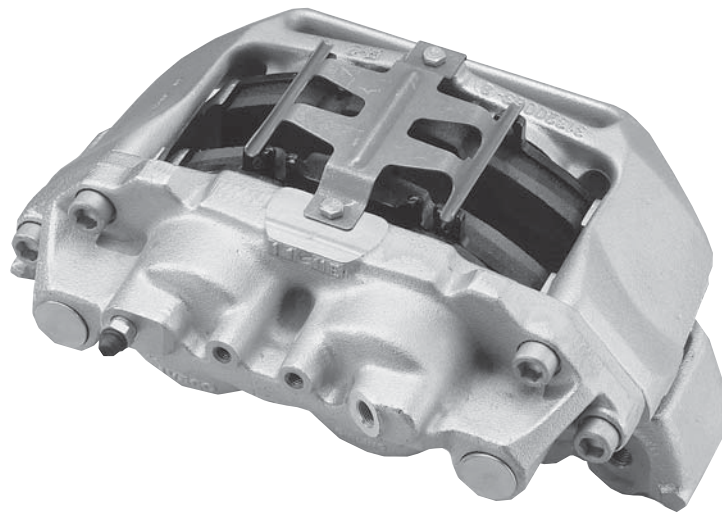


Maintenance Manual MM-0328

Reaction Beam Hydraulic Disc Brake Caliper Assembly

Issued 10-03



Service Notes

About This Manual

This manual provides instructions for the Meritor reaction beam hydraulic disc brake caliper assembly.

Before You Begin

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.


Hazard Alert Messages and Torque Symbols

WARNING

A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury and damage to components.

CAUTION

A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components.

 This symbol alerts you to tighten fasteners to a specified torque value.

How to Obtain Additional Maintenance and Service Information

On the Web

Visit the DriveTrain Plus™ by Meritor Tech Library at meritor.com to easily access product and service information. The Library also offers an interactive and printable Literature Order Form.

Meritor's Customer Service Center

Call Meritor's Customer Service Center at 800-535-5560.

Technical Electronic Library on CD

The DriveTrain Plus™ by Meritor Technical Electronic Library on CD contains product and service information for most Meritor, ZF Meritor LLC and Meritor WABCO products. \$20. Specify TP-9853.

How to Obtain Tools and Supplies Specified in This Manual

Call Meritor's Commercial Vehicle Aftermarket at 888-725-9355 to obtain Meritor tools and supplies.

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Asbestos and Non-Asbestos Fibers

ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from Meritor.

Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. **Separate Work Areas.** Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

**DANGER: ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA.**

2. **Respiratory Protection.** Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.
3. **Procedures for Servicing Brakes.**
 - a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
 - b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - c. If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.
 - d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
 - e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
4. **Cleaning Work Areas.** Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.
5. **Worker Clean-Up.** After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
6. **Waste Disposal.** Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from Meritor.

Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some scientists believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

