Bendix® ES™ Foundation Drum Brake

Formerly BW7258

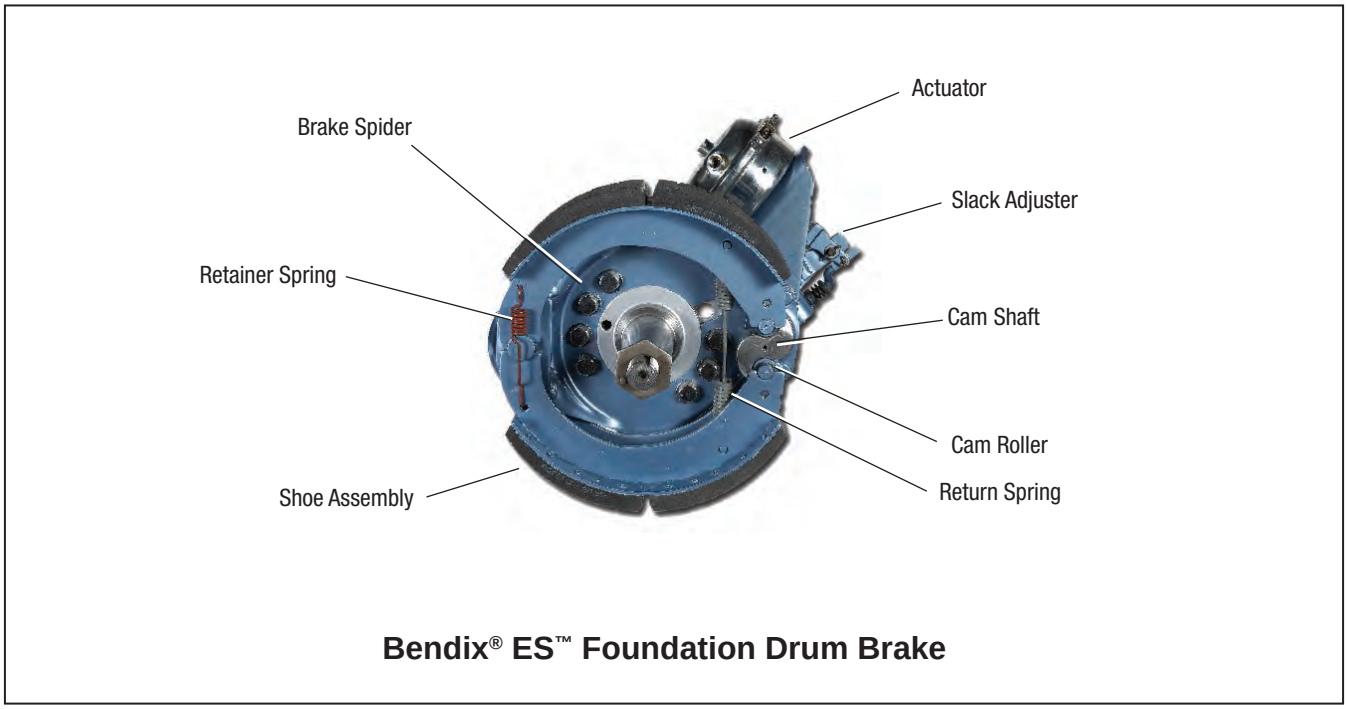

Figure 1 – Bendix® ES™ Foundation Drum Brake

DESCRIPTION

The Bendix® ES™ foundation drum brake is used in various applications on axles of commercial vehicles, providing the service and parking brake function.

With all types of drum brakes, friction forces are generated by the internal brake shoes being pressed against the inner surfaces of the brake drum by the force generated by a cam. Due to their almost completely sealed housing, the brake shoes are well protected against corrosive influences (water, salt, and dust) and dirt (sand, stones, and mud), even when driving on rough terrain.

With the S-cam brake, the cam and camshaft are rotated as a result of the force of the brake actuator acting on the slack adjuster. The brake shoes with brake linings are thereby pressed against the brake drums.

PURPOSE OF THIS MANUAL

This document is intended to act as a source of maintenance information to those involved in servicing Bendix® brakes.

ADDITIONAL SUPPORT

For additional service information contact the Bendix Tech Team online at techteam@bendix.com, or by calling 1-800-AIR-BRAKE (1-800-247-2725), option 2. Tech Team members are available Monday through Thursday, 8:00 a.m. to 6:00 p.m. and Friday, 8:00 a.m. to 5:00 p.m. ET.

Safety Guidelines/Warnings

GENERAL SAFETY GUIDELINES

WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following guidelines should be observed AT ALL TIMES:

- ▲Park the vehicle on a level surface, apply the parking brakes and always block the wheels. Always wear personal protection equipment.
- ▲Stop the engine and remove the ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, EXTREME CAUTION should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically-charged components.
- ▲Do not attempt to install, remove, disassemble or assemble a component until you have read, and thoroughly understand, the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.
- ▲If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning ANY work on the vehicle. If the vehicle is equipped with a Bendix® AD-IS® air dryer system, a Bendix® DRM™ dryer reservoir module, a Bendix® AD-9si®, AD-HF®, or AD-HF®i air dryer, be sure to drain the purge reservoir.
- ▲Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.
- ▲Never exceed manufacturer's recommended pressures.
- ▲Never connect or disconnect a hose or line containing pressure; it may whip and/or cause hazardous airborne dust and dirt particles. Wear eye protection. Slowly open connections with care, and verify that no pressure is present. Never remove a component or plug unless you are certain all system pressure has been depleted.
- ▲Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, wiring, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.
- ▲Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.
- ▲Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.
- ▲For vehicles with Automatic Traction Control (ATC), the ATC function must be disabled (ATC indicator lamp should be ON) prior to performing any vehicle maintenance where one or more wheels on a drive axle are lifted off the ground and moving.
- ▲The power MUST be temporarily disconnected from the radar sensor whenever any tests USING A DYNAMOMETER are conducted on a vehicle equipped with a Bendix® Wingman® system.
- ▲You should consult the vehicle manufacturer's operating and service manuals, and any related literature, in conjunction with the Guidelines above.

⚠WARNING: Not all wheels and valve stems are compatible with Bendix® Air Disc Brakes. Use only wheels and valve stems approved by the vehicle manufacturer to avoid the risk of valve stem shear and other compatibility issues.

⚠ WARNING: AVOID CREATING DUST. POSSIBLE CANCER AND LUNG DISEASE HAZARD.

While Bendix Commercial Vehicle Systems LLC does not offer asbestos brake linings, the long-term affects of some non-asbestos fibers have not been determined. Current Occupational Safety and Health Administration (OSHA) Regulations cover exposure levels to some components of non-asbestos linings, but not all. The following precautions must be used when handling these materials.

Avoid creating dust. Compressed air or dry brushing must never be used for cleaning brake assemblies or the work area.

- ▲ Bendix recommends that workers doing brake work must take steps to minimize exposure to airborne brake lining particles. Proper procedures to reduce exposure include working in a well-ventilated area, segregation of areas where brake work is done, use of local filtered ventilation systems or use of enclosed cells with filtered vacuums. Respirators approved by the Mine Safety and Health Administration (MSHA) or National Institute for Occupational Safety and Health (NIOSH) should be worn at all times during brake servicing.
- ▲ Workers must wash before eating, drinking, or smoking; shower after working, and should not wear work clothes home. Work clothes should be vacuumed and laundered separately without shaking.
- ▲ OSHA & EPA Regulations regarding testing, disposal of waste, and methods of reducing exposure for asbestos are set forth in 29 & 40 Code of Federal Regulations §1910.1001 & 61.150, respectively. These Regulations provide valuable information which can be utilized to reduce exposure to airborne particles.
- ▲ Safety Data Sheets on this product, as required by OSHA, are available from Bendix. Call 1-800-247-2725 and speak to the Tech Team or email techteam@bendix.com.

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Model Coverage

The service procedures and specifications in this publication cover the Bendix® brake models listed in Table 1. The basic instructions cover all 15", 16.5", and 18" brake types and sizes, unless specified otherwise. A breakdown of Bendix brake model identification is provided in *Figure 2*.

Bendix® ES™ Brake Model	Size		Configuration			Applications
	in.	mm	Shoe	Spider	Anchor	
ES-150-04D	15.0 x 4	381 x 102	Fabricated	Cast	SAP	Steer Axles
ES-150-04L	15.0 x 4	381 x 102	Fabricated	Fabricated	SAP	Steer Axles
ES-150-08D	15.0 x 8.63	381 x 219	Fabricated	Cast	SAP	Drive Axles
ES-165-05D	16.5 x 5	419 x 127	Fabricated	Cast	SAP	Steer
ES-165-05L	16.5 x 5	419 x 127	Fabricated	Fabricated	SAP	Steer
ES-165-05X	16.5 x 5	419 x 127	Fabricated	Fabricated	SAP	Steer
ES-165-06D	16.5 x 6	419 x 152	Fabricated	Cast	SAP	Steer
ES-165-06L	16.5 x 6	419 x 152	Fabricated	Fabricated	SAP	Steer
ES-165-06X	16.5 x 6	419 x 127	Fabricated	Fabricated	SAP	Steer
ES-165-07D	16.5 x 7	419 x 178	Fabricated	Cast	SAP	Steer or Drive Axles
ES-165-07H	16.5 x 7	419 x 178	Cast	Heavy Cast	DAP	On/Off Hwy. Drive Axles
ES-165-07L	16.5 x 7	419 x 178	Fabricated	Fabricated	SAP	Steer or Drive Axles
ES-165-07M	16.5 x 7	419 x 178	Fabricated	Heavy Cast	DAP	On/Off Hwy. Drive Axles
ES-165-07X	16.5 x 7	419 x 178	Fabricated	Fabricated	DAP	Steer or Drive Axles
ES-165-07Z	16.5 x 7	419 x 178	Fabricated	Fabricated	DAP	Steer or Drive Axles
ES-165-08L	16.5 x 8.63	419 x 219	Fabricated	Fabricated	SAP	Drive Axles
ES-165-08D	16.5 x 8.63	419 x 219	Fabricated	Cast	SAP	Drive Axles
ES-165-08X	16.5 x 8.63	419 x 219	Fabricated	Fabricated	SAP	Drive Axles
ES-165-08Z	16.5 x 8.63	419 x 219	Fabricated	Fabricated	SAP	Drive Axles

Table 1 – Bendix® Brake Models and Specifications

Model Coverage

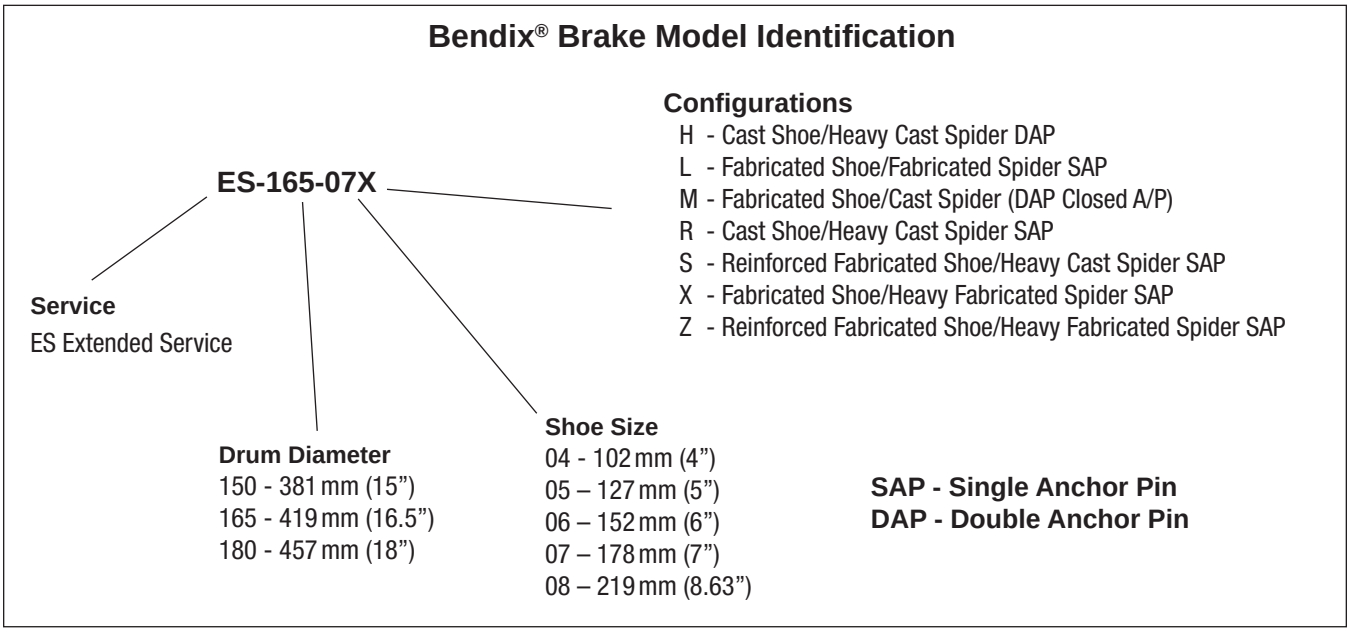


Figure 2 – Bendix® Brake Model Identification

Parts Nomenclature

General parts nomenclature for Bendix® brake models are identified in Figure 3. Exploded views of various brake models are shown for part identification.

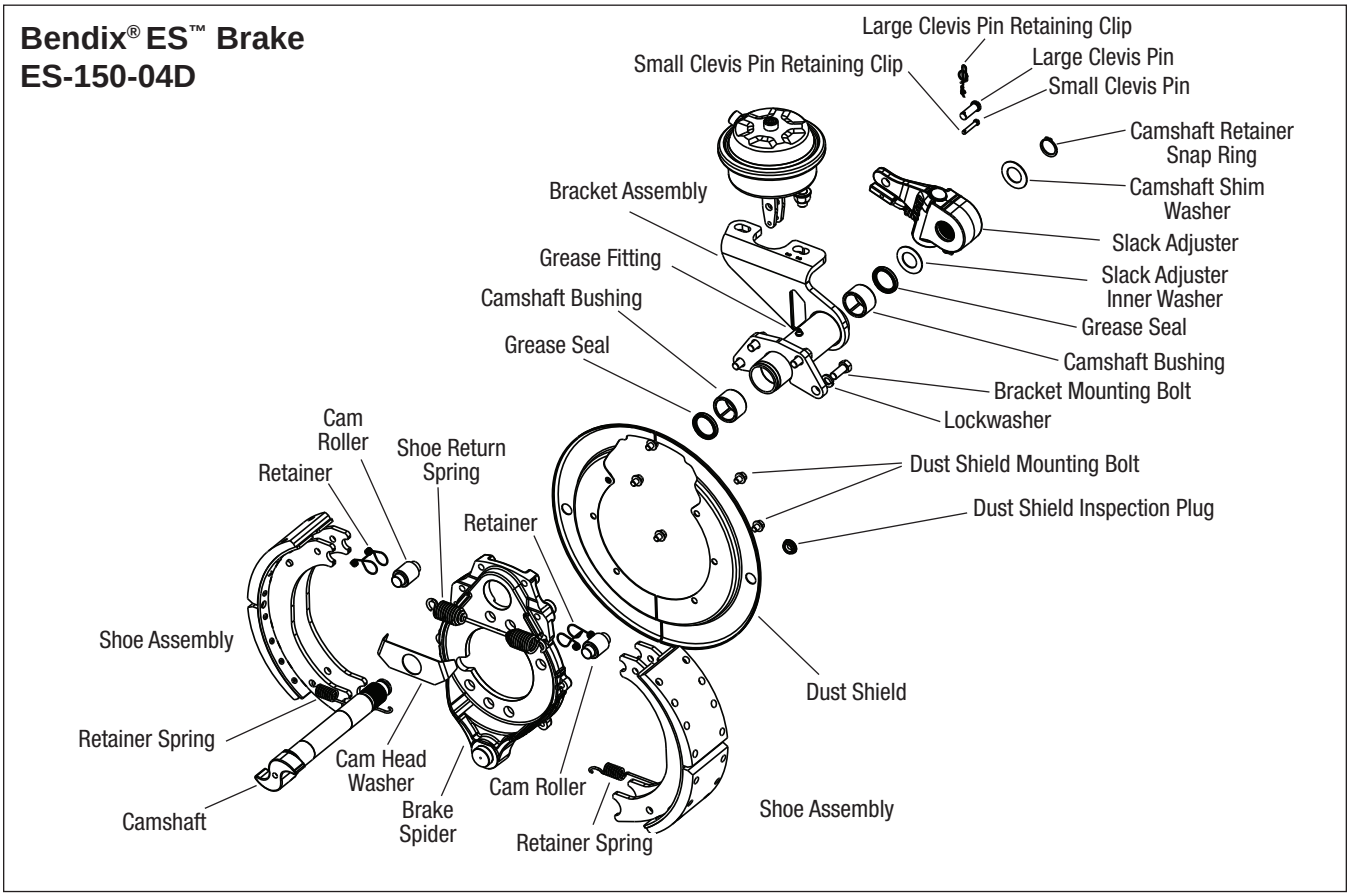


Figure 3 – Brake Part Nomenclature

Parts Nomenclature

Bendix® ES™ Brake
ES-150-04L Brake

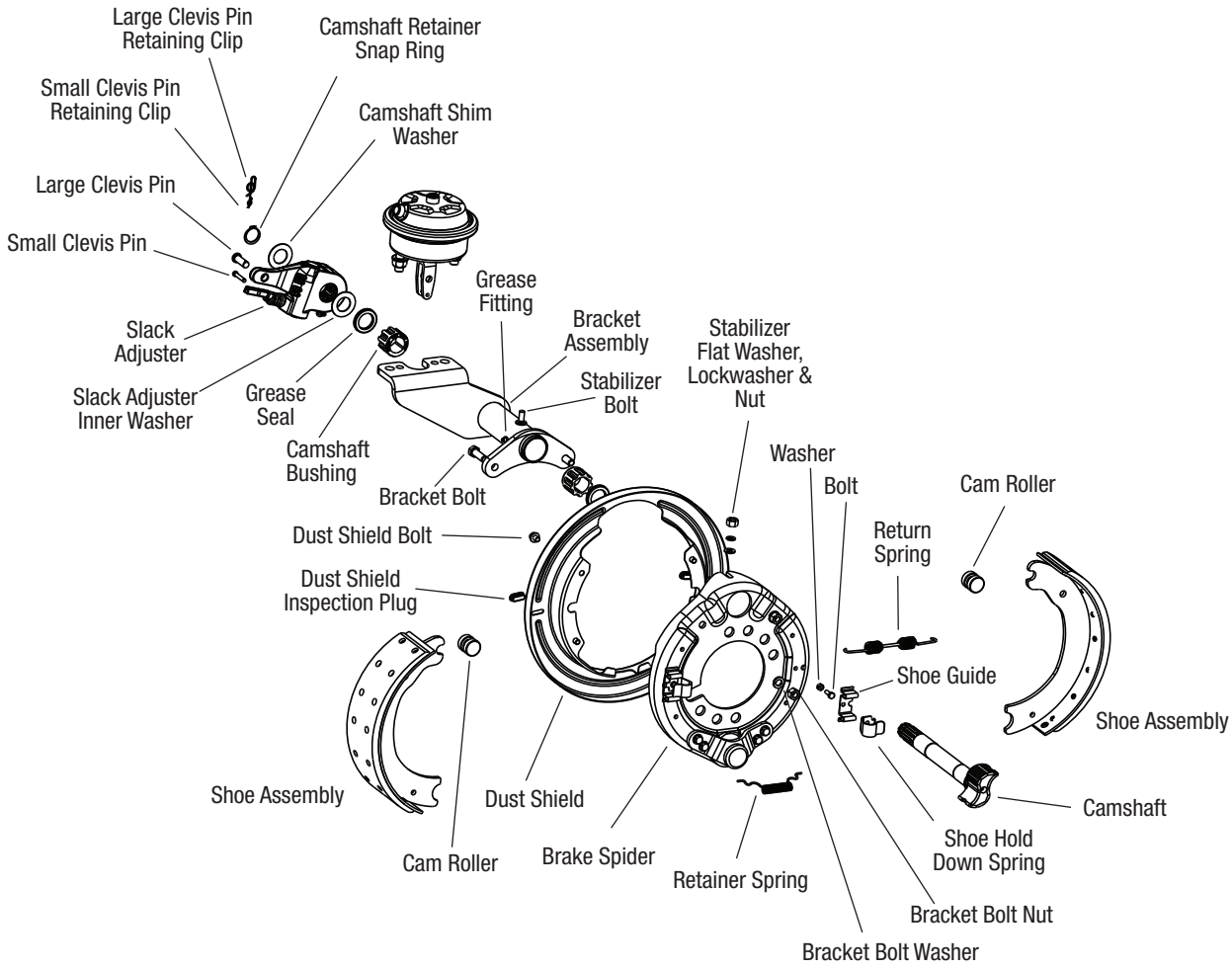
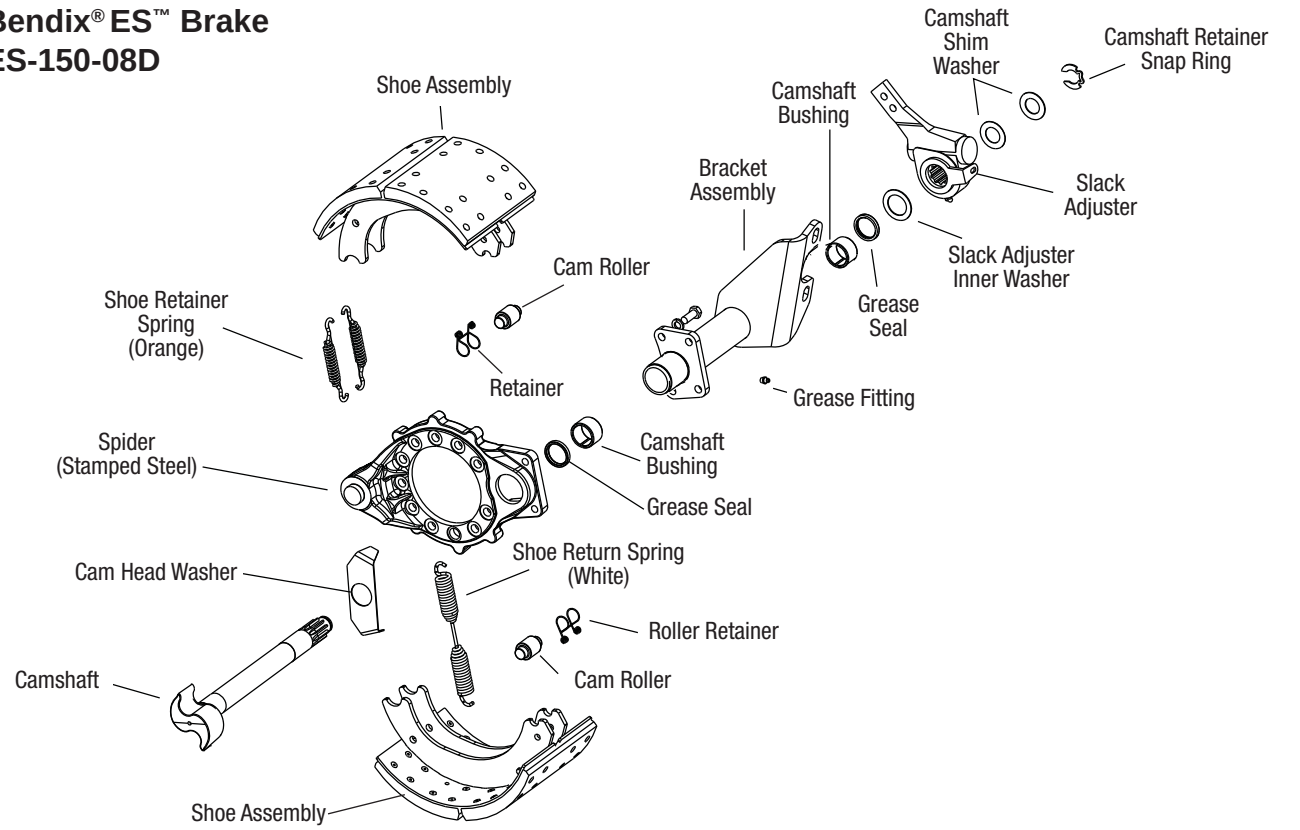


