

**CARLISLE SERVICE MANUAL
440-1085**

**OPERATION, MAINTENANCE, AND OVERHAUL OF THE
G2-7 (MO) SERIES BRAKE HEAD ASSEMBLY
419-9342**

This manual is to be used in conjunction with the appropriate
Carlisle Illustrated Parts List.

If this manual is intended for use in a foreign country, all information in
this manual should be translated prior to use.

The Brake Head Assemblies covered in this manual are for the use with
Mineral Oil Actuating Fluid Only

TABLE OF CONTENETS

SECTION	PAGE
1. DESCRIPTION	4
2. OPERATON	4
3. INSTALLATION	5
4. MAINTENANCE	6
5. OVERHAUL	11

ENGINEERING CHANGE NOTICE

REV	ECN	DESCRIPTION	DATE	DFT	CHK
-	14346	PRODUCTION RELEASE	11/06/2014	CD	

Always read this manual before start-up or maintenance:

WARNINGS:



Installation! This unit must be considered as a partial machine according to the Machine Directive. Before starting up the machinery, of which this unit is a part, it must be evaluated in order to ensure accordance with the Machine Directive. It is assumed that electric and hydraulic components have been connected, according to present standards, by educated personnel.



It is recommended that only hydraulic service personnel, or people with other relevant education, perform operation, maintenance, and overhaul of the unit.



Protection! During operation, maintenance, and overhaul always wear safety equipment such as safety glasses, facial protection, hearing protection, gloves, apron or protective suit, and safety shoes.



Pressure! Only use components tubes, fittings, hoses, and other equipment designed for use at unit's maximum pressure.



Covers! Moving parts like hydraulic motors, cylinders, and other actuators must be covered so that they can cause no injury to personnel.



If hydraulic components are mounted near personnel, a cover must be mounted so that no one can be injured by oil jets. Oil jets can cause severe damage by burst of a hose, tube, etc.



In some occasions, the unit may be heated leading to injury from scalds occurring by contact with fluids or heated surfaces.



Protection! Precautions must be taken against hazardous situations at actuators, cylinders, motors, etc. upon power failure.



Use! The unit must only be used for the specific purpose for which it has been designed.