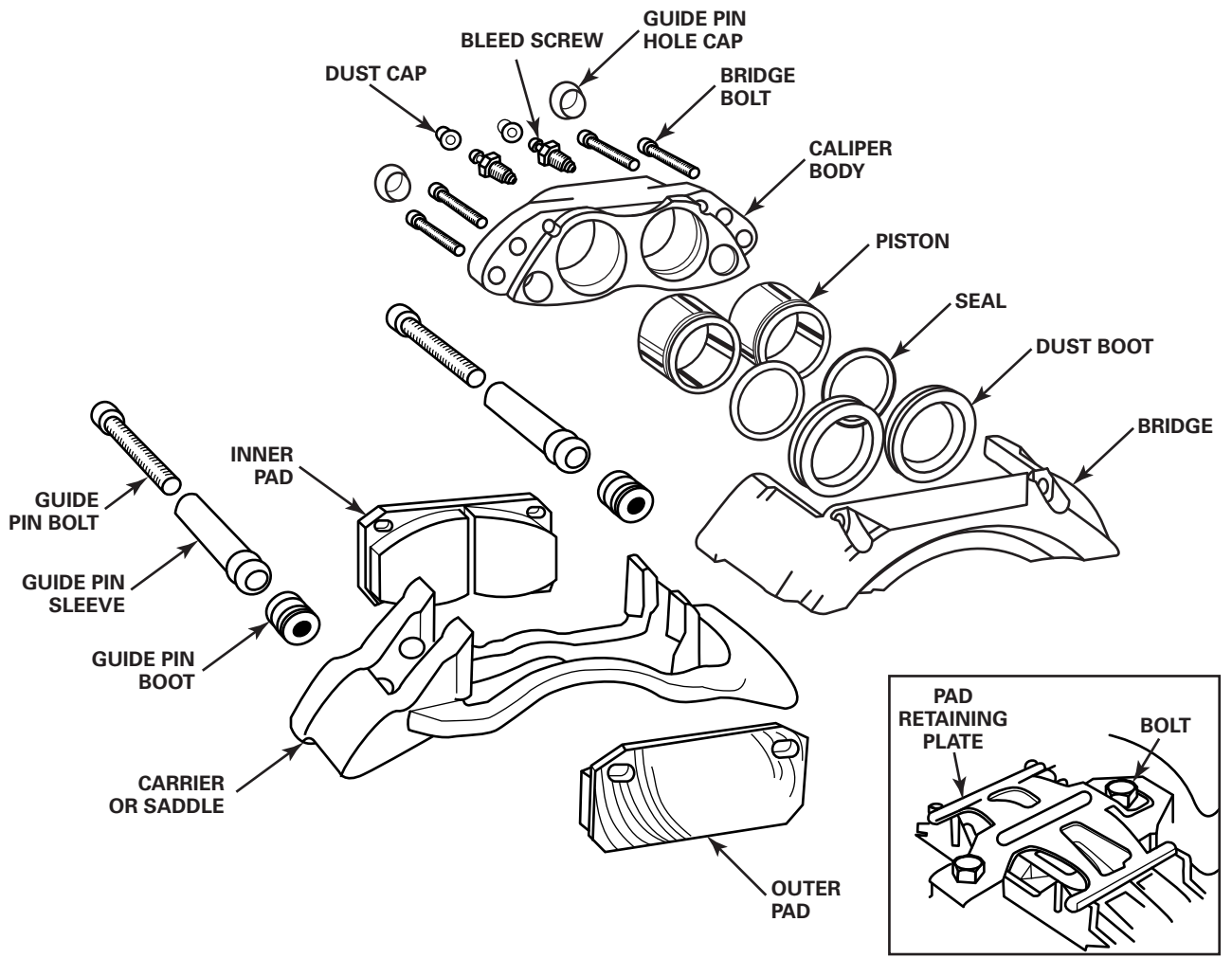
Recommended Work Practices

1. **Separate Work Areas.** Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.
 2. **Respiratory Protection.** OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m³ as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.
- Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposure levels may exceed OSHA or manufacturers' recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.
3. **Procedures for Servicing Brakes.**
 - a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
 - b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - c. If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
 - e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
 4. **Cleaning Work Areas.** Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, to minimize exposure. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.
 5. **Worker Clean-Up.** After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
 6. **Waste Disposal.** Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

1 Exploded View



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2 Introduction

Operation

The reaction beam hydraulic disc brake caliper assembly consists of a caliper housing and carrier, or saddle. The carrier is bolted directly to the torque plate. The torque plate is bolted onto the axle or may be integral with the axle. The caliper assembly slides on sealed and lubricated guide pin sleeves projecting from the carrier.

Hydraulic fluid pressure is applied to the rear of the pistons. The pistons move outward and push the inner pad onto the rotor. Figure 2.1. The caliper assembly slides on the guide pin sleeves and brings the outer pad into contact with the rotor. The clamp load on both sides of the rotor is equal when the brake is applied. When the hydraulic pressure is released, the piston's seal retracts the pistons.

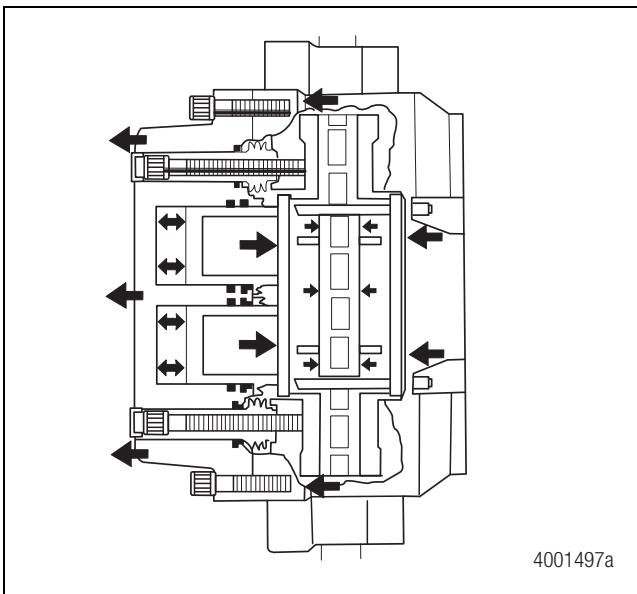


Figure 2.1

3 Removal and Disassembly

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance and service.

ASBESTOS AND NON-ASBESTOS FIBERS

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Removal

WARNING

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

1. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving.
2. Use a jack to raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
3. Remove the wheel and tire assembly according to the vehicle manufacturer's recommendation.

Pads

1. Visually inspect all brake pads. Replace pads when the lining reaches 0.08-inch (2.0 mm) thickness.
 - **If you replace the pads:** Replace all disc brake pads on the same axle at the same time to maintain original brake balance.
 - **If a complete vehicle pad replacement is not necessary or desirable:** Replace the pads on both wheel ends on the same axle.

