

# Roadranger®

## Dana® Spicer® Brakes

16.5" Series S-Cam □  
XTRALIFE™ □  
XTRALIFE II™

Cast  
P-Series

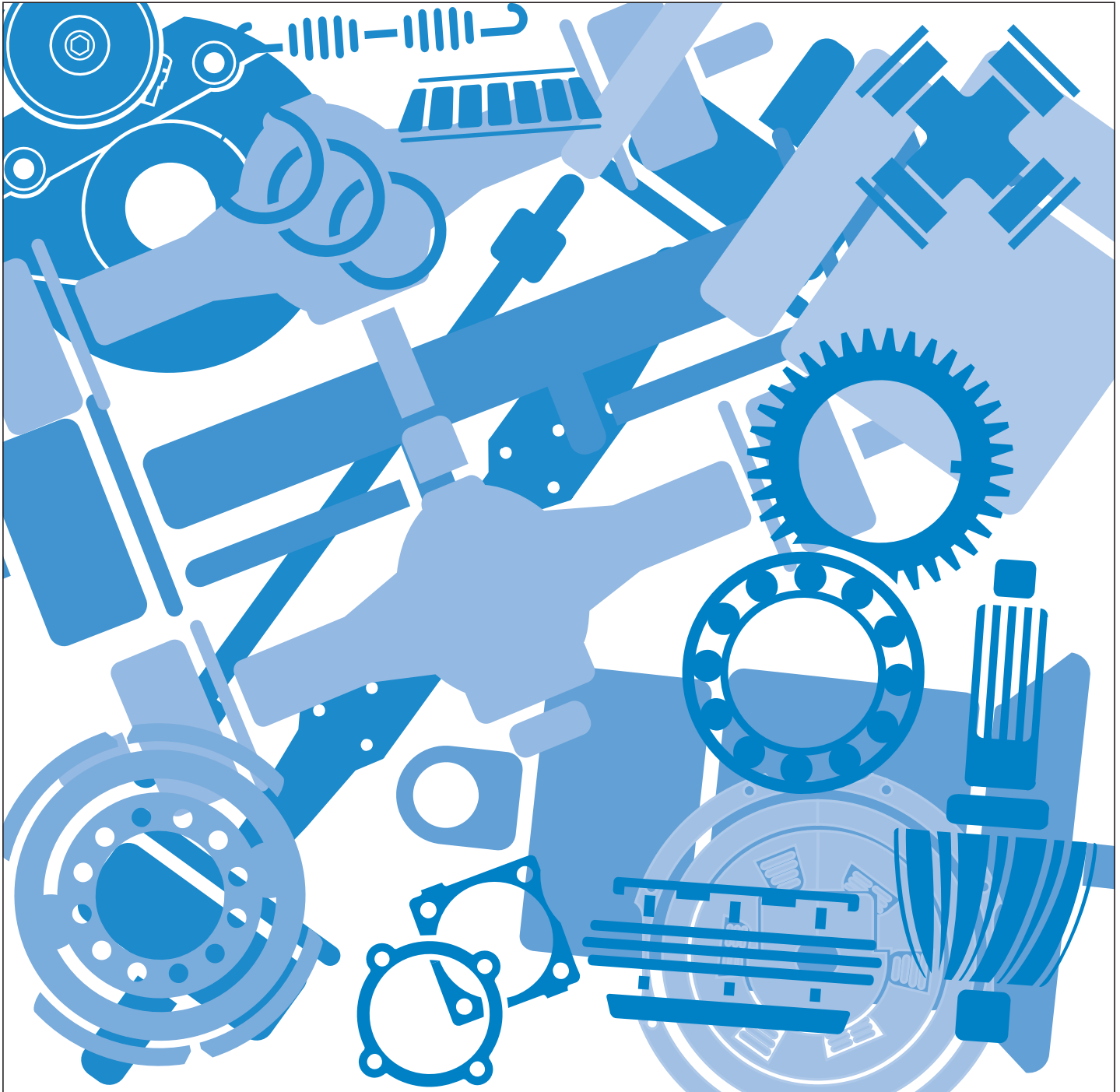


One Great Drivetrain from Two Great Companies

Service Manual

BRSM-0890

October 1997



For the most current information, visit the Roadranger web site at [www.roadranger.com](http://www.roadranger.com)



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**SPICER®**



## GENUINE SPICER SERVICE PARTS

Should a brake assembly require replacement component parts, it is recommended that Spicer Brake Service Parts be used. Spicer Brake Service Parts are manufactured under the same rigid specification as are original equipment brake components. This assures the customer who uses genuine Spicer service parts, maximum reliability for a Spicer Brake assembly. They may be obtained through your vehicle manufacturer. The use of non-original Spicer service parts may cause premature component failure and may void the warranty.

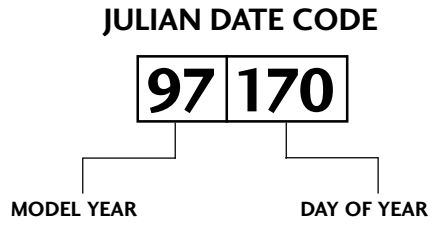
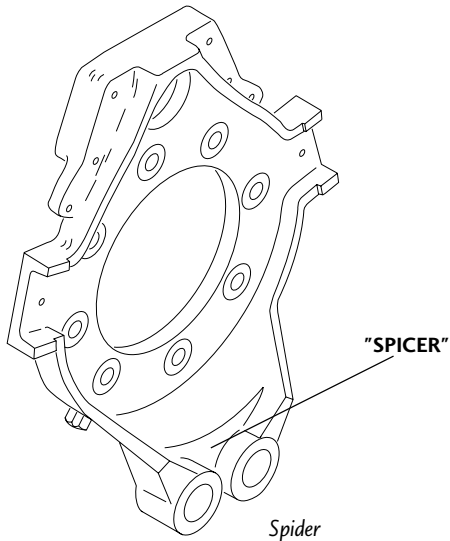
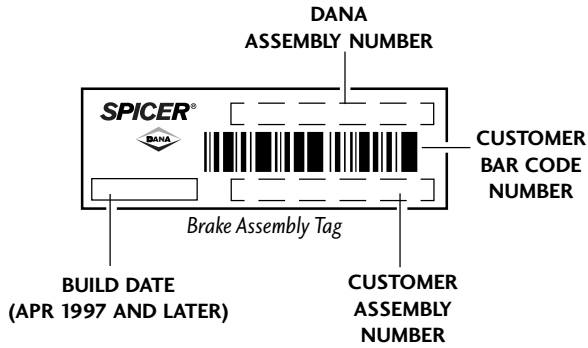
The items included in this book are currently being offered as service parts at the time of printing. The part numbers and illustrations are provided specifically for reference purposes only. Therefore, Spicer reserves the right to update this manual without notice or liability.



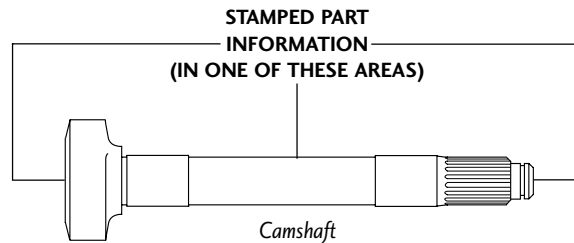
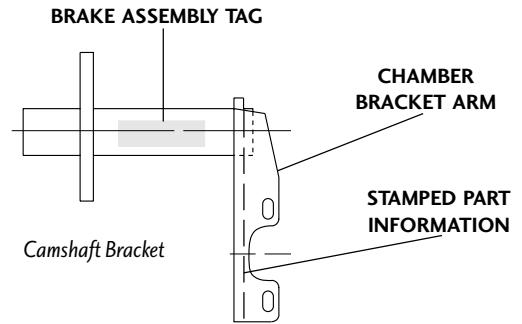
# IDENTIFICATION

The brake assembly may be identified by a tag which is located on the camshaft bracket cylinder, near the grease fitting.

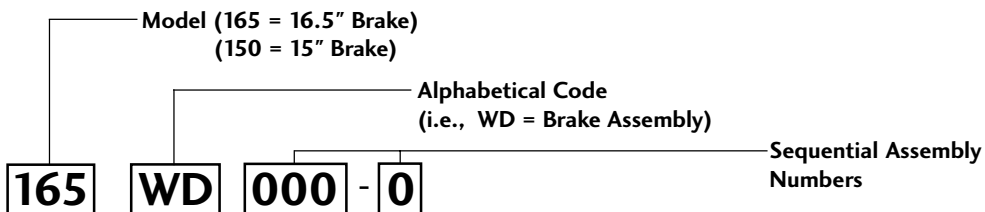
The mylar **brake assembly tag** contains the following: Dana assembly number, bar coded customer assembly number, and a numeric customer assembly number.



