

SERVICE MANUAL

SERVICE MANUAL SECTION

HUBS, BEARINGS, AND SEALS

s14001t, Formerly CTS-5137

02/26/1997

Table of Contents

DESCRIPTION.....	1
1. WHEEL BEARINGS.....	5
1.1. INSPECTION.....	5
2. BEARING CUP (RACE).....	8
2.1. REMOVE (CAST IRON HUB ASSEMBLY).....	8
2.2. INSTALL.....	8
2.3. REMOVE (ALUMINUM HUB) (WHEEL ASSEMBLY REMOVED FROM HUB).....	8
2.4. INSTALL.....	9
3. WHEEL BEARING ADJUSTMENT.....	9
3.1. BEARING END PLAY CHECK PROCEDURE.....	10
3.2. REAR AXLE JAM NUT INSTALLATION (DOUBLE NUT).....	10
3.3. AXILOK® UNITIZED SELF-LOCKING WHEEL BEARING ADJUSTING NUT.....	12
Remove.....	13
Install.....	14
4. WHEEL SEALS.....	15
4.1. OIL LUBRICATED WHEEL BEARINGS.....	16
Hub Installed Unitized Seals.....	16
Spindle (Axle Tube) Two-Piece Oil Seal.....	16
4.2. REMOVAL HUB INSTALLED UNITIZED SEAL.....	17
Spindle (Axle Tube) Two-Piece Seal.....	17
4.3. CLEANING AND INSPECTION.....	18
4.4. INSTALL SEALS.....	18
Spindle (Axle Tube) Two-Piece Seal.....	18
Hub Installed Unitized Seal.....	20
5. REAR DRIVE AXLES.....	22
6. HUB ASSEMBLY	24
6.1. CLEAN AND INSPECT.....	24
6.2. HUB ANTILOCK BRAKE SYSTEM (ABS) AIR BRAKES.....	26
Exciter Ring.....	26
Inspection.....	27
Remove and Install.....	28
6.3. HUB WHEEL STUD(S).....	28
Disc Type Wheel - Remove.....	28
Disc Type Wheel - Install.....	28
6.4. CAST SPOKE TYPE WHEEL.....	28
Remove.....	28
Install.....	29
6.5. REPLACE HUB.....	29
7. LUBRICATION.....	29
7.1. STEEL HUB WITH DISC WHEELS.....	29

8. WHEEL BEARING SEAL TROUBLESHOOTING CHART.....	30
9. SPECIAL TOOLS.....	32

DESCRIPTION

Figure 1 , Figure 2 , Figure 3 , Figure 4 and Figure 5 illustrate exploded views of the rear axle hub assembly and brake related components

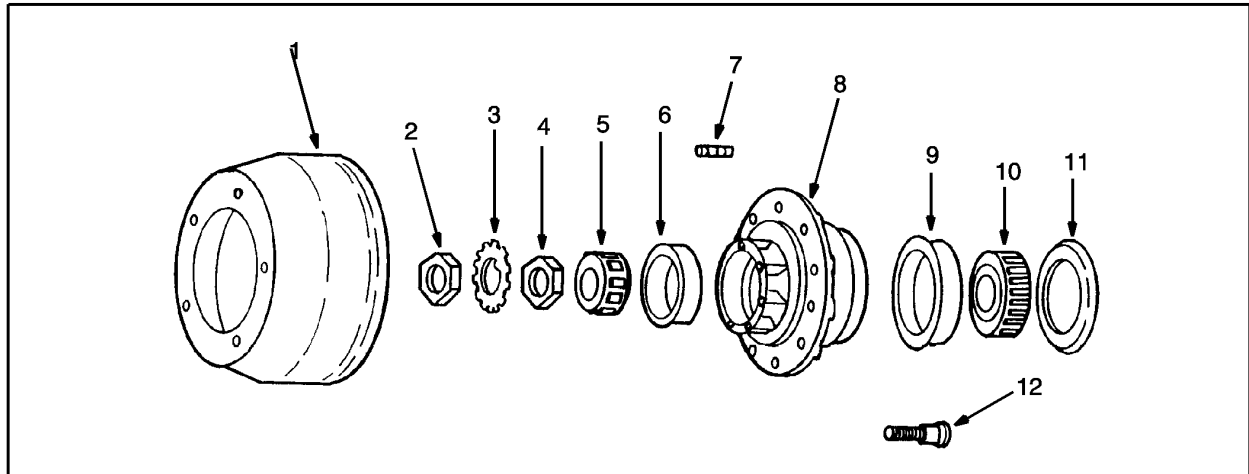


Figure 1 Exploded View of Typical Disc Type Rear Hub Assembly With Outboard Mounted Brake Drum

1. BRAKE DRUM
2. OUTER WHEEL BEARING ADJUSTER NUT
3. WHEEL BEARING ADJUSTER NUT LOCK
4. INNER WHEEL BEARING ADJUSTER NUT
5. OUTER BEARING
6. CUP OUTER BEARING
7. AXLE SHAFT FLANGE STUD
8. HUB
9. CUP INNER BEARING
10. INNER BEARING
11. SEAL/OIL
12. BRAKE DRUM AND WHEEL RETAINING STUD

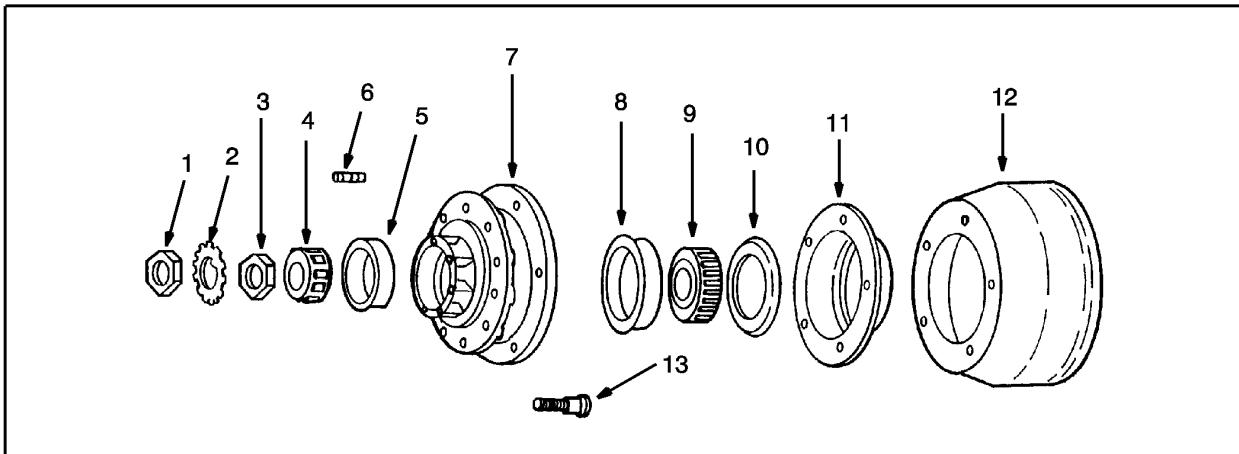


Figure 2 Exploded View of Typical Disc Type Rear Hub Assembly with Inboard Mounted Brake Drum

