

Double Check Valve Disassembly, Cleaning and Inspection, and Assembly

Disassembly

See **Fig. 1** for a cross-sectional view of the check valve.

1. Remove the valve from the vehicle. For instructions, see **Subject 120**.
2. Remove the end cap from the valve.
3. Remove the O-ring.
4. Remove the shuttle valve and shuttle guide.

2. Coat the O-ring with BW 650M silicone lubricant (BW 291126). It is not necessary to lubricate the shuttle valve.
3. Install the O-ring.
4. Install the end cap on the valve body.
5. Install the valve on the vehicle. For instructions, see **Subject 120**.
6. Test the valve. For instructions, see **Subject 110**.

Cleaning and Inspection

1. Clean all metal parts in a cleaning solvent.
2. Inspect all metal parts for signs of cracks, wear, or deterioration. Replace all parts not considered serviceable.
3. Replace all rubber parts.

Assembly

1. Install the shuttle valve and shuttle guide in the valve body.

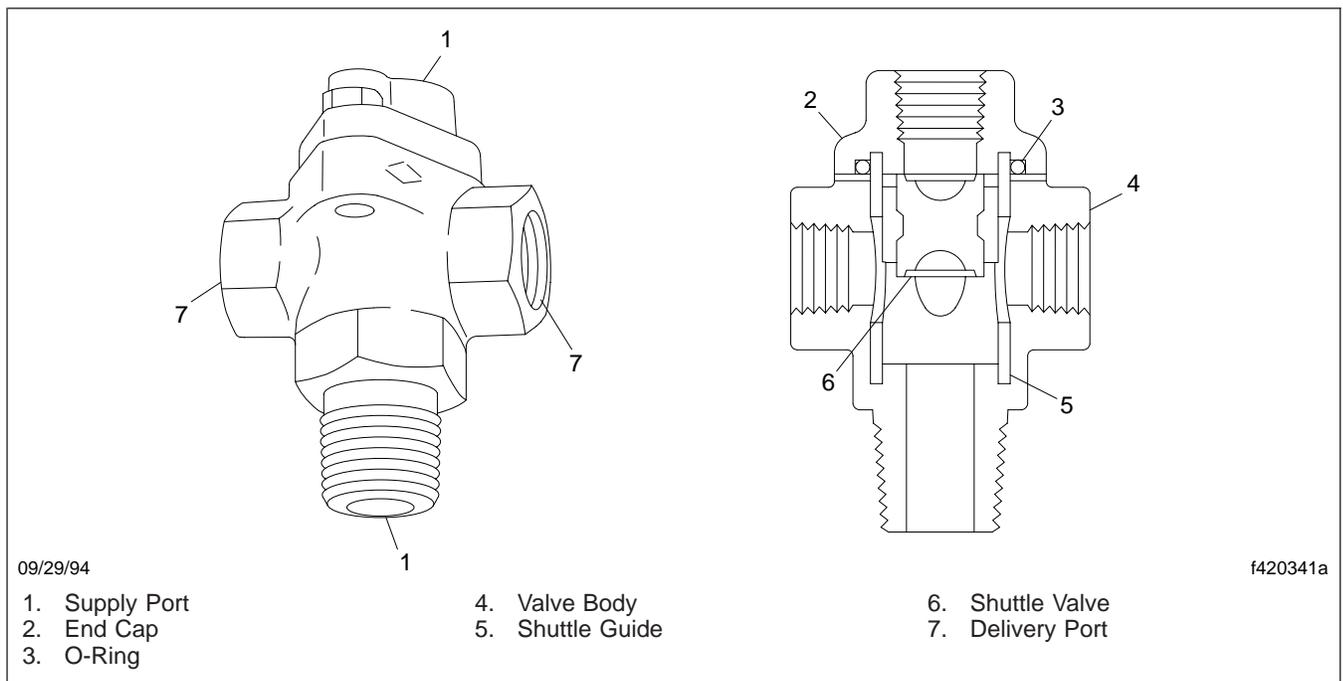


Fig. 1, Double Check Valve

General Description

The dual circuit brake valve (foot valve) controls the air supply and delivery of the dual circuit brake system. See **Fig. 1**. The brake valve is mounted on the frontwall.

Applying

The primary circuit of the brake valve is controlled by the brake pedal and a plunger. When the brake pedal is depressed, the plunger applies pressure on the spring seat, rubber spring, and the primary (upper) piston. The downward movement of the primary piston closes the upper exhaust valve, and then opens the upper inlet valve, allowing high-pressure air from port 11 to flow to low-pressure port 21.

The secondary circuit is pneumatically operated by the pressure from the primary circuit. Primary circuit pressure on top of the relay piston first closes the lower exhaust valve, and then opens the lower inlet valve, allowing high-pressure from port 12 to flow to low-pressure port 22.

Holding

As air pressure builds in the primary circuit, the pressure under the primary piston will match the pressure of the rubber spring. This allows the piston to move up enough to close the upper inlet valve, and prevent the flow of air from the primary air tank into the brake valve. The exhaust port remains closed.

Releasing

When the pedal is released, the push rod releases pressure from the spring seat, rubber spring, and the primary (upper) piston. Air pressure builds to push the piston up, opening the upper exhaust valve and allowing air from the primary circuit to escape through the exhaust port.

In the secondary circuit, the release of primary air pressure allows air under the relay piston, pushing the piston up and opening the lower exhaust valve. All remaining air pressure is vented through the exhaust port.

