

Removal and installation of brake manifold

Removal

NOTE: If the brake manifold is leaking oil, an O-ring or cartridge can be replaced without removing the manifold from the truck. Refer to "Disassembly and assembly of brake manifold".



Before disconnecting pressure lines, replacing components in the hydraulic circuits, or installing test gauges, always bleed down the steering and brake accumulators.

1. Shut down the truck. For the proper shutdown procedure, refer to Index and foreword section **Operating instructions**.
2. Open bleed down valves (1, Figure 50-13) and (2) to depressurize the brake accumulators.
3. To verify that the brake accumulators are depressurized, press the brake lock switch (key switch ON, engine off) and applying the service brake pedal. The service brake light should not come on.
4. Close the bleed down valves by rotating them clockwise.

NOTE: If the manifold must be removed from the truck, disconnect only the hydraulic lines and wires that are necessary to allow removal.

5. Disconnect and plug all necessary lines and ports to prevent possible contamination.
6. Remove the mounting hardware and move the brake manifold to a clean work area for disassembly.

Installation

1. Place the brake manifold into position in the hydraulic brake cabinet. Install and tighten the mounting hardware to the standard torque.
2. Remove all plugs and connect all lines and electrical connections to the proper locations.
3. Start the engine. Check for leaks and for proper operation.
4. Shut off the engine and make sure that the hydraulic tank is filled to the proper level.

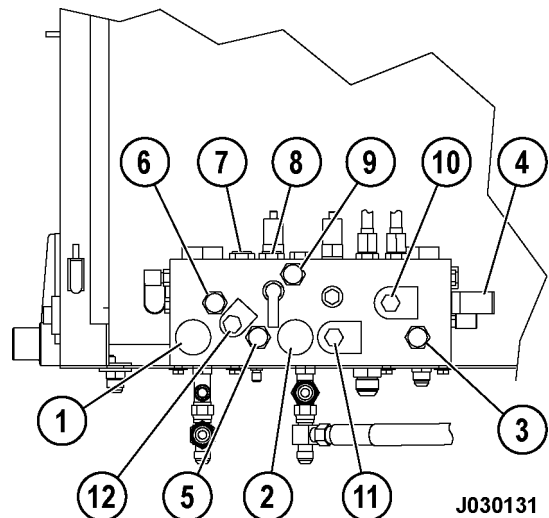


FIGURE 50-13. BRAKE MANIFOLD

1. Accumulator Bleed Down Valve (Rear Brake)
2. Accumulator Bleed Down Valve (Front Brake)
3. Check Valve
4. Pressure Reducing Valve
5. Auto Apply Sequence Valve
6. Check Valve
7. Load Shuttle Cartridge
8. Hot Oil Cartridge
9. Check Valve
10. Brake Lock Solenoid Valve
11. Parking Brake Solenoid Valve
12. Auto Apply Solenoid Valve*

NOTE: A plug is installed upon removal of auto apply solenoid valve (12).

Disassembly and assembly of brake manifold

Disassembly

1. Mark all plugs, valves and cartridges before removal to ensure proper assembly.
2. Remove the plugs, valves and cartridges as needed.

NOTE: Check valve (3, Figure 50-12) and reducing valve (4) both have an orifice disc located below them. The two orifices are different sizes. Therefore, it is very important to properly match each orifice with the correct installation location.

3. Clean all parts with an approved cleaning solution.
4. Blow all parts dry with pressure air and protect them from dust and any foreign matter until installation.
5. Replace all O-rings and any other items that are deemed unsuitable for further usage.

Assembly

1. Install new O-rings on all components that were removed from the manifold.
2. Coat all bores, cartridges and O-rings with clean C-4 hydraulic oil.

NOTE: Do not overtighten any cartridges or solenoids. Damage to the cartridge may occur.

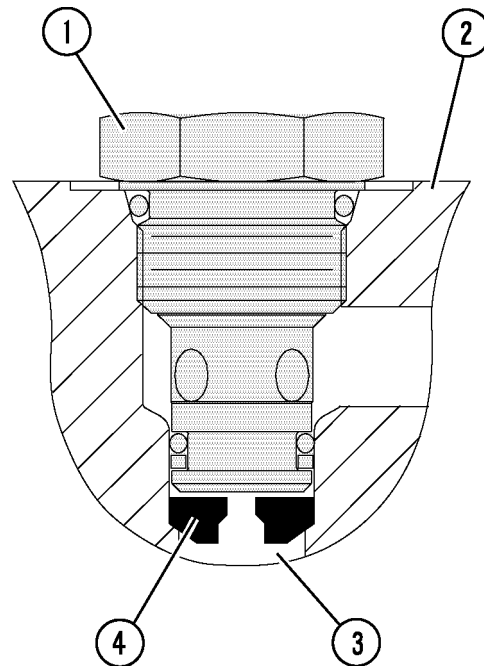
3. Install auto apply solenoid valve (12, Figure 50-13). Tighten the cartridge to **25 - 27 N·m (18 - 20 ft lb)**. Tighten the solenoid nut to **5 - 7 N·m (4 - 5 ft lb)**.
4. Install brake lock solenoid valve (10) and parking brake solenoid valve (11). Tighten the cartridges to **34 - 36 N·m (25 - 27 ft lb)**. Tighten the solenoid nut to **7 - 9 N·m (5 - 7 ft lb)**.

