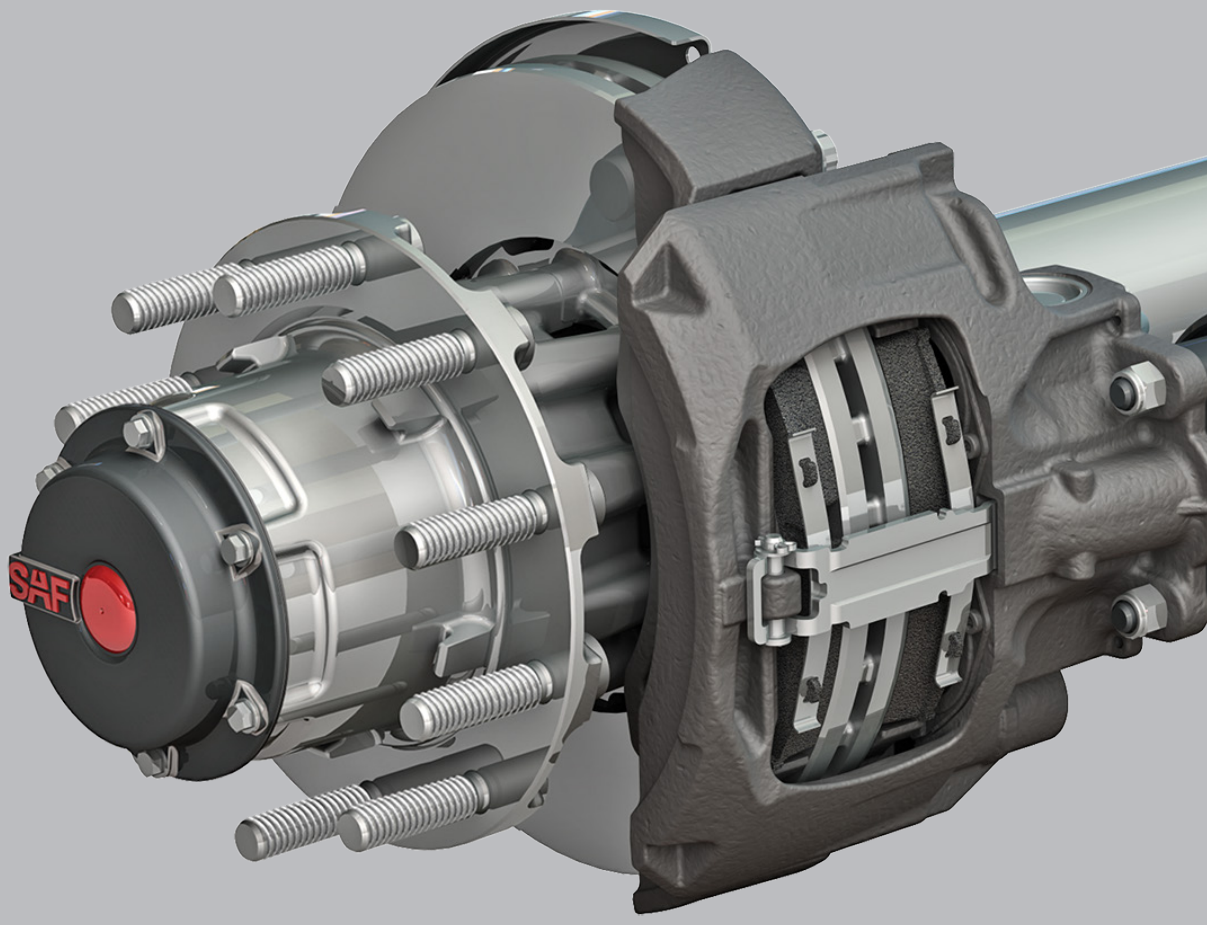
SAF-HOLLAND Group

Service Manual

P89 Disc Brake Axles



XL-SA20018UM-en-US Rev H

SAF holland

Introduction

This manual provides the necessary information for the maintenance, inspection and safe operation of the SAF® P89 disc brake. Refer to XL-SA20024UM-en-US for P89 Plus disc brake System.

Knorr® is a registered trademark of the Knorr-Bremse Group.

Read this manual before using or servicing this product and keep it in a safe location for future reference. Updates to this manual, which are published as necessary, are available on the internet at www.safholland.us.

When replacement parts are required, SAF-HOLLAND® highly recommends the use of only SAF-HOLLAND® Original Parts. A list of technical support locations that supply SAF-HOLLAND® Original Parts and an Aftermarket Parts Catalog are available on the internet at www.safholland.us or contact Customer Service at 888-396-6501.

Warranty

Refer to the complete warranty for the country in which the product will be used. A copy of the written warranty is included with the product or available on the internet at www.safholland.com.

Notes, Cautions, and Warnings

Before starting any work on the unit, read and understand all the safety procedures presented in this manual. This manual contains the terms "NOTE", "IMPORTANT", "CAUTION", and "WARNING" followed by important product information. These terms are defined as follows:

NOTE: Includes additional information to enable accurate and easy performance of procedures.

IMPORTANT: Includes additional information that, if not followed, could lead to hindered product performance.

CAUTION Used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, could result in property damage.

⚠CAUTION Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

⚠WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

1. General Safety Instructions

General and Servicing Safety Instructions

- Read and observe all Warning and Caution hazard alert messages. The alerts provide information that can help prevent serious personal injury, damage to components, or both.

⚠WARNING Failure to follow the instructions and safety precautions in this manual could result in improper servicing or operation leading to component failure which, if not avoided, could result in death or serious injury.

- All maintenance should be performed by a properly trained technician using proper/special tools, and safe procedures.

NOTE: In the United States, workshop safety requirements are defined by federal and/or state Occupational Safety and Health Act (OSHA). Equivalent laws may exist in other countries. This manual is written based on the assumption that OSHA or other applicable employee safety regulations are followed by the location where work is performed.

- Properly support and secure the vehicle from unexpected movement when servicing the unit.

⚠WARNING Failure to properly support and secure the vehicle and axles prior to commencing work could create a crush hazard which, if not avoided, could result in death or serious injury.

- Several maintenance procedures in this manual require re-positioning of the brake chamber, brake calipers and/or ABS system. Consult the manufacturer's manual for procedures on the proper operation of brake chamber, brake calipers and/or ABS system.
- Service both roadside and curbside of an axle. Worn parts should be replaced in sets. Key components on each axle's braking system, such as friction material and rotors will normally wear over time.

IMPORTANT: Key components on each axle's braking system, including brake pads and brake rotors, are intended to wear over time. Worn parts should be replaced in sets on both the driver and curb side of an axle.

⚠WARNING Failure to follow manufacturer's instructions regarding spring pressure or air pressure control could allow uncontrolled release of energy which, if not avoided, could result in death or serious injury.

- The wheel contact surfaces between the wheel and hub MUST NOT receive additional paint.

IMPORTANT: The wheel contact surfaces MUST be clean, smooth and free from grease.

⚠WARNING Failure to keep wheel and hub contact surfaces clean and clear of foreign material could allow wheel/hub separations which, if not avoided, could result in death or serious injury.

- Only the wheel and tire sizes approved by the trailer builder can be used.

Operational and Road Safety Instructions

- Before operating vehicle, ensure that the maximum permissible axle load is not exceeded and that the load is distributed equally and uniformly.
- Make sure that the brakes are not overheated from continuous operation.

⚠WARNING Failure to minimize the use of brakes during overheating conditions could result in deterioration of brake efficiency which could result in death or serious injury.

- The parking brake MUST NOT be immediately applied when the brakes are overheated. Refer to the rotor wear inspection information in Section 6.2.

CAUTION If the parking brake is immediately applied to the brakes when overheated, the brake discs could be damaged by different stress fields during cooling.

- Observe the operating recommendation of the trailer manufacturer for off-road operation of the installed axles.

IMPORTANT: The definition of OFF-ROAD means driving on non-asphalt/non-concrete routes, e.g. gravel roads, agricultural and forestry tracks, on construction sites and in gravel pits.

IMPORTANT: Off-road operation of axles beyond the approved application design could result in damage and impair suspension system performance.

- SAF® axles require routine service, inspection and maintenance in order to maintain optimum performance, and operational safety as well as an opportunity to recognize natural wear and defects before they become serious. Refer to the Routine Service Schedule in Section 19.

⚠WARNING Failure to inspect and maintain the SAF-HOLLAND® P89 disc brake axle as outlined in Section 19 can result in brake or wheel bearing failure which, if not avoided, could result in death or serious injury.

IMPORTANT: Use only SAF-HOLLAND® Original Parts to service the SAF-HOLLAND® P89 disc brake axle.

⚠WARNING Failure to maintain the SAF-HOLLAND® P89 disc brake with SAF-HOLLAND® Original Parts can result in brake or wheel bearing failure which, if not avoided, could result in death or serious injury.

2. General Service and Maintenance Instructions

1. Conduct regular visual checks of the brakes, tires and all chassis components. Refer to Section 19 for more information:
   - Inspect for secure mounting, wear, leaks,corrosion and damage.
   - Check for loose, broken or cracked air hoses, air system leaks, and damaged components.
   - Check that brake hoses and cables are properly secured.
   - For proper brake pad wear, check that there is enough clearance to allow the caliper full movement during normal operation.
2. Check the brake pads at regular service intervals to ensure that the brake pad hold down springs are in the correct position, and that brake pads are not worn beyond the minimum wear limits described in this manual.
3. When replacing brake pads, inspect the rotors for signs of wear, cracks, grooves, scoring or hot spots.
4. Visually check the brake caliper at regular service intervals as defined by the brake caliper manufacturer's basic inspection program. Refer to Section 5 of this manual for further information.
5. Check the spring brake chambers to make sure the parking springs are NOT caged in the released position. Be sure the dust plugs are properly installed.
6. Make sure that the vent holes in the air brake chamber are not covered with snow, ice, mud, etc.
7. Inspect the wheel bearing unit for grease leaks at every brake pad change.
8. Visually check the brake assembly (e.g. pads, rotor, etc.) for oil or grease contamination.
9. Check that all dust caps and boots are present and in good condition.
10. Regularly conduct general safety checks in accordance with any applicable laws.
11. After every wheel change, the wheel nuts MUST be re-tightened to the specified torque level after the initial 100 miles of operation, and then at every regular service interval.

CAUTION Failure to re-tighten wheel nuts at specified intervals could result in component failure which, if not avoided, could result in damage to property.

IMPORTANT: Use only SAF-HOLLAND® Original Parts to service the SAF-HOLLAND® P89 disc brake axle.

3. Model Identification

The disc brake axle serial tag is located near the center of the axle tube ***(Figure 1).***

4. Identification Tag

The sample tag shown will help interpret the information on the SAF-HOLLAND® USA, Inc. serial number tag. The model number, axle body part number and serial number are listed on the tag ***(Figure 2).***

Record the tag numbers below for future quick reference.

