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Rear Axle Wheel Hubs, Brake Drums, and Wheel Bearings	35.01

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General Information

Rear axle alignment should be checked whenever rear axle or suspension components are replaced. It should also be checked when there is excessive front and rear tire wear, or hard or erratic steering.

Manufacturers of axle alignment equipment offer a variety of systems to precisely measure and correct rear axle alignment. If this type of equipment is not available, the basic tools needed for checking rear axle alignment on tandem or single axles are a straightedge (that is nonflexible and at least as long as the axle), steel tape rule, and trammel bar or center point bar.

The straightedge is used to see if a single axle, or a forward-rear axle of a tandem axle installation, is in alignment with the frame. The distance from the straightedge to the center of the wheel hub is measured on each side of the vehicle; any difference in the measurements means that the axle is out of alignment.

A center point bar (**Fig. 1**) is used to see if the forward-rear axle and rearmost axle of a tandem installation are aligned with each other (parallel). It has adjustable pointers at each end, which are inserted into the axle cap holes of each axle. By comparing the distance between the two axles on one side to the distance on the other side, it can be determined if the axles are parallel.

Instructions and a list of materials for making a center point bar are in **Subject 130**.

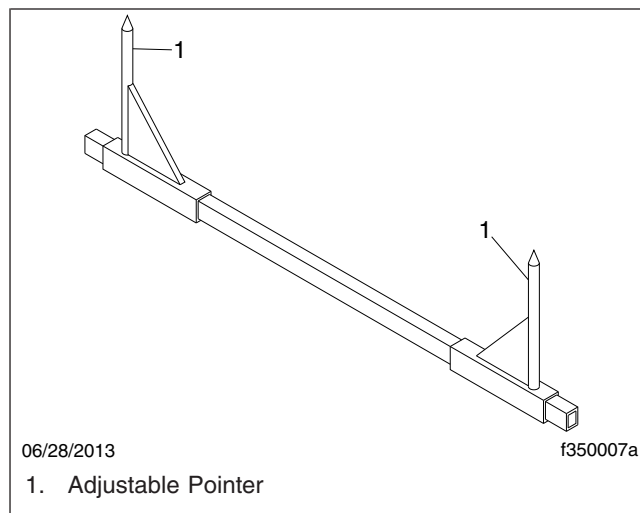


Fig. 1, Center Point Bar

The following preliminary checks should be completed before checking any alignment measurements.

Preliminary Checks

IMPORTANT: For vehicle alignment to be accurate, the shop floor must be level in every direction. Relieve internal stresses in the suspension by driving the vehicle back and forth in a straight line.

1. Wheel assemblies should be balanced, especially for vehicles that travel at sustained speeds of more than 50 mph (80 km/h). Off-balance wheel assemblies cause vibrations that result in severely shortened life for tires and suspension parts.
2. Do not mix tires of different size, type, or weight. Tire wear should be even and not worn to limits exceeding government specifications. Refer to **Group 40** in this manual and **Group 40** in the *Business Class® M2 Maintenance Manual* for more information. Replace any tire that is excessively worn.
3. Check the inflation pressure of the tires. Refer to **Group 40** in this manual for recommended pressures. An underinflated tire causes tread wear completely around both tire shoulders. An overinflated tire causes tread wear in the center of the tire. See **Fig. 1**.

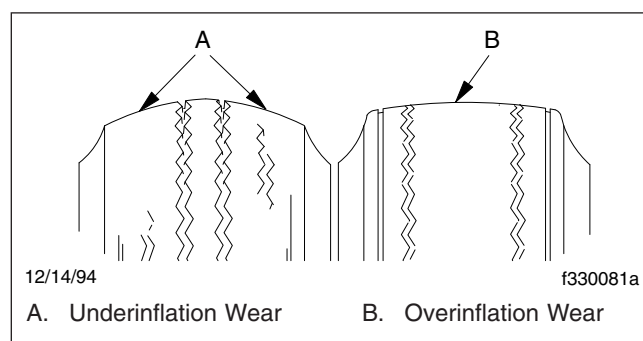


Fig. 1, Tire Damage Due to Underinflated or Overinflated Tires

see **Group 32** in this manual or the suspension manufacturer's service literature. Sagging, fatigued, or broken suspension springs create a lopsided vehicle appearance and an unbalanced weight distribution. Anything that changes the ratio of weight on the springs affects the alignment angles and also the tire tread contact area. Replace damaged springs as instructed in the applicable suspension section.

6. On a vehicle equipped with a Freightliner Air-Liner® rear suspension, check the ride height and make any necessary adjustments until it is within specification. See **Group 32** for instructions.
7. Check and, if necessary, correct frame rail alignment as instructed in **Group 31** in this manual.
8. Check and, if necessary, adjust rear axle tracking. For instructions, see **Group 32** in this manual or the suspension manufacturer's service literature.
9. Check the rear axle wheel bearings for wear and incorrect adjustment. Refer to **Section 35.01** for instructions.

4. Check for out-of-round wheels and wheel stud holes. Replace the wheel if any of these conditions exist.
5. On each side of the vehicle, check the height of the chassis above the ground; for instructions,

Alignment Checking, Single Axle

Checking Using Computerized Alignment Systems

IMPORTANT: For vehicle alignment to be accurate, the shop floor must be level in every direction. The turn plates for the front wheels must rotate freely without friction, and the alignment equipment must be calibrated every three months by a qualified technician from the equipment manufacturer. Freightliner dealers must have proof of this calibration history.

Follow the manufacturer's instructions for use of the alignment equipment, and use the alignment measurements given in [Fig. 1](#) and the applicable tables in [Specifications 400](#).

Checking Using the Manual Method

IMPORTANT: For vehicle alignment to be accurate, the shop floor must be level in every direction.

1. Park the vehicle on a level surface. Relieve internal stresses in the suspension by driving the vehicle back and forth in a straight line, or by jacking the axle up and letting it down.
2. Chock the front tires and place the transmission in neutral. Release the parking brakes.

NOTICE

Do not use scribe lines for marking on frame rails. Scribe lines, which cut or scratch the metal, can develop into starting points for structural damage to the frame.

3. Select a point on the frame rail forward of the rear axle, and mark it using a pencil or soapstone. Then mark two other points, exactly 4 inches (102 mm) forward and to the rear of the original point. Make sure that all three marks are aligned and of equal distance from the outside edge of the frame rail. Using a center point or trammel bar, place one pointer on the forwardmost point, and make an arc with a pencil or soapstone on the opposite frame rail. Then place the pointer on the rearmost point and make an arc on the opposite frame rail intersecting the

first arc. See [Fig. 2](#). The point where the two arcs intersect and the original (or middle) point on the opposite frame rail have matching locations.

4. Line up the straightedge with the two matching points. Check that the straightedge extends out about the same distance on each side of the frame rail. Using C-clamps, clamp the straightedge to the frame; see [Fig. 3](#). The straightedge must line up exactly with the points.
5. Measuring from the outside edge of each frame rail, mark the straightedge on both sides of the frame. The marks ([Fig. 3](#), Ref. A) must be of equal distance from the frame and as far from the frame rail as the tires are at their farthest point from the frame.

IMPORTANT: The distance between the mark on the straightedge and the frame rail must be equal on both sides of the vehicle.

6. On each side of the vehicle, measure the distance from the mark on the straightedge to the center of the wheel hub. See [Fig. 3](#).

The difference between these measurements should be 1/4 inch (6 mm) or less. See [Fig. 1](#). If the difference is more than 1/4 inch (6 mm), adjust the axle alignment. For instructions, see [Group 32](#) in this manual, or the suspension manufacturer's service literature.

Alignment Checking, Single Axle

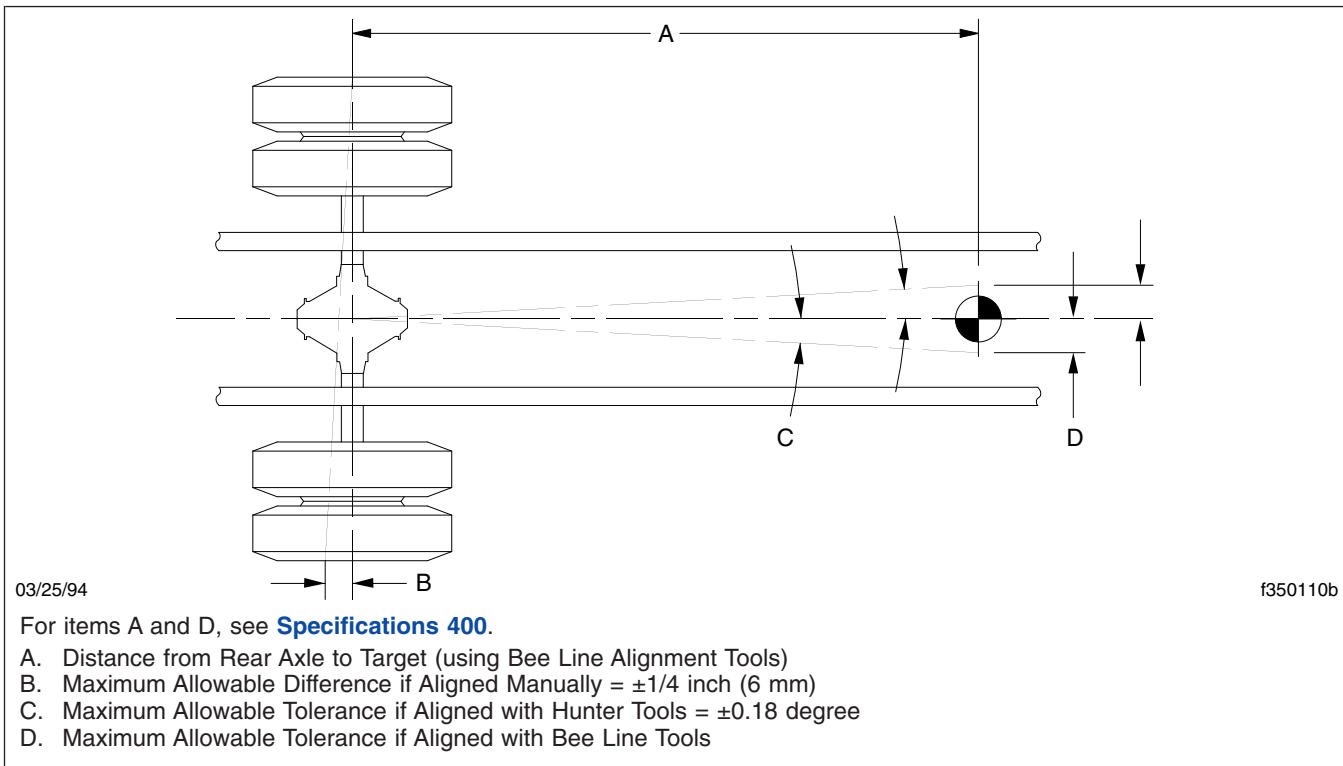


Fig. 1, Alignment Measurements

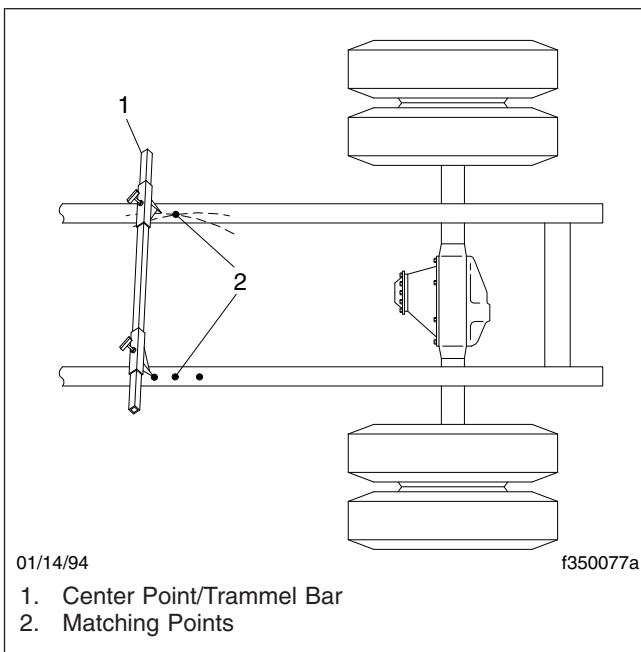


Fig. 2, Marking an Arc

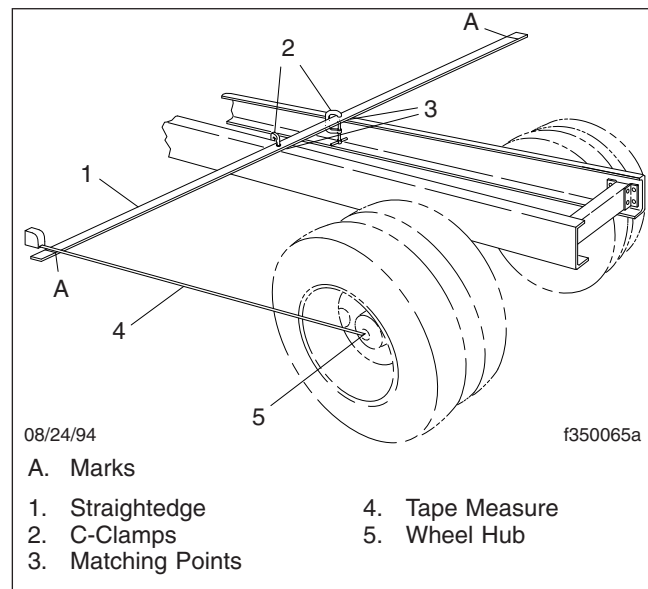


Fig. 3, Straightedge to Wheel Hub Measurement

To align a tandem axle, first, check and (if needed) align the rearmost axle; then, check and (if needed) align the forward-rear axle.

Checking Using Computerized Alignment Systems

IMPORTANT: For vehicle alignment to be accurate, the shop floor must be level in every direction. The turn plates for the front wheels must rotate freely without friction, and the alignment equipment must be calibrated every three months by a qualified technician from the equipment manufacturer. Freightliner dealers must have proof of this calibration history.

Follow the manufacturer's instructions for use of the alignment equipment, and use the alignment measurements given in [Fig. 1](#) and the applicable tables in [Specifications 400](#).

Checking Using the Manual Method

A straightedge and a center point bar are needed to manually align a tandem axle. For instructions for making a center point bar, see [Subject 130](#).

IMPORTANT: For vehicle alignment to be accurate, the shop floor must be level in every direction.

1. Using the instructions in [Subject 110](#), check and align the rearmost axle.
2. Using a center point bar, set the two points into the axle cap holes as shown in [Fig. 2](#). Lock them in place by tightening the setscrews.
3. With the points still locked in place, move the center point bar to the other side of the vehicle, set the two points into the axle cap holes, and compare the axle spacing. If there is a difference

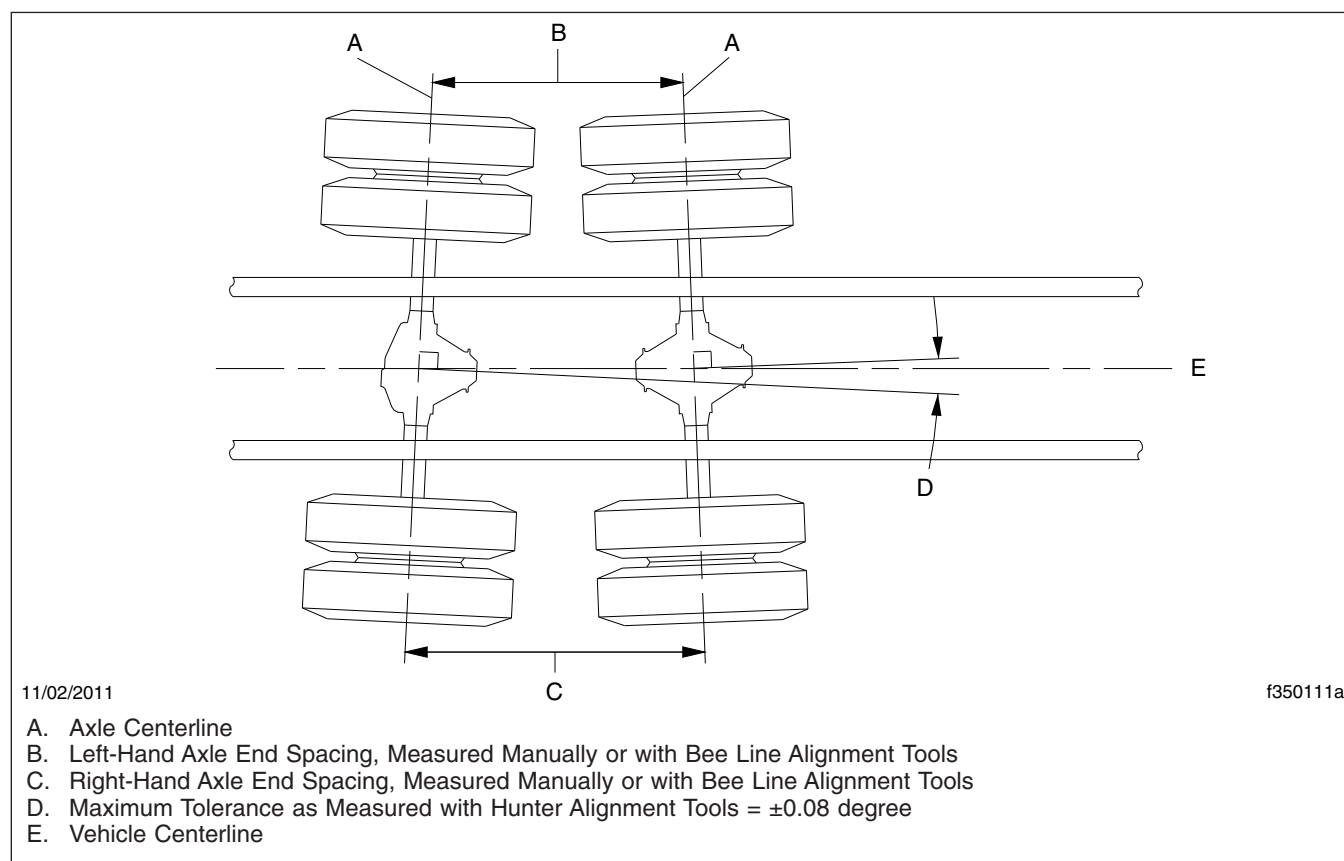


Fig. 1, Tandem Axle Measurements

Alignment Checking, Tandem Axle

of 1/8 inch (3 mm) or less between the spacing on one side of the vehicle compared to the other, no further action is necessary. If the difference is more than 1/8 inch (3 mm), adjust the forward-rear axle alignment. See [Fig. 1](#). For instructions, see [Group 32](#) in this manual, or the suspension manufacturer's service literature.

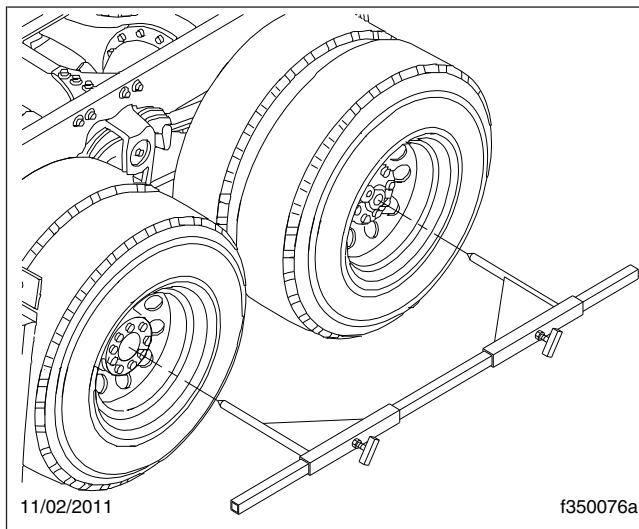


Fig. 2, Center Point Bar Placement

Center Point Bar Construction

Materials Required

NOTE: To obtain metric conversions (millimeters), multiply the number of inches by 25.4.

The following materials are required:

- 62" of square steel tube (1" x 1", measured outside)
- 12" of square steel tube (1-1/8" x 1-1/8", measured inside)
- 20" of 3/8" steel rod
- two 1/2" x 3" pieces of steel square-bar stock
- one 4" x 4" steel plate, 1/8" thick
- two 3/8-16 capscrews (grade 5), 2" long
- two 3/8-16 hexnuts (equivalent to grade 5)

Construction

1. Cut the 1-1/8 x 1-1/8 inch (inside measurement) square steel tube in half to obtain two pieces 6 inches long. These will be the sliding members (slides) of the center point bar.
2. Cut the 4-inch by 4-inch steel plate diagonally into two pieces (gussets). Weld one gusset to each slide, as shown in **Fig. 1**.
3. Cut the steel rod in half to obtain two 10-inch rods. Grind one end of each to form a point.
4. Weld the pointed steel rods to the slides and gussets, as shown in **Fig. 1**.
5. Drill a 1/2-inch hole in the center of each slide, on the side opposite where the pointer was welded. Drill through only one side of the tube.
6. Directly over each hole drilled in the step above, weld a 3/8-16 nut (equivalent to grade 5).
7. Weld a piece of steel stock, about 1/2-inch wide by 3-inches long, over the head of each of two 3/8-16 by 2-inch long capscrews.
8. Place a slide over each end of the 60-inch piece of steel tube, with the pointed rods to the outside. Screw the handscrews (made in the step above) into the slides until they are clamped tightly to the cross tube.

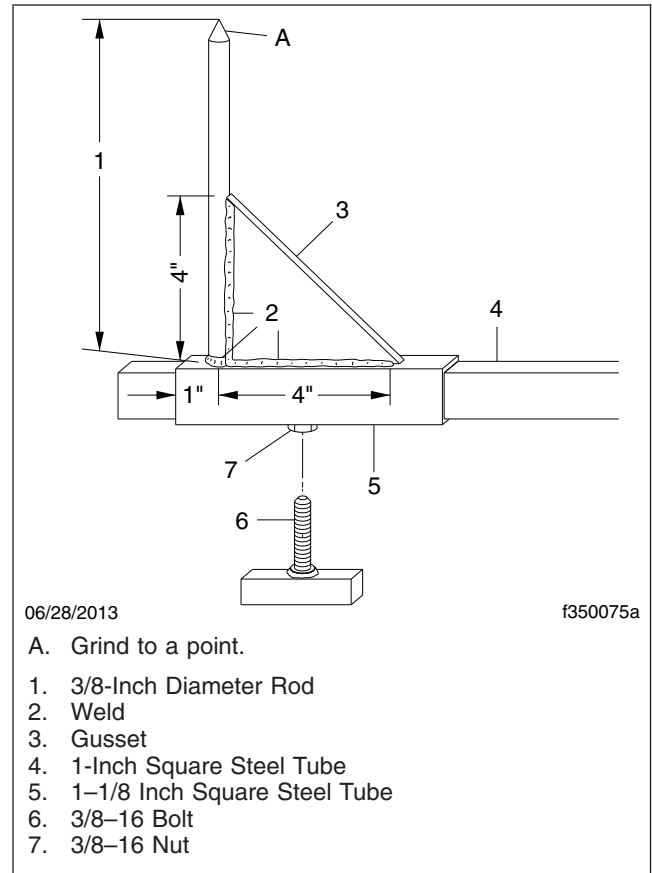


Fig. 1, Center Point Bar Construction

Maximum Tolerance from Perpendicular, Manual Method	
Method	Maximum Tolerance \pm from Perpendicular
Manual	1/4-inch (6 mm)

Table 1, Maximum Tolerance from Perpendicular, Manual Method

Rear Axle Parallelism Specifications	
Method	Maximum Tolerance
Bee Line or Manual	\pm 1/8-inch maximum difference in axle end-spacing; reference "B" minus "A" in Fig. 1 .

Table 4, Rear Axle Parallelism Specifications

Maximum Tolerance from Perpendicular, Hunter Equipment	
Method	Maximum Tolerance \pm from Perpendicular
Hunter *	\pm 0.18 degree

* To use Hunter alignment equipment, refer to the applicable Hunter service literature.

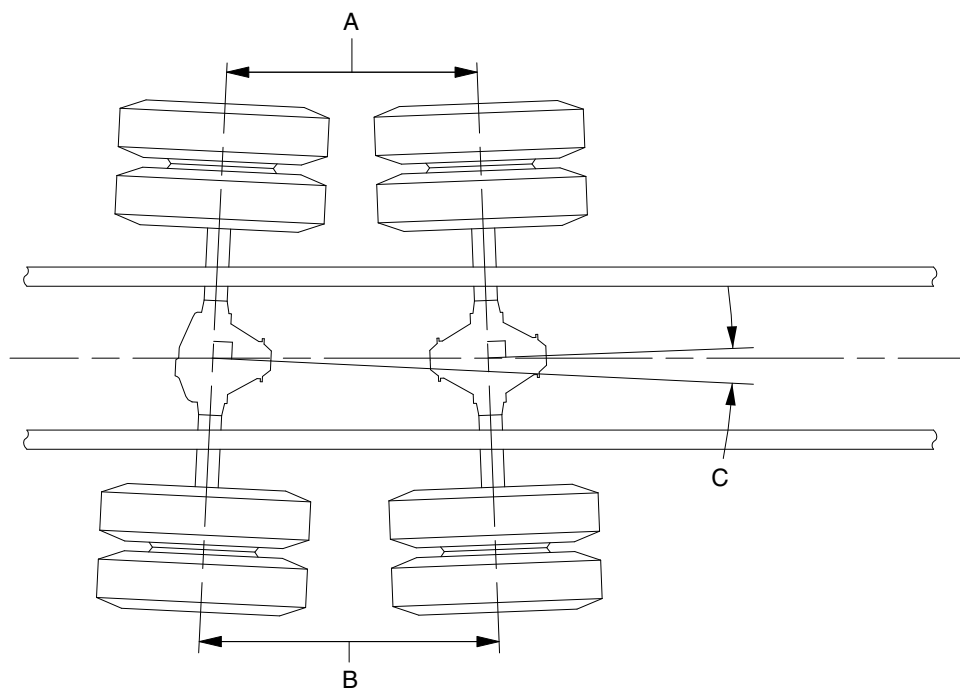
Table 2, Maximum Tolerance from Perpendicular, Hunter Equipment

Maximum Tolerance from Perpendicular at Target, Bee Line Equipment	
Distance from the Forward or Rear Drive Axle to Target inches (mm)	Maximum Tolerance \pm from Perpendicular inches (mm)
100 (2540)	5/16 (8)
120 (3048)	3/8 (10)
140 (3556)	7/16 (11)
160 (4064)	1/2 (13)
180 (4572)	9/16 (14)
200 (5080)	5/8 (16)
220 (5588)	11/16 (17)
240 (6096)	3/4 (19)
260 (6604)	13/16 (21)

Table 3, Maximum Tolerance from Perpendicular at Target, Bee Line Equipment

Rear Axle Parallelism Specifications	
Method	Maximum Tolerance
Hunter	\pm 0.08 degree maximum axle-to-axle difference; reference "C" in Fig. 1 .

Specifications



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NOTE: See [Table 4](#) for values corresponding to callouts A, B, and C.

Fig. 1, Tandem Axle Measurements

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Wheel Bearing Cup Removal and Installation, Ferrous Hubs	120
Drive Axle Stud Replacement	130
Double Spindle Nut Removal, Installation, and Adjustment	140
Axilok Spindle Nut Removal, Installation, and Adjustment	150
Outboard-Mounted Drum Removal and Installation	160
Wheel Bearing Cup Removal and Installation, Aluminum Hubs	170
Wheel Stud Replacement	180
Pro-Torq Spindle Nut Removal, Installation, and Adjustment	190
Wheel Bearing End Play Measurement	200
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General Information

A wheel end assembly consists of a wheel hub, wheel bearings, axle spindle, wheel studs, and brake drum or, for disc brakes, a rotor and caliper. See [Fig. 1](#) and [Fig. 2](#). M2 vehicles are typically equipped with one of four different wheel end assemblies:

- A ConMet PreSet® hub and double spindle nut system.

Vehicles equipped with PreSet hubs have the bearings and oil seal pre-installed. To install a new PreSet hub, mount it on the axle spindle, and secure it with a double spindle nut. For instructions, see [Subject 140](#). A spacer between the inner and outer bearings adjusts the bearings to the correct end-play and preload when the retaining nut is tightened.

- A ConMet PreSet hub and Axilok® spindle nut.

Some ConMet PreSet hubs use an Axilok nut (see [Subject 150](#)). As with ConMet PreSet hubs that use the double spindle nut, the bearings and oil seal are pre-installed and a spacer between the inner and outer bearings adjusts the bearings to the correct end-play and preload when the retaining nut is tightened.

- A ConMet PreSet Plus™ hub and spindle nut system.

The ConMet PreSet Plus system is specially designed for easy and reliable hub removal and installation. As with ConMet PreSet hubs, the spacer between the inner and outer bearings adjusts the bearings to the correct end play and preload when the nut is tightened. For instructions, see [Subject 220](#).

- The traditional hub and bearings, and a double spindle nut system.

With traditional wheel ends, the bearings and oil seal must be assembled with the hub when the hub is installed on the axle spindle. First the oil seal is placed on the spindle (some brands of oil seal are installed in the hub bore), then the inner bearing and the hub are mounted on the axle spindle. Then, the outer bearing is mounted in the hub bore. A nut is installed on the axle spindle end and tightened and loosened to adjust the bearings. Finally, locking device and jam nut are installed to se-

cure the hub and bearings on the axle. For instructions, see [Subject 140](#).

- The traditional hub and bearings, and a Pro-Torq® nut system.

This system is the same as the above traditional hub and bearing system, but in place of the double spindle nut system, it has one adjusting nut and a locking device. For instructions, see [Subject 190](#).

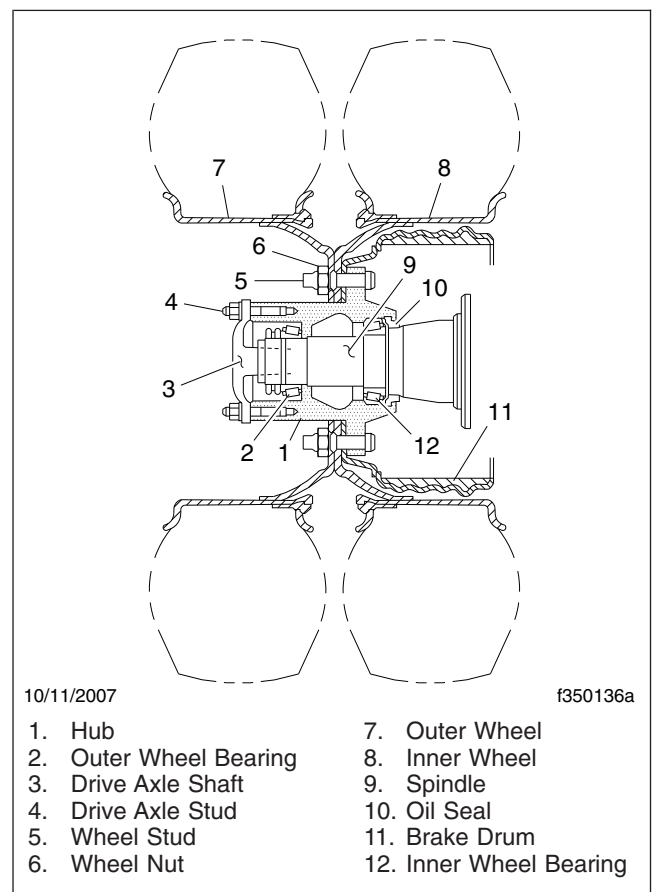


Fig. 1, Wheel End Assembly with Brake Drums

Wheel Hub

The brake drum is mounted on an aluminum or iron wheel hub. See [Fig. 2](#). Both the inner and outer bearing cups and certain types of wheel studs are press-fit in the hub. The hub is also the interconnecting point for the drive axle shaft and wheels.

General Information

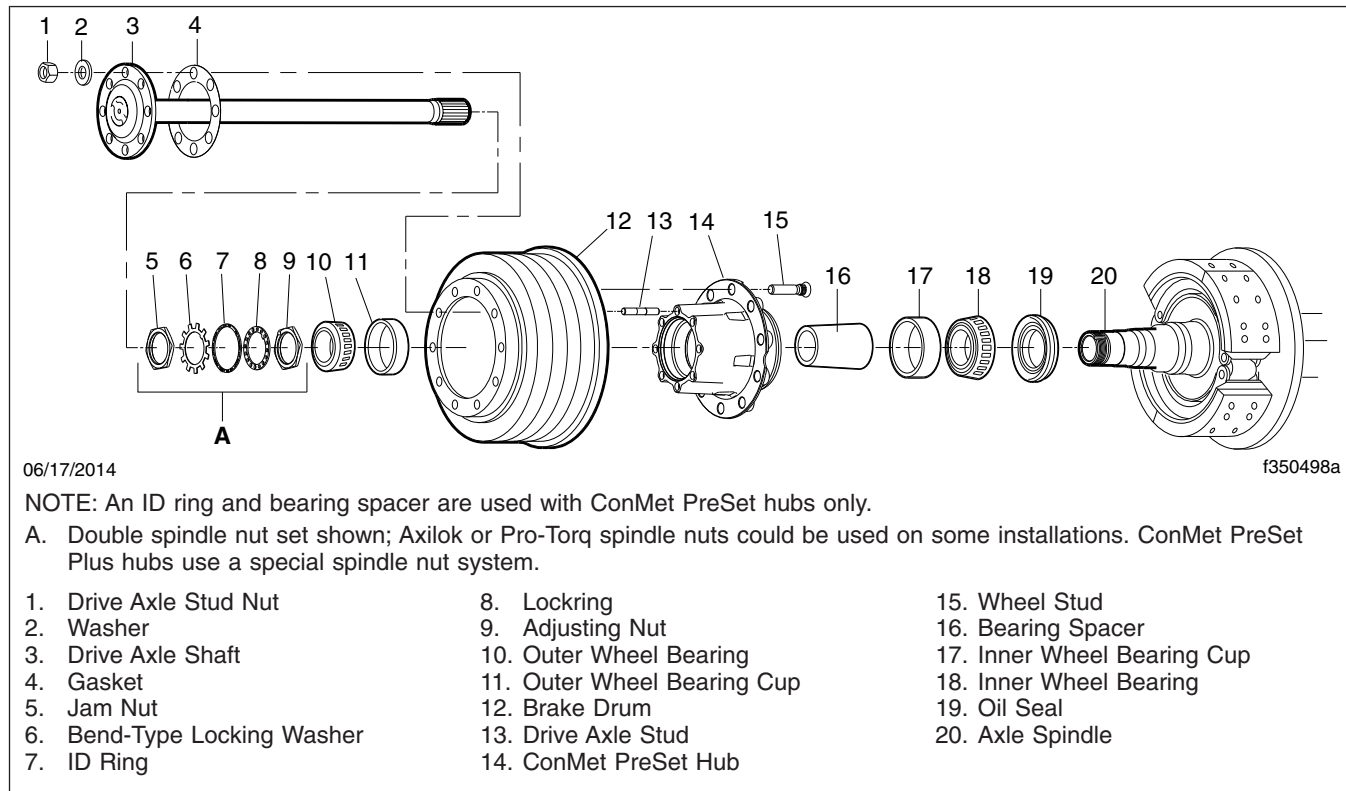


Fig. 2, Typical Wheel End Assembly, Drive Axle with Drum Brakes

Brake Drum

The brake drum and lining work together as a mated friction pair, with the drum responsible for both heat absorption and dissipation. Lining performance and life largely depend on the condition of the drum and whether it can adequately absorb and dissipate heat generated by braking action.

The brake drum is mounted on the outboard face of the hub and fits over the wheel studs. See Fig. 2.

Tapered Wheel Bearings

A typical tapered wheel bearing assembly consists of a cone, tapered rollers, a roller cage, and a separate cup that is press-fit in the hub. See Fig. 3. All components carry the load, with the exception of the cage, which spaces the rollers around the cone.

Each hub has a set of inner and outer tapered wheel bearing assemblies. See Fig. 2. ConMet PreSet and PreSet Plus hubs have special bearing assemblies.

Drive Axle Spindle Assembly

The drive axle spindle assembly is made up of a drive axle flange and shaft, drive axle studs and stud nuts, a flange gasket, an axle spindle, an oil seal, and the locking assembly described above.

The surfaces of the spindle and the nut threads are machined. When these surfaces become damaged, repairs are necessary. There are standard methods for performing those repairs that preserve the proper alignment of the axle spindle assembly. Refer to the axle manufacturer for instructions.

CAUTION

The National Highway Traffic Safety Administration (NHTSA) has warned against repairs that involve cutting off a portion of a damaged spindle and welding on a replacement part. The heat of welding can reduce the strength of spindles made with heat-treated materials and lead to spindle failure. After the cutting and welding operations, the replacement part may not be cor-

rectly aligned on the spindle. This can cause damage to the spindle nut.

Wheel Studs

A headed wheel stud is used on rear axle disc wheel hub assemblies and has either serrations on the stud body or a flat area on the stud's head to prevent the stud from turning in the wheel hub. See [Fig. 4](#).

On vehicles equipped with ball-seat or stud-piloted wheels, the end of the stud that faces away from the vehicle is stamped with an "L" or "R," depending on which side of the vehicle the stud is installed. Studs stamped with an "L" are left-hand threaded and are installed on the left side of the vehicle. Studs stamped with an "R" are right-hand threaded and are installed on the right side of the vehicle.

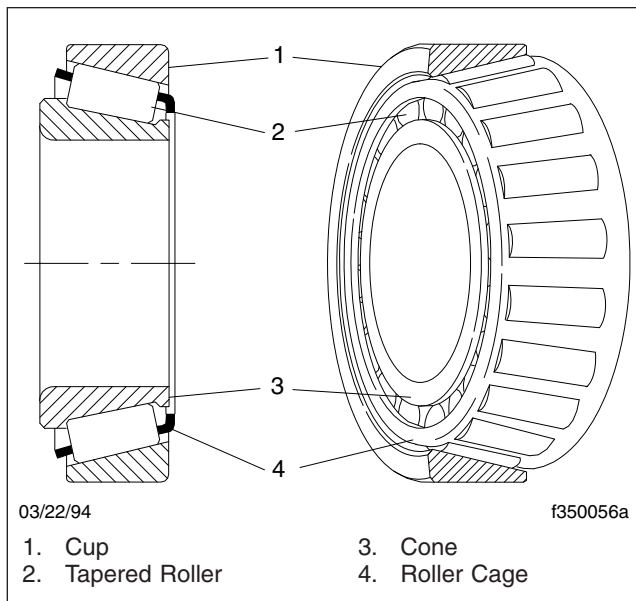


Fig. 3, Tapered Wheel Bearing Assembly

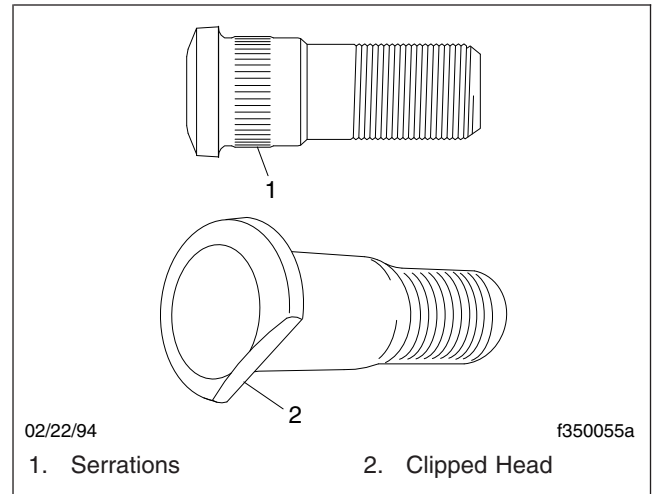


Fig. 4, Typical Headed Wheel Studs

Hub Assembly Removal and Installation

General Information

ConMet PreSet® and PreSet Plus™ hubs are equipped with a unique bearing spacer between special inner and outer bearings. See [Fig. 1](#).

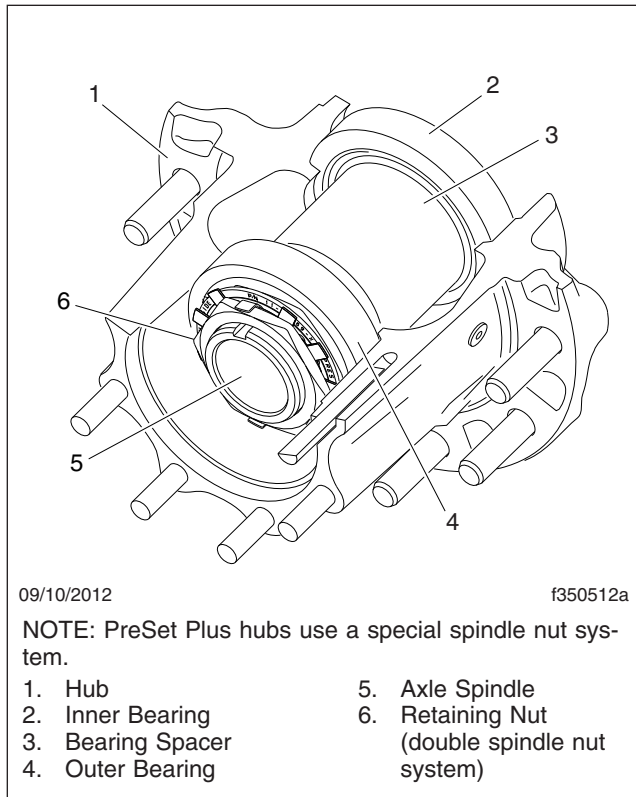


Fig. 1, ConMet PreSet Hub, Cut-Away View

When installing a PreSet or PreSet Plus hub with the spacer and special PreSet bearings, the correct end play is set automatically and wheel bearing adjustment is unnecessary.

