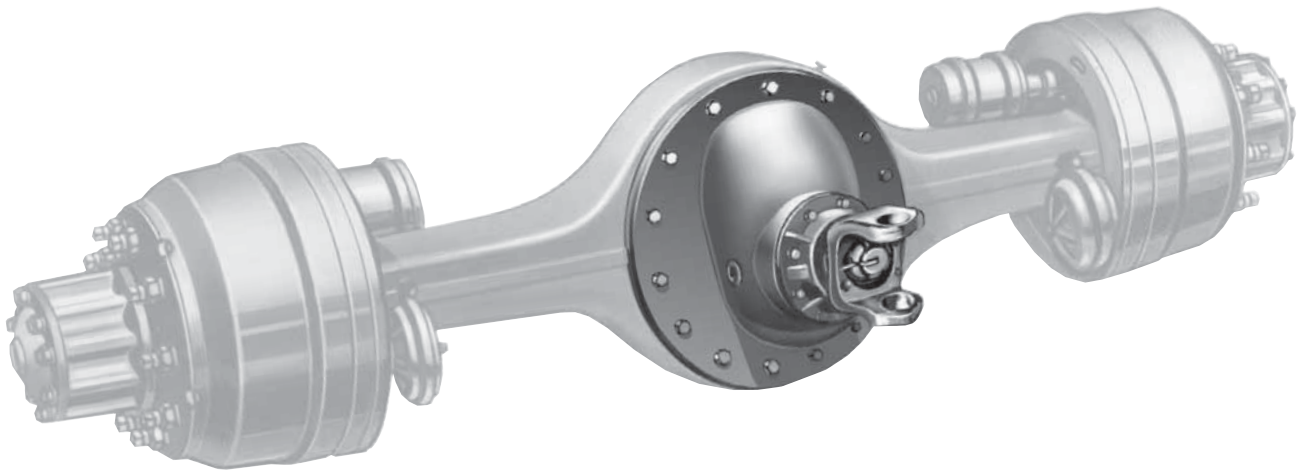


Single Reduction Differential Carriers

Maintenance Manual 5



Standard Carriers
Including: Single Axles,
Rear of Tandem Axles,
Front Drive Steering
Axles

Excluding RS and
RT Series (Rear Only),
Single Reduction Axles
and RF Series Front
Drive Axles

Before You Begin

This manual provides instructions for AxleTech's early production non-RF, -RS or -RT Series axles. Before you begin procedures:

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Caution and Warning safety alerts that precede instructions or procedures you will perform. These alerts help to avoid damage to components, serious personal injury, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.

Safety Alerts, Torque Symbol and Notes

 WARNING	A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury and damage to components.
 CAUTION	A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components and possible serious injury.
	A torque symbol alerts you to tighten fasteners to a specified torque value.
NOTE	A Note provides information or suggestions that help you correctly service a component.

Access Information on AxleTech's Web Site

Additional maintenance and service information for AxleTech's commercial vehicle systems component lineup is also available at www.axletech.com.

Additional Information

For complete maintenance and service procedures for all single reduction differential carriers, call AxleTech's Customer Service Center at 877-547-3907 to order the following publications.

- *Traction Controls* package contains two videos — *Splitting the Difference* T-87127V and *Driver-Controlled Full Locking Main Differential* T-9007V. \$50. Order T-95125V for this package or each video is available individually as well.

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Exploded View — Legend

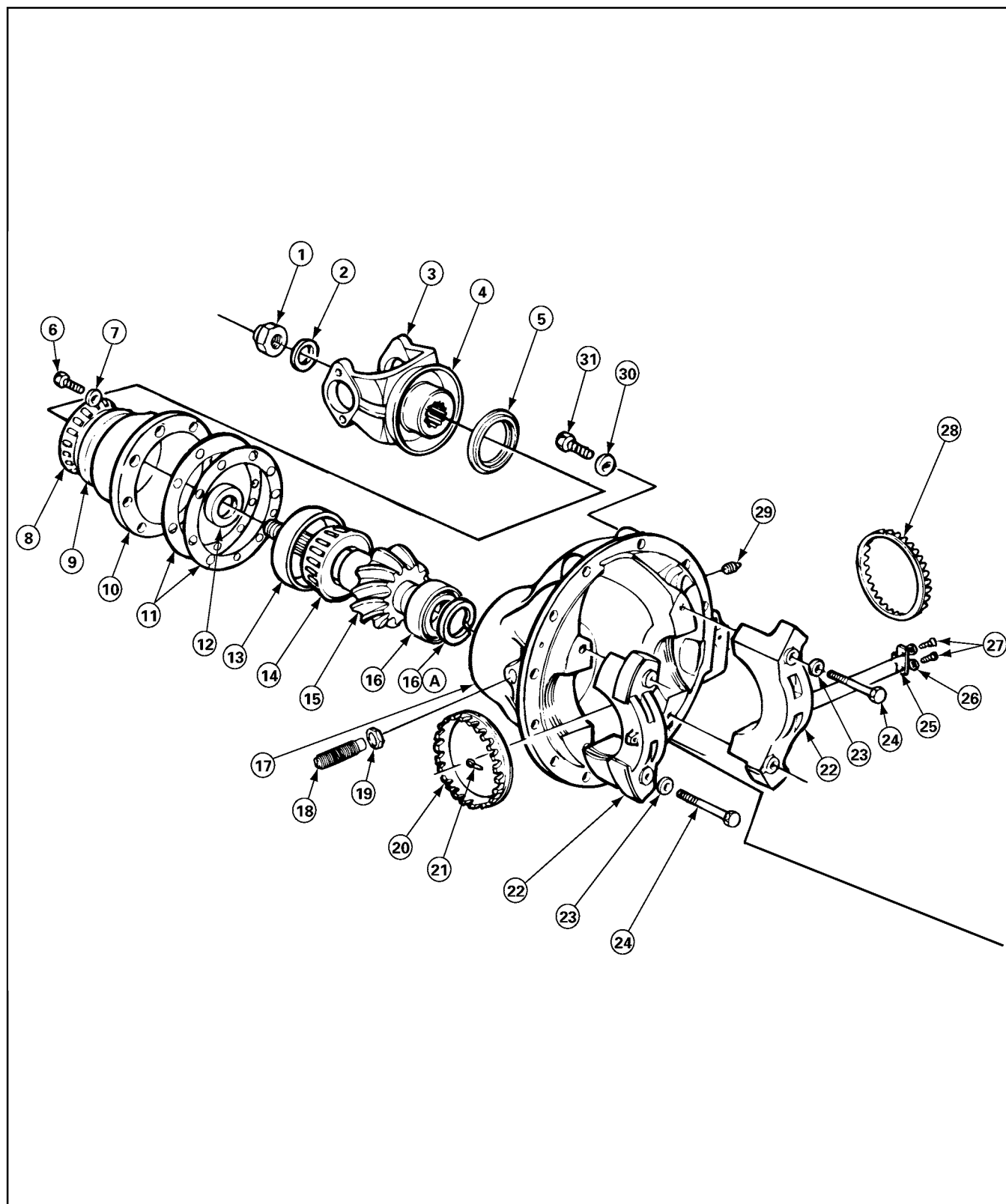
1	Nut — Drive Pinion	26	Washers* — Lock Plate
2	Washer — Drive Pinion*	27	Capscrews* — Lock Plate*
3	Input Yoke* or Flange*	28	Adjusting Ring — R.H.
4	Deflector	29	Plug* — Oil Fill Hole (carrier)
5	Oil Seal	30	Washer* — Capscrew/Plug*
6	Capscrew — Bearing Cage	31	Capscrew/Plug — Sensor Hole
7	Washer	32	Thrust Block*
8	Bearing Cone — Pinion Outer	33	Washers* — Differential Case
9	Bearing Cup — Pinion Outer	34	Nuts* — Differential Case
10	Bearing Cage — Drive Pinion	35	Bearing Cup — Differential L.H.
11	Shims	36	Bearing Cone — Differential L.H.
12	Spacer— Pinion Bearing	37	Nuts* — Ring Gear and Case Half
13	Bearing Cup — Pinion Inner	38	Case Half — Flange
14	Bearing Cone — Pinion Inner	39	Ring Gear
15	Drive Pinion	40	Bolts* or Rivets* — Ring Gear and Case Half
16	Spigot Bearing	41	Side Gears — Differential
16A	Snap Ring	42	Thrust Washers — Differential Pinion
17	Carrier	43	Pinions — Differential
18	Thrust Screw*	44	Spider — Differential
19	Jam Nut* — Thrust Screw*	45	Thrust Washers — Differential Side Gear
20	Adjusting Ring — L.H.	46	Capscrews — Differential Case
21	Cotter* or Pin*	47	Bolts* — Differential Case
22	Caps — Differential Bearing	48	Bearing Cup — Differential R.H.
23	Washers	49	Bearing Cone — Differential R.H.
24	Capscrews — Differential Bearing Cap	50	Case Half — Plain
25	Lock Plate* — Adjusting Ring		

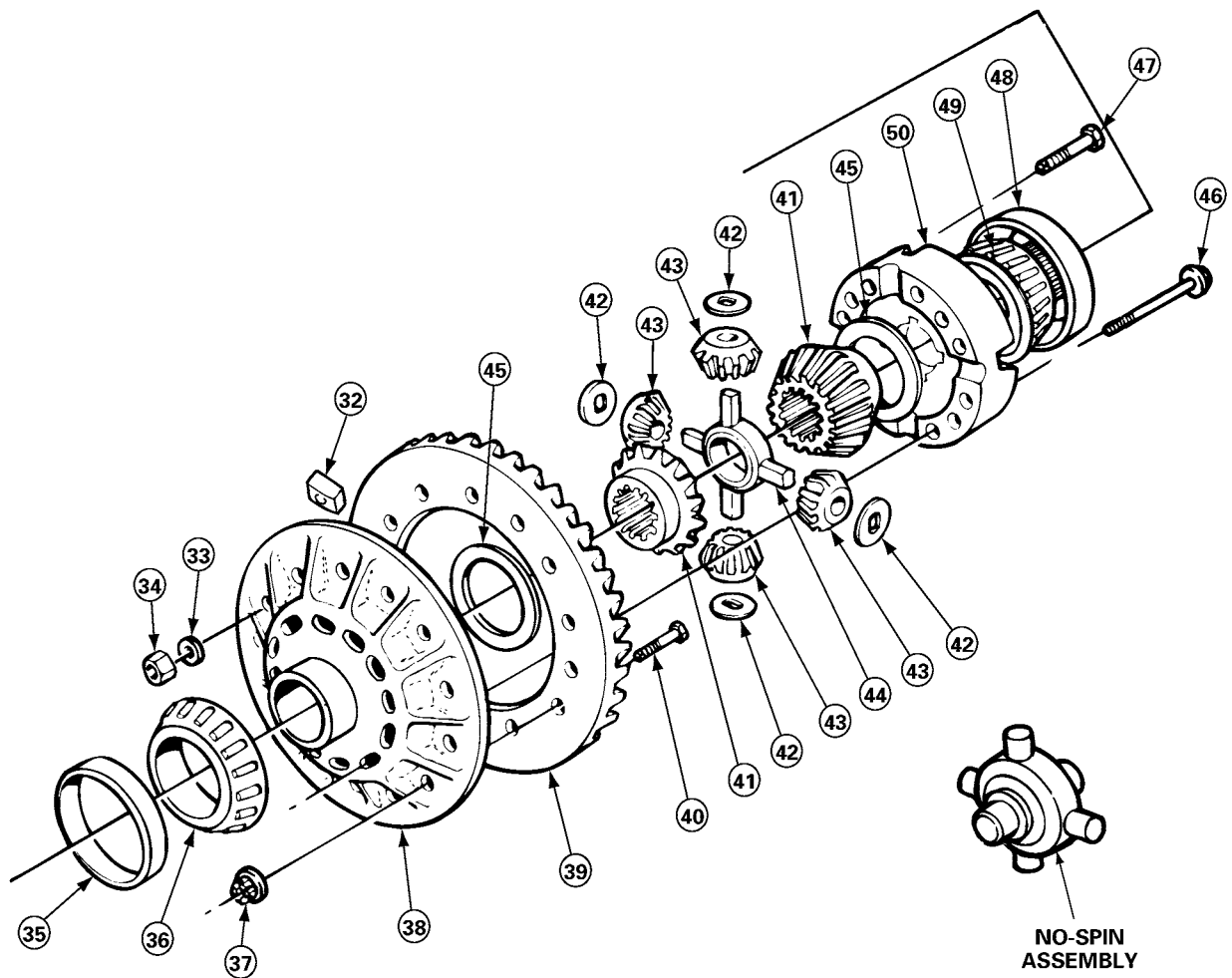
* Some AxleTech carriers do not have these described parts.

NoSPIN® is a registered trademark of Tractech, a division of Dyneer Corp.

Exploded View

Single Reduction Differential Carrier





Standard Single Reduction Carriers

NOTE: For carriers with a differential lock, refer to Maintenance Manual 5A.

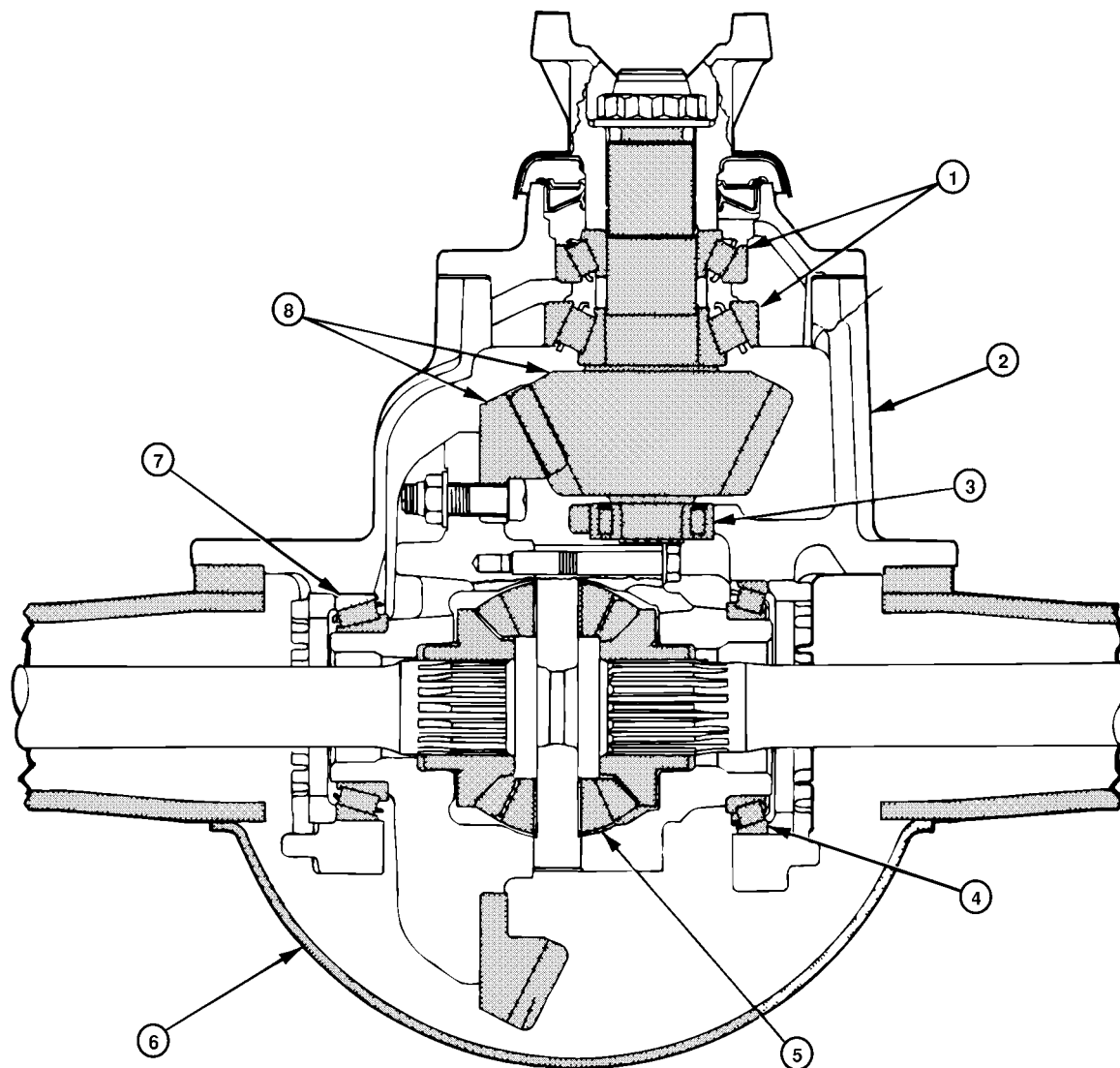
AxleTech single reduction standard carriers, **Figure 1.1**, are used in most AxleTech single axles, rear of tandem axles and front drive steering axles.

The single reduction carrier models are front mounted into the axle housing. These carriers have a hypoid drive pinion and ring gear set and bevel gears in the differential assembly.

A straight roller bearing (spigot) is mounted on the head of the drive pinion. All other bearings in the carrier are tapered roller bearings.

When the carrier operates, there is normal differential action between the wheels all the time.

Figure 1.1



- 1 TAPERED ROLLER BEARINGS
- 2 CARRIER
- 3 STRAIGHT ROLLER BEARING
- 4 TAPERED ROLLER BEARING

- 5 BEVEL DIFFERENTIAL GEARS
- 6 HOUSING
- 7 TAPERED ROLLER BEARING
- 8 HYPOID DRIVE PINION AND RING GEAR

Axle Models Covered in This Manual

The following table lists all axle models covered in this manual.

Single Drive Axles:						For All RS & RT Single Reduction Axle Model Series, Refer to Maintenance Manual 5A.
A-150	E-100	F-140	H-172	Q-100	R-163	
B-100	E-105	G-161	L-100	Q-145	R-170	
B-140	E-150	H-100	L-140	RL-170	S-170	
B-150	F-100	H-140	L-155	R-100	U-140	
C-100	F-106	H-150	L-172	R-140	W-170	
D-100	F-120	H-162	M-172	R-155		
D-140	F-121	H-170	QT-140	R-160		
Rear Axle of Tandem Axles:						
SDHD	SL-100	SQHD	SSHD	SU-170		
SFHD	SLHD	SR-170	ST-170	SUHD		
SHHD	SQ-100	SRHD	STHD	SW-170		
Front Drive Steering Axles:						
FDS-75	FDS-85	FDS-93	FDS-1807	FDS-2100	FDS-2107	FDS-2111
FDS-78	FDS-90	FDS-1600	FDS-1808	FDS-2101	FDS-2110	FDS-2117

Remove Differential Carrier from Axle Housing



WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

1. Raise the end of vehicle where the axle is mounted. Use a jack or other lifting tool, and place safety stands under each side of the axle.

Figure 2.1.



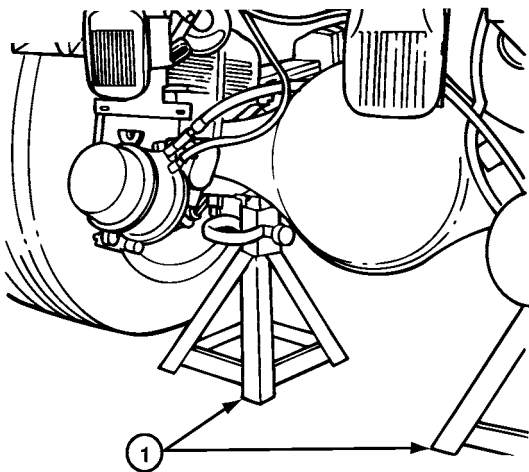
WARNING

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip or fall over. Serious personal injury can result.

2. Place jack stands under each spring seat of the axle to hold vehicle in the raised position.

Figure 2.1.

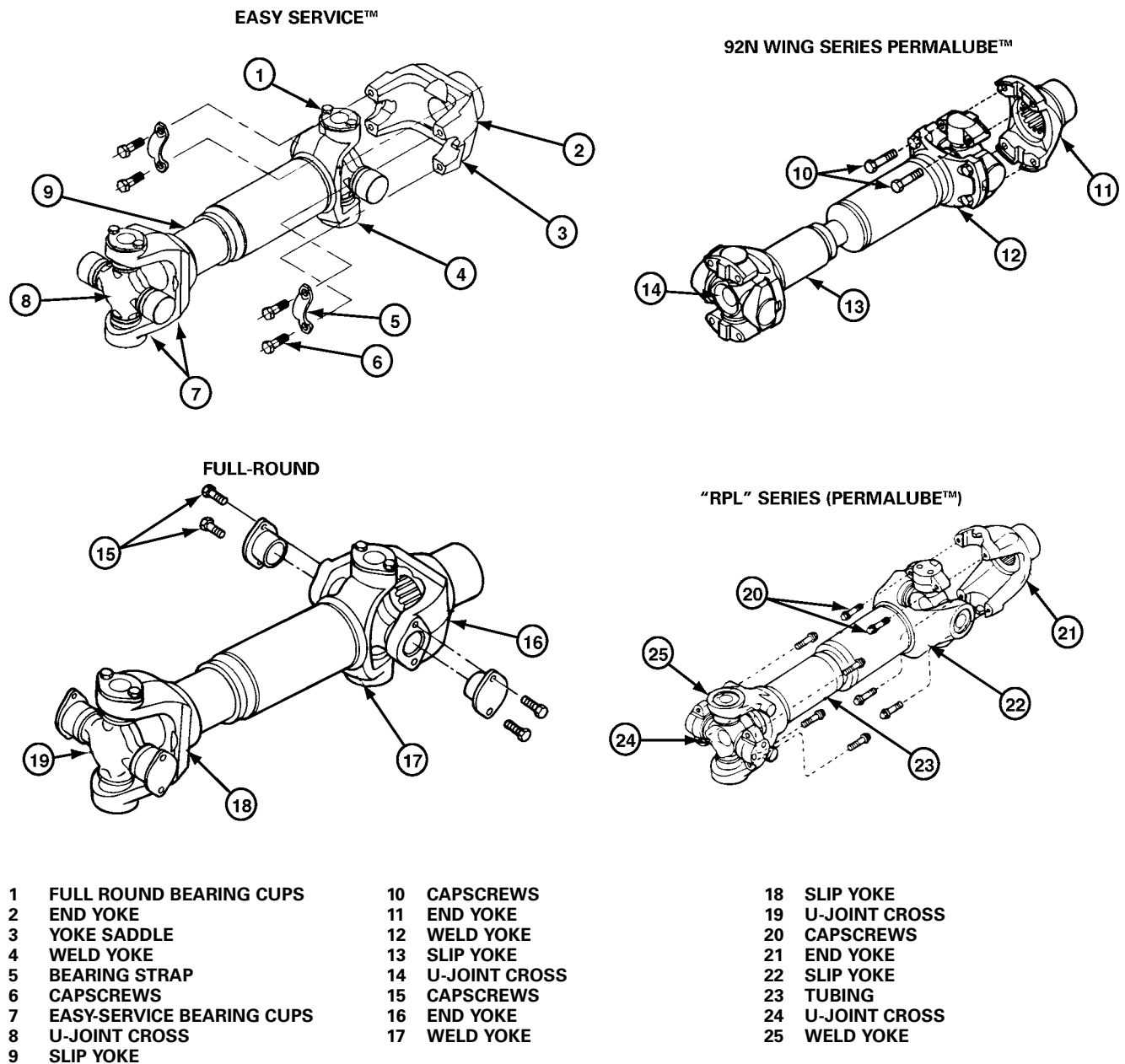
Figure 2.1



1 SAFETY STANDS

3. Remove the plug from bottom of axle housing and drain lubricant from the assembly.
 4. Disconnect the driveline universal joint from the pinion input yoke or flange on the carrier. **Figure 2.2.**
 5. Remove the capscrews* and washers or stud nuts* and washers from the flanges of both axle shafts.*
 6. Loosen the tapered dowels* if applicable, in the axle flanges of both axle shafts using either the **Brass Drift** or the **Air Hammer Vibration** method.
- *Some AxleTech carriers do not have these described parts.

Figure 2.2



Section 2 Disassembly

Brass Drift Method



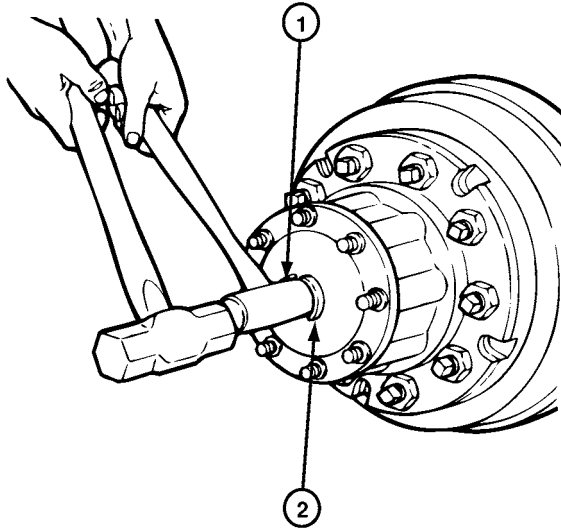
WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Do not strike the round driving lugs on the flange of an axle shaft. Pieces can break off and cause serious personal injury.

1. Hold a 1-1/2 inch diameter brass drift against the center of the axle shaft, inside the round driving lugs. **Figure 2.3.**

Figure 2.3

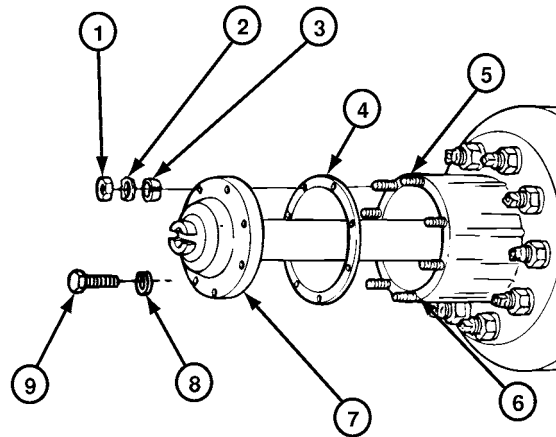


- 1 BRASS HAMMER
- 2 DRIVING LUGS

NOTE: A 1-1/2 inch diameter brass hammer can be used as a drift.

2. Strike the end of the drift with a large hammer (five to six pounds) and the axle shaft and tapered dowels will loosen.
3. Mark to identify each axle shaft before it is removed from the axle assembly.
4. Remove the tapered dowels and separate the axle shafts from the main axle hub assembly. **Figure 2.4.**

Figure 2.4



- 1 STUD NUT
- 2 WASHER
- 3 TAPERED DOWEL
- 4 GASKET
- 5 STUD
- 6 SHAFT HUB AXLE
- 7 AXLE SHAFT (FLANGE)
- 8 WASHER
- 9 CAPSCREW

5. Install a cover over the open end of each axle assembly hub where an axle shaft was removed.

Air Hammer Vibration Method



WARNING

Wear safe eye protection when using an air hammer. When using power tools, axle components can loosen and break off causing serious personal injury.

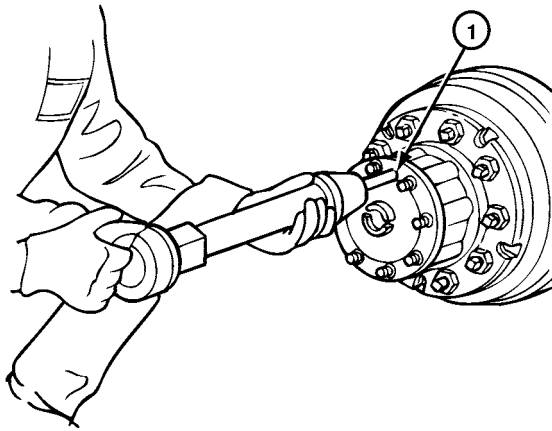


CAUTION

Do not use a chisel or wedge to loosen the axle shaft and tapered dowels. Using a chisel or wedge can result in damage to the axle shaft, the gasket and seal, and/or the axle hub.

1. Use a round hammer bit and an air hammer such as Chicago Pneumatic CP-4181-PULER, or equivalent, to loosen tapered dowels and axle shaft.
2. Place the round hammer bit against the axle shaft (flange) between the hub studs. Operate the air hammer at alternate locations between the studs to loosen the tapered dowels and axle shaft from the hub. **Figure 2.5.**

Figure 2.5



- 1 ROUND HAMMER BIT BETWEEN HUB STUDS

3. Mark to identify each axle shaft before it is removed from the axle assembly.
4. Remove the tapered dowels and separate the axle shaft from the main axle hub assembly. **Figure 2.4.**
5. Install a cover over the open end of each axle assembly hub where an axle shaft was removed.

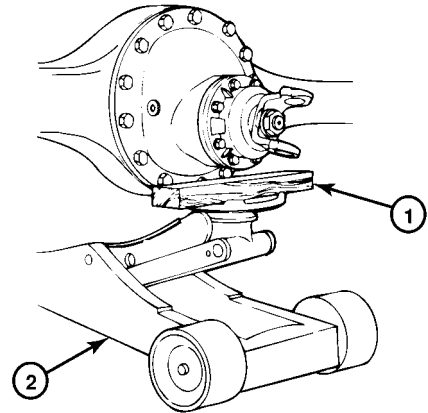
CAUTION

Do not use a chisel or wedge to loosen the axle shaft and tapered dowels. Using a chisel or wedge can result in damage to the axle shaft, the gasket and seal, and/or the axle hub.

Carrier Removal from Axle

1. Place a hydraulic roller jack under the differential carrier to support the assembly. **Figure 2.6.**
2. Remove all but the top two carrier to housing capscrews or stud nuts and washers.
3. Loosen the top two carrier-to-housing fasteners and leave attached to the assembly. The fasteners will hold the carrier in the housing.
4. Loosen the differential carrier in the axle housing. Use a leather mallet to hit the mounting flange of carrier at several points.
5. After the carrier is loosened, remove the top two fasteners.

Figure 2.6



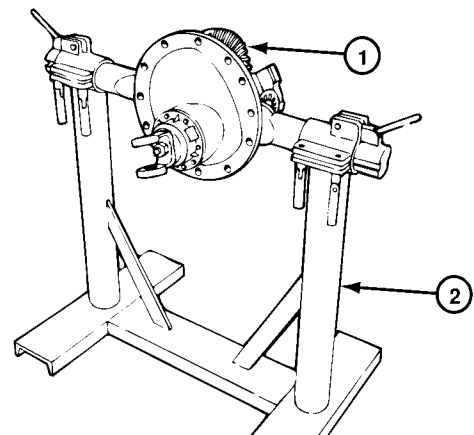
- 1 WOOD BLOCK
2 ROLLER JACK

CAUTION

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

6. Carefully remove the carrier from the axle housing using the hydraulic roller jack. Use a pry bar that has a round end to help remove the carrier from the housing.
7. Lift the differential carrier by the input yoke or flange and place the assembly in a repair stand. **Figure 2.7.** Use a lifting tool for this procedure. Do not lift by hand. A carrier stand can be built by referring to **Figure 2.8.**

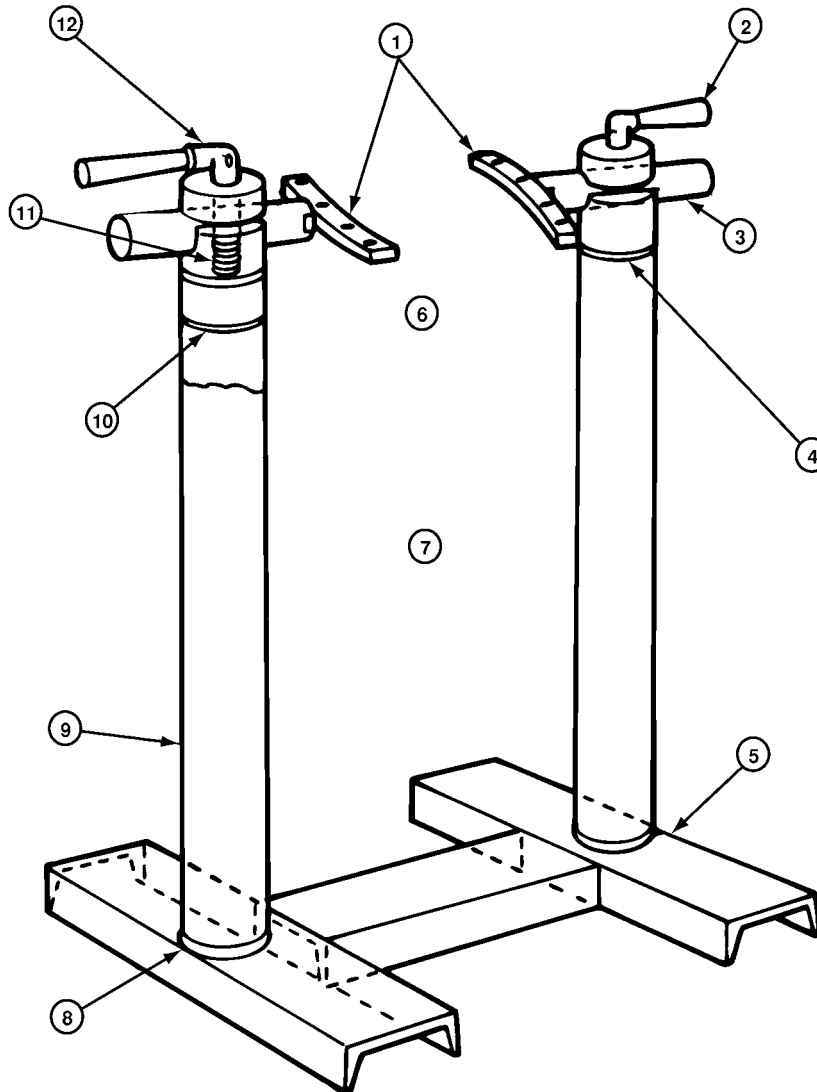
Figure 2.7



- 1 DIFFERENTIAL CARRIER
2 REPAIR STAND

AxleTech™
International

Figure 2.8



- | | | | |
|---|---|----|--|
| 1 | PLATES 8' LONG x 3/4" THICK x 1-1/4" WIDE WITH A TONGUE TO FIT SLOT IN BAR WELD PLATES TO BAR | 7 | 23-1/2" CENTER TO CENTER OF PIPE |
| 2 | HANDLE 7" LONG WITH SLOT IN ONE END TO FIT CLAMP SCREW | 8 | CHAMFER END OF PIPE FOR WELDING |
| 3 | BAR 2" DIAMETER x 9" LONG WITH ONE END SLOTTED TO FIT PLATE | 9 | 4" DIAMETER PIPE |
| 4 | WELD ALL AROUND AFTER PRESSING PLUG IN PIPE | 10 | PLUG 4" DIAMETER x 7" LONG WITH ONE END TURNED 3" LONG TO FIT PIPE. DRILL 2" HOLE AND MILL 3/16" WIDE SLOT 2" FROM TOP |
| 5 | WELD | 11 | SCREW 3-1/2" LONG x 5/8" DIAMETER WITH FLATS ON END TO FIT HANDLE AND 2-1/2" LENGTH OF THREAD ON OTHER END |
| 6 | SHAPE AND SIZE OF HOLES TO FIT CARRIER | 12 | DRILL 3/8" HOLE THROUGH HANDLE AND SCREW |

10

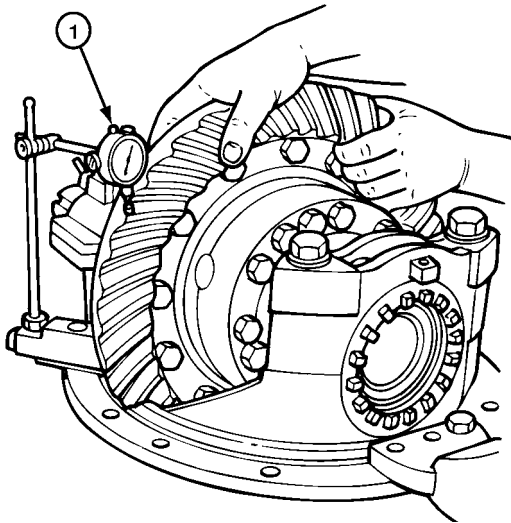
Remove the Differential and Ring Gear from the Carrier

NOTE: Before working on the differential carrier, inspect the hypoid gear set for damage. If inspection shows no damage, the same gear set can be used again. Measure the backlash of the gear set and make a record of the dimension.

Figure 2.9. (Refer to “Ring Gear Backlash Adjustment” in Section 5, Steps 1-5.) During differential reassembly, adjust the backlash to the original recorded dimension when the gear set is installed into the carrier.

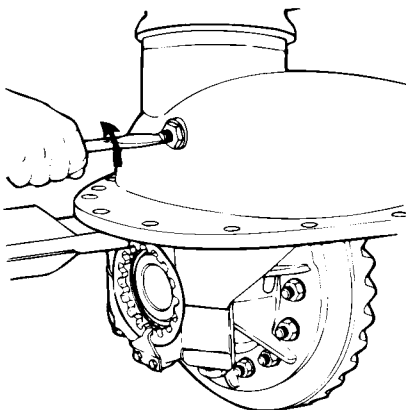
1. Loosen the jam nut* on the thrust screw*. **Figure 2.10.**

Figure 2.9



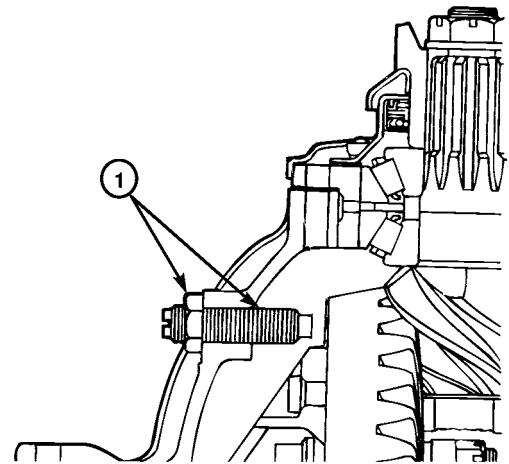
1 DIAL INDICATOR

Figure 2.10



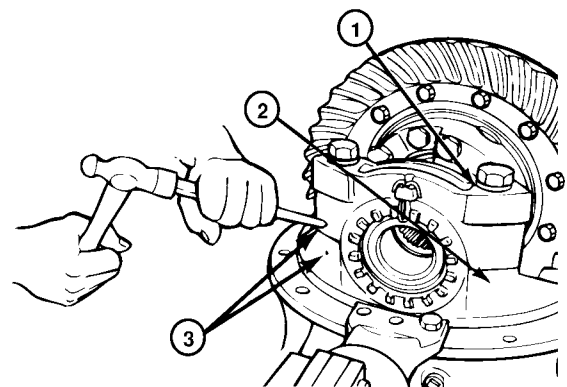
2. Remove the thrust screw* and jam nut* from the differential carrier. **Figure 2.11.**
3. Rotate the differential carrier in the repair stand until the ring gear is at the top of the assembly.
4. Mark one carrier leg and bearing cap to correctly match the parts during carrier assembly. Mark the parts using a center punch and hammer. **Figure 2.2.**

Figure 2.11



1 THRUST SCREW AND JAM NUT

Figure 2.2



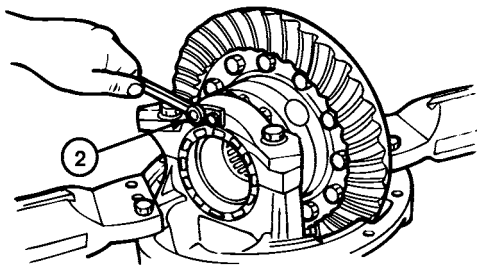
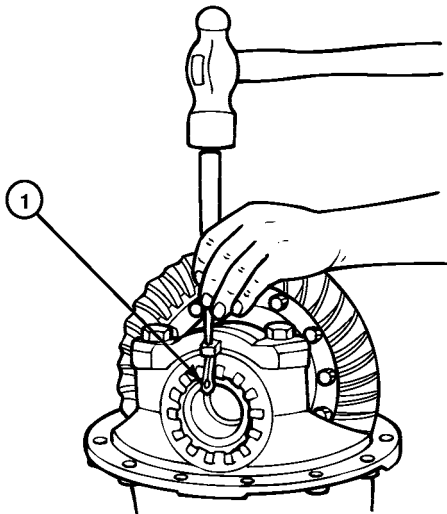
1 BEARING CAP
2 CARRIER LEG
3 MATCH MARK

*Some AxleTech carriers do not have these described parts.

Section 2 Disassembly

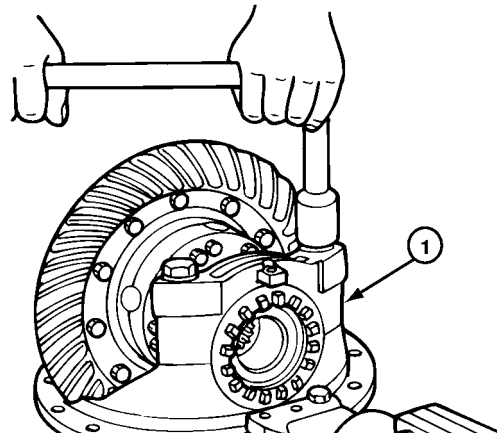
5. Remove the cotter keys*, pins* or lock plates* that hold the two bearing adjusting rings in position. Use a small drift and hammer to remove pins. Each lock plate is held in position by two capscrews. **Figure 2.3** .
6. Remove the capscrews and washers that hold the two bearing caps on the carrier. Each cap is held in position by two capscrews and washers. **Figure 2.4** .
7. Remove the bearing caps and bearing adjusting rings from the carrier. **Figure 2.5** .
8. Safely lift the main differential and ring gear assembly from the carrier. Place the assembly on a work bench. **Figure 2.16** .

Figure 2.3



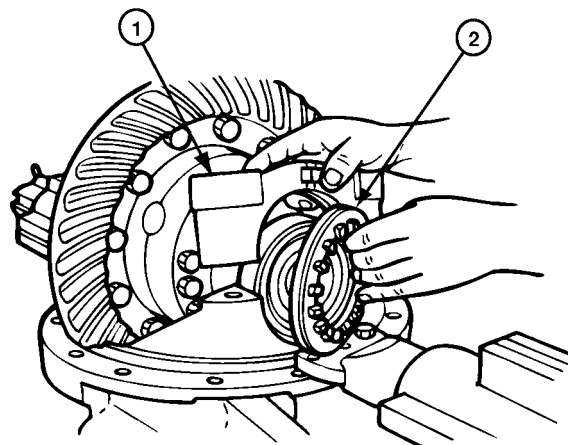
- 1 REMOVING COTTER KEY
- 2 REMOVING LOCK PLATE

Figure 2.4



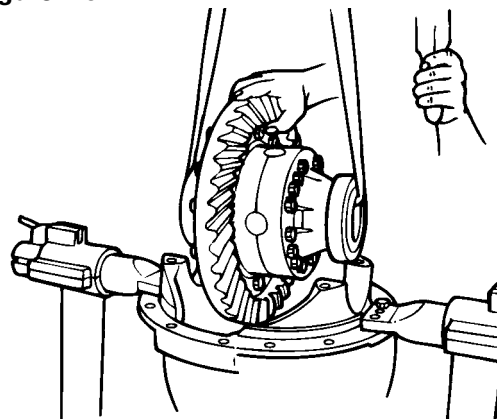
- 1 BEARING CAP

Figure 2.5



- 1 BEARING CAP
- 2 BEARING ADJUSTING RING

Figure 2.6

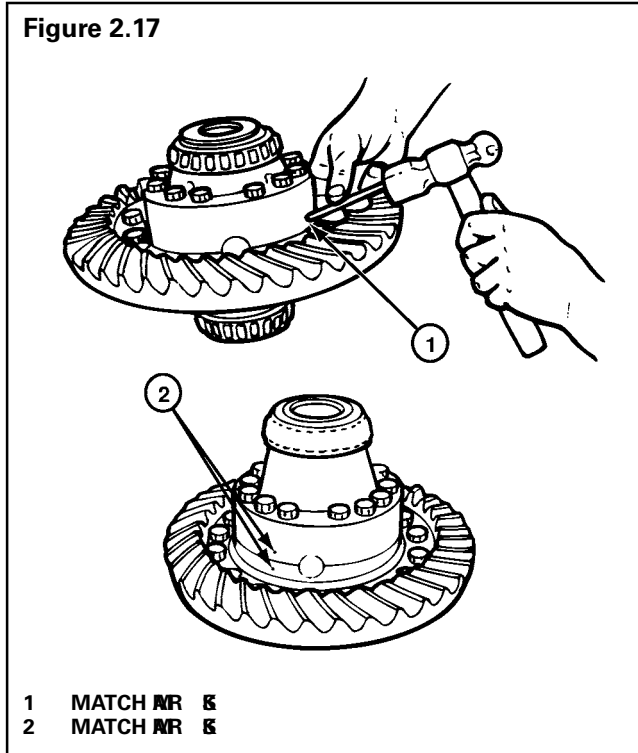


*Some AxleTech carriers do not have these described parts.

Disassemble the Differential and Ring Gear Assembly

1. If the matching marks on the case halves of the differential assembly are not visible, mark each case half with a center punch and hammer. The purpose of the marks is to match the plain half and flange half correctly when you assemble the carrier. **Figure 2.17.**

Figure 2.17



2. Remove the capscrews* and washers* or bolts*, nuts* and washers that hold the case halves together.



WARNING

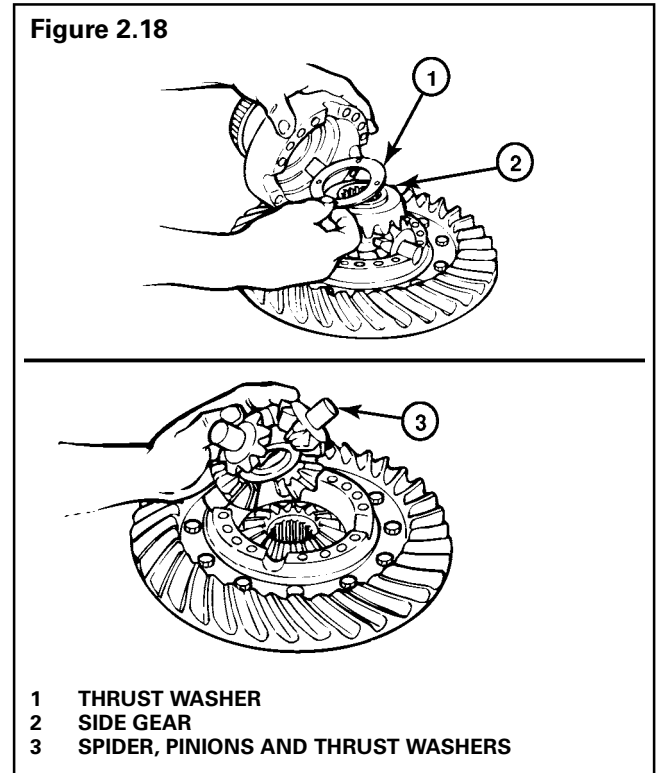
Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

3. Separate the case halves. If necessary, use a brass, plastic or leather mallet to loosen the parts.
4. Remove the differential spider (cross), four pinion gears, two side gears and six thrust washers from inside the case halves.

Figure 2.18.

5. If the ring gear needs to be replaced, remove the bolts*, nuts*, and washers* that hold the gear to the flange case half.

Figure 2.18



WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.



CAUTION

Do not remove the rivets or rivet heads with a chisel and hammer. Using a flat edge tool can cause damage to the flange case.

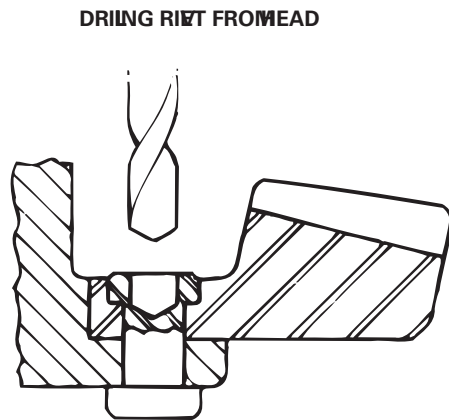
6. If rivets* hold the ring gear to the flange case half, remove the rivets as follows:
7. Carefully center punch each rivet head in the center, on the ring gear side of the assembly.

*Some AxleTech carriers do not have these described parts.

Section 2 Disassembly

8. Drill each rivet head on the ring gear side of the assembly to a depth equal to the thickness of one rivet head. Use a drill bit that is 1/32 of an inch smaller than the body diameter of the rivets. **Figure 2.19.**

Figure 2.19



9. Press the rivets through holes in the ring gear and flange case half. Press from the drilled rivet head.

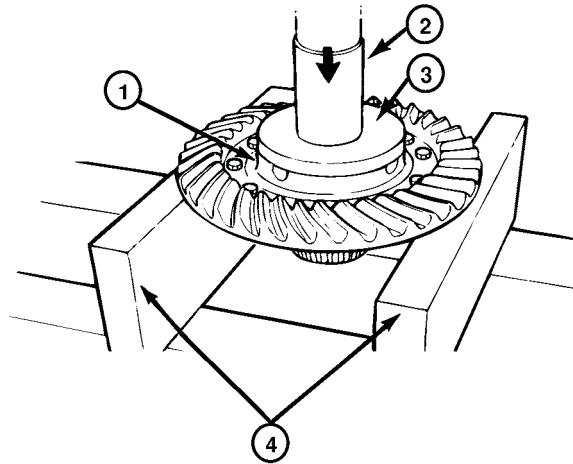


WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

10. Separate the case half and ring gear using a press. Support the assembly under the ring gear with metal or wood blocks and press the case half through the gear. **Figure 2.20 .**

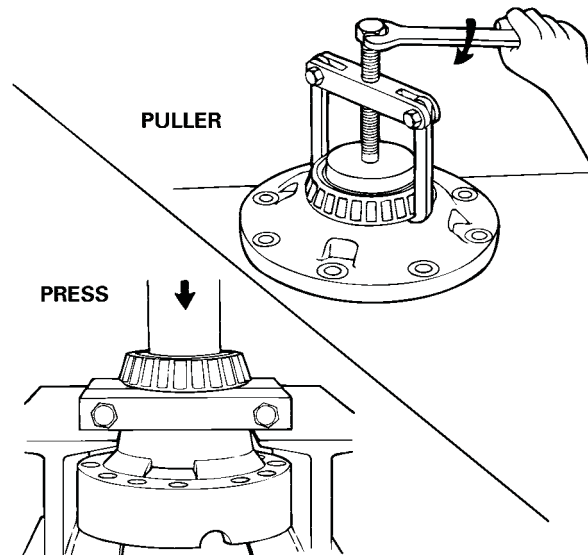
Figure 2.20



- 1 CASE HALF
- 2 PRESS
- 3 PLATE
- 4 SUPPORTS

11. If the differential bearings need to be replaced, remove the bearing cones from the case halves. Use a bearing puller or press. **Figure 2.21 .**

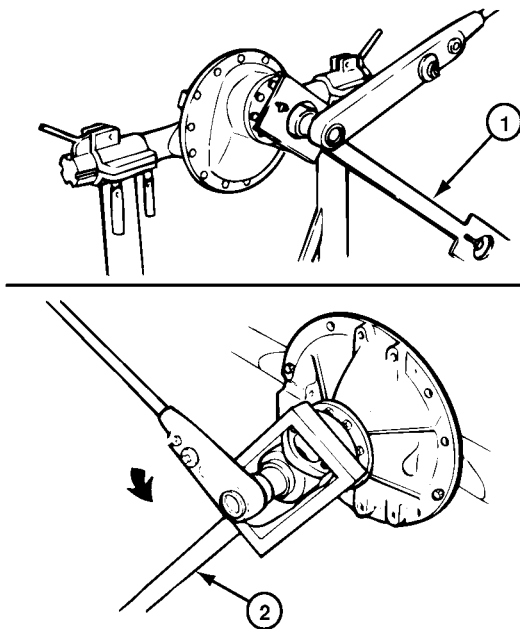
Figure 2.21



Remove the Drive Pinion and Bearing Cage from Carrier

1. Fasten a flange bar to the input yoke or flange. When the nut is removed, the bar will hold the drive pinion in position. **Figure 2.2** .

Figure 2.2



- 1 FLANGE BAR
- 2 YOKE BAR

2. Remove the nut and washer* from the drive pinion. **Figure 22** .
3. Remove the yoke or flange bar.



CAUTION

Do not use a hammer or mallet to loosen and remove the yoke or flange. A hammer or mallet can damage the parts and cause driveline runout, or driveline imbalance problems after carrier to driveline assembly.

4. Remove the yoke or flange from the drive pinion. If the yoke or flange is tight on the pinion, use a puller for removal. **Figure 2.2** .
5. Remove the capscrews and washers that hold the bearing cage in the carrier. **Figure 2.2** .

Figure 2.2

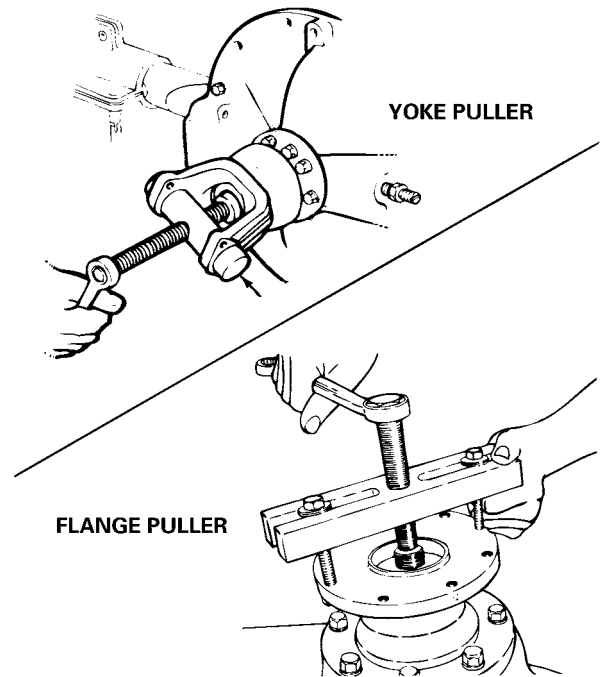
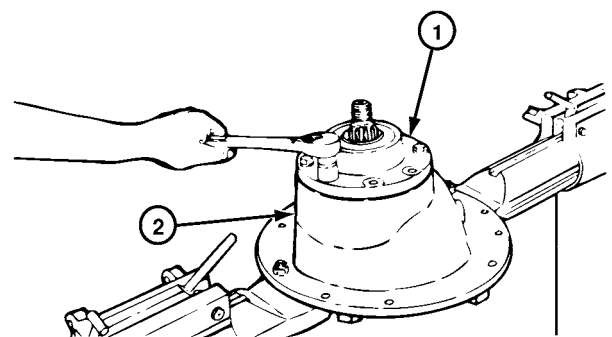


Figure 2.2



- 1 BEARING CAGE
- 2 CARRIER

*Some AxleTech carriers do not have these described parts.

Section 2 Disassembly

WARNING

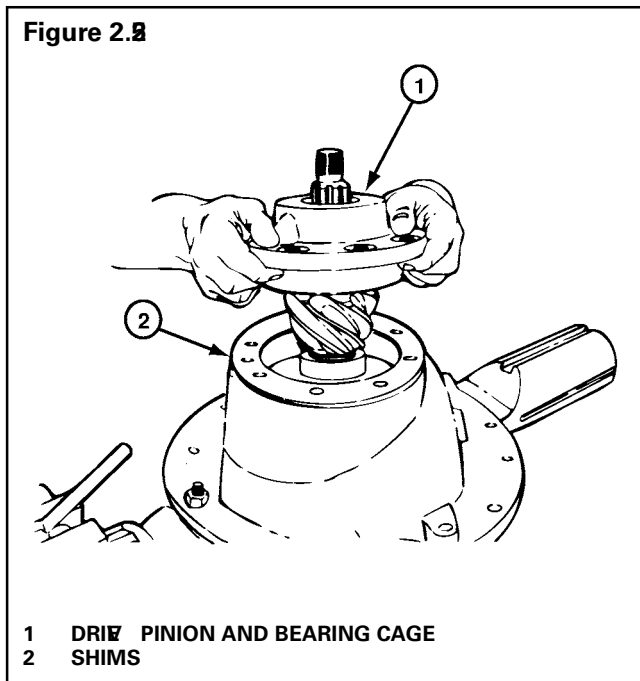
Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

CAUTION

Do not use a pry bar to remove the bearing cage from the carrier. A pry bar can damage the bearing cage, shims and carrier.

6. Remove the drive pinion, bearing cage and shims from the carrier. If the bearing cage is tight in the carrier, hit the bearing cage at several points around the flange area with a leather, plastic or rubber mallet. **Figure 2 25.**

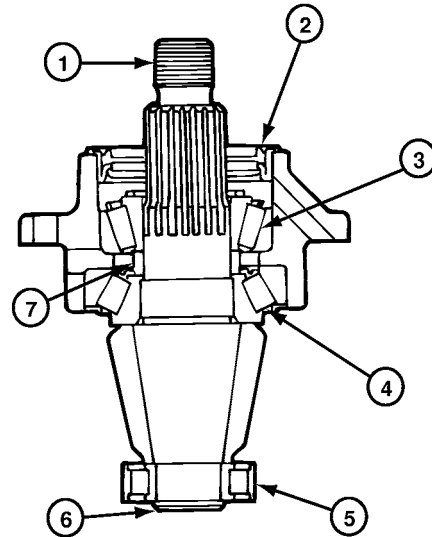
Figure 2.8



7. If the shims are in good condition, keep the shims together for use later when the carrier is assembled.
8. If shims are to be discarded because of damage, first measure the total thickness of the pack. Make a note of the dimension. The dimension will be needed to calculate the depth of the drive pinion in the carrier when the gear set is installed.

Disassemble the Drive Pinion and Bearing Cage

Figure 2.8



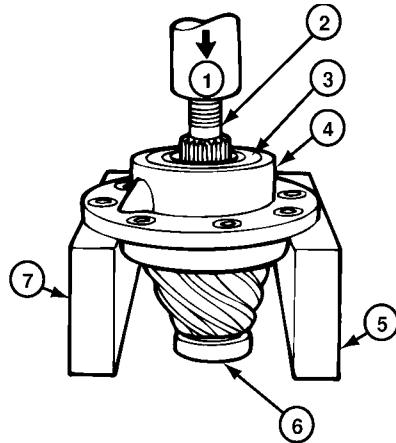
- 1 DRIVE PINION
- 2 OIL SEAL
- 3 OUTER BEARING (CUP AND CONE)
- 4 INNER BEARING (CUP AND CONE)
- 5 SPIGOT BEARING
- 6 SNAP RING
- 7 BEARING SPACER

WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

1. Place the drive pinion and bearing cage in a press. The pinion shaft must be toward the top of the assembly. **Figure 2 27.**

Figure 2.2



- 1 PRESS
- 2 DRIVE PINION
- 3 OIL SEAL
- 4 BEARING CAGE
- 5 SUPPORT
- 6 SPIGOT BEARING
- 7 SUPPORT

2. Support the bearing cage under the flange area with metal or wood blocks. **Figure 2.27.**
3. Press the drive pinion through the bearing cage. **Figure 2.27.**

WARNING

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

NOTE: The inner bearing cone and bearing spacer will remain on the pinion shaft.

4. If a press is not available, use a leather, plastic or rubber mallet to drive the pinion through the bearing cage.

CAUTION

Be careful when removing the seal. Do not damage the wall of bore. Damage to the bore wall can result in oil leaks.

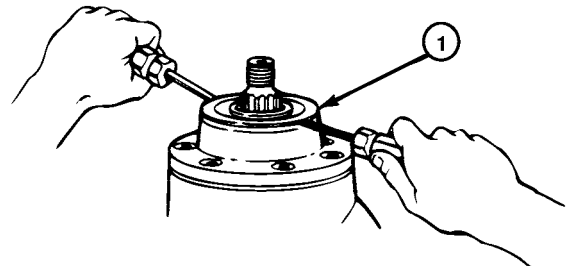
NOTE: When the oil seal has been removed, always replace it with a new triple-lip (main) seal during component reassembly.

5. If the pinion oil seal is mounted directly in the outer bore of the bearing cage, remove the seal at this time.

Be careful that you do not damage the mounting surfaces of the bearing cage.

Figure 2.2 .

Figure 2.8



- 1 OIL SEAL

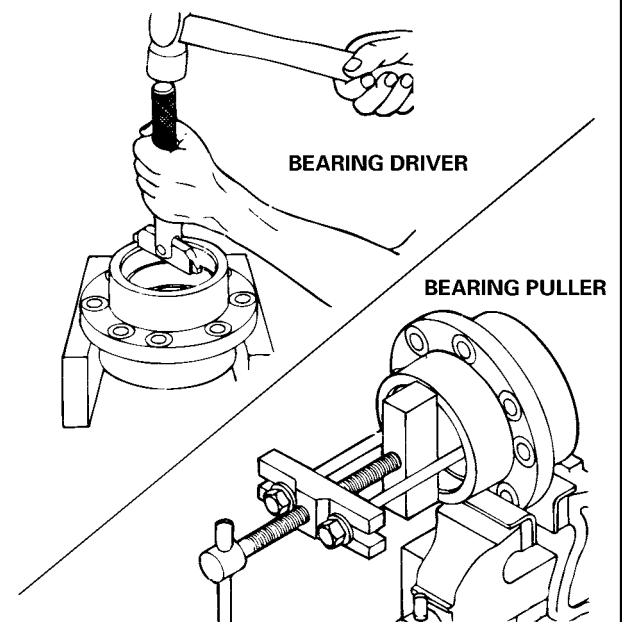
WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

6. If the pinion bearings need to be replaced, remove the inner and outer bearing cups from the inside of cage. Use a press and sleeve, bearing puller, bearing driver or a small drift hammer. The type of tool used depends on the design of the bearing cage. **Figure 2.29.**

When a press is used, support the bearing cage under the flange area with metal or wood blocks.

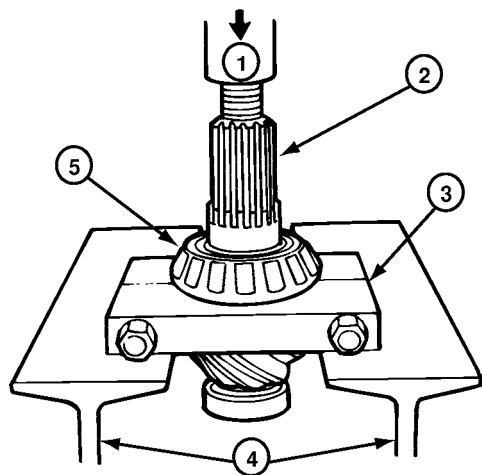
Figure 2.9



Section 2 Disassembly

7. If the pinion bearings need to be replaced, remove the inner bearing cone from the drive pinion with a press or bearing puller. The puller **MUST** fit under the inner race of the cone to remove the cone correctly without damage. **Figure 2.30.**

Figure 2.8

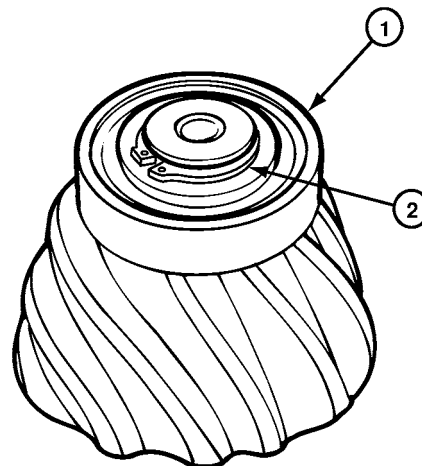


- 1 PRESS
- 2 DRIVE PINION
- 3 BEARING PULLER
- 4 SUPPORTS
- 5 INNER BEARING CONE

8. If the spigot bearing needs to be replaced, place the drive pinion in a vise. Install a soft metal cover over each vise jaw to protect the drive pinion.
9. Remove the snap ring* from the end of drive pinion with snap ring pliers that expand. **Figure 2.3**

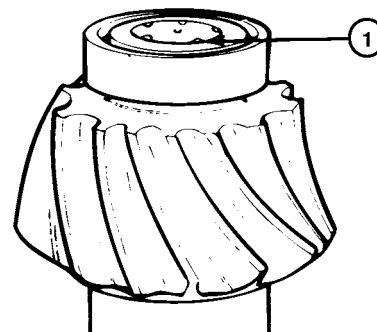
NOTE: Some spigot bearings are fastened to the drive pinion with a special peening tool. **Figure 2.2**

Figure 2.3



- 1 SPIGOT BEARING
- 2 SNAP RING

Figure 2.2



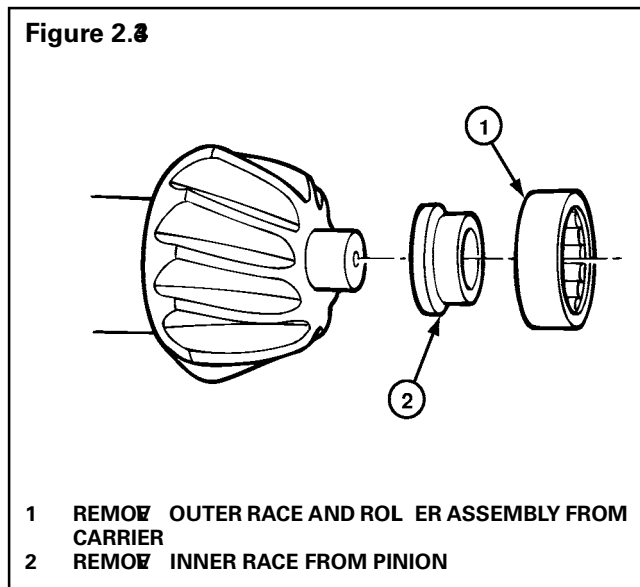
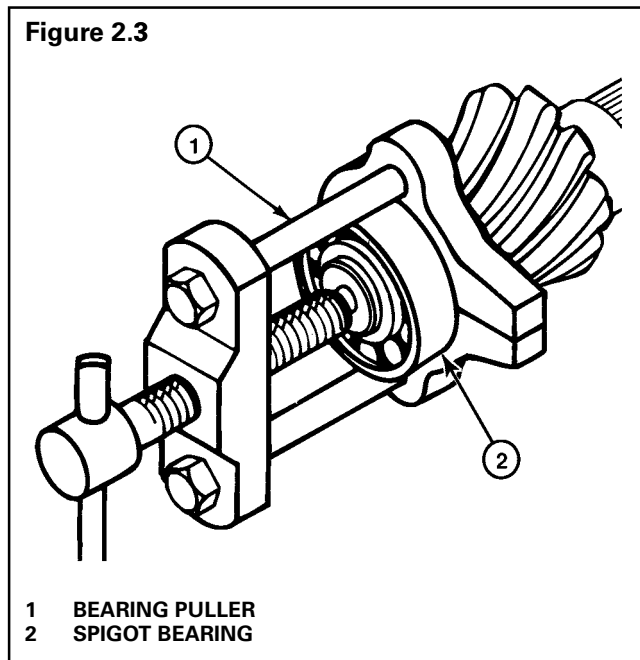
- 1 PEENING POINTS

*Some AxleTech carriers do not have these described parts.

10. Remove the spigot bearing from the drive pinion with a bearing puller. **Figure 2.33.**

NOTE: Some spigot bearings are a two-piece assembly. Remove the inner race from the pinion with a bearing puller. Remove the outer race/roller assembly from carrier with a drift or a press.

Figure 2.3



Section 3

Preparing the Parts for Assembly

Cleaning Ground and Polished Parts

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- *Wear safe eye protection.*
- *Wear clothing that protects you skin.*
- *Work in a well-ventilated area.*
- *Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.*
- *You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.*

CAUTION

Use only solvent cleaners to clean ground or polished metal parts. Hot solution tanks or water and alkaline solutions will damage parts. Isopropyl alcohol, kerosene or diesel fuel can be used for this purpose. If required, use a sharp knife to remove gasket material from parts. Be careful not to damage the ground or polished surfaces.

1. Use a cleaning solvent to clean ground or polished parts or surfaces. Kerosene or diesel fuel oil can be used for this purpose. **Do not use gasoline.**
2. Use a tool with a flat blade, if required, to remove sealant material from parts. Be careful not to damage the polished or smooth surfaces.
3. **Do not** clean ground or polished parts with water or steam. Do not immerse ground or polished parts in a hot solution tank or use strong alkaline solutions for cleaning, or the smooth sealing surface may be damaged.

Cleaning Rough Parts

WARNING

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- *Wear safe eye protection.*
 - *Wear clothing that protects you skin.*
 - *Work in a well-ventilated area.*
 - *Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.*
 - *You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.*
1. Clean rough parts with the same method as cleaning ground and polished parts.
 2. Rough parts can be cleaned in hot solution tanks with a weak or diluted alkaline solution.
 3. Parts must remain in hot solution tanks until heated and completely cleaned.
 4. Parts must be washed with water until all traces of the alkaline solution are removed.

Cleaning Axle Assemblies

1. A complete axle assembly can be steam cleaned on the outside to remove dirt.
2. Before the axle is steam cleaned, close or place a cover over all openings in the axle assembly. Examples of openings are breathers or vents in air chambers.

Drying Parts After Cleaning

CAUTION

Damage to bearings can result when they are rotated and dried with compressed air.

1. Parts must be dried immediately after cleaning and washing.
2. Dry the parts using soft, clean paper or cloth rags.
3. Except for bearings, parts can be dried with compressed air.

Preventing Corrosion on Cleaned Parts

1. Apply axle lubricant to cleaned and dried parts that are not damaged and are to be assembled.
2. To store parts, apply a special material that prevents corrosion to all surfaces. Wrap cleaned parts in a special paper that will protect the parts from moisture and prevent corrosion during storage.

Inspecting Parts

It is very important to inspect all parts carefully and completely before the axle or carrier is assembled. Inspect all parts for wear and replace damaged parts. Replacement of damaged or worn parts now, will prevent failure of the assembly later.

1. Inspecting Tapered Roller Bearings:

Inspect the cup, cone, rollers and cage of all tapered roller bearings in the assembly. If any of the following conditions exist, the bearing **MUST** be replaced:

- a. The center of large-diameter end of rollers worn level with or below the outer surface. **Figure 3.1.**
- b. The radius at large-diameter end of rollers worn to a sharp edge. **Figure 3.1.**
- c. A visible roller groove in the cup or cone inner race surfaces. The groove can be seen at the small- or large-diameter end of both parts. **Figure 3.2.**
- d. Deep cracks or breaks in the cup, cone inner race or roller surfaces. **Figure 3.2.**
- e. Bright wear marks on the outer surface of the roller cage. **Figure 3.3.**

Figure 3.1

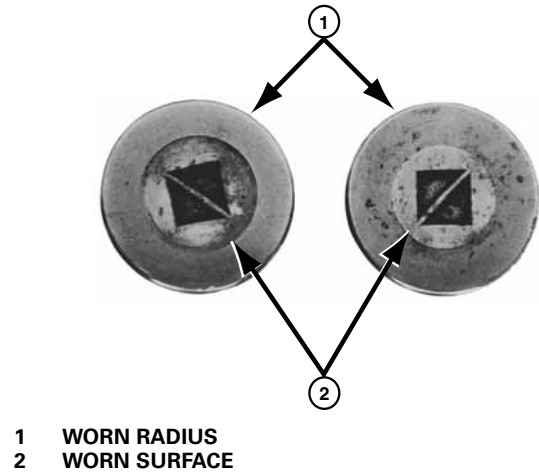


Figure 3.2

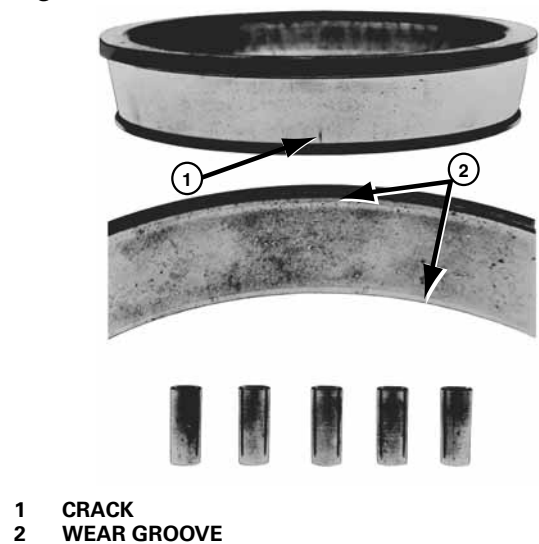


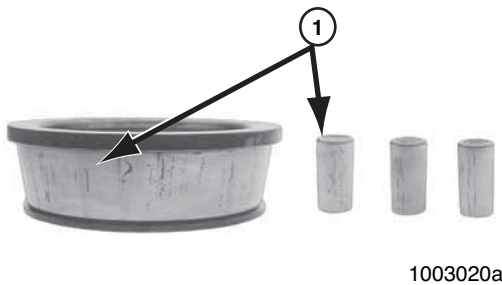
Figure 3.3



Section 3 Preparing the Parts for Assembly

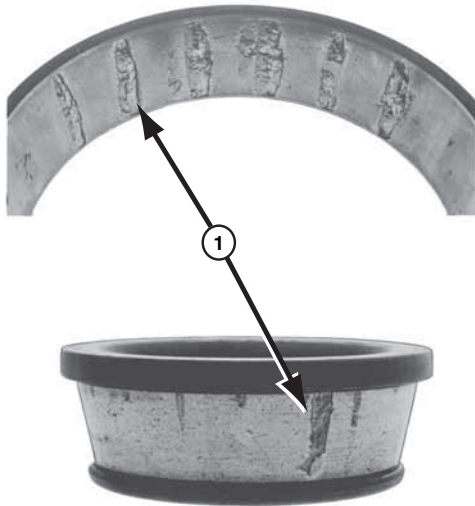
- f. Damage on rollers and on surfaces of the cup and cone inner race that touch the rollers. **Figure 3.4.**
- g. Damage on the cup and cone inner race surfaces that touch the rollers. **Figure 3.5.**

Figure 3.4



1 ETCHING AND PITTING

Figure 3.5



1 SPALLING AND FLAKING

CAUTION

Hypoid drive pinions and ring gears are machined in matched sets. When a drive pinion or ring gear of a hypoid set needs to be replaced, both drive gear and pinion must be replaced at the same time.

2. Inspect hypoid pinions and gears for wear or damage. Gears that are worn or damaged **MUST** be replaced.

CAUTION

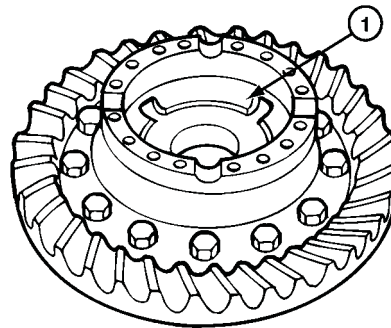
Always replace thrust washers, differential side gears and pinion gears in full matched sets. A higher stress on original parts and early failure of the entire assembly will result if a new part is used in combination with parts that are older or worn.

3. Inspect the Main Differential Assembly:

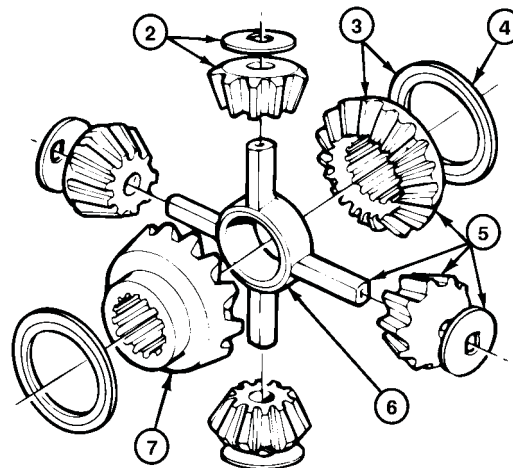
Inspect the following parts for wear or stress. Parts that are damaged **MUST** be replaced.
Figure 3.6.

Figure 3.6

DIFFERENTIAL CASE HALVES



DIFFERENTIAL GEAR NEST ASSEMBLY



- | | |
|-------------------------------|------------------|
| 1 INSPECT INSIDE SURFACES | 5 INSPECT |
| 2 PINION AND THRUST WASHER | 6 SPIDER (CROSS) |
| 3 SIDE GEAR AND THRUST WASHER | 7 INSPECT |
| 4 INSPECT | |

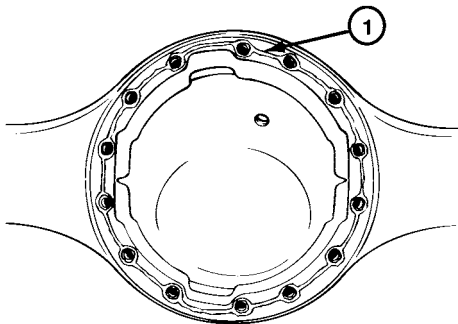
- a. Inside surfaces of both case halves.
 - b. Both surfaces of all thrust washers.
 - c. The four trunnion ends of the spider (cross).
 - d. Teeth and splines of both differential side gears.
 - e. Teeth and bore of all differential pinions.
4. Inspect Axle Shafts:
- a. Inspect axle shafts for wear and cracks at the flange, shaft and splines.
 - b. Replace axle shafts, if required.

Repair or Replacement of Parts, General

Replace worn or damaged parts of an axle assembly. The following are some examples in inspecting for part replacement or repair.

1. Replace any fastener if corners of the head are worn.
2. Replace washers if damaged.
3. Replace gaskets, oil seals or grease seals at the time of axle or carrier repair.
4. Clean parts and apply new silicone gasket material where required when axle or carrier is assembled. **Figure 3.7.**

Figure 3.7



1 REMOVE SILICONE GASKET FROM PARTS

5. Remove nicks, mars and burrs from parts with machined or ground surfaces. Use a fine file, india stone, emery cloth or crocus cloth for this purpose.

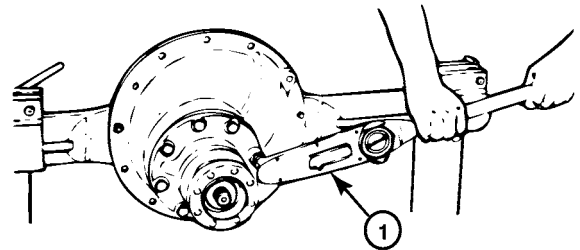


CAUTION

Threads must be without damage and clean so that accurate adjustments and correct torque values can be applied to fasteners and parts.

6. Clean and repair threads of fasteners and holes. Use a die or tap of the correct size or a fine file for this purpose.
7. Tighten all fasteners to the correct torque values. Refer to **Table J** for torque values of fasteners. **Figure 3.8.**

Figure 3.8



1 ALWAYS USE TORQUE WRENCHES

8. **DO NOT** repair rear axle housings by bending or straightening.



WARNING

Repair of axle housings by bending or straightening will cause poor or unsafe vehicle operation and early failure of the axle.

Section 3

Preparing the Parts for Assembly

Repair Axle by Welding

1.  AxleTech International will permit repairing drive axle housing assemblies by welding **ONLY** in the following areas:
 - a. Snorkel welds.
 - b.  Using seam welds between the suspension attaching brackets.
 - c. Bracket welding to drive axle housing. Refer to TP-9421.
 - d. Refer to  AxleTech Maintenance Manual 8 for approved axle welding procedures.
 - e.  Contact your  AxleTech representative for further or specific recommendations.



WARNING

Using wrong welding procedures or welding at locations other than the three areas permitted by AxleTech will make the heat-treated component weak. A weak component will cause poor or unsafe operation of the vehicle and early axle failure. The following procedure must be used.



CAUTION

Welding can be used when the crack or damaged area is within the old weld material. Replace the axle housing if the crack extends into the metal next to the old weld. A repaired housing must be used only in correct specified vehicle load applications.

2. Welding Procedure
 - a. Drain the lubricant from the axle assembly.
 - b. Remove hub, drum, wheel bearing and brake air chambers.
 - c. Remove the axle shafts and differential carrier from the axle housing.



WARNING

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- *Wear safe eye protection.*
- *Wear clothing that protects you skin.*
- *Work in a well-ventilated area.*
- *Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.*
- *You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.*

- d. Clean the damaged area inside and outside the housing. Cleaning solvent can be used.
- e. Grind the damaged weld to the base metal.
- f. Warm the complete axle housing to a temperature of 70°F–80°F (21°C–27°C) or higher.
- g. Before you start welding, heat the damaged area to be repaired to approximately 300°F (149°C).
- h. Use a 70,000 psi tensile weld material and the correct voltage and amperage for the diameter weld rod used. Examples of weld rods that can be used are E-7018 or B-70S-3.



CAUTION

If the E-7018 weld rod is used, the rod must be kept dry. Electrodes that are not stored in the correct sealed containers must be heated at 700°F (371°C) for one hour before welding. Wet electrodes must be dried at 180°F (82°C) for one to two hours and then heated at 700°F (371°C) for one hour before welding.

- i. Fill in the weld gap as follows:
 1. The opening in cover welds **MUST** be filled level with the old weld.
 2. The opening in seam welds **MUST** be ground out to 70% of the wall thickness. The wall thickness can be measured at the carrier opening of housing.
 3. Clean the new weld area. Carefully remove all the rough weld material.
 4. Install the differential carrier and axle shafts.
 5. Fill the axle assembly with the correct amount of lubricant. Refer to Maintenance Manual 1, *Lubrication*, for information on lubricants.



CAUTION

Do not connect the ground cable at any point on the axle assembly that will place a bearing between the ground cable and weld area. If a bearing is between the ground cable and weld, the bearing will be damaged because of electrical arcing in the bearing and bearing track areas.

A good location to connect the ground cable is the spring mounting pad of the housing.

NOTE: Before welding brackets or other components to the axle housing, contact AxleTech for proper welding procedures.

Bending or Straightening Drive Axle Housings

AxleTech International strongly recommends against any attempt to correct or modify drive axle housings by bending or straightening. All damaged drive axle housings should be replaced.



WARNING

Do not bend or straighten damaged drive axle housings. Any bending or straightening process may result in misalignment or weakening of the axle housing and cause component damage and result in serious personal injury.

Removing Dri-Loc[®] Fasteners

If it is difficult to remove fasteners from components, the strength of Dri-Loc[®], AxleTech adhesive or Loctite[®] 277 can be decreased by heating. Use the following procedure:

1. Heat the fastener for three to five seconds **ONLY** and try to loosen the fastener with a wrench. **DO NOT** use an impact wrench to loosen the fastener or hit the fastener with a hammer.



CAUTION

Do not exceed 350°F (177°C) maximum. Heating must be done slowly to prevent thermal stresses in the other components.

2. Repeat Step 1 until the fastener can be removed.

Section 4 General Information

Installing Fasteners with Pre-Applied Adhesive, AxleTech Liquid Adhesive 2297-C-7049, Loctite® 680 Liquid Adhesive or Equivalent

Installing New Fasteners with Pre-applied Adhesive Patches

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

1. Clean the oil and dirt from threaded holes. Use a wire brush. There is no other special cleaning required.

CAUTION

Do not apply adhesives or sealants on new fasteners with pre-applied adhesive patches or inside closed threaded holes. If other adhesives or sealants are used, the new adhesive will not function correctly.

2. Assemble parts using the new pre-applied adhesive fasteners.

NOTE: There is no drying time required for fasteners with pre-applied adhesive.

3. Tighten the fasteners to the required torque value for that size fastener.

Installing Original or Used Fasteners Using AxleTech Liquid Adhesive 2297-C-7049 or Loctite® 680 or Equivalent

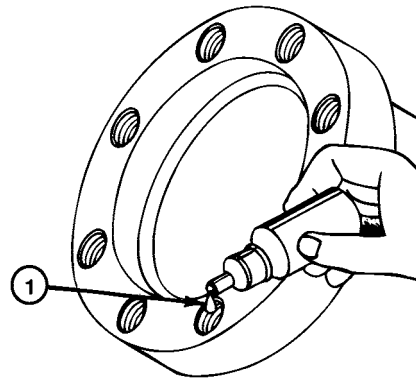
1. Clean the oil, dirt and old adhesive from all threads and threaded holes. Use a wire brush.

CAUTION

Do not apply adhesive directly to the fastener threads. Air pressure in a closed hole will push the adhesive out and away from mating surfaces as the fastener is installed.

2. Apply four or five drops of AxleTech Liquid Adhesive, Loctite® 680 or equivalent inside each threaded hole or bore ONLY. Make sure the adhesive is applied inside to the bore threads. **Figure 4.1.**

Figure 4.1



1 4 TO 5 DROPS ON BORE THREADS

3. Tighten the fasteners to the required torque value for that size fastener.

NOTE: There is no drying time required for AxleTech Liquid Adhesive 2297-C-7049, Loctite® 680 or equivalent.