Figure 3 – Brake Part Nomenclature, Continued

Parts Nomenclature

Bendix® ES™ Brake
ES-150-08D



Bendix ES Brakes
ES-165-05D
ES-165-05L
ES-165-05X
ES-165-06D
ES-165-06L
ES-165-06X
ES-165-07D
ES-165-07L
ES-165-07X
ES-165-07Z
ES-165-08D
ES-165-08X
ES-165-08Z

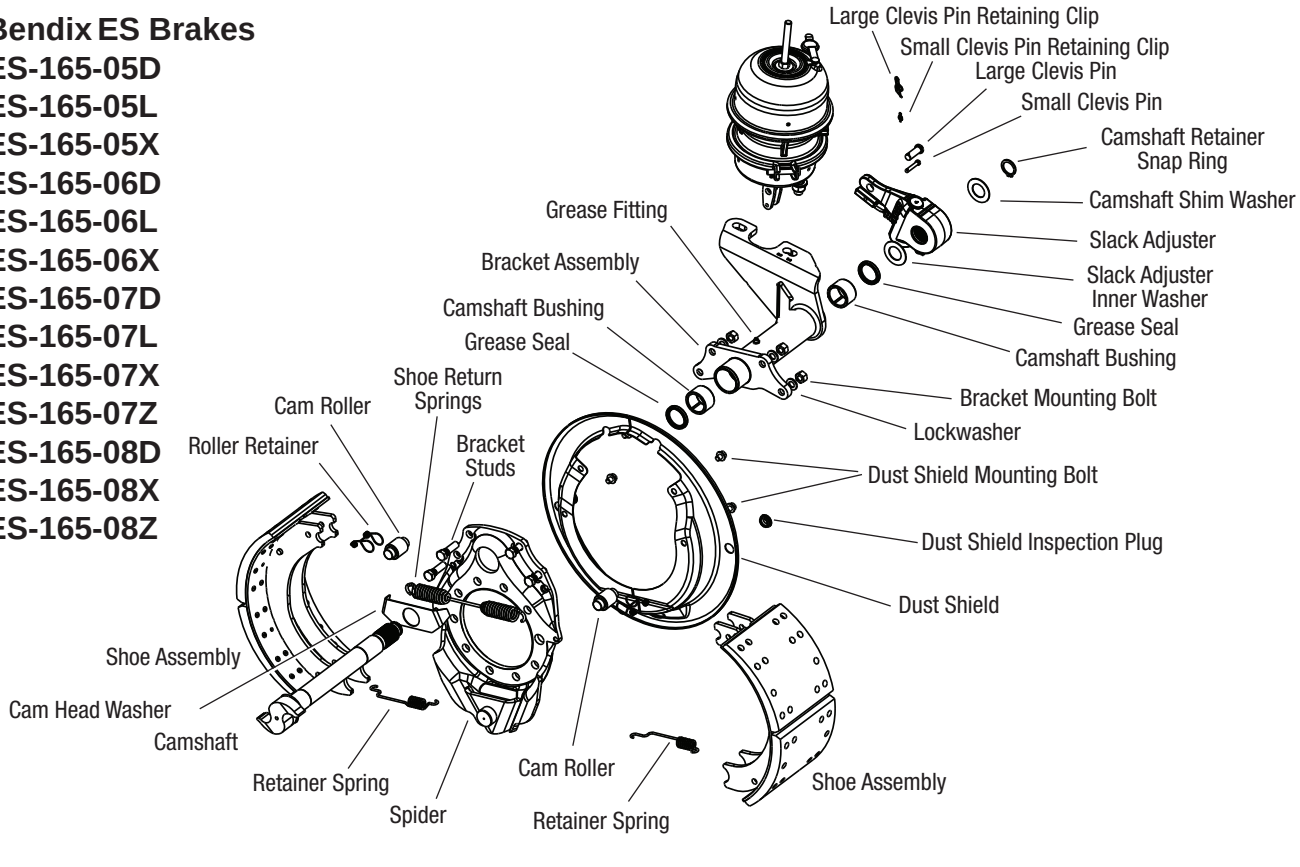
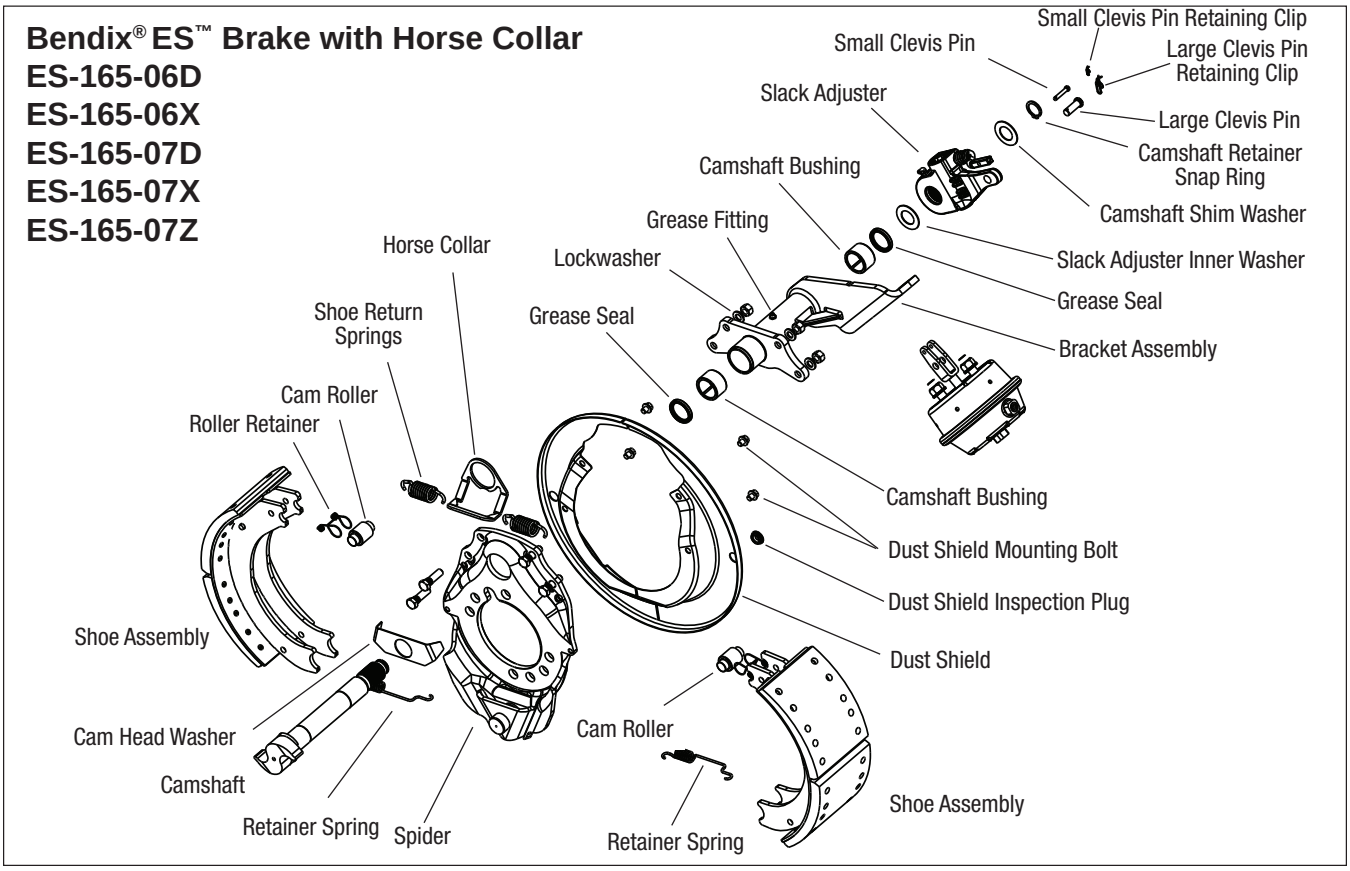


Figure 3 – Brake Part Nomenclature, Continued

Parts Nomenclature



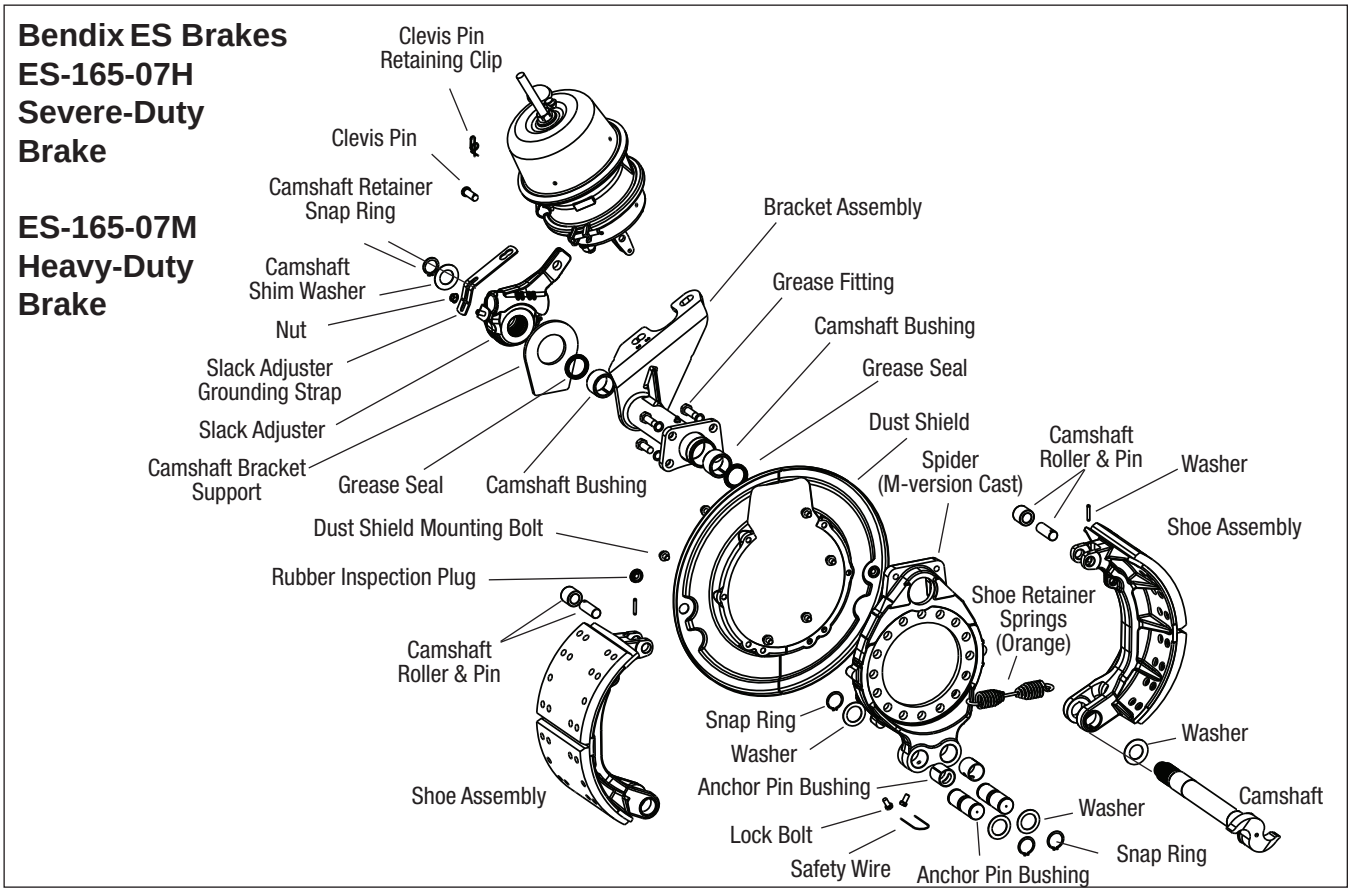


Figure 3 – Brake Part Nomenclature, Continued

Parts Nomenclature

Bendix® EB™ Brakes
EB-180-07R

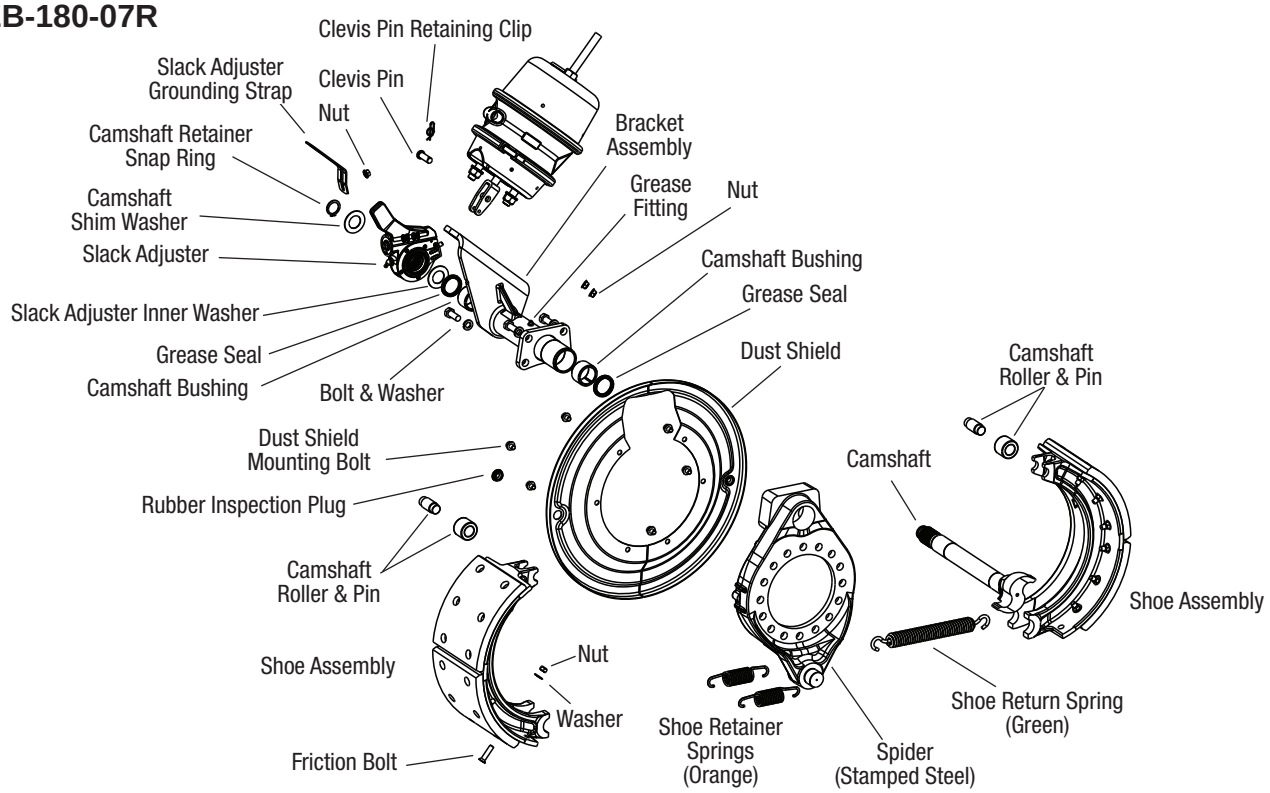


Figure 3 – Brake Part Nomenclature, Continued

Parts Nomenclature

Bendix® ES™-165 and EB™-165 Brake Interchangeability

Brake parts for the Bendix® ES™ (Extended Service) brake (Model ES-165) are unique and must not be intermixed with the Bendix® EB™ Standard Brake parts (Model EB-165) unless otherwise instructed. These parts consist of the camshaft, camshaft washer, return spring, cam roller, and shoe/lining assembly. Any attempt to operate the brake with other than its intended parts may result in unsatisfactory performance.

"On-Road" Repair: If a vehicle should need "On-Road" repair and ES brake hardware is not available, it is possible to retrofit the brake with Standard Brake parts in order to return the vehicle to service. These parts consist of the standard shoe/lining assembly, cam roller, pin, and return spring. The retaining springs and camshaft with cam washer will work in this situation and do not need to be replaced.

EB Brake Roller and ES Brake Cam Interchangeability

The EB Roller and the ES Cam are compatible and can be used together. *Figure 5* illustrates the proper fit of an EB Roller to an ES Cam. As shown, the contact pattern is at two points and the two parts will function satisfactorily with this fit.

EB-180-07R Brake

The EB-180-07R brake uses the ES Brake cam and standard service lining.

NOTE: The ES Brake roller and EB Brake cam *are not* compatible and *should not* be used together.

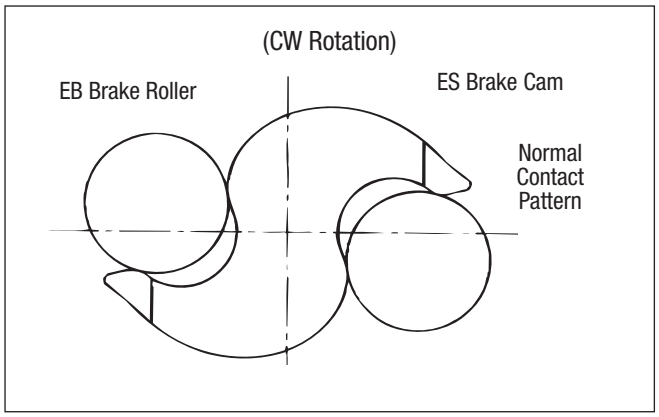


Figure 4 – EB Brake Roller and ES Brake Cam Contact Pattern and Camshafts

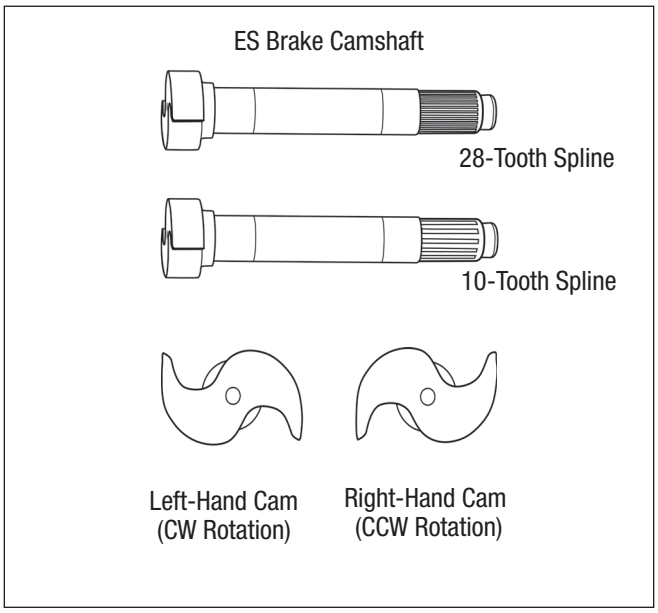
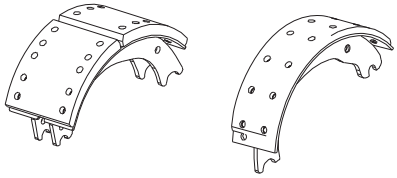


Figure 5 – ES Brake Camshafts

Parts Nomenclature

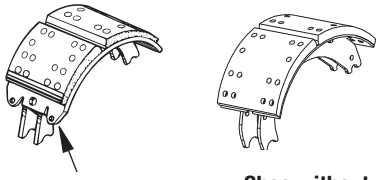
Bendix® brake model parts identification for shoes, return springs, spiders, and camshafts are identified in Figure 6.