2. Remove the master cylinder reservoir filler cap. Check the brake fluid level in the reservoir. If necessary, remove fluid to keep the reservoir from overflowing when compressing pistons into the caliper.
3. Remove the pad retaining plate bolt and remove the pad retaining plate. Figure 3.1.

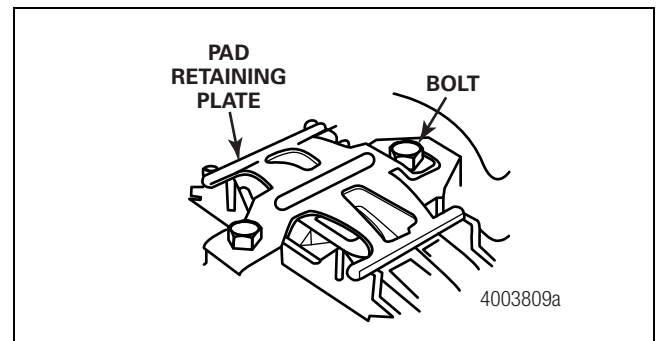


Figure 3.1

4. Remove the inner pad.
5. Compress the caliper pistons. Figure 3.2. Check that the piston boots are not damaged.

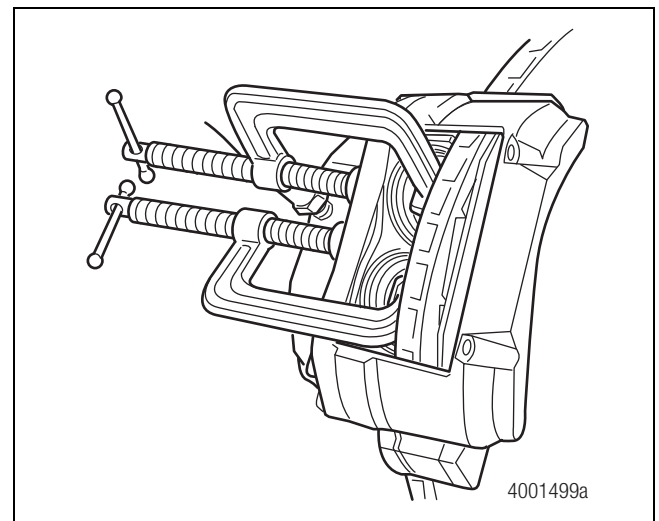


Figure 3.2

6. Remove the outer pad. Slide the caliper assembly, if necessary, to remove the outer pad.

3 Removal and Disassembly

Caliper

1. Disconnect the flexible hose from the caliper.
2. Remove the caliper assembly by removing the four bolts attaching the carrier to the axle and place it on a suitable workbench. Figure 3.3.

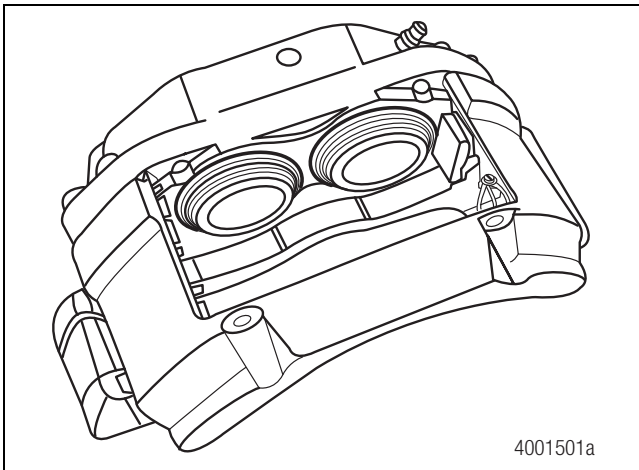


Figure 3.3

3. Open the bleed screw. Allow the fluid to drain through the bleed tubes into an appropriate container. Do not reuse the brake fluid drained from the system.

Rotor

NOTE: The resurfaced rotor thickness must exceed the minimum thickness dimension stamped or cast into the rotor. Replace the rotor if necessary.

1. Check the rotor while assembled to the hub and mounted on the axle spindle. The lateral runout of the rotor friction surfaces should not exceed 0.01-inch (0.25 mm) total indicator reading (TIR). The thickness variation of the rotor should not exceed 0.0012-inch (0.0300 mm).
 - **If the lateral runout or the thickness variation exceeds the above values:** Resurface or replace the rotor.
2. Remove the caliper. Refer to the caliper removal procedure in this section.
3. Remove the hub and rotor assembly from the axle according to the vehicle manufacturer's procedure.
4. Remove the bolts that secure the hub to the rotor.

Disassembly

Caliper

1. Do not loosen or remove the guide pin bolts unless you are replacing the guide pin bolts or sleeves. Refer to the guide pin removal procedure in this section.
2. Remove the pads. Refer to the pad removal procedure in this section.
3. Use a block of wood to prevent the pistons from hitting the caliper bridge when you remove them. Figure 3.4.