Axle Body Part Number: _____

Model Number: _____

Serial Number: _____

Figure 1

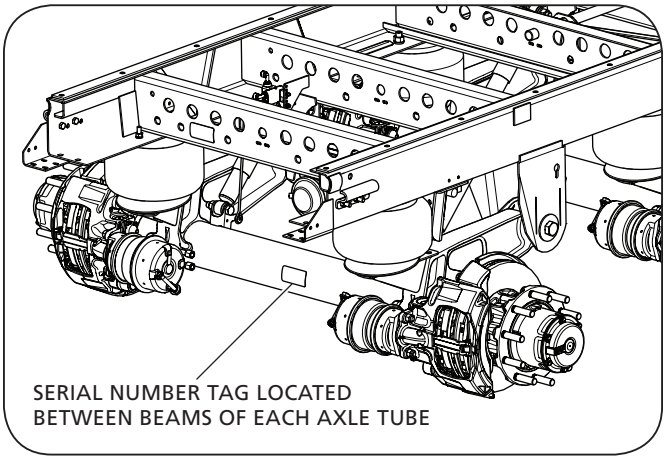
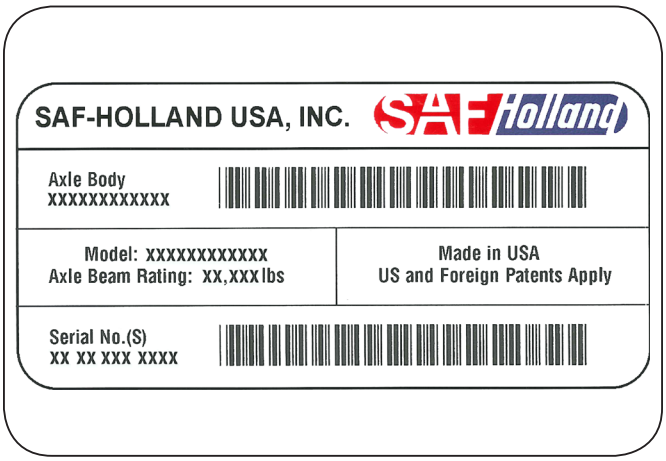
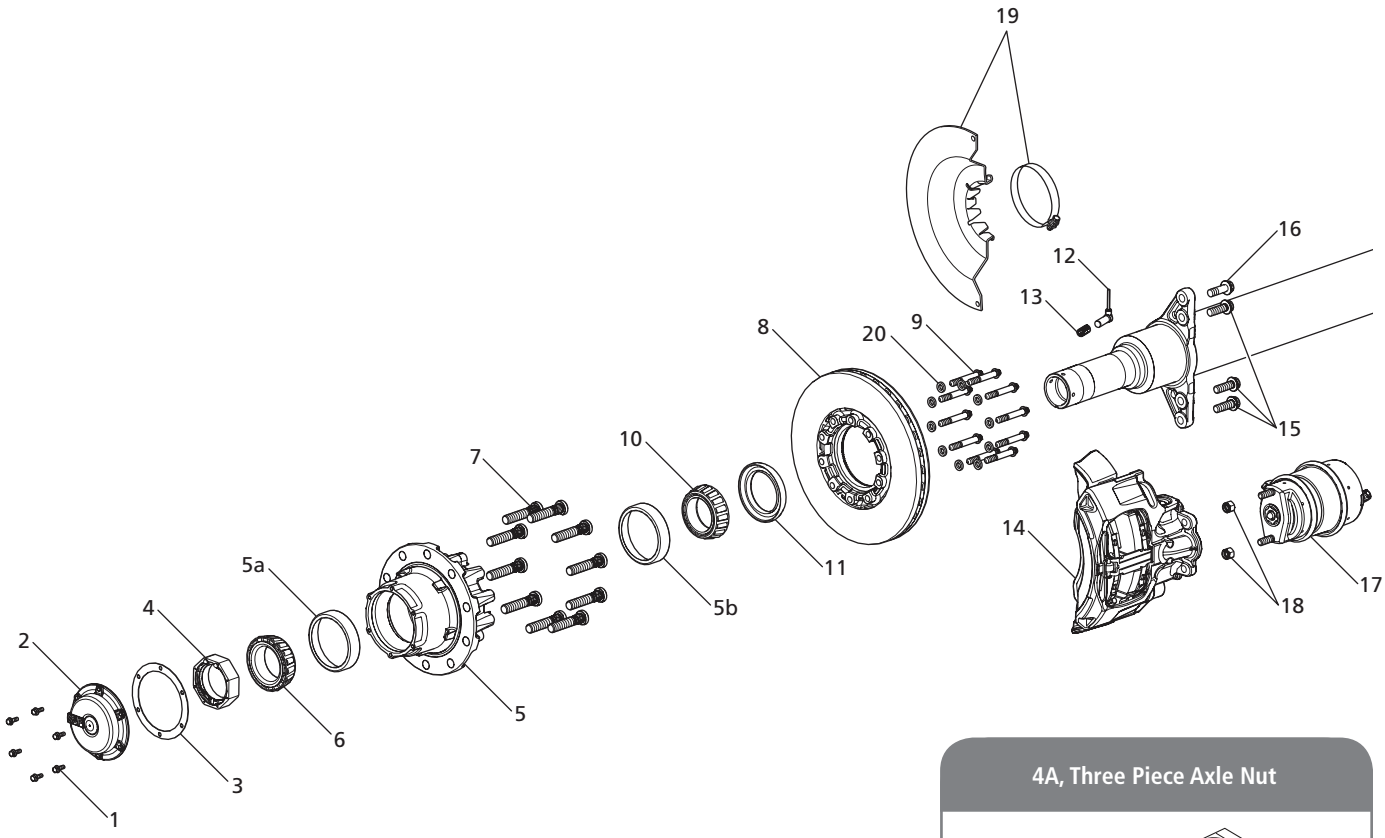
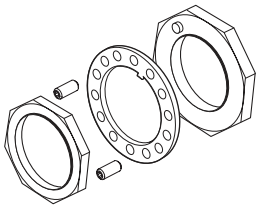


Figure 2





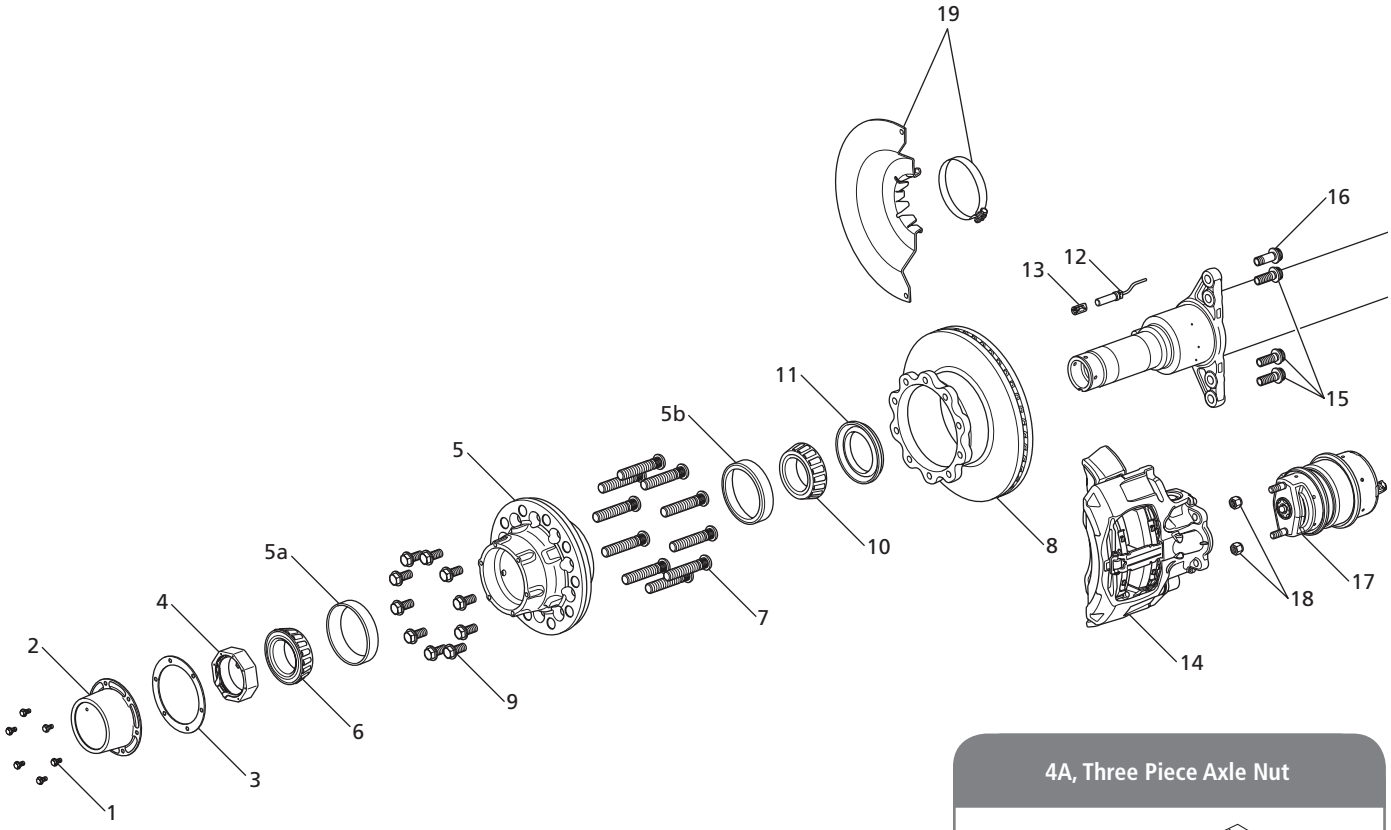
4A, Three Piece Axle Nut



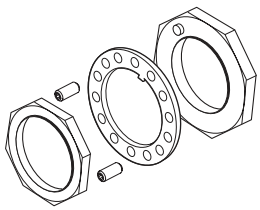
ITEM	DESCRIPTION	QTY. / AXLE
1	Bolt, Hub Cap	12
2	Hub Cap	2
3	Gasket, Hub Cap	2
4	Nut, Axle Pro-Torq®	2
4A	Three Piece Axle Nut	2
5	Hub with Bearing Cups	2
5a*	Bearing Cup, Outer	2
5b*	Bearing Cup, Inner	2
6	Cone, Bearing, Outer	2
7	Wheel Studs	20
8	INTEGRAL® Rotor with ABS Tone Ring	2
9	Rotor Attachment Bolts	20

ITEM	DESCRIPTION	QTY. / AXLE
10	Cone, Bearing, Inner	2
11	Seal, Hub	2
12	ABS Sensor (WABCO)	2
13	Clamping Bush	2
14	Brake Caliper Left-Hand Brake Caliper Right-Hand	1
15	M18 x 1.5" Bolt, Standard	6
16	M18 x 1.5" Bolt, Shoulder	2
17	Brake Chamber	2
18	Brake Chamber nut	4
19	Dust Shield with Clamp (optional)	2
20	Washers	20

* Included in hub, item number 5, but can be serviced.



4A, Three Piece Axle Nut



ITEM	DESCRIPTION	QTY. / AXLE
1	Bolt, Hub Cap	12
2	Hub Cap	2
3	Gasket, Hub Cap	2
4	Nut, Axle Pro-Torq®	2
4A	Three Piece Axle Nut	2
5	Hub with Bearing Cups and ABS Tone Ring	2
5a*	Bearing Cup, Outer	2
5b*	Bearing Cup, Inner	2
6	Cone, Bearing, Outer	2
7	Wheel Studs	20
8	U-Shaped Rotor	2

ITEM	DESCRIPTION	QTY. / AXLE
9	Rotor Attachment Bolts	20
10	Cone, Bearing, Inner	2
11	Seal, Hub	2
12	ABS Sensor (WABCO)	2
13	Clamping Bush	2
14	Brake Caliper Left-Hand Brake Caliper Right-Hand	1
15	M18 x 1.5" Bolt, Standard	6
16	M18 x 1.5" Bolt, Shoulder	2
17	Brake Chamber	2
18	Brake Chamber nut	4
19	Dust Shield with Clamp (optional)	2

* Included in hub, item number 5, but can be serviced.

5. Caliper Identification and inspection

SAF® P89 axles are equipped with one of two disc brake calipers, SAF-HOLLAND® SBS 2220 K0 Calipers, or Knorr-Bremse® SK7 calipers.

5.1 SAF-HOLLAND® SBS 2220 K0 Caliper

The SAF-HOLLAND® SBS 2220 K0 has a smooth forward face of the caliper and SAF® logo on the rear side ***(Figure 3)***.

The inner and outer brake pads for the SBS 2220 K0 are different in shape. The inner brake pad has two "circle X's" on the back side, while the outer brake pad has a relatively smooth back. There is also a notch on the pads to keep them from being installed in the wrong position ***(Figure 4)***.

For instructions on SBS 2220 KO brake caliper inspection and repair, refer to XL-AS20032RM-en-US which can be found at www.safholland.com.

5.2 Knorr-Bremse® SK7 Caliper

The Knorr-Bremse® SK7 Caliper has a large indentation on the forward face and no SAF® logo on the rear of the caliper ***(Figure 5)***.

The brake pads in the SK7 caliper are the same for the inner and outer side of the caliper. The back of the brake pad has the Knorr-Bremse® logo and six (6) slots on the back of the caliper ***(Figure 6)***.

For instructions on SK7 brake caliper inspection and repair, refer to Knorr-Bremse Pneumatic Disc Brake SN6-SN7-SK7 Service Manual Y006471 which can be found at www.knorr-bremsecvs.com/en/.