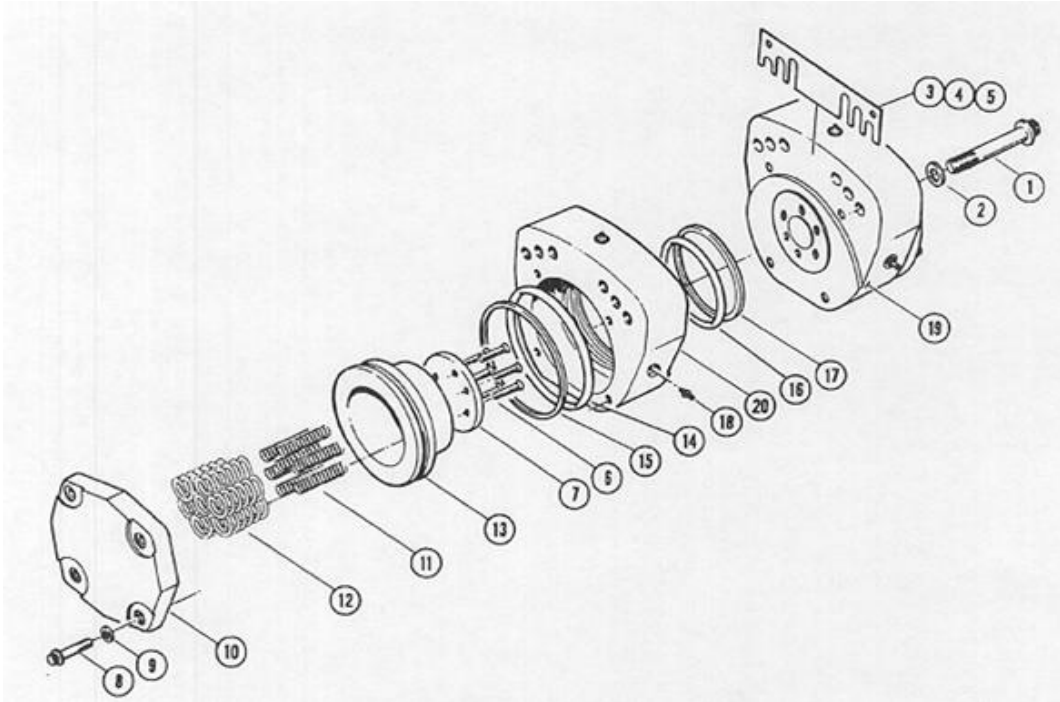


Figure 1
STANDARD COMPONENTS OF THE G2-7 (MO) SERIES BRAKE HEAD ASSEMBLY

INDEX	DESCRIPTION
1	Bolt $\frac{3}{4}$ -10, Grade 8
2	Washer
3	Shim
4	Shim
5	Shim
6	Screw
7	Carrier and Lining Assembly
8	Screw
9	Washer
10	Cap
11	Spring
12	Spring
13	Piston
14	Packing (6.498/6.452 I.D.)
15	Backup Ring (Split)
16	Packing (5.623/5.577 I.D.)
17	Backup Ring
18	Bleeder Valve
19	Piston Housing
20	Piston Housing

1. DESCRIPTION (See Figure 1 for identification of components)

WARNING

THE G2-7 (MO) SERIES BRAKE HEAD ASSEMBLY IS DESIGNED TO USE MINERAL OIL PER PARAGRAPH 2.1. USE OF IMPROPER FLUIDS WILL AFFECT RUBBER COMPONENTS OF BRAKES AND MASTER CYLINDERS RESULTING IN LOSS OF BRAKING AND POSSIBLE CATASTROPHIC FAILURE. IT IS IMPERATIVE THAT THE ABOVE WARNING BE PASSED TO ANYONE USING, SERVICING, OR SHIPPING THIS PRODUCT.

- 1.1 The G2-7 (MO) Brake Head Assembly is spring actuated and hydraulically released. Each brake head assembly consists of two piston housing assemblies and attached to a customer furnished mounting bracket (1.500" thick) with SAE Grade 8, 3/4" diameter bolts (1) with hardened steel flat washers (2) under the bolt heads. The bolts (1) are dry torqued to 380 to 390 ft./lbs. Shims (3) between the piston housings (19 & 20) and the mounting bracket or the spacer (see paragraph 3.3) center the brake. Thinner shims (4 & 5) provide finer centering adjustment when required.
- 1.2 Each piston housing assembly contains a spring loaded piston (13) secured in the piston housings (19 & 20) bores by a cap (10) fastened to the housing with four each, screws (8) and hardened steel flat washers (9). A lining and a carrier assembly (7) is secured to the piston with six screws (6). Epoxy adhesive applied prior to installation locks the screws in place. Packings (14 & 16) and backup rings (15 & 17) seated in the grooves in the piston housing bores seal against hydraulic fluid leakage. A bleeder valve (18) is installed in two of three inlet ports located on the ends of the piston housing. The 7/16-20 threads in each inlet port allow interchangeability between bleeder valve and inlet fluid line connection.

2. OPERATION

WARNING

FLUID MAY CAUSE IRRITATION. AVOID CONTACT WITH EYES OR PROLONGED CONTACT WITH SKIN. DO NOT OPERATE BRAKE AT MORE THAN 3,400 PSI. OVER-PRESSURIZATION MAY RESULT IN SEAL DAMAGE CAUSING LOSS OF BRAKING AND POSSIBLE CATASTROPHIC FAILURE.

- 2.1 The actuating fluid for this brake is mineral oil which meets the physical properties listed below.

NOTE: The aniline point must be 200°F minimum	
Saybolt Universal Viscosity at 210°F	43 seconds minimum
Saybolt Universal Viscosity at 100°F	145 to 155 seconds
Viscosity Index (Dean and Davis)	90 minimum
Pour Point (ASTM)	-25°F minimum
Color (ASTM)	No.2 or lighter
Neutralization Number (ASTM)	0.10 or less
Copper Strip Test (Corrosion) 3 Hours at 212°F	Negative
Emulsion Test at 130°F, Distilled Water: Time for Complete Separation	30 minutes maximum
Rust Test (ASTM) Distilled Water	No Rust
Oxidation Test (ASTM): Time to Neutralization Number 2.0	1,500 hours, minimum
Foam Test (ASTM): Sequence 1, 2, 3, ML Foam After 10 Minutes Standing	None
Flashpoint	370°F minimum

Additives harmful to Buna-N and Neoprene rubber compounds will not be used.