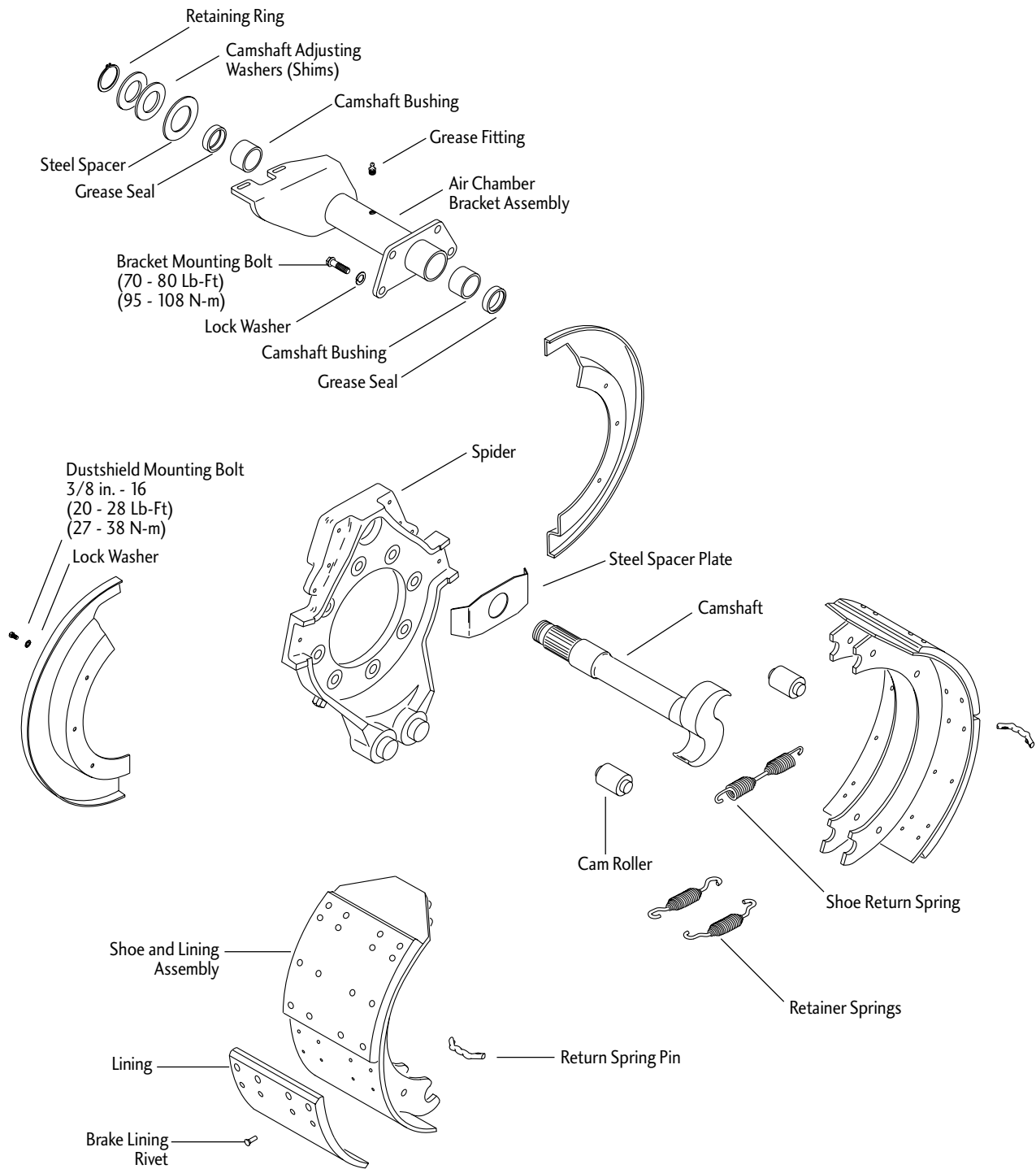
Two other markings that may be used to identify a Spicer Brake assembly are located on the assembly's components. "Spicer" will be cast into the spider assembly just above the anchor pins. Also, the inside of the chamber bracket arm contains the following stamped part information: "Spicer", julian date code, and the part number.



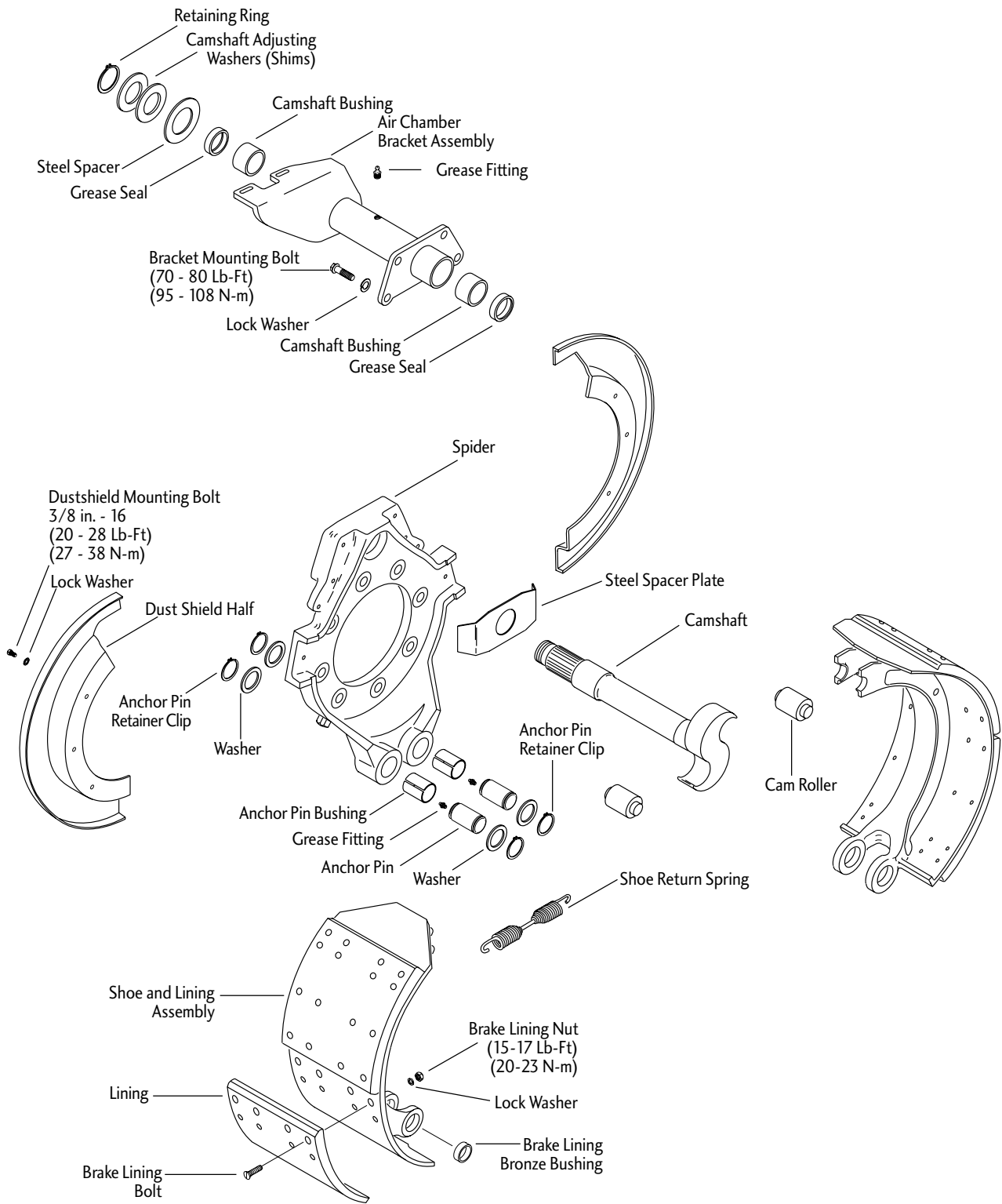
## MODEL IDENTIFICATION NUMBERING SYSTEM



