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Rear Axle Alignment Checking 35.00

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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 or 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. Alignment specifications for Hunter and Bee Line alignment equipment, and for manual measurement, are in **"Specifications, 400."**

If alignment equipment is not available, the basic tools needed for checking rear axle alignment on tandem axles are a straightedge (which is nonflexible and at least as long as the axle), a steel tape rule, and a center point bar. On single axle vehicles, a straightedge, trammel bar, and steel tape rule are needed.

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.

The 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). The center point bar 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 the center point bar are in **"Specifications, 400."**

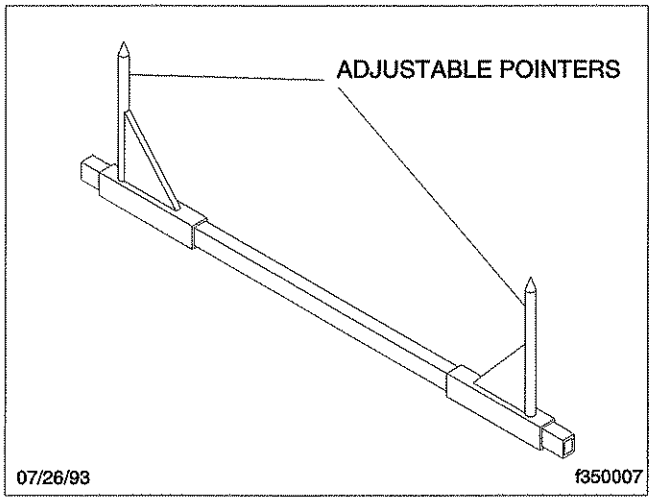


Fig. 1, Center Point Bar

Checking Thrust Angle (Perpendicularity)

NOTE: Before checking the axle alignment, make sure the wheel bearings are adjusted. For instructions, refer to the appropriate subject in this group. Make sure that no wheel rims are bent and that all rims are correctly seated. Check the frame rail alignment following the instructions in the frame group in this manual. Correct the frame rail alignment if necessary.

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.

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.

⚠ CAUTION

CAUTION: 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.

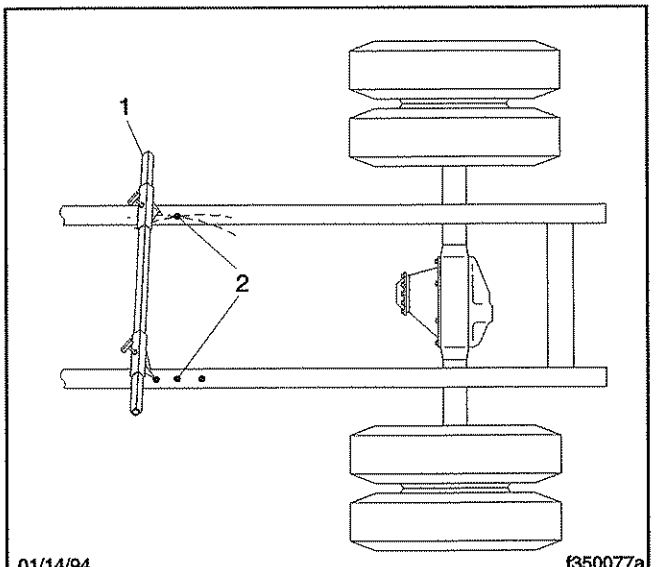
3. Select a point on the frame rail forward of the rear axle. Using a pencil or soapstone, mark two other points, about 102 mm (4 inches) forward and to the rear of the original point.

IMPORTANT: The distance from the original point to the forward and to the rear point does not have to be exactly 102 mm (4 inches), but the distance from the original point to the forward point *must* exactly equal the distance from the original point to the rear point.

4. Make sure that all three marks are aligned and of equal distance from the outside edge of the frame rail. Using a trammel bar, place one trammel pointer on the forwardmost point, and make an arc with a pencil or soapstone on the opposite frame rail. Then place the trammel pointer on the rearmost point and make an arc on the opposite frame rail intersecting the first arc. **See Fig. 1.** The point where the two arcs intersect and the original (or middle) point on the opposite frame rail have matching locations.
5. 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. 2.** The straightedge must line up exactly with the points.
6. Measuring from the outside edge of each frame rail, mark the straightedge on both sides of the frame. The marks (**Fig. 2**, 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.

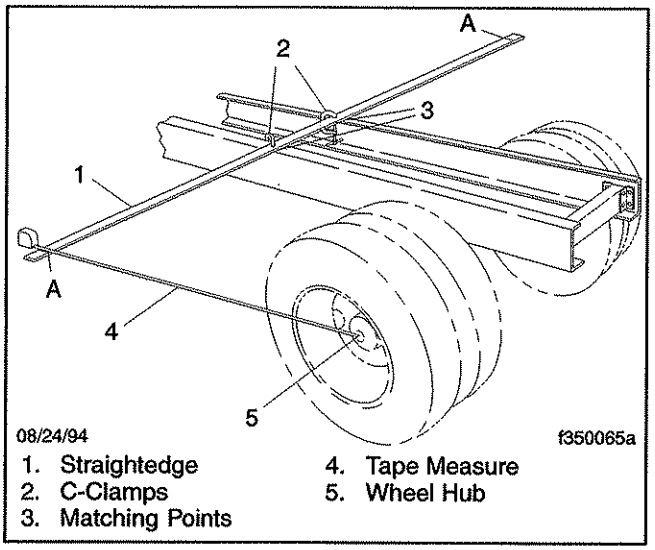
7. On each side of the vehicle, measure the distance from the mark on the straightedge to the center of the wheel hub. **See Fig. 2.** The difference between these measurements should be 9 mm (3/8 inch) or less. If the difference is more than 9 mm (3/8 inch), adjust the axle alignment. For instructions, refer to the suspension section in this manual, or to the suspension manufacturer's service literature.



1. Trammel Bar
2. Matching Points

Fig. 1, Marking an Arc With the Trammel Bar

Alignment Checking, Single Axle



1. Straightedge
2. C-Clamps
3. Matching Points
4. Tape Measure
5. Wheel Hub

Fig. 2, Straightedge to Wheel Hub Measurement

Checking

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.

A straightedge and a center point bar are needed to align a tandem axle. First, a straightedge and trammel bar are used to check and, if needed, align the rearmost axle. Then, the center point bar is used to check and, if needed, align the forward-rear axle.

Use the instructions in **Subject 100** to check and align the rearmost axle. Then, check the alignment of the forward-rear axle as follows:

IMPORTANT: Align the rearmost axle before checking the forward-rear axle.

1. Using the center point bar, set the two points into the axle cap holes as shown in **Fig. 1**. Lock them in place by tightening the setscrews.
2. 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 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. 2.** For instructions, refer to the suspension section in this manual, or to the suspension manufacturer's service literature.

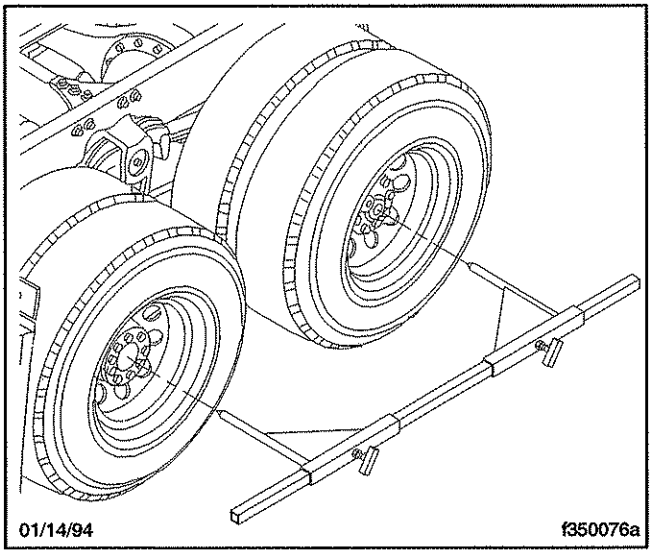
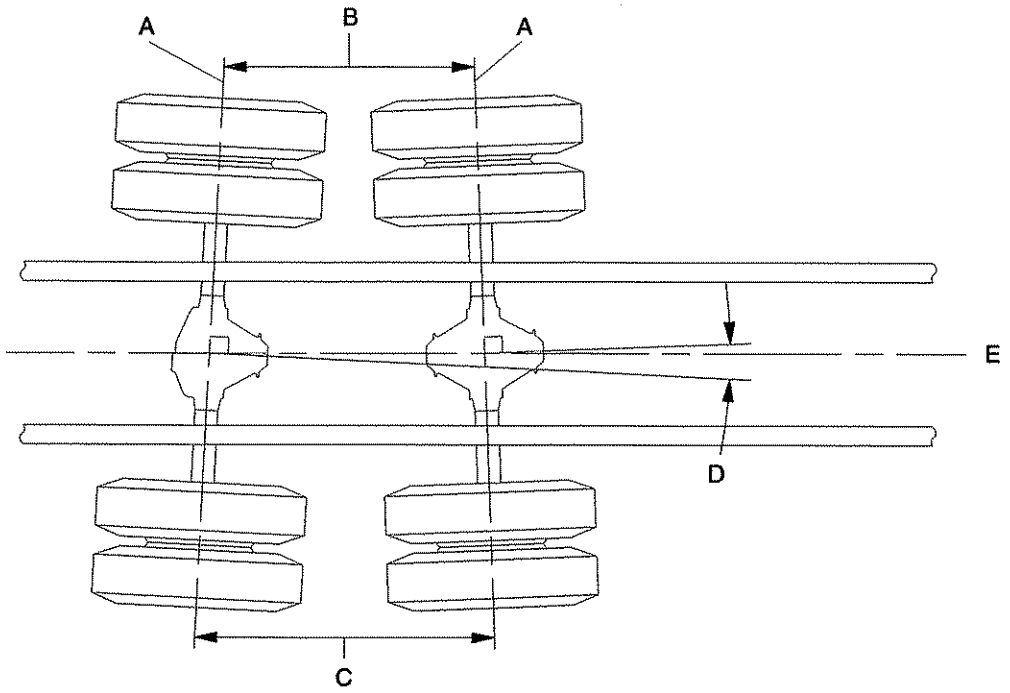


Fig. 1

Manual Alignment Checking, Tandem Axle



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A. Axle Centerline
B. Left-Hand Axle End Spacing, Measured Manually or with Bee Line Alignment Tools
C. Right-Hand Axle End Spacing, Measured Manually or with Bee Line Alignment Tools
D. Maximum Tolerance as Measured with Hunter Alignment Tools = ±0.08 degree
E. Vehicle Centerline

Fig. 2

Specifications

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. Dealers must have proof of this calibration history.

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

Table 1, Maximum Tolerance from Perpendicular, Manual Method

Maximum Tolerance from Perpendicular, Hunter Equipment	
Method	**Maximum Tolerance ± from Perpendicular**
Hunter*	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± 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	±0.08 degree maximum axle-to-axle difference; reference "C" in **Fig. 1.**
Bee Line or Manual	±1/8-inch max. difference in axle end-spacing; reference "B" minus "A" in **Fig. 1.**

Table 4, Rear Axle Parallelism Specifications

Specifications

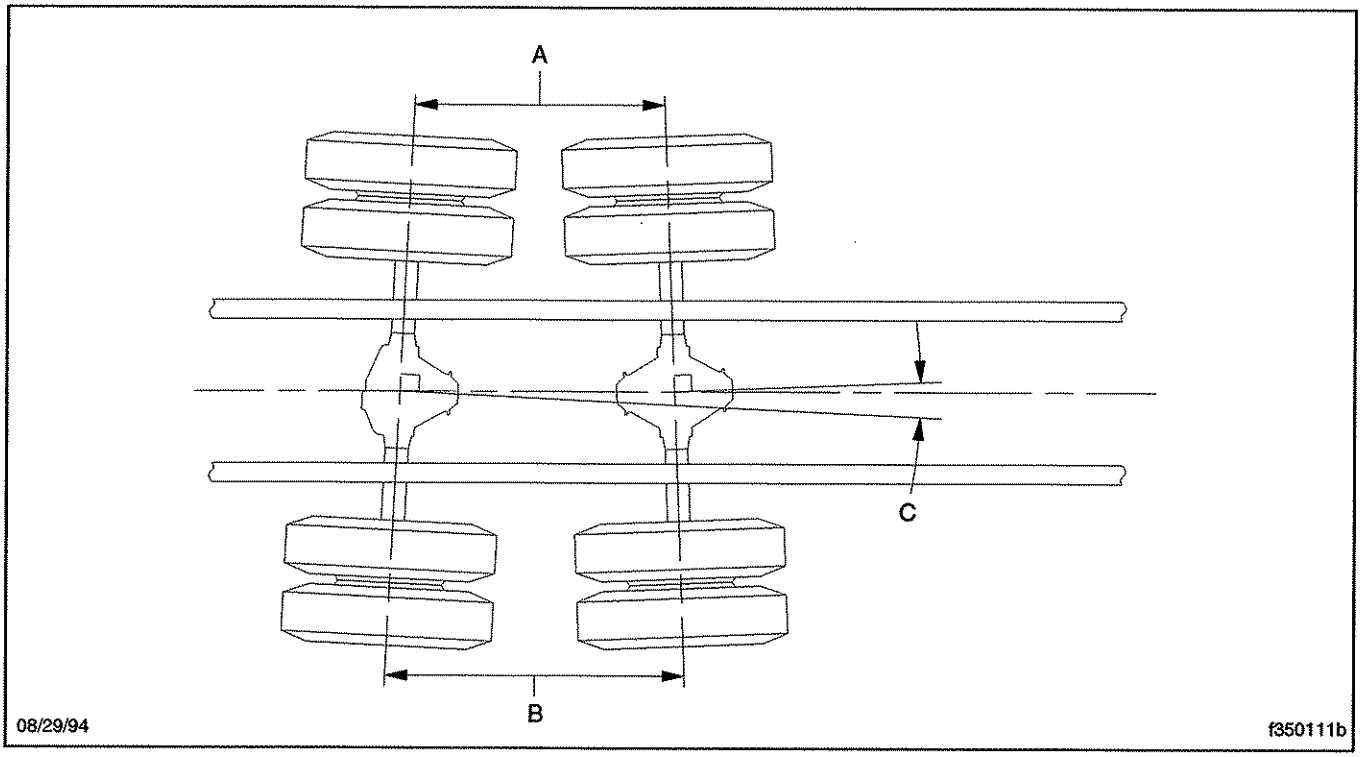


Fig. 1, Tandem Axle Measurements

Rear Axle Wheel Hubs and Wheel Bearings 35.01

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Wheel Bearing Cup Removal and Installation, Ferrous Hubs	120
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General Information

The rear axle full-floating wheel hub assembly is made up of five major components: inner and outer tapered wheel bearings, the drive axle spindle assembly, the wheel hub, the brake drum, and the wheel studs. **See Fig. 1.**

TAPERED WHEEL BEARINGS

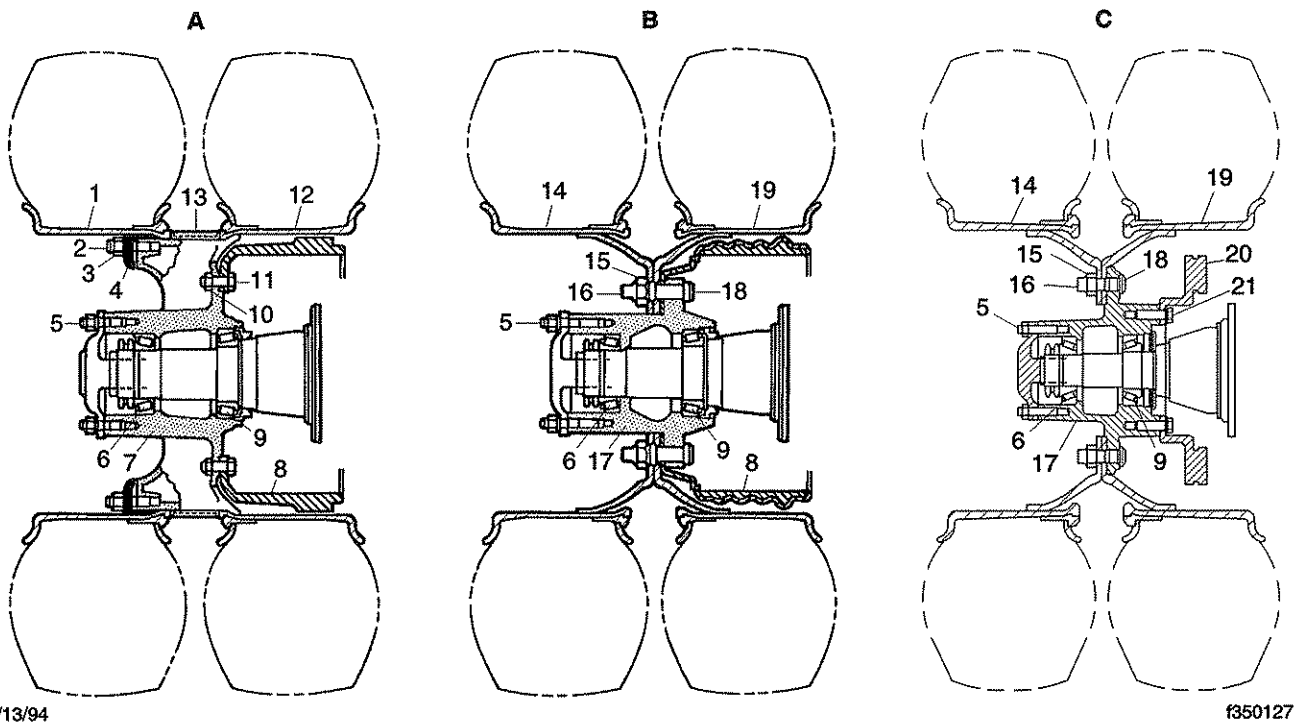
A typical tapered wheel bearing assembly consists of a cone, tapered rollers, a roller cage, and a separate cup that is press-fit in the hub. **See Fig. 2.** All components carry the load, with the exception of the cage, which spaces the rollers around the cone.