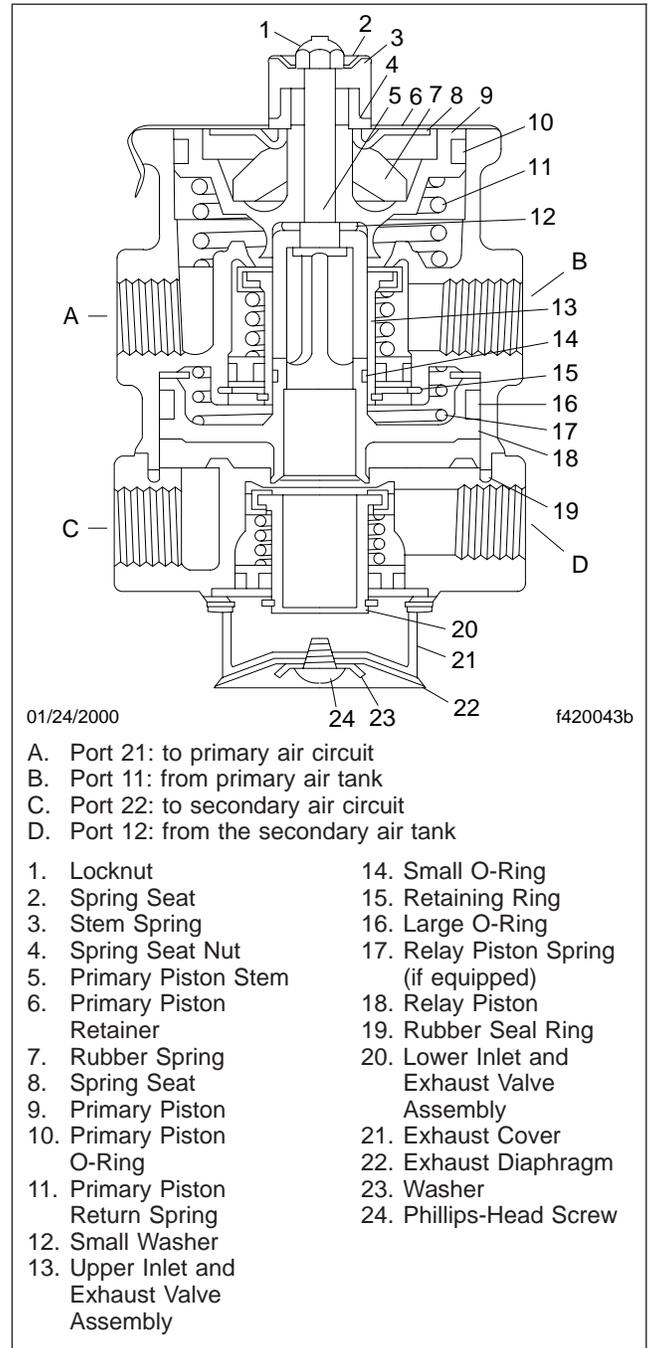


Fig. 1, Bendix E-6 Dual Circuit Foot Valve (sectional view)

Brake Valve Operating and Leakage Checks

Operating Checks

IMPORTANT: If there is a change in the way a vehicle brakes, or if low pressure warnings occur, check the operation of the air system. Although the brake system may continue to work, do not operate the vehicle until the braking circuits, including the pneumatic and mechanical devices, have been repaired and are operating normally. Always check the brake system for proper operation after doing brake work, and before returning the vehicle to service.

Check for proper brake valve operation as follows:

1. Apply the parking brakes, and chock the tires.
2. Connect test gauges to the primary and secondary delivery ports (ports 21 and 22) on the brake valve. See [Fig. 1](#) and [Fig. 2](#).

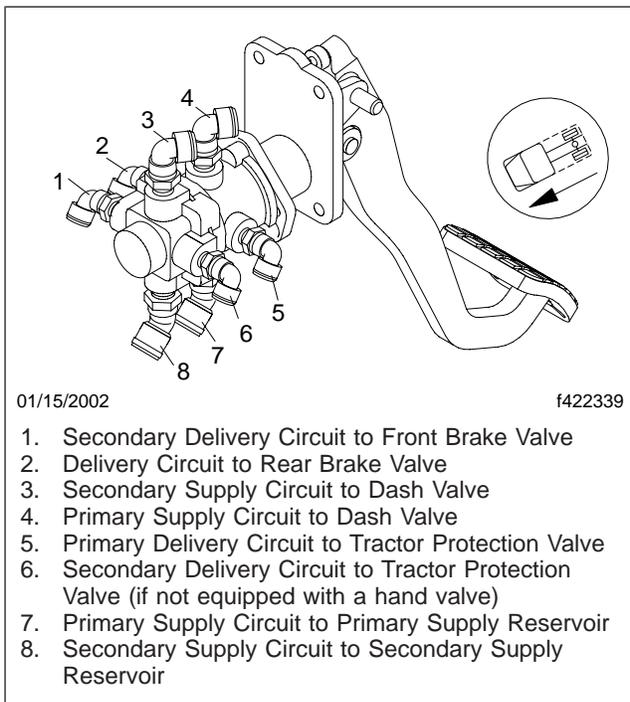


Fig. 1, Brake Valve Plumbing Circuits

NOTE: When checking the delivery pressure of the primary and secondary circuits, use test gauges that are accurate.

3. Start the engine and build air pressure to 120 psi (827 kPa).

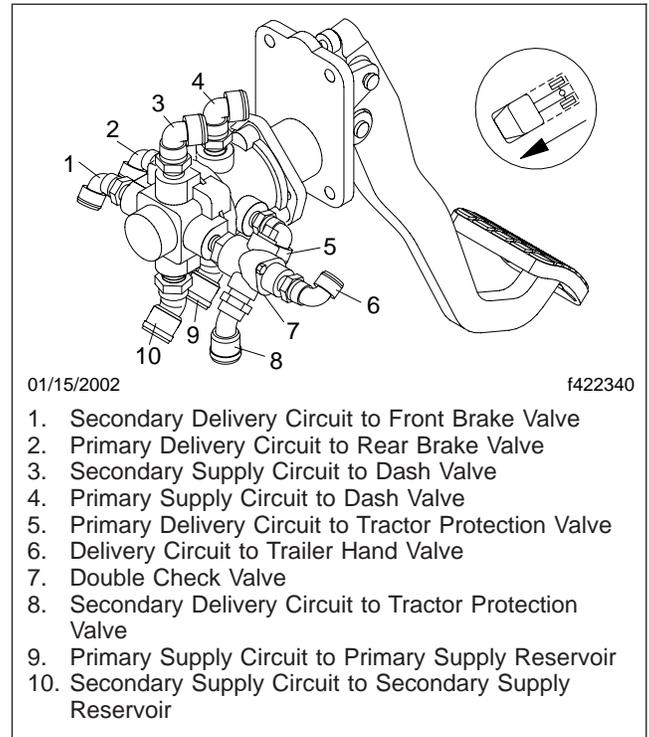


Fig. 2, Brake Valve Plumbing Circuits (with double-check valve)

4. Depress the pedal to several different positions; check the pressure on the test gauges to ensure that it varies equally and proportionately with the movement of the brake pedal.
5. Fully depress the brake pedal, then release it. After a full application is released, the reading on the test gauges should promptly fall to zero.

NOTE: Pressure in the primary delivery circuit will be about 2 psi (14 kPa) greater than pressure in the secondary delivery circuit (if both supply reservoirs are at the same pressure). This is normal for this valve.

6. Go to "Leakage Check."

Leakage Check

1. Make and hold a pressure application of 80 psi (552 kPa).
2. Check the air line fittings for leaks: tighten or replace fittings as needed.

