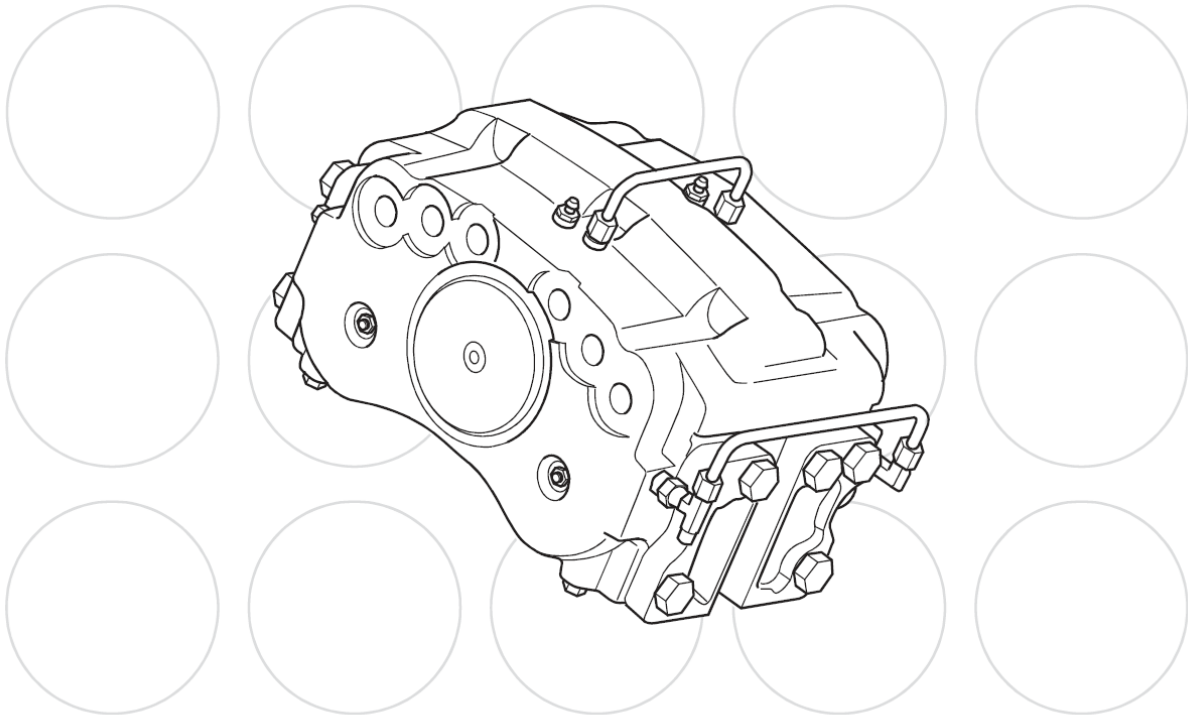




6180 COCHRAN ROAD  
SOLON, OHIO 44139 U.S.A.  
Maintenance Manual MM0383

# HDBC 4225 Dry Disc Brake Caliper Assembly



REV	ECN	DESCRIPTION	DATE	CAD	ENG
D	103731	REFER TO ECN	10SEP2018	CJB	PAP

## Service notes

### About this Manual

This manual provides maintenance and service information for Carlisle HDBC 4225 dry disc brake caliper assemblies.

### 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 diagnostic 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.



### Carlisle's customer Service Center

Call Carlisle's customer Service Center at 1-440-528-4000.

### How to Obtain Tools, Supplies and Brake Service Kits

Call Carlisle's customer Service Center at 1-440-528-4000 to obtain Carlisle tools and supplies.

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## 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 Carlisle.

### Hazard Summary

Because some brake lining contains asbestos, workers who service brakes must understand the potential hazards of asbestos and precaution 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.

- Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
- 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.
- 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.
- 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.
- 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 lining, 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.

## Asbestos and Non-Asbestos Fibers

### 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 Carlisle.

### 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/m<sup>3</sup> 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 exposures levels may exceed OSHA or manufacturer's 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.

- 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.
- 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.
- 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.
- 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.
- 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.

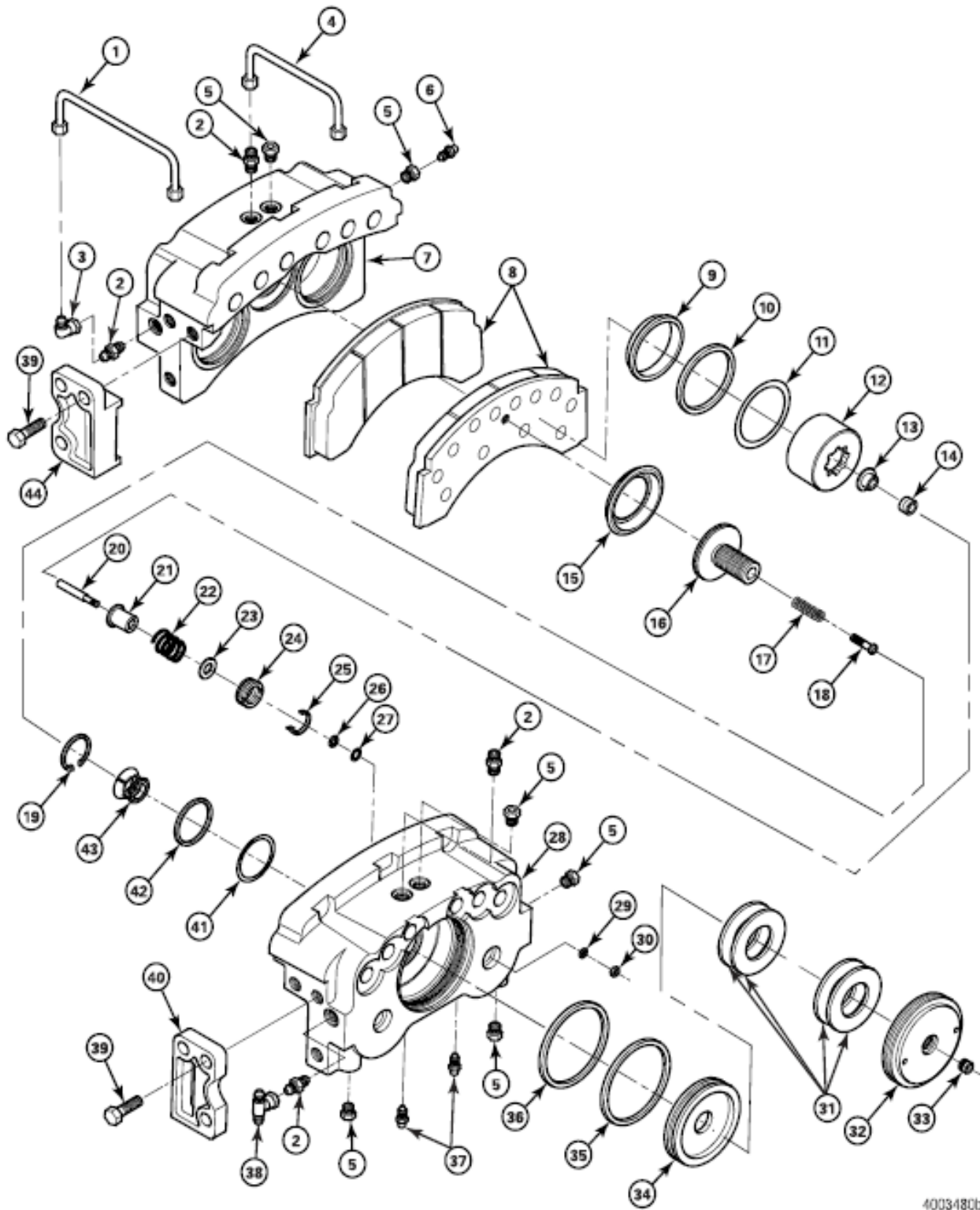
5. Worker Clean-Up. After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust 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



4003480b

## 1. Exploded View Continued



Item	Description	Sequence Number
1	Service Brake Crossover Tube	00430
2	Fitting	00400
3	Elbow Fitting	00410
4	Park Brake Crossover Tube	00440
5	9/16- Inch Plug, install if Bleeder Not Needed	00130
6	9/16- Inch Bleeder	00390
7	Caliper Housing, Inboard	00100
8	Lining Assembly	00350
9	Service Piston Wiper, Dust Seal	00160
10	Backup Ring, 3- Inch	00140
11	O-Ring Seal, 3- Inch	00150
12	Piston, Service	00171
13	Inner Spring Guide	00172
14	Adjuster Assembly	00173
15	Parking Piston Boot	00310
16	Parking Piston Adjusting Bolt	00300
17	Spring	00370
18	Shoulder Bolt	00360
19	Snap Ring	00290
20	Pin	00174
21	Outer Spring Guide	00175
22	Spring	00176
23	Retainer	00177
24	Special Ring	00178
25	Lock Ring	00179
26	Special Washer	00180
27	O- Ring	00181
28	Caliper Housing, Outboard	00110
29	Lock Washer	00190
30	Locknut	00200
31	Spring Washer	00260
32	Parking Piston Cap	00270
33	Pipe Plug	00380
34	Parking Piston	00230
35	Backup Ring, 5-Inch	00240
36	O- Ring Seal, 5-Inch	00250
37	7/6- Inch Bleeder	00120

Item	Description	Sequence Number
38	Tee Fitting	00420
39	Cap screw, Bolt	00340
40	R.H. End Plate	00330
41	O- Ring Seal, 2.5 - Inch	00220
42	Backup Ring, 2.5 -Inch	00210
43	Adjusting Collar	00280
44	L.H. End Plate	00320

<sup>1</sup> Sequence numbers as they appear in the Bill-of-material available from the manufacture

## 2. Introduction



### DESCRIPTION

The HDBC 4225 dry disc brake calipers are intended for service and parking brake use on hydraulic brake system. All calipers mount to a fixed position disc. U. S. standard fasteners hold the caliper on the axle. The caliper has four service brake pistons and two parking brake pistons with three pistons on each side of the disc. The linings are made from non-asbestos material.

One or two HDBC 4225 dry disc brake calipers can be used.

Figure 2.1.

If one caliper is used:

- It is mounted, or near, the 12 o'clock position on the outboard disc.

If two calipers are used, one on each of two discs:

- One caliper is mounted at, or near, the 12 o'clock position on the outboard disc.
- One caliper is mounted at, or near, the 6 o'clock position on the inboard disc.

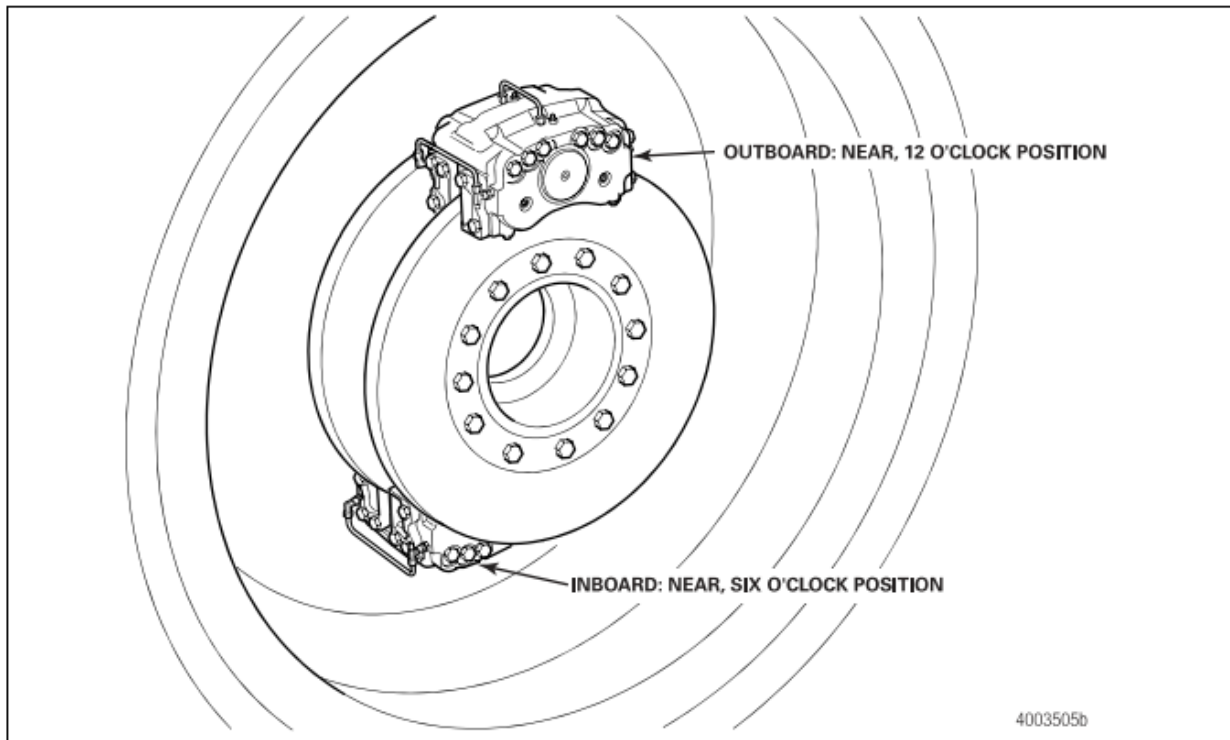


Figure 2.1

## 2. Introduction Continued



### Hydraulic Fluid

#### **⚠ WARNING**

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

Use only the type of hydraulic fluid specified by the equipment manufacturer. Do not use or mix different types of hydraulic fluid. The wrong hydraulic fluid will damage the rubber parts of the caliper and can cause damage, loss of braking, and serious personal injury.

