

SERVICE MANUAL

SERVICE MANUAL SECTION

HUBS, BEARINGS, AND SEALS (NON-DRIVE AXLES)

s02002s, Formerly CTS-5136S

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DESCRIPTION

Figure 1, Figure 2, Figure 3 and Figure 4 show exploded views of the non-drive front axle assembly with brake related components.

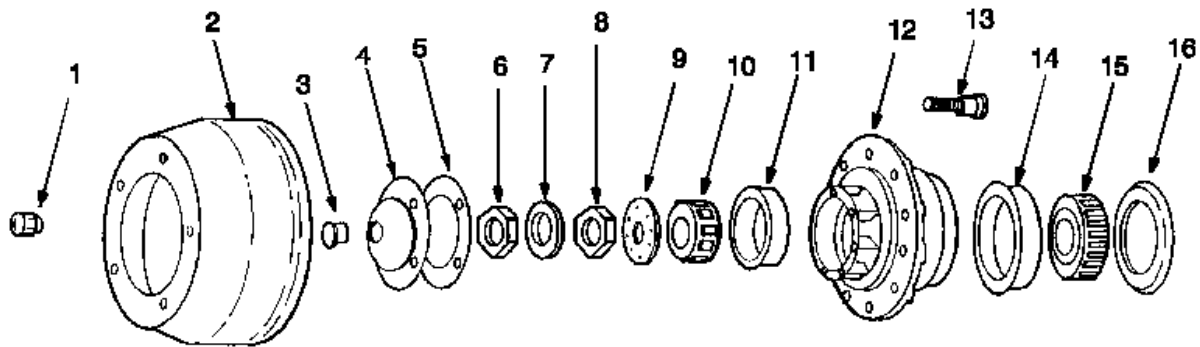


Figure 1 Exploded View of Typical Disc Type Front Hub Assembly with Outboard Mounted Brake Drum

1. WHEEL AND BRAKE DRUM RETAINING NUT
2. BRAKE DRUM
3. HUB CAP OIL FILL PLUG
4. HUB CAP OIL/GREASE
5. HUB CAP GASKET
6. OUTER WHEEL BEARING ADJUSTER NUT
7. OUTER WHEEL BEARING ADJUSTER NUT LOCK
8. INNER WHEEL BEARING ADJUSTER NUT LOCK
9. INNER WHEEL BEARING NUT LOCK
10. OUTER WHEEL BEARING
11. CUP OUTER BEARING
12. HUB
13. BRAKE DRUM AND WHEEL RETAINING STUD
14. INNER WHEEL BEARING CUP
15. INNER BEARING
16. SEAL OIL/GREASE

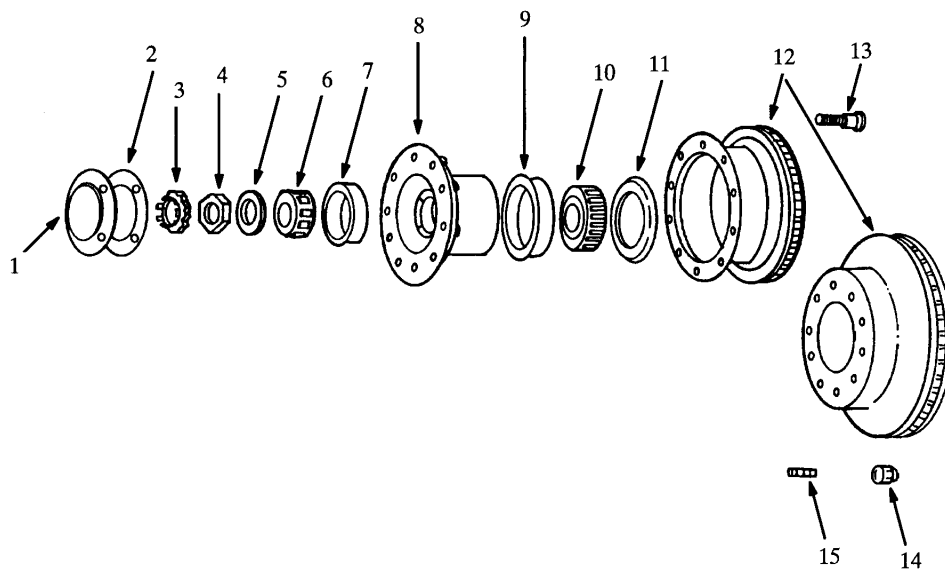


Figure 2 Exploded View of Typical Disc Type Front Hub Assembly with Disc Brakes

1. HUB CAP OIL/GREASE
2. HUB CAP GASKET
3. WHEEL BEARING ADJUSTER NUT LOCK
4. WHEEL BEARING ADJUSTER NUT
5. WHEEL BEARING RETAINER WASHER
6. OUTER BEARING
7. CUP OUTER BEARING
8. HUB
9. CUP INNER BEARING
10. INNER BEARING
11. SEAL OIL/GREASE
12. BRAKE ROTOR (EITHER STYLE)
13. WHEEL RETAINING STUD
14. ROTOR RETAINING NUT AND WASHER
15. ROTOR RETAINING STUD

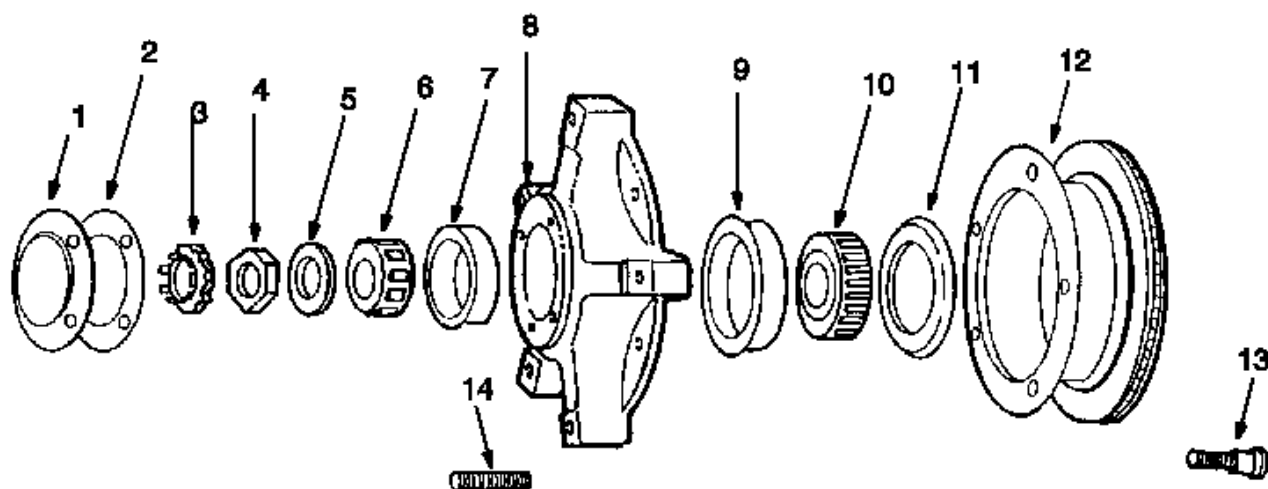


Figure 3 Exploded View of Typical Cast Spoke Front Hub Assembly with Disc Brakes

1. CAP WHEEL/GREASE
2. CAP GASKET
3. WHEEL BEARING ADJUSTER NUT LOCK
4. WHEEL BEARING ADJUSTER NUT
5. WHEEL BEARING RETAINER WASHER
6. OUTER WHEEL BEARING
7. CUP OUTER BEARING
8. WHEEL (HUB)
9. CUP INNER BEARING
10. INNER BEARING
11. SEAL WHEEL
12. BRAKE ROTOR
13. ROTOR RETAINING BOLT, WASHER AND NUT
14. RIM CLAMP RETAINING STUD

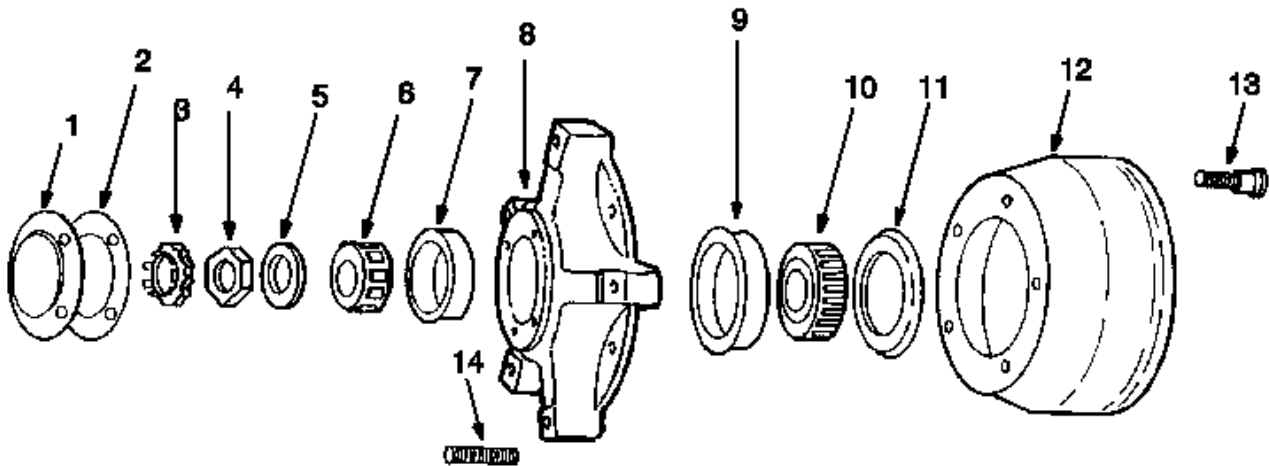


Figure 4 Exploded View of Typical Cast Spoke Front Hub Assembly with Drum Brakes

1. CAP WHEEL/GREASE
2. CAP GASKET
3. WHEEL BEARING ADJUSTER NUT LOCK
4. WHEEL BEARING ADJUSTER NUT
5. WHEEL BEARING RETAINER WASHER
6. OUTER WHEEL BEARING
7. CUP OUTER BEARING
8. WHEEL (HUB)
9. CUP INNER BEARING
10. INNER BEARING
11. SEAL WHEEL
12. BRAKE DRUM
13. BRAKE DRUM RETAINING BOLT, WASHER AND NUT
14. RIM CLAMP RETAINING STUD

1. WHEEL BEARINGS

1.1. INSPECTION

Inspection should be done with wheel/hub assembly removed from vehicle, inner wheel bearing and seal removed from hub assembly, and all components cleaned.

