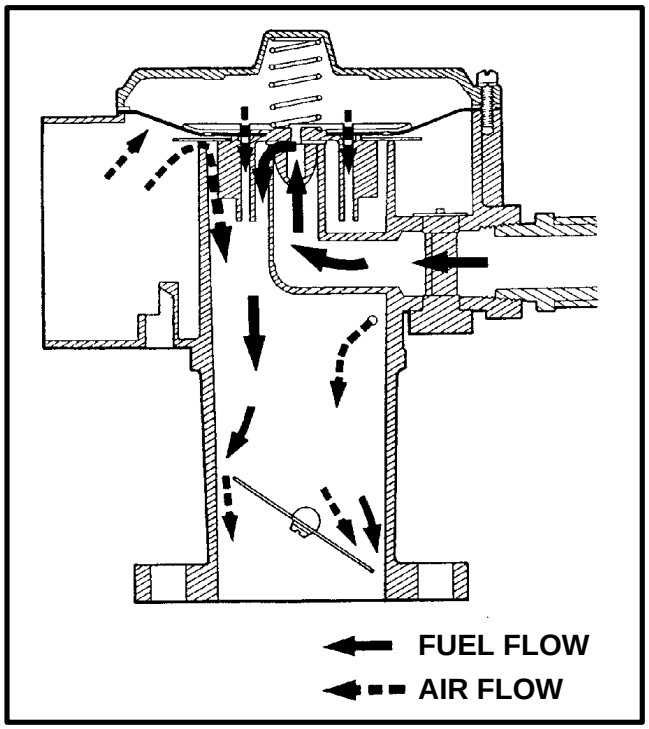


FIGURE 8. AIR AND FUEL FLOW AT IDLE

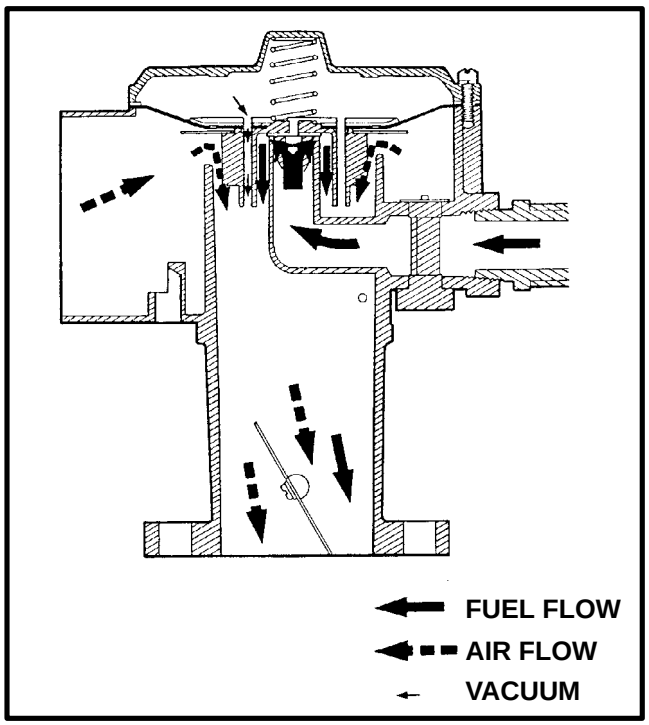


FIGURE 9. AIR FUEL FLOW AT HIGH SPEED

When the throttle plate is near the closed position, the pressure difference decreases. The metering spring pushes the valves toward their seats. Flow through the fuel valve decreases. An air screw for idle permits adjustment of the mixture of the air fuel at low engine speed.

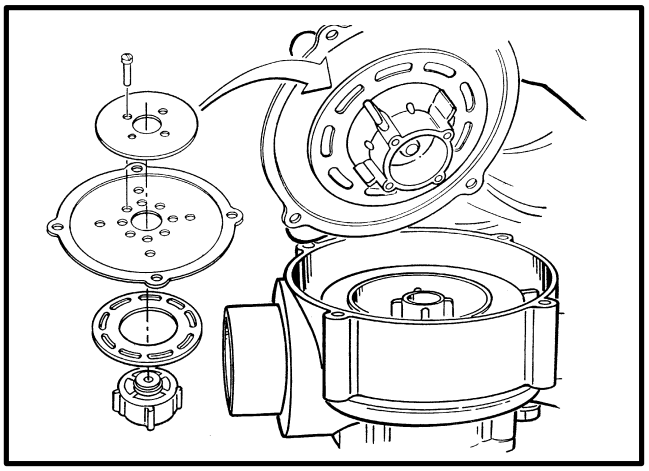


FIGURE 10. DIAPHRAGM AND FUEL VALVE ASSEMBLY

When the throttle plate is fully open at high engine speeds, the fuel metering valve is at the top of its travel. See FIGURE 9. The carburetor has an adjustable valve that controls the amount of LPG vapor that goes to the fuel metering valve. The restriction in fuel flow by this valve is small when the fuel flow is low. When more fuel flows through the valve, the valve becomes an orifice. Adjusting the valve opening changes the mixture of fuel and air when the engine is operated at high speed with a load.

Solenoid Valve (See FIGURE 2.)

The solenoid valve is installed at the fuel inlet of the carburetor. The valve opens to let fuel to the carburetor when the key switch is **ON.** When the key switch is **OFF**, the valve closes and fuel cannot flow to the carburetor.

Idle Control Actuator (See FIGURE 2.)

NOTE: Only the H2.00–3.20XM (H40–65XM) units use the idle control actuator.

The idle control actuator is a vacuum controlled device that increases idle speed when there is a load on the engine. The idle control actuator is mounted on the carburetor and acts directly on the throttle linkage. The vacuum line is connected to the governor and senses manifold vacuum. A check valve in the vacuum line keeps the vacuum at the actuator.

During normal operation, vacuum holds the actuator rod away from the throttle linkage. When the engine is at idle speed and the throttle is depressed, manifold vacuum decreases. The decrease in vacuum lets the actuator rod extend and increase the idle speed.

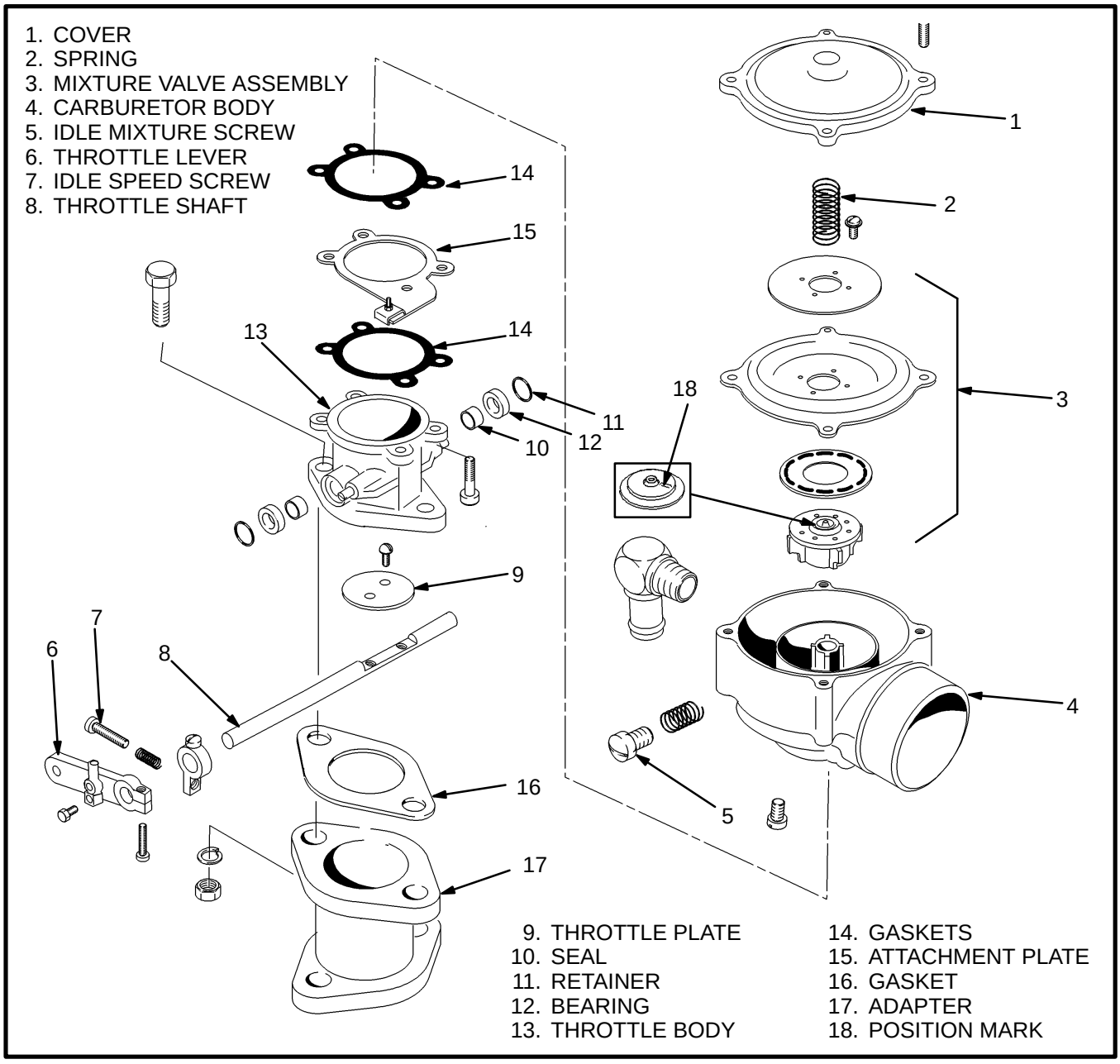


FIGURE 18. PARTS OF THE CARBURETOR, S/H1.50–1.75XM, S/H2.00XMS (S/H25–35XM, H40XMS)

Assembly (See FIGURE 16. and FIGURE 17.)

1. Install new bearings as needed in the throttle body. Install new seals in the throttle body. Install the seal retainers and the throttle shaft. Install the throttle plate to the throttle shaft using lock washers with the screws. Install the spring guides, springs and retainer on the throttle shaft.

2. Install the throttle body and attachment plate with new gaskets to the carburetor body. Connect the springs to the attachment plate. Install the idle mixture spring and screw. Install the idle control actuator and solenoid valve.

3. Assemble the the metering valve, air measuring plate, diaphragm and back–up plate. Align the position mark on the metering valve of the mixture valve assembly with the fuel inlet, and install the mixture valve assembly in the carburetor. Install the metering spring and cover. Make sure the spring is in the correct position before installing the cover.

Installation (See FIGURE 2.)

NOTE: Use a liquid thread sealant on all fittings with threads at the carburetor.

INTRODUCTION

DESCRIPTION

See FIGURE 1. The fuel tank is part of the frame weldment. Gasoline flows from the fuel tank through a filter to the fuel pump. The fuel pump is operated by a cam on the engine. The fuel pump sends the gasoline to the carburetor. The carburetor makes sure the correct air to fuel mixture goes to the combustion chambers during the different operating conditions of the engine.

The carburetor has a single venturi. A choke cable from the instrument panel controls the choke plate and the fast idle cam. A fuel solenoid valve quickly stops fuel to the engine when the ignition switch is turned to the **OFF** position.

NOTE: Parts are not available for repairing the fuel pump. If the fuel pump needs repair, install a new fuel pump.

GOVERNOR

The governor keeps the engine speed at the specification limit under all load conditions when the throttle plate in the carburetor is fully open. The governor measures the air pressure above and below the carburetor throttle plate. A piston adjusts the governor throttle plate as needed to control the maximum engine speed. A leaf spring and a coil spring are used to control the tension of the governor throttle plate. The adjustment screw changes the number of coils used by the coil spring. The adjustment wheel changes the tension of the coil spring.

NOTE: Parts are not available for repairing the governor. If the governor needs repair, install a new governor. If a new governor is installed, adjust the governor as described in CHECKS AND ADJUSTMENTS**.**

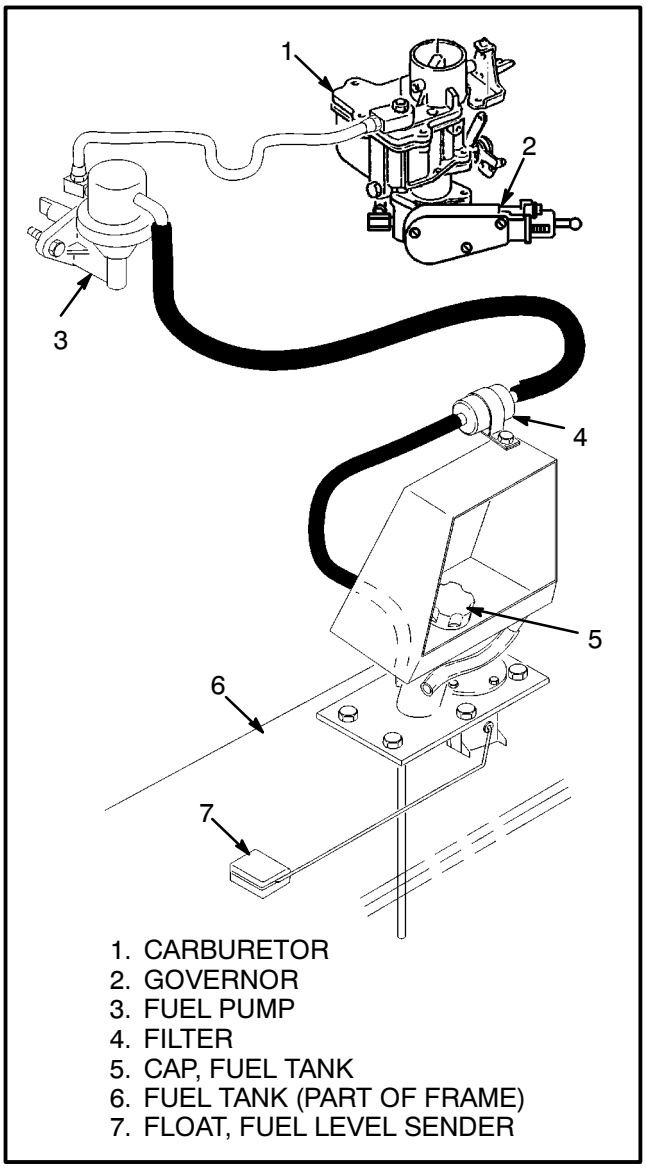


FIGURE 1. GASOLINE FUEL SYSTEM

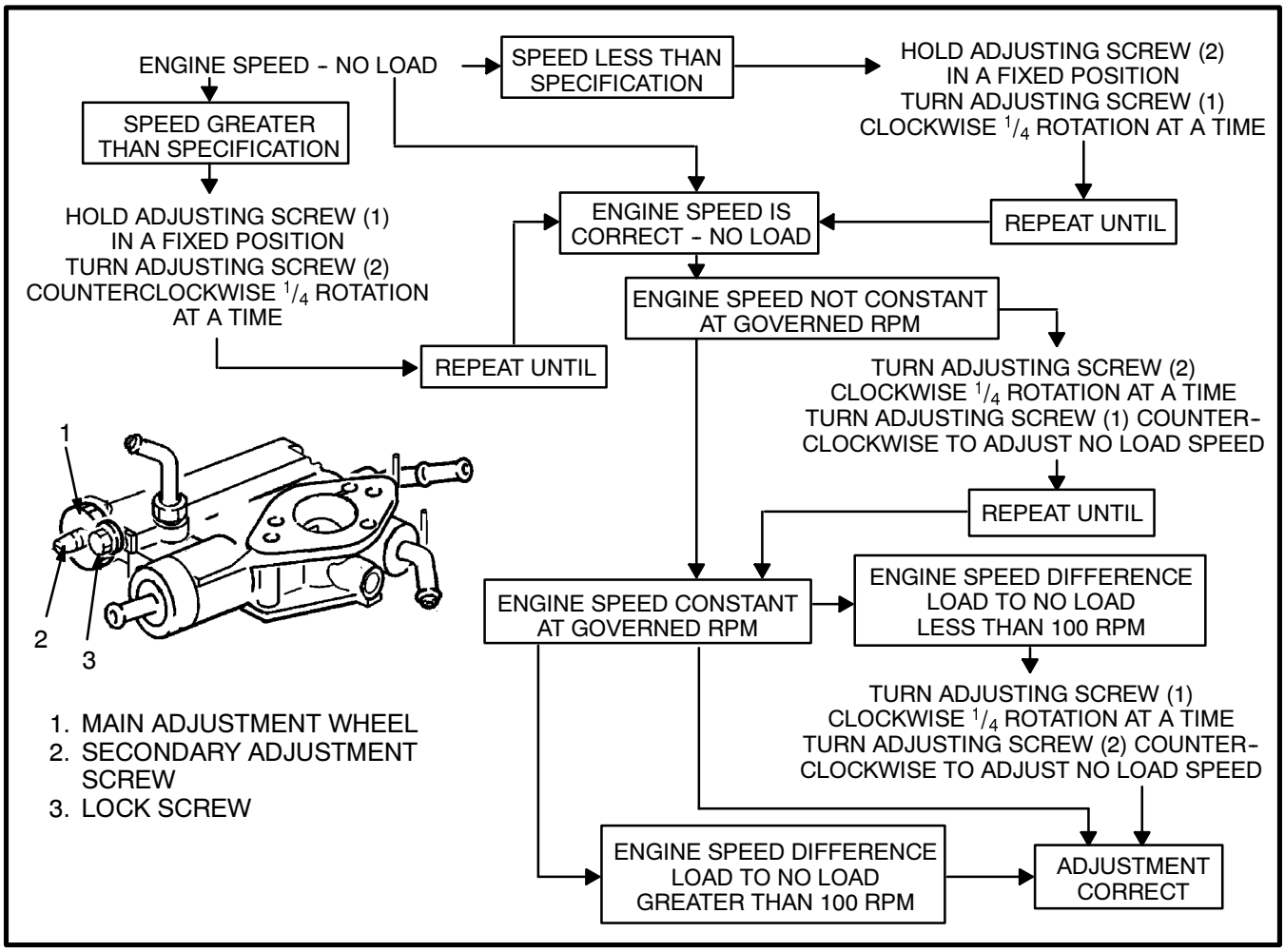


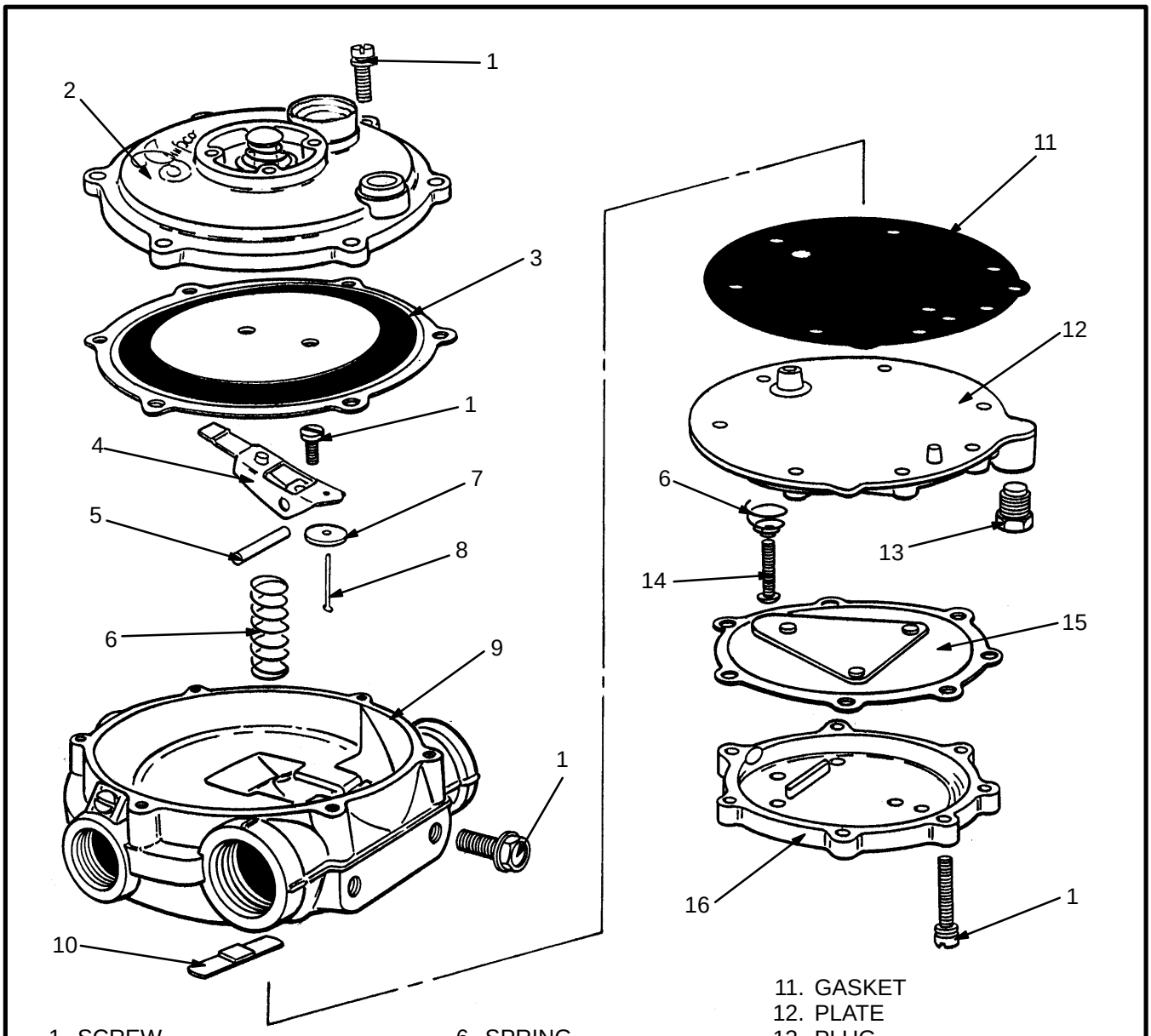
FIGURE 12. GOVERNOR ADJUSTMENTS

TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSE	PROCEDURE OR ACTION
The engine will not start or is difficult to start.	The fuel solenoid valve is not operating correctly.	Install new fuel solenoid valve.
	The screen at the fuel inlet valve has a restriction.	Clean the screen.
	The inlet valve needle does not move.	Check, clean, or install new parts as required.
	The choke plate does not move correctly.	Repair choke plate or overhaul carburetor.
The engine speed is faster than the specified governor limit.	The adjustment of the governor is not correct.	Adjust governor.
	The governor is not operating correctly.	Install new governor.
	Ice is on the throttle plate at 32 to 40°F (0 to 5°C) air temperature.	Heat inlet air. Operate in warmer and dryer air.

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 solenoid valve and 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).



