

Technical Bulletin

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Page: 1 of 10

Subject: Bendix® Versajust® LS™ Slack Adjuster Inspection Procedures

This document highlights all of the steps needed to thoroughly inspect the Bendix® Versajust® LS™ slack adjuster. *For additional information please review Service Data sheet SD-05-4630.*

PREVENTIVE MAINTENANCE

Important: Always review the Bendix Warranty Policy prior to performing any maintenance procedure. Be advised that the performance of any unauthorized maintenance on the Bendix Versajust LS Slack Adjuster may void the product warranty.

No two vehicles operate under identical conditions. As a result, maintenance intervals may vary. Experience is a valuable guide in determining the best maintenance interval for air brake system components. (Also observe any more frequent brake adjustment inspections or maintenance intervals specified by the vehicle manufacturer).

At a minimum, the Versajust LS slack adjuster should be inspected every three (3) months or 500 operating hours, whichever comes first, for proper operation. Should the Versajust LS slack adjuster not meet the elements of the operational tests noted in this document, further investigation and service of the adjuster may be required. Every 50,000 miles, six (6) months, or 1,000 operating hours – or at the time of routine vehicle chassis lubrication – whichever occurs first, the following steps should be followed:

1. Visually check for physical damage, such as broken air lines and broken or missing parts.
2. Lubricate the automatic slack adjuster through the lube fitting with a quality multipurpose chassis lubricant (N.L.G.I. Grade 2).

Lubricate the slack adjuster until clean lubricant flows from the grease relief opening in the boot (refer to Figure 1).

BRAKE SYSTEM INSPECTION OVERVIEW (WHEELS ON INSPECTION)

With the parking brakes set:

- Visually verify that the slack angles are the same at all wheel positions on the drive axle.

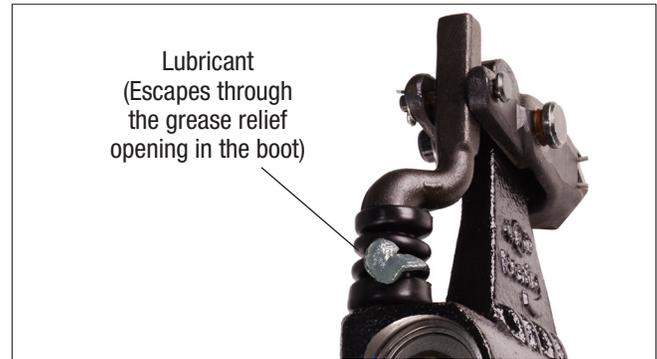


Figure 1 - Lubrication

- Visually inspect for damage or missing parts.
 - Inspect for bent pushrods.
 - Inspect for worn clevis and clevis pins.

With the parking brakes released:

- Visually verify that the slack angles are the same on all axles.
- Apply the brake pedal and check that the slack adjuster apply and release movement is the same at all wheel-ends.
 - Look for slower apply and release times (different from other wheel-ends). If this situation is evident it could be the cam-tube has not been lubricated properly causing the cam to drag in the bushing.
 - Specific cam shaft related procedures/specifications can be found on pages 7 through 10 of this document.
 - Inspect for a worn clevis and clevis pins.

Check the Lubrication:

- Grease the cam-tube until it purges at the slack adjuster end of the cam-tube. Specific details regarding cam shaft and cam tube maintenance are outlined in pages 7 through 10 of this document.
 - If water or contaminated grease is being pushed out by greasing, continue to purge until clean/new grease is visible.

- Check the clevis pin and clevis for wear or damage. If no damage is present, lubricate the clevis pin with spray lubricant or anti-seize and verify that the pin rotates freely.

IN-SERVICE INSPECTION

1. Apply and release the vehicle brakes several times while observing the Bendix® Versajust® LS™ automatic slack. The slack adjuster and brake actuator should move freely, without binding or interference, and should return to the full released position. Observe the looseness that exists between the yoke and the adapter bushing and the yoke and the link pins and their mating parts (yoke, body, link). Replace these parts if looseness appears excessive. Make certain the brake actuator pushrod jam nut is tight against the yoke adapter.