Bendix® ES™-150-XXD, -XXF **ES-150-04L**



Bendix® ES™-165-XXD, -XXL, -XXF

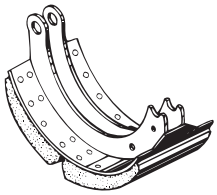
Old New



Shoes w/Spring Attaching Lugs

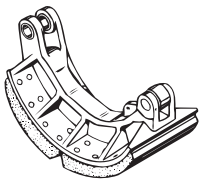
Shoe without Spring Attaching Lugs

Bendix® ES™ -165-07M



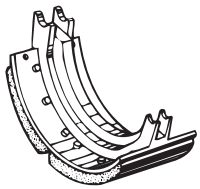
Double Anchor Pin

Bendix® ES™-165-07H



Double Anchor Pin w/Cam Roller & Anchor Pin Bushings

Bendix® EB™-180-07R



Single Anchor Pin

Shoe Return Spring

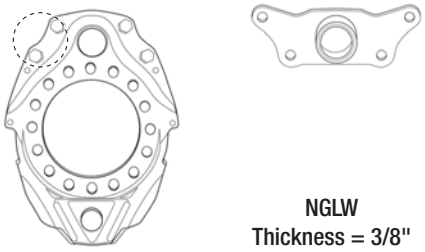
Color Coded by Application	
Blue	ES-150-04L
White	ES-150-08D, 08F
Grey	ES-165-05D, 05L, 06D, 06L,07D, 07L, 07F, 08D, 08L, 08F
Yellow	ES-165-07M
Orange	ES-165-07H
Red	ES-150-06D, ES-165-05D, 05L, 06D, 06L, 07D, 07L

Figure 6 – Parts Identification

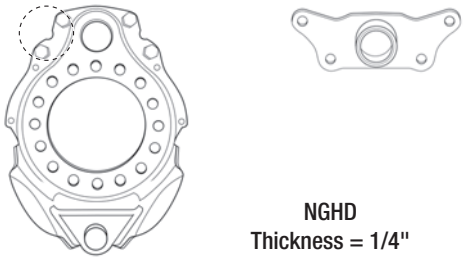
Parts Nomenclature

Brake Spiders

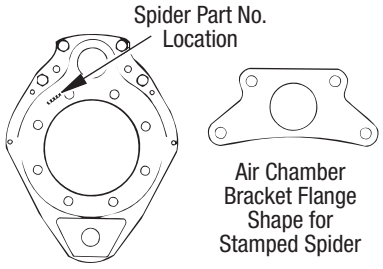
Stamped Spider
Single Anchor Pin
NGLW



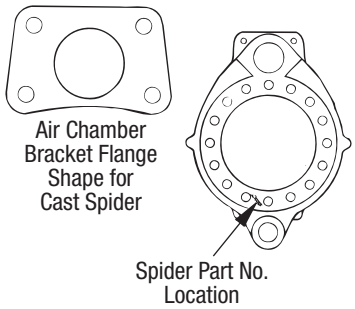
Stamped Spider Single
Anchor Pin
NGHD



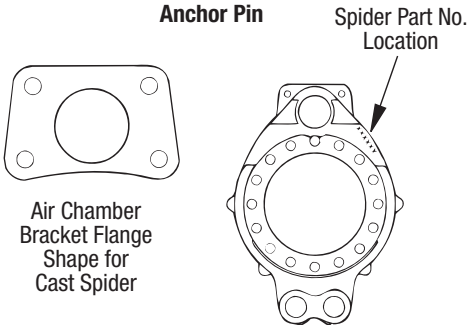
Legacy Stamped Spider
Single Anchor Pin



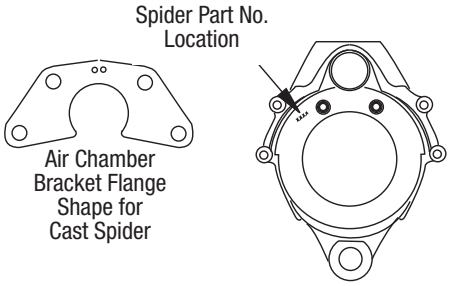
Cast Spider
Single Anchor Pin



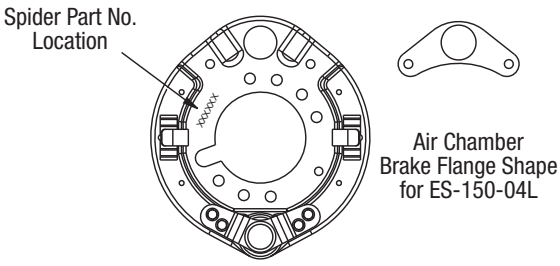
Cast Spider Double
Anchor Pin



Reduced Envelope Steer Brake
Cast Spider
Single Anchor Pin



Stamped Spider Bendix® ES™-150-04L



Reduced Envelope Drive Brake
Cast Spider
Single Anchor Pin

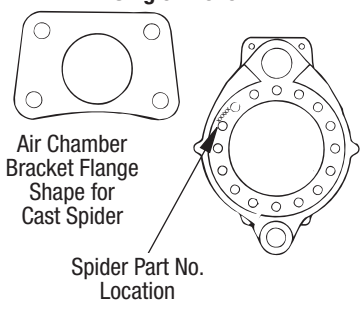


Figure 6 – Parts Identification, Continued

Maintenance and Adjustment

Due to the importance of a well-maintained brake system, the inspections and maintenance shown here must be completed by commercial vehicle operators at the intervals suggested. Since driver technique and vehicle use affect the rate of brake component wear, it may be appropriate to increase the frequency of the following inspections to fit individual needs based upon past experience.

Brake Maintenance Preliminary Steps

Prior to performing any maintenance requiring removal of the tire and wheel, the following preliminary steps must be taken to ensure your safety. *Refer to Figure 7*.

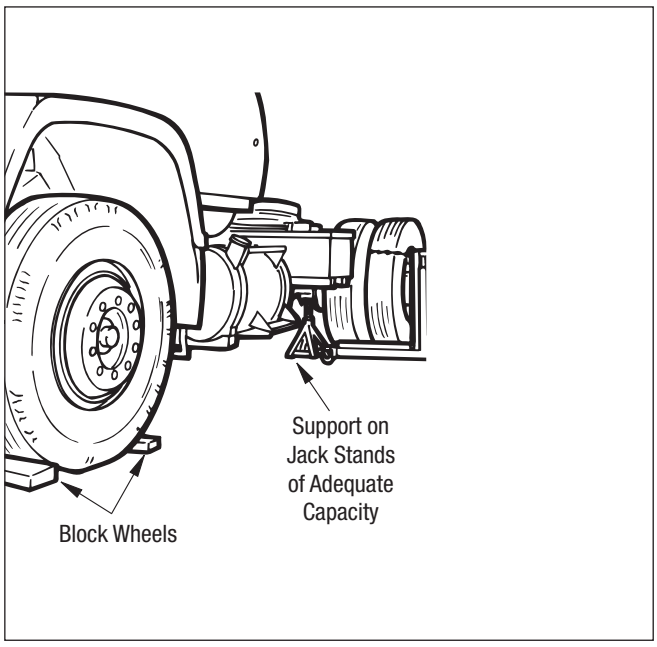


Figure 7 – Vehicle Maintenance Support

1. Set the parking brake and block the wheels to prevent vehicle movement.
2. Raise the drive axle with a jack and support it on suitable stands.

⚠ WARNING

Never work under a vehicle supported by a jack.

3. Cage the spring-type brake chamber following vehicle manufacturer's instructions.

Brake Adjustment - Automatic / Manual Slack Adjuster

NOTE: An assistant is required to make a brake adjustment.

⚠ WARNING

Block all wheels before beginning this adjustment procedure.

To determine whether the Bendix® ES™ brakes require adjustment, the applied stroke is measured and compared to the maximum value for the air chamber size in use on the vehicle.

1. Perform "Brake Maintenance Preliminary Steps" described earlier.
2. With the air chamber pushrod fully retracted, measure the distance from the face of the air chamber to the centerline of the clevis pin hole. *Refer to Figure 8*. If the measurement is not within the ranges shown in Table 2, reposition the clevis. Remeasure the distance and repeat until the measurement is within range. Record the exact measured distance as dimension "**A**".

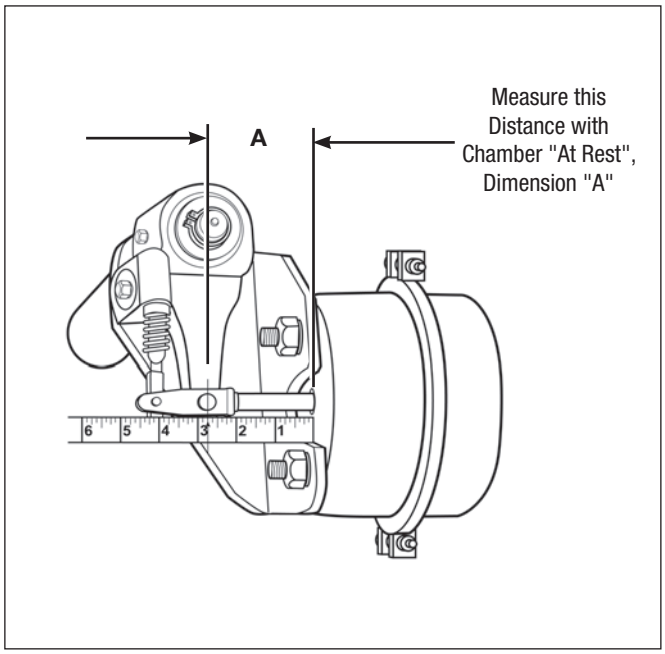


Figure 8 – Measurement, At Rest

Maintenance and Adjustment

3. Measure the applied free stroke using a lever, and again measure from the face of the air chamber to the clevis pin centerline. *Refer to Figure 9*. Record the distance as dimension "**B**".

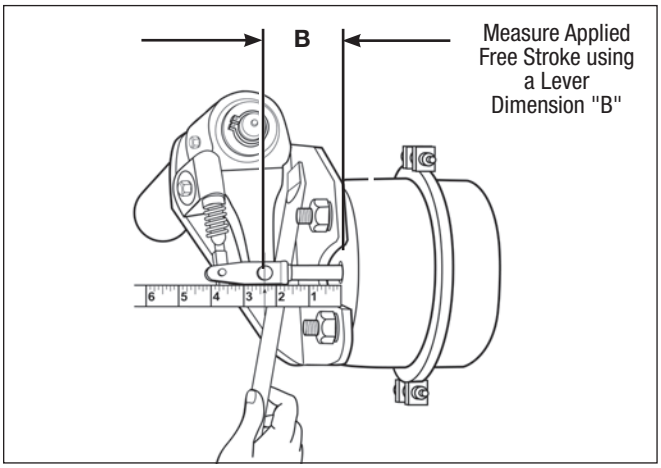


Figure 9 – Measure Applied Free Stroke Using A Lever

4. Subtract dimension "**A**" from "**B**". The difference is the applied free stroke. Compare the applied free stroke to the maximum value in *Table 2*. If the applied free stroke equals or exceeds the maximum applied stroke shown, adjust the brakes. If the applied free stroke is less than the maximum value, no adjustment is required and you may perform the Brake Operation Check (page 15).

90-100 PSI		
Air Chamber Size	**Maximum Applied Stroke**	**Desired Free Stroke**
Type 12	1-3/8"	3/8" to 1/2"
Type 16	1-3/4"	3/8" to 1/2"
Type 20	1-3/4"	3/8" to 1/2"
Type 24	1-3/4"	3/8" to 5/8" (Without Drag)
Type 24 (w/ 2-1/2" Extended Stroke)	2"	
Type 24 (w/ 3" Extended Stroke)	2.5"	
Type 30	2"	
Type 30 Long Stroke	2.5"	

Table 2 – Stroke Values

NOTE: If adjustment is necessary, Bendix® brakes are adjusted to achieve proper free stroke. The difference between free stroke and applied stroke is merely the method used to move the slack adjuster from rest. Applied stroke uses a 90-100 psi brake application; free stroke is measured using a lever to move the slack adjuster until the brake shoes contact the drum. If the applied stroke exceeded the maximum and adjustment is necessary, adjust the brakes as described in steps 5 through 7.

5. Apply 90-100 psi pressure and measure from the face of the chamber to the center of the large clevis pin. *Refer to Figure 10.* Subtract dimension "**C**" from "**A**" for the applied stroke at 90-100 psi. *Refer to Table 2* for the maximum legal stroke for the chamber you have.

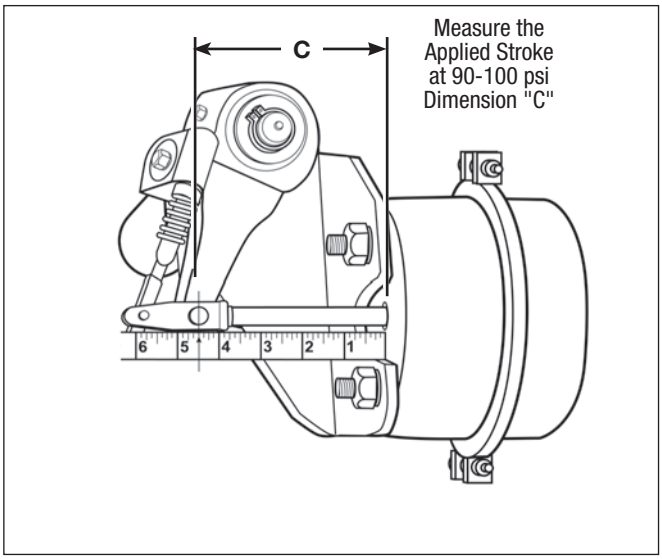


Figure 10 – Measure Applied Stroke at 90-100 PSI

6. Verify that brakes are not dragging by spinning the wheels by hand or tapping the drum lightly with a hammer and listening for a sharp ringing sound.
7. Perform the Brake Operation Check (page 15), to verify the proper operation of brakes before releasing the vehicle for service.

Periodic Inspections

Brake Adjustment - Automatic Slack Adjuster

⚠ WARNING

NOTE: A properly working Automatic Slack Adjuster (ASA) does not require manual adjustment while in service. The manual adjuster hex is intended for use during adjuster installation and brake overhaul.

Automatic slack adjusters must never be repeatedly adjusted to correct excessive in service pushrod stroke, because this condition indicates that a problem exists with the automatic adjuster, with the installation of the adjuster, or with related foundation brake components which manual adjustment will not correct.

1. Brake adjustment for automatic slack adjusters is the same as for manual slack adjusters.
2. Refer to the automatic slack adjuster manufacturer's instructions for proper installation.

Brake Operation Check

NOTE: An assistant is required to make a thorough brake operation check.

1. Apply the brakes to 80 psi and hold. Check all air line fittings and air chambers for leakage.
2. Apply and release the brakes while observing operation of the slack adjusters on each axle. As the brakes are applied and released, the slack adjusters should move in unison visually.
3. Investigate the source and make corrections for any discrepancies found in Steps 1 and 2.
4. Drive the vehicle at low speeds in a safe area and make several brake applications to verify safe operation and absence of pulling, grabbing, or noise. If any of these are noted, investigate and repair prior to releasing the vehicle for service.

⚠ CAUTION

Never release a vehicle for service if any brake discrepancy – no matter how minor – is evident.

Lubrication

When servicing brakes or replacing components, lubricate per the guidelines listed in *Table 3* below. Lubricate the following components with grease specified in the table below:

- One-piece roller - lubricate the shoe roller recess
- Two-piece roller - lubricate the shoe roller I.D.
- Roller and anchor pin recesses of each shoe on the Bendix® ES™-150-04L brake model.

Do Not Lubricate The Following:

- The cam head surface or related parts that contact the cam head surface. For efficient operation, the cam head surface must remain free of oil, grease, or other contaminants.

Note: When lubricating the camshaft bracket, lubricate until the grease comes out at the slack adjuster end. The seal is installed at this end – with the air side in – so that grease purges out.

⚠ CAUTION

Do not use moly-disulfide loaded grease or oil because this may shorten the service life.

⚠ IMPORTANT

In no case should the lubrication interval exceed the published intervals in the table below.

Slack Adjuster Lubrication: Pressure lubricate according to the manufacturer's instructions.

Component	Lubrication Interval	Type of Lubricant
Standard	Every 50,000 miles or every three (3) months	Standard Chassis Grease

Table 3 – Lubrication Intervals

Periodic Inspections

Periodic Inspections

The component inspections discussed below are general in nature. More detailed component inspections are normally done at an overhaul. For more specific guidelines, *refer to the appropriate inspection instructions in **Brake Overhaul Service Interval** on this page.*

Visual Inspection

A thorough visual inspection for brake wear, loose fasteners, broken parts, and/or obvious damage should be made each time the brake is being serviced or the wheel and drum have been removed. **In no case should the visual inspection interval exceed three (3) months of service.**

Lining Inspection

A visual check of lining thickness and condition should be made each time the vehicle is being serviced in the maintenance shop. **In no case should the lining thickness/condition inspection interval exceed three (3) months of service.**

Brake Adjustment

Brake adjustment should be checked, (if the adjustment is out of specification, inspection of all brake components for damage or out of specification) WEEKLY or any time the applied stroke exceeds the maximums shown in Periodic Maintenance: Brake Adjustment - Manual Slack Adjuster on page 13.

Brake Operation Check

A complete operation check of the braking system should be made following the instructions in the **Brake Operation Check** (page 15), after any brake service. **In no case should the operation check interval exceed three (3) months of service.**

Service Intervals

Brake Reline

A brake reline should be done any time the lining thickness or condition indicates the need.

Camshaft Radial Play

Camshaft radial play should be checked with a dial indicator any time the brake shoes have been removed from the vehicle to assess the condition of the camshaft bushings. *Refer to **Camshaft Inspection.***

Camshaft Axial Play

Camshaft axial play should be checked any time the camshaft or slack adjuster has been removed from the vehicle. *Refer to the axial play instructions in **Slack Adjuster Installation**, (page 39) starting with Step 6.*

Brake Overhaul

A complete brake overhaul following the instructions in the service manual should be accomplished at every third brake reline.

Lubrication

See Periodic Service/Lubrication for detailed lube instructions and intervals.

Shoe Removal

A complete brake overhaul consists of:

- complete disassembly
- cleaning
- inspection
- repair and replacement of components
- assembly
- brake operation check

Detailed instructions for each of these steps are listed on the following pages in the order in which they would normally be encountered during a typical brake overhaul.

⚠ WARNING

The long-term effects of non-asbestos fibers have not been determined. Therefore, precautions should be used when handling these materials. ***See General Information / Lining Material Warning.***

Brake Assembly Removal

1. Perform “Brake Maintenance Preliminary Steps”.
2. Back off the slack adjuster per the manufacturer's recommendations. *Refer to Figure 11.* Continue turning until the shoes are fully returned to the released position and clear of the drum.

NOTE: Remove the wheels and brake drums per manufacturer's recommendations.

3. Back the slack adjuster off (counterclockwise) until the brake shoes are clear of the brake drum or the slack adjuster comes to a stop.

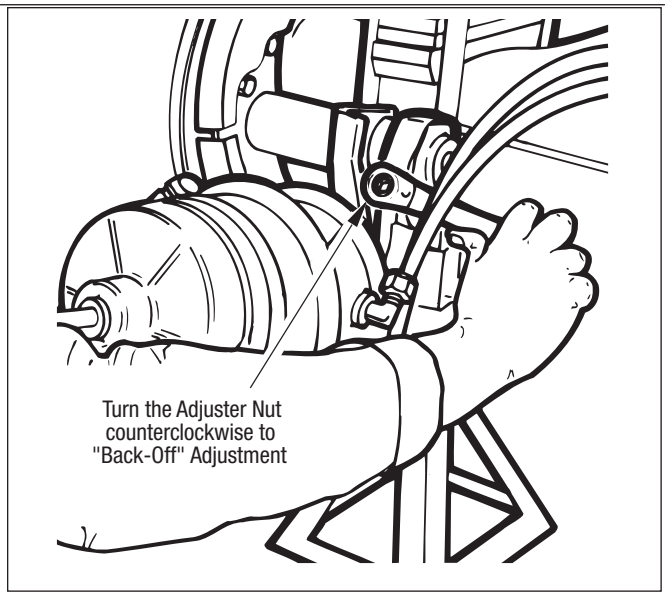


Figure 11 – Slack Adjuster Adjustment

Shoe Removal

Bendix® ES™-150-04D
ES-150-04L
ES-150-08D
ES-165-05D, L, X
ES-165-06D, L, X
ES-165-07D, L, X, Z
ES-165-08D, L, X

1. Perform steps in Removal/Disassembly: Drum Removal.
2. For Bendix models ES-150-04D/ES-150-08D/ ES-165-05,-06,-07,-08,D,L ONLY: Pry the roller retainer coiled loops out of both shoe web holes as shown in Figure 12. Pivot the roller retainer to swing the loops clear of the shoe webs.

⚠ WARNING

The long term effects of non-asbestos fibers have not been determined. Therefore, precautions should be used when handling these materials.

See General Information / Lining Material Warning

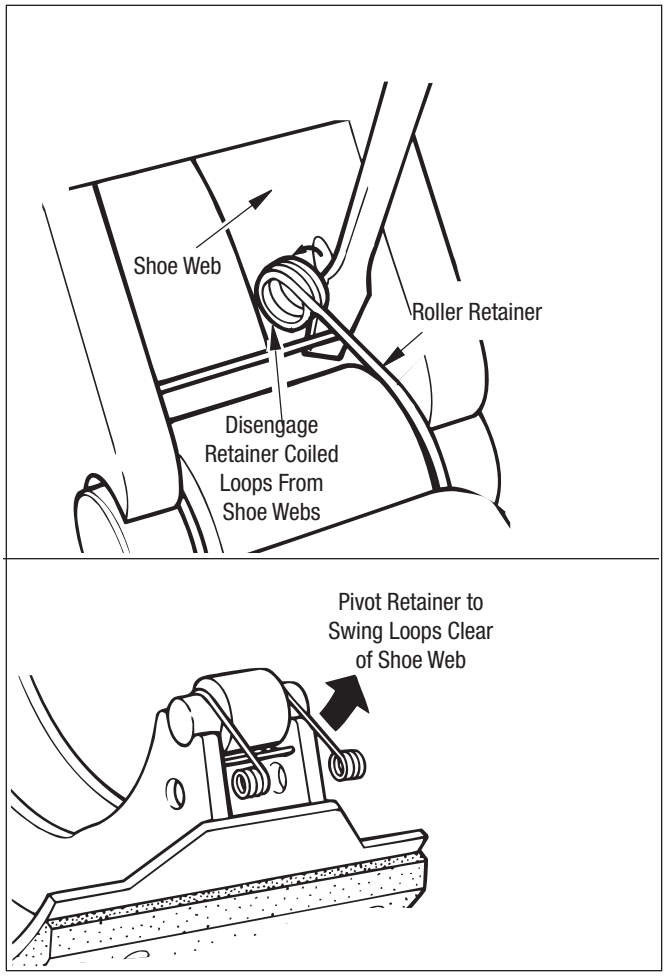


Figure 12 – Roller Retainer Removal

3. Using a large screwdriver or lever, lift the upper shoe to stretch the return spring as shown in Figure 13.

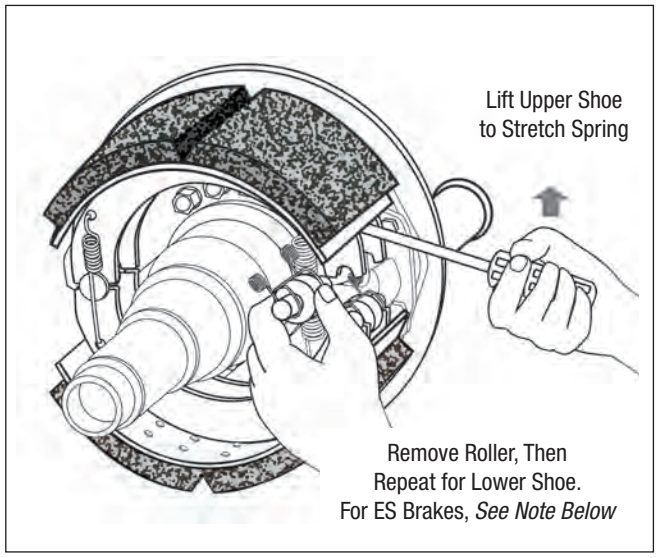


Figure 13 – Upper Cam Roller & Pin Removal

4. Remove the upper cam roller.

NOTE: For Bendix models ES-150-04D, L/ES-150-08D, ES-165-05D, L,X/ES-165-06D, L, X/ES-165-07D, L, X, Z/ ES-165-08D,L,X. Remove the roller and roller retainer as a unit.

5. Repeat Steps 2 through 4 to remove the lower shoe roller and retainer.

NOTE: Bendix recommends the use of a suitable brake tool when removing the rollers and the return springs.