5. Before installing check valves (3), (6), and (9), or reducing valve (4), refer to Figure 50-14 for proper orifice disc installation. The orifice discs must be installed in the direction shown for proper operation.

- Check valve orifice - 1.58 mm (0.062 in.)

- Reducing valve orifice - 2.54 mm (0.100 in.)

6. Install all remaining cartridges in the bores from which they were removed (See Figure 50-13). Tighten each cartridge to **34 - 36 N·m (25 - 27 ft lb)**.



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FIGURE 50-14. ORIFICE INSTALLATION

- | | |
|-------------------|-----------------|
| 1. Cartridge | 3. Cavity |
| 2. Brake Manifold | 4. Orifice Disc |

Removal and installation of brake accumulator

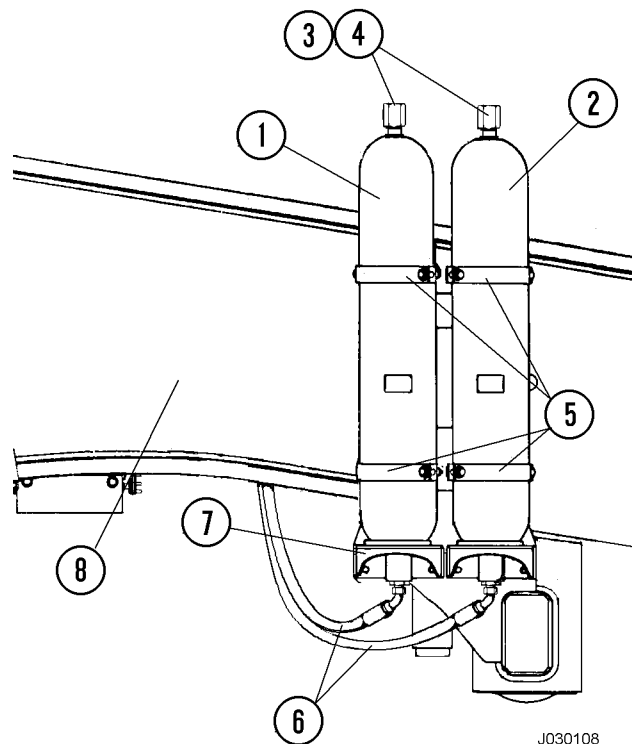
Removal

1. Shut down the truck. For the proper shutdown procedure, refer to Index and foreword section **Operating instructions**.
2. Open bleed down valves (1, Figure 50-13) and (2) to depressurize the brake accumulators.
3. To verify that the brake accumulators are depressurized, press the brake lock switch (key switch ON, engine off) and apply the service brake pedal. The service brake light should not come on.
4. Close the bleed down valves by rotating them clockwise.
5. Remove protective cover (3, Figure 50-15) from the charging valve guard on top of the accumulator.
6. Install a charging valve kit onto the accumulator charging valve. Use the charging kit to release nitrogen from the accumulator that is to be removed. Refer to Disassembly and assembly section **General information** for more information.
7. Disconnect oil line (6) from the bottom hydraulic port. Cap the port and hose fitting to prevent contamination.
8. Attach a lifting device to accumulator.



Each accumulator weighs approximately 100 kg (220 lb). Ensure that the lifting device has adequate capacity for handling the load.

9. Remove accumulator mounting clamps (5) and lift the accumulator off the mounting pad. Move the accumulator to a clean work area.



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FIGURE 50-15. BRAKE SYSTEM ACCUMULATORS

- | | |
|------------------------------------|---------------------|
| 1. Rear Brake Circuit Accumulator | 4. Charging Valve |
| 2. Front Brake Circuit Accumulator | 5. Mounting Clamps |
| 3. Protective Cover | 6. Oil Lines |
| | 7. Mounting Bracket |
| | 8. R.H. Frame Rail |

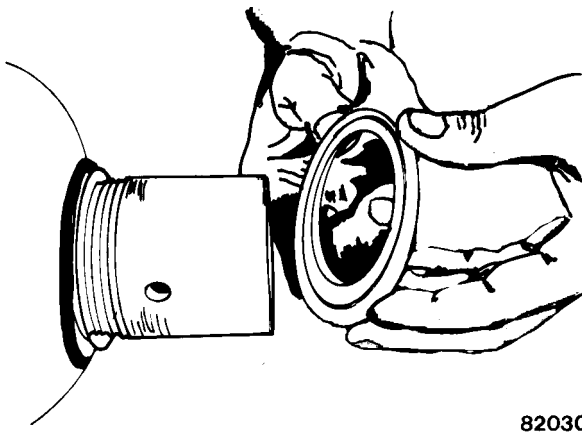
Installation

1. Position the accumulator on mounting bracket (7, Figure 50-15) with warning label visible.
2. Install mounting clamps and hardware. Tighten capscrews to standard torque.
3. Install oil line (6) at bottom (hydraulic) port.
4. Precharge the accumulator to 690 - 827 kPa (100 - 120 psi). Refer to Testing and adjusting section **Accumulators and suspensions** for the accumulator charging procedure.
5. Install protective cover (3) over charging valve on top of accumulator.

