PE13-012

BENDIX

7/1/2013

Section 7

Customer Corrective Action

VOLVO

8D CORRECTIVE ACTION REPORT

Date Initiated:12/20/12	Date Revised: 2/6/2013
Inspection report n°:	Inspection report issue date:
Supplier Parma No:	Part number: Issue/Rev:
Supplier Name: Bendix	Part description: ADB22X Air Disc Brake
Supplier Contact: MJ Brewster	Issuer at Volvo:
Rejected quantity @ Volvo Group:	Rejected Quantity after investigation:

Recurrent issue? ☐ Customer safety effect ☐ Severity: …….points

D1: Use a Team Approach

The Problem Solving Investigator, uses a multi-person approach to collect information from those directly associated with and/or impacted by the problem. The Team members names and contact info should be listed here.

Responsible

Team Members:	Business Phone:
MJ Brewster	440-329-9271
Michael O'Connor	440-329-9436
Eric Huth / Rich Lantz	440-329-9156 / 9657
Steve Bell	440-329-9406

Planned date

Achieved date

D2: Describe the Problem

Collect the data from those involved with the problem and produce a Well Formed Description.

Responsible

Planned date

WHAT is the problem in comparison to a conforming part?

There has been one fleet with Volvo (A. Duie Pyle) who has experienced 8 wheel ends that have been described as over heated by the customer. This fleet is running a pickup and delivery operation and run lightly loaded.

Four units were sent back to Elyria and it was concluded that one unit showed signs of excess heat associate with over adjustment. The remaining three did not.

Of the other remaining four units, two were inspected by a Bendix representative. One was at a dealer and one at a fleet location without service facilities. Both of the inspected brakes showed signs of heat. Bendix has not seen the other two brakes.

WHY is it a problem? *explain the effect.*

This is a customer dissatisfier with respect to expected pad life. It requires that you replace an axle set of pads, even if only one side is worn. Occasionally, the driver will see off gassing of the binders in pad material and mistake it for smoke.

WHEN was the problem discovered? **WHERE** ? **BY WHO** ?

We first spoke to A. Duie Pyle 11/1/12.

HOW was it detected ?

Fleet complaint.

HOW MANY defective parts have been detected?
Exact quantities detected at the real place (could be by dates, if detected several times)

A. Duie Pyle reported 8 affected vehicles and a search of the Bendix warranty database identified (8) suspected thermal overload events on Volvo vehicles, only 3 confirmed.

Are other part numbers affected? YES ☒ NO ☐

Ref: K027218, K027219, K027347, K027348, K027349, K027350, K027357, K027358, K027376, K027377, K031539, K031540, K031567, K031568, K057605, K057606, K057607, K057608, K057609, K057610, K065156, K065157

Achieved date

VOLVO

8D CORRECTIVE ACTION REPORT

D3: Implement and Verify Containment (temporary fix)

Implement containment to control the situation and mitigate further negative effects of the problem. (segregation, selection, temporary actions in the process etc…..)

Responsible

Planned date
1/2013

How, where , who, when, check

Short term:

Bendix has implemented what is called the “improvement package”, which consists of greased tappets, spring loaded driver, and blue pad springs. The greased tappets reduce torque applied to the threaded tube/adjuster. The spring loaded driver resists the effect of vibration / provides dampening to the system. The blue pad spring has a higher spring rate reducing the amount of relative pad movement.

Markings on delivered OK parts? YES ☒ NO ☐

The blue pad spring is the method of identification.

Sorting results at each step of the flow

Location	Material Sorted	Quantities/Comments
Customer Plant:	YES ☐ NO ☒	
Warehouse & Transit:	YES ☐ NO ☒	
Supplier Plant:	YES ☐ NO ☒	
Tier 2:	YES ☐ NO ☒	

What have we learned from the sorting?

Achieved date
1/2013



VOLVO

8D CORRECTIVE ACTION REPORT

D4: Root Cause Analysis

Identify the Possible Causes of the problem for both occurrence and non detection. Conduct a Root Cause Analysis to determine true Root Cause of the problem using the 5 why's. Reproduce the defect to confirm the true root cause.

Responsible

Occurrence: *5 Why's + proofs*

Planned date

KB Munich performed testing with higher frequency and G load. Testing was completed late 2011. KB was able to turn on/off the over-adjustment event

- Part showing thermal overload
  - over-adjustment of brake wear function
    - forward rotation of threaded tube
      - improper torque applied
        - pad kick
          - Friction between tappet and threaded tube
          - Spring stiffness
    - gap between adjuster splines and threaded tube
      - designed for assembly
        - too much gap engineered in/ not enough interference
      - high frequency of low wear /low pressure applications ***and***
      - high frequency vibration on wheel end (this is something that Bendix cannot control, but is part of the contributing factors)
        - bad roads
        - wide based tires are stiff
        - inter axle load transfer
        - lightly loaded - makes suspension stiff
        - Vehicle / application specific influences

Non detection: *5 Why's + proofs*

- why was it not detected
  - vibration was not identified in Bendix DFMEA as an adjuster issue
    - added to DFMEA
  - used standard testing
    - vibration spec did not go to high enough frequency
  - Warranty
    - Event is self-correcting
      - running clearance returns to normal due to high temperature pad wear
      - running clearance returns to normal due to reduction in pad swell (as it cools)
    - Not robust to pick up issue
      - description text not clear (not specific enough)

Achieved date



D5: Develop Permanent Corrective Actions / Solution(s)

Develop Permanent Solution(s) that address each Root Cause. Verify and test the Permanent Solution(s).

Responsible

Occurrence *(How ,where, Who, When, Check)*

Planned date

- Friction between tappet and threaded tube - Greased tappet (in place)
- Spring stiffness – Blue Pad Spring (in place)
- Gap - Spring loaded driver (short-term) (in place)
- Gap - N2G (long-term) – Q1 2014

Short-term – complete
Long-term Q1 2014

Achieved date

Non detection *(How ,where, Who, When, Check)*

Planned date

- Vibration spec – update for frequency and G force (planned Q2 2013, KB Munich / Rich Lantz)
- Warranty process updated to include:
  - Thermal overload checklist (complete)
  - Classified thermal overload as a "warranty critical" issue (complete)

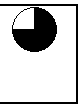
Q2 2013

Achieved date



VOLVO

8D CORRECTIVE ACTION REPORT

D6: Validate Permanent CA / Solution(s) Validate that the chosen solution is effective. N2G testing validated this.	Responsible Planned date Achieved date	
D7: Prevent Recurrence Prevent recurrence of the problem at the problem site and across the organization. Standards update (PFMEA, control plan, work instructions, maintenance plan, procedures….) *(What, Who, When, Submit update)* This will be a permanent design change. Higher frequency / G levels have been added to our test spec for use in future DVP's. Holistic View/Generalization ▪ Can this problem occur on a similar product? ▪ Can this problem occur on a similar line? ▪ Who is assigned to address this issue? Work with system engineering (VP of engineering) to assure that updated industry conditions are effectively communicated so that testing parameters can be updated/revised correspondingly.	Responsible Planned date	
D8: Close Problem and Recognize Contributions Audit implemented solutions. *(when, result)* Reinforce the 8D process with recognition of team member contributions.	Achieved date Responsible Planned date	
	Achieved date	

OPTIONAL

The undersigned have verified acceptable corrective action effectiveness on the above stated corrective actions:

Supplier Representative Responsible	Signature	Date
Name:		
Title:		

Volvo Group Supplier Quality Representative	Signature	Date
Name:		
Title:		

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Section 7

Warranty Documents

Bendix Spicer
Foundation Brake LLC
A Bendix CVS and Dana Joint Venture

LIMITED WARRANTY
Spring Brakes

Bendix Spicer Foundation Brake LLC ("Company") warrants to the original retail purchaser that the following Bendix® Spring Brakes sold by the Company will be free from defects in materials or workmanship for the warranty periods shown in this table, whichever occurs first.

Bendix® Service Chamber		Bendix® Piggyback Spring Brake		Bendix® Combination Spring Brake		Bendix® EverSure™ Spring Brake with No Touch™ Technology	
Part Number	**Type**	**Part Number**	**Type**	**Part Number**	**Type**	**Part Number**	**Type**
5007117	12	5007123	20/24	5007129	20/24	All Bendix® EverSure™ Spring Brake Part Numbers	
5007118	16	5007124	24/24	5007130	24/24		
5007119	20	5007125	24/30	5007131	24/30		
5007120	24	5007126	30/30	5007132	30/30		
5007121	30	5007127	30/36	5007133	30/36		
5007122	36	5007128	36/36	5007134	36/36		

Type of Operation	Warranty Period	Warranty Period
Line Haul Tractor, Interstate Truck, P&D Tractor, P&D Truck, Intercity Truck, Charter Bus, Interstate Bus, School Bus, Trailer	3 Years 300,000 Miles (480,000 Km) 10,800 Hours	4 Years Unlimited Miles/Km Unlimited Hours
Transit Bus, Refuse Hauler, Dump Truck, Cement Mixers, Off Highway Operation, Others	1 Year 100,000 Miles (160,000 Km) 3,600 Hours	2 Years 200,000 Miles (320,000 Km) 7,200 Hours

The limited warranty does not cover defects or damage caused by abuse, misuse, road debris, accidents or improper installation, maintenance or service, or use in non-standard vehicle applications that have not been approved by Bendix Spicer Foundation Brake or which do not meet Bendix Spicer Foundation Brake specifications and guidelines.

Product:

Product claimed to be defective must be returned freight prepaid via the Original Equipment (OE) dealership or authorized Company distributor within 30 days after the date any defect is first discovered. **Unauthorized repairs will void this limited warranty.**

Bendix Spicer Foundation Brake will inspect the product and make the final determination as to whether the product is covered under this limited warranty. When a warranty claim is allowed, Bendix Spicer Foundation Brake's responsibility is limited, at the Company's sole option, to repair or replace the defective product. The replacement unit will be warranted for the remaining time period, mileage, or hours of the original warranty, whichever occurs first.

Labor:

For the first twelve (12) months, 100,000 miles (160,000 kilometers), or 3,600 hours, whichever occurs first, the Company will reimburse at its current labor rate applied to the standard hours allowed in Removal and Replacement Schedule *(BW1322)* when the defective product has been installed.

THIS LIMITED WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, ARISING BY OPERATION OF LAW OR OTHERWISE, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND IN NO EVENT WILL BENDIX SPICER FOUNDATION BRAKE LLC BE LIABLE FOR INDIRECT, SPECIAL, PROGRESSIVE, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, COSTS INCURRED FOR SERVICE CALLS, TOWING, OR DOWNTIME.

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Section 7

Warranty Documents

Bendix Spicer
Foundation Brake LLC
A Bendix CVS and Dana Joint Venture

LIMITED WARRANTY
Air Disc Brake

Bendix Spicer Foundation Brake LLC ("Company") warrants to the original retail purchaser that all air disc brake products sold by the Company will be free from defects in materials or workmanship for the period shown below provided that only Bendix® brand brake pads, rotors, and brake chambers are used.

		Years	Miles	Hours
Bendix Designation	**Type of operation**	**Warranty Period**		
Bendix® ADB22X™ air disc brakes	On-highway	5	500,000	18,000
	Off-highway	1	Unlimited	3,600
Bendix® SN7™, SN6™, SK7™ air disc brakes	On-highway	2	Unlimited	7,200
	Off-highway	1	Unlimited	3,600

This limited warranty does not cover defects or damage caused by abuse, misuse, road debris, accidents or improper installation, maintenance or service, or use in non-standard vehicle applications that have not been approved by Bendix Spicer Foundation Brake or which do not meet Bendix Spicer Foundation Brake specifications and guidelines. Normal wear and tear of brake pads or rotors (including the cast tone ring) is not covered under this limited warranty. Boot damage resulting from road hazards or use of improper replacement tools is not covered under warranty. Any damages resulting from the use of non-OE approved replacement components, including brake pads, rotors or brake chambers are not covered under this limited warranty.

Use of non-Bendix® brand brake pads, rotors, or brake chambers reduces warranty coverage to one (1) year unlimited miles for on-highway applications and four (4) months unlimited miles for off-highway applications. ***For warranty consideration, return the sets of pads from both ends of the affected axle (road-side and curb-side sets of brake pads). Please clearly label the parts with the claim number.***

Bendix warranty requires that the application of products be properly approved pursuant to OEM and Company engineering approvals.

Product:

Product claimed to be defective must be returned freight prepaid via the Original Equipment (OE) dealership or authorized Company distributor within thirty (30) days after the date any defect is first discovered. Unauthorized repairs will void this limited warranty.

Bendix Spicer Foundation Brake will inspect the product and make the final determination as to whether the product is covered under the terms of this limited warranty. When a warranty claim is allowed, Bendix Spicer Foundation Brake's responsibility is limited — at the Company's sole option — to repair or replace the defective product with a remanufactured exchange unit. The replacement unit will be warranted for the remaining time period, mileage, or hours of the original warranty.

Labor:

For the first twelve (12) months, 100,000 miles (160,000 kilometers), or 3,600 hours, whichever comes first, the Company will reimburse at its current labor rate applied to the standard hours allowed in Removal and Replacement Schedule *(BW1322)* when the Company determines that a defective product has been installed. Labor coverage is included only when Bendix® brand brake pads, rotors, and brake chambers are used.

THIS LIMITED WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, ARISING BY OPERATION OF LAW OR OTHERWISE, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND IN NO EVENT WILL BENDIX SPICER FOUNDATION BRAKE LLC BE LIABLE FOR INDIRECT, SPECIAL, PROGRESSIVE, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, COSTS INCURRED FOR SERVICE CALLS, TOWING, OR DOWNTIME.

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Section 7

Warranty Documents

Bendix Spicer
Foundation Brake LLC
A Bendix CVS and Dana Joint Venture

LIMITED WARRANTY
Air Disc Brake

Bendix Spicer Foundation Brake LLC ("Company") warrants to the original retail purchaser that all air disc brake products sold by the Company will be free from defects in materials or workmanship for the period shown below provided that only Bendix® brand brake pads, rotors, and brake chambers are used.

		Years	Miles	Hours
Bendix Designation	**Type of operation**	**Warranty Period**		
Bendix® ADB22X™ air disc brakes	On-highway	5	500,000	18,000
	Off-highway	1	Unlimited	3,600
Bendix® SN7™, SN6™, SK7™ air disc brakes	On-highway	2	Unlimited	7,200
	Off-highway	1	Unlimited	3,600

This limited warranty does not cover defects or damage caused by abuse, misuse, road debris, accidents or improper installation, maintenance or service, or use in non-standard vehicle applications that have not been approved by Bendix Spicer Foundation Brake or which do not meet Bendix Spicer Foundation Brake specifications and guidelines. Normal wear and tear of brake pads or rotors (including the cast tone ring) is not covered under this limited warranty. Boot damage resulting from road hazards or use of improper replacement tools is not covered under warranty. Any damages resulting from the use of non-OE approved replacement components, including brake pads, rotors or brake chambers are not covered under this limited warranty.

Use of non-Bendix® brand brake pads, brake chambers, or unapproved brake rotors reduces warranty coverage to one (1) year unlimited miles for on-highway applications and four (4) months unlimited miles for off-highway applications. ***For warranty consideration, return the sets of pads from both ends of the affected axle (road-side and curb-side sets of brake pads). Please clearly label the parts with the claim number.***

Bendix warranty requires that the application of products be properly approved pursuant to OEM and Company engineering approvals.

Product:

Product claimed to be defective must be returned freight prepaid via the Original Equipment (OE) dealership or authorized Company distributor within thirty (30) days after the date any defect is first discovered. Unauthorized repairs will void this limited warranty.

Bendix Spicer Foundation Brake will inspect the product and make the final determination as to whether the product is covered under the terms of this limited warranty. When a warranty claim is allowed, Bendix Spicer Foundation Brake's responsibility is limited — at the Company's sole option — to repair or replace the defective product with a remanufactured exchange unit. The replacement unit will be warranted for the remaining time period, mileage, or hours of the original warranty.

Labor:

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Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® Air Disc Brake Checklist for Identifying Single Wheel End Thermal Overload

• Follow all General Safety Guidelines (see final page.)

Foundation brakes are designed and intended to stop a vehicle by converting its kinetic energy (energy of motion) into heat. An air disc brake by design, can, and will, run at higher temperatures and cool off faster than the drum brakes traditionally used on heavy vehicles. Also, in standard operation, air disc brakes will often have differences in temperature at wheel ends on the same axle. The temperatures generated will depend on the vehicle configuration, vocation, and brake usage.

This document is intended to address instances where an individual wheel end has evidence of thermal overload.

SECTION ONE - External Inspection

Step 1: Why was the inspection requested?

☐ Driver complaint _____

☐ Routine maintenance ☐ Other _____

Step 2: Identify Potential Problem Wheel-ends.

☐ R. Steer ☐ R. Drive ☐ R. Add'l. ☐ R. Trlr. Front ☐ R. Trlr. Rear



☐ L. Steer ☐ L. Drive ☐ L. Add'l. ☐ L. Trlr. Front ☐ L. Trlr. Rear

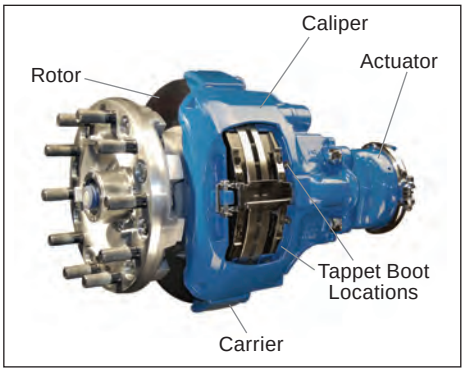


FIGURE 1 - *BENDIX® AIR DISC BRAKE*

Using the vehicle outline diagram above, check the box for any wheel end(s) where the rotor edge has a bright orange or red color. Checked boxes tend to confirm that thermal overload event has occurred at some point in the brake's service. Cases where individual wheel ends alone have this marking are important indicators that maintenance may be required.

See Figure 2 for an example showing orange coloration.



FIGURE 2 - *ROTOR INSPECTION*

Step 3: Caliper inspection.

See Figure 3. **Are any of the calipers coated with a bright orange or red colored dust?**

☐ Yes ☐ No. Yes answers tend to confirm that thermal overload has occurred at some point in the brake's service.

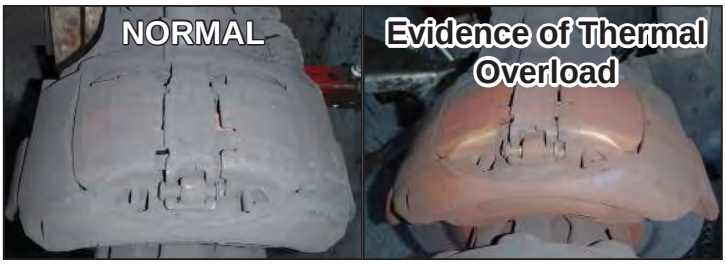


FIGURE 3 - *CALIPER INSPECTION*

Note: If more than one wheel end is affected, AND they are both on the same axle, this is NOT considered a single-wheel thermal overload event.

Evidence of whole-axle thermal overload is more typically the result of severe brake usage and/or brake balance maintenance issues.

If more than one wheel end is affected (that is, on different axles) use separate checklists to complete the following steps for each of them. (Photocopies are acceptable.)

Step 4: Boot Inspection.

See Figure 4. **Are the tappet and/or guide pin boots on the affected wheel end heat damaged?**

☐ Yes ☐ No. Yes answers tend to confirm thermal overload usage has occurred at some point in the brake's service, (and requires service to prevent water penetration/ corrosion).

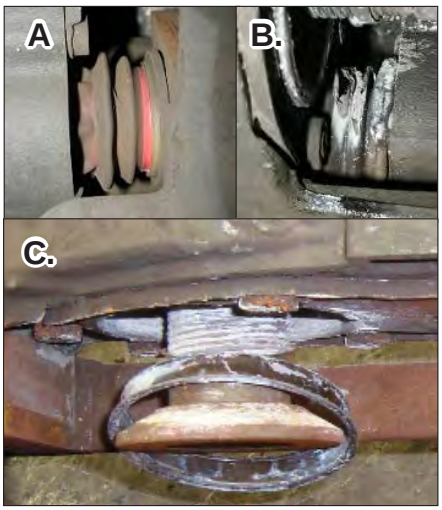


FIGURE 4 - *BRAKE BOOT INSPECTION:*

A. NORMAL GUIDE PIN BOOT

B. BURNT GUIDE PIN BOOT

C. WHITE POWDER IN THE AREA AROUND THE TAPPET BOOT

Reference Document - Service Data sheet: SD-23-7541
Bendix® ADB 22X™, ADB 22X-V™ Air Disc Brakes
Go to the document library at www.bendix.com for free downloads of Service Data Sheets and Warranty Policies, and to the Literature Center to order paper copies.

SECTION TWO: Wheel End Inspection.

Brake conditions that are caused by lack of regularly scheduled maintenance inspections and procedures are not covered by the Bendix warranty. For example, brake damage caused by worn brake pads (step 5), sticking guide pins (step 6), Jounce lines (Step 7), or actuator malfunction due to damage (steps 8 and 9) are not covered under the air disc brake warranty. *See Sections five through nine for inspections.*
CAUTION: Follow all general safety guidelines. ***See Page 3.***

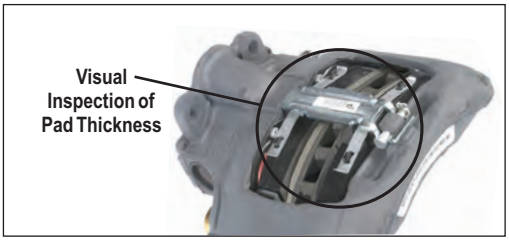


FIGURE 5 - ***BRAKE PAD THICKNESS INSPECTION***

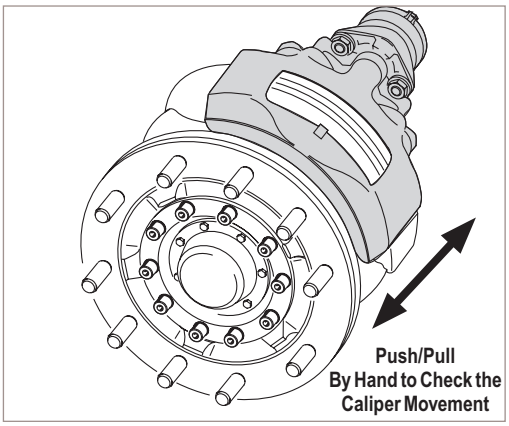


FIGURE 6 - ***CALIPER MOVEMENT INSPECTION***

Step 5: Brake Pad Inspection.

See Figure 5 **- Inspect the brake pad friction material thickness visible through the opening in the brake. (The minimum permitted is 2 mm.)**

Are the brake pads worn beyond this thickness, "metal-to-metal"?

☐ Yes ☐ No. If YES, replace the pads (axle set recommended), inspect the rotor per SD-23-7541 and check again at the next service interval.

Step 6: ***See Figure 6*** **- Caliper Movement Inspection.**

On level ground, with the wheels chocked and the parking brake temporarily released, remove the brake pads (See Service Data sheet SD-23-7541) and check for the full movement of the brake caliper in the inboard/outboard direction.

Does the caliper move properly on its guide pins?

☐ Yes ☐ No. If NO, service the guide pins, inspect the pads and rotor per SD-23-7541 and check again at the next service interval.

Step 7: Jounce Lines Inspection.

Jounce lines are required to be routed with sufficient slack to allow free movement of the caliper. (For steer axles, check that no issue is found throughout the full motion of the brake.)

7A. Are the jounce lines pulling or pushing on the caliper?

☐ Yes ☐ No. If YES, modify the jounce line routing, inspect the pads and rotor per SD-23-7541. (Check all wheel ends if a problem is found.)

7B. Are there kinks in the jounce lines? A kinked jounce line can trap air inside the actuator.

☐ Yes ☐ No. If YES, modify the jounce line routing, inspect the pads and rotor per SD-23-7541. (Check all wheel ends if a problem is found.)

7C. Taking great care to avoid the air hose whipping, carefully release the service hose (connected to port 11). Was there air trapped in the jounce line?

☐ Yes ☐ No. If YES, troubleshoot the air brake system and correct the issue. Inspect the pads and rotor per SD-23-7541 and check again at the next service interval.

Step 8: Brake Actuator Inspection.

On level ground, with the wheels chocked, cage the spring brake actuator (if equipped) using the manufacturer's guidelines. Inspect the actuator.

8A. Is there visible damage to the actuator?

☐ Yes ☐ No. If YES, replace the actuator, inspect the pads and rotor per SD-23-7541 and check again at the next service interval.

8B. Is the lowest vent or drain plug hole open?

☐ Yes ☐ No. If NO, under certain conditions, ice trapped in the actuator could prevent the brake from releasing. Remove the lowest drain plug, inspect the rotor per SD-23-7541 and check again at the next service interval.

8C. Remove the actuator. Is the seal around the push-rod damaged? Does the push-rod extends further than 15 mm. from the mounting face? If EITHER, or BOTH, condition(s) are found, replace the actuator, inspect the pads and rotor per SD-23-7541 and check again at the next service interval.

Step 9: Internal Caliper Inspection. With the brake chamber removed, use a flashlight to inspect the internal cavity of the caliper (where the actuator push-rod contacts the air brake) through the brake chamber opening.

9A. Is water or rust visible inside the caliper?

☐ Yes ☐ No. If YES, replace the caliper, replace the brake chamber if the interface seal or boot is damaged, inspect the pads and rotor per SD-23-7541 and check again at the next service interval.

9B. Does the lever fully retract (Does it touch the caliper body)?

☐ Yes ☐ No. If NO, replace the caliper, inspect the pads and rotor per SD-23-7541 and check again at the next service interval.

Step 10: If steps five through nine did not reveal a maintenance-related issue and a single wheel end thermally overloaded brake has been confirmed by steps one through four, perform the following:

- Replace the caliper on the affected wheel end and the pads on the affected axle.
- If the brake assembly is still under warranty coverage, file a claim and include the information below.
- Clearly state the claim is being filed for a single axle thermally overloaded brake.
- Return the caliper from the affected wheel end. Clearly label the caliper with the claim number.
- Return the pads from both sides of the affected axle (LH and RH set of pads). Clearly label the parts with the claim number.
- It is requested that the claim include photographs of the rotor from both sides of the affected axle with the warranty return.
- Inspect the rotor according to the guidelines in Service Data sheet SD-23-7541.

Please include this filled-out document and a copy of the warranty claim with the returned parts.

VIN #: _____ Claim #: _____

Vehicle Make: _____ Model: _____ Mileage: _____

Bendix

SAFE MAINTENANCE PRACTICES

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

When working on or around a vehicle, the following general precautions should be observed at all times:

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses. Where specifically directed, the parking brakes may have to be released, and/or spring brakes caged, and this will require that the vehicle be prevented from moving by other means for the duration of these tests/procedures.**
2. **Stop the engine and remove 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.**
3. **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.**
4. **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 or a dryer reservoir module, be sure to drain the purge reservoir.**
5. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.**
6. **Never exceed manufacturer's recommended pressures.**
7. **Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.**
8. **Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.**
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- **Avoid creating dust. Compressed air or dry brushing must never be used for cleaning brake assemblies or the work area.**
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Bendix Technical Help Line:
1-800-AIR-BRAKE, (1-800-247-2725)
option 2-1,
Mon. - Fri., 8 a.m. - 6 p.m. EST.

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PE13-012

BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® Air Disc Brake Checklist for Identifying Single Wheel-end Thermal Overload

- Follow all General Safety Guidelines (*see final page.*)
- Complete Section One to determine if there is evidence of a single wheel-end thermal event.
- If there is evidence, follow the steps in Section Two to investigate other potential external causes.

Air Disc Brakes: Background

All foundation brakes are designed to convert kinetic energy (energy of motion) into heat and work (to stop the vehicle).

Air disc brakes work the same way and in everyday operation — compared to drum brakes — will produce higher braking temperatures and cool off faster. Also, air disc brakes will often have differences in temperatures at wheel-ends on the same axle. The actual temperatures reached will depend on the vehicle configuration, vocation, and brake usage.

This document is intended to help technicians identify instances where an individual wheel-end has evidence of thermal overload, and check for potential causes.

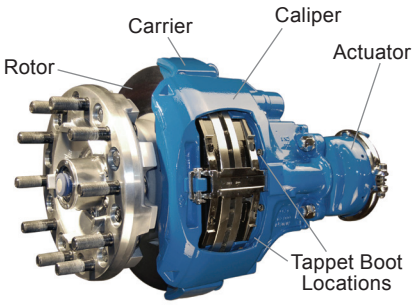


FIGURE 1 - *BENDIX® AIR DISC BRAKE*

SECTION ONE: External Inspection

1: Why was the inspection requested?

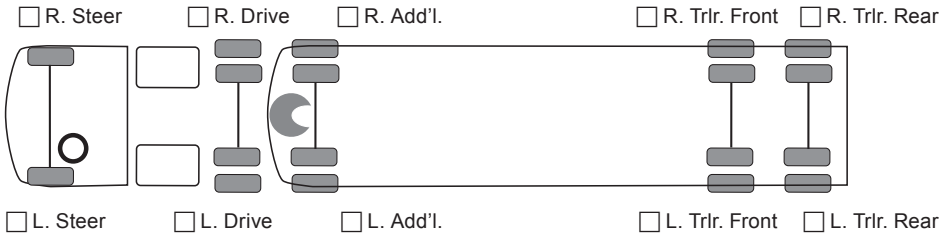
☐ Driver complaint _____ ☐ Routine maintenance ☐ Other _____

2: Identify Potential Problem Wheel-Ends

Using the vehicle outline diagram below, check the box(es) for any wheel-end(s) where the rotor edge has a bright orange or red color. Checked boxes tend to confirm that a thermal overload event has occurred at some point in the brake's service. When individual wheel-ends alone have this marking, it is an important indicator that maintenance may be required. *See Figure 2.*



FIGURE 2 - *ROTOR INSPECTION*



If You Have Checked Both Wheels on a Single Axle in the Diagram Above — STOP!

If more than one wheel-end is affected, AND both are on the same axle, this IS NOT considered a single-wheel thermal overload event. Thermal overload that affects a whole axle is more typically the result of severe brake use and/or brake balance maintenance issues. Discontinue this checklist and investigate other factors.

In cases where more than one wheel-end is affected — but on different axles — complete a separate checklist for each brake.

3: Caliper Inspection

See Figure 3. Are any of the calipers coated with a bright orange or red colored dust?

☐ No.
☐ Yes. This may confirm that a thermal overload has occurred at some point in the brake's service.



FIGURE 3 - *CALIPER INSPECTION*

4: Boot Inspection

See Figure 4. Are the tappet and/or guide pin boots on the affected wheel-end heat damaged?

- ☐ No.
- ☐ Yes. This may confirm that thermal overload usage has occurred at some point in the brake's service. (Service is required to prevent water penetration/ corrosion.)



FIGURE 4 - *BRAKE BOOT INSPECTION: A. NORMAL GUIDE PIN BOOT B. BURNT GUIDE PIN BOOT C. NOTE THE WHITE POWDER IN THE AREA AROUND THE TAPPET BOOT*

SECTION TWO: Investigate Other Potential External Causes

Single Wheel Thermal Overload: Potential External Causes

Brake conditions that are caused by lack of regularly scheduled maintenance inspections and procedures are not covered by the Bendix air disc brake warranty. For example, brake damage caused by worn brake pads (step 5), sticking guide pins (step 6), air hoses (step 7), or actuator malfunction due to damage (steps 8 & 9) are not covered. CAUTION: Follow all general safety guidelines. See Page 3.

- Follow all Safe Maintenance Practices (*see final page.*)
- Complete all the steps in Section Two to investigate potential external causes.

5: Brake Pad Inspection

See Figure 5. Inspect the brake pad friction material thickness visible through the opening in the brake. (Minimum permitted is 2 mm.)

Are the brake pads worn beyond this thickness? — or even "metal-to-metal"?

- ☐ No.
- ☐ Yes. Replace the pads (axle set recommended), inspect the rotor per SD-23-7541; and check again at the next service interval.

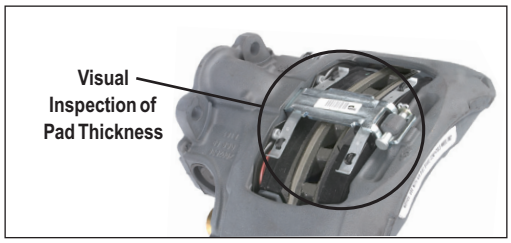


FIGURE 5 - *BRAKE PAD THICKNESS INSPECTION*

6: Caliper Movement Inspection

See Figure 6. On level ground, with the wheels chocked and the parking brake temporarily released, remove the brake pads (See Service Data sheet SD-23-7541) and check for the full movement of the brake caliper in the inboard/outboard direction.

Does the caliper slide at least ¾ in. (20 mm.)?

- ☐ Yes.
- ☐ No. Service the guide pins, inspect the pads and rotor per SD-23-7541; and check again at the next service interval.

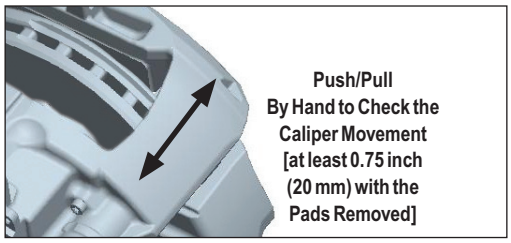


FIGURE 6 - *CALIPER MOVEMENT INSPECTION*

7: Air Hoses Inspection

Air hoses to the air disc brake (sometimes known as "jounce lines") are required to be routed with sufficient slack to allow free movement of the caliper. (For steer axles, check that no issue is found throughout the full motion of the wheel.)

7A. Are the air hoses pulling or pushing on the caliper? ☐ Yes ☐ No

If "YES", modify the air hose routing, inspect the pads and rotor per SD-23-7541. (If a problem is found, check ALL wheel-ends.)

7B. Are there kinks in the air hoses? ☐ Yes ☐ No. (A kinked air hose can trap air inside the actuator.)

If "YES", modify the air hose routing, inspect the pads and rotor per SD-23-7541. (If a problem is found, check ALL wheel-ends.)

7C. Taking great care to avoid the air hose whipping, carefully release the service hose (connected to port 11). Was there air pressure trapped in the hose? ☐ Yes ☐ No

If "YES", troubleshoot the air brake system and correct the issue. Inspect the pads and rotor per SD-23-7541; and check again at the next service interval.

8: Brake Actuator Inspection

On level ground, with the wheels chocked, cage the spring brake actuator (if equipped) per the manufacturer's guidelines, and inspect.

8A. Is there visible damage to the actuator?

- ☐ No.
- ☐ Yes. Replace the actuator, inspect the pads and rotor per SD-23-7541; and check again at the next service interval.

8B. Is the lowest vent or drain plug hole open?

- ☐ Yes.
- ☐ No. If "NO", under certain conditions, ice trapped in the actuator could prevent the brake from releasing. Remove the lowest drain plug, inspect the rotor per SD-23-7541; and check again at the next service interval.

8C. Remove the actuator.

Is the seal around the push-rod damaged?

Does the push-rod extend further than 15 mm. from the mounting face?

If EITHER, or BOTH condition(s) are found, replace the actuator, inspect the pads and rotor per SD-23-7541; and check again at the next service interval.

9: Internal Caliper Inspection

With the actuator removed, use a flashlight to inspect the internal cavity of the caliper (where the actuator push-rod contacts the air brake).

9A. Is water or rust visible inside the caliper?

- ☐ No.
- ☐ Yes. Replace the caliper, replace the brake chamber if the interface seal or boot is damaged, inspect the pads and rotor per SD-23-7541; and check again at the next service interval.

9B. Does the lever fully retract (Does it touch the caliper body)?

- ☐ Yes.
- ☐ No. Replace the caliper, inspect the pads and rotor per SD-23-7541; and check again at the next service interval.

10: If steps five through nine did not reveal another cause AND a single wheel-end thermally overloaded brake has been confirmed during steps one through four, perform the following:

Replacement:

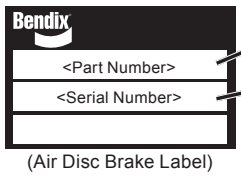
- ☐ Replace the caliper on the affected wheel-end and all the pads at both ends of the axle.
- ☐ Inspect the rotor according to the guidelines in Service Data sheet SD-23-7541.

If the brake assembly is still under warranty coverage:

- ☐ File a claim and clearly state the claim is being filed for a single axle thermally overloaded brake. The claim should include photographs of the rotor from both ends of the affected axle.
- ☐ Return the caliper from the affected wheel-end, and label the caliper with the claim number.
- ☐ Return the pads from both sides of the affected axle (LH and RH set of pads). Please clearly label the parts with the claim number.
- ☐ Please include this completed checklist and a copy of the warranty claim with the returned parts.

VIN #: _____ Claim #: _____

Vehicle Make: _____ Vehicle Model: _____ Mileage: _____



(Air Disc Brake Label)

Caliper Part Number: _____

Caliper Serial Number: _____

Bendix TechTeam Help Line:
1-800-AIR-BRAKE, (1-800-247-2725),
option 2-1. Mon. - Fri., 8 a.m.- 6 p.m. EST.

Reference Document: Service Data sheet: SD-23-7541 Bendix® ADB 22X™, ADB 22X-V™ Air Disc Brakes. Go to the document library at www.bendix.com for free downloads of Service Data Sheets and warranty policies.

Bendix®

SAFE MAINTENANCE PRACTICES

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

When working on or around a vehicle, the following general precautions should be observed at all times:

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses. Where specifically directed, the parking brakes may have to be released, and/or spring brakes caged, and this will require that the vehicle be prevented from moving by other means for the duration of these tests/ procedures.**
2. **Stop the engine and remove 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.**
3. **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.**
4. **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 or a dryer reservoir module, be sure to drain the purge reservoir.**
5. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.**
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PE13-012

BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® ADB22X™, ADB22X-V™ Air Disc Brakes

SECTION ONE: AIR DISC BRAKE OVERVIEW

1.1 DESCRIPTION

Bendix® ADB22X™ and ADB22X-V™ Air Disc Brakes (ADB) use a floating caliper design to provide foundation braking on all axles of heavy commercial vehicles, buses and trailers. Bendix Air Disc Brakes provide safety and performance as well as ease of service.

The ADB22X disc brakes mount to the axle's anchor plate (torque plate) using fasteners that are installed parallel to the axle, while the anchor-plate fasteners used for the Bendix® ADB22X-V™ air disc brakes install at right angles to the axle.

Available with or without a combination spring brake unit, these brakes may also include optional wear sensors and wear diagnostic equipment.



FIGURE 1 - *BENDIX® ADB22X™ AIR DISC BRAKES*

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2	Preventive Maintenance and Wheel-on Inspections	6-8
3	Troubleshooting Flowchart	9
4	Wheel-off Maintenance Inspections	10-15
5	Maintenance Kits and Procedures.	16-37

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1.2 Air Disc Brake Identification

Locate the identification label near the guide pin housing. See below for information about the label fields used.

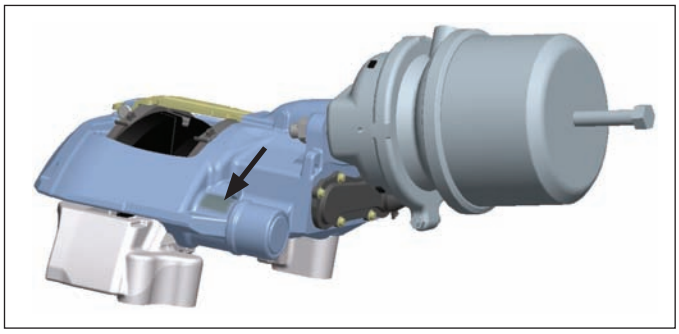


FIGURE 2 - *TYPICAL PART NUMBER LABEL LOCATION*

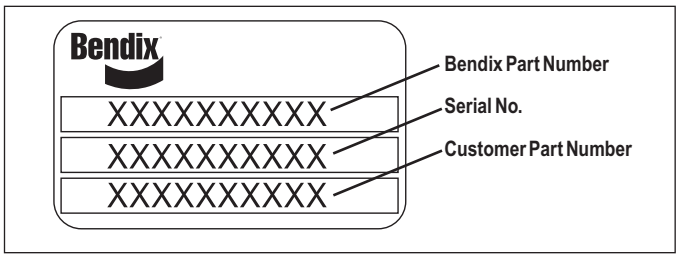


FIGURE 3 - *PART NUMBER LABEL INFORMATION*

Section One

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1.2	Air Disc Brake Identification.	1
1.3	Rotor Identification	3
1.4	Wear Sensor Identification	3
1.5	Operation	3
1.5.1	Brake Release and Adjustment	3

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- **Material 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 e-mail techteam@bendix.com**

1.3 Rotor identification

See Figure 4 to help you identify which type of rotor is used on the axle being inspected. Note that the maintenance inspection procedure will depend on the type of rotor installed.

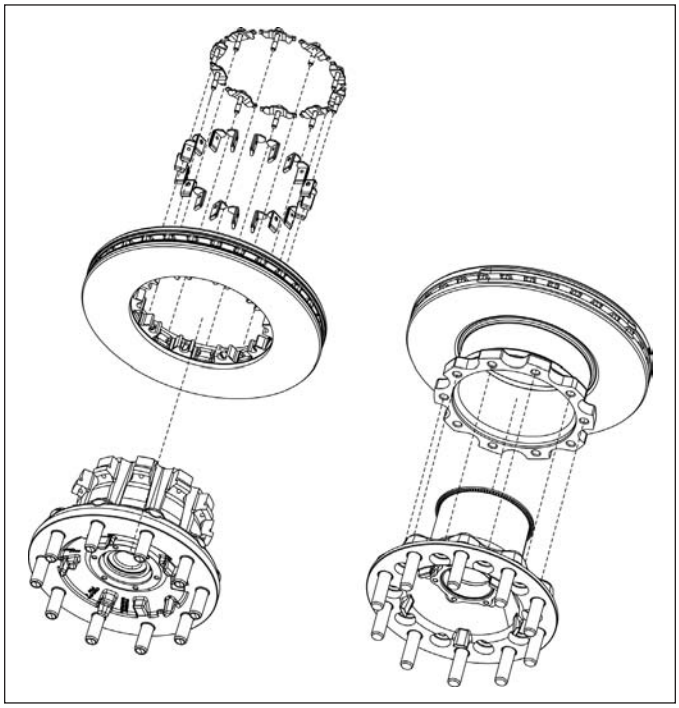
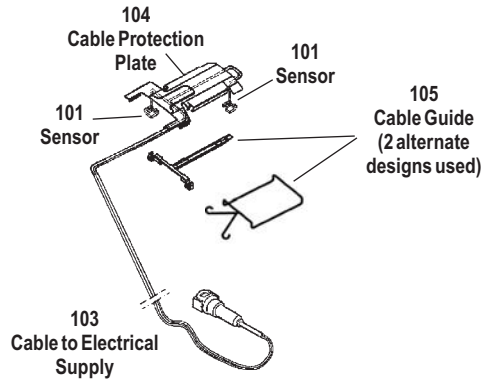


FIGURE 4 - *ROTOR IDENTIFICATION*

CAUTION: Rotors may not be mixed on a single axle: axles are only permitted to have <u>all</u> conventional or <u>all</u> splined disc rotors.

1.4 Wear Sensor Identification

See Figure 5 for the electronic wear sensor that may be present.



Sensor 101
Cable to Electrical Supply. 103
Cable Protection Plate 104
Cable Guide (two designs) 105

Consult the instruction sheet included with wear indicator kits for installation information.

FIGURE 5 - *ELECTRONIC WEAR INDICATOR COMPONENTS*

1.5 Operation

Bendix air disc brakes convert air pressure into braking force. *(See Figure 6.)* When the vehicle brakes are applied, air enters the service brake chamber through the supply port, applying pressure within the diaphragm. The pressure expands the diaphragm — applying force to, and moving, the pressure plate and push rod forward. The push rod acts against a cup in the internal lever which pivots on an eccentric bearing moving the bridge. Moving against a return spring, the bridge transfers the motion to two threaded tubes and tappets, which move the inner brake pad. The inner brake pad (from its normal position of having a running clearance between it and the rotor) moves into contact with the brake rotor. Further movement of the bridge forces the caliper — sliding on two stationary guide pins — away from the rotor. That, in turn, pulls the outer brake pad into the rotor. The clamping action of the brake pads on the rotor applies braking force to the wheel.

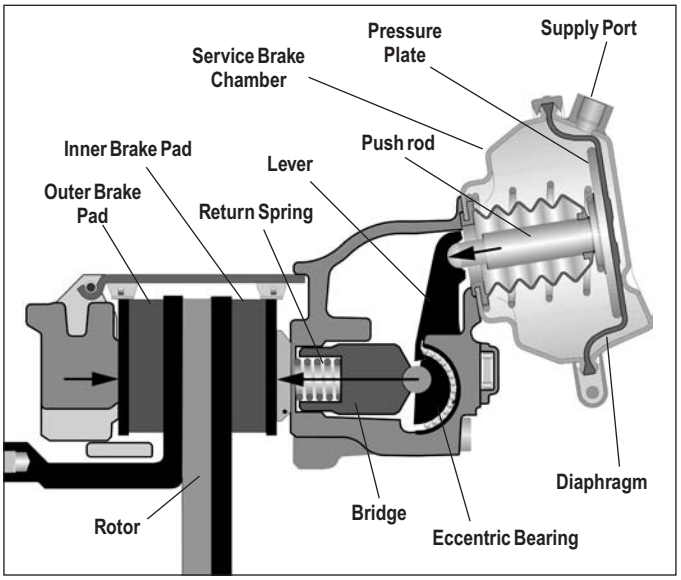


FIGURE 6 - *CROSS-SECTION VIEW SHOWING BRAKE OPERATION*

1.5.1 Brake Release and Adjustment

When the vehicle brakes are released, the air pressure in the service brake chamber is exhausted and the return springs in the chamber and the bridge return the air disc brake to a neutral, non-braked position. To maintain the running clearance gap between the rotor and the brake pads over time, the non-braked position is mechanically adjusted by a mechanism in the caliper. The adjustment mechanism operates automatically whenever the brakes are activated, to compensate for rotor and brake pad wear and to keep the running clearance constant. During pad or rotor maintenance, the technician manually sets the system's initial non-braked position. The total running clearance (the sum of clearances on both sides of the rotor) should be between 0.024 to 0.043 in. (0.6 to 1.1 mm).

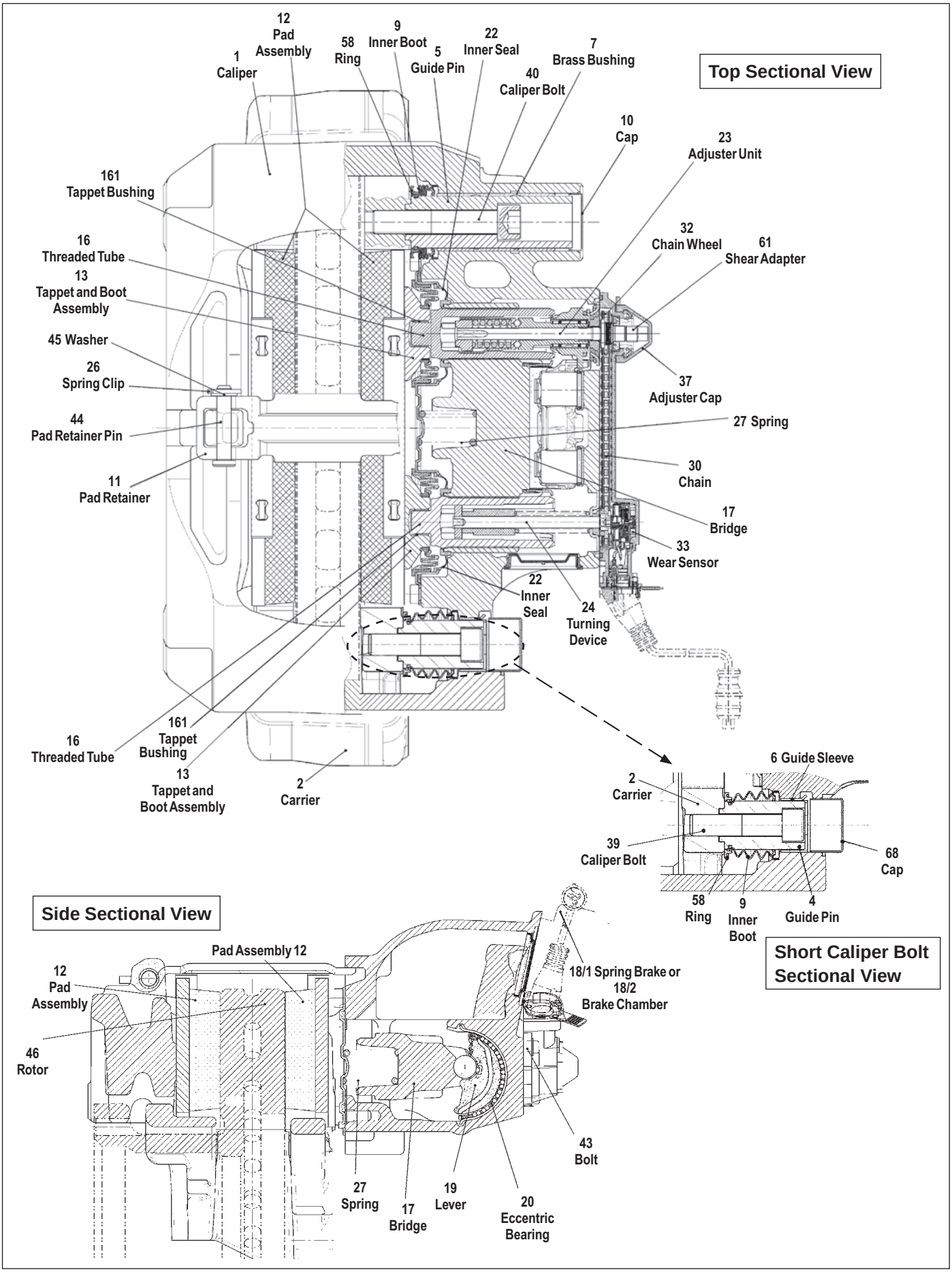


FIGURE 7 - ***SECTIONAL VIEWS***

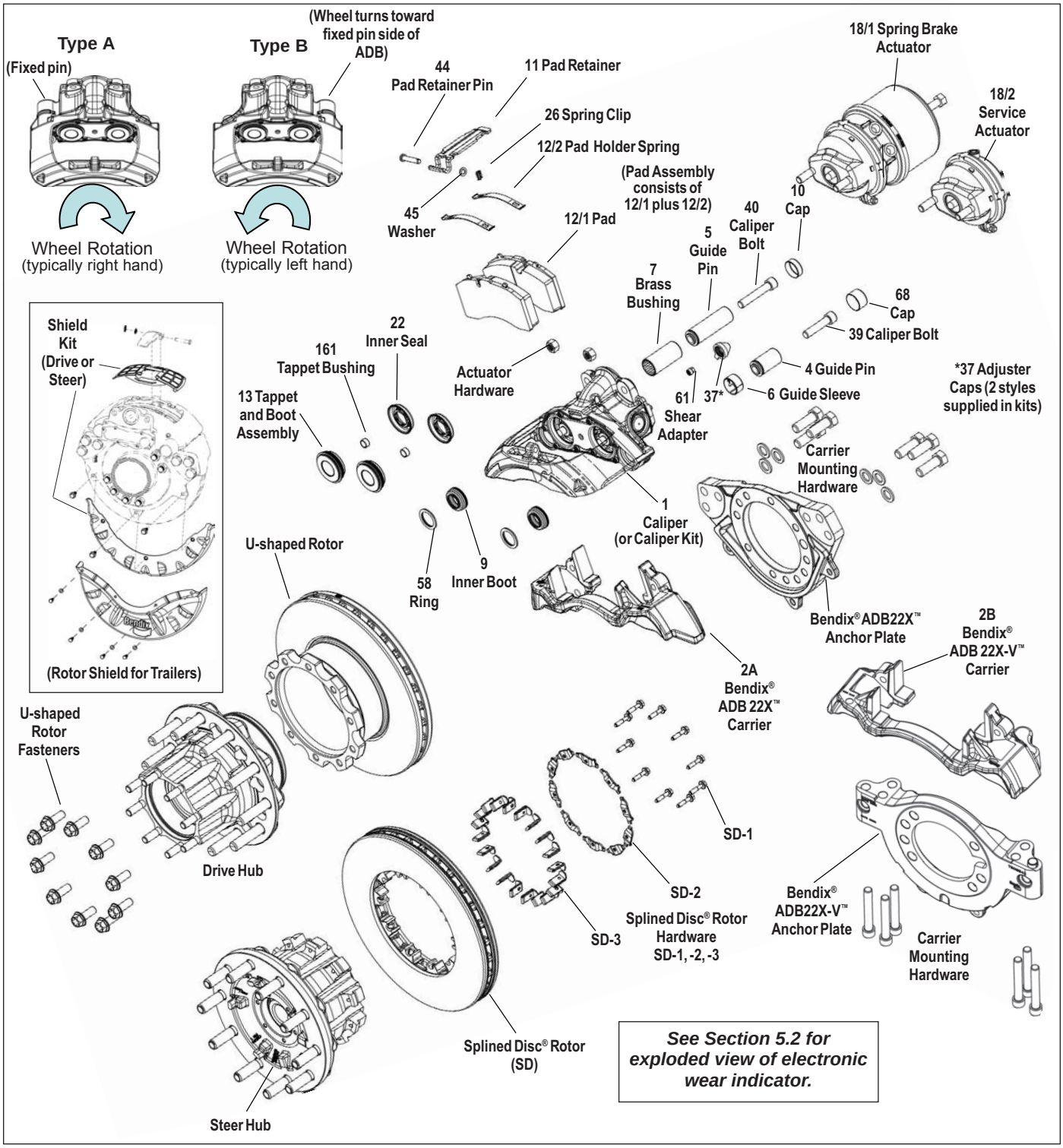


FIGURE 8 - ***EXPLODED VIEW - BENDIX® ADB22X™ AND ADB22X-V™ AIR DISC BRAKES***

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SECTION TWO: PREVENTIVE MAINTENANCE SCHEDULE AND WHEEL-ON INSPECTIONS

2.0 PREVENTIVE MAINTENANCE

Regular inspection and maintenance of air disc brake components is an important part of vehicle maintenance.

The maintenance practices outlined here are recommended in addition to all standard industry practices (including daily pre-trip inspections.) Also, see the vehicle's manual for recommendations. Keep track of the results of your maintenance inspections to assist you in determining the ideal maintenance intervals for the vehicle.

Use the table below for a guide to maintenance interval planning, however, depending on the particular vehicle's use, more frequent checks of the components may be necessary.

Section Two

Section		Page
2.0	Preventive Maintenance	6
2.1	Brake Pad and Rotor Inspections	7-8
2.2	Running Clearance Quick Inspection	8

*** For vehicles with electronic wear indicators**, use the dash indicator(s) and/or the hand-held diagnostic tool to regularly monitor the pad wear.

See Section 5.2.

Table 1: Inspection Period

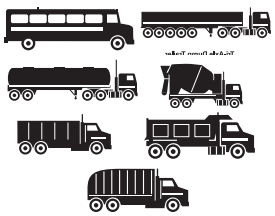
	When you check the tire pressures	(4 to 5 times during the pad lifetime)		At the very least, every four (4) months	At least once every year (and at every pad replace-ment)
		About ever four (4) months for over-the-road applications:	About every three (3) months for higher-duty applications:		
		e.g. line haul, RV, open-highway coaches, etc. 	e.g. pick-up & delivery, off-highway, construction, logger, concrete mixer, dump truck, city transit bus, refuse, school buses, etc. 		
Inspections with the wheel mounted (Sections 2.1 - 2.3)					
Inspect the pad thickness by checking the mechanical wear indicators*. *See Section 2.1.*	✔	✔	✔	✔	
Inspect the running clearances using the quick inspection technique. *See Section 2.2.*	✔	✔	✔	✔	
Inspect the visible part of the rotors for cracks, etc. *See Section 2.3.*	✔	✔	✔	✔	
Inspections with wheel removed (Section 4)					
Inspect the pads and entire rotor surfaces for cracks, etc. (Bendix® splined disc® rotors: Inspect retaining hardware and check torques) *See Section 2.3.*					✔
Inspect the running clearances and adjuster operation. *See Sections 2.2 and 4.2.*					✔
Inspect the caliper travel. *See Section 4.1.*					✔
Inspect the tappet and boot assemblies. *See Section 4.6.*					✔
Inspect all caps, hoses, and brake exterior for damage etc.					✔

TABLE 1 - ***PREVENTIVE MAINTENANCE SCHEDULE***

2.1 BRAKE PAD AND ROTOR INSPECTIONS

Visual checks of the condition of the brake pad/rotor wear can be made without removing the wheels. Where dust guards are not used, the top of the pads and part of the rotor are visible through the opening at the top of the brake. Other visible portions of the rotor can be inspected at the same time.

Unless a vehicle has been stored for some time, the main rotor surfaces that contact the pads will always appear to be shiny. Surface rust on these surfaces would indicate a malfunctioning brake that should be inspected immediately.

Pads are 1.181 in. (30 mm.) thick when new and must be replaced when they reach 0.433 in. (11 mm.). Rotors are 1.77 in. (45 mm.) thick when new and must be replaced when they reach 1.46 in. (37 mm.). *See Section 4.3 for further inspection criteria.*

2.1.1 Electronic Wear Indicators

Use the dash indicator(s) and/or a hand-held diagnostic tool to regularly monitor the pad wear. *(See Section 5.2.)*

2.1.2 Mechanical Wear Indicators

See Figure 9 for the location of the mechanical wear indicators. There are two types *(See Figure 10 for Style A and Figure 11 for Style B)*.

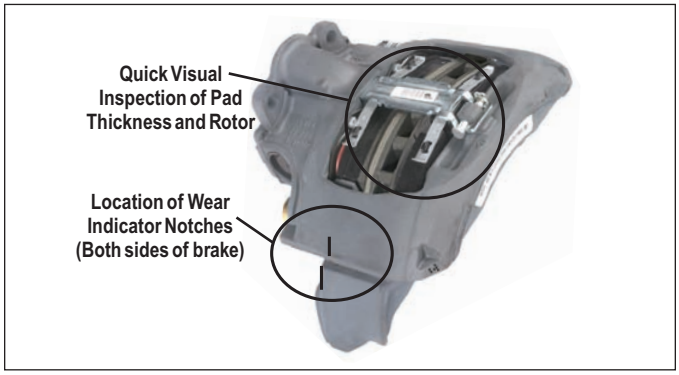


FIGURE 9 - ***LOCATION OF WEAR INDICATORS***

Note: These mechanical wear indicators do not constitute "out-of-service" criteria. These inspections only show when to schedule a full wheel-removed inspection of the brake pads and rotor. The thicknesses of the pad and rotor will both affect the wear indicator position at which maintenance is actually needed.

Wear Indicator Style A:

Where both the carrier and caliper have an indicator notch.

Compare the relative position of two notches cast into the carrier and caliper. When the two notches align, it is time to schedule a full wheel-removed inspection of the pads and rotor.

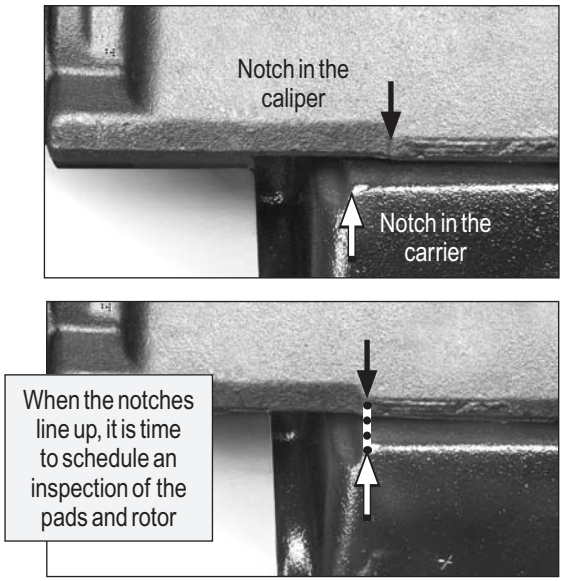


FIGURE 10 - ***STYLE A - WHEN BOTH CARRIER AND CALIPER HAVE A CAST NOTCH***

Wear Indicator Style B:

Where only the caliper has an indicator notch.

When the notch in the caliper aligns with the front edge of the torque plate, it is time to schedule a full wheel-removed inspection of the pads and rotor.

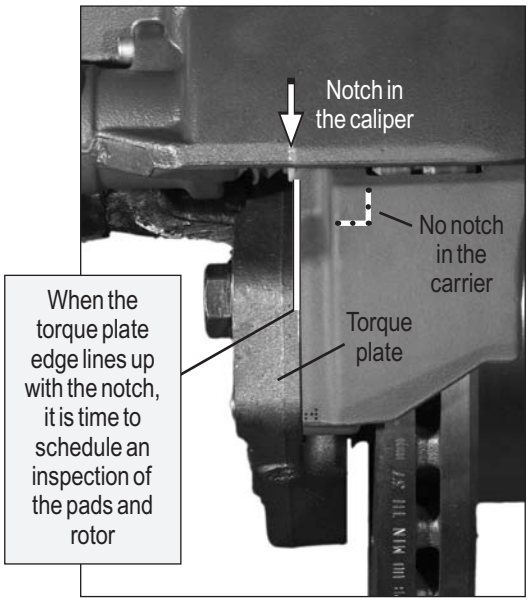


FIGURE 11 - ***CARRIER WEAR INDICATOR NOTCH AND BACKING PLATE ALIGNMENT***

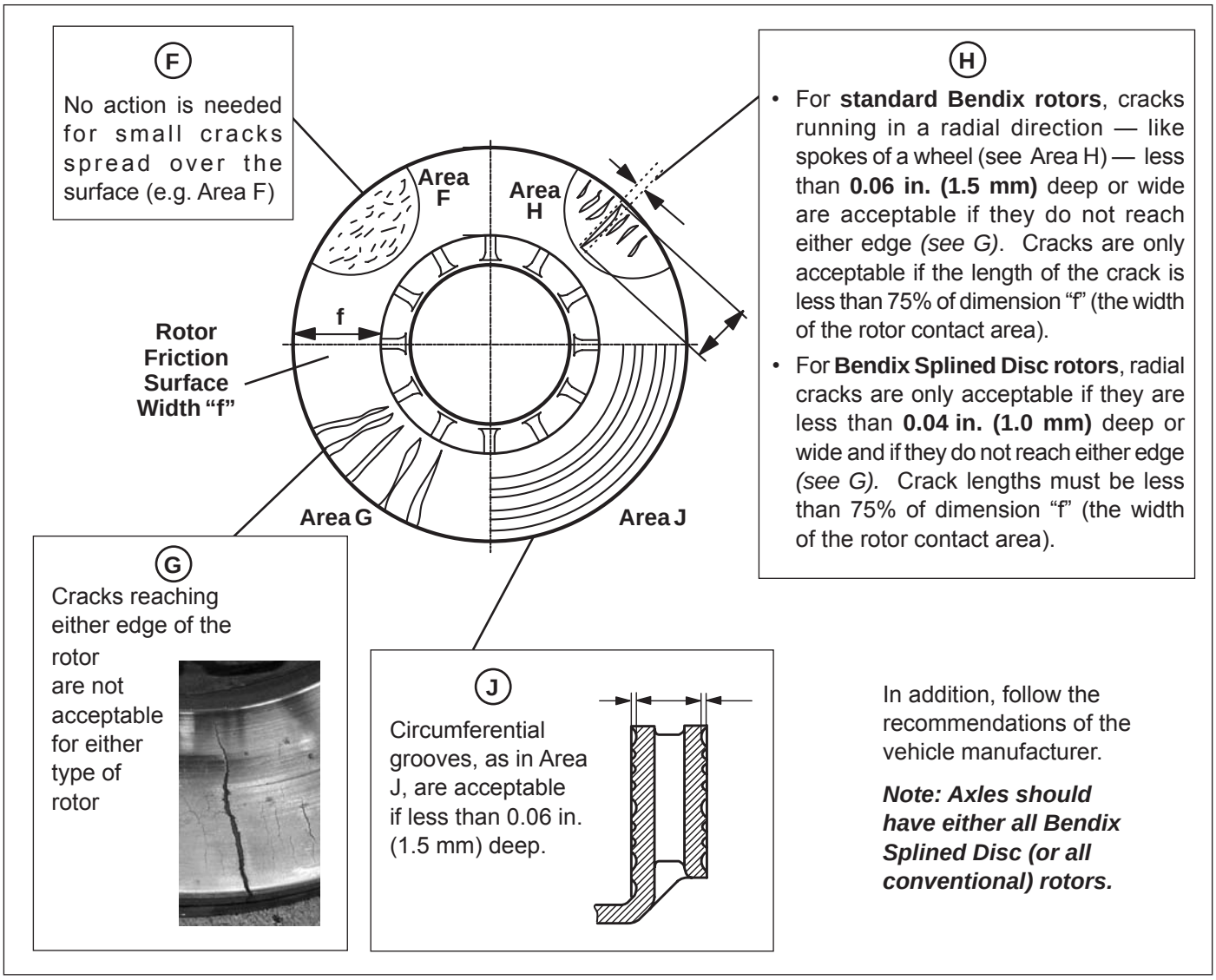


FIGURE 12 - ***EXAMPLES OF ACCEPTABLE AND NON-ACCEPTABLE ROTOR CRACKS AND GROOVES***

2.1.3 Rotor Quick Inspection

See Figure 12. See the various potential rotor conditions that you may find. See the criteria below for whether the rotor needs to be replaced and/or scheduled for a full inspection.

2.2 RUNNING CLEARANCE QUICK INSPECTION

CAUTION: Follow all safe maintenance practices.

On level ground, with the wheels chocked and the parking brake temporarily released, check for movement of the brake caliper. This small movement, less than 0.08" (2 mm) - approximately the thickness of a nickel - in the inboard/outboard direction indicates that the brake is moving properly on its guide pins.

If the caliper has no movement or appears to move greater than the distances noted above, a full wheel-removed inspection will be necessary *(See Section 4.1)*.

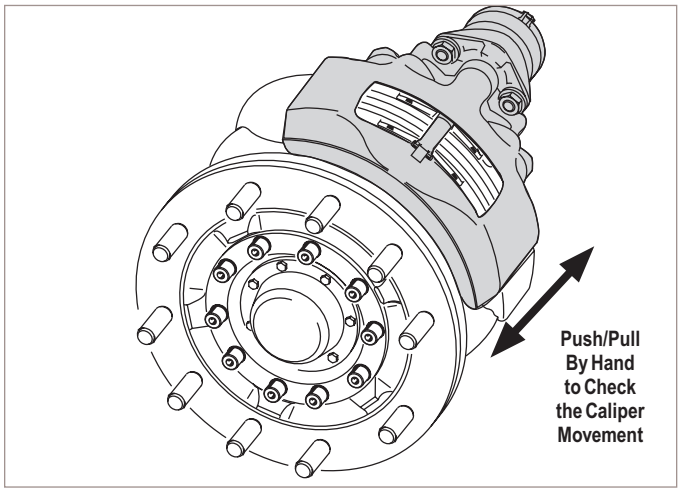


FIGURE 13 - CALIPER RUNNING CLEARANCE
(FIGURE DOES NOT SHOW WHEEL)

SECTION THREE: TROUBLESHOOTING PROCEDURE FLOWCHART

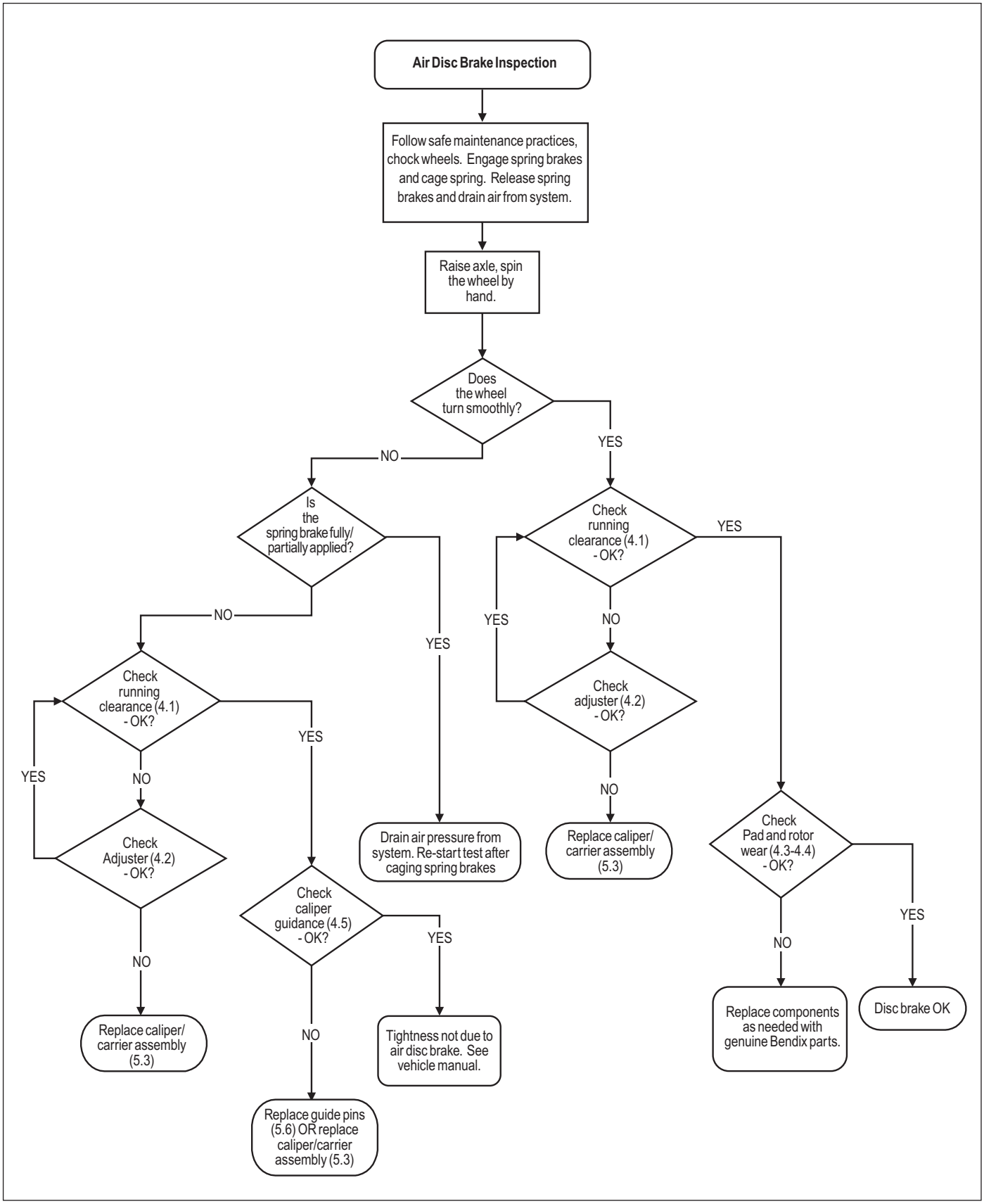


FIGURE 14 - ***TROUBLESHOOTING BENDIX AIR DISC BRAKES***

SECTION FOUR: WHEEL-OFF MAINTENANCE INSPECTIONS

Section Four

Section		Page
4.0	Wheel-Off Inspections	10
4.1	Caliper Movement Test	10
4.2	Adjuster Mechanism Inspection	11
4.3-4.4	Brake Pads and Rotors	12-14
4.3	Inspect the Brake Pads	12
4.4	Inspect the Rotor	13-14
4.4.3	Machining (Grinding or Turning) Rotors	14
4.5	Guide Pin Bearing Inspection	14-15
4.6	Tappet & Boot Assembly Inspection	15

4.0 WHEEL-OFF INSPECTIONS

CAUTION: During these inspections, follow all safe maintenance practices, including those on page two of this service manual. Also, follow the vehicle manufacturer's recommendations. When working on foundation brakes, be sure that the vehicle is on level ground, that the vehicle is parked by other means than the foundation brakes, and that the wheels are chocked.

4.0.1 Wheel Removal and Re-Installation

Refer to the vehicle manufacturer's recommendations for removing the wheel.

Note: When removing the wheel, inspect first to see that there is no contact between the caliper and axle, vehicle, chassis sections or carrier, etc. that may be impeding the free movement of the caliper.

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 risk of valve stem shear and other compatibility issues. After re-installing a wheel according to the vehicle manufacturer's recommendations, please ensure that there is sufficient clearance between the tire inflation valve stem, the caliper and the wheel rim, to avoid damage.

4.1 CALIPER MOVEMENT TEST

CAUTION: Follow all safe maintenance practices.

Remove the wheel. With the spring brakes caged, push the caliper assembly inboard on its guide pins. Using a suitable tool (for example a large flat-blade screwdriver), press the inboard pad (12) away from the tappets and check the gap between each of the tappets and the inboard pad backplate. The gap should be between 0.024 in. (0.6 mm) and 0.043 in. (1.1 mm). **If the movement is within the range given, the test is complete.**

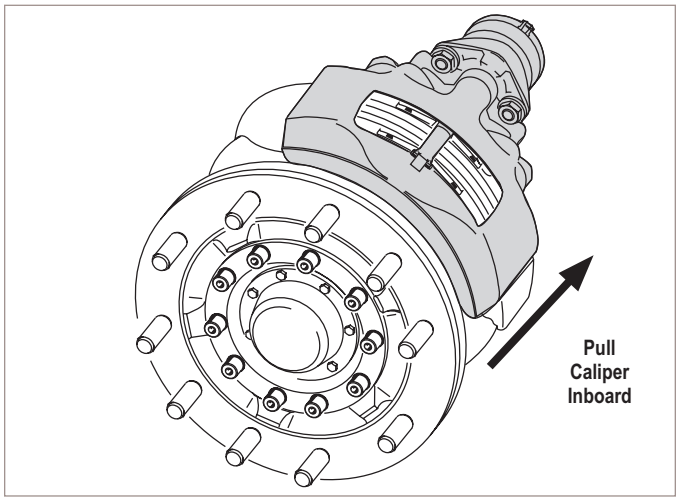


FIGURE 15 - ***PULL CALIPER INBOARD***

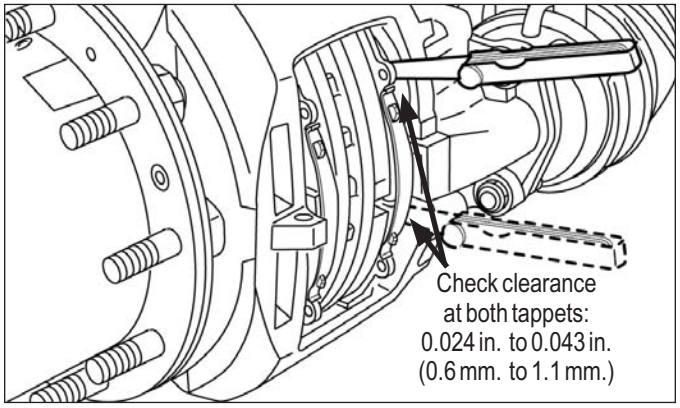


FIGURE 16 - ***RUNNING CLEARANCE CHECK***

CAUTION: If the clearance is too wide, there is a danger of brake failure. If the clearance is too small, or if there is no gap at all, there is a danger of the brake overheating. These conditions must be corrected before returning the vehicle to service.

For further investigation, where there is some gap, go to Section 4.2 and check the adjuster mechanism. Where there is no movement at all (and so no gap to measure), go to Section 4.5 "Guide Pin Inspection."

4.2 ADJUSTER MECHANISM INSPECTION

CAUTION: Follow all safe maintenance practices.

Aside from the normal maintenance schedule, the adjuster mechanism inspection that follows is also carried out when the Caliper Movement Test (4.1) finds that the running clearance is too small or too large.

4.2.1 With the spring brake released (or caged), remove the adjuster cap (37) using the tab, taking care not to move the shear adapter (61). Note: One of two styles of adjuster cap (stamped metal or plastic adjuster cap) may be used.

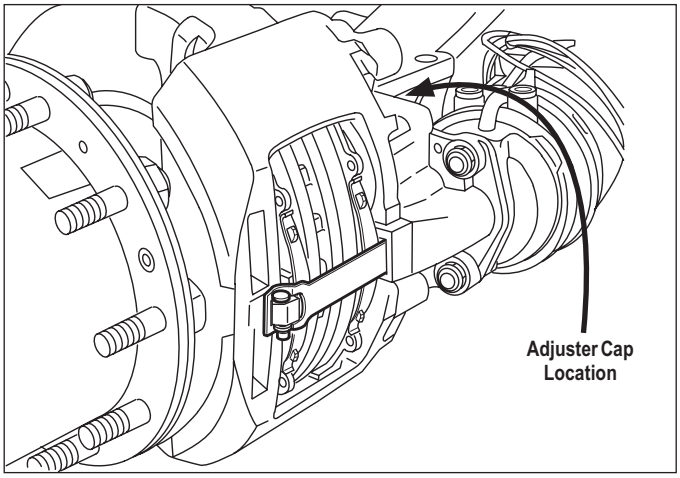


FIGURE 17 - ***ADJUSTER CAP LOCATION***

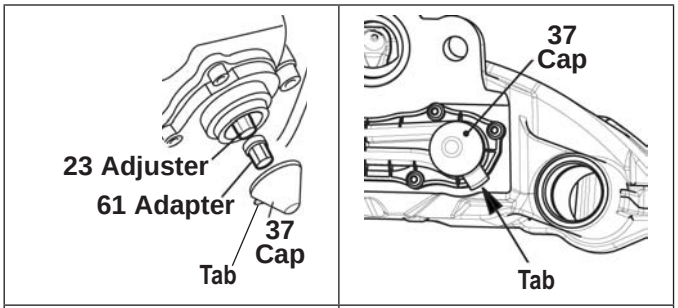


FIGURE 18 - ***EXPLODED VIEW OF ADJUSTER AND ADAPTER***

FIGURE 19 - ***CAP INSTALLED: TAB LOCATION***

For illustration purposes, the exploded view (Figure 18) shows the adjuster (23) and shear adapter (61) separated. When using the adjuster mechanism, always have the shear adapter installed on the adjuster.

4.2.2 Using a 10 mm. six-point box wrench, turn the Shear Adapter (61) **counter-clockwise** and listen for the sound of 3 clicks as the mechanism backs-off (increases) the running clearance. Note: Do not use an open-ended wrench as this may damage the adapter. *See Figure 20.*

CAUTION: Never turn the adjuster (23) without the shear adapter (61) installed. The shear adapter is a safety feature and is designed to prevent excessive torque from being applied to the adjuster. The shear adapter will fail (by breaking) if too much torque is applied.

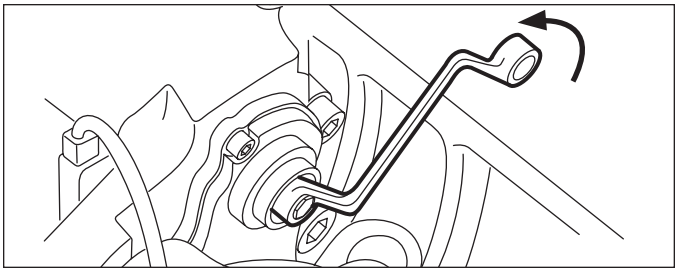


FIGURE 20 - ***BACKING-OFF (INCREASING) THE RUNNING CLEARANCE***

If the shear adapter fails, you may attempt a second time with a new (unused) shear adapter.

Note: Always double-check that the spring brake is released (where applicable) if a shear adapter fails; if this step was missed, the shear adapter will break off, and it may appear that the caliper is seized.

In cases where a second failure of the shear adapter confirms that the adjustment mechanism is seized, the caliper must be replaced.

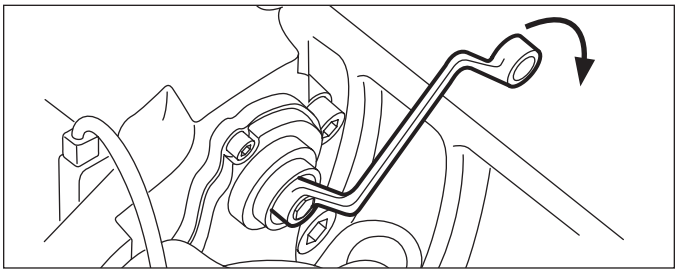


FIGURE 21 - ***APPLYING MODERATE APPLICATIONS OF THE BRAKES: THE WRENCH MOVES CLOCKWISE AS THE RUNNING CLEARANCE IS DIMINISHED***

4.2.3 Where the adjuster mechanism is able to be backed-off normally, position a box-end wrench on the shear adapter so that it can turn clockwise freely without coming into contact with parts of the vehicle *(See Figure 21).* Make five to ten moderate applications of the brakes [at about 30 psi (2 Bar)], and observe that the box-end wrench or socket should turn clockwise in small increments.

NOTE: As the number of applications increases, the turning movement will decrease (as the brake reaches its normal calibration point).

If the box-end wrench does not: (a) turn at all; (b) turns only with the first application; or (c) turns forward and backward with every application, the automatic adjuster has failed and the caliper/carrier assembly must be replaced.

After completing these wheel-off tests, Bendix recommends installing a new adjuster cap (lightly greased using white, lithium-based grease) when returning the brake to service. Ensure that the tab is in the position shown in Figure 19.

4.3- 4.4 BRAKE PADS AND ROTORS

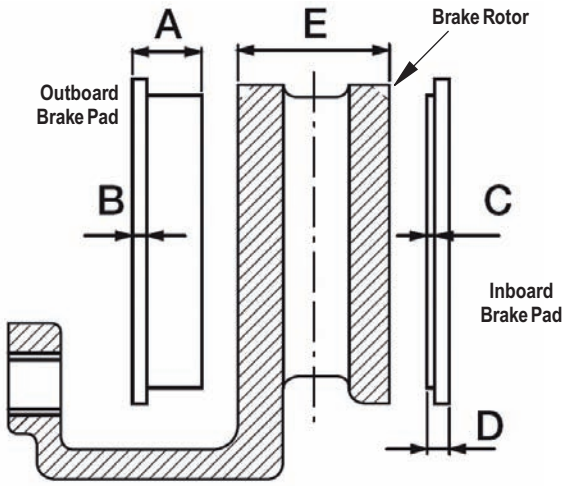
CAUTION: Follow all safe maintenance practices.

If electronic wear sensors are present, *see Section 5.2.*

If dust covers are present, *see Section 5.1.*

See Figure 23. While pressing down against the pad retaining bar (11), remove and retain the clip (26), washer (45) and pin (44). Remove the pad retainer bar (11). Bendix recommends that these items should be replaced with new *(See available kits and parts, Section 5.0)*.

Follow the steps in Section 4.2 for backing-off the adjuster mechanism. Slide the caliper inboard then outboard to permit easy removal of the brake pads.



A	Thickness of a new pad (1.181 in.) (30 mm.).
B	Backing plate thickness (0.360 in.) (9 mm.)
C	Minimum thickness of friction material (0.080 in.) (2 mm.)
D	Minimum thickness of a worn pad (0.433 in.) (11 mm.); replace pads.
E	Thickness of a new rotor (1.77 in.) (45 mm.). Minimum rotor thickness (1.46 in.) (37 mm.)

FIGURE 22 - *PAD AND ROTOR DIMENSIONS*

See Figure 22 for initial brake pad and rotor dimensions, as well as minimum acceptable dimensions.

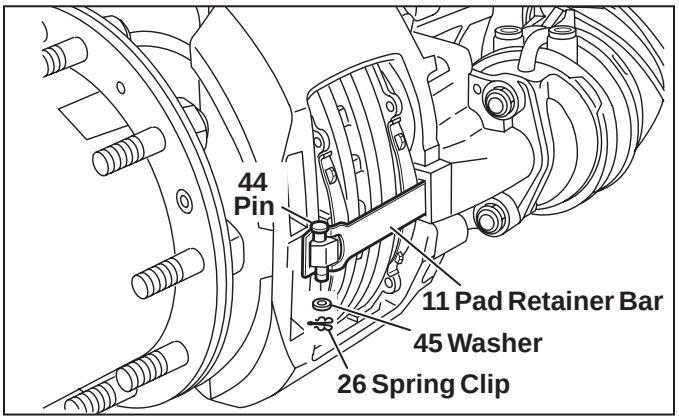


FIGURE 23 - *RETAINER BAR REMOVAL*

4.3 INSPECT THE BRAKE PADS

Regular inspection of the brake pads (even for vehicles that use an electronic wear indicator) is an important part of vehicle maintenance.

4.3.1 See Figure 22. If the thickness of the friction material — dimension “C” — is less than 0.080 in. (2 mm.), the pads must be replaced.

Bendix® ADB22X™, ADB22X-V™ air disc brakes use 0.35 in. (9 mm.) backing plates, so dimension “D” (the combined pad and backing plate thickness) must be a minimum of 0.43 in. (11 mm.).

4.3.2 Check for uneven end-to-end pad wear. If the difference in wear is greater than 0.080 in. (2 mm.), replace the brake pads and also service the guide pins *(See Section 5.4)*.

4.3.3 If the difference between the inboard and outboard pad thickness is greater than 0.138 in. (3.5 mm.), replace the brake pads and service the guide pins. (The uneven wear indicates that the caliper is not sliding freely on the guide pins.)

If the pad thickness is within the acceptable range, inspect the pad surface. *(See Figure 24)*.

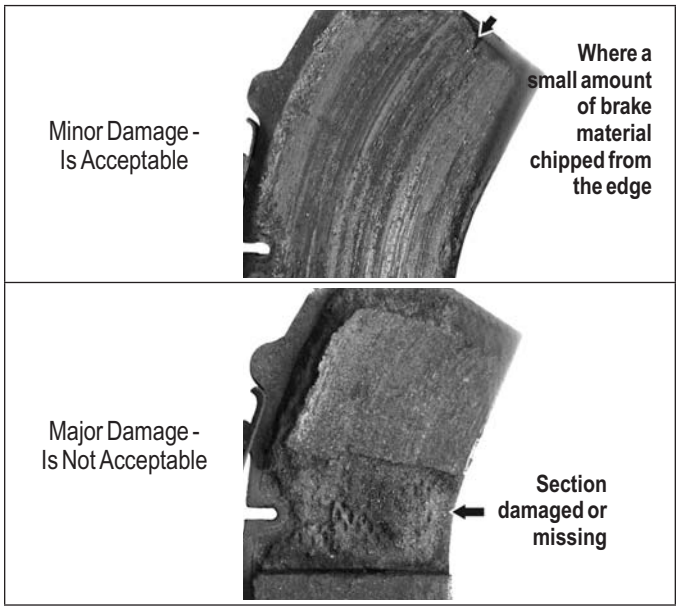


FIGURE 24 - *BRAKE PAD SURFACE INSPECTION*

Minor damage at the edges is permitted, but replace the pads if major damage on the surface of the pad is found.

When replacing brake pads, Bendix strongly recommends that all the brake pads on an axle be replaced at one time. *See Section 5.1 for the pad replacement procedure*. Also see the vehicle manufacturer’s recommendations found in the operator’s manual.

Bendix air disc brakes are precision-engineered braking mechanisms. The “friction couple” braking characteristics have been carefully optimized — and the rotor design and materials have been matched with special formulation brake pads for optimal performance. In all cases, use brake pads with the type of backing plate and lining material originally supplied by the vehicle manufacturer.

CAUTION: When replacing brake pads and rotors, use only Bendix® brand replacement pads and rotors and/or those approved by the OEM. Non-approved replacement disc pads or rotors can cause excess wear to brake components, and can increase the risk of rotors cracking, etc.

4.4 INSPECT THE ROTOR

CAUTION: Follow all safe maintenance practices.

Identify if the rotor is a Bendix® Splined Disc®, or conventional rotor (S*ee Section 1.03*). Rotors should be inspected regularly *(See Section 2.0 for recommended inspection schedule)* and at each pad change.

4.4.1 Measure the thickness of the brake rotor at the thinnest point (Dimension “E” in Figure 22). Avoid measuring near the edge of the rotor as minor burrs may result in inaccurate measurement. Replace the rotor when the minimum thickness of 1.46 in. (37 mm.) is reached.

4.4.2 Inspect the rotor surface. *See Figure 25.* The type of rotor, and also the size, depth and direction of the imperfections, must all be considered.

NOTE: If surface wear conditions F through J are in the permitted range, the rotor is still usable until it reaches the minimum acceptable thickness of 1.46 in. (37 mm.).

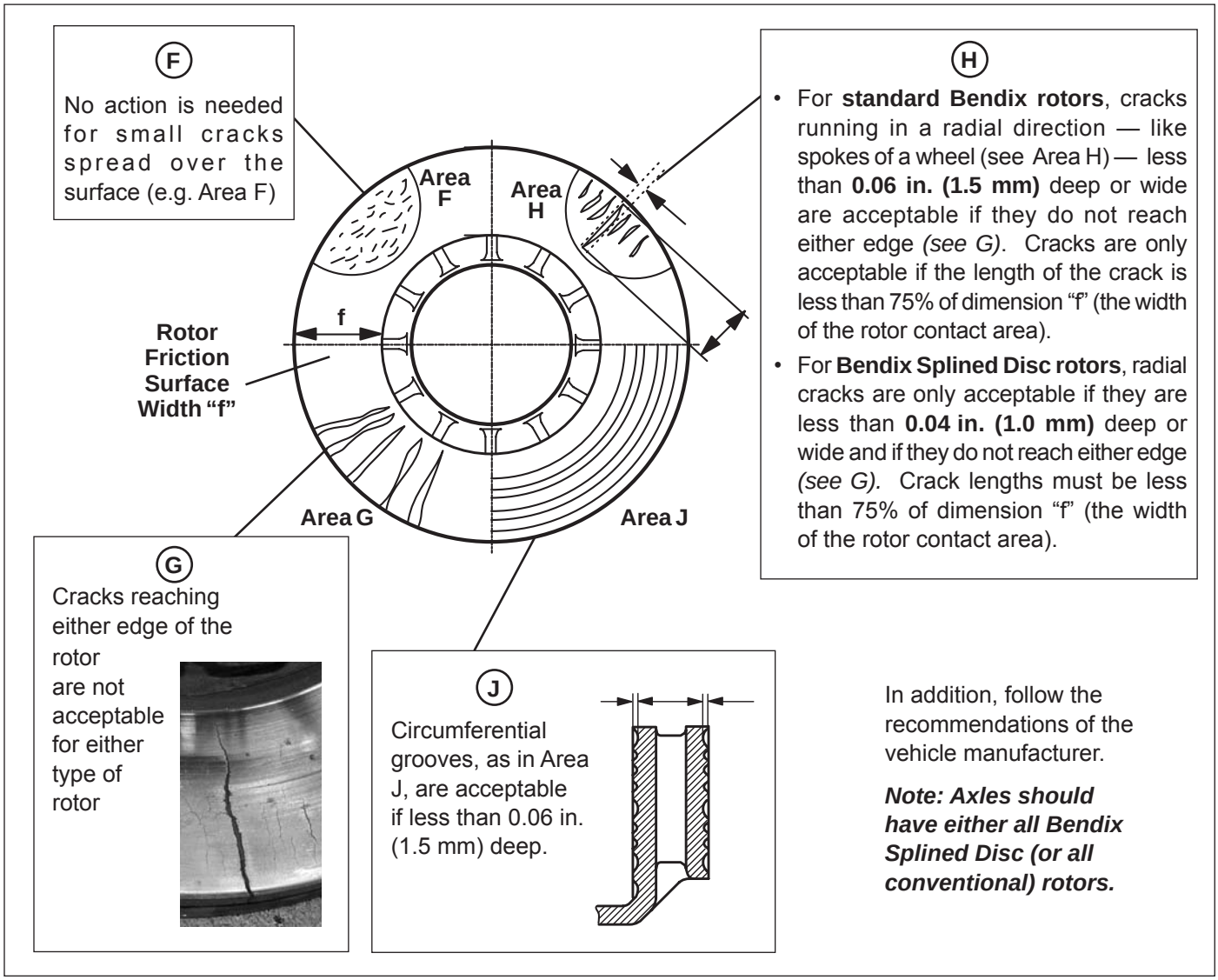


FIGURE 25 - EXAMPLES OF ACCEPTABLE AND NON-ACCEPTABLE ROTOR CONDITIONS

4.4.3 Machining (Grinding or Turning) Rotors

Bendix rotors are normally service-free. In the case of severe grooving of the entire friction surface, however, **CONVENTIONAL ROTORS** may be turned when changing pads, to increase the load-bearing surface.

MACHINING OF BENDIX® SPLINED DISC® ROTORS IS NOT PERMITTED.

CAUTION: Always maintain air disc brake pads and rotors within specifications. Excessive pad or rotor wear will degrade braking performance.

Periodic inspection of the Bendix Splined Disc attachment hardware is recommended to ensure optimum braking performance. Bendix recommends verifying the torque on the spring element fasteners whenever a brake inspection is performed.