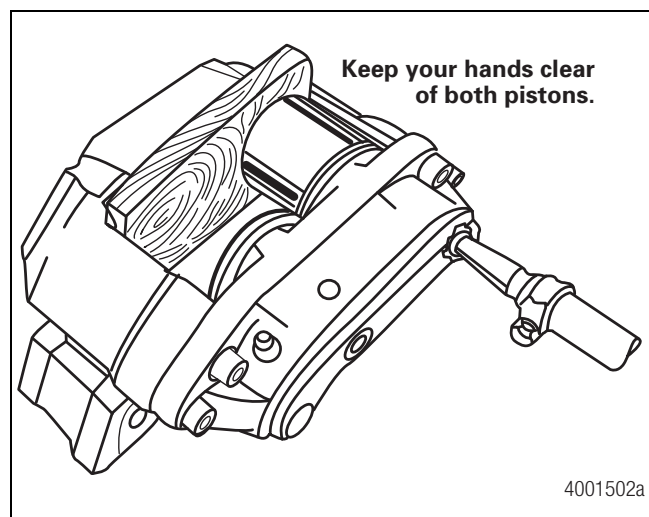


Figure 3.4

4. Gradually apply compressed air to the inlet ports to remove each piston. Do not completely remove the first piston from the caliper body until the second piston has loosened enough to remove them both. If you remove the first piston, you cannot build enough air pressure inside the caliper body to loosen the second piston.
5. Remove the piston dust boots and seals.
6. Remove the guide pin hole caps. Remove and discard the caliper bridge bolts. Do not reuse these bolts. Remove the caliper bridge. Figure 3.5.

3 Removal and Disassembly

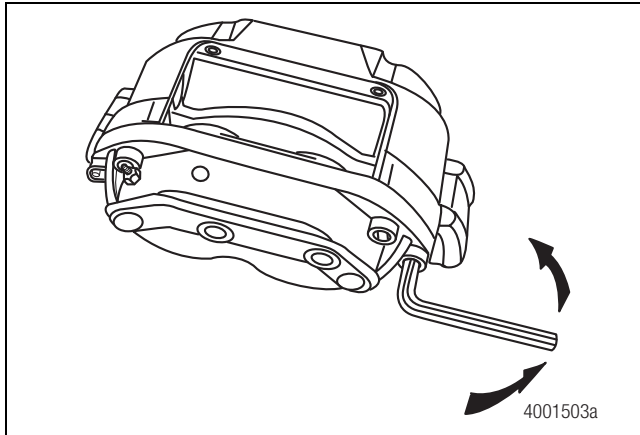


Figure 3.5

7. Remove the guide pin dust boots. Slide the caliper body off the guide pins. Remove the guide pin dust boots.

Removal

Guide Pin

NOTE: Guide pin bolts should not be removed unless you are replacing the guide pin sleeves or bolts.

1. Remove the guide pin hole caps. Figure 3.6. Loosen both bolts in the carrier.

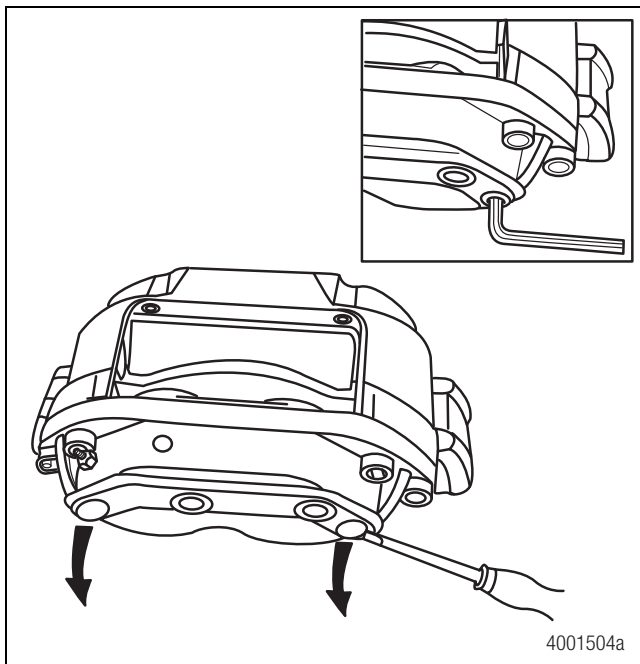


Figure 3.6

2. Support the caliper body. Remove the bolts from the carrier. Remove the caliper body.
3. Remove the socket head guide pin bolts while holding the guide pin sleeves. Figure 3.7.