ACTUATOR STROKE TABLE	
Standard Stroke	
Brake Actuator Size	Recommended Maximum Operating Stroke
30	2"
24	1 ³ / ₄ "
20	1 ³ / ₄ "
16	1 ³ / ₄ "
12	1 ³ / ₈ "
Long Stroke	
Brake Actuator Size	Recommended Maximum Operating Stroke
30LS	2 ¹ / ₂ "
24L	2"
24LS	2 ¹ / ₂ "
20L	2"
16L	2"

Table 1 - Actuator Recommended Max Stroke

2. Inspect the Versajust LS slack adjuster for physical damage, paying particular attention to the link, boot, and yoke. Inspect for bent, broken, loose, or misaligned brake actuator pushrods and cracked or damaged brake actuator brackets. Repair or replace any components found to be damaged.
3. Measure the brake actuator pushrod stroke while making a 90-100 psi service brake application. Actuator pushrod strokes should not exceed the values *shown in Table 1*. The correct pressure for this test can be achieved as follows: Build the system pressure up to a 100 psi reading on the vehicle gauge. Shut the engine off. Fan the brakes to attain a 90-95 psi reading. Make and hold a full brake application while the strokes are measured.

If the slack adjuster does not automatically adjust the brakes

If the actuator stroke exceeds those shown in the stroke table, inspection of the foundation brake and/or the automatic slack is necessary. Maintenance of the foundation brake may be a factor in the excessive stroke conditions. Inspecting the foundation brake – per the *Brake Maintenance Inspection* presented in this manual – should determine how much of the long stroke condition is caused by the condition of the foundation brake.

The Versajust LS slack adjuster can be tested using the instructions presented in this manual under *Testing the Bendix Versajust LS Adjuster Mechanism*. The automatic slack adjuster is not designed to function as a manual adjuster once it is unable to maintain adjustment automatically. Manual adjustment should be done only as a temporary measure to correct brake adjustment in an emergency situation. The routine manual adjustment of an automatic slack adjuster that is still within adjustment limits may shorten its service life. Automatic slack adjusters should not be manually adjusted in an effort to correct excessive pushrod stroke. 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 fix. Replacement of the automatic slack adjuster or other foundation brake components may be necessary. Consult with the manufacturer's troubleshooting guidelines to find and fix the problem.

WARNING: Never use an air impact wrench to adjust/de-adjust an automatic slack adjuster. Manual adjustment of automatic slack adjusters is a dangerous practice that could have serious consequences. This is because it can give the operator a false sense of security about the effectiveness of the brakes, which are likely to go out of adjustment again soon. **DO NOT** make manual adjustments of an automatic slack adjuster once it can no longer automatically adjust the brakes. Manual adjustment **DOES NOT** fix the underlying wheel-end adjustment problem. As soon as possible, have the vehicle inspected by a qualified technician or consult the manufacturer's troubleshooting guidelines to find and fix the problem.

TESTING THE BENDIX® VERSAJUST® LS™ ADJUSTER MECHANISM

The following test can be made to determine if the Bendix® Versajust® LS™ automatic slack adjuster mechanism is functioning properly.

1. With the brakes released and the vehicle wheels blocked, de-adjust the brakes by rotating the manual adjustment hex counterclockwise approximately $1/2$ to 1 revolution.
Note: Considerable torque is required to rotate the manual adjustment hex counterclockwise and should be considered normal. The required torque may be as high as 70 ft-lbs.
2. Using a straight edge, scribe a line across the manual adjustment hex head and slack adjuster body (*refer to Figure 2*).