⚠ WARNING! AFTER MACHINING/TURNING, THE MINIMUM ROTOR THICKNESS MUST BE AT LEAST 1.535 - 1.575 IN. (39 - 40 MM.). ALSO, CHECK THE VEHICLE MANUFACTURER'S RECOMMENDATIONS. FAILURE TO COMPLY MAY RESULT IN BRAKE FAILURE AND IN SERIOUS INJURY OR DEATH. MACHINING OF BENDIX SPLINED DISC ROTORS IS NOT PERMITTED.

4.4.4 Rotor Replacement

An axle is permitted to have only all Bendix Splined Disc, or all conventional, rotors.

When replacing rotors, be sure to adhere to the vehicle manufacturer's recommendations, including bolt tightening torques. It is recommended to install only Bendix® brand rotors, and also that the pads should be replaced (as an axle set) at the same time.

Non-Bendix® brand rotors. If a non-Bendix® brand rotor is used, confirm that it complies to the vehicle manufacturer's recommendations.

CAUTION: The use of <u>non-approved</u> brake rotors may reduce levels of safety and invalidate the warranty.

See Section 5.7 for re-installation procedures.

4.5 GUIDE PIN BEARING INSPECTION

CAUTION: Follow all safe maintenance practices.

This guide pin inspection should be carried out if the technician cannot move the caliper during a Caliper Movement Test (Sections 2.2 and/or 4.1).

Measure the "play" (range of movement) in the guide pin bearings:

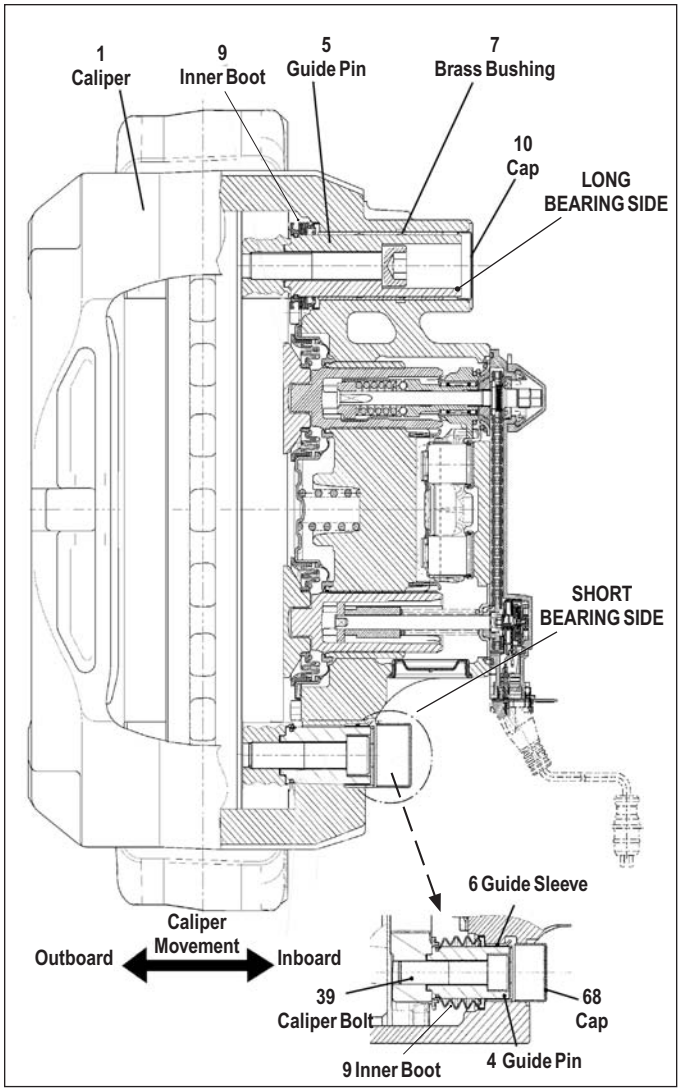


FIGURE 26 - ***GUIDE PINS***

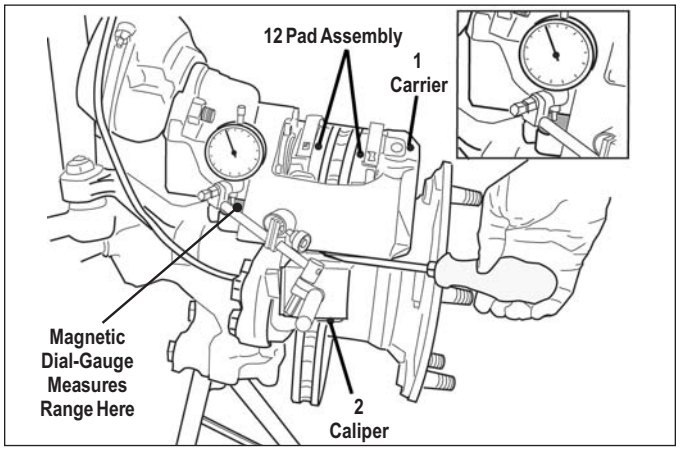


FIGURE 27 - ***MAGNETIC DIAL-GAUGE IN USE***

4.5.1 *See Figures 28 and 29.* With the wheel removed, remove the pad retainer bar (11). Temporarily replace the pads with two new pads (12). Attach a magnetic dial-gauge holder to the carrier (2) on the short bearing side of the caliper (1). Use the measuring point on the caliper (1) - see the callout in Figure 29. Press the caliper in the direction of the carrier (2) and set the dial-gauge to zero.

4.5.2 Place a suitable tool (e.g. a large flat-blade screwdriver) between carrier (2) and caliper (1) forcing them in opposite directions, and read the maximum value on the dial-gauge. *See Figure 27.*

If the value is greater than 0.078 in. (2.0 mm), replace the guide pin bushings *(See Section 5.6)* OR replace the caliper/carrier assembly *(See Section 5.3)*.

Measure the range of travel along the guide pin bearings:

4.5.3 Remove the Pads *(See Section 4.3)*. Using hand pressure only (no tools), the caliper (1) should slide freely along the whole length of the guide pins. This movement should be at least 0.95 inch (25 mm) when the pads are not present. If the movement is less than this amount, replace the caliper/carrier assembly.

Inspect the guide pin inner boots:

4.5.4 *See Figures 28 and 29.* With the pads removed, slide the carrier by hand to the inboard position *(See Figure 28)*. By looking through the opening where the pads are installed — and also from below — inspect the inner boot (9) for each of the guide pins. **INSPECT FOR DAMAGE, CUTS AND CRACKS.** Replace damaged boots immediately to prevent dirt and/or moisture affecting the movement of the guide pins *(See Section 5.4)*. Damaged or corroded guide pins will impair the operation of the brake.

In addition, during installation, the boots are compressed to minimize the amount of air trapped within them. Observe as you move the carrier back towards the outboard position; the boots should not appear to expand outwards due to trapped air — this is a sign of damaged boots. The boots should normally (due to their concertina construction) contract back into place as the caliper moves on the guide pins.

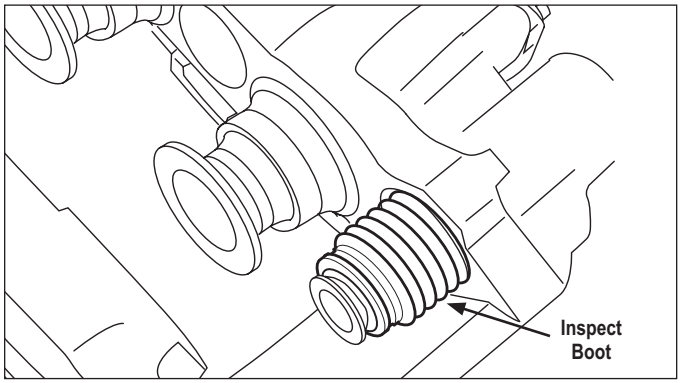


FIGURE 28 - *GUIDE PIN BOOT INSPECTION (THIS IMAGE DOES NOT SHOW THE CARRIER)*

4.5.5 Inspect the original pads *(See Section 4.3)* and they may be reused if they are in good condition with sufficient pad thickness.

4.6 TAPPET AND BOOT ASSEMBLY INSPECTION

4.6.1 In order to inspect the tappet and boot assembly, remove the pads (12) *(See Sections 4.3 or 5.2)* and advance the shear adapter (61) clockwise.

CAUTION: NEVER EXTEND THE TAPPET MORE THAN 1.75 in. (44.5 mm). *See Figure 29.* **Over-extending the tappet will result in the tappet losing engagement with the synchronizing mechanism. Since the mechanism can only be set at the manufacturing plant, the *caliper/carrier assembly must be replaced* if this happens.**

4.6.2 **INSPECT THE TAPPET AND BOOT ASSEMBLIES (13) FOR EVIDENCE OF DAMAGE, CUTS, CRACKS, AND EVIDENCE OF CORROSION, ETC.** The penetration of dirt and moisture into the brake can lead to corrosion and impair the operation of the brake. When installed, the boots are compressed to minimize the amount of air trapped within them. Observe as you move the tappet back using the shear adapter; the boots should not appear to expand outwards due to trapped air — this is a sign of damaged boots. The boots should normally (due to their concertina construction) contract back into place as the tappets move. Damaged boots lead to the penetration of dirt and moisture, and can lead to corrosion and impair the operation of the brake. Replace as necessary *(See Section 5.5)*.

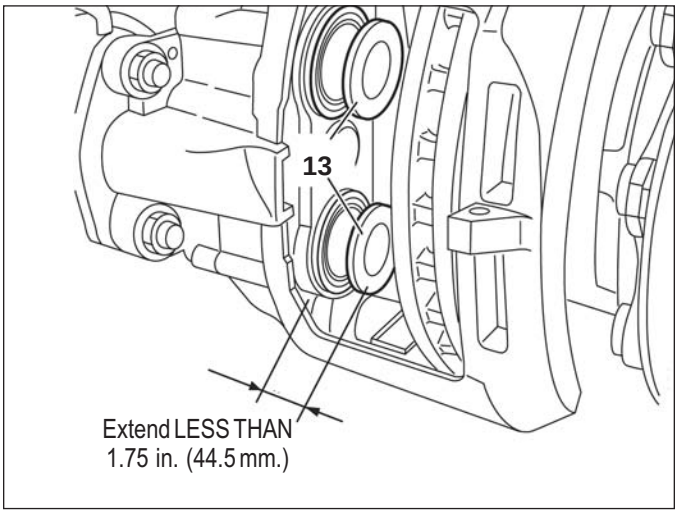


FIGURE 29 - PERMITTED TAPPET EXTENSION

Where the tappets and boots pass the inspection, retract the tappets using the shear adapter.

Follow the reinstallation steps for the brake pads *(See Section 5.2)*.

SECTION FIVE: MAINTENANCE KITS AND PROCEDURES

Section Five

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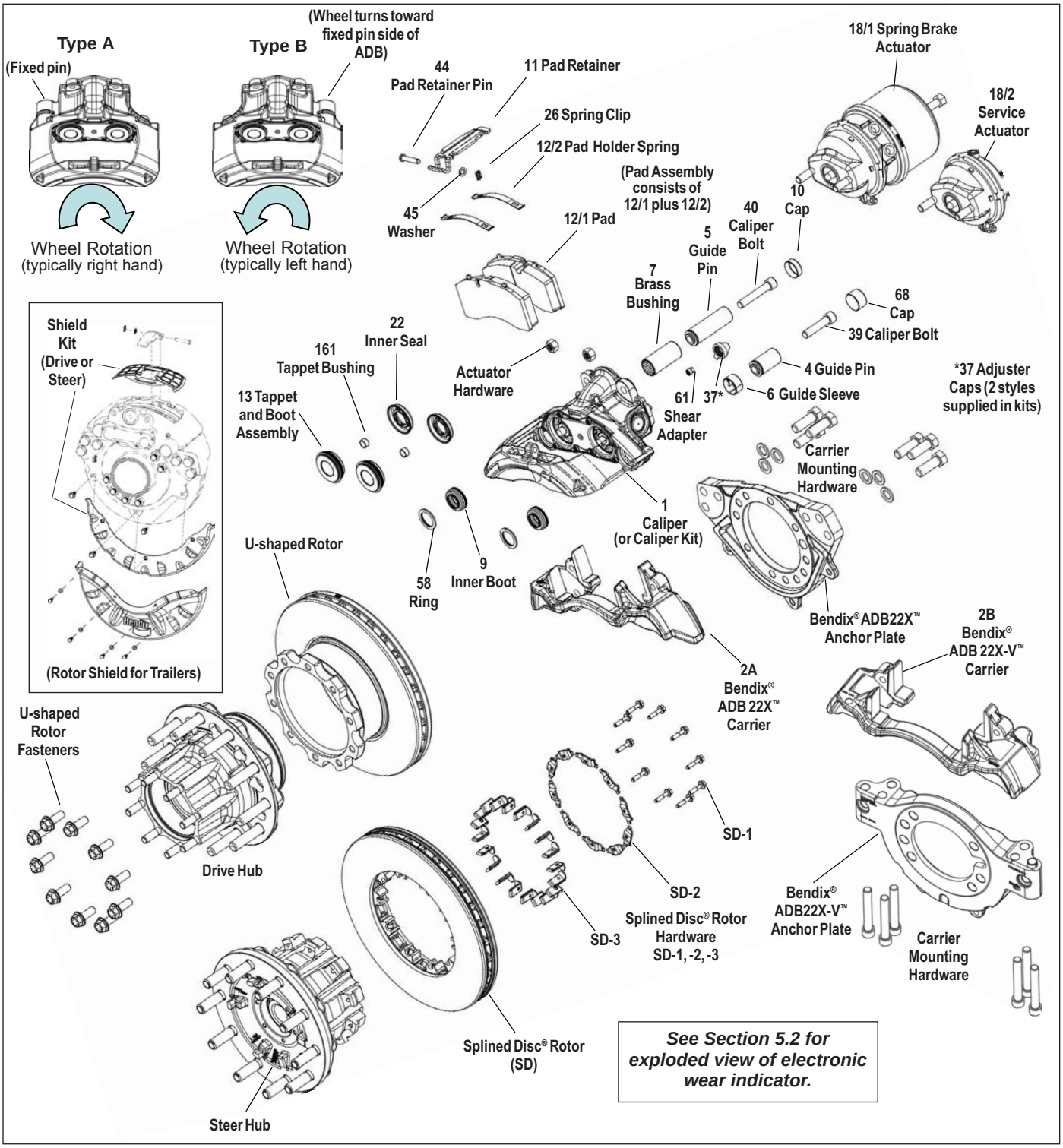


FIGURE 30 - ***EXPLODED VIEW - BENDIX® ADB22X™ AND ADB22X-V™ AIR DISC BRAKES***

5.0 MAINTENANCE KITS

Below is a list of some of the available kits. *See Figure 30 for an exploded view showing the components listed.*

Kit	See Section	Piece Number	Components Included in Kit
Dust Shields	Section 5.1	803129	Trailer Axle Pad & Rotor Shield Kit
		803130	Drive Axle Pad & Rotor Shield Kit
		802948	Steer Axle Pad Shield Kit
Pad Kit (axle set)	Section 5.2	802078	Pad retainer bars (5), set of four pads and holder springs (12), adjuster caps (37), pad retainer pins (44), washers (45), shear adapters (61).
Spring Clip Kit (box of 25)	NA	803151	Spring clips (26)
Shear Adapter (box of 10)	NA	802455	Shear adapters (61)
Tappet/Boot Kit (wheel end kit)	Section 5.5	802119	Tappet and boot assembly (13), tappet bushing (161), inner seal (22)
Adjuster Cap (non-wear sensing - box of 10)	NA	802643	Adjuster caps (37)
Guide Pin, Seal and Boot Kit (wheel end kit)	Section 5.6	803114	Ring (58), inner boot (9), brass bushing (7), guide pin (5), caliper bolt (40), cap (10), guide sleeve (6), guide pin (4), caliper bolt (39), cap (68)
Guide Pin Grease	NA	II14525	White (5 grams)
		K021964	White (500 grams)
Service Actuator	Section 5.4	K028039	Bendix® Type 14 Universal [Service brake actuator (18/2), actuator hardware]
		K028226	Bendix® Type 16 Universal [Service brake actuator (18/2), actuator hardware]
		K028022	Bendix® Type 18 Universal [Service brake actuator (18/2), actuator hardware]
		K028225	Bendix® Type 20 Universal [Service brake actuator (18/2), actuator hardware]
Spring Brake Actuator	Section 5.4	K027557	Bendix® Type 18/16 Piston Style Truck/Trailer Universal [Spring brake actuator (18/2), actuator hardware]
		K025670	Bendix® Type 18/24 Piston Style Truck/Trailer Universal [Spring brake actuator (18/2), actuator hardware]
		K025669	Bendix® Type 20/24 Piston Style Truck/Trailer Universal [Spring brake actuator (18/2), actuator hardware]
		K026451	Bendix® Type 18/24 Double Diaphragm Style Trailer Universal [Spring brake actuator (18/2), actuator hardware]
Caliper Kit (rationalized) Includes 803114 kit shown above	Section 5.3	K019174	Steer and Drive Axle "A" [Caliper kit (1)]
		K019175	Steer and Drive Axle "B" [Caliper kit (1)]
		K019180	Trailer Axle "A" [Caliper kit (1)]
		K019181	Trailer Axle "B" [Caliper kit (1)]
Carrier Kit	Sections 5.3 & 5.6	K051853	**Steer and Drive Axle, Axial** (Ring (58), inner boot(9), caliper bolt (40), cap (10), shear adapter (61), adjuster caps (37), ADB22X carrier complete (1), caliper bolt (39), cap (68).
		K043288	**Trailer Axle, Axial** (Ring (58), inner boot(9), caliper bolt (40), cap (10), shear adapter (61), adjuster caps (37), ADB22X carrier complete (1), caliper bolt (39), cap (68).
		K056559	**Steer and Drive Axle, Vertical** (Ring (58), inner boot(9), caliper bolt (40), cap (10), shear adapter (61), adjuster caps (37), ADB22X-V carrier complete (1), caliper bolt (39), cap (68).
Caliper/Carrier Kit		802090	Steer and Drive Axial “A” (1 + 2A)
		809091	Steer and Drive Axial “B” (1 + 2A)
		802984	Trailer Axial “A” (1 + 2A)
		802985	Trailer Axial “B” (1 + 2A)
		K021299	Steer and Drive Vertical “A” (1 + 2B)
		K021300	Steer and Drive Vertical “B” (1 + 2B)
Hubs	Section 5.7	K020505	Splined Disc® Brake - Aluminum - FF Steer, LMS Bearing Package (Hub)
		803134	Splined Disc® Brake - Aluminum - FL Steer, LMS Bearing Package (Hub)
		802847	Splined Disc® Brake - Aluminum - R Drive, LMS Bearing Package (Hub)
		K020514	Splined Disc® Brake - Aluminum - FF Steer, Standard Bearing Package* (Hub)
		803138	Splined Disc® Brake - Aluminum - FL Steer, Standard Bearing Package* (Hub)
		802859	Splined Disc® Brake - Aluminum - R Drive, Standard Bearing Package* (Hub)
		K045298	Splined Disc® - Aluminum - "TN" Trailer, Standard bearing package* (Hub)
		K045297	Splined Disc® - Aluminum - "TP" Trailer, Standard bearing package* (Hub)
		See hub supplier for these items	U-shaped - Iron/Aluminum, LMS/Standard Bearing Packages
			Flat - Iron/Aluminum, LMS/Standard Bearing Packages
Splined Disc® Rotor Attaching Kit	Section 5.7	K037766	All Splined Disc® Rotor Applications (Splined Disc Rotor hardware kit SD-1, -2, and -3)
Rotor	Section 5.7	802081	138mm U-shaped (Rotor, fasteners)
		802082	150mm U-shaped (Rotor, fasteners)
		802083	Severe Duty Splined Disc Kit (Splined Disc Rotor (SD), and hardware kit SD-1, -2, and -3)
		802569	Heavy Duty Splined Disc Kit (Splined Disc Rotor, and hardware kit SD-1, -2, and -3)

** Universal Replacement with standard bearing configuration and long studs. Contact 1-800-AIR-BRAKE if identification assistance is required.*

TABLE 2 - *MAINTENANCE KITS*

5.0.1 GENERAL INFORMATION ABOUT BENDIX® AIR DISC BRAKE MAINTENANCE

When working on Bendix® Air Disc brakes, please note the following:

- Read and follow the Safe Maintenance Practices on page two.
- Depending on the particular axle, the technician may need to remove the caliper/carrier to allow sufficient access to perform the work.
- **CAUTION: When using a hoist to support the air disc brake, do not attempt to use the pad retainer bar as a bracing point as it is not designed to support the weight of the brake. Use instead a brace (or chain) wrapped around the entire brake to attach the hoist.**
- When replacing bearings — or for any other maintenance procedure where the technician needs to remove the caliper/carrier assembly from the vehicle to perform the maintenance — **replacement caliper/carrier bolts will be required.** Please note that due to the high torque required, the original bolts cannot be reused. The bolts are available from the vehicle manufacturer.
- **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 risk of valve stem shear and other compatibility issues.**

5.0.2 SERVICE DVD

Order part number **BW7356** for a DVD showing the full set of maintenance procedures included in this Service Data sheet.

Kit	See Section	Remove Brake Pads? Section 5.2	Remove Caliper/ Carrier from Vehicle? Section 5.3	Remove Actuator from Caliper? Section 5.4
Dust Shields	Section 5.1	Not Typically	NA	NA
Pad Kit (axle set)	Section 5.2	Yes	No	No
Caliper Kit (rationalized)	Section 5.3	Yes	Yes	Yes
Carrier Kit	Section 5.3	Yes	Yes	Yes
Service Actuator	Section 5.4	No	Not Typically	Yes
Spring Brake Actuator	Section 5.4	No	Not Typically	Yes
Tappet/Boot Kit (wheel end kit)	Section 5.6	Yes	Typically	Typically
Guide Pin, Seal and Boot Kit (wheel end kit)	Section 5.7	Yes	Typically	Typically
Hubs	Section 5.8	Yes	Yes	Yes
Splined Disc® Rotor Attaching Kit	Section 5.9	Yes	Yes	Yes
Rotor	Section 5.10	Yes	Yes	Yes

TABLE 3 - ***OTHER REQUIRED SECTIONS FOR MAINTENANCE KITS***

5.1 AIR DISC BRAKE SHIELD KIT

5.1.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

Note: Most torque plates manufactured after January 1, 2007 have the required torque plate tabs to permit these shields to be mounted.

This shield kit includes a brake pad shield, a rotor shield and the required attaching hardware for use in Bendix® ADB22X™ and ADB22X-V™ Air Disc Brake applications where external contamination and excessive road debris is a concern. Brake pad and rotor shields can greatly reduce damage and/or premature wear of pads and rotors under these conditions.

During installation, verify that once the shield(s) are installed they will not come into contact with any vehicle components, suspension, housings, etc. through the full range of motion of the wheel. Keep in mind the particular use of the vehicle, the orientation of the brake on the axle and torque plate, the proximity of other axles, and/or the wheel/tire being used.

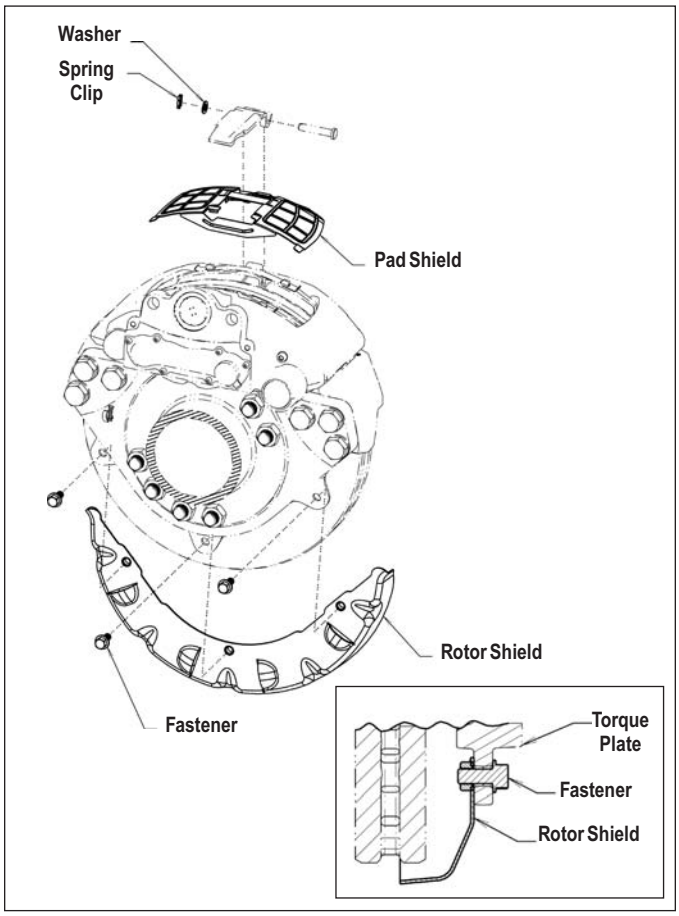


FIGURE 31 - ***DRIVE OR STEER AXLE EXPLODED VIEW WITH INSET SHOWING ROTOR SHIELD INSTALLATION***

5.1.2 Remove and discard the spring clip and washer from the pad retainer pin. Remove and retain the retainer bar and retainer pin. Position the pad shield as shown and re-insert the retainer bar. Install the retainer pin. Use the included spring clip and washer to secure the retainer pin. Check that the pad shield is held securely in place by the retainer bar. *See Figures 31 or 32.*

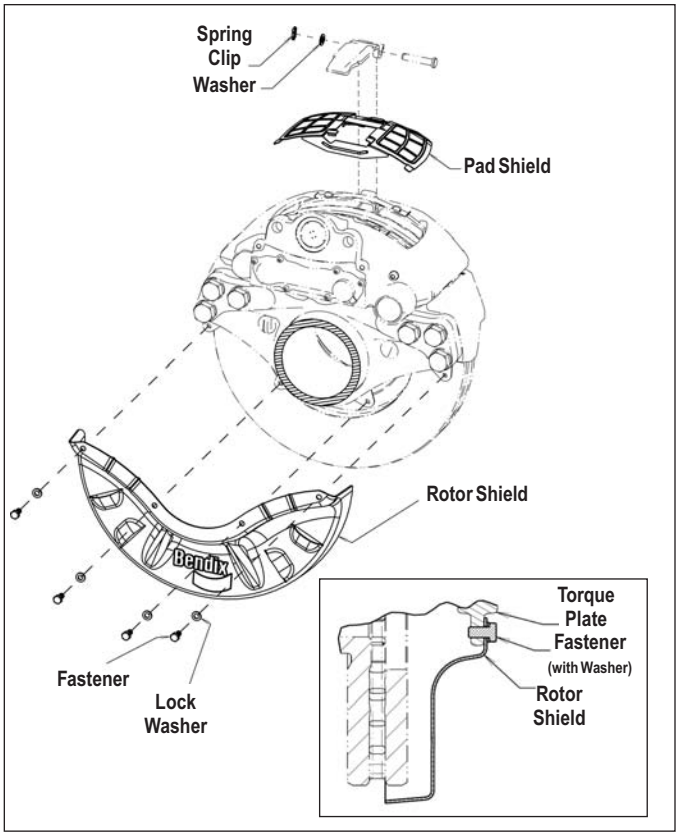


FIGURE 32 - ***TRAILER AXLE EXPLODED VIEW WITH INSET SHOWING ROTOR SHIELD INSTALLATION***

5.1.3 **Drive or Steer Axle Rotor Shields** (*See Figure 31*). Position the rotor shield *between the torque plate and the rotor*. The supplied cap screws pass through the mounting tabs in the torque plate and install into the shield. Torque cap screws to 44 Ft. Lbs. (528 in. lbs.).

5.1.4 **Trailer Axle Rotor Shields** (*See Figure 32*). Position the rotor shield with *the torque plate between the shield and the rotor*. With one (supplied) lock washer in place on each cap screw, pass the screws through the shield before mounting onto the threaded torque plate holes. Torque the cap screws to 24 Ft. Lbs. (288 in. lbs.).

Note: The installation of air disc brake shields does not eliminate the need for periodic maintenance and inspection of the air disc brake and entire wheel end for damage and/or wear. In addition, the truck and trailer manufacturer's specific criteria for the brake shield requirements on air disc brakes should be consulted before either installing or removing air disc brake shields from a wheel end(s).

5.2 PAD REPLACEMENT

5.2.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

The Bendix DVD (BW7356) shows this procedure.

Important: If the vehicle is equipped with spring brakes, cage the spring brakes on all axles to be worked on. Consult the vehicle manufacturer's instructions as necessary.

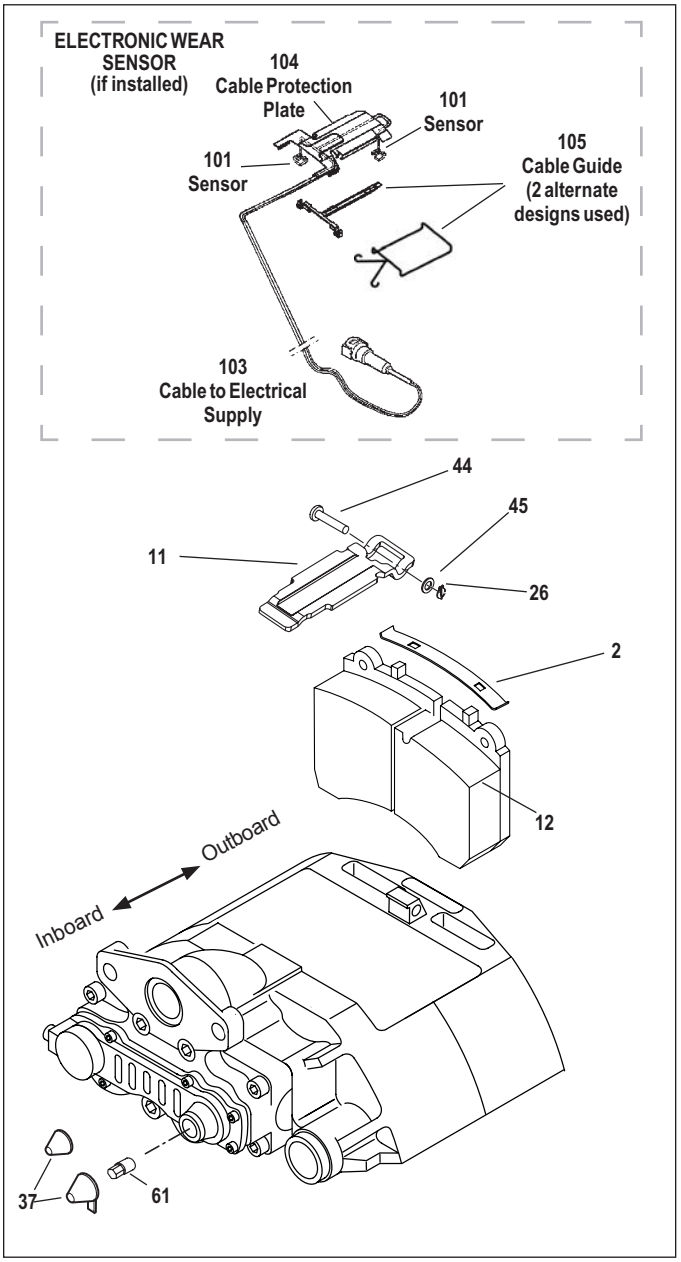


FIGURE 33 - ***PAD REPLACEMENT***

5.2.2 Raise the complete axle to be worked on until the tires clear the ground. See the vehicle maintenance manual instructions for removing the wheels.

5.2.3 If the air disc brake is equipped with an electronic wear sensor indicator *(see top of Figure 35)*, remove and retain the mounting hardware for the cable protection plate. The cable protection plate can then be set aside while servicing the pads. Note the position of the sensors in the brake pad channels, and carefully remove them. In most cases you do not need to release the cable connector in order to move the sensors away from the pad installation work area. Inspect the wear sensors - replace if damaged or abraded.

5.2.4 *See Figure 36.* Remove and discard the pin retention clip (26) and washer (5).

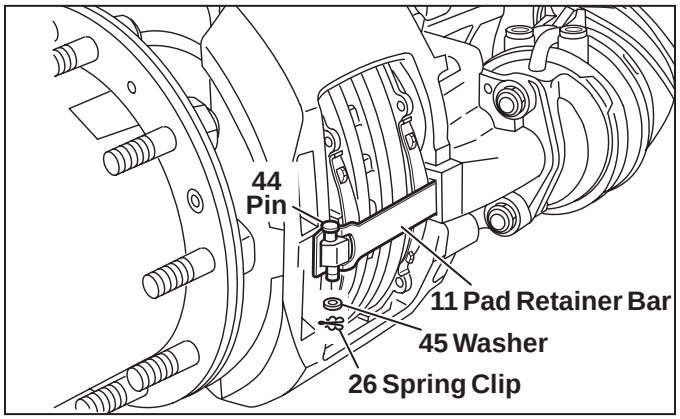


FIGURE 34 - ***PAD RETAINER BAR REMOVAL***

5.2.5 While pressing against the pad hold down bar, remove the pad retainer bar pin (11). Discard the hold down bar.

5.2.6 With the spring brake released (or caged), remove the adjuster cap (37) using the tab, taking care not to move the shear adapter (61). Note: One of two styles of adjuster cap (stamped metal or plastic adjuster cap) may be found; use the same style as a replacement in step 5.2.21.

5.2.7 Inspect the sheer adapter (61). If significant corrosion and/or damage is present, remove the adjuster adapter using needle-nose pliers and replace with the adapter supplied in the kit and clean as necessary.

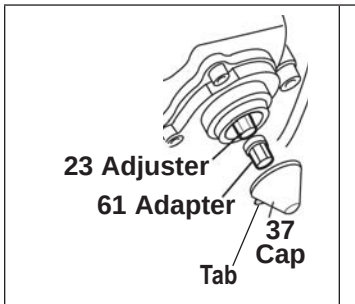


FIGURE 35 - ***EXPLODED VIEW OF ADJUSTER AND ADAPTER***

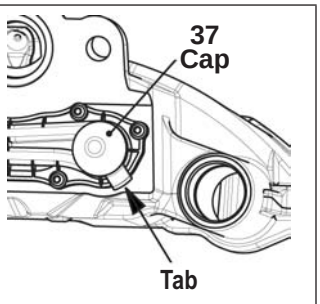


FIGURE 36 - ***CAP INSTALLED: TAB LOCATION***

For illustration purposes, the exploded view (Figure 36) shows the adjuster (23) and shear adapter (61) separated. When using the adjuster mechanism, always have the shear adapter installed on the adjuster.

CAUTION: Never turn the adjuster (23) without the shear adapter (61) installed. The shear adapter is a safety feature and is designed to prevent too much torque being applied. The shear adapter will fail (by breaking) if too much torque is used.

Note: Always double-check that the spring brake is released (where applicable) if a shear adapter fails; if this step was missed, the shear adapter will break off, and it may incorrectly that the caliper is seized.

If the shear adapter fails, you may attempt a second time with a new (unused) shear adapter. In cases where a second failure of the shear adapter confirms that the adjustment mechanism is seized, the caliper must be replaced.

5.2.8 Use a 10 mm. six-point box wrench *(See Figure 37)* to turn the adjuster counterclockwise until sufficient space exists to remove the brake pads. A clicking noise occurs each time the adjuster turns.

CAUTION! Avoid overloading or damaging the adjuster shaft. Do not use an open-ended wrench since it may damage the adjuster shaft.

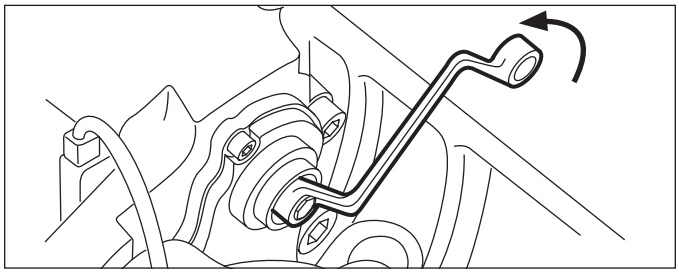


FIGURE 37 - ***BACKING OFF THE ADJUSTER FOR PAD REMOVAL***

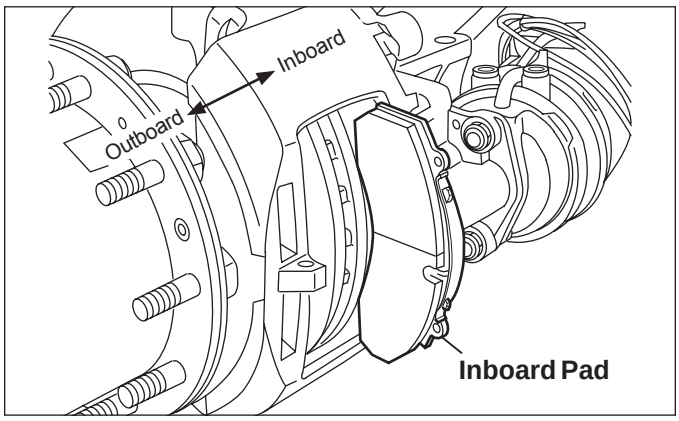


FIGURE 38 - ***PAD REMOVAL***

5.2.9 *See Figure 38.* Move the caliper fully inward and remove the inboard pad, then move the caliper fully outward and remove the outboard pad.

5.2.10 Repeat the pad removal procedure for the other end of the axle.

5.2.11 To confirm that the guide pins are sliding freely, examine the pads just removed for uneven wear. Use these two inspections:

1. Check for uneven wear from one end of each pad to the other. If the difference in wear is greater than 0.080 in. (2 mm.), service the guide pins *(See Section 5.6)*.
2. Compare the thickness of the inboard and outboard pads of each set. If the difference between them is greater than 0.119 in. (3 mm.), this also would show that the guide pins are ready to be serviced.

5.2.12 Inspect the Brake Rotor *(See Section 4.4).*

5.2.13 Inspect the guide pins *(See Sections 2.2 & 4.1)*.

Important: To maintain optimal braking, Bendix strongly recommends that whenever brake pads are replaced, the complete axle set be replaced together. Use only pads which are permitted by the vehicle manufacturer, axle manufacturer, and/or disc brake manufacturer. Failure to comply with this may invalidate the vehicle manufacturer's warranty.

Before installing the brake pads, use the adjuster to fully retract the tappets to provide adequate clearance.

5.2.15 Clean the surfaces that will come in contact with the brake pad.

Caution: When installing pads and retaining springs, where appropriate, use heavy duty gloves and always keep fingers away from potential pinch hazard areas.

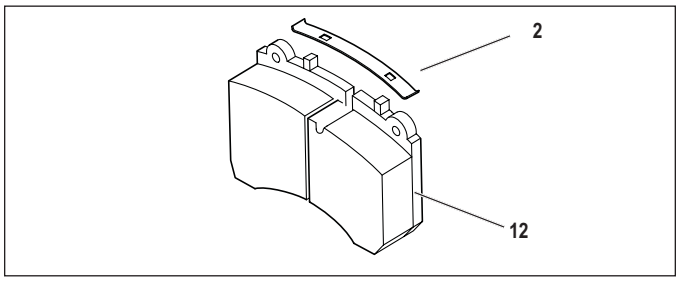


FIGURE 39 - ***PAD RETAINING SPRING INSTALLATION***

5.2.16 Install the pad retaining springs(2) onto the brake pads(12) by inserting one end of the spring onto the lug at the top of the brake pad *(See Figure 41).* Carefully apply enough force to permit the second lug to fully engage, taking care to keep fingers etc. away from the spring as it seats.

5.2.17 Pull the caliper fully outward and install the outboard pad. Move the caliper fully inward and install the inboard pad.

5.2.18 To reinstall wear indicators (if used): Insert the wear sensors into position in the new brake pads. Route the sensor cable through the cable protection plate channel and secure the plate with the mounting hardware retained at disassembly. *(See Section 5.2.)*

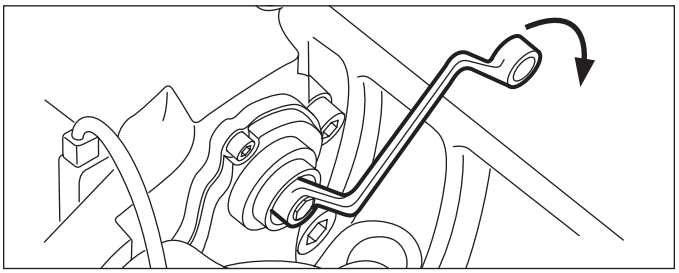


FIGURE 40 - ***RUNNING CLEARANCE ADJUSTMENT***

5.2.19 Move the caliper to the full outboard position.

5.2.20 Using a 10 mm. six-point box wrench, turn the Shear Adapter (61) **counter-clockwise** and listen for the sound of 3 clicks as the mechanism backs-off (increases) the running clearance. Note: Do not use an open-ended wrench as this may damage the adapter. *(See Figure 40).*

5.2.21 Select the correct replacement adjuster cap from those supplied with the kit. Lightly grease adjuster cap with Renolit HLT2 white grease (part number I I14525) and install the cap.

5.2.22 Push the new pad retainer bar (11) into the groove of the caliper. Press down on the pad retainer bar, and insert the pad retainer pin (44), with the pin pointing downwards, where possible. Install the supplied washer (45) and then the spring clip (26).

5.2.23 Apply and release the brakes. The hub should turn easily by hand after applying and releasing the brake.

5.2.24 Re-check the running clearance. Readjust if necessary.

5.2.25 Reinstall the wheel, following the vehicle manual instructions.

⚠ WARNING!

The brake pads and rotor must be maintained within the recommended wear limits. Failure to monitor wear and replace the brake pads and rotor when required may result in diminished brake performance.

5.3 CALIPER/CARRIER/ACTUATOR ASSEMBLY

5.3.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

The brake pads must be removed (*See Section 5.2.0*) and actuator disconnected (and caged if a spring brake), *see Section 5.4.0*.

CAUTION: When using a hoist to support the air disc brake, do not attempt to use the pad retainer bar as a bracing point. It is not designed to support the weight of the brake. Use instead a brace (or chain) wrapped around the entire brake to attach the hoist.

5.3.2 In all cases check that the current hose routing arrangement does not restrict the full travel of the caliper before beginning work on the assembly.

5.3.3 Disconnect the air hose(s) from the service or spring brake chamber.

Vertical Mounting Bolt Style

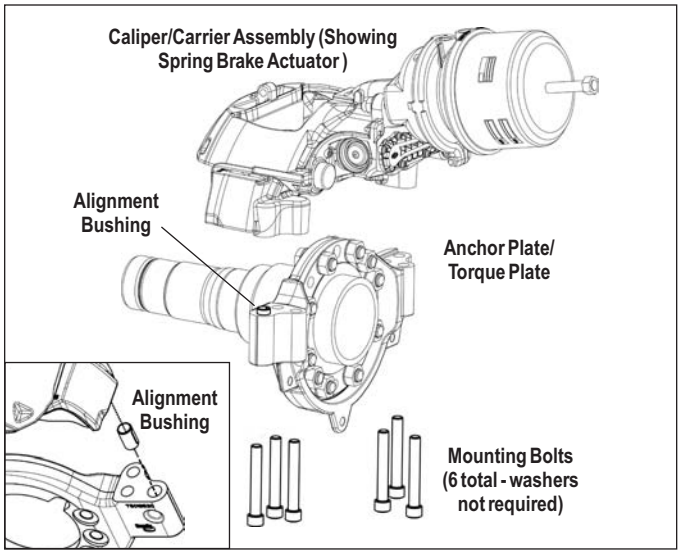


FIGURE 41 - ***VERTICAL MOUNT CALIPER/CARRIER***

5.3.3 See Figure 41. Supporting the air disc brake by necessary means, remove the six (6) mounting bolts/washers and discard. Note: Bendix strongly recommends that during re-assembly these bolts are replaced - see your vehicle manufacturer for replacement hardware. Lift the caliper up off the anchor plate.

The vertical bolt assembly includes an alignment bushing. **This bushing must be saved for re-use during re-assembly of the brake.** The bushing mounts in the torque plate and maintains the correct alignment of the brake assembly relative to the rotor.

5.3.4 If the brake assembly does not separate from the anchor plate it may be helpful to install an M16X2.0 screw longer than 120 mm at the bushing locations and tap the end of the bolt with a hammer to free the brake assembly. Remove the assembly.

Axial Mounting Bolt Style

5.3.5 Disconnect the air hose(s) to the brake chamber. *See Figure 42.* Supporting the air disc brake by necessary means, remove the six bolts attaching the brake to the anchor plate and remove the caliper/carrier assembly from the vehicle.

Note: Bendix strongly recommends that during re-assembly these bolts and washers are replaced. See your vehicle manufacturer for replacement hardware. Remove the assembly.

5.3.6 Re-installation. Supporting the air disc brake by necessary means, attach the brake to the anchor plate using six bolts. Torque to vehicle manufacturer's specifications. If torque values and bolts are not specified by the vehicle manufacturer, then select a replacement bolt as shown in Table 4.

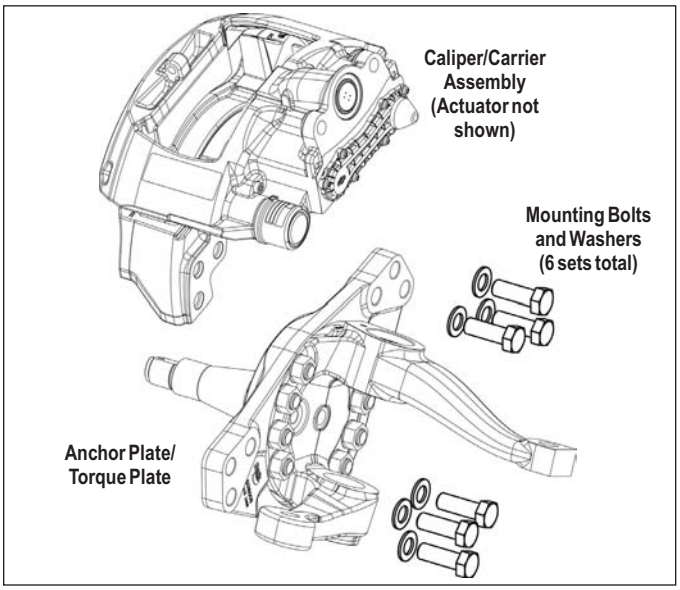


FIGURE 42 - ***AXIAL MOUNT CALIPER/CARRIER***

Air Disc Brake Attachment Hardware		
Torque Plate Manufacturer	Fastener	Torque
Bendix Axial Carrier Torque Plate 	Fastener: M20 x 2.5 x 60 mm Class 10.9 ***Washer: Requires HARDENED 3 mm (minimum thickness) for each bolt.***[1] ***If the vehicle is using a Bendix manufactured Axial Anchor Plate, with a thickness of 1.14 in. (29 mm) where these bolts are assembled, then a bolt with an overall length of 2.36 in. (60 mm) will meet these requirements***	Use the manufacturer's recommendations. If unavailable, use phosphate and oil finish fastener. Pre-Torque: 20-60 ft-lbf [27-81 N·m] Final Torque: 350-400 ft-lbf [475-542 N·m]
Bendix Vertical Carrier Torque Plate 	Fastener: M16 x 2.0 x 110 mm, Class 10.9 ***Washer: None required.***	Use the manufacturer's recommendations. If unavailable, use plain and oil finish fastener. Torque: 200-220 ft-lbf [271-298 N·m]
Trailer Torque Plate	Fastener: M20 x 2.5 x L Class 10.9 Length determination: L = Torque Plate (TP) thickness + Carrier engagement + Washer thickness L_{min} = TP thickness + 24 mm + 3 mm L_{max} = TP thickness + 29 mm + 3 mm ***Washer: Requires HARDENED 3 mm (minimum thickness) for each bolt.***[1]	Use the manufacturer's recommendations. If unavailable, use phosphate and oil finish fastener: Pre-Torque: 20-60 ft-lbf [27-81 N·m] Final Torque: 350-400 ft-lbf [475-542 N·m]
Table Note: 1. The washer outside diameter must be less than 1.1in. (28.5 mm).		

TABLE 4 - ***TORQUE PLATE FASTENERS AND TORQUE RECOMMENDATIONS (SEE MANUFACTURER'S RECOMMENDATIONS)***

5.4 SPRING OR SERVICE BRAKE

5.4.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

5.4.2 **Use the spring brake manufacturer's recommended safety practices in all cases.**

Some spring brake and vehicle manufacturers permit caging the spring brake while the spring brake is engaged.

THE FOLLOWING INSTRUCTIONS ARE FOR BENDIX® BRAND ACTUATORS.

5.4.3 With the vehicle on a level surface and the wheels properly chocked, apply air to release the spring brakes (parking brakes) by using the dash-mounted air control valve. Back out the release bolt (Figure 43, arrow "D"), using a maximum torque of 26 ft. lbs. (35 N·m) to cage the air released spring force on the push rod.

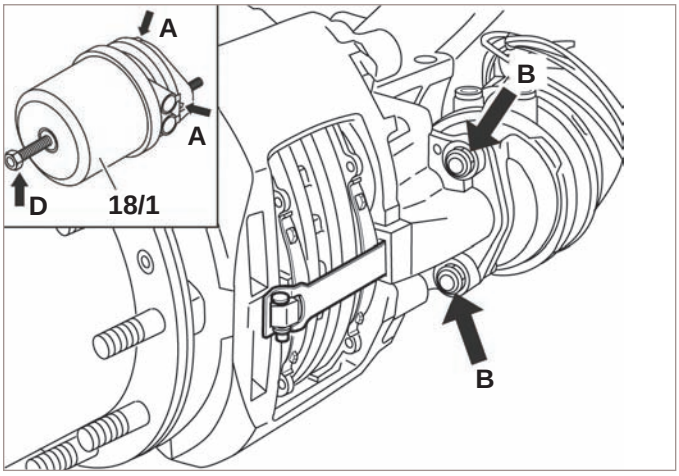


FIGURE 43 - ***ACTUATOR SPRING CAGING AND REMOVAL***

5.4.4 Exhaust the air from the brake chambers by using the dash-mounted air control valve. With all air pressure drained from the system, disconnect the air hoses from the brake chamber. While supporting the brake chamber in position, remove and discard the brake chamber mounting nuts (Figure 45, arrows marked "B"). Remove the brake chamber.

Note: Before removing the brake pads it is strongly recommended that the air disc brake adjuster mechanism be checked for correct operation *(See Section 4.2).*

5.4.5 Re-installation. Before installing the brake chamber, the actuator flange *(See Figure 46, arrow "C")* must be cleaned and inspected. Consult the vehicle manual. The spherical cup in the lever (19) must be greased with white grease (Part No. II14525 or K021964). Add grease to the rubber gasket on the chamber.

CAUTION: Do not use grease containing molybdenum disulfate.

5.4.6 The seal, as well as the push rod area, must be clean and dry.

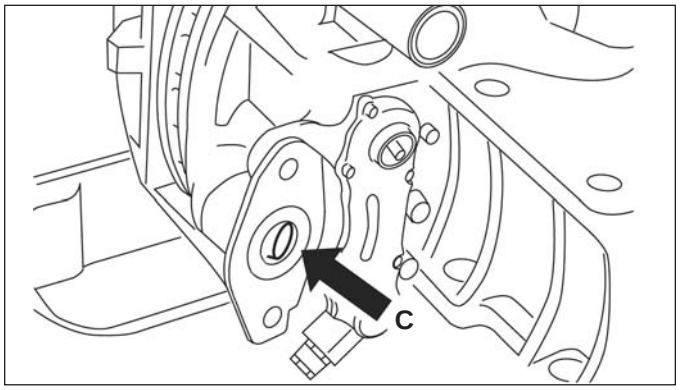


FIGURE 44 - SPRING BRAKE INSTALLATION

CAUTION: Do not use brake chambers with seals that have a thickness less than 0.12 in. (3 mm). Use only actuators which are recommended by the vehicle manufacturer.

5.4.7 Install the brake chamber using new self-locking nuts (EN ISO 10513). Alternately tighten both the nuts step by step up to a final torque of 133 ± 7 ft. lbs (180 ± 10 N·m). **Bendix strongly recommends that new nuts be used.**

5.4.8 Re-connect the air hose(s) and be sure that each hose is not twisted or in contact with moving vehicle components. The air hose routing must allow for full caliper travel. Note that for spring brake service chambers the ports are indicated by: "11" Service Brake Port and "12" Spring Brake Port

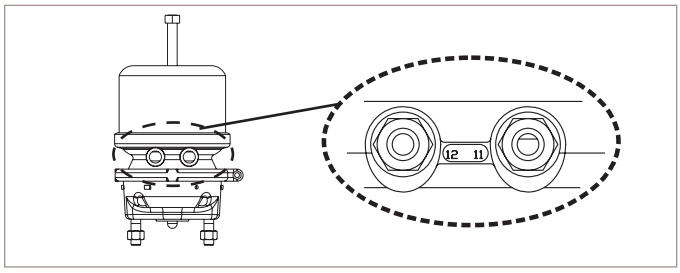


FIGURE 45 - ***PORT DESIGNATIONS***

Note: Where a new spring brake chamber is being installed, note that typically drain plugs are installed *(See Figure 43, arrows marked "A").* After installation, remove whichever plug is at the lowest position. Be sure that all other drain holes remain plugged. The selected drain hole must be aligned downwards (or within ±30°) when installed on the vehicle. In the case of spring brake chambers, install the pads before uncaging the spring.

5.4.9 Before returning vehicle to service, with the system pressurized, using a soap solution, check for air leakage. Minimal leakage in the area around the push rod hole is permitted (100 SCCM), and a one-inch bubble in one minute at the hose fitting is acceptable. If abnormal leakage is detected, the diaphragm must be replaced, or fitting adjusted, respectively.

5.5 TAPPET & BOOT ASSEMBLIES, AND TAPPET INNER SEAL REPLACEMENT

5.5.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

In some cases, the technician will need to remove the caliper carrier assembly from the vehicle. *(See Section 5.3.)* Note that new bolts (available from the vehicle manufacturer) will be needed for re-installation.

Important: If the vehicle is equipped with spring brakes, cage the spring brakes on all axles requiring work. Consult the vehicle manufacturer's instructions as necessary. This procedure may be carried out with the air disc brake installed on, or removed from, the vehicle. In cases where the caliper/carrier assembly is removed from the vehicle, NEW fasteners must be used and properly torqued during re-installation. Use only fasteners approved by the vehicle manufacturer.

Note: This maintenance procedure uses specialized tools. The full Bendix air disc brake tool kit (K029164), or Ken-Tool kit (80000), includes the complete set of tools required for all permitted maintenance procedures. Alternately, for locations where only the tappet and boot replacement procedures will be performed, the smaller Bendix tool kit (K028829), or Ken-Tool kit (80001) will suffice. The DVD (BW7356) shows this procedure.

Bendix Number/ Ken-Tool Number	Description	Typical Tool View
T1 / KT01	Cup	
T2 / KT02	Handle for KT01 cup	
T3 / KT03	Swivel assembly (KT03-1 short body + KT03-2 brass disc + KT03-3 retaining spring)	
T4 / KT04	Long strut	
T9 / KT09	Flange	
T15 / KT015	Fork	
T24 / KT024	Black Nylon Disc	

TABLE 5 - ***TAPPET AND BOOT REPLACEMENT TOOLS***

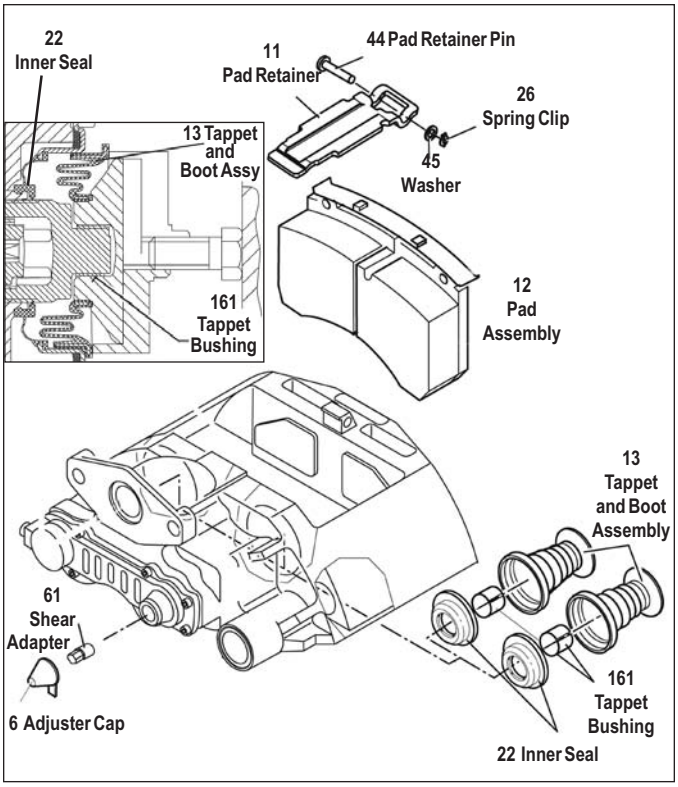


FIGURE 46 - ***ADB EXPLODED AND SECTION VIEWS***

5.5.2 Pad Removal: follow Sections 5.2.1-5.2.11 for removal of the brake pads.

5.5.3 Inspect the Brake Rotor *(See Section 4.4).*

5.5.4 Tappet and Boot Assembly (13) Removal

CAUTION: NEVER EXTEND THE TAPPET MORE THAN 1.75 in. (44.5 mm). ***See Figure 47.*** **Over-extending the tappet will result in the tappet losing engagement with the threads of the synchronizing mechanism. Since the mechanism can only be set at the manufacturing plant, the** ***caliper/carrier assembly must be replaced*** **if this happens.**

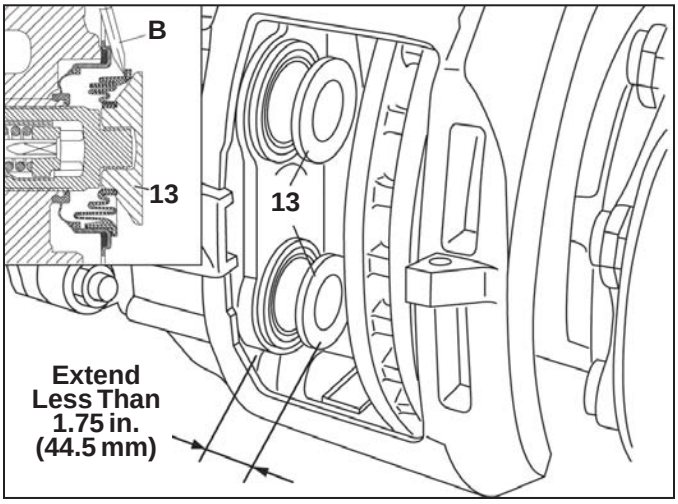


FIGURE 47 - ***PERMITTED TAPPET EXTENSION***

5.5.5 *See Figure 47.* Extend the tappets — less than 1.75 in. (44.5 mm) — by turning the shear adapter (61) clockwise. A screwdriver (callout "B" in

Figure 47 inset) should be used to move the boot and allow the wedge fork ("A" in Figure 48) to be inserted. CAUTION: Do not insert the screw driver more than ¼ inch. Take care not to damage the inner sealing face (*see arrow "X" in Figure 49*). Gouges or grooves will prevent a good seal and will require that the caliper be replaced.

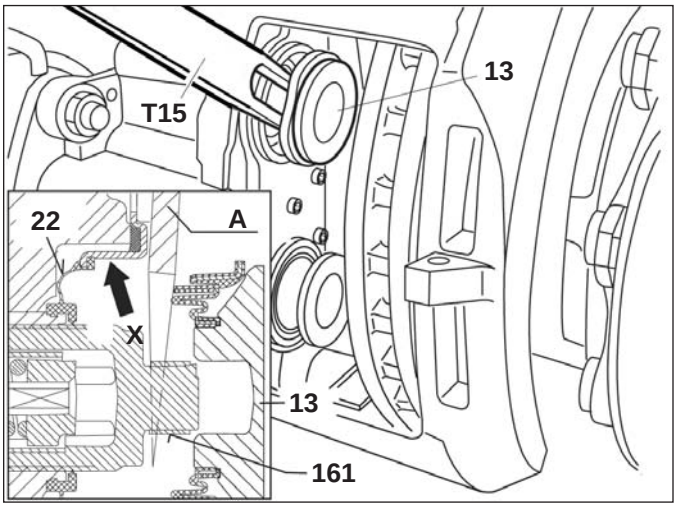


FIGURE 48 - ***WEDGE TOOL USE***

5.5.6 The tappet and boot assemblies (13) can then be removed from the threaded tubes (16) by using the wedge fork (T15). *Be sure to orient the wedge tool with the tapered side towards the tappet.*

5.5.7 Remove the old tappet bushings (161).

5.5.10 *See Figure 49.* Carefully remove the inner seal using one or two flat-blade screwdrivers as shown. Caution: Do not insert the screwdrivers so far that they come into contact with the threaded tubes. Damage to the threaded tubes would require that the brake be replaced.

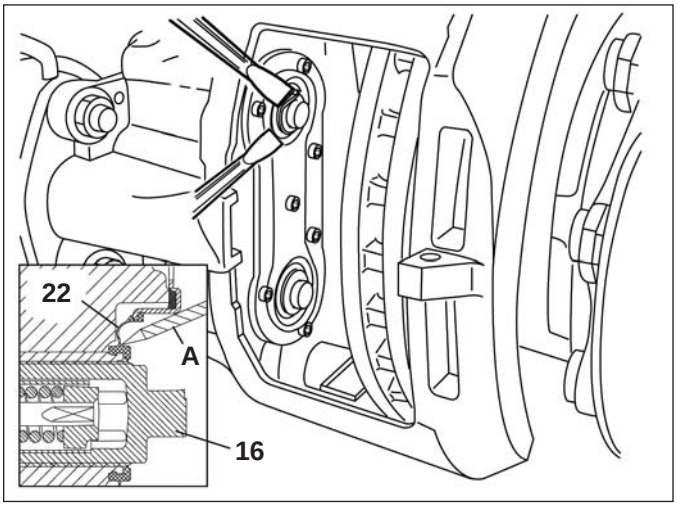


FIGURE 49 - ***INNER SEAL REMOVAL***

5.5.8 Inspect the inner sealing face for damage. If damage is found that would cause the inner seals not to be able to seal properly, the caliper/carrier assembly must be replaced. Clean the area around the inner seal.

5.5.9 Inspect the threaded tubes (16). *See Figures 50 and 51*. Extend the tubes, but by less than 1.75 in. (44.5 mm), by turning the shear adapter (61) clockwise. Inspect the threads for rust, corrosion, or damage etc. If there is evidence of damage to the threads; significant rust; or corrosion, the caliper/carrier assembly must be replaced.

If the technician is working with the caliper on the vehicle, the technician may place a new brake pad (12) into the outboard gap to help avoid the loss of thread engagement of the threaded tubes. *See Figure 51.*

If the work is being carried out at a workbench, the technician may insert a 2.76 in. (70 mm) spacer *(See callout "E" in Figure 52)* into the caliper (1) to help avoid the loss of thread engagement.

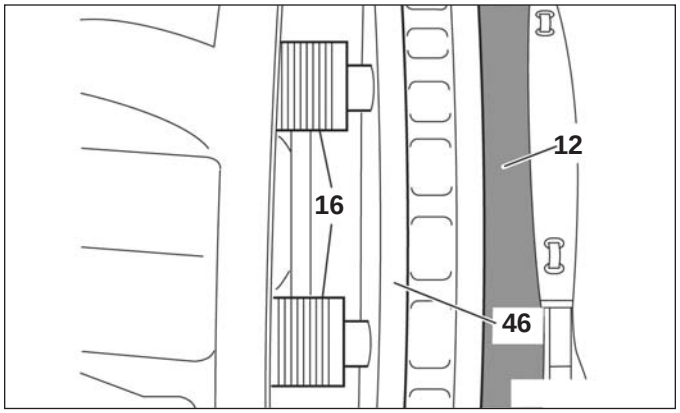


FIGURE 50 - ***USE OF A NEW BRAKE PAD AS A SPACER***

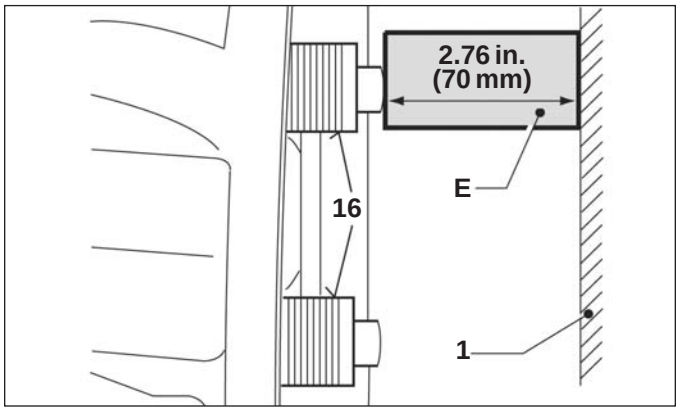


FIGURE 51 - ***USE OF A SPACER (OFF-VEHICLE INSPECTION)***

5.5.11 For threads that are in good condition, grease the threads with white grease (Part No. II14525 or K021964). Before installing the replacement inner seals (22), retract the threaded tubes by turning the shear adapter (61) counter-clockwise.

Note: If the shear adapter fails while you are retracting the threaded tubes, you may try again with another (new) shear adapter. If this also fails, this indicates that the adjuster mechanism is damaged and the caliper must be replaced.

To install inner seals where the caliper is on the vehicle:

5.5.12 Position the replacement inner seal (22) over the threaded tube (16). *See Figures 52 and 53 for the tools and installation arrangement used.* Position the L1 (T3 + T9) with the short spacer (T3) in position as shown in Figure 53. Guide the tool over the end of the threaded tube (16). Install the new inner seal (22) into position by rotating the adjuster nut on the T3 portion of the tool, using an open-ended wrench.

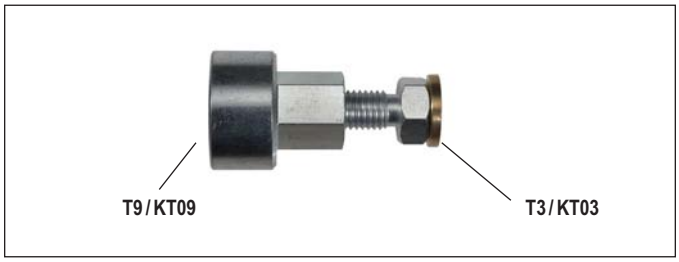


FIGURE 52 - *ON-VEHICLE INNER SEAL TOOL (L1)*

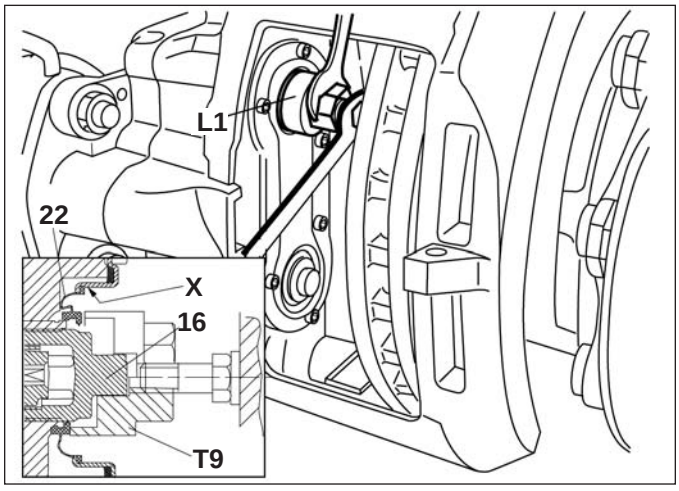


FIGURE 53 - *ON-VEHICLE INNER SEAL INSTALLATION*

To install inner seals where the caliper has been removed from the vehicle:

5.5.13 Position the replacement inner seal (22) over the threaded tube (16). *See Figures 54 and 55 for the tools and installation arrangement used.* Position the combination tool L2 (T4 + T3 + T9) with the long spacer (T4) in position as shown in Figure 55 - *typically the threaded tubes need to be partially retracted to allow the tool to set the inner seals into position*. Guide the tool over the end of the threaded tube (16). Install the new inner seal (22) into position by rotating the adjuster nut on the T4 portion of the tool using an open-ended wrench.

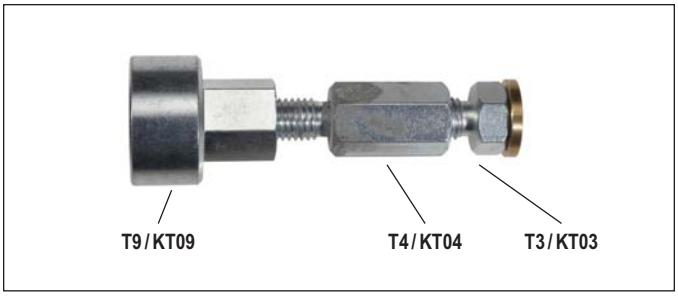


FIGURE 54 - *ON-VEHICLE INNER SEAL INSTALLATION TOOL (L2)*

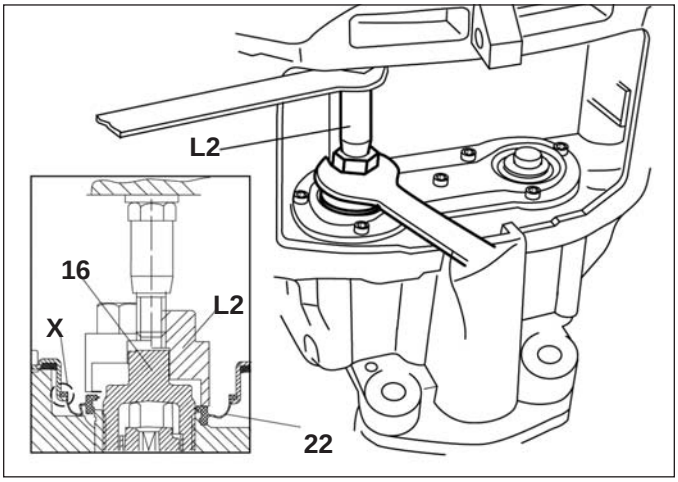


FIGURE 55 - *OFF-VEHICLE INNER SEAL INSTALLATION*

CAUTION: To confirm that the inner seal has been correctly installed, begin to extend the threaded tubes (16) by turning the shear adapter clockwise by 4-5 turns. Watch as the threaded tube extends. Inner seals that are installed correctly WILL NOT ROTATE as the threaded tube extends.

5.5.14 Grease the threaded tubes and center posts. Retract the threaded tubes.

5.5.15 Install the new tappet bushing (161) onto the center post of each threaded tube (16) by hand. By hand, ease the tappet bushings onto the center post of the threaded tubes and they will snap into position.

5.5.16 The sealing seat in the caliper for tappet and boot assemblies (13) must be clean and free of grease. Wipe the opening with a clean shop rag. Place a tappet and boot assembly (13) in position over the center post and tappet bushing.

To install tappet and boot assemblies where the caliper is on the vehicle:

5.5.17 *See Figures 56, 57 and 58.* Use tool B1, comprising tools T1, T2, and T3 to press the boot into position. The tool is then reversed, and the nylon disc (T24) is inserted into the T1 “cup” (combination tool ‘B2’). Holding the T1 handle, turn the nut on the T3 tool to fully install the tappet onto the tappet bushing (161).



FIGURE 56 - ***ON VEHICLE TAPPET AND BOOT INSTALLATION TOOL (B1 - WITH T24 INSTALLED, B2)***

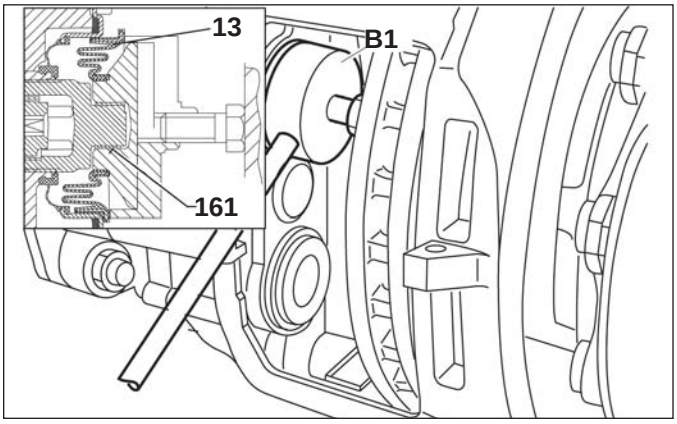


FIGURE 57 - ***ON VEHICLE TAPPET BOOT INSTALLATION***

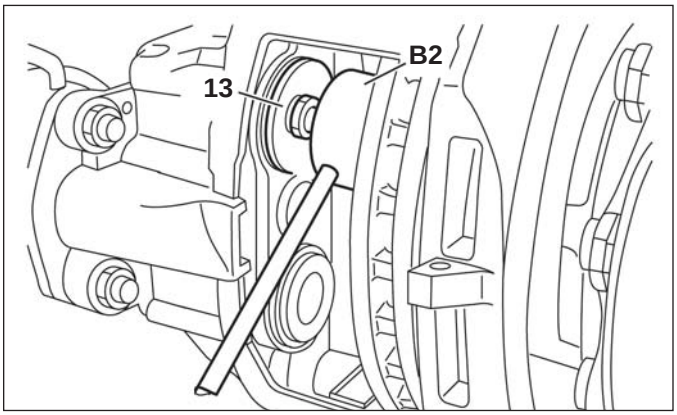


FIGURE 58 - ***ON VEHICLE TAPPET INSTALLATION***

To install tappet and boot assemblies where the caliper is removed from the vehicle:

5.5.18 *See Figures 59, 60 and 61.* Retract the tappets, as needed, in order to have room to install the tappets. Use tool B3, comprising tools T1, T2, and T3 to press the boot into position. The tool is then reversed, and the nylon disc (T24) is inserted into the T1 "cup" (combination tool 'B4'). Holding the T1 handle, turn the nut on the T3 tool to fully seat the tappet onto the tappet bushing (161).



FIGURE 59 - ***OFF VEHICLE TAPPET BOOT INSTALLATION TOOL (B3, WITH T24 INSTALLED, B4)***

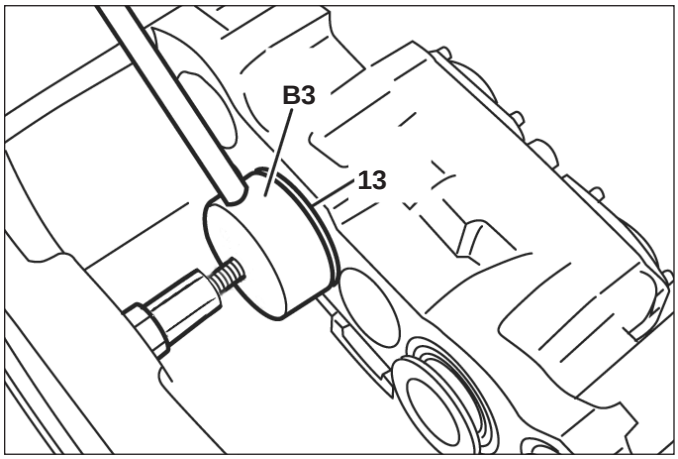


FIGURE 60 - ***OFF VEHICLE TAPPET BOOT INSTALLATION***

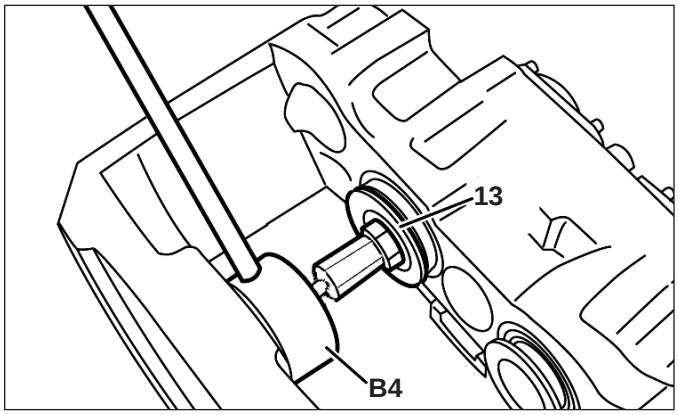


FIGURE 61 - ***OFF VEHICLE TAPPET INSTALLATION***

5.5.19 Check that the tappets are firmly attached to the bushings by gripping and turning them by hand. Properly installed tappets are able to turn, but are securely held onto the tappet bushings. Using the shear adapter, extend the threaded tubes outward, and check that the boot is held in place. Retract the tappet.

5.5.20 Re-install the caliper/carrier assembly, if it was removed from the vehicle *(See Section 5.3.)*.

5.5.21 Re-install the brake pads *(See Section 5.2).*

5.6 GUIDE PIN AND BOOT ASSEMBLIES

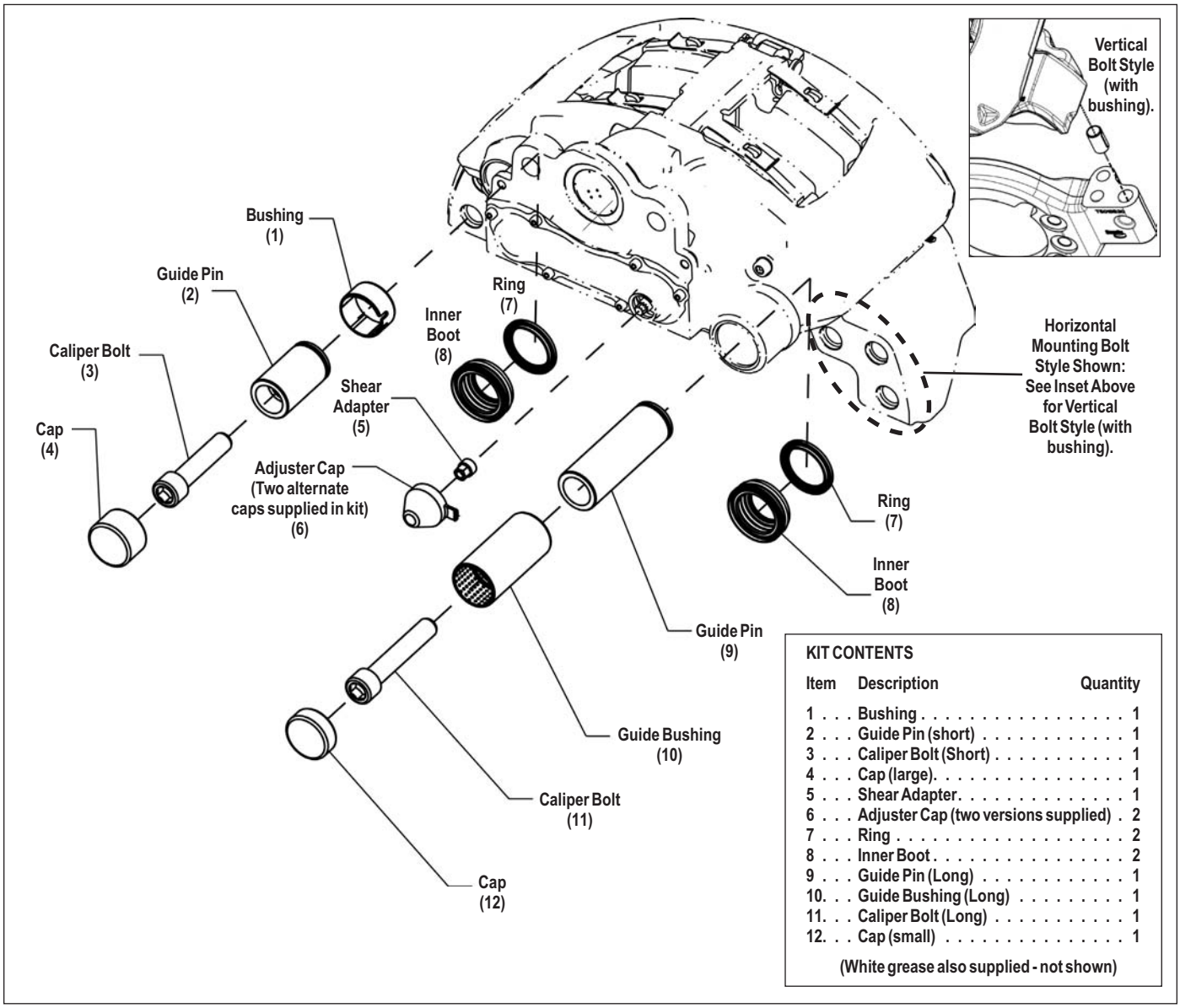


FIGURE 62 - ***GUIDE PIN EXPLODED VIEW***

The Bendix DVD (BW7356) shows this procedure.

5.6.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

Important: If the vehicle is equipped with spring brakes, cage the spring brakes on all axles to be worked on. Consult the vehicle manufacturer's instructions as necessary.

These procedures are typically carried out with the caliper/carrier removed from the vehicle (may be carried out with the air disc brake installed). In cases where the caliper/carrier assembly is removed from the vehicle, NEW fasteners must be used and properly torqued during re-installation. Use only fasteners approved by the vehicle manufacturer.

Note: This maintenance procedure uses specialized tools. The full Bendix air disc brake tool kit (K029164), or Ken-Tool kit (80000), includes the tools needed for the guide pin and boot installation. See Table 5.

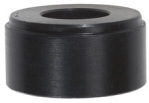
Bendix Number/ Ken-Tool Number	Description	Typical Tool View	Bendix Number/ Ken-Tool Number	Description	Typical Tool View
T05 / KT05	1-3/8 in. diameter disc		T14 / KT14	Brass nut	
T06 / KT06	1-1/2 in. diameter disc		T16 / KT16	Dimpling tool	
T07 / KT07	2 in. diameter sleeve		T20 / KT20	8 in. bolt	
T08 / KT08	2-1/8 in. diameter disc		T21 / KT21	Half Sleeve	
T10 / KT10	8 in. bolt		T26 / KT26	Cap installation tool	
T12 / KT12	3-7/8 in. long sleeve		T27 / KT27	Cap installation tool	
T13 / KT13	10 in. bolt				

TABLE 6 - *BENDIX® ADB22X™ AIR DISC BRAKE GUIDE PIN AND SEALS REPLACEMENT TOOLS. (A WASHER IS ALSO INCLUDED)*

5.6.2 Remove the wheel. Refer to the vehicle manufacturer's recommendations.

5.6.3 In nearly all cases, the air disc brake caliper/carrier will need to be removed from the vehicle in order to complete this procedure. *See Section 5.3.*

5.6.3 Remove the brake pads. *See Section 5.2.*

5.6.4 In most cases, the actuator should be removed. *See Section 5.4.* In the case of spring brake actuators, they should be caged before removing the brake assembly.

5.6.5 Place the brake on a workbench and, using a vice, secure it by the carrier.

5.6.6 Use a small chisel or similar tool to punch a hole close to the center of the guide pin cap (12) **of the short guide pin,** taking care to only insert the chisel a small amount. Using the hole just made, pry the cap off and discard. *See Figures 63-65.*



FIGURE 63 - *PUNCH GUIDE PIN CAP (12)*



FIGURE 64 - *GUIDE PIN CAP (12) HOLE*



FIGURE 65 - *PRY TO REMOVE GUIDE PIN CAP (12)*

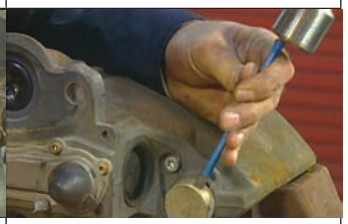


FIGURE 66 - *USING SMALL CHISEL TO REMOVE GUIDE PIN CAP (4)*

5.6.7 Remove the other cap (4) **that covers the long guide pin**, by using a small chisel and hammer to apply light blows to the cap, with the chisel aimed away from the casting. *See Figure 66.* Discard both caps.

5.6.8 Using a 14 mm hex bit socket, remove and discard the two caliper bolts (3) and (11). *See Figure 67.* By hand, retract both guide pins slightly and then remove the caliper from the carrier.



FIGURE 67 - *REMOVE THE CALIPER BOLTS*

The guide pins are now only held by the retaining rings (7).

5.6.9 Remove the boot retaining rings (7) and the guide pins (2) and (9). Use a screwdriver to pry out the inner boots (8). *See Figure 68.* Discard the removed items.



FIGURE 68 - *REMOVE THE RETAINING RINGS, GUIDE PINS, AND BOOTS*

5.6.10 Clean the caliper upper and lower surfaces around the bushings.

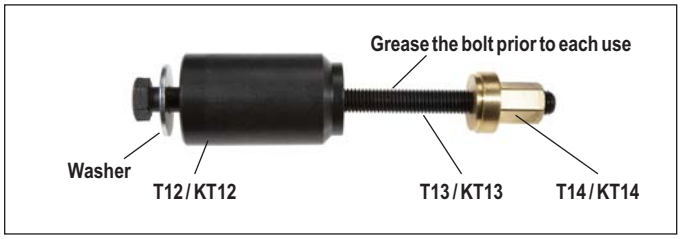


FIGURE 69 - *BRASS BUSHING REMOVAL TOOL*

5.6.11 Prepare to remove the brass bushing used in the long guide pin side. Assemble the long bolt (T13), washer, and sleeve (T12) as in Figure 70.

5.6.12 Apply grease to the bolt and — after inserting through the guide pin channel — engage the brass nut (T14). Always double-check that the brass nut is correctly in place in the bushing before beginning to extract the bushing.

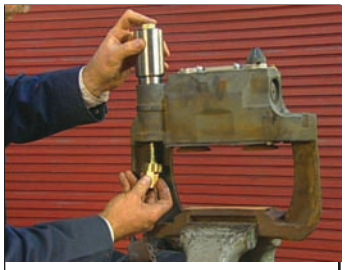


FIGURE 70 - *INSTALL THE REMOVAL TOOL*

5.6.13 Turning the nut at the top, draw the brass nut up, bring the brass bushing up and out of the channel. Discard the bushing.



FIGURE 71 - *REMOVE THE LONG GUIDE PIN*

Caution: Keep the removal tool exactly aligned with the guide pin channel to permit the bushing to be removed. *See Figure 72.*

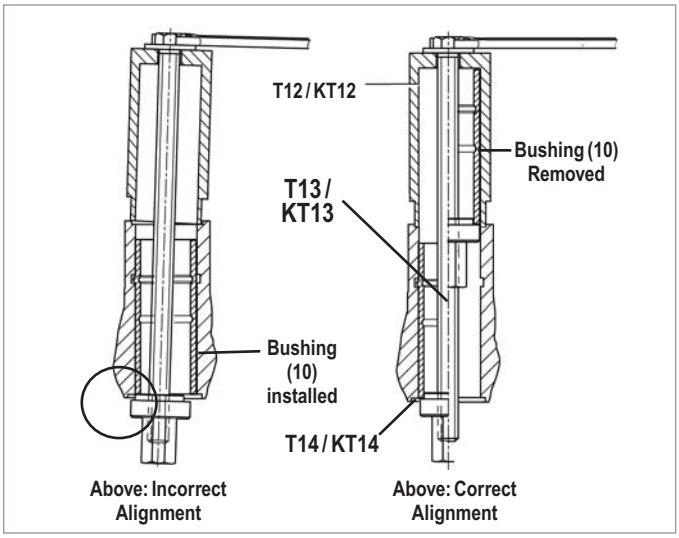


FIGURE 72 - *KEEP THE CORRECT ALIGNMENT*

5.6.14 Prepare to remove the short guide pin bushing by locating the bushing (1) tab, and using a small chisel (narrower than the tab) or similar tool, remove the tab as shown in Figure 73, by striking low on the base of the tab.



FIGURE 73 - *REMOVE THE TAB THAT HOLDS THE BUSHING IN POSITION*

Remove the tab with a magnet and use a clean shop cloth to remove any excess debris. Note that in some cases, the tab may be in the opposite (outer) slot in the bore.

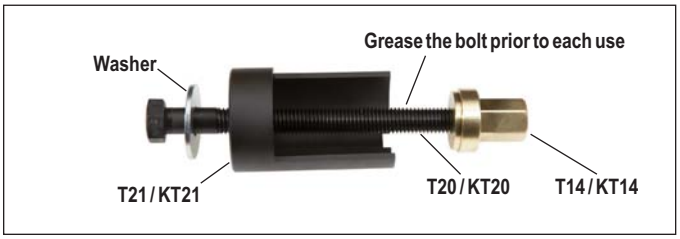


FIGURE 74 - *SHORT GUIDE PIN REMOVAL TOOL*

5.6.15 Use the tool combination shown in Figure 75 (comprising T14, T20, T21, and a washer) to remove the bushing (1). Screw nut (T14) onto the assembly by hand, then tighten the bolt (T20) using a box end wrench to draw out the bushing. Discard the removed bushing, and verify that the bore is clean by wiping with a shop cloth.

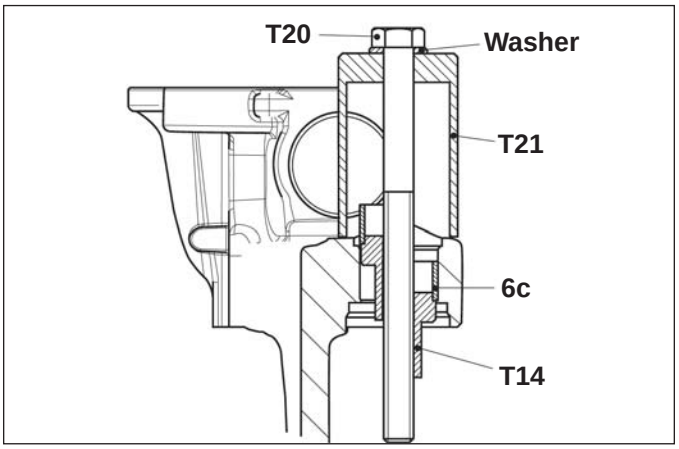


FIGURE 75 - ***SECTIONAL VIEW: SHORT GUIDE PIN BUSHING REMOVAL***

Installation of the Fixed Guide Pin Brass Bushing

5.6.16 Clean the caliper upper and lower surfaces around the bushings.

5.6.17 Clamp the carrier in a vise so that the guide channel is vertically oriented.

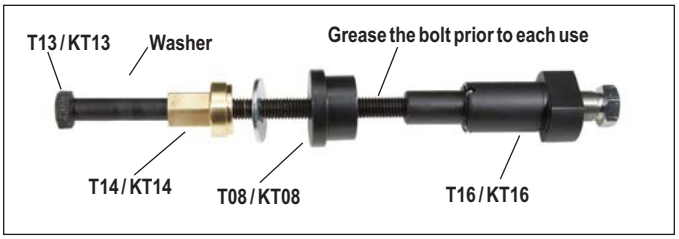


FIGURE 76 - ***LONG GUIDE PIN BUSHING INSTALLATION AND DIMPLING TOOL***

5.6.18 Place the washer and thread the brass nut (T14) on to the bolt (T13) followed by the flange (T08).

5.6.19 Place a new brass bushing (10) on the dimpling tool (T16) and insert it into the caliper bore.

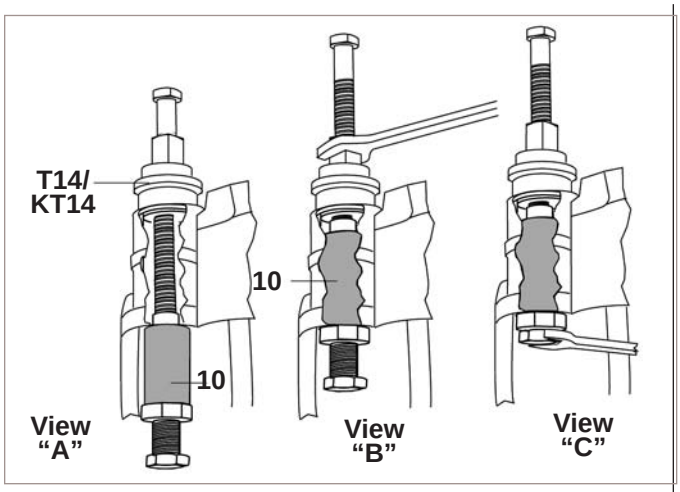


FIGURE 77 - VIEW "A" AND "B": ***DRAW THE BRASS BUSHING INTO POSITION. VIEW "C": LOCK THE BUSHING INTO POSITION***

5.6.20 Check that the flange (T08) is in an upright position at the top of the caliper recess as you draw the brass bushing (10) up, by turning the brass nut (T14), until the dimpling tool bottoms on the caliper. When it reaches the correct position, the brass bushing extends out of the guide pin channel 0.039 in. (1 mm.).

5.6.21 With the dimpling tool (T16) in position, tighten the screw in its base until it contacts the dimpling screw housing. The movement of this screw forces three points outwards, leaving indentations in the brass bushing. *See Figure 77, view "C".*

5.6.22 Unscrew the dimpling screw out approximately 0.75 inches (20 mm.). Loosen the brass nut (T14) and rotate the dimpling tool (T16) 60 degrees. Repeat the dimpling process by tightening the brass nut (T14) and then tighten the dimpling screw until it contacts the dimpling screw housing. Back out the dimpling screw approximately 0.75 inches (20 mm.). The brass bushing (10) is now held in position by the six dimples made by the tool.