1. SCREW
2. COVER FOR VAPOR VALVE DIAPHRAGM
3. VAPOR VALVE DIAPHRAGM
4. VAPOR VALVE LEVER
5. PIVOT PIN
6. SPRING
7. VAPOR VALVE PAD
8. PIN
9. HOUSING
10. PAD FOR PRESSURE REDUCER VALVE
11. GASKET
12. PLATE
13. PLUG
14. ACTUATING PIN
15. DIAPHRAGM FOR PRESSURE REDUCER VALVE
16. COVER

FIGURE 7. PARTS OF THE VAPORIZER

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	CORRECTING ACTION
Engine does not idle smoothly	Idle mixture screw is not adjusted correctly.	Adjust idle mixture screw.
	Diaphragm in carburetor is damaged.	Install new diaphragm or carburetor.
	Air leak between carburetor and governor or between governor and intake manifold.	Fix air leak.
	PCV system has a restriction.	Remove restriction. Install new PCV valve.
	Air leak at throttle shaft.	Repair or install new carburetor.
	Hose from vaporizer to carburetor is damaged.	Install new hose.
	Balance line is disconnected.	Connect balance line.
	Pressure reducer diaphragm has a hole.	Install new diaphragm.
	Low pressure valve in vaporizer is damaged.	Install new low pressure valve or new vaporizer.
	Idle speed is too low.	Adjust idle speed.
	Idle speed screw is loose.	Tighten screw and adjust idle speed.
	Water in fuel.	Check fuel supply and tank filling procedure. Clean system.
	Fuel tank is installed in the wrong position.	Install fuel tank in correct position.
	Fuel valve on the tank is in the wrong port.	Install fuel valve in the correct port.
Engine does not run smoothly.	The governor is damaged.	Install new governor.
	Low pressure diaphragm or valve in vaporizer is damaged.	Repair or install new vaporizer.
	Wrong or damaged fuel valve in carburetor.	Repair or install new carburetor.
	PCV system has a restriction.	Remove restriction. Install new PCV valve.
	Air leaks in the intake manifold.	Repair leaks.
	Balance line has a restriction.	Remove restriction.

As the air filter clogs, the intake vacuum increases for any relative throttle position. This increased vacuum has a similar increase in the vacuum of chambers C and 2. By increasing the vacuum of chambers C and 2 by the same level as the intake restriction, a balance is maintained and the relative position of the diaphragms remains unchanged. This maintains a constant fuel mixture regardless of the air filter restriction. See Figure 4.

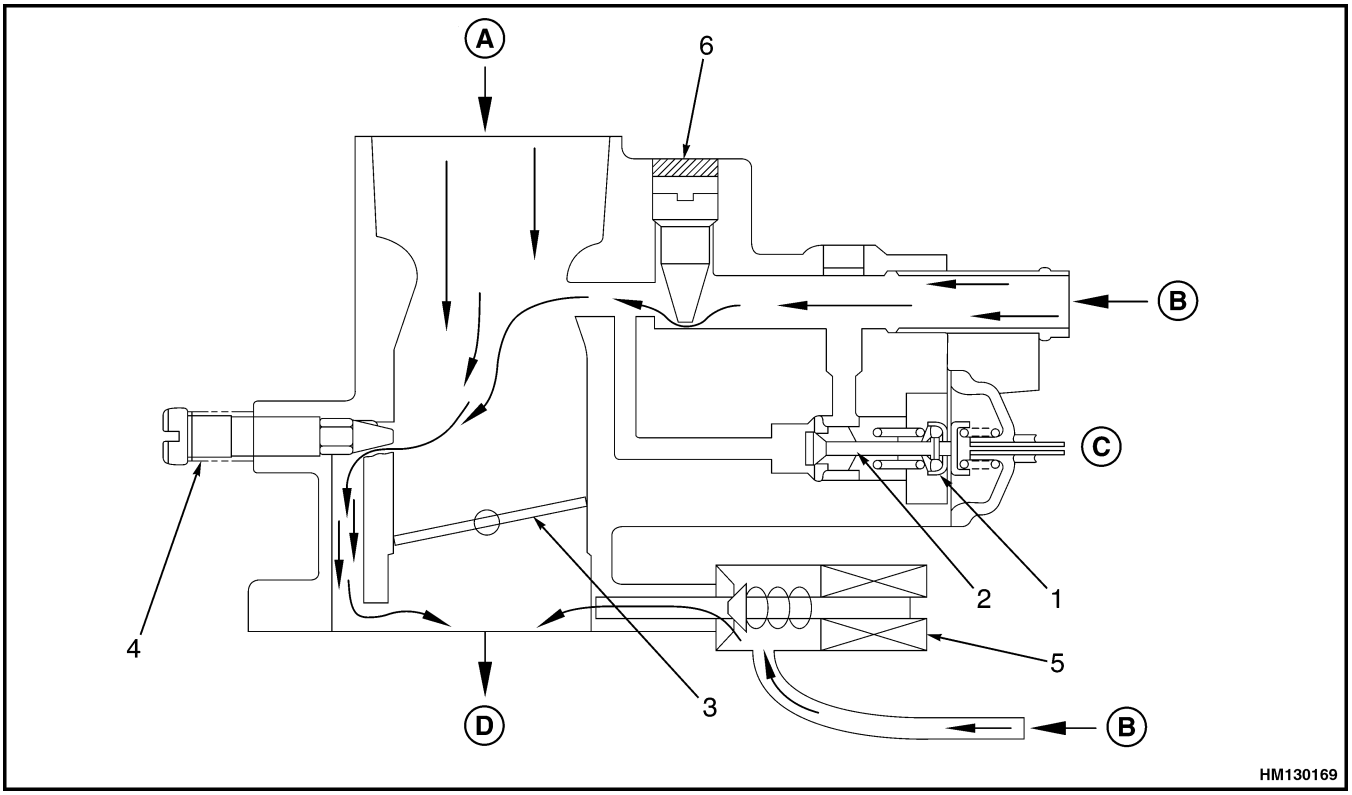
The special orifice fitting and the resonator act as vacuum dampeners. The air being drawn through the intake system does not flow in a constant stream, but rather in small pulses generated during the intake stroke of the pistons. Without the resonator and orifice, these pulses could be generated at a frequency that is a natural harmonic of the diaphragm. This would cause the diaphragm to vibrate uncontrollably and force the engine mixture to be either very rich or lean under certain operating conditions.

CARBURETOR

Like the regulator, the carburetor has three operating modes: start mode, idle mode, and run mode. These modes are described in detail in the following sections.

Start Mode

Before any fuel is provided to the carburetor, the ignition switch must be turned to the ON position and the engine must be cranked without pressing the accelerator. See Figure 6. The ECU level control unit on the engine wiring harness senses that the engine is in start mode and provides an electrical signal to energize the main solenoid, the idle bypass solenoid, and the fuel injector. Fuel then flows from the regulator to the carburetor.



A. AIR
B. LPG
C. VACUUM FROM MANIFOLD
D. TO INTAKE MANIFOLD

1. POWER DIAPHRAGM
2. POWER VALVE
3. THROTTLE VALVE
4. IDLE AIR BYPASS ADJUSTING SCREW
5. FUEL INJECTOR
6. TAMPER-PROOF PLUG

Figure 6. Carburetor, Start Mode

ADJUSTMENTS

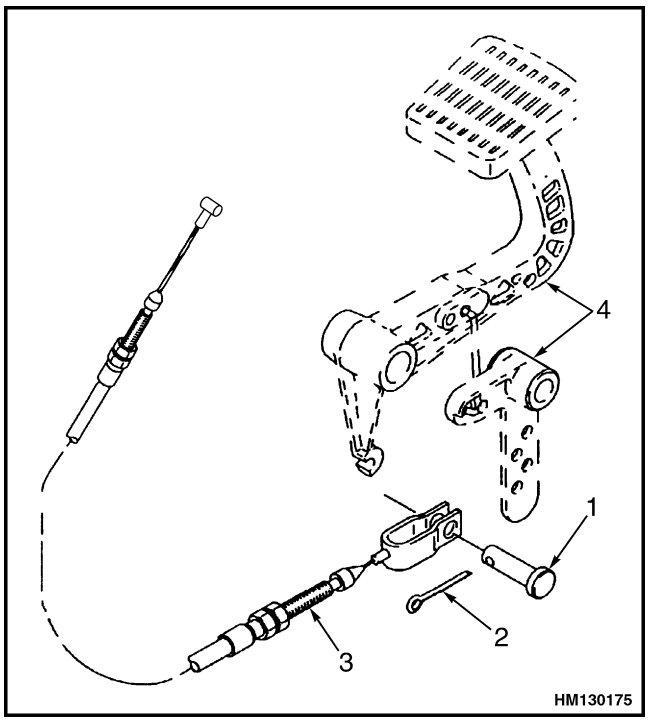
With the engine at operating temperature, adjust governor as follows:

1. Remove lock wire from lockscrew. Loosen lockscrew. Apply parking brake.
2. With no load on engine, run engine at full open throttle to obtain maximum engine speed. To adjust maximum no-load speed, hold secondary adjusting screw and turn main adjustment wheel. Turn main adjusting screw clockwise to increase engine speed or counterclockwise to decrease engine speed. Set maximum engine speed to 2800 rpm Mazda and GM 3.0L S2.00-3.20XM (S40-65XM), 2450 rpm S/H1.50-2.00XMS (S/H25-40XMS), and 2900 rpm GM3.0L H2.00-3.20XM (H40-65XM).
3. Tighten lockscrew.
4. Run engine with throttle fully open, then pull on tilt lever to load engine. The governor setting is correct when the engine runs smoothly (without speed changes) and the difference in speed between the load and no-load conditions is within the limits of the specifications.
5. If the engine speed changes, loosen lockscrew and turn secondary adjusting screw 1/4 turn clockwise. Set maximum no-load engine speed by turning main adjustment wheel counterclockwise. Repeat this procedure until engine speed is steady.
6. If the engine speed difference between the load and no-load conditions is greater than specified, turn main adjustment wheel 1/4 turn clockwise. Set maximum no-load engine speed by turning secondary adjusting screw counterclockwise. Repeat this procedure until engine runs correctly.
7. When governor adjustment is correct, tighten lockscrew and install wire between lockscrew and secondary adjusting screw.

Throttle Linkage Adjustment

NOTE: Each time the throttle system is disassembled, it is important to adjust the throttle cables.

1. Adjust idle speed as described in Idle Control Adjustment.
2. Make sure that throttle linkage at pedal assembly is in correct position. See Figure 14.
3. Push MONOTROL® or throttle pedal until it stops against floor plate. Adjust throttle cable so that pedal stops on floor plate just as throttle plate reaches wide-open position. Use nuts at pedal end of cable housing to change adjustment of cable.
4. Adjust pedal return stop so there is no tension on throttle cable at idle position. See Figure 15. To check this adjustment, perform the following steps:
   - **a.** Run engine at idle speed. Make sure that rod on idle control actuator is retracted and throttle linkage is against idle air bypass adjusting screw.
   - **b.** When pedal return stop is in correct position, tighten capscrew that holds stop to bracket.



1. PIN
2. COTTER PIN
3. THROTTLE CABLE
4. PEDAL LINKAGE ASSEMBLY

Figure 14. Throttle Cable Arrangement

REPAIRS

NOTE: The procedure for the removal of the transmission is found in the section **THE FRAME, 100 SRM 545.**

TORQUE CONVERTER AND TRANSMISSION PUMP

NOTE: The torque converter cannot be repaired.

Removal And Disassembly (See FIGURE 9. and FIGURE 10.)

⚠ CAUTION

Be careful that you do not damage parts of the torque converter or transmission when the transmission is separated from the engine. Keep the transmission and engine in alignment until they are completely separated so that parts of the transmission are not damaged. Use a crane or lifting device to separate the transmission from the engine.

1. Remove the access cover from the top of the torque converter housing.

2. Remove the capscrews that hold the drive plate to the flywheel.

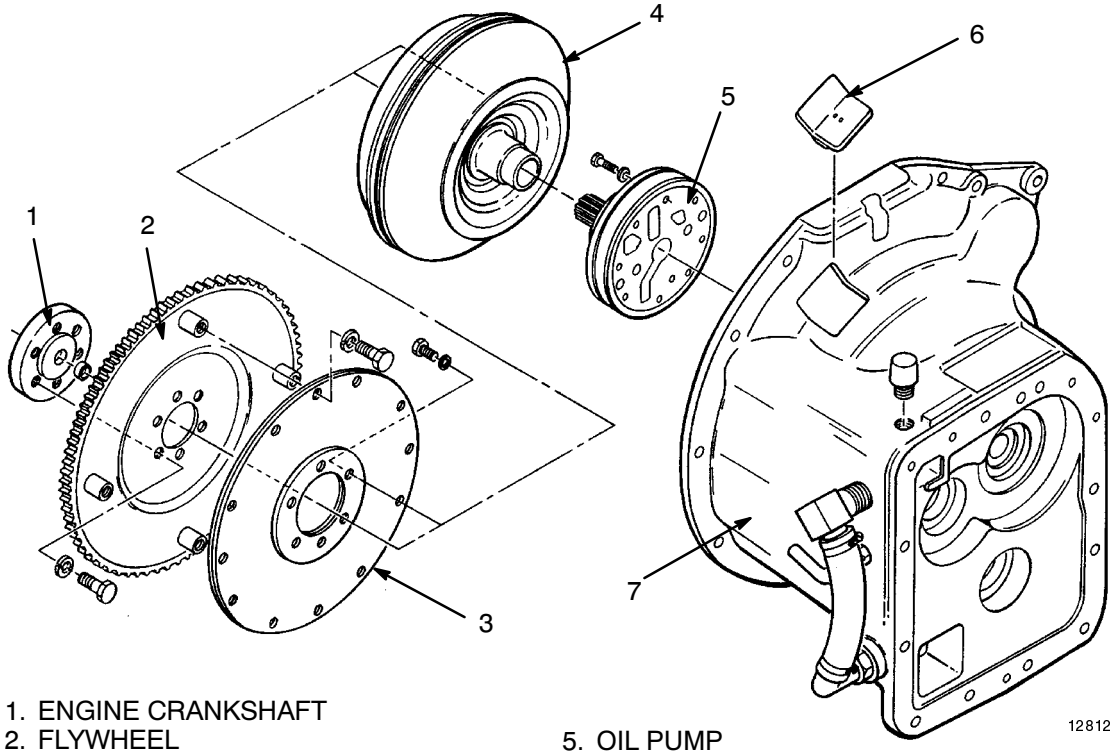
3. Remove the capscrews that hold the torque converter housing to the engine. Remove the starter. Carefully separate the transmission from the engine. Make sure the torque converter stays with the transmission.

4. Remove the torque converter from the transmission.

5. Remove the transmission pump from the housing. Disassemble the pump as follows:

a. Remove the eight capscrews that hold the pump to the torque converter housing. Remove the two cover capscrews from the pump. Install two of the pump mounting capscrews in the cover holes. Tighten the two capscrews to push the pump from the housing.

b. Remove the gears from the pump. Remove the seal and O-ring from the pump.



1. ENGINE CRANKSHAFT
2. FLYWHEEL
3. DRIVE PLATE
4. TORQUE CONVERTER
5. OIL PUMP
6. ACCESS COVER
7. TORQUE CONVERTER HOUSING

FIGURE 9. TORQUE CONVERTER AND HOUSING

CONTROL VALVE

Removal and Disassembly (See FIGURE 20.)

Clean the area around the control valve.

1. Disconnect the inching spool from the crank. Disconnect the wires from the solenoid valve.

2. Remove the capscrews that hold the control valve to the transmission. Remove the control valve. Put a cover on top of the transmission to keep dirt from inside of the transmission.

3. Remove the solenoid valve from the control valve. Disassemble the solenoid valve as necessary. Only the O-rings and solenoid coil can be replaced. See FIGURE 21.

⚠ WARNING

There are compressed springs in the control valve. Carefully remove the covers so that the compressed springs do not cause injury.

4. Remove the cover (6). Remove the inching spool assembly. Remove the clutch pressure regulator, torque converter regulator and springs. Keep the springs with the regulators.

5. Remove the stop (10) for the modulator. Remove the modulator and springs.

6. Remove the pin from the inching spool. Remove the spring seat, spring and plunger (9).

Inspection

Make sure there are no scratches or damage on the spools or in the bores.

Check that the springs are not bent or damaged.

Make sure the spools move freely in their bores.

Assembly and Installation (See FIGURE 20.)

Lubricate the parts of the control valve with clean transmission oil during assembly.

1. Install the modulator spool and springs in the control valve. Install the stop with a new gasket. Tighten the capscrews to 12 to 15 N.m (9 to 11 lb_f ft).

2. Install a new seal (7) in the cover (6). Install the plunger (9) on the inching spool. Install the spring, spring seat and the pin.

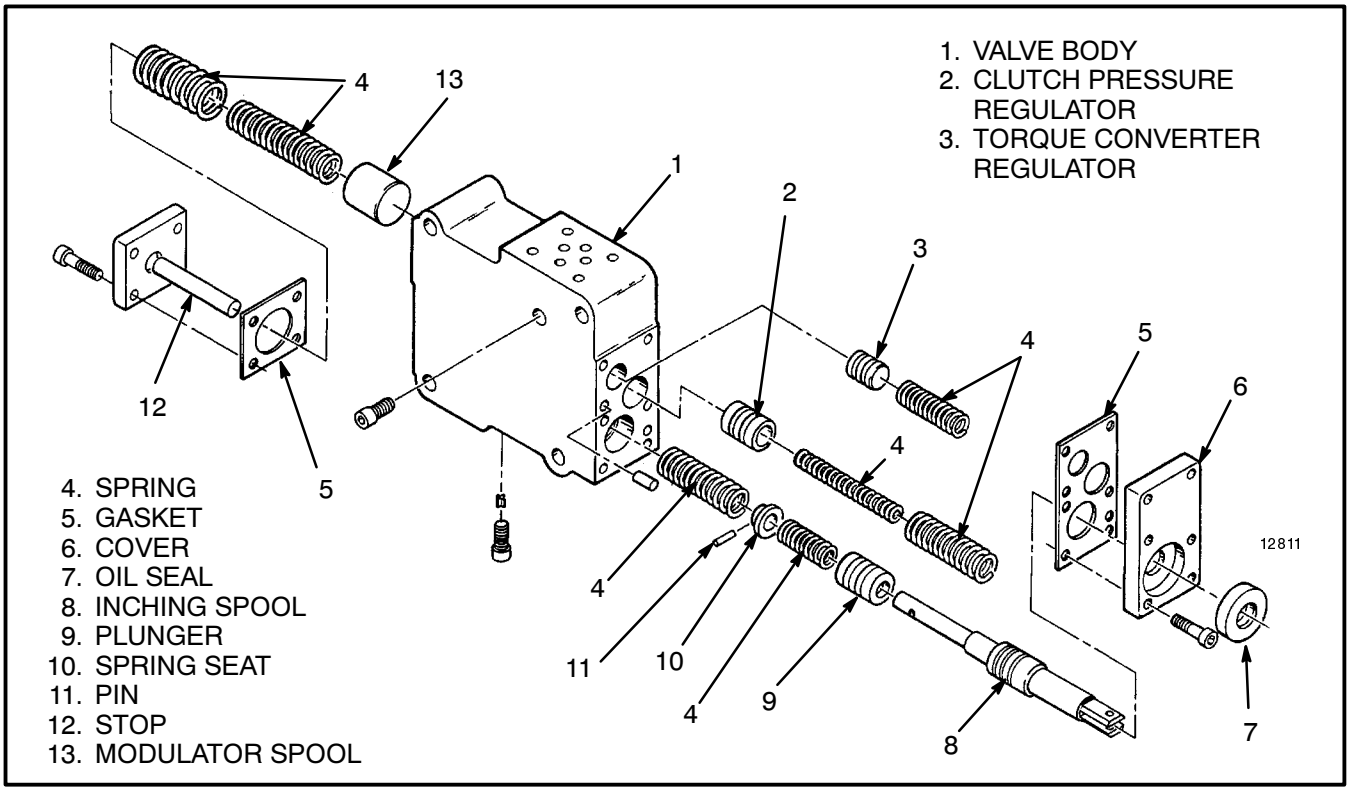


FIGURE 20. CONTROL VALVE

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Bubbles in the oil fill tube.	Air leak on the suction side of the transmission charge pump.	Repair leak. Install new parts as required.
	Oil level is not correct.	Check and adjust oil to the correct level.
	Water in the oil.	Check oil supply and storage. Oil cooler has damage. Install new oil cooler or radiator. Drain system and fill with clean oil.
	Oil is too hot.	See "Transmission is too hot."
	The torque converter is damaged.	Preform stall test. Repair or install new torque converter.
Lift truck will not move in either direction. Engine is running, direction control lever is in position for travel, and parking brake is released.	Switches at direction control lever have damage or are not connected.	Check wiring and adjust switches. Install new switches.
	Transmission oil level is too low.	Check and fill to correct level. Check for leaks.
	Axle shaft(s) or transmission/differential is damaged.	Repair or install new parts.
	Brakes are not released.	Check operation of parking and service brakes. Repair as required.
	Forward and Reverse solenoids do not operate.	Check switches at control lever. Check wiring to solenoids. Check solenoids. Install new parts as required.
	Transmission pump is damaged.	Check pressures at the control valve. Install new pump.
	Pressure regulator(s) is in the open position.	Check operation of pressure regulators. Repair or install new parts.
	Direction spool will not move.	Check operation of directional spool. Repair or install new spool.
	Torque converter is disconnected from the flywheel.	Check torque converter mounting hardware. Repair as required.
	Tube to direction spool is damaged or disconnected.	Check tube. Connect or install new tube.
	Control valve gasket is damaged.	Remove control valve and check gasket. Install new gasket.
	Control valve is damaged.	Check operation of control valve. Install new control valve.