Brake Valve Operating and Leakage Checks

3. Coat the exhaust port and body of the valve with a soap solution, and check for leakage. The leakage permitted is a 1-inch (25-mm) bubble in 3 seconds.

If the brake valve does not function as described above, or if leakage is excessive, replace it with a new or remanufactured unit.

Repeat the leakage test before placing the brake valve in service.

4. Remove the chocks from the tires.

Brake Valve Removal and Installation

Removal

1. Check the tires, then tilt the hood.

WARNING

When draining the air system, do not look into the air lines/ports or direct them toward another person, because dirt or sludge particles may be in the airstream. Do not disconnect pressurized hoses because they may whip as air escapes from the line. Failure to take all necessary precautions during service operations of the air brake system can result in personal injury.

2. Drain all of the air reservoirs.
3. Mark the brake valve air supply and delivery lines for assembly reference. Disconnect the air lines from the brake valve, and plug them to keep out contaminants.
4. Remove the 5/16–18 capscrews and flatwashers that attach the brake valve and mounting adaptor to the front cab mount plate. See Fig. 1.
5. Remove the 5/16–18 locknuts and washers that attach the brake valve to the mounting adaptor.
6. Remove the plunger from the mounting adaptor. Wipe off the old grease from the plunger and adaptor.
7. Note the location and position of the double check valve (if equipped), then remove it from the brake valve. Clean off the dirt and old sealant from the threads of the valve and elbows.

Installation

WARNING

When applying sealant, make sure that excess sealant does not get inside either the male or the female fittings. Loose foreign material inside the air plumbing may clog a valve, causing a loss of brake control, which could result in personal injury.

1. If equipped with a hand brake valve, apply a small quantity of Loctite® Pipe Sealant (with Teflon® 59241), or an equivalent sealant, to the male threads of the double check valve and the elbows.
2. Lubricate the sliding surface of the brake plunger with barium grease, part number BW 246671 or Pennzoil Adhezoplex EP 2. Install the plunger in the mounting adaptor.

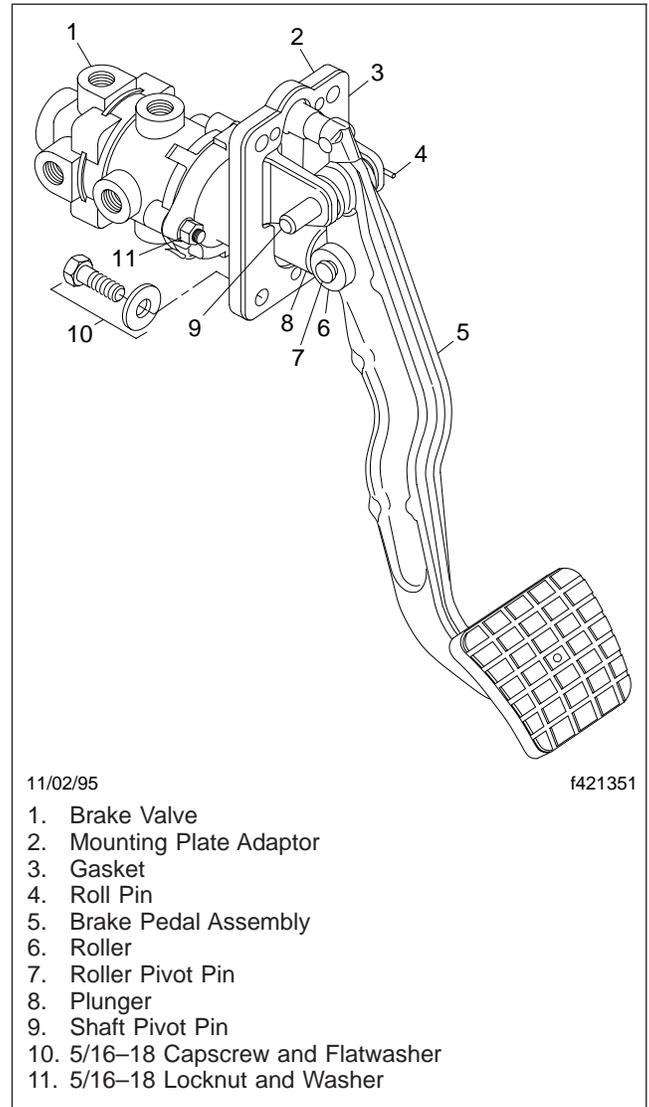


Fig. 1, Brake Valve Mounting

Install the double check valve and elbows in the ports of the brake valve. Tighten the valve fingertight, then tighten one additional turn with a wrench. As needed, further tighten until the valve is properly positioned.

Brake Valve Removal and Installation

3. Using the 5/16–18 locknuts and washers, attach the mounting adaptor to the brake valve. Tighten the locknuts 10 to 13 lbf·ft (14 to 18 N·m).
4. Install the brake valve and mounting adaptor on the outside of the front cab mount plate. Install the adaptor mounting capscrews and flatwashers. Tighten the capscrews 10 to 13 lbf·ft (14 to 18 N·m). See [Fig. 1](#).
5. Connect the air lines, as previously marked. Tighten the nuts finger-tight. Using a wrench, further tighten the nuts until there is resistance, then tighten one-sixth additional turn.
6. Check and secure the air lines and electrical wires so they can't interfere with the movement of the brake pedal.
7. Return the hood to the operating position.
8. Perform the operating and leakage checks. For instructions, see [Subject 100](#).
9. Remove the chocks from the tires.
10. Test drive the vehicle in a safe area at low speed. Make several brake applications to be sure the vehicle comes to a safe stop.

Brake Valve Disassembly, Cleaning and Inspecting, and Assembly

Disassembly

Refer to **Fig. 1** while performing the disassembly procedure.

1. Remove the valve from the vehicle. For instructions, see **Subject 110**.
2. Remove the four screws that attach the exhaust cover to the lower valve body.
3. Remove the lower inlet and exhaust valve assembly.
4. Remove the four hexhead capscrews and washers that attach the lower and upper valve bodies. Separate the valve bodies.
5. Remove the rubber seal ring from the lower valve body.

WARNING

The locknut and spring seat are used to restrain the primary piston return spring, stem spring, and the relay piston spring. The combined force of these springs is about 50 pounds (220 N). When removing these springs, use care to prevent them from flying out and possibly causing personal injury. Manually or mechanically hold down these springs when removing the locknut.