For vehicles equipped with ConMet PreSet hubs, it is highly recommended to **stay with the PreSet system** to optimize bearing and seal life. However, if you are replacing the bearings for a PreSet hub, and the special PreSet bearings are not available, standard wheel bearings can be used. In this case, the bearing spacer must be removed and the bearings adjusted manually. See the installation instructions for more information.

Wheel ends equipped with ConMet PreSet Plus hubs must use PreSet Plus components. Do not substitute non-PreSet-Plus components on these installations.

Removal

For typical wheel end and axle assemblies, see [Fig. 2](#) and [Fig. 3](#).

1. Shut down the engine and chock the front tires. Release the parking brakes.
2. Raise the rear of the vehicle until the tires clear the ground. Then place safety stands under the axle.
3. For drum brakes, back off the slack adjuster to release the rear axle brake shoes.

WARNING

Breathing brake lining dust (asbestos or non-asbestos) could cause lung cancer or lung disease. OSHA has set maximum levels of exposure and requires workers to wear an air purifying respirator approved by MSHA or NIOSH. Wear a respirator at all times when servicing the brakes, starting with removal of the wheels and continuing through assembly.

4. Remove both wheel and tire assemblies. For instructions, see [Group 40](#).
5. For drum brakes, remove the brake drum. See [Subject 160](#) for instructions.

For disc brakes, remove the brake caliper. See [Section 42.32](#) for instructions.

NOTE: Oil will spill as the drive axle shaft (or hub cap) and the wheel hub are removed. Place a suitable container under the drive axle flange or hub cap to catch any spilled oil. Dispose of the oil properly.

6. Remove the drive axle stud nuts and washers. See [Fig. 4](#).

NOTICE

When tapping the drive axle flange, avoid striking the drive axle studs. If struck, the studs may bend or break, or the stud threads can be damaged. Replace damaged studs.

7. Using a hammer and a soft drift, such as one made of brass, sharply tap the center portion of the drive axle flange. The shaft will usually spring slightly outward after the seal has broken.

Hub Assembly Removal and Installation

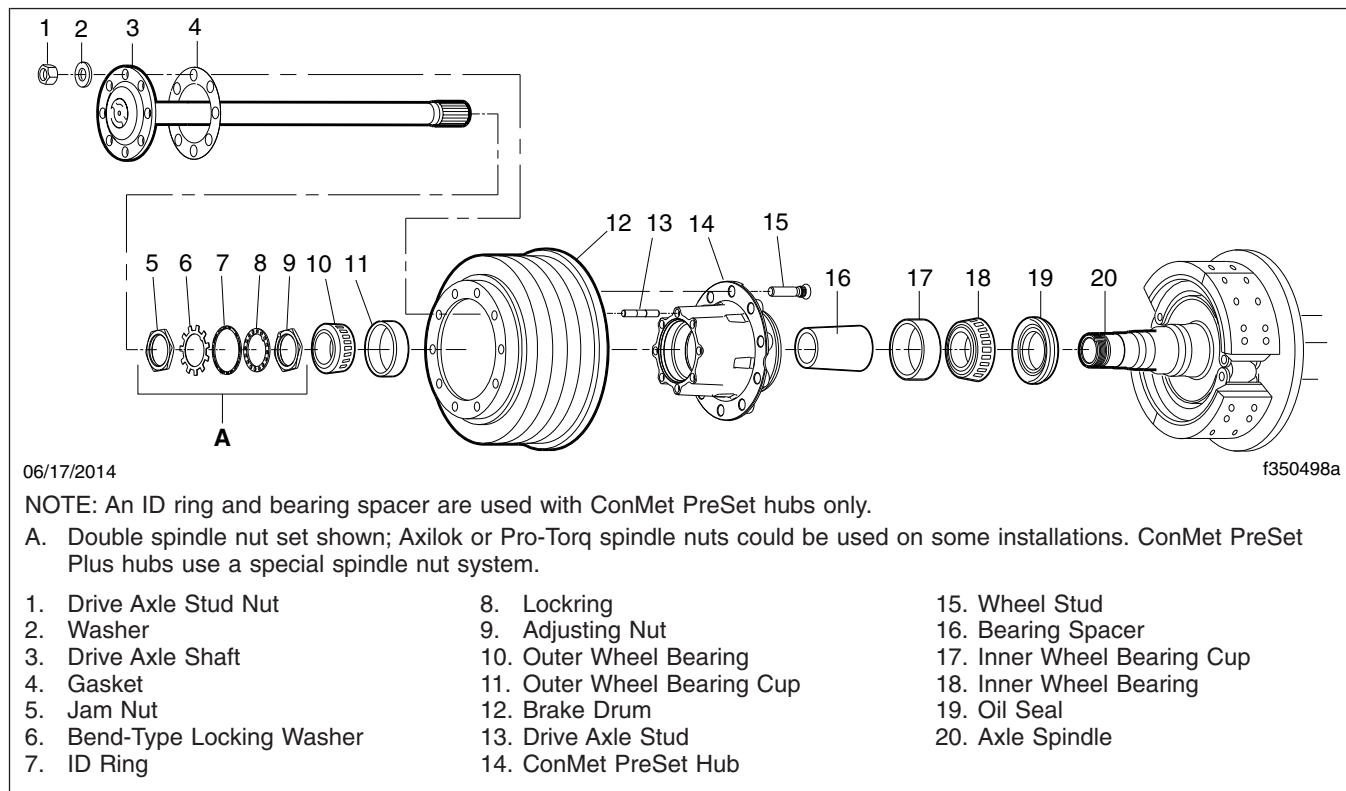


Fig. 2, Typical Wheel End Assembly, Drive Axle with Drum Brakes

NOTE: Even if the drive axle shaft doesn't spring outward, the seal may have loosened enough to allow the shaft to be pulled from the axle housing. If the seal has not broken, repeat the step above.

8. If so equipped, remove the tapered dowels and washers from the drive axle flange.
9. Remove the drive axle shaft.
10. Remove and discard the gasket.
11. Remove the wheel bearing locking device:
 - For an Axilok spindle nut, see [Subject 150](#); then go to the next step.
 - For a Pro-Torq spindle nut, see [Subject 190](#); then go to the next step.
 - If the axle is equipped with a double spindle nut system, see [Subject 140](#); then go to the next step.

- For ConMet PreSet Plus hubs, see [Subject 220](#); then go to the next applicable step.

NOTICE

Be careful not to let the outer wheel bearing drop from the axle spindle. Dropping the bearing can warp the cage or damage the rollers, ruining the bearing. On vehicles equipped with WABCO ABS, use care when working with the hubs. To prevent damage to the tone wheel, do not drop the hub, or lay it down in a way that would damage the tone wheel.

12. Move the hub about 1/2 inch (13 mm) to jar loose the outer wheel bearing (allow the hub-only assembly to rest on the axle spindle; be careful not to damage the axle spindle threads).
13. Carefully remove the outer wheel bearing; handle the bearings with clean, dry hands. Wrap the bearings in either clean oil-proof paper or lint-free rags.

Hub Assembly Removal and Installation

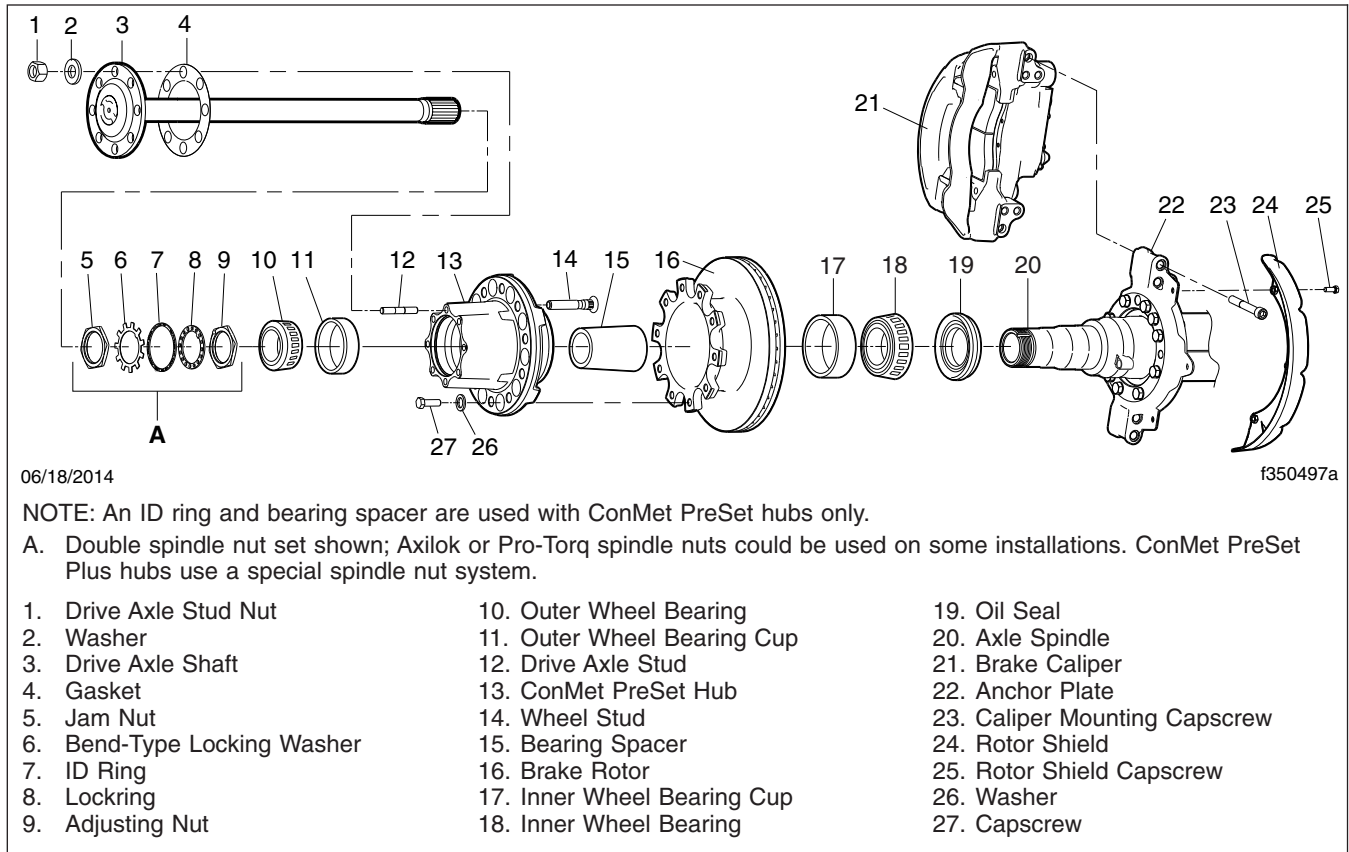


Fig. 3, Typical Wheel End Assembly, Drive Axle with Disc Brakes

NOTICE

Do not spin bearing rollers at any time. Dirt or grit can scratch the roller surface and cause rapid wear of the bearing assembly. Treat used bearings as carefully as new ones.

14. Remove the hub. Be careful not to damage the axle spindle threads as the assembly is removed.
15. Remove the inner wheel bearing. Handle the bearings with clean, dry hands, then wrap the bearings in either clean oil-proof paper or lint-free rags. If the inner wheel bearing remains in the hub after the hub is removed from the axle, place a protective cushion where it will catch the bearings, then use a hardwood drift and a light hammer to gently tap the bearing (and seal, if necessary) out of the cup.

16. Remove the oil seal from the axle spindle, if not already removed. See [Section 35.02](#) for oil seal removal instructions.

NOTE: For vehicles equipped with disc brakes, instructions for removing the rotor from the hub are given in [Section 42.32](#).

Installation

For typical wheel end and axle assemblies, see [Fig. 2](#) and [Fig. 3](#).

WARNING

Breathing brake lining dust (asbestos or non-asbestos) could cause lung cancer or lung disease. OSHA has set maximum levels of exposure and requires workers to wear an air purifying respirator approved by MSHA or NIOSH. Wear a respirator at all times when servicing the brakes,

Hub Assembly Removal and Installation

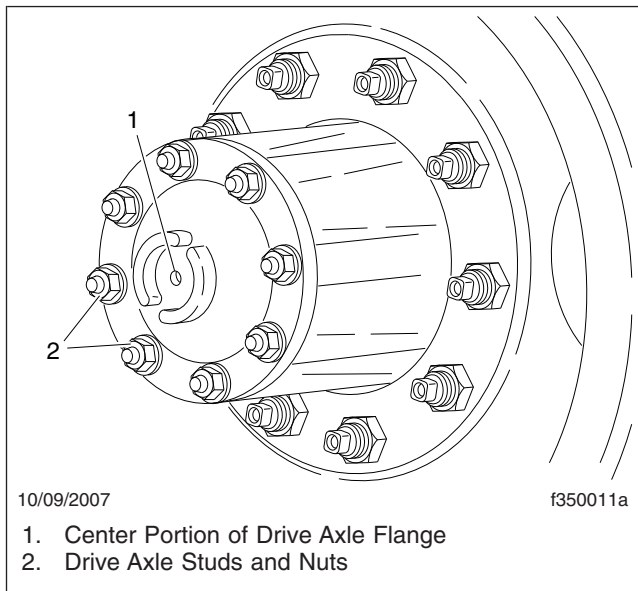


Fig. 4, Wheel Assembly and Hub

starting with removal of the wheels and continuing through assembly.

NOTE: For vehicles equipped with disc brakes, instructions for installing the rotor to the hub are given in [Section 42.32](#).

- Using cleaning solvent, remove the old oil from the axle spindle and the disassembled parts. Allow the parts to dry, or dry them with clean, absorbent, and lint-free cloth or paper. Wrap a protective layer of friction tape on the axle spindle threads.

For PreSet hubs that are being reused, the bearing spacer must be replaced. For PreSet Plus hubs, the bearing spacer must be cleaned and inspected before being reused; see [Subject 110](#). If the bearing spacer is worn or damaged, replace it with a new one.
- Coat both bearing assemblies with fresh oil. Then install the inner wheel bearing and oil seal. Handle the bearings with clean, dry hands. See [Section 35.02](#) for oil seal installation instructions.

NOTICE

Use only fresh oil on the bearing assemblies; old oil could be contaminated with dirt or water (both are corrosives) and could cause damage to both wheel bearing assemblies and the wheel hub.

- Wipe a film of axle oil on the axle spindle to prevent rust from forming behind the inner wheel bearing.

NOTICE

Do not use the bearing spacer with standard wheel bearings. To do so may result in too much bearing end-play, which could damage the wheel bearings, oil seals, the axle spindle, and the hub.

- If using PreSet bearings, ensure the tubular spacer is in the PreSet hub.

If replacing PreSet bearings with non-PreSet bearings, remove the tubular spacer from inside the hub. Save it for future use to convert the hub back to the PreSet system.

NOTICE

When installing a hub, remember the following:

- On vehicles equipped with WABCO ABS, use care when installing the hubs. To prevent damage to the tone wheel, do not drop the hub or lay it down in a way that would damage the tone wheel.
- Do not remove the outer wheel bearing once the hub is installed on the axle. Removing the outer bearing could cause the oil seal to become misaligned, which could cause damage to the wheel bearings, the hub, and the axle spindle.

NOTE: A temporary plastic alignment sleeve may be installed in the center of a new hub. It will be pushed out when the hub is installed on the axle spindle. If it is present, remove and discard this sleeve.

- Mount the bearings and hub on the spindle.
- Remove the friction tape, then adjust and secure the bearings:
 - For an Axilok spindle nut, see [Subject 150](#); then go to the next step.
 - For a Pro-Torq spindle nut, see [Subject 190](#); then go to the next step.
 - If the axle is equipped with a double spindle nut system, see [Subject 140](#); then go to the next step.

Hub Assembly Removal and Installation

- For ConMet PreSet Plus hubs, see [Subject 220](#); then go to the next applicable step.
- 7. Install a new gasket, and the drive axle shaft or, on non-drive axles, the hub cap. The splined end of the axle shaft must seat before the drive axle flange will fit over the studs.
- 8. If equipped, install the dowels and washers on the drive axle studs. Install the drive axle stud nuts. Using the sequence shown in [Fig. 5](#), tighten the nuts 150 to 170 lbf-ft (203 to 230 N·m).
- 9. For drum brakes, install the brake drum on the wheel hub. See [Subject 160](#) for instructions.
For disc brakes, install the the brake caliper. See [Section 42.32](#) for instructions.

WARNING

If the wheel nuts cannot be tightened to minimum torque values, the wheel studs have lost their locking ability, and the hub flange is probably damaged. In this case, replace it with a new wheel hub assembly. Failure to replace the wheel hub assembly when the conditions described above exist, could result in the loss of a wheel or loss of vehicle control, and possible personal injury and property damage.

10. Install the inner and outer wheel and tire assemblies. For instructions, see [Group 40](#).

WARNING

Add oil to the axle housing bowl or the wheel hub after the drive axle shaft and wheel hub have been serviced. Failure to add oil will damage the wheel bearings and cause them to seize during vehicle operation. Seized bearing rollers can cause sudden damage to the tire or axle, possibly resulting in personal injury.

11. Lubricate the wheel bearings, as follows.
 - For drive axles, see [Subject 210](#).
 - For non-drive axles, add about 1 to 1-1/2 pints (0.5 to 0.7 liter) of oil to the level shown on the hub cap. Do not overfill. Install the vent plug or threaded filler plug.
12. Adjust the rear axle brakes. For instructions, see [Group 42](#).

13. Remove the safety stands from under the axle, then lower the vehicle.

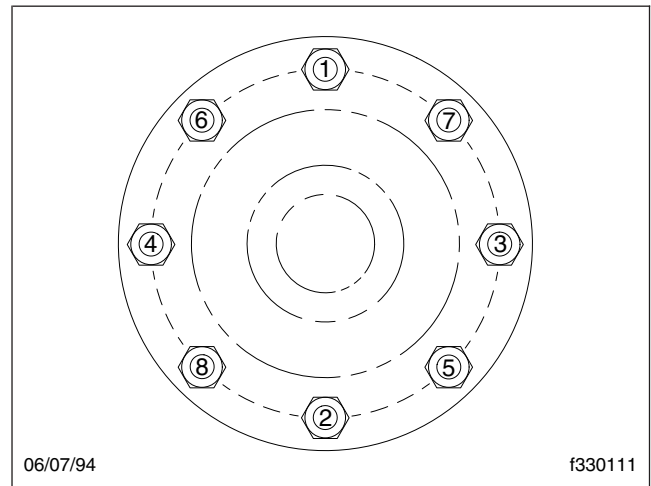


Fig. 5, Tightening Sequence, Drive Axle Stud Nuts

Wheel Hub Assembly Inspection

1. Inspect the wheel hub mounting flange. A loose wheel assembly will cause the flange to be worn, jagged, or warped. See [Fig. 1](#). Replace the wheel hub if any of these conditions exist.

Inspect the flange surface around the wheel studs. Improperly torqued wheel nuts will cause worn or cracked stud grooves on the hub. See [Fig. 2](#). If wear spots or cracks appear anywhere on the hub, or if the hub is otherwise damaged, replace it with a new one.

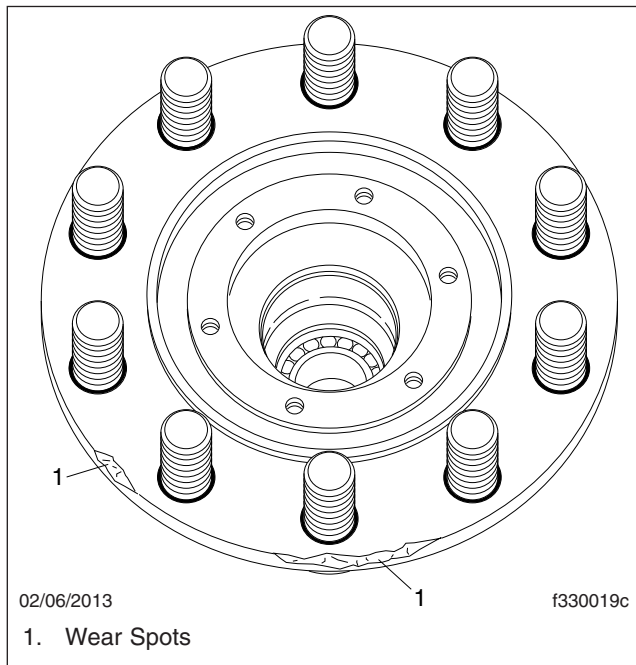


Fig. 1, Damaged Front Axle Wheel Hub

2. Remove all the old oil from the wheel hub cavity. Inspect the inner surface of the hub for cracks, dents, wear, or other damage. Replace the wheel hub if damage exists.
3. Remove all the old grease or oil from the surfaces of the wheel bearing cups. Inspect the wheel bearing cups for cracks, wear, spalling, or flaking. See [Fig. 3](#). Replace the cups if damaged in any way. For instructions, see [Subject 120](#) or [Subject 170](#).

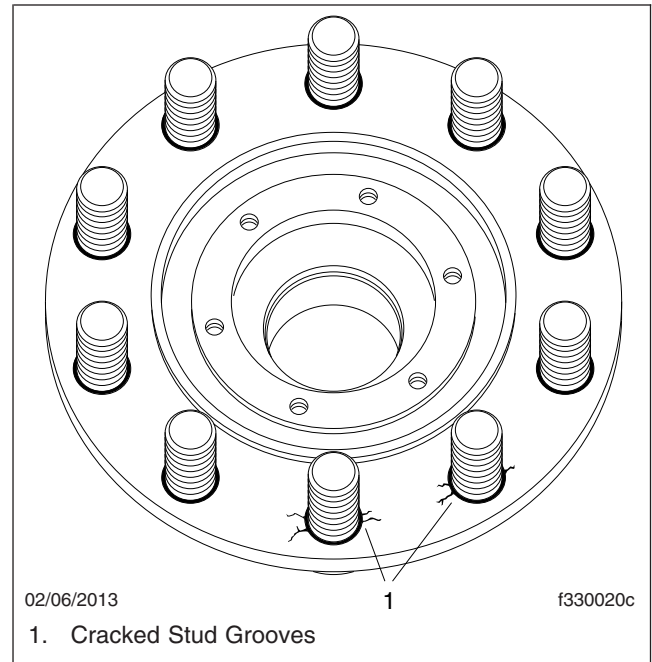


Fig. 2, Damaged Front Axle Wheel Hub

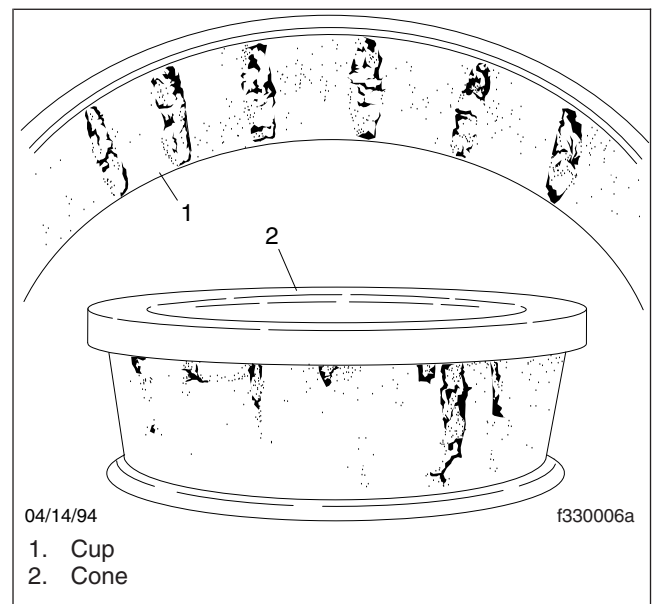


Fig. 3, Spalling (Flaking) of Wheel Bearing Assembly

4. Inspect the wheel nuts on disc wheel installations, or the rim nuts on spoke-wheel installations. Damaged nuts are usually caused by inadequate tightening and must be replaced with new ones. See [Fig. 4](#).

Axle Components Cleaning and Inspection

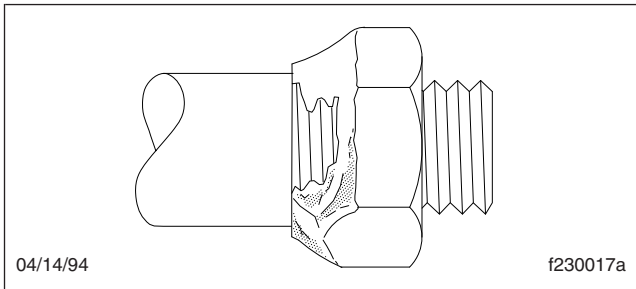


Fig. 4, Damaged Wheel Stud Nut

5. Inspect the wheel or rim studs. Replace studs that are stripped, broken, bent, or otherwise damaged. For instructions, see [Subject 180](#).

Wheel Bearing Inspection

Wheel bearings should be very closely inspected at the time of disassembly. Optimal inspection conditions are possible only after the bearings have been thoroughly cleaned using nonflammable solvent and a stiff brush. Before inspecting, clean the bearings.

1. Remove the wheel hub and bearing cones. For instructions, see [Subject 100](#).
2. Using nonflammable solvent and a stiff brush, clean all the oil from the bearings and hub cavity. Do not use gasoline or heated solvent.
3. Allow the cleaned parts to dry, or dry them with a clean absorbent cloth or paper. Clean and dry your hands and all tools used in the maintenance operation. Oil will not stick to a surface which is wet with kerosene or diesel fuel, and the kerosene or diesel fuel may dilute the lubricant.

NOTICE

Do not spin the bearing rollers at any time. Dirt or grit can scratch the roller surface and cause premature wear of the bearing assembly. Treat a used bearing as carefully as a new one.

4. After the bearings are cleaned, inspect the assemblies, which include the rollers, cones, cups, and cages. If any of the following conditions exist, replace the bearing assemblies.
 - Large ends of rollers worn flush to the recess, or radii at the large ends of the rollers worn sharp. These are indications of advanced wear. See [Fig. 5](#).

- Visible step wear, particularly at the small end of the roller track. Deep indentations, cracks, or breaks in the cone surfaces. See [Fig. 6](#).
- Bright rubbing marks on the dark phosphate surfaces of the bearing cage. See [Fig. 7](#).
- Water etch on any bearing surface. Water etch appears as gray or black stains on the steel surface, and it greatly weakens the affected area. If water etch is present, replace the bearing seals.
- Etching or pitting on functioning surfaces. See [Fig. 8](#).
- Spalling (flaking) of the bearing cup, roller, or cone surfaces. See [Fig. 3](#).

After inspection, brush the bearings with fresh axle lubricant.

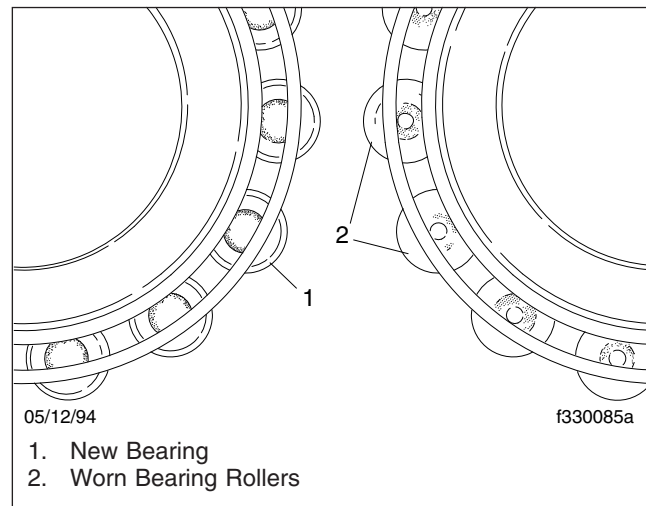


Fig. 5, Wheel Bearing Roller Wear

Brake Drum Inspection

New brake drums are purposely undersized to allow for turning (remachining), since in mounting drums on the hub, there can be some eccentricity. If a new drum is installed, the protective coating on the inner friction surface must be removed with a solvent, prior to drum installation, then rinsed with a hot water wash. Use a clean rag to remove any oily residue or metal chips from the friction surface.

Axle Components Cleaning and Inspection

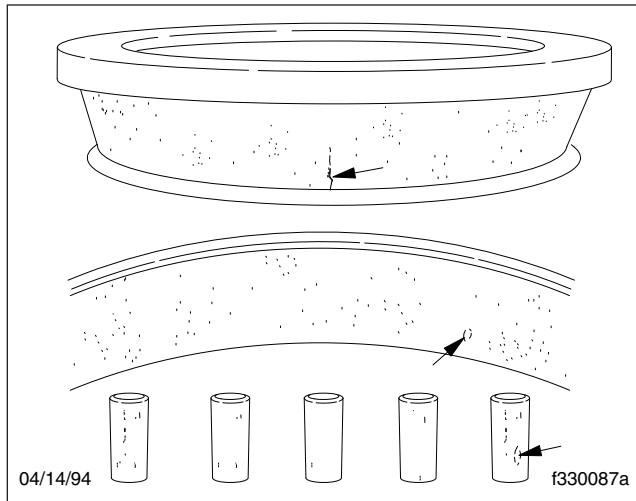


Fig. 6, Indentations, Cracks, or Breaks in Bearing Surfaces

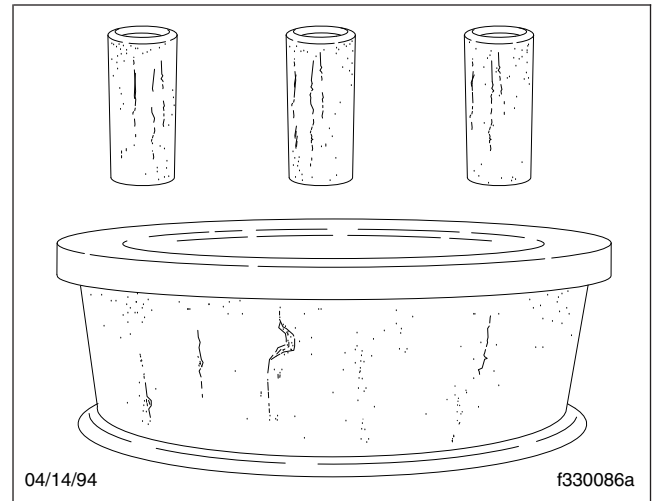


Fig. 8, Etching (Pitting) on Bearing Surfaces

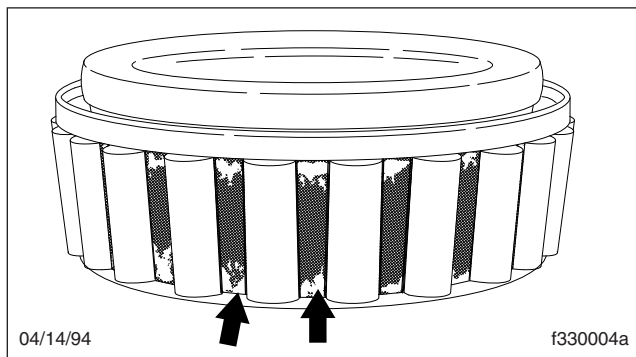


Fig. 7, Rubbing Marks on Bearing Cage

If a drum must be turned or replaced, the other same-axle drum must be similarly turned or replaced to provide the same braking power on both wheels. Turned drums should not exceed the maximum allowable diameter, which is stamped on the outside surface of the drum. See [Fig. 9](#) for a typical location of this stamp.

NOTE: Drums that have been turned should then be cleaned, using fine emery cloth followed with a hot water wash. Drums that have been renewed using emery cloth should also be washed with hot water.

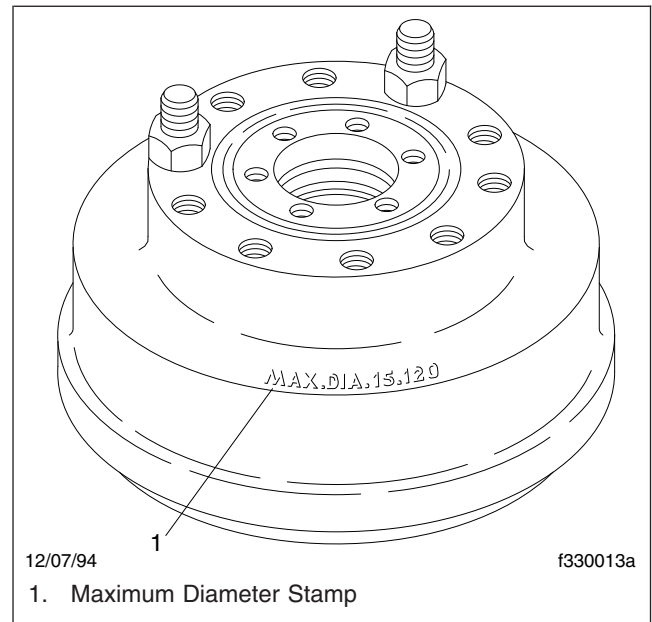


Fig. 9, Outboard Mounted Hub and Drum Assembly

NOTICE

Failure to replace drums when worn or turned to limits exceeding the maximum allowable diameter will result in drum weakness and reduced braking capacity, which can lead to distortion, higher drum temperatures, and ultimately, drum breakage.

Axle Components Cleaning and Inspection

If the drums are turned or replaced, replace the brake linings. See [Group 42](#) for instructions.

1. Inspect the inner friction surface. If a veneered (highly glossed) or glazed surface exists, renew the drum by using 80-grit emery cloth or by turning the drums.
2. Inspect for heat checking, which is a form of buckling (cracking) resulting from a temperature differential in the drum wall between a relatively cool exterior and a hot friction surface. Heat checking is normal on all drums and may not impair performance and lining life if the network of fine hairline cracks remains small. Examine heat checks of drums frequently to be certain the checks have not widened into drum weakening cracks (substantial cracks extending to the open edge of the drum). Replace the same-axle drums if substantial cracks are present, or if widening of the fine hairline cracks occurs.

NOTE: If normal heat checking as described above is present, inspect the drums at least every 12,000 miles (19 300 km) thereafter. Inspect the drums (using a flashlight from the in-board side of the wheels) every 6000 miles (9700 km). Inspect more often under adverse operating conditions.

3. Check for a contaminated inner friction surface. If fluids are present, such as oil or grease, remove the contaminants. Locate and correct the source of the contamination. If the brake drums are contaminated with fluids, the brake linings will also be affected. Since oil or grease saturated linings cannot be salvaged, they must be replaced. For brake lining replacement procedures, see [Group 42](#).

WARNING

If the brake drums are contaminated with fluids, replace the brake linings. Failure to replace fluid contaminated brake linings could result in a partial loss of braking capacity, which could lead to personal injury or property damage.

4. Measure the inside diameter of the drum. If the measured diameter is greater than the maximum allowable diameter, replace the same-axle drums and linings.

NOTE: It may be necessary to remove the brake dust shield to measure the roundness of the drum.

5. Ensure the roundness of the drum is within acceptable limits, as follows. Set the measuring tip of a dial indicator against the working surface of the drum between the brake shoes as far out-board as possible. Zero the gauge, then turn the drum one revolution and note the highest and lowest measurements.

If the difference is 0.010 inch (0.25 mm) or less, proceed to the next step. If the difference is more than 0.010 inch (0.25 mm), mark the drum and hub to record their relative positions, and remove the drum. Clean the mating surfaces of the hub and drum, and re-install the drum rotated 90 degrees from its earlier position. Tighten four wheel nuts 50 lbf-ft (68 N-m), and repeat the measurement. If the difference is more than 0.010 inch (0.25 mm), the drum is out of round beyond acceptable limits and all drums on the axle must be re-machined or replaced.

6. Inspect the outside surface of the drum. Remove any accumulation of mud, dirt, or rust; foreign matter acts as an insulator, trapping heat within the drum.
7. Check for hard, slightly raised dark-colored spots on the inner friction surface or for a bluish cast on the brake parts, both of which are caused by high temperatures. If the drums' maximum allowable diameters have not been exceeded, remachine both same-axle drums. If the spots or discoloration cannot be removed, or if remachining is not possible, replace the drums. Also replace the brake shoe return springs.

Bearing Spacer Cleaning and Inspection, PreSet Plus™ Hubs

WARNING

Do not repair or recondition a damaged or worn bearing spacer; replace it. Using repaired, reconditioned, damaged, or worn components can cause wheel end failure, which can result in serious injury and property damage.

Axle Components Cleaning and Inspection

1. Use a cleaning solvent to clean the bearing spacer; do not use gasoline. Remove the solvent completely with clean, absorbent cloth or paper.

NOTE: PreSet Plus bearing spacers have undergone a heat-treating process that discolors the ends; see [Fig. 10](#). This type of discoloration is normal for heat-treated spacers.

2. Inspect the bearing spacer for signs of wear or damage. Look for a sharp ring of standing metal that has been worn into the spacer at either end; see [Fig. 11](#). If the spacer is worn or damaged, replace it.

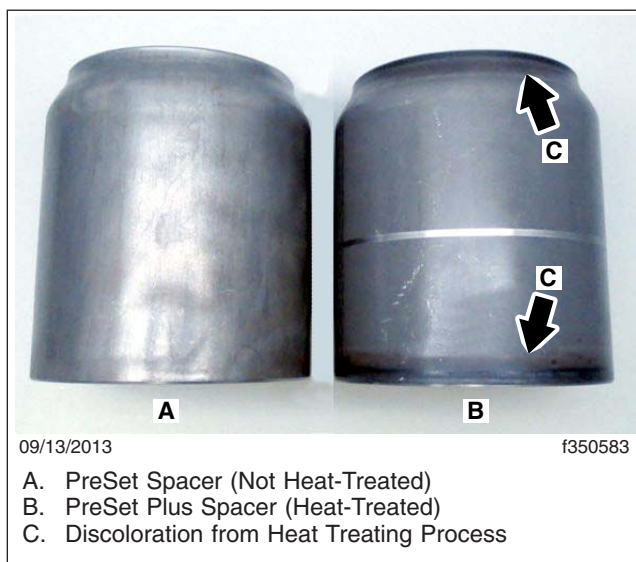


Fig. 10, PreSet and PreSet Plus Bearing Spacers

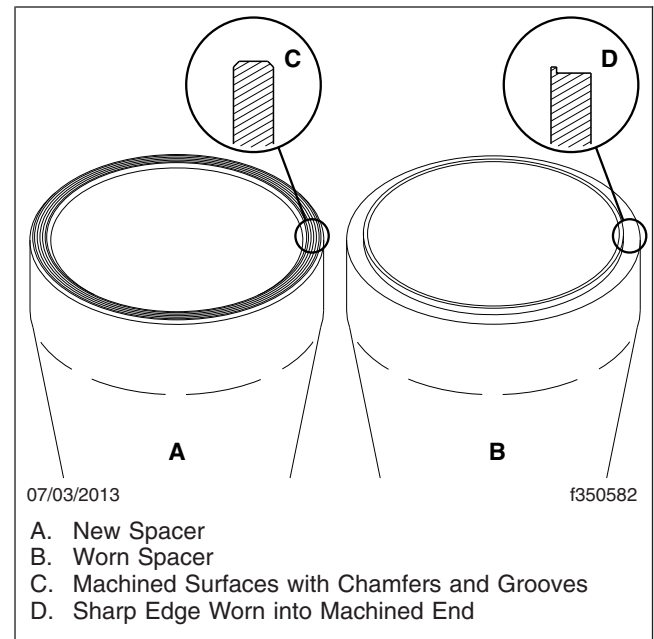


Fig. 11, Comparison of New and Worn Bearing Spacers

Wheel Bearing Cup Removal and Installation, Ferrous Hubs

Removal

Wheel bearing cups on ferrous hubs are removed and installed by driving them out and pressing them in without heating the hub.

1. Using a solvent, completely remove all grease, oil, and other debris from the outer and inner surfaces of the wheel hub assembly.
2. Using a mild-steel rod through the opposite end of the hub, drive against the inner edge of the bearing cup. Alternately drive on opposite sides of the cup to avoid cocking the cup and damaging the inside of the hub.

Installation

1. Using a solvent, completely remove all grease, oil, and other debris from the outer and inner surfaces of the wheel hub assembly, including the bearing cup bores.
2. Inspect the bearing cup bores of the hub for warpage or uneven surfaces. If a bearing cup bore is damaged, replace the wheel hub assembly.
3. Coat the replacement bearing cup hub contact surface with a film of grease.
4. Position the cup in the hub and press it into place, using a suitable driving tool. Cups must seat against the shoulder in the hub.



WARNING

To prevent skin irritation, wear chemical resistant gloves when working with diesel fuel or kerosene. Also, do not expose these fluids to flames or heat exceeding 100°F (38°C); both are combustible, and could cause personal injury or property damage if ignited.

5. Wipe off the accumulation of grease left after the bearing cup has been seated. Then, using a clean lint-free cloth dampened with kerosene or diesel fuel oil, clean the inner surface of the bearing cup. Wipe the surface dry using a clean, absorbent, and lint-free cloth or paper.