# BRAKE COMPONENTS STANDARD/ XTRALIFE 16.5"

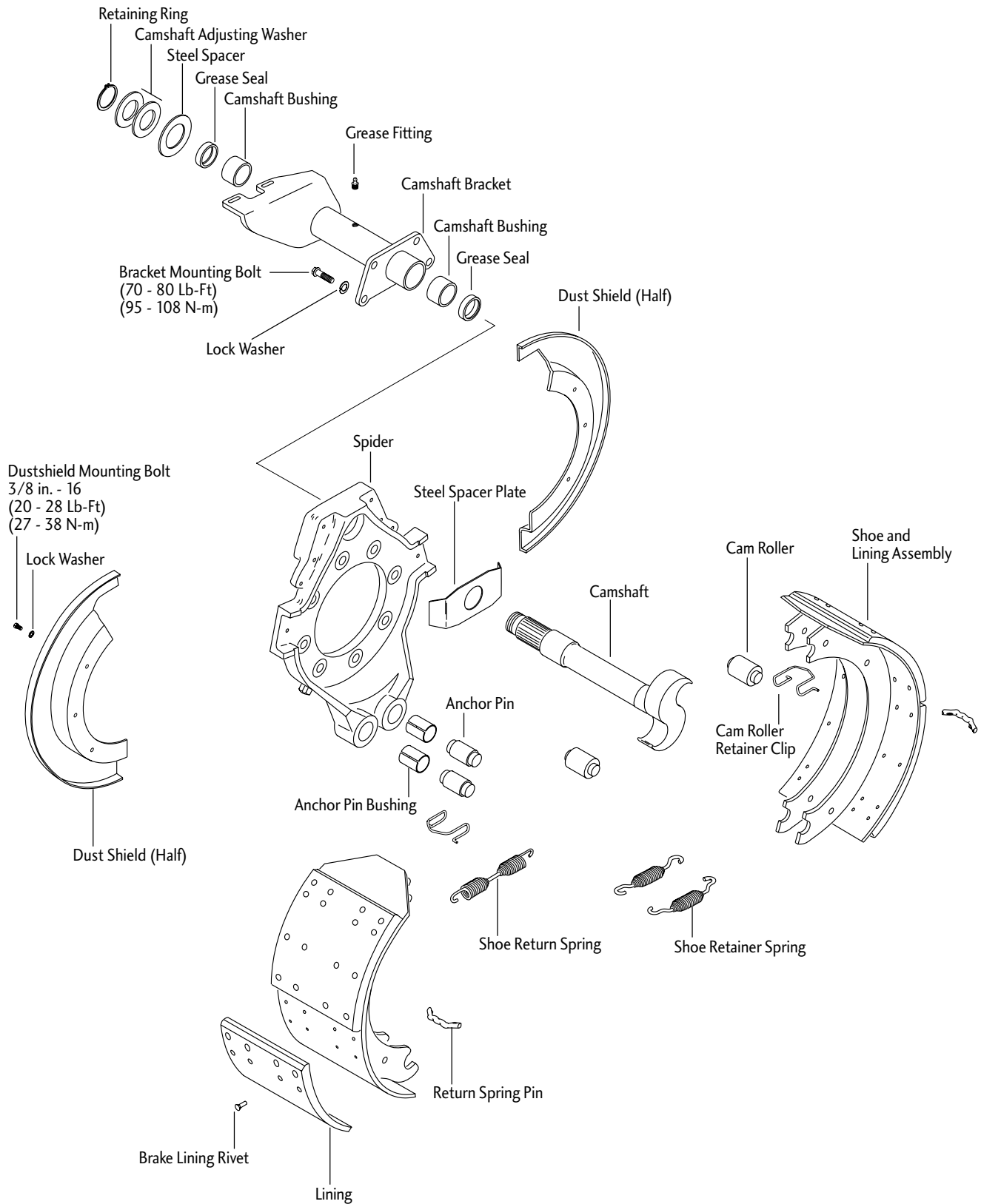


# BRAKE COMPONENTS 16.5" CAST SHOE SERIES

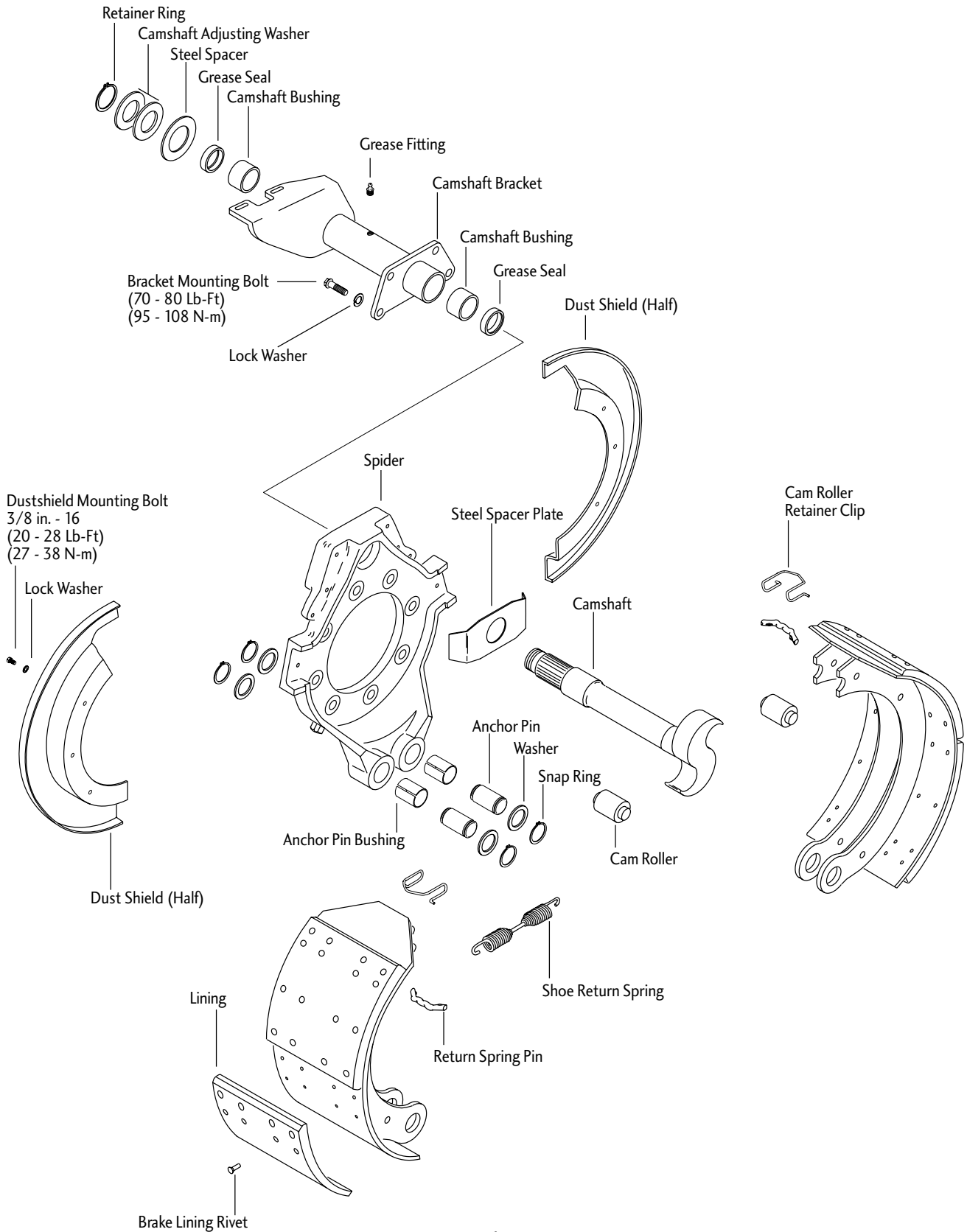


# BRAKE COMPONENTS

## 16.5" XL II SERIES BRAKE



# BRAKE COMPONENTS 16.5" P SERIES BRAKE






# GENERAL PRECAUTIONS

## **IMPORTANT** **READ THIS SECTION BEFORE STARTING ANY SERVICE PROCEDURES**

All Spicer original equipment or service parts for steering and drive axle brakes are manufactured using non-asbestos brake lining. It is recommended that original Spicer service parts be used when brake maintenance is necessary.

### **SAFETY PRECAUTIONS**


Proper service and repair of vehicle components is important to the safe and reliable operation of all motor vehicles. This applies particularly to brakes such as the ones described in this manual. The procedures recommended and described in this manual are tested, effective methods for performing service operation. Follow each procedure closely, making use of both the text and pictures. Some of these service procedures show the use of certain tools designed especially for the operation being performed. It is not mandatory that these tools be used; they are shown only as preferred means of performing the operation. It is not practical to anticipate and advise the service trade of all possible alternate service methods, and of all possible hazardous consequences that could result from any particular method. Accordingly, anyone who uses a service procedure or tool different than shown must insure that their safety, and that the vehicle's safety will not be jeopardized by the service method selected.

 **CAUTION: When working on or around air brake systems and components, the following precautions should be observed:**

1. Always block vehicle wheels. Stop engine when working under a vehicle. Depleting vehicle air system pressure may cause vehicle to roll. Keep hands away from chamber push rods and slack adjusters; they may automatically apply as system pressure drops.
2. Never connect or disconnect a hose or line containing air pressure. It may whip as air escapes.

Never remove a component or pipe plug unless you are certain all system pressure has been depleted.

3. Never exceed recommended air pressure and always wear safety glasses when working with air pressure. Never look into air jets or direct them at anyone.
4. Never attempt to disassemble a component until you have read and understand recommended procedures. Some components contain powerful springs and injury can result if not properly disassembled. Use only proper tools and observe all precautions pertaining to use of those tools.
5. Use only genuine Spicer replacement parts and components.
  - A. Only components, devices, mounting and attaching hardware specifically designed for use in air brake systems should be used.
  - B. Replacement hardware, tubing, hose, fittings, etc. should be of equivalent size, type, length and strength as the original equipment.
  - C. Make certain that when replacing tubing or hose, all supports, clamps or suspending devices that were originally installed by the vehicle manufacturer are reinstalled.
6. Devices with stripped threads or damaged parts should be replaced. Repairs requiring machining should not be attempted.

 **CAUTION**

BRAKE LININGS CONTAIN NON-ASBESTOS FIBERS

BREATHING BRAKE DUST MAY BE HAZARDOUS TO YOUR HEALTH AND MAY CAUSE SERIOUS RESPIRATORY OR OTHER BODILY HARM.

AVOID CREATING DUST

DO NOT REMOVE BRAKE DRUM WITHOUT PROPER PROTECTIVE EQUIPMENT.  
DO NOT WORK ON LININGS WITHOUT PROPER PROTECTIVE EQUIPMENT.  
DO NOT REPLACE LININGS WITHOUT PROPER PROTECTIVE EQUIPMENT.  
DO NOT ATTEMPT TO SAND, GRIND, CHISEL, FILE, HAMMER OR ALTER BRAKE LININGS IN ANY MANNER WITHOUT PROPER PROTECTIVE EQUIPMENT.

FOLLOW O.S.H.A. STANDARDS FOR PROPER PROTECTIVE DEVICES TO BE USED WHEN WORKING WITH BRAKE MATERIALS.

## GENERAL PRECAUTIONS (CONTINUED)

### PREPARATION

1. Park vehicle on a level surface and prevent movement by means other than the brakes.
2. If equipped with spring brakes, cage the spring on all axles to be worked on.
3. Raise the axle, to be worked on until the tires clear the ground. Support axle with heavy duty jack stands.
4. "Back-off" slack adjuster by turning adjusting nut until the brake shoes are fully retracted.

**CAUTION:** Rockwell Auto Slacks require the pawl assembly to be removed before turning the adjusting nut.

**WARNING:** Never work under a vehicle supported only by a jack. Always use a jack stand.

5. Remove wheels and drums using the procedures specified in the vehicle maintenance manual.

**WARNING:** The long term effects of exposure to non-asbestos has not been determined. Avoid creating dust when performing service on brake assemblies. Excessive exposure to brake dust may cause respiratory damage or other bodily harm.



**Safety glasses should be worn at all times when assembling or disassembling brakes.**

## PREVENTATIVE MAINTENANCE

A schedule should be established for periodic adjustment, inspection and lubrication. This schedule is determined from vehicle owner/operators experience and the type of operation.