Figure 3

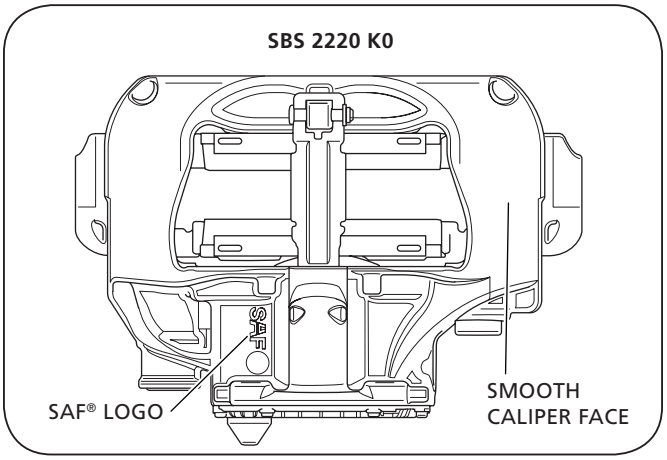


Figure 4

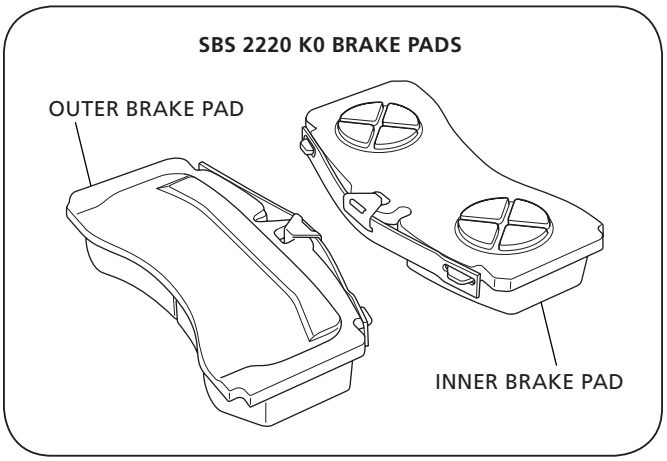


Figure 5

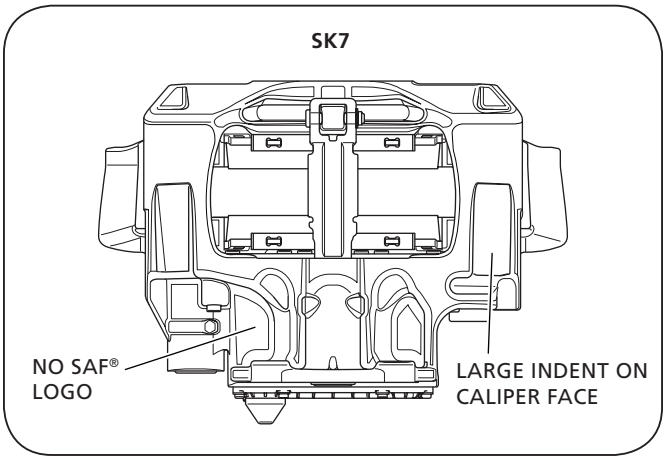
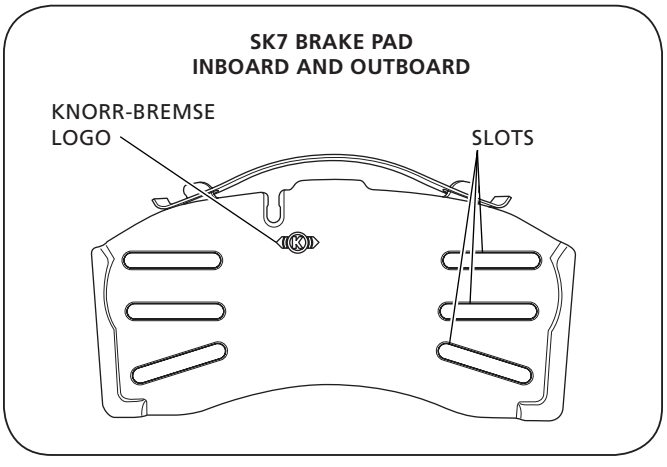


Figure 6



6. Disc Brake Inspection

IMPORTANT: During removal inspect components for wear and replace worn components.

⚠WARNING Failure to properly support axle during maintenance could allow axle to fall which, if not avoided, could result in death or serious injury.

NOTE: For further disc brake inspection information, refer to the latest version of the TMC recommended practice RP 652–Service and Inspection of Air Disc Brakes (TMC DVD supplement).

6.1 Pad Wear Inspection

Check the brake pads for proper thickness at regular service intervals based on vehicle usage. Brake pad inspections should be carried out at least every three (3) months or 20,000 miles, whichever comes first, and in accordance with any legal requirements. Refer to Routine Service Schedule in Section 19.

NOTE: Regular service intervals may be required more frequently for severe duty applications. Refer to Section 19.

A quick visual inspection of the condition of the brake pads can be performed without removing the wheel:

1. Compare the position of the caliper marking to the carrier marking located on the underside of the caliper unit ***(Figure 7)***.
   a. ***Figure 7*** - View A shows the positions of the two (2) markings when the brake pads are in good condition.
   b. ***Figure 7*** - View B shows the positions of the two (2) markings when the wheel MUST be removed for further inspection of wear to the brake pads and brake rotor.

For further inspection of the brake pads, the wheel and brake pads MUST be removed. Refer to Section 5 for caliper and service manual identification.

IMPORTANT: After inspecting the brake pads, check that the brake system is functioning properly.

IMPORTANT: When replacing worn brake pads, ALL pads on the axle MUST be replaced.

If the friction material of the brake pad is less than 0.43" (2 mm) at its thinnest area, the brake pad MUST be replaced. ***(Figure 10)***.

NOTE: Minor breakouts at the edges are permitted. Major breakouts on the surface of the brake pad are NOT permitted ***(Figure 8)***.

Figure 7

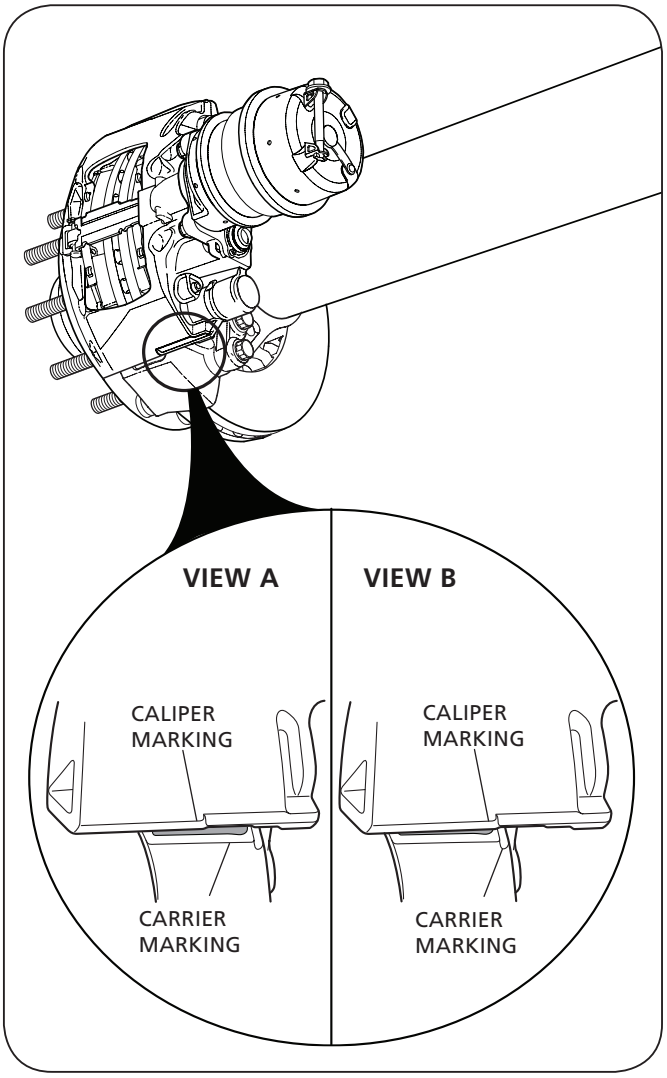
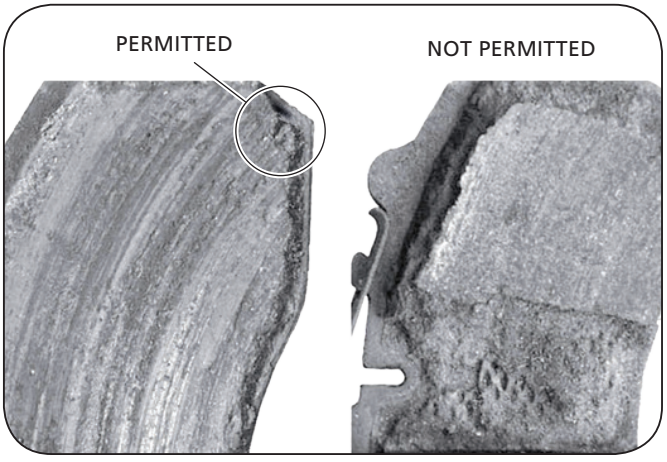


Figure 8



6.2 Rotor Wear Inspection

1. Carefully inspect both sides of the brake rotor friction surface ***(Figure 9).***
   a. Spider web cracking is acceptable ***(Area A)***.
   b. Radial cracks less than 0.06" (1.5 mm) deep or wide with lengths less than 75% of the width of the rotor friction surface ***(Area B)*** are acceptable.
   c. Grooves in the rotor surface are acceptable only if they are less than 0.06" (1.5 mm) deep ***(Area C)***.
   d. Cracks that run completely to either edge of the hub are NOT acceptable, regardless of depth ***(Area D)***.
2. Measure the brake rotor thickness and re-surface, if necessary. For proper brake function, the minimum thickness for re-surfacing the brake rotor is defined as 1.54" (39 mm).

⚠WARNING Re-surfacing the brake rotor beyond the minimum thickness could cause component failure which, if not avoided, could result in death or serious injury.

IMPORTANT: DO NOT use high-pressure cleaners or liquid cleaners on the brake rotor.

If the overall wear limits for the brake rotor or brake pads are exceeded ***(Figure 10)***, the rotor and pads MUST be replaced. Refer to rotor replacement instructions as detailed in Section 9. For brake pad replacement, refer to caliper instruction manuals identified in Section 5.

For both the inner and outer pads, the maximum brake pad wear difference is 0.2" (5.0 mm).

BRAKE ROTOR			BRAKE PAD	
DIAMETER	"A" NEW	"B" WEAR LIMIT	"C" NEW	"D" WEAR LIMIT
430 mm	45 mm	37 mm	23 mm	2 mm
16.93"	1.77"	1.46"	1.18"	0.08"

⚠WARNING Failure to replace brake rotor and pads when minimum wear limits are reached could cause component failure which, if not avoided, could result in death or serious injury.

NOTE: When replacing the brake pads or brake rotor, use only Original SAF-HOLLAND® rotors and approved brake pads.

IMPORTANT: When replacing worn brake pads, ALL pads on the axle MUST be replaced.

NOTE: During brake repairs, conduct a visual inspection of the seals on the brake caliper. Refer to Section 6.3 for more information.

Figure 9

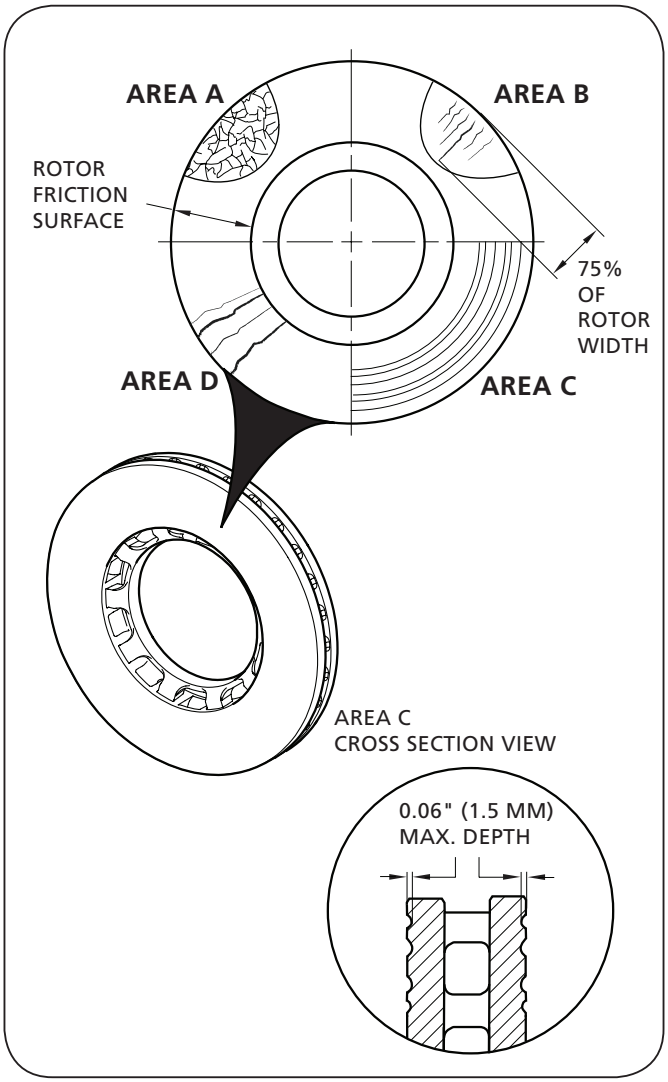
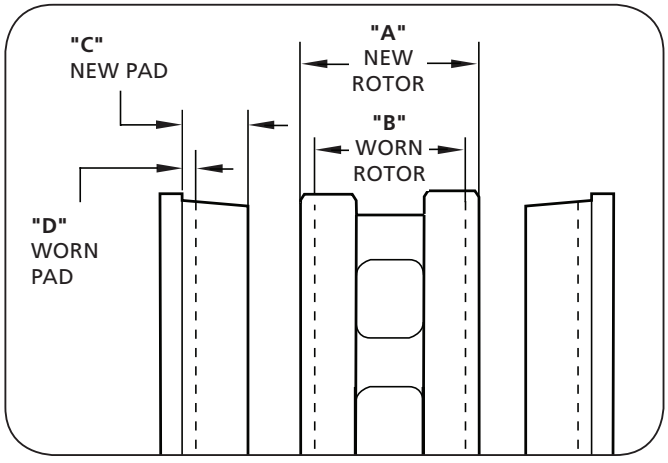


Figure 10



7. Hub, Bearing and Seal Removal

NOTE: Before beginning any axle/brake service procedures, park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle and axles(s) with safety stands. DO NOT work under a vehicle supported only by jacks. Jacks can slip or fall over. Serious personal injury and damage to components can result.