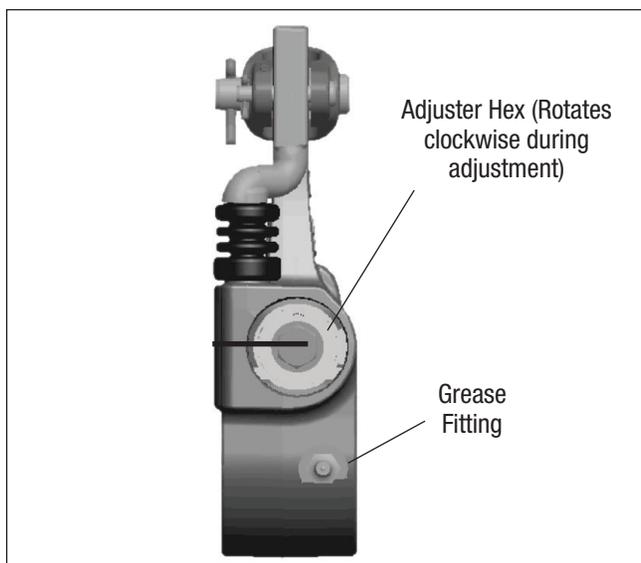


Figure 2 - Testing The Adjuster Mechanism

3. Apply, and COMPLETELY RELEASE, the service brakes several times while observing the manual adjustment hex and the scribed line. The Bendix Versajust LS automatic slack adjuster manual adjustment hex should rotate clockwise during the application and remain stationary during release. No counterclockwise rotation of the hex should be observed. The amount of clockwise rotation (adjustment) will decrease progressively as the brake nears proper adjustment. If the Versajust LS slack adjuster fails to perform as described, it will be necessary to repair or replace it.
4. Manually re-adjust the Versajust LS slack adjuster being tested before returning the vehicle to service.
Note: While it is possible to use the automatic adjustment feature of the Versajust LS slack adjuster to bring the brake back into adjustment, this process will require numerous applications and COMPLETE RELEASES (the number of applications depends on how much the slack was de-adjusted).
5. Manually adjust the brakes.
Note: The vehicle brakes should be adjusted using either the vehicle or brake manufacturer's recommendation. If these are not available, the following procedure can be used: Rotate the manual adjustment hex clockwise until the linings are snug against the drum. Turn the adjustment hex counterclockwise $1/2$ turn. Pull the actuator pushrod to confirm that approximately $1/2$ inch of pushrod free stroke exists. Apply 90-100 psi and check that the pushrod stroke is below the readjustment limit. If the stroke exceeds the readjustment limit, check the condition of the foundation brake. Refer to the Brake Maintenance Inspection section in this document.
6. Manually uncage the spring brakes before returning the vehicle to service.
7. With the Versajust LS slack adjuster installed, check to ensure clearance requirements with the brake fully released and at the actuator's maximum stroke. Also, consider clearances with the vehicle suspension springs depressed to the jounce bumpers, as well as in rebound.

AL Factor	15"x4" Front Brake	16.5"x7" Tractor, Truck, or Bus Brake	16.5"x7" Trailer Brake
12 x 5.0"	1/2"	N/A	N/A
12 x 5.5"	1/2"	N/A	N/A
16 x 5.0"	5/8"	1/2"	N/A
16 x 5.5"	3/4"	1/2"	N/A
16 x 6.0"	7/8"	5/8"	N/A
20 x 5.0"	5/8"	1/2"	3/8"
20 x 5.5"	3/4"	5/8"	1/2"
20 x 6.0"	7/8"	3/4"	5/8"
24 x 5.0"	N/A	5/8"	1/2"
24 x 5.5"	N/A	5/8"	5/8"
24 x 6.0"	N/A	3/4"	5/8"
30 x 5.0"	N/A	3/4"	5/8"
30 x 5.5"	N/A	7/8"	3/4"
30 x 6.0"	N/A	1"	7/8"

Table 2 - AL Factor

BRAKE MAINTENANCE INSPECTION

Note: Make certain the vehicle has been prepared according to the instructions under the heading *GENERAL SAFETY GUIDELINES* in this manual.