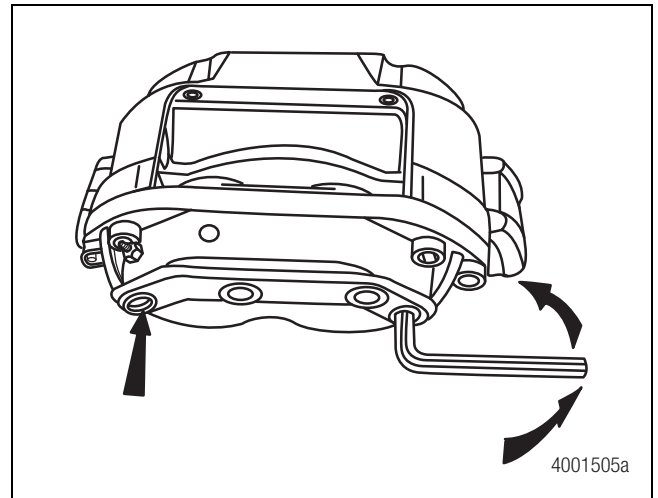


Figure 3.7

4. Remove the guide pin sleeves. Remove the guide pin dust boots.

4 Prepare Parts for Assembly

Hazard Alert Messages

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WARNING

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

ASBESTOS AND NON-ASBESTOS FIBERS

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Clean, Dry and Inspect Parts

Clean Parts

WARNING

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, and emulsion-type and petroleum-base cleaners. Read the manufacturer's instructions before using a solvent cleaner, then carefully follow the instructions. Also follow the procedures below.

- Wear safe eye protection.
- Wear clothing that protects your skin.
- Work in a well-ventilated area.
- Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.
- You must use hot solution tanks or alkaline solutions correctly. Read the manufacturer's instructions before using hot solution tanks and alkaline solutions. Then carefully follow the instructions.

CAUTION

Do not use hot solution tanks or water and alkaline solutions to clean ground or polished parts. Damage to parts can result.

1. Use new heavy-duty DOT 3 brake fluid or equivalent, clear methylated spirits or isopropyl alcohol to clean parts.

2. Use a wire brush to clean fastener and fitting threads.
3. Remove mud and dirt on the linings. Replace all linings contaminated with oil or grease.

Dry and Inspect Parts

1. Use soft, clean paper or cloth rags to completely dry parts immediately after you clean them.
2. Carefully inspect all parts for wear or damage before you assemble them.
3. Repair or replace worn or damaged parts.

Corrosion Protection

1. Apply DOT 3 brake fluid to cleaned, dried parts. Be careful that you do not apply the brake fluid to the linings or rotor. Verify that the linings and rotor are clean of brake fluid or other dirt and grease.
2. If you will store the parts, apply a special material, which prevents corrosion and rust, to all surfaces. Store parts inside special paper or other material that prevents rust and corrosion.

5 Assembly and Installation

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

⚠ WARNING

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

⚠ ASBESTOS AND NON-ASBESTOS FIBERS WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Assembly

Caliper

1. Use new heavy-duty DOT 3 or equivalent brake fluid to lubricate parts.
2. Install a new piston seal into the caliper body groove. Figure 5.1.

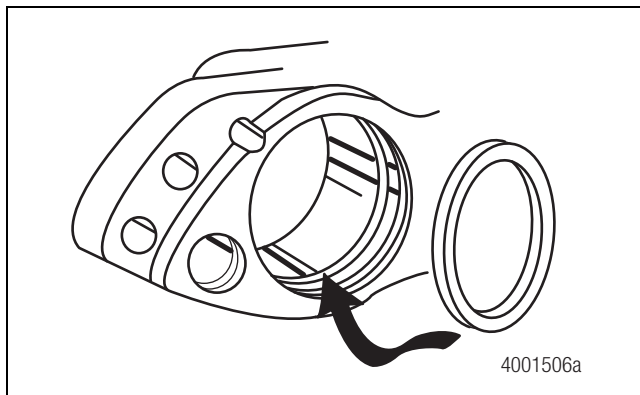


Figure 5.1

3. Install the dust boot into the caliper body groove. Figure 5.2.

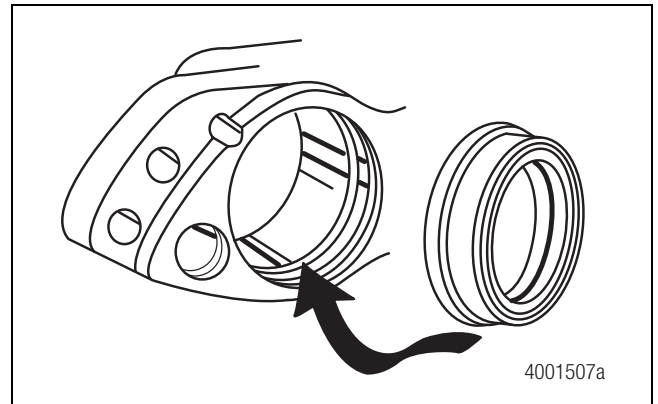


Figure 5.2

4. With assistance, open up the dust boot and slide the piston through the dust boot and down the bore. Figure 5.3. Ensure that the piston does not trap or cut the dust cover. Release the dust boot, pucker it to release any trapped air and settle it into the groove in the piston.

