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This section is for the following models:

RS45-27CH, RS45-31CH, RS46-36CH, RS46-40CH, RS46-41S CH, RS46-41L  
 CH, RS46-41LS CH, RS45-24IH, RS45-28IH, RS46-33IH, RS46-37IH,  
 RS46-38S IH, RS46-38L IH, RS46-38LS IH (HR45-27, HR45-31, HR45-36,  
 HR45-40, HR45-41S, HR45-41L, HR45-41LS) [B222]

## General

This section has the description and repair procedures for the boom assembly. This section also has removal, disassembly, cleaning, inspection, assembly, and installation procedures for the dampening cylinder, boom extension cylinder, and derricking cylinders.

## Description and Operation

### BOOM

The boom is the support for the attachment/rotator attachment. See Figure 1. The boom pivots on two support towers at the back of the lift truck. Two derricking cylinders mount to the boom and the lift truck in front of the support towers and allow the operator to raise or lower the boom. The boom has an inner section that can be extended from the outer section to allow the attachment to reach over one container to a container behind it. The outer boom section has the pivot and derricking cylinder mounts. The inner section rides on wear plates and is fastened to the rod end of the boom extension cylinder by a pin. The shell of the boom extension cylinder has wear pads at the front that ride on the inside of the inner boom. The back end of the shell mounts to the back of the outer boom by a pin and bushings.

The boom has a yoke at the inner end that connects to the attachment/rotator attachment. The attachment pivots on pins in the yoke, but the movement is controlled by the dampening cylinder that is attached between the boom and the attachment.

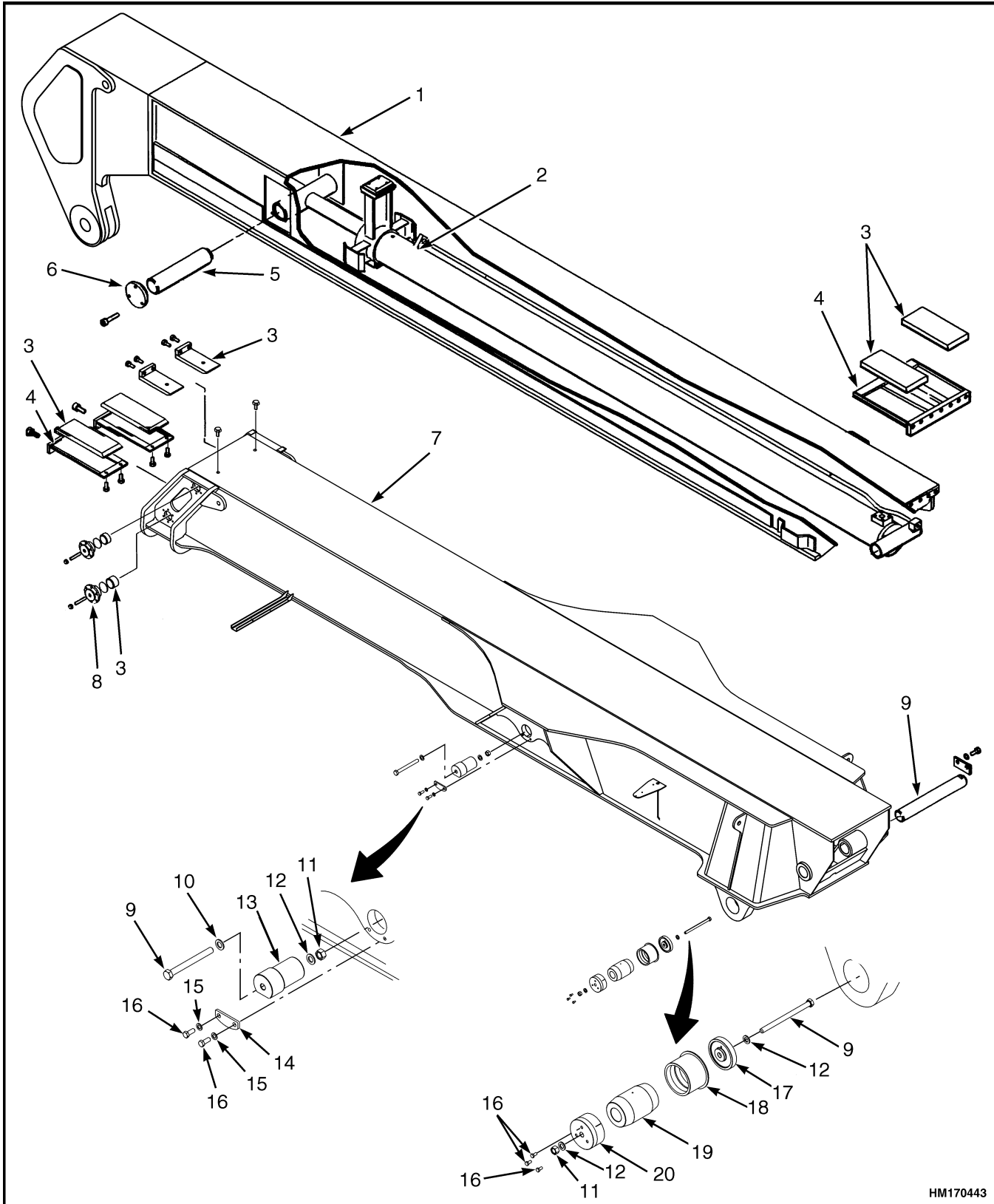
The hydraulic hoses for the dampening cylinder and for the attachment are held in a support chain

that keeps the hoses and wiring from bending at the wrong angles when the boom is extended or retracted.

### HYDRAULIC SYSTEM

The derricking cylinders and the boom extension cylinder are all double-acting cylinders. The boom cylinders are controlled by two parallel hydraulic valves mounted on the lift truck. A large volume hydraulic pump and a flow divider provide enough oil flow to operate the boom cylinders at full speed at all engine speeds. The hydraulic system for the boom cylinders is described in the manual for the lift truck.

Each of the two derricking cylinders and the boom extension cylinder has a valve mounted on the cylinder to prevent any movement of the rod until there is hydraulic pressure at the pressure port. The oil from the opposite side of the cylinder cannot return to the tank until there is pressure at the other port. This arrangement prevents even the smallest movement of the rod caused by leaks in the cylinder.



HM170443

Figure 1. Boom Assembly

**Legend for Figure 1**

- |                         |                    |
|-------------------------|--------------------|
| 1. INNER BOOM           | 11. NUT            |
| 2. EXTENSION CYLINDER   | 12. WASHER         |
| 3. WEAR PADS            | 13. PIN CYLINDER   |
| 4. RETAINER             | 14. PLATE          |
| 5. PIN                  | 15. WASHER         |
| 6. CAP                  | 16. CAPSCREW       |
| 7. OUTER BOOM           | 17. CAP            |
| 8. ADJUSTABLE RETAINERS | 18. BUSHING        |
| 9. CAPSCREW             | 19. PIN BOOM MOUNT |
| 10. WASHER              | 20. CAP            |

**Boom Repair****REMOVE**

Repairs to parts of the boom can be made with the boom installed. Remove the complete boom only if necessary.

1. Fully retract the boom.
2. Place the attachment on a loaded container, or use a 15 ton fork lift truck to support the boom.
3. Place the boom in a slightly upwards position.
4. Apply the parking brake.

**WARNING**

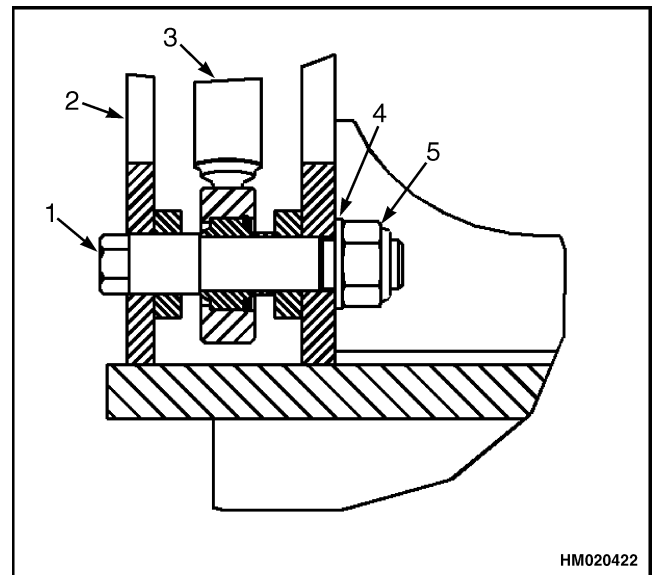
**Do not disconnect any hydraulic lines when the engine is running or personal injury may occur.**

5. Shut down the engine.

**NOTE:** Move all control levers back and forth a minimum of 20 times to remove all hydraulic pressure from the pilot system.