The following test can be used to inspect the maintenance condition of the foundation brake and to determine how much of the chamber stroke is caused by the condition of the foundation brake.

1. Always chock the wheels to keep the vehicle from moving.
2. Raise the axle so the wheel can be rotated.
3. Adjust the slack adjuster to produce light brake drag with wheel rotation.
4. Apply the brake to 90-100 psi and measure the stroke (*See Item 3 of In Service Inspection for pressure tips*).
5. If the stroke significantly exceeds the values shown in Table 2, the brake may be out of the norm, and brake maintenance may be required.

BENDIX® VERSAJUST® LS™ AUTOMATIC SLACK ADJUSTER REMOVAL

Note: Make certain the vehicle has been prepared according to the instructions under the heading *GENERAL SAFETY GUIDELINES* in this manual.

1. If the Bendix® Versajust® LS™ automatic slack adjuster is equipped with the easy-on yoke assembly illustrated in Figure 3:
 - A. Loosen the brake actuator pushrod jam nut and run it back on the brake actuator pushrod approximately 5/8 inch.
 - B. Loosen the easy-on yoke adapter and run it back on the brake actuator pushrod until it is free of the yoke.
 - C. Rotate the manual adjustment hex counterclockwise until the Versajust LS slack adjuster is clear of the brake actuator pushrod.

Note: Considerably more torque is required to rotate the manual adjustment hex counterclockwise than is necessary to rotate it clockwise. The torque may be as high as 70 ft-lbs.

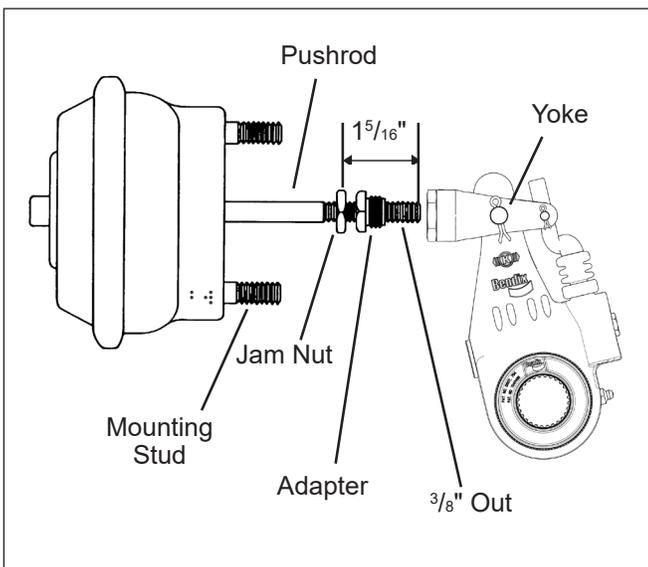


Figure 3 - Easy-On Yoke

Figure 4 - Quick Connect Yoke

2. If the Bendix® Versajust® LS™ automatic slack adjuster is equipped with the quick-connect yoke assembly *illustrated in Figure 4*:
 - A. Rotate the Versajust LS slack adjuster's manual adjustment hex counterclockwise until the brake actuator pushrod begins to move just out of the actuator.
 - B. Pinch the legs of the retaining ring together and pull the Versajust LS slack adjuster away from the brake actuator pushrod until the adapter bushing is free of the yoke. Remove the retaining ring from the adapter bushing.
 - C. Rotate the manual adjustment hex counterclockwise until the Versajust LS slack adjuster is clear of the brake actuator pushrod.
3. Remove the Versajust LS slack adjuster from the camshaft of the foundation brake by removing the retaining clip and any spacers or washers that may be present.

CLEANING AND INSPECTION

1. Inspect the worm gear camshaft splines for damage. If damaged, replace the Bendix Versajust LS automatic slack adjuster.
2. Clean and inspect the yoke pin and link pin holes in the yoke, the adjuster link, and the slack adjuster body. The holes should be visually round with no perceptible "egg shaping." A new yoke pin and link pin can be used to make this inspection. If this condition is noted, the affected part must be replaced.
3. Clean out the retaining ring grooves in the yoke.