- 2.2 During non-braking operation, lining and carrier assemblies (7) and pistons (13) are retracted by hydraulic pressure fed through the piston housing inlet ports into the piston bore areas. The pressure compresses the springs (11 & 12) seated in the pistons until the pistons bottom. Full retraction of the piston will not occur at less than 1,800 psi. Normal operating pressure is 1,800 to 3,000 psi.

Note: See front of corresponding Illustrated Parts Catalog for inlet thread size.

- 2.2 Braking action occurs when hydraulic pressure is released allowing the springs (11 & 12) to force the pistons (13) and attached lining and carrier assemblies (7) against the disc.

3. INSTALLATION

- 3.1 Attach the brake fluid supply line to the 7/16-20 threaded ports of both piston housings (19 & 20). The supply line connection fittings must be threaded for the 7/16-20 straight threads to fit the threaded inlet ports. Use bulkhead or O-ring type fittings to prevent fluid leakage.
- 3.2 Pressurize the connected supply lines to 1,800 to 3,000 psi to retract pistons (13) in the piston housings (19 & 20) before proceeding with installation. Maintain pressure during installation.
- 3.3 Attach piston housing assemblies to mounting bracket (customer furnished) with six each, bolts (1) and washers (2).

WARNING

SAE GRADE 8 BOLTS WITH HARDENED STEEL FLAT WASHERS UNDERNEATH THE BOLT HEADS AND NUTS MUST BE USED TO ENSURE SECURE MOUNTING OF DISCS AND BRAKE HEADS.

Note: Brake heads must always be installed on the vehicle to allow access to mounting bolts (1) that attach piston housing assemblies to the mounting bracket.

Note: In applications where the mounting bolts thread into the piston housing (20), the G2-7 Brake Head Assembly requires the use of a customer supplied mounting bracket (1.500" thick) inserted between the piston housings (19 & 20). In a side mount application where the mounting bolts extend through the piston housing (20) the bracket is not centered over the disc. It is attached at the outside of the piston housing (20). A customer supplied spacer (1.500" thick) is then inserted between the piston housings (19 & 20).

- 3.4 Install three shims (3, 4, & 5) on each side of the mounting bracket or spacer located between the piston housings (19 & 20). Tighten the two outside mounting bolts (1). **DO NOT FINAL TORQUE BOLTS.**
- 3.5 Use a feeler gage to measure for clearance between lining and carrier assemblies (7) and disc, on each side of the discs as follows:
- 3.5.1 Shim mounting bracket or spacer to center it over the disc to within 0.010 inch.
- 3.5.2 Adjust piston housings (19 & 20) with shims (3, 4, & 5) to provide 0.020" to 0.050" clearance on each side between lining and carrier assemblies (7) and disc.

- 3.6 Dry torque mounting bolts (1) at 380 to 390 ft/lbs. and recheck clearance adjustment. Re-shim if necessary.

Note: If piston housing assemblies must be installed without pressurization, the six bolts (1) must be tightened alternately one turn at a time to the required torque. Centering should then be checked and established per paragraphs 3.5 through 3.5.2.

- 3.7 Using a bleeder hose to direct fluid away from the brake heads, bleed each brake head until fluid is free from air bubbles.

Note: Bleeder valves (18) are interchangeable and should be installed in top port of each piston housing (19 & 20) for efficient bleeding.

WARNING

FLUID MAY CAUSE IRRITATION. AVOID CONTACT WITH EYES OR PROLONGED CONTACT WITH SKIN.

- 3.8 Replenish brake fluid supply in system during and after the bleeding procedure.

WARNING

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- 3.9 Pressurize the brake head at 1,800 to 3,400 psi and check clearance between lining and carrier assemblies (7) and disc. The clearance should be equal for each side of the disc. Shim the disc or mounting bracket or spacer to obtain the correct clearance per paragraph 3.5.

