

# INTRODUCTION

## GENERAL

This section has a description and the service procedures for the brake system. The parts of the brake system include the master cylinder, the brake shoes, wheel cylinders, pedals and linkage and the parking brake system.

## DESCRIPTION AND OPERATION (See FIGURE 1.)

The master cylinder has a housing, a piston with two ring cups, a return spring and a check valve. (See FIGURE 2. and FIGURE 3.) On early models, the reservoir for the brake fluid is separate from the master cylinder. On late models, the reservoir is part of the master cylinder. When the brake pedal is pushed, the push rod moves the piston assembly in the master cylinder. The primary cup pushes the brake fluid through the check valve to the wheel cylinders. The secondary cup keeps the fluid that is above the primary cup in the master cylinder.

When the brake pedal is released, the return spring pushes the piston assembly against the retainer washer. The return springs for the brake shoes cause the pistons in the wheel cylinders to retract. Some of the brake fluid in the wheel cylinders flows through the brake lines to the check valve in the master cylinder. The pressure in the brake lines moves the check valve from its seat. The fluid flows through the check valve to the master cylinder bore.

When the brake pedal is quickly released, the return spring on the brake pedal moves the piston faster than the brake fluid can flow around the check valve. To prevent cavitation, holes are drilled in the piston. Fluid from the inlet port flows through the holes in the piston and fills the pressure chamber. The flow of the brake fluid through the holes in the piston bends the lip of the primary cup and permits the brake fluid to enter the pressure chamber.

The check valve permits brake fluid from the pressure chamber to flow to the brake lines when the brake pedal is pushed. When the brake pedal is released, the pressure in the brake lines is greater than the pressure in the pressure chamber. The check valve then moves against the spring pressure to permit brake fluid to return to the pressure chamber. The check valve returns to its seat when the pressure in the brake lines decreases to less than the spring pressure. This action keeps a low pressure in the wheel cylinders to hold the lips of the seals against the bores. This low pressure prevents leaks in the wheel cylinders.

A small hole is drilled between the inlet port and the pressure chamber. The hole is just below the primary cup when the piston is against the stop washer. The hole is a compensator port to permit brake fluid to flow between the reservoir and the pressure chamber. The brake fluid expands because of the heat generated by using the brakes. The additional volume from the expansion of the brake fluid flows through the compensator port when the pedal is fully released. If the push rod is adjusted so that there is no clearance, the primary cup can close the compensator port. This condition can cause the brakes to be applied without pushing the pedal.

A service brake assembly is installed on each of the two load wheels. The parts of the brake system are shown in FIGURE 5. through FIGURE 7. When the brake pedal is pushed, brake fluid flows from the master cylinder and extends the pistons of the wheel cylinders. The pistons in the wheel cylinders expand the brake shoes against the brake drums.

The parking brake system uses the service brake shoes. When the lever is moved to apply the parking brake, the cables actuate linkage to expand the brake shoes against the brake drums.

The clearance between the brake shoes and the brake drum is adjusted manually. The adjuster wheel is adjusted through a hole in the back plate of the brake assembly.