6. Using a 3/8-inch wrench, hold the locknut on the threaded end of the primary piston stem. Insert a screwdriver in the exhaust passage through the center of the valve, and engage the slotted head of the stem.
7. Using the screwdriver to keep the stem from turning, remove the locknut, spring seat, and the stem spring.
8. Being careful to avoid damaging the valve seats, remove the relay piston, relay piston spring, and the primary piston and primary piston return spring.
9. Remove the small washer from the cavity in the lower side of the primary piston.

IMPORTANT: Be sure not to damage the piston when removing the spring seat nut. A damaged piston can cause air leakage and premature wear of the piston.

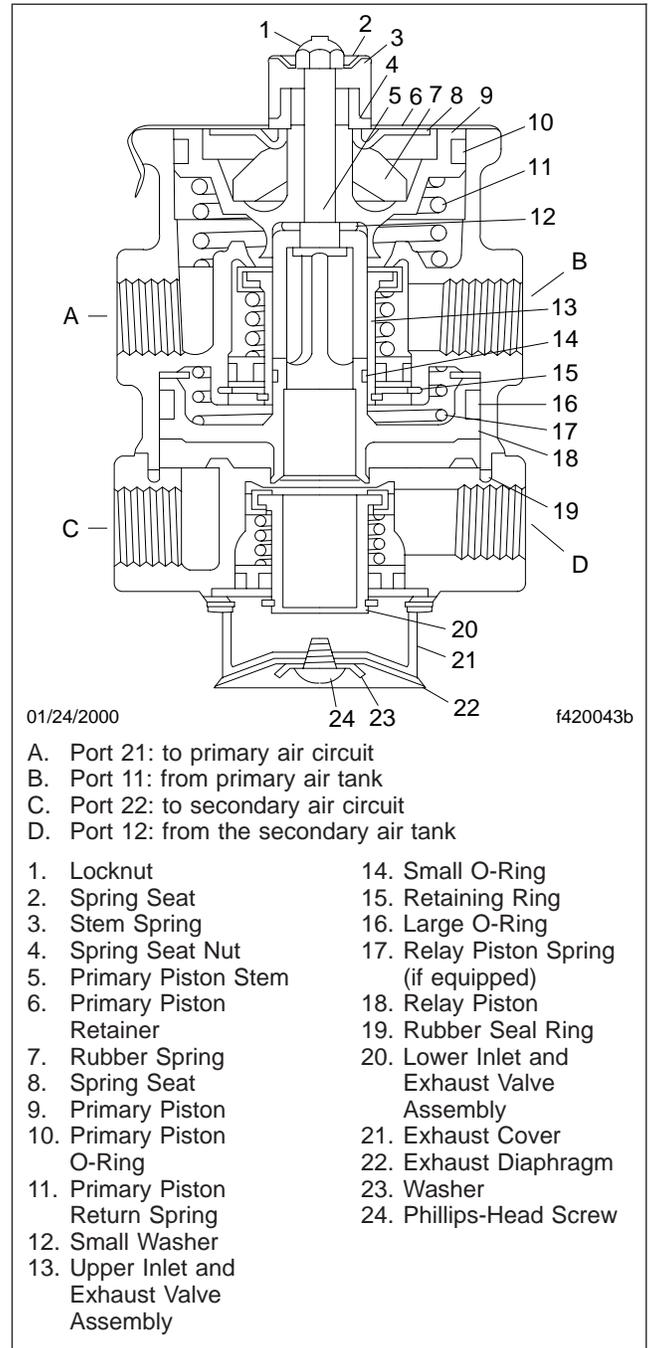


Fig. 1, Bendix E-6 Dual Circuit Foot Valve (sectional view)

10. Turn the spring seat nut counterclockwise, and separate the spring seat nut, spring seat, and the rubber spring. Remove the primary piston O-ring.

Brake Valve Disassembly, Cleaning and Inspecting, and Assembly

11. Remove the small and large O-rings from the relay piston.
12. Remove the retaining ring. Remove the upper inlet and exhaust valve assembly.

Cleaning and Inspecting

Wash all metal parts in mineral spirits and dry them thoroughly with compressed air. Inspect the valve seat surfaces of the pistons and the valve housings for conditions that could cause leakage. Inspect air line fittings for corrosion, and replace corroded fittings.

Assembly

Refer to [Fig. 1](#) while performing the assembly procedure.

NOTE: Keep the work area, tools, and brake valve parts clean during assembly.

1. Using Dow Corning 55-M pneumatic grease, or equivalent, lightly grease all the new O-rings, O-ring grooves, piston bores, and all sliding surfaces.
2. Place the upper inlet and exhaust assembly in the upper body, and secure the assembly with the retaining ring. Make sure that the retaining ring is seated in its groove.
3. Install the large and small O-rings on the relay piston.
4. Install the primary piston O-ring in the piston O-ring groove.
5. Install the rubber spring, concave side down, in the primary piston. Place the spring seat, flat side up, over the rubber spring.
6. Install the spring seat nut and turn the nut clockwise until the top surface of the spring seat is even with the top surface of the piston. Set this assembly aside.
7. Place the relay piston spring, if equipped, in the concave portion of the relay piston. Install the relay piston through the upper inlet and exhaust assembly, and into the underside of the upper valve body.
8. Place a screwdriver (blade up) in a vise. Place the primary piston stem in the relay piston. Position the upper valve body over the screwdriver blade, with the blade engaged in the slotted head of the piston stem.
9. Place the small washer over the stem.
10. Install the primary piston return spring in the upper valve body piston bore.
11. Install the primary piston and rubber spring assembly (assembled previously) over the stem, and into the upper valve body piston bore.

WARNING

The locknut and spring seat are used to restrain the primary piston return spring, stem spring, and the relay piston spring. The combined force of these springs is about 50 pounds (220 N). When installing these springs, use care to prevent them from flying out and possibly causing personal injury. Manually or mechanically hold down these springs when installing the locknut.

12. Push down and hold the primary and relay pistons in the upper valve body.
13. Place the stem spring over the spring seat nut (Item 4). Place the spring seat over the stem.
14. Install the locknut on the stem. Tighten the locknut 20 to 30 lbf-in (220 to 340 N-cm).
15. Install the rubber seal ring in the lower valve body.
16. Attach the lower and upper valve bodies. Install the four hexhead capscrews and washers. Tighten the capscrews 11 lbf-ft (15 N-m).
17. Install the lower inlet and exhaust valve assembly (Item 20).
18. Install the four screws that attach the exhaust cover to the lower valve body.
19. Install the brake valve. For instructions, see [Subject 110](#).

