

SERVICE REPAIR

MANUAL

Hyster C210 (N30XMH (Pre-SEM)) Forklift

HYSTER

INTRODUCTION

GENERAL

This section describes the hydraulic system and the steering system. The section includes REPAIR, CHECKS AND ADJUSTMENTS and TROUBLESHOOTING. This section has repair procedures for the main hydraulic pump and the steering pump. Other repair procedures are in the following sections:

- MAIN CONTROL VALVE, 2000 SRM 562
- MAST – Repair, 4000 SRM 522
- FOUR STAGE MAST – Repair, 4000 SRM 563
- VISTA MAST – Repair, 4000 SRM 482 (N30XMH ONLY)
- TILT CYLINDERS, 2100 SRM 103
- LIFT CYLINDERS, 4000 SRM 481 (N30XMH ONLY)
- STEERING HOUSING AND CONTROL UNIT, 1600 SRM 512
- STEERING AXLE, 1600 SRM 258
- DC MOTOR MAINTENANCE, 620 SRM 294

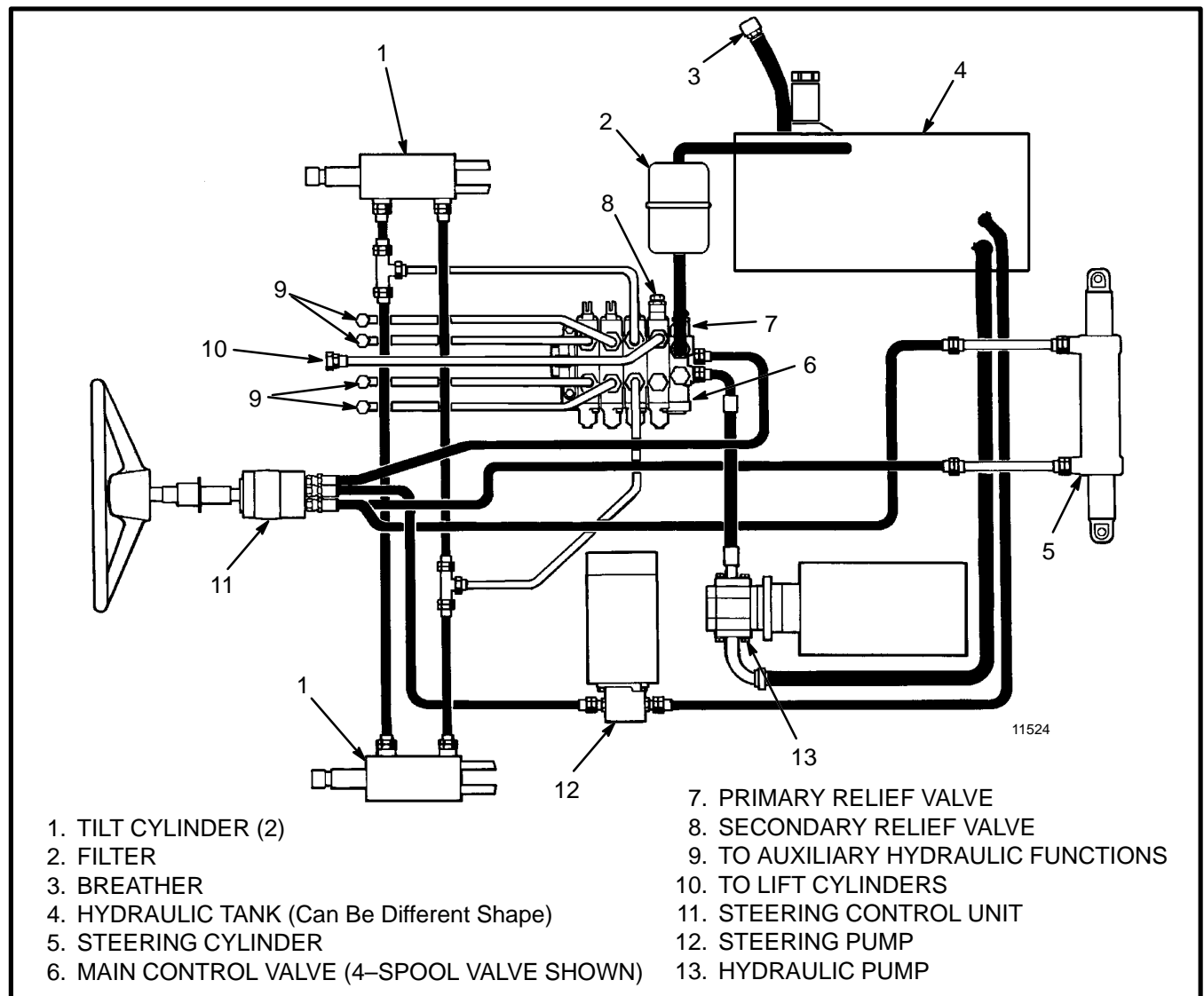


FIGURE 1. E1.50-3.20XM (E25-65XM) HYDRAULIC SYSTEM

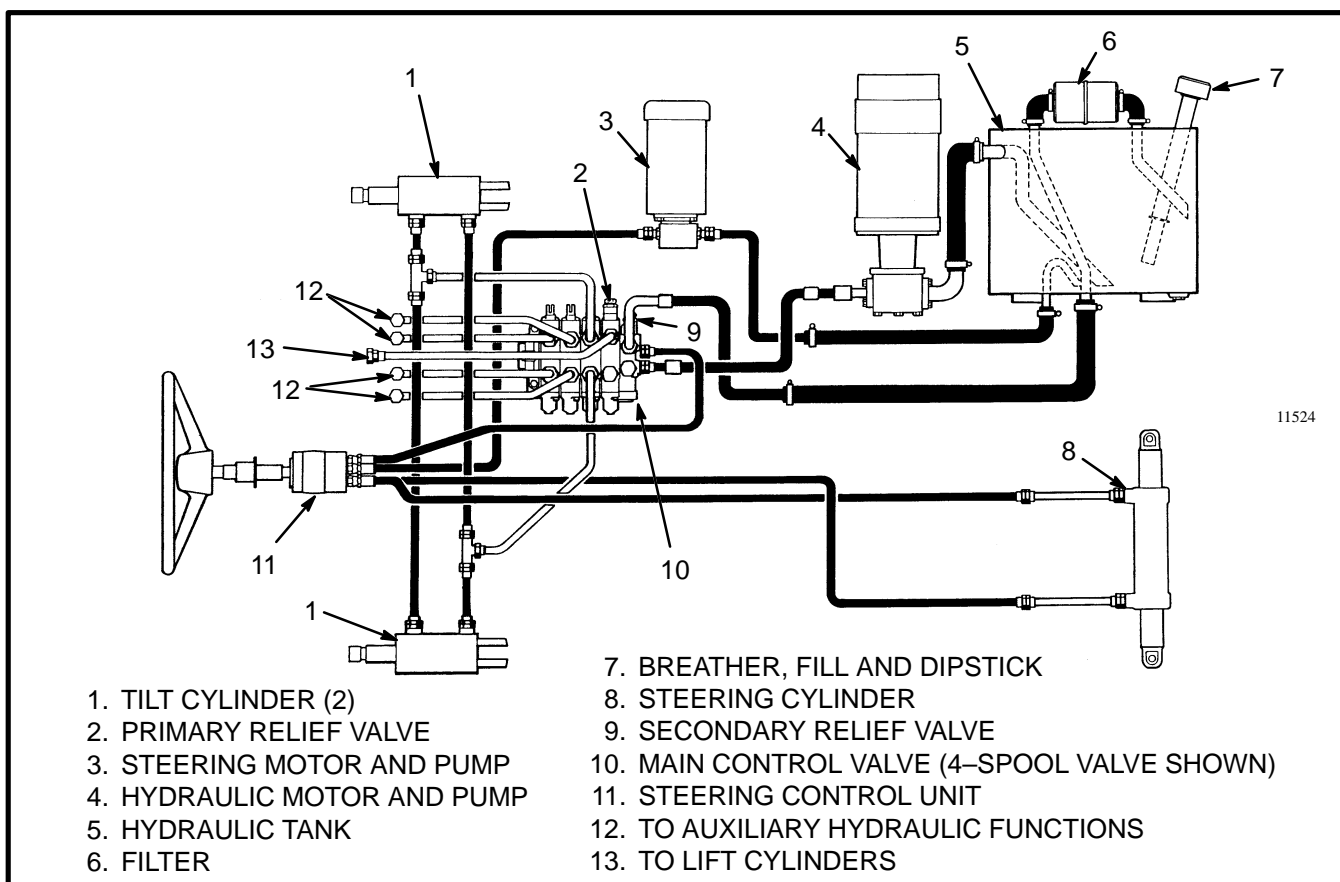


FIGURE 2. J2.00-3.20XM (J40-65XM) HYDRAULIC SYSTEM

DESCRIPTION

Hydraulic System

(See FIGURE 1., FIGURE 2. or FIGURE 3.)

The parts of the hydraulic system for the E1.50-3.20XM (E25-65XM) are shown in FIGURE 1. The parts of the hydraulic system for the J2.00-3.20XM (J40-65XM) are shown in FIGURE 2. The parts of the hydraulic system for the N30XMH are shown in FIGURE 3. The diagrams show components and interconnections that are typical of all models. It does not show all hydraulic systems. Not all units have a four spool valve.

The hydraulic system includes the steering system and the lift system. One hydraulic tank supplies both systems. The steering system and the lift system have separate pumps. Both pumps are gear pumps.

OPERATION

Hydraulic System

(See FIGURE 4. or FIGURE 5.)

The hydraulic pump causes oil to flow from the tank to

the main control valve. The main control valve controls the flow of oil to the lift cylinders, tilt cylinders, traverse cylinder, rotary actuator and auxiliary functions when applicable. A relief valve on the main control valve keeps pressure within the design limits of the hydraulic system. A test port for checking the pressure when the relief valve opens is on the main control valve.

Some auxiliary functions require less pressure than the lift function. A secondary relief valve on the main control valve provides lower pressure for auxiliary functions.

The steering pump causes oil to flow from the tank to the steering control unit. The steering control unit is a metering pump actuated by the steering wheel. When the steering wheel is turned, oil flows to actuate the steering cylinder. Oil returns from the steering control unit to the main control valve. A relief valve in the pump keeps pressure within the design limits of the steering system.