6. Put identification tags on hydraulic lines and electrical connectors.
7. Disconnect the two electrical connectors between the boom and the rotator frame.
8. Disconnect the dampening cylinder as follows:
  - a. Put identification tags on the hydraulic lines during removal.
  - b. Disconnect the hydraulic lines at the dampening cylinder. Put caps on the open lines.

- c. Disconnect the dampening cylinder at the rotator frame by removing nut from the pin. See Figure 2.
- d. Push the pin through the cylinder head and frame mounting brackets with a drift.
- e. Remove the pin on the other dampening cylinder using the same procedure.
- f. Remove the two spacers.



1. PIN
2. ROTATOR FRAME
3. DAMPENING CYLINDER
4. WASHER
5. NUT

**Figure 2. Dampening Cylinder to Rotator Frame Mounting**

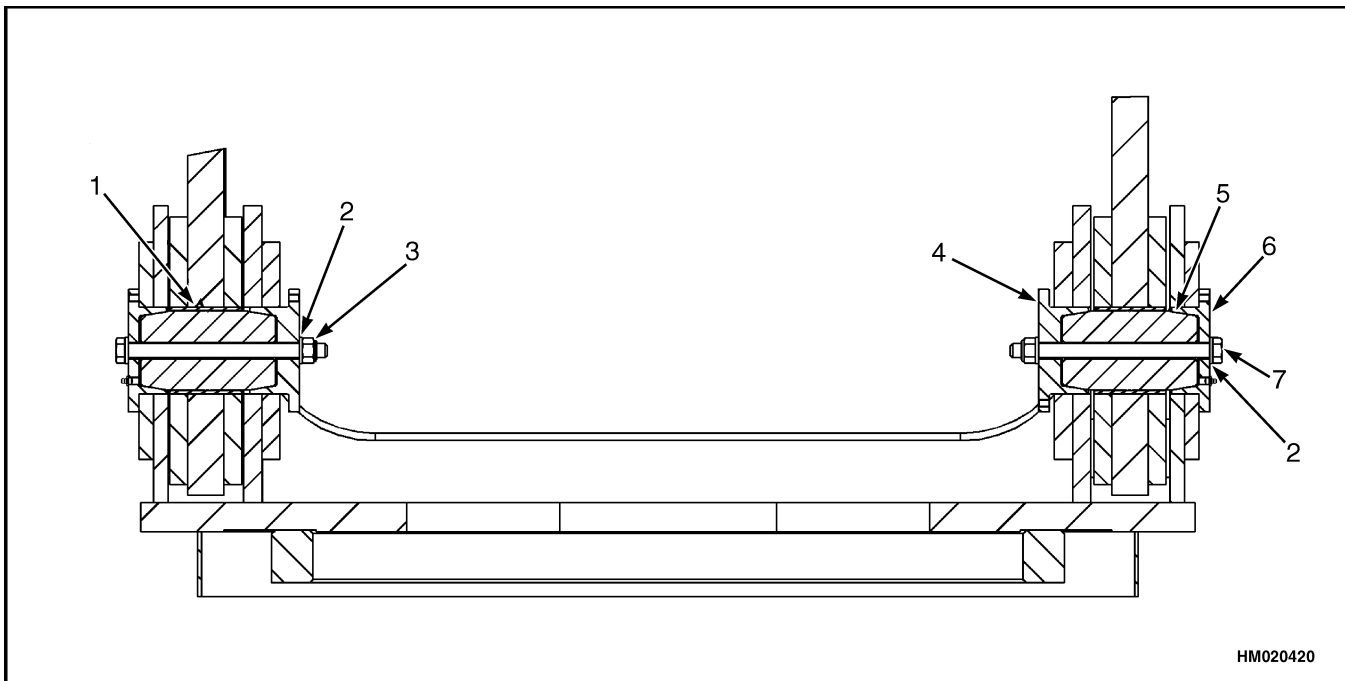
9. Disconnect the boom from the rotator frame as follows:
  - a. Disconnect the hydraulic lines between the boom and rotator frame. Put caps on the open lines.
  - b. Remove the lock nut and washer from the capscrew. See Figure 3.
  - c. Use three capscrews in the threaded holes on the flange of the sliding bushing to pull the sliding bushing out.

**WARNING**  
 Verify that the dampening cylinder and rotator frame cannot move.

- d. Remove capscrew that holds pin in position.
- e. Use a drift to push the pin out of the boom and rotator frame hole.
- f. Remove the pin from the other side of the rotator frame using the same procedure.
- g. Remove the bushings from the boom holes.

**WARNING**  
 Verify that the lifting device has a capacity of 17,000 kg (37,485 lb) to lift the boom or personal injury may occur.

10. Connect a lifting device to the lifting eyes located at the boom tip and to the lifting eyes located at the rear side of the boom. The center of gravity is approximately 3360 mm (132 in.) forward of the pivot mounts. The used chain for the rear side must be approximately 0.75 mm (29.5 in.) longer than the chain used at the boom tip side.
11. Disconnect the derricking cylinders from the boom as follows:
  - a. Use a lifting device to support derricking cylinder.
  - b. Remove the two capscrews, washers, and plate for the pivot pin at the top of the derricking cylinder. See Figure 4.
  - c. Remove the nut, washer, ring, and capscrew.



- |                    |                  |
|--------------------|------------------|
| 1. BUSHING         | 5. PIN           |
| 2. WASHER          | 6. FIXED BUSHING |
| 3. LOCK NUT        | 7. CAPSCREW      |
| 4. SLIDING BUSHING |                  |

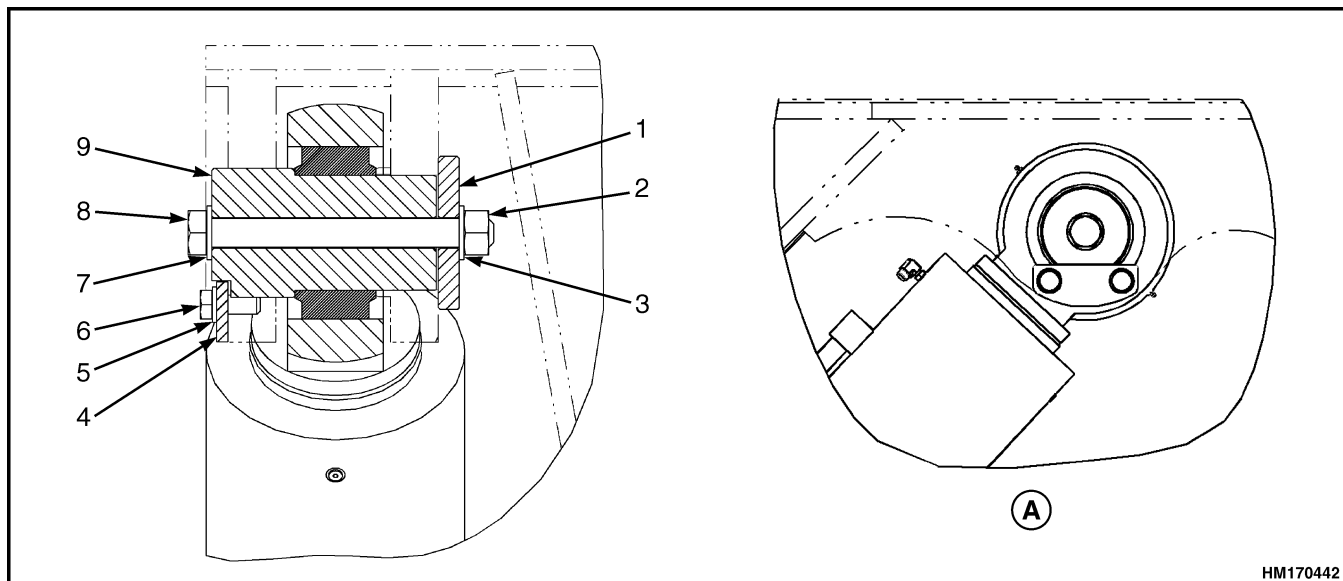
Figure 3. Boom to Rotator Frame Mounting

(More Content includes: Brake system, Capacities, and specifications, Frame, Hydraulic, System, Industrial battery, Main control, Valve, Mast repair, Fasteners, Schematics diagrams, Steering axle, Steering system, Wire harness repair And more)

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much.**



**A. SIDE VIEW SHOWN**

- |           |                 |
|-----------|-----------------|
| 1. RING   | 6. CAPSCREW     |
| 2. NUT    | 7. WASHER       |
| 3. WASHER | 8. CAPSCREW     |
| 4. PLATE  | 9. PIN CYLINDER |
| 5. WASHER |                 |

**Figure 4. Lift Cylinders to Boom Mounting**



**WARNING**

Verify that the lifting device has the rated capacity to lift the pin or personal injury may occur.