⚠WARNING Failure to properly support the vehicle and axles prior to commencing work could create a crush hazard which, if not avoided, could result in death or serious injury.

1. Release the trailer brakes, and cage the spring brakes according to the spring brake manufacturer's instructions. Remove the tire and wheel assembly to access hub and rotor.
2. Remove wheels from hub using support device such as a wheel dolly.

⚠CAUTION Failure to support weight during installation or removal of wheels could create a crush hazard which, if not avoided, could result in minor to moderate injury.

3. Remove the ABS sensor by following the instructions detailed in Section 16.1.
4. Detach the brake chamber from the brake caliper by loosening and removing the two (2) mounting nuts ***(Figure 11)***.
5. Remove the brake caliper from the brake spider by using a size 24 mm socket to loosen. Discard all four (4) brake caliper bolts ***(Figure 12)***.
6. With a 1/2" socket, remove the six (6) hub cap bolts and the hub cap ***(Figure 13)***.

NOTE: Be prepared to collect lubrication fluid when removing hub cap.

Figure 11

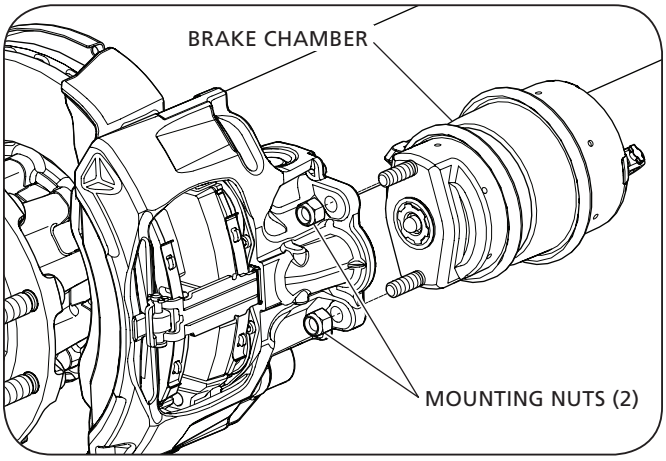


Figure 12

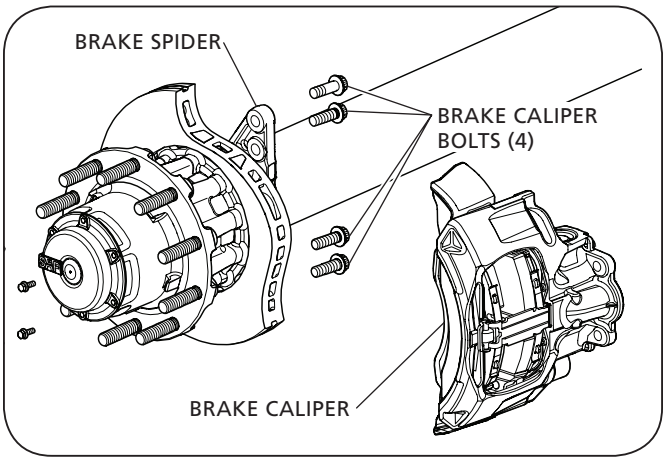
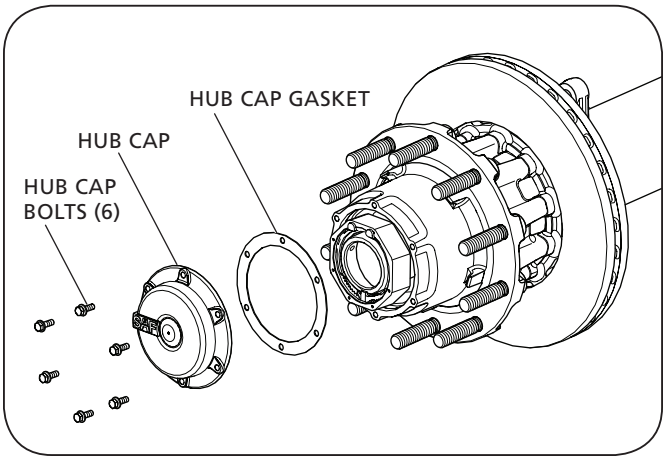


Figure 13



7. Remove the axle nut(s)
   - Three (3) piece axle nut ***(Figure 14)***.
     a Remove the set screws.
     b Remove the outer axle nut from the spindle using a wrench with the axle nut socket.
     c Remove the axle washer and the inner axle nut from the spindle.
   - Pro-Torq® axle nut ***(Figure 15)***.
     a Utilizing a screwdriver, carefuly pry the orange keeper arm from the undercut groove on each side of the Pro-Torq® wheel nut until the keeper is released from it.
     b Remove the axle nut from the spindle using a wrench with the axle nut socket.
8. Using a standard P- or N-Spindle wheel nut socket, remove the axle spindle nut (Pro-Torq®) by rotating the nut in a counter-clockwise direction ***(Figure 15)***.

NOTE: All axle nuts on SAF-HOLLAND® P89 Disc Brake Axles are right-hand threaded.

9. Remove the outer hub bearing from the spindle ***(Figure 15)***.

NOTE: With the axle nut(s) removed, it is possible to access the outer bearing.

⚠CAUTION DO NOT hit steel parts with a steel hammer as parts could break, sending flying steel fragments in any direction creating a hazard which, if not avoided, could result in minor to moderate injury.

10. Grasp the head unit with both hands and pull the head unit off the axle spindle ***(Figure 16)***.

NOTE: Depending on type of hub seal, the hub seal and inner bearing may remain on spindle or come off with the head unit.

Figure 14

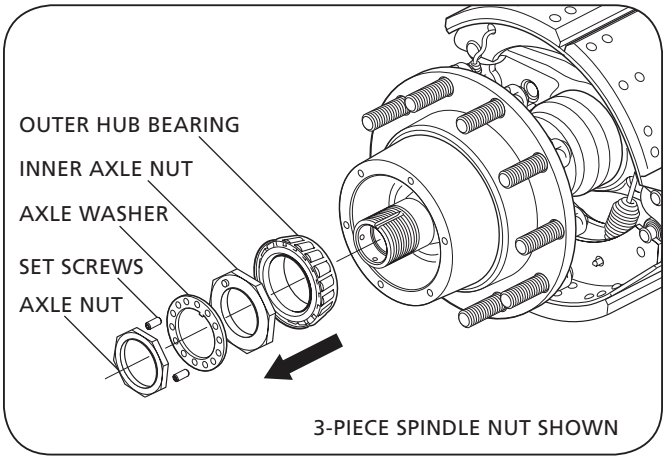


Figure 15

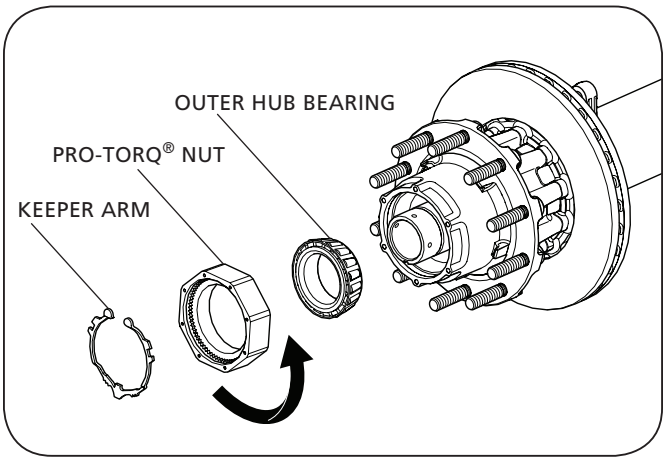
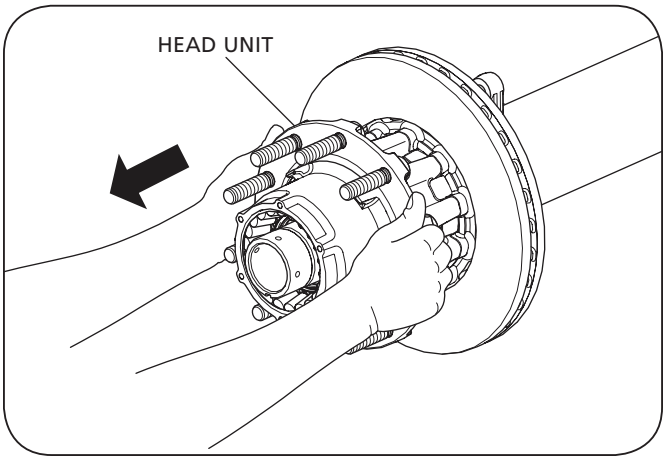


Figure 16



12. Remove the inner hub bearing from the spindle or from the inside of the hub ***(Figure 17)***.
13. The spindle mount hub seal can be driven off the spindle by striking the ring from the back side or prying off with a crow's foot bar. Be careful not to gouge the spindle shoulder. Discard the used seal. A new seal is required when re-assembled ***(Figure 17)***.

CAUTION DO NOT use a chisel to cut the seal. The shoulder can be damaged, resulting in a leak which, if not avoided, could lead to wheel end and/or brake failure.

8. Bearing Inspection

CAUTION Thoroughly clean bearings. DO NOT mix a synthetic base grease or oil with an organic/mineral base lubricant.

CAUTION DO NOT dry hub bearings with compressed air. Bearing damage could result.

1. After removing the head unit, clean excess grease from the bearings.

IMPORTANT: A bearing which has been removed from a vehicle should be cleaned with solvent. NEVER use steam or water which will rust bearings.

IMPORTANT: Bearings that are rusted, flaked, pitted, or have damaged cages should be replaced. It is recommended to replace all questionable bearings and ALWAYS replace the cup and cone as a matched set.

IMPORTANT: NEVER re-assemble a tapered roller bearing in a damaged or worn bearing cup or spindle. Bearing cup or spindle should be replaced and NOT re-machined if damaged or worn.

9. Rotor Replacement

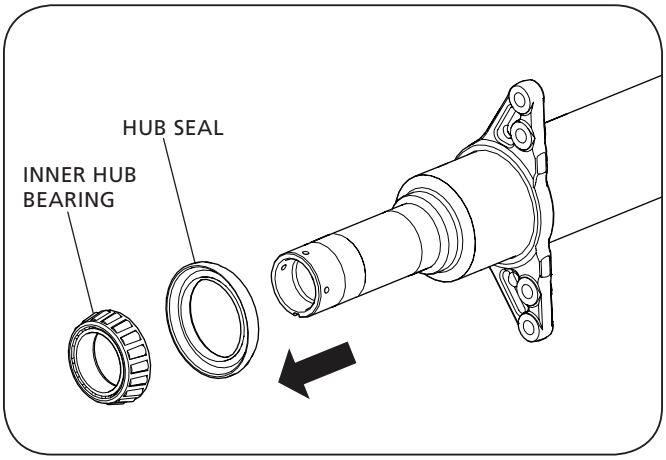
⚠WARNING Failure to follow these instructions could cause component failure which, if not avoided, could result in death or serious injury.

9.1 INTEGRAL® Rotor

Refer to pages 6 and 7 for Integral and U-Shaped Identification. See Section 9.2 for U-Shaped Rotor.

1. Remove the ABS sensor by following the instructions detailed in Section 16.1.
2. Remove the hub, refer to Section 6 instructions.
3. Remove the rotor from the hub using a size 15 mm socket to loosen and discard all ten (10) connection bolts ***(Figure 18)***.

Figure 17



4. Clean the rotor contact surface on the hub. Using compressed air, clean the tapped holes in the hub. Check to make sure the threads are undamaged.
5. Attach the new rotor to the hub using ten (10) new SAF® specific INTEGRAL® bolts and washers ***(Figure 18)***. Using a torque wrench, pre-torque the bolts to 40 ft.-lbs. (54 N•m). For final torque, tighten the bolts to 140 ft.-lbs. (190 N•m) using a crisscross pattern. Refer to the Torque Chart in Section 17 for more information.

IMPORTANT: When attaching a new rotor to the head unit, use only new SAF® specified connection bolts. Bolts MUST be clean and free from oil and grease.

⚠WARNING Failure to use only SAF® specified connection bolts could cause component failure which, if not avoided, could result in death or serious injury.