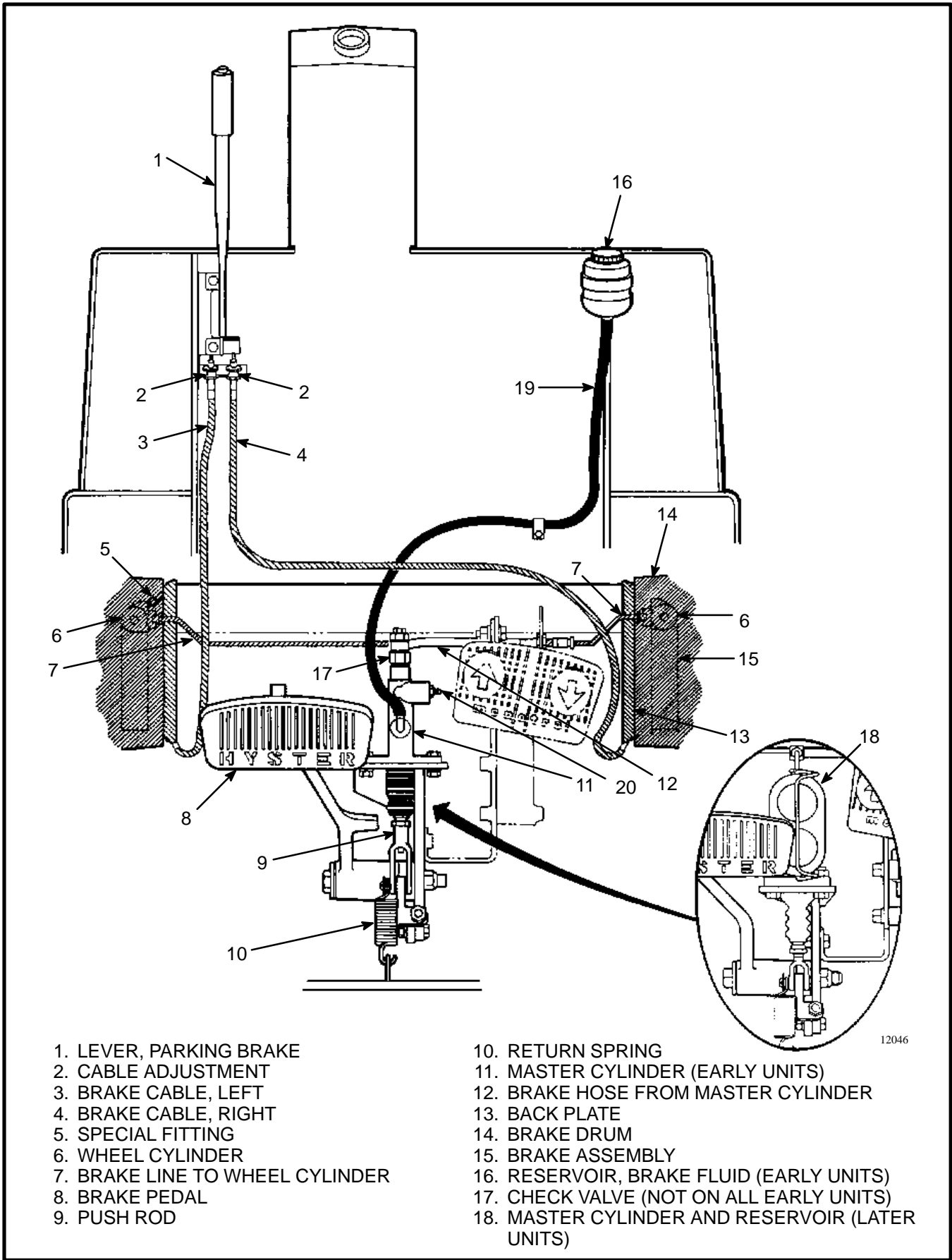


FIGURE 1. DIAGRAM, SERVICE AND PARKING BRAKE SYSTEM

## REPAIRS

### MASTER CYLINDER, EARLIER MODELS

#### Removal And Disassembly (See FIGURE 1. and FIGURE 2.)

1. Remove the floor plate. Disconnect the clevis from the brake pedal and remove the push rod.

2. Disconnect the special fitting from the port at the end of the master cylinder. Some units will have an external check valve installed between the special fitting and the end of the master cylinder.

#### **CAUTION**

**Brake fluid damages paint. Immediately remove any brake fluid that is on a painted surface.**

3. Remove the hose from the nipple fitting on the top of the master cylinder. Put a plug in the hose to prevent draining of the reservoir for the brake fluid.

4. Remove the bolts that hold the master cylinder to the bracket. Remove the master cylinder from the lift truck.

5. Remove the rubber dust cover and push rod. Put the bottom of the master cylinder in a container. Push on the piston to remove the brake fluid.

#### **WARNING**

**There is a spring behind the piston. Do not permit the spring to be released and cause injury.**

6. Put the master cylinder in a vise with soft jaws as shown in FIGURE 4. Push on the piston to release the tension on the snap ring. Remove the snap ring, washer and piston. Remove the spring.

7. Remove the external check valve, if installed on the end of the master cylinder.

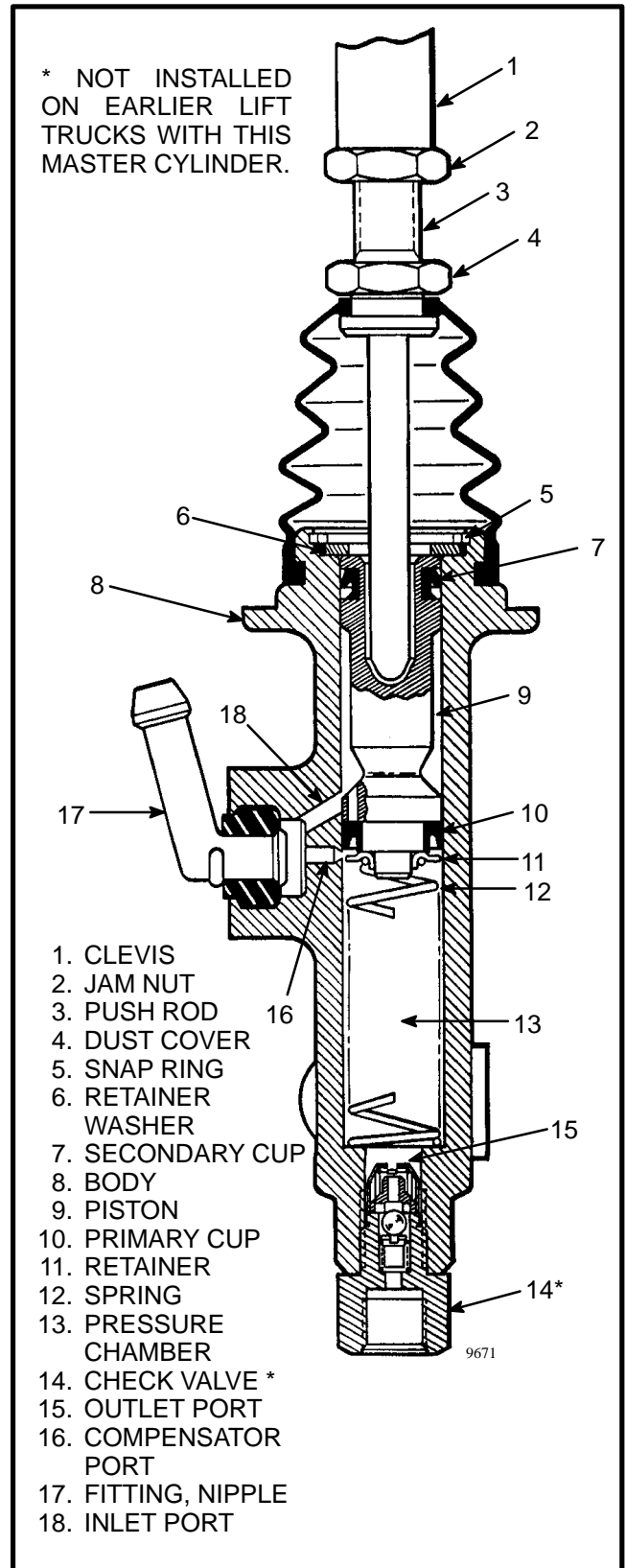


FIGURE 2. MASTER CYLINDER

## Cleaning And Inspection

### **CAUTION**

**DO NOT use mineral oil solvent to clean the master cylinder. Use alcohol or a solvent approved for cleaning brake parts to clean the master cylinder.**

Inspect the bore of the master cylinder for holes or scratches. Replace the master cylinder assembly if there is damage. Install a new repair kit in the master cylinder.

