SERVICE REPAIR

MANUAL

Hyster D001 (H1.50XM H1.75XM H2.00XMS Europe) Forklift

HYSTER

SAFETY PROCEDURES WHEN WORKING NEAR THE MAST

The following procedures must be used when inspecting or working near the mast. Additional precautions and procedures can be required when repairing or removing the mast. See the correct Service Manual section for the specific mast being repaired.

⚠ WARNING **Mast parts are heavy and can move. Distances between parts are small. Serious injury or death can result if part of the body is hit by parts of the mast or the carriage.**

- **Never put any part of the body into or under the mast or carriage unless all parts are completely lowered or a safety chain is installed. Also make sure that the power is off and the key is removed. Put a "DO NOT OPERATE" tag in the operator's compartment.**
- **Be careful of the forks. When the mast is raised, the forks can be at a height to cause an injury.**
- **DO NOT climb on the mast or lift truck at any time. Use a ladder or personnel lift to work on the mast.**
- **DO NOT use blocks to support the mast weldments nor to restrain their movement.**
- **Mast repairs require disassembly and removal of parts and can require removal of the mast or carriage. Follow the repair procedures in the correct Service Manual for the mast.**

WHEN WORKING NEAR THE MAST ALWAYS:

- Lower the mast and carriage completely. Push the lift/lower control lever forward and make sure there is no movement in the mast. Make sure that all parts of the mast that move are fully lowered.

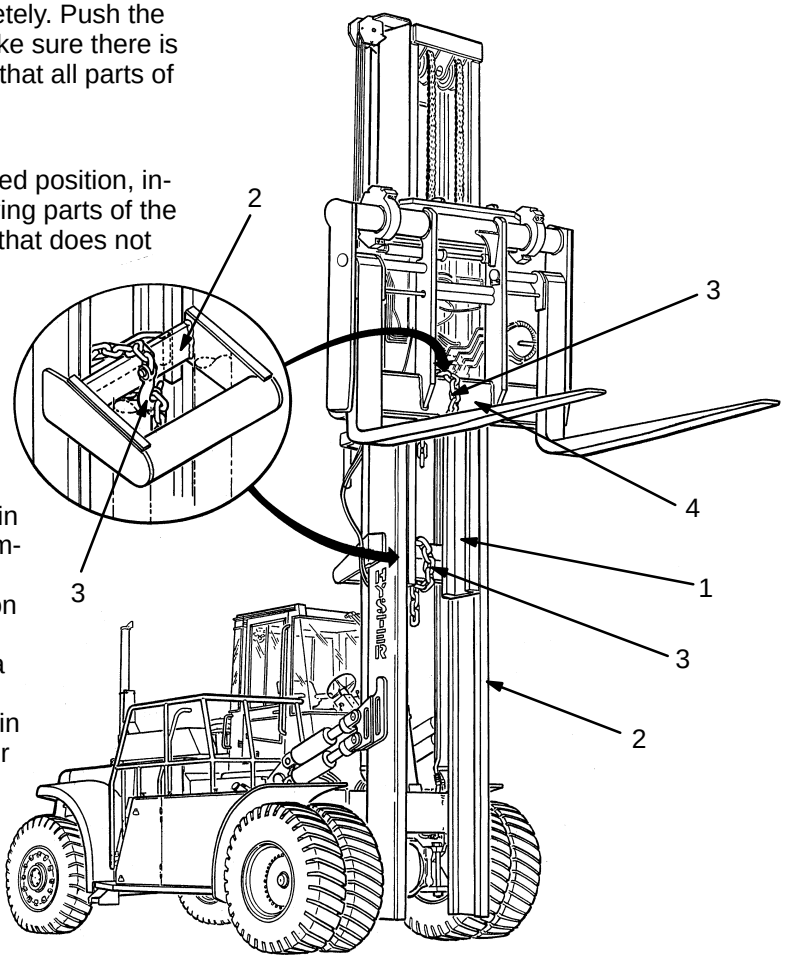
OR

- If parts of the mast must be in a 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 crossmember of the inner weldment (1) with a crossmember on the outer weldment (2).

c. Use a 1/2 inch minimum safety chain with a hook (3) to fasten the crossmembers together so that the movable member can not lower. Put the hook on the back side of the mast. Make sure the hook is completely engaged with a link in the chain. Make sure the safety chain does not touch lift chains or chain sheaves, tubes, hoses, fittings or other parts on the mast.



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

e. Install another safety chain (1/2 inch minimum) between the top or bottom crossmember of the carriage (4) and a crossmember on the outer weldment.

- Apply the parking brake. After lowering or restraining the mast, shut off the power and remove the key. Put a **"DO NOT OPERATE"** tag in the operator's compartment.

SAFETY PROCEDURES WHEN WORKING NEAR THE MAST

The following procedures must be used when inspecting or working near the mast. Additional precautions and procedures can be required when repairing or removing the mast. See the correct Service Manual section for the specific mast being repaired.

⚠ WARNING **Mast parts are heavy and can move. Distances between parts are small. Serious injury or death can result if part of the body is hit by parts of the mast or the carriage.**

- **Never put any part of the body into or under the mast or carriage unless all parts are completely lowered or a safety chain is installed. Also make sure that the power is off and the key is removed. Put a "DO NOT OPERATE" tag in the operator's compartment.**
- **Be careful of the forks. When the mast is raised, the forks can be at a height to cause an injury.**
- **DO NOT climb on the mast or lift truck at any time. Use a ladder or personnel lift to work on the mast.**
- **DO NOT use blocks to support the mast weldments nor to restrain their movement.**
- **Mast repairs require disassembly and removal of parts and can require removal of the mast or carriage. Follow the repair procedures in the correct Service Manual for the mast.**

WHEN WORKING NEAR THE MAST ALWAYS:

- Lower the mast and carriage completely. Push the lift/lower control lever forward and make sure there is no movement in the mast. Make sure that all parts of the mast that move are fully lowered.

OR

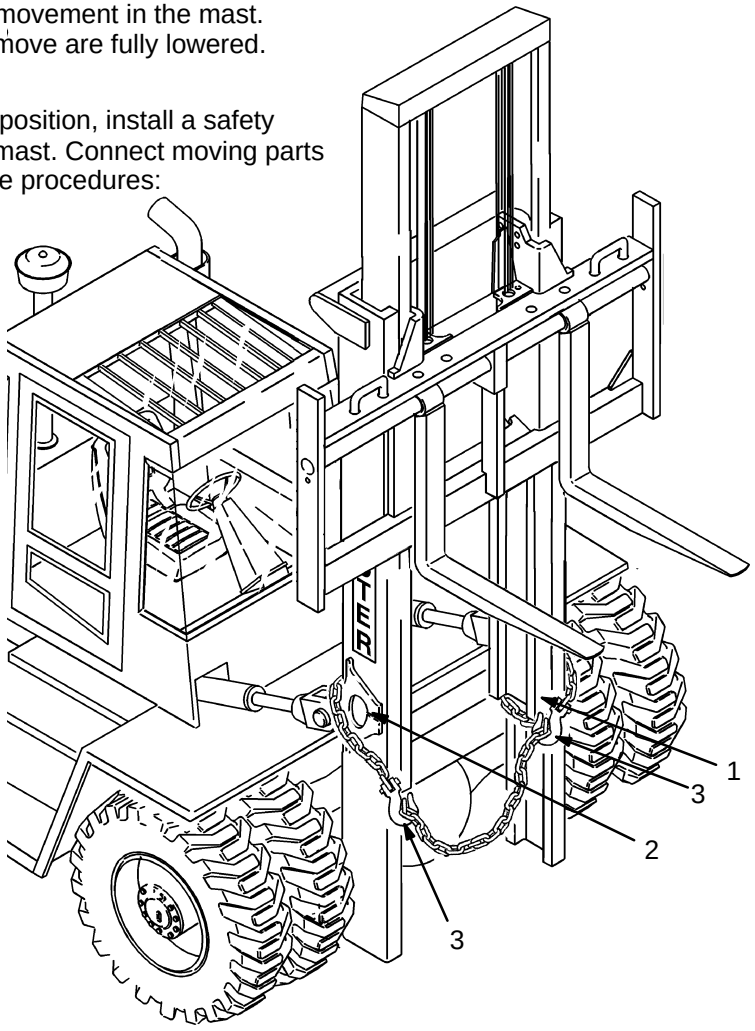
- If parts of the mast must be in a raised position, install a safety chain to restrain the moving parts of the mast. Connect moving parts to a part that does not move. Follow these procedures:

a. Put the mast in a vertical position.

b. Raise the mast to align the bottom of the inner weldment (1) to below the anchor for the tilt cylinders (2).

c. Use a $^1/_2$ inch minimum safety chain with a hook (3) to fasten the weldmentss together so that the inner weldment can not 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.



SAFETY PROCEDURES WHEN WORKING NEAR THE MAST (1 of 2)

The following procedures must be used when inspecting or working near the mast. Additional precautions and procedures can be required when repairing or removing the mast. See the correct Service Manual section for the specific mast being repaired.

⚠ WARNING

Mast parts are heavy and can move. Distances between parts are small. Serious injury or death can result if part of the body is hit by parts of the mast or the carriage.

- **Never put any part of the body into or under the mast or carriage unless all parts are completely lowered or a safety chain is installed. Also make sure that the power is off and the key is removed. Put a "DO NOT OPERATE" tag in the operator's compartment.**
- **Be careful of the forks. When the mast is raised, the forks can be at a height to cause an injury.**
- **Do NOT climb on the mast or lift truck at any time. Use a ladder or personnel lift to work on the mast.**
- **Do NOT use blocks to support the mast weldments nor to restrain their movement.**
- **Mast repairs require disassembly and removal of parts and can require removal of the mast or carriage. Follow the repair procedures in the correct SERVICE MANUAL section for the mast.**

WHEN WORKING NEAR THE MAST ALWAYS:

- Lower the mast and carriage completely. Push the lift/lower control lever forward and make sure there is no movement in the mast. Make sure that all parts of the mast that move are fully lowered.

OR

- If parts of the mast must be in a 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.