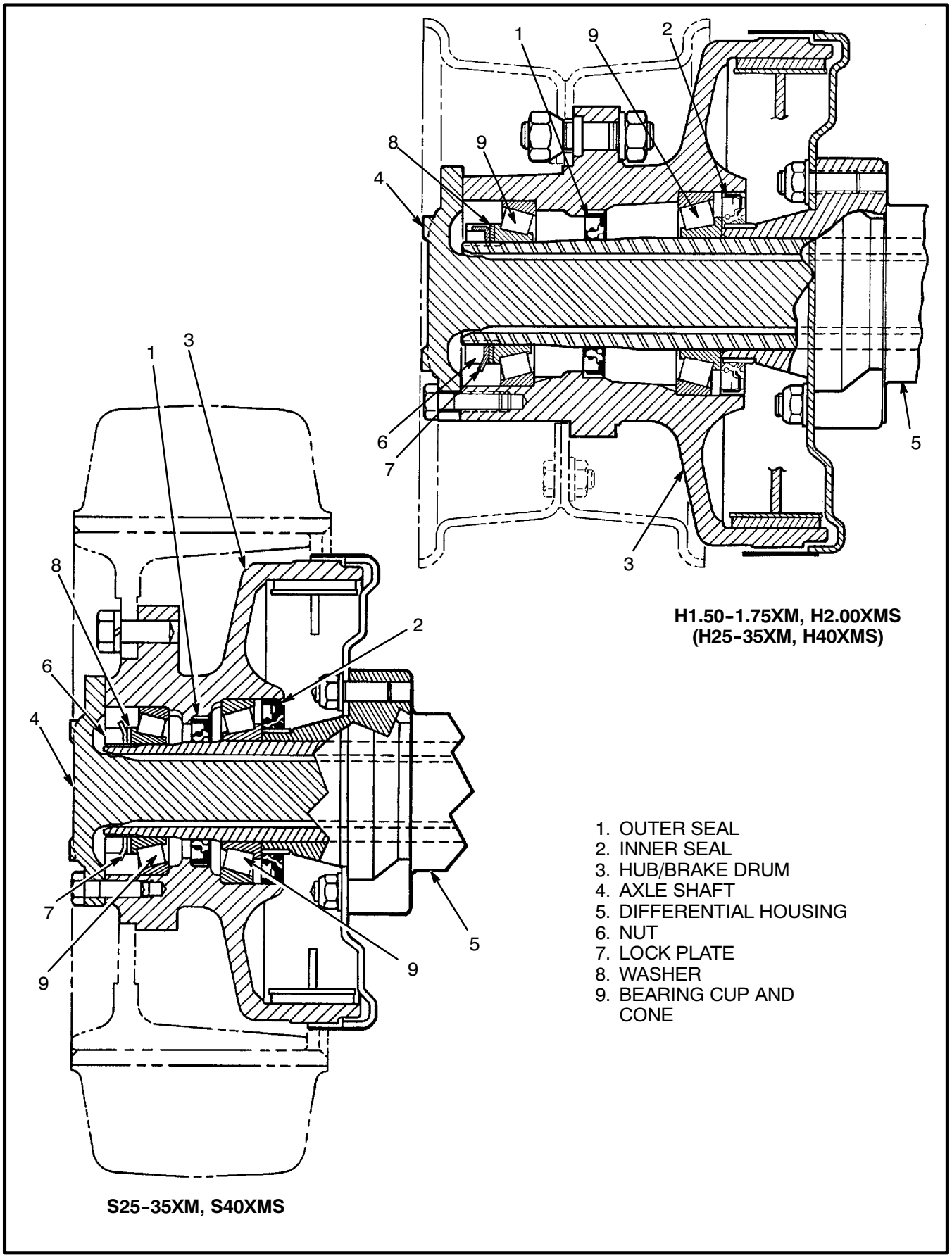
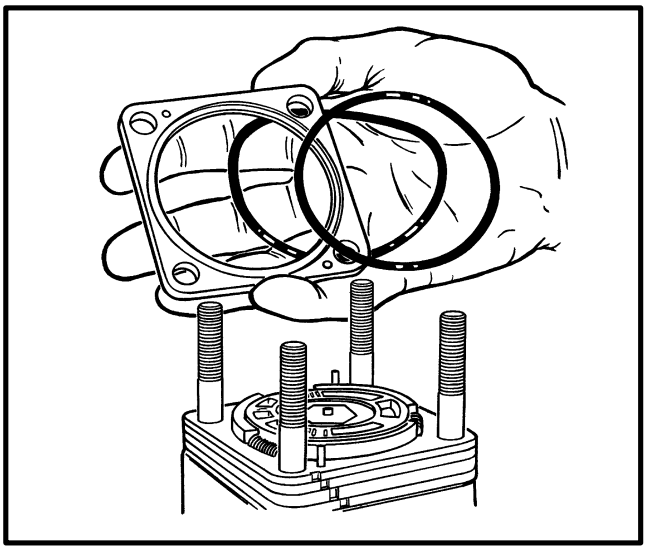


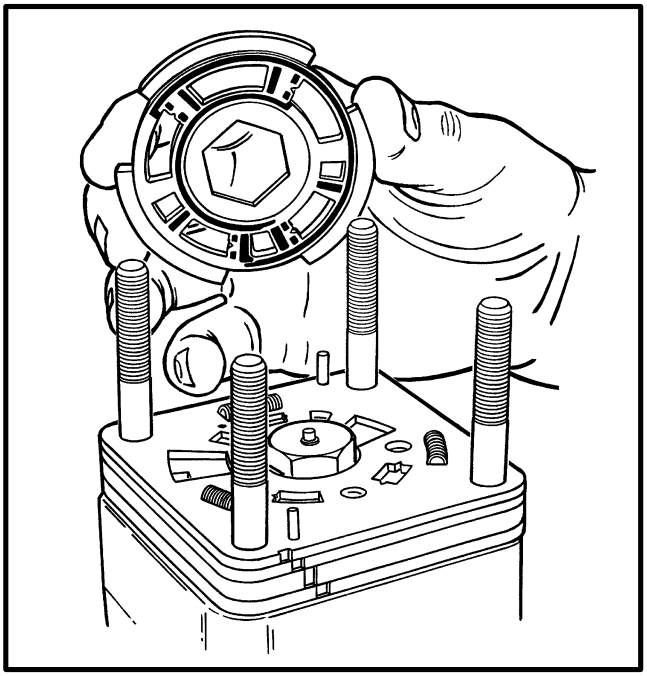
FIGURE 3. HUB ASSEMBLY

port manifold and the isolator manifold must be replaced.

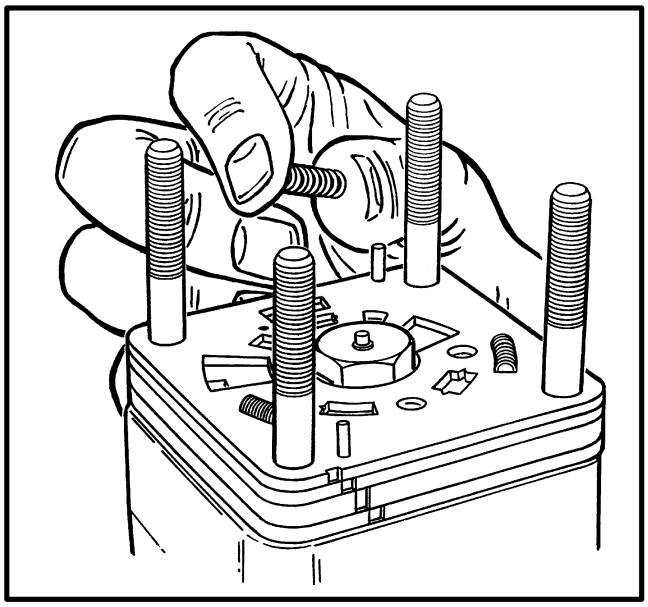
Inspect the port manifold. The rotation of the valve plate will normally polish a pattern in the port manifold. An acceptable part can have this pattern if there are not scratches, grooves, or other damage.



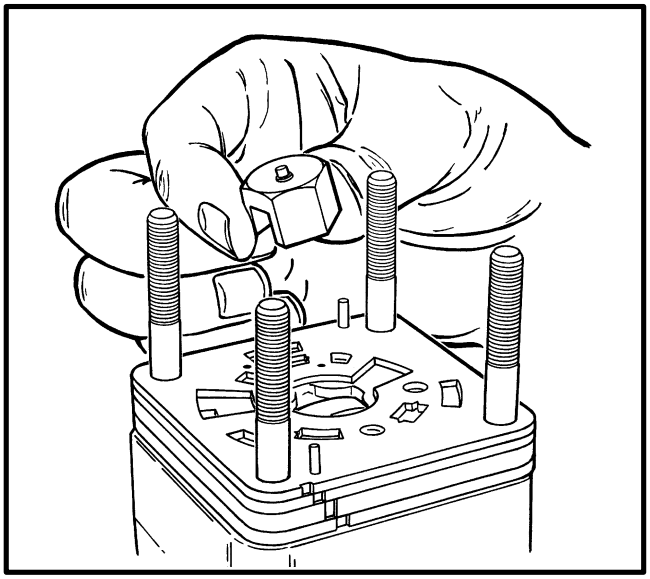
7. Remove the valve ring (12). Discard the two seal rings (3).



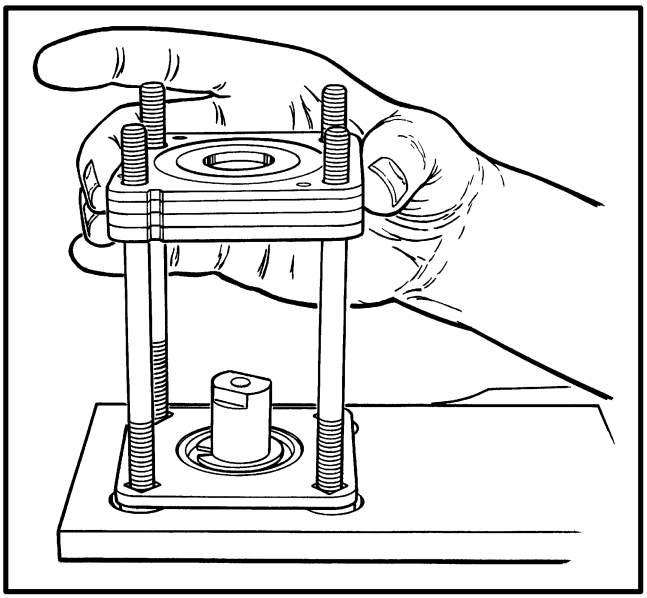
8. Remove the valve plate (13). Inspect the edges and surfaces for wear and damage. The slots must have sharp edges. The valve ring and valve plate must be replaced as a set.



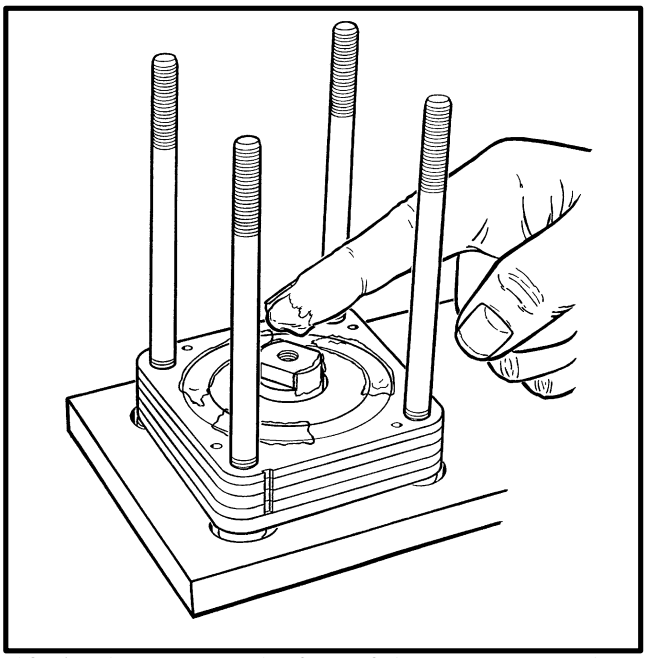
9. Remove the three springs from the isolator manifold. See the NOTE about the springs in step 6.



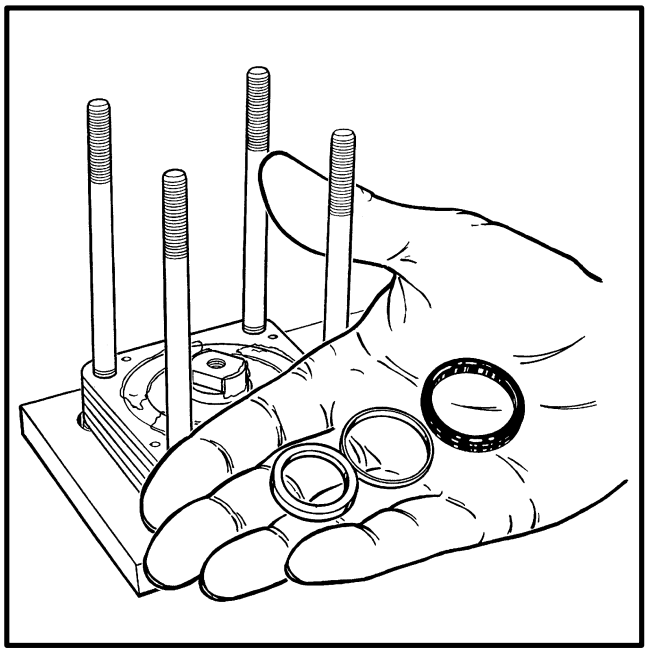
10. Remove the drive assembly (10) from the drive link. The alignment pin (11) in the drive assembly must not be worn and must fit the hole tightly. The sides and slot of the drive assembly must be replaced if there is wear.



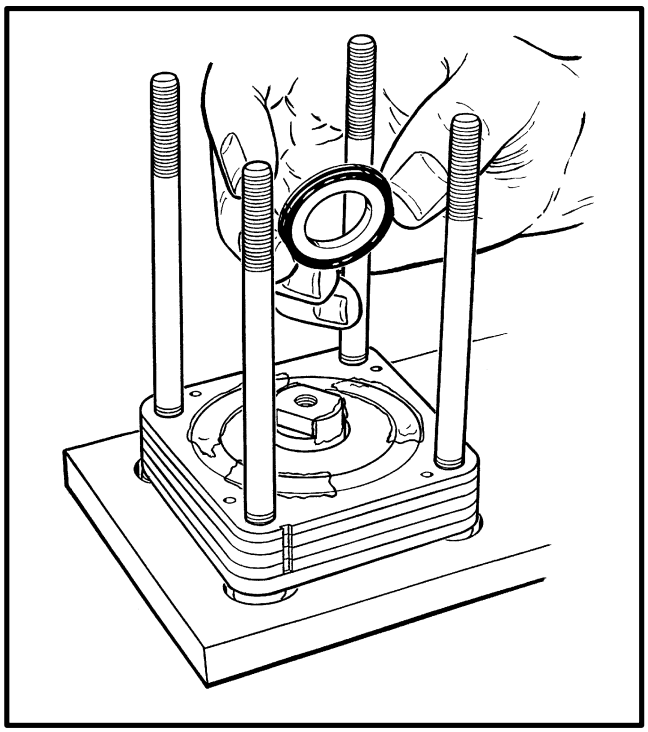
9. Install the upper cover plate (32). The finished surface must be towards the metering section. Make the identification groove and the hole for the horn contact assembly are in the correct positions. See also FIGURE 3.



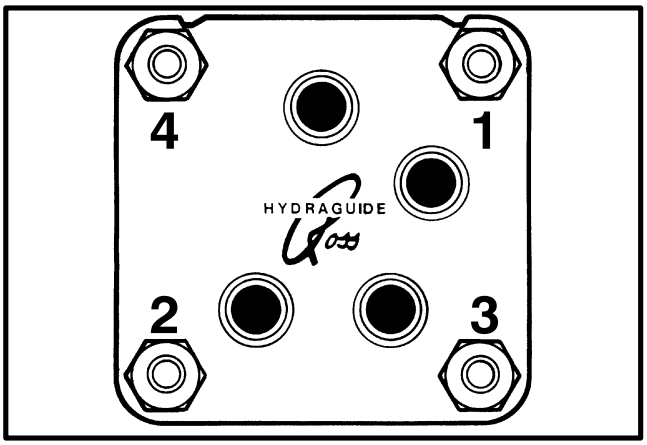
10. Apply grease to the face of the upper cover plate and to the end of the input shaft.



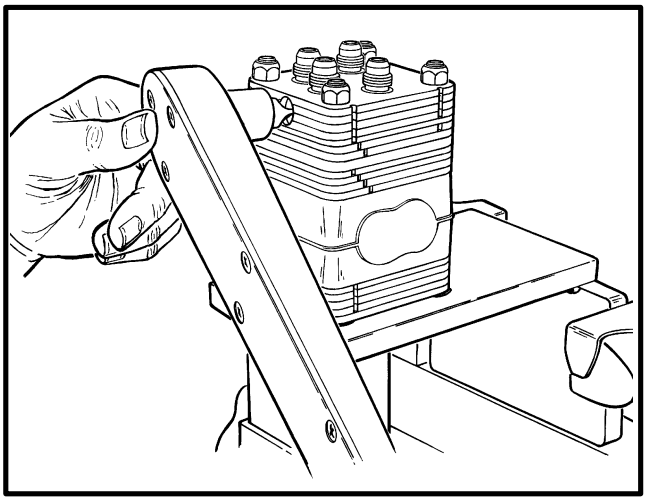
11. Assemble the back-up ring (30) and seal (29) on the seal spacer (31).



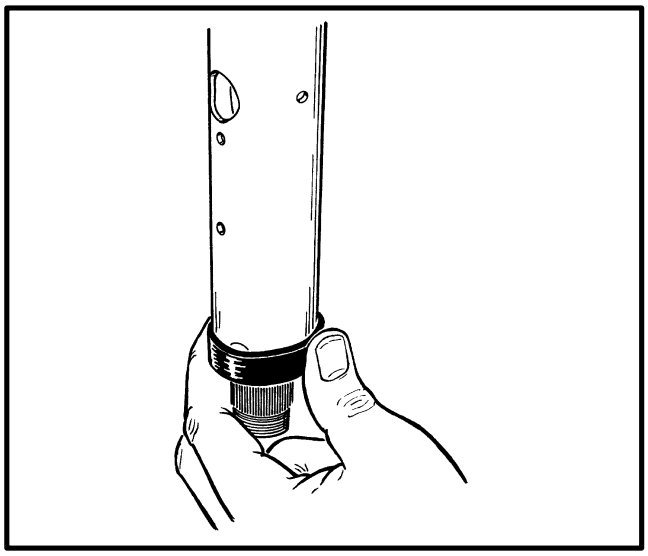
12. Install the seal assembly on the upper cover plate.



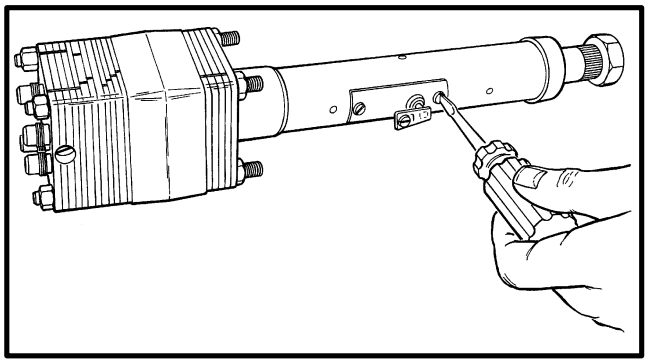
47. Install the special lock nuts on the through bolts. Tighten the nuts in steps in the sequence shown in the illustration. Tighten the lock nuts to 27 to 33 Nm (20 to 24 lbf ft).



48. Tighten the plug to 11 to 16 Nm (97 to141 lbf in).



49. Apply a thin layer of grease to the dirt and water seal (39). Install the seal on the jacket tube.



50. Install the electric connection for the horn.

1600SRM532 NEW 9/93 KR

ADDED S25–35XM, 40XMS 11/94 K.R.

Removal Of The Assembly Components (See FIGURE 3., FIGURE 4. and FIGURE 5.)

NOTE: This procedure is for the removal of all components of the steering column assembly. All components are not often removed for a repair procedure. Do only those steps of the procedure necessary to remove the required component.

⚠ CAUTION

Disconnect the negative battery cable on internal combustion trucks. Disconnect the battery connector on electric trucks. Disconnect the battery before removing any covers.

1. Attach a tag on the battery connector or negative cable stating "DO NOT CONNECT BATTERY". Move the steering column to the most forward position. Remove the access cover from the steering column.

2. Remove the key switch from the housing of the steering column. Make an identification of the electric wires and disconnect them from the key switch.

3. On units with the Direction Control Handle, remove the handle, dust cover and large nut that fastens the direction switch. Remove the direction switch from the housing of the steering column. Make an identification of the electric wires and disconnect them from the direction switch.

4. Remove the capscrew that fastens the bracket for the horn switch to the housing of the steering column. Move the horn switch and bracket away from the steering column.

5. Remove the horn cover, snap ring and base plate (no base plate in Petri steering wheel, see FIGURE 5.). Lift the push rod and adjuster spool from the top of the steering shaft. Remove the large hex nut and remove the steering wheel from the shaft. A puller makes removal of the steering wheel easier, but not all steering wheels have puller holes.

6. Some electric units have On–Demand steering. Remove the optical encoder and activator and the brackets of the On–Demand steering. Make an identification of the electrical wires and disconnect them from the assemblies.

7. Make an identification of the hydraulic hoses at the steering control unit so they can be connected correctly during assembly. Some hydraulic hoses have fittings that will permit disconnection at the steering control unit. Disconnect the other hydraulic hoses at the base of the cowl, the control valve or the steering pump. Remove all mount clamps so that the hoses will turn freely and not become twisted. Disconnect the hydraulic hoses at the bottom of the steering control unit. Install plugs at all hoses and ports to prevent dirt from entering the steering hydraulic system.

8. If there is a display panel on the steering column housing, disconnect all plugs connected to the display panel.

NOTE: The repair procedures for the instrument cluster for the S/H2.00–3.20XM (S/H40–65XM) and H/S1.50–2.00XMS (H/S30–40XMS) are in the section **INSTRUMENT CLUSTER, 2200 SRM 514**.

NOTE: The repair procedures for the instrument cluster for the E/J2.00–3.20XM (E/J45–65XM), J1.60–2.00XMT (J30–40XMT) and N30XMH are in the section **ELECTRICAL SYSTEM, 2200 SRM 560.**

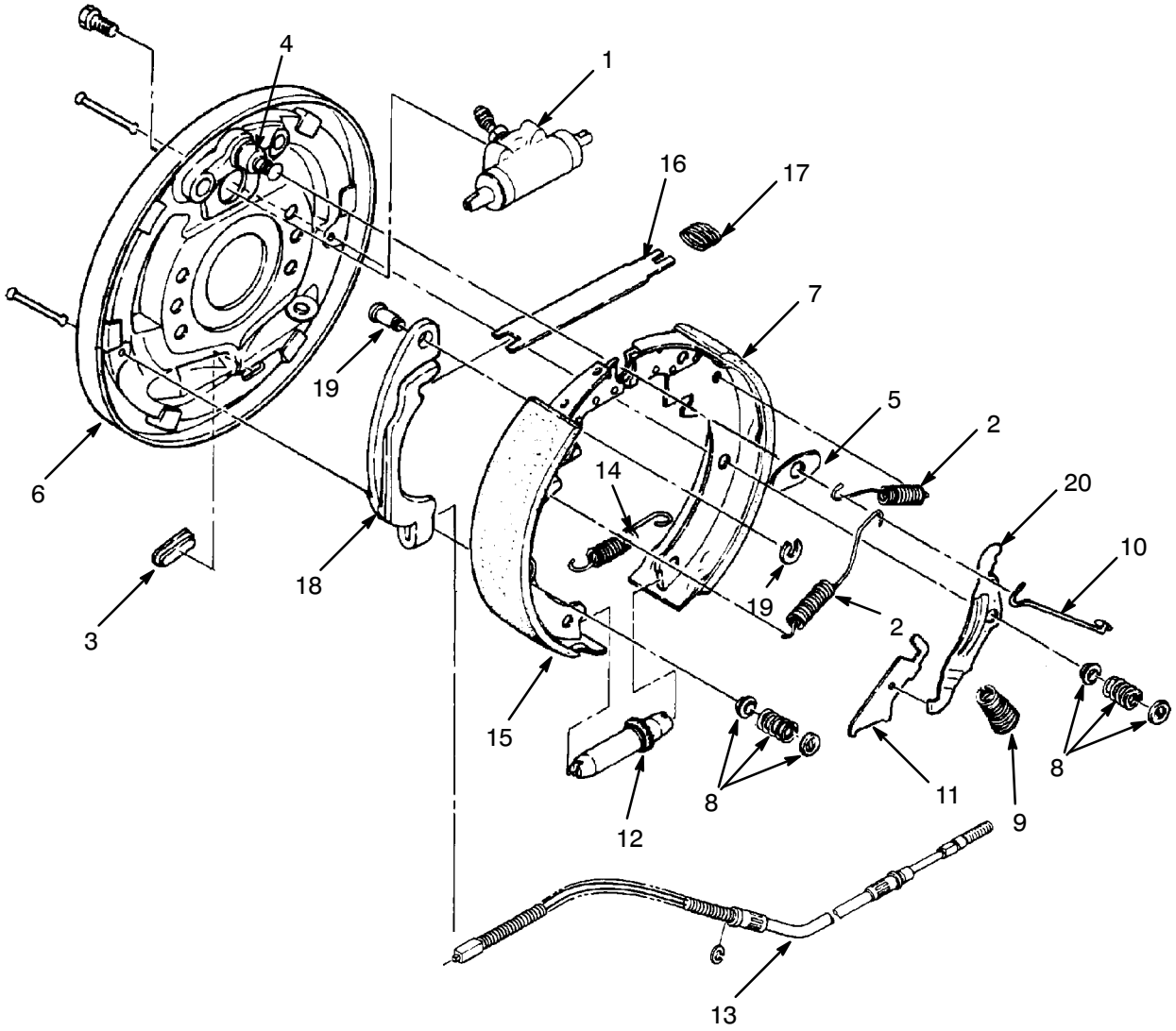
9. Remove the capscrews, lock washers and lock plates that fasten the steering column to the pivots on the lift truck. Remove the steering column from the lift truck. Make sure the electric wires and the hydraulic hoses are not damaged as the steering column is removed.