The brake system uses one of two types of fluid.

- Petroleum –based hydraulic fluid, mineral oil  
Example: meets MIL-H-5606 specification
- Non- petroleum-based hydraulic fluid,  
automotive brake fluid Example: Glycol DOT 3,  
meets SAE J-1703 specifications

**NOTE:** For the type of fluid and specifications, refer to the recommendation of the equipment manufacturer.

### Identification

#### **⚠ WARNING**

Use only the specified components when you assemble the caliper. Do not mix components from other calipers. If you install the wrong components, the caliper cannot operate correctly and can cause damage, loss of braking, and serious personal injury.

Older assemblies are identified by an identification tag located on the inside radius of the caliper opposite from the mounting plate.

See Figure 2.2.

All current assemblies are identified by the assembly number impression stamped into the housing.

See Figure 2.3

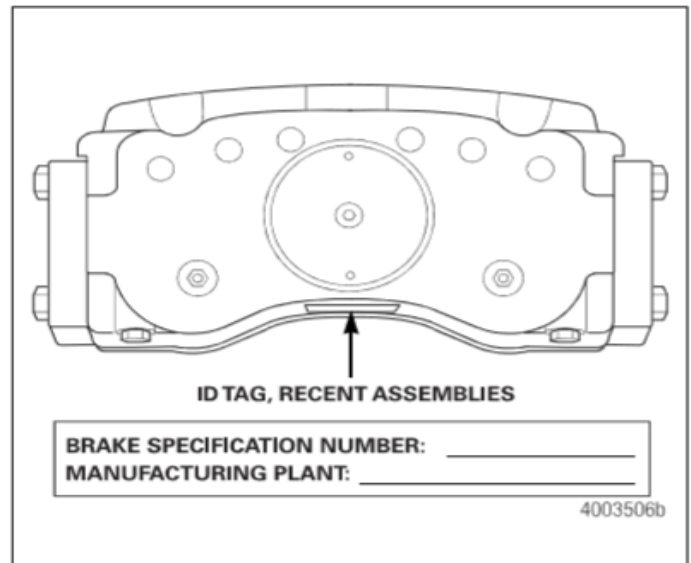
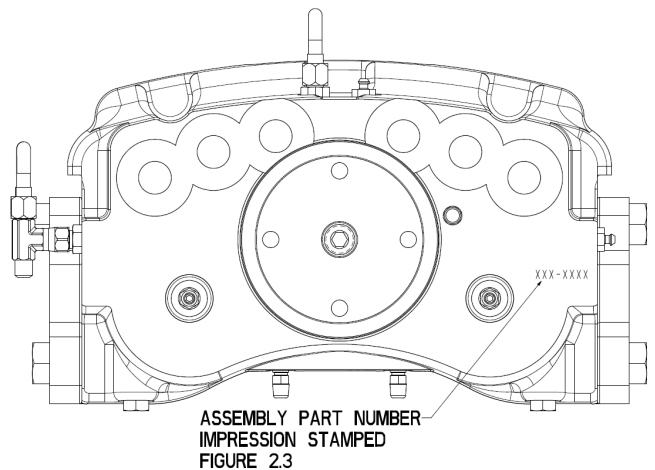


Figure 2.2





### 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 or service.

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.

#### Removal

##### Brake Assembly

1. Park the vehicle on a level surface and block all the wheels.
2. Verify that brake hydraulic pressure is not present in the wheel system being serviced.
3. Remove all hydraulic lines attached to the brake assembly being serviced. Mark the lines for correct reassembly.
4. Remove the service and parking brake crossover tubes from the brake caliper housing. Figure 3.1.

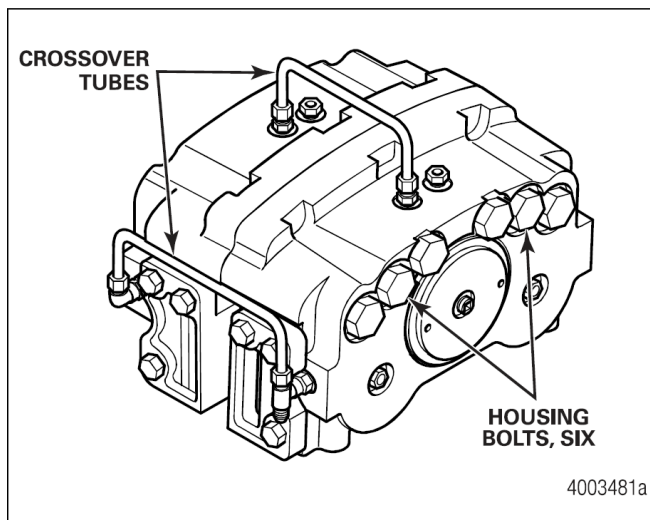


Figure 3.1



#### **⚠️ WARNING**

When working with these heavy assemblies, use suitable lifting devices that have sufficient lifting capacity. These caliper assemblies are very heavy and can cause serious personal injury.

5. Remove the brake assembly from the vehicle.

#### Disassembly

##### Preparation

1. To prepare for brake disassembly, open all bleeder screws and allow the fluid to drain from the assembly into an approved container.
2. Thoroughly clean the exterior of brake assembly with an approved solvent.

#### **⚠️ WARNING**

These brake assemblies are very heavy and can cause serious personal injury. Verify that the service bench is strong enough to support the weight of the assembly.

3. Place the assembly, with the housing opening down, into a service bench that has sufficient load bearing capacity.

#### Brake Caliper

1. Use a suitable hex wrench to remove the plug from the center of the parking piston cap. Figure 3.2.

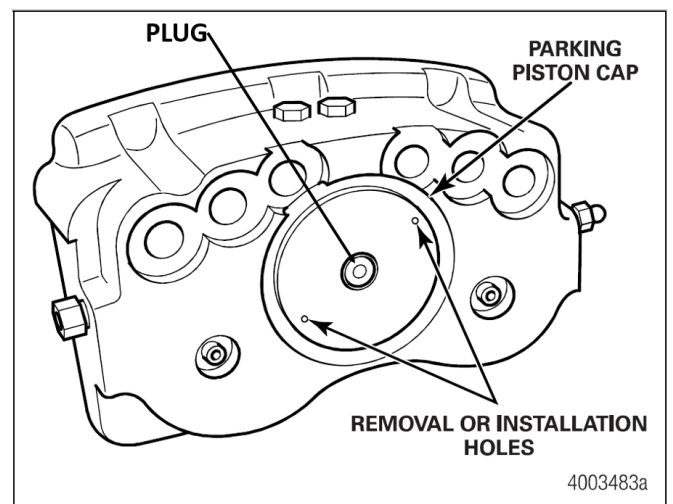


Figure 3.2

### 3. Removal and Disassembly

- Use a 3/16 inch (4.763mm) hex wrench through the hole in the center of the parking piston cap to loosen the shoulder bolt that attaches the parking piston adjusting bolt to the lining assembly.
- Remove the brake pad.
- Separate the two lining end plates from the caliper housing half by removing the six bolts, three bolts from each end plate. Figure 3.3.

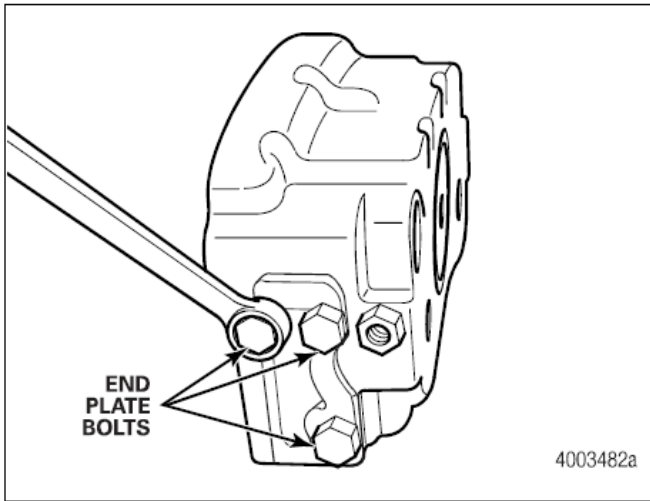


Figure 3.3

- Use a suitable tool that can overcome a torque of 500 lb-ft minimum to remove the parking piston cap. The cap will have 2 or 4 holes Figure 3.4.1

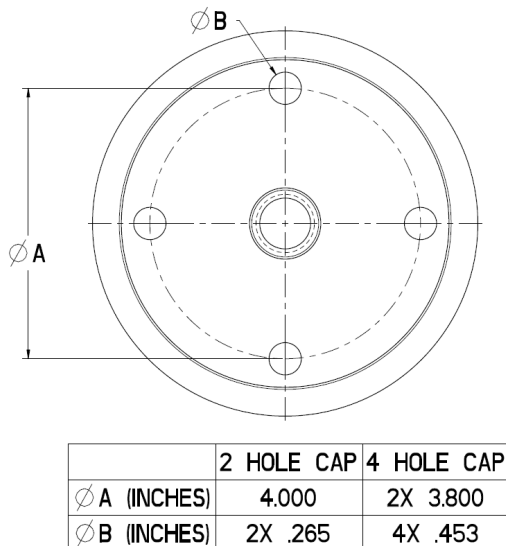


FIGURE 3.4.1



FIGURE 3.4.2 (Example Tool)

- Remove the four belleville springs from the parking piston cavity of the caliper housing. Figure 3.5

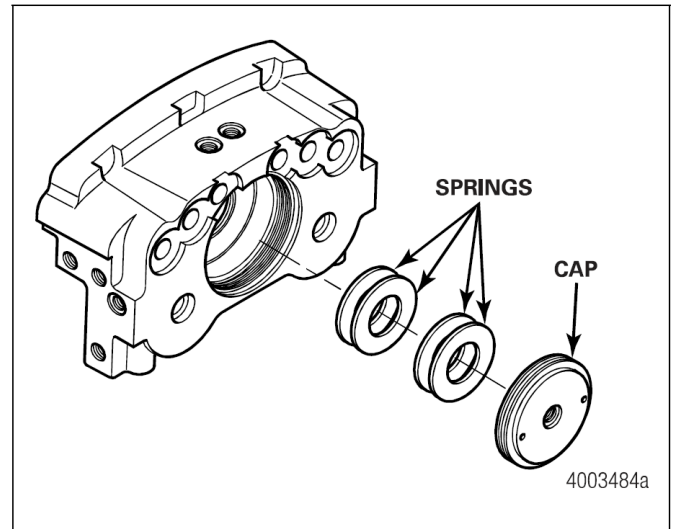


Figure 3.5

- Remove the shoulder bolt and spring, loosened in the step 2, from the parking piston cavity. Figure 3.6

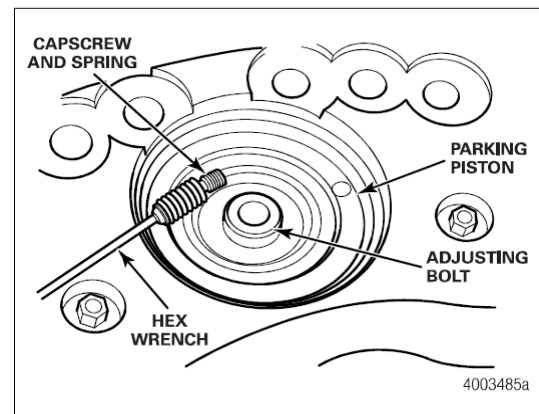


Figure 3.6

### 3. Removal and Disassembly

- Twist and pull the adjusting bolts from the collars inside the parking pistons of each caliper housing. Figure 3.7