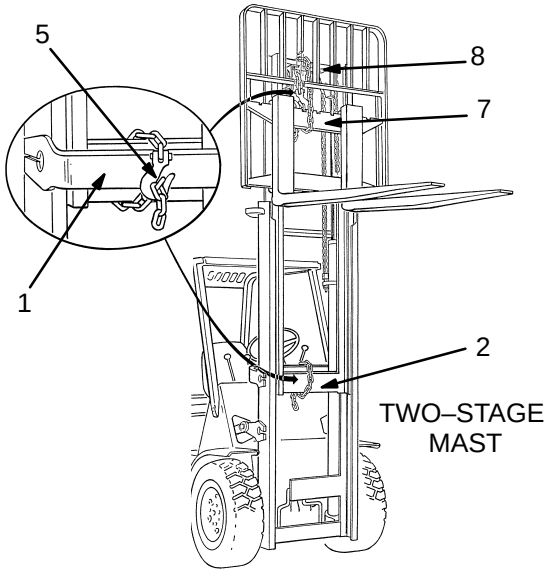
b. Raise the mast to align the bottom crossmember of the weldment that moves in the outer weldment with a crossmember on the outer weldment (1). On the two–stage and free–lift mast, the moving part is the inner weldment (2). On the three–stage mast it is the intermediate weldment (3). On the four–stage mast it is the first intermediate weldment (4).

c. Use a 3/8 inch minimum safety chain with a hook (5) to fasten the crossmembers together so that the movable member can not lower. Put the hook on the back side of the mast. Make sure the hook is completely engaged with a link in the chain. Make sure the safety chain does not touch lift chains or chain sheaves, tubes, hoses, fittings or other parts on the mast.

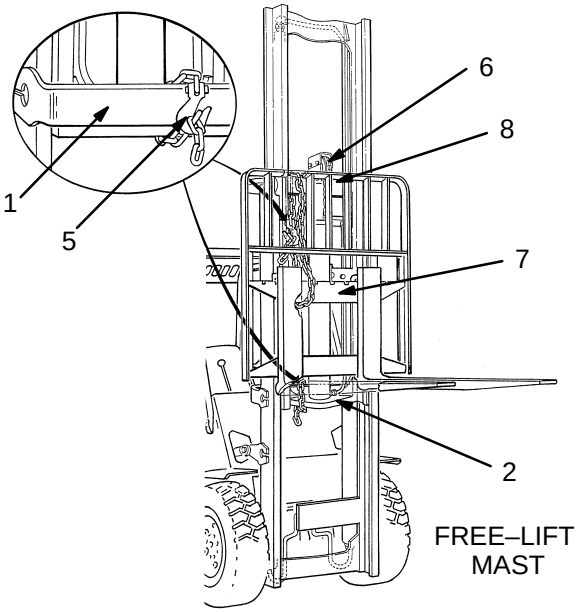
d. Lower the mast until there is tension in the safety chain and the free–lift cylinder (6) (free–lift and three–stage masts only) is completely retracted. If the engine is running, stop the engine. Apply the parking brake. Install a **"DO NOT REMOVE"** tag on the safety chain(s).

e. Install another safety chain (3/8 inch minimum) between the top or bottom crossmember of the carriage (7) and a crossmember on the outer weldment (8).

- Apply the parking brake. After lowering or restraining the mast, shut off the power and remove the key. Put a **"DO NOT OPERATE"** tag in the operator's compartment.

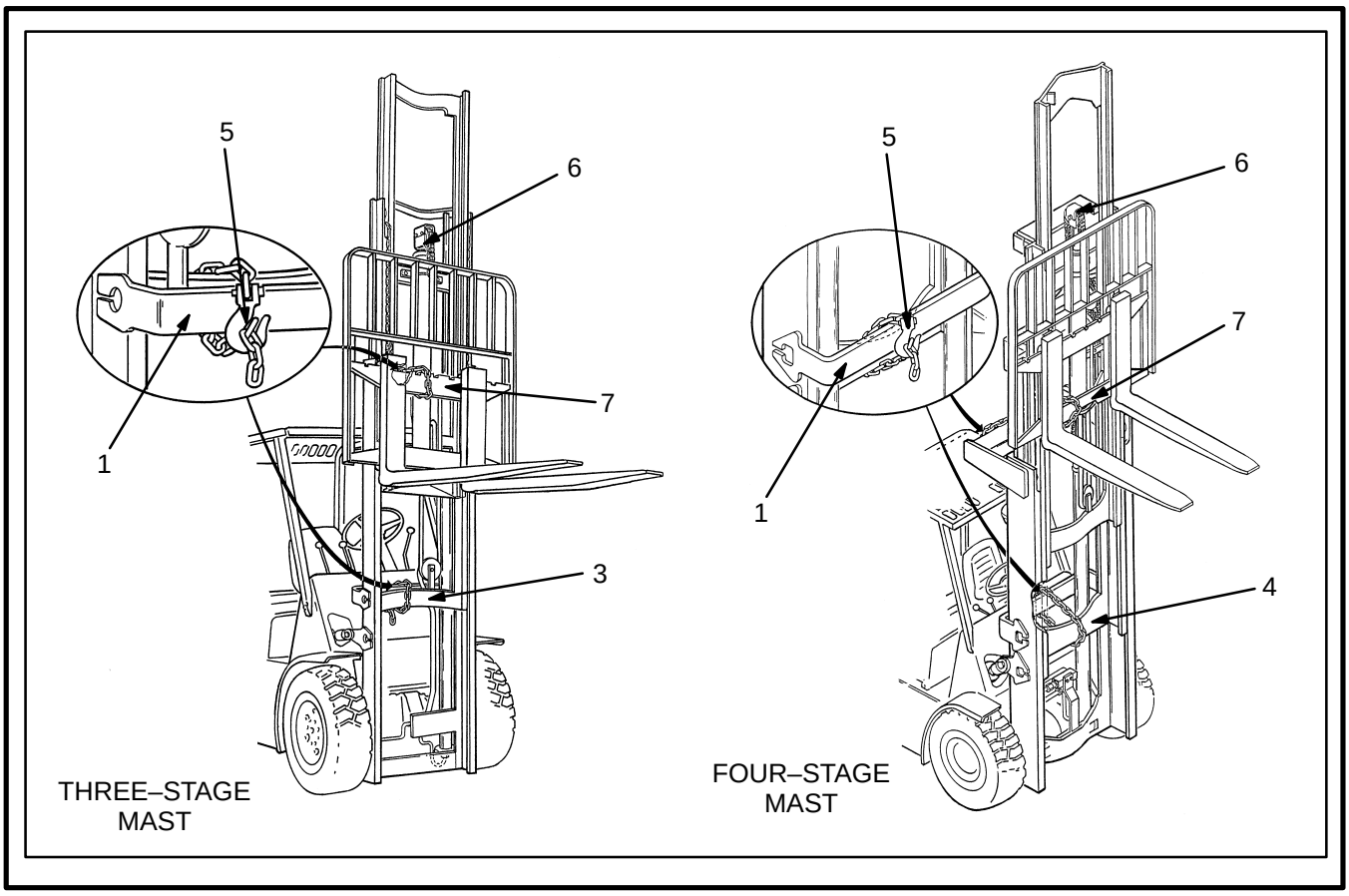


TWO–STAGE MAST



FREE–LIFT MAST

SAFETY PROCEDURES WHEN WORKING NEAR THE MAST (2 of 2)



LIFT CYLINDERS

GENERAL

This section has the description for lift cylinders used in masts and the instructions for their repair. There are many different sizes of lift cylinders used in Hyster Company lift trucks. The operation and repair procedures for the different lift cylinders are similar. The illustrations in this section are for typical lift cylinders. All of the variations in lift cylinders used in lift trucks are not shown. A section for Lift Cylinders For VISTAR Masts is included later in this section.

DESCRIPTION (See FIGURE 1.)

All lift cylinders are single acting 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 retracts the piston rod.

The most common maintenance problem is the repair of oil leaks from the seals and wiper around the piston rod. The most common problem is damage to the shell of the lift cylinder. If the damage cannot be removed with a hone, the lift cylinder must be replaced.

Lowering Control Valve

A lowering control valve is installed in the inlet port. (See FIGURE 2.) It permits easy entry of hydraulic oil into the cylinder, but gives a restriction when the rod is retracted. This restriction gives limits to the speed that a load on the forks can be lowered.

There are two types of lowering control valves. Both types have the same function and similar operation. The most common type of valve has a design that has good operation using large flows and lower pressures. Some lift truck have a lift system design using higher pressures and a lower flow. These systems need a different type of lowering control valve.