5.6.23 Remove the installation tools and check the brass bushing (10), removing any burrs, being careful not to leave any metal filings in the bushing. Coat the inside of the bushing (10) with the white grease included in the kit.

Installation of the Floating Guide Pin Bushing

5.6.24 To install the bushing (1) into the short guide pin side, first inspect the bore for corrosion, damage etc. Clean as necessary.

5.6.25 Place the new bushing (1) in position so that **when drawn into position, the tab will align with the slot in the casting**. With the tab aligned, place tool (T14) over the bushing and tap lightly. To position the bushing, *see Figure 78.*



FIGURE 78 - POSITION *THE NEW BUSHING*

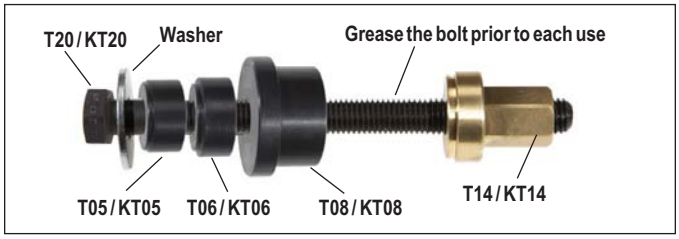


FIGURE 79 - *SHORT GUIDE PIN BUSHING INSTALLATION TOOL*

5.6.26 Use the tool combination shown in Figure 78 to draw the bushing (1) into the caliper. *See also Figure 80*, to see the orientation (with tool T14 at the top). Hand tighten the nut (T14) into position. Then tighten the bolt (T20) using a box end wrench or socket to draw the bushing (1) into the caliper until the bushing (1) contacts the machined step in the bore. Remove the tool.

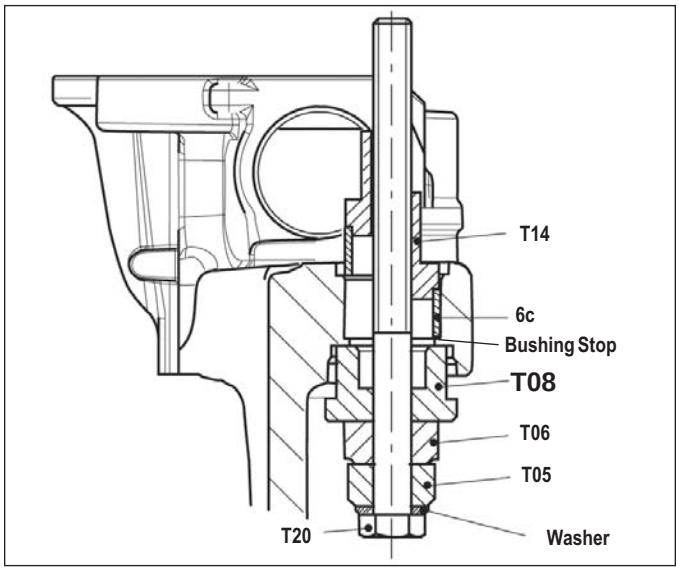


FIGURE 80 - *GUIDE PIN BUSHING INSTALLATION*

5.6.27 Using a punch, bend the tab into the groove by aligning the punch with the upper part of the tab and tapping the punch with a hammer.

5.6.28 Coat the inside of the bushing (6c) with a light coat of the white grease included in the kit.

5.6.29 Install the two identical inner boots (8) by first cleaning the area where the inner boots will be installed and inspect for corrosion. If the sealing surface of the caliper is damaged, replace the caliper.

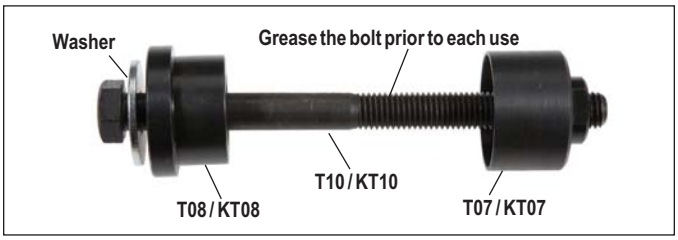


FIGURE 81 - *SHORT GUIDE PIN BOOT INSTALLATION TOOL*

5.6.30 *See Figure 82.* Place a boot into the installation tool (T7), making sure that the inner bellows are arranged close to the side walls of the tool and will not be damaged during installation. Also check that the outer edge of the boot rests on the front edge of the tool.



FIGURE 82 - POSITION *THE NEW BOOT IN THE INSTALLATION TOOL (T7)*

5.6.31 Using 70 in. lbs. (8 N·m) of torque maximum, tighten bolt (T10) to install the inner boot.

5.6.32 Repeat the installation procedure for the second inner boot.

5.6.33 Check that the boots are held securely in place and that no damage occurred during installation.

5.6.34 *See Figure 83.* To install the guide pins, first lubricate both guide pins with the white grease supplied. Insert the guide pins into their respective bores with the grooved end towards the bellows.



FIGURE 83 - PLACE *THE RETAINING RING ONTO THE GROOVE IN THE GUIDE PIN*

Fit the lip in the end of the inner boots (8) into the groove of the guide pins. Push on each ring (7) ensuring that the boot (8) is engaged onto the end of the guide pins (2 or 9).

5.6.35 With the caliper resting on a bench, slide the carrier into place with a slight rocking motion, taking care that as you do so, the inner boots and guide pins are seated in their proper place on the carrier.

5.6.36 Identify the two caliper bolts (3) and (11). With the shorter bolt placed in the floating pin bushing (2), and the longer bolt placed in the fixed pin bushing

(9), begin to tighten the bolts. With the caliper/carrier in a vice, continue installing the bolts to a torque of 133 ft. lbs. (180 N·m) . Finally tighten each bolt an additional 90º (ninety degrees).

Installation of the Guide Pin Caps

5.6.37 *See Figure 84.* Place the caliper/carrier assembly on a bench so that the inner boots are fully compressed, check that the bores are clean and dry (e.g. free from lubrication).

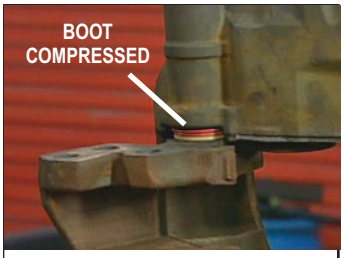


FIGURE 84 - *BOOTS MUST BE COMPRESSED FULLY DURING CAP INSTALLATION*

Note: It is important that the inner boots are fully compressed during this procedure to ensure that the least amount of air is retained within the guide pin channel. If too much air is trapped, the bellows can potentially be damaged during the operation of the brake. *It is also important that the technician double-check that the retaining rings remain in their correct position during this procedure.*

5.6.38 Clean the two caps, and check that the caliper surfaces where the caps will be installed are clean and have no signs of damage.

5.6.39 Select one cap to install. Using the correct press-in tool — the smaller cap (12) uses tool (T26), and the larger cap (4) uses tool (T27) — place the cap in position, using the machined channel in the caliper to assist in centering the tool.



FIGURE 85 - *BOOTS MUST BE COMPRESSED FULLY DURING CAP INSTALLATION*

Use a hammer to tap the cap into position. *See Figure 85.* Note that the tool needs to remain perpendicular to the channel to prevent damage during installation. Note that, after installation, the smaller cap (12) extends 0.08 in. (2 mm.), and the larger cap (4) extends 0.61 in. (15.5 mm.).

Repeat for the second cap.

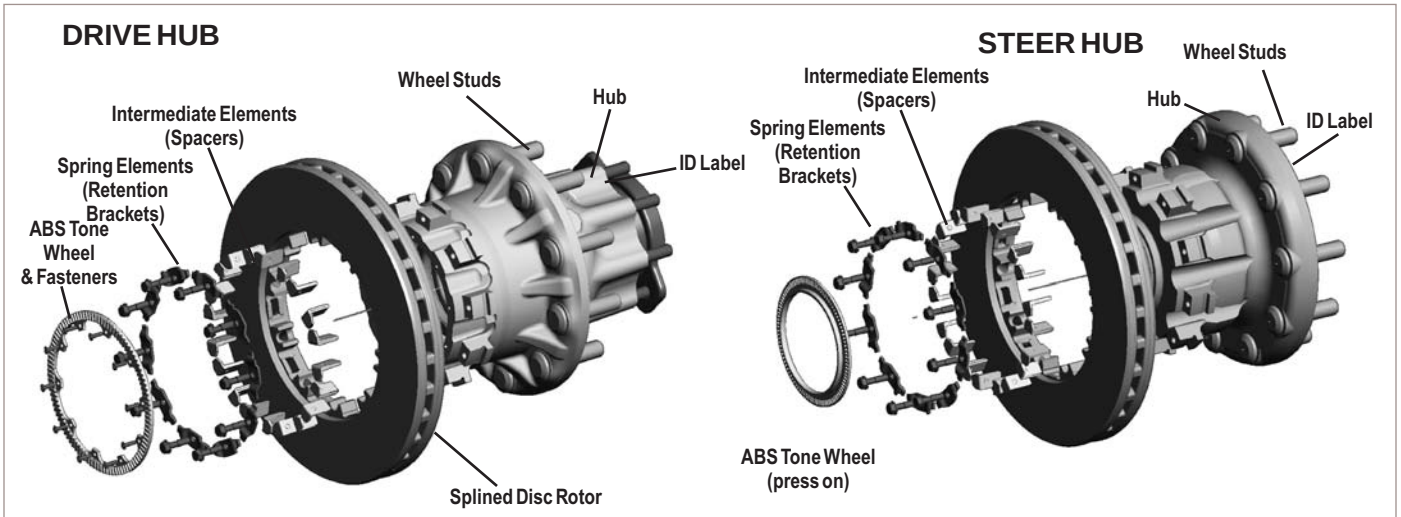
5.6.40 Check that the guide pins move freely when the carrier is moved laterally, and that air is not trapped within the inner boots, and that the boots (8) and ring (7) are in the proper position before continuing with the installation.

5.6.41 Install the caliper/carrier *(See Section 5.3).*

5.6.42 Install the brake chamber *(See Section 5.4).*

5.6.43 Install the brake pads *(See Section 5.2).*

5.7 BENDIX® SPLINED DISC® HUB ROTOR



Above: Splined Disc Rotor on Aluminum Drive Hub

Above: Splined Disc Rotor on Aluminum Steer Hub

FIGURE 86 - *SPLINED DISC ROTOR EXAMPLES - EXPLODED VIEWS*

Bendix® Splined Disc® Hub Rotors are designed to assist vehicle maintenance by typically allowing the rotor to be serviced without requiring the entire hub/rotor assembly be replaced.

Periodic inspection of the Splined Disc attachment hardware is recommended to ensure optimum braking performance. Bendix recommends verifying the torque on the spring element fasteners whenever a brake inspection is performed.

NOTE: In situations where the entire hub/rotor assembly is to be replaced, follow the vehicle manufacturer's guidelines. Bendix recommends that the wheel seal also be replaced at the same time, using a high-temperature seal. Follow the wheel seal and/or vehicle manufacturer's guidelines for full installation instructions. Adjust the bearings and refill bearing oil to vehicle manufacturer's specifications.

When replacing a Splined Disc Rotor, Bendix strongly recommends that the brake pads be replaced (as an axle set.) Contact 1-800-AIR-BRAKE for appropriate brake pad kit. Rotor replacement necessitates the removal of the pads.

CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels. Also read the vehicle manufacturer's recommendations. When installing pads, where appropriate, use heavy duty gloves and always keep fingers away from potential pinch hazard areas.

Bendix Air Disc Brakes are precision-engineered braking mechanisms. The “friction couple” braking characteristics have been carefully optimized and the rotor design and materials have been matched with special formulation brake pads for optimal performance, therefore use only genuine Bendix® brand parts and brake pads.

Rotor Replacement

5.7.1 Before removing the brake pads it is strongly recommended that the air disc brake adjuster mechanism be checked for correct operation (*See Section 4.1*). When replacing brake pads, Bendix strongly recommends that the pads be replaced as an axle set.

5.7.2 Refer to the vehicle manufacturer’s recommendations and release (or cage) spring brakes and remove the wheel.

5.7.3 Remove the pads (*See Section 5.2*).

5.7.4 Remove the air disc brake (*See Section 5.3)*.

Note: Follow the vehicle manufacturer's guidelines for removal of the wheel hub and rotor assembly from the vehicle in lieu of these instructions, where available.

CAUTION: Be sure to secure both the rotor and hub before removing the retention clips.

5.7.5 Use suitable hand tools to remove the intermediate elements (spacers). Remove all the right-hand intermediate elements (spacers) of each set first and then the rotor can be turned slightly to release the remaining intermediate elements (spacers). In all cases, take care not to damage the hub and its teeth. Remove and discard the intermediate elements (spacers) and retention clips attaching the rotor. Discard the rotor.

5.7.6 Following industry standards, clean and inspect the hub before installing the rotor. Look for corrosion and/or damage to the hub and inspect the wheel speed tone ring. Where necessary, consult the hub manufacturer's guidelines for more details.

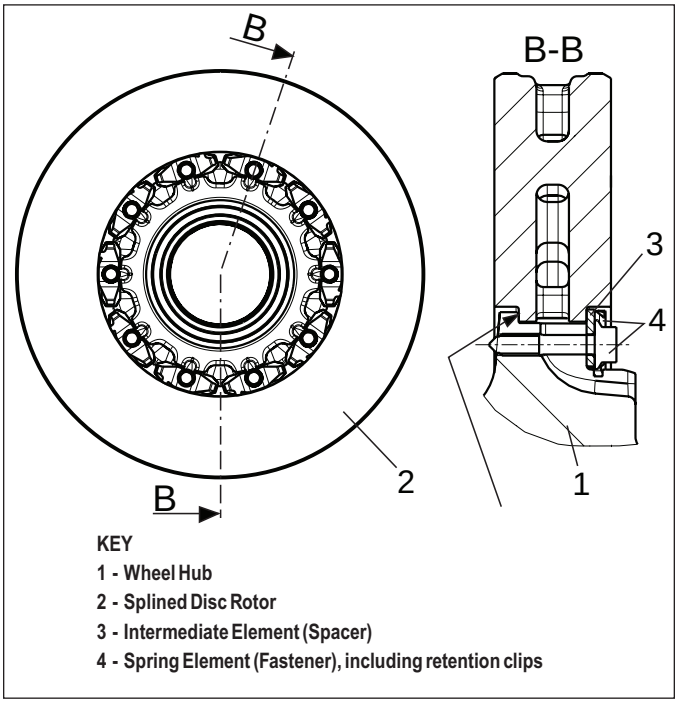


FIGURE 87 - ***ROTOR WITH CROSS-SECTION VIEW***



FIGURE 88 - ***ROTOR INSTALLATION***

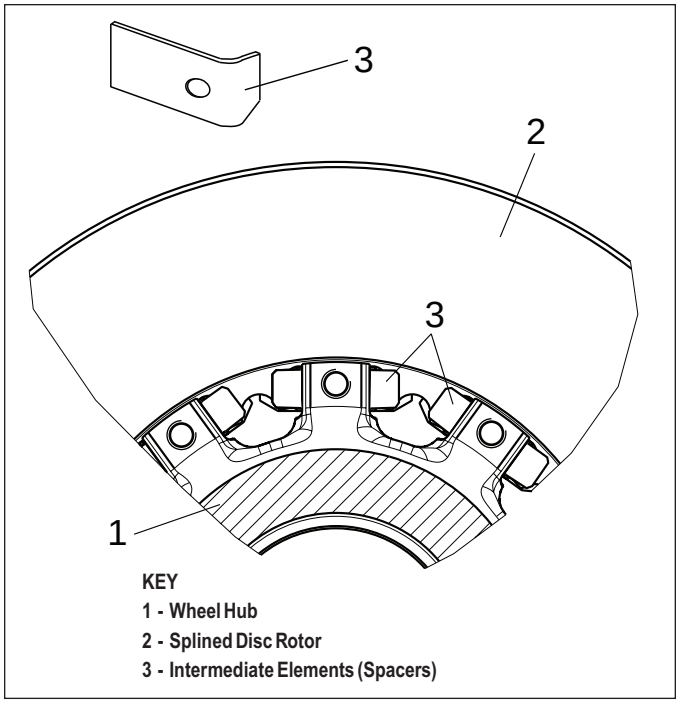


FIGURE 89 - ***INTERMEDIATE ELEMENT (SPACER) INSTALLATION***



FIGURE 90 - ***INTERMEDIATE ELEMENTS (SPACERS) INSTALLED***

ROTOR INSTALLATION

5.7.7 *See Figures 87 through 91.* Place the rotor into position on the hub. Install the new intermediate elements (spacers) as shown in Figure 89. With all the intermediate elements (spacers) correctly inserted into position, verify that the gap between the intermediate elements (spacers) and the wheel hub does not exceed 0.004 in (0.1 mm). If a gap is found that exceeds this maximum value, verify the installation of new intermediate elements (spacers). Replace the wheel hub if the excess gap cannot be corrected with proper installation of new rotor retaining hardware.

5.7.8 Install the new fasteners included in the kit in an evenly-distributed cross-pattern sequence. Torque to 22.1 ft. lbs. (30 N·m.)

5.7.9 Re-install the air disc brake *(See Section 5.3).* Supporting the air disc brake by all necessary means, attach the brake to the anchor plate using six bolts and washers as required (Bendix recommends the original bolts not be re-used). Torque to vehicle manufacturer's specifications. If torque values and bolts are not specified by the vehicle manufacturer, then torque according to the chart below. Be sure to select bolts with the same thread pitch, length and grade as originally provided from vehicle manufacturer.

5.7.10 Reinstall the brake pads *(See Section 5.2).*



FIGURE 91 - ***FASTENERS INSTALLED***

Air Disc Brake Attachment Hardware		
Torque Plate Manufacturer	Fastener	Torque
Bendix Axial Carrier Torque Plate 	Fastener: M20 x 2.5 x 60 mm Class 10.9 ***Washer: Requires HARDENED 3 mm (minimum thickness) for each bolt.***[1] ***If the vehicle is using a Bendix manufactured Axial Anchor Plate, with a thickness of 1.14 in. (29 mm) where these bolts are assembled, then a bolt with an overall length of 2.36 in. (60 mm) will meet these requirements***	Use the manufacturer's recommendations. If unavailable, use phosphate and oil finish fastener. Pre-Torque: 20-60 ft-lbf [27-81 N·m] Final Torque: 350-400 ft-lbf [475-542 N·m]
Bendix Vertical Carrier Torque Plate 	Fastener: M16 x 2.0 x 110 mm, Class 10.9 ***Washer: None required.***	Use the manufacturer's recommendations. If unavailable, use plain and oil finish fastener. Torque: 200-220 ft-lbf [271-298 N·m]
Trailer Torque Plate	Fastener: M20 x 2.5 x L Class 10.9 Length determination: L = Torque Plate (TP) thickness + Carrier engagement + Washer thickness L_{min} = TP thickness + 24 mm + 3 mm L_{max} = TP thickness + 29 mm + 3 mm ***Washer: Requires HARDENED 3 mm (minimum thickness) for each bolt.***[1]	Use the manufacturer's recommendations. If unavailable, use phosphate and oil finish fastener: Pre-Torque: 20-60 ft-lbf [27-81 N·m] Final Torque: 350-400 ft-lbf [475-542 N·m]

Table Note: 1. The washer outside diameter must be less than 1.1in. (28.5 mm).

TABLE 7 - ***TORQUE PLATE FASTENERS AND TORQUE RECOMMENDATIONS (SEE MANUFACTURER'S RECOMMENDATIONS)***

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CONTACTING BENDIX

www.foundationbrakes.com

Bendix on-line information is available 24/7/365. It's your complete Bendix resource.

Bendix Technical Assistance Team

For direct personal technical support, call the Bendix TechTeam at

1-800-AIR-BRAKE (1-800-247-2725).

Representatives are available to assist you Monday through Friday, 8:00 A.M. to 6:00 P.M. EST, or e-mail the Bendix Tech Team at:

techteam@bendix.com.

To better serve you, please collect the following information before you call the Bendix Tech Team, or include this information in your e-mail:

- Bendix product model number, part number and configuration.
- Vehicle make and model.
- Vehicle configuration. (Number of axles, tire size, etc.)
- System performance symptoms: When do they occur?
- What troubleshooting/measurements have been performed?
- What Bendix service data literature do you have or need?

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BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® Air Disc Brake Checklist for Identifying Single Wheel End Thermal Overload

Follow all General Safety Guidelines (*see final page.*)

Start Here

All foundation brakes are designed to convert kinetic energy (energy of motion) into heat and work (to stop the vehicle).

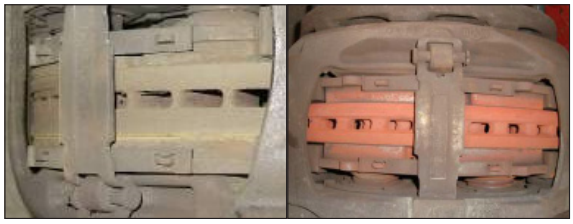
Air disc brakes work the same way and in everyday operation — compared to drum brakes — will produce higher braking temperatures and cool off faster. Also, air disc brakes will often have differences in temperatures at wheel ends on the same axle. The actual temperatures reached will depend on the vehicle configuration, vocation and brake usage.

This document is intended to help technicians identify instances where an individual wheel end has evidence of thermal overload, and check for potential causes.

SECTION ONE: Inspect the Vehicle

Question One:

Do any of the rotors have bright orange or red color edges? Check the box(es) on the vehicle diagram to the right for any found.



Normal — *Evidence of thermal overload*

Question Two:

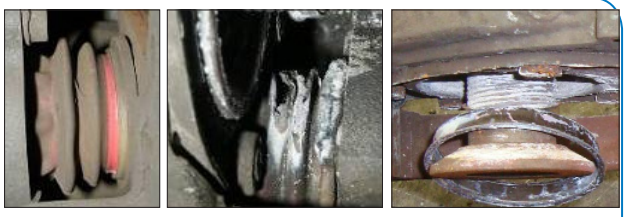
Are any of the calipers coated with a bright orange or red colored dust? Check the box(es) on the vehicle diagram to the right for any found.



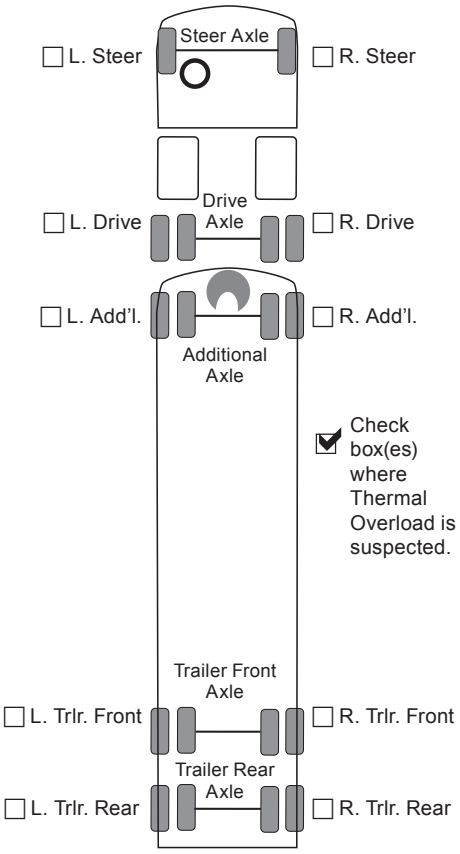
Normal — *Evidence of thermal overload*

Question Three:

Are any tappets and/or guide pin boots heat damaged? Check the box(es) on the vehicle diagram to the right for any found.



Typical — *Evidence of thermal overload* — *Evidence of thermal overload*



Are any boxes checked?

- **NO** → **STOP! Exit this flowchart.** STOP
- **YES** ☑

Are both boxes on a single axle checked?

- **YES** ☑ ☑ → **This is not a single wheel end Thermal Overload event. When both ends of an axle are affected, a thorough brake system diagnosis is needed, as other factors — such as brake balance, overloaded vehicles, or extreme use — are more likely the source.**
- **NO**

Only one box has a check mark?

- **YES** ☑ → **Go to Section Two** *(over)*
- **NO**

In cases where more than one wheel end is affected — but on different axles — complete a separate checklist for each brake being examined.

SECTION TWO: Investigate Other Potential External Causes
- Follow all Safe Maintenance Practices (see final page.)

Inspect the brake pads.
(New pads have 21 mm of brake pad, plus a 9 mm backing plate.)

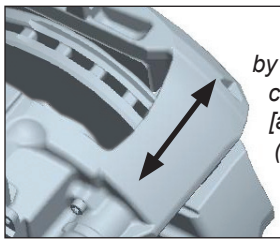
Is there 2 mm, or less, of brake pad friction material?*

YES → **Replace the pads (axle set recommended) after performing all Section Two inspections. (Not a Thermal Overload warranty condition.)**

*2 mm of friction material, plus a 9 mm backing plate, for a total of 11 mm.

NO

Inspect the caliper



Push/pull by hand to check the caliper movement [at least 0.75 Inch (20 mm) with the pads removed]

Complete this step on level ground, with the wheels chocked and the parking brake temporarily released!

Does the brake caliper have restricted movement in the inboard/outboard direction?

YES → **Service the guide pins. Perform all Section Two inspections. (Not a Thermal Overload warranty condition.)**

NO

Inspect the air hoses ("jounce lines").

- *Is air trapped in the hose?***
- *Do the hose(s) pull or push on the caliper? (It is important that the hoses permit the lateral motion of the caliper, the vertical motion of the suspension, and — for steering axles — the full turn of the wheels.)*
- *Are there any kinks, restrictions?*
- *Are the hoses in good condition?*

**Take full safety precautions during the inspection for trapped air, to avoid the air hose whipping if air pressure is found to be trapped. Conditions that might cause trapped air include kinked lines, or when an ABS modulator is malfunctioning and not exhausting service air.

Are any of these conditions found?

YES → **Service as needed. Perform all Section Two inspections. (Not a Thermal Overload warranty condition.)**

NO

Go to the next page . . .

SECTION TWO *Continued*

Inspect the actuator.

On level ground, with the wheels chocked, cage the spring brake actuator (if equipped) per the manufacturer's guidelines, remove and inspect the actuator.

- *Is there visible damage?*
- *In the installed position, was the lowest drain plug sealed?*
- *Is the seal in poor condition/damaged?*
- *Does the push-rod extend further than 15 mm from the mounting face?*

Are any of these conditions found?

YES → **Service the actuator. (Not a Thermal Overload warranty condition.)**

NO

With the actuator removed, inspect the internal caliper surfaces through the actuator push rod opening.

- *Is there visible damage, rust, water?*
- *With the pads removed, use a screw driver to depress the lever. Does the lever have a restricted range of motion? (The lever must touch the caliper body when fully retracted.)*

Are any of these conditions found?

YES → **Replace the caliper. Inspect the rotor. (Not a Thermal Overload warranty condition.)**

Where other external causes were found, perform service and exit this flowchart. STOP

NO

No Section Two external causes found? Replace the caliper. Where applicable, process a thermal overload warranty claim.

Actions When Replacing a Caliper

Replacement:

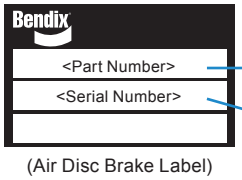
- ☐ Replace the caliper on the affected wheel end and all the pads at both ends of the axle.
- ☐ Inspect the rotor according to the guidelines in Service Data sheet SD-23-7541.

If the brake assembly is still under warranty coverage:

- ☐ File a claim. Clearly state the claim is for a single axle thermally overloaded brake. The claim must include photographs of the rotor from both ends of the affected axle.
- ☐ Return the caliper from the affected wheel end, and label the caliper with the claim number.
- ☐ Return the pads from both sides of the affected axle (LH and RH set of pads). Please clearly label the parts with the wheel position and claim number.
- ☐ Please include this completed checklist, the photographs of the rotors, and a copy of the warranty claim with the returned parts.

VIN #: _____ Claim #: _____

Vehicle Make: _____ Vehicle Model: _____ Mileage: _____



(Air Disc Brake Label)

Caliper Part Number: _____

Caliper Serial Number: _____

Bendix TechTeam Help Line:
1-800-AIR-BRAKE, (1-800-247-2725),
option 2-1. Mon. - Fri., 8 a.m.- 6 p.m.

Reference Document:
Service Data: SD-23-7541 *Bendix® ADB 22X™, ADB 22X-V™ Air Disc Brakes*. Go to the document library at www.bendix.com for free downloads of Service Data Sheets and warranty policies.

SAFE MAINTENANCE PRACTICES

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

When working on or around a vehicle, the following general precautions should be observed at all times:

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses. Where specifically directed, the parking brakes may have to be released, and/or spring brakes caged, and this will require that the vehicle be prevented from moving by other means for the duration of these tests/ procedures.**
2. **Stop the engine and remove 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.**
3. **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.**
4. **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 or a dryer reservoir module, be sure to drain the purge reservoir.**
5. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.**
6. **Never exceed manufacturer's recommended pressures.**
7. **Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.**
8. **Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.**
9. **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.**
10. **Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.**
11. **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.**

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 Spicer Foundation Brake LLC does not offer asbestos brake linings, the long-term affects of some non-asbestos fibers have not been determined. Current 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 Regulations regarding testing, disposal of waste and methods of reducing exposure for asbestos are set forth in 29 Code of Federal Regulations §1910.001. These Regulations provide valuable information which can be utilized to reduce exposure to airborne particles.**
- **Material 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 e-mail techteam@bendix.com**

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PE13-012

BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® ADB22X™, ADB22X-V™ Air Disc Brakes

SECTION ONE: AIR DISC BRAKE OVERVIEW

1.1 DESCRIPTION

Bendix® ADB22X™ and ADB22X-V™ Air Disc Brakes (ADB) use a floating caliper design to provide foundation braking on all axles of heavy commercial vehicles, buses and trailers. Bendix Air Disc Brakes provide safety and performance as well as ease of service.

The ADB22X disc brakes mount to the axle's anchor plate (torque plate) using fasteners that are installed parallel to the axle, while the anchor-plate fasteners used for the Bendix® ADB22X-V™ air disc brakes install at right angles to the axle.

Available with or without a combination spring brake unit, these brakes may also include optional wear sensors and wear diagnostic equipment.



FIGURE 1 - *BENDIX® ADB22X™ AIR DISC BRAKES*

Sections in this Document

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1	Overview	1-5
2	Preventive Maintenance and Wheel-on Inspections	6-8
3	Troubleshooting Flowchart	9
4	Wheel-off Maintenance Inspections	10-15
5	Maintenance Kits and Procedures.	16-37

Full Index - see Page 38

1.2 Air Disc Brake Identification

Locate the identification label near the guide pin housing. See below for information about the label fields used.

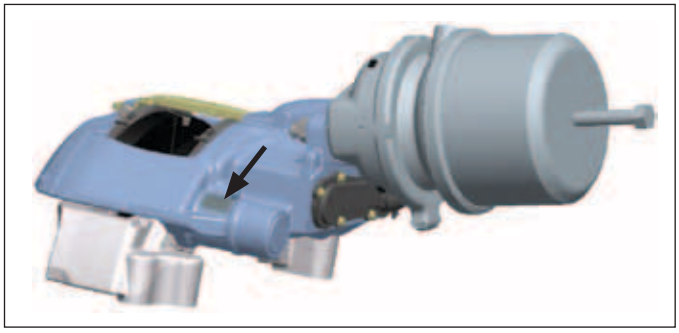


FIGURE 2 - *TYPICAL PART NUMBER LABEL LOCATION*

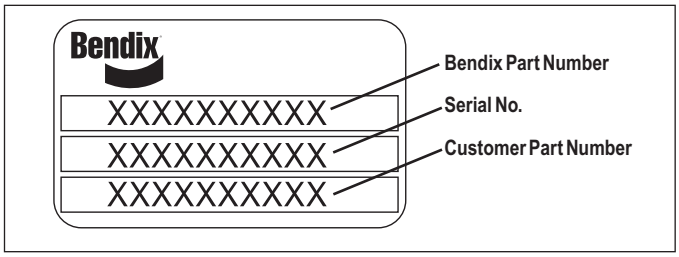


FIGURE 3 - *PART NUMBER LABEL INFORMATION*

Section One

Section		Page
1.1	Description	1
1.2	Air Disc Brake Identification.	1
1.3	Rotor Identification	3
1.4	Wear Sensor Identification	3
1.5	Operation	3
1.5.1	Brake Release and Adjustment	3

SAFE MAINTENANCE PRACTICES

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

When working on or around a vehicle, the following general precautions should be observed at all times:

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses. Where specifically directed, the parking brakes may have to be released, and/or spring brakes caged, and this will require that the vehicle be prevented from moving by other means for the duration of these tests/procedures.**
2. **Stop the engine and remove 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.**
3. **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.**
4. **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 or a dryer reservoir module, be sure to drain the purge reservoir.**
5. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.**
6. **Never exceed manufacturer's recommended pressures.**
7. **Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.**
8. **Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.**
9. **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.**
10. **Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.**
11. **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.**

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- **Material 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 e-mail techteam@bendix.com**

1.3 Rotor identification

See Figure 4 to help you identify which type of rotor is used on the axle being inspected. Note that the maintenance inspection procedure will depend on the type of rotor installed.

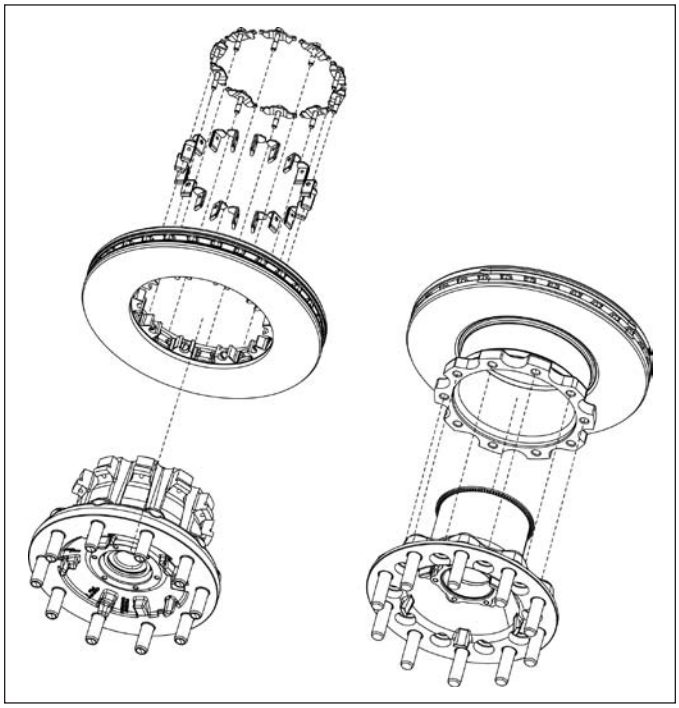
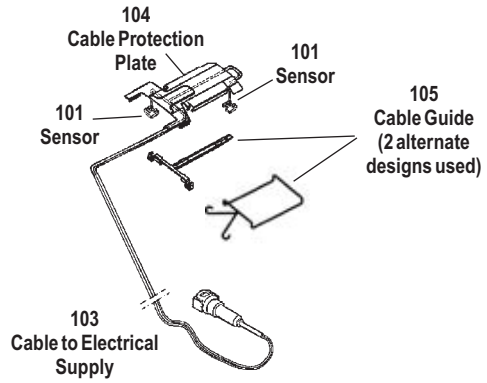


FIGURE 4 - *ROTOR IDENTIFICATION*

CAUTION: Rotors may not be mixed on a single axle: axles are only permitted to have <u>all</u> conventional or <u>all</u> splined disc rotors.

1.4 Wear Sensor Identification

See Figure 5 for the electronic wear sensor that may be present.



Sensor 101
Cable to Electrical Supply. 103
Cable Protection Plate 104
Cable Guide (two designs) 105

Consult the instruction sheet included with wear indicator kits for installation information.

FIGURE 5 - *ELECTRONIC WEAR INDICATOR COMPONENTS*

1.5 Operation

Bendix air disc brakes convert air pressure into braking force. *(See Figure 6.)* When the vehicle brakes are applied, air enters the service brake chamber through the supply port, applying pressure within the diaphragm. The pressure expands the diaphragm — applying force to, and moving, the pressure plate and push rod forward. The push rod acts against a cup in the internal lever which pivots on an eccentric bearing moving the bridge. Moving against a return spring, the bridge transfers the motion to two threaded tubes and tappets, which move the inner brake pad. The inner brake pad (from its normal position of having a running clearance between it and the rotor) moves into contact with the brake rotor. Further movement of the bridge forces the caliper — sliding on two stationary guide pins — away from the rotor. That, in turn, pulls the outer brake pad into the rotor. The clamping action of the brake pads on the rotor applies braking force to the wheel.

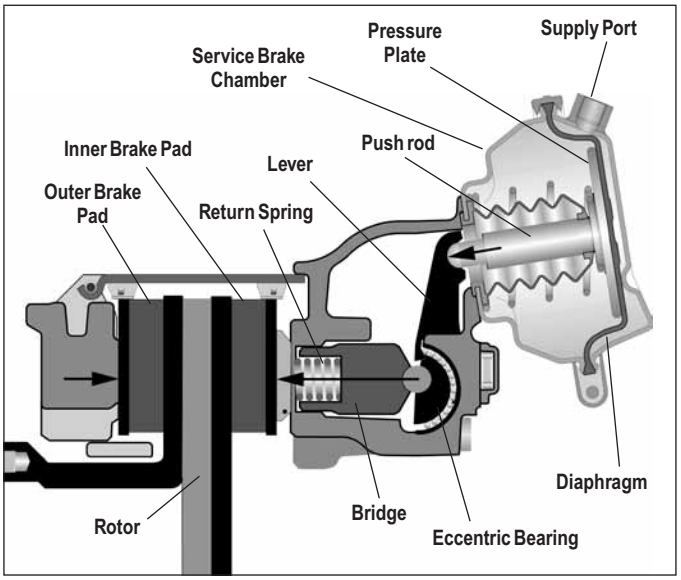


FIGURE 6 - *CROSS-SECTION VIEW SHOWING BRAKE OPERATION*

1.5.1 Brake Release and Adjustment

When the vehicle brakes are released, the air pressure in the service brake chamber is exhausted and the return springs in the chamber and the bridge return the air disc brake to a neutral, non-braked position. To maintain the running clearance gap between the rotor and the brake pads over time, the non-braked position is mechanically adjusted by a mechanism in the caliper. The adjustment mechanism operates automatically whenever the brakes are activated, to compensate for rotor and brake pad wear and to keep the running clearance constant. During pad or rotor maintenance, the technician manually sets the system's initial non-braked position. The total running clearance (the sum of clearances on both sides of the rotor) should be between 0.024 to 0.043 in. (0.6 to 1.1 mm).

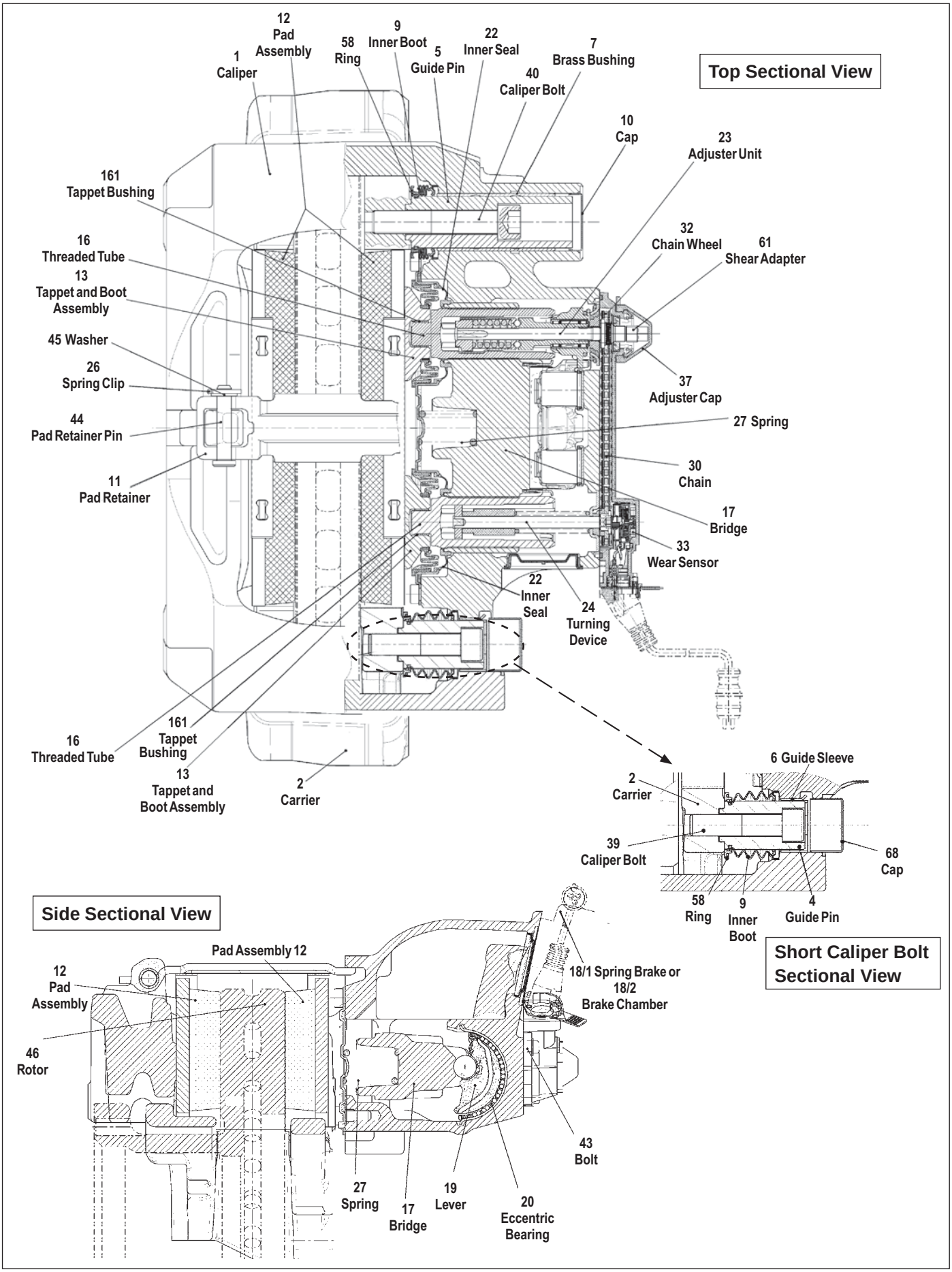


FIGURE 7 - ***SECTIONAL VIEWS***

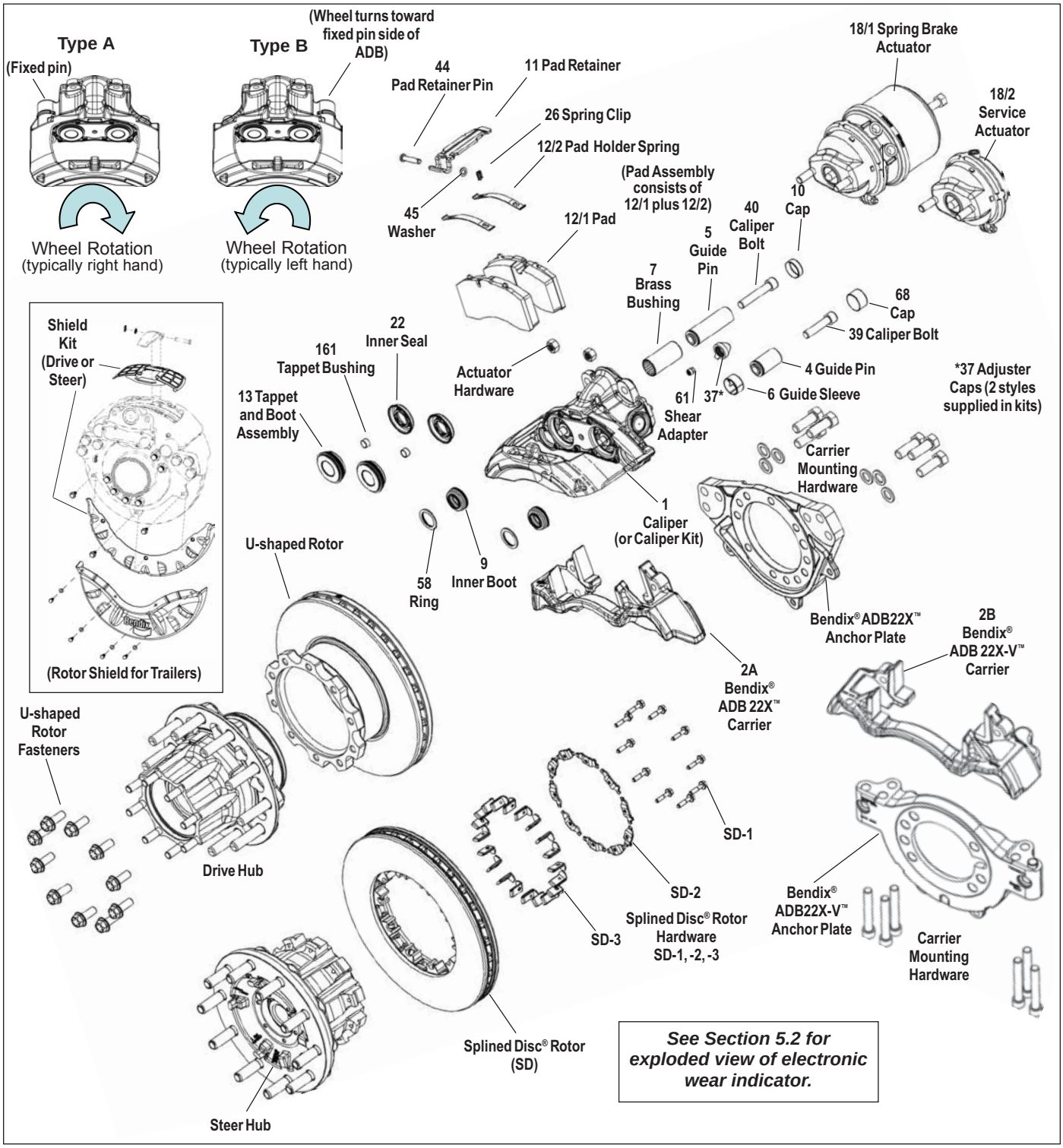


FIGURE 8 - ***EXPLODED VIEW - BENDIX® ADB22X™ AND ADB22X-V™ AIR DISC BRAKES***

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Guide Sleeve 6
Inner Boot 9
Inner Seal 22
Lever 19
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Pad Holder Spring 12/2
Pad Assembly 12
Pad Retainer 11
Pad Retainer Pin 44
Ring 58
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SECTION TWO: PREVENTIVE MAINTENANCE SCHEDULE AND WHEEL-ON INSPECTIONS

2.0 PREVENTIVE MAINTENANCE

Regular inspection and maintenance of air disc brake components is an important part of vehicle maintenance.

The maintenance practices outlined here are recommended in addition to all standard industry practices (including daily pre-trip inspections.) Also, see the vehicle's manual for recommendations. Keep track of the results of your maintenance inspections to assist you in determining the ideal maintenance intervals for the vehicle.

Use the table below for a guide to maintenance interval planning, however, depending on the particular vehicle's use, more frequent checks of the components may be necessary.

Section Two

Section		Page
2.0	Preventive Maintenance	6
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*** For vehicles with electronic wear indicators**, use the dash indicator(s) and/or the hand-held diagnostic tool to regularly monitor the pad wear.

See Section 5.2.

Table 1: Inspection Period

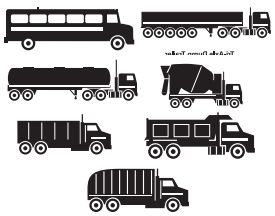
	When you check the tire pressures	(4 to 5 times during the pad lifetime)		At the very least, every four (4) months	At least once every year (and at every pad replace-ment)
		About ever four (4) months for over-the-road applications:	About every three (3) months for higher-duty applications:		
		e.g. line haul, RV, open-highway coaches, etc. 	e.g. pick-up & delivery, off-highway, construction, logger, concrete mixer, dump truck, city transit bus, refuse, school buses, etc. 		
Inspections with the wheel mounted (Sections 2.1 - 2.3)					
Inspect the pad thickness by checking the mechanical wear indicators*. *See Section 2.1.*	✔	✔	✔	✔	
Inspect the running clearances using the quick inspection technique. *See Section 2.2.*	✔	✔	✔	✔	
Inspect the visible part of the rotors for cracks, etc. *See Section 2.3.*	✔	✔	✔	✔	
Inspections with wheel removed (Section 4)					
Inspect the pads and entire rotor surfaces for cracks, etc. (Bendix® splined disc® rotors: Inspect retaining hardware and check torques) *See Section 2.3.*					✔
Inspect the running clearances and adjuster operation. *See Sections 2.2 and 4.2.*					✔
Inspect the caliper travel. *See Section 4.1.*					✔
Inspect the tappet and boot assemblies. *See Section 4.6.*					✔
Inspect all caps, hoses, and brake exterior for damage etc.					✔

TABLE 1 - ***PREVENTIVE MAINTENANCE SCHEDULE***

2.1 BRAKE PAD AND ROTOR INSPECTIONS

Visual checks of the condition of the brake pad/rotor wear can be made without removing the wheels. Where dust guards are not used, the top of the pads and part of the rotor are visible through the opening at the top of the brake. Other visible portions of the rotor can be inspected at the same time.

Unless a vehicle has been stored for some time, the main rotor surfaces that contact the pads will always appear to be shiny. Surface rust on these surfaces would indicate a malfunctioning brake that should be inspected immediately.

Pads are 1.181 in. (30 mm.) thick when new and must be replaced when they reach 0.433 in. (11 mm.). Rotors are 1.77 in. (45 mm.) thick when new and must be replaced when they reach 1.46 in. (37 mm.). *See Section 4.3 for further inspection criteria.*

2.1.1 Electronic Wear Indicators

Use the dash indicator(s) and/or a hand-held diagnostic tool to regularly monitor the pad wear. *(See Section 5.2.)*

2.1.2 Mechanical Wear Indicators

See Figure 9 for the location of the mechanical wear indicators. There are two types *(See Figure 10 for Style A and Figure 11 for Style B)*.

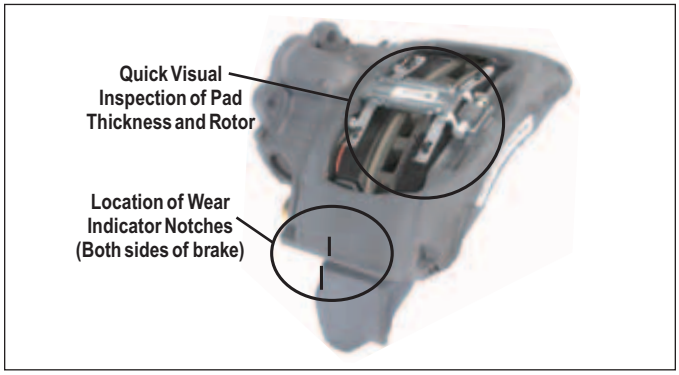


FIGURE 9 - ***LOCATION OF WEAR INDICATORS***

Note: These mechanical wear indicators do not constitute "out-of-service" criteria. These inspections only show when to schedule a full wheel-removed inspection of the brake pads and rotor. The thicknesses of the pad and rotor will both affect the wear indicator position at which maintenance is actually needed.

Wear Indicator Style A:

Where both the carrier and caliper have an indicator notch.

Compare the relative position of two notches cast into the carrier and caliper. When the two notches align, it is time to schedule a full wheel-removed inspection of the pads and rotor.

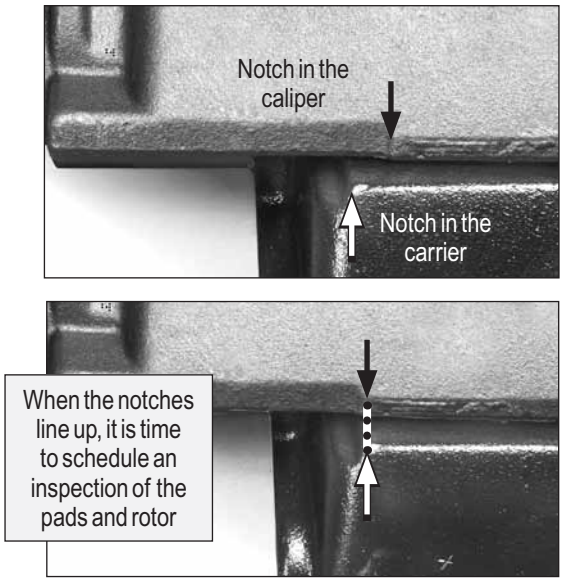


FIGURE 10 - ***STYLE A - WHEN BOTH CARRIER AND CALIPER HAVE A CAST NOTCH***

Wear Indicator Style B:

Where only the caliper has an indicator notch.

When the notch in the caliper aligns with the front edge of the torque plate, it is time to schedule a full wheel-removed inspection of the pads and rotor.

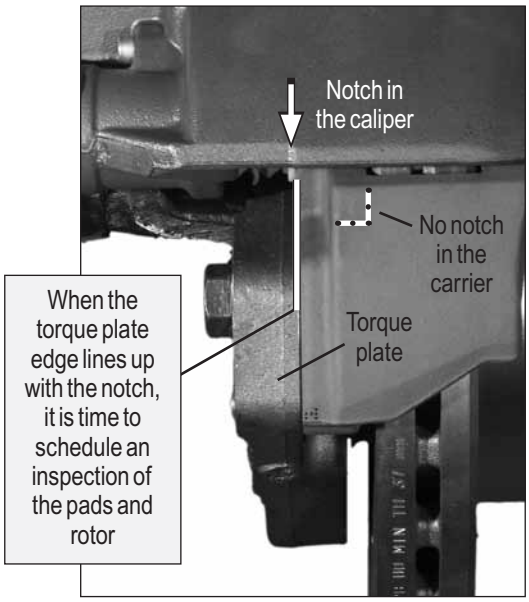


FIGURE 11 - ***CARRIER WEAR INDICATOR NOTCH AND BACKING PLATE ALIGNMENT***

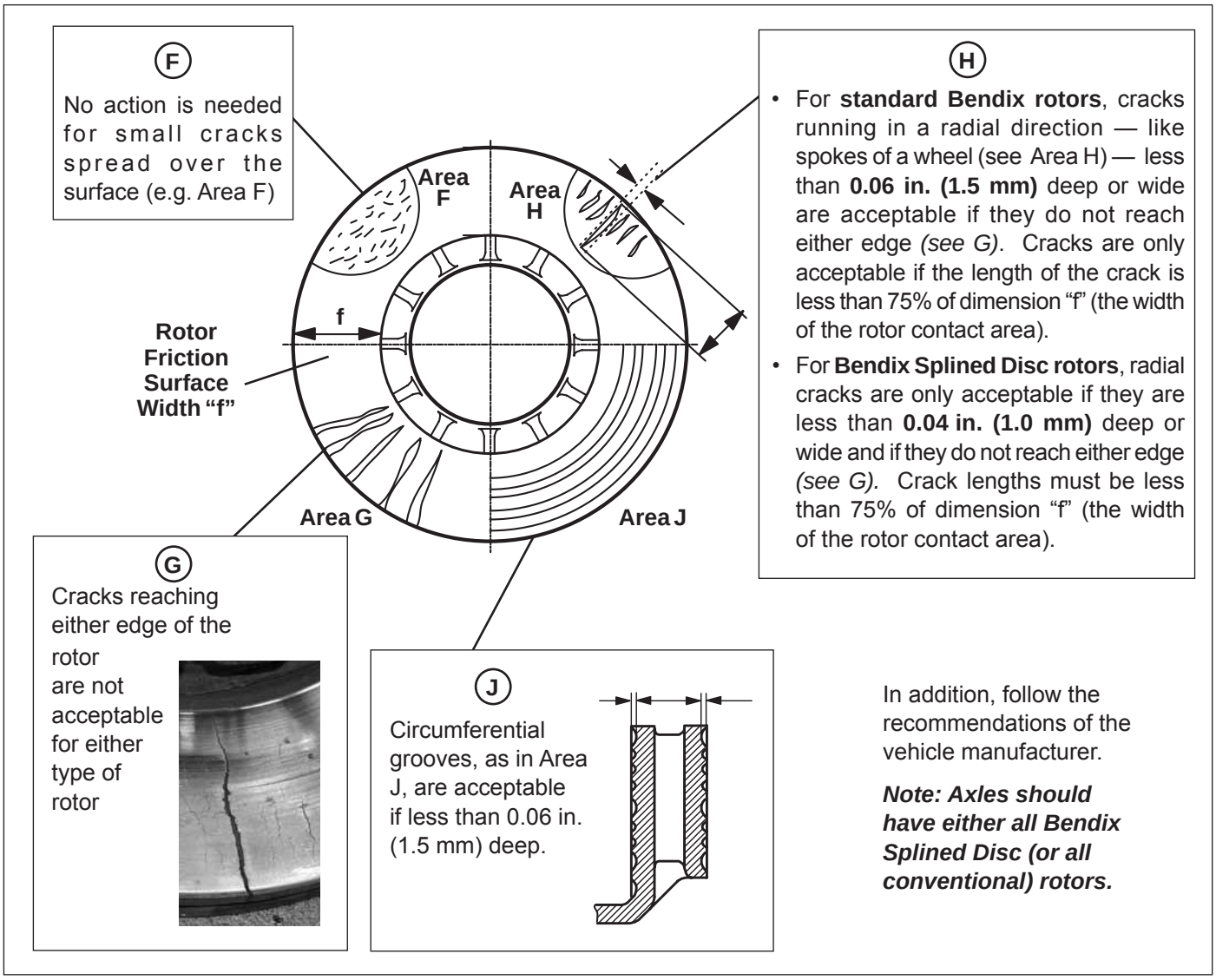


FIGURE 12 - ***EXAMPLES OF ACCEPTABLE AND NON-ACCEPTABLE ROTOR CRACKS AND GROOVES***

2.1.3 Rotor Quick Inspection

See Figure 12. See the various potential rotor conditions that you may find. See the criteria below for whether the rotor needs to be replaced and/or scheduled for a full inspection.

2.2 RUNNING CLEARANCE QUICK INSPECTION

CAUTION: Follow all safe maintenance practices.

On level ground, with the wheels chocked and the parking brake temporarily released, check for movement of the brake caliper. This small movement, less than 0.08" (2 mm) - approximately the thickness of a nickel - in the inboard/outboard direction indicates that the brake is moving properly on its guide pins.

If the caliper has no movement or appears to move greater than the distances noted above, a full wheel-removed inspection will be necessary *(See Section 4.1)*.

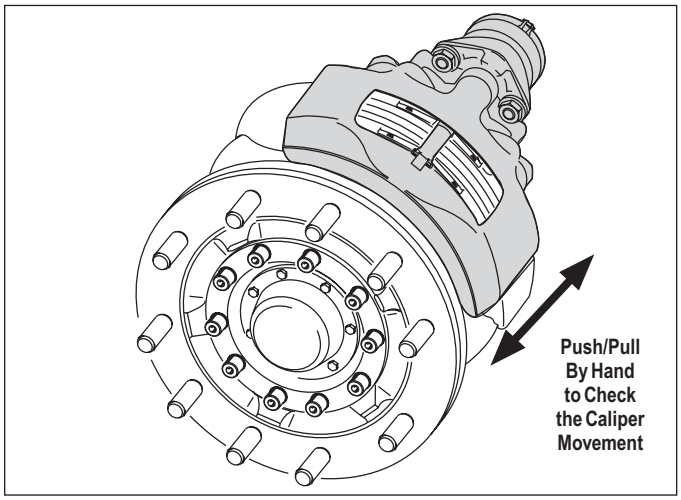


FIGURE 13 - CALIPER RUNNING CLEARANCE
(FIGURE DOES NOT SHOW WHEEL)

SECTION THREE: TROUBLESHOOTING PROCEDURE FLOWCHART

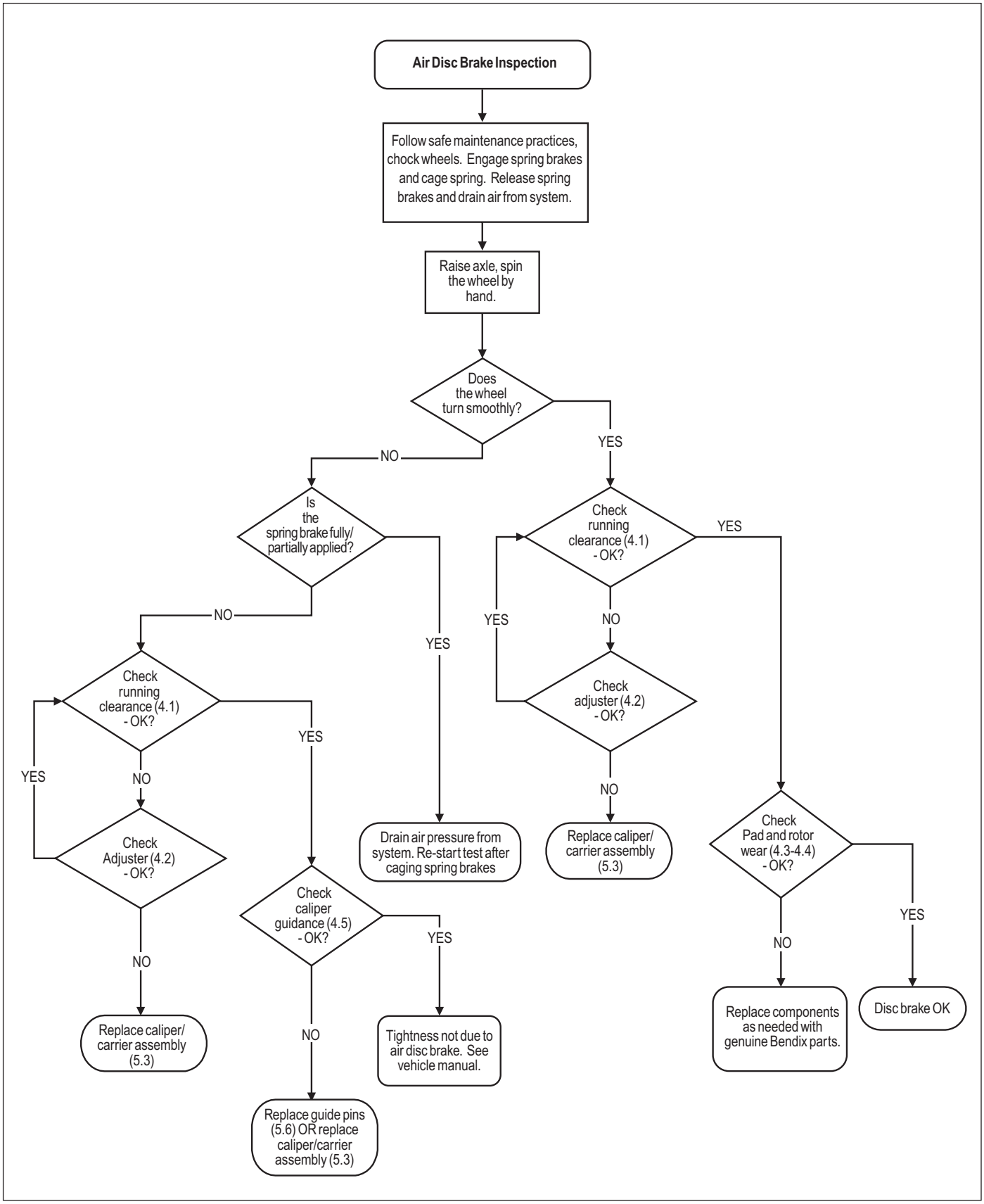


FIGURE 14 - ***TROUBLESHOOTING BENDIX AIR DISC BRAKES***

SECTION FOUR: WHEEL-OFF MAINTENANCE INSPECTIONS

Section Four

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4.4.3	Machining (Grinding or Turning) Rotors	14
4.5	Guide Pin Bearing Inspection	14-15
4.6	Tappet & Boot Assembly Inspection	15

4.0 WHEEL-OFF INSPECTIONS

CAUTION: During these inspections, follow all safe maintenance practices, including those on page two of this service manual. Also, follow the vehicle manufacturer's recommendations. When working on foundation brakes, be sure that the vehicle is on level ground, that the vehicle is parked by other means than the foundation brakes, and that the wheels are chocked.

4.0.1 Wheel Removal and Re-Installation

Refer to the vehicle manufacturer's recommendations for removing the wheel.

Note: When removing the wheel, inspect first to see that there is no contact between the caliper and axle, vehicle, chassis sections or carrier, etc. that may be impeding the free movement of the caliper.

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 risk of valve stem shear and other compatibility issues. After re-installing a wheel according to the vehicle manufacturer's recommendations, please ensure that there is sufficient clearance between the tire inflation valve stem, the caliper and the wheel rim, to avoid damage.

4.1 CALIPER MOVEMENT TEST

CAUTION: Follow all safe maintenance practices.

Remove the wheel. With the spring brakes released or caged, push the caliper assembly inboard on its guide pins. *Note: To fully release the spring brakes, assure that the air system pressure is at least 90 PSI.* Using a suitable tool (for example a large flat-blade screwdriver), press the inboard pad (12) away from the tappets. Check that there is no dirt, etc. in the gap, and clean if necessary. Then use two long-blade feeler gauges to measure over the whole tappet surface the gap between them and the inboard pad backplate. *(See Figure 16.)* The gap should be between 0.024 in. (0.6 mm) and 0.043 in. (1.1 mm). **If the gap is within the range given, the test is complete.**

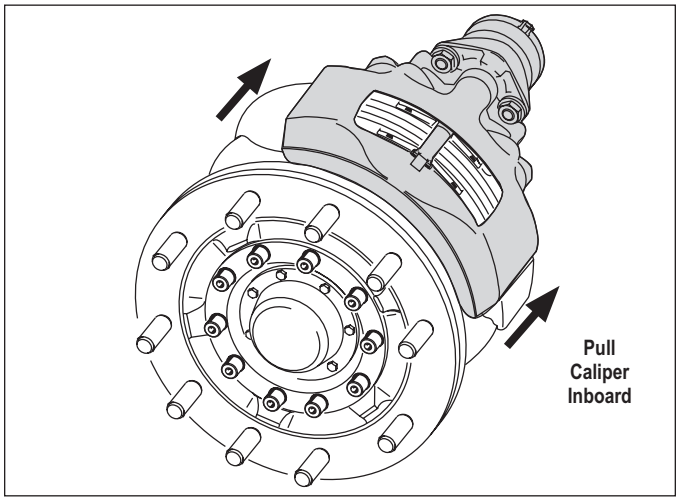


FIGURE 15 - *PULL CALIPER INBOARD*

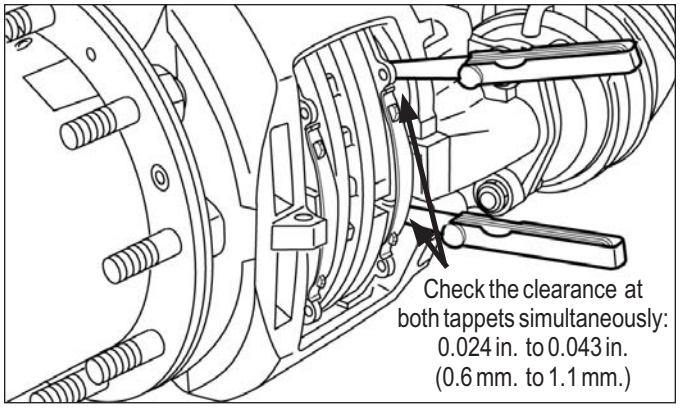


FIGURE 16 - *RUNNING CLEARANCE CHECK*

CAUTION: If the clearance is too wide, there is a danger of brake failure. If the clearance is too small, or if there is no gap at all, there is a danger of the brake overheating. These conditions must be corrected before returning the vehicle to service.

For further investigation, where there is some gap, go to Section 4.2 and check the adjuster mechanism. Where there is no movement at all (and so no gap to measure), go to Section 4.5 "Guide Pin Inspection."

4.2 ADJUSTER MECHANISM INSPECTION

CAUTION: Follow all safe maintenance practices.

Aside from the normal maintenance schedule, the adjuster mechanism inspection that follows is also carried out when the Caliper Movement Test (4.1) finds that the running clearance is too small or too large.

4.2.1 With the spring brake released (or caged), remove the adjuster cap (37) using the tab, taking care not to move the shear adapter (61). Note: One of two styles of adjuster cap (stamped metal or plastic adjuster cap) may be used.

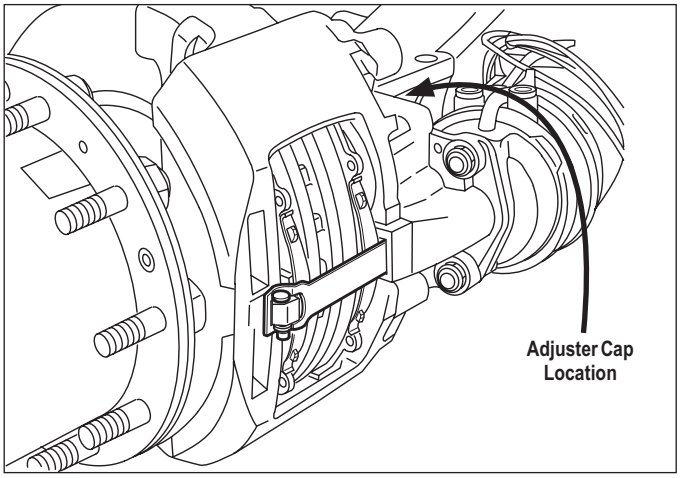


FIGURE 17 - ***ADJUSTER CAP LOCATION***

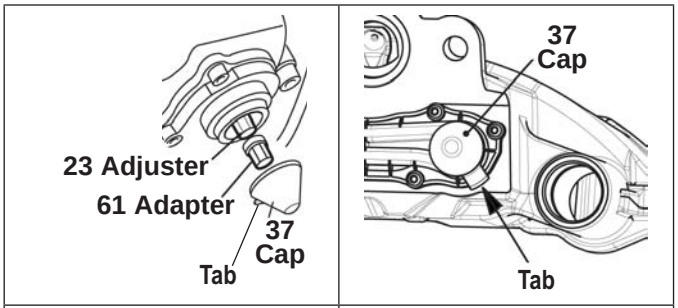


FIGURE 18 - ***EXPLODED VIEW OF ADJUSTER AND ADAPTER***

FIGURE 19 - ***CAP INSTALLED: TAB LOCATION***

For illustration purposes, the exploded view (Figure 18) shows the adjuster (23) and shear adapter (61) separated. When using the adjuster mechanism, always have the shear adapter installed on the adjuster.

4.2.2 Using a 10 mm. six-point box wrench, turn the Shear Adapter (61) **counter-clockwise** and listen for the sound of 3 clicks as the mechanism backs-off (increases) the running clearance. Note: Do not use an open-ended wrench as this may damage the adapter. *See Figure 20.*

CAUTION: Never turn the adjuster (23) without the shear adapter (61) installed. The shear adapter is a safety feature and is designed to prevent excessive torque from being applied to the adjuster. The shear adapter will fail (by breaking) if too much torque is applied.

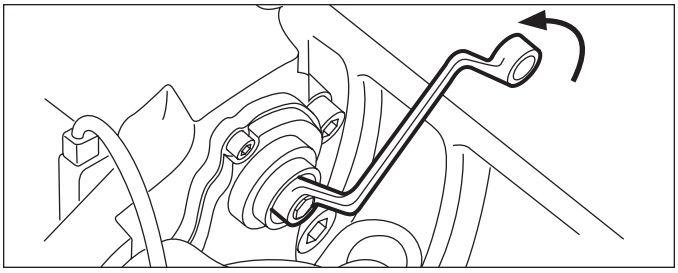


FIGURE 20 - ***BACKING-OFF (INCREASING) THE RUNNING CLEARANCE***

If the shear adapter fails, you may attempt a second time with a new (unused) shear adapter.

Note: Always double-check that the spring brake is released (where applicable) if a shear adapter fails; if this step was missed, the shear adapter will break off, and it may appear that the caliper is seized.

In cases where a second failure of the shear adapter confirms that the adjustment mechanism is seized, the caliper must be replaced.

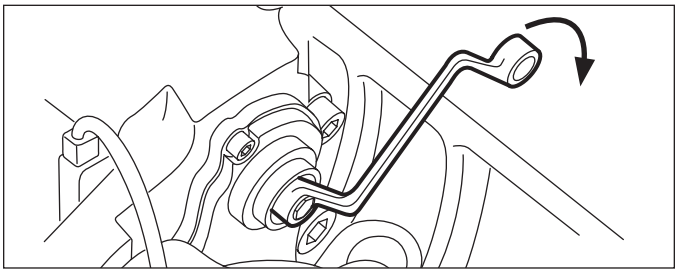


FIGURE 21 - ***APPLYING MODERATE APPLICATIONS OF THE BRAKES: THE WRENCH MOVES CLOCKWISE AS THE RUNNING CLEARANCE IS DIMINISHED***

4.2.3 Where the adjuster mechanism is able to be backed-off normally, position a box-end wrench on the shear adapter so that it can turn clockwise freely without coming into contact with parts of the vehicle *(See Figure 21).* Make five to ten moderate applications of the brakes [at about 30 psi (2 Bar)], and observe that the box-end wrench or socket should turn clockwise in small increments.

NOTE: As the number of applications increases, the turning movement will decrease (as the brake reaches its normal calibration point).

If the box-end wrench does not: (a) turn at all; (b) turns only with the first application; or (c) turns forward and backward with every application, the automatic adjuster has failed and the caliper/carrier assembly must be replaced.

After completing these wheel-off tests, Bendix recommends installing a new adjuster cap (lightly greased using white, lithium-based grease) when returning the brake to service. Ensure that the tab is in the position shown in Figure 19.

4.3- 4.4 BRAKE PADS AND ROTORS

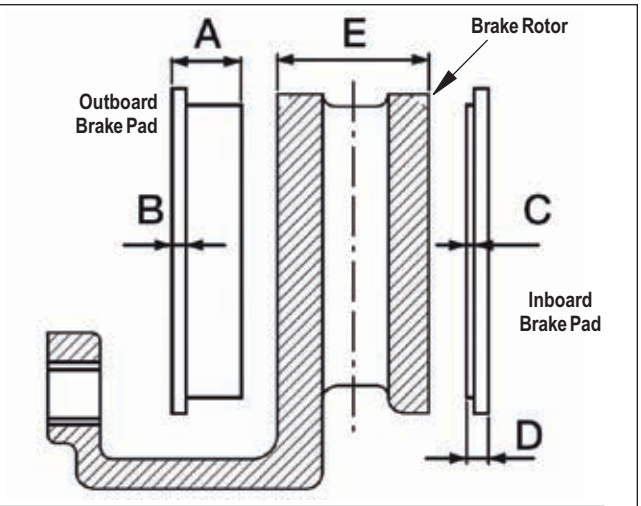
CAUTION: Follow all safe maintenance practices.

If electronic wear sensors are present, *see Section 5.2.*

If dust covers are present, *see Section 5.1.*

See Figure 23. While pressing down against the pad retaining bar (11), remove and retain the clip (26), washer (45) and pin (44). Remove the pad retainer bar (11). Bendix recommends that these items should be replaced with new *(See available kits and parts, Section 5.0)*.

Follow the steps in Section 4.2 for backing-off the adjuster mechanism. Slide the caliper inboard then outboard to permit easy removal of the brake pads.



A	Thickness of a new pad (1.181 in.) (30 mm.).
B	Backing plate thickness (0.360 in.) (9 mm.)
C	Minimum thickness of friction material (0.080 in.) (2 mm.)
D	Minimum thickness of a worn pad (0.433 in.) (11 mm.); replace pads.
E	Thickness of a new rotor (1.77 in.) (45 mm.). Minimum rotor thickness (1.46 in.) (37 mm.)

FIGURE 22 - *PAD AND ROTOR DIMENSIONS*

See Figure 22 for initial brake pad and rotor dimensions, as well as minimum acceptable dimensions.

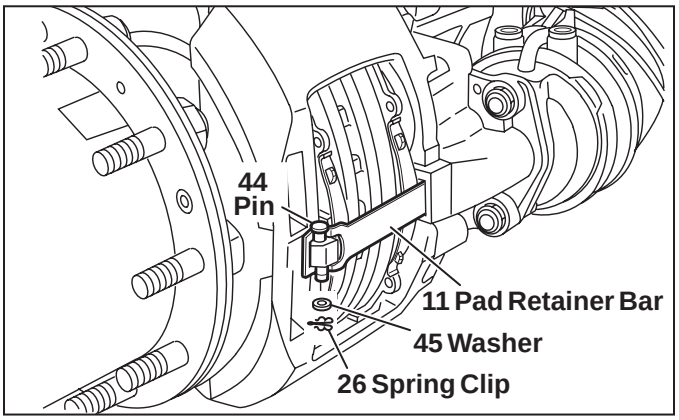


FIGURE 23 - *RETAINER BAR REMOVAL*

4.3 INSPECT THE BRAKE PADS

Regular inspection of the brake pads (even for vehicles that use an electronic wear indicator) is an important part of vehicle maintenance.

4.3.1 See Figure 22. If the thickness of the friction material — dimension “C” — is less than 0.080 in. (2 mm.), the pads must be replaced.

Bendix® ADB22X™, ADB22X-V™ air disc brakes use 0.35 in. (9 mm.) backing plates, so dimension “D” (the combined pad and backing plate thickness) must be a minimum of 0.43 in. (11 mm.).

4.3.2 Check for uneven end-to-end pad wear. If the difference in wear is greater than 0.080 in. (2 mm.), replace the brake pads and also inspect the guide pins *(See Section 4.5)*.

4.3.3 Compare the thickness of the inboard and outboard pads of each set. If the difference between the inboard and outboard pad thickness is greater than 0.138 in. (3.5 mm.), replace the brake pads and inspect the guide pins *(See Section 4.5)*.

If the results of the pad inspections are within the acceptable range, inspect the pad surface. *(See Figure 24)*.

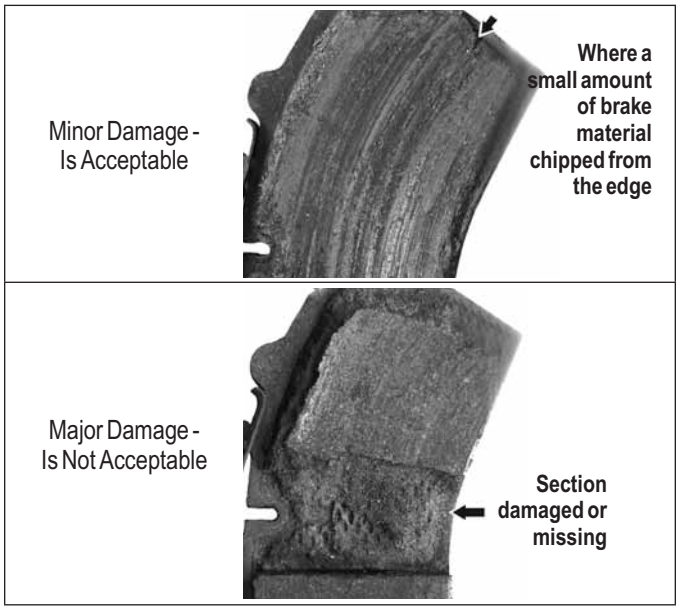


FIGURE 24 - *BRAKE PAD SURFACE INSPECTION*

Minor damage at the edges is permitted, but replace the pads if major damage on the surface of the pad is found.

When replacing brake pads, Bendix strongly recommends that all the brake pads on an axle be replaced at one time. *See Section 5.1 for the pad replacement procedure*. Also see the vehicle manufacturer’s recommendations found in the operator’s manual.

Bendix air disc brakes are precision-engineered braking mechanisms. The “friction couple” braking characteristics have been carefully optimized — and the rotor design and materials have been matched with special formulation brake pads for optimal performance. In all cases, use brake pads with the type of backing plate and lining material originally supplied by the vehicle manufacturer.

CAUTION: When replacing brake pads and rotors, use only Bendix® brand replacement pads and rotors and/or those approved by the OEM. Non-approved replacement disc pads or rotors can cause excess wear to brake components, and can increase the risk of rotors cracking, etc.

4.4 INSPECT THE ROTOR

CAUTION: Follow all safe maintenance practices.

Identify if the rotor is a Bendix® Splined Disc®, or Bendix® brand conventional rotor (S*ee Section 1.03*). Rotors should be inspected regularly *(See Section 2.0 for recommended inspection schedule)* and at each pad change.

4.4.1 Measure the thickness of the brake rotor at the thinnest point (Dimension “E” in Figure 22). Avoid measuring near the edge of the rotor as minor burrs may result in inaccurate measurement. **For Bendix® brand rotors, replace the rotor when the minimum thickness of 1.46 in. (37 mm.) is reached.** For other brands of rotors, refer to the rotor manufacturer’s guidelines.

4.4.2 Inspect the rotor surface. *See Figure 25.* The type of rotor, and also the size, depth and direction of the imperfections, must all be considered.

NOTE: If surface wear conditions F through J are in the permitted range, the rotor is still usable until it reaches the minimum acceptable thickness for the rotor manufacturer’s guideline.

4.4.3 Machining (Grinding or Turning) Rotors

Bendix® brand rotors are normally service-free. In the case of severe grooving of the entire friction surface, however, **CONVENTIONAL ROTORS** may be turned when changing pads, to increase the load-bearing surface.

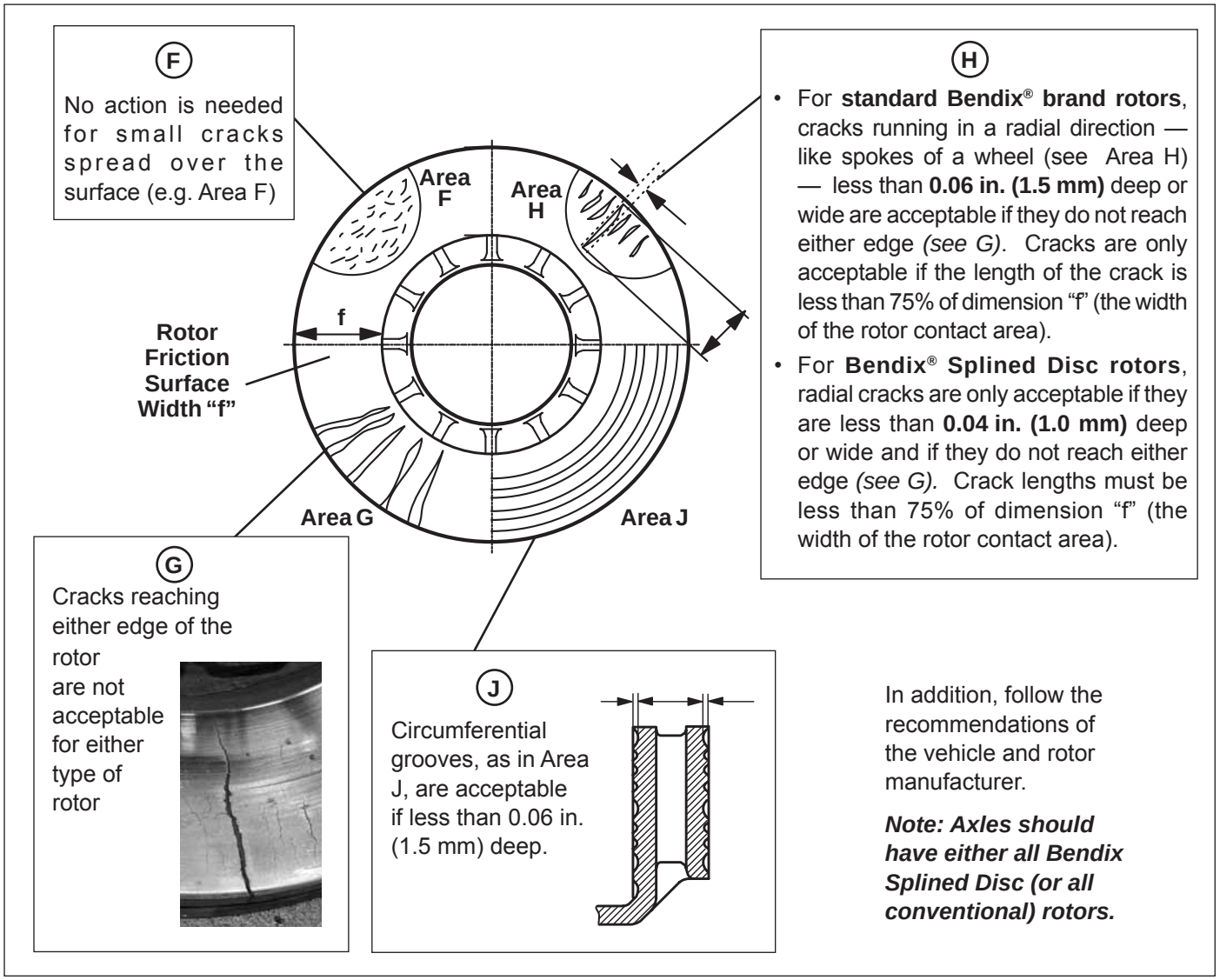


FIGURE 25 - EXAMPLES OF ACCEPTABLE AND NON-ACCEPTABLE ROTOR CONDITIONS

MACHINING OF BENDIX® SPLINED DISC® ROTORS IS NOT PERMITTED.

CAUTION: Always maintain air disc brake pads and rotors within specifications. Excessive pad or rotor wear will degrade braking performance.

Periodic inspection of the Bendix Splined Disc attachment hardware is recommended to ensure optimum braking performance. Bendix recommends verifying the torque on the spring element fasteners whenever a brake inspection is performed.

⚠ WARNING! AFTER MACHINING/TURNING, THE MINIMUM ROTOR THICKNESS FOR BENDIX® BRAND ROTORS MUST BE AT LEAST 1.535 - 1.575 IN. (39 - 40 MM.) - FOR OTHER BRANDS, CONSULT THE MANUFACTURER'S GUIDELINES. ALSO, CHECK THE VEHICLE MANUFACTURER'S RECOMMENDATIONS. FAILURE TO COMPLY MAY RESULT IN BRAKE FAILURE AND IN SERIOUS INJURY OR DEATH. MACHINING OF BENDIX SPLINED DISC ROTORS IS NOT PERMITTED.

4.4.4 Rotor Replacement

An axle is permitted to have only all Bendix Splined Disc, or all conventional, rotors.

When replacing rotors, be sure to adhere to the vehicle manufacturer's recommendations, including bolt tightening torques. It is recommended to install only Bendix® brand rotors, and also that the pads should be replaced (as an axle set) at the same time.

Non-Bendix® brand rotors. If a non-Bendix® brand rotor is used, confirm that it complies to the vehicle manufacturer's recommendations.

CAUTION: The use of <u>non-approved</u> brake rotors may reduce levels of safety and invalidate the warranty.

See Section 5.7 for re-installation procedures.

4.5 GUIDE PIN BEARING INSPECTION

CAUTION: Follow all safe maintenance practices.

This guide pin inspection should be carried out if the technician cannot move the caliper during a Caliper Movement Test (Sections 2.2 and/or 4.1).

Measure the range of travel along the guide pin bearings:

4.5.1 Remove the Pads *(See Section 4.3)*. Using hand pressure only (no tools), the caliper (1) should slide freely along the whole length of the guide pins. This movement should be at least 0.95 inch (25 mm) when the pads are not present. If the movement is less than this amount, replace the caliper/carrier assembly.

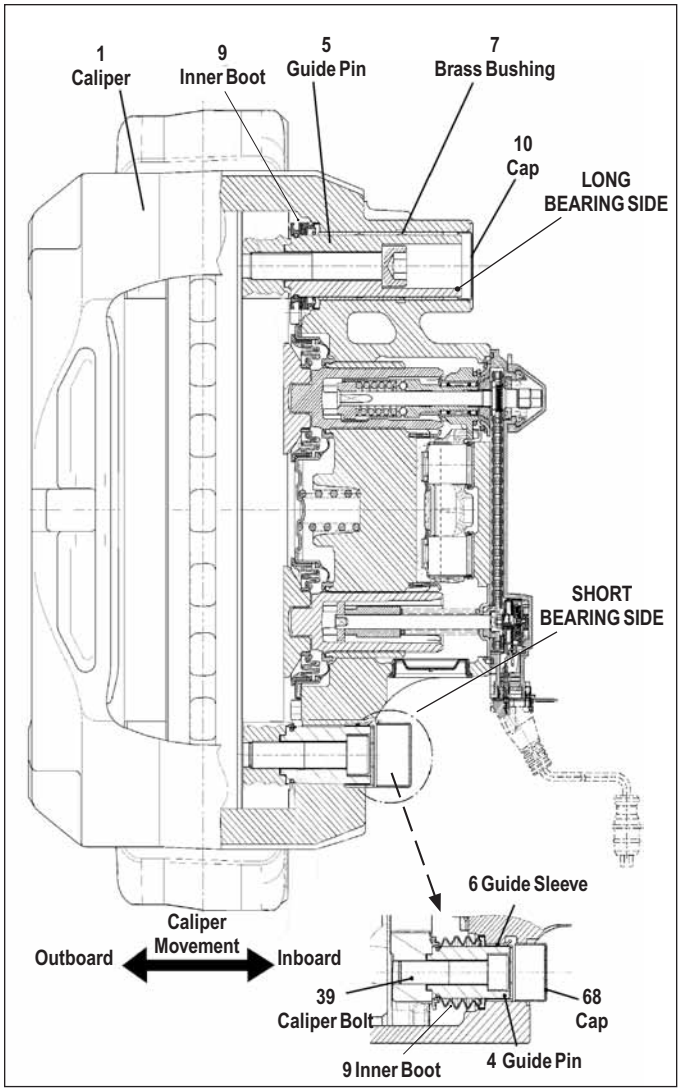


FIGURE 26 - *GUIDE PINS*

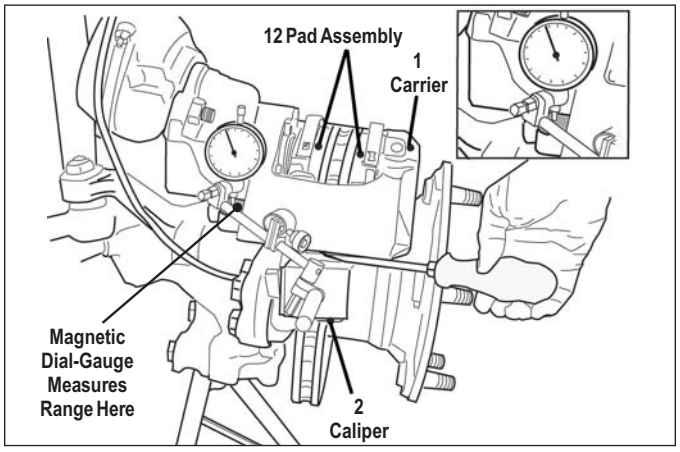


FIGURE 27 - *MAGNETIC DIAL-GAUGE IN USE*

Measure the "play" (range of movement) in the guide pin bearings:

4.5.2 *See Figures 26 and 27.* With the wheel removed, remove the pad retainer bar (11). Temporarily replace the pads with two new pads (12). Attach a magnetic dial-gauge holder to the carrier (2) on the short bearing side of the caliper (1). Use the measuring point on the caliper (1) - see the callout

in Figure 27. Press the caliper in the direction of the carrier (2) and set the dial-gauge to zero.

4.5.3 Place a suitable tool (e.g. a large flat-blade screwdriver) between carrier (2) and caliper (1) and use light hand force to move the caliper away from the carrier, until the movement stops. Read the maximum value on the dial-gauge. *See Figure 27.*

If the value is greater than 0.078 in. (2.0 mm), replace the guide pin bushings *(See Section 5.6)* OR replace the caliper/carrier assembly *(See Section 5.3)*.

Inspect the guide pin inner boots:

4.5.4 *See Figures 28 and 29.* With the pads removed, slide the carrier by hand to the inboard position *(See Figure 28)*. By looking through the opening where the pads are installed — and also from below — inspect the inner boot (9) for each of the guide pins. **INSPECT FOR DAMAGE, CUTS AND CRACKS.** Replace damaged boots immediately to prevent dirt and/or moisture affecting the movement of the guide pins *(See Section 5.4)*. Damaged or corroded guide pins will impair the operation of the brake.

In addition, during installation, the boots are compressed to minimize the amount of air trapped within them. Observe as you move the carrier back towards the outboard position; the boots should only expand outwards a small amount due to trapped air. The boots should normally (due to their ribbed construction) contract back into place as the caliper moves on the guide pins. The boots are not air-tight and so some trapped air is normal; excess air trapped will dissipate.