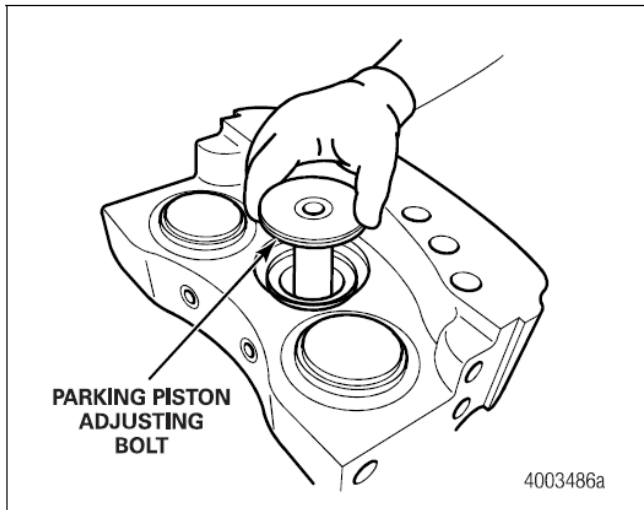


Figure 3.7

- Use a pick or suitable tool to remove the parking piston boots from each caliper housing. Ensure no damage to the piston bore or groove occurs.
- Use suitable snap ring pliers to remove the parking piston adjusting collar retaining snap ring from inside the groove of the parking piston. Figure 3.8

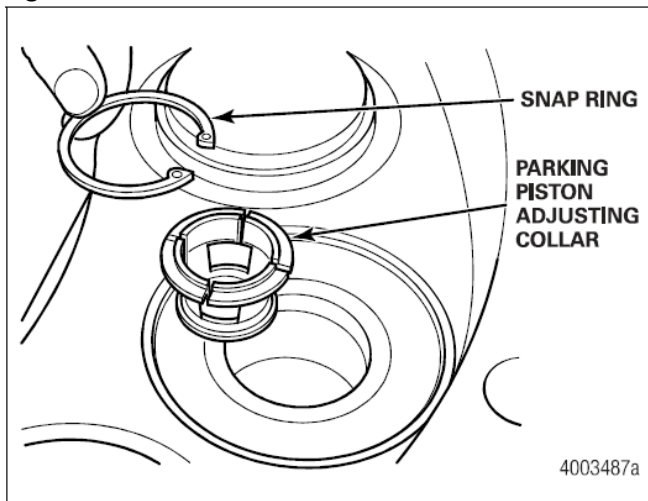


Figure 3.8

- Use a suitable tool to push the parking piston out of the caliper housing. Ensure parking piston does not cock or damage bore as it is removed.

- Remove the five-inch (127 mm) diameter O-ring and backup ring from the parking piston. Discard the O-ring and backup ring. Figure 3.9

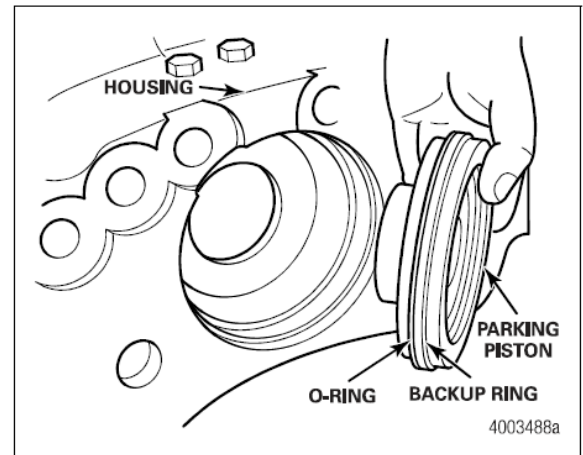


Figure 3.9

- Use a suitable tool to remove the 2.5-inch (63.5 mm) diameter parking piston O-ring and backup ring from the caliper housing. Discard the O-ring and backup ring. Figure 3.10.

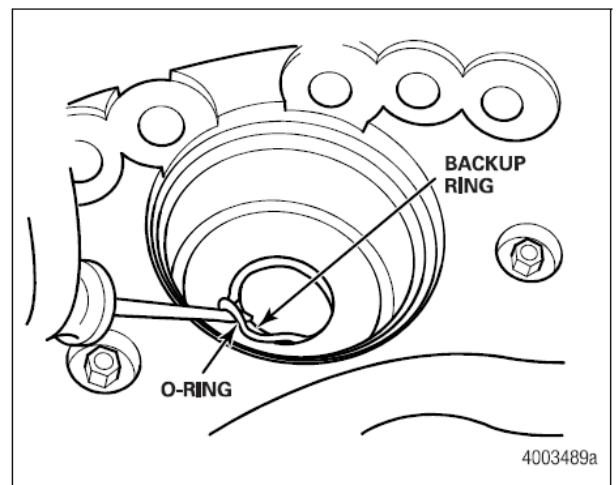


Figure 3.10

- Position the caliper housing so that the ends of the adjuster pin and nut are up. Use a 5/32-inch hex wrench to hold the pin and remove the nut and washer from the caliper housing.

### 3. Removal and Disassembly

15. Use a suitable dowel or punch that fits in the adjuster pin to push the service pistons out of each caliper housing, Figure 3.11.

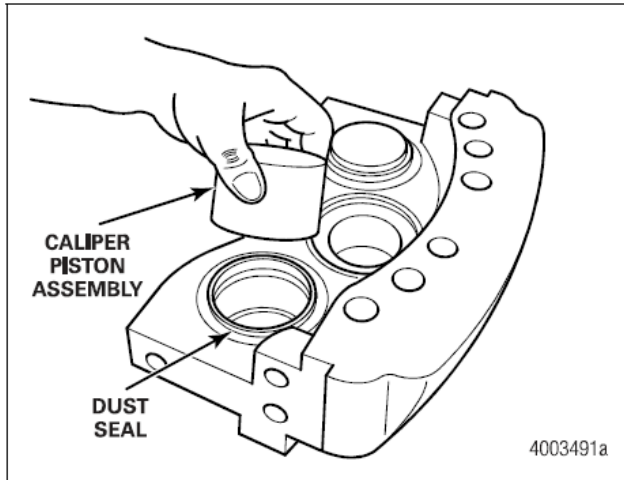


Figure 3.11

16. Use your finger or suitable tool to remove the two service piston dust seals from the caliper housing. Discard the dust seals, Figure 3.12.

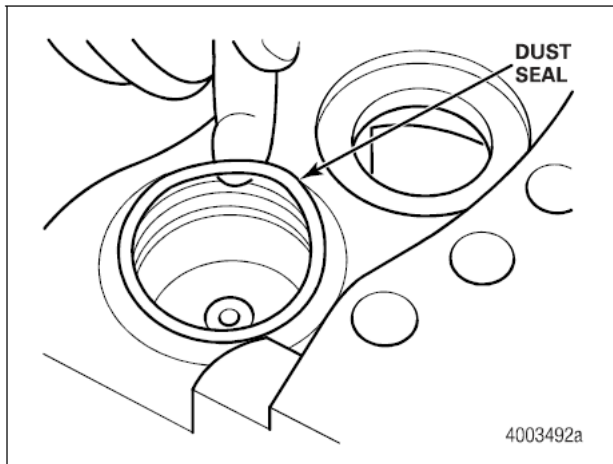


Figure 3.12

17. Use a pick or a suitable tool to remove the three-inch (76,2 mm) diameter service piston O-ring and backup ring from each piston bore groove of the caliper housing. Discard the O-rings and backup rings, Figure 3.13. Use **EXTREME CAUTION** not to damage the bore or O-ring groove.

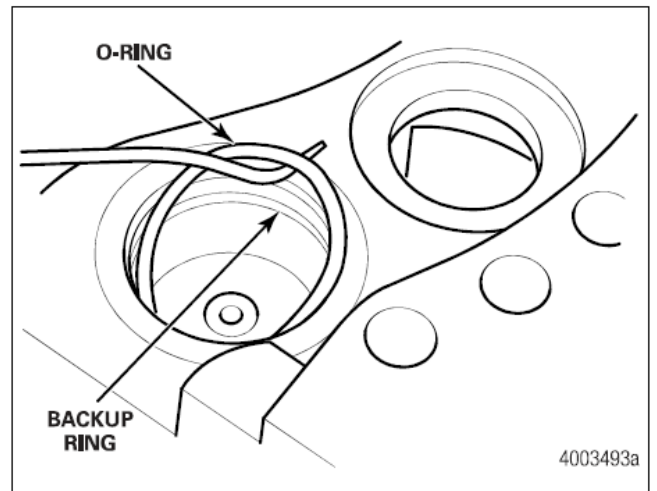


Figure 3.13

18. Remove all fittings, plugs and bleeder screws from each caliper housing. Mark the position and location of the fittings for correct reinstallation. Note the location of the bleeder screws and plugs for correct reinstallation.
19. Thoroughly clean the exterior and interior of the brake caliper housing with approved solvent.  
**NOTE:** Verify that all O-ring grooves are clean and free of foreign material. Use compressed air to blow out the entire brake caliper housing. Be sure to blow out internal passageways.
20. Repeat this procedure for each caliper half.

### 3. Removal and Disassembly



#### Piston Subassembly

**NOTE:** Disassembly of the piston subassembly during brake overhaul is not mandatory. Clean the piston subassembly thoroughly. If the piston surface is acceptable for reuse and the piston subassembly passes the functional tests for adjusting grip force, spring force and built-in clearance (BIC), return the piston subassembly to service. See Section 4 for functional tests.

1. Remove the O-ring and adjuster pin washer.
2. Remove the lock ring.

#### WARNING

Observe all warnings and cautions provided by the press manufacture to avoid damage to components and serious personal injury.

3. Place the piston subassembly on an arbor press table. Figure 3.14. Use special sleeve A. Figure 4.5.1, over the adjuster pin. Lower the arbor and compress the return spring to minimum height, and hold.

4. Back out the threaded ring. Use a spanner wrench if the threaded ring will not unscrew by hand.
5. Slowly raise the arbor until all compression of the piston return spring is relieved
6. Remove the spring retainer, return spring, outer spring guide, adjusting pin with adjuster assemblies, inner spring guide and piston.
7. Check the adjuster force of the adjuster assembly. Refer to section 4.
8. Inspect and test the piston return spring. Refer to Section 4.

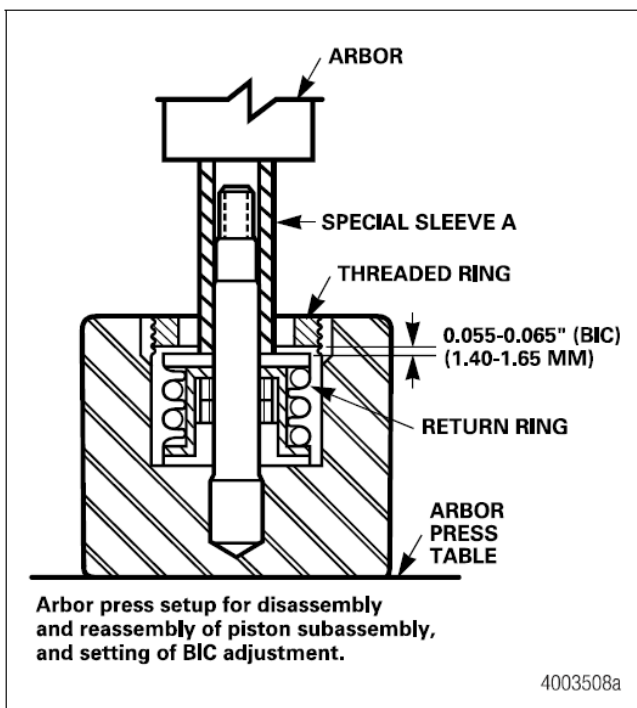


Figure 3.14

## 4. Prepare Parts for Assembly

### 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 performing vehicle maintenance or service.

Solvent cleaner can be flammable, poisonous and cause burns. Example of solvent cleaners are carbon tetrachloride, and emulsion-type and petroleum-based 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.

### Clean Parts

#### For Ground or Polished Metal Parts

#### **CAUTION**

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

Use a cleaning solvent or kerosene or diesel fuel to clean ground or polished metal parts or surfaces.

#### For rough metal parts

Use a cleaning solvent or kerosene solution in a hot solution tank to clean rough metal parts. If you use a hot solution tank, follow the instructions below.



1. Leave the rough parts in the tank until they are completely cleaned and heated.
2. Remove the rough parts from the tank
3. Wash the parts with water until you remove the alkaline solution

### Dry and Inspect parts

1. Use soft, clean paper towels, cloth rags or compressed air 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

Apply brake system fluid to the cleaned and parts that are not damaged are to be immediately assembled. Do NOT apply fluid to the brake linings or the disc.

If parts are to be stored, apply a special material that prevents corrosion to all surfaces. Do NOT apply the material to the brake linings or the disc. Store the parts inside special paper or other material that prevents corrosion.