Replacement

1. Remove the wheel hub from the axle. For instructions, see **Subject 100**.
2. If enough threads remain on the damaged stud, remove it by double-nutting the stud. Turn the inner nut with a wrench in order to remove the stud. Then, proceed to the next step.

If the drive axle stud is broken near the surface of the hub, the stud should be center-drilled using a high-speed drill, and then removed with an easy-out tool. If needed, grind off a flat surface on the damaged stud, then center-punch the surface as a starting point for drilling. Follow these recommendations:

 - 2.1 Determine the correct drill diameter by referring to the easy-out tool manufacturer's guidelines. At no time should it be large enough to penetrate the threads of the stud; if the stud threads in the wheel hub are damaged, replace the hub.
 - 2.2 Do not drill more than 1.25 inches (32 mm) into the broken stud, as measured at the stud's entrance into the wheel hub. Drilling through the bottom of the drive axle stud could damage the hub. If the wheel hub is drilled into, replace it.
 - 2.3 While drilling, keep the cutting surfaces of the drill well lubricated with oil, which acts as a coolant. Allow the drill and drill bit to cool frequently.
3. After the damaged stud is removed, tap out the drive axle stud hole in the wheel to rid the threads of old stud-locking compound. Use an appropriate sized tap, depending on the original drive axle stud installation size.
4. Be sure the threads of the new stud are clean and dry. Then, coat the insertion end of the drive axle stud (the coarse threads) with an anaerobic thread-lock compound.
5. Using double nuts on the fine-thread portion of the stud, install the new stud. Seat the drive axle stud using the torque values in **Specifications 400**.
6. Allow sufficient time for the thread-lock compound to set, as suggested by the manufacturer.

7. If the hub was removed from the axle, see **Subject 100** for installation instructions.

Double Spindle Nut Removal, Installation, and Adjustment

General Information

ConMet PreSet hubs may use a double spindle nut system. See [Fig. 1](#). A plastic ID ring between the adjusting nut and locking washer indicates that a ConMet Preset hub has been installed.

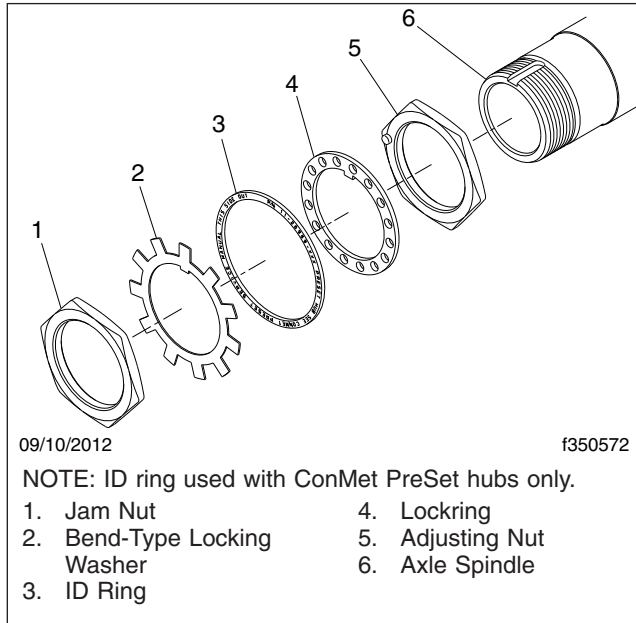


Fig. 1, Double Spindle Nut Set

Removal

Once a double spindle nut set is removed, discard the bend-type locking washer. Inspect the adjusting nut, lockring, and jam nut for visible damage prior to reuse.

Installation

Instructions for installing a double spindle nut set for both PreSet and non-PreSet type bearings are provided in this subject. See the pertinent instructions for the type you are installing.

Using PreSet Bearings

1. Install the adjusting nut onto the axle spindle, and tighten it 300 lbf-ft (410 N·m). See [Fig. 1](#).

NOTE: The gaps between holes in the lockring are spaced unevenly, so to fit the tab on the ad-

justing nut into one of the holes with minimal turning of the adjusting nut, gauge the distance on one side of the lockring, then the other, and choose the side that requires the adjusting nut to be advanced the least. **Do not back off the nut.**

2. Install the locking (as described in the note above), ID ring (for ConMet PreSet hubs only), and bend-type locking washer.
3. Install the jam nut, and tighten it 200 lbf-ft (271 N·m).
4. Bend the tabs on the locking washer at 6 o'clock and 12 o'clock to lock the jam nut in place. See [Fig. 2](#).

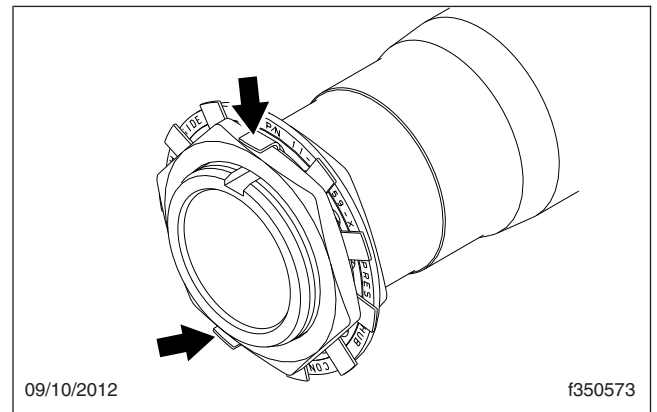


Fig. 2, Tabs Bent to Lock the Jam Nut

5. Rotate the hub in both directions. It should turn freely with no dragging or binding.

Using Non-PreSet Bearings

For ConMet PreSet hubs, when there is no bearing spacer installed and non-PreSet type bearings are being used, proper wheel bearing adjustment is critical to the performance of the bearings, wheel seals, and other related wheel end components.

1. Install the adjusting nut, as follows. See [Fig. 1](#).
 - 1.1 Install the adjusting nut on the spindle, and tighten it finger-tight.
 - 1.2 While rotating the wheel hub assembly, tighten the adjusting nut 200 lbf-ft (271 N·m).
 - 1.3 Back off the adjusting nut one full turn.

Double Spindle Nut Removal, Installation, and Adjustment

- 1.4 Tighten the adjusting nut 50 lbf-ft (68 N·m) while rotating the wheel hub assembly.
- 1.5 Back off the adjusting nut one-quarter turn.

NOTE: The gaps between holes in the locking are spaced unevenly, so to fit the tab on the adjusting nut into one of the holes with minimal turning of the adjusting nut, gauge the distance on one side of the locking, then the other, and choose the side that requires the adjusting nut to be turned the least.

2. Install the locking (as described in the note above) and bend-type locking washer.
3. Install the jam nut, and tighten it 300 to 400 lbf-ft (410 to 540 N·m).
4. Measure the end play; see [Subject 200](#) for instructions.

WARNING

Correct wheel-bearing end play is crucial to the safe and sound operation of the vehicle. If the end play is not correct, the wheel bearings could fail and cause the loss of the wheel and hub assembly and result in an accident causing property damage, serious injury, or death. Use a dial indicator to measure the end play.

5. **The end play must be between 0.001 and 0.005 inch (0.03 and 0.13 mm).** If the end play is not within this range, adjust the end play as follows.
 - 5.1 Remove the jam nut and locking device, and back off or tighten the inner adjusting nut.
 - 5.2 Install the locking device and jam nut as described earlier, and measure the end play. If the end play is not between 0.001 and 0.005 inch (0.03 and 0.13 mm), turn the adjusting nut again.
 - 5.3 Measure the end play.

If the end play is not between 0.001 and 0.005 inch (0.03 and 0.13 mm), repeat the adjustment procedure until the correct end play is achieved.

IMPORTANT: The correct end play **must** be achieved before completing the hub assembly installation procedure.

6. Once the end play is between 0.001 and 0.005 inch (0.03 and 0.13 mm), bend two tabs on the locking washer at 6 o'clock and 12 o'clock to lock the jam nut in place. See [Fig. 2](#).
7. Rotate the hub in both directions. It should turn freely with no dragging or binding.

Axilok Spindle Nut Removal, Installation, and Adjustment

General Information

Axilok® spindle nuts may be used on ConMet PreSet hubs. See [Fig. 1](#). These nuts can be damaged if they are not removed or installed correctly. Use the following guidelines when removing and installing Axilok retaining nuts.

- Use only the correct size, *six-point* socket to remove or install Axilok spindle nuts. Do not use a worn or loose-fitting socket. **Do not use a 12-point socket.**
- Do not use hammers, chisels, pliers, wrenches, or power tools to remove or install Axilok nuts.
- Do not use an Axilok nut if the locking clips are damaged or missing, or if the retainer cage tab or D-flat is damaged or missing.
- Never try to repair a damaged Axilok nut; always replace it with a new one.
- Always start an Axilok installation by hand. A good-fitting six-point socket will completely disengage the nut's locking clips, allowing it to spin freely by hand. See [Fig. 2](#). Use an accurately calibrated torque wrench to tighten the nut to its final torque value.

Installation

Instructions for installing an Axilok nut for both Pre-Set and non-PreSet type bearings are provided in this subject. See the pertinent instructions for the type you are installing.

Using PreSet Bearings

WARNING

Follow the guidelines at the beginning of this subject when installing an Axilok nut. Axilok retaining nuts secure the hub assemblies on the axle. If the Axilok nut is not correctly installed, the hub could separate from the axle, resulting in severe personal injury or death.

1. Apply a few drops of oil through one of the holes in the Axilok retainer cage to reduce friction between the retainer cage and nut..
2. By hand, install the Axilok nut onto the axle spindle. See [Fig. 1](#).

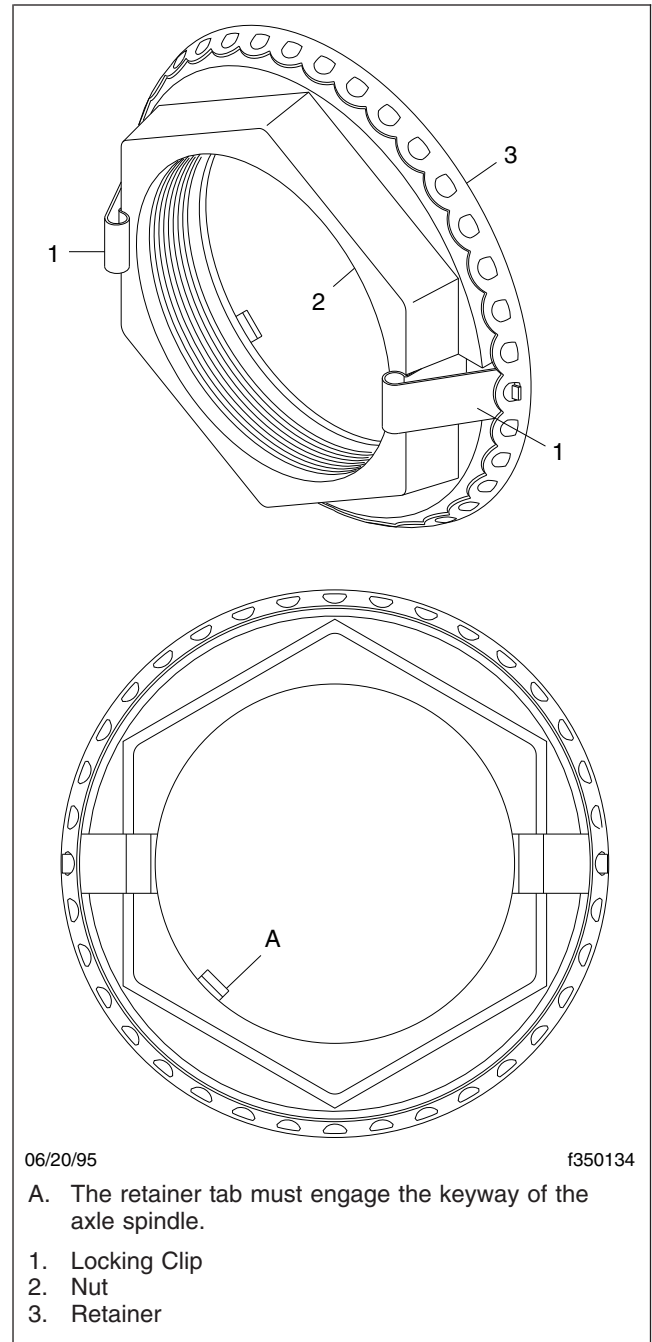


Fig. 1, Rear Axle Axilok Nut

3. Tighten the retaining nut 250 lbf-ft (339 N·m). The nut should lock in place when you remove the wrench. If it does not, advance the nut until it does. **Do not back it off.**

Axilok Spindle Nut Removal, Installation, and Adjustment

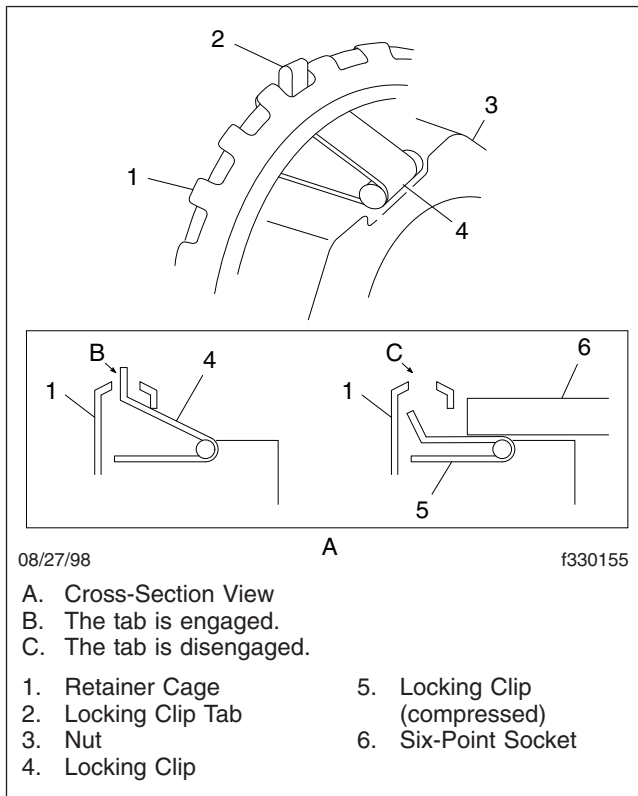


Fig. 2, Axilok Nut, Checking the Position of the Locking Clip

4. Ensure that both locking clips are present and engaged in the retainer cage. See [Fig. 2](#). If the locking clips are not engaged, the nut is not locked in position and can rotate freely.

Using Non-PreSet Bearings

For ConMet PreSet hubs, when there is no bearing spacer installed and non-PreSet type bearings are being used, proper wheel bearing adjustment is critical to the performance of the bearings, wheel seals, and other related wheel end components.

! WARNING

Follow the guidelines at the beginning of this subject when installing an Axilok nut. Axilok retaining nuts secure the hub assemblies on the axle. If the Axilok nut is not correctly installed, the hub could separate from the axle, resulting in severe personal injury or death.

1. Apply a few drops of oil through one of the holes in the Axilok retainer cage to reduce friction between the retainer cage and nut.
2. Install the Axilok nut and adjust the wheel bearings, as follows.
 - 2.1 By hand, install the Axilok nut onto the axle spindle. Then turn it against the bearing while spinning the hub. See [Fig. 1](#).
 - 2.2 Tighten the nut 90 to 110 lbf·ft (122 to 149 N·m) while spinning the hub in both directions.
 - 2.3 Loosen the nut to zero torque, and spin the hub a few turns.
 - 2.4 Tighten the nut 50 lbf·ft (68 N·m) while spinning the hub in both directions. Back off the nut one-eighth to one-sixth turn.
 - 2.5 Remove the wrench from the nut, and verify whether both locking clips are present and engaged in the retainer cage. See [Fig. 2](#). If the locking clips are not engaged, advance the Axilok until they are.
3. Measure the end play; see [Subject 200](#) for instructions.

! WARNING

Correct wheel-bearing end play is crucial to the safe and sound operation of the vehicle. If the end play is not correct, the wheel bearings could fail and cause the loss of the wheel and hub assembly and result in an accident causing property damage, serious injury, or death. Use a dial indicator to measure the end play.

4. **The end play must be between 0.001 and 0.005 inch (0.03 and 0.13 mm).** If it is not within this range, remove the Axilok nut, and repeat the tightening sequence as described earlier in this procedure. Once the end play is correct, continue with your service procedure.

Outboard-Mounted Drum Removal and Installation

WARNING

When replacing brake pads, shoes, rotors, or drums, always replace components as an axle set.

- Always reline both sets of brakes on an axle at the same time.
- Always replace both rotors/drums on an axle at the same time.
- Always install the same type of linings/pads or drums/rotors on both axle ends of a single axle, and all four axle ends of a tandem axle, at the same time. Do not mix component types.

Failure to do so could cause uneven braking and loss of vehicle control, resulting in property damage, personal injury, or death.

Removal

1. Park the vehicle, shut down the engine, release the parking brakes and chock the front tires.
2. Raise the rear of the vehicle until the tires clear the ground. Then place safety stands under the axle.

WARNING

Never work under a vehicle that is supported only by a jack. Jacks can slip, causing the vehicle to fall. This could result in a person being pinned under or crushed by the vehicle, causing severe personal injury or death. Always use safety stands to support a vehicle.

3. Back off the slack adjuster to release the rear axle brake shoes. See [Group 42](#) for instructions.

WARNING

Breathing brake lining dust (asbestos or non-asbestos) could cause lung cancer or lung disease. OSHA has set maximum levels of exposure and requires workers to wear an air purifying respirator approved by MSHA or NIOSH. Wear a respirator at all times when servicing the brakes, starting with removal of the wheels and continuing through assembly.

4. Remove the wheel and tire assembly. See [Group 40](#) for instructions.

To minimize the possibility of creating airborne brake lining dust, clean the dust from the brake drum, brake backing plate, and brake assembly, using an industrial-type vacuum cleaner equipped with a high-efficiency filter system. Then, using a rag soaked in water and wrung until nearly dry, remove any remaining dust. Don't use compressed air or dry brushing to clean the brake assembly.

5. Remove the brake drum.
6. Inspect the drum. See [Subject 110](#) for instructions.

Installation

1. Install the brake drum on the wheel hub.
 - 1.1 On hub-piloted drums, position the brake drum on the top step of the pilot pad. One of the hub's pilot pads should be at the twelve o'clock (top center) position. See [Fig. 1](#).

IMPORTANT: If the drum is not positioned correctly, the pilot pad could be damaged when the wheel nuts are tightened.

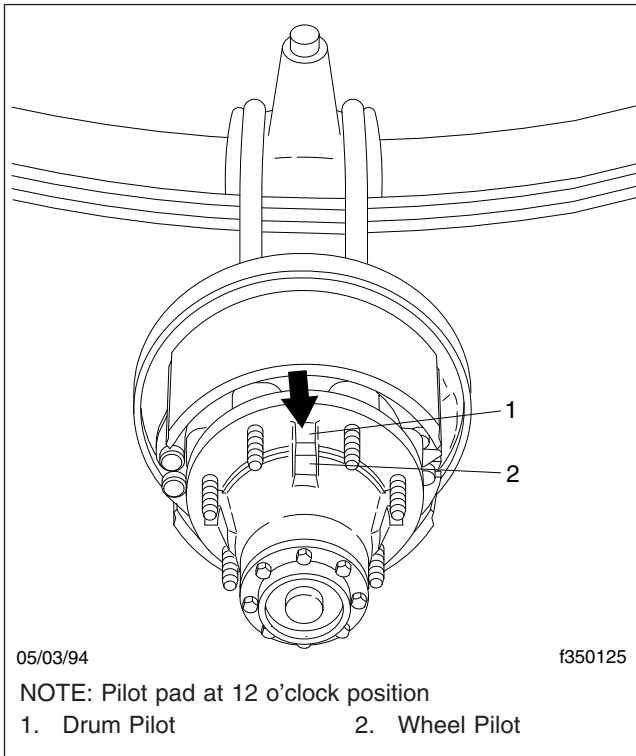
- 1.2 Make sure that the pilot pads securely center the drum (space between drum and hub is equal all around the hub).

IMPORTANT: If damage to the pads prevents the drum from centering, replace the hub. If necessary to hold the drum in position, adjust the brakes before installing the wheels.

2. Install the wheel and tire assembly. To ensure that the drum does not slip off the pilot pad, follow the correct nut tightening sequence. For instructions, see [Group 40](#).

WARNING

If the wheel nuts cannot be tightened to minimum torque values, the wheel studs have lost their locking ability, and the hub flange is probably damaged. In this case, replace it with a new wheel hub assembly. Failure to replace the wheel hub assembly when the conditions described

Outboard-Mounted Drum Removal and Installation**Fig. 1, Hub Pilot Pads**

above exist, could result in the loss of a wheel or loss of vehicle control, and possible personal injury.

3. Adjust the rear axle brakes. For instructions, see [Group 42](#).
4. Remove the safety stands from under the axle; lower the vehicle.

Wheel Bearing Cup Removal and Installation, Aluminum Hubs

Removal

To ensure a tight fit, wheel bearing cups are purposely larger than the wheel hub bores they occupy. To remove the bearing cups, aluminum hub bores must be temporarily expanded by heating the hub in an oven (the bearing cups will also expand, but to a considerably lesser extent). If adequate heating facilities are not available, replace the hub, wheel stud, and bearing cup assembly.

1. Using a solvent, completely remove all grease, oil, and other debris from the outer and inner surfaces of the wheel hub assembly.

IMPORTANT: Be sure to follow all the manufacturer's warnings and instructions when using any solvent.

2. Oven-heat the hub to a temperature range of 240 to 280°F (116 to 138°C). Make sure the oven thermostat is accurately set; if unsure, use an oven thermometer to check the temperature of the oven before placing the hub inside.

If adequate heating facilities are not available, replace the hub, wheel stud, and bearing cup assembly.

WARNING

Do not use oxyacetylene equipment or similar equipment to heat the hub. Oxyacetylene equipment or similar equipment will cause cracks in the hub which could cause loss of a wheel and loss of vehicle control, leading to personal injury or property damage.

3. Wearing heavy protective gloves, remove the hub from the oven. Place the hub on a suitable press so that the base is fully supported. Quickly press out the bearing cups.

Installation

To install the bearing cups, aluminum hubs must again be temporarily expanded using oven heating. When the hub is properly heated, the bearing cup and hub can be press-fit together, using a suitable press.

1. Using a solvent, completely remove all grease, oil, and other debris from the outer and inner

surfaces of the wheel hub assembly, including the bearing cup bores.

2. Inspect the bearing cup bores of the hub for warpage or uneven surfaces. If a bearing cup bore is damaged, replace the wheel hub assembly.
3. Oven-heat the hub to a temperature range of 240 to 280°F (116 to 138°C). Make sure the oven thermostat is accurately set; if unsure, use an oven thermometer to check the temperature of the oven before placing the hub inside.

WARNING

Do not use oxyacetylene equipment or similar equipment to heat the hub. Oxyacetylene equipment or similar equipment will cause cracks in the hub which could cause loss of a wheel and loss of vehicle control, leading to personal injury or property damage.

4. Coat the replacement bearing cup hub contact surface with a film of grease.
5. Wearing heavy protective gloves, remove the hub from the oven.
6. Place the hub on a suitable press so that the base is fully supported. Quickly press-fit the bearing cup into the wheel hub until it is completely and evenly seated. Be careful not to shave the sides of the bearing cup bore as the bearing cup is seated. The accumulation of debris will prevent the cup from being seated and will also cause permanent damage to the wheel hub. If the sides of the bearing cup bore are damaged during installation, replace the wheel hub assembly.
7. Allow the wheel hub to cool before handling. Then, using a 0.0015-inch feeler gauge, check at several places for the seating of the bearing cup in the bearing cup bore. The gauge should not enter beneath the cup. If it does, there is probably dirt or debris preventing the cup from seating. Using the instructions above, remove the cup, then remove the foreign matter. Reinstall the cup.

WARNING

To prevent skin irritation, wear chemical-resistant gloves when using kerosene or diesel fuel. Also, do not expose these fluids to flames or heat ex-

Wheel Bearing Cup Removal and Installation, Aluminum Hubs

ceeding 100°F (38°C); both are combustible and could cause personal injury or property damage if ignited.

8. Wipe off the accumulation of grease left after the bearing cup has been seated. Then, using a clean, lint-free cloth dampened with kerosene or diesel fuel oil, clean the inner surface of the bearing cup. Wipe the surface dry using a clean, absorbent, and lint-free cloth or paper.

Wheel Stud Replacement

Replacement

WARNING

If a wheel stud breaks, the remaining studs are subjected to undue strain and could fail due to fatigue. When a broken stud is replaced, replace the stud on each side of it. See [Fig. 1](#). If more than one stud is broken, replace all of the studs. Failure to replace the studs could result in the loss of a wheel or loss of vehicle control, possibly resulting in personal injury.

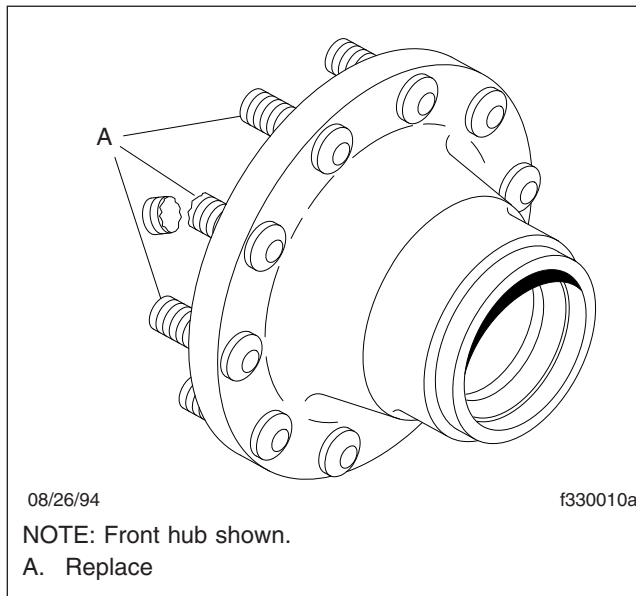


Fig. 1, Wheel Stud Replacement

1. Remove the wheel hub from the axle. For instructions, see [Subject 100](#).
2. If a bent portion of a wheel stud will have to pass through the wheel stud bore, cut off the bent portion before removing the wheel stud.
3. Place the wheel hub on a suitable press; make sure the hub flange is supported evenly around and next to the stud being removed. With steady movement, press the damaged stud out of the hub.

CAUTION

Do not use a drift and hammer or concentrated heat for removing and installing the wheel studs.

Constant, smooth movement of the wheel stud is necessary to ensure the least amount of metal removal from the wheel stud bore. Concentrated heat will damage the hub. If the hub is damaged during wheel stud removal or installation, replace it.

4. Apply a coating of clean axle grease to the entire shaft on headed studs.
5. With the hub on a suitable press, make sure the hub flange is supported evenly around and next to the stud being installed.
6. Position the stud in its hole. *Be sure the flat edge of the head flange on clipped studs is in line with the shoulder on the hub.*

CAUTION

If headed studs with serrations are being installed, position the teeth of the serrated portion in the notches carved by the original wheel studs during factory installation. If additional metal is scraped from the wheel stud bores, the locking action provided by the serrations will be greatly weakened. Loss of locking action will prevent achieving final torque of the wheel nuts during wheel installation. If final wheel nut torques during wheel installation cannot be achieved, replace the wheel hub assembly.

NOTE: If the left side of the vehicle is being serviced, the replacement wheel stud must be stamped with an "L" (left-hand threaded), and the face of the nut must be stamped "Left." If the right side of the vehicle is being serviced, the replacement stud must be stamped with an "R" (right-hand threaded), and the face of the nut must be stamped "Right." See [Fig. 2](#).

7. With steady movement, press the new stud all the way into the hub.
8. Make sure the stud is fully seated and that its head (flange) is not embedded into the hub. If the head of the stud is embedded into the hub, replace the hub.

WARNING

Don't embed the wheel stud heads in the wheel hub. Wheel studs with heads embedded in the wheel hub will weaken the wheel hub flange. Weakness in the wheel hub can result in the loss

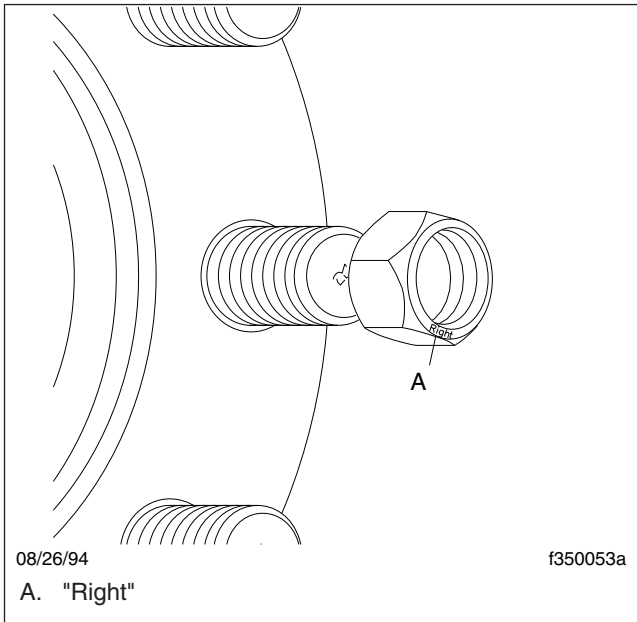
Wheel Stud Replacement

Fig. 2, Thread Stamp Location

of a wheel or loss of steering control, possibly resulting in personal injury.

9. Wipe off any grease on the wheel studs and wheel hub. Install wheel nuts on dry wheel studs only.
10. Install the wheel hub on the axle. For instructions, see [Subject 100](#).

Pro-Torq Spindle Nut Removal, Installation, and Adjustment

General Information

Pro-Torq® spindle nuts may be used on ConMet Pre-Set hubs. See [Fig. 1](#) and [Fig. 2](#).

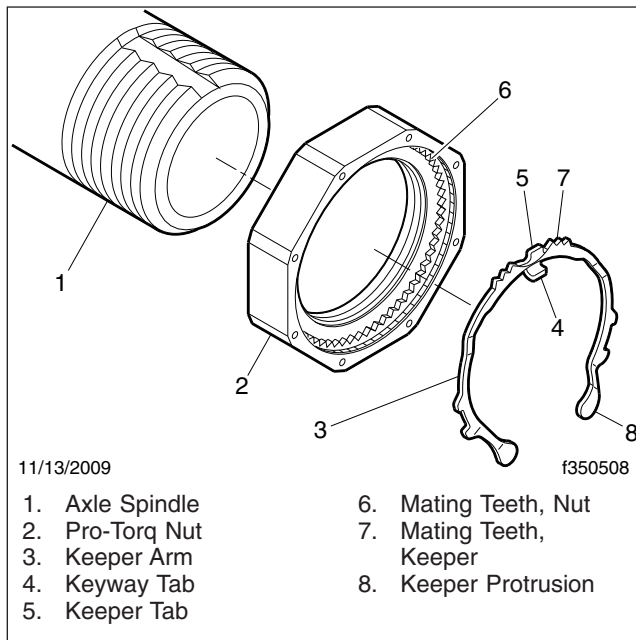


Fig. 1, Pro-Torq Spindle Nut and Keeper

Each time the Pro-Torq nut assembly is removed for maintenance purposes, replacing the "keeper" is recommended.

Removal

⚠ WARNING

Do not place the nut on the spindle or tighten or loosen the nut on the spindle while the keeper is locked inside the nut. Doing so may damage the spindle threads and deform the keeper, and allow the nut to unthread during operation. Failure to follow this instruction could cause the hub to separate from the axle, resulting in severe personal injury or death.

1. Insert the blade of a flathead screwdriver (or similar tool) in the slot of one of the keeper arms; see [Fig. 3](#). Ensuring that the tool contacts the keeper and not the teeth of the nut, turn the tool slightly and carefully pry the arm from the undercut groove of the nut.

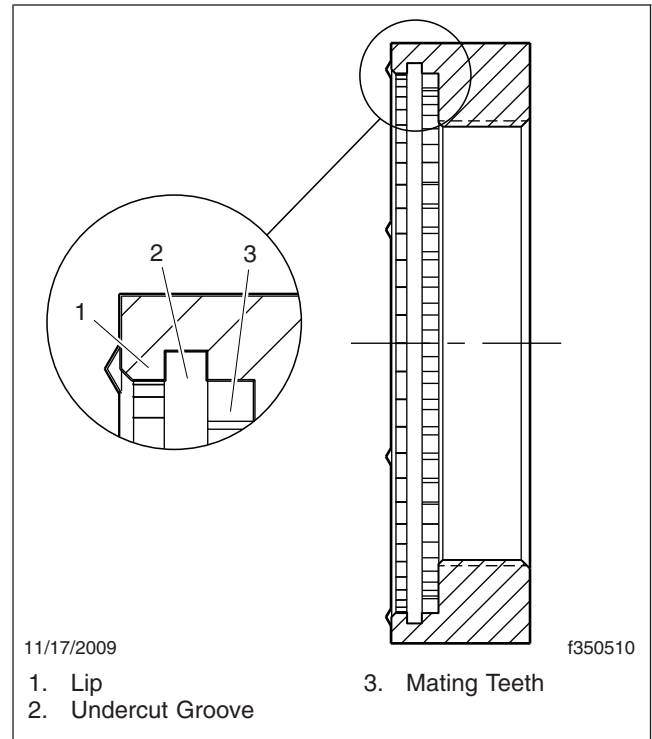


Fig. 2, Pro-Torq Spindle Nut, Cross Section

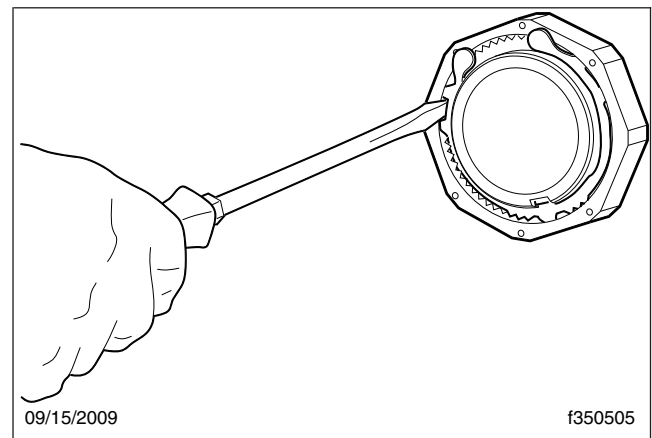


Fig. 3, Removing the Keeper

2. Repeat at the other arm, and remove the keeper from the nut.
3. Remove the Pro-Torq nut.

Pro-Torq Spindle Nut Removal, Installation, and Adjustment

Installation

The following procedure applies to Pro-Torq drive axle nut 449-4973. The part number is stamped on the nut.

⚠ WARNING

Do not place the nut on the spindle or tighten or loosen the nut on the spindle while the keeper is locked inside the nut. Doing so may damage the spindle threads and deform the keeper, and allow the nut to unthread during operation. Failure to follow this instruction could cause the hub to separate from the axle, resulting in severe personal injury or death.

Instructions for installing a Pro-Torq spindle nut for both PreSet and non-PreSet type bearings are provided in this subject. See the instructions pertaining to the bearing type used with the hub you are securing.

Using PreSet Bearings

1. Ensure the keeper is removed from the nut.
2. Install the Pro-Torq spindle nut, and tighten it 250 lbf-ft (339 N-m). **Do not back it off.**

⚠ WARNING

Do not bend or manipulate the keyway tab in any way. Doing so may cause it to break off in service, which could lead to the hub separating from the axle and result in severe personal injury or death.

3. Install the keeper.
 - 3.1 With the protrusions facing outboard, insert the keeper tab in the undercut groove of the Pro-Torq nut and the keyway tab in the spindle keyway.

IMPORTANT: If the keeper cannot be engaged, advance the nut until it can be. Do not back off the nut.

- 3.2 Engage the mating teeth.
- 3.3 Use a flathead screwdriver to carefully compress and guide each arm past the lip and into the undercut groove of the nut as shown in **Fig. 4**. To secure the keeper it

may be necessary to nudge the arms into the groove.

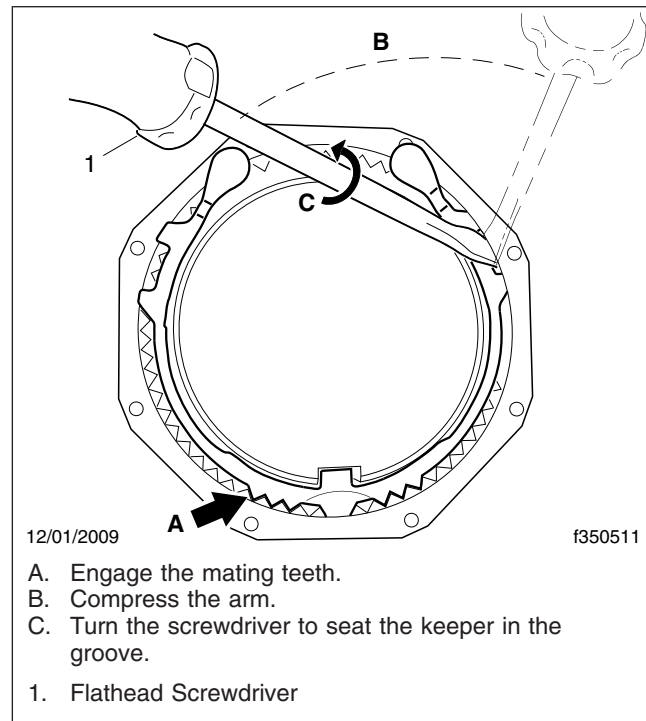


Fig. 4, Installing the Keeper

⚠ WARNING

Failure to secure the keeper and lock the Pro-Torq nut could cause the wheel assembly to come off the vehicle, resulting in severe personal injury or death.

4. Inspect the installation; ensure the keeper is locked in the undercut groove and that the keyway tab does not contact the bottom of the keyway.

Using Non-PreSet Bearings

For ConMet PreSet hubs, when there is no bearing spacer installed and non-PreSet type bearings are being used, proper wheel bearing adjustment is critical to the performance of the bearings, wheel seals, and other related wheel end components.

1. Ensure the keeper is removed from the nut.
2. Seat the bearings.

Pro-Torq Spindle Nut Removal, Installation, and Adjustment

- 2.1 Using a torque wrench, tighten the nut 200 lbf-ft (270 N·m). Spin the hub at least one full rotation.

NOTE: Torque is lost when the hub is spun.

- 2.2 Tighten the nut 200 lbf-ft (270 N·m). Spin the hub at least one full rotation.
 - 2.3 Tighten the nut 200 lbf-ft (270 N·m), but *do not spin the hub*.
 3. Loosen the nut to zero torque. *Do not spin the hub*.
 4. Adjust the bearing.
 - 4.1 Using a torque wrench, tighten the nut 100 lbf-ft (136 N·m). Spin the hub at least one full rotation.
- NOTE: Torque is lost when the hub is spun.
- 4.2 Tighten the nut 100 lbf-ft (136 N·m). Spin the hub at least one full rotation.
 - 4.3 Tighten the nut 100 lbf-ft (136 N·m).
 - 4.4 Back off the nut one-eighth turn.

WARNING

Do not bend or manipulate the keyway tab in any way. Doing so may cause it to break off in service, which could lead to the hub separating from the axle and result in severe personal injury or death.

IMPORTANT: If the keeper cannot be engaged, advance the nut until it can be. Do not back off the nut.

5. Install the keeper.
 - 5.1 With the protrusions facing outboard, insert the keeper tab in the undercut groove of the Pro-Torq nut and the keyway tab in the spindle keyway.
 - 5.2 Engage the mating teeth.
 - 5.3 Use a flathead screwdriver to carefully compress and guide each arm past the lip and into the undercut groove of the nut as shown in **Fig. 4**. To secure the keeper it may be necessary to nudge the arms into the groove.

WARNING

Failure to secure the keeper and lock the Pro-Torq nut could cause the wheel assembly to come off the vehicle, resulting in severe personal injury or death.

6. Inspect the installation; ensure the keeper is locked in the undercut groove and that the keyway tab does not contact the bottom of the keyway.
7. Measure the end play; see **Subject 200** for instructions.

WARNING

Correct wheel-bearing end play is crucial to the safe and sound operation of the vehicle. If the end play is not correct, the wheel bearings could fail and cause the loss of the wheel and hub assembly and result in an accident causing property damage, serious injury, or death. Use a dial indicator to measure the end play.

8. **The end play must be between 0.001 and 0.005 inch (0.03 and 0.13 mm).** If it is not within this range, remove the Pro-Torq nut, and repeat the tightening sequence as described in previous steps. Once the end play is correct, continue your service procedure.

Wheel Bearing End Play Measurement

WARNING

Correct wheel-bearing end play is crucial to the safe and sound operation of the vehicle. If the end play is not correct, the wheel bearings could fail and cause the loss of the wheel and hub assembly and result in an accident causing property damage, serious injury, or death. Use a dial indicator to measure the end play.

IMPORTANT: Do not measure the wheel bearing end play with the wheel mounted on the hub; you cannot accurately measure or adjust bearing end play with the wheel mounted on the hub. Also, ensure that the brakes are not applied so that that drum and hub can move freely.

Measurement

Using a dial indicator, measure the end play as follows.