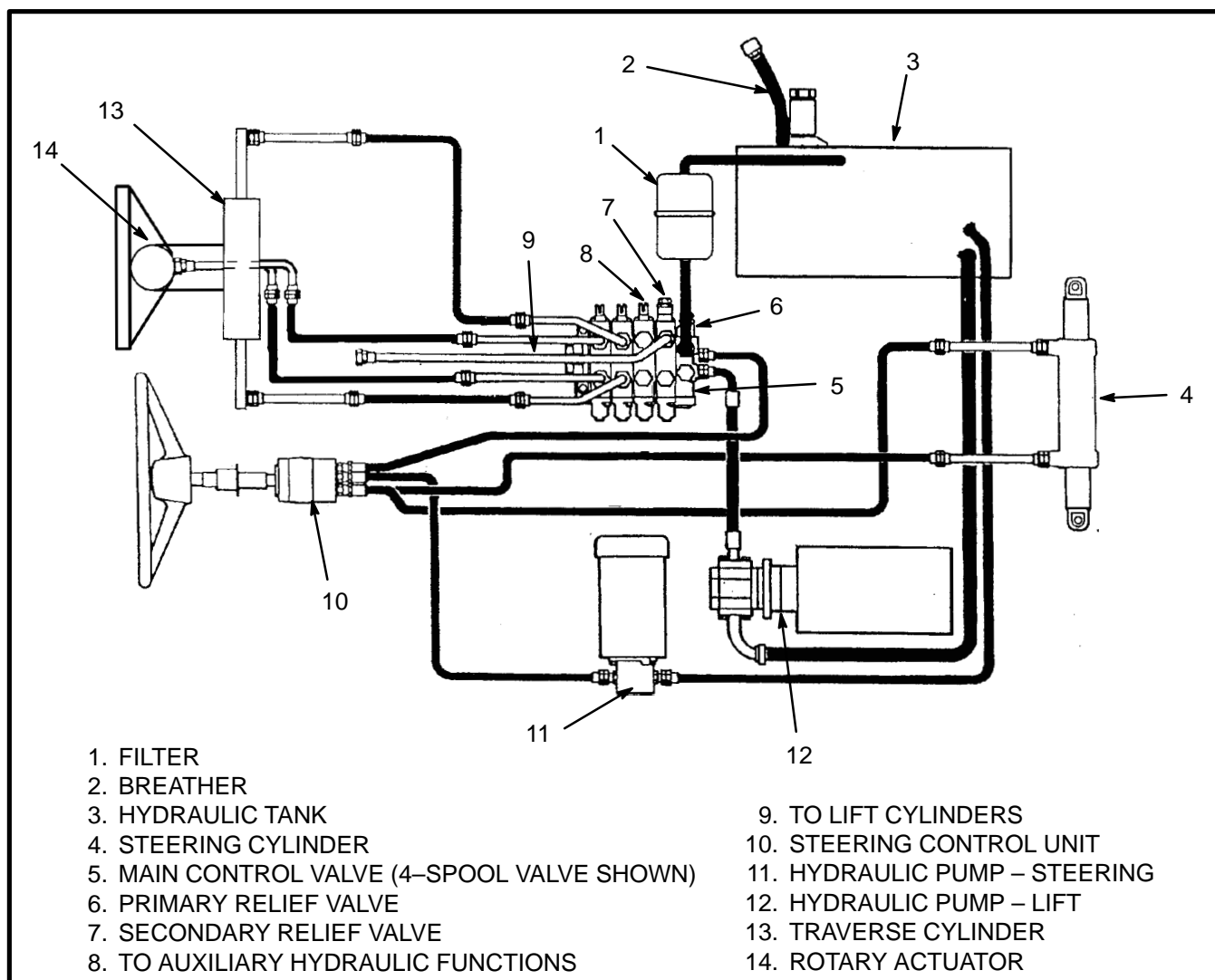


FIGURE 3. N30XMH HYDRAULIC SYSTEM

The oil returns from the main control valve and flows through a filter in the hydraulic tank. The filter removes small particles from the oil. The filter has a by-pass valve so that the oil can flow through the system if the filter becomes too dirty.

Hydraulic Gear Pump (See FIGURE 14.)

There can be two different sizes of hydraulic pumps used on these lift trucks: a 12 cc/revolution gear pump or a 19 cc/revolution gear pump. The larger pump is standard. The smaller pump is used when there is a contactor motor control with a closed motor or for a slower speed requirement. These hydraulic pumps are all single-section gear pumps that fasten to the end of the motor housing. A hose connects the pump inlet to the hydraulic tank. A hose connects the pump outlet to the main control valve. A flexible coupling connects the motor shaft to the pump shaft. Bushings at each side of each gear of

the pump are the bearings for the gear shafts. The bushings also have passages for the oil flow to the pump outlet and for lubrication. Seals prevent leaks between sections of the pump housing.

Rotator Actuator Valve

On the N30XMH only, the rotary actuator valve is connected between the rotary spool and the rotary actuator. The rotary actuator valve has two check valves, a shuttle, and two relief valves. The check valves prevent the rotary actuator from rotating when the lever on the main control valve is in the center position. The check valves prevent any oil flow from the rotary actuator until pressure from the main control valve pushes on the shuttle. The oil pressure opens the inlet check valve and at the same time the shuttle pushes against the return check valve. The shuttle moves the check valve from its seat and permits oil to flow to the hydraulic tank. A relief

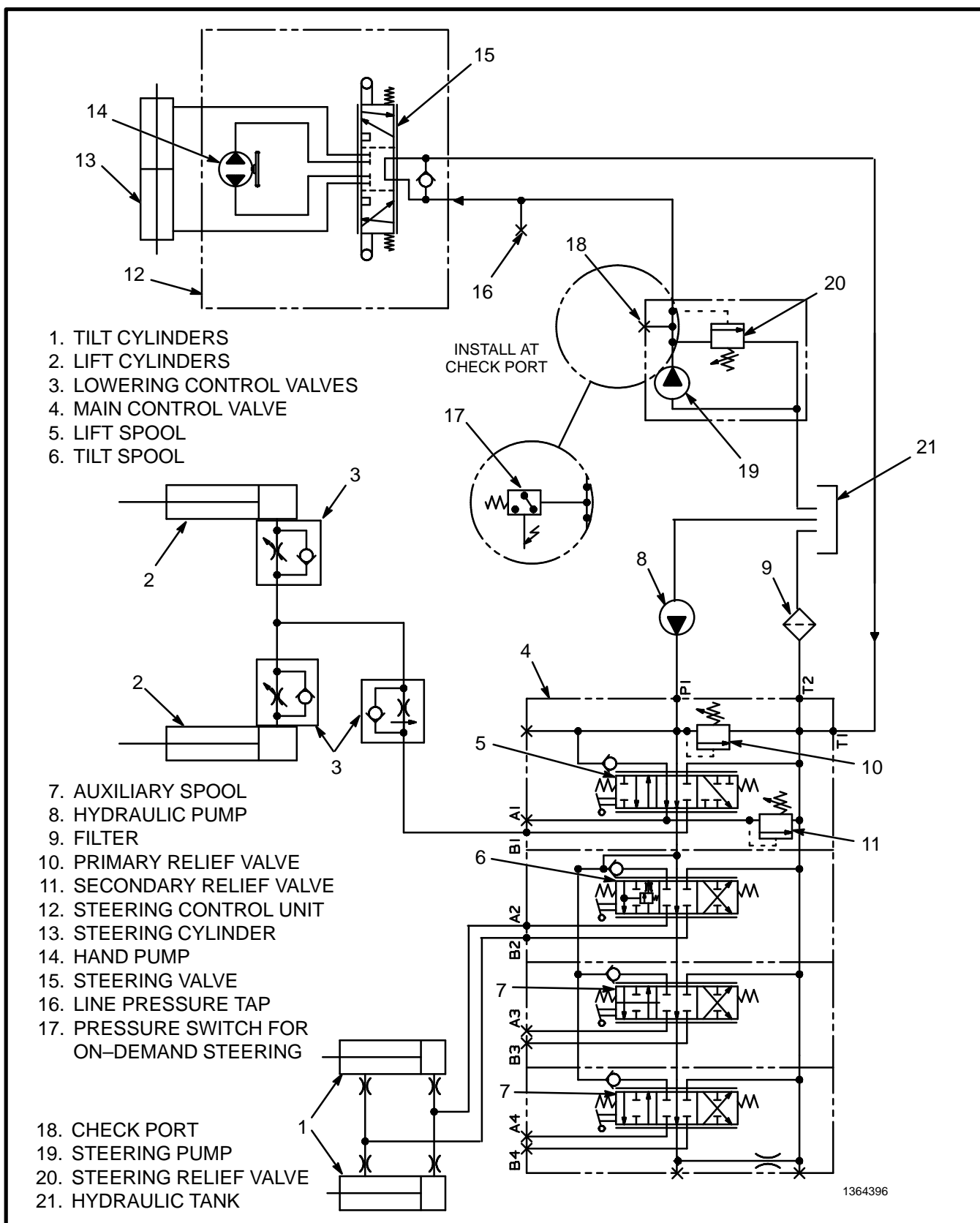


FIGURE 4. E1.50-3.20XM (E25-65XM) AND J2.00-3.20XM (J40-65XM)HYDRAULIC SCHEMATIC

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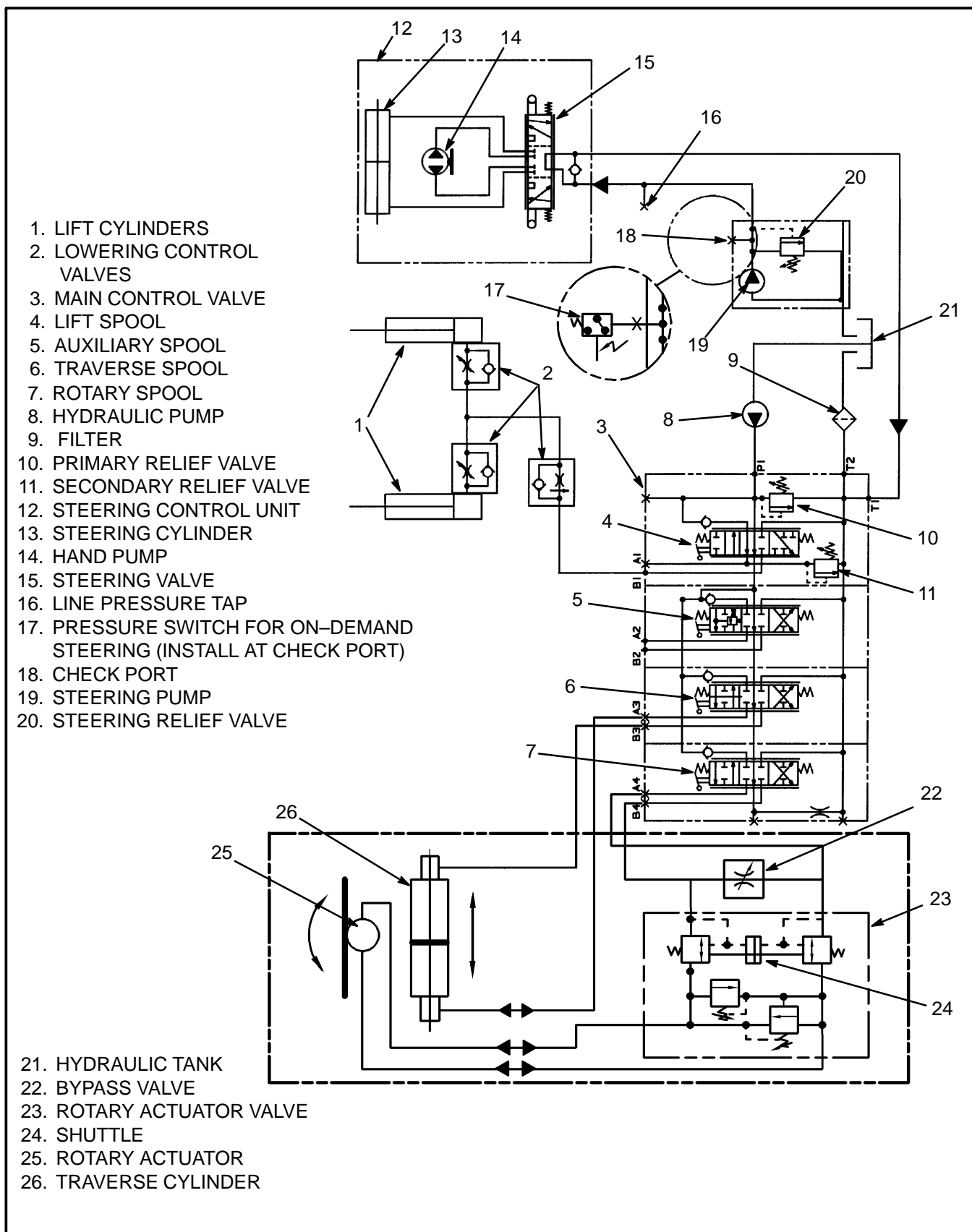


FIGURE 5. N30XMH HYDRAULIC SCHEMATIC

valve opens when the rotary actuator moves to the end of its stroke. One relief valve is installed for each direction of rotary actuator travel. These relief valves also protect the rotary actuator from damage if the forks hit an object. An adjustable bypass valve for the rotary actuator is connected in parallel to the rotary actuator valve. The bypass valve permits some of the oil from the main control valve to flow directly to the return line. The bypass valve decreases the speed of the rotary actuator.

For the location of the pressure check fitting for steering pressure, see FIGURE 6., FIGURE 7. or FIGURE 8.

Steering Pump

(See FIGURE 6., FIGURE 7. or FIGURE 8.)