### BRAKE DRUMS

Inspect for heat checks, grooves, hot spots, glazing, cracks, and out of round. Drums which are glazed, grooved, or have moderate heat checking may be resurfaced and returned to service. The drum should not be used if it exceeds the manufacturer's recommended maximum diameter stamped on the drum.

### BRAKE ADJUSTMENT

Brakes should be adjusted whenever the air chamber push rod stroke exceeds the maximum distance according to the chart shown in **Figure 2**. To determine if brake adjustment is required measure the push rod stroke with the brakes applied as shown in **Figure 3** on **page 10**.

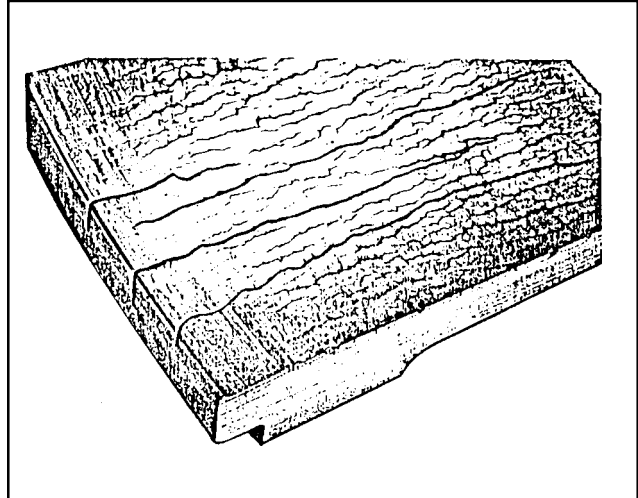
### RECOMMENED AIR BRAKE ACTUATOR SERVICE STROKE

Chamber Size Type	Standard Chamber		Long Stroke Chamber	
	Rated Stroke	Max Readjust Stroke	Rated Stroke	Max Readjust Stroke
12	1.75	1.38	2.00	1.50
16	2.25	1.75	2.50	2.00
20	2.25	1.75	2.50	2.00
24	2.25	1.75	2.50	2.00
30	2.50	2.00	2.75	2.25
36	3.00	2.25	-	-

Source: The Maintenance Council RP 635

**Figure 2**

**CAUTION:** Drums displaying heat checks with a continuous length of four inches or more and extends around the edge of the drum should be replaced. See Figure 1.



**Figure 1**

# PREVENTATIVE MAINTENANCE

## MEASURING PUSH ROD STROKE

1. Measure the distance between the air chamber mounting face and the center of the clevis pin, with brakes released.
2. Make an 70-90 PSI application and hold it. Measure the distance between the air chamber and the mounting face and the center of the clevis pin.
3. Subtract measurement A from measurement B. If this measurement equals or exceeds the maximum readjust stroke the brakes need to be adjusted.  
**See Figure 3.**
4. If adjustment is required, spin the wheel slowly and adjust the slack adjuster just enough for wheel to spin freely. Be sure to adjust brakes equally on each axle.
5. Apply and release brakes and observe slack adjusters. Both slacks on each axle should respond rapidly and in unison during application and release.
6. Drive vehicle at a low speed in a safe area and check for brake effectiveness prior to putting back in service.

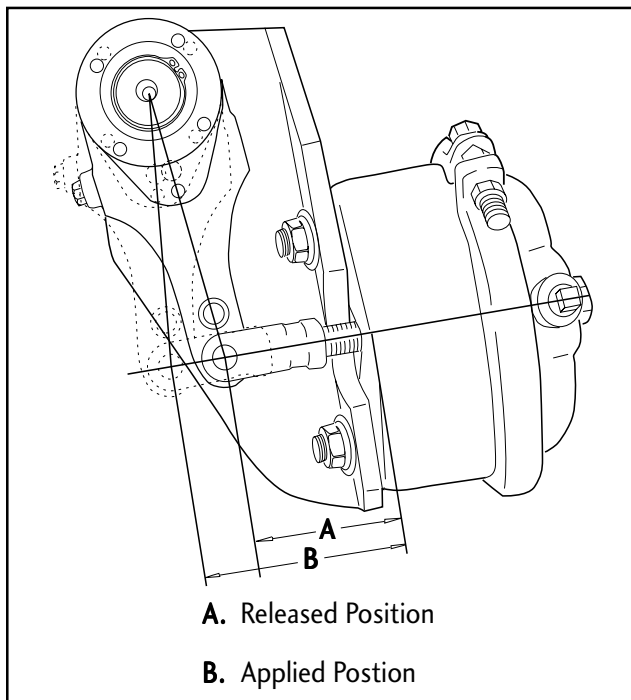


Figure 3

## BRAKE LUBRICATION

Lubricate the camshaft thru the grease fitting on the camshaft bracket with the chassis lube specified by the vehicle manufacturer. Lube once every six months or at every chassis lubrication.

## BRAKE RELINE

The life of the brake lining is dependent on many factors such as the material of the lining, type of operation the vehicle is used for, geographic terrain, maintenance practice of the shop, and the driver of the vehicle. If driving conditions require frequent braking, lining replacement will be required more often.

### FOR RIVET LINING

Reline when thickness of lining is 1/4 " at thinnest point, or 1/16" above rivet head.

### FOR CAST SHOES WITH BOLTED LININGS

Reline when lining is below wear indicator line or thickness is .31" at the thinnest point or 1/16" above bolt head.

## BRAKE OVERHAUL

As often as necessary to maintain satisfactory brake performance. When overhauling the brakes, provide equal service to both the left and right side of an axle.

# BRAKE DISASSEMBLY

## CAST SHOE & "P" SERIES

1. Insert sturdy lever between end of shoe and spider. Pry shoe away from cam until cam rollers can be removed. Repeat procedure for opposite shoe.
2. Unhook shoe return spring by pushing shoes together, allow tension on spring to be reduced.
3. Discard shoe return spring and replace with new at time of reassembly.
4. Remove snap ring from anchor pin and push anchor pin through.

**NOTE: Tap lightly with brass drift if anchor pin will not push out with finger.**

5. Remove brake shoe and place on floor. Repeat procedure for opposite shoe.

## STANDARD, XL, & XLII SERIES

1. Insert sturdy lever between end of shoe and spider. Pry shoe away from cam until cam rollers can be removed. Repeat procedure for opposite shoe.
2. Unhook shoe return spring by pushing shoes together, allow tension on spring to be reduced.
3. Discard shoe return spring and replace with new at time of reassembly.

### 4a. STANDARD & XL

Remove shoes by rotating the bottom shoe off the anchor pin to release the tension on the two retaining springs.


### 4b. XLII SERIES

Remove snap ring from anchor pin and push anchor pin through.

5. Remove the two retaining springs and discard.
6. Remove shoes from spider.

## SLACK ADJUSTER REMOVAL

1. Disconnect clevis from slack adjuster arm by removing the clevis pin or pins depending on type of slack adjuster.
2. Remove retaining ring and shims from splined end of camshaft.
3. Remove slack adjuster from the camshaft.

 **CAUTION: Do not hammer on slack adjuster to remove. Serious damage to the slack adjuster and/or the camshaft splines may result.**


## CAMSHAFT REMOVAL

1. Before removing camshaft check to see if cam bushings need replacement. **See Figure 4 on Page 12.**
2. Remove spacer from between slack adjuster and camshaft bracket.
3. Grasp camshaft at the camshaft head and pull in the outward direction to remove.
4. Clean and inspect camshaft splines and head.

## AIR CHAMBER/ CAMSHAFT BRACKET

### ASSMEBLY REMOVAL

1. Remove two nuts and washers that secure brake chamber to camshaft bracket.
2. Remove brake chamber and temporarily set it aside.

 **CAUTION: Do not let the air chamber hang by the air lines**

3. Remove four bracket mounting bolts and lock washers.
4. Remove bracket assembly from spider.



## BRAKE DISASSEMBLY (CONTINUED)

### SPIDER REMOVAL

1. Mark the position of the spider on the axle (L.H. or R.H.) and the orientation on the axle flange by making a reference mark on the spider and flange.

See Figure 4.

2. Remove the spider to axle mounting bolts.
3. Remove spider.

### DUST SHIELD REMOVAL

1. Mark dust shields (upper left, lower right, etc.) prior to removal.
2. Detach dust shield by removing the six cap screws using a 9/16" socket. Do not remove dust shield unless there is apparent damage.

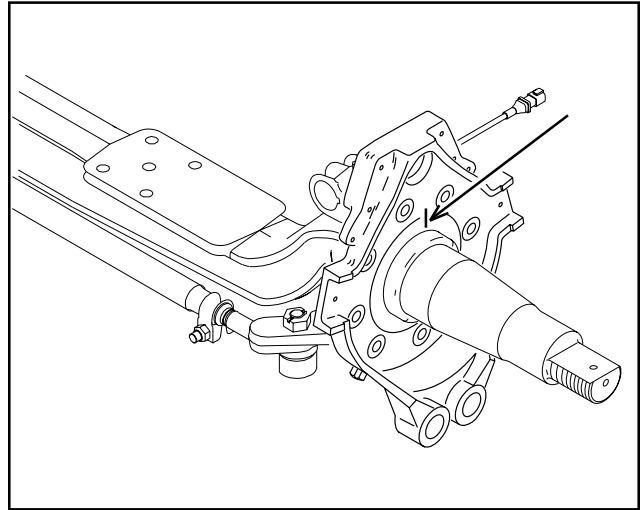


Figure 4

## INSPECTION OF PARTS

### AIR CHAMBER BRACKET ASSEMBLY

1. Check assembly for bent chamber bracket, broken welds, cracks, and correct alignment.
2. Inspect camshaft bushings for signs of wear. Bearing surfaces should be smooth and free of any pitting or fractures. Insert camshaft and measure looseness up and down side to side at both ends with a dial indicator. If more than .030" movement, replace bushings and/or camshaft. See Figure 5.