Each hub has a set of inner and outer tapered wheel bearing assemblies. The bearing setting is locked in place on the axle spindle by an adjusting nut, lockring, and jam nut. **See Fig. 3.**

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 nut/lockring assembly described above (**see Fig. 4**, Refs. 3 through 10, 13).

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



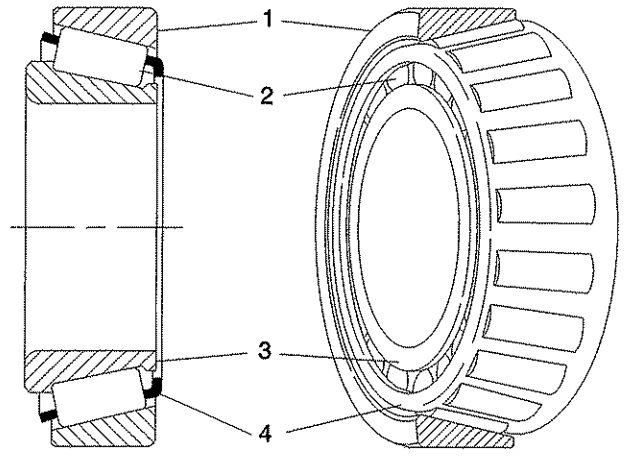
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A. Spoke Wheel and Brake Drum Assembly
B. Disc Wheel, Wheel Hub, and Brake Drum Assembly
C. Disc Wheel, Wheel Hub, and Brake Rotor Assembly

1. Outer Rim
2. Rim Stud
3. Rim Stud Nut
4. Rim Clamp
5. Drive Axle Stud
6. Outer Wheel Bearing
7. Spoke Wheel
8. Brake Drum
9. Inner Wheel Bearing
10. Brake Drum Nut
11. Brake Drum Bolt
12. Inner Rim
13. Rim Spacer
14. Outer Wheel
15. Outer Wheel Nut
16. Inner Wheel Nut
17. Wheel Hub
18. Wheel Stud
19. Inner Wheel
20. Brake Rotor
21. Rotor Bolt

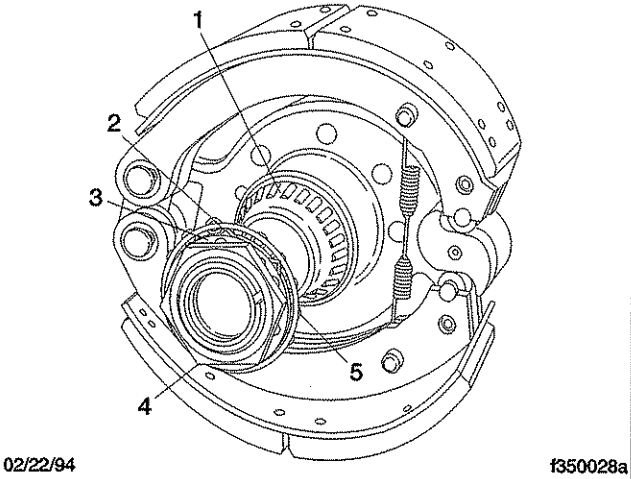
Fig. 1

General Information



1. Cup
2. Tapered Roller
3. Cone
4. Roller Cage

Fig. 2, Tapered Wheel Bearing Assembly



1. Inner Wheel Bearing
2. Wheel Bearing Inner Adjusting Nut
3. Lockring
4. Axle Spindle Jam Nut
5. Outer Wheel Bearing

Fig. 3, Drive Axle Bearings and Spindle Assembly

alignment of the axle spindle assembly. Refer to the axle manufacturer for instructions.

⚠ CAUTION

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

WHEEL HUB

The inner disc wheel and/or brake drum is mounted on an aluminum or iron wheel hub (**Fig. 4**, Ref. 20). 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.

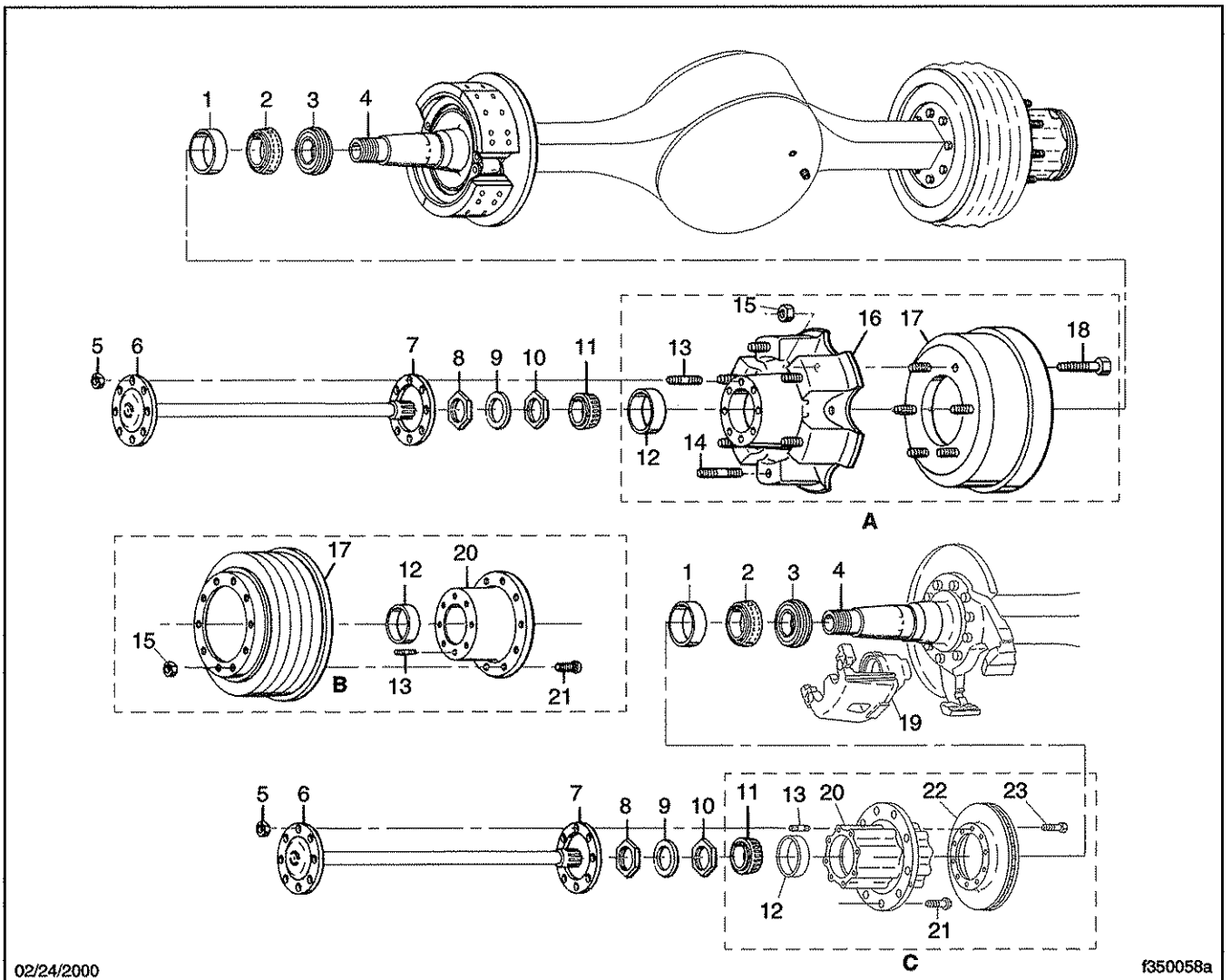
Each spoke wheel (**Fig. 4**, Ref. 16) combines both wheel and hub into a single unit.

WHEEL STUDS

A headed wheel stud (**Fig. 5**) 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.

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 driver's side of the vehicle. Studs stamped with an "R" are right-hand threaded and are installed on the passenger's side of the vehicle.

Spoke wheels have rim studs. Rim studs are threaded on both ends, with a nonthreaded section midway along the shaft of the stud. The studs are coated with an anaerobic locking compound.



A. Spoke Wheel and Drum Assembly
B. Disc Wheel, Hub, and Drum Assembly
C. Disc Wheel, Hub, and Rotor Assembly

1. Inner Wheel Bearing Cup
2. Inner Wheel Bearing
3. Oil Seal
4. Axle Spindle
5. Drive Axle Stud Nut
6. Drive Axle Flange and Shaft
7. Gasket
8. Jam Nut
9. Lockring
10. Wheel Bearing Inner Adjusting Nut
11. Outer Wheel Bearing
12. Outer Wheel Bearing Cup
13. Drive Axle Stud
14. Rim Stud
15. Brake Drum Nut
16. Spoke Wheel
17. Brake Drum
18. Brake Drum Bolt
19. Brake Caliper
20. Wheel Hub
21. Wheel Stud
22. Brake Rotor
23. Rotor Bolt

Fig. 4, Typical Drive Axle (exploded view)

General Information

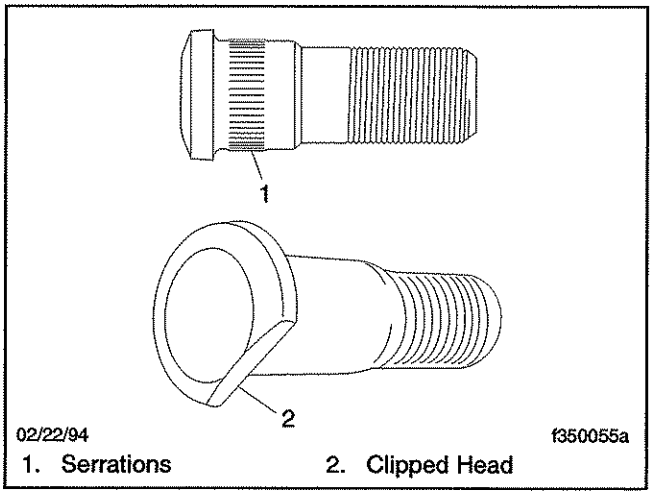
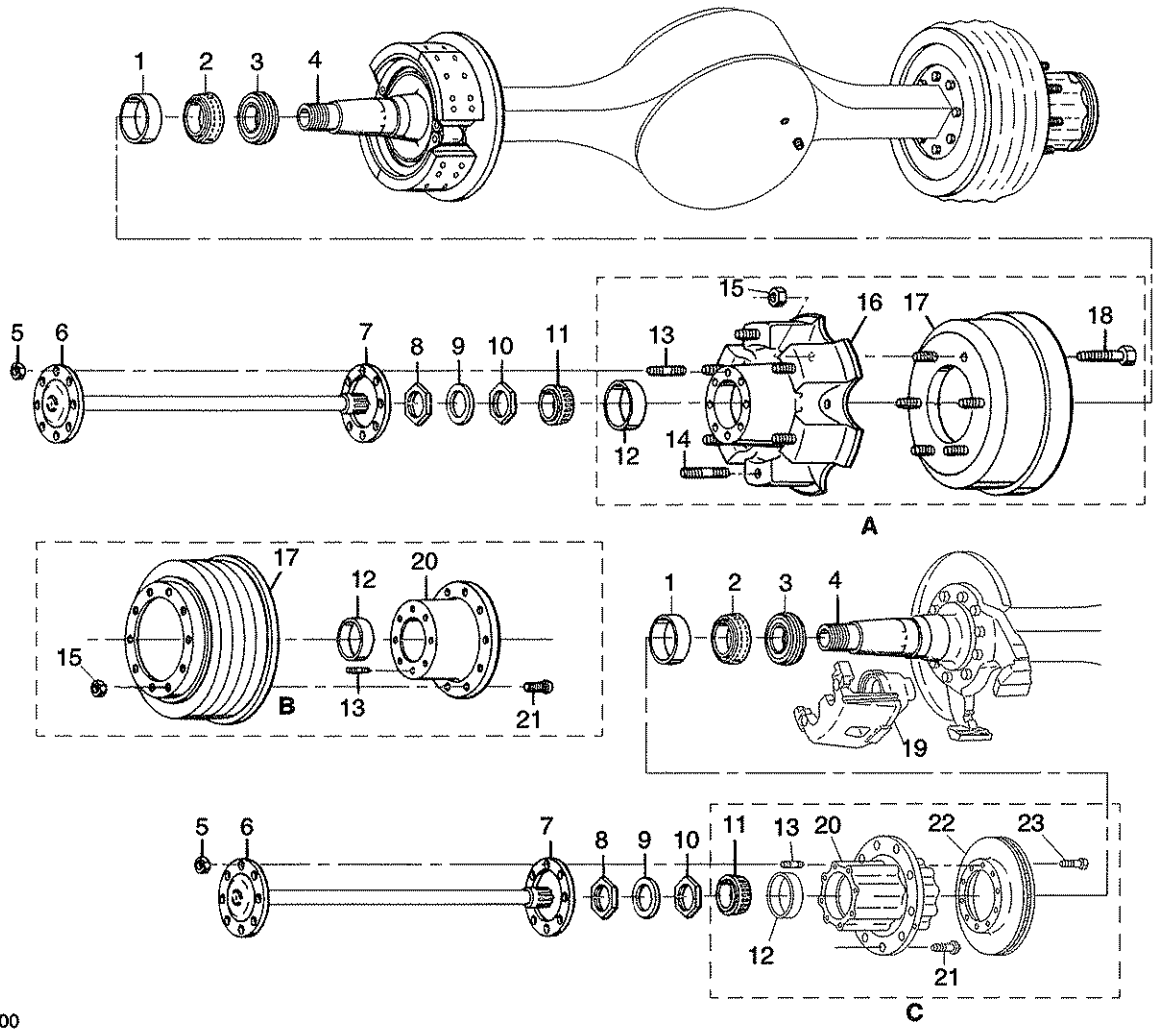


Fig. 5, Typical Headed Wheel Studs

Hub Assembly Removal and Installation, Disc Wheels

Removal (See Fig. 1)



A. Spoke Wheel and Drum Assembly
B. Disc Wheel Hub and Drum Assembly
C. Disc Wheel Hub and Rotor Assembly

1. Inner Wheel Bearing Cup
2. Inner Wheel Bearing
3. Oil Seal
4. Axle Spindle
5. Drive Axle Stud Nut
6. Drive Axle Flange and Shaft
7. Gasket
8. Jam Nut
9. Lockring
10. Wheel Bearing Inner Adjust Nut
11. Outer Wheel Bearing
12. Outer Wheel Bearing Cup
13. Drive Axle Stud
14. Rim Stud
15. Brake Drum Nut
16. Spoke Wheel
17. Brake Drum
18. Brake Drum Bolt
19. Brake Caliper
20 Wheel Hub
21. Wheel Stud
22. Brake Rotor
23. Rotor Bolt

Fig. 1, Typical Rear Axle Assembly

1. Chock the front tires to prevent vehicle movement. Release the parking brakes.
2. Raise the rear of the vehicle until the tires clear the ground. Then place safety stands under the axle.