## 4. Prepare Parts for Assembly



### Inspection

#### Caliper Parts

1. Inspect the piston, housing bores and O-ring grooves for scratches or corrosion. Remove small scratches or corrosion with a fine emery cloth. Replace the components if they are worn beyond wear limits or if there are large scratches or large amounts of corrosion.
2. Measure the outer diameter of the service piston. Replace the piston if the outer diameter is less than 2.995-inches (76.07 mm)
3. Measure the outer diameter of the parking piston. Replace the piston if the outer diameter measures less than 2.495-inches (63.73 mm) and 4.996-inches (126.90 mm).
4. Measure the diameter of the housing service piston bore. Replace the housing if the diameter exceeds 3.004-inches (76.30 mm).
5. Measure the diameter of the housing parking piston bore. Replace the housing if the diameter exceeds 2.504-inches (63.60 mm) and 5.005-inches (127.13 mm).
6. Inspect caliper ports and end plate bolt holes for thread damage. Use the appropriate taps lubricated with light oil to inspect tapped holes for thread damage and to clean up minor thread damage.
  - Fluid ports – Use 9/16-18 UNF -2B tap
  - Fluid ports – Use 7/20-18 UNF -2B tap
  - End plate bolt holes – use 3/4 -16 UNF -2B tap

**NOTE:** replace any component that has thread damage that cannot be repaired.

7. Discard all backup rings O- rings and dust boots and use new ones when you assemble the caliper.

### Linings and End Plates

To help prevent abnormal lining wear, replace worn, bent or cracked end plates and distorted shoes. Inspect the end plate bolts for wear. Replace the bolts if worn.

**NOTE:** End plate bolts are highly stressed. Replacement is recommended.

Inspect the linings for:

- **Lining wear.** Replace the linings when the thickness of the lining is less than 0.125 –inch (3.2mm) from the backplate.
- **Lining Wear Not Even.** Replace the linings if thickness of the two linings is significantly different. Check the piston for correct operation. Replace the piston and /or housing if a piston is a cocked in the bore. Check that the disc surface is flat and parallel to the linings
- **Oil or grease on the Linings.** Replace the linings.
- **Cracks on the Linings.** Replace linings that have larger or deeper cracks than the small, tight cracks on the surface of the lining which are normal when the caliper is used under high temperature conditions. These cracks are referred to as heat check cracks.

### CAUTION

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

## 4. Prepare Parts for Assembly

### Check

### Piston Assembly Return Spring Force and Built –In Clearance (BIC).

#### **⚠️ WARNING**

Observe all warnings and cautions provided by the press manufacture to avoid damage to components and serious personal injury.

1. Place the piston subassembly onto spring tester table. Install special sleeve A, figure 4.5.1, over exposed adjuster pin. Figure 4.1.
2. Set a dial indicator between the spring tester and table use a dial indicator with a total range of 0.100-0.125- inch (2.45-3.1mm) such as federal Mod C6K or C71, or equivalent, having a -0.020 or 0.025n-inch (0.508 or 0.635 mm) scale with 0.0005- inch (0.0127) increments.
3. Lower the spring tester arbor to compress the spring to minimum height. Figure 4.1 the indicator pointer will stop rotating.

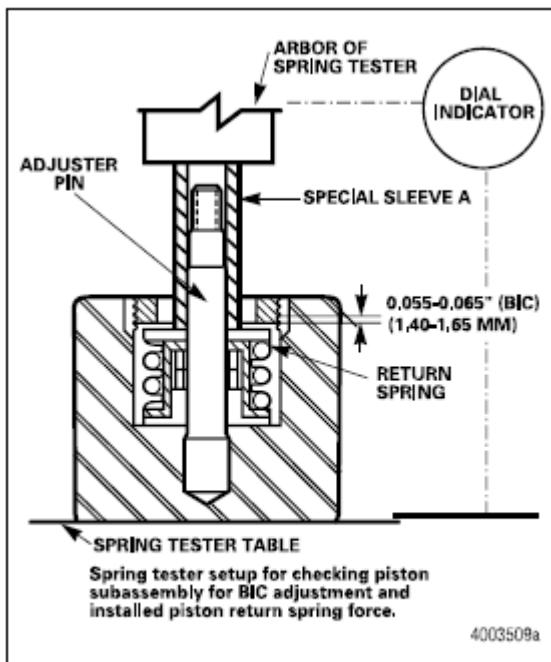


Figure 4.1



4. Hold the spring compressed and rotate the indicator dials to indicate ZERO.
5. Raise the arbor slowly until the spring tester force scale reads ZERO, indicator dial reading will be the BIC (Built-In Clearance).
6. Lower the arbor slowly until the indicator again reads ZERO, the spring tester force scale will now indicate the spring return force

**NOTE:** The return spring force should be a minimum of 250 lbs. (113kg) when spring is compressed the maximum amount in the piston subassembly. Replace the spring if the reading is less than 250 lbs. (113 kg.) Refer to section 3 for piston disassembly.

7. Slowly raise and lower the arbor several times to verify both BIC and spring return force. The BIC should be between 0.055-0.065-inch (1.40-1.65mm). If not in this range readjust the BIC. Refer to section 5. Recheck for the correct BIC step 3 through step 5 above.

#### **⚠️ CAUTION**

If one defective spring is found the other return springs in the same brake assembly should also be replaced. Overheating of the brake in service usually cause this condition. Also check for hardening and compression set of the piston seal and backup rings and for bluing of steel back plates of the linings, etc. The free height of the return spring should be 0.872- inches (22.15mm). The springs must not be reinstalled if below 0.850- inches (21.59mm) free height.



## 4. Prepare Parts for Assembly

### Adjuster Force

#### **⚠️ WARNING**

Observe all warning and caution provided by the press manufacture to avoid damage to components and serious personal injury.

#### **⚠️ CAUTION**

Do not use the spring tester for making adjuster force measurements. Sudden adjuster force release can destroy calibration and possibly result in damage to the tester.

To obtain adjuster force measurements of the adjuster subassemblies installed onto the adjuster pin, it is necessary to remove the adjuster pin and adjuster from the piston subassembly and have a force calibrated hydraulic shop press. The press must have a gauge capable of reading up to 800 pounds of force accurately calibrated. Obtain force measurements as illustrated in Figure 4.5.

**Note:** A calibrated spring pod can be used if force measurements cannot be accurately measured with the press. See figure 4.5.2 and 4.5.3

1. Use both special sleeves, shown in Figure 4.5.1 as illustrated in Views A and B of Figure 4.5 to slip the adjuster back and forth several times on the adjuster pin.

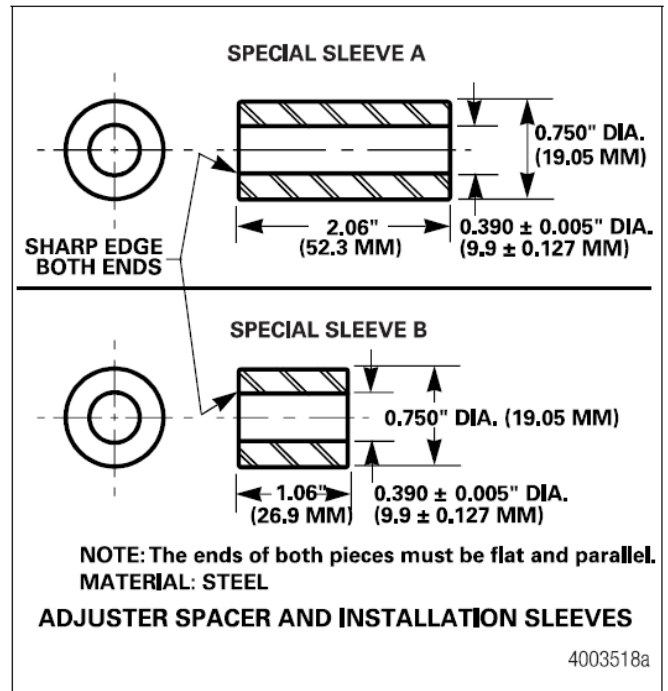


FIGURE 4.5.1

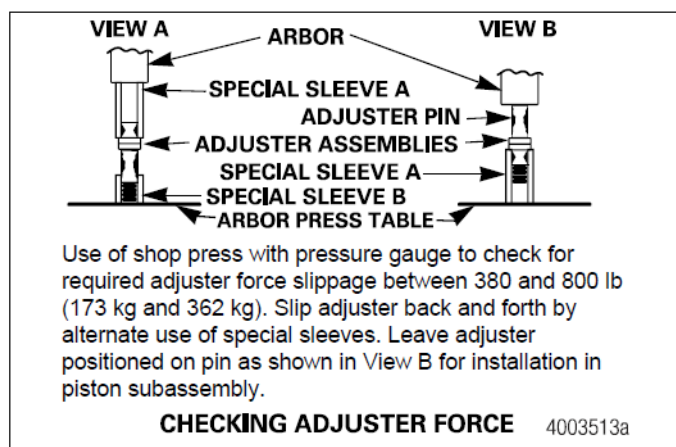
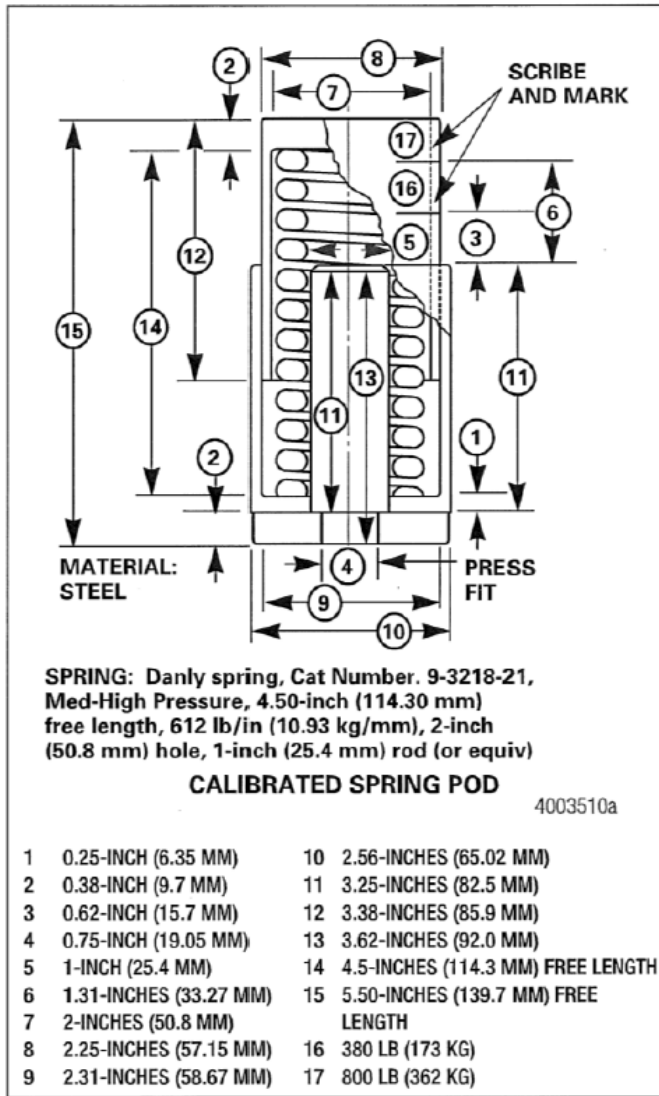


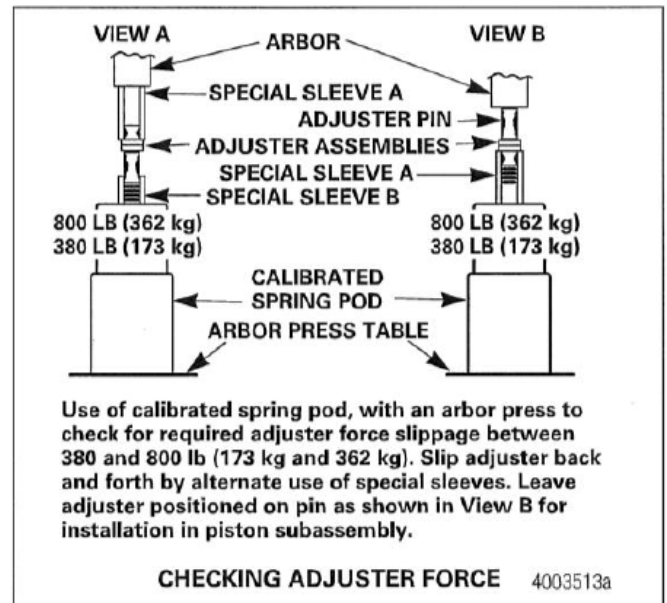
Figure 4.5

## 4. Prepare Parts for Assembly



**FIGURE 4.5.2**

- Apply force from the arbor slowly to observe that slippage occurs between the 380 and 800 lb. (173 and 362 kg) markings on the spring pod. See Figure 4.5.2
- If slippage occurs between the specified limits, slip the adjuster to position on the pin as shown in Figure 4.5 or 4.5.2 reinstall it into the piston subassembly.