Disassembly and assembly of brake accumulator

Disassembly

1. Secure accumulator shell (10, Figure 50-17) with a chain wrench or similar device to prevent rotation during disassembly.
2. Remove cap (14). Verify that the nitrogen has been released and remove charging valve (11). Remove bleed plug (2) from hydraulic port assembly (1).
3. Use a spanner wrench to remove locking ring (3) from the hydraulic port assembly. Use an adjustable wrench on the flats of the hydraulic port assembly to prevent the port assembly from rotating.
4. Remove spacer (4) as shown in Figure 50-16. Then push the hydraulic port assembly into the shell.



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FIGURE 50-16. SPACER REMOVAL

5. Insert a hand into the accumulator shell and remove O-ring backup (5), O-ring (6) and metal backup washer (7).
6. Separate anti-extrusion ring (8) from the hydraulic port.

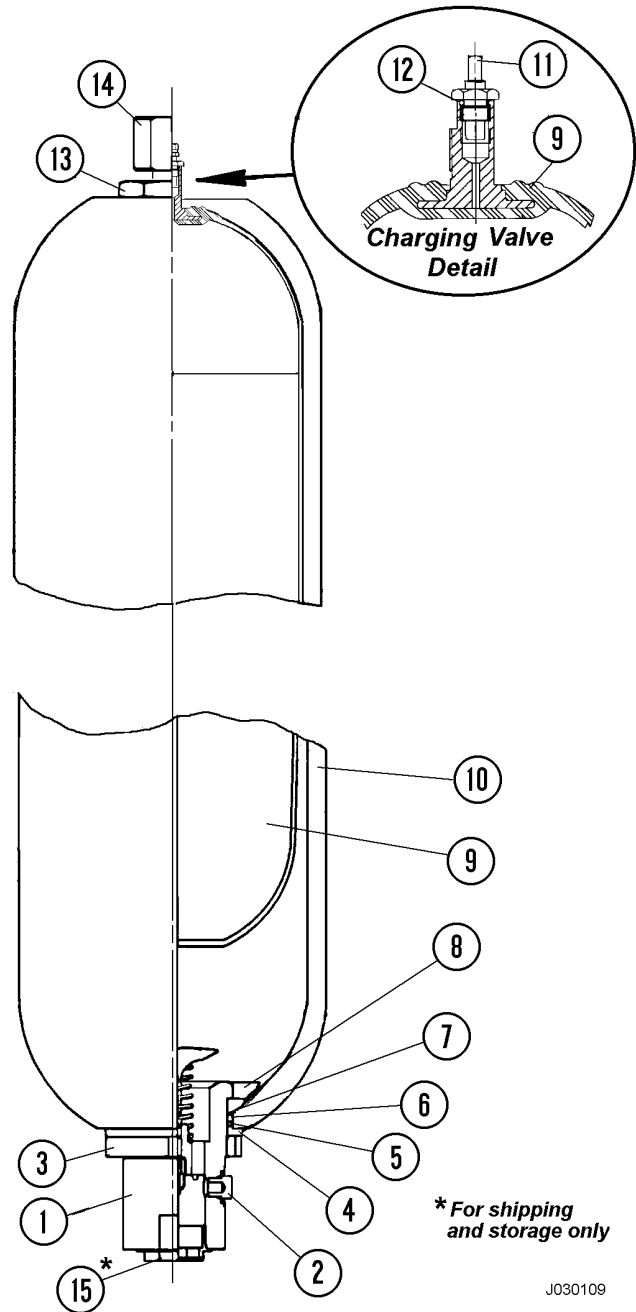
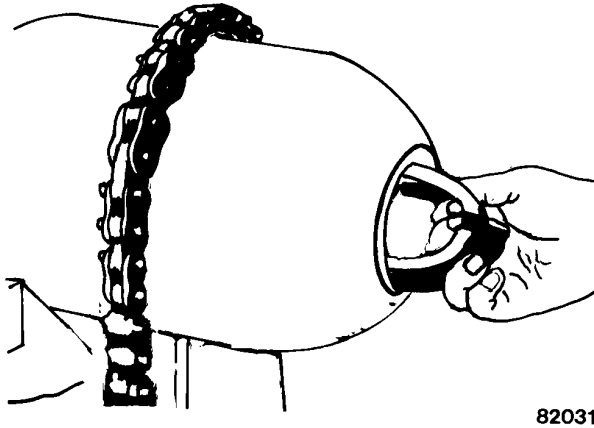


FIGURE 50-17. ACCUMULATOR ASSEMBLY

- | | |
|----------------------------|------------------------|
| 1. Hydraulic Port Assembly | 8. Anti-Extrusion Ring |
| 2. Bleed Plug | 9. Bladder Assembly |
| 3. Locking Ring | 10. Shell |
| 4. Spacer | 11. Charging Valve |
| 5. O-Ring Backup | 12. O-Ring |
| 6. O-Ring | 13. Locknut |
| 7. Metal Backup Washer | 14. Protective Cap |
| | 15. Port Protector* |

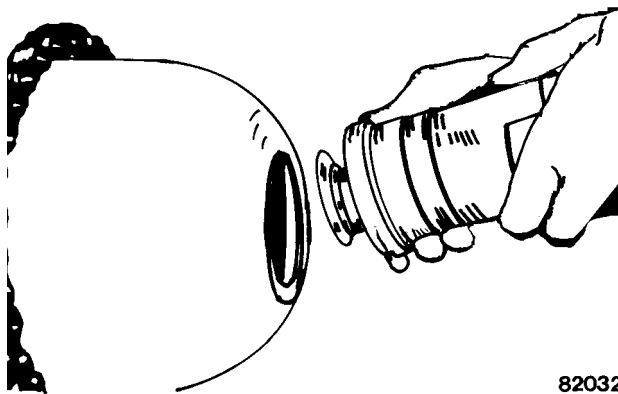
7. Fold the anti-extrusion ring and remove it from the shell as shown in Figure 50-18.