The steering pump is a small gear pump connected to a

permanent-magnet DC motor. The steering pump and motor are in a horizontal mount under the battery compartment on the E1.50–2.00XM (E25–40XM) trucks. The steering pump and motor are in a vertical mount under the floor plate on the E2.00–3.20XM (E45–65XM) and N30XMH trucks. The steering pump and motor are also in a vertical mount that is located behind the battery on the J2.00–3.20XM (J40–65XM) trucks. Capscrews hold the motor mount to the frame mount bracket that has isolators. A relief valve and a pressure switch are mounted at ports in the pump housing. The pressure switch at the bottom of the pump is used with On-Demand Steering only.

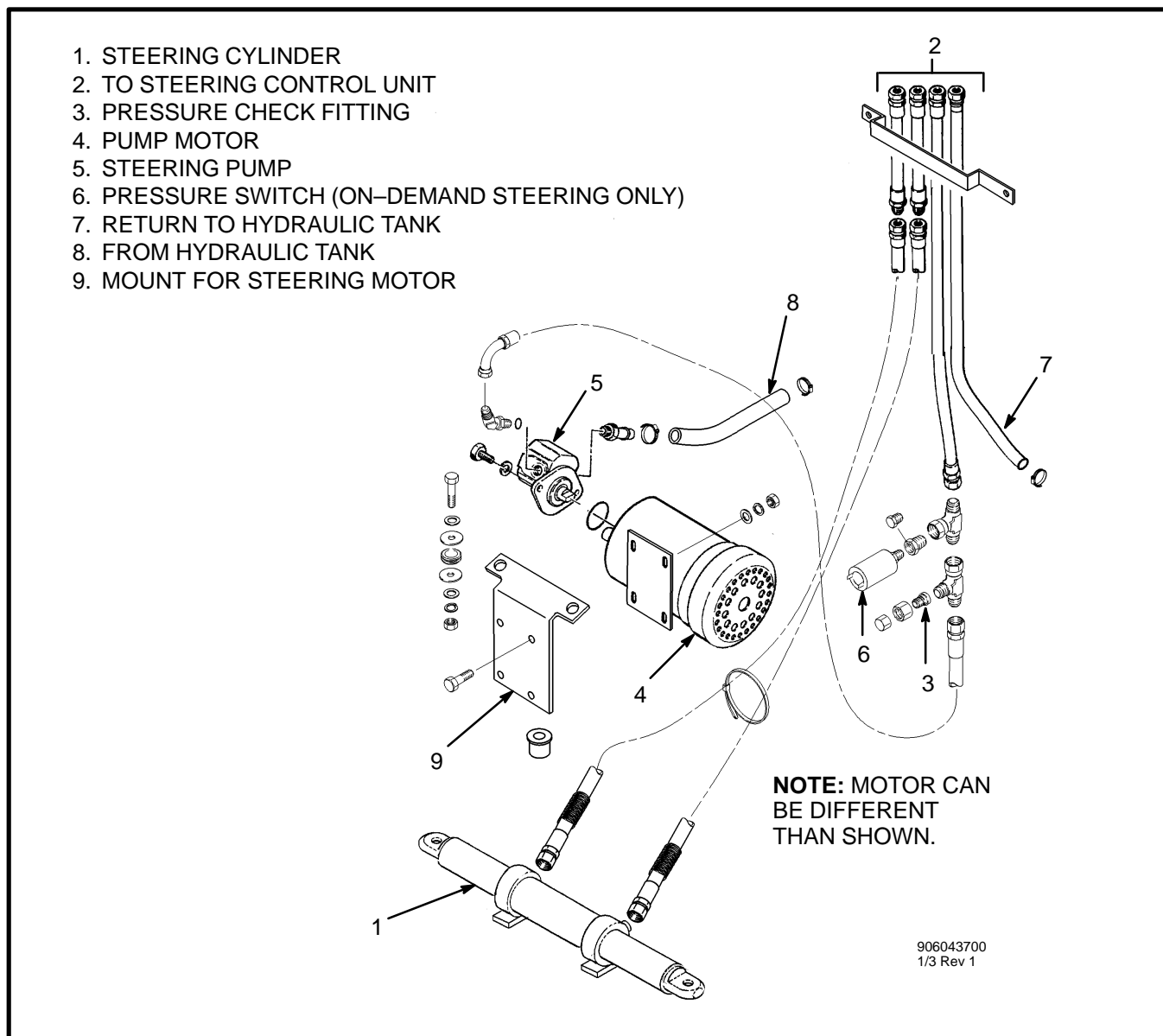


FIGURE 6. E1.50–2.00XM (E25–40XM) STEERING PUMP AND HYDRAULIC CIRCUIT

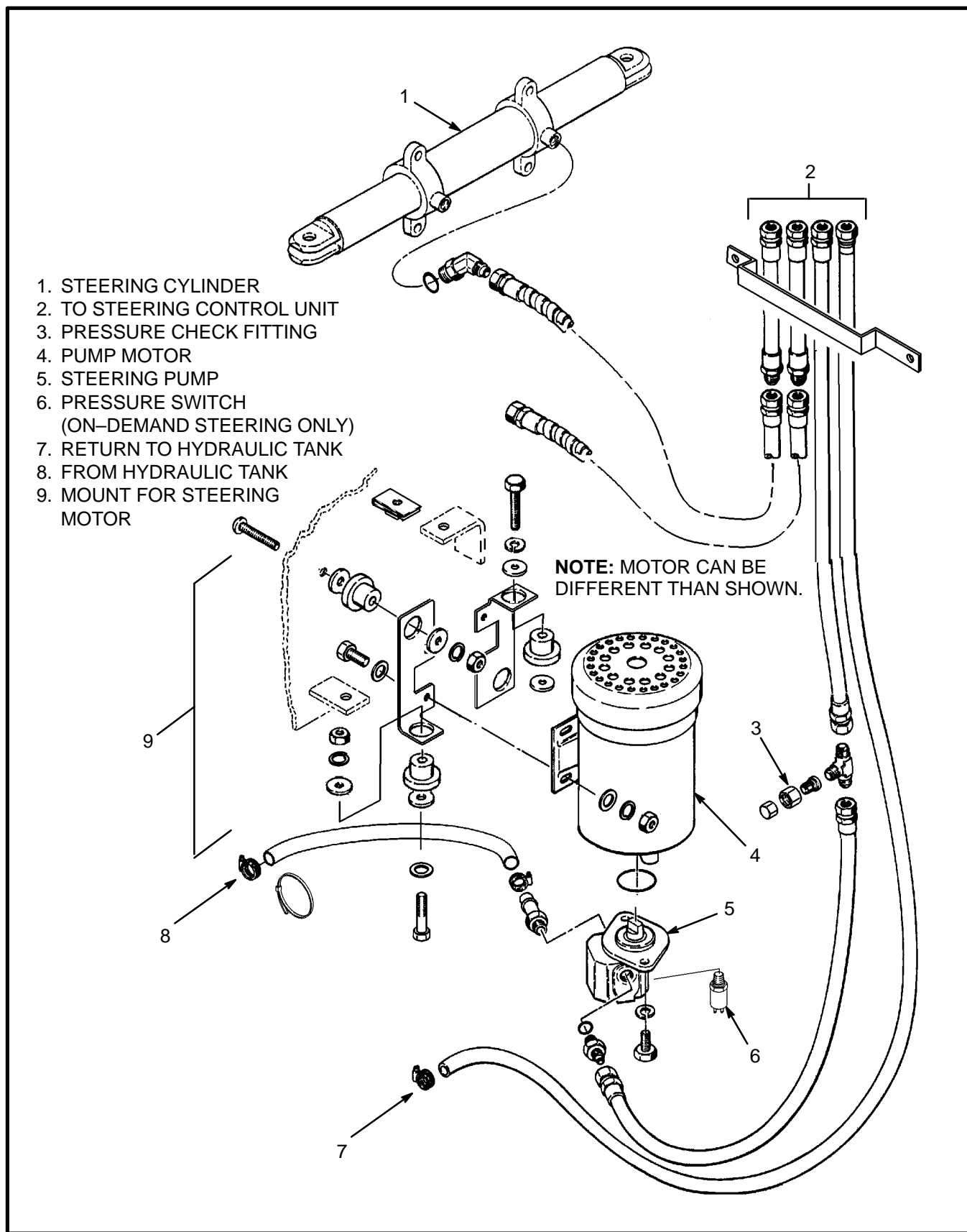


FIGURE 7. E2.00-3.20XM (E45-65XM) AND N30XMH STEERING PUMP AND HYDRAULIC CIRCUIT

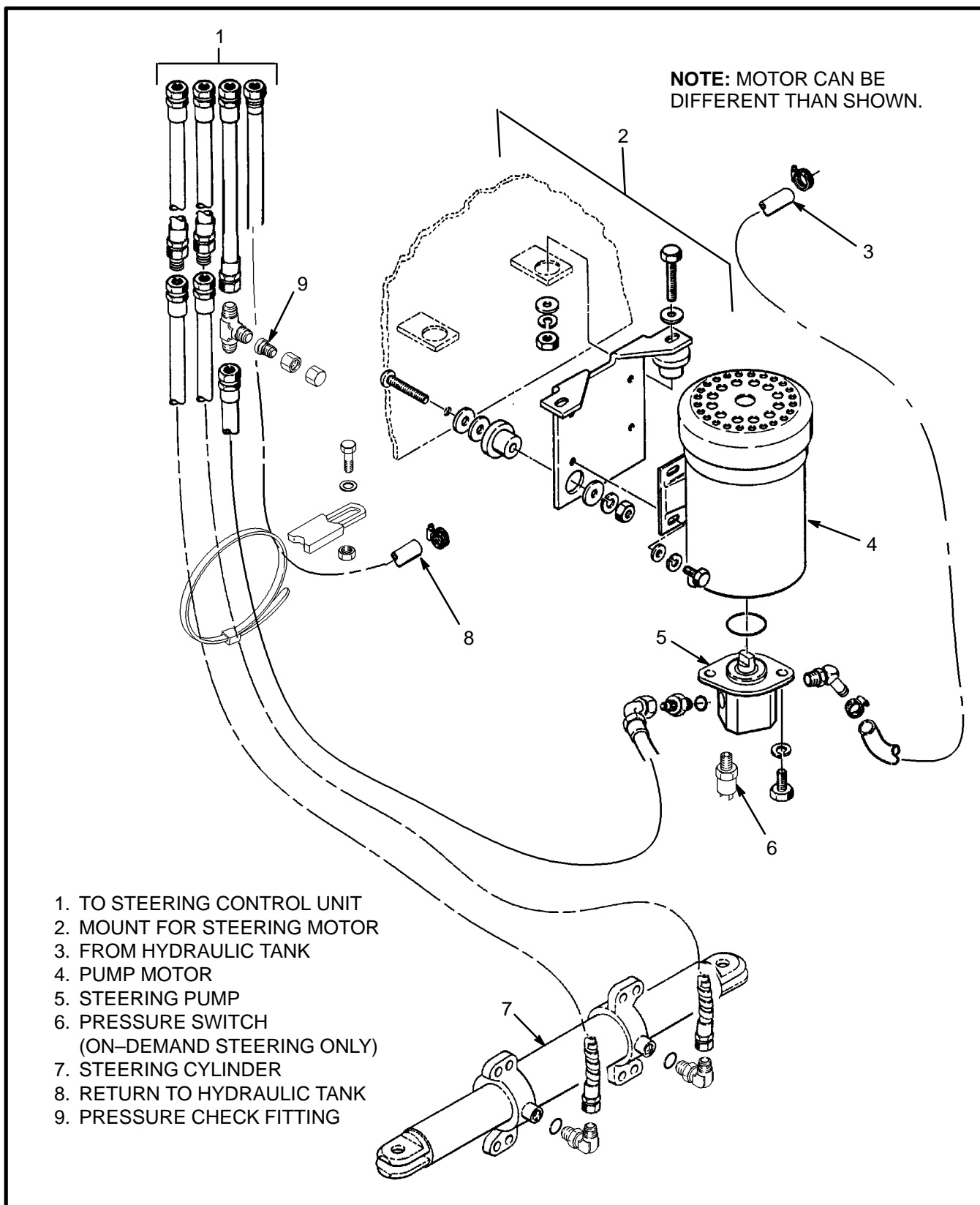


FIGURE 8. J2.00-3.20XM (J40-65XM) STEERING PUMP AND HYDRAULIC CIRCUIT

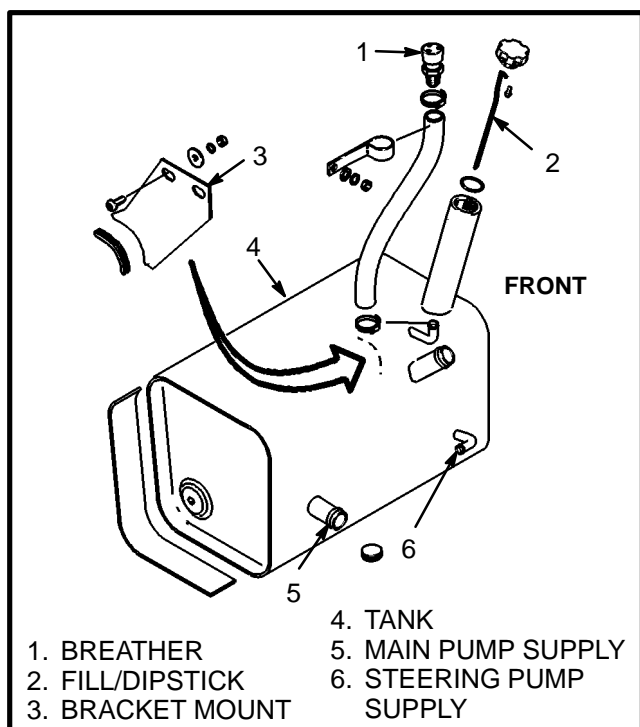


FIGURE 9. E1.50-2.00XM, (E25-40XM)
HYDRAULIC TANK ASSEMBLY

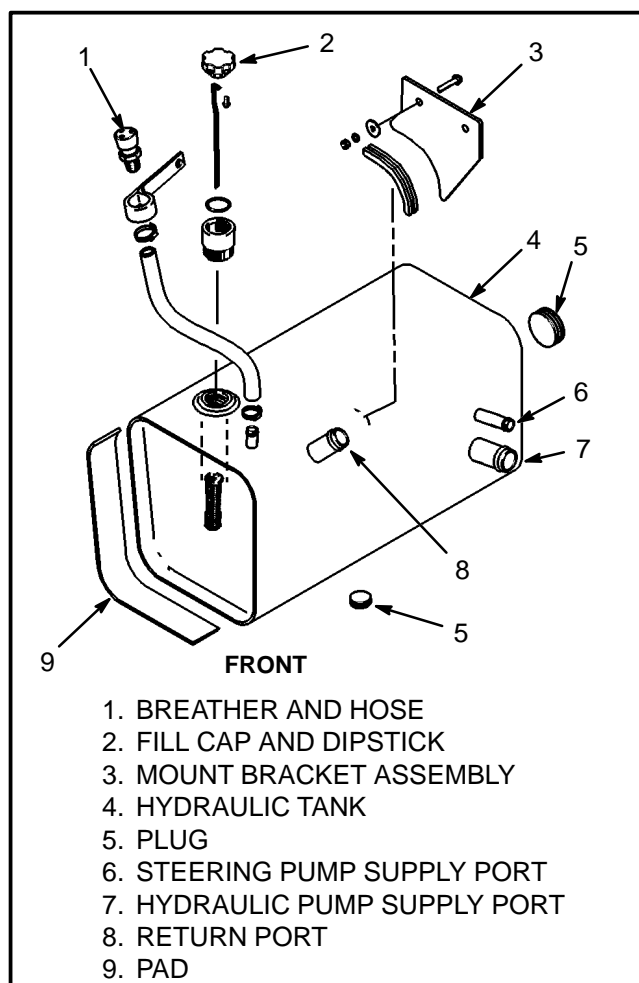


FIGURE 11. E2.00-3.20XM (E45-65XM) and
N30XMH HYDRAULIC TANK ASSEMBLY

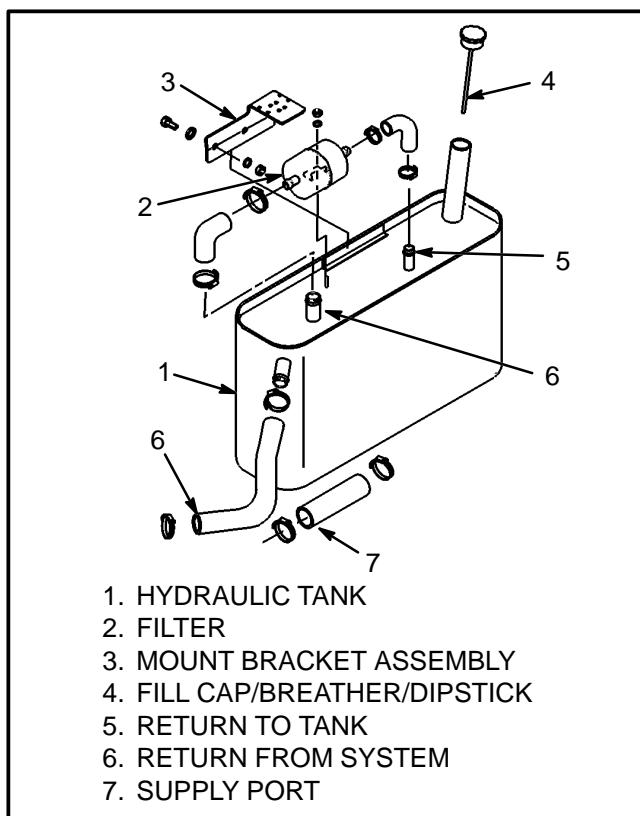


FIGURE 10. J2.00-3.20XM (J40-65XM)
HYDRAULIC TANK ASSEMBLY

REPAIRS

See the INTRODUCTION for a list of sections of the **SERVICE MANUAL** for hydraulic parts other than the pumps and tank.

WARNING

Before making any repairs, fully lower all parts of the mast and tilt it forward until the tips of the forks touch the ground. This action will prevent the mast from lowering suddenly when hydraulic lines are disconnected.

HYDRAULIC TANK

NOTE: To repair leaks in the hydraulic tank, see one of the following **SERVICE MANUAL** sections: **FRAME, 100 SRM 617** for the E1.50–2.00XM (E26–40XM)

FRAME, 100 SRM 558 for the E2.00–3.20XM (E45–65XM) and N30XMH trucks

FRAME, 100 SRM 582 for the J2.00–3.20XM (J40–65XM)

E1.50–3.20XM (E25–65XM) and N30XMH Tank Removal (See FIGURE 9. or FIGURE 11.)

1. Install a container under the drain plug of the hydraulic tank with enough capacity. See the SPECIFICATIONS table at the back of this section.

2. Remove the drain plug and let the oil drain from the hydraulic tank. Install and tighten the drain plug.

3. Remove the floor plate for access to the hydraulic tank.

4. Remove and install plugs in all the hoses fastened to the hydraulic tank. Remove the fill cap and the short tube. Install a plug in the opening of the tank.

5. Remove the traction motor as described in one of the following **SERVICE MANUAL** sections:

DRIVE AXLE, SPEED REDUCER AND DIFFERENTIAL, 1400 SRM 618 for the E1.50–2.00XM (E25–40XM) trucks

DRIVE AXLE, SPEED REDUCER AND DIFFERENTIAL, 1400 SRM 285 for the E2.00–3.20XM (E45–65XM) and N30XMH trucks

6. Remove the screws that fasten the bracket holding the hydraulic tank in the truck frame. Remove the bracket assembly.

7. Carefully remove the hydraulic tank from the frame.

8. Make repairs to the hydraulic tank.

J2.00–3.20XM (J40–65XM) Tank Removal (See FIGURE 10.)

1. Turn the key to the **OFF** position and remove the key.

WARNING

Never put tools or other metal on the battery. Metal on the battery can cause a short circuit and possible damage or injury.

2. Open the hood and install a cardboard or plywood cover on the top of the battery to prevent accidental short circuits.

3. Turn the steering wheel for a full left turn for access to the drain plug near the front of the right rear wheel. Install a container under the drain plug of the hydraulic tank with enough capacity. See the SPECIFICATIONS table at the back of this section.

4. Remove the drain plug and let the oil drain from the hydraulic tank. Install and tighten the drain plug.

5. Remove and install plugs in all the hoses fastened to the hydraulic tank. Remove the breather/dipstick/fill cap and install a plug in the opening of the fill tube.

6. Remove the screws from the bracket that fastens the bracket holding the hydraulic tank in the truck frame. See item 3 of FIGURE 10. Remove the bracket assembly.