1. Attach the magnetic base of a dial indicator to the spindle, and place the measuring end of the indicator squarely against the flange as shown in [Fig. 1](#).

IMPORTANT: Maintain continual pressure on the hub until you have taken both the inboard and outboard measurements. If you release the hub, an accurate measurement is not possible.

2. To seat the bearings, grip the hub at the three o'clock and nine o'clock positions, and push inward while oscillating it approximately 45 degrees. Maintain pressure on the hub, note the inboard measurement, and then pull the hub outward while oscillating it as before. Maintain pressure on the hub, and note the outboard measurement.

The end play is the difference between the two measurements.

NOTE: If the end play exceeds the limit, the hub may need to be serviced. See [Subject 110](#) and manufacturer literature for procedures.

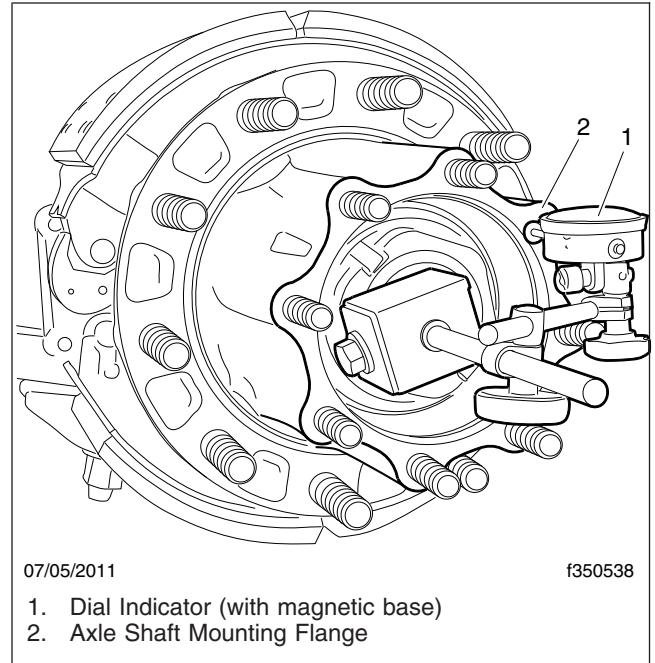


Fig. 1, Dial Indicator Setup

Wheel Bearing Lubrication

General Information

Proper wheel bearing lubrication is critical to sound wheel end health and safe vehicle operation. Insufficient lubrication can lead to catastrophic consequences that can be avoided.

The procedure for lubricating wheel bearings depends on whether or not the hub has an oil fill port. This subject provides instructions for ConMet hubs with and without a fill port.

ConMet Hub with an Oil Fill Port

For ConMet hubs with an oil fill port, lubricant is added through the fill port; see [Fig. 1](#) and use the following instructions.

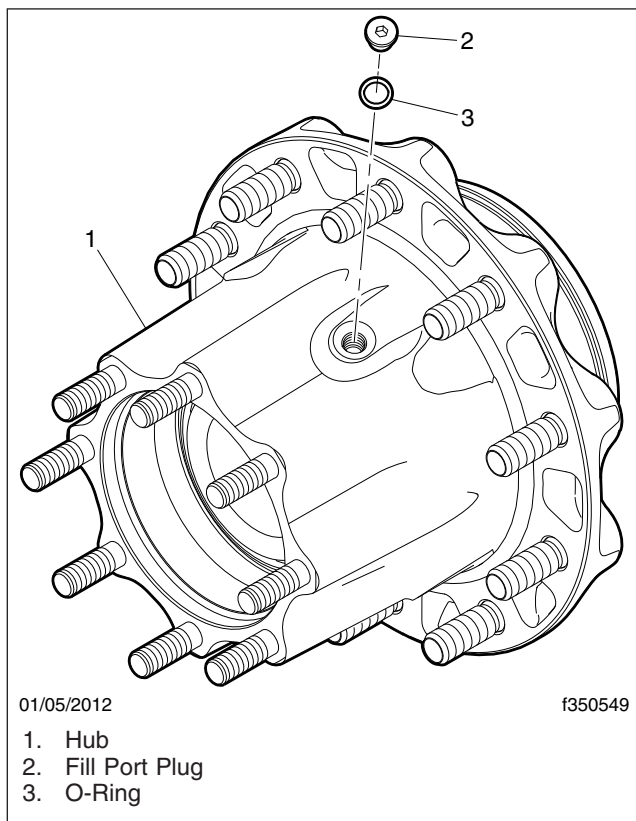


Fig. 1, ConMet Hub with Oil Fill Port

1. Park the vehicle on a level surface, shut down the engine, and set the parking brake. Chock the tires.

IMPORTANT: When removing the fill port plug, make sure the rubber O-ring is attached to it and not stuck inside the fill port.

2. Clean the area surrounding the oil fill port plug, then remove the plug and O-ring.

NOTE: The fill port plug is magnetic. On drive axles, it is normal to find a small amount of very fine metallic particles from the carrier housing on the magnetic fill plug. These particles should be removed from the magnet anytime the plug is removed for inspection.

3. Inspect the plug for metallic particles picked up by the magnet. If very fine metallic particles are found, remove them from the magnet. If larger particles or chunks of metal are found, remove the hub from the spindle and inspect the bearings and other wheel end and axle components for signs of damage or excessive wear, and make the necessary repairs.

WARNING

Failure to adequately lubricate wheel bearings can cause them to seize during vehicle operation. Seized wheel bearings can cause sudden, catastrophic damage to the wheel end and axle, possibly resulting in severe personal injury or death.

4. Using a clean funnel, add 1.0 quart (0.95 liter) of the recommended drive axle lubricant through the oil fill port. For recommended lubricants, see the vehicle maintenance manual.
5. Install the fill port plug, and tighten it 20 to 25 lbf-ft (27 to 34 N·m).

ConMet Hub without an Oil Fill Port

For ConMet hubs without an oil fill port, lubricant must be transferred from the axle carrier housing to the hubs. To ensure each bearing is adequately lubricated, the axle must be filled with lubricant and tilted *three* times. See [Fig. 2](#) and use the following instructions to lubricate the wheel bearings on a rear drive axle.

Wheel Bearing Lubrication

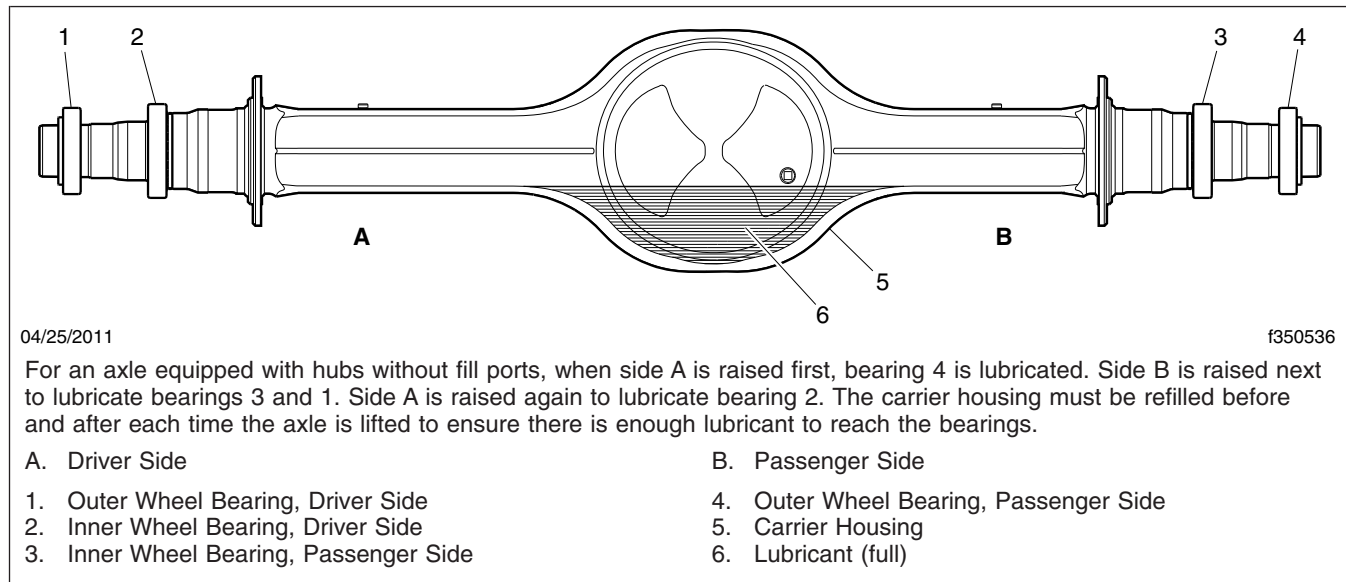


Fig. 2, Rear Drive Axle and Wheel Bearings

1. Park the vehicle on level ground, apply the parking brakes, and chock the front wheels.

NOTE: Some Detroit and Meritor axles have a small tapped and plugged hole located below the housing oil fill hole. This smaller hole is for a lubricant temperature sensor only and must not be used as a fill hole.

2. With the axle level and all wheels on the ground, clean the oil fill hole plug and the area surrounding it, then remove the fill plug. For Detroit axles, see [Fig. 3](#); for Meritor axles, see [Fig. 4](#); for Dana Spicer axles, see [Fig. 5](#).

WARNING

Failure to adequately lubricate wheel bearings can cause them to seize during vehicle operation. Seized wheel bearings can cause sudden, catastrophic damage to the wheel end and axle, possibly resulting in severe personal injury or death.

IMPORTANT: A lubricant level close enough to be seen or touched is not sufficient; it must be level with the bottom of the fill hole. See [Fig. 6](#).

3. Use a clean funnel to add lubricant until it reaches the fill hole, then install the fill plug. For recommended lubricants, see the vehicle maintenance manual. For fill plug torque values, see [Table 1](#).

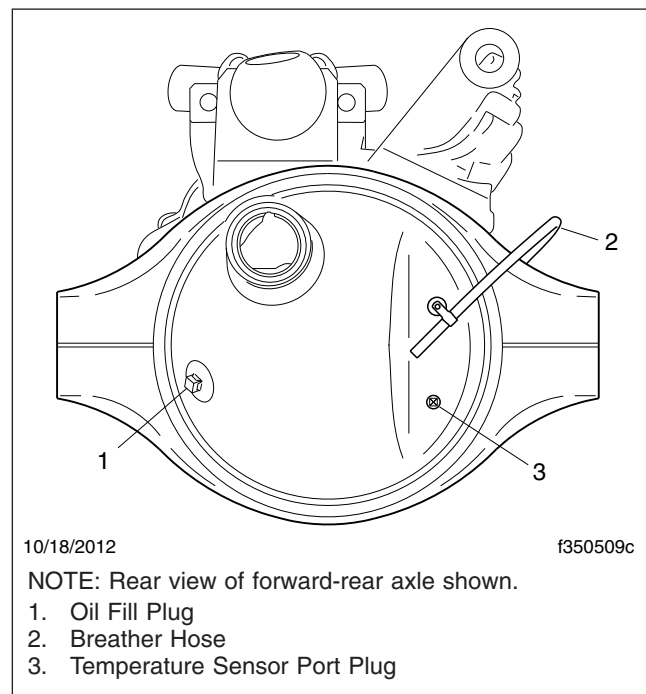


Fig. 3, Fill Hole Plug Location, Detroit Tandem Axle

Wheel Bearing Lubrication

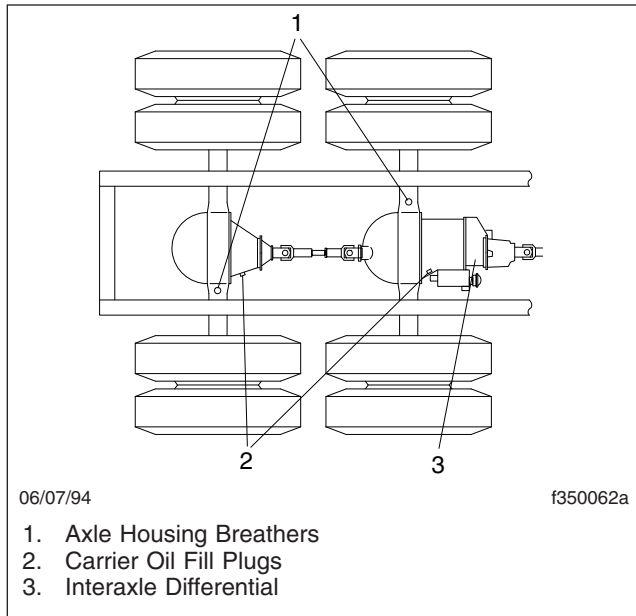


Fig. 4, Fill Hole Plug Locations, Meritor Axles

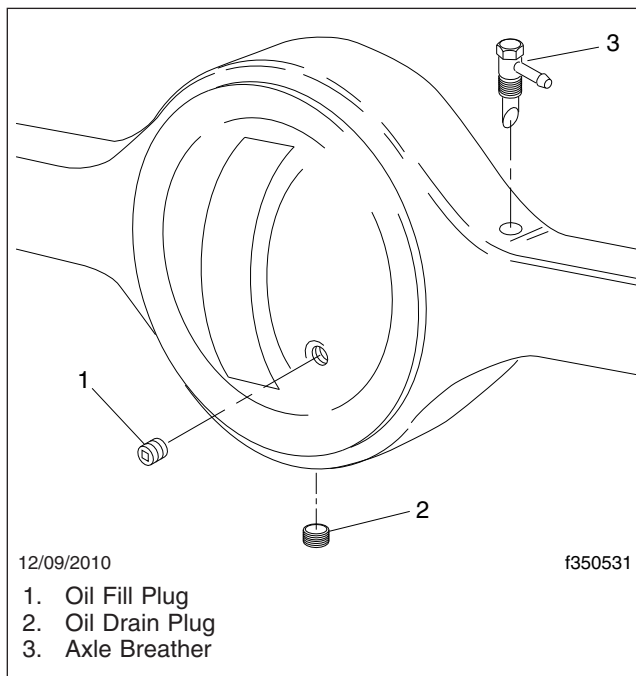


Fig. 5, Fill Hole Plug Location, Dana Spicer Axles

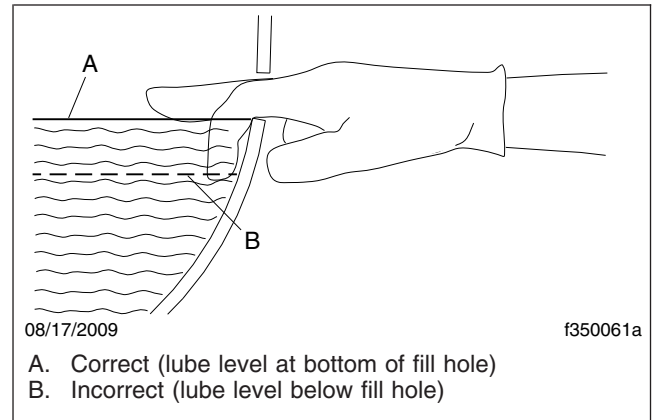


Fig. 6, Axle Lubricant Level Check

Oil Fill Plug Torque Values	
Brand	Torque: lbf·ft (N·m)
Detroit	30 (41)
Meritor	35 (47)
Dana Spicer	40 to 60 (54 to 81)

Table 1, Oil Fill Plug Torque Values

IMPORTANT: The axle must be tilted three times and the tilted position must be held for two minutes each time to allow enough lubricant to reach the hub and wheel bearings.

4. To tilt the axle, position a suitable jack at a leaf spring U-bolt, and raise it until the bottom of the outside part of the outside tire is 8 inches (20 cm) above the ground. See [Fig. 7](#) and [Fig. 8](#).

After two minutes, lower the axle, and add lubricant as described earlier in this procedure.

5. At a leaf spring U-bolt on the other end of the axle, tilt the axle as described earlier in this procedure.

After two minutes, lower the axle, and add lubricant as described earlier in this procedure.

6. At the U-bolt where the axle was first lifted, tilt the axle as described earlier in this procedure.

After two minutes, lower the axle, and add lubricant as described earlier in this procedure.

35.01

Rear Axle Wheel Hubs, Brake Drums, and Wheel Bearings

Wheel Bearing Lubrication

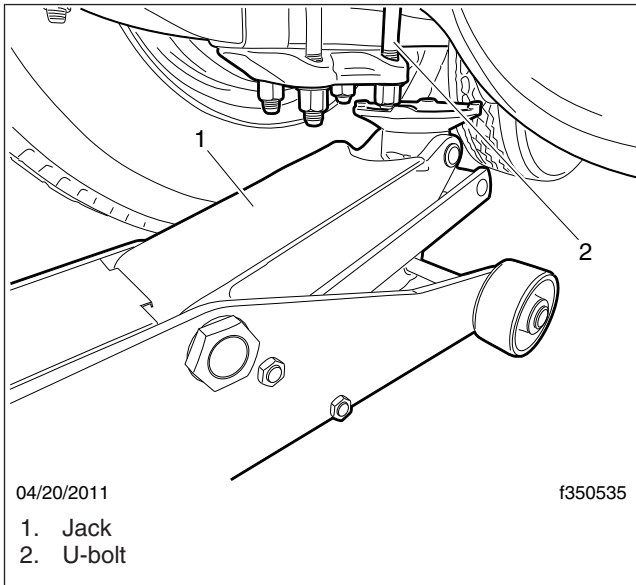


Fig. 7, Axle Lifted at Leaf Spring U-bolt

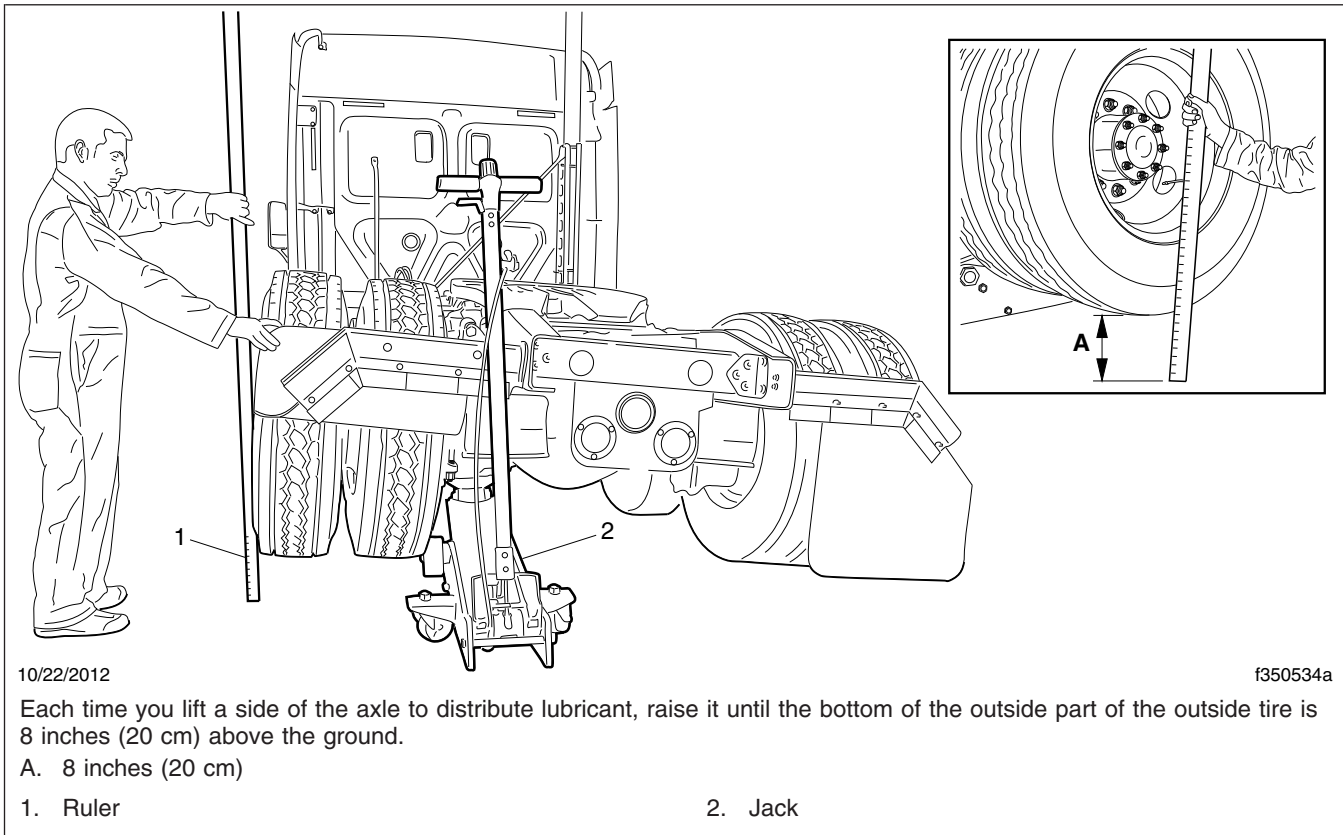


Fig. 8, Distributing Lubricant from Carrier Housing to Wheel Bearings for ConMet Hubs without Oil Fill Ports

ConMet PreSet Plus Spindle Nut Removal and Installation

General Information

ConMet PreSet Plus hubs use a special integrated spindle nut designed specifically for PreSet Plus hubs. See [Fig. 1](#).

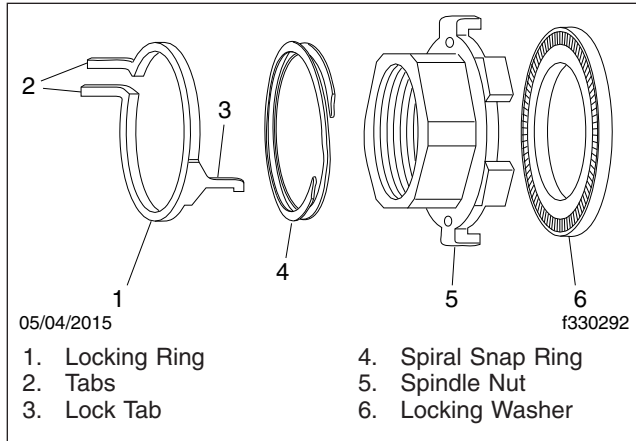


Fig. 1, PreSet Plus Spindle Nut System

Removal

1. To remove the red locking ring from the spindle nut assembly, compress the tabs and pivot the ring to unlock it from the nut.

IMPORTANT: Do not exceed 50 lbf·ft (68 N·m) of torque when removing a PreSet Plus hub using the spindle-nut system as a hub puller.

2. Loosen the spindle nut. As the spindle nut is loosened, it can act as a hub puller. However, if the hub will not come off of the spindle without exceeding 50 lbf·ft (68 N·m) of torque, remove the spiral snap ring (see [Fig. 2](#)) and then the spindle nut assembly.

Installation

WARNING

Each PreSet Plus hub assembly requires special bearings, a PreSet Plus bearing spacer, and the unique PreSet Plus spindle nut system. Wheel ends equipped with the PreSet Plus hub assembly must use these special components; do not use non-PreSet-Plus components with a PreSet Plus hub.

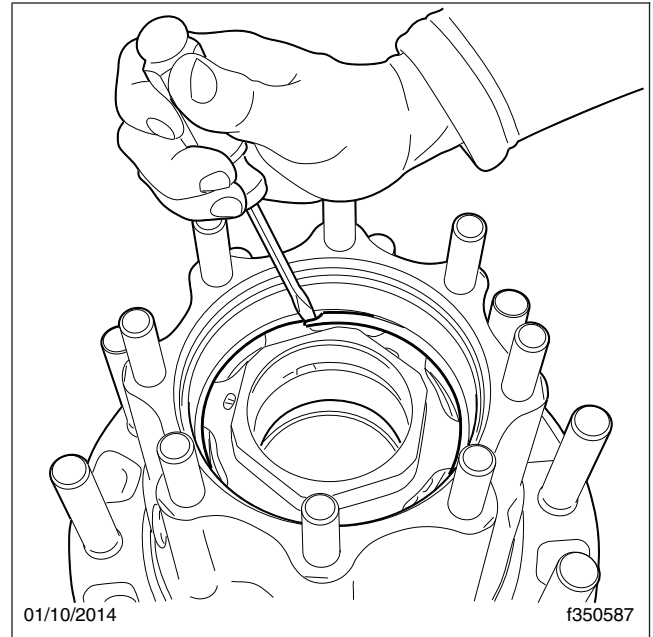
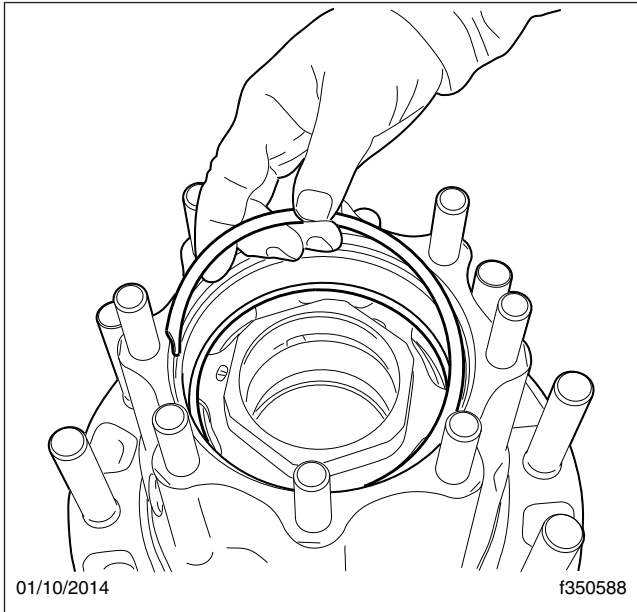


Fig. 2, Removing a Spiral Snap Ring

If a PreSet Plus hub is not correctly installed with the required components, the hub could separate from the axle, resulting in property damage, severe personal injury, or death.

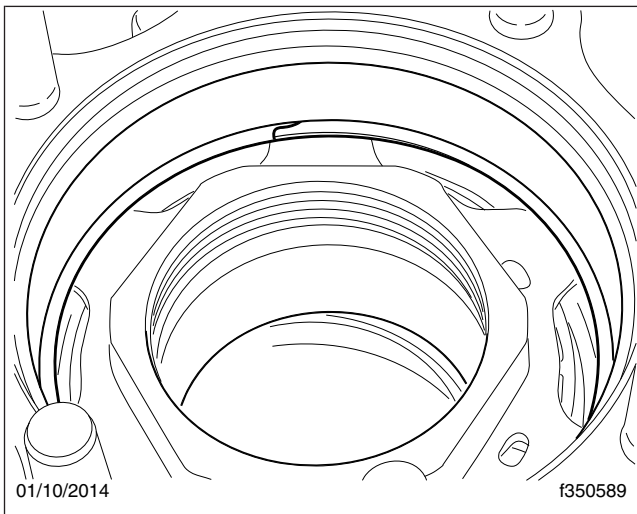
The following instructions are for installing a PreSet Plus spindle nut. In some cases, the spindle nut components will have been removed along with the hub; in other cases, they will have been already installed in the hub. Use the pertinent instructions for your installation.

1. If the red locking snap ring is locked into the spindle nut, compress the tabs and pivot the ring to remove it from the nut. See [Fig. 1](#).
2. If needed, begin installing the PreSet Plus spindle nut components, as follows.
 - 2.1 Seat the flat washer into the back of the spindle nut.
 - 2.2 Position the spindle nut and washer against the outer bearing.
 - 2.3 Install the spiral snap ring into the snap ring groove in the hub. Ensure that it fully seats into the groove in the hub. See [Fig. 3](#) and [Fig. 4](#).
3. Tighten the spindle nut 500 lbf·ft (678 N·m) while rotating the hub. Do not back off the spindle nut.

ConMet PreSet Plus Spindle Nut Removal and Installation**Fig. 3, Installing a Spiral Snap Ring**

Insert the lock tab of the locking ring through aligned holes.

- 4.2 Using the handle tabs, seat the locking ring in the machined grooves of the spindle nut.

**Fig. 4, Fully Seated Spiral Snap Ring****NOTICE**

When bending the locking ring, be careful not to deform it permanently. If the locking ring is damaged or bent, replace it with a new one.

4. Install the locking ring, as follows.

- 4.1 One of the holes in the face of the spindle nut will line up with a hole in the washer.

Hub Runout Measurements

If either the lateral or radial runout of the hub is beyond acceptable limits, replace the hub. For instructions, see [Subject 100](#) in this section.

Measurements

1. Park the vehicle on a level surface, shut down the engine, and set the parking brake. Chock the tires.

WARNING

Breathing brake lining dust (asbestos or non-asbestos) could cause lung cancer or lung disease. OSHA has set maximum levels of exposure and requires workers to wear an air purifying respirator approved by MSHA or NIOSH. Wear a respirator at all times when servicing the brakes, starting with removal of the wheels and continuing through assembly.

2. Remove the wheel and tire assembly. See [Group 40](#) for instructions.
3. For drum brakes, remove the brake drum. See [Subject 160](#) for instructions.
4. Clean the hub surfaces where the measurements will be taken—see [Fig. 1](#) and [Fig. 2](#).
5. To measure lateral runout, set up a dial indicator as shown in [Fig. 1](#), then turn the hub one revolution and note the highest and lowest measurements.

For ConMet hubs, the acceptable lateral runout is 0.008 inch (0.2 mm); for other hubs, see the hub OEM for the acceptable lateral runout specification.

6. To measure radial runout, set up a dial indicator as shown in [Fig. 2](#), then turn the hub one revolution and note the highest and lowest

For ConMet hubs, the acceptable radial runout is 0.008 inch (0.2 mm); for other hubs, see the hub OEM for the acceptable radial runout specification.



Fig. 1, Setup to Measure Lateral Runout

35.01

Rear Axle Wheel Hubs, Brake Drums, and Wheel Bearings

Hub Runout Measurements

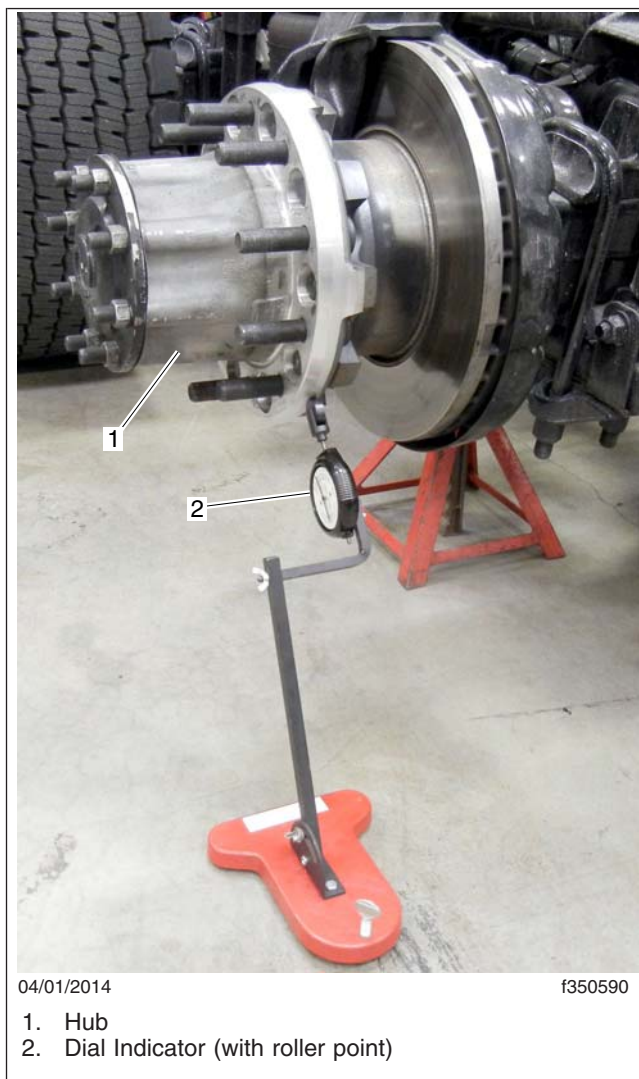


Fig. 2, Setup to Measure Radial Runout

Troubleshooting Tables

Problem — Noisy Bearings or Excessive Bearing Replacement Intervals

Problem — Noisy Bearings or Excessive Bearing Replacement Intervals	
Possible Cause	Remedy
Not enough oil was used on the bearings, or the wrong type of oil was used.	Clean, then inspect the bearings for wear. Replace worn seals. Coat the bearing assemblies with fresh oil. For lubricant specifications, see Group 35 of the <i>Business Class M2 Maintenance Manual</i> .
Foreign matter or corrosive agents entered the bearing assembly. Dirt or metallic debris from the bearings was not removed.	Clean, then inspect the bearings for wear. Replace worn seals. Also clean the wheel hub, the axle spindle, and any other component in contact with the bearing lubricant.
An incorrect adjustment of the wheel bearings is causing noise and wear.	Adjust the wheel bearings following the applicable instructions in this section.
Flat spots or dents on the roller surface were caused by skidding of the roller or improper handling of the wheel bearing during installation.	Clean, then inspect the bearing rollers. Replace the bearing if damaged. Coat the replacement bearings with fresh oil. For lubricant specifications, see Group 35 of the <i>Business Class M2 Maintenance Manual</i> .

Problem — Broken Wheel or Rim Studs

Problem — Broken Wheel or Rim Studs	
Possible Cause	Remedy
The wheel or rim nuts were overtightened.	Replace the wheel or rim studs. See Group 40 of the <i>Business Class M2 Maintenance Manual</i> for the wheel or rim nut tightening sequence.
An incorrect nut tightening sequence was used.	
The wrong brake drums were installed.	Install new brake drums.
Wheels are mismatched (hub-piloted wheels are mixed with stud-piloted wheels).	Install properly matched wheels.
The vehicle is being overloaded.	Do not exceed the maximum load-carrying capacity of the vehicle.

Problem — Damaged Hub

Problem — Damaged Hub	
Possible Cause	Remedy
(Cracked hub) Local surface of an aluminum hub was heated higher than 350°F (177°C) during bearing cup removal.	Replace the hub assembly; see Subject 100 . When removing the bearing cup, oven-heat the hub.
(Bent flange) Incorrect installation of the wheel studs, such as using a hammer and drift, or the hub flange was not fully supported on the press during wheel stud replacement.	Replace the hub assembly. Replace the wheel studs as instructed in Subject 180 .
The wrong brake drums were installed.	Install new brake drums.
Insufficient tightening of the wheel nuts to the wheel hub.	Replace the hub assembly; see Subject 100 .

Troubleshooting

Problem — Loss of Lubricant From the Wheel Hubs

Problem — Loss of Lubricant From the Wheel Hubs	
Possible Cause	Remedy
The drive axle studs are loose.	Tighten the nuts to the torque values in Subject 100 . Add lubricant to the axle housing or to the wheel hub.
The seals or gaskets are worn or damaged.	Replace worn or damaged parts.
Minor burrs or rough spots are on the inboard portion of the drive axle flange.	Use fine-grit emery cloth to remove the burrs or rough spots. If they cannot be removed, replace the drive axle shaft.

Problem — Vehicle Does Not Slow Down Quickly Enough When Brakes Are Applied

Problem — Vehicle Does Not Slow Down Quickly Enough When Brakes Are Applied	
Possible Cause	Remedy
The brake linings are glazed (dirt or grease build-up) or are worn unevenly.	Install new brake linings on both sets of axle brake shoes. Clean, turn, or replace the drums.
The brake drums are worn, heat-checked, or cracked.	Install new brake drums.

Problem — Service Brakes Grab or Pull

Problem — Service Brakes Grab or Pull	
Possible Cause	Remedy
The drum could be out of round if it was not correctly positioned on the drum pilot tabs before the wheel was installed.	Position one of the hub-piloted tabs in the top position before placing the drum on the hub. When doing so, be sure the drum is located flat against the hub and on the largest-diameter portion of the pilot tabs. After placing the wheel(s) on the studs, firmly hand-tighten the nut on the stud closest to the top position. Proceed with the other nuts.
See the air brake system troubleshooting section in Group 42 .	

Problem — Poor Lining-to-Drum Contact

Problem — Poor Lining-to-Drum Contact	
Possible Cause	Remedy
The inside surface of the brake drum is scored or grooved.	Install new brake linings on both sets of axle brake shoes. Turn or replace the brake drums.
The brake shoes are stretched or bent.	Replace the brake shoes.
Undersized linings were installed.	Install new brake linings on both sets of axle brake shoes.
An incorrect grind was used on the brake linings.	
The wrong brake drums were installed.	Install new brake drums.
An incorrect adjustment of the wheel bearings is causing wheel instability.	Adjust the wheel bearings following the applicable instructions in this section.

Problem — Brake Linings Are Tapered Across the Width

Problem — Brake Linings Are Tapered Across the Width	
Possible Cause	Remedy
The inside surface of the brake drum is scored or grooved.	Install new brake linings on both sets of axle brake shoes. Turn or replace the brake drums.
The brake shoes are bent.	Replace the brake shoes.
An incorrect adjustment of the wheel bearings is causing wheel instability.	Adjust the wheel bearings following the applicable instructions in this section.

Problem — Brake Shoes on the Same Brake Are Wearing Unequally

Problem — Brake Shoes on the Same Brake Are Wearing Unequally	
Possible Cause	Remedy
The brake linings are not a matched set. Different friction codes or different brands of brake linings are installed.	Install a new matched set of brake linings on both sets of axle brake shoes. Clean, turn, or replace the drums.
The inside surface of the brake drum is in poor condition.	Turn or replace the brake drums.
The wheel bearings are out of adjustment.	Adjust the wheel bearings following the applicable instructions in this section.

Problem — Edge of the Lining Is Showing Wear

Problem — Edge of the Lining Is Showing Wear	
Possible Cause	Remedy
The brake lining is too wide.	Install new brake linings on both sets of axle brake shoes.
The brake linings are misaligned because their holes were incorrectly drilled.	
Undersized brake drums were installed.	Install new brake drums.
The wheel bearings are out of adjustment.	Adjust the wheel bearings following the applicable instructions in this section.
There is an improper fit of the wheel onto the spindle due to the wrong wheel bearings or cone.	Install and adjust the new wheel bearings and cone.
The brake shoes are bent.	Replace the brake shoes.

Problem — Brake Linings Are Scored or Grooved

Problem — Brake Linings Are Scored or Grooved	
Possible Cause	Remedy
Worn or scored brake drums have been causing poor contact with the brake linings.	Install new brake linings on both sets of axle brake shoes. Turn or replace the brake drums.
There is abrasive material between the lining and the drum.	

Troubleshooting

Problem — Brake Linings Are Loose

Problem — Brake Linings Are Loose	
Possible Cause	Remedy
The rivet holes in the brake shoes are too large.	Replace the brake shoes.
Improperly crimped rivets are working loose and allowing the linings to move.	Replace the rivets.
Rust has built up on the shoe table.	Clean the brake shoe table of all rust, dirt, scale, and paint.

Problem — Brake Lining is Cracked at the Rivet Holes or Bolt Holes

Problem — Brake Lining is Cracked at the Rivet Holes or Bolt Holes	
Possible Cause	Remedy
Overtightening of the lining bolts is causing cracks.	Replace the brake linings. Replace the rivets or bolts with the correct size.
The wrong size counter bore for the rivet holes was made.	
The wrong rivets or bolts were used.	Replace the rivets or bolts with the correct size.
Improperly crimped rivets are working loose and allowing the linings to move.	Replace the rivets.
Rust has built up on the shoe table.	Clean the brake shoe table of all rust, dirt, scale, and paint.

Problem — Out-of-Round Rivet Holes or Bolt Holes

Problem — Out-of-Round Rivet Holes or Bolt Holes	
Possible Cause	Remedy
The rivets or bolts are loose.	Replace the brake shoes or linings.

Problem — Brake Drums Are Heat-Checked

Problem — Brake Drums Are Heat-Checked	
Possible Cause	Remedy
The brake drums are out-of-round.	Turn or replace the brake drums.
The wrong brake drums were installed.	Install new brake drums.
The wheel bearings are out of adjustment.	Adjust the wheel bearings following the applicable instructions in this section.
The brake linings are glazed (dirt or grease build-up) or are worn unevenly.	Install new brake linings on both sets of axle brake shoes. Clean, turn, or replace the drums.
The lining friction material for the operation of the vehicle is incorrect.	
There is a brake imbalance between the tractor and the trailer.	Do a brake balance test (tractor versus trailer). Contact the District Service Manager if help is needed.

Problem — Brake Drums Are Heavily Scored

Problem — Brake Drums Are Heavily Scored	
Possible Cause	Remedy
The brake linings are damaged.	Install new brake linings on both sets of axle brake shoes. Turn or replace the drums.
There is excessive wear on the linings.	
On the last brake reline, the drums were not turned.	Turn the brake drums.

Problem — Excessive Brake Lining Wear

Problem — Excessive Brake Lining Wear	
Possible Cause	Remedy
There is a brake imbalance between the tractor and the trailer.	Do a brake balance test (tractor versus trailer). Contact the District Service Manager if help is needed.