Hub Assembly Removal and Installation, Disc Wheels

3. If the vehicle is equipped with air brakes, back off the slack adjuster to release the rear axle brake shoes. For instructions, see the applicable slack adjuster section in **Group 42.**
4. Remove both wheel and tire assemblies. For instruction, see **Group 40.**

⚠ 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.

5. On outboard drums, remove the brake drum. On disc brakes, remove the brake caliper; for instructions, see **Group 42.**

   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.
6. Oil will spill as the drive axle shaft and the wheel hub are removed. Place a suitable container under the drive axle flange to catch any spilled oil, which should later be safely discarded.
7. Remove the drive axle stud nuts and washers. See **Fig. 2.**
8. Using a hammer and a soft drift, such as one made of brass, sharply tap the center portion of the drive axle flange. See **Fig. 2.** The shaft will usually spring slightly outward after the seal has broken. Remove the drive axle shaft.

⚠ CAUTION

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.

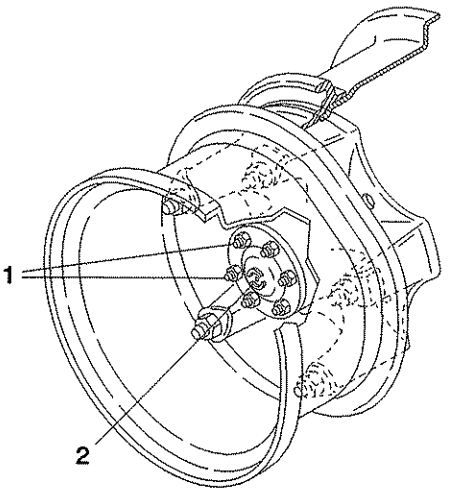
NOTE: Even if the drive axle shaft doesn't spring outward, the seal may have loosened enough to allow the shaft to be pulled from the axle spindle. If the seal has not broken, repeat this step.

9. If equipped, remove the tapered dowels and washers from the drive axle flange.
10. Remove and discard the gasket.
11. Remove the axle spindle jam nut and the lockring or nut-lock, as equipped. See **Fig. 3.**
12. Back off the wheel bearing inner adjusting nut about two turns, or enough to allow the weight of the hub to be lifted from the wheel bearings.
13. Lift the hub until all weight is removed from the wheel bearings; remove the wheel bearing inner adjusting nut.

⚠ CAUTION

When moving the hub, be careful not to let the outer wheel bearing drop from the axle spindle. If the wheel bearing is dropped, cage warpage or roller damage can occur.

14. Move the hub about 13 mm (1/2 inch) to jar loose the outer wheel bearing (allow the hub-only

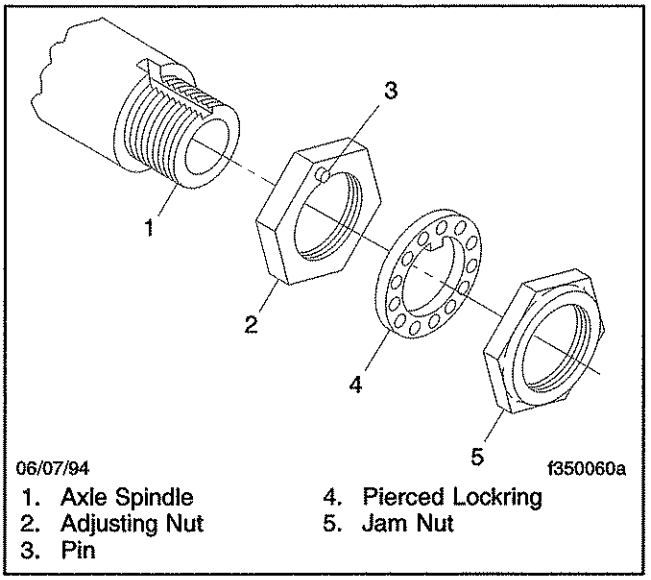


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1. Drive Axle Studs and Nuts
2. Center Portion of Drive Axle Flange

Fig. 2, Wheel Assembly and Hub

Hub Assembly Removal and Installation, Disc Wheels



1. Axle Spindle
2. Adjusting Nut
3. Pin
4. Pierced Lockring
5. Jam Nut

Fig. 3, Axle Secured With a Lockring

assembly to rest on the axle spindle; be careful not to damage the axle spindle threads).

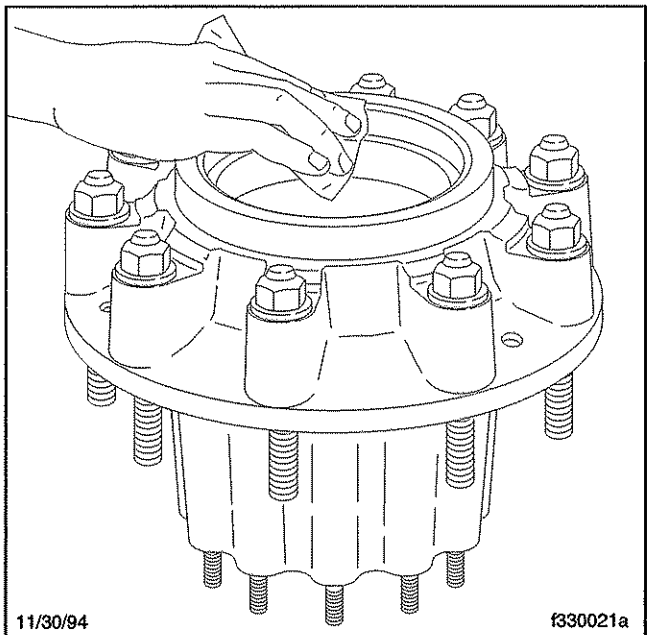
15. Carefully remove the outer wheel bearing; handle the bearings with clean, dry hands. Wrap them in either clean oil-proof paper or lint-free rags.

⚠ CAUTION

Don't spin bearing rollers at any time. Dirt or grit can scratch their surfaces and cause rapid wear of the bearing assembly. Treat used bearings as carefully as new ones.

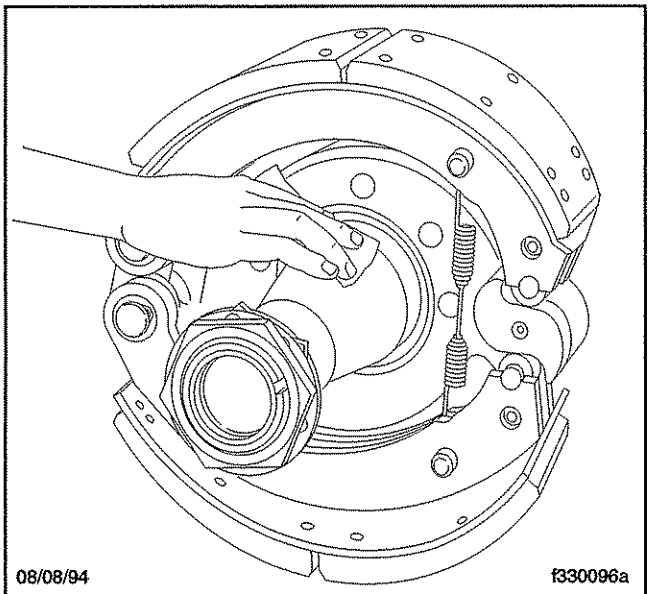
16. Remove the hub. Be careful not to damage the axle spindle threads as the assembly is removed.
17. Using a seal removal tool, remove the oil seal from the hub, if not already removed.
18. Remove the inner wheel bearing from the hub. If the bearings aren't easily removed, place a protective cushion where it will catch them. Then, use a hardwood drift and a light hammer to gently tap the bearings (and seal, if needed) out of the cup. Handle the bearings with clean, dry hands. Wrap them in either clean oil-proof paper or lint-free rags.
19. Remove all burrs from the shoulder and the seal bore with an emery cloth or a file. See **Fig. 4** and **Fig. 5**. Clean any metal filings from the parts.

IMPORTANT: Use extreme care in cleaning the wheel hub cavity and axle. Dirt, metal filings, or other debris



NOTE: Typical application.

Fig. 4, Clean the Hub Shoulder



NOTE: Typical application.

Fig. 5, Clean the Spindle

Hub Assembly Removal and Installation, Disc Wheels

can scratch the bearing roller surfaces, and cause premature wear of the bearing assembly.

20. Go to **Subject 110.**

Installation

⚠ 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, continuing through installation of the wheels.

Commercial cleaning solvents are toxic, can cause severe skin irritation, and may be fire hazards. When using solvents, follow the safety precautions recommended by the solvent manufacturer.

1. Using clean solvent, remove the old oil from the axle spindle and the disassembled parts. Allow the parts to dry, or dry them with a clean, absorbent, and lint-free cloth or paper. Wrap a protective layer of friction tape on the axle housing threads.
2. Coat both bearing assemblies with fresh oil. Install the inner wheel bearing and oil seal. Handle the bearings with clean, dry hands. For lubricant specifications, see **Specifications, 400.**

⚠ CAUTION

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.

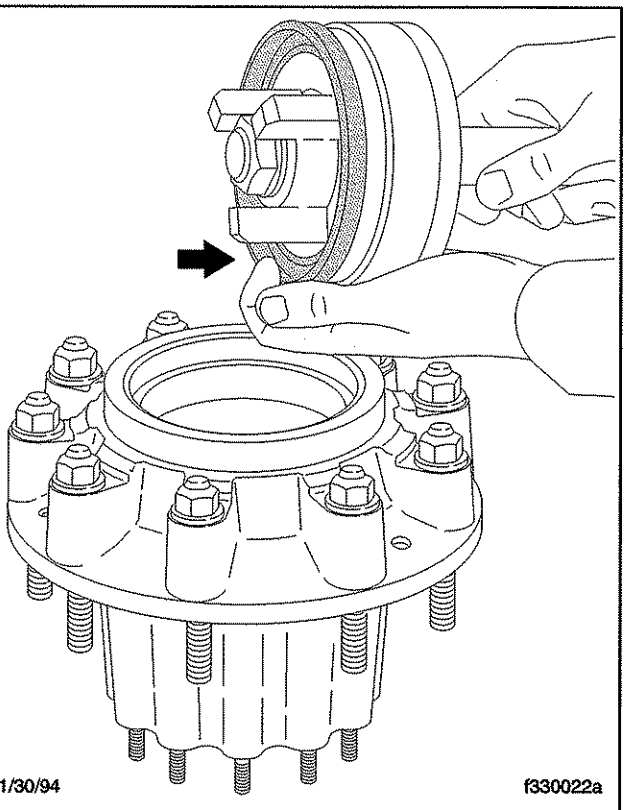
2.1 Seat the small outer diameter of the seal in the recess of the tool adaptor. See **Fig. 6.** The correct adaptor is identified on the box.

2.2 Insert the centering plug of the tool in the bore of the inner bearing cone. See **Fig. 7.** The plug prevents cocking of the seal in the bore.

2.3 Hold the tool handle firmly, and strike it until the sound of the impact changes as the seal bottoms out. See **Fig. 8.** Hold the tool firmly to avoid bounce or unseating of the seal from the adaptor.

2.4 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.

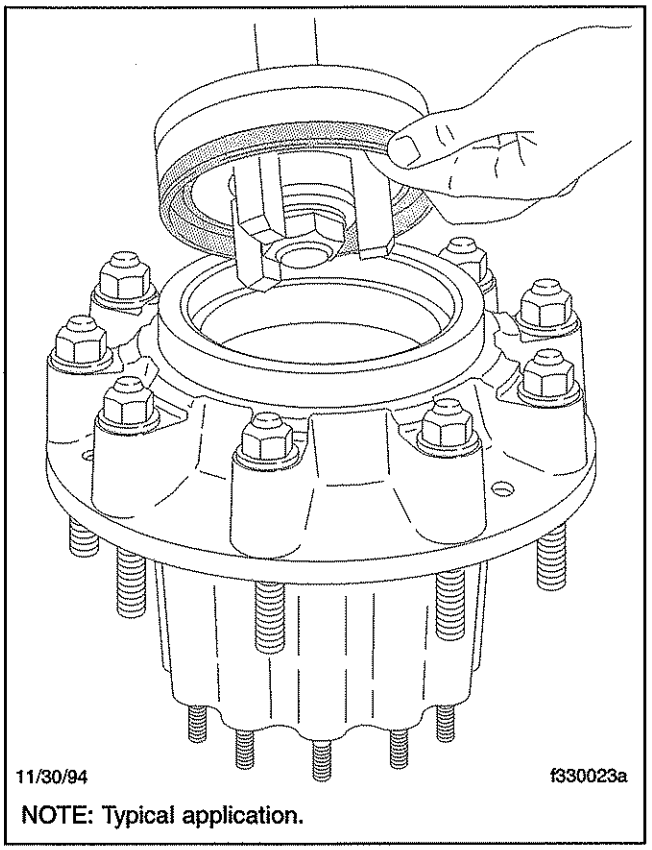
3. Wipe a film of axle oil on the axle spindle to prevent rust from forming behind the inner wheel bearing.
4. Carefully mount the hub and inner wheel bearing assembly on the axle spindle. Be careful not to unseat the inner wheel bearing or seal.
5. Fill the hub cavity with oil, and install the outer wheel bearing; handle the bearings with clean, dry hands. Use care not to damage the bearings as they are seated in the bearing cups. Then remove the friction tape from the axle spindle threads.
6. Adjust the wheel bearings as follows (see **Fig. 3**):



NOTE: Typical application.

Fig. 6, Seat the Seal in the Tool

Hub Assembly Removal and Installation, Disc Wheels



NOTE: Typical application.

Fig. 7, Insert the Tool

IMPORTANT: Be sure there is enough clearance between the brake shoes and the brake drum, so brake shoe drag won't interfere with bearing adjustment.