WARNING

CLEARANCE BETWEEN THE DISC AND LINING AND CARRIER ASSEMBLIES MUST BE MAINTAINED DURING VEHICLE OPERATION. OPERATIONAL PRESSURE LESS THAN 1,800 PSI MAY CAUSE THE BRAKE TO DRAG.

4. MAINTENANCE

- 4.1 Inspect brake periodically to insure that all bolts are tight and that there are no leaks. Inspect for excessive lining wear.
- 4.2 Check for 0.020 inch minimum clearance with required pressure applied and shim if necessary to obtain correct clearance (see paragraph 3.5) for new lining and carrier assemblies.

- 4.3 If pressure fails causing a locked brake, release the lining and carrier assemblies (7) from the disc loosening the bolts (1) that secure the piston housing assemblies to the mounting bracket one turn at a time until the lining and carrier assemblies are free of the disc. Re-tighten the bolts (1) one turn at a time and torque to 380 to 390 ft/lbs. (dry torque) after restoring the hydraulic pressure.
- 4.4 Check the disc thickness. Scrap discs that are less than 0.750" thick when measured at the thinnest (most worn) area.

WARNING

CONTINUED USE OF THE DISC BEYOND THE MINIMUM THICKNESS MAY RESULT IN LOSS OF BRAKING AND POSSIBLE CATASTROPHIC FAILURE

- 4.5 Inspect linings and disc wear every 500 hours of vehicle operation in accordance with the following procedure. Replace linings and carrier assemblies (7) and disc as follows:

WARNING

VARIOUS LINING MATERIALS, INCLUDING SINTERED METALLIC TYPES, ARE OFFERED IN THE AFTERMARKET FOR USE ON CARLISLE OFF-HIGHWAY DISC BRAKES. THE USE OF MATERIALS WHICH HAVE NOT BEEN TESTED AND APPROVED BY CARLISLE CAN LEAD TO PROBLEMS SUCH AS BURNED BOOTS, PISTON SEAL HEAT DETERIORATION, AND POSSIBLE VAPORIZATION OF THE BRAKE SYSTEM HYDRAULIC FLUID. ADDITIONALLY, THE FRICTION COEFFICIENTS OF THESE MATERIALS MAY NOT BE SUFFICIENT TO PROVIDE THE BRAKE CONTROL AND STOPPING ABILITY REQUIRED AND THE STRUCTURAL INTEGRITY OF THE BOND BETWEEN THE LINING MATERIAL AND CARRIER MAY BE INADEQUATE. THE ULTIMATE RESULT COULD BE CATASTROPHIC LOSS OF BRAKING, LEADING TO PROPERTY DAMAGE OR EVEN LOSS OF LIFE.