Shoe Removal

6. Push the cam end of both shoes toward the cam and unhook the shoe return spring. Remove and discard the spring.

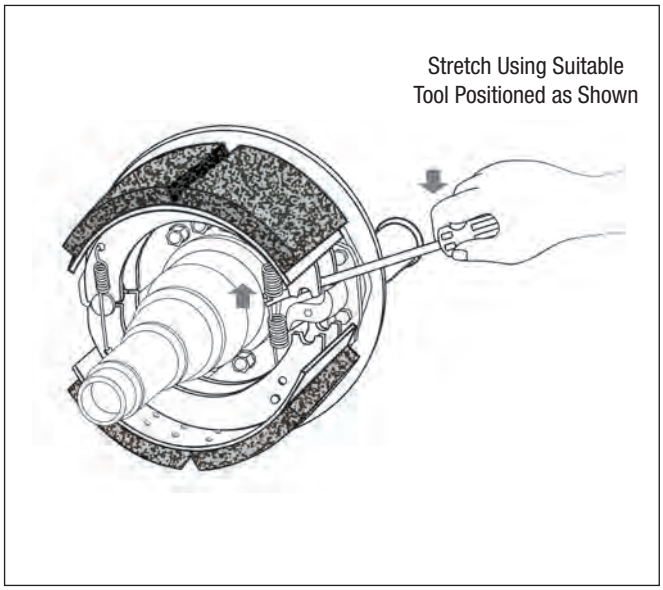


Figure 14 – Bendix® ES™-165-07D, L Shoe Removal

NOTE: To remove the return spring, position a lever or suitable tool – with a notch – to engage the spring rod. *Refer to Figure 14.* Apply a downward force to stretch the spring, allowing removal of the upper spring hook. Remove and discard the spring.

7. Rotate both shoes around the anchor pin and remove them from the vehicle. *Refer to Figure 15.*
8. Clean and inspect the remaining parts as outlined in the removal/disassembly section of this manual.

NOTE: Bendix® ES™-150-06D / ES-165-05D,L,X / ES-165-06D,L,X/ES-165-07D,L,X,Z / ES-165-08Z: steer axle brakes may use two return springs with a horse collar or dual spring post. To remove the return springs, position a lever or suitable tool – with a notch – to engage the spring. *Refer to Figure 14*. Apply a downward force to stretch the upper spring, allowing removal of the upper spring hook. Remove and discard. Repeat the procedure for the lower spring.

Brake Assembly Inspection

1. Clean the brake spider, anchor pin, and cam head.
2. Inspect all fasteners, spider mounting, cam bracket, and chamber mounting bolts.
3. Inspect all welds for cracks.
4. Measure the cam-bushing radial play and cam end-play.
5. Replace out-of-spec parts as needed.

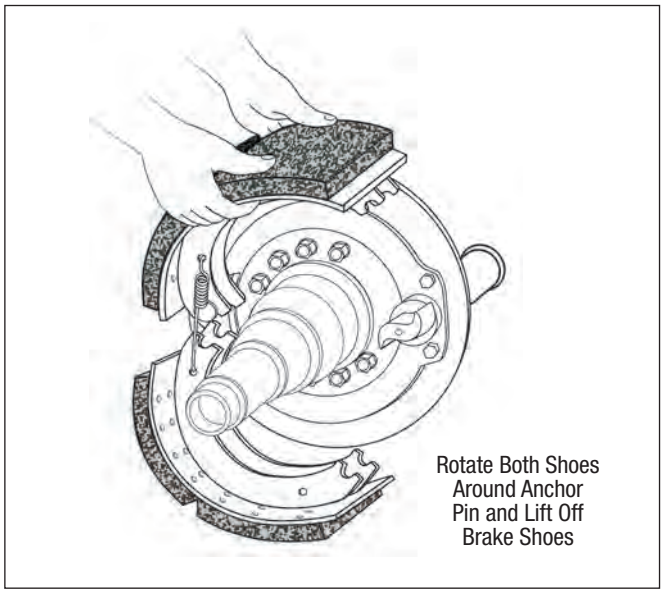


Figure 15 – Shoe Removal

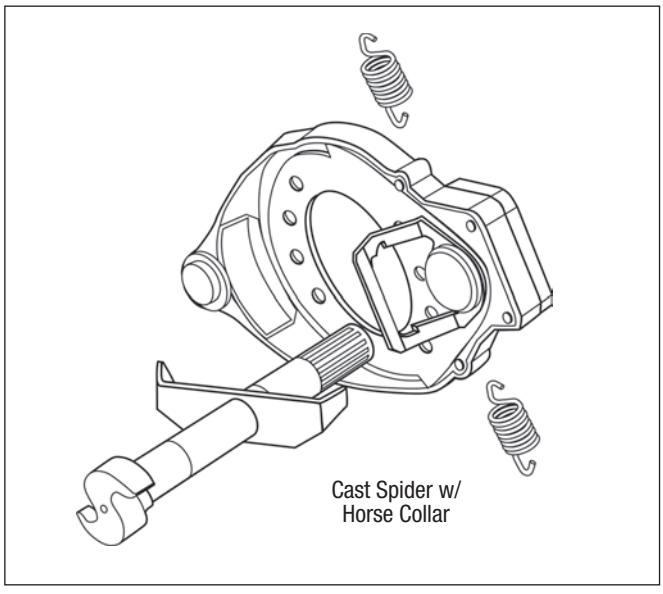


Figure 16 – Cast Spider With Horse Collar

Shoe Removal

Bendix® ES™-150-04L Brake

1. Perform the steps in Removal/Disassembly: Drum Removal.
2. Using a large screwdriver or lever, lift the upper shoe to stretch the return spring.
3. Remove the upper roller.
4. Repeat steps 2 through 3 to remove the lower roller.
5. Stretch the shoe return spring and unhook it from the upper shoe web. *Refer to Figure 18.*

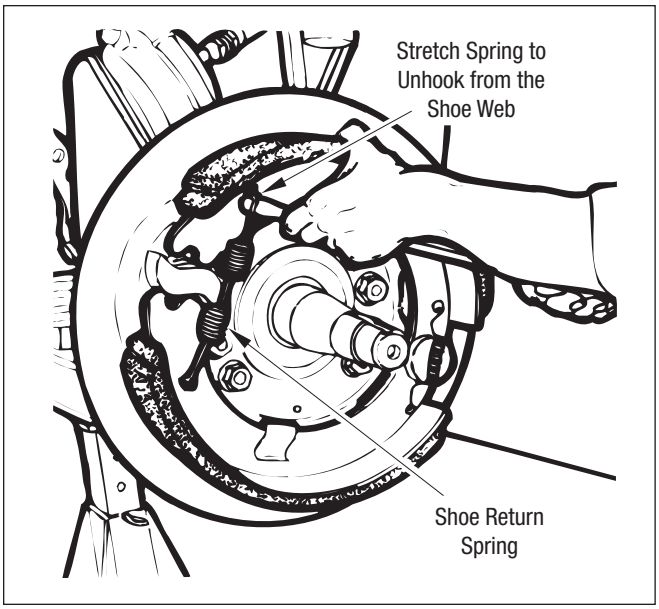


Figure 17 – Shoe Return Spring Removal

WARNING

The long term effects of non-asbestos fibers, have not been determined. Therefore, precautions should be used when handling these materials.

See General Information / Lining Material Warning

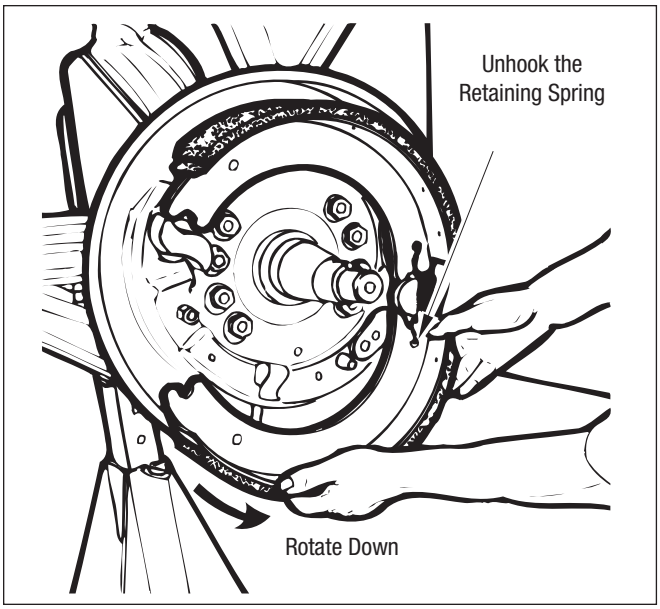


Figure 18 – Lower Shoe Removal

6. Rotate the shoe downward and turn it to allow disengagement of the shoe retaining spring from the lower shoe web. *Refer to Figure 17.*
7. Rotate the upper shoe upward and remove the shoe and shoe retaining spring.
8. Clean and inspect the remaining brake parts as outlined in the Removal/Disassembly section of this manual.

Roller Removal

Bendix® ES™-165-07M Heavy-Duty Brake

1. Remove the retaining ring and washer from the drum side of both anchor pins. *Refer to Figure 19.*

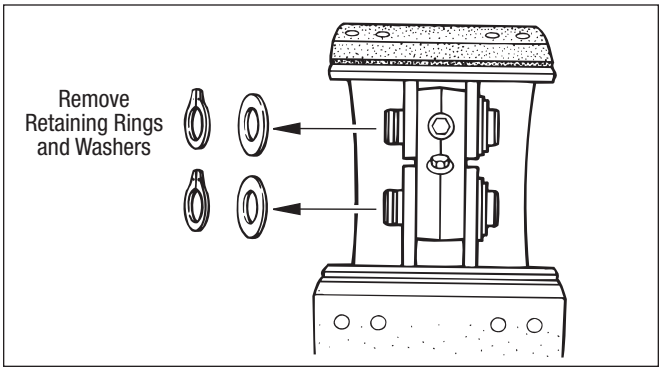


Figure 19 – Retaining Ring and Washer Removal

2. To allow removal of the anchor pins, cut the lockwire and remove the cap screws from the spider. *Refer to Figure 20.*

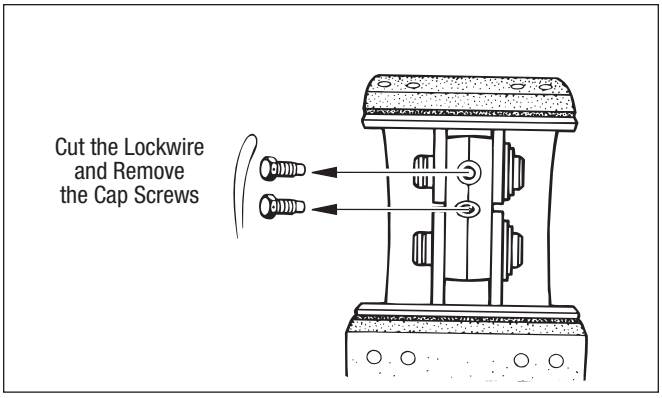


Figure 20 – Cap Screw Removal

3. To remove the upper and lower shoes, remove the anchor pins with a brass drift or a mallet. *Refer to Figure 21.*

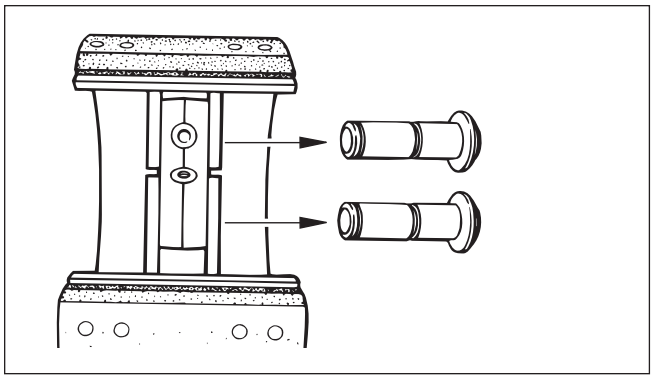


Figure 21 – Anchor Pin Removal

NOTE: Inspect the anchor pin and bushings. If the pin was seized, or if the bushing is grooved or worn beyond 0.031" (0.79mm), replace the pin and bushing. Always replace the pins and bushings with each brake reline.

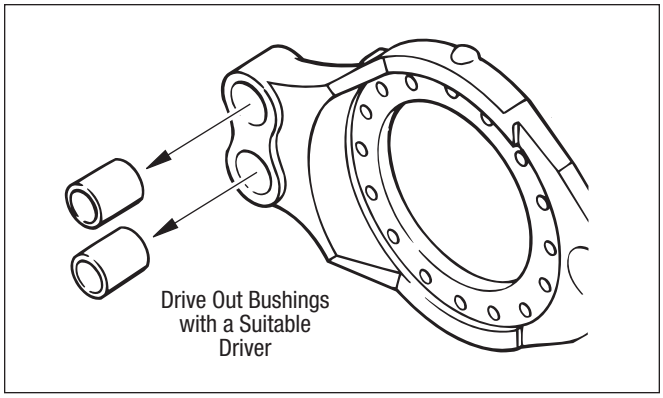


Figure 22 – Anchor Pin Bushing Removal

4. If any noted conditions are found, drive out the old anchor pin bushings from the spider. *Refer to Figure 22.*
5. Clean and inspect the remaining brake parts as outlined in the Removal/Disassembly section of this manual.

Roller Removal

Bendix® ES™ -165-07H Severe-Duty Brake

⚠ WARNING

The long term effects of non-asbestos fibers, have not been determined. Therefore, precautions should be used when handling these materials.

See General Information / Lining Material Warning

1. Perform the steps necessary for drum removal, see Removal/Disassembly: Drum Removal.
2. Remove the cap screws and dust shield, if applicable.
3. Remove the retaining ring and washer from the drum side of each anchor pin. *Refer to Figure 23*.

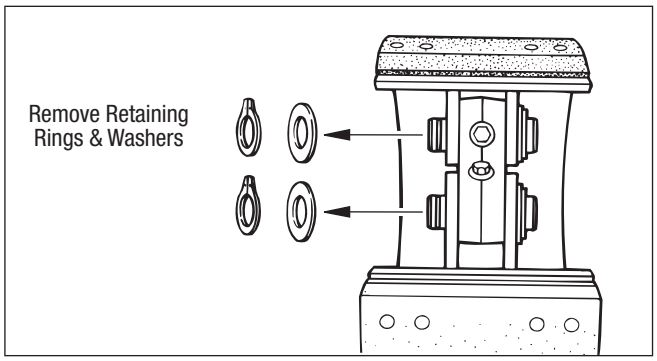


Figure 23 – Retaining Ring and Washer Removal

4. To allow removal of the anchor pin, cut the lockwire and remove the cap screws from the spider. *Refer to Figure 24.*

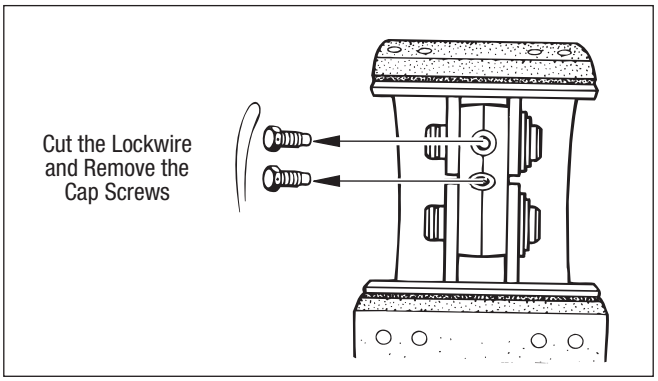


Figure 24 – Cap Screw Removal

5. Remove the upper anchor pin with a brass drift or a mallet. *Refer to Figure 25.*

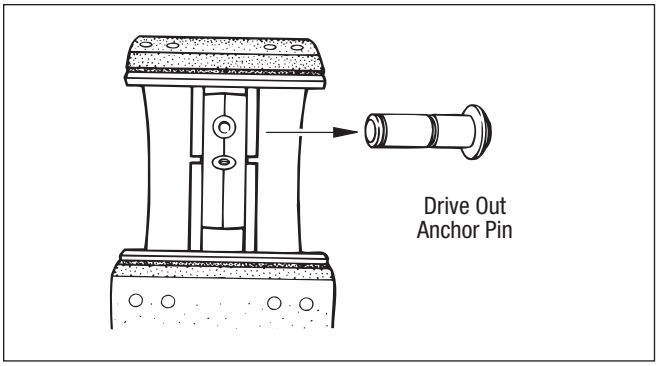


Figure 25 – Anchor Pin Removal

6. Rotate the upper shoe around the cam end, disengage the roller end from the cam, then unhook the return spring from the shoe and remove the upper shoe. *Refer to Figure 26*. Discard the return spring.

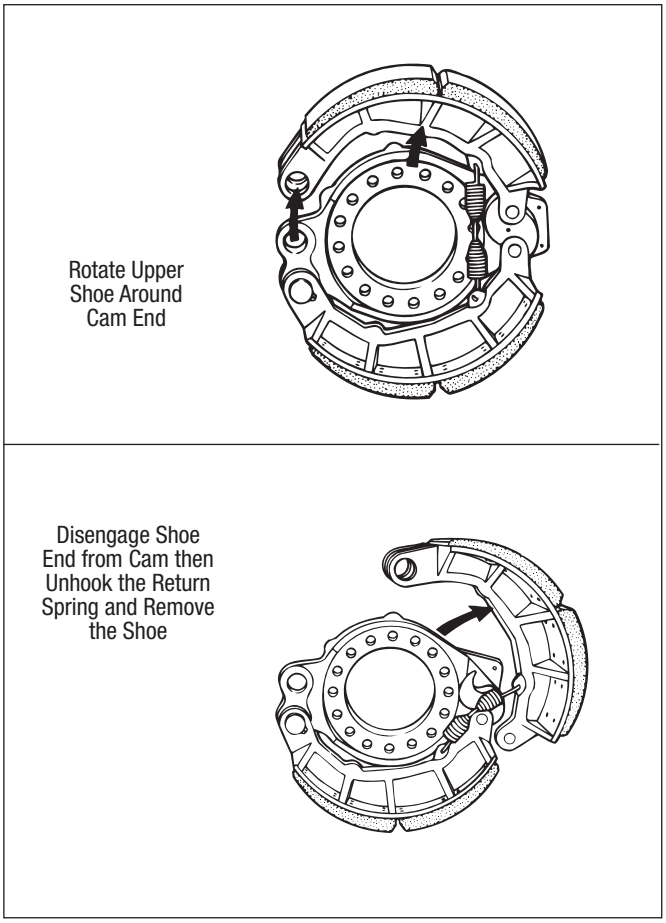


Figure 26 – Shoe Removal

Roller Removal

Bendix® ES™-165-07H Severe-Duty Brake, Continued

7. Remove the lower anchor pin to remove the lower shoe.

NOTE: Inspect the anchor pin and bushings. If the pin was seized, or if the bushing is grooved or worn beyond 0.031" (0.79mm), replace the pin and bushing. Always replace the pins and bushings with each brake reline.

8. Drive out the old anchor pin bushings from the brake shoe and spider with a suitable driver. *Refer to Figure 27.*

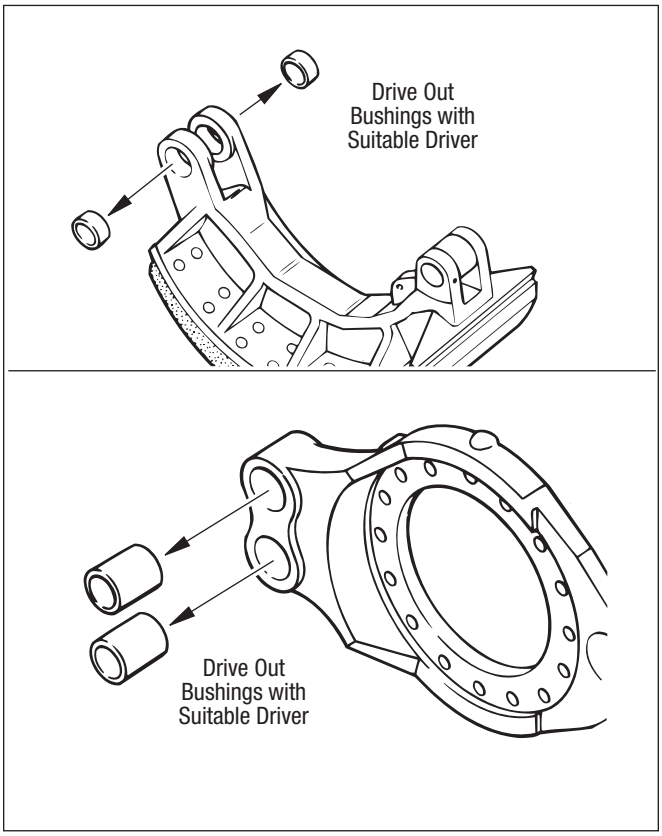


Figure 27 – Anchor Pin Bushing Removal

9. Do not remove the roller from the brake shoe, unless: the roller does not roll freely; there are flat spots on the roller; or there is more than 0.025" play between the roller and pin. If removal of the roller is necessary, use a steel punch to drive out the groove pin, then push the pin out of the shoe. Discard the roller and pin. *Refer to Figure 28.*

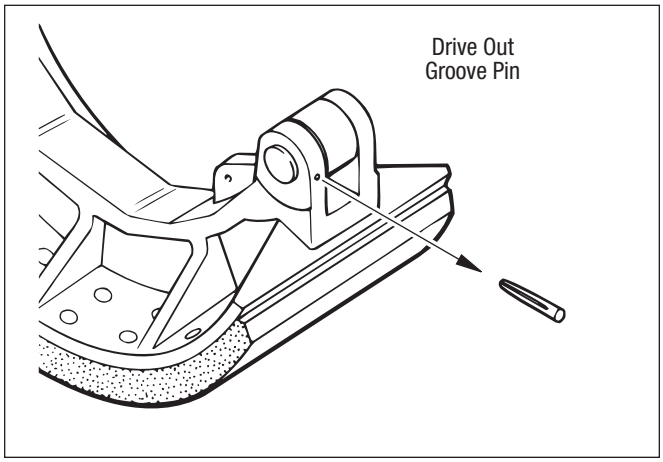


Figure 28 – Groove Pin Removal

10. Clean and inspect remaining brake parts as outlined in the Removal/Disassembly section of this manual.

Slack Adjuster Removal

1. Remove the cotter pin/retaining clip and clevis pin from the air chamber pushrod clevis.
2. Turn the adjuster nut counterclockwise until the slack adjuster is clear of the air chamber pushrod clevis. *Refer to Figure 29.*

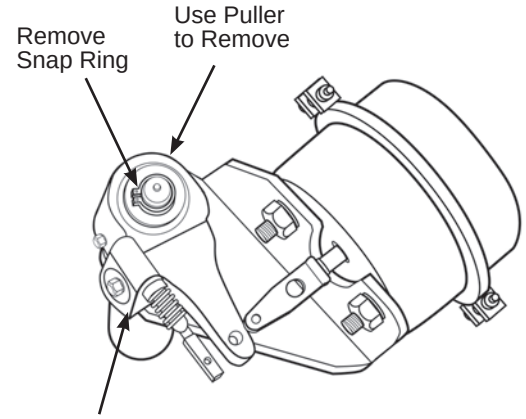


Figure 29 – Slack Adjuster Removal

NOTE: Follow the manufacturer's instructions for self-adjusting slack adjusters.