Torque Values			
Description		Size (grade 8)	Torque: lbf·ft (N·m)
Drive Axle Studs (to Hub)		1/2–13	70 (95)
		5/8–11	135 (185)
IMPORTANT: Vehicles specifying 5/8–18 or 1/2–20 axle shaft flange nuts and built: <ul style="list-style-type: none">• March 2, 2012 or before were built with phosphate and oil finished axle shaft flange nuts.• March 30, 2012 or after were built with zinc aluminum finished axle shaft flange nuts.• between March 2 and March 30, 2012 may have zinc aluminum or phosphate and oil finished axle shaft flange nuts.			
Axle Shaft Stud Nuts, Phosphate and Oil Finished	With Dowels	1/2–20	75 to 115 (102 to 156)
	With Dowels	5/8–18	130 to 140 (175 to 190)
	Without Dowels	5/8–18	150 to 170 (203 to 230)
Axle Shaft Stud Nuts, Zinc Aluminum Finished	With Dowels	1/2–20	58 to 67 (79 to 91)
	With Dowels	5/8–18	115 to 134 (155 to 181)
	Without Dowels	5/8–18	115 to 134 (155 to 181)

Table 1, Torque Values

Subject	Subject Number
General Information	050
Service Operations	
Seal Replacement, Chicago Rawhide	100
Seal Replacement, Dana Spicer	110

General Information

Wheel oil seals (also called "oil bath seals" or "hub seals") work as a dam to keep oil in the hub cavity so that it constantly "bathes" the wheel bearings. The seals also protect the wheel bearings by keeping dirt, dust, and water out of the hub.

The oil seal fits between the hub bore and the axle spindle, and the sealing element either turns with the wheel (*hub-mounted seals*) and seals against the axle spindle, or the sealing element stays stationary with the axle spindle (*spindle-mounted seals*) and seals against the turning hub.

Most wheel oil seals consist of four basic parts:

- The outside edge (also called the outer "cup" or "case")
- The inside edge (also called the inner "cup" or "case")
- The sealing element
- The garter spring

The outside edge is usually metal coated with rubber or another sealing agent so that it grips the hub bore tight enough to prevent oil escaping between the outer edge of the seal and the hub bore.

The inside edge is usually metal or rubber with a metal ring within it to prevent the sealing element from wearing a groove in the axle spindle.

The sealing element is usually molded rubber, leather, or a synthetic such as nitrile or silicone. The element is molded into lips which will seal against the axle spindle or against the outside or inside edge described above. The innermost lip, called the "primary lip," keeps the oil inside the hub cavity. The outermost lip, called the "secondary lip," keeps dirt out of the hub cavity.

The garter spring is a coiled wire spring with its ends connected to make a loop. On hub-mounted seals, the spring runs around the outside of the sealing element to press the element inwards against the sealing surface. On spindle-mounted seals, the spring runs around the inside of the sealing element to press the element outward against the sealing surface.

Freightliner uses two brands of axle oil seals:

- Chicago Rawhide (Scotseal® and Scotseal Plus®)

- Dana Spicer (Outrunner™)

Chicago Rawhide

The Chicago Rawhide Scotseal is a unitized, one-piece design consisting of a sealing element (packing) that is assembled between metal outer and inner cups. See [Fig. 1](#). The sealing element consists of three sealing lips; a spring-loaded primary sealing lip that is factory pre-lubed and two dirt exclusion lips. The seal is press fit into the hub bore using Scotseal service installation tools. *Do not install the Scotseal directly onto the axle spindle.*

Although you install the Scotseal into the hub bore, the seal's element grips the axle spindle tightly enough that the sealing element stays stationary with the spindle and seals against the outer cup which turns with the hub.

The Chicago Rawhide Scotseal maintains a metal-to-metal contact between the outer cup and the hub bore surface as well as a metal-to-metal contact between the sealing element inside edge and the axle spindle.

Dana Spicer

The Dana Spicer Outrunner has a rubber-coated outside edge and is installed in the hub bore using Dana Spicer installation tools. See [Fig. 2](#).

General Information

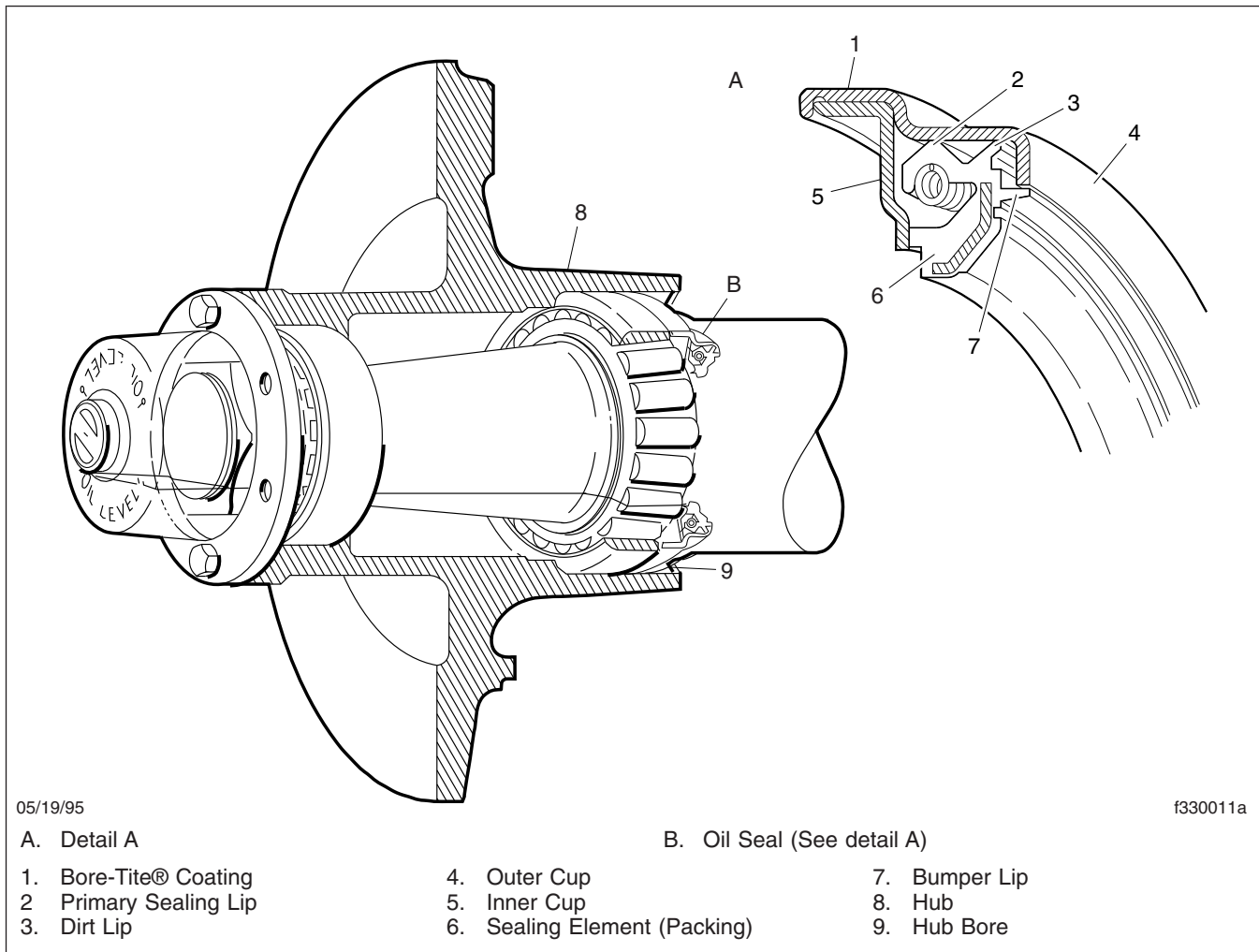


Fig. 1, Chicago Rawhide Scotseal

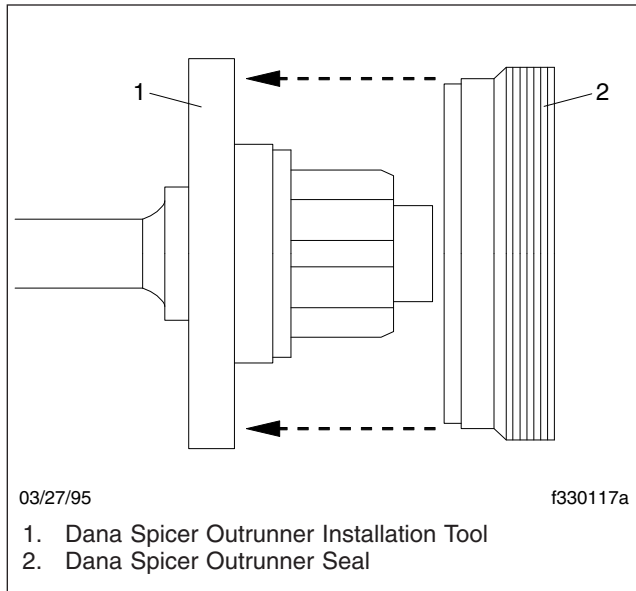


Fig. 2, Dana Spicer Outrunner Seal

Seal Replacement, Chicago Rawhide

Replacement

NOTE: This procedure applies to the Chicago Rawhide Scotseal®.

1. Remove the wheel, drum, and hub from the axle. For instructions, see [Section 35.01](#), Subject 100.
2. Remove the oil seal from the hub.
3. Remove the inner wheel bearing assembly from the hub. Handling the bearings with clean dry hands, wrap the bearings in clean oil-proof paper or lint-free cloths. Occasionally, the inner wheel bearing cone assembly will remain in the hub after the seal is removed. In those cases, place a protective cushion to catch the bearing assembly. Using a hardwood drift and a light hammer, gently tap the bearing out of the inner wheel bearing cup.
4. Clean the spindle, spindle threads, seal bore, and the hub cavity. See [Fig. 1](#) and [Fig. 2](#).
5. Remove all burrs from the shoulder and the seal bore with an emery cloth or a file. Clean any metal filings from the components.

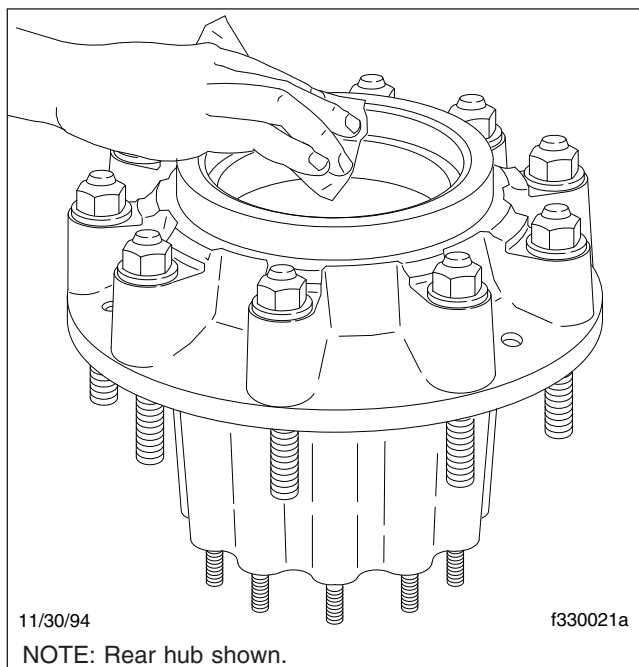


Fig. 1, Clean the Hub

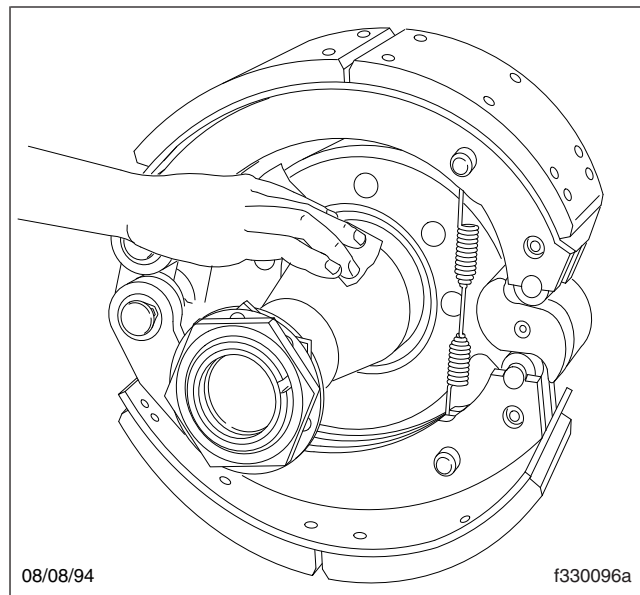


Fig. 2, Clean the Spindle

CAUTION

Do not spin bearing rollers at any time. Dirt or grit can scratch the roller surface and cause rapid wear of the bearing assembly. Treat used bearings as carefully as new ones.

IMPORTANT: Use extreme care in cleaning the wheel hub cavity and axle spindle. Dirt, metal filings, or other contaminants can scratch the bearing roller surfaces, and cause premature wear of the bearing assembly.

6. Inspect the bearings and hub components for wear or damage. Replace any worn or damaged components as necessary.
7. Coat the wheel bearing cones with oil.
8. Install the inner wheel bearing cone in the inner wheel bearing cup.
9. Seat the small outside edge of the seal in the recess of the tool adaptor. See [Fig. 3](#). The correct adaptor is identified on the box.
10. Insert the centering plug of the tool in the bore of the inner bearing cone. See [Fig. 4](#). The plug prevents cocking of the seal in the bore.
11. Hold the tool handle firmly, and strike it until the sound of the impact changes as the seal bottoms

Seal Replacement, Chicago Rawhide

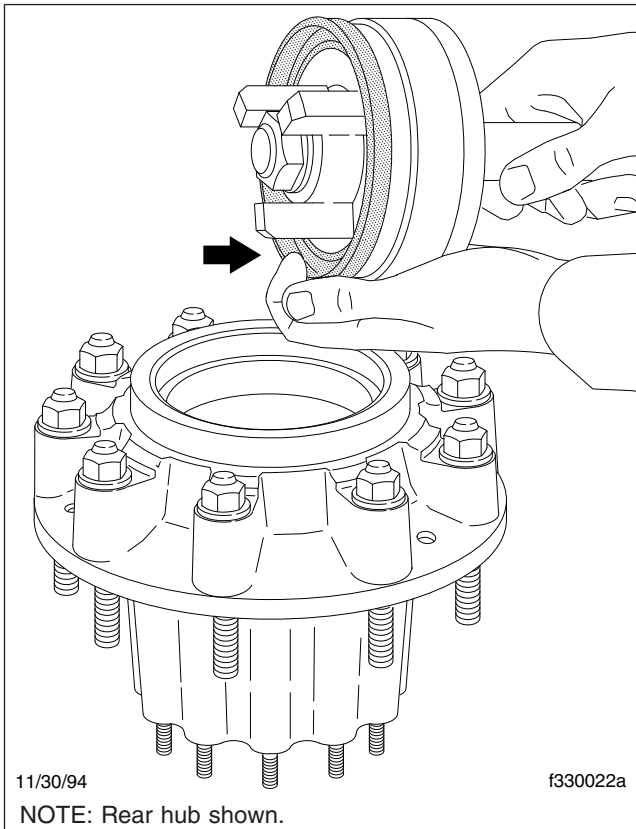


Fig. 3, Place the Seal on the Installation Tool

out. See [Fig. 5](#). Hold the tool firmly to avoid bounce or unseating of the seal from the adaptor.

12. After the seal is bottomed in the bore, check for freedom of movement by manually moving the interior rubber part of the seal back and forth. A slight movement indicates a damage-free installation.
13. Install the wheel hub on the axle, and adjust the wheel bearings. For instructions, see [Section 35.01](#), Subject 100.

IMPORTANT: When starting the wheel on the spindle, center the hub carefully to avoid seal damage from the leading edge of the spindle.

14. Place the hubcap and a new gasket in position, then install the capscrews. Tighten the capscrews 15 lbf-in (20 N·m).
15. Fill the hub with oil to the level shown on the hubcap. See [Fig. 6](#). Do not overfill.

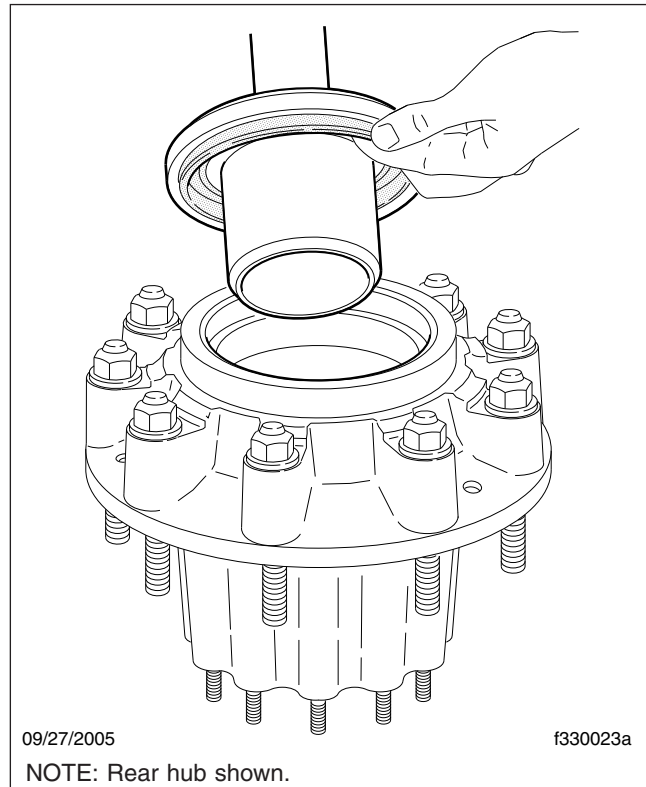


Fig. 4, Insert the Tool in the Hub Bore

16. Spin the wheel and check the oil level.
17. Adjust the brake shoe-to-drum clearance. For instructions, see Group 42 of the *Business Class M2 Maintenance Manual*.

Seal Replacement, Chicago Rawhide

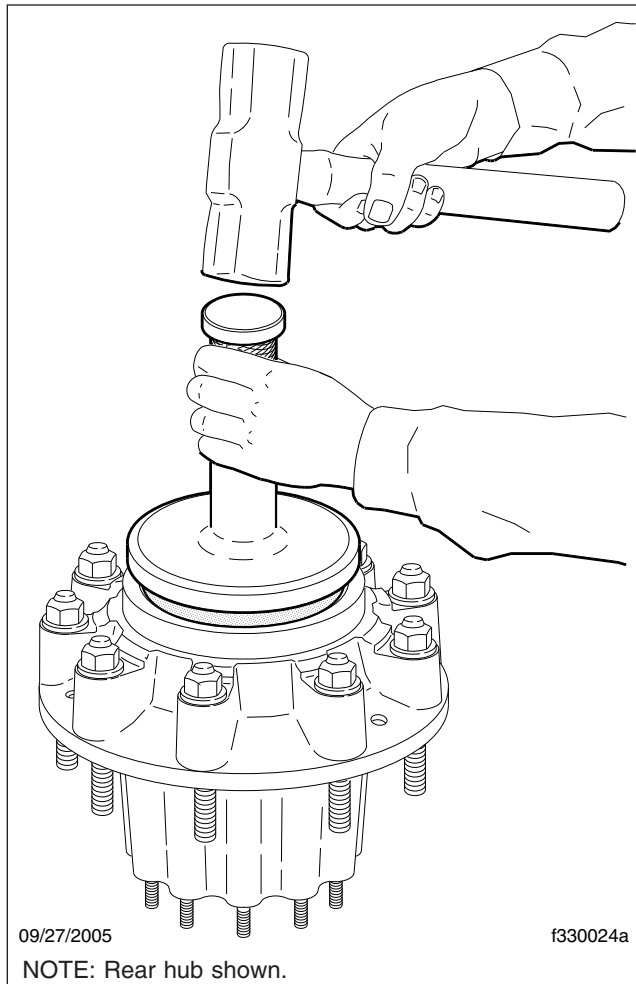


Fig. 5, Strike the Tool

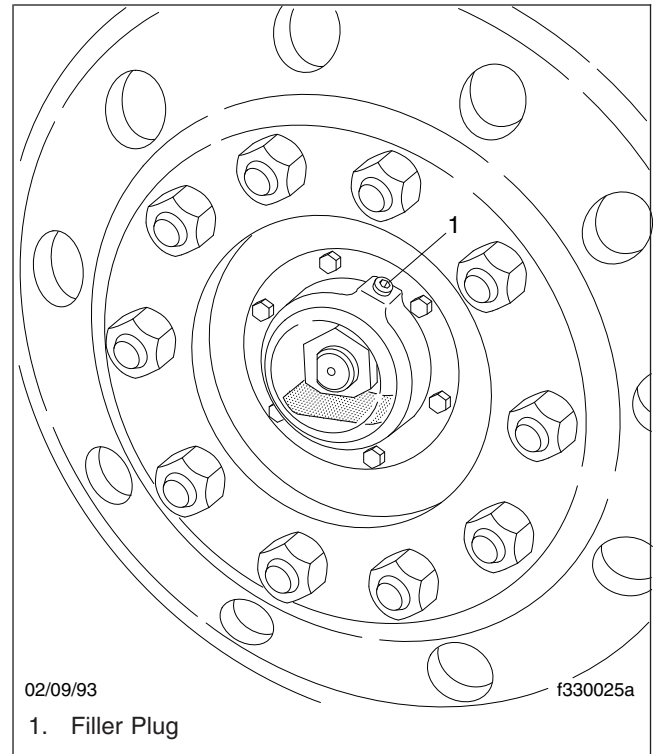


Fig. 6, Fill the Hub with Oil

Seal Replacement, Dana Spicer

Replacement

NOTE: This procedure applies to the Dana Spicer Outrunner™ seal.

1. Remove the wheel, drum, and hub from the axle. For instructions, see [Section 35.01](#), Subject 100.
2. Remove the oil seal from the hub.
3. Remove the inner wheel bearing assembly from the hub. Handling the bearings with clean dry hands, wrap the bearings in clean oil-proof paper or lint-free cloths. Occasionally, the inner wheel bearing cone assembly will remain in the hub after the seal is removed. In those cases, place a protective cushion to catch the bearing assembly. Using a hardwood drift and a light hammer, gently tap the bearing out of the inner wheel bearing cup.
4. Clean and inspect the bearings, the spindle, spindle threads, seal bore, and the hub cavity.

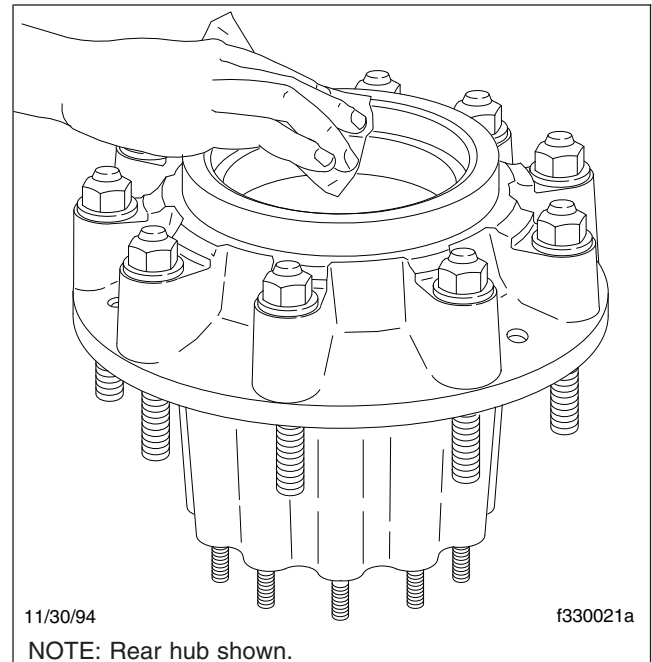
IMPORTANT: Use extreme care in cleaning the wheel hub cavity and axle spindle. Dirt, metal filings, or other contaminants can scratch the bearing roller surfaces, and cause premature wear of the bearing assembly.

- 4.1 Inspect the inner hub bore. Remove dirt and contaminants from all recesses and corners. Smooth any sharp edges with emery cloth, and fill in any grooves with filler. See [Fig. 1](#).
- 4.2 Wipe the hub area with a clean shop cloth.
- 4.3 After removing the hub, inspect the spindle. Remove any sharp edges and burrs from the leading edges and the shoulder area. Repair deep gouges with filler and smooth with an emery cloth. See [Fig. 2](#).
- 4.4 Wipe the seal and shoulder area with a clean shop cloth.



CAUTION

Do not spin bearing rollers at any time. Dirt or grit can scratch the roller surface and cause rapid wear of the bearing assembly. Treat used bearings as carefully as new ones.



NOTE: Rear hub shown.

Fig. 1, Clean and Inspect the Hub Bore

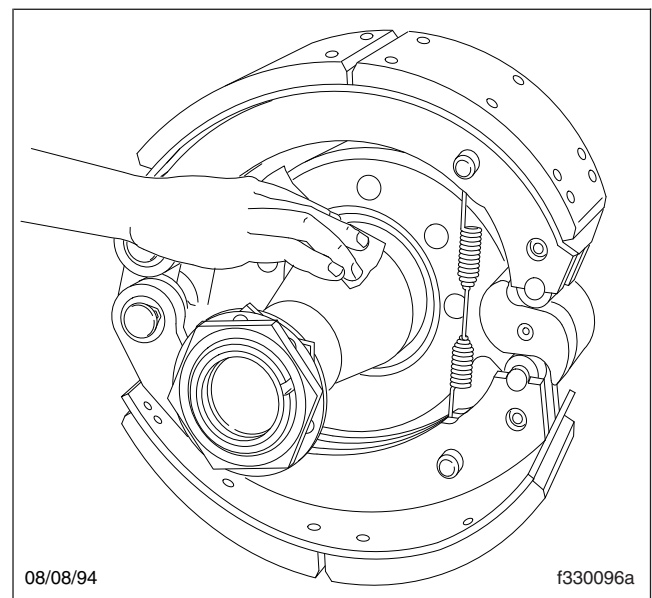


Fig. 2, Clean and Inspect the Axle Spindle

- 4.5 Inspect the bearings and hub components for wear or damage. Replace any worn or damaged components as necessary.
- 4.6 Coat the wheel bearing cones with oil.

Seal Replacement, Dana Spicer

5. Install the inner wheel bearing cone in the inner wheel bearing cup.

IMPORTANT: Use the Dana Spicer Outrunner installation tool *with the centering tool* when installing the seal. See [Fig. 3](#).

6. Install the oil seal in the hub bore.

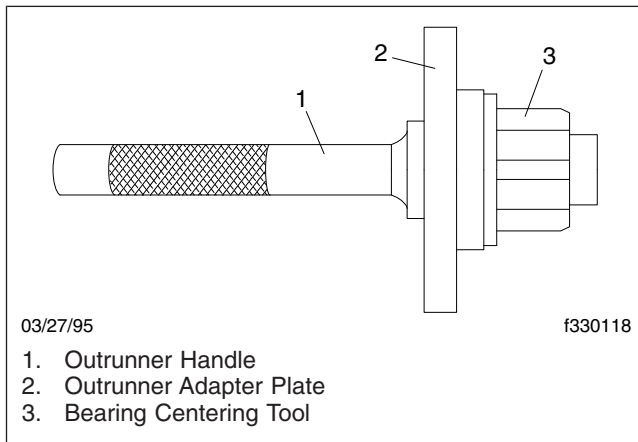


Fig. 3, Dana Spicer Outrunner Installation Tool

CAUTION

Do not use any silicone or permatex type bore sealant with this seal. The Dana Spicer Corporation recommends a light coating of bearing oil on the outer circumference of the seal.

Do not mix lubricants of different grades. Do not mix mineral and synthetic lubricants. Do not pack the bearings with grease when using an oil bath system. Failure to follow these installation guidelines will result in less than desired performance of the Outrunner seal, and installation-related failures are not covered under warranty.

- 6.1 Place the Outrunner seal tool with the words "air side" facing the adaptor plate of the installation tool. See [Fig. 4](#). Lubricate the seal outer circumference with wheel bearing oil.

IMPORTANT: Install the seal in the hub bore with the hub laid flat. Do not install the seal with the hub in the vertical (upright) position.

- 6.2 With the hub and the wheel assembly laid flat on the floor, place the inner bearing cone in the cup.

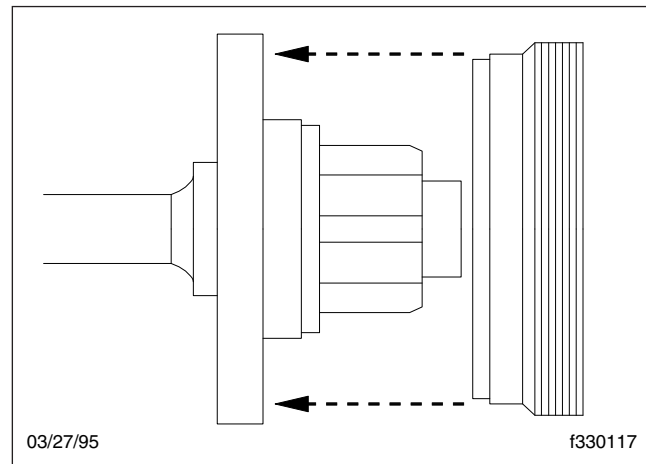


Fig. 4, Seal Placement on Tool

- 6.3 Position the oil seal in the hub bore. Before striking the handle of the installation tool, tap the adaptor plate around the outer edge to position the seal. See [Fig. 5](#).

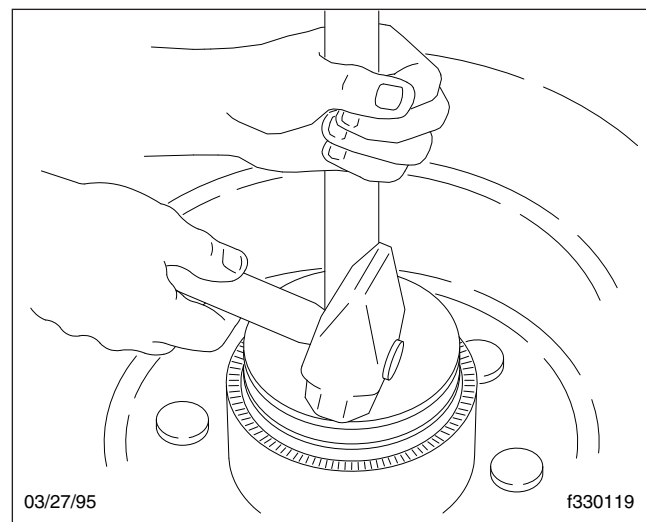


Fig. 5, Position the Seal

- 6.4 Hit the handle of the installation tool *gently*. See [Fig. 6](#).

Because of the rubber outer circumference, the Outrunner seal is easier to install than seals with metal outer circumferences. When the adaptor plate bottoms out on the hub surface, the seal is in-

Seal Replacement, Dana Spicer

stalled correctly. You will hear a metal-to-metal sound.

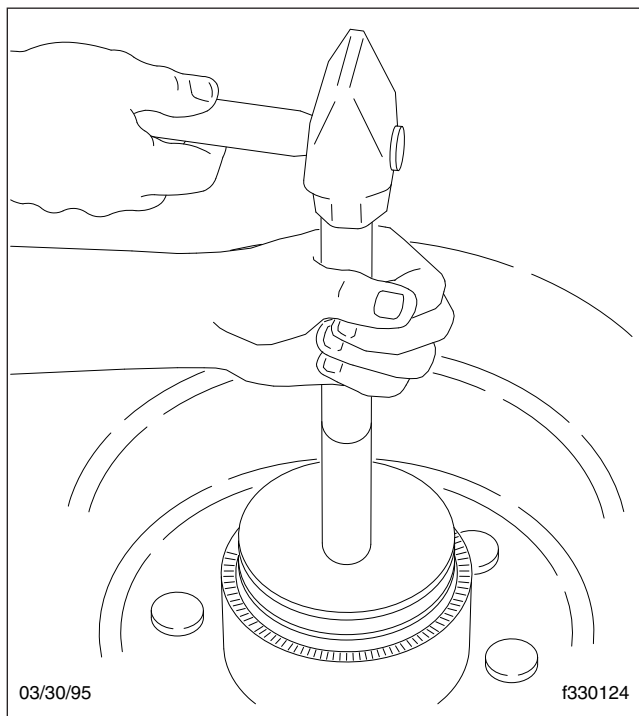


Fig. 6, Install the Seal

- 6.5 Check that the seal is not cocked, and that the unitized seal inner circumference and inner bearing turn freely.
- 6.6 Lubricate the inner circumference of the seal with a light film of clean bearing oil.
7. Install the wheel hub on the axle, and adjust the wheel bearings. For instructions, see [Section 35.01](#), Subject 100.

IMPORTANT: When starting the wheel on the spindle, center the hub carefully to avoid seal damage from the leading edge of the spindle.

8. Place the hubcap and a new gasket in position, then install the capscrews. Tighten the capscrews 15 lbf·ft (20 N·m).
9. Fill the hub with oil to the level shown on the hubcap. See [Fig. 7](#). Do not overfill.
10. Spin the wheel and check the oil level.

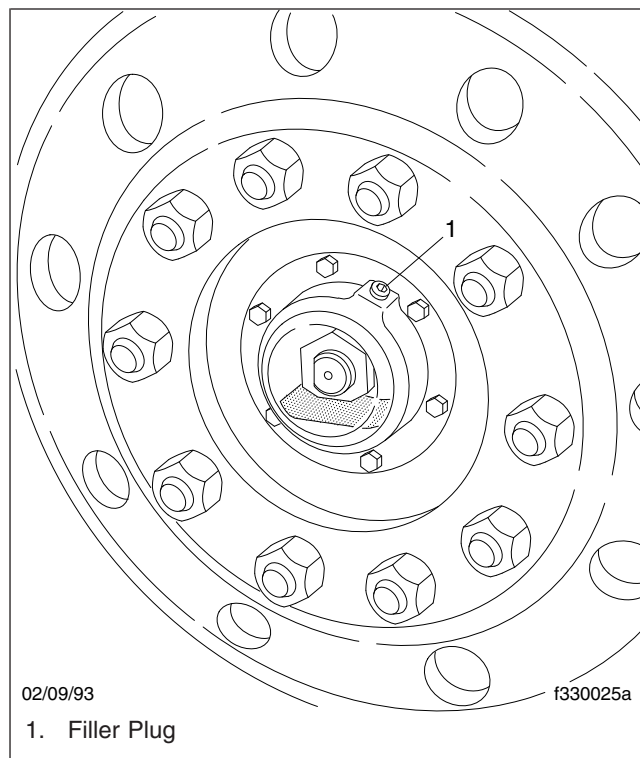


Fig. 7, Fill the Hub with Oil

11. Adjust the brake shoe-to-drum clearance. For instructions, see Group 42 of the *Business Class M2 Maintenance Manual*.

Subject	Subject Number
General Information	050
Service Operations	
Single or Rearmost Axle Removal and Installation	100
Single or Rearmost Axle Differential Carrier Removal and Installation	110
Axle Shaft Removal and Installation	120
Single or Rearmost Axle Yoke and Seal Replacement, Model 2 and Model 4 Axles	130
Forward-Rear Axle Removal and Installation	140
Forward-Rear Axle Differential Carrier Removal and Installation	150
Thru-Shaft Repair	160
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Main Differential Lock Disassembly and Assembly, Model 2 Axles	180
Main Differential Lock Disassembly and Assembly, Model 4 Axles	190
Interaxle Differential Lock Adjustment	200
Threaded Ring Repair	210
Interaxle Differential Replacement	220
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General Information

Detroit rear axles are compatible with industry-standard brakes, hubs, and wheel bearings.

The following explains an example of the number found on a Detroit rear axle identification tag, which is located on the carrier. See [Fig. 1](#).

Typical Model Number: ART-40.0-4

- *ART* = tandem rear axle
- *40.0* = weight rating (times 1000 lb)
- *4* = basic model number

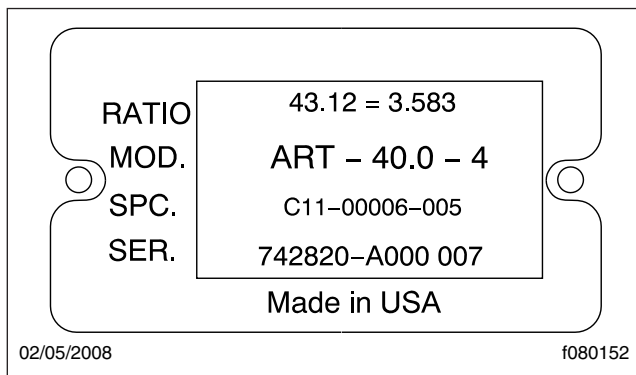


Fig. 1, Rear Axle ID Tag

Detroit rear axles may have a main differential lock, which is commonly known as the "DCDL" (Driver-Controlled Differential Lock). The DCDL is an optional feature that can lock the differential assembly. When the differential lock is engaged, the clutch collar completely locks the differential case, gearing, and axle shafts together to maximize traction of both wheels and protect against spinout. Each part of the DCDL is replaceable; see [Subject 180](#) for Model 2 axles, and [Subject 190](#) for Model 4 axles.

On tandem axles there are three possible differential lock options: forward-rear carrier only, rear-rear carrier only, or both rear carriers.

NOTE: Detroit axles are a proprietary product, though in some applications they may be referred to as "Freightliner" or "Axle Alliance" axles or "MB components."

Warranty

To assist in the determination of warrantable and non-warrantable failures for these axles, warranty evaluation guides are available through WarrantyLit on www.accessfreightliner.com. These guides help determine whether or not pre-approval is needed for a repair. The following evaluation guides are available:

- [Warranty Evaluation Guide](#)
- [Submission Guidelines - Differential Cross Failure](#)
- [Submission Guidelines - Pinion Bearing Cage Damage](#)
- [Submission Guidelines - Pinion Nut Failure](#)
- [Submission Guidelines - Thrust Bearing Failure](#)
- [Submission Guidelines - Yoke \(Pinion\) End Play](#)

Single or Rearmost Axle Removal and Installation

Removal

For rear axle components, see [Fig. 1](#).

1. Park the vehicle on a level surface, shut down the engine, set the parking brake, and chock the front tires. Put the transmission in neutral.
2. Using a suitable jack, raise the vehicle enough to take the weight off the axles, but not enough to raise the tires off the ground.
3. At both ends of the axle, loosen all the wheel nuts.
4. Continue to raise the vehicle evenly until there is room to fit a stand underneath the axle housing.



WARNING

Never work around or under a vehicle that is supported only by a jack. Always support the vehicle with safety stands. Jacks can slip, allowing the vehicle to fall, which could result in serious injury or death.

5. Support the vehicle with safety stands.
6. Remove the tire and wheel assemblies. For instructions, see [Group 40](#).
7. Remove the oil drain plug from the bottom of the differential housing and drain the oil. Install the drain plug after emptying.
8. Disconnect the driveshaft from the differential carrier. For instructions, see [Section 41.00, Subject 120](#). Using suitable straps, support the end of the driveshaft by attaching it to the frame rail.
9. Release the parking brakes.
10. Cage the parking brake springs to prevent the parking brakes from engaging. For instructions, see [Group 42](#).
11. If DCDL is installed on the vehicle, use the DCDL switch in the cab to engage the lock. An indicator light comes on when the differential lock is engaged. Turn the appropriate wheels to ensure the lock is fully engaged.

IMPORTANT: The wheel lock must be fully engaged to prevent the possibility of damage to wheel lock components while the axle shafts are being removed.

12. Place a basin under the axle shaft flanges to catch any oil, then remove the axle shafts. For instructions, see [Subject 120](#).
13. Drain the air system, if installed.
14. If installed, disconnect the DCDL air line from the carrier housing.
15. If necessary, back off the slack adjusters. Remove the brake drums.
16. Remove the hubs from the axle spindles. For instructions, see [Section 35.00, Subject 100](#).
17. Remove the brake shoes. For instructions, see the applicable service brake section in [Group 42](#).
18. If applicable, disconnect the leveling valve rod(s) from the suspension.
19. If installed, disconnect the air lines from the rear brake chambers. Then remove the brake air chambers and the slack adjusters from the axle housing. For instructions, see [Group 42](#).
20. Remove the brake spiders from the axle flanges.
 - 20.1 At the frame rail or crossmember, disconnect the wiring for the ABS sensors. Remove any tie straps that hold the wires to the frame rails.
 - 20.2 Remove the ABS sensors and wiring.
 - 20.3 Remove the fasteners that hold the brake spiders to the axle flanges. Remove the spiders from the axle.
21. Using a suitable jack, support the axle housing.
22. If applicable, remove the hexnuts that hold the bottom of each suspension air bag to its suspension bracket.
23. Remove the suspension components that attach the axle to the vehicle. If applicable, remove the U-bolt nuts from the U-bolts. Discard the U-bolt nuts and U-bolts.
24. Lower the axle enough to clear the suspension components.
25. Remove the axle from the vehicle.
26. If you are going to replace the differential carrier, place the axle on a secure axle stand.

