

SERVICE REPAIR

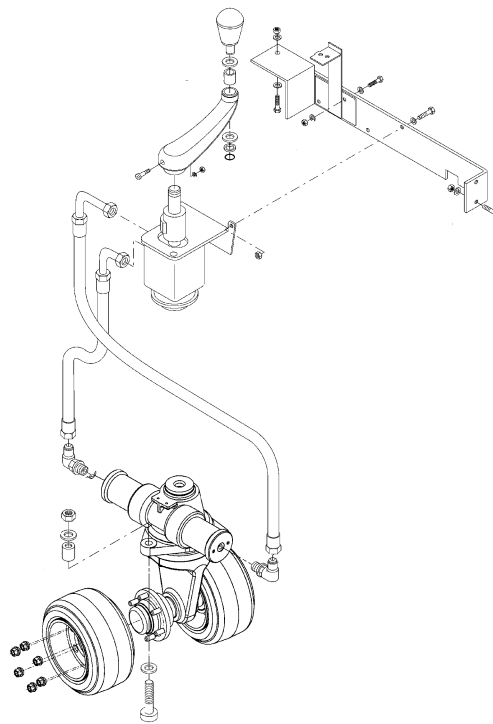
MANUAL

Hyster A219 (E30HSD, E35HSD, E40HSD) Forklift

HYSTER

STEERING SYSTEM

E30-40HSD [A219]



BM220004

HYSTER

SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- **DISCONNECT THE BATTERY CONNECTOR** before doing any maintenance or repair on electric lift trucks.
- Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See **HOW TO PUT THE LIFT TRUCK ON BLOCKS** in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a **DO NOT OPERATE** tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

NOTE: The following symbols and words indicate safety information in this manual:



WARNING

Indicates a condition that can cause immediate death or injury!



CAUTION

Indicates a condition that can cause property damage!

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This section is for the following models:

E30-40HSD [A219]

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manual**

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**"THE
QUALITY
KEEPERS"**

**HYSTER
APPROVED
PARTS**

General

This section provides the description and repair procedures for the steering system for models E30-40HSD (A219).

Description and Features

The steering system for the three-wheel stand truck has four main areas:

- Steering Control Handle, On-Demand Steering Circuit, and Steering Control Unit (SCU)
- Power Steering Pump and Motor
- Kordel™ Steering Unit Actuator
- Traction Controllers and Drive Motors

Turning the Steering Control Handle activates the On-Demand Steering Circuit and the SCU. The On-Demand Steering Circuit consists of a sensor attached to the steering column assembly and the power steering pump motor. When the steering control handle is not being turned, the sensor sends a constant, positive 5 volts through wire number 52 (the green wire) to the steering pump motor. When the sensor senses that the Steering Control Handle is turning, it sends a low-going signal (5 to 0 volts) to the steering pump motor through wire number 52. This low-going signal is variable and depends on how fast the Steering Control Handle is turned (the faster it is turned, the lower the signal goes). When the power steering pump motor receives the low-going signal from the sensor, it speeds up, or "ramps up" and turns the steering pump faster. This increase in speed increases the amount of oil flowing through the steering pump and thereby increases pressure on the pistons of the Kordel™ Steering Unit Actuator.

The SCU is a rotary pump operated by the steering control handle. During steering, the SCU controls the direction and amount of oil that flows to the steering actuator. Hydraulic oil returns from the steering actuator to the SCU and then returns to the hydraulic tank.

The Power Steering Pump and Motor are bolted together to form a single unit. The power steering pump is a single-section gear pump which draws hydraulic oil from the hydraulic tank and directs the oil to the SCU. The power steering pump motor is a brushless DC motor that requires no maintenance. The motor runs at a very slow pace until it receives a less than 5-volts signal from the On-Demand Steering Circuit Sensor, then it ramps up in speed to provide the necessary power to turn the steering actuator. This feature saves battery energy and wear and tear on the motor. If the motor runs at full speed all the time, then the On-Demand Steering Circuit Sensor may be defective, or the wiring may be broken or disconnected.

The Kordel™ Steering Unit Actuator is a self contained unit that uses the hydraulic oil pressure generated by the pump and directed by the SCU to turn the steer wheels. It does this by having two opposing hydraulic pistons attached to both ends of a gear rack. When the operator turns the steering control handle, the SCU is also turned and it supplies hydraulic oil to the correct piston and allows hydraulic oil to leave the other piston. This pushing action causes the gear rack to move and turn the steer wheels.

The Traction Controllers have been programmed to aid in steering by slowing down the drive motor on the side which the truck is turning. The further the truck is steered into the turn, the slower the motor turns the drive wheel. If the truck is steered into the turn enough, the motor may even turn in reverse.

On-Demand Steering Circuit

DESCRIPTION

The on-demand steering circuit (see Figure 1) is an energy-saving feature that is engineered to provide additional safety. The circuit saves energy by keeping the steering pump motor in an idle state until the steering control handle is turned. The circuit is engineered to allow the steering pump motor to continuously run at full speed if the steering column sensor becomes defective. This will allow the operator to steer the truck safely.

Prior to the operator pressing down on the brake pedal, the steering pump motor receives battery voltage from wire 95, also known as the Steering Inhibit Signal. This signal inhibits or prevents the steering pump motor from running and pumping hydraulic oil. When the operator presses down on the brake

pedal, the system reacts by turning on the traction contactor driver transistor, which is inside the left 1243 SEM Traction Motor Controller. This causes wire 95 to be near 0 volts. This low signal enables the steering pump motor to operate.

When the steering control handle is turned, the Steer Motor Speed Command Signal from the steering column sensor (wire 52) decreases from plus 5 volts, depending on how quickly the steering control handle is turned (the faster it is turned, the lower the voltage goes).

A quick test of the steering pump motor is to unplug the connector at the motor. The absence of both the inhibit and speed command signals will cause the steering pump motor to operate at full speed until the truck is turned off.