- d. Use a press to push the pivot pin towards the outside of the boom.
  - e. Remove the pivot pin.
  - f. Follow Step a through Step e to remove the pivot pin of the other derricking cylinder.
  - g. Start the engine.
  - h. Fully retract the derricking cylinders.
  - i. Shut down the engine.
- 12. Disconnect the boom from the frame as follows:**
- a. Disconnect the two hydraulic lines and three electrical connectors between the boom and frame. Put caps on open lines.

b. Remove nut, two washers, and cap screw from the pivot pin. See Figure 5.

c. Remove the cap, positioned at the center of the frame.

d. Remove the three cap screws and replace with longer cap screws for removing the cap, located at the outside. Tighten cap screws alternating each screw to remove cap from the pivot pin

e. Remove the cap.

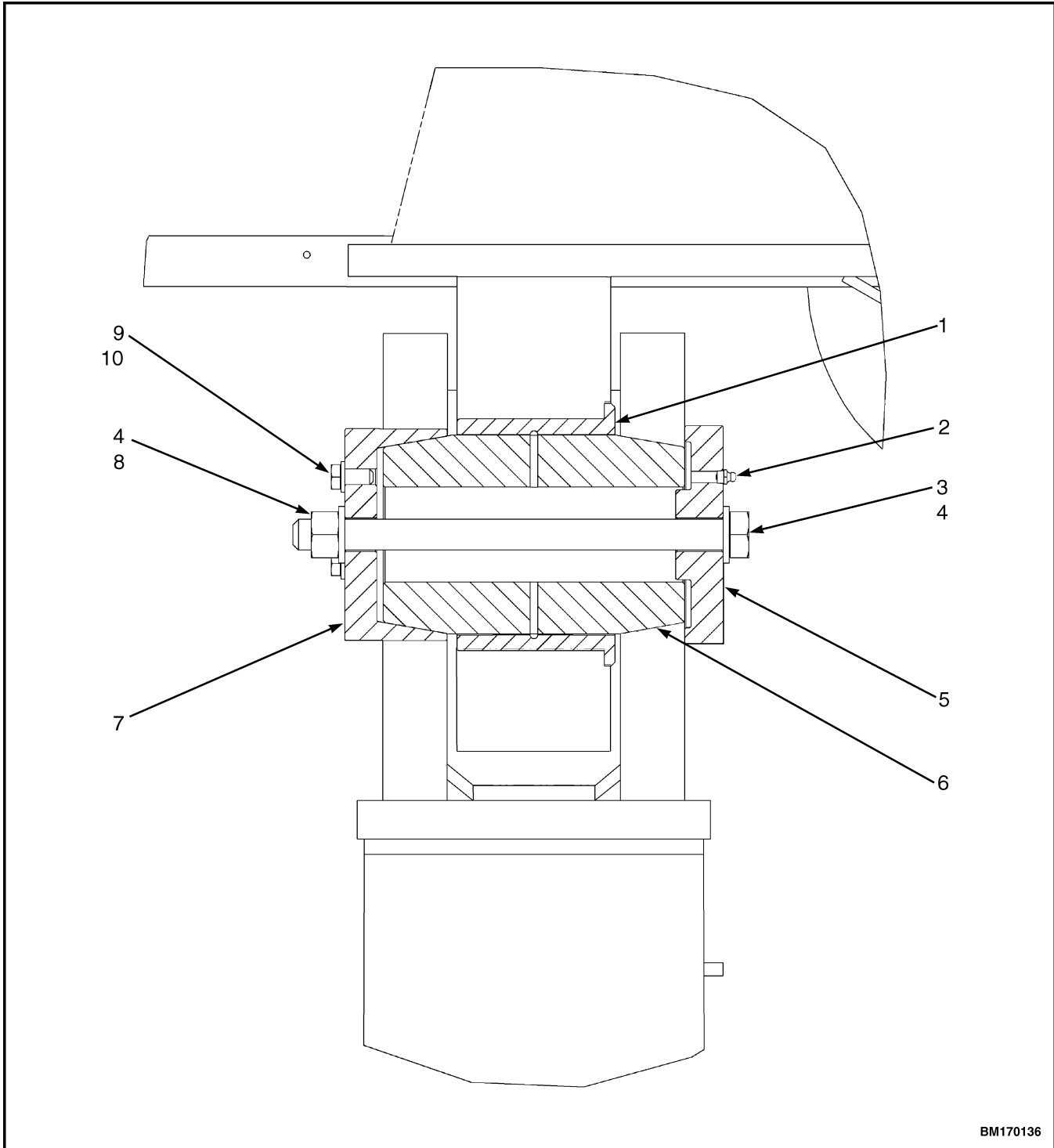


**WARNING**

Verify that the lifting device has the rated capacity to lift the pin or personal injury may occur.

f. Remove pivot pin.

g. Remove the pivot pin from the other side of the boom using the same procedure.



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- |                 |                      |
|-----------------|----------------------|
| 1. BUSHING      | 6. PIN BOOM MOUNTING |
| 2. LUBE FITTING | 7. CAP               |
| 3. CAPSCREW     | 8. NUT               |
| 4. WASHER       | 9. WASHER            |
| 5. CAP          | 10. CAPSCREW         |

**Figure 5. Boom to Frame Mounting**



13. Lift the boom assembly from the lift truck and set the boom on supports.
14. Remove the bushing.

## DISASSEMBLE

1. Disassemble the boom extension cylinder as follows:
  - a. Disconnect the hose support chain from the support weldment on the right side of the inner boom section.
  - b. Put identification tags on the hoses.
  - c. Disconnect the hoses. Put caps or plugs in all open fittings.
  - d. Remove the two capscrews and beveled washers and the keeper from the boom extension cylinder at the rear side of the boom.
  - e. Push the pin through the hole with a drift.
  - f. Connect a lifting device to the inner boom section.
  - g. Pull the inner boom section out of the outer boom section until boom extension cylinder pin is out of the outer boom section.
  - h. Place the inner boom section on supports.
  - i. Remove the six capscrews and left and right cover from the boom extension cylinder at the boom top side.
  - j. Remove the pin.
  - k. Connect a lifting device to the boom extension cylinder.
  - l. Pull out the boom extension cylinder from the rear of the inner boom section.
2. Remove the adjustment wear caps and wear pads from the front of the boom by removing the capscrews for the wear pads retainers.
3. Disconnect the wiring and indicator lamps only if there is damage.

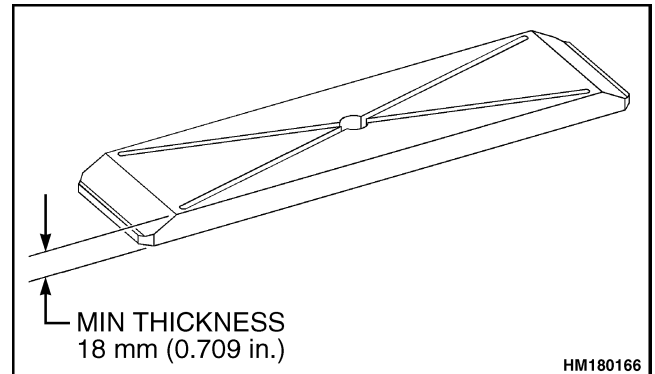
## CLEAN AND INSPECT

### WARNING

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

**NOTE:** When the wearplates have been worn to a minimum thickness of 18 mm (0.709 in.), the wearplates must be replaced.

Clean all the parts of the boom section with solvent. Inspect all the welds for cracks. Inspect the wear plates and retainers for damaged threads, deep grooves, or cracks. Check the wear surfaces of the boom sections. Replace wear plates that are worn. See Figure 6.



*Figure 6. Wearplate*

## ASSEMBLE

1. If necessary, connect the wiring and indicator lamps.
2. Connect a lifting device to the boom extension cylinder.
3. Install the boom extension cylinder into the inner boom section so the pin tube on the cylinder rod is aligned with the holes for the mount pin.
4. Install the pin through the holes into the pin tube.
5. Install the left and right cover.