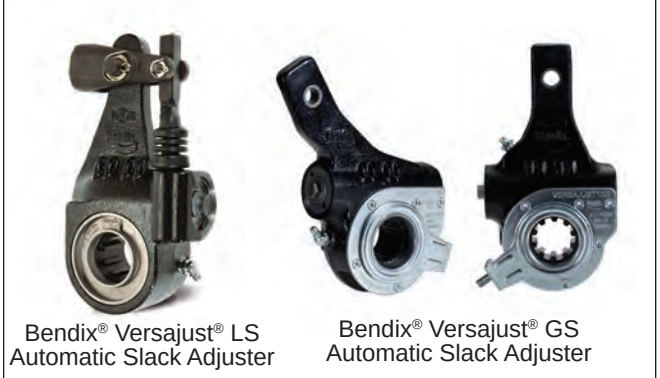


Figure 30 – Bendix® Versajust® Automatic Slack Adjusters

3. Remove the snap ring and outer shim washer(s) from the camshaft.
4. Note the orientation of the slack adjuster with reference to the pushrod before removal to ensure assembly is in the proper orientation. Remove the slack adjuster with a suitable puller.

⚠ CAUTION

Do not hammer on the slack adjuster to remove! Damage to the slack adjuster and/or camshaft splines may result.

Camshaft Removal

1. Under certain situations the hub will need to be removed before the camshaft removal. ***NOTE:*** *follow the hub manufacture guidelines for removal.*
2. Grasp the camshaft head and pull the camshaft outboard to remove.

Air Chamber Bracket Removal

1. Perform all steps for drum, shoe, slack adjuster, and camshaft removal as outlined in the Removal / Disassembly section.
2. Disconnect the chamber air line.
3. Remove the attaching fasteners and pull the air chamber bracket away from the spider. **NOTE:** On 16.5" diameter brakes with stamped spiders, the air chamber bracket-to-spider studs are welded into the spider. Their removal is not required to remove the air chamber bracket.

NOTE: On the Bendix® ES™-150-04L brake, a stabilizing nut has to be removed. The bracket-to-spider studs are welded into the air chamber bracket flange. Their removal is not required to remove the air chamber bracket.

⚠ WARNING

To prevent personal injury, be sure to "cage" the spring before removing the spring brake type air-chambers.

NOTE: For information on slack adjuster removal, refer to the slack adjuster manufacturer's service manual.

Spider Removal

1. Perform all steps for drum and shoe removal as outlined in the Removal / Disassembly section.
2. Remove the spider-to-axle attachment nuts and bolts. *Refer to Figure 31.*
3. Remove the spider.

Dust Shield Removal

NOTE: On Bendix® ES™-165-07H, M Brakes, the dust shield must be removed before the shoes and anchor pins are removed.

1. If applicable, remove the screws and the retaining clip. Remove all screws attaching the dust shield to the spider (4-6 screws depending on model). *Refer to Figure 32.*
2. Remove the dust shield.

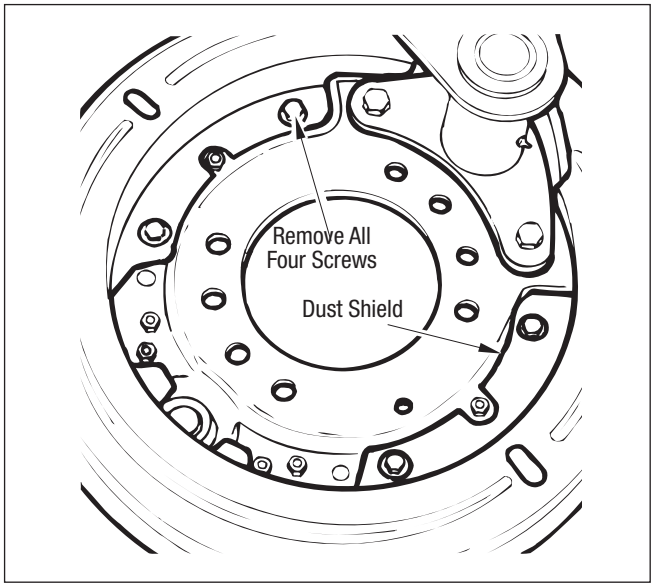


Figure 31 – Dust Shield Mounting Hardware Removal

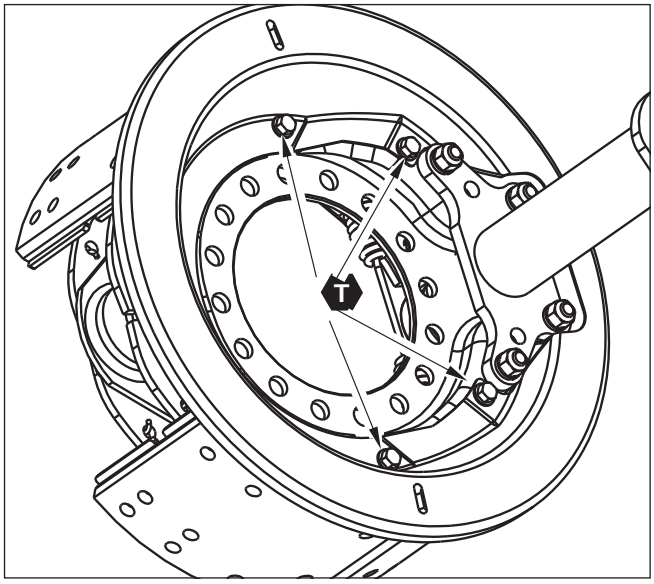


Figure 32 – For All 165-XX Models

Cleaning Brake Parts

After removing the brake parts to be serviced, the following cleaning procedures should be followed:

1. With a wire brush, clean all parts exposed to mud, road dirt, and salt, including the spider, air chamber bracket, dust shields, and the exterior of the drum.

⚠ CAUTION

A layer of oxidation and dirt on the outside of a brake drum acts as an insulator and may hinder normal heat dissipation.

2. Remove excessive deposits by wire brushing.
3. Use a vacuum cleaner to remove the brake dust from the drums. Wipe the interior of the drums with a greaseless solvent to remove any spilled oil.

⚠ WARNING

The long term effects of non-asbestos fibers have not been determined. Therefore, precautions should be used when handling these materials.

See General Information / Lining Material Warning

Inspection

Drum Inspection

Clean all remaining brake parts thoroughly with a suitable shop solvent. Wipe dry with a clean, lint-free cloth.

NOTE: This information is general in nature. For specific brake drum inspection guidelines, refer to the drum manufacturer's instructions.

1. Check for cracks, heat-checks, glazing, grooving, run-out, and out-of-round. *Refer to Figure 33.* Cracked drums must be replaced. Drums which are glazed, grooved, out-of-round, etc., may be returned to service if they can be repaired without exceeding manufacturer's maximum diameter or run-out specifications.

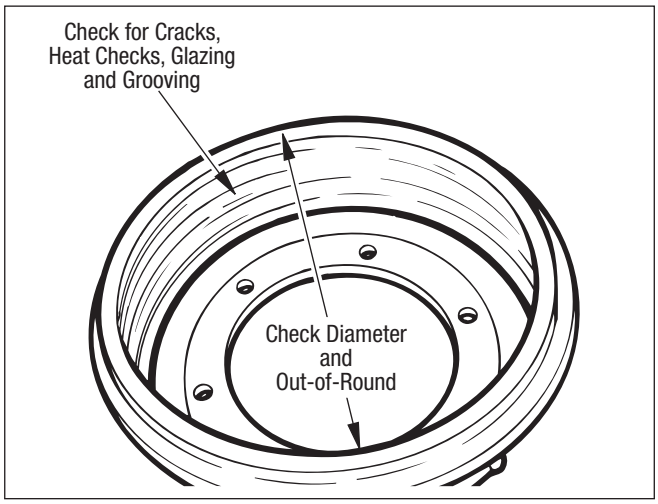


Figure 33 – Drum Inspection

2. Check the drum diameter. Replace the drum if it exceeds the maximum diameter stamped in the drum.

⚠ CAUTION

Under no circumstances should the drum be used if it exceeds the manufacturer's recommended maximum diameter or run-out specification.

Bendix does not recommend the turning or reboring of brake drums. The reduction of wall thickness reduces the amount of thermal energy that can be absorbed by the drum during braking. Also, the decrease in wall thickness increases the amount of deflection for the same input load. Both of these are undesirable. If the drums are refaced or oversized, the new diameter MUST NOT exceed the maximum diameter marked on the drum during its service life.

Inspection

Shoe and Lining Inspection

1. Check the shoes for bent or cracked webs or table, broken welds, loose rivets, or elongated rivet holes. *Refer to Figure 34.* If any issues are found, replace the shoes with Bendix® OEM-grade lining and shoe assemblies.

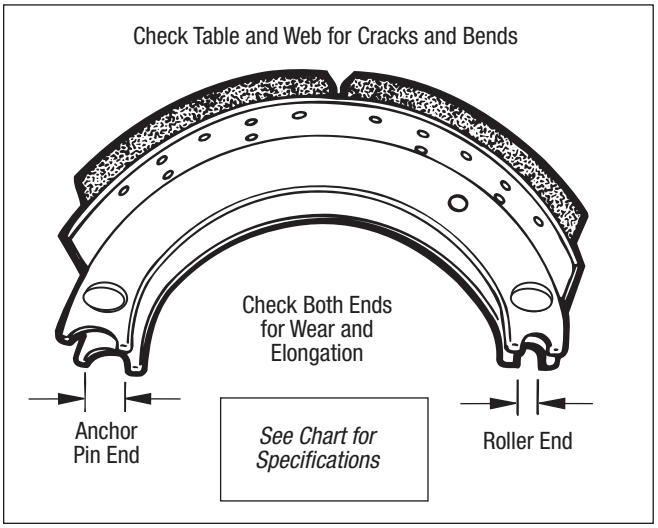


Figure 34 – Shoe & Lining Inspection

2. Check the anchor pin and cam roller contact areas in the shoe webs for elongation or wear. Replace the shoe if the diameter exceeds the following specifications.

Bendix® ES™ Brake Model	Roller End	Anchor Pin End
All ES-165, ES-150-04D, ES-150-06D, ES-150-08D, F	0.836"	1.400"
ES-165-07M	0.774"	1.280"

3. For Bendix® ES™-165-07H severe-duty brake only: Anchor pin bushings are mounted in these brake shoes. *Refer to Inspection-Spider Inspection (Double Anchor Pin) for instructions.*

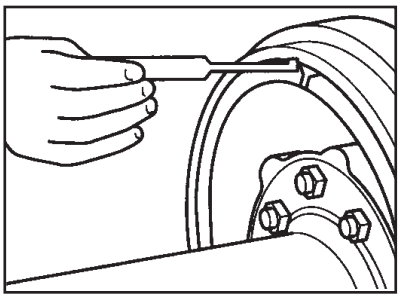
NOTE: The two-piece roller and pin are mounted in the brake shoes for the -07H model brake. Do not remove the roller and roller pin unless: the roller does not roll freely;there are flat spots on the rollers; or there is more than 0.025" play between the roller and the pin. Replace the roller and the pin if these conditions are found.

4. Check the linings and replace with Bendix OEM-grade shoe and lining assembly if contaminated, cracked, or worn to less than 1/4" (6.4mm) thickness at any point (*see instructions that follow*) or 3/16" (4.5mm) for the Bendix® ES™-150-04L brake.

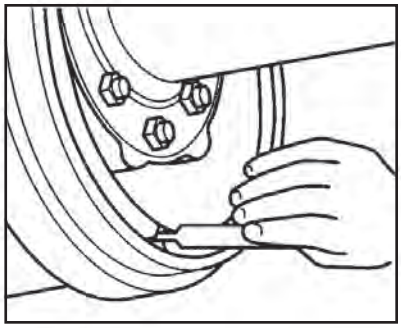
NOTE: To eliminate premature lining replacement, Bendix recommends the use of the Bendix® ES™ Brake Lining Wear Gauge to accurately measure lining thickness. This tool is available through Bendix as BW7261.

Important: The wear gauge is for use with air actuated cam brakes where minimum allowable lining thickness is 1/4". (**Note:** Do not use for strip linings on 15 x 4 brakes or similar brakes.)

5. With the brake not applied, place the tip of the gauge between the two lining blocks, between the top of the shoe table and the drum. Use the gauge to scrape away any mud, rust, or other contaminants that could interfere with proper lining measurement.



6. Remove the gauge from the brake.
7. With the vehicle's brakes applied, try to put the gauge between the two lining blocks and the top of the shoe table. Note the "hook" of the gauge allows insertion around a worn drum lip. If the tip of the gauge will not fit between the brake drum and the top of the shoe table, the lining is worn below 5/16" and will need to be replaced.
8. If the tip of the gauge fits between the brake drum and the shoe table, the lining is not worn below 1/4" at this time.



9. Because brake shoes can wear at different rates, check both shoes on each brake and all brakes on the vehicle.

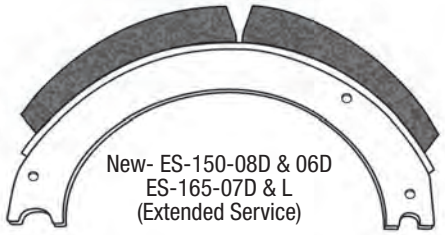
Inspection

Shoe and Lining Inspection (cont'd)

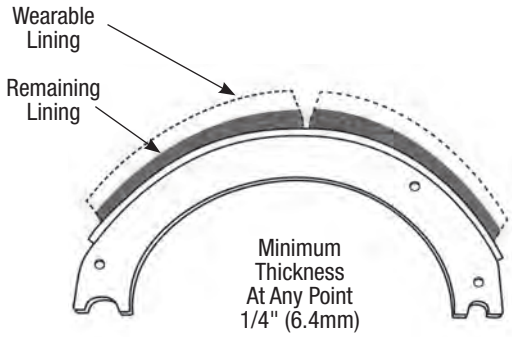
⚠ WARNING

The long term effects of non-asbestos fibers, have not been determined. Therefore, precautions should be used when handling these materials.

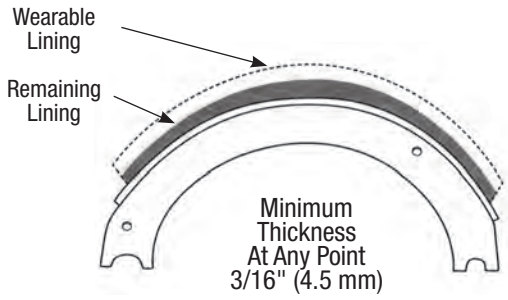
See General Information / Lining Material Warning



- When the Bendix® ES™ Extended Service linings require replacement due to normal wear, the lining thickness will be uniform all along its length.



Worn ES-150-04D, ES-150-08D, F &
ES-150-06D, ES-165-07D, L & F
(Extended Service)



Worn ES-150-04L
(Extended Service)

Figure 35 – Brake and Lining Blocks

Inspection

Camshaft Radial Play Inspection

The camshaft radial play should be checked any time the brake shoes have been removed from the vehicle. *Refer to Figure 36.*

1. Mount a suitable dial indicator (with a plunger), referencing the cam head at the roller contact area.
2. Set the dial indicator to zero.
3. Move the cam head up and down and note the maximum reading.

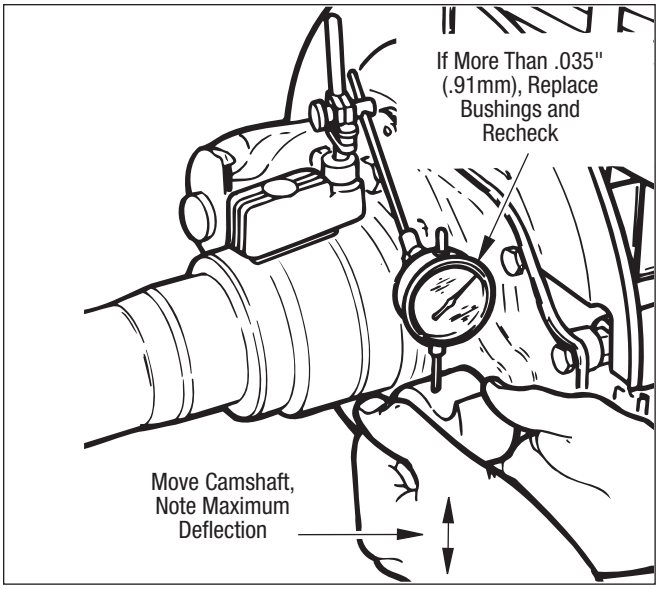


Figure 36 – Camshaft Radial Play Inspection

4. If the play exceeds 0.035" (0.91 mm), rebush the air chamber bracket. *See Repair/Replacement - Camshaft Bushing and Grease Seal Replacement.*

Camshaft Inspection

1. *Refer to Figure 37.* Check the spline end for cracks, worn, or deformed splines. Replace as necessary.
2. Check the camshaft bushing journals for wear and corrosion. Replace the camshaft if it shows visible wear or if roughness is felt in the journal areas.
3. Inspect the camshaft head for brinelling, cracking, or flat spots. Replace the camshaft if a ridge can be felt between the worn areas and the cam head surface.

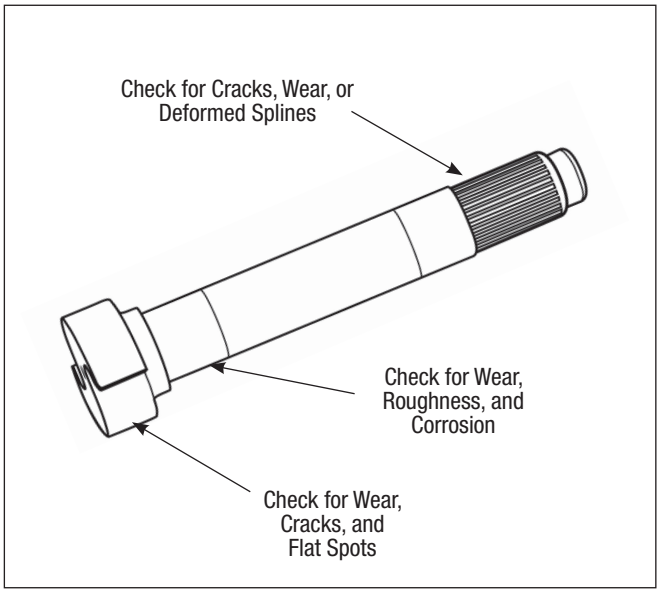


Figure 37 – Camshaft Inspection

Camshaft Bushing and Seal Inspection

NOTE: Steer and drive axle camshaft bushings and seals are mounted in the air chamber bracket assembly.

1. Check the bushing for deterioration or wear. The inner surface must be smooth. If the surface is rough or abrasive, replace the bushing, *see Repair/ Replacement - Camshaft Bushing and Grease Seal Replacement.*
2. Inspect the grease seals. Replace the seal if the lip is nicked, cut, or distorted. *See Repair/Replacement - Camshaft Bushing and Grease Seal Replacement.*

Inspection

Spider Inspection (Single Anchor Pin)

1. Visually inspect for cracks around the mounting bolt holes, in the cam area, and around the anchor pin. *Refer to Figure 38*. Replace the spider if any are found.
2. Check the anchor pin. If it is loose or grooved more than 0.031" (0.79mm) below the original surface, replace the spider assembly.

NOTE: Anchor pins are not replaceable on single anchor pin brake spiders.

3. On the Bendix® ES™-150-04L brake, check the anchor pin retaining nut torque. Refer to the last page of this manual for current torque values.

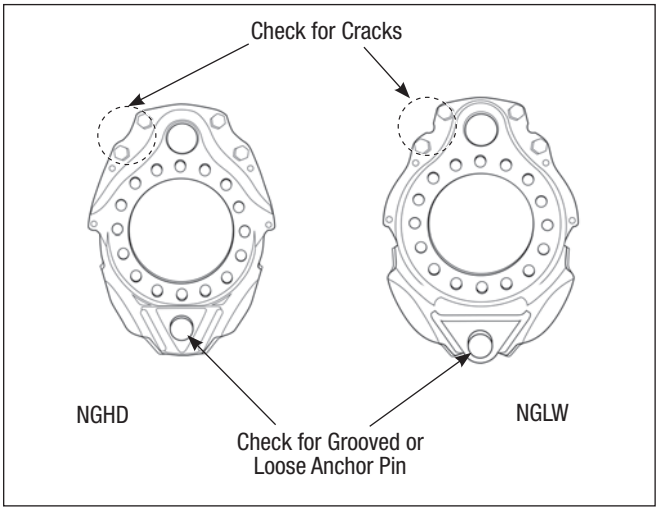


Figure 38 – Spider Inspection

SPECIAL NOTE: ES-150-04L R.H. brakes use a right-hand thread anchor pin retaining nut and L.H. brakes use a left-hand thread nut. Ensure that the nut is being turned in the proper direction when checking the nut torque.

⚠ CAUTION

If the anchor pin turns while checking the retaining nut torque, the spider assembly must be replaced.

Spider Inspection (Double Anchor Pin)

1. Visually check for cracks around the mounting bolt holes and cam and anchor pin areas. Replace the spider if any are found.
2. Check the anchor pin and bushings for wear, grooves, and free movement of the pin. If the pin is seized, worn, or grooved beyond 0.031" (0.79mm), replace the pin and bushing. Refer to the Shoe Removal and Installation Sections for the procedure.

NOTE: Replace the pins and the bushings at each brake reline.

Air Chamber Bracket Inspection

1. Check for a bent, broken, or cracked arm and cracked welds. *Refer to Figure 39*. Replace the bracket if any are evident.
2. Check the mounting studs (or bolts) for looseness, damaged threads, or a bent condition. Replace the mounting stud if any of these conditions are evident.

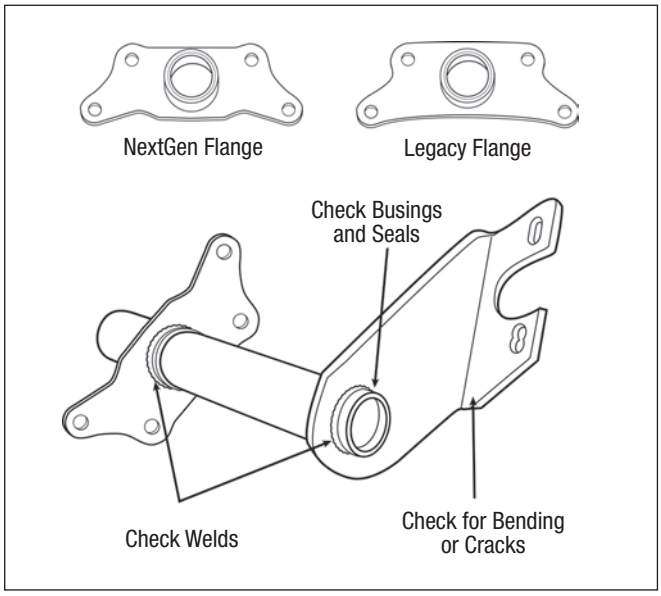


Figure 39 – Air Chamber Bracket Inspection

Inspection

Air Chamber Inspection

⚠ WARNING

To prevent personal injury, be sure to “cage” the spring before removing the spring-brake type air chamber.

NOTE: This information is general in nature. For specific air chamber inspection guidelines, refer to the manufacturer’s instructions.

1. Check for air leaks, cracked housing, a bent pushrod, a loose clamp ring, clogged vent holes, or a loose air fitting. Repair or replace as recommended by the manufacturer.
2. If the air chamber is repaired or replaced, check the distance from the clevis pin hole centerline to the air chamber face. *Refer to Figure 40 and Table 4 for manual slack adjusters.* For self-adjusting slack adjusters, refer to the manufacturer's guidelines.