## Assembly And Installation (See FIGURE 1. and FIGURE 2.)

1. Lubricate the parts with clean brake fluid. Use only HYSTER Approved parts.

2. Install the secondary cup in the piston with the lip away from the push rod.

3. Install the primary cup and retainer on the piston. The lip must be toward the spring.

4. Put the spring and the piston assembly in the bore. Push on the piston with a screwdriver when the retainer washer and snap ring are installed. Install the retainer washer and snap ring.

5. Install the push rod and dust cover.

6. Install the external check valve in the port on the end of the master cylinder.

7. Install the master cylinder in the lift truck. Connect the hose from the reservoir to the master cylinder. Adjust the length of push rod by turning the clevis. The clearance between the piston and the push rod must be 0.25 to 0.50 mm (0.010 to 0.020 in) when the brake linkage is connected. See CHECKS AND ADJUSTMENTS in this section.

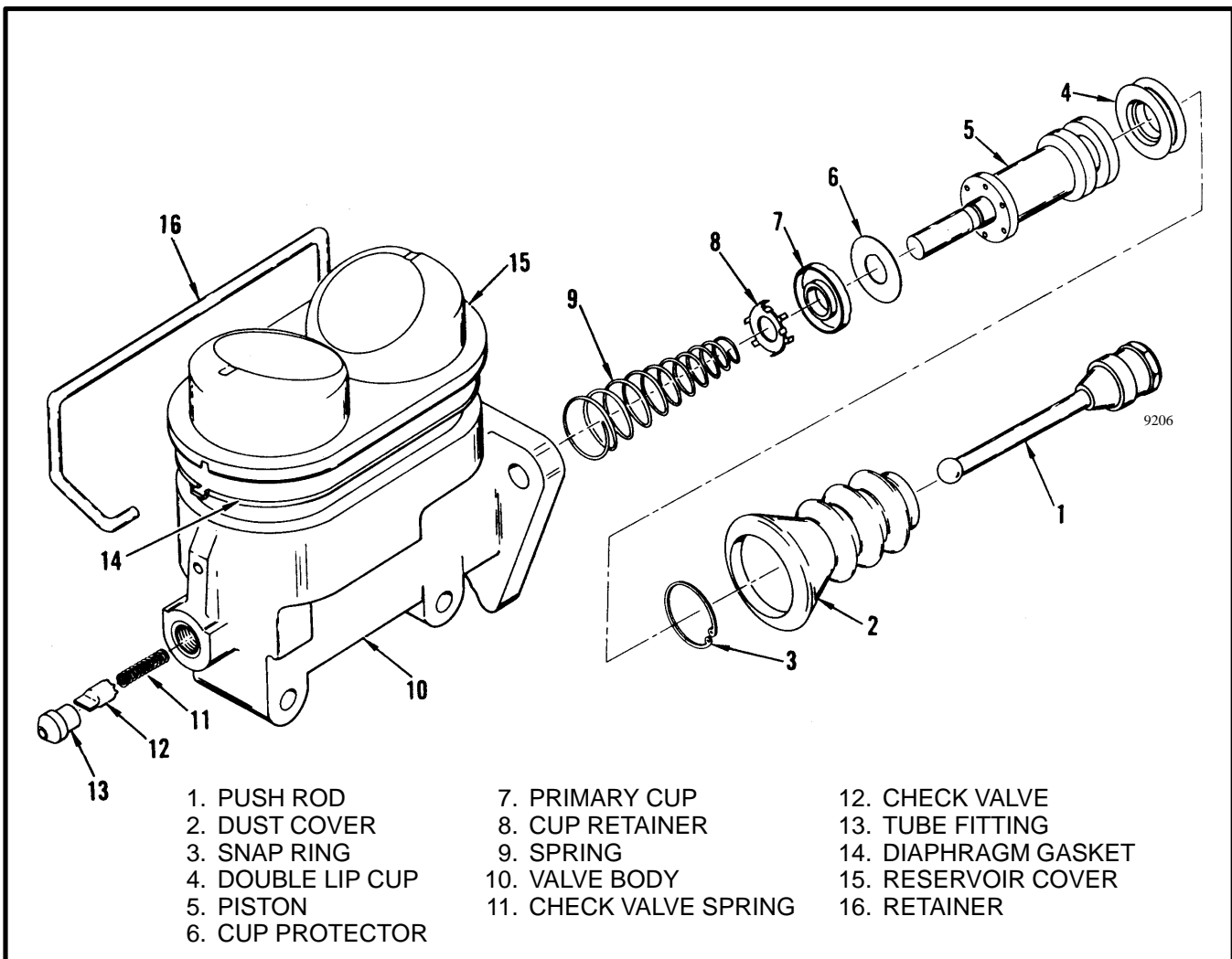


FIGURE 3. MASTER CYLINDER, LATE MODELS

8. Remove the air from the master cylinder. Fill the reservoir with clean brake fluid. Put a container under the master cylinder and slowly push the brake pedal. Release the pedal slowly. Repeat this procedure until brake fluid without bubbles flows from the outlet port.

