SERVICE REPAIR

MANUAL

Hyster A214 (H360H, H400H, H400H-EC5, H450H, H450H-EC6) Forklift



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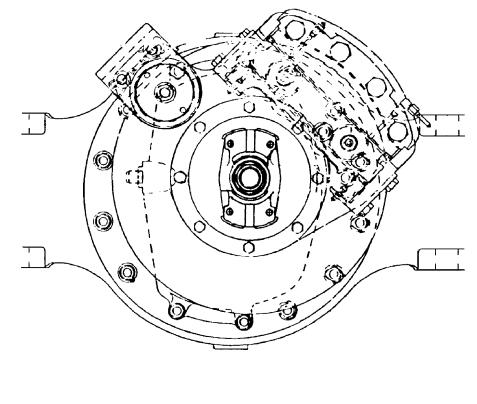
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PARKING BRAKE

H14.00-20.00XM (H360-450H) [A214]; H16.00-18.00XM-12EC (H400-450H-EC5-6) [A214]; RS45-30CH, RS46-33CH, RS46-36CH, RS45-27IH, RS46-30IH, RS46-33IH [A222]; H20.00-32.00F, H28.00F-16CH (H440, H550, H620, H700F, FS) [E008]; H36.00-48.00E (H800-1050E) [D117]; H36.00-48.00E-16CH (H800-1050E-16CH) [D117]



HYSTER

SAFETY PRECAUTIONS MAINTENANCE AND REPAIR

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

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

Indicates a condition that can cause immediate death or injury!



Indicates a condition that can cause property damage!

TABLE OF CONTENTS

1
1
2
2
2
2
2
3
5
5
5
5
6
6
8
8
9
9
10
10

This section is for the following models:

H14.00-20.00XM (H360-450H) [A214]; H16.00-18.00XM-12EC (H400-450H-EC5-6) [A214]; RS45-30CH, RS46-33CH, RS46-36CH, RS45-27IH, RS46-30IH, RS46-33IH [A222]; H20.00-32.00F, H28.00F-16CH (H440, H550, H620, H700F, FS) [E008]; H36.00-48.00E (H800-1050E) [D117]; H36.00-48.00E-16CH (H800-1050E-16CH) [D117]

"THE QUALITY KEEPERS"

HYSTER APPROVED PARTS

General

The main components of the parking brake system are:

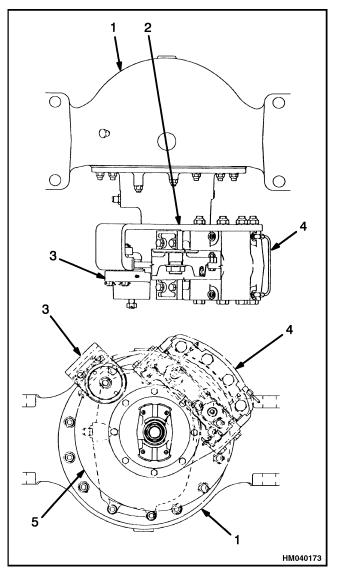
- Parking brake switch
- Solenoid valve
- Parking brake caliper

Description and Operation

The parking brake system uses a disc brake that is installed at the rear of the differential housing. See Figure 1 for typical system configuration. The spring-applied caliper is installed on the differential housing. The brake rotor is installed on the pinion shaft.

When hydraulic pressure is released, the springs inside the brake expand to force the piston and linings against the disc. To release the brake, hydraulic pressure must be applied to release the springs. The brake can be released manually if hydraulic pressure is not available.

The operation of the parking brake is controlled by a solenoid valve for the parking brake. The solenoid is operated by a switch on the instrument panel. The solenoid is normally energized during operation for oil pressure to compress the spring to release the parking brake.



- 1. DIFFERENTIAL
- 2. BRAKE ASSEMBLIES AND MOUNT
- 3. PARKING BRAKE CALIPER
- 4. AUXILIARY BRAKE CALIPER
- 5. ROTOR

Figure 1. Auxiliary and Parking Brake Assemblies

This parking brake is for use on hydraulic brake systems only.