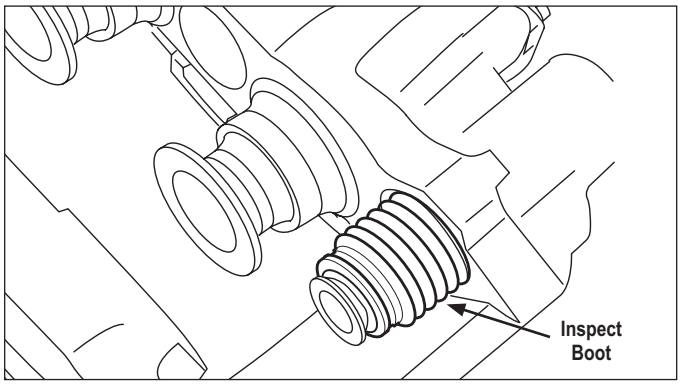


FIGURE 28 - *GUIDE PIN BOOT INSPECTION (THIS IMAGE DOES NOT SHOW THE CARRIER)*

4.5.5 Inspect the original pads *(See Section 4.3)* and they may be reused if they are in good condition with sufficient pad thickness.

4.6 TAPPET AND BOOT ASSEMBLY INSPECTION

4.6.1 In order to inspect the tappet and boot assembly, remove the pads (12) *(See Sections 4.3 or 5.2)* and advance the shear adapter (61) clockwise.

CAUTION: NEVER EXTEND THE TAPPET MORE THAN 1.75 in. (44.5 mm). *See Figure 29.* **Over-extending the tappet will result in the tappet losing engagement with the synchronizing mechanism. Since the mechanism can only be set at the manufacturing plant, the *caliper/carrier assembly must be replaced* if this happens.**

4.6.2 **INSPECT THE TAPPET AND BOOT ASSEMBLIES (13) FOR EVIDENCE OF DAMAGE, CUTS, CRACKS, TEARS AND EVIDENCE OF CORROSION, ETC.** Damaged boots lead to the penetration of dirt and moisture, and can lead to corrosion and impair the operation of the brake. Replace as necessary *(See Section 5.5)*.

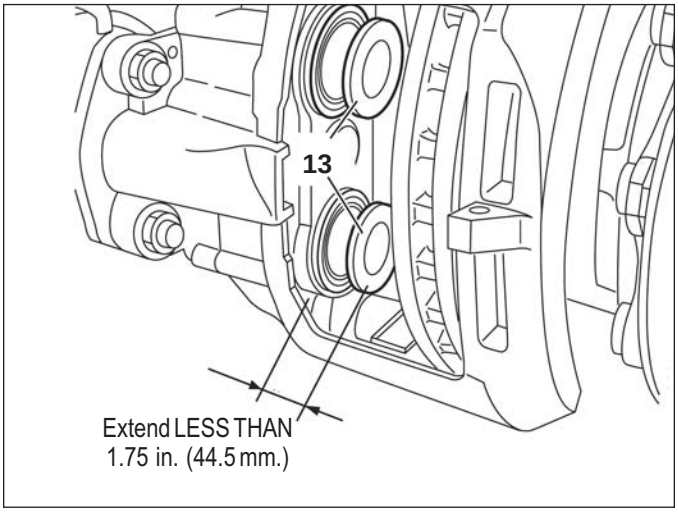


FIGURE 29 - PERMITTED TAPPET EXTENSION

Where the tappets and boots pass the inspection, retract the tappets using the shear adapter.

When installed, the boots are compressed to minimize the amount of air trapped within them. Observe as you move the tappet back using the shear adapter; the boots should only expand outwards a small amount due to trapped air. The boots should normally (due to their ribbed construction) contract back into place as the tappets move. Note: If the bellows have excess air trapped, then with the tappets retracted, remove and re-install the actuator to vent the excess trapped air *(See Section 5.4).*

Follow the reinstallation steps for the brake pads *(See Section 5.2)*.

SECTION FIVE: MAINTENANCE KITS AND PROCEDURES

Section Five

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5.3	Caliper/Carrier/Actuator Assembly	22-23
5.4	Spring/Service Brake	24
5.5	Tappet & Boot, and Tappet Inner Seal	25-28
5.6	Guide Pin and Boot Assemblies	29-34
5.7	Bendix® Splined Disc® Hub Rotor	35-37

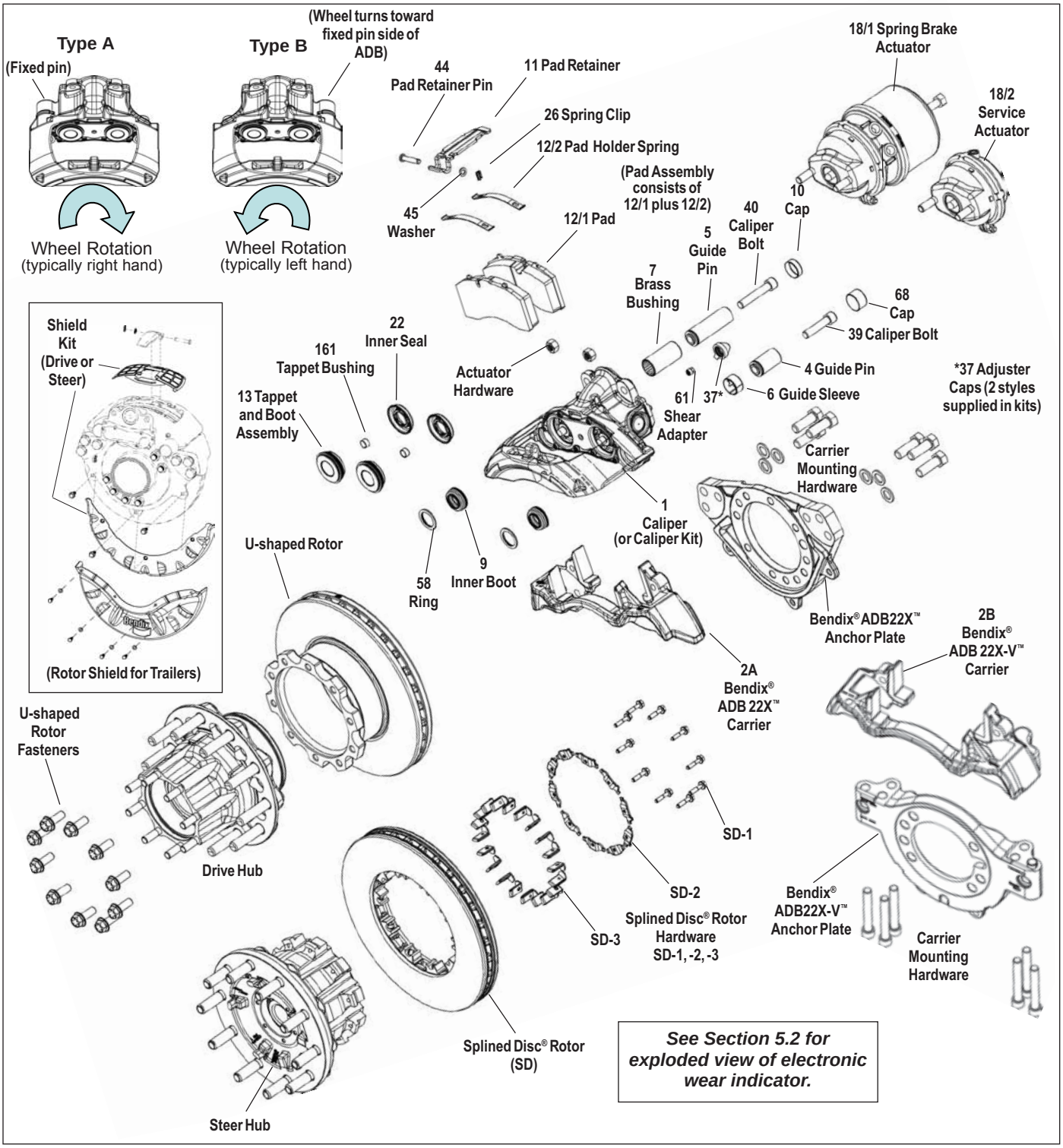


FIGURE 30 - ***EXPLODED VIEW - BENDIX® ADB22X™ AND ADB22X-V™ AIR DISC BRAKES***

5.0 MAINTENANCE KITS

Below is a list of some of the available kits. *See Figure 30 for an exploded view showing the components listed.*

Kit	See Section	Piece Number	Components Included in Kit
Dust Shields	Section 5.1	803129	Trailer Axle Pad & Rotor Shield Kit
		803130	Drive Axle Pad & Rotor Shield Kit
		802948	Steer Axle Pad Shield Kit
Pad Kit (axle set)	Section 5.2	802078	Pad retainer bars (5), set of four pads and holder springs (12), adjuster caps (37), pad retainer pins (44), washers (45), shear adapters (61).
Spring Clip Kit (box of 25)	NA	803151	Spring clips (26)
Shear Adapter (box of 10)	NA	802455	Shear adapters (61)
Tappet/Boot Kit (wheel end kit)	Section 5.5	802119	Tappet and boot assembly (13), tappet bushing (161), inner seal (22)
Adjuster Cap (kit has ten each of two styles)	NA	802643	Adjuster caps (37)
Guide Pin, Seal and Boot Kit (wheel end kit)	Section 5.6	803114	Ring (58), inner boot (9), brass bushing (7), guide pin (5), caliper bolt (40), cap (10), guide sleeve (6), guide pin (4), caliper bolt (39), cap (68)
Guide Pin Grease	NA	II14525	White (5 grams)
		K021964	White (500 grams)
Service Actuator	Section 5.4	K028039	Bendix® Type 14 Universal [Service brake actuator (18/2), actuator hardware]
		K028226	Bendix® Type 16 Universal [Service brake actuator (18/2), actuator hardware]
		K028022	Bendix® Type 18 Universal [Service brake actuator (18/2), actuator hardware]
		K028225	Bendix® Type 20 Universal [Service brake actuator (18/2), actuator hardware]
Spring Brake Actuator	Section 5.4	K027557	Bendix® Type 18/16 Piston Style Truck/Trailer Universal [Spring brake actuator (18/2), actuator hardware]
		K025670	Bendix® Type 18/24 Piston Style Truck/Trailer Universal [Spring brake actuator (18/2), actuator hardware]
		K025669	Bendix® Type 20/24 Piston Style Truck/Trailer Universal [Spring brake actuator (18/2), actuator hardware]
		K026451	Bendix® Type 18/24 Double Diaphragm Style Trailer Universal [Spring brake actuator (18/2), actuator hardware]
Caliper Kit (rationalized) Includes 803114 kit shown above	Section 5.3	K019174	Steer and Drive Axle "A" [Caliper kit (1)]
		K019175	Steer and Drive Axle "B" [Caliper kit (1)]
		K019180	Trailer Axle "A" [Caliper kit (1)]
		K019181	Trailer Axle "B" [Caliper kit (1)]
Carrier Kit	Sections 5.3 & 5.6	K051853	**Steer and Drive Axle, Axial** (Ring (58), inner boot(9), caliper bolt (40), cap (10), shear adapter (61), adjuster caps (37), ADB22X carrier complete (1), caliper bolt (39), cap (68).
		K043288	**Trailer Axle, Axial** (Ring (58), inner boot(9), caliper bolt (40), cap (10), shear adapter (61), adjuster caps (37), ADB22X carrier complete (1), caliper bolt (39), cap (68).
		K056559	**Steer and Drive Axle, Vertical** (Ring (58), inner boot(9), caliper bolt (40), cap (10), shear adapter (61), adjuster caps (37), ADB22X-V carrier complete (1), caliper bolt (39), cap (68).
Caliper/Carrier Kit		802090	Steer and Drive Axial “A” (1 + 2A)
		809091	Steer and Drive Axial “B” (1 + 2A)
		802984	Trailer Axial “A” (1 + 2A)
		802985	Trailer Axial “B” (1 + 2A)
		K021299	Steer and Drive Vertical “A” (1 + 2B)
		K021300	Steer and Drive Vertical “B” (1 + 2B)
Hubs	Section 5.7	K020505	Splined Disc® Brake - Aluminum - FF Steer, LMS Bearing Package (Hub)
		803134	Splined Disc® Brake - Aluminum - FL Steer, LMS Bearing Package (Hub)
		802847	Splined Disc® Brake - Aluminum - R Drive, LMS Bearing Package (Hub)
		K020514	Splined Disc® Brake - Aluminum - FF Steer, Standard Bearing Package* (Hub)
		803138	Splined Disc® Brake - Aluminum - FL Steer, Standard Bearing Package* (Hub)
		802859	Splined Disc® Brake - Aluminum - R Drive, Standard Bearing Package* (Hub)
		K045298	Splined Disc® - Aluminum - "TN" Trailer, Standard bearing package* (Hub)
		K045297	Splined Disc® - Aluminum - "TP" Trailer, Standard bearing package* (Hub)
		See hub supplier for these items	U-shaped - Iron/Aluminum, LMS/Standard Bearing Packages
			Flat - Iron/Aluminum, LMS/Standard Bearing Packages
Splined Disc® Rotor Attaching Kit	Section 5.7	K037766	All Splined Disc® Rotor Applications (Splined Disc Rotor hardware kit SD-1, -2, and -3)
Rotor	Section 5.7	802081	138mm U-shaped (Rotor, fasteners)
		802082	150mm U-shaped (Rotor, fasteners)
		802083	Severe Duty Splined Disc Kit (Splined Disc Rotor (SD), and hardware kit SD-1, -2, and -3)
		802569	Heavy Duty Splined Disc Kit (Splined Disc Rotor, and hardware kit SD-1, -2, and -3)

** Universal Replacement with standard bearing configuration and long studs. Contact 1-800-AIR-BRAKE if identification assistance is required.*

TABLE 2 - *MAINTENANCE KITS*

5.0.1 GENERAL INFORMATION ABOUT BENDIX® AIR DISC BRAKE MAINTENANCE

When working on Bendix® Air Disc brakes, please note the following:

- Read and follow the Safe Maintenance Practices on page two.
- Depending on the particular axle, the technician may need to remove the caliper/carrier to allow sufficient access to perform the work.
- **CAUTION: When using a hoist to support the air disc brake, do not attempt to use the pad retainer bar as a bracing point as it is not designed to support the weight of the brake. Use instead a brace (or chain) wrapped around the entire brake to attach the hoist.**
- When replacing bearings — or for any other maintenance procedure where the technician needs to remove the caliper/carrier assembly from the vehicle to perform the maintenance — **replacement caliper/carrier bolts will be required.** Please note that due to the high torque required, the original bolts cannot be reused. The bolts are available from the vehicle manufacturer.
- **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 risk of valve stem shear and other compatibility issues.**

5.0.2 SERVICE DVD

Order part number **BW7356** for a DVD showing the full set of maintenance procedures included in this Service Data sheet.

Kit	See Section	Remove Brake Pads? Section 5.2	Remove Caliper/ Carrier from Vehicle? Section 5.3	Remove Actuator from Caliper? Section 5.4
Dust Shields	Section 5.1	Not Typically	NA	NA
Pad Kit (axle set)	Section 5.2	Yes	No	No
Caliper Kit (rationalized)	Section 5.3	Yes	Yes	Yes
Carrier Kit	Section 5.3	Yes	Yes	Yes
Service Actuator	Section 5.4	No	Not Typically	Yes
Spring Brake Actuator	Section 5.4	No	Not Typically	Yes
Tappet/Boot Kit (wheel end kit)	Section 5.6	Yes	Typically	Typically
Guide Pin, Seal and Boot Kit (wheel end kit)	Section 5.7	Yes	Typically	Typically
Hubs	Section 5.8	Yes	Yes	Yes
Splined Disc® Rotor Attaching Kit	Section 5.9	Yes	Yes	Yes
Rotor	Section 5.10	Yes	Yes	Yes

TABLE 3 - ***OTHER REQUIRED SECTIONS FOR MAINTENANCE KITS***

5.1 AIR DISC BRAKE SHIELD KIT

5.1.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

Note: Most torque plates manufactured after January 1, 2007 have the required torque plate tabs to permit these shields to be mounted.

This shield kit includes a brake pad shield, a rotor shield and the required attaching hardware for use in Bendix® ADB22X™ and ADB22X-V™ Air Disc Brake applications where external contamination and excessive road debris is a concern. Brake pad and rotor shields can greatly reduce damage and/or premature wear of pads and rotors under these conditions.

During installation, verify that once the shield(s) are installed they will not come into contact with any vehicle components, suspension, housings, etc. through the full range of motion of the wheel. Keep in mind the particular use of the vehicle, the orientation of the brake on the axle and torque plate, the proximity of other axles, and/or the wheel/tire being used.

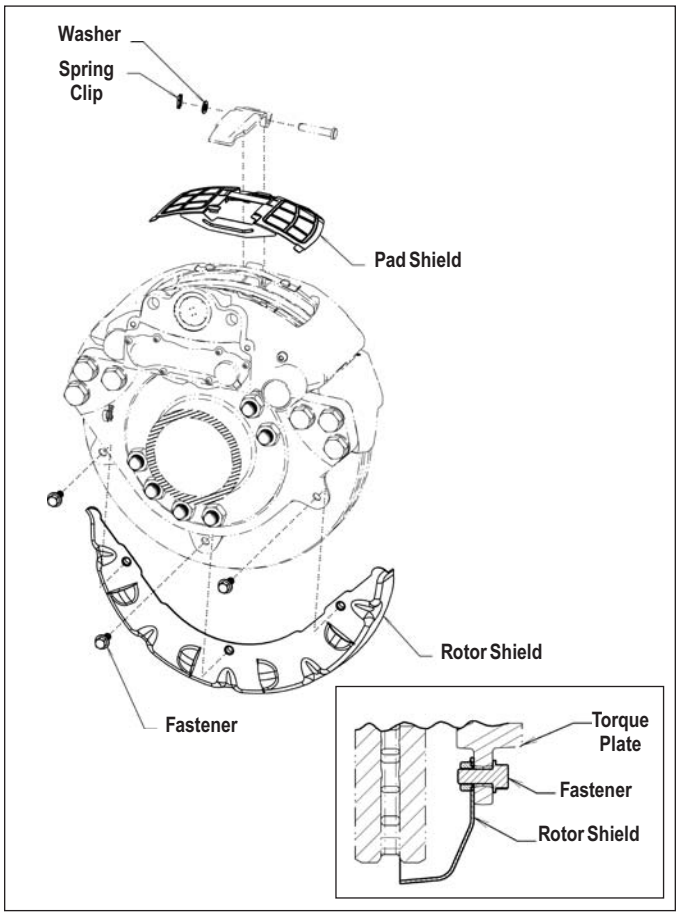


FIGURE 31 - ***DRIVE OR STEER AXLE EXPLODED VIEW WITH INSET SHOWING ROTOR SHIELD INSTALLATION***

5.1.2 Remove and discard the spring clip and washer from the pad retainer pin. Remove and retain the retainer bar and retainer pin. Position the pad shield as shown and re-insert the retainer bar. Install the retainer pin. Use the included spring clip and washer to secure the retainer pin. Check that the pad shield is held securely in place by the retainer bar. *See Figures 31 or 32.*

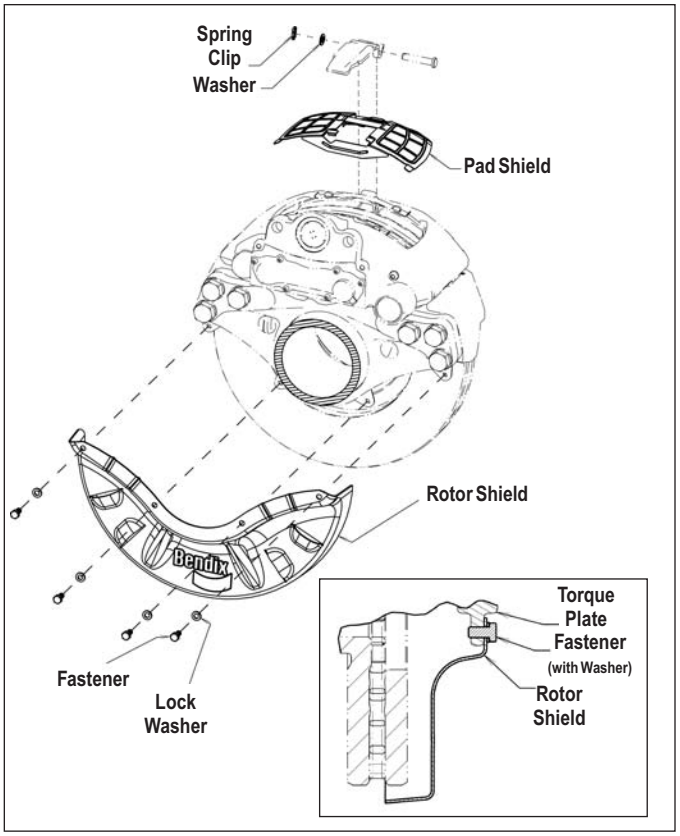


FIGURE 32 - ***TRAILER AXLE EXPLODED VIEW WITH INSET SHOWING ROTOR SHIELD INSTALLATION***

5.1.3 **Drive or Steer Axle Rotor Shields** (*See Figure 31*). Position the rotor shield *between the torque plate and the rotor*. The supplied cap screws pass through the mounting tabs in the torque plate and install into the shield. Torque cap screws to 44 Ft. Lbs. (528 in. lbs.).

5.1.4 **Trailer Axle Rotor Shields** (*See Figure 32*). Position the rotor shield with *the torque plate between the shield and the rotor*. With one (supplied) lock washer in place on each cap screw, pass the screws through the shield before mounting onto the threaded torque plate holes. Torque the cap screws to 24 Ft. Lbs. (288 in. lbs.).

Note: The installation of air disc brake shields does not eliminate the need for periodic maintenance and inspection of the air disc brake and entire wheel end for damage and/or wear. In addition, the truck and trailer manufacturer's specific criteria for the brake shield requirements on air disc brakes should be consulted before either installing or removing air disc brake shields from a wheel end(s).

5.2 PAD REPLACEMENT

5.2.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

The Bendix DVD (BW7356) shows this procedure.

Important: If the vehicle is equipped with spring brakes, cage the spring brakes on all axles to be worked on. Consult the vehicle manufacturer's instructions as necessary. *For Bendix piston-style, see Section 5.4.*

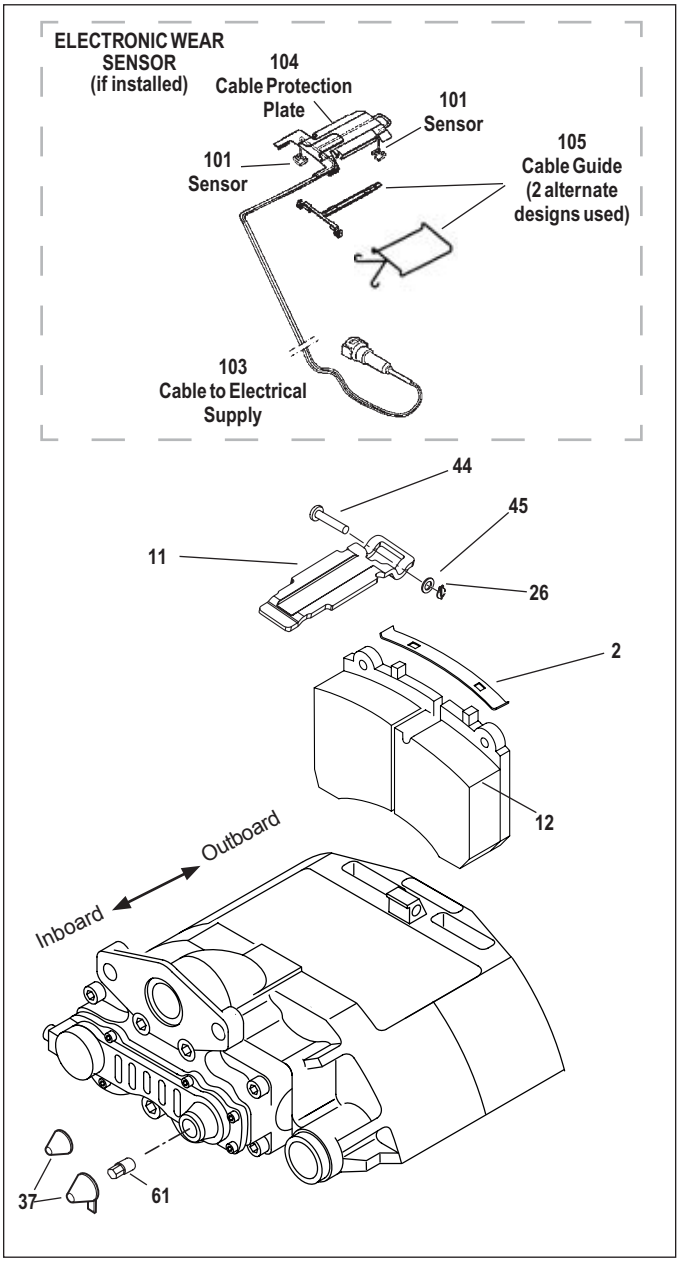


FIGURE 33 - ***PAD REPLACEMENT***

5.2.2 Raise the complete axle to be worked on until the tires clear the ground. See the vehicle maintenance manual instructions for removing the wheels.

5.2.3 If the air disc brake is equipped with an electronic wear sensor indicator *(see top of Figure 33)*, remove and retain the mounting hardware for the cable protection plate. The cable protection plate can then be set aside while servicing the pads. Note the position of the sensors in the brake pad channels, and carefully remove them. In most cases you do not need to release the cable connector in order to move the sensors away from the pad installation work area. Inspect the wear sensors - replace if damaged or abraded.

5.2.4 *See Figure 34.* Remove and discard the pin retention clip (26) and washer (5).

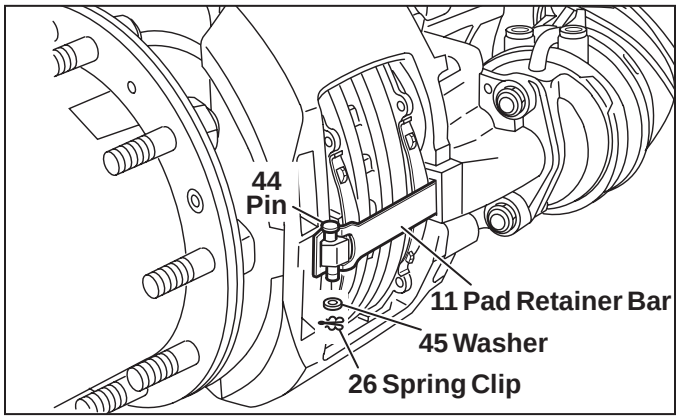


FIGURE 34 - ***PAD RETAINER BAR REMOVAL***

5.2.5 While pressing against the pad hold down bar, remove the pad retainer bar pin (11). Discard the hold down bar.

5.2.6 With the spring brake released (or caged), remove the adjuster cap (37) using the tab, taking care not to move the shear adapter (61). Note: Two sizes of adjuster cap are supplied in kits; use the same size as before in step 5.2.20.

5.2.7 Inspect the shear adapter (61). If significant corrosion and/or damage is present, remove the adjuster adapter using needle-nose pliers and replace with the adapter supplied in the kit and clean as necessary.

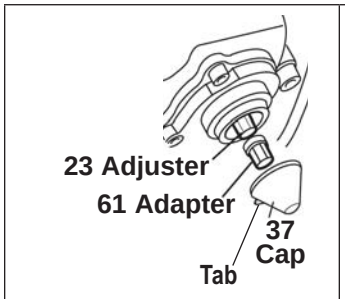


FIGURE 35 - ***EXPLODED VIEW OF ADJUSTER AND ADAPTER***

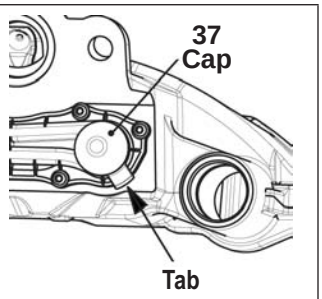


FIGURE 36 - ***CAP INSTALLED: TAB LOCATION***

For illustration purposes, the exploded view (Figure 35) shows the adjuster (23) and shear adapter (61) separated. When using the adjuster mechanism, always have the shear adapter installed on the adjuster.

CAUTION: Never turn the adjuster (23) without the shear adapter (61) installed. The shear adapter is a safety feature and is designed to prevent too much torque being applied. The shear adapter will fail (by breaking) if too much torque is used.

Note: For wheel-ends with spring brakes, if a shear adapter fails, always double-check to verify that the spring brake has been released (or caged). If the spring brake is applied, release or cage the brake (assure that the air system pressure is at least 90 PSI) and start the procedure again.

If the shear adapter fails, you may attempt a second time with a new (unused) shear adapter. In cases where a second failure of the shear adapter confirms that the adjustment mechanism is seized, the caliper must be replaced.

5.2.8 Use a 10 mm. six-point box wrench *(See Figure 37)* to turn the adjuster counterclockwise until sufficient space exists to remove the brake pads. A clicking noise occurs each time the adjuster turns.

CAUTION! Avoid overloading or damaging the adjuster shaft. Do not use an open-ended wrench since it may damage the adjuster shaft.

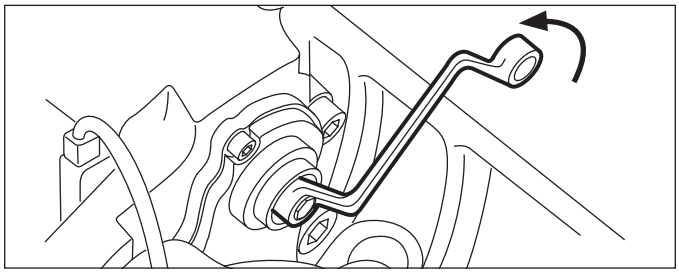


FIGURE 37 - *BACKING OFF THE ADJUSTER FOR PAD REMOVAL*

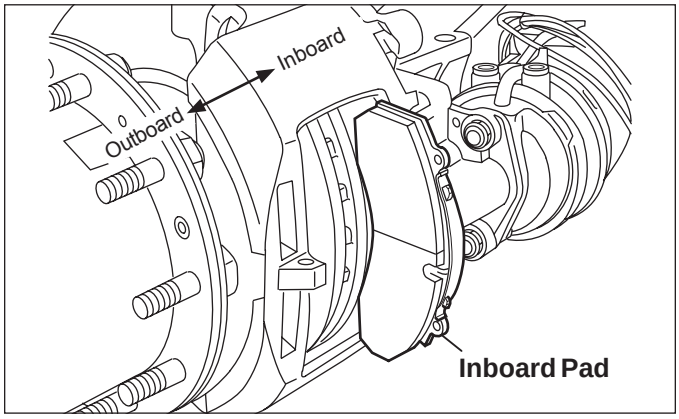


FIGURE 38 - *PAD REMOVAL*

5.2.9 *See Figure 38.* Move the caliper fully inward and remove the inboard pad, then move the caliper fully outward and remove the outboard pad.

5.2.10 Repeat the pad removal procedure for the other end of the axle.

5.2.11 To confirm that the guide pins are sliding freely, examine the pads just removed for uneven wear. Use these two inspections:

A. Check for uneven end-to-end pad wear. If the difference in wear is greater than 0.080 in. (2 mm.), replace the brake pads and also inspect the guide pins *(See Section 4.5)*.

B. Compare the thickness of the inboard and outboard pads of each set. If the difference between the inboard and outboard pad thickness is greater than 0.138 in. (3.5 mm.), replace the brake pads and inspect the guide pins *(See Section 4.5)*.

5.2.12 Inspect the Brake Rotor *(See Section 4.4).*

5.2.13 Inspect the guide pins *(See Section 4.5)*.

Important: To maintain optimal braking, Bendix strongly recommends that whenever brake pads are replaced, the complete axle set be replaced together. Use only pads which are permitted by the vehicle manufacturer, axle manufacturer, and/or disc brake manufacturer. Failure to comply with this may invalidate the vehicle manufacturer's warranty.

Before installing the brake pads, use the adjuster to fully retract the tappets to provide adequate clearance.

5.2.14 Clean the surfaces that will come in contact with the brake pad.

Caution: When installing pads and retaining springs, where appropriate, use heavy duty gloves and always keep fingers away from potential pinch hazard areas.

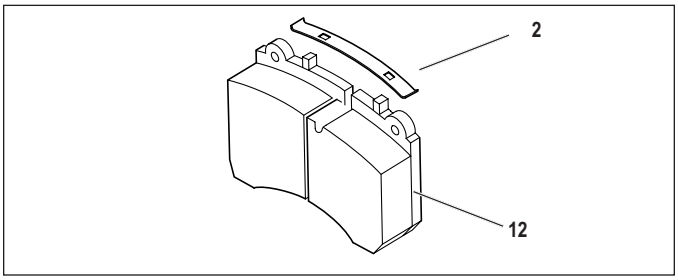


FIGURE 39 - *PAD RETAINING SPRING INSTALLATION*

5.2.15 Install the pad retaining springs(2) onto the brake pads(12) by inserting one end of the spring onto the lug at the top of the brake pad *(See Figure 39).* Carefully apply enough force to permit the second lug to fully engage, taking care to keep fingers etc. away from the spring as it seats.

5.2.16 Pull the caliper fully outward and install the outboard pad. Move the caliper fully inward and install the inboard pad.

5.2.17 To reinstall wear indicators (if used): Insert the wear sensors into position in the new brake pads. Route the sensor cable through the cable protection plate channel and secure the plate with the mounting hardware retained at disassembly. *(See Section 5.2.)*

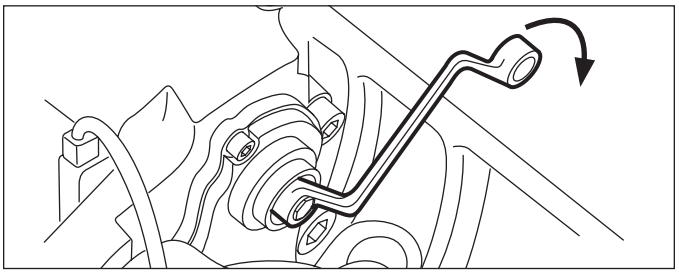


FIGURE 40 - *RUNNING CLEARANCE ADJUSTMENT*

5.2.18 Using a 10 mm. six-point box wrench, turn the Shear Adapter (61) **clockwise** until the pads contact the rotor. Note: Do not use an open-ended wrench as this may damage the adapter. *(See Figure 40)*.

5.2.19 Using the same tool, turn the Shear Adapter (61) **counter-clockwise** and listen for the sound of 3 clicks as the mechanism backs-off (increases) the running clearance. *(See Figure 37).*

5.2.20 Select the correct replacement adjuster cap from those supplied with the kit. Lightly grease adjuster cap with Renolit HLT2 white grease (part number I I14525) and install the cap.

5.2.21 Push the new pad retainer bar (11) into the groove of the caliper. Press down on the pad retainer bar, and insert the pad retainer pin (44), with the pin pointing downwards, where possible. Install the supplied washer (45) and then the spring clip (26). *(See Figure 34).*

5.2.22 Apply and release the brakes. The hub should turn easily by hand after applying and releasing the brake.

5.2.23 Re-check the running clearance. Readjust if necessary.

5.2.24 Reinstall the wheel, following the vehicle manual instructions.

⚠ WARNING!

The brake pads and rotor must be maintained within the recommended wear limits. Failure to monitor wear and replace the brake pads and rotor when required may result in diminished brake performance.

5.3 CALIPER/CARRIER/ACTUATOR ASSEMBLY

CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.

CAUTION: When using a hoist to support the air disc brake, do not attempt to use the pad retainer bar as a bracing point. It is not designed to support the weight of the brake. Use instead a brace (or chain) wrapped around the entire brake to attach the hoist.

5.3.1 In all cases check that the current hose routing arrangement does not restrict the full travel of the caliper before beginning work on the assembly.

5.3.2 Remove the brake pads **(***See Section 5.2***).**

5.3.3 *(See Section 5.4)***.** If the actuator used is a spring brake, following the manufacturer's guidelines, cage the spring. With all air pressure drained from the system, disconnect the air hoses from the brake chamber.

Vertical Mounting Bolt Style

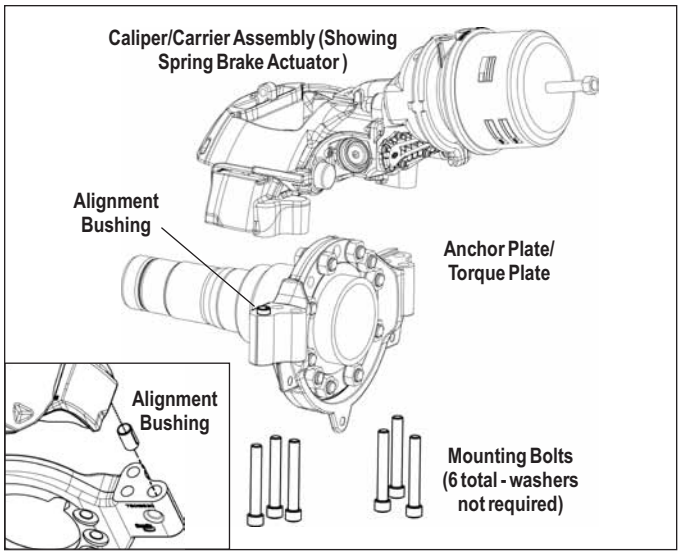


FIGURE 41 - *VERTICAL MOUNT CALIPER/CARRIER*

5.3.4 *See Figure 41.* Supporting the air disc brake by necessary means, remove the six (6) mounting bolts/washers and discard. Note: Bendix strongly recommends that during re-assembly these bolts are replaced - see your vehicle manufacturer for replacement hardware. Lift the caliper up off the anchor plate.

The vertical bolt assembly includes an alignment bushing. **This bushing must be saved for re-use during re-assembly of the brake.** The bushing mounts in the torque plate and maintains the correct alignment of the brake assembly relative to the rotor.

5.3.5 If the brake assembly does not separate from the anchor plate it may be helpful to install an M16X2.0 screw longer than 120 mm at the bushing locations and tap the end of the bolt with a hammer to free the brake assembly. Remove the assembly.

Axial Mounting Bolt Style

5.3.6 Disconnect the air hose(s) to the brake chamber. *See Figure 42.* Supporting the air disc brake by necessary means, remove the six bolts attaching the brake to the anchor plate and remove the caliper/carrier assembly from the vehicle.

Note: Bendix strongly recommends that during re-assembly these bolts and washers are replaced. See your vehicle manufacturer for replacement hardware. Remove the assembly.

Re-installation (Both Styles)

5.3.7 Supporting the air disc brake by necessary means, attach the brake to the anchor plate using six (new) bolts. Torque to vehicle manufacturer's specifications. If torque values and bolts are not specified by the vehicle manufacturer, then select a replacement bolt as shown in Table 4.

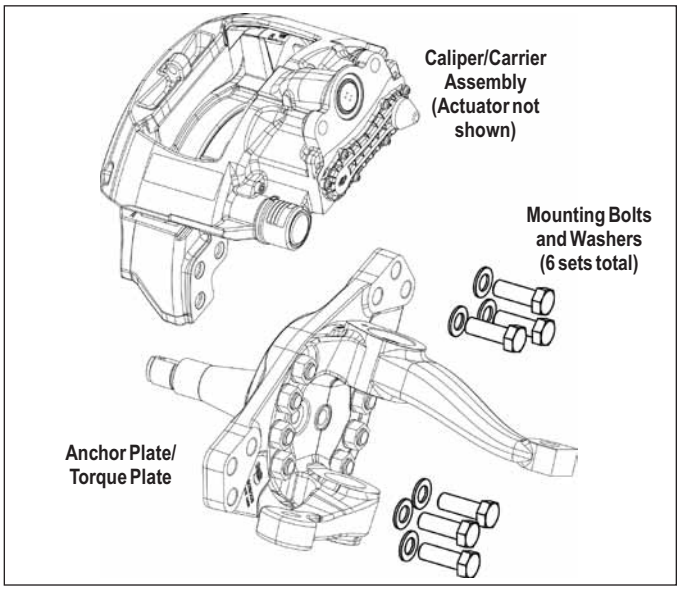


FIGURE 42 - *AXIAL MOUNT CALIPER/CARRIER*

5.3.8 Re-install the air hoses *(See Section 5.4.8-9) and check for leaks*.

5.3.9 Inspect and re-install the pads *(See Section 5.2)*.

Air Disc Brake Attachment Hardware		
Torque Plate Manufacturer	Fastener	Torque
Bendix Axial Carrier Torque Plate 	Fastener: M20 x 2.5 x 60 mm Class 10.9 ***Washer: Requires HARDENED 3 mm (minimum thickness) for each bolt.***[1] ***If the vehicle is using a Bendix manufactured Axial Anchor Plate, with a thickness of 1.14 in. (29 mm) where these bolts are assembled, then a bolt with an overall length of 2.36 in. (60 mm) will meet these requirements***	Use the manufacturer's recommendations. If unavailable, use phosphate and oil finish fastener. Pre-Torque: 20-60 ft-lbf [27-81 N·m] Final Torque: 350-400 ft-lbf [475-542 N·m]
Bendix Vertical Carrier Torque Plate 	Fastener: M16 x 2.0 x 110 mm, Class 10.9 ***Washer: None required.***	Use the manufacturer's recommendations. If unavailable, use plain and oil finish fastener. Torque: 200-220 ft-lbf [271-298 N·m]
Trailer Torque Plate	Fastener: M20 x 2.5 x L Class 10.9 Length determination: L = Torque Plate (TP) thickness + Carrier engagement + Washer thickness L_{min} = TP thickness + 24 mm + 3 mm L_{max} = TP thickness + 29 mm + 3 mm ***Washer: Requires HARDENED 3 mm (minimum thickness) for each bolt.***[1]	Use the manufacturer's recommendations. If unavailable, use phosphate and oil finish fastener: Pre-Torque: 20-60 ft-lbf [27-81 N·m] Final Torque: 350-400 ft-lbf [475-542 N·m]
Table Note: 1. The washer outside diameter must be less than 1.1in. (28.5 mm).		

TABLE 4 - *TORQUE PLATE FASTENERS AND TORQUE RECOMMENDATIONS (SEE MANUFACTURER'S RECOMMENDATIONS)*

5.4 SPRING OR SERVICE BRAKE

5.4.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

5.4.2 **Use the spring brake manufacturer's recommended safety practices in all cases.**

Some spring brake and vehicle manufacturers permit caging the spring brake while the spring brake is engaged.

THE FOLLOWING INSTRUCTIONS ARE FOR BENDIX® BRAND PISTON-STYLE ACTUATORS.

5.4.3 With the vehicle on a level surface and the wheels properly chocked, apply air to release the spring brakes (parking brakes) by using the dash-mounted air control valve. Back out the release bolt (Figure 43, arrow "D"), using a maximum torque of 26 ft. lbs. (35 N·m) to cage the air released spring force on the push rod.

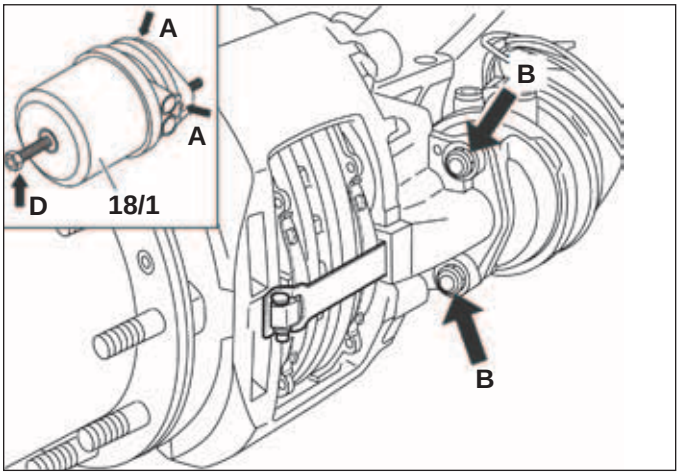


FIGURE 43 - ***ACTUATOR SPRING CAGING AND REMOVAL***

5.4.4 Exhaust the air from the brake chambers by using the dash-mounted air control valve. With all air pressure drained from the system, disconnect the air hoses from the brake chamber. While supporting the brake chamber in position, remove and discard the brake chamber mounting nuts (Figure 45, arrows marked "B"). Remove the brake chamber.

5.4.5 Re-installation. Before installing the brake chamber, the actuator flange *(See Figure 46, arrow "C")* must be cleaned and inspected. Consult the vehicle manual. The spherical cup in the lever (19) must be greased with white grease (Part No. II14525 or K021964). Add grease to the rubber gasket on the chamber.

CAUTION: Do not use grease containing molybdenum disulfate.

5.4.6 The seal, as well as the push rod area, must be clean and dry.

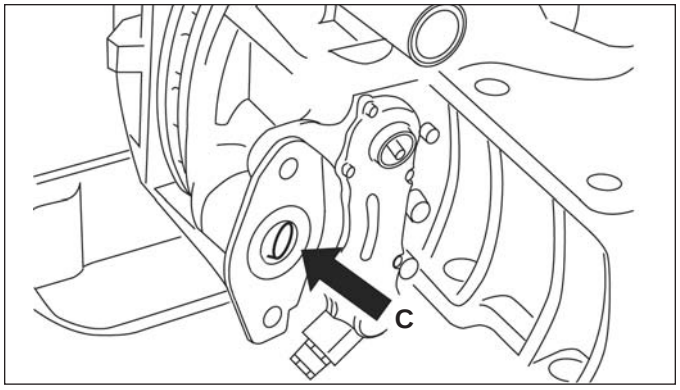


FIGURE 44 - SPRING BRAKE INSTALLATION

CAUTION: Do not use brake chambers with seals that have a thickness less than 0.12 in. (3 mm). Use only actuators which are recommended by the vehicle manufacturer.

5.4.7 Install the brake chamber using new self-locking nuts (EN ISO 10513). Alternately tighten both the nuts step by step up to a final torque of 133 ± 7 ft. lbs (180 ± 10 N·m). **Bendix strongly recommends that new nuts be used.**

5.4.8 Re-connect the air hose(s) and be sure that each hose is not twisted or in contact with moving vehicle components. The air hose routing must allow for full caliper travel. Note that for spring brake service chambers the ports are indicated by: "11" Service Brake Port and "12" Spring Brake Port

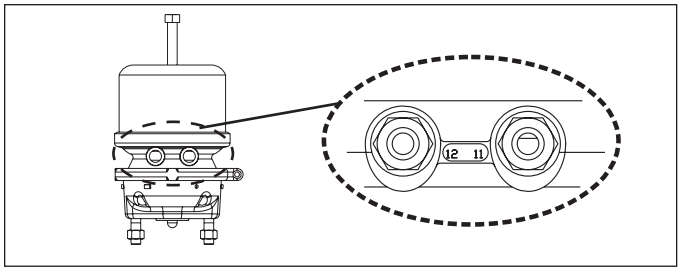


FIGURE 45 - ***PORT DESIGNATIONS***

Note: Where a new spring brake chamber is being installed, note that in some cases drain plugs are installed *(See Figure 43, arrows marked "A").* Where drain plugs are present, after installation, remove whichever plug is at the lowest position. The selected drain hole must be aligned downwards (or within ±30°) when installed on the vehicle. In the case of spring brake chambers, install the pads before uncaging the spring.

5.4.9 Before returning vehicle to service, with the system pressurized, using a soap solution, check for air leakage. Minimal leakage in the area around the diaphragm is permitted (100 SCCM), and a one-inch bubble in one minute at the hose fitting is acceptable. If abnormal leakage is detected, the diaphragm must be replaced, or fitting adjusted, respectively.

5.5 TAPPET & BOOT ASSEMBLIES, AND TAPPET INNER SEAL REPLACEMENT

5.5.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

In some cases, the technician will need to remove the caliper carrier assembly from the vehicle. *(See Section 5.3.)* Note that new bolts (available from the vehicle manufacturer) will be needed for re-installation.

Important: If the vehicle is equipped with spring brakes, cage the spring brakes on all axles requiring work. Consult the vehicle manufacturer's instructions as necessary. This procedure may be carried out with the air disc brake installed on, or removed from, the vehicle. In cases where the caliper/carrier assembly is removed from the vehicle, NEW fasteners must be used and properly torqued during re-installation. Use only fasteners approved by the vehicle manufacturer.

Note: This maintenance procedure uses specialized tools. The full Bendix air disc brake tool kit (K029164), or Ken-Tool kit (80000), includes the complete set of tools required for all permitted maintenance procedures. Alternately, for locations where only the tappet and boot replacement procedures will be performed, the smaller Bendix tool kit (K028829), or Ken-Tool kit (80001) will suffice. The DVD (BW7356) shows this procedure.

Bendix Number/ Ken-Tool Number	Description	Typical Tool View
T1 / KT01	Cup	
T2 / KT02	Handle for KT01 cup	
T3 / KT03	Swivel assembly (KT03-1 short body + KT03-2 brass disc + KT03-3 retaining spring)	
T4 / KT04	Long strut	
T9 / KT09	Flange	
T15 / KT015	Fork	
T24 / KT024	Black Nylon Disc	

TABLE 5 - ***TAPPET AND BOOT REPLACEMENT TOOLS***

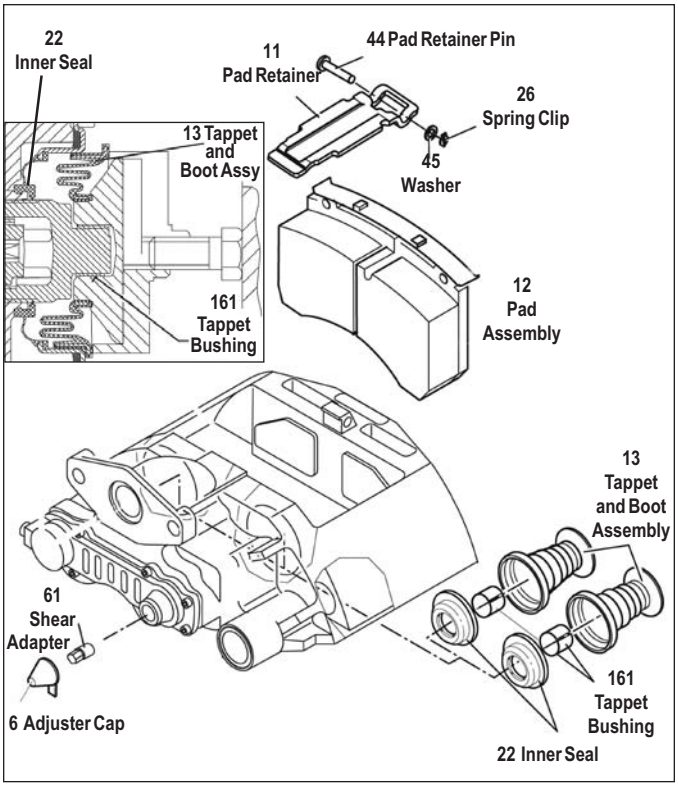


FIGURE 46 - ***ADB EXPLODED AND SECTION VIEWS***

5.5.2 Pad Removal: follow Sections 5.2.1-5.2.11 for removal of the brake pads.

5.5.3 Inspect the Brake Rotor *(See Section 4.4).*

Tappet and Boot Assembly (13) Removal

CAUTION: NEVER EXTEND THE TAPPET MORE THAN 1.75 in. (44.5 mm). ***See Figure 47.*** **Over-extending the tappet will result in the tappet losing engagement with the threads of the synchronizing mechanism. Since the mechanism can only be set at the manufacturing plant, the** ***caliper/carrier assembly must be replaced*** **if this happens.**

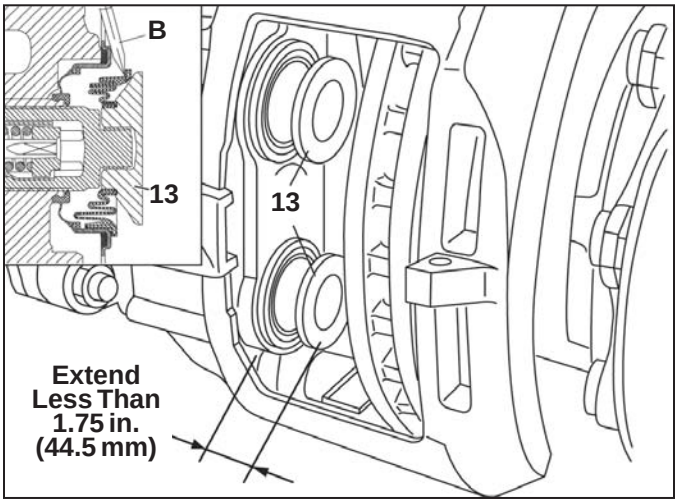


FIGURE 47 - ***PERMITTED TAPPET EXTENSION***

5.5.4 *See Figure 47.* Extend the tappets — less than 1.75 in. (44.5 mm) — by turning the shear adapter (61) clockwise. A screwdriver (callout "B" in

Figure 47 inset) should be used to move the boot and allow the wedge fork ("A" in Figure 48) to be inserted.

CAUTION: Do not insert the screw driver more than ¼ inch. Take care not to damage the inner sealing face (*see arrow "X" in Figure 48*). Gouges or grooves will prevent a good seal and will require that the caliper be replaced.

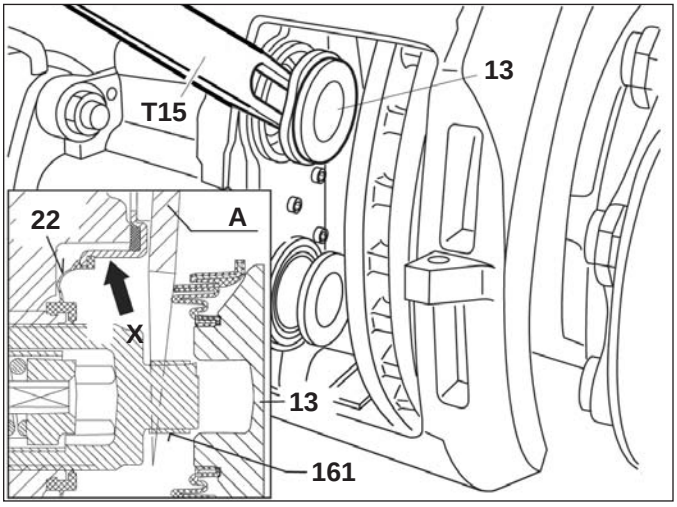


FIGURE 48 - *WEDGE TOOL USE*

5.5.5 The tappet and boot assemblies (13) can then be removed from the threaded tubes (16) by using the wedge fork (T15). *Be sure to orient the wedge tool with the tapered side towards the tappet.*

5.5.6 Remove the old tappet bushings (161).

5.5.7 Retract the threaded tubes by turning the shear adapter (61) counter-clockwise.

5.5.8 *See Figure 49.* Carefully remove the inner seal using one or two flat-blade screwdrivers as shown. Caution: Do not insert the screwdrivers so far that they come into contact with the threaded tubes. Damage to the threaded tubes would require that the brake be replaced.

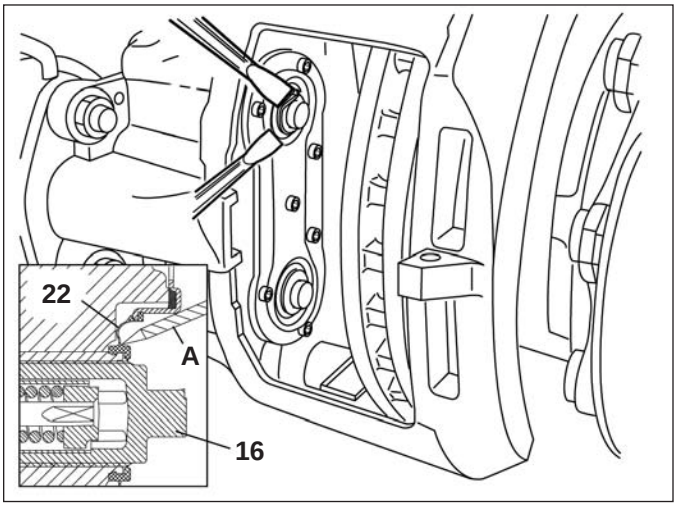


FIGURE 49 - *INNER SEAL REMOVAL*

5.5.9 Inspect the inner sealing face for damage. If damage is found that would cause the inner seals not to be able to seal properly, the caliper/carrier assembly must be replaced. Clean the area around the inner seal.

5.5.10 Inspect the threaded tubes (16). *See Figures 50 and 51*. Extend the tubes, but by less than 1.75 in. (44.5 mm), by turning the shear adapter (61) clockwise. Inspect the threads for rust, corrosion, or damage etc. If there is evidence of damage to the threads; significant rust; or corrosion, the caliper/carrier assembly must be replaced.

If the technician is working with the caliper on the vehicle, the technician may place a new brake pad (12) into the outboard gap to help avoid the loss of thread engagement of the threaded tubes. *See Figure 50.*

If the work is being carried out at a workbench, the technician may insert a 2.76 in. (70 mm) spacer *(See callout "E" in Figure 51)* into the caliper (1) to help avoid the loss of thread engagement.

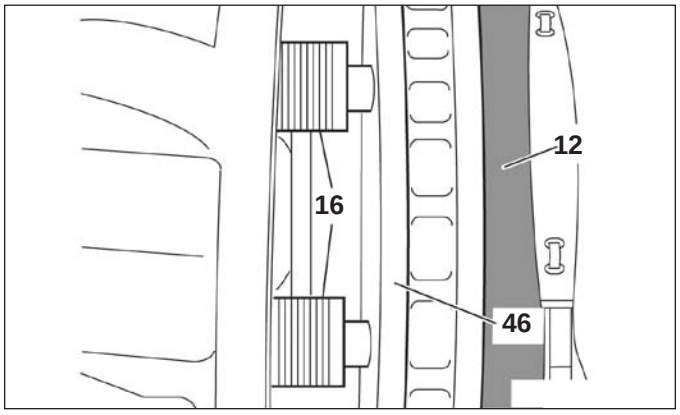


FIGURE 50 - *USE OF A NEW BRAKE PAD AS A SPACER*

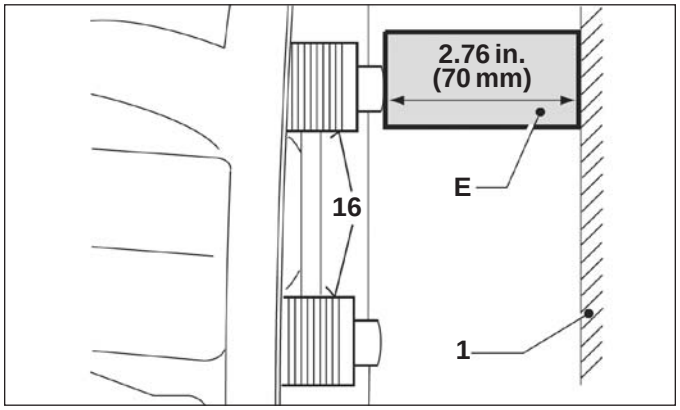


FIGURE 51 - *USE OF A SPACER (OFF-VEHICLE INSPECTION)*

5.5.11 For threads that are in good condition, grease the threads with white grease (Part No. II14525 or K021964). Before installing the replacement inner seals (22), retract the threaded tubes by turning the shear adapter (61) counter-clockwise.

Note: If the shear adapter fails while you are retracting the threaded tubes, you may try again with another (new) shear adapter. If this also fails, this indicates that the adjuster mechanism is damaged and the caliper must be replaced.

To install inner seals where the caliper is on the vehicle:

5.5.12 Position the replacement inner seal (22) over the threaded tube (16). *See Figures 52 and 53 for the tools and installation arrangement used.* Position the L1 (T3 + T9) with the short spacer (T3) in position as shown in Figure 53. Guide the tool over the end of the threaded tube (16). Install the new inner seal (22) into position by rotating the adjuster nut on the T3 portion of the tool, using an open-ended wrench.

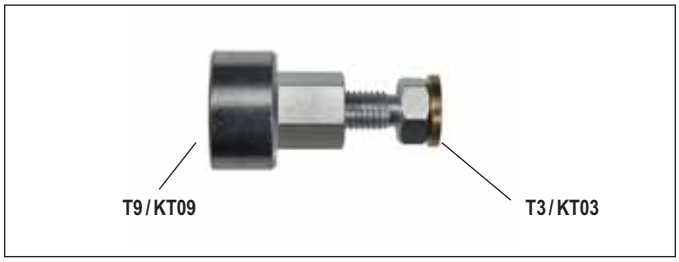


FIGURE 52 - *ON-VEHICLE INNER SEAL TOOL (L1)*

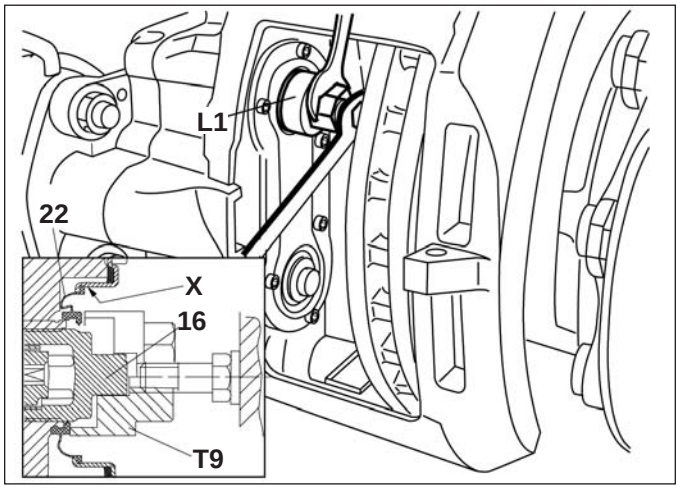


FIGURE 53 - *ON-VEHICLE INNER SEAL INSTALLATION*

To install inner seals where the caliper has been removed from the vehicle:

5.5.13 Position the replacement inner seal (22) over the threaded tube (16). *See Figures 54 and 55 for the tools and installation arrangement used.* The threaded tubes need to be retracted to allow the tool to be inserted. Use the combination tool L2 (T4 + T3 + T9) with the long spacer (T4) as shown in Figure 55. Since the installation tool is guided by the center post of the threaded tube, advance the tube a small amount to align the tool and the center post. Install the new inner seal (22) into position by rotating the adjuster nut on the T4 portion of the tool using an open-ended wrench.

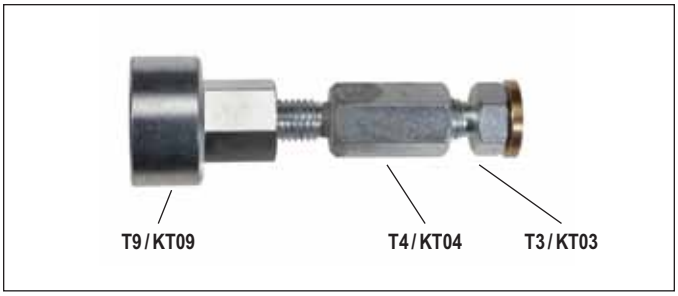


FIGURE 54 - *ON-VEHICLE INNER SEAL INSTALLATION TOOL (L2)*

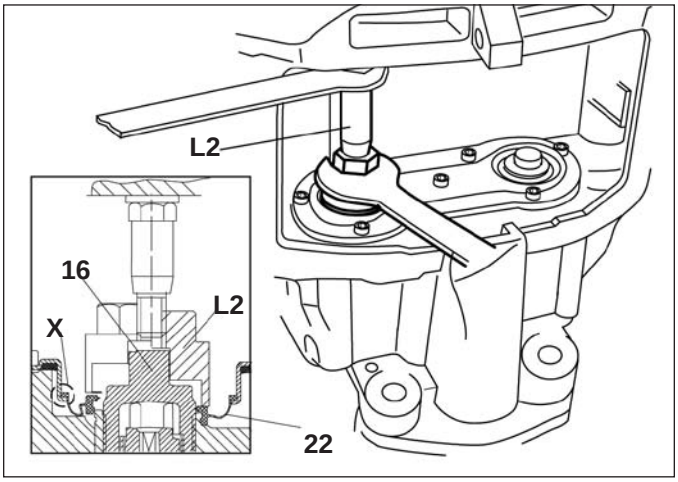


FIGURE 55 - *OFF-VEHICLE INNER SEAL INSTALLATION*

CAUTION: To confirm that the inner seal has been correctly installed, begin to extend the threaded tubes (16) by turning the shear adapter clockwise by 4-5 turns. Watch as the threaded tube extends. Inner seals that are installed correctly WILL NOT ROTATE as the threaded tube extends.

5.5.14 Note: Inspect the tappet/boot kit to determine if the tappets supplied are already pre-greased (a plastic cover should be present — be sure to remove the cover when installing the tappet). Only in the case of kits that are not pre-greased will the installer need to apply grease to the tappets. In all cases, the threaded portion of the tubes will need to be greased. Retract the threaded tubes.

5.5.15 Install the new tappet bushing (161) onto the center post of each threaded tube (16) by hand. By hand, ease the tappet bushings onto the center post of the threaded tubes and they will snap into position.

5.5.16 The sealing seat in the caliper for tappet and boot assemblies (13) must be clean and free of grease. Wipe the opening with a clean shop rag. Place a tappet and boot assembly (13) in position over the center post and tappet bushing.

To install tappet and boot assemblies where the caliper is on the vehicle:

5.5.17 *See Figures 56, 57 and 58.* Use tool B1, comprising tools T1, T2, and T3 to press the boot into position. The tool is then reversed, and the nylon disc (T24)

is inserted into the T1 “cup” (combination tool ‘B2’). Holding the T1 handle, turn the nut on the T3 tool to fully install the tappet onto the tappet bushing (161).



FIGURE 56 - *ON VEHICLE TAPPET AND BOOT INSTALLATION TOOL (B1 - WITH T24 INSTALLED, B2)*

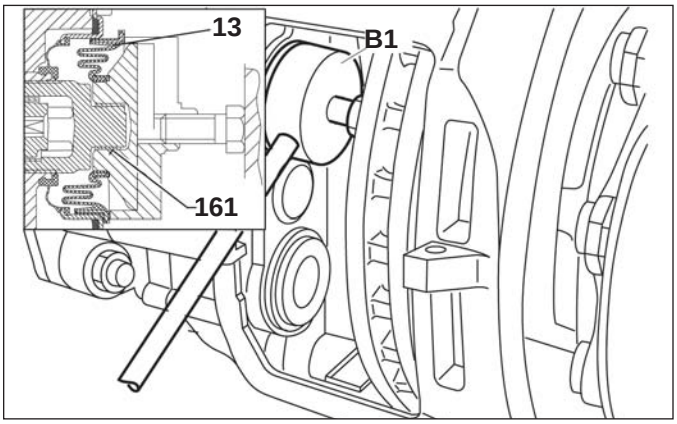


FIGURE 57 - *ON VEHICLE TAPPET BOOT INSTALLATION*

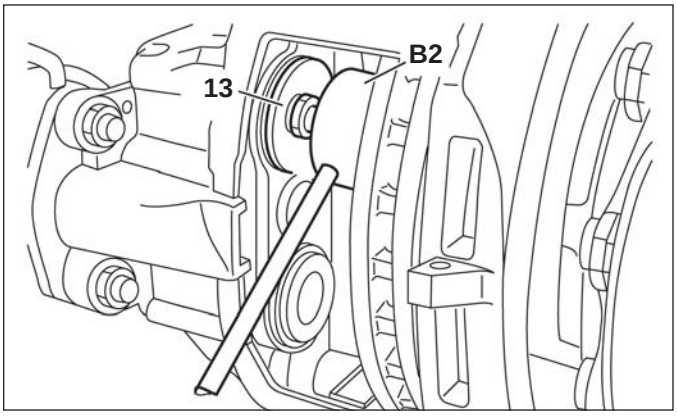


FIGURE 58 - *ON VEHICLE TAPPET INSTALLATION*

To install tappet and boot assemblies where the caliper is removed from the vehicle:

5.5.18 *See Figures 59, 60 and 61.* Retract the tappets, as needed, in order to have room to install the tappets. Use tool B3, comprising tools T1, T2, and T3 to press the boot into position. The tool is then reversed, and the nylon disc (T24) is inserted into the T1 “cup” (combination tool ‘B4’). Holding the T1 handle, turn the nut on the T3 tool to fully seat the tappet onto the tappet bushing (161).



FIGURE 59 - *OFF VEHICLE TAPPET BOOT INSTALLATION TOOL (B3, WITH T24 INSTALLED, B4)*

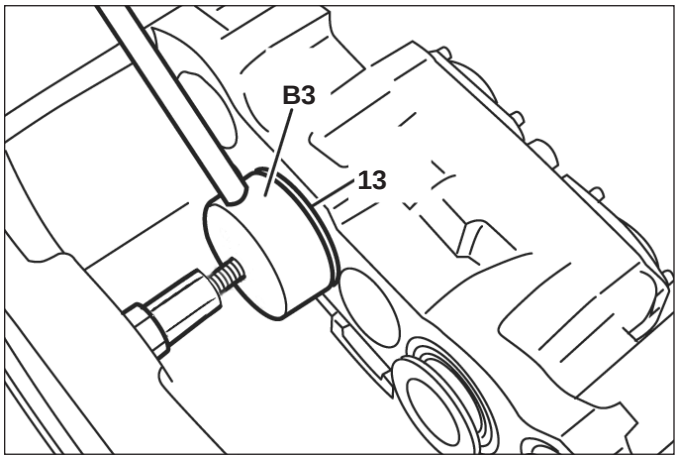


FIGURE 60 - *OFF VEHICLE TAPPET BOOT INSTALLATION*

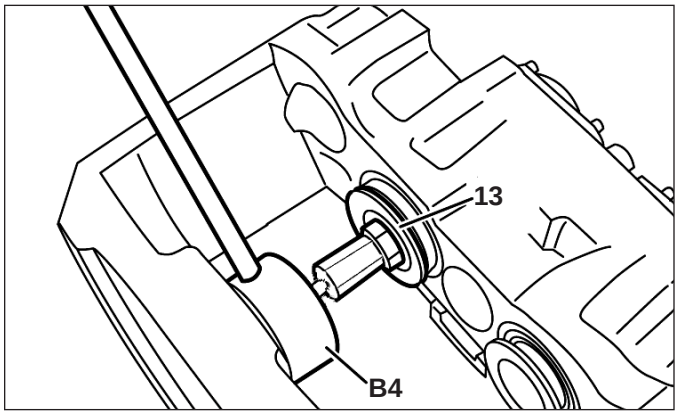


FIGURE 61 - *OFF VEHICLE TAPPET INSTALLATION*

5.5.19 Check that the tappets are firmly attached to the bushings by gripping and pulling lightly on them by hand. Confirm that the tappets are able to rotate a small amount on the tappet bushings by grasping and turning them by hand. Finally, using a box-end wrench on the shear adapter, extend the threaded tubes outward, and check that the boots are held in place. Retract the tappets.

5.5.20 Re-install the caliper/carrier assembly, if it was removed from the vehicle *(See Section 5.3)*.

5.5.21 Re-install the brake pads *(See Section 5.2).*

5.6 GUIDE PIN AND BOOT ASSEMBLIES

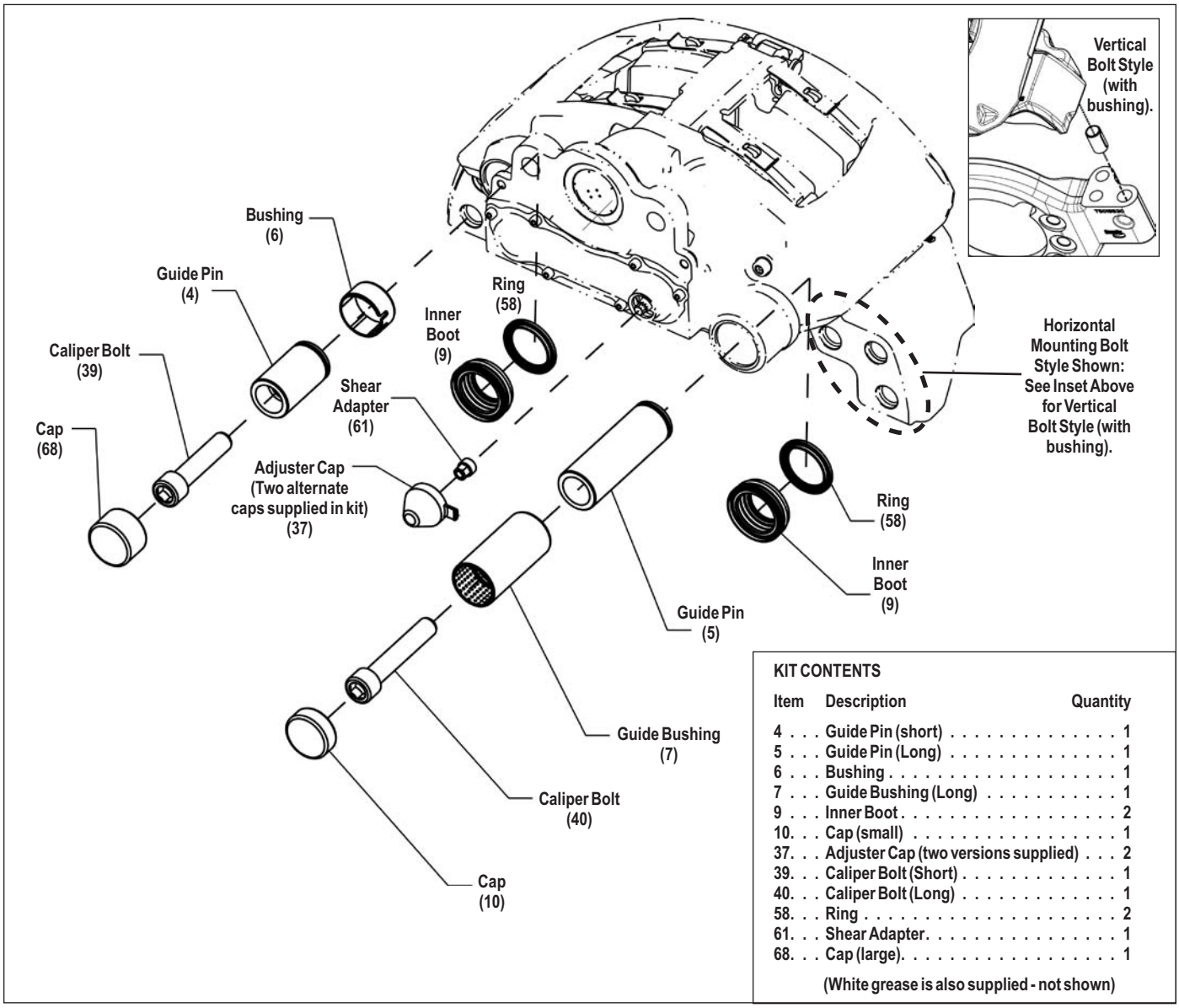


FIGURE 62 - ***GUIDE PIN EXPLODED VIEW***

The Bendix DVD (BW7356) shows this procedure.

5.6.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

Important: If the vehicle is equipped with spring brakes, cage the spring brakes on all axles to be worked on. Consult the vehicle manufacturer's instructions as necessary. ***For Bendix® brand piston-style spring brake chambers, see Section 5.4.***

These procedures are typically carried out with the caliper/carrier removed from the vehicle (may be carried out with the air disc brake installed). In cases where the caliper/carrier assembly is removed from the vehicle, NEW fasteners must be used and properly torqued during re-installation. Use only fasteners approved by the vehicle manufacturer.

Note: This maintenance procedure uses specialized tools. The full Bendix air disc brake tool kit (K029164), or Ken-Tool kit (80000), includes the tools needed for the guide pin and boot installation. See Table 6.

Note that a smaller Bendix tool kit (K029107), or Ken-Tool kit (80002) may be used where only the guide pins will be serviced.

Bendix Number/ Ken-Tool Number	Description	Typical Tool View	Bendix Number/ Ken-Tool Number	Description	Typical Tool View
T05 / KT05	1-3/8 in. diameter disc		T14 / KT14	Brass nut	
T06 / KT06	1-1/2 in. diameter disc		T16 / KT16	Dimpling tool	
T07 / KT07	2 in. diameter sleeve		T20 / KT20	8 in. bolt	
T08 / KT08	2-1/8 in. diameter disc		T21 / KT21	Half Sleeve	
T10 / KT10	8 in. bolt		T26 / KT26	Cap installation tool	
T12 / KT12	3-7/8 in. long sleeve		T27 / KT27	Cap installation tool	
T13 / KT13	10 in. bolt				

TABLE 6 - *BENDIX® ADB22X™ AIR DISC BRAKE GUIDE PIN AND SEALS REPLACEMENT TOOLS. (A WASHER IS ALSO INCLUDED)*

5.6.2 Remove the wheel. Refer to the vehicle manufacturer's recommendations.

5.6.3 Remove the brake pads. *See Section 5.2.*

5.6.4 In most cases, the actuator should be removed. *See Section 5.4.* In the case of spring brake actuators, they should be caged before removing the brake assembly.

5.6.5 In nearly all cases, the air disc brake caliper/carrier will need to be removed from the vehicle in order to complete this procedure. *See Section 5.3.*

5.6.6 Place the brake on a workbench and, using a vice, secure it by the carrier.

5.6.7 Use a small chisel or similar tool to punch a hole close to the center of the guide pin cap (10) **of the short guide pin,** taking care to only insert the chisel a small amount. Using the hole just made, pry the cap off and discard. *See Figures 63-65.*



FIGURE 63 - *PUNCH GUIDE PIN CAP (10)*



FIGURE 64 - *GUIDE PIN CAP (10) HOLE*

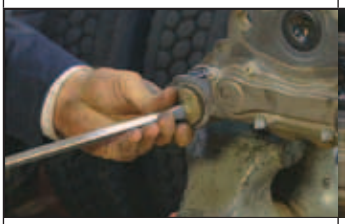


FIGURE 65 - *PRY TO REMOVE GUIDE PIN CAP (10)*



FIGURE 66 - *USING SMALL CHISEL TO REMOVE GUIDE PIN CAP (68)*

5.6.8 Remove the other cap (68) **that covers the long guide pin**, by using a small chisel and hammer to apply light blows to the cap, with the chisel aimed away from the casting. *See Figure 66.* Discard both caps.

5.6.9 Using a 14 mm hex bit socket, remove and discard the two caliper bolts (39) and (40). *See Figure 67.* By hand, retract both guide pins slightly and then remove the caliper from the carrier.



FIGURE 67 - *REMOVE THE CALIPER BOLTS*

The guide pins are now only held by the retaining rings (58).

5.6.10 Remove the boot retaining rings (58) and the guide pins (39) and (40). Use a screwdriver to pry out the inner boots (9). *See Figure 68.* Discard the removed items.



FIGURE 68 - *REMOVE THE RETAINING RINGS, GUIDE PINS, AND BOOTS*

5.6.11 Clean the caliper upper and lower surfaces around the bushings.

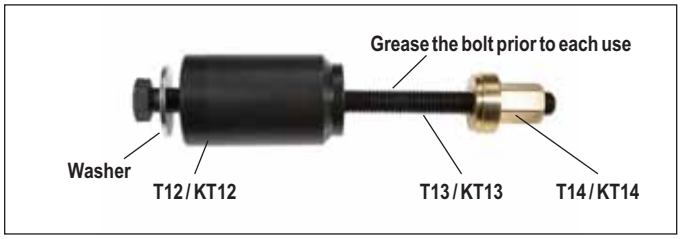


FIGURE 69 - *BRASS BUSHING REMOVAL TOOL*

5.6.12 Prepare to remove the brass bushing used in the long guide pin side. Assemble the long bolt (T13), washer, and sleeve (T12) as in Figures 69 and 70.

5.6.13 Apply grease to the bolt and — after inserting through the guide pin channel — engage the brass nut (T14). Always double-check that the brass nut is correctly in place in the bushing before beginning to extract the bushing.



FIGURE 70 - *INSTALL THE REMOVAL TOOL*

5.6.14 Turning the bolt at the top, draw the brass nut up, bring the brass bushing up and out of the channel. Discard the bushing.



FIGURE 71 - *REMOVE THE LONG GUIDE PIN*

Caution: Keep the removal tool exactly aligned with the guide pin channel to permit the bushing to be removed. *See Figure 72.*

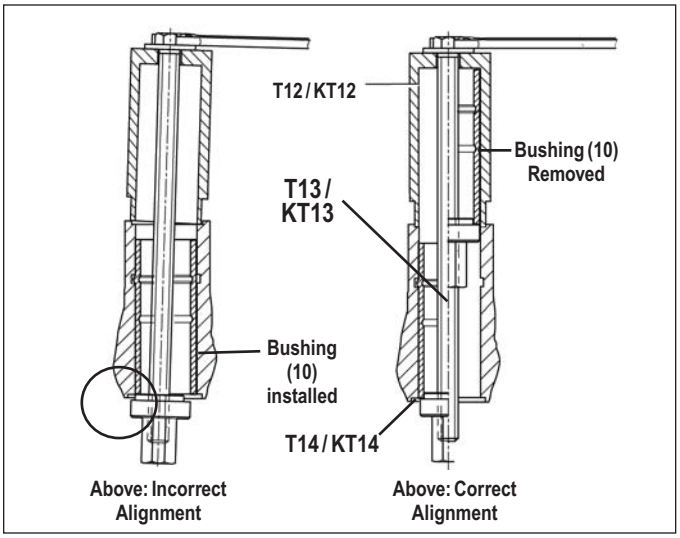


FIGURE 72 - *KEEP THE CORRECT ALIGNMENT*

5.6.15 Prepare to remove the short guide pin bushing by locating the bushing (6) tab, and using a small chisel (narrower than the tab) or similar tool, remove the tab as shown in Figure 73, by striking low on the base of the tab.



FIGURE 73 - *REMOVE THE TAB THAT HOLDS THE BUSHING IN POSITION*

Remove the tab with a magnet and use a clean shop cloth to remove any excess debris. Note that in some cases, the tab may be in the opposite (outer) slot in the bore.

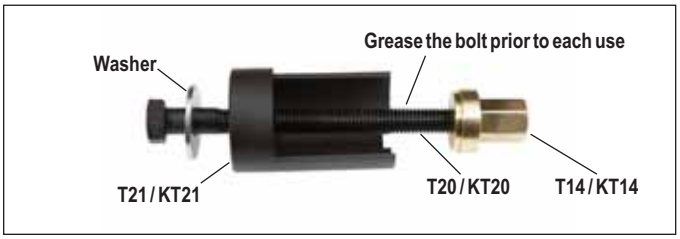


FIGURE 74 - *SHORT GUIDE PIN REMOVAL TOOL*

5.6.16 Use the tool combination shown in Figures 74 and 75 (comprising T14, T20, T21, and a washer) to remove the bushing (6). Screw nut (T14) onto the assembly by hand, then tighten the bolt (T20) using a box end wrench to draw out the bushing. Discard the removed bushing, and verify that the bore is clean by wiping with a shop cloth.

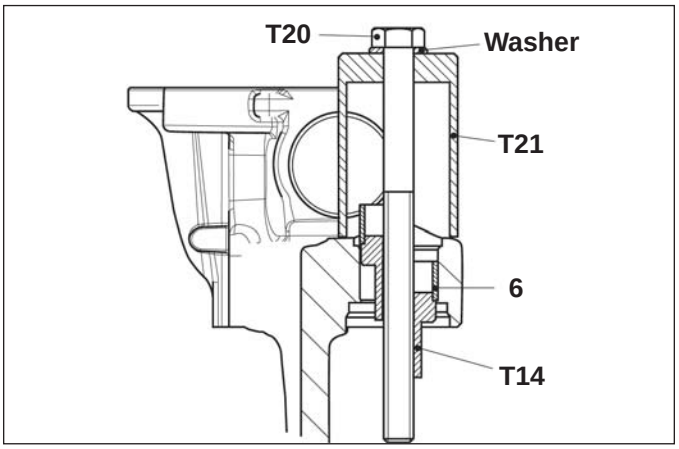


FIGURE 75 - ***SECTIONAL VIEW: SHORT GUIDE PIN BUSHING REMOVAL***

Installation of the Fixed Guide Pin Brass Bushing

5.6.17 Clean the caliper upper and lower surfaces around the bushings.

5.6.18 Clamp the carrier in a vise so that the guide channel is vertically oriented.

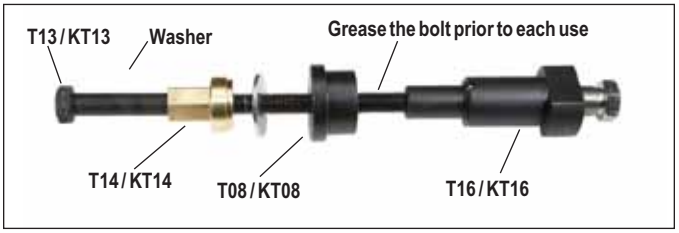


FIGURE 76 - ***LONG GUIDE PIN BUSHING INSTALLATION AND DIMPLING TOOL***

5.6.19 Place the washer and thread the brass nut (T14) on to the bolt (T13) followed by the flange (T08). *See Figure 76.*

5.6.20 Place a new brass guide bushing (7) on the dimpling tool (T16) and insert it into the caliper bore.

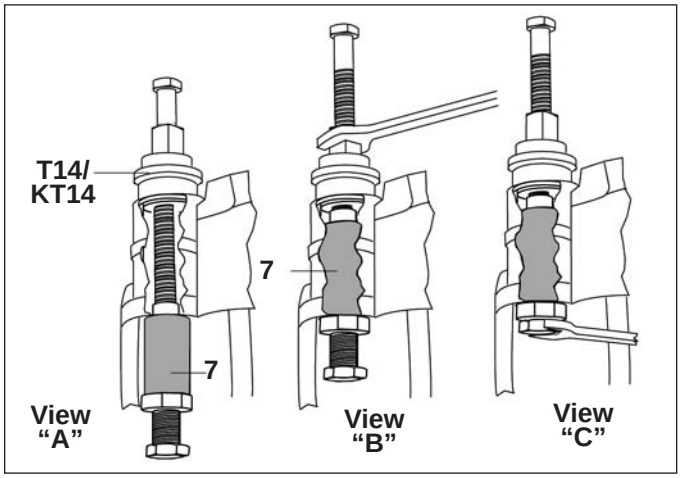


FIGURE 77 - VIEW "A" AND "B": ***DRAW THE BRASS BUSHING INTO POSITION. VIEW "C": LOCK THE BUSHING INTO POSITION***

5.6.21 Check that the flange (T08) is in an upright position at the top of the caliper recess as you draw the brass bushing (7) up, by turning the brass nut (T14), until the dimpling tool bottoms on the caliper. When it reaches the correct position, the brass bushing extends out of the guide pin channel 0.039 in. (1 mm.).

5.6.22 With the dimpling tool (T16) in position, tighten the screw in its base until it contacts the dimpling screw housing. The movement of this screw forces three points outwards, leaving indentations in the brass bushing. *See Figure 77, view "C".*

5.6.23 Unscrew the dimpling screw out approximately 0.75 inches (20 mm.). Loosen the brass nut (T14) and rotate the dimpling tool (T16) 60 degrees. Repeat the dimpling process by tightening the brass nut (T14) and then tighten the dimpling screw until it contacts the dimpling screw housing. Back out the dimpling screw approximately 0.75 inches (20 mm.). The brass bushing (7) is now held in position by the six dimples made by the tool.

5.6.24 Remove the installation tools and check the brass bushing (7), removing any burrs, being careful not to leave any metal filings in the bushing. Coat the inside of the bushing with the white grease included in the kit.

Installation of the Floating Guide Pin Bushing

5.6.25 To install the bushing (6) into the short guide pin side, first inspect the bore for corrosion, damage etc. Clean as necessary.

5.6.26 Place the new bushing (6) in position so that **when drawn into position, the tab will align with the slot in the casting**. With the tab aligned, place tool (T14) over the bushing and tap lightly. To position the bushing, *see Figure 78.*



FIGURE 78 - POSITION *THE NEW BUSHING*

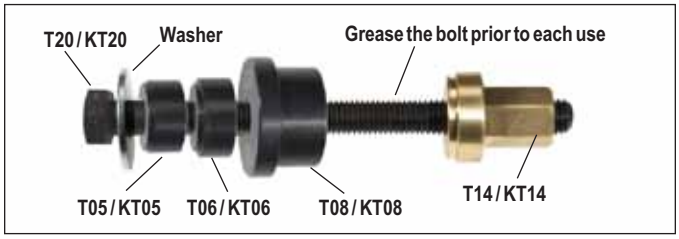


FIGURE 79 - *SHORT GUIDE PIN BUSHING INSTALLATION TOOL*

5.6.27 Use the tool combination shown in Figure 79 to draw the bushing (6) into the caliper. *See also Figure 80*, to see the orientation (with tool T14 at the top). Hand tighten the nut (T14) into position. Then tighten the bolt (T20) using a box end wrench or socket to draw the bushing (6) into the caliper until the bushing (6) contacts the machined step in the bore. Remove the tool.

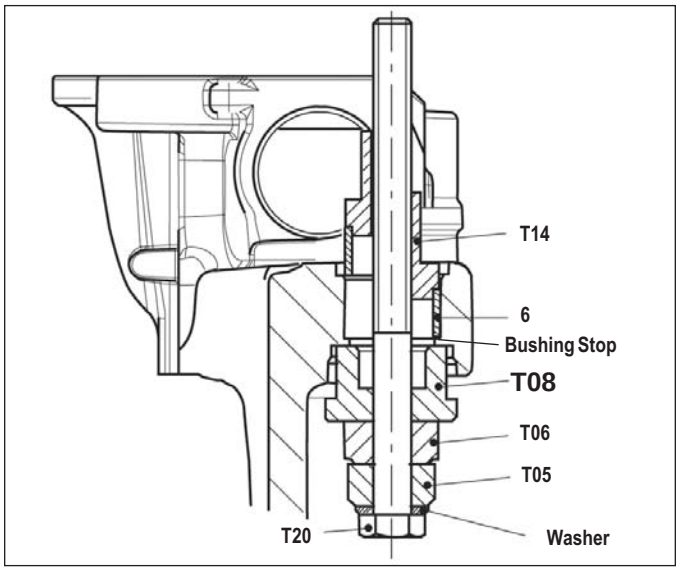


FIGURE 80 - *GUIDE PIN BUSHING INSTALLATION*

5.6.28 Using a punch, bend the tab into the groove by aligning the punch with the upper part of the tab and tapping the punch with a hammer.

5.6.29 Coat the inside of the bushing (6) with a light coat of the white grease included in the kit.

5.6.30 Install the two identical inner boots (9) by first cleaning the area where the inner boots will be installed and inspect for corrosion. If the sealing surface of the caliper is damaged, replace the caliper.

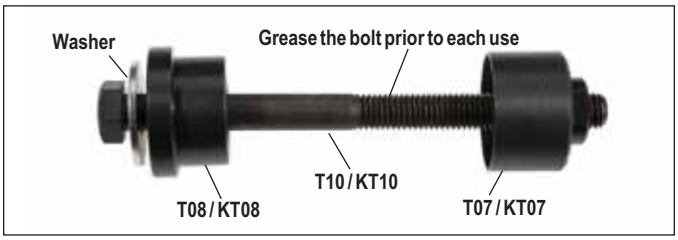


FIGURE 81 - *SHORT GUIDE PIN BOOT INSTALLATION TOOL*

5.6.31 *See Figure 82.* Place a boot into the installation tool (T7), making sure that the inner bellows are arranged close to the side walls of the tool and will not be damaged during installation. Also check that the outer edge of the boot rests on the front edge of the tool.



FIGURE 82 - POSITION *THE NEW BOOT IN THE INSTALLATION TOOL (T7)*

5.6.32 Using 70 in. lbs. (8 N·m) of torque maximum, tighten bolt (T10) to install the inner boot.

5.6.33 Repeat the installation procedure for the second inner boot.

5.6.34 Check that the boots are held securely in place and that no damage occurred during installation.

5.6.35 *See Figure 83.* To install the guide pins, first lubricate both guide pins with the white grease supplied. Insert the guide pins into their respective bores with the grooved end towards the bellows.



FIGURE 83 - PLACE *THE RETAINING RING ONTO THE GROOVE IN THE GUIDE PIN*

Fit the lip in the end of the inner boots (8) into the groove of the guide pins. Push on each ring (7) ensuring that the boot (9) is engaged onto the end of the guide pins (5 or 6).

5.6.36 With the caliper resting on a bench, slide the carrier into place with a slight rocking motion, taking care that as you do so, the inner boots and guide pins are seated in their proper place on the carrier.

5.6.37 Identify the two caliper bolts (39) and (40). With the shorter bolt placed in the floating pin bushing (4), and the longer bolt placed in the fixed pin bushing (5),

begin to tighten the bolts. With the caliper/carrier in a vice, continue installing the bolts to a torque of 133 ft. lbs. (180 N·m) . Finally tighten each bolt an additional 90º (ninety degrees).

Installation of the Guide Pin Caps

5.6.38 *See Figure 84.* Place the caliper/carrier assembly on a bench so that the inner boots are fully compressed, check that the bores are clean and dry (e.g. free from lubrication).

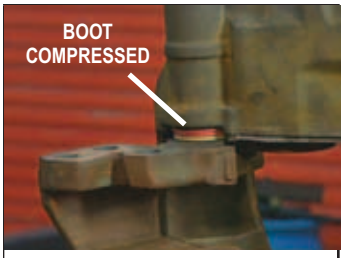


FIGURE 84 - *BOOTS MUST BE COMPRESSED FULLY DURING CAP INSTALLATION*

Note: It is important that the inner boots are fully compressed during this procedure to ensure that the least amount of air is retained within the guide pin channel. If too much air is trapped, the bellows can potentially be damaged during the operation of the brake. *It is also important that the technician double-check that the retaining rings remain in their correct position during this procedure.*

5.6.39 Clean the two caps, and check that the caliper surfaces where the caps will be installed are clean and have no signs of damage.