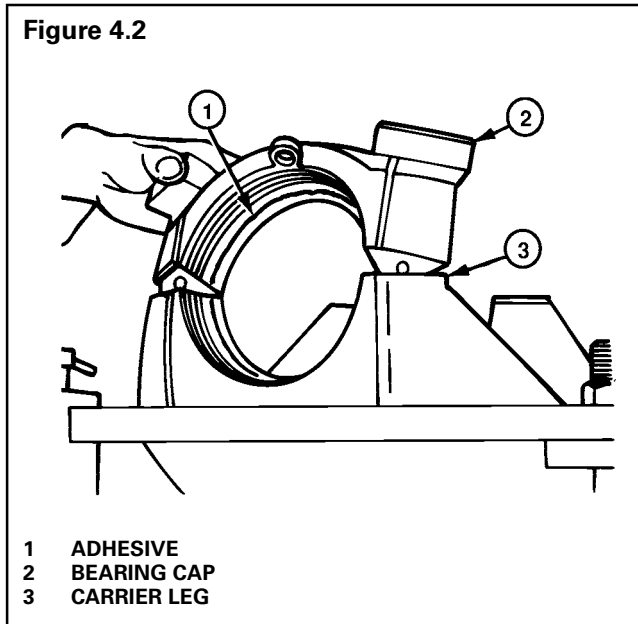
Application of AxleTech Adhesive 2297-T-4180 in Bearing Bores for the Differential

Use adhesive 2297-T-4180 for all axles.

1. Clean the oil and dirt from outer diameters of bearing cups and bearing bores in the carrier and bearing caps. There is no special cleaning required.
2. Apply axle lubricant to the bearing cones and the inner diameters of the bearing cups of the main differential. **DO NOT** get oil on the outer diameter of the bearing cup and **DO NOT** permit oil to drip on the bearing bores.

3. Apply a single continuous bead of the adhesive to the bearing bores in the carrier and bearing caps. Apply the adhesive 360° around the smooth, ground surfaces only. **DO NOT** place adhesive on threaded areas. **Figure 4.2.**

Figure 4.2



NOTE: AxleTech adhesive 2297-T-4180 will become hard (dry) in approximately two hours. The following two steps of the procedure must be done in two hours from the time the adhesive was applied. If two hours have passed since application, clean the adhesive from the parts again and apply new adhesive.

4. Install the main differential assembly, bearing cups and bearing caps into the carrier. Use the normal procedure, refer to "Install the Differential and Ring Gear Assembly" in Section 5.
5. Adjust preload of the differential bearings, backlash and tooth contact patterns of the gear set as required using the normal procedures. Refer to "Adjust Preload of Differential Bearings" in Section 5.

Application of Three Bond 1216 or Equivalent Silicone Gasket Material



WARNING

Take care when you use silicone gasket materials to avoid serious personal injury. Follow the manufacturer's instructions to prevent irritation to the eyes and skin.

NOTE: The following silicone gasket products or equivalent are available in 3 oz (85 gram) tubes and can be used for AxleTech components:

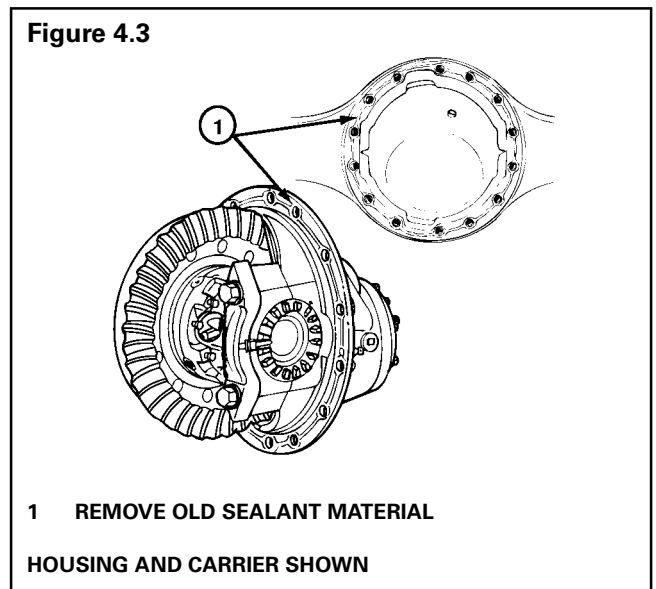
- Three Bond RTV No. TB 1216 (Grey) — AxleTech Part Number 2297-Z-708
- Loctite® Ultra Grey Adhesive/Sealant #18581 — AxleTech Part Number 2297-A-7021

Also available in 120 oz (3.4 kg) cartridges:

- Three Bond RTV1216 (Grey) — AxleTech Part Number 2297-A-701

1. Remove all old gasket material from both surfaces. **Figure 4.3.**
2. Clean the surfaces where silicone gasket material will be applied. Remove all oil, grease, dirt and moisture without damaging the mating surfaces. **Figure 4.3.**

Figure 4.3



Section 4 General Information

3. Dry both surfaces.

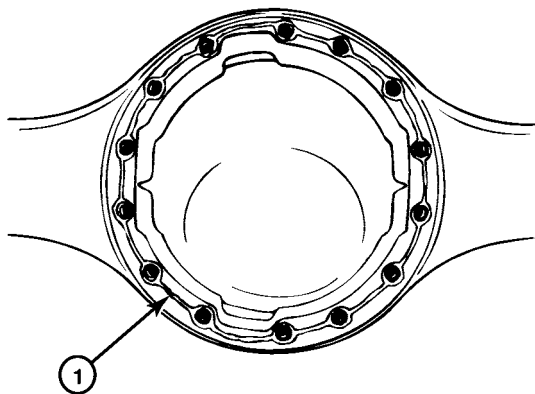


CAUTION

The amount of silicone gasket material applied must not exceed 0.125-inch (3 mm) diameter bead. Too much gasket material can block lubrication passages and result in damage to the components.

4. Apply 0.125-inch (3 mm) diameter continuous bead of the silicone gasket material around one surface. Also apply the gasket material around the edge of all fastener holes on that surface. **Figure 4.4.**
5. Assemble the components immediately to permit the silicone gasket material to compress evenly between the parts. Tighten fasteners to the required torque value for that size fastener. There is no special procedure or additional torque value required. Refer to **Table J.** **T**
6. Wait 20 minutes before filling the assembly with lubricant.

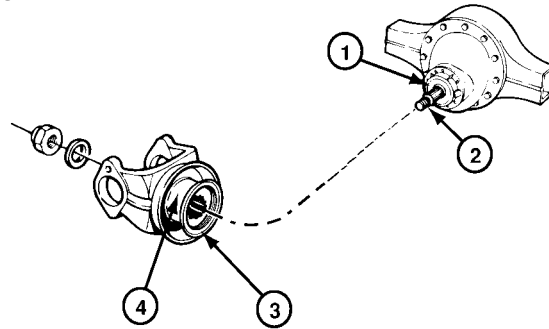
Figure 4.4



- 1 0.125" (3 MM) DIAMETER SILICONE GASKET BEAD

Installing Tight Fit Yokes and POSE™ Seal

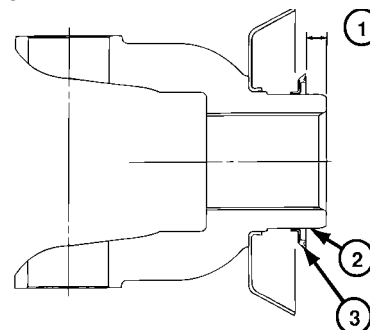
Figure 4.5



- 1 LUBRICATE TRIPLE-LIP (MAIN) SEAL
- 2 INPUT SHAFT (PINION)
- 3 POSE™ SEAL 0.25"–0.50" (6.4 MM–12.7 MM) ONTO HUB
- 4 INSPECT YOKE HUB

1. Apply the same lubricant used in the axle housing to the hub of the yoke or flange.
2. Inspect and make sure the lips of the POSE™ seal and the outer retainer of the triple-lip (main) seal are clean and free from dirt and particles that may cause lubricant leakage between the seals.
3. Install the POSE™ seal on the hub of the yoke or flange by hand. The lips of the seal must face toward the end of the hub (opposite shoulder). Slide the POSE™ seal on the hub until the lips are from 0.25-inch to 0.50-inch (6.4 mm-12.7 mm) from the end of the hub. **Do not install the POSE™ seal against the shoulder. Figure 4.6.**

Figure 4.6



- 1 0.25"–0.50" (6.4 MM–12.7 MM)
- 2 YOKE HUB
- 3 FACE SEAL ASSEMBLY (POSE™ SEAL ELEMENT)

NOTE: The POSE[™] seal will position itself correctly as the yoke or flange is pressed on the shaft.

4. Before you install the yoke or flange on the shaft, apply the same lubricant used in the axle housing to the hub.
5. Install the yoke or flange using the correct procedure.

NOTE: The yoke must be completely seated before tightening pinion nut to the input shaft.

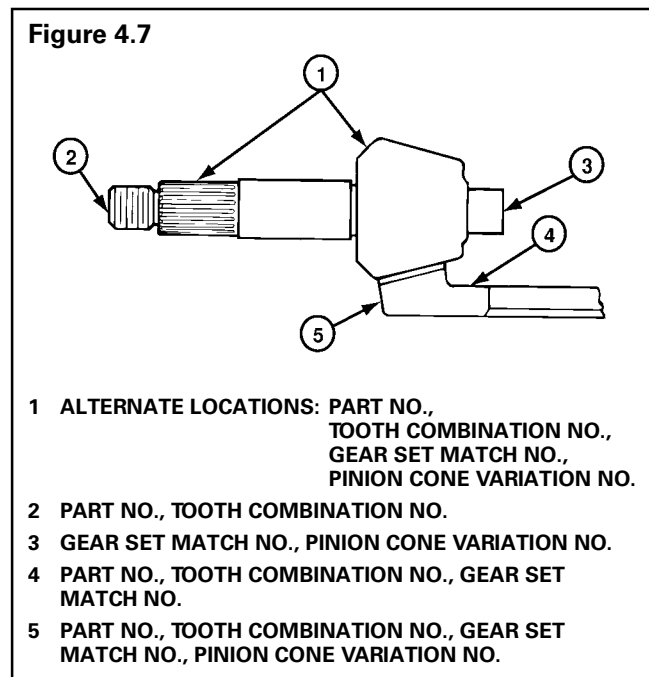
General Yoke and U-Joint Reassembly

Install the end yoke hub capscrews by hand after seating the U-joint. Tighten the capscrews according to manufacturer's torque specifications.

Gear Set Information (Drive Pinion and Ring Gear Marks)

NOTE: Read the following information before installing a new gear set in the carrier. Always inspect the gear set for correct marks to make sure the gears are a matched set.

The locations of the marks are shown in **Figure 4.7**.



1. Part Number

a. Examples of gear set part numbers:

- Conventional ring gear, 36786.
- Conventional drive pinion, 36787.
- Generoid ring gear, 36786 K or 36786 K2.
- Generoid drive pinion, 36787 K or 36787 K2.

NOTE: The last digit in part numbers for Generoid gears is a letter or letter and number.

b. Location on Drive Pinion: End at threads.

c. Location on Ring Gear: Front face or outer diameter.

2. Tooth Combination Number

a. Example of a tooth combination number: 5-37.

NOTE: A 5-37 gear set has a 5-tooth drive pinion and a 37-tooth ring gear.

b. Location on Drive Pinion: End at threads.

c. Location on Ring Gear: Front face or outer diameter.

3. Gear Set Match Number

AxleTech drive pinions and ring gears are available only as matched sets. Both gears of a set have a match number.

a. Example of a gear set match number: M29.

NOTE: A gear set match number has any combination of a number or letter and number.

b. Location on Drive Pinion: End of gear head.

c. Location on Ring Gear: Front face or outer diameter.

Section 4

General Information

NOTE: The pinion cone variation number is not used when inspecting for a matched gear set. The number is used when you adjust the depth of the pinion in the carrier. Refer to the procedure for adjusting the shim pack thickness under the pinion cage heading.

4. Pinion Cone Variation Number

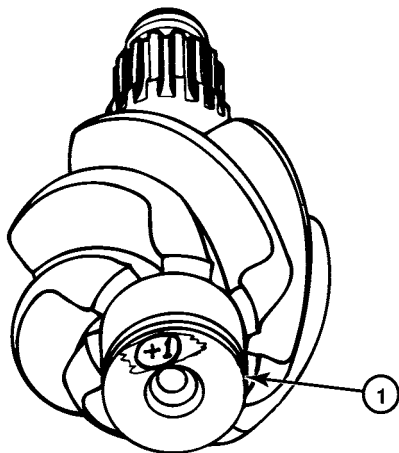
- a. Examples — refer to **Figure 4.8**.

Pinion cone variation numbers:

- PC+3
- PC-5
- +2
- -1
- +0.01 mm
- -0.02 mm

- b. **Location on Gear Set:** End of pinion gear head or outer diameter of ring gear.

Figure 4.8



1 PINION CONE VARIATION NUMBER

Assemble the Drive Pinion, Bearings and Bearing Cage



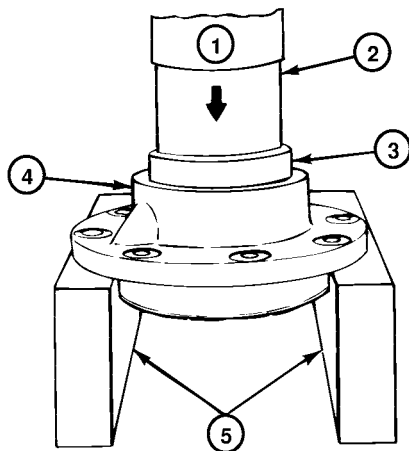
WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

1. Place the bearing cage in a press. **Figure 5.1.**

Figure 5.1



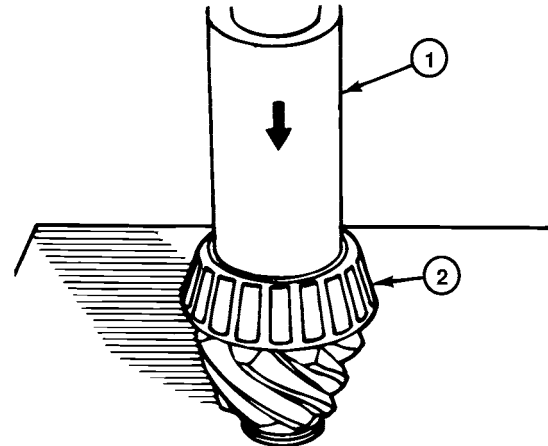
- 1 PRESS
- 2 SLEEVE
- 3 BEARING CUP
- 4 CAGE
- 5 SUPPORTS

2. Support the bearing cage with metal or wood blocks.
3. Press the bearing cup into the bore of bearing cage until cup is flat against bottom of bore. Use a sleeve of the correct size to install bearing cup. **Figure 5.1.**

NOTE: Use the same procedure for both bearing cups.

4. Place the drive pinion in a press, gear head (teeth) toward the bottom. **Figure 5.2.**

Figure 5.2



- 1 SLEEVE
- 2 INNER BEARING CONE

5. Press the inner bearing cone on the shaft of the drive pinion until the cone is flat against the gear head. Use a sleeve of the correct size against the bearing inner race.

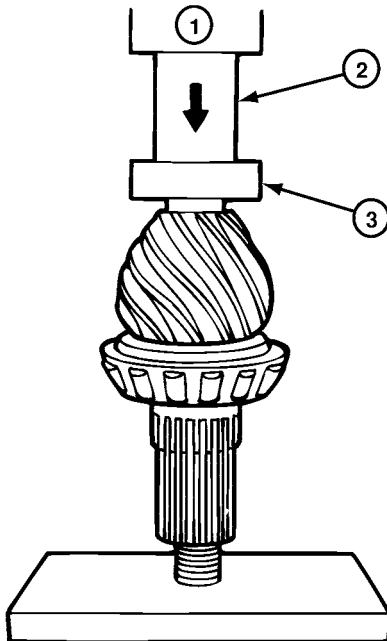
NOTE: Spigot bearings are usually fastened to the drive pinion with a snap ring. Some are fastened with a peening tool, and some are a two-piece bearing assembly with the inner race pressed on the nose of the pinion and the outer race pressed into its bore in the carrier. Use the following procedure to install the spigot bearing, then continue with Steps 9-12 under "Staking the One-Piece Spigot Bearing on the Drive Pinion (Without Snap Ring)."

6. Installing the One-Piece Spigot Bearing on the Drive Pinion with Snap Ring:

NOTE: This step applies to all axles except:

- Some 160 Series single axles may use snap rings.
 - Some 160 and 180 Series rear rear tandem axles may use snap rings.
- a. Place the drive pinion in a press, gear head (teeth) toward the top. **Figure 5.3.**
 - b. Press the spigot bearing on the end of drive pinion until the bearing is flat against the gear head. Use a sleeve of the correct size against the bearing inner race. **Figure 5.3.**

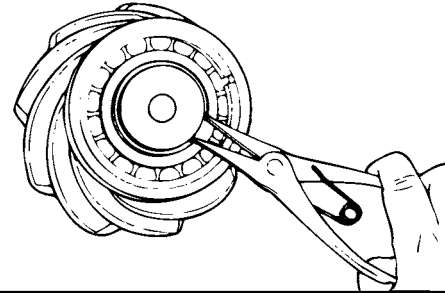
Figure 5.3



- 1 PRESS
- 2 SLEEVE
- 3 SPIGOT BEARING

- c. Install the snap ring* into groove in end of drive pinion with snap ring pliers. **Figure 5.4.**

Figure 5.4



- 1 SNAP RING
- 2 SPIGOT BEARING

7. Staking the One-Piece Spigot Bearing on the Drive Pinion (Without Snap Ring):

NOTE: This procedure applies to some 180 Series rear rear tandem axles with existing snap ring components.

Specification

- Apply 6,614 lb. (3,000 kg) force on a 0.375-inch (10 mm) ball.
- Stake the end of drive pinion at a minimum of five points. **Figure 5.5.**

When using a staking tool and press, **Figure 5.6**, calculate the force required on the tool as follows.

6,614 lb. (3,000 kg) x amount of balls in tool = pounds or kilograms

*Some AxleTech carriers do not have these described parts.

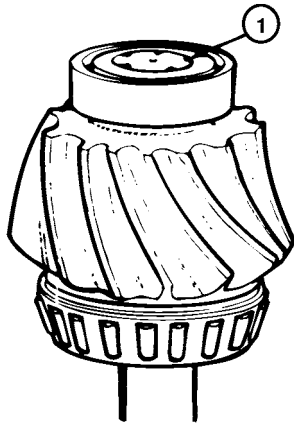
Example

6,614 lb. x 3 balls = 19,842 pounds

For information about the staking tool, contact your local AxleTech representative. **Figure 5.6**

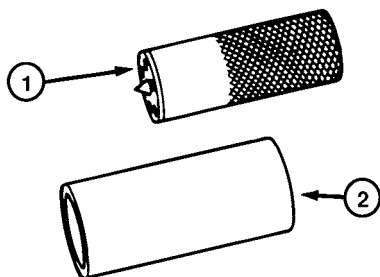
- Place the drive pinion and the tube of the staking tool in a press, spigot bearing toward the top. **Figure 5.7.**
- Calculate the amount of force that will be required on the staking tool. Refer to specification and example calculation.
- Place the punch of the staking tool over the end of the pinion and spigot bearing. Apply the required amount of force on the punch. **Figure 5.7.**

Figure 5.5



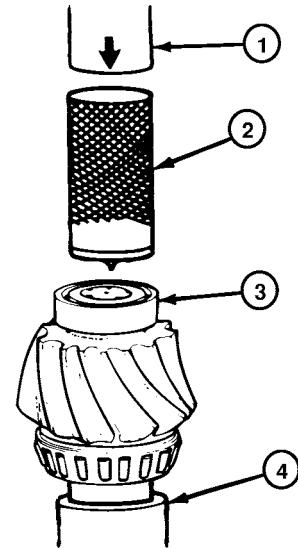
1 STAKING POINTS

Figure 5.6



1 PUNCH
2 TUBE

Figure 5.7



- PRESS
- INSTALL AND CENTER THE PUNCH ON THE END OF PINION.
- SPIGOT BEARING
- PUT THE SHAFT OF PINION INTO TUBE.



CAUTION

Do not align new points with grooves in end of drive pinion or in old points. If the new staked points are placed in the wrong areas, the spigot bearing will not be held correctly on the pinion shaft.

- Rotate the punch as many times as required for a minimum of five points. Repeat Step c for each point.

NOTE: If a three-ball stake tool is used, rotate the tool 180° (degrees).

8. Installing and Staking the Two-Piece Spigot Bearing on the Drive Pinion:

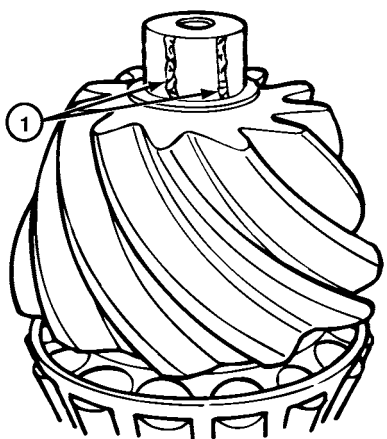
NOTE: This procedure applies to some 160 Series single rear axles and rear rear tandem axles. These axles may also use a one-piece spigot bearing with a snap ring retainer.

The inner race of two-piece spigot bearings may need to be staked in place on some R-160 series rear axles. Before you stake the pinion, you must heat the pinion stem to soften it.

Kent-Moore Kit J-39 39 includes the staking tool, temperature indicating liquid, heating shield and plastigage needed for this job.

- a. Apply two stripes of temperature indicating liquid on the pinion stem from the top to the bottom. **Figure 5.8.** Apply a green stripe to indicate 400°F (205°C) and a blue stripe to indicate 500°F (260°C).

Figure 5.8



1 TEMPERATURE INDICATING LIQUID APPLICATION



WARNING

Always wear safe clothing, gloves and eye protection when working with a torch for heating parts to prevent serious personal injury during assembly.

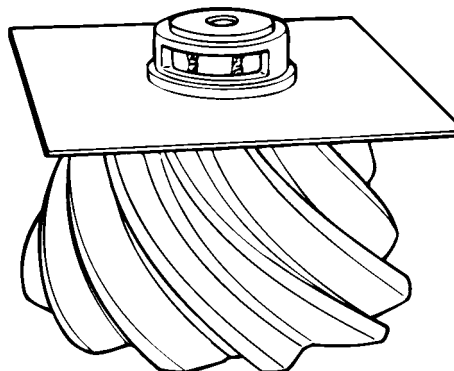


CAUTION

Do not heat the pinion stem without the heat shield in place. Also, do not overheat the pinion stem or you will weaken the metal which can cause early failure. Correct heating will take approximately 25-35 seconds, depending on how hot the torch is.

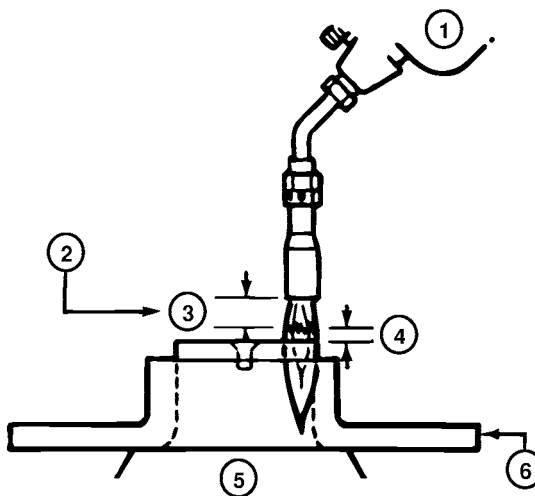
- b. Place the heating shield over the pinion stem so that you can see the temperature indicating liquid through the hole in the shield. **Figure 5.9.**

Figure 5.9



- c. Light and adjust the torch until the white part of the flame is approximately 1/4-inch long. Keep the white part of the flame approximately 1/8-inch from the top of the stem. **Figure 5.10.** Move the flame around the outer diameter of the top of the pinion stem. The green temperature indicating liquid will turn black before the blue liquid does. Heat the stem until the blue liquid turns black at a point in the middle of the window.

Figure 5.10



- 1 TORCH
- 2 WHITE PART OF FLAME
- 3 1/4"
- 4 1/8"
- 5 PINION
- 6 HEATING SHIELD

- d. Remove the flame and the heat shield from the pinion. Let the pinion air cool for 10 minutes. Use a razor blade to remove the temperature indicating liquid.



WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.



CAUTION

Do not press or directly strike the new inner race in Step e or damage to the bearing will result.

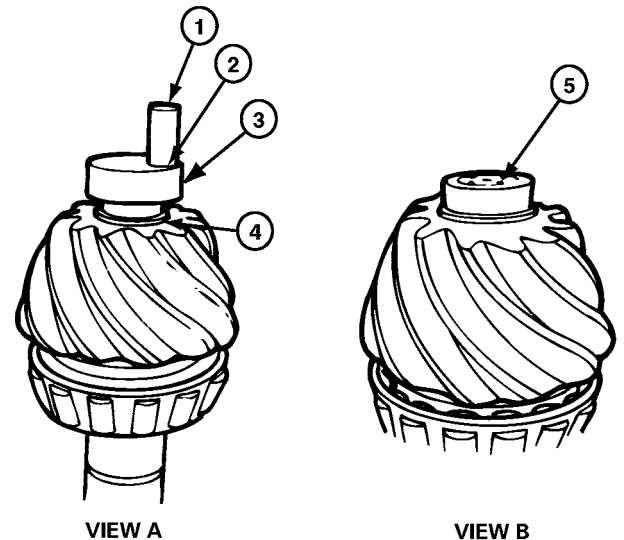
- e. Use a press, if available, or a brass hammer to install the new inner race. Use the old inner race as a sleeve. The face is completely seated when you cannot fit a 0.002-inch feeler gauge between the race and the pinion shoulder.

NOTE: To hold the races in place, use a staking tool, instead of the old race, to start the new race on the stem. The old race can be used to completely seat the new race.

In Step f, you do not need to use the plastigage for every stake. Use the plastigage until you are sure you are hitting the punch with the correct amount of force.

- f. Place the staking tool over the bearing race. Cut a one inch piece from the green plastigage strip and place in between the punch and the staking tool. **Figure 5.11 — View A.**
- g. Strike the punch with a two-three pound brass hammer to upset the end of the pinion stem. Then, remove the strip and measure its thickness against the gauge on the wrapper that the strip came in. The strip must not be less than 0.003-inch thick. This thickness indicates that you are using enough force when you hit the punch. If the strip is too thin, then you must hit the punch harder so the stake will hold the race in place. Rotate the tool and repeat this procedure until there are six evenly spaced stake marks around the stem. **Figure 5.11 — View B.**

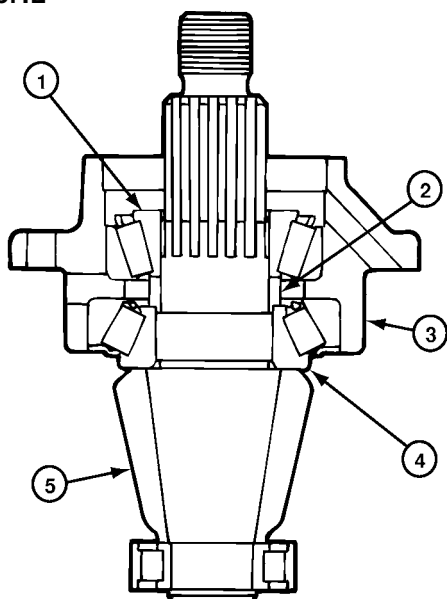
Figure 5.11



- 1 PUNCH
- 2 PLASTIGAGE
- 3 STAKING TOOL
- 4 BEARING INNER RACE
- 5 STAKES

- h. With a press or a soft mallet and sleeve, install the outer race and roller assembly into its bore in the carrier. Use a sleeve that is the same size as the outer race and press the bearing until it is squarely against the shoulder in the bottom of its bore.
9. Apply axle lubricant to the bearing cups and to the bearing cones in the cage.
10. Install the drive pinion into the bearing cage.
11. Install the bearing spacer or spacers on pinion shaft against the inner bearing cone. **Figure 5.12.**

Figure 5.12



- 1 OUTER BEARING CONE
- 2 BEARING SPACER
- 3 BEARING CAGE
- 4 INNER BEARING CONE
- 5 DRIVE PINION

NOTE: The spacer or spacers control the preload adjustment of the drive pinion bearings.

12. Install the outer bearing cone on pinion shaft against the spacer. **Figure 5.12.**

NOTE: **D** NOT install pinion seal in bearing cage. Continue with adjusting preload of pinion bearings.

Adjusting Preload of Pinion Bearings

Specifications

- New pinion bearings — torque
— 5 to 45 lb-in (0.56-5.08 N•m) **T**
- Used pinion bearing in good condition — torque
— 10 to 30 lb-in (1.13-3.39 N•m) **T**

Press Method

NOTE: If a press is not available, or the press does not have a pressure gauge, use the yoke or flange method to adjust pinion bearing preload. Refer to “Yoke or Flange Method” in this section.

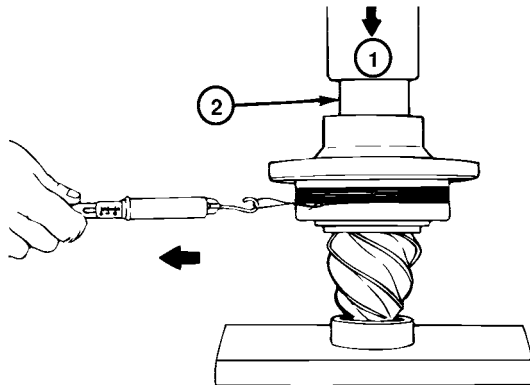
1. Place the drive pinion and cage assembly in a press, gear head (teeth) toward the bottom.
2. Install a sleeve of the correct size against the inner race of the outer bearing. **Figure 5.13.**
3. Apply and hold the correct amount pressure to the pinion bearings. Refer to **Table A.** As pressure is applied rotate the bearing cage several times so that bearings make normal contact.

Table A: Pinion Bearing Preload Adjustment Values

Thread Size of Pinion Shaft	Press Pressure Needed on Bearings for Correct Preload.		T Torque Value Needed on Pinion Nut for Correct Bearing Preload.	
	pounds/tons	(kg/metric tons)	lb-ft	(N•m)
7/8"-20	22,000/1	(9979/10)	200-275	(271-373)
1"-20	30,000/15	(13608/13.6)	300-400	(407-542)
1 1/4"-12	54,000/27	(24494/24.5)	700-900	(949-1220)
1 1/4"-18	54,000/27	(24494/24.5)	700-900	(949-1220)
1 1/2"-12	54,000/27	(24494/24.5)	800-1100	(108 -1491)
1 1/2"-18	54,000/27	(24494/24.5)	800-1100	(108 -1491)
1 3/4"-12	50,000/25	(22680/22.7)	900-1200	(1220-1627)
2"-12	50,000/25	(22680/22.7)	1200-1500	(1627-2034)

4. While pressure is held against the assembly, wind a cord around the bearing cage several times.

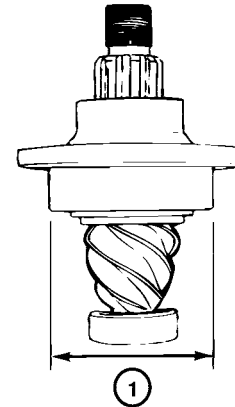
Figure 5.13



- 1 PRESS
- 2 SLEEVE

5. Attach a spring scale to the end of the cord.
6. Pull the cord with scale on a horizontal line. As the bearing cage rotates, read the value indicated on scale. Write down and record the reading. **Figure 5.13.**
NOTE: Do not read starting torque. Read only the torque value after the cage starts to rotate. Starting torque will give a false reading.
7. Measure the diameter of bearing cage where the cord was wound. Measure in inches or centimeters. **Figure 5.14.**
8. Divide the dimension in half to get the radius. Write down and record the radius dimension.

Figure 5.14



- 1 MEASURE DIAMETER OF CAGE.

9. Use the following procedure to calculate the bearing preload (torque).

- Pounds Pulled x Radius (inches) =
lb-in Preload
— Preload x 0.113 = N•m Preload
- Kilograms Pulled x Radius (cm) =
kg-cm Preload
— Preload x 0.098 = N•m Preload

or

Examples

- Reading from spring scale = 7.5 pounds (3.4 kg)
- Diameter of bearing cage = 6.62 inches (16.80 cm)
- Radius of bearing cage = 3.31 inches (8.40 cm)

$$7.50 \text{ lb.} \times 3.31 \text{ in.} = 24.80 \text{ in-lb Preload}$$

$$\text{Preload} \times 0.113 = 2.800 \text{ N}\cdot\text{m Preload}$$

or

$$3.4 \text{ kg} \times 8.4 \text{ cm} = 28.6 \text{ kg-cm Preload}$$

$$\text{Preload} \times 0.098 = 2.800 \text{ N}\cdot\text{m Preload}$$

Section 5 Assembly

10. If the preload (torque) of pinion bearings is not within specifications, do the following procedure then repeat Steps a through i.

To increase preload, install a thinner bearing spacer. To decrease preload, install a thicker bearing spacer.

11. Inspect the bearing preload with the drive pinion and cage assembly installed in the carrier. Follow the procedures to adjust preload of pinion bearings, yoke or flange method.

Yoke or Flange Method



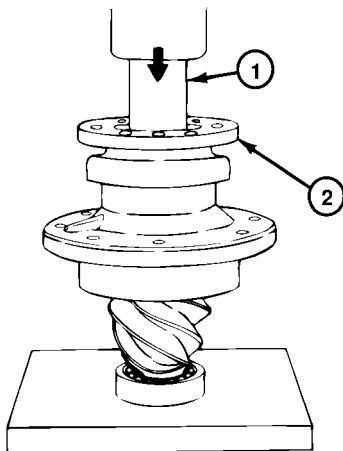
WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

1. Install the input yoke or flange, nut and washer* on the drive pinion. The yoke or flange **MUST** be seated against the outer bearing.

NOTE: Use a press to install the yoke or flange. **Figure 5.15.**

Figure 5.15



- 1 PRESS
- 2 INPUT FLANGE SHOWN

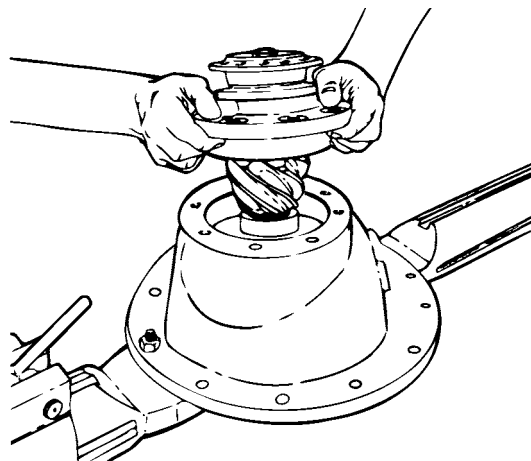


CAUTION

Do not install tight fit yokes or flanges on shafts using a hammer or mallet. A hammer or mallet will damage the yoke or flange.

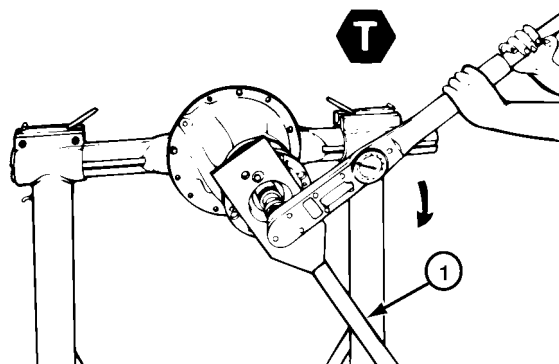
2. Temporarily install the drive pinion and cage assembly in the carrier. Do not install shims under the bearing cage. **Figure 5.16.**

Figure 5.16



3. Install the bearing cage to carrier capscrews. Washers are not required at this time. Tighten the capscrews by hand until snug.
4. Fasten a yoke or flange bar to the input yoke or flange. The bar will hold the drive pinion in position when the nut is tightened. **Figure 5.17.**

Figure 5.17



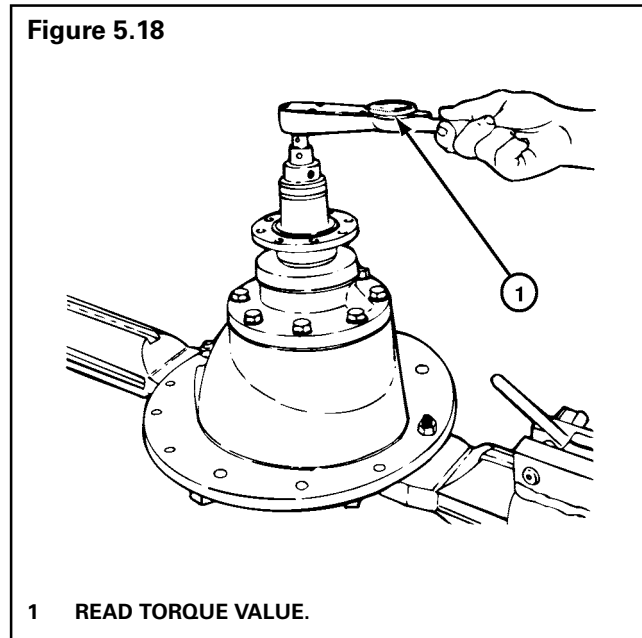
- 1 USE FLANGE OR YOKE BAR.

5. Tighten the nut on drive pinion to the correct torque value. **Figure 5.17.** Refer to **Table A.**

*Some AxleTech carriers do not have these described parts.

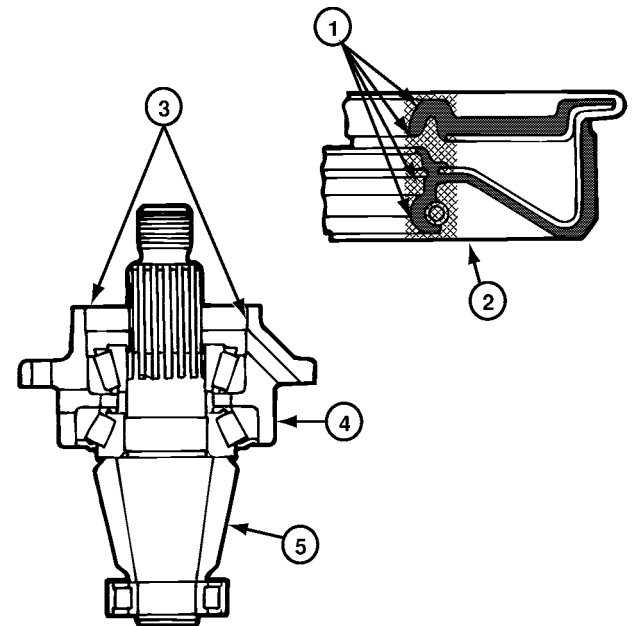
6. Remove the yoke or flange bar.
7. Attach a torque wrench on the drive pinion nut. Rotate the drive pinion and read the value indicated on torque wrench. **Figure 5.18.**

Figure 5.18



8. If the preload (torque) of pinion bearings is not within specifications, remove the pinion and cage assembly from carrier. Do the following procedure, then repeat Steps a through g.
 - To **INCREASE** preload, install a thinner bearing spacer.
 - To **DECREASE** preload, install a thicker bearing spacer.
9. After adjusting preload of pinion bearings, remove the drive pinion and bearing cage from carrier. Follow Steps 1-5 under "Remove the Drive Pinion and Bearing Cage from Carrier."
10. Install a new triple-lip seal as follows.
 - a. Apply the same lubricant used in the axle housing to the outer surface of the seal and the seal bore in the bearing cage. **Figure 5.19.**

Figure 5.19



- 1 APPLY GREASE.
- 2 TRIPLE-LIP (MAIN) SEAL
- 3 APPLY LUBRICANT TO SEAL BORE.
- 4 BEARING CAGE
- 5 DRIVE PINION

CAUTION

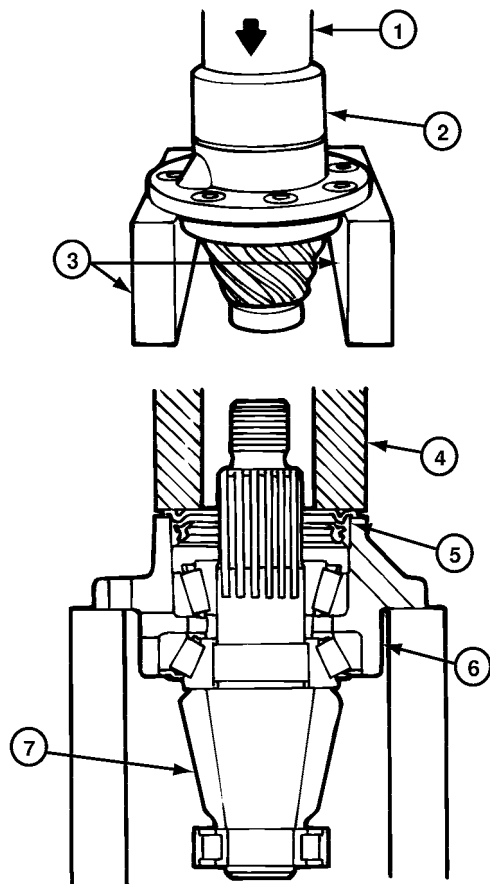
Make sure that the seal lips are clean and free from dirt and particles that will cause a leak between the yoke and the seal.

- b. Place the drive pinion and cage assembly in a press, seal bore toward the top.

Section 5 Assembly

- c. Press the seal into bearing cage until flange of seal is flat against the top of bearing cage. Use a sleeve or seal driver of the correct size that fits against the metal flange of seal. The diameter of the sleeve or drive **MUST** be larger than the diameter of the flange. **Figure 5.20.**

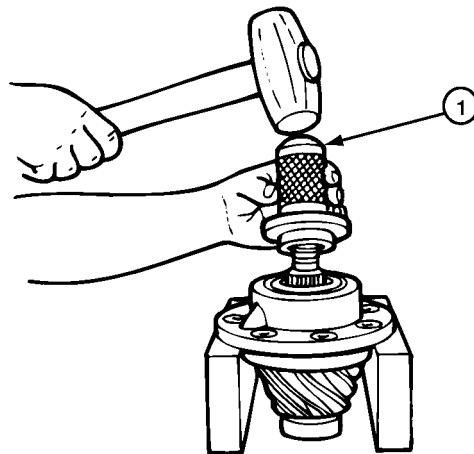
Figure 5.20



- 1 PRESS
- 2 SLEEVE
- 3 SUPPORTS
- 4 SLEEVE
- 5 SEAL
- 6 BEARING CAGE
- 7 DRIVE PINION

NOTE: If a press is not available, use a mallet and the sleeve or driver to install the seal. **Figure 5.21.**

Figure 5.21

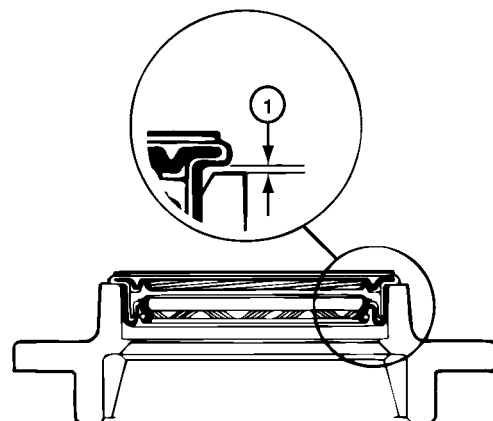


- 1 SEAL DRIVER

- d. After the triple-lip seal is installed, a gap of approximately 0.015- to 0.030-inch (0.38-0.76 mm) between the flange and bearing cage is normal. **Figure 5.22.**

Inspect the gap with a feeler gauge at several points around the seal. The gap must be within 0.015- to 0.030-inch (0.38-0.76 mm). The difference between the largest and smallest gap measurement **MUST NOT** exceed 0.010-inch (0.254 mm).

Figure 5.22



- 1 0.015-0.030" (0.38-0.76 MM)

SHOWN WITHOUT BEARINGS AND PINION



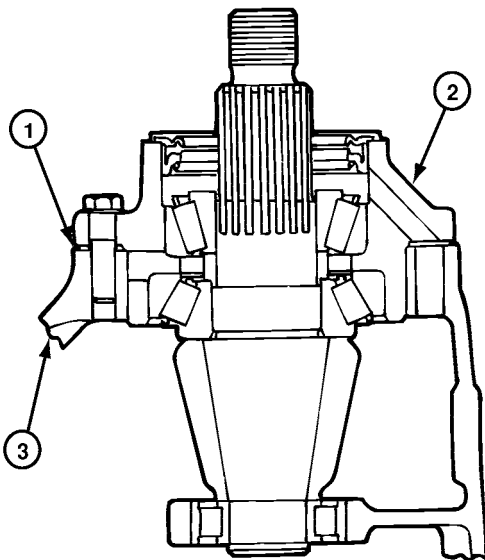
WARNING

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

Adjusting Shim Pack Thickness for the Pinion Cage (Depth of Pinion)

NOTE: Use this procedure if a new drive pinion and ring gear set is installed, or if the depth of the drive pinion has to be adjusted. **Figure 5.23.**

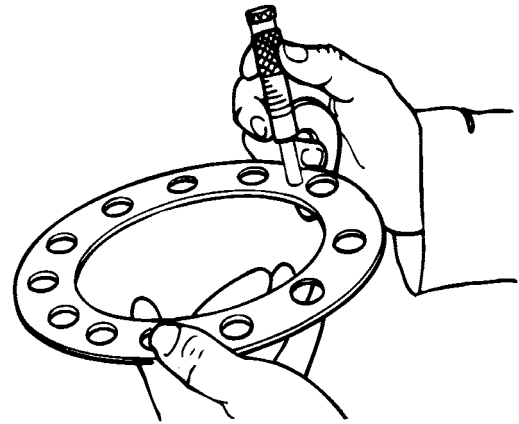
Figure 5.23



- 1 SHIM PACK CONTROLS DEPTH OF PINION.
- 2 BEARING CAGE
- 3 CARRIER

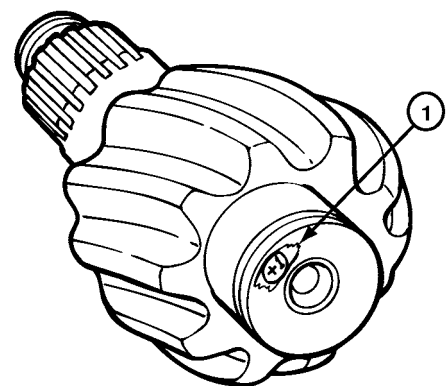
1. Measure the thickness of the old shim pack that was removed from under the pinion cage with a micrometer. Record the measurement for use later. **Figure 5.24.**

Figure 5.24



2. Look at the pinion cone (PC) variation number on the old drive pinion that is being replaced. Refer to "Gear Set Information," Step 4, in Section 4 for examples and location of the number. Record the number for later use. If (PC) variation number cannot be located, assemble gear set with shim pack thickness found in Step 1 under "Adjusting Shim Pack Thickness for the Pinion Cage (Depth of Pinion)." **Figure 5.25.**

Figure 5.25



- 1 PINION CONE VARIATION NUMBER

Section 5 Assembly

NOTE: The pinion cone number can be either 10ths of a millimeter or 1,000ths of an inch. Refer to the following examples.

PC +3, PC-3, +3 or -3 = 0.003 inch

PC +.03, PC-0.03 mm, +0.03 mm
or -0.03 = 0.03 mm

To change millimeters to inches — millimeters
x 0.09

To change inches to millimeters —
inches x 25.40

3. If the old pinion cone number is a plus (+) number, subtract the number from the old shim pack thickness that was measured in Step 2.
4. If the old pinion cone number is a minus (-) number, add the number to the old shim pack thickness that was measured in Step 2.

NOTE: The value calculated in Step 3 or 4 is the thickness of the standard shim pack, without a variation.

5. Look at the pinion cone (PC) variation number on the new drive pinion that will be installed. Record the number for later use.
6. If the new pinion cone number is a plus (+) number, add the number to the standard shim pack thickness that was calculated in Step 3 or 4.
7. If the new pinion cone number is a minus (-) number, subtract the number from the standard shim pack thickness that was calculated in Step 3 or 4.

NOTE: The value calculated in Step 6 or 7 is the thickness of the new shim pack that will be installed. Refer to the following examples, **Table B**.

8. Install the drive pinion, bearing cage and new shim pack into the carrier.

Table B: Shim Pack Thickness Calculations

Examples:	Inches	mm
1. Old Shim Pack Thickness Old PC Number, PC +2 inches (+0.05 mm) Standard Shim Pack Thickness New PC Number, PC +5 inches (+0.13 mm) New Shim Pack Thickness	$0.030 - 0.002 = 0.028$ $+ 0.005 = 0.033$	$0.760 - 0.050 = 0.710$ $+ 0.130 = 0.840$
2. Old Shim Pack Thickness Old PC Number, PC -2 inches (-0.05 mm) Standard Shim Pack Thickness New PC Number, PC +5 inches (+0.13 mm) New Shim Pack Thickness	$0.030 + 0.002 = 0.032$ $+ 0.005 = 0.037$	$0.760 + 0.050 = 0.810$ $+ 0.130 = 0.940$
3. Old Shim Pack Thickness Old PC Number, PC +2 inches (+0.05 mm) Standard Shim Pack Thickness New PC Number, PC -5 inches (-0.13 mm) New Shim Pack Thickness	$0.030 - 0.002 = 0.028$ $- 0.005 = 0.023$	$0.760 - 0.050 = 0.710$ $- 0.130 = 0.580$
4. Old Shim Pack Thickness Old PC Number, PC -2 inches (-0.05 mm) Standard Shim Pack Thickness New PC Number, PC -5 inches (-0.13 mm) New Shim Pack Thickness	$0.030 + 0.002 = 0.032$ $- 0.005 = 0.027$	$0.760 + 0.050 = 0.810$ $- 0.130 = 0.680$

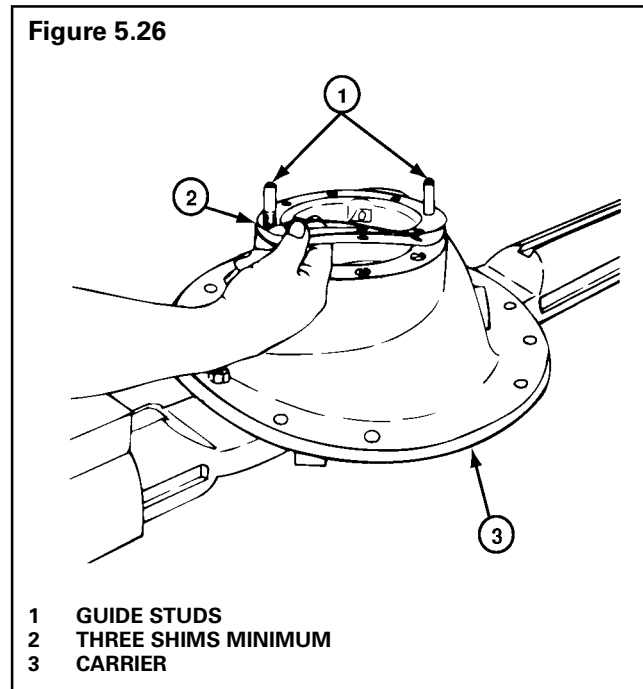
NOTE: Drive pinions and ring gears **MUST** be replaced as fully matched sets.

Installing the Drive Pinion, Bearing Cage and Shim Pack into the Carrier

NOTE: If a new drive pinion and ring gear set is installed, or if the depth of the drive pinion has to be adjusted, calculate the thickness of the shim pack. Refer to "Adjusting Shim Pack Thickness for the Pinion Cage (Depth of Pinion)" in this section.

1. Select the correct shim pack between the bearing cage and carrier. **Figure 5.26.**
2. Apply Loctite® 518 Gasket Eliminator to face of carrier.
3. Align the oil slots in the shims with oil slots in the bearing cage and carrier. The use of guide studs will help align the shims. **Figure 5.26.**

Figure 5.26



NOTE: If the pack is made from different thickness shims, install the thinnest shims on both sides of the pack for maximum sealing.

4. Apply Loctite® 518 Gasket Eliminator to top of shim pack.

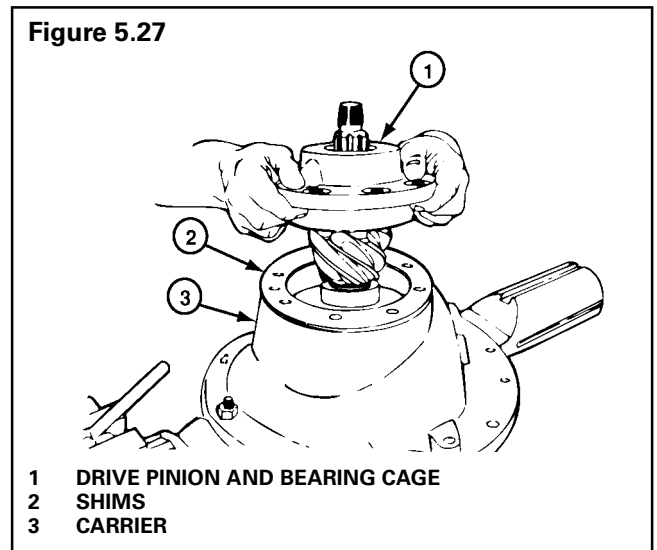


WARNING

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

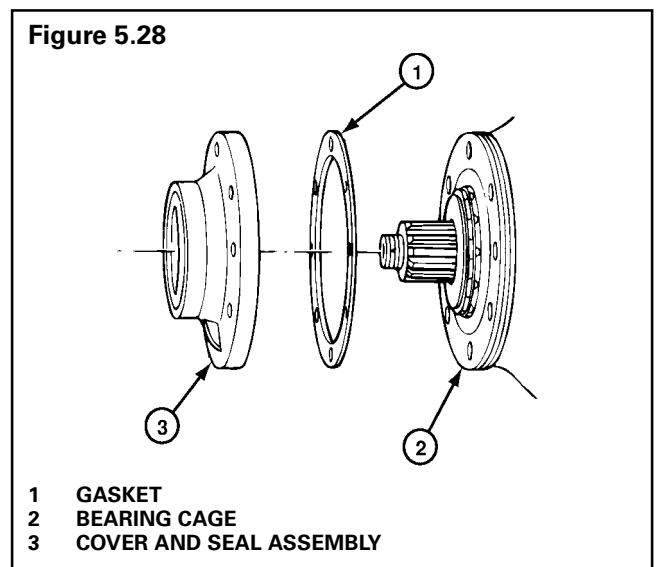
5. Install the drive pinion and bearing cage into the carrier. If necessary, use a rubber, plastic or leather mallet to hit the assembly into position. **Figure 5.27.**

Figure 5.27



6. If used, install the cover* and seal assembly and gasket* over the bearing cage. **Figure 5.28.**

Figure 5.28

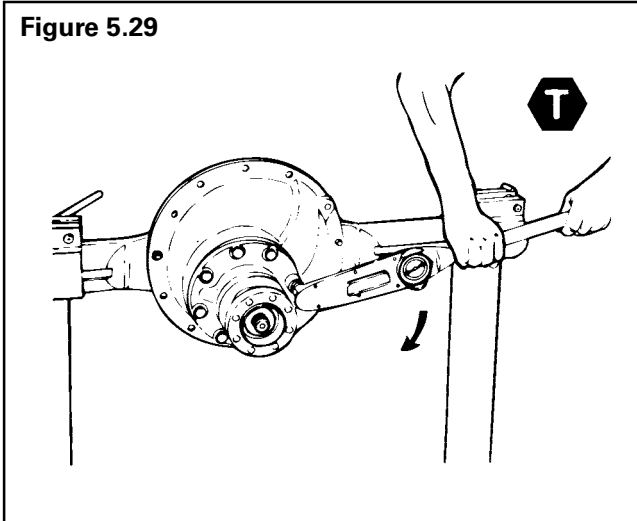


*Some AxleTech carriers do not have these described parts.

Section 5 Assembly

7. Align the oil slots in the cover* and gasket* with oil slot in the bearing cage.
8. Install the bearing cage to carrier capscrews and washers. Tighten capscrews to correct torque value. Refer to **Table J. Figure 5.29.**

Figure 5.29



Installing Tight Fit Yokes and POSETM Seal

CAUTION

Make sure that the seal lips are clean and free from dirt and particles that will cause a leak between the yoke and the seal.

Do not install tight fit yokes on shafts using a hammer or mallet. Using a hammer or mallet can damage the yoke.

1. Apply axle lubricant on the yoke seal.
2. Inspect all surfaces of the yoke hub for damage.

If carrier uses a POSETM seal element, install a new POSETM seal as follows:

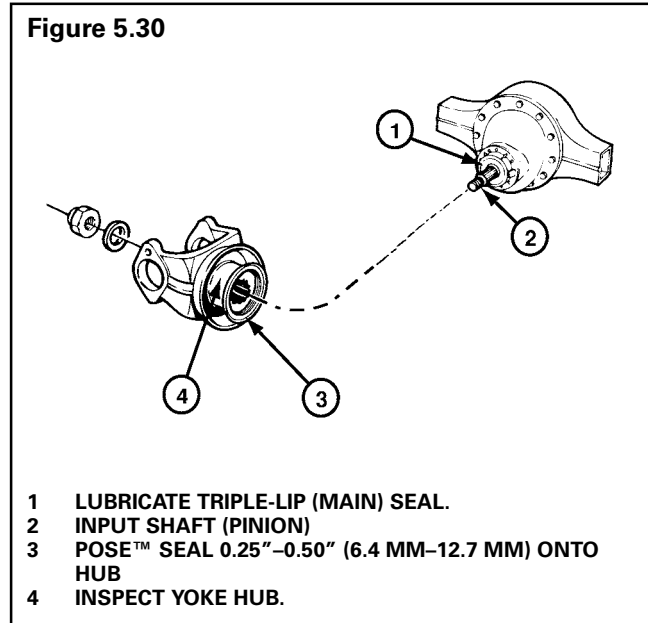
- a. Lightly lubricate yoke journal with same lubricant used in the axle housing.

CAUTION

Make sure that the seal lips are clean and free from dirt and particles that can cause a leak between the yoke and the POSETM seal.

- b. Partially install the POSETM seal onto the yoke to 1/4-inch – 1/2-inch as shown in **Figure 5.30.**

Figure 5.30



- 1 LUBRICATE TRIPLE-LIP (MAIN) SEAL.
- 2 INPUT SHAFT (PINION)
- 3 POSETM SEAL 0.25" – 0.50" (6.4 MM–12.7 MM) ONTO HUB
- 4 INSPECT YOKE HUB.

NOTE: DO NOT install POSETM seal all the way against the yoke shoulder. This seal is designed to position itself as yoke is installed.

- c. Before installing the yoke onto the drive pinion, lubricate the yoke again with the same lubricant used in the axle housing.
3. Slide the yoke over the input shaft pinion. Align the yoke splines with the shaft splines.

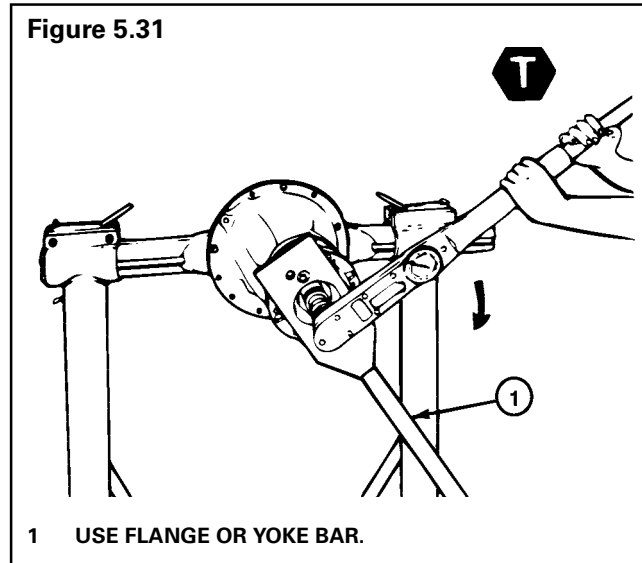
CAUTION

Do not use a hammer or mallet to install the yoke to the input pinion shaft. Using a hammer or mallet can damage the yoke or flange.

4. Install the input yoke flange onto the drive pinion shaft. The yoke or flange must be fully seated against the outer differential bearing **BEFORE** the nut is torqued to specifications.

*Some AxleTech carriers do not have these described parts.

5. Install the drive pinion nut on the input pinion shaft and against the yoke collar. Tighten the nut against yoke collar to torque specifications. **Figure 5.31.** Refer to **Table J.** 



Assemble the Main Differential and Ring Gear Assembly

CAUTION

Do not press a cold ring gear on the flange case half. A cold ring gear will damage the case half because of the tight fit. Metal particles between the parts will cause gear runout that exceeds the AxleTech specification of 0.008-inch (0.200 mm).

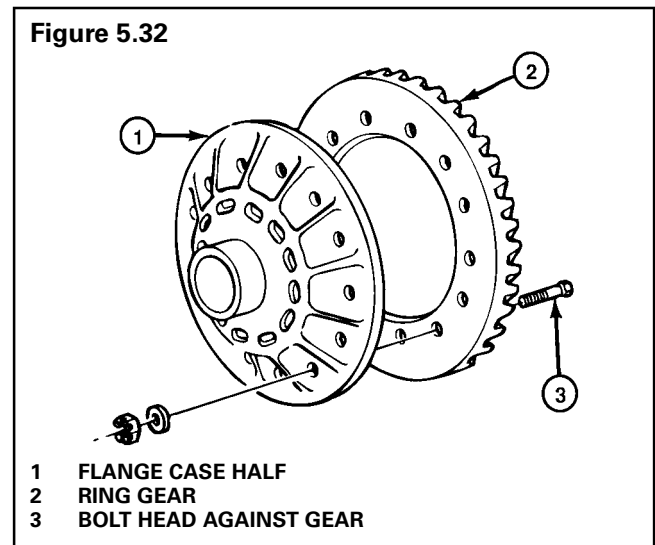
1. Expand the ring gear by heating the gear in a tank of water to a temperature of 160°F to 180°F (71°C-82°C) for 10 to 15 minutes.

WARNING

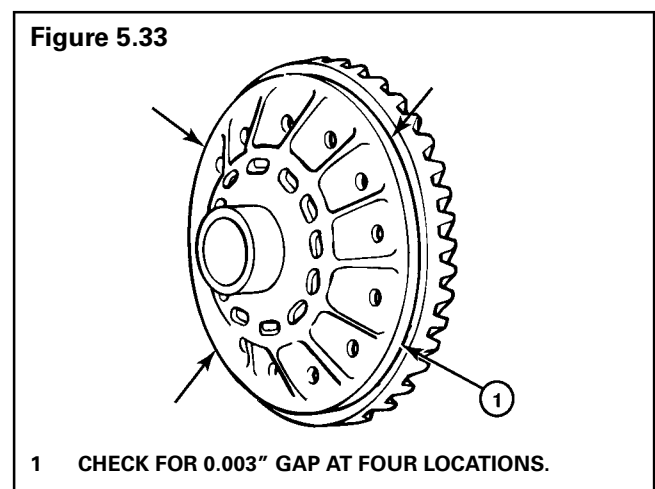
Wear safe clothing and gloves for protection from injury when working with the hot ring gear.

2. Safely lift the ring gear from the tank of water using a lifting tool.
3. Install the ring gear on the flange case half immediately after the gear is heated. If the ring gear does not fit easily on the case half, heat the gear again. Repeat Step 1.
4. Align fastener holes of the ring gear and flange case half. Rotate the ring gear as needed.

5. If rivets* were used to hold the ring gear to the flange case half, replace them with bolts, nuts and washers.
6. Install the bolts*, nuts* and washers* that hold the ring gear to the flange case half. Install the bolts from the gear side of the assembly. The bolt heads **MUST** be against the ring gear. **Figure 5.32.**



7. Tighten the bolts* and nuts* to the correct torque value. Refer to **Table J.** 
8. Inspect for gaps between the back surface of the ring gear and the case flange after the bolts are installed. Use an 0.003-inch (0.080 mm) feeler gauge and inspect at four points around the assembly. **Figure 5.33.**

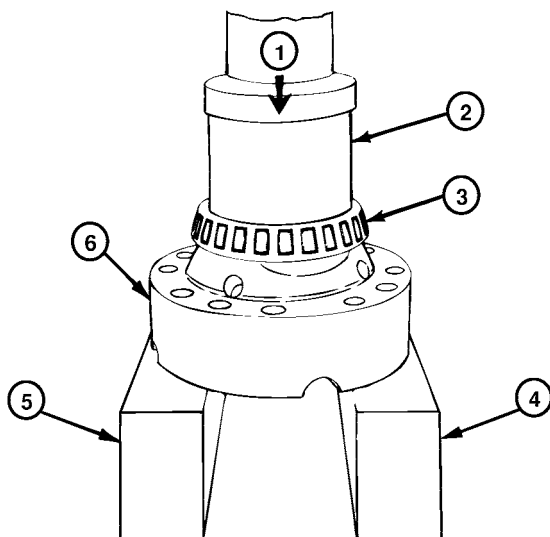


*Some AxleTech carriers do not have these described parts.

Section 5 Assembly

9. Inspect the flange case half and ring gear for the problem that causes the gap. Repair or replace parts that do not meet specifications.
10. Assemble the repaired or replaced ring gear on the flange case half. Repeat the Main Differential and Ring Gear Assembly procedure.
11. Install the bearing cones on both of the case halves. Use a press and sleeve of the correct size. **Figure 5.34.**

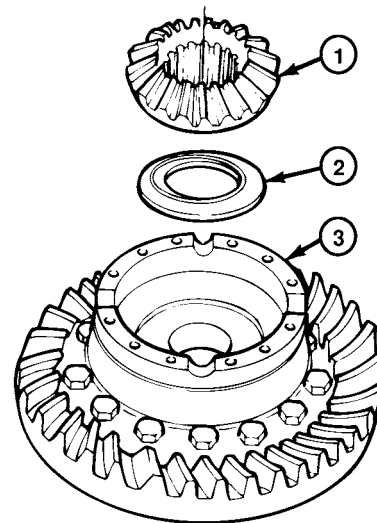
Figure 5.34



- 1 PRESS
- 2 SLEEVE
- 3 BEARING CONE
- 4 SUPPORT
- 5 SUPPORT
- 6 CASE HALF

12. Apply axle lubricant on the inside surfaces of both case halves, spider (cross), thrust washers, side gears and differential pinions.
13. Place the flange case half on a bench, ring gear teeth toward top.
14. Install one thrust washer and side gear into the flange case half. **Figure 5.35.**

Figure 5.35



- 1 SIDE GEAR
- 2 THRUST WASHER
- 3 FLANGE CASE HALF

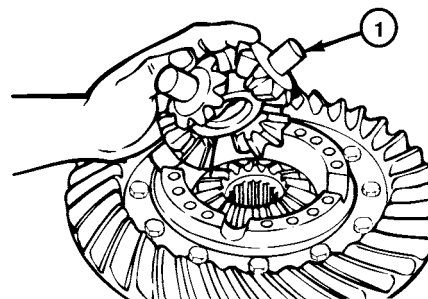


CAUTION

The side gears in some carrier models have hubs of different lengths. Install the correct length side gear into the flange case half.

15. Install the spider (cross), differential pinions and thrust washers into the flange case half. **Figure 5.36.**

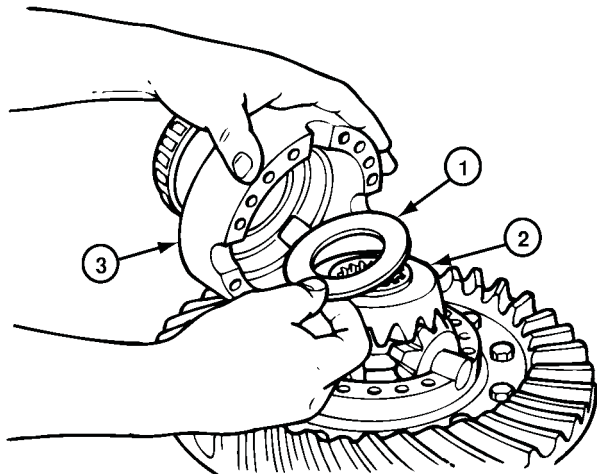
Figure 5.36



- 1 SPIDER, PINION AND THRUST WASHERS

16. Install the second side gear and thrust washer over spider and differential pinions.
Figure 5.37.

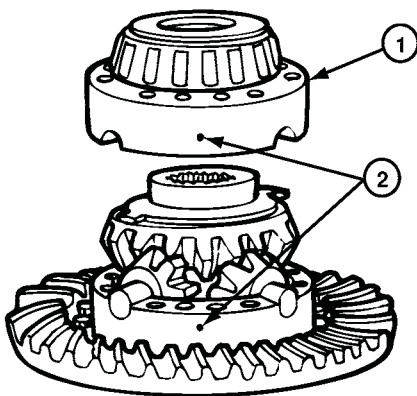
Figure 5.37



- 1 THRUST WASHER
- 2 SIDE GEAR
- 3 PLAIN CASE HALF

17. Place the plain half of the differential case over the flange half and gears. Rotate the plain half as needed to align the match marks. **Figure 5.37** and **Figure 5.38.**

Figure 5.38

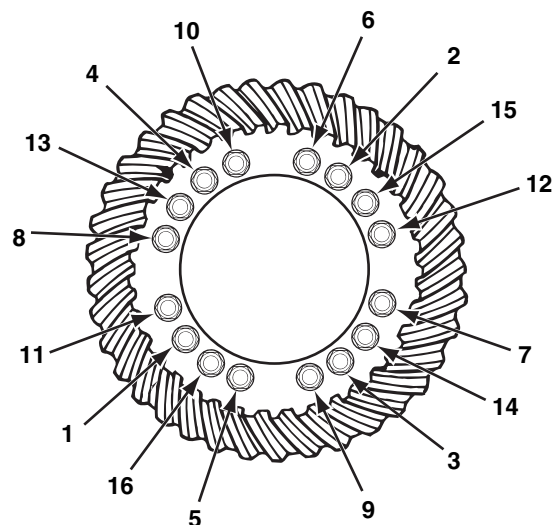


- 1 PLAIN CASE HALF
- 2 MATCH MARKS

18. Install Dri-Loc fasteners into the case halves. Refer to "Application of Three Bond 1216 or Equivalent Silicone Gasket Material" in Section 4 and the following Steps **a** and **b**.

- a. Install four capscrews* and washers* or bolts*, nuts* and washers* into the case halves. The distance between the fasteners **MUST** be equal. Tighten the fasteners to the correct torque value in a progressive criss-cross pattern opposite each other. Refer to **Figure 5.39** and to **Table J**. **T**

Figure 5.39



- b. Install the other fasteners into the case halves. Tighten the fasteners to the correct torque value. Refer to **Table J**. **T**

19. Inspect the rotating resistance of the differential gears. Use the following procedure.

*Some AxleTech carriers do not have these described parts.

Inspecting the Rotating Resistance of the Differential Gears

Specification

- 50 lb-ft (67.8 N•m) maximum torque applied to one side gear. **1**

NOTE: Make a tool for inspecting the rotating resistance of the differential gears. The tool can be made from an axle shaft that matches the spline size of the differential side gear. Refer to **Figure 5.40** and **Figure 5.41**.

Figure 5.40

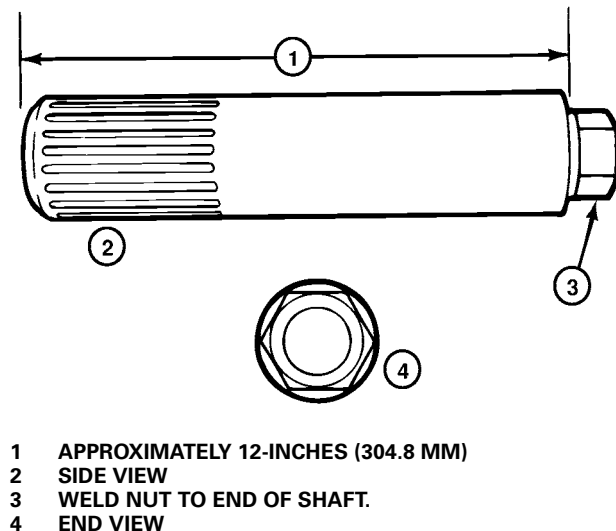


Figure 5.41

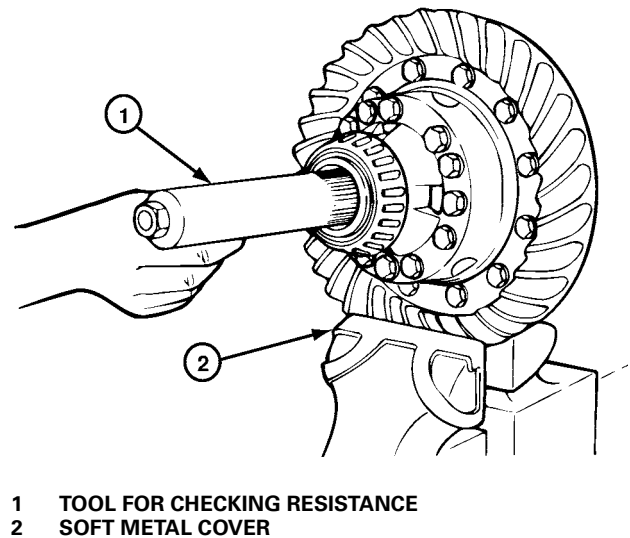
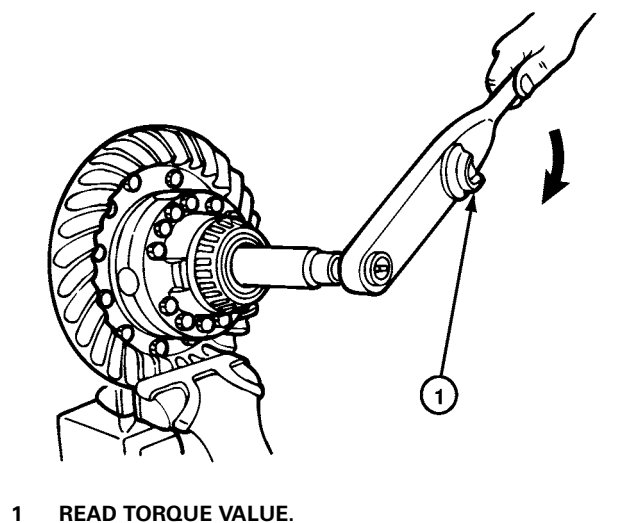


Figure 5.42

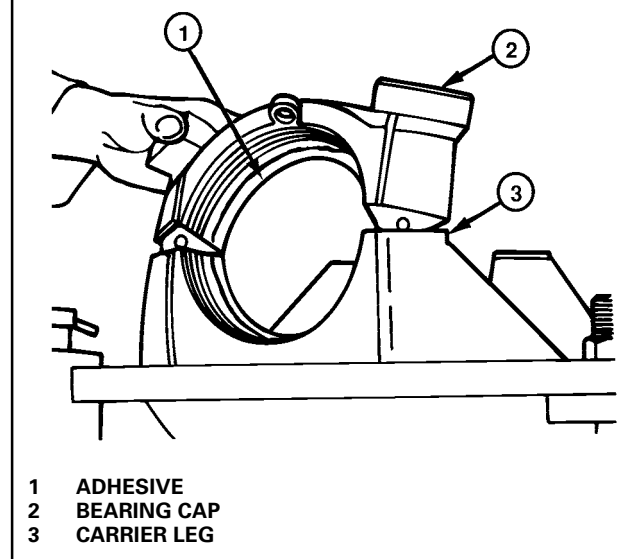


1. Install soft metal covers over vise jaws to protect the ring gear. **Figure 5.41**.
2. Place the differential and ring gear assembly in the vise and close the vise jaws.
3. Install the tool into the differential until the splines of the tool and one side gear are engaged. **Figure 5.41**.
4. Engage a torque wrench to the nut of the tool and rotate the differential gears. As the differential gears rotate, read the value indicated on the torque wrench. **Figure 5.42**.
5. If the torque value exceeds the specification, disassemble the differential gears from the case halves.
6. Inspect the case halves, spider, gears and thrust washers for the problem that causes the torque value to exceed the specification. Repair or replace parts.
7. After all the differential assembly parts are repaired or replaced, assemble the parts and repeat Steps 1 through 7.

Install the Differential and Ring Gear Assembly

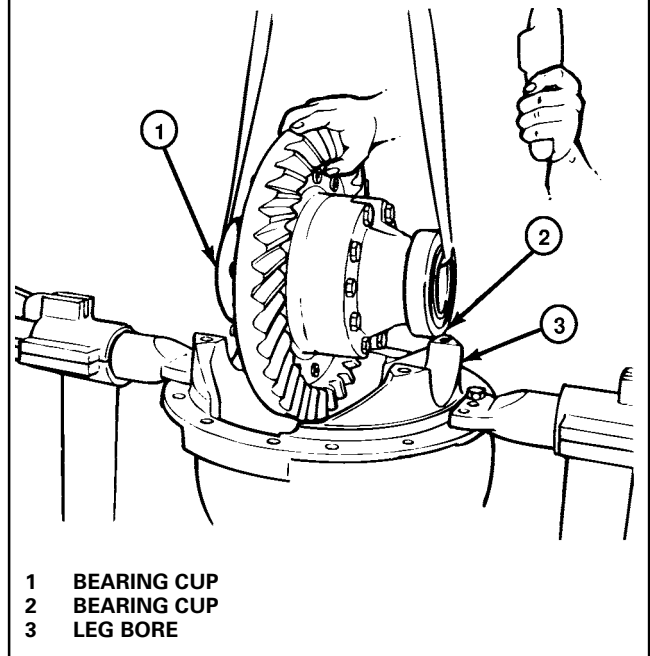
1. Clean and dry the bearing cups and bores of the carrier legs and bearing caps.
2. Apply axle lubricant on the inner diameter of the bearing cups and on both bearing cones that are assembled on the case halves.
3. Apply AxleTech Adhesive into the bearing bores of the carrier legs and bearing caps. Make certain not to allow adhesive to contact adjusting ring threads. Refer to "Application of Three Bond 1216 or Equivalent Silicone Gasket Material" in Section 4. **Figure 5.43.**

Figure 5.43



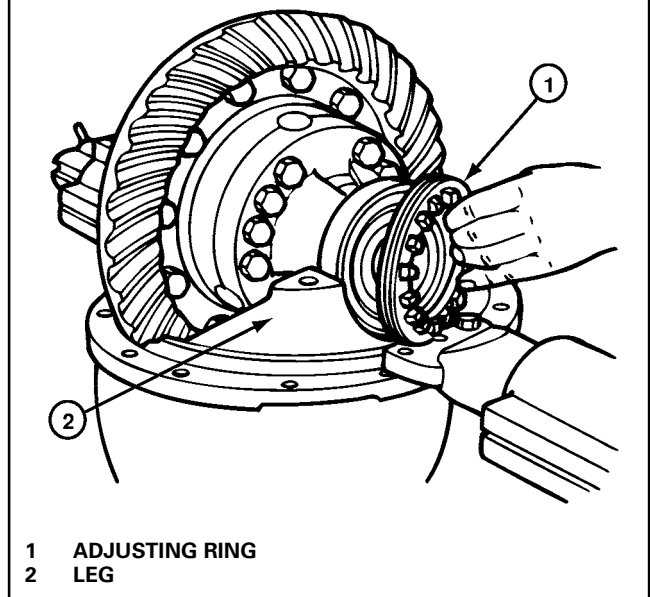
4. Install the bearing cups over the bearing cones that are assembled on the case halves. **Figure 5.44.**
5. Safely lift the differential and ring gear assembly and install into the carrier. The bearing cups **MUST** be flat against the bores between the carrier legs. **Figure 5.44.**

Figure 5.44



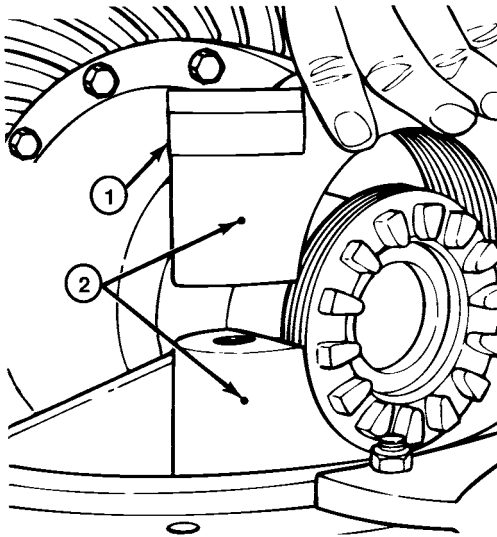
6. Install both of the bearing adjusting rings into position between the carrier legs. Turn each adjusting ring hand-tight against the bearing cup. **Figure 5.45.**

Figure 5.45



7. Install the bearing caps over the bearings and adjusting rings in the correct location as marked before removal. **Figure 5.46.**

Figure 5.46



- 1 BEARING CAP
- 2 MATCH MARKS

WARNING

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

8. Seat each bearing cap with a light leather, plastic or rubber mallet. The caps **MUST** fit easily against the bearings, adjusting rings and carrier. **Do not force the bearing caps into position.**

CAUTION

If bearing caps are not installed in the correct original locations, the bores and threads in caps will not match the carrier. Assembling mismatched caps into the carrier can result in carrier damage after reassembly to axle and during vehicle operation. Do not force the bearing caps into unmatched bore locations in the carrier.

9. If bearing caps do not correctly fit into position, inspect the alignment of match marks between caps and carrier. Remove the caps and repeat Steps 6-8.

10. Install the capscrews and washers that hold bearing caps to the carrier. Tighten the capscrews by hand four to six turns, then tighten the capscrews to the correct torque value. Refer to **Table J.** 

NOTE: Do not install the cotter keys*, pins* or lock plates* that hold the bearing adjusting rings in position. Continue by adjusting the preload of differential bearings, adjust backlash of the hypoid gear and inspect tooth contact patterns.

* Some AxleTech carriers do not have these described parts.

Adjust Preload of Differential Bearings

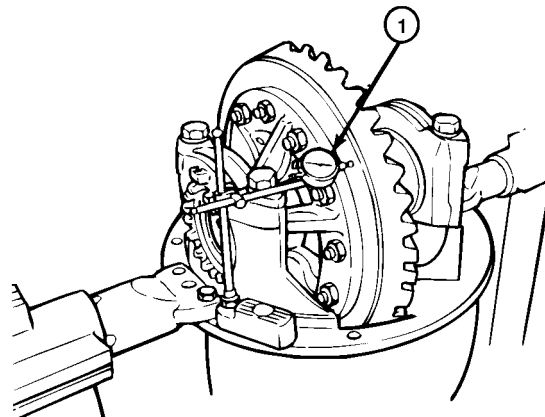
Specifications

- Preload of differential bearings (all carrier models)
 - 15 to 35 lb-in (1.7-3.9 N•m) torque. 
- Expansion between bearing caps (leg spread)
 - R-140, R-155 and R-160 carrier models: 0.002- to 0.009-inch (0.050-0.229 mm)
 - R, S, U and W 120 series and most (check latest specifications) other carrier models: 0.00- to 0.013-inch (0.150-0.330 mm)

Method 1

1. Attach a dial indicator on the mounting flange of the carrier.
2. Adjust the dial indicator so that the plunger or pointer is against the back surface of the ring gear. **Figure 5.47.**

Figure 5.47



- 1 DIAL INDICATOR

CAUTION

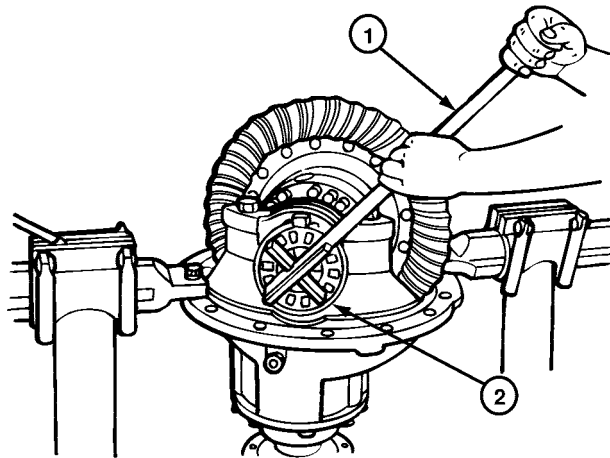
When you turn the adjusting rings, always use a tool that engages two or more opposite notches in the ring. A "T" bar wrench can be used for this purpose. If the tool does not correctly fit into the notches, damage to the lugs will occur.

Figure 5.48.

3. Loosen the bearing adjusting ring that is opposite the ring gear so that a small amount of end play shows on the dial indicator.

Figure 5.48. Move the differential and ring gear to the left and right with pry bars while you read the dial indicator. Use the following Step a or b.