10. Do the following procedure to remove the steering shaft:

a. Move the plastic tube and washer toward the steering control unit and compress the spring for the horn switch. Then remove the pin that goes through the steering shaft and engages the plastic tube.

b. Remove the external snap ring that holds the bearing in the steering column. On units that have On–Demand steering, loosen the set screw in the gear on the shaft. The return spring, washer and tube are removed at the same time as the steering shaft and bearing are removed. Use a small prybar at the bottom of the steering shaft near the steering control unit to remove the steering shaft and bearing (also, return spring, washer and tube) from the steering column.

11. Remove the two capscrews that hold the steering control unit and the bracket to the steering column. Remove the four capscrews or nuts that fasten the steering control unit to the bracket.



1. WHEEL CYLINDER
2. RETURN SPRING
3. PLUG
4. ANCHOR
5. ANCHOR GUIDE
6. BACK PLATE
7. BRAKE SHOE
8. RETAINER SPRING ASSEMBLY (4)
9. SPRING, ACTUATOR
10. LINK
11. ADJUSTER WHEEL ACTUATOR
12. ADJUSTER WHEEL
13. PARKING BRAKE CABLE
14. ADJUSTER SPRING
15. BRAKE SHOE
16. LINK, PARKING BRAKE
17. SPRING, PARKING BRAKE LEVER
18. PARKING BRAKE LEVER.
19. PIVOT PIN
20. ACTUATOR LEVER

FIGURE 3. PARTS OF THE SERVICE BRAKE

9. Make a note of the arrangement of parts and disassemble the brake assembly. Remove the parking brake link (16) and spring (17) if they are still engaged with brake shoes. The parking brake link and spring will frequently fall from the brake assembly when the brake assembly is removed from the back plate. The adjuster wheel (12) will also disengage from the brake shoes after the brake assembly is removed.

10. Remove the spring (14) for the adjuster wheel actuator (11). Remove the adjuster wheel actuator (11) from the brake shoe.

4. Apply the parking brake with the parking brake lever. The two-circuit microswitch will open the Monotrol circuit (deenergize the solenoids for the powershift transmission) and permit the starter circuit to be energized with the ignition switch.

5. Turn the ignition switch to the **START** position. The starter will operate if the parking brake switch operates correctly. Turn the ignition switch to the **OFF** position.

6. Check the wires for the parking brake switch 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 INCHING/BRAKE PEDAL (See FIGURE 9.)

The following adjustment procedure gives a small amount of transmission "inching" as the brakes are applied (called as inching/brake "overlap"). This overlap makes the "inching" function smooth on small grades. As the inching/brake pedal is pushed in, 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 the lift truck on blocks so that the drive wheels can be rotated. Put blocks at each side of the steer tires to prevent forward or backward movement of the lift truck.

b. Use an adjuster tool (or a screwdriver) to rotate the adjuster wheel so that the teeth of the wheel move down. This adjustment moves the brake shoes. Move the brake shoes so that the wheel will not rotate.

c. Push the automatic adjuster lever away from the adjuster wheel with small screwdriver. Use the adjuster tool to loosen the adjuster wheel approximately 10 teeth.

d. Remove the lift truck from the blocks. Operate the lift truck in the FORWARD and REVERSE directions. Stop the lift truck 10 times in each direction. This procedure causes the brake shoes to wear a small amount and fit the brake drums better.

5. Do the following procedure to adjust the "inching" operation:

a. Adjust the length of the push rod (8) so that dimension **E** is 5 mm (0.20 in). Tighten the jam nut on the rod end.

b. Adjust the free movement (dimension **D**) of the push rod (8) by turning the adjustment capscrew (7). Turn the capscrew until the push rod touches the piston of the master cylinder, then loosen the capscrew $^1/_2$ to $^3/_4$ of a turn. Tighten the jam nut.

c. Set the pedal height (dimension **M**) to 160 to 170 mm (6.3 to 6.7 in) using the adjustment capscrew (9).

d. Install the inching cable (11) and adjust the cable to remove any free movement in the cable. After the cable is installed, there must not be any free movement in the lever (10) when the brake pedal is applied.

e. The brake/inching overlap is shown as dimension **F**. When the pedal reaches dimension **F**, the crank (6) begins to move. Turn the adjustment capscrew (3) until it touches the crank. then loosen the adjustment capscrew one turn to set the correct overlap. Tighten the jam nut. Dimension **F** will be approximately 8 mm (0.31 in).

The gears in the pump have their teeth engaged in the center of the pump body. The pump has close tolerances between the teeth and the pump body. When the input shaft is turned, the drive gear turns the driven gear. The tolerances and seals make tight chambers between the gear teeth. When the teeth of each gear move apart at the inlet port, they make a vacuum. Oil from the tank enters the inlet port and is moved around the circumference of the gear by the chambers between the gear teeth. Passages opposite the inlet connect the gear chambers for outlet oil flow to the flow control valve. Oil lubricates the bearings and the gear surface of each bearing. Oil at the inlet flows through bores and passages in the bearings (pressure plates on some models) to both sides of each bearing. Other bores and passages in the bearings let the outlet oil pressure go to the sides of the bearing away from the gears. The passages also let this outlet oil flow to the side of the inlet circumference of each bearing to balance the pressure on the bearings. The outlet pressure on the gears puts a force on the bearings to keep them tight against the gears for better pump efficiency and to allow for wear.

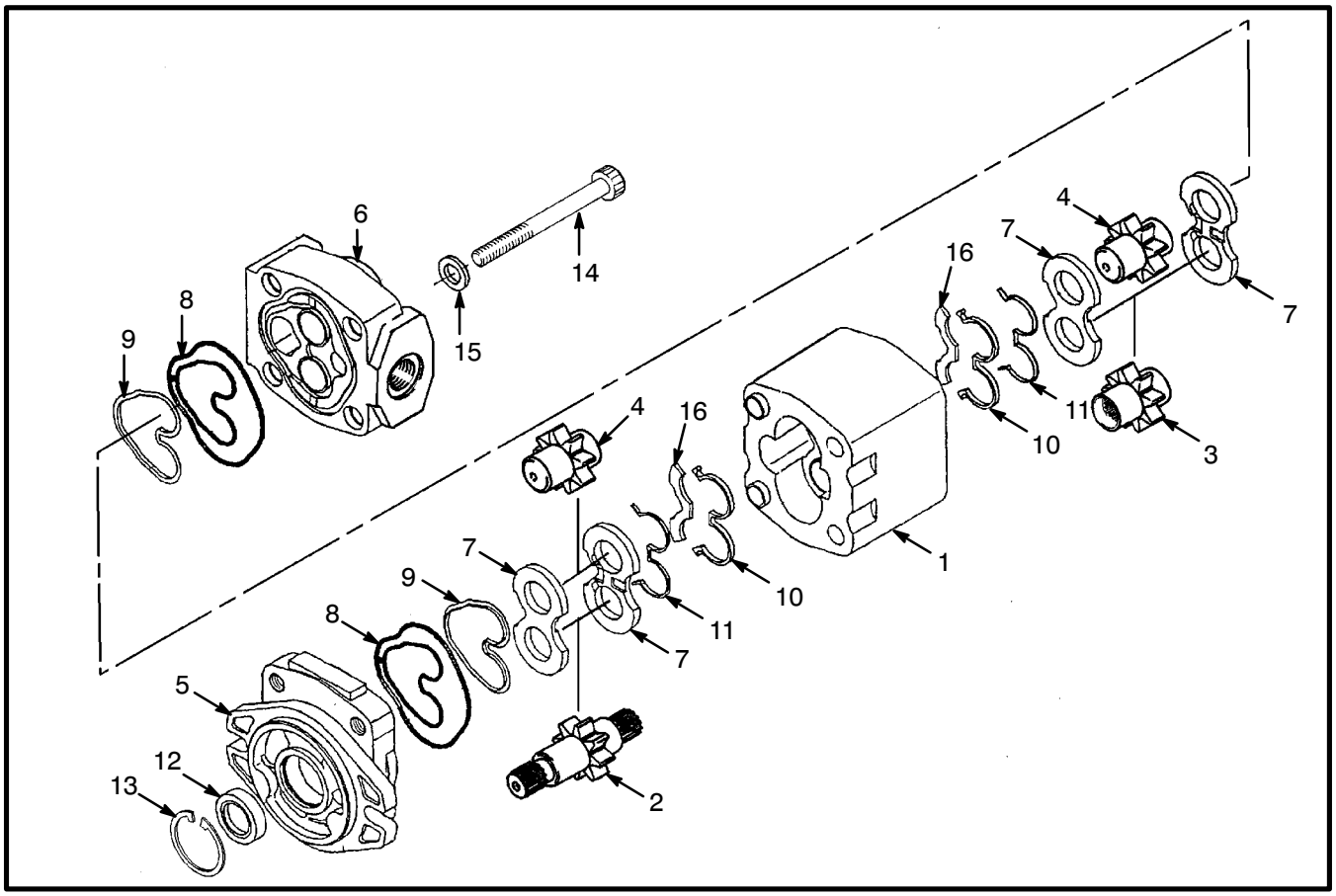


FIGURE 4. GEAR PUMP ASSEMBLY, DUAL GEAR SET

Legend For FIGURE 4.

1. BODY
2. DRIVE GEAR
3. DRIVE GEAR
4. DRIVEN GEAR
5. FLANGE
6. END COVER
7. PRESSURE PLATE
8. SEAL
9. BACK-UP RING
10. BUSHING SEAL
11. BACK-UP SEAL
12. SEAL
13. SNAP RING
14. CAPSCREW
15. WASHER
16. ISOLATION PLATE
13. LOCKWASHER
14. OIL SEAL
15. SNAP RING

spool gives a path from the supply cavity to the hydraulic cylinder to do work.

The control valve has three control levers. The first lever to the right of the operator controls the lifting and lowering of the mast. The second lever controls the tilt function. The third control lever is for attachments and has three methods of operation depending on the attachment and control valve.

- **Control Lever Without a Detent - Attachments Without a Clamp Action**: The lever is operated by moving forward or backward.
- **Control Lever With Detent - Required For Attachments With a Clamp Action**: The lever is spring-loaded toward the operator. The lever is operated by moving it to the right, then forward or backward.
- **Control Lever With a Detent - Four Function Control Valve**: The lever is spring loaded toward the operator and controls the third and fourth functions. The third function is operated by moving the lever forward or backward. The fourth function is operated by moving the lever to the right, then forward or backward.

Lift Section (See FIGURE 3.)

When the spool is moved to the Lift position, the spool makes a restriction in the open center passage. The increased pressure in the parallel passage causes oil to flow through the check valve to the supply cavity. The oil flows from the supply cavity through a section of the spool to the lift cylinder. The check valve prevents the movement of the load until the system pressure is great enough to control the load.

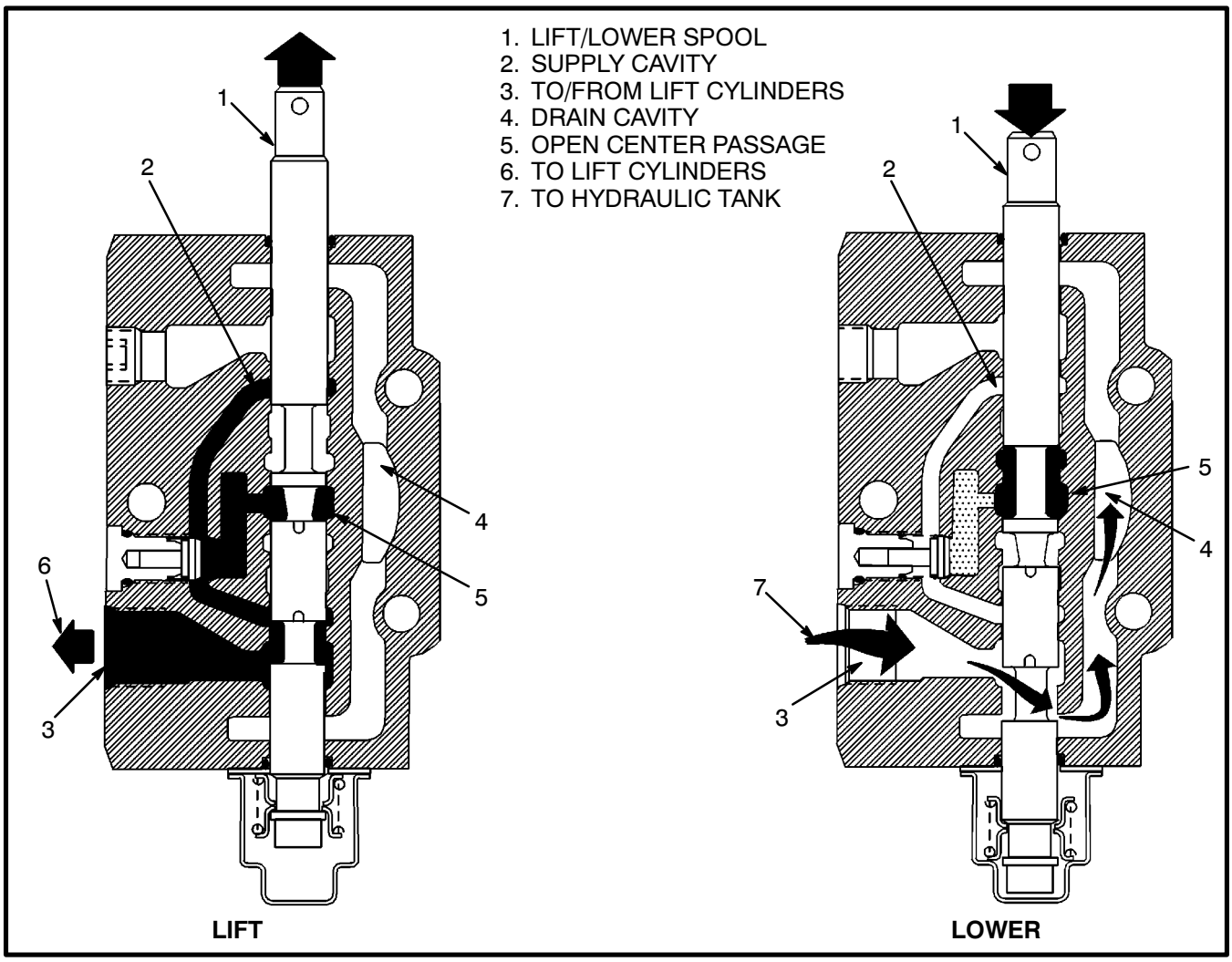
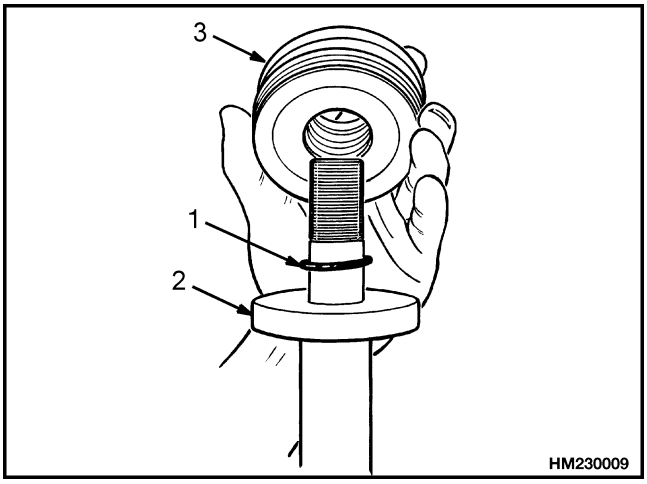


FIGURE 3. LIFT AND LOWER

TROUBLESHOOTING

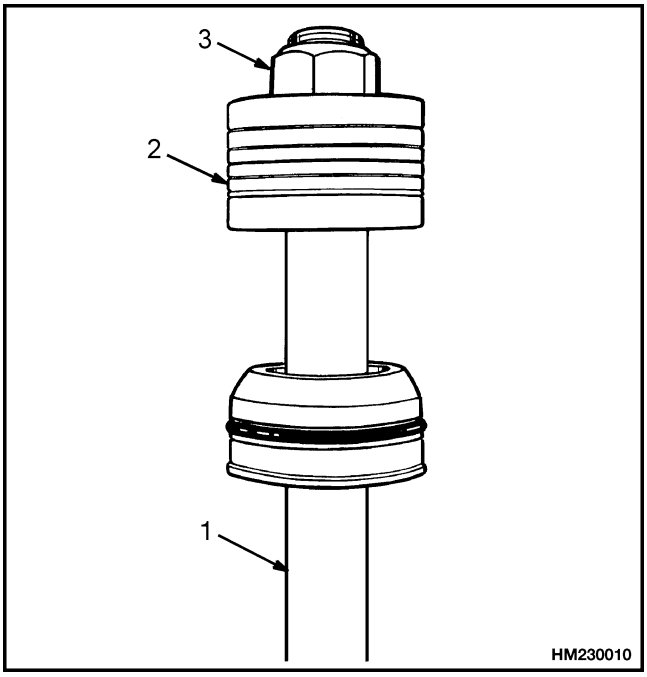
PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Tilt cylinders extend suddenly when the tilt spool is moved to FORWARD TILT position.	Tilt control spool inside the tilt spool is damaged.	Replace valve section.
Lift cylinders retract when the lift spool is in the NEUTRAL position.	Check valve for the lift spool is damaged.	Replace check valve.
	Cylinder seals have leaks.	Repair lift cylinders.
	Hydraulic lines have leaks.	Repair or tighten lines or fittings.
	Leaks between the lift spool and the bore.	Replace valve section.

STEP 4.
Install the piston half with the packing on the cylinder rod. Make sure the O-ring fits into the piston groove when the piston half is installed. Install the piston rod nut. Tighten to the specifications given in Torque Specifications.



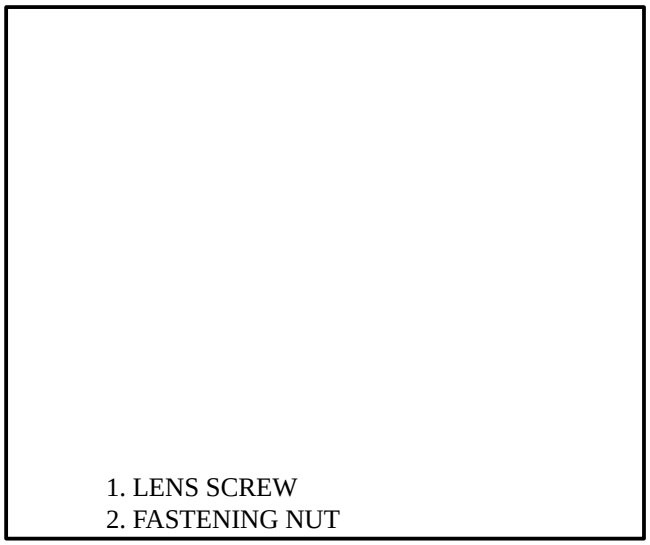
1. O-RING
2. PISTON HALF
3. PISTON HALF WITH PACKING

STEP 5.
Push the piston into the cylinder bore. Push the retainer into the bore. Make sure the O-ring is not damaged.



1. CYLINDER ROD
2. PISTON AND PACKING
3. ROD NUT

in this way, a separate switch is operated automatically by the equipment function.



1. LENS SCREW
2. FASTENING NUT

FIGURE 4. WARNING LIGHTS

REPLACEMENT

General

Horns, light assemblies, flashing devices, buzzers and switches are not repairable items. The most accurate and usually easiest checks for proper operation of individual items is direct replacement. However, the most common cause of failure is poor connections or defective or improper wiring. Also, there are no adjustments to perform. Therefore, only replacement procedures are given. Before replacing an item, make sure of the following:

a. Other electrical circuits are operating correctly.

b. Battery is fully charged and the cable terminals are clean and correctly connected.

c. Wiring and connections to device are tight and in good condition.

Replacing Horns Or Bells (See FIGURE 5.)

1. Make sure the KEY switch is in the “OFF” position or the battery is electrically disconnected.

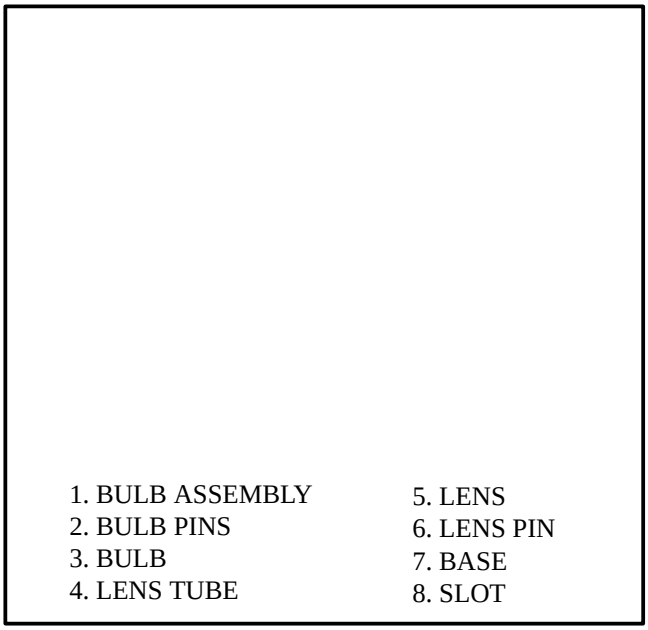
2. Mark the horn or bell wires for reconnection and disconnect them.

3. Remove the screws, nuts or other items fastening the horn or bell to the equipment.

4. Remove the horn or bell and install the replacement.

5. Tighten the screws, nuts, or other items fastening the horn or bell to the equipment.

6. Connect the wires as marked, to the electrical terminals.



1. BULB ASSEMBLY
2. BULB PINS
3. BULB
4. LENS TUBE
5. LENS
6. LENS PIN
7. BASE
8. SLOT

FIGURE 5. REPLACEMENT OF INSTRUMENT PANEL LIGHTS

Replacing Horn Relay Or Buzzer

The horn relay if used, is frequently located under the instrument panel or near the horn. Electrically powered equipment does not use relays. If necessary, follow the horn electrical leads to find the relay. Replace the relay as follows:

1. Disconnect the battery or batteries, to remove all voltage from the terminals.

2. Mark the wires for reconnection.

3. Disconnect the wires.

4. Remove the screws, nuts, or other items fastening the unit to the equipment.

5. Remove the unit and install the replacement unit.

6. Connect the marked wires to the correct terminals or connectors.

Replacing Warning Lights BULBS (See FIGURE 2., FIGURE 4. and FIGURE 5.)