5.6.40 Select one cap to install. Using the correct press-in tool — the smaller cap (10) installs in the long guide pin side using tool (T26), and the larger cap (68) installs in the short guide pin side using tool (T27) — place the cap in position, using the machined channel in the caliper to assist in centering the tool.



FIGURE 85 - *BOOTS MUST BE COMPRESSED FULLY DURING CAP INSTALLATION*

Use a hammer to tap the cap into position. *See Figure 85.* Note that the tool needs to remain perpendicular to the channel to prevent damage during installation. Note that, after installation, the smaller cap (10) extends 0.08 in. (2 mm.), and the larger cap (68) extends 0.61 in. (15.5 mm.).

Repeat for the second cap.

5.6.41 Check that the guide pins move freely when the carrier is moved laterally, and that air is not trapped within the inner boots, and that the boots (9) and ring (58) are in the proper position before continuing with the installation.

5.6.42 Install the caliper/carrier *(See Section 5.3).*

5.6.43 Install the brake chamber *(See Section 5.4).*

5.6.44 Install the brake pads *(See Section 5.2).*

5.7 BENDIX® SPLINED DISC® HUB ROTOR

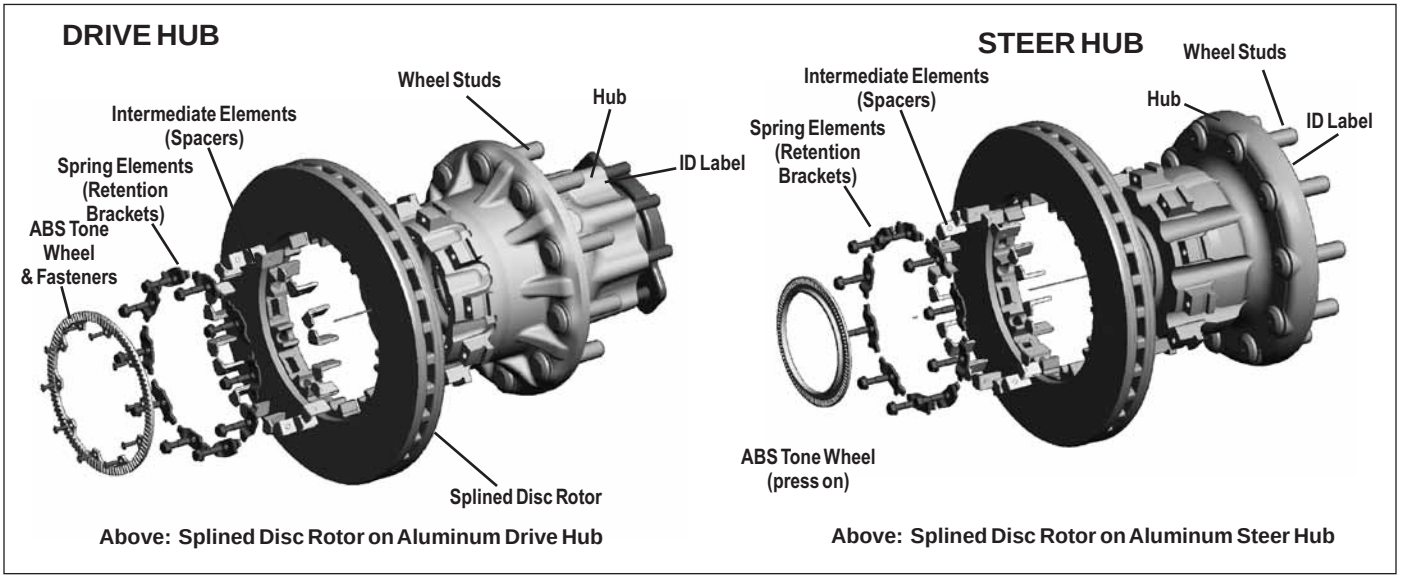


FIGURE 86 - *SPLINED DISC ROTOR EXAMPLES - EXPLODED VIEWS*

Bendix® Splined Disc® Hub Rotors are designed to assist vehicle maintenance by typically allowing the rotor to be serviced without requiring the entire hub/rotor assembly be replaced.

Periodic inspection of the Splined Disc attachment hardware is recommended to ensure optimum braking performance. Bendix recommends verifying the torque on the spring element fasteners whenever a brake inspection is performed.

NOTE: Anytime that the entire hub/rotor assembly is removed, Bendix recommends that the wheel seal also be replaced at the same time, USING A HIGH-TEMPERATURE SEAL. Follow the wheel seal and/or vehicle manufacturer's guidelines for full installation instructions. Adjust the bearings and refill bearing oil to vehicle manufacturer's specifications.

When replacing a Splined Disc Rotor, Bendix strongly recommends that the brake pads be replaced (as an axle set.) Contact 1-800-AIR-BRAKE for appropriate brake pad kit. Rotor replacement necessitates the removal of the pads.

CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels. Also read the vehicle manufacturer's recommendations. When installing pads, where appropriate, use heavy duty gloves and always keep fingers away from potential pinch hazard areas.

Bendix Air Disc Brakes are precision-engineered braking mechanisms. The “friction couple” braking characteristics have been carefully optimized and the rotor design and materials have been matched with special formulation brake pads for optimal performance, therefore use only genuine Bendix® brand parts and brake pads.

Rotor Replacement

5.7.1 Before removing the brake pads it is strongly recommended that the air disc brake adjuster mechanism be checked for correct operation (*See Section 4.1*). When replacing brake pads, Bendix strongly recommends that the pads be replaced as an axle set.

5.7.2 Refer to the vehicle manufacturer’s recommendations and release (or cage) spring brakes and remove the wheel.

5.7.3 Remove the pads (*See Section 5.2*).

5.7.4 Remove the air disc brake (*See Section 5.3)*.

5.7.5 Remove the hub rotor assembly.

Note: Follow the vehicle manufacturer's guidelines for removal of the wheel hub and rotor assembly from the vehicle in lieu of these instructions, where available.

CAUTION: Be sure to secure both the rotor and hub before removing the retention clips.

5.7.6 Remove and discard the ten spring elements.

5.7.7 On drive axles, the ABS tone ring must also be removed. *(See Figure 86.)* Retain for re-installation.

5.7.8 Use suitable hand tools to remove the intermediate elements (spacers). Remove all the right-hand intermediate elements (spacers) of each set first and then the rotor can be turned slightly to release

the remaining intermediate elements (spacers). In all cases, take care not to damage the hub and its teeth. Remove and discard the intermediate elements (spacers) and retention clips attaching the rotor. Discard the rotor.

5.7.9 Following industry standards, clean and inspect the hub before installing the rotor. Look for corrosion and/or damage to the hub and inspect the wheel speed tone ring. Where necessary, consult the hub manufacturer's guidelines for more details.

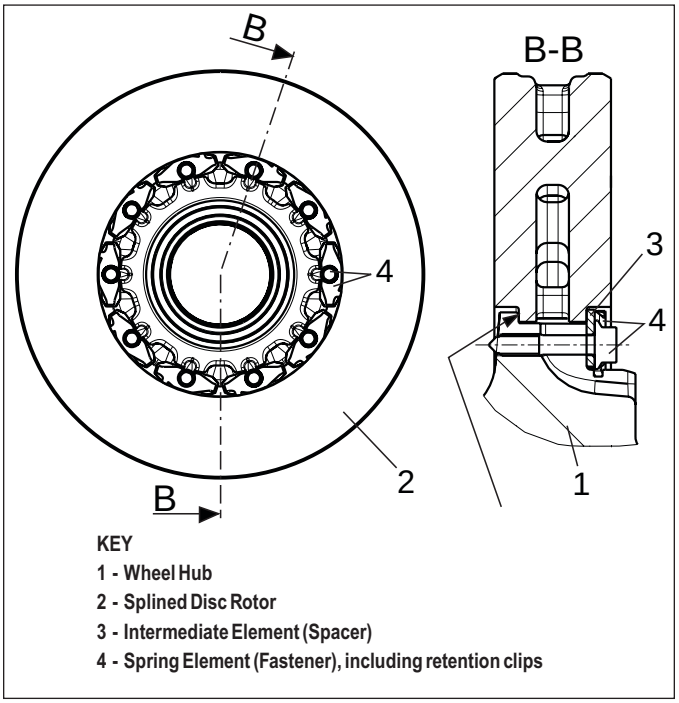


FIGURE 87 - ***ROTOR WITH CROSS-SECTION VIEW***



FIGURE 88 - ***ROTOR INSTALLATION***

ROTOR INSTALLATION

5.7.10 *See Figures 87 through 91.* Place the rotor into position on the hub. Install the new intermediate elements (spacers) as shown in Figure 89. With all the intermediate elements (spacers) correctly inserted into position, verify that the gap between the intermediate elements (spacers) and the wheel hub does not exceed 0.004 in (0.1 mm). If a gap is found that exceeds this maximum value, verify the installation of new intermediate elements (spacers). Replace the wheel hub if the excess gap cannot be corrected with proper installation of new rotor retaining hardware.

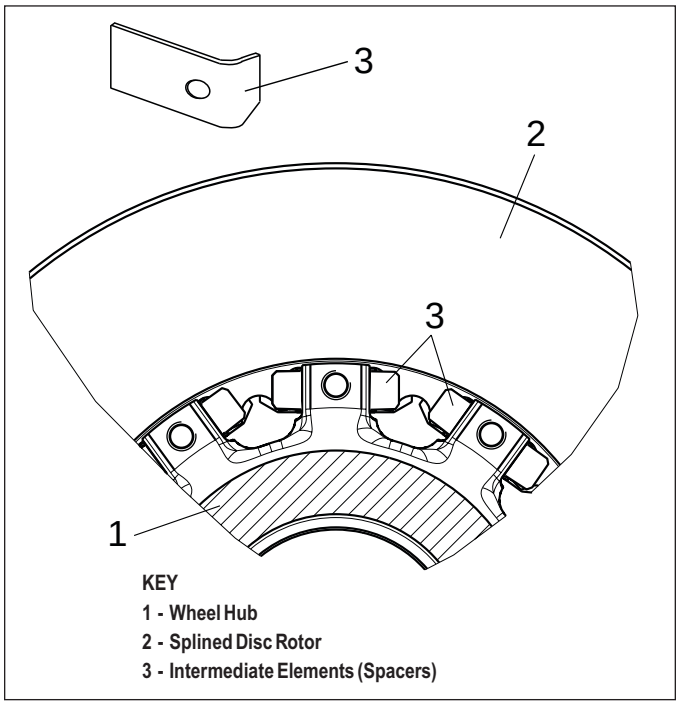


FIGURE 89 - ***INTERMEDIATE ELEMENT (SPACER) INSTALLATION***



FIGURE 90 - ***INTERMEDIATE ELEMENTS (SPACERS) INSTALLED***

5.7.11 Install the ten new spring elements included in the kit in an evenly-distributed cross-pattern sequence. Torque to 22.1 ft. lbs. (30 N·m.)

5.7.12 Where the tone ring was removed during step 5.7.7, re-install the tone ring. Use a professional grade fastener compound, such as Loctite blue 242, on the fasteners. Torque to 19-22 in. lbs. (2.1-2.5 N·m.)

5.7.13 Re-install the hub rotor assembly using a new high-temperature wheel seal, following the vehicle manufacturer’s instructions.

5.7.14 Re-install the air disc brake *(See Section 5.3).* Supporting the air disc brake by all necessary means, attach the brake to the anchor plate using six bolts and washers as required (Bendix recommends the original bolts not be re-used). Torque to vehicle manufacturer's specifications. If torque values and bolts are not specified by the vehicle manufacturer, then torque according to the chart below. Be sure to select bolts with the same thread pitch, length and grade as originally provided from vehicle manufacturer.

5.7.15 Reinstall the brake pads *(See Section 5.2).*



FIGURE 91 - ***FASTENERS INSTALLED***

Air Disc Brake Attachment Hardware		
Torque Plate Manufacturer	Fastener	Torque
Bendix Axial Carrier Torque Plate 	Fastener: M20 x 2.5 x 60 mm Class 10.9 ***Washer: Requires HARDENED 3 mm (minimum thickness) for each bolt.***[1] ***If the vehicle is using a Bendix manufactured Axial Anchor Plate, with a thickness of 1.14 in. (29 mm) where these bolts are assembled, then a bolt with an overall length of 2.36 in. (60 mm) will meet these requirements***	Use the manufacturer's recommendations. If unavailable, use phosphate and oil finish fastener. Pre-Torque: 20-60 ft-lbf [27-81 N·m] Final Torque: 350-400 ft-lbf [475-542 N·m]
Bendix Vertical Carrier Torque Plate 	Fastener: M16 x 2.0 x 110 mm, Class 10.9 ***Washer: None required.***	Use the manufacturer's recommendations. If unavailable, use plain and oil finish fastener. Torque: 200-220 ft-lbf [271-298 N·m]
Trailer Torque Plate	Fastener: M20 x 2.5 x L Class 10.9 Length determination: L = Torque Plate (TP) thickness + Carrier engagement + Washer thickness L_{min} = TP thickness + 24 mm + 3 mm L_{max} = TP thickness + 29 mm + 3 mm ***Washer: Requires HARDENED 3 mm (minimum thickness) for each bolt.***[1]	Use the manufacturer's recommendations. If unavailable, use phosphate and oil finish fastener: Pre-Torque: 20-60 ft-lbf [27-81 N·m] Final Torque: 350-400 ft-lbf [475-542 N·m]

Table Note: 1. The washer outside diameter must be less than 1.1in. (28.5 mm).

TABLE 7 - ***TORQUE PLATE FASTENERS AND TORQUE RECOMMENDATIONS (SEE MANUFACTURER'S RECOMMENDATIONS)***

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CONTACTING BENDIX

www.foundationbrakes.com

Bendix on-line information is available 24/7/365. It's your complete Bendix resource.

Bendix Technical Assistance Team

For direct personal technical support, call the Bendix TechTeam at

1-800-AIR-BRAKE (1-800-247-2725).

Representatives are available to assist you Monday through Friday, 8:00 A.M. to 6:00 P.M. EST, or e-mail the Bendix Tech Team at:

techteam@bendix.com.

To better serve you, please collect the following information before you call the Bendix Tech Team, or include this information in your e-mail:

- Bendix product model number, part number and configuration.
- Vehicle make and model.
- Vehicle configuration. (Number of axles, tire size, etc.)
- System performance symptoms: When do they occur?
- What troubleshooting/measurements have been performed?
- What Bendix service data literature do you have or need?

Bendix® brand foundation brake products are brought to you by:

Bendix Spicer Foundation Brake LLC

A Bendix CVS and Dana Joint Venture

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PE13-012

BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® Air Disc Brake Checklist for Identifying Single Wheel End Thermal Overload

Follow all General Safety Guidelines (*see final page.*)

Start Here

All foundation brakes are designed to convert kinetic energy (energy of motion) into heat and work (to stop the vehicle).

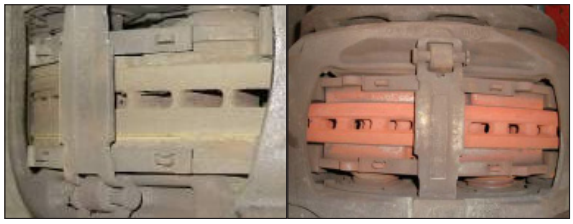
Air disc brakes work the same way and in everyday operation — compared to drum brakes — will produce higher braking temperatures and cool off faster. Also, air disc brakes will often have differences in temperatures at wheel ends on the same axle. The actual temperatures reached will depend on the vehicle configuration, vocation and brake usage.

This document is intended to help technicians identify instances where an individual wheel end has evidence of thermal overload, and check for potential causes.

SECTION ONE: Inspect the Vehicle

Question One:

Do any of the rotors have bright orange or red color edges? Check the box(es) on the vehicle diagram to the right for any found.



Normal — *Evidence of thermal overload*

Question Two:

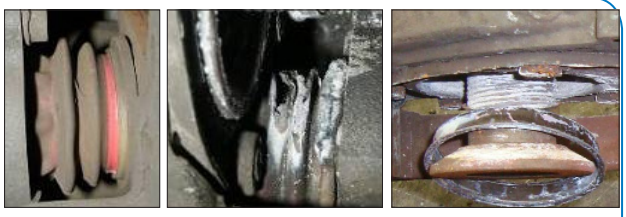
Are any of the calipers coated with a bright orange or red colored dust? Check the box(es) on the vehicle diagram to the right for any found.



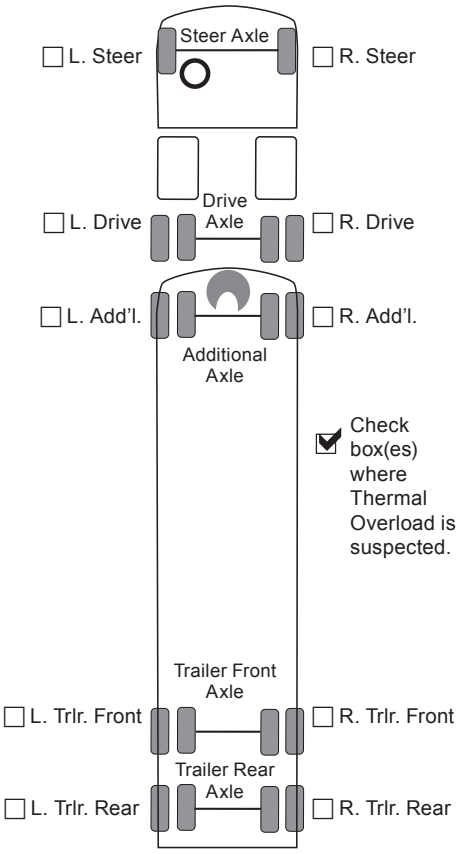
Normal — *Evidence of thermal overload*

Question Three:

Are any tappets and/or guide pin boots heat damaged? Check the box(es) on the vehicle diagram to the right for any found.



Typical — *Evidence of thermal overload* — *Evidence of thermal overload*



Are any boxes checked?

- **NO** → **STOP! Exit this flowchart.** STOP
- **YES** ☑

Are both boxes on a single axle checked?

- **YES** ☑ ☑ → **This is not a single wheel end Thermal Overload event. When both ends of an axle are affected, a thorough brake system diagnosis is needed, as other factors — such as brake balance, overloaded vehicles, or extreme use — are more likely the source.**
- **NO**

Only one box has a check mark?

- **YES** ☑ → **Go to Section Two** *(over)*
- **NO**

In cases where more than one wheel end is affected — but on different axles — complete a separate checklist for each brake being examined.

SECTION TWO: Investigate Other Potential External Causes
- Follow all Safe Maintenance Practices (see final page.)

Inspect the brake pads.
(New pads have 21 mm of brake pad, plus a 9 mm backing plate.)

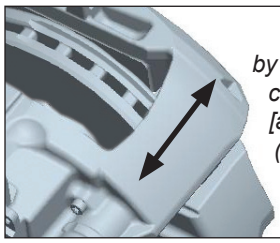
Is there 2 mm, or less, of brake pad friction material?*

YES → **Replace the pads (axle set recommended) after performing all Section Two inspections. (Not a Thermal Overload warranty condition.)**

*2 mm of friction material, plus a 9 mm backing plate, for a total of 11 mm.

NO

Inspect the caliper



Push/pull by hand to check the caliper movement [at least 0.75 Inch (20 mm) with the pads removed]

Complete this step on level ground, with the wheels chocked and the parking brake temporarily released!

Does the brake caliper have restricted movement in the inboard/outboard direction?

YES → **Service the guide pins. Perform all Section Two inspections. (Not a Thermal Overload warranty condition.)**

NO

Inspect the air hoses ("jounce lines").

- *Is air trapped in the hose?***
- *Do the hose(s) pull or push on the caliper? (It is important that the hoses permit the lateral motion of the caliper, the vertical motion of the suspension, and — for steering axles — the full turn of the wheels.)*
- *Are there any kinks, restrictions?*
- *Are the hoses in good condition?*

**Take full safety precautions during the inspection for trapped air, to avoid the air hose whipping if air pressure is found to be trapped. Conditions that might cause trapped air include kinked lines, or when an ABS modulator is malfunctioning and not exhausting service air.

Are any of these conditions found?

YES → **Service as needed. Perform all Section Two inspections. (Not a Thermal Overload warranty condition.)**

NO

Go to the next page . . .

SECTION TWO *Continued*

Inspect the actuator.

On level ground, with the wheels chocked, cage the spring brake actuator (if equipped) per the manufacturer's guidelines, remove and inspect the actuator.

- *Is there visible damage?*
- *In the installed position, was the lowest drain plug sealed?*
- *Is the seal in poor condition/damaged?*
- *Does the push-rod extend further than 15 mm from the mounting face?*

Are any of these conditions found?

YES → **Service the actuator. (Not a Thermal Overload warranty condition.)**

NO

With the actuator removed, inspect the internal caliper surfaces through the actuator push rod opening.

- *Is there visible damage, rust, water?*
- *With the pads removed, use a screw driver to depress the lever. Does the lever have a restricted range of motion? (The lever must touch the caliper body when fully retracted.)*

Are any of these conditions found?

YES → **Replace the caliper. Inspect the rotor. (Not a Thermal Overload warranty condition.)**

Where other external causes were found, perform service and exit this flowchart. STOP

NO

No Section Two external causes found? Replace the caliper. Where applicable, process a thermal overload warranty claim.

Actions When Replacing a Caliper

Replacement:

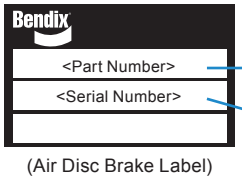
- ☐ Replace the caliper on the affected wheel end and all the pads at both ends of the axle.
- ☐ Inspect the rotor according to the guidelines in Service Data sheet SD-23-7541.

If the brake assembly is still under warranty coverage:

- ☐ File a claim. Clearly state the claim is for a single axle thermally overloaded brake. The claim must include photographs of the rotor from both ends of the affected axle.
- ☐ Return the caliper from the affected wheel end, and label the caliper with the claim number.
- ☐ Return the pads from both sides of the affected axle (LH and RH set of pads). Please clearly label the parts with the wheel position and claim number.
- ☐ Please include this completed checklist, the photographs of the rotors, and a copy of the warranty claim with the returned parts.

VIN #: _____ Claim #: _____

Vehicle Make: _____ Vehicle Model: _____ Mileage: _____



(Air Disc Brake Label)

Caliper Part Number: _____

Caliper Serial Number: _____

Bendix TechTeam Help Line:
1-800-AIR-BRAKE, (1-800-247-2725),
option 2-1. Mon. - Fri., 8 a.m.- 6 p.m.

Reference Document:
Service Data: SD-23-7541 *Bendix® ADB 22X™, ADB 22X-V™ Air Disc Brakes*. Go to the document library at www.bendix.com for free downloads of Service Data Sheets and warranty policies.

SAFE MAINTENANCE PRACTICES

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

When working on or around a vehicle, the following general precautions should be observed at all times:

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses. Where specifically directed, the parking brakes may have to be released, and/or spring brakes caged, and this will require that the vehicle be prevented from moving by other means for the duration of these tests/ procedures.**
2. **Stop the engine and remove 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.**
3. **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.**
4. **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 or a dryer reservoir module, be sure to drain the purge reservoir.**
5. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.**
6. **Never exceed manufacturer's recommended pressures.**
7. **Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.**
8. **Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.**
9. **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.**
10. **Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.**
11. **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.**

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 Spicer Foundation Brake LLC does not offer asbestos brake linings, the long-term affects of some non-asbestos fibers have not been determined. Current 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 Regulations regarding testing, disposal of waste and methods of reducing exposure for asbestos are set forth in 29 Code of Federal Regulations §1910.001. These Regulations provide valuable information which can be utilized to reduce exposure to airborne particles.**
- **Material 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 e-mail techteam@bendix.com**

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PE13-012

BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® ADB22X™, ADB22X-V™ Air Disc Brakes

SECTION ONE: AIR DISC BRAKE OVERVIEW

1.1 DESCRIPTION

Bendix® ADB22X™ and ADB22X-V™ Air Disc Brakes (ADB) use a floating caliper design to provide foundation braking on all axles of heavy commercial vehicles, buses and trailers. Bendix Air Disc Brakes provide safety and performance as well as ease of service.

The ADB22X disc brakes mount to the axle's anchor plate (torque plate) using fasteners that are installed parallel to the axle, while the anchor-plate fasteners used for the Bendix® ADB22X-V™ air disc brakes install at right angles to the axle.

Available with or without a combination spring brake unit, these brakes may also include optional wear sensors and wear diagnostic equipment.



FIGURE 1 - *BENDIX® ADB22X™ AIR DISC BRAKES*

Sections in this Document

Section		Page
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2	Preventive Maintenance and Wheel-on Inspections	6-8
3	Troubleshooting Flowchart	9
4	Wheel-off Maintenance Inspections	10-15
5	Maintenance Kits and Procedures.	16-37

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1.2 Air Disc Brake Identification

Locate the identification label near the guide pin housing. See below for information about the label fields used.

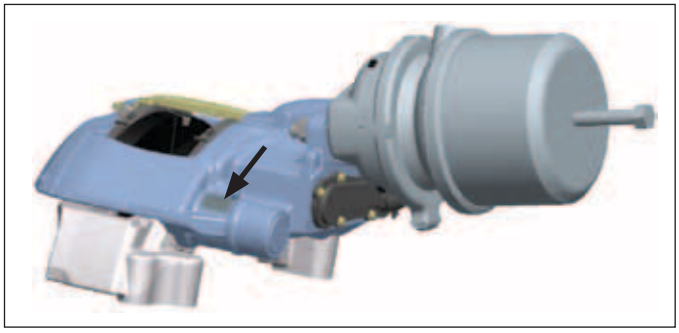


FIGURE 2 - *TYPICAL PART NUMBER LABEL LOCATION*

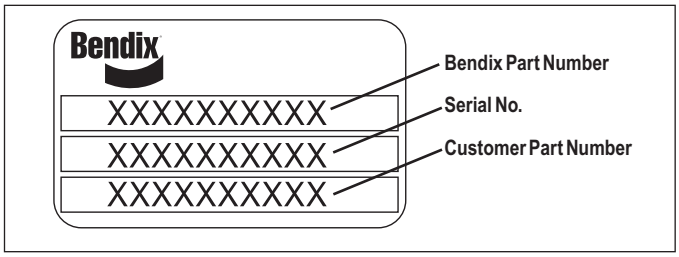


FIGURE 3 - *PART NUMBER LABEL INFORMATION*

Section One

Section		Page
1.1	Description	1
1.2	Air Disc Brake Identification.	1
1.3	Rotor Identification	3
1.4	Wear Sensor Identification	3
1.5	Operation	3
1.5.1	Brake Release and Adjustment	3

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3. **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.**
4. **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 or a dryer reservoir module, be sure to drain the purge reservoir.**
5. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.**
6. **Never exceed manufacturer's recommended pressures.**
7. **Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.**
8. **Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.**
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10. **Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.**
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- **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 Regulations regarding testing, disposal of waste and methods of reducing exposure for asbestos are set forth in 29 Code of Federal Regulations §1910.001. These Regulations provide valuable information which can be utilized to reduce exposure to airborne particles.**
- **Material 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 e-mail techteam@bendix.com**

1.3 Rotor identification

See Figure 4 to help you identify which type of rotor is used on the axle being inspected. Note that the maintenance inspection procedure will depend on the type of rotor installed.

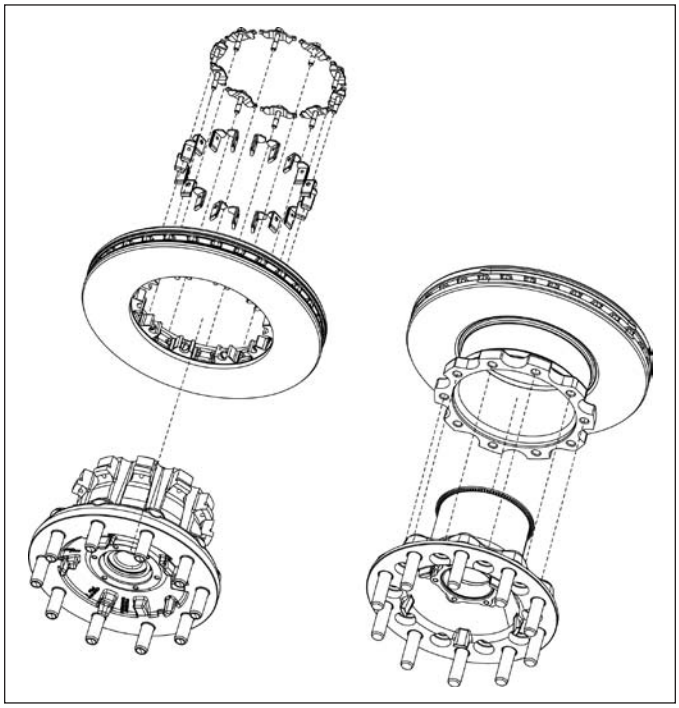
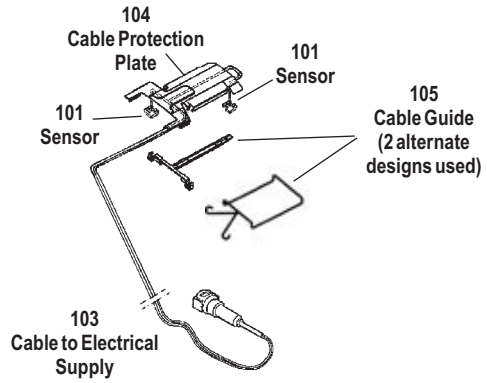


FIGURE 4 - *ROTOR IDENTIFICATION*

CAUTION: Rotors may not be mixed on a single axle: axles are only permitted to have <u>all</u> conventional or <u>all</u> splined disc rotors.

1.4 Wear Sensor Identification

See Figure 5 for the electronic wear sensor that may be present.



Sensor 101
Cable to Electrical Supply. 103
Cable Protection Plate 104
Cable Guide (two designs) 105

Consult the instruction sheet included with wear indicator kits for installation information.

FIGURE 5 - *ELECTRONIC WEAR INDICATOR COMPONENTS*

1.5 Operation

Bendix air disc brakes convert air pressure into braking force. *(See Figure 6.)* When the vehicle brakes are applied, air enters the service brake chamber through the supply port, applying pressure within the diaphragm. The pressure expands the diaphragm — applying force to, and moving, the pressure plate and push rod forward. The push rod acts against a cup in the internal lever which pivots on an eccentric bearing moving the bridge. Moving against a return spring, the bridge transfers the motion to two threaded tubes and tappets, which move the inner brake pad. The inner brake pad (from its normal position of having a running clearance between it and the rotor) moves into contact with the brake rotor. Further movement of the bridge forces the caliper — sliding on two stationary guide pins — away from the rotor. That, in turn, pulls the outer brake pad into the rotor. The clamping action of the brake pads on the rotor applies braking force to the wheel.

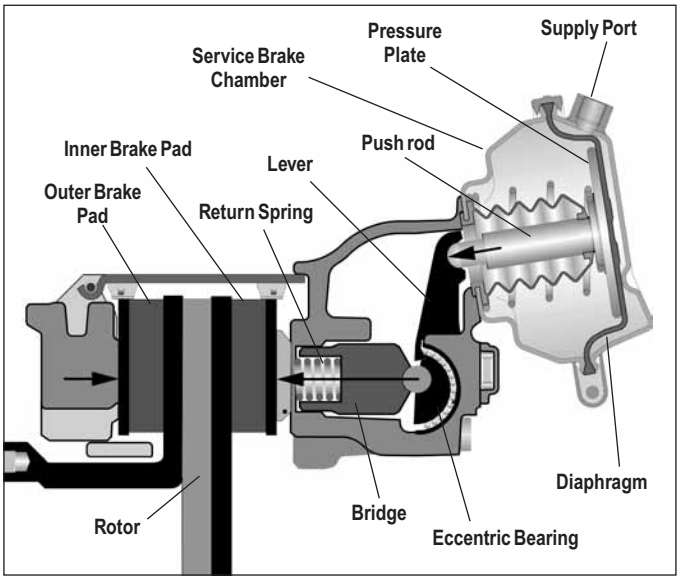


FIGURE 6 - *CROSS-SECTION VIEW SHOWING BRAKE OPERATION*

1.5.1 Brake Release and Adjustment

When the vehicle brakes are released, the air pressure in the service brake chamber is exhausted and the return springs in the chamber and the bridge return the air disc brake to a neutral, non-braked position. To maintain the running clearance gap between the rotor and the brake pads over time, the non-braked position is mechanically adjusted by a mechanism in the caliper. The adjustment mechanism operates automatically whenever the brakes are activated, to compensate for rotor and brake pad wear and to keep the running clearance constant. During pad or rotor maintenance, the technician manually sets the system's initial non-braked position. The total running clearance (the sum of clearances on both sides of the rotor) should be between 0.024 to 0.043 in. (0.6 to 1.1 mm).

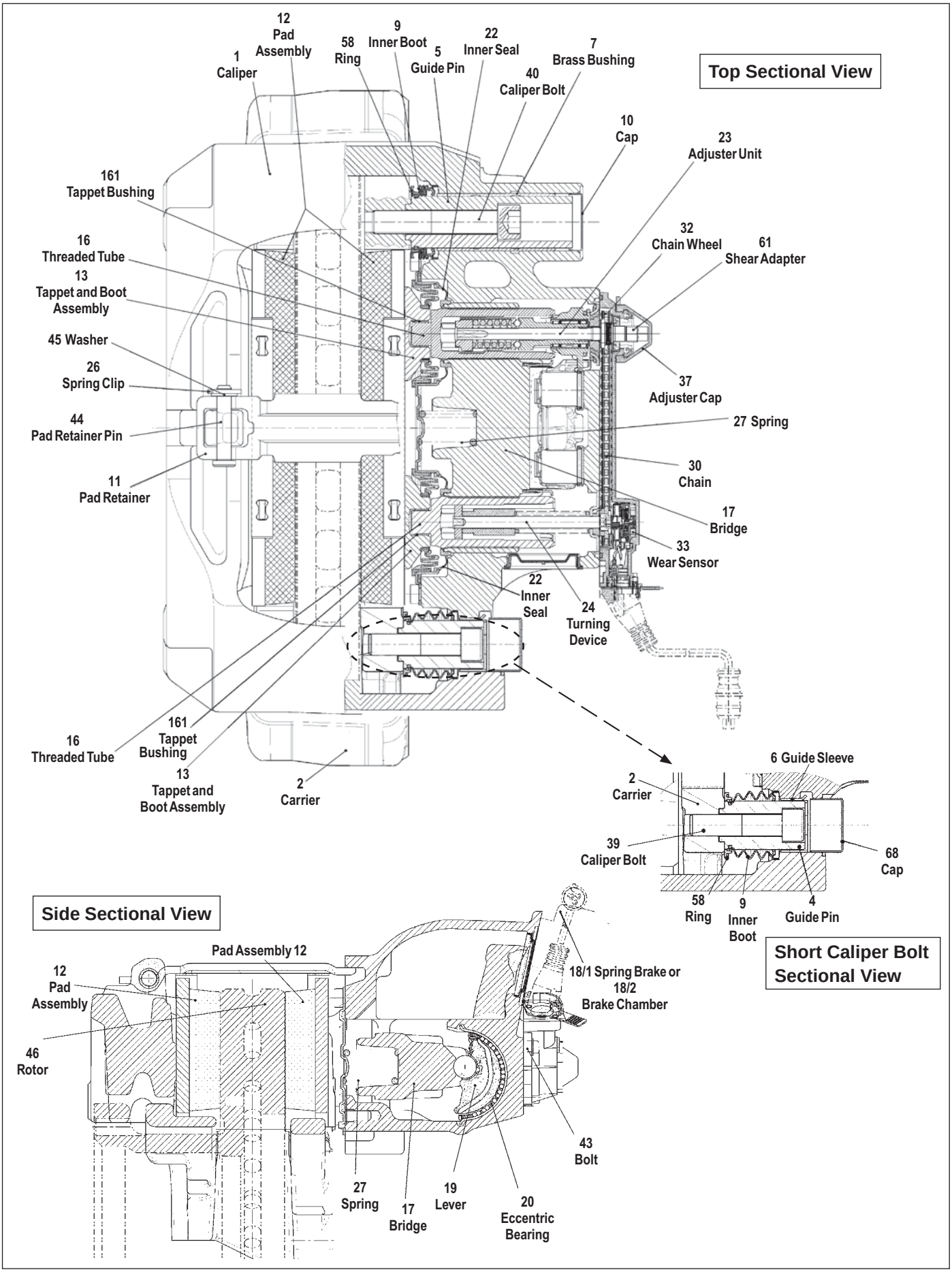


FIGURE 7 - ***SECTIONAL VIEWS***

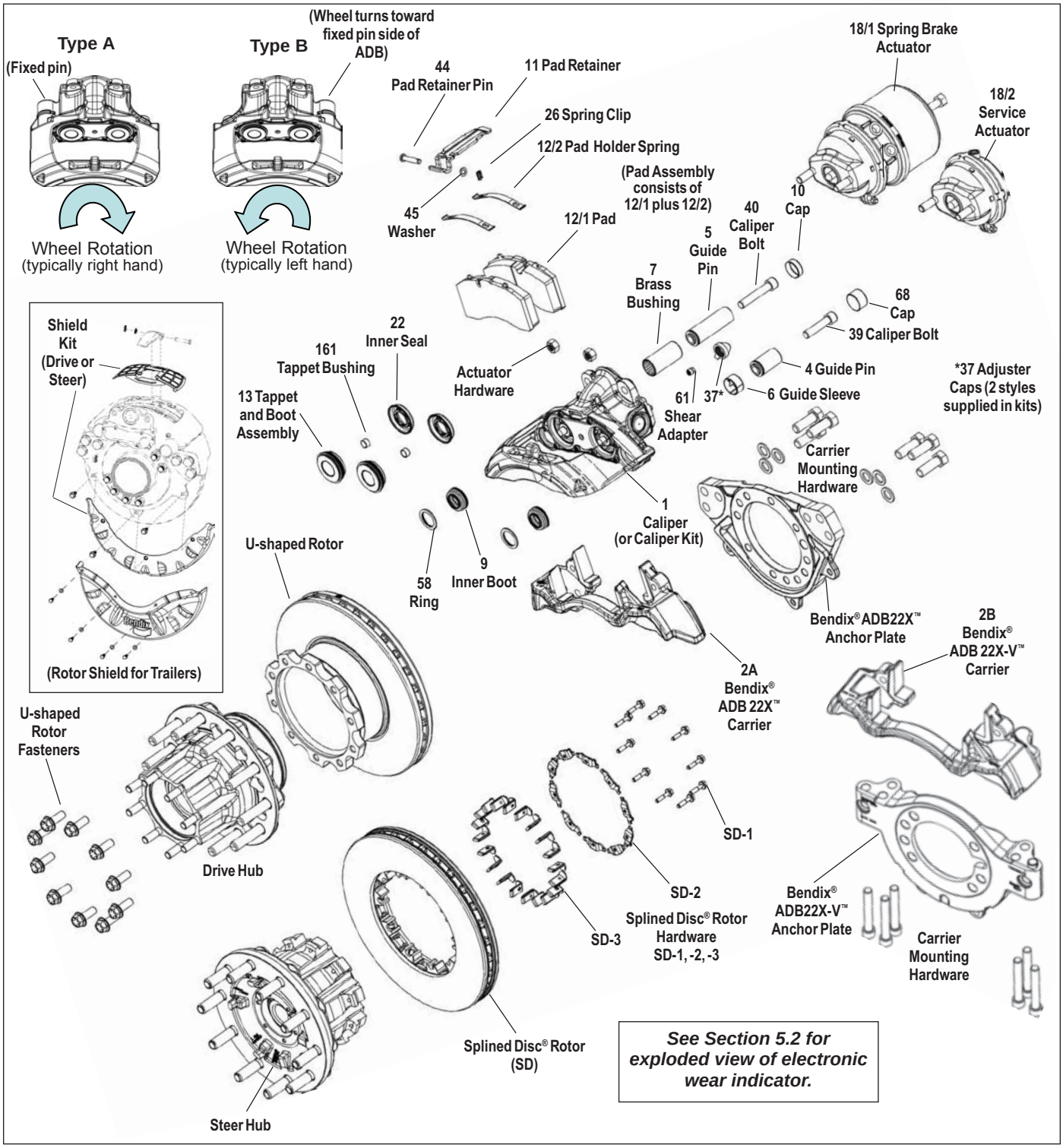


FIGURE 8 - ***EXPLODED VIEW - BENDIX® ADB22X™ AND ADB22X-V™ AIR DISC BRAKES***

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SECTION TWO: PREVENTIVE MAINTENANCE SCHEDULE AND WHEEL-ON INSPECTIONS

2.0 PREVENTIVE MAINTENANCE

Regular inspection and maintenance of air disc brake components is an important part of vehicle maintenance.

The maintenance practices outlined here are recommended in addition to all standard industry practices (including daily pre-trip inspections.) Also, see the vehicle's manual for recommendations. Keep track of the results of your maintenance inspections to assist you in determining the ideal maintenance intervals for the vehicle.

Use the table below for a guide to maintenance interval planning, however, depending on the particular vehicle's use, more frequent checks of the components may be necessary.

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*** For vehicles with electronic wear indicators**, use the dash indicator(s) and/or the hand-held diagnostic tool to regularly monitor the pad wear.

See Section 5.2.

Table 1: Inspection Period

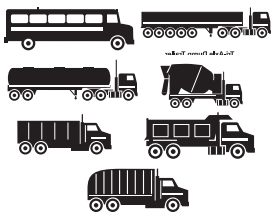
	When you check the tire pressures	(4 to 5 times during the pad lifetime)		At the very least, every four (4) months	At least once every year (and at every pad replace-ment)
		About ever four (4) months for over-the-road applications:	About every three (3) months for higher-duty applications:		
		e.g. line haul, RV, open-highway coaches, etc. 	e.g. pick-up & delivery, off-highway, construction, logger, concrete mixer, dump truck, city transit bus, refuse, school buses, etc. 		
Inspections with the wheel mounted (Sections 2.1 - 2.3)					
Inspect the pad thickness by checking the mechanical wear indicators*. *See Section 2.1.*	✔	✔	✔	✔	
Inspect the running clearances using the quick inspection technique. *See Section 2.2.*	✔	✔	✔	✔	
Inspect the visible part of the rotors for cracks, etc. *See Section 2.3.*	✔	✔	✔	✔	
Inspections with wheel removed (Section 4)					
Inspect the pads and entire rotor surfaces for cracks, etc. (Bendix® splined disc® rotors: Inspect retaining hardware and check torques) *See Section 2.3.*					✔
Inspect the running clearances and adjuster operation. *See Sections 2.2 and 4.2.*					✔
Inspect the caliper travel. *See Section 4.1.*					✔
Inspect the tappet and boot assemblies. *See Section 4.6.*					✔
Inspect all caps, hoses, and brake exterior for damage etc.					✔

TABLE 1 - ***PREVENTIVE MAINTENANCE SCHEDULE***

2.1 BRAKE PAD AND ROTOR INSPECTIONS

Visual checks of the condition of the brake pad/rotor wear can be made without removing the wheels. Where dust guards are not used, the top of the pads and part of the rotor are visible through the opening at the top of the brake. Other visible portions of the rotor can be inspected at the same time.

Unless a vehicle has been stored for some time, the main rotor surfaces that contact the pads will always appear to be shiny. Surface rust on these surfaces would indicate a malfunctioning brake that should be inspected immediately.

Pads are 1.181 in. (30 mm.) thick when new and must be replaced when they reach 0.433 in. (11 mm.). Rotors are 1.77 in. (45 mm.) thick when new and must be replaced when they reach 1.46 in. (37 mm.). *See Section 4.3 for further inspection criteria.*

2.1.1 Electronic Wear Indicators

Use the dash indicator(s) and/or a hand-held diagnostic tool to regularly monitor the pad wear. *(See Section 5.2.)*

2.1.2 Mechanical Wear Indicators

See Figure 9 for the location of the mechanical wear indicators. There are two types *(See Figure 10 for Style A and Figure 11 for Style B)*.

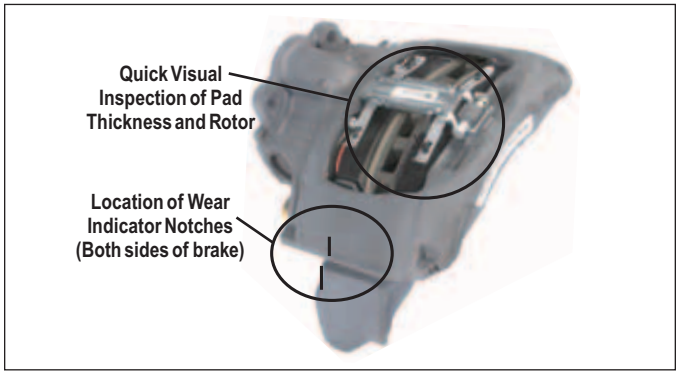


FIGURE 9 - ***LOCATION OF WEAR INDICATORS***

Note: These mechanical wear indicators do not constitute "out-of-service" criteria. These inspections only show when to schedule a full wheel-removed inspection of the brake pads and rotor. The thicknesses of the pad and rotor will both affect the wear indicator position at which maintenance is actually needed.

Wear Indicator Style A:

Where both the carrier and caliper have an indicator notch.

Compare the relative position of two notches cast into the carrier and caliper. When the two notches align, it is time to schedule a full wheel-removed inspection of the pads and rotor.

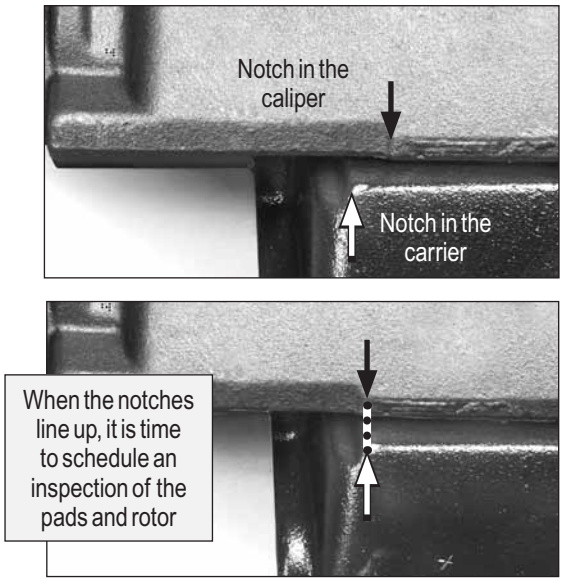


FIGURE 10 - ***STYLE A - WHEN BOTH CARRIER AND CALIPER HAVE A CAST NOTCH***

Wear Indicator Style B:

Where only the caliper has an indicator notch.

When the notch in the caliper aligns with the front edge of the torque plate, it is time to schedule a full wheel-removed inspection of the pads and rotor.

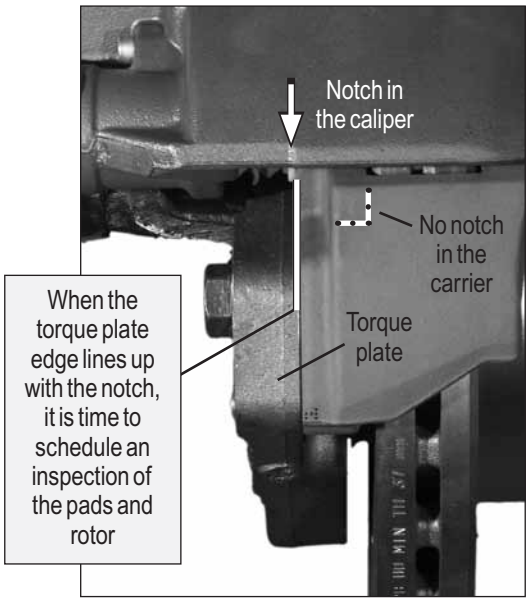


FIGURE 11 - ***CARRIER WEAR INDICATOR NOTCH AND BACKING PLATE ALIGNMENT***

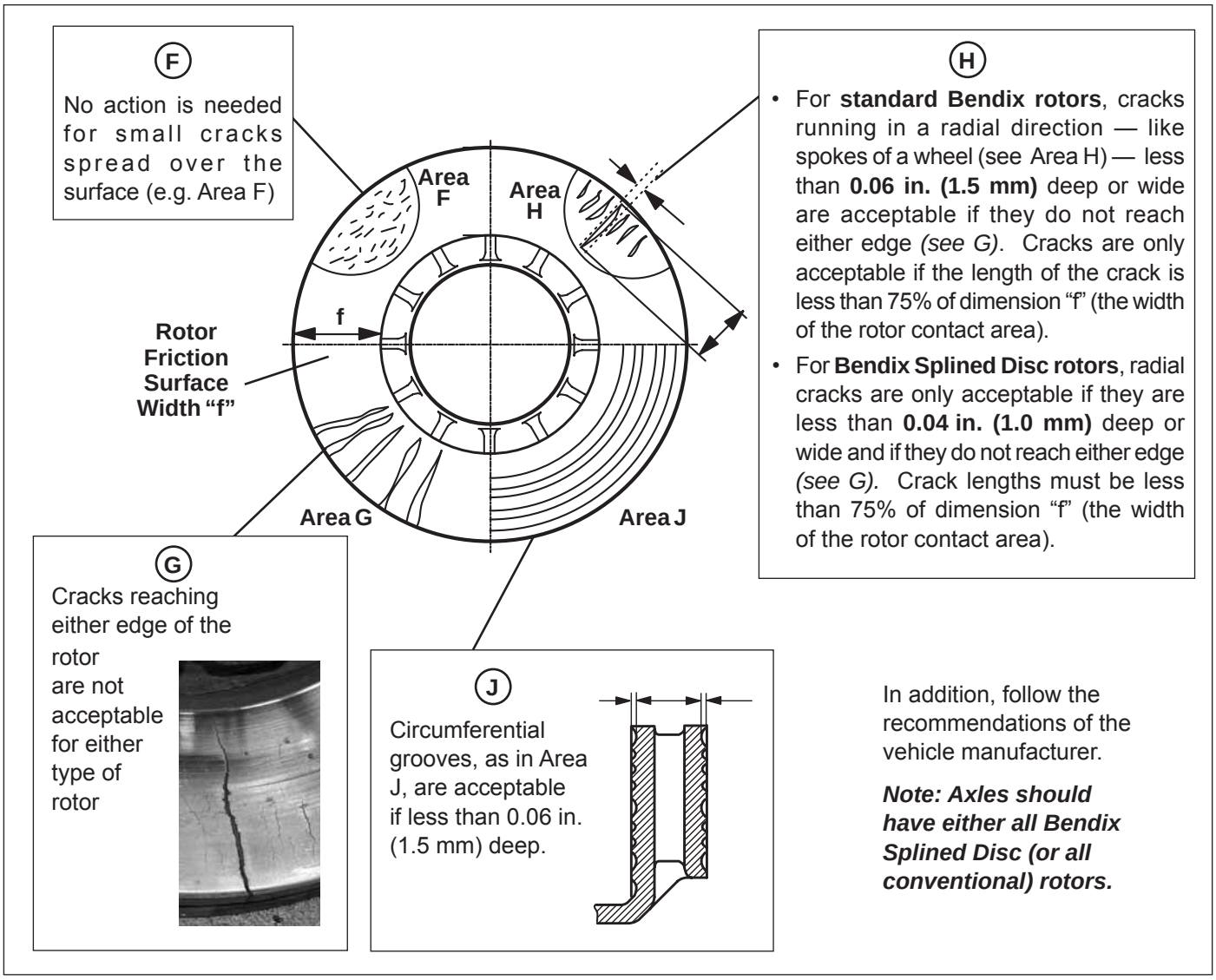


FIGURE 12 - ***EXAMPLES OF ACCEPTABLE AND NON-ACCEPTABLE ROTOR CRACKS AND GROOVES***

2.1.3 Rotor Quick Inspection

See Figure 12. See the various potential rotor conditions that you may find. See the criteria below for whether the rotor needs to be replaced and/or scheduled for a full inspection.

2.2 RUNNING CLEARANCE QUICK INSPECTION

CAUTION: Follow all safe maintenance practices.

On level ground, with the wheels chocked and the parking brake temporarily released, check for movement of the brake caliper. This small movement, less than 0.08" (2 mm) - approximately the thickness of a nickel - in the inboard/outboard direction indicates that the brake is moving properly on its guide pins.

If the caliper has no movement or appears to move greater than the distances noted above, a full wheel-removed inspection will be necessary *(See Section 4.1)*.

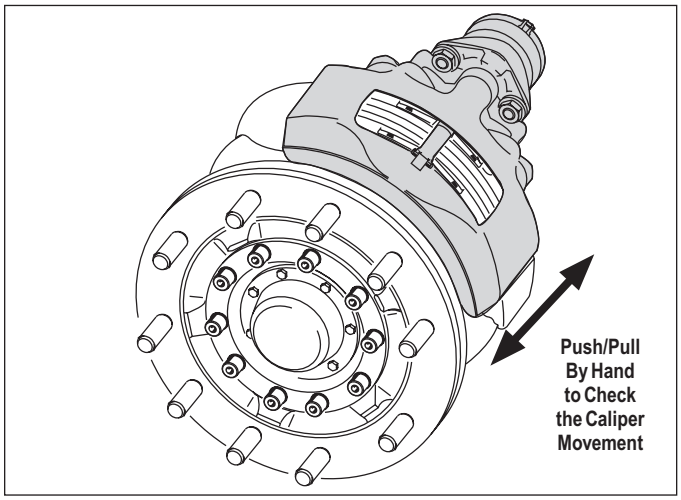


FIGURE 13 - CALIPER RUNNING CLEARANCE
(FIGURE DOES NOT SHOW WHEEL)

SECTION THREE: TROUBLESHOOTING PROCEDURE FLOWCHART

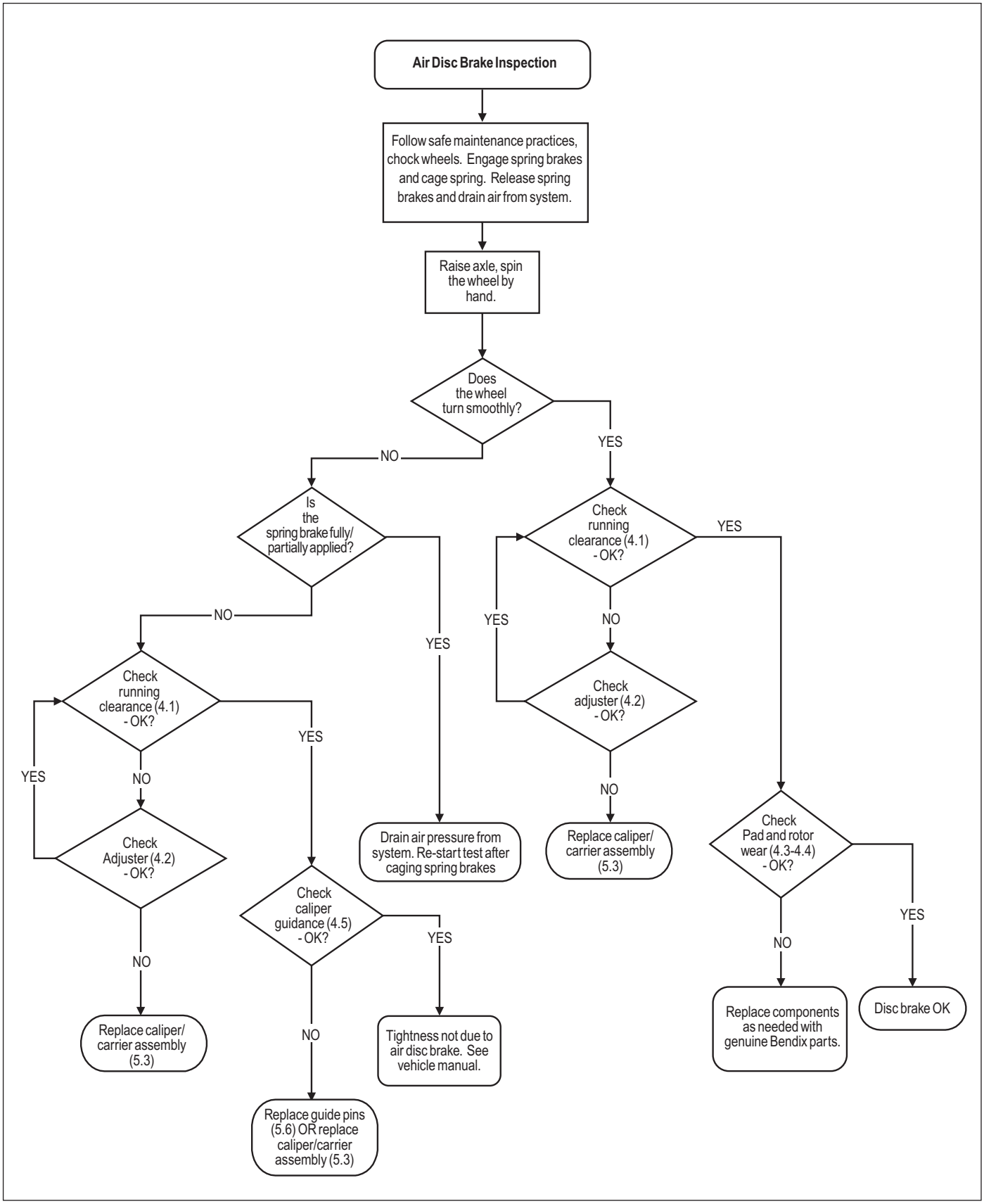


FIGURE 14 - ***TROUBLESHOOTING BENDIX AIR DISC BRAKES***

SECTION FOUR: WHEEL-OFF MAINTENANCE INSPECTIONS

Section Four

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4.5	Guide Pin Bearing Inspection	14-15
4.6	Tappet & Boot Assembly Inspection	15

4.0 WHEEL-OFF INSPECTIONS

CAUTION: During these inspections, follow all safe maintenance practices, including those on page two of this service manual. Also, follow the vehicle manufacturer's recommendations. When working on foundation brakes, be sure that the vehicle is on level ground, that the vehicle is parked by other means than the foundation brakes, and that the wheels are chocked.

4.0.1 Wheel Removal and Re-Installation

Refer to the vehicle manufacturer's recommendations for removing the wheel.

Note: When removing the wheel, inspect first to see that there is no contact between the caliper and axle, vehicle, chassis sections or carrier, etc. that may be impeding the free movement of the caliper.

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 risk of valve stem shear and other compatibility issues. After re-installing a wheel according to the vehicle manufacturer's recommendations, please ensure that there is sufficient clearance between the tire inflation valve stem, the caliper and the wheel rim, to avoid damage.

4.1 CALIPER MOVEMENT TEST

CAUTION: Follow all safe maintenance practices.

Remove the wheel. With the spring brakes released or caged, push the caliper assembly inboard on its guide pins. *Note: To fully release the spring brakes, assure that the air system pressure is at least 90 PSI.* Using a suitable tool (for example a large flat-blade screwdriver), press the inboard pad (12) away from the tappets. Check that there is no dirt, etc. in the gap, and clean if necessary. Then use two long-blade feeler gauges to measure over the whole tappet surface the gap between them and the inboard pad backplate. *(See Figure 16.)* The gap should be between 0.024 in. (0.6 mm) and 0.043 in. (1.1 mm). **If the gap is within the range given, the test is complete.**

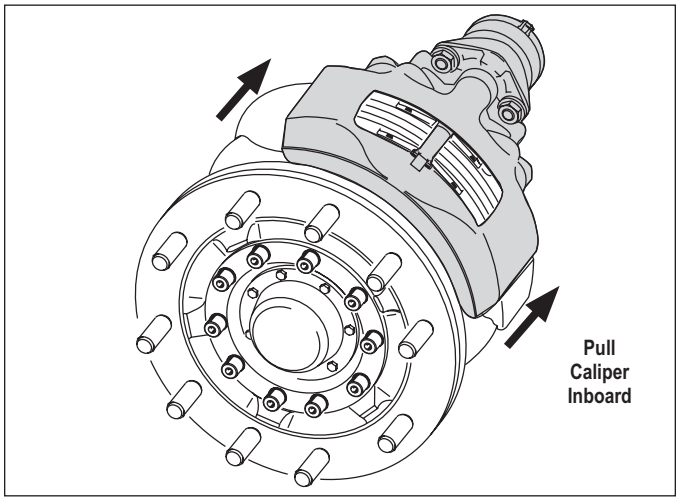


FIGURE 15 - *PULL CALIPER INBOARD*

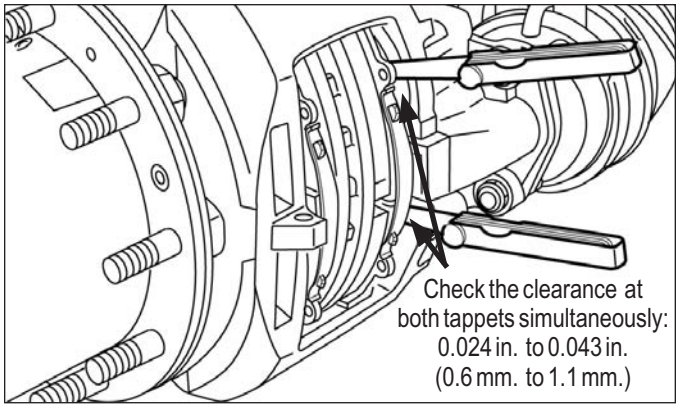


FIGURE 16 - *RUNNING CLEARANCE CHECK*

CAUTION: If the clearance is too wide, there is a danger of brake failure. If the clearance is too small, or if there is no gap at all, there is a danger of the brake overheating. These conditions must be corrected before returning the vehicle to service.

For further investigation, where there is some gap, go to Section 4.2 and check the adjuster mechanism. Where there is no movement at all (and so no gap to measure), go to Section 4.5 "Guide Pin Inspection."

4.2 ADJUSTER MECHANISM INSPECTION

CAUTION: Follow all safe maintenance practices.

Aside from the normal maintenance schedule, the adjuster mechanism inspection that follows is also carried out when the Caliper Movement Test (4.1) finds that the running clearance is too small or too large.

4.2.1 With the spring brake released (or caged), remove the adjuster cap (37) using the tab, taking care not to move the shear adapter (61). Note: One of two styles of adjuster cap (stamped metal or plastic adjuster cap) may be used.

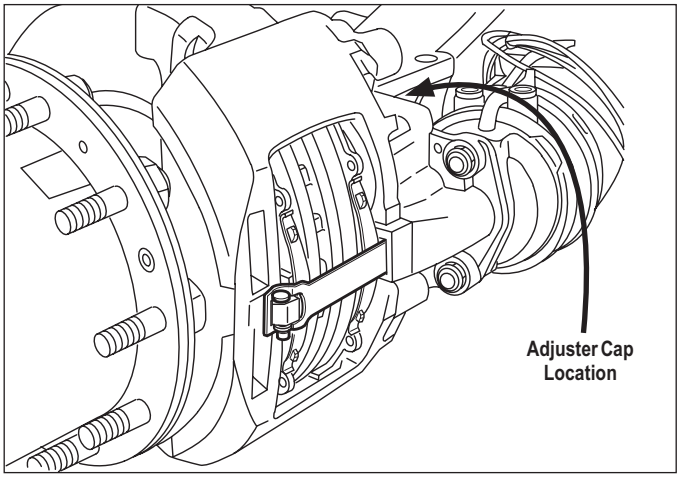


FIGURE 17 - ***ADJUSTER CAP LOCATION***

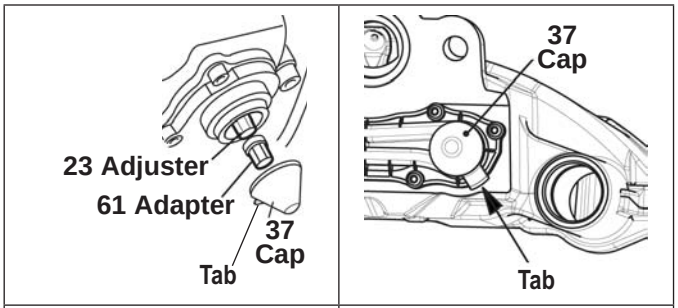


FIGURE 18 - ***EXPLODED VIEW OF ADJUSTER AND ADAPTER***

FIGURE 19 - ***CAP INSTALLED: TAB LOCATION***

For illustration purposes, the exploded view (Figure 18) shows the adjuster (23) and shear adapter (61) separated. When using the adjuster mechanism, always have the shear adapter installed on the adjuster.

4.2.2 Using a 10 mm. six-point box wrench, turn the Shear Adapter (61) **counter-clockwise** and listen for the sound of 3 clicks as the mechanism backs-off (increases) the running clearance. Note: Do not use an open-ended wrench as this may damage the adapter. *See Figure 20.*

CAUTION: Never turn the adjuster (23) without the shear adapter (61) installed. The shear adapter is a safety feature and is designed to prevent excessive torque from being applied to the adjuster. The shear adapter will fail (by breaking) if too much torque is applied.

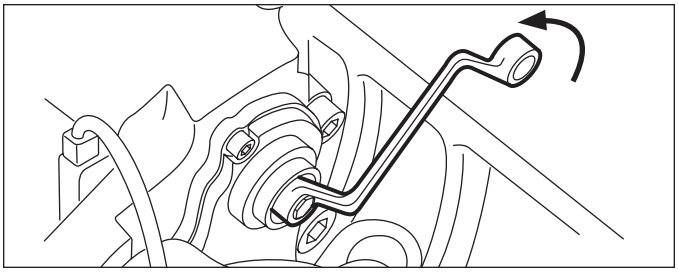


FIGURE 20 - ***BACKING-OFF (INCREASING) THE RUNNING CLEARANCE***

If the shear adapter fails, you may attempt a second time with a new (unused) shear adapter.

Note: Always double-check that the spring brake is released (where applicable) if a shear adapter fails; if this step was missed, the shear adapter will break off, and it may appear that the caliper is seized.

In cases where a second failure of the shear adapter confirms that the adjustment mechanism is seized, the caliper must be replaced.

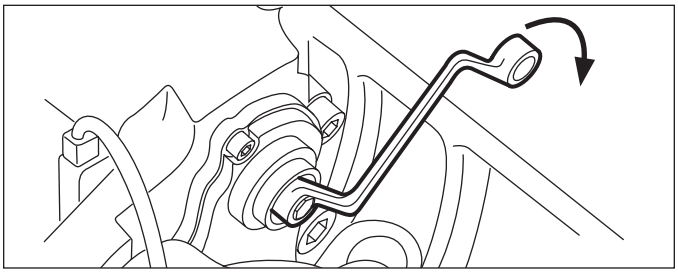


FIGURE 21 - ***APPLYING MODERATE APPLICATIONS OF THE BRAKES: THE WRENCH MOVES CLOCKWISE AS THE RUNNING CLEARANCE IS DIMINISHED***

4.2.3 Where the adjuster mechanism is able to be backed-off normally, position a box-end wrench on the shear adapter so that it can turn clockwise freely without coming into contact with parts of the vehicle *(See Figure 21).* Make five to ten moderate applications of the brakes [at about 30 psi (2 Bar)], and observe that the box-end wrench or socket should turn clockwise in small increments.

NOTE: As the number of applications increases, the turning movement will decrease (as the brake reaches its normal calibration point).

If the box-end wrench does not: (a) turn at all; (b) turns only with the first application; or (c) turns forward and backward with every application, the automatic adjuster has failed and the caliper/carrier assembly must be replaced.

After completing these wheel-off tests, Bendix recommends installing a new adjuster cap (lightly greased using white, lithium-based grease) when returning the brake to service. Ensure that the tab is in the position shown in Figure 19.

4.3- 4.4 BRAKE PADS AND ROTORS

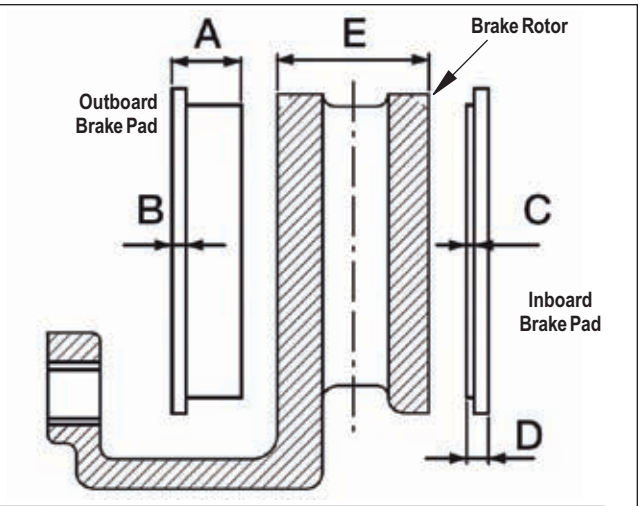
CAUTION: Follow all safe maintenance practices.

If electronic wear sensors are present, *see Section 5.2.*

If dust covers are present, *see Section 5.1.*

See Figure 23. While pressing down against the pad retaining bar (11), remove and retain the clip (26), washer (45) and pin (44). Remove the pad retainer bar (11). Bendix recommends that these items should be replaced with new *(See available kits and parts, Section 5.0)*.

Follow the steps in Section 4.2 for backing-off the adjuster mechanism. Slide the caliper inboard then outboard to permit easy removal of the brake pads.



A	Thickness of a new pad (1.181 in.) (30 mm.).
B	Backing plate thickness (0.360 in.) (9 mm.)
C	Minimum thickness of friction material (0.080 in.) (2 mm.)
D	Minimum thickness of a worn pad (0.433 in.) (11 mm.); replace pads.
E	Thickness of a new rotor (1.77 in.) (45 mm.). Minimum rotor thickness (1.46 in.) (37 mm.)

FIGURE 22 - *PAD AND ROTOR DIMENSIONS*

See Figure 22 for initial brake pad and rotor dimensions, as well as minimum acceptable dimensions.

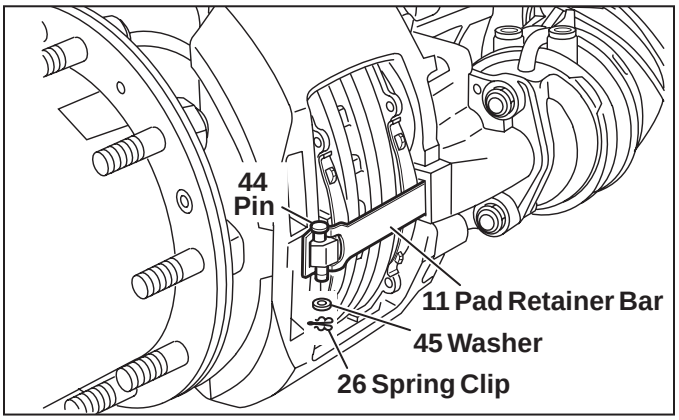


FIGURE 23 - *RETAINER BAR REMOVAL*

4.3 INSPECT THE BRAKE PADS

Regular inspection of the brake pads (even for vehicles that use an electronic wear indicator) is an important part of vehicle maintenance.

4.3.1 See Figure 22. If the thickness of the friction material — dimension “C” — is less than 0.080 in. (2 mm.), the pads must be replaced.

Bendix® ADB22X™, ADB22X-V™ air disc brakes use 0.35 in. (9 mm.) backing plates, so dimension “D” (the combined pad and backing plate thickness) must be a minimum of 0.43 in. (11 mm.).

4.3.2 Check for uneven end-to-end pad wear. If the difference in wear is greater than 0.080 in. (2 mm.), replace the brake pads and also inspect the guide pins *(See Section 4.5)*.

4.3.3 Compare the thickness of the inboard and outboard pads of each set. If the difference between the inboard and outboard pad thickness is greater than 0.138 in. (3.5 mm.), replace the brake pads and inspect the guide pins *(See Section 4.5)*.

If the results of the pad inspections are within the acceptable range, inspect the pad surface. *(See Figure 24)*.

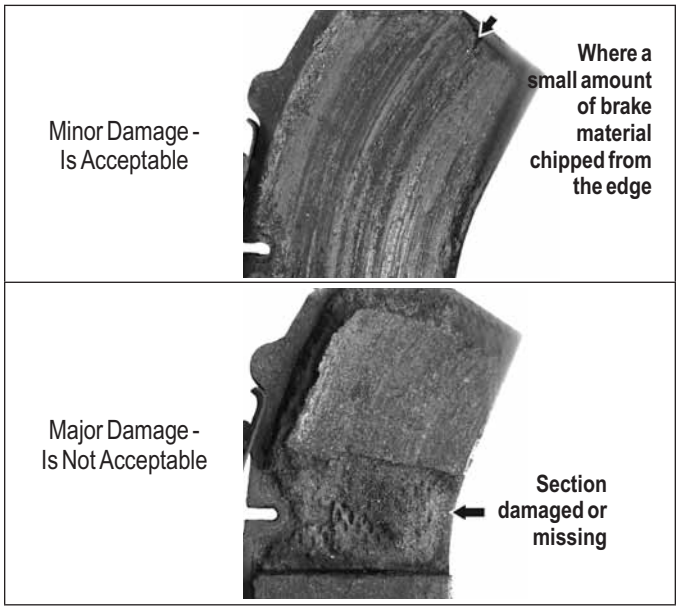


FIGURE 24 - *BRAKE PAD SURFACE INSPECTION*

Minor damage at the edges is permitted, but replace the pads if major damage on the surface of the pad is found.

When replacing brake pads, Bendix strongly recommends that all the brake pads on an axle be replaced at one time. *See Section 5.1 for the pad replacement procedure*. Also see the vehicle manufacturer’s recommendations found in the operator’s manual.

Bendix air disc brakes are precision-engineered braking mechanisms. The “friction couple” braking characteristics have been carefully optimized — and the rotor design and materials have been matched with special formulation brake pads for optimal performance. In all cases, use brake pads with the type of backing plate and lining material originally supplied by the vehicle manufacturer.

CAUTION: When replacing brake pads and rotors, use only Bendix® brand replacement pads and rotors and/or those approved by the OEM. Non-approved replacement disc pads or rotors can cause excess wear to brake components, and can increase the risk of rotors cracking, etc.

4.4 INSPECT THE ROTOR

CAUTION: Follow all safe maintenance practices.

Identify if the rotor is a Bendix® Splined Disc®, or Bendix® brand conventional rotor (S*ee Section 1.03*). Rotors should be inspected regularly *(See Section 2.0 for recommended inspection schedule)* and at each pad change.

4.4.1 Measure the thickness of the brake rotor at the thinnest point (Dimension “E” in Figure 22). Avoid measuring near the edge of the rotor as minor burrs may result in inaccurate measurement. **For Bendix® brand rotors, replace the rotor when the minimum thickness of 1.46 in. (37 mm.) is reached.** For other brands of rotors, refer to the rotor manufacturer’s guidelines.

4.4.2 Inspect the rotor surface. *See Figure 25.* The type of rotor, and also the size, depth and direction of the imperfections, must all be considered.

NOTE: If surface wear conditions F through J are in the permitted range, the rotor is still usable until it reaches the minimum acceptable thickness for the rotor manufacturer’s guideline.

4.4.3 Machining (Grinding or Turning) Rotors

Bendix® brand rotors are normally service-free. In the case of severe grooving of the entire friction surface, however, **CONVENTIONAL ROTORS** may be turned when changing pads, to increase the load-bearing surface.

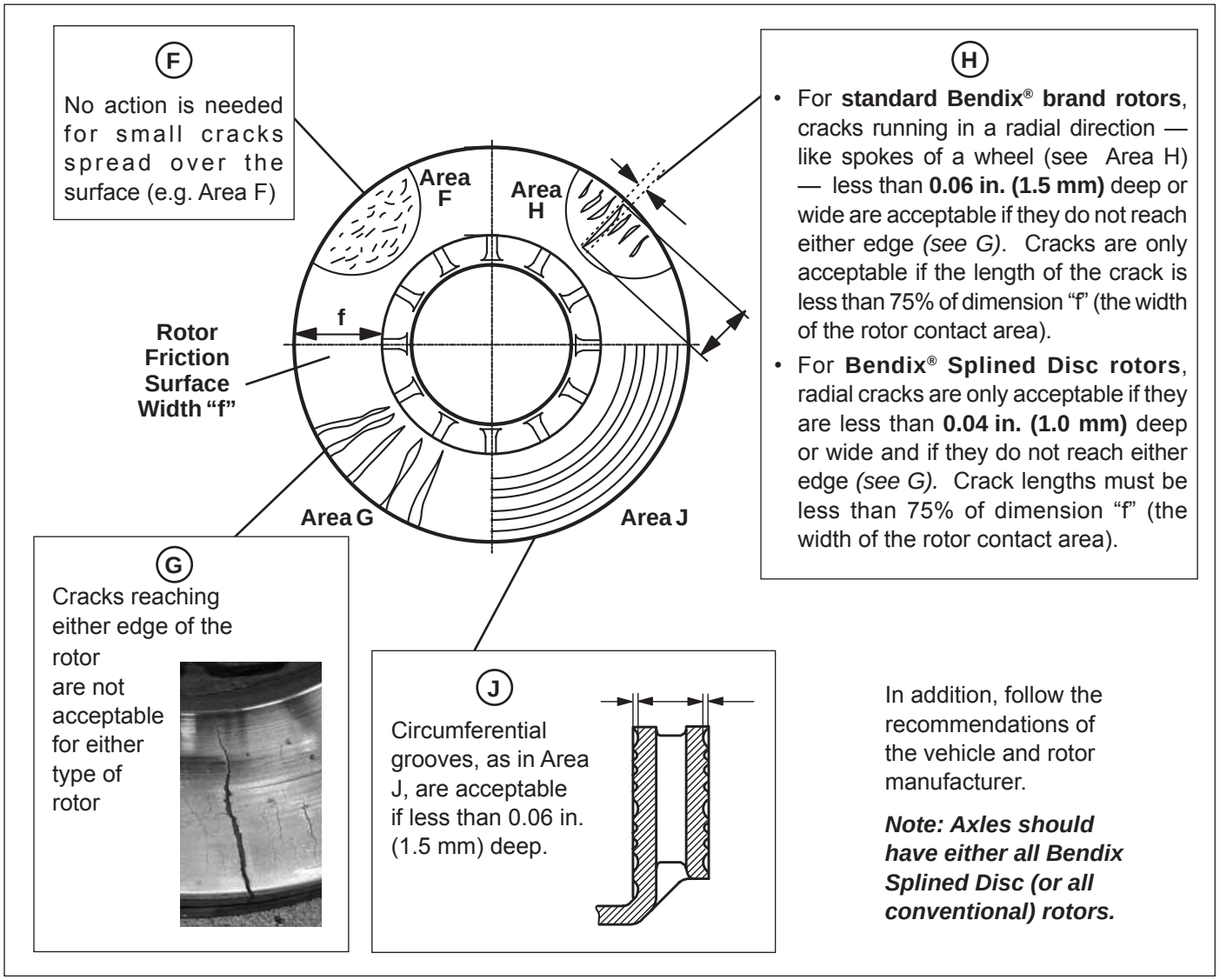


FIGURE 25 - EXAMPLES OF ACCEPTABLE AND NON-ACCEPTABLE ROTOR CONDITIONS

MACHINING OF BENDIX® SPLINED DISC® ROTORS IS NOT PERMITTED.

CAUTION: Always maintain air disc brake pads and rotors within specifications. Excessive pad or rotor wear will degrade braking performance.

Periodic inspection of the Bendix Splined Disc attachment hardware is recommended to ensure optimum braking performance. Bendix recommends verifying the torque on the spring element fasteners whenever a brake inspection is performed.

⚠ WARNING! AFTER MACHINING/TURNING, THE MINIMUM ROTOR THICKNESS FOR BENDIX® BRAND ROTORS MUST BE AT LEAST 1.535 - 1.575 IN. (39 - 40 MM.) - FOR OTHER BRANDS, CONSULT THE MANUFACTURER'S GUIDELINES. ALSO, CHECK THE VEHICLE MANUFACTURER'S RECOMMENDATIONS. FAILURE TO COMPLY MAY RESULT IN BRAKE FAILURE AND IN SERIOUS INJURY OR DEATH. MACHINING OF BENDIX SPLINED DISC ROTORS IS NOT PERMITTED.

4.4.4 Rotor Replacement

An axle is permitted to have only all Bendix Splined Disc, or all conventional, rotors.

When replacing rotors, be sure to adhere to the vehicle manufacturer's recommendations, including bolt tightening torques. It is recommended to install only Bendix® brand rotors, and also that the pads should be replaced (as an axle set) at the same time.

Non-Bendix® brand rotors. If a non-Bendix® brand rotor is used, confirm that it complies to the vehicle manufacturer's recommendations.

CAUTION: The use of <u>non-approved</u> brake rotors may reduce levels of safety and invalidate the warranty.

See Section 5.7 for re-installation procedures.

4.5 GUIDE PIN BEARING INSPECTION

CAUTION: Follow all safe maintenance practices.

This guide pin inspection should be carried out if the technician cannot move the caliper during a Caliper Movement Test (Sections 2.2 and/or 4.1).

Measure the range of travel along the guide pin bearings:

4.5.1 Remove the Pads *(See Section 4.3)*. Using hand pressure only (no tools), the caliper (1) should slide freely along the whole length of the guide pins. This movement should be at least 0.95 inch (25 mm) when the pads are not present. If the movement is less than this amount, replace the caliper/carrier assembly.

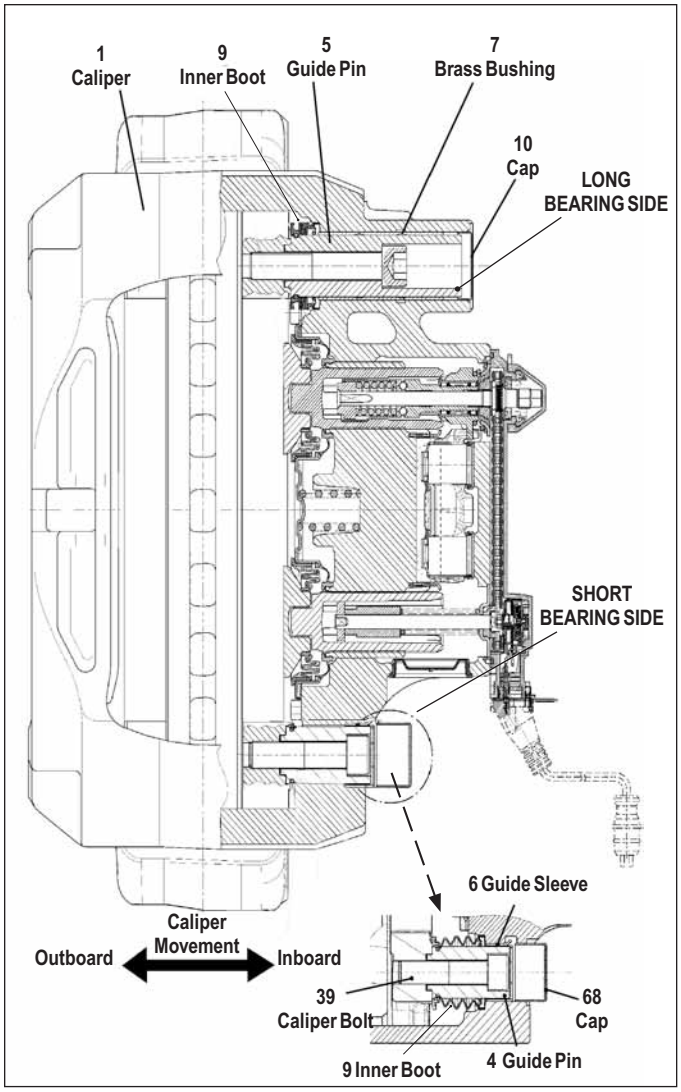


FIGURE 26 - *GUIDE PINS*

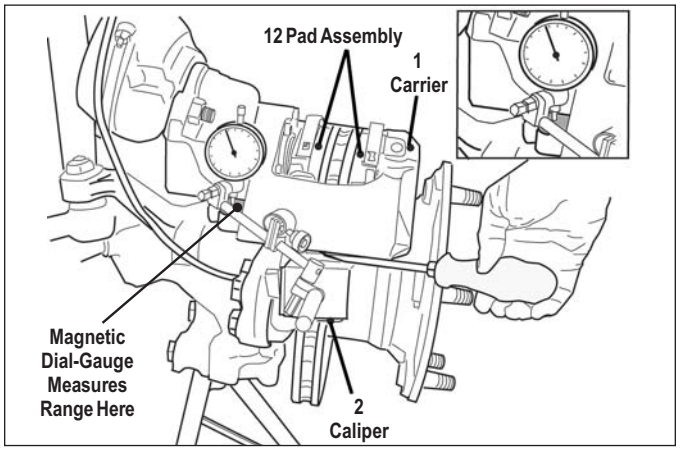


FIGURE 27 - *MAGNETIC DIAL-GAUGE IN USE*

Measure the "play" (range of movement) in the guide pin bearings:

4.5.2 *See Figures 26 and 27.* With the wheel removed, remove the pad retainer bar (11). Temporarily replace the pads with two new pads (12). Attach a magnetic dial-gauge holder to the carrier (2) on the short bearing side of the caliper (1). Use the measuring point on the caliper (1) - see the callout

in Figure 27. Press the caliper in the direction of the carrier (2) and set the dial-gauge to zero.

4.5.3 Place a suitable tool (e.g. a large flat-blade screwdriver) between carrier (2) and caliper (1) and use light hand force to move the caliper away from the carrier, until the movement stops. Read the maximum value on the dial-gauge. *See Figure 27.*

If the value is greater than 0.078 in. (2.0 mm), replace the guide pin bushings *(See Section 5.6)* OR replace the caliper/carrier assembly *(See Section 5.3)*.

Inspect the guide pin inner boots:

4.5.4 *See Figures 28 and 29.* With the pads removed, slide the carrier by hand to the inboard position *(See Figure 28)*. By looking through the opening where the pads are installed — and also from below — inspect the inner boot (9) for each of the guide pins. **INSPECT FOR DAMAGE, CUTS AND CRACKS.** Replace damaged boots immediately to prevent dirt and/or moisture affecting the movement of the guide pins *(See Section 5.4)*. Damaged or corroded guide pins will impair the operation of the brake.

In addition, during installation, the boots are compressed to minimize the amount of air trapped within them. Observe as you move the carrier back towards the outboard position; the boots should only expand outwards a small amount due to trapped air. The boots should normally (due to their ribbed construction) contract back into place as the caliper moves on the guide pins. The boots are not air-tight and so some trapped air is normal; excess air trapped will dissipate.

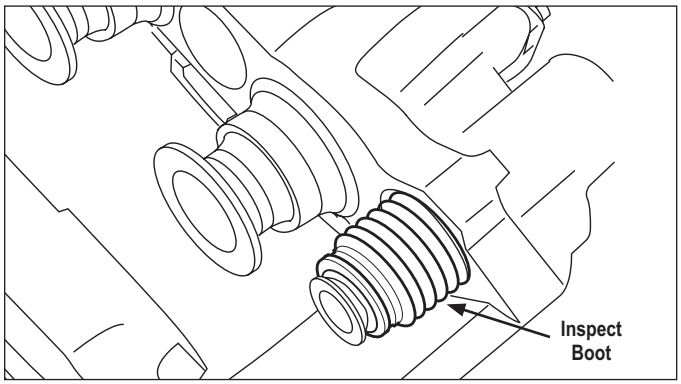


FIGURE 28 - *GUIDE PIN BOOT INSPECTION (THIS IMAGE DOES NOT SHOW THE CARRIER)*

4.5.5 Inspect the original pads *(See Section 4.3)* and they may be reused if they are in good condition with sufficient pad thickness.

4.6 TAPPET AND BOOT ASSEMBLY INSPECTION

4.6.1 In order to inspect the tappet and boot assembly, remove the pads (12) *(See Sections 4.3 or 5.2)* and advance the shear adapter (61) clockwise.

CAUTION: NEVER EXTEND THE TAPPET MORE THAN 1.75 in. (44.5 mm). *See Figure 29.* **Over-extending the tappet will result in the tappet losing engagement with the synchronizing mechanism. Since the mechanism can only be set at the manufacturing plant, the *caliper/carrier assembly must be replaced* if this happens.**

4.6.2 **INSPECT THE TAPPET AND BOOT ASSEMBLIES (13) FOR EVIDENCE OF DAMAGE, CUTS, CRACKS, TEARS AND EVIDENCE OF CORROSION, ETC.** Damaged boots lead to the penetration of dirt and moisture, and can lead to corrosion and impair the operation of the brake. Replace as necessary *(See Section 5.5)*.

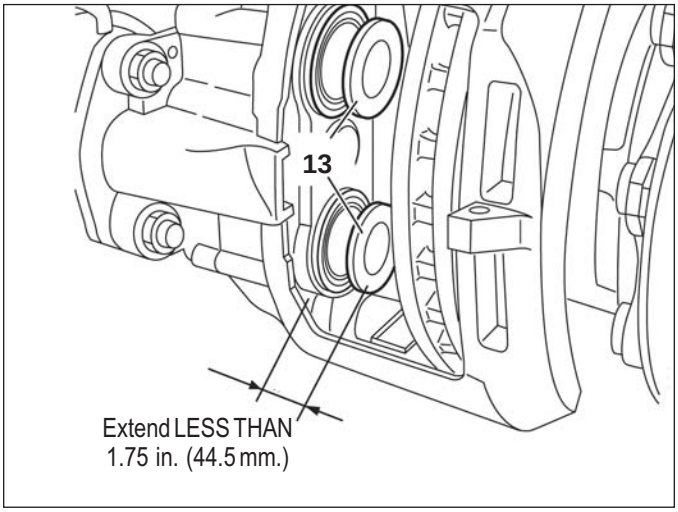


FIGURE 29 - PERMITTED TAPPET EXTENSION

Where the tappets and boots pass the inspection, retract the tappets using the shear adapter.

When installed, the boots are compressed to minimize the amount of air trapped within them. Observe as you move the tappet back using the shear adapter; the boots should only expand outwards a small amount due to trapped air. The boots should normally (due to their ribbed construction) contract back into place as the tappets move. Note: If the bellows have excess air trapped, then with the tappets retracted, remove and re-install the actuator to vent the excess trapped air *(See Section 5.4).*

Follow the reinstallation steps for the brake pads *(See Section 5.2)*.