9. Connect the brake hose to the master cylinder. Remove any air in the system as described in CHECKS AND ADJUSTMENTS in this section.

## MASTER CYLINDER, LATER MODELS

### Removal And Disassembly (See FIGURE 1. and FIGURE 3.)

1. Remove the floor plate. Disconnect the clevis from the brake pedal and remove the push rod. Disconnect the hydraulic line from the master cylinder port. Install a plug in the master cylinder port to prevent leakage of the brake fluid.

2. Remove the bolts and the master cylinder from the frame. Drain the fluid from the reservoir.

3. Put the master cylinder in a vise with soft jaws as shown in FIGURE 4.

### **⚠ WARNING**

**There is a spring behind the piston. Do not permit the spring to be released and cause injury.**

4. Hold the piston against the spring with a screwdriver. Remove the snap ring and carefully remove the piston assembly and spring.

5. Remove the check valve and the spring. Use a thin rod as a driver to remove the check valve and tube fitting.

### Cleaning And Inspection

### **⚠ CAUTION**

**DO NOT use mineral oil solvent to clean the master cylinder. Use alcohol or a solvent approved for cleaning brake parts to clean the master cylinder.**

Inspect the bore of the master cylinder for holes or scratches. Replace the master cylinder assembly if

there is damage. Install a new repair kit in the master cylinder.

### Assembly and Installation

1. Use a repair kit. Install the parts in the order shown in FIGURE 4. Hold the piston in the cylinder with a screwdriver. Make sure the snap ring is in the correct position.

2. Install the check valve assembly. Install the diaphragm gasket and reservoir cover. Install the dust cover.

3. Fasten the master cylinder to the frame. Install the push rod and connect the clevis to the pedal.

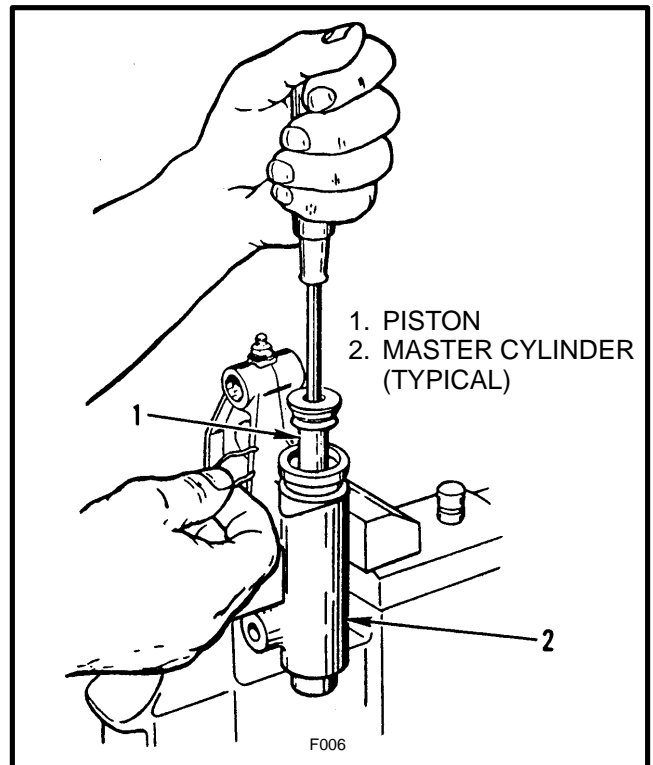


FIGURE 4. REMOVE THE PISTON

4. Check the clearance between the push rod and the piston. Adjust the clearance so that the pedal can move approximately 6 mm (0.25 inch) before the piston begins to move. Loosen the jam nut and turn the push rod to adjust the clearance. Adjust the brake switch so that the switch is closed when the brake pedal is in the up position.

5. Fill the reservoir with SAE J1703 brake fluid. Operate the brake pedal to remove air from the master cylinder. Connect the hydraulic line to the master cylinder.

6. Remove the air from the system. Put the end of a small hose on the special fitting for removing the air from the wheel cylinder. Put the other end of the hose in a clean container. Loosen the special fitting one turn to permit brake fluid to flow from the wheel cylinder when the pedal is pushed. Slowly push the brake pedal and hold it at the end of its stroke. Close the special fitting. Repeat this procedure until air bubbles do not come from the hose. Make sure you do not completely drain the reservoir. Tighten the special fitting and remove the hose. Fill the reservoir. Repeat this procedure on the other wheel cylinder.

### **CAUTION**

Do not permit brake fluid to flow from the special fitting on to any part of the axle. The brake fluid can cause damage to the oil and dust seals on the axle and cause a lubrication problem inside of the mast pivots. Brake fluid will also damage the paint on the lift truck.