1. Access the different assemblies’ bulbs as follows:

a. Large instrument panel assemblies – push the assembly base toward the lens and turn. Do not let spring fall.

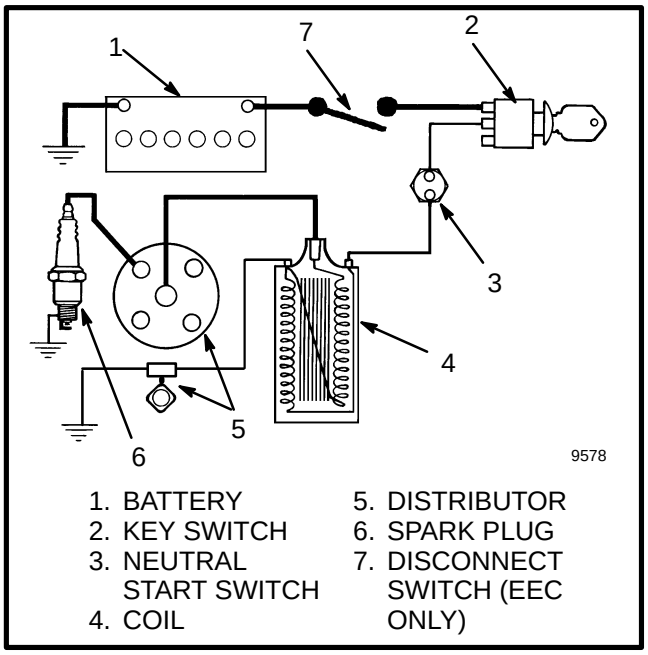


FIGURE 2. THE IGNITION CIRCUIT

When the engine is running, current flows from the battery, through the key switch, coil, and distributor and then returns to the battery. Distributor operation is the same during engine starting or running conditions except for the timing advance mechanisms.

Charging System (See FIGURE 3.)

The charging system includes the key switch, the battery and the alternator, and voltage regulator. The key switch connects battery voltage to the regulator. The regulator controls the alternator to charge the battery. Battery voltage decreases as the starting circuit and other circuits take energy from the battery. The regulator senses this decrease in battery voltage and increases the alternator output to charge the battery. The alternator is either **ON** or **OFF**. The alternator generates maximum current when it is **ON** and no current when it is **OFF**. The regulator switches the alternator between **ON** and **OFF** to get the average current needed to charge the battery. Alternator output is directly changed by engine speed and rotor current.

The alternator has four main parts that include the stator, the rotor, the diode assembly, and the voltage regulator. Mechanical power from the engine turns the rotor inside the stator windings. The voltage regulator controls the flow of battery current to the rotor brushes, slip rings, and rotor windings. A magnetic field that rotates is the result of this current flow in the stator windings.

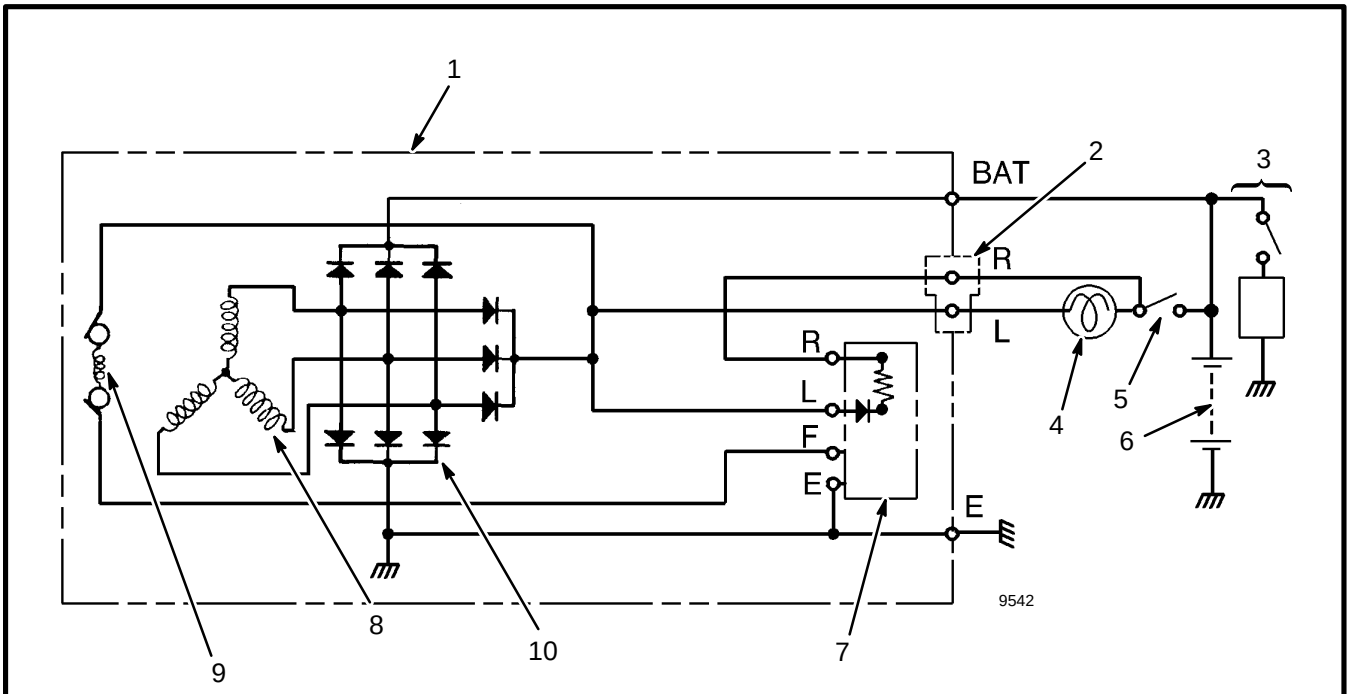
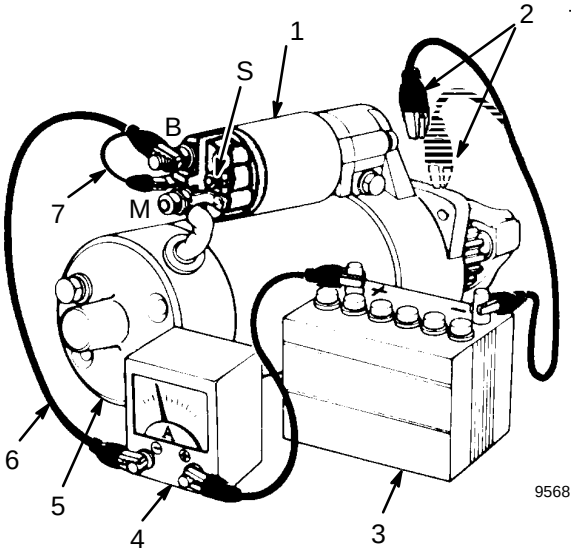


FIGURE 3. THE CHARGING CIRCUIT

Now, remove the negative lead from the starter housing. Remove the small jumper wire from the **S** terminal.



1. STARTER SOLENOID
2. NEGATIVE LEAD **(DO NOT CONNECT)**
3. 12V BATTERY
4. AMMETER
5. STARTER
6. POSITIVE LEAD
7. JUMPER WIRE

FIGURE 10. CHECK THE STARTER

4. The starter is in good condition if all of the following items are correct:

a. Clutch assembly moves so that it can engage the flywheel.

b. Smooth rotation occurs just after clutch movement.

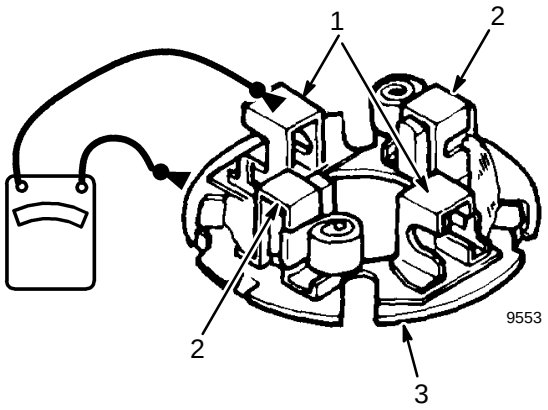
c. Ammeter must indicate 53 ampere or less.

d. Clutch assembly moves so that it can disengage the flywheel after jumper wire is removed from **S** terminal.

Check Brush Holder (See FIGURE 11.)

Remove the brush holder from the motor housing. Remove the brushes from the brush holder. Connect an ohmmeter between each bracket that holds each brush and the mount plate for the brackets. The indications for the two positive brackets must be infinity. The indications for the two other brackets must be zero ohms.

NOTE: BRUSH ASSEMBLY CAN BE DIFFERENT THAN SHOWN.



1. NEGATIVE BRACKETS
2. POSITIVE BRACKETS
3. MOUNT PLATE

FIGURE 11. CHECK THE BRUSH HOLDER

Check Armature

Remove the armature. Use an ohmmeter to check for an infinity indication between any commutator bar and the armature shaft. Check for continuity (zero ohms) between any two commutator bars. If either check is wrong, replace the armature.

Check Field Windings

Remove the motor, brush holder, and armature. Use an ohmmeter to check for continuity between the positive brush and electrical lead of the motor. Check for a indication of infinity between a positive brush and the motor housing. If the indication is not infinity, check that the brush lead connections are not touching the housing. If either check shows a wrong condition, replace the complete motor housing.

Check Clutch And Bearing

Check the teeth of the gear. If the teeth are worn or damaged, replace the clutch assembly. Check the teeth of the ring gear on the flywheel. If the teeth are worn or damaged, replace the ring gear. See the section for the **ENGINE**. Check that the clutch bearing rotates freely and smoothly. The bearing must not be loose.

IGNITION SYSTEM

Adjust Engine Timing (See FIGURE 12.)

Check that the distributor is adjusted for the correct timing. Connect a timing light to the number one spark plug

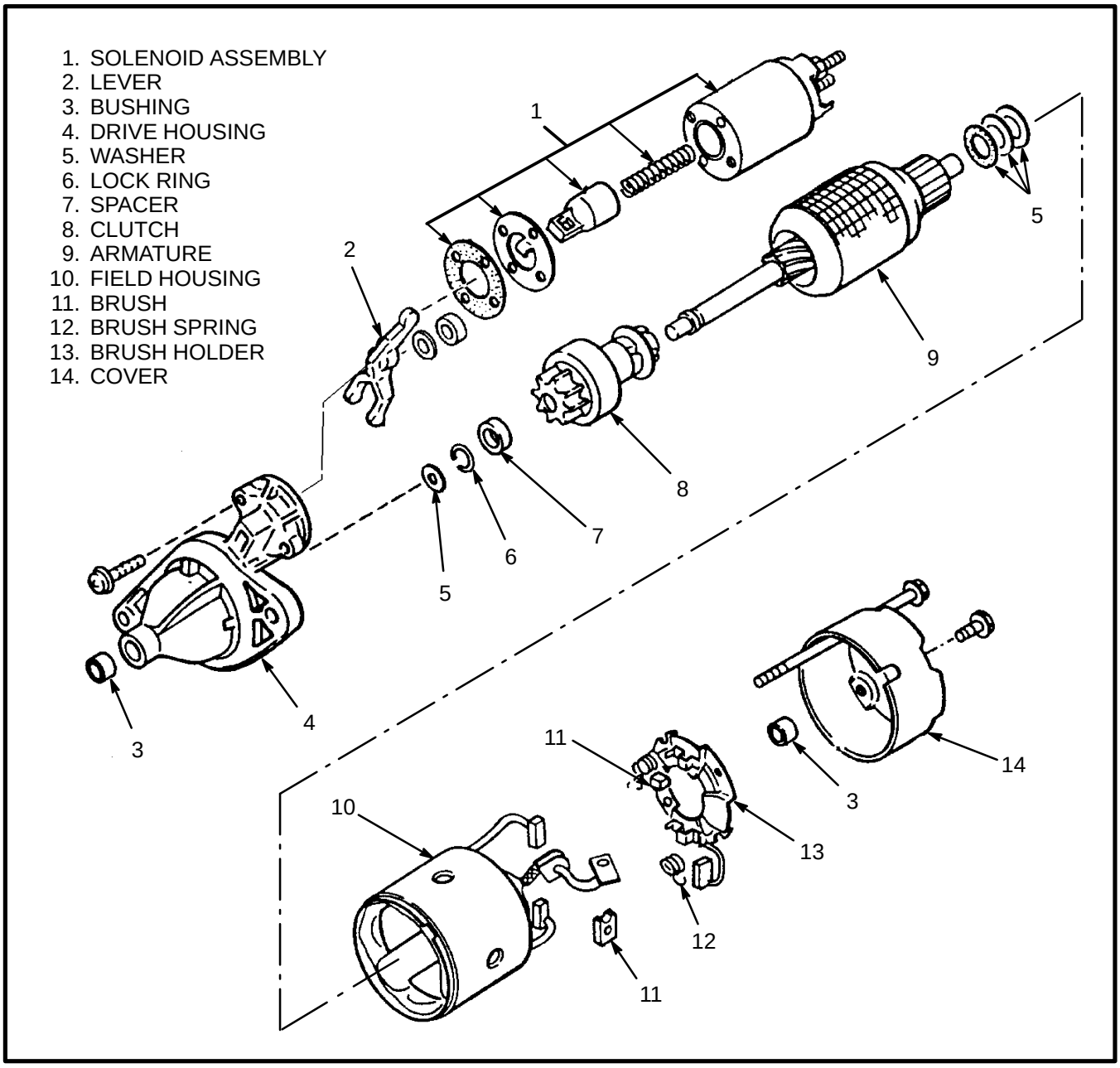


FIGURE 5. PARTS OF THE STARTER

Assembly And Installation (See FIGURE 5.)

1. Install the clutch assembly on the armature shaft. See FIGURE 5. Install the retainer and snap ring to hold the clutch assembly on the armature shaft.

2. Install the lever on the clutch assembly. Install the solenoid plunger on the lever. Install the armature, clutch assembly, solenoid plunger and lever in the drive housing. Install the washer springs and spring seat for the lever in the drive housing.

3. Install the field housing over the armature. Carefully install the brush holder assembly in the field housing. Make sure that the assembly is in the correct position. Make sure that the brush leads are free.

4. Lift the brush springs and install all of the brushes. Install the washers on the armature shaft. See FIGURE 5.

5. Install the end cover, the two long bolts and the two screws that fasten the end cover.

6. Install the solenoid washers, spring and solenoid on the drive housing using the screws. Connect the strap from the motor to the motor terminal of the solenoid. Install the washer, lock washer and nut on the motor terminal. Tighten the nut.

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE
Starter operates, but engine crankshaft does not rotate.	Wiring connections are broken, loose or have corrosion.
	Starter clutch assembly has damage.
	Solenoid has damage and will not keep the clutch assembly engaged.
	Starter clutch assembly will not move freely.
	Gear teeth on starter clutch assembly are damaged.
	Gear teeth on ring gear are damaged.
Starter continues to run.	Contacts of solenoid are welded together.
	Solenoid coil has a short–circuit.
	Spring that disengages the starter clutch is broken.
	Key switch is damaged.
Engine will not start – no spark or weak spark.	Distributor has damage.
	Coil has damage.
	Key switch has damage.
	Electronic module or sensing coil has damage.
Battery does not stay charged.	Battery terminals have corrosion.
	Battery has damage inside the case.
	Drive belt for alternator is loose.
	Wiring connections are broken, loose or have corrosion.
	Short–circuit between wiring connector(s).
	Alternator brushes are worn.
	Alternator brushes have weak springs.
	Alternator has dirty slip rings.
	Stator coil for alternator has a short–circuit.
	Voltage regulator has damage.
Battery is charged more than necessary.	Wiring connections are broken, loose or have corrosion.
	Short–circuit between wiring connector(s).
	Field coil in alternator has damage.

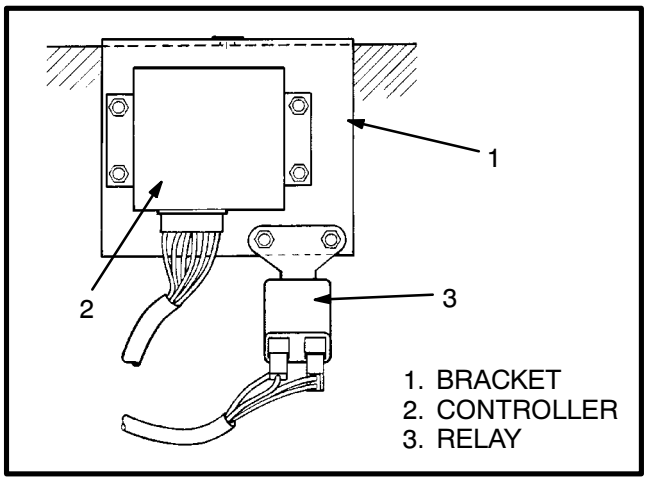


FIGURE 10. RELAY AND CONTROLLER FOR GLOW PLUG CIRCUIT

CHARGING CIRCUIT

Always check the general condition of the complete system before doing a complete check on each part. Check the general condition of the following parts: (1) battery, (2) battery cables and connections and (3) alternator wires and connectors. Also check the condition and tension of the drive belt for the alternator.

⚠ CAUTION

NEVER operate the engine if the alternator output B terminal is not connected to the battery.

Do not short-circuit or connect jumper wires to any of the alternator terminals unless told to by the procedures.

Make sure polarity is correct before connecting a battery charger or another battery.

The two problems of the charging circuit are low output and high output. Low output causes a low battery and difficult starting. A high output causes heating of the battery and evaporation of water from the electrolyte. The following two checks will find out if the alternator, regulator or wiring has the charging fault. The two checks will also find out if the charging system has a correct output. Do the following two checks before removal, disassembly or replacement of alternator or regulator.

Check For Low Output (See FIGURE 11.)

⚠ WARNING

Do not connect the wire from the "BAT" terminal to the electrical ground. A short-circuit will occur and make sparks, which can cause injury.

NOTE: Make sure the wire from the voltmeter makes contact with each terminal on the alternator.

1. Connect a voltmeter between the battery terminal **B** and the electrical ground. Turn the key switch to the **ON** position and check the indication.

2. Connect a voltmeter to the Field terminal **L** and the Regulator terminal **R**. Follow the procedure in Step 1 and check the indication.

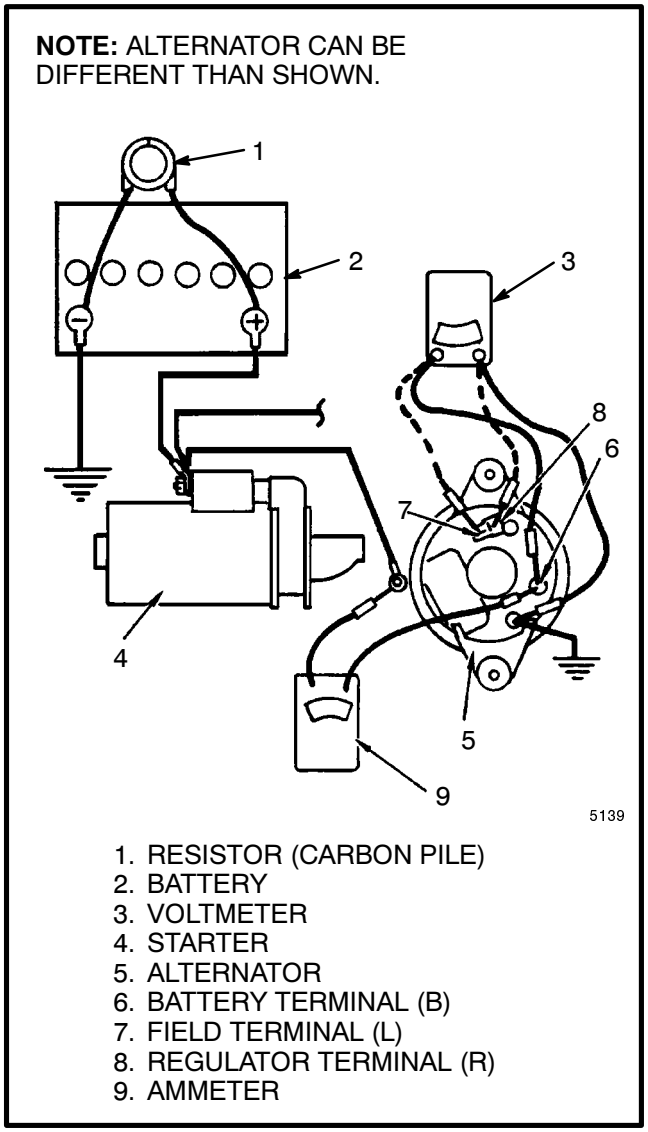


FIGURE 11. CHECK ALTERNATOR OUTPUT

sure that all parts of the mast that move are fully lowered.