**FIGURE 4.5.2**

**NOTE:** Any rework of the adjuster pin must be avoided unless absolutely necessary

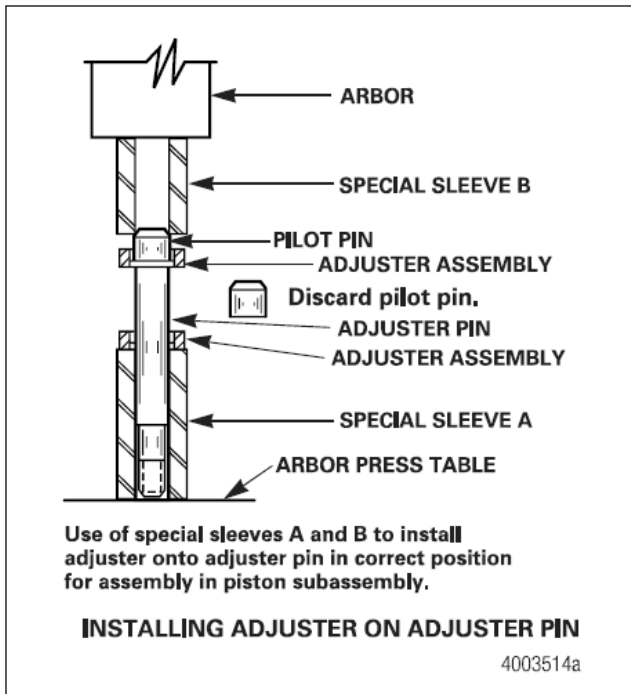
- If slippage occurs below the 380 lb. (173 kg) limit, either the adjuster or adjuster and adjuster pin must be replaced. Use special sleeve A and the arbor press to slip both adjuster assemblies off the adjuster pin. Inspect the adjuster pin for nicks and wear. Adjuster pins with slight nicks that can be polished out by hand can be reused if subsequent slip inspection is acceptable. Replace adjuster pins that are bent or worn to less than 0.374-inch (9.499 mm) diameter. Burred adjuster pin threads can be repaired with a 5/16-24 UNF-3A thread die.

### **CAUTION**

Adjusters and adjuster pins are critical items in the operation of the piston return mechanism and must not be mishandled. Under no circumstances should the pin diameter be clamped in a vise or gripped with pliers. In normal use, the surface of the pin will show only a very slow rate of wear and both pins and adjusters will normally outlast many brake lining changes and brake overhauls.

- If required, install the adjuster on the adjuster pin as follows Figure 4.6.

## 4. Prepare Parts for Assembly



**Figure 4.6**

- A. Place the adjuster and pilot pin subassembly onto the end of the adjuster pin.
- B. Press the adjuster off the expendable pilot pin, onto the adjuster pin. Figure 4.6.
- C. Press the second adjuster onto the adjuster pin.
- D. Continue to push the adjuster along the adjuster pin until it contacts the previously installed adjuster.
- E. After assembly, check the adjuster force of the adjuster assembly.

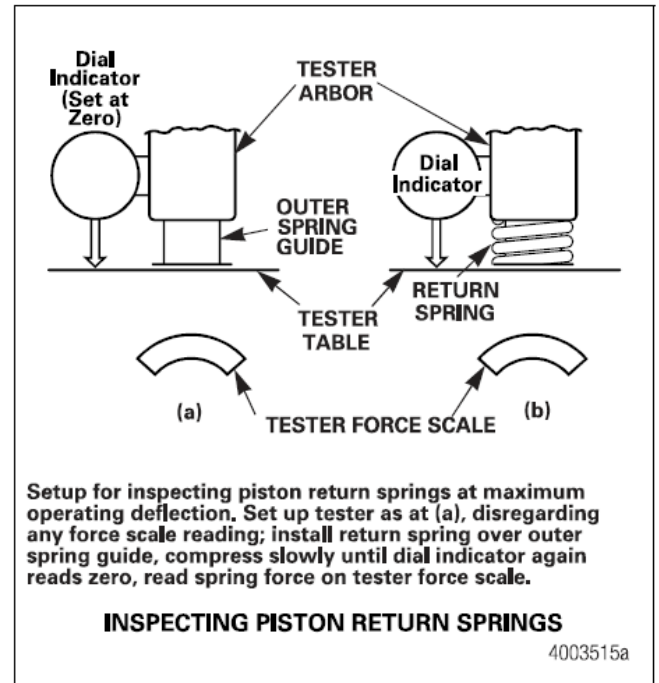
## Inspection

### Piston Return Spring

1. Inspect the return spring for a free height dimension of 0.872-inch (22.15 mm). A measured height of less than 0.850-inch (21.59 mm) is an indication that the brake assembly has been subjected to high temperature operation, resulting in permanent set of the spring. This causes loss of spring force at working height.



2. Measure the spring force at maximum service deflection of a spring tester. Use an outer spring guide for test setup purposes. Figure 4.7.



**Figure 4.7**

3. Set up the dial indicator between the tester arbor and the table. Place the outer spring guide under the tester arbor. Lower the arbor firmly onto the spring guide. Disregard any tester reading, Hold the arbor in this position and set the indicator dial to ZERO, as shown in View A Figure 4.7.
4. Raise the arbor. Place the return spring over the spring guide and lower the arbor slowly until the dial indicator again reads ZERO. Read the spring force on the tester scale, as shown in View B Figure 4.7.  
This value is the spring return force exerted under maximum deflection installed in the piston subassembly. Because of the manufacturing tolerances, this can be as low as 250 lbs. (113 kg), but will usually measure greater than 300 lbs. (136 kg). It is recommended that springs measuring a lower force than 250 lbs. (113 kg) under these test conditions be replaced.

## 5. Assembly and Installation



### Piston Subassembly

1. Install the inner spring guide into the piston cavity. Figure 5.2.
2. Install the adjuster pin with the adjuster assemblies installed onto the adjuster pin.

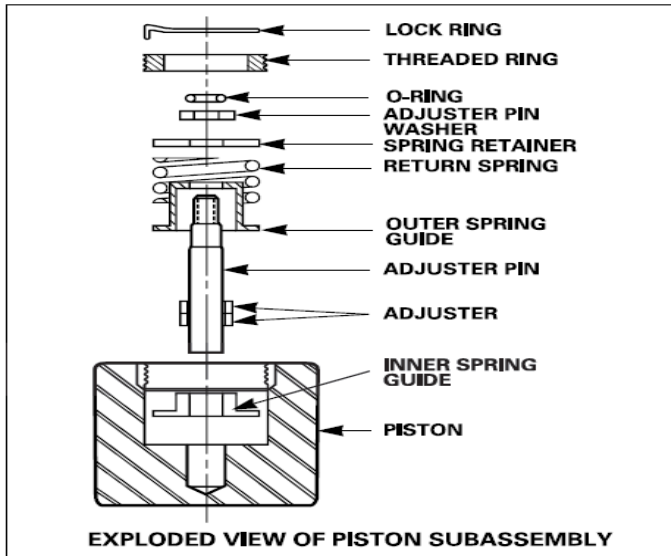


Figure 5.2

3. Install the outer spring guide.
4. Install the return spring.
5. Install the spring retainer.
6. Position the piston assembly onto an arbor press table. Figure 3.14. Use special sleeve A shown in Figure 4.5.1 over the adjuster pin. Position the threaded ring over the special sleeve.
7. Slowly lower the arbor and compress the return spring to minimum height, and hold.
8. Screw the threaded ring against the spring retainer, using a spanner wrench to ensure that the threaded ring is bottomed. Holding the spring compressed, back off the threaded ring one full turn, plus the additional amount needed to install

the lock ring into the first available lock ring position.

**NOTE:** This procedure provides the required built-in clearance (BIC).

9. Raise the arbor, remove the piston assembly from the arbor press, and install the lock ring.

## 5. Assembly and Installation

### Brake Caliper

#### **⚠️ WARNING**

Use only the specified components for the brake assembly. Do not mix components from other calipers. If you install the wrong components, the caliper cannot operate correctly and can cause damage to the equipment. Use of non-Carlisle parts can cause damage, loss of braking and serious personal injury.

1. Position the housing onto a work surface so that the cylinder bores are up.
2. Lubricate all cylinder bores, seals, backup rings, piston seal surfaces and seal grooves with silicone grease, such as Dow Corning DC4. If this is not available, use the same hydraulic fluid used in the brake system to lubricate the parts.
3. Install a new piston O-ring into the groove of each service piston bore, Push the O-rings to the bottom of the grooves.
4. Install a new piston backup ring above each piston O-ring.

**NOTE:** Do not apply grease to the dust seals.

5. Install two new service piston dust seals into the dust seal grooves of each caliper housing. Verify that the dust seals are fully seated.
6. Install a washer and new O-ring onto the exposed part of each adjuster pin.
7. Lightly apply silicone grease to the four service piston assemblies and adjuster pin O-rings.

#### **⚠️ CAUTION**

Inspect the outside diameter of each service piston for nicks, scratches, surface roughness or other defects. Replace service pistons having any of these defects. See inspection section in section 4.



**NOTE:** Seat each piston evenly around each O-ring and with even pressure push the piston through the O-ring and backup ring. Prevent the piston from cocking in the bore.

8. Install the four service pistons into the piston bores of each caliper housing. Verify that the piston pin is aligned with its hole in the housing. Figure 5.4.

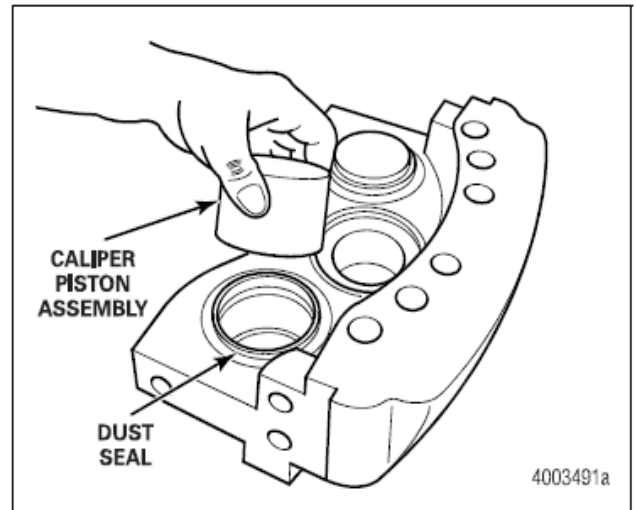


Figure 5.4

9. Install a lock washer and locknut onto each piston pin.

#### **⚠️ CAUTION**

When tightening the nuts, avoid turning the adjuster pins. This can cause damage to the O-ring and cause the seal to leak.

10. Hold the adjuster pin using a 5/32-inch hex wrench and tighten the nuts to 120-150 lb.-in (13.6-17.00 N.m).

## 5. Assembly and Installation

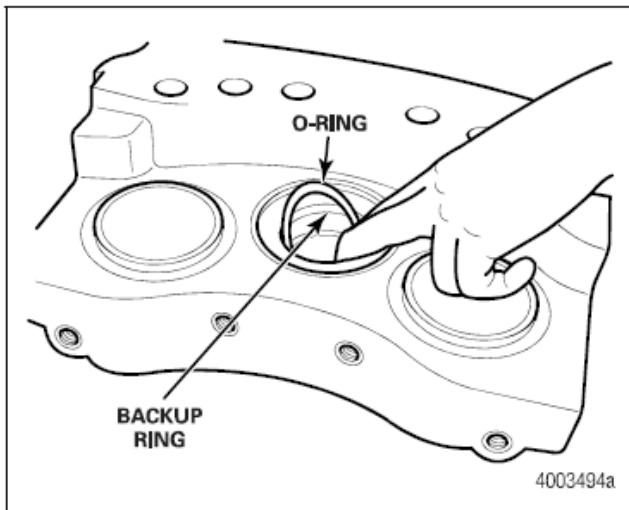
### **⚠️ WARNING**

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

11. Place each housing subassembly onto the arbor press, and press the piston subassemblies into their cavities to the maximum retracted position. Retorque adjuster pine nuts as described in Step 10.

**Note:** C-Clamp can be used to put the piston in its fully retracted state. Retorque adjuster pine nuts as described in Step 10.