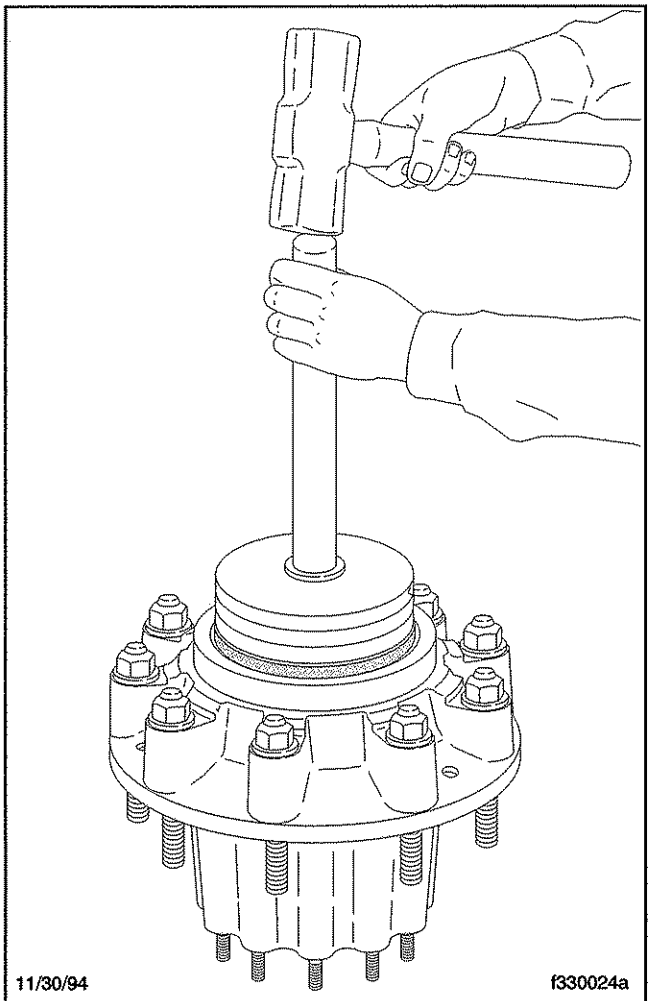
6.1 After the wheel hub and bearings are assembled on the spindle, tighten the inner (adjusting) nut 271 N·m (200 lbf·ft) while rotating the wheel hub assembly.

6.2 Back off the inner nut one full turn.

6.3 Tighten the inner nut 68 N·m (50 lbf·ft) while rotating the wheel hub assembly.

6.4 Back off the inner nut one quarter turn.

NOTE: If you're securing the wheel bearings with a pierced lockring, and no hole in the lockring aligns with the dowel on the adjusting nut, remove the lockring, turn it over and install it, again. If a hole still doesn't align with the dowel, loosen the adjusting nut, but only enough to align the dowel with a hole in the lockring.



NOTE: Typical application.

Fig. 8, Strike the Tool

6.5 Install the locking device:

- Tanged nut-lock
- Lockring
- Lockwasher *and* a lockring
- Nut-lock *and* a lockring

Then install the jam nut, and tighten it to the applicable torque in **Table 1.**

Hub Assembly Removal and Installation, Disc Wheels

Locking Device	Torque: lbf·ft (N·m)	
	1-1/8 to 2-1/2 Inch Jam Nuts	2-5/8 Inch or Larger Jam Nuts
Tanged Nut-Lock	200–300 (271–407)	
Lockring		
Tanged Nut-Lock and Lockring	200–300 (271–407)	250–400 (339–542)
Lockwasher and Lockring		

Table 1, Jam Nut Torques

6.6 With the jam nut installed and tightened, attach a dial indicator to the hub and set the point of the indicator in line with the end of the axle spindle.

If using aluminum hubs, you may have to install the brake drum on the hub to provide a steel base for the magnet of the dial indicator. Mount the drum on the hub's drum pilot, then adjust the brake or have someone apply the brakes to hold the drum securely while you secure the drum using the stud at the 12 o'clock position, then the studs at about the 4 o'clock and 8 o'clock positions.

NOTE: If using a stud-piloted hub and a steel drum, install 1–1/4 inch washers between the nuts and the drum.

6.7 Release the brakes if you used them to hold the drum while installing it.

Grip the sides of the hub at the three o'clock and nine o'clock positions, then push the hub (and drum, if applicable), to seat the inboard bearing set. Zero the dial indicator.

Grip the sides of the hub at the three o'clock and nine o'clock positions, then pull the hub (and drum, if applicable). Read the dial indicator, and note the end play.

Push the hub back in to confirm that the needle of the dial indicator returns to zero.

The end play must be between 0.025 and 0.127 mm (0.001 and 0.005 inch).

7. If the end play is not within this range, remove the jam nut and locking device, and back off or tighten the inner (adjusting) nut to adjust the end play. Keep the following in mind:

If you're using a nut-lock: turning the inner nut 1/4 turn will change the end play about 0.508 mm (0.020 inch).

If you're using a lockring: turning the inner nut one lockring hole will change the end play about 0.127 mm (0.005 inch). If you take the lockring off and reverse it, then turn the inner nut to the next hole, this will change the end play about 0.0635 mm (0.0025 inch).

Install the locking device and jam nut as described earlier, and measure the end play. If the end play is not between 0.025 and 0.127 mm (0.001 and 0.005 inch), adjust the inner (adjusting) nut, again.

8. Once the end play is correct, bend the nut-lock or lockwasher as applicable to lock the jam nut and/or adjusting nut in place.
9. Rotate the wheel in both directions. It should rotate freely with no dragging or binding.
10. Install a new gasket on the drive axle studs.
11. Install the drive axle shaft. The splined end of the axle shaft must seat before the drive axle flange will fit over the studs.
12. If equipped, install the dowels and washers on the drive axle studs. Install the drive axle nuts. Using the sequence shown in **Fig. 9**, tighten the nuts to the torque values in the torque table in **Specifications, 400.**
13. Install the brake drum on the wheel hub.
14. Install the inner and outer wheel and tire assemblies. For instructions, see **Group 40.**

⚠ WARNING

If the inner wheel nuts cannot be tightened to minimum torque values, the wheel studs have lost

Hub Assembly Removal and Installation, Disc Wheels

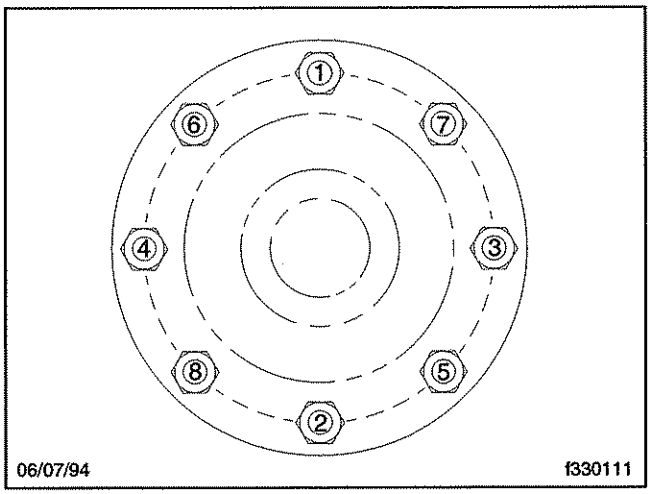


Fig. 9, Axle Shaft Flange Nut-Tightening Sequence

their locking action, 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 loss of a wheel or loss of vehicle control, and possible personal injury.

15. Fill the axle with lubricant.

⚠ WARNING

Failure to add oil to the axle housing bowl or the wheel hub after the drive axle shaft and wheel hub have been serviced will damage the wheel bearings and cause them to seize during vehicle operation. See Fig. 10. Seized bearing rollers can cause sudden damage to the tire or axle, possibly resulting in personal injury.

15.1 Pour the recommended drive axle lubricant through the axle housing filler hole (**Fig. 11** or **Fig. 12**) until the lubricant is level with the bottom of the hole. See **Fig. 13**. See **Specifications, 400** for the recommended axle lubricants. Tighten the plug 47 N·m (35 lbf·ft).

15.2 Tilt the axle to the left and right, by jacking the opposite side. Hold the tilted position for one minute on each side, to allow oil to run into the wheel end.

15.3 Return the axle to a level position, and add oil through the axle housing fill hole. About one extra liter (two pints) of lubricant will be needed to bring the oil level even with the base of the fill hole.

NOTE: Drive axle wheel bearings are lubricated by oil drawn from the axle housing bowl section. This method ensures good exchange of heat, prevents stagnation, and minimizes the maintenance required on bearings and hub assemblies.

16. Turn the wheels, and check the lubricant level.

17. Adjust the rear axle brakes at the slack adjuster. For instructions, refer to the brakes group in the vehicle maintenance manual.

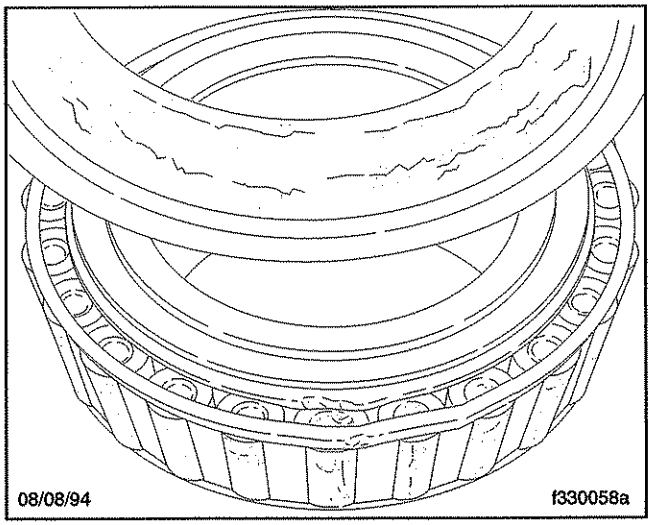


Fig. 10, Bearing Damage Resulting from Inadequate Lubrication

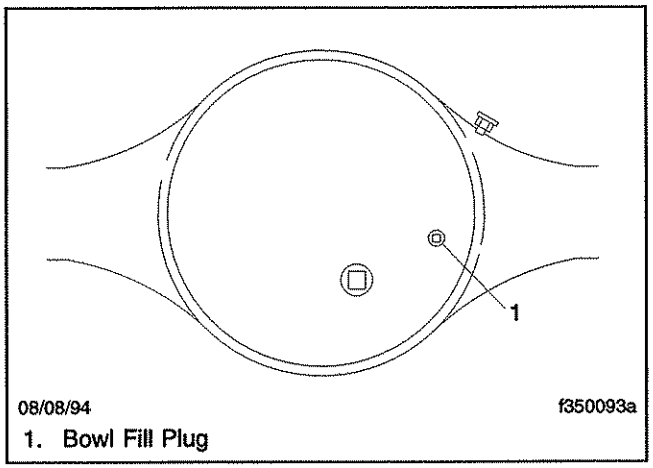
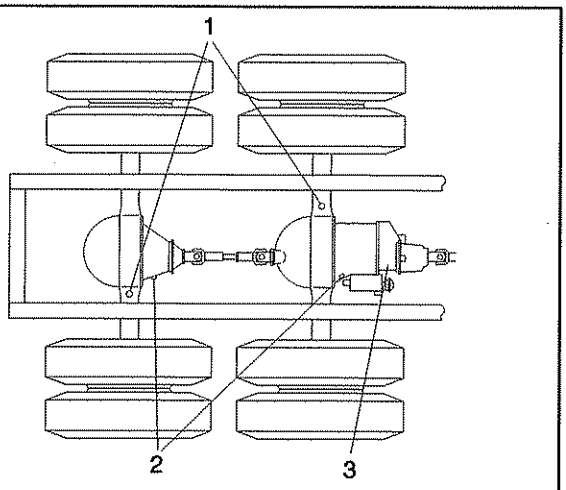


Fig. 11, Filler Hole

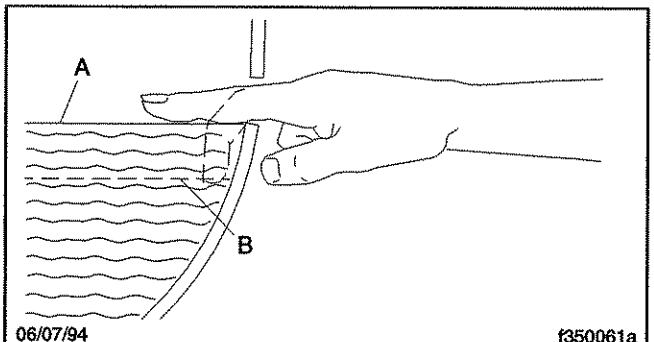
Hub Assembly Removal and Installation, Disc Wheels



06/07/94 f350062a

1. Axle Housing Breathers
2. Carrier Fill Hole Plugs
3. Interaxle Differential

Fig. 12, Axle Filler Holes



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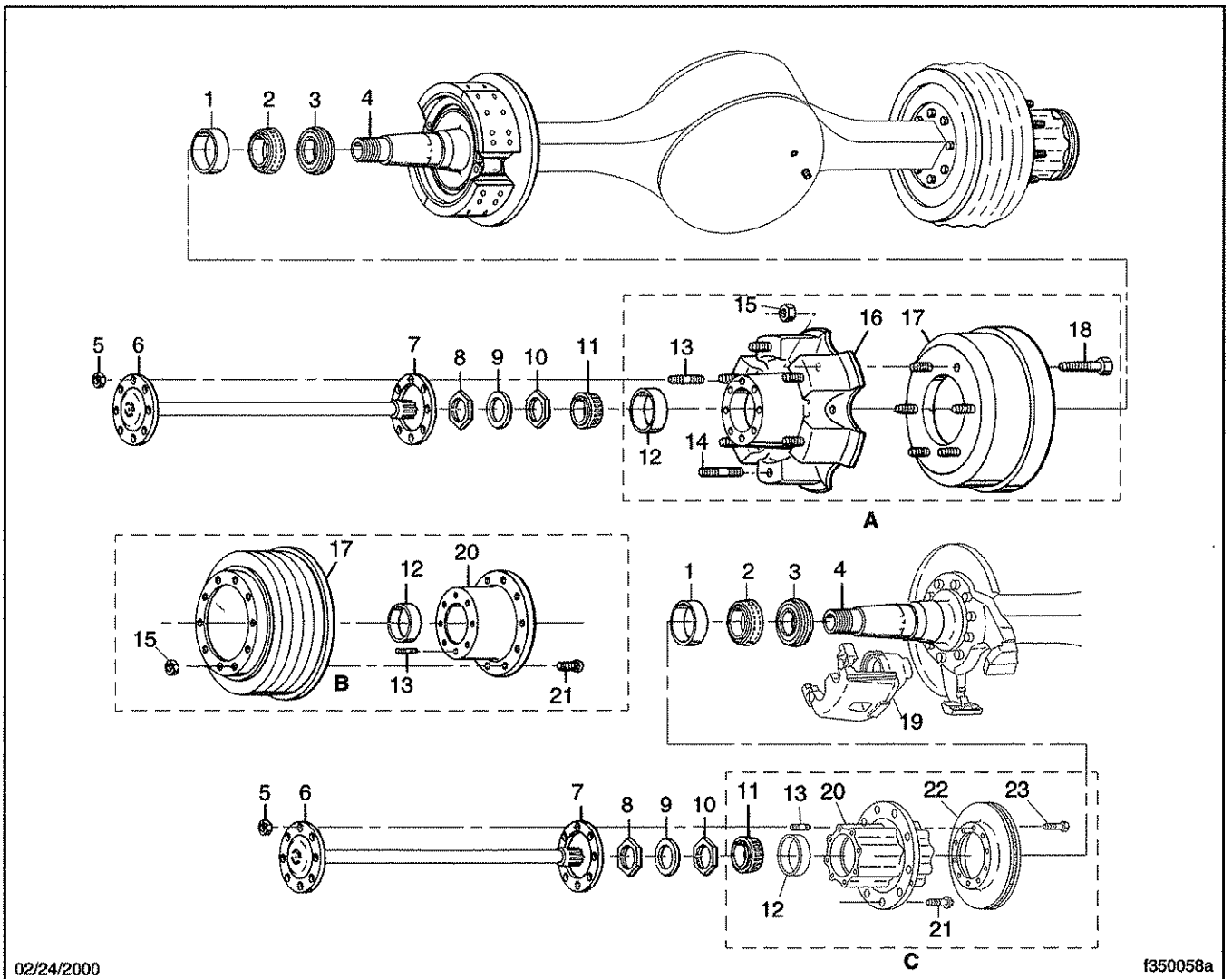
A. Correct: Lube level at the bottom of the fill hole.
B. Incorrect: Lube level is below the fill hole.