OR

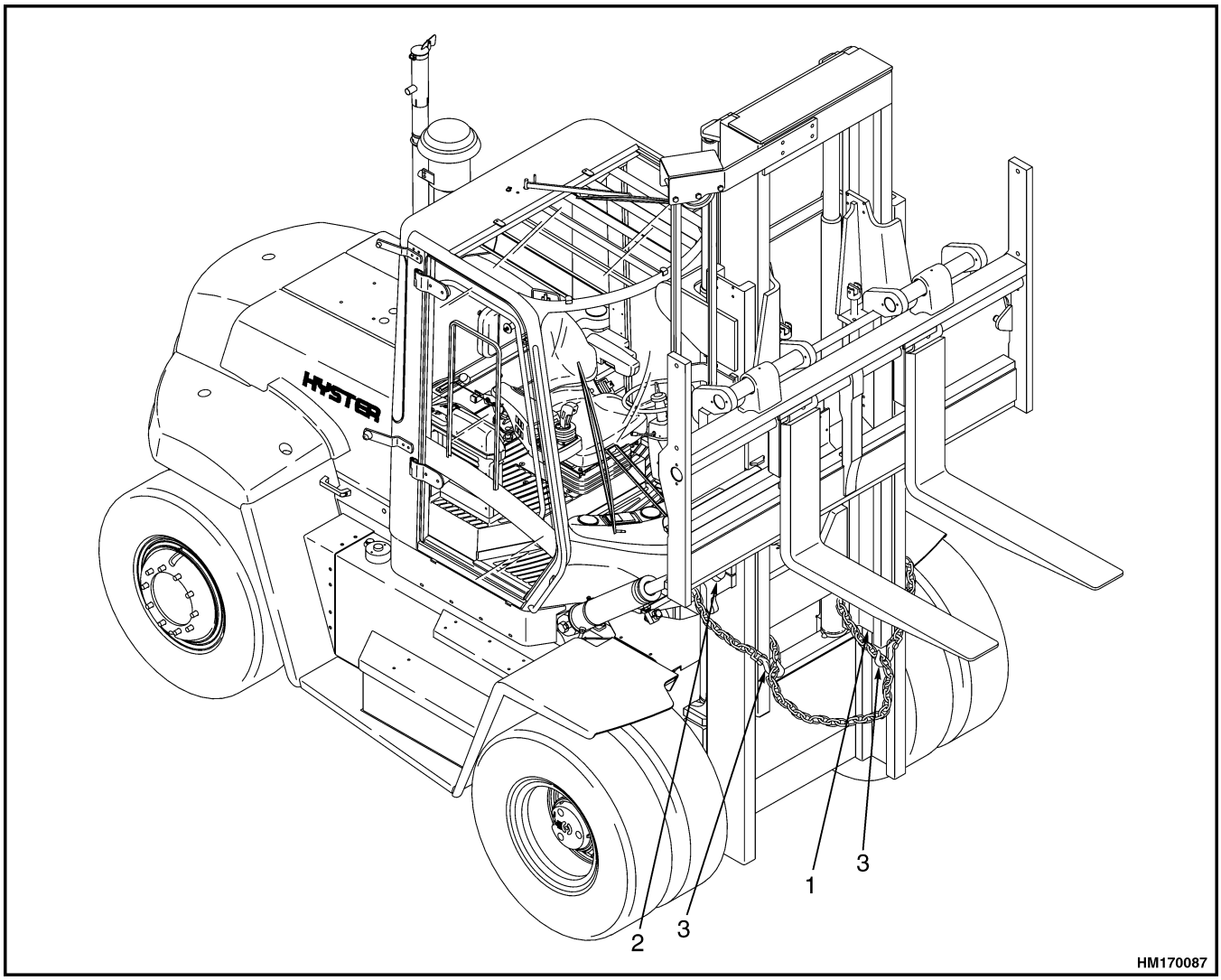
2. If parts of the mast must be in raised position, install a safety chain to restrain the moving parts of the mast. Connect moving parts to a part that does not move. Follow these procedures:

a. Put the mast in a vertical position.

b. Raise the mast to align the bottom of the inner weldment to below the anchor for the tilt cylinders. See Figure 2.

c. Use a 12 mm (0.5 in.) minimum safety chain with a hook to fasten the weldments together so that the inner weldment cannot lower. Install the chain on both sides of the mast. Make sure the hooks are completely engaged with a link in the chain.

d. Lower the mast until there is tension in the safety chain. If the engine is running, stop the engine. Apply the parking brake. Install a **"DO NOT REMOVE"** tag on the safety chain. Put a **"DO NOT OPERATE"** tag in the operator's compartment.



1. INNER WELDMENT 2. TILT CYLINDERS 3. HOOK

Figure 2. Mast

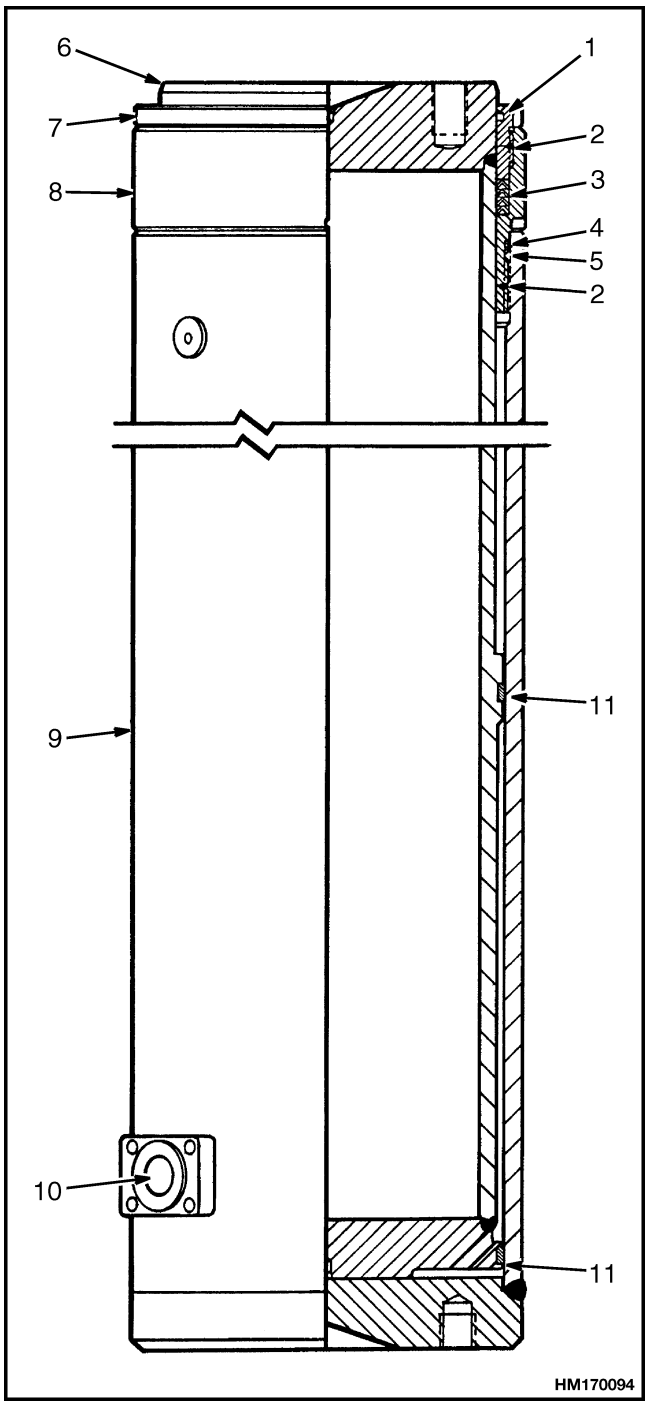


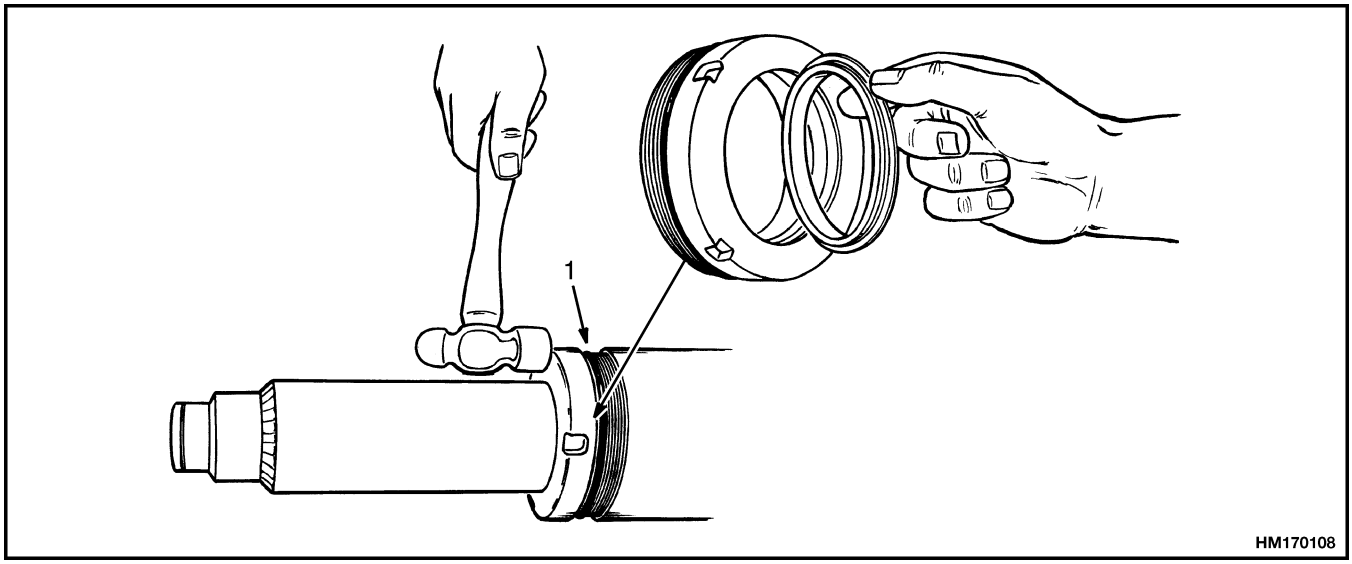
Figure 10. Displacement Cylinders

Legend for Figure 10

NOTE: OIL LEAKAGE IS NOT CONTROLLED BY THE TORQUE ON THE PACKING GLAND. TIGHTEN THE PACKING RETAINER TO STOP OIL LEAKS. REPLACE CHEVRON-STYLE PACKING WHEN PACKING RETAINER CANNOT COMPRESS PACKING FURTHER TO CONTROL OIL LEAKS. DO NOT TIGHTEN MORE THAN NECESSARY TO STOP OIL LEAKS.

1. WIPER
2. NYLON RING
3. CHEVRON-STYLE PACKING
4. BACK-UP RING
5. O-RING
6. ROD HEAD
7. PACKING RETAINER
8. PACKING GLAND
9. CYLINDER SHELL
10. INLET AND OUTLET PORT
11. WEAR RING

STEP 4.
Install a new wiper ring and spring on the retainer. Install the retainer against the packing gland nut. Lightly hit the retainer to move against the internal threads in the cylinder shell. Use a spanner to tighten the retainer.



1. O-RING

Lift Cylinders for Vista® Masts

DESCRIPTION

All lift cylinders for Vista® masts are single-action hydraulic cylinders. The hydraulic force is applied only in one direction. When hydraulic oil enters one end of the lift cylinder, the hydraulic force extends the piston rod. When the force is removed, the weight of the carriage and inner mast causes the piston rod to retract.

The most common maintenance problem is the repair of oil leaks. If the bore of the shell of the lift cylinder is damaged and cannot be repaired, the lift cylinder must be replaced.

VISTA® two-stage, three-stage, and four-stage masts have two main lift cylinders. The free-lift mast has two main lift cylinders and a shorter free-lift cylinder. See Figure 17 and Figure 18.

Spacers are used in some cylinders to limit the stroke of the piston rod. Worn spacers must be replaced with the same size spacer.

The free-lift cylinder has a single-lip seal on the piston to prevent hydraulic oil leaks past the piston and retainer. The piston rod is a smaller diameter than the piston.

During operation, some hydraulic oil will leak past the piston area to the rod end of the lift cylinder. Small leaks are permitted if the internal leak rate of the hydraulic system is not greater than the specification. An internal check valve is installed in the piston of the free-lift cylinders. When the piston rod extends, the pressure increases more quickly on any oil in the rod end of the lift cylinder. The hydraulic oil transfers through the check valve to the piston end of the free-lift cylinder. This action prevents hydraulic damage to the single lip seal and the wiper ring. See Figure 19.

Lowering Control Valve

A lowering control valve is installed in the hydraulic line to the bases of the lift cylinders. See Figure 20. The lowering control valve permits easy entry of hydraulic oil into the cylinders, but gives a restriction when the rods retract. This restriction controls the maximum speed at which a load on the forks can be lowered. The lowering control valve prevents a load

INTRODUCTION

GENERAL

This section has the description and operation of the masts. Repair procedures for the masts are described in the section, **MASTS, REPAIR, 4000 SRM 522**. The description and repairs for the tilt cylinders are described in the section **THE TILT CYLINDERS, 2100 SRM 103.**

The mast is used to lift a load vertically. The mast has two movements controlled by hydraulic cylinders: forward and backward tilt and the lifting and lowering of the mast weldments and carriage. The outer weldment can move on the pivot pins at the mast mounts. The operation of the tilt cylinders causes the mast to tilt forward and backward. The tilt cylinders are fastened between the frame of the lift truck and the outer weldment of the mast. Hydraulic lift cylinders are installed vertically on the masts. The lift cylinders raise and lower the weldments and the carriage. The hydraulic operation of the lift cylinders and tilt cylinders is described in the **MAIN CONTROL VALVE** section for your lift truck.

There are three types of masts available:

- two–stage, limited free–lift
- two–stage, full free–lift
- three–stage, full free–lift

Each type of mast is described separately in this section.

DESCRIPTION AND OPERATION

Carriages (See FIGURE 1.)

The carriage is a part of the mast assembly and moves within the vertical channels of the inner weldment. Load rollers, attached to the carriage, travel in the channels of the inner weldment. Forks or other types of load handling equipment are attached to the carriage. A load backrest extension is attached to the carriage and adds support for a load that has multiple pieces.

The side–shift carriage lets the operator move the forks and load from side–to–side. This function makes it easier for the operator to align the forks with a load or align the load with a stack. The side–shift carriage hangs on the fork bars of the standard carriage. Special bushings fit between the side–shift carriage and the fork bars. A side–shift cylinder is installed on a plate that fits on the standard carriage. The side–shift cylinder moves the side–shift carriage on the standard carriage.

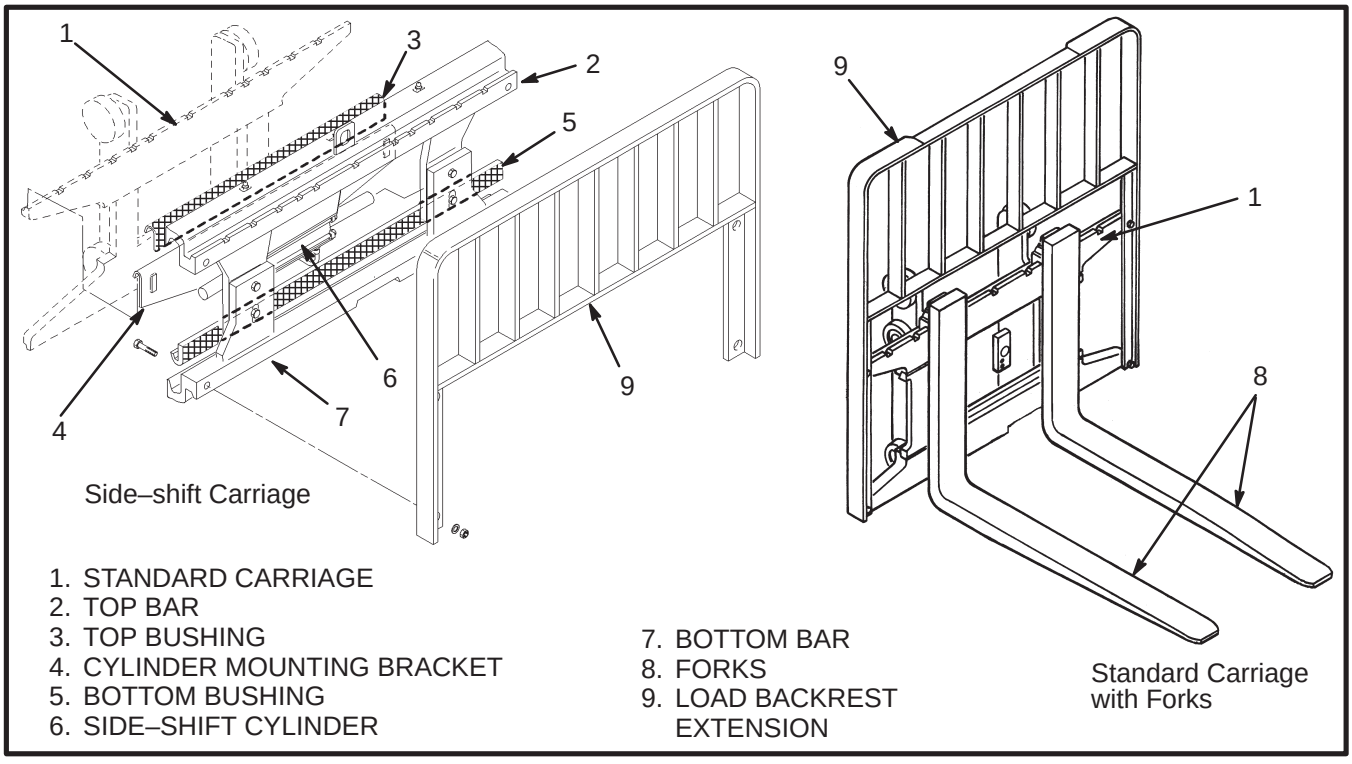


FIGURE 1. CARRIAGES

fork removal notch. See FIGURE 2. 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.

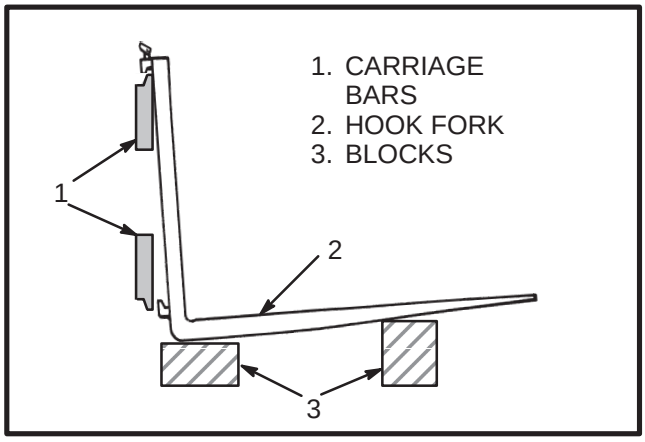


FIGURE 1. REMOVE A HOOK FORK

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.

CARRIAGES

Removal, Standard Carriage (See FIGURE 2. and FIGURE 3.)

1. Put a one–quarter capacity load on the forks. The load must give the carriage stability so that the carriage cannot fall when it is disconnected from the mast.

2. Lower the carriage and forks on blocks so that the lift chains become loose.

⚠ WARNING

When disconnecting the lift chains, keep control of the ends. Use wire to temporarily connect the ends of the lift chains to the mast. This procedure will prevent the lift chains from falling from the sheaves and causing an injury or damage.

3. Remove the pin from each chain anchor at the carriage. Disconnect the lift chains from the carriage. Use wire to connect the ends of the lift chains to a part of the mast. Make sure the chains can move freely when the inner weldment is raised.

⚠ WARNING

Make sure that the carriage has stability when the inner weldment is above the load rollers of the carriage.

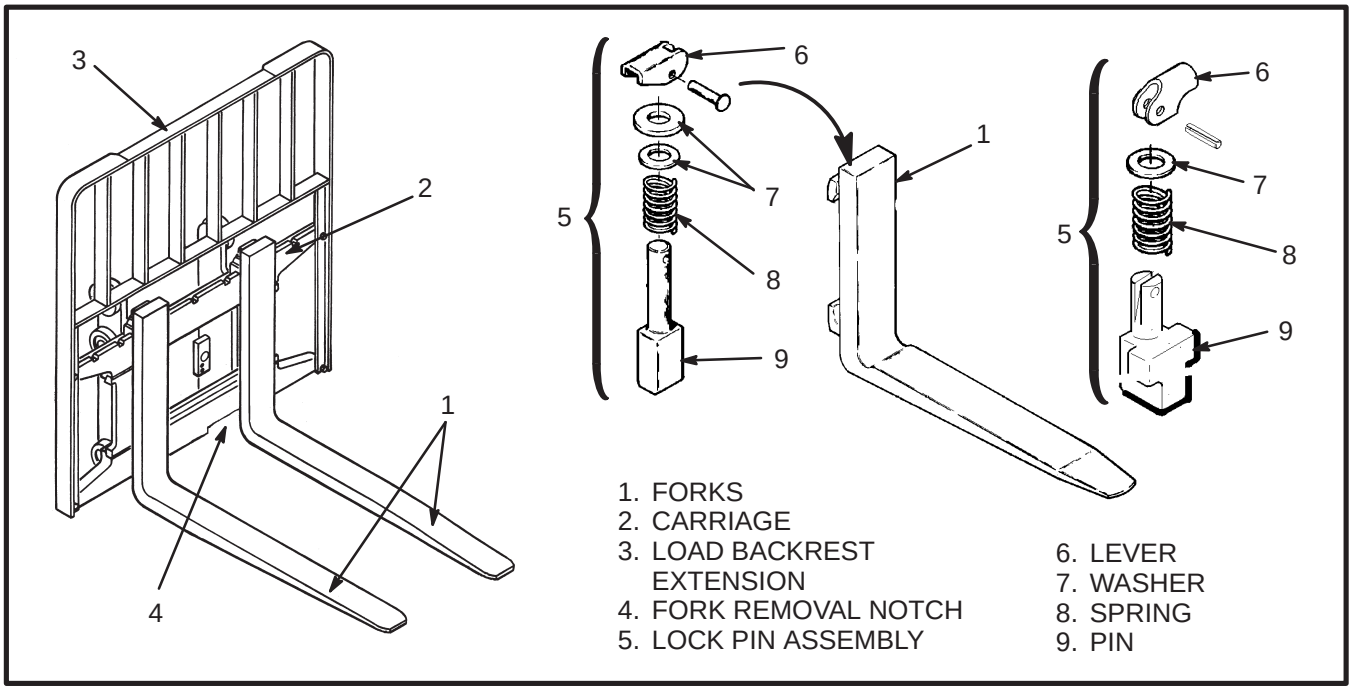


FIGURE 2. CARRIAGE AND FORKS

2. Clean the lift chains with solvent. Remove all dirt and grease. Inspect the lift chains for wear or damage. The lift chains must be installed on the mast before they can be checked for length. A lift chain becomes longer when it is worn. If a chain is 3% longer than a new lift chain, the lift chain must be replaced. If a chain scale is available, check the lift chain as shown in FIGURE 11. If a chain scale is not available, measure 20 links of the lift chain. Compare the measurement with the lengths given in FIGURE 11. Lubricate the chains with SAE 30 engine oil. The best procedure is to soak them in engine oil.