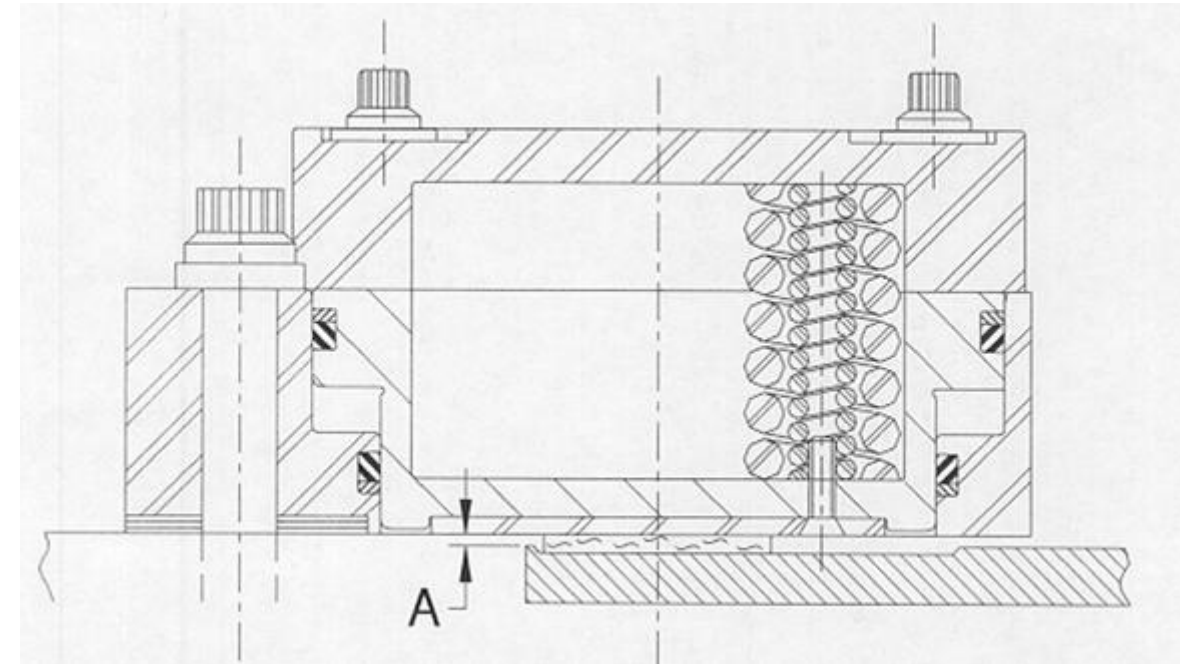


Figure 2

WARNING

FAILURE TO REPLACE LININGS WHEN WORN TO LIMITS MAY RESULT IN LOSS OF BRAKING AND POSSIBLE CATASTROPHIC FAILURE

- 4.5.1 Park the machine on level ground and chock the wheels.
- 4.5.2 While the parking brake pressure is released, measure the distance between the disc outer edge and the lining carrier with a feeler gage. (See dimension "A" in Figure 2) Measure carefully being sure to include any rind which may exist at the O.D. of the disc. Also measure the disc thickness at the most worn surfaces.
- 4.5.2.1 If the "A" dimension clearance is greater than 0.040", and the disc thickness is greater than 0.750", continue to paragraph 4.7. If the disc thickness is 0.750" or less, it must be replaced before continuing to paragraph 4.7.
- 4.5.2.2 If the "A" dimension clearance is less than 0.040", either the disc or the lining and carrier assemblies must be replaced. Remove the parking brake and measure the lining thickness remaining. Determine replacement as follows:
- 4.5.2.3 Replace the disc if:**
- A) The disc thickness is less than 0.750".
 - B) The disc has a rind at the O.D. and the remaining lining material thickness is greater than 0.165".

4.5.2.4 Replace the lining and carrier assemblies if:

- A) No rind exists at the disc O.D.
- B) The disc has a rind at the O.D. and the disc thickness is greater than 0.750" when measured at the worst worn area.

4.5.3 Consult the vehicle owner's manual for information on how to replace the disc.

4.6 Lining and Carrier Assembly replacement procedure.

4.6.1 Remove the attaching bolts (1) and washers (2) and dismount the brake heads from the mounting bracket. Remove the screws (6) and worn lining and carrier assemblies (7) from the pistons (13).

Note: An epoxy adhesive is used to lock the screws (6) to the pistons (13) which may require more than normal torque to loosen the screws. Heat (350°F maximum) applied to the screw heads will facilitate loosening stubborn screws.

4.6.2 Prior to attaching new lining and carrier assemblies (7), clean the previously removed screws (6) with solvent to remove old adhesive and other foreign material. Apply a liberal coat of epoxy adhesive (Scotch-Weld Brand Structural Adhesive No.2158 B/A) to cover at least four or five threads of the screws.

Note: Scotch-Weld Brand Structural Adhesive No.2158 B/A is a two part epoxy adhesive manufactured by Minnesota Mining and Manufacturing Company (3M), St. Paul, Minnesota. Follow manufacturer's instructions for correct use of adhesive.

Note: While the parking brake is removed, disassemble and inspect the springs (11 & 12) for damage. If broken springs are found, replace all springs in that brake as a set. Inspect the brake linings for damage and replace if broken.

WARNING

FAILURE TO REPLACE SPRINGS WHEN BROKEN OR DAMAGED MAY RESULT IN LOSS OF BRAKING AND POSSIBLE CATASTROPHIC FAILURE

4.6.3 Assemble new lining and carrier assemblies (7) to the pistons (13) and secure in place with adhesive coated screws (6). Re-install the brake heads on the mounting bracket in accordance with the instructions in Section 3. INSTALLATION.