6. Apply Loctite® 270 to the six capscrews and install the six capscrews.
7. Connect a lifting device to the inner boom section.
8. Install the two wear plates under the wear plate retainers and put the assemblies on the lower inside surface at the front end of the outer boom.
9. Install the four capscrews and washers in each retainer at the end of the boom and then install the capscrew and washer from under the outer boom into each wear pad retainer.
10. Slide the inner boom section into the outer boom section so the pin tube on the cylinder shell aligns with the holes at the rear of the outer boom section.
11. Install the pin so the slot for the keeper is at the top side.
12. Install the keeper, two capscrews, and washers. Tighten capscrews to 265 N•m (195 lbf ft).
13. Push the inner boom section fully into the outer boom section and install the wear plate retainer at the rear of the inner boom section.
14. Apply Loctite® 270 to the retainer capscrews and install the wear plate retainer at the rear of the inner boom section.
15. Install the two wear plates on the upper side of the inside of the outer boom section.
16. Install the capscrews from the outer end of the outer boom section.
17. Install the capscrews and washers from the top of the boom.
18. Install one of the adjustable wear cup assemblies, in one of the holes in the sides of the outer boom section near the front.
19. Loosen the jam nut and turn the adjuster screw counterclockwise so the retainer is fully against the boom.
20. Apply Loctite® 270 to the retainer capscrews. Install and tighten capscrews.
21. Install the other retainer assemblies above and on the other side of the boom.
22. Adjust each adjuster screw so the inner boom section is in the center of the outer boom section.
23. Tighten the jam nuts.
24. Fasten the hose support chain to the support weldment on the left side of the inner boom section.
25. Attach the hoses to the extension cylinder.
26. Install the hoses.
27. Install the bushing into the boom pivot supports.
28. Install the spherical bearing in each derricking cylinder.
29. Install a snap ring into one of the grooves at the rod end of the dampening cylinder.
30. Install the joint ball in the dampening cylinder.

## INSTALL



### CAUTION

**Verify the used chain for the rear side is approximately 0.75 mm (29.5 in.) then the chain used at the boom tip side.**

**NOTE:** Orientation of the boom must be slightly upwards to allow a correct line up.

1. Connect a lifting device to lift the boom assembly at the boom tip and rear side.
2. Lift and place the boom assembly into position for installing the pins and carefully align the center of the spherical bushing with the center of the spacer tubes.
3. Connect the boom to the frame as follows:



### WARNING

**Verify that the lifting device has the rated capacity to lift the pin or personal injury may occur.**

- a. Install the pivot pin from the outside, towards the center of the frame.
- b. Install the two caps, capscrews, two washers, and nut to the pivot pin.

**CAUTION**

Verify if the correct capscrews are assembled in the outer cap.

- c. Tighten nut to 550 to 688 N•m (406 to 507 lbf ft).
  - d. Install the pivot pin from the other side of the boom using the same procedures.
  - e. Connect the two hydraulic lines and three electrical connectors between the boom and frame.
4. Connect the derricking cylinders to the boom as follows.

**WARNING**

Verify the lifting device has a lifting capacity of 2,000 kg (4,410 lb) to lift the derricking cylinder or personal injury may occur.

Do not use the lifting eyes on the derricking cylinder for removal and install activities. The derricking cylinder can suddenly swing to horizontal position and can cause serious personal injury.

- a. Connect a lifting device to the derricking cylinder.
- b. Carefully align the center of the spherical bearing with the center of the hole in the frame.

**WARNING**

Verify that the lifting device has the rated capacity to lift the pin or personal injury may occur.

**NOTE:** Verify that the pin is aligned correctly to install the plate.

- c. Install the pivot pin from the outside so the pivot pin can be fixed with the plate, using a press.
- d. Install the ring and capscrew from the outside of the pivot pin.
- e. Install the washer and nut onto the capscrew and torque the nut to 1100 N•m (812 lbf ft).
- f. Install the plate, two capscrews and washers.

- g. Connect the hydraulic lines to the derricking cylinder.
  - h. Start the engine.
  - i. Extend the derricking cylinders and carefully align the center of the spherical bearings with the center of the hole in the boom.
  - j. Shut down the engine.
  - k. Install the pivot pin from the outside so the pivot pin can be fixed with the plate, using a press.
  - l. Install the ring and capscrew from the outside of the pivot pin.
  - m. Install the washer and nut onto the capscrew and torque the nut to 1100 N•m (812 lbf ft).
  - n. Install the plate, two capscrews and washers.
  - o. Remove the lifting device from the derricking cylinder.
5. Start the engine.
6. If the attachment is on a container, drive the lift truck toward the container.
7. Apply parking brake.
8. Shut down the engine.
9. Connect the boom to the rotator frame as follows:
- a. Install the bushings in both holes on the boom so the bushings are in the center of the holes.
  - b. Use the lift truck to move the boom into position for installing the pins and carefully align the center of the bushings with the center of the rotator frame holes.
  - c. Install the pin and fixed bushing from the outside toward the center of the rotator frame.
  - d. Install the capscrew.
  - e. Install the sliding bushing.
  - f. Install the washer and lock nut on the capscrew and tighten to 320 N•m (236 lbf ft).
  - g. Connect the hydraulic lines between the boom and the rotator frame.

10. Connect the dampening cylinder as follows:

**NOTE:** Lubricate the pin with molybdenum disulfide grease before installing.

- a. Align the rod end of the dampening cylinder with the pin yoke.
- b. Push the pin partway in the dampening cylinder head from the outside towards the center of the rotator frame.
- c. Install the spacer and push the pin completely through the dampening cylinder head.
- d. Install the nut and tighten.
- e. Install the pin on the other dampening cylinder using the same procedure.

f. Connect the hydraulic lines at the dampening cylinder.

11. Start the engine and operate the boom functions. Check that functions of the boom assembly work correctly as described in the **Operating Manual**.

12. Operate the hydraulic system until air is out of the system. Bleed air from system if necessary.



### WARNING

**Do not try to locate hydraulic leaks by putting hands on pressurized hydraulic components. Hydraulic oil can be injected into the body by pressure.**

13. Check for leaks.

## Dampening Cylinder Repair

### REMOVE

1. Place the lift truck on a solid, level surface.
2. Fully lower and retract the boom.
3. Apply the parking brake.



### WARNING

**Do not disconnect any hydraulic lines when the engine is running or personal injury may occur.**

4. Shut down the engine.

**NOTE:** Move all control levers back and forth a minimum of 20 times to remove all hydraulic pressure from the pilot system.

5. Put identification tags on the lines during removal.
6. Disconnect the hydraulic lines at the dampening cylinder. Put caps on the open lines.
7. Disconnect the dampening cylinder at the rotator frame by removing nut from the pin. See Figure 4.
8. Push the pin through the cylinder head and frame mounting brackets with a drift.



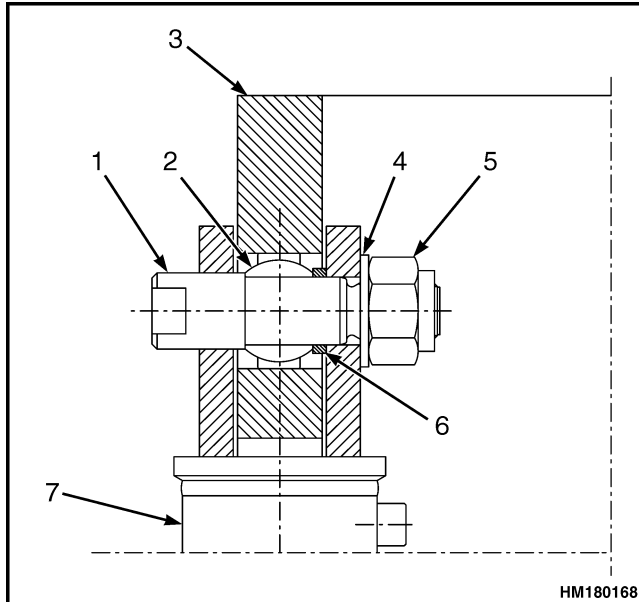
### WARNING

**Verify that the lifting device has the rated capacity to lift the dampening cylinder or personal injury may occur.**

9. Connect a lifting device to the dampening cylinder.
10. Remove the nut and washer from the pin. See Figure 7.
11. Push the pin through the cylinder holes and boom mounting bracket with a drift.
12. Remove the spacer and ball joint from the boom mounting bracket hole.
13. Remove the dampening cylinder from the rotator frame and boom tip.
14. Remove the pin on the other dampening cylinder using the same procedure.

### DISASSEMBLE

1. Put the dampening cylinder in a vise with soft jaws, placed in a horizontal position.
2. Disassemble the gland using a pin wrench to unscrew the gland. See Figure 8.