Fig. 13, Checking Lubricant Level

18. Remove the safety stands from under the axle, then lower the vehicle.
19. Apply the parking brakes, then remove the chocks from the front tires.

Hub Assembly Removal and Installation, Spoke Wheels

Removal (See Fig. 1)



A. Spoke Wheel and Drum Assembly
B. Disc Wheel Hub and Drum Assembly
C. Disc Wheel Hub and Rotor Assembly

1. Inner Wheel Bearing Cup
2. Inner Wheel Bearing
3. Oil Seal
4. Axle Spindle
5. Drive Axle Stud Nut
6. Drive Axle Flange and Shaft
7. Gasket
8. Jam Nut
9. Lockring
10. Wheel Bearing Inner Adjust Nut
11. Outer Wheel Bearing
12. Outer Wheel Bearing Cup
13. Drive Axle Stud
14. Rim Stud
15. Brake Drum Nut
16. Spoke Wheel
17. Brake Drum
18. Brake Drum Bolt
19. Brake Caliper
20 Wheel Hub
21. Wheel Stud
22. Brake Rotor
23. Rotor Bolt

Fig. 1, Typical Rear Axle Assembly

Hub Assembly Removal and Installation, Spoke Wheels

Spoke wheel assemblies with inboard drums don't need to be completely disassembled for brake component maintenance. The tires and rims can remain attached to the wheel, and the wheel to the brake drum. The assembly is then removed from the axle as a single unit to expose brake components. See **Group 42** for brake assembly service information.

1. Chock the front tires to prevent vehicle movement. Release the parking brakes.
2. Raise the rear of the vehicle until the tires clear the ground. Then place safety stands under the axle to be serviced. Position a jack or wheel-and-tire dolly under the tires.
3. Remove both rim and tire assemblies. For instructions, see **Group 40.**
4. If the vehicle is equipped with air brakes, back off the slack adjuster to release the rear axle brake shoes. For instructions, see the applicable slack adjuster section in **Group 42.** If the vehicle is equipped with hydraulic brakes, remove the brake caliper. For instruction, see **Group 42.**
5. Remove the drive axle flange nuts (**Fig. 2**) and washers.

NOTE: Oil will spill as the drive axle shaft and wheel are removed. Place a suitable container under the wheel to catch any spilled oil. Safely discard the oil.

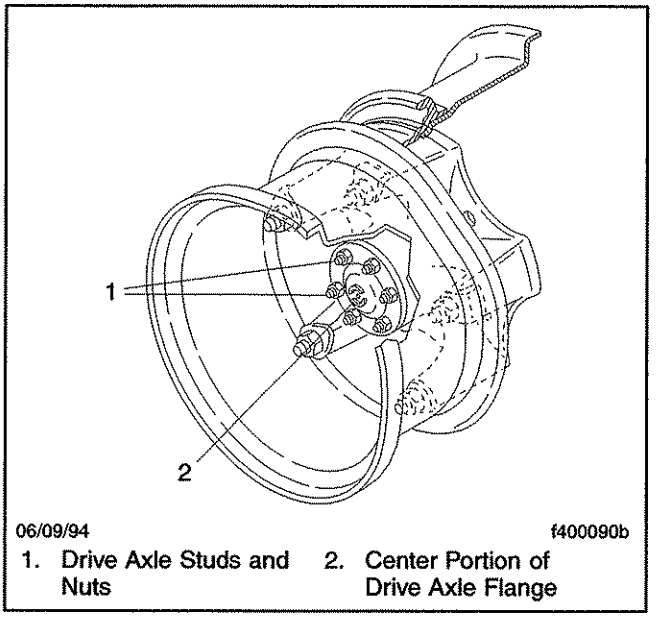
6. Using a hammer and a soft drift, such as one made of brass, sharply tap the center portion of the drive axle flange. See **Fig. 2.** The shaft will usually spring slightly outward after the seal has broken. Then remove the drive axle shaft.

⚠ CAUTION

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.

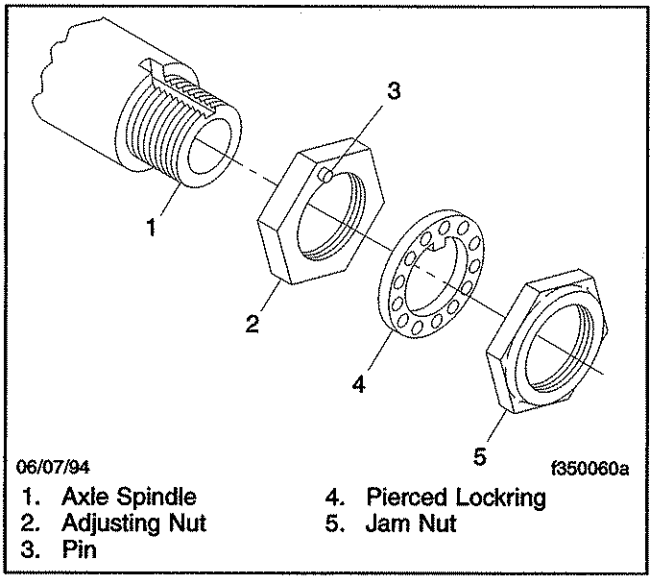
NOTE: Even if the drive axle shaft doesn't spring outward, the seal may have loosened enough to allow the shaft to be pulled from the axle housing. If the seal has not broken, repeat the above step.

7. If so equipped, remove the tapered dowels and washers from the drive axle flange.
8. Remove and discard the gasket.
9. Remove both the axle spindle jam nut and the lockring. See **Fig. 3.** Then, back off the wheel bearing inner adjusting nut about two turns, or enough to allow the weight of the wheel and drum assembly to be lifted from the wheel bearings.



1. Drive Axle Studs and Nuts
2. Center Portion of Drive Axle Flange

Fig. 2, Wheel Assembly and Hub



1. Axle Spindle
2. Adjusting Nut
3. Pin
4. Pierced Lockring
5. Jam Nut

Fig. 3, Axle Secured With a Lockring

Hub Assembly Removal and Installation, Spoke Wheels

10. Using the wheel dolly or jack, raise the wheel and drum assembly until all weight is removed from the bearings. Then remove the wheel bearing inner adjusting nut.
11. Carefully remove the outer wheel bearing; handle the bearings with clean, dry hands. If the wheel bearings have not loosened from the cup, move the wheel assembly about 1/2 inch (13 mm) to jar loose the outer wheel bearing. Be careful to not drop the bearings. Wrap them in clean oil-proof paper or lint-free rags.

⚠ 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.

⚠ CAUTION

Don't 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.

12. Using the wheeled support, pull the wheel assembly away from the vehicle. Be careful not to damage the axle spindle threads as the assembly is removed.
13. Remove the brake drum or rotor nuts (**Fig. 1**) and detach the brake drum or rotor from the wheel. For instructions, see **Group 42.**

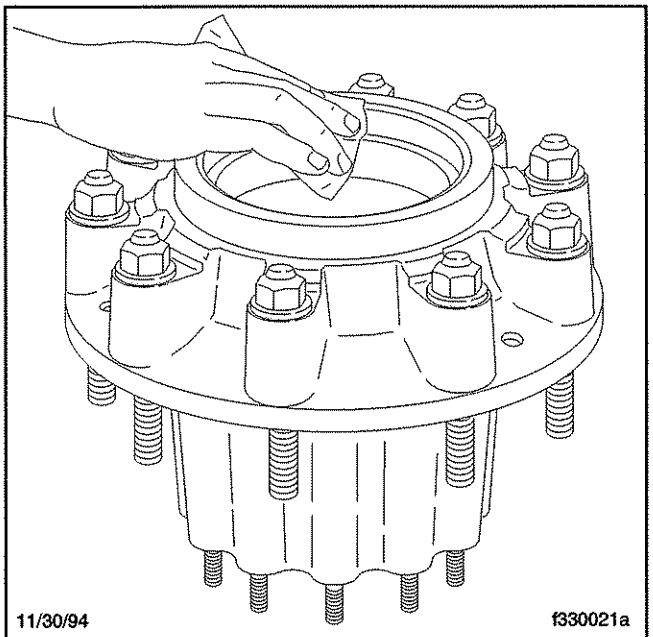
    To minimize the possibility of creating airborne brake lining dust, clean the dust from the brake drum, brake backing plate, and brake assembly, using an industrial-type vacuum cleaner equipped with a high-efficiency filter system. Then, using a rag soaked in water and wrung until nearly dry, remove any remaining dust. Don't use compressed air or dry brushing to clean the brake assembly.
14. Remove the oil seal, using an oil seal removal tool.
15. Remove the inner wheel bearing from the hub. If the bearings aren't easily removed, place a protective cushion where it will catch the bearing. Then, use a hardwood drift and a light hammer to gently tap the bearing (and seal, if needed) out of the cup. Handle the bearings with clean, dry hands. Wrap them in clean oil-proof paper or lint-free rags.
16. Remove all burrs from the shoulder and the seal bore with an emery cloth or a file. See **Fig. 4** and **Fig. 5**. Clean any metal filings from the parts.

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.

Installation (See Fig. 1)

⚠ WARNING

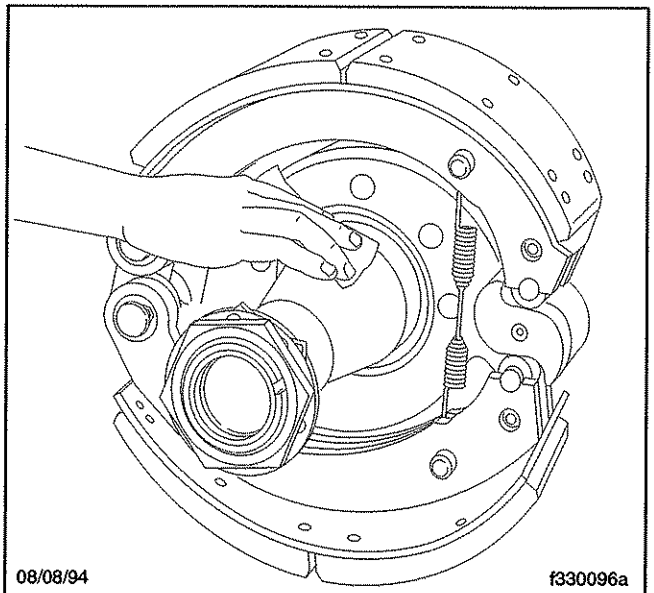
Breathing brake lining dust (asbestos or non-asbestos) could cause lung cancer or lung disease. OSHA has set maximum levels of exposure and requires workers to wear an air purifying respirator approved by MSHA or NIOSH. Wear a res-



NOTE: Typical application.

Fig. 4, Clean the Hub Shoulder

Hub Assembly Removal and Installation, Spoke Wheels



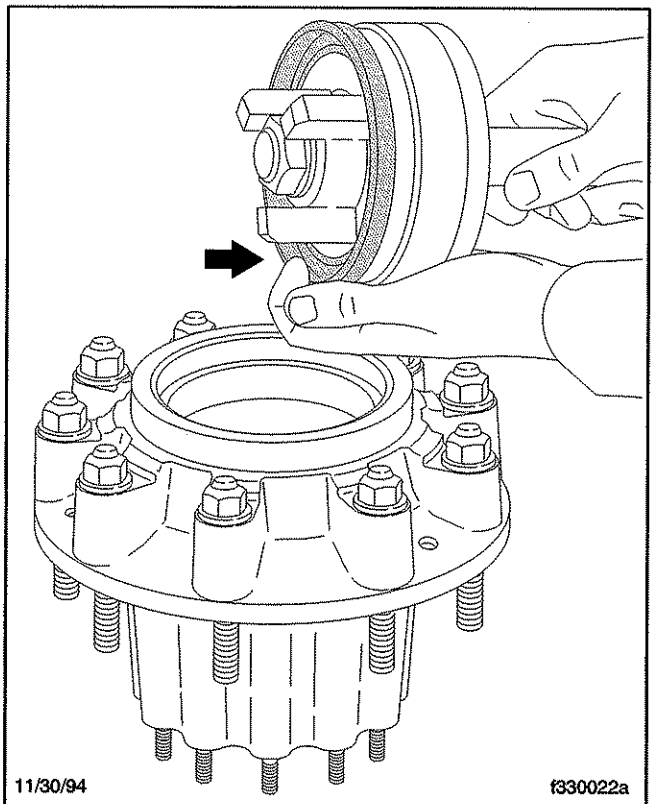
NOTE: Typical application.

Fig. 5, Clean the Spindle

pirator at all times when servicing the brakes, continuing through installation of the wheels.

Commercial cleaning solvents are toxic, can cause severe skin irritation, and may be fire hazards. When using solvents, follow the safety precautions recommended by the solvent manufacturer.

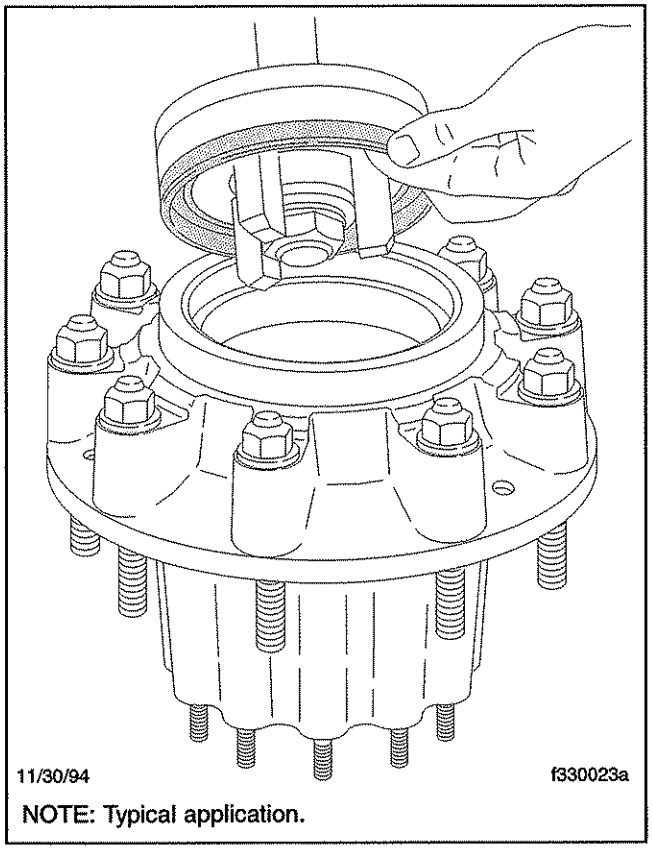
1. Using clean solvent, remove the old oil from the axle spindle and also the disassembled parts. Inspect and clean the wheel hub cavity and the wheel bearings as instructed under **Subject 110**. Allow the parts to dry, or dry them with a clean, absorbent, and lint-free cloth or paper.
2. Wrap a protective layer of friction tape on the axle spindle threads.
3. If it was removed, attach the brake drum or rotor to the wheel. Install the brake drum or rotor bolts and nuts, then tighten the nuts to the torque values in the torque table in **Specifications, 400**. See **Group 42** for additional instructions.
4. Coat both bearing assemblies with fresh oil. Install the inner wheel bearing and oil seal. Handle the bearings with clean, dry hands.
   - 4.1 Seat the small outer diameter of the seal in the recess of the tool adaptor. See **Fig. 6**. The correct adaptor is identified on the box.
   - 4.2 Insert the centering plug of the tool in the bore of the inner bearing cone. See **Fig. 7**. The plug prevents cocking of the seal in the bore.
   - 4.3 Hold the tool handle firmly, and strike it until the sound of the impact changes as the seal bottoms out. See **Fig. 8**. Hold the tool firmly to avoid bounce or unseating of the seal from the adaptor.
   - 4.4 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.
5. Wipe a film of axle oil on the axle spindle to prevent rust from forming behind the inner wheel bearing.
6. Using a wheeled support, mount the wheel and drum assembly on the axle spindle; be careful not to unseat the bearings or seal.