7. Carefully lift the hydraulic tank up out of the frame.

8. Make repairs to the hydraulic tank.

Tank Inspection

Make a visual inspection of all sides of the tank. Inspect the welds for cracks and leakage. Check for wet areas, accumulation of dirt, and loose or missing paint caused by leakage. Areas of the tank that are not easily seen can be checked with an inspection mirror and a light that is approved for locations with flammable vapors.

The hydraulic tank is a separate sheet metal tank and can be removed from the lift truck if necessary to check for leaks or for replacement. Repairs for leaks in the hydraulic tank can require special procedures described in the next paragraphs. The most common cause of leaks is from rust caused by the moisture of condensation. Drain any water out of the tank by removing the drain plug and letting the tank drain until there is no water in the oil.

Tank Repairs, Small Leaks

Use the following procedure to seal small leaks:

- a. Use steam to clean the area around the leak. Remove all paint and dirt around the leak.

WARNING

Do not use tools that can make sparks, heat or static electricity. The vapors in the tank can cause an explosion.

- b. Apply Loctite® 290 to the leak. Follow the instructions of the manufacturer.

Tank Repairs, Large Leaks

1. Use one of the procedures described under Tank Cleaning, Steam Method Of Cleaning Tank or Chemical Solution Method Of Cleaning Tank to clean and prepare the tank for repairs.

2. Use acceptable welding practices to repair the tank. See the American National Standard *Safety In Welding And Cutting* ANSI Z 49.1 – 1973.

Tank Cleaning

WARNING

Special procedures must be followed when large leaks or other repairs need welding or cutting. All work must be done by authorized personnel. If the tank is cleaned inside of a building, make sure there is enough ventilation. See the following manuals for additional information:

- **Safe Practices For Welding And Cutting Containers That Have Held Combustibles**” by the American Welding Society, A6.0–65.
- **Safety In Welding And Cutting**”, American National Standard, ANSI Z 49.1 – 1973.

When cleaning the tank, do not use solutions that make dangerous gases at normal temperatures or when

heated. Wear eye and face protection. Protect the body from burns.

Steam Method Of Cleaning Tank

When cleaning with steam, use a hose with a minimum diameter of 19 mm (0.75 inch). Control the pressure of the steam by a valve installed at the nozzle of the hose. If a metal nozzle is used, it must be made of a material that does not make sparks. Make an electrical connection between the nozzle and the tank. Connect a ground wire to the tank to prevent static electricity.

Use the following procedure to clean the tank with steam:

- a. Remove all the parts from the tank. Install the drain plug.
- b. Fill the tank 1/4 full with a solution of water and sodium bicarbonate (baking soda) or sodium carbonate. Mix 0.5 kg (1 lb) per 4 litres (1 gal) of water.
- c. Mix the solution in the tank using air pressure. Make sure all the surfaces on the inside of the tank are flushed with the solution. Drain the tank.
- d. Put steam into the tank until the tank does not have odors and the metal is hot. Steam vapors must come from all the openings.
- e. Flush the inside of the tank with boiling water. Make sure all the loose material is removed from the inside of the tank.
- f. Make an inspection of the inside of the tank. If it is not clean, repeat Steps d and e and make another inspection. When making inspections, use a light that is approved for locations with flammable vapors.
- g. Put plugs in all the openings in the tank. Wait 15 minutes, then remove the inlet and outlet plugs. Test a sample of the vapor with a special indicator for gas vapors. If the amount of flammable vapors is above the lower flammable limit, repeat the cleaning procedures.

Chemical Solution Method Of Cleaning Tank

If the tank cannot be cleaned with steam, use the following procedure:

- a. Mix a solution of water and trisodium phosphate or a cleaning compound with an alkali base. Follow the instructions given by the manufacturer.