The Bendix® Versajust® LS™ Slack Adjuster Troubleshooting Chart

Symptom	Cause	Remedy
<p>1. The brake actuator stroke is too long.</p> <p>WARNING: Automatic slack adjusters should not be manually adjusted in an effort to correct excessive 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 fix.</p>	A. Loose actuator pushrod jam nut.	A. Reposition the components and torque to the proper specification.
	B. Excessive clearance between the adapter, adapter bushing, and yoke due to wear.	B. Replace damaged or worn parts.
	C. Excessive clearance between the yoke, yoke pin, link pin, and body.	C. Replace worn parts.
	D. Damaged (worn) splines on slack or camshaft.	D. Replace damaged parts.
	E. Weak or broken brake actuator return springs. Weak or broken brake shoe return spring.	E. Replace weak or broken springs.
	F. Worn or broken foundation brake components, including camshaft bushings, brake chamber bracket, etc.	F. Repair or replace as required per <i>In-Service Inspection</i> .
	G. Bendix® Versajust® LS™ slack adjuster mechanism not functioning.	G. Lubricate the test adjuster mechanism, conduct in service inspection, repair components as necessary, replace.
	H. Brake drum worn, excessively machined, bell-mouthed, or excessive thermal expansion.	H. Replace or repair as required.
	I. Damaged Versajust LS slack adjuster.	I. Replace component(s) or slack adjuster.
	J. Versajust LS slack adjuster improperly installed.	J. Correct installation position.
<p>2. Brakes are dragging – apparent over-adjustment of brakes.</p>	A. Versajust LS slack adjuster improperly installed. Too close to actuator preventing the brakes from fully releasing.	A. Correct the Versajust LS slack adjuster installation.
	B. Loose actuator pushrod jam nut.	B. Reposition the components and torque to specification.
	C. Spring brakes not fully retracting.	C. Check spring brake release air pressure and repair or replace air valving as necessary. Repair or replace spring brake.
	D. Broken foundation brake components, including camshaft bushings.	D. Repair or replace as required per <i>In-Service Inspection</i> .
	E. Vehicle brake torque imbalance. (More work done by some brakes than others, thermal expansion of drums).	E. Check other brakes to ensure they are working. Check air pressure balance and threshold pressure (<i>refer to Bendix publication BW1555</i>). Check driver braking habits, e.g. use of trailer control valve. Use same friction material on all axles.
	F. Brake drum out-of-round, excessive thermal expansion.	F. Replace or repair as required.
	G. Air system malfunction, not exhausting completely.	G. Inspect and correct.
	H. New lining swells during break-in.	H. Back off the adjustment until the brakes are free.

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 5).

1. Mount a suitable dial indicator with a plunger referencing 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.

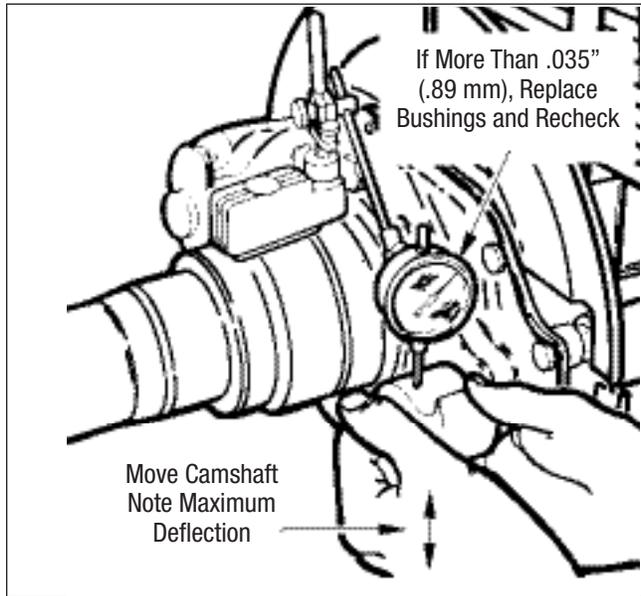


Figure 5 - Camshaft Radial Play Inspection

4. If the play exceeds 0.035" (.89mm), rebush the air chamber bracket. See *Repair/Replacement - Camshaft Bushing and Grease Seal Replacement*.