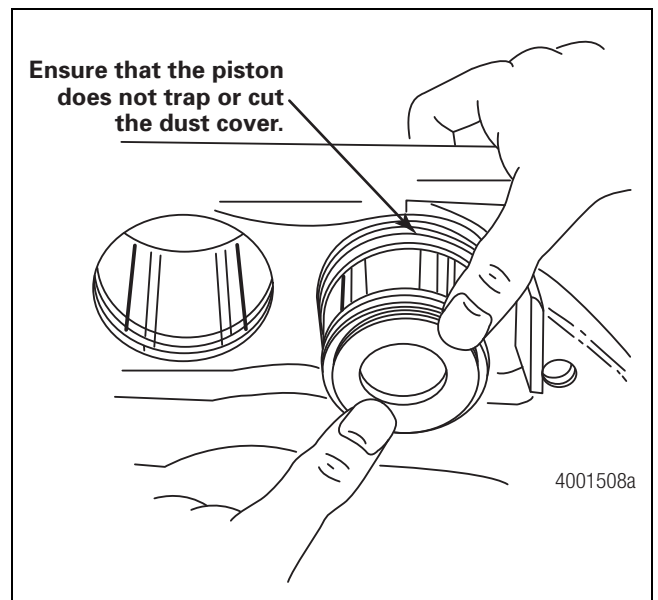



Figure 5.3


5. Repeat the same procedure with the other piston.
6. Install the guide pin dust boots into the caliper body. Verify that they are located correctly by gently pulling.
7. Use the special grease provided to grease the bores and inside the sleeves.

5 Assembly and Installation

- Support the carrier. Slide the guide pins through the dust boots into their bores in the caliper body. Install the dust boots into their grooves in the guide pin sleeves.
- Position and support the bridge against the caliper body. Use new bridge bolts and tighten them to 70-85 lb-ft (95-115 N•m). 

Installation

Guide Pin

- Install the guide pin dust boots into the caliper body. Verify that they are located correctly by gently pulling.
- Use the special grease provided to grease the bores and inside the sleeves.
- Install the guide pin bolts into the sleeves and slide them carefully through the dust boots into the bores. Place the dust boots into their groove in the sleeves.
- Install the caliper body onto the carrier. Hand-tighten the guide pin bolts. Verify that the caliper slides easily on the sleeves. First tighten the bolt on the side marked with the “T” or “>” symbol to 70-85 lb-ft (95-115 N•m). Figure 5.4. Tighten the other bolt to 70-85 lb-ft (95-115 N•m). 

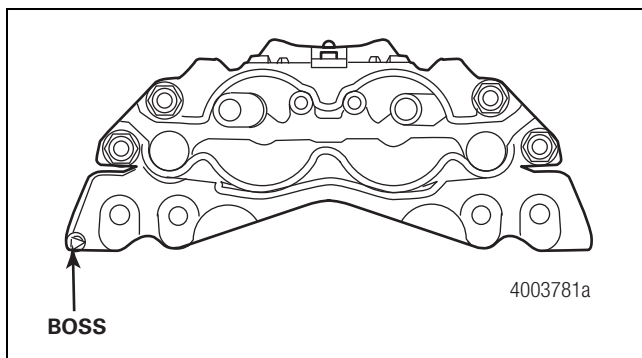


Figure 5.4

- Verify that the caliper slides easily on the sleeves. If necessary, loosen the guide pin bolts, slide the caliper and re-tighten the bolts.
- The caliper body must be installed as far down the guide pins as possible. Tap or screw in the guide pin hole caps.

Rotor

NOTE: Do not resurface a new replacement rotor.

- Examine the rotor for corrosion, grooving and deep crazing. Surface crazing is acceptable. Repair or replace as necessary. Resurface rotors and use as required. Discard rotors that require resurfacing equal to or below the discard dimension shown on the rotor.
- Remove all scale and rust from around the edge of the rotor. Do not damage the dust boots. Place a scraper against the caliper body and rotate the rotor to remove most of the corrosion. Use an emery cloth to finish cleaning the rotor. Figure 5.5.