CAUTION When installing new washers, the attachment bolts can interfere with the ABS sensor block. Ensure that there is clearance provided for ABS Sensor Block ***(Figure 19)***. Failure to provide clearance can cause damage to property. Refer to service bulletin XL-SA20031SB-en-US

9.2 U-Shaped Rotor

1. Remove the ABS sensor by following the instructions detailed in Section 16.1.
2. Remove the head unit, Refer to Section 6 instructions.
3. Remove the rotor from the hub using a size 15/16" socket. Loosen and discard all ten (10) connection bolts and washers.
4. Clean the rotor contact surface on the hub. Using compressed air, clean the tapped holes in the hub. Check to make sure the threads are undamaged.
5. Attach the new rotor using ten (10) new bolts and washers supplied in the rotor kit ***(Figure 20)***. Using a torque wrench, tighten the bolts to 190 to 210 ft.-Lbs. (260-285 N•m).

IMPORTANT: When attaching a new rotor to the hub, use only SAF® specified connection bolts and washers. Bolts MUST be clean and free from oil and grease.

⚠WARNING Failure to use only SAF® specified connection bolts and washers could cause component failure which, if not avoided, could result in death or serious injury.

Figure 18

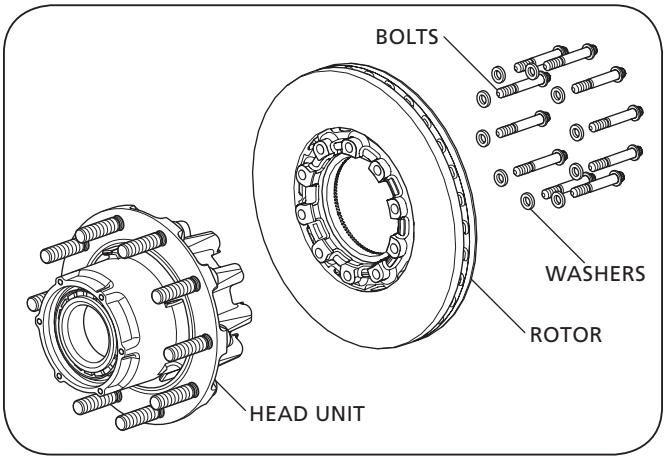


Figure 19

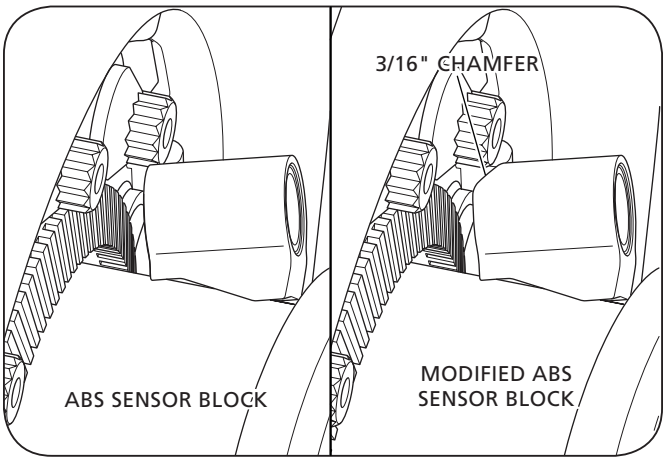
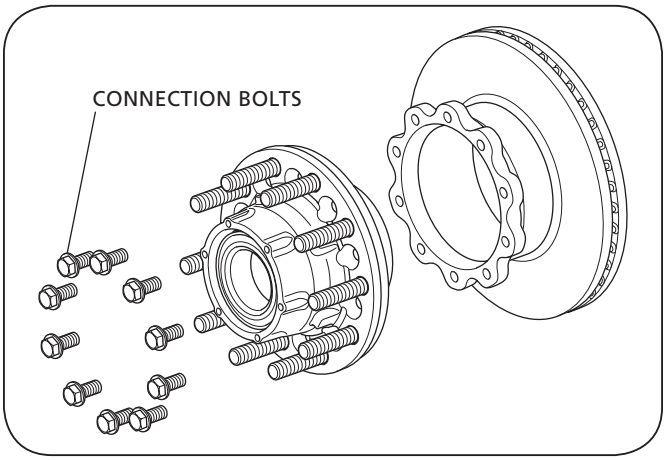


Figure 20



10. Hub Wheel Bolt Servicing

When replacing the wheel bolts, refer to the rotor removal instructions described in Section 9.

NOTE: NOT all bolts may need to be replaced. ONLY replace bolts that are damaged or in need of replacement.

1. Remove the wheel bolts by pressing them out of the head unit and discard ***(Figure 21).***
2. Install new wheel bolts by pressing them into the head unit.
3. For INTEGRAL® rotor hub, ensure correct alignment of the bolts during installation, position the flat side of each wheel bolt head so that it is facing the center of the hub ***(Figure 22)***.

⚠CAUTION DO NOT hit steel parts with a steel hammer as parts could break, sending flying steel fragments in any direction creating a hazard which, if not avoided, could result in minor to moderate injury.

11. Seal, Bearing, and Hub Installation and Adjustment

IMPORTANT: DO NOT mix oil and grease wheel end lubricants. All SAF-HOLLAND® P89 Disc Brake wheel ends can be serviced with oil or grease. Before servicing the SAF-HOLLAND® P89 wheel end with oil, all grease MUST be cleaned with appropriate solvent from the bearings and hub.

NOTE: Although all SAF-HOLLAND® P89 Disc Brake wheel ends are manufactured with spindle mounted wheel seals they can be serviced with either spindle or hub mounted seals.

11.1 Spindle mounted wheel seal Installation instructions. (Refer to 11.2 for hub mounted wheel seal instructions)

1. Before installing the wheel seal on the axle spindle, inspect the machined spindle seal surface for nicks, scratches, burrs or marks. If needed, use crocus cloth or emery cloth to repair any damaged areas.
2. Clean the threads and keyway thoroughly with a wire brush to avoid false bearing adjustments and to avoid introduction of contaminants into the lubricant cavity.

Figure 21

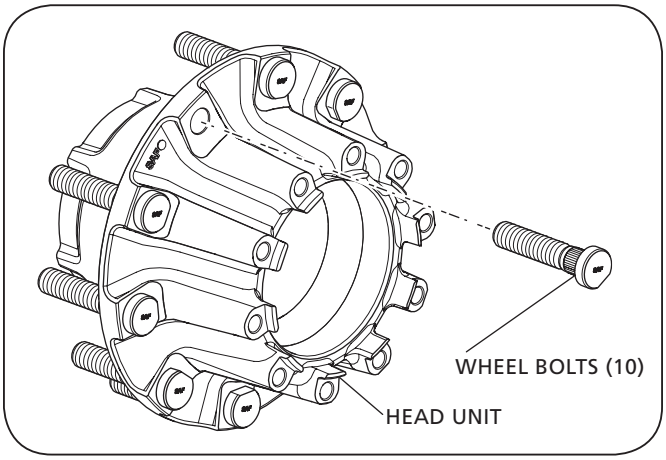


Figure 22

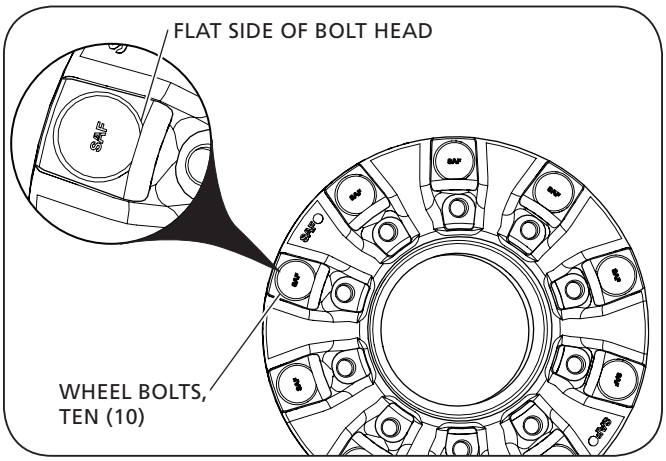
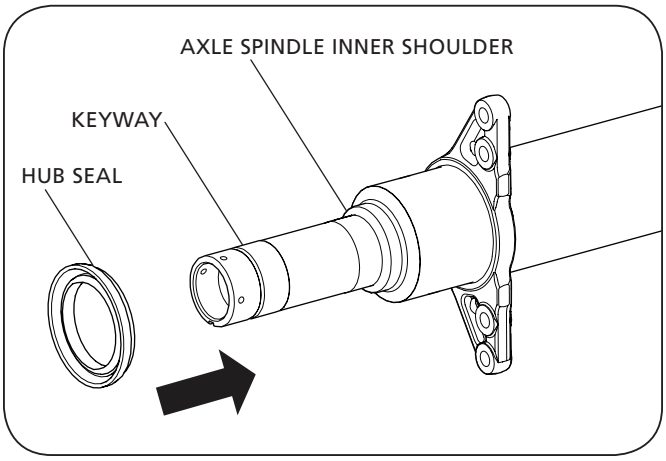


Figure 23



3. Thoroughly clean the spindle and spindle threads of rust, dirt, grease or any other contaminants that could damage the hub seal and cause it to leak.

CAUTION NEVER install a spindle mounted wheel seal in the hub and then force it onto the axle spindle by tightening the axle nut. Damage to seal will result.

CAUTION To avoid damaging the seal, support the hub against the spindle inner shoulder until the outer bearing and adjusting nut are installed.

4. Apply a thin layer of sealant to the O.D. of the spindle shoulder. Place the wheel seal on the spindle with the side labeled "oil-bearing side" facing out towards the end of the spindle ***(Figure 23)***.
5. Seat wheel seal into place using a hub seal installation tool and hammer. Rotate the wheel seal installation tool 1/4-turn with every hammer tap until the seal is properly seated with the metal face of the seal flush with the inner shoulder of the axle spindle ***(Figure 24)***. Clean and remove any excess sealant.
6. Prepare the hub. Remove the old lube and thoroughly clean the hub cavity and hub bore. If needed, use emery cloth to remove any burrs or old bore sealant. Inspect the hub bore for damage. Replace if necessary.
7. Install new inner and outer bearing cups into the hub as necessary ***(Figure 25)***.
8. Install inner bearing on spindle ***(Figure 25)***.

NOTE: If using oil for lubrication, coat bearings with oil before installation. Refer to Section 12 for proper wheel end oil lubrication instructions ***(Figure 27)***.

CAUTION Failure to lubricate bearing correctly and maintain proper lubrication could result in bearing damage.

NOTE: If using grease and NOT oil for hub lubrication, the inner and outer bearing, and the hub cavity MUST be pre-packed with grease before installation. Lubricate wheel end components with grease specified in Section 17.

9. Lubricate inside of hub cavity and install on spindle ***(Figure 25)***.

NOTE: Be sure wheel seals are properly installed before performing the hub bearing adjustment procedure.

Figure 24

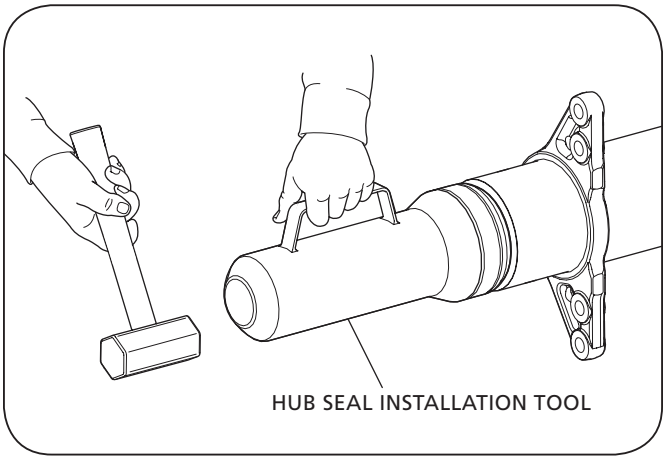


Figure 25

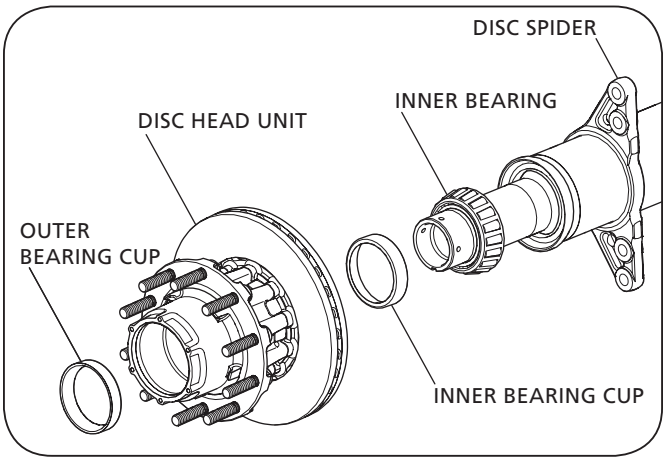
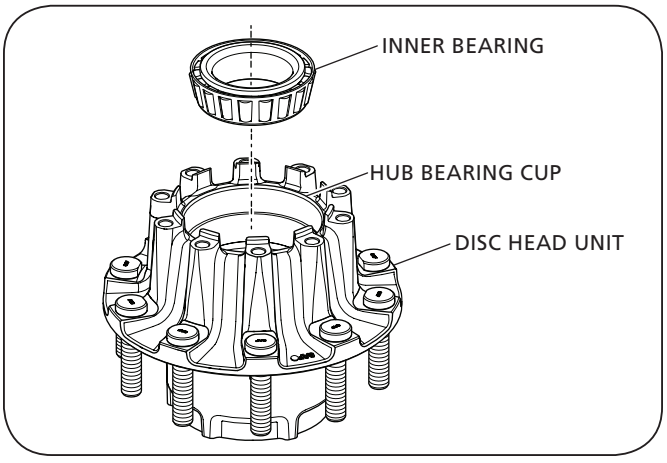


Figure 26



11.2 Hub Mounted Wheel Seal Installation Instructions (Refer to 11.1 for spindle mounted seal installation)

1. Remove all burrs from the hub bore and spindle. Thoroughly clean hub cavity and spindle.

NOTE: DO NOT apply any sealant to the spindle shoulder.