Parking Brake Caliper Repair

RELEASE BRAKE MANUALLY

Hydraulic Pressure Available

To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.

If it is necessary to raise the vehicle to service the parking brake, support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip or fall over and cause serious personal injury.

Never try to turn or remove the spring cap while hydraulic pressure is applied to the brake. Turning the cap while pressure is applied can damage the O-ring seals and the spring cap threads. Removing the cap can cause serious personal injury by the sudden release of hydraulic pressure. Verify that the nut is at the end of the stud before you place the vehicle in service. If the nut is tightened against the spring cap, the brake cannot be applied and serious personal injury can result.

- 1. Verify that the vehicle is on a level surface.
- 2. Put blocks under the wheels not being serviced to keep the vehicle from moving.
- **3.** Apply hydraulic pressure to release the brake.

NOTE: The manual release stud and nut have left-hand threads.

- 4. To lock the brake in the released position, remove the cotter pin from the stud nut until it touches the spring cap.
- 5. Release the hydraulic pressure.

Hydraulic Pressure not Available

- 1. Verify that the vehicle is on a level surface.
- 2. Put blocks under the wheels not being serviced to keep the vehicle from moving.

3. Remove the cotter pin from the stud nut. Tighten the nut against the spring cap and continue tightening to manually retract the piston and lining from the disc. Stop tightening when the spring cap starts to turn.

REMOVE

- 1. Verify that the vehicle is on a level surface.
- 2. Put blocks under the wheels not being serviced to keep the vehicle from moving.

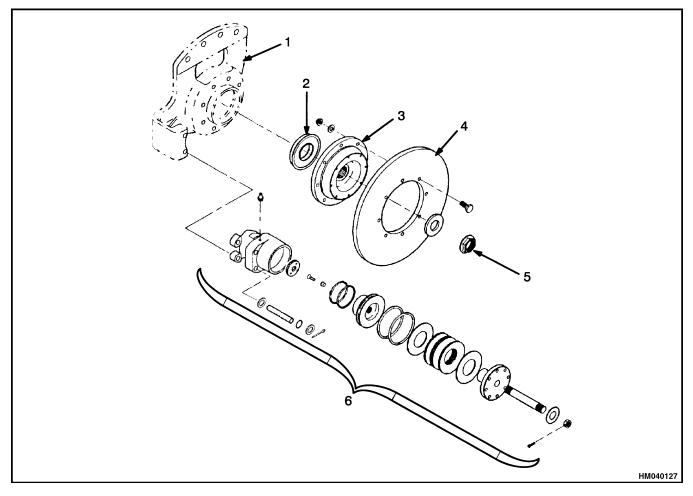
Before disconnecting any hydraulic lines, release pressure from the hydraulic circuit as follows:

- a. Shut off the engine and completely lower the carriage. Install blocks at the wheels to prevent the lift truck from moving.
- b. Operate the lift/lower lever and the brake pedals until the hydraulic pressure is released.

Brake linings can contain dangerous fibers. Breathing the dust from these linings can be a cancer or lung disease hazard. Do not make dust! Do not clean brake parts with compressed air or by brushing. Use vacuum equipment approved for brake dust or follow the cleaning procedure in this section. When calipers are removed, do not make dust.

Do not sand, grind, chisel, hammer, or change linings in any way that will make dust. Any changes to linings must be done in a restricted area with special ventilation. Protective clothing and a respirator must be used.

- **3.** Manually release the brakes using the procedures described in **Release Brake Manually**.
- **4.** Disconnect the brake line from the caliper inlet. Put plugs in the brake line and in the inlet to prevent contamination of the system. See Figure 2.
- **5.** Remove the centering device if one is assembled on the end of the caliper.