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FIGURE 50-18. ANTI-EXTRUSION RING

8. Remove the hydraulic port from the shell as shown in Figure 50-19.

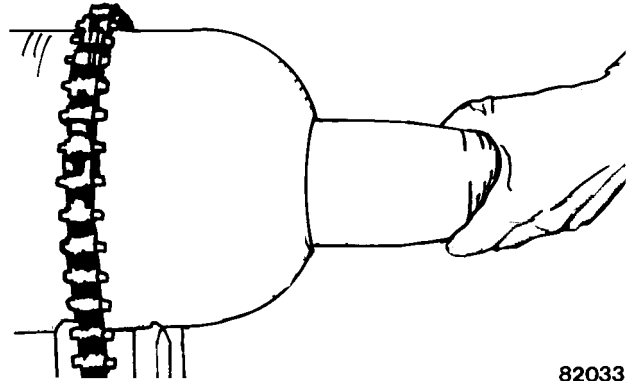


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FIGURE 50-19. HYDRAULIC PORT REMOVAL

9. At the opposite end of the accumulator assembly, remove locknut (13, Figure 50-17) from the bladder valve stem.
10. Reach inside the shell at the hydraulic port end and compress the bladder to expel as much air as possible.

11. Fold the bladder and pull it out of the bottom of the accumulator shell using a twisting motion as shown in Figure 50-20. A cloth may keep your hand from slipping due to the oil film on the bladder.



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FIGURE 50-20. BLADDER REMOVAL

Cleaning and inspection

1. All metal parts should be cleaned with a cleaning agent.
2. Seals and soft parts should be wiped clean.
3. Inspect the hydraulic port assembly for damage. Check the poppet plunger to see that it spins freely and functions properly.
4. Check the anti-extrusion ring and soft seals for damage and wear. Replace all worn or damaged seals with original equipment seals.
5. After the shell has been cleaned with a cleansing agent, check the inside and outside of the shell. Pay special attention to the area where the gas valve and hydraulic assembly pass through the shell. Any nicks or damage in this area could destroy the accumulator bladder or damage new seals. If this area is pitted, consult your Komatsu service manager.

Assembly

1. After shell (10, Figure 50-17) has been cleaned and inspected, secure it in place to prevent rotation during assembly.
 2. Apply 2 liters (64 oz.) of clean type C-4 hydraulic oil inside the shell to lubricate and provide a cushion for the bladder.
 3. With all gas completely exhausted from bladder (9), collapse the bladder and roll it longitudinally into a compact roll. To keep the bladder rolled up, insert the gas valve core to prevent air from entering the bladder.
 4. Insert the bladder pull rod through the valve stem opening and through the shell hydraulic port. Attach the bladder pull rod to the bladder valve stem.
 5. With one hand, pull the bladder pull rod while feeding the bladder into the shell with the other hand. A slight twisting of the bladder will ease installation.
 6. Once the bladder valve stem has been pulled through the valve stem opening in the shell, install the name plate (if used) over the valve stem and install locknut (13) by hand.
 7. Once locknut (13) is in place, remove the bladder pull rod. Tighten the nut to **76 N·m (56 ft lb)**.
 8. Grasp hydraulic port assembly (1) at the threaded end and insert the poppet end into the shell. Lay the assembly inside the shell.
 9. Fold anti-extrusion ring (8) to enable insertion through the shell opening, then insert the ring into the shell. Once the anti-extrusion ring has cleared the shell opening, place the ring on the poppet assembly with the steel collar facing toward the shell hydraulic oil port.
 10. Pull the threaded end of the hydraulic port assembly through the shell until it seats solidly into position in the shell fluid port opening.
 11. With the hydraulic port assembly firmly in place, install the charging valve into the bladder stem.
 12. Slowly pressurize the bladder with dry nitrogen. Use a sufficient pressure of 275 - 345 kPa (40 - 50 psi) to hold the poppet assembly in place.
 13. Install metal backup washer (7) over the poppet assembly. Push the washer into the shell fluid port until it has bottomed out on anti-extrusion ring (8).
 14. Install O-ring (6) over the poppet assembly. Push it into the shell fluid port until it has bottomed out against washer (7). **Do not twist the O-ring.**
 15. Install O-ring backup (5) over the poppet assembly. Push it until it bottoms against O-ring (6).
 16. Insert spacer (4) with the smaller diameter of the shoulder facing the shell.
 17. Install locking ring (3) on the poppet assembly and tighten it. This will squeeze the O-ring into position. Use a wrench on the flats of the port assembly to prevent it from rotating. Tighten the nut to a final torque of **373 N·m (275 ft lb)**.
 18. Release all of the nitrogen from the bladder.
 19. Install bleed plug (2) and tighten it to **14 N·m (10 ft lb)**.
 20. Pour approximately 4 liters (1 gallon) of clean Type C-4 hydraulic oil into the accumulator through the hydraulic port.
- NOTE: The hydraulic oil added in Step 20 will act as a cushion when the accumulator is installed on the truck and precharged with nitrogen.*
21. Precharge the accumulator to 690 - 827 kPa (100 - 120 psi). Refer to Testing and adjusting section **Accumulators and suspensions** for the accumulator charging procedure.
 22. After precharging, install a plastic cover over the hydraulic port to prevent contamination. **Do not use a screw-in type plug.**
 23. Tighten cap (14) to **19 N·m (14 ft lb)**.