- b. Fill the tank with the cleaning solution. Use compressed air to mix the solution in the tank.
- c. Drain the tank. Flush the inside of the tank with hot (boiling) water. Make sure all the cleaning compound is removed.
- d. Make an inspection of the inside of the tank. If the tank is not clean, repeat Steps a through c. Make another inspection of the tank. When making inspections, use a light that is approved for locations with flammable vapors.
- e. Check the tank for flammable vapors as described in the previous section Step g. If the amount of flammable vapors is not below the lower flammable limit, repeat the cleaning procedures.

Additional Preparations For Tank Repair

If nitrogen gas or carbon dioxide gas is available, prepare the tank for welding using these gases. See the manual *Safe Practices For Welding and Cutting Containers That Have Held Combustibles* by the American Welding Society, A6.0–65. If these gases are not available, another method using water can be used as follows:

- a. Fill the tank with water to just below the point where the work will be done. Make sure the space above the level of the water has a vent.
- b. Use acceptable welding practices to repair the tank. See the American National Standard “Safety in Welding and Cutting,” ANSI Z 49.1 – 1973.

E1.50–3.20XM (E25–65XM) And N30XMH Tank Installation (See FIGURE 9. or FIGURE 11.)

NOTE: Make sure to install the tank so that the fill neck is centered in the opening in the step of the frame. Make sure to install all plugs, hoses and clamps to prevent leaks when oil is added to the tank.

1. Install the repaired or replacement hydraulic tank in the truck frame. Make sure the tank is correctly aligned for connection of the hoses. Make sure the pads are installed between the tank and truck frame.
2. Install the bracket assembly to hold the tank in position. Do not tighten the screws.
3. Remove the plugs and install all hoses at the same locations as during removal. Do NOT remove the drain

plug. Align the tank so that the fill tube and fill cap will be in the center of the access hole. Install the fill tube and fill cap. Tighten the screws that fasten the mount bracket assembly.

CAUTION

Do NOT fill the tank above the FULL mark on the dipstick. If the tank is too full, oil will come out the breather during operation.

4. Make sure all hoses and plugs are installed and tight. Fill the tank using the oil specified in one of the following **SERVICE MANUAL** sections:

PERIODIC MAINTENANCE, 8000 SRM 632 for the E1.50–2.00XM (E25–40XM) trucks

PERIODIC MAINTENANCE, 8000 SRM 552 for the E2.00–3.20XM (E45–65XM) trucks

PERIODIC MAINTENANCE, 8000 SRM 555 for the N30XMH trucks

Loosen the clamp at the inlet hose of the hydraulic pump to let the air out until the hose fills with oil. Tighten the hose clamp as soon as oil leaks out of the hose. Do the same procedure for the steering pump.

5. Install the traction motor as described in one of the following **SERVICE MANUAL** sections:

DRIVE AXLE, SPEED REDUCER AND DIFFERENTIAL, 1400 SRM 618 for the E1.50–2.00XM (E25–40XM) trucks

DRIVE AXLE, SPEED REDUCER AND DIFFERENTIAL, 1400 SRM 285 for the E2.00–3.20XM (E45–65XM) and N30XMH trucks

6. Operate the lift and steering systems and check for leaks.

J2.00–3.20XM (J40–65XM) Tank Installation (See FIGURE 10.)

1. Turn the key to the **OFF** position and remove the key.

WARNING

Never put tools or other metal on the battery. Metal on the battery can cause a short circuit and possible damage or injury.

2. Open the hood and install a cardboard or plywood cover on the top of the battery to prevent accidental short circuits.

3. Carefully position the hydraulic tank over the correct position in the frame and install the hoses on the bottom

of the tank. Lower the tank into the correct position in the frame.

4. Install the other hoses and if removed, the filter on the tank. Install the bracket that fastens the hydraulic tank in the truck frame. See item 3 of FIGURE 10.

5. Fill the tank to the **FULL** mark on the dipstick and install the breather/dipstick/fill cap.

6. Operate the lift and steering systems and check for leaks.

FILTER REPLACEMENT

1. Loosen the hose clamp near the control valve end of the filter (system dump). Carefully remove the hose and raise the filter to let the oil drain out of the filter into the hydraulic tank.

2. Loosen the other hose clamp and remove the filter from the hose.

3. Install a new filter in the hose to the hydraulic tank. Make sure the filter is installed for the correct direction of flow (control valve to tank). Align and tighten the hose clamp.

4. Install the hose on the other end of the filter. Align and tighten the hose clamp.

5. Operate the hydraulic system and check for leaks.

HYDRAULIC PUMP

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

Removing E1.50–3.20XM (E25–65XM) and N30XMH Hydraulic Pump (See FIGURE 12. and FIGURE 15.)

1. Remove the battery and the access panel in the bottom of the battery compartment. See one of the following **SERVICE MANUAL** sections:

PERIODIC MAINTENANCE, 8000 SRM 632 for the E1.50–2.00XM (E25–40XM) trucks

PERIODIC MAINTENANCE, 8000 SRM 552 for

the E2.00–3.20XM (E45–65XM) trucks

PERIODIC MAINTENANCE, 8000 SRM 555 for the N30XMH trucks

2. Put a drain pan under the hydraulic pump and put a clamp on the inlet hose from the hydraulic tank. Remove the breather for the hydraulic tank and install a plug in the breather hose. Make sure the dipstick/fill cap is tight. This will help prevent oil flow when the hydraulic line is disconnected. Disconnect the inlet hose at the pump and quickly raise the end of the hose above the level of the oil in the hydraulic tank. Install a plug in the hose. If it is necessary to drain the hydraulic system, use a drain pan with enough capacity. See the **SPECIFICATIONS** table at the back of this section.

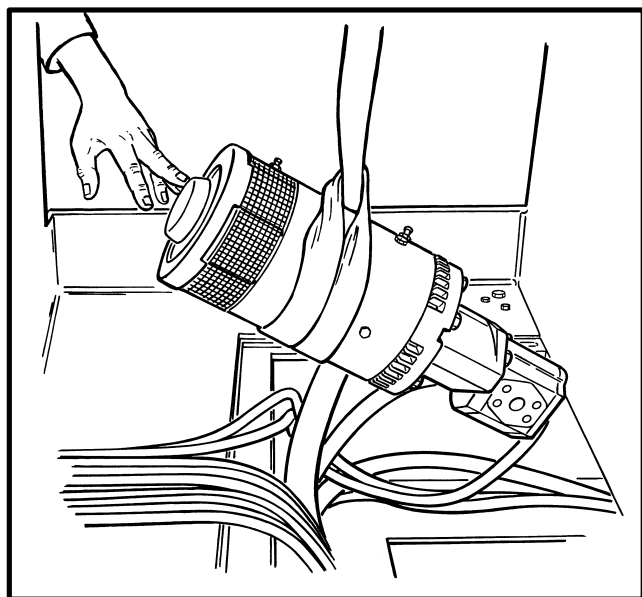


FIGURE 12. REMOVE THE HYDRAULIC PUMP AND MOTOR

3. Remove the pressure hose from the pump. Put a cap on the open hydraulic hose.

NOTE: In Step 4, remove the clamps from the pin in the pivot mount bracket to remove the pump and motor under the battery. Remove the clamps under the floor plate for the pump and motor to disconnect the pivot mount bracket at the motor. See FIGURE 15. The motor under the battery will tip down with force when the bracket is removed. Use a lifting device to keep the motor vertical. Make sure the lifting device will securely hold the motor before disconnecting the mount at the bottom of the motor.

4. Connect a sling and crane to the motor. See FIGURE 12. Make sure the crane and sling have a capacity of approximately 50 kg (110 lb) or more. Discon-

nect the power cables and mark the cables for correct installation. Disconnect the pivot mount bracket from the motor. Use the crane to lift the hydraulic pump and motor from the lift truck.

5. Make a note of the position of the inlet and outlet ports of the pump for correct alignment to the motor during assembly. Loosen the two set screws in the coupling. Remove the capscrews that fasten the pump to the motor and carefully remove the pump. Do not lose the two keys between the coupling and each shaft. Remove the coupling from the shaft.

Remove The J2.00–3.20XM (J40–65XM) Hydraulic Pump (See FIGURE 13. and FIGURE 15.)

1. Turn the key to the **OFF** position and remove the key.

WARNING

Never put tools or other metal on the battery. Metal on the battery can cause a short circuit and possible damage or injury.

2. Open the hood and install a cardboard or plywood cover on the top of the battery to prevent accidental short circuits.

3. If the oil will not be drained from the hydraulic tank, remove the dipstick and install a plug in the fill tube. Disconnect the inlet hose at the pump and quickly raise the end of the hose above the level of the oil in the hydraulic tank. Install a plug in the hose.

4. If it is necessary to drain the hydraulic system, turn the steering wheel for a full left turn for access to the drain plug near the front of the right rear wheel. Install a container under the drain plug of the hydraulic tank with enough capacity. See the **SPECIFICATIONS** table at the back of this section.

5. Remove the pressure hose from the pump. Put a cap on the open hydraulic hose.

6. Connect a sling and crane to the motor. See FIGURE 13. Make sure the crane and sling have a capacity of approximately 50 kg (110 lb) or more. Disconnect the power cables and mark the cables for correct installation. Disconnect the pivot mount bracket from the motor. Use the crane to lift the hydraulic pump and motor from the lift truck.

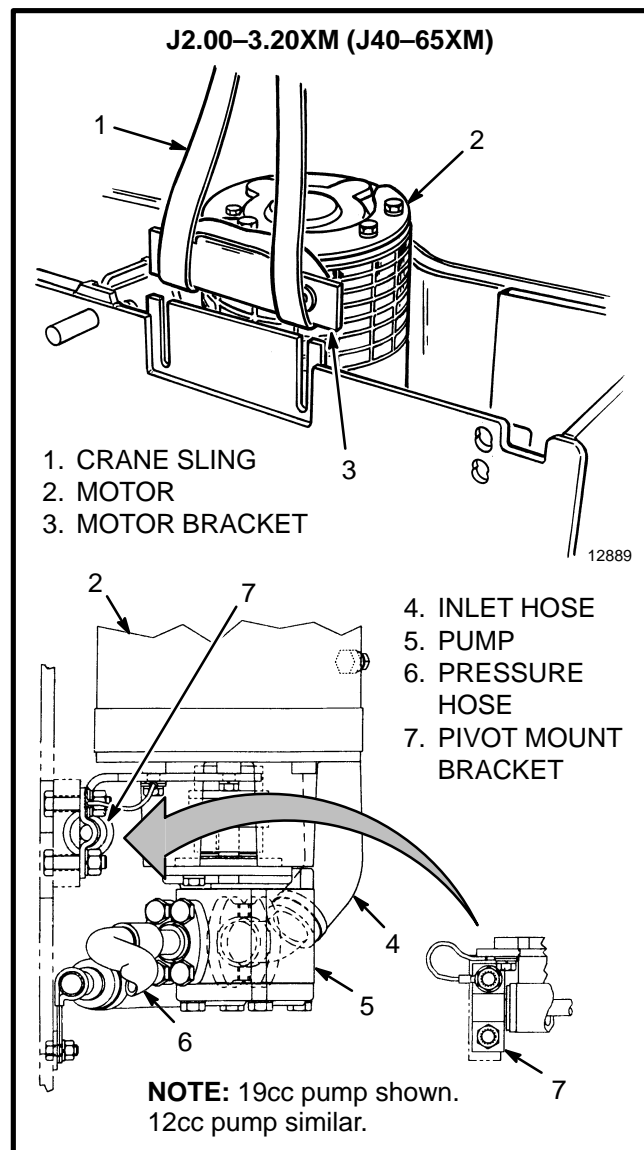


FIGURE 13. REMOVE THE J2.00–3.20XM (J40–65XM) HYDRAULIC PUMP AND MOTOR

7. Make a note of the position of the inlet and outlet ports of the pump for correct alignment to the motor during assembly. Loosen the two set screws in the coupling. Remove the capscrews that fasten the pump to the motor and carefully remove the pump. Do not lose the two keys between the coupling and each shaft. Remove the coupling from the shaft.