- 1. CALIPER MOUNT
- 2. OIL SEAL
- 3. ROTOR FLANGE

- 4. ROTOR 5. NUT AND WASHER
 - 6. CALIPER ASSEMBLY

Figure 2. Parking Brake Assembly

- **6.** Remove the caliper slide pin fasteners. Remove slide pins.
- 7. Remove the caliper from the disc.

DISASSEMBLE

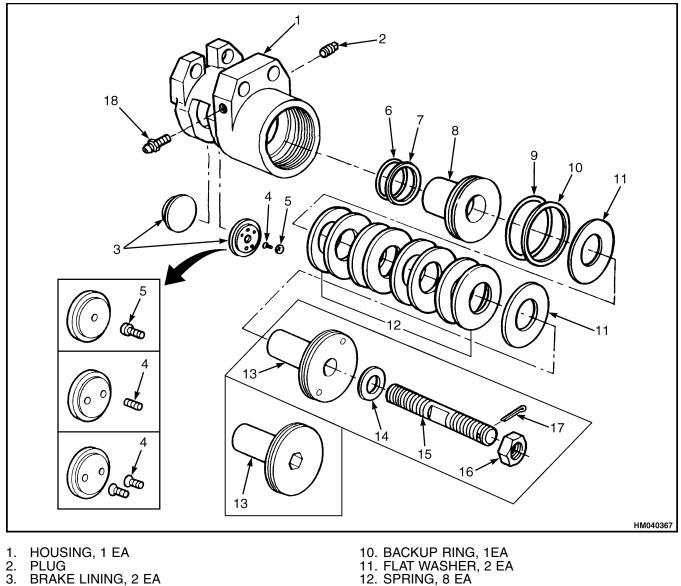
To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.

If it is necessary to raise the vehicle to service the parking brake, support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip or fall over and cause serious personal injury.

- 1. Remove the inlet fitting and the O-ring from the housing. Drain and discard the fluid. See Figure 3.
- **2.** Put a plug in the inlet to prevent contamination of the housing.
- **3.** Remove lining fasteners. Remove linings by using a pry bar between the lining and piston or housing.

NOTE: The manual release stud and nut have left-hand threads.

4. If necessary, remove the pin and nut from the manual release stud. Do not remove the washer from around the stud unless the washer is loose or damaged.



- BRAKE LINING, 2 EA
- SCREW, 2 EA 4.
- 5.
- SNAP FASTENER, 2 EA BACKUP RING, 1 EA 6.
- 7. O-RING SEAL, 1 EA
- PISTON, 1 EA 8. 9.
- O-RING SEAL, 1 EA

- 12. SPRING, 8 EA 13. SPRING CAP, 1 EA
- 14. WASHER, 1 ÉA
- 15. STUD, 1 ÉA
- 16. NUT. 1 EA
- 17. COTTER PIN, 1 EA
- **18. BLEEDER SCREW**

Figure 3. Parking Brake Caliper Components

- 5. Use a spanner wrench or an Allen wrench as required to remove the spring cap.
- 7. Remove the piston through the hole for the spring cap.
- 6. Remove the washers and springs from inside the caliper housing.
- 8. If necessary, remove the setscrews or snaps if either hold the linings to the piston and housing.

Use a wooden tool and vise with soft jaws in the following steps to prevent damage to the caliper piston or housing.

9. Remove and discard the O-rings and backup rings from the piston and housing.

NOTE: The piston has right-hand threads.

10. If necessary, hold the piston in a vise and remove the stud from the piston.

CLEAN

To prevent serious eye injury, always wear safe eye protection when performing vehicle maintenance or service.

To avoid personal injury when cleaning parts, work in a well-ventilated area, wear protective clothing (face shield or safety glasses and protective gloves), and follow chemical manufacturer's recommendations for safe usage.

Solvent cleaners can be flammable, poisonous, and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners, and petroleum-based cleaners. To avoid serious personal injury when using solvent cleaners, carefully follow manufacturer's instructions and these procedures:

- Wear safe eye protection.
- Wear clothing that protects skin.
- Work in a well-ventilated area.
- Do not use gasoline or solvents that contain gasoline. Gasoline can explode.
- Use hot solution tanks or alkaline solutions correctly. Carefully follow manufacturer's instructions.