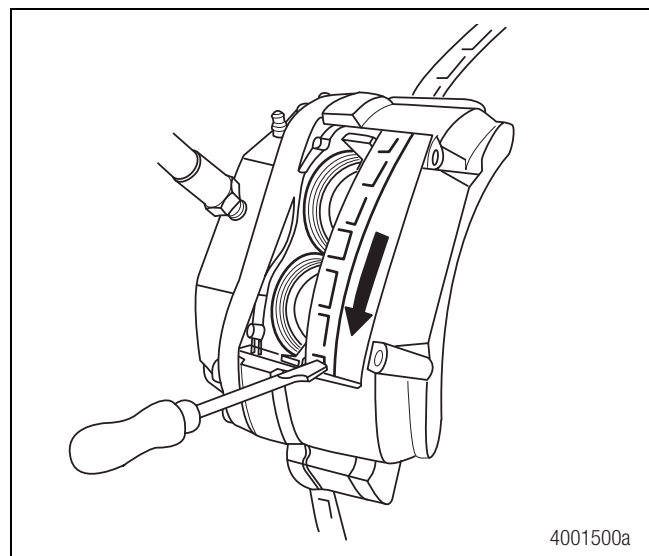



Figure 5.5


- Verify that the mating surfaces of the hub and rotor are clean and free of rust build-up.
- Install the bolts that secure the hub to the rotor.
- Install the hub and rotor assembly onto the axle according to the vehicle manufacturer's procedure.
- Install the caliper. Refer to the caliper installation procedure in this section.
- Check the rotor for lateral runout.
 - If the lateral runout exceeds 0.010-inch (0.25 mm):** The rotor may be rotated to a different mounting hole position on the hub to reduce the value.

5 Assembly and Installation

Caliper

1. Install the caliper assembly by installing the four bolts to the carrier and axle. Tighten the bolts to 81-96 lb-ft (110-130 N•m). 
2. Install the pads per the procedure in this section.
3. Slide the caliper assembly inboard. Inspect the piston dust boots.
 - **If the dust boots are damaged or cracked:** Inspect the pistons for corrosion. Replace the pistons and seals as necessary.
 - **If the pistons are not damaged or corroded:** New dust boots can be installed.

Pad

1. Clean the pad slide faces prior to installing the pads.
2. Carefully install the new inner pad with the lining material against the rotor. Slide the caliper assembly outboard. Install the new outer pad.
3. Install the pad retaining plate and bolts. Tighten the bolts to 6.6-8.9 lb-ft (9-12 N•m). 
4. Repeat the procedure for all other calipers on the vehicle.

Bleed the Brakes

1. Connect the hydraulic lines. Bleed the brakes. Apply the pedal two or three times.
2. Check and fill the fluid reservoir with heavy-duty DOT 3 or equivalent brake fluid as required. Install the filler cap.
3. Repeat the procedure for all the other calipers on the vehicle.
4. Check all connections for fluid leakage.
5. Install the wheel and tire assembly.
6. Remove the safety stands. Lower the vehicle. Remove the blocks.
7. Road test the vehicle. Brake gently several times from 50-30 mph (80-50 km/h). Avoid heavy braking for the first 100 miles (160 km).

6 Maintenance

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

WARNING

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

Maintenance


1. Check the pads for wear every 10,000 miles (15 000 km) or at the preventive maintenance schedule. Install new pads when the lining thickness has worn to 0.08-inch (2.0 mm).
2. Never allow the lining to wear below 0.059-inch (1.5 mm).
3. Examine all brake lines and flexible hoses for leaks, corrosion, fretting and damage every 10,000 miles (15 000 km) or at the preventive maintenance schedule.
4. Change the brake fluid every two years. Use only heavy-duty DOT 3 brake fluid or equivalent.
5. At each pad change, examine the pistons, piston boots and guide pin boots for damage. If there is any damage, check the condition of the pistons and guide pin sleeves. Replace parts as necessary.

Cleaning and Inspection

1. Use new heavy-duty DOT 3 brake fluid or equivalent, clear methylated spirits or isopropyl alcohol to clean parts.

WARNING

Use only the recommended fluid when cleaning brake parts. Use of gasoline, paraffin or any other mineral-based fluid is dangerous.

2. Remove the bleed screws from the caliper body. Inspect the piston bores for damage, scuffing and corrosion. Use wire wool or emery cloth to clean corrosion outboard of the seal. Badly corroded pistons must be replaced.
3. If the piston bores are not serviceable, install a new caliper body complete with piston seals and dust boots onto the original caliper bridge. Install new bridge bolts and tighten to 70-85 lb-ft (95-115 N•m). 

4. Check the guide pin dust boots for damage. Inspect the guide pin sleeves for corrosion and damage. Replace parts as necessary.
5. Use a lint-free rag to clean the guide pin bores.