## **SERVICE AND PARKING BRAKES**

### **Removal And Disassembly (See FIGURE 5. through FIGURE 7.)**

### **WARNING**

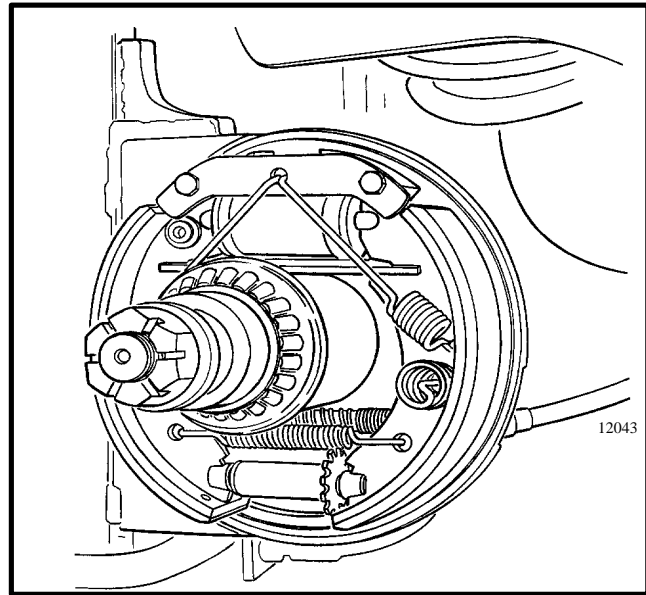
Brake linings can contain dangerous fibers. Breathing the dust from these brake linings is a cancer or lung disease hazard. Do not create dust! Do not clean brake parts with compressed air or by brushing. Use vacuum equipment approved for brake dust or follow the cleaning procedure in this section. When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

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

1. Put the lift truck on blocks under the frame so that the load wheels are raised from the floor. Remove the load wheels.

2. Remove the hub cap from the end of the hub. Remove the cotter pin and the castle nut from the end of

the spindle. Remove the outer bearing cone. Remove the hub and brake drum from the spindle. Do not permit the hub and brake drum to drop on the spindle and damage the grease seal.



**FIGURE 5. BRAKE ASSEMBLY**

3. Remove the spring and adjuster linkage from the brake shoes. Remove the retainer springs that hold the brake shoes to the back plate. Remove the strap plate. Remove the brake shoes. Disconnect the parking brake cable from the actuating lever on the brake shoes.

4. Disconnect the brake line at the wheel cylinder.

5. Remove the wheel cylinder from the back plate.

6. If the parking brake cables must be replaced, disconnect them from the lever assembly on the cowl. Remove the cables from the lift truck.

### **Cleaning**

### **CAUTION**

Do not use an oil solvent to clean the wheel cylinder. Use a solvent approved for cleaning of brake parts. Do not permit oil or grease in the brake fluid or on the brake linings.

### **WARNING**

Cleaning solvents can be flammable and toxic, and can cause skin irritation. When using cleaning solvents, always follow the safety instructions of the solvent manufacturer.

(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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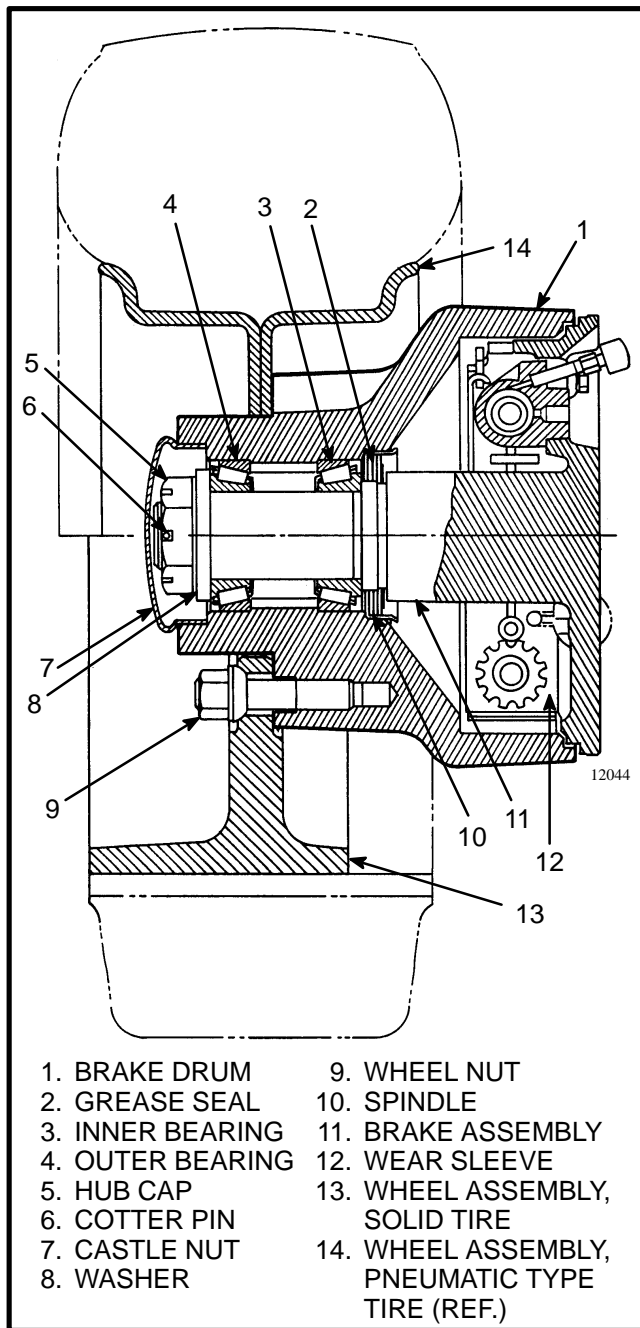


FIGURE 6. WHEEL AND BEARING ASSEMBLY

1. Do not release brake lining dust from the brake linings into the air when the brake drum is removed.
2. Use a solvent approved for cleaning of brake parts to wet the brake lining dust. Follow the instructions and cautions of the manufacturer for the use of the solvent. If a solvent spray is used, spray at a distance so that the dust is not released into the air.
3. When the brake lining dust is wet, clean the parts. Put any rags or towels in a plastic bag or an airtight container while they are still wet. Put a “DANGER-

OUS FIBERS” warning label on the plastic bag or airtight container.