Single or Rearmost Axle Removal and Installation

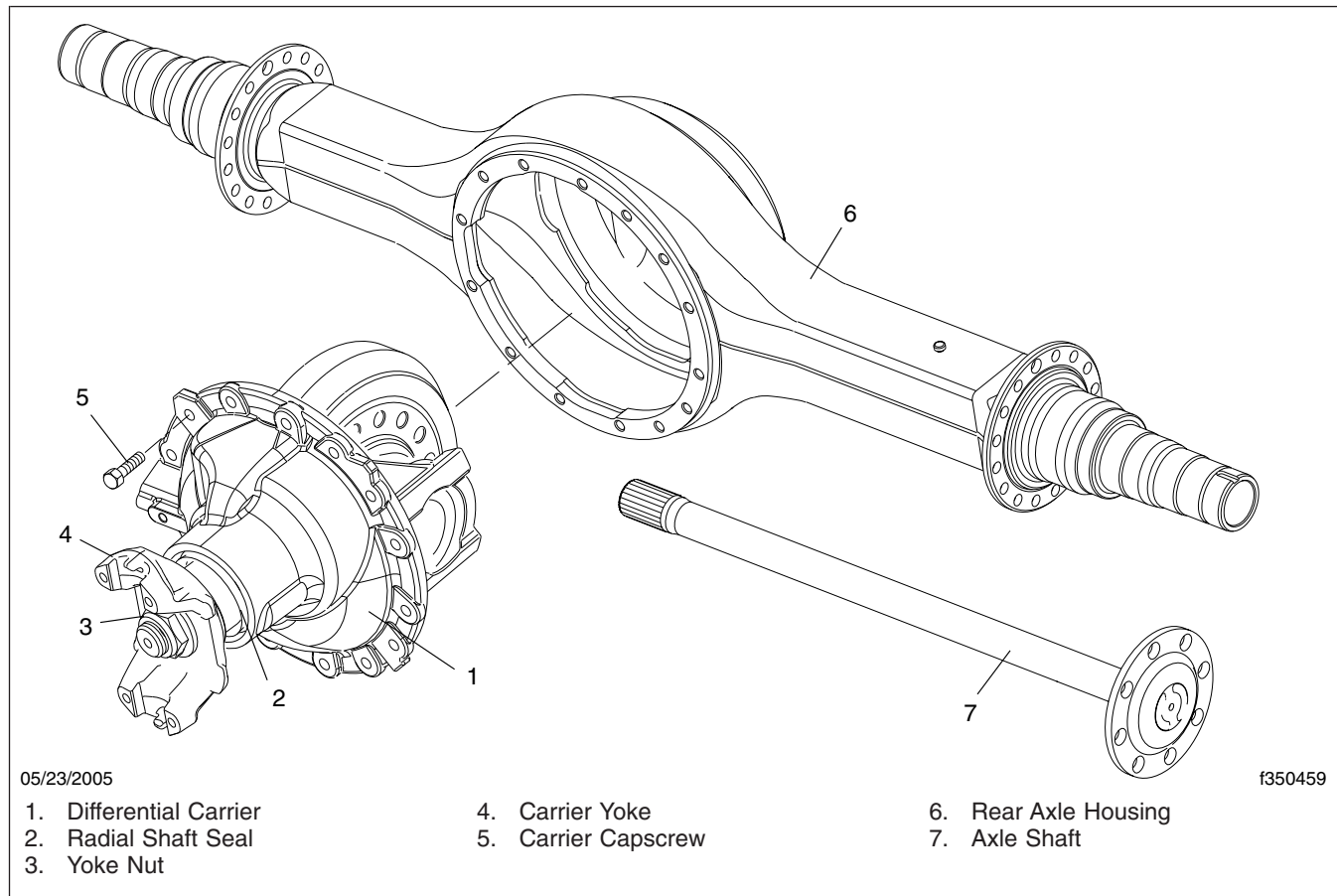


Fig. 1, Single or Rearmost Axle Components

Installation

1. Position the axle underneath the vehicle.
2. Install the suspension components that attach the axle to the vehicle, as follows.

NOTE: U-bolts and U-bolt nuts cannot be reused.

- 2.1 On vehicles with conventional suspensions, install the upper U-bolt brackets, new U-bolts, lower U-bolt brackets, and new U-bolt nuts.

On vehicles with air suspensions, in addition to the U-bolts, install the hexnuts that attach the air springs to the suspension brackets. For torque values, see [Group 32](#).

On vehicles without U-bolts, install the walking beams.

- 2.2 If applicable, tighten the new U-bolt nuts in a diagonal pattern. For torque values, see [Group 32](#).
3. Connect the driveshaft to the differential carrier yoke. For instructions, see [Section 41.00, Subject 120](#).
4. Install the brake spiders on the axle flanges. For instructions, see the applicable service brake section in [Group 42](#).
5. Install the ABS sensors and connect the wiring at the frame rail. Secure the wiring with tie straps as needed.
6. Install the brake air chambers (if removed) and slack adjusters on the axle housing brackets. For instructions, see [Group 42](#).

Single or Rearmost Axle Removal and Installation

7. Connect the air lines to the brake air chambers.
8. Install the brake shoes, as removed. For instructions, see the applicable service brake section in [Group 42](#).
9. Fill each hub with approved axle oil until you can see a small amount of oil trickling out of the back of the hub (fill with about 0.8 quart, or 0.75 liter). Install the hubs on the axle spindles, and adjust the wheel bearings. For instructions, see [Section 35.00](#).

NOTE: See [Table 1](#) for approved axle oils.

10. If DCDL is installed on the vehicle, connect the DCDL air line, fill the air system, and use the DCDL switch in the cab to engage the lock. An indicator light comes on when the differential lock is engaged.

IMPORTANT: The wheel lock must be fully engaged to prevent the possibility of damage to wheel lock components while the axle shafts are being installed.

11. Using new gaskets, install the axle shafts. For instructions, see [Subject 120](#).
12. Install the brake drums on the hubs.
13. Install the tire and wheel assemblies. For instructions, see [Group 40](#).
14. Adjust the brakes. For instructions, see the applicable service brake section in [Group 42](#).
15. Uncage the parking brake springs.
16. Using approved axle oil, fill the axle housing to the bottom of the fill hole, or until filled to capacity as shown in [Table 1](#).

Approved Single Rear Axle Oil Type and Capacity				
Model	Oil Type		Capacity: quarts (liters)	
	Mineral	Synthetic	Hubs Full	Hubs Dry
2	80W-90	75W-90	5.8 (5.5)	7.4 (7.0)
4			10.6 (10.0)	12.2 (11.5)

Table 1, Approved Single Rear Axle Oil Type and Capacity

17. If the hubs are dry, raise one side of the vehicle about 8 inches (20 cm) to let the oil flow into the hub on the opposite side, then raise the other side in the same manner. On each side, hold the

tilted position for three minutes to allow oil to run into the wheel end.

NOTICE

Make sure the hubs are filled. Driving with the hubs dry will cause bearing damage.

18. Turn the wheels, wait one minute, and check the lubricant level.
19. Raise the vehicle, remove the safety stands, then lower the vehicle.
20. If applicable, connect the suspension leveling valve(s). Start the engine, build the air pressure, and make sure the suspension air bags inflate correctly. Make sure the ride height is correct. For instructions, see [Group 32](#).
21. Check the operation of the DCDL, if installed.
22. Check the oil level in the axle housing. The level should be up to the bottom of the fill hole. Add approved axle oil, if needed.
23. Set the parking brake, then remove the chocks from the front tires.

Single or Rearmost Axle Differential Carrier Removal and Installation

When the wheel lock is removed, inspect the carrier for damage and replace it if damage is found. If no damage is found, install the carrier again.

Removal

NOTE: The differential carrier can be removed either with the rear axle installed on the vehicle or with the rear axle removed from the vehicle.

Axle Installed on Vehicle

1. Park the vehicle on a level surface, shut down the engine, set the parking brake, and chock the front tires. Put the transmission in neutral.
2. If applicable, release the suspension air pressure.
3. Using suitable jacks, raise the vehicle evenly until there is room to fit a stand underneath the axle housing.
4. Remove the tire and wheel assemblies. For instructions, see [Group 40](#).
5. Remove the oil drain plug from the bottom of the rear axle housing and drain the oil. Install the drain plug after emptying.
6. If DCDL is installed on the vehicle, use the DCDL switch in the cab to engage the lock. An indicator light comes on when the differential lock is engaged. Turn the appropriate wheels to ensure the lock is fully engaged.
7. Disconnect the driveshaft from the carrier input yoke. For instructions, see [Section 41.00, Subject 120](#). Using suitable straps, support the end of the driveshaft by attaching it to the frame rail.
8. Place a basin under the axle shaft flanges, then remove the axle shafts. For instructions, see [Subject 120](#).
9. Do the steps under the heading, "Axle Removed from Vehicle."

Axle Removed from Vehicle



WARNING

The differential carrier is heavy. Do not try to move it without a suitable support. To do so could result in the carrier falling, which could cause serious personal injury and component

damage. Support the carrier with a suitable jack and chain it to the jack, or use a hoist if the axle has been removed from the vehicle.

1. Using a suitable jack, support the differential carrier. Chain the differential carrier to the jack.
2. If DCDL is installed on the vehicle, ensure the lock is engaged. Turn the appropriate wheels to verify it is fully engaged.
3. Remove the carrier capscrews that hold the differential carrier to the axle housing. See [Fig. 1](#).
4. With the differential carrier securely supported, remove it from the axle housing.

Installation

IMPORTANT: If you replace the yoke on the differential carrier, use a *new* nut when installing the new yoke.

NOTE: Use a cleaning solvent and clean rags to remove dirt. Blow dry the cleaned areas with air.

1. Remove any old sealant material from the mating surfaces of the axle housing. Clean the inside of the rear axle housing and the forward carrier mating surface.
2. Inspect the axle housing for damage. Repair or replace the axle housing as necessary.
3. Apply a thin bead of Loctite® 5900 sealant all the way around the mating surface of the axle housing, and around each bolt hole.

NOTE: Alignment dowels for installing the differential carrier can be made by sawing off the heads of two M12 x 1.5 x 100 mm bolts (for Model 2 axles) or M16 x 1.5 x 100 mm bolts (for Model 4 axles).

4. Install alignment dowels 180 degrees apart at the 3 o'clock and 9 o'clock positions on the axle housing flange.
5. If DCDL is installed on the vehicle, ensure it is engaged.

NOTICE

Make sure the differential carrier is centered and straight on the axle housing before you install the mounting capscrews. Attempting to install

Single or Rearmost Axle Differential Carrier Removal and Installation

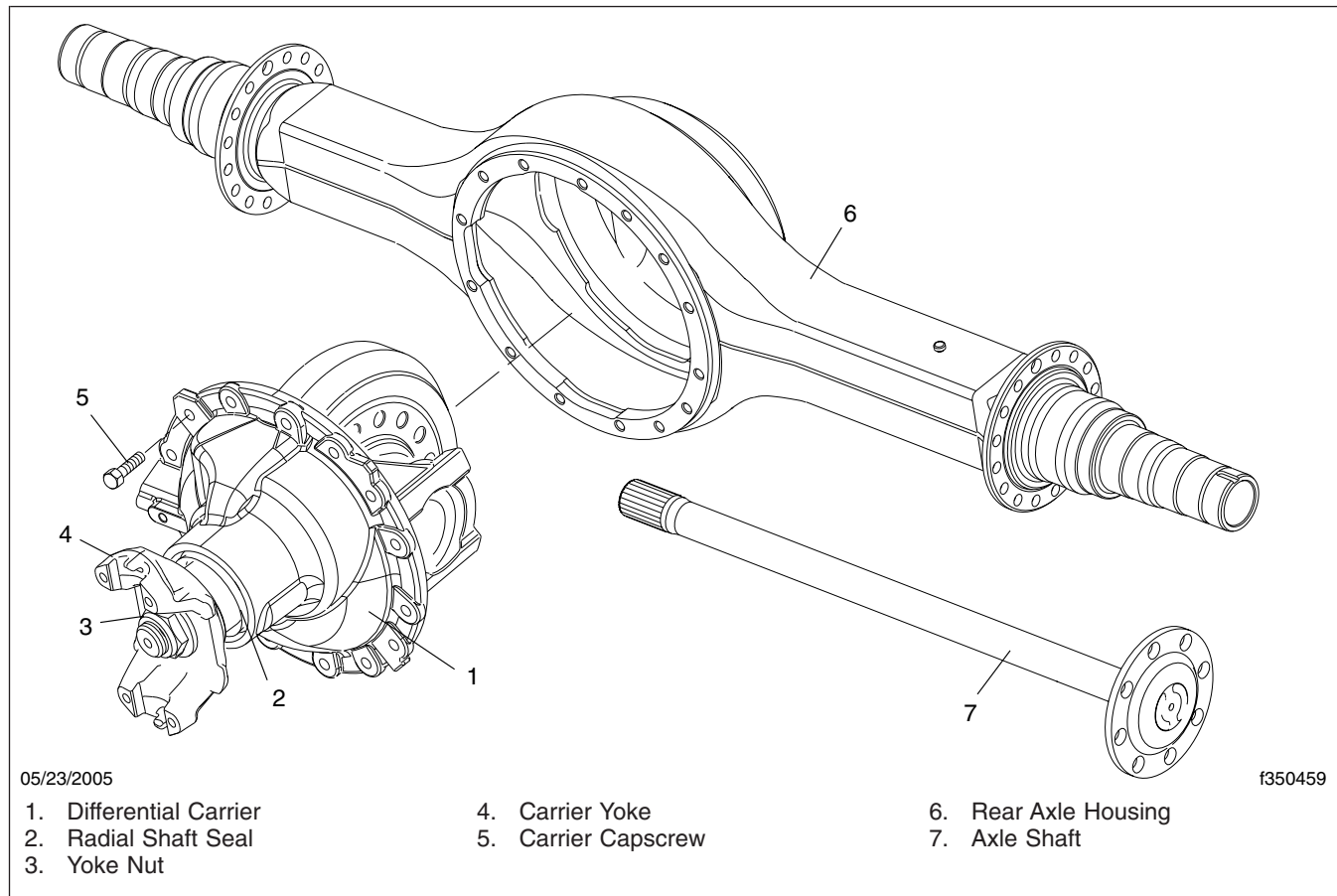


Fig. 1, Single or Rearmost Axle Components

the carrier when it is not centered or straight may cause damage to the carrier.

6. Using a hoist (if the axle is removed from the vehicle) or a suitable transmission jack, install the differential carrier into the axle housing. Use the alignment dowels to center the carrier on the axle housing.

7. Install the end caps at the sides of the carrier into the corresponding slots in the axle housing. See [Fig. 2](#).

- 7.1 For the last 3/4 inch (19 mm) or so of travel, walk the carrier slowly into the housing.

IMPORTANT: The end caps fit tightly into the axle housing. Be very careful not to cock the carrier.

- 7.2 Install the carrier capscrews finger-tight. Make sure the carrier capscrews turn easily in the axle housing.

- 7.3 In a star pattern, gradually tighten the carrier capscrews to the values given.

- M12 capscrews: 115 lbf·ft (156 N·m)
- M16 capscrews: 200 lbf·ft (270 N·m)

8. If removed, install the axle on the vehicle. For instructions, see [Subject 100](#).

If the axle is already on the vehicle, go to the next step.

9. Connect the driveshaft to the carrier input yoke. For instructions, see [Section 41.00, Subject 120](#).

10. Using new gaskets, install the axle shafts. For instructions, see [Subject 120](#).

Single or Rearmost Axle Differential Carrier Removal and Installation

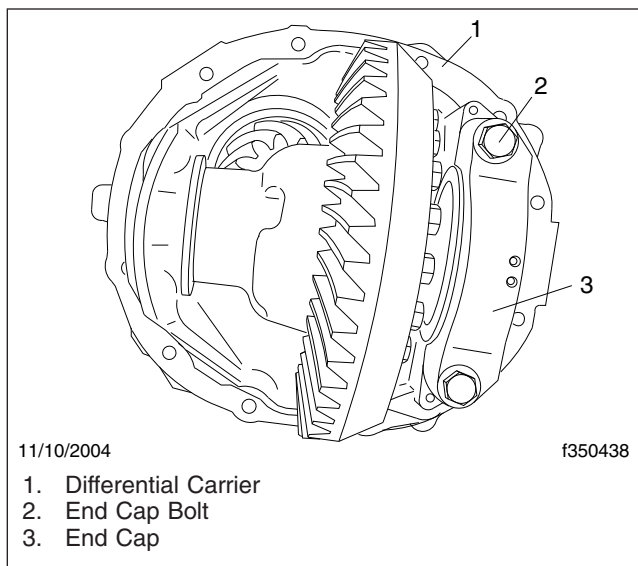


Fig. 2, Carrier End Caps

15. Raise the vehicle, remove the safety stands, then lower the vehicle.
 16. Start the engine, build the air pressure, and check that the suspension air bags inflate evenly and correctly. Make sure the ride height is correct.
 17. Check the oil level in the axle housing. The level should be up to the bottom of the fill hole. Add approved axle oil, if needed.
 18. Remove the chocks from the front tires.
11. Install the tire and wheel assemblies. For instructions, see [Group 40](#).
 12. Using approved axle oil, fill the axle housing to the bottom of the fill hole, or until filled to capacity as shown in [Table 1](#).

Approved Single Rear Axle Oil Type and Capacity				
Model	Oil Type		Capacity: quarts (liters)	
	Mineral	Synthetic	Hubs Full	Hubs Dry
2	80W-90	75W-90	5.8 (5.5)	7.4 (7.0)
4			10.6 (10.0)	12.2 (11.5)

Table 1, Approved Single Rear Axle Oil Type and Capacity

13. Raise one side of the vehicle about 8 inches (20 cm) to let the oil flow into the hub on the opposite side, then raise the other side in the same manner. On each side, hold the tilted position for three minutes to allow oil to run into the wheel end.

NOTICE

Make sure the hubs are filled. Driving with the hubs dry will cause bearing damage.

14. Turn the wheels, wait one minute, and check the lubricant level.

Axle Shaft Removal and Installation

Removal

1. Chock the front tires.
2. If DCDL is installed on the vehicle, use the DCDL switch in the cab to engage the lock. An indicator light comes on when the differential lock is engaged. Turn the appropriate wheels to ensure the lock is fully engaged.
3. Raise the rear of the vehicle with a suitable jack high enough to clear the axle. Support the axle with jack stands.
4. Place a basin under the axle shaft flanges to catch any oil. Dispose of used oil properly.
5. If necessary, remove the rear wheels and tires. For procedures, see [Group 40](#).

NOTE: This procedure can be done with the wheels and tires installed or with the wheels and tires removed.

6. Remove the drive axle stud nuts that attach the axle shaft to the wheel hub.
7. If DCDL is installed on the vehicle, use the DCDL switch in the cab to engage the lock. An indicator light comes on when the differential lock is engaged. Turn the appropriate wheels to ensure the lock is fully engaged.
8. Tap the axle shaft flange if necessary to loosen it and slide the axle shaft out of the axle. Remove and discard the gasket.

Installation

1. Position a new gasket on the axle shaft flange.
2. If DCDL is installed on the vehicle, ensure it is engaged.

IMPORTANT: The wheel lock must be fully engaged to prevent the possibility of damage to wheel lock components while the axle shafts are being installed.

3. Install the axle shaft, as follows. See [Fig. 1](#).
 - 3.1 Carefully raise the axle with the floor jack, and support the axle with jack stands. Slide the axle shaft into the axle.
 - 3.2 Apply light pressure with the hand or knee to the axle flange.

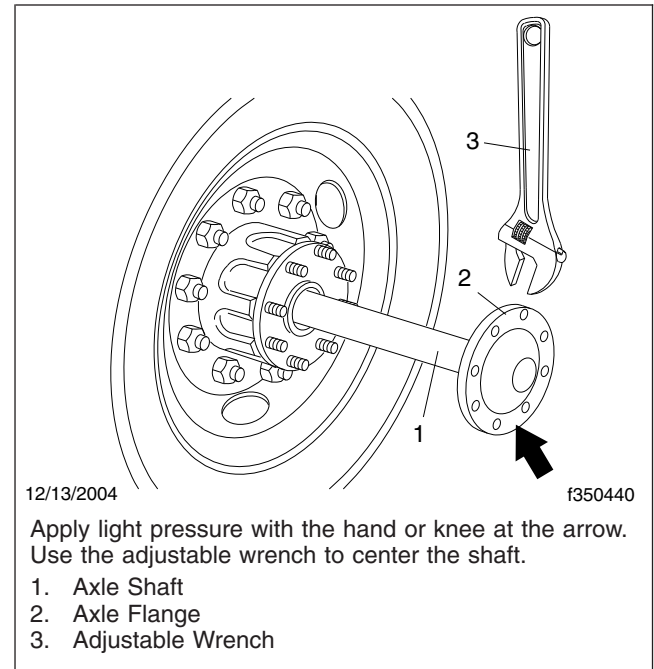



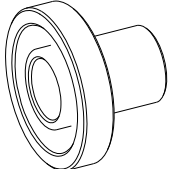
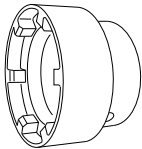
Fig. 1, Installing the Axle Shaft

- 3.3 Use an adjustable wrench to center the shaft. Turn the shaft with a slight rotating motion.
- 3.4 Install the drive axle stud nuts and tighten them to the values given.
 - 1/2–20 nuts: 75 to 115 lbf-ft (102 to 156 N·m)
 - 5/8–18 nuts: 150 to 170 lbf-ft (203 to 230 N·m)
4. If removed, install the rear wheels and tires. Tighten the wheel nuts according to the procedures in [Group 40](#).
5. Remove the supports and lower the vehicle.
6. As needed, replace any oil that was drained from the hub when the axle shaft was removed.
7. Remove the chocks from the front tires.

Single or Rearmost Axle Yoke and Seal Replacement, Model 2 and Model 4 Axles

Special Tools

Special tools are required for Model 4 axles; see [Table 1](#). There are no special tools for Model 2 axles.

Special Tools, Model 4 Axles			
Tool	Description	Manufacturer	Part Number
 f580400	Universal Handle*	Kent-Moore	J-8092
 f580406	Rear Pinion Seal Installer*	Kent-Moore	J-47354
 f580450	Yoke Nut Socket†	Daimler	MBA 742589020700

* To order Kent-Moore tools call 1-800-328-6657.

† The yoke nut socket is needed to remove the round, slotted yoke nut installed on some vehicles. It can be ordered through Paragon.

Table 1, Special Tools, Model 4 Axles

Replacement

1. Disconnect the driveshaft from the differential carrier. For instructions, see [Section 41.00, Subject 120](#). Using suitable straps, support the end of the driveshaft by attaching it to the frame rail.

IMPORTANT: For Model 4 axles, if the yoke nut is round and slotted, use the yoke nut socket shown in [Table 1](#).

2. Remove the yoke nut from the center of the carrier yoke. See [Fig. 1](#). Be careful not to damage the seal bore.
3. Remove the carrier yoke from the input shaft.
4. Pry up the seal, using a prybar or large screwdriver. Clean any old sealant from the axle hous-

ing. Do not allow dirt or grease to contaminate the seal bore or shaft bearings. See [Fig. 2](#).

IMPORTANT: For Model 4 axles, assemble the rear pinion seal installer onto the threaded end of the universal handle. See [Table 1](#).

5. Install the rear pinion seal on the rear input shaft, as follows.

- 5.1 Inspect the area around the seal for damage. Use emery paper to remove scratches, nicks, or burrs on the seal bore.

IMPORTANT: Be careful not to cock the seal during installation.

Single or Rearmost Axle Yoke and Seal Replacement, Model 2 and Model 4 Axles

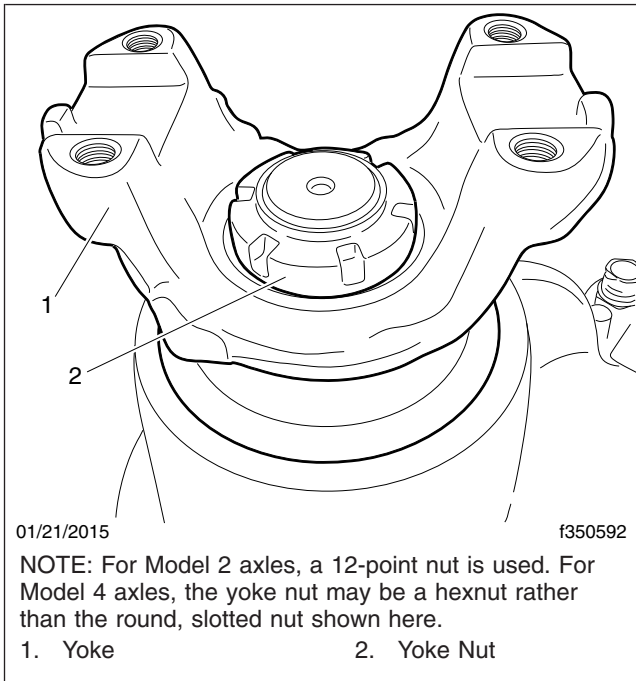


Fig. 1, Yoke Nut on the Carrier

- 5.2 Press the seal into the bore until the seal surface is flush with the bottom surface of the counterbore. For Model 4 axles, use the rear pinion seal installer assembly; see [Fig. 3](#).

IMPORTANT: The bent area has to reach the bottom of the pinion groove.

9. Connect the driveshaft. For instructions, see [Section 41.00, Subject 120](#).

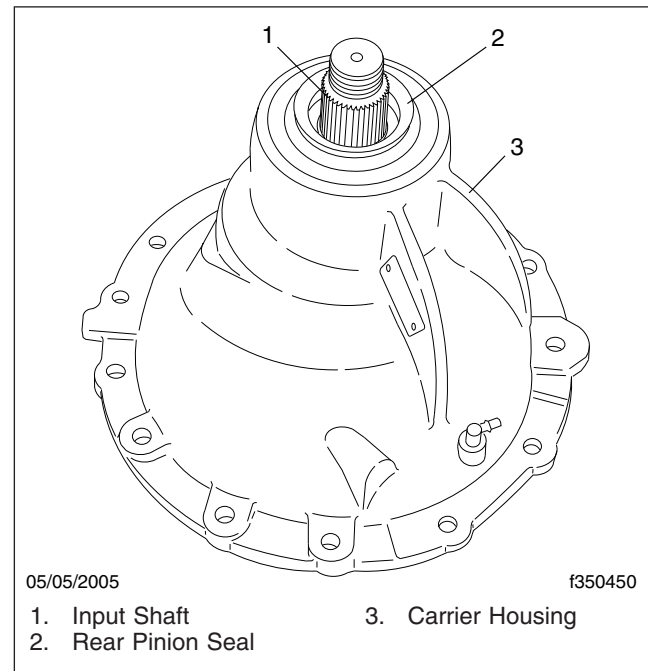


Fig. 2, Rear Pinion Seal

NOTICE

Do not use excessive force when setting the yoke. Just tap it on with a hammer, and then drive it down with the nut.

NOTE: It is not necessary to replace the yoke when replacing the seal.

6. Install the carrier yoke on the input shaft. If the yoke is damaged or worn, install a new yoke.
7. For Model 2 axles, install a new M40 x 1.5 yoke nut on the carrier yoke and tighten 370 lbf·ft (502 N·m).

For Model 4 axles, install a new M45 x 1.5 yoke nut on the carrier yoke and tighten 627 lbf·ft (850 N·m).
8. Punch in the cylindrical area at the pinion groove to lock the nut in place.

Single or Rearmost Axle Yoke and Seal Replacement, Model 2 and Model 4 Axles

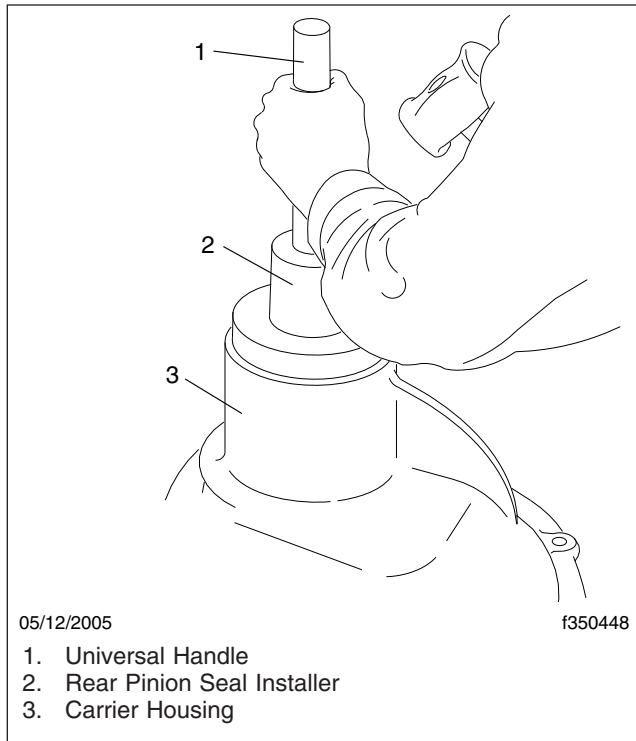


Fig. 3, Installing the Rear Pinion Seal, Model 4 Axle

Forward-Rear Axle Removal and Installation

Removal

For forward-rear axle components of a tandem installation, see [Fig. 1](#).

1. Park the vehicle on a level surface, shut down the engine, set the parking brake, and chock the front tires. Put the transmission in neutral.
2. Using a suitable jack, raise the vehicle enough to take the weight off the axles, but not enough to raise the tires off the ground.
3. At both ends of the axle, loosen all the wheel nuts.
4. Using a suitable jack, continue to raise the vehicle evenly until there is room to fit a stand underneath the axle housing.

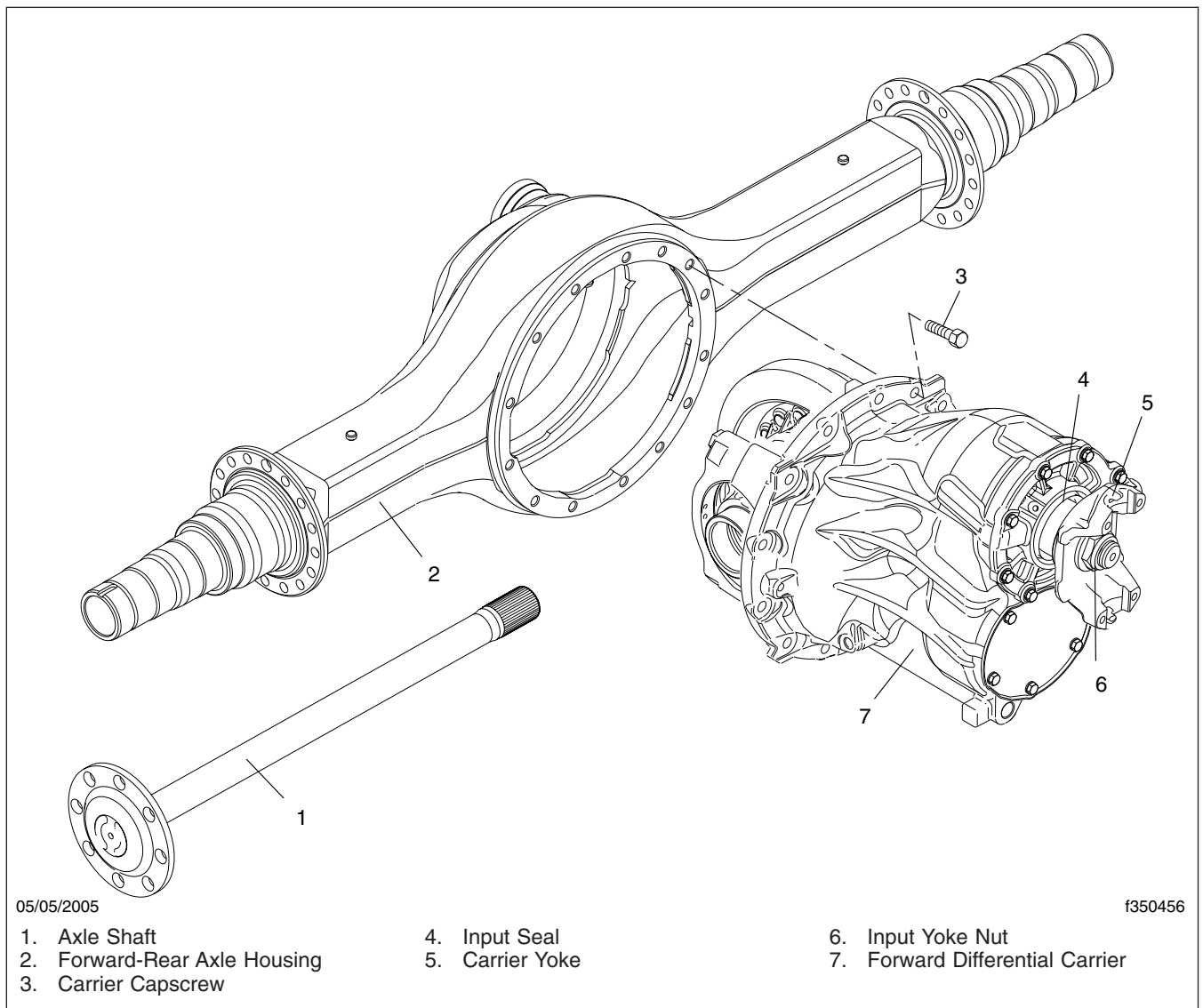


Fig. 1, Forward-Rear Axle Components

Forward-Rear Axle Removal and Installation

WARNING

Never work around or under a vehicle that is supported only by a jack. Always support the vehicle with safety stands. Jacks can slip, allowing the vehicle to fall, which could result in serious injury or death.

5. Support the vehicle with safety stands.
 6. Remove the oil drain plug from the bottom of the axle housing and drain the oil from the axle housing. Install the drain plug after emptying.
 7. Remove the tire and wheel assemblies. For instructions, see [Group 40](#).
 8. Release the parking brakes.
 9. If necessary, back off the slack adjusters. Then remove the brake drums.
 10. If installed, make sure the optional DCDL (main differential lock) has been shifted into the engaged (locked) position.
- IMPORTANT:** The wheel lock must be fully engaged to prevent the possibility of damage to wheel lock components while the axle shafts are being removed.
11. If not done previously, disconnect the air lines at the interaxle lock and (if installed) the wheel lock.
 12. Disconnect the main driveshaft from the forward differential carrier. For instructions, see [Section 41.00, Subject 120](#). Using suitable straps, support the end of the driveshaft by attaching it to the frame rail.
 13. Disconnect the interaxle driveshaft from the output yoke of the forward-rear axle, and the input yoke of the rearmost axle. For instructions, see [Section 41.00, Subject 120](#).
 14. Cage the parking brake springs to prevent the parking brakes from engaging. For instructions, see [Group 42](#).
 15. Drain the air system.
 16. Place a basin under the axle shaft flanges to catch any oil; then remove the axle shafts. For instructions, see [Subject 120](#).
 17. Remove the hubs from the axle spindles. For instructions, see [Section 35.01, Subject 100](#).

18. Remove the brake shoes. For instructions, see the applicable service brake section in [Group 42](#).
19. Remove the ABS sensors and wiring, and the fasteners that hold the brake spiders to the axle flanges. Remove the spiders from the axle.
20. If applicable, disconnect the leveling valve rod(s) from the suspension.
21. At the frame rail or crossmember, disconnect the wiring for the ABS sensors. Remove any tie straps that hold the wires to the frame rails.
22. Disconnect the air lines from the rear brake chambers. Remove the brake air chambers and the slack adjusters from the axle housing. For instructions, see [Group 42](#).
23. Using a suitable jack, support the axle housing.
24. If applicable, remove the hexnuts that hold the bottom of each suspension air bag to its suspension bracket.
25. Remove the suspension components that attach the axle to the vehicle. If applicable, remove the U-bolt nuts from the U-bolts. Discard the U-bolt nuts and U-bolts.
26. Lower the axle enough to clear the suspension components.
27. Remove the axle from the vehicle.
28. If you are going to replace the differential carrier, place the axle on a secure axle stand.

Installation

1. Position the axle underneath the vehicle.
2. Install the suspension components that attach the axle to the vehicle, as follows.

NOTE: U-bolts and U-bolt nuts cannot be reused.

- 2.1 On vehicles with conventional suspensions, install the upper U-bolt brackets, new U-bolts, lower U-bolt brackets, and new U-bolt nuts.

On vehicles with air suspensions, in addition to the U-bolts, install the hexnuts that attach the air springs to the suspension brackets. For torque values, see [Group 32](#).

Forward-Rear Axle Removal and Installation

- On vehicles without U-bolts, install the walking beams.
- 2.2 If applicable, tighten the new U-bolt nuts in a diagonal pattern. For torque values, see [Group 32](#).
 3. Connect the interaxle driveshaft to the output yoke of the forward carrier and the input yoke of the rear carrier. For instructions, see [Section 41.00, Subject 120](#).
 4. Install the brake spiders on the axle flanges. For instructions, see the applicable service brake section in [Group 42](#).
 5. Install the ABS sensors and connect the wiring at the frame rail. Secure the wiring with tie straps as needed.
 6. Install the brake air chambers and slack adjusters on the axle housing brackets. For instructions, see [Group 42](#).
 7. Connect the air lines to the brake air chambers.
 8. Install the brake shoes, as removed. For instructions, see the applicable service brake section in [Group 42](#).
 9. If equipped with a wheel lock, engage the lock with air.
- IMPORTANT:** The wheel lock must be fully engaged to prevent the possibility of damage to wheel lock components while the axle shafts are being removed.
10. Using new gaskets, install the axle shafts. For instructions, see [Subject 120](#).
 11. Connect the main driveshaft to the forward input yoke. For instructions, see [Section 41.00, Subject 120](#).
 12. Connect the air hoses to the air cylinder for the interaxle lock and (if installed) the wheel lock.
 13. Connect the electrical connector of the sensor unit for axles equipped with a wheel lock.
 14. Fill each hub with approved axle oil until you can see a little amount of oil trickling out of the back of the hub (fill with about 0.8 quart, or 0.75 liter). Install the hubs on the axle spindles, and adjust the wheel bearings. For instructions, see [Section 35.00, Subject 100](#). See [Table 1](#) for approved axle oils.
 15. Install the brake drums on the hubs.

16. Install the tire and wheel assemblies. For instructions, see [Group 40](#).
17. Adjust the brakes. For instructions, see the applicable service brake section in [Group 42](#).
18. Uncage the parking brake springs.
19. Using approved axle oil, fill the forward-rear axle housing to the bottom of the fill hole, or until filled to capacity as shown in [Table 1](#).

Forward-Rear Axle Oil Type and Capacity		
Approved Oil Type	Capacity: quarts (liters)	
	Hubs Full	Hubs Dry
80W-90 Gear Oil	14.3 (13.5)	15.9 (15.0)
75W-90 Synthetic Gear Oil		

Table 1, Forward-Rear Axle Oil Type and Capacity

20. Raise one side of the vehicle about 8 inches (20 cm) to let the oil flow into the hubs on the opposite side, then raise the other side in the same manner.
21. Raise the vehicle, remove the safety stands, then lower the vehicle.
22. If applicable, connect the suspension leveling valve(s). Start the engine, build the air pressure, and make sure the suspension air bags inflate correctly. Make sure the ride height is correct. For instructions, see [Group 32](#).
23. Check the operation of the wheel lock, if installed.
24. Check the oil level in the axle housing. The level should be up to the bottom of the fill hole. Add approved axle oil, if needed.
25. Set the parking brake, then remove the chocks from the front tires.

Forward-Rear Axle Differential Carrier Removal and Installation

For forward-rear axle components of a tandem installation, see [Fig. 1](#).

When the wheel lock is removed, inspect the carrier for damage and replace it if damage is found. If no damage is found, install the carrier again.

Forward-Rear Axle Differential Carrier

Removal

1. Park the vehicle on a level surface, shut down the engine, set the parking brake, and chock the front tires. Put the transmission in neutral.
2. If applicable, release the suspension air pressure.
3. Using suitable jacks, raise the vehicle evenly until there is room to fit a stand underneath the axle housing.
4. Remove the tire and wheel assemblies. For instructions, see [Group 40](#).
5. Remove the oil drain plug from the bottom of the axle housing and drain the oil from the axle housing. Install the drain plug after emptying.
6. Disconnect the driveshaft from the carrier yoke. For instructions, see [Section 41.00, Subject 120](#). Using suitable straps, support the end of the driveshaft by attaching it to the frame rail.
7. Place a basin under the axle shaft flanges to catch any oil; then remove the axle shafts. For instructions, see [Subject 120](#).

WARNING

The differential carrier is heavy. Do not try to move it without a suitable support. To do so could result in the carrier falling, which could cause serious personal injury and component damage. Support the carrier with a suitable jack and chain it to the jack, or use a hoist if the axle has been removed from the vehicle.

8. Using a suitable jack, support the differential carrier. Chain the differential carrier to the jack.

NOTICE

When using a pry bar, be careful not to damage the carrier or housing flange. Damage to these surfaces will cause oil leaks.

9. Remove the differential carrier from the axle housing, as follows. See [Fig. 1](#).
 - 9.1 If equipped with a wheel lock, engage the lock with air. This will help separate the carrier from the axle housing.
 - 9.2 Remove all but the top two carrier capscrews.
 - 9.3 Loosen and back off, but do not remove, the top two carrier capscrews. The capscrews will hold the carrier in the housing.
 - 9.4 Using a pry bar, separate the mating surfaces of the forward differential carrier and axle housing.

NOTE: Use a pry bar that has a round end to help separate the carrier from the housing.

- 9.5 When the surfaces are separated, remove the top two capscrews.
- 9.6 With the carrier on the jack, slide the carrier away from the axle housing.
- 9.7 Lift the carrier assembly onto a suitable stand.

Installation

NOTE: Use a cleaning solvent and clean rags to remove dirt. Blow dry the cleaned areas with air.

1. Remove any old sealant material from the mating surfaces of the axle housing. Clean the inside of the axle housing and the carrier mating surface.
2. Inspect the axle housing for damage. Repair or replace the axle housing as necessary.
3. Apply a thin bead of Loctite® 5900 sealant all the way around the mating surface of the axle housing, and around each bolt hole.