Inspect inner and outer wheel bearing cups, cones and roller for wear or damage. If any of the following conditions exist, the bearing and cup must be replaced.

NOTE – Do not use air gun to rotate (spin) wheel bearing.

Large ends of rollers are worn flush up to recess, or radii at large ends of rollers are worn sharp (Figure 5).

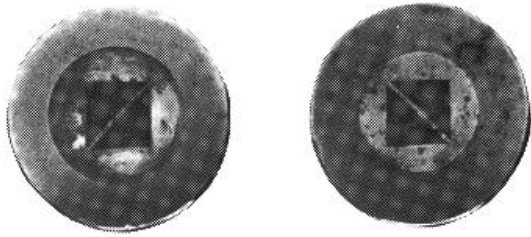


Figure 5 Roller End Wear

There is a visible wear step, particularly at the large end of roller and roller track, or deep indentations, cracks or breaks in bearing cup and/or cone surfaces (Figure 6).

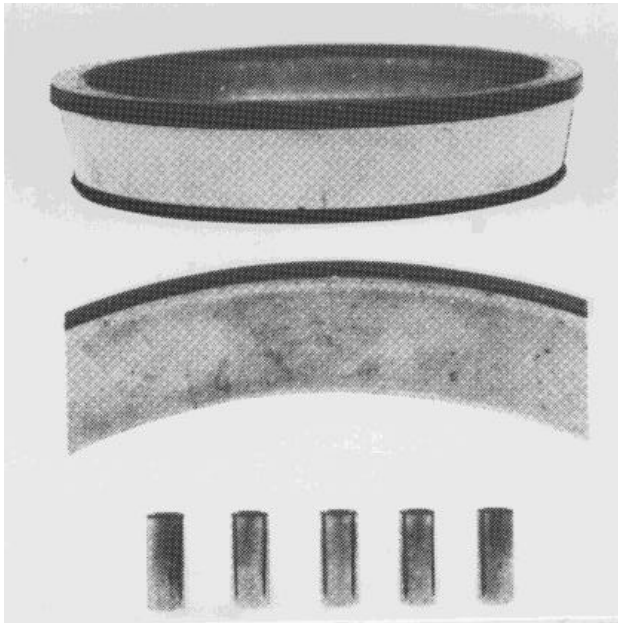


Figure 6 Bearing Cup Wear

There are bright rubbing marks on the dark phosphate surfaces of the bearing cage (Figure 7).

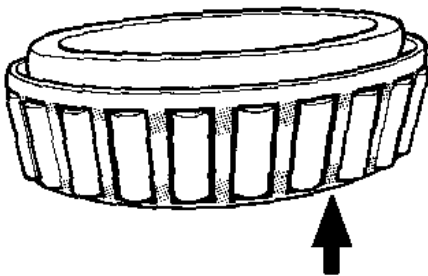


Figure 7 Bearing Cage Wear

There is an etching or pitting on contact surfaces of cup, cone or rollers (Figure 8).

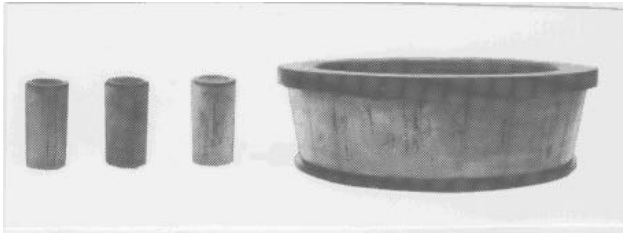


Figure 8 Pitted Contact Surface

There is any spalling or flaking on either the bearing cup and/or cone surfaces (Figure 9).

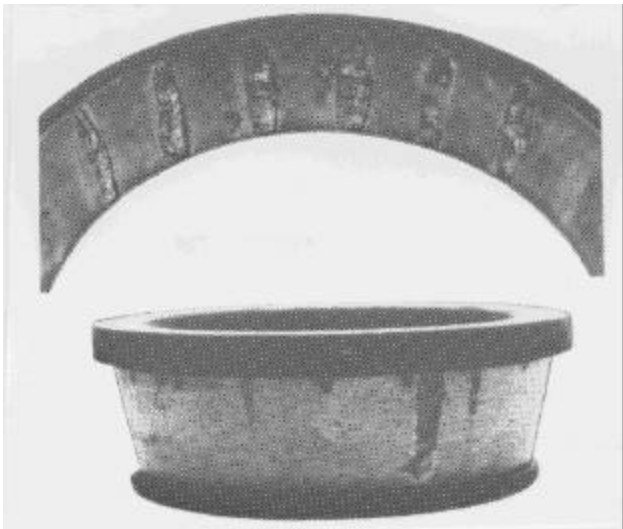


Figure 9 Flaking Cup/Cone Surface

1.2. BEARING CUP (RACE)

Remove (Cast Iron Hub Assembly)

Removal is done with hub assembly removed from vehicle (with or without wheel(s) removed from hub assembly), and inner bearing and seal removed from hub assembly.

1. To remove inner bearing cup, place hub assembly flat on floor with outer bearing facing up (toward you).
2. Use a long suitable steel punch placed through the hub bore. In most cases, the hub assembly will have a couple of notches machined out of the hub assembly. These notches are there for the removal of the bearing cup.
3. Place the punch in the notch on the cup. Strike the punch with a hammer. Move the punch to the opposite notch and repeat procedure. Moving back and forth in the notches and striking the cup will force the cup from the hub.

NOTE – If hub does not have removal notches machined into the hub assembly, use a suitable steel punch with a flat end. Place punch on cup portion that is protruding from hub assembly. Strike punch with hammer and work your way around cup in a criss-cross pattern, forcing cup from hub.

NOTE – To remove outer bearing cup, place hub assembly on floor with brake drum/disc facing up (toward you) and repeat steps 2 and 3 above.

Install

1. To install inner bearing cup, place hub assembly on floor with brake drum/disc facing up (toward you).
2. Lube hub cup surface and outer cup surface with engine oil and place cup into hub bore in the same position as the one removed.
3. Using a brass drift, punch with a flat end and a hammer, and tap cup into bore. Be sure cup is not cocked.
4. Working around the circumference of the cup in a criss-cross pattern, drive cup into the hub bore until it is bottomed.
5. Clean any brass shavings from bore.
6. To install outer bearing cup, place hub assembly on floor with brake drum/disc facing floor and repeat steps 2 through 5 above.

Remove (Aluminum Hub) (Wheel Assembly Removed From Hub)

1. Clean hub with a non-flammable cleaner.
2. Place the hub on a firm, clean surface with the cup to be removed facing down.
3. Using a hammer and a drift, carefully drive the cup out of the hub by striking on the lip of the cup. It is necessary to use many soft blows placed about 90° apart.

Alternate Method: After the hub is clean from grease and debris, place hub in an oven and heat the hub assembly evenly to 180°F to 210°F. Quickly remove the hub from the oven and place the hub on a firm, clean surface with the cup to be removed facing down, then proceed with step 3.



WARNING – Wear gloves when handling hot hub assembly to prevent personal injury.

Install

1. The bore must be clean of grease and debris. Heat the hub evenly throughout in an oven to 180°F to 210°F (82°C - 99°C) for approximately 30 minutes.
2. After the hub is up to temperature, quickly remove it from the oven and place the bearing cup into the bore. Carefully tap cup into hub using a criss-cross pattern. Be sure cup is properly seated. If the cup does not fit easily into the hub:
 - a. Remove cup from hub per cup removal procedure.
 - b. Reheat the hub.
 - c. Refrigerate a new cup to -20°F.
 - d. Repeat step 2.

3. To verify that the cup is fully seated and aligned, a 0.002" feeler gauge should not fit between the cup and bearing backup.
4. After hub is at room temperature, proceed with normal seal and hub installation.

2. INSTALLATION (WHEEL BEARINGS - OIL LUBRICATED)

- A. Prelubricate inner and outer bearings with a coating of recommended oil bearing lube as described in LUBRICATION.
- B. Assemble bearings and seal as described in section INSTALL SEALS.
- C. Adjust bearings. For bearing adjustment, refer to WHEEL BEARING ADJUSTMENT. Install the hub cap and fill hub to a level that is up to but not to exceed 5/16 inch above the MIN lube line as shown on window face of hub cap.

IMPORTANT – For aluminum type hub caps, apply sealant to the threads on the fill plug before installing. With rubber plug type hub caps, be sure that the rubber plug is seated. Wipe excess lubricant from hub cap which could appear as a leaking cap after vehicle operation. On hub caps that are made of composite materials, tighten the fill screw to 20 in-lbs. (2.3 N·m)

NOTE – For grease lubricated bearings, refer to LUBRICATION.

2.1. FRONT WHEEL HUB CAP/OIL

Figure 10 is the new style hub cap for 6,000 and 8,000 lb. axles manufactured June 1995 and after.