Use only solvent cleaners to clean ground or polished metal parts. Hot solution tanks or water and alkaline solutions will damage these

parts. Isopropyl alcohol can be used for this purpose.

- 1. Use solvent cleaners to clean all metal parts that have a ground or polished surface. Metal surfaces that have a rough surface can be cleaned with solvent cleaners or alkaline solutions.
- 2. Clean all threads and fittings with a wire brush.
- **3.** Clean all parts not made of metal with soap and water.
- **4.** Scrape off all mud and dirt from the brake linings. Discard all linings contaminated with oil or grease.
- 5. Dry all parts with clean paper or rags.
- **6.** Apply hydraulic fluid used in the system to the clean parts that are to be assembled. Do not apply fluid to the linings or disc.

INSPECT

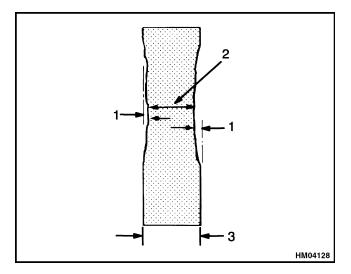
Linings

Always replace both linings. If only one lining is replaced, possible disc damage can occur.

- 1. Replace linings when the thickness of the lining is less than 3 mm (0.125 in.) from the piston or housing.
- **2.** Replace the lining if the thickness of the two linings is different.
- **3.** Replace the linings if contaminated with oil or grease.
- 4. Replace linings that have larger or deeper cracks than the normal, small, tight cracks on the surface caused by the caliper when used under high temperature conditions.

Disc

If the disc is worn beyond the wear limits, replace the disc. See Figure 4 and Table 1.



- 1. MAXIMUM DISC THICKNESS
- 2. MINIMUM DISC THICKNESS
- 3. ORIGINAL DISC THICKNESS

Figure 4. Disc Maximum Wear Limits

	Table	<i>1</i> .	Disc	Wear	Limits
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Original Disc	Maximum Disc	Minimum Disc
Thickness	Wear	Wear
12.7 mm	1.5 mm	9.7 mm
(0.5 in.)	(0.06 in.)	(0.38 in.)
20 mm	1.5 mm	17 mm
(0.79 in.)	(0.06 in.)	(0.67 in.)

Caliper Parts

- 1. Inspect the piston, housing bore, and O-ring for scratches or corrosion. Remove small scratches or corrosion with fine emery cloth. Replace the components if there are large scratches or excessive corrosion.
- 2. Measure the diameter of the piston at the large and small end. Replace the piston if the large end diameter is less than 101.47 mm (3.995 in.) or the small end diameter is less than 63.37 mm (2.495 in.).
- **3.** Measure the diameter of the housing bore at the large and small end. Replace the housing if the large end is greater than 101.68 mm (4.003 in.) or the small end is greater than 63.63 mm (2.505 in.).
- **4.** Inspect the housing for damage. If damage cannot be repaired, replace the housing.

- **5.** Inspect springs for wear and damage. Always replace springs as a set.
- 6. Inspect the threads of the spring cap for damage. If damage cannot be repaired, replace the spring cap.
- 7. Inspect the stud and threads on the stud in the piston. Replace studs if damaged.
- 8. Inspect the lining fasteners for wear or damage. Replace worn or damaged fasteners.

ASSEMBLE

Use only specified components when assembling the caliper. Do not use components from other calipers. If the wrong components are installed, the caliper will not operate correctly and can cause damage to the equipment. Use of parts not approved by Hyster can cause damage and loss of braking which could result in serious personal injury.

Take care when using Loctite[®] to avoid serious personal injury. Follow manufacturer's instructions to prevent irritation to eyes and skin. If Loctite[®] gets into eyes, flush them with water for 15 minutes. Have eyes checked by a doctor as soon as possible.