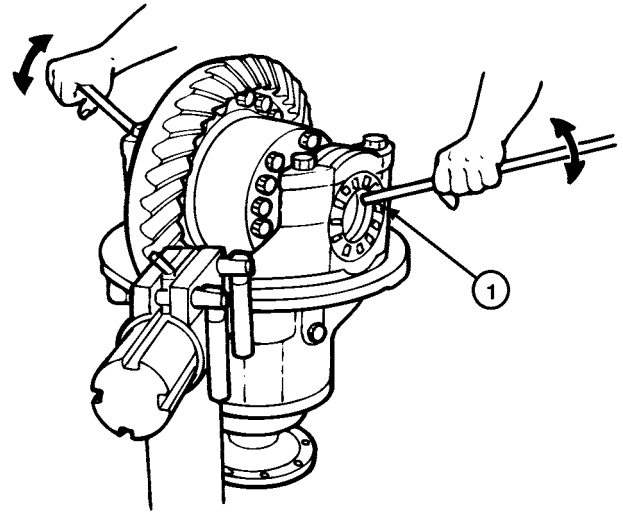
Figure 5.48



- 1 "T" BAR WRENCH
- 2 ADJUSTING RING OPPOSITE RING GEAR

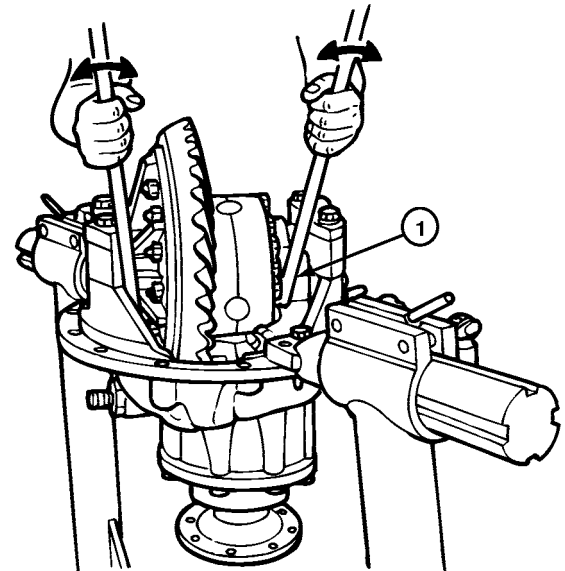
- a. Use two pry bars that fit between the bearing adjusting rings and ends of the differential case. The pry bars **MUST NOT** touch the differential bearings. **Figure 5.49.**
- b. Use two pry bars between the differential case or ring gear and the carrier at locations other than described in Step a. The pry bars **MUST NOT** touch the differential bearings. **Figure 5.50.**

Figure 5.49



- 1 BARS MUST NOT TOUCH BEARINGS.

Figure 5.50



- 1 BARS MUST NOT TOUCH BEARINGS.

4. Tighten the same bearing adjusting ring so that no end play shows on the dial indicator. Move the differential and ring gear to the left and right as needed. Repeat Step **a** or **b**.
5. Tighten each bearing adjusting ring one notch from the zero end play measured in Step 4.
6. Continue by checking runout of the ring gear.

Method 2

A second method of inspecting preload is to measure the expansion between the bearing caps (leg spread) after the adjusting rings are tightened. Use the following procedure.

1. Turn both adjusting rings hand tight against the differential bearings.
2. Measure the distance X or Y between opposite surfaces of the bearing caps. Use a large micrometer of the correct size. **Figure 5.51** and **Figure 5.52**. Record the measurement.

Figure 5.51

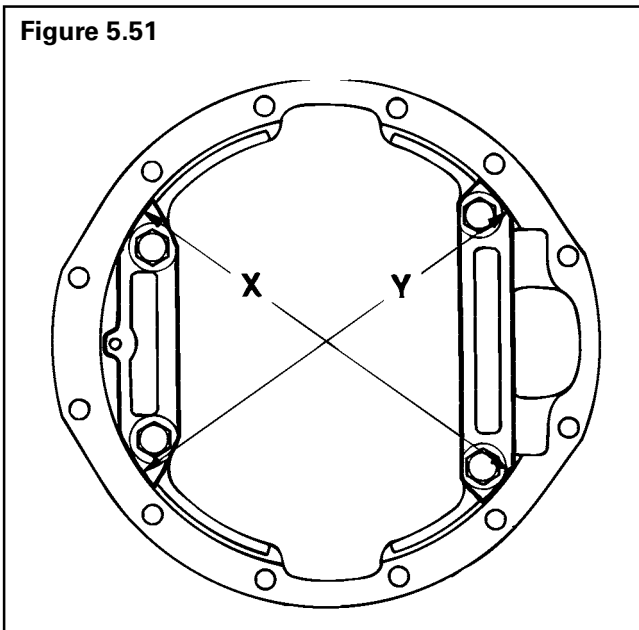
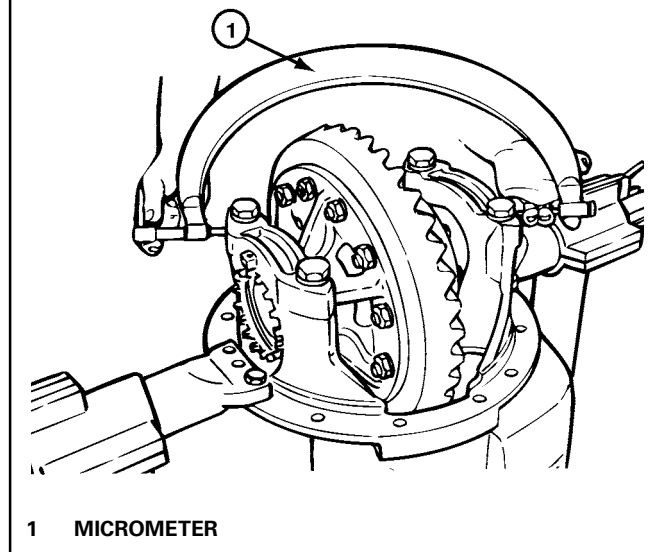


Figure 5.52



3. Tighten each bearing adjusting ring one notch.
4. Measure the distance X or Y again. Compare the dimension with the distance X or Y measured in Step 2. The difference between the two dimensions is the amount the bearing caps have expanded.

Example

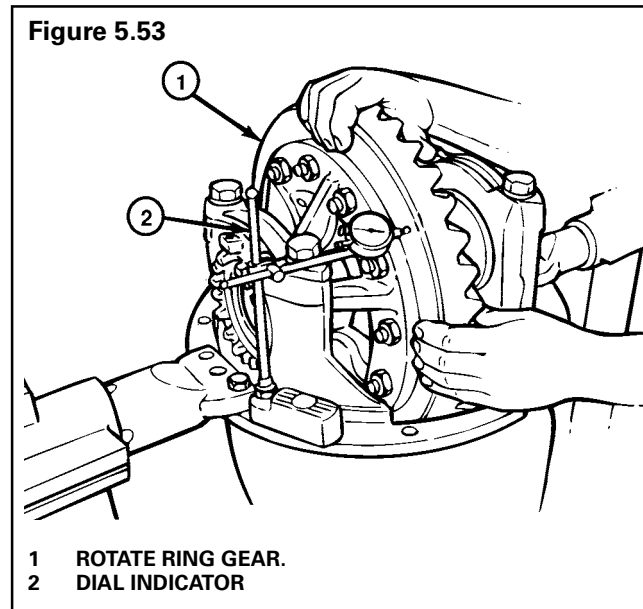
- Measurements of R-155 carrier
- Distance X or Y
 - before tightening adjusting rings = 13.927-inch (353.740 mm)
- Distance X or Y
 - after tightening adjusting rings = 13.936-inch (353.970 mm)
- 13.936-inch – 13.927-inch = 0.009-inch (0.230 mm) difference

If the dimension is within specifications, continue by checking runout of the ring gear. If the dimension is less than specifications, repeat Steps 3 and 4 as needed.

Inspect Runout of Ring Gear

Runout Specification

- 0.008-inch (0.200 mm)
1. Attach a dial indicator on the mounting flange of the carrier. **Figure 5.53.**



2. Adjust the dial indicator so that the plunger or pointer is against the back surface of the ring gear.
3. Set the dial indicator to zero (0).
4. Rotate the differential and ring gear and read the dial indicator. The runout of the ring gear **must not exceed** 0.008-inch (0.200 mm). **Figure 5.53.**

If runout of the ring gear exceeds specifications, remove the differential and ring gear assembly from the carrier. Refer to "Remove the Differential and Ring Gear from the Carrier" in Section 2 and the following Steps 5 and 6.

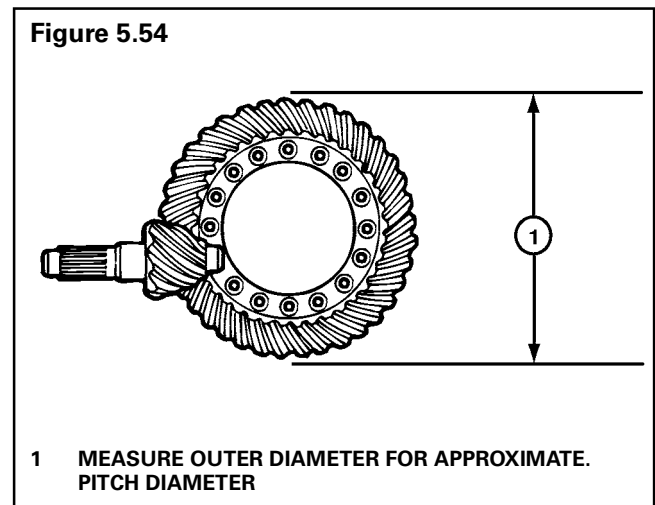
5. Inspect the differential parts including the carrier for the problem that causes the runout of gear to exceed specifications. Repair or replace parts.
6. After the parts are repaired or replaced, install the differential and ring gear into the carrier. Refer to "Install the Differential and Ring Gear Assembly" in this section.
7. Repeat preload adjustment of differential bearings.

Ring Gear Backlash Adjustment

Specifications

- Ring gears that have a pitch diameter of less than 17-inches (431.8 mm)
 - Range of backlash setting: 0.008- to 0.018-inch (0.200-0.460 mm).
 - Backlash setting for new gear sets: 0.012-inch (0.300 mm)
- Ring gears that have a pitch diameter greater than 17-inches (431.8 mm)
 - Range of backlash setting: 0.010- to 0.020-inch (0.250-0.510 mm)
 - Backlash setting for new gear sets: 0.015-inch (0.380 mm)

NOTE: Measure the outer diameter of ring gear for approximate pitch diameter. **Figure 5.54.**



If the old gear set is installed, adjust the backlash to the setting that was measured before the carrier was disassembled.

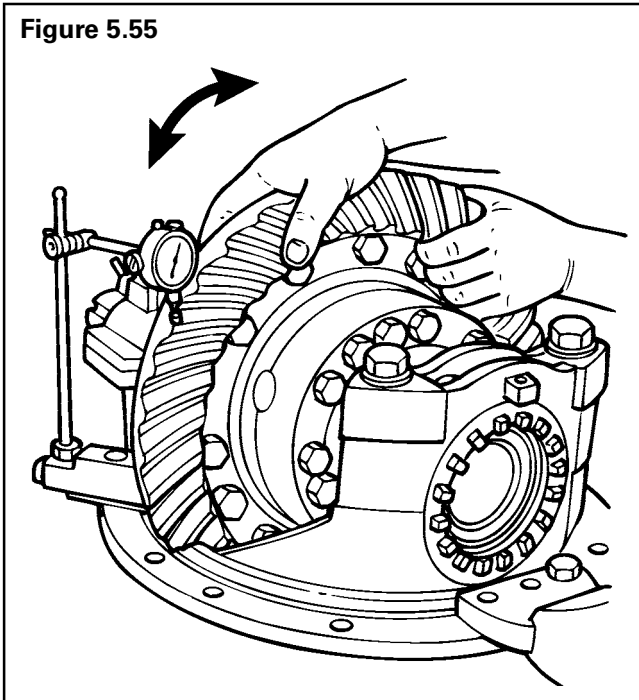
If a new gear set is installed, adjust the backlash to the correct specification for new gear sets.

After inspection of the tooth contact patterns, the backlash can be adjusted within specification limits, if needed. To change the location of the pattern use the following procedures.

Section 5 Assembly

1. Attach a dial indicator on the mounting flange of the carrier. **Figure 5.55.**

Figure 5.55



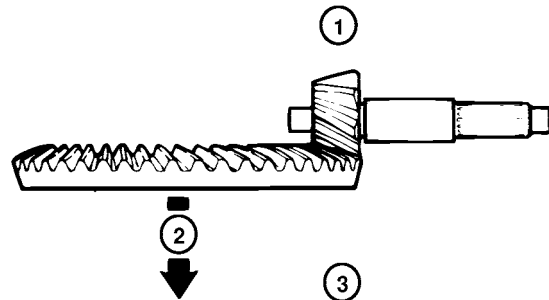
2. Adjust the dial indicator so that the plunger or pointer is against the tooth surface. **Figure 5.55.**
3. Adjust the indicator dial to zero (0).
4. Hold the drive pinion in position.
5. After reading the dial indicator, rotate the differential and ring gear a small amount in both directions, against the drive pinion teeth. If the backlash reading is within specification, continue inspecting tooth contact patterns. If the backlash reading is not within specifications, adjust backlash as needed. Continue following Steps 6 and 7.

NOTE: Backlash is increased by moving the ring gear away from the drive pinion. **Figure 5.56.**

Backlash is decreased by moving the ring gear toward the drive pinion. **Figure 5.57.**

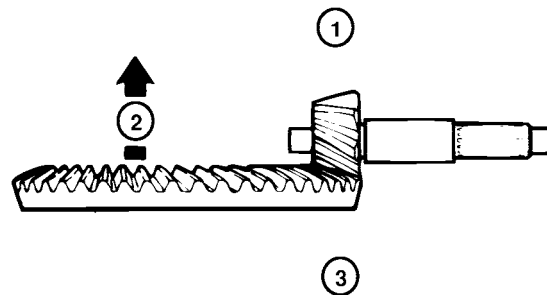
6. Loosen one bearing adjusting ring one notch then tighten the opposite ring the same amount. Refer to **Figure 5.56** and **Figure 5.57.**

Figure 5.56



- 1 TIGHTEN ADJUSTING RING THIS SIDE.
- 2 INCREASE BACKLASH.
- 3 LOOSEN ADJUSTING RING THIS SIDE.

Figure 5.57



- 1 LOOSEN ADJUSTING RING THIS SIDE.
- 2 DECREASE BACKLASH.
- 3 TIGHTEN ADJUSTING RING THIS SIDE.

NOTE: When you adjust backlash, move the ring gear **ONLY**. **DO NOT** move the drive pinion.

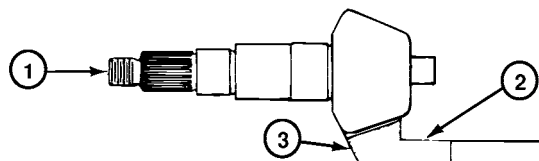
7. Repeat Steps 2-6 until the backlash is within specifications.

Inspect Tooth Contact Patterns of the Gear Set

General Information

AxleTech carriers can have a conventional **HYPOID** gear set or a **GENEROID** hypoid gear set. The tooth contact patterns for each type of gear set are different. Look at the part numbers to see what type of gear set is in the carrier. Refer to **Figure 5.58** for the location of part numbers.

Figure 5.58



- 1 PART NO.
- 2 PART NO.
- 3 PART NO. OPTION

Examples of part numbers for conventional **HYPOID** gear sets.

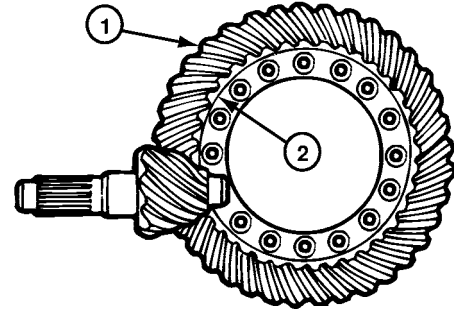
- 36786 for the ring gear.
- 36787 for the drive pinion.

Examples of part numbers for **GENEROID** gear sets.

- 36786-K or 36786-K2 for the ring gear.
- 36787-K or 36787-K2 for the drive pinion.

In the following procedures, movement of the contact pattern in the length of the tooth is indicated as, toward the “heel” or “toe” of the ring gear. **Figure 5.59**.

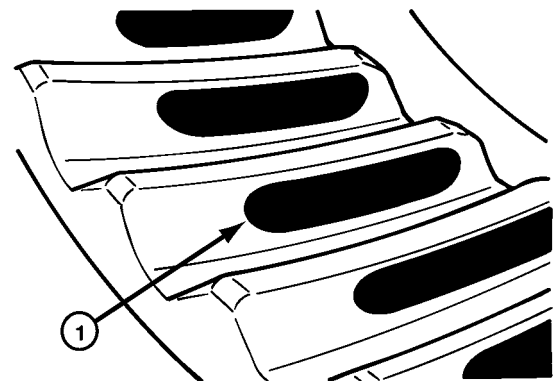
Figure 5.59



- 1 HEEL
- 2 TOE

Always inspect tooth contact patterns on the drive side of the gear teeth. **Figure 5.60**.

Figure 5.60

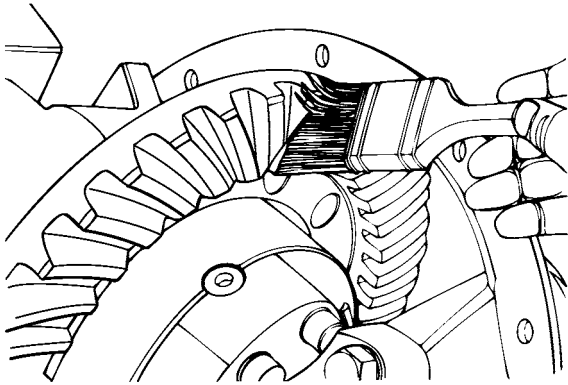


- 1 DRIVE SIDE (CONVEX)

Tooth Contact Patterns of Conventional Hypoid and Generoid Hypoid Gear Sets

1. Adjust the backlash of a new gear set to either 0.012-inch (0.305 mm) or 0.015-inch (0.380 mm) depending on the size of the ring gear. Adjust the backlash of an old gear set to the setting that was measured before the carrier was disassembled. Refer to "Ring Gear Backlash Adjustment" in this section.
2. Apply a marking compound to approximately 12 gear teeth of the ring gear. Rotate the ring gear so that the 12 gear teeth are next to the drive pinion. **Figure 5.61.**

Figure 5.61



3. Rotate ring gear forward and backward so that the 12 gear teeth go past the drive pinion six times to get the contact patterns. Repeat if needed to get a more clear pattern.
4. Look at the contact patterns on the ring gear teeth. Compare the patterns to **Figure 5.62** or **Figure 5.65**, **Figure 5.63** or **Figure 5.66**, and **Figure 5.64** or **Figure 5.67**.

The Location of Good Hand-Rolled Contact Patterns.

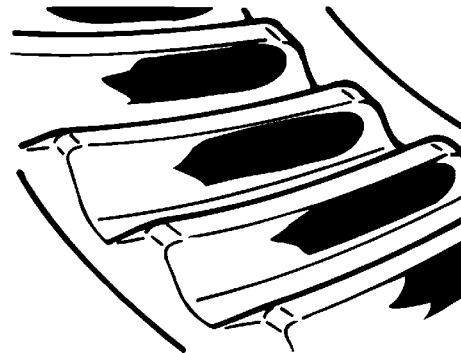
New Conventional and Generoid Gear Sets — toward the toe of the gear tooth and in the center between the top and bottom of the tooth. Refer to **Figure 5.62** and **Figure 5.65**.

When the carrier is being operated, a good pattern will extend approximately the full length of the gear tooth. The top of the pattern will be near the top of the gear tooth. Refer to **Figure 5.68** or **Figure 5.69**.

The location of a good hand-rolled contact pattern for an old gear set **MUST** match the wear pattern in the ring gear. The contact pattern will be smaller in area than the wear pattern.

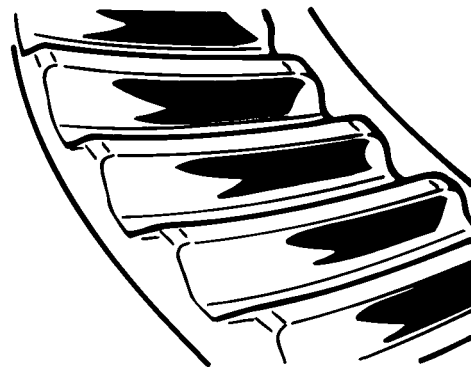
If the contact patterns require adjustment, continue by following Step 5 to move the contact patterns between the top and bottom of the gear teeth. If the contact patterns are in the center of the gear teeth, continue by following Step 6.

Figure 5.62



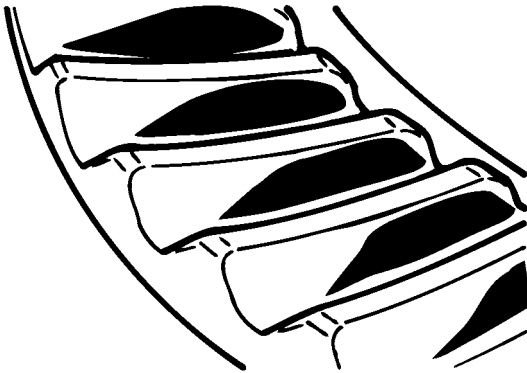
Good Hand-Rolled Pattern/Conventional Gears

Figure 5.63



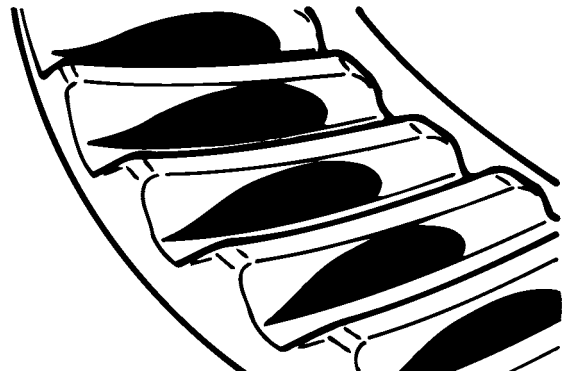
High Pattern/Conventional Gears

Figure 5.64



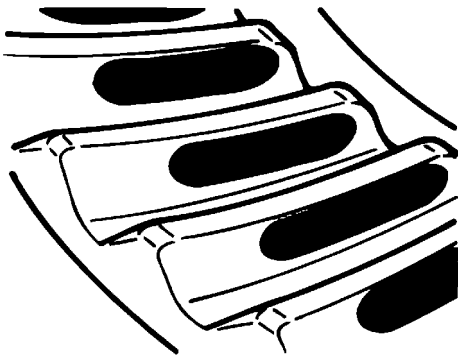
Low Pattern/Conventional Gears

Figure 5.67



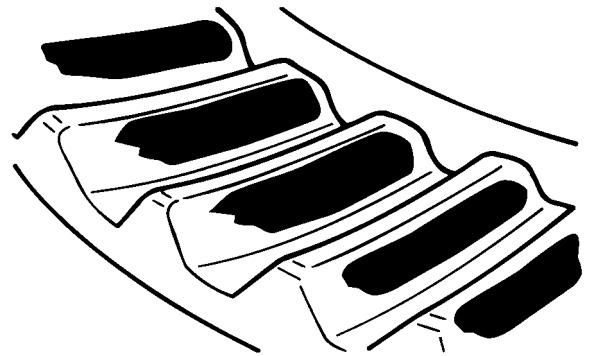
Low Pattern/Generoid Gears

Figure 5.65



Good Hand-Rolled Pattern/Generoid Gears

Figure 5.68



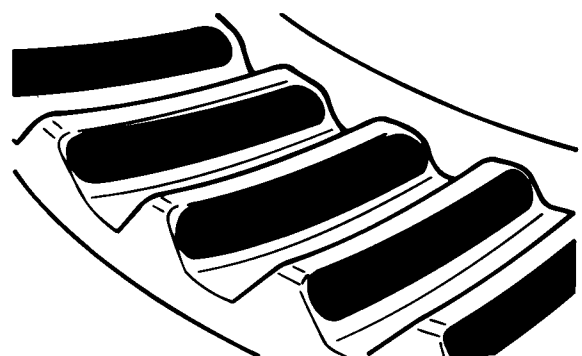
Good Pattern in Operation Conventional Gears

Figure 5.66



High Pattern/Generoid Gears

Figure 5.69



Good Pattern in Operation Generoid Gears

Section 5 Assembly

5. Change the thickness of the shim pack under bearing cage to move the contact patterns between the top and bottom of the gear teeth. Use the following procedure.

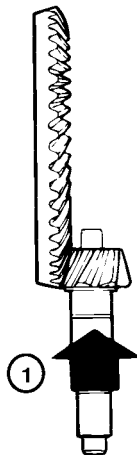
- a. Remove the drive pinion and bearing cage from the carrier. Refer to "Remove the Drive Pinion and Bearing Cage from Carrier" in Section 2.

NOTE: A high contact pattern indicates that the drive pinion was not installed deep enough into the carrier. A low contact pattern indicates that the drive pinion was installed too deep in the carrier.

- b. To correct a high contact pattern, **Figure 5.63**, decrease the thickness of the shim pack under the bearing cage. When decreasing the thickness of the shim pack, the drive pinion will move toward the ring gear. **Figure 5.70**.

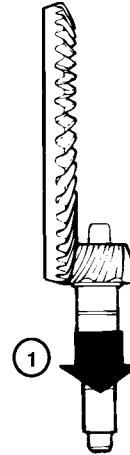
To correct a low contact pattern, **Figure 5.71**, increase the thickness of shim pack under the bearing cage. When increasing the thickness of the shim pack, the drive pinion will move away from the ring gear. **Figure 5.71**.

Figure 5.70



1 DECREASE SHIM PACK.

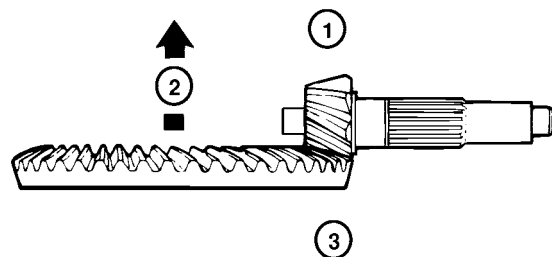
Figure 5.71



1 INCREASE SHIM PACK.

- c. Install the drive pinion, bearing cage and shims into the carrier. Refer to "Adjusting Shim Pack Thickness for the Pinion Cage (Depth of Pinion)" in this section.
 - d. Repeat Steps 2-5 until the contact patterns are in the center between the top and bottom of the gear teeth.
6. Adjust backlash of the ring gear within specification range to move the contact patterns to the correct location in the length of the gear teeth. Refer to "Ring Gear Backlash Adjustment" in this section.
 - a. Decrease backlash to move the contact patterns toward the toe of the ring gear teeth. **Figure 5.72**.

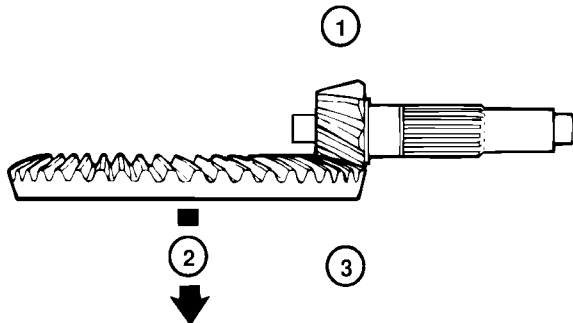
Figure 5.72



- 1 MOVE PATTERN TOWARD TOE, LOOSEN ADJUSTING RING THIS SIDE.**
- 2 DECREASE BACKLASH.**
- 3 TIGHTEN ADJUSTING RING.**

- b. Increase backlash to move the contact patterns toward the heel of the ring gear teeth. **Figure 5.73.**
- c. Repeat Steps 2-4 and 6 until the contact patterns are at the correct location in the length of the gear teeth.

Figure 5.73



- 1 MOVE PATTERN TOWARD TOE, LOOSEN ADJUSTING RING THIS SIDE.
- 2 DECREASE BACKLASH.
- 3 LOOSEN ADJUSTING RING.

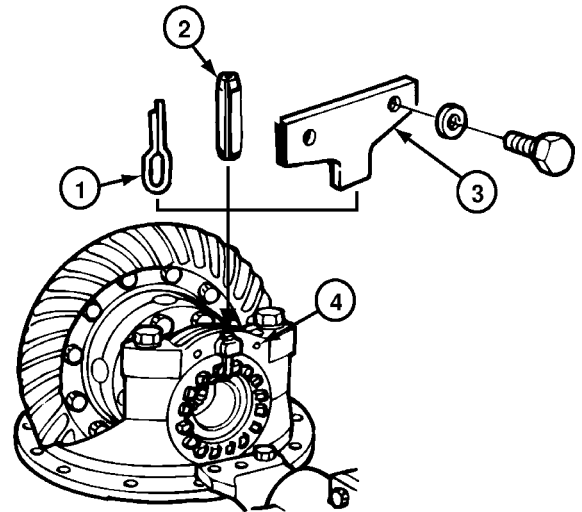
CAUTION

If the carrier has cotter keys, lock the adjusting rings only with cotter keys. If your carrier has roll pins, reuse the roll pins or lock the adjusting rings with cotter keys. Do not force a roll pin into a cotter key hole.

7. Install cotter keys*, pins*, or lock plates* that hold the two bearing adjusting rings in position. Use the following procedures.
 - a. **Cotter Keys*** — Install cotter keys between lugs of the adjusting ring and through the boss of the bearing cap. Bend the two ends of the cotter key around the boss. **Figure 5.74.**
 - b. **Pins*** — Install pin through boss of the bearing cap until the pin is between lugs of the adjusting ring. Use a drift and hammer to install the pin. **Figure 5.74.**

- c. **Lock Plates*** — Install lock plate on bearing cap so that the tab is between lugs of the adjusting ring. Install the two capscrews that hold the lock plate to the bearing cap. Tighten the capscrews to correct torque value. Refer to **Table J. Figure 5.74.** 

Figure 5.74



- 1 COTTER KEY
- 2 PIN
- 3 LOCK PLATE
- 4 THREADED HOLES IN CAP WHEN LOCK PLATE IS USED

SHOWN WITH COTTER KEY INSTALLED

*Some AxleTech carriers do not have these described parts.

Install and Adjust the Thrust Screw*

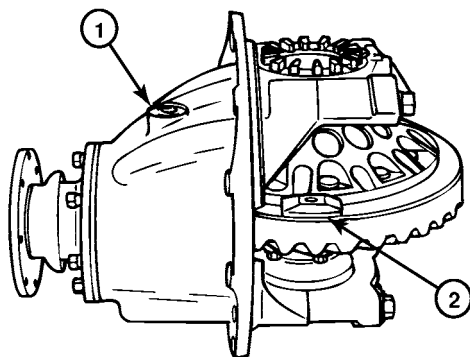
Specification

- Clearance between thrust screw and ring gear — 0.025- to 0.045-inch (0.650-1.140 mm).
- Loosen the thrust screw 1/2 turn or 180°.

If the carrier does not have a thrust block*, start at Step 4.

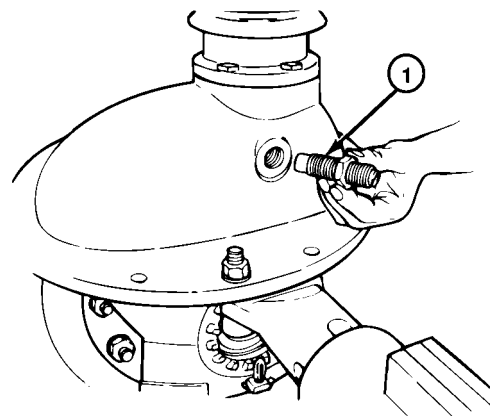
1. Rotate the carrier in the repair stand until the back surface of ring gear is toward the top. **Figure 5.75.**
2. Place the thrust block* on the back surface of the ring gear. The thrust block* **MUST** be in the center between the outer diameter of gear and differential case.
3. Rotate the ring gear until the thrust block* and hole for thrust screw, in carrier, are aligned. **Figure 5.75.**
4. Install the jam nut* on the thrust screw*, one half the distance between both ends.
5. Install the thrust screw* into the carrier until the screw stops against the ring gear or thrust block*. **Figure 5.76.**
6. Loosen the thrust screw* 1/2 turn, 180°. **Figure 5.77.**

Figure 5.75



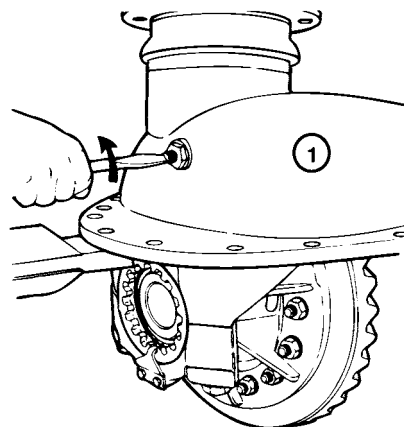
- 1 HOLE FOR THRUST SCREW
2 THRUST BLOCK

Figure 5.76



- 1 THRUST SCREW AND JAM NUT

Figure 5.77

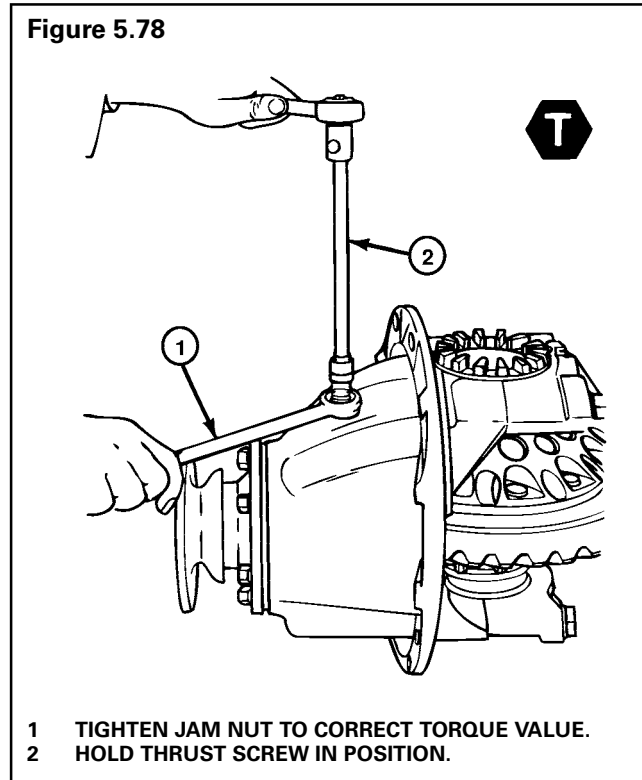


- 1 LOOSEN THRUST SCREW 1/2 TURN.

*Some AxleTech carriers do not have these described parts.

7. Tighten the jam nut* to the correct torque value against the carrier. Refer to **Table J**. **Figure 5.78.** 

Figure 5.78



Install Differential Carrier into Axle Housing



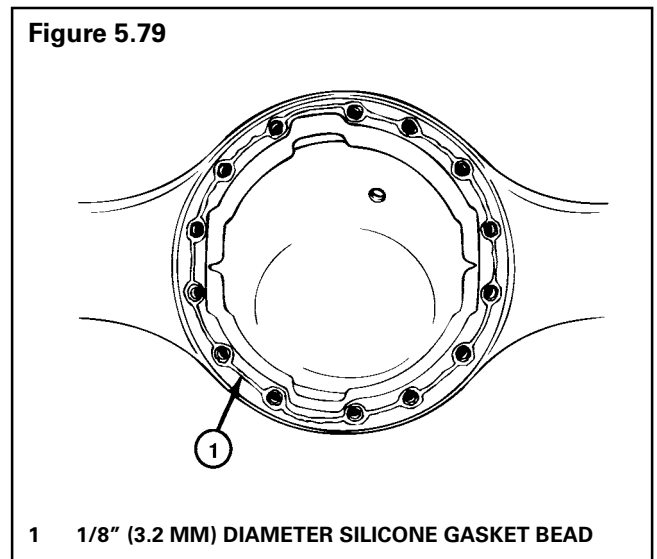
WARNING

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- *Wear safe eye protection.*
- *Wear clothing that protects you skin.*
- *Work in a well-ventilated area.*
- *Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.*
- *You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.*

1. Clean the inside of axle housing and the mounting surface where the carrier fastens. Use a cleaning solvent and rags to remove dirt. Blow dry the cleaned areas with air. Also refer to "Cleaning Axle Assemblies" in Section 3.
2. Inspect the axle housing for damage. Repair or replace the axle housing. Refer to "Repair or Replacement of Parts, General" in Section 3.
3. Inspect for loose studs* in the mounting surface of the housing where the carrier fastens. Remove and clean the studs* that are loose.
4. Apply liquid adhesive to the threaded holes and install the studs* into axle housing. Refer to "Application of AxleTech Adhesive 2297-T-4180 in Bearing Bores for the Differential" in Section 4. Tighten studs* to correct torque value. Refer to **Table J**. 
5. Apply silicone gasket material to the mounting surface of the housing where the carrier fastens. Refer to "Application of Three Bond 1216 or Equivalent Silicone Gasket Material" in Section 4. **Figure 5.79.**

Figure 5.79



*Some AxleTech carriers do not have these described parts.

Section 5 Assembly

6. Install the carrier into the axle housing. Use a hydraulic roller jack or a lifting tool.

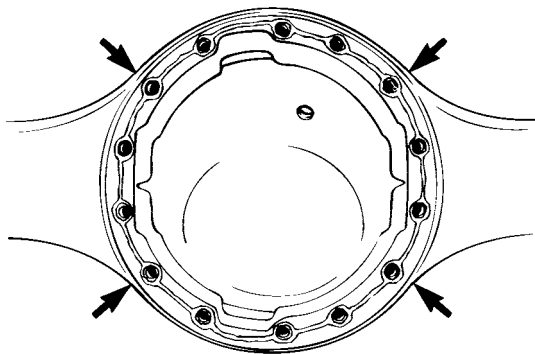


CAUTION

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

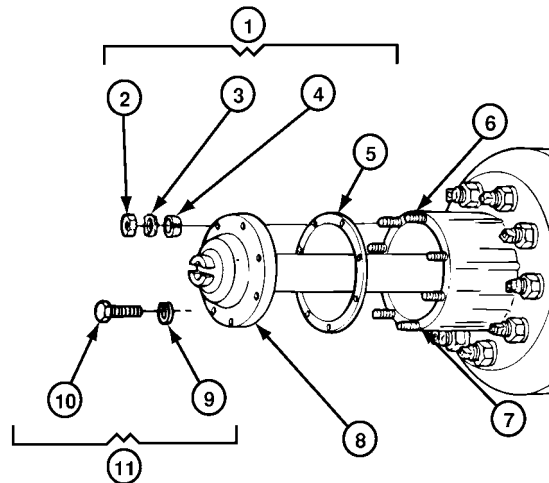
7. Install the nuts* and the washers or the capscrews and washers in the four corner locations around the carrier and the axle housing. Tighten the fasteners by hand. Do not tighten to the specified torque. **Figure 5.80.**
8. Carefully push the carrier into position. Tighten the four fasteners two or three turns each in a pattern opposite each other. Refer to **Figure 5.80.**

Figure 5.80



12. Install the gaskets and axle shafts into the axle housing and carrier. The gasket and flange of the axle shafts **MUST** fit flat against the wheel hub. **Figure 5.81.**

Figure 5.81



1	TAPERED DOWEL RETENTION	7	SHAFT HUB AXLE
2	STUD NUT	8	AXLE SHAFT (FLANGE)
3	WASHER	9	WASHER
4	TAPERED DOWEL	10	CAPSCREW
5	GASKET	11	NON-TAPERED DOWEL RETENTION
6	STUD		

9. Repeat Step 9 until the four fasteners are tightened to the correct torque value. **T**
- **Fasteners with standard flat washers:**
Tighten fasteners to 150-230 lb-ft (203-312 N•m).
10. Install the remaining fasteners and washers that hold the carrier in the axle housing. Tighten fasteners to the correct torque value. Refer to **Table J.** **T**
11. Connect the driveline universal joint to the pinion input yoke or flange on the carrier.

*Some AxleTech carriers do not have these described parts.

Straight Holes, Nuts and Hardened Washers

1. Clean the mating surfaces of the axle shaft and the wheel hub.
2. If silicone gasket material is used, apply a 1/8-inch diameter bead of the gasket material around the mating surface of the hub and around the edge of each fastener hole in that surface.
3. Install the gasket and the axle shaft into the housing. The gasket and the flange of the axle shaft **MUST** fit flat against the wheel hub. Refer to **Figure 5.81**.
4. Install the Grade 8 nuts and hardened washers on the stud. (Lock washers are an acceptable alternative.) Tighten the stud nuts to the torque specified in **Table C**.

Tapered Dowel, Hardened Washer and Hardened Nut

1. Clean the mating surfaces of the axle shaft and the wheel hub.
2. If silicone gasket material is used, apply a 1/8-inch diameter bead of the gasket material around the mating surface of the hub and around the edge of each fastener hole in that surface.
3. Install the gasket and the axle shaft into the housing. The gasket and the flange of the axle shaft **MUST** fit flat against the wheel hub. Refer to **Figure 5.81**.
4. Install solid tapered dowels over each stud and into the flange of the axle shaft. Use a punch or a drift and hammer, if necessary.
5. Install the Grade 8 nuts and hardened washers on the stud. (Lock washers are an acceptable alternative.) Tighten the stud nuts to the torque specified in **Table D**.

Table C: Shaft-to-Hub Torque Fastener — Non-tapered Dowel Applications

Fastener	Thread Size	Torque Value — Grade 8 Nuts lb-ft (N•m) 	
		Plain Nut	Lock Nut
Stud Nut (Axle Shaft)	.62-18	150-230 (203-312)	130-190 (176-258)
	.75-16	310-400 (420-542)	270-350 (366-475)
Studs	All	Install the course thread end of stud into hub and tighten to last thread.	

Table D: Shaft-to-Hub Torque Fastener — Tapered Dowel Applications

Fastener	Thread Size	Torque Value — Grade 8 Nuts lb-ft (N•m) 	
		Plain Nut	Lock Nut
Stud Nut (Axle Shaft)	.44-20	50-75 (81-102)	40-65 (67-88)
	.50-20	75-115 (115-156)	65-100 (102-136)
	.56-18	110-165 (176-224)	100-145 (149-197)
	.62-18	150-230 (203-312)	130-190 (176-258)
Studs	All	Install the course thread end of stud into hub and tighten to last thread.	

Section 6 Lubrication

NOTE: For complete information on lubricating drive axles and carriers, refer to Maintenance Manual 1, *Lubrication*.

Refer to **Table E**, **Table F** and **Table I** for standard information on lubricants, schedules and capacities.

Table E: Lubricant Cross Reference (Viscosity) and Temperature

AxleTech Lubricant Specification	Description	Cross Reference	Minimum Outside Temperature	Maximum Outside Temperature
O-76-A	Hypoid Gear Oil	GL-5, S.A.E. 85W/140	+10°F (–12.2°C)	– – –**
O-76-B	Hypoid Gear Oil	GL-5, S.A.E. 80W/140	–15°F (–26.1°C)	– – –**
O-76-D	Hypoid Gear Oil	GL-5, S.A.E. 80W/90	–15°F (–26.1°C)	– – –**
O-76-E	Hypoid Gear Oil	GL-5, S.A.E. 75W/90	–40°F (–40°C)	– – –**
O-76-J	Hypoid Gear Oil	GL-5, S.A.E. 75W	–40°F (–40°C)	+ 35°F (+ 1.6°C)
O-76-L	Hypoid Gear Oil	GL-5, S.A.E. 75W/140	–40°F (–40°C)	– – –**
**There is no upper limit on these outside temperatures, but the axle sump temperature <i>must never exceed 250°F (+ 121°C)</i> .				

Table F: Rear Drive Axle Oil Change Intervals and Specifications ^①

APPLIES TO ALL REAR AXLES EXCEPT THE “ADVANCED LUBE” REAR AXLES.

On-Highway Operation Intervals				Off-Highway Operation Intervals				②	AxleTech Specifications (Military)	Oil Description	Outside Temperature			
Initial Oil Change	Inspect Oil Level	Petroleum Oil Change	Synthetic Oil Change	Initial Oil Change	Inspect Oil Level	Petroleum Oil Change ③	Synthetic Oil Change	F°			C°			
								Min.			Max.	Min.	Max.	
3,000 miles (4,800 km)	3,000 miles (4,800 km), once a month or the fleet maintenance interval (whichever comes first)	If annual mileage is less than 100,000 miles (160,000 km) change oil once a year.	250,000 miles (400,000 km)	1,000 miles (1,600 km)	1,000 miles (1,600 km)	If annual mileage is less than 60,000 miles (96,000km) change oil twice a year.	50,000 miles (80,000 km)	O-76A, Gear Oil (MIL-L-2105Dor MIL-PRF-2105E)	GL-5, SAE 85W/140	10	None	-12	None	
								O-76D, Gear Oil (MIL-L-2105Dor MIL-PRF-2105E)	GL-5, SAE 80W/90	-15	None	-26	None	
								O-76E, Gear Oil (MIL-L-2105Dor MIL-PRF-2105E)	GL-5, SAE 75W/90	-40	None	-40	None	
								O-76J, Gear Oil (MIL-L-2105Dor MIL-PRF-2105E)	GL-5, SAE 75W	-40	35	-40	2	
								O-76L, Gear Oil (MIL-L-2105Dor MIL-PRF-2105E)	GL-5, SAE 75W/140	-40	None	-40	None	
		O-76M, Full Synthetic Gear Oil (MIL-L-2105Dor MIL-PRF-2105E)				GL-5, SAE 75W/140		-40	None	-40	None			
		O-76N, Full Synthetic Gear Oil (MIL-L-2105Dor MIL-PRF-2105E)				GL-5, SAE 75W/90		-40	None	-40	None			
		If annual mileage is more than 100,000 miles (160,000km), change oil every 100,000 miles (160,000 km).				If annual mileage is more than 60,000 miles (96,000 km), change oil every 30,000 miles (48,000 km).								

NOTES

- ① If oil pump and filter is used, change filter every 100,000 miles (160,000 km). Inspect oil level. Add correct oil as required.
- ② Includes heavy-duty on-highway and on/off-highway applications.
- ③ For continuous heavy-duty operation, inspect oil level every 1,000 miles (1,600 kilometers).

Table G: “Advanced Lube” Rear Drive Axle without Oil Pump and Filter Oil Change Intervals and Specifications^①

APPLIES TO TANDEM REAR AXLES MANUFACTURED AFTER JANUARY 1, 1993 EQUIPPED WITH “MEMBRANE” TYPE BREATHERS AND ADVANCED MATERIAL TRIPLE-LIP SEALS.

On-Highway Operation Intervals			On/Off-Highway Operation Intervals ②			AxleTech Specifications (Military)	Oil Description	Outside Temperature			
Inspect Oil Level	Petroleum Oil Change ③	Synthetic Oil Change ④	Inspect Oil Level ⑤	Petroleum Oil Change ③	Synthetic Oil Change ④			F°		C°	
								Min.	Max.	Min.	Max.
3,000 miles (4,800 km), once a month or the fleet maintenance interval (whichever comes first)	100,000 miles (160,000 km)	250,000 miles (400,000 km)	3,000 miles (4,800 km) or 200 hours of operation	40,000 miles (64,000 km)	80,000 miles (128,000 km)	O-76A, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 85W/140	10	None	-12	None
						O-76D, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 80W/90	-15	None	-26	None
						O-76E, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/90	-40	None	-40	None
						O-76J, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W	-40	35	-40	2
						O-76L, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/140	-40	None	-40	None
						O-76M, Full Synthetic Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/140	-40	None	-40	None
						O-76N, Full Synthetic Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/90	-40	None	-40	None

NOTES

- ① If a No-Spin differential is installed, oil (petroleum or synthetic) must be changed at minimum interval of 64,000 km (40,000 miles) or a maximum interval of 50,000 miles (80,000 km).
- ② Also applies to heavy-duty on-highway applications. Does not apply to off-highway applications.
- ③ For petroleum oil with extended drain additives, use the “Synthetic Oil Change” interval.
- ④ Applies to semi-synthetic oils and full-synthetic oils. For a list of approved synthetic oils, refer to Maintenance Manual 1, *Lubrication*.
- ⑤ For continuous heavy-duty operation, inspect the oil level every 1,000 miles (1,600 km). Add the correct oil as required.

Table H: Tandem “Advanced Lube” Rear Drive Axle with Oil Pump and Filter Oil Change Intervals and Specifications^{①②}

APPLIES TO TANDEM REAR AXLES MANUFACTURED AFTER JANUARY 1, 1993 EQUIPPED WITH “MEMBRANE” TYPE BREATHERS AND ADVANCED MATERIAL TRIPLE-LIP SEALS.

On-Highway Operation Intervals			On/Off-Highway Operation Intervals ③			AxleTech Specifications (Military)	Oil Description	Outside Temperature			
Inspect Oil Level	Petroleum Oil Change ④	Synthetic Oil Change ⑤	Inspect Oil Level ⑥	Petroleum Oil Change ④	Synthetic Oil Change ⑤			F°		C°	
								Min.	Max.	Min.	Max.
3,000 miles (4,800 km), once a month or the fleet maintenance interval (whichever comes first)	100,000 miles (160,000 km)	500,000 miles (800,000 km)	3,000 miles (4,800 km) or 200 hours of operation	50,000 miles (80,000 km)	100,000 miles (160,000 km)	O-76A, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 85W/140	10	None	-12	None
						O-76D, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 80W/90	-15	None	-26	None
						O-76E, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/90	-40	None	-40	None
						O-76J, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W	-40	35	-40	2
						O-76L, Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/140	-40	None	-40	None
						O-76M, Full Synthetic Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/140	-40	None	-40	None
						O-76N, Full Synthetic Gear Oil (MIL-PRF-2105E)	GL-5, SAE 75W/90	-40	None	-40	None

NOTES

- ① Replace oil filter every 100,000 miles (160,000 km). Inspect oil level. Add specified oil as required.
- ② If No-Spin differential is installed, oil (petroleum or synthetic) must be changed at minimum interval of 40,000 miles (64,000 km) or a maximum interval of 50,000 miles (80,000 km).
- ③ Applies to heavy-duty on-highway applications and to on/off highway applications. Does not apply to off-highway applications.
- ④ For petroleum oil with extended drain additives, use the “Synthetic Oil Change” interval.
- ⑤ Applies to semi-synthetic oils. For a list of approved synthetic oils, refer to Maintenance Manual 1, *Lubrication*.
- ⑥ For continuous heavy-duty operation, inspect the oil level every 1,000 miles (1,600 km). Add the correct oil as required.

Section 6 Lubrication

Axle Lubricant Capacities

Use the following lubricant capacities as a guide only. The capacities are measured with the drive pinion in the horizontal position. When the angle of the drive pinion changes, the lubricant capacity of the axle will change.

Table I: Axle Lubricant Capacities

Axle Model	Capacity	
	U.S. Pints	Liters
Single Drive Axles		
A-150	5.5	2.6
B-100	10	4.7
B-140	12	5.7
B-150	3.5	1.7
C-100	12.5	5.9
D-100	12.5	5.9
D-140	12.5	5.9
E-100	15	7.1
E-105	12.5	5.9
E-150	9	4.3
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H-162	20	9.5
H-170	27*	12.8
H-172	27	12.8
L-100	23	10.9
L-140	24	11.4
L-155	24	11.4

Axle Model	Capacity	
	U.S. Pints	Liters
Single Drive Axles (Continued)		
L-172	27	12.8
M-172	27	12.8
QT-140	24	11.4
Q-100	31	14.7
Q-145	24	11.4
RL-170	48	22.7
R-100	30	14.2
R-140	28	13.2
R-155	28	13.2
R-160	28	13.2
R-163	34	16.1
R-170	43	20.3
S-170	43	20.3
U-140	24	11.4
U-170	43	20.3
W-170	43	20.3
* Includes 1 pint (0.97 liter) for each wheel end and with drive pinion angle at 3°.		

Axle Model	Capacity	
	U.S. Pints	Liters
Rear Axle of Tandems		
SDHD (DHR rear)	16	7.6
SFHD (FHR rear)	16.5	7.8
SHHD (HHR rear)	26	12.3
SL-100 (LR-100 rear)	37	17.5
SLHD (HR rear)	32	15.1
SQ 100 (B- 100 rear)	33	15.7
SQHD (BR rear)	31	14.7
SQHP (QAR rear)	36	17
SR-170 (RR-170 rear)	43	20.3
SRHD (RHR rear)	36	17
SSHD (SHR rear)	28	13.2
ST-170 (TR-170 rear)	43	20.3
STHD (THR rear)	28	13.2
SU-170 (B- 170 rear)	43	20.3
SUHD (HR rear)	28	13.2
SW-170 (W -170 rear)	43	20.3

Torque Values for Fasteners

General Information

1. The torque values in **Table J** are for fasteners that have a light application of oil on the threads.
2. If the fasteners are dry, increase the torque values by ten percent (10%).
3. If the fasteners have a heavy application of oil on the threads, decrease the torque values by ten percent (10%).
4. If you do not know the size of the fastener that is being installed, measure the fastener. Use the following procedure.

American Standard Fasteners

- a. Measure the diameter of the threads in inches, dimension X **Figure 7.1**.
- b. Count the amount of threads there are in one inch (1.0 inch). **Figure 7.1**.

Example

- American Standard size fastener is .50-13.
 - 0.50 is the diameter of the fastener in inches or dimension X.
 - 13 is the amount of threads in one inch (1.0 inch).

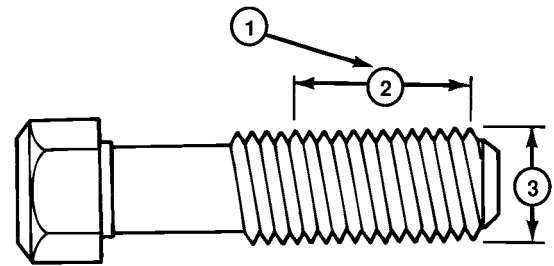
Metric Fasteners

- a. Measure the diameter of the threads in millimeters (mm), dimension X. **Figure 7.2**.
- b. Measure the distance of ten (10) threads, point to point in millimeters (mm), dimension Y. Make a note of dimension Y. **Figure 7.2**.
- c. Divide dimension Y by ten (10). The result will be the distance between two threads or pitch.

Example

- Metric size fastener is M8 x 1.25.
 - M8 is the diameter of the fastener in millimeters (mm) or dimension X
 - 1.25 is the distance between two threads or pitch.
 - Compare the size of fastener measured in Step 4 to the list of fasteners in **Table J** to find the correct torque value.

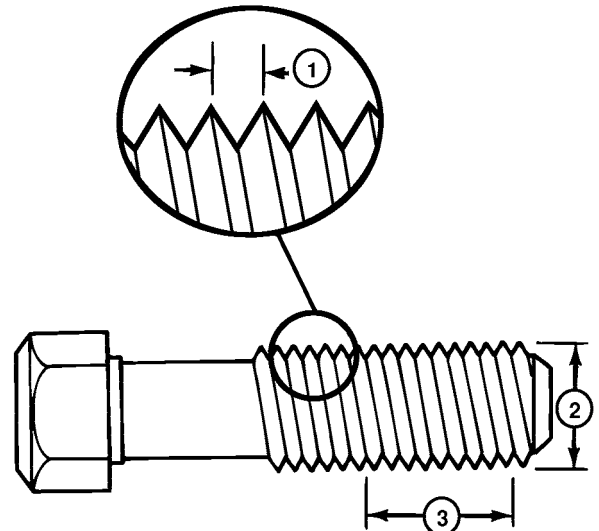
Figure 7.1



- 1 AMOUNT OF THREADS IN ONE INCH
- 2 1"
- 3 X

X DIMENSION = (EXAMPLE 1/2")

Figure 7.2

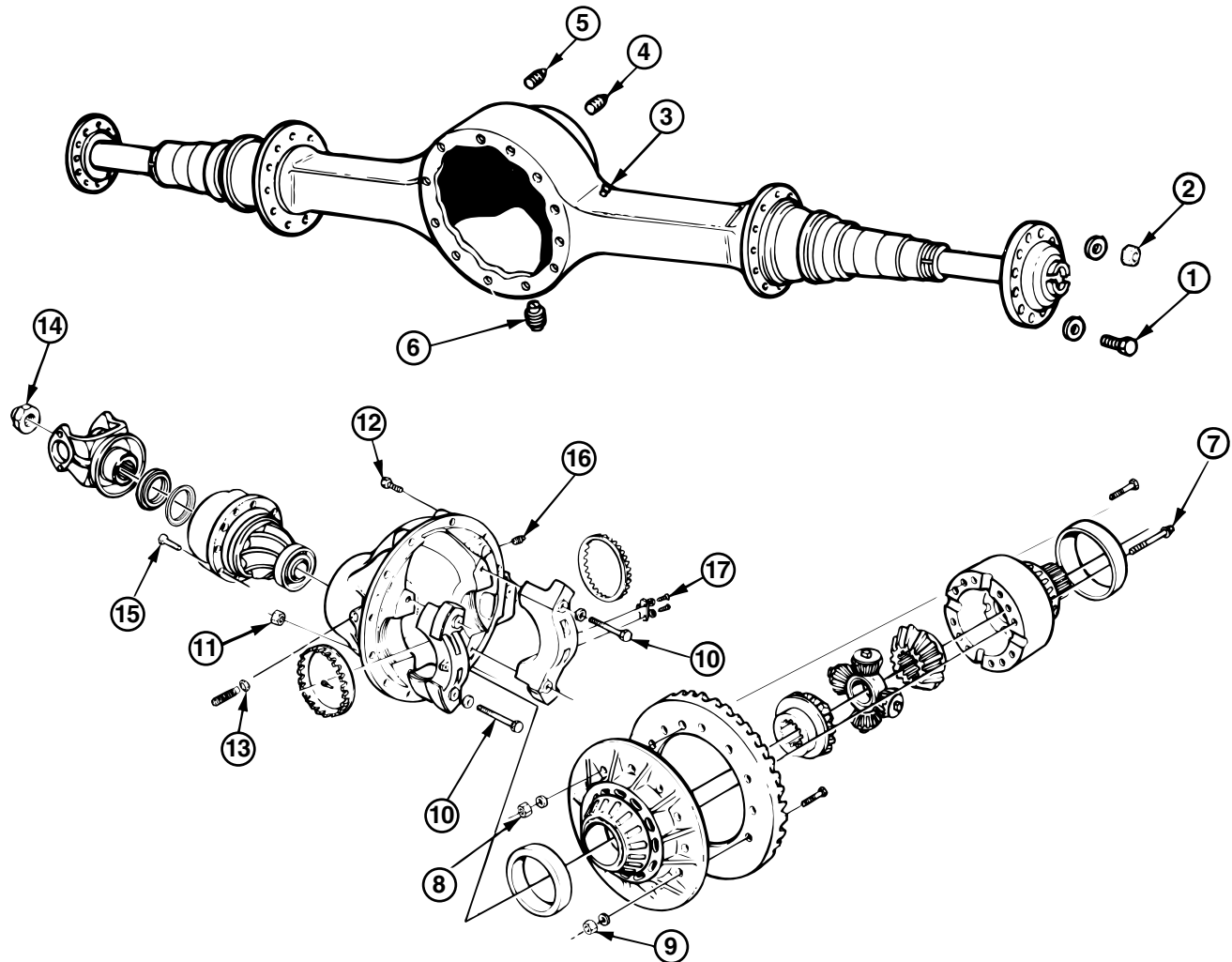


- 1 PITCH
- 2 X
- 3 Y

X DIMENSION = (EXAMPLE M8 OR 8 MM)
Y DIMENSION = DISTANCE OF 10 THREADS

Section 7 Fastener Torque Information

Figure 7.3



1003115c

Table J: Fastener Torque Information

Fastener		Thread Size	Torque Value lb-ft (N•m) 	
1.	*Capscrew, Axle Shaft	.31-24 .50-13	18-24 85-115	(24-33) (115-156)
2.	*Nut, Axle Shaft Stud	Plain Nut .44-20 .50-20 .56-18 .62-18 Lock Nut .44-20 .50-20 .56-18 .62-18	50-75 75-115 110-165 150-230 40-65 65-100 100-145 130-190	(68-102) (102-156) (149-224) (203-312) (54-88)3 (88-136) (136-197) (176-258)

* Some AxleTech carriers do not have these described parts.

Table J: Fastener Torque Information

Fastener		Thread Size	Torque Value lb-ft (N•m) 	
3.	Breather	.38-18	20 minimum (27 minimum)	
4.	*Plug, Oil Fill (Housing)	.75-14	35 minimum (47.5 minimum)	
5.	*Plug, Heat Indicator	.50-14	25 minimum (34 minimum)	
6.	Plug, Oil Drain	.50-14	25 minimum (34 minimum)	
7.	Capscrew, Differential Case	.38-16 .44-14 .50-13 .56-12 .62-11 Grade 10.9 Flange Head M12 x 1.75 Grade 10.9 Standard Hex Head M12 x 1.75 Grade 12.9 Standard Hex Head M12 x 1.75 Grade 12.9 Flange Head M16 x 2 Grade 12.9 Standard Head M16 x 2	35-50 60-75 85-115 130-165 180-230 85-103 74-96 105-125 203-251 220-310	(48-68) (81-102) (115-156) (176-224) (244-312) (115-140) (100-130) (143-169) (275-340) (300-420)
8.	*Nut, Differential Case Bolt	.50-13 .50-20 .62-11 .62-18 M12 x 1.75 M16 x 2	75-100 85-115 150-190 180-230 74-96 220-310	(102-136) (115-156) (203-258) (244-312) (100-130) (300-420)
9.	*Nut, Ring Gear Bolt	.50-13 .50-20 .62-11 .62-18 M12 x 1.25 M12 x 1.75 Flange Head M16 x 1.5 Standard Hex Head M16 x 1.5	75-100 85-115 150-190 180-230 66-81 77-85 192-214 196-262	(102-136) (115-156) (203-258) (244-312) (90-110) (104-115) (260-190) (265-355)
10.	Capscrew, Bearing Cap	.56-12 .62-11 .75-10 .88-14 .88-9 M16 x 2 M20 x 2.5 M22 x 2.5	110-145 150-190 270-350 360-470 425-550 181-221 347-431 479-597	(149-197) (203-258) (366-475) (488-637) (576-746) (245-300) (470-585) (650-810)
11.	Nut, Housing to Carrier Stud	.44-20 .50-20 .56-18 .62-18	50-75 75-115 110-165 150-230	(68-102) (102-156) (149-224) (203-312)
12.	Capscrew, Carrier to Housing	.44-14 .50-13 .56-12 .62-11 .75-10 M12 x 1.75 M16 x 2	50-75 75-115 110-165 150-230 270-400 74-89 181-221	(68-102) (102-156) (149-224) (203-312) (366-542) (100-120) (245-300)

* Some AxleTech carriers do not have these described parts.

Section 7

Fastener Torque Information

Table J: Fastener Torque Information

Fastener		Thread Size	Torque Value lb-ft (N•m) 	
13.	*Jam Nut, Thrust Screw	.75-16 .88-14 1.12-16 M22 x 1.5 M30 x 1.5	150-190 150-300 150-190 148-210 236-295	(203-258) (203-407) (203-258) (200-285) (320-400)
14.	Nut, Drive Pinion	.88-20 1.00-20 1.25-12 1.25-18 1.50-12 1.50-18 1.75-12 M32 x 1.5 M39 x 1.5 M45 x 1.5	200-275 300-400 700-900 700-900 800-1100 800-1100 900-1200 738-918 922-1132 996-1232	(271-373) (407-542) (949-1220) (949-1220) (1085-1491) (1085-1491) (1220-1627) (1000-1245) (1250-1535) (1350-1670)
15.	Capscrew, Bearing Cage	.38-16 .44-14 .50-13 .56-12 .62-11 M12 x 1.75	30-50 50-75 75-115 110-165 150-230 70-110	(41-68) (68-102) (102-156) (149-224) (203-312) (90-150)
16.	*Plug, Oil Fill (Carrier)	.75-14 1.5-11.5 M24 x 1.5	25 minimum (34 minimum) 120 minimum (163 minimum) 35 minimum (47 minimum)	
17.	*Capscrew, Lock Plate	.31-18 M8 x 1.25	20-30 21-26	(27-41) (28-35)

* Some AxleTech carriers do not have these described parts.

Drive Pinion Bearings — Preload (Refer to Section 5)

Specification	New bearings — 5 to 45 lb-in (0.56-5.08 N•m) torque  Used bearings — 10 to 30 lb-in (1.13-3.39 N•m) torque 
Adjustment	Preload is controlled by the thickness of the spacer between bearings. — To increase preload install a thinner spacer — To decrease preload install a thicker spacer

Drive Pinion — Depth in Carrier (Refer to Section 5)

Specification	Install the correct amount of shims between the bearing cage and carrier. To calculate, use old shim pack thickness and new and old pinion cone numbers.
Adjustment	Change the thickness of the shim pack to get a good gear tooth contact pattern.

Hypoid Gear Set — Tooth Contact Patterns (Hand Rolled) (Refer to Section 5)

Specification	Conventional gear set — Toward the toe of the gear tooth and in the center between the top and bottom of the tooth Generoid gear set — Between the center and toe of the tooth and in the center between the top and bottom of the tooth
Adjustment	Tooth contact patterns are controlled by the thickness of the shim pack between the pinion bearing cage and carrier and by ring gear backlash — To move the contact pattern lower, decrease the thickness of the shim pack under the pinion bearing cage — To move the contact pattern higher, increase the thickness of the shim pack under the pinion bearing cage — To move the contact pattern toward the toe of the tooth, decrease backlash of the ring gear — To move the contact pattern toward the heel of the tooth, increase backlash of the ring gear.

Main Differential Bearings — Preload (Refer to Section 5)

Specification	15 to 35 lb-in (1.7-3.9 N•m) torque  <i>or</i> Expansion between bearing caps — R-140, R-155 and R-160 carrier models — 0.002 to 0.009 inch (0.050-0.229 mm) — All other carrier models — 0.006 to 0.013 inch (0.150-0.330 mm)
Adjustment	Preload is controlled by tightening both adjusting rings after zero end play is reached

Section 8

Adjustments and Specifications

Main Differential Gears — Rotating Resistance (Refer to Section 5)

Specification	50 lb-ft (68 N•m) torque applied to one side gear 
----------------------	--

Ring Gear — Backlash (Refer to Section 5)

Specification	Ring gears that have a pitch diameter of less than 17 inches (431.8 mm) — Range: 0.008 to 0.018 inch (0.200-0.460 mm) 0.012 inch (0.300 mm) for a new gear set Ring gears that have a pitch diameter of 17 inches (431.8 mm) or greater — Range: 0.010 to 0.020 inch (0.250-0.510 mm) 0.015 inch (0.380 mm) for a new gear set
Adjustment	Backlash is controlled by the position of the ring gear. Change backlash within specifications to get a good tooth contact pattern. — To increase backlash, move the ring gear away from the drive pinion — To decrease backlash, move the ring gear toward the drive pinion

Ring Gear — Runout (Refer to Section 5)

Specification	0.008 inch (0.200 mm) maximum
----------------------	-------------------------------

Spigot Bearing — Peening on the Drive Pinion (Refer to Section 5)

Specification	Apply 6,614 lb (3,000 kg) load on a 0.375 inch or 10 mm ball. Peen the end of the drive pinion at a minimum of five points. Softening of the pinion stem end by heating may be required.
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AxleTech[™] International Vehicle Towing Instructions (Non-DCDL)

Section 9

SINGLE AXLE without Driver Controlled Main Differential Lock (DCDL)

TANDEM AXLE without Driver Controlled Main Differential Lock (DCDL), with Inter-Axle Differential (IAD)

These instructions are for vehicles equipped with AxleTech single or tandem rear drive axles.

The instructions supersede all other instructions for the purpose of transporting vehicles for service or new vehicle drive-away dated before April 1995, including those contained in AxleTech Maintenance Manuals.

When transporting a vehicle with the wheels of one or both drive axles on the road, it is possible to damage the axles if the wrong procedure is used before transporting begins. AxleTech recommends that you use the following procedure.

Before Towing or Drive-Away

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Engage the parking brake to prevent the vehicle from moving before you begin maintenance or service procedures that require you to be under the vehicle. Serious personal injury can result.

1. Apply the vehicle parking brakes using the switch inside the cab of the vehicle.
2. Shift the transmission into neutral and start the vehicle's engine.
3. Shift the IAD to the unlocked (disengaged) position using the switch inside the cab of the vehicle. The indicator light in the cab will go off.
4. Stop the engine.

NOTE: Remove both axle shafts from the axle(s) that will remain on the road when the vehicle is transported. Continue with Step 5 for both axle shafts.

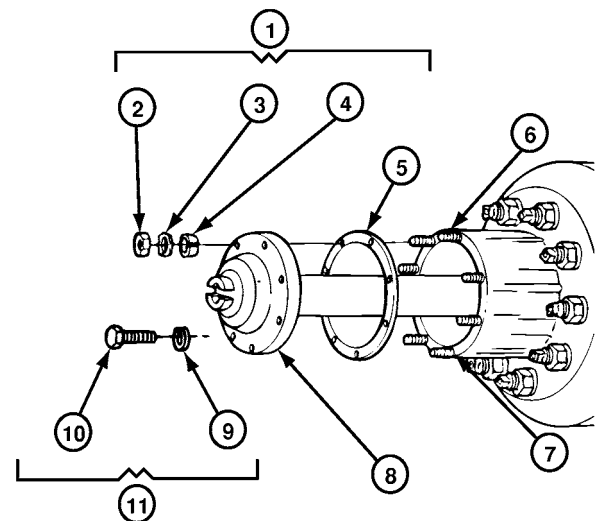
5. Remove the stud nuts or capscrews and the washers from the flange of the axle shaft.
- Figure 9.1.**

CAUTION

Do not use a chisel or wedge to loosen the axle shaft and tapered dowels. Using a chisel or wedge can result in damage to the axle shaft, the gasket and seal, and/or the axle hub.

6. Loosen the tapered dowels, if used, in the flange of the axle shaft using one of the two following methods. **Figure 9.1.**

Figure 9.1



- | | |
|----|-----------------------------|
| 1 | TAPERED DOWEL RETENTION |
| 2 | STUD NUT |
| 3 | WASHER |
| 4 | TAPERED DOWEL |
| 5 | GASKET |
| 6 | STUD |
| 7 | SHAFT HUB AXLE |
| 8 | AXLE SHAFT (FLANGE) |
| 9 | WASHER |
| 10 | CAPSCREW |
| 11 | NON-TAPERED DOWEL RETENTION |

Section 9

Vehicle Towing Instructions (Non-DCDL) **AxleTechTM** International

7. Brass Drift Method:



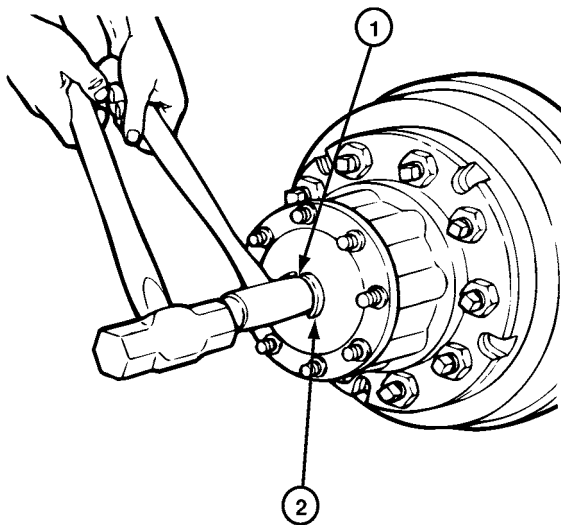
WARNING

Do not strike the round driving lugs on the flange of an axle shaft. Pieces can break off and cause serious personal injury.

NOTE: A 1.5-inch (38.1 mm) diameter brass hammer can be used as a drift.

- a. Hold a 1.5-inch (38.1 mm) diameter brass drift against the center of the axle shaft flange, **inside the round driving lugs**. **Figure 9.2.**

Figure 9.2



- 1 BRASS HAMMER INSIDE LUGS
- 2 ROUND DRIVING LUG

- b. Hit the end of the drift with a large hammer (5 to 6 lbs, 2 to 3 kg) to loosen the axle shaft and tapered dowels from the hub. **Figure 9.2.**



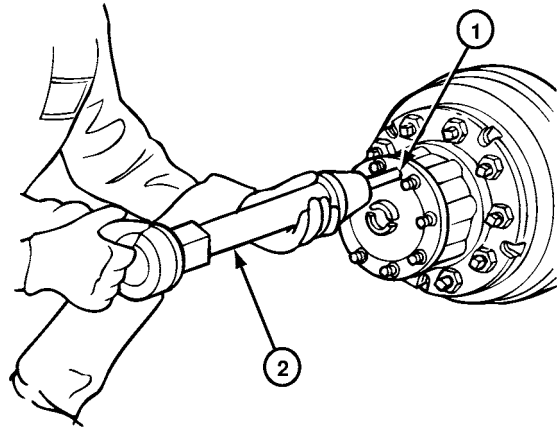
WARNING

Wear safe eye protection when using an air hammer. Power tools and components can loosen and break and cause serious personal injury.

8. Air Hammer Vibration Method:

- a. Use an air hammer, such as Chicago Pneumatic CP-4181-PULER, or equivalent, with a round hammer bit to loosen the axle shaft and dowels.
- b. Place the round hammer bit against the axle shaft flange between the studs, at different points around the flange. Operate the air hammer at each location and loosen the axle shaft and tapered dowels from the hub. **Figure 9.3.**

Figure 9.3



- 1 BIT PLACED BETWEEN STUDS
- 2 AIR HAMMER AND BIT

9. Identify each axle shaft that is removed from the axle assembly so they can be installed in the same location after transporting or repair is completed. (Example: Match mark a mating axle shaft and hub.)
10. Remove the tapered dowels, gasket (if used) and the axle shaft from the axle assembly. **Figure 9.1.**
11. Install a cover over the open end of each hub where an axle shaft was removed. This will prevent dirt from entering the bearing cavity and loss of lubricant.

AxleTech[™] International Vehicle Towing Instructions (Non-DCDL)

Section 9

NOTE: If an air supply will be used for the brake system of the transported vehicle, continue with Steps 12 and 13, otherwise continue with Step 14.

12. Connect an auxiliary air supply to the brake system of the vehicle that is being transported. Before moving the vehicle, charge the brake system with the correct amount of air pressure to operate the brakes. Refer to the instructions supplied by the manufacturer of the vehicle for procedures and specifications. If an auxiliary air supply is not used, continue with Step 14.
13. When the correct amount of air pressure is in the brake system, release the parking brakes of the vehicle that is being transported. Step 14 is not required.



WARNING

When you work on a spring chamber, carefully follow the service instructions of the chamber manufacturer. Sudden release of a compressed spring can cause serious personal injury.

14. If there are spring (parking) brakes on the axle(s) that will remain on the road when the vehicle is transported, and they cannot be released by air pressure, manually compress and lock each spring so that the brakes are released. Refer to the manufacturer's instructions.

After Towing or Drive-Away



WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Engage the parking brake to prevent the vehicle from moving before you begin maintenance or service procedures that require you to be under the vehicle. Serious personal injury can result.

1. If an auxiliary air supply was used, apply the vehicle parking brakes using the switch inside the cab of the vehicle. If an auxiliary air supply was not used, begin with Step 2.



WARNING

When you work on a spring chamber, carefully follow the service instructions of the chamber manufacturer. Sudden release of a compressed spring can cause serious personal injury.

2. Apply the vehicle spring (parking) brakes by manually releasing each spring that was compressed before transporting started. Refer to manufacturer's instructions.

3. Disconnect the auxiliary air supply, if used, from the brake system of the vehicle that was transported. Connect the vehicle's air supply to the brake system.

4. Remove the covers from the hubs.

NOTE: Continue with Steps 5 through 7 to install all axle shafts.

5. Install the gasket, if used, and axle shaft into the axle housing and carrier in the same location it was removed from. The gasket and flange of the axle shaft must be flat against the hub. Rotate the axle shaft and/or the driveline as necessary to align the splines and the holes in the flange with the studs in the hub.

Figure 9.1.

6. Install the dowels, if used, over each stud and into the tapered holes of the flange.
7. Install the washers and capscrews or stud nuts. Determine the size of the fasteners and tighten the capscrews or nuts to the corresponding torque value shown in **Table K**.

Table K

Fasteners	Thread Size	Torque Value lb-ft (N•m) 
Capscrews:	0.31"-24 0.50"-13	18-24 (24-33) 85-115 (115-156)
Stud Nuts: (plain nuts)	0.44"-20 0.50"-20 0.56"-18 0.62"-18 0.75"-16	50-75 (68-102) 75-115 (102-156) 110-165 (149-224) 150-230 (203-312) 310-400 (420-542)
(lock nut)	0.44"-20 0.50"-20 0.56"-18 0.62"-18 0.75"-16	40-65 (54-88) 65-100 (88-136) 100-145 (136-197) 130-190 (176-258) 270-350 (366-475)

8. Inspect the lubricant level in the axles and hubs where the axle shafts were removed. Add the correct type and amount of lubricant if necessary. For information about lubrication, refer to Maintenance Manual MM 1, *Lubrication*, or refer to the Lubrication Section of the Maintenance Manual for the axle model you are working with.

AxleTechTM **International**

Suite 400
3001 West Big Beaver Road
Troy, Michigan 48084
U.S.A.
Toll Free: 877-877-9717
Non-Toll Free: 248-816-5401
Fax: 248-435-1990
Website: www.axletech.com

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AxleTech International France
4, Rue Jean Servanton
Boite Postale 656
42042 Saint Etienne Cédex 1
France
(33) 477.92.88.00
Fax: (33) 477.92.88.93

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AxleTech do Brasil Sistemas Automotivos Ltda.
Avendia Joao Batista, 830
Centro-Osasco-SP
06097095 Brasil
Phone: +55 11 36846641
Fax: +55 11 36846859

Planetary Axle Wheel Ends

Covered Planetary Spider Design

Maintenance Manual No. 8



Rigid Axle		Tandem and Tridem Axles		Steering Axle
PRLC 1925	PRC 4805	SPRC 1926	EPRC 4806	PSC 1875
PRLC 1927	PRLC 4805	EPRC 1927	SPRC 4806	PSC 1876
PRC 1935	PRC 4807	SPRC 1927	EPRC 4808	PSC 4564
PRLC 1935	PRC 5324	SPRC 4026	SPRC 4808	PSC 4565
PRC 3795	PRC 5814			
PRC 3805	PRLC 7314			
PRLC 4026	PRC 7534			

Service Notes

This publication provides maintenance and service procedures for AxleTech covered planetary spider design wheel end assemblies. The information contained in this publication was current at the time of printing and is subject to revision without notice or liability.

1. You must understand all procedures and instructions before you begin maintenance and service procedures.
2. You must follow your company's maintenance and service guidelines.
3. You must use special tools, when required, to avoid serious personal injury and damage to components.

AxleTech uses the following notations to alert the user of possible safety issues and to provide information that will help to prevent damage to equipment and components.



WARNING

A WARNING indicates a procedure that you must follow exactly to avoid serious personal injury.



CAUTION

A CAUTION indicates a procedure that you must follow exactly to avoid damaging equipment or components. Serious personal injury can also occur.

NOTE: A NOTE indicates an operation, procedure or instruction that is important for proper service. A NOTE can also supply information that can help to make service quicker and easier.



This symbol indicates that fasteners must be tightened to a specific torque value.

Additional Publications

- *Cam-Master® Cam Brakes*
Maintenance Manual No. 4
- *Wet Disc Brakes*
Maintenance Manual No. 4L
- *Stopmaster® Off-Highway Heavy-Duty Brakes*
Maintenance Manual No. 4P
- *SCL 2 Series Dry Disc Brake Calipers*
Maintenance Manual No. 4S
- *SCL 35, 46, 53 Dry Disc Brake Calipers*
Maintenance Manual No. 4Y

How To Order

Order items from AxleTech International.

Phone orders are also accepted by calling AxleTech International's Customer Service Center at 877-547-3907 or send a fax to 866-547-3987.

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ASBESTOS FIBER WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from AxleTech.

Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. **Separate Work Areas.** Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

**DANGER: ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA**

2. **Respiratory Protection.** Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.
3. **Procedures for Servicing Brakes.**
 - a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
 - b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - c. If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.
 - d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
 - e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
4. **Cleaning Work Areas.** Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.
5. **Worker Clean-Up.** After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
6. **Waste Disposal.** Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.



NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a potential cancer and lung disease hazard. Material Safety Data Sheets are available from AxleTech.

Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some scientists believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. **Separate Work Areas.** Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.
2. **Respiratory Protection.** OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m³ as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.