1. OUTER WHEEL BEARING ADJUSTER NUT
2. WHEEL BEARING ADJUSTER NUT LOCK
3. INNER WHEEL BEARING ADJUSTER NUT
4. OUTER WHEEL BEARING
5. CUP OUTER BEARING
6. AXLE SHAFT FLANGE STUD
7. HUB
8. CUP INNER BEARING
9. INNER BEARING
10. SEAL/OIL
11. SLINGER OIL/GREASE
12. BRAKE DRUM
13. WHEEL RETAINING STUD

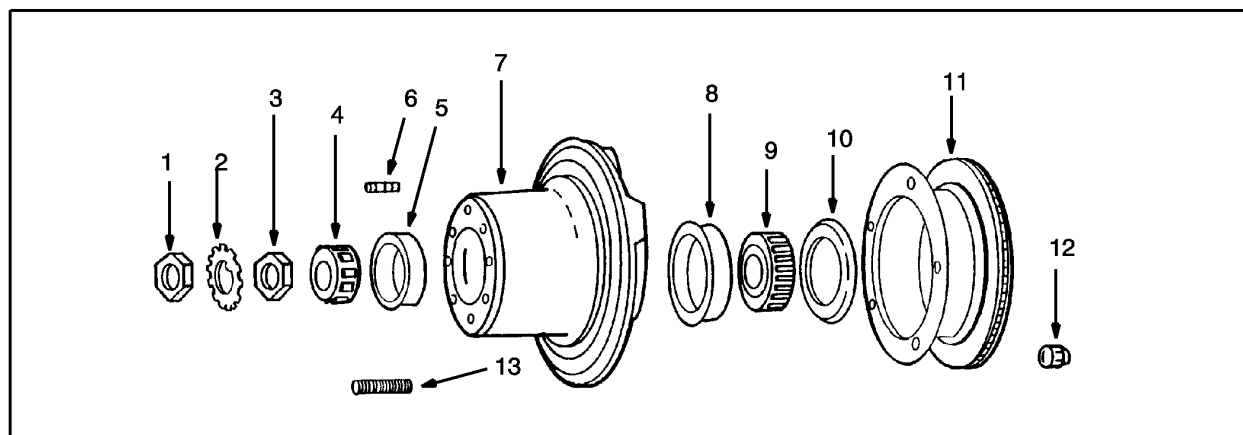


Figure 3 Exploded View of Typical Disc Type Rear Hub Assembly with Disc Brakes

1. OUTER WHEEL BEARING ADJUSTER NUT
2. WHEEL BEARING ADJUSTER NUT LOCK
3. INNER WHEEL BEARING ADJUSTER NUT
4. OUTER WHEEL BEARING
5. CUP WHEEL BEARING
6. AXLE SHAFT FLANGE STUD
7. HUB
8. CUP INNER BEARING
9. INNER BEARING
10. SEAL/OIL
11. BRAKE ROTOR
12. BRAKE ROTOR RETAINING NUT
13. WHEEL AND BRAKE ROTOR RETAINING STUD

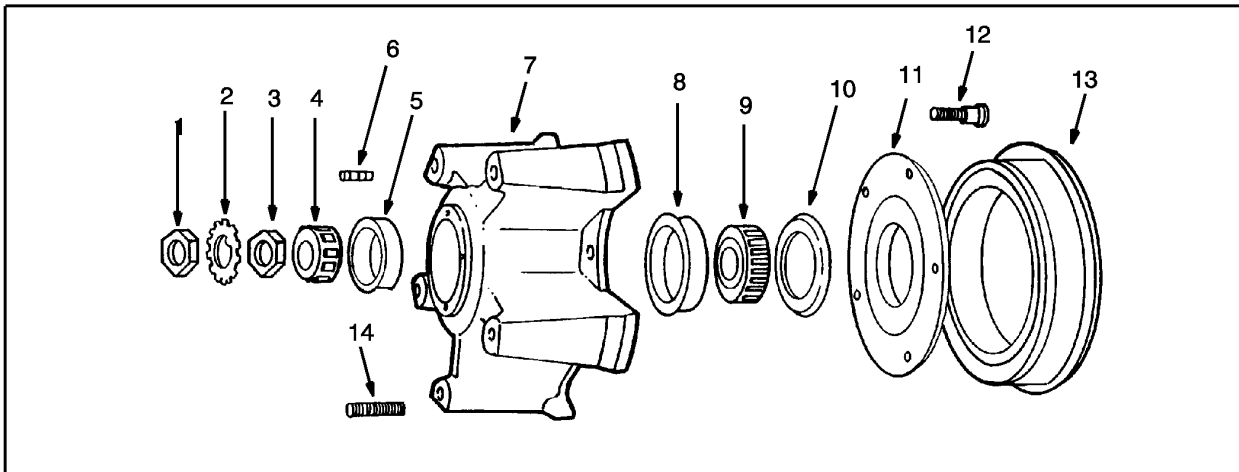


Figure 4 Exploded View of Typical Cast Spoke Rear Hub Assembly with Drum Brakes

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

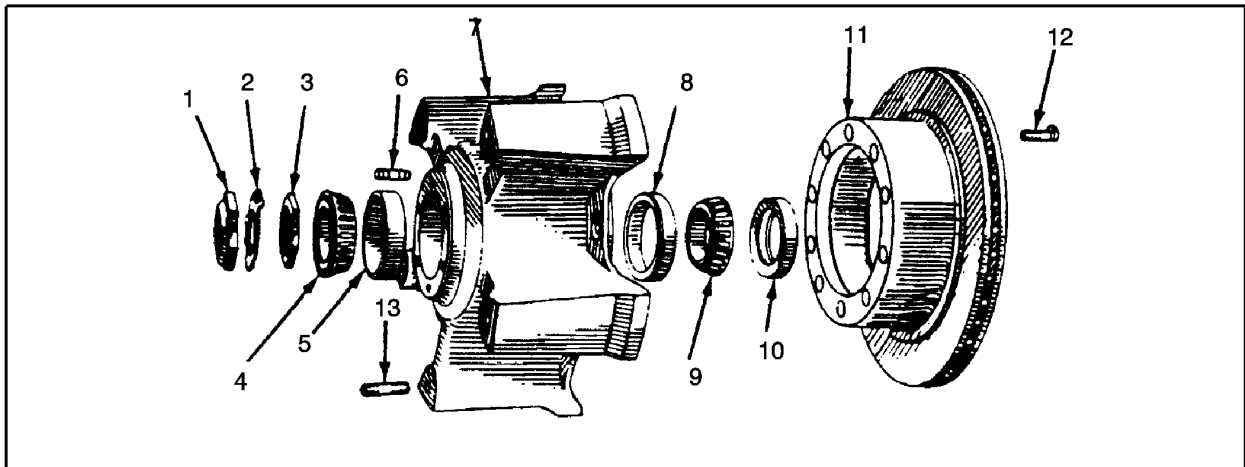


Figure 5 Exploded View of Typical Cast Spoke Rear Hub Assembly with Disc Brakes

1. OUTER WHEEL BEARING ADJUSTER NUT
2. WHEEL BEARING ADJUSTER NUT LOCK
3. INNER WHEEL BEARING ADJUSTER NUT
4. OUTER WHEEL BEARING
5. CUP OUTER BEARING
6. AXLE SHAFT FLANGE STUD
7. WHEEL (HUB)
8. CUP INNER BEARING
9. INNER BEARING
10. SEAL OIL
11. BRAKE ROTOR
12. BRAKE ROTOR RETAINING BOLT, WASHER AND NUT
13. 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 6).