SECTION FIVE: MAINTENANCE KITS AND PROCEDURES

Section Five

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5.0	Maintenance Kits	16-17
5.1	Air Disc Brake Shield Kit	19
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5.3	Caliper/Carrier/Actuator Assembly	22-23
5.4	Spring/Service Brake	24
5.5	Tappet & Boot, and Tappet Inner Seal	25-28
5.6	Guide Pin and Boot Assemblies	29-34
5.7	Bendix® Splined Disc® Hub Rotor	35-37

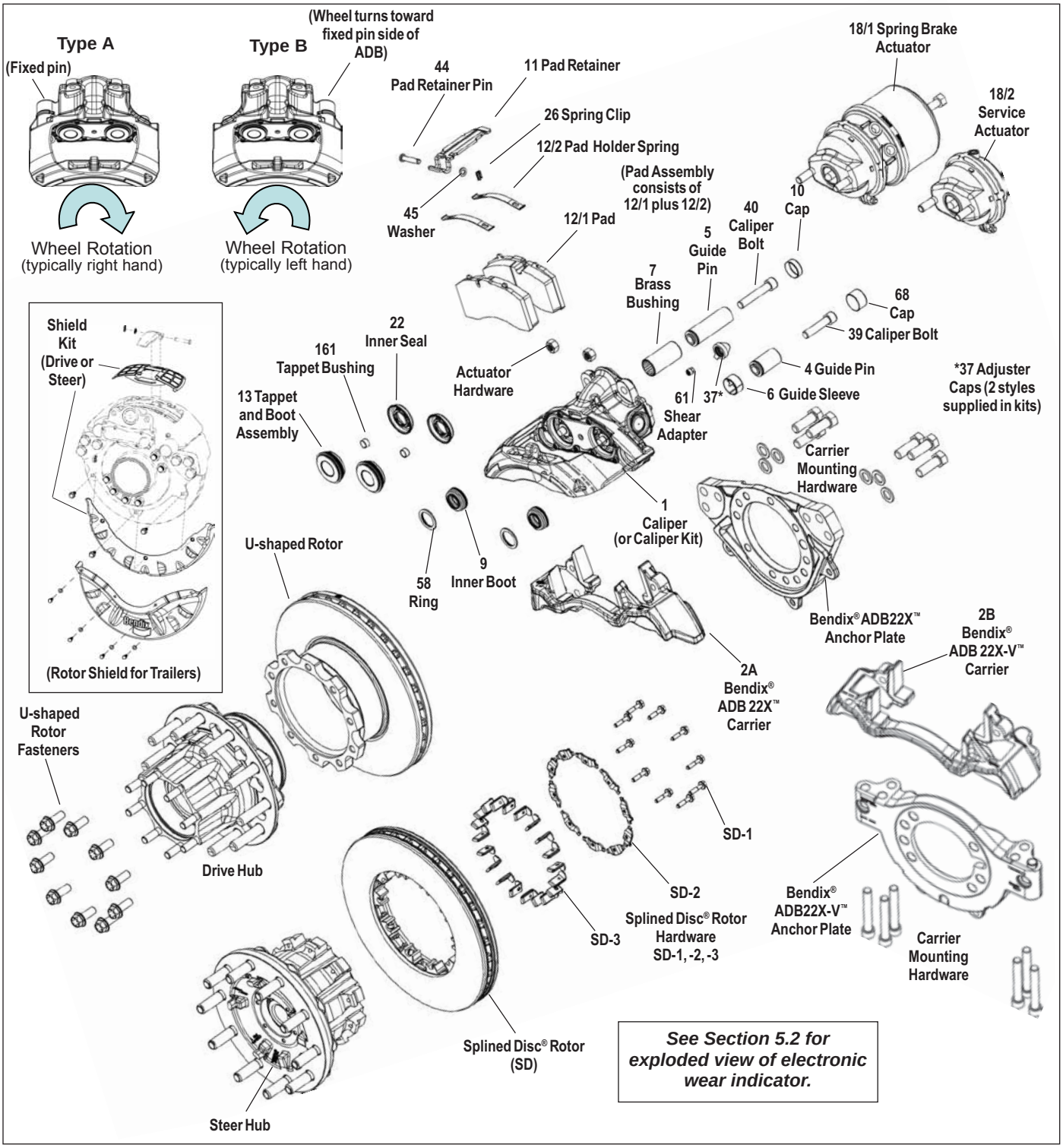


FIGURE 30 - ***EXPLODED VIEW - BENDIX® ADB22X™ AND ADB22X-V™ AIR DISC BRAKES***

5.0 MAINTENANCE KITS

Below is a list of some of the available kits. *See Figure 30 for an exploded view showing the components listed.*

Kit	See Section	Piece Number	Components Included in Kit
Dust Shields	Section 5.1	803129	Trailer Axle Pad & Rotor Shield Kit
		803130	Drive Axle Pad & Rotor Shield Kit
		802948	Steer Axle Pad Shield Kit
Pad Kit (axle set)	Section 5.2	802078	Pad retainer bars (5), set of four pads and holder springs (12), adjuster caps (37), pad retainer pins (44), washers (45), shear adapters (61).
Spring Clip Kit (box of 25)	NA	803151	Spring clips (26)
Shear Adapter (box of 10)	NA	802455	Shear adapters (61)
Tappet/Boot Kit (wheel end kit)	Section 5.5	802119	Tappet and boot assembly (13), tappet bushing (161), inner seal (22)
Adjuster Cap (kit has ten each of two styles)	NA	802643	Adjuster caps (37)
Guide Pin, Seal and Boot Kit (wheel end kit)	Section 5.6	803114	Ring (58), inner boot (9), brass bushing (7), guide pin (5), caliper bolt (40), cap (10), guide sleeve (6), guide pin (4), caliper bolt (39), cap (68)
Guide Pin Grease	NA	II14525	White (5 grams)
		K021964	White (500 grams)
Service Actuator	Section 5.4	K028039	Bendix® Type 14 Universal [Service brake actuator (18/2), actuator hardware]
		K028226	Bendix® Type 16 Universal [Service brake actuator (18/2), actuator hardware]
		K028022	Bendix® Type 18 Universal [Service brake actuator (18/2), actuator hardware]
		K028225	Bendix® Type 20 Universal [Service brake actuator (18/2), actuator hardware]
Spring Brake Actuator	Section 5.4	K027557	Bendix® Type 18/16 Piston Style Truck/Trailer Universal [Spring brake actuator (18/2), actuator hardware]
		K025670	Bendix® Type 18/24 Piston Style Truck/Trailer Universal [Spring brake actuator (18/2), actuator hardware]
		K025669	Bendix® Type 20/24 Piston Style Truck/Trailer Universal [Spring brake actuator (18/2), actuator hardware]
		K026451	Bendix® Type 18/24 Double Diaphragm Style Trailer Universal [Spring brake actuator (18/2), actuator hardware]
Caliper Kit (rationalized) Includes 803114 kit shown above	Section 5.3	K019174	Steer and Drive Axle "A" [Caliper kit (1)]
		K019175	Steer and Drive Axle "B" [Caliper kit (1)]
		K019180	Trailer Axle "A" [Caliper kit (1)]
		K019181	Trailer Axle "B" [Caliper kit (1)]
Carrier Kit	Sections 5.3 & 5.6	K051853	**Steer and Drive Axle, Axial** (Ring (58), inner boot(9), caliper bolt (40), cap (10), shear adapter (61), adjuster caps (37), ADB22X carrier complete (1), caliper bolt (39), cap (68).
		K043288	**Trailer Axle, Axial** (Ring (58), inner boot(9), caliper bolt (40), cap (10), shear adapter (61), adjuster caps (37), ADB22X carrier complete (1), caliper bolt (39), cap (68).
		K056559	**Steer and Drive Axle, Vertical** (Ring (58), inner boot(9), caliper bolt (40), cap (10), shear adapter (61), adjuster caps (37), ADB22X-V carrier complete (1), caliper bolt (39), cap (68).
Caliper/Carrier Kit		802090	Steer and Drive Axial “A” (1 + 2A)
		809091	Steer and Drive Axial “B” (1 + 2A)
		802984	Trailer Axial “A” (1 + 2A)
		802985	Trailer Axial “B” (1 + 2A)
		K021299	Steer and Drive Vertical “A” (1 + 2B)
		K021300	Steer and Drive Vertical “B” (1 + 2B)
Hubs	Section 5.7	K020505	Splined Disc® Brake - Aluminum - FF Steer, LMS Bearing Package (Hub)
		803134	Splined Disc® Brake - Aluminum - FL Steer, LMS Bearing Package (Hub)
		802847	Splined Disc® Brake - Aluminum - R Drive, LMS Bearing Package (Hub)
		K020514	Splined Disc® Brake - Aluminum - FF Steer, Standard Bearing Package* (Hub)
		803138	Splined Disc® Brake - Aluminum - FL Steer, Standard Bearing Package* (Hub)
		802859	Splined Disc® Brake - Aluminum - R Drive, Standard Bearing Package* (Hub)
		K045298	Splined Disc® - Aluminum - "TN" Trailer, Standard bearing package* (Hub)
		K045297	Splined Disc® - Aluminum - "TP" Trailer, Standard bearing package* (Hub)
		See hub supplier for these items	U-shaped - Iron/Aluminum, LMS/Standard Bearing Packages
			Flat - Iron/Aluminum, LMS/Standard Bearing Packages
Splined Disc® Rotor Attaching Kit	Section 5.7	K037766	All Splined Disc® Rotor Applications (Splined Disc Rotor hardware kit SD-1, -2, and -3)
Rotor	Section 5.7	802081	138mm U-shaped (Rotor, fasteners)
		802082	150mm U-shaped (Rotor, fasteners)
		802083	Severe Duty Splined Disc Kit (Splined Disc Rotor (SD), and hardware kit SD-1, -2, and -3)
		802569	Heavy Duty Splined Disc Kit (Splined Disc Rotor, and hardware kit SD-1, -2, and -3)

** Universal Replacement with standard bearing configuration and long studs. Contact 1-800-AIR-BRAKE if identification assistance is required.*

TABLE 2 - *MAINTENANCE KITS*

5.0.1 GENERAL INFORMATION ABOUT BENDIX® AIR DISC BRAKE MAINTENANCE

When working on Bendix® Air Disc brakes, please note the following:

- Read and follow the Safe Maintenance Practices on page two.
- Depending on the particular axle, the technician may need to remove the caliper/carrier to allow sufficient access to perform the work.
- **CAUTION: When using a hoist to support the air disc brake, do not attempt to use the pad retainer bar as a bracing point as it is not designed to support the weight of the brake. Use instead a brace (or chain) wrapped around the entire brake to attach the hoist.**
- When replacing bearings — or for any other maintenance procedure where the technician needs to remove the caliper/carrier assembly from the vehicle to perform the maintenance — **replacement caliper/carrier bolts will be required.** Please note that due to the high torque required, the original bolts cannot be reused. The bolts are available from the vehicle manufacturer.
- **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 risk of valve stem shear and other compatibility issues.**

5.0.2 SERVICE DVD

Order part number **BW7356** for a DVD showing the full set of maintenance procedures included in this Service Data sheet.

Kit	See Section	Remove Brake Pads? Section 5.2	Remove Caliper/ Carrier from Vehicle? Section 5.3	Remove Actuator from Caliper? Section 5.4
Dust Shields	Section 5.1	Not Typically	NA	NA
Pad Kit (axle set)	Section 5.2	Yes	No	No
Caliper Kit (rationalized)	Section 5.3	Yes	Yes	Yes
Carrier Kit	Section 5.3	Yes	Yes	Yes
Service Actuator	Section 5.4	No	Not Typically	Yes
Spring Brake Actuator	Section 5.4	No	Not Typically	Yes
Tappet/Boot Kit (wheel end kit)	Section 5.6	Yes	Typically	Typically
Guide Pin, Seal and Boot Kit (wheel end kit)	Section 5.7	Yes	Typically	Typically
Hubs	Section 5.8	Yes	Yes	Yes
Splined Disc® Rotor Attaching Kit	Section 5.9	Yes	Yes	Yes
Rotor	Section 5.10	Yes	Yes	Yes

TABLE 3 - ***OTHER REQUIRED SECTIONS FOR MAINTENANCE KITS***

5.1 AIR DISC BRAKE SHIELD KIT

5.1.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

Note: Most torque plates manufactured after January 1, 2007 have the required torque plate tabs to permit these shields to be mounted.

This shield kit includes a brake pad shield, a rotor shield and the required attaching hardware for use in Bendix® ADB22X™ and ADB22X-V™ Air Disc Brake applications where external contamination and excessive road debris is a concern. Brake pad and rotor shields can greatly reduce damage and/or premature wear of pads and rotors under these conditions.

During installation, verify that once the shield(s) are installed they will not come into contact with any vehicle components, suspension, housings, etc. through the full range of motion of the wheel. Keep in mind the particular use of the vehicle, the orientation of the brake on the axle and torque plate, the proximity of other axles, and/or the wheel/tire being used.

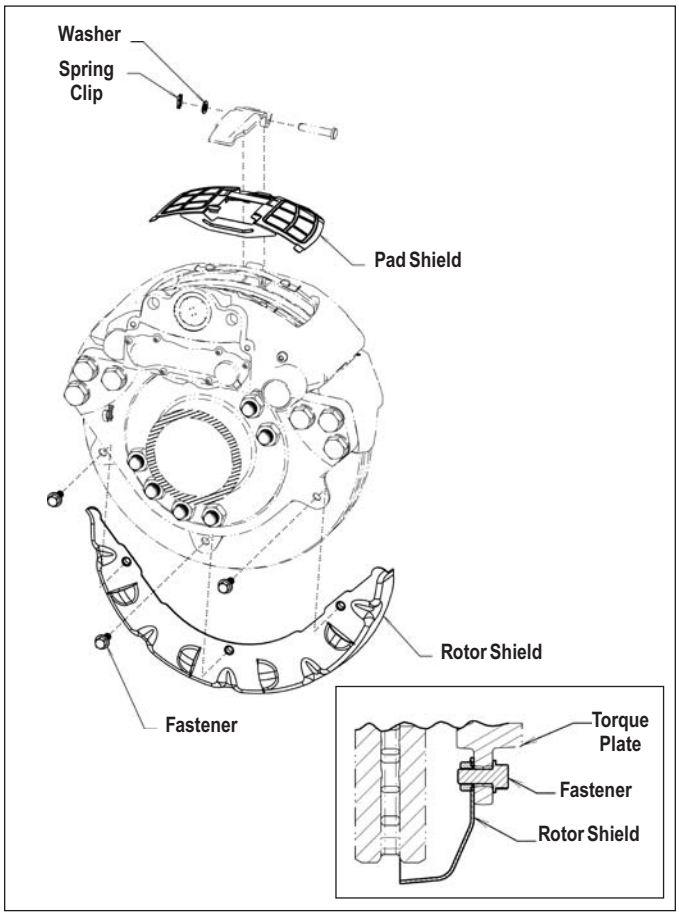


FIGURE 31 - ***DRIVE OR STEER AXLE EXPLODED VIEW WITH INSET SHOWING ROTOR SHIELD INSTALLATION***

5.1.2 Remove and discard the spring clip and washer from the pad retainer pin. Remove and retain the retainer bar and retainer pin. Position the pad shield as shown and re-insert the retainer bar. Install the retainer pin. Use the included spring clip and washer to secure the retainer pin. Check that the pad shield is held securely in place by the retainer bar. *See Figures 31 or 32.*

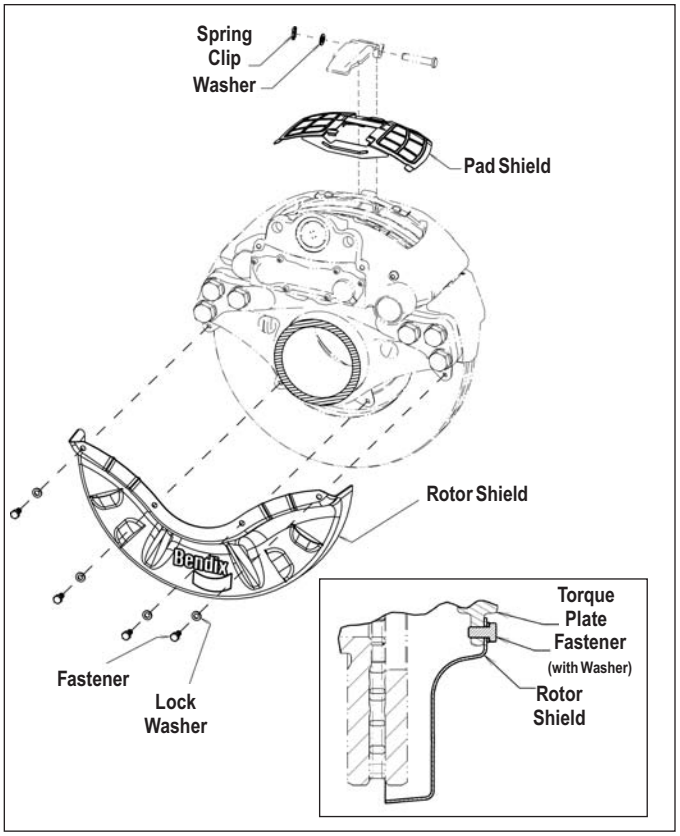


FIGURE 32 - ***TRAILER AXLE EXPLODED VIEW WITH INSET SHOWING ROTOR SHIELD INSTALLATION***

5.1.3 **Drive or Steer Axle Rotor Shields** (*See Figure 31*). Position the rotor shield *between the torque plate and the rotor*. The supplied cap screws pass through the mounting tabs in the torque plate and install into the shield. Torque cap screws to 44 Ft. Lbs. (528 in. lbs.).

5.1.4 **Trailer Axle Rotor Shields** (*See Figure 32*). Position the rotor shield with *the torque plate between the shield and the rotor*. With one (supplied) lock washer in place on each cap screw, pass the screws through the shield before mounting onto the threaded torque plate holes. Torque the cap screws to 24 Ft. Lbs. (288 in. lbs.).

Note: The installation of air disc brake shields does not eliminate the need for periodic maintenance and inspection of the air disc brake and entire wheel end for damage and/or wear. In addition, the truck and trailer manufacturer's specific criteria for the brake shield requirements on air disc brakes should be consulted before either installing or removing air disc brake shields from a wheel end(s).

5.2 PAD REPLACEMENT

5.2.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

The Bendix DVD (BW7356) shows this procedure.

Important: If the vehicle is equipped with spring brakes, cage the spring brakes on all axles to be worked on. Consult the vehicle manufacturer's instructions as necessary. *For Bendix piston-style, see Section 5.4.*

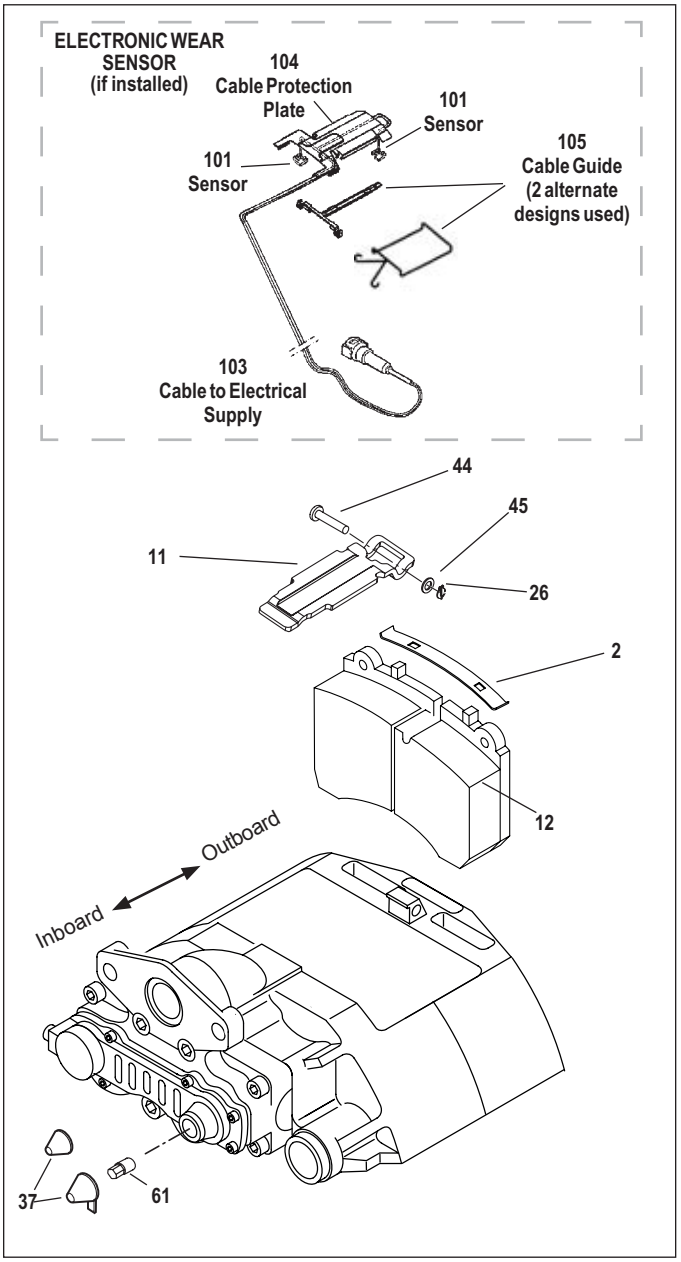


FIGURE 33 - ***PAD REPLACEMENT***

5.2.2 Raise the complete axle to be worked on until the tires clear the ground. See the vehicle maintenance manual instructions for removing the wheels.

5.2.3 If the air disc brake is equipped with an electronic wear sensor indicator *(see top of Figure 33)*, remove and retain the mounting hardware for the cable protection plate. The cable protection plate can then be set aside while servicing the pads. Note the position of the sensors in the brake pad channels, and carefully remove them. In most cases you do not need to release the cable connector in order to move the sensors away from the pad installation work area. Inspect the wear sensors - replace if damaged or abraded.

5.2.4 *See Figure 34.* Remove and discard the pin retention clip (26) and washer (5).

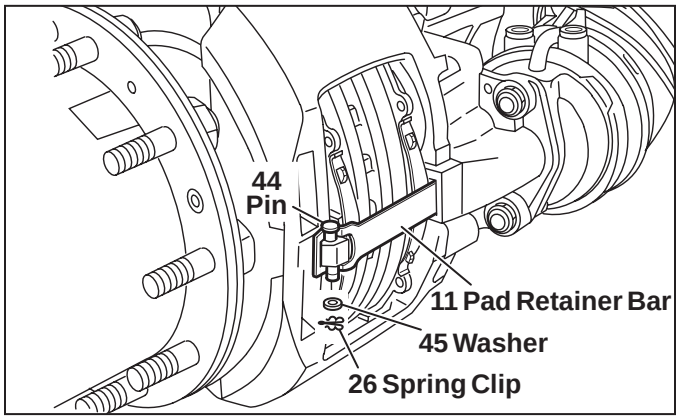


FIGURE 34 - ***PAD RETAINER BAR REMOVAL***

5.2.5 While pressing against the pad hold down bar, remove the pad retainer bar pin (11). Discard the hold down bar.

5.2.6 With the spring brake released (or caged), remove the adjuster cap (37) using the tab, taking care not to move the shear adapter (61). Note: Two sizes of adjuster cap are supplied in kits; use the same size as before in step 5.2.20.

5.2.7 Inspect the shear adapter (61). If significant corrosion and/or damage is present, remove the adjuster adapter using needle-nose pliers and replace with the adapter supplied in the kit and clean as necessary.

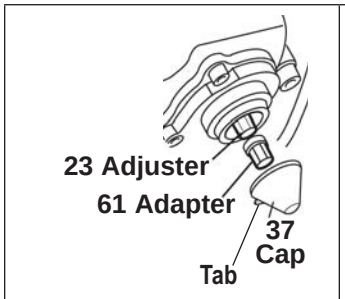


FIGURE 35 - ***EXPLODED VIEW OF ADJUSTER AND ADAPTER***

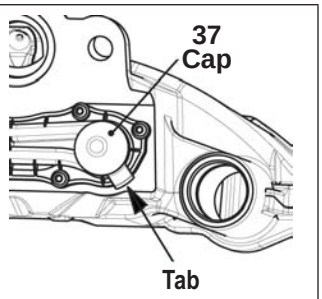


FIGURE 36 - ***CAP INSTALLED: TAB LOCATION***

For illustration purposes, the exploded view (Figure 35) shows the adjuster (23) and shear adapter (61) separated. When using the adjuster mechanism, always have the shear adapter installed on the adjuster.

CAUTION: Never turn the adjuster (23) without the shear adapter (61) installed. The shear adapter is a safety feature and is designed to prevent too much torque being applied. The shear adapter will fail (by breaking) if too much torque is used.

Note: For wheel-ends with spring brakes, if a shear adapter fails, always double-check to verify that the spring brake has been released (or caged). If the spring brake is applied, release or cage the brake (assure that the air system pressure is at least 90 PSI) and start the procedure again.

If the shear adapter fails, you may attempt a second time with a new (unused) shear adapter. In cases where a second failure of the shear adapter confirms that the adjustment mechanism is seized, the caliper must be replaced.

5.2.8 Use a 10 mm. six-point box wrench *(See Figure 37)* to turn the adjuster counterclockwise until sufficient space exists to remove the brake pads. A clicking noise occurs each time the adjuster turns.

CAUTION! Avoid overloading or damaging the adjuster shaft. Do not use an open-ended wrench since it may damage the adjuster shaft.

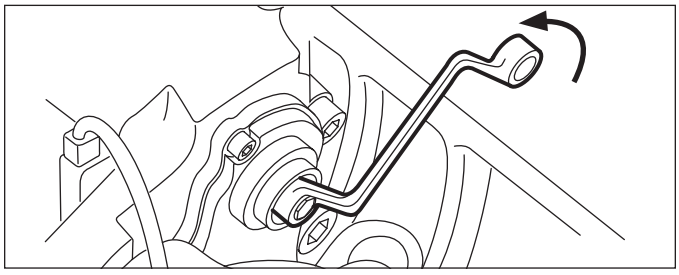


FIGURE 37 - *BACKING OFF THE ADJUSTER FOR PAD REMOVAL*

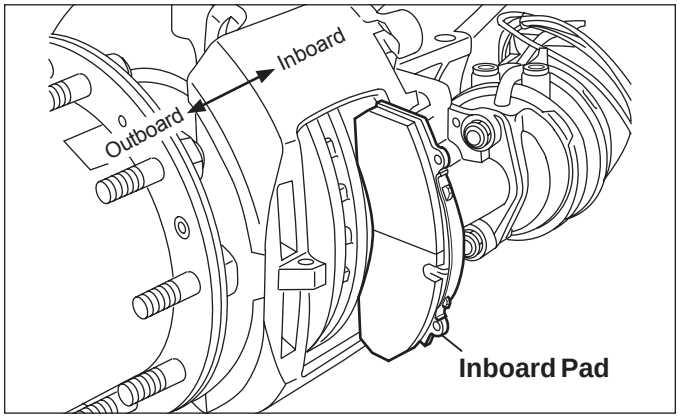


FIGURE 38 - *PAD REMOVAL*

5.2.9 *See Figure 38.* Move the caliper fully inward and remove the inboard pad, then move the caliper fully outward and remove the outboard pad.

5.2.10 Repeat the pad removal procedure for the other end of the axle.

5.2.11 To confirm that the guide pins are sliding freely, examine the pads just removed for uneven wear. Use these two inspections:

A. Check for uneven end-to-end pad wear. If the difference in wear is greater than 0.080 in. (2 mm.), replace the brake pads and also inspect the guide pins *(See Section 4.5)*.

B. Compare the thickness of the inboard and outboard pads of each set. If the difference between the inboard and outboard pad thickness is greater than 0.138 in. (3.5 mm.), replace the brake pads and inspect the guide pins *(See Section 4.5)*.

5.2.12 Inspect the Brake Rotor *(See Section 4.4).*

5.2.13 Inspect the guide pins *(See Section 4.5)*.

Important: To maintain optimal braking, Bendix strongly recommends that whenever brake pads are replaced, the complete axle set be replaced together. Use only pads which are permitted by the vehicle manufacturer, axle manufacturer, and/or disc brake manufacturer. Failure to comply with this may invalidate the vehicle manufacturer's warranty.

Before installing the brake pads, use the adjuster to fully retract the tappets to provide adequate clearance.

5.2.14 Clean the surfaces that will come in contact with the brake pad.

Caution: When installing pads and retaining springs, where appropriate, use heavy duty gloves and always keep fingers away from potential pinch hazard areas.

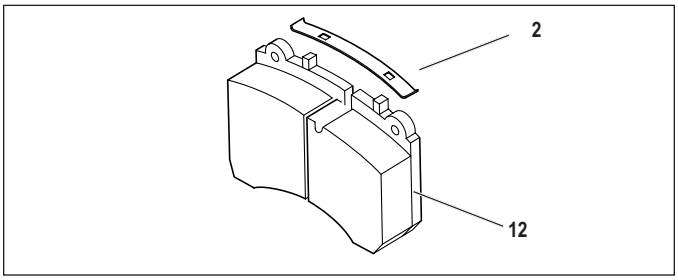


FIGURE 39 - *PAD RETAINING SPRING INSTALLATION*

5.2.15 Install the pad retaining springs(2) onto the brake pads(12) by inserting one end of the spring onto the lug at the top of the brake pad *(See Figure 39).* Carefully apply enough force to permit the second lug to fully engage, taking care to keep fingers etc. away from the spring as it seats.

5.2.16 Pull the caliper fully outward and install the outboard pad. Move the caliper fully inward and install the inboard pad.

5.2.17 To reinstall wear indicators (if used): Insert the wear sensors into position in the new brake pads. Route the sensor cable through the cable protection plate channel and secure the plate with the mounting hardware retained at disassembly. *(See Section 5.2.)*

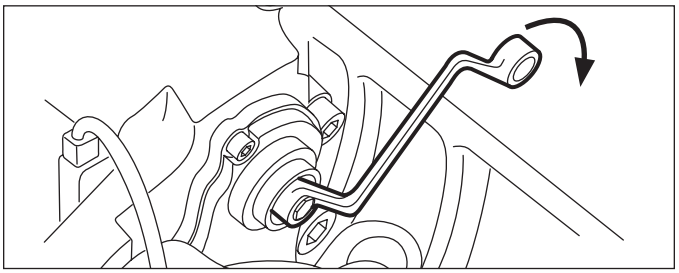


FIGURE 40 - *RUNNING CLEARANCE ADJUSTMENT*

5.2.18 Using a 10 mm. six-point box wrench, turn the Shear Adapter (61) **clockwise** until the pads contact the rotor. Note: Do not use an open-ended wrench as this may damage the adapter. *(See Figure 40)*.

5.2.19 Using the same tool, turn the Shear Adapter (61) **counter-clockwise** and listen for the sound of 3 clicks as the mechanism backs-off (increases) the running clearance. *(See Figure 37).*

5.2.20 Select the correct replacement adjuster cap from those supplied with the kit. Lightly grease adjuster cap with Renolit HLT2 white grease (part number I I14525) and install the cap.

5.2.21 Push the new pad retainer bar (11) into the groove of the caliper. Press down on the pad retainer bar, and insert the pad retainer pin (44), with the pin pointing downwards, where possible. Install the supplied washer (45) and then the spring clip (26). *(See Figure 34).*

5.2.22 Apply and release the brakes. The hub should turn easily by hand after applying and releasing the brake.

5.2.23 Re-check the running clearance. Readjust if necessary.

5.2.24 Reinstall the wheel, following the vehicle manual instructions.

⚠ WARNING!

The brake pads and rotor must be maintained within the recommended wear limits. Failure to monitor wear and replace the brake pads and rotor when required may result in diminished brake performance.

5.3 CALIPER/CARRIER/ACTUATOR ASSEMBLY

CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.

CAUTION: When using a hoist to support the air disc brake, do not attempt to use the pad retainer bar as a bracing point. It is not designed to support the weight of the brake. Use instead a brace (or chain) wrapped around the entire brake to attach the hoist.

5.3.1 In all cases check that the current hose routing arrangement does not restrict the full travel of the caliper before beginning work on the assembly.

5.3.2 Remove the brake pads **(***See Section 5.2***).**

5.3.3 *(See Section 5.4)***.** If the actuator used is a spring brake, following the manufacturer's guidelines, cage the spring. With all air pressure drained from the system, disconnect the air hoses from the brake chamber.

Vertical Mounting Bolt Style

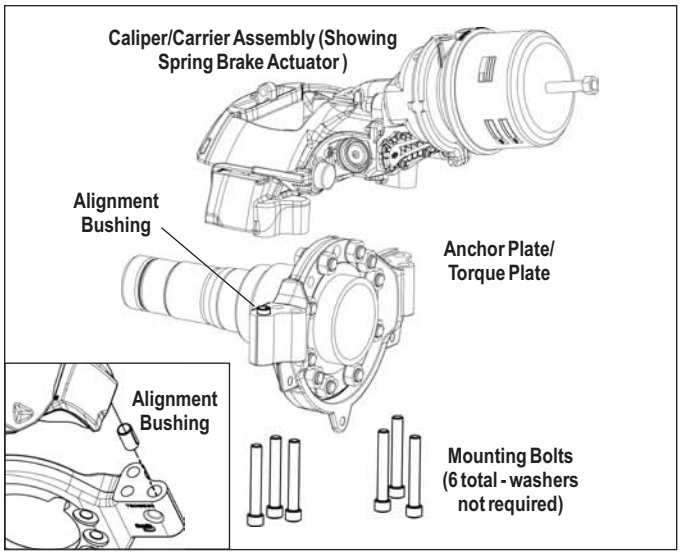


FIGURE 41 - *VERTICAL MOUNT CALIPER/CARRIER*

5.3.4 *See Figure 41.* Supporting the air disc brake by necessary means, remove the six (6) mounting bolts/washers and discard. Note: Bendix strongly recommends that during re-assembly these bolts are replaced - see your vehicle manufacturer for replacement hardware. Lift the caliper up off the anchor plate.

The vertical bolt assembly includes an alignment bushing. **This bushing must be saved for re-use during re-assembly of the brake.** The bushing mounts in the torque plate and maintains the correct alignment of the brake assembly relative to the rotor.

5.3.5 If the brake assembly does not separate from the anchor plate it may be helpful to install an M16X2.0 screw longer than 120 mm at the bushing locations and tap the end of the bolt with a hammer to free the brake assembly. Remove the assembly.

Axial Mounting Bolt Style

5.3.6 Disconnect the air hose(s) to the brake chamber. *See Figure 42.* Supporting the air disc brake by necessary means, remove the six bolts attaching the brake to the anchor plate and remove the caliper/carrier assembly from the vehicle.

Note: Bendix strongly recommends that during re-assembly these bolts and washers are replaced. See your vehicle manufacturer for replacement hardware. Remove the assembly.

Re-installation (Both Styles)

5.3.7 Supporting the air disc brake by necessary means, attach the brake to the anchor plate using six (new) bolts. Torque to vehicle manufacturer's specifications. If torque values and bolts are not specified by the vehicle manufacturer, then select a replacement bolt as shown in Table 4.

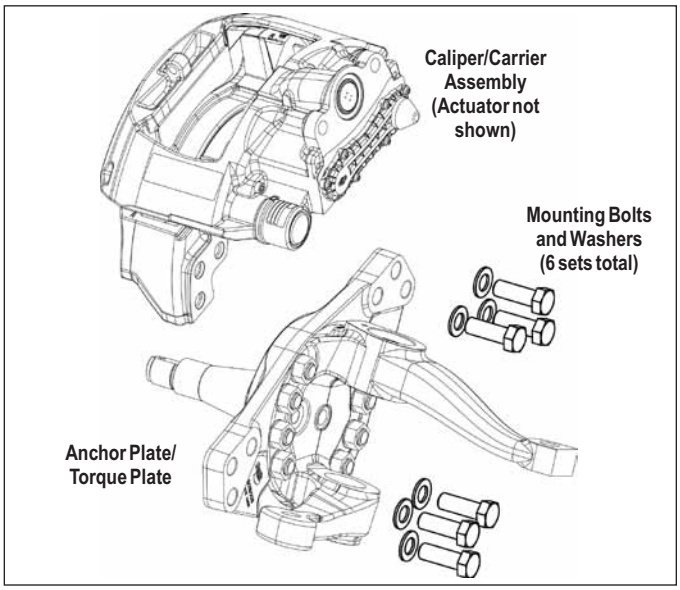


FIGURE 42 - *AXIAL MOUNT CALIPER/CARRIER*

5.3.8 Re-install the air hoses *(See Section 5.4.8-9) and check for leaks*.

5.3.9 Inspect and re-install the pads *(See Section 5.2)*.

Air Disc Brake Attachment Hardware		
Torque Plate Manufacturer	Fastener	Torque
Bendix Axial Carrier Torque Plate 	Fastener: M20 x 2.5 x 60 mm Class 10.9 ***Washer: Requires HARDENED 3 mm (minimum thickness) for each bolt.***[1] ***If the vehicle is using a Bendix manufactured Axial Anchor Plate, with a thickness of 1.14 in. (29 mm) where these bolts are assembled, then a bolt with an overall length of 2.36 in. (60 mm) will meet these requirements***	Use the manufacturer's recommendations. If unavailable, use phosphate and oil finish fastener. Pre-Torque: 20-60 ft-lbf [27-81 N·m] Final Torque: 350-400 ft-lbf [475-542 N·m]
Bendix Vertical Carrier Torque Plate 	Fastener: M16 x 2.0 x 110 mm, Class 10.9 ***Washer: None required.***	Use the manufacturer's recommendations. If unavailable, use plain and oil finish fastener. Torque: 200-220 ft-lbf [271-298 N·m]
Trailer Torque Plate	Fastener: M20 x 2.5 x L Class 10.9 Length determination: L = Torque Plate (TP) thickness + Carrier engagement + Washer thickness L_{min} = TP thickness + 24 mm + 3 mm L_{max} = TP thickness + 29 mm + 3 mm ***Washer: Requires HARDENED 3 mm (minimum thickness) for each bolt.***[1]	Use the manufacturer's recommendations. If unavailable, use phosphate and oil finish fastener: Pre-Torque: 20-60 ft-lbf [27-81 N·m] Final Torque: 350-400 ft-lbf [475-542 N·m]
Table Note: 1. The washer outside diameter must be less than 1.1in. (28.5 mm).		

TABLE 4 - *TORQUE PLATE FASTENERS AND TORQUE RECOMMENDATIONS (SEE MANUFACTURER'S RECOMMENDATIONS)*

5.4 SPRING OR SERVICE BRAKE

5.4.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

5.4.2 **Use the spring brake manufacturer's recommended safety practices in all cases.**

Some spring brake and vehicle manufacturers permit caging the spring brake while the spring brake is engaged.

THE FOLLOWING INSTRUCTIONS ARE FOR BENDIX® BRAND PISTON-STYLE ACTUATORS.

5.4.3 With the vehicle on a level surface and the wheels properly chocked, apply air to release the spring brakes (parking brakes) by using the dash-mounted air control valve. Back out the release bolt (Figure 43, arrow "D"), using a maximum torque of 26 ft. lbs. (35 N·m) to cage the air released spring force on the push rod.

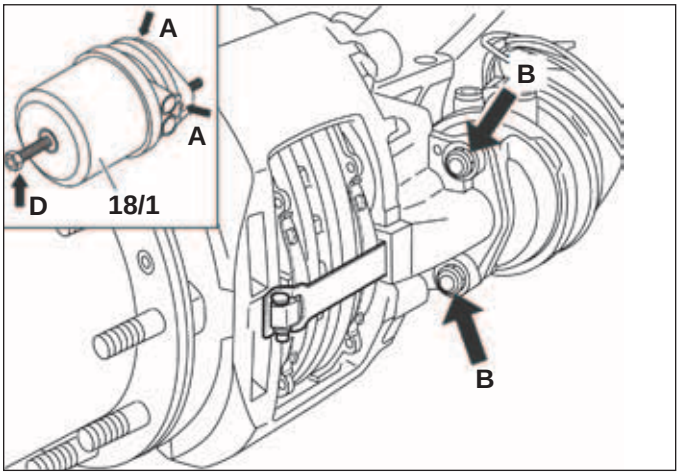


FIGURE 43 - ***ACTUATOR SPRING CAGING AND REMOVAL***

5.4.4 Exhaust the air from the brake chambers by using the dash-mounted air control valve. With all air pressure drained from the system, disconnect the air hoses from the brake chamber. While supporting the brake chamber in position, remove and discard the brake chamber mounting nuts (Figure 45, arrows marked "B"). Remove the brake chamber.

5.4.5 Re-installation. Before installing the brake chamber, the actuator flange *(See Figure 46, arrow "C")* must be cleaned and inspected. Consult the vehicle manual. The spherical cup in the lever (19) must be greased with white grease (Part No. II14525 or K021964). Add grease to the rubber gasket on the chamber.

CAUTION: Do not use grease containing molybdenum disulfate.

5.4.6 The seal, as well as the push rod area, must be clean and dry.

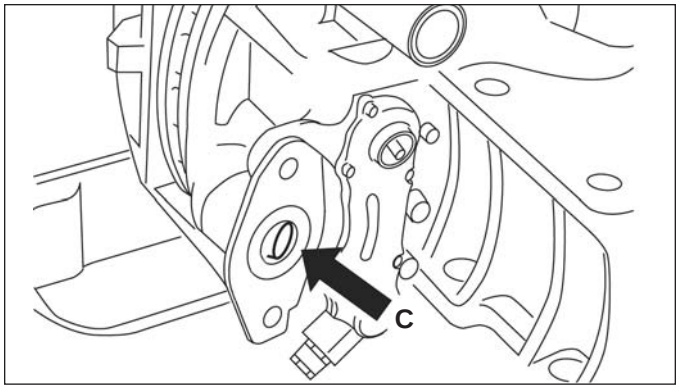


FIGURE 44 - SPRING BRAKE INSTALLATION

CAUTION: Do not use brake chambers with seals that have a thickness less than 0.12 in. (3 mm). Use only actuators which are recommended by the vehicle manufacturer.

5.4.7 Install the brake chamber using new self-locking nuts (EN ISO 10513). Alternately tighten both the nuts step by step up to a final torque of 133 ± 7 ft. lbs (180 ± 10 N·m). **Bendix strongly recommends that new nuts be used.**

5.4.8 Re-connect the air hose(s) and be sure that each hose is not twisted or in contact with moving vehicle components. The air hose routing must allow for full caliper travel. Note that for spring brake service chambers the ports are indicated by: "11" Service Brake Port and "12" Spring Brake Port

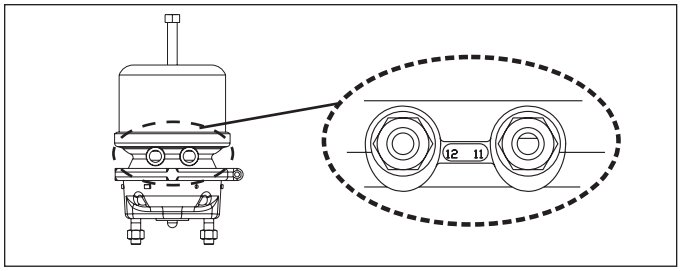


FIGURE 45 - ***PORT DESIGNATIONS***

Note: Where a new spring brake chamber is being installed, note that in some cases drain plugs are installed *(See Figure 43, arrows marked "A").* Where drain plugs are present, after installation, remove whichever plug is at the lowest position. The selected drain hole must be aligned downwards (or within ±30°) when installed on the vehicle. In the case of spring brake chambers, install the pads before uncaging the spring.

5.4.9 Before returning vehicle to service, with the system pressurized, using a soap solution, check for air leakage. Minimal leakage in the area around the diaphragm is permitted (100 SCCM), and a one-inch bubble in one minute at the hose fitting is acceptable. If abnormal leakage is detected, the diaphragm must be replaced, or fitting adjusted, respectively.

5.5 TAPPET & BOOT ASSEMBLIES, AND TAPPET INNER SEAL REPLACEMENT

5.5.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

In some cases, the technician will need to remove the caliper carrier assembly from the vehicle. *(See Section 5.3.)* Note that new bolts (available from the vehicle manufacturer) will be needed for re-installation.

Important: If the vehicle is equipped with spring brakes, cage the spring brakes on all axles requiring work. Consult the vehicle manufacturer's instructions as necessary. This procedure may be carried out with the air disc brake installed on, or removed from, the vehicle. In cases where the caliper/carrier assembly is removed from the vehicle, NEW fasteners must be used and properly torqued during re-installation. Use only fasteners approved by the vehicle manufacturer.

Note: This maintenance procedure uses specialized tools. The full Bendix air disc brake tool kit (K029164), or Ken-Tool kit (80000), includes the complete set of tools required for all permitted maintenance procedures. Alternately, for locations where only the tappet and boot replacement procedures will be performed, the smaller Bendix tool kit (K028829), or Ken-Tool kit (80001) will suffice. The DVD (BW7356) shows this procedure.

Bendix Number/ Ken-Tool Number	Description	Typical Tool View
T1 / KT01	Cup	
T2 / KT02	Handle for KT01 cup	
T3 / KT03	Swivel assembly (KT03-1 short body + KT03-2 brass disc + KT03-3 retaining spring)	
T4 / KT04	Long strut	
T9 / KT09	Flange	
T15 / KT015	Fork	
T24 / KT024	Black Nylon Disc	

TABLE 5 - ***TAPPET AND BOOT REPLACEMENT TOOLS***

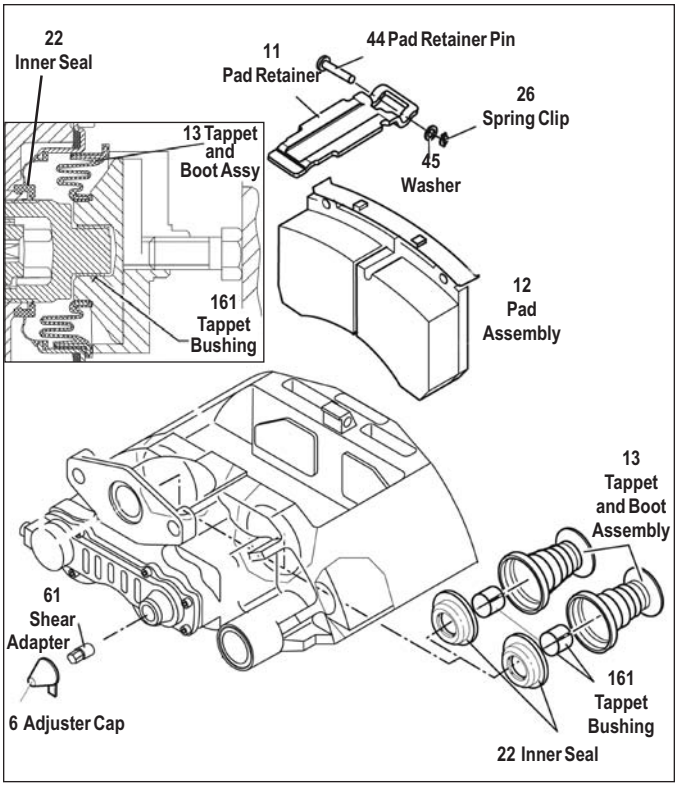


FIGURE 46 - ***ADB EXPLODED AND SECTION VIEWS***

5.5.2 Pad Removal: follow Sections 5.2.1-5.2.11 for removal of the brake pads.

5.5.3 Inspect the Brake Rotor *(See Section 4.4).*

Tappet and Boot Assembly (13) Removal

CAUTION: NEVER EXTEND THE TAPPET MORE THAN 1.75 in. (44.5 mm). ***See Figure 47.*** **Over-extending the tappet will result in the tappet losing engagement with the threads of the synchronizing mechanism. Since the mechanism can only be set at the manufacturing plant, the** ***caliper/carrier assembly must be replaced*** **if this happens.**

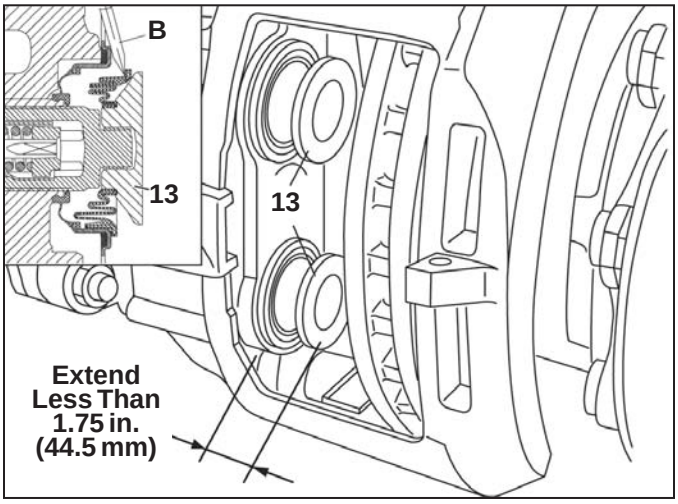


FIGURE 47 - ***PERMITTED TAPPET EXTENSION***

5.5.4 *See Figure 47.* Extend the tappets — less than 1.75 in. (44.5 mm) — by turning the shear adapter (61) clockwise. A screwdriver (callout "B" in

Figure 47 inset) should be used to move the boot and allow the wedge fork ("A" in Figure 48) to be inserted.

CAUTION: Do not insert the screw driver more than ¼ inch. Take care not to damage the inner sealing face (*see arrow "X" in Figure 48*). Gouges or grooves will prevent a good seal and will require that the caliper be replaced.

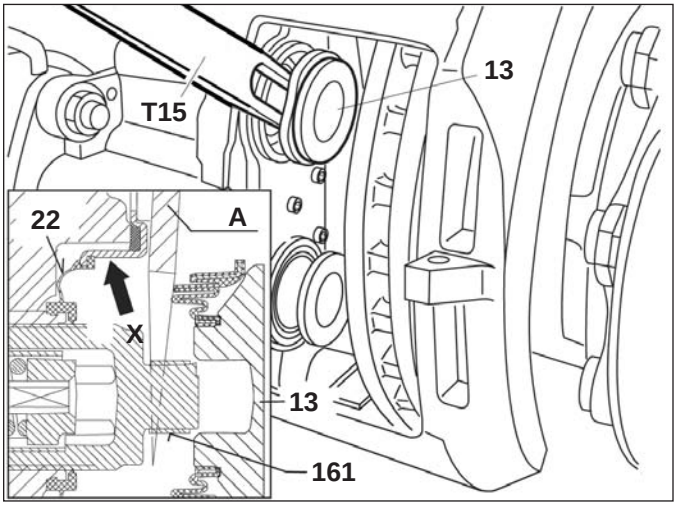


FIGURE 48 - *WEDGE TOOL USE*

5.5.5 The tappet and boot assemblies (13) can then be removed from the threaded tubes (16) by using the wedge fork (T15). *Be sure to orient the wedge tool with the tapered side towards the tappet.*

5.5.6 Remove the old tappet bushings (161).

5.5.7 Retract the threaded tubes by turning the shear adapter (61) counter-clockwise.

5.5.8 *See Figure 49.* Carefully remove the inner seal using one or two flat-blade screwdrivers as shown. Caution: Do not insert the screwdrivers so far that they come into contact with the threaded tubes. Damage to the threaded tubes would require that the brake be replaced.

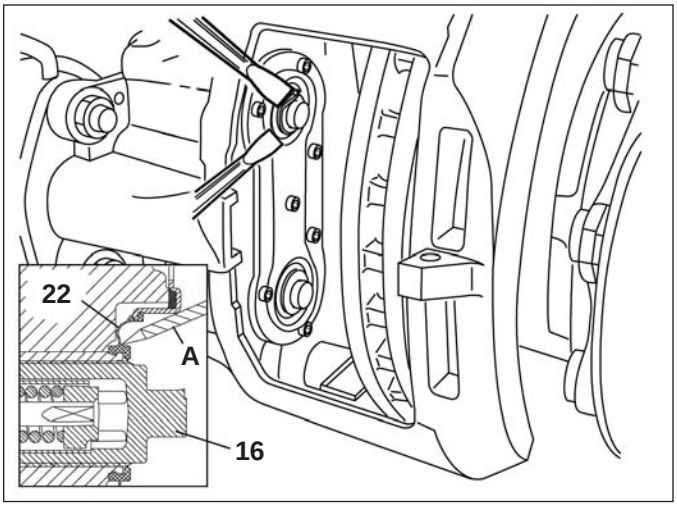


FIGURE 49 - *INNER SEAL REMOVAL*

5.5.9 Inspect the inner sealing face for damage. If damage is found that would cause the inner seals not to be able to seal properly, the caliper/carrier assembly must be replaced. Clean the area around the inner seal.

5.5.10 Inspect the threaded tubes (16). *See Figures 50 and 51*. Extend the tubes, but by less than 1.75 in. (44.5 mm), by turning the shear adapter (61) clockwise. Inspect the threads for rust, corrosion, or damage etc. If there is evidence of damage to the threads; significant rust; or corrosion, the caliper/carrier assembly must be replaced.

If the technician is working with the caliper on the vehicle, the technician may place a new brake pad (12) into the outboard gap to help avoid the loss of thread engagement of the threaded tubes. *See Figure 50.*

If the work is being carried out at a workbench, the technician may insert a 2.76 in. (70 mm) spacer *(See callout "E" in Figure 51)* into the caliper (1) to help avoid the loss of thread engagement.

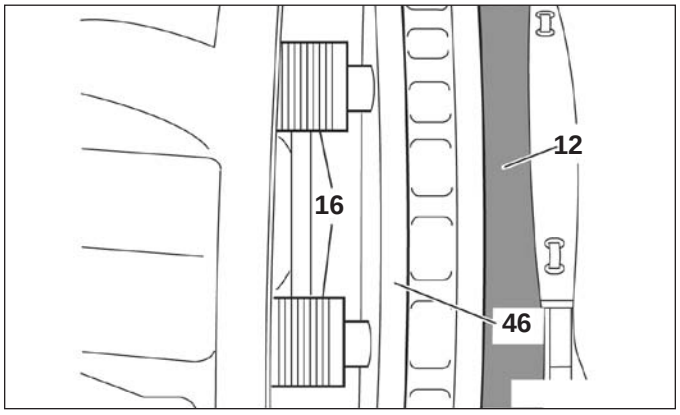


FIGURE 50 - *USE OF A NEW BRAKE PAD AS A SPACER*

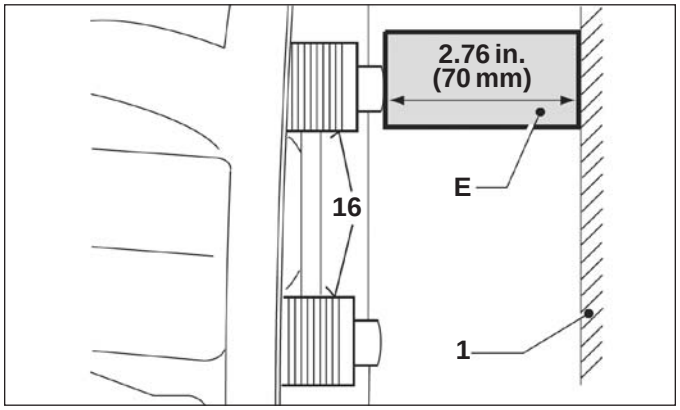


FIGURE 51 - *USE OF A SPACER (OFF-VEHICLE INSPECTION)*

5.5.11 For threads that are in good condition, grease the threads with white grease (Part No. II14525 or K021964). Before installing the replacement inner seals (22), retract the threaded tubes by turning the shear adapter (61) counter-clockwise.

Note: If the shear adapter fails while you are retracting the threaded tubes, you may try again with another (new) shear adapter. If this also fails, this indicates that the adjuster mechanism is damaged and the caliper must be replaced.

To install inner seals where the caliper is on the vehicle:

5.5.12 Position the replacement inner seal (22) over the threaded tube (16). *See Figures 52 and 53 for the tools and installation arrangement used.* Position the L1 (T3 + T9) with the short spacer (T3) in position as shown in Figure 53. Guide the tool over the end of the threaded tube (16). Install the new inner seal (22) into position by rotating the adjuster nut on the T3 portion of the tool, using an open-ended wrench.

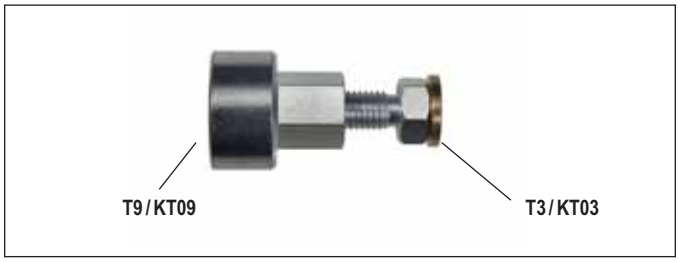


FIGURE 52 - *ON-VEHICLE INNER SEAL TOOL (L1)*

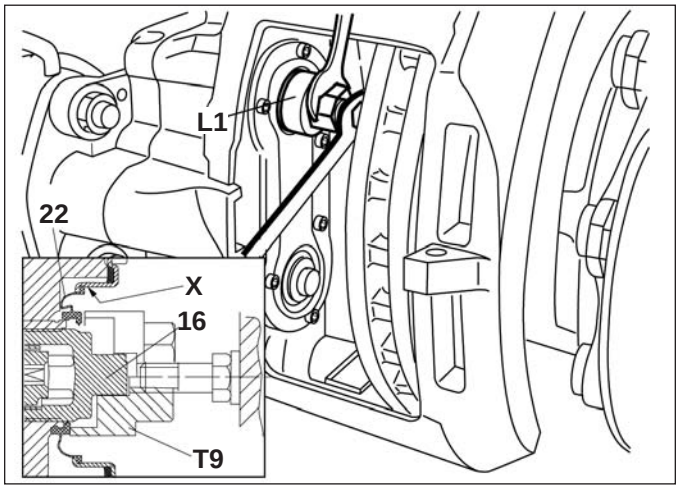


FIGURE 53 - *ON-VEHICLE INNER SEAL INSTALLATION*

To install inner seals where the caliper has been removed from the vehicle:

5.5.13 Position the replacement inner seal (22) over the threaded tube (16). *See Figures 54 and 55 for the tools and installation arrangement used.* The threaded tubes need to be retracted to allow the tool to be inserted. Use the combination tool L2 (T4 + T3 + T9) with the long spacer (T4) as shown in Figure 55. Since the installation tool is guided by the center post of the threaded tube, advance the tube a small amount to align the tool and the center post. Install the new inner seal (22) into position by rotating the adjuster nut on the T4 portion of the tool using an open-ended wrench.

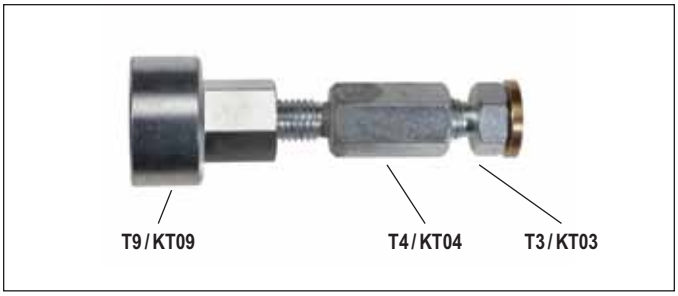


FIGURE 54 - *ON-VEHICLE INNER SEAL INSTALLATION TOOL (L2)*

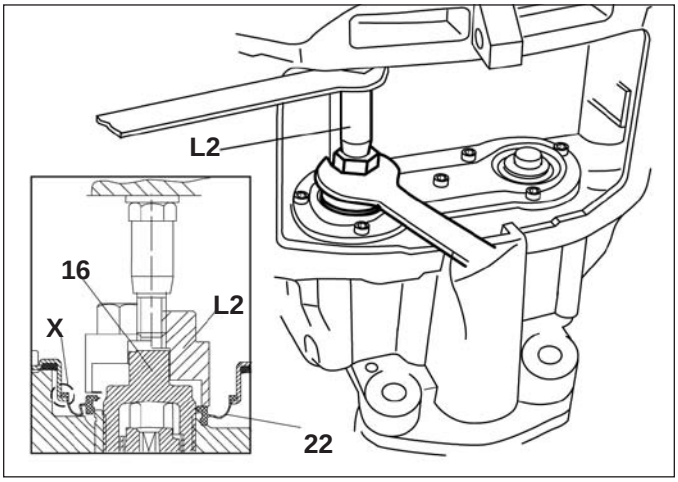


FIGURE 55 - *OFF-VEHICLE INNER SEAL INSTALLATION*

CAUTION: To confirm that the inner seal has been correctly installed, begin to extend the threaded tubes (16) by turning the shear adapter clockwise by 4-5 turns. Watch as the threaded tube extends. Inner seals that are installed correctly WILL NOT ROTATE as the threaded tube extends.

5.5.14 Note: Inspect the tappet/boot kit to determine if the tappets supplied are already pre-greased (a plastic cover should be present — be sure to remove the cover when installing the tappet). Only in the case of kits that are not pre-greased will the installer need to apply grease to the tappets. In all cases, the threaded portion of the tubes will need to be greased. Retract the threaded tubes.

5.5.15 Install the new tappet bushing (161) onto the center post of each threaded tube (16) by hand. By hand, ease the tappet bushings onto the center post of the threaded tubes and they will snap into position.

5.5.16 The sealing seat in the caliper for tappet and boot assemblies (13) must be clean and free of grease. Wipe the opening with a clean shop rag. Place a tappet and boot assembly (13) in position over the center post and tappet bushing.

To install tappet and boot assemblies where the caliper is on the vehicle:

5.5.17 *See Figures 56, 57 and 58.* Use tool B1, comprising tools T1, T2, and T3 to press the boot into position. The tool is then reversed, and the nylon disc (T24)

is inserted into the T1 “cup” (combination tool ‘B2’). Holding the T1 handle, turn the nut on the T3 tool to fully install the tappet onto the tappet bushing (161).



FIGURE 56 - *ON VEHICLE TAPPET AND BOOT INSTALLATION TOOL (B1 - WITH T24 INSTALLED, B2)*

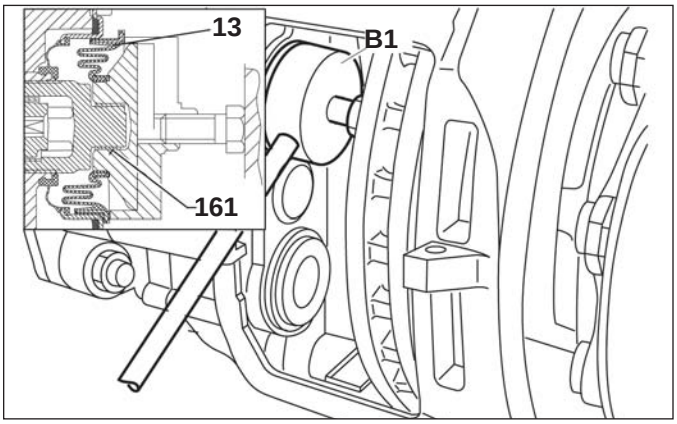


FIGURE 57 - *ON VEHICLE TAPPET BOOT INSTALLATION*

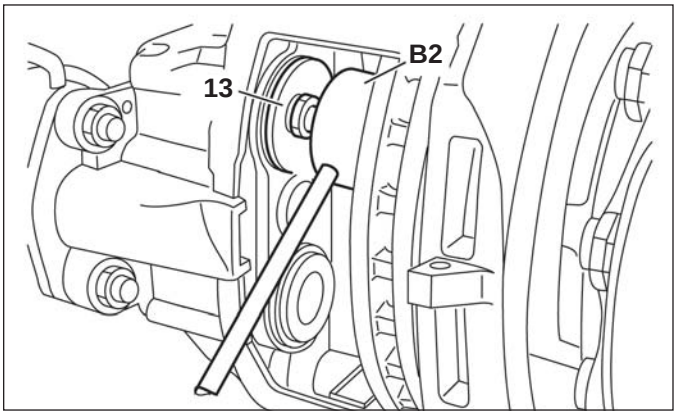


FIGURE 58 - *ON VEHICLE TAPPET INSTALLATION*

To install tappet and boot assemblies where the caliper is removed from the vehicle:

5.5.18 *See Figures 59, 60 and 61.* Retract the tappets, as needed, in order to have room to install the tappets. Use tool B3, comprising tools T1, T2, and T3 to press the boot into position. The tool is then reversed, and the nylon disc (T24) is inserted into the T1 “cup” (combination tool ‘B4’). Holding the T1 handle, turn the nut on the T3 tool to fully seat the tappet onto the tappet bushing (161).



FIGURE 59 - *OFF VEHICLE TAPPET BOOT INSTALLATION TOOL (B3, WITH T24 INSTALLED, B4)*

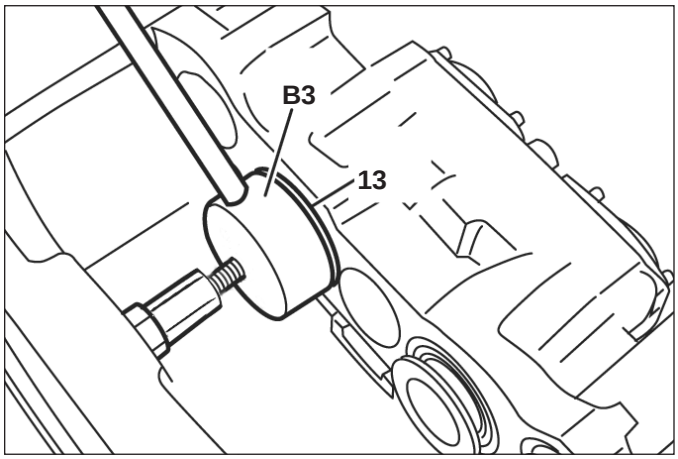


FIGURE 60 - *OFF VEHICLE TAPPET BOOT INSTALLATION*

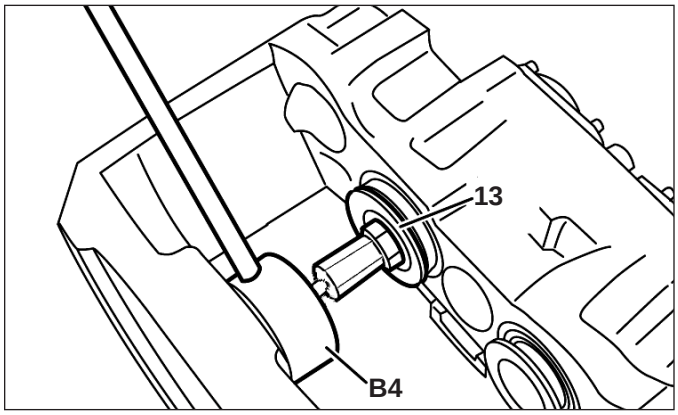


FIGURE 61 - *OFF VEHICLE TAPPET INSTALLATION*

5.5.19 Check that the tappets are firmly attached to the bushings by gripping and pulling lightly on them by hand. Confirm that the tappets are able to rotate a small amount on the tappet bushings by grasping and turning them by hand. Finally, using a box-end wrench on the shear adapter, extend the threaded tubes outward, and check that the boots are held in place. Retract the tappets.

5.5.20 Re-install the caliper/carrier assembly, if it was removed from the vehicle *(See Section 5.3)*.

5.5.21 Re-install the brake pads *(See Section 5.2).*

5.6 GUIDE PIN AND BOOT ASSEMBLIES

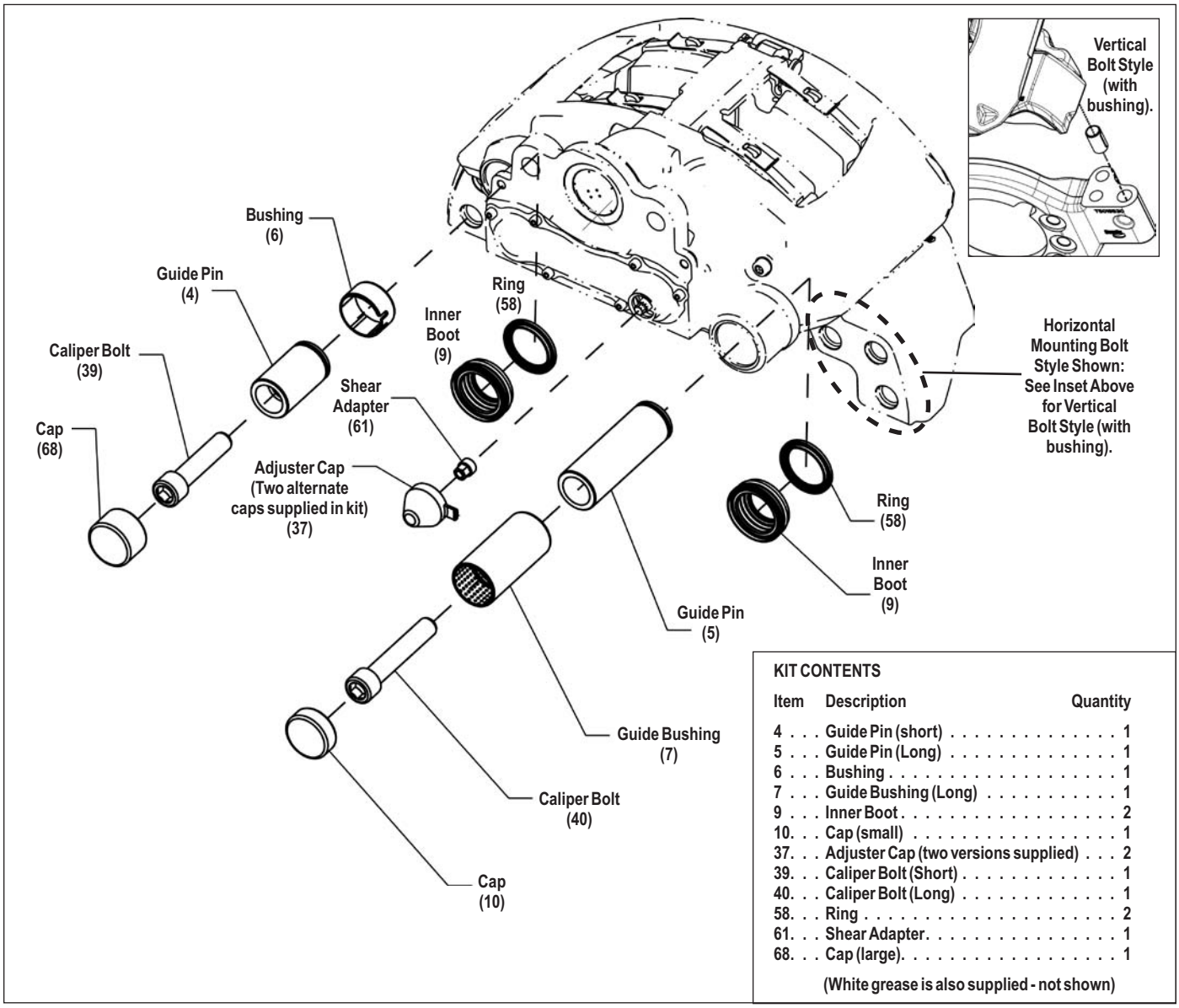


FIGURE 62 - ***GUIDE PIN EXPLODED VIEW***

The Bendix DVD (BW7356) shows this procedure.

5.6.1 **CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels.**

Important: If the vehicle is equipped with spring brakes, cage the spring brakes on all axles to be worked on. Consult the vehicle manufacturer's instructions as necessary. ***For Bendix® brand piston-style spring brake chambers, see Section 5.4.***

These procedures are typically carried out with the caliper/carrier removed from the vehicle (may be carried out with the air disc brake installed). In cases where the caliper/carrier assembly is removed from the vehicle, NEW fasteners must be used and properly torqued during re-installation. Use only fasteners approved by the vehicle manufacturer.

Note: This maintenance procedure uses specialized tools. The full Bendix air disc brake tool kit (K029164), or Ken-Tool kit (80000), includes the tools needed for the guide pin and boot installation. See Table 6.

Note that a smaller Bendix tool kit (K029107), or Ken-Tool kit (80002) may be used where only the guide pins will be serviced.

Bendix Number/ Ken-Tool Number	Description	Typical Tool View	Bendix Number/ Ken-Tool Number	Description	Typical Tool View
T05 / KT05	1-3/8 in. diameter disc		T14 / KT14	Brass nut	
T06 / KT06	1-1/2 in. diameter disc		T16 / KT16	Dimpling tool	
T07 / KT07	2 in. diameter sleeve		T20 / KT20	8 in. bolt	
T08 / KT08	2-1/8 in. diameter disc		T21 / KT21	Half Sleeve	
T10 / KT10	8 in. bolt		T26 / KT26	Cap installation tool	
T12 / KT12	3-7/8 in. long sleeve		T27 / KT27	Cap installation tool	
T13 / KT13	10 in. bolt				

TABLE 6 - *BENDIX® ADB22X™ AIR DISC BRAKE GUIDE PIN AND SEALS REPLACEMENT TOOLS. (A WASHER IS ALSO INCLUDED)*

5.6.2 Remove the wheel. Refer to the vehicle manufacturer's recommendations.

5.6.3 Remove the brake pads. *See Section 5.2.*

5.6.4 In most cases, the actuator should be removed. *See Section 5.4.* In the case of spring brake actuators, they should be caged before removing the brake assembly.

5.6.5 In nearly all cases, the air disc brake caliper/carrier will need to be removed from the vehicle in order to complete this procedure. *See Section 5.3.*

5.6.6 Place the brake on a workbench and, using a vice, secure it by the carrier.

5.6.7 Use a small chisel or similar tool to punch a hole close to the center of the guide pin cap (10) **of the short guide pin,** taking care to only insert the chisel a small amount. Using the hole just made, pry the cap off and discard. *See Figures 63-65.*



FIGURE 63 - *PUNCH GUIDE PIN CAP (10)*



FIGURE 64 - *GUIDE PIN CAP (10) HOLE*

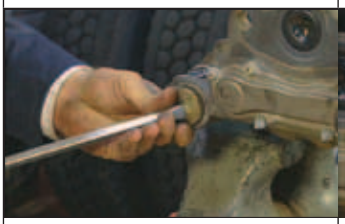


FIGURE 65 - *PRY TO REMOVE GUIDE PIN CAP (10)*



FIGURE 66 - *USING SMALL CHISEL TO REMOVE GUIDE PIN CAP (68)*

5.6.8 Remove the other cap (68) **that covers the long guide pin**, by using a small chisel and hammer to apply light blows to the cap, with the chisel aimed away from the casting. *See Figure 66.* Discard both caps.

5.6.9 Using a 14 mm hex bit socket, remove and discard the two caliper bolts (39) and (40). *See Figure 67.* By hand, retract both guide pins slightly and then remove the caliper from the carrier.



FIGURE 67 - *REMOVE THE CALIPER BOLTS*

The guide pins are now only held by the retaining rings (58).

5.6.10 Remove the boot retaining rings (58) and the guide pins (39) and (40). Use a screwdriver to pry out the inner boots (9). *See Figure 68.* Discard the removed items.



FIGURE 68 - *REMOVE THE RETAINING RINGS, GUIDE PINS, AND BOOTS*

5.6.11 Clean the caliper upper and lower surfaces around the bushings.

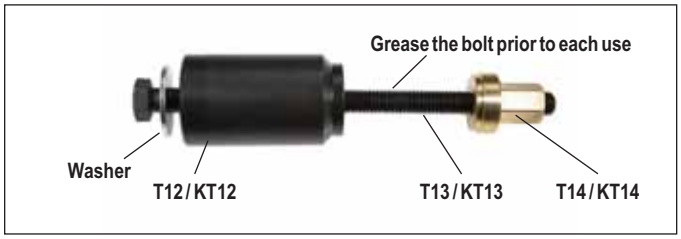


FIGURE 69 - *BRASS BUSHING REMOVAL TOOL*

5.6.12 Prepare to remove the brass bushing used in the long guide pin side. Assemble the long bolt (T13), washer, and sleeve (T12) as in Figures 69 and 70.

5.6.13 Apply grease to the bolt and — after inserting through the guide pin channel — engage the brass nut (T14). Always double-check that the brass nut is correctly in place in the bushing before beginning to extract the bushing.



FIGURE 70 - *INSTALL THE REMOVAL TOOL*

5.6.14 Turning the bolt at the top, draw the brass nut up, bring the brass bushing up and out of the channel. Discard the bushing.



FIGURE 71 - *REMOVE THE LONG GUIDE PIN*

Caution: Keep the removal tool exactly aligned with the guide pin channel to permit the bushing to be removed. *See Figure 72.*

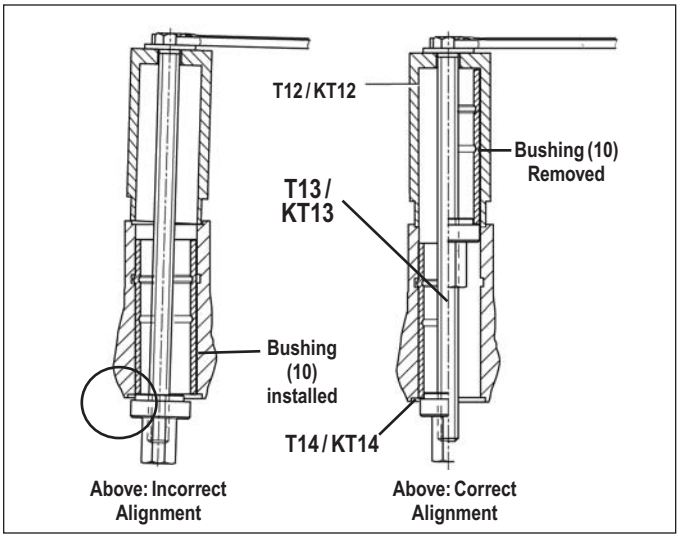


FIGURE 72 - *KEEP THE CORRECT ALIGNMENT*

5.6.15 Prepare to remove the short guide pin bushing by locating the bushing (6) tab, and using a small chisel (narrower than the tab) or similar tool, remove the tab as shown in Figure 73, by striking low on the base of the tab.



FIGURE 73 - *REMOVE THE TAB THAT HOLDS THE BUSHING IN POSITION*

Remove the tab with a magnet and use a clean shop cloth to remove any excess debris. Note that in some cases, the tab may be in the opposite (outer) slot in the bore.

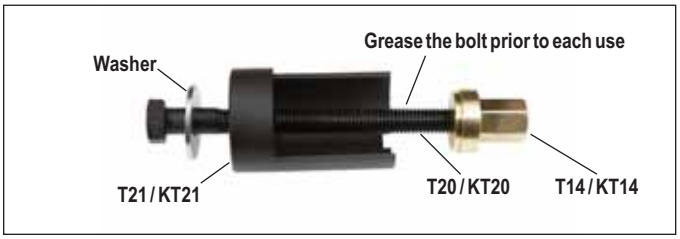


FIGURE 74 - *SHORT GUIDE PIN REMOVAL TOOL*

5.6.16 Use the tool combination shown in Figures 74 and 75 (comprising T14, T20, T21, and a washer) to remove the bushing (6). Screw nut (T14) onto the assembly by hand, then tighten the bolt (T20) using a box end wrench to draw out the bushing. Discard the removed bushing, and verify that the bore is clean by wiping with a shop cloth.

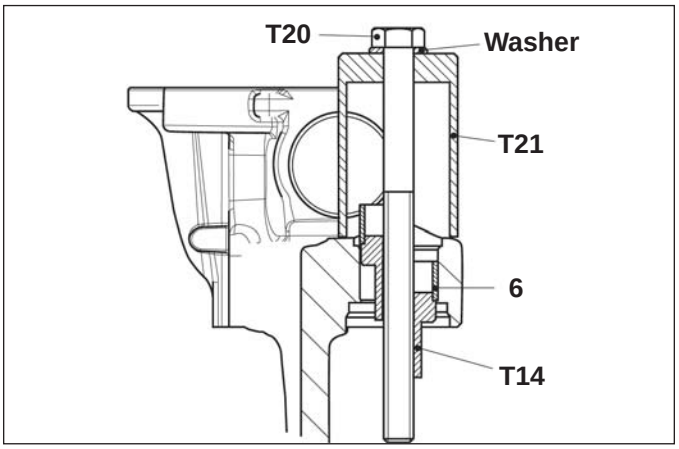


FIGURE 75 - ***SECTIONAL VIEW: SHORT GUIDE PIN BUSHING REMOVAL***

Installation of the Fixed Guide Pin Brass Bushing

5.6.17 Clean the caliper upper and lower surfaces around the bushings.

5.6.18 Clamp the carrier in a vise so that the guide channel is vertically oriented.

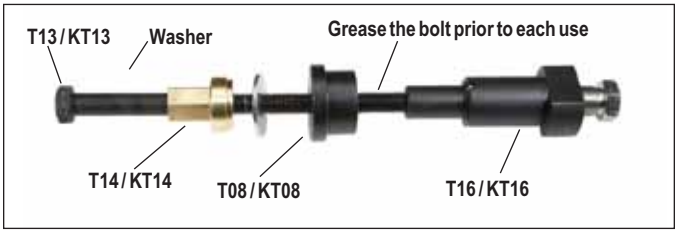


FIGURE 76 - ***LONG GUIDE PIN BUSHING INSTALLATION AND DIMPLING TOOL***

5.6.19 Place the washer and thread the brass nut (T14) on to the bolt (T13) followed by the flange (T08). *See Figure 76.*

5.6.20 Place a new brass guide bushing (7) on the dimpling tool (T16) and insert it into the caliper bore.

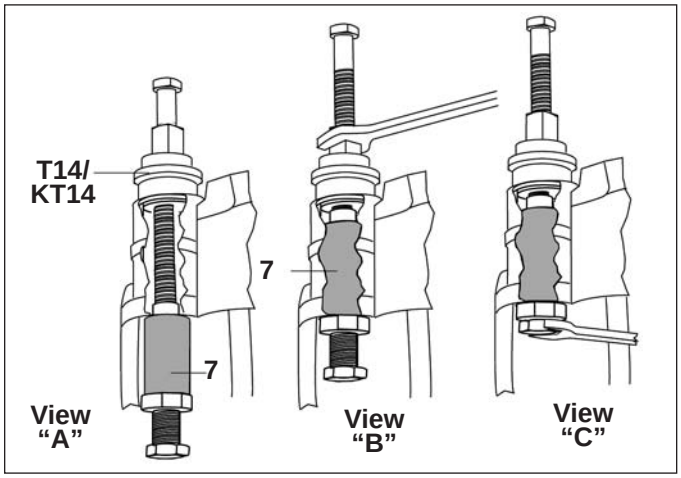


FIGURE 77 - VIEW "A" AND "B": ***DRAW THE BRASS BUSHING INTO POSITION. VIEW "C": LOCK THE BUSHING INTO POSITION***

5.6.21 Check that the flange (T08) is in an upright position at the top of the caliper recess as you draw the brass bushing (7) up, by turning the brass nut (T14), until the dimpling tool bottoms on the caliper. When it reaches the correct position, the brass bushing extends out of the guide pin channel 0.039 in. (1 mm.).

5.6.22 With the dimpling tool (T16) in position, tighten the screw in its base until it contacts the dimpling screw housing. The movement of this screw forces three points outwards, leaving indentations in the brass bushing. *See Figure 77, view "C".*

5.6.23 Unscrew the dimpling screw out approximately 0.75 inches (20 mm.). Loosen the brass nut (T14) and rotate the dimpling tool (T16) 60 degrees. Repeat the dimpling process by tightening the brass nut (T14) and then tighten the dimpling screw until it contacts the dimpling screw housing. Back out the dimpling screw approximately 0.75 inches (20 mm.). The brass bushing (7) is now held in position by the six dimples made by the tool.

5.6.24 Remove the installation tools and check the brass bushing (7), removing any burrs, being careful not to leave any metal filings in the bushing. Coat the inside of the bushing with the white grease included in the kit.

Installation of the Floating Guide Pin Bushing

5.6.25 To install the bushing (6) into the short guide pin side, first inspect the bore for corrosion, damage etc. Clean as necessary.

5.6.26 Place the new bushing (6) in position so that **when drawn into position, the tab will align with the slot in the casting**. With the tab aligned, place tool (T14) over the bushing and tap lightly. To position the bushing, *see Figure 78.*



FIGURE 78 - POSITION *THE NEW BUSHING*

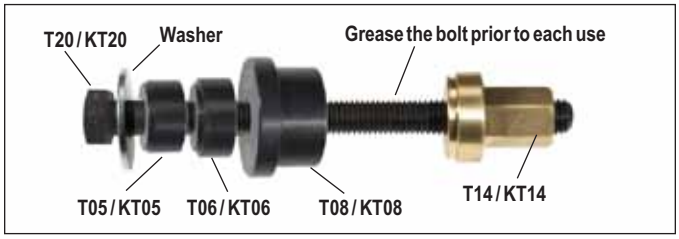


FIGURE 79 - *SHORT GUIDE PIN BUSHING INSTALLATION TOOL*

5.6.27 Use the tool combination shown in Figure 79 to draw the bushing (6) into the caliper. *See also Figure 80*, to see the orientation (with tool T14 at the top). Hand tighten the nut (T14) into position. Then tighten the bolt (T20) using a box end wrench or socket to draw the bushing (6) into the caliper until the bushing (6) contacts the machined step in the bore. Remove the tool.

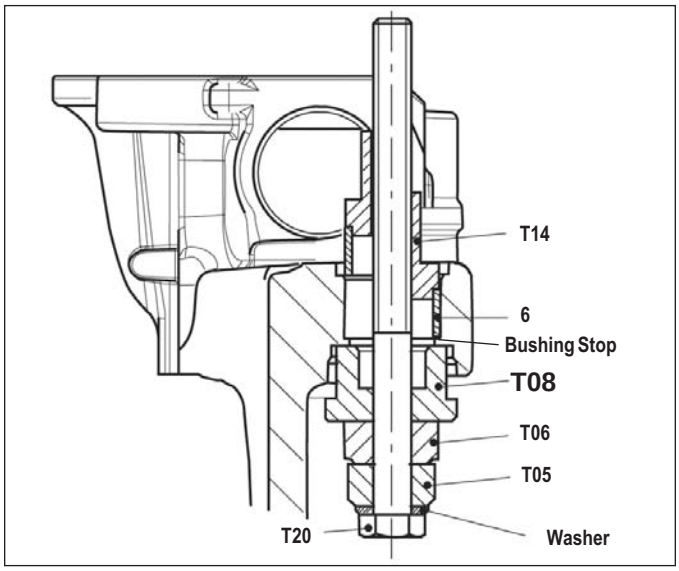


FIGURE 80 - *GUIDE PIN BUSHING INSTALLATION*

5.6.28 Using a punch, bend the tab into the groove by aligning the punch with the upper part of the tab and tapping the punch with a hammer.

5.6.29 Coat the inside of the bushing (6) with a light coat of the white grease included in the kit.

5.6.30 Install the two identical inner boots (9) by first cleaning the area where the inner boots will be installed and inspect for corrosion. If the sealing surface of the caliper is damaged, replace the caliper.

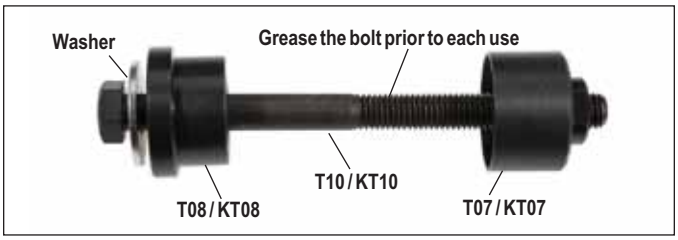


FIGURE 81 - *SHORT GUIDE PIN BOOT INSTALLATION TOOL*

5.6.31 *See Figure 82.* Place a boot into the installation tool (T7), making sure that the inner bellows are arranged close to the side walls of the tool and will not be damaged during installation. Also check that the outer edge of the boot rests on the front edge of the tool.



FIGURE 82 - POSITION *THE NEW BOOT IN THE INSTALLATION TOOL (T7)*

5.6.32 Using 70 in. lbs. (8 N·m) of torque maximum, tighten bolt (T10) to install the inner boot.

5.6.33 Repeat the installation procedure for the second inner boot.

5.6.34 Check that the boots are held securely in place and that no damage occurred during installation.

5.6.35 *See Figure 83.* To install the guide pins, first lubricate both guide pins with the white grease supplied. Insert the guide pins into their respective bores with the grooved end towards the bellows.



FIGURE 83 - PLACE *THE RETAINING RING ONTO THE GROOVE IN THE GUIDE PIN*

Fit the lip in the end of the inner boots (8) into the groove of the guide pins. Push on each ring (7) ensuring that the boot (9) is engaged onto the end of the guide pins (5 or 6).

5.6.36 With the caliper resting on a bench, slide the carrier into place with a slight rocking motion, taking care that as you do so, the inner boots and guide pins are seated in their proper place on the carrier.

5.6.37 Identify the two caliper bolts (39) and (40). With the shorter bolt placed in the floating pin bushing (4), and the longer bolt placed in the fixed pin bushing (5),

begin to tighten the bolts. With the caliper/carrier in a vice, continue installing the bolts to a torque of 133 ft. lbs. (180 N·m) . Finally tighten each bolt an additional 90º (ninety degrees).

Installation of the Guide Pin Caps

5.6.38 *See Figure 84.* Place the caliper/carrier assembly on a bench so that the inner boots are fully compressed, check that the bores are clean and dry (e.g. free from lubrication).

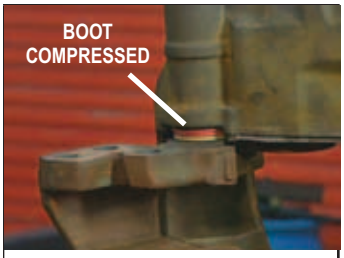


FIGURE 84 - *BOOTS MUST BE COMPRESSED FULLY DURING CAP INSTALLATION*

Note: It is important that the inner boots are fully compressed during this procedure to ensure that the least amount of air is retained within the guide pin channel. If too much air is trapped, the bellows can potentially be damaged during the operation of the brake. *It is also important that the technician double-check that the retaining rings remain in their correct position during this procedure.*

5.6.39 Clean the two caps, and check that the caliper surfaces where the caps will be installed are clean and have no signs of damage.

5.6.40 Select one cap to install. Using the correct press-in tool — the smaller cap (10) installs in the long guide pin side using tool (T26), and the larger cap (68) installs in the short guide pin side using tool (T27) — place the cap in position, using the machined channel in the caliper to assist in centering the tool.



FIGURE 85 - *BOOTS MUST BE COMPRESSED FULLY DURING CAP INSTALLATION*

Use a hammer to tap the cap into position. *See Figure 85.* Note that the tool needs to remain perpendicular to the channel to prevent damage during installation. Note that, after installation, the smaller cap (10) extends 0.08 in. (2 mm.), and the larger cap (68) extends 0.61 in. (15.5 mm.).

Repeat for the second cap.

5.6.41 Check that the guide pins move freely when the carrier is moved laterally, and that air is not trapped within the inner boots, and that the boots (9) and ring (58) are in the proper position before continuing with the installation.

5.6.42 Install the caliper/carrier *(See Section 5.3).*

5.6.43 Install the brake chamber *(See Section 5.4).*

5.6.44 Install the brake pads *(See Section 5.2).*

5.7 BENDIX® SPLINED DISC® HUB ROTOR

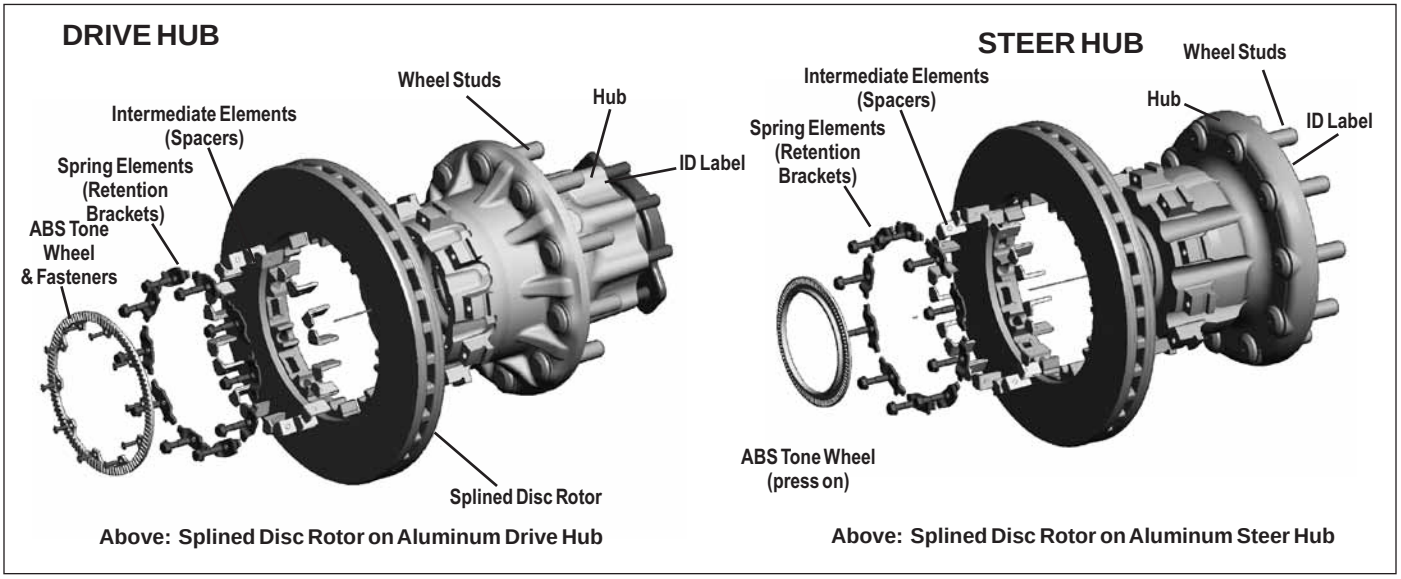


FIGURE 86 - *SPLINED DISC ROTOR EXAMPLES - EXPLODED VIEWS*

Bendix® Splined Disc® Hub Rotors are designed to assist vehicle maintenance by typically allowing the rotor to be serviced without requiring the entire hub/rotor assembly be replaced.

Periodic inspection of the Splined Disc attachment hardware is recommended to ensure optimum braking performance. Bendix recommends verifying the torque on the spring element fasteners whenever a brake inspection is performed.

NOTE: Anytime that the entire hub/rotor assembly is removed, Bendix recommends that the wheel seal also be replaced at the same time, USING A HIGH-TEMPERATURE SEAL. Follow the wheel seal and/or vehicle manufacturer's guidelines for full installation instructions. Adjust the bearings and refill bearing oil to vehicle manufacturer's specifications.

When replacing a Splined Disc Rotor, Bendix strongly recommends that the brake pads be replaced (as an axle set.) Contact 1-800-AIR-BRAKE for appropriate brake pad kit. Rotor replacement necessitates the removal of the pads.

CAUTION: Follow all safe maintenance practices, including those listed on page two of this document. Park the vehicle (by other means than the foundation brakes) on level ground and chock the wheels. Also read the vehicle manufacturer's recommendations. When installing pads, where appropriate, use heavy duty gloves and always keep fingers away from potential pinch hazard areas.

Bendix Air Disc Brakes are precision-engineered braking mechanisms. The “friction couple” braking characteristics have been carefully optimized and the rotor design and materials have been matched with special formulation brake pads for optimal performance, therefore use only genuine Bendix® brand parts and brake pads.

Rotor Replacement

5.7.1 Before removing the brake pads it is strongly recommended that the air disc brake adjuster mechanism be checked for correct operation (*See Section 4.1*). When replacing brake pads, Bendix strongly recommends that the pads be replaced as an axle set.

5.7.2 Refer to the vehicle manufacturer’s recommendations and release (or cage) spring brakes and remove the wheel.

5.7.3 Remove the pads (*See Section 5.2*).

5.7.4 Remove the air disc brake (*See Section 5.3)*.

5.7.5 Remove the hub rotor assembly.

Note: Follow the vehicle manufacturer's guidelines for removal of the wheel hub and rotor assembly from the vehicle in lieu of these instructions, where available.