Disassembly and assembly of wheel brake

Disassemble and reassemble the brake assembly on a clean, dry work surface. The surface should be wooden or, if it is metal, covered with padding to prevent damage to machined surfaces. Match mark individual parts for correct orientation before disassembly.



WARNING
The front brake assembly weighs approximately 1 460 kg (3,210 lb) The rear brake assembly weighs approximately 1 820 kg (4,000 lb). Ensure that the lifting devices have adequate capacities for handling the load.

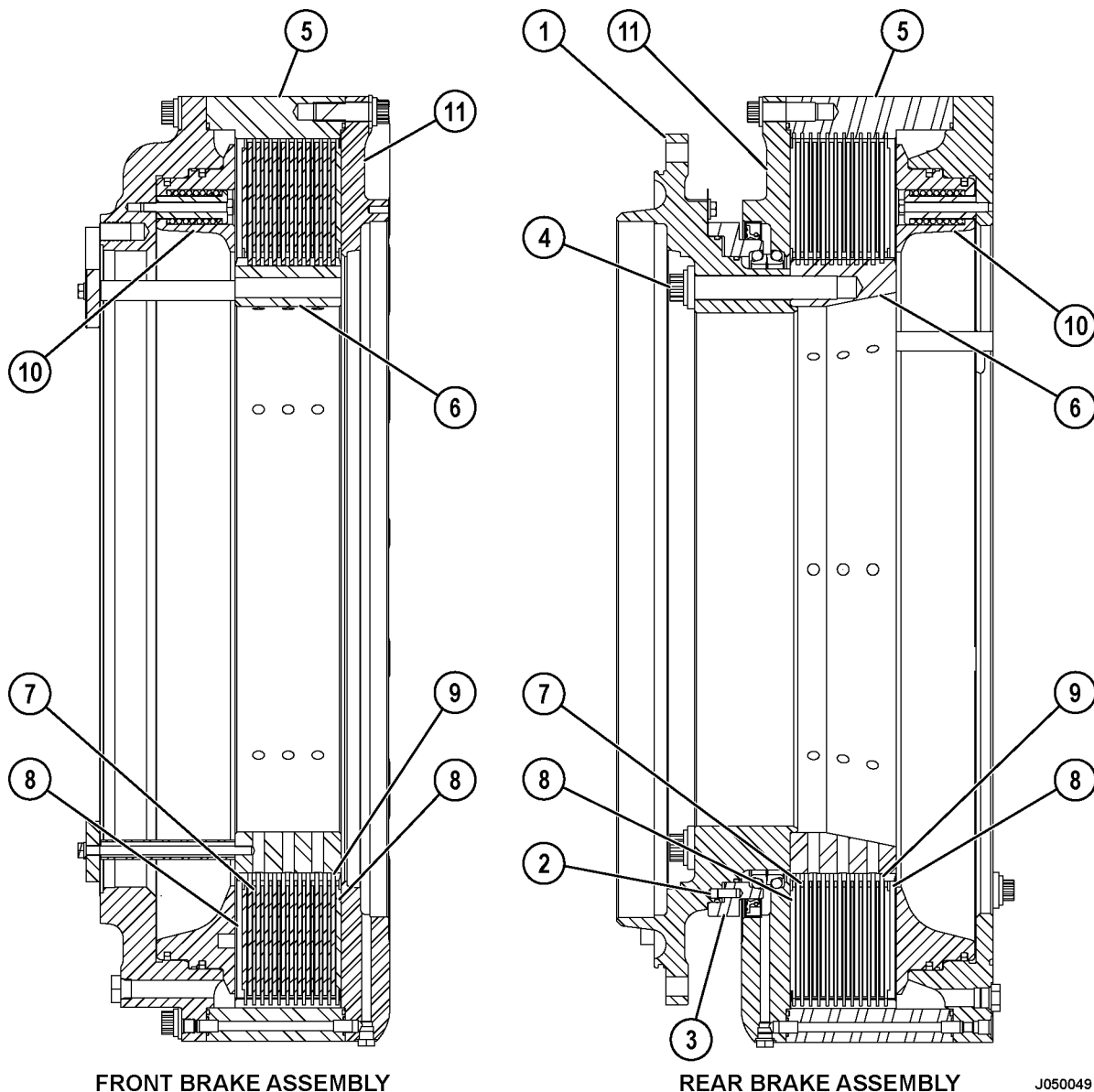


FIGURE 50-21. WET DISC BRAKE ASSEMBLIES

- | | | |
|---------------------------------|------------------|---------------------|
| 1. Hub Adapter | 5. Ring Gear | 9. Separator Plates |
| 2. Dowel Pin | 6. Inner Gear | 10. Piston Assembly |
| 3. Seal Carrier | 7. Friction Disc | 11. Back Plate |
| 4. Capscrew and Hardened Washer | 8. Damper | |

Disassembly

NOTE: If a rear wheel brake is to be disassembled, start with Steps 1 - 4. If a front wheel brake is to be disassembled, start with Step 5.