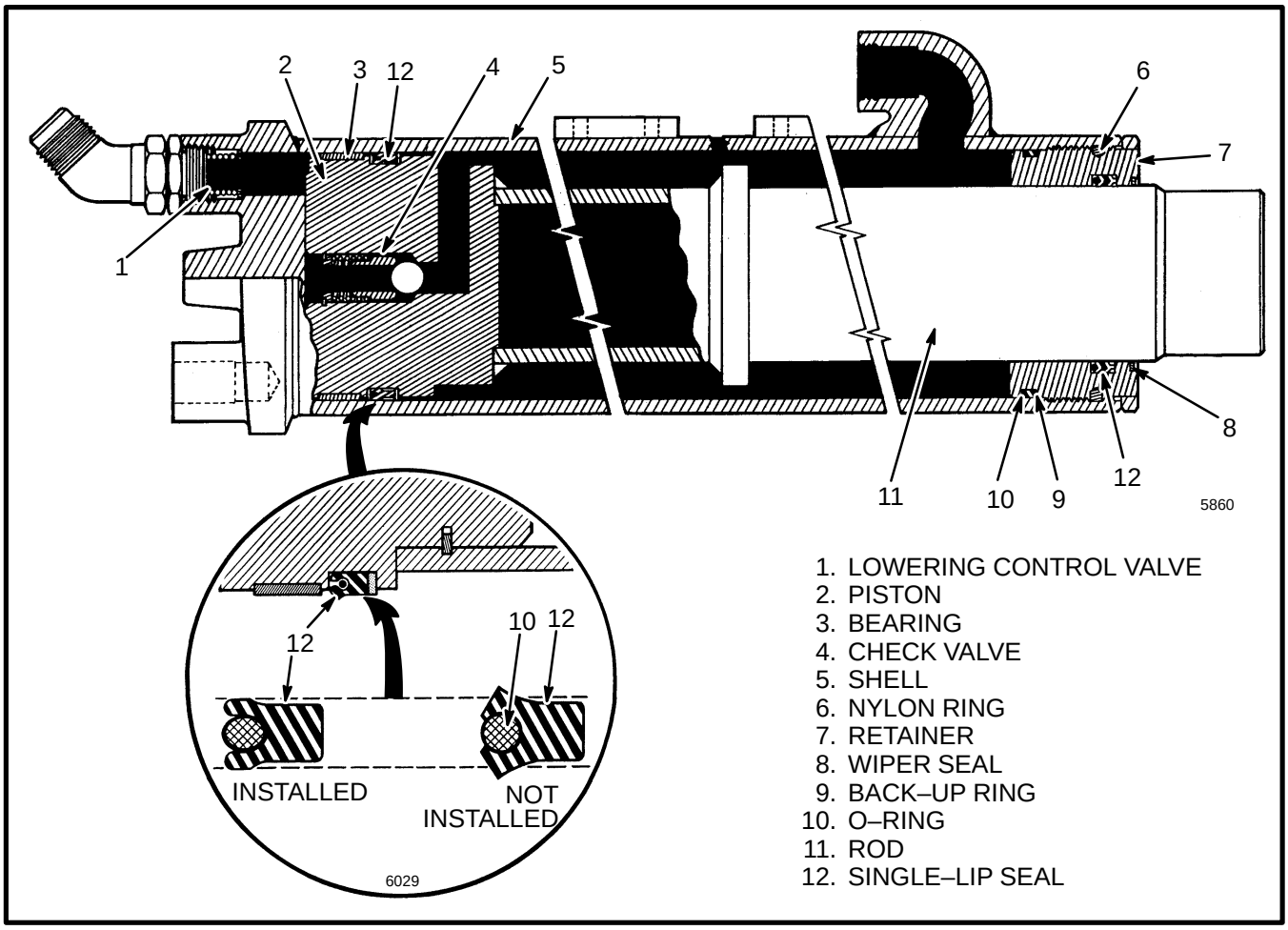


FIGURE 1. LIFT CYLINDER, TWO–SPEED

The most common type of lowering control valve uses these parts: (1) a special fitting for the valve body, (2) a spring and (3) a special washer. There is a variation in the shapes of the special washer. Different lift cylinders use different shapes of special washers. The volume of the hydraulic oil flowing through the inlet port controls the shape of the special washer. (A typical shape of a special washer is shown in FIGURE 2.) When the piston rod is lowered, the oil flow pushes against the special washer and spring. When the oil flow reaches the limit, the special washer is moved against the special fitting. The oil then flows only through the hole in the center of the special washer. This restriction permits the piston rod to lower only at a maximum controlled speed.

The other type of lowering control valve uses these basic parts: (1) valve body, (2) spring, (3) washer, (4) cylinder, (5) orifice sleeve, (6) plunger and (7) main sleeve. The orifice sleeve position is controlled completely by oil flow. The plunger position is controlled by oil pressure and spring tension. During lifting, oil entering the lift cylinder goes through the center of the main sleeve to the large holes. The oil flow through the plunger and bore moves the orifice sleeve to the end of the plunger. The flange of the orifice sleeve is then aligned with the large part of the bore in the body. This alignment lets the oil flow past the orifice sleeve to the cylinder.

During lowering, oil from the lift cylinder moves the orifice sleeve. The orifice sleeve moves away from the larger inner diameter area of the bore in the valve body. This movement makes a restriction to the oil flow. As the pressure increases, the plunger begins to move against the spring. The movement begins to close the openings of the large holes in the main sleeve. Additional pressure will push the plunger against the main sleeve to close the large holes completely. All the oil must then go through the small holes to the center of the main sleeve. This restriction permits the piston rod to lower only at a maximum controlled speed.

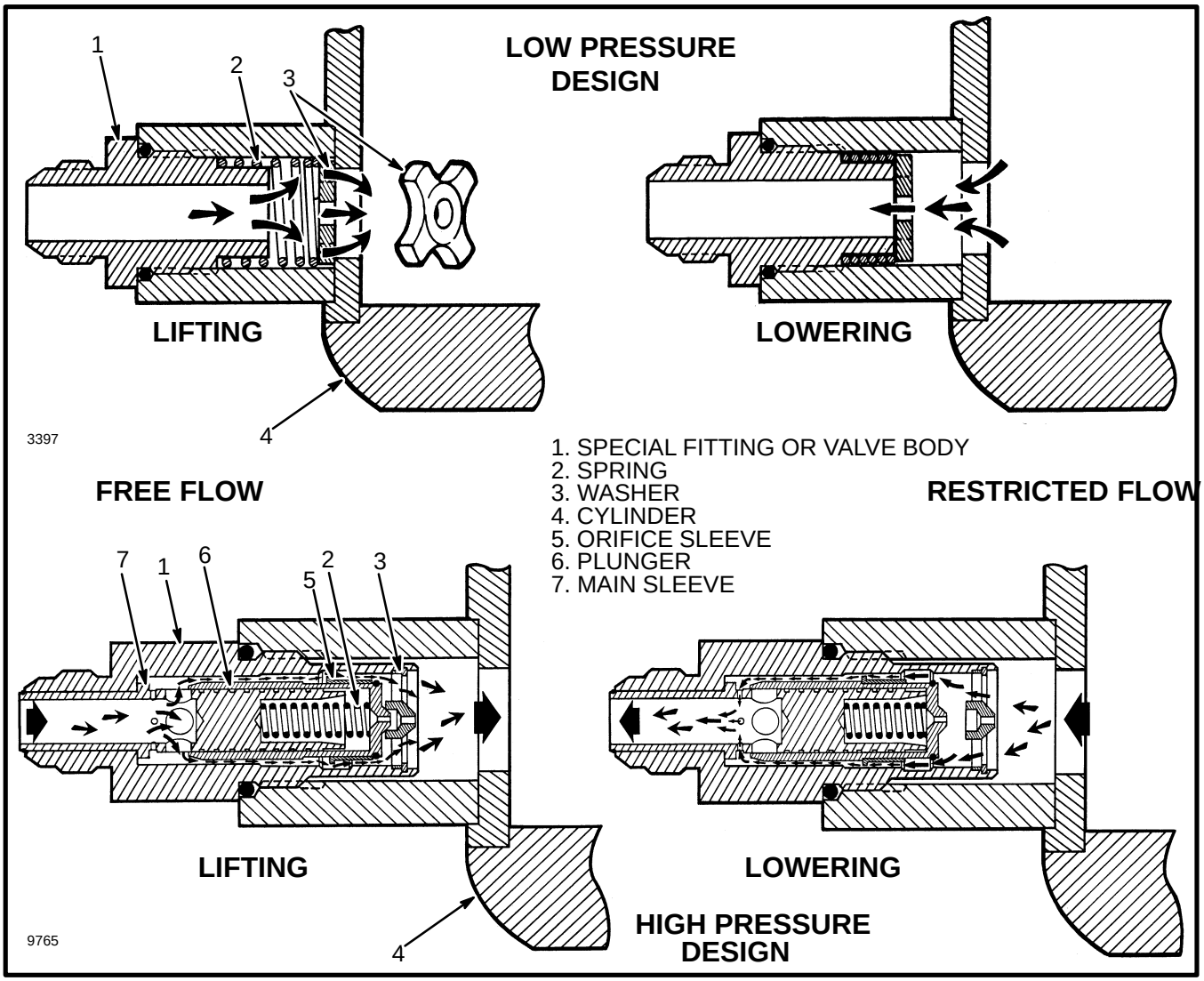


FIGURE 2. LOWERING CONTROL VALVES

Cylinders (General)

Standard masts use a single–stage lift cylinder. Most three–stage and four–stage masts use two single–stage lift cylinders. A single–stage lift cylinder has one piston rod. See FIGURE 3.

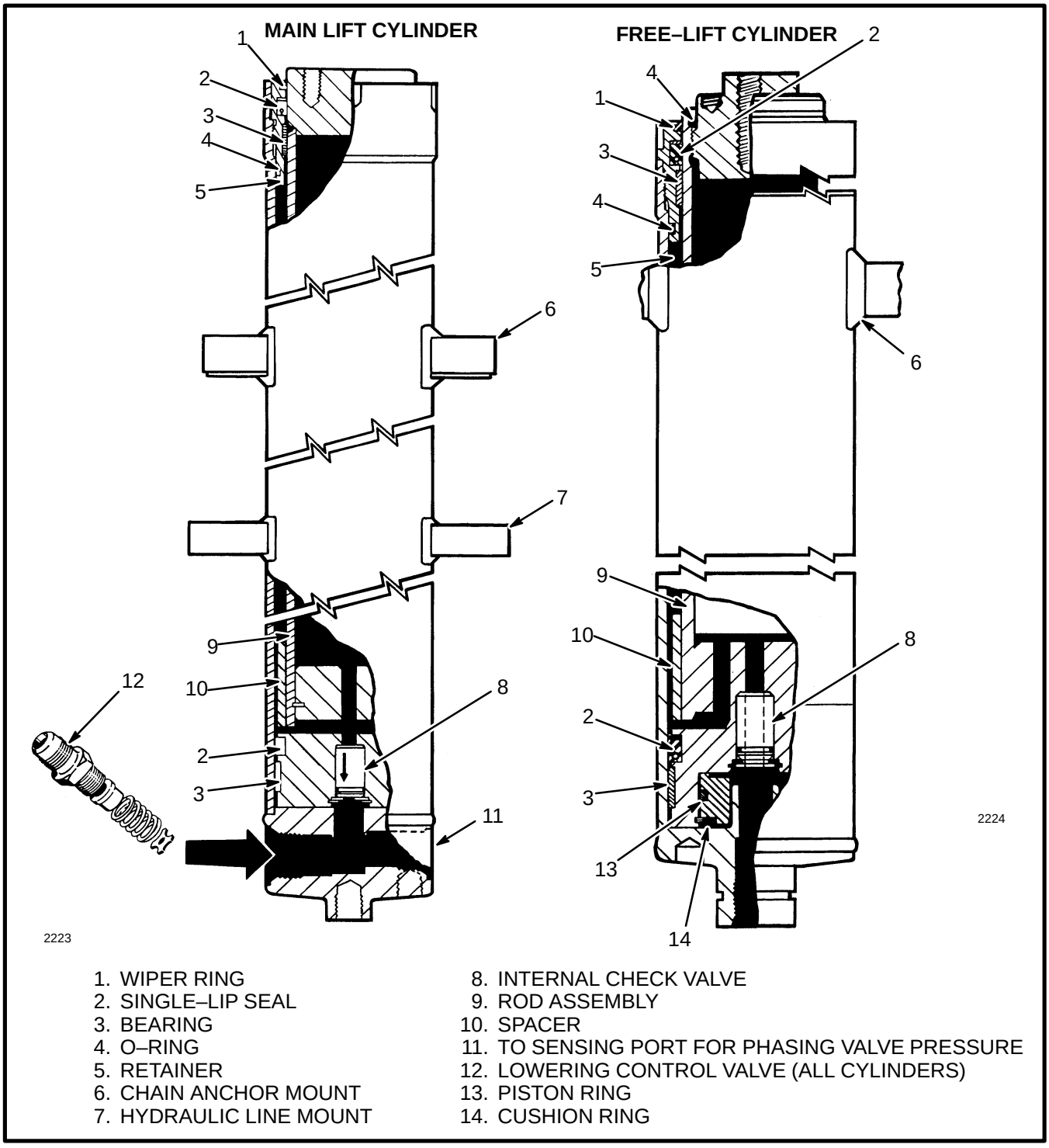
Most full free–lift masts and some three–stage masts use a two–stage lift cylinder. A two–stage lift cylinder has two telescopic piston rods. See FIGURE 4. The two–stage lift cylinder operates similar to a one–stage lift cylinder. Hydraulic pressure pushes the primary (larger) piston rod from the cylinder first because it has a larger diameter. The secondary piston rod moves with the primary piston rod. When the primary piston rod reaches the limit of its stroke, the secondary piston rod extends from the primary piston rod.