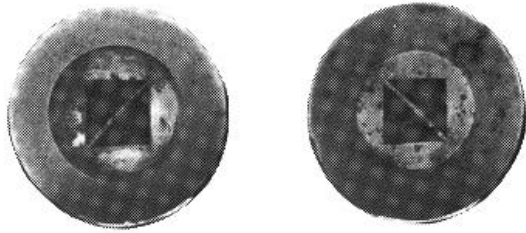


Figure 6 Roller End Wear

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 7).

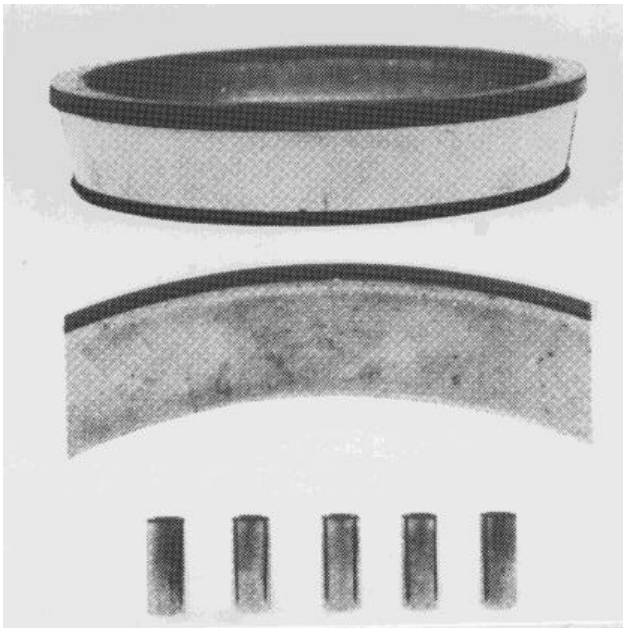


Figure 7 Bearing Cap Wear

There are bright rubbing marks on the dark phosphate surfaces of the bearing cage (Figure 8).

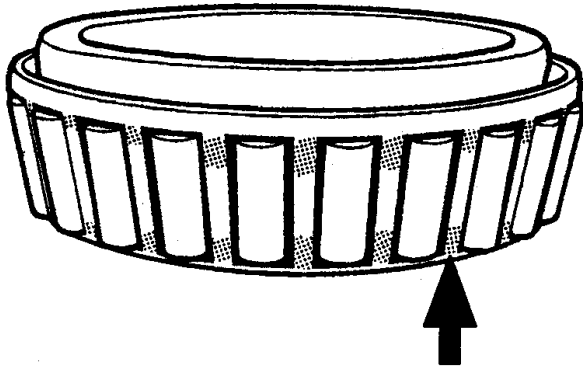


Figure 8 Bearing Cage Wear

There is an etching or pitting on contact surfaces of cup, cone or rollers (Figure 9).

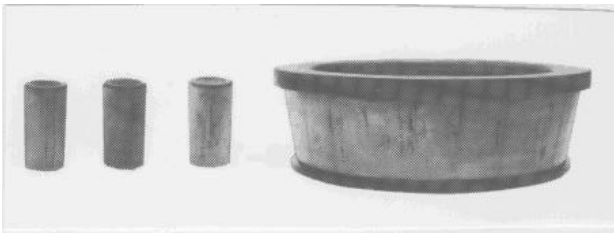


Figure 9 Pitted Contact Surface

There is any spalling or flaking on either the bearing cup and/or cone surfaces (Figure 10).

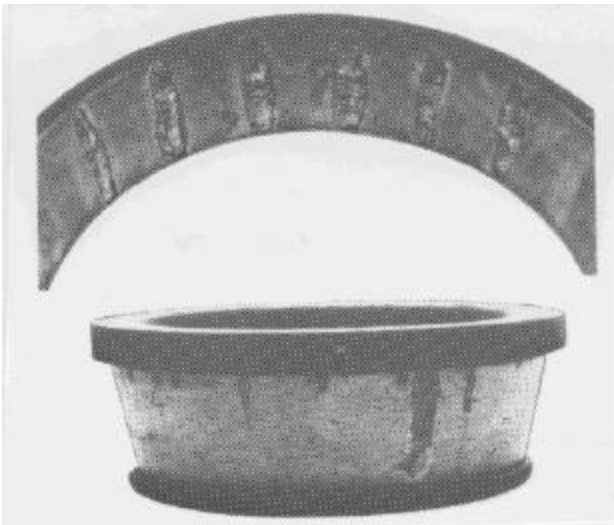


Figure 10 Flaking Cup/Cone Surface

2. BEARING CUP (RACE)

2.1. 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.



WARNING – To prevent eye injury, safety glasses should be worn at all times when assembling or disassembling components.

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.

2.2. 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.

2.3. 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 (82°C - 99°C). 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.

2.4. 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 (-29°C).



WARNING – Wear gloves when handling hot or cold components to prevent personal injury.

- 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.

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 wheels and hubs.

Wheels or hubs, bearing cups, nuts, locks, washers, shafts 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 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 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 (jam nut jammed). Use a dial indicator to measure hub end play (Figure 11) with respect to the axle tube (spindle) with **axle shaft not installed**. It is recommended that the wheel assembly not be installed also.

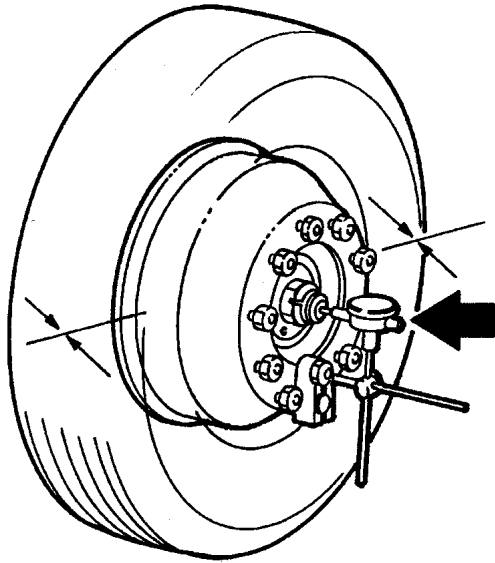


Figure 11 Measuring End Play with Dial Indicator

Mount the dial indicator to the drum or hub as illustrated in Figure 11 or to the bottom of the wheel (remove axle shaft if installed). 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 .005 inch (.0254 to .127 mm) end play with no preload (measured after the jam nut is tightened).

3.2. REAR AXLE JAM NUT INSTALLATION (DOUBLE NUT)

Refer to Figure 12 , Figure 13 , Figure 14 and Figure 15 .

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

With a doweled adjusting nut, install lockwasher. If lockwasher does not fit dowel, back off adjuster nut to the nearest hole in the lockwasher.