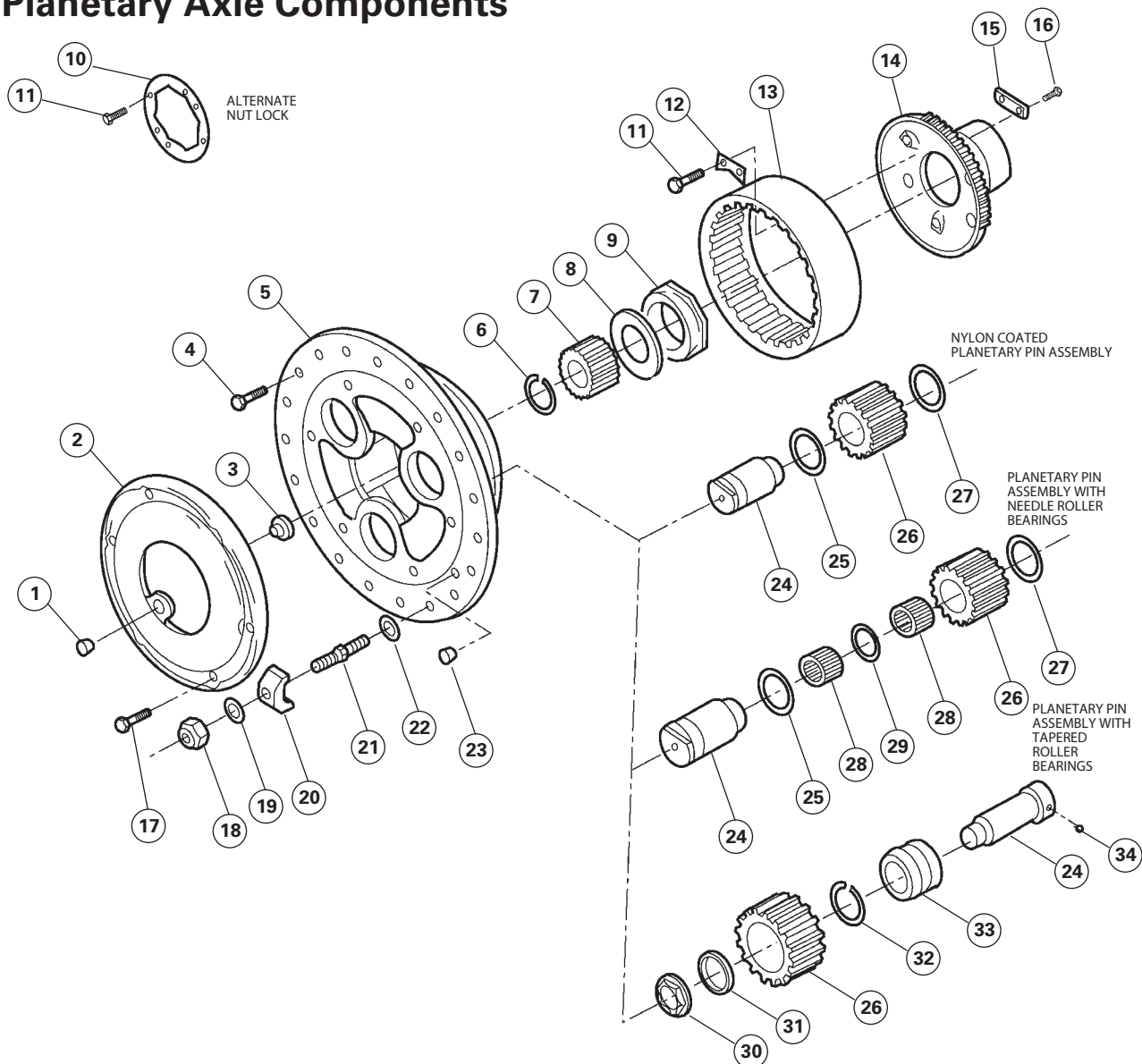
Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposures levels may exceed OSHA or manufacturer's recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.
3. **Procedures for Servicing Brakes.**
 - a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
 - b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - c. If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
 - e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
4. **Cleaning Work Areas.** Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, to minimize exposure. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.
5. **Worker Clean-Up.** After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
6. **Waste Disposal.** Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

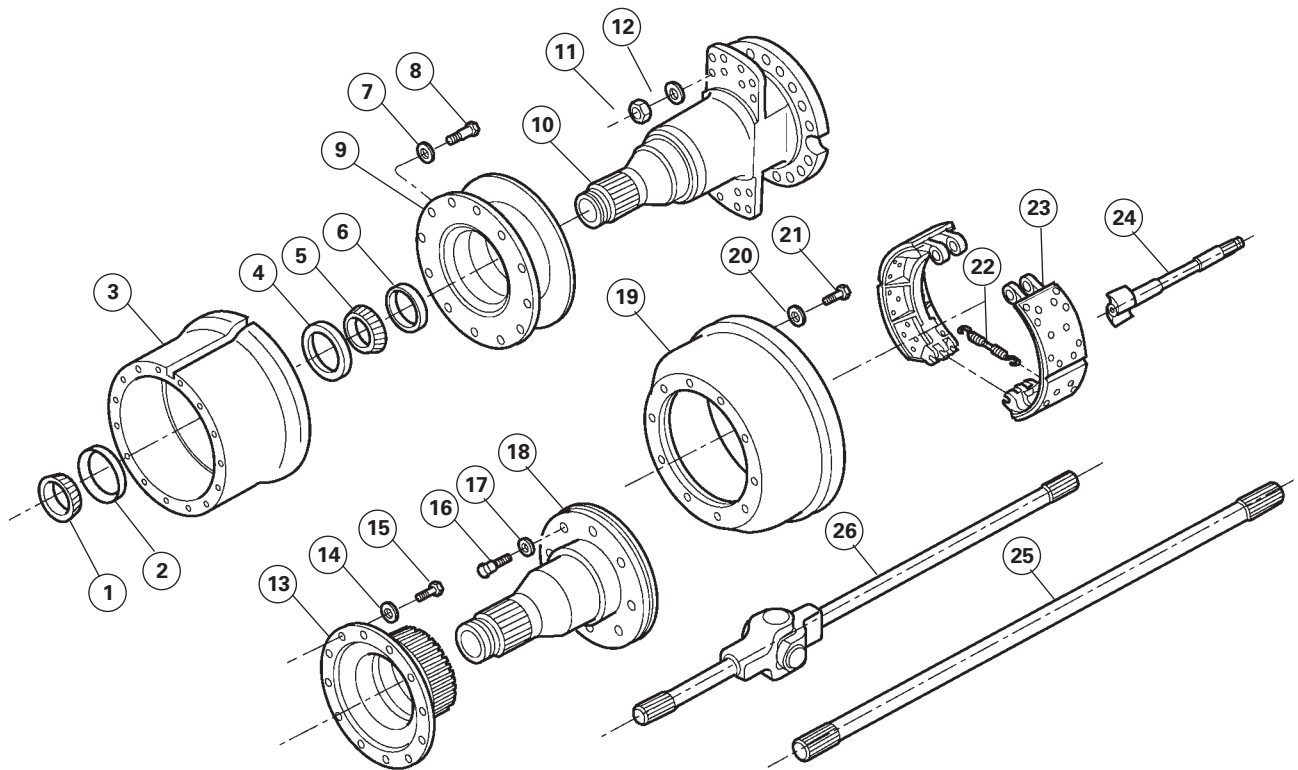
Section 1 Exploded View

Planetary Axle Components



Item	Description	Item	Description	Item	Description
1	Rug -oil level /fill	13	Car -planetary ring	26	Pinion -planetary drive
2	Cover -planetary spider	14	Hub -planetary ring gear	27	Washer -planet pinion inner thrust
3	Thrust button -axle shaft	15	Back -planetary ring gear	28	Needle Roller Bearings
4	Capscrew -planetary spider mount	16	Capscrew -planetary ring gear lock	29	Spacer -needle roller bearing
5	Planetary spider	17	Capscrew -planetary spider cover	30	Backnut -planetary pinion shaft
6	Snap Ring -axle shaft	18	Nut -wheel stud	31	Spacer -planetary pinion bearing
7	Sun Gear -planetary	19	Washer -wheel stud nut	32	Snap Ring -tapered bearing assembly
8	Washer -sun gear thrust	20	Clamp -wheel rim	33	Tapered Roller Bearing Assembly
9	Nut -wheel bearing adjusting	21	Wheel Stud	34	Bill -pinion shaft lock
10	Back -wheel bearing adjusting nut	22	Washer -wheel stud		
11	Capscrew -hub nut lock	23	Rug -oil drain		
12	Back -wheel bearing adjusting nut	24	Shaft -planet pinion		
		25	Washer -planet pinion outer thrust		

Wheel End Components



Item	Description	Item	Description
1	Cone -outer wheel bearing	14	Washer -brake driver mount
2	Cup -outer wheel bearing	15	Capscrew -brake driver mount
3	Wheel Hub	16	Capscrew -spindle mount
4	Cup -inner wheel bearing	17	Washer -spindle mount
5	Cone -inner wheel bearing	18	Spindle (typical wet or drum brake)
6	O-ring -hub inner bearing	19	Brake Drum
7	Washer -brake disc to hub	20	Washer -drum mount
8	Capscrew -brake disc to hub	21	Capscrew -drum mount
9	Disc -Brake	22	Return Spring -brake shoe
10	Spindle (Dry Disc Version shown)	23	Brake Shoe & Lining Assembly
11	Locknut -brake caliper mount	24	Camshaft -air actuated brake
12	Washer -brake caliper mount	25	Axle Shaft (for rigid axle)
13	Brake Driver -wet disc brake	26	Axle Shaft Universal Joint Assembly

Section 2 Introduction



Description

AxleTech covered spider design planetary axles incorporate a single or double reduction carrier with hypoid gearing mounted in the axle center. Final gearing reduction occurs in the wheel hubs by planetary design spur gears.

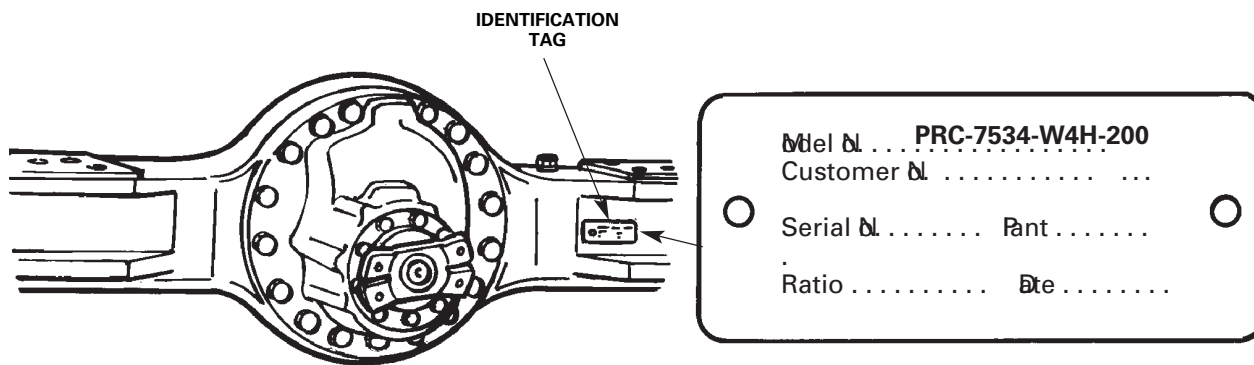
AxleTech planetary axles permit the carrier hypoid gearing and axle shafts to carry only nominal torsional loads. At the same time, the planetary axles also provide the highest practical numerical gear reduction at the wheels.

- Power is transmitted by the hypoid gear set in the carrier to the axle shafts and the sun gear of the final reduction, through the revolving planetary gears and into the planetary spider which drives the wheel hub.
- The floating sun gear teeth mesh with teeth of the planetary spur gears.
- The planetary gears rotate on planetary shafts mounted on the spider. The planetary gear teeth, in turn, mesh with the fixed or floating ring gear teeth.

Identification

To determine the exact axle model specification, refer to the identification tag located on the axle. **Figures 2.1, 2.2 and Figure 2.3.**

Figure 2.1



Axle Identification Tag Location

Figure 2.2

TANDEM AND TRIDEM AXLES

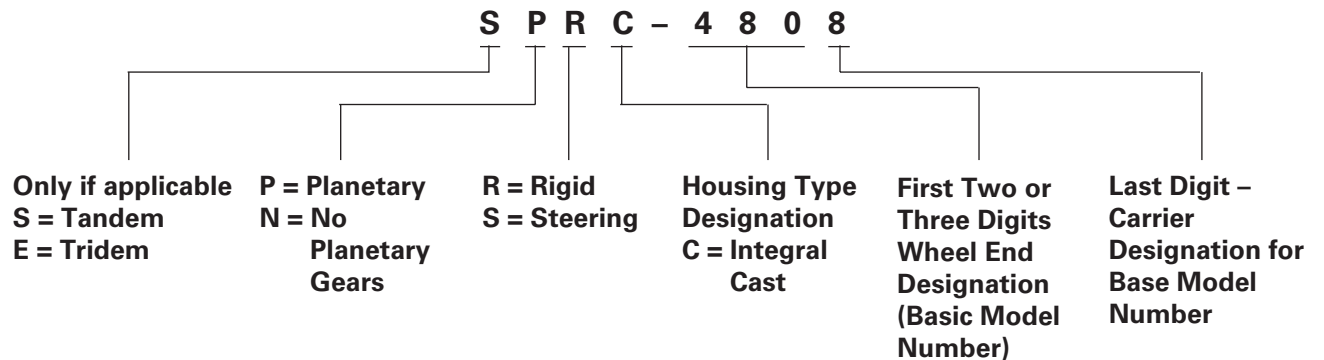
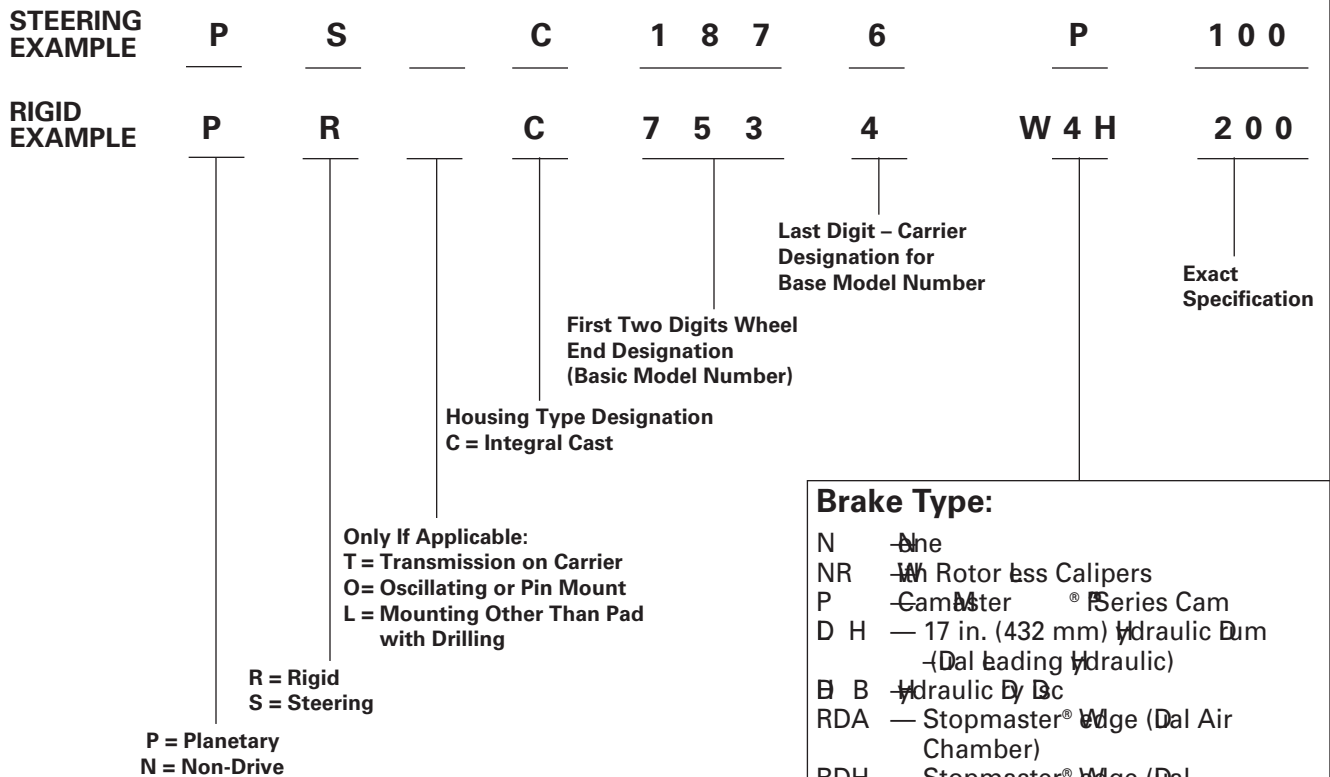


Figure 2.3

SINGLE PLANETARY AXLE



Brake Type:

- N — None
- NR — Non-Rotorless Calipers
- P — Cam Master Series Cam
- D H — 17 in. (432 mm) Hydraulic Drum (Dual Leading Hydraulic)
- B B — Hydraulic Disc
- RDA — Stopmaster® Wedge (Dual Air Chamber)
- RDH — Stopmaster® Wedge (Dual Hydraulic Cylinders)
- RSA — Stopmaster® Wedge Single Air Chamber
- RSH — Stopmaster® Wedge (Single Hydraulic Cylinders)
- W H — Disc® 17 in. (432 mm) W Bc
- W M — Disc® 17 in. (432 mm) W Bc Spring Applied Hydraulic Release
- B2 — Disc® 17 in. (432 mm) W Bc (bit Munt)

Section 3 Disassembly

Removing and Disassembling the Planetary Wheel Ends



WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.



WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle that is supported only by jacks. Jacks can slip or fall over and cause serious personal injury.

1. Park the vehicle on a level surface.
2. Block the wheels that will not be raised to keep the vehicle from moving.
3. Raise the vehicle, so that the area you will service is off of the ground. Support the vehicle with safety stands. Refer to the vehicle maintenance manual for instructions on raising the vehicle.

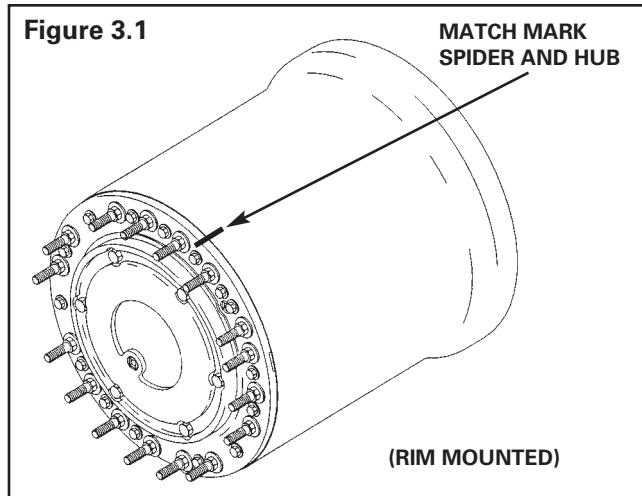
Removing the Tires and Rims

NOTE: You can service the planetary gearing on flange mounted hubs without removing the tire from the planetary wheel end.

1. Remove the nuts, washers and wheel rim clamps. Remove the tire, rim and spacer.
2. Rotate the hub assembly until the oil drain plug in the planetary spider is at the bottom.
3. Remove the oil drain plug. Drain and discard the lubricant.

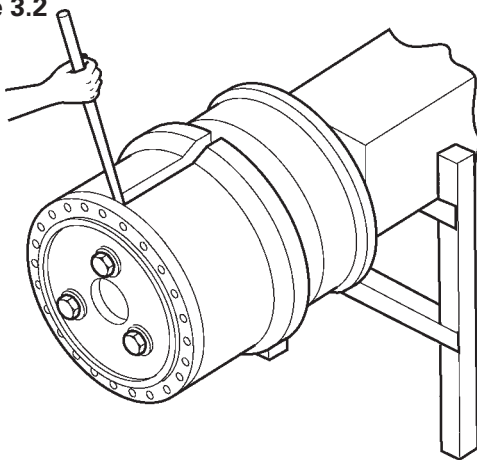
Removing the Planetary Spider Assembly

1. Match mark the spider and wheel hub for correct alignment when you reassemble the unit. **Figure 3.1.**



2. Remove the planetary spider cover capscrews. Remove the planetary spider cover.
3. Remove the spider to hub capscrews and washers or nuts and washers.
 - **To remove studs with integral hex and washers:** Use a 3.25 inch internal depth, extra deep socket.
4. Insert a pry bar into the assembly notches and separate the planetary spider assembly from the wheel hub assembly. **Figure 3.2.** Do not remove the spider assembly at this time.
 - **For axles without assembly notches:** Strike the spider with a plastic or rubber mallet to separate the planetary assembly from the wheel hub assembly. Do not remove the spider assembly at this time.

Figure 3.2

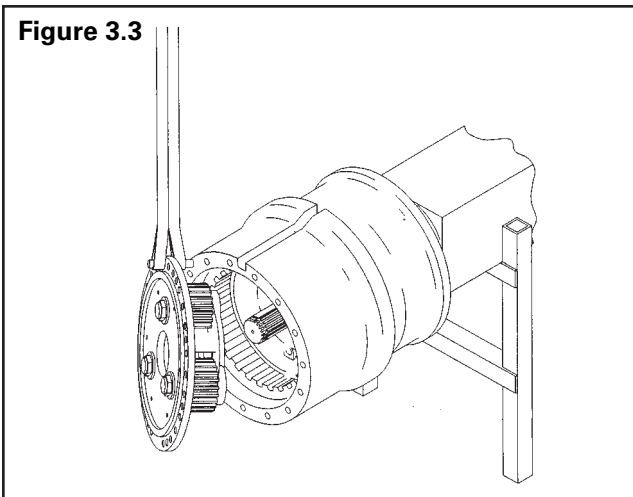


WARNING

Take care when you use lifting devices. When you use a lifting strap, inspect the strap for damage before you use it. Do not use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components can result.

5. Use a lifting device to remove the planetary spider assembly from the wheel hub assembly. **Figure 3.3.**

Figure 3.3



Identifying the Planetary Spider Assembly

AxleTech planetary wheel ends come equipped with different planetary designs:

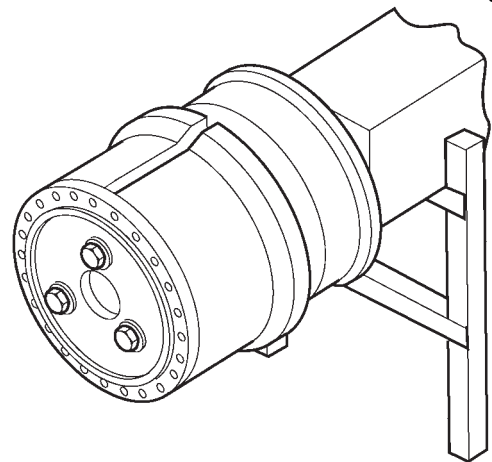
- Planetary pinion shafts with tapered roller bearings
- Planetary pinion shafts with needle roller bearings
- Planetary pinion shafts with nylon coating

To identify the design you are servicing, inspect the outside planetary spider flange.

Planetary spider assemblies with a locknut on the outside flange: This type of planetary design includes planetary pinion shafts with tapered roller bearings. **Figure 3.4.**

Figure 3.4

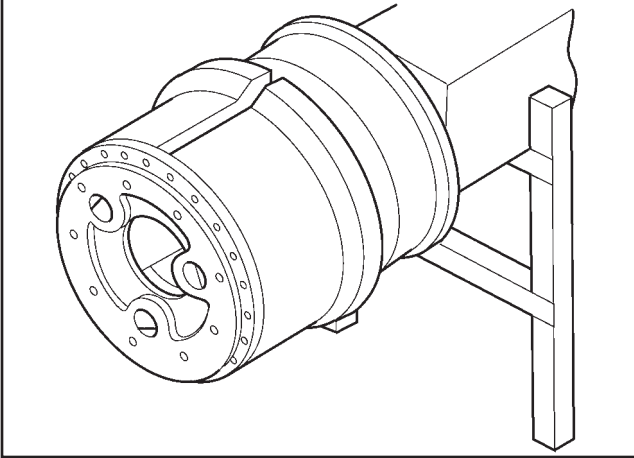
Planetary spider assembly with locknuts on the outside flange



Planetary spider assemblies without a locknut on the outside flange: This type of planetary design can include planetary pinion shafts with needle roller bearings or planetary pinion shafts with nylon coating. **Figure 3.5.**

Section 3 Disassembly

Figure 3.5 Planetary spider assembly without locknuts on the outside flange



Disassembling the Planetary Spider Assembly

NOTE: During disassembly, mark or tag the planetary spider parts you do not plan to replace. Marking and tagging these parts, will aid correct installation during assembly.

Follow the correct disassembly procedure for the type of planetary design you are servicing.

Planetary Pinion Shaft With Tapered Roller Bearings

CAUTION

Carefully remove the planetary pinion shafts. A ball in the large end of each planetary pinion shaft, prevents the pinion shaft from rotating and can become lost as it disengages from the spider.

NOTE: Mix bearing components from one bearing set with those of other bearing sets. A matched bearing set consists of two cups, two cones, a cone spacer and a cup spacer.

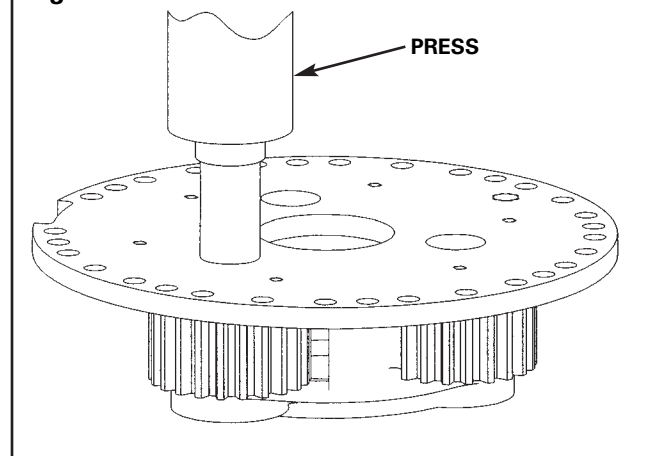
1. Remove the planetary pinion shaft lock nuts.

WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

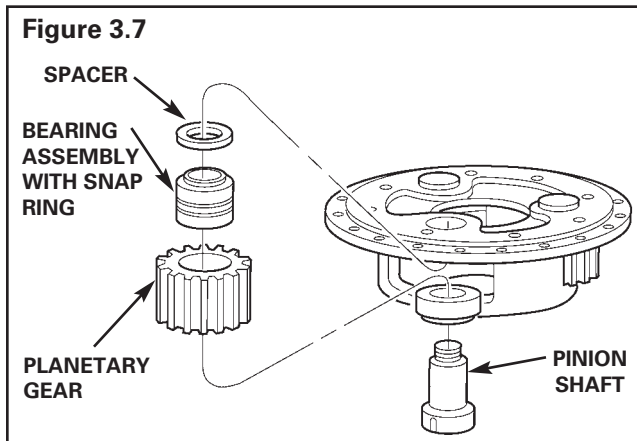
2. Place the spider assembly in a press, flange side **UP**.
 - If a press is not available: Use a brass drift and a mallet to remove the pinion shafts.
3. Support the spider assembly as required.
4. Place a container of cushioning material under the press to catch the planetary pinion shafts as they are pressed out of the spider and planetary pinion gears. **Figure 3.6.**
5. Press a planetary pinion shaft out of the spider. **Figure 3.6.**

Figure 3.6



NOTE: Mark the bearings to aid correct installation during assembly.

6. Remove the bearing cones and bearing cone spacer from the planetary pinion gear.
Figure 3.7.



NOTE: The bearing cups are positioned in the planetary pinion gears with a snap ring between them. DO NOT press both cups out from one end of the planetary pinion gear at the same time. If the bearing cups do not need to be replaced, do not remove them from the planetary pinion gears.

7. Inspect the bearing cups and bearing cones for wear and damage.
 - **If the bearing cups and bearing cones are free of wear and damage:** Clean and lubricate the components.
 - **If the bearing cups and bearing cones are worn or damaged:** Remove and replace the two bearing cups and spacer. Avoid damaging the internal diameter of the gear when you remove the bearing cups.
- 8 Remove the snap ring and spacer.
- 9 Press out the remaining bearing cup.

Planetary Pinion Shaft With Needle Roller Bearings

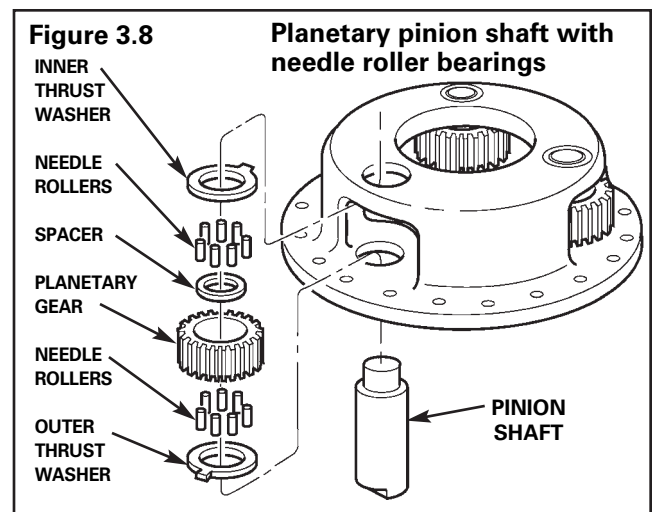
Planetary Pinion Shaft With Nylon Coating



WARNING

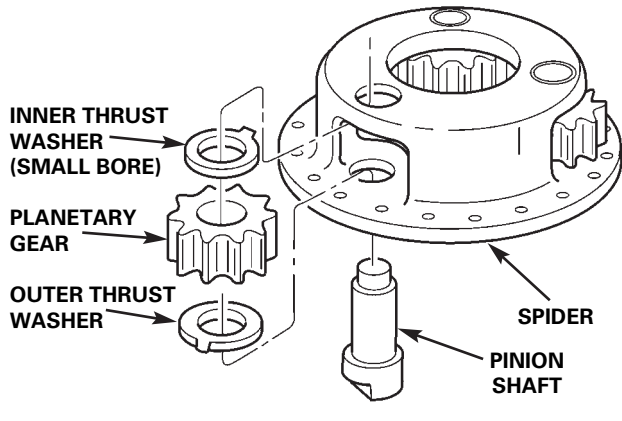
Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

1. Place the spider assembly in a press with the flange side **DOWN**.
 - **If a press is not available:** Use a brass drift and mallet to remove the pinion shafts.
2. Support the spider assembly as required.
3. Place a container of cushioning material under the press to catch the planetary pinion shafts as you press them out of the spider and planetary pinion gears.
4. Press each pinion shaft out of the spider and planetary gear. **Figure 3.8 and Figure 3.9.**
 - **For bolted cover designs:** You may be able to remove the planetary pinion shaft by hand. Use a press to remove the planetary shaft only when necessary.



Section 3 Disassembly

Figure 3.9 Planetary pinion shaft with nylon coating

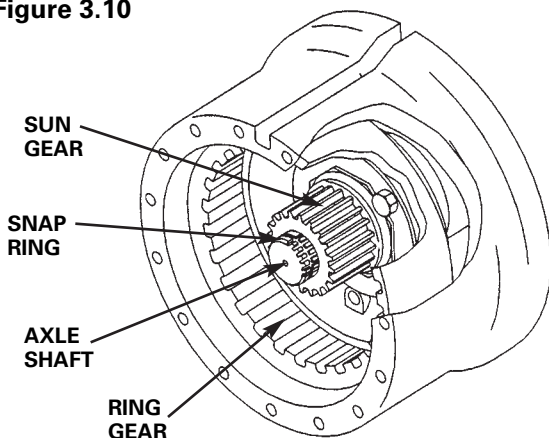


5. Remove the planetary gears and thrust washers from the planetary spider.
6. **For planetary pinion shafts with needle roller bearings:** Remove the needle roller bearings and spacer from the bore of the planetary gear.

Removing the Ring Gear and Axle Shaft

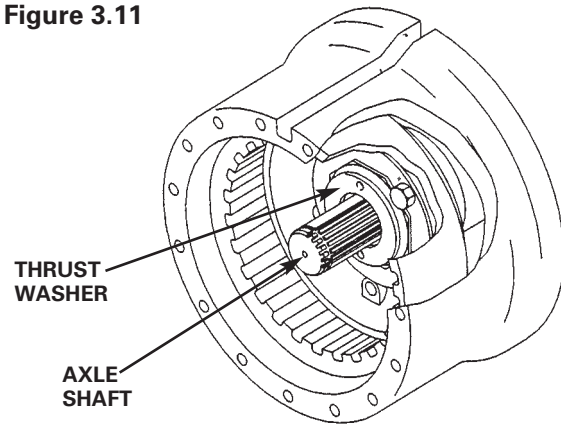
1. For models where the ring gear is not secured to the ring gear hub, remove the floating ring gear. If necessary, use a lifting device to remove the ring gear. **Figure 3.10.**
2. Remove the snap ring from the end of the axle shaft.
3. Remove the sun gear. **Figure 3.10.**
 - **On rigid axles with integral axle shaft and sun gear:** Remove the complete axle shaft.

Figure 3.10



4. Remove the sun gear thrust washer assembly. **Figure 3.11.**

Figure 3.11



5. **On rigid axle models without integral sun gear:** Remove the axle shaft.
6. **To remove the axle shaft from a steering axle:** Remove the wheel hub and spindle before you remove the axle shaft.

Preparing to Remove the Wheel Hub

Axles With Dry Disc Brakes

Remove the brake caliper and adapter assembly. Refer to *Maintenance Manual* **NL 4S**, **SCL 2 Series Dry Disc Brake Calipers** and *Maintenance Manual* **NL 4Y**, **SCL 35, 46, 53 Dry Disc Brake Calipers**. To order these publications, call AxleTech's Customer Service Center at 8754730.

Axles With Wet Disc Brakes

Refer to *Maintenance Manual* **NL 4L**, **Wet Disc Brakes**, for instructions on removing and servicing the wheel hub, brake driver, hub oil seal, wheel bearings and spindle. To order this manual, call AxleTech's Customer Service Center at 8754730.

Axles With P Series or RSA Drum Brakes

! WARNING

When you work on a spring chamber, carefully follow the service instructions of the chamber manufacturer. Sudden release of a compressed spring can cause serious personal injury.

1. If the brake has spring chambers, manually compress and lock the springs to release the brakes.

NOTE: If AxleTech automatic slack adjusters are used, refer to AxleTech Maintenance Manual N 4B PayMaster® Automatic Slack Adjuster for the correct adjustment procedure. To order this publication, call AxleTech's Customer Service Center at 8754730.

2. Turn the slack adjuster manual adjusting nut until the brake shoes fully retract and the drum clears the lining.

Removing the Ring Gear Hub and Wheel Hub

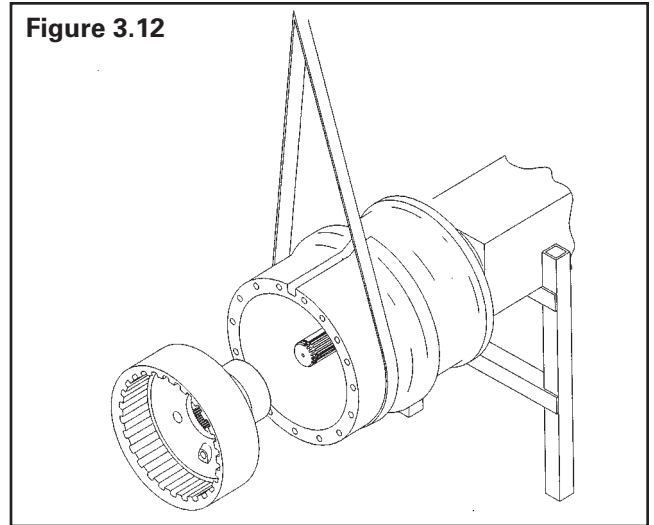
1. Remove the capscrews from the adjusting nut lock. The adjusting nut lock features one of the following designs:
 - A ring that secures all corners of the nut
 - One or two bow ties that secure one or two corners of the adjusting nut or the flat of the nut
2. Remove the wheel bearing adjusting nut lock and wheel bearing nut.

! CAUTION

Support the wheel hub, as shown in Figure 3.12, before you remove the ring gear and the ring gear hub assembly. Do not remove the ring gear and the ring gear hub assembly without supporting the wheel hub. Serious personal injury and damage to components can result.

3. Remove the ring gear hub by pulling it straight out of the wheel hub and off of the spindle. To avoid dropping and possibly damaging the outer wheel bearing cone, ensure that the outer wheel bearing cone remains in place as you remove the ring gear hub. **Figure 3.12.**

Figure 3.12

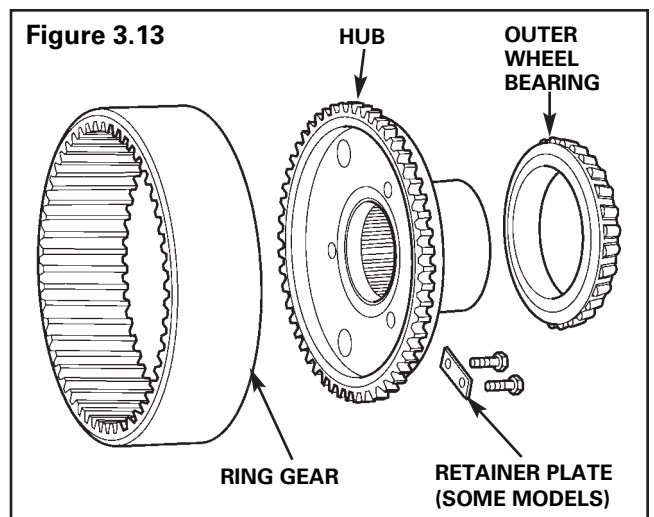


- **If you cannot remove the ring gear hub by hand:** Install capscrews into the puller screw holes in the ring gear hub flange (Ø25x11 N C thread). Tighten each capscrew the same amount to separate the ring gear hub assembly from the spindle and the wheel hub.

NOTE: On models without a floating ring gear, the ring gear is secured to the ring gear hub with capscrews and retainer plates on the back side of the assembly.

4. Remove the retainer plate capscrews to remove the ring gear from the ring gear hub. **Figure 3.13.**

Figure 3.13



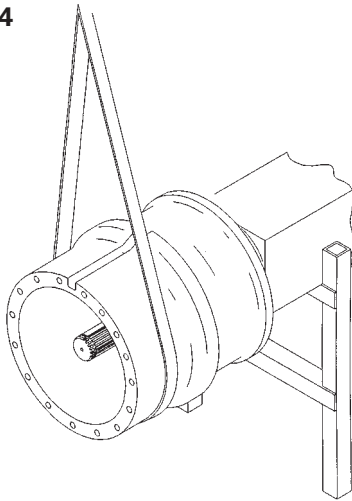
5. Remove the outer wheel bearing from the ring gear hub.

Section 3 Disassembly

NOTE: The ring gear hub assembly includes the hub and ring sleeve insert. You can not service these components separately.

6. Use a chain fall or similar device to lift the hub and drum slightly to relieve the hub weight and drum to brake shoe drag. Remove the assembly from the hub spindle. **Figure 3.14.**

Figure 3.14



Removing the Hub Oil Seal and Bearings

1. Position the wheel hub with the brake end **UPWARD**.

NOTE: Some axle model designs with dry disc brakes provide enough clearance to remove the hub oil seal, bearing cone and bearing cups without removing the rotor.

- **If you can remove the hub oil seal, bearing cone and bearing cups from the axle without removing the rotor:** Proceed to Step 3.
 - **If you must remove the rotor from the wheel hub to remove the hub oil seal, bearing cone and bearing cups:** Proceed to Step 2.
2. Remove the rotor mounting capscrews and washers. Remove the rotor.
 3. Remove the hub oil seal with a suitable puller. **Do not** scratch the hub seal bore surface.
 4. Remove the inner bearing cone.
 5. Remove the bearing cups with a suitable puller.

Removing the Brake Drum or Disc Brake Rotor

1. Mark the drum and hub.
2. Remove the capscrews and washers from the brake drum or rotor pint.



WARNING

Take care when you use lifting devices. When you use a lifting strap, inspect the strap for damage before you use it. Do not use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components can result.

3. Remove the brake drum or rotor from the wheel hub. If necessary, use a lifting device to remove the brake drum or rotor.

Removing the Brake Shoes

To remove the brake shoes, refer to the correct maintenance manual.

- **For P series brakes:** Refer to Maintenance Manual **DL 4**, *Cam-Master® Cam Brakes*.
- **For RSA drum brakes:** Refer to Maintenance Manual **DL 4P**, *Stopmaster® Off-Highway Heavy-Duty Brakes*.
- **For SCL 2 series dry disc brakes:** Refer to Maintenance Manual **DL 4S**, *SCL 2 Series Dry Disc Brake Calipers*.
- **For SCL 35, 46 or 53 series dry disc brakes:** Refer to Maintenance Manual **DL 4Y**, *SCL 35, 46, 53 Dry Disc Brake Calipers*.

To order these publications, call AxleTech's Customer Service Center at 8754730.

Removing the Spindle

Axles With Dry Disc Brakes

1. Mark the spindle and housing flange.
2. Use straps and a lifting device to support the spindle.
3. Remove the spindle mounting capscrews and washers.
4. Remove the spindle from the axle housing or steer knuckle.

Steering Axles With RSA Drum Brakes

1. Remove all air from the air system.
2. Remove the air lines from the air chamber. Tag the lines and ports to aid reassembly.

WARNING

When you work on a spring chamber, carefully follow the service instructions of the chamber manufacturer. Sudden release of a compressed spring can cause serious personal injury.

3. If the brake has spring chambers, manually compress and lock the springs to release the brakes.
4. Mark the air chamber housing tube and the brake spider plunger housing to aid reassembly.
5. Remove the setscrew that retains the air chamber assembly in the spider plunger housing.
6. **If there is a collet nut on the threads of the chamber housing tube:** Use a hammer and a brass drift to loosen the collet nut.
7. Remove the air chamber assembly from the plunger housing. If necessary, use a strap wrench to remove the air chamber assembly.
8. Remove the brake shoe return springs.
9. Rotate the brake shoes to allow access to the spindle/brake spider mounting capscrews.

10. Mark the brake spider and steering knuckle to aid correct installation at assembly.
 11. Remove the two capscrews and washers that mount the brake spider and spindle to the steering knuckle at the 11 and 1 o'clock positions.
 12. Install two studs 46 inches long with Ø51 N F threads on the end that engages the steering knuckle to aid spindle removal.
 13. Support the spindle and brake spider assembly.
 14. Remove the remaining capscrews and washers.
 15. Remove the brake spider and brake shoe assembly.
- NOTE:** The oil seal in the bore of the spindle large end may be damaged during spindle removal.
16. Remove the spindle from the steering knuckle by sliding the spindle over the outer end of the axle shaft and universal joint assembly.
 17. Remove the axle shaft and universal joint assembly.

Steering Axles With P Series Cam Brakes

1. Remove the brake shoe return springs.
2. Rotate the brake shoes until enough clearance exists to remove the spindle mounting nuts and washers with a wrench.
3. Remove the spindle mounting nuts and washers.

NOTE: The oil seal in the bore of the spindle large end may be damaged during spindle removal.

4. Remove the spindle from the steer knuckle by sliding the spindle over the outer end of the axle shaft assembly.
5. Remove the axle shaft and universal joint assembly.

Rigid Axles With P Series Cam Brakes

NOTE: Some rigid axles feature a twopiece camshaft and coupling which allows you to remove the camshaft without removing the slack adjuster. When servicing an axle with a twopiece camshaft and coupling, proceed to Step 6.

1. Remove the brake shoe return springs.
2. Rotate the brake shoes to allow access to the brake camshaft and the spindle mounting capscrews.
3. Remove the slack adjuster clevis pin that connects the air chamber push rod.
4. Remove the snap ring and washers that connect the slack adjuster to the brake camshaft. Stack the washers and separate them from other parts.
5. Remove the slack adjuster and washers. Separate the washers from other parts and prevent them from mixing with the washers you previously removed.
6. Remove the snap rings that retain the camshaft in the spindle support boss.
7. Remove the brake camshaft from the spindle. Separate the washers you removed from the face of the spindle boss. Prevent the washers from mixing with the washers you previously removed.

WARNING

Take care when you use lifting devices. When you use a lifting strap, inspect the strap for damage before you use it. Do not use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components can result.

- 8 Use straps and a lifting device to support the spindle and brake shoe assembly.
- 9 Mark the housing and spindle flange.
- 10 Remove the mounting capscrews and washers.
11. Remove the spindle from the axle housing.

Cleaning Ground or Polished Parts



WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners and petroleum-based cleaners. To avoid serious personal injury when you use solvent cleaners, you must carefully follow the manufacturer's product instructions and these procedures:

- *Wear safe eye protection.*
- *Wear clothing that protects your skin.*
- *Work in a well-ventilated area.*
- *Do not use gasoline or solvents that contain gasoline. Gasoline can explode.*
- *You must use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.*
- *Use a cleaning solvent to clean ground or polished parts or surfaces. Kerosene or diesel fuel oil can be used for this purpose. .*
- *Remove gasket material from parts. Be careful not to damage ground surfaces.*
- * Clean ground or polished parts in a hot solution tank, water, steam or alkaline solution.*

Cleaning Parts With Rough Finishes

- *Parts with a rough finish can be cleaned with cleaning solvent or in a hot solution tank with a weak alkaline solution.*
- *Parts must remain in hot solution tanks until completely cleaned and heated.*
- *Parts must be washed with water until the alkaline solution is removed.*

Cleaning Axle Assemblies

- *A complete axle assembly can be steam cleaned on the outside to remove dirt.*
- *Before the axle is steam cleaned, close or put a cover over all openings in the axle assembly. Examples of openings are breathers or vents in air chambers.*

Drying Cleaned Parts

- *Dry the parts immediately after cleaning and washing.*
- *Dry the parts with soft clean paper or rags.*



CAUTION

Damage to bearings can be caused if dried by rotating with compressed air.

- *Except for bearings, parts can be dried with compressed air.*

Preventing Corrosion

- *Apply a light lubricant to cleaned and dried parts that are not damaged and are to be assembled.*
- *Apply a special material that prevents corrosion to all surfaces. If parts are to be stored, wrap the parts in special paper that prevents corrosion.*

Inspecting Parts

It is very important to inspect all parts carefully and completely before the axle or carrier is assembled. Check all parts for wear and replace damaged parts. Replacement of damaged or worn parts will prevent breakdown of assembly later.

Section 4

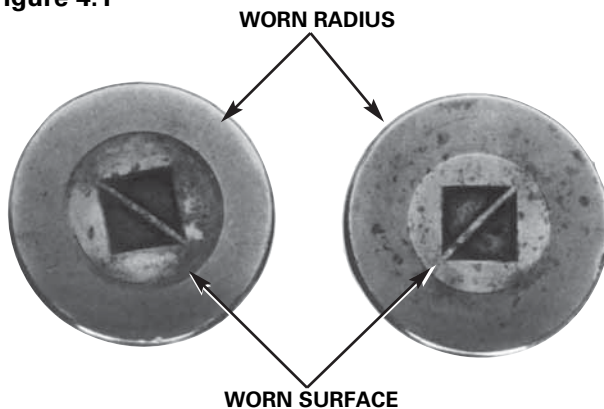
Prepare Parts for Assembly

Inspecting Tapered Roller Bearings

Inspect the cup, cone, rollers and cage of all tapered roller bearings in the assembly. If any of the following conditions exist, the bearing must be replaced:

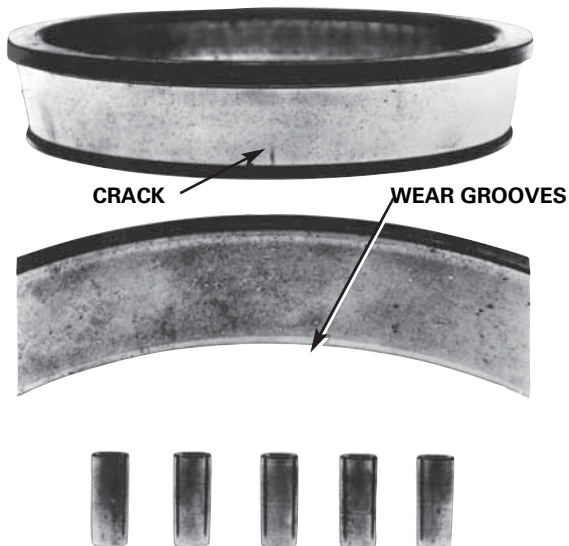
- The center of the large diameter end of the rollers are worn level with, or below the surface.
- The center of the large diameter end of the rollers are worn to a sharp edge. **Figure 4.1.**

Figure 4.1



- A visible roller groove in the cup or cone inner race surfaces. The groove can be seen at the small or large diameter end of both parts. **Figure 4.2.**

Figure 4.2



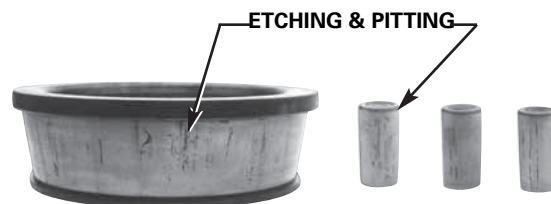
- Deep cracks or breaks in the cup, cone inner race or roller surfaces.
- Bright wear marks on the outer surface of the roller cage. **Figure 4.3.**

Figure 4.3

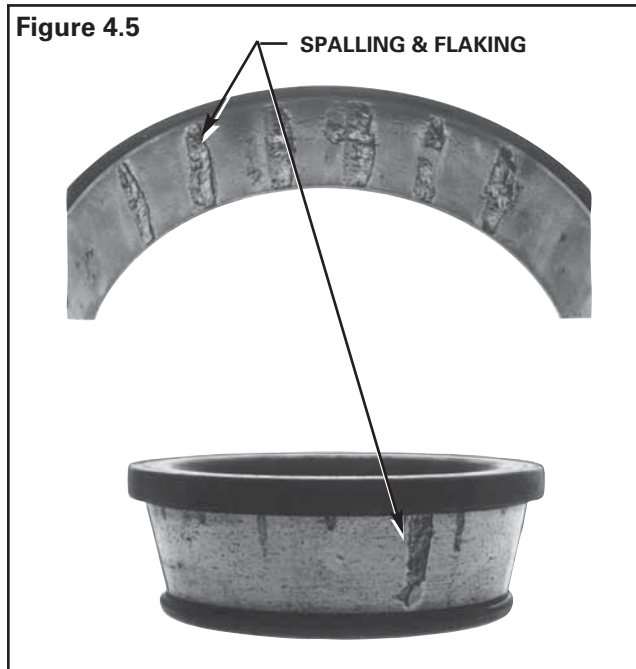


- Damage on rollers and on surfaces of the cup and cone inner race that touch the rollers. **Figure 4.4.**

Figure 4.4



- Damage on the cup and cone inner race surfaces that touch the rollers. **Figure 4.5.**



Inspecting Planetary Wheel End Components

Inspect the planetary reduction, planetary gears, sun gear and ring gear assembly for wear or damage. Replace gears, shafts or thrust washers that are scored, pitted, ridged, chipped or worn.

Repairing or Replacing Parts

Replace worn or damaged parts of an axle assembly. The following are some examples to check for repair and possible replacement:

- Replace any fastener if corners of the head are worn.
- Replace washers if damaged.
- Replace gaskets, oil seals or grease seals at the time of axle repair.
- Clean parts and apply new liquid gasket material where required when axle is assembled.

- Remove nicks, marks and burrs from parts having machined or ground surfaces. Use a fine file, India stone, emery cloth or crocus cloth for this purpose.
- Clean and repair threads of fasteners and holes. Use a die or tap of the correct size or a fine file for this purpose.



CAUTION

Threads must be without damage and clean so that accurate adjustment and correct torque values can be applied to fasteners and parts.

- Tighten all fasteners to correct torque values.



WARNING

Do not repair axle housings by bending or straightening. Repair of axle housings by bending or straightening can cause poor performance and possible unsafe operation of the axle. This can cause serious personal injury.

Repair Welding

Do not repair weld drive axle assemblies. Repair welding can detract from the structural integrity of a component, particularly to heat treated parts where the benefit of heat treatment can be nullified by welding.

Removing Capscrews Fastened With Liquid Adhesive



CAUTION

Do not use impact wrenches or strike components with a hammer.

To remove capscrews fastened with liquid adhesive, use the regular mechanical disassembly procedure.

If the removal of a capscrew, for example, becomes difficult due to a worn head or unusually high breakaway torque, the locking strength can be reduced by heating the threaded area to approximately 300 (150). Heat slowly to avoid thermal stresses in components.

Section 4

Prepare Parts for Assembly

Cleaning

WARNING

To avoid serious personal injury, trichloroethylene must not come in contact with your skin. Do not smoke and avoid breathing vapors in closed rooms without ventilation. Do not use trichloroethylene near flames, welding operations or hot surfaces exceeding 900°F (482°C).

Clean the capscrew, nut or bolt tapped hole and fastener thread carefully. Use a cleaning solvent such as trichloroethylene or equivalent to remove dirt, oil, grease or moisture.

Using Dri-Loc Fasteners and AxleTech Liquid Adhesive

NOTE: Do not apply AxleTech liquid adhesive or any other type of fastener retainer material, sealant or adhesive on Dbc fasteners or in the threaded holes.

NOTE: A cure time is required for Dbc fasteners before rebuilding the axle and returning it to service.

1. Wipe excess oil residue from the threaded holes of all components that use Dbc fasteners.
2. Assemble the components that use Dbc fasteners.
3. Tighten the Dbc fasteners to the specified torque value.

Reusing Dri-Loc Fasteners and Loctite® No. 277

WARNING

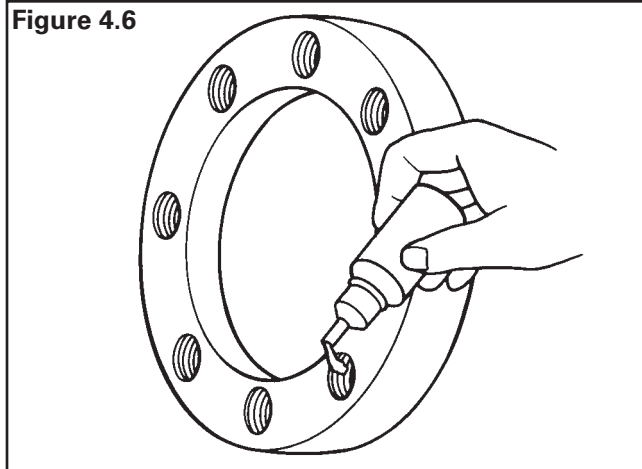
Take care when using Loctite® to avoid serious personal injury. Follow the manufacturer's instructions to prevent irritation to the eyes and skin. If Loctite® gets into your eyes, flush them with water for 15 minutes. Have your eyes checked by a doctor as soon as possible.

1. Wipe excess oil residue from the Dbc fasteners and threaded holes.

NOTE: Do not apply liquid adhesive to the fastener. Trapped air in the threaded hole will create back pressure and blow out the adhesive as the fastener advances.

2. Apply bctite ® NL 277 adhesive to the threaded holes only. Before threading in the fasteners, visually check to make sure that the adhesive contacts the threads. **Figure 4.6.**

Figure 4.6



3. Tighten the fasteners to the specific torque value recommended for the fastener. bctite ® NL 277 will not alter the torque requirement.

NOTE: A cure time is required for bctite ® NL 277 before rebuilding the axle and returning it to service.

4. **When servicing drive units assembled with Dri-Loc fasteners or with Loctite® No. 277 in threaded holes where the fasteners do not require removal:** Check each fastener for tightness by tightening the fastener to the minimum specified torque.
 - If the fastener does not rotate, the fastener is tightened to the correct torque.
 - If the fastener rotates to any degree, remove it from the component and apply liquid adhesive to the threaded hole.

Applying Silicone Gasket Material

AxleTech recommends the following liquid gasket materials:

- ThreeBond 1216
- Loctite[®] 569

WARNING

When you apply some silicone gasket materials, small amounts of acid vapor are present. To prevent possible serious injury, the work area must be well-ventilated. If the silicone gasket material gets into your eyes, flush them with water for 15 minutes. Have your eyes checked by a doctor as soon as possible.

CAUTION

The amount of liquid gasket material applied must not exceed a 0.125 in. (3.18 mm) diameter bead. Too much gasket material can block lubrication passages and result in damage to components.

1. Remove all old gasket material from both surfaces.
2. Clean the surfaces where liquid gasket material will be applied. Remove all oil, grease, dirt and moisture.
3. Thoroughly dry both surfaces.
4. Apply approximately a 0.125 inch (3.18 mm) diameter continuous bead of liquid gasket material around one surface.

Also apply gasket material around the edge of all fastener holes on that surface. **Figure 4.7.**

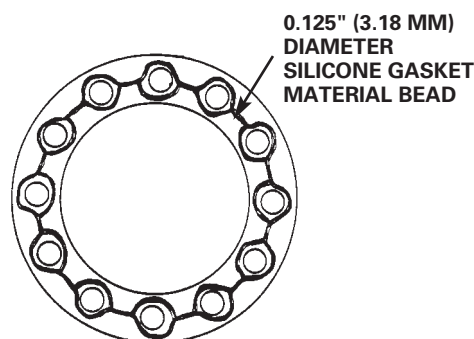
5. Assemble the components quickly to permit the gasket material to compress evenly between parts.
6. Tighten the fasteners with the required torque.

Flushing Lube From the Axle

NOTE: The rigid axle wheel end and housing bowl share the same oil. Lubricant contamination of the wheel end or housing bowl can spread to all areas of the axle.

Flush lubricant from the entire axle, including the wheel ends and housing bowl, before you assemble the axle.

Figure 4.7



Section 5 Assembly

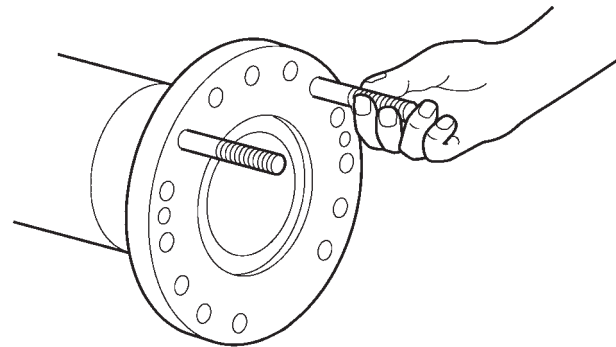
Installing the Spindle on Rigid Axles With P Series Cam Brakes

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

1. Install two 4inch long temporary studs into the axle housing flange at the 1 and 11 o'clock positions. **Figure 5.1.**

Figure 5.1



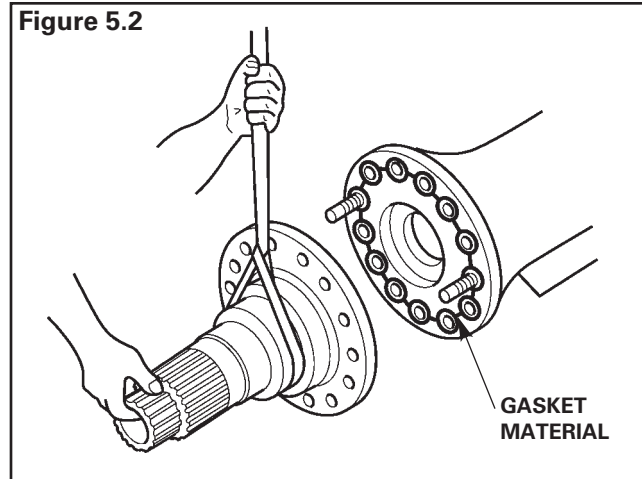
2. Apply a 0.125inch diameter continuous bead of liquid gasket material around the flange mounting face of the axle housing.

⚠ WARNING

Take care when you use lifting devices. When you use a lifting strap, inspect the strap for damage before you use it. Do not use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components can result.

3. Align the spindle and axle housing match marks. Install the spindle on the axle housing. If necessary, use an overhead crane to lift and support large spindles. **Figure 5.2.**

Figure 5.2



4. Install and hand tighten the spindle mounting capscrews and washers. Remove the temporary studs and replace them with capscrews and washers.
5. Tighten the capscrews according to the torque specifications shown in **Table A.** **ⓘ**

Table A: Spindle Mounting Capscrew Torque Specifications

Size	Torque	
	lb-ft	N•m
3/4" 0	31 00 0	42 042
7/8" 4	57 565 0	78
1 1/2" 4	80 10 0	115 2149
1 1/4" 2	17 020 0	23 028
1 3/4" on stud)	65 0 5	84 18

6. Replace the brake camshaft bushings and grease seals in the spindle boss and camshaft brackets. Refer to **Maintenance Manual** 4, **Cam-Master® Cam Brakes**. To order this publication, call AxleTech's Customer Service Center at 8754730.
7. Install the cam head thrust washer onto the camshaft. Apply 617A or 617B chassis grease to the camshaft bushings and journals.
8. Install the camshaft through the spindle bushings. Install the washers and slide the camshaft through the air chamber support bracket.
 - **For two-piece camshaft designs:**
Engage the coupling when you install the camshafts.

- 9 Install the slack adjuster, washers, and snap ring. Connect the slack adjuster to the air chamber push rod yoke. Check that the snap ring is installed to the camshaft at the inner face of the spindle boss.

Installing the Spindle on Rigid Axles With Dry Disc Brakes

1. For axle models that use capscrews to mount the spindle: Install two 4inch long temporary studs into the axle housing flange at the 1 and 11 o'clock positions. **Figure 5.1.**
2. Apply a 0.25inch diameter continuous bead of liquid gasket material around the flange mounting face of the axle housing.
3. Align the spindle with the axle housing match marks to correctly position the brake caliper mounting bosses. Install the spindle on the axle housing.
4. Install and hand tighten the spindle mounting capscrews and washers. Remove the temporary studs and replace them with capscrews and washers.
 - For models with studs in the axle housing: Install washers and locknuts.
5. Tighten the capscrews or locknuts according to the torque specifications shown in **Table B.** 

Table B: Spindle Mounting Capscrew and Locknut Torque Specifications

Size	Torque	
	lb-ft	N•m
3/4" 0	3100 0	42042
7/8" 4	57565 0	78
1 1/2" 4	8010 0	1152149
1 1/4" 2	17020 0	23028
1 3/4" on stud)	650 5	8118

Installing the Spindle on Steering Axles With P Series Cam Brakes

NOTE: Install the differential carrier assembly and the steering knuckles on the steering axles before performing the following procedure.

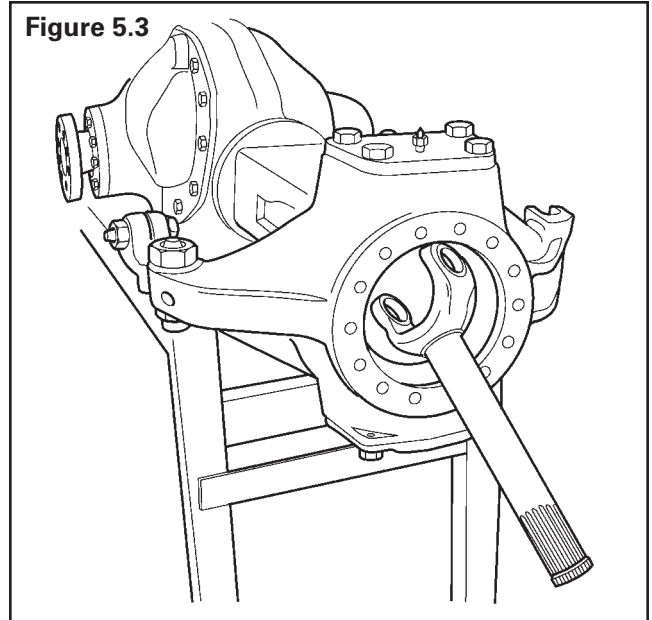
1. Apply a thin coat of  1 grade 1 or 2 grease to the following areas:
 - Oil seal lips and bushing bore in the end of the axle housing
 - Axle shaft assembly seal and bushing journals

CAUTION

Avoid damaging the housing oil seal when you install the shaft assembly. Lubricant loss and damage to components can result.

2. Install the axle shaft assembly through the steering knuckle and axle housing until the shaft engages the differential assembly side gear. **Figure 5.3.**

Figure 5.3



3. If the original shaft support bushing in the bore of the spindle is worn or damaged: Remove the oil seal and bushing and install a new bushing.
4. Install a new oil seal in the spindle bore. Apply a thin coat of  1 grade 1 or 2 grease to the seal lips and bushing bore.

CAUTION

Avoid damaging the oil seal in the spindle when you install the spindle. Lubricant loss and damage to components can result.

5. Install the spindle on the steering knuckle by carefully sliding it over the outer end of the axle shaft assembly.
6. Install the spindle mounting washers and nuts.  and tighten the nuts .
7. Tighten the 3/4inch19 nuts to 3100 lbft (42042 Nm). .
8. **If you removed the brake shoes or camshaft:** Install the brake shoes or camshaft. Refer to *Maintenance Manual* **DL 4, Cam-Master® Cam Brakes. To order this publication, call AxleTech's Customer Service Center at 8355560 .**

Installing the Spindle on Steering Axles With RSA Drum Brakes

NOTE: Install the differential carrier assembly and the steering knuckles on the steering axle before performing the following procedure.

1. Apply a thin coating of  grade 1 or 2 grease to the following areas:
 - Oil seal lips and bushing bore in the end of the axle housing
 - Axle shaft assembly seal and bushing journals

CAUTION

Avoid damaging the housing oil seal when you install the shaft assembly. Lubricant loss and damage to components can result.

2. Install the axle shaft assembly through the steering knuckle and axle housing until the shaft engages the differential assembly side gear.
3. **If the original shaft support bushing in the bore of the spindle is worn or damaged:** Remove the oil seal and bushing and install a new bushing.
4. Install a new oil seal in the spindle bore. Apply a thin coat of  grade 1 or 2 grease to the seal lips and bushing bore.

CAUTION

Avoid damaging the oil seal in the spindle when you install the spindle. Lubricant loss and damage to components can result.

5. ~~Use~~ a lifting device to install the spindle onto the steering knuckle. Carefully slide the spindle over the outer end of the axle shaft assembly and engage the two temporary guide studs.
6. Align the brake spider and brake shoe assembly with the spindle match marks. Install the brake spider and brake shoe assembly on the spindle. Refer to *Maintenance Manual* **DL 4P Stopmaster Off-Highway Heavy-Duty Brakes.**
7. Install the spindle and brake spider mounting capscrews and washers. Remove the two temporary studs you installed during disassembly. Replace the temporary studs with capscrews and washers.
8. Tighten the 7/8inch14 capscrews and washers to 575650bft (78 Nm). .
9. Install the air chamber assembly into the brake spider. Refer to *Maintenance Manual* **DL 4P Stopmaster Off-Highway Heavy-Duty Brakes**.
10. Install the brake shoe return spring.

NOTE: Release the spring chamber after you finish adjusting the wheel hub.

11. Connect the air lines to the correct ports in the air chamber assembly.

Installing the Axle Shaft in Rigid Axle Models

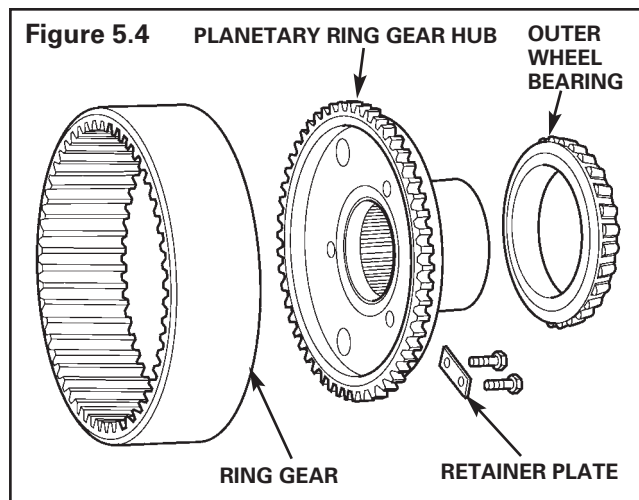
NOTE: If the axle uses a one piece shaft/sun gear, install the shaft/sun gear after adjusting the wheel bearings.

Install the axle shaft through the spindle bore and housing until it engages the differential side gear. The shaft end with the snap ring groove must extend beyond the outer end of the spindle.

Assembling the Ring Gear Hub Assembly

NOTE: When servicing an axle model with a floating ring gear, install the ring gear immediately before you assemble the planetary spider.

1. For axle models that include a planetary ring gear with tapped holes, lock plates and capscrews: Assemble the ring gear to the ring gear hub. **Figure 5.4.**



2. Install the outer wheel bearing cone on the ring gear hub journal squarely against the hub shoulder. Apply the same lubricant used in the wheel ends to the rollers. Slip fit the bearing cone over the ring gear hub journal. Do not install the ring gear hub assembly on the spindle at this time.

Assembling the Hub, Bearings, Oil Seal and Drum or Rotor

1. If the hub bearing cups need to be replaced, install the new cups with a suitable driver.

NOTE: Most models require installation of the inner bearing cone prior to installation of the wheel hub oil seal into the bore of the wheel hub.

2. Apply lubricant to the inner bearing cone rollers. Install the bearing cone into the wheel hub.
3. If used, install the oil seal guard washer.
4. Position the new wheel hub oil seal so that the spring lip of the seal faces the wheel bearing. Use a suitable seal driver to drive the seal into the same location as the original wheel hub oil seal. Refer to the following list for three possible seal installation locations:
 - Bottom of the hub bore
 - Bashed in until it contacts the guard washer
 - Push with the end face of the hub

CAUTION

Use extreme care to avoid nicking the oil seal wear sleeve end when you install the oil seal wear sleeve. A nicked oil seal wear sleeve end can damage the seal lip when you install the wheel hub. Lubricant loss and damage to components can result.

5. If a sleeve is used, carefully install a new oil seal wear sleeve on the spindle.
6. Lubricate the seals in the following areas only.
 - **Conventional seals:** Lubricate the oil seal lips.
 - **Unitized seals:** Lubricate the inside diameter of the seal.
 - **Face seals:** Lubricate the contact surfaces of the metal rings. Do not apply lubricant to any other part of the face seal.
7. Apply a thin coat of lubricant to the oil seal journal surface of the spindle.

Section 5 Assembly

- 8 Install the brake rotor or drum and oil slinger.
 - **If the slinger fits loosely between the hub and drum:** Apply a bead of liquid gasket material to prevent rattling.
- 9 Install the drum or rotor mounting capscrews and washers.
 - **For dual tire models:** Align the air valve stem clearance notch in the drum outside diameter with the wheel hub notch.
- 10 Tighten the capscrews according to the torque specifications shown in **Table C.** 

Table C: Brake Rotor Mounting Capscrew Torque Specifications

Size	Torque	
	lb.-ft.	N•m
3/4" 0	31 00 0	42 042
1" 2	80 10 0	115 214 9
7/8" 4	57 575 0	7 007

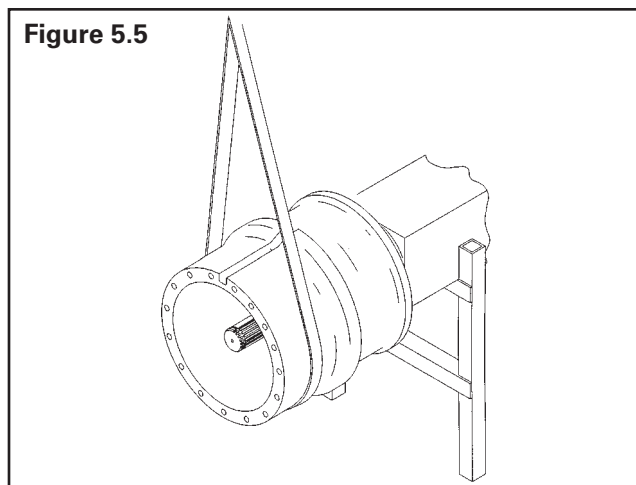
Installing the Wheel Hub

WARNING

Take care when you use lifting devices. When you use a lifting strap, inspect the strap for damage before you use it. Do not use a lifting strap to shock load or drop load a component. Serious personal injury and damage to components can result.

1. Use a lifting device to carefully lift and slide the wheel hub assembly over the spindle. Keep the wheel hub assembly aligned with the spindle to avoid oil seal damage. **Figure 5.5.**
 - **For axle models with three threaded holes (5/8 inch-11 UNC) in the boss area near the outer wheel bearing:** You can temporarily attach the planetary ring gear hub assembly to the wheel hub prior to installation on the spindle.

Figure 5.5



2. Install the ring gear hub assembly, which includes the outer bearing cone, on the spindle. **Figure 5.4.**
3. Install the wheel bearing adjusting nut on the spindle.
 - **If you temporarily attached the planetary ring gear hub assembly to the wheel hub in Step 1:** Remove the temporary capscrews from the ring gear hub.

Adjusting the Wheel Bearing Preload

NOTE: For wheel bearing adjustment procedures for axles equipped with wet disc brakes, refer to AxleTech Maintenance Manual **DL 4L Wet Disc Brakes**. To order this publication, call AxleTech's Customer Service Center at 8754730.

1. Tighten the wheel bearing adjusting nut to the initial seating torque listed in **Table D**, while rotating the wheel hub. 
2. Continue to rotate the hub a minimum of one full revolution in both directions.

Table D: Wheel Bearing Adjustment

Rigid Axle Models	Steering Axle Models	Adjusting Nut Torque			
		Initial Seating		Final Adjustment	
		lb.-ft.	N•m	lb.-ft.	N•m
RC 1 2 5 through 4807 SRC & ER C-196 through 4808	PSC18 75 through 4564	500	678	400	542
RC 5 324 through 7314		600	813	500	678
PRC-7534 (wet brake)		700	949	550	746

3. Tighten the wheel bearing adjusting nut again to the initial seating torque listed in **Table E**, while rotating the wheel hub in both directions. 
4. Repeat Steps 1 and 2 until the adjusting nut will not advance with the application of the initial seating nut torque. 
5. Loosen the adjusting nut 1 1/8 to 1 1/4 turn.
6. Tighten the adjusting nut to the final adjustment nut torque listed in **Table E** while rotating the wheel hub. 

NOTE: Do not loosen the adjusting nut from the setting in Step 6 when you install the adjusting nut lockplate. Loosening the adjusting nut can result in an incorrect bearing preload.

7. Use one of the following procedures to install the adjusting nut lockplate:
 - Place the flat side of the lockplate against a flat surface of the nut.
 or
 - Place the lockplate notch over a corner of the adjusting nut.

If necessary, tighten the adjusting nut to align the lockplate holes with the threaded holes in the ring gear hub. Do not loosen the adjusting nut.

WARNING

Take care when using Loctite® to avoid serious personal injury. Follow the manufacturer's instructions to prevent irritation to the eyes and skin. If Loctite gets into your eyes, flush them with water for 15 minutes. Have your eyes checked by a doctor as soon as possible.

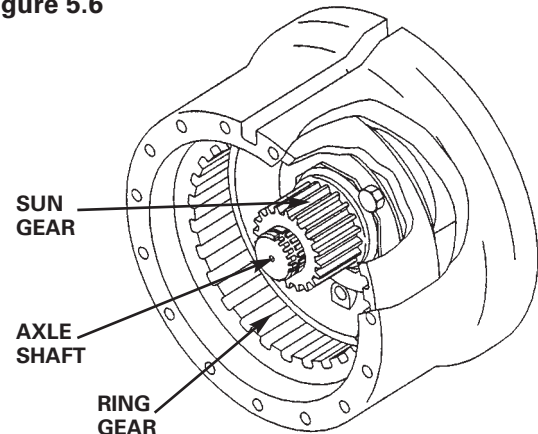
8. Install new lockplate capscrews with preapplied locking agent on the threads. If you use the original capscrews, apply 2 or 3 drops of Loctite 277 or equivalent to the internal threads of the ring gear hub. Tighten the capscrews 60-65 lbft (81-87 Nm). 

Installing the Planetary Ring Gear and Sun Gear

1. Apply grease to the inner face of the sun gear thrust washer (the side with tangs or dowel pins). Install the thrust washer so that the tangs or dowels engage the slots or holes in the wheel bearing adjusting nut.

2. Install the sun gear on the axle shaft and against the thrust washer.
 - **For a one piece axle shaft/sun gear:** Install the axle shaft/sun gear by engaging the differential side gear until the sun gear is against the thrust washer. **Figure 5.6.**

Figure 5.6



3. Install the snap ring into the axle shaft groove.
4. **For axle models with a floating ring gear:** Install the planetary ring gear onto the ring gear hub.

Assembling the Planetary Spider

AxleTech's planetary wheel ends come equipped with three different planetary designs:

- Planetary pinion shaft with tapered roller bearings
- Planetary pinion shaft with needle roller bearings
- Non coated planetary pinion shafts

Follow the correct assembly procedure for the type of planetary design you are servicing.

Planetary Pinion Shaft With Tapered Roller Bearings

1. Carefully inspect the planetary gears, pinion shafts and planetary gear tapered roller bearings. Replace damaged or worn parts.
2. If you removed the bearing cups, install new bearing cups with a suitable driver. To install the new bearing cups, refer to the following procedure:
 - a. Install a snap ring into the groove on the inside diameter of the planetary gear.
 - b. Press one bearing cup into the planetary gear bore until it seats against the snap ring. You must install the bearing cup into the side of the gear closest to the snap ring. Be care to avoid pressing the cup through the snap ring.
 - c. Install the cup spacer against the snap ring in the other planetary gear end.
 - d. Press the other bearing cup into the planetary gear bore until it seats against the cup spacer.
3. Install the bearing cones and bearing cone spacer in the planetary gear bore.
 - **If you reuse the bearing cup and bearing cone:** Assemble the bearing cup and bearing cone in the original position.

WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

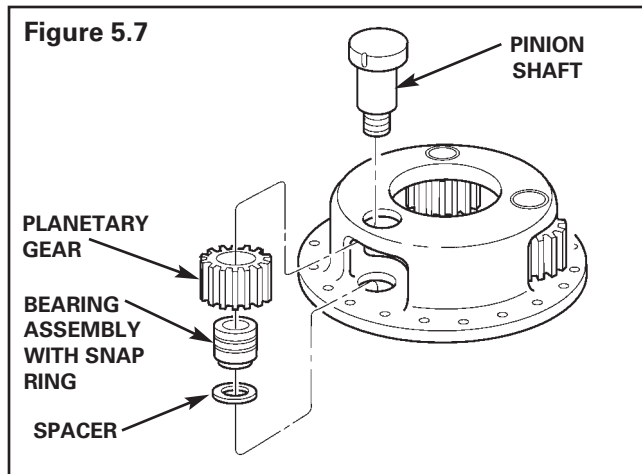
4. Support the planetary spider in a press, flange side **DOWN**. Install the planetary gear and bearing assembly with the gear spacer toward the small hole in the spider. Look through the hole in the spider to check that the bearings and spacer align with the spider bores.

NOTE: You must place the spacer at the correct end of the planetary gear for correct gear alignment.

5. Place the ball in the hole on the large outside diameter of the planetary pinion shaft. Carefully align the ball with the slot in the planetary spider. Use grease to retain the ball in the hole during assembly.

6. Install the planetary pinion shaft by hand. **Figure 5.7.**

- **If you cannot install the planetary pinion shaft by hand:** Use a press to press in the planetary pinion shaft through the planetary gear assembly until the shoulder of the pin bottoms out. When a press is not available, use a brass drift and mallet to tap the pinion shafts through the spider and planetary gear assembly.



7. Install the planetary pinion shaft locknut and tighten to 4860bft (6583 Nm). 
- 8 Repeat Steps 17 for the remaining shaft, gear, and bearing assemblies.

Planetary Pinion Shaft With Needle Roller Bearings

NOTE: For maximum planetary gear life, change the pinion shafts and needle roller bearings on both wheel ends at the same time.

NOTE: The inner diameter of the inner thrust washer is smaller than the outer thrust washer.

1. Apply approved 617A or  I grade 1 or 2 grease to the side of the inner thrust washer opposite the tang. Place the greased side of the thrust washer toward the planetary gear. The thrust washer tangs fit into the spider grooves.

NOTE: Replace the needle roller bearings and planetary gears when you replace the pinion shafts.

2. Face the thrust washer on the end of the new planetary gear.
3. Apply approved **617A** or **3** I grade 1 or 2 grease to the bore of the planetary gear.

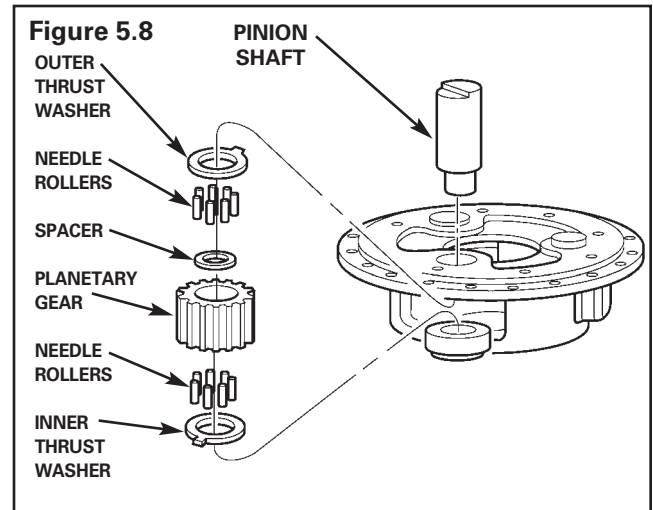
NOTE: Replace the needle roller bearings and planetary gears when you replace the pinion shafts.

NOTE: The number of needle roller bearings used in the pinion bore differs for each axle model.

4. Install a row of needle rollers around the bore in the pinion and against the inner thrust washer. Install as many rollers as will fit.
5. Face the spacer into the bore of the gear on top of the needle rollers. Install another row of needle rollers on top of the spacer.
6. Apply approved **617A** or **3** I grade 1 or 2 grease to the side of the outer thrust washer opposite the tang.
7. Face the outer thrust washer on the end of the planetary gear. The tang must align with the tang of the opposite washer.
8. Set the planetary spider on a level surface with the flange side facing **UP**. Carefully slide the loaded planetary gear assembly into the planetary spider. Check that the following conditions exist before you proceed to Step 9
 - The outer thrust washer (large bore) must be on top of the gear assembly.
 - The washer tangs must be in the planetary spider grooves.
 - The needle roller bearings must be in place.

NOTE: You must align the pinion shaft so that the flat surface on the large end faces the outside of the spider. This alignment provides clearance for the spider cover and prevents the shaft from rotating when you install the spider cover.

9. Install the pinion shaft through the spider, the planetary gear and the thrust washers. Allow the pinion shaft to extend out from spider. **Do not** press the pinion shaft into the spider at this time. **Figure 5.8.**



10. Repeat Steps 1 through 9 to install the second and third sets of pinion shafts, gears, needle rollers and thrust washers.
11. Check the alignment of the pinion shafts.
 - Face the spider cover over the shaft ends. When necessary, rotate the shafts so that spider cover fits over the flats. After you align the shafts, remove the cover.



WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

12. Install each pinion shaft into the spider gear assembly by hand.
 - If you cannot install a pinion shaft into the spider gear assembly by hand: Use a press to install the pinion shaft into the spider assembly until the shoulder of the shaft bottoms against the inner (bottom) thrust washer. When a press is not available, use a brass drift and mallet to install the pinion shafts.

Nylon Coated Planetary Pinion Shaft

1. Inspect the large bore chamfers. The chamfers must be smooth to prevent damage to the nylon coating on the planetary pinion shaft during installation.
 - **If the large bore chamfers are not smooth:** Use an emery cloth to clean the chamfer surface.
2. Inspect the planetary gear bores. Do not use planetary gears with rough bore surfaces.

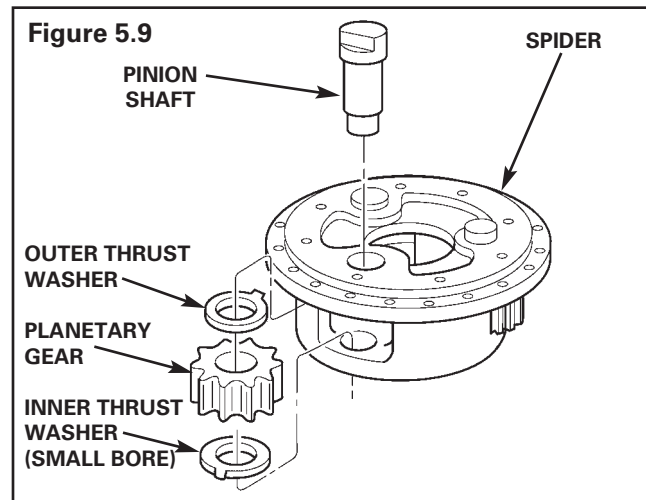
! WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components during assembly and installation procedures.

3. Place the spider in a press with the flange side **UP**. Support the spider as required.
4. Install the inner thrust washer (small bore). Place the washer tab into the spider indent and align the washer bore with the spider bore.
5. Apply a thin coat of the same gear lubricant used in the wheel end to the planetary gear bore.
6. Slide the planetary gear and the outer thrust washer into the spider. Align the bores of the parts and place the outer thrust washer tab into the spider indent.
7. Apply a thin coat of gear lube to the nylon coating on the pinion shaft.

NOTE: You must align the pinion shaft so that the flat surface on the large end faces the outside of the hub circle. This alignment provides clearance for the spider cover and prevents the shaft from rotating when you install the spider cover.

8. Install the planetary pinion shaft in the spider and through the planetary gear and thrust washer. Allow the large end of the shaft to extend from the spider. **Figure 5.9.**



9. Repeat Steps 1 to 8 to install the second and third sets of planetary pinion shafts, gears and washers.
10. Check the alignment of the pinion shafts by placing the spider cover over the shaft ends. When necessary, rotate the shafts so that the spider cover fits over the flats. After you align the shafts, remove the cover.
11. Install each pinion shaft into the spider gear assembly by hand.
 - **If you cannot install a pinion shaft into the spider gear assembly by hand:** Use a press to install the pinion shaft into the spider assembly until the shoulder of the shaft bottoms against the inner (bottom) thrust washer. When a press is not available, use a brass drift and a mallet to install the pinion shafts.

Installing the Planetary Spider Assembly

⚠ WARNING

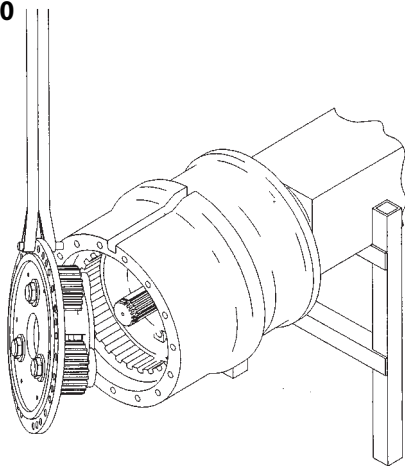
Small amounts of acid vapor are present when applying some silicone gasket materials. To prevent possible serious personal injury, make sure there is good ventilation in the work area. If the silicone gasket material gets in your eyes, flush your eyes with water for 15 minutes. Have your eyes checked by a doctor.

⚠ CAUTION

Use only the correct gasket material. Do not use non-approved gasket material. Lubricant loss and damage to components can result.

1. Apply silicone (RTV) gasket material to the spider flange at the hub mounting face. Refer to **Silicone (RTV) Gasket Material Application** in Section 3.
2. Install the spider and pinion assembly in the wheel hub. Align the planetary gear teeth with the sun gear and ring gear teeth. Align the spider flange and wheel hub match marks you previously marked at disassembly. **Figure 5.10.**

Figure 5.10



3. Correctly align the spider mounting holes with the wheel hub holes or studs. Push the spider assembly against the hub.
4. Install the nuts and washers or capscrews and washers.
 - **To install studs with integral hex and washers:** Use a 3.25-inch internal depth, extra deep socket.
5. Tighten the wheel studs, capscrews or nuts according to the torque specifications shown in **Table F.** **T**

Table F: Planetary Spider Mounting Capscrew and Stud Torque Specifications

Size	Torque	
	lb-ft	N•m
1 1/2" 3	811 5	115156
1 3/4" 2	1306 5	176224
2" 0	3100 0	42042
2 1/2" 4	57575 0	7807

Installing the Planetary Spider Cover

1. Apply silicone (RTV) gasket material to the cover flange at the spider mounting face. Refer to **Applying Silicone Gasket Material** in Section 4.
2. Align the drain arrow on the spider cover with the drain plug. Install the spider cover and capscrews.
3. Tighten the cover capscrews to 8115 lbft (115156 Nm). **T**

Adjusting the Brakes

Adjust the brakes for axles with **Series** and **RSA** drum brakes only.

- **For P series brakes:** Refer to **Maintenance Manual** 4, **Cam-Master® Cam Brakes.**
- **For RSA brakes:** Refer to **Maintenance Manual** 4P **Stopmaster® Off-Highway Heavy Duty Brakes.**

To order these publications, call AxleTech's Customer Service Center at 8754730.

Installing the Tires and Rims

1. Install the tires and rims. Secure them with wheel rim clamps, nuts and washers.
2. Tighten the wheel nuts according to the vehicle manufacturer's specifications.