Pump Seal Replacement And Pump Assembly (See FIGURE 14.)

NOTE: If the pump is held in a vise for disassembly, make sure the vise does not hold the pump too tightly and cause distortion of the pump body. The O-ring surface of the outlet port can also be damaged

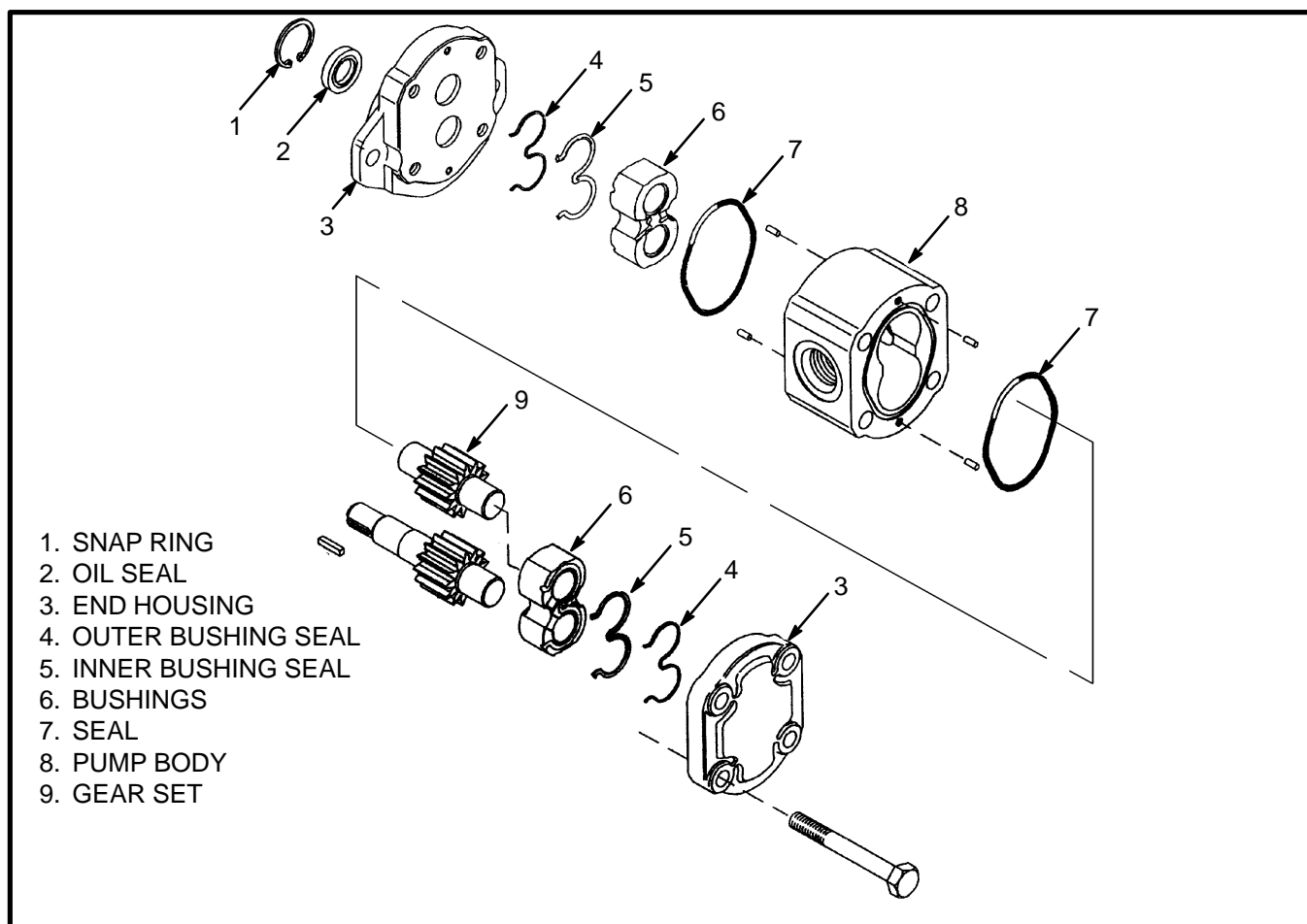


FIGURE 14. HYDRAULIC GEAR PUMP ASSEMBLY

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

1. Remove the pump coupling from the shaft by loosening the set screws. Do not lose the keys between the coupling and each shaft.

2. Remove the four capscrews that hold the pump together. Carefully remove the end housings. Push the shaft through the oil seal in the end housing as the end housing is removed from the pump. Make a note of the seal arrangement. Do not disassemble the pump gear assembly.

3. Carefully remove the oil seals from the bushings. Remove the snap ring and the shaft seal from the end housing with the flange.

4. Inspect the pump gear assembly and the pump body for wear and damage. Replace a damaged or worn hydraulic pump.

NOTE: Some pump bodies will show gear marks where the gears rotate because of the small clearances between the parts. These gear marks do not indicate a worn or damaged pump unless the pump will not supply the volume and pressure shown in the specifications.

5. Make sure the internal parts of the pump are clean. Lubricate the parts with hydraulic oil as they are installed in the pump. Install new seals in the bushings.

6. Install the gears and bushing assembly in the pump body. Make sure each bushing is aligned correctly.

7. Install the seals and the end of the pump with the flat face. See FIGURE 14.

8. Install the seals in the end of the pump with the flange. Install the end of the pump.

9. Make sure that all of the parts are in the correct position and install the four capscrews. Tighten the capscrews.

10. Install a new oil seal on the input shaft. Install the snap ring.

Assemble Pump On The Motor (See FIGURE 15.)

NOTE: Inspect the coupling. If the cushion material has pieces missing or has distortion, replace the cushion ring.

1. If the coupling half was removed from the pump or the motor, install the coupling and key on the pump shaft. Install the key and coupling on the motor shaft as the pump is aligned to the motor.

2. Make sure that the halves of the coupling are correctly engaged. Make sure the Allen screws that fasten the coupling to the shafts are tight. Make sure the pump is aligned to the motor as marked during disassembly. Install the capscrews that fasten the pump to the motor. See FIGURE 15.

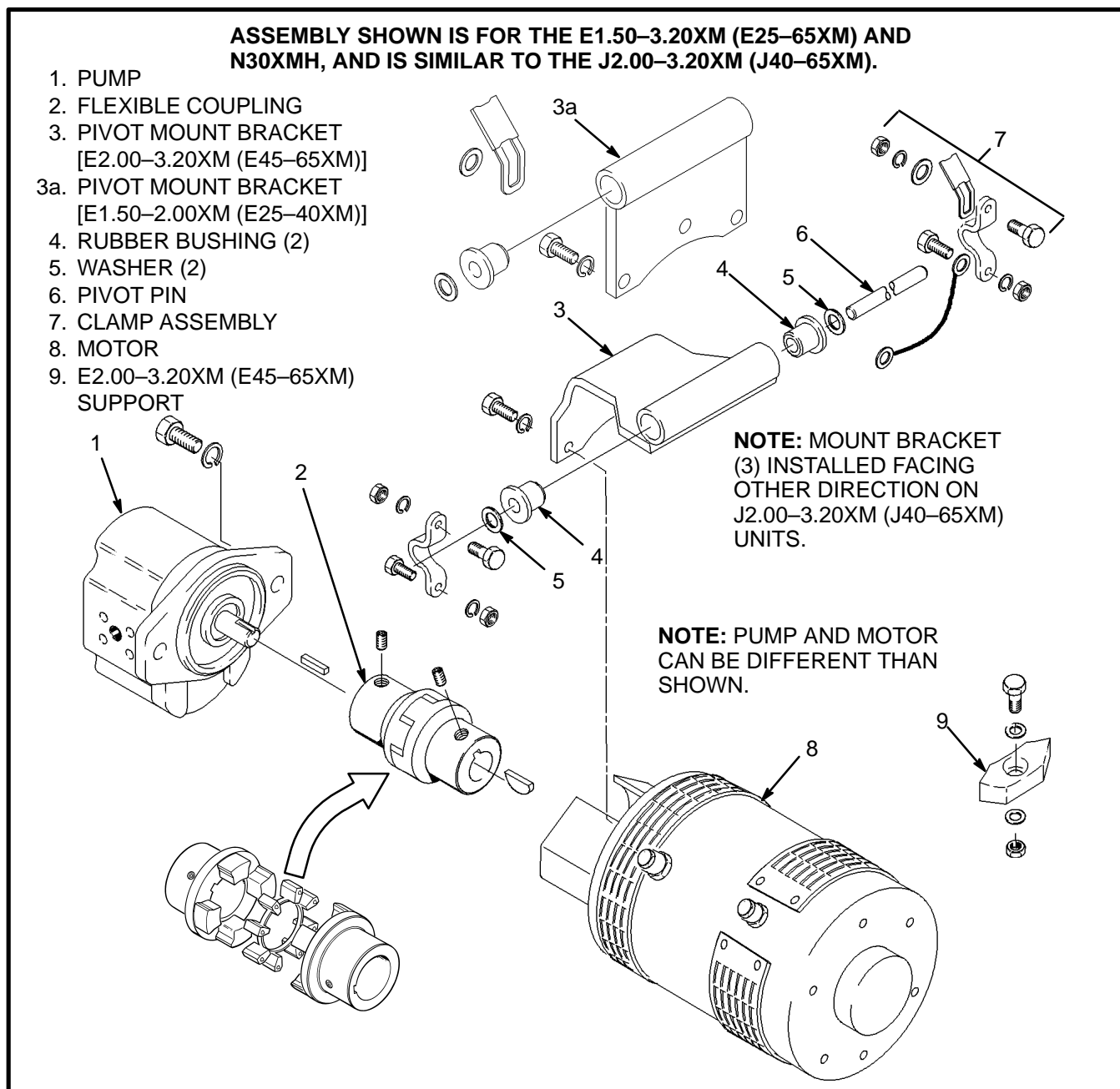


FIGURE 15. HYDRAULIC PUMP AND MOTOR ASSEMBLY WITH MOUNT

Install The Hydraulic Pump And Motor Assembly [E1.50–3.20XM (E25–65XM) and N30XMH]

1. Connect the pivot mount bracket to the motor as shown in FIGURE 15. Connect a sling and crane to the motor. See FIGURE 12. Make sure the crane and sling have a capacity of approximately 50 kg (110 lb) or more. Use the crane to lift the hydraulic pump and motor into the correct position in the lift truck. Connect the power cables as marked during removal.

NOTE: Tighten the connections for power cables at M8 X 1.25 or 5/16 UNC terminals on General Electric motors to 18 to 22 Nm (13 to 16 lb_f ft). Tighten all other connections for power cables as follows:

5/16 UNC threads – 13.5 to 17.5 Nm (10.0 to 12.9 lb_f ft)

1/4 UNC threads – 4.0 to 6.0 Nm (3.0 to 4.4 lb_f ft)

#6 UNC threads – 0.73 to 1.02 Nm (0.5 to 0.8 lb_f ft)

M8 X 1.25 threads – 13.5 to 17.5 Nm (10.0 to 12.9 lb_f ft)

M10 X 1.5 threads – 15.0 to 18.0 Nm (11.1 to 13.3 lb_f ft)

NOTE: If the rubber bushings of the pivot mount bracket were removed, use soap or rubber lubricant to install the bushings. Do NOT use oil. The oil will soften the bushings and they will need replacement.

2. Install the clamps on the frame to mount the pump and motor. Align the pivot mount bracket of the motor. See FIGURE 15. Install the clamps over the pin in the pivot mount bracket. Make sure to install the washers and wire (ground connection) between the mount and clamp brackets.

3. Remove the cap on the pressure hose. Install the pressure hose on the outlet of the pump. Remove the plug in the inlet hose and quickly connect the inlet hose at the pump. Leave the fittings loose.