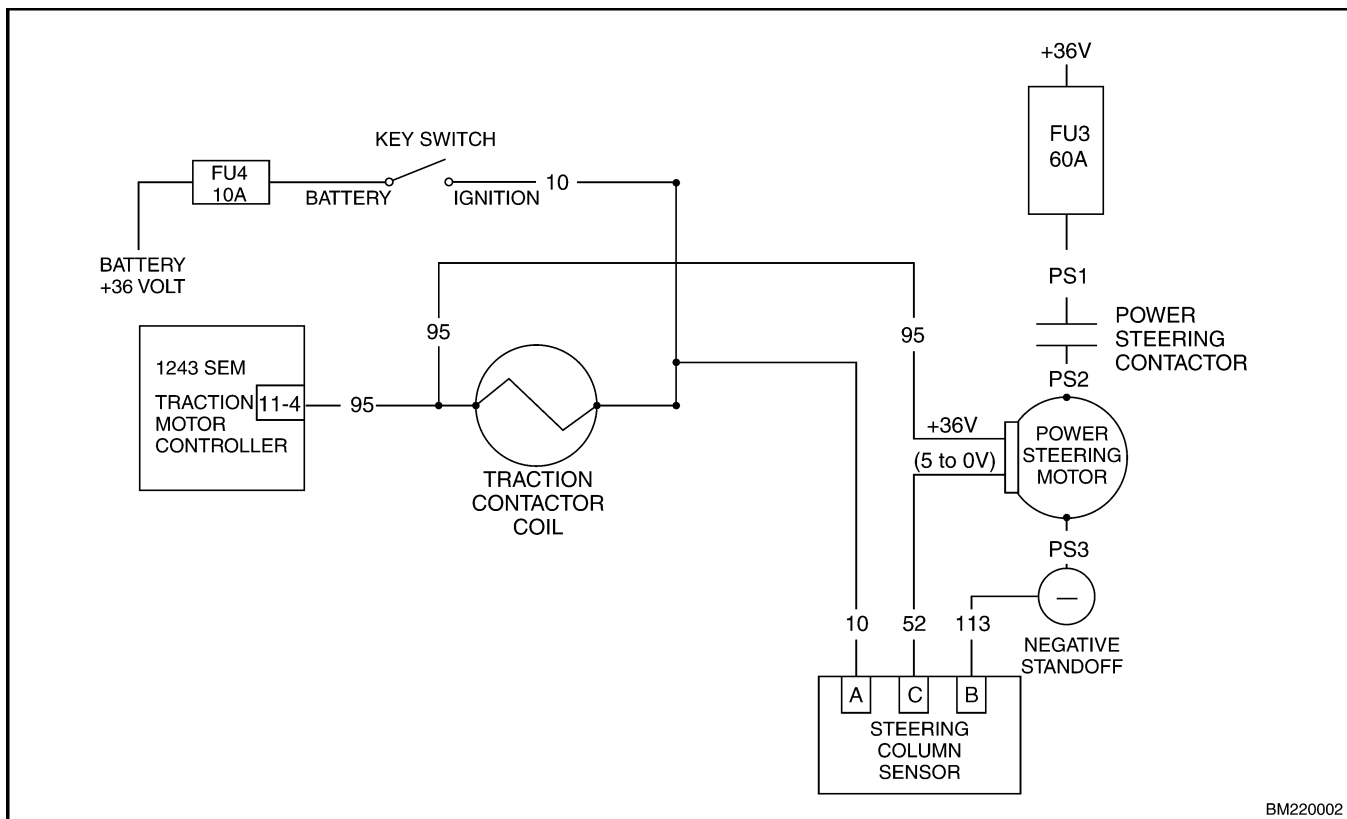


Figure 1. On-Demand Steering Circuit

STEERING CONTROL HANDLE

Remove

NOTE: The steering control handle must be removed before the steering compartment cover can be removed.

The steering control handle is attached to the steering column assembly with a shoulder screw (4.0 mm Allen head), lockwasher, and nut (10 mm).

1. Remove nut and lockwasher. Be careful not to drop the nut and lockwasher.
2. Remove shoulder screw.
3. Remove handle.

Install

1. Install handle and align with hole in steer column assembly.
2. Install shoulder screw, lockwasher, and nut.

STEERING SENSOR

Test

The steering sensor can be tested in place, without removing it by any of the following methods:

NOTE: To perform these checks, the battery must be connected, the key must be **ON**, and the covers must be removed.

1. Using a small mechanics mirror, check for a green light on bottom of sensor body.
2. Disconnect wires at sensor connector or steering pump connector. Steering motor should run at full speed continuously.
3. Using a digital multimeter check that voltage as measured across wire 52 (green wire) and wire 113 (brown wire) goes from a constant plus 5 volts to a variable less than plus 5 volts, as the steering

control handle is turned. This method is best done by using T-tap connectors to splice into the wires beyond the connector.

Remove

NOTE: The steering sensor cannot be repaired. If it is defective or broken, it must be replaced. A defective (or disconnected) steering sensor will cause the steering pump motor to run at full speed continuously. Before replacing a suspected defective steering sensor, inspect the wires and connectors for breaks.

1. Remove steering control handle and steering compartment cover.
2. Remove operator pads to allow access to sensor wiring harness connector.
3. Turn key to **OFF** position and disconnect battery by pressing forward on battery disconnect lever.
4. Disconnect steering sensor wiring from main wiring harness.
5. Remove two screws that attach sensor body to steering column assembly and remove steering sensor.

Install

1. Install new sensor and tighten two screws, be careful not to over tighten so as to avoid breaking new sensor.
2. Connect steering sensor wires to main harness.
3. Install steering control handle to test new sensor.
4. Connect battery connector and turn key **ON**.
5. Test new sensor by turning steering control handle. Listen for steering pump motor to ramp up.
6. Remove steering control handle and install all covers and pads.
7. Install steering control handle.

Steering Control Unit (SCU)

DESCRIPTION

The Steering Control Unit (SCU) is the device that controls the hydraulic steering circuit and thereby controls the steering of the lift truck. It does this by controlling the amount of hydraulic oil that flows to the pistons of the steering actuator. The SCU is a rotary pump that is designed to allow the operator to steer the truck to a controlled stop, even if the steering pump motor becomes defective.

INSPECT

Check the SCU for any oil leaks by first turning the control handle from stop to stop to exercise the SCU. Using a clean cloth, wipe the SCU and hose connections. If any oil appears on the cloth then tighten the hose connections. Exercise the SCU again while observing the hose connections for leaking oil. Wipe the SCU again, if any oil has leaked repair the SCU.

A defective SCU may spin freely without pumping any oil, or it may lock up and become very difficult to turn.

REMOVE

Be sure to move the lift truck to a safe, level area before removing the SCU.



WARNING

Make sure the brake pedal is released and the brake is applied. Put blocks on both sides (front and back) of the drive tires to prevent movement of the lift truck.



WARNING

Disconnect the battery, remove the key, and put a DO NOT OPERATE tag on the multi-function control handle as a warning to keep anyone from operating the truck.

For the following procedures, refer to Figure 2.

1. Turn key **OFF** and remove it.
2. Disconnect battery.

3. Remove steering control handle. See Steering Control Handle, Remove.
4. Remove covers and operator pads to allow access to SCU.
5. Tag four hydraulic hoses connected to SCU for correct installation.