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

Most of the lift cylinders use a single–lip seal assembly to prevent hydraulic oil leaks past the piston and past the retainer. See FIGURE 1. There are many lift cylinders in use that have an older design chevron packing. The chevron packing can be replaced with a seal kit that has the newer single lip seal and an adaptor. There are no replacements of single lip seals for chevron packing for lift trucks over 7 000 kg (15 000 lb) capacity.

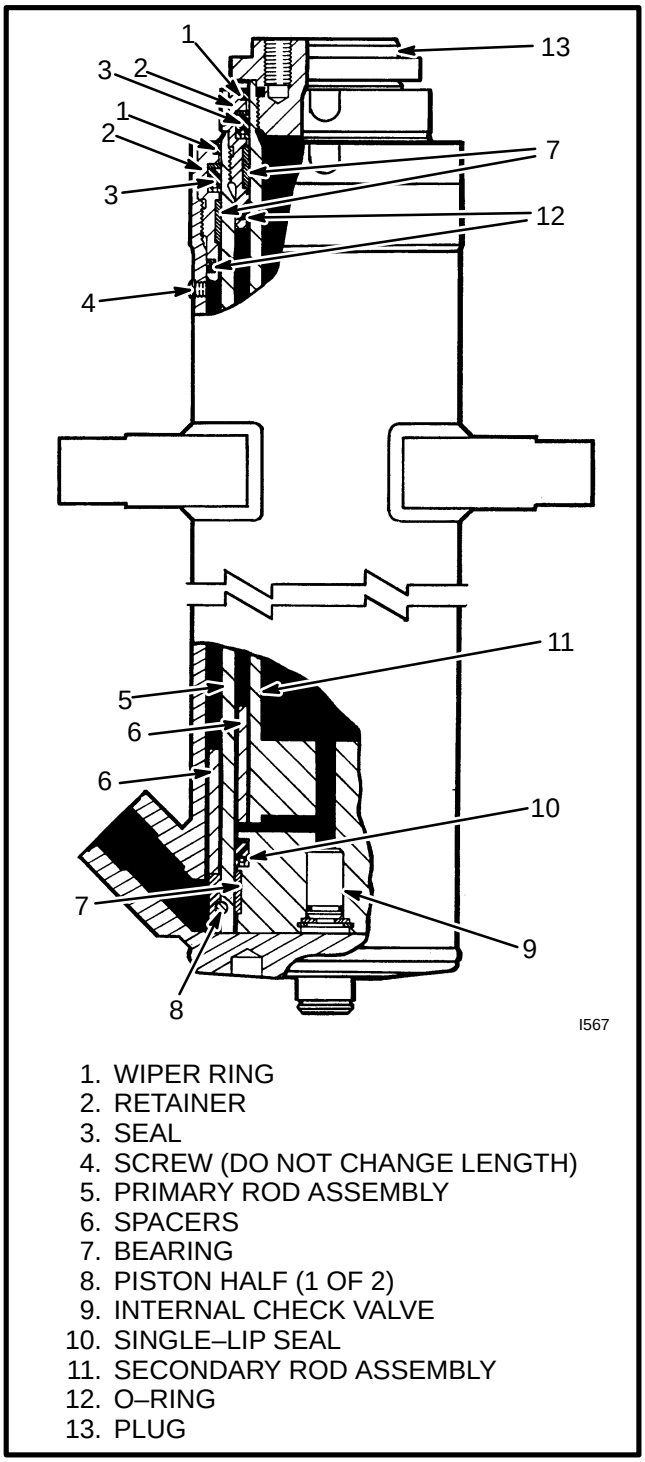
Lift cylinders and other hydraulic parts can have internal leaks. Internal leakage will increase as the temperature of the hydraulic oil increases. The internal leak rate of the hydraulic system is normally checked after every 1000 hours of operation. See CHECKS AND ADJUST-

MENTS for test procedures and leakage rates within the specifications.



1. WIPER RING
2. SINGLE–LIP SEAL
3. BEARING
4. O–RING
5. RETAINER
6. CHAIN ANCHOR MOUNT
7. HYDRAULIC LINE MOUNT
8. INTERNAL CHECK VALVE
9. ROD ASSEMBLY
10. SPACER
11. TO SENSING PORT FOR PHASING VALVE PRESSURE
12. LOWERING CONTROL VALVE (ALL CYLINDERS)
13. PISTON RING
14. CUSHION RING

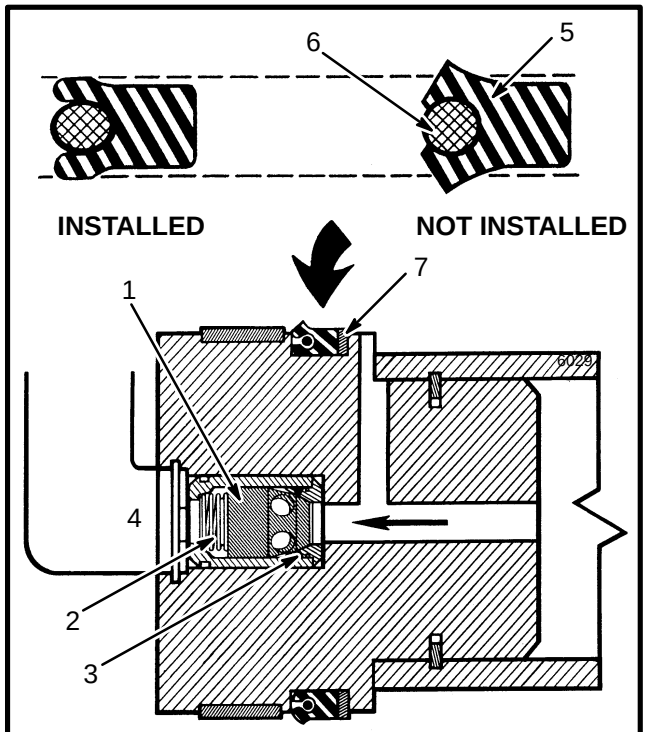
FIGURE 3. SINGLE–STAGE LIFT CYLINDERS



1. WIPER RING
2. RETAINER
3. SEAL
4. SCREW (DO NOT CHANGE LENGTH)
5. PRIMARY ROD ASSEMBLY
6. SPACERS
7. BEARING
8. PISTON HALF (1 OF 2)
9. INTERNAL CHECK VALVE
10. SINGLE–LIP SEAL
11. SECONDARY ROD ASSEMBLY
12. O–RING
13. PLUG

FIGURE 4. TWO–STAGE LIFT CYLINDER

During operation, some leakage of hydraulic oil can move past the piston seal to the rod side of the piston. A small leakage is 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 many of the lift cylinders. When the rod extends, the pressure increases more quickly on any oil in the rod end of the cylinder. The hydraulic oil transfers through the check valve to the piston end of the cylinder. This action prevents hydraulic damage to the wiper seal. See FIGURE 5. Lift cylinders that do not have an internal check valve have a drain line on the outside of the cylinder shell.



1. POPPET
2. SPRING
3. SEAL
4. INLET AND OUTLET PORT
5. SINGLE–LIP SEAL
6. O–RING
7. NYLON BACK–UP RING

FIGURE 5. INTERNAL CHECK VALVE AND SINGLE–LIP SEAL

INSTALLATION OF THE RETAINER

STEP 1. Install the retainer over the piston and into the cylinder. Make sure the single–lip seal assembly (4), the O–ring (7), and the back–up ring (6) are not damaged.

STEP 2. Turn the retainer ring (3) into the threads in the cylinder. Turn the retainer ring until it is even with the top of the cylinder.

STEP 3. Install the capscrews (2) loosely.

STEP 4. The stroke of the cylinder rod can be adjusted by turning the retainer ring one–half turn in either direction.

STEP 5. Install and tighten the set screw (11).

STEP 6. Tighten the capscrews (2) to 36 to 46 N.m (30 to 35 lbf ft).

1. SETSCREW (1)
2. CAPSCREW (2)
3. RETAINER RING
4. SINGLE–LIP SEAL ASSEMBLY
5. RETAINER
6. BACK–UP RING
7. O–RING
8. CYLINDER SHELL
9. ROD
10. SPACER
11. PISTON
12. PISTON RING NUT
13. NYLON SET SCREW
14. SPRING
15. FLANGE
16. SPACER PLATE
17. SPACER
18. VALVE BODY
19. SPECIAL WASHER

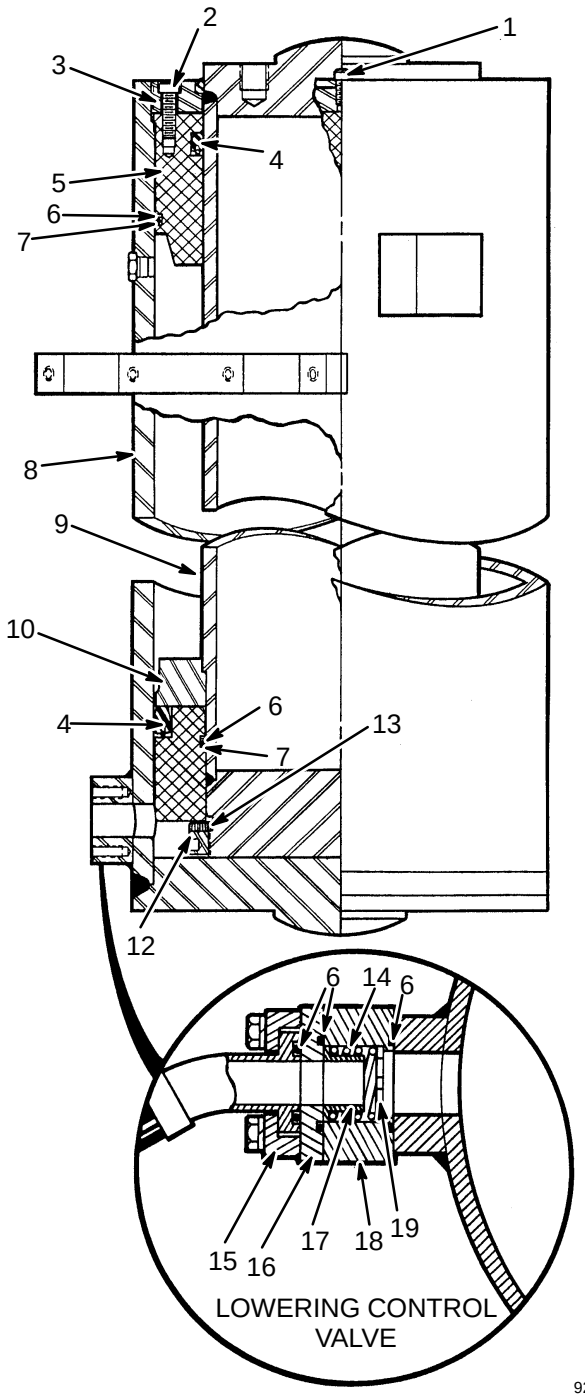


FIGURE 6. LIFT CYLINDER FOR H700–800A

Cylinders (H520–620B, H700–800A)

The rod side of the lift cylinder is used for the storage of hydraulic oil on the H520–620B and H700–800A lift trucks. This storage decreases the required size of the hydraulic tank. When the piston raises in the cylinder, the oil on the rod side of the piston transfers to the hydraulic tank. When the piston lowers in the cylinder, some of the oil transfers to the rod side of the cylinder. Approximately one half of the oil in the bottom of the cylinder goes through the main control valve to the rod side of the cylinder. See **THE MAIN CONTROL VALVE, 2000 SRM 36** for more information. See FIGURE 6.