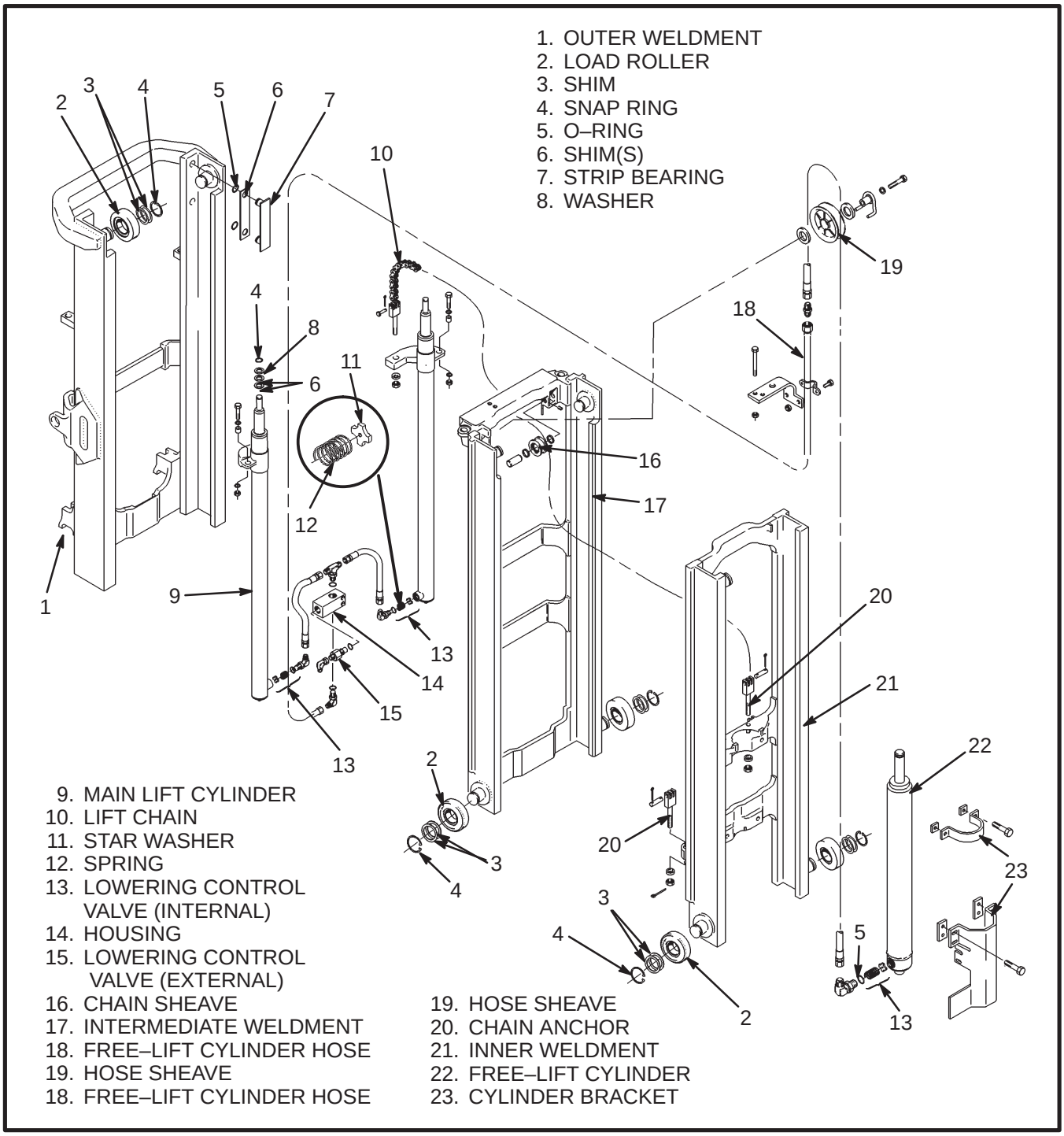


FIGURE 10. THREE–STAGE, FULL FREE–LIFT MAST H/S/E/J2.00–3.20XM (H/S/E/J40–65XM) and S/E/J2.00–3.00XL (S/E/J40–60XL) (1 Of 2)

*** METRIC FORMULAS (ALL DIMENSIONS ARE IN MILLIMETERS)**

@ DIMENSION "E" = (0.985 x Z) + (0.985 x Y) + 244

DIMENSION "E" = (0.985 x Z) + (0.985 x Y) + 220

% DIMENSION "E" = (0.985 x Z) + (0.985 x Y) + 283

EXAMPLE: DIMENSION "E" = (0.985 x Z) + (0.985 x Y) + 244

STEP 1. DIMENSION "E" = (0.985 x 135) + (0.985 x 2290) + 244

STEP 2. DIMENSION "E" = 133 + 2255.7 + 244

STEP 3. DIMENSION "E" = 2388.7 + 244

STEP 4. DIMENSION "E" = 2633

*** INCH FORMULAS (ALL DIMENSIONS ARE IN INCHES)**

@ DIMENSION "E" = (0.985 x Z) + (0.985 x Y) + 9.6

DIMENSION "E" = (0.985 x Z) + (0.985 x Y) + 8.7

% DIMENSION "E" = (0.985 x Z) + (0.985 x Y) + 11.1

EXAMPLE: DIMENSION "E" = (0.985 x Z) + (0.985 x Y) + 9.6

STEP 1. DIMENSION "E" = (0.985 x 5.3) + (0.985 x 90.0) + 9.6

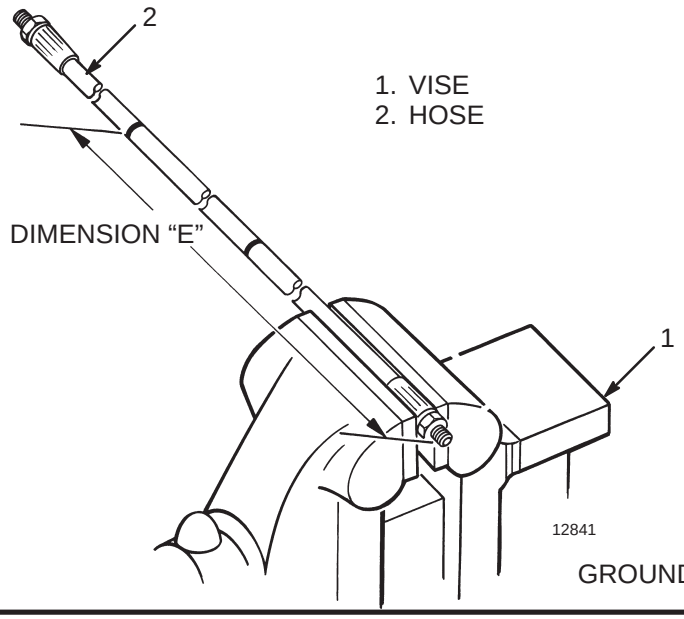
STEP 2. DIMENSION "E" = 5.2 + 88.7 + 9.6

STEP 3. DIMENSION "E" = 93.9 + 9.6

STEP 4. DIMENSION "E" = 103.5

* ALL OF THE MEASUREMENTS ARE MADE WITH MAST VERTICAL AND FULLY LOWERED.

@ H2.00–2.50XM (H40–50XM)
# H3.00–3.20XM (H60–65XM)
J2.00–3.00XL (J40–60XL)
% E2.00–3.20XM (E40–65XM)
S/E2.00–3.00XL (S/E40–60XL)



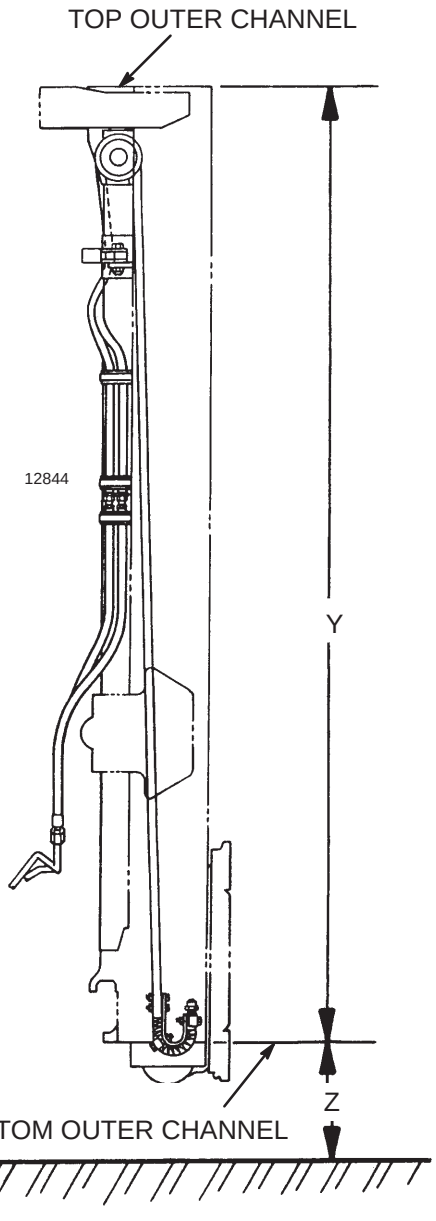


FIGURE 19. HEADER HOSE MEASUREMENT – TWO–STAGE LIMITED FREE–LIFT MAST

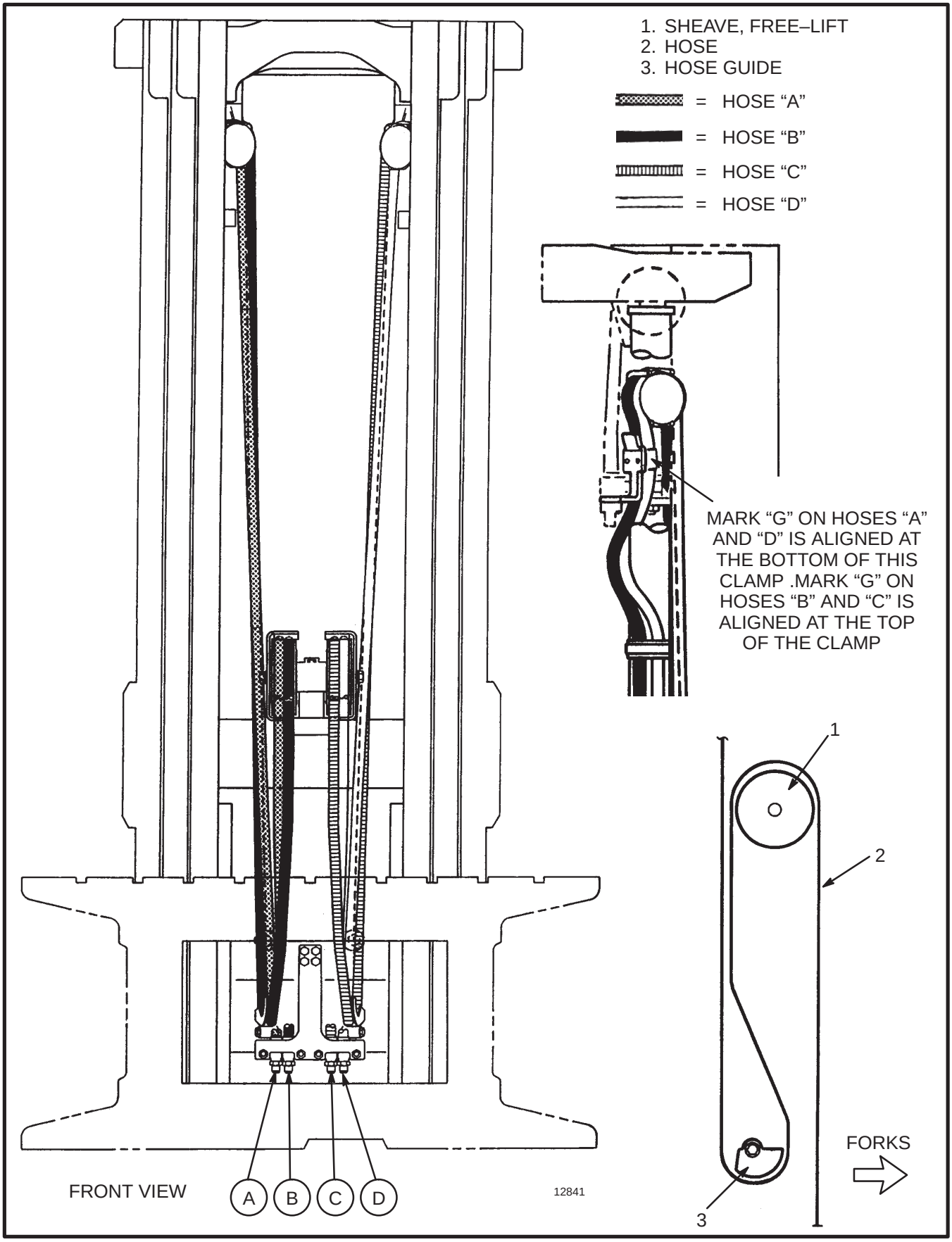


FIGURE 27. HEADER HOSE ALIGNMENT – THREE–STAGE FULL FREE–LIFT MAST (1 OF 3)

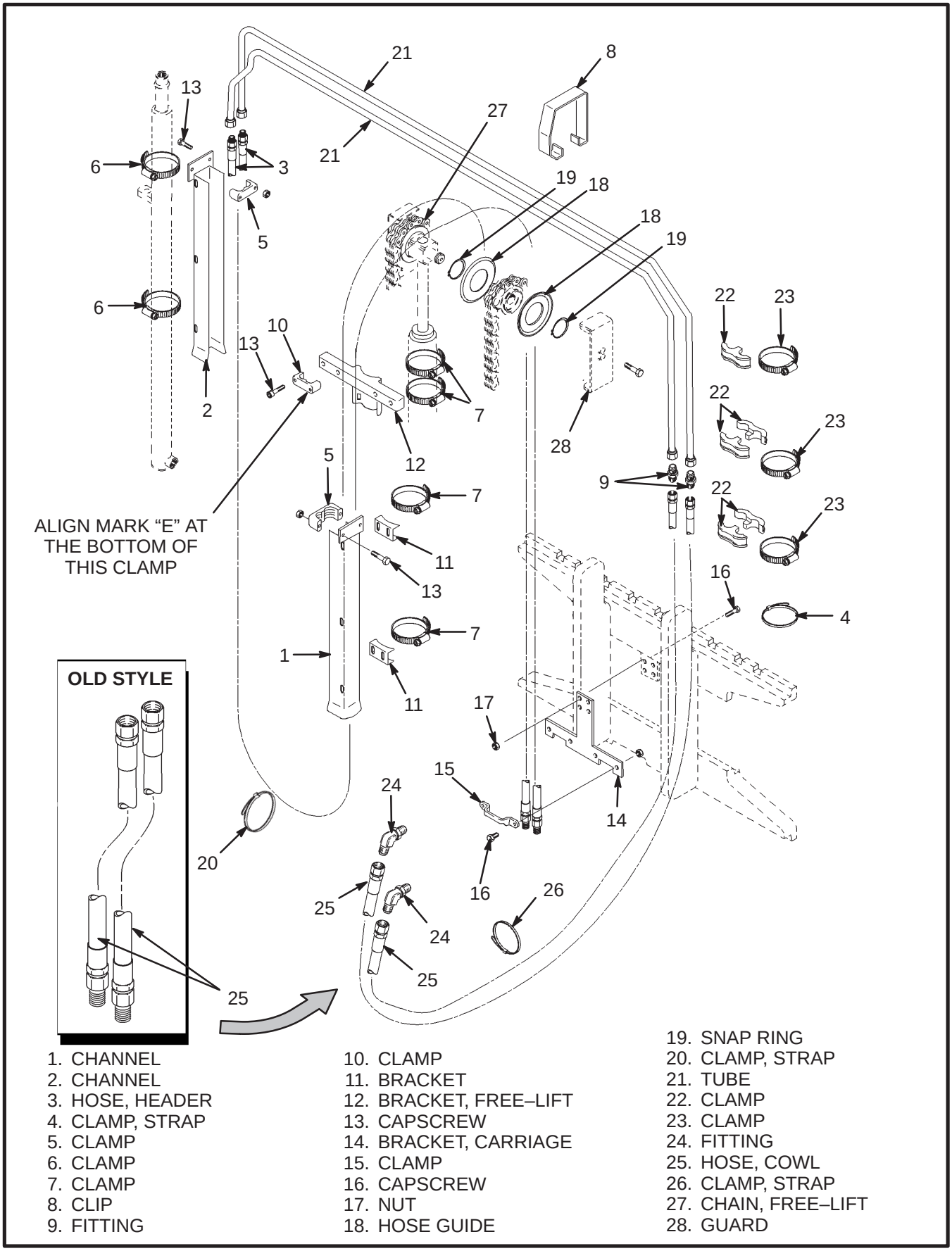


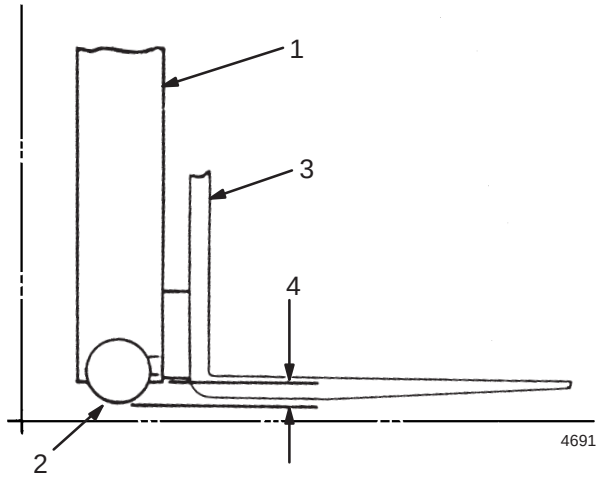
FIGURE 32. HEADER HOSES – TWO–STAGE FULL FREE–LIFT MAST

2. Adjust the main lift chains for the three–stage mast as follows:

a. Adjust the chain anchors at the main lift cylinders so that the top of the inner weldment is even with the top of the outer weldment within ±1.5mm (±0.06 in).

b. Adjust the chain for the carriage as described in step 1.

3. 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. See FIGURE 38. Lower the mast completely and put a capacity load on the forks. Tilt the mast fully backward and check the amount that the bottom carriage load roller extends below the inner channel. When adjustments are correct, no more than one–third of the roller will be visible.



1. TILT MAST FULLY BACKWARD
2. CARRIAGE ROLLER
3. FORK
4. CARRIAGE ROLLER MUST NOT EXTEND MORE THAN 1/3 OF ROLLER DIAMETER BELOW INNER MAST CHANNEL

FIGURE 38. LIFT CHAIN ADJUSTMENTS

ADJUST THE MAST (See FIGURE 39.)

NOTE: Shims are installed on both sides of the load rollers. Do not add or remove shims from the stub shafts. To change the position of the roller on the stub shaft, move the shims from one side of the load roller to the other.

During assembly, the shim arrangement will be approximately the same as before disassembly. Check the clearance and adjust for wear or change because of repairs.

1. The load rollers control the alignment of the mast weldments. The alignment conditions are given on a list below with the most important condition first. See FIGURE 39.

a. The weldments must be parallel to each other.

b. Use shims to adjust the load rollers so that there is zero clearance between the load roller and the channel at the point of tightest fit.

c. The number of shims under a load roller must be approximately the same as the stub shaft in the opposite side of the weldment. The weldments will be approximately in the center.

2. Adjust the load rollers on the mast as follows:

a. Use a prybar to move the weldments from side–to–side to measure the amount of movement. Repeat this step in a minimum of three different positions (top, middle, bottom) of the weldments.

b. Separate the weldments and change the shim arrangements as needed. Assemble the weldments. Slide the weldment all the way to the top and bottom to find the tightest fit.

c. Repeat steps a and b until there is zero clearance at the point of tightest fit.

d. Measure the distance between the channels of the weldments on the top and bottom. Change shims to keep the distance equal between the top and bottom of the weldments. Also make sure that the weldments are parallel within 1.5 mm (0.060 in).

3. Adjust the strip bearings. Insert shims between the strip bearing and the channel. Adjust the strip bearings so that the maximum clearance at the point of tightest fit is 0.8 mm (0.030 in). See FIGURE 12.

FASTENER TORQUE TABLES

*Table 5. Torque Values for Metric Fasteners**

Size and Pitch	Property Class 5.8 [1]		Grade 8.8 [2]		Grade 10.9 [3]	
	N•m	lbf ft	N•m	lbf ft	N•m	lbf ft
M3 × 0.5	0.62	0.5	0.99	0.7	1.34	1.0
M3.5 × 0.6	0.97	0.7	1.55	1.1	2.11	1.6
M4 × 0.7	1.44	1.1	2.30	2.1	3.13	2.3
M5 × 0.8	2.91	2.1	4.65	3.6	6.33	4.7
M6 × 1	4.94	3.6	7.90	6	10.8	8
M8 × 1.25	12.0	9	19.2	14	26.1	19
M8 × 1	12.8	9	20.5	15	27.9	21
M10× 1.5	23.8	18	38.0	28	52	38
M10 × 1.25	25.1	19	40.1	30	55	41
M12 × 1.75	41.4	31	66	49	90	66
M12 × 1.25	45.3	33	72	53	98	72
M14 × 2	66	49	105	77	145	105
M14 × 1.5	72	53	115	85	155	115
M16 × 2	105	77	165	122	225	165
M16 × 1.5	110	81	175	130	240	175
M20 × 2.5	200	150	320	235	435	320
M20 × 1.5	225	165	355	260	485	360
M24 × 3	345	255	555	410	755	560
M24 × 2	375	275	605	445	820	605
M27× 3	505	370	810	600	1,100	810
M27 × 2	550	405	875	645	1,190	880
M30 × 3.5	690	510	1,100	810	1,500	1,100
M30 × 3	715	530	1,140	840	1,550	1,140
M30 × 2	765	565	1,220	900	1,660	1,230
M33 × 3.5	940	695	1,500	1,100	2,040	1,510
M33 × 2	1,030	760	1,640	1,210	2,240	1,660
M36 × 4	1,200	885	1,930	1,430	2,620	1,940
M36 × 3	1,280	945	2,040	1,510	2,780	2,050
M39× 4	1,560	1,150	2,490	1,840	3,390	2,500
M39 × 3	1,640	1,210	2,630	1,940	3,570	2,640
M42 × 4.5	1,930	1,430	3,080	2,280	4,200	3,100
M42 × 3	2,070	1,530	3,320	2,450	4,510	3,330
M45 × 4.5	2,410	1,780	3,850	2,840	5,240	3,870
M45 × 3	2,580	1,910	4,120	3,040	5,610	4,140
M48 × 5	2,900	2,140	4,630	3,420	6,300	4,650
M48× 3	3,160	2,330	5,040	3,720	6,860	5,060

* Unless otherwise specified
[1] Approximately equal to Grade 2
[2] Approximately equal to Grade 5
[3] Approximately equal to Grade 8

General

This section contains a Maintenance Schedule and the instructions for maintenance and inspection.

The Maintenance Schedule has time intervals for inspection, lubrication, and maintenance for your lift truck. The service intervals are given in both operating hours recorded on the lift truck hourmeter and in calendar time. Use the interval that comes first.

The recommendation for the time intervals is for 8 hours of operation per day. The time intervals in the Maintenance Schedule must be decreased for the following conditions:
- The lift truck is used more than 8 hours per day.
- The lift truck must work in dirty operating conditions.

Your dealer for Hyster lift trucks has the equipment and trained service personnel to do a complete program of inspection, lubrication, and maintenance. A regular program of inspection, lubrication, and maintenance will help your lift truck provide more efficient performance and operate for a longer period of time.

WARNING

Do not make repairs or adjustments unless you have both authorization and training. Repairs and adjustments that are not correct can make a dangerous operating condition.

Do not operate a lift truck that needs repairs. Report the need for repairs immediately. If repair is necessary, put a DO NOT OPERATE tag in the operator's area. Remove the key from the key switch.

Some users have service personnel and equipment to do the inspection, lubrication, and maintenance shown in the Maintenance Schedule. Service Manuals are available from your dealer for Hyster lift trucks to help users who do their own maintenance.

SERIAL NUMBER

The serial number for the lift truck is on the nameplate. It is also on the rear of the base frame (two lines) in front of the steering tire, on the right-hand side.

HOW TO MOVE DISABLED LIFT TRUCK

How to Tow Lift Truck

WARNING

Use extra caution when towing a lift truck if any of the following conditions exist:
- **Brakes do not operate correctly.**
- **Steering does not operate correctly.**
- **Tires are damaged.**
- **Traction conditions are bad.**
- **The lift truck must be towed on a slope.**

If the engine cannot run, there is no power available for the hydraulic steering system. This condition can make the lift truck difficult to steer. Poor traction can cause the disabled lift truck or towing vehicle to slide. A slope will also make the lift truck more difficult to stop.

Never lift and move a disabled lift truck unless the disabled lift truck MUST be moved and cannot be towed. A lift truck used to move a disabled lift truck MUST have a capacity rating equal to or greater than the weight of the disabled lift truck. The capacity of the lift truck used to move a disabled lift truck must have a load center equal to half the width of the disabled lift truck. See the nameplate of the disabled lift truck for the approximate total weight. The forks must extend the full width of the disabled lift truck. Put the weight center of the disabled lift truck on load center of the forks. Be careful not to damage the underside of the lift truck.