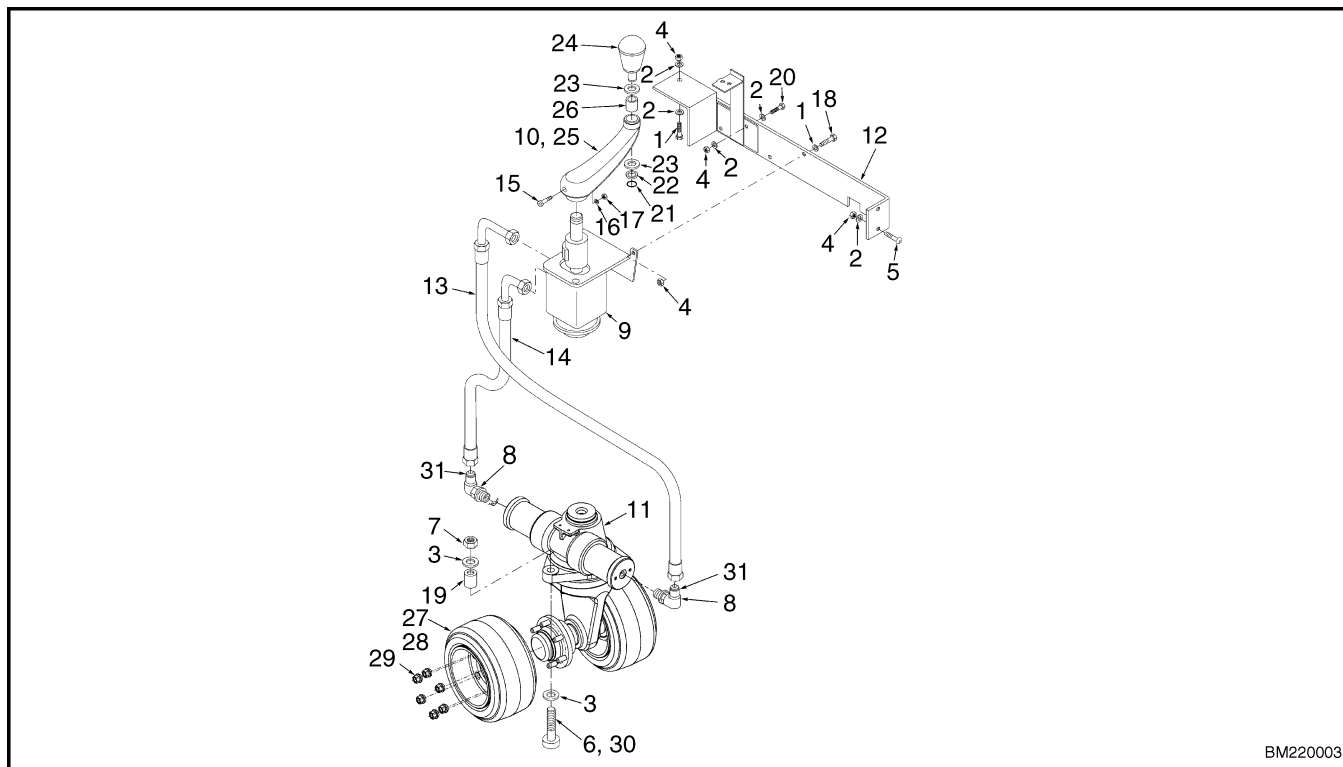
CAUTION

To prevent possible accidents, always clean up any oil spills immediately.

6. Remove four hydraulic hoses. Be sure to plug ports of the SCU and hoses. Clean up any oil that spilled from hoses and SCU.
7. Disconnect steering column sensor wires.
8. Remove two lock nuts that hold SCU assembly (Figure 3) to plate (Figure 2) and discard them.
9. Support SCU assembly with one hand while removing two capscrews and washers.
10. Remove SCU assembly.
11. Drain remaining oil inside SCU into an appropriate container.
12. Place SCU assembly in a soft-jawed vice.
13. Remove two capscrews, lockwashers, and spacers holding bracket to the SCU.
14. Remove bracket.
15. Remove two capscrews and lockwashers holding steer column to SCU.
16. Remove steer column.

REPAIR

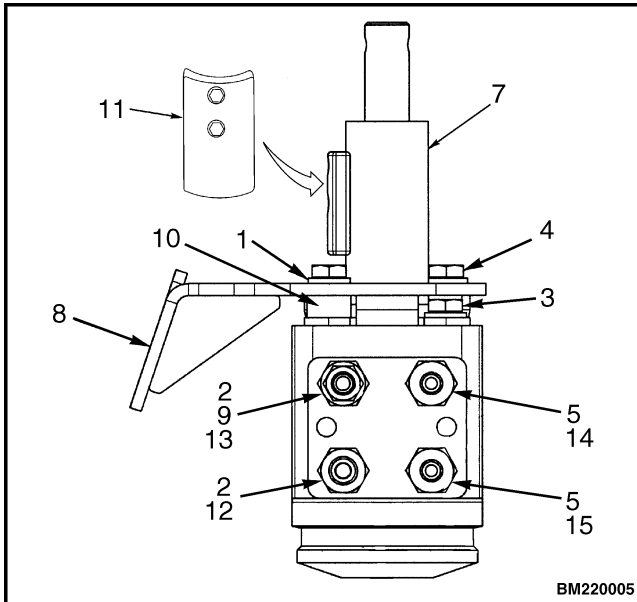
The SCU is a relatively inexpensive device that is not simple to repair. Therefore, it is more cost effective to replace it.



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- | | |
|------------------------------|-----------------------------------|
| 1. CAPSCREW | 17. NUT |
| 2. WASHER | 18. WASHER |
| 3. WASHER | 19. SPACER |
| 4. LOCK NUT | 20. CAPSCREW |
| 5. CAPSCREW | 21. SNAP RING |
| 6. CAPSCREW | 22. WASHER |
| 7. NUT | 23. THRUST WASHER |
| 8. FITTING | 24. KNOB |
| 9. SCU ASSEMBLY | 25. CONTROL HANDLE |
| 10. CONTROL HANDLE | 26. BUSHING |
| 11. ACTUATOR | 27. WHEEL ASSEMBLY |
| 12. PLATE | 28. WHEEL ASSEMBLY |
| 13. LEFT LINE HOSE ASSEMBLY | 29. LUG NUT |
| 14. RIGHT LINE HOSE ASSEMBLY | 30. LOCTITE 242 ADHESIVE SEALANT |
| 15. SCREW | 31. LOCTITE 545 HYDRAULIC SEALANT |
| 16. LOCKWASHER | |

Figure 2. Steering System



1. LOCKWASHER
2. FITTING
3. CAPSCREW
4. CAPSCREW
5. FITTING
6. SCU
7. STEERING COLUMN
8. STEERING BRACKET
9. TUBE
10. SPACER
11. STEERING SENSOR
12. PUMP LINE PORT
13. TANK LINE PORT
14. LEFT LINE PORT
15. RIGHT LINE PORT

Figure 3. Steering Control Unit Assembly

Steering Pump and Motor Assembly

DESCRIPTION

The steering pump and motor are bolted together and then mounted onto the frame of the lift truck and are located under the hydraulic cover.