NOTE: Typical application.

Fig. 6, Seat the Seal in the Tool

Hub Assembly Removal and Installation, Spoke Wheels



NOTE: Typical application.

Fig. 7, Insert the Tool

7. Fill the hub cavity with oil, and install the outer wheel bearing; handle the bearings with clean, dry hands. Then remove the friction tape from the axle spindle threads.

8. Adjust the wheel bearings as follows (see **Fig. 3**):

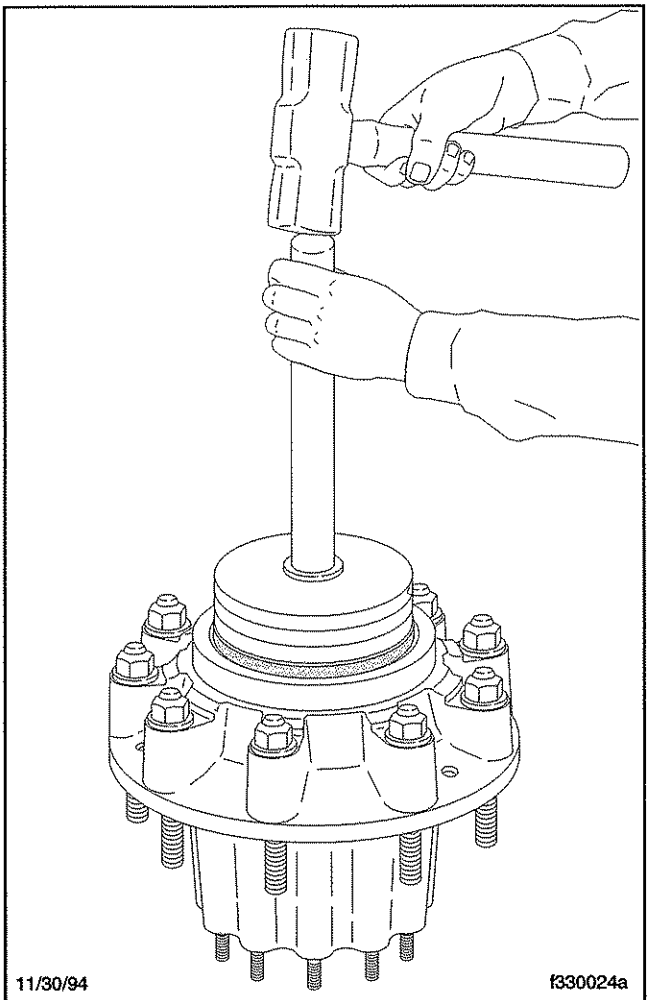
   IMPORTANT: Be sure there is enough clearance between the brake shoes and the brake drum, so brake shoe drag won't interfere with bearing adjustment.

   8.1 After the wheel hub and bearings are assembled on the spindle, tighten the inner (adjusting) nut 200 lbf·ft (271 N·m) while rotating the wheel hub assembly.

   8.2 Back off the inner nut one full turn.

   8.3 Tighten the inner nut 50 lbf·ft (68 N·m) while rotating the wheel hub assembly.

   8.4 Back off the inner nut one quarter turn.



NOTE: Typical application.

Fig. 8, Strike the Tool

NOTE: If you're securing the wheel bearings with a pierced lockring, and no hole in the lockring aligns with the dowel on the adjusting nut, remove the lockring, turn it over and install it, again. If a hole still doesn't align with the dowel, loosen the adjusting nut, but only enough to align the dowel with a hole in the lockring.

8.5 Install the locking device:

- Tanged nut-lock
- Lockring
- Lockwasher *and* a lockring
- Nut-lock *and* a lockring

Hub Assembly Removal and Installation, Spoke Wheels

Then install the jam nut, and tighten it to the applicable torque in **Table 1**.

8.6 With the jam nut installed and tightened, attach a dial indicator to the hub and set the point of the indicator in line with the end of the axle spindle.

If using aluminum hubs, you may have to install the brake drum on the hub to provide a steel base for the magnet of the dial indicator. Mount the drum on the hub's drum pilot, then adjust the brake or have someone apply the brakes to hold the drum securely while you secure the drum using the stud at the 12 o'clock position, then the studs at about the 4 o'clock and 8 o'clock positions.

NOTE: If using a stud-piloted hub and a steel drum, install 1–1/4 inch washers between the nuts and the drum.

8.7 Release the brakes if you used them to hold the drum while installing it.

Grip the sides of the hub at the three o'clock and nine o'clock positions, then push the hub (and drum, if applicable), to seat the inboard bearing set. Zero the dial indicator.

Grip the sides of the hub at the three o'clock and nine o'clock positions, then pull the hub (and drum, if applicable). Read the dial indicator, and note the end play.

Push the hub back in to confirm that the needle of the dial indicator returns to zero.

The end play must be between 0.001 and 0.005 inch (0.025 and 0.127 mm).

9. If the end play is not within this range, remove the jam nut and locking device, and back off or tighten the inner (adjusting) nut to adjust the end play. Keep the following in mind:

If you're using a nut-lock: turning the inner nut 1/4 turn will change the end play about 0.020 inch (0.508 mm).

If you're using a lockring: turning the inner nut one lockring hole will change the end play about 0.005 inch (0.127 mm). If you take the lockring off and reverse it, then turn the inner nut to the next hole, this will change the end play about 0.0025 inch (0.0635 mm).

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 (0.025 and 0.127 mm), adjust the inner (adjusting) nut, again.

10. Once the end play is correct, bend the nut-lock or lockwasher as applicable to lock the jam nut and/or adjusting nut in place.
11. Rotate the wheel in both directions. It should rotate freely with no dragging or binding.
12. Install a new gasket on the drive axle studs.
13. Install the drive axle shaft. The splined end of the axle shaft must seat before the drive axle flange will fit over the studs.
14. If equipped, install the dowels and washers on the drive axle studs. Install the drive axle nuts. Using the sequence shown in **Fig. 9**, tighten the nuts to the torque values in the torque table in **Specifications, 400.**
15. Install the brake caliper, if removed. See **Group 42** for instructions.
16. Install the rim and tire assemblies. For instructions, see **Group 40.**

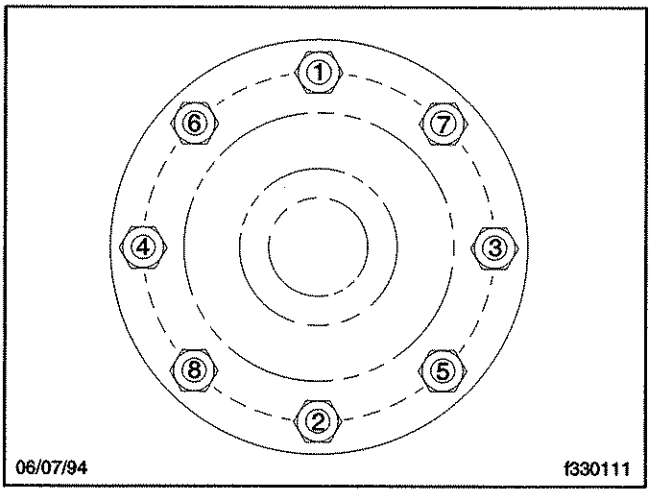


Fig. 9, Axle Shaft Flange Nut-Tightening Sequence

Hub Assembly Removal and Installation, Spoke Wheels

Locking Device	Torque: lbf·ft (N·m)	
	1-1/8 to 2-1/2 Inch Jam Nuts	2-5/8 Inch or Larger Jam Nuts
Tanged Nut-Lock	200–300 (271–407)	
Lockring		
Tanged Nut-Lock and Lockring	200–300 (271–407)	250–400 (339–542)
Lockwasher and Lockring		

Table 1, Jam Nut Torques

⚠ WARNING

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

17. Fill the axle with lubricant.

⚠ WARNING

Failure to add oil to the axle housing bowl or the wheel hub after the drive axle shaft and wheel have been serviced will damage the wheel bearings and cause them to seize during vehicle operation. See Fig. 10. Seized bearing rollers can cause sudden damage to the tire or axle, possibly resulting in personal injury.

17.1 Pour the recommended drive axle lubricant through the axle housing filler hole (**Fig. 11** or **Fig. 12**) until the lubricant is level with the bottom of the hole. See **Fig. 13**. See **Specifications, 400** for the recommended axle lubricants. Tighten the plug 35 lbf·ft (47 N·m).

17.2 Tilt the axle to the left and right, by jacking the opposite side. Hold the tilted position for one minute on each side, to allow oil to run into the wheel end.

17.3 Return the axle to a level position, and add oil through the axle housing filler hole. About one extra liter (two pints) of lubricant will be needed, to bring the oil level even with the base of the filler hole.

NOTE: Drive axle wheel bearings are lubricated by oil drawn from the axle housing bowl section.

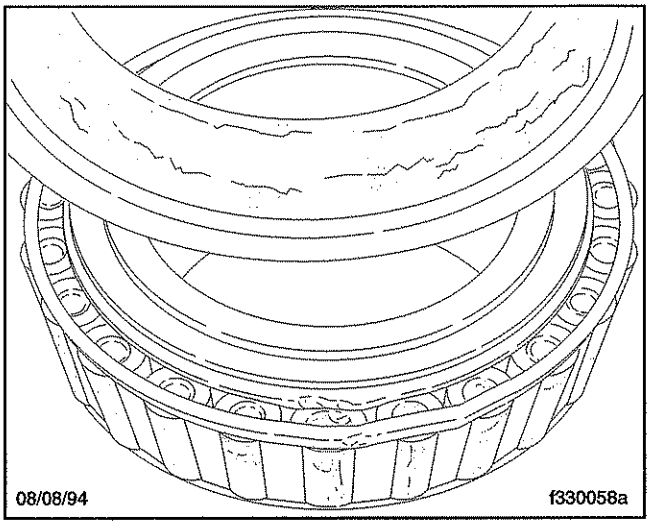
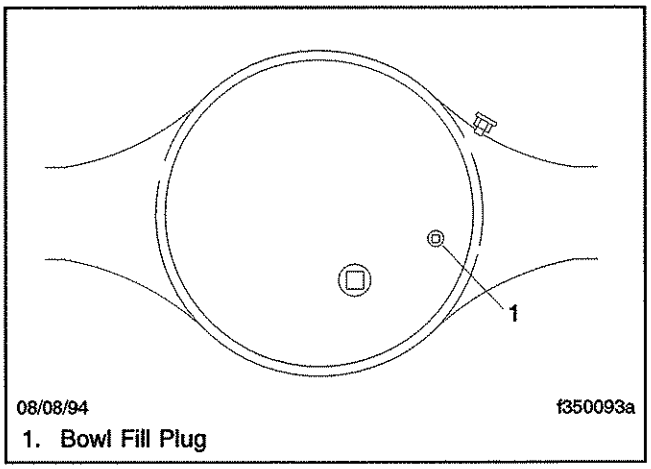


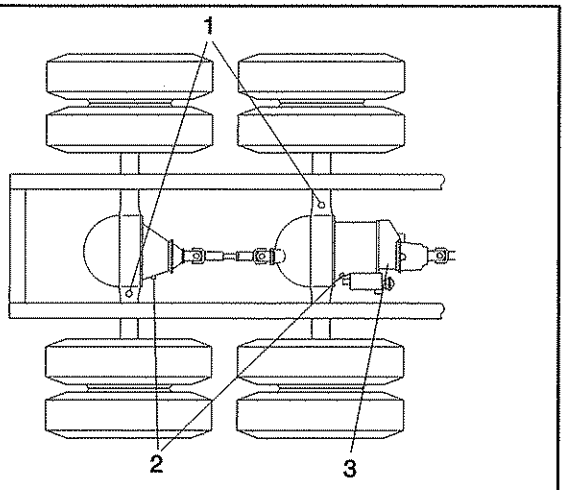
Fig. 10, Bearing Damage Resulting from Inadequate Lubrication



1. Bowl Fill Plug

Fig. 11, Filler Hole

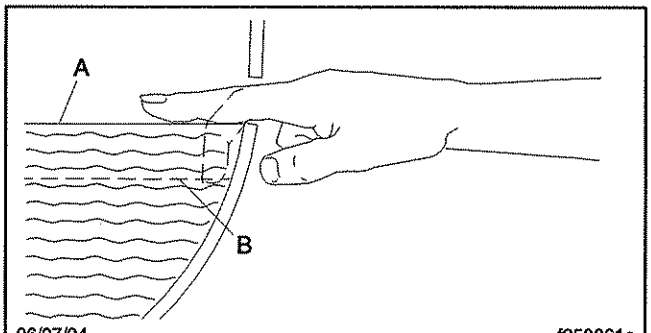
Hub Assembly Removal and Installation, Spoke Wheels



06/07/94 f350062a

1. Axle Housing Breathers
2. Carrier Fill Hole Plugs
3. Interaxle Differential

Fig. 12, Fill Hole Plug and Axle Housing Breather Locations



06/07/94 f350061a

A. Correct: Lube level at the bottom of the fill hole.
B. Incorrect: Lube level is below the fill hole.

Fig. 13, Checking the Lubricant Level

This method ensures good exchange of heat, prevents stagnation, and minimizes the maintenance required on bearings and hub assemblies.

18. Turn the wheels, and check the lubricant level.
19. If the vehicle is equipped with air brakes, adjust the rear axle brakes at the slack adjusters. For instructions, see **Group 42** of the *Business Class Trucks Maintenance Manual.*
20. Remove the safety stands from under the axle, then lower the vehicle.
21. Apply the parking brakes, then remove the chocks from the front tires.

Wheel Hub Assembly and Drive Axle Inspection

1. Inspect the wheel hub 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.

2. Remove all the old oil from the spoke wheel or hub cavity. Inspect the inner surface of the wheel or hub for cracks, dents, wear, or other damage. Replace the wheel or hub if damaged.

3. Remove all the old grease or oil from the surfaces of the wheel bearing cups. Inspect the cups for cracks, wear, spalling, or flaking. **See Fig. 3.** Replace the cups if damaged in any way; for instructions, **refer to "Wheel Bearing Cup Removal and Installation, Ferrous Hubs, 120."**

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

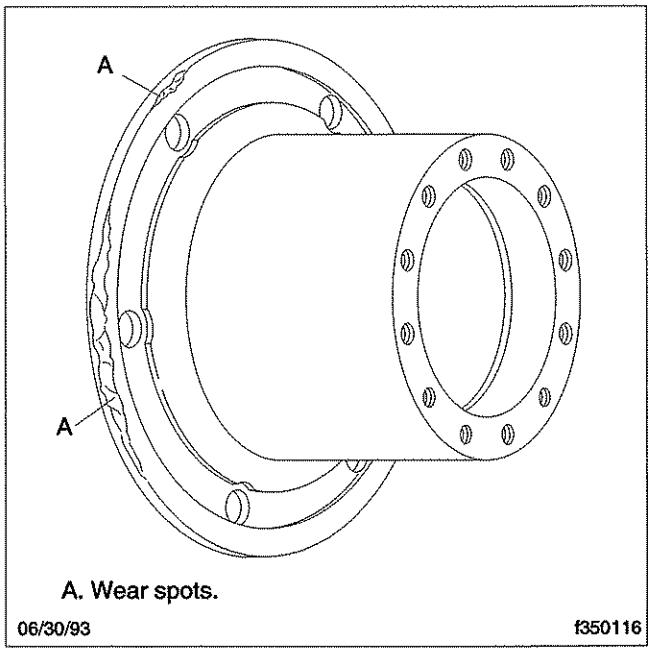
   Inspect the wheel studs or rim studs. Replace studs that are stripped, broken, bent, or otherwise damaged **(Fig. 5);** for instructions, **refer to "Wheel Stud Replacement, Disc Wheels, 130"** or **"Spoke Rim Stud Replacement, Spoke Wheels, 140."**

5. Inspect the drive axle studs. Replace the studs that have stripped threads or are broken. Also, replace bent or otherwise damaged studs; for instructions, **refer to "Drive Axle Stud Replacement, 150."**

6. Inspect the drive axle shaft. If the vehicle has been overloaded, or used under severe or improper operations, the drive axle shaft may be twisted, bent, or otherwise damaged. **See Fig. 6.** Replace the drive axle shaft and flange assembly if damaged.