*Legend for Figure 7*

1. PIN
2. BALL JOINT
3. INNER BOOM (BOOM TIP)
4. WASHER
5. NUT
6. SPACER
7. DAMPENING CYLINDER

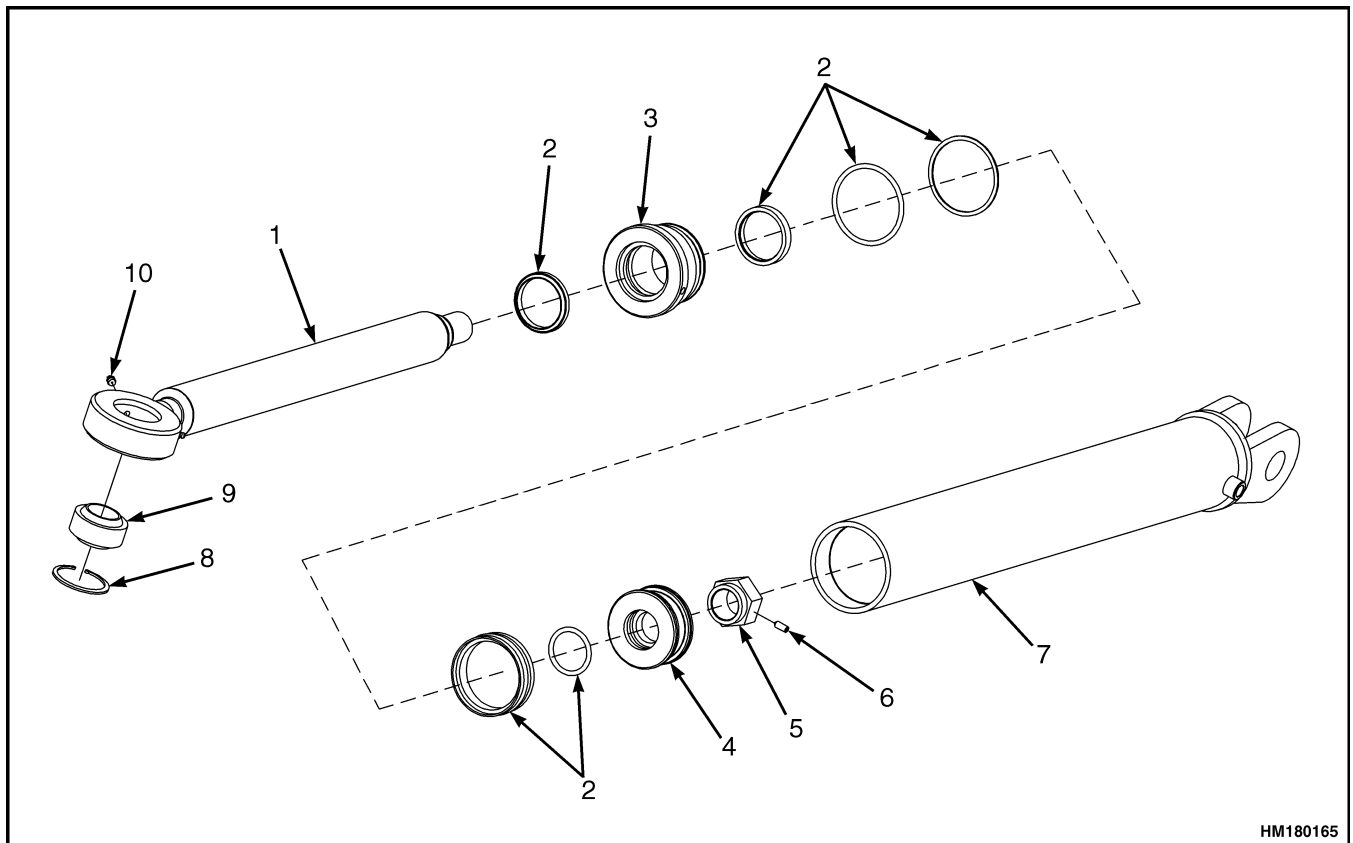


**CAUTION**

Use caution not to damage the finished surface of the piston rod when removing the piston rod from the cylinder shell in a horizontal position (parallel with the cylinder shell).

3. Disassemble the piston rod by pulling it out of the cylinder shell.

**Figure 7. Dampening Cylinder to Boom Mounting**



1. PISTON ROD
2. SEAL KIT
3. GLAND
4. PISTON

5. NUT
6. SETSCREW
7. SHELL
8. SNAP RING

9. BALL JOINT
10. GREASE NIPPLE

**Figure 8. Dampening Cylinder**

 **CAUTION**

Be careful not to damage the grooves when removing seals and rings.

4. Disassemble and remove the piston.
5. Loosen the setscrew on the nut and remove the nut.
6. Remove the piston and the gland.
7. Remove all seals from the gland and piston.

**CLEAN**
 **WARNING**

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

 **WARNING**

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

Clean all parts with solvent and remove residual solvent or allow the solvent to evaporate.

**INSPECT**

Inspect the parts of the dampening cylinder for damage, rust, or wear. Carefully inspect the rod surfaces for dents and scratches. Verify that the internal stroke surfaces of the cylinder shell and the grooves for the seals do not show any nicks, scratches, or other damage. Repair or replace parts as needed.

**ASSEMBLE**

**NOTE:** Verify that all parts are clean before assembly.

**NOTE:** Always use new seals. Lubricate all parts with clean hydraulic oil.

1. Assemble new seals on the piston and gland.
2. Assemble the gland on the piston rod.

3. Using the nut and setscrew, assemble the piston on the piston rod. Tightly fasten the nut and fix with the setscrew.

 **CAUTION**

Use caution not to damage the finished surface of the piston rod when installing the piston rod into the cylinder shell in a horizontal position (parallel to the cylinder shell).

4. Lubricate the cylinder shell bore with clean hydraulic oil. Put the piston rod assembly into the cylinder shell.

**NOTE:** No special torque is required when tightening the gland. Tightly fasten the gland.

5. Lubricate the thread of the gland, and screw the gland into the cylinder shell. Fasten the gland.

**INSTALL**
 **WARNING**

Verify that the lifting device has the rated capacity to lift the dampening cylinder or personal injury may occur.

1. Install the ball joint in the boom mounting bracket holes.
2. Use a lifting device to put the dampening cylinder in position.
3. Install the pin from the outside toward the center of the rotator frame.
4. Install the washer and nut. Tighten nut to 500 N•m (369 lbf ft).
5. Align the rod end of the dampening cylinder with the pin yoke.
6. Push the pin partway in the dampening cylinder head from the outside toward the center of the rotator frame.
7. Install the spacer and push the pin completely through the dampening cylinder head.
8. Install the nut and tighten.
9. Install the pin on the other dampening cylinder using the same procedure.
10. Connect the hydraulic lines at the dampening cylinders as tagged during removal.

11. If power dampening is available, start the engine and operate the dampening cylinders. Check that functions of the dampening cylinders work correctly.
12. If power dampening is **NOT** available, start the engine and operate the boom up and down to verify all air is out of the dampening cylinders.

## Boom Extension Cylinder Repair

### REMOVE

1. Place the lift truck on a solid, level surface.
2. Fully lower the boom.
3. Retract the boom and stop about 1.5 m (4.92 ft) before fully retracting, still having access to the extension pin located in the inner boom section.
4. Apply the parking brake.



### WARNING

**Do not disconnect any hydraulic lines while the engine is running or personal injury may occur.**

5. Shut down the engine.

**NOTE:** Move all control levers back and forth a minimum of 20 times to remove all hydraulic pressure from pilot system.

6. Disconnect the boom extension cylinder at the inner boom section by removing the six capscrews and left and right cover from the pin. See Figure 9.
7. Push the pin through the hole with a drift.

**NOTE:** It is possible to use the threaded hole to pull out the pin with a special tool.



### WARNING

**Verify that the lifting device has the rated capacity to lift the dampening cylinder or personal injury may occur.**

8. Connect a lifting device to the boom extension cylinder.
9. Put identification tags on the hoses.



### WARNING

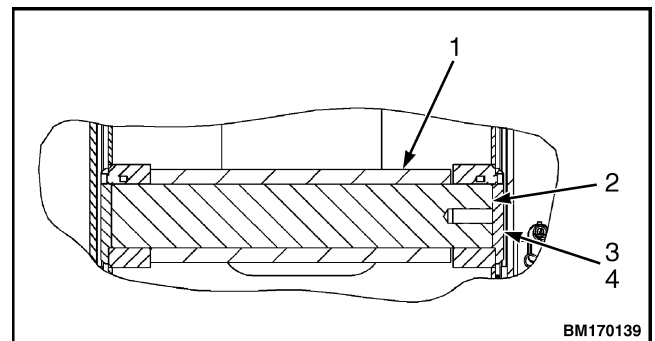
**Do not try to locate hydraulic leaks by placing hands on pressurized hydraulic components. Hydraulic oil can be injected into the body by pressure.**

13. Check for leaks.

10. Disconnect the three hoses. Put caps or plugs in open fittings.
11. Remove the two capscrews, beveled washers, and the keeper from the boom extension cylinder.
12. Push the pin through the hole with a drift.
13. Pull out the extension cylinder from the rear of the outer boom section.

### DISASSEMBLE

1. Place the entire cylinder on a support that is long enough to support the cylinder in a horizontal position.
2. Drain the remaining hydraulic oil out of the extension cylinder.
3. Put identification tags on the hoses that are connected to the load holding valve.
4. Disconnect the hoses from the boom extension cylinder hoses.



1. EXTENSION CYLINDER
2. PIN
3. CAPSCREW
4. COVER

**Figure 9. Extension Cylinder to Inner Boom Mounting**



5. Remove the four capscrews from the load holding valve.
6. Remove the load holding valve.
7. Remove the capscrews from the extension cylinder. See Figure 10.