INSPECT



WARNING

Make sure the brake pedal is released and the brake is applied. Put blocks on both sides (front and back) of the drive tires to prevent movement of the lift truck.

REPLACE

To replace SCU, reverse removal procedure.

1. Install steer column to SCU using two capscrews and lockwashers.
2. Install bracket to SCU using two capscrews and lockwashers.
3. Install SCU assembly to lift truck. Make sure to replace lock nuts with new lock nuts and torque them to 25 N•m (18 lbf ft).



WARNING

The hydraulic hoses MUST be connected to the correct ports and fittings or the steering system will not operate properly. Improper operation can cause damage or personal injury. Make sure the hoses are identified and connected correctly.

4. Install four hydraulic hoses. Refer to Figure 3 and Figure 2 for the correct order of installation.
5. Connect steering column sensor wires.
6. Install steering control handle.
7. Connect battery. Install key and turn it **ON**.
8. Turn control handle from stop to stop to exercise SCU.
9. Inspect steering system for oil leaks.
10. Remove steering control handle and install covers. Then reinstall steering control handle.

5. Check four nuts and bolts that hold pump and motor assembly to frame with your hand. If any are loose, remove them one at a time and clean threads of bolt. Apply Loctite 242 to threads and tighten them. Correct torque is 61 N•m (45 lbf ft).
6. Visually check wires of steering pump for damage. Replace damaged wires or connectors.

REMOVE



WARNING

Make sure the brake pedal is released and the brake is applied. Put blocks on both sides (front and back) of the drive tires to prevent movement of the lift truck.

1. Move lift truck to safe, level area and put blocks under drive wheels to keep them from rolling.
2. Turn ignition key **OFF** and disconnect battery.
3. Remove hydraulic cover to allow access to steering pump and motor.
4. Remove battery to allow access to four capscrews that hold steering pump and motor assembly to frame.



CAUTION

The power steering pump and motor assembly takes hydraulic oil directly from the bottom of the hydraulic tank. Most of the hydraulic oil will drain out of the tank when the hydraulic hoses are removed. To avoid spilling oil, always use a hose clamping plier to close off the hydraulic line before it is disconnected.

5. Place a large drip pan under lift truck below power steering pump and motor.
6. Use hose clamping pliers to close off intake hose to pump.
7. Loosen hose clamp holding intake hose to the pump and remove intake hose. Plug both hose and pump port to prevent dirt from entering system and oil from leaking out.
8. Remove high pressure outlet hose from pump and immediately plug both hose and pump port

to prevent dirt from entering system and oil from leaking out.

9. Mark electrical wires for identification at assembly. Disconnect wires from motor.



WARNING

The power steering pump and motor assembly is heavy, approximately 13.6 kg (30 lb). Be sure that all lifting devices (lifts, cables, chains, slings, etc.) are suitable and of adequate capacity to lift the power steering pump and motor.

10. Install lifting device onto steering pump and motor assembly.
 11. Loosen two bottom capscrews that hold steering pump and motor assembly to frame. See Figure 4.
 12. Remove top two capscrews, nuts, washers, brackets, and rubber channels.
- NOTE:** Inspect rubber channels for wear or damage. Replace any rubber channels if worn or damaged.
13. Remove steering pump and motor assembly and place it on a clean workbench.
 14. Clean up any spilled oil.

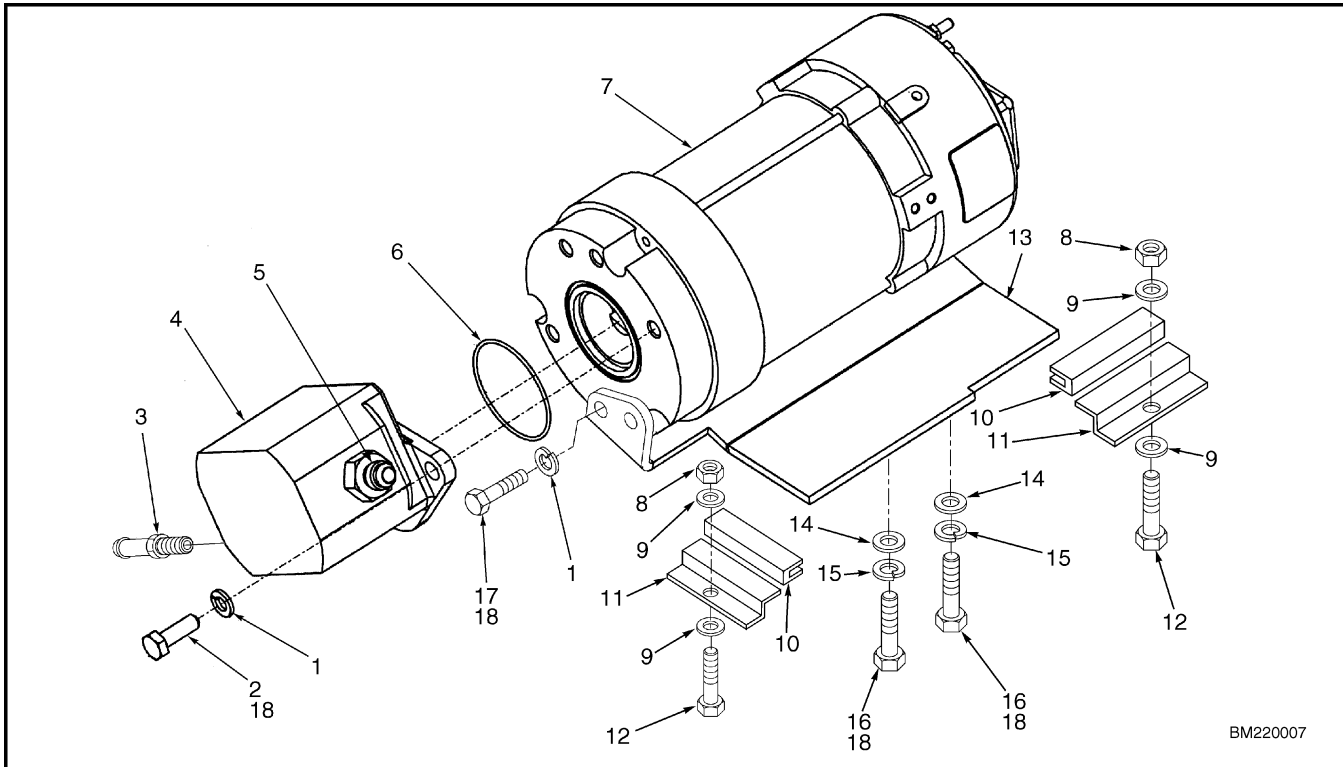
REPAIR

Refer to Figure 4 for following instructions.