General Information

The Bosch parking brake is a lever-actuated, duo-servo, single-anchor drum brake. See [Fig. 1](#). The brake is designed for driveline-mounted applications, typically on the rear axle yoke. Its self-adjusting feature enables the brake to maintain a consistent functional clearance between the brake shoes and the drum as the shoe linings wear.

Major Components

The foundation of the brake is a ductile iron backing plate that mounts to the differential pinion housing with four capscrews. Major actuating components are a cam and a lever, which are fastened to the backing plate by an anchor screw. An anti-rattle spring under the head of this screw prevents clatter. The anchor point for brake actuation and shoe abutment is located at the 12 o'clock position when the assembly is properly mounted. See [Fig. 2](#).

NOTE: The parking brake drum is not a Bosch part, it is a stamped steel drum supplied by Meritor.

Brake Shoes and Related Components

Brake shoes are attached to the backing plate by hold-down springs and pins. See [Fig. 2](#). Both shoes seat against the backing plate anchor post at the top and are connected by the adjuster nut and screw assembly at the bottom. Shoe hold-down brackets are permanently mounted to the backing plate to assist in guiding the shoes. The shoes are pulled toward each other by two low-tension shoe-return springs. Proper orientation of the various springs, including their hook ends, must be maintained for the brake to function properly. The starwheel used for adjusting shoe clearance to the drum is on the adjuster nut. See [Fig. 3](#).

The clearance between the shoe linings and the inside drum surface is adjusted in response to excessive movement of a given shoe when the brake is actuated. This excessive movement is typically due to normal wear of the lining during use. The adjuster cable is anchored at the top, by the anchor screw, routed along the side of the shoe by a cable guide, and attached to the auto-adjuster lever via a spring, assembled on the cable end-fitting, at the bottom of

the brake. The adjuster lever seats against the starwheel on the adjuster nut and rotates the starwheel when adjustment is necessary. See [Fig. 4](#).

General Information

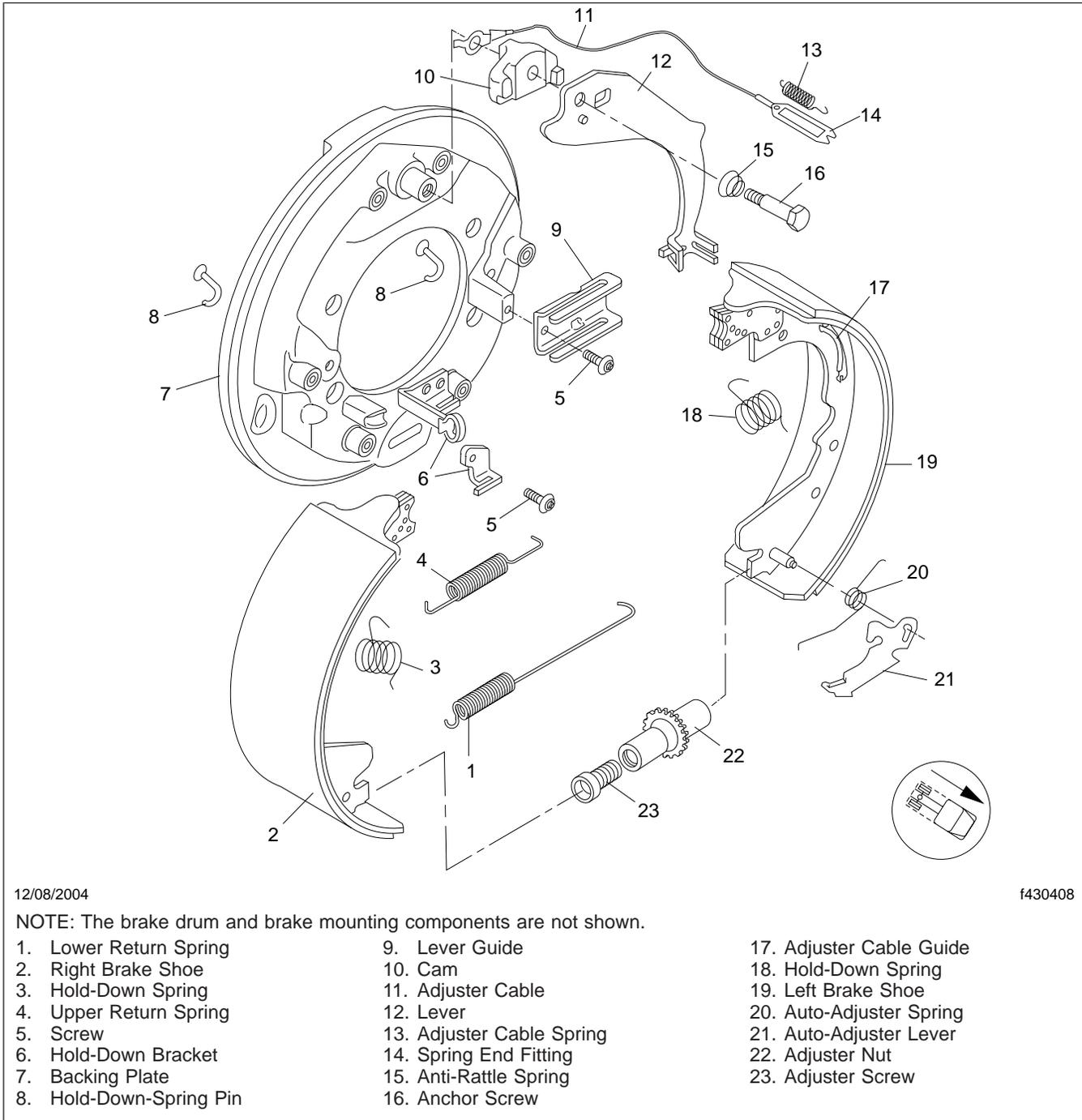


Fig. 1, Bosch Parking Brake (exploded view)