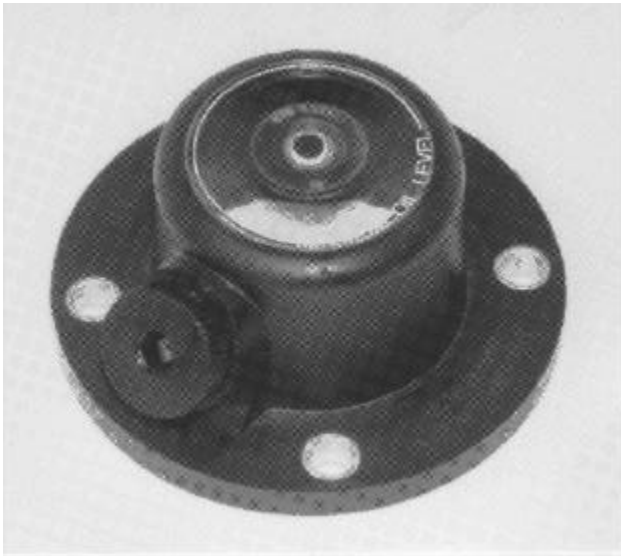


Figure 10 New Style Hub Cap - June, 1995 and Later

Figure 11 is for 9,000 - 20,000 lb. axles manufactured August 1993 and after.



Figure 11 Hub Cap, 1993 and Later

Operation

During normal vehicle driving, the lube and air inside the hub/wheel cavity expands, and if not vented causes pressure build-up in the wheel cavity resulting in accelerated seal wear.

The vent plug has a slit in it to allow the pressure in the hub/wheel cavity to be maintained in a safe operating range. International uses the slit type of venting because it allows less contamination (moisture, dust, etc.) to get into the hub/wheel cavity during normal operation, including chassis cleaning operations.

As the air and oil expand, an oil/air mist is expelled through the vent. It is normal for a slight film of oil to be present on the outside of the hub cap around the vent slit or hole.

Maintenance

Over a period of time, if not wiped off, the film of oil that gathers around the vent slit or hole may collect dust and become unsightly.

If the hub cap is not routinely cleaned, a slight film of oil can collect dirt around the rubber fill plug and face which could be perceived as a leak. Furthermore, routine cleaning ensures that the lube level can be easily observed through the clear window as intended.

NOTE – Do not clean the hub cap with a high pressure cleaner as cleaning fluid, water and/or steam may be forced through the vent and contaminate the oil.

In a case where the window is clear on the outside but discolored on the inside from the type of lubricant used, the lube level may be checked by removing the rubber vent plug and inserting a finger through the hole in the face plate.

The specified lube level for clear window type hub caps is from the minimum line to 5/16 inch above the minimum line.

If the lube level should suddenly drop below the minimum level indicator during inspection intervals, it is an indication that there may be a possible leak problem. Take the following steps:

1. Inspect the area around the gasket to determine if the gasket is leaking. A dry hub cap and a wet area around the gasket indicate the gasket could be leaking or the hub cap mounting bolts may be loose.
2. Check to be sure the mounting bolts are tight. Torque should be 16 to 20 ft-lbs. (13.5 to 27 N·m).
3. Inspect for a leaking wheel seal.
4. Check the rubber vent for nicks or other damage that could cause leakage between the rubber plug and the outer edge of the plug opening.
5. Replace any defective parts as required.
6. If there is no leak, add same lube as used in hub to raise level to MIN line. **Do not** exceed 5/16 inch above MIN line.
7. If these steps do not reveal leakage, the hub cap can be pressure checked to determine if it is leaking between the clear window and the hub cap body.

Leakage Test Procedures

1. Remove the hub cap from vehicle and mount securely to a flat plate with silicone or similar sealer between the hub cap mounting surface and the plate.

NOTE – It is best to remove the hub cap from the vehicle before pressure checking. Air pressure inside the hub could cause some wheel seals to move, thus causing premature seal wear.

2. Thoroughly clean the hub cap and the area around the mounting surface with a hot water/soap solution.
3. Remove the threaded fill plug in the side of the hub cap.
4. Screw an air line adapter in the fill plug hole. The standard aluminum International hub cap is tapped with 3/8-18 NBTF threads.
5. Connect a pressure regulator (1 - 10 PSI) and control valve to the adapter.
6. Apply a soap and water solution to entire hub cap body and around mounting flange.
7. Hold finger or thumb over slit in rubber vent plug or hole in clear face.
8. **Slowly** open air valve and raise pressure to 10 PSI.
9. Check for air leaking between face and body or around rubber vent and face. There should be no air escaping from these two potential leak areas.
10. If air escapes between window face and body, discard the hub cap.
11. If air escapes between rubber vent and/or face/body interface area, replace rubber vent plug or hub cap as necessary.
12. If air escapes between hub mounting face and cap, install new gasket, and check cap for warpage. If cap is warped, replace cap.

3. WHEEL BEARING ADJUSTMENT

Satisfactory wheel seal operation as well as long bearing life depends on correct wheel bearing installation, cleanliness, lubrication and adjustment. The following will help you perform these required services for front wheels and hubs.

Wheels or hubs, bearing cups, locking nuts, washers, hub caps, and spindles are to be clean from any foreign matter. Bearings must be pre-lubed before installation. Refer to GROUP 10 - LUBRICATION in the CTS-5000 Master Service Manual for the proper lube specifications.

NOTE – If new bearing(s) are being installed, the new bearings must be seated to insure maximum service reliability. After the bearing and hub are assembled on the spindle, install the bearing adjustment nut. Tighten the adjustment nut to 120 to 140 ft-lbs. (163 to 190 Nm) while rotating the hub to seat the bearing. Back off the adjusting nut 1/2 turn and follow the procedure below.

3.1. BEARING END PLAY CHECK PROCEDURE

This procedure is done with vehicle on floor stands.

The bearing must be fully installed before checking end play (cotter key installed or jam nut jammed). Use a dial indicator to measure hub end play (Figure 12) with respect to the spindle.

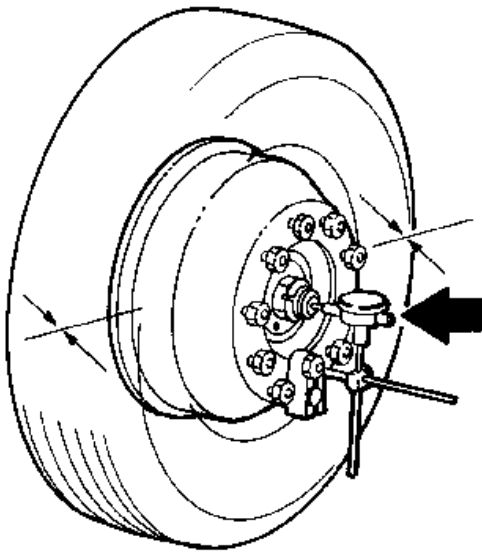


Figure 12 Measuring Hub End Play

When servicing the hub assembly, check the bearing end play before the brake drum and wheels are installed.

Mount the dial indicator at the bottom of the wheel (remove hub cap or axle shaft if installed), or on the drum or hub as illustrated in Figure 12 . Grasp drum, hub or tire at 3 o'clock and 9 o'clock position. First push, then pull evenly on the drum hub or tire to measure the amount of end play. Note total indicator reading.

The bearing adjustment procedures are intended to result in .001 to .010 inch (.0254 to .254 mm) end play with no preload. However, for longer seal life, the .001 to .005 inch (.0254 to .1270 mm) end play (clearance) should be strived for (measured after the jam nut is torqued).

3.2. AXLE JAM NUT INSTALLATION PROCEDURE

Front Axle Jam Nut Installation (Double Nut Figure13, Figure 14, Figure 15 and Figure 16