4.7 Procedure for checking brake adjustment.

4.7.1 With the parking brake released (pressure applied) measure the clearance between the parking brake lining and disc with a feeler gage. (See dimension "B" in Figure 3)

Note: Even though the disc and/or lining and carrier assemblies may have been replaced in accordance with paragraph 4.5.2 the brake may require adjustment under some conditions.

4.7.2 If the "B" dimension clearance is greater than 0.020" and less than 0.065", return the vehicle to service unless otherwise specified in the vehicle owner's manual.

4.7.3 If the "B" dimension clearance is less than 0.020" or greater than 0.065", the brake requires adjustment unless otherwise specified in the vehicle owner's manual. Use the shims provided to establish 0.020" to 0.050" clearance. Return the machine to service.

WARNING

**FAILURE TO ADJUST BRAKE WHEN WORN BELOW THE LIMITS MAY RESULT IN
HAZARDOUS LOSS OF GRADE HOLDING ABILITY**

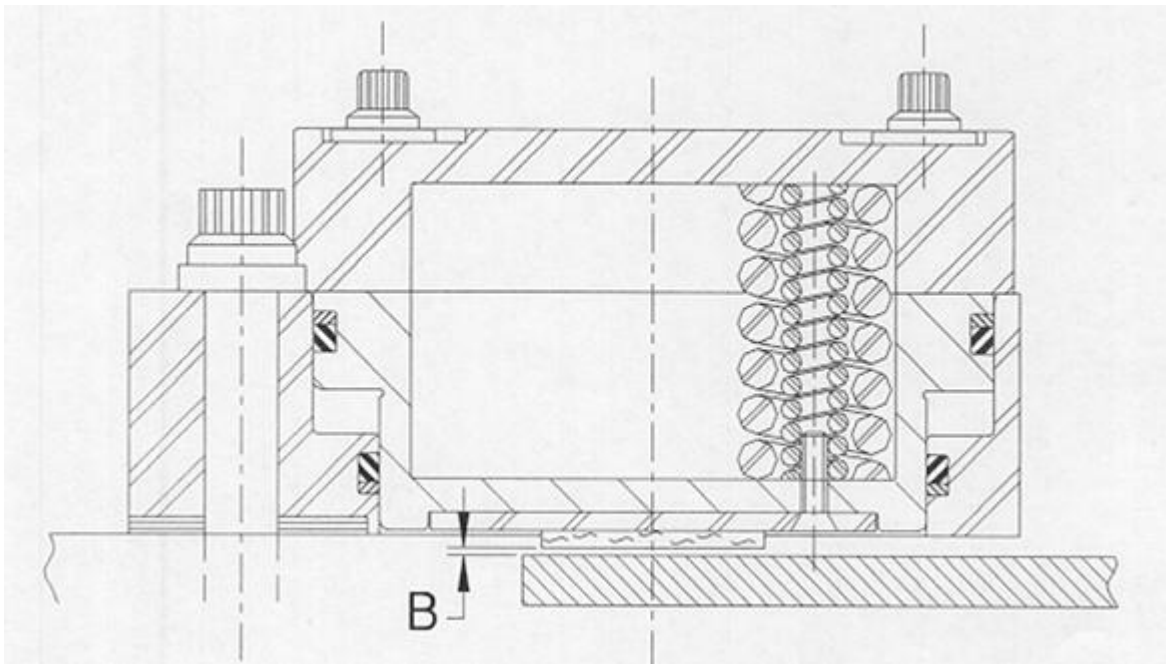


Figure 3

5. OVERHAUL

Note: Thoroughly inspect the brake head and overhaul as required when other major components of the vehicle require overhauling. Use only Carlisle approved parts for brake overhaul.

Note: Lining and carrier assemblies and discs should be checked prior to disassembly in accordance with paragraphs 4.5.2 through 4.5.2.4 to determine the need for lining or disc replacement. The brake heads must still be on the vehicle to perform these checks.

5.1 Disassembly

WARNING

BRAKE HEAD COMPONENTS ARE SPRING LOADED. USE EXTREME CARE AND FOLLOW INSTRUCTIONS FOR DISASSEMBLY.