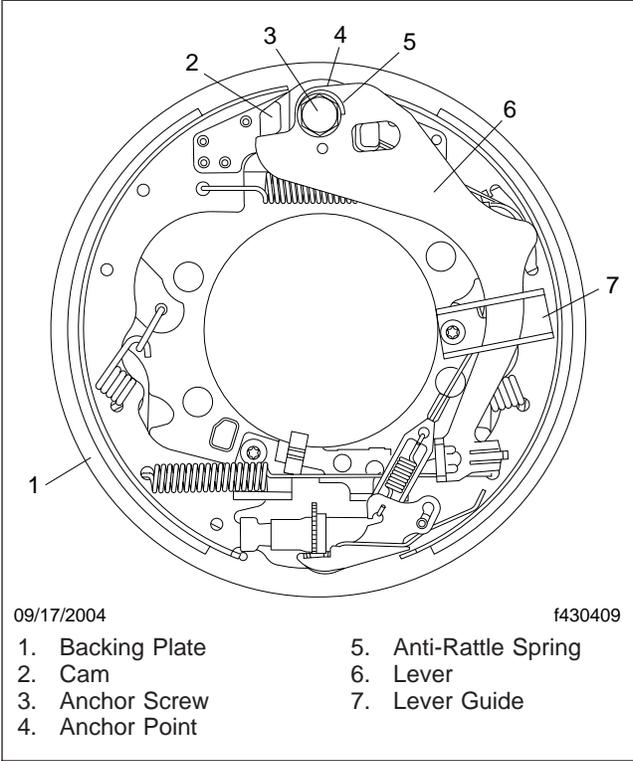


Fig. 2, Parking Brake Major Components

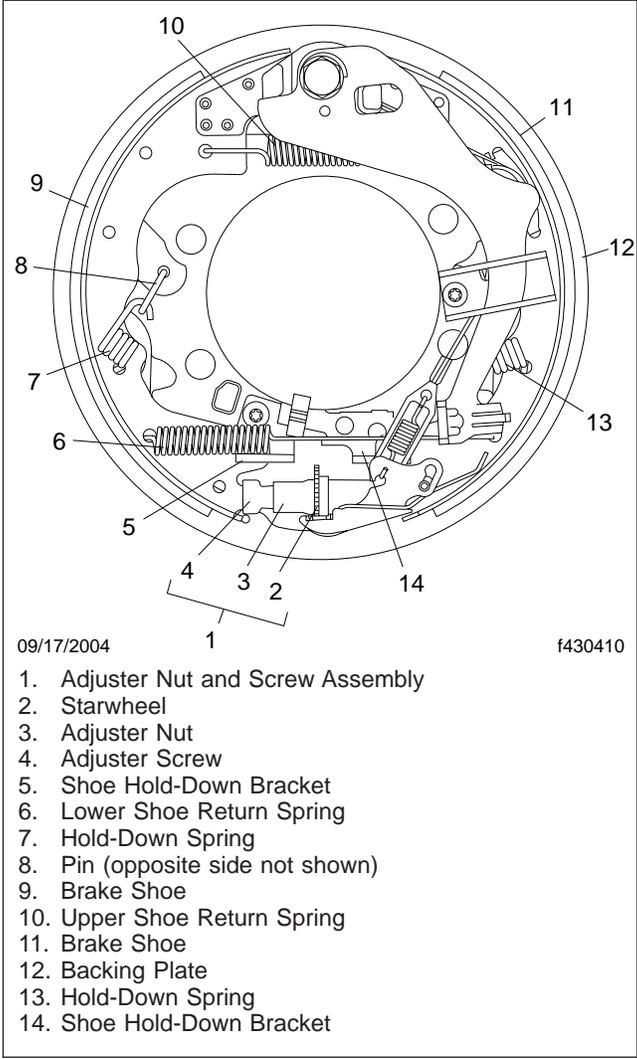


Fig. 3, Brake Shoes and Related Components

General Information

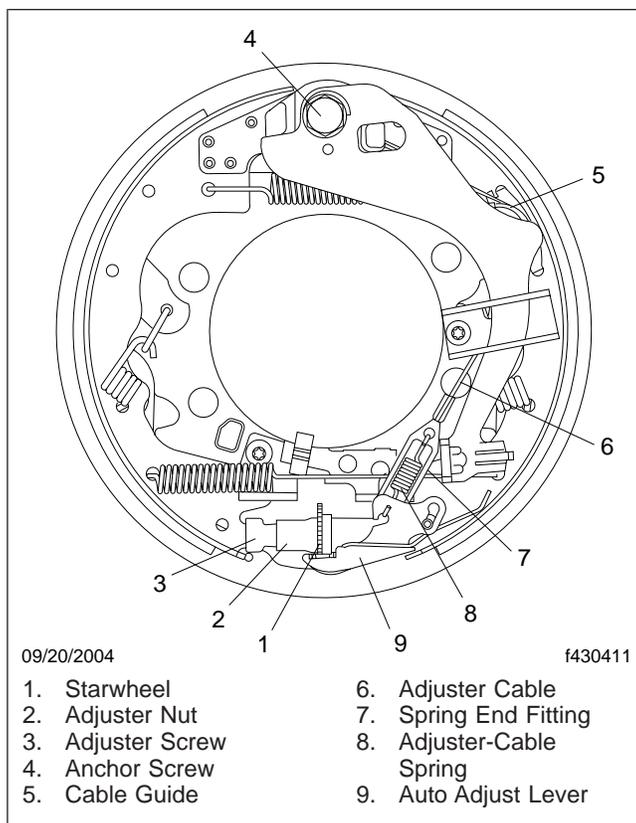


Fig. 4, Shoe Cage Adjusting Components

General Safety Precautions

WARNING

When replacing brake pads, shoes, rotors, or drums, always replace components as an axle set.

- Always reline both sets of brakes on an axle at the same time.
- Always replace both rotors/drums on an axle at the same time.
- Always install the same type of linings/pads or drums/rotors on both axle ends of a single axle, and all four axle ends of a tandem axle, at the same time. Do not mix component types.

Failure to do so could cause uneven braking and loss of vehicle control, resulting in property damage, personal injury, or death.

When working on or around a vehicle, observe the following precautions:

- Park the vehicle on a level surface and apply the parking brake. Shut down the engine and chock the tires.
- If the vehicle is equipped with air brakes, make certain to drain the air pressure from all reservoirs before beginning any work on the vehicle. Depleting air system pressure may cause the vehicle to roll. Keep hands away from brake chamber pushrods and slack adjusters, which may apply as air pressure drops.
- Disconnect the batteries.
- Never connect or disconnect a hose or line containing compressed air. It may whip as air escapes. Never remove a component or pipe plug unless you are certain all system pressure has been released.
- Never exceed recommended air pressure. Always wear safety glasses when working with compressed air. Never look into air jets or direct them at anyone.
- Do not remove, disassemble, assemble, or install a component until you have read and understand the service procedures. Some components contain powerful springs, and injury can result if not properly disassembled. Use

the correct tools and observe all precautions pertaining to use of those tools.

- Replacement hardware, tubing, hose, fittings, etc. should be the equivalent size, type, length, and strength of the original equipment.
- Make sure when replacing tubes or hoses that all of the original supports, clamps, or suspending devices are installed or replaced.
- Replace devices that have stripped threads or damaged parts. Repairs requiring machining should not be attempted.
- Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.