CAUTION: Be sure to secure both the rotor and hub before removing the retention clips.

5.7.6 Remove and discard the ten spring elements.

5.7.7 On drive axles, the ABS tone ring must also be removed. *(See Figure 86.)* Retain for re-installation.

5.7.8 Use suitable hand tools to remove the intermediate elements (spacers). Remove all the right-hand intermediate elements (spacers) of each set first and then the rotor can be turned slightly to release

the remaining intermediate elements (spacers). In all cases, take care not to damage the hub and its teeth. Remove and discard the intermediate elements (spacers) and retention clips attaching the rotor. Discard the rotor.

5.7.9 Following industry standards, clean and inspect the hub before installing the rotor. Look for corrosion and/or damage to the hub and inspect the wheel speed tone ring. Where necessary, consult the hub manufacturer's guidelines for more details.

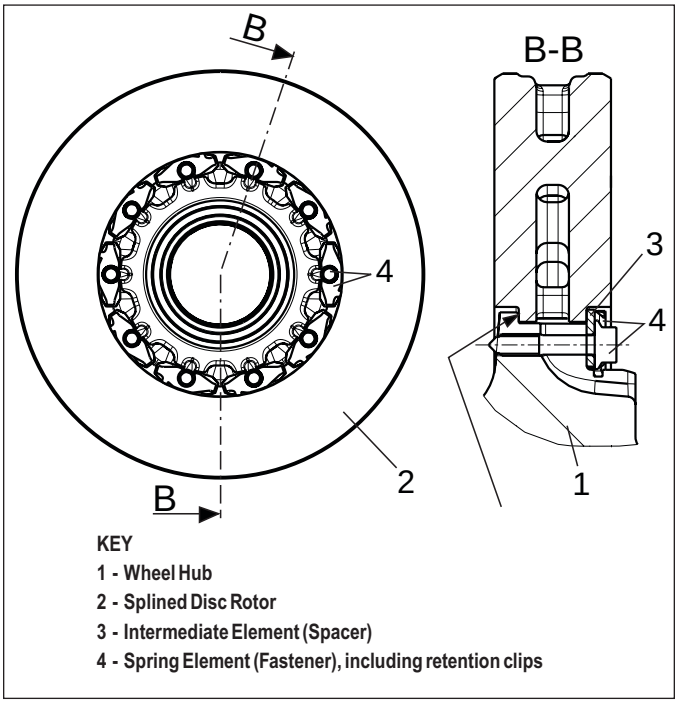


FIGURE 87 - ***ROTOR WITH CROSS-SECTION VIEW***



FIGURE 88 - ***ROTOR INSTALLATION***

ROTOR INSTALLATION

5.7.10 *See Figures 87 through 91.* Place the rotor into position on the hub. Install the new intermediate elements (spacers) as shown in Figure 89. With all the intermediate elements (spacers) correctly inserted into position, verify that the gap between the intermediate elements (spacers) and the wheel hub does not exceed 0.004 in (0.1 mm). If a gap is found that exceeds this maximum value, verify the installation of new intermediate elements (spacers). Replace the wheel hub if the excess gap cannot be corrected with proper installation of new rotor retaining hardware.

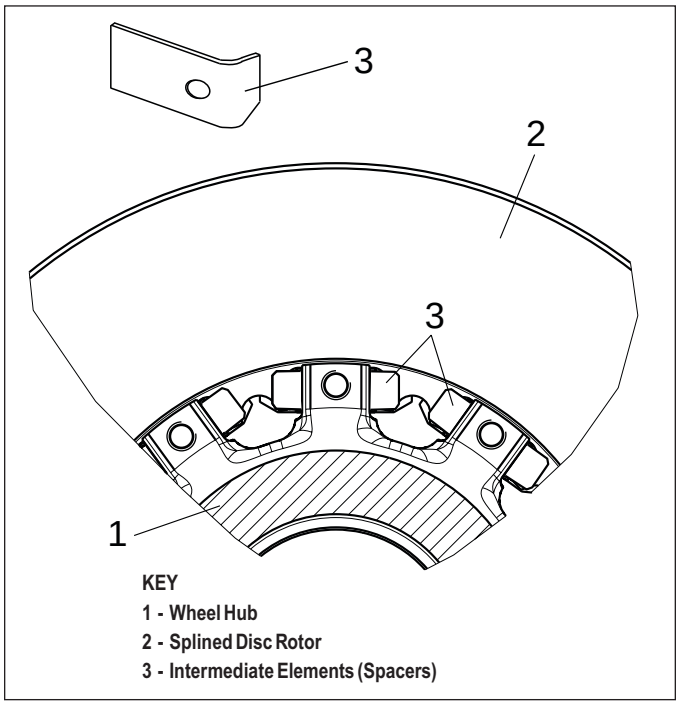


FIGURE 89 - ***INTERMEDIATE ELEMENT (SPACER) INSTALLATION***



FIGURE 90 - ***INTERMEDIATE ELEMENTS (SPACERS) INSTALLED***

5.7.11 Install the ten new spring elements included in the kit in an evenly-distributed cross-pattern sequence. Torque to 22.1 ft. lbs. (30 N·m.)

5.7.12 Where the tone ring was removed during step 5.7.7, re-install the tone ring. Use a professional grade fastener compound, such as Loctite blue 242, on the fasteners. Torque to 19-22 in. lbs. (2.1-2.5 N·m.)

5.7.13 Re-install the hub rotor assembly using a new high-temperature wheel seal, following the vehicle manufacturer’s instructions.

5.7.14 Re-install the air disc brake *(See Section 5.3).* Supporting the air disc brake by all necessary means, attach the brake to the anchor plate using six bolts and washers as required (Bendix recommends the original bolts not be re-used). Torque to vehicle manufacturer's specifications. If torque values and bolts are not specified by the vehicle manufacturer, then torque according to the chart below. Be sure to select bolts with the same thread pitch, length and grade as originally provided from vehicle manufacturer.

5.7.15 Reinstall the brake pads *(See Section 5.2).*



FIGURE 91 - ***FASTENERS INSTALLED***

Air Disc Brake Attachment Hardware		
Torque Plate Manufacturer	Fastener	Torque
Bendix Axial Carrier Torque Plate 	Fastener: M20 x 2.5 x 60 mm Class 10.9 ***Washer: Requires HARDENED 3 mm (minimum thickness) for each bolt.***[1] ***If the vehicle is using a Bendix manufactured Axial Anchor Plate, with a thickness of 1.14 in. (29 mm) where these bolts are assembled, then a bolt with an overall length of 2.36 in. (60 mm) will meet these requirements***	Use the manufacturer's recommendations. If unavailable, use phosphate and oil finish fastener. Pre-Torque: 20-60 ft-lbf [27-81 N·m] Final Torque: 350-400 ft-lbf [475-542 N·m]
Bendix Vertical Carrier Torque Plate 	Fastener: M16 x 2.0 x 110 mm, Class 10.9 ***Washer: None required.***	Use the manufacturer's recommendations. If unavailable, use plain and oil finish fastener. Torque: 200-220 ft-lbf [271-298 N·m]
Trailer Torque Plate	Fastener: M20 x 2.5 x L Class 10.9 Length determination: L = Torque Plate (TP) thickness + Carrier engagement + Washer thickness L_{min} = TP thickness + 24 mm + 3 mm L_{max} = TP thickness + 29 mm + 3 mm ***Washer: Requires HARDENED 3 mm (minimum thickness) for each bolt.***[1]	Use the manufacturer's recommendations. If unavailable, use phosphate and oil finish fastener: Pre-Torque: 20-60 ft-lbf [27-81 N·m] Final Torque: 350-400 ft-lbf [475-542 N·m]

Table Note: 1. The washer outside diameter must be less than 1.1in. (28.5 mm).

TABLE 7 - ***TORQUE PLATE FASTENERS AND TORQUE RECOMMENDATIONS (SEE MANUFACTURER'S RECOMMENDATIONS)***

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CONTACTING BENDIX

www.foundationbrakes.com

Bendix on-line information is available 24/7/365. It's your complete Bendix resource.

Bendix Technical Assistance Team

For direct personal technical support, call the Bendix TechTeam at

1-800-AIR-BRAKE (1-800-247-2725).

Representatives are available to assist you Monday through Friday, 8:00 A.M. to 6:00 P.M. EST, or e-mail the Bendix Tech Team at:

techteam@bendix.com.

To better serve you, please collect the following information before you call the Bendix Tech Team, or include this information in your e-mail:

- Bendix product model number, part number and configuration.
- Vehicle make and model.
- Vehicle configuration. (Number of axles, tire size, etc.)
- System performance symptoms: When do they occur?
- What troubleshooting/measurements have been performed?
- What Bendix service data literature do you have or need?

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BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® Air Disc Brake Checklist for Identifying Single Wheel End Thermal Overload

Follow all General Safety Guidelines (*see final page.*)

Start Here

All foundation brakes are designed to convert kinetic energy (energy of motion) into heat and work (to stop the vehicle).

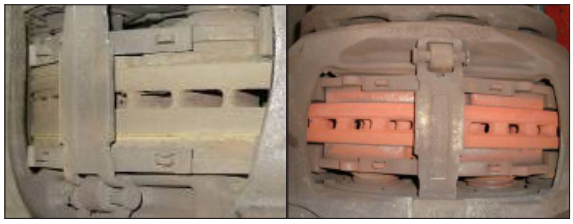
Air disc brakes work the same way and in everyday operation — compared to drum brakes — will produce higher braking temperatures and cool off faster. Also, air disc brakes will often have differences in temperatures at wheel ends on the same axle. The actual temperatures reached will depend on the vehicle configuration, vocation and brake usage.

This document is intended to help technicians identify instances where an individual wheel end has evidence of thermal overload, and check for potential causes.

SECTION ONE: Inspect the Vehicle

Question One:

Do any of the rotors have bright orange or red color edges? Check the box(es) on the vehicle diagram to the right for any found.



Normal — *Evidence of thermal overload*

Question Two:

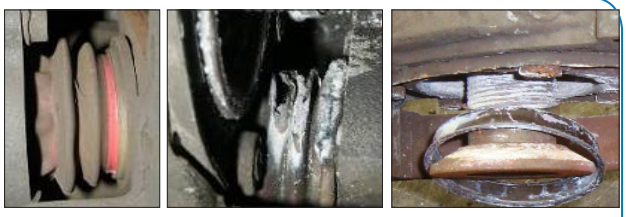
Are any of the calipers coated with a bright orange or red colored dust? Check the box(es) on the vehicle diagram to the right for any found.



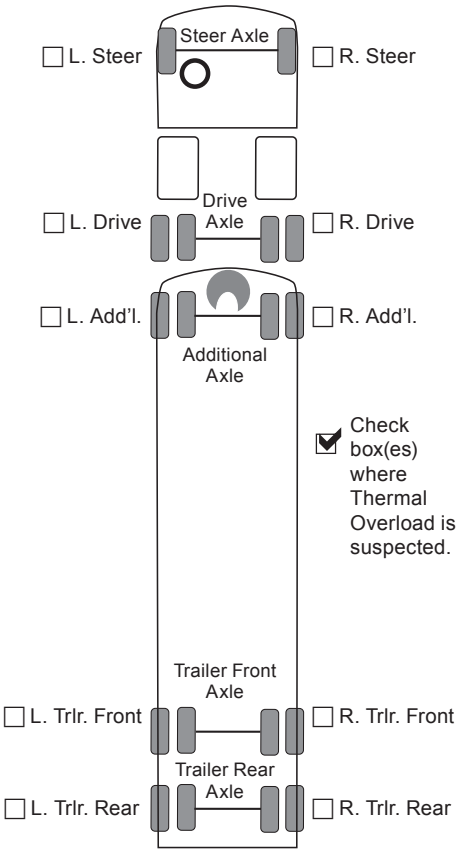
Normal — *Evidence of thermal overload*

Question Three:

Are any tappets and/or guide pin boots heat damaged? Check the box(es) on the vehicle diagram to the right for any found.



Typical — *Evidence of thermal overload* — *Evidence of thermal overload*



Are any boxes checked?

- **NO** → **STOP! Exit this flowchart.** STOP
- **YES** ☑

Are both boxes on a single axle checked?

- **YES** ☑ ☑ → **This is not a single wheel end Thermal Overload event. When both ends of an axle are affected, a thorough brake system diagnosis is needed, as other factors — such as brake balance, overloaded vehicles, or extreme use — are more likely the source.**
- **NO**

Only one box has a check mark?

- **YES** ☑ → **Go to Section Two** *(over)*
- **NO**

In cases where more than one wheel end is affected — but on different axles — complete a separate checklist for each brake being examined.

SECTION TWO: Investigate Other Potential External Causes
- Follow all Safe Maintenance Practices (see final page.)

Inspect the brake pads.
(New pads have 21 mm of brake pad, plus a 9 mm backing plate.)

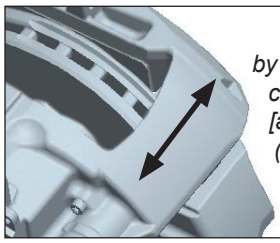
Is there 2 mm, or less, of brake pad friction material?*

YES → **Replace the pads (axle set recommended) after performing all Section Two inspections. (Not a Thermal Overload warranty condition.)**

*2 mm of friction material, plus a 9 mm backing plate, for a total of 11 mm.

NO

Inspect the caliper



Push/pull by hand to check the caliper movement [at least 0.75 Inch (20 mm) with the pads removed]

Complete this step on level ground, with the wheels chocked and the parking brake temporarily released!

Does the brake caliper have restricted movement in the inboard/outboard direction?

YES → **Service the guide pins. Perform all Section Two inspections. (Not a Thermal Overload warranty condition.)**

NO

Inspect the air hoses ("jounce lines").

- *Is air trapped in the hose?***
- *Do the hose(s) pull or push on the caliper? (It is important that the hoses permit the lateral motion of the caliper, the vertical motion of the suspension, and — for steering axles — the full turn of the wheels.)*
- *Are there any kinks, restrictions?*
- *Are the hoses in good condition?*

**Take full safety precautions during the inspection for trapped air, to avoid the air hose whipping if air pressure is found to be trapped. Conditions that might cause trapped air include kinked lines, or when an ABS modulator is malfunctioning and not exhausting service air.

Are any of these conditions found?

YES → **Service as needed. Perform all Section Two inspections. (Not a Thermal Overload warranty condition.)**

NO

Go to the next page . . .

SECTION TWO *Continued*

Inspect the actuator.

On level ground, with the wheels chocked, cage the spring brake actuator (if equipped) per the manufacturer's guidelines, remove and inspect the actuator.

- *Is there visible damage?*
- *In the installed position, was the lowest drain plug sealed?*
- *Is the seal in poor condition/damaged?*
- *Does the push-rod extend further than 15 mm from the mounting face?*

Are any of these conditions found?

YES → **Service the actuator. (Not a Thermal Overload warranty condition.)**

NO

With the actuator removed, inspect the internal caliper surfaces through the actuator push rod opening.

- *Is there visible damage, rust, water?*
- *With the pads removed, use a screw driver to depress the lever. Does the lever have a restricted range of motion? (The lever must touch the caliper body when fully retracted.)*

Are any of these conditions found?

YES → **Replace the caliper. Inspect the rotor. (Not a Thermal Overload warranty condition.)**

NO

No Section Two external causes found? Replace the caliper. Where applicable, process a thermal overload warranty claim.

Where other external causes were found, perform service and exit this flowchart. STOP

Actions When Replacing a Caliper

Replacement:

- ☐ Replace the caliper on the affected wheel end and all the pads at both ends of the axle.
- ☐ Inspect the rotor according to the guidelines in Service Data sheet SD-23-7541.

If the brake assembly is still under warranty coverage:

- ☐ File a claim. Clearly state the claim is for a single axle thermally overloaded brake. The claim must include photographs of the rotor from both ends of the affected axle.
- ☐ Return the caliper from the affected wheel end, and label the caliper with the claim number.
- ☐ Return the pads from both sides of the affected axle (LH and RH set of pads). Please clearly label the parts with the wheel position and claim number.
- ☐ Please include this completed checklist, the photographs of the rotors, and a copy of the warranty claim with the returned parts.

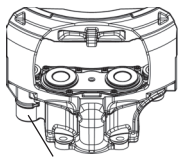
VIN #: _____ Claim #: _____

Vehicle Make: _____ Vehicle Model: _____

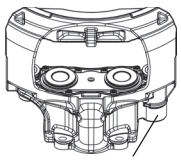
Mileage: _____

Bendix® ADB22X® Air Disc Brake Replacement Part Numbers

Caliper/Carrier		
Axial Bolt 12 degree	Right Fixed Pin	K081142
	Left Fixed Pin	K081143
Vertical Bolt 12 degree	Right Fixed Pin	K081256
	Left Fixed Pin	K081257



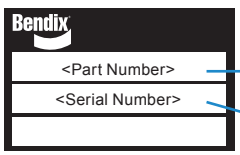
Left Fixed Pin



Right Fixed Pin

Please note that replacement caliper/carrier bolts (available from the vehicle manufacturer) are recommended.

Caliper Only		
12 degree	Right Fixed Pin	K081258
	Left Fixed Pin	K081259



(Air Disc Brake Label)

Caliper Part Number: _____

Caliper Serial Number: _____

Bendix TechTeam Help Line: 1-800-AIR-BRAKE, (1-800-247-2725), option 2-1. Mon. - Fri., 8 a.m. - 6 p.m.

Reference Document:

Service Data: SD-23-7541 *Bendix® ADB 22X™, ADB 22X-V™ Air Disc Brakes*. Go to the document library at www.bendix.com for free downloads of Service Data Sheets and warranty policies.

SAFE MAINTENANCE PRACTICES

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

When working on or around a vehicle, the following general precautions should be observed at all times:

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses. Where specifically directed, the parking brakes may have to be released, and/or spring brakes caged, and this will require that the vehicle be prevented from moving by other means for the duration of these tests/ procedures.**
2. **Stop the engine and remove 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.**
3. **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.**
4. **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 or a dryer reservoir module, be sure to drain the purge reservoir.**
5. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.**
6. **Never exceed manufacturer's recommended pressures.**
7. **Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.**
8. **Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.**
9. **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.**
10. **Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.**
11. **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.**

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 Spicer Foundation Brake LLC does not offer asbestos brake linings, the long-term affects of some non-asbestos fibers have not been determined. Current 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 Regulations regarding testing, disposal of waste and methods of reducing exposure for asbestos are set forth in 29 Code of Federal Regulations §1910.001. These Regulations provide valuable information which can be utilized to reduce exposure to airborne particles.**
- **Material 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 e-mail techteam@bendix.com**

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PE13-012

BENDIX

7/1/2013

Section 7

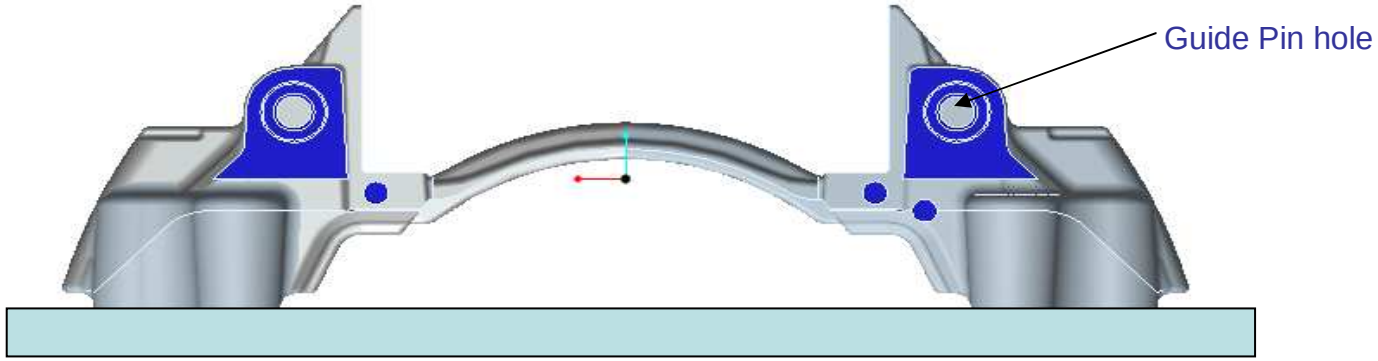
Service Data Sheets & Troubleshooting Guides

Vertical Bolt Carrier fixture improvement
Caliper to Carrier assembly

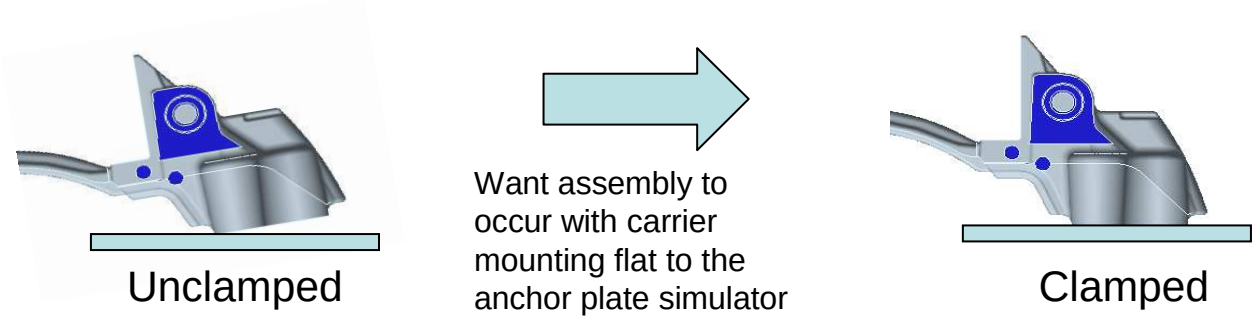
12/15/2011

Goal: The carrier needs to be constrained for three purposes

1. Prevent the complete brake assembly from moving in the pallet
2. Hold /clamp the carrier to simulate the carriers assembly to the torque plate



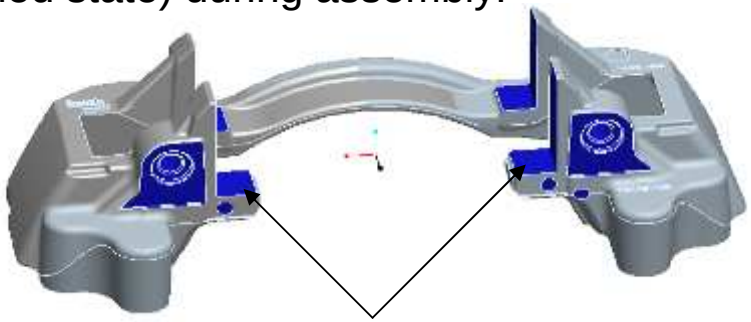
We want to clamp the carrier to a simulated torque plate mounting taking out any twist or flex in the carrier during the caliper to carrier assembly process.



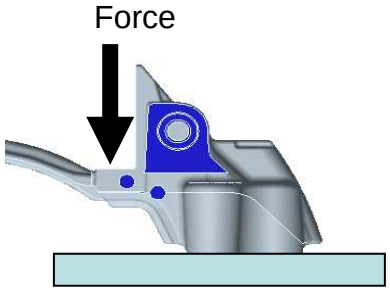
3. Prevent the carrier from flexing/ twisting / moving during the assembly process
   - Maintain clamped state against the simulated torque plate
   - Minimize or prevent misalignment of the guide pin holes relative to the caliper during assembly

Possible issues with current setup

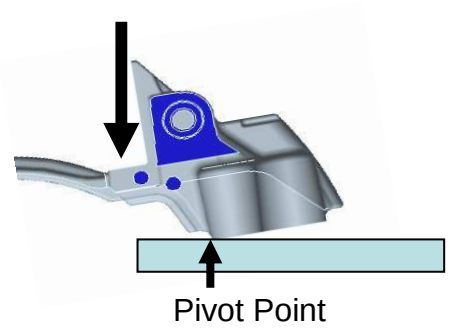
1. There is not enough clamp force to hold the carrier against the backup plate during the tightening operation.
2. Current clamping location may add to the misalignment of the carrier mounting surface (relative to the assembled state) during assembly.



From the video, the current clamps interface with the carrier on the pad abutment surface

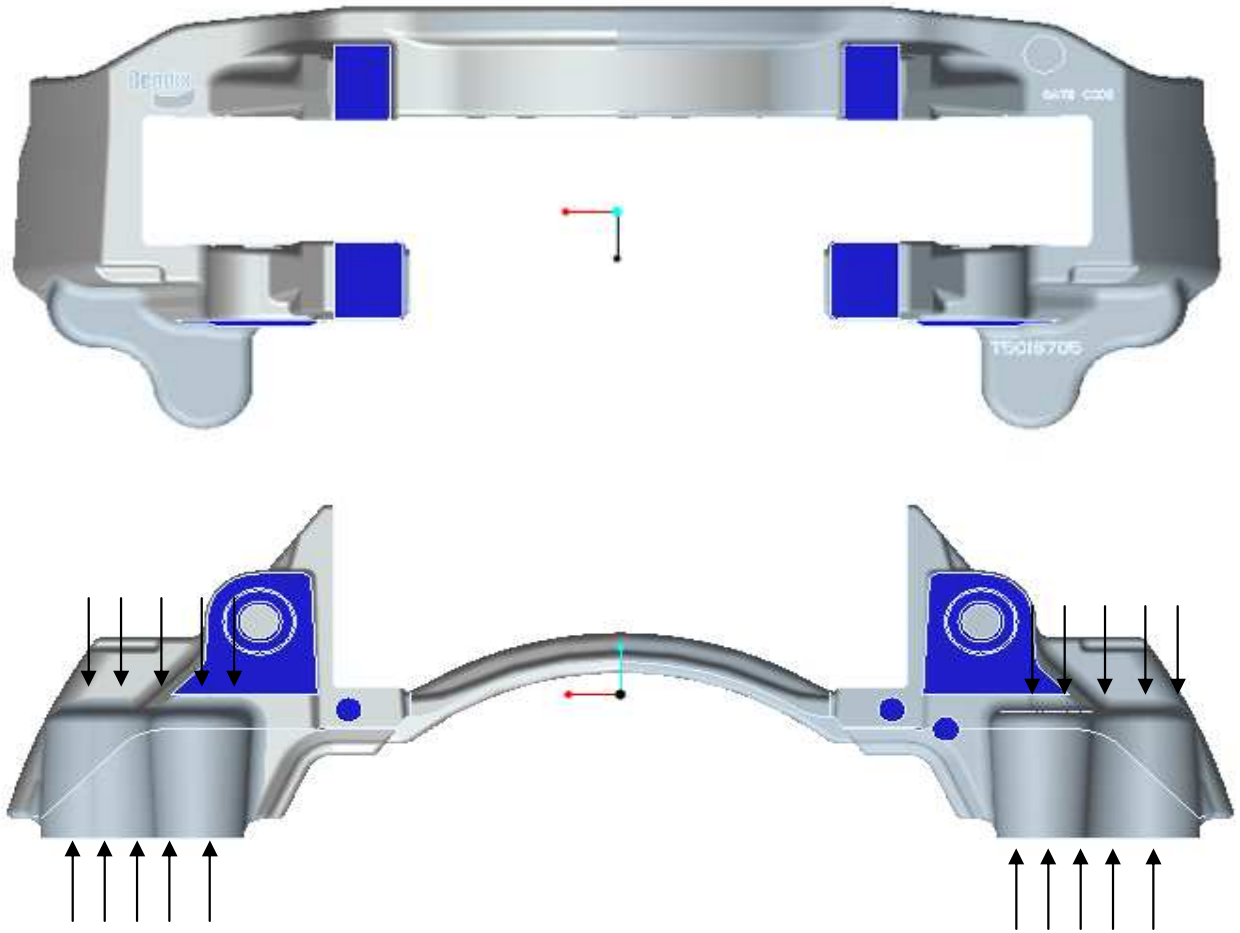


Force applied on the pad abutment may actually tend to misalign the carrier to the back up plate. Unconstrained the carrier will easily flex



Clamping recommendation

It is recommended to apply the clamping force through the carrier mounting surface



PE13-012

BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® Vertical Bolt ADB22X™ Caliper Slide-ability Inspection and Rework Procedure

Bendix Spicer Foundation Brake LLC

Dutch Maid Inspections

August 18, 2011



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Scope:

This document will provide an inspection procedure to identify wheel ends that experience a slide-ability issue after being installed onto the anchor plate. The document includes a section on inspecting brakes on the vehicle, inspecting brakes on a dressed axle or during the assembly process, and a re-work process for brakes identified with the issue.

Vehicle inspection Page 3
Re-work process Page 5

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Vehicle Inspection Procedure (Page 1 of 2)

The following inspection is performed with the wheels installed. The inspection should be performed on each air disc brake equipped wheel end.

Step 1:

Chock the wheels of the vehicle.

Step 2:

Fully charge the air system (build pressure until the governor cut-out is reached)

Step 3:

Release the park brakes and verify the system pressure is a minimum of 100 PSI.

Step 4:

Identify and remove the adjuster cap item 37 (See figure 1.1)

Step 5:

Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise. (Figure 1.2) The brake assembly will make a clicking sound as the brake is backed off. With new pads installed there is a limited adjustment range possible, the brake assembly should be backed off 3 to 4 clicks, or until resistance is met. The sheer adapter is designed to break, protecting the adjuster from damage. If the sheer adapter breaks it can be replaced. If the sheer adapter breaks multiple times or adjustment of the brake is not possible verify the park brake is released.

Step 6:

Holding the brake by the center of the brake chamber, slide the brake assembly into and out of the wheel (See Figure 1.3). The brake should move freely at least 2 – 4 mm. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a possible slide-ability issue, proceed to the re-work section for this wheel end. If the brake slides freely continue this inspection procedure.

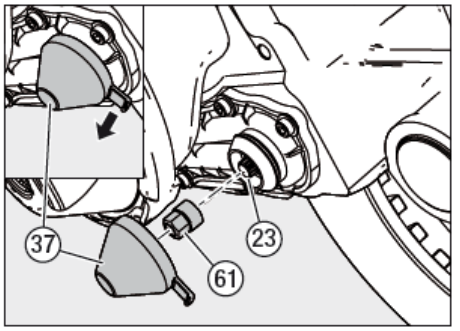


Figure 1.1

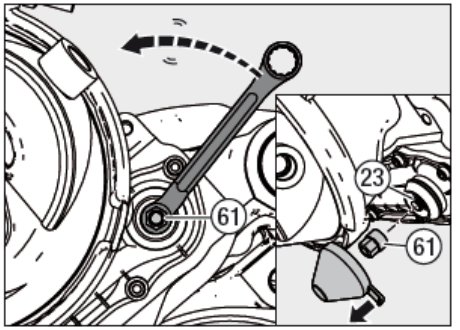


Figure 1.2

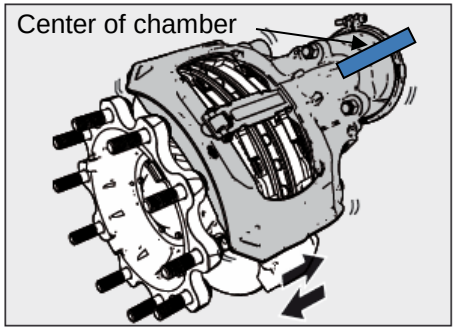


Figure 1.3

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Vehicle Inspection Procedure (Page 2 of 2)

Step 7:

Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:

- Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 1.4).
- Turn the adjuster counter clockwise 2 clicks.

Step 8:

Inspect the adjuster cap, Item 37, for damage. If damaged replace the cap.

Step 9:

Replace the adjuster cap with the tab oriented as shown in Figure 1.5.

Step 10:

Mark the brake chamber with a green X, Record the VIN number of the vehicle, wheel end location, and serial number of the brake assembly for future reference. (See Figures 1.6,1. 7, and 1.8)

Step 11:

Repeat steps 4 through 10 for each ADB equipped wheel end

Step 12:

Apply the parking brakes.

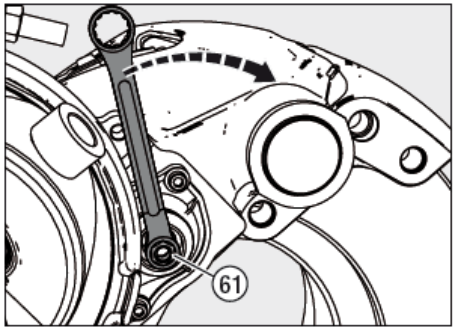


Figure 1.4

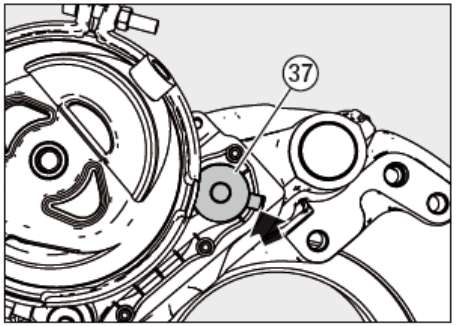
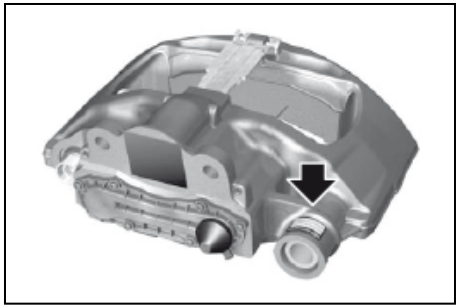


Figure 1.5



Serial Number Tag Location
Figure 1.6

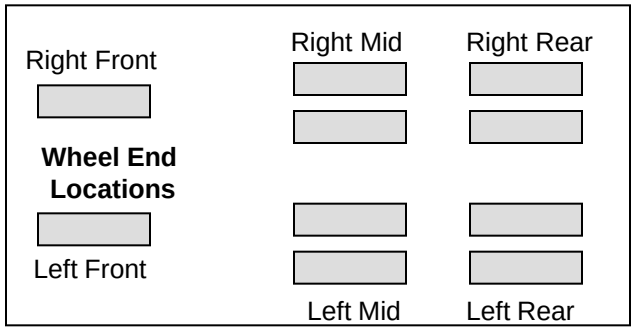
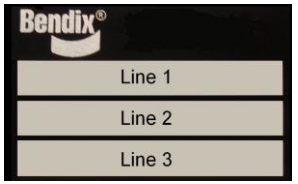


Figure 1.8



Line 1 = Part Number
Line 2 = Serial Number

Figure 1.7

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Re-work Procedure, wheel ends with slide-ability issues (Page 1 of 5)

The following steps are for Re-working and correcting an identified caliper slide-ability issue.

Step 1: Verify the slide-ability issue with pads removed

1. If working on a vehicle, following all standard shop and safety practices, remove the wheel on the affected wheel end. On spring brake equipped wheel ends charge the air system to full pressure, release and cage the spring brake.
2. Remove the spring clip (26), washer (45), pin (44) and pad retainer bar (11). (See Figure 3.1)
3. Identify and remove the adjuster cap item 37 (See figure 3.2)
4. Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise. (Figure 3.3) The brake assembly will make a clicking sound as the brake is backed off.
5. Remove the pads (12) and identify there installed position (Figure 3.4)
6. With the pads removed slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, continue with the Re-work procedure section. If the caliper slides freely go to Step 5.

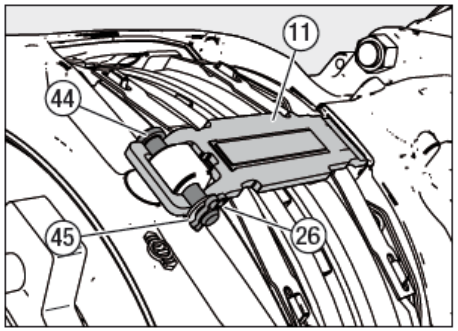


Figure 3.1

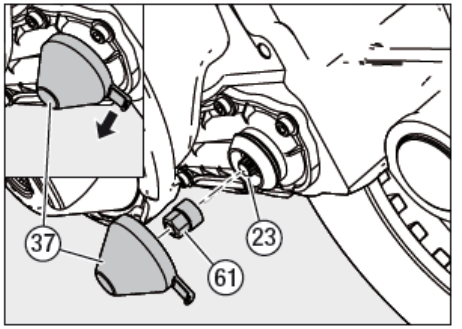


Figure 3.2

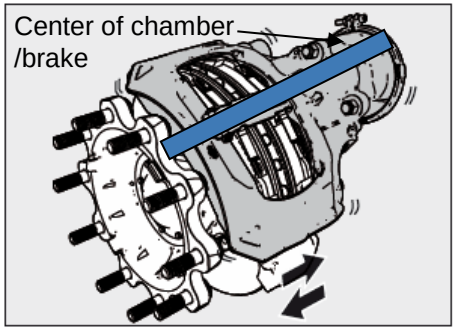


Figure 3.5

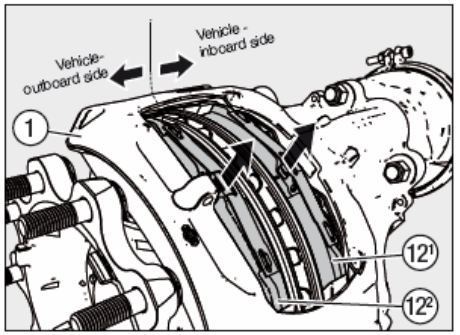


Figure 3.4

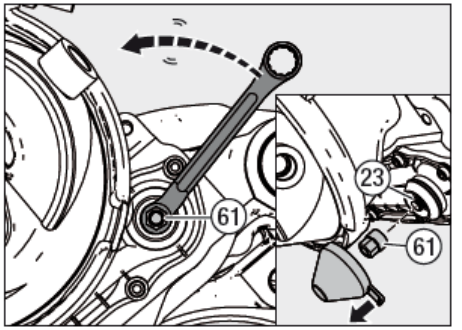


Figure 3.3

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Re-work Procedure, wheel ends with slide-ability issues (Page 2 of 5)

Step 2: Measure Pad Thickness off both wheel ends of the affected axle

1. Remove the wheel on the opposite side of the axle being inspected.
2. Remove the pad retainer bar and pads as described in Step 1.
3. Measure the thickness of the brake pads off the affected axle in the four corners. Position the pad as shown in Figure 3.5A with the friction material facing you and measure the thickness at the four corners. Identify the vehicle, wheel end and position of the pads when recording the measurements, Figure 3.5B and Figure 3.5C

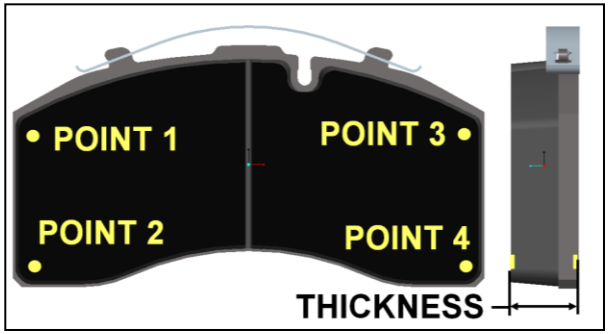


Figure 3.5A

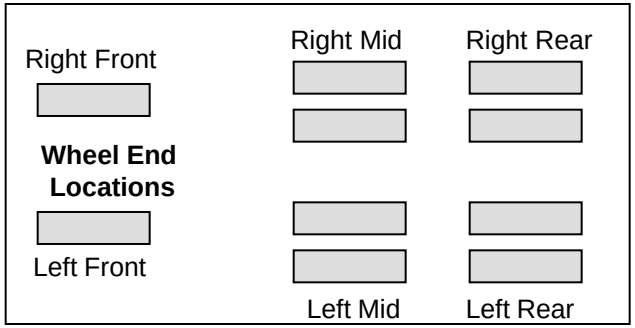


Figure 3.5C



Figure 3.5B

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Re-work Procedure, wheel ends with slide-ability issues

Step 3: Verify free state slide-ability and bolt torque sequence.

1. Loosen the (6) carrier to torque plate mounting bolts until they can all be turned by hand.
2. Slide the caliper inboard and outboard. If the caliper does not slide with the mounting bolts loose replace the brake assembly. If the caliper slides freely continue with the re-work procedure.
3. Tighten the carrier mounting bolts (Figure 3.8) using the pattern shown in Figures 3.6 for RH brakes or Figure 3.7 for LH brakes . The brake assemblies are handed, so there is a LH and RH caliper assembly. The pattern will always start on the short (floating) pin side. Tighten the carrier mounting bolts to between 180 and 200 ft-lbs of torque.
4. Slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, continue with the re-work procedure. If the caliper slides freely skip Step 3 and go to Step 4.

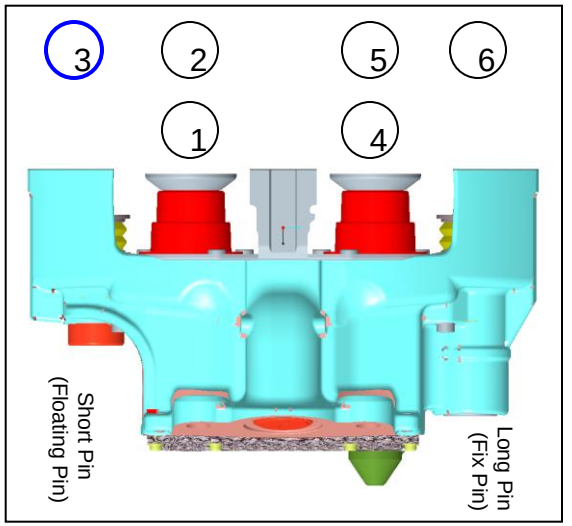


Figure 3.6 Right Hand Brake

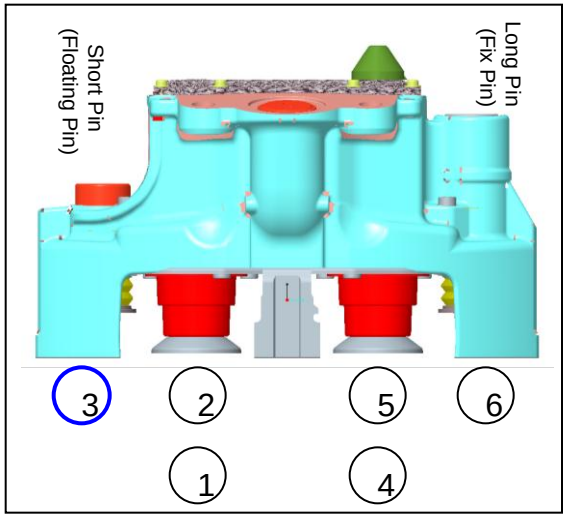


Figure 3.7 Left Hand Brake

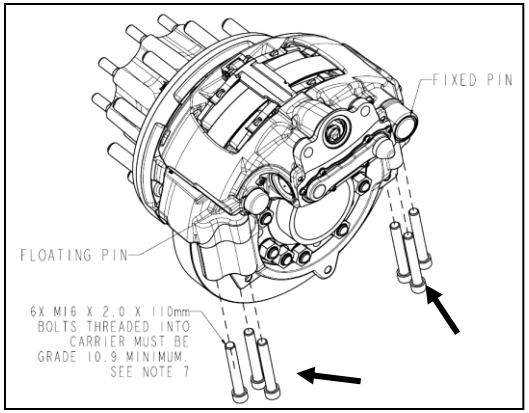


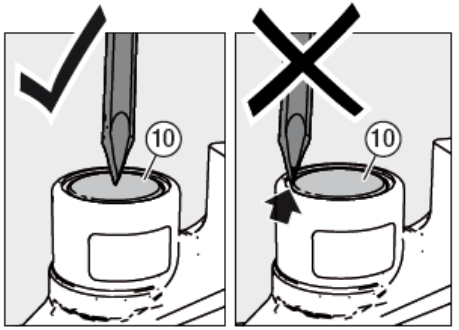
Figure 3.8 Carrier Mounting Bolts

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Re-work procedure, wheel ends with slide-ability issues (Page 4 of 5)

Step 4: Loosen and tighten guide pin bolts (reference instruction sheet 1484 for additional information).

1. Remove the long (fix) (10) and short (floating) pin(68) cap using a chisel or punch as shown in Figure 3.9 , 3.10, and 3.11.
2. Use a 14mm allan head socket remove and dispose of the short pin bolt (39) Figure 3.12.
3. Install a new short pin bolt and tighten the bolt enough to retain the guide pin.
4. Assure the guide pin (5) is seated in the carrier and the bellows retainer (58) is installed correctly. Figure 3.13 , 3.14
5. Use a 14mm allan head socket remove and dispose of the long pin bolt (40) Figure 3.12.
6. Install a new long pin bolt and tighten the bolt enough to retain the guide pin.
7. Assure the guide pin (5) is seated in the carrier and the bellows retainer (58) is installed correctly. Figure 3.13 , 3.14.
8. Torque each guide pin bolt to 133 ft-lbs + 90 degrees of rotation.



Long (fix) Pin Cap Removal
Figure 3.9

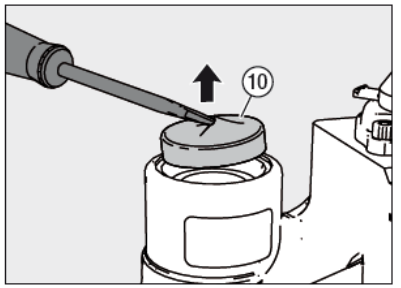


Figure 3.10



Figure 3.14

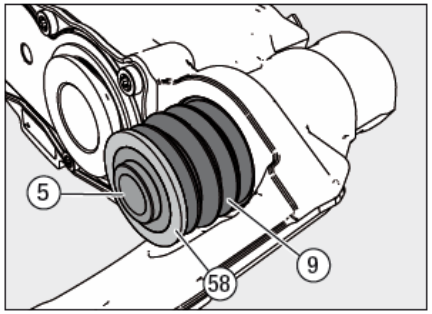


Figure 3.13

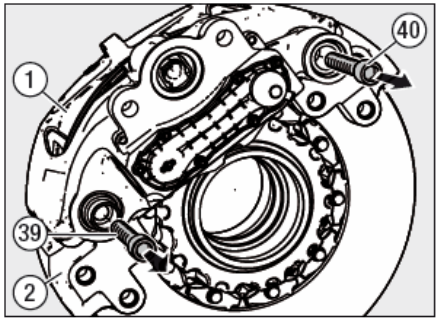
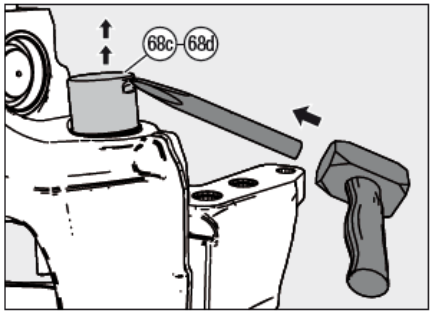


Figure 3.12



Short (floating) Pin Cap Removal
Figure 3.11

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Re-work procedure, wheel ends with slide-ability issues (Page 5 of 5)

Step 4: Loosen and tighten guide pin bolts (CONTINUED).

9. Slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, replace the brake assembly. If the caliper slides freely continue the re-work procedure.
10. Install the long and short pin caps as follows
    1. Slide or pull the caliper outboard to fully compress the guide pin bellow (9) figure 3.13,
    2. With the guide pin bellows compressed, use the guide pin tools (figure 3.18) to insert the long and short pin caps, keeping the tool perpendicular to the guide pins. See Figures 3.15, 3.16, 3.17

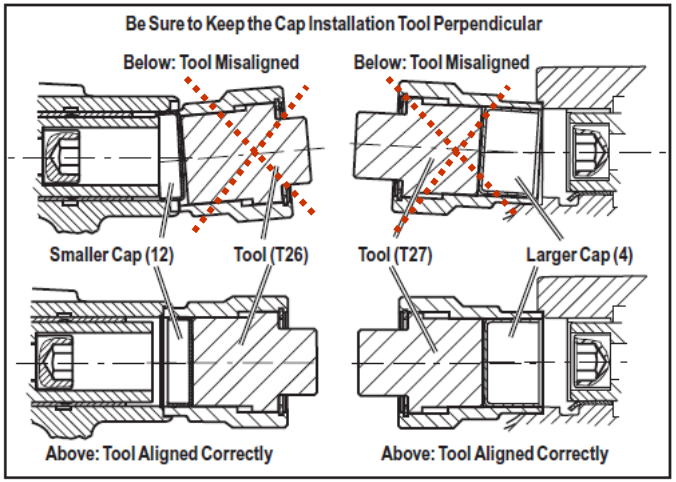


Figure 3.15

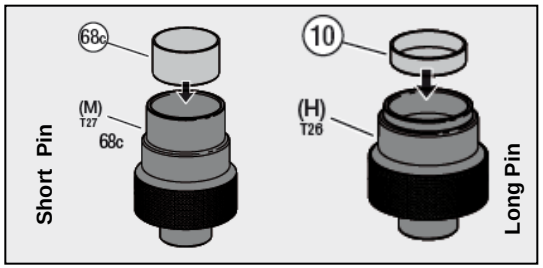
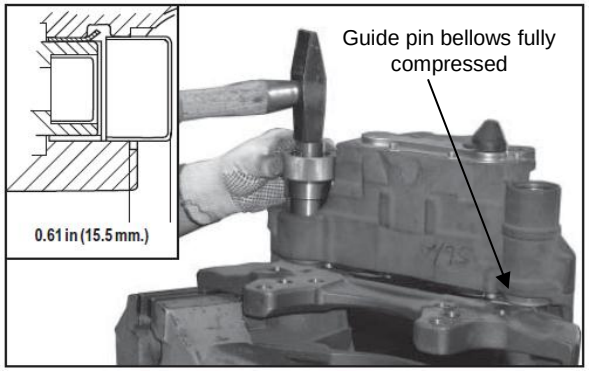
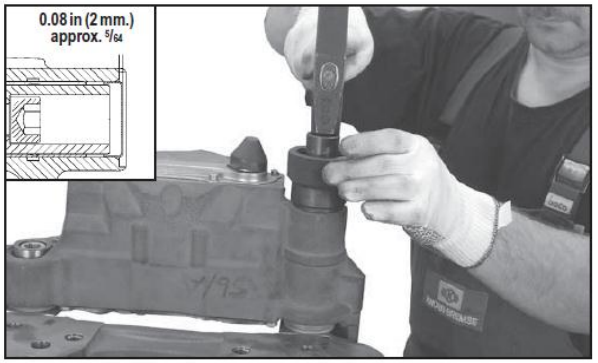


Figure 3.18



Short (floating) Pin Cap Installation
Figure 3.17



Long (fix) Pin Cap Installation
Figure 3.16

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Re-work procedure, wheel ends with slide-ability issues (Page 6 of 5)

Step 5: Re-install brake pads and adjust the brakes on inspected wheel ends.

1. Install brake pads into the caliper. Assure the pads are installed in the correct direction with the friction material on the rotor side of the pad. Figure 3.19 and 3.20
2. Install the pad retainer bar (11), push down on the bar and insert the pad retainer pin (44), washer (45) and spring clip (26) Figure 3.21.
3. Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:
   - Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 3.22).
   - Turn the adjuster counter clockwise 2 clicks
4. Inspect the adjuster cap, Item 37, for damage. If damaged replace the cover
5. Replace the adjuster cap with the tab oriented as shown in Figure 3.23
6. Mark the brake chamber with a green X, Record the VIN number of the vehicle, wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 1.6,1. 7, and 1.8)
7. If the park brake was caged, un-cage the park brake chamber.
8. If the wheels were removed re-install the wheels

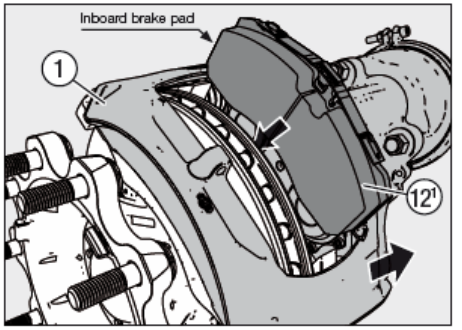


Figure 3.19

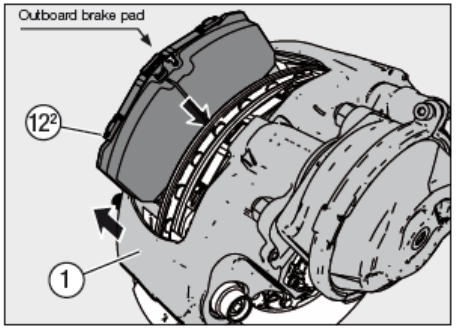


Figure 3.20

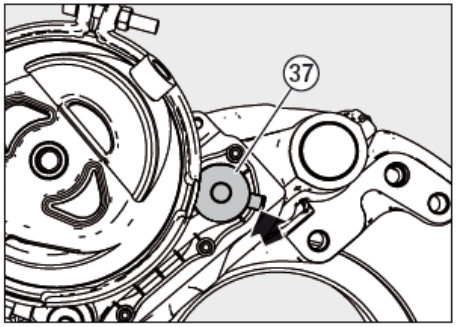


Figure 3.23

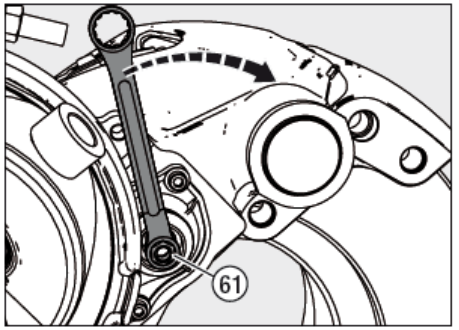


Figure 3.22

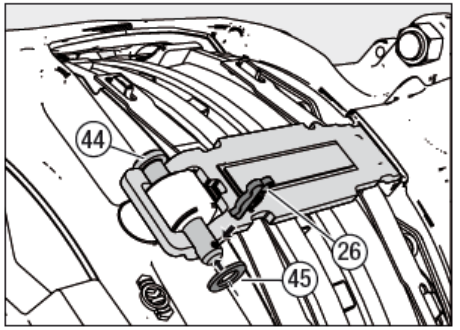


Figure 3.21

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PE13-012

BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® Vertical Bolt ADB22X™ Caliper Slide-ability Inspection and Rework Procedure

Bendix Spicer Foundation Brake LLC

June 2011



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Background:

The vertical bolt version of the ADB22X™ has experienced an issue where the caliper does not slide freely once it is installed to the anchor plate.

Scope:

This document will provide an inspection procedures to identify wheel ends with the slide-ability issue on the vehicle and on a dressed axle or during the assembly process. It will also provide a procedure to correct the issue on identified wheel ends.

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Vehicle Inspection Procedure (Page 1 of 2)

The following inspection is performed with the wheels installed. The inspection should be performed on each air disc brake equipped wheel end.

Step 1:

Chock the wheels of the vehicle.

Step 2:

Fully charge the air system (build pressure until the governor cut-out is reached)

Step 3:

Release the park brakes and verify the system pressure is a minimum of 100 PSI.

Step 4:

Identify and remove the adjuster cap item 37 (See figure 1.1)

Step 5:

Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise. (Figure 1.2) The brake assembly will make a clicking sound as the brake is backed off. With new pads installed there is a limited adjustment range possible, the brake assembly should be backed off 3 to 4 clicks, or until resistance is met. The sheer adapter is designed to break, protecting the adjuster from damage. If the sheer adapter breaks it can be replaced. If the sheer adapter breaks multiple times or adjustment of the brake is not possible verify the park brake is released.

Step 6:

Holding the brake by the center of the brake chamber, slide the brake assembly into and out of the wheel (See Figure 1.3). The brake should move freely at least 2 – 4 mm. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a possible slide-ability issue, proceed to the trouble shooting section for this wheel end. If the brake slides freely continue this inspection procedure.

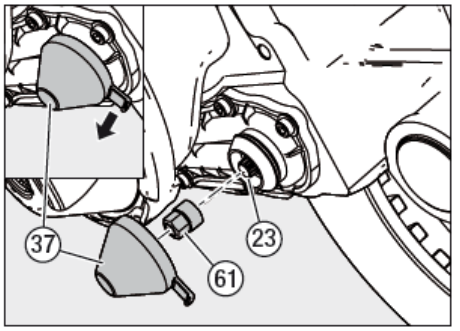


Figure 1.1

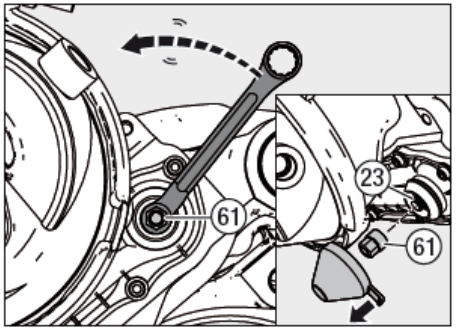


Figure 1.2

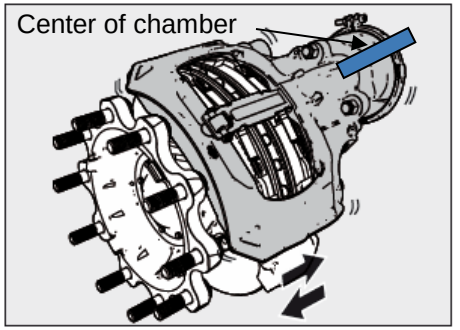


Figure 1.3

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Vehicle Inspection Procedure (Page 2 of 2)

Step 7:

Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:

- Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 1.4).
- Turn the adjuster counter clockwise 2 clicks.

Step 8:

Inspect the adjuster cap, Item 37, for damage. If damaged replace the cover

Step 9:

Replace the adjuster cap with the tab oriented as shown in Figure 1.5.

Step 10:

Mark the brake chamber with a green X, Record the VIN number of the vehicle, wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 1.6,1. 7, and 1.8)

Step 11:

Repeat steps 4 through 10 for each ADB equipped wheel end

Step 12:

Apply the parking brakes.

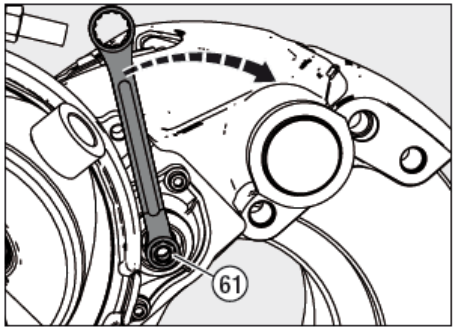


Figure 1.4

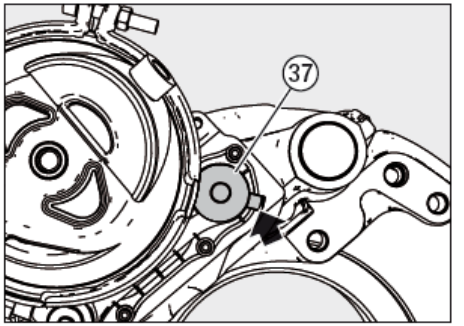
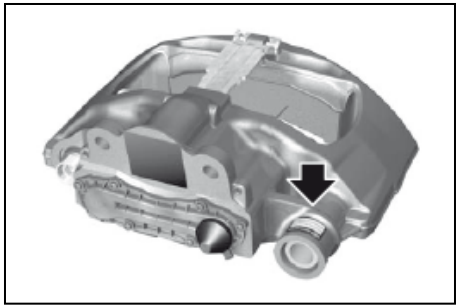


Figure 1.5



Serial Number Tag Location
Figure 1.6

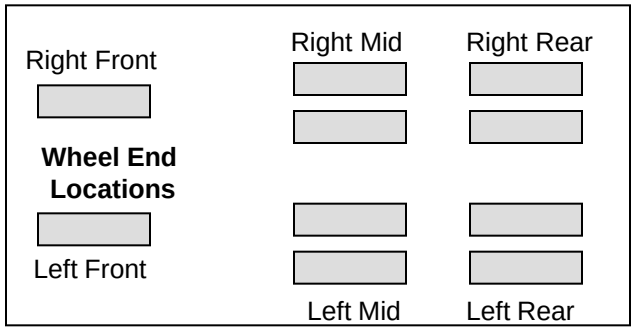
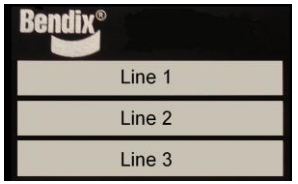


Figure 1.8



Line 1 = Part Number
Line 2 = Serial Number

Figure 1.7

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Dressed or Assembled Axle Inspection Procedure (Page 1 of 2)

The following inspection is performed on an axle before it is installed into a vehicle.

Step 1:

If equipped, verify the park brake chamber is caged.

Step 2

Identify and remove the adjuster cap item 37 (See figure 2.1)

Step 3:

Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise (Figure 2.2). The brake assembly will make a clicking sound as the brake is backed off. With new pads installed there is a limited adjustment range possible, the brake assembly should be backed off 3 to 4 clicks, or until resistance is met. The sheer adapter is designed to break, protecting the adjuster from damage. If the sheer adapter breaks it can be replaced. If the sheer adapter breaks multiple times or adjustment of the brake is not possible verify the park brake is caged.

Step 4:

Slide the brake assembly, through the center of the chamber or brake, inboard and outboard (See Figure 2.3). The brake should move freely in taking up the running clearance between the brake assembly and rotor. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a possible slide-ability issue, proceed to the trouble shooting section for this wheel end. If the brake slides freely continue this inspection procedure.

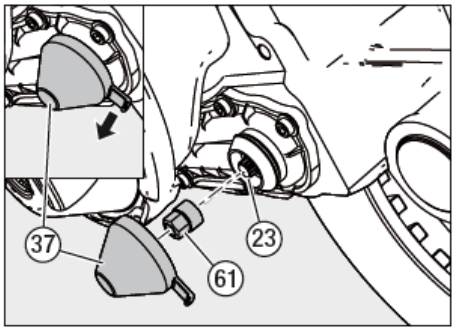


Figure 2.1

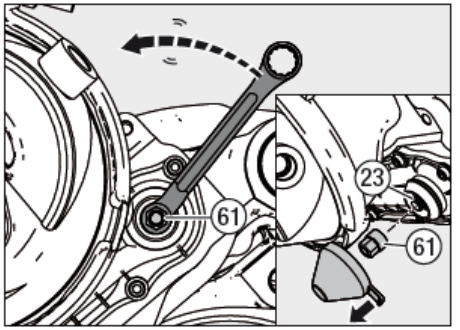


Figure 2.2

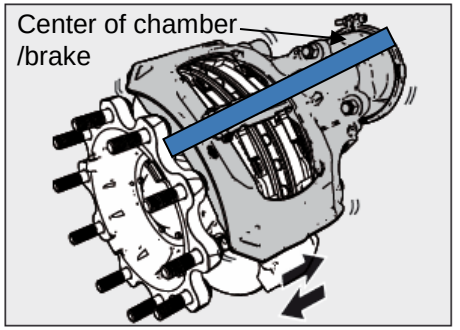


Figure 2.3

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Dressed or Assembled Axle Inspection Procedure (Page 2 of 2)

Step 5:

Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:

- Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 2.4).
- Turn the adjuster counter clockwise 2 clicks.

Step 6:

Inspect the adjuster cap, Item 37, for damage. If damaged replace the cover

Step 7:

Replace the adjuster cap with the tab oriented as shown in Figure 2.5.

Step 8:

Mark the brake chamber with a green X, Record the intended VIN number (if available), wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 2.6, 2.7, and 2.8)

Step 9:

Repeat steps 1 through 8 for each wheel end.

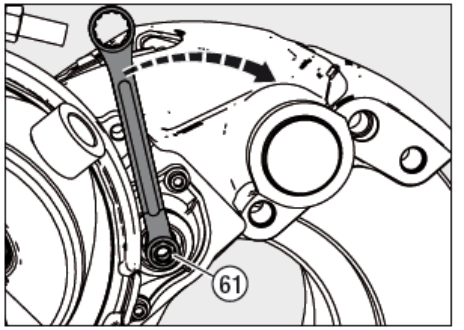


Figure 2.4

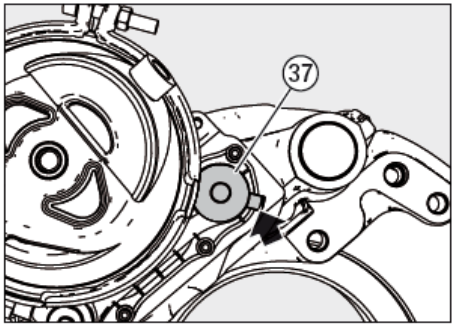


Figure 2.5

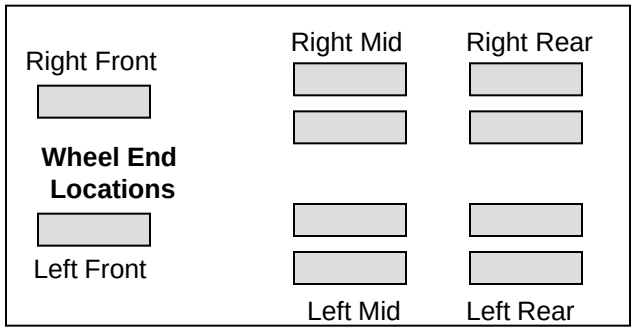
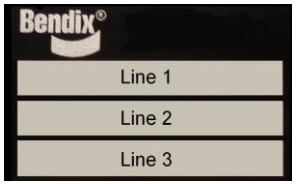
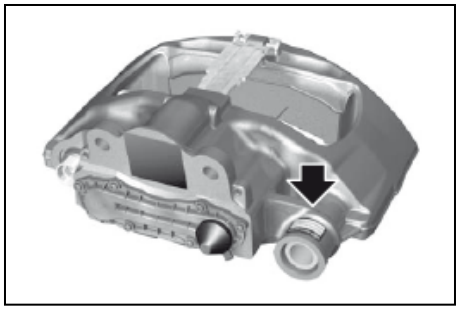


Figure 2.8



Line 1 = Part Number
Line 2 = Serial Number

Figure 2.7



Serial Number Tag Location
Figure 2.6

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Trouble Shooting, wheel ends with slide-ability issues (Page 1 of 5)

The following steps are for trouble shooting and correcting the caliper slide-ability issue.

Step 1: Verify the slide-ability issue with pads removed

1. If working on a vehicle, following all standard shop and safety practices remove the wheel on the affected wheel end. On spring brake equipped wheel ends charge the air system to full pressure, release and cage the spring brake.
2. Remove the spring clip (26), washer (45), pin (44) and pad retainer bar (11). (See Figure 3.1)
3. Identify and remove the adjuster cap item 37 (See figure 3.2)
4. Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise. (Figure 3.3) The brake assembly will make a clicking sound as the brake is backed off.
5. Remove the pads (12). (Figure 3.4)
6. With the pads removed slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, continue with trouble shooting section. If the caliper slides freely go to Step 4

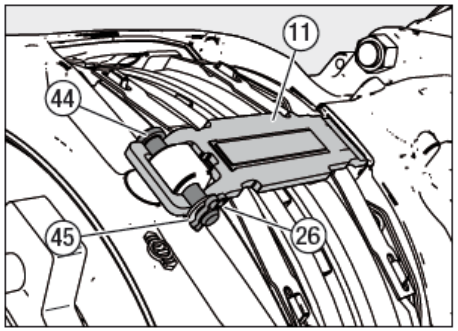


Figure 3.1

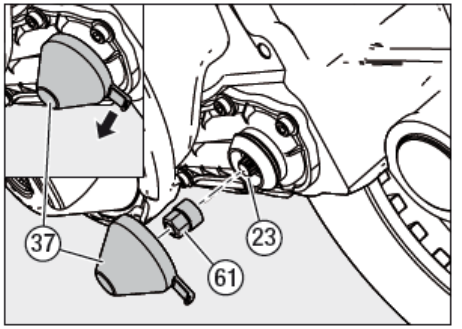


Figure 3.2

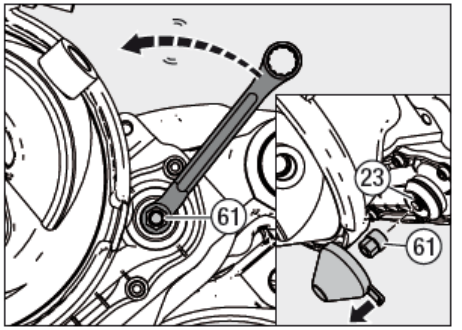


Figure 3.3

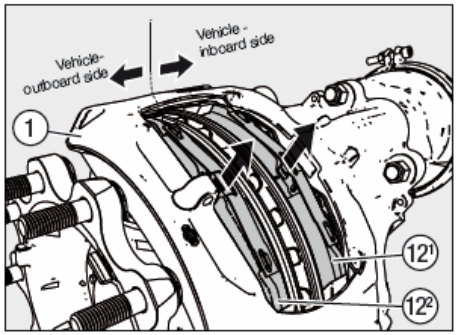


Figure 3.4

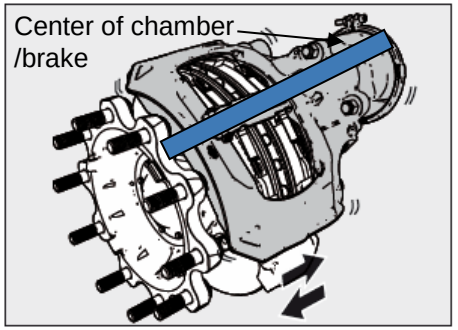


Figure 3.5

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Trouble Shooting, wheel ends with slide-ability issues (Page 2 of 5)

Step 2: Verify free state slide-ability and bolt torque sequence.

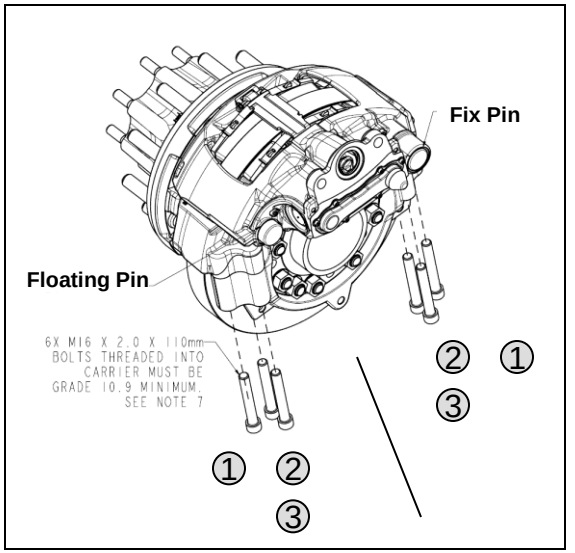
1. Loosen the (6) carrier to torque plate mounting bolts until they can all be turned by hand
2. Slide the caliper inboard and outboard. If the caliper does not slide with the mounting bolts loose replace the brake assembly. If the caliper slides freely continue with the trouble shooting.
3. Tighten the mounting bolt using the following procedure:

   Tighten bolts in the following order for all steps (Figure 3.6),

   (1) Fix Pin Bolt 3 (2) Fix Pin Bolt 2 (3) Floating Pin bolt 3

   (4) Floating pin bolt 2 (5) Floating pin bolt 1 (6) Fix Pin Bolt 1.

   A. Push the fix pin side of the caliper against the shelf on the anchor plate
   B. Set the floating pin side of the brake assembly over the sheer sleeve.
   C. Tighten Fix Pin Bolt 3 to 20 ft-lbs followed by Fix Pin Bolt 2 to 20 ft-lbs.
   D. Tighten remaining bolts to 20 ft-lbs in the order listed above.
   E. Tighten all bolts to 80 ft-lbs in the order listed above.
   F. Check caliper slide-ability. If it slides freely go to item H, if not item G
   G. Using a small hammer tap the carrier a few times at the mounting joint in the location shown in figure 3.7. This may remove some twist that was applied to the carrier during the initial tightening operations.
   H. Tighten all bolts to 180 – 200 ft-lbs in the order listed above.
4. Slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, continue with the trouble shooting section. If the caliper slides freely go to Step 4



Mounting Bolt Identification
Figure 3.6

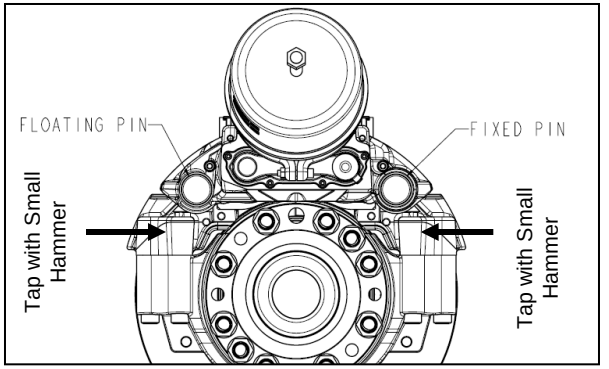


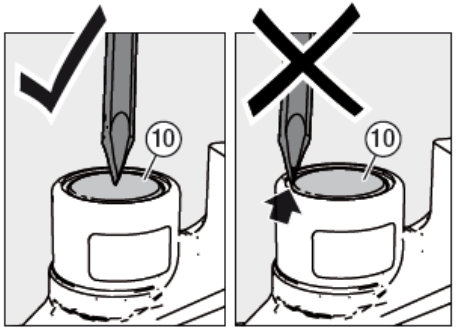
Figure 3.7

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Trouble Shooting, wheel ends with slide-ability issues (Page 3 of 5)

Step 3: Loosen and tighten guide pin bolts (reference instruction sheet 1484 for additional information).

1. Remove the fix (10) and floating pin(68) cap using a chisel or punch as shown in Figure 3.8 , 3.9, and 3.10
2. Use a 14mm allan head socket remove the floating pin bolt (39) Figure 3.11.
3. Install a new floating pin bolt and hand tighten the bolt.
4. Assure the guide pin (5) is seated in the carrier and the bellows retainer (58) is installed correctly. Figure 3.12 , 3.13
5. Use a 14mm allan head socket remove the fix pin bolt (40) Figure 3.11.
6. Install a new fix pin bolt and hand tighten the bolt
7. Assure the guide pin (5) is seated in the carrier and the bellows retainer (58) is installed correctly. Figure 3.12 , 3.13.
8. Torque each guide pin bolt to 133 ft-lbs + 90 degrees of rotation..



Fix Pin Cap Removal
Figure 3.8

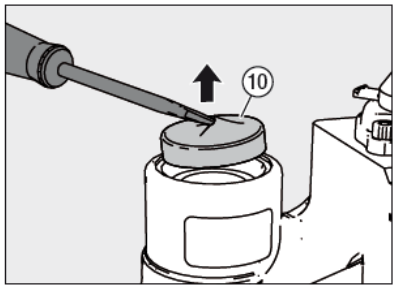


Figure 3.9



Figure 3.12

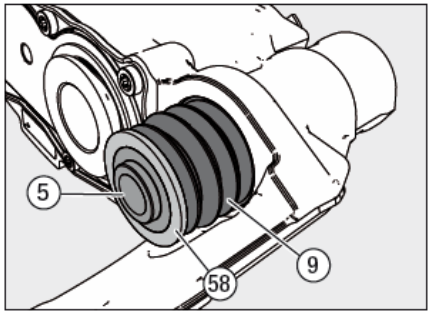


Figure 3.11

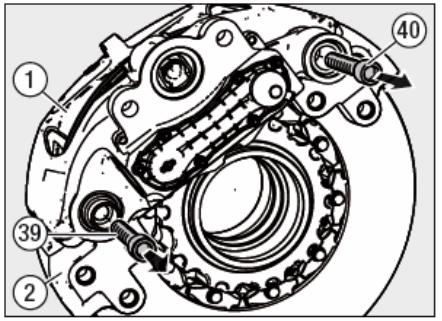
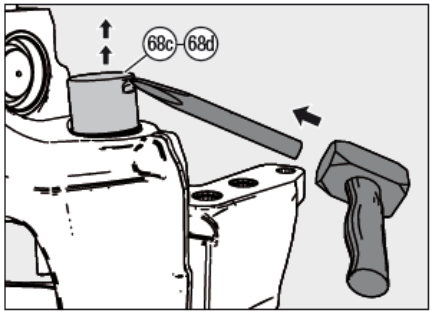


Figure 3.10



Floating Pin Cap Removal
Figure 3.10

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Trouble Shooting, wheel ends with slide-ability issues (Page 4 of 5)

Step 3: Loosen and tighten guide pin bolts (CONTINUED).

9. Slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, replace the brake assembly. If the caliper slides freely continue the trouble shoot section.
10. Install the fix and floating pin caps as follows
    1. Slide or pull the caliper outboard to fully compress the guide pin bellow (9) figure 3.11
    2. Using the guide pin tools (figure 3.16) insert the fix and floating pin caps, keeping the tool perpendicular to the guide pins. See Figures 3.13, 3.14, 3.15

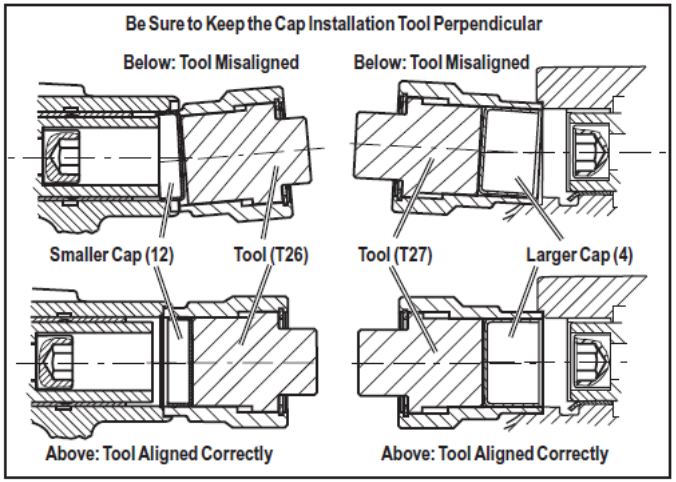


Figure 3.13

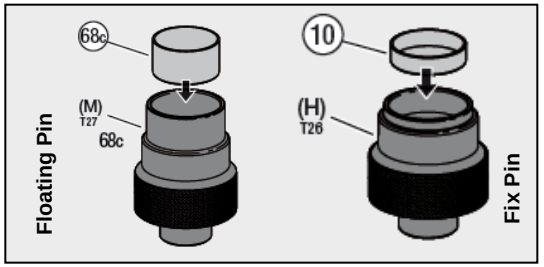
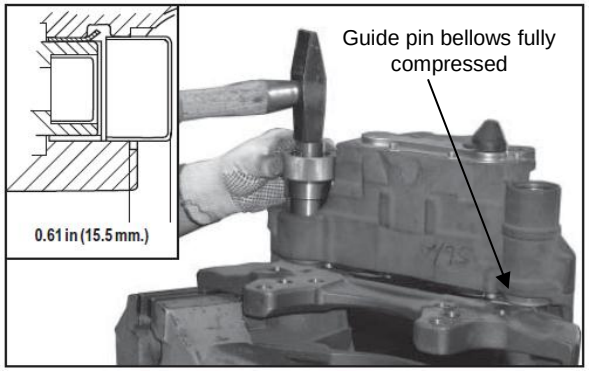
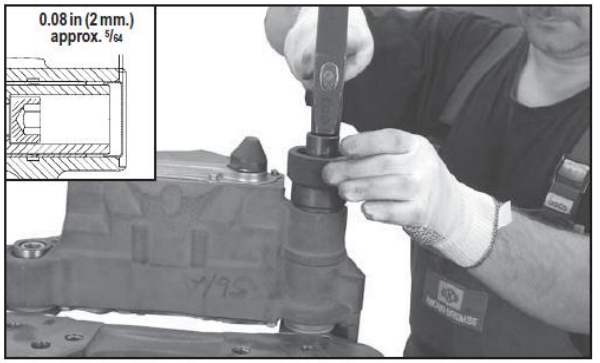


Figure 3.16



Floating Pin Cap Installation
Figure 3.15



Fix Pin Cap Installation
Figure 3.14

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Trouble Shooting, wheel ends with slide-ability issues (Page 5 of 5)

Step 4: Re-install brake pads and adjust brake.

1. Install brake pads into the caliper. Assure the pads are installed in the correct direction with the friction material on the rotor side of the pad. Figure 3.17 and 3.18
2. Install the pad retainer bar (11), push down on the bar and insert the pad retainer pin (44), washer (45) and spring clip (26) Figure 3.19
3. Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:
   - Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 3.20).
   - Turn the adjuster counter clockwise 2 clicks
4. Inspect the adjuster cap, Item 37, for damage. If damaged replace the cover
5. Replace the adjuster cap with the tab oriented as shown in Figure 3.21
6. Mark the brake chamber with a green X, Record the VIN number of the vehicle, wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 1.6,1. 7, and 1.8)
7. If the park brake was caged, un-cage the park brake chamber.
8. If the wheels were removed re-install the wheels

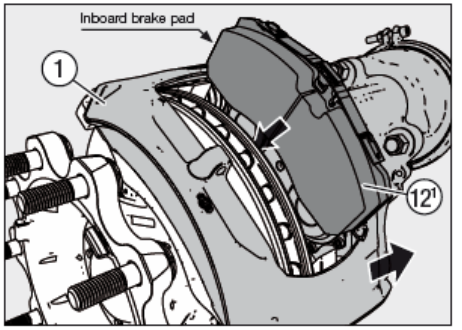


Figure 3.17

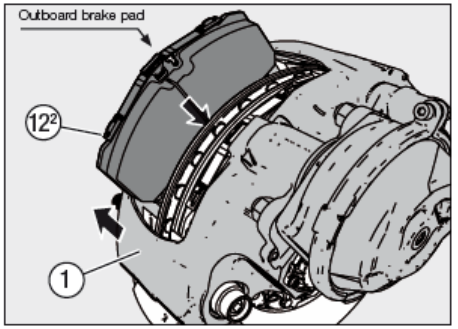


Figure 3.18

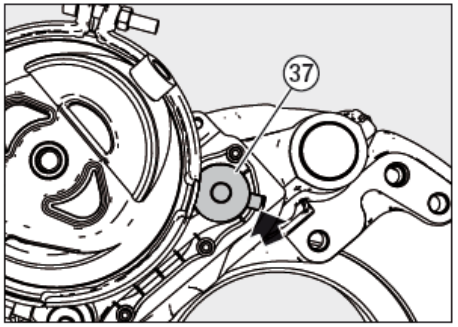


Figure 3.21

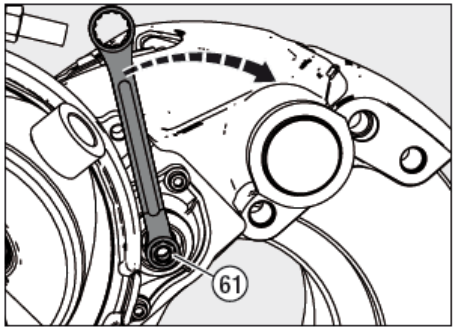


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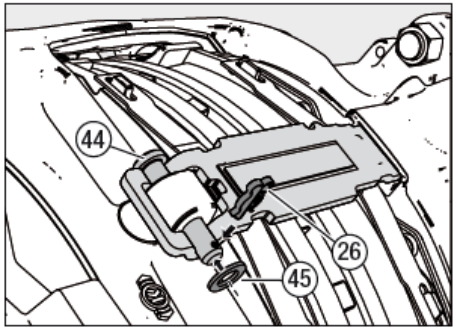


Figure 3.19

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PE13-012

BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® Vertical Bolt ADB22X™ Caliper Slide-ability Inspection and Rework Procedure

Bendix Spicer Foundation Brake LLC

Revision 1

August 16, 2011



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Scope:

This document will provide an inspection procedure to identify wheel ends that experience a slide-ability issue after being installed onto the anchor plate. The document includes a section on inspecting brakes on the vehicle, inspecting brakes on a dressed axle or during the assembly process, and a re-work process for brakes identified with the issue.

Vehicle inspection Page 3
Dressed axle inspection Page 5
Re-work process Page 7

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Vehicle Inspection Procedure (Page 1 of 2)

The following inspection is performed with the wheels installed. The inspection should be performed on each air disc brake equipped wheel end.

Step 1:

Chock the wheels of the vehicle.

Step 2:

Fully charge the air system (build pressure until the governor cut-out is reached)

Step 3:

Release the park brakes and verify the system pressure is a minimum of 100 PSI.

Step 4:

Identify and remove the adjuster cap item 37 (See figure 1.1)

Step 5:

Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise. (Figure 1.2) The brake assembly will make a clicking sound as the brake is backed off. With new pads installed there is a limited adjustment range possible, the brake assembly should be backed off 3 to 4 clicks, or until resistance is met. The sheer adapter is designed to break, protecting the adjuster from damage. If the sheer adapter breaks it can be replaced. If the sheer adapter breaks multiple times or adjustment of the brake is not possible verify the park brake is released.

Step 6:

Holding the brake by the center of the brake chamber, slide the brake assembly into and out of the wheel (See Figure 1.3). The brake should move freely at least 2 – 4 mm. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a possible slide-ability issue, proceed to the re-work section for this wheel end. If the brake slides freely continue this inspection procedure.

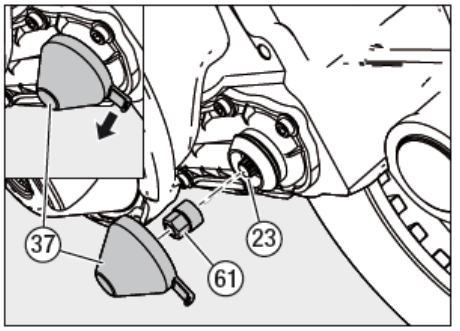


Figure 1.1

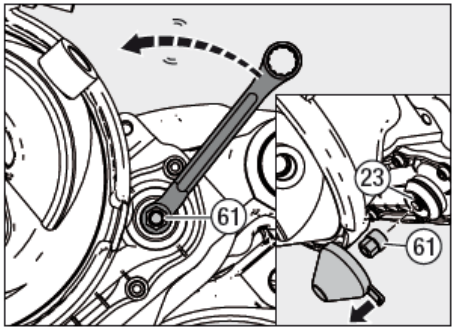


Figure 1.2

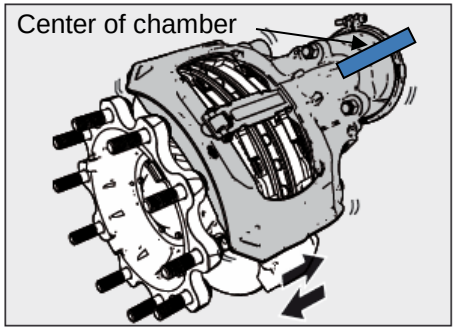


Figure 1.3

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Vehicle Inspection Procedure (Page 2 of 2)

Step 7:

Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:

- Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 1.4).
- Turn the adjuster counter clockwise 2 clicks.

Step 8:

Inspect the adjuster cap, Item 37, for damage. If damaged replace the cap.

Step 9:

Replace the adjuster cap with the tab oriented as shown in Figure 1.5.

Step 10:

Mark the brake chamber with a green X, Record the VIN number of the vehicle, wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 1.6,1. 7, and 1.8)

Step 11:

Repeat steps 4 through 10 for each ADB equipped wheel end

Step 12:

Apply the parking brakes.

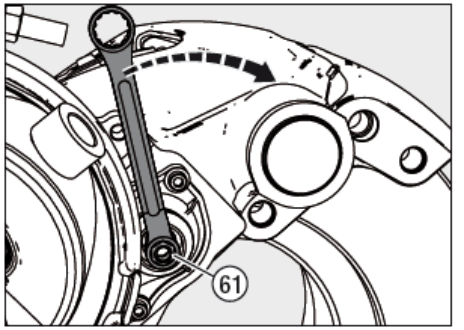


Figure 1.4

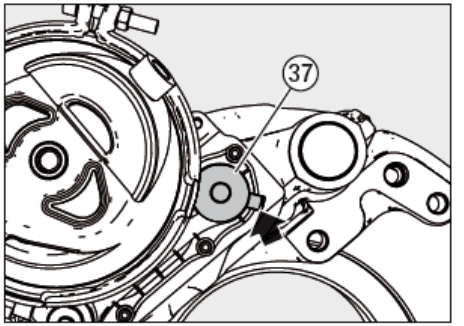
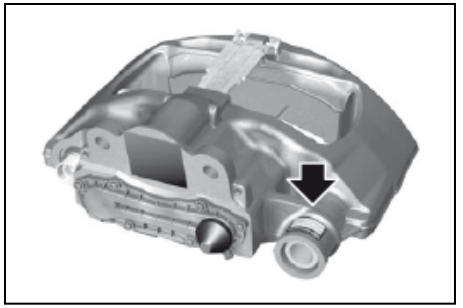


Figure 1.5



Serial Number Tag Location
Figure 1.6

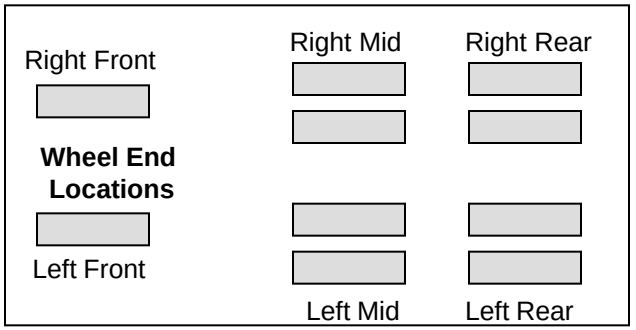
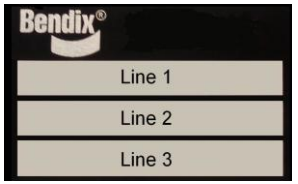


Figure 1.8



Line 1 = Part Number
Line 2 = Serial Number

Figure 1.7

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Dressed or Assembled Axle Inspection Procedure (Page 1 of 2)

The following inspection is performed on an axle before it is installed into a vehicle.

Step 1:

If equipped, verify the park brake chamber is caged.

Step 2

Identify and remove the adjuster cap item 37 (See figure 2.1)

Step 3:

Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise (Figure 2.2). The brake assembly will make a clicking sound as the brake is backed off. With new pads installed there is a limited adjustment range possible, the brake assembly should be backed off 3 to 4 clicks, or until resistance is met. The sheer adapter is designed to break, protecting the adjuster from damage. If the sheer adapter breaks it can be replaced. If the sheer adapter breaks multiple times or adjustment of the brake is not possible verify the park brake is caged.

Step 4:

Slide the brake assembly, through the center of the chamber or brake, inboard and outboard (See Figure 2.3). The brake should move freely in taking up the running clearance between the brake assembly and rotor. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a possible slide-ability issue, proceed to the re-work section for this wheel end. If the brake slides freely continue this inspection procedure.

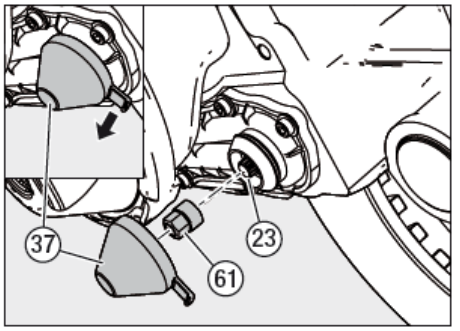


Figure 2.1

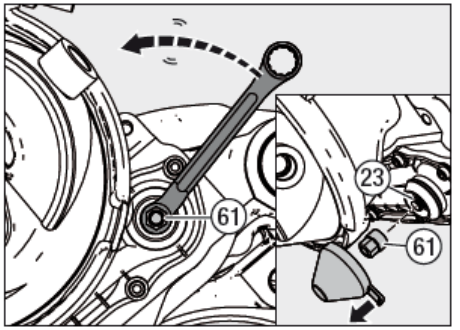


Figure 2.2

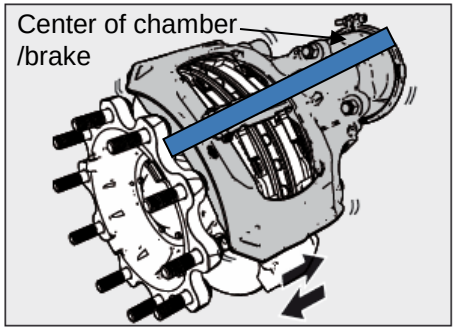


Figure 2.3

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Dressed or Assembled Axle Inspection Procedure (Page 2 of 2)

Step 5:

Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:

- Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 2.4).
- Turn the adjuster counter clockwise 2 clicks.

Step 6:

Inspect the adjuster cap, Item 37, for damage. If damaged replace the cap.

Step 7:

Replace the adjuster cap with the tab oriented as shown in Figure 2.5.

Step 8:

Mark the brake chamber with a green X, Record the intended VIN number (if available), wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 2.6, 2.7, and 2.8)

Step 9:

Repeat steps 1 through 8 for each wheel end.