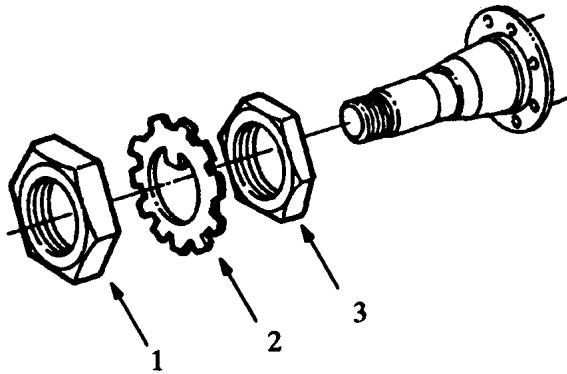


Figure 12 Rear Axle Jam Nut Installation - Bend Lockwasher Type

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

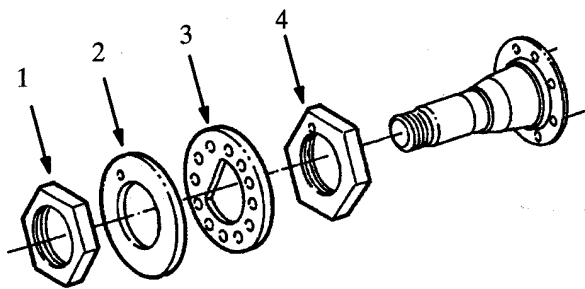


Figure 13 Rear Axle Jam Nut Installation - Doweled Adjusting Nut Type

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

4. Tighten jam as follows:

- a. Lock nut up to and including 3 1/4 inches (82.55 mm) with bend type lockwasher. Tighten the jam nut to 250 - 275 ft-lbs. (339 - 373 N•m). After the jam nut is tightened, bend one tab over the jam nut.
- b. Doweled adjusting nut 3 3/8 inches (85.73 mm) and larger with pierced lockwasher. Tighten the jam nut to 350 - 375 ft-lbs. (475 - 508 N•m).
- c. Check bearing end play (See BEARING END PLAY CHECK PROCEDURE, page 10).

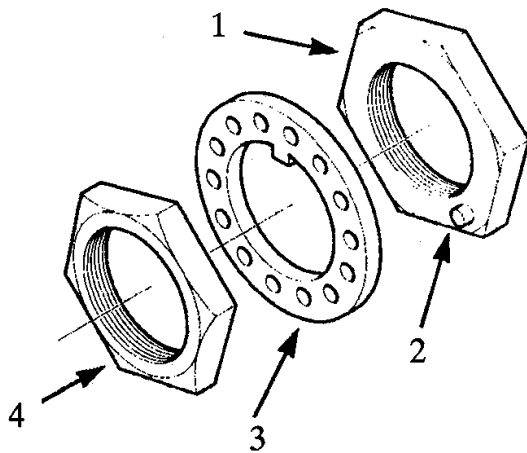


Figure 14 Adjusting Nut Identification and Installation - Dowel-Type Spindle Nut Washer

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

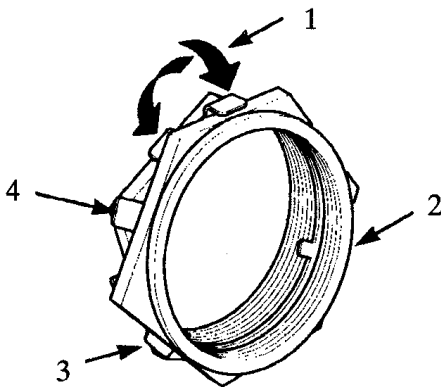


Figure 15 Adjusting Nut Identification and Installation - Tang-Type Spindle Nut Washer

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

3.3. AXILOK® UNITIZED SELF-LOCKING WHEEL BEARING ADJUSTING NUT

Refer to Figure 16.

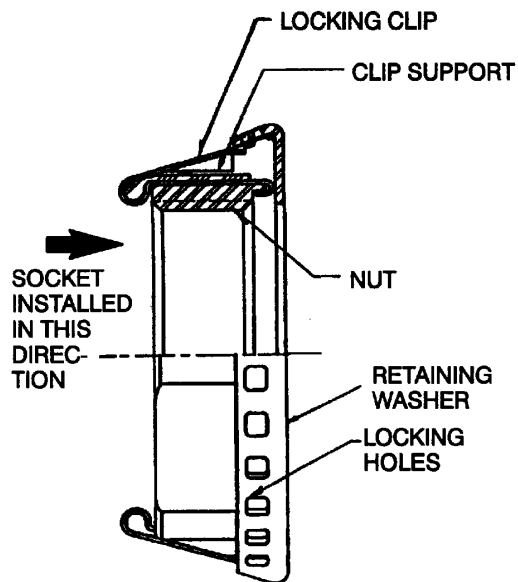


Figure 16 Axilok Unitized Self-Locking Wheel Bearing Adjusting Nut

International vehicles with 23,000 to 30,000 lb. single rear axles and 38,000 to 58,000 lb. tandem rear axles may have the Axilok unitized self-locking wheel bearing adjusting nut. The Axilok unitized self-locking nut enhances accurate, reliable wheel bearing adjustment. Its unitized design allows precise wheel bearing adjustment end play settings of .001 inch to .005 inch (.0254 to .127 mm) which provides for improved wheel seal and bearing life and meets the requirements of antilock brake systems.

A 6 or 12 point 4 inch socket is required to depress the locking clips for the installation and removal of the Axilok wheel bearing adjusting nut.

IMPORTANT – Always use the correct socket. Do not use any other type of instrument to depress the locking clips such as pliers, channel locks, etc.

CAUTION – Never use an impact wrench to install or remove an Axilok.

CAUTION – Before re-installing the Axilok, be certain the threads, locking tab, locking clips and retaining washer are free of defects and are in proper working condition.

Be certain the socket is not worn or damaged to the point it will not fully depress the locking clips or properly engage the hex nut feature. Always use a properly calibrated torque wrench when installing an Axilok.

Remove

1. Place the 4 inch socket over the hex portion of the nut to depress the locking clips (Figure 17).

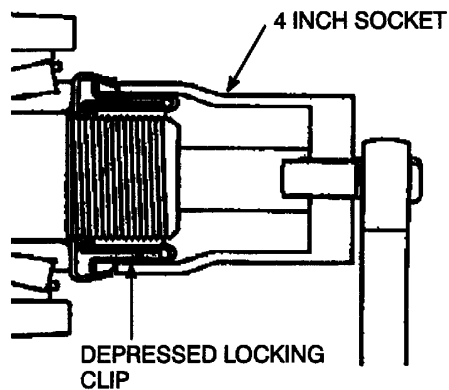


Figure 17 Depress Locking Clips

2. Turn nut counterclockwise to remove. When removing the Axilok, it is required to manually keep the retaining washer moving toward the end of the spindle with nut as nut is removed (Figure 17).

Install

1. Apply a few drops of light weight lubricating oil through one of the holes of the retaining washer. This will allow the nut and retaining washer to rotate freely during installation (Figure 18).