Remove the brake assembly from the truck. Refer to the Disassembly and assembly section **Wheels, spindles and rear axle**.

Rear wheel brake only:

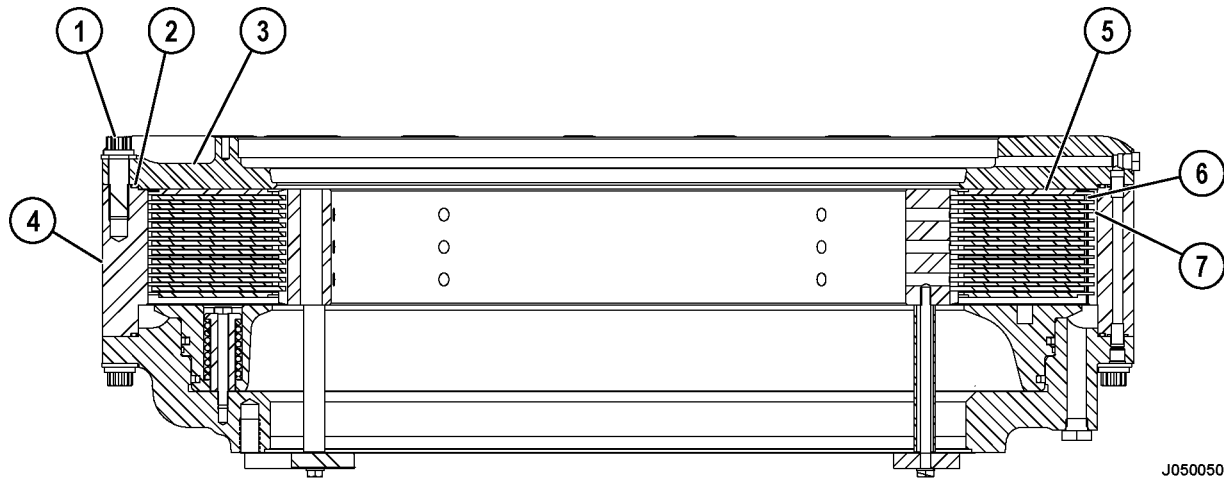
1. Ring gear retainer bars must be installed to retain inner gear inside the brake assembly.
2. Remove 12-point capscrews and hardened washers (4, Figure 50-21).
3. Make sure that the hub and other parts are marked to ensure proper orientation during reassembly. Lift hub adapter (1) from the brake assembly. Note the shim packs installed at six locations between the seal carrier and hub.
4. Remove seal carrier (3) with the oil seal and seal assembly.

Front and rear wheel brakes:

5. Position the brake assembly on a work surface with the ring gear retainer bars on the bottom as shown in Figure 50-22.
6. Remove capscrews and hardened flat washers (1, Figure 50-22) from backplate (3).
7. Insert a 7/8" - 9NC x 2" pusher bolt in each of the three tapped holes in the back plate. Tighten the bolts evenly to lift the back plate from ring gear (4). Remove and discard O-ring (2).

NOTE: Note the order of the discs and dampers as they are removed from the brake pack.

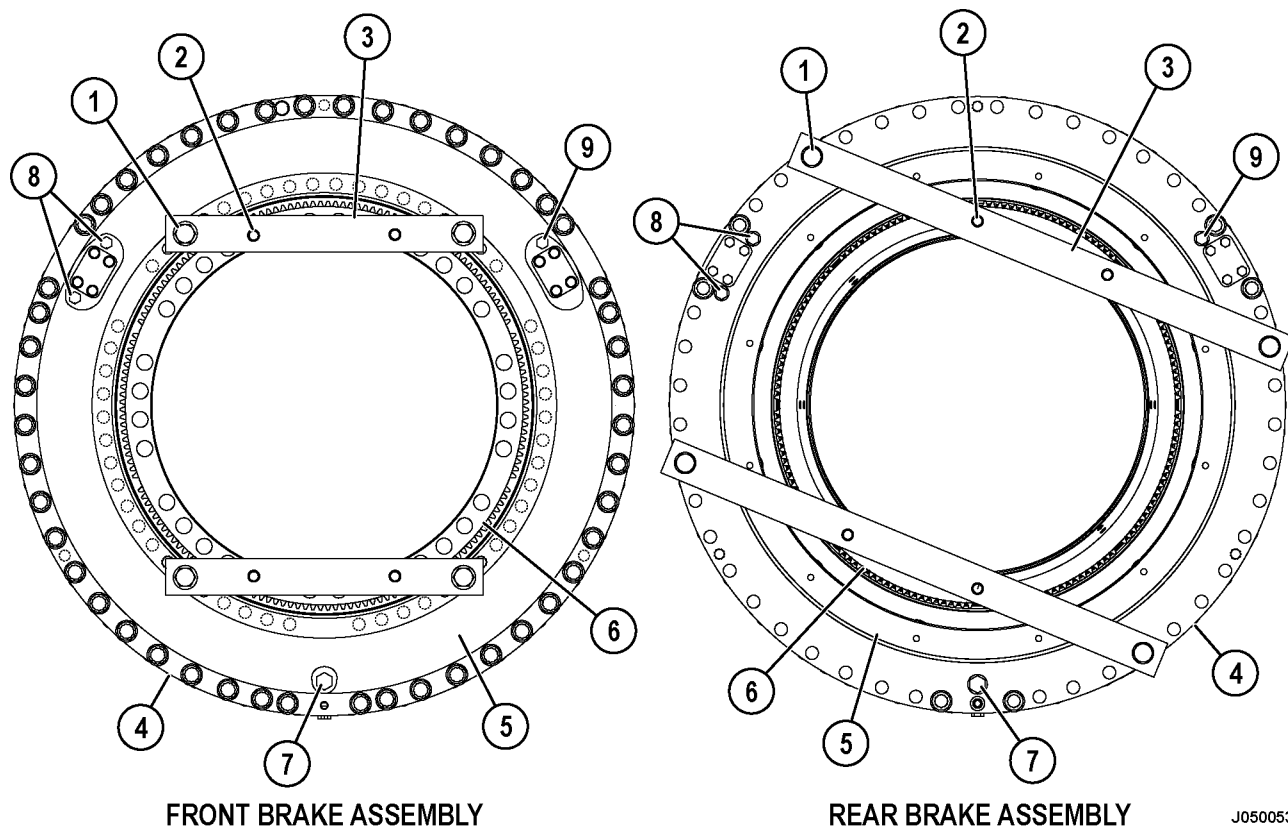
8. Remove damper (5) from the top of the brake pack. Remove separator plates (6), friction discs (7), and the remaining damper at the bottom of the brake pack.