⚠ CAUTION

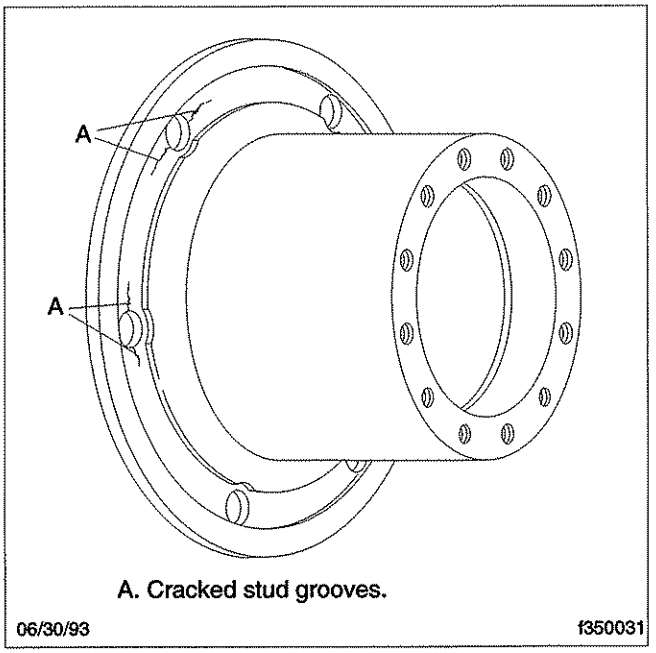
CAUTION: If the drive axle shaft and flange assembly is not replaced once the shaft is twisted or otherwise damaged, it will continue to twist until fracture occurs. With complete fracture of the shaft, other axle parts may be damaged which will increase the cost of repairs. Whenever a drive axle



A. Wear spots.

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Fig. 1, Typical Wheel Hub, Damaged



A. Cracked stud grooves.

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Fig. 2, Typical Wheel Hub, Damaged

Axle Components Cleaning and Inspection

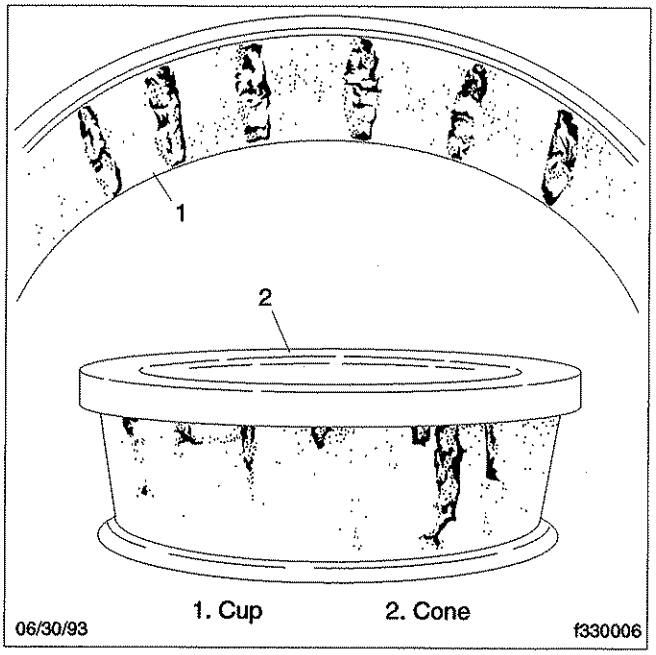


Fig. 3, Spalling (Flaking) of Wheel Bearing Assembly

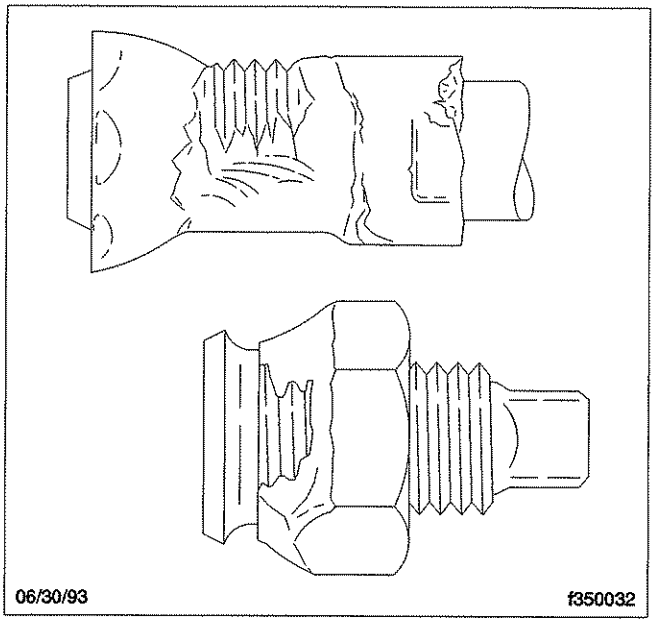


Fig. 4, Damaged Wheel Stud Nuts

assembly is damaged, the drive axle shaft and flange on the opposite side of the axle should also be carefully examined, and replaced if damaged.

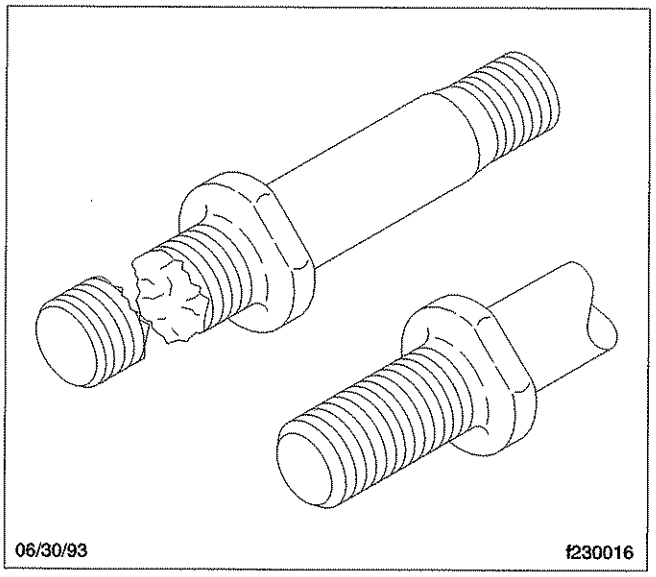


Fig. 5, Damaged Wheel Studs (shouldered type)

7. Inspect the drive axle shaft-to-flange surface. Loose wheel bearings can lead to progressive fatigue fractures where the shaft and flange meet. **See Fig. 7.** Replace the drive axle assembly if damaged.

8. Inspect the inboard portion of the drive axle flange. Minor burrs or rough spots can adversely affect the

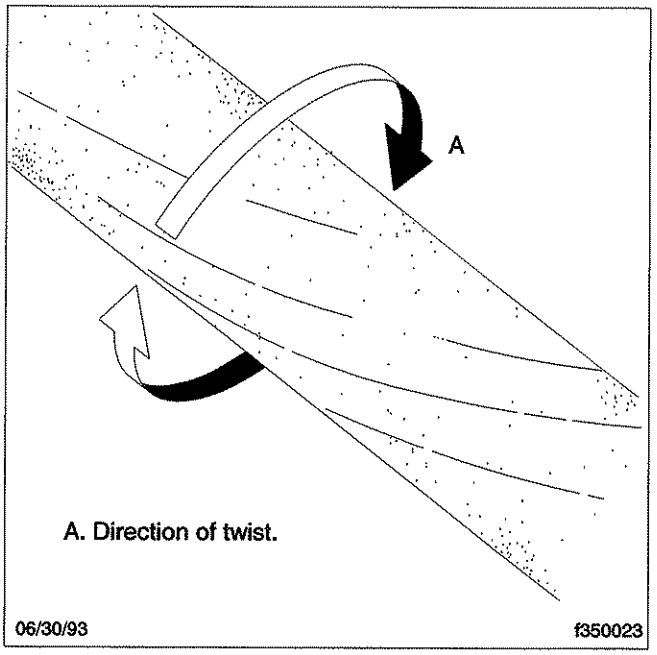
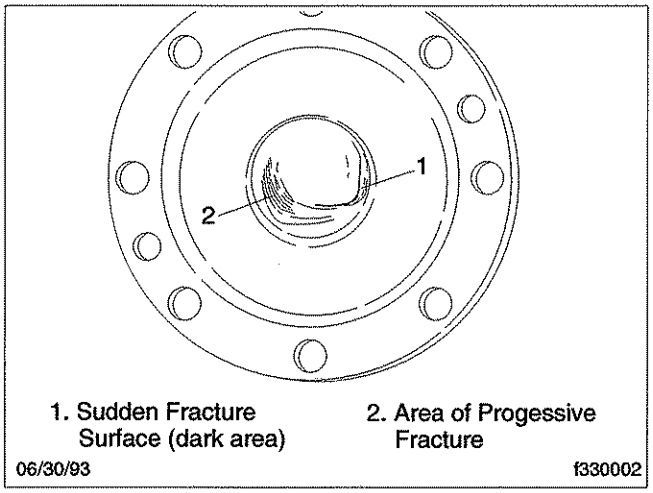


Fig. 6



1. Sudden Fracture Surface (dark area)
2. Area of Progessive Fracture

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Fig. 7

sealing action of the oil or grease seals. Remove the burrs or rough spots using fine-grit emery cloth. If they cannot be removed, replace the drive axle shaft.

9. Inspect the drive axle flange around the stud holes. Replace the drive axle shaft and flange assembly if any of the following conditions exist:
   - cracks on the flange surface;
   - metal build-up around the stud holes (a result of wear);
   - out-of-round stud holes.

Wheel Bearing Cleaning and Inspection

CLEANING

⚠ WARNING

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

Don't 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.

Wheel bearings should be very closely inspected at the time of disassembly. The best inspection conditions are possible only after the bearings have been thoroughly cleaned using kerosene or diesel fuel oil, and a stiff brush **(Fig. 8).** Before inspecting, clean the bearings as follows:

1. Clean all old oil from the bearings and hub cavities, with kerosene or diesel fuel and a stiff brush. **See Fig. 8.** Don't use gasoline or heated solvent.
2. 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 that is wet with kerosene or diesel fuel, and the kerosene or diesel fuel may dilute the lubricant.

INSPECTION

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:

1. The large ends of the rollers are worn flush to the recess; the radii at the large ends of the rollers are worn sharp. These are signs of advanced wear. **See Fig. 9.**
2. Visible step wear, especially at the small end of the roller track, or deep indentations, cracks, or breaks in the cone surfaces. **See Fig. 10.**
3. Bright rubbing marks on the dark phosphate surfaces of the bearing cage. **See Fig. 11.**
4. 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, check the oil seal sealing surfaces.
5. Etching or pitting on functioning surfaces. **See Fig. 12.**
6. Spalling (flaking) of the bearing cup, roller, or cone surfaces. **See Fig. 3.**

After inspection, brush the bearings with fresh axle lubricant.

Axle Components Cleaning and Inspection

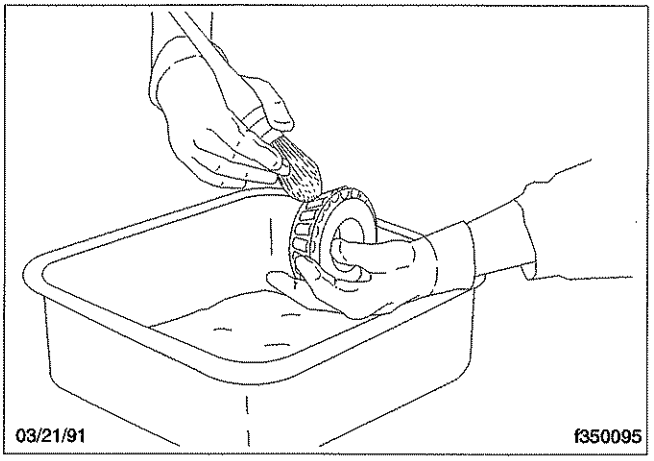


Fig. 8

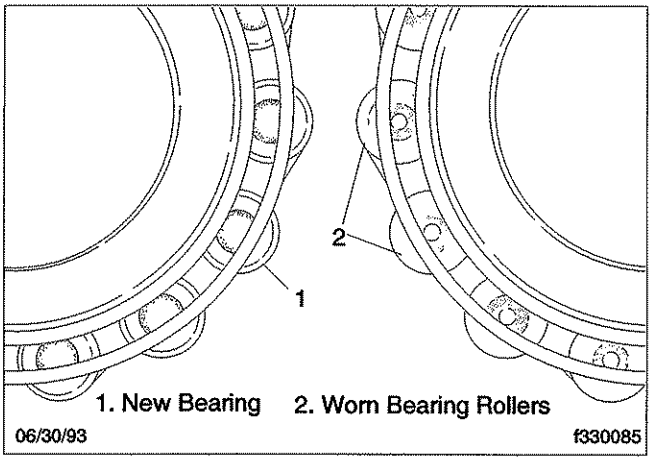


Fig. 9

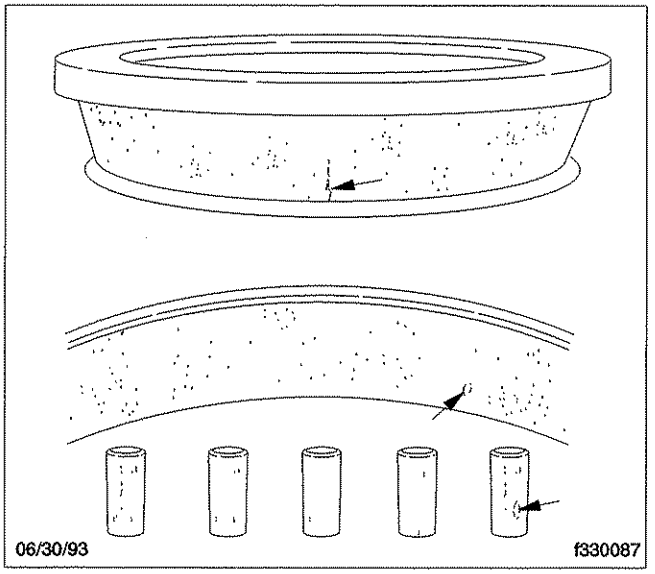


Fig. 10, Indentations, Cracks, or Breaks in Bearing Surfaces

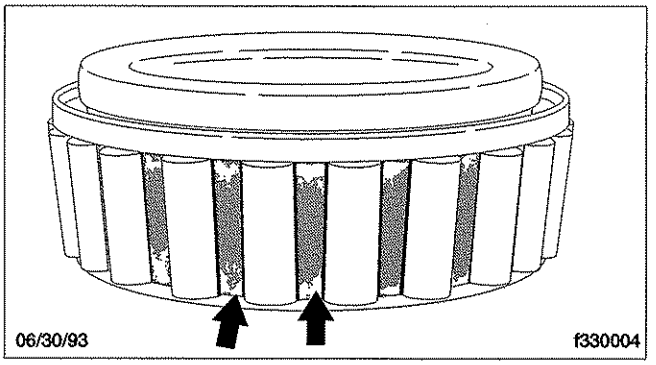


Fig. 11, Rubbing Marks on Bearing Cage

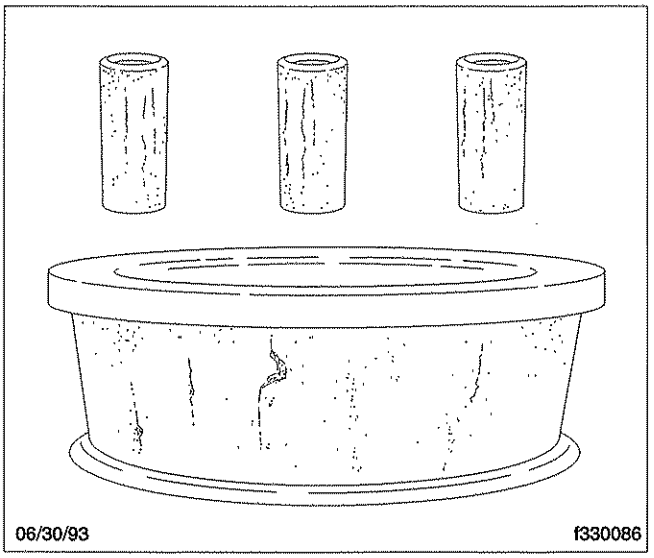


Fig. 12, Etching (Pitting) on Bearing Surfaces

Wheel Bearing Cup Removal and Installation, Ferrous Hubs

Removal

Wheel bearing cups are removed from ferrous hubs by driving them out; there is no need to first heat the hubs.