5.1.1 Loosen and remove screws (8) and washers (9) that secure the cap (10) to the piston housings (19 & 20). Use one of the following procedures to remove screws:

Option 1

1. Place each half assembly in a hydraulic press.
2. Apply press force to the center of the cap (10) over a distributed area of not less than 6 sq. in. until the cap is seated against the housing (19 & 20). Care must be taken to avoid overloading the cap as this can cause cracking.
3. Remove screws (8), washers (9) and caps (10).

Option 2

1. Loosen screws one turn at a time to relieve spring load on the piston (13). After the spring load is completely released, remove the screws (8) washers (9) and caps (10).

5.1.2 Remove the springs (11 & 12).

5.1.3 Loosen the screws (6) securing the lining and carrier assemblies (7) to the pistons. Remove the lining and carrier assemblies.

Note: An epoxy adhesive is used to lock the screws (6) to the pistons (13) which may require more than normal torque to loosen the screws. Heat (350°F maximum) applied to the screw heads will facilitate loosening stubborn screws.

5.1.4 Remove the pistons (13) from the housings (19 & 20) using hydraulic press.

5.1.5 Remove the packings (14 & 16), the backup rings (15 & 17), and the bleeder valves (18) from the piston housings (19 & 20).

5.2 Inspection and Repair

- 5.2.1 Inspect the lining and carrier assemblies (7), and springs (11 & 12) for wear and damage. Replace these parts according the specifications in paragraphs 4.6 through 4.6.4
- 5.2.2 Inspect the pistons (13) for scratches, nicks and other slight surface damage. If a piston is badly nicked or scratched, or if the chrome plate is visibly worn, replace the piston. Smooth minor surface damage with crocus cloth. If the sealing surfaces (small and large diameters) cannot be smoothed without damaging the plating, replace the piston. Replace the piston if the small diameter is below 5.621 in. or the large diameter is below 6.990 in.
- 5.2.3 Inspect the piston housings (19 & 20) for cracks, breaks or surface damage. Use crocus cloth to smooth minor surface damage on sealing surfaces. Replace any housing that is cracked or broken. Replace any housing if the small bore is greater than 5.634 in. or the large bore is greater than 7.005 in.
- 5.2.4 Check the disc for wear and cracks. Replace if worn more than 0.250 in. total when measured at the thinnest or most worn area, or if it is cracked.
- 5.2.5 Check all bleeder valves (18) and fittings for thread damage. Replace damaged parts.

5.3 Replacement

Note: Use only Carlisle approved replacement parts.

- 5.3.1 Replace all packings (14 & 16) and backup rings (15 & 17) at each overhaul.
- 5.3.2 Replace damaged or worn parts as determined by inspection.