 **CAUTION**

**Be careful not to damage the finished surface of the piston hose when removing the piston hose from the cylinder shell in a horizontal position (parallel with the cylinder shell).**

8. Disassemble the piston hose assembly from the cylinder shell by pulling it out.
9. Disassemble and remove the piston from the piston hose.
10. Remove the screws on the piston head.
11. Remove the piston head from the piston hose by turning the piston head counterclockwise.
12. Remove the cylinder and piston rod from the piston hose.

 **CAUTION**

**Be careful not to damage the grooves when removing seals and rings.**

13. Disassemble and remove all seals and rings.

**CLEAN**

 **WARNING**

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

 **WARNING**

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

Clean all parts in solvent and remove residual solvent or allow the solvent to evaporate.

**INSPECT**

Inspect the parts of the extension cylinder for damage, rust, or wear. Carefully inspect the rod surfaces for dents and scratches. Verify that the internal stroke surfaces of the cylinder shell and the grooves for the seals do not show any nicks, scratches, or other damage. Repair or replace parts as needed.

**ASSEMBLE**

**NOTE:** Verify that all parts are clean before assembly.

**NOTE:** Always use new seals. Lubricate all parts with clean hydraulic oil.

1. Assemble the new seals and rings on the cylinder and piston rod.
2. Assemble the piston, piston rod, and cylinder on the piston hose.

 **CAUTION**

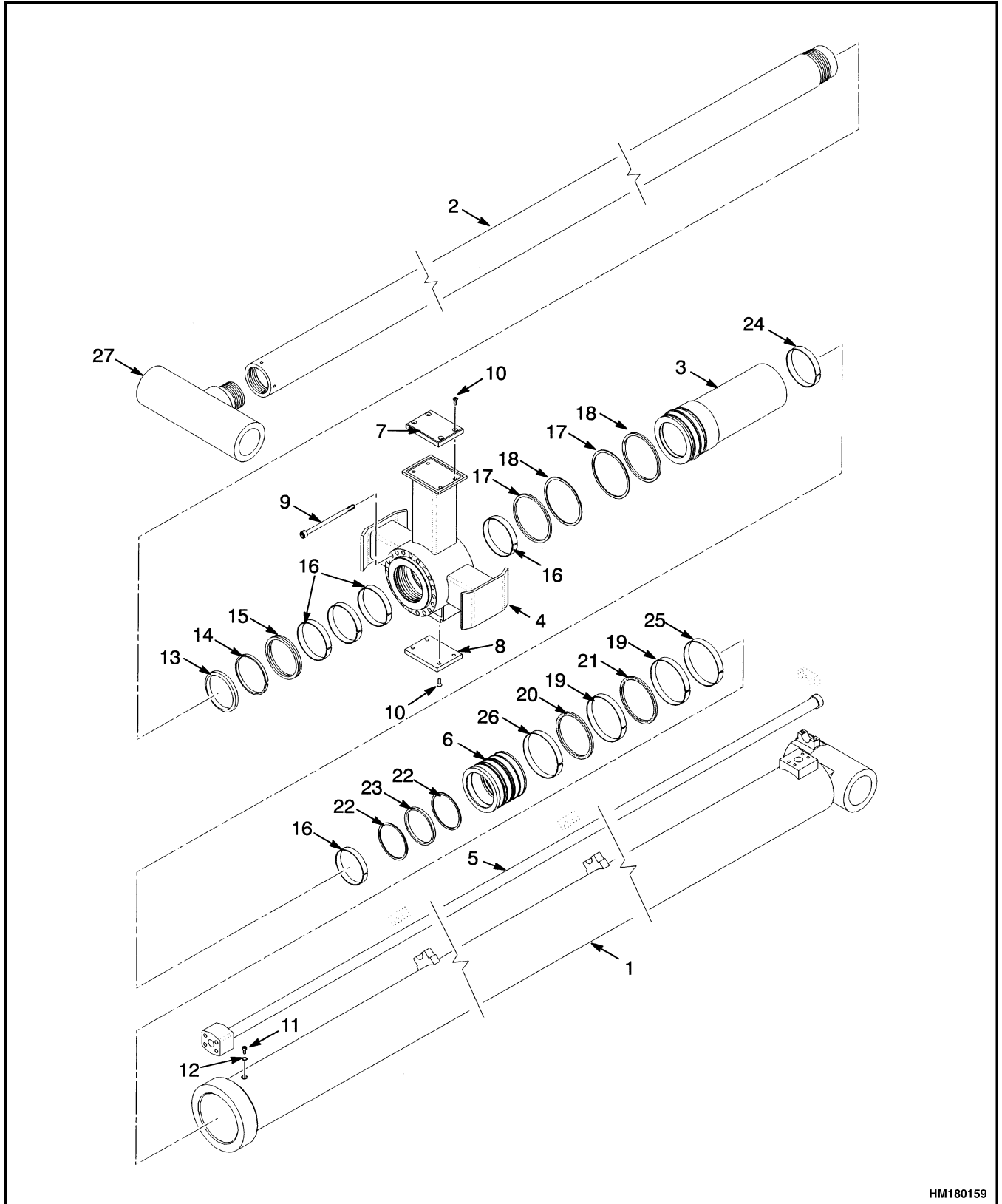
**Be careful not to damage the finished surface of the piston hose when installing the piston hose into the cylinder shell in a horizontal position (parallel to the cylinder shell).**

3. Lubricate the cylinder shell bore with clean hydraulic oil. Put the piston hose assembly into the cylinder shell.

*Legend for Figure 10*

- |                |              |                 |
|----------------|--------------|-----------------|
| 1. TUBE        | 10. SCREW    | 19. SEAL        |
| 2. PISTON HOSE | 11. CAPSCREW | 20. RING        |
| 3. PISTON ROD  | 12. WASHER   | 21. SEAL        |
| 4. CYLINDER    | 13. PLUG     | 22. SEAL        |
| 5. TUBE        | 14. RING     | 23. RING        |
| 6. PISTON      | 15. RING     | 24. SEAL        |
| 7. PLATE       | 16. SEAL     | 25. RING        |
| 8. PLATE GUIDE | 17. RING     | 26. RING        |
| 9. SCREW       | 18. RING     | 27. PISTON HEAD |

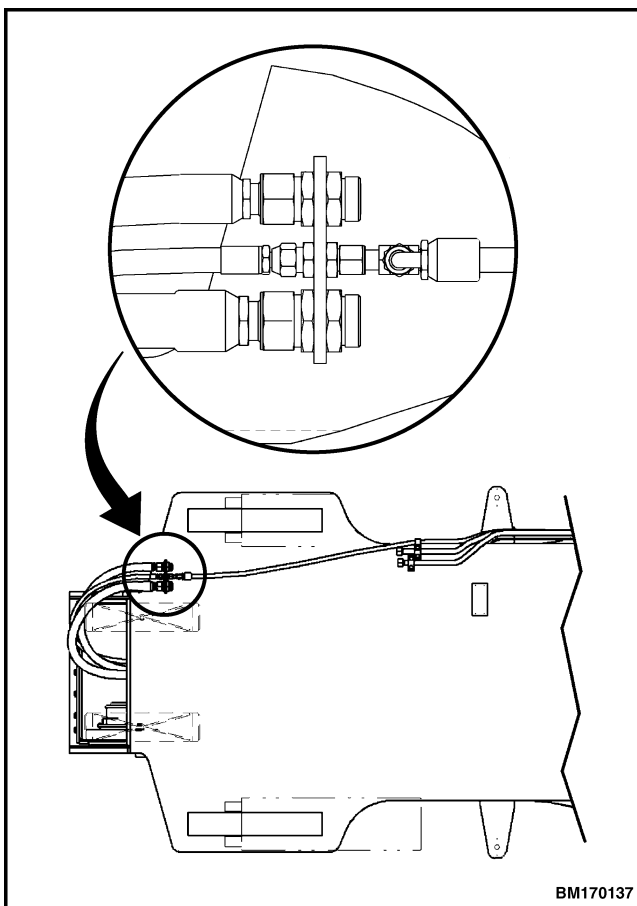




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Figure 10. Extension Cylinder

4. Assemble the cylinder onto the cylinder shell with 20 capscrews and tightly fasten the capscrews.
5. Assemble the piston head on the piston hose by turning the piston head clockwise.
6. Tighten the piston head using the screws.
7. Install the load holding valve with four capscrews.
8. Attach the two hoses to the boom extension cylinder fittings.
9. Route the three hoses as shown in Figure 11.