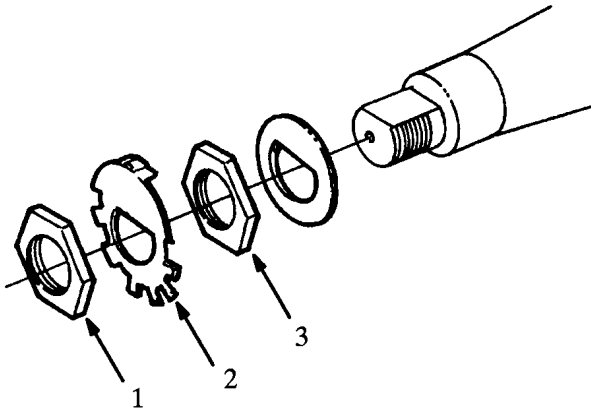


Figure 13 Bend Lockwasher Type

1. JAM NUT
2. LOCKING WASHER
3. ADJUSTING NUT

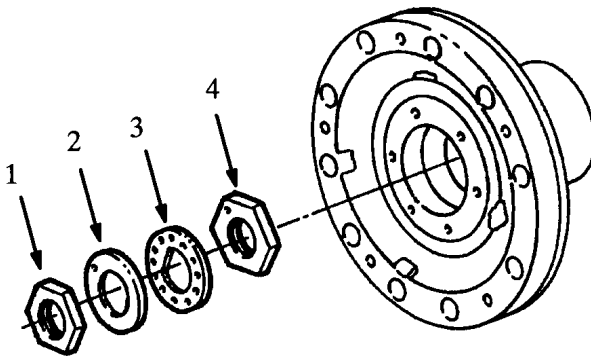


Figure 14 Doweled Adjusting Nut Type

1. JAM NUT
2. JAM NUT LOCKING WASHER
3. PIERCED LOCK RING
4. ADJUSTING NUT

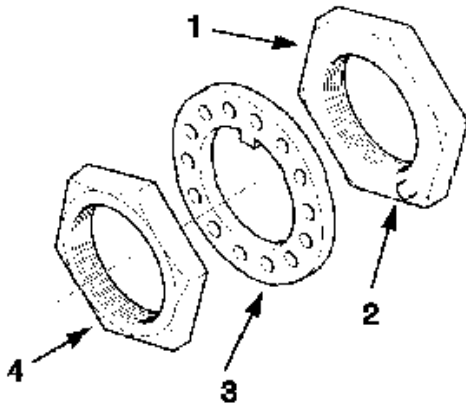


Figure 15 Dowel-Type Spindle Nut Washer

1. WHEEL BEARING ADJUSTING NUT (INNER)
2. DOWEL PIN
3. SPINDLE WASHER
4. OUTER NUT

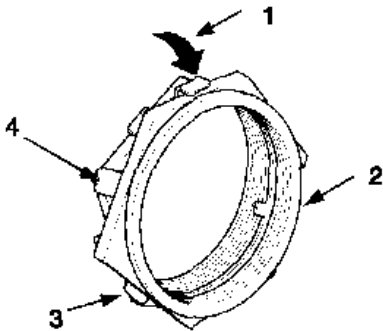


Figure 16 Tang-Type Spindle Nut Washer

1. BEND TANGS PERPENDICULAR TO CLOSEST FLAT
2. WHEEL BEARING ADJUSTING NUT (INNER)
3. OUTER NUT
4. NUT LOCK

1. Install the wheel hub, bearings, and inner nut on the spindle, and rotate the wheel and hub assembly while tightening the inner nut to 50 ft-lbs. (68 N·m).
2. Back off adjusting nut 1/4 turn.
3. Install the locking washer.

With a doweled adjusting type nut, install lockwasher. If dowel on adjusting nut does not line up with hole in lockwasher, back off adjusting nut until the dowel fits into the nearest hole.

4. Install the jam nut and tighten to 100 - 150 ft-lbs. (136 - 203 N·m).

5. Bend lock over one flat of jam nut. This applies to both round or tab type locks.
6. Install hub cap, gasket and bolts. Tighten bolts to 16 to 20 ft-lbs. (13.5 to 27 N·m).

3.3. TYPES OF COTTER KEY LOCK INSTALLATION

Front Axle Single Nut with Stamped Locking Device or Castellated Nut (Figure 17 and Figure 18)

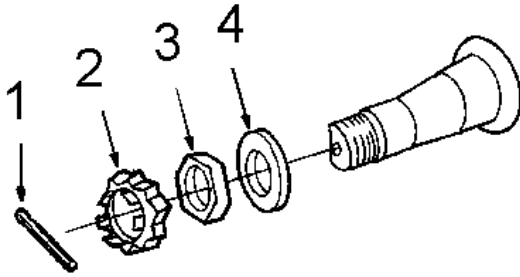


Figure 17 Stamped Locking Device

1. COTTER KEY
2. STAMPED WHEEL BEARING ADJUSTER NUT RETAINER
3. ADJUSTING NUT
4. BEARING RETAINER WASHER

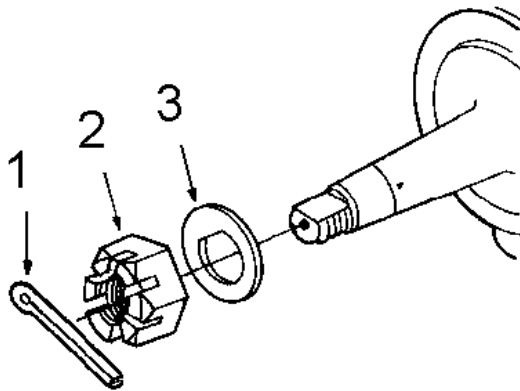


Figure 18 Castellated Nut

1. COTTER KEY
2. CASTELLATED NUT
3. BEARING RETAINER WASHER

1. After wheel hub, bearings and adjusting nut are installed, rotate the wheel and hub assembly while tightening the adjusting nut or castellated nut to 50 ft-lbs. (68 N·m).

NOTE – If new bearing(s) are being installed, the new bearings must be seated to insure maximum service reliability. After the bearing and hub are assembled on the spindle, install the bearing adjustment nut. Tighten the adjustment nut to 200 ft-lbs. (271 N·m) while rotating the hub to seat the bearing. Back off the adjusting nut 1/2 turn and follow the BEARING END PLAY CHECK PROCEDURE.

2. Back off the adjusting or castellated nut 1/8 turn.
3. Install the stamped adjuster nut retainer over the adjusting nut. The retainer can be installed in a number of positions and should be installed so the cotter key can be installed without rotating the adjusting nut. If the stamped retainer cannot be installed in any position, **back the nut off** slightly to allow the stamped locking device to be installed.

The castellated nut is secured with a cotter key through the castellated portion of the nut and one of the two holes drilled in the spindle. If the cotter key does not align with the hole in the spindle (either horizontal or vertical), **back off** the nut to the first position in which the cotter key can be installed.

4. Install the cotter key. A correctly installed cotter key should have the appearance as shown in Figure 19.

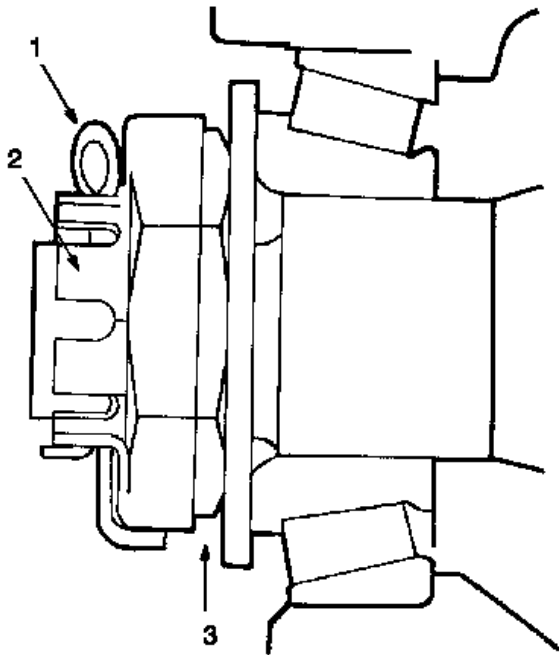


Figure 19 Correctly Installed Cotter Key

1. COTTER KEY
2. STAMPED ADJUSTER NUT RETAINER
3. ADJUSTING NUT

5. Install hub cap, gasket and bolts. Tighten bolts to 16 to 20 ft-lbs. (13.5 to 27 N·m).
6. Remove floor stands.

4. WHEEL SEALS

To insure satisfactory performance of wheel seals, various precautions are necessary whether the vehicle is equipped with grease or oil lubricated wheel bearings.

Always replace wheel seals whenever the wheel and hub assembly is removed.

Due to various types of wheel seals, it is important that the seal installation and position be checked at the time of disassembly to be assured that the new seals are properly installed.

The types of wheel seals used are designed to be used with grease packed wheel bearings and oil lubricated wheel bearings.

NOTE – When installing seals, use the proper installation tool. These tools are supplied by the seal manufacturer. Also, refer to SPECIAL TOOLS.

NOTE – Before installing a new seal, check seal for damage that may have been caused during shipping and handling.

4.1. GREASE LUBRICATED WHEEL BEARINGS

For the most part, the seals used with grease lubricated wheel bearings will be of the lip type seal similar to that shown in Figure 20 . The seal is installed with lip toward the inner wheel bearing. The unitized seal is also used with grease lubricated bearings.

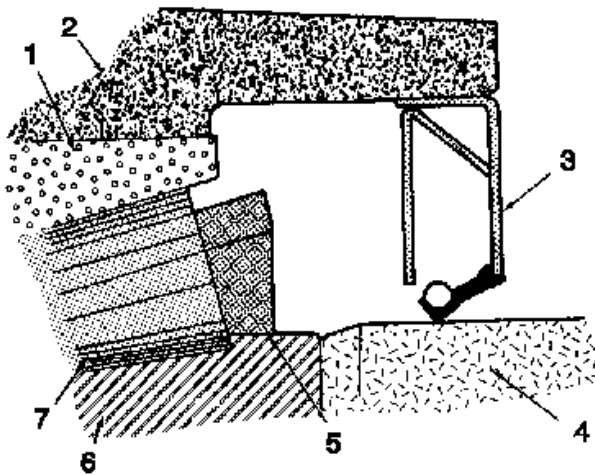


Figure 20 Lip Type Seal

1. BEARING CUP
2. HUB
3. LIP TYPE WHEEL SEAL
4. AXLE
5. BEARING CAGE
6. BEARING CONE
7. BEARING ROLLERS

4.2. OIL/GREASE LUBRICATED WHEEL BEARINGS

Different types of oil lubricated wheel bearing seals are used:

- Hub Installed Unitized Seals
- Spindle Installed Two-Piece Seals.

Hub Installed Unitized Seals

The outer shell of the seal being press fit in the wheel hub rotates with the wheel around the sealing element which is press fit on the axle spindle. When replacement is made, the worn surface being created by the sealing lip is also replaced by virtue of a new seal (Figure 21).

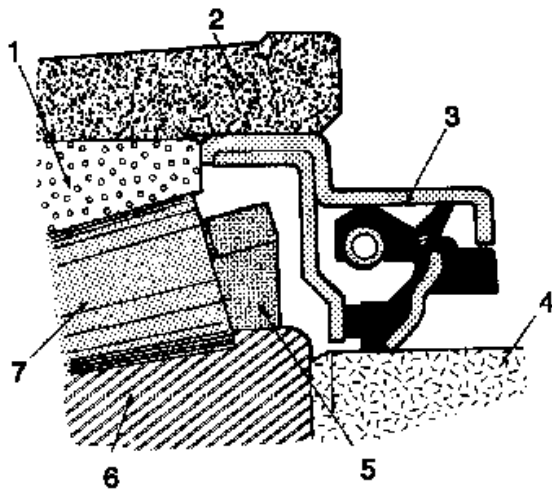


Figure 21 Hub Installed Unitized Seal

1. BEARING CUP
2. HUB
3. SEAL ASSEMBLY
4. AXLE
5. BEARING CAGE
6. BEARING CONE
7. BEARING ROLLERS

In other words, the Hub Installed Unitized Seal turns within itself and no moving part touches the spindle sealing surface.