CAMSHAFT INSPECTION

1. Check the spline end for cracks, worn, or deformed splines. Replace as necessary (refer to Figure 6).
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 worn areas and the cam head surface.

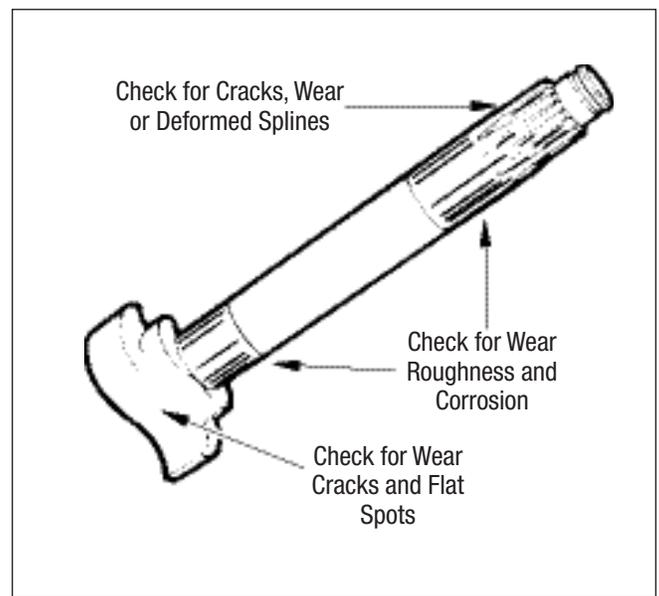


Figure 6 - Camshaft Inspection

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*.

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, refer to **Figure 7 and Table 3**.
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 8**.