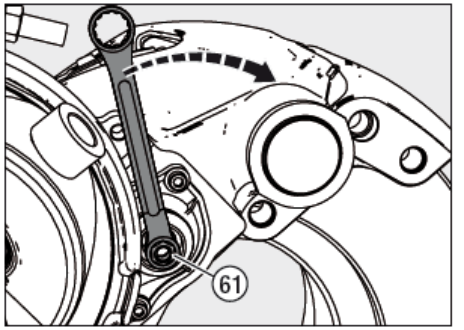


Figure 2.4

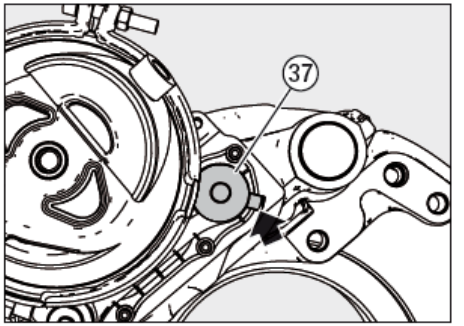


Figure 2.5

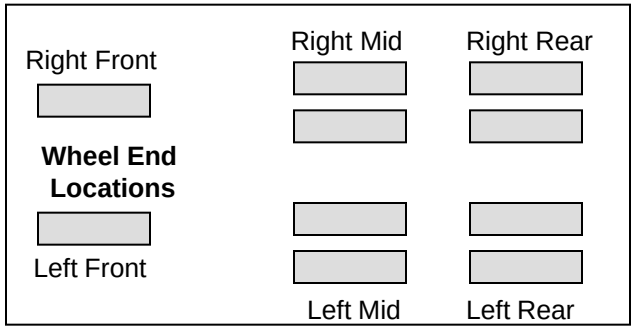
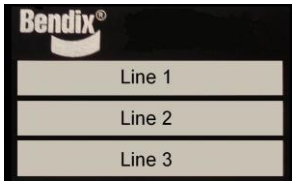
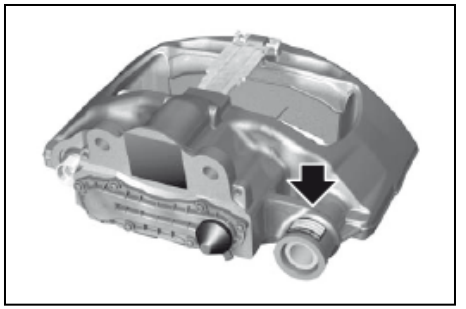


Figure 2.8



Line 1 = Part Number
Line 2 = Serial Number

Figure 2.7



Serial Number Tag Location
Figure 2.6

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Re-work Procedure, wheel ends with slide-ability issues (Page 1 of 4)

The following steps are for Re-working and correcting an identified caliper slide-ability issue.

Step 1: Verify the slide-ability issue with pads removed

1. If working on a vehicle, following all standard shop and safety practices, remove the wheel on the affected wheel end. On spring brake equipped wheel ends charge the air system to full pressure, release and cage the spring brake.
2. Remove the spring clip (26), washer (45), pin (44) and pad retainer bar (11). (See Figure 3.1)
3. Identify and remove the adjuster cap item 37 (See figure 3.2)
4. Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise. (Figure 3.3) The brake assembly will make a clicking sound as the brake is backed off.
5. Remove the pads (12). (Figure 3.4)
6. With the pads removed slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, continue with the Re-work procedure section. If the caliper slides freely go to Step 3

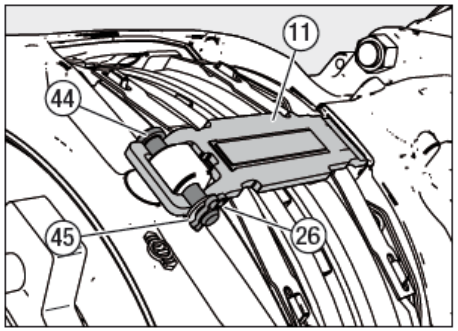


Figure 3.1

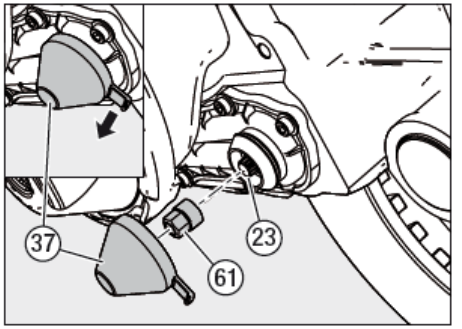


Figure 3.2

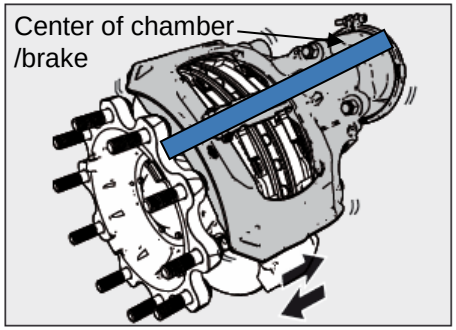
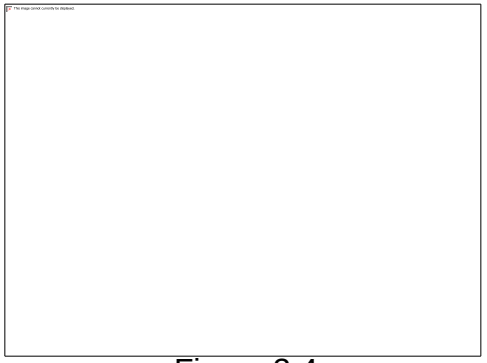


Figure 3.5


Figure 3.4

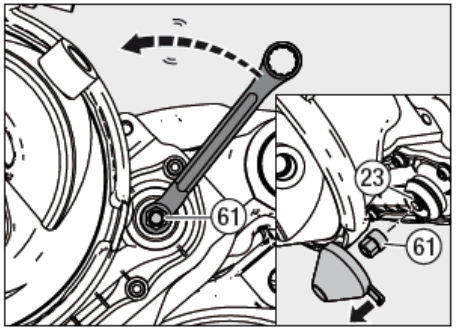


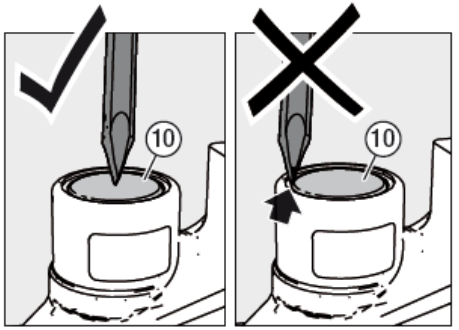
Figure 3.3

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Re-work procedure, wheel ends with slide-ability issues (Page 2 of 4)

Step 2: Loosen and tighten guide pin bolts (reference instruction sheet 1484 for additional information).

1. Remove the long (fix) (10) and short (floating) pin(68) cap using a chisel or punch as shown in Figure 3.6 , 3.7, and 3.8
2. Use a 14mm allan head socket remove and dispose of the short pin bolt (39) Figure 3.9.
3. Install a new short pin bolt and tighten the bolt enough to retain the guide pin.
4. Assure the guide pin (5) is seated in the carrier and the bellows retainer (58) is installed correctly. Figure 3.10 , 3.11
5. Use a 14mm allan head socket remove and dispose of the long pin bolt (40) Figure 3.9.
6. Install a new long pin bolt and tighten the bolt enough to retain the guide pin.
7. Assure the guide pin (5) is seated in the carrier and the bellows retainer (58) is installed correctly. Figure 3.10 , 3.11.
8. Torque each guide pin bolt to 133 ft-lbs + 90 degrees of rotation..



Long (fix) Pin Cap Removal
Figure 3.6

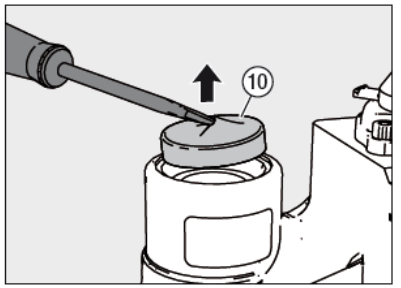


Figure 3.7



Figure 3.11

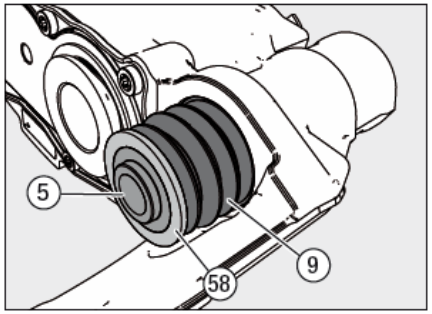


Figure 3.10

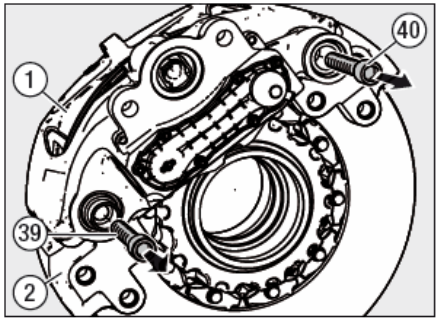
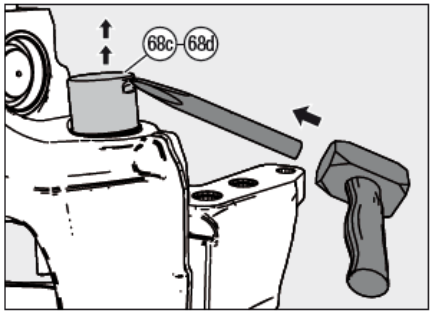


Figure 3.9



Short (floating) Pin Cap Removal
Figure 3.8

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Re-work procedure, wheel ends with slide-ability issues (Page 3 of 4)

Step 2: Loosen and tighten guide pin bolts (CONTINUED).

9. Slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, replace the brake assembly. If the caliper slides freely continue the re-work procedure.
10. Install the long and short pin caps as follows
    1. Slide or pull the caliper outboard to fully compress the guide pin bellow (9) figure 3.10,
    2. Using the guide pin tools (figure 3.15) insert the long and short pin caps, keeping the tool perpendicular to the guide pins. See Figures 3.12, 3.13, 3.14

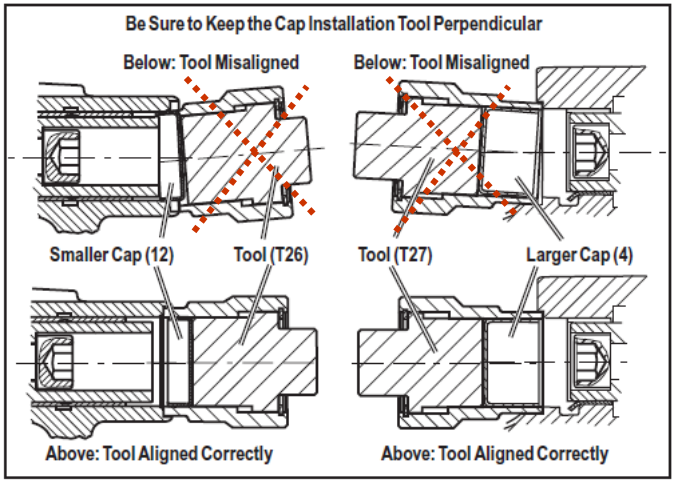


Figure 3.12

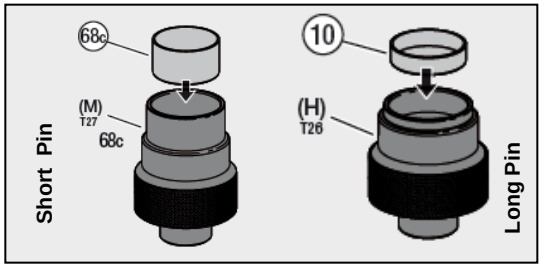
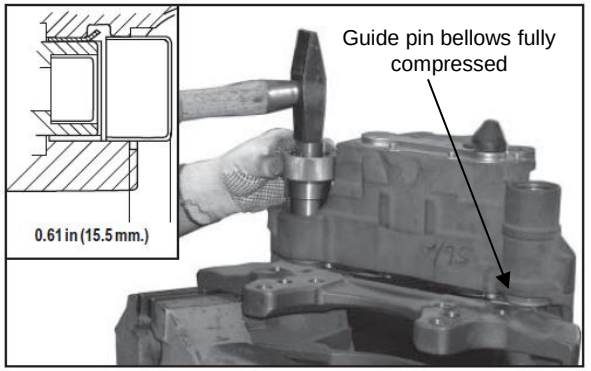
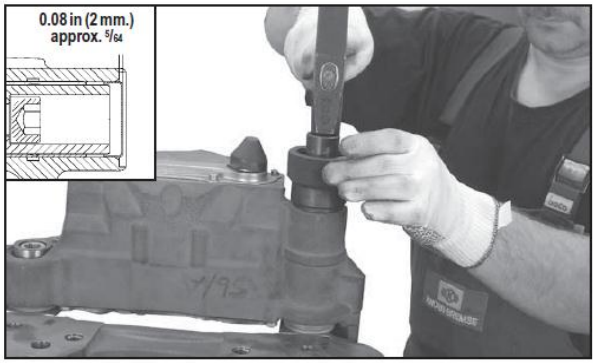


Figure 3.15



Short (floating) Pin Cap Installation
Figure 3.14



Long (fix) Pin Cap Installation
Figure 3.13

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Re-work procedure, wheel ends with slide-ability issues (Page 4 of 4)

Step 3: Re-install brake pads and adjust the brake.

1. Install brake pads into the caliper. Assure the pads are installed in the correct direction with the friction material on the rotor side of the pad. Figure 3.16 and 3.17
2. Install the pad retainer bar (11), push down on the bar and insert the pad retainer pin (44), washer (45) and spring clip (26) Figure 3.18
3. Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:
   - Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 3.19).
   - Turn the adjuster counter clockwise 2 clicks
4. Inspect the adjuster cap, Item 37, for damage. If damaged replace the cover
5. Replace the adjuster cap with the tab oriented as shown in Figure 3.20
6. Mark the brake chamber with a green X, Record the VIN number of the vehicle, wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 1.6,1. 7, and 1.8)
7. If the park brake was caged, un-cage the park brake chamber.
8. If the wheels were removed re-install the wheels

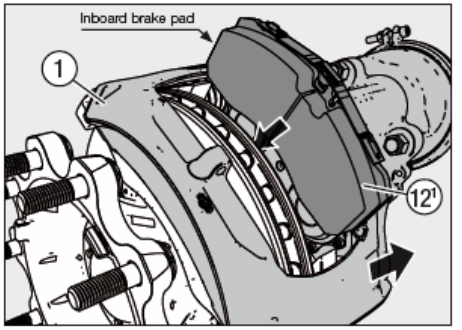


Figure 3.16

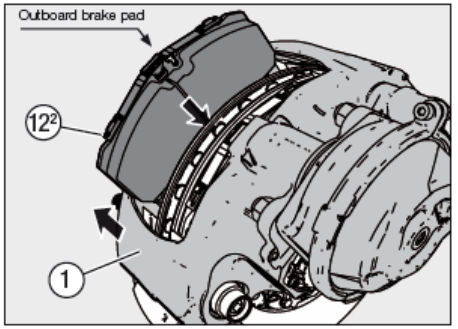


Figure 3.17

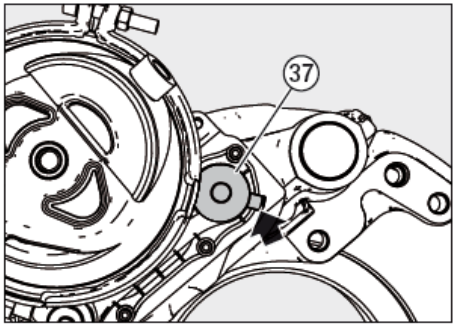


Figure 3.20

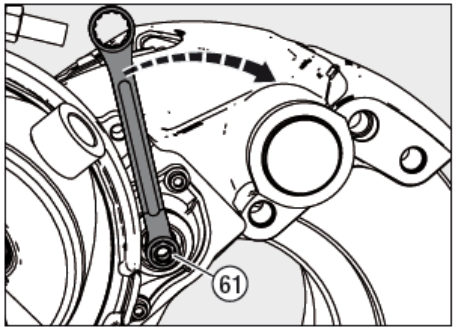


Figure 3.19

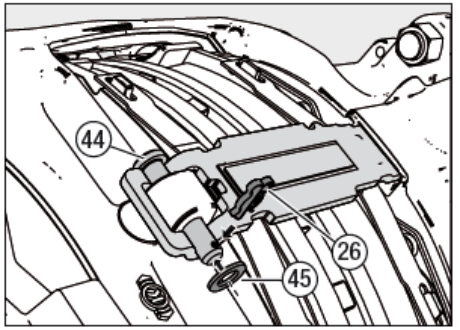


Figure 3.18

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PE13-012

BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® Vertical Bolt ADB22X™ Caliper Slide-ability Inspection and Rework Procedure

Bendix Spicer Foundation Brake LLC

Revision 2

August 18, 2011



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Scope:

This document will provide an inspection procedure to identify wheel ends that experience a slide-ability issue after being installed onto the anchor plate. The document includes a section on inspecting brakes on the vehicle, inspecting brakes on a dressed axle or during the assembly process, and a re-work process for brakes identified with the issue.

Vehicle inspection Page 3
Dressed axle inspection Page 5
Re-work process Page 7

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Vehicle Inspection Procedure (Page 1 of 2)

The following inspection is performed with the wheels installed. The inspection should be performed on each air disc brake equipped wheel end.

Step 1:

Chock the wheels of the vehicle.

Step 2:

Fully charge the air system (build pressure until the governor cut-out is reached)

Step 3:

Release the park brakes and verify the system pressure is a minimum of 100 PSI.

Step 4:

Identify and remove the adjuster cap item 37 (See figure 1.1)

Step 5:

Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise. (Figure 1.2) The brake assembly will make a clicking sound as the brake is backed off. With new pads installed there is a limited adjustment range possible, the brake assembly should be backed off 3 to 4 clicks, or until resistance is met. The sheer adapter is designed to break, protecting the adjuster from damage. If the sheer adapter breaks it can be replaced. If the sheer adapter breaks multiple times or adjustment of the brake is not possible verify the park brake is released.

Step 6:

Holding the brake by the center of the brake chamber, slide the brake assembly into and out of the wheel (See Figure 1.3). The brake should move freely at least 2 – 4 mm. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a possible slide-ability issue, proceed to the re-work section for this wheel end. If the brake slides freely continue this inspection procedure.

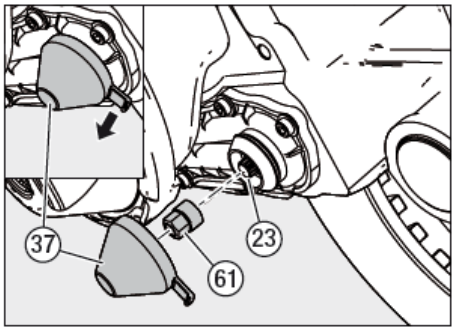


Figure 1.1

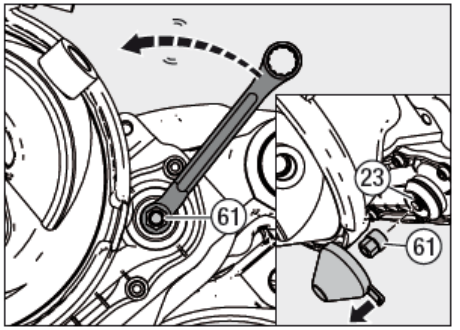


Figure 1.2

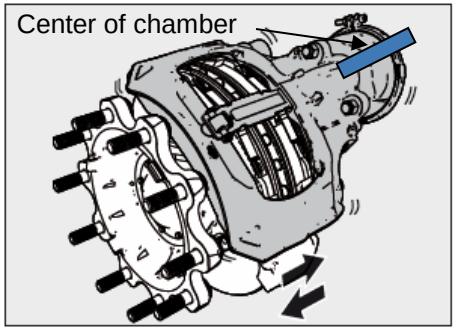


Figure 1.3

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Vehicle Inspection Procedure (Page 2 of 2)

Step 7:

Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:

- Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 1.4).
- Turn the adjuster counter clockwise 2 clicks.

Step 8:

Inspect the adjuster cap, Item 37, for damage. If damaged replace the cap.

Step 9:

Replace the adjuster cap with the tab oriented as shown in Figure 1.5.

Step 10:

Mark the brake chamber with a green X, Record the VIN number of the vehicle, wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 1.6,1. 7, and 1.8)

Step 11:

Repeat steps 4 through 10 for each ADB equipped wheel end

Step 12:

Apply the parking brakes.

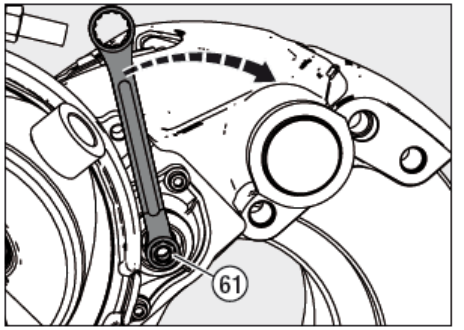


Figure 1.4

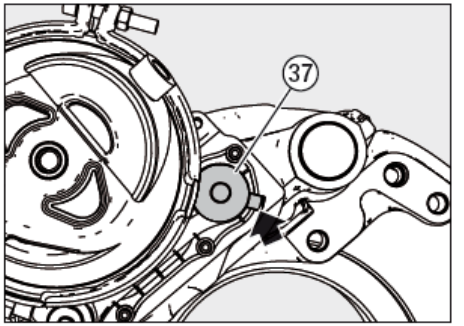
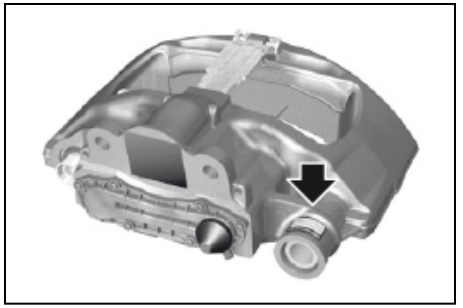


Figure 1.5



Serial Number Tag Location
Figure 1.6

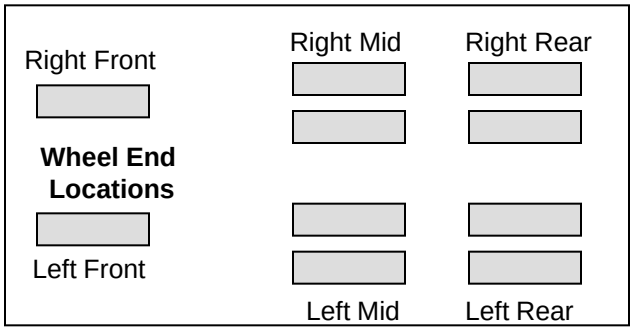
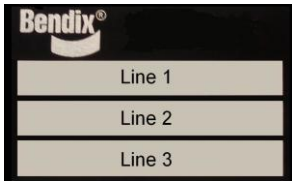


Figure 1.8



Line 1 = Part Number
Line 2 = Serial Number

Figure 1.7

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Dressed or Assembled Axle Inspection Procedure (Page 1 of 2)

The following inspection is performed on an axle before it is installed into a vehicle.

Step 1:

If equipped, verify the park brake chamber is caged.

Step 2

Identify and remove the adjuster cap item 37 (See figure 2.1)

Step 3:

Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise (Figure 2.2). The brake assembly will make a clicking sound as the brake is backed off. With new pads installed there is a limited adjustment range possible, the brake assembly should be backed off 3 to 4 clicks, or until resistance is met. The sheer adapter is designed to break, protecting the adjuster from damage. If the sheer adapter breaks it can be replaced. If the sheer adapter breaks multiple times or adjustment of the brake is not possible verify the park brake is caged.

Step 4:

Slide the brake assembly, through the center of the chamber or brake, inboard and outboard (See Figure 2.3). The brake should move freely in taking up the running clearance between the brake assembly and rotor. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a possible slide-ability issue, proceed to the re-work section for this wheel end. If the brake slides freely continue this inspection procedure.

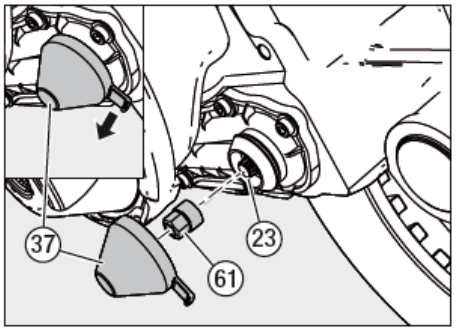


Figure 2.1

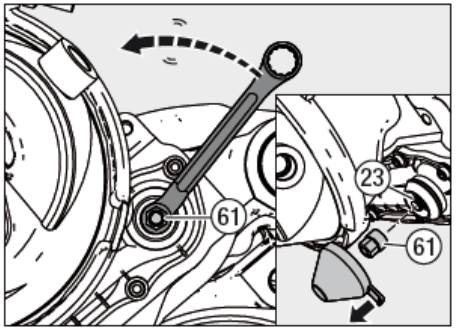


Figure 2.2

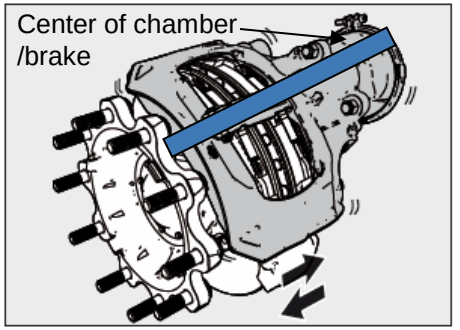


Figure 2.3

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Dressed or Assembled Axle Inspection Procedure (Page 2 of 2)

Step 5:

Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:

- Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 2.4).
- Turn the adjuster counter clockwise 2 clicks.

Step 6:

Inspect the adjuster cap, Item 37, for damage. If damaged replace the cap.

Step 7:

Replace the adjuster cap with the tab oriented as shown in Figure 2.5.

Step 8:

Mark the brake chamber with a green X, Record the intended VIN number (if available), wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 2.6, 2.7, and 2.8)

Step 9:

Repeat steps 1 through 8 for each wheel end.

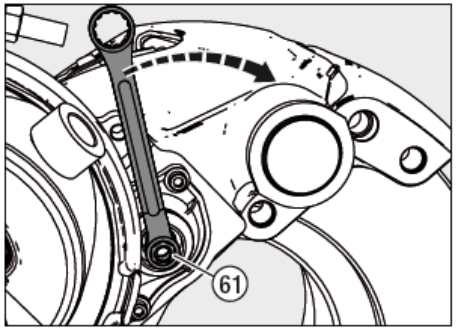


Figure 2.4

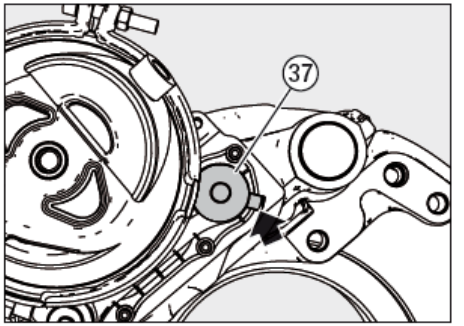


Figure 2.5

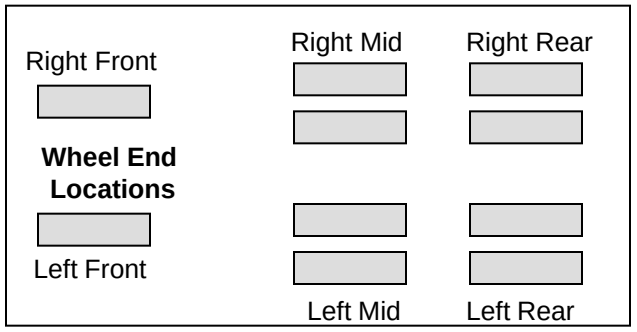
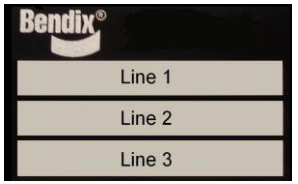
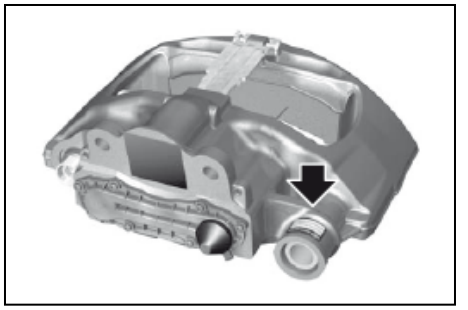


Figure 2.8



Line 1 = Part Number
Line 2 = Serial Number

Figure 2.7



Serial Number Tag Location
Figure 2.6

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Re-work Procedure, wheel ends with slide-ability issues (Page 1 of 5)

The following steps are for Re-working and correcting an identified caliper slide-ability issue.

Step 1: Verify the slide-ability issue with pads removed

1. If working on a vehicle, following all standard shop and safety practices, remove the wheel on the affected wheel end. On spring brake equipped wheel ends charge the air system to full pressure, release and cage the spring brake.
2. Remove the spring clip (26), washer (45), pin (44) and pad retainer bar (11). (See Figure 3.1)
3. Identify and remove the adjuster cap item 37 (See figure 3.2)
4. Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise. (Figure 3.3) The brake assembly will make a clicking sound as the brake is backed off.
5. Remove the pads (12). (Figure 3.4)
6. With the pads removed slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, continue with the Re-work procedure section. If the caliper slides freely go to Step 4.

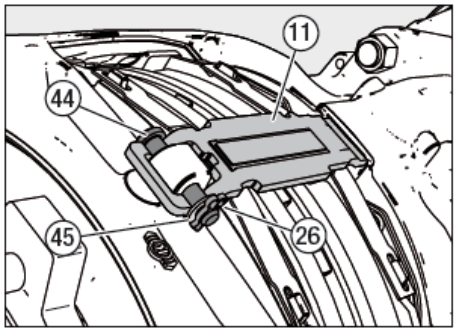


Figure 3.1

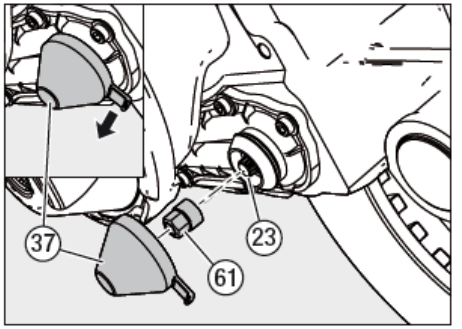


Figure 3.2

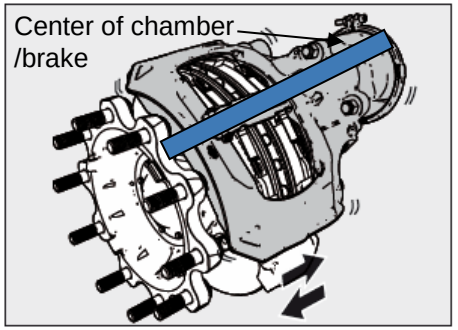


Figure 3.5

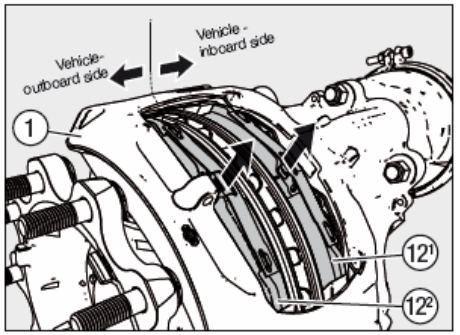


Figure 3.4

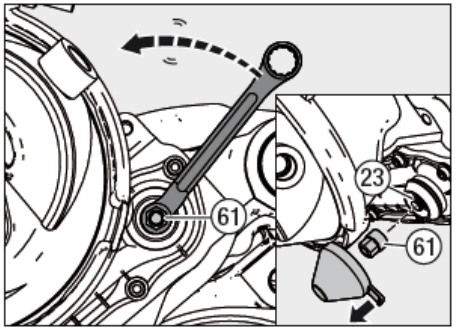


Figure 3.3

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Re-work Procedure, wheel ends with slide-ability issues

Step 2: Verify free state slide-ability and bolt torque sequence.

1. Loosen the (6) carrier to torque plate mounting bolts until they can all be turned by hand.
2. Slide the caliper inboard and outboard. If the caliper does not slide with the mounting bolts loose replace the brake assembly. If the caliper slides freely continue with the re-work procedure.
3. Tighten the carrier mounting bolts (Figure 3.8) using the pattern shown in Figures 3.6 for RH brakes or Figure 3.7 for LH brakes . The brake assemblies are handed, so there is a LH and RH caliper assembly. The pattern will always start on the short (floating) pin side. Tighten the carrier mounting bolts to between 180 and 200 ft-lbs of torque.
4. Slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, continue with the re-work procedure. If the caliper slides freely skip Step 3 and go to Step 4.

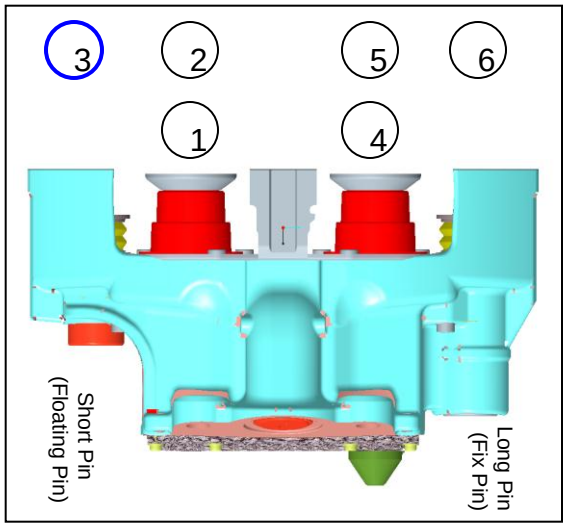


Figure 3.6 Right Hand Brake

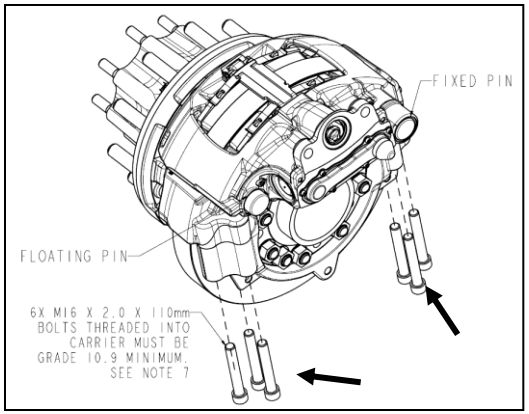


Figure 3.8 Carrier Mounting Bolts

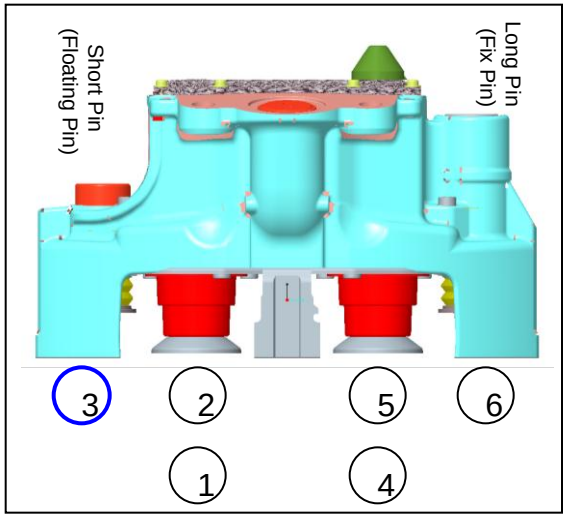


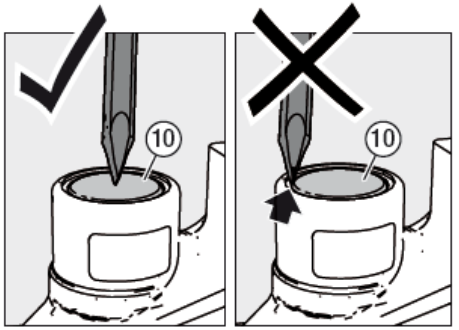
Figure 3.7 Left Hand Brake

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Re-work procedure, wheel ends with slide-ability issues (Page 3 of 5)

Step 3: Loosen and tighten guide pin bolts (reference instruction sheet 1484 for additional information).

1. Remove the long (fix) (10) and short (floating) pin(68) cap using a chisel or punch as shown in Figure 3.9 , 3.10, and 3.11.
2. Use a 14mm allan head socket remove and dispose of the short pin bolt (39) Figure 3.12.
3. Install a new short pin bolt and tighten the bolt enough to retain the guide pin.
4. Assure the guide pin (5) is seated in the carrier and the bellows retainer (58) is installed correctly. Figure 3.13 , 3.14
5. Use a 14mm allan head socket remove and dispose of the long pin bolt (40) Figure 3.12.
6. Install a new long pin bolt and tighten the bolt enough to retain the guide pin.
7. Assure the guide pin (5) is seated in the carrier and the bellows retainer (58) is installed correctly. Figure 3.13 , 3.14.
8. Torque each guide pin bolt to 133 ft-lbs + 90 degrees of rotation.



Long (fix) Pin Cap Removal
Figure 3.9

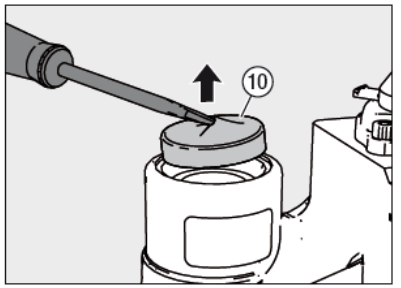


Figure 3.10



Figure 3.14

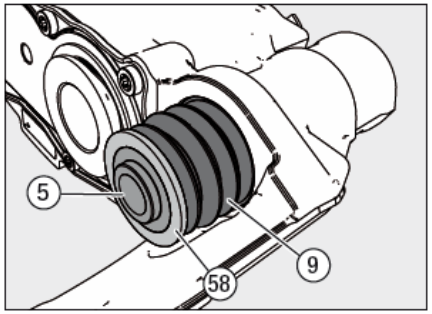


Figure 3.13

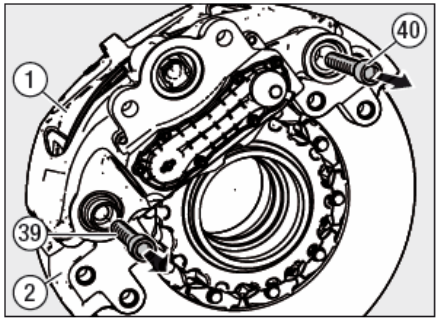
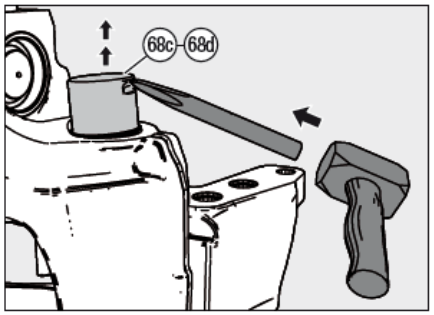


Figure 3.12



Short (floating) Pin Cap Removal
Figure 3.11

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Re-work procedure, wheel ends with slide-ability issues (Page 4 of 5)

Step 3: Loosen and tighten guide pin bolts (CONTINUED).

9. Slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, replace the brake assembly. If the caliper slides freely continue the re-work procedure.
10. Install the long and short pin caps as follows
    1. Slide or pull the caliper outboard to fully compress the guide pin bellow (9) figure 3.13,
    2. With the guide pin bellows compressed, use the guide pin tools (figure 3.18) to insert the long and short pin caps, keeping the tool perpendicular to the guide pins. See Figures 3.15, 3.16, 3.17

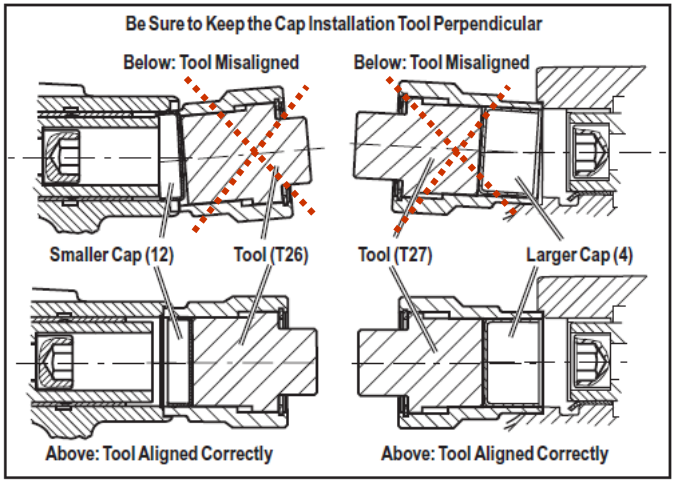


Figure 3.15

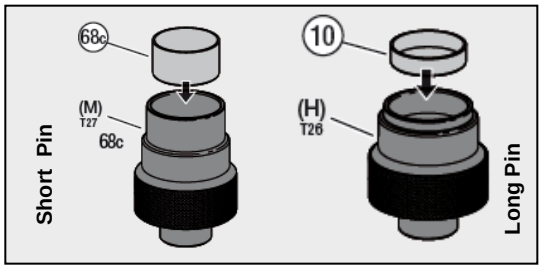
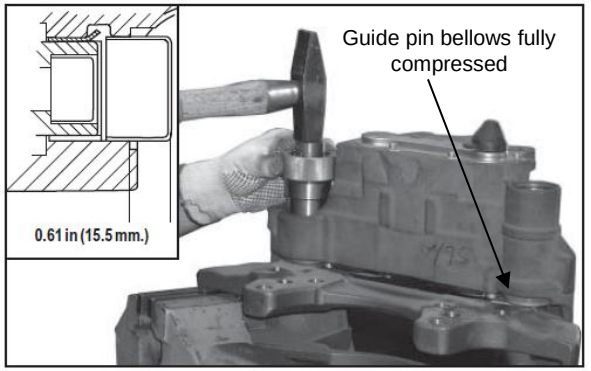
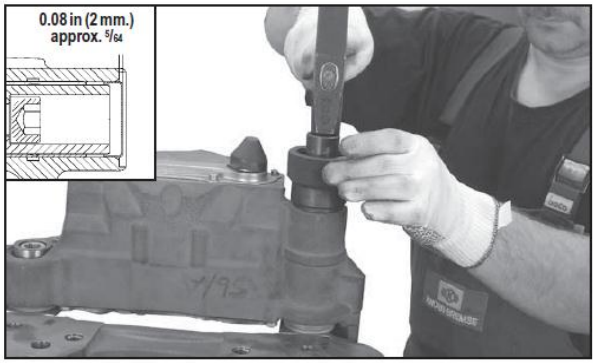


Figure 3.18



Short (floating) Pin Cap Installation
Figure 3.17



Long (fix) Pin Cap Installation
Figure 3.16

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Re-work procedure, wheel ends with slide-ability issues (Page 5 of 5)

Step 4: Re-install brake pads and adjust the brake.

1. Install brake pads into the caliper. Assure the pads are installed in the correct direction with the friction material on the rotor side of the pad. Figure 3.19 and 3.20
2. Install the pad retainer bar (11), push down on the bar and insert the pad retainer pin (44), washer (45) and spring clip (26) Figure 3.21.
3. Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:
   - Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 3.22).
   - Turn the adjuster counter clockwise 2 clicks
4. Inspect the adjuster cap, Item 37, for damage. If damaged replace the cover
5. Replace the adjuster cap with the tab oriented as shown in Figure 3.23
6. Mark the brake chamber with a green X, Record the VIN number of the vehicle, wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 1.6,1. 7, and 1.8)
7. If the park brake was caged, un-cage the park brake chamber.
8. If the wheels were removed re-install the wheels

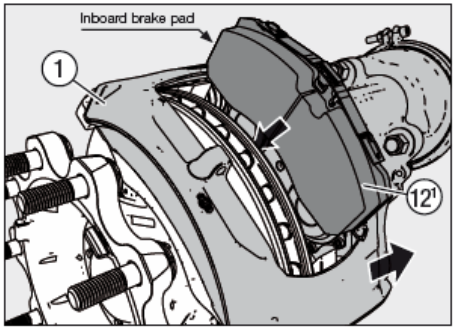


Figure 3.19

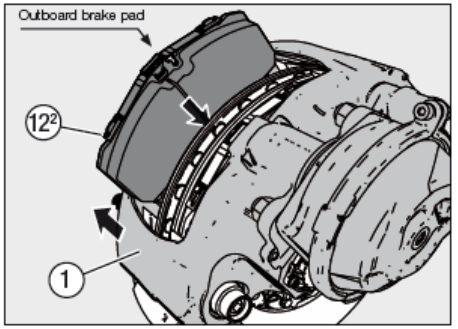


Figure 3.20

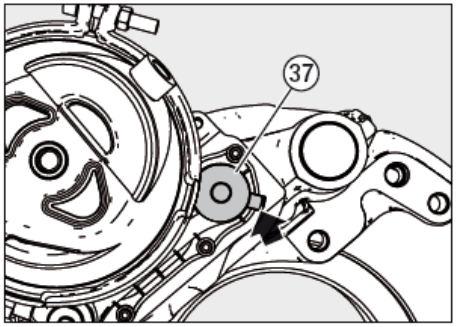


Figure 3.23

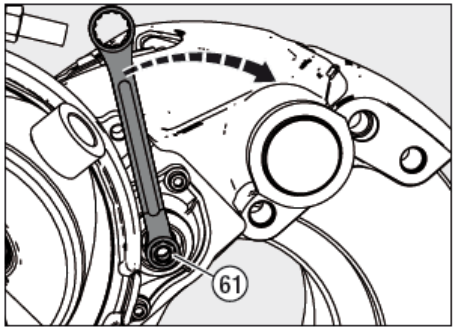


Figure 3.22

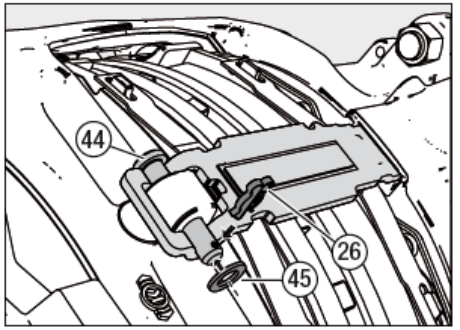


Figure 3.21

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PE13-012

BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® Vertical Bolt ADB22X™ Caliper Slide-ability Inspection and Rework Procedure

Bendix Spicer Foundation Brake LLC

Revision 2

August 18, 2011



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Scope:

This document will provide an inspection procedure to identify wheel ends that experience a slide-ability issue after being installed onto the anchor plate. The document includes a section on inspecting brakes on the vehicle, inspecting brakes on a dressed axle or during the assembly process, and a re-work process for brakes identified with the issue.

Vehicle inspection Page 3
Dressed axle inspection Page 5
Re-work process Page 7

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Vehicle Inspection Procedure (Page 1 of 2)

The following inspection is performed with the wheels installed. The inspection should be performed on each air disc brake equipped wheel end.

Step 1:

Chock the wheels of the vehicle.

Step 2:

Fully charge the air system (build pressure until the governor cut-out is reached)

Step 3:

Release the park brakes and verify the system pressure is a minimum of 100 PSI.

Step 4:

Identify and remove the adjuster cap item 37 (See figure 1.1)

Step 5:

Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise. (Figure 1.2) The brake assembly will make a clicking sound as the brake is backed off. With new pads installed there is a limited adjustment range possible, the brake assembly should be backed off 3 to 4 clicks, or until resistance is met. The sheer adapter is designed to break, protecting the adjuster from damage. If the sheer adapter breaks it can be replaced. If the sheer adapter breaks multiple times or adjustment of the brake is not possible verify the park brake is released.

Step 6:

Holding the brake by the center of the brake chamber, slide the brake assembly into and out of the wheel (See Figure 1.3). The brake should move freely at least 2 – 4 mm. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a possible slide-ability issue, proceed to the re-work section for this wheel end. If the brake slides freely continue this inspection procedure.

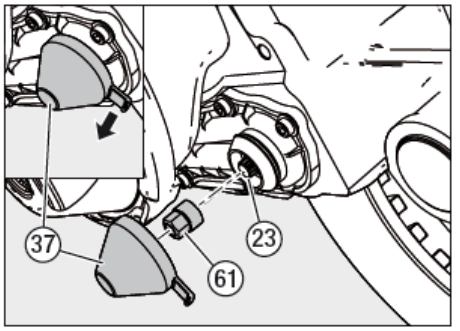


Figure 1.1

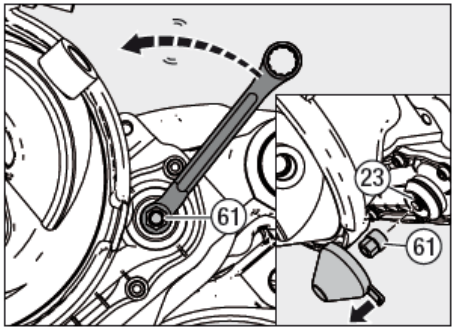


Figure 1.2

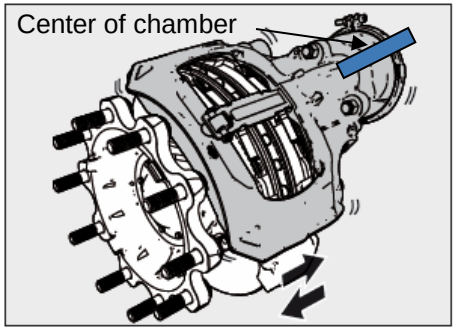


Figure 1.3

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Vehicle Inspection Procedure (Page 2 of 2)

Step 7:

Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:

- Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 1.4).
- Turn the adjuster counter clockwise 2 clicks.

Step 8:

Inspect the adjuster cap, Item 37, for damage. If damaged replace the cap.

Step 9:

Replace the adjuster cap with the tab oriented as shown in Figure 1.5.

Step 10:

Mark the brake chamber with a green X, Record the VIN number of the vehicle, wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 1.6,1. 7, and 1.8)

Step 11:

Repeat steps 4 through 10 for each ADB equipped wheel end

Step 12:

Apply the parking brakes.

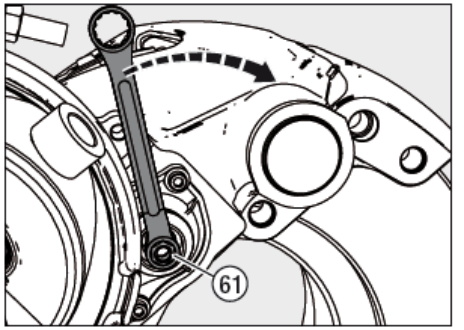


Figure 1.4

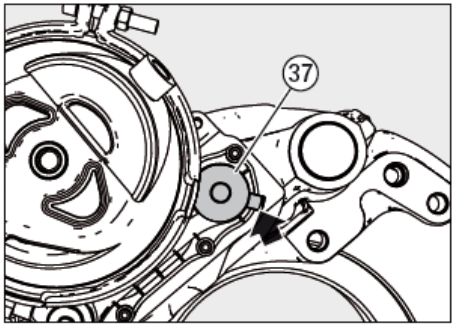
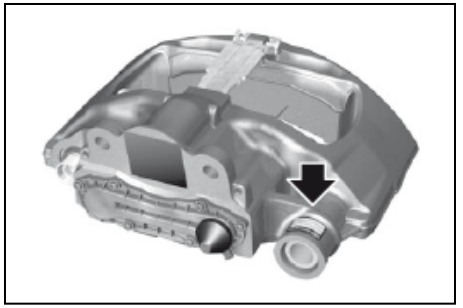


Figure 1.5



Serial Number Tag Location
Figure 1.6

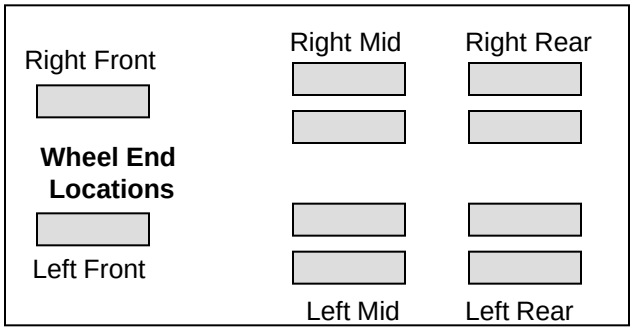
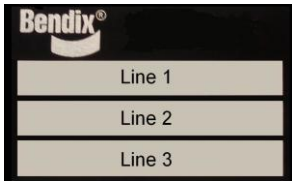


Figure 1.8



Line 1 = Part Number
Line 2 = Serial Number

Figure 1.7

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Dressed or Assembled Axle Inspection Procedure (Page 1 of 2)

The following inspection is performed on an axle before it is installed into a vehicle.

Step 1:

If equipped, verify the park brake chamber is caged.

Step 2

Identify and remove the adjuster cap item 37 (See figure 2.1)

Step 3:

Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise (Figure 2.2). The brake assembly will make a clicking sound as the brake is backed off. With new pads installed there is a limited adjustment range possible, the brake assembly should be backed off 3 to 4 clicks, or until resistance is met. The sheer adapter is designed to break, protecting the adjuster from damage. If the sheer adapter breaks it can be replaced. If the sheer adapter breaks multiple times or adjustment of the brake is not possible verify the park brake is caged.

Step 4:

Slide the brake assembly, through the center of the chamber or brake, inboard and outboard (See Figure 2.3). The brake should move freely in taking up the running clearance between the brake assembly and rotor. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a possible slide-ability issue, proceed to the re-work section for this wheel end. If the brake slides freely continue this inspection procedure.

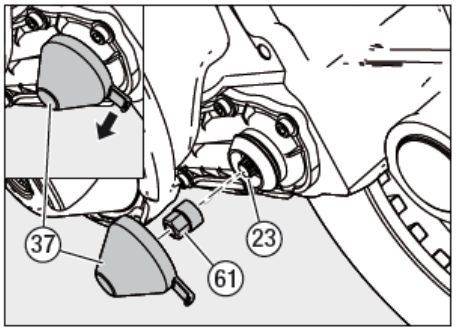


Figure 2.1

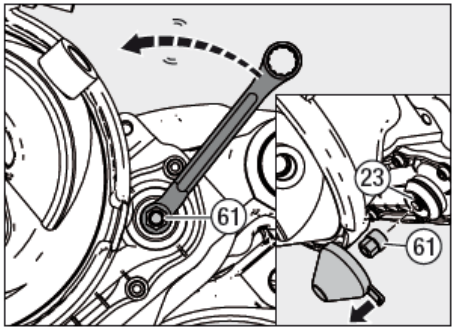


Figure 2.2

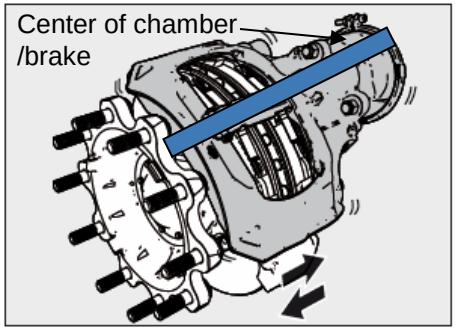


Figure 2.3

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Dressed or Assembled Axle Inspection Procedure (Page 2 of 2)

Step 5:

Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:

- Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 2.4).
- Turn the adjuster counter clockwise 2 clicks.

Step 6:

Inspect the adjuster cap, Item 37, for damage. If damaged replace the cap.

Step 7:

Replace the adjuster cap with the tab oriented as shown in Figure 2.5.

Step 8:

Mark the brake chamber with a green X, Record the intended VIN number (if available), wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 2.6, 2.7, and 2.8)

Step 9:

Repeat steps 1 through 8 for each wheel end.

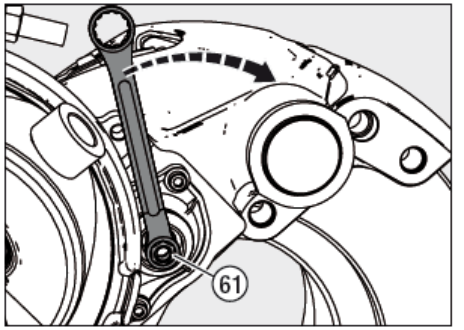


Figure 2.4

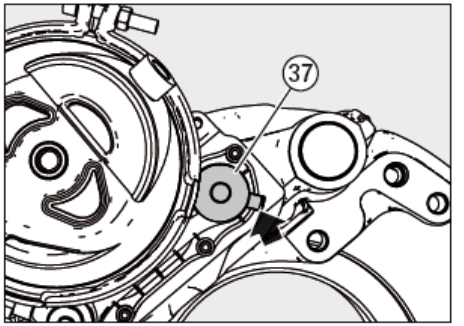


Figure 2.5

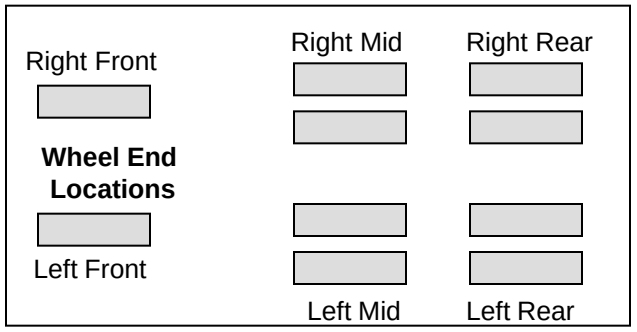
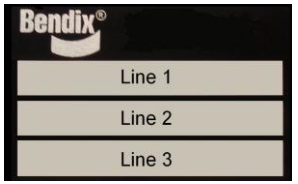
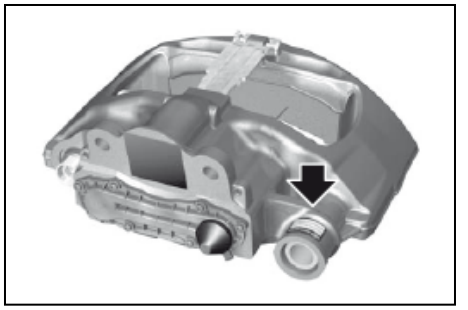


Figure 2.8



Line 1 = Part Number
Line 2 = Serial Number

Figure 2.7



Serial Number Tag Location
Figure 2.6

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Re-work Procedure, wheel ends with slide-ability issues (Page 1 of 4)

The following steps are for Re-working and correcting an identified caliper slide-ability issue.

Step 1: Verify the slide-ability issue with pads removed

1. If working on a vehicle, following all standard shop and safety practices, remove the wheel on the affected wheel end. On spring brake equipped wheel ends charge the air system to full pressure, release and cage the spring brake.
2. Remove the spring clip (26), washer (45), pin (44) and pad retainer bar (11). (See Figure 3.1)
3. Identify and remove the adjuster cap item 37 (See figure 3.2)
4. Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise. (Figure 3.3) The brake assembly will make a clicking sound as the brake is backed off.
5. Remove the pads (12). (Figure 3.4)
6. With the pads removed slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, continue with the Re-work procedure section. If the caliper slides freely go to Step 3

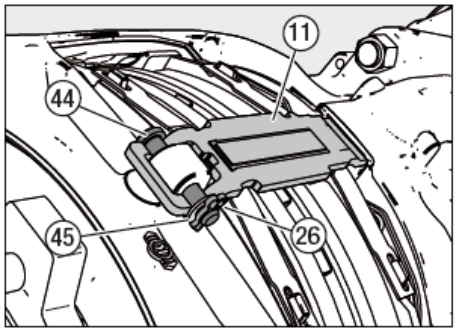


Figure 3.1

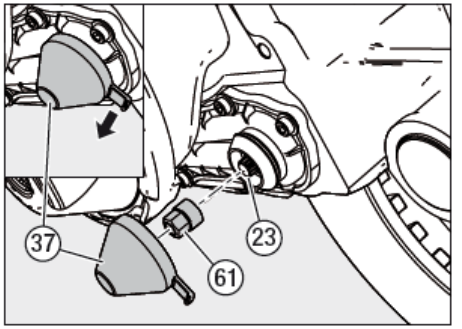


Figure 3.2

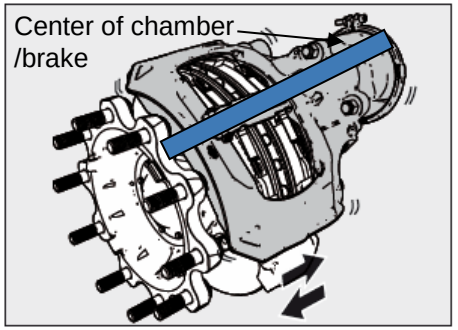


Figure 3.5

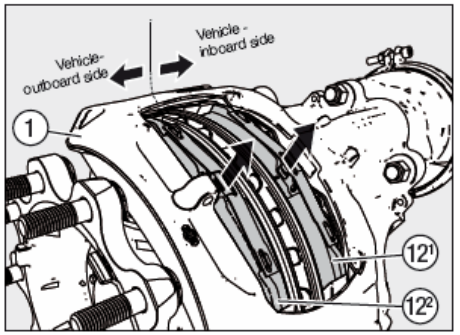


Figure 3.4

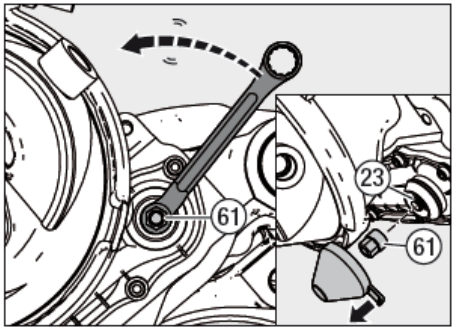


Figure 3.3

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Trouble Shooting, wheel ends with slide-ability issues (Page 2 of 5)

Step 2: Verify free state slide-ability and bolt torque sequence.

1. Loosen the (6) carrier to torque plate mounting bolts until they can all be turned by hand
2. Slide the caliper inboard and outboard. If the caliper does not slide with the mounting bolts loose replace the brake assembly. If the caliper slides freely continue with the trouble shooting.
3. Tighten the carrier mounting bolts (Figure 3.8) using the pattern shown in Figures 3.6 and 3.7. The brake assemblies are handed, so there is a LH and RH caliper assembly. The pattern will always start on the short (floating) pin side. Tighten the carrier mounting bolts to between a 180 to 200 Nm of torque.
4. Slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, continue with the re-work section. If the caliper slides freely skip Step 3 and go to Step 4.

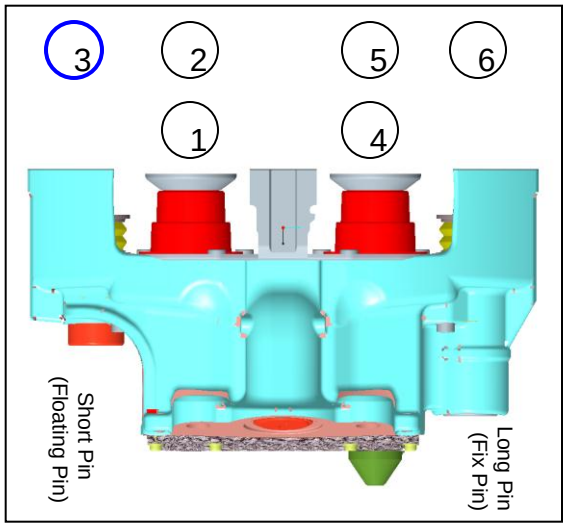


Figure 3.6 Right Hand Brake

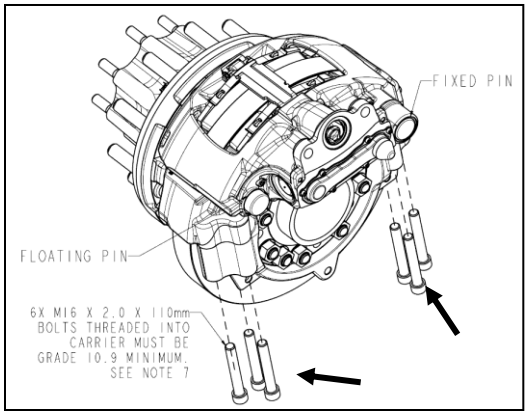


Figure 3.8 Carrier Mounting Bolts

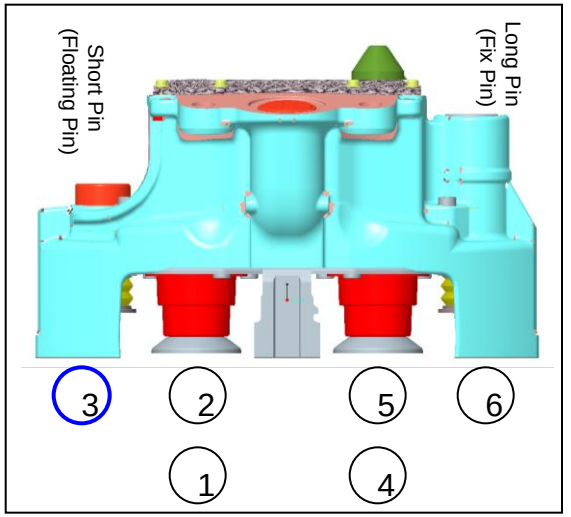


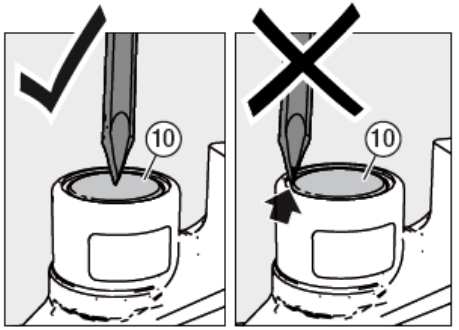
Figure 3.7 Left Hand Brake

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Re-work procedure, wheel ends with slide-ability issues (Page 2 of 4)

Step 3: Loosen and tighten guide pin bolts (reference instruction sheet 1484 for additional information).

1. Remove the long (fix) (10) and short (floating) pin(68) cap using a chisel or punch as shown in Figure 3.9 , 3.10, and 3.11.
2. Use a 14mm allan head socket remove and dispose of the short pin bolt (39) Figure 3.12.
3. Install a new short pin bolt and tighten the bolt enough to retain the guide pin.
4. Assure the guide pin (5) is seated in the carrier and the bellows retainer (58) is installed correctly. Figure 3.13 , 3.14
5. Use a 14mm allan head socket remove and dispose of the long pin bolt (40) Figure 3.12.
6. Install a new long pin bolt and tighten the bolt enough to retain the guide pin.
7. Assure the guide pin (5) is seated in the carrier and the bellows retainer (58) is installed correctly. Figure 3.13 , 3.14.
8. Torque each guide pin bolt to 133 ft-lbs + 90 degrees of rotation.



Long (fix) Pin Cap Removal
Figure 3.9

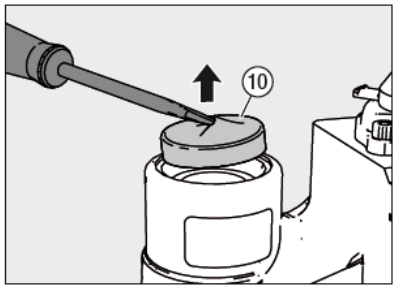


Figure 3.10



Figure 3.14

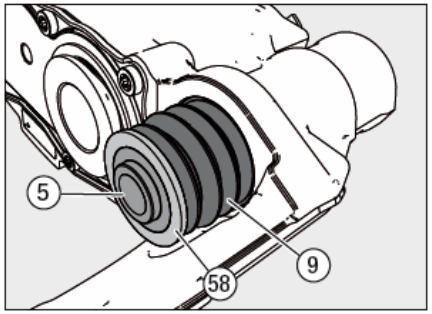


Figure 3.13

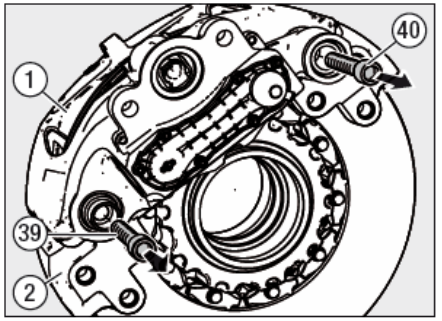
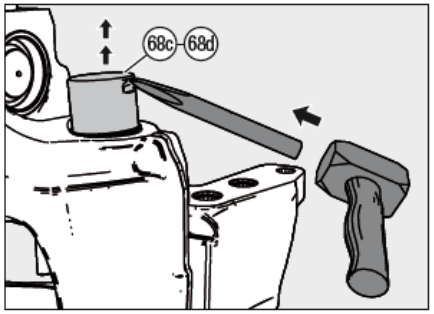


Figure 3.12



Short (floating) Pin Cap Removal
Figure 3.11

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Re-work procedure, wheel ends with slide-ability issues (Page 3 of 4)

Step 3: Loosen and tighten guide pin bolts (CONTINUED).

9. Slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, replace the brake assembly. If the caliper slides freely continue the re-work procedure.
10. Install the long and short pin caps as follows
    1. Slide or pull the caliper outboard to fully compress the guide pin bellow (9) figure 3.13,
    2. With the guide pin bellows compressed, use the guide pin tools (figure 3.18) to insert the long and short pin caps, keeping the tool perpendicular to the guide pins. See Figures 3.15, 3.16, 3.17

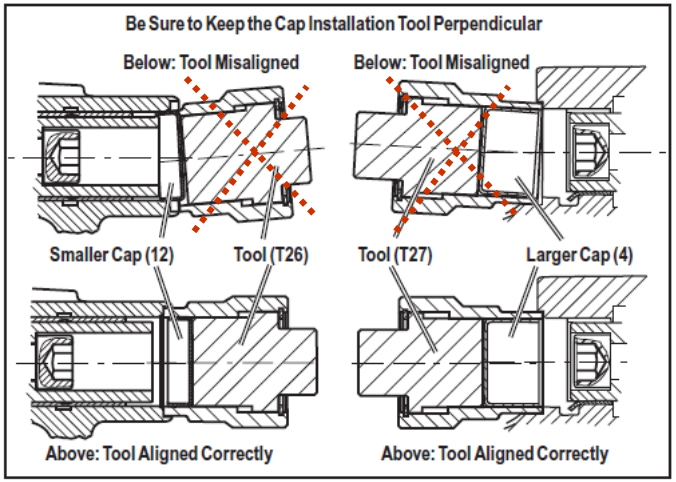


Figure 3.15

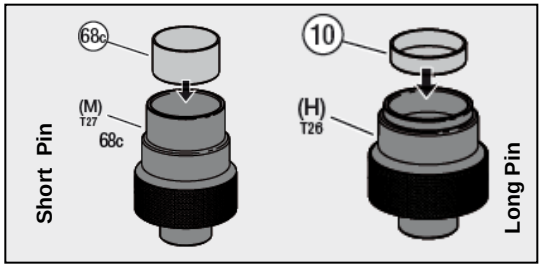
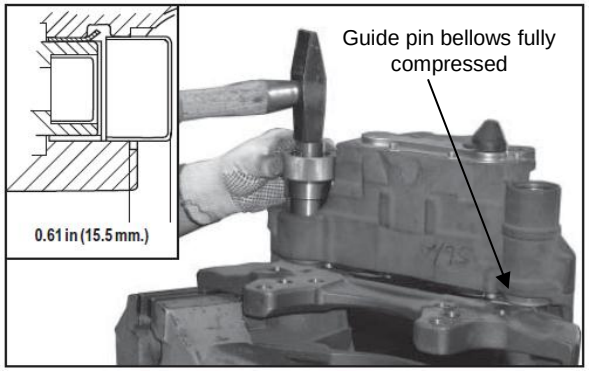
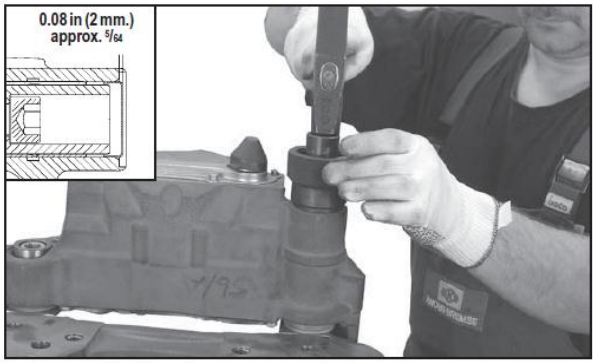


Figure 3.18



Short (floating) Pin Cap Installation
Figure 3.17



Long (fix) Pin Cap Installation
Figure 3.16

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Re-work procedure, wheel ends with slide-ability issues (Page 4 of 4)

Step 4: Re-install brake pads and adjust the brake.

1. Install brake pads into the caliper. Assure the pads are installed in the correct direction with the friction material on the rotor side of the pad. Figure 3.19 and 3.20
2. Install the pad retainer bar (11), push down on the bar and insert the pad retainer pin (44), washer (45) and spring clip (26) Figure 3.21.
3. Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:
   - Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 3.22).
   - Turn the adjuster counter clockwise 2 clicks
4. Inspect the adjuster cap, Item 37, for damage. If damaged replace the cover
5. Replace the adjuster cap with the tab oriented as shown in Figure 3.23
6. Mark the brake chamber with a green X, Record the VIN number of the vehicle, wheel end location, part number, and serial number of the brake assembly for future reference. (See Figures 1.6,1. 7, and 1.8)
7. If the park brake was caged, un-cage the park brake chamber.
8. If the wheels were removed re-install the wheels

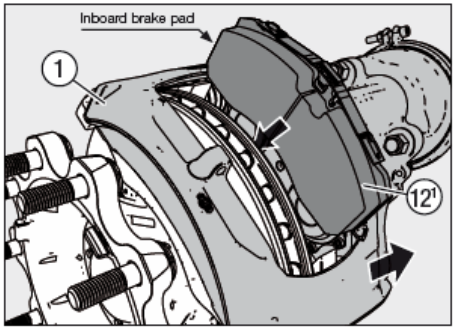


Figure 3.19

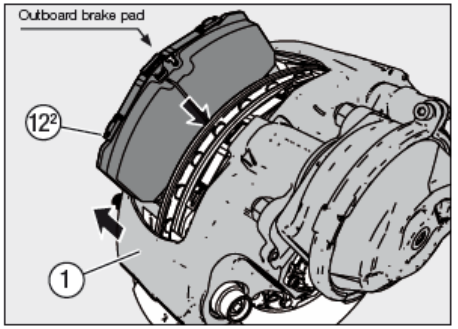


Figure 3.20

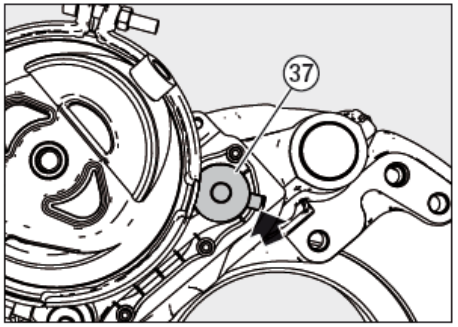


Figure 3.23

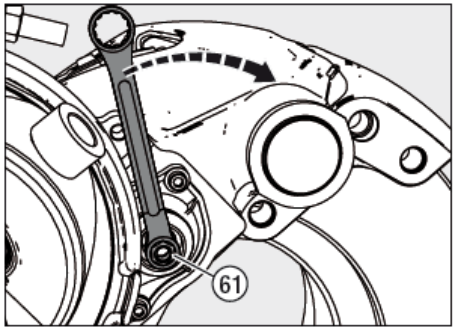


Figure 3.22

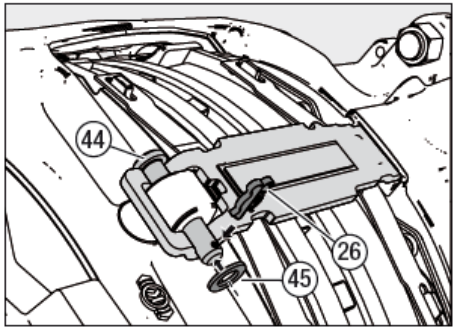


Figure 3.21

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PE13-012

BENDIX

7/1/2013

Section 7

Service Data Sheets & Troubleshooting Guides

Bendix® Vertical Bolt ADB22X™ Slide-ability inspection and recommended installation Torque Sequence

Bendix Spicer Foundation Brake LLC

Document Y143236
Revision 0
September 6, 2012



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Re-work Procedure, wheel ends with slide-ability issues

The following steps are for Re-working and correcting an identified caliper slide-ability issue.

Step 1: Verify the slide-ability issue with pads removed

1. If working on a vehicle, following all standard shop and safety practices, remove the wheel on the affected wheel end. On spring brake equipped wheel ends charge the air system to full pressure, release and cage the spring brake.
2. Remove the spring clip (26), washer (45), pin (44) and pad retainer bar (11). (See Figure 3.1)
3. Identify and remove the adjuster cap item 37 (See figure 3.2)
4. Using a 10mm box end wrench, manually back off the brake assembly by turning the sheer adapter, item 61, counter clockwise. (Figure 3.3) The brake assembly will make a clicking sound as the brake is backed off.
5. Remove the pads (12). (Figure 3.4)
6. With the pads removed slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, continue with the Re-work procedure section. If the caliper slides freely go to Step 4

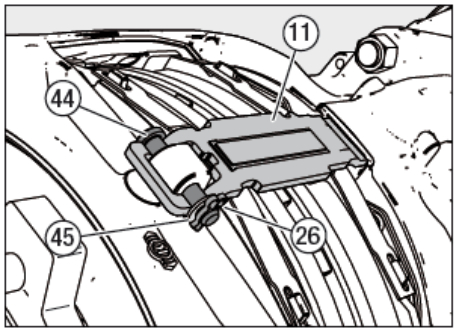


Figure 3.1

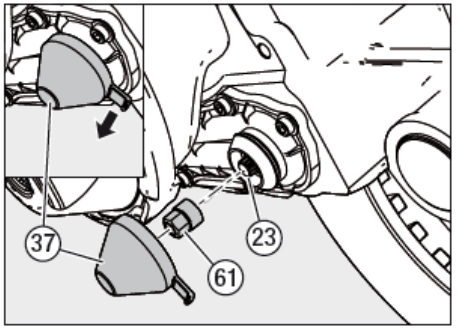


Figure 3.2

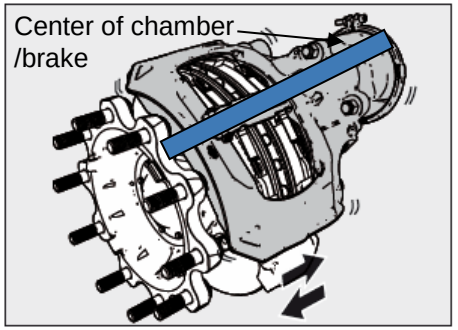


Figure 3.5

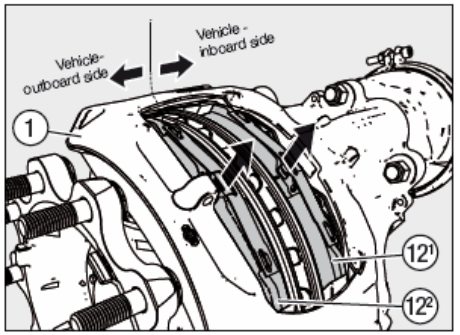


Figure 3.4

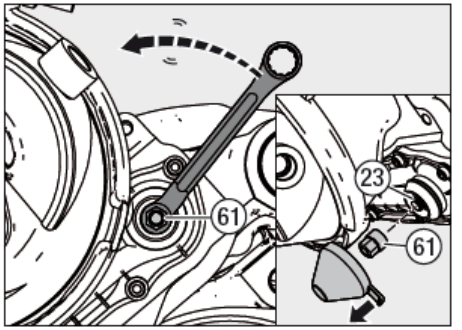


Figure 3.3

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Trouble Shooting, wheel ends with slide-ability issues

Step 2: Verify free state slide-ability and bolt torque sequence.

1. Loosen the (6) carrier to torque plate mounting bolts until they can all be turned by hand
2. Slide the caliper inboard and outboard. If the caliper does not slide with the mounting bolts loose replace the brake assembly or service the guidance system with the appropriate service kit. If the caliper slides freely continue with the trouble shooting.
3. Tighten the carrier mounting bolts (Figure 3.8) using the pattern shown in Figures 3.6 or 3.7. The brake assemblies are handed, so there is a LH and RH caliper assembly. The pattern will always start on the short (floating) pin side with the bolt that passes through the sheer sleeve. Install all the bolts hand tight. Next align the caliper with the rotor by pushing fix pin side of the caliper against the shelf on the torque plate (Figure 3.9). Tighten the carrier mounting bolts in the sequence shown to between 40 and 50 ft-lbs. Then perform the final tightening in the pattern shown to 180 – 200 ft-lbs for OEM bolts.
4. Slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, continue with the re-work section. If the caliper slides freely skip Step 3 and go to Step 4.

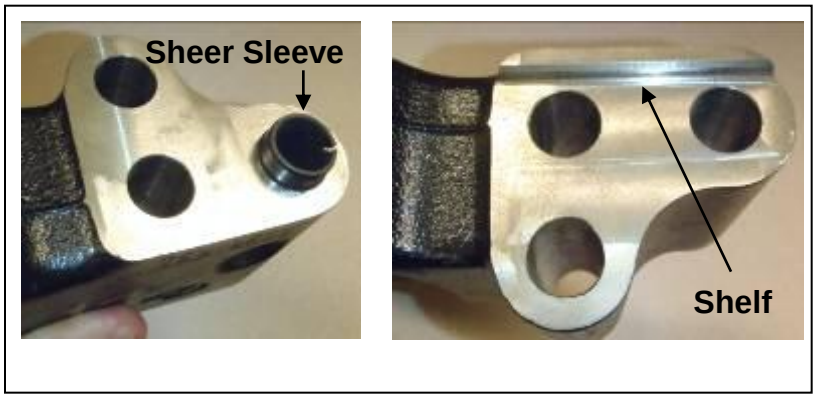


Figure 3.9 Shelf and sheer sleeve identification

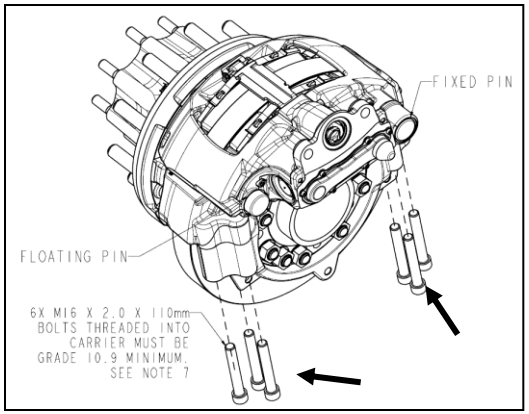


Figure 3.8 Carrier Mounting Bolts

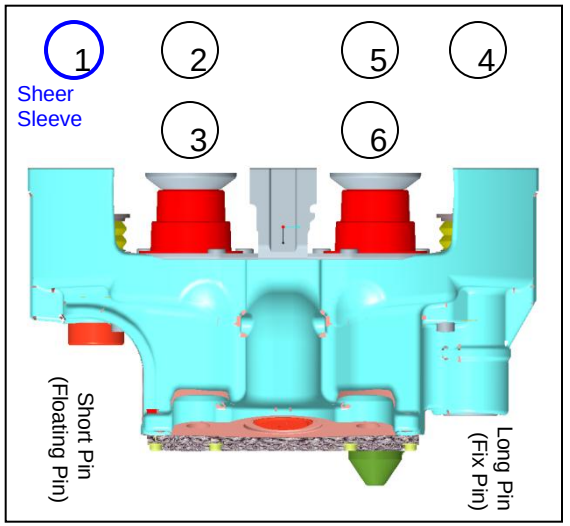


Figure 3.6 Right Hand Brake

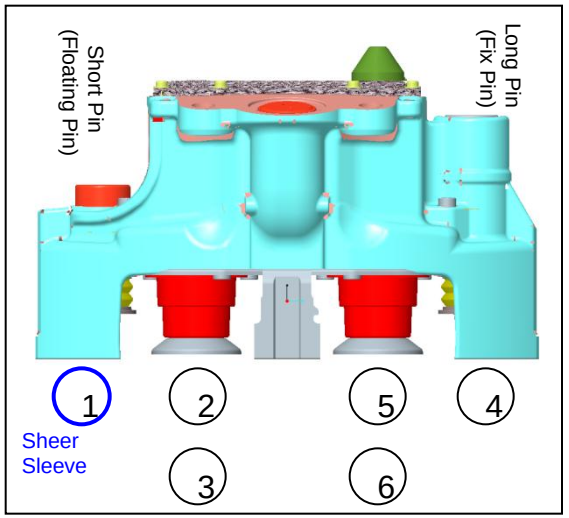


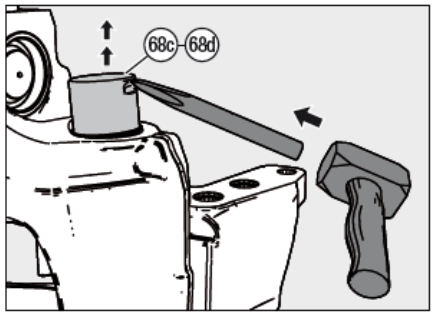
Figure 3.7 Left Hand Brake

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Re-work procedure, wheel ends with slide-ability issues

Step 3: Loosen and tighten the floating guide pin bolt (reference service data sheet SD-23-7541 for additional information).

1. Service kit 803114 will be required for the floating pin cap and bolt components .
2. Remove the short (floating) pin(68) cap using a chisel or punch as shown in Figure 3.10.
3. Use a 14mm allen head socket remove and dispose of the short pin bolt (39) Figure 3.11.
4. Install a new short pin bolt and tighten the bolt enough to retain the guide pin.
5. Assure the guide pin (5) is seated in the carrier and the bellows retainer ring (58) is installed correctly. Figure 3.12 , 3.13
6. Torque the floating pin bolt to 133 ft-lbs + 90 degrees of rotation.



Short (floating) Pin Cap Removal
Figure 3.10

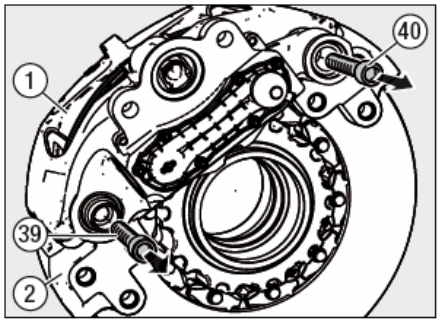


Figure 3.11

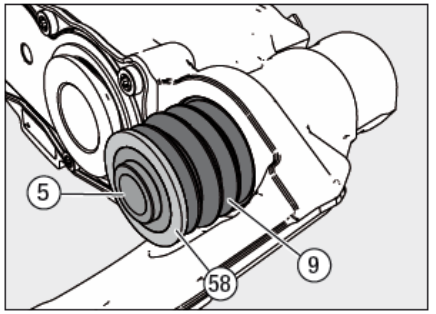


Figure 3.12

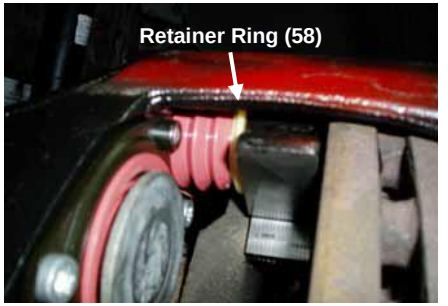


Figure 3.13

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Re-work procedure, wheel ends with slide-ability issues

Step 3: Loosen and tighten floating pin bolt (CONTINUED).

7. Slide the caliper inboard and outboard, through the center of the chamber or brake (Figure 3.5). The caliper must have a minimum 20mm of travel. If the brake assembly does not move or requires more than 40 lbs of force the caliper has a slide-ability issue, replace the brake assembly. If the caliper slides freely continue the re-work procedure.
8. Install the floating pin cap as follows
    1. Slide or pull the caliper outboard to fully compress the guide pin bellow (9) figure 3.16,
    2. With the guide pin bellows compressed, use the guide pin tool (M) (figure 3.18) to insert the floating pin caps, keeping the tool perpendicular to the guide pin. See Figures 3.14, 3.15.

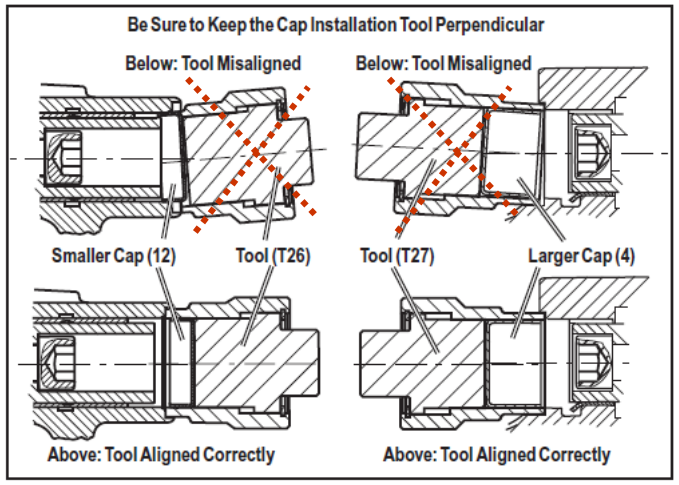
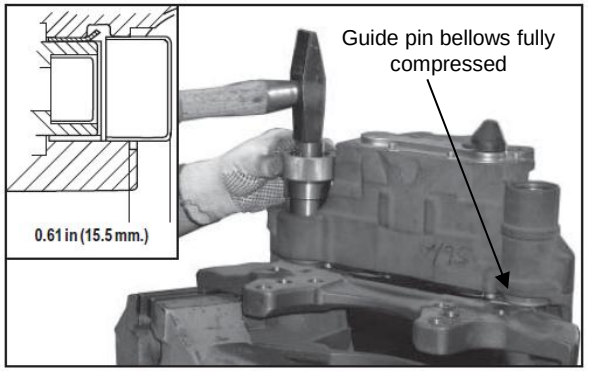


Figure 3.14



Short (floating) Pin Cap Installation
Figure 3.15

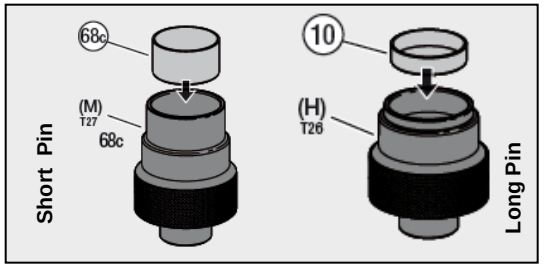


Figure 3.16

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Re-work procedure, wheel ends with slide-ability issues

Step 4: Re-install brake pads and adjust the brake.

1. Install brake pads into the caliper. Assure the pads are installed in the correct direction with the friction material on the rotor side of the pad. Figure 3.19 and 3.20
2. Install the pad retainer bar (11), push down on the bar and insert the pad retainer pin (44), washer (45) and spring clip (26) Figure 3.21.
3. Using a 10mm box end wrench and the sheer adapter re-adjust the brake as follows:
   - Turn the adjuster clockwise until resistance is felt. Do not over tighten the adjuster (See Figure 3.22).
   - Turn the adjuster counter clockwise 3 clicks
4. Inspect the adjuster cap, Item 37, for damage. If damaged replace the cover
5. Replace the adjuster cap with the tab oriented as shown in Figure 3.23
6. If the park brake was caged, un-cage the park brake chamber.

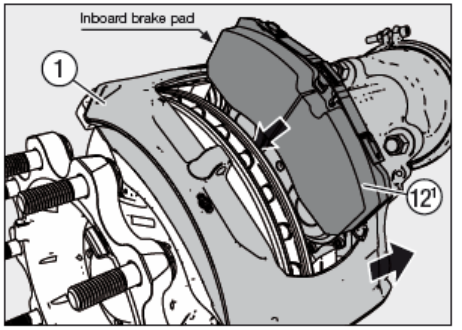


Figure 3.19

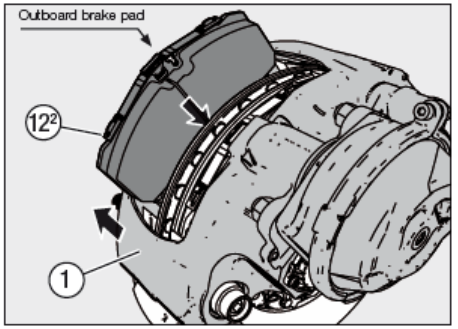


Figure 3.20

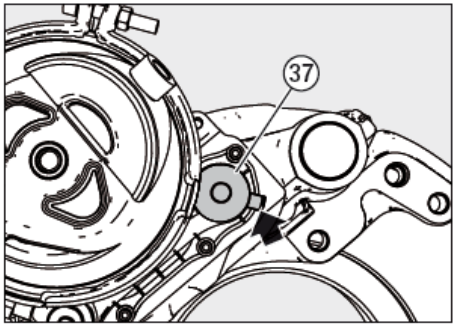


Figure 3.23

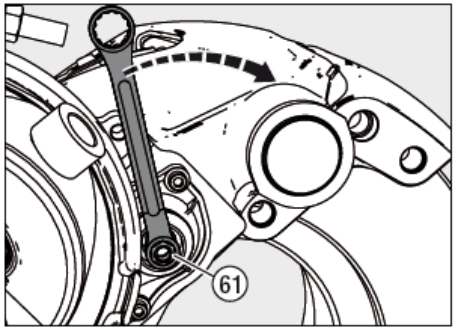


Figure 3.22

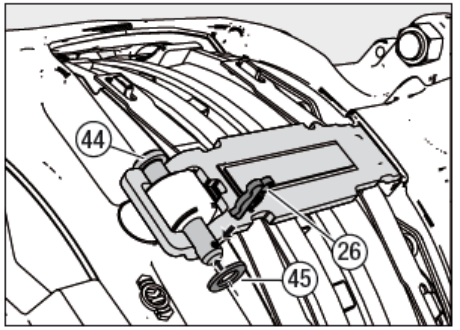


Figure 3.21

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