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FIGURE 50-22. INITIAL DISASSEMBLY

- | | |
|---------------------------------|--------------------|
| 1. Capscrew and Hardened Washer | 5. Damper |
| 2. O-Ring | 6. Separator Plate |
| 3. Back Plate | 7. Friction Disc |
| 4. Ring Gear | |

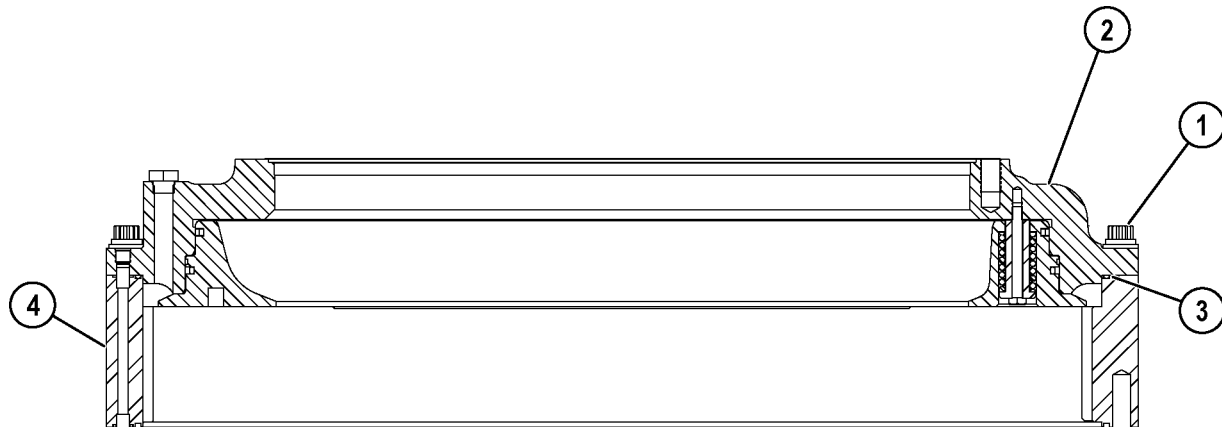


J050053

FIGURE 50-23. INNER GEAR INSTALLATION

- | | | |
|-----------------------------|-------------------|-------------------------------|
| 1. Capscrew and Flat Washer | 4. Ring Gear | 7. Drain Plug |
| 2. Capscrew and Lockwasher | 5. Piston Housing | 8. Brake Apply Pressure Ports |
| 3. Retainer Bar | 6. Inner Gear | 9. Brake Wear Indicator Port |

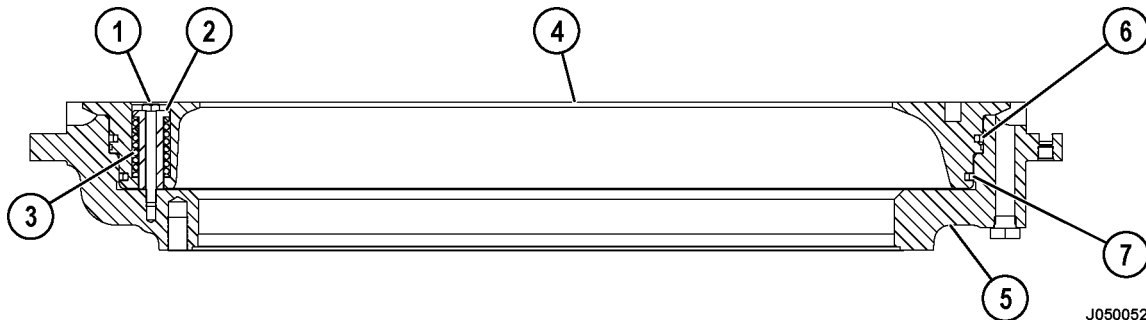
10. Turn over the brake assembly to position the ring gear retainer bars on top as shown in Figure 50-23.
11. Remove capscrews (1, Figure 50-23) and (2) that attach retainer bars (3) to piston housing (5) and inner gear (6).
12. Attach a lifting strap through retainer bars (3) and lift inner gear (6) out of the brake assembly. Remove the retainer bars and spacers.