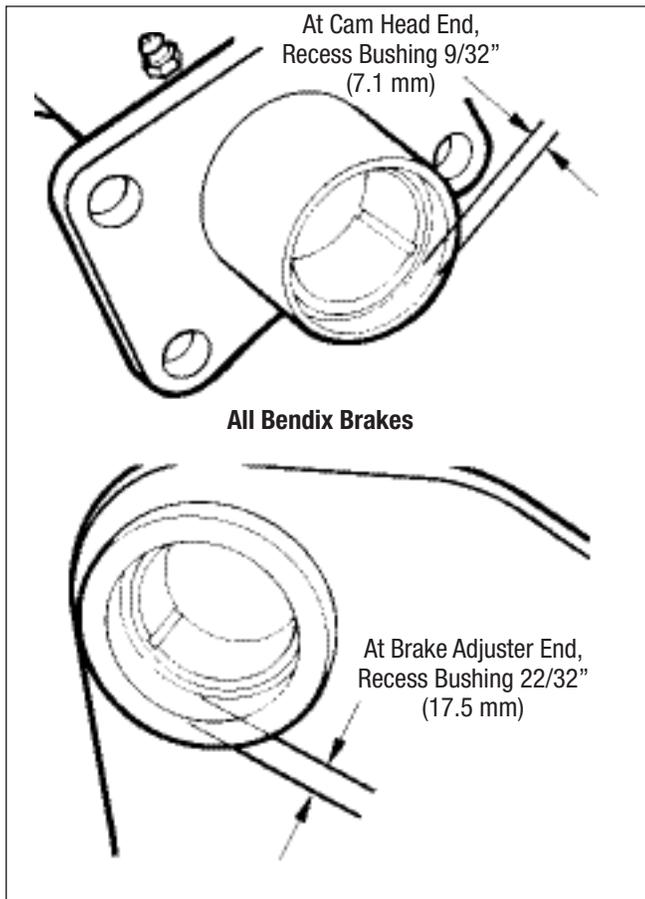


Figure 7 - Air Chamber Bracket Bushing Installation



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

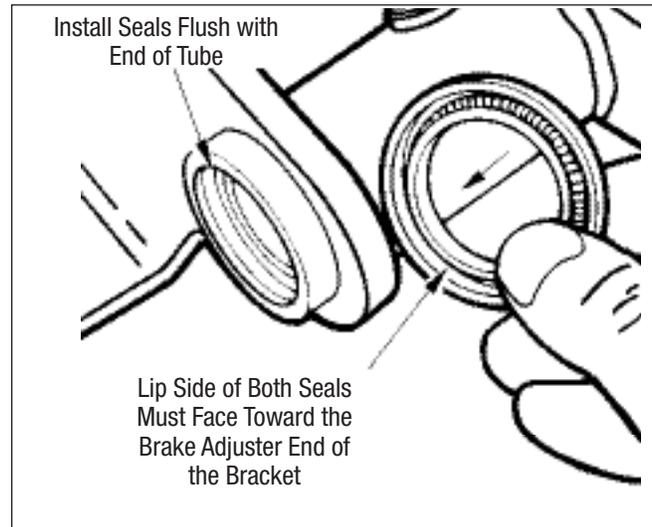


Figure 8 - Camshaft Bushing Installation

Bendix®		
Brake Model	At Cam Head	At Brake Adjuster
ES™-165D, L ES-150L, D	Non-metallic	Non-metallic
EB™-180	Bronze	Non-metallic
Installation Specs: (All except Trailer Axle)	Recessed 9/32" (7.1 mm) from tube end	Recessed 22/32" (17.5 mm) from tube end
Trailer Axle Spider Bushings	Flush with inner recess shoulder at each end of spider (to allow space for the seals)	
Note: Non-metallic bushings are labeled. Install these bushings with labeled ends facing each other.		

Table 3 - Camshaft Bushing Installation Specifications

Note: The LMS Low Maintenance Systems uses a bronze bushing at the cam head (with the exception of the LMS 15 x 4 brakes.)

SPECIAL NOTE: For Bendix® ES™ -16.5, 5,6,7 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 & finally the cam.

CAM HEAD WASHER INSTALLATION BRAKE ADJUSTER INSTALLATION

1. Verify that the brake adjuster is serviceable, see *Inspection - Brake Adjuster Inspection*.
2. Install the brake adjuster inner washer on the camshaft. The inner washer is identified by its 0.060" thickness and larger hole (see *Figure 9*).

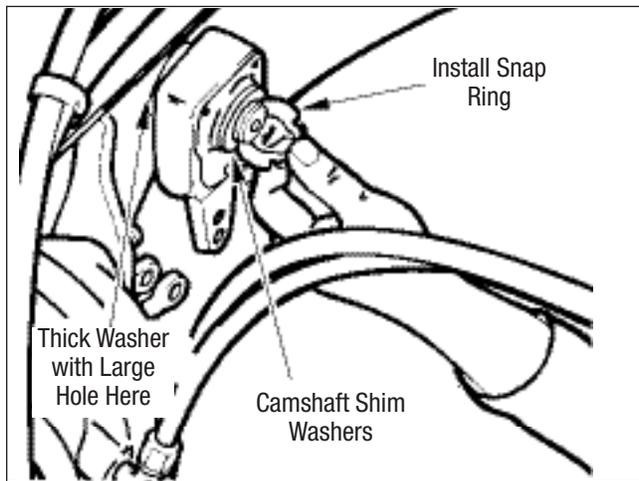


Figure 9 - Shim Washer and Snap Ring Installation

3. Apply a thin film of chassis grease to the brake adjuster splines.
4. Install the brake adjuster on the camshaft in the same position as noted before removal.
5. Install the camshaft shim washers and snap ring (see *Figure 9*). 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 (see *Figure 10*).