Spindle Installed Two-Piece Oil Seals

The rubber encased lip type seal with axle installed wiper ring has direct contact between the seal and wiper ring. The wiper ring provides a smooth contact for the lip of the seal. The lip of the seal retains the oil in the bearing cavity. The rubber encasement has ribs around its circumference which retains the seal in place in the hub. Pay special attention to the installation of this seal (Figure 22).

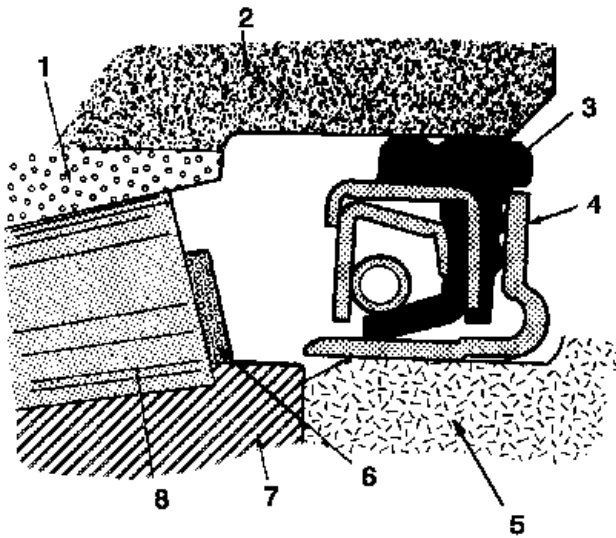


Figure 22 Two-Piece Oil Seal

1. BEARING CUP
2. HUB
3. SEAL ASSEMBLY
4. WIPER RING WITH GRIT GUARD
5. AXLE
6. BEARING CAGE
7. BEARING CONE
8. BEARING ROLLERS

4.3. REMOVE

Hub Installed Unitized Seals

Wheel, hub and drum assembly removed.

The wheel seals are removed using a brass drift and hammer. Position the drift through the outer opening of hub and against the inner bearing. Tap bearing and seal out through the brake drum side of hub. Take care so that seal bore is not damaged.

NOTE – Never use a steel punch to remove inner bearing and seal. Possible damage to the bearing or seal bore may occur and the bearing and cup will have to be replaced.

Spindle Installed Two-Piece Seal

Wheel, hub and drum assembly removed.

If outer seal assembly is still in the hub, then remove seal and inner bearing as described above.

Remove inner bearing from spindle. Use a small hammer to tap seal off the wear ring. To remove the seal wear ring, use a ball peen hammer to tap in several places around the wear ring. This action will expand the wear ring, then it can be removed from the spindle.

Do not use a chisel to cut the ring since the chisel could damage the machined surface of the spindle.

4.4. CLEAN AND INSPECT

The contact surfaces where the new seal will be installed must be free from rust, scale, old sealant, nicks, burrs, and any roughness that would prevent a good seal. Clean contact surfaces with scrapers that are softer than the hub material to avoid scratching the hub or seal bore. When cleaning aluminum hubs, use non-metallic scrapers to prevent damage.

Inspecting and Preparing the Hub Bore

1. Inspect the bore into which the seal fits. Check for nicks or gouges that could cause leakage. Sharp corners at the bore entrance can score the seal O.D. when it is pressed in and can cause oil leakage (Figure 23).

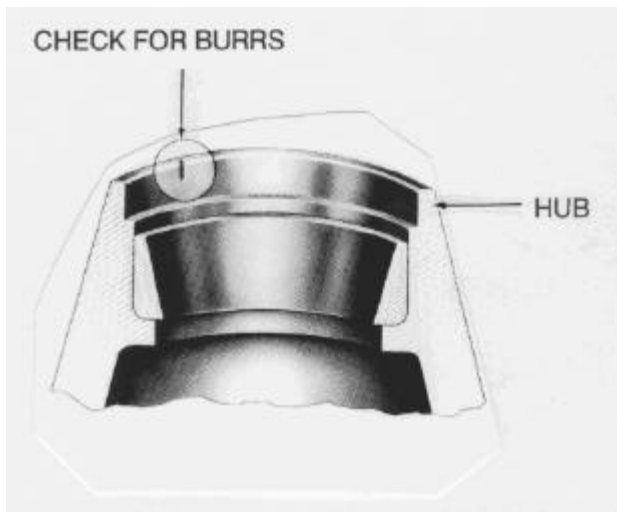


Figure 23 Check for Burrs at Bore Entrance

2. Remove any rust, scale, old sealant, and roughness with a scraper. Then use fine emery or crocus cloth for a final cleaning. If there are any deep grooves, fill them in with a hardening gasket material. Redress the filled area with emery or crocus cloth.
3. Sharp edges on the bore entrance should be chamfered or rounded off with a scraper, then carefully smoothed with an abrasive cloth.
4. Thoroughly clean and dry the entire area. Make certain it is completely free of dirt, grit, chips or other abrasives which will score or mar the seal's outer surface and cause leakage.
5. Be sure all oil is removed from the lubricant cavity. Wipe the cavity clean using a clean, dry cloth.
6. Inspect for porous or cracked hub which could allow oil leakage. This is important where leakage has been encountered.

Inspecting and Preparing the Spindle

1. Thoroughly clean the spindle with solvent and a clean, dry shop rag, then examine the spindle for flaws.
2. Remove any rust, old sealant, and roughness with a scraper and use crocus cloth to polish the spindle area that contacts the sealing surface. Fill deep scratches or chisel marks with a hardening gasket material and redress the damaged area. Clean all threads and keyways thoroughly with a wire brush to avoid false bearing adjustment and to avoid introduction of contaminants into the lubricant cavity.

3. Wipe the entire spindle surface with a clean, dry cloth, making certain the spindle is completely free of dirt, grit, chips or other abrasives which could damage the seal's inner surface and cause oil leakage. Clean all threads and keyways.
4. Replace all parts as necessary.

4.5. INSTALL

Spindle Installed Two-Piece Seal

IMPORTANT – The care with which the two-piece seal is installed cannot be over-emphasized. Pay close attention to the following instructions and use proper installation tools.

1. Apply a thin coat of Gasket Eliminator to shoulder of the spindle. Place the seal assembly on the spindle so the words "DRY SIDE" face toward the brake backing plate. A slight step in the inside diameter of the seal will allow it to be placed by hand approximately 1/8 inch onto the shoulder of the spindle (Figure 24 and Figure 25).

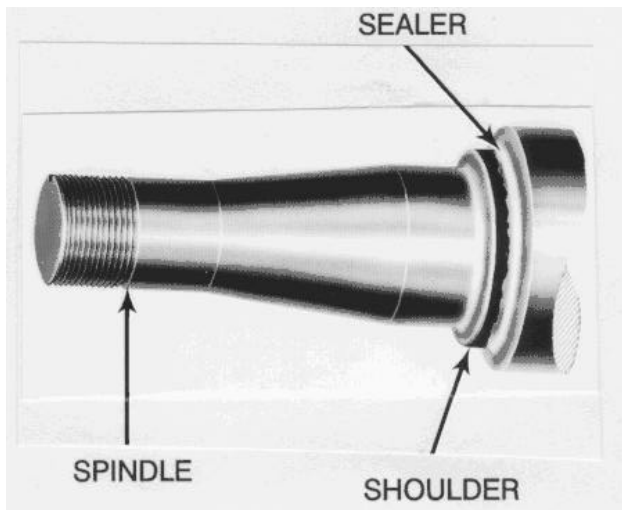


Figure 24 Sealer on Two-Piece Seal



Figure 25 Placing Seal on Spindle

NOTE – Do not install seal into hub bore.

2. Place recommended installation tool over the end of spindle. Use a 3 to 5 pound hammer to strike the end of the tool until the tool bottoms against the spindle shoulder. After bottoming, rotate the tool while applying several light blows with the hammer to insure that the seal I.D. is flush and square with the face of the shoulder. Wipe clean any excess sealant (Figure 26).

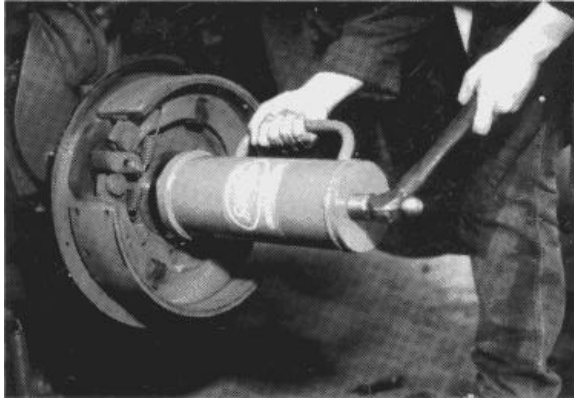


Figure 26 Wipe Clean Excess Sealant

3. Check to make sure that the seal I.D. is installed flush with the face of the shoulder within .005 inch (.127 mm) (Figure 27).