4. Any cleaning rags that will be washed must be cleaned so that fibres are not released into the air.

**⚠ CAUTION**

**Do not permit oil or grease on the brake linings. Use a brake cleaning fluid as necessary to clean linings that will not be replaced.**

**Inspection**

1. Check the bore of the wheel cylinder for holes or scratches. Replace the wheel cylinder if there is any damage. Always install a new repair kit in the wheel cylinder as minimum service if damage is not found in the wheel cylinder.
2. Check the return springs for damage. Inspect the back plate for wear where the brake shoes touch the back plate. Grind the back plate to make it smooth if it has grooves worn in it.
3. Inspect the brake shoes for cracks or damage. If the brake shoes are worn or damaged, replace the brake shoes. If a brake shoe is damaged, both brake shoes must be replaced as a unit.
4. Inspect the brake drum for grooves or other damage. If the brake surface of the brake drums has grooves, use a lathe to make a clean smooth brake surface. The normal inside diameter of the brake drum is 180.00 to 180.27 mm (7.02 to 7.03 in). The limit (wear limit) of the inside diameter is 182.27 mm (7.11 in). If the internal diameter of the brake drum is greater than the limit, the brake drum must be replaced.

5. The teeth of the adjuster wheel must not be worn. The adjuster wheel must turn freely. Check the adjuster links for damage.
6. Make sure the parking brake levers in both of the brake assemblies move freely.
7. Check the surfaces of the seals for wear or damage.

**Assembly And Installation  
(See FIGURE 5. through FIGURE 7.)**

1. Assemble the wheel cylinder. Use only HYSTER APPROVED parts.



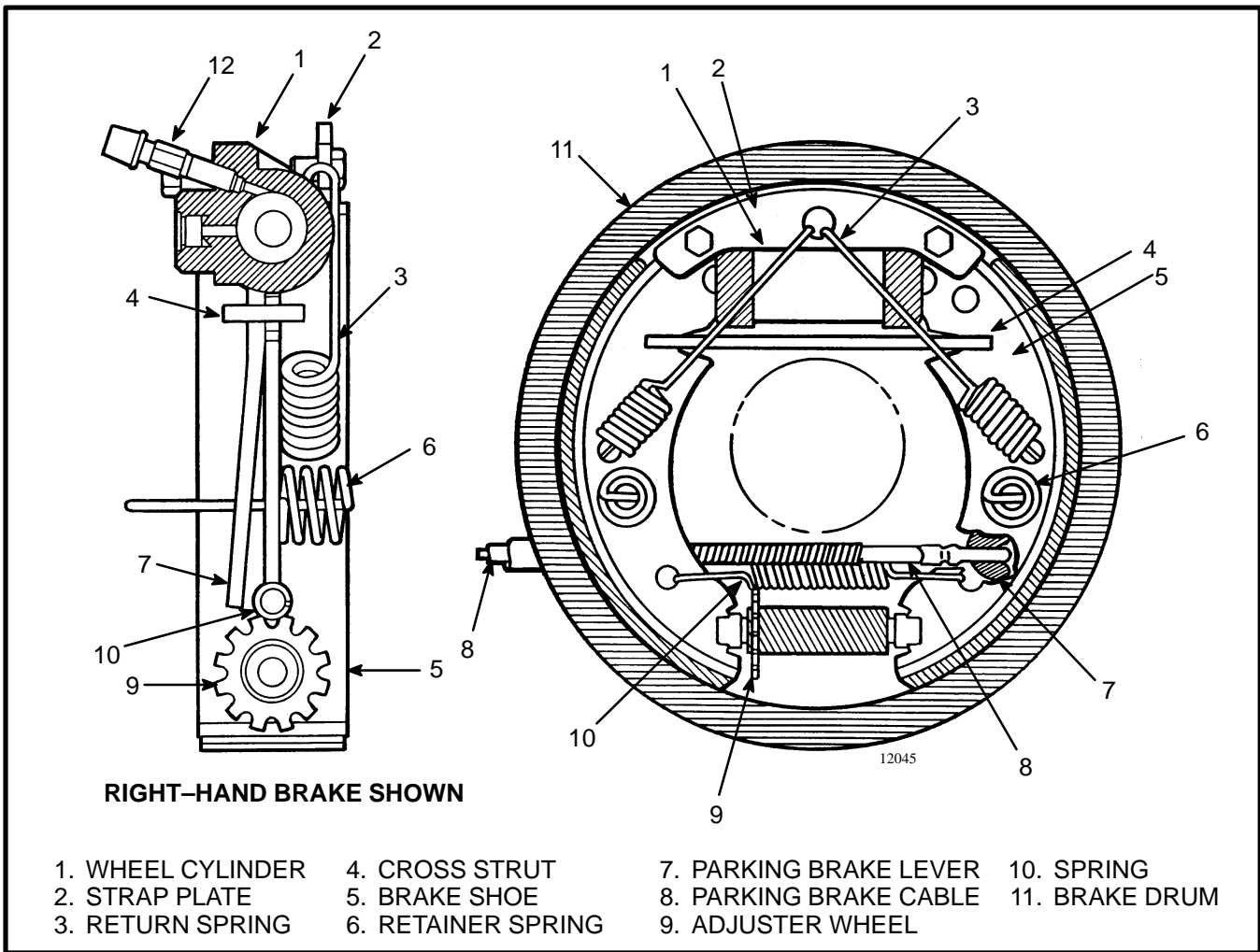


FIGURE 7. BRAKE ASSEMBLY

2. Install the wheel cylinder on the back plate of the spindle assembly with the two washers and capscrews. Tighten the capscrews.