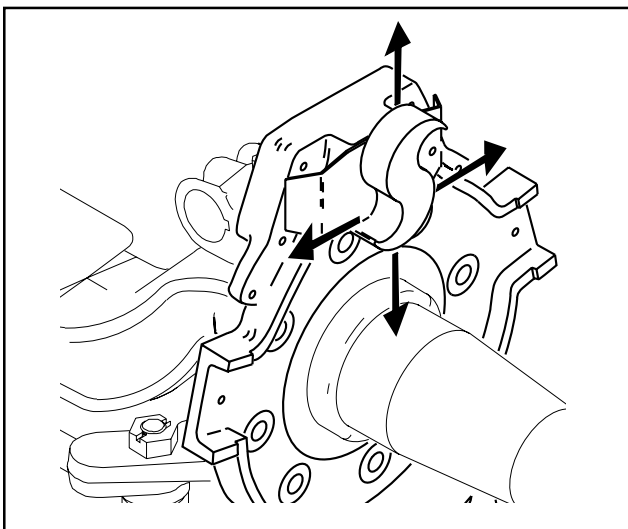


Figure 5

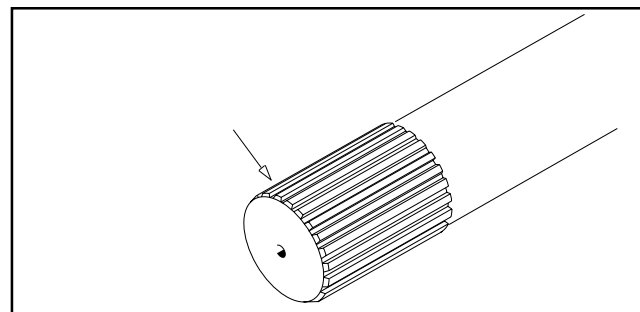


Figure 6

**NOTE:** If it is determined that a bushing requires replacement, both camshaft bushings and seals should be replaced. All CAST SHOE and P SERIES brakes have bronze cam bushings. The STANDARD, XL, and XLII SERIES brakes use nylon bushings with the bronze bushing as an option.

### CAMSHAFT

1. Inspect camshaft spline and body for chips and excessive deformation. Replace as necessary. See Figure 6.
2. Inspect cam head for cracks, and its roller surfaces for flat spots, brinelling, or ridges.

**NOTE:** Unusual wear patterns which may indicate an out-of-square condition. Replace damaged camshafts.

# INSPECTION OF PARTS

## SPIDER

1. Inspect for cracked or broken surfaces on the spider at the cam, anchor pins, and mounting bolt holes. Replace any spider with visible damage. Do not attempt to weld or repair the spiders. **See Figure 7.**

### XLII, P, & CAST SHOE SERIES

- 2a. Check the inside diameter of the anchor pin hole with bushing in place. Diameter must not exceed 1.282". Replace bushing if necessary.

### STANDARD & XL SERIES

- 2b. The anchor pins are staked into the spider and are not serviced separately. If the pins are loose or grooved more than .030 inch, the spider assembly must be replaced.

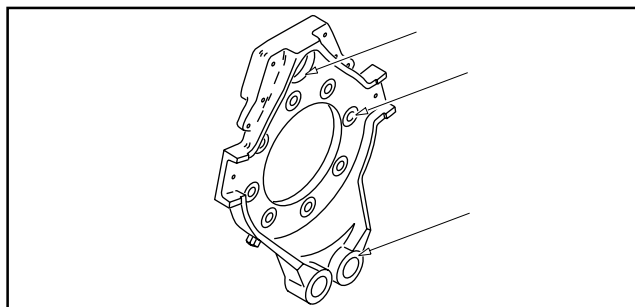


Figure 7

## ROLLERS AND ANCHOR PINS, BUSHINGS

1. Inspect rollers and anchor pins for flat spots, galling, broken or cracked surfaces. Replace as necessary. **See Figure 8.**

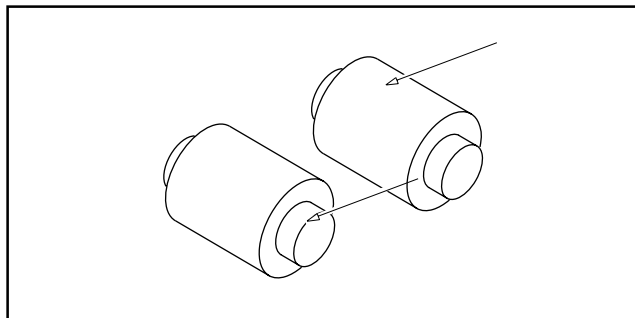


Figure 8

## SHOES AND LINING

### STANDARD, XL, XL II AND P SERIES

1. Check shoes for bent shoe ribs, cracks in shoe table welds or ribs, and elongated rivet holes. Replace shoes if any of these conditions exist. **See Figure 9.**
2. Measure the shoe span by loosely installing the anchor pin and cam roller in the appropriate ends of the shoe rib. If the distance from center of anchor pin to center of cam roller exceeds 12.76 inches replace shoe.
3. Check linings and replace when any of the following conditions exist: See page 21 for reline procedure.
  - A. Total lining thickness at thinnest point is 1/4" or less, or 1/16" above the rivets.
  - B. Linings are cracked or worn in an unusual or odd pattern. For example: lining wear tapered from side to side across the shoe table. Unusual wear pattern can indicate damage to foundation brake parts.
  - C. Rivet holes are elongated in lining or shoes.
  - D. Lining is oil soaked.
  - E. Linings can be moved by hand because of loose rivets.

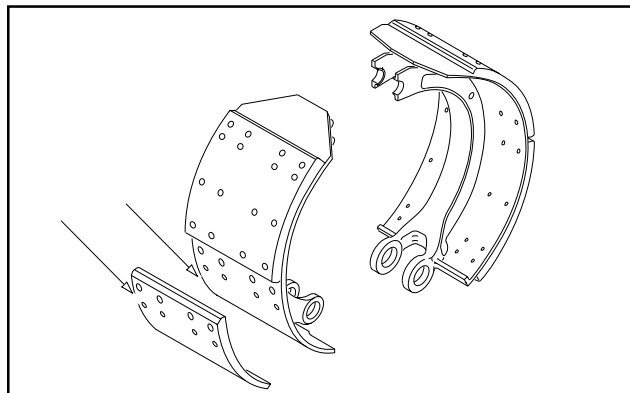


Figure 9

# INSPECTION OF PARTS (CONTINUED)

## SHOES AND LINING

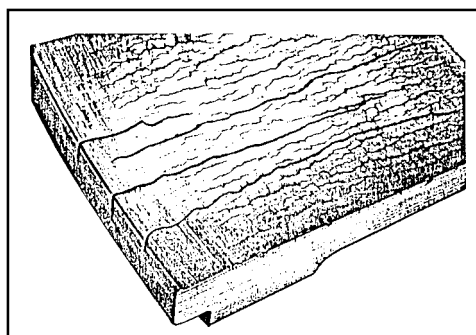
### CAST SHOE TYPE

1. Check shoes for cracks and elongated bolt holes.
2. Measure the shoe span by loosely installing the anchor pin and cam roller in the appropriate ends of the shoe rib. If the distance from center of anchor pin to center of cam roller exceeds 12.76 inches replace shoe.
3. Check linings, replace when any of the following conditions exist.
  - A. Total lining thickness at thinnest point is .31" or less than 1/16" above screw head. Also, if the material is worn beyond the wear groove on the side of the lining.
  - B. Linings are cracked or worn in an unusual or odd pattern. For example: lining wear tapered from side to side across the shoe table. Unusual wear pattern can indicate damage to foundation brake parts.
  - C. Screw holes are elongated.
  - D. Lining is oil soaked.
  - E. Lining can be moved by hand. (loose bolts)

## BRAKE DRUMS

1. Inspect drums for cracks, heat checking, glazing, grooving, severe out-of-round condition or bell mouthing **must not exceed .025 T.I.R. (Total Indicator Reading)** Replace any drums that are cracked. The drum should not be used if it exceeds the manufacturer's recommended maximum diameter stamped on the drum.
2. Measure the drum I.D. to be sure the maximum limit allowed (stamped on drum) has not been exceeded due to wear or machining.

**⚠ CAUTION: Drums displaying heat checks with a continuous length of four inches or more and extend around the edge of the drum should be replaced. See Figure 10.**



**Figure 10**

## TRANSIT BRAKE (CAST SHOE ONLY) DRUM/ LINING CROSS REFERENCE CHART

1. When installing new drums always use standard thickness lining. If used drums are rebored carefully measure inside diameter (in several places) of rebored drum.
2. Refer to the chart below for proper oversized lining required based on drum measurements.