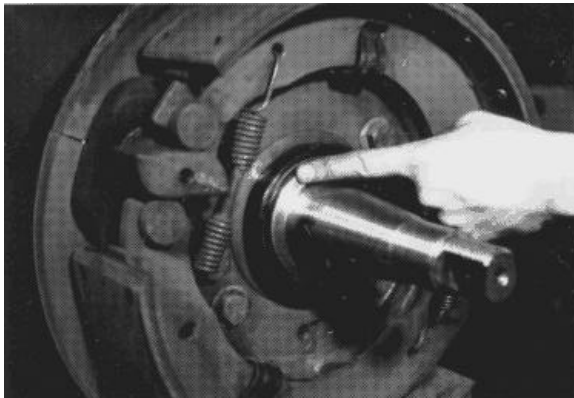


Figure 27 Seal I.D. is Flush With Shoulder

4. Install pre-lubed or grease packed inner bearing in position on the spindle. No additional lubrication is required (Figure 28).

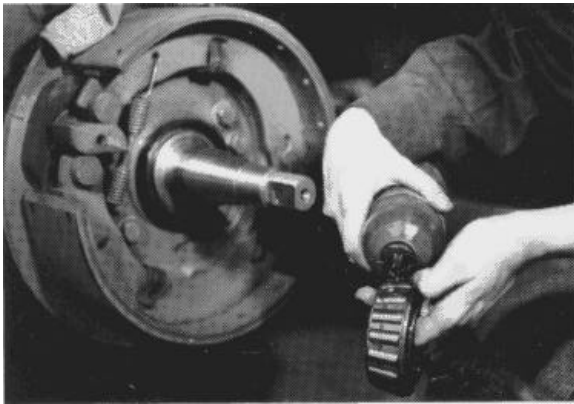


Figure 28 Install Pre-lubed Bearing

5. Install wheel, hub/drum assembly. Using wheel dolly, push wheel assembly onto spindle until it contacts the seal (Figure 29).



Figure 29 Install Wheel, Hub/Drum Assembly

NOTE – Do not push the wheel assembly onto the seal by hand. The seal will be pushed into the hub when the outer bearing and adjuster nuts are installed and adjusted.

6. Prelube outer wheel bearing. Install outer bearing, adjusting nuts, and washer. Adjust bearings. Refer to WHEEL BEARING ADJUSTMENT for proper specifications.

Hub Installed Unitized Seal

1. Apply a thin coat of Loctite Gasket Eliminator (purple) to the hub seal bore. The coating must be very light, yet cover the press fit area. Gasket eliminator should never be allowed to contact lip of seal.

2. Install prelubed or grease packed inner bearing in hub bore as described in INSTALLATION (WHEEL BEARINGS-OIL LUBRICATED).
3. To install seal, place outer face of seal in the recess of the selected tool adapter (Figure 30).

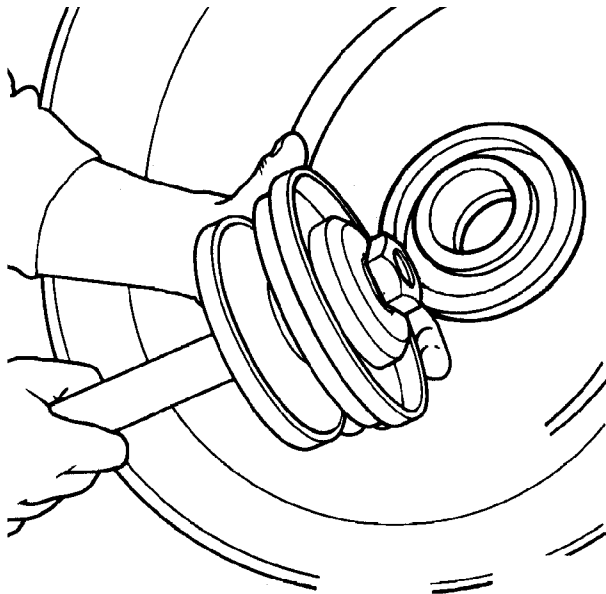


Figure 30 Seal In Recess of Tool Adapter

4. Install tool, centering into the bore of inner bearing cone (Figure 31). Start seal into bore. Be sure seal is not cocked; tap tool handle lightly to start seal into hub bore. Check to see that seal is not cocked.

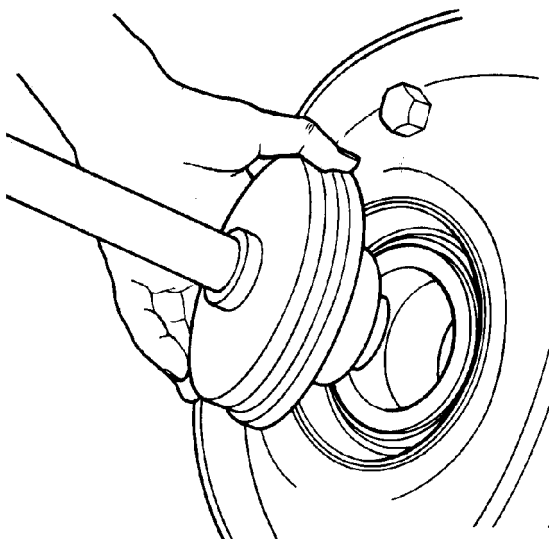


Figure 31 Install Tool, Centering Into Bore

5. Hold tool handle straight and firmly, and strike tool handle until the sound of impact changes when seal is seated (Figure 32). Check seal to be sure it is uniformly seated but not crushed. Also check bearing for free movement. Remove excess sealant.

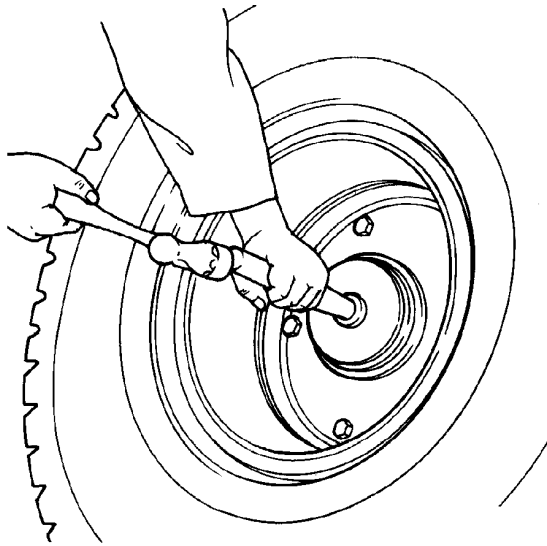


Figure 32 Seating Seal in Hub Bore

IMPORTANT – Any time wheel is removed with a Unitized Seal, the seal should be replaced.

A good check of proper seal installation is to move the I.D. portion that grips the spindle with your fingers after installation in wheel hub. There should be slight in and out movement present.

6. Install wheel, hub/drum assembly. Adjust wheel bearings. Refer to WHEEL BEARING ADJUSTMENT.

Lip Type Seal

1. Apply a thin coat of Gasket Eliminator on hub seal bore. The coating must be very light, yet cover press fit area. Gasket Eliminator should never be allowed to contact lip of seal nor contaminate oil.
2. Lay wheel flat with brake drum up. Place prepacked inner wheel bearing into bearing cup and place hub seal into starting position on hub.
3. Install hub seal using seal installer set to prevent cocking seal (Figure 33). Select the size disc which will apply force to outer edge of hub seal and prevent seal from becoming distorted or damaged.

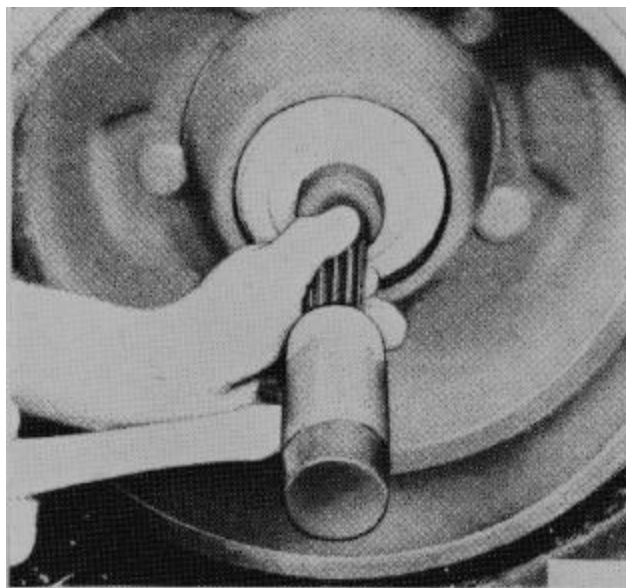


Figure 33 Using Seal Installer

4. Drive hub seal into hub until it bottoms in hub bore. Do not continue to drive after seal is once seated as this will distort or damage the seal. After removal of seal installer tool, clean off excess Gasket Eliminator. Be sure to confirm uniform seating of seal (Figure 34).

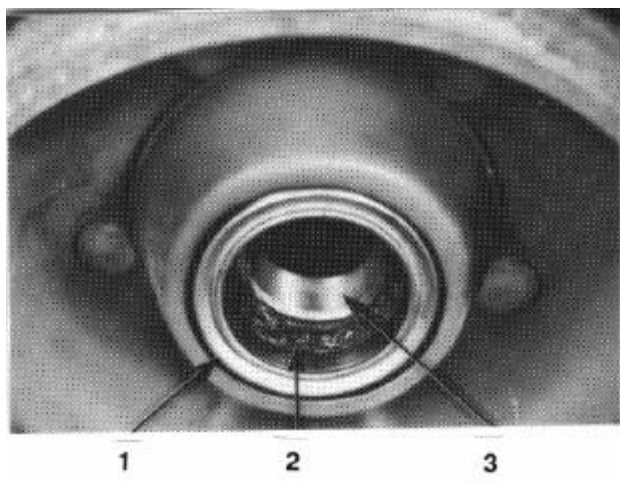


Figure 34 Confirm Uniform Seating of Seal

5. Install wheel, hub/drum assembly. Adjust wheel bearings. Refer to WHEEL BEARING ADJUSTMENT.

5. HUB ASSEMBLY

5.1. CLEAN AND INSPECT

Clean hub with mineral solvent and air pressure dry. Check assembly for:

1. Worn Stud Holes (Figure 35). This condition is caused by stud turning in the hole because of insufficient torque on the inner nut (stud). Replace hub.