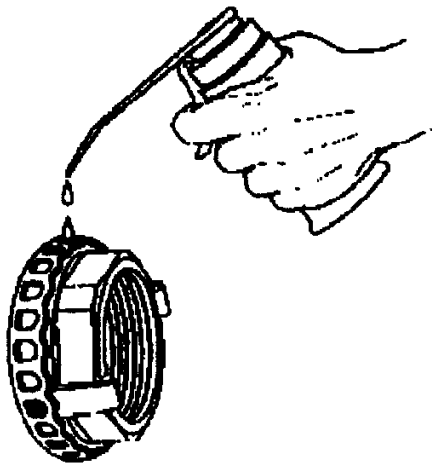


Figure 18 Apply Lubricating Oil

2. The nut and retaining washer of the Axilok are locked together with two locking clips. Place the 4 inch standard 6 or 12 point socket over the hex feature of the nut to depress the locking clips, thereby releasing locking clips and allowing the nut to rotate freely within the retaining washer (Figure 19).

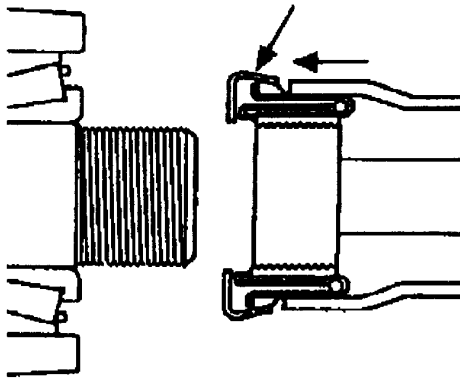


Figure 19 Release Locking Clips

3. Align the tab on the retaining washer with the keyway in the spindle. Thread the nut onto the spindle with the socket.
4. After spoke/disc wheel hub, bearings, and Axilok unitized self-locking nut are installed, rotate the assembly while tightening the self-locking nut to 200 ft-lbs. (271 N•m).
5. Back off Axilok unitized self locking nut to zero torque.
6. Rotate the spoke/disc hub assembly a minimum of one complete revolution while retightening the Axilok unitized self locking nut to 50 ft-lbs. (68 N•m).
7. Back off the Axilok unitized self-locking nut 1/8 turn.
8. Remove the socket from the Axilok allowing the spring clips to release and engage into the holes in the retaining washer. If the tabs of the locking clips do not line up with the retaining washer holes, rotate the Axilok counterclockwise until the locking clips engage into locking holes (Figure 16).
9. Install axle shaft. Refer to GROUP 14 - REAR AXLES in the CTS-5000 Master Service Manual for detailed information.

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 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 (See SPECIAL TOOLS, page 32) .

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

4.1. OIL LUBRICATED WHEEL BEARINGS

Different types of oil lubricated wheel bearing seals are used:

- Hub Installed Unitized Seals
- Spindle (Axle Tube) 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 20).

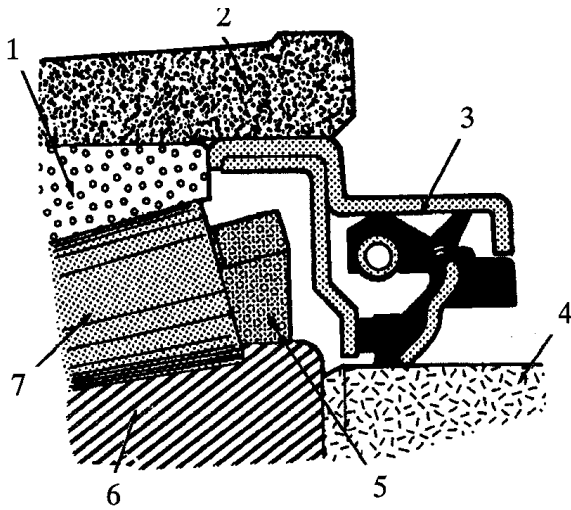


Figure 20 Typical Unitized Seal for Oil/Grease Lubricated Bearings

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

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

Spindle (Axle Tube) Two-Piece Oil Seal

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 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 21).

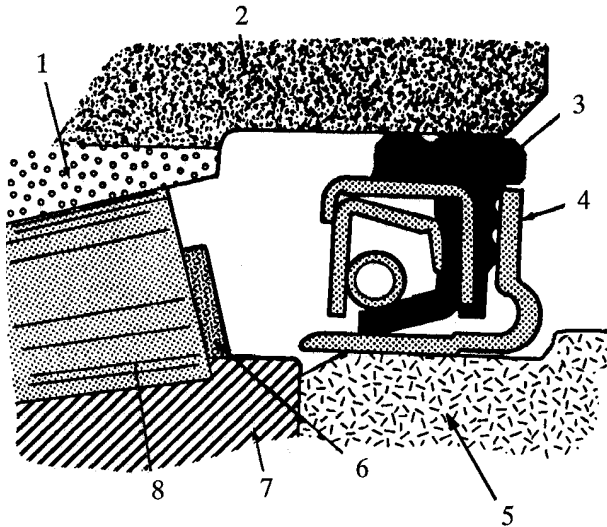


Figure 21 Typical Two-Piece Seal

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

4.2. REMOVAL HUB INSTALLED UNITIZED SEAL

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 (Axle Tube) 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 axle spindle.

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

4.3. CLEANING AND INSPECTION

1. Thoroughly clean all parts: axle hub or spindle, bearings, nuts and inside of wheel hub.

Use fine grit emery cloth to clean up burrs or marks from hub or axle tube end.

2. All burrs from inside back edge of hub must be removed. Hub must be smooth and free from burrs which will scratch the outside diameter of seal (Figure 22).

When cleaning aluminum hubs, use a non-metallic scraper to prevent damage to hub.

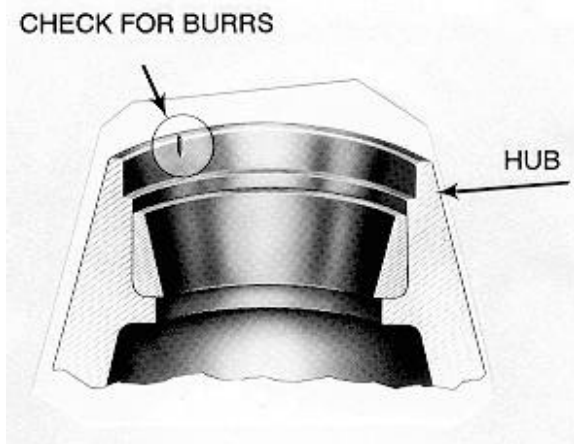


Figure 22 Check Hub for Burrs

3. Remove burrs from axle tube or spindle shoulder. Shoulder must be smooth.
4. Inspect for porous or cracked hub which could allow oil leakage. This is important where leakage has been encountered.
5. Replace all parts as necessary. More information pertaining to lubricant leakage causes and corrections will be found in WHEEL BEARING SEAL TROUBLESHOOTING CHART (See WHEEL BEARING SEAL TROUBLESHOOTING CHART, page 30).

4.4. INSTALL SEALS

Spindle (Axle Tube) Two-Piece Seal

IMPORTANT – The care with which the two-piece axle 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 Loctite Gasket Eliminator (purple) 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 23).

NOTE – Do not install seal into hub bore.