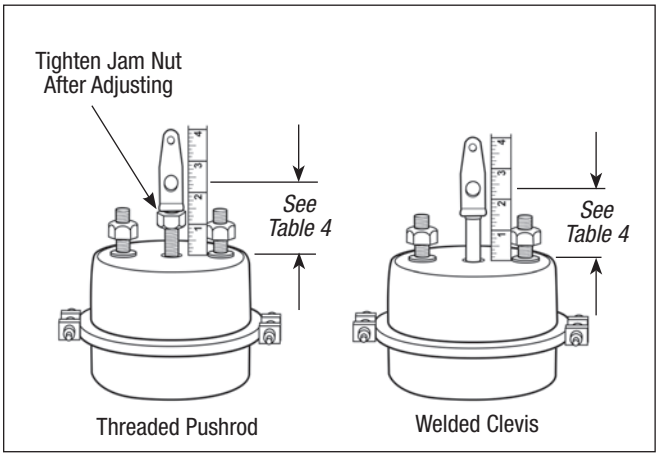


Figure 40 – Air Chamber Inspection

Distance: Clevis Pin Hole Centerline to Air Chamber Face	
All brakes (for threaded clevis)	2-5/8" ± 1/16" (66.7 ± 1.59 mm)
Welded Clevis	2-1/4" ± 1/16" (57 mm ± 1.59 mm)

Table 4 – Air Chamber Clevis Dimensions

3. If a new air chamber is installed, ensure that the cut-off pushrod does not project too far into the clevis. Minimum clearance: clevis-centerline-to-pushrod-end should be 7/8" (22.2 mm).
4. Check the clevis pin for cracks and wear.

Slack Adjuster Inspection

NOTE: This information is general in nature. For specific manual or self-adjusting slack adjuster inspection guidelines, refer to the manufacturer’s instructions.

1. Check the clevis pin bushing for cracks and wear. *Refer to Figure 41*. Replace as necessary.
2. Check the splines for chipped teeth and deformation. Replace the slack adjuster if necessary.

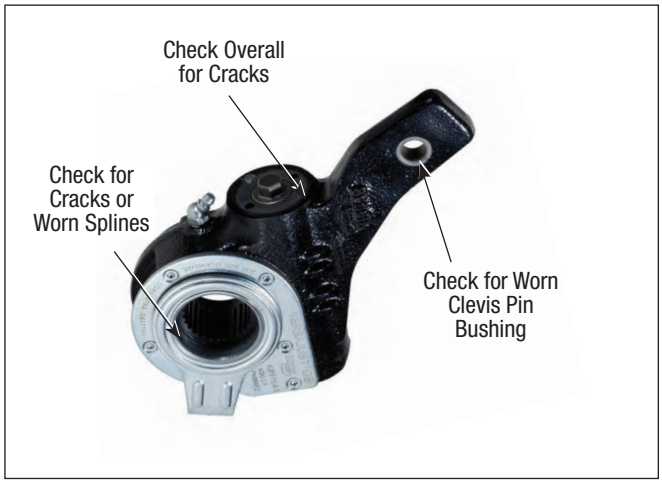


Figure 41 – Automatic Slack Adjuster Inspection

3. Turn the slack adjuster adjustment nut with a wrench – at least one turn in each direction. If binding is present, or if excessive force is required to rotate, replace the slack adjuster. If binding is present, consult with the manufacturer's literature to determine if the slack adjuster needs serviced or replaced.

⚠ CAUTION

If any of those conditions are found, consult with the manufacturer's literature to determine if the slack adjuster needs serviced or replaced.

Camshaft Bushing/Lining Replacement

Camshaft Bushing/Lining Replacement

Routinely replace lower-cost items – such as springs, seals, bushings, and heavily-worn, but unbroken parts. If these components aren't replaced routinely, more extensive damage may result.

Camshaft Bushing/Grease Seal Replacement

1. Remove the air chamber bracket, *see Removal/ Disassembly - Air Chamber Bracket Removal.*
2. Drive out the old bushings and grease seals with a suitable driver.
3. Clean and inspect the air chamber bracket, *see Inspection - Air Chamber Bracket Inspection.*
4. Install new bushings in the air chamber bracket (Drive and Steer Axles) with a suitable piloted driver. For identification and installation specifications, r*efer to Figure 42.*

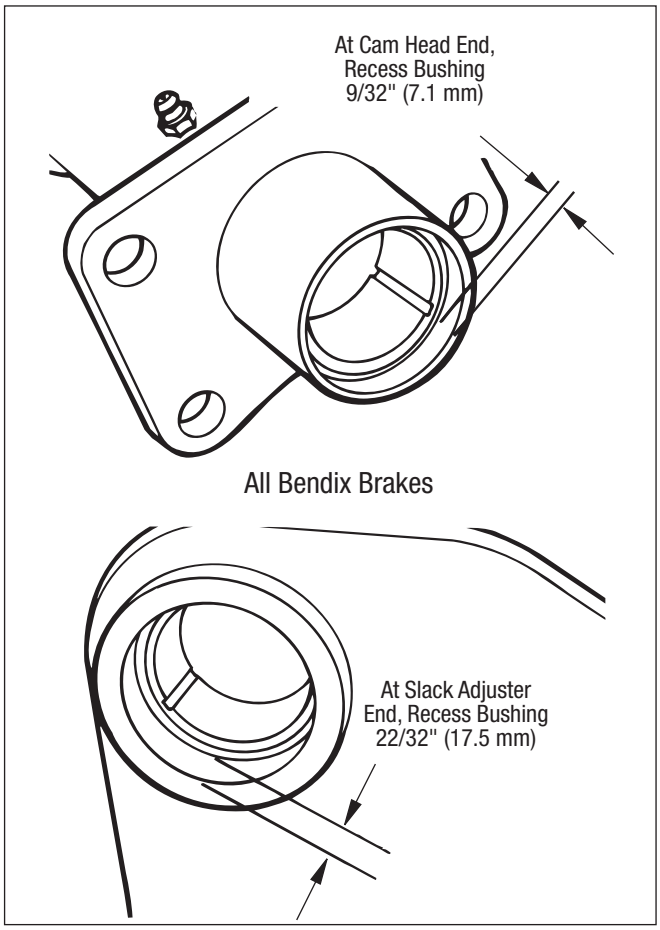


Figure 42 – Air Chamber Bracket Bushing Installation

5. Install new grease seals with a suitable piloted driver so that the seals are flush with the end of the air chamber bracket tube. *Refer to Figure 43.*

CAUTION

Seals must be installed as indicated so that the lip side (with spring) of both seals faces toward the slack adjuster end of the bracket. Improperly oriented seals may allow grease to exit camshaft head end of the air chamber bracket and contaminate the lining material.

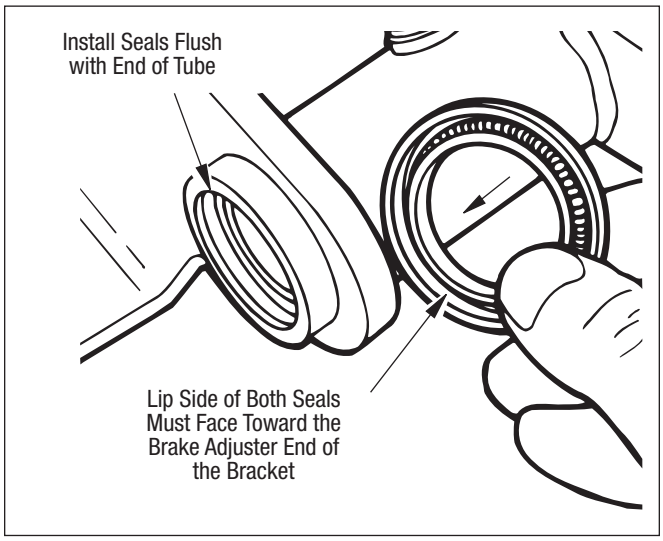


Figure 43 – Camshaft Bushing Installation

Lining Replacement

Lining Replacement

⚠ WARNING

The long-term effects of non-asbestos fibers have not been determined. Therefore, precautions should be used when handling these materials.

See General Information / Lining Material Warning

NOTE: Reline the brakes when the inspection indicates replacement is necessary, *see Inspection - Shoe, and Lining Inspection*. When replacing the lining only, make sure the shoes are in good condition. For replacement, use only Bendix® OEM-grade linings or shoe and lining assemblies.

1. Remove the shoe and lining assemblies.
2. Remove the lining blocks.

⚠ CAUTION

- If the blocks are bolted, use suitable tools to remove the bolts and discard.
- Inspect the shoe to be sure it can be reused.

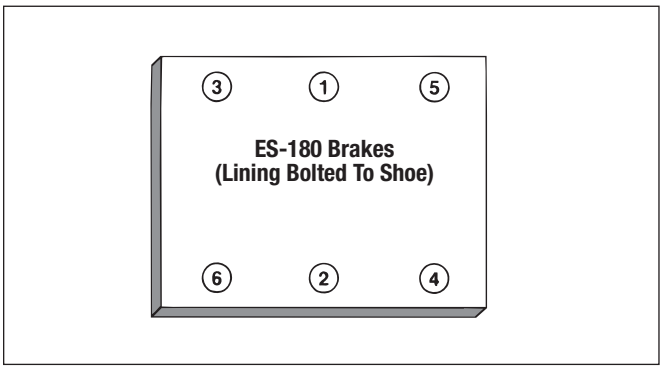


Figure 44 – Bolt on Lining Tightening Sequence

3. Clean the shoe with solvent if necessary. Using a wire brush, clean the shoe table. Paint with rust inhibitive paint.
4. Install the lining blocks.

NOTE: When installing linings or blocks, make sure they are positioned properly to match the rivet or bolt patterns. *Refer to Figure 44.*

For Bolted Linings: Using the machine screws provided in the lining kit, assemble the blocks to the shoes in the sequence shown in the illustration for Bendix® EB™-180 brakes. Torque the nuts as specified on the instructions provided within the lining kit. **T**

5. Check the lining installation by trying to insert a .006" (.15 mm) feeler gauge between the lining and the shoe table along the edges. It should not be possible to insert a feeler gauge in this manner anywhere along the edge with the exception of the outside ends beyond the last row of rivets. A larger clearance may exist in these areas.

Spider Installation

Spider Installation

SPECIAL NOTE: For the Bendix® ES™-150-04L brake, distinct right-hand (R.H.) and left-hand (L.H.) spider assemblies must be used. Although similar in appearance, differences exist in the anchor pin and retaining nut threads - L.H. brake uses L.H. threads and R.H. brake uses R.H. threads.

1. Verify the spider is serviceable, *see Spider Inspection.*
2. Verify that the spider is the correct part number for the axle being serviced.
3. Position the spider on the axle flange and install attaching the bolts and nuts.

NOTE: Use hardened washers under the bolt heads.

4. Sequentially torque the nuts according to the manufacturer's specifications, *Refer to Figure 45.*

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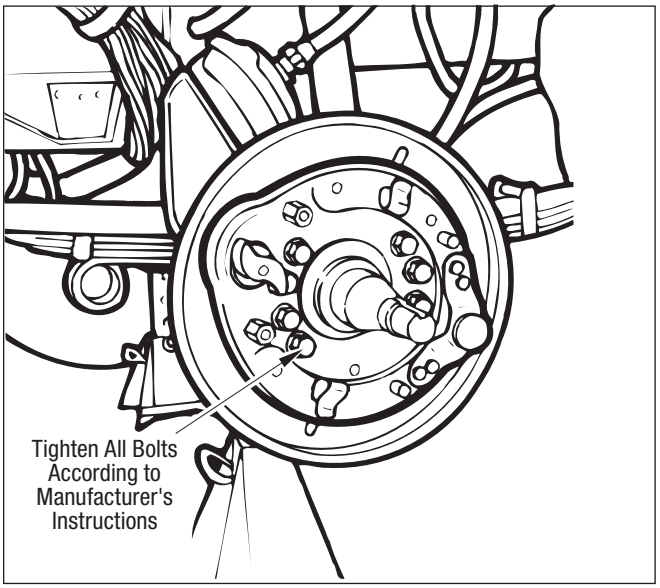

Figure 45 – Installing Spider Mounting Hardware

Dust Shield Installation (Two Piece)

NOTE: On Bendix® ES™-165-07H, M Brakes, the dust shield is installed after the shoes and anchor pins are installed, *see Installation/Assembly - Shoe Installation.*

1. Place both dust shield halves into position against the spider. Install all attaching screws finger tight.
2. Install the retaining clip and screws, if applicable.
3. Reposition the dust shield, as required, to allow a uniform space of 1/8" (3.2 mm) all along the parallel mating edges. *Refer to Figure 46*.
4. Torque the attaching screws to the proper torque; *see the Specifications chart.* T

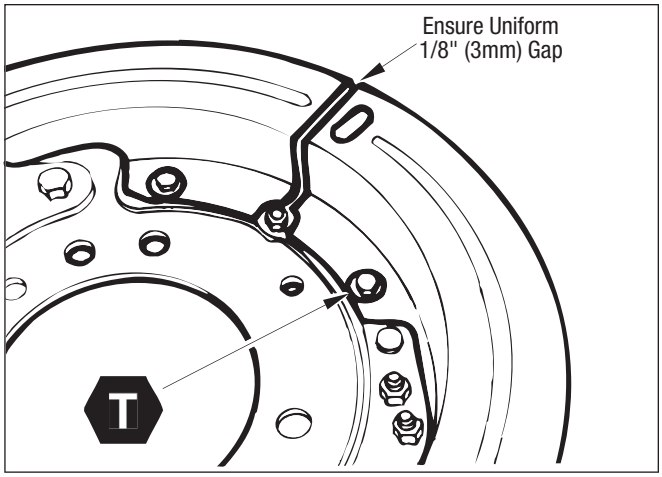

Figure 46 – Dust Shield Spacing

SPECIAL NOTE: For the ES-150-04L brake, a designed interference fit at the upper dust shield to the air chamber bracket area may cause the need to deform the upper dust shield by hand, slightly, to allow the upper dust shield half to align properly with the lower half. *Refer to Figure 47.*

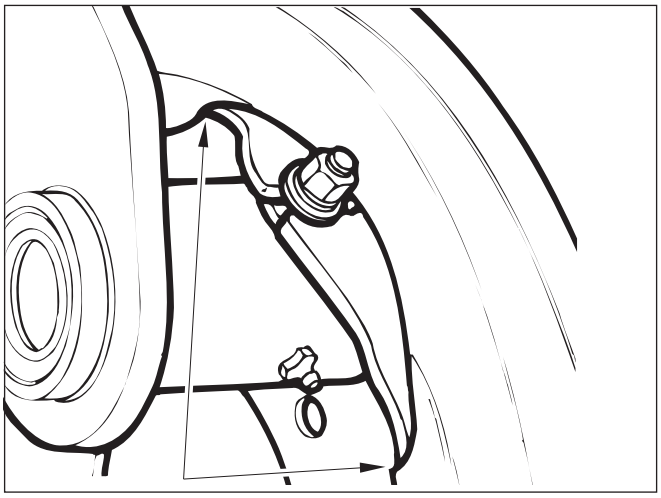

Figure 47 – Designed Interference Fit

Dust Shield Installation for HW and LW

Dust Shield Installation

1. Position the dust shield against the spider and install the screws finger tight.
2. Torque the attaching screws to the proper torque; *see the Specifications Chart and Figures 48 and 49.*

T

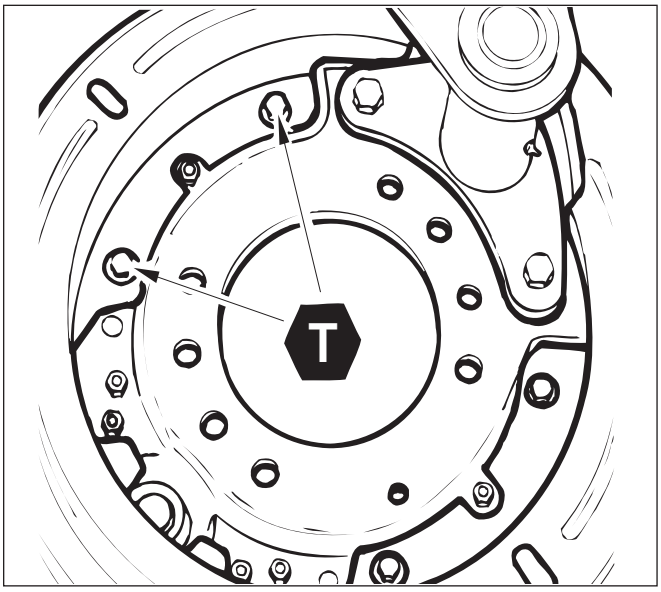

Figure 48 – Attaching Screw Location

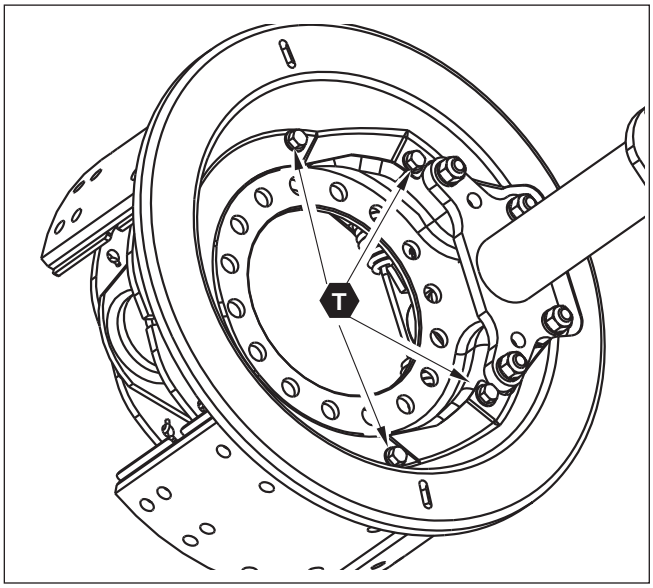

Figure 49 – Attaching Screw Location

Air Chamber Bracket Installation

Air Chamber Bracket Installation

1. Verify that the air chamber bracket is serviceable, *see Air Chamber Bracket Inspection, page 31.*
2. On the stamped steel spider, orient the bracket to align the mounting studs with the holes in the bracket.
3. Position the bracket against the spider and install the lock washers and nuts.
4. Torque the stud nuts to the proper torque; s*ee Specifications chart.* T
5. On the cast spider, orient the bracket to align the bracket holes with the tapped holes in the spider.
6. Position the bracket against the spider and install the bolts and lock washers.
7. Torque the bolts to the proper torque; *see Specifications chart.* T
8. If the air chamber was removed, install the chamber and tighten the nuts to the correct torque; *see Specifications chart.* T

Bendix® ES™-150-04L Brake

1. Verify that the air chamber bracket is serviceable. *Refer to Removal/Disassembly - Air Chamber Bracket Removal.*
2. Orient the bracket to align the stabilizing screw with the slot in the spider and the mounting studs with the holes in the spider.
3. Position the bracket against the spider and install the lock washers and barrel (or standard) nuts on the mounting bolts. *Refer to Figure 50.*

NOTE: Two brake shoe hold-down spring designs are used on the Bendix® ES™-150 brakes, *see General Information - Parts Nomenclature.*

4. Torque the standard nut to the proper torque, s*ee the Specifications chart.* T
5. Install the plain washer, lock washer, and nut on the stabilizing screw.
6. Torque the nut to the proper torque, *see the Specifications chart.* T

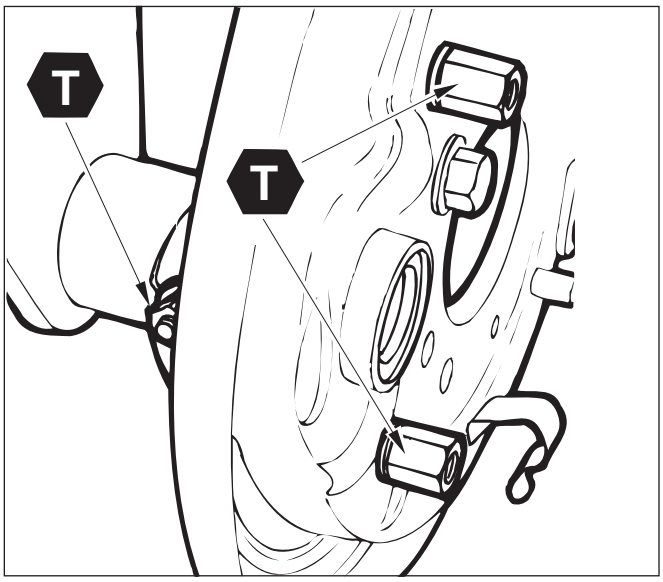

Figure 50 – Air Chamber Bracket Mounting Hardware

Camshaft Installation

Camshaft Installation

1. Verify that the camshaft is serviceable and is the correct part for the application, *see Inspection - Camshaft Inspection.*

NOTE: The camshaft mounting and related parts vary with brake models. Be sure to follow the instructions for special parts when installing the camshafts.

⚠ CAUTION

Ensure the camshaft being installed is correct for the application.

2. To ensure that camshaft being installed is correct for the application, rotate the camshaft in the direction of air chamber pushrod extension and check that the roller starts to ride up on the convex side of the cam head. *Refer to Figure 51.*
3. Apply a thin film of chassis grease on the inside of the camshaft bushing and seals, and on the spline area of the camshaft.

⚠ CAUTION

Do not grease the cam head surface. For efficient operation, this surface must remain free of oil, grease, or other contaminants.

4. Carefully slip the camshaft into the mounting position.

SPECIAL NOTE: For the Bendix® ES™-165-07M, H install the flat washer adjacent to the cam head before installing the camshaft.