Filling the Wheel Ends With Lubricant

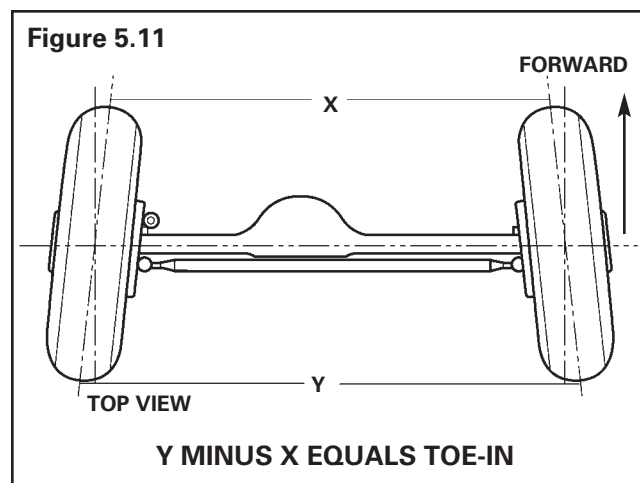
1. Rotate the wheel end until the oil fill line and oil level line are parallel to the ground.
2. Lower the vehicle to the ground.
3. Remove the oil fill plug from the cover. Clean all magnetic plugs and install the oil drain plug in the spider prior to filling the wheel end with lubricant.

NOTE: The rigid axle wheel end and housing bowl share the same oil and oil level.

4. Add oil to each wheel end and then to the bowl. Refer to Section 6 for lubrication specifications. Do not add oil through the bowl only. Wait for the oil to evenly distribute throughout the axle. Check the oil level and add oil if necessary.
5. Replace and securely tighten all plugs.

Measuring and Adjusting the Toe Setting

Toe is the difference in distance between the front of the front tires and the rear of the front tires. **Figure 5.11.**



Check and adjust the toe setting after you install any of the following components:

- a front steering axle
- a new steering knuckle
- a tie rod component

AxleTech performs the toe adjustment with the axle in an unloaded condition.

The toe specification for AxleTech offhighway steering axles is $1/16$ inch toe in ($\pm 1/16$ inch). This specification is based on a 24 inch radius (theoretical tire with a 48 inch outside diameter).

Tandem and Tridem Axle Tire Matching



CAUTION

Unmatched tires on both tandem drive units and tridem drive units will cause tire wear and scuffing and possible damage to the drive units. AxleTech recommends that the tires be matched to within 1/8 inch of the same rolling radius, 3/4 inch of the same rolling circumference.

Tandem Units

The four largest tires should never be installed on one driving axle or the four smallest tires on the other driving axle. Such tire mounting will cause an interaxle fight, unusually high axle lubricant temperatures that result in premature lubricant breakdown and possible costly axle service.

In addition to matching individual tire rolling radii or rolling circumference, AxleTech recommends matching, as nearly as possible, the total tire circumference of one driving axle to the total tire circumference of the other driving axle. This will usually result in satisfactory tandem axle lubricant temperatures that lengthen drive unit service with higher tire mileage.

Tridem Units

When three driving axles are hooked together in a Tridem Series, unmatched tires will compound the problems described in the preceding paragraphs. AxleTech recommends matching, as nearly as possible, the total tire circumference of each of the three driving axles.

How to Match Tires

Tandem Units

Work the vehicle on a level floor. The vehicle must carry a correctly distributed rated capacity load. All the tires must be the same size. Measure new tires to verify that they will be correctly matched.

1. Inflate all tires to the same pressure.
2. Carefully measure the rolling circumference of each tire with a steel tape.
3. Mark the size on each tire with chalk and arrange the tires in order of size, largest to smallest.

4. Mount the two largest tires on one side of one axle and mount the two smallest on the opposite side of the same axle.
5. Mount the four other tires on the other axle in the same manner.
6. Test run the vehicle to gather accurate rear axle lubricant temperature readings on the two axle lubricant temperature gauges.
7. Vary tire air pressure within the tire manufacturer's recommended range so the lubricant temperature of both axles is within 30°C (86°F) of each other and not in excess of 100°C (212°F). This will usually result in uniform tire loading and good tire life.

Tridem Units

To match tires on Tridem bits, follow the same procedure used for Tandem bits.

Arrange the tires in order of size:

- The two largest and two smallest go on one axle.
- The next two largest and smallest go on the second axle.
- The remaining four tires go on the third axle.

Section 6 Lubrication

NOTE: Do not fill only through the axle housing bowl. For axles with a common level, fill the axle at each wheel end and the axle housing bowl to the bottom of the fill/level plug hole with the specified oil. Wait and allow the oil to flow through the axle. Check the oil level again and fill to the specified level if necessary.

NOTE: Refer to AxleTech Maintenance Manual NL 1, *Lubrication*, for further lubrication information. To order this publication, call AxleTech's Customer Service Center at 8754730.

Lubrication Schedule

Operation	Off-Highway ^①
Initial Oil Change	250 operating hours ^①
Check Oil Level	250 operating hours ^①
Petroleum Oil Change	1,500 operating hours or twice a year (whichever comes first) ^①
Synthetic Oil or Semi-Synthetic Oil Change	3,000 operating hours or once a year (whichever comes first)

^① The interval depends on the individual operating conditions, speeds and loads. Severe operating conditions may require more frequent intervals.

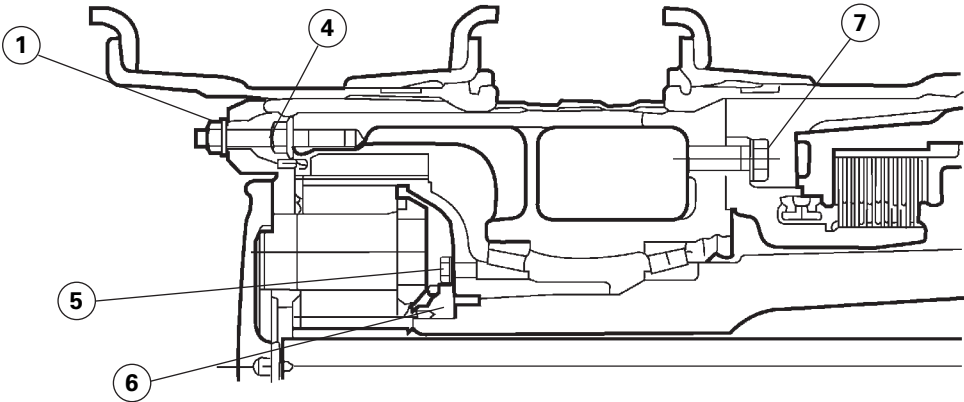
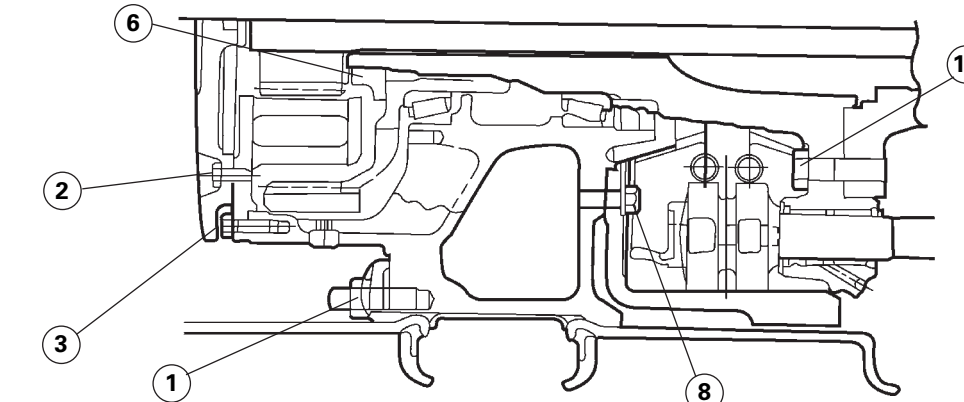
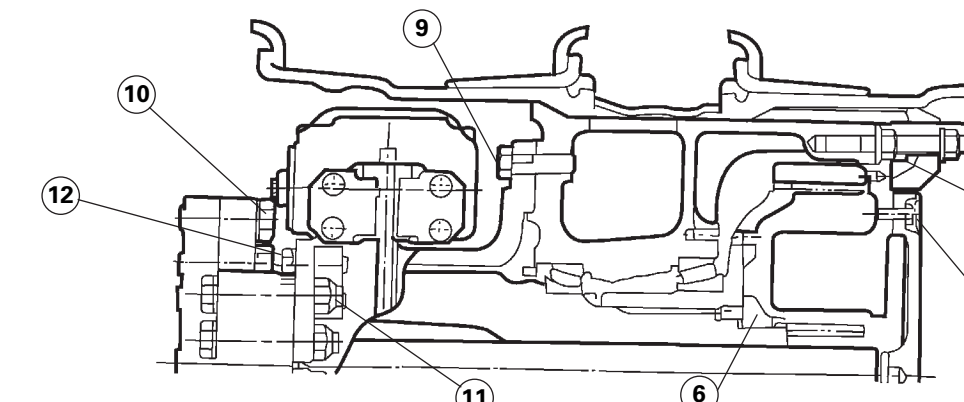
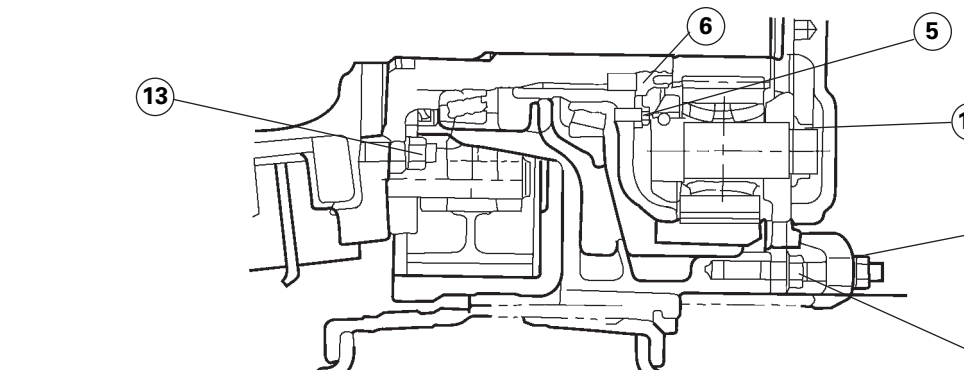
Lubrication Specifications

AxleTech Specifications	Military Specification Approval	Oil Description	Outside Temperature			
			°F		°C	
			Min.	Max.	Min.	Max.
O-76A, Gear Oil	M16 D or M216-E	GL-5, SAE 85W/140	10	None	-12	None
O-76B, Gear Oil		GL-5, SAE 85W/140	15	None	-6	None
O-76C, Gear Oil		GL-5, SAE 75W/140	40	None	40	None
O-76D, Gear Oil		GL-5, SAE 75W/140	40	None	40	None
O-76M, Gear Oil		GL-5, SAE 75W/140	-40	None	-40	None
O-76N, Gear Oil		GL-5, SAE 75W/140	-40	None	-40	None

Planetary Axle Wheel End Torque Specifications

Item	Fastener Description	Size	Torque	
			lb.-ft.	N•m
1	Wheel Rim Clamp Nut		Refer to OEM specifications	
2	Planetary Spider Cover Capscrew w	12 ¹ / ₄ 3	841 5	115456
3	Planetary Spider Mounting Capscrew w	12 ¹ / ₄ 3	841 5	115456
		96 ¹ / ₄ 2	1306 5	176224
		34 ¹ / ₄ 0	3100 0	42042
4	Planetary Spider Mounting Stud d	34 ¹ / ₄ 0	3100 0	42042
		7 ³ / ₈ 4	57575 0	7007
5	Lockplate Capscrew	7/16"-14	60-75	81-102
6	Wheel Baring Adjusting Nut t	Refer to "Adjusting the Wheel Baring Preload" in Section 5.		
7	Wheel Brake Drum Mounting Capscrew w	7 ³ / ₈ 4	57575 0	7007
		1 ¹ / ₄ 2	8010 0	1152149
8	Brake Drum Mounting Capscrew w	34 ¹ / ₄ 0	3100 0	42042
		7 ³ / ₈ 4	57575 0	7007
		1 ¹ / ₄ 2	8010 0	1152149
9	Brake Rotor Mounting Capscrew w	34 ¹ / ₄ 0	3100 0	42042
		1 ¹ / ₄ 2	8010 0	1152149
10	Spindle Mounting Capscrew w (Nut on stud)	34 ¹ / ₄ 0	3100 0	42042
		7 ³ / ₈ 4	57565 0	70
		1 ¹ / ₂ & 14	8010 0	1152149
		114 ¹ / ₄ 2	17020 0	23020
		1"-8	650-875	881-1186
11	Caliper Adapter to Spindle Bolt	7 ³ / ₈ 9	4408 0	5976
12	Caliper to Adapter Capscrew	34 ¹ / ₄ 0	3100 0	42042
		M 0	3607 9	5050
13	Spindle to Steer Knuckle Stud Nut t	34 ¹ / ₄ 6	3100 0	42042
	Spindle to Steer Knuckle Capscrew w	7 ³ / ₈ 4	57575 0	7007
14	Pinion Shaft Locknut	1-3/4"-12	485-600	658-813
	Oil Level/Drain Plug	3/4"-14	35	47
	Planetary Ring Carrier Capscrew w (Not Shown)	3 ³ / ₈ 6	355 0	4768
		7/16"-14	60-75	81-102

Section 7 Specifications

Rigid Axle Wet Brake	
Rigid Axle Drum Brake	
Rigid Axle Dry Disc Brake	
Steer Axle Drum Brake	

AxleTechTM **International**

Suite 400
3001 West Big Beaver Road
Troy, Michigan 48084
U.S.A.
Toll Free: 877-877-9717
Non-Toll Free: 248-816-5401
Fax: 248-435-1990
Website: www.axletech.com

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AxleTech International France
4, Rue Jean Servanton
Boite Postale 656
42042 Saint Etienne Cédex 1
France
(33) 477.92.88.00
Fax: (33) 477.92.88.93

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AxleTech do Brasil Sistemas Automotivos Ltda.
Avendia Joao Batista, 830
Centro-Osasco-SP
06097095 Brasil
Phone: +55 11 36846641
Fax: +55 11 36846859

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Hydraulic and Mechanical Drum Brakes

Maintenance Manual No. 4H Revised 4-96

Hydraulic Brakes

- DLH
- DSH
- DH
- FSH
- H

Mechanical Brakes

- DCM
- DLM
- DM

Service Notes



This maintenance manual describes the correct service and repair procedures for Meritor hydraulic and mechanical brakes. Information contained in this publication was in effect at the time the publication was approved for printing and is subject to change.

You must follow your company procedures when you service or repair equipment or components. You must understand all procedures and instructions before you begin to work on a unit. Some procedures require the use of special tools for safe and correct service. Failure to use special tools when required can cause serious personal injury to service personnel, as well as damage to equipment and components.

Meritor uses the following notations to warn the user of possible safety problems and to provide information that will prevent damage to equipment and components.



WARNING

*A **WARNING** indicates a procedure that you must follow exactly to avoid serious personal injury.*

NOTE: A NOTE indicates an operation, procedure or instruction that is important for proper service. A NOTE can also supply information that can help to make service quicker and easier.



CAUTION

*A **CAUTION** indicates a procedure that you must follow exactly to avoid damaging equipment or components. Serious personal injury can also occur.*



This symbol indicates that fasteners must be tightened to a specific torque value.

How to Order

Order items from Meritor Literature Distribution Center, c/o Vispac, Inc., 35000 Industrial Road, Livonia, MI 48150. For videos, include a purchase order or check for \$20 payable to Meritor International for each video.

Phone orders are also accepted by calling Meritor's Customer Service Center at 800-535-5560.

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ASBESTOS FIBER WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from Meritor.

Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. **Separate Work Areas.** Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

**DANGER: ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA**

2. **Respiratory Protection.** Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.
3. **Procedures for Servicing Brakes.**
 - a) Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
 - b) As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - c) If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.
 - d) Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
 - e) **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
4. **Cleaning Work Areas.** Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.
5. **Worker Clean-Up.** After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
6. **Waste Disposal.** Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.



NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a potential cancer and lung disease hazard. Material Safety Data Sheets are available from Meritor.

Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some medical experts believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. **Separate Work Areas.** Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.
2. **Respiratory Protection.** OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m³ as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust. Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposures levels may exceed OSHA or manufacturer's recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.
3. **Procedures for Servicing Brakes.**
 - a) Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
 - b) As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - c) If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - d) Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
 - e) **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
4. **Cleaning Work Areas.** Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, if the exposure levels may exceed OSHA or manufacturers' recommended maximum levels. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.
5. **Worker Clean-Up.** After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
6. **Waste Disposal.** Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

Section 1

Introduction



Meritor supplies a complete line of brakes for heavy-duty vehicle applications. This Maintenance Manual covers the hydraulic and mechanical brakes shown below.

Hydraulic Brake Model	Sizes
DLH (Dual Leading Hydraulic)	17" x 4" (431.8 mm x 101.6 mm)
DSH (Duo Servo Hydraulic)	12.5" x 2.5" (317.5 mm x 63.5 mm)
DH (Duplex Hydraulic)	16.5" x 4", 5", 6" (419.1 mm x 101.6 mm, 127 mm, 152.4 mm)
FSH (Floating Shoe Hydraulic)	8" x 1.75" (203.2 mm x 44.4 mm) 10.5" x 1.5", 2.25" (266.7 mm x 38.1 mm, 57.1 mm) 12.5" x 2.25" (317.5 mm x 57.1 mm)
H (Hydraulic Brake)	7.125" x 2" (180.9 mm x 50.8 mm) 10.5" x 2.25" (266.7 mm x 57.1 mm) 15" x 3" (381 mm x 76.2 mm) 16" x 2.25" (406.4 mm x 57.1 mm) 16" x 3.5" (406.4 mm x 88.9 mm) 16.25" x 3.5" (412.7 x 88.9) 16.5" x 5.5" (419.1 mm x 139.7 mm) 17" x 4" (431.8 mm x 101.6 mm) 17.25" x 4" (438.1 mm x 101.6 mm)

Mechanical Brake Model	Sizes
DCM (Duplex Cam Mechanical)	10" x 3" (254 mm x 76.2 mm) 12" x 3", 4", 5" (304.8 mm x 76.2 mm, 101.6 mm, 127 mm)
DLM (Duplex Lever Mechanical)	7.25" x 1.5" (184.1 mm x 38.1 mm) 10" x 1.5" (254 mm x 38.1 mm) 13.375" x 2" (339.7 mm x 50.8 mm)
DM (Duplex Mechanical)	7.125" x 2" (180.9 mm x 50.8 mm)

DLH Brake

(Dual Leading Hydraulic)

Description

The DLH brake is a 17" x 4", (431.8 mm x 101.6 mm) two cylinder hydraulic actuated brake. The dual leading shoe design permits balanced, equal torque action in both forward and reverse directions. Each shoe transfers its force into an anchor pin during forward direction stops and into an adjustment bolt during reverse direction stops. The two wheel cylinders balance the forces within the brake. The DLH brake has manual brake adjustment. Figures 2.1 and 2.2.

Figure 2.1



WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Disassemble DLH Brake



WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

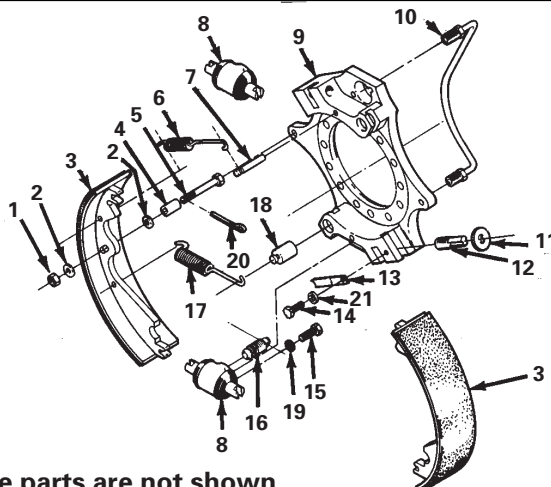


WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Remove the wheels and brake drums from the axle. If necessary, manually retract the brake shoes by rotating the adjustment bolt star wheel so that the brake drums will clear the linings.
5. Remove the four brake shoe return springs from their pins on the spider.
6. Support each shoe with one hand and remove the two shoe guide nuts and washers from their bolts.
7. Disassemble the shoes, anchor pins, star wheel clips and adjustment bolts.
8. If complete disassembly is necessary, disconnect the hydraulic brake tube and hydraulic brake lines. Remove the wheel cylinder capscrews and the cylinders.

Figure 2.2



1. Nut
2. Washer
3. Shoe and Lining Assy.
4. Shoe Guide Bolt Spacer
5. Shoe Guide Bolt
6. Shoe Return Spring
7. Brake Spring Pin
8. Wheel Cylinder Assy.
9. Spider
10. Hydraulic Tube
11. Adjuster Starwheel
12. Adjuster Bolt
13. Starwheel Clip
14. Capscrew
15. Capscrew
16. Hydraulic Fitting
17. Shoe Return Spring
18. Anchor Pin
19. Lock Washer
20. Cotter Pin
21. Washer

NOTE: Some duplicate parts are not shown.

Section 2 Hydraulic Brakes



9. Clean and inspect all parts. Refer to Section 4.

Assemble DLH Brake

CAUTION

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings *MUST* be replaced.

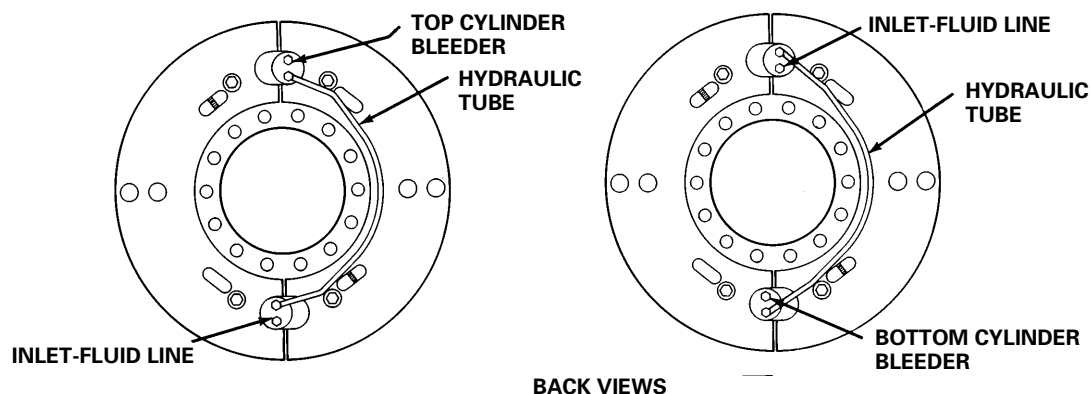
- Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
 - Adjustment bolt assemblies.
 - Anchor pins, anchor pin holes and anchor pin slots.
 - Push rod ends of the wheel cylinders.
 - The surfaces of the guide washers that slide against the brake shoes.
- Install the wheel cylinder to the spider. Tighten the wheel cylinder capscrews to 15-20 lb. ft. (20-27 N•m).
- Install the two adjustment bolt and star wheel assemblies into their threaded holes. The end of each adjustment bolt must extend into the slot for the shoe approximately 0.125 inch (3.175 mm). Install each star wheel clip with its screw and lock washer.

- Install the two anchor pins, with their slots in position to engage the shoes, in the anchor pin holes.
- Install both shoe guide bolts into their holes from the back of the spider and assemble one spacer and one washer on each bolt.
- Place one shoe in position to engage the anchor pin slot, the adjustment bolt slot and the wheel cylinder push rod. Install a shoe guide washer and nut to the shoe guide bolt.
- Put the other shoe in position to engage the opposite anchor pin slot, adjustment bolt and wheel cylinder push rod. Install a shoe guide washer and nut to the shoe guide bolt.
- Tighten the shoe guide nut on each shoe guide bolt until there is no clearance between the washer and the shoe. Loosen the nut 1/2 turn and install the cotter pins.
- Install the four shoe return springs.

NOTE: The bleeder cylinder can be installed at either the top or bottom positions on the brake. In either installation the bleeder outlet **MUST** be installed at the top of the cylinder. **Figure 2.3.**

- Install the hydraulic brake tube assembly to the two wheel cylinders.
- Connect the hydraulic line and install the brake drum and wheel.
- Bleed the hydraulic system after all brakes are assembled and adjusted. (See page 19.)

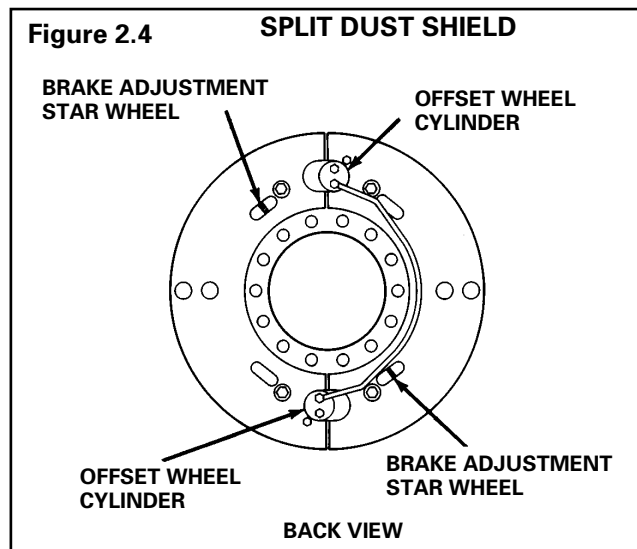
Figure 2.3



Adjust DLH Brake

NOTE: Each brake shoe must be adjusted separately.

1. The DLH brake is adjusted manually by rotating the adjustment bolt star wheels from the back of the brake. **Figure 2.4.**



2. The adjustment wheels are located opposite the wheel cylinder offset.
3. Adjust one shoe by rotating its star wheel with a brake adjusting spoon until a small resistance can be felt when the brake drum is rotated. Then adjust in the other direction until the brake drum can rotate freely.

NOTE: The adjusting tool pivots against the dust shield hole (or against the brake spider if no dust shield is used) and rotates the star wheel in the direction opposite to the handle movement. Move the handle of the adjusting tool toward the axle housing while the spoon of the tool is engaged in the star wheel to adjust the shoes closer to the brake drum. Move the handle away from the axle housing to adjust the shoes away from the brake drum.

4. Adjust the other shoe after you complete the first shoe adjustment.

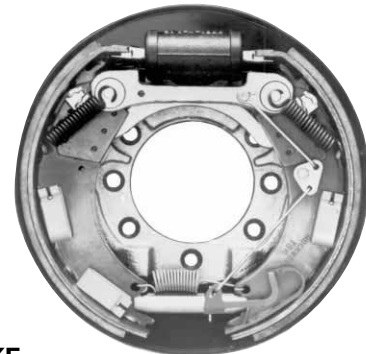
DSH Brake

(Duo Servo Hydraulic)

Description

The DSH brake is a 12.50" x 2.50" (317.5 mm x 63.5 mm) hydraulic actuated brake. The duo servo design permits the leading shoe to transfer all of its force through the adjusting bolt to the trailing shoe. This increases the braking action, because the force from both shoes is transmitted into the anchor of the trailing shoe. The brake has automatic adjustment and can be supplied with an optional cable operated lever for parking brake linkage. **Figures 2.5 and 2.6.**

Figure 2.5



DSH BRAKE

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Disassemble DSH Brake

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

WARNING

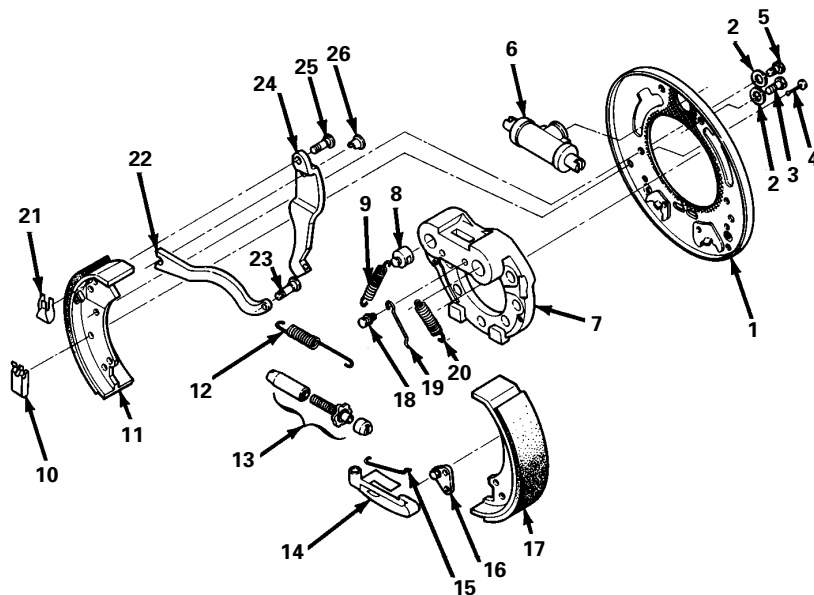
Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.

Section 2 Hydraulic Brakes



Figure 2.6



ITEM	DESCRIPTION
1	Backing Plate
2	Lock Washer
3	Capscrew
4	Hold Down Retainer Pin
5	Capscrew
6	Wheel Cylinder Assy.
7	Spider
8	Anchor Pin
9	Shoe Return Spring (Black)
10	Shoe Hold Down Clip
11	Shoe Lining Assy. (Trailing)
12	Shoe Spring
13	Adjuster Bolt Assy.
14	Automatic Adjuster Stamped Spring
15	Automatic Adjuster Wire (Long)
16	Automatic Adjuster Pivot
17	Shoe and Lining Assy.(Leading)
18	Adjuster Wire Pin
19	Automatic Adjuster Wire (Short)
20	Shoe Return Spring (Green)
21	Parking Lever Spring Clip
22	Link
23	Pivot Pin - Link
24	Parking Lever
25	Pivot Pin - Parking Lever
26	Slide Pin - Link

NOTE: Some duplicate parts are not shown.

3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Remove the wheels and brake drums from the axle. If necessary, manually retract the brake shoes through the forward adjustment slot so that the brake drums will clear the linings. Insert a stiff wire or pick through the adjustment slot to push the automatic adjustment stamped spring away from the star wheel while using an adjusting tool to rotate the adjustment bolt star wheel.
5. Remove the fastener that attaches the automatic adjusting wires and the pivot to the leading shoe.
6. Remove the two brake shoe return springs from the anchor pins.
7. Support the leading shoe with one hand and remove the shoe hold-down spring clip. Lift and rotate the spring clip until it is released from the retainer pin.
8. Remove the shoe spring and the adjustment bolt at the bottom of the brake.
9. Support the trailing shoe with one hand and remove the two shoe hold-down spring clips. Lift and rotate each spring clip until it is released from the retainer pin.

10. If the brake has a parking brake lever, disassemble the link from the leading shoe by removing the spring clip. To disassemble the parking lever from the trailing shoe, remove its spring clip.
11. Remove the anchor pins from holes.
12. If complete disassembly is necessary, disconnect the hydraulic line and remove the wheel cylinder capscrews and the wheel cylinder.
13. Clean and inspect all parts. Refer to Section 4.

Assemble DSH Brake



CAUTION

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

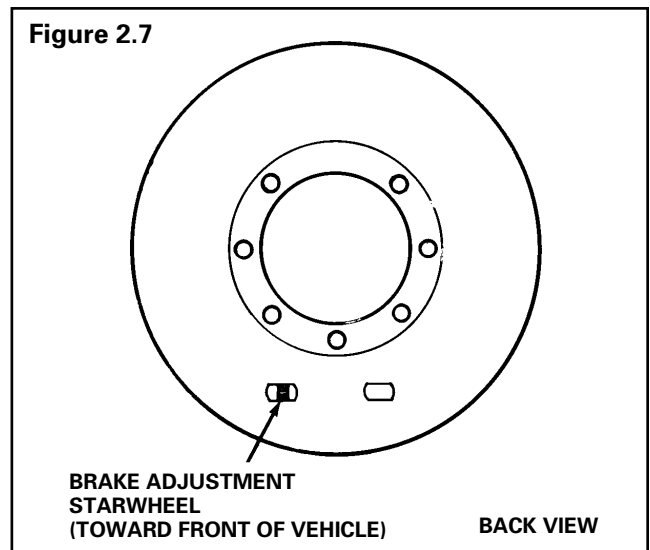
1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
 - a. Adjustment bolt assemblies.
 - b. All edges of brake levers and shoes that slide against each other.

- c. Push rod ends of the wheel cylinder.
- d. Anchor pins, anchor pin holes and anchor pin slots.
2. Install the wheel cylinder to the backing plate. Tighten the wheel cylinder capscrews to 15-20 lb. ft. (20-27 N•m). 
3. If used, install the parking brake lever on the trailing shoe and the parking brake link on the leading shoe.
4. Install the two anchor pins in the holes in the backing plate.
5. Put the trailing shoe in position into the anchor pin slot and engage it with the wheel cylinder push rod.
6. To install the two shoe retainer clips, engage the clip on to the retainer pin and rotate the clip down until it sets flat on the shoe.
7. If used, install the parking cable through the backing plate and engage the cable in the parking brake lever. Install a cable retainer bracket (not supplied by Meritor) where the cable enters through the backing plate.
8. Install the stamped automatic adjustment spring on the leading shoe.
9. Assemble a star wheel adjustment bolt and shoe spring on both shoes while you put the leading shoe in position into the anchor pin slot and engage it with the wheel cylinder push rod.
10. If used, install the parking link to engage with the parking lever slide pin.
11. Hold the shoe in its correct position and install the shoe hold-down spring clip on to the retainer pin.
12. Install the green shoe return spring on to the leading shoe for right hand brake and onto trailing shoe for left hand brake.
13. Install the short automatic adjustment wire to connect the pivot to the pin near the anchor location. Install the long automatic adjustment wire to connect the pivot to the stamped automatic adjustment spring.
14. Install the automatic adjustment pivot and spacer to the leading shoe on its shoulder bolt fastener. Be careful that the pivot is not pinched under the edge of the shoulder.

15. Rotate the star wheel on the adjustment bolt to see that it can easily rotate with a “click” in one direction and cannot easily rotate in the other direction.
16. Connect the hydraulic line and install the brake drum and wheel.
17. Bleed the hydraulic system after all brakes are assembled. (See page 20).

Adjust DSH Brake

1. Adjust the DSH brake through the forward adjustment slot (toward the front of the vehicle) at the bottom of the backing plate. **Figure 2.7.**



2. Insert an adjusting tool through the forward slot of the backing plate to engage the star wheel on the adjustment bolt. To move the shoes closer to the brake drum, move the tool handle down. The adjusting tool pivots against the backing plate slot and rotates the star wheel in the direction opposite to the handle movement.
3. Adjust the linings until a light resistance can be felt when the brake drum is rotated. Then adjust in the other direction until the brake drum can just rotate freely.
4. If the brake has a parking brake lever, adjust the parking cable until a light resistance can be felt when the brake drum is rotated. Then adjust the cable in the opposite direction until the brake drum can rotate freely. Apply and release the parking brake to see that it operates correctly.

Section 2 Hydraulic Brakes



DH Brake (Duplex Hydraulic)

Description

The DH brake is a dual primary shoe, hydraulic actuated brake and it is available in 16.50" x 4", 5" and 6" (419.1 mm x 101.6 mm, 127 mm, 152.4 mm) sizes. The brake has manual adjustment. Figures 2.8 and 2.9.

Figure 2.8



DH BRAKE

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Disassemble DH Brake

WARNING

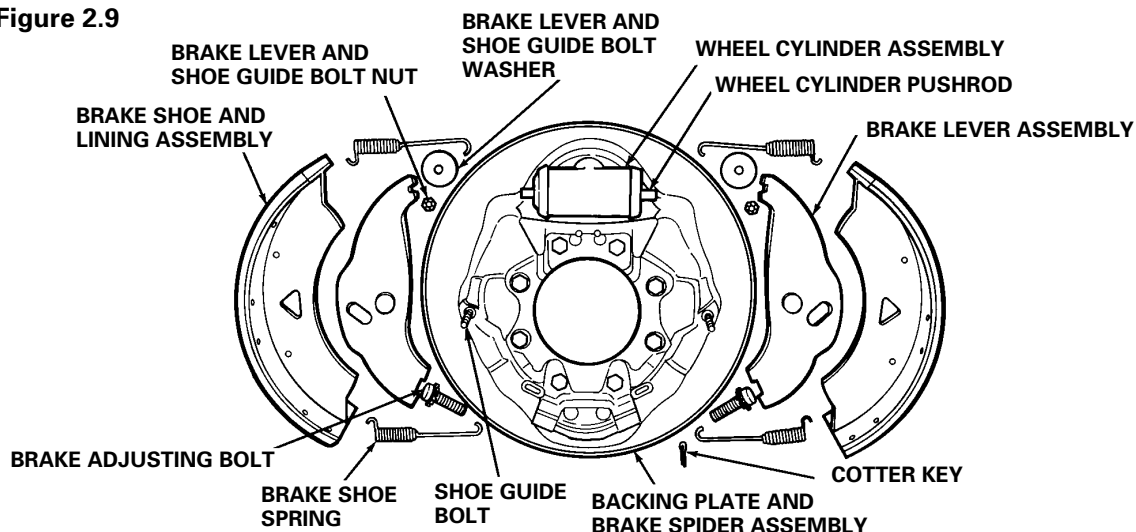
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Remove the wheels and brake drums from the axle. If necessary, manually retract the brake shoes by rotating the adjustment bolts so that the brake drums will clear the linings.
5. Remove the cotter keys from the two shoe guide bolts.
6. Install a wheel cylinder clamp to hold the pistons in the wheel cylinder.
7. Push one shoe against the backing plate with one hand and remove the shoe guide bolt nut and washer with the other hand.

Figure 2.9



NOTE: Some duplicate parts are not shown.

8. Allow the shoe to rotate about the abutment ends until the return spring tension is relaxed. Remove the return springs, brake shoe and the brake lever assembly.
9. Use the same procedure (Steps 6 and 7) to disassemble the other brake shoe and lever.
10. Remove the brake shoe adjusting bolts.
11. If complete disassembly is necessary, disconnect the hydraulic line, and remove the wheel cylinder capscrews and the wheel cylinder.
12. Clean and inspect all parts. Refer to Section 4.

Assemble DH Brake

CAUTION

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
 - a. Brake shoe adjustment bolts.
 - b. The edges of the brake levers and shoes that slide against each other.
 - c. Push rod ends of the brake levers and cylinder.
2. Install the wheel cylinder to the backing plate. Tighten the wheel cylinder capscrews to 25-35 lb. ft. (34-47 N•m). 
3. Install the two brake shoe adjusting bolts until the bolts are fully retracted.
4. Install the brake levers in position so that the ends match with the push rod at the top and the adjusting bolts at the bottom.

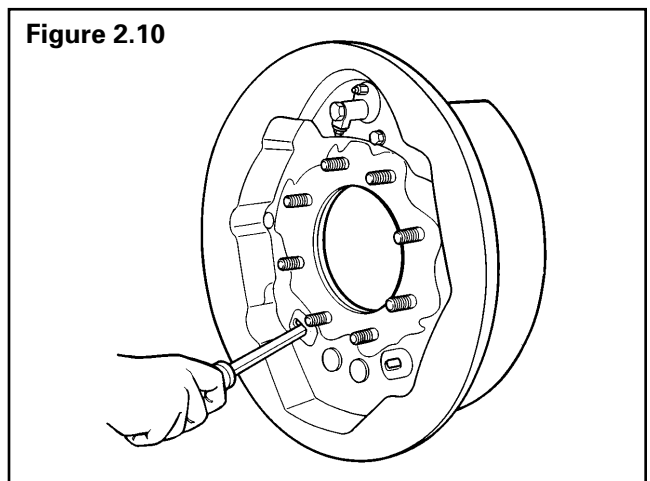
NOTE: There are right and left hand brake levers. Make sure that the levers are installed in the correct positions.

5. Attach the short ends of the shoe return springs into the brake shoe web holes of one brake shoe.
6. Attach the long end of the upper shoe return spring to the pin on the spider.
7. Attach the long end of the lower shoe return spring into the end of the adjusting bolt.
8. Lift the shoe and lining assembly over the shoe guide bolt and into position on the brake lever, pivoting about the abutments.
9. Assemble the washer and nut on the shoe guide bolt. Tighten the nut until the cotter key can be put into its hole in the guide bolt. The shoe and lever must be able to move freely.
10. Lock the guide bolt nut with the cotter key.
11. Use the same procedure (Step 5 -10) to install the other shoe.
12. Connect the hydraulic line.
13. Bleed the hydraulic system after all brakes are assembled. (See page 19).

Adjust DH Brake

NOTE: Each brake shoe must be adjusted separately.

1. The DH brakes are adjusted through the slots in the rear of the backing plate. **Figure 2.10.**



Section 2 Hydraulic Brakes



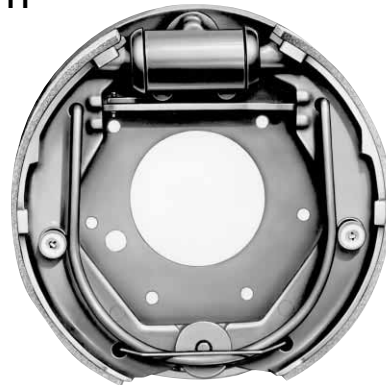
2. Put an adjusting tool through the slots to engage the lugs on the adjusting bolts. To expand the shoes, move the handle of the tool down when in the left hand slot and move the handle up when in the right hand slot.
3. Adjust one shoe until a slight resistance can be felt when the brake drum is rotated. Then adjust in the other direction until the brake drum can rotate freely.
4. Adjust the other shoe after you complete the first shoe adjustment.

FSH Brake (Floating Shoe Hydraulic)

Description

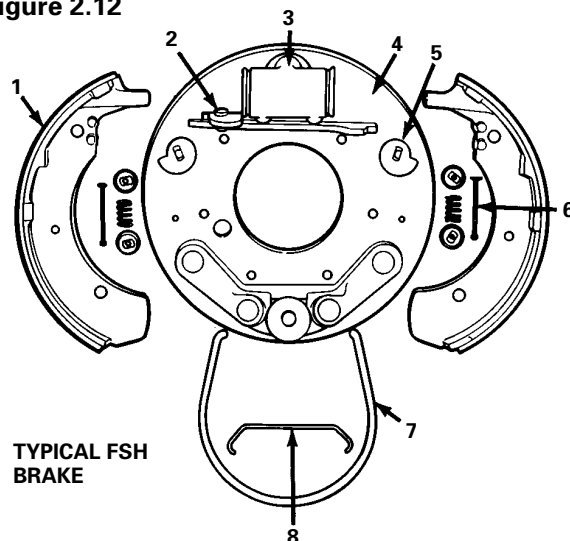
The FSH brakes are floating shoe, hydraulic actuated brakes. They are available in 8" x 1.75" (203.2 mm x 44.4 mm), 10.5" x 1.5", 2.25" (266.7 mm x 38.1 mm, 57.1 mm), 12.5" x 2.25" (317.5 mm x 57.1 mm) and 14" x 2.25" (355.6 mm x 57.1 mm) sizes. The brakes can be supplied with an optional mechanical parking brake and automatic or manual brake adjustments. **Figures 2.11, 2.12, and 2.13.**

Figure 2.11



FSH BRAKE

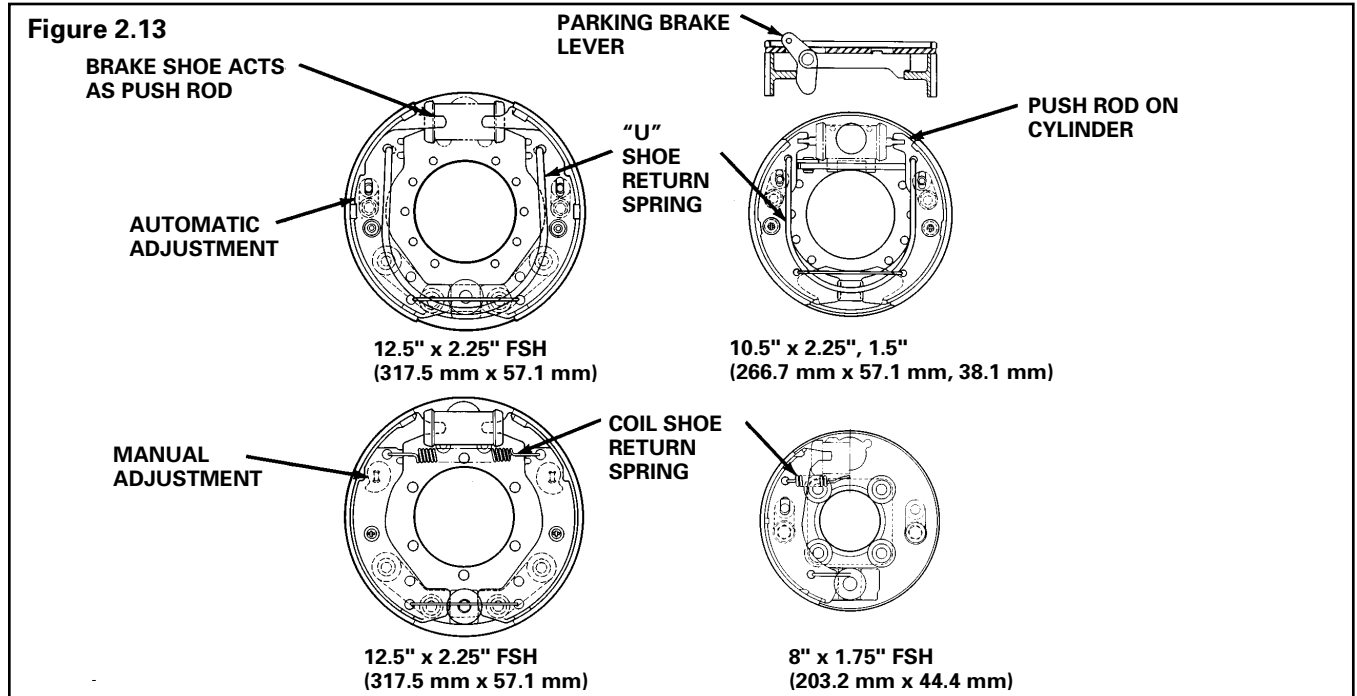
Figure 2.12



TYPICAL FSH
BRAKE

- | | |
|------------------------------|---------------------------------|
| 1. Shoe and Lining Assy. | 5. Manual Shoe Adjustment Shown |
| 2. Parking Brake Lever Assy. | 6. Shoe Hold Down Spring Assy. |
| 3. Wheel Cylinder Assy. | 7. "U" Return Spring |
| 4. Backing Plate Assy. | 8. Retainer Spring Clip |

Some of the designs of the FSH brake are shown in **Figure 2.13**.



WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Disassemble FSH Brake

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

WARNING

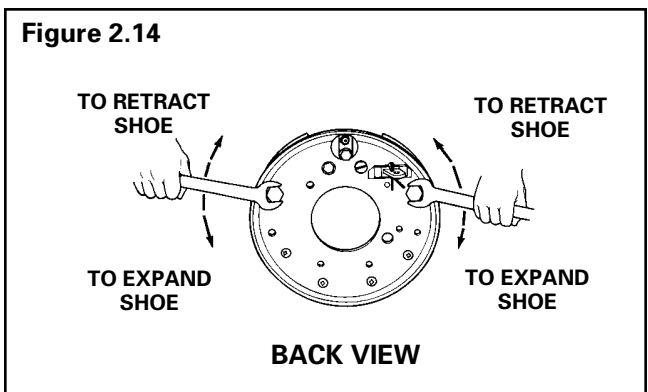
Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.

CAUTION

Do NOT apply more than 20 lb. ft. (27 N·m) torque to the heads of the adjustment bolts in step 4. More torque can damage the automatic adjustment assemblies. Do NOT use a power wrench on the adjustment bolts.

4. Remove the wheels and brake drums from the axle. If necessary, manually retract the brake shoes by rotating the adjustment bolts so that the brake drums will clear the linings. To retract each brake shoe rotate the adjustment bolt heads 1/8 of a turn. **Figure 2.14**.
5. Remove the retainer spring clip from over the "U" spring.



Section 2 Hydraulic Brakes



NOTE: Some FSH brakes, which do not have an optional parking brake, have an upper coil shoe return spring in place of the "U" spring.

6. Release and remove the shoe return spring.
7. Push down on the shoe retainers so that the retainer nails can be reached with pliers. Hold the retainers so that they do not twist while you rotate the nails 1/4 turn. Remove the retainers, springs and retainer nails.
8. Remove the brake shoes.
9. On brakes with the mechanical parking brake, remove the cotter key, spacer, spring clip and lever assembly.
10. If complete disassembly is necessary, disconnect the hydraulic line and remove the wheel cylinder attaching capscrews and wheel cylinder.
11. Clean and inspect all parts. Refer to Section 4.

Assemble FSH Brake



CAUTION

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
 - a. Push rod ends of shoes and cylinder.
 - b. Surfaces of the adjusting cams and the matching surfaces of the brake shoes.
 - c. Surfaces of the shoe support pads on the backing plate assembly and the ends of the shoe webs that slide against the anchor bracket.
2. Install the wheel cylinder to the backing plate. Tighten the wheel cylinder attaching screw and capscrew to 25-35 lb. ft. (34-47 N•m). 
3. Connect the hydraulic line.
4. If a mechanical parking brake is used, install the lever assembly, spring clip, spacer and cotter key.

5. Install the brake shoes in position so that the push rod ends of the shoes are engaged with the wheel cylinder or push rods.
6. Assemble the retainer nails, springs and retainers. Lock the nails in position by pushing down on the retainers while you twist the nails 1/4 turn with pliers.
7. To assemble the shoe return spring, put one hook in position in a brake shoe. Pull the spring open to install the opposite hook in the other shoe.
8. Assemble the retainer spring clip into the brake shoes.
9. On brakes with automatic adjustment, you must tap the shoes with a soft mallet until the brake assembly will fit into the brake drum.
10. Bleed the hydraulic system after all the brakes are assembled. (See page 19)

Adjust FSH Brake

1. FSH brakes with automatic adjustment will adjust to the correct lining to brake drum clearance when you pump down on the brake pedal to set the adjuster. These brakes have 9/16 inch or 3/4 inch adjustment bolt heads.

NOTE: Each brake shoe must be adjusted separately.

2. The manual adjustment FSH brakes have two eccentric cams that can be adjusted with either an 11/16 inch or a 15/16 inch open end wrench on the two adjustment bolt heads.
 - a. Position the wrench handle horizontally, away from the brake, then rotate the handle down to move the lining closer to the brake drum. Adjust the shoes until a slight resistance can be felt when the brake drum is rotated by hand. **Figure 2.14.**
 - b. Turn the adjustment bolt head in the opposite direction until the brake drum can just rotate freely.
 - c. Adjust the other shoe after you complete the first shoe adjustment.

H Brake (Hydraulic)

Description

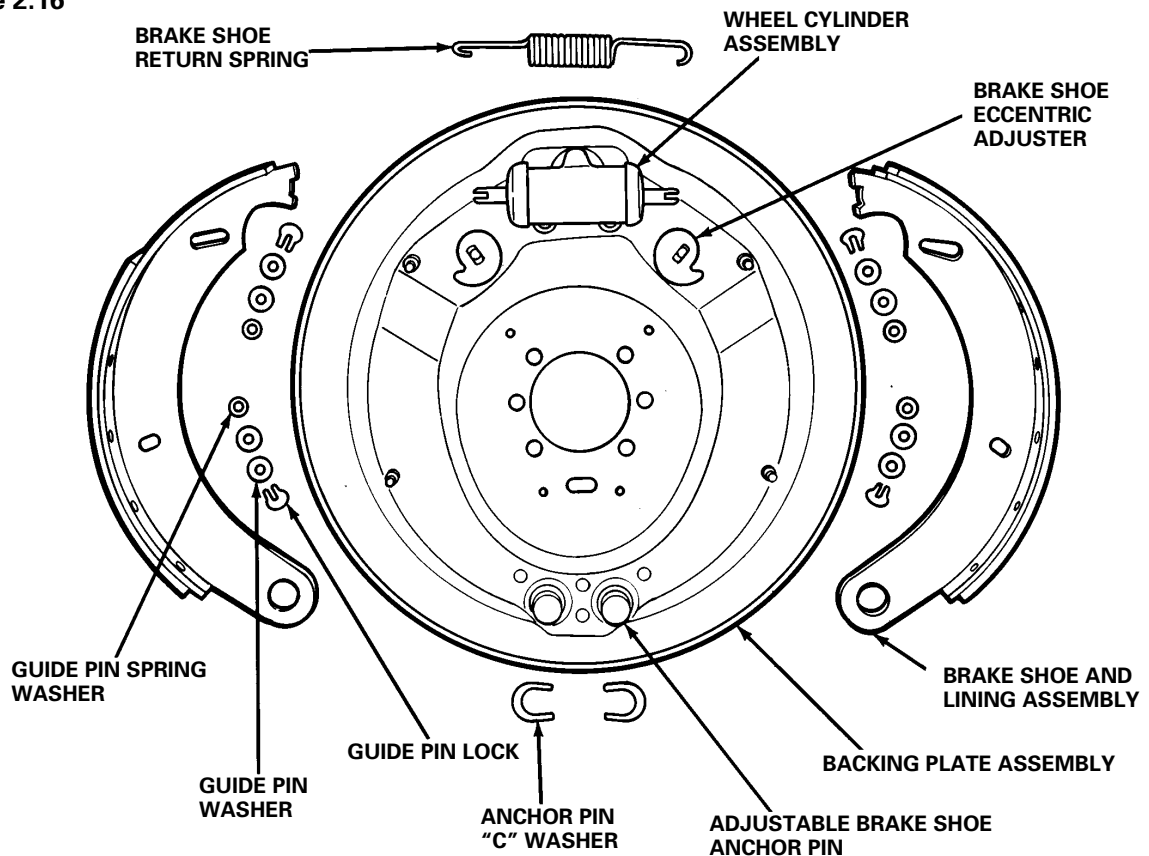
The H brakes are two shoe hydraulic brakes mounted on backing plates or on planetary axle housings. Many of the H brakes have adjustable anchor pins to permit the centering of the brake shoe arc with the drum and eccentric cams for secondary brake shoe adjustment. H brakes are available in nine different sizes from 7.125" x 2" to 17.25" x 4" (180.9 mm x 50.8 mm to 438.1 mm x 101.6 mm). **Figures 2.15 and 2.16.**

Figure 2.15



H BRAKE

Figure 2.16



Section 2 Hydraulic Brakes



There are several design variations within the nine models of H brakes. Several of the designs are shown in **Figure 2.17**.

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Disassemble H Brake

WARNING

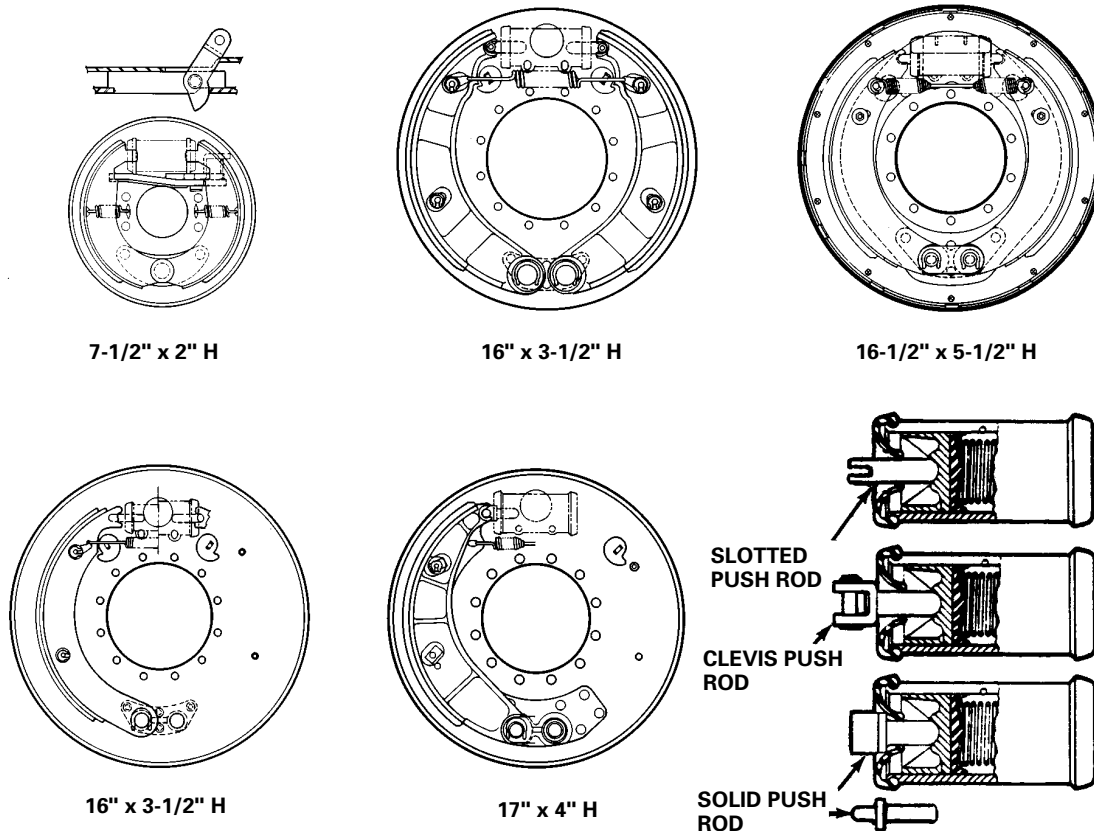
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Remove the wheels and brake drums from the axle. If necessary, manually retract the brake shoes by rotating the adjustment cams from the back of the brake so that the brake drums will clear the linings.

Figure 2.17



5. Disconnect the brake shoe return spring or springs.
6. Remove the anchor pin "C" washers and the guide pin locks and washers.
7. Remove the brake shoe and lining assemblies.
8. Remove the anchor pin lock nuts, lock washers and anchor pins.
9. If complete disassembly is necessary, remove the capscrews, washers and wheel cylinder assembly. Disconnect the hydraulic lines.
10. Clean and inspect all parts. Refer to Section 4.

Assemble H Brake



CAUTION

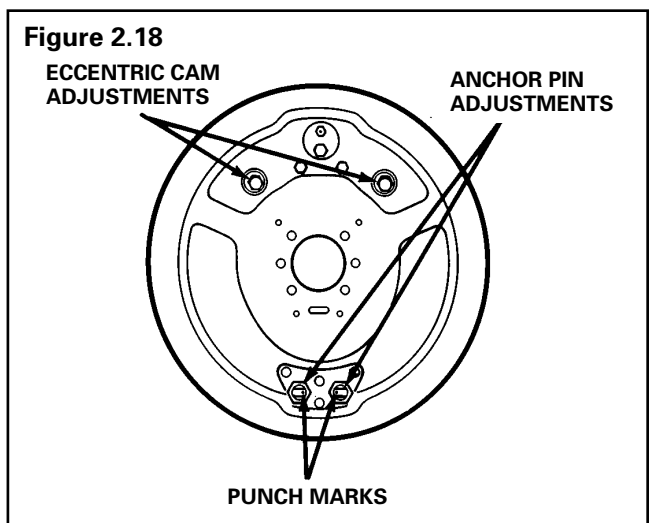
Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
 - a. Surfaces of the adjusting cams and the matching surfaces of the shoe webs.
 - b. Push rod ends of shoes and cylinder.
 - c. Surfaces of anchor pins and matching surfaces of shoe webs.

2. Install the wheel cylinder to the backing plate. Tighten the capscrews and lock washers to 25-35 lb-ft (34-47 N•m). 
3. Connect the hydraulic lines.
4. Assemble the anchor pins to the backing plate with the washers and lock nuts.

NOTE: The punch marks on the base of the adjustable anchor pins must meet and the flat sides of the anchor pins must be aligned.

Figure 2.18.



5. Put the shoe and lining assemblies in correct position over the guide pins. Install the guide pin washers, lock rings and the anchor pin "C" washers.
6. Turn the adjusting cams so that the push rod ends of the shoes are engaged with the wheel cylinder push rods.
7. To assemble the shoe return spring, put one hook in position in the brake shoe. Pull the spring open to install the opposite hook in the other shoe.
8. Bleed the hydraulic system after all the brakes are assembled. (See page 19).

Section 2 Hydraulic Brakes



Adjust H Brake

NOTE: Each brake shoe must be adjusted separately.

NOTE: If adjustable anchor pins are not used, omit Brake Adjustment Steps 2 and 3.

The first adjustment after assembly must be carefully made to put the shoes in the correct position in the brake drum.

1. Turn the eccentric cam adjustment so that the lining touches the brake drum. **Figure 2.18.**
2. Turn the anchor pin adjustment, if used, until the brake drum just rotates freely. **Figure 2.18.**
3. Repeat Steps one and two until additional rotation of the anchor pin no longer decreases the brake drum resistance.
4. Tighten the anchor pin lock nut to the torque shown below: 
 - **0.750-16 Thread Size:**
Tighten to 85-115 lb-ft (115-156 N•m)
when using a 13X-13 jam nut.

Tighten to 100-145 lb-ft (136-197 N•m)
when using a standard height nut.
 - **0.875-14 Thread Size:**
Tighten to 150-190 lb-ft (203-258 N•m).
 - **0.875-11 Thread Size:**
Tighten to 180-230 lb-ft (244-312 N•m).
5. Turn the adjusting cam in the opposite direction until the brake can rotate freely.
6. Use the same procedure (Steps 1 - 5) to adjust the other shoe.
7. Further adjustment for lining wear must be made with the adjustment cams only. Adjust the lining until a slight resistance can be felt when the brake drum is rotated.
8. Turn the cams in the opposite direction until the brake drum just can rotate freely.

Wheel Cylinder Maintenance



WARNING

- *These hydraulic brakes are all internal wheel cylinder brakes. If master cylinders and/or power units are being serviced, it is required that they be able to maintain 12-20 PSI (0.8-1.3 bar) residual line pressure. Otherwise these internal wheel cylinder brakes will not perform properly and can cause serious personal injury.*
- *Leaks that coat the outside of the boot and cylinder with fluid can cause a decreased fluid level in the reservoir or dampen and stain the brake linings. Any leaks must be immediately corrected. Contaminated linings must be replaced to prevent serious personal injury.*
- *Some hydraulic brake systems use a non-petroleum hydraulic brake fluid (SAE-J-1703 or SAE-J-1702f) some systems use petroleum base brake fluids. Make sure that you use the correct brake fluid and seals as required in the vehicle brake system specifications. Do not mix different types of brake fluid. The use of the wrong brake fluid can damage the cup seals of the wheel cylinder, cause loss of braking and serious personal injury.*

Check to determine if wheel cylinders need overhauling or replacing:

- when you replace the brake shoes and
- when a cylinder leaks.

Wheel Cylinder Diagnostics

There are two types of wheel cylinder problems:

1. Leaks

Cylinder leaks can be caused by:

- using the incorrect type of brake fluid causing the seals to leak,
- corrosion or damage on the surface of the cylinder bore,
- worn or oversize cylinder bore, and
- damaged seal cups.

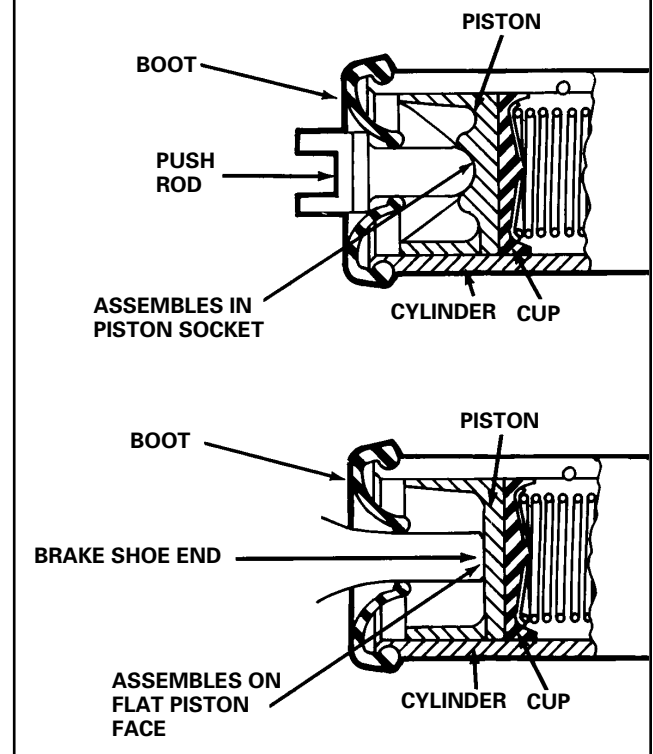
To find leaks that are not immediately visible, pull back the cylinder boot. A small amount of fluid on the inside of the boot is normal. Unless other conditions causing poor brake performance are known, the wheel cylinder must be checked.

2. Poor Cylinder Action

Cylinder binding can be caused by:

- Corrosion or deposits in the cylinder bore.
- Swollen cups caused by contaminated or wrong type of brake fluid.
- Cups wedged into excessive clearance between the piston and the cylinder bore.
- Wrong type of pistons for push rods or brake shoe ends. **Figure 2.19.**

Figure 2.19



Section 2 Hydraulic Brakes



Disassemble Wheel Cylinder

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

CAUTION

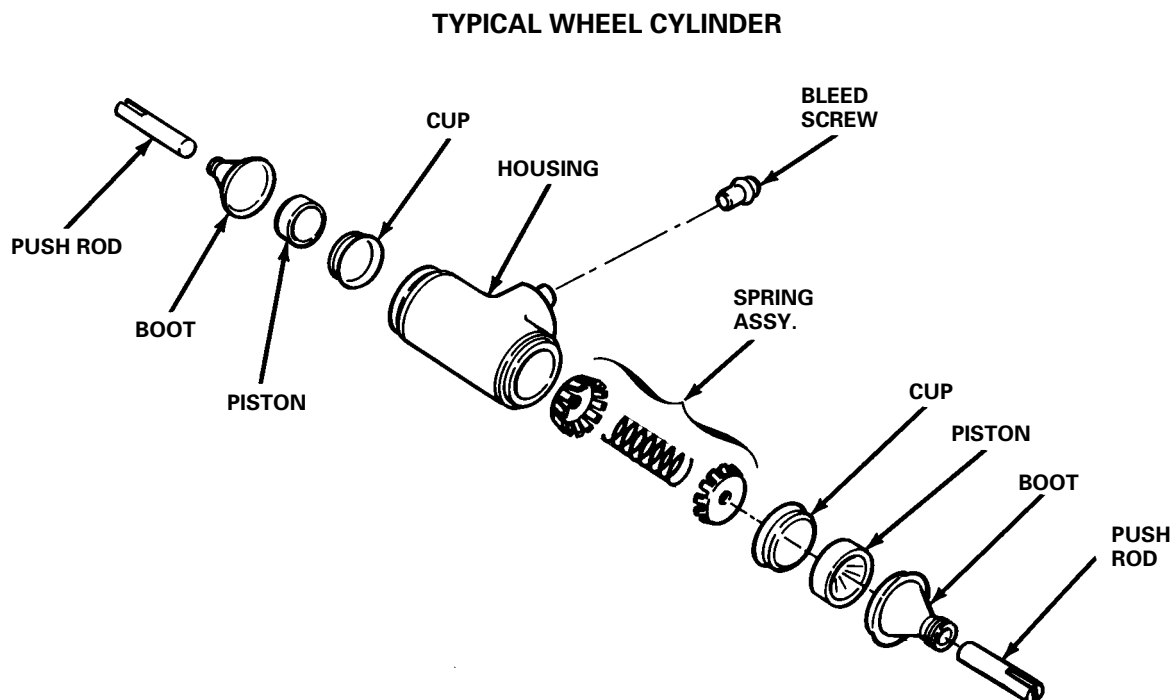
Hydraulic system parts must not contact oil or grease. Even a small amount of a petroleum product from dirty hands is enough to damage the rubber parts. Figure 2.20.

1. Remove dust boots from the cylinder.
2. Remove the internal parts of the cylinder from the housing. If necessary, use a wood dowel driver or apply low pressure compressed air to the fluid inlet port.

NOTE: Parts which cannot be easily removed indicate that they are damaged and the cylinder must be replaced.

3. Clean the cylinder and the parts in the correct brake fluid for the vehicle. Do NOT use gasoline or other petroleum products. Use only lint-free wiping rags.
4. Use a crocus cloth to clean small scratches, rust, corrosion or discoloration from the cylinder bore and pistons. Use the crocus cloth in a circular movement, not a lengthwise movement. A clean-up hone can be used. Remove any burrs at the edge of the fluid intake or bleeder screw ports.
5. After the cylinder is cleaned, check the clearance of the piston in the cylinder. Replace cylinder with more than 0.002 inch (0.05 mm) diameter clearance.

Figure 2.20



Assemble Wheel Cylinder

1. Before the cylinder is assembled, lubricate the **new** cups and the piston with the correct brake fluid.
2. If the boots are deteriorated, or do not fit tightly on the push rods and the cylinder housing, replace the boots.
3. Wash the wheel cylinder with brake fluid.
4. Install the spring in the cylinder.
5. Install the cups in each end of the cylinder with the open ends of the cups toward each other.
6. Install the pistons in each end of the cylinder with the recessed end of the pistons toward the open ends of the cylinder.
7. Install dry boots over each end of the cylinder.

Bleed Hydraulic System

After servicing the brakes it is necessary to bleed all of the components of the hydraulic system. Follow the bleeding instructions in the OEM'S vehicle maintenance manual. If the manual is not available, the following procedures will provide a proper bleed:

Bleeding must start first with the hydrovac, power cluster or master cylinder. The first wheel cylinder to be bled **MUST** be the one that is the greatest distance from the master cylinder.



CAUTION

Some hydraulic brake systems use a non-petroleum hydraulic brake fluid (SAE-J-1703 or SAE-J-1702f) some hydraulic brake systems use petroleum base brake fluids. Make sure that you use the correct brake fluid and seals as required in the vehicle brake system specifications. The use of the wrong brake fluid can damage the cup seals of the wheel cylinder. Different types of brake fluids MUST NOT be mixed.

1. Fill the master cylinder with brake fluid. Connect one end of the bleeder hose to the bleeder screw and hang the other end of the hose in a clean container. **Do not permit fluid to contact brake lining.**
2. Loosen the bleeder screw and slowly push the brake pedal to the floor. Close the bleeder screw before you release the brakes. If the bleeder hose is kept submerged in the container of brake fluid, it is not necessary to close the bleeder screw on each application. Repeat this procedure eight or ten times on each component bleed.
3. Fill the master cylinder or power cluster with the correct hydraulic fluid and check the brake pedal for correct pressure and travel. (The brakes must be in correct adjustment).
 - a. If pressure bleeding equipment is used, connect the outlet hose to the master cylinder or power cluster and bleed the system following the same procedures as above. The flow of the brake fluid must be checked while the bleeder hose is kept submerged in the brake fluid in the container. When the air bubbles are eliminated and the brake fluid runs in a clean, solid flow, the bleeding is complete.
 - b. If vacuum bleeding equipment is used, small air bubbles can be drawn past the cylinder seals into the wheel cylinders. A conventional bleed of each wheel cylinders. A conventional bleed of each wheel cylinder should be performed after a vacuum bleeding.
4. Repeat this procedure at each wheel cylinder. Fill the master cylinder reservoir after each wheel cylinder is bled.
5. When bleeding is complete, check the fluid level of the master cylinder. If necessary, fill to the specified level.

Section 3 Mechanical Brakes



DCM Brake (Duplex Cam Mechanical)

Description

The DCM brake is a two shoe mechanically actuated brake. The brake is available in 10" x 3" (254 mm x 76.2 mm) and 12" x 3", 4" and 5" (304.8 mm x 76.2 mm, 101.6 mm, 127 mm) sizes. Figures 3.1 and 3.2.

Figure 3.1

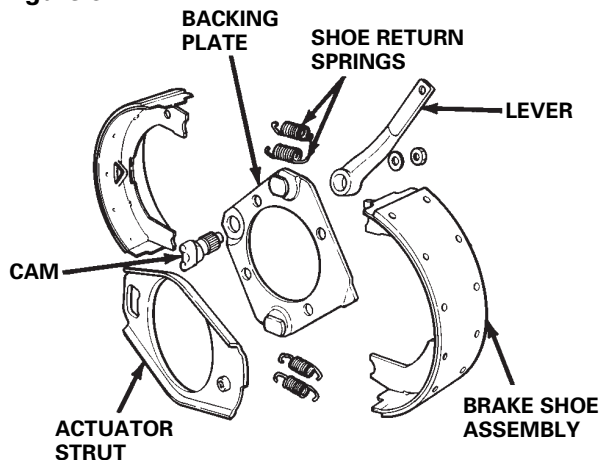


DCM BRAKE

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Figure 3.2



Disassemble DCM Brake

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Disconnect the drive shaft using standard procedures.
5. Release the brake.
6. Remove the brake drum using standard procedures
7. Remove the nut and washer that hold the cam to the lever.
8. Remove the cam and the lever.
9. Use a brake shoe return spring removal tool to remove the two or four brake shoe return springs from the ends of the brake shoes. Discard the springs and replace them with new springs at assembly.
10. Remove both brake shoes and mark them to identify their original position at assembly.
11. Remove the actuator strut.

NOTE: Make a note of how the brake backing plate is mounted. Use the position of the cam as the reference point.

12. If complete disassembly is necessary, remove the four brake backing plate capscrews and washers.
13. Clean and inspect all parts. Refer to Section 4.

Assemble DCM Brake

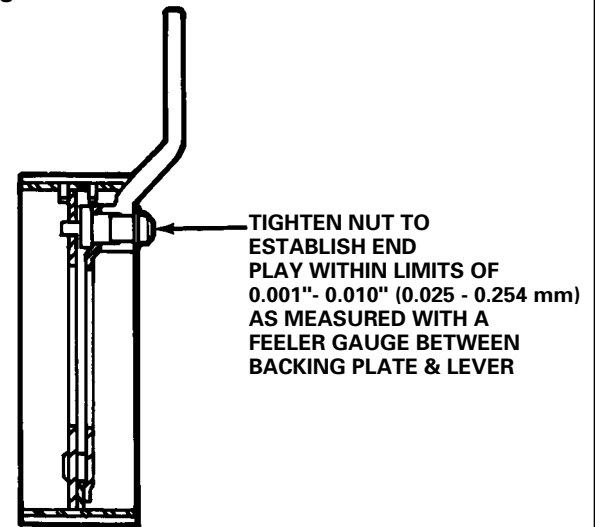


CAUTION

*Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings **MUST** be replaced.*

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
 - a. Cam head face and journals.
 - b. The sides of the shoe webs and the actuator strut that slide together.
 - c. Both sides of the backing plate at the cam hole.
2. If it was removed, install the brake backing plate in the same position as marked in Step 10 of the Disassembly Section. Tighten the four capscrews to the specifications set by the OEM.
3. Install the brake shoes in the same position as marked in Step 8 of the Disassembly Section with the web ends in position on the backing plate bosses.
4. Use a brake shoe installation tool to install the **four new** brake shoe return springs at the ends of the brake shoes.
5. Assemble the cam through the backing plate, lever, lock washer and nut. Tighten the nut to give an end play of 0.001" to 0.010" (0.025 - 0.254 mm) as measured with a feeler gauge between the backing plate and the lever. **Figure 3.3.**

Figure 3.3



6. Install the actuator strut with the pressure points against the shoe web pressure points and the cam head in position in the slot of the strut.
7. Assemble the brake drum and drive shaft using standard procedures.

Adjust DCM Brake

Equal adjustment of the brake shoes is controlled by the actuating lever. The only required adjustment is through the connecting linkage to the lever arm. The adjustment can be made after the brake drum and drive shaft are assembled.

Section 3 Mechanical Brakes



DLM Brake

(Duplex Lever Mechanical)

Description

The DLM brake is a two-shoe mechanically actuated brake. The brake is available in 7.25" x 1.5", 10" x 1.5" and 13.375" x 2" (184.1 mm x 38.1 mm, 254. mm x 38.1 mm and 339.7 mm x 50.8 mm) sizes. **Figures 3.4 and 3.5.**

Figure 3.4

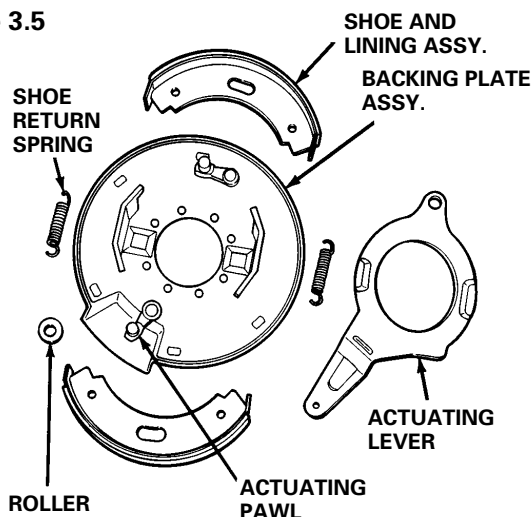


DLM BRAKE

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Figure 3.5



Disassemble DLM Brake

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Disconnect the drive shaft using standard procedures.
5. Release the brake.
6. Remove the brake drum using standard procedures.
7. Use a brake shoe return spring removal tool to remove the two brake shoe return springs.
8. Remove both brake shoe and lining assemblies.
9. Lift the brake actuator lever from the pawls and remove the roller from the actuator pawl pin under the arm of the lever.

NOTE: Some smaller DLM brakes use a roller on each pawl.

10. If complete disassembly is necessary, remove the brake backing plate capscrews and washers. Make a note of how the brake backing plate is mounted. Use the position of the actuator lever opening as a reference point.
11. Clean and inspect all parts. Refer to Section 4.

Assemble DLM Brake

CAUTION

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings MUST be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
 - a. The sides of the brake lever and shoes that slide against each other.
 - b. The ends of the shoe webs.
 - c. The surfaces of the wear pads and actuating pawls.
2. If it was removed, install the brake backing plate in the same position as marked in Step 10 of the Disassembly Section. Tighten the capscrews to the specifications set by the vehicle builder.
3. Put the roller(s) in position on the actuator pawl pin at the lever opening on the backing plate.
4. Install the brake actuator lever with the large hole in the tab over the pawl pin that is opposite the actuator pawl. Set the lever arm in the backing plate opening with the outer edge of the lever next to the roller.
5. Install the brake shoes with the webs against the actuator lever and the pawl pins through the web slots.

WARNING

Failure to correctly install spring in slot could pull shoe away from actuating pawl and render brake inoperative. Serious personal injury can occur.

6. Use a brake shoe return spring installation tool to connect the shoe return springs to the brake shoes in the slots nearest the backing plate.
7. Assemble the brake drum and drive shaft using standard procedures.

Adjust DLM Brake

Equal alignment of the brake shoes is controlled by the actuating lever. The only required adjustment is through the connecting linkage to the lever arm. The adjustment can be made after the brake drum and drive shaft are assembled.

Section 3 Mechanical Brakes



DM Brake (Duplex Mechanical)

Description

The DM brake is a two shoe mechanically actuated brake. The brake is available in 7.125" x 2" (180.9 mm x 50.8 mm), sizes. **Figures 3.6 and 3.7.**

Figure 3.6



DM BRAKE

WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Disassemble DM Brake

WARNING

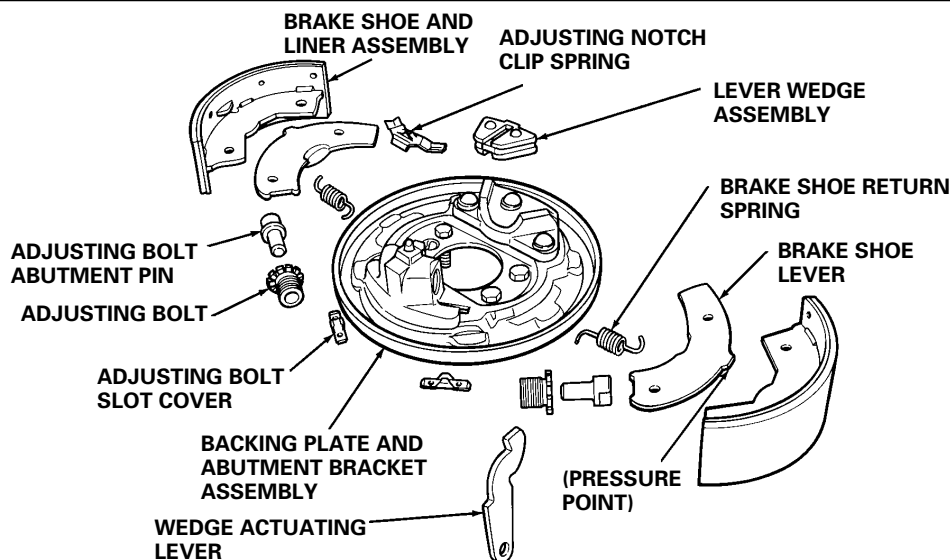
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

WARNING

Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

1. Make sure the vehicle is on a level surface.
2. Place blocks under the wheels not being serviced to keep the vehicle from moving.
3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
4. Disconnect the drive shaft using standard procedures.
5. Release the brake.

Figure 3.7



6. Remove the brake drum using standard procedures.
 7. Disconnect and remove the shoe return springs with a "button hook" type of spring tool.
 8. Remove the shoe and lining assemblies.
 9. Disassemble the actuating lever, both shoe levers and the wedge assembly.
 10. Remove the adjusting bolt spring clip.
 11. Pull the abutment pins from the bores inside the adjusting bolts.
 12. Remove both adjusting bolts.
- NOTE:** Make a note of how the brake backing plate is mounted. Use the position of the slot for the actuator lever as the reference point.
13. If complete disassembly is necessary, remove the four brake backing plate capscrews and washers.
 14. Clean and inspect all parts. Refer to Section 4.

Assemble DM Brake

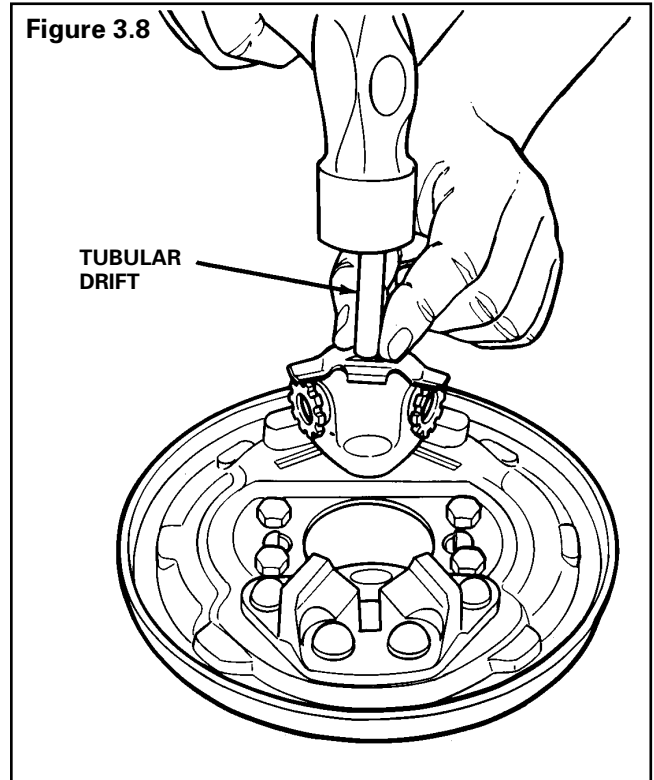


CAUTION

Do not permit grease to contact the brake drum or linings. Grease on the linings can cause poor brake performance. Contaminated linings *MUST* be replaced.

1. Before assembly, apply a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent (listed on page 31) to the following parts:
 - a. Adjusting bolts.
 - b. Side slots and the actuator lever groove in the wedge assembly.
 - c. The sides of the brake levers and shoes that slide against each other.
2. Install both adjusting bolts.
3. Put the abutment pins in the adjusting bolt bores.

4. Install the adjusting bolt spring clip with a tubular drift. **Figure 3.8.**



5. Install shoe and lining assemblies on the backing plate with the web pressure points above the center line.
6. Put the straight ends of the shoe return springs in the shoe webs. Install the round ends in the backing plate slots.
7. Install the brake shoe levers with the pressure points against the pressure points on the webs of the shoes.
8. Put the actuator lever through the slot in the back of the backing plate. Pull apart the shoe and shoe lever assemblies to install the wedge assembly.
9. Assemble the brake drum and drive shaft using standard procedures.

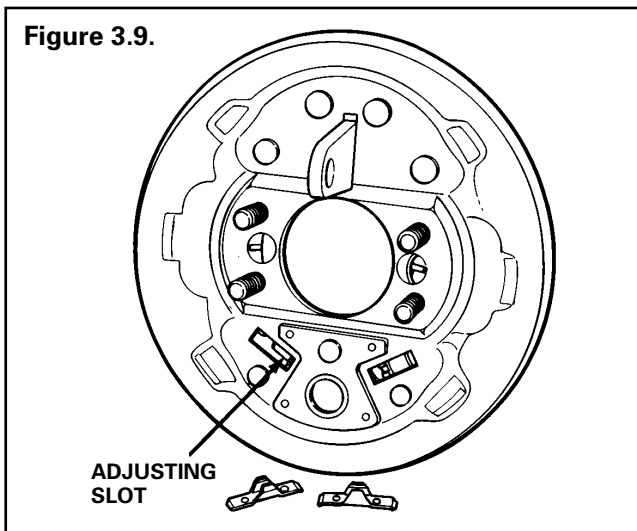
Section 3 Mechanical Brakes



Adjust DM Brake

NOTE: Each brake shoe must be adjusted separately.