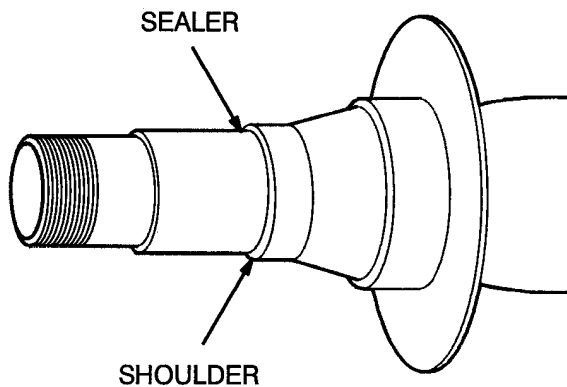


Figure 23 Putting Sealer on Spindle

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 axle 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 24).



Figure 24 Installing Seal

NOTE – Check to make sure that the seal I.D. is installed flush with the face of the shoulder within .005 inch.

3. Prelube the inner bearing and place it in position on the axle spindle. No additional lubrication is required (Figure 25).



Figure 25 Prelube Bearing

4. Install wheel, hub/drum assembly. Using wheel dolly, push wheel assembly onto axle spindle until it contacts the seal (Figure 26).



Figure 26 Install Wheel Assembly Using Wheel Dolly

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.

5. Prelube outer wheel bearing. Install outer bearing, adjusting nuts, and washer. Adjust bearings. Refer to WHEEL BEARING ADJUSTMENT (See WHEEL BEARING ADJUSTMENT, page 9) 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 inner bearing in hub bore.

3. To install seal, place outer face of seal in the recess of the selected tool adapter (Figure 27).

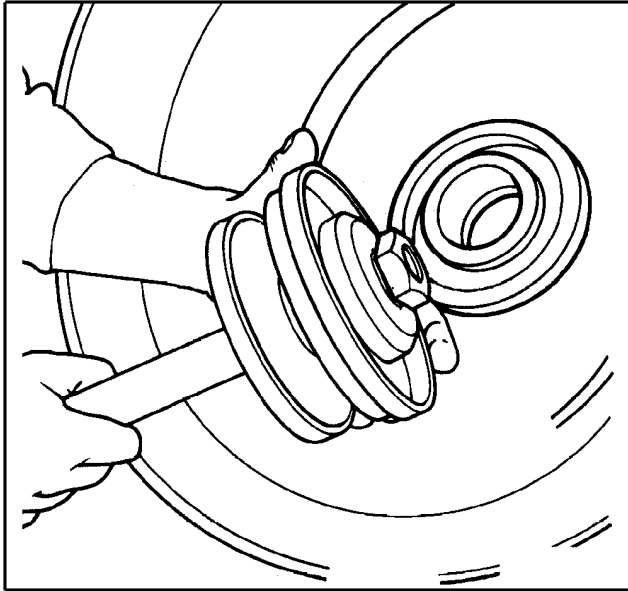


Figure 27 Installation of Unitized Seal Onto Tool Adapter

4. Install tool, centering into bore of inner bearing cone (Figure 28). 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.

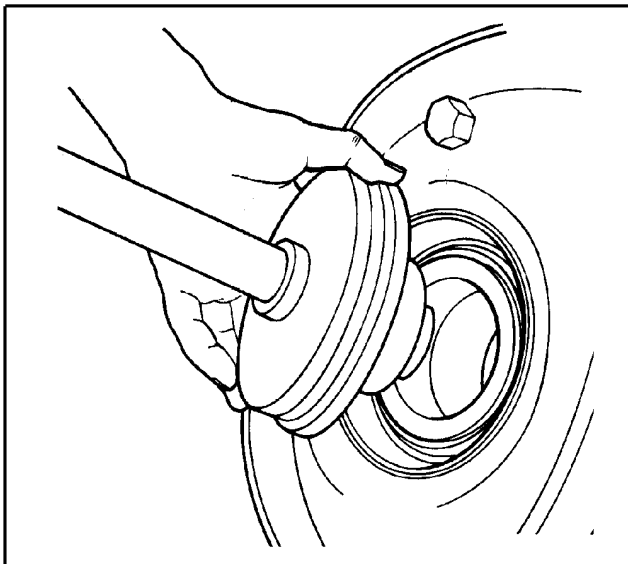


Figure 28 Installation of Unitized Seal Into Hub

5. Hold tool handle straight and firmly and strike tool handle until the sound of impact changes when seal is seated (Figure 29). Check seal to be sure it is uniformly seated but not crushed. Also check bearing for free movement. Remove excess sealant.

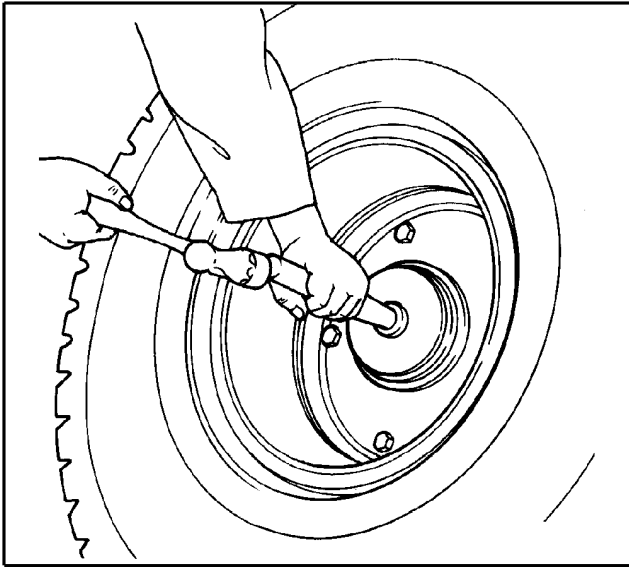


Figure 29 Seating Seal in Hub Bore

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 (See WHEEL BEARING ADJUSTMENT, page 9).

5. REAR DRIVE AXLES

1. Prelubricate inner and outer bearings with a coating of recommended oil bearing lube.
2. Assemble bearings and seal as described in section WHEEL SEALS (See WHEEL SEALS, page 15).
3. Use a wheel dolly to place the wheel/hub assembly on the axle tube spindle. Care must be taken so that the seal is not damaged when sliding hub assembly onto spindle (Figure 30).

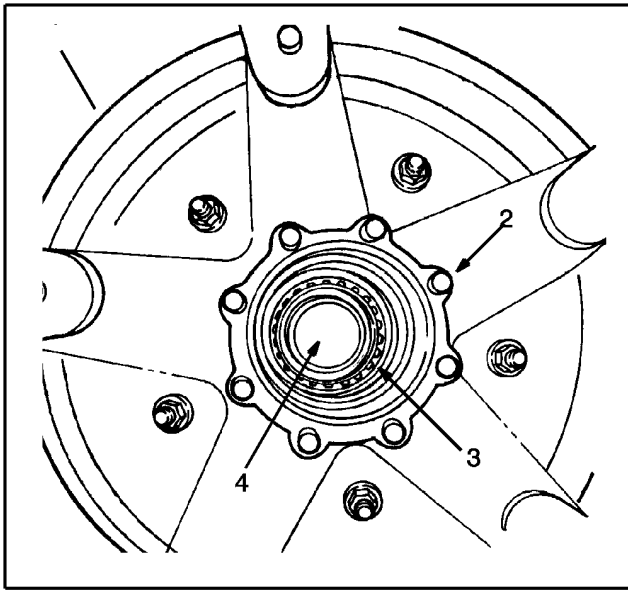


Figure 30 Head-on View of Installing Wheel (Hub) Assembly Using a Wheel Dolly

1. RIM
 2. WHEEL (HUB)
 3. INNER BEARING
 4. AXLE/SPINDLE
4. Fill wheel or hub cavity with differential lubricant to level of largest bearing cup.
 5. Adjust wheel bearings. Refer to WHEEL BEARING ADJUSTMENT (See WHEEL BEARING ADJUSTMENT, page 9).
 6. Install axle shaft (Figure 31). Refer to GROUP 14 - REAR AXLES in the CTS-5000 Master Service Manual for axle shaft specifications.