**⚠ CAUTION: Never shim brake linings. See page 21, Reline Procedure, for more detail.**

LINING MAXIMUM THICKNESS (IN)	DRUM DIA. (IN) AT RELINE
.867" (Standard Thickness)	16.500" - New
.927" (1X Oversize)	16.620"
.987" (Premium Thickness)	Over 16.620" <b>⚠ CAUTION: Maximum discard diameter is 16.750"</b>



# BRAKE ASSEMBLY

## CHAMBER BRACKET ASSEMBLY

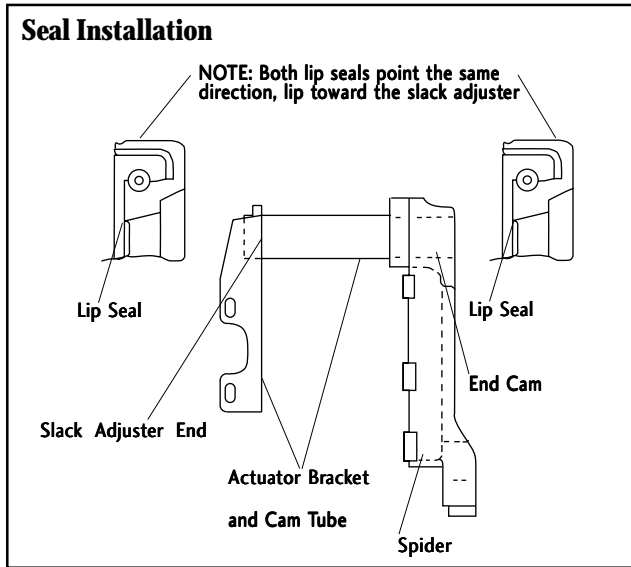


Figure 11

**CAUTION:** The lip of the grease seals must be installed correctly to prevent possible damage. The lip of the seal that is installed in the spider end must enter the opening first. The lip of the seal that is installed in the opposite end of the cam tube must enter last. See Figure 11. Install the chamber bracket and the cam tube assembly onto the spider using four cap screws and lockwashers. Torque to 70-80 Lb-Ft.

If removed, reinstall the dust shields. Tighten the six cap screws and lockwashers to 20-28 Lb-Ft of torque.

### SPIDER

1. Use a wire brush to remove heavy contamination from the spider mounting flange, knuckle, spider, brake drum exterior, and chamber mounting bracket.
2. Install the spider and chamber bracket assembly onto the axle flange. Be sure spider is properly oriented, as noted during disassembly. Tighten mounting fastener to manufacturer's specifications.

### CAMSHAFT

1. Prior to reassembly, verify the part number is correct there are L.H. and R.H. camshafts and they can not be interchanged. See Figure 12.

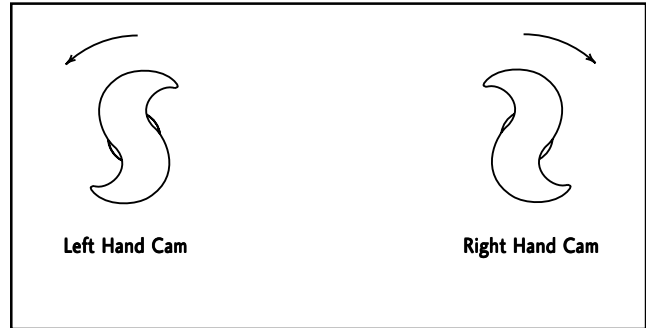


Figure 12

**CAUTION:** Left Hand and Right Hand does not establish which side of the vehicle the cam goes on. Left and right are used to identify the two different types of cams only.

2. Place steel spacer plate over splined end and slide next to cam head. (See brake components on pages 3-6)
3. Coat bushing, seals, journals and camshaft spline with light film of chassis lube.

**IMPORTANT:** Do not coat "S" cam head.

4. Carefully install camshaft through the chamber bracket tube, from spider end. Cam must rotate freely when turned by hand.

**IMPORTANT:** Be careful not to damage the grease seals.

### SPICER S-CAM BRAKE RETURN SPRINGS

Brake Series	Return Springs P/N & Color
Standard	165WJ110 Dark Blue
XL & Cast Shoe	165WJ115 White
XLII	165WJ129 Light Blue

## BRAKE ASSEMBLY (CONTINUED)

### BRAKE SHOE ASSEMBLY

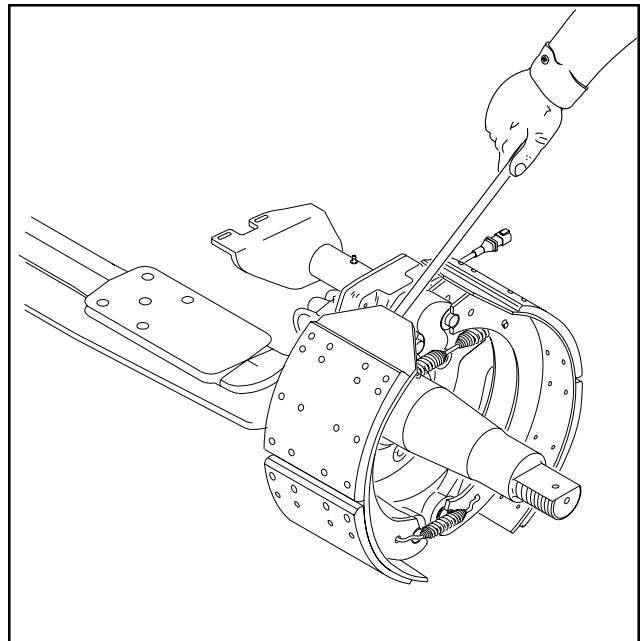
#### STANDARD, XL & XL II SERIES

1. Install new return spring pins:
  - A. **Standard Series**- Wireform pin installed in shoe ribs with mallet.
  - B. **XL Series**- 2 piece kit assembly consisting of inner pin and outer pin.
2. Apply a thin film of Lubriplate 630-A grease or its equivalent to the anchor pin.
3. Install new brake retaining springs in the anchor end of shoes. Place the top shoe onto the spider by engaging the open slots on the end with the retaining springs onto the anchor pin. Place opposite end of the shoe against the S-cam. Swing the lower shoe, with springs attached, back until slots in the shoe engage the anchor pin. Rotate the shoe toward the S-cam. Lower shoe may require support while completing assembly.
- 4a. **Standard Series**- Utilize leg on shoe return spring to aid in assembly. Place the one hook of the brake shoe return spring onto the return spring pin. Hold shoes firmly against the S-cam. Push the other hook of the brake shoe return spring over the opposite return spring pin until it snaps in place.
- 4b. **XL/XL II Series**- place the one hook of the brake shoe return spring onto the return spring pin located between the shoe ribs. Hold both shoes against the S-cam head. Push the other hook of the return spring over the opposite shoe spring pin until it snaps in place.
5. Apply a thin film of Lubriplate 630-A grease or its equivalent to the cam roller journal, and the roller side only. Do not put grease on the end of the roller which contacts the cam head.
6. Insert sturdy lever between end of shoe and the return spring pin. **See Figure 13.** Pry away from the cam until cam rollers can be installed between

the S-cam and the slots in the end of the brake shoe. Make sure the cam rollers are in the lowest position on the cam. Repeat procedure for opposite side.

#### CAST SHOE SERIES

1. Apply a thin film of Lubriplate 630-A grease or its equivalent to the anchor pin.
2. Place snap ring on anchor pin end with grease fitting. Place thin spacer onto anchor pin.
3. Align anchor pin end of cast shoe with spider bore.
4. Install anchor pin through backside of shoe and spider. Repeat procedure for opposite shoe.



**Figure 13**

5. Place thin spacer onto opposite side of anchor pins and install snap rings.
6. Hook shoe return spring by pushing shoes together. The cast shoe does not have a separate return spring pin. The spring hook-up feature is designed into the shoe casting.
7. Insert sturdy lever between end of shoe and spider. Pry shoe away from cam until cam rollers can be installed. Repeat procedure for opposite side. **See Figure 13.**

## BRAKE ASSEMBLY (CONTINUED)

### “P” SERIES

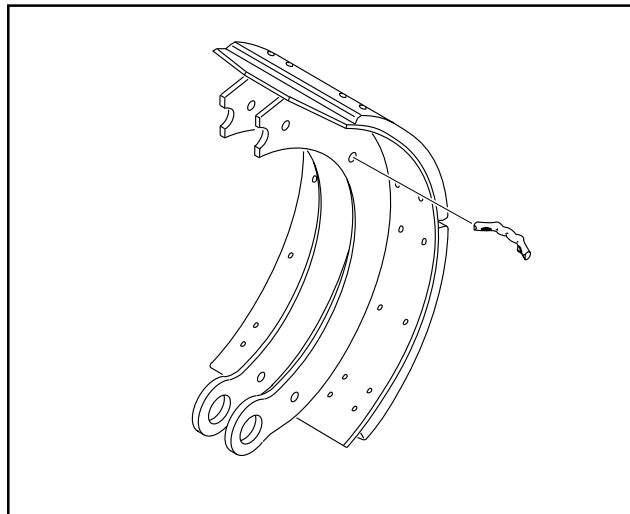
1. Install new return spring pins. **See Figure 14.**
2. Align lower end of fabricated shoe with spider bore.
3. Place snap ring on anchor pin end with grease fitting. Place thin spacer onto anchor pin.
4. Install anchor pin through backside of shoe and spider.
5. Apply a thin film of Lubriplate 630-A grease or its equivalent to the anchor pin.
6. Place thin spacer onto opposite side of anchor pin and install snap ring.
7. Hook shoe return spring by pushing shoes together.
8. Insert sturdy lever between end of shoe and spider. Pry shoe away from cam until cam rollers can be installed. Repeat procedure for opposite side.

### SLACK ADJUSTER ASSEMBLY

1. Reinstall thick camshaft flatwasher.
2. Install new slack adjuster, shims, and a new snap ring (In that sequence) into the splined end of the camshaft.
3. Adjust camshaft end play of the camshaft to between .005" and .045" by using the appropriate number of shims. Make sure the snap ring is seated into the groove at the end of the splined camshaft.

### BRAKE LUBRICATION

1. Lubricate the camshaft bushings by filling the camshaft tube with lube through the zerk fitting provided. Fill until grease is forced out in the area of the slack adjuster. Grease should not appear at the cam head end. If it does, the seal has not been properly installed, or the old seals should be replaced.
2. Reinstall brake drums and wheels. Torque and adjust wheel bearings to manufacturer's specifications.