2. Place the hub on a smooth, hard surface in a horizontal position. Pre-lube the inner bearing and place it into the hub bearing cup ***(Figure 26)***.

NOTE: When using grease, pre-pack the inner bearing before placement into the hub.

3. Place the wheel seal on the installation tool, make sure that the words "oil-bearing side" faces the inner bearing. Position the tool (with the seal correctly mounted in the tool head) into the hub bore. Use a three to five pound hammer to drive against the end of the tool. Drive seal into bore until complete bottoming is assured ***(Figure 27)***. Remove the installation tool and apply a thin layer of lubricant on the I.D surface of the seal.

NOTE: DO NOT apply lubricant to the O.D. of the seal.

11.3 Hub Installation and Bearing Adjustment

1. Gently push the head unit onto the spindle to the proper position. Fill the hub cavity with lubricant until it runs over the outer bearing cup.

NOTE: When using grease, pre-pack the hub cavity. The grease fill amount should be to a 3 o'clock and 9 o'clock level. This is to ensure a 50% hub cavity fill. Use a template to hold grease in place while filling the hub cavity ***(Figure 28)***. 3shoulder. This could damage the wheel seal.

CAUTION

2. Coat the outer bearing with lubricant and place the outer bearing on the spindle and into the bearing cup ***(Figure 28)***. Install outer bearing on spindle.
3. Install the axle nut(s)
   - Three (3) piece axle nut:
     a. Install the bearing inner-axle adjustment nut finger tight against the outer bearing ***(Figure 29)***.
     b. While rotating the hub assembly, tighten the inner axle adjustment nut to 200 ft.-lbs. (271 N•m).
     c. Back off the inner axle adjustment nut one full turn and then re-torque the nut to 50 ft.-lbs. (68 N•m) while rotating the hub assembly.

Figure 27

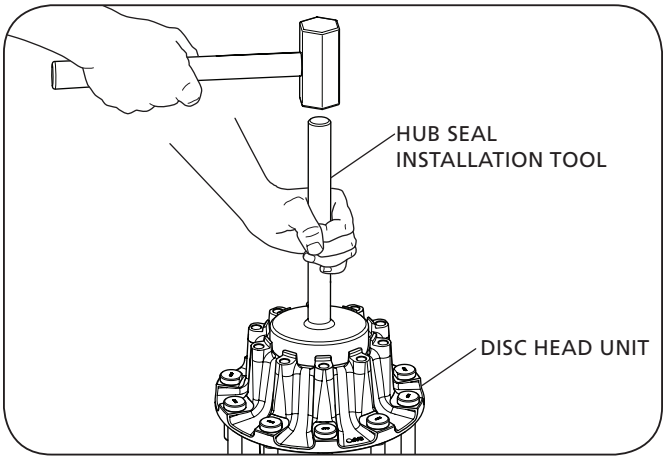


Figure 28

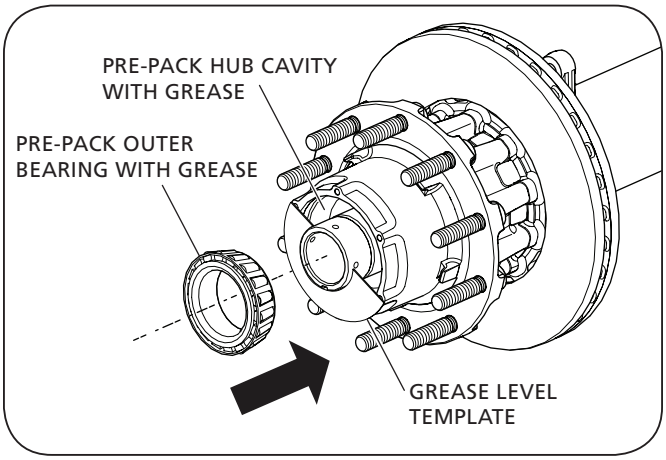
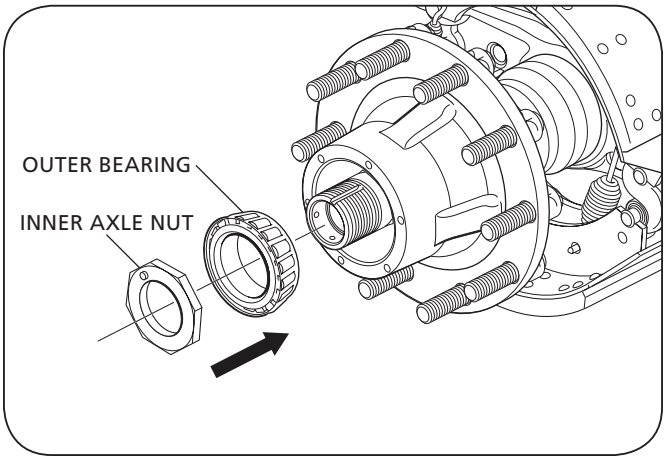


Figure 29



d. Back off the inner axle nut approximately 1/4 turn and install the axle lock washer ***(Figure 30)***. DO NOT include socket backlash in the 1/4 turn.

e. Install the lock washer. If the hole in the washer is NOT aligned with the pin on the inner nut, turn the washer around and re-install. If the pin and hole are still NOT aligned, slightly adjust parts as needed.

f. Install the outer axle nut finger tight against the axle lock washer ***(Figure 30)***.

g. Tighten the outer axle nut to 200-300 ft.-lbs. (271-407 N•m).

h. Measure wheel bearing end play (distance wheel end assembly moves in and out) with a dial indicator gauge. Wheel bearing end play to be .001-.005" (.03- .13mm).

NOTE: if wheel end bearing end play needs adjustment, remove the outer nut and lock washer, then tighten or loosen inner nut as needed. Return to step "6.e".

i. Install the set screw into an accessible threaded hole in the lock washer. The set screw must contact the inner adjusting nut. Tighten to 16 - 20 in.-lbs. (1.8 - 2.2 N•m).

- Pro-Torq® axle nut ***(Figure 31)***:

a. Use a screwdriver to carefully pry the keeper arm from the undercut groove on each side until the keeper is released.

b. Seat the bearing. Using a torque wrench, tighten the nut to 200 ft.-lbs. (271 N•m) and spin the wheel at least one (1) full rotation. PERFORM THIS STEP THREE (3)TIMES.

c. Back the nut off until it is loose.

d. Adjust the bearing. Using a torque wrench, tighten the nut to 100 ft.-lbs. (137 N•m). Spin the wheel at least one (1) full rotation. PERFORM THIS STEP THREE (3) TIMES.

e. Back the nut off one raised face mark (1/8 of a turn) ***(Figure 31)***.

f. Install the keeper with orange side facing out by inserting the keeper tab into the undercut groove of the nut and engage the keyway tang in the axle keyway. Insert keeper tab with bent legs facing out.

g. Engage the mating teeth of the keeper with the teeth of the wheel nut.

h. Compress and insert the keeper arms, one at a time, into the undercut groove with a screwdriver.

i. If the keeper teeth DO NOT line up with teeth in nut, loosen the nut slightly until they engage.

Figure 30

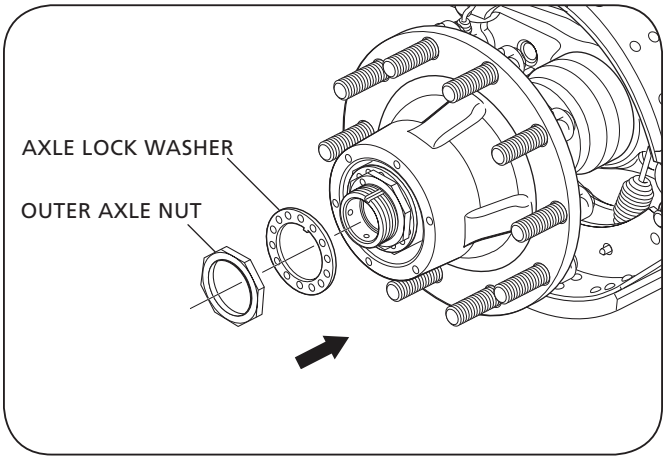
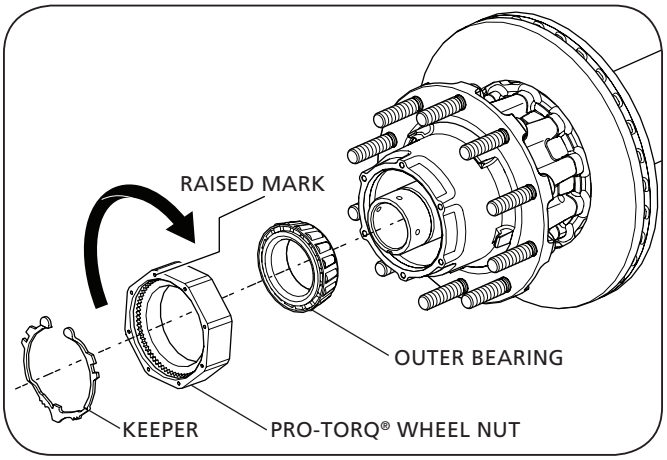


Figure 31



IMPORTANT: DO NOT tighten nut to align teeth.

CAUTION Failure to properly tighten nut could result in bearing damage which, if not avoided, could result in bearing failure.

j. Using a dial indicator, verify that end play reading is .001" (0.03 mm) to .003" (0.08 mm). Re-adjust bearing, if necessary.

k. Make sure that the keeper tab and keeper arms are fully seated into the undercut groove. Inspect the keyway tang to ensure it does not contact the bottom of the keyway ***(Figure 32)***. If contact exists, immediately notify a Pro-Torq® representative.

⚠WARNING Failure to ensure that the keeper is properly installed could cause wheel separation which, if not avoided, could result in death or serious injury.

4. ABS sensor block must clear rotor attachment bolts. Refer to Section 9.

CAUTION When installing new washers, the attachment bolts can interfere with the ABS sensor block. Ensure that there is clearance provided for ABS Sensor Block ***(Figure 33)***. Failure to provide clearance can cause damage to property. Refer to service bulletin XL-SA20031SB-en-US for ABS Sensor Block Modification Procedure.

5. Check the wheel bearing end play as follows:

a. Attach the magnetic base of a dial indicator to the spindle. Touch dial indicator stem to hub cap gasket face ***(Figure 34)***.

b. Reading Number One - Slightly rotate wheel-end in both directions while pushing inward until dial indicator does not change. Set the dial indicator to zero ***(Figure 34)***.

c. Reading Number Two - Slightly rotate hub in both directions while pulling outward until dial indicator does not change ***(Figure 34)***.

d. End play is the difference between reading number one and reading number two.

NOTE: Final adjustment should allow the wheel to rotate freely with 0.001" - 0.003" (0.03 mm - 0.08 mm) end play. If end play is not within specification, re-adjustment of bearing is required.

IMPORTANT: If end play is not within specification, re-adjustment is required.

⚠WARNING Failure to maintain proper hub bearing adjustment could allow bearing failure and wheel-end separation which, if not avoided, could result in death or serious injury.