4. If the oil was drained from the hydraulic system, make sure the drain plug is installed in the tank. If drained, fill the hydraulic tank with the type and quantity of hydraulic oil shown in one of the following **SERVICE MANUAL** sections:

PERIODIC MAINTENANCE, 8000 SRM 632 for the E1.50–2.00XM (E25–40XM) trucks

PERIODIC MAINTENANCE, 8000 SRM 552 for the E2.00–3.20XM (E45–65XM) trucks

PERIODIC MAINTENANCE, 8000 SRM 555 for the N30XMH trucks

Fill the tank to the **FULL** mark on the dipstick. If the tank was not drained, remove the plug from the breather hose and install the breather. Let some of the oil leak from around the inlet fitting on the pump, then tighten the capscrews on the flanges of the fittings. The smaller pump has O-ring fittings. Tighten the outlet hose fitting. Use this procedure to make sure the pump has oil for first operation.

5. Install the access panel in the bottom of the battery compartment and install the battery. See one of the following **SERVICE MANUAL** sections for the correct procedure.:

PERIODIC MAINTENANCE, 8000 SRM 632 for the E1.50–2.00XM (E25–40XM) trucks

PERIODIC MAINTENANCE, 8000 SRM 552 for the E2.00–3.20XM (E45–65XM) trucks

PERIODIC MAINTENANCE, 8000 SRM 555 for the N30XMH trucks

Operate the lift system and check for leaks.

Install J2.00–3.20XM (J40–65XM) Hydraulic Pump And Motor Assembly

1. Turn the key to the **OFF** position and remove the key.

WARNING

Never put tools or other metal on the battery. Metal on the battery can cause a short circuit and possible damage or injury.

2. Open the hood and install a cardboard or plywood cover on the top of the battery to prevent accidental short circuits.

3. Connect the pivot mount bracket to the motor. Make sure the bracket is installed so that the tube of the bracket is on the pump side NOT the motor side as shown in FIGURE 15. Connect a sling and crane to the motor. See FIGURE 13. Make sure the crane and sling have a capacity of approximately 50 kg (110 lb) or more. Use the crane to lift the hydraulic pump and motor into the correct position in the motor compartment. Connect the power cables as marked during removal.

NOTE: Tighten the connections for power cables at M8X1.25 or 5/16 UNC terminals on General Electric motors to 18 to 22 Nm (13 to 16 lb_f ft). Tighten all other connections for power cables as follows:

$\frac{5}{16}$ UNC threads – 13.5 to 17.5 Nm (10.0 to 12.9 lb_f ft)

$\frac{1}{4}$ UNC threads – 4.0 to 6.0 Nm (3.0 to 4.4 lb_f ft)

#6 UNC threads – 0.73 to 1.02 Nm (0.5 to 0.8 lb_f ft)

M8 X 1.25 threads – 13.5 to 17.5 Nm (10.0 to 12.9 lb_f ft)

M10 X 1.5 threads – 15.0 to 18.0 Nm (11.1 to 13.3 lb_f ft)

NOTE: If the rubber bushings of the pivot mount bracket were removed, use soap or rubber lubricant to install the bushings. Do NOT use oil. The oil will soften the bushings and they will need replacement.

4. Keep the motor vertical. Install the clamps on the rear bulkhead of the battery compartment to mount the pump and motor. Align the pivot mount bracket of the motor. See FIGURE 15. Install the clamps over the pin in the pivot mount bracket. Make sure to install the washers and wire (ground connection) between the mount and clamp brackets.

5. Remove the cap on the pressure hose. Install the pressure hose on the outlet of the pump. Remove the plug in the inlet hose and quickly connect the inlet hose at the pump. Leave the fittings loose.

6. If the oil was drained from the hydraulic system, make sure the drain plug is installed in the tank. If necessary, turn the steering wheel for a full left turn for access to the drain plug near the front of the right rear wheel. If drained, fill the hydraulic tank with the type and quantity of hydraulic oil shown in the **SERVICE MANUAL** section **PERIODIC MAINTENANCE, 8000 SRM 552**. Fill the tank to the **FULL** mark on the dipstick. If the tank was not drained, remove the plug from the fill tube. Let some of the oil leak from around the inlet fitting on the pump, then tighten the capscrews on the flanges of the fittings. The smaller pump has O-ring fittings. Tighten the outlet hose fitting. Use this procedure to make sure the pump has oil for first operation.

7. Install the top bracket to fasten the motor to the bulkhead. Operate the lift system and check for leaks.

MAIN CONTROL VALVE

NOTE: The operation, removal and repair of the control valve is described in the **SERVICE MANUAL** section **MAIN CONTROL VALVE, 2000 SRM 562**.

STEERING PUMP

NOTE: A worn or damaged steering pump is normally replaced instead of repaired. The cost of repair can often

be more than the cost of a new pump. The following procedure does not include repair.

Pump Removal And Disassembly, E1.50–3.20XM (E25–65XM) and N30XMH (See FIGURE 16. or FIGURE 17.)

1. Disconnect the battery connector. Remove the floor plate. Remove the battery as described in one of the following **SERVICE MANUAL** sections for the correct procedure.:

PERIODIC MAINTENANCE, 8000 SRM 632 for the E1.50–2.00XM (E25–40XM) trucks

PERIODIC MAINTENANCE, 8000 SRM 552 for the E2.00–3.20XM (E45–65XM) trucks

PERIODIC MAINTENANCE, 8000 SRM 555 for the N30XMH trucks

Remove the breather for the hydraulic tank and install a plug in the breather hose. Make sure the dipstick/fill cap is tight. This will help prevent oil flow when the hydraulic line is disconnected.

2. Put a drain pan under the steering pump and remove the hose at the pump that comes from the hydraulic tank. Oil will flow from the hose, so quickly install a plug in the hose fitting.

3. Disconnect the other hose for the steering pump. Install a plug at the fitting for the hose. If installed, disconnect the electrical plug at the pressure switch on the bottom of the motor.

4. Install tags for correct connection during installation and disconnect the electrical cables at the pump motor terminals.

5. Install a sling around the steering pump and motor assembly. Connect a crane to the sling and raise the crane so that it is a support for the assembly. Make sure the crane and sling have a capacity of 18.5 kg (41 lbs) or more.

6. Make a note of the positions of the rubber bushings at the mount brackets and remove the capscrews that fasten the brackets. See FIGURE 17.

7. Carefully lift the steering pump and motor assembly up out of the frame. Do not damage the pressure switch on the bottom of the pump.

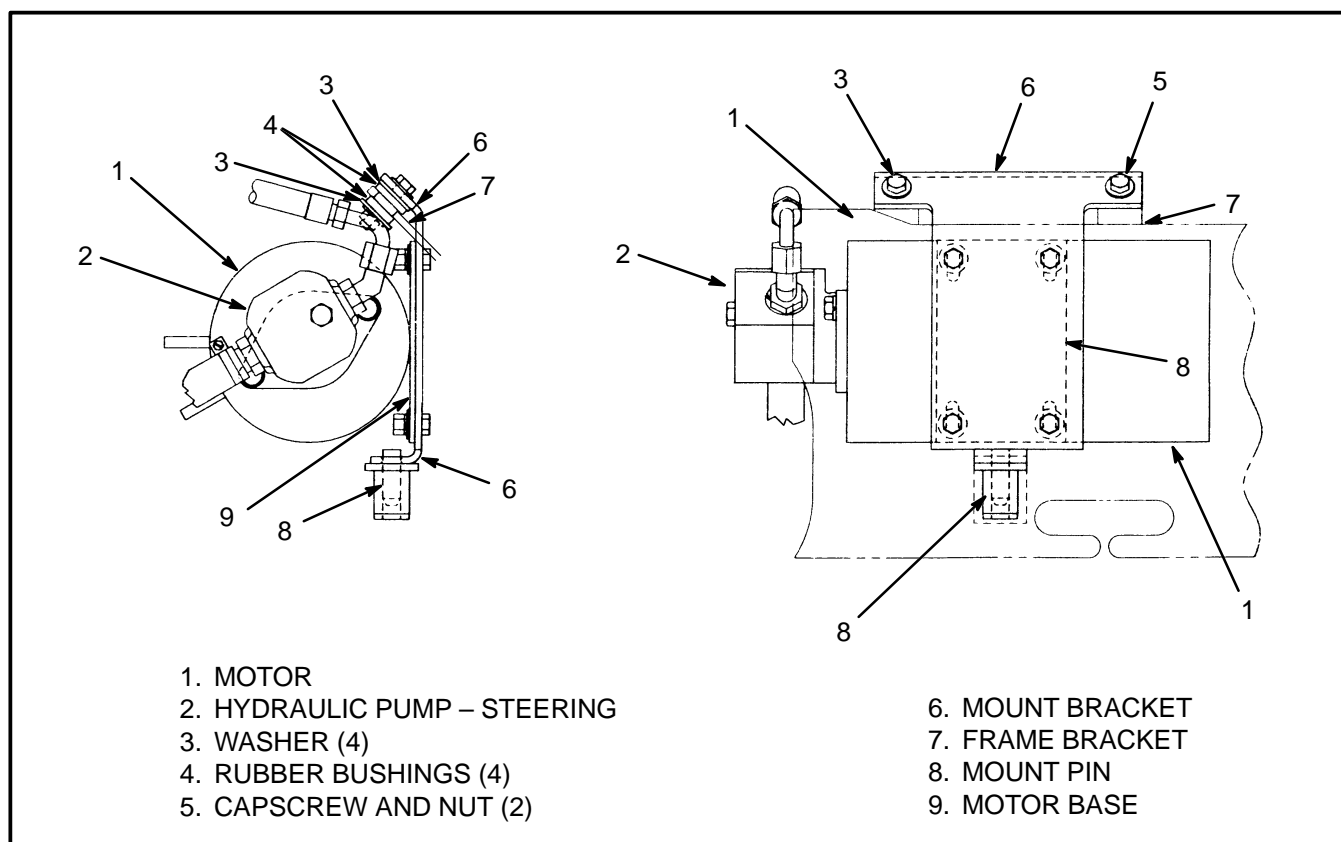


FIGURE 16. E1.50–2.00XM (E25–40XM) STEERING PUMP AND MOTOR

NOTE: Do not remove the mount brackets from the motor base unless the motor will be replaced. These brackets must be correctly aligned on the motor base.

8. Make a note of the position of the inlet and outlet ports of the pump for correct alignment to the motor during assembly. Remove the two capscrows that fasten the pump to the motor and carefully remove the pump. Remove the O-ring at the pump shaft.

Pump Removal And Disassembly, J2.00–3.20XM (J40–65XM) (See FIGURE 17.)

1. Turn the key to the **OFF** position and remove the key.

⚠ WARNING

Never put tools or other metal on the battery. Metal on the battery can cause a short circuit and possible damage or injury.

2. Open the hood and install a cardboard or plywood cover on the top of the battery to prevent accidental short circuits.

3. Put a drain pan under the steering pump. Remove the dipstick and install a plug in the fill tube. Remove the

hose at the pump that comes from the hydraulic tank. Oil will flow from the hose, so quickly install a plug in the hose fitting.

4. Disconnect the other hose for the steering pump. Install a plug at the fitting for the hose. If installed, disconnect the electrical plug at the pressure switch on the bottom of the motor.

5. Install tags for correct connection during installation and disconnect the electrical cables at the pump motor terminals.

6. Install a sling around the steering pump and motor assembly. Connect a crane to the sling and raise the crane so that it is a support for the assembly. Make sure the crane and sling have a capacity of 18.5 kg (41 lbs) or more.

7. Make a note of the positions of the rubber bushings at the mount brackets and remove the capscrows that fasten the brackets. See FIGURE 17.

8. Carefully lift the steering pump and motor assembly up out of the frame. Do not damage the pressure switch on the bottom of the pump.

NOTE: Do not remove the mount brackets from the motor base unless the motor will be replaced. These brackets must be correctly aligned on the motor base.

9. Make a note of the position of the inlet and outlet ports of the pump for correct alignment to the motor during assembly. Remove the two capscrews that fasten the pump to the motor and carefully remove the pump. Remove the O-ring at the pump shaft.

Pump Assembly And Installation (See FIGURE 16. or FIGURE 17.)

1. Install a new O-ring at the shaft of the replacement pump. Install the replacement pump on the motor using the two capscrews. Make sure the pump is correctly aligned with the motor as noted during disassembly.