Asbestos and Non-Asbestos Safety

WARNING

Wear a respirator at all times when servicing the brakes, starting with the removal of the wheels and continuing through assembly. Breathing brake lining dust (asbestos or non-asbestos) could cause lung cancer or lung disease. Occupational Safety and Health Administration (OSHA) has set maximum levels of exposure and requires workers to wear an air purifying respirator approved by Mining Safety and Health Administration (MSHA) or National Institute for Occupational Safety and Health (NIOSH).

Because some brake linings contain asbestos, you should know the potential hazards of asbestos and the precautions to be taken. Exposure to airborne asbestos brake lining dust can cause serious and possibly fatal diseases such as asbestosis (a chronic lung disease) and cancer.

Because medical experts believe that long-term exposure to some *non-asbestos* fibers could also be a health hazard, the following precautions should also be observed if servicing non-asbestos brake linings.

Areas where brake work is done should be separate from other operations, if possible. As required by OSHA regulations, the entrance to the areas should have a sign displayed indicating the health hazard.

During brake servicing, an air purifying respirator with high-efficiency filters must be worn. The respirator

Safety Precautions

and filter must be approved by MSHA or NIOSH, and worn during all procedures.

OSHA recommends that enclosed cylinders equipped with vacuums and high-efficiency particulate air (HEPA) filters be used during brake repairs. Under this system, the entire brake assembly is placed within the cylinder and the mechanic works on the brake through sleeves attached to the cylinder. Compressed air is blown into the cylinder to clean the assembly, and the dirty air is then removed from the cylinder by the vacuum.

If such an enclosed system is not available, the brake assembly must be cleaned in the open air. During disassembly, carefully place all parts on the floor to minimize creating airborne dust. Using an industrial vacuum cleaner with a HEPA filter system, remove dust from the brake drums, brake backing plates, and brake parts. After vacuuming, any remaining dust should be removed using a rag soaked in water and wrung until nearly dry. Do not use compressed air or dry brushing to clean the brake assembly.

If grinding or other machining of the brake linings is necessary, other precautions must be taken because exposure to asbestos dust is highest during such operations. In addition to the use of an approved respirator, there must be local exhaust ventilation such that worker exposure is kept as low as possible.

Work areas should be cleaned by industrial vacuums with HEPA filters or by wet wiping. Compressed air or dry sweeping should never be used for cleaning. Asbestos-containing waste, such as dirty rags, should be sealed, labeled, and disposed of as required by EPA and OSHA regulations. Respirators should be used when emptying vacuum cleaners and handling asbestos waste products.

Workers should wash before eating, drinking, or smoking, should shower after work, and should not wear work clothes home. Work clothes should be vacuumed after use and then laundered, without shaking, to prevent the release of asbestos fibers into the air.

Drum Removal and Installation

General Information

The driveline parking brake uses a stamped steel drum supplied by Meritor. See [Fig. 1](#). The drum can be removed without removing the axle-input-flange-yoke from the pinion shaft. However, if you are going to work on the rest of the parking brake assembly, it is easier to remove the flange-yoke along with the drum.

Removal



Before starting the procedures below, read the information in [Safety Precautions, 100](#). Failure to follow the safety precautions during service operations on the brake system can cause personal injury.

IMPORTANT: Do not use a drum puller or a torch to remove a brake drum. Drum distortion may result.

1. Park the vehicle on a level surface, shut down the engine, and chock the front tires.
2. Raise the vehicle so that the axles can turn freely, and secure it on jack stands.

NOTE: Flange and driveshaft configurations will vary with the axle application.

3. Mark the position of the driveshaft in relation to the differential flange-yoke, then unbolt the driveline and secure it out of the way. See [Group 41](#).
4. If you are removing the drum only, mark the position of the drum on the flange-yoke, then remove the eight capscrews and washers that hold the drum to the yoke flange, then pull the drum off of the flange. If the drum is difficult to remove, insert a narrow screwdriver through the brake adjusting hole in the backing plate and disengage the adjuster lever from the adjuster nut teeth. With the adjuster lever disengaged (see [Fig. 2](#)), insert a brake adjusting tool through the adjusting hole to engage the adjusting nut teeth. Move the teeth upward enough times to retract the brake shoes to clear the drum. If the drum is rusted to the axle-input-flange-yoke pilot, tap the center of the brake drum with a non-metallic mallet to loosen it.

5. If you are removing the drum and flange, mark the position of the flange on the pinion shaft, then remove the flange nut and slide the drum and flange off of the pinion shaft spline as an assembly.

Installation



Before starting the procedures below, read the information in [Safety Precautions, 100](#). Failure to follow the safety precautions during service operations on the brake system can cause personal injury.

1. Clean the mounting surface of all dirt, debris, grease, and oil.
2. If you removed the drum only, position the drum on the flange-yoke as marked during removal, then install the capscrews and washers. Tighten to 48 lbf·ft (65 N·m).
3. If you removed the drum and flange as an assembly, position the assembly on the pinion spline as marked during removal, then install the pinion nut. See [Group 35](#).
4. Attach the driveline. See [Group 41](#).
5. Adjust the brake shoes. See [Subject 140](#).
6. Lower the vehicle.
7. Test the brake for proper operation before returning the vehicle to service.