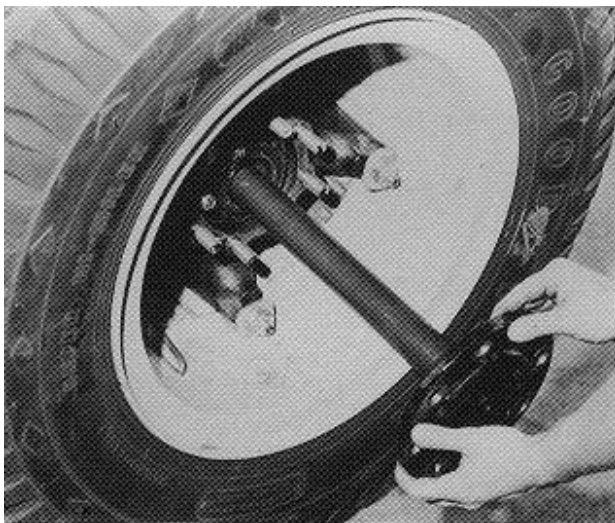


Figure 31 Rear Axle Shaft Installation

7. Check differential for proper lubricant level.

6. HUB ASSEMBLY

6.1. CLEAN AND INSPECT

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

1. Worn Stud Holes (Figure 32). This condition is caused by stud turning in the hole because of insufficient torque on the inner nut (stud). Replace hub.



Figure 32 Worn Stud Holes

2. Worn Mounting Face (Figure 33). 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.

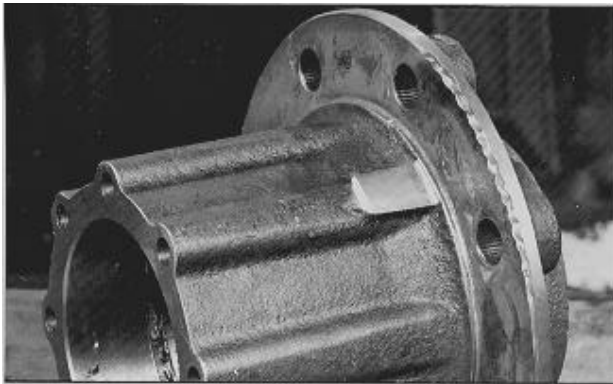


Figure 33 Worn Mounting Face

3. Broken or Stripped Threads Wheel Stud (Figure 34 and Figure 35) Replace studs.

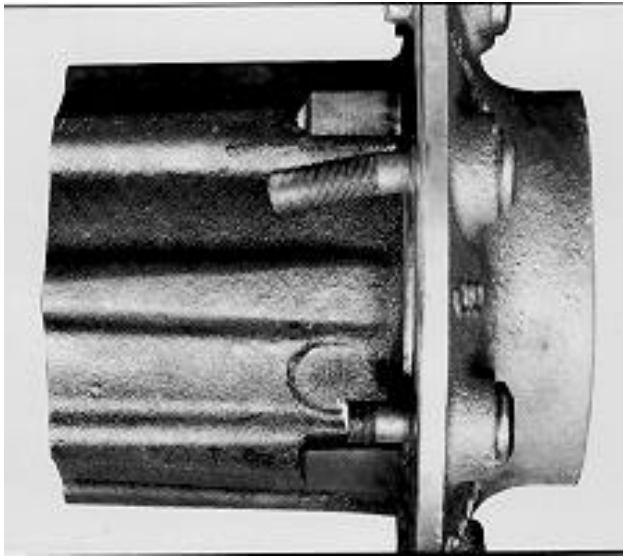


Figure 34 Broken Threads

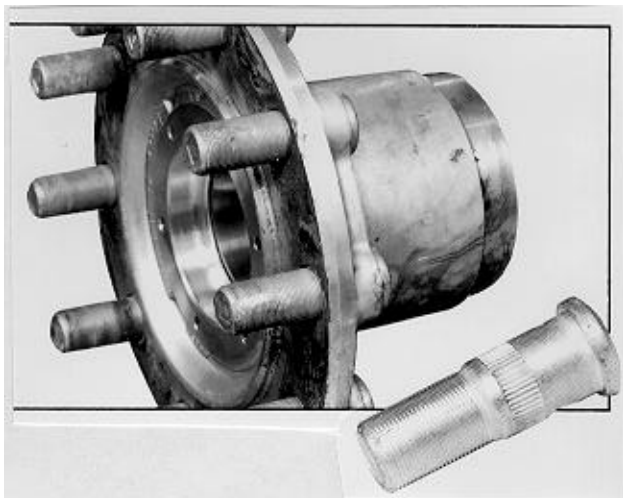


Figure 35 Stripped Threads

4. Porous Condition Where Leakage May Occur. Replace hub.
5. Bent Hub Face (Figure 36). 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 36 , replace hub.

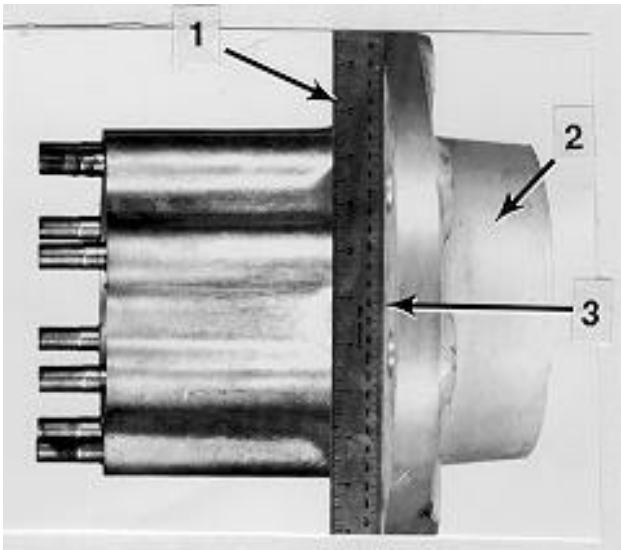


Figure 36 Checking for Bent Hub Face

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

6.2. HUB ANTILOCK BRAKE SYSTEM (ABS) AIR BRAKES

Exciter Ring

Refer to Figure 37 and Figure 38 .

The exciter ring is machined to close tolerances and has 100 equally spaced teeth (Figure 38). 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 EC-15.