1. The towed lift truck must have an operator.

2. Raise the carriage and forks approximately 30 cm (12 in.) from the surface. Install a chain to prevent the carriage and mast channels from moving.

3. If another lift truck is used to tow the disabled lift truck, that lift truck must have an equal or larger capacity than the disabled lift truck. Install approximately 1/2 of a capacity load on the forks of the lift truck that is being used to tow the disabled lift truck. This 1/2-capacity load will increase the traction of the towing lift truck. Keep the load as low as possible.

Maintenance Procedures Every 8 Hours or Daily

HOW TO MAKE CHECKS WITH ENGINE STOPPED

WARNING

Do not operate a lift truck that needs repairs. Report the need for repairs immediately. If repair is necessary, put a DO NOT OPERATE tag in the operator's area. Remove the key from the key switch.

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

Put the lift truck on a level surface. Lower the carriage and forks, stop the engine, and apply the parking brake. Do all the checks outside the engine compartment first. Open the hood and check for leaks and conditions that are not normal. Clean any oil or fuel spills. Make sure that lint, dust, paper, and other materials are removed from the engine compartment.

Tires and Wheels

WARNING

Air pressure in pneumatic tires can cause tire and wheel parts to explode. The explosion of wheel parts can cause serious injury or death.

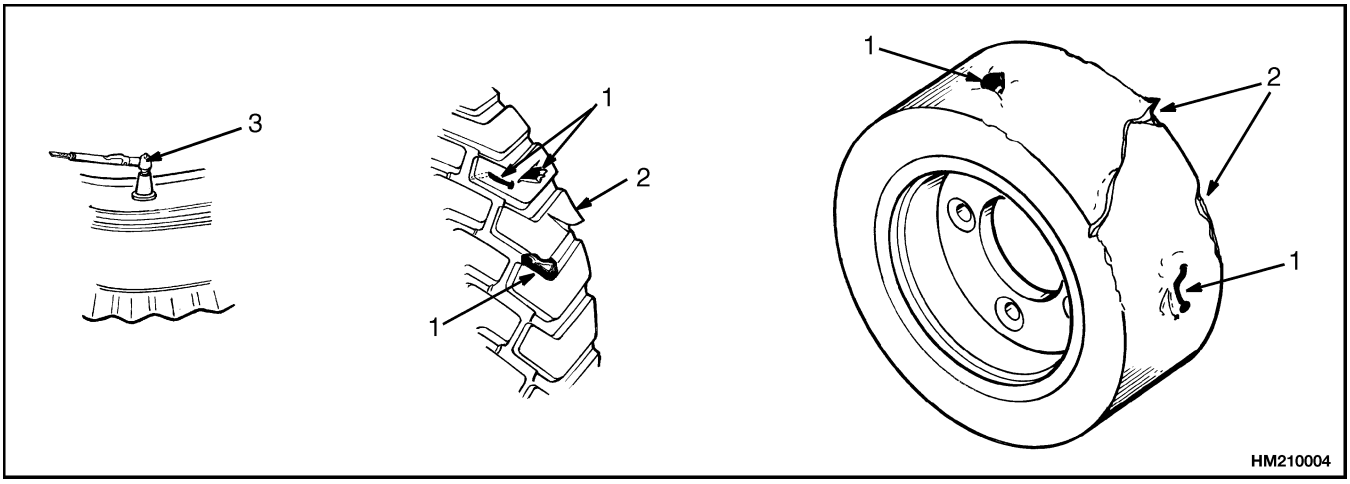
Remove all of the air from the tires before the tires are removed from the lift truck.

If the air pressure is less than 80% of the correct air pressure, the tire must be removed before air is added. Put the tire in a safety cage when adding air pressure to the tire. Follow the procedures described in Add Air to Pneumatic Tires.

When air is added to the tires, use a remote air chuck. The person adding air must stand away and to the side and not in front of the tire.

If the lift truck has pneumatic tires, keep the tires at the correct air pressure. See the Nameplate. Check the air pressure with a gauge when the tires are cold. See Figure 3. If it is necessary to add air to a tire that is warm, check one of the other tires on the same axle and add air to the tire that has low pressure so that the air pressures are equal. The air pressure of the warm tires must always be equal to or greater than the specification for air pressure for cold tires.

Check the tires for damage. Inspect 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.



1. CHECK FOR DAMAGE (REMOVE NAILS, GLASS, AND OTHER OBJECTS FROM TREAD)
2. MAKE SMOOTH EDGES
3. CHECK TIRE PRESSURE (PNEUMATIC TIRES)

Figure 3. Tires Check

6. Check that the controls for the attachment operate the functions of the attachment. See the symbols by each of the controls. Make sure all of the hydraulic lines are connected correctly and do not leak.

Maintenance Procedures Every 250 Hours or 6 Weeks

NOTE: Do these procedures in addition to the 8-hour checks.

PARKING BRAKE LINKAGE

Lubricate the linkage for the parking brake using a small amount of engine oil.

ENGINE FILTER AND OIL

Oil Filter and Oil

NOTE: Change the oil and filter at the first 100 hours with new or rebuilt engines. Use only the hourmeter hours.

CAUTION

Long-term exposure to used engine oil can cause skin irritation or cancer. Wash with detergent and water.

Never operate the engine without oil.

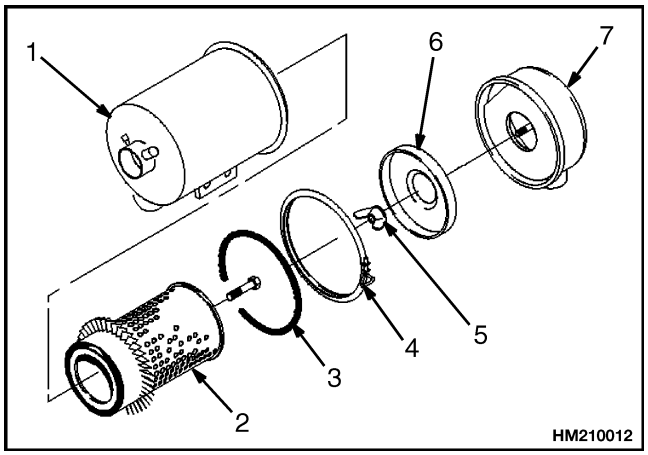
Change the oil filter at the same time engine oil is changed. See Figure 9. Use the correct oil as shown in the Maintenance Schedule. Install a new filter. Apply clean oil to the gasket of the new filter. Turn the filter until the gasket touches; then tighten 1/2 to 3/4 turn with your hand. Start the engine. Check the area around the oil filter for leaks.

Air Filter

There is an indicator light on the instrument cluster for the air filter. The red light is **ON** when the key switch is in the **START** position and must go **OFF** when the engine is running. If the light is **ON** when the engine is running, the air filter has a restriction and needs cleaning.

Inspect the filter element. Put a bright light inside the filter element and look for holes or other damage. If the filter element is damaged, install a new filter element. See Figure 14. Use a cloth with solvent to clean the inside of the canister when the filter element is installed.

Clean or install a new air filter when it is dirty. Use compressed air to clean the filter element. Air pressure must be less than 210 kPa (30 psi) and the air must be dry. Apply the air from the inside to the outside of the filter element. Install a new air filter every 1000 hours or 6 months of operation. If there is a problem with dirty air in the operating areas, the air filter must be changed more frequently than 1000 hours.



1. CANISTER
2. FILTER ELEMENT
3. SEAL
4. CLAMP
5. WING NUT
6. BAFFLE
7. END COVER

Figure 14. Air Filter

Gasoline and LPG Fuel Filters

NOTE: Change the fuel filter at the first 100 hours on a new lift truck. Use only the hourmeter hours. See Maintenance Procedures Every 1000 Hours or 6 Months for the procedures to change the filters.

b. If the measurement is less than 1.00 mm (0.0394 in.), move the injection pump in the direction opposite of engine rotation as far as it will move. Move the injection pump in the opposite direction until the indication is 1.00 mm (0.0394 in.).

4. Tighten the mounting nuts for the injection pump. Repeat the timing procedure to make sure the timing is correct.

5. Remove the dial indicator and install the capscrew in the distributor head. Connect the fuel lines to the injection pump.

6. Remove the air from the fuel system.

VALVE CLEARANCE, CHECK AND ADJUST

Check the valve clearance on the Mazda engines and make adjustments as needed.

NOTE: Additional information on the engines can be found in the following sections of the **Service Manual:**

- **Mazda M4-1.5G Engine** 600 SRM 537
  Mazda M4-2.0G Engine 600 SRM 496
- **Mazda M4-2.5D Engine** 600 SRM 538

Maintenance Procedures Every 2000 Hours or Yearly

NOTE: Do these procedures in addition to the 1000-hour checks.

THROTTLE CABLE

Install a new throttle cable every other year or every 4000 hours. See the **Service Manual** section for the **Fuel System** to install a new throttle cable.

DIFFERENTIAL

Change the oil in the differential and drive axle. The differential and drive axle use the same oil supply. Use a drain pan that has a capacity of more than the amount shown in the Maintenance Schedule. Remove the drain plug and allow the oil to drain. The drain plug is at the bottom of the differential, so allow time for the oil to drain. Install the drain plug and fill the differential with the oil shown in the Maintenance Schedule. The oil level must be even with the bottom of the fill hole. The fill hole is on the front of the differential housing. Install the fill plug and check for leaks.

NOTE: Additional information can be found in the section for **Drive Axle** 1400 SRM 542 in the **Service Manual**.

HYDRAULIC SYSTEM

NOTE: Change the oil filter for the hydraulic system at the first 100 hours of operation on new lift trucks.

Hydraulic Oil and Filter, Replace

WARNING

At operating temperature, the hydraulic oil is HOT. Do not permit the oil to touch the skin and cause a burn.

CAUTION

Do not permit dirt to enter the hydraulic system when the oil level is checked or the filter is changed. Dirt can cause damage to components of the hydraulic system.

1. Put the lift truck on a level surface and lower the carriage. Disconnect the small hose, near the dipstick, for the steering system. Disconnect the larger hose, in front of the breather and fill tube.

2. Drain the oil from the hydraulic tank. Install a container under the drain plug that has a capacity of approximately 30 liter (9 gal). Remove the drain plug.

3. Remove the screws that fasten the tank cover assembly. Carefully lift the cover assembly out of the hydraulic tank.

4. Remove the return filter from the tube of the cover assembly. Use a wrench to remove the suction filter in the bottom of the hydraulic tank.

5. Install new filters and use a new gasket for the cover assembly. Install the capscrews and connect all hydraulic hoses. Install the drain plug. See Figure 28.

Service Brake Check

WARNING

Brake linings can contain dangerous fibers. Breathing dust from these brake linings is a cancer or lung disease hazard. Do not create dust! Do not clean brake parts with compressed air or by brushing. Follow the cleaning procedure in this section. When brake drums are removed, do not create dust.

Do not sand, grind, chisel, hammer, or change linings in any way that will create dust. Any changes to brake linings must be done in a restricted area with special ventilation. Protective clothing and a respirator must be used.

Check brake lining and parts of brake assembly for wear or damage. See the section **Brake System** 1800 SRM 540 for removal and installation procedures of drive wheels and brake drums. If brake linings or brake shoes are worn or damaged, they must be replaced. Brake shoes must be replaced in complete sets. Inspect brake drums for cracks or damage. Replace any damaged parts.

Cleaning Procedures:

1. Do not release brake lining dust from brake linings into air when brake drum is removed.

CAUTION

Do not use an oil solvent to clean wheel cylinder. Use a solvent approved for cleaning of brake parts. Do not permit oil or grease in brake fluid or on brake linings.

2. Use a solvent approved for cleaning of brake parts to wet lining dust. Follow instructions and cautions of manufacturer for use of solvent. If a solvent spray is used, do not create brake lining dust with spray.

3. When brake lining dust is wet, clean parts. Put any cloth or towels in a plastic bag or an airtight container while they are still wet. These variations in the tires also cause a variation in the types of wheels and the disassembly and assembly procedures. Put a DANGEROUS FIBERS warning label on plastic bag or airtight container.

4. Any cleaning cloths that will be washed must be cleaned so that fibers are not released into air.

Diesel Engine Fuel Injector Check

WARNING

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

NOTE: The inspection and repair of fuel injectors require special tools and training. Many users have a special repair service make repairs on fuel injectors. Fuel injector nozzles that do not operate correctly will cause black smoke in the exhaust, a decrease in engine power, and an increase in engine noise.

The engine will run roughly if a fuel injector is dirty or damaged. 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.

NOTE: Additional information about the diesel engine can be found in the section **Mazda M4-2.5D Engine** 600 SRM 538 of the **Service Manual**.

Remove Tire From Wheel

WARNING

Keep tire tools in firm contact with wheel. If tool slips, it can move with enough force to cause serious injury.

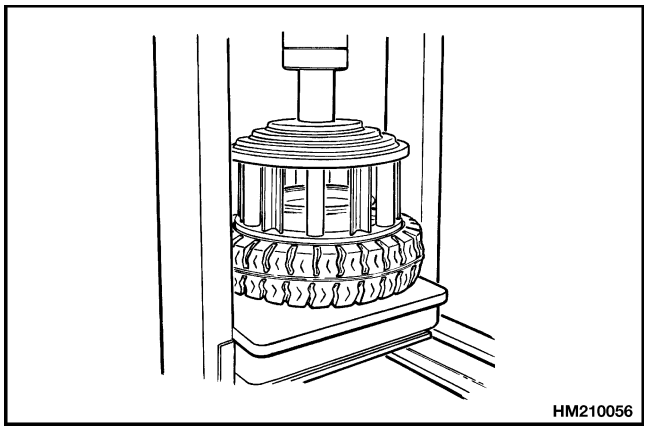
When disassembling wheels, see Figure 36. There are several types of wheels used on these series of lift trucks.

WARNING

Wheels must be changed and tires repaired by trained personnel only.

Always wear safety glasses.

STEP 1.
Put wheel rim on bed of press. Put cage in position on tire. Use press to push tire away from side flange.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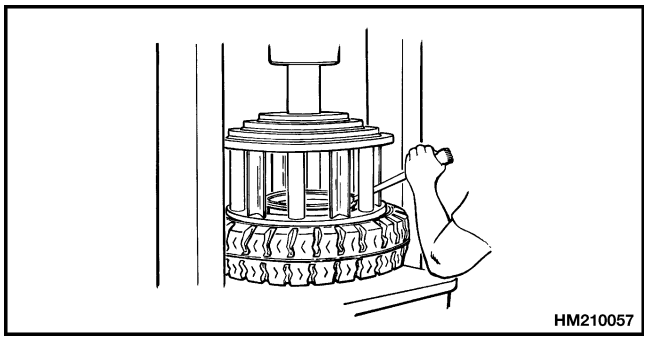
STEP 2.
Put tire tool into slot between lock ring and wheel rim. Remove lock ring and side flange.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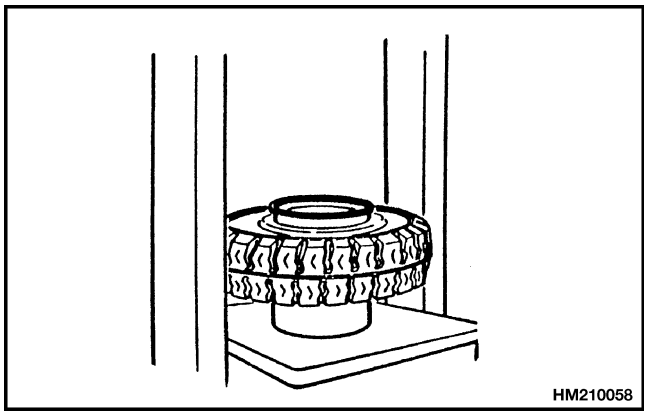
STEP 3.
Turn tire over. Put a support under wheel rim. Make sure wheel rim is at least 150 to 200 mm (6 to 8 in.) from bed of press.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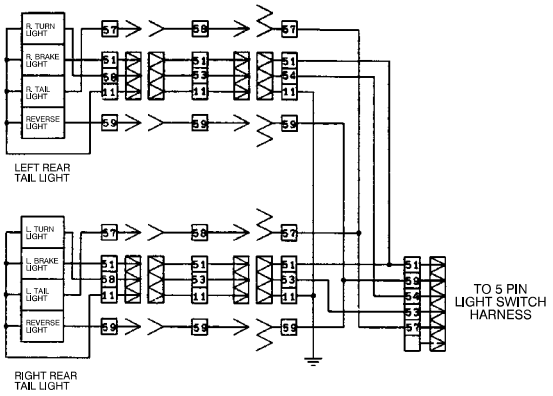
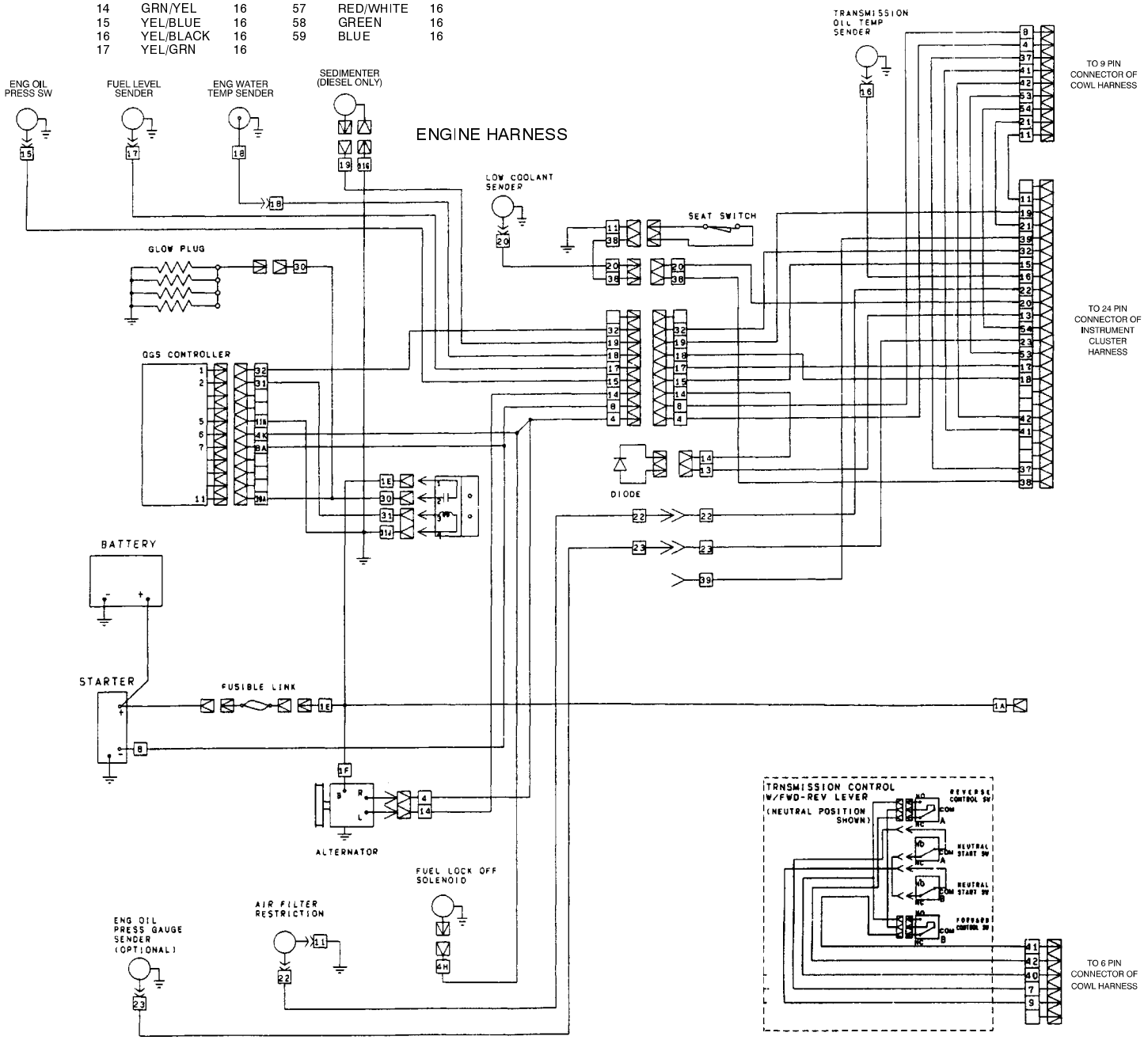
ELECTRICAL WIRE CODES

WIRE	COLOR	GAGE	WIRE	COLOR	GAGE
1	WHITE	12	18	YEL/RED	16
1A	WHITE	12	19	YELLOW	16
1B	WHITE	14	20	BRN/WHT	16
1E	WHITE	10	21	BLUE	16
1F	WHITE	12	22	BLUE/RED	16
2	RED	16	23	GRN/YEL	16
3	WHITE/BLUE	14	24	WHT/BLUE	16
4	BLUE/WHITE	16	30	WHITE/BLK	10
4H	BLUE/WHITE	16	30A	WHITE/BLK	16
4K	BLUE/WHITE	16	32	WHITE/RED	16
5	GRN/YEL	16	31	RED	16
6	YEL/GRN	16	37	BLUE/YEL	16
7	WHITE/RED	16	38	ORANGE	16
8	BLK/YEL	14	39	RED/GRN	16
8A	BLK/YEL	14	40	RED	16
9	WHT/BLK	16	41	BRN/BLK	16
10	GREEN	16	42	LT.GRN/BLK	16
11	BLACK	16	50	RED/WHT	16
11G	BLACK	16	51	RED/BLK	16
11H	BLACK	16	52	GRN/WHT	16
11J	BLACK	16	53	GRN/BLK	16
13	RED/BLUE	16	54	GRN/RED	16
14	GRN/YEL	16	57	RED/WHITE	16
15	YEL/BLUE	16	58	GREEN	16
16	YEL/BLACK	16	59	BLUE	16
17	YEL/GRN	16			





9/9/93 - Lloyd
Copied Dean's Diagrams, 8000 SRM 504 of the D177 to modify for the D1. No SRM or part number assigned yet.

9/15/93 - Lloyd
Harold assigned me Dean's Transmission (Repair) SRM and Part Number. Dean has added the repairs to the Description & Operation section, SRM 543. Am now working on this again after vacation.

9/20/93 - Lloyd
Checked with Shelley in Reprographics on how they got the schematics from S-Y. She said they got the drawings on micro film, so did not have the schematics in digital form. I'll need to scan them.

9/23/90 - Lloyd
Section is finished except for the lighting schematics that John L. is reworking for me. Could add engine, chassis, cowl and lights wiring/cable diagrams at some later date. This section is now similar to Dean's SRM 504 (Delta - D177).

9/28/93 - Lloyd
John got back from vacation today and gave me the last drawing. I finished processing them to add callouts and etc. To Harold for printing.

1/3/95 - Lloyd
Started revising to include ECN changes and to add S25-45XM (C10).

1/16/95 - Lloyd
Finished above. To Harold for routing/printing.

DIAGRAMS, 8000 SRM 544
For the D1 (Beta) trucks - H25-40XMS
Also the C10 (Beta) trucks - S25-40XMS

Part Number 897558 **1/95 (9/93) Litho in U.S.A.**