**Figure 11. Boom Extension Hose Routing**

## INSTALL

1. Connect a lifting device to the boom extension cylinder.
2. Install the boom extension cylinder in the inner boom section (through the rear of the outer boom section) so the pin tube on the cylinder rod is aligned with the holes for the mount pin.
3. Install the pin through the holes into the pin tube at the cylinder rod side.
4. Install the two covers.
5. Apply Loctite® 270 to the six capscrews and install capscrews.
6. Align the pin tube on the cylinder shell with the holes at the rear of the outer boom section.
7. Install the pin so the slot for the keeper is at the top side.
8. Install the keeper, two capscrews, and washers. Tighten the capscrews to 265 N•m (195 lbf ft).
9. Attach the hoses to the boom extension cylinder.
10. Start the engine and operate the boom functions. Verify that the boom extension cylinder functions correctly.

### **WARNING**

**Do not try to locate hydraulic leaks by placing hands on pressurized hydraulic components. Hydraulic oil can be injected into the body by pressure.**

11. Check for leaks.

## Derricking Cylinder Repair

### REMOVE

1. Place the lift truck on a solid, level surface.
2. Raise the boom approximately 1 m (3.3 ft) and set the attachment on a container. This will allow removal of the derricking cylinders.

3. Apply the parking brake.



### WARNING

Do not disconnect any hydraulic lines when the engine is running or personal injury may occur.

4. Shut down the engine.
5. Use a lifting device to support the derricking cylinder for removal.
6. Remove the two capscrews, washers, and plate for the pivot pin at the top of the derricking cylinder.

7. Remove the nut, washer, ring, and capscrew. See Figure 12.

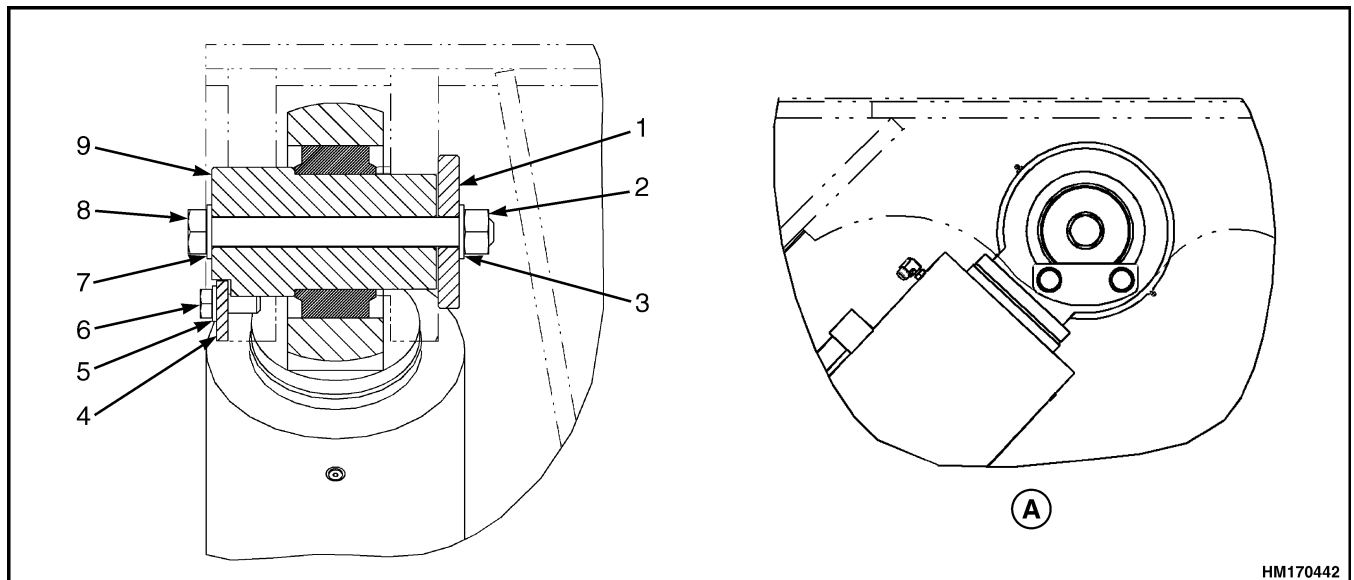
8. Use a press to push the pivot pin towards the outside of the boom.



### WARNING

Verify that the lifting device has the rated capacity to lift the pin or personal injury may occur.

9. Remove the pivot pin.
10. Follow Step 5 through Step 9 to remove the pivot pin of the other derricking cylinder.
11. Start the engine.
12. Fully retract the derricking cylinders.
13. Shut down the engine.
14. Put identification tags on hydraulic lines.



### A. SIDE VIEW SHOWN

1. RING
2. NUT
3. WASHER
4. PLATE
5. WASHER

6. CAPSCREW
7. WASHER
8. CAPSCREW
9. PIN CYLINDER

*Figure 12. Derricking Cylinder to Frame Mount*

**NOTE:** Move all control levers back and forth a minimum of 20 times to remove all hydraulic pressure from pilot system.

15. Disconnect the hydraulic lines at the derricking cylinder.

**⚠ WARNING**

Verify the lifting device has a lifting capacity of 2,000 kg (4,410 lb) to lift the derricking cylinder or personal injury may occur.

Do not use the lifting eyes on the derricking cylinder for removal and install activities. The derricking cylinder can suddenly swing to horizontal position and can cause serious personal injury.

16. Connect a lifting device to the derricking cylinder.
17. Remove the two capscrews, washers, and plate from the pivot pin at the frame. See Figure 13.
18. Remove the nut, washer, ring, and capscrew.
19. Use a press to push the pivot pin towards the outside of the boom.

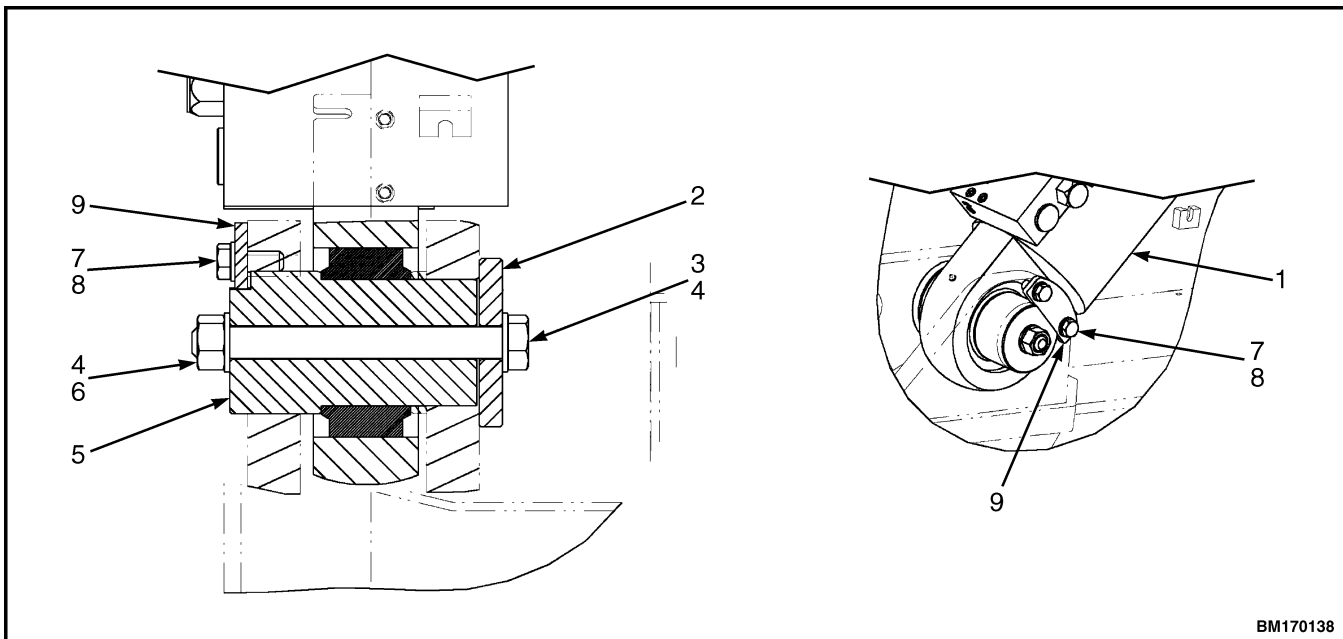
**⚠ WARNING**

Verify the lifting device has a lifting capacity of 2,000 kg (4,410 lb) to lift the derricking cylinder or personal injury may occur.

20. Remove the pivot pin.
21. Remove the derricking cylinder from the lift truck.
22. Remove the special tool from the lift truck.
23. If necessary, remove the other derricking cylinder using the same procedure.