**Figure 14**

**NOTE: Due to the many combinations of slack adjusters and brake chambers, follow vehicle manufacturer's specifications and procedures for assembly and final adjustment.**

3. Spin the wheel slowly and adjust the slack adjuster until wheel will no longer turn. Back off slack adjuster just enough for wheel to spin freely. Be sure to adjust brakes equally on each axle.
4. Apply the release brakes and observe slack adjusters. Both slacks on each axle should respond rapidly and in unison during application and release.
5. Drive vehicle at a low speed in a safe area and check for brake effectiveness prior to putting back in service.

# FOUNDATION BRAKE TROUBLESHOOTING CHART

SYMPTOM	CAUSE	REMEDY
1. Degraded brake performance.	A. Too much push rod free travel.	A. Adjust brake.
	B. Severely glazed or worn out linings.	B. Deglaze linings or replace.
	C. Grease or oil on linings.	C. Replace linings.
	D. Worn, seared, heat checked, cracked drums.	D. Replace part.
	E. Push rod length too long.	E. Adjust clevice, shorten push rod length
	F. Air chamber in wrong position.	F. Reposition.
	G. Broken or bent parts.	G. Replace part.
	H. Flat spots on cam or rollers.	H. Replace flat-spotted parts.
2. Slow brake application.	A. Cam shaft bushings binding.	A. Clean and lubricate. Check for seal leakage.
3. Slow brake release.	A. Binding cam shaft and bushing.	A. Clean and lubricate.
	B. Weak or broken shoe return spring.	B. Replace part.
	C. Flat spotted cam or rollers.	C. Replace flat-spotted parts.
4. Grabbing or pulling.	A. Grease, oil, or dirt on linings.	A. Replace lining.
	B. Glazed linings.	B. Deglaze lining or replace.
	C. Brake linings not a balanced set, different friction codes, or lining brand.	C. Replace linings.
	D. Loose or broken linings.	D. Replace linings.
	E. Brake drum out-of-round.	E. Turn, per manufacturer's specifications.
	F. Defective brake drum.	F. Replace part.
	G. Clevis pin or camshaft binding at one or more wheels.	G. Clean and lubricate.
	H. Defective slack adjuster.	H. Replace part.
	I. Uneven brake adjustment (side to side).	I. Adjust brakes.
	J. Broken or bent parts.	J. Replace part.
	K. Loose spider or drum mounting bolts.	K. Inspect and replace as necessary.
	L. Different air chamber size or slack adjuster length (side to side).	L. Use same size and type both ends of the axle.

# BRAKE SHOE & LINING TROUBLESHOOTING CHART

SYMPTOM	CAUSE	REMEDY
1. Poor lining to drum contact.	<ul style="list-style-type: none"> <li>A. Bell-mouth drum.</li> <li>B. Bent brake spider.</li> <li>C. Bent or stretched brake shoe.</li> <li>D. Undersize linings.</li> <li>E. Loose wheel bearing.</li> <li>F. Improper lining grind.</li> </ul>	<ul style="list-style-type: none"> <li>A. Replace part.</li> <li>B. Replace part.</li> <li>C. Replace part.</li> <li>D. Replace linings.</li> <li>E. Correct as required.</li> <li>F. Re grind linings to drum radius minus .015"</li> </ul>
2. Linings tapered across width.	<ul style="list-style-type: none"> <li>A. Bell-mouth drum.</li> <li>B. Bent brake shoe.</li> <li>C. Bent brake spider.</li> <li>D. Loose wheel bearings.</li> </ul>	<ul style="list-style-type: none"> <li>A. Replace parts.</li> <li>B. Replace parts.</li> <li>C. Replace part.</li> <li>D. Correct as required.</li> </ul>
3. Unequal wear on same brake.	<ul style="list-style-type: none"> <li>A. Mismatched lining friction codes.</li> <li>B. Stretched shoe.</li> <li>C. Flat spots on cam or roller.</li> <li>D. Worn anchor pin.</li> <li>E. Worn camshaft or bushings.</li> </ul>	<ul style="list-style-type: none"> <li>A. Replace linings.</li> <li>B. Replace parts.</li> <li>C. Replace flat-spotted parts.</li> <li>D. Correct as required.</li> <li>E. Replace part.</li> </ul>
4. Unequal wear side to side brakes, same axle.	<ul style="list-style-type: none"> <li>A. Mismatched lining friction codes.</li> <li>B. Seized or binding camshaft.</li> <li>C. Brake drum surface in poor condition.</li> <li>D. Loose wheel bearing.</li> <li>E. Relining one brake.</li> </ul>	<ul style="list-style-type: none"> <li>A. Replace linings.</li> <li>B. Clean and lubricate.</li> <li>C. Replace or turn I.D.</li> <li>D. Correct as required.</li> <li>E. Reline both brakes together.</li> </ul>
5. Wear on edge of lining.	<ul style="list-style-type: none"> <li>A. Wrong width lining.</li> <li>B. Holes improperly drilled in lining.</li> <li>C. Wrong drum, or improperly machined.</li> <li>D. Loose wheel bearing</li> <li>E. Improper wheel bearing or cone.</li> <li>F. Bent brake shoe.</li> <li>G. Bent brake spider.</li> <li>H. Worn axle spindle.</li> </ul>	<ul style="list-style-type: none"> <li>A. Replace linings.</li> <li>B. Replace linings.</li> <li>C. Replace or turn I.D.</li> <li>D. Correct as required.</li> <li>E. Correct as required.</li> <li>F. Replace part.</li> <li>G. Replace part.</li> <li>H. Correct as required.</li> </ul>
6. Glazed linings (hard & shiny).	<ul style="list-style-type: none"> <li>A. Overheating, due to unbalanced braking system.</li> <li>B. Wrong type linings for service involved.</li> </ul>	<ul style="list-style-type: none"> <li>A. Correct as required.</li> <li>B. Replace linings.</li> </ul>

## BRAKE SHOE AND LINING TROUBLESHOOTING CHART

7. Scored or grooved linings and drum.	<p><b>A.</b> Scored or worn drum, not machined at reline.</p> <p><b>B.</b> Abrasive material between lining and drum.</p>	<p><b>A.</b> Replace or re-machine.</p> <p><b>B.</b> Clean, remove dirt and debris.</p>
8. Loose lining.	<p><b>A.</b> Improper size rivets (too long, too short, improper diameter).</p> <p><b>B.</b> Improper crimping of rivet.</p> <p><b>C.</b> Enlarged rivet holes in shoe.</p> <p><b>D.</b> Incorrect lining hole size or counter bore depth.</p> <p><b>E.</b> Rust build up on shoe table.</p>	<p><b>A.</b> Re-rivet.</p> <p><b>B.</b> Re-rivet.</p> <p><b>C.</b> Replace part.</p> <p><b>D.</b> Replace linings.</p> <p><b>E.</b> Clean, remove rust and paint shoe.</p>
9. Cracked lining at rivet holes.	<p><b>A.</b> Wrong type rivets.</p> <p><b>B.</b> Rivets not properly crimped.</p> <p><b>C.</b> Dirt or rust on shoe table.</p> <p><b>D.</b> Wrong size lining counter bore.</p>	<p><b>A.</b> Replace part.</p> <p><b>B.</b> Replace lining.</p> <p><b>C.</b> Clean, remove dirt and debris.</p> <p><b>D.</b> Replace linings.</p>
10. Elongated rivet holes.	<p><b>A.</b> Loose rivets.</p>	<p><b>A.</b> Replace shoe and lining.</p>

## BRAKE DRUM TROUBLESHOOTING CHART

SYMPTOM	CAUSE	REMEDY
1. Brake drum heat checked.	<p><b>A.</b> Out round brake drum.</p> <p><b>B.</b> Eccentric mounting of drum.</p> <p><b>C.</b> Loose wheel bearing.</p> <p><b>D.</b> Glazed linings.</p> <p><b>E.</b> Improper friction materials for duty cycle of vehicle.</p> <p><b>F.</b> Overworked brake.</p> <p><b>G.</b> Driver abuse.</p> <p><b>H.</b> Wrong drum, too light.</p>	<p><b>A.</b> Turn, per manufacturer's specifications.</p> <p><b>B.</b> Inspect wheel and drum and replace defective part.</p> <p><b>C.</b> Correct as required.</p> <p><b>D.</b> Replace linings.</p> <p><b>E.</b> Consult vehicle manufacturer.</p> <p><b>F.</b> Check proper brake balance.</p> <p><b>G.</b> Correct as required.</p> <p><b>H.</b> Replace part.</p>
2. Excessive scoring of drum.	<p><b>A.</b> Defective brake lining.</p> <p><b>B.</b> Abrasive material between lining and drum.</p> <p><b>C.</b> Soft drum.</p> <p><b>D.</b> Excessive lining wear, rivets contacting drum.</p> <p><b>E.</b> Drum not turned at last reline.</p> <p><b>F.</b> Build up of abrasives in rivet holes.</p>	<p><b>A.</b> Replace linings.</p> <p><b>B.</b> Clean, remove dirt and debris.</p> <p><b>C.</b> Check hardness on flange.</p> <p><b>D.</b> Replace lining.</p> <p><b>E.</b> Turn per manufacturer's specifications.</p> <p><b>F.</b> Blow out debris.</p>



## RELINE PROCEDURE

### Bolts/Rivets Removal

When removing bolts/rivets from the brake shoes, be careful to avoid doing any damage to the holes in the shoe. Do not use a chisel to shear them off. The force will elongate the bolt/rivet holes. Neglecting any elongated holes may result in a loose fitting installation. If holes are burred, they should be filed down flush with the shoe table.