On ES-165-05/06/07,08D, L, brakes the camshafts use a special washer between the cam head and the spider. It is important that this washer be installed correctly. *Refer to Figure 52.*

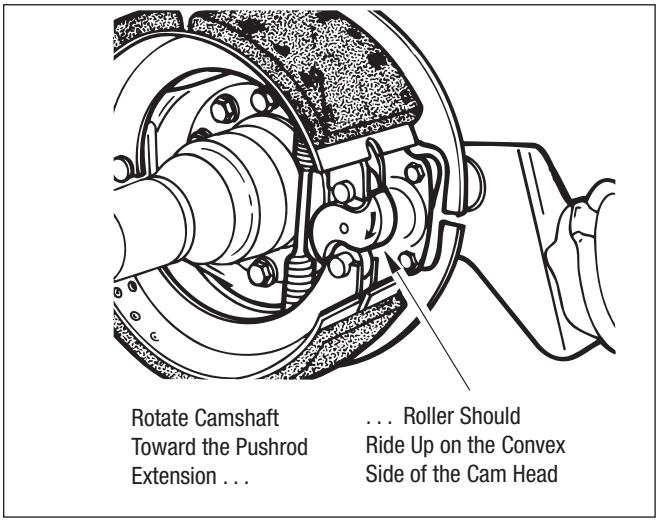

Figure 51 – Camshaft Installation

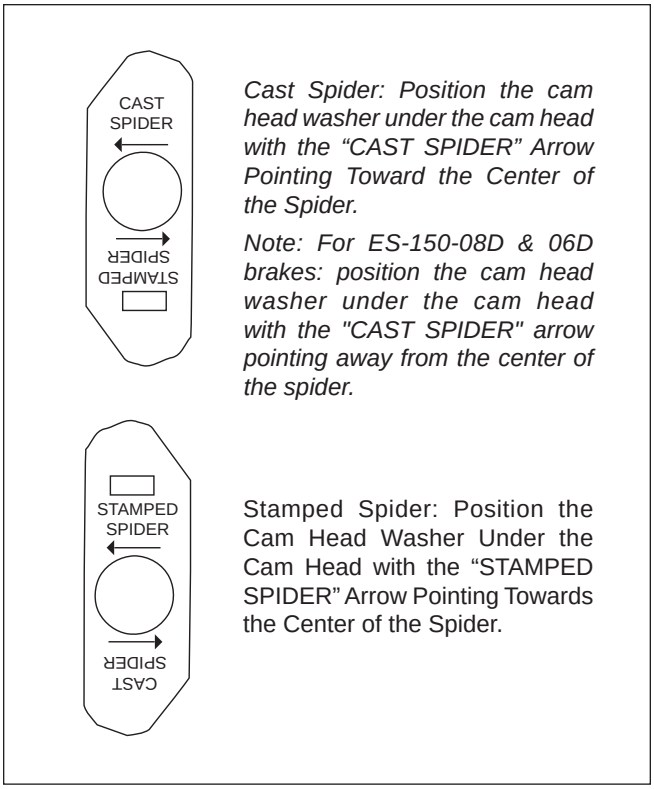

Figure 52 – Cam Head Washer Installation

SPECIAL NOTE: For ES-165-05,06,07 DL steer axle brakes using the horse collar spring retention system, position the cam head washer with the "stamped spider" arrow pointing towards the center of the spider. The horse collar should be placed over the cam tube first, then the ES washer, and finally the cam. *Refer to Figure 53.*

ES-165-05,06,D,L / ES-165-07,08,X,Z

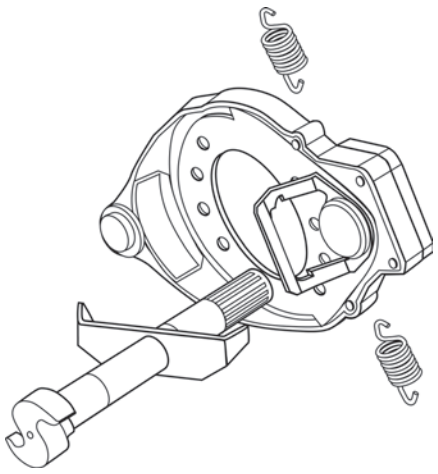

Figure 53 – Horse Collar Retention System

Camshaft Bushing/Lining Replacement

Cam Head Washer Installation
Slack Adjuster Installation

1. Verify that the slack adjuster is serviceable, *see Inspection - Slack Adjuster Inspection.*
2. Install the slack adjuster inner washer on the camshaft. The inner washer is identified by its 0.060" thickness and larger hole. *Refer to Figure 54*.

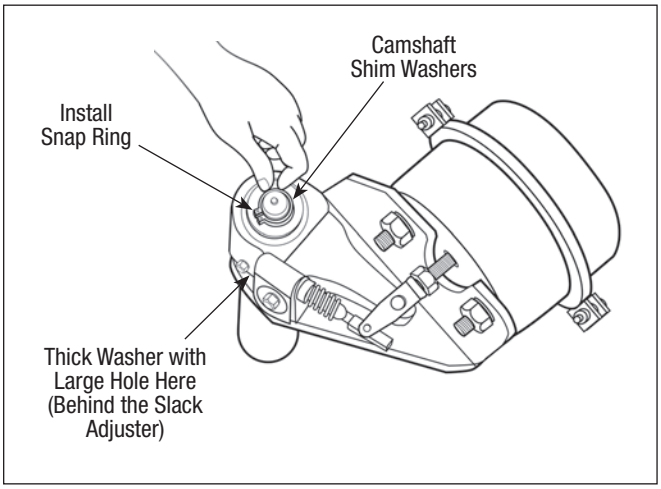

Figure 54 – Shim Washer and Snap Ring Installation

3. Apply a thin film of chassis grease to the slack adjuster splines.
4. Install the slack adjuster on the camshaft in the same position as noted before removal.
5. Install the camshaft shim washers and snap ring. *Refer to Figure 54*. Check and adjust the camshaft axial play. *See Step 6*.

NOTE: The camshaft axial play must be checked before the camshaft installation is complete. *Follow the instructions below.*

6. Mount a suitable dial indicator with the plunger referencing the end of the cam head. *Refer to Figure 55*.
7. Pull inboard on the slack adjuster end of the cam to take up the end play.
8. Set the dial indicator to zero.
9. Push outboard on the slack adjuster end of the cam and note the maximum reading. If necessary, add or delete camshaft shim washers to obtain end play between 0.005" - 0.045" (0.13 mm - 1.14 mm) with the slack adjuster centered between the air chamber bracket and the snap ring groove.
10. Pressure lubricate the slack adjuster according to the manufacturer's instructions. Pressure lubricate the air chamber bracket until grease flows out of the slack adjuster end of the tube. *Refer to Figure 56*.

⚠ CAUTION

Grease should not flow out the end of tube toward the cam head. If it does, the seal is defective and must be replaced.

⚠ CAUTION

Do not replace the existing grease fitting with a pressure relief type. Only standard non-vented fittings are to be used with spring loaded lip seals.

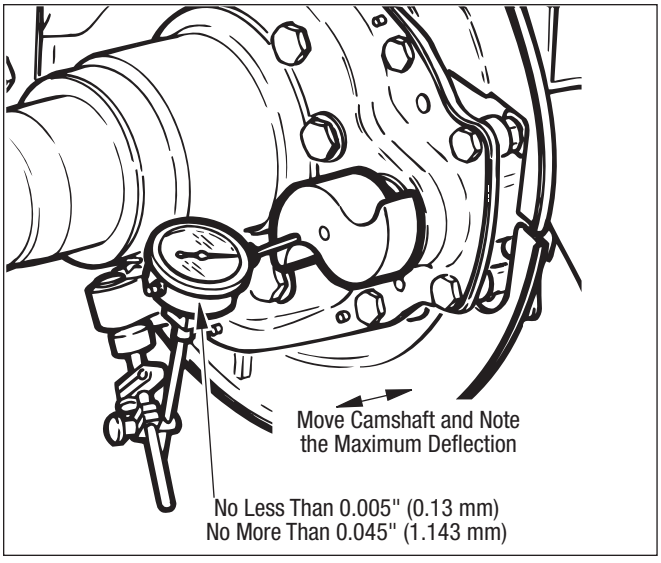

Figure 55 – Slack Adjuster End Play Check

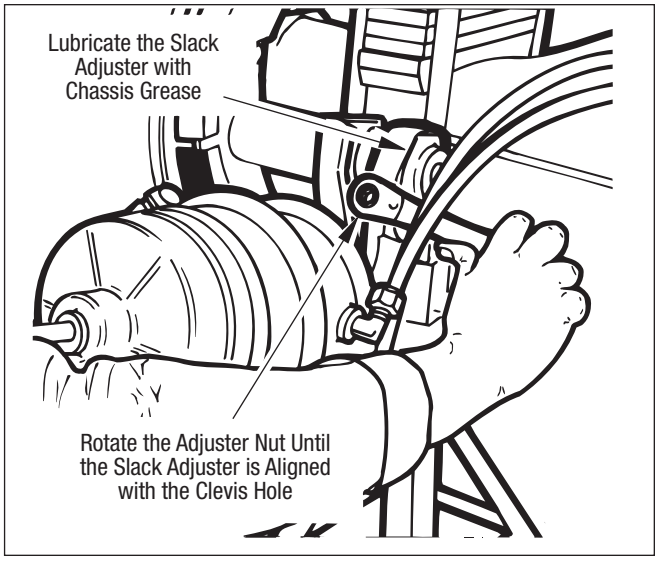

Figure 56 – Slack Adjuster Lubrication and Adjustment

Camshaft Bushing/Lining Replacement

11. Verify that the air chamber face-to-clevis centerline dimension is correct, *see Air Chamber Inspection*. Ensure that the clevis lock nut is securely tightened.
12. All chambers equipped by the OE on new trucks come with a welded clevis. Rotate the adjusting nut as required until the appropriate hole in the slack adjuster is aligned with the hole in the clevis. *Refer to Figure 56.*
13. Lubricate the clevis pin before inspection and install the washer and cotter pin or spring clip. If using a spring clip, lock the clip after installation. *Refer to Figure 57.*

Figure 57 – Spring Clips

Shoe and Lining Installation

Locate the brake model being serviced to identify the location of the appropriate shoe installation procedures.

Bendix® ES™-150-04L Brake

1. Verify that the spider, camshaft, air chamber bracket, and slack adjuster are serviceable and properly installed.

NOTE: *See General Information - Parts Nomenclature for shoe hold-down spring variations.*

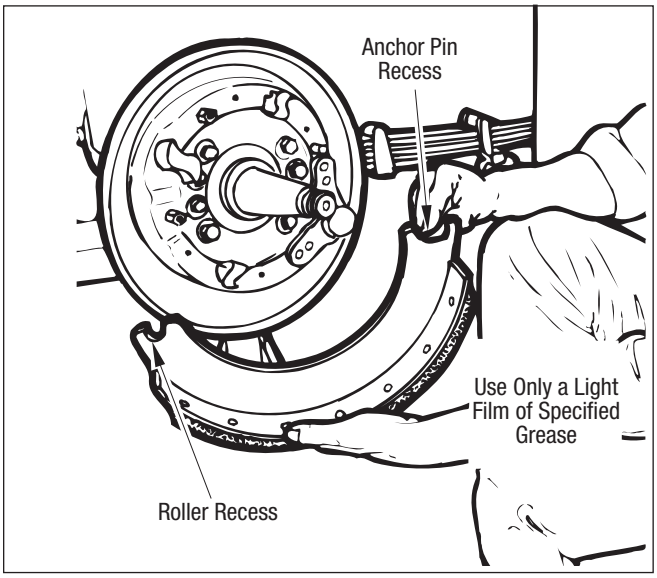

Figure 58 – Shoe Web Lubrication

2. Apply a thin film of grease to the cam roller and the anchor pin recesses of each shoe web. *Refer to Figure 58.*

⚠ CAUTION

Use only grease conforming to NLGI grade #1, high temperature and waterproof.

3. Position the upper shoe and lining web on the anchor pin and rotate down. Continue the rotation until the shoe is held in place by the shoe hold-down spring.
4. Hook one end of a new shoe retaining spring into the hole in the upper shoe web so the coil lays across the anchor pin. *Refer to Figure 59.*
5. Hook the opposite end of the spring into the hole on the lower shoe web.
6. Stretch the spring to allow positioning of the lower shoe web against the anchor pin.

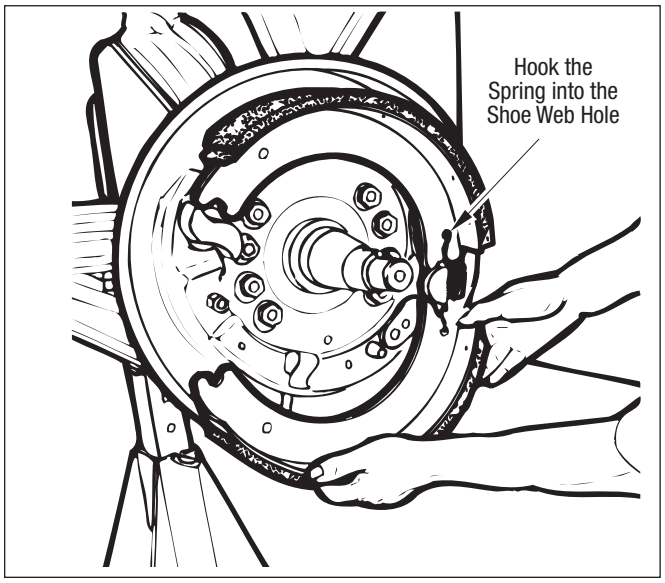

Figure 59 – Shoe Retaining Spring Installation

7. Rotate the lower shoe into position on the spider.
8. Hook one end of a new shoe return spring in the lower shoe web hole. Using a screwdriver for assistance, stretch the shoe return spring to hook it in the upper shoe web hole. *Refer to Figure 60.*
9. Using a large screwdriver or lever with tip, stretch the shoe return spring to allow insertion of a new cam roller on the upper shoe web.
10. Install a new cam roller on the lower shoe web in the same manner.

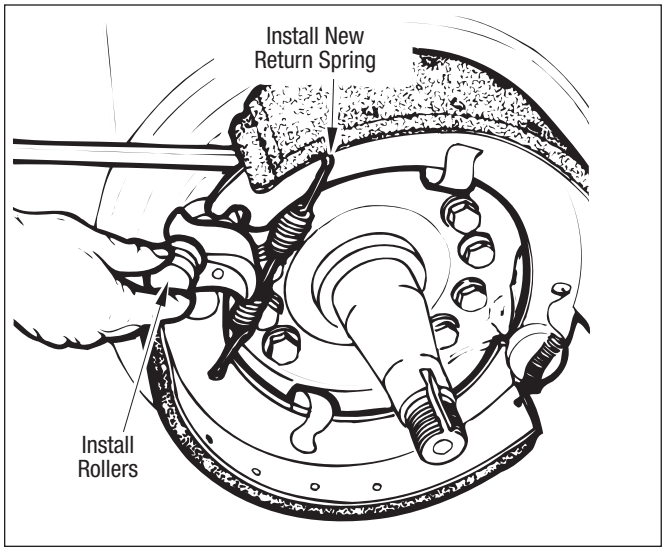

Figure 60 – Shoe Return Spring and Roller Installation

Shoe Installation

All Bendix® ES™-165-05/06/07/08D,X / ES-165-08Z Brakes

NOTE: The following procedures are divided into sections, identified by the brake model numbers.

1. *See Inspection & Repair / Replacement* to verify that the spider camshaft, bracket, and slack adjuster are serviceable and properly installed.
2. During the shoe installation, lubricate as follows:
   - Shoe roller recess - one-piece roller.
   - Roller I.D. - two-piece roller.

⚠ CAUTION

Use only grease conforming to NLGI grade #1, high-temperature, waterproof.

Do Not Lubricate:

- Cam head surface. For efficient operation, this surface must remain free of oil, grease or other contaminants.

3. Hook the ends of the new retainer springs into the holes in both shoe tables, and the web.
4. Position the upper and lower shoes around the anchor pin. *Refer to Figure 61*.

⚠ WARNING

The long-term effects of non-asbestos fibers, have not been determined. Therefore, precautions should be used when handling these materials.
See General Information / Lining Material Warning.

5. Install a new shoe return spring. *Refer to Figure 62.*

NOTE: For ES-165-D, L, X, Z brakes, a lever may be required to assist in hooking the shoe return spring.

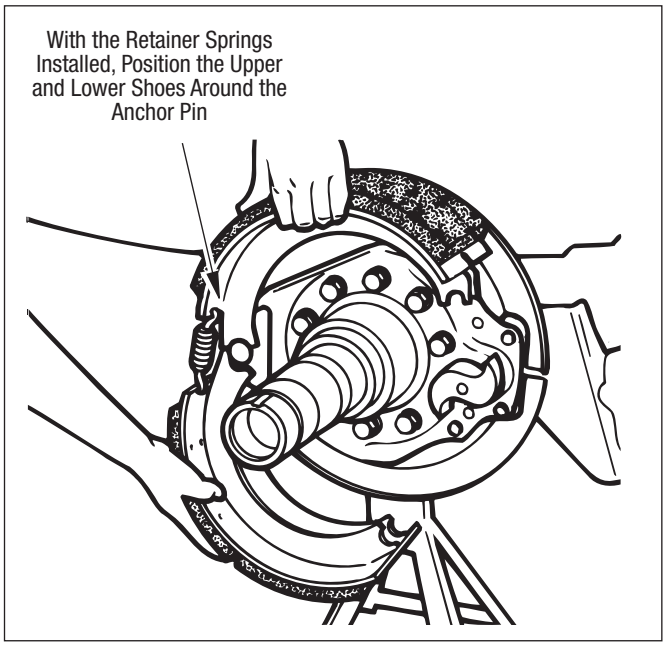

Figure 61 – Upper and Lower Shoe Positioning

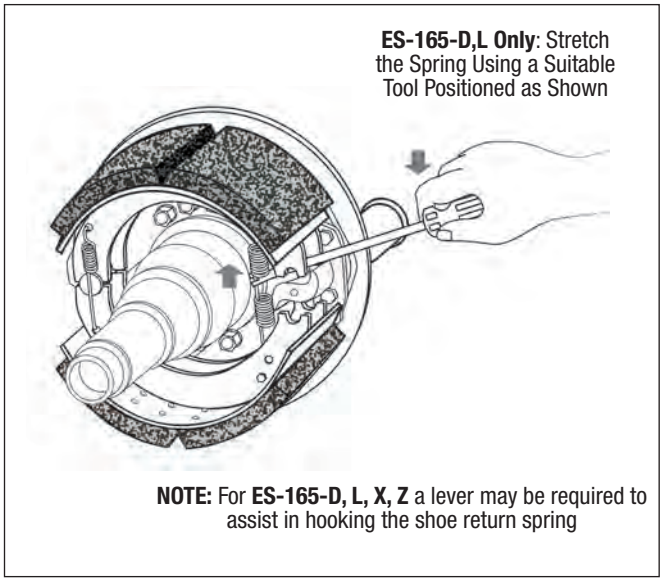

Figure 62 – Shoe Return Spring Installation

Shoe Installation

6. Install the shoe return spring. Ensure the return spring hooks face the rollers. *Refer to Figure 63.*

NOTE: A lever may be required to assist in hooking the return spring.

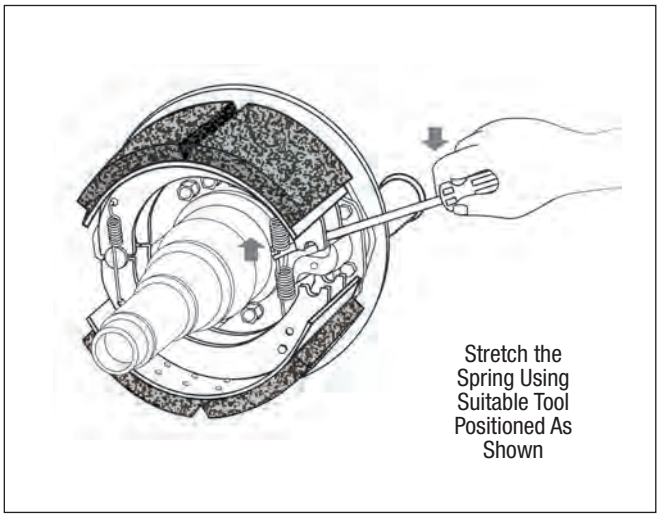

Figure 63 – Shoe Return Spring Installation

NOTE: If drums are oversized, *see* ***Inspection - Drum Inspection.***

7. Assemble the roller retainer on the ends of the roller as shown below. **NOTE:** Be sure to lubricate the roller pockets on the shoe before installing the roller. *Refer to Figure 64.*

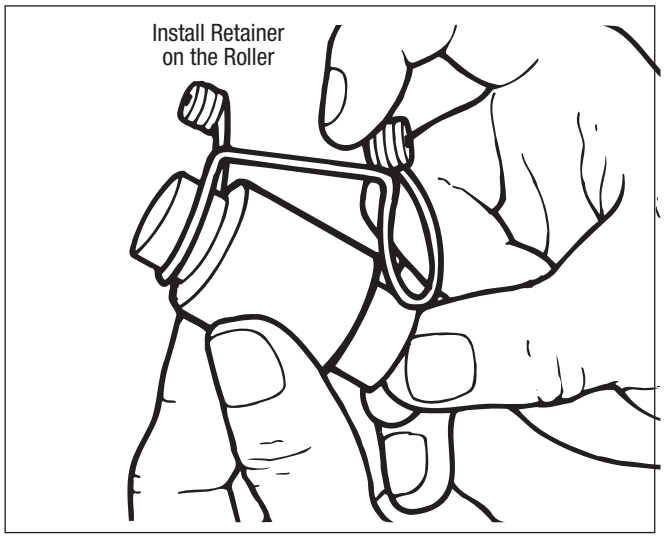

Figure 64 – Roller Retainer Installation

8. Using a lever or large screwdriver, stretch the shoe return spring to allow installation of the new roller and retainer assembly on the lower shoe web. *Refer to Figure 65.*

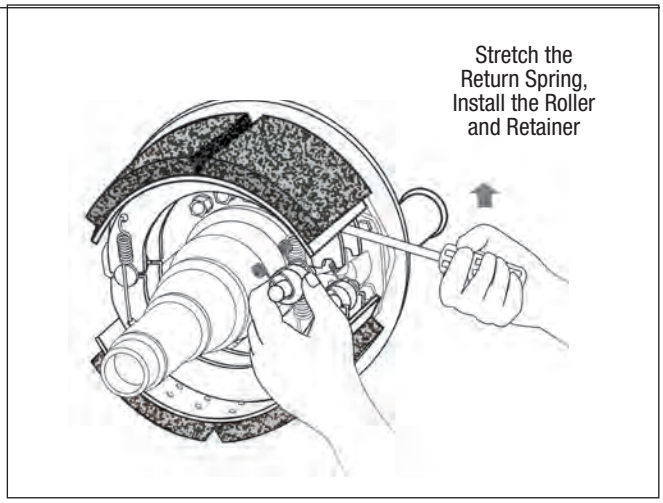

Figure 65 – Roller and Retainer Installation

9. Position the roller and retainer in the shoe recess as *shown in Figure 65*. Squeeze the loops and swing the retainer into position to snap the loops in the shoe web holes. *Refer to Figure 66.* Verify that both retainer loops are engaged in the web holes before proceeding.

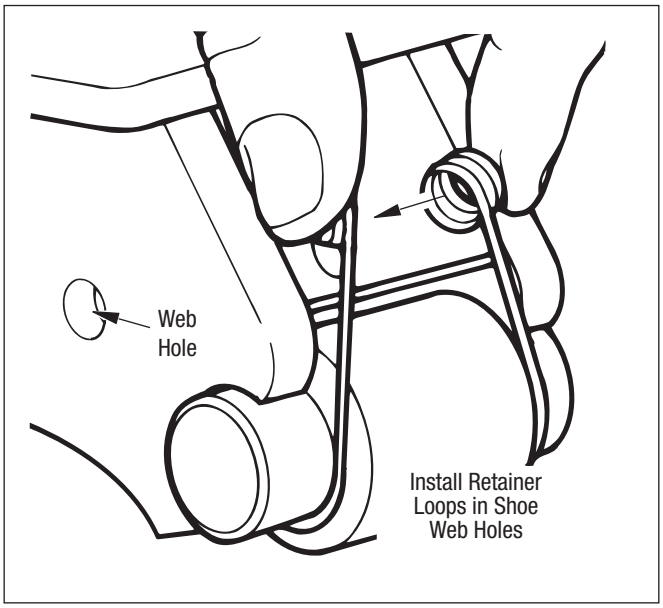

Figure 66 – Retainer Installation

10. Repeat the process on the upper shoe.
11. Install the dust shield. Secure the dust shield with cap screws, and tighten to correct torque, *see Specifications chart.*

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Shoe Installation

Bendix® ES™-165-07M Heavy-Duty Brake

⚠ WARNING

The long-term effects of non-asbestos fibers, have not been determined. Therefore, precautions should be used when handling these materials.