1. Insert an adjusting tool through the holes in the backing plate to engage the teeth on the adjusting bolts. To expand the shoes, move the tool handle down when the tool is in the right hand slot, and move the handle up when the tool is in the left hand slot. **Figure 3.9.**



2. Adjust the lining tight against the brake drum, then release the adjustment until the brake drum just can rotate freely.
3. Install the adjusting slot covers.

Clean Ground or Polished Parts

 WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

 WARNING

If you use cleaning solvents, hot solution tanks or alkaline solutions incorrectly, serious personal injury can occur. To prevent serious personal injury, follow the instructions supplied by the manufacturer of these products. Do NOT use gasoline to clean parts. Gasoline can explode and cause serious personal injury.

 CAUTION

- *Do not use cleaning solvents on hydraulic seals, boots or pistons. Cleaning solvents can damage these components. Protect the brake lining from solvents, lubricants, rust inhibitors, or other contaminants that can change the friction properties of the lining. Contaminated linings MUST be replaced.*
- *Use only solvent cleaners to clean ground or polished metal parts. Hot solution tanks or water and alkaline solutions will damage these parts. Isopropyl alcohol, kerosene or diesel fuel can be used for this purpose.*
- *If required, use a sharp knife to remove gasket material from parts. Be careful not to damage the ground or polished surfaces.*
 - a. Use a cleaning solvent to clean ground or polished parts and surfaces. Kerosene or diesel fuel can be used for this purpose. DO NOT USE GASOLINE.
 - b. DO NOT clean ground or polished parts in a hot solution tank or with water, steam or alkaline solutions. These solutions will cause corrosion of the parts.

Clean Parts With Rough Finishes

- a. Rough parts can be cleaned with the ground or polished parts.
- b. Rough parts also can be cleaned in hot solution tanks with a weak alkaline solution.
- c. Parts must remain in the hot solution tanks until they are completely cleaned and heated.

Dry Cleaned Parts

- a. Parts must be dried immediately after they are cleaned.
- b. Dry parts with clean paper or rags, or compressed air.

Prevent Corrosion and Rust on Cleaned Parts

 CAUTION

Wheel cylinders and cup seals must only be lubricated with the fluid used in vehicle brake system. Cylinder boots must be kept dry to avoid rust and corrosion.

- a. Apply axle lubricant to the cleaned and dried metal parts that are to be immediately assembled.
- b. If parts are to be stored, apply a special material that prevents rust and corrosion to all surfaces.

Inspect Parts

It is important that you carefully inspect all parts before assembly starts. Check all parts for wear or damage and repair or replace them as required. Replacement of these parts now can prevent problems with the assembly later.

- a. Check all castings and backing plates for cracks, loose rivets and correct alignment. Replace all damaged parts.
- b. Check all adjusting bolts, guide pins and pawl pins for corrosion and wear. Replace or repair damage parts.

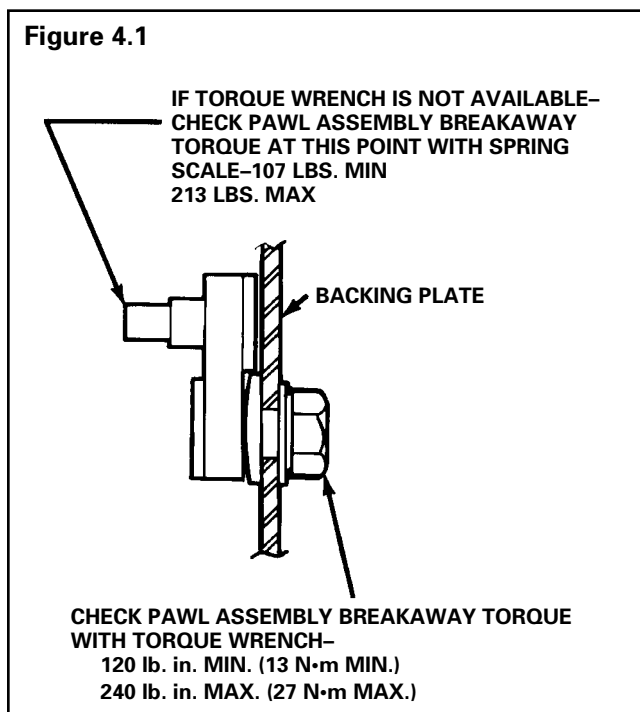
Section 4

Prepare Parts for Assembly



- c. If the brake has automatic adjuster pawls, check the pawl breakaway torque with a torque wrench to verify that the torque is between 120-240 lb. in. (13-27 N•m). 

Figure 4.1.



Check brake shoes for rust, expanded rivet holes, broken welds and correct alignment. Replace damaged shoes.

- d. Check anchors, anchor pins and shoe bushings for wear or damage. Replace as necessary.
- e. Replace all shoe return springs at time of brake overhaul.
- f. Check the brake drums for cracks, severe heat checking, heat spotting, scoring, pitting and distortion. Replace damaged brake drums.
- g. Inspect wheel cylinders for leaks and smooth action. (See page 17).

Maintenance Schedules



WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

A schedule for periodic adjustment, cleaning, inspection, and lubricating of the brake equipment must be made according to type of brake and type of vehicle operation. Each operator must establish maintenance schedules based on vehicle applications. Start with inspections every two months and adjust the schedules as necessary. Severe service and high levels of contamination must have more frequent brake adjustments and inspections.

Brakes must be cleaned, inspected, lubricated and adjusted every time the wheel hubs are removed. Do NOT clean or contaminate the linings with fluid.

Minor Inspection: Hydraulic Brakes

1. Check the brake pedal travel with brake drums assembled. Too much travel can indicate the need for brake adjustment.
2. Check the brake adjustment unless the brakes are equipped with automatic adjustment.
3. Check the operation of the parking brake by actuating and releasing the parking brake control and observing the brake actuation and release.
4. Check lining wear:
 - a. Check the wear side-to-side and end-to-end.
 - b. The lining wear must be even on both shoes of the brake and on both sides of the axle.
5. Check the brake lining to brake drum contact pattern. Contact must be the same on both shoes of the brake and on both sides of the axle.
6. Check the operation of the brake by pressing and releasing the brake pedal in the cab and observing the brake actuation and release.

Major Inspection: Hydraulic Brakes

Major inspection must be made at every reline. Severe duty cycles or environmental conditions require more frequent major inspections.

1. Check all of the points described in the minor inspection procedures.
2. Check the anchors and the shoes bushings for wear.
3. Check the levers for rust, bending or seizing.
4. Check the adjustment components for rust, bending or seizing.
5. Check for loose shoe return springs.
6. Check for loose or broken lining rivets.
7. Check for brake fluid, grease or oil on the linings. Do NOT reuse contaminated linings.
8. Check the brake shoes for rust and bending.
9. Check the brake drums for wear or damage.
10. Check the brake lines for cracking, pinching and corrosion.
11. Check the wheel cylinders for leaking and binding. (See page 17).
12. Before assembly, lubricate the sliding parts with a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent listed on page 31.
13. Assemble the brakes.
14. Bleed the hydraulic system. (See page 19.)

Section 5

Recommended Periodic Service



Minor Inspection: Mechanical Brakes

1. Check lining wear. Lining wear must be even on both shoes.
2. Check the lining to brake drum contact pattern. Contact must be the same on both shoes.
3. Check the operation of the brake by actuating and releasing the brake control and observing the actuation and release.
4. Check the brake adjustment.

Major Inspection: Mechanical Brakes

Major inspection must be made at every reline and when there is poor brake performance.

1. Check all the points described in the minor inspection procedures.
2. Check for worn or corroded areas where components contact or slide against each other.
3. Replace all shoe return springs.
4. Check the cam (if used) for wear, rust, bending and seizing.
5. Check the actuator lever for rust, bending, seizing or other damage.
6. Check the spider or backing plate for looseness and elongated mounting holes.
7. Check for loose or broken lining rivets.
8. Check for grease or oil on the lining. Do NOT reuse contaminated linings.
9. Check the brake shoes for bending and rust.
10. Check the actuator pawl, if used, for wear and correct alignment.
11. Check the brake drums for wear and damage.
12. Before assembly, lubricate the sliding parts with a thin layer of Meritor specification 0-616 brake lubricant such as Texaco Thermatex EP-2 grease or equivalent listed on page 31.

Torque Chart

DLH Brake wheel cylinder capscrews	15-20 lb-ft (20-27 N•m)
DSH Brake wheel cylinder capscrews	15-20 lb-ft (20-27 N•m)
DH Brake wheel cylinder capscrews	25-30 lb-ft (34-47 N•m)
FSH Brake wheel cylinder attaching screw and capscrew	25-35 lb-ft (34-47 N•m)
H Brake wheel cylinder lock washers and capscrews	25-35 lb-ft (34-47 N•m)
H Brake anchor pin lock nut: 0.750-16 thread size: • w/13x-13 jam nut • w/ standard height nut 0.875-14 thread size 0.875-11 thread size	85-115 lb-ft (115-156 N•m) 100-145 lb-ft (136-197 N•m) 150-190 lb-ft (203-258 N•m) 180-230 lb-ft (244-312 N•m)
Adjuster pawl	120-240 lb-in (13-27 N•m)

Lubrication

Meritor Specification 0-616:	
Standard Oil of Ohio	Sohio #101
Warren Refining Co.	Plastilube #2
Fisher Bros. Refining Co.	SA Lubricant
Shell Oil Company	Darina Grease 2 Extrema EP-2 Darina EP-2
Texaco	Thermatex EP-2

Notes



Notes





Meritor Heavy Vehicle Systems, LLC
2135 West Maple Road
Troy, MI 48064 U.S.A.
248-435-1085
800-535-5560 (North America only)
www.meritorauto.com

Meritor do Brasil Ltda.
Av. João Batista, 824
06097-900 Osasco-SP
BRAZIL
(55-11) 704-6510
Fax: (55-11) 702-6510

Meritor Heavy Vehicle Systems, LLC – St. Etienne S.A.
4, rue Jean Servanton
BP 656
42042 St. Etienne Cedex 1
FRANCE
(33-477) 92-8800 Fax: (33-477) 92-8890

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Maintenance Manual No. 4H
Revised 4-96
47865/Meritor



Wet Disc Brakes

Freins a bain d'huile

W3H*, W4H, W4M and WDM Series
Series W3H*, W4H, W4M, et WDM

Maintenance Manual 4L
Manuel de Maintenance 4L

Issued 08-06
Distribué 08-06

***Note: W3H Series 330 mm – contained herein**
W3H Series 360 mm – see MM-20195
Series 330 mm - conenu en ceci
Series 360 mm - Voir MM-20195

This maintenance manual describes the correct service and repair procedures for all AxleTech International W3H, W4H, W4M and WDM Series Wet Disc Brakes. The information contained in this manual was current at time of printing and is subject to change without notice or liability.

You must follow your company procedures when you service or repair equipment or components. You must understand all procedures and instructions before you begin to work on a unit. Some procedures require the use of special tools for safe and correct service. Failure to use special tools when required can cause serious personal injury to service personnel, as well as damage equipment and components.

The instructions contained in this Field Maintenance Manual are intended for use by skilled and experienced mechanics knowledgeable in the installation, repair and replacement of the AxleTech product described herein. Installation, maintenance and replacement of such products require a high degree of skill and experience. The consequences of improper installation, maintenance or replacement (including the use of inferior or substandard components) are grave and can result in product failure and resulting loss of control of the vehicle, possible injury to or death of persons and/or possible future or additional axle damage. AxleTech does not authorize anyone other than highly skilled and experienced individuals to attempt to utilize the instructions contained in this Manual for the installation, maintenance or replacement of the product described herein, and AxleTech shall have no liability of any kind for damages arising out of (or in connection with) any other use of the information contained in this Manual.

AxleTech International uses the following notations to warn the user of possible safety problems and to provide information that will prevent damage to equipment and components.

 WARNING	A WARNING indicates a procedure that you must follow exactly to avoid serious personal injury.
 CAUTION	A CAUTION indicates a procedure that you must follow exactly to avoid damaging equipment or components. Serious personal injury can also occur.
	This symbol indicates that fasteners must be tightened to a specific torque.
NOTE:	A NOTE indicates an operation, procedure or instruction that is important for proper service. A NOTE can also supply information that will help to make service quicker and easier.

Additional Publications

For AxleTech service manuals, please contact:
1-877-877-9717 and 248-816-5401 or visit our website at
www.axletech.com.

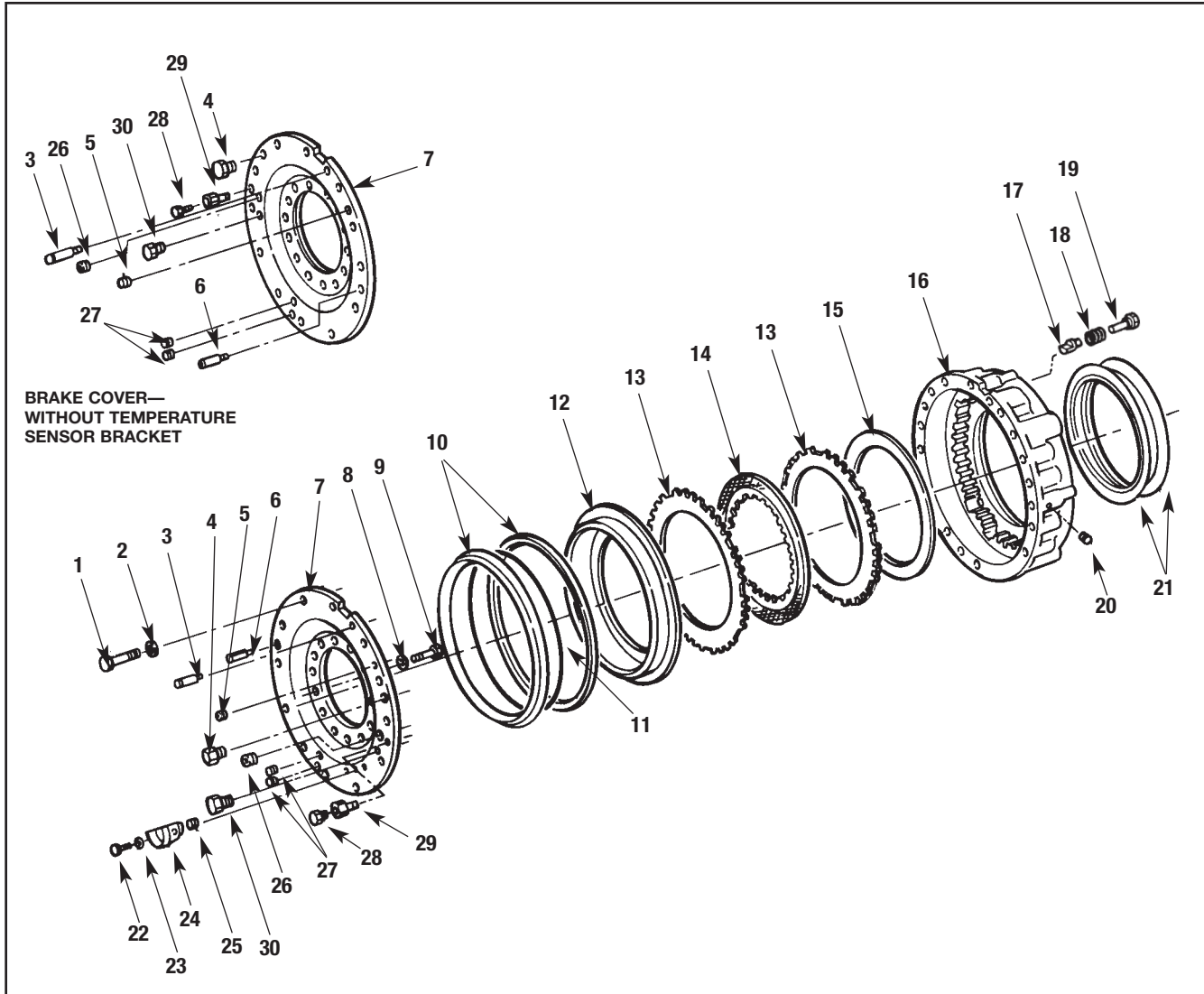
How to Order

Order items from AxleTech International.

Phone orders are also accepted by calling AxleTech International's Customer Service Center at 877-547-3907 or send a fax to 866-547-3987.

W3H AND W4H WET DISC BRAKE ONE-PIECE HOUSING (TYPICAL)

AxleTech™
International



Item	Description	Quantity*
1	Cover-to-Brake Housing Capscrew	As req'd.
2	Cover-to-Brake Housing Washer	As req'd.
3	Bleeder Screw	1
4	Forced Cooling Inlet Plug	As req'd.
5	Brake Housing Cover Plug	1
6	Inlet Fitting Plug	1
7	Brake Housing Cover	1
8	Cover-to-Axle Housing Washer	As req'd.
9	Cover-to-Axle Housing Capscrew	As req'd.
10	Piston Seal	2
11	Piston Seal Spacer (Garter Spring)	1
12	Piston	1
13	Stationary Disc	As req'd.
14	Friction Disc	As req'd.

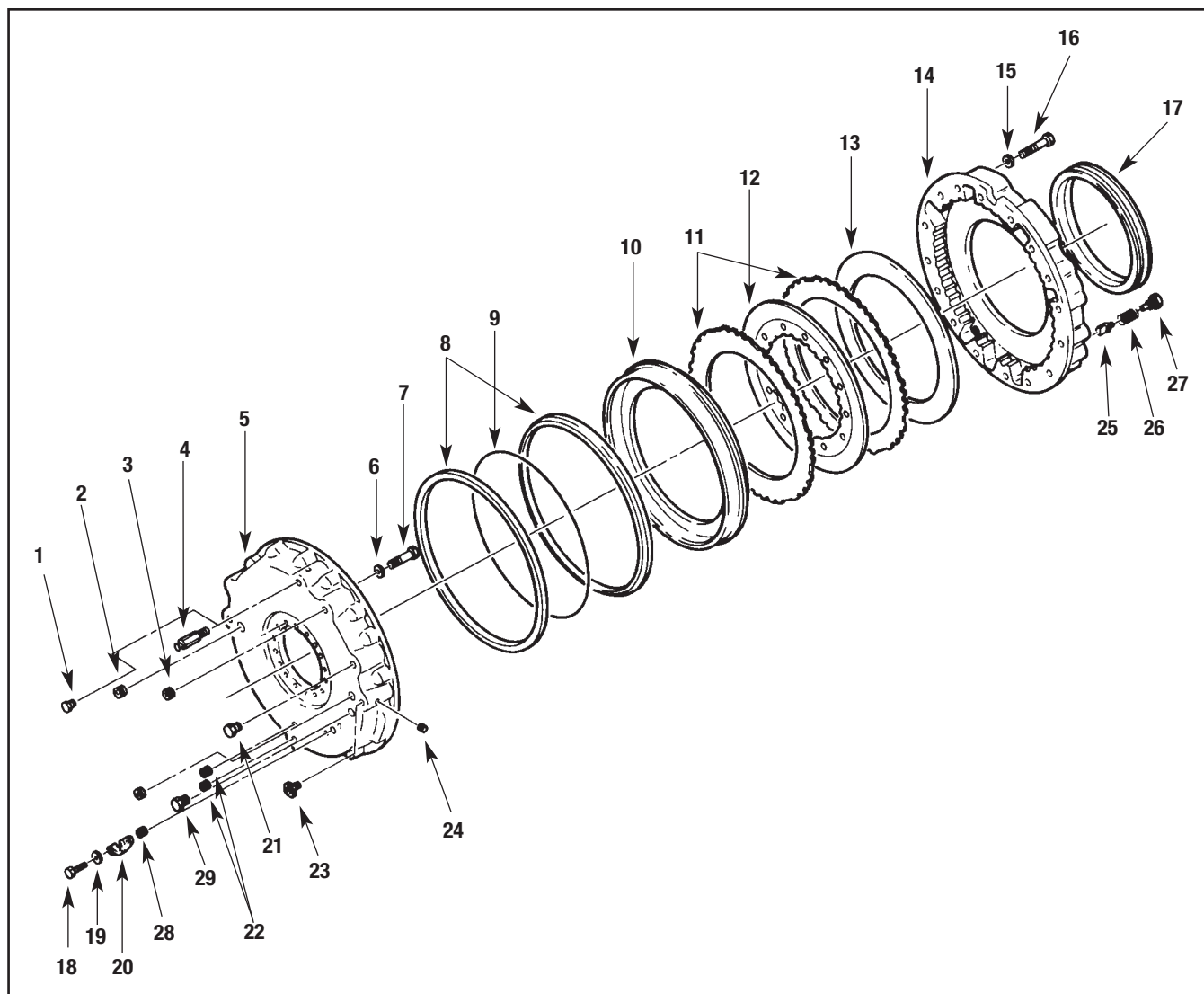
Item	Description	Quantity*
15	Brake Housing to Stationary Disc Spacer	1
16	Brake Housing	1
17	Piston Return Spring Guide—	4
18	Piston Return Spring—	
19	Piston Return Spring Plug—	4
20	Brake Housing Plug	3
21	Face Seal Assembly	1
22	Temperature Sensor Bracket Capscrew	2
23	Temperature Sensor Bracket Washer	2
24	Temperature Sensor Bracket	1
25	Temperature Sensor Plug	1
26	Fill and Level Plug	1
27	Magnetic Drain Plug	As req'd.
28	Inlet Fitting Plug	1
29	Brake Inlet Fitting	1
30	Forced Cooling Outlet Plug	As req'd.

*Per Brake

Note: components shown vary with specific brake specifications.

W3H AND W4H WET DISC BRAKE TWO-PIECE HOUSING (TYPICAL)

AxleTech
International



Item	Description	Quantity*
1	Optional Inlet Fitting Hole Plug	1
2	Oil Filler Plug	1
3	Brake Housing Cover Plug	1
4	Brake Bleeder Screw	1
5	Inner Housing	1
6	Brake Hsg. to Spindle Washer	As req'd.
7	Brake Hsg. to Spindle Capscrew	As req'd.
8	Piston Seal	2
9	Piston Seal Spacer (Garter Spring)	1
10	Hydraulic Piston	1
11	Stationary Disc	As req'd.
12	Friction Disc	As req'd.
13	Brake Hsg. to Stationary Disc Spacer	1
14	Outer Housing	1

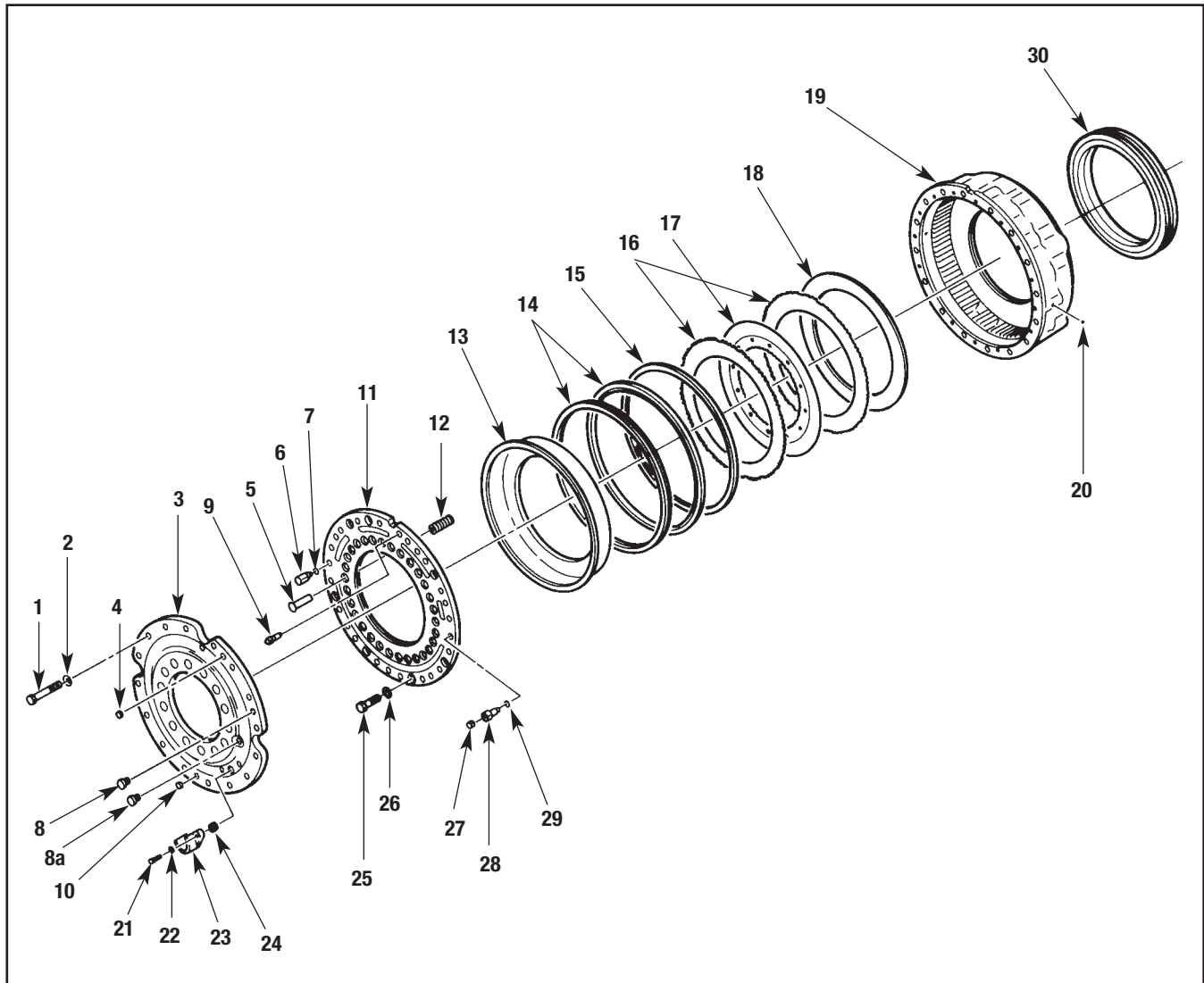
Item	Description	Quantity*
15	Brake Hsg. Halves Washer	As req'd.
16	Brake Hsg. Halves Capscrew	As req'd.
17	Face Seal Assy.	1
18	Temp. Sensor Brkt. Capscrew	2
19	Temp. Sensor Brkt. Washer	2
20	Temp. Sensor Bracket	1
21	Forced Cooling Inlet Plug	As req'd.
22	Oil Drain (Magnetic) Plug	As req'd.
23	Inlet Hole Plug (Shipping)	1
24	Brake Housing Plug	3
25	Piston Return Spring Guide	4
26	Piston Return Spring	4
27	Piston Return Spring Plug Assy.	4
28	Oil Temp. Hole Plug	1
29	Forced Cooling Outlet Plug	As req'd.

*Per Brake

Note: components shown vary with specific brake specifications.

W4M AND WDM WET DISC BRAKE (SPRING APPLIED HYDRAULIC RELEASE)

AxleTech™
International



Item	Description	Quantity*
1	Capscrew	As req'd.
2	Hardened Washer	As req'd.
3	Outer Cover	1
4	Housing Plug	1
5	Brake Spring Pin	30
6	Optional Inlet Plug	1
7	O-ring	1
8	Forced Cooling Inlet Plug	1
8a	Forced Cooling Outlet Plug	1
9	Bleeder Screw	1
10	Magnetic Drain Plug	1
11	Inner Cover	1
12	Spring	30
13	Piston	1
14	"Z"-Type Piston Seal	2
15	Piston Seal Backup Ring	1

Item	Description	Quantity*
16	Stationary Disc	As req'd.
17	Friction Disc	As req'd.
18	Brake Housing to Stationary Disc Spacer	1
19	Brake Housing	1
20	Plug	3
21	Temperature Sensor Capscrew	2
22	Temperature Sensor Hardened Washer	2
23	Temperature Sensor Bracket	1
24	Temperature Sensor Plug	1
25	Capscrew	7
26	Hardened Washer	7
27	Inlet Plug (Shipping)	1
28	Actuation Inlet Fitting	1
29	O-ring	1
30	Face Seal Assembly	1

*Per Brake

Note: components shown vary with specific brake specifications.

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Description

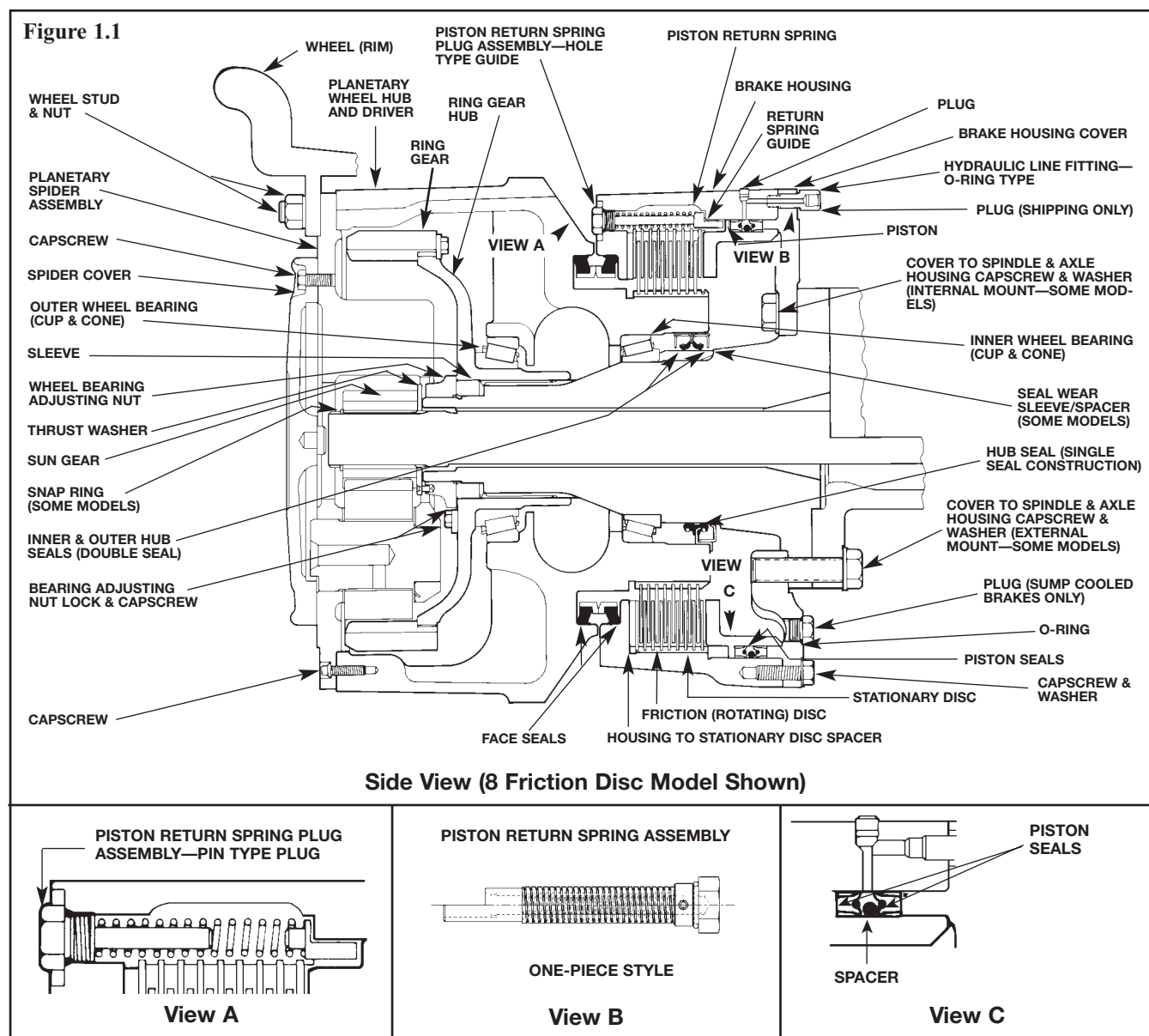
- The W3H, W4H, and Dura-Disc wet disc brakes are hydraulically actuated friction brakes. **Figure 1.1.**
- The W4M and WDM Dura-Disc wet disc brake is spring applied and hydraulically released.

Three sizes of brakes are available:

- W3H 13 in. (330 mm)
- W4H, W4M, WDM 17 in. (432 mm)

Two to ten friction discs are used in the housing depending on the requirements of the brake system.

- Friction discs, each between stationary discs, rotate with the wheel hub.
- Stationary discs are locked to the brake housing.



Section 1

Introduction

All brake housings, except the two and some four disc models, are one-piece. The two disc model and some four disc models use a two-piece housing. The outer cover of the two-piece housing contains the discs while the brake housing contains the piston and the piston seals. **Figure 1.2.**

Cooling Systems

One of two cooling systems are used: **sump cooling** or **forced cooling**.

The **sump cooling system** uses the brake housing fluid as a coolant. The discs are submerged in coolant that removes the heat generated by the discs during braking.

The **forced cooling system** removes additional heat from the discs. An external pump moves hydraulic fluid from a reservoir to the brake housing and back to the reservoir.

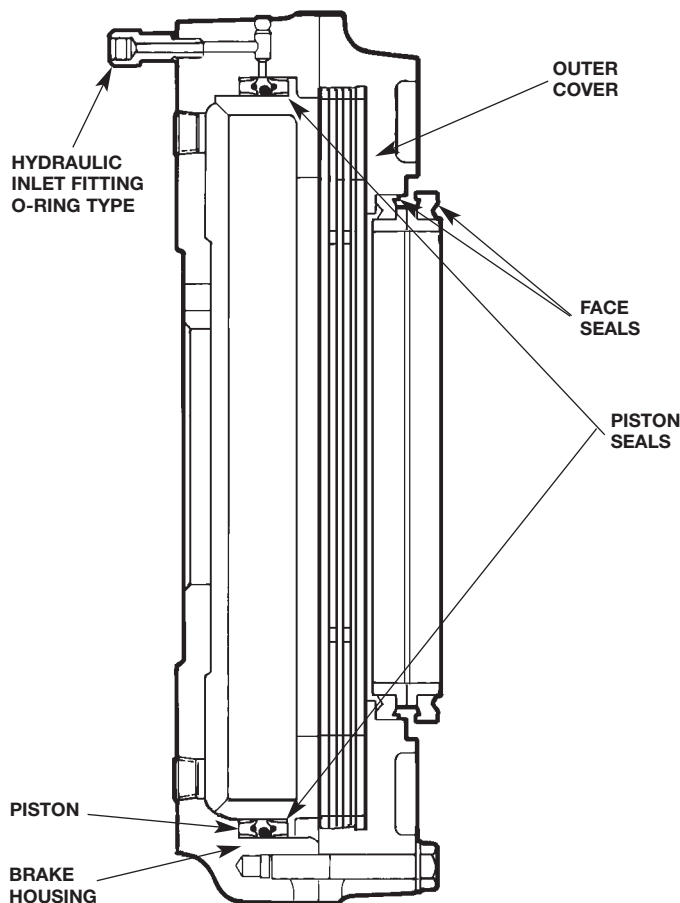
Hub seals on all **forced cooling systems**, and most **sump cooling systems**, separate the coolant from the lubricant in the wheel end.



CAUTION

The operating temperature of the coolant must never reach or exceed 250°F (120°C). If the operating temperature of the coolant reaches or exceeds 250°F (120°C), the internal components of the brake will be damaged. A forced cooling system may be required to assure that the coolant temperature remains below 250°F (120°C).

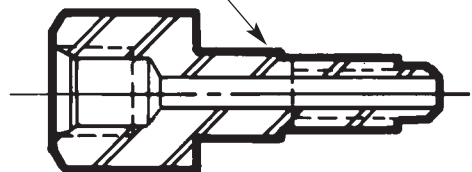
Figure 1.2 Two-Piece Brake Housing



Side View (2 Friction Disc Model Shown)

Figure 1.3

TAPERED SEAT
HYDRAULIC INLET
FITTING

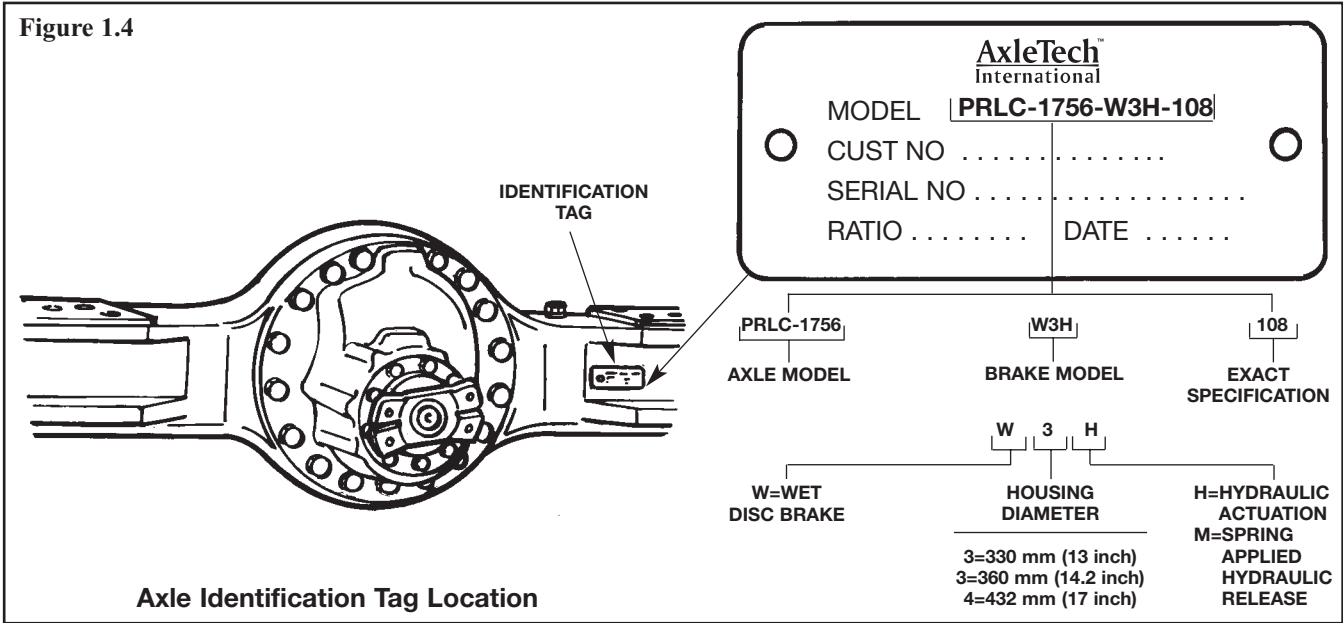


NOTE: SOME EARLY MODELS HAVE
TAPERED SEAT TYPE INLET
FITTING.

Identification

The brake model is indicated by the model number of the planetary axle on a tag on the axle housing. **Figure 1.4.**

The brake assembly can also be identified from the Bill of Material for the axle.



Section 2

Coolant Draining and Filling

Drain and Fill W3H, W4H, W4M, WDM Brake Housings



WARNING

To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.



WARNING

- *Use only the type of fluid specified by the equipment manufacturer. Do not use or mix different types of fluid. The wrong fluid will damage the rubber parts of the assemblies which could cause loss of braking and serious personal injury.*
- *Do not reuse hydraulic fluid or coolant. Used fluid can be contaminated and can cause incorrect operation which could result in serious personal injury.*

Change the coolant at the following times:

- **First Coolant Change:** after the first month or after the first 200-250 hours of operation.
- **Regular Maintenance Coolant Change:** every six months or every 3,000 hours of operation.

Sump Cooling Systems with Hub Seals

When hub seals are used in sump cooling systems, coolant is in each brake housing. At the specified times, coolant must be changed in each housing.

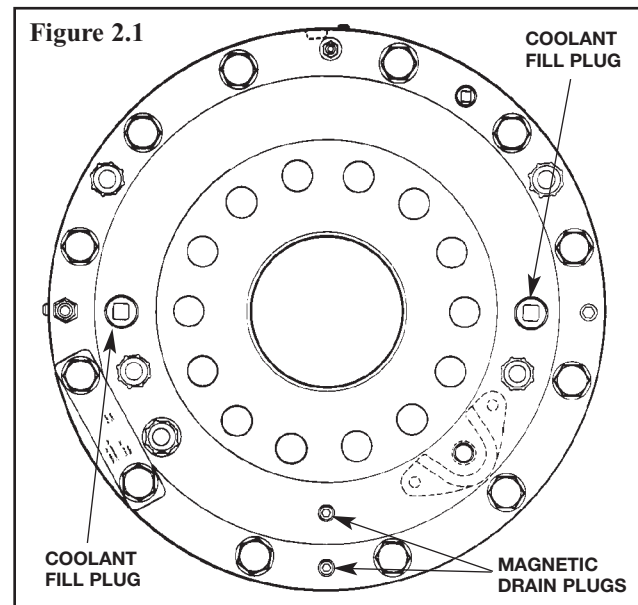
1. Make sure the axle and brake housing assembly is in a level position.
2. Put a container under each brake housing.

NOTE:

Dispose of all collected fluids in an environmentally friendly approved practice.

3. Remove the two magnetic drain plugs from the bottom of each brake housing. Drain the coolant from each brake housing into a suitable container. Discard the coolant. **Figure 2.1.**

Figure 2.1



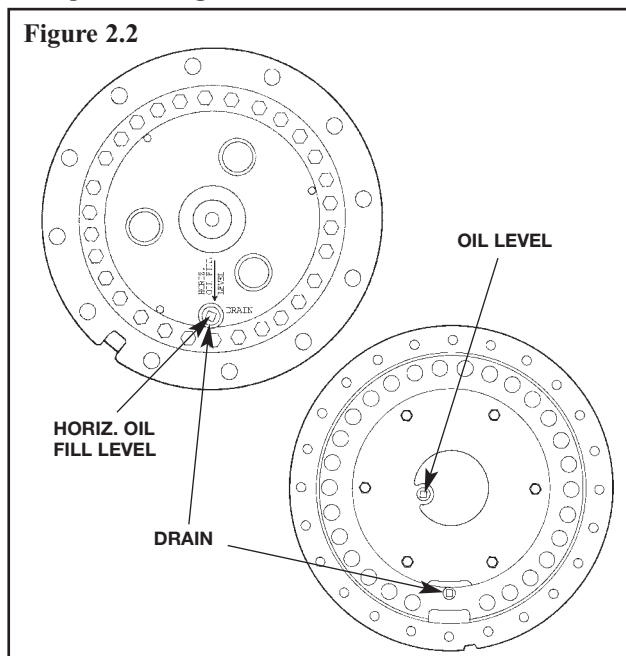
4. Clean the drain plugs. Install and tighten the drain plugs to a minimum torque of 20 lb-ft (27 N•m). **T**
5. Remove the coolant fill plugs located next to the fittings for the hydraulic fluid. **Figure 2.1.**
6. Fill the brake housings with the specified coolant until the coolant flows from the bottom of the holes for the fill plugs. See **Section 10, Specifications.**
7. Install and tighten the fill plugs to a minimum torque of 35 lb-ft (47 N•m). **T**
8. Operate the brakes. Check for leaks and that the brake system operates correctly.

Sump Cooling Systems without Hub Seals

In sump cooling systems without hub seals, the brake housings, wheel ends and axle housing use the same fluid. The fluid cools the discs in the brake housing and also lubricates and cools the components in the wheel ends and the axle housing. At the specified times, fluid must be changed in the complete assembly.

1. Make sure:

- The axle and brake housing assembly is in a level position.
- The drain plugs in the wheel ends are in the lowest position. **Figure 2.2.**



2. Put a container under:

- Each Brake Housing
- Each Wheel End.
- The Bottom of the Axle Housing.

NOTE:

When the assembly is drained be sure to remove all of the fluid.

3. Drain the fluid by removing the drain plugs from the bottom of:

- Each Wheel End. **Figure 2.2.**
- Each Brake Housing. **Figure 2.1.**
- The Axle Housing. **Figure 2.3.**

Discard the coolant in an environmentally friendly approved practice.

4. Clean the drain plugs. Install the drain plugs and tighten to a minimum torque of 20 lb-ft (27 N•m).



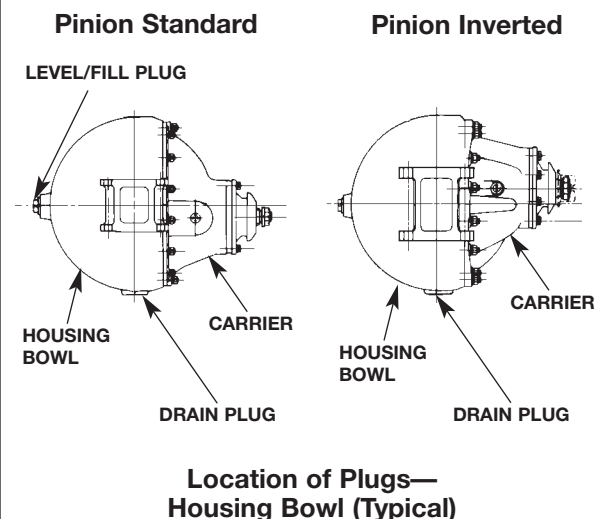
5. Rotate the wheel ends so the oil level line is horizontal.

NOTE:

When the assembly is filled, make sure the fluid flows through the complete assembly.

6. Remove the fill plug from the axle housing. Remove the OIL LEVEL plugs from the wheel ends. **Figure 2.2 and Figure 2.3.**

Figure 2.3



7. Fill the axle housing with the specified type and amount of fluid until fluid flows from the hole for the fill plug. **See Section 10, Specifications.**

8. Fill each wheel end until fluid flows from the OIL LEVEL holes.

Section 2

Coolant Draining and Filling

9. Install the fill plug in the axle housing and the OIL LEVEL plugs in the wheel ends. Tighten to the specified torque of the equipment manufacturer.



10. Operate the brakes. Check for leaks and that the brake system operates correctly.

NOTE:

Make sure coolant has been completely drained from all cooling lines and the coolant reservoir.

5. Clean the drain plugs. Install and tighten the drain plugs to a minimum torque of 20 lb-ft (27 N•m).



6. Fill the reservoir with the specified coolant. See **Section 10, Specifications.**

7. Loosen the plug in the top of the cover of the brake housing. When the housing is filled, the loose plug permits air to be removed. **Figure 2.4.**

8. Put the transmission in the NEUTRAL position and start the engine. When the level in the reservoir goes down, add coolant to adjust the level to the specified position. See the recommendations of the equipment manufacturer for the specified level in the reservoir. Stop the engine when the coolant leaks from the loose plug in the cover of the housing.

9. Tighten the plug at the top of the cover of the brake housing to the torque specified on page 51.



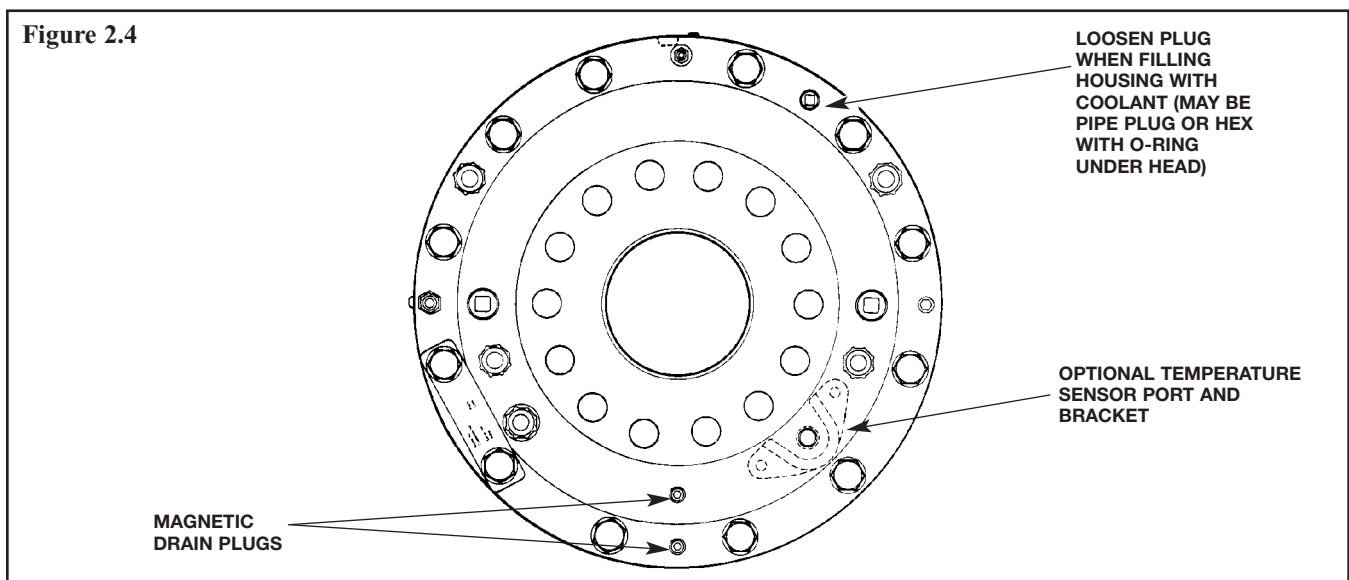
10. Operate the brakes. Check for leaks and that the brake system operates correctly.

Forced Cooling Systems

Brake housings with forced cooling systems use a pump to move coolant in and out of the housings. Coolant is supplied from a reservoir. The movement of coolant removes heat from the discs. A hub seal separates the brake housing from the wheel end assembly. At the specified times, coolant must be changed in the complete brake cooling system.

1. Make sure the axle and brake housing assembly is in a level position.
2. Put a container under each brake housing.
3. If the cooling system uses shut-off valves, make sure the valves are in the ON position so that fluid flows to the brake housing.
4. Remove the two magnetic drain plugs from the bottom of each brake housing. Drain the coolant from each brake housing. Discard the coolant in an environmentally friendly approved practice.

Figure 2.4.



Remove W3H, W4H, W4M, WDM Brake Housings



WARNING

To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.



WARNING

Support the vehicle with safety stands. Do not work under a vehicle only supported by jacks. Jacks can slip or fall over and cause serious injury.

1. Make sure the vehicle is on a level surface.
 2. Put blocks under the wheels not being serviced to keep the vehicle from moving.
 3. Raise the vehicle so that the wheels to be serviced are off the ground. Support the vehicle with safety stands.
 4. Remove the nuts that fasten the tire and rim assembly to the hub. Remove the tire and rim assembly.
 5. When a fluid change is necessary, drain the fluid from the axle housing. Put a suitable container under the axle housing. Remove the drain plug from the bottom of the axle housing. Drain the fluid from the axle housing. Install the drain plug. **Figure 2.3.**
- NOTE:**
Dispose of all collected fluids and grease in an environmentally friendly approved practice.
- NOTE:**
The fluid can also be drained from the wheel end by loosening the capscrews fastening the cover of the planetary spider to the hub. If necessary, use a sharp knife to cut the gasket material between the cover and the wheel hub. Do not remove the cover or the capscrews until all the fluid is drained.
6. Remove the drain plug from the wheel end. Drain the fluid from the wheel end. On some wheel ends, the bottom cap screw that fastens the cover to the planetary spider is used as a drain plug. Install the drain plug after the fluid is drained. **Figure 2.2.**
 7. Drain the coolant from the brake housing. Use one of the following procedures:

Drain Coolant: Forced Cooling Systems with Shut-off Valves

Use this procedure to remove the minimum amount of coolant from the forced cooling system:

- a. Put a container under the inboard side of the brake housing.
- b. Make sure the shut-off valves are in the OFF position so that coolant does not flow into the brake housing.
- c. Measure and record the amount of coolant that is drained from the housing. Remove the drain plugs from the bottom of the inboard side of the brake housing. Drain the coolant from the housing. **Figure 3.1.**
- d. When the coolant is drained, install the drain plug.

Drain Coolant: Forced Cooling Systems without Shut-off Valves

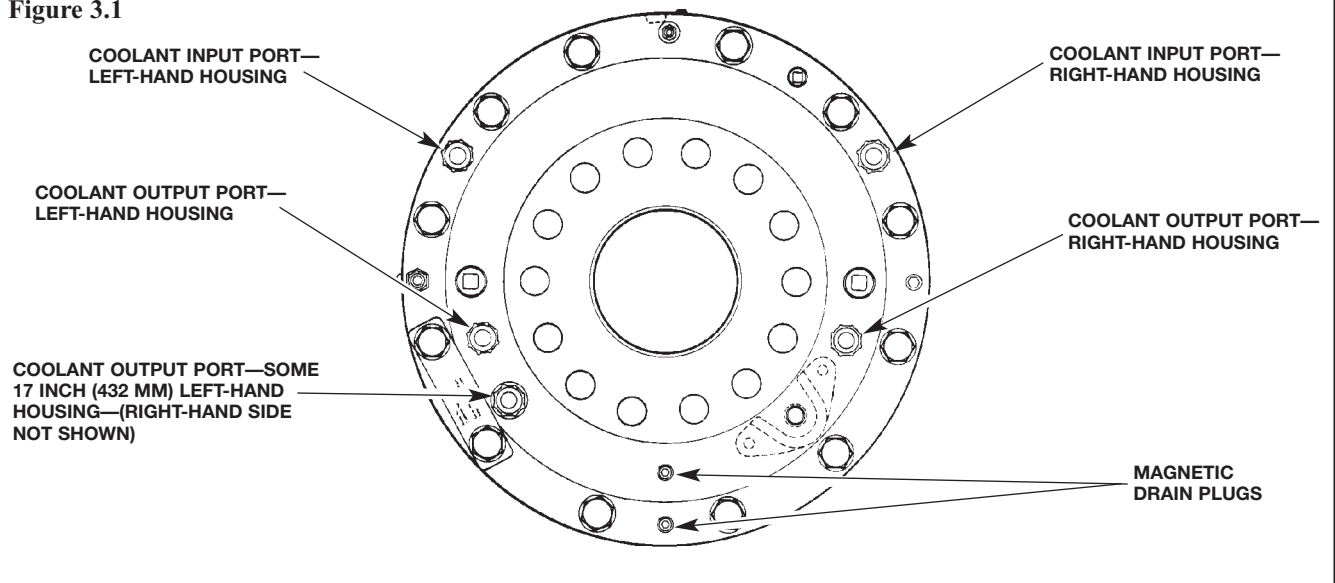
Use this procedure to remove the minimum amount of coolant from the forced cooling system:

- a. Put a container under the inboard side of the brake housing.
- b. Disconnect the coolant input line from the brake housing. Put a plug in the coolant input line. Drain the coolant until the coolant does not flow from the input port. **Figure 3.1.**
- c. Disconnect the coolant output line from the brake housing. Put a plug in the coolant output line. Drain the coolant until the coolant does not flow from the output port. **Figure 3.1.**

Section 3

Removal

Figure 3.1



- c. Disconnect the coolant output line from the brake housing. Put a plug in the coolant output line. Drain the coolant until the coolant does not flow from the output port. **Figure 3.1.**
- d. Measure and record the amount of coolant that is drained from the housing. Remove the drain plug from the bottom of the brake housing. Drain all of the coolant that remains in the brake housing.
- e. After the coolant is drained, install the drain plug.

Drain Coolant: Sump Cooling System

NOTE:

On housings without hub seals most of the coolant is removed when the fluid is removed from the wheel end.

- a. Put a suitable container under the inboard side of the brake housing.
- b. Remove the drain plug from the bottom of the brake housing. Drain all of the coolant from the brake housing. **Figure 2.1.**
- c. After the coolant is drained, install the drain plug.

NOTE:

AxleTech axles commonly use either a medium or high strength thread locker applied to capscrew threads. Reference F.M.M. 9 Series for specific thread locker information.

NOTE:

Procedures in Steps 8-17 are Recommended for Typical AxleTech Axle Wheel Ends.

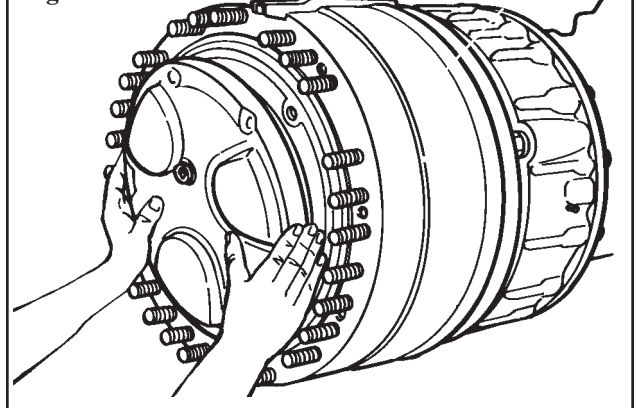


CAUTION

Use a sharp knife to remove gasket material from parts. Be careful not to damage the ground or polished surfaces.

8. If the wheel end has a planetary cover, remove the capscrews that fasten the cover of the planetary spider to the wheel end. Remove the cover from the planetary spider. Remove all gasket material from the cover-to-planetary spider mounting surfaces. **Figure 3.2.**

Figure 3.2



9. If possible, pull the axle shaft straight out of the axle housing (wheel ends with planetary covers only). The thrust washer can remain behind the sun gear when the axle shaft is removed. **If the axle shaft cannot be removed, the planetary spider must be removed before the axle shaft.** Figure 3.3 and Figure 3.4.

Figure 3.3

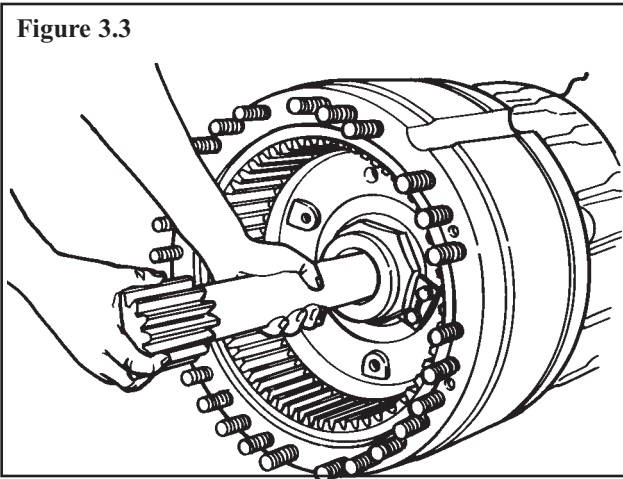
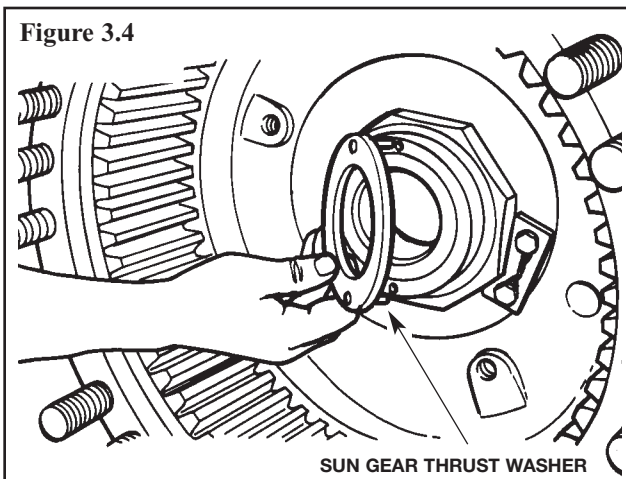


Figure 3.4



NOTE:

The sun gear is held on the axle shaft with a snap ring. Do not disassemble the axle shaft. If the axle shaft needs to be serviced, see AxleTech Maintenance Manual Number 9 series.

10. Remove the capscrews and washers that fasten the planetary spider to the wheel hub.
11. Separate, but do not remove, the planetary spider from the wheel hub.

- **Planetary Spider with Notches:** Put a pry bar in the notches of the assembly to separate the planetary spider from the wheel hub. **Do not use a pry bar to separate the planetary spider from the wheel hub if notches are not used in the assembly.**

- **Planetary Spider with Puller Holes:** Install a cap screw that is the correct size in the puller holes in the planetary spider until the capscrews touch the hub. Tighten each cap screw the same amount until the assembly separates from the hub.



WARNING

Do not hit steel parts with a steel hammer. Parts can break and cause serious personal injury.

- If puller holes or notches are not on the planetary spider, tap on the assembly with a plastic or leather mallet to separate it from the hub.



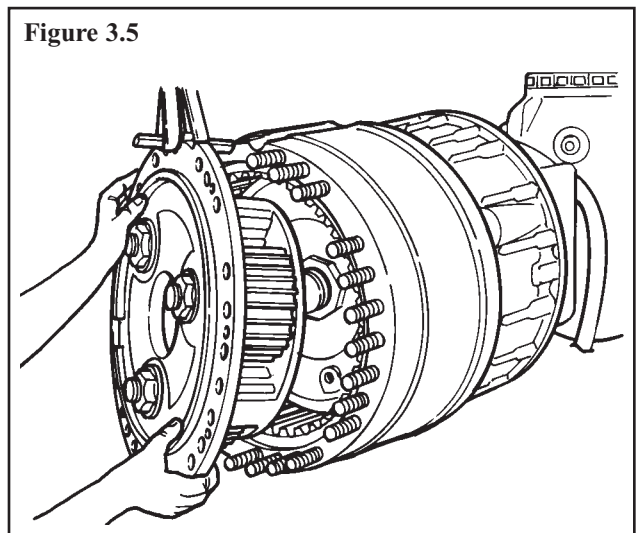
WARNING

To avoid serious personal injury and possible damage to components, be very careful when using lifting devices.

- *Inspect to make sure that neither lifting strap is damaged.*
- *Do not subject lifting straps to any shock or drop loading.*

12. Use a lifting device to remove the planetary spider from the wheel hub. **Figure 3.5.** If the axle shaft has not been removed, remove it at this time.

Figure 3.5



Section 3 Removal

NOTE:

If the planetary spider needs to be serviced, see AxleTech Maintenance Manual Number 9 series.



WARNING

Support the wheel end before removing the wheel bearing adjusting nut or the wheel end may fall off the spindle and cause damage or serious personal injury.

13. Support the wheel hub with a lifting device and strap.
14. Remove ring gear, spindle nut and ring gear hub with one of the following procedures:

NOTE:

Make sure wheel hub is supported when spindle nut and ring gear hub are removed.

All axle models (except PRC and PRS 130-265):

- a. Remove ring gear.

NOTE:

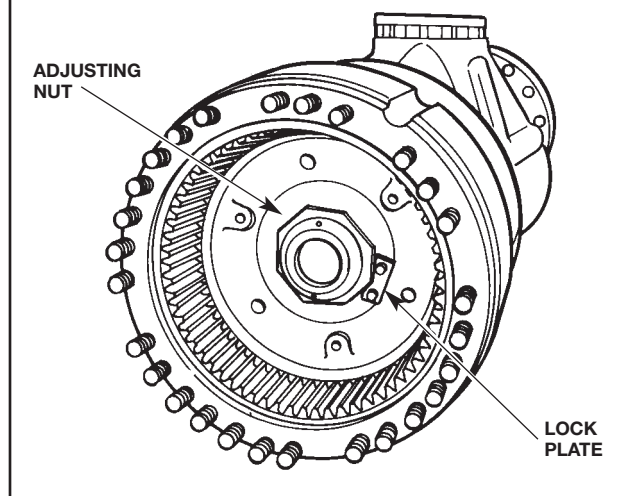
On some PRC 4805 and PRC 7314 axles, the ring gear is secured to the ring gear hub. If the ring gear and ring gear hub are bolted together, first remove the spindle nut and then remove the ring gear and hub as an assembly.

- b. Remove wheel bearing adjusting nut. Wheel bearing adjusting nuts may be either single or double nut construction.

Single nut used:

Remove two screws that fasten adjusting nut lock plate to ring gear hub. Remove adjusting nut lock plate. Remove adjusting nut from spindle. **Figure 3.6.**

Figure 3.6



Double nut used:

Remove jam nut, locking washer and adjusting nut.

NOTE:

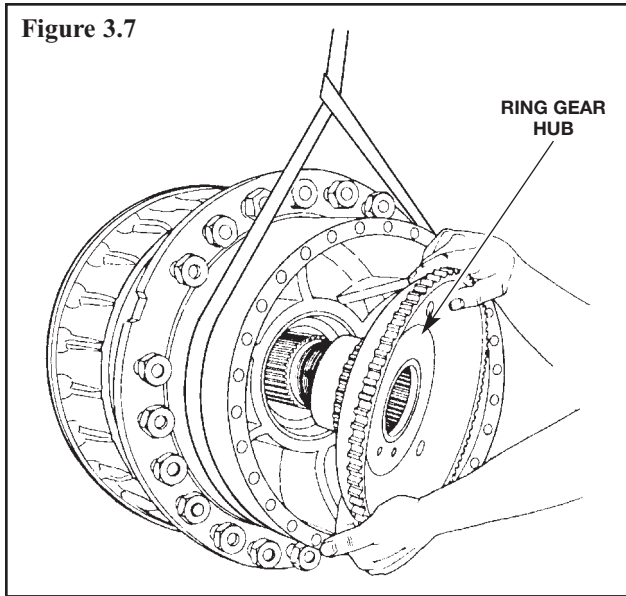
For alternate spindle lock nut designs, see AxleTech Maintenance Manual Number 9 series for your specific model.



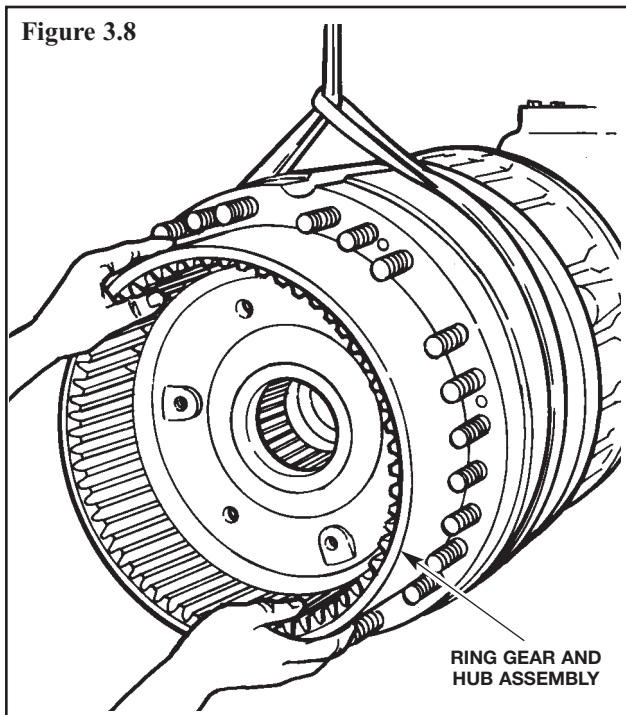
CAUTION

The outer bearing cone is mounted on the ring gear hub. Be careful not to drop the outer bearing cone when the ring gear is removed. Damage can occur.

- c. Remove ring gear hub by pulling it straight out of wheel hub and off spindle. **Figure 3.7.**



- If ring gear and ring gear hub are bolted together (some PRC 4805 and 7314 axles), remove the assembly. **Figure 3.8.**



- If ring gear hub cannot be removed by hand, install capscrews in the puller holes. Tighten each cap screw the same amount to separate the hub of the ring gear from the wheel hub.



WARNING

Do not hit steel parts with a steel hammer. Parts can break and cause serious personal injury.

- If puller holes are not used, tap on the hub of the ring gear with a leather or plastic hammer to separate it from the wheel hub.

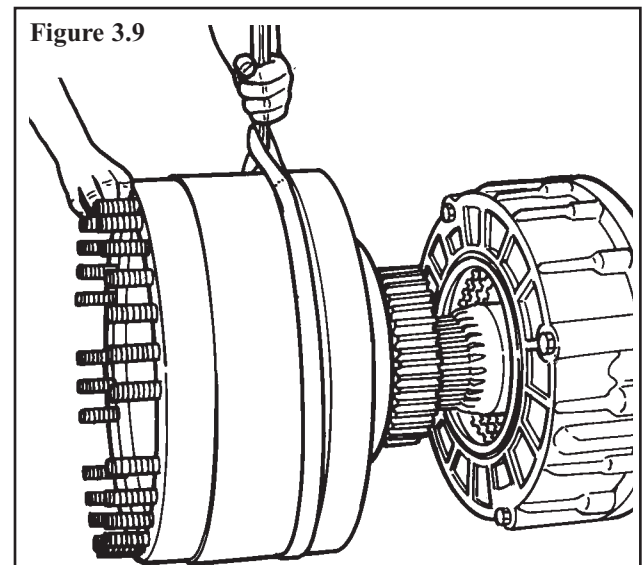
Axles models PRC and PRS 130-265:

- Remove ring gear.
- Remove dowel from adjusting nut.
- Remove adjusting nut.
- Remove outer bearing cone from spindle.

NOTE:

If the hub of the ring gear or ring gear needs to be serviced, see AxleTech Maintenance Manual Number 9 series.

- Remove the wheel hub. Pull the wheel hub out of the brake housing and off the spindle. Put the wheel hub on the floor so that the splines are toward you. **Figure 3.9.**



Section 3 Removal

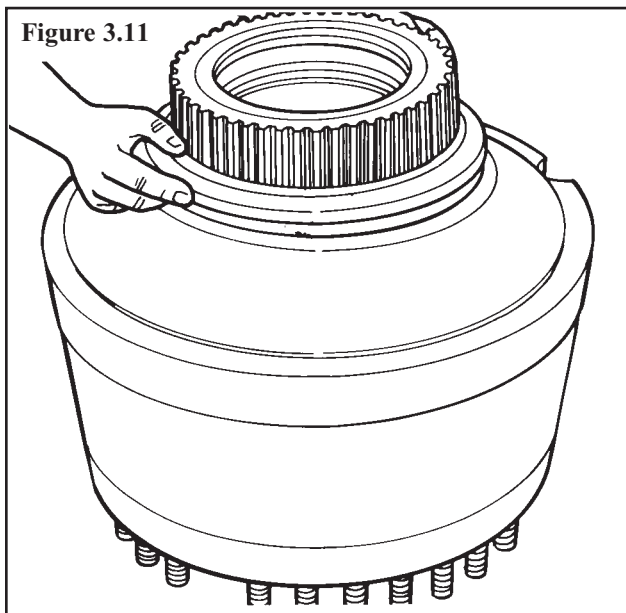
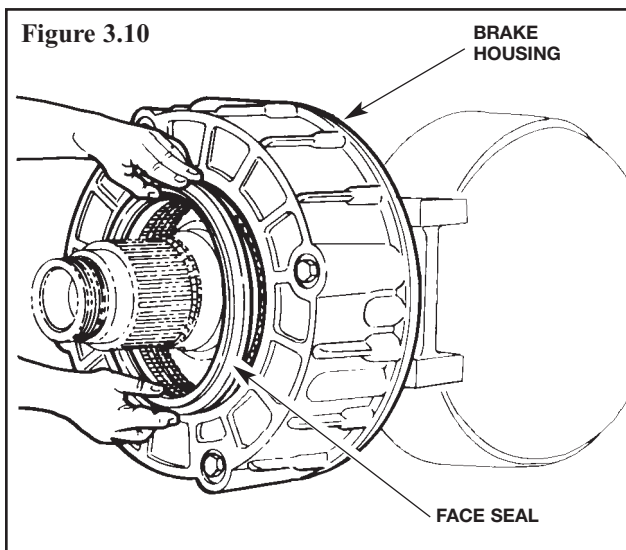


CAUTION

Do not drop the metal sealing rings. The sealing rings are damaged if they are dropped.

16. Remove the face seals. Remove the inner face seal from the inside of the brake housing. Remove the outer face seal from the wheel hub. Separate the rubber elements from the metal sealing rings.

Figure 3.10 and Figure 3.11.



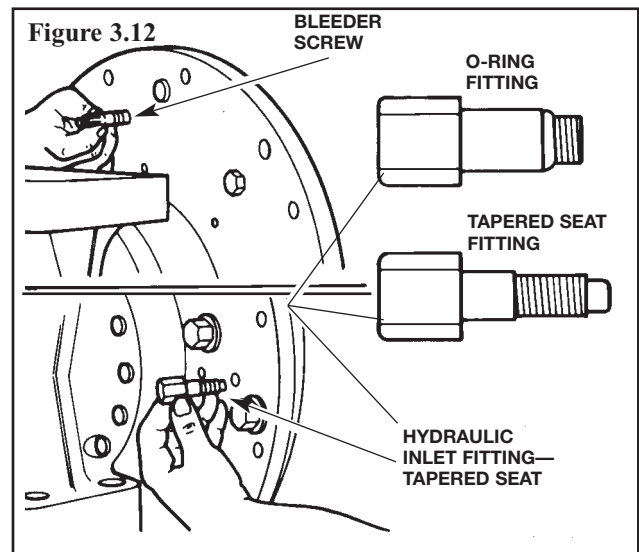
NOTE:

If these parts are intended to be reused, care should be taken to not scratch or damage the shiny metal sealing faces and keep them clean.

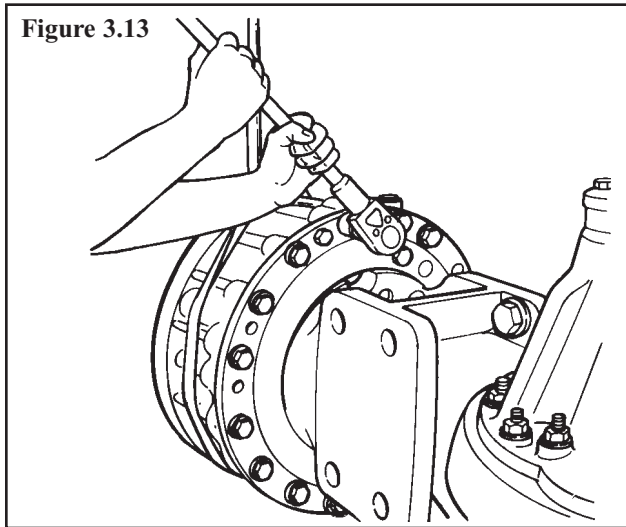
17. If equipped, remove the capscrews and washers that fasten the bracket and the temperature sensor to the cover of the brake housing. Remove the bracket and the sensor.

18. Remove the following components from the back (inboard) side of the cover of the brake housing. **Figure 3.12.**

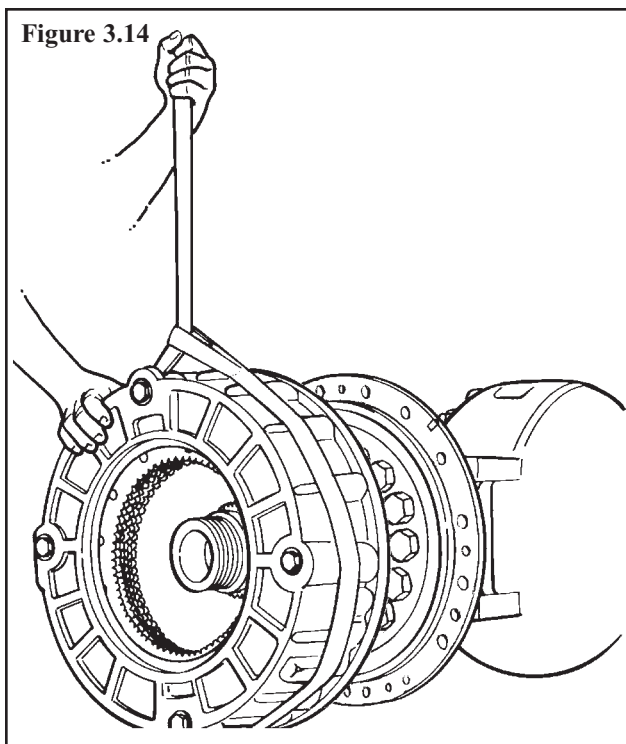
- Bleeder Screw.
- Inlet Fitting for the Hydraulic Line. Two types of fittings are used: a tapered seat fitting and an O-ring fitting.
- Plug. The plug is opposite from the hydraulic line fitting.



19. Make sure the brake housing is supported. Remove the capscrews and the washers that fasten the cover to the brake housing. **Figure 3.13.**



20. Use the lifting device to remove the brake housing from the cover. **Figure 3.14.**



21. Remove all gasket material from the mounting surfaces between the brake housing and the cover.
22. If damaged or leaking, remove and discard the hub oil seals from the inner diameter of the wheel hub. Some axle assemblies use a two piece brake driver and wheel hub assembly. The brake driver may need to be removed prior to removing the spindle-to-hub seals.

NOTE:

One or two hub oil seals are used on all brake housings with forced cooling and on most brake housings with sump cooling.



CAUTION

Do not damage the spindle in the areas where the seals are installed when you remove the capscrews and the washers.

23. If necessary, remove the spindle and the cover of the brake housing from the axle housing according to the following procedure.

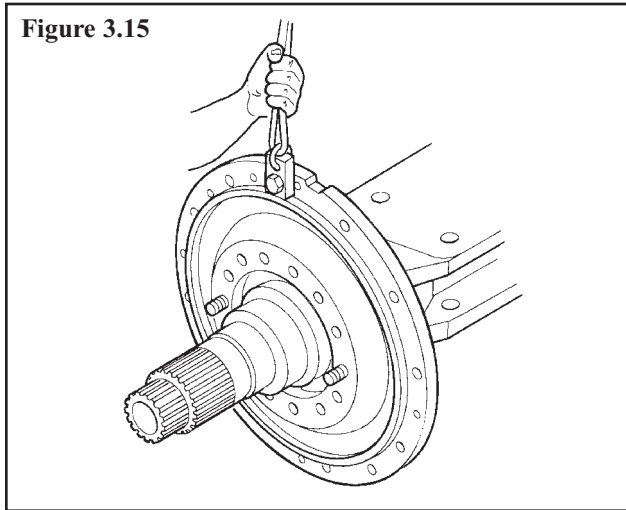
NOTE:

On some axle assemblies, the brake cover is mounted between the spindle and axle housing flanges. To remove the spindle and brake cover, use the following procedure, but remove the spindle first, followed by the brake cover.

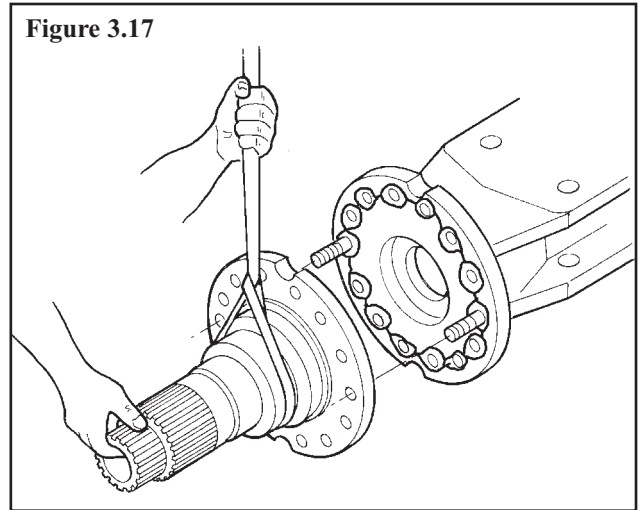
- a. Support the cover of the brake housing with a lifting device.

Section 3 Removal

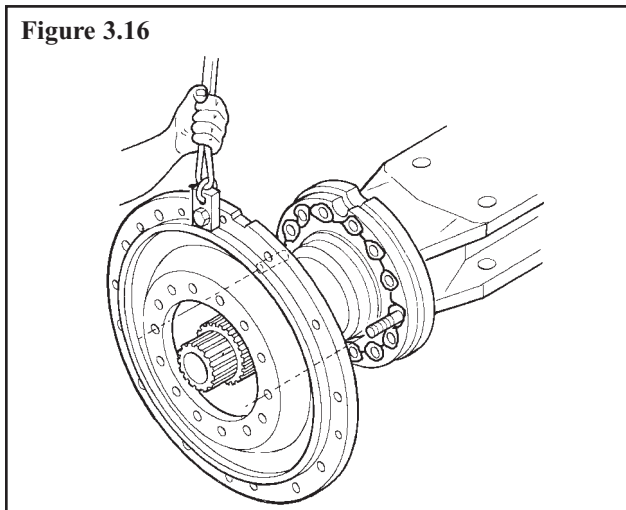
- b. Remove two of the capscrews that fasten the brake cover and spindle to the axle housing. Replace them with two studs. Remove the remaining capscrews. **Figure 3.15.**



- d. Use a lifting device to remove the spindle. If necessary, tap the spindle with a rubber or plastic hammer to separate it from the axle housing. **Figure 3.17.**



- c. Hold the spindle against the axle housing. Use a lifting device to remove the brake cover. If necessary, tap the brake cover with a rubber or plastic hammer to separate it from the spindle. **Figure 3.16.**



- e. Remove all gasket material from the mounting surfaces of the cover, spindle and axle housing.

Disassemble W3H and W4H Brake Housings



WARNING

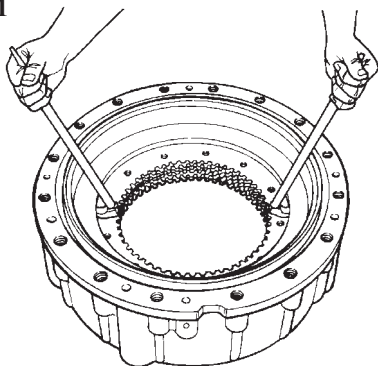
To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.

NOTE:

To Disassemble the W4M brake refer to page 33.

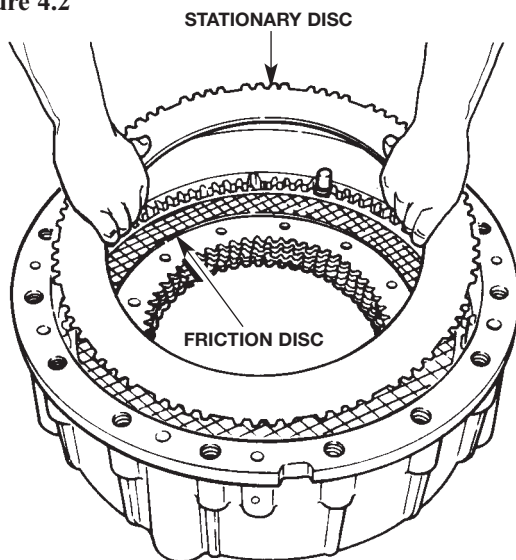
1. Put the appropriate pry bars under the inner diameter of the piston to lift the piston out of the housing. The two piston seals and the seal spacer are removed when the piston is removed from the housing. **Figure 4.1.**

Figure 4.1



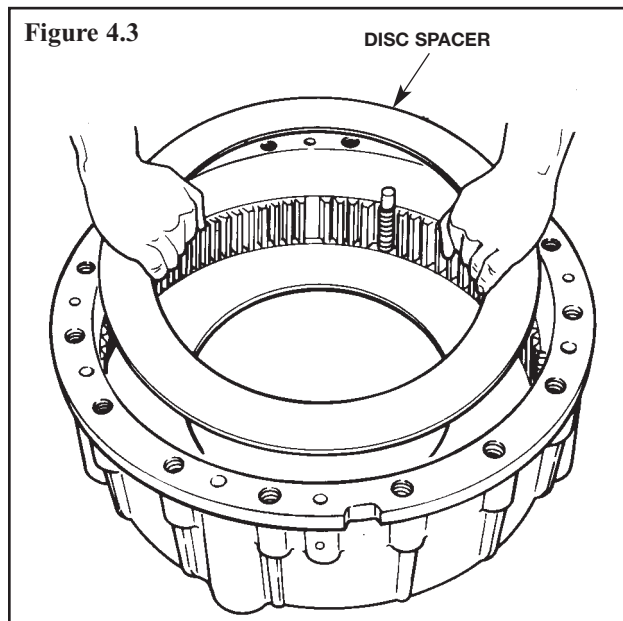
2. Remove the stationary discs and the friction discs from the brake housing. **Figure 4.2.**

Figure 4.2



3. Remove the disc spacer from the bottom of the brake housing. **Figure 4.3.**

Figure 4.3

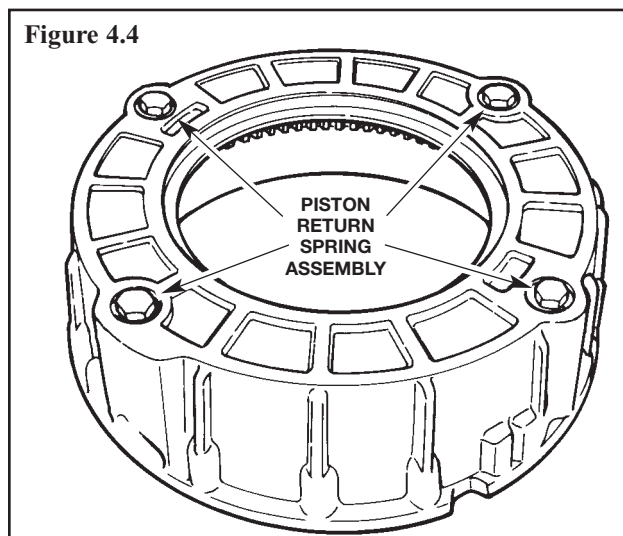


NOTE:

Some brake assemblies use a spacer and standard stationary disc. Some use a single thick splined stationary disc as the first disc against the housing instead of a spacer and standard stationary disc combination. Brake housings are designed to use only one type of disc configuration. Do not interchange parts.