J050051

FIGURE 50-24. PISTON/HOUSING ASSEMBLY REMOVAL

- | | |
|---------------------------------|--------------|
| 1. Capscrew and Hardened Washer | 3. O-Ring |
| 2. Piston Housing | 4. Ring Gear |



J050052

FIGURE 50-25. PISTON REMOVAL

- | | |
|--------------------------|-------------------|
| 1. Capscrew | 5. Piston Housing |
| 2. Spring Guide | 6. Seal Assembly |
| 3. Piston Retract Spring | 7. Seal Assembly |
| 4. Piston | |

13. Remove capscrews and hardened washers (1, Figure 50-24) from piston housing (2).
14. Insert a 7/8" - 9NC x 2" pusher bolt in each of the three tapped holes in the piston housing. Tighten the bolts evenly to lift the housing from ring gear (4). Remove and discard O-ring (3).
15. Position the piston assembly so that piston retract springs (3, Figure 50-25) are on top.
16. Remove capscrews (1), spring guides (2), and piston retract springs (3).

NOTE: Capscrew (1) threads are coated with Loctite® during assembly. A small amount of heat applied to the piston housing may be required for easier removal.

17. Loosen or remove the plugs that are installed in the ports in piston housing (5). Carefully lift piston (4) out of the housing. Remove seal assemblies (6) and (7).

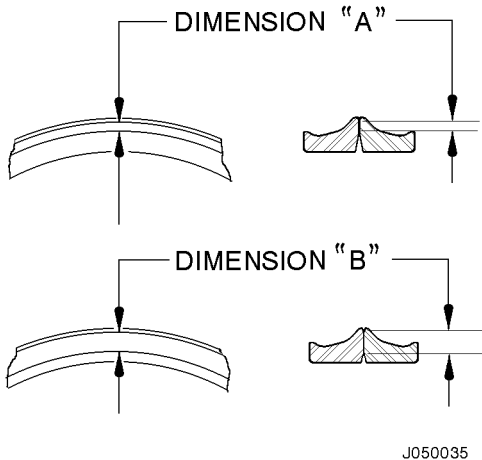
Cleaning and inspection



If the brake wear indicator test indicates that internal brake components are worn to the maximum allowable limit, all friction discs, separator plates and dampers should be replaced with new parts. Always replace seal assemblies and O-rings with new parts.

1. Clean all parts thoroughly before inspection.
2. For the rear brake assembly, remove and discard the toric rings from the seal assembly in seal carrier (3, Figure 50-21) and back plate (11). Inspect the oil seal's polished mating surfaces for scratches and other damage. Inspect the contact band of the mating faces to determine the amount of wear.

A new oil seal will have a contact band (dimension "A", Figure 50-26) approximately 1.6 mm (0.06 in.) wide. As wear occurs, the contact band will widen slightly (dimension "B") and migrate inward until the inside diameter is reached and the entire seal assembly must be replaced. Remaining seal life can be estimated by the width of the contact band.
3. Inspect the piston housing for nicks and scratches in the piston seal area. If any nicks or scratches cannot be removed by polishing, replace the piston housing.



J050035

FIGURE 50-26. SEAL WEAR PROGRESSION

4. Inspect the piston seal assembly grooves for damage.
5. Inspect piston retract springs (3, Figure 50-25). Check the free height and test for height under load. Replace the springs if they are not within approximately 10% of specification.
 - Free Height: 88.9 mm (3.50 in.)
 - Height @ 1 000 N (225 lb) working load: 74.60 mm (2.937 in.)
 - Height @ 2 669 N (600 lb) working load: 56.46 mm (2.223 in.)
6. Inspect the friction discs for warping, tooth wear, and excessive friction material wear. Replace the friction discs if wear exceeds the minimum allowable groove depth.
 - Disc thickness including friction material: 7.7 ± 0.3 mm (0.30 ± 0.01 in.)
 - Friction material thickness (new): 1.1 mm (0.04 in.)
 - Nominal friction material groove depth: 0.63 mm (0.025 in.)
 - Minimum allowable friction material groove depth: 0.25 mm (0.010 in.)
 - Flatness over friction material (new): 0.45 mm (0.018 in.)
7. Inspect the separator plates for warping and tooth wear.
 - Disc thickness (new): 3.7 ± 0.1 mm (0.146 ± 0.004 in.)
 - Flatness (new): 0.5 mm (0.020 in.)
8. Inspect the dampers for warping, tooth wear and excessive facing material wear.
 - Disc thickness including facing material: 6.9 ± 0.5 mm (0.272 ± 0.020 in.)
 - Disc thickness, steel plate only (new): 3.7 ± 0.1 mm (0.146 ± 0.004 in.)
 - Flatness, steel plate (new): 0.5 mm (0.020 in.)
9. Inspect ring gear (4, Figure 50-23) for excessive tooth wear and for nicks and scratches in the O-ring seal grooves.
10. Inspect inner gear (6) for excessive tooth wear and damage at the capscrew holes.