12. Install one new, smaller diameter (2.5-inch-63.5 mm) parking piston backup ring into the ring groove of each caliper housing. Figure 5.5



**Figure 5.5**

**NOTE:** Position the O-rings into the grooves below the backup rings so that the backup rings are closest to the disc.

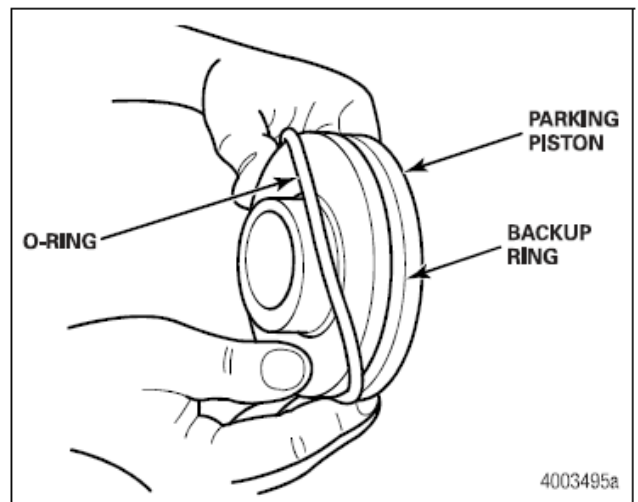
13. Lightly lubricate two new, smaller diameter 2.5-inch (63.5 mm) parking piston O-rings using silicone grease. Install one O-ring into the O-rings grooves of each caliper housing. Figure 5.5.



### **⚠️ CAUTION**

Inspect the outside surfaces and grooves of each parking piston for nicks, scratches, surface roughness or other defects. Replace parking pistons having any of these defects. See inspection section in section 4.

14. Install one new, larger diameter (5-inch-127 mm) parking piston backup ring into the outer groove of each parking piston Figure 5.6.
15. Lightly lubricate two new, larger diameter 5-inch (127 mm) parking piston O-rings using silicone grease. Install one O-ring into the O-ring groove of each parking piston. Figure 5.6.



**Figure 5.6**

**NOTE:** Position the O-rings into the parking piston grooves next to the backup rings so that the O-rings are toward the smaller diameter of the parking piston and the backup ring will be farthest from the disc.

16. Lightly apply silicone grease to the outside surfaces of each parking piston.

## 5. Assembly and Installation

17. Install the two parking pistons into the parking piston bore of each caliper housing until fully seated. The smaller diameter portion of each parking piston is inserted into the caliper housing bore first, toward the inside of the caliper housing. Figure 5.7.

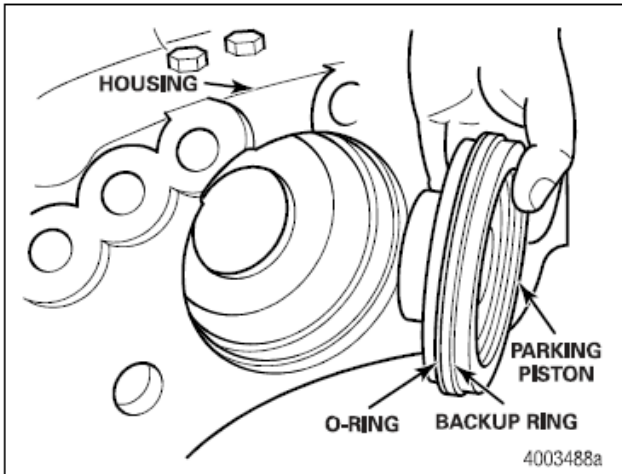


Figure 5.7

**NOTE:** Seat the piston evenly around each O-ring and with even pressure, push the piston through the smaller diameter O-ring and backup ring into the caliper housing bore. A press or C-clamp may be needed to seat the parking piston. Prevent the piston from cocking in the bore.

18. Apply graphite-based anti-seize compound to the tapered surfaces of the adjusting collar.
19. Working from the inside of each caliper housing, install the parking piston adjusting collar into the inner bore of each piston. The collar should conform to the shape of the inner bore of the parking piston.
20. Install a snap ring into the snap ring groove of each parking piston inner bore to retain the adjusting collars. Figure 5.8.

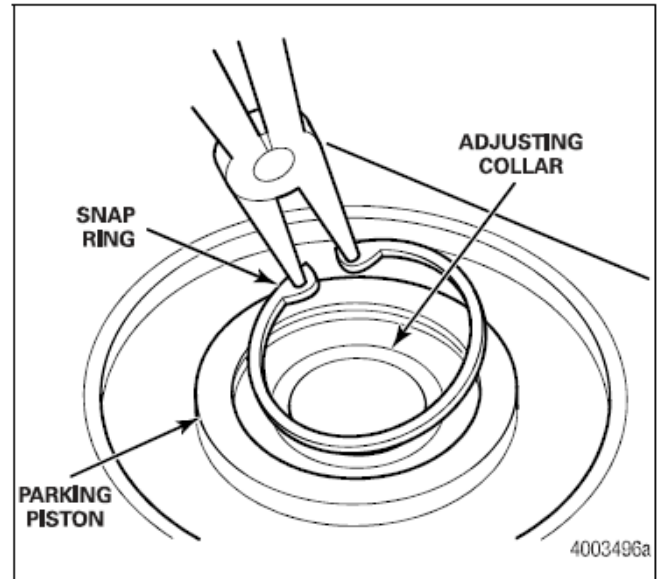


Figure 5.8

21. Make a short bend in the end of a length of safety wire. Hook the bent end of the wire into one of the slots in the adjusting collar to keep it from turning when the adjusting bolt is installed.

**Note:** Safety wire may not be needed if you can keep the adjusting collar from moving.

22. Screw the adjusting bolt into the adjusting collar finger tight, until fully seated into the parking piston. Figure 5.9.

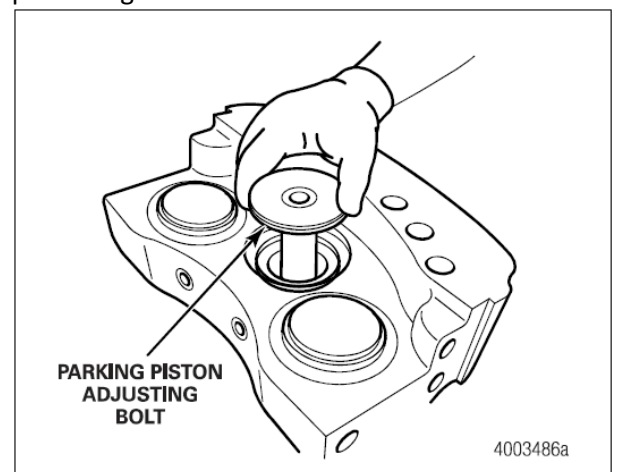
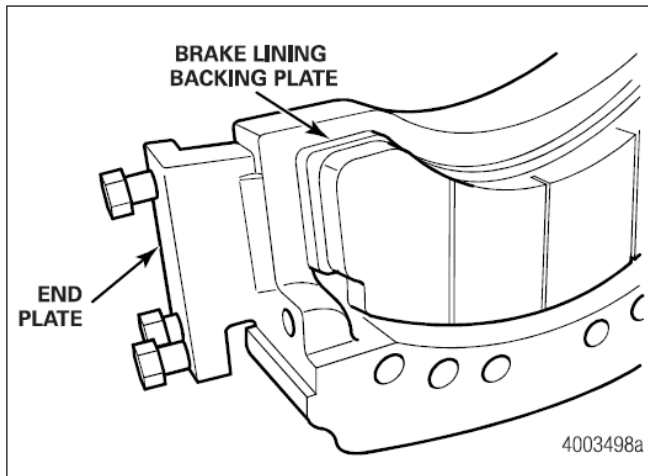


Figure 5.9

## 5. Assembly and Installation

23. Remove the safety wire.
24. Press a new parking piston boot into each caliper housing until fully seated. Snap the inner lip of the parking piston boot into the groove of the parking piston adjusting bolt.
25. Install the end plates and end plate bolts into each caliper half. Figure 5.10. Tighten the bolts to 380-460 lb-ft (515-624 N-m)



**Figure 5.10**

**Note:** The end plates have a left and right orientation. Verify that the end plates are correctly installed to match the contour of each brake lining backing plate. Verify that the lining assembly slides freely in the end plates and is not binding.

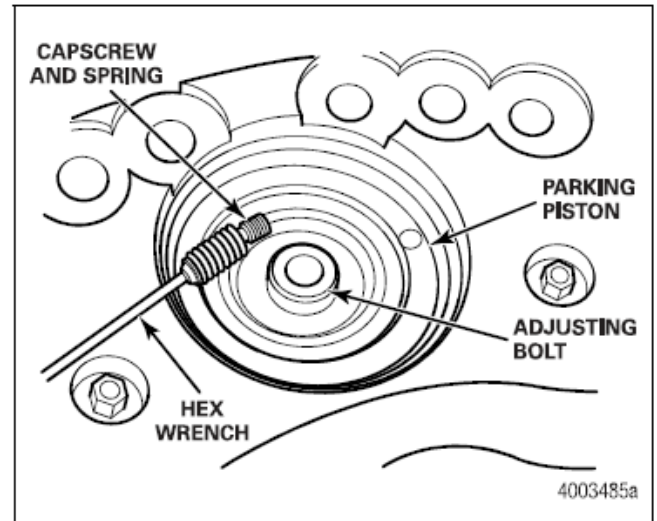
26. Install a new lining assembly into the caliper half. Position the threaded hole into each lining assembly backing plate, to align with the hole in the parking piston adjusting bolt.

### **CAUTION**

**Secure the lining assembly to the caliper housing using wire ties or safety wire so that it cannot move. Movement of the lining assembly after the next steps will affect the parking piston adjustment, which may cause the brake to drag after installation. The lining must remain secure until the brake is installed onto the vehicle.**



27. Install the spring onto the shoulder bolt. Apply Loctite 272 to the threads. Insert the shoulder bolt and spring into the adjusting bolt. Figure 5.11.



**Figure 5.11**

28. Using a 3/16-inch (4.763 mm) hex wrench, align the backing plate threaded hole with the shoulder bolt and install the shoulder bolt and tighten to 120-150 lb-in (13.6-17.0 N.m)



## 5. Assembly and Installation

29. Thoroughly apply a graphite-base anti-seize compound to all spring washer surfaces, outer parking piston surfaces and to the threads of the parking piston cap.

30. Install four spring washers onto the surface of each parking piston. Figure 5.12.

**NOTE:** The concave side of the first spring washer must face the parking piston, cup down. Install the second cup up, third cup down and fourth cup up.

**NOTE:** Center each of the spring washer in the piston to make installation of the parking piston cap easier.

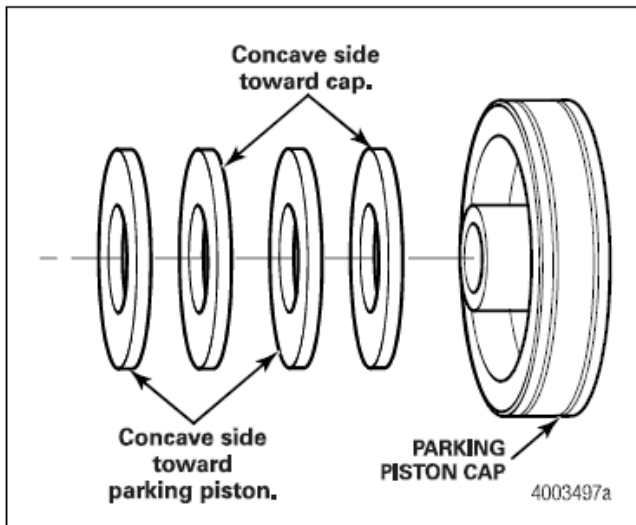


Figure 5.12

31. Using a suitable tool (Figure 3.4.1 and 3.4.2), install the parking piston caps into each caliper housing. Thoroughly apply a graphite-base anti-seize compound to all threads of the cap. Tighten to a minimum of 500 lb-ft (678 N-m).

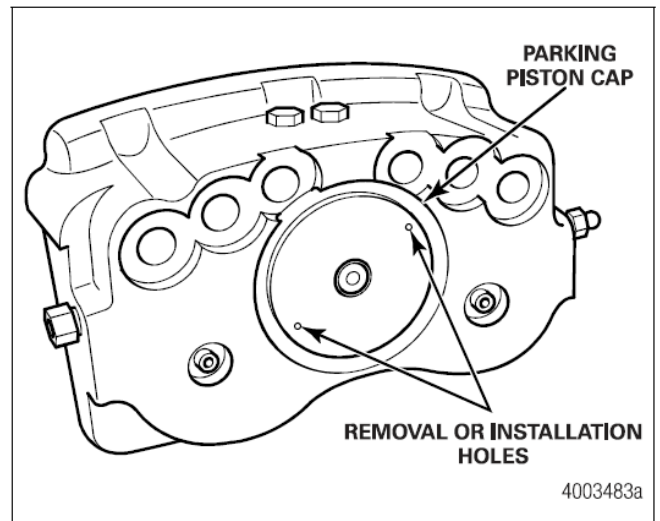


Figure 5.13

32. Using a suitable hex wrench, install the pipe plug into the center hole of each parking piston cap. Tighten each pipe plug until it is flush with the surface of the cap.