Disassembly

Lay steering pump and motor assembly down flat on workbench.

1. If the two hose fittings are to be replaced, they should be replaced before the pump is removed from motor.
2. Remove two capscrews and lockwashers that hold pump to the motor.
3. Remove pump. To repair pump, refer to Power Steering Pump.
4. Remove O-ring.



- | | | |
|-------------------------|--------------------|----------------------------|
| 1. LOCKWASHER | 7. STEER MOTOR | 13. PLATE |
| 2. CAPSCREW | 8. LOCK NUT | 14. WASHER |
| 3. HOSE FITTING, INTAKE | 9. WASHER | 15. LOCKWASHER |
| 4. GEAR PUMP | 10. RUBBER CHANNEL | 16. CAPSCREW |
| 5. HOSE FITTING, OUTLET | 11. BRACKET | 17. CAPSCREW |
| 6. O-RING | 12. CAPSCREW | 18. ADHESIVE, LOCTITE 242™ |

Figure 4. Steering Pump and Motor Assembly

5. Remove four cap screws and lockwashers that hold plate to motor.
6. Remove plate.

The power steering motor is not designed to be repaired and should be replaced if it is malfunctioning.

Assembly

1. Use a wire brush to clean old adhesive off four cap screws that hold plate to motor.
2. Apply Loctite 242 to threads of cap screws.
3. Install plate to motor by installing four cap screws and washers finger tight.
4. Torque two cap screws (16) to 3 N•m (26 lbf in).
5. Torque two cap screws (18) to 15 N•m (11 lbf ft).
6. Install O-ring.
7. Apply moly grease lubricant HCE-38 to pump shaft before assembly.
8. Install pump by aligning pump shaft with motor and screw holes.
9. Apply Loctite 242 to threads of two cap screws (2).
10. Install two cap screws (2) and lockwashers that hold pump to the motor.
11. Torque two cap screws (18) to 15 N•m (11 lbf ft)

INSTALL

1. Put four rubber channels on plate. Make sure rubber channels are flush with outside edges of plate.

**WARNING**

The power steering pump and motor assembly is heavy, approximately 13.6 kg (30 lb). Be sure that all lifting devices (lifts, cables, chains, slings, etc.) are suitable and of adequate capacity to lift the power steering pump and motor.

2. Place power steering pump and motor assembly with two rubber channels in two bottom brackets.
3. Install two upper capscrews and washers through frame.
4. Align plate equally between capscrews.
5. Install upper brackets, washers, and new lock nuts.
6. Torque new lock nuts to 61 N•m (45 lbf ft).

7. Remove plugs from high-pressure outlet port and high-pressure outlet hose.
8. Install high-pressure outlet hose onto pump.
9. Remove plugs from intake port and intake hose.
10. Install intake hose onto pump.
11. Remove hose-clamping pliers.
12. Connect wires to motor.
13. Install battery and turn key ON.

**WARNING**

Always test drive the lift truck in a level, open, safe area. Never test drive it around personnel, buildings, landing docks, and other vehicles.

14. Test power steering pump and motor by carefully driving lift truck in a level, open, safe area. Be sure to turn steering control handle from lock to lock several times.

Power Steering Pump**DESCRIPTION**

The power steering pump is a gear pump that is driven by the power steering motor and provides hydraulic oil to the SCU.

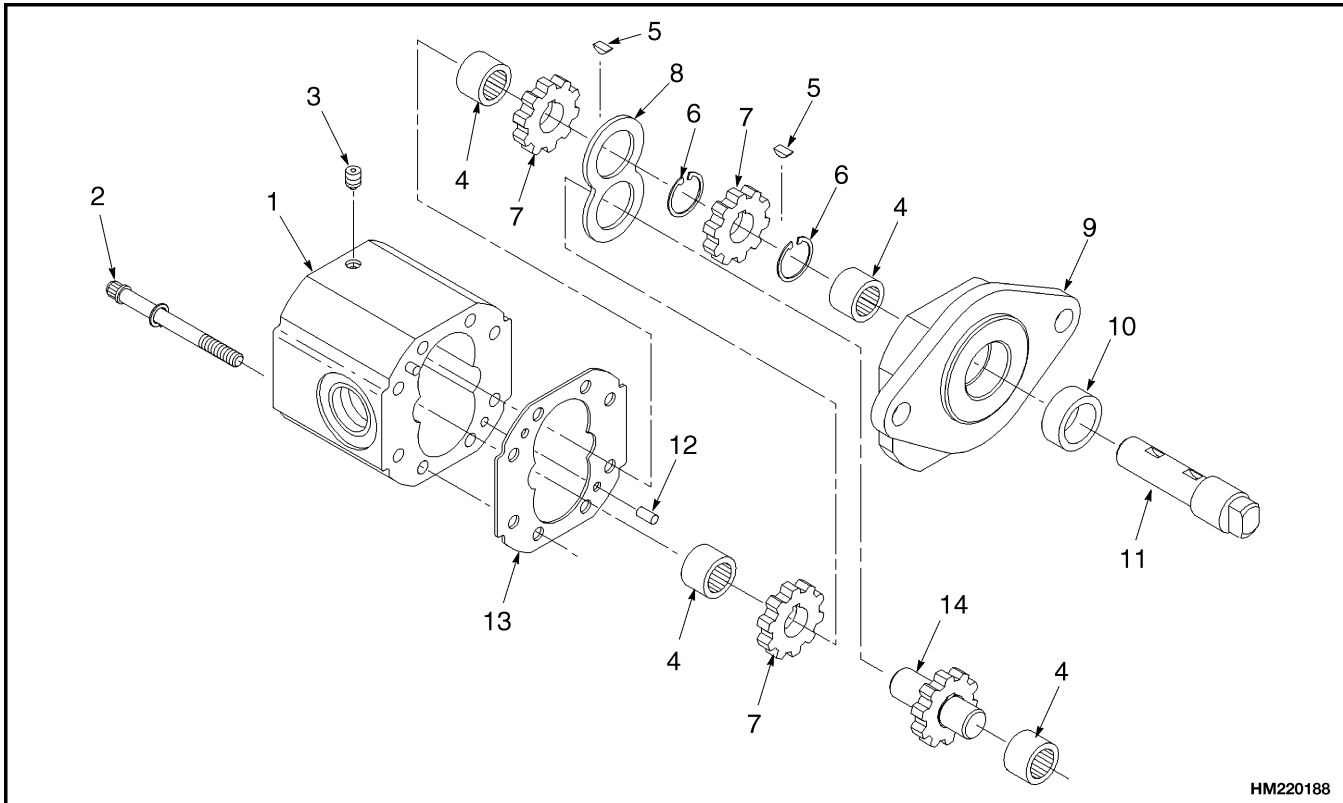
REPAIR**Disassemble**

1. Remove eight capscrews and washers that hold housing and cover together.
2. Carefully separate cover from housing.
3. Remove gears, drive shaft, keys, spacers, idler shaft, and gear.