2. If removed, install the pressure switch in the pump end frame.

3. If the mount brackets were removed from the motor base, the brackets must be correctly aligned before installation of the assembly. Align the brackets as follows:

- a. Install the mount brackets on the motor base. See FIGURE 17. Leave the capscrews and nuts loose so that the brackets can move.
- b. Align the two brackets so that the center lines of the capscrew holes are 160 mm ($6\frac{19}{64}$ in) apart as shown in FIGURE 17. Keep the brackets centered in the slots of the motor base as much as possible.
- c. Carefully tighten the capscrews at the motor base without changing the alignment.

4. Install a sling around the steering pump and motor assembly. Use a crane to lift and align the assembly on the mounts in the lift truck frame.

5. Install the mount capscrews, washers and rubber bushings as noted during disassembly. See FIGURE 17. Install the clip nut at the top left mount of the frame. Tighten the capscrews without compressing the rubber bushings.

6. Connect the hydraulic line to the outlet port of the pump. Install a drain pan under the pump and quickly install the hose from the hydraulic tank to the inlet port.

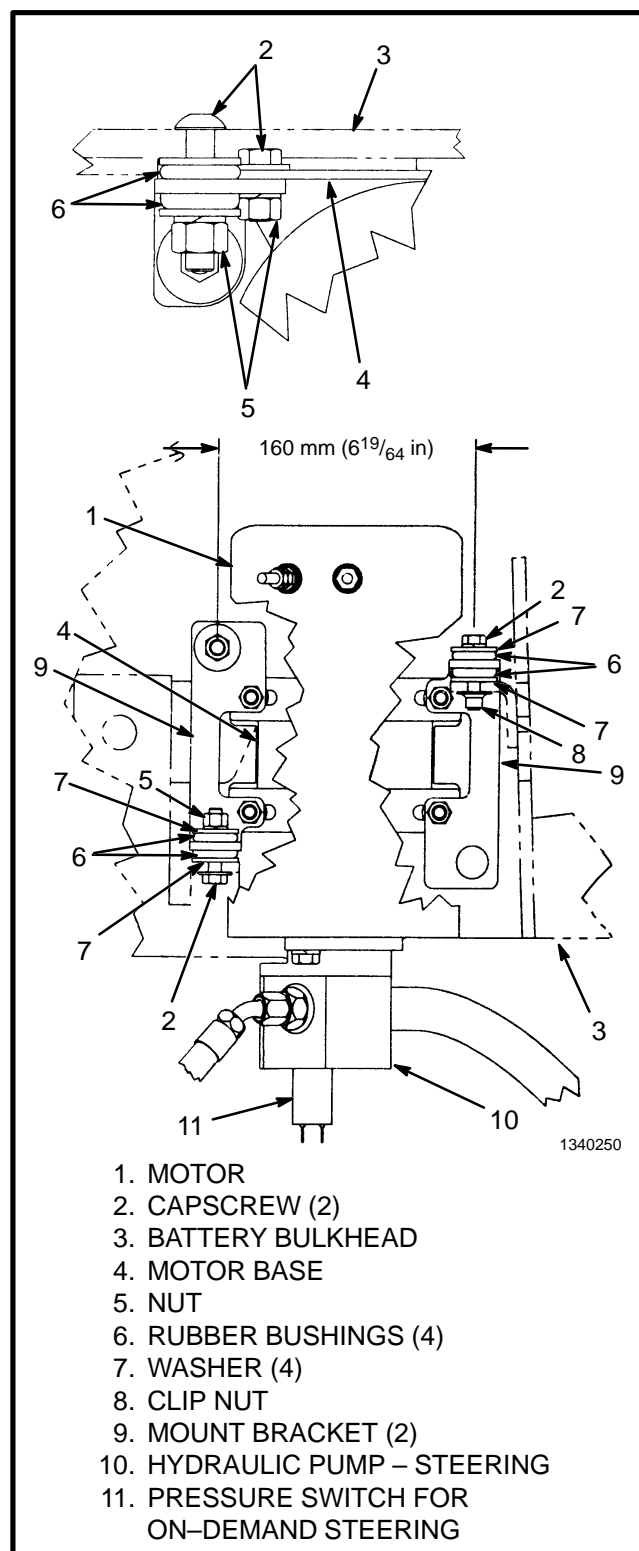


FIGURE 17. E2.00-3.20XM (E45-65XM),
N30XMH AND J2.00-3.20XM (J40-65XM)
STEERING PUMP AND MOTOR

7. Install the electrical plug on the terminals of the pressure switch. Install the electrical cables on the motor terminals as noted during removal.

NOTE: Tighten the connections for power cables at M8 X 1.25 or 5/16 UNC terminals on General Electric motors to 18 to 22 Nm (13 to 16 lb_f ft). Tighten all other connections for power cables as follows:

5/16 UNC threads – 13.5 to 17.5 Nm (10.0 to 12.9 lb_f ft)

1/4 UNC threads – 4.0 to 6.0 Nm (3.0 to 4.4 lb_f ft)

#6 UNC threads – 0.73 to 1.02 Nm (0.5 to 0.8 lb_f ft)

M8 X 1.25 threads – 13.5 to 17.5 Nm (10.0 to 12.9 lb_f ft)

M10 X 1.5 threads – 15.0 to 18.0 Nm (11.1 to 13.3 lb_f ft)

8. Remove the plug from the breather hose and install the breather. Install the battery as described in one of the following **SERVICE MANUAL** sections for the correct procedure.:

PERIODIC MAINTENANCE, 8000 SRM 632 for the E1.50–2.00XM (E25–40XM) trucks

PERIODIC MAINTENANCE, 8000 SRM 552 for the E2.00–3.20XM (E45–65XM) trucks

PERIODIC MAINTENANCE, 8000 SRM 555 for the N30XMH trucks

Install the floor plate. Operate the steering system and check for leaks.

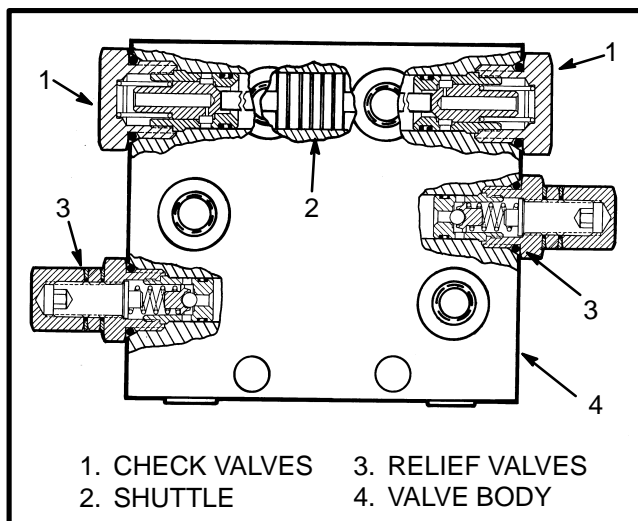


FIGURE 18. ROTARY ACTUATOR VALVE

ROTARY ACTUATOR VALVE (See FIGURE 18.)

The rotating actuator valve and the bypass valve are found on the attachment for the N30XMH. The instructions for the removal and installation and the adjustment procedures for these valves are in the **ATTACHMENTS** section, 5000 SRM 580.

Disassembly, Cleaning and Inspection

1. Turn the cap with a wrench to remove the check valve assembly from the valve body. Push the shuttle out of the valve body.
2. Inspect the seat and poppet for dirt or scratches. The poppet must slide freely in the seat sleeve. The spring must not be bent or broken.
3. Inspect the shuttle and bore for dirt or scratches. The shuttle must slide freely in the bore.
4. Remove the two relief valves from the valve body by turning the bushings with a wrench.

⚠ CAUTION

The adjustment of the relief valves is set at the factory. DO NOT loosen the cap or jam nut from the bushings. DO NOT turn the adjuster screw.

5. Inspect the poppet, ball, and seat for dirt or scratches. Make sure the spring is not bent or broken.
6. Clean all parts of the rotating actuator valve with solvent. Use compressed air to dry the parts and to remove dirt from the passages.

Assembly

1. Lubricate the relief valve parts with hydraulic oil. Install new O-rings on the bushing.
2. Install the relief valves into the valve body. Use a wrench to tighten the bushing.
3. Lubricate and install new O-rings and install one check valve into the valve body. Lubricate the shuttle and slide it into the bore for the check valves. Lubricate and install the other check valve.
4. Install new O-rings on the fittings that were removed. Lubricate and install the fittings.

STEERING CONTROL UNIT

NOTE: See the **SERVICE MANUAL** section **STEERING HOUSING AND CONTROL UNIT, 1600 SRM 512** to repair the steering control unit. Following is the correct procedure to remove and install the steering control unit.

NOTE: The repair procedures for the instrument cluster are in the **SERVICE MANUAL** section **ELECTRICAL SYSTEM, 2200 SRM 560**.

Control Unit Removal (See FIGURE 19.)

1. Disconnect the battery connector. Move the steering column to the forward position. Remove the panel under the steering column for access to the hoses of the steering control unit.

2. Remove the front and rear covers for the steering column. The instrument cluster is fastened to the front cover. Install tags and disconnect the wires for the horn connector and if installed, on-demand power steering and the forward/reverse switches. If installed, remove the parts for on-demand power steering and the forward/reverse switches and lever. See the **SERVICE MANUAL** sections **STEERING SYSTEM, 1600 SRM 485** and **STEERING HOUSING AND CONTROL UNIT, 1600 SRM 512**.

3. Put tags for identification on the hydraulic hoses at the steering control unit so that they can be connected correctly during assembly. Disconnect the hydraulic hoses at the bottom of the steering control unit. Install plugs at all hose fittings and control unit ports to prevent dirt from entering the steering hydraulic system.

4. Hold the steering column and remove the capscrews that hold the steering column and pivot shaft to the bracket. See FIGURE 19. Remove the two plates, pivot shaft and spring. Remove the steering column assembly. Do not lose the rod, washer and spring for the latch.

5. Make a note of the alignment of the steering control unit in the bracket for correct installation. Remove the four capscrews that fasten the steering shaft assembly and steering control unit in the steering column bracket. Do not let the steering control unit or steering wheel and shaft assembly fall. Do not let the washers fall. It is not necessary to remove the steering wheel or on-demand steering parts from the shaft.

Control Unit Installation (See FIGURE 19.)

1. Install the steering control unit in the bracket. Make sure it is in correct alignment, as noted during removal, so that the hoses can be correctly connected. Install the washers, spacers, steering shaft assembly and capscrews to hold all parts in the bracket.

2. Hold the bracket assembly in alignment and install the pivot shaft, spring, plates, washers and capscrews to

hold the assembly on the mount. Install the spring, washer and rod for the latch. Install the knob on the latch. Install the allen screw and nut.

WARNING

The hydraulic hoses MUST be connected to the correct ports or the steering system will not operate as expected. This operation that is not expected can cause damage or personal injury. Make sure the hoses are identified and connected correctly.

3. Connect the hydraulic hoses at the steering control unit as marked during removal OR see the **SERVICE MANUAL** section **STEERING HOUSING AND CONTROL UNIT, 1600 SRM 512** for correct connections.

4. If removed, install the parts for on-demand power steering and the forward/reverse switches and lever. See the **SERVICE MANUAL** sections **STEERING SYSTEM, 1600 SRM 485** and **STEERING HOUSING AND CONTROL UNIT, 1600 SRM 512**.

5. Connect the wires for the horn connector and if installed, the on-demand power steering and forward/reverse switches. Install the front and rear covers for the steering column.

WARNING

After making repairs, do not extend hands or arms through the center of the steering wheel. Wrong assembly or connections can make the steering wheel rotate with a strong force when the steering pump operates. This strong force can cause serious injury. If this action occurs, disassemble the control unit and correct the problem.

6. Operate the steering system and check for leaks and correct operation.

STEERING CYLINDER

NOTE: The correct procedure for the removal and repair of the steering cylinder is in the following sections of the **SERVICE MANUAL**:

STEERING AXLE, 1600 SRM 619 for the E1.50–2.00XM (E25–40XM) trucks

STEERING AXLE, 1600 SRM 258 for the other trucks