Use a vise with soft jaws in the following step to prevent damage to the caliper piston.

- 1. Apply Loctite[®] 277 or equivalent to the threads of the stud. Using a vise with soft jaws to hold the piston, install the stud into the piston.
- 2. Lubricate the piston outer diameter and ring groove, housing bore and ring groove, new O-rings, and backup rings with Dow Corning[®] DC4 or with the type of hydraulic fluid used in the system.
- **3.** Install new O-rings and backup rings in both the piston groove and housing groove so that the curved side of the backup ring is against each O-ring. Verify the O-ring on the piston is closest to the disc. In the housing the O-ring goes closest to the spring cap. See Figure 5.

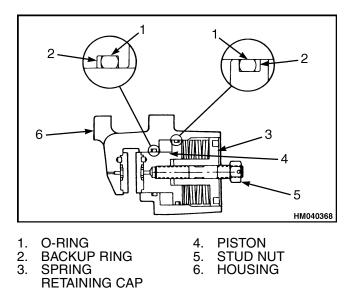
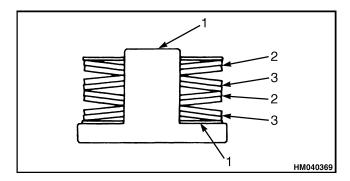


Figure 5. Parking Brake Caliper

- **4.** Install the linings.
 - **a.** Linings fastened with adhesive and setscrews:
 - (1) Apply Loctite[®] 271, or equivalent, to the threads of the setscrews.
 - (2) Install the setscrews in the piston and the housing. The top of the screw must have a clearance of 3 mm (0.12 in.) from the surfaces of the piston and housing.
 - (3) Apply 3M[®] Super 77 spray adhesive, or equivalent, to the linings where contact is made with the piston and the housing. Follow manufacturer's instructions for use of spray adhesive.
 - (4) Install the linings on the piston and the housing.
 - **b.** Linings fastened with one-piece snaps:
 - (1) Apply Loctite[®] 271, or equivalent, to the threads of the snap fastener screws.
 - (2) Screw the snap onto the piston and the housing. Torque to 5 to 6 N•m (44 to 53 lbf in).
 - (3) Align the lining pins with the holes and engage the snaps on the linings with the snaps on the piston and the housing.

- **c.** Linings fastened with screws:
 - (1) Apply Loctite[®] 271, or equivalent, to the threads of the screws.
 - (2) Attach the linings to the piston and the housing. Torque the screws to 5 to 6 N•m (44 to 53 lbf in)
- **5.** Install the piston and lining through the hole for the spring cap. Press the pistons through the seals with a steady force.
- **6.** Apply a graphite base antisieze compound to the surfaces of the springs and the housing threads of the spring cap.
- 7. Install the washers and springs on the spring cap. See Figure 6.



- 1. FLAT WASHER
- 2. 2 SPRINGS, CUP UP
- 3. 2 SPRINGS, CUP DOWN

Figure 6. Spring Cap

- 8. Install the spring cap into the housing. Tighten the spring cap until the top of the spring cap is even with the top of the housing.
- **9.** Install the washer around the stud and attach the washer with 3M[®] Super 77 spray adhesive, or equivalent. Follow manufacturer's instructions for use of spray adhesive.
- **10.** Install the stud nut at the end of the stud and fasten in place with the pin.

INSTALL

- 1. Check the slide pins and the caliper holes for nicks, burrs, or other damage that could keep the caliper from sliding along the pins. Repair or replace components as necessary.
- **2.** Apply a graphite base antisieze compound to the slide pin outside diameter.
- **3.** Remove the plugs from the brake line and caliper inlet and connect the line to the inlet.
- 4. Remove all air from the brake hydraulic system. See section **Bleed Brakes**.
- 5. Apply hydraulic pressure to retract the piston to provide clearance to slide the piston over the disc.
- **6.** Install the pins and fasteners to hold the caliper to the mounting bracket.
- 7. Verify that the brake slides easily on the slide pins.
- 8. Adjust brakes.