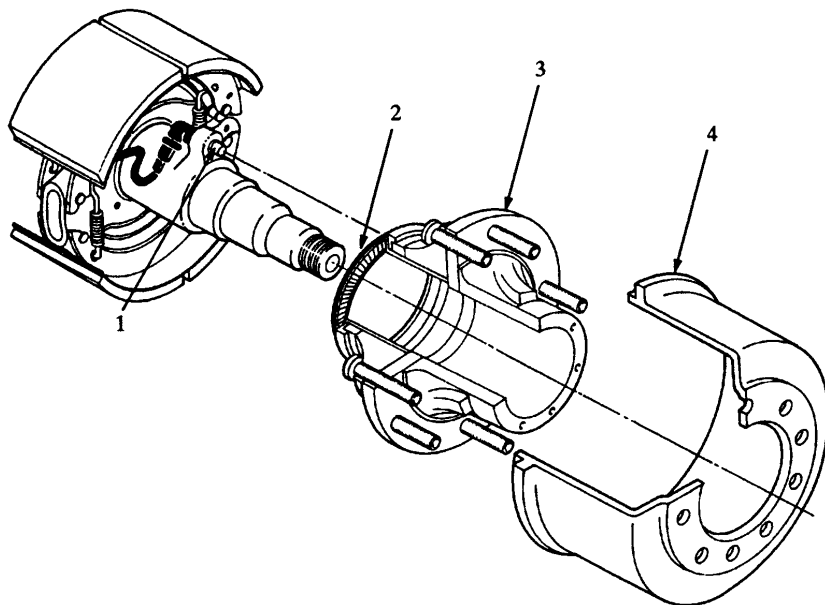


Figure 37 Exciter Ring Installed

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

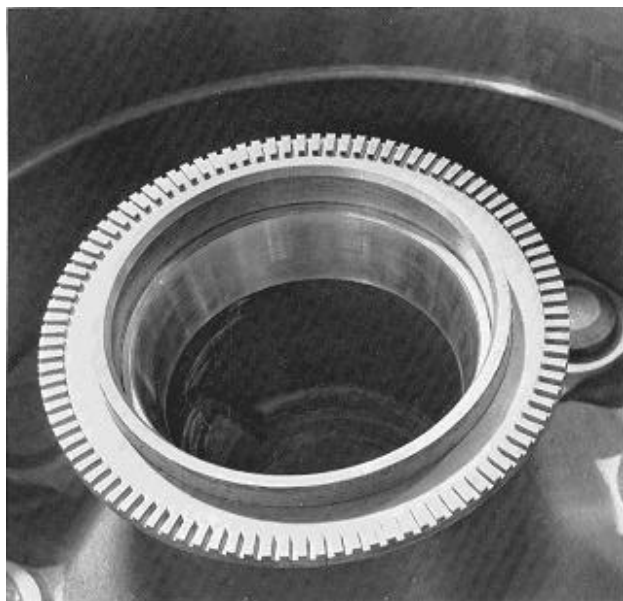


Figure 38 Exciter Ring

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. **Do not heat with a torch as the exciter ring may develop hot spots, causing the exciter ring to distort.**
3. Install the hub to the axle (less the brake drum) and adjust the wheel bearings. Refer to WHEEL BEARING ADJUSTMENT (See WHEEL BEARING ADJUSTMENT, page 9). The bearing end play should not exceed .005 inch. Install the sensor and then inspect for runout as described in INSPECTION (See Inspection, page 27). Install the brake drum after the inspection is complete.

6.3. 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.

6.4. CAST SPOKE TYPE WHEEL

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.

6.5. REPLACE HUB

To replace old hub with new hub, it is recommended that all new wheel studs be installed. Refer to HUB WHEEL STUD, Install page 28, described in above steps. If the old bearings are in good condition and are to be re-used, refer to BEARING CUP, REMOVE, (See REMOVE (CAST IRON HUB ASSEMBLY), page 8) AND BEARING CUP, INSTALL (See INSTALL, page 8).

7. 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.

7.1. STEEL HUB WITH DISC WHEELS

NOTE – As of the latter part of model year 1993, International vehicles with steel hubs and disc wheels have an oil fill/drain capability through the axle mounting flange stud hole. One stud was omitted and the hole drilled clear through, and a thread sealed capscrew used in place of the stud (Figure 39). This design enables the service mechanic to drain/fill and check the lube for contamination without removing the hub assembly. To drain or remove some lube from the hub, place hub drain/fill screw at 6 o'clock position and remove screw. Use container to catch lube. To fill hub with lube, place drain/fill screw at 12 o'clock position.

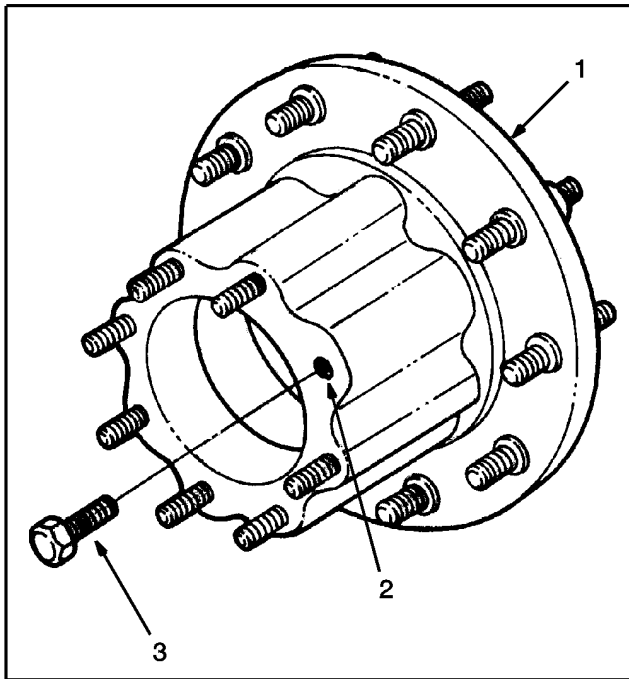


Figure 39 Hub Drain/Fill Hole and Screw

- 1. HUB ASSEMBLY
- 2. DRAIN/FILL HOLE
- 3. THREAD SEALED CAPSCREW (BOLT)

1. If a small amount of lube was removed to check lube condition, replace same amount with new lube fluid. If totally drained, add one quart.
2. If hub assembly is removed from axle for any reason, after hub assembly is installed on the axle, add one quart of lube fluid to each hub assembly that was removed from the axle.
3. Tighten drain/fill screw to 219 - 240 ft-lbs. (297 - 325 N•m).
4. Check rear differential for proper lube fluid level. Add if necessary. Refer to GROUP 10 - LUBRICATION in the CTS-5000 Master Service Manual for correct fluid type.

8. WHEEL BEARING SEAL TROUBLESHOOTING CHART

Prior to replacing a leaking wheel seal, 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 three categories where the leakage could occur; do not overlook any of the categories.

Table 1 Wheel Bearing Seal Troubleshooting Chart

CAUSE	CORRECTION
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 emery cloth if necessary. Seal can also be damaged due to abuse during installation of hub assembly by contact with axle end 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.
Hubs 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 axle flange) 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.
Axle Housing	
Axle Housing has Burrs or Nicks	Remove all burrs and nicks. Correct rough finish. Do not use chisel to remove wiper ring.
Leakage at Axle Shaft Flange	Missing or fractured axle gasket or lack of sealing compound. Replace gasket or apply sealing compound.
Cosmolene on Spline or Axle Housing	Thoroughly clean all cosmolene from sealing surfaces and bearing shoulder.
Axle Breather Inoperative	Excessive lube pressure could cause wheel seal leakage. Clean or replace breather.

9. SPECIAL 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