See General Information / Lining Material Warning.

1. *See Inspection & Repair / Replacement* to verify that spider camshaft, bracket, and slack adjuster are serviceable and properly installed.
2. During the shoe installation, lubricate as follows:
   - Shoe roller recess.
   - Anchor pin - light film of grease.

⚠ CAUTION

Use only grease conforming to NLGI grade #1, high-temperature, waterproof.

Do Not Lubricate:

- Cam head surface. For efficient operation, this surface must remain free of oil, grease, or other contaminants.

3. After driving out the old anchor pin bushings from the spider, *see Removal/Disassembly - Shoe Removal.* Press new anchor pin bushings in the spider, aligning the slot in the bushing with the tapped holes in the spider. *Refer to Figure 67*.

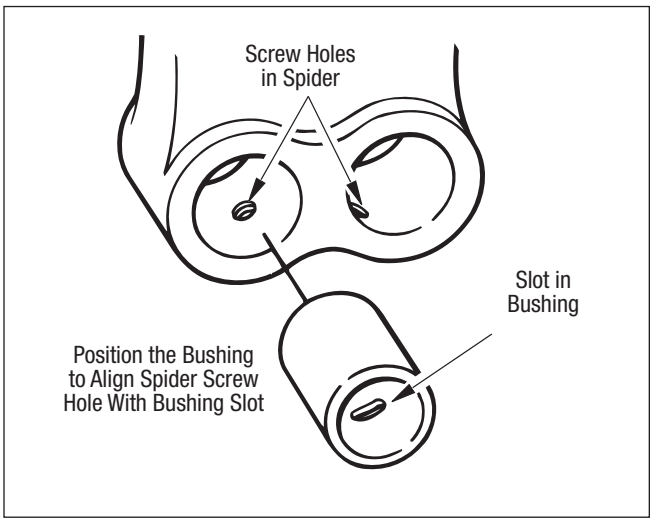
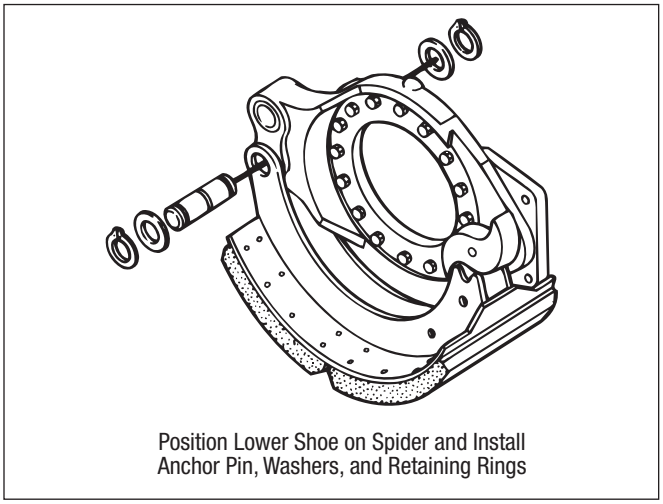


Figure 67 – Anchor Pin Bushing Installation

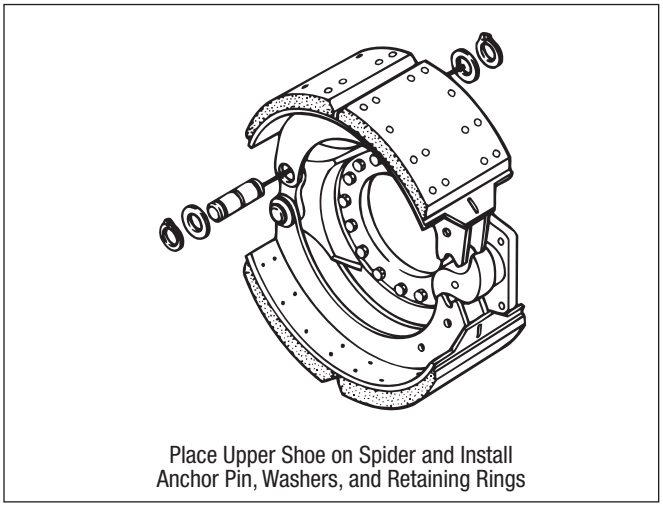
4. Lubricate the anchor pins during the installation. *See Step 2.*



Position Lower Shoe on Spider and Install
Anchor Pin, Washers, and Retaining Rings

Figure 68 – Lower Shoe and Anchor Pin Installation

5. Place the lower shoe in the mounting position on the spider, and install the lower anchor pin, washers, and retaining rings. *Refer to Figure 68.*



Place Upper Shoe on Spider and Install
Anchor Pin, Washers, and Retaining Rings

Figure 69 – Upper Shoe and Anchor Pin Installation

6. Place the upper shoe in the mounting position on the spider, and install the upper anchor pin, washers, and retaining rings. *Refer to Figure 69.*

Shoe Installation

7. Install the shoe return spring. Ensure the return spring hooks face the rollers. *Refer to Figure 70.*

NOTE: A lever may be required to assist in hooking the return spring.

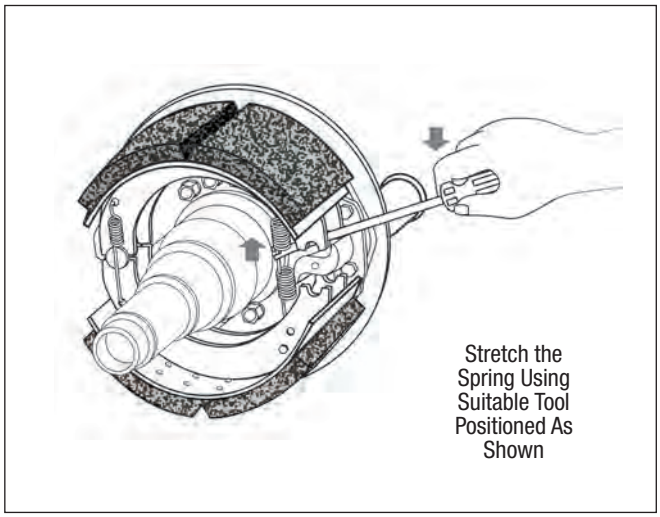


Figure 70 – Shoe Return Spring Installation

NOTE: If drums are oversized, *see Inspection - Drum Inspection.*

8. Assemble the roller retainer on the ends of the roller as shown below. **NOTE:** Be sure to lubricate the roller pockets on the shoe before installing the roller. *Refer to Figure 71.*

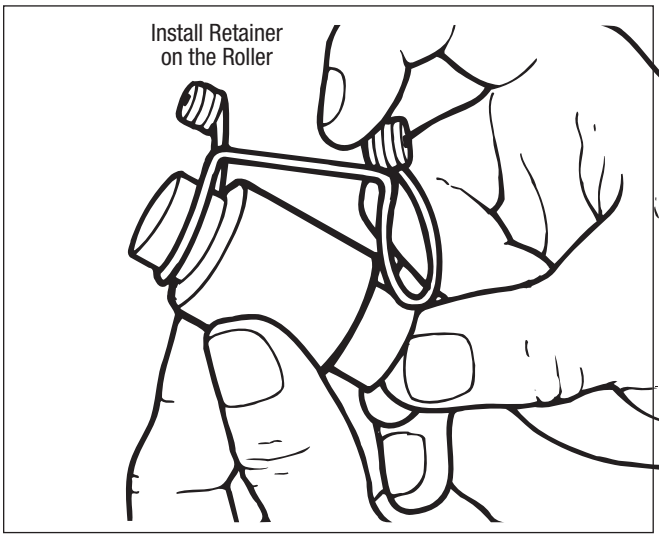


Figure 71 – Roller Retainer Installation

9. Using a lever or large screwdriver, stretch the shoe return spring to allow installation of the new roller and retainer assembly on the lower shoe web. *Refer to Figure 65.*

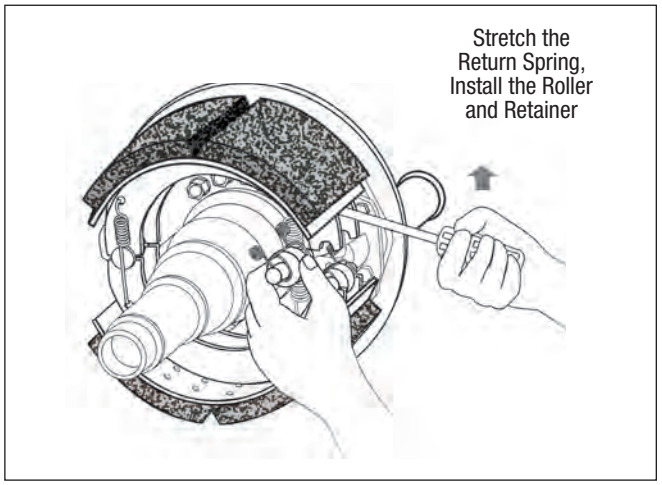


Figure 72 – Roller and Retainer Installation

10. Position the roller and retainer in the shoe recess *as shown in Figure 72*. Squeeze the loops and swing the retainer into position to snap the loops in the shoe web holes. *Refer to Figure 73.* Verify that both retainer loops are engaged in the web holes before proceeding.

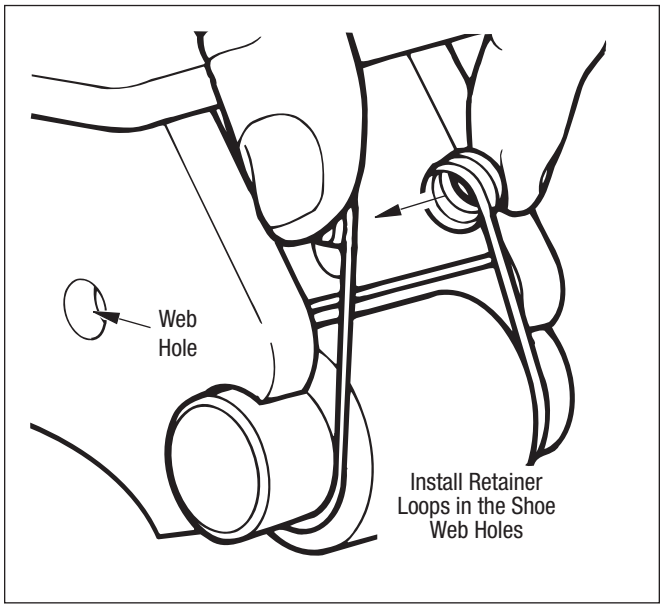


Figure 73 – Retainer Installation

11. Repeat the process on the upper shoe.

12. Install the dust shield. Secure the dust shield with cap screws, and tighten to correct torque, *see Specifications chart.* T

Shoe Installation

Bendix® ES™-165-07-H Severe-Duty Brake

⚠ WARNING

The long-term effects of non-asbestos fibers have not been determined. Therefore, precautions should be used when handling these materials.

See General Information/Lining Material Warning.

1. *See Inspection & Repair / Replacement* to verify that the spider, camshaft, bracket, and slack adjuster are serviceable and properly installed.
2. During the shoe installation, lubricate as follows:
   - Roller inside diameter.
   - Anchor pin - light film of grease.

⚠ CAUTION

Use only grease conforming to NLGI grade #1, high-temperature, waterproof.

Do Not Lubricate:

- Cam head surface. For efficient operation, this surface must remain free of oil, grease, or other contaminants.

NOTE: If the rollers were removed, replace with new Bendix® OEM rollers and pins.

3. Lubricate the roller inside diameter (*see Step 2*), prior to installation. Assemble the roller and pin to the shoe and secure with the groove pin. Stake the casting area around the groove pin. *Refer to Figure 74.*
4. After driving out the old anchor pin bushings from the spider, *see Removal/Disassembly - Shoe Removal,* press the new anchor pin bushings in the spider, aligning the slots in the bushing with the tapered holes in the spider. *Refer to Figure 75.*
5. Press the anchor pin bushings in the brake shoes. *Refer to Figure 76.*
6. Lubricate the anchor pin prior to installation. *See Step 2.*
7. Place the lower shoe in position on the spider, and install the lower anchor pin, washers, and retaining rings. *Refer to Figure 77.*

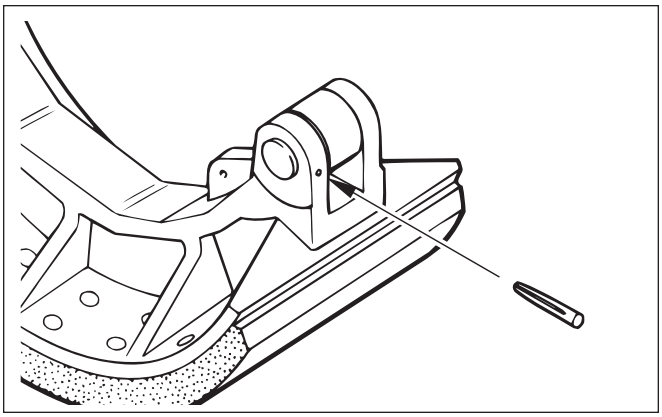


Figure 74 – Groove Pin Installation

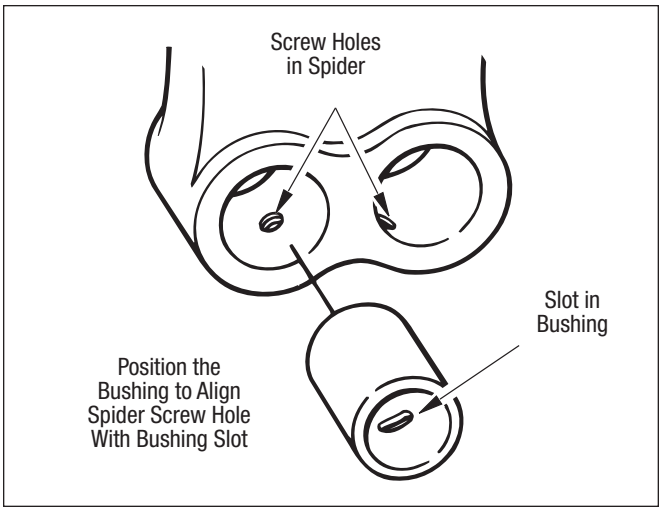


Figure 75 – Spider Anchor Pin Bushing Installation

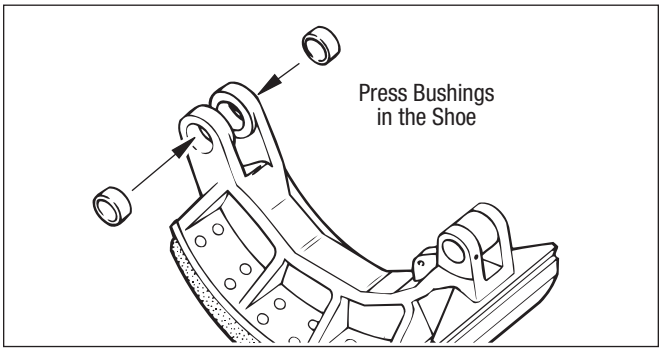


Figure 76 – Shoe Anchor Pin Bushing Installation

Shoe Installation

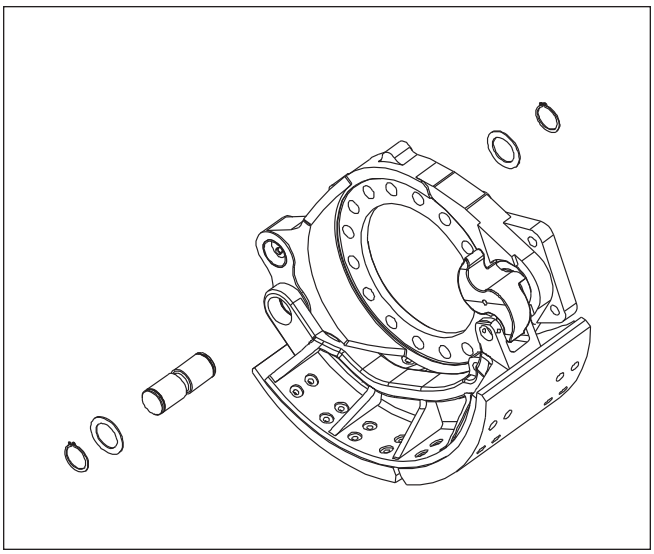


Figure 77 – Lower Shoe Positioning

8. Connect a new return spring to the lower shoe.
9. Position the upper shoe for installation on the spider (partially installed with the shoe end disengaged from the cam), then connect the return spring to the upper shoe. *Refer to Figure 78.*

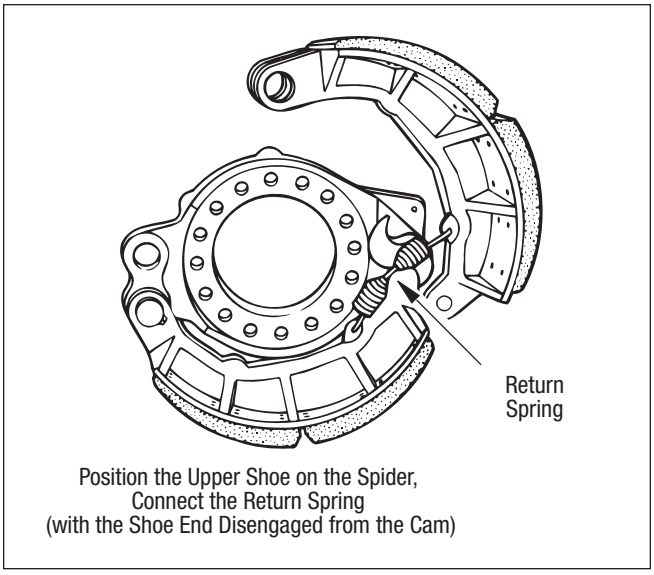


Figure 78 – Upper Shoe Positioning

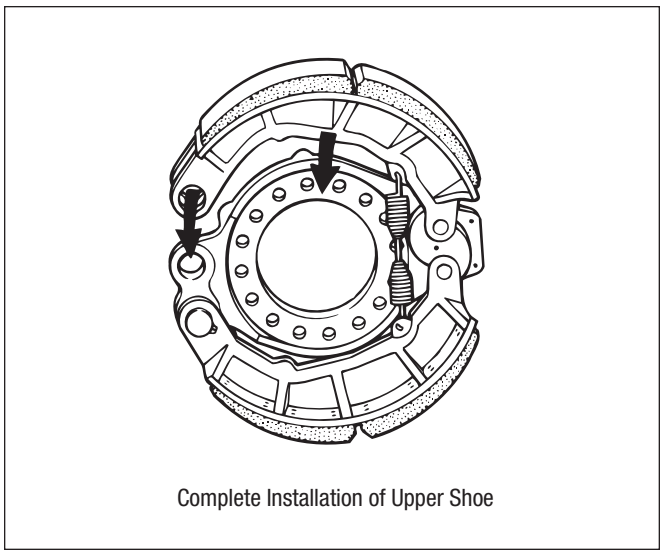


Figure 79 – Upper Shoe Installation

10. Complete the installation of the upper shoe and install the anchor pin, washers, and retaining rings. *Refer to Figure 79.*
11. Install the cap screws in the spider to secure the anchor pins. Tighten the screws to the proper torque, *see the Specifications chart*, then secure the lockwire. *Refer to Figure 80.*

T

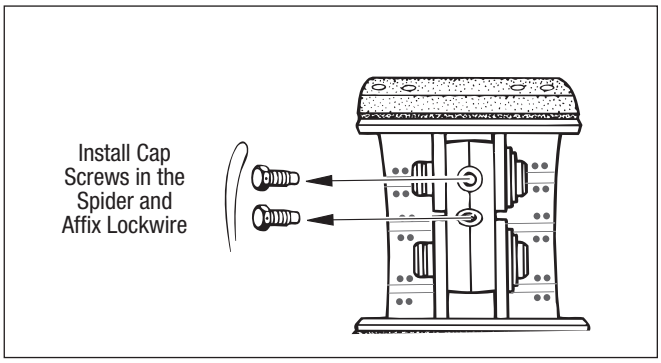


Figure 80 – Lower Shoe and Anchor Pin Installation

12. Install the dust shield. Secure with the cap screws. Tighten the screws to the correct torque, *see the Specifications chart.*

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Specification Chart

Specifications

Fastener Torque Specifications		
Fastener	Torque	
	English	Metric
Bendix® ES™-165		
Dust Shield to Spider Screws	150-180 lb-in	16.9-20.3 N.m
Air Chamber Bracket to Steel Stamped Spider Nuts	65-85 lb-ft	88-115 N.m
Air Chamber Bracket to Cast Spider Bolts	65-85 lb-ft	88-115 N.m
Air Chamber Mounting Nuts (7/16"-20 Nuts)	35-40 lb-ft	48-54 N.m
Air Chamber Mounting Nuts (5/8"-18 Nuts)	135-155 lb-ft	180-210 N.m
Lining Bolts/Nuts	For torque specs refer to the installation note in the lining kit	
Anchor Pin Cap Screw (ES-165-07H, 07M)	120-150 lb-in	13.6-16.9 N.m
ES-150-04L		
Dust Shield Attaching Screws	11-16 lb-ft	15-22 N.m
Air Chamber Bracket Nuts	55-65 lb-ft	75-88 N.m
Stabilizing Screw Nut	23-27 lb-ft	31-37 N.m
Anchor Pin Reinforcement Nuts	35-40 lb-ft	47-54 N.m
Anchor Pin Retaining Nut	475-525 lb-ft	644-712 N.m
Shoe Hold-Down Spring Screws	6-9 lb-ft	8-12 N.m
Key Dimensional Specifications		
Minimum Lining Thickness (*See Shoe and Lining Inspection*)		
ES-150-4L	3/16" (4.76 mm) or 1/16" (1.59 mm) from rivet heads	
ES-165	1/4" (6.4 mm) or 1/16" (4.76 mm) from rivet heads	
Camshaft End Play (Axial)	.005" - .045" (0.127-1.143 mm)	
Camshaft Radial Play	.035" (.91 mm) maximum	
Air Chamber Face to Clevis Pin Centerline (clevis pin center line on all threaded clevis)	2-5/8" ± 1/16" (66.7 mm ± 1.59 mm)	
Welded Clevis	2-1/4" ± 1/16" (57 mm ± 1.59 mm)	
Air Chamber / Applied & Free Stroke		
Max. Air Chamber Size	**Max Desired Applied Stroke**	**Free Stroke**
30" (762.0 mm)	2" (50.8 mm)	3/8" to 5/8"
30" (762.0 mm) Long Stroke	2.5" (63.5 mm)	

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