**NOTE:** Retain the crossover tubes for assembly after the brake is installed onto the vehicle.

33. Install the fittings, bleeder screws and plugs into the housing subassemblies according to 12 o'clock or 6 o'clock installation requirements. Figure 5.14 and Figure 5.15.

## 5. Assembly and Installation



### Test

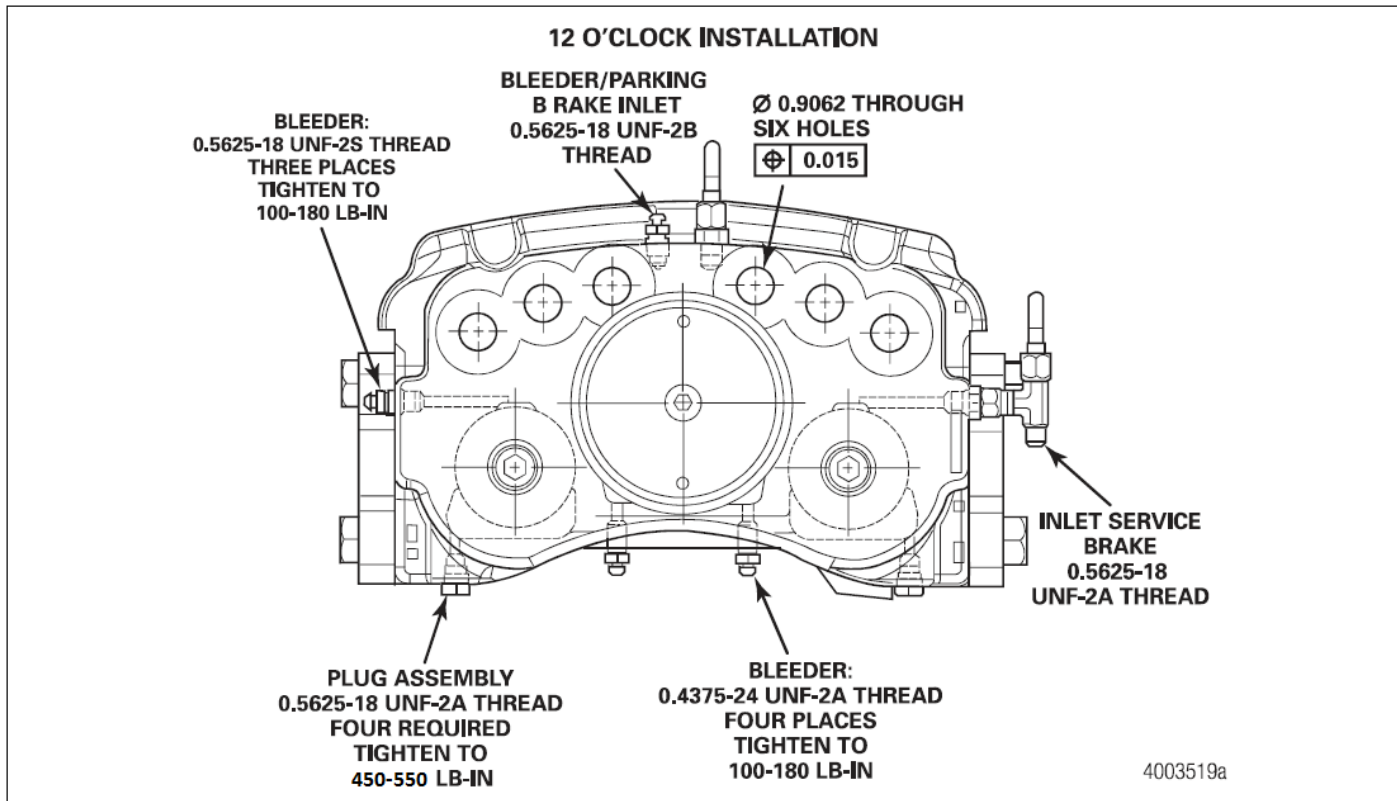
#### Park Circuit

1. Park circuit testing can be done independently on each caliper half without bolting them together, or with the salves bolted together and crossover tubing installed.
2. Ensure there are bleeders or crossover tubes in all four ports of the park circuit on each caliper half except one port to be used for oil supply. Install hydraulic inlet line to this port.
3. Evacuate air from the caliper assembly using bleeder(s) oriented at the top of the caliper.
4. Clean the assembly of any oil or debris.
5. Apply 3.000 psi to the assembly and allow pressure to stabilize for 2-3 minutes.

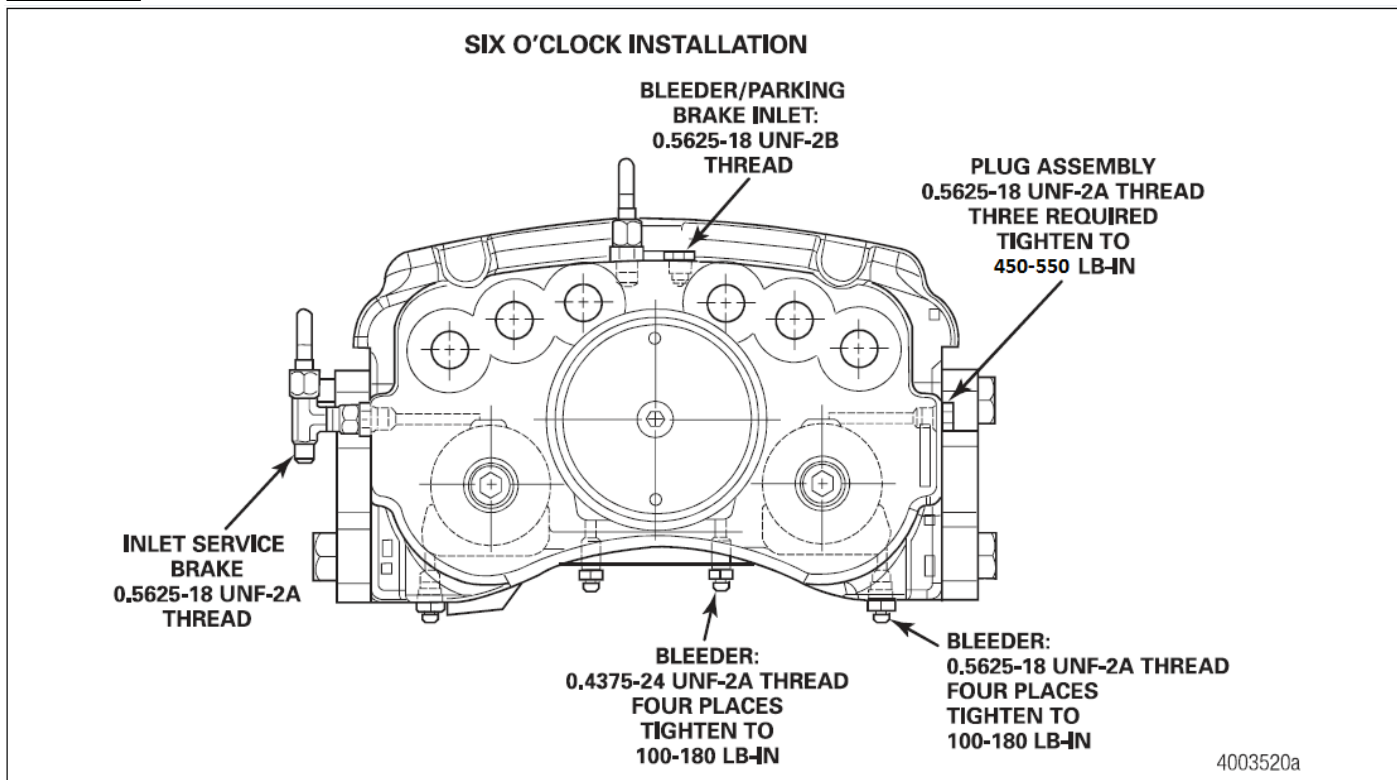
#### Service Circuit

1. Caliper must be fully assembled with proper torque applied to the mounting bolts before test.
2. Insure there are bleeders in all ports, except one to be used for oil supply. Install hydraulic inlet line to his port.
3. Place a 1.00 inch thick steel spacer plate in the caliper between linings to limit piston travel during test.
4. Evacuate air from the caliper assembly using bleeder(s) oriented at the top of the caliper.
5. Clean the assembly of any oil or debris.
6. Apply 3,000 psi to the assembly and allow pressure to stabilize for 2-3 minutes.
7. Inspect caliper for any signs of oil leakage.
8. After successful test results (no observed leakage), remove the spacer and linings.
9. Press pistons back into their bores completely before completing assembly and installing caliper to vehicle.

# 5. Assembly and Installation



**Figure 5.14**



**Figure 5.15**

## 5. Assembly and Installation



### INSTALLATION

#### Brake Assembly

#### **⚠️ WARNING**

When working with these heavy assemblies, use correct lifting devices that have sufficient lifting capacity. These caliper assemblies are very heavy and can cause serious personal injury.

1. Prepare the brake assembly for installation. Support the assembly using a suitable lifting device with adequate load carrying capacity.
2. Unless the disc has been removed, slide the caliper housing subassembly between the disc and axle mounting. Support the housing subassembly in place while installing the two special studs into the two inner bolt holes. Figure 5.16.

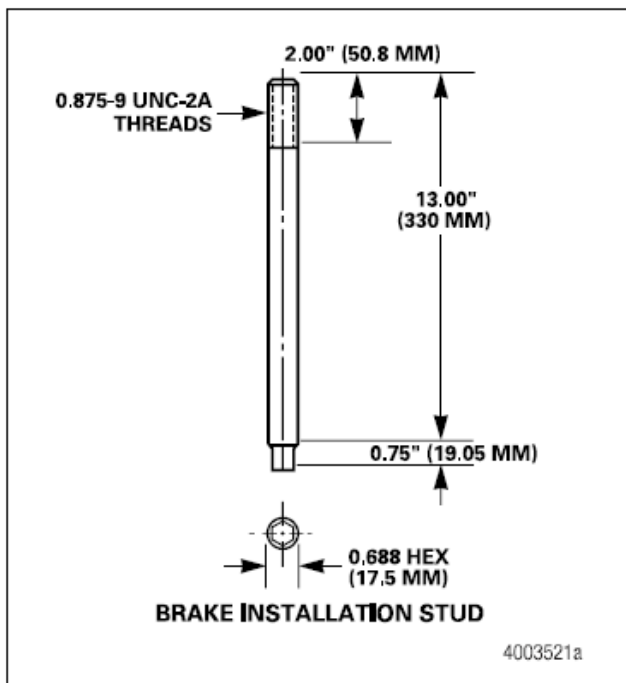


Figure 5.16

3. Slide the remaining housing subassembly over the special studs, and install the two outer bolts.
4. Remove the special studs and install the four remaining bolts.

5. Tighten the bolts to 550-650 lb-ft (746-881 N-m)
6. Install the crossover tubes and reconnect the hydraulic fluid inlet lines.
7. Bleed the brake. Refer to the procedure in this section.
8. Remove the wire ties or safety wire used to secure the lining assemblies.
9. Perform the initial adjustment as follows.
  - A. Release the parking brake by applying 1,650-3,000 psi (114-207 bar) hydraulic pressure.
  - B. Apply the service brake by applying full service brake pressure, 3,000 psi (207 bar). The service brake piston adjusters will adjust automatically when pressure is applied to the service brake.
  - C. Parking brake adjustment occurs automatically when the parking brake is released and the service brake is applied.
10. Burnish the new brake linings before releasing the vehicle for operation. Refer to the procedure in this section.

## 5. Assembly and Installation

### Bleed the Brakes

#### WARNING

**Failure to bleed the brakes will allow air to remain in the brake system. This will prevent the hydraulic pressure in the brake system from rising enough to apply the brakes correctly. This will cause the stopping distance to increase and can result in serious personal injury.**


**NOTE:** The HDBC 4225 dry disc brake is designed to bleed correctly when mounted at the 12 o'clock or six o'clock positions when configured as shown in figure 5.14 and Figure 5.15.


**Note:** If you loosen any brake system hydraulic connection, you must then bleed the brakes to remove all air from the system. Always start at the point in the system that is furthest from the master cylinder and work back toward the master cylinder. Bleed every bleeder screw on every caliper on every wheel. When you complete a bleeder screw, go to the next closest bleeder screw on the same caliper. When you complete a caliper, go to the next closest caliper on the same wheel. When you complete a wheel, go to the furthest bleeder screw on the next closest wheel.