NOTE: OIL LEAKAGE IS NOT CONTROLLED BY THE TORQUE ON THE PACKING GLAND.

TIGHTEN THE PACKING RETAINER (7) TO STOP OIL LEAKS. REPLACE CHEVRON PACKING WHEN PACKING RETAINER (7) CAN NOT COMPRESS PACKING FURTHER TO CONTROL OIL LEAKS. DO NOT TIGHTEN MORE THAN NECESSARY TO STOP OIL LEAKS.

1. WIPER
2. NYLON RING
3. CHEVRON 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

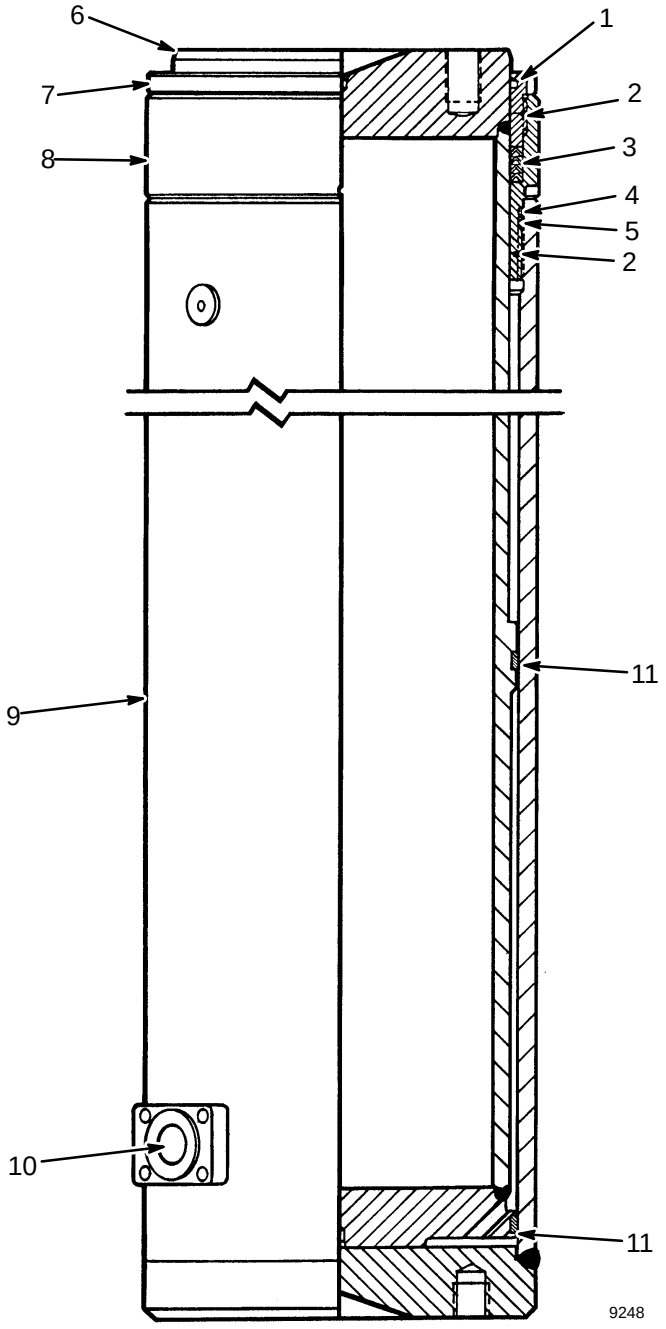


FIGURE 7. DISPLACEMENT CYLINDERS

Cylinders (H360–460B)

The lift cylinders used in the H360–460B lift trucks are displacement cylinders. The design and repairs for these cylinders are similar to the other lift cylinder in this section. A displacement cylinder does not have a piston or piston seal. The rod diameter is almost the same as the inside diameter of the cylinder. There are wear rings on the rod that are the bearings between the rod and the walls of the cylinder. The wiper seal at the top of the cylinder is also the high pressure seal for these cylinders. The wiper seal is a chevron packing. See FIGURE 7.

Cylinders (Two–Speed)

Two–speed lift cylinders are single–stage lift cylinders with a special valve and path for the hydraulic oil. The lift cylinder is filled with oil on both sides of the piston. For loads less than 45% of the rated capacity, the cylin-

der rod can be extended at high speed. When the cylinder rod extends, the oil on the rod side of the piston transfers to the bottom of the piston. When the oil transfers, the increase almost doubles the flow of oil to the base of the cylinder. The pump pressure is applied to both sides of the piston. The area on the bottom of the piston is greater than the rod side of the piston. The difference in force pushes the piston up the cylinder. See FIGURE 8.

For loads greater than 45% of capacity, the cylinder rod extends at normal speed. A special valve senses the increased oil pressure caused by the load. The oil is returned from the rod side of the lift cylinder to the hydraulic tank. All of the pump pressure is applied to the bottom side of the piston. The cylinder rod extends at a slower speed, but can lift a greater load. The two–speed lifting system is used only with standard masts. A two–speed lift system is used on the following lift trucks:

S60–80B Hl50–250E
S125–150A H150–275H
H60–80C H250–300A
H300–350B P125–180A
H110–150F P150–200B

NOTE: The maximum loads that the above models will lift at high speed are shown on TABLE 1.

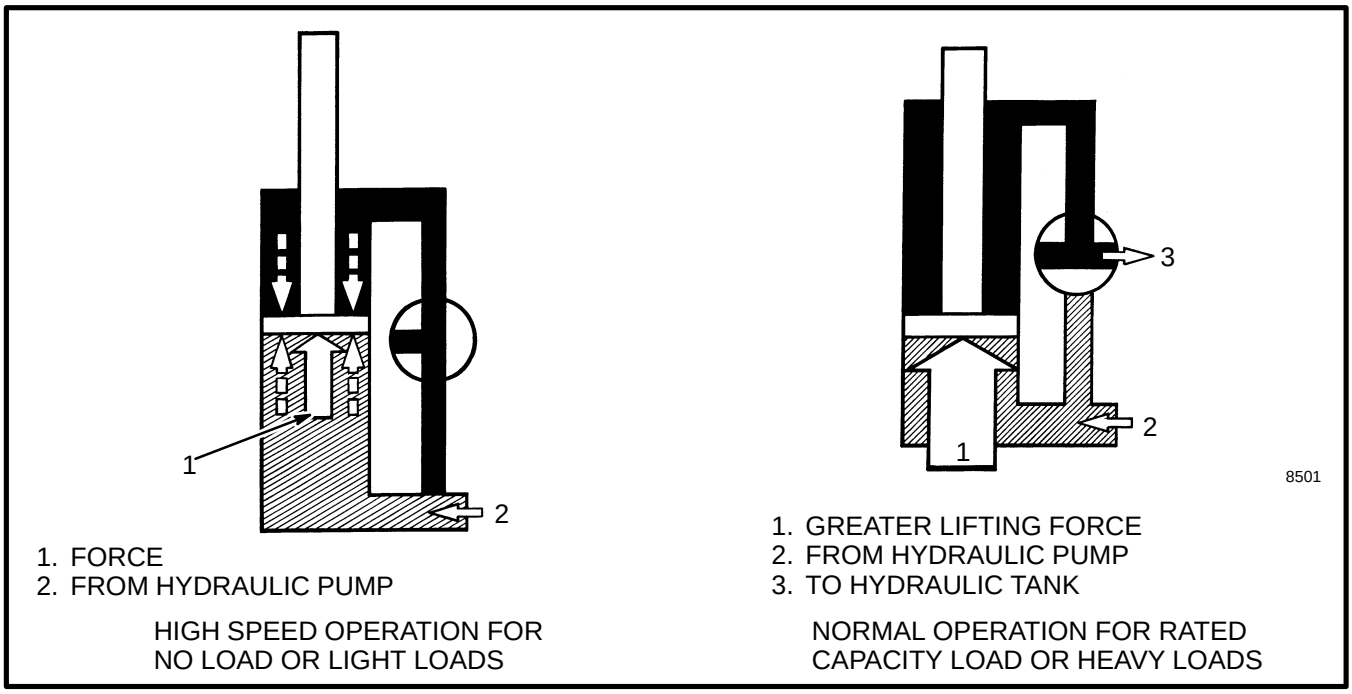


FIGURE 8. TWO–SPEED LIFT CYLINDERS

REPAIRS

REMOVAL OF THE LIFT CYLINDER WITHOUT REMOVING THE MAST

Remove the carriage before the lift cylinder. See the procedure described in the MASTS section. If the mast must be removed for repairs, then remove the lift cylinder when the mast is disassembled. Remove the lift cylinder from the mast as described in the following paragraphs.

Standard Masts with the Main Lift Cylinder Fastened to the Crossmember of the Inner Mast

1. Fully lower the mast. Loosen, but do not disconnect the capscrew that fastens the cylinder rod to the crossmember of the inner mast.

2. Clean the area next to the fittings that connect the hydraulic lines to the lift cylinder. Put a drain pan under the area where the hydraulic lines will be disconnected. Dis-

connect the hydraulic lines and put a cap on each open fitting.

⚠ WARNING

Make sure the lifting mechanism has enough capacity to lift the loads. See the Weight Guide for lift cylinders in TABLE 1. at the end of this section.

3. Connect a lifting mechanism to the inner mast. Lift the inner mast approximately 300 mm (12 in). Fasten the inner and outer masts together at the crossmembers with a heavy chain. Make sure that the inner mast cannot move. Remove the lifting mechanism.

4. Connect a heavy–duty sling to the upper part of the cylinder. Raise the lifting mechanism until the sling is tight. Make sure the sling will not slide.