BLEED BRAKES

Remove air from the brake system after each installation or repair of hydraulic or brake system components or hydraulic lines. The brakes will not operate correctly with air in the system and can cause injury or damage.

Properly discard hydraulic fluid that is removed from the brake system. Hydraulic fluid that is removed can be contaminated and cause damage, loss of braking, and serious personal injury.

Use only the type of hydraulic fluid specified by Hyster. Do not use or mix different types of hydraulic fluid. The wrong hydraulic fluid can damage rubber parts of the caliper and can cause damage, loss of braking, and serious personal injury. Always start at the point that is the farthest from the master cylinder and work back toward the master cylinder. Bleed every bleeder screw on every caliper at every brake position. When you complete a caliper, go to the next closest caliper at the same position. When you complete a position, go to the farthest bleeder screw on the next closest position.

- 1. Verify that the master cylinder is filled. Keep the master cylinder filled during bleeding so you do not draw air into the system through the master cylinder. Verify that the master cylinder is filled when you are done bleeding the system.
- 2. Put a clear tube on the bleeder screw. Place the other end of the clear tube in a container of clean hydraulic fluid.
- 3. Bleed brakes.
 - **a.** For full hydraulic systems:
 - (1) Slowly apply hydraulic pressure to the brake.
 - (2) Loosen the bleeder screw and continue to apply pressure until no air bubbles appear in the container of fluid.
 - (3) Tighten the bleeder screw to 20 to 27 N•m (15 to 20 lbf ft). Release the pressure to the brake.
 - **b.** For air/hydraulic or mechanical actuator systems:
 - (1) Apply brake pedal, then loosen the bleeder screw.
 - (2) Tighten the bleeder screw to 20 to 27 N•m (15 to 20 lbf ft) before releasing the brake, so air is not pulled back into the system.
 - (3) Repeat steps 1 and 2 until no air bubbles appear in the container of fluid when you apply the brake pedal.
- 4. Check for fluid leaks.

ADJUST

If the brake has too little clearance, it may not release properly. This will cause the linings to drag and damage to both linings and the disc.

If there is too much clearance, the clamping force applied to the disc will be reduced. This can cause the brake to slip after it is applied. Too much pressure also puts extra stress on the springs in the caliper. This can cause premature spring wear and damage.

Adjust the brake to provide the lining to disc clearance to a maximum of 2.54 mm (0.100 in.) and a minimum of 0.5 mm (0.020 in.). Recommended clearance is 2 mm (0.080 in.).

The brake must have less than 2.54 mm (0.100 in.) when the brake is released. Check and adjust the brake until the correct clearance is released.

1. Apply hydraulic pressure to release the brake.

NOTE: The manual release stud and nut have left-hand threads.

- 2. Remove the cotter pin from the stud nut and tighten the nut until it touches the spring cap. This will lock the brake in the release position.
- **3.** Release hydraulic pressure.

Never try to turn or remove the spring cap when hydraulic pressure is applied to the brake. Turning the cap while pressure is applied can cause damage to the O-ring seals and the spring cap threads. Removing the cap can cause serious personal injury by the sudden release of hydraulic pressure.

4. Use a spanner wrench to turn the spring cap to the disc clearance required. A quarter of a turn of the spring cap in either direction will change the total clearance by 0.4 mm (0.016 in.). See Figure 7.

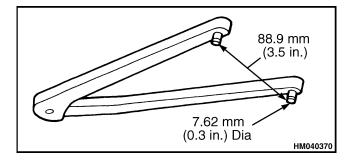


Figure 7. Spanner Wrench

5. Apply hydraulic pressure to the brake to overcome the spring pressure.

Verify that the nut is at the end of the stud before you put the vehicle in service. If the nut is tightened against the spring cap, the brake cannot be applied and serious personal injury can result.