3. Assemble the brake components on the back plate of the spindle assembly. Install the brake shoes, springs, lever for the parking brake, cross strut and strap plate. The strap plate at the top of the brake assembly holds the brake shoes in position. Tighten the two capscrews in the strap plate to 2 N.m. (17.7 lbf in).

4. Connect the parking brake cable to the actuating lever on the brake shoes.

5. Put NEVER-SEEZ® on the threads of the adjuster wheel. Turn the adjuster wheel into the adjuster nut so that the adjuster assembly is in the shortest position.

6. Install the adjuster wheel assembly, and the return springs for the brake shoes. Make sure the adjuster

wheel is installed toward the rear of the lift truck and is aligned with the adjustment slot when it is installed.

7. If the inner bearing assembly was removed, lubricate the inner wheel bearing with multi-purpose grease. See **PERIODIC MAINTENANCE, 8000 SRM 370** for the correct lubricant. Install the inner bearing into the bore of the brake drum. Install the wear sleeve and a new grease seal in the bore next to the inner bearing.

8. Carefully install the brake drum onto the spindle and brake assembly. Lubricate the cone of the outer bearing, then install the cone into the opening between the brake drum and the spindle.

9. Install the washer, lock washer and nut. Tighten the nut to 203 N.m (150 lbf ft) while rotating the brake drum. Loosen the nut until the brake drum rotates freely. Tighten the nut to 34 N.m (25 lbf ft) or to the

first alignment position after 34 N.m (25 lbf ft). Install the cotter pin to hold the nut. Install the hub cap.

10. Install the load wheels. Tighten the wheel nuts to 140 N.m (104 lbf ft).

11. Adjust the clearance of the brake shoes. See CHECKS AND ADJUSTMENTS in this section of the repair manual.

12. If the parking brake cables were removed, install them in the brake lever assembly on the cowl. (See Fig-

ure 1). The cable for the right-hand brake fits in the cable holder at the right of the lever assembly. Tighten the cable nuts and install the lever assembly in the lift truck with the two capscrews, washers and nuts. Adjust the parking brake as described in CHECKS AND ADJUSTMENTS in this section.

13. Remove the air from the brake system as described in CHECKS AND ADJUSTMENTS in this section.

14. Remove the lift truck from the blocks. Check the operation of the brakes.

## CHECKS AND ADJUSTMENTS

### REMOVE THE AIR FROM THE BRAKE SYSTEM

1. Before the air is removed from the brake system, make sure the service brakes are adjusted correctly. Make sure the reservoir is filled with brake fluid. Make sure you do not drain the reservoir and put additional air into the system during this procedure.

2. Put one end of a rubber hose on the special fitting on the side of the master cylinder. Loosen the special fitting one turn. Slowly push the brake pedal and hold it at the end of its stroke. Close the special fitting and release the brake pedal. Repeat the procedure until no air bubbles come from the rubber hose.

3. Put one end of a rubber hose on the special fitting of the wheel cylinder. Put the other end of the hose into a clear container of brake fluid. Loosen the special fitting one turn. Slowly push the brake pedal and hold it at the end of its stroke. Close the special fitting. Repeat the procedure until there are no bubbles in the container.

4. Check the level of the brake fluid in the reservoir for the master cylinder during the procedure. Make sure you do not drain the reservoir and put air into the brake system. Repeat the procedure for the other wheel cylinder. If air still remains in the system, the air must be removed from the master cylinder. Slowly push on the brake pedal. Release the pedal slowly. Repeat this procedure until no air bubbles enter the reservoir.

### ADJUST THE SERVICE BRAKES

Use the procedure that follows to manually adjust the brakes after repairs are made.

1. Put the lift truck on blocks so that the load wheels are raised from the surface and can be rotated. Use a brake adjuster tool to adjust the brake shoes so that the brake drum will not rotate. Use the brake adjuster tool to loosen the adjuster wheel until the brake shoes permit the brake drum to rotate.

2. Remove the lift truck from the blocks. Operate the lift truck in the Forward and Reverse directions. Stop the lift truck 10 times in each direction to check the operation of the brakes.

**NOTE:** If the lift truck is operated in wet conditions or areas with high humidity, the brakes can make a high pitch noise when the brakes are first applied. This occurrence normally happens after the lift truck has not been used for a day or more. If the noise does not stop after the first few times that the brakes are applied, begin Troubleshooting procedures.

### ADJUST THE BRAKE PEDAL, EARLIER MODELS

Check and adjust the brake pedal and the push rod of the master cylinder, if the brake shoes were replaced or adjusted.

Adjust the push rod for the master cylinder so that it touches the piston. Turn the push rod approximately 1/2 rotation counterclockwise to increase the clearance between the push rod and the piston of the master cylinder. Adjust to the correct clearance of 0.25 to 0.50 mm (0.010 to 0.020 in). Tighten the jam nut. Make sure there is a minimum clearance between the push rod and the piston of the master cylinder or the compensator port will be closed.

## ADJUST THE BRAKE PEDAL, LATER MODELS (See FIGURE 8.)

Check and adjust the brake pedal and the push rod of the master cylinder, if the brake shoes were replaced or adjusted.

Adjust the brake pedal for the correct dimensions as shown in FIGURE 8. Loosen the jam nut and adjust the push rod so that the pedal moves down 1 to 4 mm (0.04 to 0.16 in) before the push rod touches the piston. Apply Loctite® to the threads and tighten the jam nut against the clevis.