### Cleaning the Shoe

Rust often develops on the surface of the shoe table under the brake lining or blocks. During every reline job, shoe tables should be cleaned thoroughly. The best procedure is to steam clean the entire shoe or put it into a degreaser.

After cleaning the shoe, the shoe should be scraped clean of rust and scale. Any burrs or nicks should be filed smooth. At the same time, the entire shoe should be examined to see if it is worn or bent.

### Shoe Inspection

The shoe should be either reconditioned or discarded. It is also necessary to check for flat spots on the shoe that can be caused by cleaning away the rust from the area that was under the block previously. This can cause a mismatch of shoe and lining arcs. After the shoe is cleaned and inspected, it should be given a coating of rust preventative paint. Treatment of a new, unpainted shoe is also suggested to prevent the initial rusting problem.

### Lining Installation

**IMPORTANT: Never shim the brake linings.** Brake noise may result because of cracked and/or loose lining since a tight installation is not possible with shims. The inside surface of the correct arc to match the shoe table, and the rivet/bolt holes in the linings will only line up with holes in the shoes when they are in direct contact. Prior to riveting/bolting be sure the holes in the lining blocks and the shoes are exactly matched.

The sequence of riveting/bolting should be such that the center of the block is attached first and then the ends. **See page 22 for bolting sequence.**

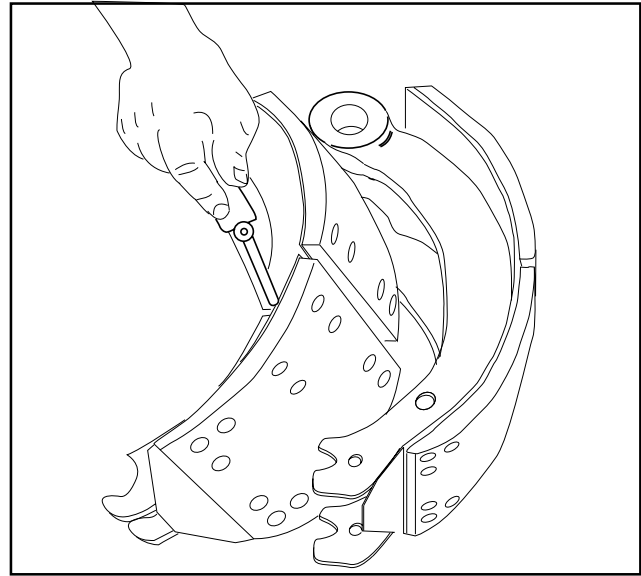


Figure 16

The installation should be checked by attempting to insert a .006" feeler gage between the lining and shoe table. It should not be possible to insert the feeler gage anywhere along the edge. **See Figure 16.** The only exception is at each end and beyond the last row of rivets/bolts. A slightly larger clearance may exist in these areas.

### Riveting Application

Some brake failures result from the use of rivets which are too short, too long, or the wrong diameter. Incorrect setting of the riveting machine may induce other types of failures.

The solid portion of the rivet should end just at the inner surface of the shoe. The hollow portion of the rivet should extend past the inner surface of the shoe. The proper size rivet must be used to completely fill the hole.

### USE ONLY 10-8<sup>1/2</sup> RIVETS

Brass plated steel rivets are recommended. The riveting machine must be adjusted so that the roll of the rivet is complete, but the rivet should not split. Always use a roll set, never a star set, when riveting brake linings. A star set does not compress the rivet and expand it to fill the hole. Consequently, the lining may work loose in service.

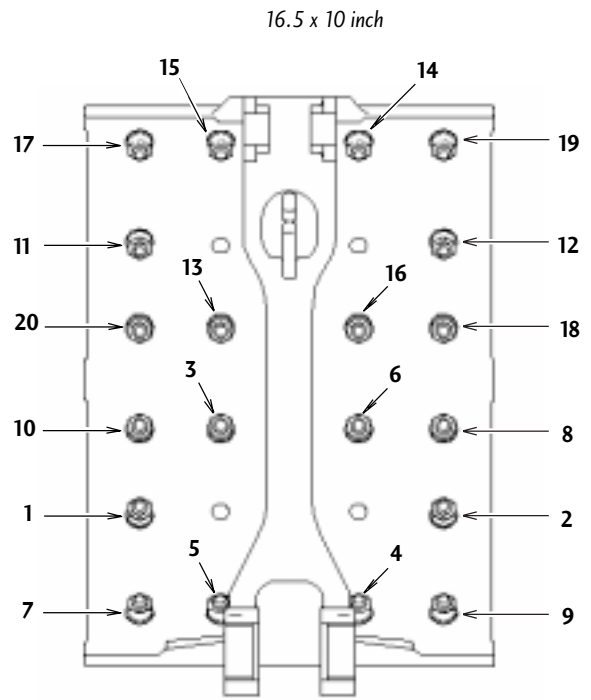
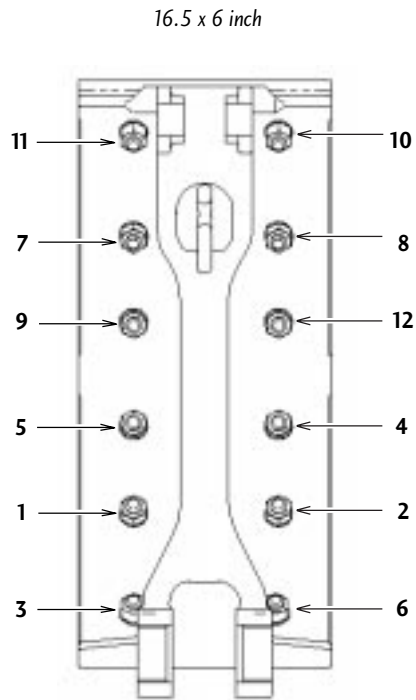
# RELINE PROCEDURE

## Bolting Application

Use 3/8 inch diameter copper alloy bolts.

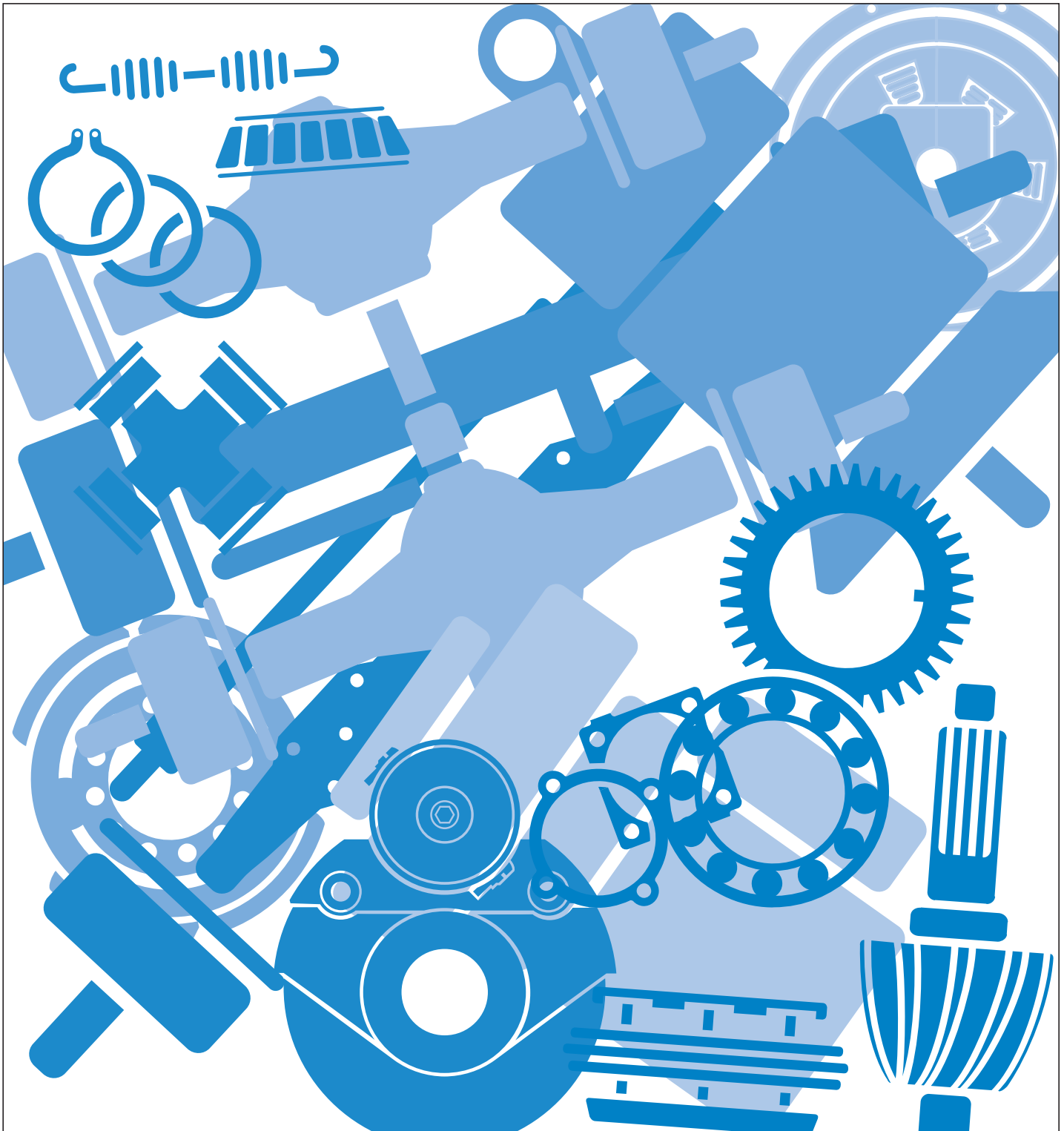
Torque bolts to 15-17 Lb-Ft (20-23 N-m)

Follow the sequence below for the bolt application only.









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