5. Remove the capscrew and washer connecting the piston rod to the inner mast. Remove the spacer.

⚠ CAUTION

Oil can come out of the cylinder fittings with pressure when retracting the rod.

6. Loosen the cap on the lower fitting of the cylinder. Manually retract the piston rod.

7. Remove the capscrew and the plate from the lower side of the cylinder.

8. Raise the cylinder and move it away from the mast. Move the lift cylinder to a position where it can be disassembled.

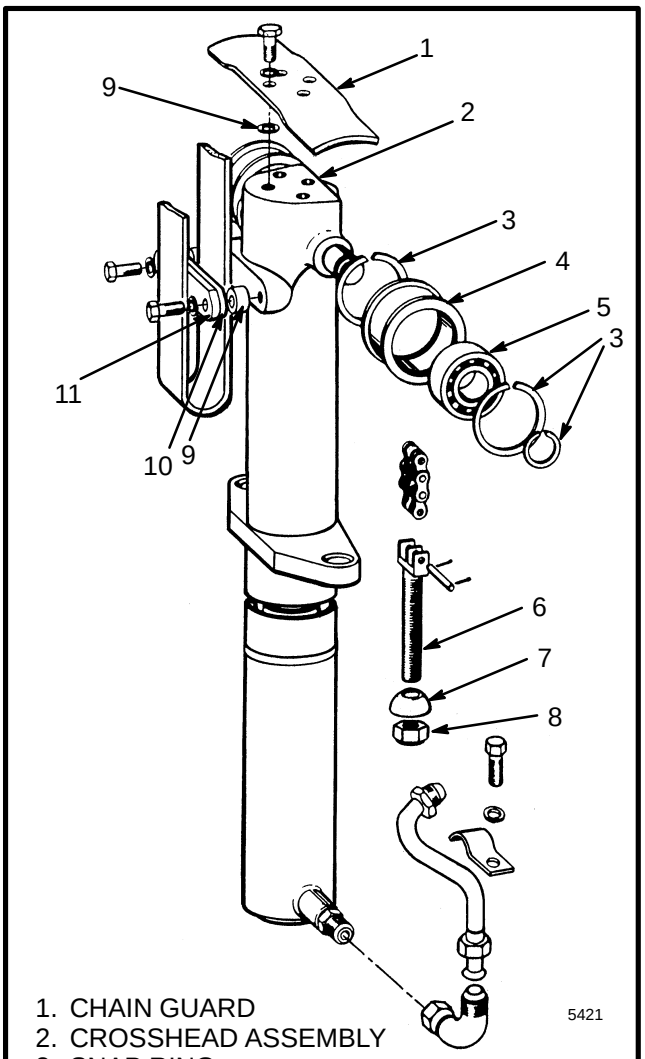
Standard and Full Free–Lift Masts with the Lift Cylinder Fastened to a Crosshead (See FIGURE 9. and FIGURE 10.)

1. Remove the lift chains and chain anchors from the mast and the lift cylinder. Connect a sling to the upper area of the lift cylinder. Raise the lifting mechanism until the sling is tight.

2. Remove the capscrews that connect the piston rod to the crosshead.

3. Disconnect and remove the crosshead assembly from the mast. Make a note of the shim arrangement on the crosshead guide.

4. Clean the area next to the fittings that connect the hydraulic lines to the lift cylinder. Put a drain pan under the area where the hydraulic lines will be disconnected. Disconnect the hydraulic lines and put a cap on each open fitting.



1. CHAIN GUARD
2. CROSSHEAD ASSEMBLY
3. SNAP RING
4. SHEAVE
5. BEARING
6. CHAIN ANCHOR
7. SPECIAL WASHER
8. LOCK NUT
9. SPACER
10. WEAR PLATE
11. PAD

FIGURE 9. STANDARD MAST CYLINDER AND CROSSHEAD

5. Remove the snap ring that connects the bottom of the lift cylinder to the outer mast.

6. Raise the lift cylinder and move it away from the mast. Move the lift cylinder to a position where it can be disassembled.

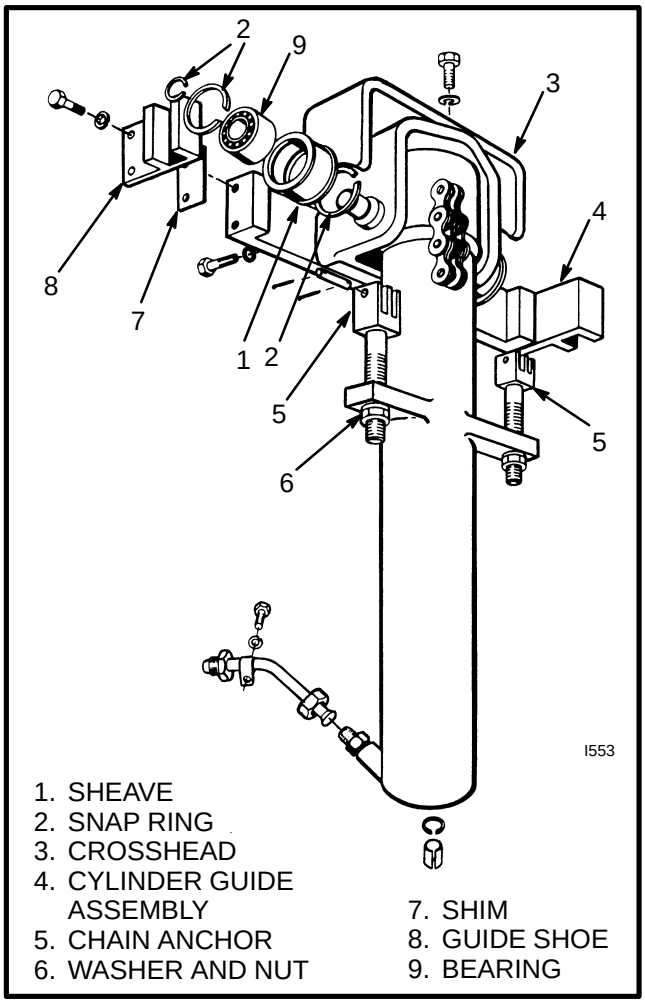


FIGURE 10. FREE–LIFT CYLINDER AND CROSSHEAD

Masts that have Two Cylinders, A Main Lift Cylinder and a Free–Lift Cylinder

1. Remove the free–lift cylinder as described in the section above for removing a lift cylinder fastened to a crosshead.

2. Remove the main lift cylinder as described in the section above for removing a lift cylinder fastened to an inner mast.

DISASSEMBLY
(See FIGURE 11. and FIGURE 12.)

⚠ WARNING

Use slings and a crane to handle and disassemble the lift cylinders of most lift trucks. Make sure that the crane and slings can lift the load. See TABLE 1. for a weight guide at the end of this section.

⚠ CAUTION

Carefully disassemble and assemble the lift cylinders so that the rods and sliding surfaces are not damaged.

NOTE: Disassembly of single–stage and two–stage lift cylinders is the same except the two–stage lift cylinder has a second piston rod assembly. The disassembly of the secondary piston rod assembly is similar to the disassembly of the primary piston rod assembly.

1. Loosen the retainer (3) with a spanner. Disconnect the retainer from the shell (8).

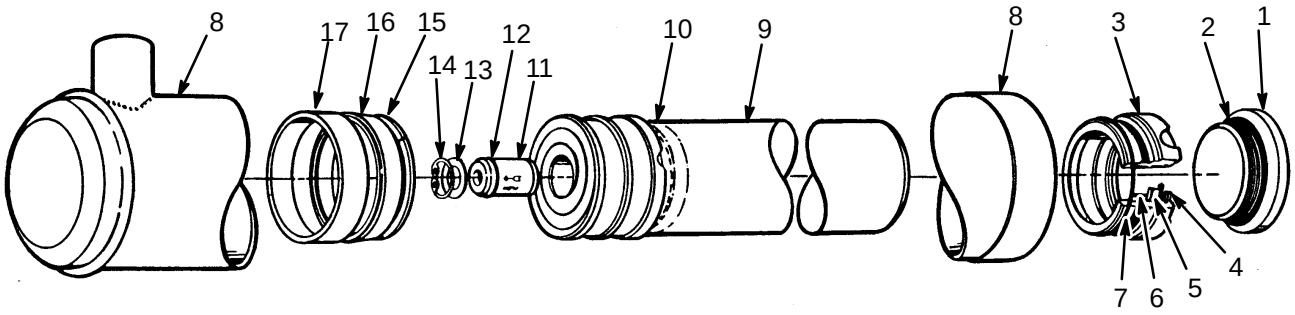
2. Remove the cap from the inlet and slide the piston rod assembly from the shell. Use drain pans for the hydraulic oil.

3. Remove the retainer from the piston rod. Remove and discard the O–rings, seals and bearings (6) (16).

4. Remove the internal check valve.

5. Remove the lowering control valve.

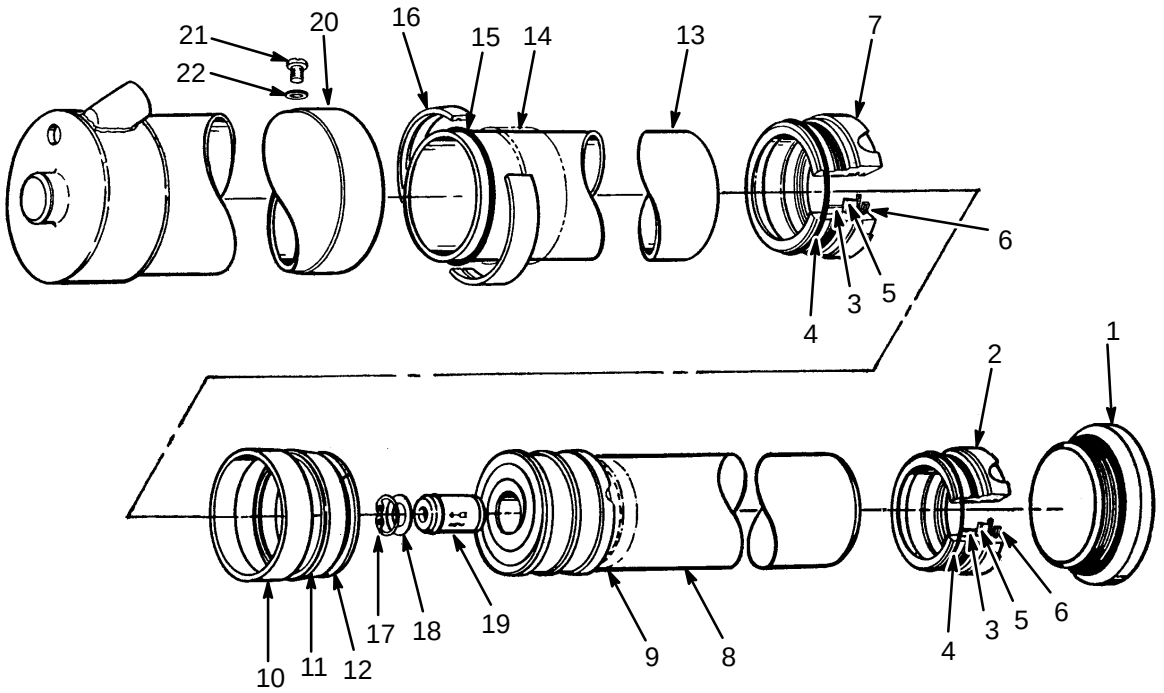
6. Clean all the parts. Check the sliding surfaces for damage. Repair or replace any damaged parts.