**WARNING**

Be careful when removing or installing snap rings. Snap rings can come loose during removal or installation with enough force to cause an injury. Always use correct snap ring pliers and wear eye and face protection during removal and installation.

4. Remove snap rings and needle bearings.
5. Clean and inspect needle bearings for damage.
6. Clean and inspect gears, idler shaft, and gear drive shaft for wear or damage.
7. Replace all defective parts.
8. Replace oil seal and joints.



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| 1. HOUSING | 6. SNAP RING | 11. DRIVE SHAFT |
| 2. SCREW | 7. GEAR | 12. GUIDE PIN |
| 3. PLUG | 8. SPACER | 13. GASKET |
| 4. NEEDLE BEARING | 9. COVER | 14. IDLER SHAFT AND GEAR |
| 5. KEY | 10. OIL SEAL | |

Figure 5. Power Steering Pump

Assembly

1. Lubricate all components with clean hydraulic oil before assembly.
2. Install bearings in pump halves.



WARNING

Be careful when removing or installing snap rings. Snap rings can come loose during removal or installation with enough force to cause an injury. Always use correct snap ring pliers and wear eye and face protection during removal and installation.

3. Install snap rings to retain the bearings.
4. Install spacer on shafts.
5. Install remaining two gears.

6. Install oil seal in upper half of pump.
7. Carefully install drive shaft through oil seal and needle bearing.
8. Install keys on drive shaft.
9. Install idler shaft and gear in needle bearing of upper half of housing.
10. Align and install gear on drive shaft and key so it mates with idler gear.
11. Ensure housing and cover are properly aligned and install gasket.
12. Install eight capscrews and washers that hold housing and cover together.

Steer Unit Actuator-Kordel™

DESCRIPTION

The Kordel™ Steer Unit Actuator has a horizontal shaft and gear assembly that extends through the gear housing, which is mounted in the rear of the truck frame. The shaft and gear assembly is rotated by the horizontal movement of a gear rack. The power steering pump feeds hydraulic oil to the steering control unit, which directs the oil to two pistons in the gear housing. These two pistons control the movement of the gear rack.

INSPECT

WARNING

Make sure the brake pedal is released and the brake is applied. Put blocks on both sides (front and back) of the drive tires to prevent movement of the lift truck.

Use the following steps to inspect the steering actuator.

1. Move lift truck to a safe level area and put blocks under drive wheels to keep them from rolling.
2. Turn ignition key **OFF** and disconnect battery.
3. Remove covers and operator pads to allow access to steering actuator.
4. Visually check for oil leaks. See Figure 2.
5. If oil has leaked from one of two hoses, tighten hose connection, wipe area around it with a clean cloth, and monitor it for further leaks. If it continues to leak, replace hose and/or fittings.
6. If oil has leaked from steering actuator, remove and repair actuator.
7. Check three nuts and bolts that hold actuator to frame with your hand. If any are loose then remove them all one at a time and clean threads of bolt. Apply Loctite 242™ to threads and tighten them. Torque nuts to 290 N•m (215 lbf ft).
8. Visually check wires of steering potentiometer for any damage.

REMOVE

WARNING

The steering actuator and wheels are heavy. They weigh approximately 68 kg (150 lb). Be sure that all lifting devices (lifts, cables, chains, slings, etc.) are suitable and of adequate capacity to lift the steering actuator and wheels.

WARNING

Make sure the brake pedal is released and the brake is applied. Put blocks on both sides (front and back) of the drive tires to prevent movement of the lift truck.

CAUTION

Removal of the steering actuator is a two-person job. The three nuts and bolts that hold the actuator to the frame are difficult to remove without help.

Use the following steps to remove the steering actuator.

1. Move lift truck to a safe level area and put blocks under drive wheels to keep them from rolling.
2. Turn ignition key **OFF** and disconnect battery.
3. Use a vehicle jack to lift steer wheels off the ground and carefully brace it using two jack stands.
4. Remove covers and operator pads to allow access to steering actuator.
5. Disconnect steering potentiometer wires from main wiring harness.
6. Remove steering potentiometer, setscrew, bolt, bracket, nut, and special fitting. See Figure 7.
7. Remove floor pad, plate, and shield. See Floor Plates and Covers.

NOTE: Do not remove the overhead guard unless it is absolutely necessary.

8. Depending upon type of lifting device, it may be necessary to remove overhead guard to allow access to steering actuator. See Overhead Guard.

**CAUTION**

The steering actuator removal tool is designed to be used to remove the Kordel™ steering unit only. It should not be used for any other purpose.

9. Install steering actuator removal tool. See Figure 6.
10. Hand tighten capscrew only. No threads should be visible.
11. Install lifting tool to lifting device.