Figure 32

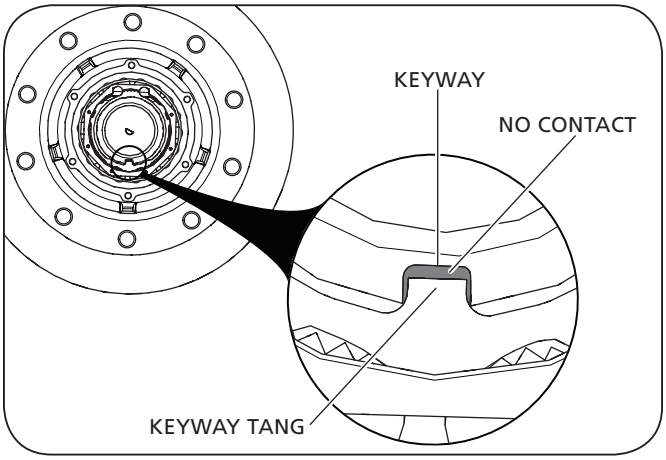


Figure 33

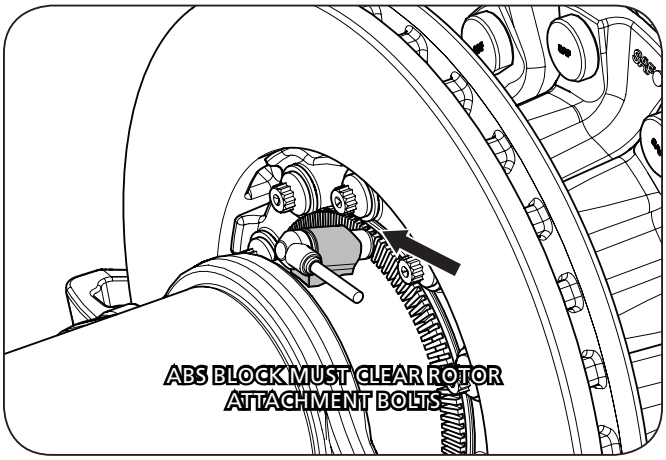
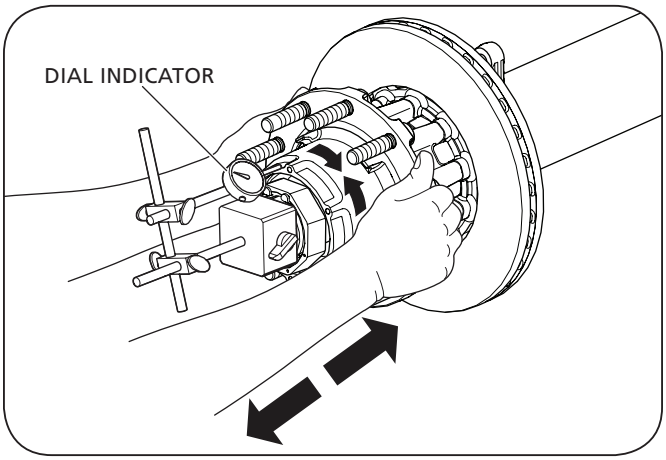


Figure 34



12. Hub Lubrication (Oil)

IMPORTANT: DO NOT mix oil with grease. If the bearing assembly has been lubricated with grease, DO NOT add oil.

⚠WARNING Failure to correctly lubricate bearings could damage bearings which, if not avoided, could result in death or serious injury.

1. Remove plug and fill the hub to the FULL mark with specified lubricant (oil), through the hole in the hub cap ***(Figure 35).***
2. Allow the oil to flow through the bearings and level off.
3. Insert the plug into the hole in the hub cap ***(Figure 35).***

IMPORTANT: Axles equipped with a centralized tire inflation system MUST use a vented hub cap.

4. Re-install wheel on hub using support device such as a wheel dolly jack.

⚠CAUTION Failure to support weight during installation or removal of brake drum could create a crush hazard which, if not avoided, could result in minor to moderate injury.

CAUTION Failure to uncage spring brakes in accordance with manufacturer's instructions after servicing is complete will prohibit proper brake function which could result in uneven brake system component wear.

13. Hub Cap Installation

1. Install the hub cap assembly, making sure the hub cap gasket is in place ***(Figure 36)***.

IMPORTANT: When installing hub cap, make sure the hub cap gasket is not bent or damaged.

IMPORTANT: DO NOT over torque. This can crush the hub cap gasket.

CAUTION Failure to avoid damaging the hub cap gasket could allow lubricant to lead which, if not avoided, could result in bearing failure.

2. Install the six (6) bolts to secure the hub cap assembly ***(Figure 36)***. Tighten bolts to 12-16 ft.-lbs. (16-21 N•m).

Figure 35

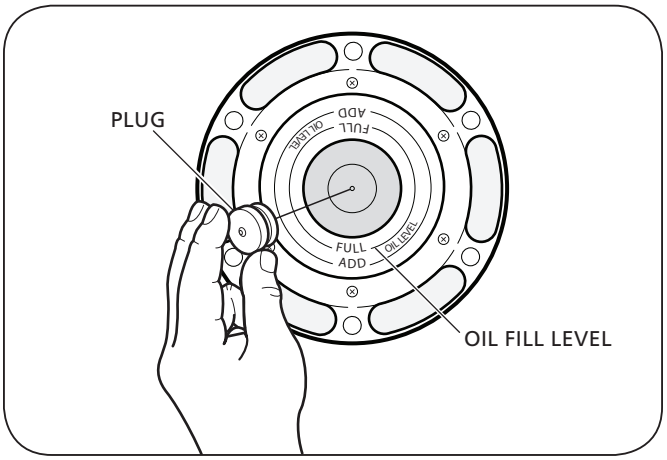
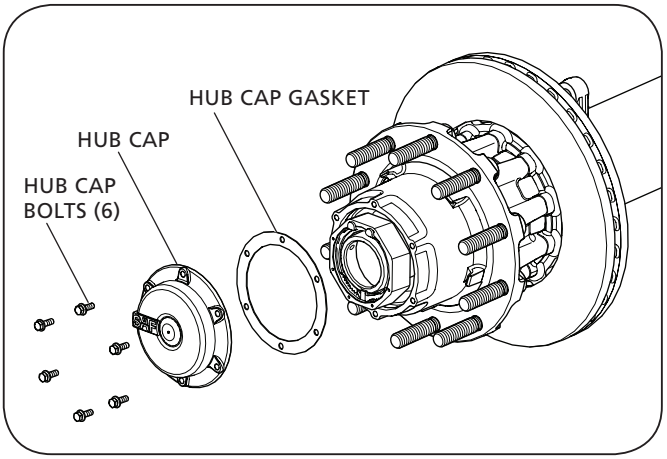


Figure 36



14. Caliper Installation

1. Re-install the caliper onto the brake spider using four (4) new SAF® specific brake caliper bolts ***(Figure 37):***
   a. Pre-torque the bolts to 88 ft.-lbs. (120 N•m) from inner bolts to outer bolts using a size 24 mm socket.
   b. Verify the pre-torque of the bolts a second time, and if necessary re-tighten all bolts to 88 ft.-lbs. (120 N•m).
   c. Final torque from inner bolts to outer bolts to 331 ± 22 ft.-lbs. (450 ± 30 N•m).

NOTE: The caliper is connected to the disc brake spider using four (4) SAF specific bolts: three (3) standard bolts and one (1) shoulder bolt ***(Figure 37).*** The shoulder bolt is located at the top mounting hole whether the caliper is installed forward or rearward of the axle.

IMPORTANT: Make sure that the brake caliper is mounted on the correct side of the axle. The correct position can be identified by the lengths of the guide pins on the caliper unit. The longer guide pins should be positioned on the bottom of the caliper unit when installed rear of the axle and on top when forward of the axle ***(Figure 38).***

2. Re-install the SAF® brake chamber by following the instructions in SAF® Brake Chambers Installation and Service Guide XL-SA10062IM-en-US available on the internet at www.safholland.us.
3. Re-install the ABS sensor by following the instructions detailed in Section 16.1.
4. To enable the ABS sensor to function properly press the ABS sensor against the ABS toner ring at the hub unit to eliminate any clearance between these parts.

IMPORTANT: After replacing the rotor, verify that the brake system is functioning properly.

⚠WARNING Failure to verify brake system function after rotor replacement could result in brake malfunction which, if not avoided, could result in death or serious injury.

Figure 37

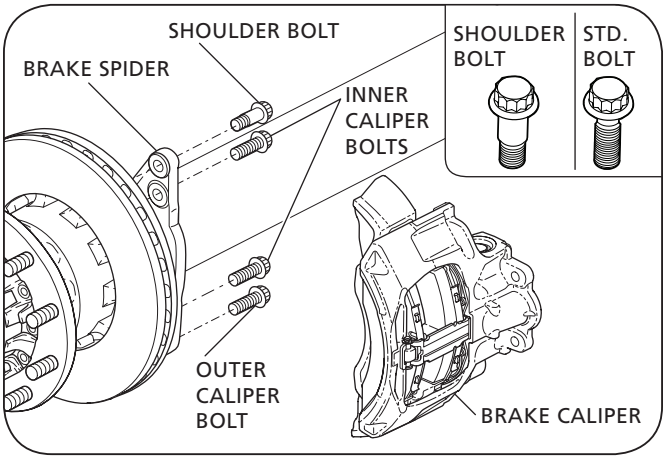
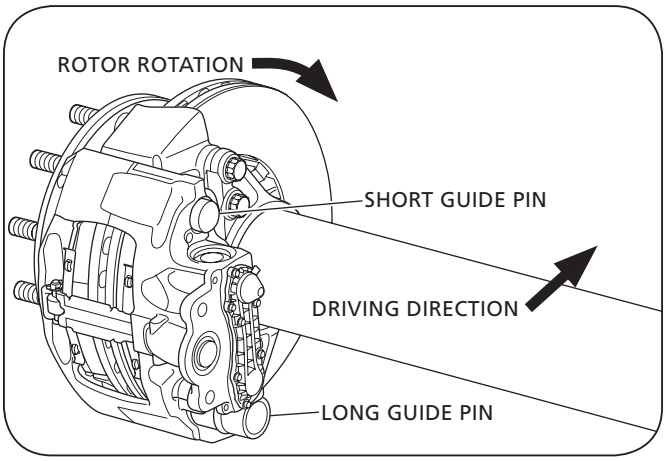


Figure 38



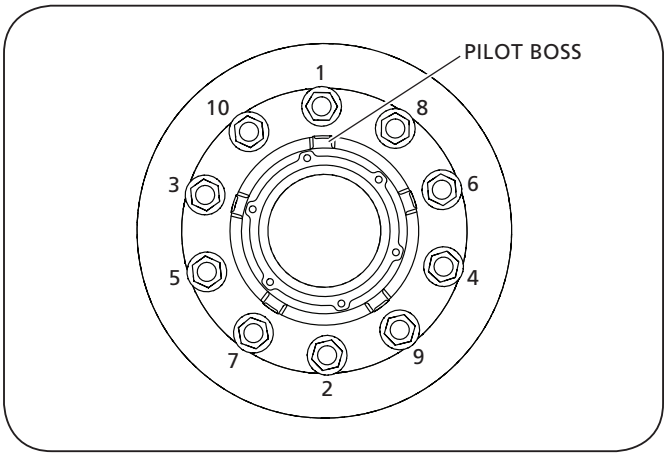
15. Wheel Installation Procedure

The following information is intended to provide basic wheel installation instructions. Refer to TMC RP222C for complete installation details.

1. Clean all mating surfaces on hub, wheels and nuts.
2. Rotate the hub so a pilot boss is at the top (12 o'clock) position.
3. Mount wheel(s) on hub. One or more of the wheel nuts can be started in order to hold wheel in position.
4. Tighten the top wheel nut first. Apply 50 ft.-lbs. (68 N•m) of torque to draw the wheel up fully against the hub.
5. Install remaining wheel nuts. Using sequence shown in ***(Figure 39)***, tighten all wheel nuts to 50 ft.-lbs. (68 N•m) of torque.
6. Repeating sequence shown in ***(Figure 39)***, retighten all wheel nuts to 475 ± 25 ft. lbs. (644 ± 34 N•m) of torque.
7. Check seating of wheel at the pilot bosses. Rotate wheel and check for any rotational irregularity.

Re-torque all wheel nuts after 5 to 100 miles of service on the initial "in-service" following any installation of wheel to hub assembly.

Figure 39



16. Optional Equipment

16.1 ABS Sensor

NOTE: When replacing the ABS sensor, DO NOT mix sensors from different manufacturers.

1. Disconnect the ABS sensor.
2. Remove the ABS sensor from the sensor holder by pulling it straight out from the holder and discard ***(Figure 40).***
3. If necessary, remove the sensor retaining spring clip from the sensor holder and replace with a new clip. ***(Figure 40).***
4. Install a new ABS sensor by pushing it directly into the sensor holder/spring clip until it contacts the ABS toner ring in the hub assembly ***(Figure 40).***
5. Re-connect the ABS sensor.

16.2 Hubodometer

The SAF-HOLLAND® P89 disc brake axle can be factory equipped or retrofitted with any hubodometer currently compatible with a North American standard six bolt hub cap. For information on specific hubodometer availability, contact SAF-HOLLAND® Customer Service at 888-396-6501.

16.3 Tire Inflation System

SAF-HOLLAND® DOES NOT supply tire inflation systems. However, the SAF-HOLLAND® P89 disc brake axle can be factory equipped to be compatible with many tire inflation systems currently compatible with a North American standard six bolt hub cap. This includes providing tire inflation system hubcaps that are compatible with hubodometers. For information on specific Tire Inflation fitting availability, contact SAF-HOLLAND® Customer Service at 888-396-6501.