SINGLE–STAGE LIFT CYLINDER

1. PLUG
2. O–RING
3. RETAINER
4. WIPER RING
5. SINGLE–LIP SEAL
6. BEARING
7. O–RING
8. CYLINDER SHELL
9. CYLINDER ROD
10. SPACER
11. INTERNAL CHECK VALVE
12. O–RING
13. WASHER
14. SNAP RING
15. BACK–UP RING
16. SINGLE–LIP SEAL
17. BEARING

2120



TWO–STAGE LIFT CYLINDER

G309

1. PLUG
2. RETAINER
3. BEARING
4. O–RING
5. SINGLE–LIP SEAL
6. WIPER RING
7. RETAINER
8. SECONDARY CYLINDER ROD
9. SPACER
10. BEARING
11. SINGLE–LIP SEAL
12. BACK–UP RING
13. PRIMARY CYLINDER ROD
14. SPACER
15. O–RING
16. PISTON RING HALF (2)
17. SNAP RING
18. WASHER
19. INTERNAL CHECK VALVE
20. CYLINDER
21. SCREW
22. SEAL

FIGURE 11. LIFT CYLINDERS

ASSEMBLY

NOTES: Lubricate all internal parts of the lift cylinder with hydraulic oil during assembly.

Use new O–rings, seals and bearings. Apply lubricant during assembly. Packing lubricant (Part Number 186061) is available.

Make sure the single–lip seal assemblies are installed with the O–ring towards the base of the lift cylinder. (See FIGURE 5.)

The spacers (10) control the maximum stroke of the piston rod assembly. If a new spacer is necessary, make sure the same size spacer is installed.

1. Install the internal check valve. Make sure the arrow on the internal check valve is towards the base of the piston.

2. Install the seal and bearing (and spacer if equipped) on the rod piston. Use shim material and a clamp as a guide to move the single–lip seal past the threads of the shell.

⚠ CAUTION

A difficult and important step in assembling cylinders is the correct installation of the seals without damage. Most cylinder maintenance is caused by seal leakage. Special tools are available from Hyster Parts and Service. See Parts–Service Gram L–A–2 (Latest Revision) for the available tools.

3. Carefully push piston and piston rod into the shell. Release the clamp on the seal when the seal travels past the threads of the shell.

4. Install the seals, O–rings and bearings (when used) in the retainer. If the wiper seal has a spring back–up ring, the spring must be towards the base of the lift cylinder.

5. Carefully install the retainer on the piston rod.

6. Engage the threads and tighten the retainer in the shell to the correct torque. Use a correct spanner. Do not hit the retainer with a hammer and driver.

7. Install the lowering control valve. Make sure the special washer and the spring are installed correctly. A wrong installation can cause the load to lower too fast.

⚠ CAUTION

When the screw (20) is installed on two–stage cylinders, never use a screw longer than 3/8 inch (9.5 mm). A longer screw will touch and damage the primary piston rod. Always install a seal (21) under the head of the screw. If you do not install the screw and seal, the cylinder will have leaks.

INSTALLATION OF THE LIFT CYLINDER IN THE MAST

Standard Masts with the Main Lift Cylinder Fastened to the Crossmember of the Inner Mast

1. Put the lift cylinder into position in the mast. Make sure the base of the lift cylinder is aligned correctly on its mount.

2. Connect a chain to the upper section of the lift cylinder and the overhead guard. Make sure the chain will hold the lift cylinder in position until it can be fastened to the mast.

3. Connect a lifting mechanism to the inner mast.

4. Disconnect the inner mast from the outer mast. Lower the inner mast until it touches the piston rod. Align the holes of the inner mast and the piston rod.

⚠ CAUTION

Do not connect a wrench to the sliding surface of the piston rod. Any damage to the sliding surface will cause leaks.

5. Install capscrews, washer and spacer to fasten the lift cylinder to the crossmember of the inner mast.

6. Fasten the base of the lift cylinder to the crossmember of the outer mast with a capscrew and plate.

7. Connect the hydraulic lines.

8. Install the carriage.

Standard and Full Free–Lift Masts with the Lift Cylinder Fastened to a Crosshead

1. Put the lift cylinder into position in the mast. Align the guide pin with the hole in the bottom crossmember.

2. Install the crosshead assembly in the mast. Align the holes in the piston rod and the crosshead.

3. Fasten the crosshead to the piston rod with capscrews.

4. Fasten the base of the lift cylinder to its mount with a snap ring.

5. Connect the hydraulic lines.

6. Install the chain anchors.

7. Install the lifting chains.

8. Install the carriage. See masts section for checks and adjustments.

CHEVRON PACKING

The replacement seal kits for chevron packing have a single–lip seal and an aluminum spacer. The seal kits also have one or two back–up rings. If one back–up ring is in the seal kit, install it as shown in B of FIGURE 12. Two back–up rings are installed as shown in C of FIGURE 12. Make sure the single–lip seal is always installed correctly against the direction of pressure.

The installation of chevron packing on a piston is shown in FIGURE 13. The installation of chevron packing in a packing gland used at the top of the cylinder is shown in FIGURE 14. There will be some variation in the design of the different lift cylinders. The principles of installation of the chevron packing is similar.

Lubricate the parts with hydraulic oil or packing lubricant (Part No. 186061) before assembly. See Part–Service Gram L–A–2 (Latest Revision) for special tools to help install the packing into the lift cylinder.

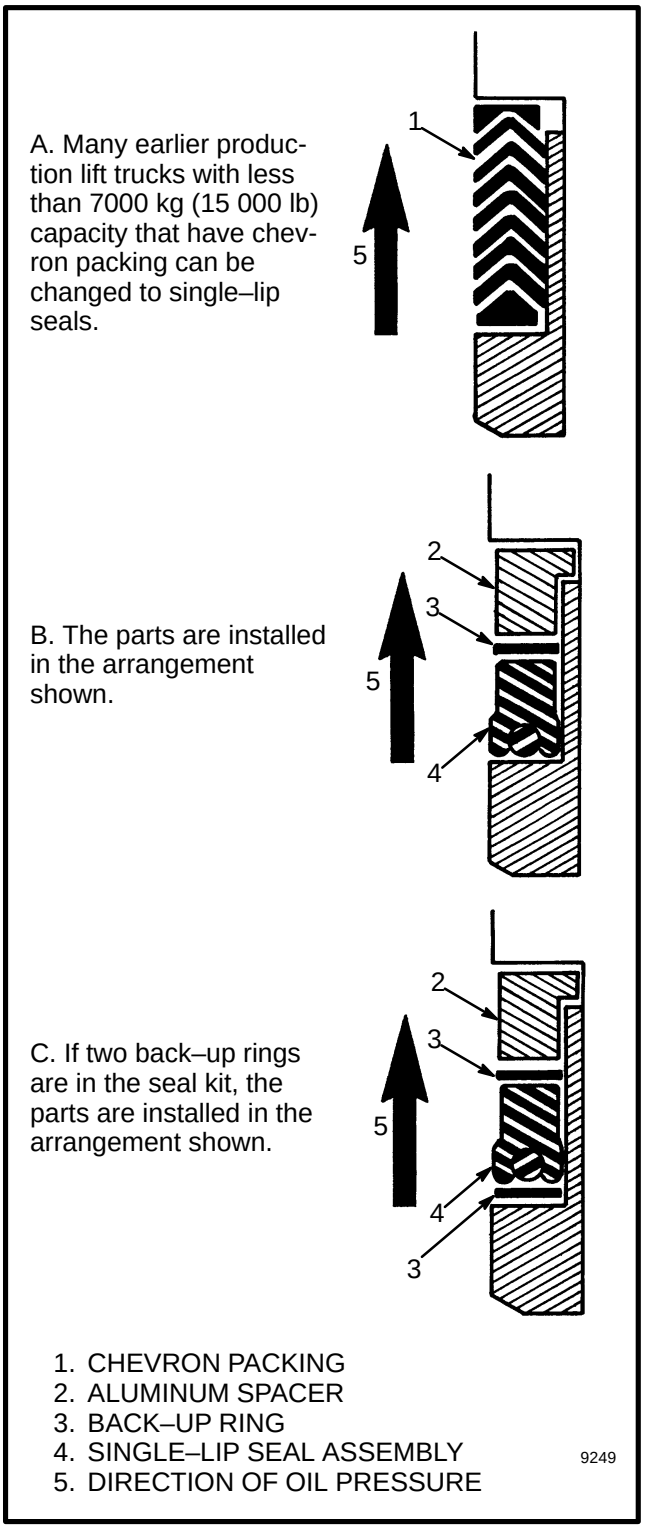
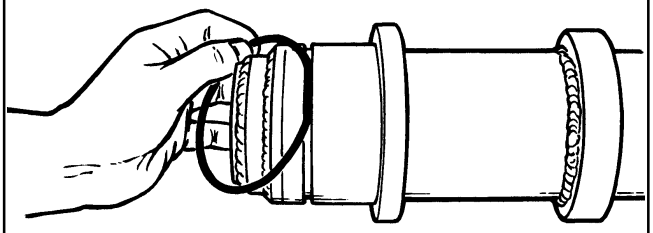
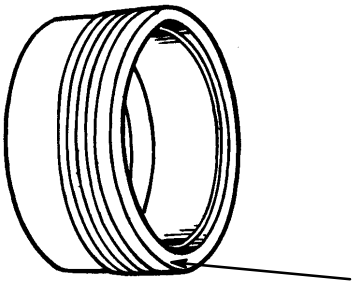


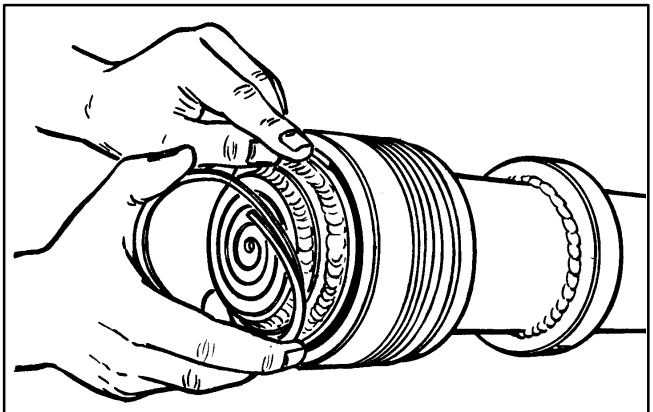
FIGURE 12. REPLACEMENT SEAL KITS FOR CHEVRON PACKING



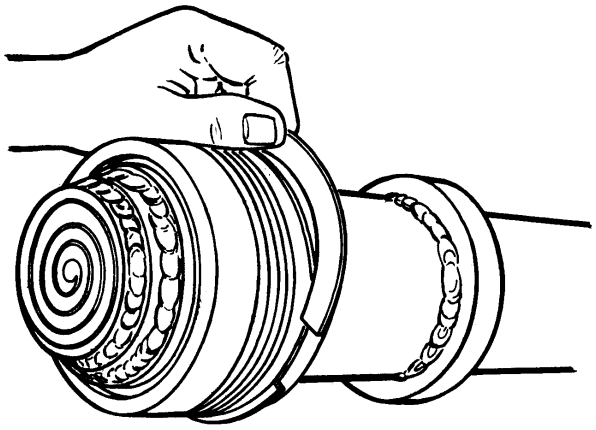
STEP 1. Lubricate the new O–ring with hydraulic oil and then install it on the piston end of the cylinder rod.