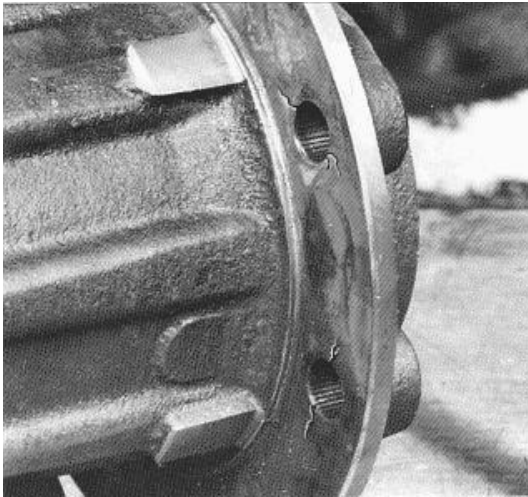


Figure 35 Worn Stud Holes

2. Worn Mounting Face (Figure 36). This condition is caused by a loose wheel assembly with outboard mounted drum. The outer mounting face of the brake drum is worn. Replace hub or brake drum.

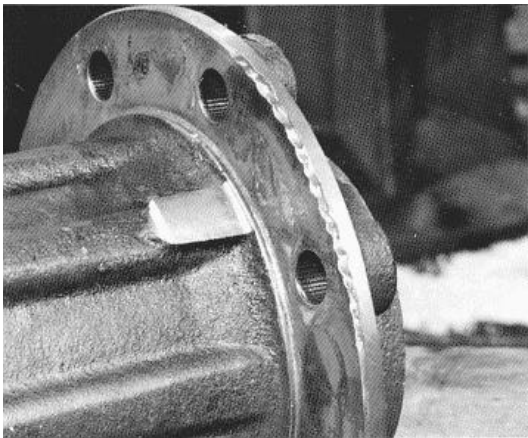


Figure 36 Worn Mounting Face

3. Broken or Stripped Threads Wheel Stud (Figure 37 and Figure 38). Replace studs.

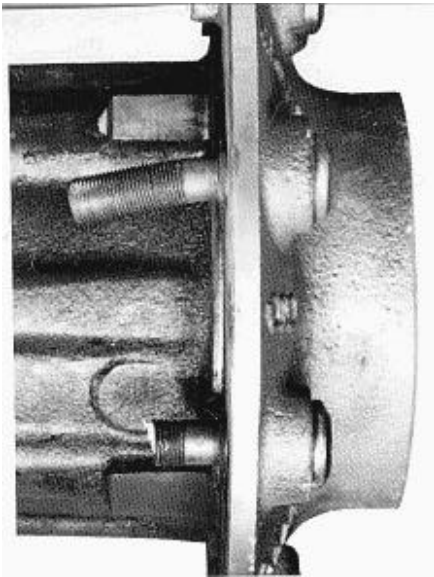


Figure 37 Broken Studs

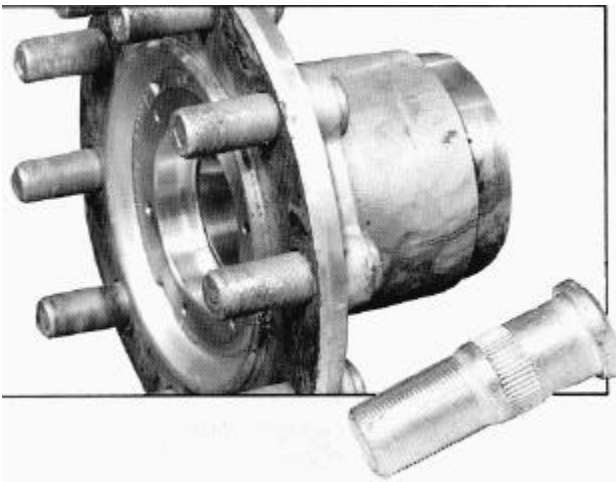


Figure 38 Stripped Threads

4. Porous Condition Where Leakage May Occur. Replace hub.
5. Bent Hub Face (Figure 39). This condition can be caused by wheels running loose for an extended period of time. Continual retightening of wheel nuts is an indication of bent hub; hub should be checked. If there is more than a 1/32 inch gap as shown in Figure 39 , replace hub.

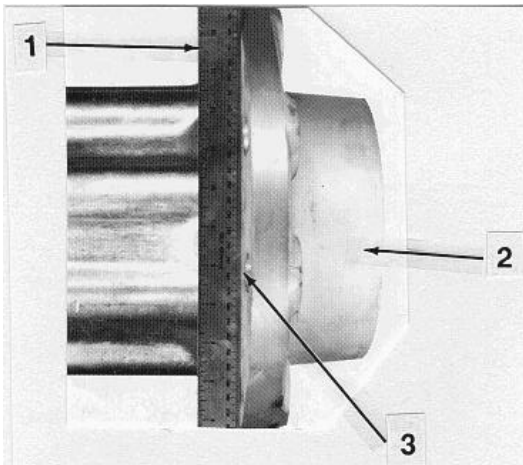


Figure 39 Bent Hub Face

- 1. STRAIGHT EDGE
- 2. HUB
- 3. GAP BETWEEN HUB FACE AND STRAIGHT EDGE

- 6. Abused Hub (Figure 40). This condition is caused by overloading, improper tire changes, hitting curbs at high speeds, or hitting curbs at sharp angles.

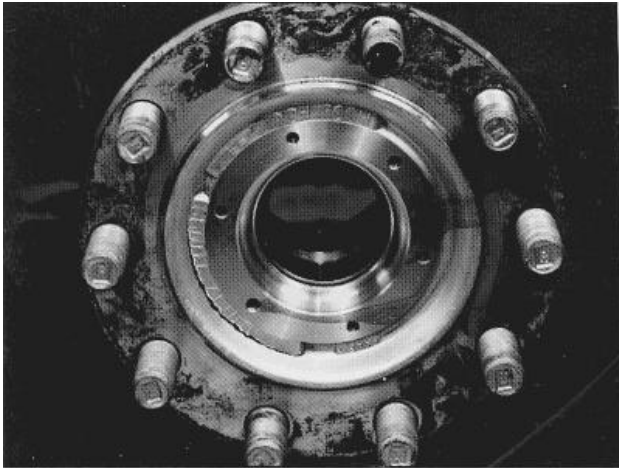


Figure 40 Abused Hub

- 7. Dirty hub. Clean aluminum hub with a wire brush (Figure 41).

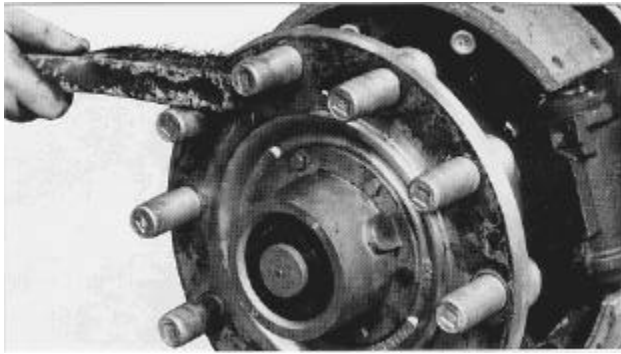


Figure 41 Cleaning Aluminum Hub

5.2. HUB ANTILOCK BRAKE SYSTEM (ABS) AIR BRAKES

Exciter Ring (Figure 42 and Figure 43)