- **6.** Loosen the stud nut and move it to the end of the stud. Install the cotter pin to hold the nut in place.
- 7. Verify that the brake slides easily on the slide pins.
- **8.** Install the centering device if one was removed from the end of the caliper.

TEST

NOTE: The caliper should always be tested after it is assembled and before it is put into service.

- 1. Apply hydraulic pressure to verify that the caliper will release when required. If the piston does not retract in the housing, readjust the brake.
- 2. Release the hydraulic pressure and verify that the springs expand and force the piston out to apply the brake. If not, remove and disassemble the caliper and find and correct the problem.
- **3.** To verify that there are no leaks, apply and release the hydraulic pressure three times. If there is a leak, disassemble and repair or replace components as necessary.

Specifications

Table 2.	Torque	Requirements
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Component	Torque
Lining snap fastener screws	5 to 6 N•m (44 to 53 lbf in)
Bleeder screws	20 to 27 N•m (15 to 20 lbf ft)

Table 3. Wear Limits

Component	Replace
Disc	Wear exceeds maximum of 1.524 mm (0.06 in.)
Housing	Large end bore diameter exceeds 101.68 mm (4.003 in.) or small end bore exceeds 63.63 mm (2.505 in.).
Linings	Thickness is less than 3 mm (0.125 in.) from piston or housing.
Piston	Large end diameter is worn to less than 101.47 mm (3.995 in.) or small end is worn to less than 63.37 mm (2.495 in.).

Table 4. Lining to Disc Clearance

Maximum	2.54 mm (0.100 in.)
Minimum	0.5 mm (0.020 in.)

Troubleshooting

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
The parking brake does not release.	The hydraulic pressure is too low.	Check for low fluid level, air in sys- tem, restricted lines, fluid leaks, damaged seals or seals installed backward.
	The piston is cocked in the bore.	Replace piston if large end diameter is less than 101.47 mm (3.995 in.) or the small end is less than 63.37 mm (2.495 in.). Replace housing if the large end of bore exceeds 101.68 mm (4.003 in.) or the small end of the bore exceeds 63.63 mm (2.505 in.).

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
The parking brake will not apply.	The springs in the brake caliper are damaged.	Replace springs.
	The piston is cocked in the bore.	Replace piston if large end diameter is less than 101.47 mm (3.995 in.) or the small end is less than 63.37 mm (2.495 in.). Replace housing if the large end of bore exceeds 101.68 mm (4.003 in.) or the small end of the bore exceeds 63.63 mm (2.505 in.).
	The caliper is locked in the released position.	Move the stud nut to the end of the stud.
The brake does not hold.	Brake is not properly adjusted.	Adjust the brake.
	Linings or disc is excessively worn.	Replace linings when the thick- ness of the lining is less than 3 mm (0.118 in.) from the piston or hous- ing. Replace the disc when wear exceeds a maximum of 1.524 mm (0.06 in.).
	Linings are contaminated with oil or grease.	Replace linings.
	The springs in the brake caliper are damaged.	Replace springs.
Damaged seals.	Wrong type of fluid is being used.	Drain, flush, and refill with the correct fluid. Replace O-rings and backup rings.
	Spring cap turned when hydraulic pressure was applied to the brake.	Replace O-rings and backup rings.
Damaged springs.	Brake is not properly adjusted. Springs worn.	Replace the springs and adjust the brake.
	Lack of lubrication.	Replace the springs and apply an an- tisieze compound to the springs.

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Damaged linings or disc.	Brake is not properly adjusted. Lin- ings are dragging.	Adjust brake. Replace parts as needed.
	The caliper is seized on the slide pins.	Clean, replace or repair slide pins or caliper. Replace linings.
	The piston is cocked in the bore.	Replace piston if large end diameter is less than 101.47 mm (3.995 in.) or the small end is less than 63.37 mm (2.495 in.). Replace housing if the large end of bore exceeds 101.68 mm (4.003 in.) or the small end of the bore exceeds 63.63 mm (2.505 in.).



Hyster Easy Language Program



1800 SRM 1037