4. If necessary, remove the four piston return spring assemblies with the following procedure. **Figure 4.4.**

Figure 4.4



Section 4

Disassembly



WARNING

The piston return spring applies pressure to the plug. Use the following procedure or the spring can push the plug out of the housing with enough force to cause serious personal injury.

- Put the brake housing on a bench so that the outboard side is toward you.

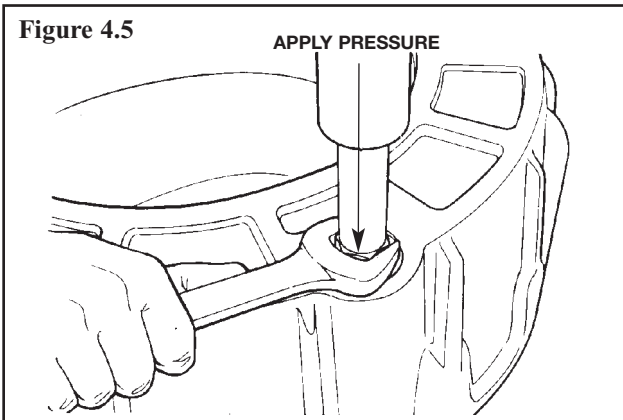


WARNING

Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components.

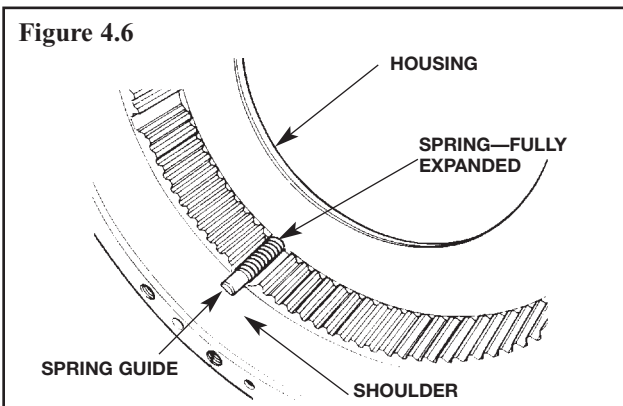
- Use a press to apply and keep pressure on the plug.
Figure 4.5.

Figure 4.5



- Slowly release pressure while loosening the plug until the threads are completely disengaged and the spring is fully expanded. Figure 4.6.

Figure 4.6

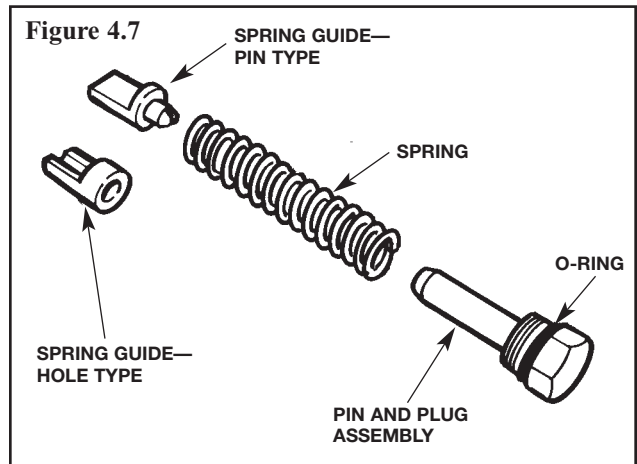


- Remove the plug and pin assembly, the spring and the spring guide from the housing.

NOTE:

Two types of spring guides are used. One type of guide has a pin on the bottom that is installed inside the spring. The other type of guide has a hole in the bottom so that the end of the pin is installed inside the guide. Figure 4.7.

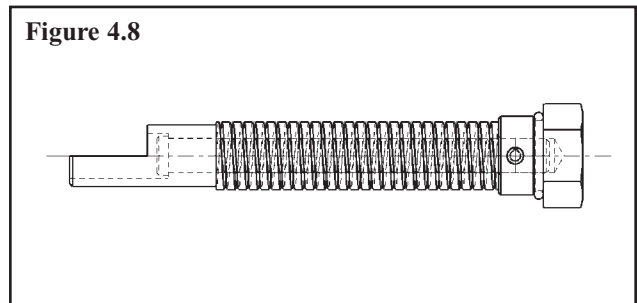
Figure 4.7



- Inspect the O-ring on the plug. If necessary, remove and replace the O-ring.

Newer designs are one-piece integral units which are easier to install. Figure 4.8.

Figure 4.8



Disassemble W4M and WDM Brake Housing



WARNING

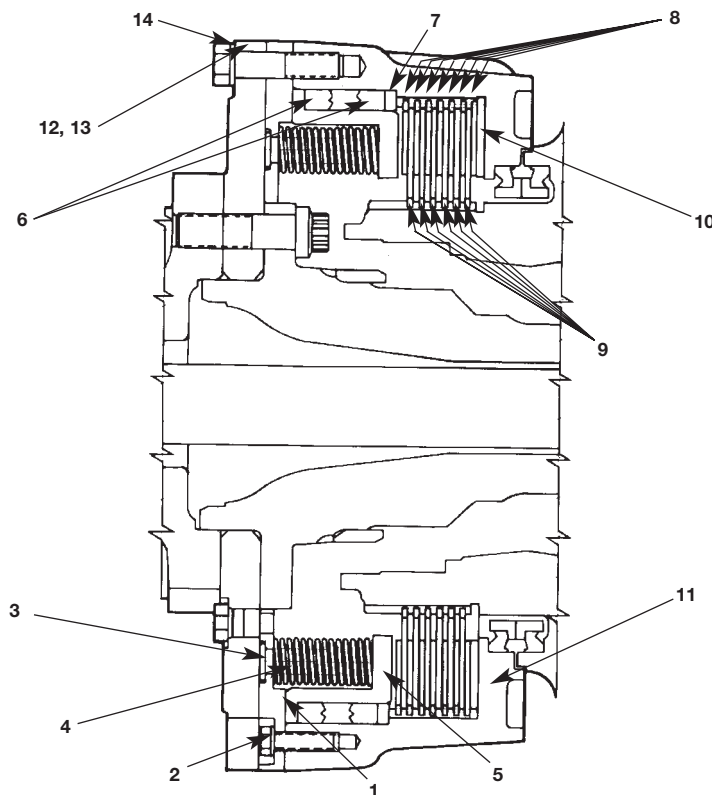
- *Cage the W4M and WDM brake in a press before disassembly or serious personal injury may result due to the sudden release of spring pressure.*

- *Observe all WARNINGS and CAUTIONS provided by the press manufacturer concerning press operation to avoid serious personal injury and possible damage to components.*

NOTE:

Numbers in parenthesis refer to the W4M Spring Applied Hydraulic Release Brake parts as they appear in Figure 4.9.

Figure 4.9

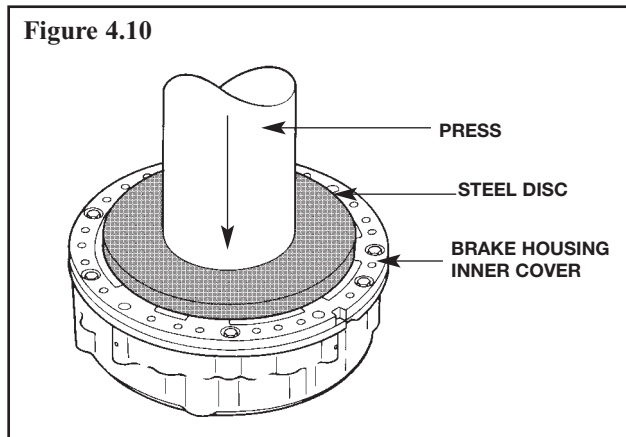


Item	Description
1	Brake Housing Inner Cover
2	Capscrews
3	Spring Retaining Pins
4	Springs
5	Piston
6	Piston Seals
7	Piston Seal Back Up Ring

Item	Description
8	Stationary Discs
9	Friction Discs
10	Brake Housing to Stationary Disc Spacer
11	Brake Housing
12	Brake Mounting Cover, R. H.
13	Brake Mounting Cover, L. H.
14	Washers

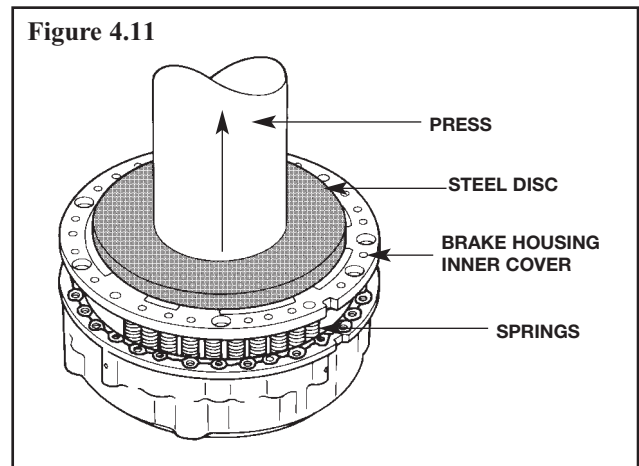
Section 4 Disassembly

1. Cage the brake housing in a press before disassembly to prevent sudden spring release. Place a solid steel disc approximately 17 inch diameter X 1 inch thick (431.8 mm X 25.4 mm) on the brake housing inner cover (1). **Figure 4.10.**



2. Apply 20 tons (18,144 Kg) of force to the center of the disc to cage the brake.
3. After caging the brake, remove the capscrews (2) that fasten the brake housing inner cover to the brake housing.

4. Slowly relieve the force from the press. This allows the springs to expand slowly for safe disassembly. **Figure 4.11.**



5. Remove the brake housing inner cover (1), spring retaining pins (3), springs (4) and piston (5).
6. Remove the piston seals (6) and piston seal back up ring (7).
7. Remove the stationary discs (8), friction discs (9) and disc spacer (10).

Clean Ground and Polished Parts



WARNING

To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.



WARNING

If you use cleaning solvents, hot solution tanks or alkaline solutions incorrectly, serious personal injury can occur. To prevent serious personal injury, follow the instructions supplied by the manufacturer of these products. Do NOT use gasoline to clean parts. Gasoline can explode and cause serious personal injury.



CAUTION

- *Use only solvent cleaners to clean ground or polished metal parts. Hot solution tanks or water and alkaline solutions will damage these parts. Isopropyl alcohol, kerosene or diesel fuel can be used for this purpose.*
- *If required, use a sharp knife to remove gasket material from parts. Be careful not to damage the ground or polished surfaces.*

Clean Parts with Rough Finish

NOTE:

Do not clean friction discs. Wipe off each disc with a clean rag before applying brake cooling fluid to their surfaces during assembly.

- Parts with a rough finish can be cleaned with cleaning solvent or in a hot solution tank with a weak alkaline solution. DO NOT USE GASOLINE.
- Parts must remain in hot solution tanks until completely cleaned and heated.
- Remove parts from the hot solution and wash them with water until the hot solution is removed.

Clean Wet Disc Brake and Axle Assembly

- Use steam to clean the wet disc brake and axle assembly on the outside to remove dirt.

- Before the assembly is cleaned, close or put a cover over all openings. Breathers or vents in the axle assembly are some examples of openings.

Dry Cleaned Parts

- Dry the parts immediately after the parts are cleaned and washed.
- Dry the parts with soft, clean paper or rags.



CAUTION

The bearing cones can be damaged if the cones are dried by rotating with compressed air.

- The parts, except the bearing cones, can be dried with compressed air.

Prevent Corrosion and Rust on Cleaned Parts

- Apply the fluid used in the brake housing to the cleaned and the dried parts that are not damaged and are to be assembled. See **Section 10, Coolant and Hydraulic Fluid Specifications**.
- Apply a special material that prevents corrosion and rust to all surfaces. If parts are to be stored, put the parts in a special paper that prevents corrosion and rust.

Inspect Parts

Inspect all the parts before assembling the wet disc brake. Check all parts for wear and replace the damaged parts. Replacing worn or damaged parts prevents the failure of the assembly later.

Inspect Face Seals

Inspect the rubber elements and metal rings for wear, damage or distortion. If there is a problem with either ring, then always replace both rings with a matched pair of rings. A matched pair is two new rings or two used rings that have been run together. Do **not** use one new and one used ring or two used rings that were not run together or leaks may occur. **Figure 5.1** and **Figure 5.2** show 2 styles of face seals — **Figure 5.1** with the Belleville Washer style energizers and **Figure 5.2** with the Toric Ring (TRS) style energizers.

Section 5

Prepare Parts for Assembly

Figure 5.1

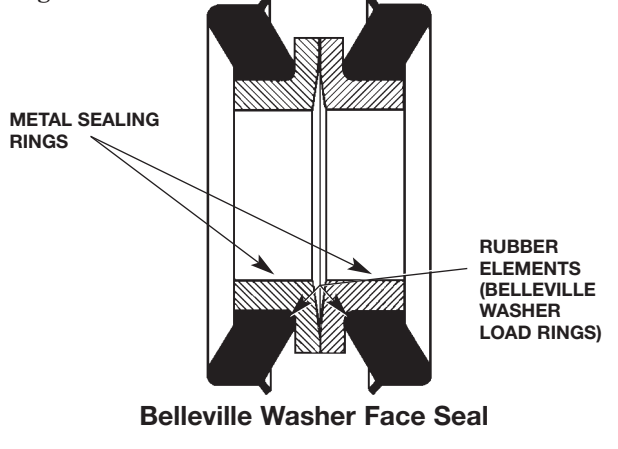
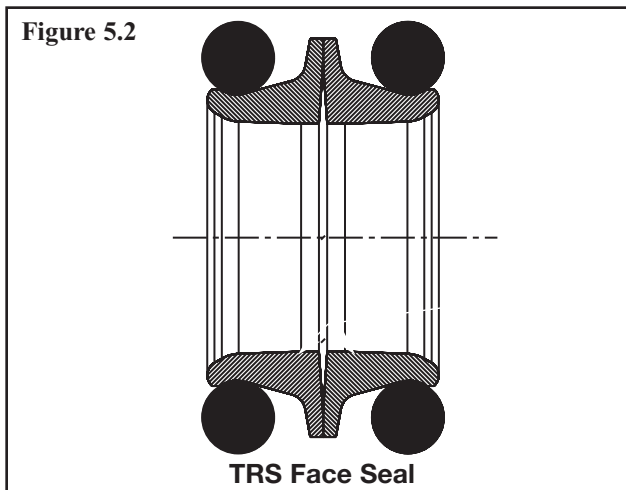


Figure 5.2



Inspect Discs

If any of the following conditions exist with a friction or stationary disc, replace full disc stack:

- Thickness worn beyond limits
- Uneven wear
- Localized surface damage
- Warpage
- Scoring
- Damaged splines

NOTE:

If discs are reusable, maintain disc stack order.

Disc Wear Limits

If thickness of any friction or stationary disc is less than or equal to overall thickness limits, replace full disc stack.

FRICITION DISCS (Hydraulic Apply Brakes Only):

Disc Size	Part No.	Overall Thickness Limit
13 in (330 mm)	3281-Y-25	0.167 in (4.25 mm)
17 in (432 mm)	3281-S-19	0.192 in (4.87 mm)
	3281-K-37	0.192 in (4.87 mm)

STATIONARY DISCS (Hydraulic Apply Brakes Only):

Disc Size	Part No.	Overall Thickness Limit
13 in (330 mm)	3281-X-24	0.109 in (2.76 mm)
17 in (432 mm)	3281-W-23	0.121 in (3.07 mm)
17 in (432 mm)	3281-P-42	0.175 in (4.44 mm)

NOTE:

For W4M Spring Applied/Hydraulic Release brake disc wear limits, consult AxleTech.

Repair or Replace Parts

Replace worn or damaged parts of the wet disc brake assembly. The following are some examples to check.

1. Replace any fasteners if the corners of the head are worn.
2. Replace the washers if damaged.
3. Replace the oil seals, face seals and gaskets when the components are separated from each other.
4. Clean the parts before applying silicone gasket material.
5. Remove small damage from the parts that have machined or ground surfaces. Use a fine-tooth file, india stone, emery cloth or crocus cloth for this purpose.
6. Clean and repair the threads of the fasteners and the holes. Use a tap or a die of the correct size or a fine-tooth file for this purpose.



CAUTION

The threads must be clean and not damaged so that accurate adjustments and correct torque values can be applied to fasteners and parts.

7. Tighten all fasteners to the correct torque value. See **Section 10, Torque Chart** for the torque value of the fasteners.



Fasteners

Removing Fasteners Secured With Adhesive

If it is difficult to remove fasteners secured with Dri-Lock®, AxleTech adhesive or Loctite 277® adhesive, use the following procedure.



CAUTION

Do not exceed 177° C (350° F) maximum. Heating must be done slowly to prevent thermal stresses in the other components.

1. Heat the fastener for three to five seconds. Try to loosen the fastener with a wrench. Do not use an impact wrench or hit the fastener with a hammer.
2. Repeat Step 1 until you can remove the fastener.

New Fasteners With Pre-Applied Adhesive

NOTE:

No drying time is required of fasteners with pre-applied adhesive.

1. Use a wire brush to clean the oil and dirt from threaded holes.
2. Install new fasteners with pre-applied adhesive to assemble parts. Do not apply adhesives or sealants to fasteners with pre-applied adhesive, or to fastener holes.
3. Tighten the fasteners to the required torque value for that size fastener. Refer to “Torque Table” in Section 6, when tightening all fasteners.



Original or Used Fasteners

Use a wire brush to clean the oil, dirt and old adhesive from all threads and threaded holes.

Apply Silicone (RTV) Gasket Material

Silicone (RTV) gasket material is used between the following mounting surfaces:

- Axle Housing and Spindle (or Cover)
- Spindle and Cover
- Brake Housing and Cover
- Wheel Hub and Planetary Spider Assembly
- Planetary Spider Assembly and Cover

NOTE:

The following silicone gasket products or equivalent can be used on AxleTech components.

1. From AxleTech:
 - Ten ounce tubes, Part Number 2297-G-5259
 - Three ounce tubes, Part Number 2297-Z-6656
2. Dow Corning Silicone Rubber Sealant, Number 737.
3. General Electric, Number RTV-1673LV.
4. General Electric, Number RTV-123.
5. Dow Corning (Europe), Number Q3-7098



WARNING

Small amounts of acid vapor are present when applying some silicone gasket materials. To prevent possible serious personal injury, make sure there is good ventilation in the work area. If the silicone gasket material gets in your eyes, flush your eyes with water for 15 minutes. Have your eyes checked by a doctor.

1. Remove all gasket material from both surfaces.
2. Clean the surfaces where the silicone gasket material will be applied. Remove all oil, grease, dirt and moisture.
3. Dry both surfaces.
4. Apply a 0.125 inch maximum (3.0 mm) diameter continuous bead of the silicone gasket material around the edge of all the fastener holes and ports on that surface. Flatten or smear the bead of silicone around the ports on the brake housing. Do not get silicone into the ports or the brake housing bore.



CAUTION

Do not exceed a 0.125 inch maximum (3.0 mm) diameter bead of silicone gasket material. Too much gasket material blocks the passages and damages the components.

5. Assemble the components immediately to permit the silicone gasket material to compress equally between the parts. Tighten the fasteners to the required torque value for that size fastener. There is not a special procedure or an additional torque value required.
6. Wait 20 minutes before filling the assembly with fluid.

Assemble W3H and W4H Brake Housings



WARNING

To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.

NOTE:

To assemble the W4M brake refer to page 28.

1. If the piston return spring assemblies were removed, the assemblies must be installed in the housing. See the following procedure.

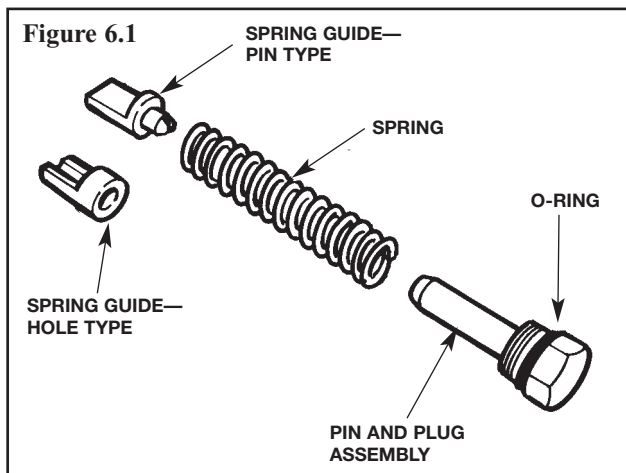


WARNING

The piston return spring applies pressure to the plug. Use the following procedure or the spring can push the plug out of the housing with enough force to cause serious personal injury.

NOTE:

Two types of spring guides are used. One type of guide has a pin on the bottom that is installed inside the spring. The other type of guide has a hole in the bottom so that the end of the pin is installed in the guide. Use the correct parts for the piston return spring assembly. Do not mix parts of the different assemblies. Use only one type of spring guide on each brake housing assembly. Figure 6.1.



- a. Put the brake housing so that the wheel hub side of the housing is toward you.
- b. Install the O-ring on the plug.
- c. Put the spring guide inside the brake housing below the plug hole. Make sure the flat area of the guide is against the housing.
- d. Install the spring on top of the guide.
- e. Put the plug and pin assembly in the hole in the brake housing and through the return spring.

NOTE:

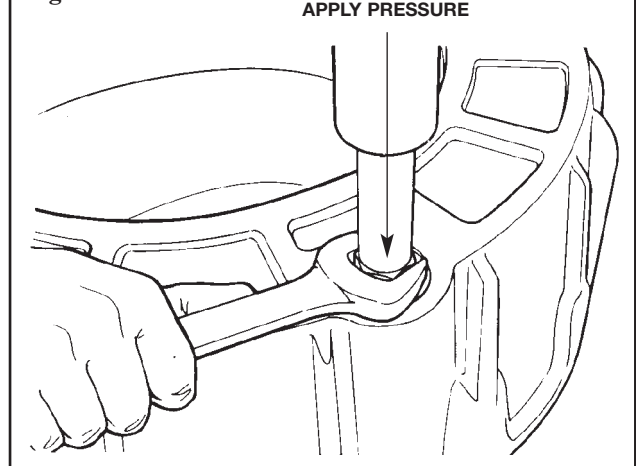
Newer designs are one-piece integral units which are easier to install. Figure 6.2.

Figure 6.2

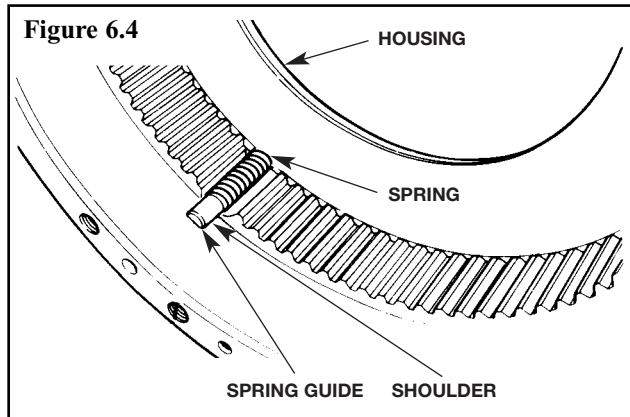


- f. Apply and hold pressure on the plug while the plug is installed into the housing see Figure 6.3. Make sure that the pin is correctly installed in the spring guide and that the flat areas on the spring guide are against the housing. Figure 6.4.

Figure 6.3

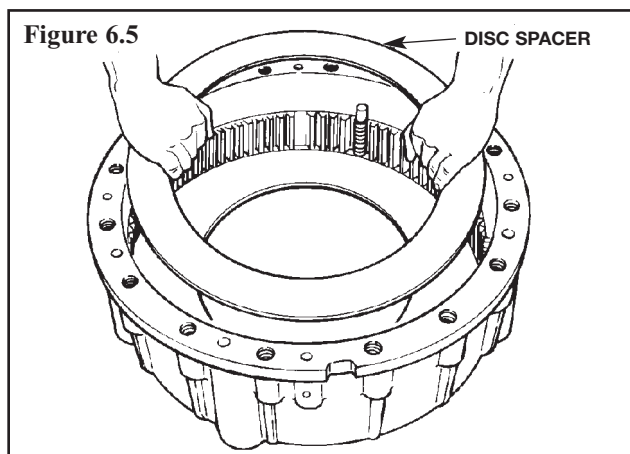


- g. When the threads fully engage the housing, release the pressure on the plug. **Figure 6.4.**



- h. Tighten the plug to 60-75 lb-ft (81-102 N•m). **T**

7. Put the brake housing on a bench. The cover side of the housing must be toward you.
- a. Make sure the housing walls are clean and checked for nicks and the housing entrance chamfers free of nicks and/or burrs (same for the piston, all OD surfaces).
8. Install the disc spacer in the bottom of the brake housing. **Figure 6.5.**

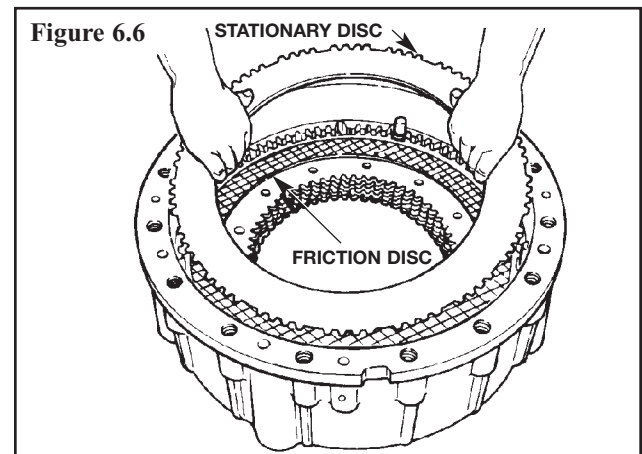


9. Install the disc pack as follows:
- a. Apply the same fluid used in the brake cooling system to the disc surfaces as the discs are installed.

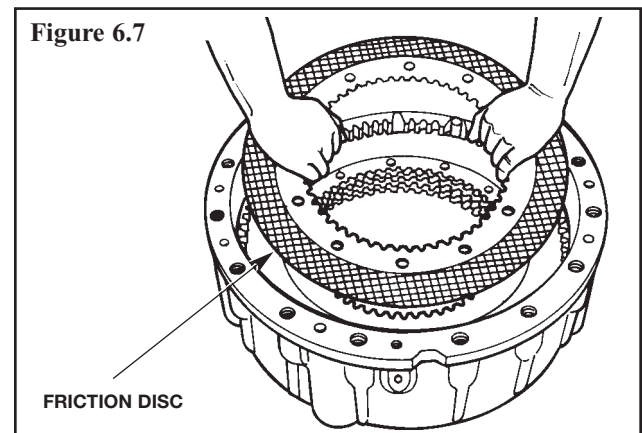
NOTE:

To help avoid premature friction disc wear, it is recommended that the new friction discs be soaked overnight before doing heavy braking. This can be accomplished by soaking prior to disc installation into the housing or after final installation and oil filling the brakes.

- b. Install a stationary disc in the housing. The first stationary disc must be against the disc spacer. Make sure the splines on the outer diameter of the stationary disc engage the splines in the brake housing. Make sure the wide spaces on the outer diameter of the disc are over the return spring assemblies. **Figure 6.6.**



- c. Install a friction disc in the housing. **Figure 6.7.**

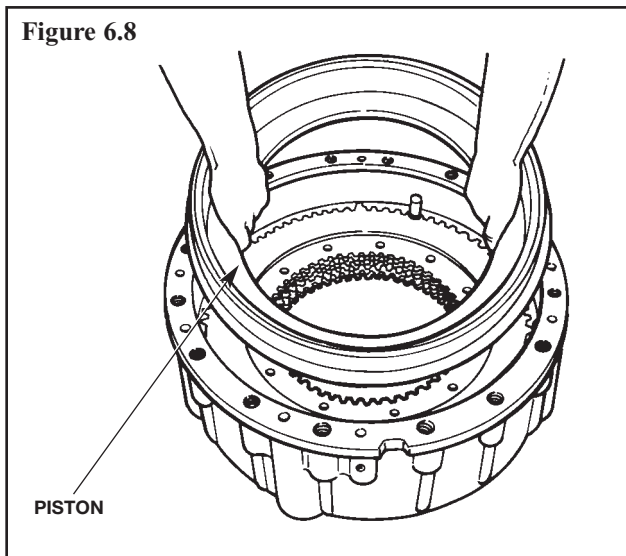


- d. Complete the installation of the disc pack. Repeat steps 'b' and 'c' until the complete disc pack is installed.

NOTE:

Disc stacks should be installed per the Bill of Materials and Assembly drawing referenced.

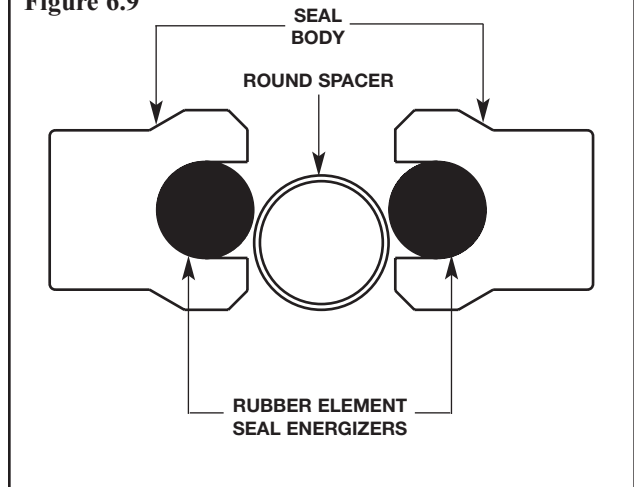
10. Align all of the teeth on the inner diameter of the friction discs. When the discs are aligned, the wheel hub can be installed without damaging the discs.
11. Lubricate the outside diameter of the piston, the housing bore and seals with the same fluid used in the brake actuation system.
12. Lower the piston into the housing until the piston is installed on the guides of the return springs. Make sure the surfaces on the piston and the housing are not damaged when the piston is installed. **Figure 6.8.**



NOTE:

The sealing arrangement between the piston and the housing consists of one spacer and two piston seals. Figure 6.9.

Figure 6.9

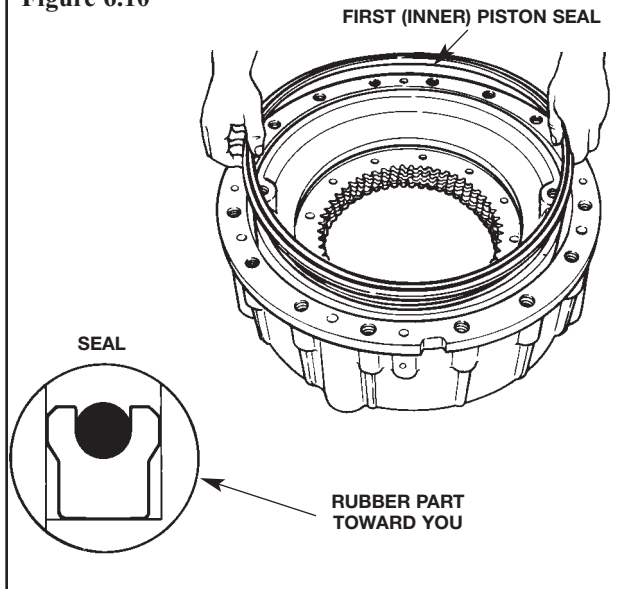


CAUTION

To prevent housing or piston damage, use fingers or a non-metallic object to install the seals and round spacer. Fluid can leak between the housing and the piston if the surfaces are damaged.

- Use brake coolant oil to lubricate the lead-in chamfers on the housing and piston.
- Lubricate the new (first) piston seal with your brake coolant oil and set the seal face up in the 'groove' (i.e. with O-ring facing up) and carefully tap around the circumference with a blunt plastic drift tool (you can make this tool out of hard plastic or nylon, etc); it can be 1" to 2" wide (slightly shaped to the curvature of the housing ID) and narrower than the width of the groove where the seal is pressed down into. You want to make sure NOT to scratch the housing or piston wall, or else the seal may leak.
- Push on the seal until the complete plastic bottom surface of the seal touches the shoulder of the piston all the way around the circumference. **Figure 6.10.**

Figure 6.10

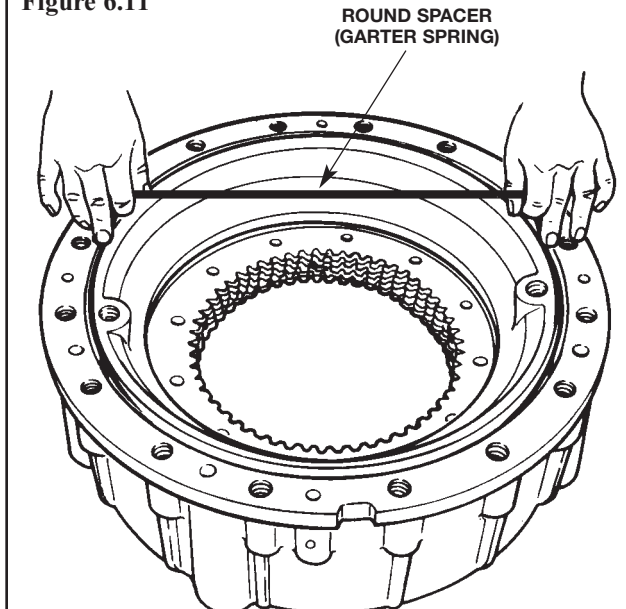


13. Install the spacer around the outer diameter of the piston. Push on the spacer until the entire bottom surface of the spacer touches the top of the first seal. **Figure 6.9 and Figure 6.11.**

NOTE:

A garter spring seal spacer is used.

Figure 6.11



- 14 Then fully lubricate the top (second) piston seal and set it face down (O-ring facing down) onto the groove. **Figure 6.11.**

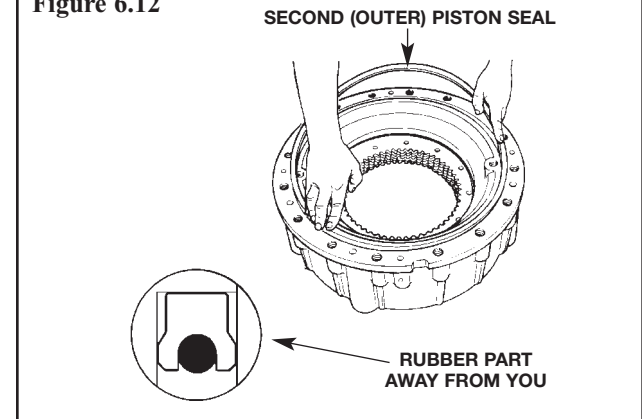
NOTE:

The seal may seem too large, but it is not.

15. The circumference of the seal may look slightly longer than the groove. That is ok, and normal, since you will tap it down, just as you did the first seal, except this time the lips of the seal are working against you as well as the slightly longer length. One method is to start on one side and tap/poke the seal in, in one area, and then go 180 degrees and start it in, then work both halves of the circumference until it is in, 360 degrees. **BUT do NOT** push this seal down all the way; just push it down about 0.25 inch below the metal face of the housing all the way around. **Figure 6.12.**

16. Then let the brake cover tongue push the seal down as you lower the cover onto the housing and install the cover-to-housing capscrews.

Figure 6.12



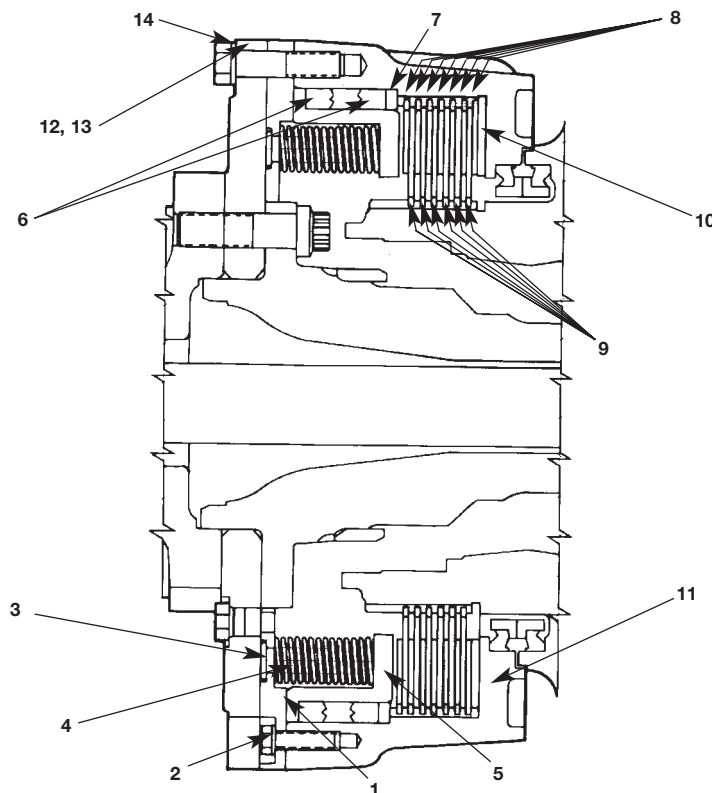
Assemble W4M and WDM Brake Housing

NOTE:

Numbers in parenthesis refer to the W4M and WDM Spring Applied Hydraulic Release brake parts as they appear in Figure 13.

1. Install the disc spacer (10) in the bottom of the brake housing (11).
2. Apply the same fluid used in the brake cooling system to each surface of each disc as they are installed
3. Install alternating stationary discs (8) and friction discs (9). Make sure that a stationary disc (8) is next to the disc spacer (10).
4. Install the piston seal back up ring (7), piston seals (6) and piston (5).
- a. Install the piston seal back up ring in the brake housing.
- b. Lubricate the outside diameter of the piston, housing bore and piston seals with the same fluid used in the brake actuation system.
- c. Install the first piston seal with the hard plastic heel on the seal back up ring. The rubber part must be toward you. **Figure 6.14.**

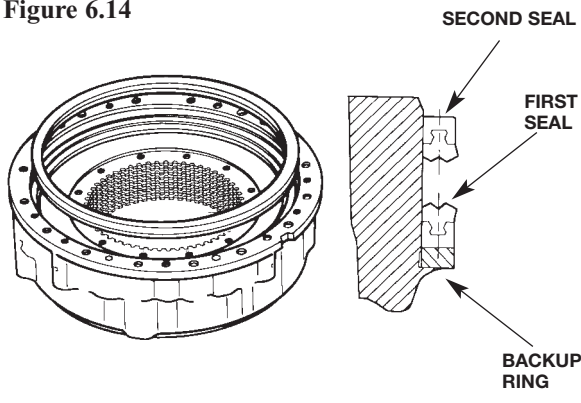
Figure 6.13



Item	Description
1	Brake Housing Inner Cover
2	Capscrews
3	Spring Retaining Pins
4	Springs
5	Piston
6	Piston Seals
7	Piston Seal Back Up Ring

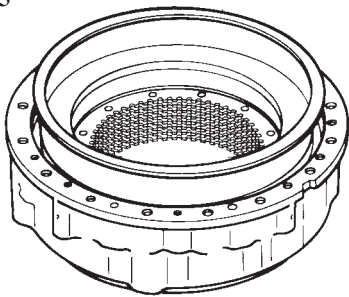
Item	Description
8	Stationary Discs
9	Friction Discs
10	Brake Housing to Stationary Disc Spacer
11	Brake Housing
12	Brake Mounting Cover, R.H.
13	Brake Mounting Cover, L.H.
14	Washers

Figure 6.14



- d. Install the second piston seal with the rubber part pointed down. Push the seal in until the rubber portion of the second seal touches the rubber portion of the first seal. **Figure 6.14.**
- e. Rest the piston on the seals. Make sure the piston is level and centered in the brake housing. Tap the piston into the brake housing and seal assembly with a rubber mallet. Push the piston into the housing until it bottoms. **Figure 6.15.**

Figure 6.15



5. Apply a 0.125 inch maximum (3.0 mm) diameter bead of silicone gasket material on the surface of the brake housing. The bead must go around each capscrew hole and port. Flatten or smear the silicone bead around the ports. Be careful not to get silicone into ports or brake housing bore.
6. Arrange the springs (4) around the piston (5). Place the brake cover (1) on top of the springs (4). Align the holes in the brake cover (1) with the springs (4) and insert the spring retaining pins (3) through the brake cover (1) and into the springs (4).

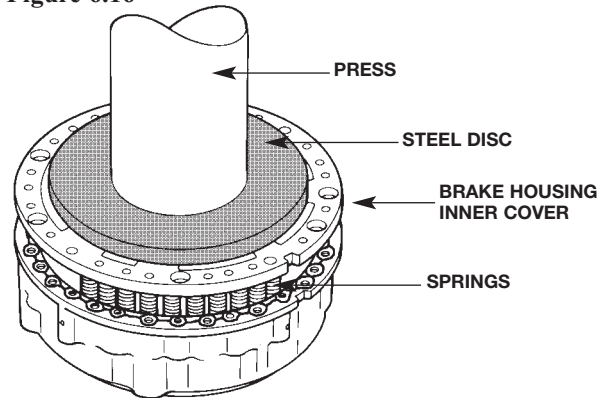


WARNING

Observe all **WARNINGS** and **CAUTIONS** provided by the press manufacturer concerning press operation to avoid serious personal injury.

7. Put the brake assembly, with the cover on top, in a press. Put a solid steel disc approximately 17 inches (431 mm) diameter X 1 inch thick (25.40 mm) over the cover. Make sure the holes in the cover and the holes in the brake housing are aligned. **Figure 6.16.**

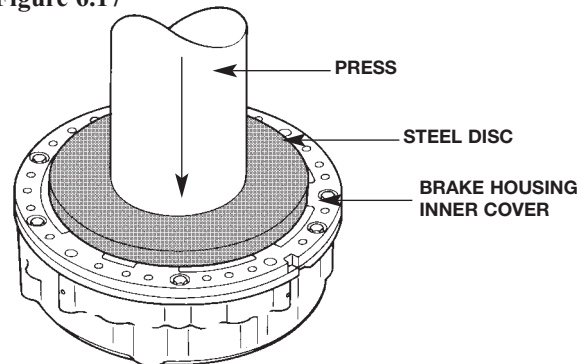
Figure 6.16



8. Apply 20 tons (18,144 Kg) of force to compress the springs. Install and tighten the cover capscrews (2) to 85-115 lb-ft (115.2-155.9 N•m) and release the press pressure. **Figure 6.17.**



Figure 6.17



9. Install the brake. See Section 7.

Section 7

Installation

Install W3H, W4H, W4M, WDM Hub Oil Seals



WARNING

To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.

NOTE:

Single or double hub oil seals are used on all brake housings with forced cooling and most brake housings with sump cooling.

Install Double Oil Seals In Hub

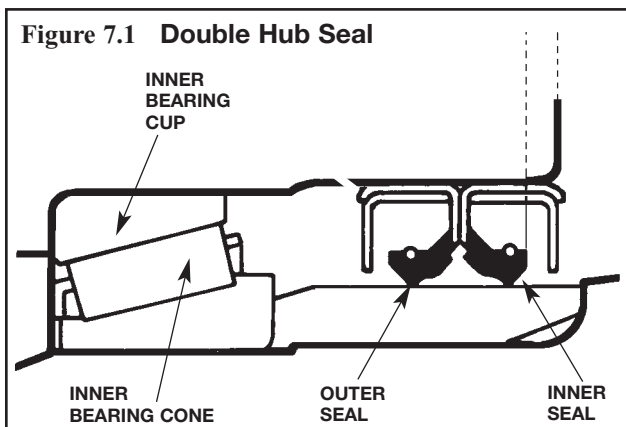
1. Position the wheel hub so that the wheel hub is flat on the floor.



WARNING

To avoid serious personal injury be careful when using Permatex. Follow the manufacturer's instructions for safe use to prevent irritation to eyes and skin. Wash after skin contact. If the Permatex gets in the eyes, flush your eyes with water for 15 minutes. Have eyes checked by doctor.

2. Apply Permatex 51D or its equivalent to the outer diameter of the seal casing.
3. Put the outer seal into the bore so the stamped AxleTech part number on the seal casing is toward you.
4. Use a suitable driver and a leather or plastic mallet to install the seal. Tap on the driver until the seal casing is even with the top of the bore. **Figure 7.1.**



NOTE:

When installed, the inner seal pushes the first or outer seal into the correct position.

5. Install the inner seal with the stamped AxleTech part number on the bottom, over the outer seal.
6. Use a suitable driver and a leather or plastic hammer to install the seal. Tap on the driver until the metal part of the second seal is even with the top of the bore.

Install Single Oil Seal in Hub

1. Position the wheel hub and brake housing so that the wheel hub is flat on the floor.
2. Apply Permatex 51D or its equivalent to the outer diameter of the seal casing.
3. Position the seal over the bore so that the metal part of the seal is toward you.

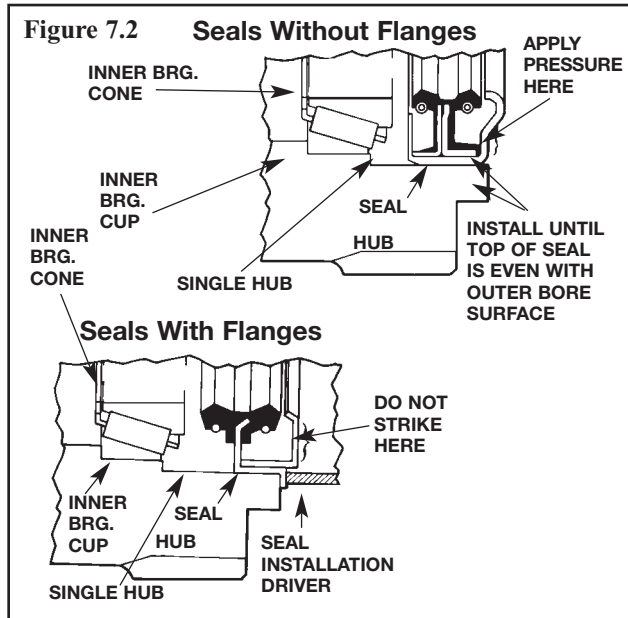


CAUTION

Do not apply pressure to the inner metal part of the seal. Apply pressure only to the outer diameter of the ring on the seal. The application of pressure to the inner diameter of the ring damages the seal.

4. Use a sleeve that is installed on the outer metal flange of the seal and a leather or plastic mallet to install the seal.
- On seals with flanges, tap on the sleeve until the flange touches the outer surface of the hub.

- On seals without flanges, press the seal in the hub until the top of the seal is even with the outer surface of the hub. **Figure 7.2.**



Install Brake Driver (Some Axle Models Only)

1. Some models have a one-piece integral hub and driver. Other models have separate parts. If necessary, install the brake driver on the wheel hub according to the following procedure:

- a. Stand the wheel hub on end.

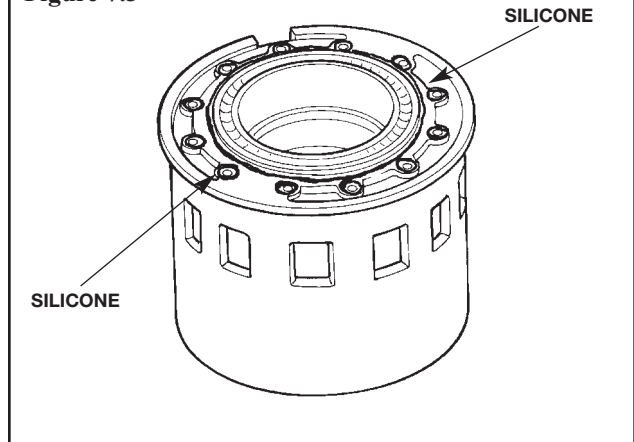


WARNING

Small amounts of acid vapor are present when applying some silicone gasket materials. To prevent possible serious personal injury, make sure there is good ventilation in the work area. If the silicone gasket material gets in your eyes, flush your eyes with water for 15 minutes. Have your eyes checked by a doctor.

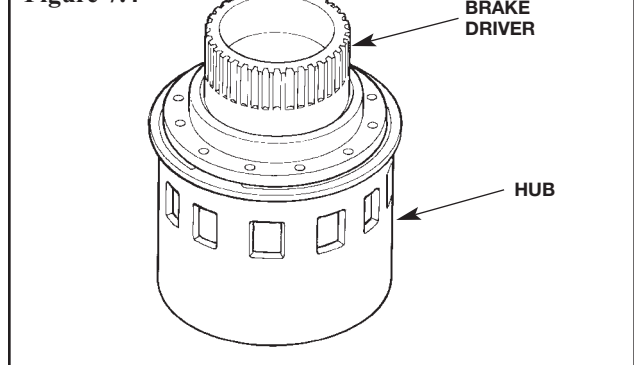
- b. Apply a bead of silicone gasket material on the surface of the wheel hub. See Applying Silicone (RTV) Gasket Material on page 37. **Figure 7.3.**

Figure 7.3



- c. Use a lifting device to put the brake driver on the wheel hub. **Figure 7.4.**

Figure 7.4



WARNING

To avoid serious personal injury be careful when using Loctite. Follow the manufacturer's instructions for safe use to prevent irritation to eyes and skin. Wash after skin contact. If the Loctite gets into your eyes, flush your eyes with water for 15 minutes. Have eyes checked by doctor.

NOTE:

When thread locker is used, recommended AxleTech procedure is to apply approved thread locker to oil free threads, when being assembled into "Through Hole" applications. Several drops of thread locker is to be applied to hole threads in "Blind Hole" applications.

- d. Use new capscrews with preapplied locking solution on the threads. If new capscrews are not used, put several drops of Loctite 271 or equivalent to the capscrew threads. Tighten the capscrews to the torque specified in the torque chart on page 54.

Section 7

Installation

Install W3H, W4H, W4M, WDM Brake Housings

1. If necessary, install the spindle and the cover of the brake housing on the axle housing according to the following procedure:

NOTE:

On some axle assemblies, the brake cover is mounted between the spindle and axle housing flanges. Use the following procedure to install the spindle and brake cover but first install the brake cover followed by the spindle.

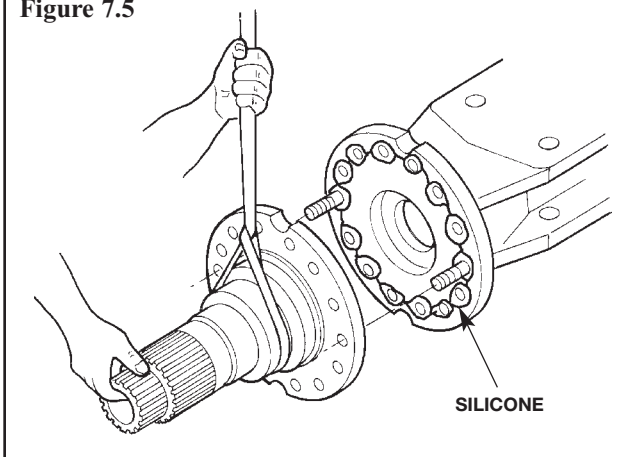


WARNING

Small amounts of acid vapor are present when applying some silicone gasket materials. To prevent possible serious personal injury, make sure there is good ventilation in the work area. If the silicone gasket material gets in your eyes, flush your eyes with water for 15 minutes. Have your eyes checked by a doctor.

- a. Install two studs opposite each other on the axle housing flange. Make sure the studs are long enough to support the spindle and brake cover.
- b. Apply a bead of silicone gasket material on the mounting surface of the axle housing flange. The bead must go around each capscrew hole. See Applying Silicone (RTV) Gasket Material on page 37. **Figure 7.5.**

Figure 7.5

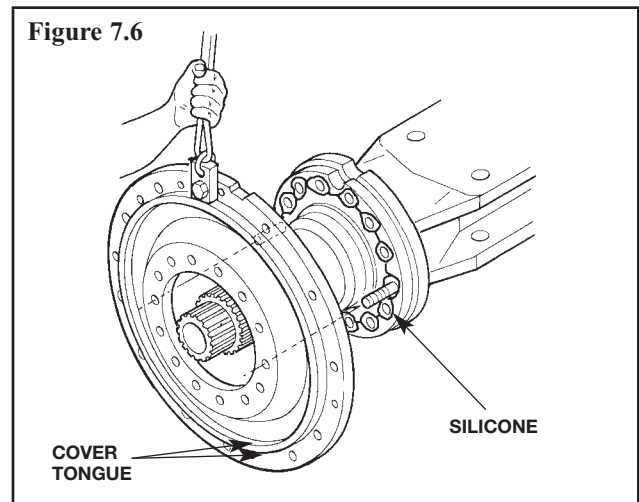


- c. Use a lifting device to install the spindle on the guide studs. Make sure the spindle cannot fall before removing the lifting device. **Figure 7.5.**

- d. Before installing the cover, make sure the cover tongue ID and edges are smooth. Use emery cloth or scotch bright to smooth surface. Remove nicks or burrs from tongue corners so as not to damage housing or piston later.
- e. Apply a bead of silicone gasket material on the spindle flange where the brake cover will mount. Make sure to go around each capscrew hole.

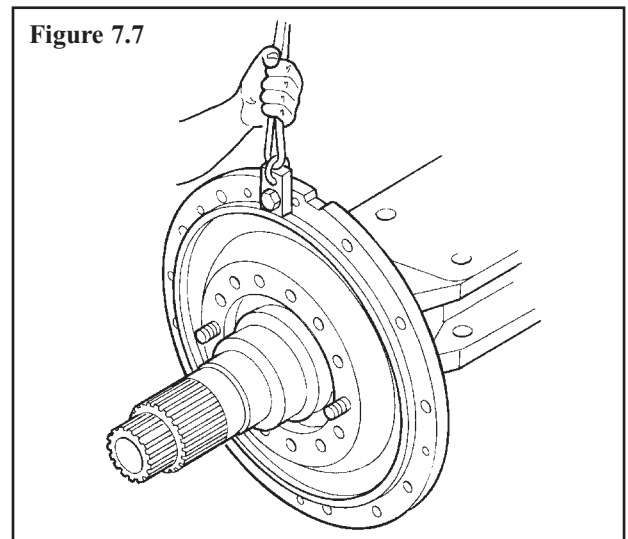
Figure 7.6.

Figure 7.6



- f. Use a lifting device to install the brake cover over the spindle and onto the housing. Make sure the drain hole is located at the bottom of the cover when installed. **Figure 7.7.**

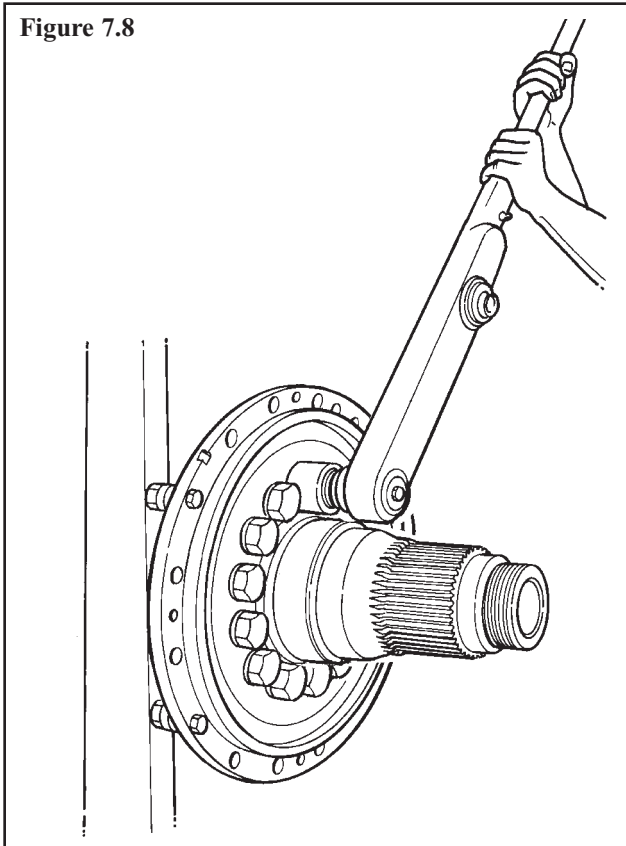
Figure 7.7



- g. Install the capscrews and washers. Remove the guide studs and install the remaining two capscrews and washers. Tighten the capscrews to the torque specified on page 50. **Figure 7.8.**



Figure 7.8



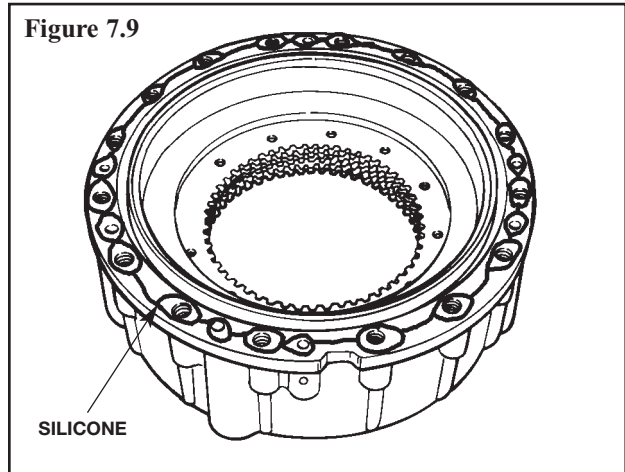
2. Apply a 0.125 inch maximum (3.0 mm) diameter continuous bead of silicone gasket material on the mounting surface of the brake housing. The bead must go around each cap screw hole and port. Flatten or smear the bead of silicone around the ports. Be careful not to get silicone into the ports or brake housing bore. **Figure 7.9.**



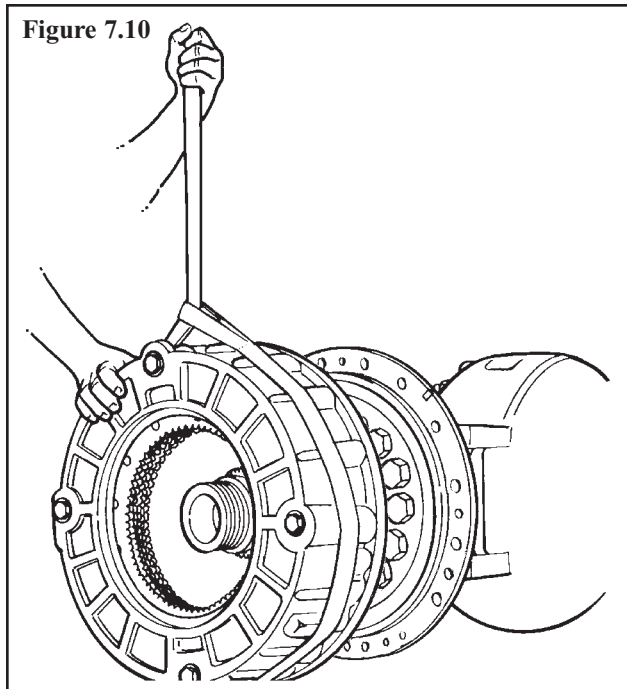
CAUTION

Do not exceed a 0.125 (3.0 mm) diameter bead of silicone gasket material. Too much gasket material can block coolant flow passages and damage the components.

Figure 7.9



3. Install the brake assembly.
- Connect a lifting device to the brake housing so that the bores for the bleeder screw and the inlet fitting in the housing are aligned with the correct holes in the cover.
 - Install two studs in the brake housing. The studs are installed opposite each other. Make the stud by removing the head of a housing-to-cover cap screw. Cut a flat-bladed screwdriver slot in the end of the stud without the threads. The studs help install the housing correctly on to the cover.
 - Lift the housing on to the cover so that the studs go through the holes in the cover. Make sure the bores for the bleeder screw and the inlet fitting are aligned with the holes in the cover. Push and hold the brake housing against the cover. **Figure 7.10.**



- d. Install the capscrews and washers that fasten the brake housing to cover. Remove the two assembly studs and install the last two capscrews and washers. Tighten the capscrews to the specified torque. See the Torque Chart on page 50.



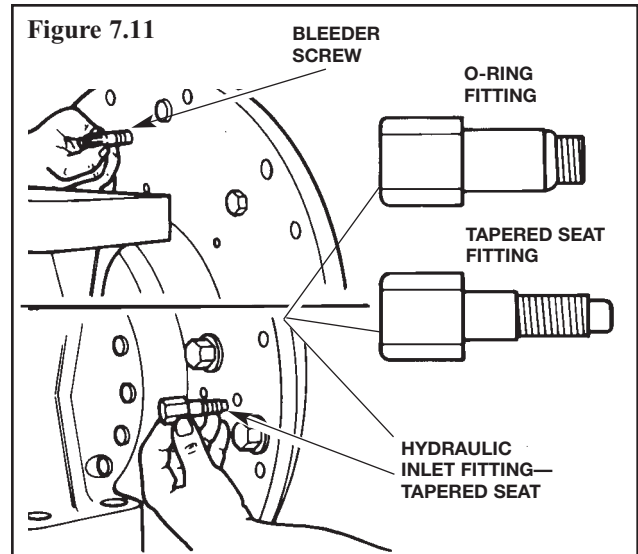
- e. Remove the lifting device from the brake housing.

4. Install and tighten the following components on the back (inboard) side of the cover of the brake housing. **Figure 7.11.**

- a. Bleeder Screw: Tighten to 15-20 lb-ft (20-27 N•m)



- b. Inlet Fitting for the Hydraulic Line: A tapered seat fitting or an O-ring fitting.



CAUTION

Use the correct fitting. You cannot replace a tapered seat fitting with an O-ring fitting. You cannot replace an O-ring fitting with a tapered seat fitting. If the wrong fitting is used, the housing and the fitting will be damaged.

- Tapered Seat Fitting: Make sure all of the threads are clean. Install the fitting in the brake housing. Tighten the fitting to 25-35 lb-ft (34-47 N•m) BUT DO NOT TIGHTEN THE TAPERED SEAT FITTING MORE THAN 35 lb-ft (47 N•m).



- O-ring Fitting: Make sure all of the threads are clean. Inspect the O-ring. Replace the O-ring if it is damaged. Install the fitting in the brake housing. Tighten the fitting to 25-35 lb-ft (34-47 N•m).



- c. Plug: The plug is opposite from the inlet fitting for the hydraulic line. Tighten the plug to 25-35 lb-ft (34-47 N•m).



5. The following optional procedure may be used to check the piston seals for leakage.

- a. Install a pressure gauge that reads between ZERO and 2,000 psi (138 bar) and a shut off valve at the brake actuation inlet. Make sure the shut off valve is rated for 2500 psi (172 bar) minimum.

- b. Bleed the brake. Refer to the procedure on page 47.
- c. Apply the brakes with the vehicle brake actuation system. Close the shut off valve when the brakes are fully applied.
- d. Watch the gauge for one or two minutes.
 - If the pressure drops, determine the cause of the leak.
 - If the pressure does not drop, continue with this test procedure.
- e. Slowly open the shut off valve to allow the actuation pressure to drop to 150 to 75 psi (10-12 bar). When the pressure reaches 150 to 75 psi, close the shut off valve.
- f. Observe the gauge for one to two minutes. If the pressure drops, determine and repair the cause of the leak.

Install Brake Adjuster Screws

Some models are equipped with 3 adjuster screws per brake as shown in Figure 7.12.

Procedure for Setting Three Adjuster Screws

NOTE:

The adjuster screws were preset by the original manufacturing plant. The procedure below is used if later adjustments are necessary or if repairs have been made.

Three setscrews are used to adjust and limit piston travel on some models.

1. Remove the jam-nuts, leaving the setscrews in place.



CAUTION

If complete removal of the setscrew is necessary, first drain the oil from the brake.

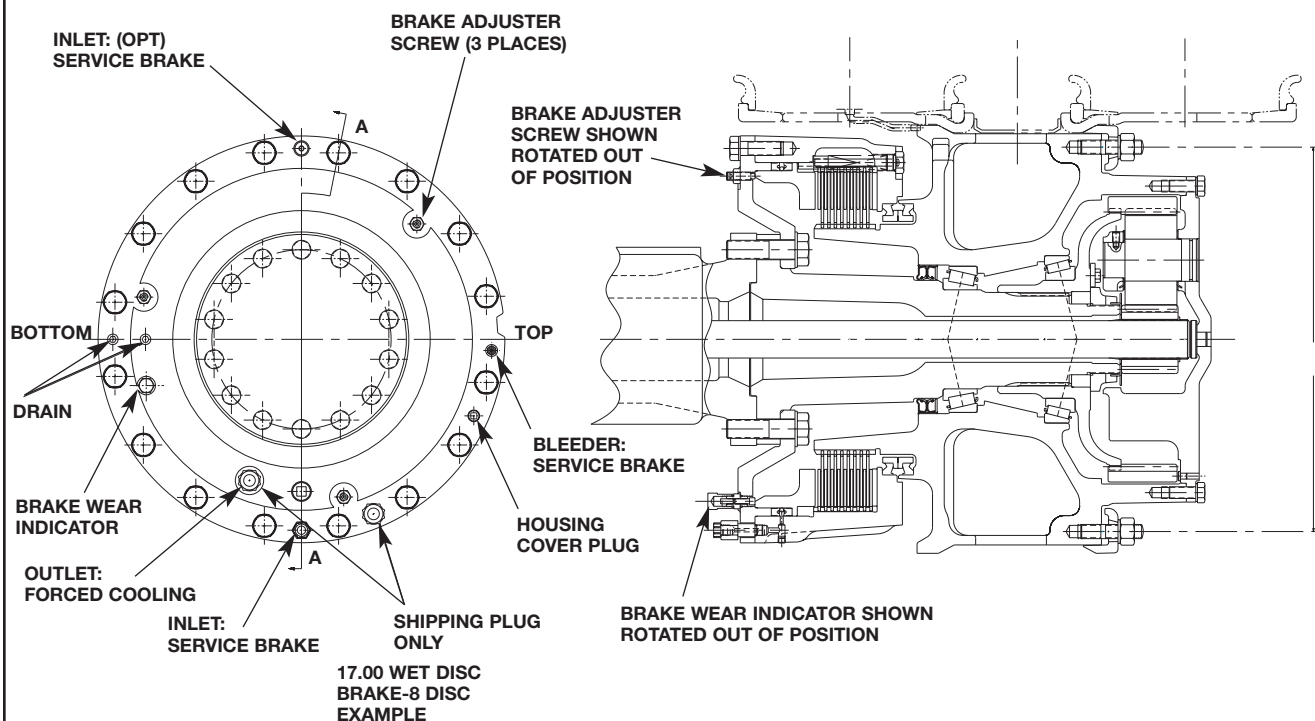
Then loosen the setscrews 3 turns or until 7/8 inch of its length is showing outside the cover.

2. Apply sealant 2297G5259 Silastic 737 (Dow Corning 737, General Electric RTV-123, or equivalent) onto the middle of setscrew threads near the cover.

NOTE:

Once the sealant is applied to threads, complete the adjustment procedure before the sealant sets up.

Figure 7.12



Section 7 Installation

3. Turn setscrews in through the brake cover until they touch the piston.
4. Bleed the brakes (actuation).
5. Apply and hold 1500 psi and turn three setscrews in until they touch the piston in the applied position.
6. For the PRLC1794W4H axle (with 8 friction plates per brake): Turn all three setscrews out (back off) exactly 2 turns. Mark three setscrews positions on setscrews and cover to ensure they remain in that position. Install jam-nuts on setscrews and torque to specification** without allowing the setscrews to turn.

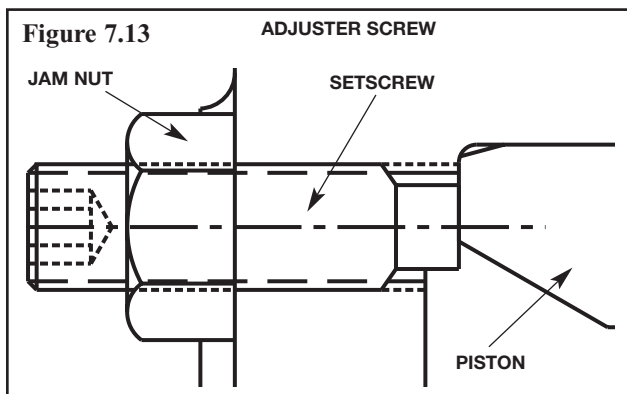
NOTE:

Exact adjustment depends on several factors including axle/brake model number of plates and adjuster screw thread. See below chart for example.

Axle/Brake Model	# of Friction Plates	Thread	# Turns Backoff
PRLC1794W4H	8	7/16-14	2

7. Release actuation pressure.
8. If an oil was drained from the brake, check level and refill as necessary.

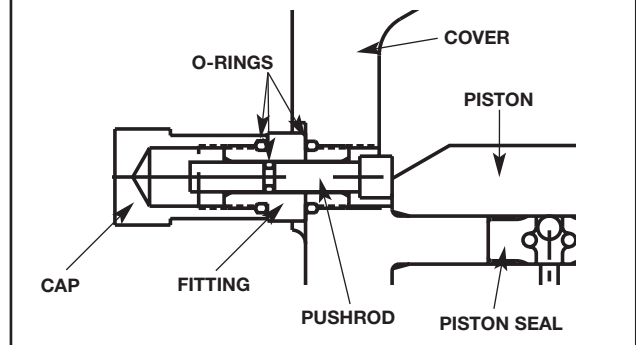
** Torque for 7/16-14 piston travel setscrew jam nut: 54-75 N•m (40-55 lb-ft). **Figure 7.13.**



Install Brake Wear Indicator

Some models are equipped with wear indicators as shown in **Figure 7.14**. It consists of a fitting in the brake cover with a push-rod inserted in it and a cap to cover it (contains two O-rings on fitting and one O-ring on push-rod).

Figure 7.14



Procedure for Checking Plate Wear

1. Shut off engine and make sure there is no residual pressure in the actuation system which could partially apply the piston (the piston must be returned fully).
2. Remove cap and push the visible end of the rod inward.
3. If the end of the rod goes flush or below the end of the fitting, the friction and/or stationary plates may need to be replaced. (See section 5 and section 6).
4. Put cap back onto fitting.

Install Face Seals

NOTE:

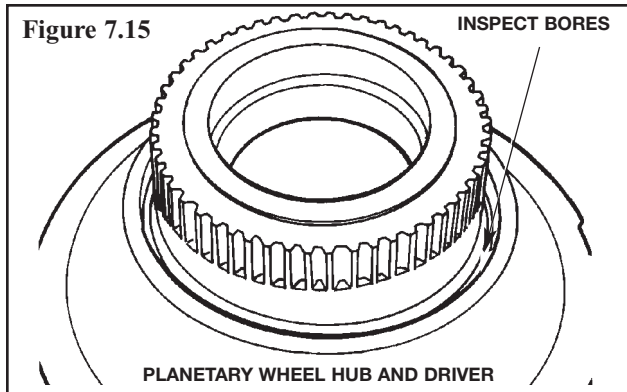
Follow steps 1-2 to install face seals in the W3H, W4H, and W4M brake housing and hub driver.

There are 2 types of face seals used—one or the other is used:

- a. Belleville washer style face seals or
- b. Toric ring seals, see below:

1. Before the inner and the outer face seals are installed, inspect and clean the following areas:
 - a. The bore for the outer face seal in the wheel hub and the bore for the inner face seal in the brake housing. Remove small marks in the bore with a fine emery cloth or india stone. If the marks cannot be removed, the assembly must be replaced. Clean the bore with a solvent that removes grease. Use a clean cloth.

Figure 7.15.



- b. Inner and outer face seals. Clean the inner and the outer face seals with a solvent that removes grease and a clean, lint-free cloth. If new face seals are being installed, make sure the seals are clean.

Seal rings must be handled with care. Lapped seal faces must not be damaged or scratched. All parts are to be free of grease, oil dirt and scale. All metal rings must be cleaned with isopropyl or denatured alcohol.

2. Install the rubber element on the metal ring of the face seal.



CAUTION

Install the rubber element on the metal ring before the face seal is installed or fluid can leak between the housing and the hub.

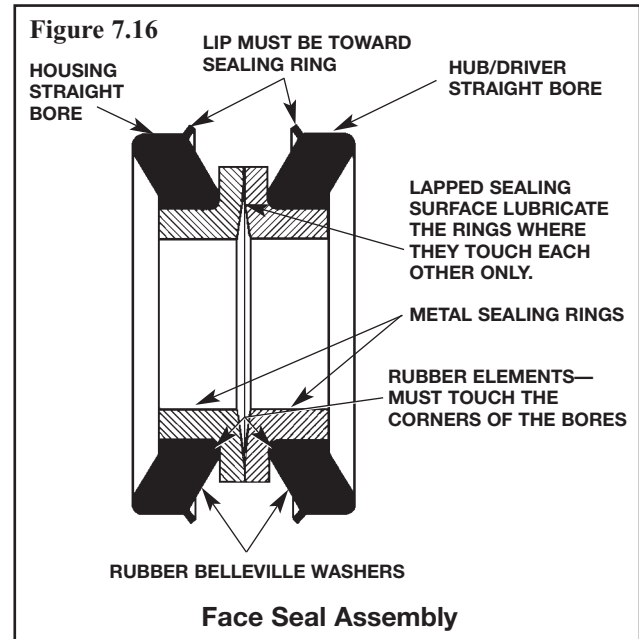
NOTE:

The rubber element must be installed on the metal rings clean and dry. All surfaces that contact the rubber element must be clean and dry.

NOTE:

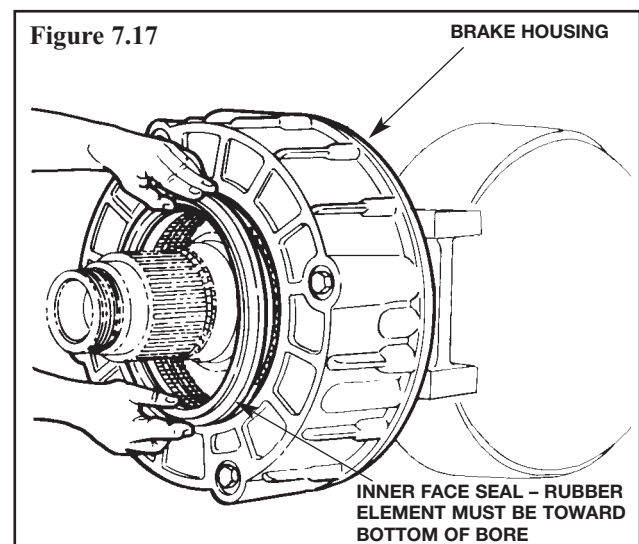
Follow the proper procedure for either Belleville Washer Style Face Seal or Toric Ring Style Face Seals.

Seal Assembly and Installation Instructions for Belleville Washer Style Face Seals



Face Seal Installation Into Housing and Hub/Driver Process

- a. Install each seal half (Belleville washer and sealing ring) into the housing, **Figure 7.17**, by carefully pushing on the seal half until it is fully seated. If lubrication is necessary to insert the seal half, use isopropyl or denatured alcohol on the rubber belleville. Check to be sure that the seal is not cocked and that the washer is seated evenly at the bottom of the bore.



Section 7

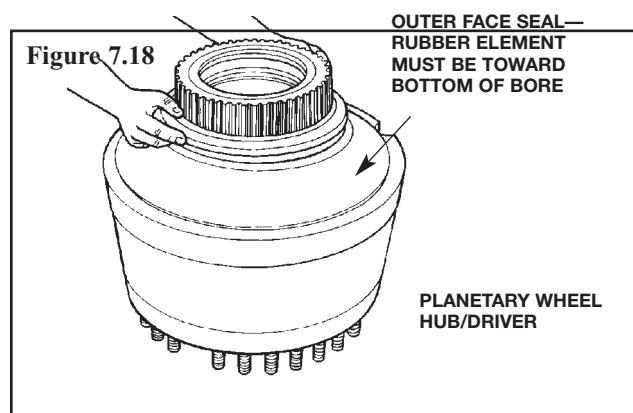
Installation

b. Use similar procedure to install the other half seal into the hub/driver. **Figure 7.18.**

c. After installing the seal halves into the unit, wipe both metal sealing faces clean with a lint-free wipe. Apply a thin film of Molykote G-n Metal Assembly Paste (part # 2297 M4303) (Mfg: Dow Corning) to the sealing faces with a lint-free applicator. Lubricant must not contact any surfaces other than the sealing faces.

*The same oil as used in the coolant section of the brake can be substituted (light film onto sealing faces).

Figure 7.18.



Assemble Hub/Driver into Brake Housing

a. While completing the assembly of the brake housing and hub/driver units, make sure that both are in correct alignment and are concentric. Observe carefully that the rubber rings do not unseat from the bottom of the housing. Slowly bring the two units together. High impact can scratch or break the seal components.

b. Proceed to page 40 - Install Wheel Hub.

Seal Assembly and Installation Instructions for Toric Ring Style Faceseals

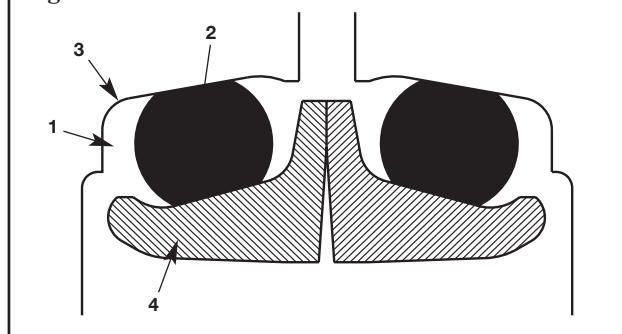
NOTE:

For AxleTech 17" (432 mm) wet disc brakes (on W4H axles) use installation tool part #860901007T (used with face seal part #A1205 P2720).

Seal Preparation

a. Remove any foreign material from the rubber torics (2) and the ramps (3) and lips (4) of both seal rings. This should also be done with a lint-free wipe and a non-petroleum based solvent. Dry with a clean wipe. **Figure 7.19.**

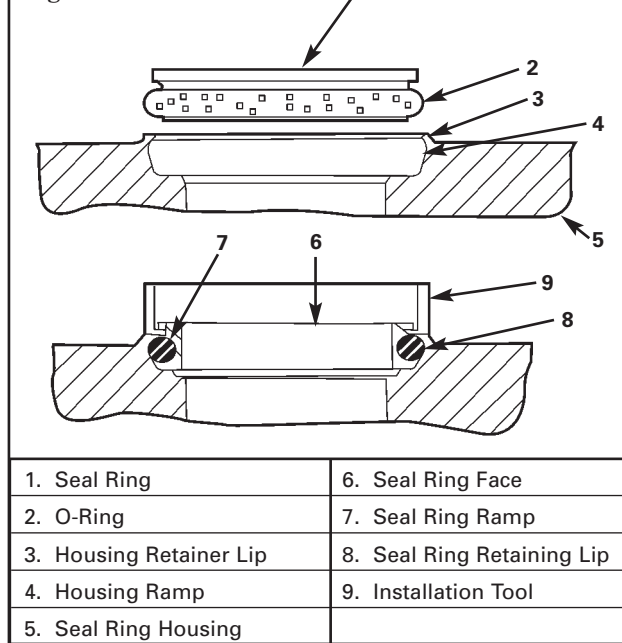
Figure 7.19



b. Place the rubber torics on the metal seal ring at the bottom of the seal ring ramp and against the retaining lip. Make sure the rubber toric is straight on the seal ring and not twisted. Be careful not to nick or cut the torics during this assembly, this can cause leaks. If a twist is apparent it can be eliminated by gently pulling a section of the toric radially away from the metal ring and letting it "Snap" back. Repeat around the ring as required to eliminate twists.

c. Put the installation tool onto the metal seal ring and rubber toric. **Figure 7.20.** Wet the complete rubber toric with isopropyl alcohol. Techniques to wet the toric include wiping with a lint-free towel, lubricating using a clean foam brush, or dipping in a container lined with towels saturated in the assembly lubricant.

Figure 7.20



1. Seal Ring	6. Seal Ring Face
2. O-Ring	7. Seal Ring Ramp
3. Housing Retainer Lip	8. Seal Ring Retaining Lip
4. Housing Ramp	9. Installation Tool
5. Seal Ring Housing	

Face Seal Installation into housing and Hub/Driver

- a. With the complete rubber toric wet, immediately use the installation tool to position the seal ring and the rubber toric squarely against the housing and press into the gland before the toric dries. For smaller diameter seals, use sudden and even pressure to push the rubber toric under the retaining lip of the housing. For larger diameter seals which will not press in with sudden even pressure, it is acceptable to work the toric past the retaining lip by starting on one side and tapping the opposite side of the installation tool with a rubber mallet working around complete diameter of the seal until it is engaged past the retaining lip of the housing or wheel hub/driver.
- b. Check the assembled height (A) in at least four places, 90° apart. Using a caliper or any other calibrated measuring device, the difference in height around the ring must not be more than 0.040 in (1.0 mm). If small adjustments are necessary, do not push or pull directly on the seal ring. Use the installation tool to push down and your fingers to pull up uniformly on the rubber toric and seal ring.

Figure 7.21 and 7.22.

Figure 7.21

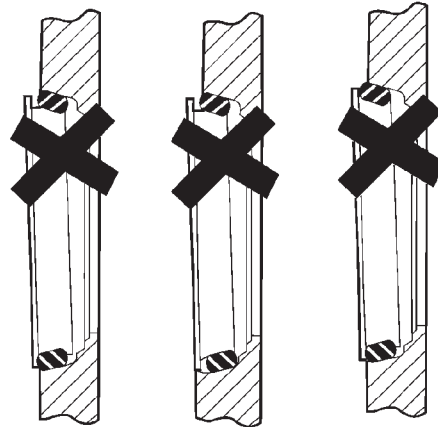


- c. The rubber toric can twist if it is not wet around the complete diameter during installation or if there are burrs or nicks on the retaining lip of the housing. Twists, misalignment, and bulges of the toric will result in seal failure. If correct installation is not obvious, remove seal from the housing or hub/driver and repeat the process.
- d. Wipe the face of each seal ring using a lint-free wipe. No particles of any kind are permissible on the sealing surfaces. (Even a hair can hold the seal faces apart and cause a leak.) Apply a thin film of Molykote G-n Metal Assembly Paste (part # 2297 M4303) (Mfg: Dow Corning). The same oil as used in the coolant section of the brake can be substituted, on the entire sealing face of both seals using a clean finger or a lint-free applicator. Lubricant must **not** contact surfaces other than the polished sealing faces.

Assemble Hub/Driver into Brake Housing

- a. While completing the assembly of these two units, make sure that both subassemblies are in correct alignment and are concentric. Slowly bring the housings together. High impact can scratch or break the seal components.
- b. If the rubber toric slips at any location, it will twist, causing the seal rings to cock. Cocked seal create uneven pressure on the seal faces, resulting in galling, scoring and leakage. Any wobbling motion of the seal is an indication of cocked seals. This wobbling action can cause dirt to enter by effectively pumping it past the torics. **Figure 7.22** shows examples of incorrect installation.

Figure 7.22



Section 7

Installation

Install Wheel Hub

1. Lubricate the cups and the cones on the inner and outer wheel bearings on the hub with the fluid that is used in the wheel end.
2. Make sure all of the splines on the inside diameter of the friction discs in the brake housing are aligned.



WARNING

Support the wheel end until the wheel bearing adjusting nut is installed or the wheel end may fall and cause serious personal injury.

3. Connect a lifting device to the wheel hub and install the wheel hub into the brake housing.

NOTE:

Procedures in the following steps are Recommended for Typical AxleTech Axle Wheel Ends. Refer to the appropriate AxleTech number 9 series Maintenance Manual.

NOTE:

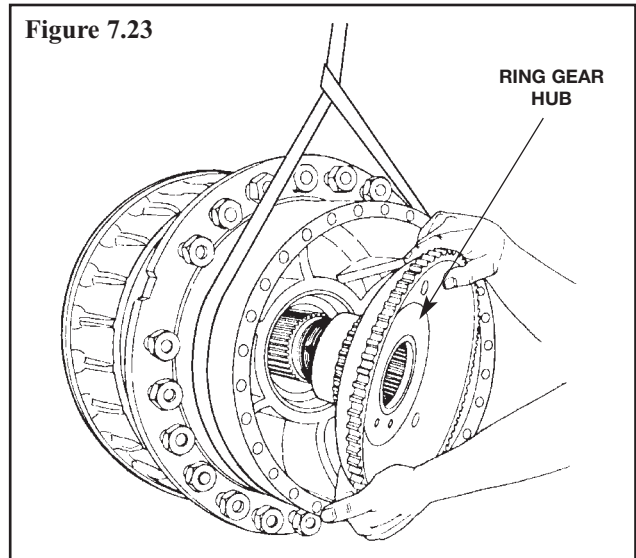
Some PRC 4805 and 7314 axles require the ring gear be bolted to the ring gear hub prior to installation. If applicable, the ring gear and ring gear hub should be assembled prior to proceeding.