7 Troubleshooting

Hazard Alert Messages

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WARNING

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

Brakes

Conditions	Possible Causes	Correction
Excessive Pedal Effort	Pads worn below minimum thickness	Install new pads.
	Faded, overheated condition, glazed pads, blued or heat-checked rotors	Replace the rotor and reface pads if sufficient lining remains.
	Grease, oil or brake fluid on linings	Install new pads in the axle sets.
	Seized or frozen pistons	Disassemble the calipers and free pistons, or replace the caliper.
Pedal Pulsation (Brake Roughness or Chatter)	Excessive lateral runout of brake rotor	Check with a dial indicator. Install a new rotor if the runout exceeds the maximum specified.
	Excessive out-of-parallelism of brake rotor	Check the parallelism or rotor thickness variation with a micrometer. Resurface the rotor or install a new rotor if the parallelism exceeds the maximum allowed.
	Loose or worn steering or suspension parts	Replace the parts and realign.
	Excessive front bearing clearance	Readjust the bearing to specifications.
Vehicle Pulls to One Side	Brake fluid, oil or grease on linings	Install new pads in the axle sets.
	Unmatched linings, uneven lining wear, distorted pads	Install new pads in the axle sets.
	Rough rotor surfaces on one rotor	Resurface or replace the rotor in the axle sets.
	Seized or frozen pistons	Disassemble the caliper and repair or replace.
	Loose caliper mounting bolts	Tighten to specifications.
	Uneven tire pressure, tread wear or size, right to left	Equalize to the recommended pressures. Install the correct size tires with good tread.
	Excessive rotor parallelism or runout	Resurface or replace the rotor.
	Restricted hose or line	Examine the hoses and lines, and replace as necessary.
Front end out of alignment	Reset the alignment.	

7 Troubleshooting

Conditions	Possible Causes	Correction
Leaky Caliper	Cylinder bore surface scored or corroded	Disassemble the calipers, clean the bore and replace the seals and boots.
	Caliper piston seal damaged or worn	Disassemble the calipers and install new seals and boots.
	Caliper piston damaged	Replace the piston.
No Braking Effect or Excessive Pedal Travel	Reservoir fluid level low	Check for causes of fluid leak, repair as required and refill the reservoir. Bleed the system as needed.
	Air in the hydraulic system	Bleed the system.
	Bleed screw loose or open	Bleed the system and tighten the bleed screw.
	Caliper piston seal damaged	Disassemble the caliper and replace the piston seals. Replace the piston if it is damaged.
	Excessive rotor runout or bent rotor	Check the rotor with a dial indicator. Install a new rotor if the runout exceeds the maximum specified.
	Worn or excessively loose wheel bearings	Adjust or replace the bearings as needed.
	Low quality brake fluid	Drain and clean the system. Replace with the recommended brake fluid.
	Weak brake hose that expands under pressure	Replace the hoses.
Brake Noise (Chatter)	Excessive lateral runout of rotor	Check the runout with a dial indicator. Install a new rotor if the runout exceeds the maximum specified.
	Lack of rotor parallelism	Check the parallelism with a micrometer. Resurface or install a new rotor as required.
	Loose wheel bearing	Readjust the bearing to the specified torque.
Brake Noise (Scraping)	Rust or mud build-up on edges of rotor and on caliper housing	Clean or replace as necessary.
	Worn pad or pad installed backward	Replace the pads in the axle sets only with the friction surface against the rotor.
	Incorrect caliper alignment permitting rotor to scrape on housing	Correct the alignment.
Brake Noise (Groan)	Pressure on the brake pedal too light	Slightly increase the pedal effort to eliminate the noise.
Brake Noise (Rattle)	Excessive clearance between the shoe and caliper	Install new pads.
	Pad retainer plate missing or not correctly positioned	Install a new pad retainer spring or position it correctly.
Brake Noise (Squeal)	Glazed pads	Resurface or replace the pads in the axle sets only.
	Weak pad retainer spring	Install a new pad retainer spring.
	Pad wear indicator contacting rotor	Install new pads in the axle sets only.
	Foreign material embedded in linings	Replace the pads in the axle sets only.

8 Specifications

Torque Specifications

Description	Specification
Inlet Port, Inverted Flare Nut, M10	5.2-9.6 lb-ft (7-13 N•m)
Pad Retainer Plate Bolt, M8	6.6-8.9 lb-ft (9-12 N•m)
Bleed Screw, M10	5.2-9.6 lb-ft (7-13 N•m)
Saddle-to-Axle, M12	81-96 lb-ft (110-130 N•m)
Guide Pin Bolt, M12 Socket Head Capscrew	70-85 lb-ft (95-115 N•m)
Bridge Bolt, M12 Socket Head Capscrew	70-85 lb-ft (95-115 N•m)
Rotor-to-Hub Bolt, 1/2"	75-100 lb-ft (101.7-135.6 N•m)

Description	Specification
Brake Pad —	
Thickness Above Metal (New)	0.61" (15.5 mm)
Minimum Thickness Above Metal (Discard)	0.08" (2 mm)
Brake Fluid — High-Performance Brake Fluid	DOT 3 or DOT 4
Rotor —	
Thickness (New)	1.18" (30 mm)
Thickness (Discard)	1.04" (26.4 mm)

Meritor Heavy Vehicle Systems, LLC
2135 West Maple Road
Troy, MI 48084 USA
800-535-5560
meritor.com

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