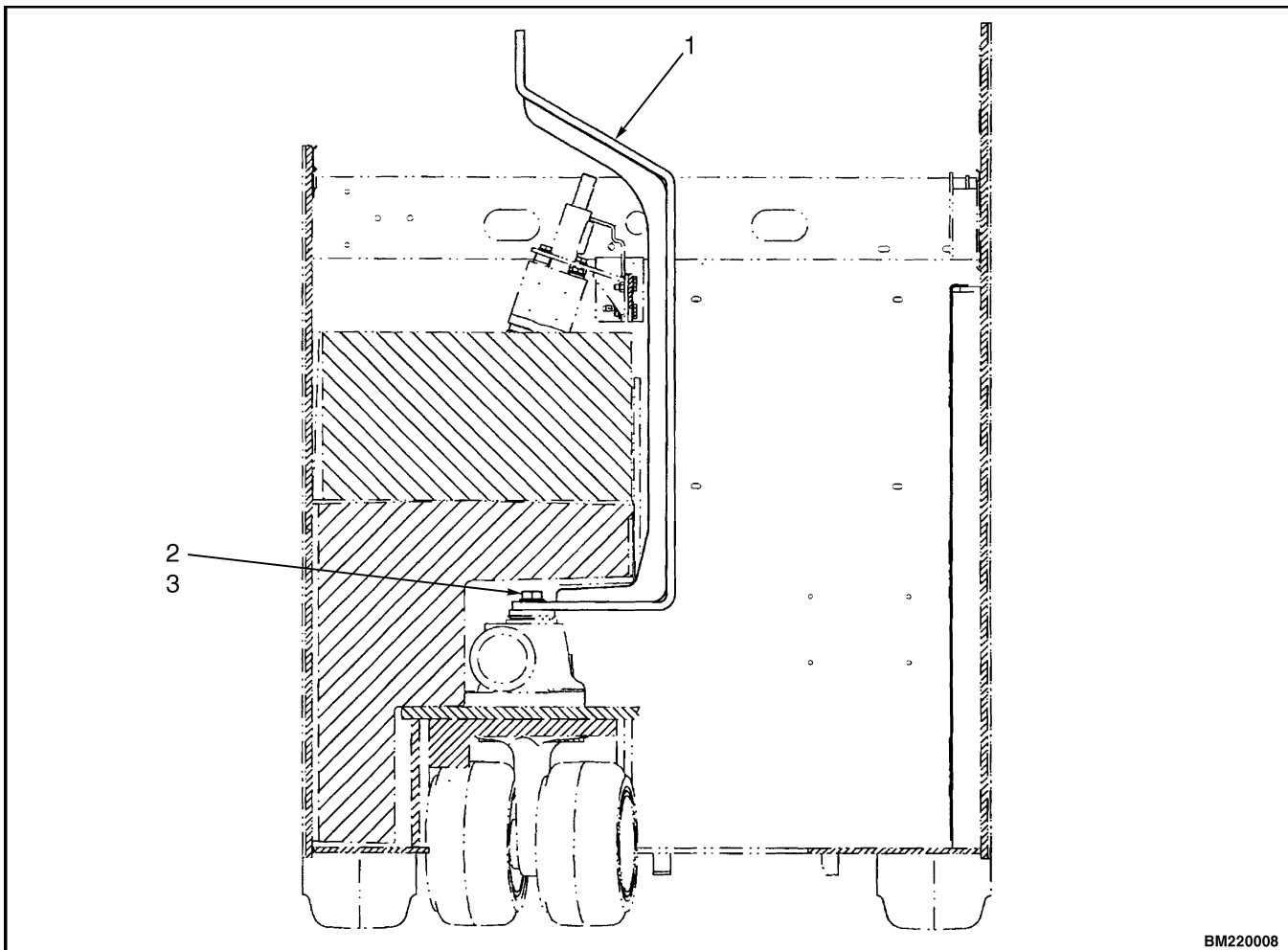
12. Remove three nuts and bolts that hold actuator to frame. Carefully inspect bolts. If they show any sign of damage or wear, replace them with recommended replacement bolts only.

13. Remove steering actuator by lifting and rotating it.

NOTE: Once the steering actuator is removed, it is much easier to remove and replace the wheels, and they should be inspected at this time.

14. Remove wheels.

15. Place steering actuator on clean workbench.



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1. LIFTING TOOL

2. CAPSCREW

3. WASHER

Figure 6. Steering Actuator Removal Tool

REPAIR

Refer to Figure 7 for the following instructions.

Disassemble

1. Unscrew cylinder from gear housing. Remove O-ring from gear housing.
2. Remove piston from inside cylinder.
3. Remove two piston guideways and compact seal from piston.
4. Remove eight capscrews that fasten yoke assembly and gear housing shaft assembly. Separate shaft assembly from yoke assembly.
5. Remove protection cover from end of yoke shaft. Remove cotter pin, nut, and U-disc.
6. Remove assembled wheel hub from end of the yoke shaft.
7. Remove nilos ring from yoke shaft.
8. Remove nut, washer, shims, nilos ring, and bearings from flange shaft.
9. Remove flange shaft from gear housing.
10. Remove bearing and nilos ring from flange shaft.
11. Slide gear rack out of gear housing. Remove liners from each end of gear housing.
12. Remove safety ring, shaft seals, and bearing raceway from top and bottom opening of gear housing if necessary.

Clean



WARNING

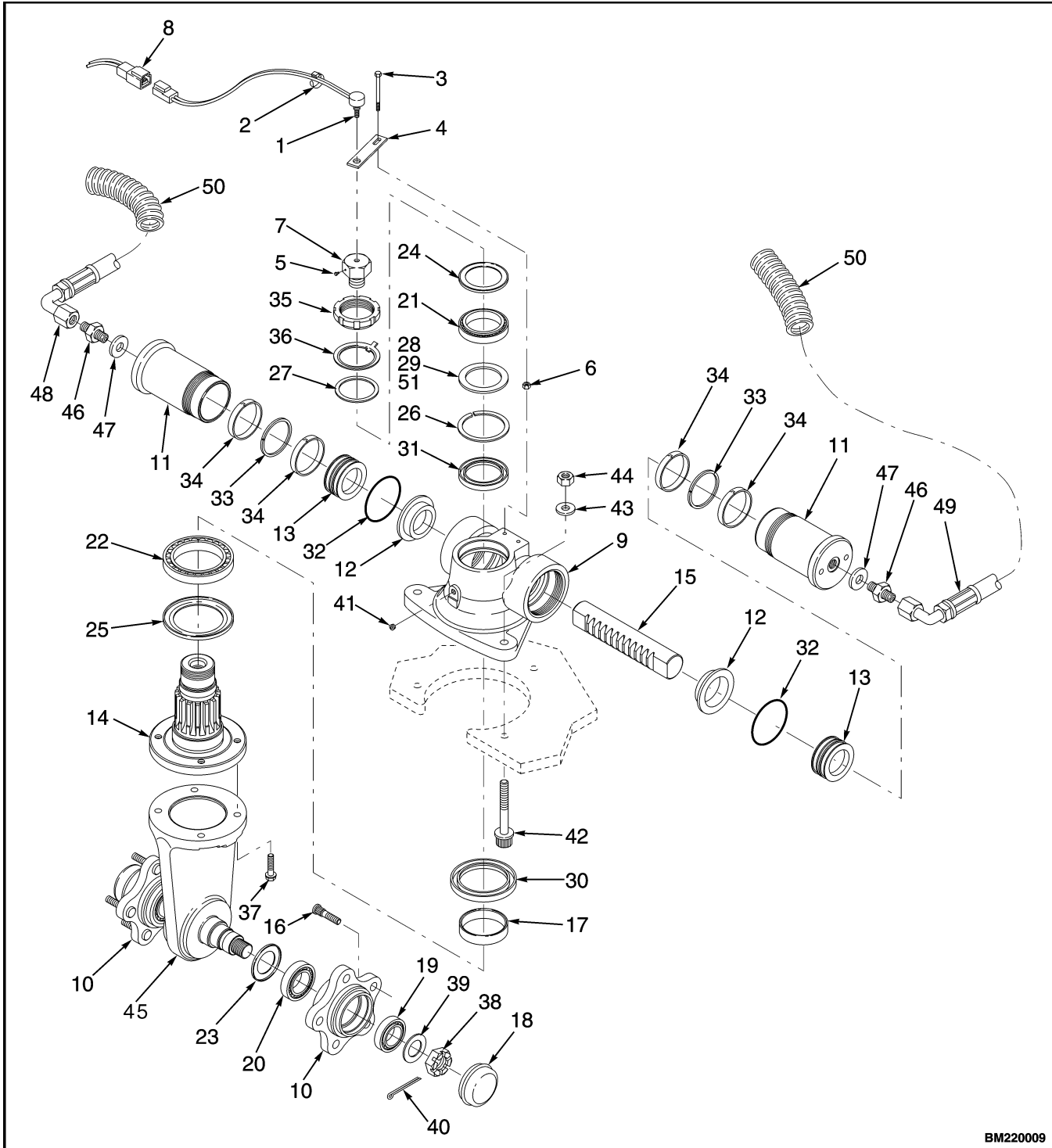
Cleaning solvents can be flammable and toxic, and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety precautions and procedures.