Drum Removal and Installation

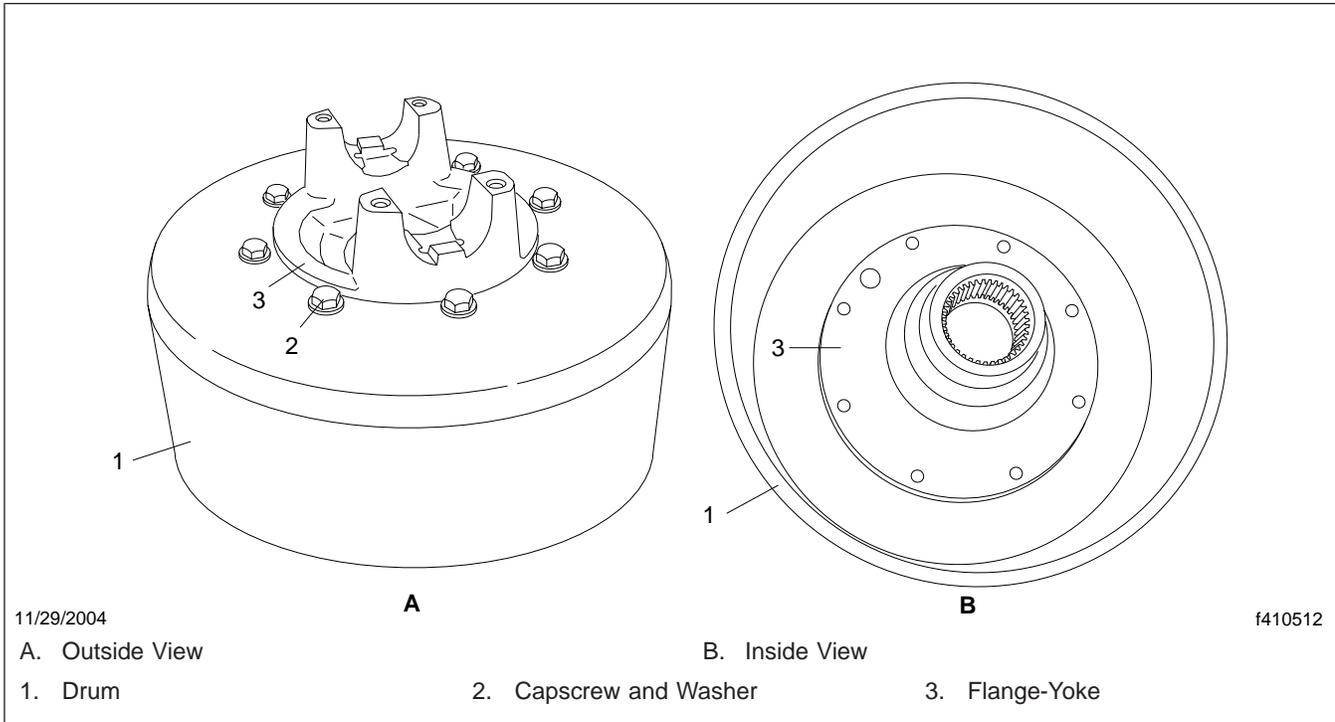


Fig. 1, Drum and Flange Assembly (typical)

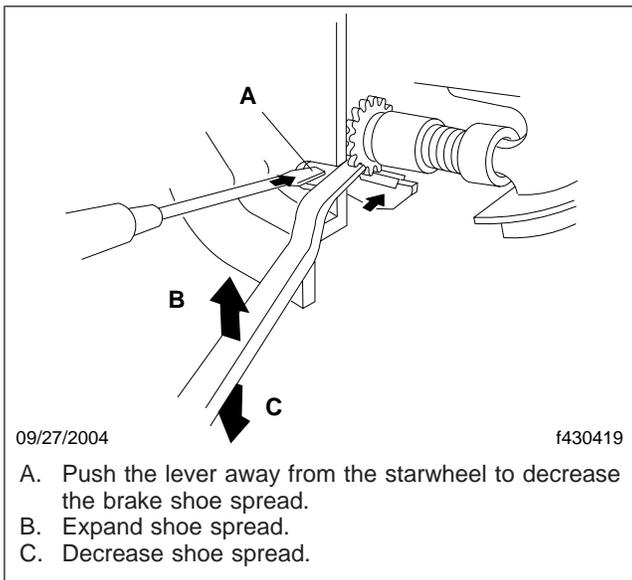


Fig. 2, Brake Adjustment

Brake Shoe Removal and Installation

Removal

 **WARNING**

Before starting the procedures below, read the information in [Safety Precautions, 100](#). Failure to follow the safety precautions during service operations on the brake system can cause personal injury.

1. Park the vehicle on a level surface, shut down the engine, and chock the front wheels.
2. Place the transmission in gear and release the parking brake.
3. Raise the rear of the vehicle so the wheels clear the floor, and install jack stands.
4. Mark the position of the driveshaft in relation to the differential, then unbolt the driveshaft from the differential and secure it out of the way. See [Group 41](#).
5. Remove the drum. See [Subject 110](#).
6. Inspect the brake. See [Subject 170](#).

NOTE: Special tools are available for many of the steps in this procedure. See [Subject 400](#).

7. Detach the adjuster cable from the adjuster lever and slide the cable off of the adjuster cable guide. See [Fig. 1](#).
8. Remove the adjuster lever and the adjuster spring. See [Fig. 1](#). Save the parts for installation.
9. Using pliers, or a special tool, remove both shoe-return springs. See [Fig. 2](#).
10. Detach the parking brake cable and the lever return spring from the lever.
11. Remove the anchor bolt and move the lever to provide access to the shoe hold-down spring. See [Subject 130](#) for the procedure.
12. Using a brake shoe spring tool or needlenose pliers, remove both of the shoe hold-down springs. See [Fig. 3](#).
13. Remove the brake shoes from the backing plate.
14. Disassemble the adjuster nut and screw assembly for cleaning and inspection of the threads.

Installation

Proper orientation of all brake components, particularly the various springs, including their hook-ends must be maintained for proper brake function.

1. Clean the backing plate.
2. Apply a light film of Wolfrakote paste ledge grease, or an equivalent, to the six backing plate shoe ledges and the anchor post. See [Fig. 4](#).
3. Apply a Chevron heavy-duty, lithium complex, extreme-pressure grease, or equivalent, to the cam plate lugs where they contact the shoe ends and the brake lever.
4. Apply a Chevron heavy-duty, lithium complex, extreme-pressure grease, or an equivalent, to the threads of the adjuster screw and the socket end of the adjuster nut. Install the screw fully into the adjuster nut. Ensure the screw moves in and out freely. If any damage to the threads prohibits free movement, or if the starwheel is damaged, replace the adjuster assembly.
5. Place one shoe in the installed position. See [Fig. 5](#). Make sure the shoe with the adjuster cable guide and adjuster pin is installed on the correct side.
6. Install the shoe hold-down pin. See [Fig. 5](#).
7. Position the second shoe and the adjuster nut and screw assembly. See [Fig. 3](#). The adjuster nut should be seated against the shoe with the adjuster cable guide and pin. Attach the shoe hold-down spring to the shoe hold-down pin, using a brake spring tool. See [Fig. 3](#).
8. Install both shoe-return springs. See [Fig. 5](#).
9. Install the adjuster spring and the adjuster lever. Ensure that the adjuster lever is properly seated against the starwheel. See [Fig. 5](#).
10. If the lever has been removed, install the lever and its associated components. See [Subject 130](#).
11. Route the adjuster cable around the adjuster cable guide, under the shoe hold-down spring, and attach it to the adjuster lever.

Correctly assembled, the adjuster cable end-fitting is behind the adjuster lever, with the spring hook facing out. See [Fig. 6](#).