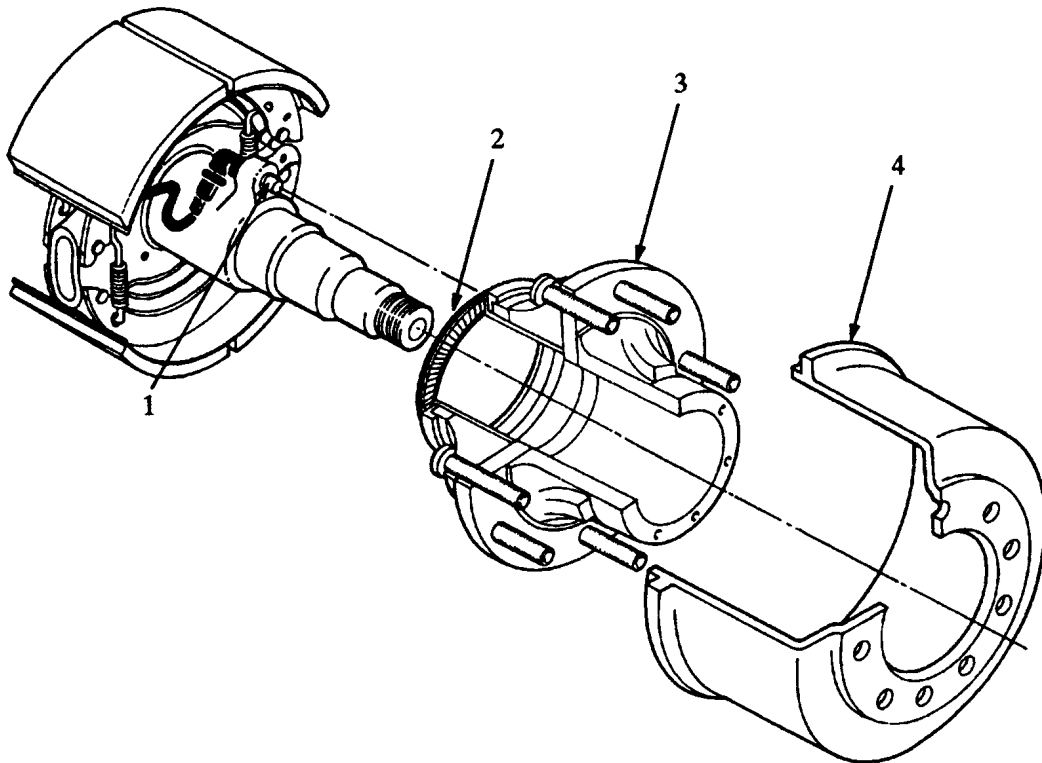


Figure 42 Exciter Ring Installed

1. WHEEL SENSOR
2. EXCITER RING
3. HUB
4. BRAKE DRUM

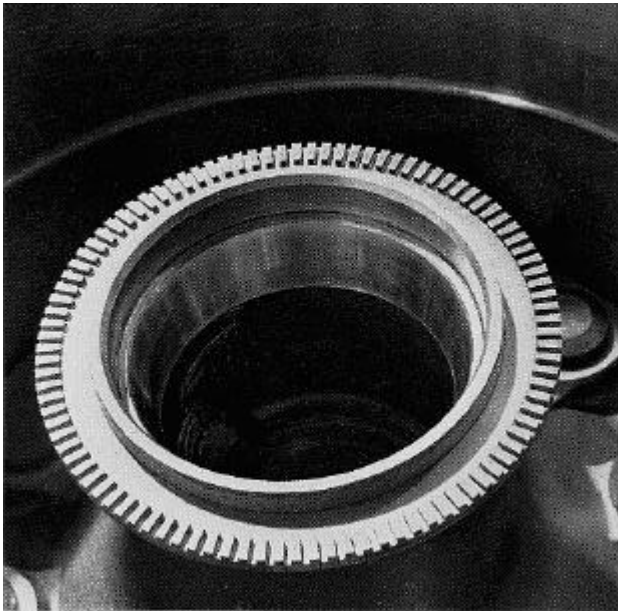


Figure 43 100 Equally Spaced Teeth

The exciter ring is machined to close tolerances and has 100 equally spaced teeth (Figure 43). The ring is heated and then installed onto the wheel hub assembly. Then as the exciter ring cools, it shrinks on the mating surface of the wheel hub. The signal is transmitted from the sensor to the ABS electronic control unit.

Inspection

Inspect the exciter rings for damage by removing the brake drum from the wheel hub. If damaged, the exciter ring should be replaced. Observe the exciter ring, noting that it is properly seated on the wheel hub. To inspect for exciter ring runout with respect to the installed sensor, (with drum removed) push the sensor in against the exciter ring.

Using a feeler gauge, slowly rotate the wheel hub observing the clearance between the exciter ring and the sensor. The gap must be between 0 and 0.025 inch for proper signal output.

Remove and Install

1. Exciter Ring - To remove the exciter ring, first remove the brake drum from the wheel hub. Then remove the hub from the vehicle. Using a suitable puller, lightly heat the exciter ring to expand it and remove from wheel assembly.
2. To install the exciter ring on the wheel hub, uniformly heat soak the exciter ring to a temperature of approximately 200°F. It is recommended that the exciter ring be heated by placing it in a 200-degree-Fahrenheit (approximate) bath (water or oil) until the desired temperature is achieved. Then install the exciter ring onto the wheel hub, taking care to fully seat the exciter ring, then allow the exciter ring to cool and "shrink fit" on the wheel hub.

<p>CAUTION – Do not heat with a torch as the exciter ring may develop hot spots, causing the exciter ring to distort.</p>
--

3. Install the hub to the axle (less the brake drum) and adjust the wheel bearings. Refer to WHEEL BEARING ADJUSTMENT. The bearing end play should not exceed .005 inch. Install the sensor and then inspect for runout as described in INSPECTION. Install the brake drum after the inspection is complete.

5.3. HUB WHEEL STUD(S)

Disc Type Wheel - Remove

With hub assembly off vehicle wheel(s) and outboard mounted brake drum removed:

1. Place hub or hub with inboard mounted brake drum on press table and secure properly.
2. Using suitable adapters, press out damaged stud(s).

Disc Type Wheel - Install

1. Invert hub assembly and properly secure on press table.
2. Using suitable adapters, press in new stud(s).

NOTE – If replacing hub with new hub, it is recommended that all new wheel studs be installed.

5.4. CAST SPOKE TYPE WHEEL STUD(S)

To replace wheel studs on cast spoke wheel, the wheel assembly does not have to be removed.

Remove

1. Remove tire/rim. Refer to GROUP 17 - RIMS, WHEELS AND TIRES in the CTS-5000 Master Service Manual.
2. Use a stud extractor to remove broken stud. If stud is broken with very little of the stud showing, the stud will have to be drilled and extracted using an easy out tool.

Install

1. Start stud into wheel hub spoke by hand.
2. Start wheel nut onto stud until it is almost bottomed.
3. Start second nut onto stud and tighten (lock) with first nut.
4. Turn second nut with tool until stud bottoms into hub spoke.
5. Break two nuts loose and remove nuts.

5.5. REPLACE HUB

To replace old hub with new hub, it is recommended that all new wheel studs be installed. Refer to wheel stud, install described in above steps. If the old bearings are in good condition and are to be re-used, refer to BEARING CUP (RACE).

6. LUBRICATION

Wheel bearings will either be grease or oil lubricated. Refer to the GROUP 10, LUBRICATION in the CTS-5000 Master Service Manual for the correct type of lubricant to use.

6.1. GREASE LUBRICATED

1. Pressure lubricate inner and outer bearing assemblies so that grease is forced between the cone and cage until grease is expelled between the cage and rollers.
2. Apply grease to wheel or hub cavity so that it is even with inside diameter of bearing cups.
3. Assemble bearings and seal as described in section, INSTALL SEALS.

7. WHEEL BEARING SEAL AND BEARING HUB CAP TROUBLESHOOTING CHART

Prior to replacing a leaking wheel seal or front wheel hub cap/gasket, the actual cause of the leakage should be diagnosed to insure that the leakage problem will not reoccur.

You will note that the chart has four categories where the leakage could occur; do not overlook any of the categories.

7.1. TROUBLESHOOTING CHART

Table 1 Troubleshooting

Condition	Remedy
Hub and Bearings	
Wheel Hub Bore has Burrs, Rust or Nicks	Hub must be smooth and free of excessive rough finish which could cause damage to outside diameter of seal. Clean up if possible, or replace hub.
Hub Bore Diameter	Seal should be press fit. Check for correct application of seal.
Porous or Cracked Hub	Leakage which would appear at the hub (not at bearing cap) is an indication of a possible crack or porous opening allowing lube leakage. To correct this condition, a new hub must be installed.
Loose Wheel Bearing Adjustment	Loose wheel bearing adjustment will permit side movement of seal and cause abnormal wear or shaft bore misalignment. Oil pumping past seal will result. Set and maintain proper wheel bearing adjustment. Adjusting wheel bearings too tight can cause early bearing failure.
Spindle	
Spindle has Burrs or Nicks	Remove all burrs and nicks. Correct rough finish. Do not use chisel to remove wiper ring (wear sleeve).

Table 1 Troubleshooting (cont.)

Condition	Remedy
Cosmolene on Spline	Thoroughly clean all cosmolene from sealing surfaces and bearing shoulder.
Wheel Seal	
Seal Cocked or Not Properly Seated in Hub	Be sure to conform uniform seating of seal after installation. Use proper installation procedures.
Inside and Outside Diameter Damaged on Unitized Seals	New seal could have been damaged prior to installation. Inspect hub seal bore and spindle for burrs and nicks. Smooth with an emery cloth if necessary. Seal can also be damaged due to abuse during installation of hub assembly by contact with spindle, or threads.
Worn or Damaged Wiper Ring on Two-Piece Seal	Normal wear of seal lip ring contact area or improper installation of seal. Replace seal using correct installation tools.
Seal Loose or Too Tight in Hub Bore	Check for correct application of seal assembly.
Sealant Not Applied to Seal Outside Diameter When Required	Use Gasket Eliminator when instructed to do so.
Brake Camshaft Seal Leakage	Excessive lubrication of brake camshaft can cause grease to enter brake groups and may be mistaken for faulty wheel seals. Do not over-lubricate brake camshafts.
Hub Cap Oil/Grease	
Lubricant on Exterior of Hub Cap	Lubricant spillage either at initial fill or lube added. Clean lubricant from grease cap so that it is not mistaken as a faulty sight glass, bearing cap or gasket.
Overfill of Lubricant	Excessive lubricant can cause lube to be expelled from hub cap plug vent. Maintain proper fill level mark on window.
Cracked Housing	Hub cap can be damaged by mishandling or improper tightening of cap bolts. Replace cap if cracked. Tighten cap bolts alternately in a crisscross pattern to 16 - 20 ft-lbs. (13 - 27 N·m).
Sight Glass Cracked or Broken	Sight glass can be damaged through abuse in handling cap or object striking it. Replace hub cap.
Gasket Leaking at Hub or Wheel Mounting Face	Tighten bolts to 16 - 20 ft-lbs. (13 - 27 N·m) alternately in a crisscross pattern. Use proper length bolts and the correct size lockwashers. Replace gasket.
Sight Glass Leaking	Replace cap.
Rubber Vent Plug Not Sealed	After filling with lubricant, be sure the rubber vent plug is seated in cap window.
Threaded Filler Plug Leaking Lubricant	Apply thread sealant pipe thread type to threaded plug. Tighten plug.

SPECIAL SERVICE TOOLS

Special tools can be ordered through PDC.

Special seal installation tools can be ordered from the seal manufacturer.

Table 2 Special Tools

Tool Number	Description
ZTOEM 6233	Bearing and Seal Driver Set
ZTOEM 4185	Universal Bearing Cup Installer
ZTOEM 1027	Universal Dial Indicator Set