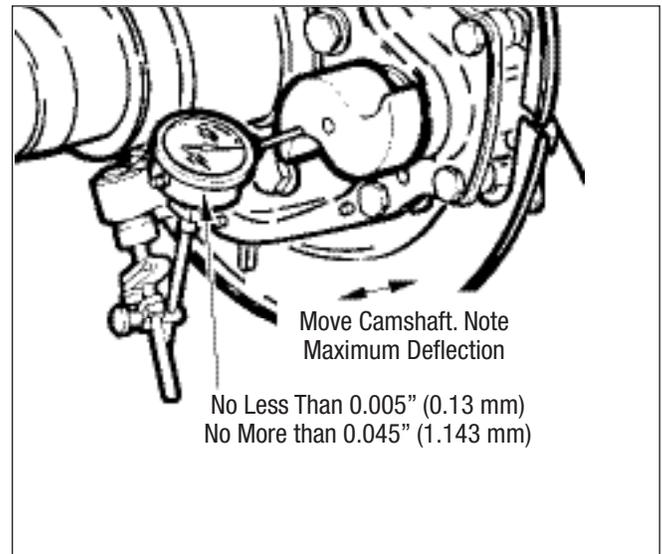


Figure 10 - Brake Adjuster End Play Check

7. Pull inboard on the brake adjuster end of the cam to take up the end play.
8. Set the dial indicator to zero.
9. Push outboard on brake 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 - 1.143 mm) with brake adjuster centered between air chamber bracket and snap ring groove.

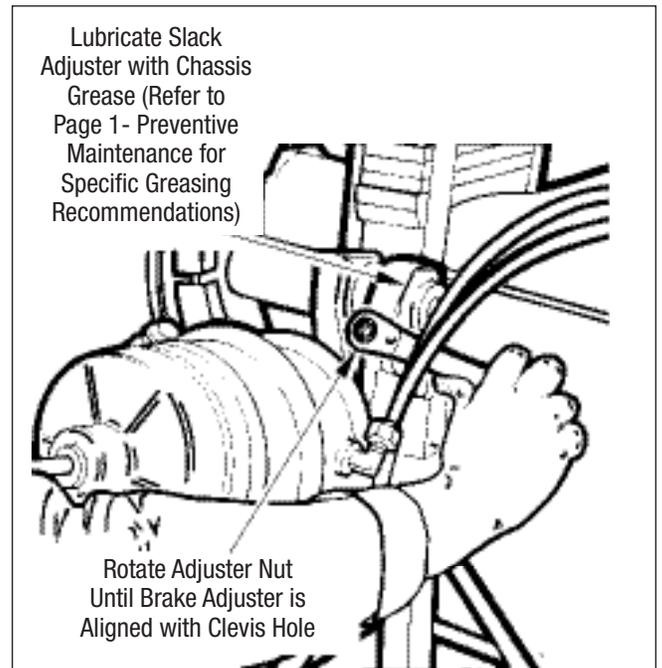


Figure 11 - Brake Adjuster Lubrication and Adjustment

10. Pressure lubricate the brake adjuster according to the manufacturer's instructions. Pressure lubricate the air chamber bracket until grease flows out of brake adjuster end of the tube (*refer to Figure 11*).



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



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.

Specification Chart

Fastener Torque Specifications

Fastener	Torque	
	English	Metric
Bendix® ES™ -165 Brake		
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)	110-115 lb-ft	149-156 N.m
Lining Bolts/Nuts	<i>For torque specs refer to the installation note in the lining kit.</i>	
Anchor Pin Cap Screw (ES-165-7H, 7M)	120-150 lb-in	13.6-16.9 N.m
Bendix® ES™ -150-04L Brake		
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 (<i>See Shoe and Lining Inspection</i>)		
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)	0.005" - .045" (.13 - 1.143 mm)	
Camshaft Radial Play	0.035" (0.89 mm) maximum	
Air Chamber Face to Clevis Pin Centerline (clevis pin center line on all threaded clevises)	2-5/8" ± 1/16" (66.7 ± 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)	