#### WARNING

**Discard hydraulic fluid that is removed from the brake system in an appropriate manner. Hydraulic fluid that is removed can be contaminated and can cause damage, loss of braking, and serious personal injury. Use only the type of hydraulic fluid specified by the equipment manufactured. Do not use or mix different types of hydraulic fluid. The wrong hydraulic fluid will damage the rubber parts of the caliper and can cause damage, loss of braking, and serious personal injury.**

1. Verify that the master cylinder is filled to the specified level with the type of hydraulic fluid specified by the equipment manufactured. Keep the master cylinder filled during bleeding so that you do not pull air into the system through the master cylinder. Verify that the master cylinder is filled when you are done bleeding the system.

2. Place a clear tube onto the bleeder screw. Submerge the other end of the tube into a clear container of the specified fluid.
3. For a full hydraulic system, slowly apply low hydraulic pressure to the caliper. Loosen the bleeder screw. Continue to apply pressure until no air bubbles appear in the container of fluid. Tighten the bleeder screw to 100-180 lb-in, then release the pressure to the caliper. 

For an air/hydraulic or mechanical actuator system, apply the brake pedal, then loosen the bleeder screw. Tighten the bleeder screw to 100-180 lb-in before you release the brake pedal so that air is not pulled back into the system. Repeat this procedure until no air bubbles appear in the container of fluid when you apply the brake pedal. 

4. Apply and release the brakes three times to verify that the caliper operates correctly. Check for fluid leaks. Verify that the linings move freely in the caliper.

### Burnish Linings

#### CAUTION

**The front brakes may require burnishing independently from the rear brakes in order to control disc temperatures. Do not exceed 800°F (427°C) disc temperatures during burning procedures.**

1. Drive the vehicle on a level terrain while dragging the brakes until disc temperatures reach or exceed 600°F (316°C).
2. Cool the brake disc to approximately 250°F (121°C) between brake dragging cycles.
3. Repeat Step 1 until disc temperatures reach or exceed 600°F (316°C)
4. If linings smoke or smell, continue the burnish procedure until the smoke and smell are gone.
5. Cool the brake discs to approximately 250°F (121°C) before operating the vehicle.



## 6. Adjustment

### Adjustment

#### Initial Brake Caliper Adjustment and Readjustment

1. Release the parking brake by applying 1,650-3,000 psi (114-207 bar) hydraulic pressure.
2. Apply the service brake by applying full service brake, pressure, 3,000 psi (207 bar) maximum. Service brake piston adjusters will adjust automatically when pressure is applied to the service brake.
3. Parking brake adjustment occurs automatically when the parking brake is released and the service brake is applied.

## 7. Lubrication and Maintenance

### Lubrication

#### Hydraulic Fluid

- Petroleum-based hydraulic fluid, mineral oil  
Example: Meets MIL-H-5606 specifications
- Non-petroleum-based hydraulic fluid, automotive brake fluid  
Example: Glycol DOT 3, meets SAE J-1703 specifications

**NOTE:** Refer to the fluid and specification recommendations of the equipment manufacturer.

#### Periodic Inspections

##### **WARNING**

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

Inspect the caliper, linings, and disc as specified by the maintenance schedule of the vehicle or equipment manufacturer.

#### Inspection

##### Shoes, Linings and End Plates

To help prevent abnormal lining wear, replace worn, bent or cracked end plates and distorted shoes. Inspect the end plate bolts for wear. Replace the bolts if worn.

**NOTE:** End plate bolts are highly stressed.

Inspect the linings for the following conditions.

**Lining Wear.** Replace the linings when the thickness of the linings is less than 0.125-inch (3.2 mm) from the backplate.

**Lining Wear Not Even.** Replace the linings if the thickness of the two linings is significantly different. Check the pistons for correct operation. Replace the piston or housing if a piston is cocked in the bore. Check that the disc surface is flat and parallel to the linings.



**Oil or grease on the Linings.** Replace the linings.

**Cracks on the Linings.** Replace the linings that have larger or deeper cracks than the small, tight cracks on the surface of the lining which are normal when the caliper is used under high temperature conditions. These Cracks are referred to as heat check cracks.

##### **CAUTION**

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


##### **Caliper Leaks-**

Inspect the following areas for fluid leaks.

**Pistons-** If fluid leaks at a piston, disassemble the caliper. Inspect the piston, bore, O-rings and backup rings. Service as necessary.

**Elbow Fitting-** If fluid leaks at the elbow fitting, tighten the fitting. If the leak continues, replace the O-ring.

**Tube Assembly-** If fluid leaks from the tube assembly, tighten or replace the tube or fitting.

**Adjuster Pin-** If fluid leaks at the adjuster pin, hold the pin and tighten the nut to 120-150 lb-in (13.6-17 N-m) if the leak continues, replace the O-ring. 

**Bleeder Screw-** If fluid leaks at the bleeder screw, tighten the bleeder screw. If the leak continues, replace the bleeder screw.

**Inlet Fitting-** If fluid leaks at the inlet fitting, tighten the fitting. If the leak continues, replace the O-ring

##### **Dust Boots**

Verify that the dust boots are soft and flexible, disassemble the caliper and replace the dust boots that are hard or damaged.

## 7. Lubrication and Maintenance



### Brake Disc

If the disc is worn beyond the wear limits, replace the disc, Figure 7.1. Refer to the specifications of the vehicle manufacturer for wear limits may be different from those shown.

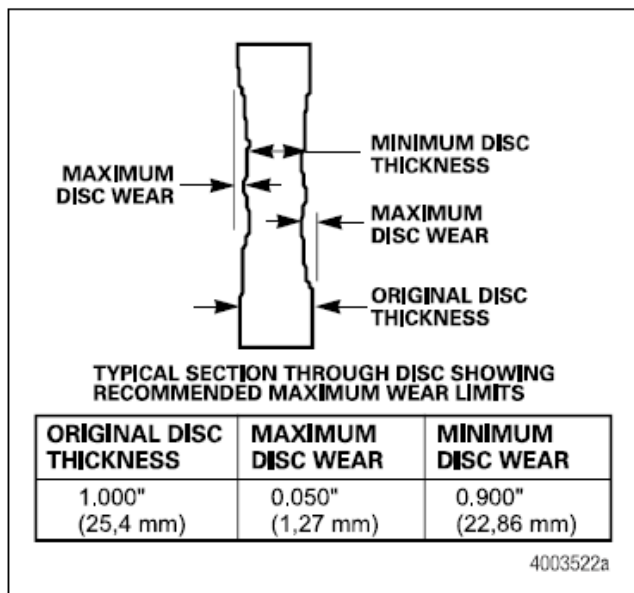


Figure 8.1

### Caliper Parts

1. Inspect the pistons, housing bores and O-ring grooves for scratches or corrosion. Remove small scratches or corrosion with a fine emery cloth. Replace the components if they are worn beyond wear limits or if there are large scratches or large amounts of corrosion.
2. Measure the outer diameter of the service piston. Replace the piston if the outer diameter is less than 2.995-inches (76.073 mm)
3. Measure the outer diameter of the parking piston, replace the piston if the large end diameter is worn to less than 4.996-inches (126.898 mm) or the small end diameter is worn to less than 2.495-inches (63.373 mm)

4. Measure the diameter of the housing service piston bore. Replace the housing if the diameter exceeds 3.004-inches (76.30 mm)
5. Measure the inner diameter of the parking piston housing bore. Replace the housing if the large end of the bore exceeds 5.005-inches (127.127 mm) or the small end of the bore exceeds 2.504-inches (63.602 mm)
6. Inspect the linings. Refer to the procedure in this section.  
**NOTE:** Replace any component that has thread damage that cannot be repaired.
7. Inspect the caliper ports and end plate bolt holes for thread damage. Use the appropriate taps lubricated with light oil to inspect tapped holes for thread damage and to clean up minor thread damage.
  - Fluid ports: Use 9/16-18 UNF-2B tap
  - Fluid ports: Use 7/16-20 UNF-2B tap
  - End plate bolt holes: Use 3 /4-16 UNF-2B tap
8. Discard all backup rings, O-rings and dust boots and use new ones when you assemble the caliper.

### Torque Specifications

#### Brake Assembly

Table A: Brake Assembly Torque Specifications

Description	Lb.-Ft	N.m
Bleeder Screws	100-180 lb-in	11.3-10.3
Caliper Housing Mounting Bolts	550-650	746-881
End Plate Bolts	380-460	515-624
Prevailing Torque Nut	120-150 lb-in	13.6-17.0
Parking Piston Cap	500 Minimum	678 Minimum
Shoulder Bolt	120-150 lb-in	13.6-17.0



## 8 Diagnostics

### Troubleshooting



**Table B: Service Brake Does Not Apply**

Condition	Possible Cause	Correction
<b>No pressure to service brake</b>	Empty fluid reservoir	Fill the reservoir to the correct level with the specified fluid.
	Damage hydraulic system	Repair the hydraulic system.
<b>Piston does not move.</b>	No pressure to brake	Fill the reservoir to the correct level with the specified fluid.
	Piston cocked in bore	Piston diameter worn less than 2.995-inches (76.073 mm): Replace the piston. Caliper bore diameter worn greater than 3.004-inches (76.30 mm): Replace the caliper housing.
<b>Service brake leaking</b>	Loose bleeder screw	Tighten the bleeder screw to 100-180 lb-in (11.3-20.3 N-m)
	Loose inlet fitting	Tighten the inlet fitting
	Damaged inlet fitting	Replace the inlet fitting
	Worn or damaged O-rings and/or backup rings	Replace the O-rings or backup rings. Inspect the piston for wear and damage. Service as necessary.
	Loose adjuster pin nut	Tighten the adjuster pin hex nut to 120-150 lb.-in (13.6-17.0 N-m)
<b>Damaged linings</b>	Lining thickness worn less than 0.125-inch (3.2 mm)	Replace the linings
	Lining wear not even	Inspect the piston. Service as necessary. Caliper bore diameter worn greater than 3.004-inches (76.3 mm): replace the caliper.
	Cracked or broken linings	Replace the linings.
	Oil or grease on linings	Replace the linings.

**Table C: Service Brake Does Not Release**

Condition	Possible Cause	Correction
<b>Vehicle does not move.</b>	Parking brake applied	Release the parking brake.
	Damaged hydraulic system	Repair the hydraulic system.
<b>Brakes dragging on disc and running too hot</b>	Pressure, more than 20 psi or 1.4 bar applied when brakes are released	Repair the hydraulic system so that the pressure is less than 20 psi (1.4 bar) when the brakes are released.
	Vehicle or equipment not operated correctly	Advise the operator on the correct vehicle or equipment operation.
	Piston cocked in bore	Service piston diameter worn less than 2.995-inches (76.073 mm): Replace the piston.
		Caliper bore diameter worn greater than 3.004-inches (76.30 mm): Replace the caliper housing.  Tapered lining wear: Replaces the linings.
Parking brake applied	Release the parking brake.	

## 8 Diagnostics



**Table D: Parking Brake Concerns**

Condition	Possible Cause	Correction
<b>Parking brake does not apply.</b>	Wrong or damage spring washers	Remove and replace the spring washers.
	Piston does not move.	Replace the housing if the large end of the bore exceeds 5.005-inches (127.127 mm) or the small end of the bore exceeds 2.504-inches (63.602).  Replace the piston if the large end diameter is worn to less than 4.996-inches (126.898 mm) or the small end diameter is worn to less than 2.495-inches (63.373 mm).
<b>Parking brake does not release.</b>	Damaged hydraulic system	Repair the hydraulic system.
	Parking piston cocked in bore	Replace the housing if the large end of the bore exceeds 5.005-inches (127.127 mm) or the small end of the bore exceeds 2.504-inches (63.602 mm).  Replace the piston if the large end diameter is worn to less than 4.996-inches (126.898 mm) or the small end diameter is worn to less than 2.495-inches (63.373 mm)
	Hydraulic parking release pressure too low, 1650 psi (114 bar) minimum	Increase the hydraulic pressure 3,000 psi (207 bar) Maximum.
	Worn or damaged seals and/or backup rings	Replace the seals or backup rings.
	Parking piston does not move	Replace the housing if the large end of the bore exceeds 5.005-inches (127.127 mm) or the small end of the bore exceeds 2.504-inches (63.602).  Replace the piston if the large end diameter is worn to less than 4.996-inches (126.898 mm) or the small end diameter is worn to less than 2.495-inches (63.373 mm)
	Worn or damaged spring washers	Remove and replace the spring washers.
<b>Parking brake does not hold vehicle on a grade</b>	Brake pressure is not released.	Repair the brake system as required.
	Worn or damaged spring washers	Remove and replace the spring washers.
	Vehicle parked on a grade over 15%.	Park the vehicle on less than a 15% grade.
	Brakes not burnished	Burnish the brakes.
<b>Cannot attain correct parking brake adjustment</b>	Shoulder bolt loose	Tighten the shoulder bolt to 120-150 lb-in (13.6-17.0 N-m)
	Spring washers not assembled correctly	Assemble the spring washers into correct configuration.
	Spring washers worn or damaged	Replace the damaged spring washers