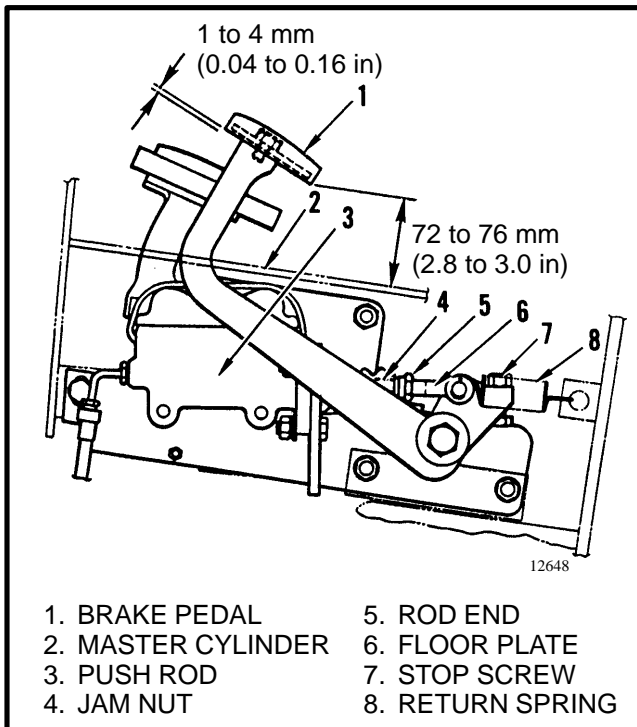


FIGURE 8. ADJUST THE BRAKE PEDAL

## ADJUST THE PARKING BRAKE (See FIGURE 1.)

Make sure that the service brakes are adjusted correctly. Test the operation of the parking brake. The parking brake, when in good condition and correctly adjusted, will hold a lift truck with a capacity load on a 15% grade [a slope of 1.5 metre in 10 metres (a slope of 1.5 ft in 10 ft.)]. The adjustment for the parking brake is below the lever assembly on the cowl.

Put blocks in front and back of the drive tires. Release the parking brake lever. Adjust the cable housings so that the parking brake lever can travel four notches on the ratchet as it is applied. Put the parking brake lever in the released position (this is the first position on the ratchet). Adjust the nuts on the cable housings so that the ball ends of the cables are tight in the equalizer link under the lever.

## TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
The brakes do not operate equally.	Oil or brake fluid is on the linings. The linings are worn or hardened. The brake lines have a restriction. The brake shoes or back plates have damage. The drum is worn unevenly.	Replace linings. Replace linings Clear brake lines or replace. Replace brake shoes or back plate.  Replace brake drum.
One brake does not release.	The shoes require more clearance.  A shoe is damaged. A return spring is damaged. The brake lines have a restriction. A parking cable is damaged. The wheel bearings are adjusted too tight. The wheel cylinder is damaged. The back plate is damaged.	Increase clearance between shoe and drum  Replace shoes. Replace return spring. Clear brake lines or replace. Replace parking cable. Adjust wheel bearing clearance.  Replace wheel cylinder. Replace back plate.
Both brakes do not release.	The parking brake is not released. The push rod in the master cylinder requires more clearance. The master cylinder is damaged. The shoes require more clearance.  The use of oil, instead of brake fluid, in the system caused damage to the seals.	Repair or replace park brake cable. Replace push rod and/or master cylinder. Replace master cylinder Increase clearance between shoe and drum  Flush the system with brake fluid until oil is purged. Replace seals.
The brake pedal is difficult to push.	There is not enough clearance for the push rod. The linings are too hard. Water or oil is on the linings. The master cylinder is damaged. The wheel cylinders are damaged. The pedal return spring is damaged.	Replace push rod and/or master cylinder. Replace linings. Replace linings. Replace master cylinder. Replace wheel cylinders. Replace return spring.
The brake pedal does not have enough resistance.	Air is in the brake system. The master cylinder is loose.  The shoes are damaged. A brake drum has a crack. A back plate is damaged. A wheel cylinder is damaged. The linings do not fit the brake drums.	Remove air from the system. Tighten master cylinder mounting hardware. Replace shoes. Replace brake drum. Replace back plate. Replace wheel cylinder. Replace shoes and/or brake drum.

## TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
The brake pedal travels too far.	Air is in the brake system. The shoes require adjustment. The linings are worn. The clearance at the push rod is too great.	Remove air from the system. Adjust brake shoe clearance. Replace linings. Replace push rod and/or master cylinder.
The brake pedal moves to the floor.	Air is in the brake system. The master cylinder is damaged. The brake system has a leak.	Remove air from the system. Replace master cylinder. Tighten fittings or replace brake lines.
The brakes make too much noise.	Oil, water or brake fluid is on the linings. The linings are worn. A shoe is damaged. Dirt is on the linings. Lift truck is operated in wet conditions or high humidity.	Clean linings or replace. Replace linings. Replace shoes. Clean linings or replace. Contact your dealer for Hyster lift trucks.
The brakes do not stop the truck.	Oil, water or brake fluid is on the linings. The linings are worn. The wheel cylinders are damaged. The shoes are not adjusted correctly. The master cylinder is damaged.	Clean linings or replace. Replace linings. Replace wheel cylinders. Adjust brake shoe clearance. Replace master cylinder.
The parking brake will not hold.	Oil, water or brake fluid is on the linings. The parking brake cables require correct adjustment. A parking brake cable is damaged. The brake linings are worn.	Clean linings or replace. Adjust parking brake cable. Replace parking brake cable. Replace brake linings.
The parking brake hand lever will not release the brake.	The parking brake cable must be loosened. The parking brake cables are damaged.	Adjust parking brake cable. Replace parking brake cable.