STEP 2. Install a new packing assembly on the piston half. The packing must extend approximately 3mm ($^1/_8$ inch) beyond the end of the piston half.



STEP 3. Install the piston half and snap ring.



STEP 4. Install the nylon spacer.

STEP5. Install the piston in the lift cylinder. Carefully push the piston and piston rod into the lift cylinder. Release the clamp on the packing when the packing moves past the threads of the cylinder.

1. PISTON
2. SPECIAL TOOL OR CLAMP TO INSTALL PACKING

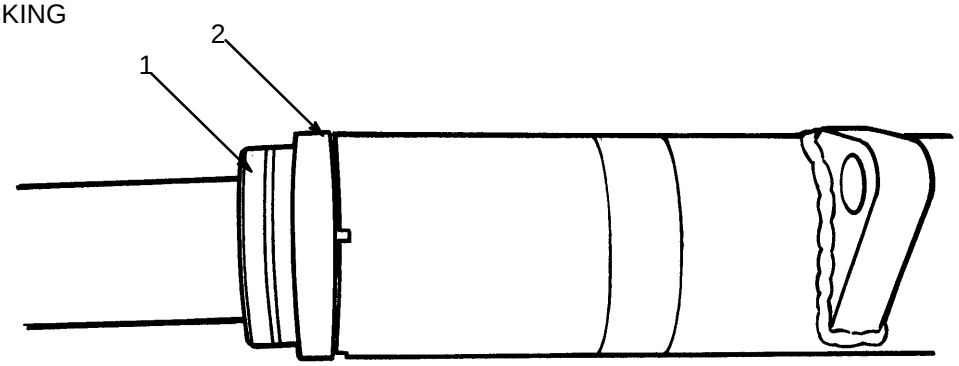


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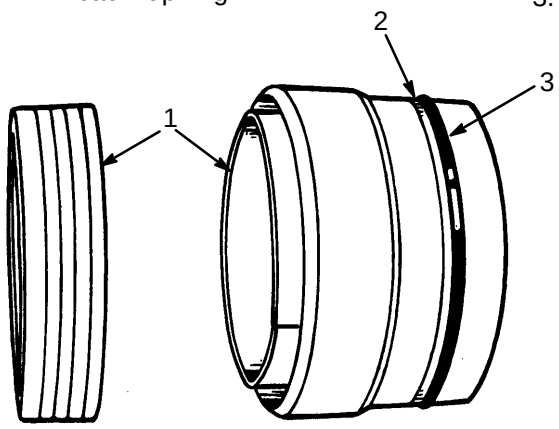
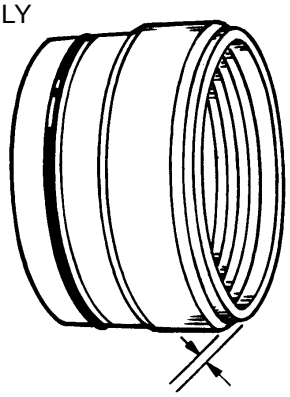
FIGURE 13. INSTALLATION OF CHEVRON PACKING ON A PISTON

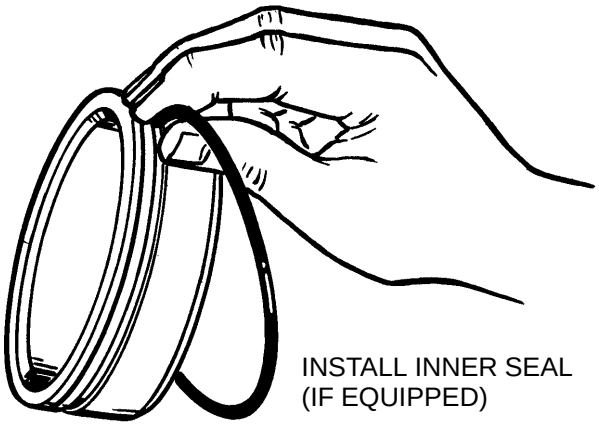
STEP 1. Assemble the packing gland using new packing, o–ring, and back–up ring.

1. PACKING ASSEMBLY
2. BACK–UP RING
3. O–RING



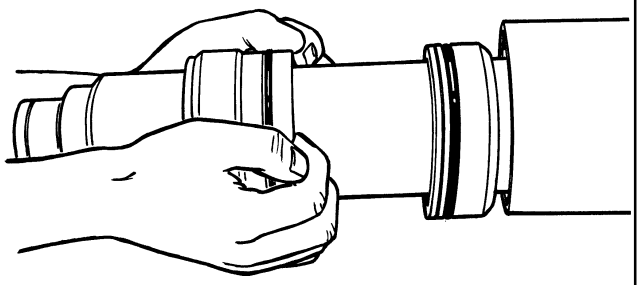


PACKING RING MUST EXTEND 3 mm ($^{1}/_{8}$ inch) BEYOND EDGE OF BUSHING



INSTALL INNER SEAL (IF EQUIPPED)

STEP 2. Assemble the gland using a new O–ring, back–up ring, and inner seal.



STEP 3. Install the bushing assembly and gland assembly in the rod.

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

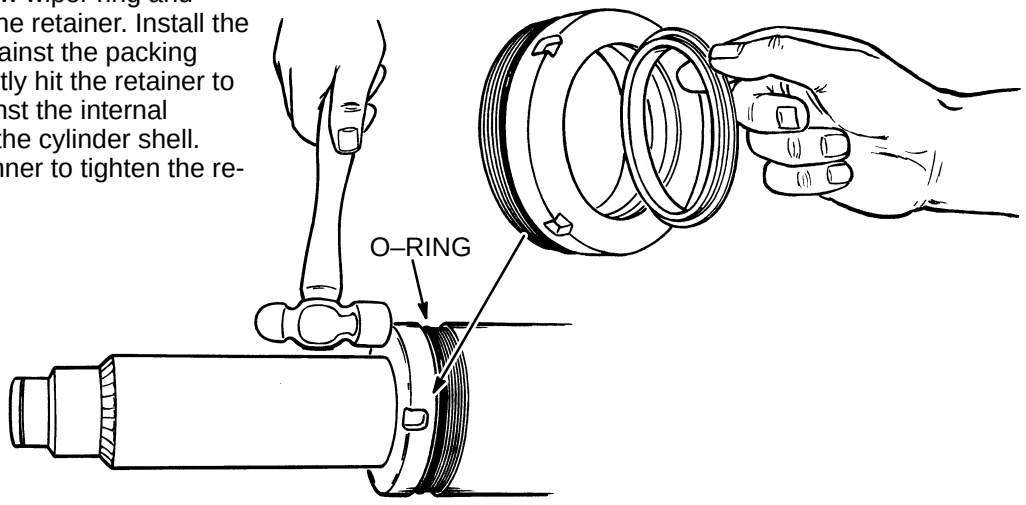


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FIGURE 14. INSTALLATION OF CHEVRON PACKING IN A PACKING GLAND

LIFT CYLINDERS FOR VISTA MASTS

DESCRIPTION (See FIGURE 16.)

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 16. and FIGURE 17.)

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 15.

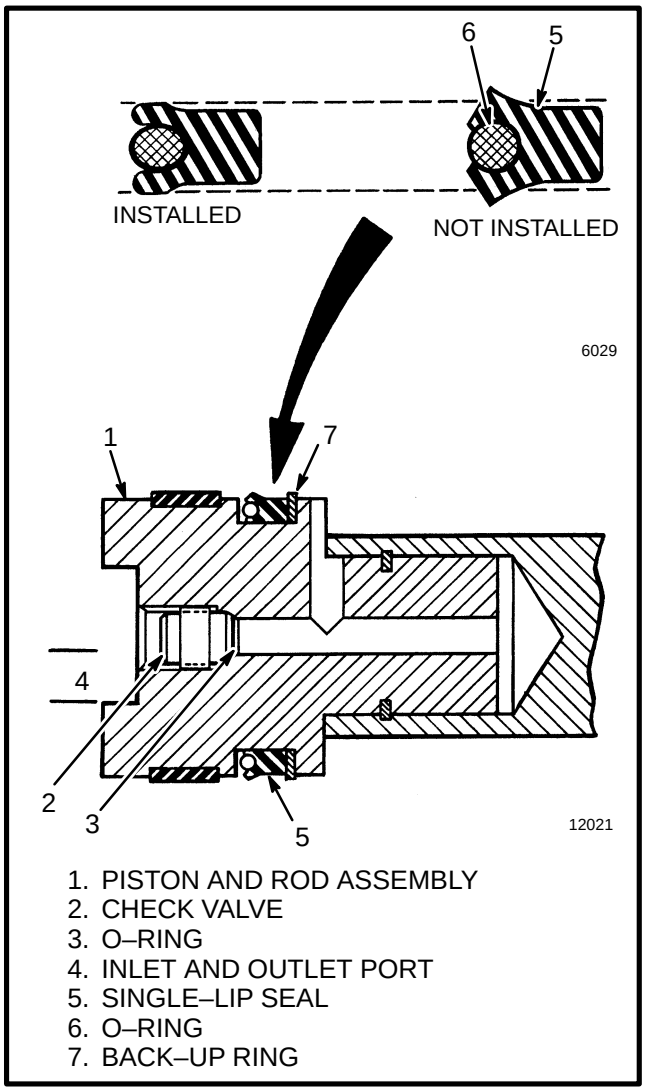

FIGURE 15. INTERNAL CHECK VALVE AND SINGLE LIP SEAL