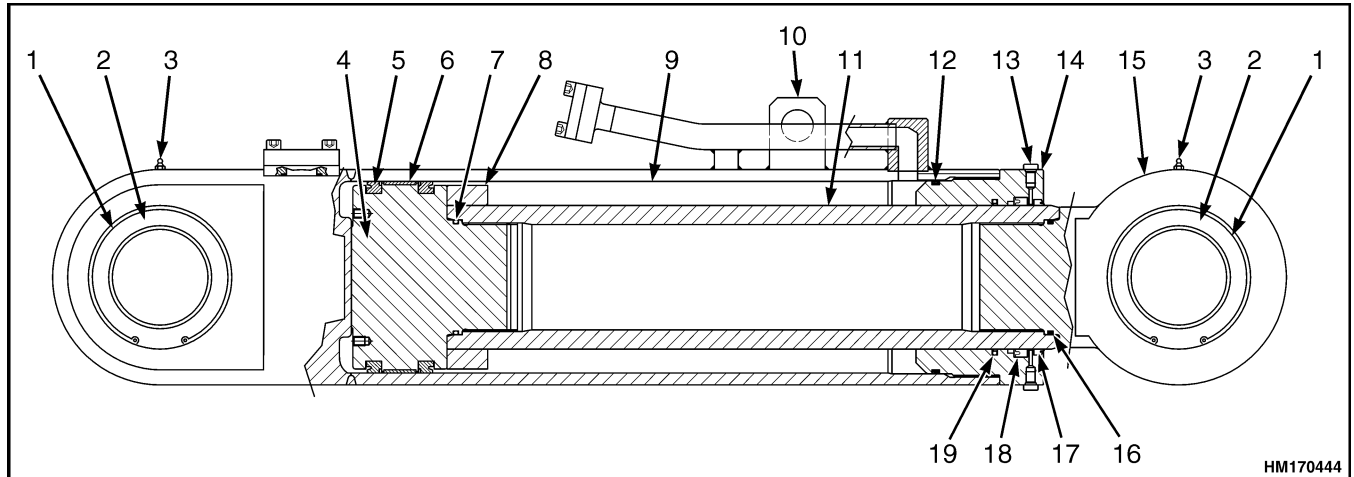
**DISASSEMBLE**

1. Place the entire cylinder on a support that is long enough to support the cylinder in a horizontal position.
2. Drain the remaining hydraulic oil out of the derricking cylinder.
3. Disassemble the bearing using a pin wrench to unscrew the bearing counterclockwise. See Figure 14.



- |                  |                          |             |
|------------------|--------------------------|-------------|
| 1. LIFT CYLINDER | 4. WASHER                | 7. WASHER   |
| 2. RING          | 5. PIN-CYLINDER MOUNTING | 8. CAPSCREW |
| 3. CAPSCREW      | 6. NUT                   | 9. PLATE    |

**Figure 13. Lift Cylinder to Frame Mounting**



- |                      |                |
|----------------------|----------------|
| 1. SNAP RING         | 11. PISTON ROD |
| 2. SPHERICAL BEARING | 12. ROD SEAL   |
| 3. GREASE FITTING    | 13. PLUG       |
| 4. PISTON            | 14. BEARING    |
| 5. PISTON SEAL       | 15. ROD END    |
| 6. WEARBAND          | 16. WIPER      |
| 7. O-RING            | 17. O-RING     |
| 8. SPACER            | 18. ROD SEAL   |
| 9. CYLINDER SHELL    | 19. ROD SEAL   |
| 10. LIFTING EYE      |                |

**Figure 14. Derricking Cylinder**

**CAUTION**

Be careful not to damage the finished surface of the piston rod when installing the piston rod into the cylinder shell in a horizontal position (parallel to the cylinder shell).

4. Disassemble the piston rod assembly from the cylinder shell by pulling it out.
5. Remove the piston from the piston rod by turning the piston counterclockwise.
6. Remove the rod end from the piston rod by turning the piston rod counterclockwise.
7. Remove the spacer from the piston rod.

**CAUTION**

Be careful not to damage the grooves when removing seals and rings.

8. Disassemble and remove all seals, O-rings, backup rings, wearband, and wiper.
9. Remove the snap rings out of the grooves at the rod side and piston side of the derricking cylinder.

10. Remove the spherical bearings out of the rod side and piston side of the derricking cylinder.

**CLEAN**

**WARNING**

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

**WARNING**

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

1. Clean all parts with solvent and remove residual solvent or allow the solvent to evaporate.

## INSPECT

Inspect the parts of the lift cylinder for damage, rust, or wear. Carefully inspect the rod surfaces for dents and scratches. Verify that the internal stroke surfaces of the cylinder shell and the grooves for the seals do not show any nicks, scratches, or other damage. Repair or replace parts as needed.

## ASSEMBLE

**NOTE:** Verify that all parts are clean before assembly.

**NOTE:** Always use new seals. Lubricate all parts with clean hydraulic oil.

1. Assemble the piston on the piston rod by turning the piston clockwise. Apply Loctite® 243 on the threaded area of the piston rod. Torque the piston to 4000 N•m (2952 lbf ft).
2. Assemble the new seals, O-rings, backup ring, wearband, and wiper on the piston rod, piston, and bearing.
3. Assemble the spacer and bearing on the piston rod.
4. Assemble the rod end on the piston rod by turning the rod end clockwise. Apply Loctite® 270 on the threaded area of the piston rod. Torque the rod end to 4000 N•m (2952 lbf ft).



### CAUTION

**Be careful not to damage the finished surface of the piston rod when installing the piston rod into the cylinder shell in a horizontal position (parallel to the cylinder shell).**

5. Lubricate the cylinder shell bore with clean hydraulic oil. Put the piston rod assembly into the cylinder shell.

**NOTE:** No special torque is required when tightening the bearing. Securely tighten the bearing into the cylinder shell.

6. Lubricate the thread of the bearing with clean hydraulic oil and screw the bearing into the cylinder shell.

## INSTALL

1. Install a locking ring in one of the grooves at the rod side of the derricking cylinder and one

locking ring at the piston side of the derricking cylinder.

2. Install the spherical bearings and the other locking rings into the rod side and piston side of the derricking cylinder.



### WARNING

**Verify the lifting device has a lifting capacity of 2,000 kg (4,410 lb) to lift the derricking cylinder or personal injury may occur.**

**Do not use the lifting eyes on the derricking cylinder for removal and install activities. The derricking cylinder can suddenly swing to horizontal position and can cause serious personal injury.**

3. Connect a lifting device to the derricking cylinder.
4. Carefully align the center of the spherical bearing with the center of the hole in the frame.



### WARNING

**Verify that the lifting device has the rated capacity to lift the pin or personal injury may occur.**

**NOTE:** Verify that the pin is aligned correctly to install the plate.

5. Install the pivot pin from the outside so the pivot pin can be fixed with the plate, using a press.
6. Install the ring and capscrew from the outside of the pivot pin.
7. Install the washer and nut onto the capscrew and torque the nut to 1100 N•m (812 lbf ft).
8. Install the plate, two capscrews and washers.
9. Connect the hydraulic lines to the derricking cylinder.
10. Start the engine.
11. Extend the derricking cylinders and carefully align the center of the spherical bearings with the center of the hole in the boom.
12. Shut down the engine.
13. Install the pivot pin from the outside so the pivot pin can be fixed with the plate.

- 14. Install the ring and capscrew from the outside of the pivot pin.
- 15. Install the washer and nut onto the capscrew and torque the nut to 1100 N•m (812 lbf ft).
- 16. Install the plate, two capscrews and washers.
- 17. Remove the lifting device from the derricking cylinders.
- 18. Start the engine and operate the derricking cylinders. Verify that the derricking cylinders function correctly.



**WARNING**

**Do not try to locate hydraulic leaks by placing hands on pressurized hydraulic components. Hydraulic oil can be injected into the body by pressure.**

- 19. Check for leaks.

## Troubleshooting

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Boom extends or retracts slowly or not at all.	Relief valve adjusted wrong.	Adjust relief valve.
	Boom wear pads worn or adjusted too tight.	Replace or adjust boom wear pads.
	Boom extension cylinder is damaged.	Repair or replace boom extension cylinder.
	Hydraulic pump is damaged.	Repair or replace hydraulic pump.
	Flow divider is damaged.	Repair or replace flow divider.
	Boom extension cylinder hoses have restrictions.	Replace hoses.
Boom lifts slowly or not at all.	Relief valve adjusted wrong.	Adjust relief valve.
	Boom pivot bushings worn or stuck.	Replace bushing.
	Derricking cylinder(s) is damaged.	Replace or repair derricking cylinder.
	Flow divider is damaged.	Repair or replace flow divider.
	Hydraulic pump is damaged.	Repair or replace hydraulic pump.
	Derricking cylinder hoses have restrictions.	Replace hoses.

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
All attachment cylinders operate slowly or not at all.	Attachment relief valve adjusted wrong.	Adjust attachment relief valve.
	Flow divider is damaged.	Repair or replace flow divider.
	Hydraulic pump is damaged.	Repair or replace hydraulic pump.
	Attachment supply hose has restriction.	Replace hose.