⚠ WARNING

WARNING: Commercial cleaning solvents are toxic, can cause severe skin irritation, and may be fire hazards. When using solvents, follow the safety precautions recommended by the solvent manufacturer.

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

Wheel bearing cups are installed in ferrous hubs by pressing them in; there is no need to first heat the hubs.

⚠ WARNING

WARNING: Commercial cleaning solvents are toxic, can cause severe skin irritation, and may be fire hazards. When using solvents, follow the safety precautions recommended by the solvent manufacturer.

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 hub-contact surface of the replacement bearing cup with a film of grease.
4. Position the cup in the hub and press it into place, using a suitable tool against the outer edge of the cup. Cups must seat against the shoulder in the hub.

⚠ WARNING

WARNING: To prevent skin irritation, wear chemical resistant gloves when working with diesel fuel or kerosene. Also, don't expose these fluids to flames or heat exceeding 38°C (100°F); both are combustible, and could cause personal injury 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.

Wheel Stud Replacement, Disc Wheels

Replacement

⚠ WARNING

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 (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.

1. Remove the wheel hub from the axle. For instructions, refer to **"Hub Assembly Removal and Installation, Disc Wheels, 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 evenly supported around and next to the stud being removed. With steady movement, press the damaged stud out of the hub.

⚠ CAUTION

CAUTION: Don't use a drift and hammer or concentrated heat to remove or install 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.

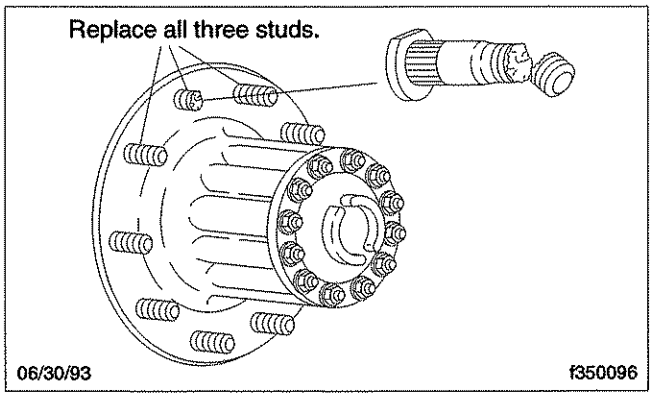


Fig. 1

4. Apply a coat 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 evenly supported around and next to the stud being installed.
6. Position the stud in its hole.

⚠ CAUTION

CAUTION: 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.

IMPORTANT: If the driver's side of the vehicle is being serviced, the replacement wheel stud and inner wheel nut must be stamped with an "L" (left-hand threaded), and the nut's face must be stamped "Left." **Refer to Fig. 2.** If the passenger's side of the vehicle is being serviced, the replacement stud and inner wheel nut must be stamped with an "R" (right-hand threaded), and the nut's face must be stamped "Right."

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 in the hub. If the head of the stud is embedded in the hub, replace the hub.

⚠ WARNING

WARNING: 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 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, **refer to "Hub Assembly Removal and Installation, Disc Wheels, 100."**

Wheel Stud Replacement, Disc Wheels

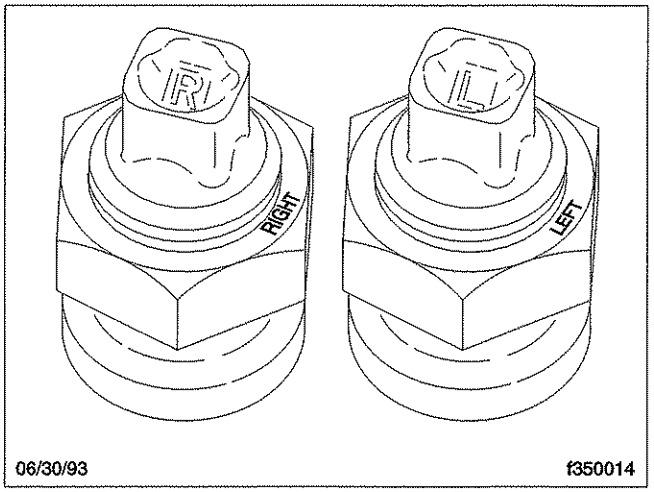


Fig. 2, Wheel Nuts

Rim Stud Replacement, Spoke Wheels

Replacement

1. Remove the rim and tire assemblies from the spoke wheel. For instructions, **refer to the wheels and tires group.**
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, go to the step for tapping out the rim stud hole.

   If the rim stud is broken near the surface of the wheel, 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 centerpunch the surface as a starting point for drilling. Remove the stud.

   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 are damaged, replace the wheel.

   2.2 Don't drill more than 32 mm (1-1/4 inches) into the broken stud, as measured at the stud's entrance into the wheel. Drilling through the bottom of the rim stud could damage the wheel. If the wheel 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 rim stud hole in the wheel to rid the threads of old stud-locking compound. Use an appropriate sized tap, depending on the original rim stud installation size.
4. Be sure the threads of the new stud are clean and dry. Then, coat the insertion end of the rim stud with an anaerobic thread-lock compound.
5. Using double nuts on the fine thread portion of the stud, install the new stud. Seat the rim stud using the torque values in the torque table in **"Specifications, 400."**
6. Allow enough time for the thread-lock compound to set, as suggested by the manufacturer.
7. Install the rim and tire assemblies. For instructions, **refer to the wheels and tires group.**

Drive Axle Stud Replacement

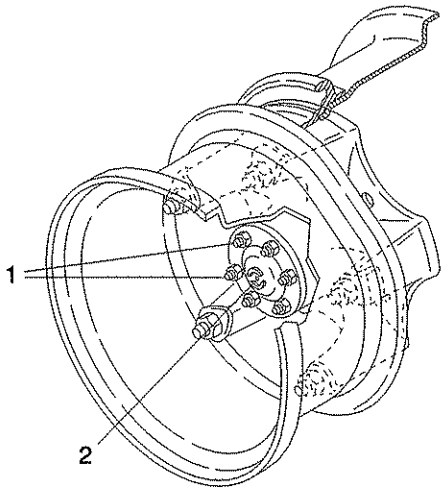
Replacement

NOTE: If the hub has been removed from the axle, go to the step for removing the stud.

1. Apply the parking brakes.
2. Oil will spill as the drive axle shaft is removed. Place a suitable container inside the wheel and under the drive axle flange. Safely discard the lubricant after removal.
3. Remove the drive axle shaft.
   - 3.1 Remove the drive axle stud nuts (**see Fig. 1**), and the washers.
   - 3.2 Using a hammer and a soft drift, such as one made of brass, sharply tap the center portion of the drive axle flange (**see Fig. 1**). The shaft will usually spring slightly outward after the seal has broken.

⚠ CAUTION

CAUTION: 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.



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1. Drive Axle Studs and Nuts
2. Center Portion of Drive Axle Flange

Fig. 1

   - 3.3 If the drive axle shaft does not spring outward, the seal may have loosened enough to allow the shaft to be manually pulled from the axle housing. Try to manually remove the drive axle shaft from the housing. If the seal has not broken, repeat steps as required.
4. If equipped, remove the tapered dowels and washers from the drive axle flange.
5. Remove and discard the gasket.
6. 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, go to the step for tapping out the drive axle stud hole.

   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 centerpunch the surface as a starting point for drilling.
   - 6.1 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.
   - 6.2 Do not drill more than 32 mm (1-1/4 inches) 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.
   - 6.3 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.
7. 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.
8. 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.

Drive Axle Stud Replacement

9. 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 the torque table in **Specifications, 400.**
10. Allow sufficient time for the thread-lock compound to set, as suggested by the manufacturer.
11. If the hub was removed from the axle, proceed to **Subject 100** or **Subject 102** for installation instructions. If the hub was not removed from the axle, install the drive axle shaft.
    - 11.1 Install a new axle flange gasket over the drive axle studs.
    - 11.2 Install the drive axle shaft in the axle housing. The splined end of the shaft must seat before the drive axle flange will fit over the drive axle studs.
    - 11.3 If equipped, install the dowels and washers on the drive axle studs. Install the drive axle nuts. Using the sequence shown in **Fig. 2**, tighten the nuts to the torque values in the torque table in **Specifications, 400.**
    - 11.4 Add fresh oil to the wheel hub. For instructions, refer to **Subject 100** or **Subject 102.**

⚠ WARNING

WARNING: Failure to add oil to the wheel hub after the drive axle shaft has been serviced 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.

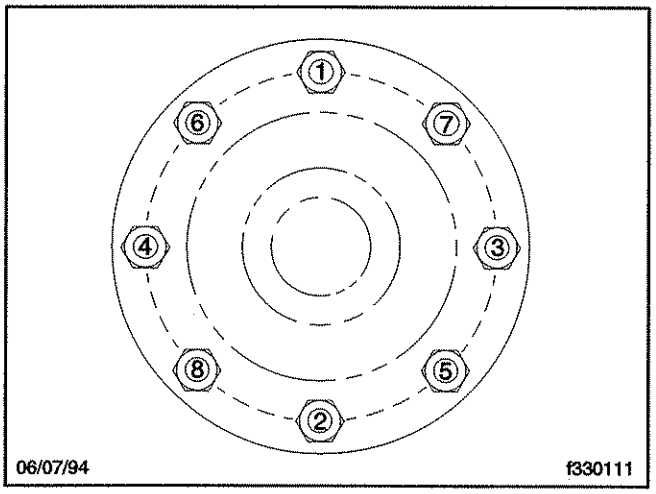


Fig. 2, Axle Shaft Flange Nut-Tightening Sequence

Troubleshooting

This subject contains the following troubleshooting tables:

- Noisy Bearings or Excessive Bearing Replacement Intervals
- Broken Wheel or Rim Studs
- Damaged Hub
- Loss of Lubricant From the Wheel Hubs

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, **refer to "Specifications, 400."**
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 part in contact with the bearing lubricant.
An incorrect adjustment of the wheel bearings is causing noise and wear.	Adjust the wheel bearings following the instructions in **Subject 100** and **Subject 102** 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 the installation.	Clean then inspect the bearing rollers. Replace the bearing if damaged. Coat the replacement bearings with fresh oil. For lubricant specifications, **refer to "Specifications, 400."**

Problem—Broken Wheel or Rim Studs

Possible Cause	Remedy
The wheel or rim nuts were overtightened.	Replace the wheel or rim studs. **Refer to the wheels and tires group** for the wheel or rim tightening sequence.
The vehicle is being overloaded.	Don't exceed the maximum load-carrying capacity of the vehicle.

Problem—Damaged Hub

Possible Cause	Remedy
(Bent flange) Incorrect installation of the wheel studs, such as using a hammer and drift, or the hub flange wasn't fully supported on the press during wheel stud replacement.	Replace the hub assembly. Replace the wheel studs as instructed under **"Wheel Stud Replacement, Disc Wheels, 130."**
Insufficient tightening of the wheel nuts to the wheel hub.	Replace the hub assembly and tighten the wheel nuts to the values in the torque table in **"Specifications, 400."**

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 the torque table in **"Specifications, 400."** 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 can't be removed, replace the drive axle shaft.

Specifications

Torque Values		
Description	**Size (grade 8)**	**Torque lbf.ft (N.m)**
Spoke Wheel Brake Drum Nuts	3/4–10	240 (325)
Hub Cap Capscrews	5/16–18	15 (20)
Drive Axle Studs-to-Hub	1/2–13	70 (95)
	5/8–11	135 (185)
Drive Axle Stud Nuts	1/2–20	75–115 (102–156)
	5/8–18	185–230 (250–312)
Spoke Wheel Rim Studs	3/4–10	240 (325)
Rotor Capscrews	9/16–12	130 (175)

Table 1, Torque Values

Meritor Drive Axle Lubricant Capacities, Single Axles*			
Axle Model	**Capacity:† pints (liters)**	**Axle Model**	**Capacity:† pints (liters)**
RS-13-120	16 (7.6)	RS-19-220	31 (14.7)
RS-15-120	16 (7.6)	RS-21-145	32 (15.1)
RS-15-210	16 (7.6)	RS-21-160	39.5 (18.7)
RS-17-140	31 (14.7)	RS-21-230	39 (18.5)
RS-17-145	33.6 (15.9)	RS-23-160	42 (19.9)
RS-17-220	31 (14.7)	RS-23-240	45 (21.3)
RS-19-145	34.4 (16.3)		

* Single drive axles equipped with traction equalizers may require a "friction modifier" to correct a slip-stick condition, as described in the vehicle driver's manual. Meritor's experience shows that the following additives perform adequately: Add Elco No. 2 Friction Modifier (1 ounce [30 ml] of additive for each 1 pint [0.5 liter] of lube capacity) or Lubrizol No. 797 or 762 (1 ounce [30 ml] of additive for each 1 pint [0.5 liter] of lube capacity).

† Quantities listed are approximate and include 1 pint (0.5 liter) for each wheel end and with the drive pinion at 3 degrees.

Table 2, Meritor Drive Axle Lubricant Capacities, Single Axles

Eaton Drive Axle Lubricant Capacities, Tandem Axles	
Axle Model	**Capacity:* pints (liters)**
RT-34-135	Forward 29.8 (14.1) Rear 34 (16.1)
RT-40-145	Forward 30.4 (14.4) Rear 34.4 (16.3)

* Quantities listed are approximate and include 1 pint (0.5 liter) for each wheel end and with the drive pinion at 3 degrees.

Table 3, Eaton Drive Axle Lubricant Capacities, Tandem Axles

Specifications

Meritor Drive Axle Recommended Lubricant			
Recommended Lubricant Type	**Ambient Temperature**	**Lubricant SAE Viscosity Grade**	**Meritor Specification**
Hypoid Gear Oil API Service Classification GL-5	–12.2°C (+10°F) and up*	85W–140	0-76-A
	–26.1°C (–15°F) and up*	80W–140	0-76-B
	–26.1°C (–15°F) and up*	80W–90	0-76-D
	–40°C (–40°F) and up*	75W–90	0-76-E
	–40°C (–40°F) to +2°C (+35°F)	75W	0-76-J
	–40°C (–40°F) and up*	75W–140	0-76-L
Synthetic Gear Oil	–40°C (–40°F) and up*	75W–90	0-76-N
	–40°C (–40°F) and up*	75W–140	0-76-M

* There is no upper limit on these ambient temperatures, but axle sump temperature must never exceed 121°C (250°F).

Table 4, Meritor Drive Axle Recommended Lubricant