NOTE: Alignment dowels for installing the differential carrier can be made by sawing off the heads of two M16 x 1.5 x 100 mm bolts.

Forward-Rear Axle Differential Carrier Removal and Installation

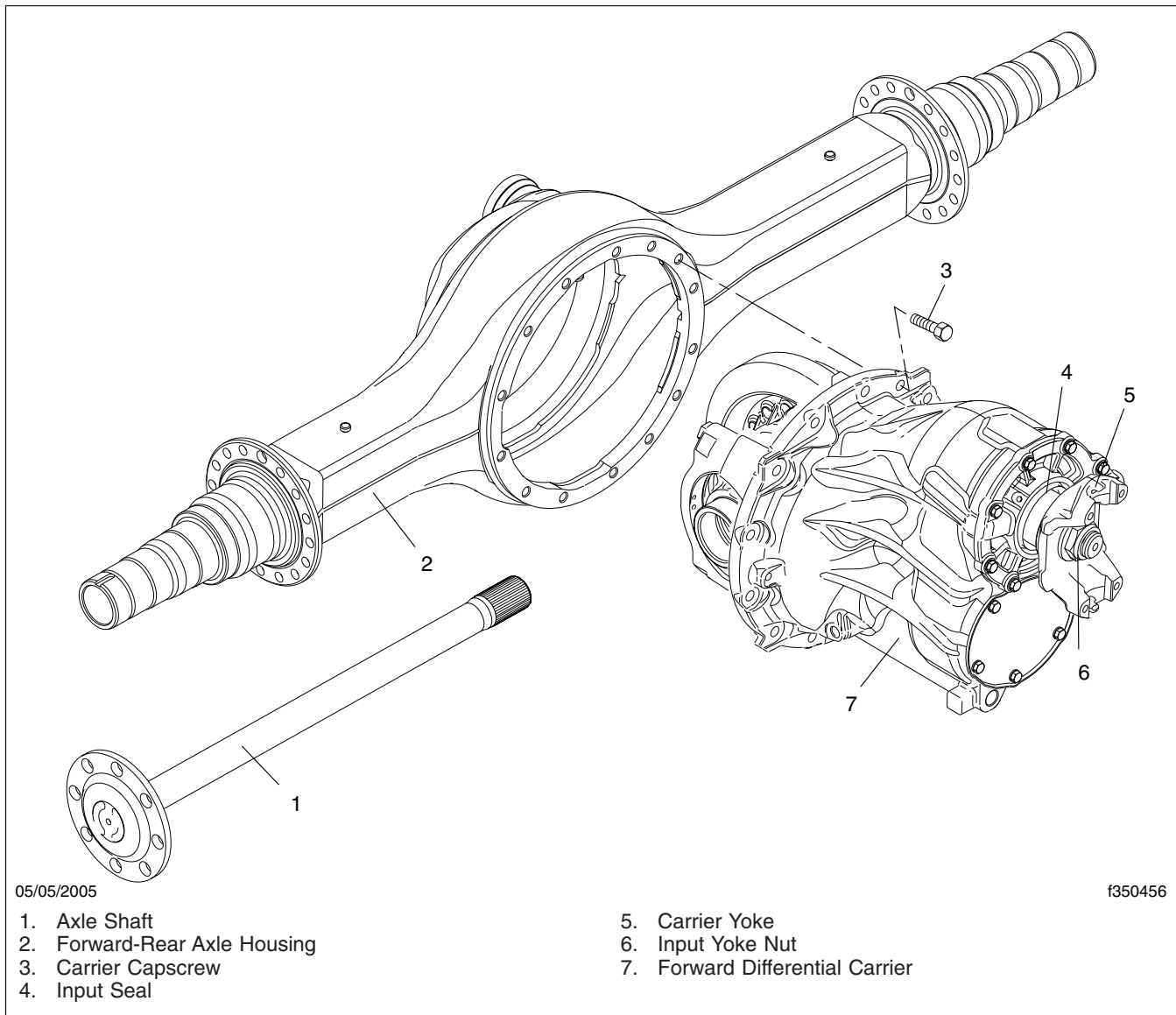


Fig. 1, Forward-Rear Axle Components

4. Install alignment dowels 180 degrees apart at the 3 o'clock and 9 o'clock positions on the axle housing flange.

⚠ WARNING

The differential carrier is heavy. Do not try to move it without a suitable support. To do so could result in the carrier falling, which could cause serious personal injury and component

damage. Support the carrier with a suitable jack and chain it to the jack, or use a hoist if the axle has been removed from the vehicle.

5. Position the forward differential carrier in front of the axle housing, using an axle jack or other suitable lifting tool.
6. If equipped with a wheel lock, engage the lock with air. This will help the carrier assembly join the axle housing.

Forward-Rear Axle Differential Carrier Removal and Installation

NOTICE

Do not use a hammer or a mallet to install the differential carrier. A hammer or a mallet will damage the mounting flange of the carrier and cause oil leaks.

7. Install the end caps at the sides of the forward differential carrier into the corresponding slots in the axle housing. See [Fig. 2](#).

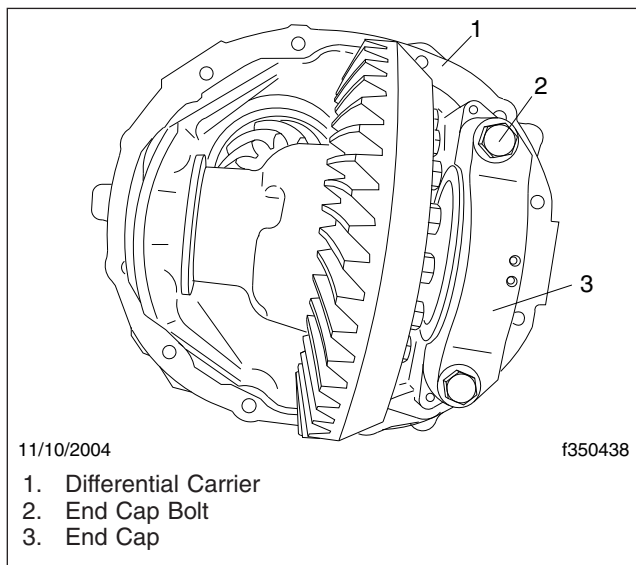


Fig. 2, Carrier End Caps

- 7.1 For the last 3/4 inch (19 mm) or so of travel, walk the carrier slowly into the housing.

IMPORTANT: The end caps fit tightly into the axle housing. Be very careful not to cock the carrier.

- 7.2 Install the carrier capscrews finger-tight. Make sure the carrier capscrews turn easily in the axle housing.
- 7.3 In a star pattern, gradually tighten the capscrews 200 lbf-ft (270 N-m).
8. Connect the driveshaft to the forward input yoke. For instructions, see [Section 41.00, Subject 120](#).
9. Using new gaskets, install the axle shafts. For instructions, see [Subject 120](#).

10. Install the tire and wheel assemblies. For instructions, see [Group 40](#).

11. Using approved axle oil, fill the axle housing to the bottom of the fill hole, or until filled to capacity as shown in [Table 1](#).

Forward-Rear Axle Oil Type and Capacity		
Approved Oil Type	Capacity: quarts (liters)	
	Hubs Full	Hubs Dry
80W-90 Gear Oil	14.3 (13.5)	15.9 (15.0)
75W-90 Synthetic Gear Oil		

Table 1, Forward-Rear Axle Oil Type and Capacity

12. If the hubs are dry, raise one side of the vehicle about 8 inches (20 cm) to let the oil flow into the hub on the opposite side, then raise the other side in the same manner. On each side, hold the tilted position for three minutes to allow oil to run into the wheel end.

NOTICE

Make sure the hubs are filled. Driving with the hubs dry will cause bearing damage.

13. Turn the wheels, wait one minute, and check the lubricant level.
14. Raise the vehicle, remove the safety stands, then lower the vehicle.
15. Start the engine, build the air pressure, and check that the suspension air bags inflate evenly and correctly. Make sure the ride height is correct.
16. Check the oil level in the axle housing. The level should be up to the bottom of the fill hole. Add approved axle oil, if needed.
17. Remove the chocks.

Repair

1. Remove the output yoke nut, washer, and output yoke; see [Subject 170](#).
2. Remove the output oil seal from the thru-shaft bore; see [Subject 170](#).
3. Remove the snap ring and spacer from the thru-shaft. See [Fig. 1](#).

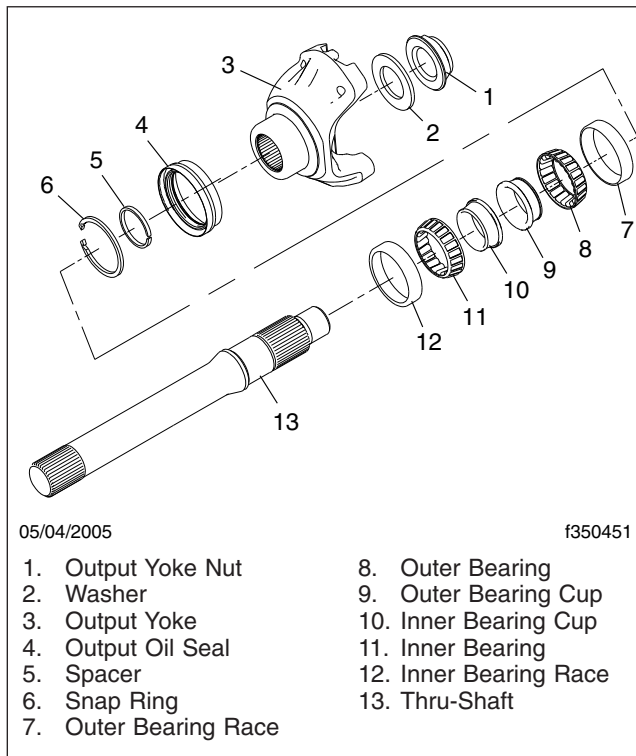


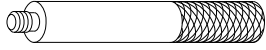
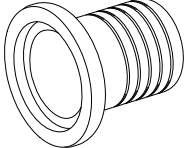
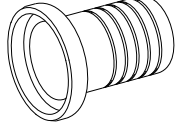
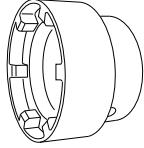
Fig. 1, Thru-Shaft Components

4. Using a suitable shaft puller, draw the thru-shaft out of the bore.
5. Using a suitable bearing puller on the outer races, remove both the inner and outer bearings from the thru-shaft.
6. Inspect the bearings for wear and damage. Replace both bearings if any damage is found.
7. Install the inner bearing race in the thru-shaft bore.
8. Using an arbor press or other suitable pressing tool, press the bearings and bearing cups onto the thru-shaft.
9. Insert the thru-shaft into its bore.
10. Install the outer bearing race onto the thru-shaft and bore.
11. Install the snap ring and spacer. Use the next thicker snap ring from the snap ring pack supplied with the bearings.
12. Install the output oil seal; see [Subject 170](#).
13. Install the output yoke, nut, and washer; see [Subject 170](#). Make sure the output yoke nut is firmly tightened, but do not tighten the nut to specifications at this time.
14. Attach a dial indicator to the flat surface of the output yoke.
15. Using a pry bar or other lever, apply force to the base of the output yoke. If the dial indicator shows a deflection of 0.0012 to 0.0024 inches (0.03 to 0.06 mm), the end play is correct.
If the deflection is too large, use a thicker snap ring. If the deflection is too small, use a thinner snap ring.
16. Coat the threads of the nut with Loctite® 577. Tighten the output yoke nut 516 lbf-ft (700 N-m).

Forward-Rear Axle Yoke and Seal Replacement

Special Tools

Special tools are required for this procedure. See [Table 1](#).

Special Tools for Forward-Rear Axle Yoke and Seal Replacement			
Tool	Description	Manufacturer	Part Number
 f580400	Universal Handle*	Kent-Moore	J-8092
 f580410	Input Seal Installer*	Kent-Moore	J-47369
 f580408	Output Seal Installer*	Kent-Moore	J-47368
 f580450	Yoke Nut Socket†	Daimler	MBA 742589020700

* To order Kent-Moore tools call 1-800-328-6657.

† The yoke nut socket is needed to remove the round, slotted yoke nut installed on some vehicles. It can be ordered through Paragon.

Table 1, Special Tools for Forward-Rear Axle Yoke and Seal Replacement

Replacement

Forward Carrier Input Yoke and Seal

1. Disconnect the main driveshaft from the forward carrier input yoke. For instructions, see [Section 41.00, Subject 120](#). Using suitable straps,

support the end of the driveshaft by attaching it to the frame rail.

2. Remove the input yoke nut and washer from the center of the forward carrier input yoke.
3. Remove the old forward carrier input yoke from the forward input shaft.
4. If there is an oil leak at the threaded ring, repair it; for instructions, see [Subject 200](#).

Forward-Rear Axle Yoke and Seal Replacement

5. If there is a leak between the bearing cage and the carrier housing, remove the bearing cage, as follows. See [Fig. 1](#).

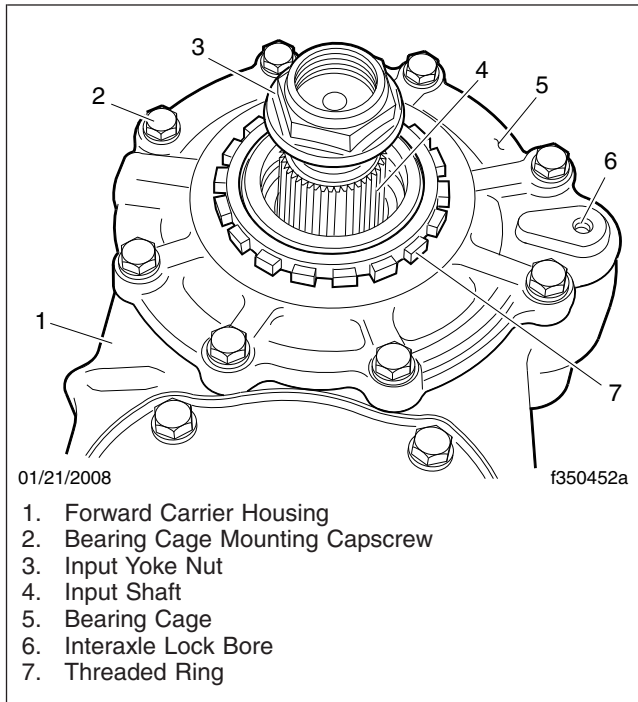


Fig. 1, Bearing Cage

- 5.1 Remove the bearing cage capscrews from the bearing cage.
- 5.2 Pry the bearing cage from the forward carrier housing. Clean any remnants of sealant clinging to the mating surfaces of the carrier housing and the bearing cage.
6. Pry up the input seal, using a prybar or large screwdriver. Clean any old sealant from the axle housing. Do not allow dirt or grease to contaminate the seal bore or shaft bearings.
7. Install the seal in the input shaft bore, as follows. See [Fig. 2](#).
 - 7.1 Inspect the area around the seal for damage. Use emery paper to remove scratches, nicks, or burrs on the seal bore.
 - 7.2 Assemble the input seal installer onto the threaded end of the universal handle. See [Table 1](#).

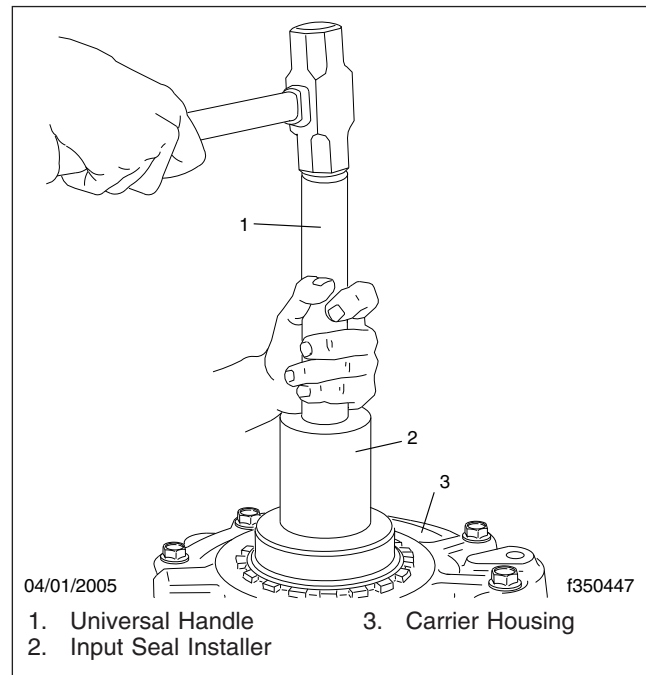


Fig. 2, Installing the Forward Carrier Input Seal

- 7.3 Using the input seal installer assembly, press the seal into the bore until the seal surface is flush with the threaded ring.

8. On the mating surface of the bearing cage, lay down a bead of Loctite® 5900 sealant, or equivalent. Go around all of the bolt holes and other openings in the inside cover of the bearing cage. See [Fig. 3](#).

IMPORTANT: Do not allow sealant to get into the interaxle lock bore. See [Fig. 4](#). Do not attempt to repair the interaxle differential lock (IAD). No repairs to this component are possible.

9. Install the bearing cage onto the forward carrier housing. Tighten the M12 bearing cage capscrews 107 lbf-ft (145 N-m).
10. Install the forward carrier input yoke on the forward input shaft. If the yoke is damaged or worn, install a new yoke.

NOTE: It is not necessary to replace the yoke when replacing the seal.

11. Coat the threads of a new M45 x 1.5 input yoke nut with Loctite® 277. Install the new washer and

Forward-Rear Axle Yoke and Seal Replacement

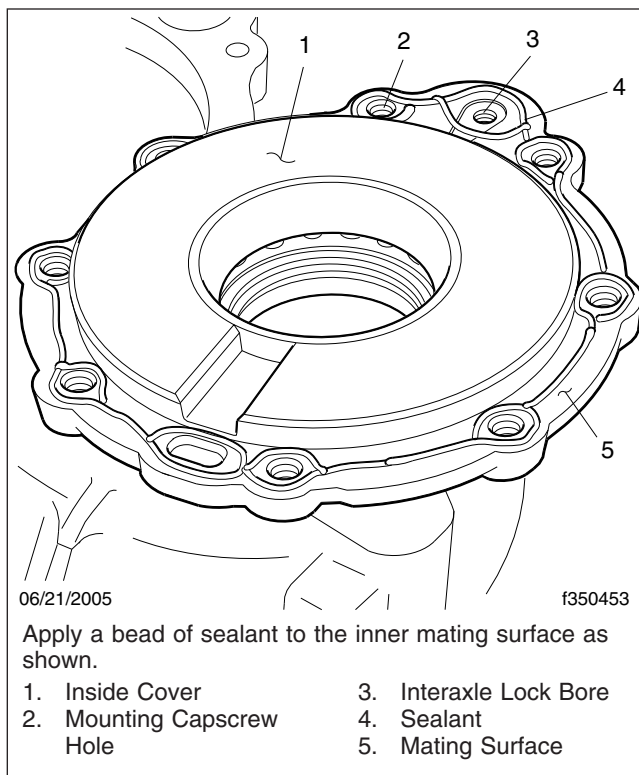


Fig. 3, Sealant Application

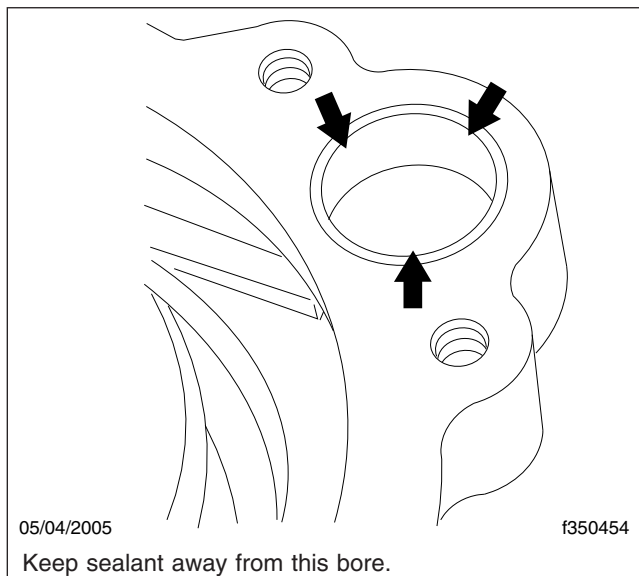


Fig. 4, Interaxle Lock Bore

input yoke nut on the forward carrier input yoke. Tighten the nut 627 lbf-ft (850 N·m).

12. Connect the main driveshaft; see [Section 41.00, Subject 120](#).

Output Yoke and Seal

1. Disconnect the interaxle driveshaft from the output yoke; see [Section 41.00, Subject 120](#). Using suitable straps, support the end of the driveshaft by attaching it to the frame rail.
2. Remove the output yoke nut and washer from the center of the output yoke.
3. Remove the output yoke from the thru-shaft. See [Fig. 5](#).

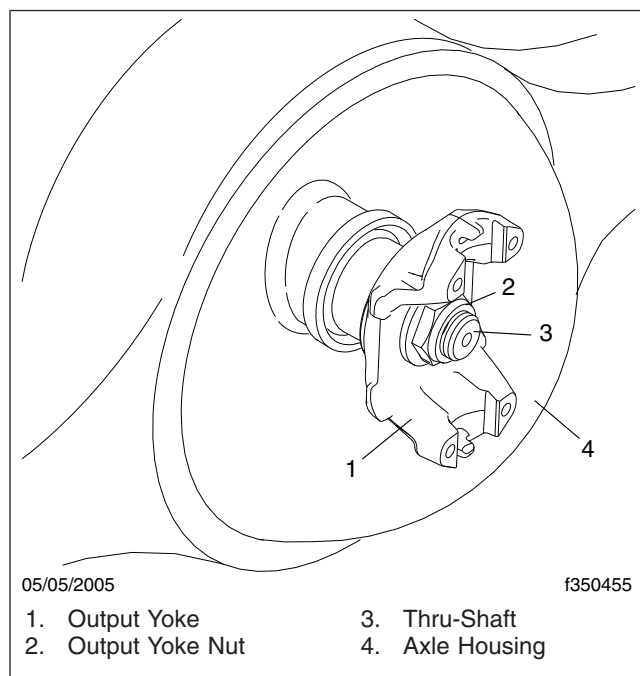


Fig. 5, Output Yoke

4. Pry up the output oil seal, using a prybar or large screwdriver. Clean any old sealant from the axle housing. Do not allow dirt or grease to contaminate the seal bore or thru-shaft bearings.
5. Install the seal on the thru-shaft, as follows.
 - 5.1 Inspect the area around the output oil seal for damage. Use emery paper to remove scratches, nicks, or burrs on the seal bore.

Forward-Rear Axle Yoke and Seal Replacement

- 5.2 Assemble the output seal installer onto the threaded end of the universal handle. See [Table 1](#).
- 5.3 Using the output seal installer assembly, press the seal into the bore until the seal surface is flush with the thru-shaft receptacle.
- 6. Install the output yoke on the thru-shaft. If the yoke is damaged or worn, install a new yoke.

NOTE: It is not necessary to replace the yoke when replacing the seal.

- 7. Coat the threads of a new M39 x 1.5 output yoke nut with Loctite® 577. Install the new washer and output yoke nut on the forward carrier output yoke. Tighten the nut 516 lbf-ft (700 N·m).
- 8. Connect the interaxle driveshaft; see [Section 41.00](#), [Subject 120](#).

Main Differential Lock Disassembly and Assembly, Model 2 Axles

General Information

Commonly known as DCDL (Driver-Controlled Differential Lock), a main differential lock is available on single and tandem rear axles. The following procedures only apply to Model 2 rear axles equipped with the optional DCDL.

Each part of the main differential lock is replaceable. See [Fig. 1](#).

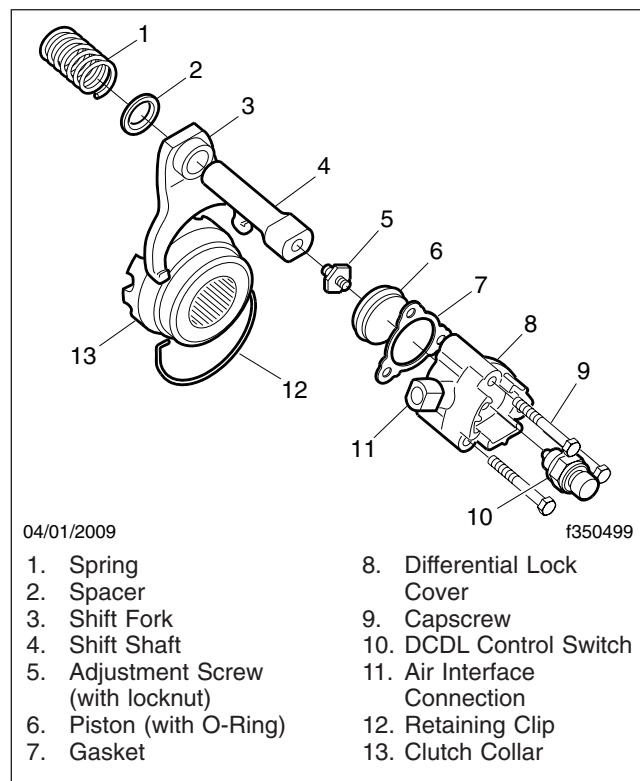


Fig. 1, DCDL Components, Model 2 Axles

Disassembly

1. Park the vehicle on a level surface, shut down the engine, set the parking brake, and chock the front tires.
2. Remove the differential carrier, and place it on a work stand.
To remove a Model 2 axle differential carrier, see [Subject 110](#).
3. Remove the capscrews that attach the differential lock cover to the carrier housing. See [Fig. 1](#).

4. Remove the DCDL control switch.
5. Remove the differential lock cover (including the air interface connection).
6. Remove the gasket, piston, and adjustment screw.
7. Unlatch the retaining clip, and remove it.
8. Remove the clutch collar.
9. Carefully remove the shift shaft from the bore in the carrier housing.
10. Due to spring tension, carefully remove the shift fork, spacer, and spring from the carrier housing.

Assembly

1. Install the spring in the carrier housing, and compress it to install the spacer and shift fork in the housing. Ensure that the spring is centered in the bore.
2. Install the shift shaft into the bore in the carrier housing and through the shift fork, spacer, and spring, being careful to properly align it in the bore. Do not force the shift shaft into the bore.
3. Install the clutch collar, and secure it by installing the retaining clip on the shift fork.
4. Install the adjustment screw as follows.
 - 4.1 Press the shift shaft in until the clutch collar teeth are fully engaged with the ring gear.
 - 4.2 Install the adjustment screw, and tighten it until the outer end of it is 0.02 – 0.06 inch (0.5 – 1.5 mm) below the top of the bore in the carrier housing. The screw advances 0.04 inch (1.0 mm) per full revolution, so one complete turn should be sufficient. Use an inside micrometer or depth micrometer to measure the gap.
 - 4.3 Hold the shift shaft and adjustment screw in a fixed position, and tighten the locknut on the adjustment screw to 18 lbf·ft (24 N·m).
5. Grease the o-ring on the piston.
6. Place the gasket on the differential lock cover, and press the flat side of the piston into the differential lock cover.

Main Differential Lock Disassembly and Assembly, Model 2 Axles

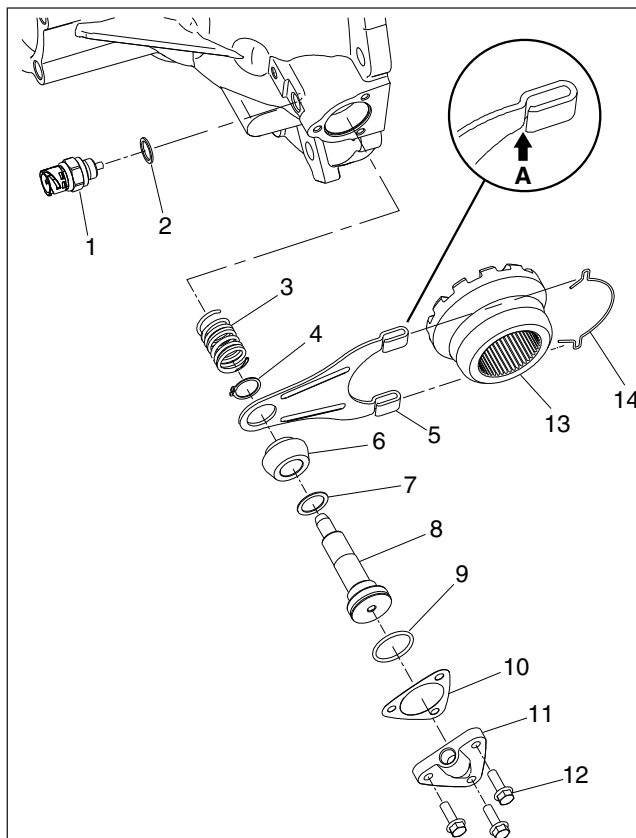
7. Place the differential lock cover over the cap-screw bores in the carrier housing, and install the DCDL control switch. Tighten the nut 21 lbf·ft (28 N·m).
8. Install the differential lock cover, and in a regular sequence that seats the cover evenly, tighten the capscrews 18 lbf·ft (24 N·m).
9. Connect the DCDL air line, and engage the DCDL. Ensure the teeth of the lock fully engage the teeth of the gear inside the carrier housing.
10. Install the differential carrier; for instructions, see [Subject 110](#).

Main Differential Lock Disassembly and Assembly, Model 4 Axles

General Information

Commonly known as DCDL (Driver-Controlled Differential Lock), a main differential lock is available on single and tandem rear axles. On tandem rear axles DCDL is available for the forward, rear, or both axles. The following procedures only apply to Model 4 rear axles with optional DCDL.

Each part of the main differential lock is replaceable. See [Fig. 1](#).



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A. Opening in fork loop faces away from the clutch collar as shown.

- | | |
|----------------------|--------------------------|
| 1. Sending Unit | 8. Shift Shaft Piston |
| 2. Sending Unit Seal | 9. O-Ring |
| 3. Spring | 10. Air Interface Gasket |
| 4. Snap Ring | 11. Air Interface |
| 5. Shift Fork | 12. Capscrew |
| 6. Alignment Boss | 13. Clutch Collar |
| 7. Shim(s) | 14. Retaining Clip |

Fig. 1, DCDL Components

Disassembly

1. Park the vehicle on a level surface, shut down the engine, set the parking brake, and chock the front tires.
2. Remove the differential carrier, and place it on a work stand.

To remove a single or rearmost axle differential carrier, see [Subject 110](#).

To remove a forward-rear differential carrier, see [Subject 140](#).

3. Unlatch the retaining clip, and remove it. See [Fig. 1](#).
4. Remove the clutch collar.
5. Remove the DCDL sending unit from the carrier housing.
6. Remove the three bolts that attach the air interface to the carrier housing.
7. Remove the air interface and gasket.
8. Remove the shift shaft piston from the bore in the carrier housing, and note the number of shims found on the piston. There should be at least one shim, and a maximum of three.
9. Compress the spring and pull the shift fork from the carrier housing.
10. Remove the spring from the carrier housing.

Assembly

1. Install the spring in the carrier housing, and compress it to install the shift fork in the housing. Ensure that the spring is centered in the bore.
2. Ensure the O-ring on the shift shaft piston is properly installed and lubricated. Then install the piston, being careful to properly align it in the bore. Do not force the piston into the bore.
3. Place the air interface and gasket over the air interface bore, and insert the three capscrews that attach the air interface to the carrier housing. Tighten the capscrews in a regular sequence that ensures it seats evenly. Tighten the capscrews 19 lbf·ft (25 N·m).
4. Install the clutch collar.
5. Install the retaining clip on the shift fork.

Main Differential Lock Disassembly and Assembly, Model 4 Axles

6. Install the DCDL sending unit in the carrier housing, as removed.
7. Connect the DCDL air line, and engage the DCDL. Ensure the teeth of the lock fully engage the teeth of the gear inside the carrier housing.
8. The clearance between the clutch collar and ring gear must be between 0.4 and 1.4 mm. Engage the DCDL, and use a feeler gauge to measure the gap.

If the gap between the clutch collar and ring gear measured between 0.4 and 1.4 mm, ensure the same number of shims are on the shift shaft piston (as when it was removed).

If the gap between the clutch collar and ring gear was not between 0.4 and 1.4 mm, add or remove shims to vary the gap until it measures within the acceptable range. The acceptable maximum number of shims is three, and the minimum is one.

9. Install the differential carrier.

For instructions on installing a single or rearmost axle differential carrier, see [Subject 110](#).

For instructions on installing a forward-rear axle differential carrier, see [Subject 140](#).

10. Remove the chocks.

Interaxle Differential Lock Adjustment

Adjustment

The Interaxle Differential (IAD) has an adjustment screw that can become loose or even fall out, causing an oil leak, and malfunction of the IAD. To ensure the adjustment screw is properly tightened and secured, follow the steps below. The IAD is sometimes called the power divider. See **Fig. 1**.

1. Chock the front tires.
2. Use the IAD switch in the cab to engage the lock.
3. Using a suitable jack, raise the vehicle until the tires are off the ground.
4. Support the vehicle with safety stands.
5. At the forward-rear axle, rotate one of the wheels to ensure the teeth of the lock fully engage the teeth of the gear inside the carrier housing.
6. Remove the adjustment screw, and using a suitable solvent (such as brake cleaner), clean the threads of the screw and bore. Dry the surfaces completely, making sure no cleaning solvent remains.
7. Coat the threads of the adjustment screw with Loctite® 577, install it, and hand-tighten it until it hits the shaft.
8. Disengage the IAD to relieve the air pressure exerted on the adjustment screw.
9. Hand-tighten the adjustment screw one quarter turn, then tighten the locknut 30 lbf·ft (41 N·m).
10. Raise the vehicle, remove the safety stands, then lower the vehicle.

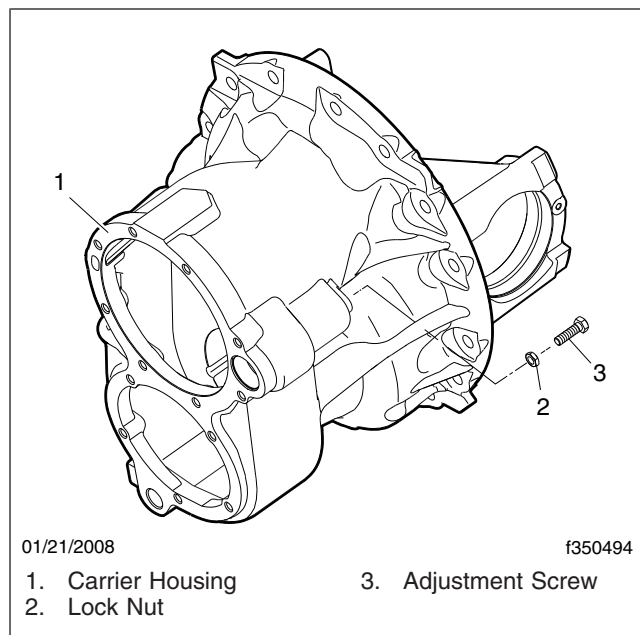
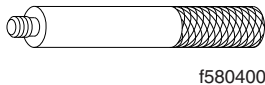
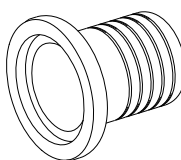


Fig. 1, Interaxle Differential and Adjustment Screw

Special Tools

Special tools are required for this procedure. See [Table 1](#).

Special Tools for Threaded Ring Repair			
Tool	Description	Manufacturer	Part Number
 f580400	Universal Handle*	Kent-Moore	J-8092
 f580410	Input Seal Installer*	Kent-Moore	J-47369

* To order Kent-Moore tools call 1-800-328-6657.

Table 1, Special Tools for Threaded Ring Repair

Repair

1. Apply the parking brakes, shut down the engine, and chock the tires.
2. Disconnect the main driveshaft from the forward carrier input yoke. For instructions, see [Section 41.00, Subject 120](#). Using suitable straps, support the end of the driveshaft by attaching it to the frame rail.
3. Remove the yoke nut and washer from the input shaft of the forward differential carrier, then remove the yoke.
4. Remove the capscrew and the locking plate from the bearing cage on the front of the differential carrier. See [Fig. 1](#).
5. Using a spanner wrench, remove the threaded ring to expose the bearing cavity. See [Fig. 2](#).
6. Using a suitable solvent, such as brake cleaner, clean the surface of the bearing cavity. See [Fig. 2](#). Dry the surface, making sure no cleaning solvent remains.
7. Coat the threads of the threaded ring with Loctite® 577 sealant. Apply a 1/8-inch (3-mm) diameter bead all the way around the bottom thread,

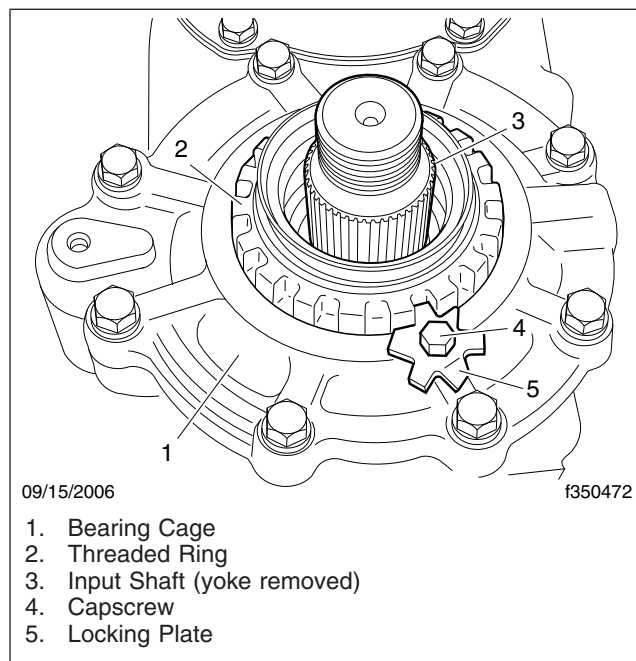


Fig. 1, Forward-Rear Axle Differential Housing

then spread the sealant evenly over the threads, so that all threads are thoroughly covered with the sealant.

Threaded Ring Repair

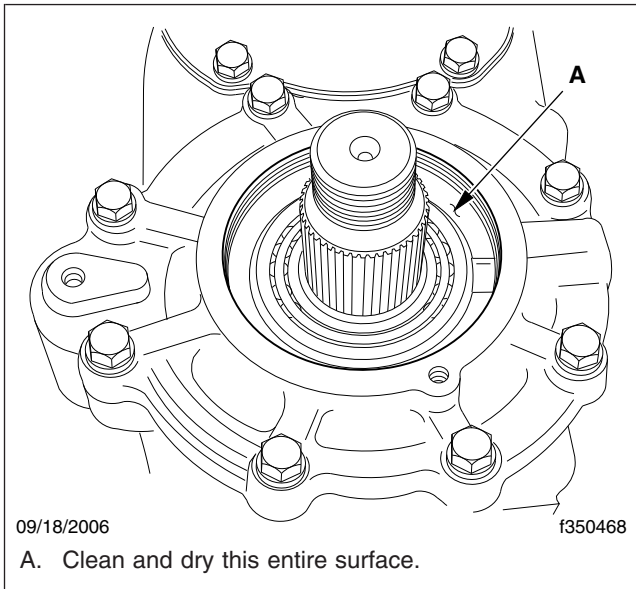


Fig. 2, Bearing Cavity Exposed

8. Install the threaded ring (without the new input-shaft seal) and turn it clockwise (tighten it) enough to form a uniform bead of sealant all the way around the threaded ring. See [Fig. 3](#).

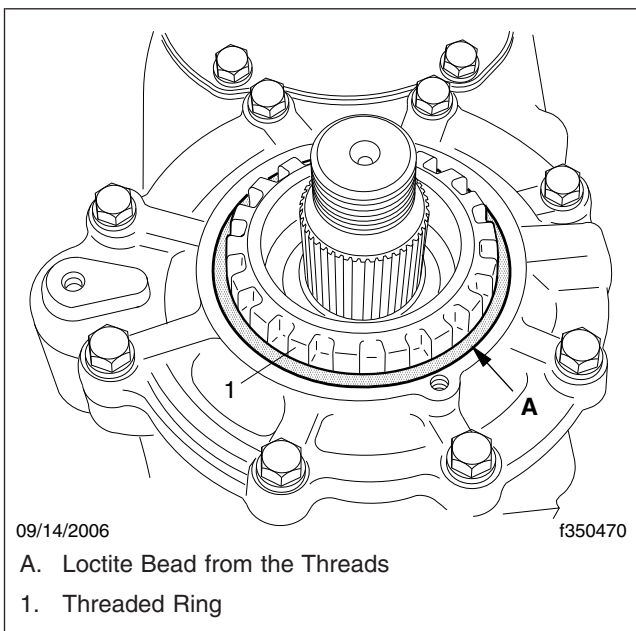


Fig. 3, Preliminary Installation of the New Threaded Ring

9. Install the old yoke nut on the input shaft to protect the threads, then strike the nut sharply with a brass mallet to unseat the bearing.
10. Adjust the initial bearing preload to 0.002 inch (0.05 mm), as follows:
 - 10.1 Install a dial indicator on the bearing cage, and using two pry bars, pry up evenly on the yoke nut (and the input shaft) to determine the bearing preload. See [Fig. 4](#).