Clean all parts in solvent. Dry the parts with compressed air. Do not dry parts with a cloth. Make sure all surfaces are free of scratches and sharp edges.

Assemble

NOTE: Use new seals and O-rings during assembly. Lubricate all parts with clean hydraulic oil.

1. Install shaft seal and bearing raceway into bottom of gear housing.
2. Install safety ring in groove at the top of the gear housing. Install shaft seal into top of gear housing.
3. Install liners into each end of gear housing. Install gear rack through both liners in gear housing, making sure middle groove of gear rack is located in middle of gear housing.
4. Fill nilos ring with grease and position ring over flange shaft. Press bearing on flange shaft.
5. Install flange shaft through gear housing. Install selected shims, bearing, nilos ring, additional shims, washer, and nut over end of flange shaft.
6. Install five wheel bolts into each of wheel hubs. Press the bearings into each end of wheel hubs. Fill nilos ring with grease and place it over yoke shaft. Install assembled wheel hub over yoke shaft. Fill inside area of wheel hub with grease.
7. Install U-disc and nut over end of the yoke shaft. Tighten nut firmly and secure assembly in place with cotter pin. Install protection cover over end of yoke shaft.
8. Assemble yoke assembly to gear housing with shaft assembly. A pressed pin in yoke will help to properly align two assemblies. Fasten two assemblies together with four capscrews.
9. Install two piston guideways and a compact seal over piston. Install piston into cylinder and push piston to the end of cylinder.
10. Fill cylinder with 125 cm³ (7.63 in.³) of grease.
11. Apply a light film of hydraulic oil on cylinder and O-ring. Install O-ring into gear housing on top of liners. Screw cylinder into the end of gear housing.
12. Operate unit by hand several times to be sure it works smoothly. Install plug screw into gear housing.



BM220009

Figure 7. Steering Actuator Assembly

Legend for Figure 7

- | | | |
|------------------|-------------------|----------------|
| 1. POTENTIOMETER | 18. BEARING COVER | 35. NUT |
| 2. STRAP CLAMP | 19. BEARING | 36. WASHER |
| 3. BOLT | 20. BEARING | 37. SCREW |
| 4. BRACKET | 21. BEARING | 38. NUT |
| 5. NUT | 22. BEARING | 39. SEAL |
| 6. SETSCREW | 23. SEAL | 40. SPLIT PIN |
| 7. FITTING | 24. SEAL | 41. PLUG SCREW |
| 8. WIRE HARNESS | 25. SEAL | 42. BOLT |
| 9. HOUSING | 26. SAFETY RING | 43. WASHER |
| 10. WHEEL HUB | 27. SHIM | 44. NUT |
| 11. CYLINDER | 28. SHIM | 45. YOKE |
| 12. BUSHING | 29. SHIM | 46. FITTING |
| 13. PISTON | 30. SHAFT SEAL | 47. WASHER |
| 14. SHAFT | 31. SHAFT SEAL | 48. HOSE |
| 15. GEAR RACK | 32. O-RING | 49. HOSE |
| 16. WHEEL BOLT | 33. COMPACT SEAL | 50. GUARD |
| 17. BUSHING | 34. GUIDE RING | 51. SHIM |

INSTALL**WARNING**

The steering actuator and wheels are heavy, they weigh approximately 68 kg (150 lb). Be sure that all lifting devices (lifts, cables, chains, slings, etc.) are suitable and of adequate capacity to lift the steering actuator and wheels.

**CAUTION**

Installation of the steering actuator is a two-person job. The three nuts and bolts that hold the actuator to the frame are too difficult to install without help.

Use the following steps to install the steering actuator.

NOTE: When installing the wheels, make sure the wheel mounting nut hole chamfers face outward. See Figure 8.

1. Install wheels onto steering actuator.
2. Install lug nuts and torque to 81 N•m (60 lbf ft).
3. Install steering actuator removal tool onto steering actuator. See Figure 6.
4. Lower steering actuator onto truck frame using lifting device.
5. Align holes on frame with holes on steering actuator.
6. Apply Loctite 242™ to threads of bolts and insert them into holes.
7. Install nuts and torque them to 290 N•m (215 lbf ft).
8. Install special fitting, bolt, bracket, nut, setscrew, and steering potentiometer.
9. Connect steering potentiometer wires to main wiring harness.
10. Apply hydraulic sealant to hydraulic hose by following these steps.
 - a. Wipe threads clean to remove oil, grease, dirt, or excess metal scraps.
 - b. If cleaner and/or primer is used, allow fittings to dry.
 - c. Fill second and third threads (approximately 2 drops) completely for 360°. Wipe off any excess sealant on seat part of fitting.
 - d. For system cleanliness, do not fill the leading thread.

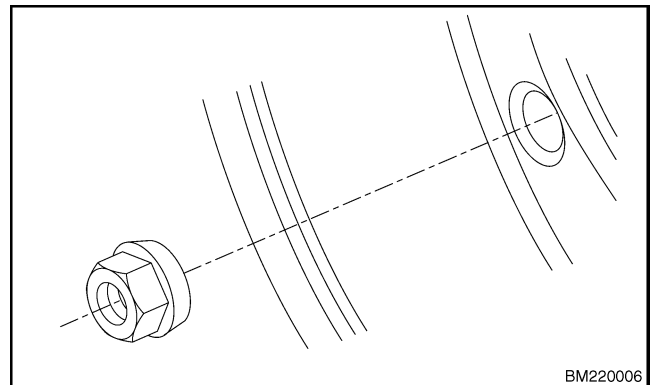


Figure 8. Wheel and Lug Nut Installation