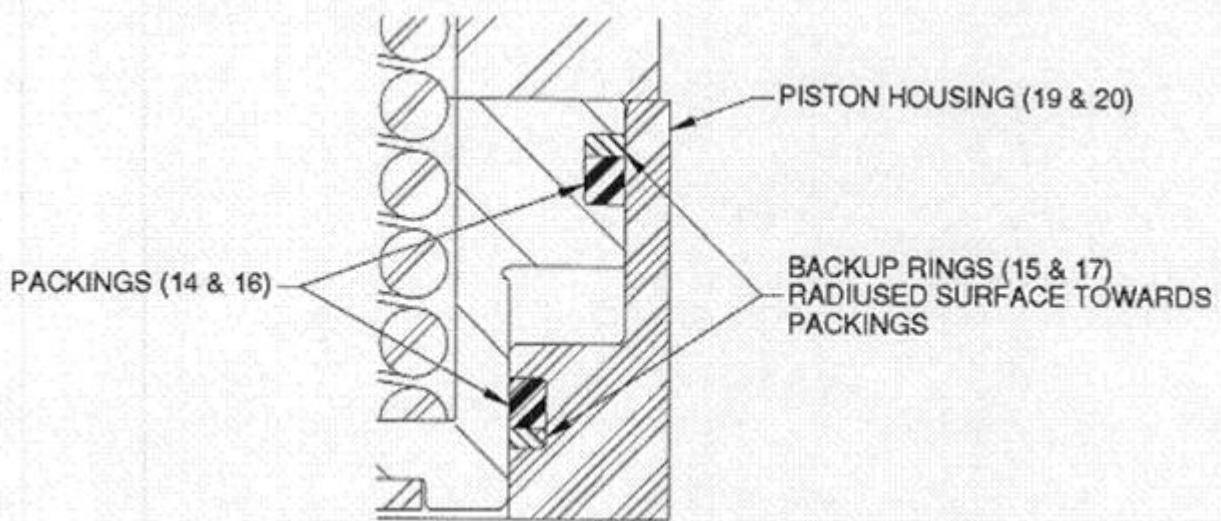


Figure 4
CORRECT INSTALLATION OF PACKINGS & BACKUP RINGS

5.4 Reassembly

- 5.4.1 Reassemble in reverse order of the index numbers of the exploded view in Figure 1, noting the following:
- 5.4.2 Assemble the lining and carrier assemblies (7) on the pistons (13) and secure with the screws (6). Prior to attaching the new lining and carrier assemblies (7), clean the previously removed screws (6) with solvent to remove old adhesive and other foreign material. Apply a liberal coat of epoxy adhesive (Scotch-Weld Brand Structural Adhesive No. 2158 B/A) to cover at least four to five threads of the screws. Assemble new lining and carrier assemblies (7) to the pistons (13) and secure in place with adhesive coated screws (6).
- 5.4.3 As a precaution, apply masking tape or equivalent over the linings to prevent contact with oil during the remaining steps in the process.
- 5.4.4 Lubricate packings (14 & 16) and backup rings (15 & 17) with clean actuation fluid (mineral oil per paragraph 2.1) prior to installation in the pistons (13) and piston housings (19 & 20).
- 5.4.5 Install the packings (14 & 16) and the backup rings (15 & 17) in the OD grooves of the pistons (13) and ID grooves of the piston housings (19 & 20) with the backup rings (15 & 17) installed in accordance with the diagram in Figure 4.

Note: Make sure the packings (14 & 16) and the backup rings (15 & 17) are properly seated in the grooves before continuing assembly.

- 5.4.6 Install the pistons in the piston housings taking care not to damage the packings (14 & 16) and backup rings (15 & 17) previously installed in the pistons and housings. This is most easily accomplished with hydraulic press. Special care must be taken to insure the ends of the large backup rings (15) are not protruding from the piston OD to prevent cutting them during piston installation into the housing.
- 5.4.7 Install the cap (10) over the springs (11 & 12) with the word 'TOP' just below the mounting bolt holes in the housings (19 & 20), and secure to the piston housings (19 & 20) with the screws (8) and washers (9). Use one of the following procedures to tighten the screws:

Option 1

1. Place each half assembly in hydraulic press with cap sitting loosely over springs
2. Install the screws (8) and washers (9), starting threads by hand.
3. Apply press force to the center of the cap (10) over a distributed area of not less than 6 sq. in. until the cap is seated against the housing (19 & 20). Care must be taken to avoid overloading the cap as this can cause cracking.
4. Dry torque screws (8) to 110-120 ft-lbf.
5. Remove press force.

Option 2

1. Install the screws (8) and washers (9), starting threads by hand.
2. Sequentially turn each screw one turn at a time until the caps (10) are seated on the face of the housings (19 and 20).
3. Dry torque screws (8) to 110-120 ft-lbf.

5.4.8 Install bleeders (18) as necessary to complete assembly. Torque to 100-180 in-lbf.

5.4.9 If new linings or new discs have been installed, check the brake adjustment per section 4.7.

5.5 Testing

Note: Each caliper half should be tested to ensure leak-free operation and proper performance.

5.5.1 Insure there are bleeders (18) in all housing ports except one. Use the one available port to install hydraulic inlet line.

5.5.2 Clean the assembly of any oil or debris.

5.5.3 Apply 3,000-3,400 psi to assembly and allow pressure to stabilize.

5.5.4 Use dial indicator or other linear measurement device to track movement of the piston (13) relative to the housing (19 & 20). The device should be in contact with the piston or lining and set to zero at this time.

5.5.5 Following pressure stabilization for 2-3 minutes, reduce pressure to 1,800 psi. The piston (and indicator) should not move.

5.5.6 Check assembly for signs of oil leakage.