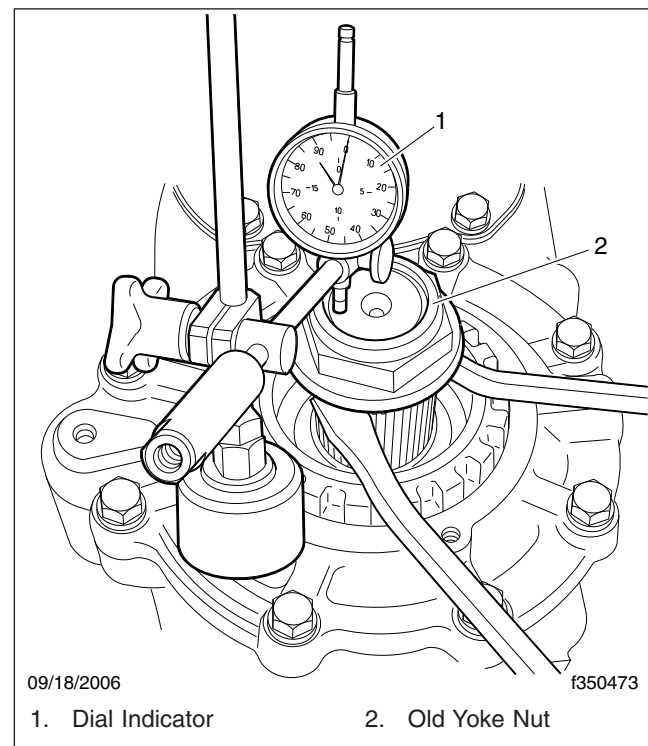


Fig. 4, Measuring Bearing Preload

- 10.2 Tighten the threaded ring until the dial indicator reads 0.002 inch (0.05 mm).
11. Using a suitable marker or paint, mark the center of one of the teeth on the threaded ring and the surface of the bearing cage. See [Fig. 5](#).

IMPORTANT: The next step is critical. Tightening the threaded ring by advancing it one tooth will set the bearing preload to 0.00 to 0.0012 inch (0.00 to 0.03 mm). If you tighten the threaded ring beyond this tolerance, you cannot back it off; you will need to remove the threaded ring and repeat the entire installation procedure.

Threaded Ring Repair

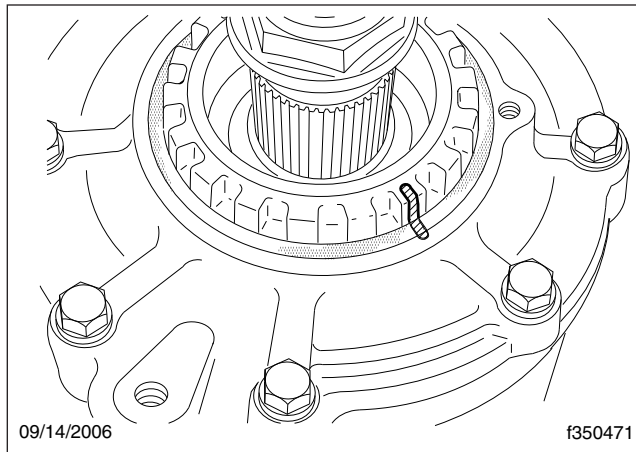
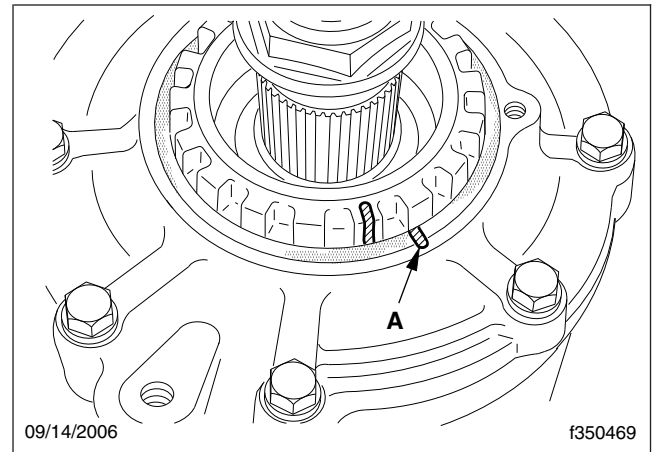


Fig. 5, Marking the Tooth and Bearing Cage

12. Very carefully advance the threaded ring one tooth while checking the paint mark. Stay close to a one-tooth advancement when making the final adjustment. Bear in mind that the new locking plate must fit into place once the correct tightness is achieved. The locking tab should fit in place either slightly before or slightly past a one-tooth advancement of the threaded ring. *You cannot back off the threaded ring once it is tightened.*

Try fitting the new locking plate in place by turning and flipping it over as you slowly tighten the threaded ring. Tighten the threaded ring so the bearing preload is 0.00 to 0.0012 inch (0.00 to 0.03 mm). When the correct tolerance is reached, the mark on the surface of the bearing cage should line up with the center of the next tooth. See [Fig. 6](#). Do not tighten the threaded ring any further.

13. When the bearing preload is correct, install the new locking plate and capscrew. Tighten the capscrew 18 lbf-ft (24 N·m).
14. Install the new input-shaft seal as follows (see [Fig. 7](#)):
 - 14.1 Inspect the area around the seal for damage. Use emery paper to remove scratches, nicks, or burrs on the seal bore.
 - 14.2 Apply a light coating of axle oil to the seal bore.
 - 14.3 Coat the mating surfaces of the new seal with Loctite® 5900 sealant, or equivalent.



- A. Measure preload at this point. At final tightening, this mark should be opposite the center of the next tooth, but no further.

Fig. 6, Advancing the Threaded Ring

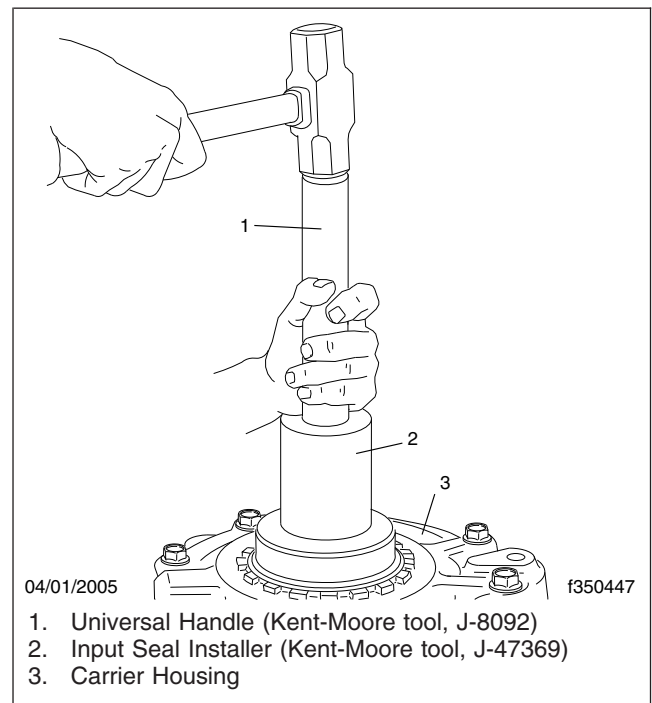


Fig. 7, Installing the Forward Carrier Input Seal

1. Universal Handle (Kent-Moore tool, J-8092)
2. Input Seal Installer (Kent-Moore tool, J-47369)
3. Carrier Housing

- 14.4 Assemble the input shaft seal installer onto the threaded end of the universal handle. See [Fig. 7](#).

Threaded Ring Repair

- 14.5 Using the input shaft seal installer assembly, press the seal into the bore until the seal surface is flush with the threaded ring.
15. Apply Loctite 242 to the threads of the new yoke nut, then using it and a new washer, install the existing yoke on the input shaft. Tighten the yoke nut 628 lbf·ft (850 N·m).
16. Connect the main driveshaft to the input shaft.
For instructions, see [Section 41.00, Subject 120](#).
17. Remove the chocks.

Interaxle Differential Replacement

The following on-vehicle procedure replaces the interaxle differential (IAD) assembly and accomplishes a minor carrier rebuild by replacing the bearing races and, as needed, the shift shaft bushing. The front cover is resealed and the input shaft seal is replaced. See [Fig 1](#).

Special Tools

Special tools are required for this procedure. See [Table 1](#).

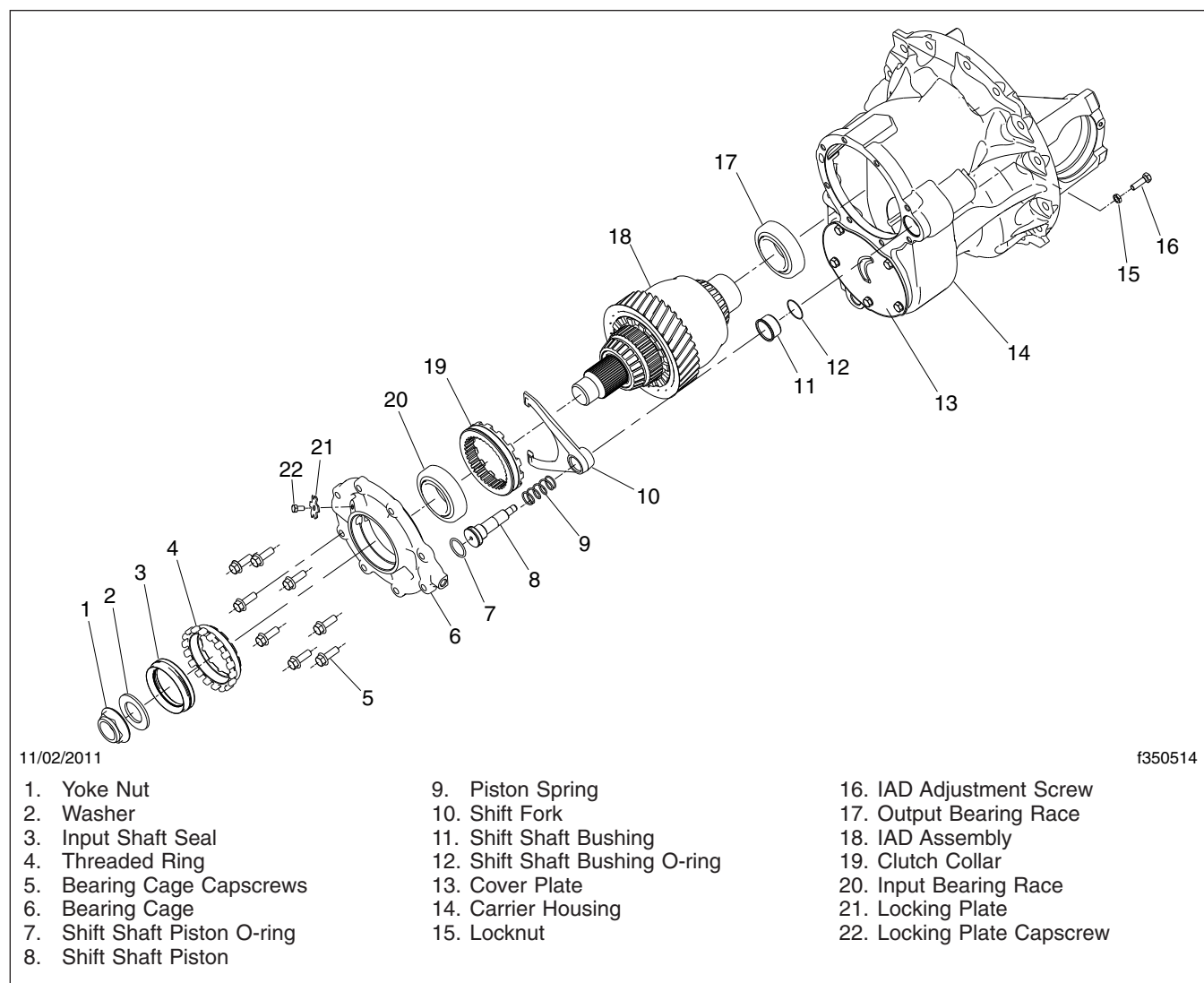
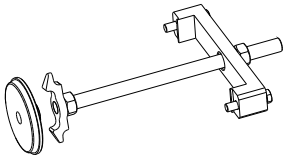
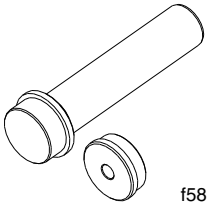
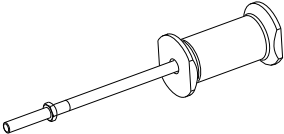
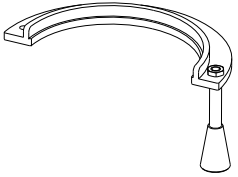
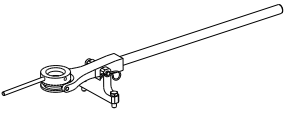


Fig. 1, The Interaxle Differential and Carrier Housing Components

Interaxle Differential Replacement

Special Tools for Interaxle Differential Replacement			
Tool	Description	Manufacturer	Part Number
 f580478	Output Bearing Remover and Installer	Daimler	MBA 420589003300
 f580480	Shift Shaft Bushing Remover and Installer	Daimler	MBA 420589013300
 f580476	Slide Hammer	Daimler	MBA 060589003300
 f580479	Half-Moon Device	Daimler	MBA 420589006300
 f580477	Push-Pull Device	Daimler	MBA 420589001600

Interaxle Differential Replacement

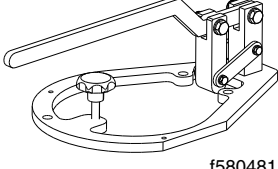
Special Tools for Interaxle Differential Replacement			
Tool	Description	Manufacturer	Part Number
 f580481	Shift Shaft Piston Installer	Daimler	MBA 420589023300

Table 1, Special Tools for Interaxle Differential Replacement

Replacement

1. Park the vehicle on a level surface, shut down the engine, set the parking brake, and chock the front tires.
2. Ensure the interaxle differential is disengaged and the system is charged with air. The rear wheels will need to turn near the end of this procedure.
3. Place a suitable strap around the driveshaft and frame to hold the driveshaft out of the way after it is disconnected.
4. Disconnect the main driveshaft from the forward carrier input yoke (for instructions, see [Section 41.00, Subject 120](#)), and support it with the strap.
5. Clean the carrier housing and surrounding area as needed to remove any debris that could enter the housing.
6. Drain the oil from the carrier housing.
7. Disconnect the air line connected to the bearing cage.
8. Remove the yoke nut and washer from the input shaft of the forward differential carrier, then remove the yoke.
9. Remove the capscrew and the locking plate. See [Fig 1](#).
10. Using a spanner wrench, remove the threaded ring by turning it counterclockwise.
11. Remove the bearing cage capscrews from the bearing cage, and pry the bearing cage from the carrier housing. It may help to tap the bearing cage loose with a chisel; see [Fig. 2](#).

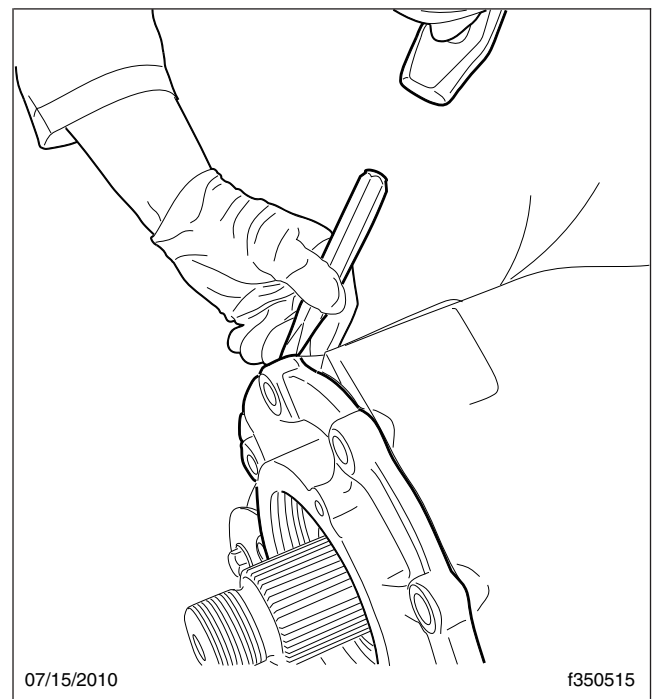


Fig. 2, Tapping the Bearing Cage Loose

12. Remove the IAD adjustment screw and locknut.

NOTICE

When unseating the shift shaft piston, multiple taps may be needed, but use moderate force only and be careful to hit the piston only (not the housing). Stop tapping it once it protrudes from the housing. The use of excessive force, or tapping it while it protrudes from the housing can damage the piston and the housing.

Interaxle Differential Replacement

13. Using a brass or plastic mallet, squarely tap the shift shaft piston to unseat it, and then remove it from the carrier housing.
14. Remove the piston spring, clutch collar, and shift fork.

NOTICE

The IAD assembly is heavy. Use appropriate support while removing and transporting it to prevent dropping and damaging it. Do not allow it to rest on the oil slinger; see Fig. 3. Resting the IAD assembly on the oil slinger could damage the oil slinger.

15. Remove the IAD assembly.

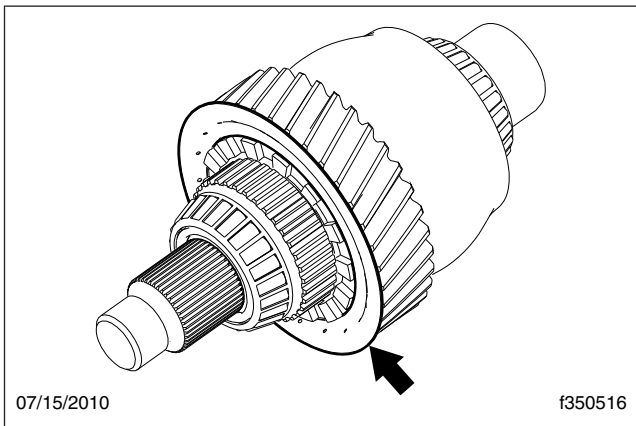


Fig. 3, Oil Slinger

16. Align the output bearing remover (see Table 1) with the notches in the rear of the carrier housing, then attach it to the housing with bearing cage capscrews, and use it to remove the output bearing race. See Fig. 4.
17. If the brass shift shaft bushing is damaged or worn, assemble the slide hammer and shift shaft bushing remover (see Table 1), and slide the hammer handle to remove the bushing. See Fig. 5.
18. Using a suitable solvent (such as brake cleaner), clean any remaining sealant from the threaded ring and mating surfaces of the carrier housing and the bearing cage. Dry the surfaces with compressed air, ensuring no cleaning solvent remains.

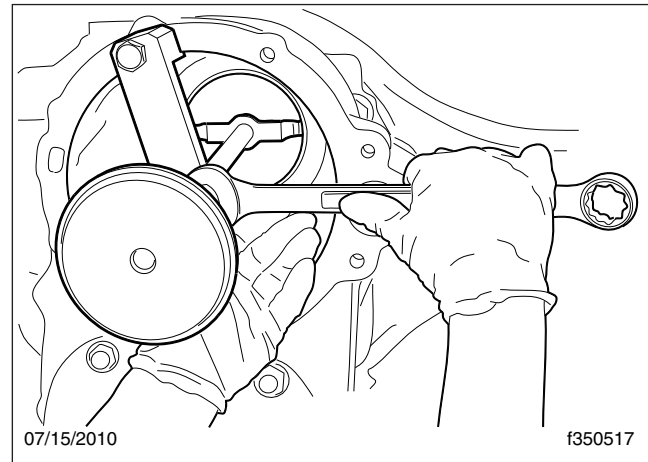


Fig. 4, Removing the Output Bearing Race

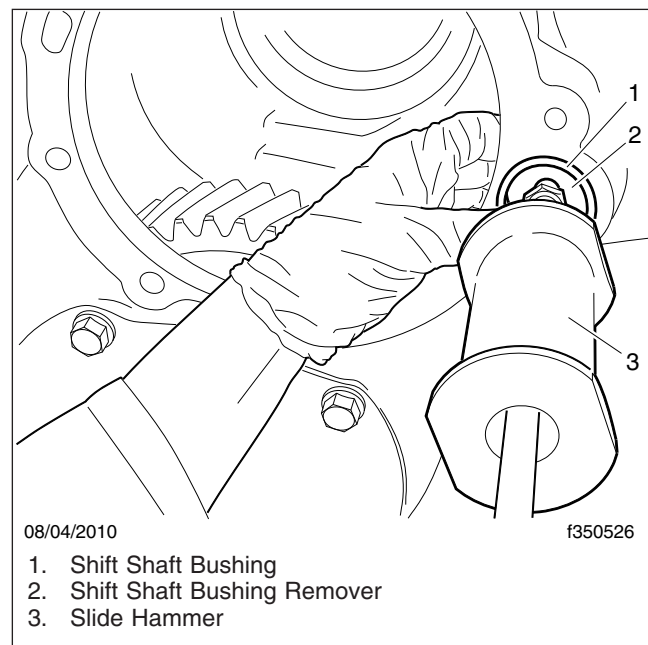


Fig. 5, Installing the Bushing Remover

19. As in the previous step, clean the groove at the piston bushing bore.
20. If the brass shift shaft bushing was removed, install a new one using a mallet and the Shift Shaft Bushing Installer. See Fig. 6.
21. A new output bearing race is included with the new IAD. Install it as follows.
 - 21.1 To get it started, lightly tap the race into place with a hammer handle or wood

Interaxle Differential Replacement

block. The race must be square in the housing or damage will occur when it is pressed. See [Fig. 7](#).

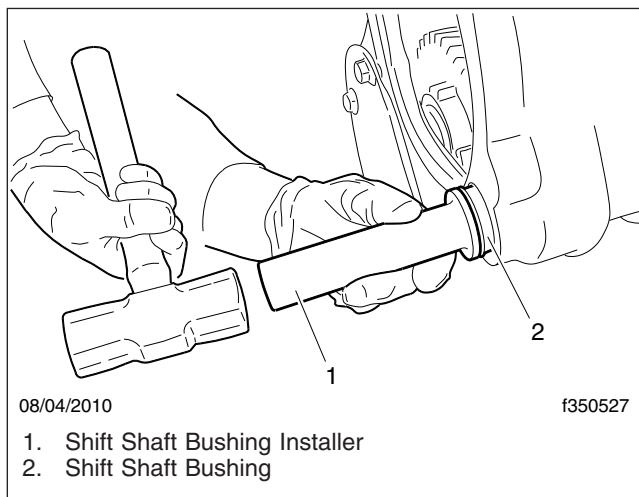


Fig. 6, Installing the Bushing

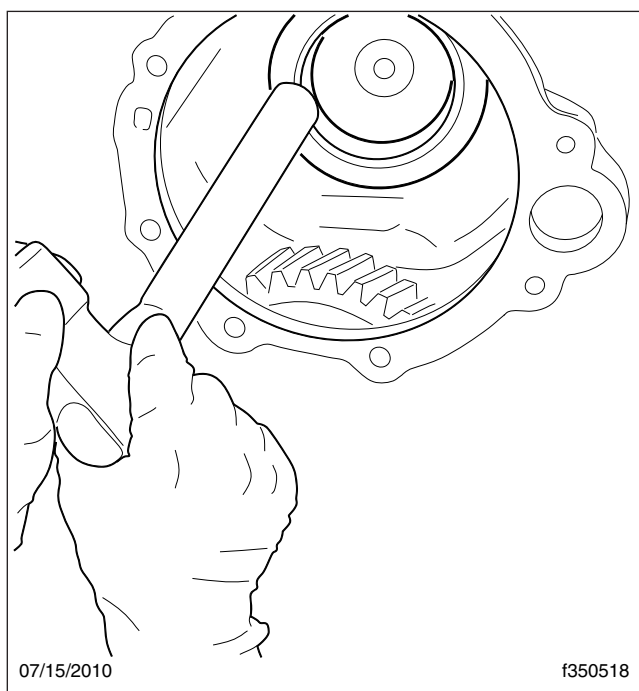


Fig. 7, Setting the Race

- 21.2 Fasten the output bearing installer to the carrier housing, and use it to press the race into the housing. As the race is in-

stalled, slight jerks can be felt and heard. See [Fig. 8](#).

22. Lubricate the output gear and bearing of the new IAD assembly with white grease.

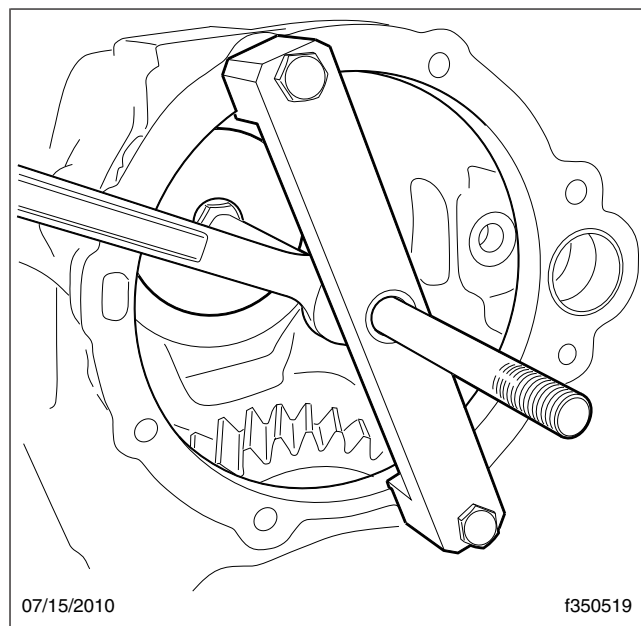


Fig. 8, Pressing a New Race into the Housing

23. Install the IAD assembly and output gear. Do not allow the assembly to rest on the oil slinger.
24. Install the clutch collar and shift fork.
25. Apply a thin film of white grease to the shift shaft piston, and insert it with the piston spring into the housing until about 1 inch (2.5 cm) of the piston protrudes from the bore.
26. The half-moon device (see [Table 1](#)) helps align the shift fork and shift shaft piston. To install it, slide it between the oil slinger and the shift fork. See [Fig. 9](#).
27. Install the shift shaft piston as follows.
 - 27.1 The shift shaft piston installer (see [Table 1](#)) is designed to install the piston without damaging it or the carrier housing. Use two bearing cage capscrews to mount it to the carrier housing. See [Fig. 10](#).
 - 27.2 Adjust the hex screw until the shift fork is snug but not bound.

Interaxle Differential Replacement

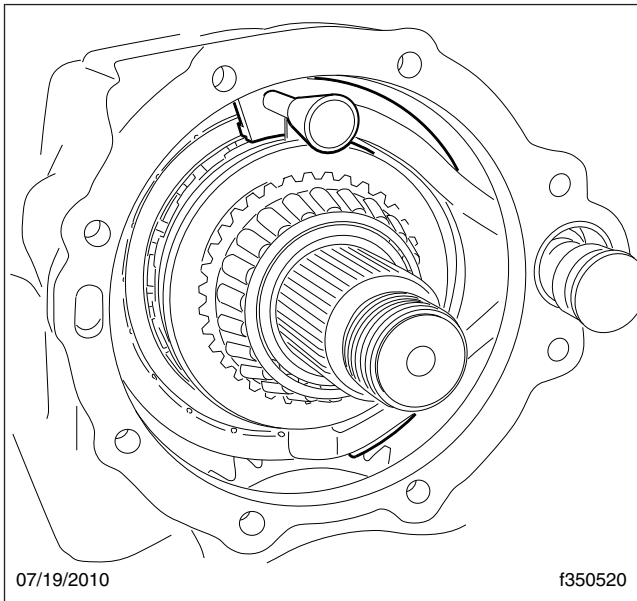


Fig. 9, The Half-Moon Device, Installed

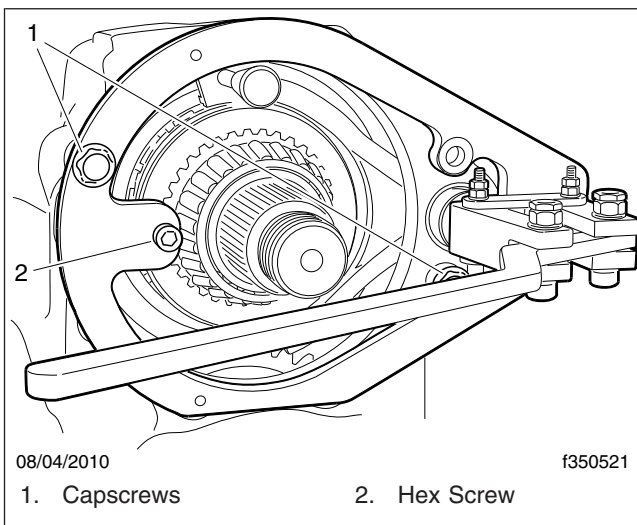


Fig. 10, Shift Shaft Piston Installer, Mounted

- 27.3 In a single movement of moderate force, use the lever of the installer to press the piston into the bore until only about 1/8 to 1/16 inch (2 to 3 mm) of the piston protrudes from the carrier housing. When the piston seats, a "click" sound may be audible. If the piston does not seat readily, adjust the hex screw, and try again.

- 27.4 Once the piston is seated, remove the shift shaft piston installer and the half-moon device.

28. Remove the input bearing race from the bearing cage. Place the new race into the cage so that it is more forward than in the final position. As the preload is adjusted, the race will seat to its final position.

29. Apply Loctite® 577 sealant to the threads of the threaded ring and tighten it until it is snug against the race.

IMPORTANT: Do not overapply sealant. Do not allow sealant to enter the oil return or touch the shift shaft piston.

30. Apply a small bead of Loctite 5900 to the carrier housing. See Fig. 11. To help ensure a good seal, spread it uniformly over the surface area.

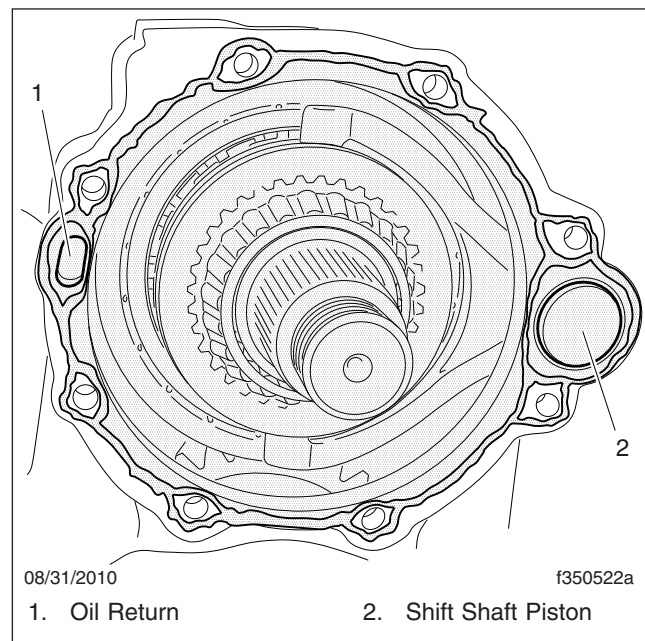


Fig. 11, Sealant Applied to Carrier Housing

31. Install the bearing cage, and using a star pattern tighten the capscrews to 103 lbf-ft (140 N-m).
32. The push-pull device (see Table 1) is used to set pre-load on the input bearing. Remove the two upper capscrews from the cover plate and install the device as shown in Fig. 12.
33. Set the correct end play as follows.

Interaxle Differential Replacement

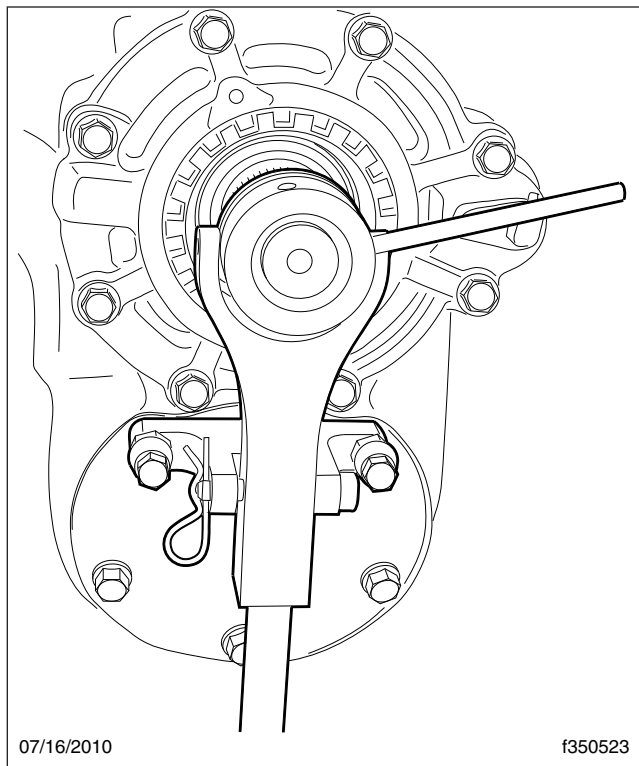


Fig. 12, Push-Pull Device, Installed

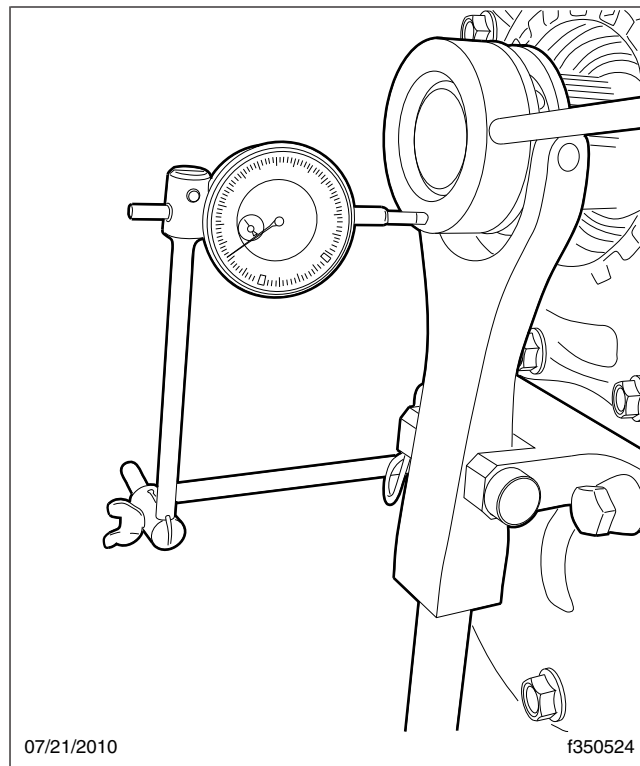


Fig. 13, Dial Indicator and Push-Pull Device

- 33.1 Set up a dial indicator as shown in [Fig. 13](#).
- 33.2 Turn the input shaft three revolutions and tighten the threaded ring until there is between 0.002 and 0.003 inch (0.05 and 0.08 mm) of end play. Turn the input shaft three more revolutions and verify the measurement.
- 33.3 When there is between 0.002 and 0.003 inch (0.05 and 0.08 mm) of end play, align a mark on the threaded ring with one on the bearing cage. See [Fig. 14](#).
- 33.4 Tighten the threaded ring almost one notch.

IMPORTANT: Do not loosen the threaded ring. If the threaded ring is loosened, the bearing cage must be removed and the race re-installed.

- 33.5 The locking plate has six positions that can lock the threaded ring. Find the posi-

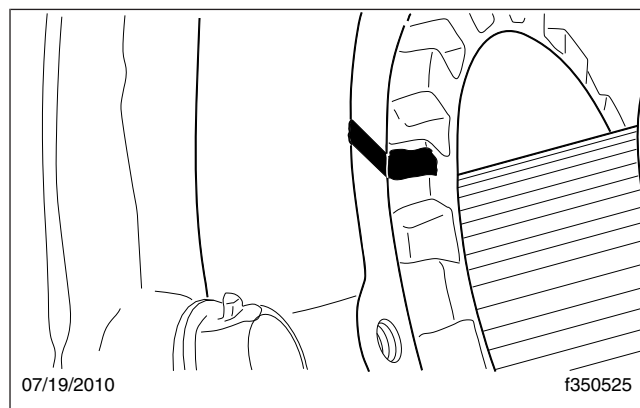


Fig. 14, Threaded Ring and Bearing Cage, Marked

tion that fits best, install it, and tighten the capscrew 18 lbf·ft (24 N·m).

- 33.6 Remove the push-pull device and dial indicator, and install the the two upper capscrews on the cover plate. Tighten the capscrews 63 lbf·ft (85 N·m).

Interaxle Differential Replacement

34. Install a new input shaft seal and the yoke, nut, and washer; see [Subject 170](#) for instructions.
35. Clean, install, and adjust the IAD adjustment screw and locknut as follows.
 - 35.1 Clean the IAD adjustment screw and locknut with a suitable solvent (such as brake cleaner). Dry the cleaned surfaces, ensuring no solvent remains.
 - 35.2 Connect an air line at the interaxle lock.
 - 35.3 Apply air, and by hand, turn the input shaft to ensure the gear cogs fully engage.
 - 35.4 Coat the threads of the adjustment screw with Loctite® 577.
 - 35.5 Install the adjustment screw, with the locknut, into the carrier housing, and handtighten the screw until it touches the engaged shift shaft piston.
 - 35.6 Disengage the IAD to relieve the air pressure exerted on the adjustment screw.
 - 35.7 Hand-tighten the adjustment screw one quarter turn, then tighten the locknut 30 lbf-ft (41 N·m).
36. Connect the main driveshaft; for instructions, see [Section 41.00, Subject 120](#).
37. Using approved axle oil, fill the axle housing to the bottom of the fill hole, or until filled to capacity as shown in [Table 2](#).

Forward-Rear Axle Oil Type and Capacity		
Approved Oil Type	Capacity: quarts (liters)	
	Hubs Full	Hubs Dry
80W-90 Gear Oil	14.3 (13.5)	15.9 (15.0)
75W-90 Synthetic Gear Oil		

Table 2, Forward-Rear Axle Oil Type and Capacity


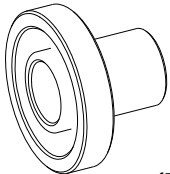
38. To lubricate the wheel ends, tilt the axle to the left and right by jacking the opposite side 8 inches (20 cm). Hold the tilted position for two minutes on each side to allow oil to run into the wheel end. Return the axle to a level position, and add oil through the axle housing filler hole. About two more pints (1 liter) of lubricant will be needed to bring the oil level even with the base of the filler hole.

Torque Values		
Application	Size	Torque: lbf·ft (N·m)
<i>Detroit Axles (all models)</i>		
Carrier Capscrews	M12	115 (156)
	M16	200 (270)
Drive Axle Stud Nuts	1/2–20	75–115 (102–156)
	5/8–18	150–170 (203–230)
Pinion Nut (model 2 axles)	M40 x 1.5	370 (500)
Pinion Nut (model 4 axles)	M45 x 1.5	627 (850)
<i>Tandem Forward Axles (Model 4 only)</i>		
Bearing Cage Capscrews	M12	107 (145)
Input Yoke Nut	M45 x 1.5	627 (850)
Output Yoke Nut	M39 x 1.5	516 (700)

Table 1, Torque Values

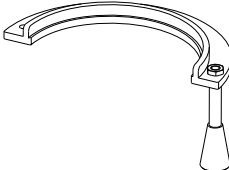
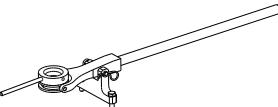
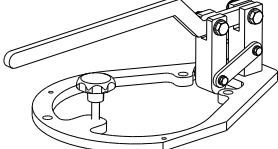
Single Rear Axle Oil Type and Capacity				
Model	Approved Oil Type		Capacity: quarts (liters)	
	Mineral	Synthetic	Hubs Full	Hubs Dry
Model 2	80W-90	75W-90	5.8 (5.5)	7.4 (7.0)
Model 4			10.6 (10.0)	12.2 (11.5)

Table 2, Single Rear Axle Oil Type and Capacity

Special Tools for Detroit Rear Axles			
Tool	Description	Manufacturer	Part Number
 f580400	Universal Handle*	Kent-Moore	J-8092
 f580406	Rear Pinion Seal Installer*	Kent-Moore	J-47354

Specifications

Special Tools for Detroit Rear Axles			
Tool	Description	Manufacturer	Part Number
 f580410	Input Seal Installer*	Kent-Moore	J-47369
 f580408	Output Seal Installer*	Kent-Moore	J-47368
 f580450	Yoke Nut Socket†	Daimler	MBA 742589020700
 f580478	Output Bearing Remover and Installer	Daimler	MBA 420589003300
 f580480	Shift Shaft Bushing Remover and Installer	Daimler	MBA 420589013300
 f580476	Slide Hammer	Daimler	MBA 060589003300

Special Tools for Detroit Rear Axles			
Tool	Description	Manufacturer	Part Number
 f580479	Half-Moon Device	Daimler	MBA 420589006300
 f580477	Push-Pull Device	Daimler	MBA 420589001600
 f580481	Shift Shaft Piston Installer	Daimler	MBA 420589023300

* To order Kent-Moore tools call 1-800-328-6657.

† The yoke nut socket is needed to remove the round, slotted yoke nut installed on some vehicles. It can be ordered through Paragon.

Table 3, Special Tools for Detroit Rear Axles