16.4 Dust Shield

The SAF-HOLLAND® P89 disc brake can be factory equipped or retrofitted with a disc dust shield.

1. Route any ABS sensor wires through one of the two rubber grommets on the dust shield and position the dust shield on the axle.***(Figure 41)***.
2. Wrap the clamp band around the axle and dust shield and loosely install the clamp band bolt.
3. Slide the dust shield and clamp band toward the disc brake until the dust shield is about 1/2" (12mm) from the brake rotor, pulling the ABS wire through the rubber grommet as necessary.
4. Torque the clamp band bolt to 20-25 ft.-lbs. (27-34 N•m).
5. Use a pry bar and/or a rubber mallet to ensure that there is clearance between the dust shield and the rotor.
6. Plug the ABS sensor into the ABS system wire.

Figure 40

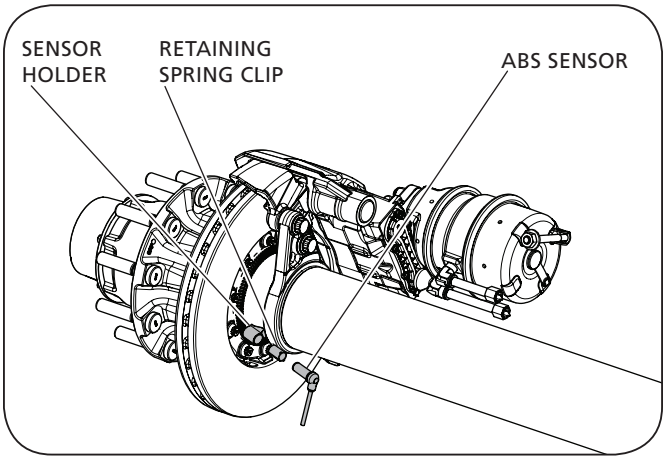
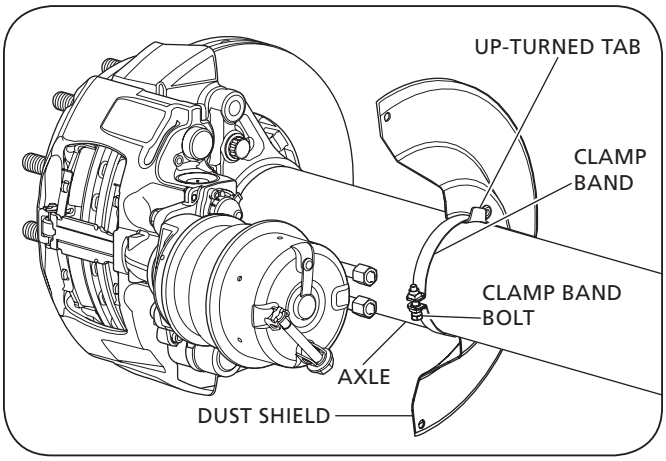


Figure 41



17. Lubrication and Torque Specifications

LUBRICATION SPECIFICATION		
COMPONENT	SURFACE TO BE LUBRICATED	LUBRICANT
Axle	Bearings and Hubs	NLGI 00 Semi-Fluid Grease (Standard) 80/90 Gear Oil (Optional)

* Oil lubed bearings and hubs should remain lubricated with oil, grease lubed bearings and hubs should remain lubricated with grease.

NOTE: Intervals are based upon normal operations. Reduce intervals to compensate for abnormal operations or severe conditions. During inactive periods, sufficient lubrication MUST be performed for equipment preservation.

PART	APPLICATION	TORQUE SPECIFICATIONS
Pro-Torq® Axle Spindle Nut	Head Unit – Axle	Refer to Section 11.3, Pro-Torq® Axle Nut procedures.
SAF® Specific INTEGRAL® Bolt M14 x 1.5"	Rotor – Hub	Torque all ten (10) bolts in a criss-cross pattern. 1. Pre-torque to 40 ft.-lbs. (54 N•m). 2. For final torque tighten to 140 ft.-lbs. (190 N•m).
SAF® Specific Caliper Bolt M18 x 1.5"	Caliper – Spider	Torque bolts from inner bolts to outer bolts. 1. Pre-torque to 88 ft.-lbs. (120 N•m). 2. Verify the pre-torque of the bolts a second time, and, if necessary re-tighten all bolts to 88 ft.-lbs. (120 N•m). 3. Final torque from inner bolts to outer bolts to 331 ± 22 ft.-lbs. (450 ± 30 N•m).
SAF® Specific Brake Chamber Nut 5/8"-11 UNC Nylock or M16 x 1.5"	Brake Chamber	1. Pre-torque both chamber nuts to 60-75 ft.-lbs. (80-100 N•m). 2. For final torque tighten both chamber nuts to 130-155 ft.-lbs. (180-210 N•m)
5/16"-18 Bolt	Hub Cap	12-16 ft.-lbs. (16-22 N•m)
M8 x 1.25 Bolt	Dust Shield Clamp	20-25 ft.-lbs. (27-34 N•m)
SAF® U-Shaped Rotor Bolt	Rotor – Hub	Torque all ten (10) bolts in a criss-cross pattern to 190-210 ft.-lbs. (260-285 N•m)
Three (3) Piece Axle Nut Inner	Head Unit – Axle	Refer to Section 11.3 Three Piece Axle Nut.
Three (3) Piece Axle Nut Outer	Head Unit – Axle	200-300 ft.-lbs. (271-407 N N•m) 11.3 Three Piece Axle Nut.
Three (3) Piece Axle Nut Set Screws	Head Unit – Axle	16-20 in.-lbs. (1.8-2.2 N N•m) 11.3 Three Piece Axle Nut.

18. Troubleshooting Chart (SAF-HOLLAND® suspensions equipped with disc brake axles)

PROBLEM	POSSIBLE CAUSE	POSSIBLE REMEDY
Brakes will not release	Disc brake caliper bound up	Lubricate or replace brake caliper
	Brake hoses restricted	Replace hoses
	Brake control valve restricted/inoperable	Repair/replace control valve
	Brake out of adjustment	Adjust brake/repair or replace automatic adjustment device as necessary
	Damaged brake chamber	Replace brake chamber
	Damaged brake assembly	Replace or repair brake assembly
	Supply air interrupted	Open glad hand cut-out cock or push brake control valve in
	Supply line improperly coupled	Properly couple supply air line
	Brake pads frozen to rotor in cold weather	Warm brakes
No brakes or insufficient brake performance	Service air interrupted	Open glad hand cut-out cock
	Service air line improperly coupled	Properly couple service air line
	Brake hoses restricted	Relieve restriction or obstruction or replace hoses
	Brake control valve restricted/inoperable	Repair/replace control valve
	Brake out of adjustment	Adjust brake/repair or replace automatic adjustment device as necessary
	Damaged brake chamber	Replace brake chamber
	Damaged brake assembly	Replace or repair brake assembly
Dragging Brakes/Slow brake application or release timing	Brake hoses restricted	Relieve restriction or obstruction or replace hoses
	Brake control valve restricted/inoperable	Repair/replace control valve
	Brake out of adjustment	Adjust brake/repair or replace automatic adjustment device as necessary
	Damaged brake chamber	Replace brake chamber
	Damaged brake assembly	Replace or repair brake assembly
Dog Tracking	Axle not properly aligned	Align axle
	Slider assembly racked or not aligned properly	Repair or replace slider assembly
	Frame bent or not aligned properly	Repair or align frame
	Damaged suspension component	Repair or replace suspension component
	Bent axle	Replace axle
Uneven tire wear	Improper tire inflation	Inflate tire to proper pressure
	Loose wheel stud nuts	Inspect for and repair any resultant wheel end damage and tighten properly
	Improper wheel bearing adjustment	Inspect for and repair any resultant wheel end damage and adjust properly
	Axle not properly aligned	Align axle
	Slider assembly racked or not aligned properly	Repair or replace slider assembly
	Frame bent or not aligned properly	Repair or align frame
	Damaged suspension component	Repair or replace suspension component
	Bent axle	Replace axle
	Mismatched tire sizes	Properly match tire sizes
	Unequal brake balance or timing	Repair brakes as necessary
	Overly aggressive braking	Instruct/train driver in proper brake use
	High speed turns	Instruct/train driver in proper vehicle speeds
	High level of side scrub	Instruct/train driver in proper vehicle maneuvering
	Anti-Lock Brake System malfunction	Refer to ABS manufacturer's service literature

PROBLEM	POSSIBLE CAUSE	POSSIBLE REMEDY
Grabbing brakes	Contaminants on brake lining	Replace brake pads
	Brake out of adjustment	Adjust brake/repair or replace automatic adjustment device as necessary
	Warped brake rotor	Machine or replace brake rotor
	Damaged brake chamber	Replace brake chamber
	Damaged brake assembly	Replace or repair brake assembly
	Unequal brake balance or timing	Repair brakes as necessary
	Anti-Lock Brake System malfunction	Refer to ABS manufacturer's service literature
Excessive heat cracks in rotor	Brake out of adjustment	Adjust brake/repair or replace automatic adjustment device as necessary
	Overly aggressive braking	Instruct/train driver in proper brake use
	Unequal brake balance or timing	Repair brakes as necessary
	Anti-Lock Brake System malfunction	Refer to ABS manufacturer's service literature
	Damaged brake chamber	Replace brake chamber
	Damaged brake assembly	Replace or repair brake assembly

19. Routine Service Schedule

⚠WARNING Failure to inspect and maintain the SAF-HOLLAND® P89 disc brake axle as outlined in this section can result in brake or wheel bearing failure which, if not avoided, could result in death or serious injury.

IMPORTANT: Use only SAF-HOLLAND® Original Parts to service the SAF-HOLLAND® P89 disc brake axle.

⚠WARNING Failure to maintain the SAF-HOLLAND® P89 disc brake with SAF-HOLLAND® Original Parts can result in brake or wheel bearing failure which, if not avoided, could result in death or serious injury.

NOTE: Service intervals are based upon normal operations. Reduce intervals to compensate for abnormal operations or severe conditions. During inactive periods, sufficient lubrication MUST be performed for equipment preservation.

WHICHEVER OCCURS FIRST		PERIODIC CHECKS		
MILEAGE INTERVALS	After First 3,000 Miles	Every 20,000 Miles	Every 50,000 Miles	Every 100,000 Miles
TIME INTERVALS	After First Month	Every 3 Months	Every 6 Months	Every 12 Months
VISUAL AND SAFETY INSPECTION				
Head Unit – Check for grease leaks.			■	
Inspect the brake caliper guide system. Check for free movement and sliding action. Refer to Section 5. For caliper and caliper service manual identification.			■	
Check rubber dust covers for cracks and damage. Check adjuster cap for correct seating. Refer to Section 5. For caliper and caliper service manual identification.			■	
Inspect brake pad thickness regularly. Refer to Section 6.		■		
Inspect brake rotors for cracks. Refer to Section 6.			■	
Perform general service/maintenance inspection. Refer to Section 2.	■			
Perform disc brake/head unit inspection. Refer to Section 5.	■		■	

MECHANICAL CHECK				
Attention: Check torque of wheel nuts after the first 5-100 miles (8-160 km) from date vehicle was placed into service and after every wheel removal. Continually check wheel torque every 10,000 miles (16,000 km), or at the intervals indicated in the vehicle owner's manual, whichever occurs first.				
Check and adjust wheel bearing end play.	■			■
Pack hub bearings with fresh lubricant (also after every brake lining replacement, check hub bearing wear).				■

SPECIAL SERVICE CONDITIONS	
Vehicles with long standing periods.	Service at specified time intervals, e.g. Trailer used for storage or frequently left standing for several days at a time.
Vehicles used under severe duty and extreme conditions.	Service at suitably reduced intervals, e.g. Trailer operating in continuous multi-shifts or in off-road construction sites.

ORIGINAL PARTS™

From fifth wheel rebuild kits to suspension bushing repair kits, SAF-HOLLAND Original Parts are the same quality components used in the original component assembly.

SAF-HOLLAND Original Parts are tested and designed to provide maximum performance and durability. Will-fits, look-alikes or, worse yet, counterfeit parts will only limit the performance potential and could possibly void SAF-HOLLAND's warranty. Always be sure to spec SAF-HOLLAND Original Parts when servicing your SAF-HOLLAND product.

SAF-HOLLAND USA • 888.396.6501 • Fax 800.356.3929
www.safholland.us

SAF-HOLLAND CANADA • 519.537.3494 • Fax 800.565.7753
WESTERN CANADA • 604.574.7491 • Fax 604.574.0244
www.safholland.ca

SAF-HOLLAND MEXICO • 52.55.5362.8743 • Fax 52.55.5362.8743
www.safholland.com.mx

info@safholland.com

SAF-HOLLAND USA, INC.
1950 Industrial Blvd., Muskegon, MI 49442
www.safholland.com

Engineering Your Road to Success