- a. The following procedure applies to all axles except models PRC and PRS 130-265:

1. Install outer bearing cone on ring gear hub.

2. Install ring gear hub with outer bearing cone onto the spindle. **Figure 7.23.**

Figure 7.23

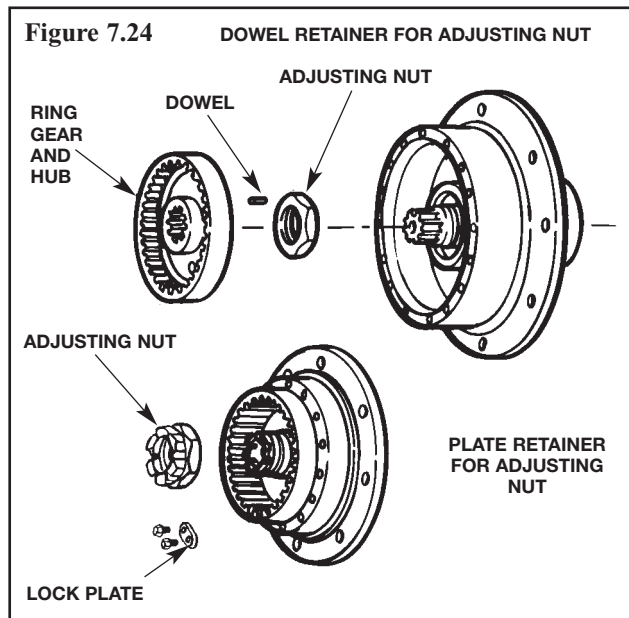


3. Install adjusting nut for wheel bearing on spindle. Nut must be against ring gear hub.

- b. The following procedure applies to axle models PRC and PRS 130-265:

1. Install outer bearing cone on spindle.
 2. Install adjusting nut on spindle. Nut must be against outer bearing cone.
- c. Remove the lifting devices from the brake housing and the wheel hub.
 - d. Use one of the following procedures to set the bearing preload.
 - For spindles with single adjusting nuts or
 - For spindles with double adjusting nuts

Spindles with Single Adjusting Nuts



- a. To seat the bearings, rotate the hub while tightening the adjusting nut as follows:

PRTA-134 - PRC-416	100 lb-ft (135 N•m)
PSC-165 - PSC-205	100 lb-ft (135 N•m)
PRC-10253 & 4	1000-1200 lb-ft (1355-1630 N•m)
All other models.....	400 lb-ft (542 N•m)
PRC-1794, PRC-1925-4807	500 lb-ft (678 N•m)
SPRC & EPRC 1926-4808	500 lb-ft (678 N•m)
PRC-7534.....	700 lb-ft (949 N•m)
PRC-5224-PRC-7314.....	600 lb-ft (813 N•m)

- b. Rotate the wheel hub in each direction. Repeat step 'a' of this procedure until the adjusting nut cannot be tightened without the specified torque from step 'a' being exceeded.
- c. Loosen the adjusting nut to release the preload on the wheel bearings. Tighten the adjusting nut to the torque specified in Chart 1.



Chart 1		
RIGID AXLES	STEER AXLES	TORQUE LB-FT (N•M)
PRTA-134 - PRC-146	PSC-165 - PSC-205	100 (135)
PRC-454 - PRLC-804	PSC-334 - PSC-825	200 (270)
PRC-823 - PRLC-1794	PSC-826 - PSC-1794	350 (472)
PRC-1794, PRC-1925-4807	PSC-1875 - PSC-4564	400 (542)
SPRC and EPRC-1926-4808	PSC-1875 - PSC-4564	400 (542)
PRC-5224-PRC-7314	N/A	500 (678)
PRC- 10253 - PRC-10254	N/A	600 (815)
PRC-7534	N/A	550 (746)

- d. If used, install the adjusting nut lock plate. Put the flat side of the lock plate against a flat surface on the adjusting nut; or put the lock plate notch over a corner of the adjusting nut. If necessary, tighten the adjusting nut so the lock plate can be installed.

- e. Install the fasteners for lock plate according to the following procedure.



WARNING

To avoid serious personal injury be careful when using Loctite. Follow the manufacturer's instructions for safe use to prevent irritation to eyes and skin. Wash after skin contact. If the Loctite gets in the eyes, flush the eyes with water for 15 minutes. Have eyes checked by doctor.

Capscrews: Use new capscrews with a pre-applied locking solution on the threads. If new capscrews are not used, put several drops of Loctite #277 or equivalent to the threads of the capscrews. Tighten the capscrews to the torque specified in the torque chart on page 54.



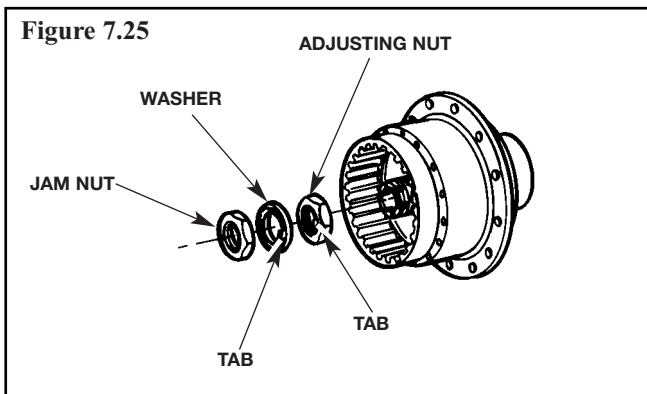
Flat Head Screws: Use flat head screws to fasten lockplates that have countersunk holes in the plate.

- f. If a dowel is used to lock the adjusting nut, install the dowel in the hole of the ring gear. If necessary, tighten the adjusting nut so that the dowel can be installed.

NOTE:

The dowel pin is used on axle models PRC and PRS 130-265.

Spindles with Double Adjusting Nuts



- a. To seat the bearings, rotate the hub while tightening the adjusting nut as follows:

PRTA-134 - PRC-416	100 lb-ft (135 N•m)
PSC-165 - PSC-205	100 lb-ft (135 N•m)
PRC-10253 & 4	1000-1200 lb-ft (1355-1630 N•m)
All other models.	400 lb-ft (542 N•m)

- b. Rotate the wheel hub in each direction. Repeat step 'a' of this procedure until the adjusting nut cannot be tightened without the specified torque from step 'a' being exceeded.

- c. Loosen the adjusting nut to release the preload on the wheel bearings.

- d. Tighten the adjusting nut to 25 lb-ft (34 N•m).



- e. Install the lock washer over the spindle and against the adjusting nut. Make sure the tab on the washer is in the slot on the spindle and that the tab on the adjusting nut is through the hole in the washer. If necessary, tighten the adjusting nut so that the tab on the nut can be installed through the hole in the washer.

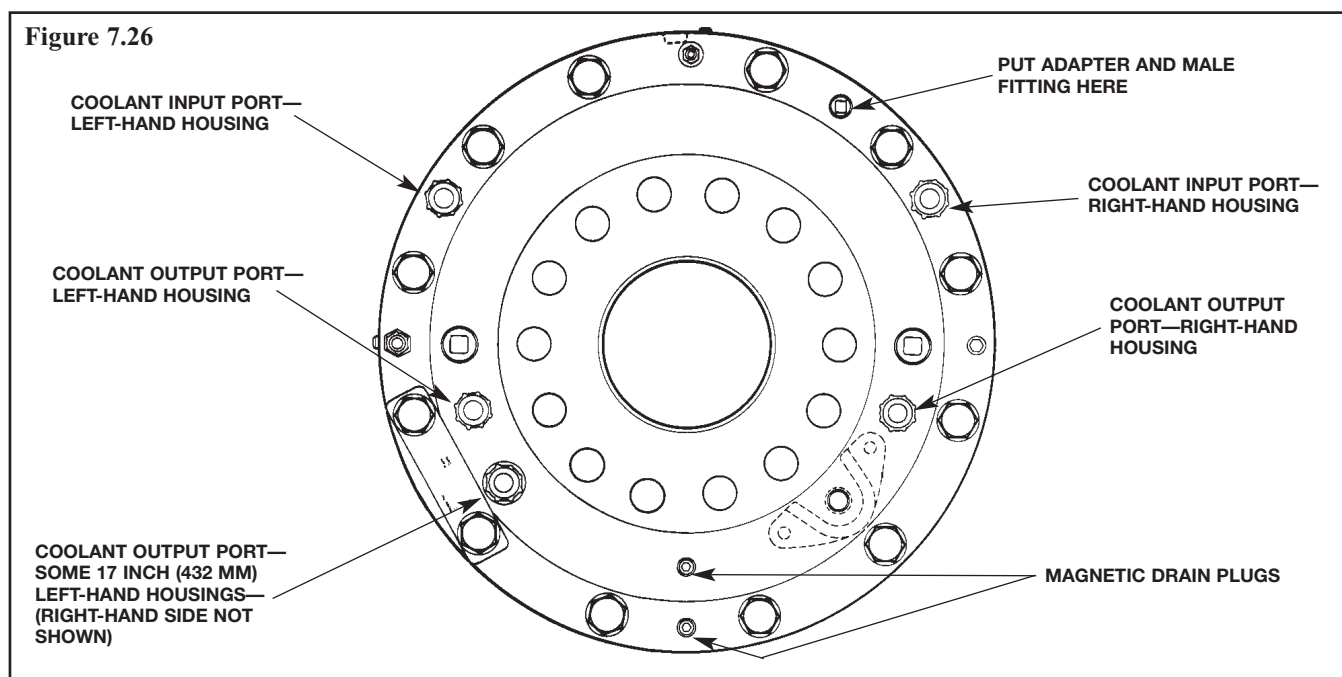
- f. Install the jam nut against the lock washer. Tighten the jam nut to 800 lb-ft (1084 N•m).



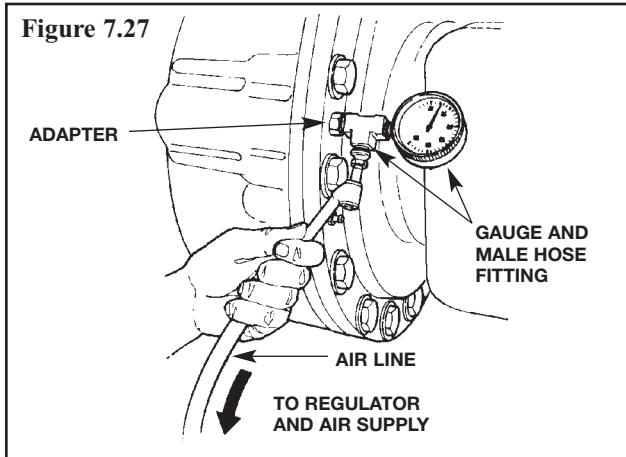
Inspect Brake Housing

- a. Check the brake housing for leaks with the following procedure:

1. Put a plug in the coolant inlet and outlet ports on the inboard side of the cover of the brake housing cover. **Figure 7.26.**
2. Remove plug at top of brake housing cover. Install a 0.375 inch pipe thread adapter or a 0.875 inch O-ring fitting adapter and male fitting for an air hose. **Figure 7.26.**



3. Connect an air pressure gauge and regulator assembly to the male fitting on the adapter. The gauge must measure pressure accurately to 15 psi (1 bar). **Figure 7.27.**
4. Connect an auxiliary air supply system to the gauge and regulator assembly. **Figure 7.27.**

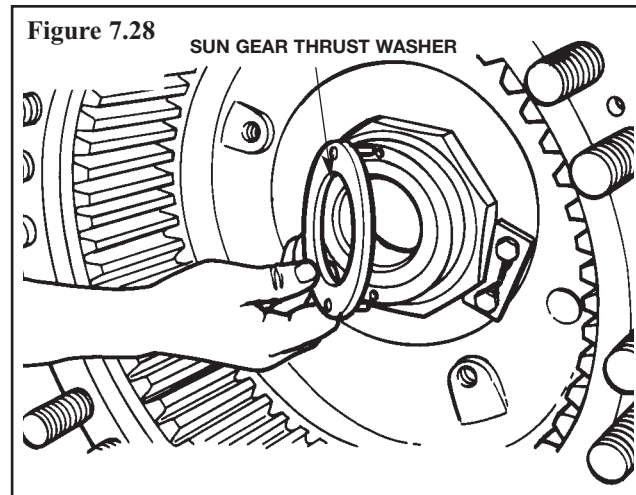


5. Apply 15 psi (1 bar) of pressure to the brake housing. Turn the regulator to the CLOSED position. Look at the gauge for 3-5 minutes. The pressure in the brake housing must remain at 15 psi (1 bar).
6. If pressure falls below 15 psi (1 bar), find the cause of the loss of pressure. See the following procedure:
 - Apply a soap and water solution to the capscrews, the fittings and the joints.
 - Apply and hold 15 psi (1 bar) of pressure in the brake housing.
 - If bubbles appear at any external location, service the cause of the leak.
 - If bubbles do not appear at any external location, there is an internal leak. Remove the wheel hub. Inspect the spindle to hub seal, face seal and seal surface on the spindle for possible causes of leaks. Repair or replace as necessary.
7. Remove the plugs from the inlet and outlet ports. Remove the air pressure gauge and regulator assembly.

Final Assembly

1. Install ring gear on ring gear hub. For axle models PRC and PRS 130-265 only, install one piece ring gear and hub on spindle.
2. If a temperature sensor is used, install the sensor in the brake housing. Put the bracket over the sensor on the housing. Install and tighten the capscrews and washers.

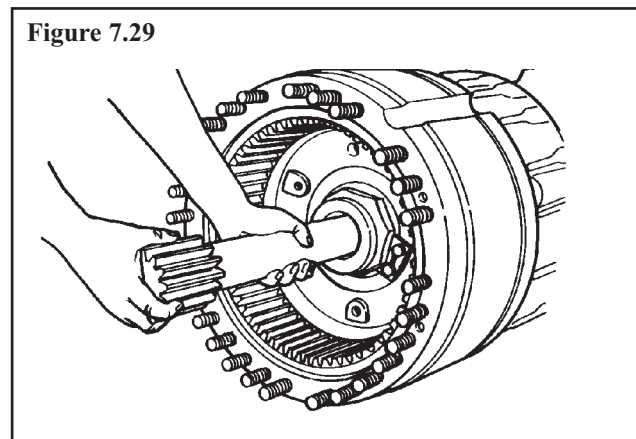
3. Apply a grease such as petroleum jelly or equivalent to the tab side of the thrust washer for the sun gear. Put the washer on the end of the spindle so that the tabs engage the slots in the adjusting nut. The grease holds the washer on the spindle. **Figure 7.28.**



NOTE:

Procedures in Steps 4-8 are Recommended for Typical AxleTech Axle Wheel Ends.

4. Install the axle shaft and sun gear assembly in the axle housing. Rotate the axle shaft so that the splines on the shaft engage the splines in the differential side gear. When correctly installed, the gear is against the thrust washer. **Figure 7.29.**



Section 7

Installation

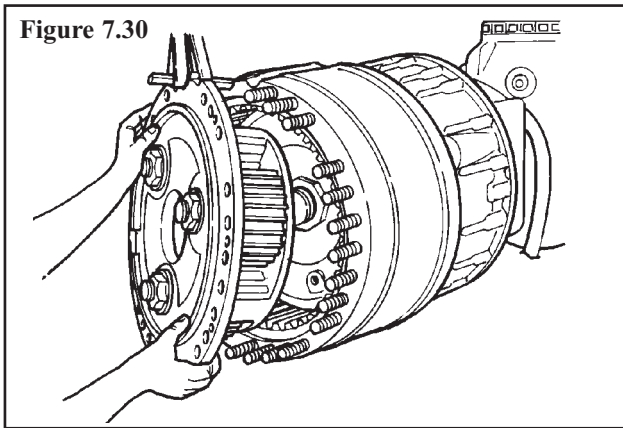


WARNING

Small amounts of acid vapor are present when applying some silicone gasket materials. To prevent possible serious personal injury, make sure there is good ventilation in the work area. If the silicone gasket material gets in your eyes, flush your eyes with water for 15 minutes. Have your eyes checked by a doctor.

5. Put a bead of silicone gasket material on the flange of the planetary spider. Make sure the bead goes around each capscrew hole. See page 23 for the procedure on applying silicone gasket material.
6. Use a lifting device to install the planetary spider in the wheel hub. **Figure 7.30.**

Figure 7.30



- a. Lift the planetary spider into the wheel hub.
- b. Rotate the pinion gears in the planetary spider so the teeth engage the ring gear and the sun gear.
- c. Make sure the capscrew holes are aligned and push the planetary spider into the wheel hub.
- d. Install the capscrews and washers that fasten the planetary spider to the wheel hub.
- e. Tighten the capscrews to the specified torque. See the Torque Chart on page 54.

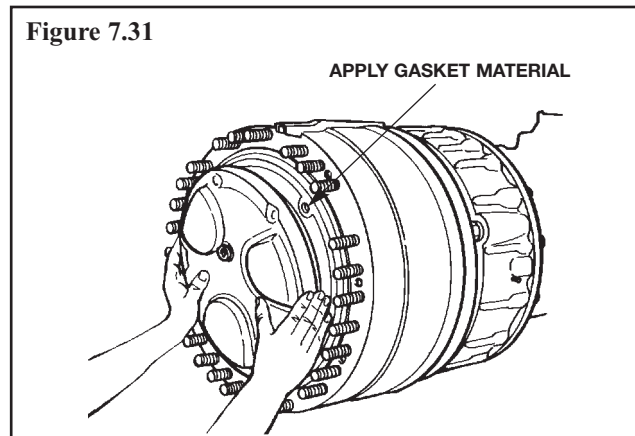


7. Put a bead of silicone gasket material on the cover flange of the planetary spider. The bead should also go around each capscrew hole.

8. Make sure the capscrew holes are aligned and install the cover on the planetary spider. Install the capscrews and tighten to the specified torque. See the Torque Chart on page 54. **Figure 7.31.**

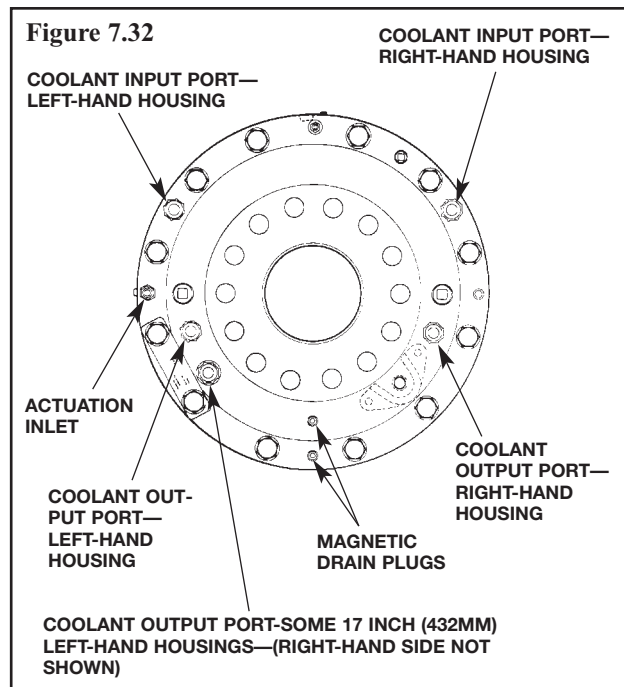


Figure 7.31



9. Connect the brake hydraulic line to the inlet fitting in the brake housing.
10. On brake housings with forced cooling, connect the coolant input and output lines to the ports in the cover of the brake housing. The outer port is the input port and the inner port is the output port. **Figure 7.32.**

Figure 7.32

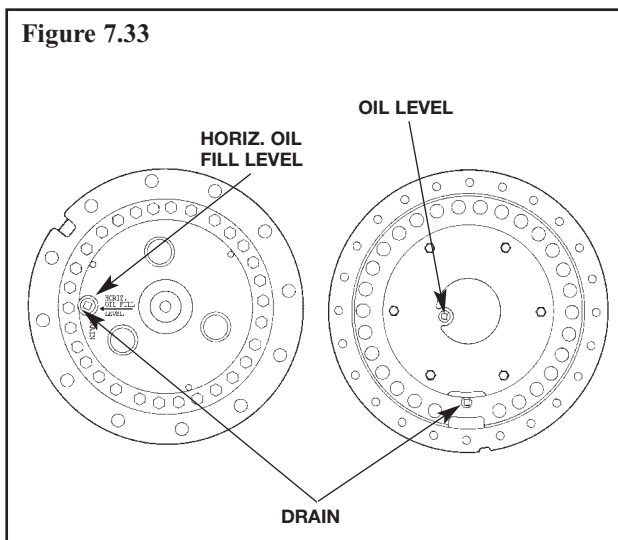




WARNING

- Use only the type of fluid specified by the equipment manufacturer. Do not use or mix different types of fluid. The wrong fluid will damage the rubber parts of the assemblies which could cause loss of braking and serious personal injury.
- Do not reuse hydraulic fluid or coolant. Used fluid can be contaminated and can cause incorrect operation which could result in serious personal injury.

11. Fill the axle housing and the wheel ends with fluid according to the following procedure. **Figure 7.33.**



NOTE:

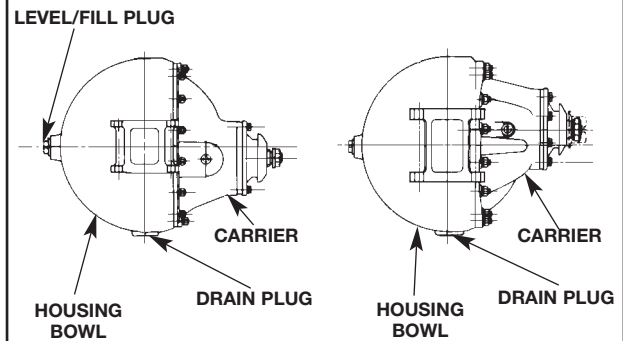
When the assembly is filled, make sure fluid flows through the complete assembly.

- Make sure:
 - The axle and the brake housing assembly is in a level position.
 - The OIL LEVEL line on the wheel ends are parallel to the ground. **Figure 7.33.**
- Remove the fill plug from the axle housing. Remove the plugs from the OIL LEVEL holes in the wheel ends.
- Fill the axle housing until fluid flows from the bottom of the hole for the fill plug hole. **Figure 7.34.**

Figure 7.34

Pinion Standard

Pinion Inverted



Location of Plugs—Housing Bowl (Typical)

- Fill each wheel end until fluid flows from the bottom of the OIL LEVEL holes.
- Install the fill plug in the axle housing and the OIL LEVEL plugs in the wheel ends. Tighten the plugs to a minimum torque of 35 lb-ft (47 N•m).



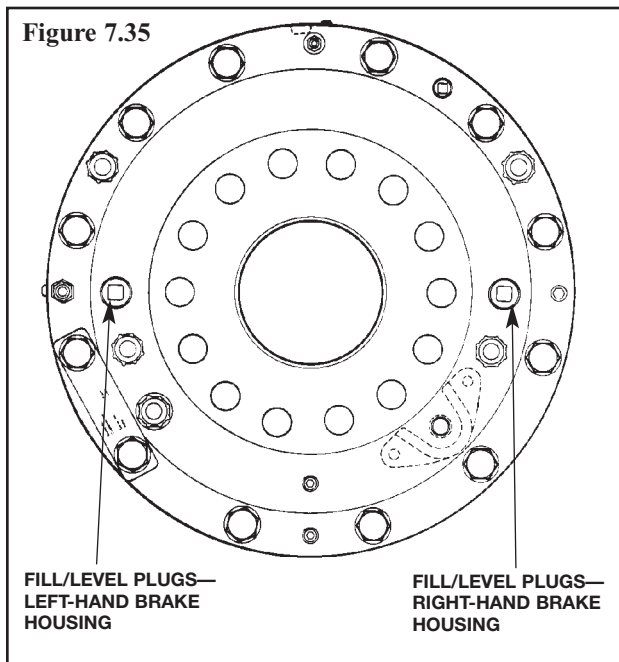
12. Fill the brake housing with coolant according to the following procedure.

NOTE:

Use the specified coolant to fill the brake housing. See Section 10 Coolant and Hydraulic Fluid Specifications.

Sump Cooling Systems with Hub Seals

- Remove the coolant fill plugs in the brake housings that are next to the inlet fittings for the hydraulic fluid. **Figure 7.35.**
- Fill the brake housings with coolant until the coolant flows from the bottom of the fill plug holes. **Figure 7.35.**



- c. Install the coolant fill plugs in the brake housings. Tighten the fill plugs to a minimum torque of 35 lb-ft (47 N•m).



Sump Cooling Systems without Hub Seals

NOTE:

On housings without hub seals most of the coolant is installed when the wheel ends are filled with fluid.

- a. Loosen the coolant fill plugs that are next to the fittings for the hydraulic fluid. If coolant flows from the bottom of the holes for the fill plugs, the coolant is at the specified level. If coolant does not flow from the bottom of the hole for the fill plug, remove the fill plug. Fill the housings until fluid flows from the bottom of the fill plug holes. Install the fill plugs. **Figure 7.35.**

- b. Tighten the coolant fill plugs in the brake housings to a minimum torque of 35 lb-ft (47 N•m).

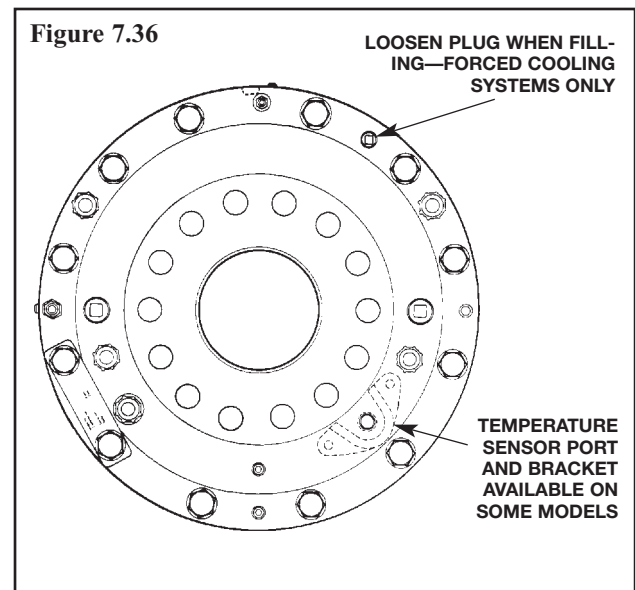


Forced Cooling Systems

NOTE:

Use the same amount of coolant that was removed when the brake housing was drained.

- If the cooling system uses shut-off valves, make sure the valves are in the ON position so that fluid flows to the brake housing.
- Loosen the plug in the top of the cover of the brake housing. When the housing is filled, the loose plug permits air to be removed. **Figure 7.36.**



- c. Put the transmission in the NEUTRAL position and start the engine. When the level in the reservoir goes down, add coolant to adjust the level to the specified position. See the recommendations of the equipment manufacturer for the specified level in the reservoir. Stop the engine when coolant leaks from the loose plug in the cover of the housing.

- d. Tighten the plug at the top of the cover. If a pipe plug is used, tighten to a minimum torque of 20 lb-ft (27 N•m). If an O-ring plug is used, tighten to a minimum torque of 60-75 lb-ft (81-102 N•m).



NOTE REGARDING PRESSURES AND FLOW IN COOLING CAVITY SIDE OF THE BRAKE:

- Heavy duty braking cycles require a forced cooling system applied to the wet disc brake.
- The vehicle OEM normally determines when forced cooling is necessary for a particular application.

- Maximum allowed pressure in the forced cooling cavity side of the brake is 15 psi (1 bar).
- The amount of coolant flow (and cooling system capacity) has normally been pre-determined and set up by the vehicle OEM - and depends on the application duty cycle.
- It is recommended that a temperature monitoring device be installed within at least one brake oil cavity or immediately into the brake cooling oil outlet.
- The brake oil temperature must be below 250°F (120°C).

13. Bleed brakes.

Bleed Brakes



WARNING

When you loosen any brake system hydraulic connection, you must bleed the brakes to remove all air from the system. Air can prevent hydraulic pressure from applying the brakes properly which could increase stopping distances and result in serious personal injury.

NOTE:

Always start at the point in the system that is furthest from the master cylinder and work back toward the master cylinder.

1. Make sure that the master cylinder is filled to the specified level with the type of hydraulic fluid specified by the equipment manufacturer. Keep the master cylinder filled during bleeding so that you do not pull air into the system through the master cylinder. Make sure the master cylinder is filled when you are done bleeding the system.
2. Put a clear tube on the bleeder screw. Submerge the other end of the tube in a clear container of the specified fluid.
3. Bleed brakes.

For full hydraulic systems:

Slowly apply low hydraulic pressure to the brake. Loosen the bleeder screw. Continue to apply pressure until no air bubbles appear in the container of fluid. Tighten the bleeder screw 15-20 lb-ft (20-27 N•m), then release the pressure to the brake.



For air/hydraulic or mechanical actuator systems:

Apply the brake pedal, then loosen the bleeder screw. Tighten the bleeder screw 15-20 lb-ft (20-27 N•m) before you release the brake pedal so that air is not pulled back into the system. Repeat this procedure until no air bubbles appear in the container of fluid when you apply the brake pedal.



4. Check for fluid leaks.
5. Install the tire and rim assembly on the hub. Install the fasteners that hold the tire and rim assembly to the hub. Tighten to the specification of the equipment manufacturer.

NOTE REGARDING PRESSURES IN THE BRAKE ACTUATION:

Hydraulic apply (W3H, W4H, WDH series) brakes should have zero residual pressure on the actuation side when the brake is not applied.

Spring apply/hydraulic released (WDM and W4M series) brakes should have 30 psi (2 bar) residual pressure on the actuation side.

W4M, WDM Brake Release Procedure for Towing

When the vehicle hydraulic system cannot release the brakes, the following procedure can be used to release the brakes to allow the vehicle to be towed to a service area.



WARNING

- *The following procedure is used only to release the brakes so the vehicle can be towed to a service area. Do not operate the vehicle after the brakes have been disconnected. This can cause serious personal injury.*
- *Block the wheels of the vehicle to be towed and connect and apply the brakes of the towing vehicle. Failure to do so can cause the disabled vehicle to roll and cause serious personal injury.*

1. Connect the towing vehicle to the disabled vehicle. Apply the brakes of the towing vehicle. Block the wheels of the disabled vehicle.
2. Connect a portable pressure unit and apply 1500 psi (103 bar) of hydraulic pressure to release the brakes of the disabled vehicle.



WARNING

Before the towing vehicle is disconnected from the disabled vehicle, block the wheels of the disabled vehicle. Failure to do so can cause the disabled vehicle to roll and cause serious personal injury.

3. After the disabled vehicle has been towed to the service area, block the wheels of the disabled vehicle. Apply the brakes of the towing vehicle.
4. Release the hydraulic pressure provided by the portable pressure unit to apply the brakes of the disabled vehicle. disconnect the portable pressure unit.
5. Disconnect the towing vehicle from the disabled vehicle.

Brake Does Not Apply – W3H, W4H

Condition	Possible Causes	Correction
1. Low or no pressure to brake.	1. Empty fluid reservoir. 2. Damaged hydraulic system. 3. Leakage of brake actuation fluid.	1. Fill reservoir to correct level with specified fluid. 2. Repair hydraulic system. 3. See “Brake Leaks Actuation Fluid” page 47.

Brake Does Not Apply – W4M, WDM

Condition	Possible Causes	Correction
No apply or partial apply.	1. Hydraulic pressure circuit still energized. 2. Apply springs damaged, broke, missing.	1. Check hydraulics/connections. 2. Replace all springs.

Brake Does Not Release – W3H, W4H

Condition	Possible Causes	Correction
Vehicle does not move.	Damaged hydraulic system.	Repair hydraulic system.
Brakes dragging.	1. More than 20 psi (1.4 bar) pressure applied when brakes released. 2. Damaged piston return spring assembly. 3. Piston not returning. 4. Wrong cooling and/or actuation fluid used.	1. Repair hydraulic system so pressure is less than 20 psi (1.4 bar) when brakes released and while machine is operating in any mode. 2. Repair or replace piston return spring assembly. 3. Check piston seals and seal separator for swelling or damage. Replace as necessary. 4. Check piston seals and seal separator for swelling or damage. Replace as necessary. Purge system and use specified fluid.

Section 9 Diagnostics

Brake Does Not Release – W4M, WDM

Condition	Possible Causes	Correction
Insufficient or no pressure to brake.	1. Empty fluid reservoir. 2. Damaged hydraulic system. 3. Leakage of brake actuation fluid.	1. Fill reservoir to correct level with specified fluid. 2. Repair hydraulic system. 3. See “Brake Leaks Actuation Fluid” page 47.
Brakes dragging.	Piston seal lip covers brake housing inlet hole due to lack of 30 psi (2 bar) residual pressure.	System should provide 30 psi (2 bar) residual pressure. See page 30.

Braking Performance - W3H, W4H, W4M, WDM

Condition	Possible Causes	Correction
Noticeable change or decrease in stopping performance.	1. Inadequate actuation fluid supply to brakes. 2. Inadequate pressure to apply brakes. 3. Worn or damaged discs. 4. Overheated seals and/or discs. 5. W4M only: Damaged or broken springs. 6. Dirty or contaminated cooling fluid.	1. Replenish fluid in brake system. Check for leakage and correct cause. 2. Check brake apply system. Check for leakage in brake system or brakes, and correct cause. 3. Inspect and replace discs if necessary. NOTE: As disc wear occurs, make sure brake system can supply adequate fluid to fully apply brakes. 4. Inspect and replace discs and seals if necessary. 5. Replace as necessary. 6. Drain and flush cooling fluid from brakes and entire brake system. Replace with approved fluid. In some cases, it may be necessary to replace discs. Clean or replace filter.
Brake does not fully apply - W3H, W4H	1. Empty fluid reservoir. 2. Damaged hydraulic system. 3. Leakage of brake actuation fluid.	1. Fill reservoir to correct level with specified fluid. 2. Repair hydraulic system. 3. See “Brake Leaks Actuation Fluid” page 47.
Brake does not fully apply – W4M	1. Hydraulic pressure circuit still energized. 2. Apply springs damaged, broke, missing.	1. Check hydraulics/connections. 2. Replace all springs.
Brakes feel spongy/soft.	Brakes or brake system not properly bled.	Bleed brakes and brake system.

Brake Leaks Actuation Fluid - W3H, W4H, W4M, WDM

Condition	Possible Causes	Correction
Internal leak: Fluid bypasses seals into brake cavity and leaks out housing at face seal joint and/or fills axle with fluid bypassing spindle-to-hub seal and blows out breather.	1. Worn or damaged piston seal. 2. Melted or extruded piston seals. 3. Corrosion, pitting, wear or other damage, marks, scratches to piston and/or brake housing bore in area or seal/sealing lips. 4. Either piston seal moves off its seat and moves past the fluid inlet, allowing fluid behind it.	1. Replace piston seals. 2. Correct cause of overheating and replace seals. 3. Clean, smooth, rework or replace affected parts. 4. W4M, WDM only: System should provide 30 psi (2 bar) residual pressure. See page 47.
External leak.	1. Loose bleeder screw. 2. Loose inlet fitting or plugs. 3. Damaged inlet fitting or plugs or damaged seats.	1. Tighten bleeder screw to 15-20 lb.-ft. (20-27 N•m). 2. Tighten inlet fitting to 25-35 lb.-ft. (34-47 N•m). 3. Replace inlet fitting or plug and O-ring if used. Repair or resurface area; or replace as necessary.

Brake Cooling Fluid Leakage - W3H, W4H, W4M, WDM

Condition	Possible Causes	Correction
Coolant leaking out of brake housing.	1. Face seal damaged, worn or improperly installed. 2. Loose drain plug, fill plug, forced cooling plug, or other fittings or hydraulic connections to brake. 3. Damaged plug. 4. Deteriorated or inadequate sealant used at joint. 5. Pressure in cooling cavity too high.	1. Reinstall and/or replace face seal. 2. Tighten plugs, fittings, connections. 3. Replace plug. 4. Disassemble, clean, re-seal and reassemble joint. 5. Make sure cooling system does not produce more than 15 psi (1 bar) normal (or 20 psi [1.4 bar] intermittent pressure spikes) into brake cooling cavity.
Axle housing filling with oil (forced cooling systems only) and may be forced out the breather.	1. Worn or damaged spindle to hub seal. 2. Brush hair lodged in grease under hub-to-spindle seal lip. 3. Pressure in cooling cavity too high.	1. Replace spindle to hub seal and check seal. Journals. 2. Do not use brush to apply grease to seal areas. 3. Make sure cooling system does not produce more than 15 psi (1 bar) normal (or 20 psi [1.4 bar] intermittent pressure spikes) into brake cooling cavity.

Brake Noise And Vibration - W3H, W4H, W4M, WDM

Condition	Possible Causes	Correction
Brakes produce noise, chatter, vibration.	Incorrect cooling fluid and/or friction material used.	1. Use only AxleTech recommended or approved materials. 2. Drain and flush cooling fluid from brake system. Replace with approved fluid. 3. Replace all friction discs. Thoroughly clean or replace stationary discs.

Brake Overheats - W3H, W4H, W4M, WDM

Condition	Possible Causes	Correction
Overheating due to excessive duty cycle.	Inadequate coolant flow or heat exchange.	Re-analyze and re-size brake system if necessary.
Inadequate coolant flow.	Low pump output, blocked filter, coolant lines, or coolant passages in brake housing	Check pump output at different operating modes. Replace filter and check lines. Do not use excessive sealant at cover to housing joint. Too much sealant may squeeze into housing flow passages causing blockage or reduced flow.
Low or no coolant.	1. Improper fill or leaks. 2. Leaking face seal 3. Loose or damaged plugs or other fittings. 4. Deteriorated or inadequate sealant used at joint.	1. Check for proper fill level. 2. Replace or reinstall face seal assembly. 3. Tighten drain, fill or forced cooling plugs and fittings. Replace if damaged. 4. Disassemble, clean, re-seal and re-assemble brake housing joint.
Brake drags - W3H, W4H	1. More than 20 psi. (1.4 bar) pressure applies when brakes released. 2. Damaged piston return spring assembly. 3. Piston not returning. 4. Wrong cooling and/or actuation fluid used. 5. Tight or damaged splines (eg., friction disc-to-hub driver.)	1. Repair hydraulic system so pressure is less than 20 psi. (1.4 bar) when brakes released and while machine is operating in any mode. 2. Repair or replace piston return spring assembly. 3. Check piston seals and seal separator. 4. Check piston seals and seal separator for swelling or damage. Replace as necessary. Purge system and use correct fluid. 5. Repair or replace parts.
Brake drags - W4M	1. Insufficient or no pressure to brake. 2. Tight or damaged splines (Eg. friction disc-to-hub driver). 3. See "Brake Does Not Release".	1. See "Brake Does Not Release - W4M, WDM" page 50. 2. Repair or replace parts.

Fastener Torque Values

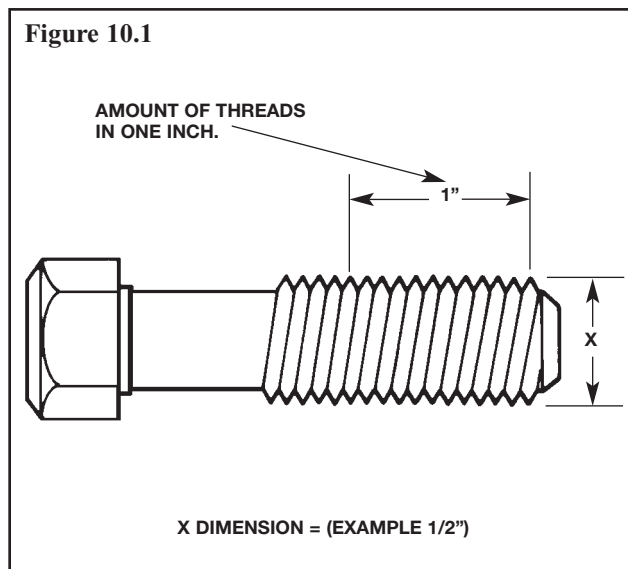
General Information

The torque values in the charts are for fasteners that have a light application of oil on the threads.

- If the fasteners are dry, increase the torque values by ten percent (10%).
- If the fasteners have a heavy application of oil on the threads, decrease the torque values by ten percent (10%).
- If you do not know the size of the fastener that is being installed, measure the fastener. Use the following procedure.

American Standard Fasteners

1. Measure the diameter of the threads in inches, dimension X. **Figure 10.1.**
2. Count the amount of threads there are in one inch (1.0 inch). **Figure 10.1.**



Example of an American Standard size fastener is 0.50-13.

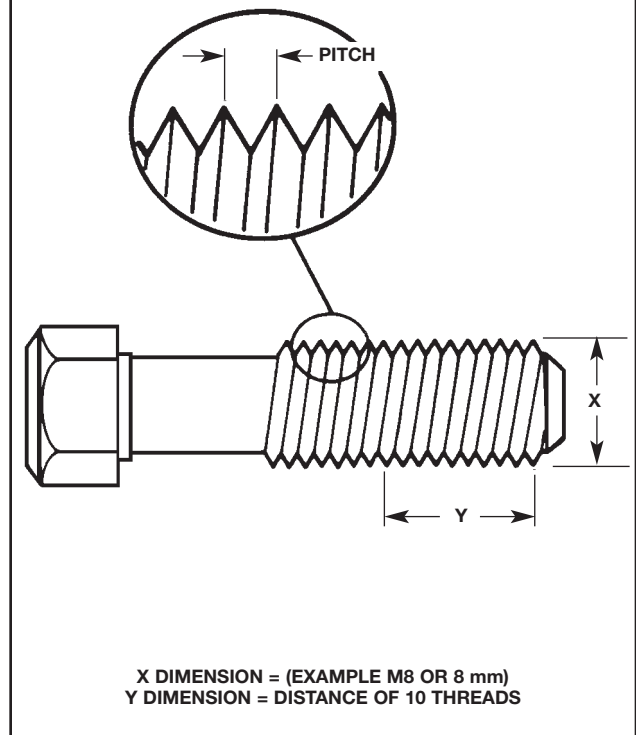
The 0.50 is the diameter of the fastener in inches or dimension X.

The 13 is the amount of threads in one inch (1.0 inch).

Metric Fasteners

1. Measure the diameter of the threads in millimeters (mm), dimension X. **Figure 10.2.**
2. Measure the distance of ten (10) threads, point to point in millimeters (mm), dimension Y. Make a note of dimension Y. **Figure 10.2.**
3. Divide dimension Y by ten (10). The result will be the distance between two threads or pitch.

Figure 10.2



Example of a Metric size fastener is M 8 x 1.25.

The M 8 is the diameter of the fastener in millimeters (mm) or dimension X.

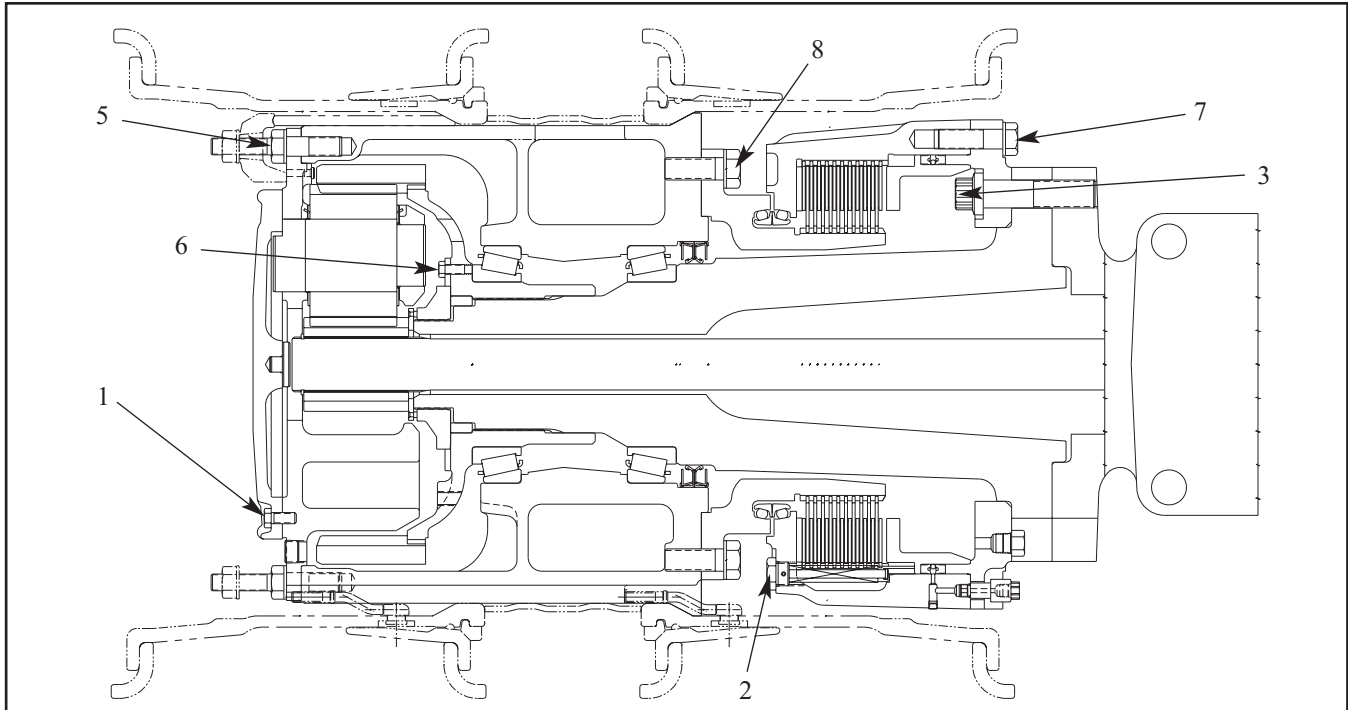
The 1.25 is the distance between two threads or pitch.

Compare the size of fastener measured in step 4 to the list of fasteners in the charts to find the correct torque value.

Section 10

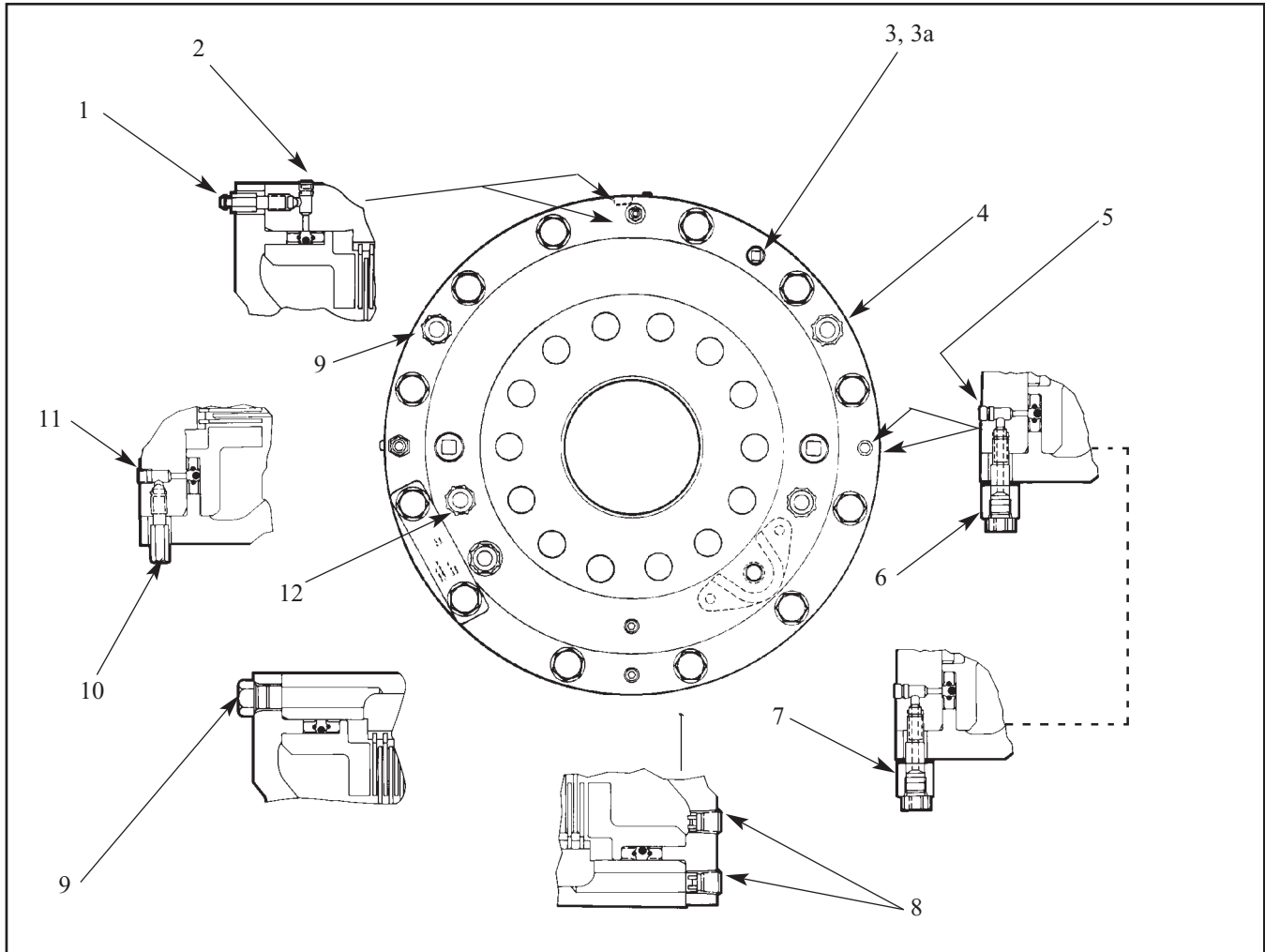
Specifications

Torque Chart: Wheel Hub and Brake Housing (Side View)



No.	Description	Size	Torque	
			Lb-Ft.	N•m
1	Cover-to-Planetary Spider Capscrew	7/16"-14 1/2"-13	60-75 85-115	82-102 116-156
2	Piston Return Spring Plug	—	60-75	81-102
3	Cover and Spindle-to-Axle Housing Capscrew— Internal Mount	5/8"-11 3/4"-10 7/8"-9 7/8"-14 1"-12 1-1/4"-12	180-230 310-400 500-650 500-650 725-950 1700-2200	244-312 450-542 678-881 678-881 938-1288 2305-2983
4	Cover and Spindle-to-Axle Housing capscrew—External Mount (Not Shown)	M16 x 2.00 M20 x 2.50	199-258 369-479	270-350 500-650
5	Planetary Spider-to-Wheel Hub Capscrew and Stud	3/8"-16 1/2"-13 9/16"-12 3/4"-10 7/8"-14	35-50 85-115 130-165 310-400 575-750	48-68 115-156 176-224 450-542 780-1017
6	Bearing Adjusting Nut Lock Plate Capscrew	3/8"-16 7/16"-14	35-50 60-75	48-68 81-102
7	Cover-to-Brake Housing Capscrew	9/16"-12 M16 x 2.00 M20 x 2.50 5/8"-11 3/4"-10 3/4"-16 7/8"-9	125-165 199-258 369-479 180-230 310-400 360-470 500-650	169-224 270-350 500-650 244-312 450-542 488-637 678-881
8	Brake Driver to Wheel Hub Capscrew	3/4"-10 7/8"-14 1"-14	310-400 575-750 850-1100	450-542 780-1017 1152-1491

Torque Chart: Brake Housing Cover (Right-Hand W3H Model Shown)



No.	Description	Torque	
		Lb-Ft.	N•m
1	Hydraulic Bleeder Screw	15-20	20-27
2	Plug	10 (minimum)	14 (minimum)
3	Housing Cover Plug — Pipe Plug	20 (minimum)	27 (minimum)
3a	Housing Cover Plug—O-ring Plug	60-75	81-102
4	Coolant Fill/Level Plug—Sump Cooling Only	35 (minimum)	47 (minimum)
5	Plug	10 (minimum)	14 (minimum)
6	Hydraulic Fluid Inlet Fitting—Tapered Seat	25-35 (1)	34-47 (1)
7	Hydraulic Fluid Inlet Fitting—O-ring	25-35	34-47
8	Magnetic Drain Plugs—Cooling System	20 (minimum)	27 (minimum)
9	Coolant Input Port Plugs	60-75	81-102
10	Optional Hydraulic Fluid Inlet Plug	25-35	34-47
11	Plug	10 (minimum)	14 (minimum)
12	Coolant Output Port Plug	60-75	81-102

Brake Coolant Specifications: Sump and Forced Cooling Systems with Hub Seals

Coolant	Specification
Petroleum Base SAE 10W, SAE 20W or SAE 10W30	See the recommendations of the vehicle manufacturer.

- Tractor oil universal fluid, 'TOU' types formulated for wet disc brakes is recommended for use in the wet disc brake housing. Make sure that the specifications of the tractor fluid are the same as the recommended specifications of the vehicle manufacturer.



CAUTION

The operating temperature of the coolant must never reach or exceed 250°F (120°C). If the operating temperature of the coolant reaches or exceeds 250°F (120°C), the internal components of the brake will be damaged. A forced cooling system may be required to assure the coolant temperature remains below 250°F (120°C).

Coolant Change Intervals

Break-In Interval:	Change the fluid in the brake housing after the first month or the first 200-250 hours of operation, which ever comes first.
Normal Maintenance Interval:	Change the fluid every 6 months or every 3000 hours of operation, which ever comes first.

Hydraulic Fluid Specifications

USE ONLY THE BRAKE HYDRAULIC FLUID SPECIFIED BY THE MANUFACTURER OF THE VEHICLE. DO NOT USE DIFFERENT HYDRAULIC FLUIDS. THE WRONG FLUID WILL DAMAGE THE SEALS ON THE PISTON.

Other Lubrication Wheel End and Axle

REFER TO THE APPROPRIATE AXLETECH NUMBER 9 SERIES MAINTENANCE MANUAL.

AxleTechTM **International**

Suite 400
3001 West Big Beaver Road
Troy, Michigan 48084
U.S.A.
Toll Free: 877-877-9717
Non-Toll Free: 248-816-5401
Fax: 248-435-1990
Website: www.axletech.com

MM4L
Revised 08-06

AxleTech International France
4, Rue Jean Servanton
Boite Postale 656
42042 Saint Etienne Cédex 1
France
(33) 477.92.88.00
Fax: (33) 477.92.88.93

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AxleTech do Brasil Sistemas Automotivos Ltda.
Avendia Joao Batista, 830
Centro-Osasco-SP
06097095 Brasil
Phone: +55 11 36846641
Fax: +55 11 36846859

PD 1591 Series

Dry Disc Brake Calipers

Maintenance Manual No. 4AA



SERVICE NOTES

This Maintenance Manual describes the correct service and repair procedures for Meritor PD 1591 Series Dry Disc Brake Calipers.

The information contained in this manual was current at the time of printing and is subject to change without notice or liability.

You must follow your company safety procedures when you service or repair equipment. Be sure you understand all the procedures and instructions before you begin work on the unit.

Meritor uses the following types of notes to give warning of possible safety problems and to give information that will prevent damage to equipment.



WARNING

A warning indicates procedures that must be followed exactly. Serious personal injury can occur if the procedure is not followed.



CAUTION

A caution indicates procedures that must be followed exactly. If the procedure is not followed, damage to equipment or components can occur. Serious personal injury can also occur in addition to damaged or malfunctioning equipment or components.



TORQUE

This symbol is used to indicate fasteners that must be tightened to a specific torque value.

NOTE:

A note indicates an operation, procedure or instruction that is important for correct service. A note can also give information that will make service quicker and easier.

Some procedures require the use of special tools for safe and correct service. Failure to use these special tools when required, can cause injury to service personnel or damage to vehicle components.



ASBESTOS AND NON-ASBESTOS FIBER WARNING

Current Meritor PD 1591 Series Dry Disc Brake Caliper linings do not use asbestos fibers. Some aftermarket brake linings contain asbestos fiber, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers whose long term effects are unknown.

Caution should be exercised in handling both asbestos and non-asbestos materials as described on page 2.



Base Model: PD 1591

ITEM	DESCRIPTION	QTY.	*SEQUENCE NUMBERS
1	Housing	1	00100
**2	Plug	As req'd.	00260
3	Brake Lining	2	00130
****4	Screw	2	00115
****5	Snap Fastener	2	00120
6	Back-Up Ring	1	00170
7	O-Ring Seal	1	00180
8	Piston	1	00110
9	O-Ring Seal	1	00160
10	Back-Up Ring	1	00150
11	Flat Washer	2	00200
12	Spring	8	00210
13	Spring Cap	1	00190
14	Washer	1	00220
15	Stud	1	00140
16	Nut	1	00230
17	Cotter Pin	1	00240
***18	Bleeder Screw	As req'd.	00270

* Sequence numbers as they appear in the Bill of Material available from the equipment manufacturer.

** 1/8-27 NPTE threaded inlet fitting and pipe plug bleeder.

*** .4374-20-UNF threaded inlet fitting and bleeder screw.

**** Lining retainers.

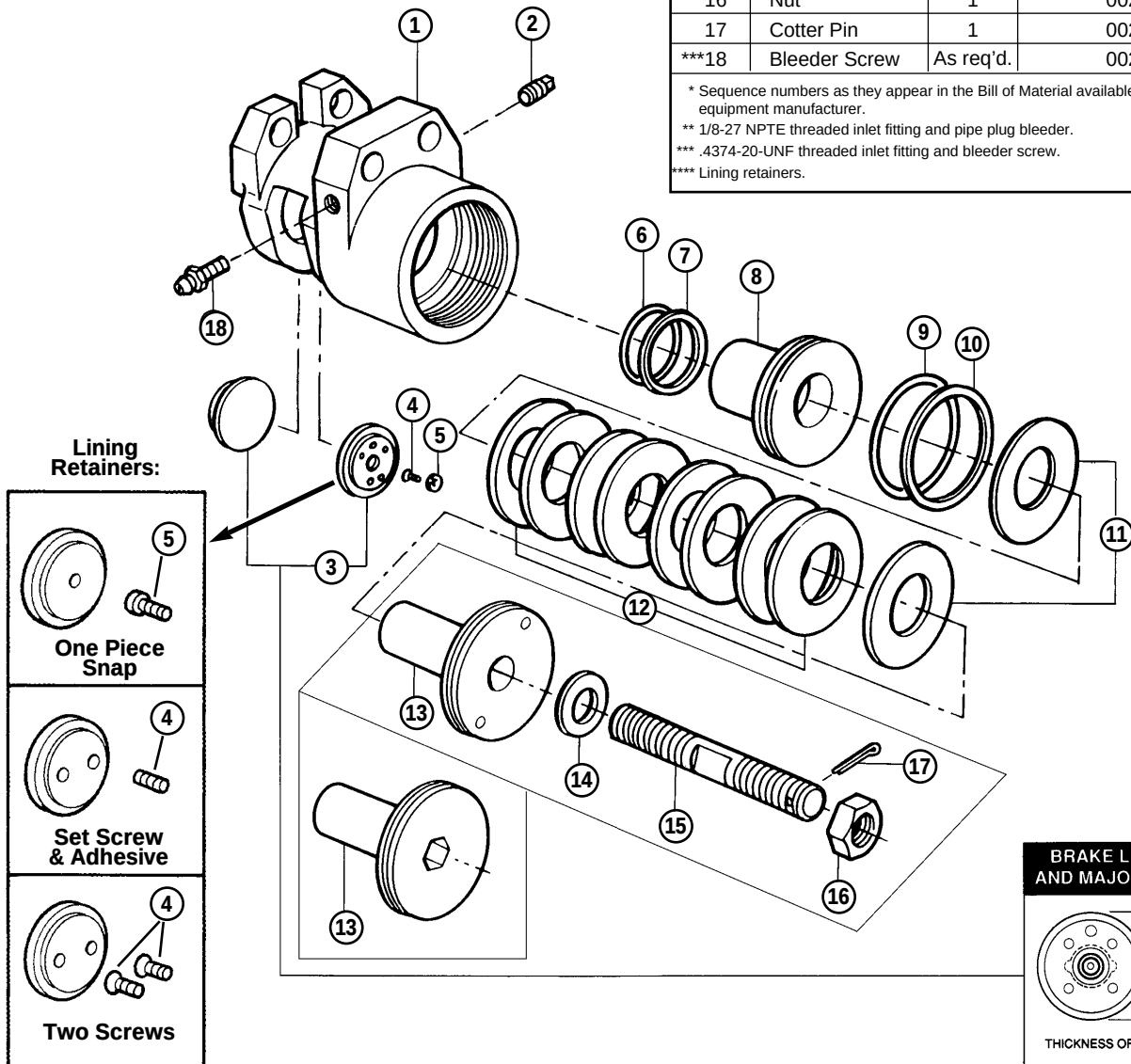


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Asbestos and Non-Asbestos Fibers



ASBESTOS FIBER WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from Meritor.

Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. **Separate Work Areas.** Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

**DANGER: ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA**

2. **Respiratory Protection.** Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.
3. **Procedures for Servicing Brakes.**
 - a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
 - b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - c. If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.
 - d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
 - e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
4. **Cleaning Work Areas.** Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.
5. **Worker Clean-Up.** After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
6. **Waste Disposal.** Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.



NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a potential cancer and lung disease hazard. Material Safety Data Sheets are available from Meritor.

Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some scientists believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. **Separate Work Areas.** Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.
 2. **Respiratory Protection.** OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m³ as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.
- Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposures levels may exceed OSHA or manufacturer's recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.
3. **Procedures for Servicing Brakes.**
 - a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
 - b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - c. If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
 - e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
 4. **Cleaning Work Areas.** Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, to minimize exposure. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.
 5. **Worker Clean-Up.** After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
 6. **Waste Disposal.** Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

Section 1

Introduction

Description

The PD 1591 Series dry disc brake calipers are intended primarily for parking use on hydraulic brake systems. All calipers are free floating and are mounted at the 10 o'clock through 2 o'clock position over the brake disc. **Figure 1.**

Figure 1



Hydraulic pressure keeps the PD 1591 brake released while the vehicle is moving. After the vehicle is stopped with service brakes, the PD 1591 parking brake can be applied to keep the vehicle from moving. When hydraulic pressure is released, the springs inside the brake expand to force the piston and linings against the disc. To release the brake, hydraulic pressure must be applied to compress the springs.

- A loss of hydraulic pressure to the brake will cause it to automatically apply.
- The brake can be released manually if hydraulic pressure is not available.



CAUTION

Application of the PD 1591 in a service situation where the disc is moving can damage the linings. Replace damaged linings.

Hydraulic Fluid



WARNING

- *Use only the type of hydraulic fluid specified by the equipment manufacturer. Do not use or mix different types of hydraulic fluid. The wrong type of hydraulic fluid will damage the rubber parts of the caliper and cause damage, loss of braking and serious personal injury.*
- *Do not reuse hydraulic fluid. Used fluid can be contaminated and can cause loss of braking which could result in serious personal injury.*

The brake system uses one of two types of fluid:

- Petroleum Base Hydraulic Fluid
Example: Meets MIL-H-5606 specifications.
- Non-Petroleum Base Hydraulic Fluid (Automotive Brake Fluid)
Example: Glycol DOT 3, meets SAE J-1703 specifications.

For the type of fluid and specifications, see the recommendations of the equipment manufacturer.

Section 1

Introduction

IDENTIFICATION

Figure 2



Identification

Older assemblies can be identified by a seven-digit assembly number marked on the side of the caliper. More recent assemblies are identified by an identification tag located on the outside of the caliper housing. **Figure 2.**



WARNING

Use only the specified components when you assemble the caliper. Do not mix components from other calipers. If you install the wrong components, the caliper will not operate correctly and may cause damage to the equipment. Use of non-Meritor parts can cause damage and loss of braking which could result in serious personal injury.

Section 2

Troubleshooting

CONDITION	POSSIBLE CAUSES	CORRECTION
Brake does not apply.	1. Damaged springs. 2. Piston cocked in bore. 3. Caliper locked in released position.	1. Replace springs. 2. Replace piston if large end diameter is worn to less than 3.995 inches (101.47 mm) or small end diameter is worn to less than 2.495 inches (63.37 mm). Replace housing if large end of bore exceeds 4.003 inches (101.68 mm) or small end of bore exceeds 2.505 inches (63.63 mm). 3. Move stud nut to end of stud.
Brake does not hold.	1. Brake under-adjusted. 2. Linings or disc excessively worn 3. Grease or oil on linings 4. Damaged springs	1. Adjust brake. 2. Replace linings when thickness is less than 0.125 inch (3 mm) from piston or housing. Replace disc when wear exceeds maximum of 0.06 inch (1.524 mm) per side. 3. Replace linings. 4. Replace springs.
Brake does not release.	1. Piston cocked in bore. 2. Lack of hydraulic pressure.	1. Replace piston if large end diameter is worn to less than 3.995 inches (101.47 mm) or small end diameter is worn to less than 2.495 inches (63.37 mm). Replace housing if large end of bore exceeds 4.003 inches (101.68 mm) or small end of bore exceeds 2.505 inches (63.63 mm). 2. Check for low fluid level, air in system, clogged lines, fluid leaks, damaged seals or seals installed backwards.
Damaged seals	1. Wrong type of fluid used in brake. 2. Spring cap turned while hydraulic pressure was applied to the brake.	1. Drain, flush, refill with correct fluid. Replace O-rings and back-up rings. 2. Replace O-rings and back-up rings.
Damaged springs	1. Brake under-adjusted. Springs fatigued. 2. Lack of lubricant.	1. Replace springs. Adjust brake. 2. Replace springs. Apply anti-seize compound to springs.
Damaged linings or disc.	1. Brake over-adjusted. Linings dragging. 2. Caliper seized on slide pins. 3. Brake used for service or emergency. 4. Piston cocked in bore.	1. Adjust brake. Replace parts as needed. 2. Clean, repair or replace pins or caliper. Replace linings. 3. Replace linings. 4. Replace piston if large end diameter is worn to less than 3.995 inches (101.47 mm) or small end diameter is worn to less than 2.495 inches (63.37 mm). Replace housing if large end of bore exceeds 4.003 inches (101.68 mm) or small end of bore exceeds 2.505 inches (63.63 mm). Replace linings.

Section 3

Removal and Installation

Release Brake Manually



WARNING

To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.



WARNING

If it is necessary to raise the vehicle to service the parking brake, support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip or fall over and cause serious personal injury.



WARNING

Never try to turn or remove the spring cap while hydraulic pressure is applied to the brake. Turning the cap while pressure is applied can damage the O-ring seals and the spring cap threads. Removing the cap can cause serious personal injury by the sudden release of hydraulic pressure. Make sure the nut is at the end of the stud before you put the vehicle in service. If the nut is tightened against the spring cap, the brake cannot be applied and serious personal injury can result.

Release Brake with Caging Stud and Nut

Hydraulic pressure available:

1. Make sure the vehicle is on a level surface.
2. Put blocks under the wheels not being serviced to keep the vehicle from moving.
3. Apply hydraulic pressure to release the brake.
4. To lock the brake in the released position, remove the cotter pin from the stud nut and tighten the nut until it touches the spring cap

NOTE:

The manual release stud and nut have left-hand threads.

5. Release the hydraulic pressure.

Hydraulic pressure not available:

1. Make sure the vehicle is on a level surface.
2. Put blocks under the wheels not being serviced to keep the vehicle from moving.
3. Remove the cotter pin from the stud nut. Tighten the nut against the spring cap and continue tightening to manually retract the piston and lining from the disc. Stop tightening when the spring cap starts to turn.

Release Brake Without Caging Stud and Nut

1. Make sure the vehicle is on a level surface.
2. Put blocks under the wheels not being serviced to keep the vehicle from moving.
3. Release the hydraulic pressure to the brake.
4. Use an Allen-head wrench to loosen the spring cap until all spring pressure is released and the disc rotates freely.

NOTE:

Loosening the spring cap does not retract the piston and lining. It only releases the spring pressure against the piston and lining.

Section 3

Removal and Installation

Remove Caliper

1. Manually release the brake using the procedures described earlier in this section.
2. Disconnect the brake line from the caliper inlet. Put plugs in the brake line and the inlet to prevent contamination of the system.
3. Remove the centering device if one is assembled on the end of the caliper.
4. Remove the caliper slide pin fasteners. Remove slide pins. Remove the caliper from the disc.

Install Caliper

NOTE:

Make sure the caliper has been tested before you do the following steps. See "Testing the Caliper" in Section 5. Make sure all the steps listed below have been done.

1. Check the slide pins and the caliper holes for nicks, burrs or other damage that could keep the caliper from sliding along the pins. Repair or replace components as necessary.
2. Apply a graphite base anti-seize compound to slide pin O.D.
3. If necessary, remove the plugs from the brake line and the caliper inlet and connect the line to the inlet.
4. Remove all air from the brake hydraulic system. See "Bleed Brakes" on page 9.
5. Apply hydraulic pressure to retract the piston and provide clearance to install the caliper over the disc. Install the pins and fasteners to hold the caliper to the mounting bracket. Tighten the fasteners to the torque specified by the vehicle manufacturer. 
6. Check for the correct lining clearance while the brake is released. If necessary, adjust the brake using the procedure later in this section.
7. Make sure the brake slides easily on the slide pins.
8. Reinstall the centering device if one was removed from the end of the caliper.

Adjust Brake

Adjust the brake to provide the lining to disc clearance specified by Meritor or by the equipment manufacturer.

Total lining to disc clearance recommended by Meritor:

Maximum: 0.100 inch (2.54mm)
Minimum: 0.020 inch (0.5mm)

- If the brake has too little clearance, it may not release properly. This will cause the lining to drag and damage both the linings and the disc.
- If there is too much clearance, the clamping force applied to the disc will be reduced. This can cause the brake to slip after it is applied. Too much clearance also puts extra stress on the springs in the caliper. This can cause premature spring wear and damage.

The brake must have less than 0.100 inch (2.54mm) total lining to disc clearance when the brake is released. Check and adjust the brake until the correct clearance is achieved.



WARNING

Never try to turn or remove the spring cap while hydraulic pressure is applied to the brake. Turning the cap while pressure is applied can damage the O-ring seals and the spring cap threads. Removing the cap can cause serious personal injury by the sudden release of hydraulic pressure.

Section 3

Removal and Installation

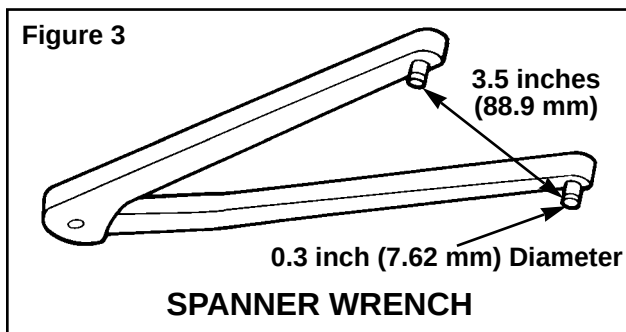
Adjust Brake with Caging Stud and Nut

1. Apply hydraulic pressure to release the brake.
2. To lock the brake in the released position, remove the cotter pin from the stud nut and tighten the nut until it touches the spring cap.

NOTE:

The manual release stud and nut have left-hand threads.

3. Release the hydraulic pressure.
4. Use a spanner wrench to turn the spring cap to provide the lining to disc clearance that is specified by the equipment manufacturer. A quarter turn of the spring cap in either direction changes the total clearance by 0.016 inch (0.4 mm). **Figure 3.**



NOTE:

If equipment manufacturer specifications are not available, Meritor recommends 0.080 inch (2.0 mm) total lining to disc clearance (1-1/4 turns back off) on Meritor axles.

5. Apply hydraulic pressure to the brake to overcome the spring pressure.



WARNING

Make sure the nut is at the end of the stud before you put the vehicle in service. If the nut is tightened against the spring cap, the brake cannot be applied and serious personal injury could result.

6. Loosen the nut, move it to the end of the stud and install the cotter pin to hold the nut in place.
7. Make sure the brake slides easily on the slide pins.
8. Reinstall the centering device if one was removed from the end of the caliper during disassembly.

Adjust Brake without Caging Stud and Nut

1. Apply hydraulic pressure to release the brake.
2. Measure the clearance between the linings and the disc. The clearance must be within the manufacturer's specification.

NOTE:

If equipment manufacturer specifications are not available, Meritor recommends 0.080 inch (2.0 mm) total lining to disc clearance (1-1/4 turns back off) on Meritor axles.

3. To adjust the clearance:
 - A. Release the hydraulic pressure to the brake.
 - B. Use an Allen wrench to tighten or loosen the spring cap to adjust the clearance. A quarter turn of the spring cap in either direction changes the total clearance by 0.016 inch (0.4 mm).
4. Repeat steps 1-3 until the clearance is correct.

Section 3

Removal and Installation

Bleed Brakes



WARNING

When you loosen any brake system hydraulic connection, you must bleed the brakes to remove all air from the system. Air can prevent hydraulic pressure from applying the brakes properly which could increase stopping distances and result in serious personal injury.

NOTE:

The PD 1591 Series Dry Disc Brake Calipers are designed to bleed properly when installed at the 10 o'clock through 2 o'clock position.

Always start at the point in the system that is farthest from the master cylinder and work back toward the master cylinder. Bleed every bleeder screw on every caliper at every brake position. When you complete a bleeder screw, go to the next closest bleeder screw on the same caliper. When you complete a caliper, go to the next closest caliper at the same position. When you complete a position, go to the furthest bleeder screw on the next closest position.

1. Make sure that the master cylinder is filled to the specified level with the type of hydraulic fluid specified by the equipment manufacturer. Keep the master cylinder filled during bleeding so that you do not pull air into the system through the master cylinder. Make sure the master cylinder is filled when you are done bleeding the system.
2. Put a clear tube on the bleeder screw. Submerge the other end of the tube in a clear container of the specified fluid.
3. Bleed brakes.

For full hydraulic systems:

Slowly apply low hydraulic pressure to the brake. Loosen the bleeder screw. Continue to apply pressure until no air bubbles appear in the container of fluid. Tighten the bleeder screw 15-20 lb-ft (20-27 N.m), then release the pressure to the brake.



For air/hydraulic or mechanical actuator systems:

Apply the brake pedal, then loosen the bleeder screw. Tighten the bleeder screw 15-20 lb-ft (20-27 N.m) before you release the brake pedal so that air is not pulled back into the system. Repeat this procedure until no air bubbles appear in the container of fluid when you apply the brake pedal.



4. Check for fluid leaks.

Section 4

Disassembly and Assembly

Disassemble Caliper



WARNING

To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.



WARNING

If it is necessary to raise the vehicle to service the parking brake, support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip or fall over and cause serious personal injury.

1. Remove the inlet fitting and O-ring from the housing. Drain and discard the fluid. Put a plug in the inlet to prevent contamination of the housing.
2. Linings are fastened with either screws, set screws with adhesive, or snaps. Remove fastener. Then remove linings by using a pry bar between the lining and the piston or housing.
3. Use isopropyl alcohol to clean the outside of the housing. Dry the housing with a clean cloth.
4. If necessary, remove the pin and nut from the manual release stud. Do not remove the washer from around the stud unless the washer is loose or damaged.

NOTE:

The manual release stud and nut have left-hand threads.

5. Use a spanner wrench or Allen-head wrench as required to remove the spring cap.
6. Remove the washers and springs from inside the housing.
7. Remove the piston through the hole for the spring cap.
8. If necessary, remove the set screws or snaps if either hold the linings in place on the piston and housing.



CAUTION

Use a wooden tool and a vise with soft jaws in steps 9 and 10 so that you do not damage the housing or piston.

9. Remove and discard the O-rings and back-up rings from the piston and housing.
10. If necessary, hold the piston in a vise with soft jaws and remove the stud from the piston.

NOTE:

The piston has right-hand threads.

Assemble Caliper



WARNING

Use only the specified components when you assemble the caliper. Do not mix components from the other calipers. If you install the wrong components, the caliper will not operate correctly and can cause damage to the equipment. Use of non-Meritor parts can cause damage and loss of braking which could result in serious personal injury.



CAUTION

Use a vise with soft jaws in step 1 so that you do not damage the piston.



WARNING

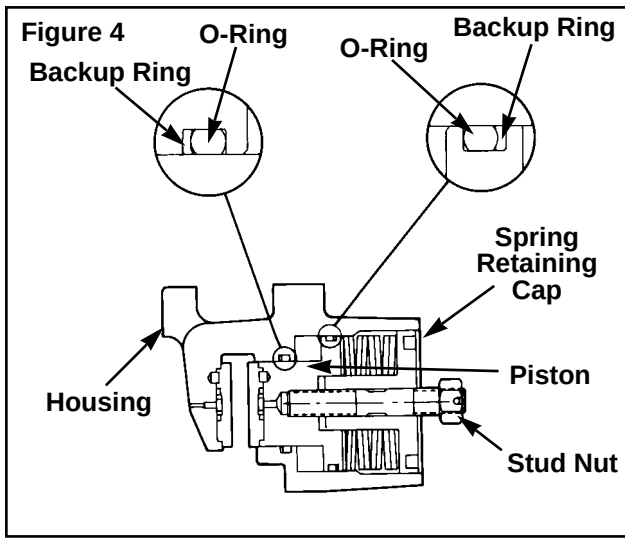
To avoid serious personal injury, be careful when using Loctite. Follow the manufacturer's instructions for safe use to prevent irritation to eyes and skin. Wash after contact. If Loctite gets in the eyes, flush the eyes with water for 15 minutes. Have eyes checked by a doctor.

1. If necessary, install the stud in the piston. Hold the piston in a vise with soft jaws. Apply Loctite 277 or equivalent to the threads in the piston.
2. Lubricate the following components with silicone grease like Dow Corning DC4 or with the type of hydraulic fluid used in the system:
 - Piston outer diameter and ring groove
 - Housing bore and ring groove
 - **New** O-rings and back-up rings

Section 4

Disassembly and Assembly

3. Install a **new** O-ring and a **new** back-up ring in both the piston groove and the housing groove so that the curved side, if applicable, of the back-up ring is against each O-ring. On the piston, the O-ring goes closest to the disc. In the housing, the O-ring goes closest to the spring cap. **Figure 4.**



4. Install the linings:

Linings fastened with adhesive and set screws:

- A. Apply Loctite 271, or equivalent, to the threads of the set screws.
- B. Install the set screws in the piston and the housing. The tops of the screws must be 0.12 inch (3 mm) from the surfaces of the piston and housing.
- C. Apply 3M Super 77 Spray Adhesive, or equivalent, to the linings where they touch the piston and the housing. Follow the manufacturer's instructions for use of the adhesive.
- D. Install the linings on the piston and the housing.

Linings fastened with one piece snaps:

- A. Apply Loctite 271, or equivalent, to the threads of the snap fastener screws.
- B. Screw the snap onto the piston and the housing. Torque to 45-55 lb-in (5-6 N•m). 
- C. Align the lining pins with the holes and engage the snaps in the linings with the snaps on the piston and the housing.

Linings fastened with screws:

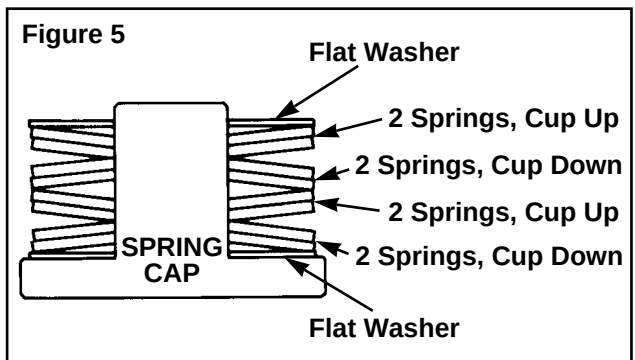
- A. Apply Loctite 271, or equivalent, to the threads of the screws.
- B. Attach linings to the piston and housing. Torque screws to 45-55 lb-in (5-6 N•m). 



WARNING

Replace brake linings when contaminated with grease or hydraulic fluid. Brake linings contaminated with grease or hydraulic fluid can cause loss of braking and serious personal injury.

5. Install the piston and lining through the hole for the spring cap. Push pistons through seals with a steady force. Do not get grease or hydraulic fluid on linings.
6. Apply a graphite-base anti-seize compound to all surfaces of the springs and to the housing threads for the spring cap.
7. Install the washers and springs on the spring cap as shown in **Figure 5.**



8. Install the spring cap, washers and springs into the housing. Tighten the spring cap until the top of the spring cap is even with the top of the housing.
9. If necessary, install the washer around the stud. Attach the washer to the spring cap with 3M Super 77 Spray Adhesive, or equivalent. Follow the manufacturer's instructions for use of the adhesive.
10. If necessary, install the stud nut at the end of the stud and fasten it in place with the pin. **Figure 4.**

Section 5

Inspecting, Cleaning and Testing

Periodic On-Vehicle Inspections



WARNING

To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.

Inspect the caliper, linings and disc as specified by the maintenance schedule of the equipment manufacturer.

Inspect Linings

Inspect the linings for:

- **Lining Wear.** Replace the linings when the thickness of the lining is less than 0.125 inch (3 mm) from the piston or housing.
- **Lining Wear Not Even.** Replace the linings if the thickness of the two linings is different. Check the piston for correct operation. Replace the piston and/or housing if the piston is cocked in the bore. **Refer to “Troubleshooting” for piston and housing wear limits.** Check that the disc surface is flat and parallel to the linings. Check that the brake slides easily on the slide pins.
- **Oil or Grease on Linings.** Replace the linings.
- **Cracks on Linings.** Replace linings that have larger or deeper cracks than the small, tight cracks on the surface of the lining which are normal when the caliper is used under high temperature conditions. These cracks are referred to as “Heat Check Cracks”.



CAUTION

Always replace both linings. If only one lining is replaced, possible disc damage can occur.

Inspect for Caliper Leaks

Inspect the following areas for fluid leaks:

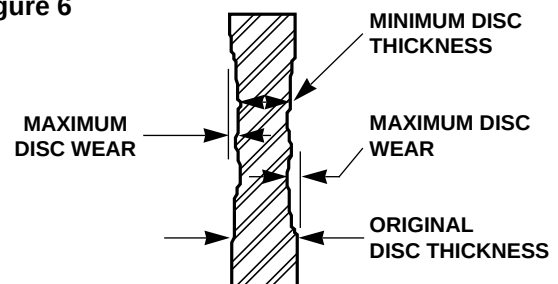
- **Piston or Spring Cap.** If fluid leaks at either the piston or the spring cap, disassemble the caliper. Inspect the piston, the bore, the O-rings and the back-up rings. Service as necessary.

- **Bleeder Screw.** If fluid leaks at the bleeder screw, tighten the bleeder screw. If the leak continues, replace the bleeder screw.
- **Inlet Fitting.** If fluid leaks at the inlet fitting, tighten the fitting. If the leak continues, replace the O-ring.

Inspect Disc

If the disc is worn beyond the wear limits, replace the disc. **Figure 6.** See the specifications of the equipment manufacturer for wear limits that may be different from those shown below.

Figure 6



TYPICAL SECTION THROUGH DISC SHOWING RECOMMENDED MAXIMUM WEAR LIMITS

ORIGINAL DISC THICKNESS	MAXIMUM DISC WEAR (EACH SIDE)	MIN. DISC THICKNESS
0.5 inch (12.7 mm)	0.06 inch (1.5 mm)	0.38 inch (9.7 mm)
0.79 inch (20.0 mm)	0.06 inch (1.5 mm)	0.67 inch (17.0 mm)

Section 5

Inspecting, Cleaning and Testing

Inspect Caliper Parts

1. Inspect the piston, housing bore and O-ring grooves for scratches or corrosion. Remove small scratches or corrosion with fine emery cloth. Replace the component if there are large scratches or large amounts of corrosion.
2. Measure the diameter of the piston at the large end and the small end. Replace the piston if the large end is worn to less than 3.995 inches (101.47 mm) or the small end is worn to less than 2.495 inches (63.37 mm).
3. Measure the diameter of the housing bore at both ends. Replace the housing if the large end exceeds 4.003 inch (101.68 mm) or the small end exceeds 2.505 inch (63.63 mm).
4. Inspect the springs for wear and damage. Replace worn or damaged springs as a set.
5. Inspect the linings as described earlier in this section.
6. Inspect the threads of the spring cap and the housing for damage. If the damage cannot be repaired, replace the cap or housing.
7. If equipped, inspect the threads on the stud in the piston. Replace damaged studs.
8. If equipped, inspect the lining snap fasteners for wear or damage. Replace worn or damaged fasteners.

Cleaning



WARNING

If you use cleaning solvents, hot solution tanks or alkaline solutions incorrectly, serious personal injury can occur. To prevent serious personal injury, follow the instructions supplied by the manufacturer of these products. Do NOT use gasoline to clean parts. Gasoline can explode and cause serious personal injury.



CAUTION

Use only solvent cleaners to clean ground or polished metal parts. Hot solution tanks or water and alkaline solutions will damage these parts. Isopropyl alcohol, kerosene or diesel fuel can be used for this purpose.

- Use solvent cleaners to clean all metal parts that have ground or polished surfaces. Examples of ground or polished parts are the piston and the piston bore in the caliper.
- Metal parts with rough surfaces can be cleaned with solvent cleaners or with alkaline solutions.
- Use a wire brush to clean the threads of fasteners and fittings.
- Use soap and water to clean parts that are not made of metal.
- Scrape away build-ups of mud and dirt on the linings. **Replace all linings contaminated with oil or grease.**
- Immediately after cleaning, dry all parts with clean paper or rags.

Corrosion Protection

Apply brake system fluid to the cleaned and dried parts that are not damaged and are to be immediately assembled. Do NOT apply fluid to the brake linings or the disc.

If parts are to be stored, apply a special material that prevents corrosion to all surfaces. Do NOT apply the material to the brake linings or the disc. Store the parts inside special paper or other material that prevents corrosion.

Section 5

Inspecting, Cleaning and Testing

Test Caliper

NOTE:

The caliper should always be tested after it is assembled and before it is put into service. The tests can be done on a bench or on the vehicle while you install the caliper. To avoid extra work while installing the caliper:

- *Do the tests on the vehicle while you install the caliper, if possible.*
- *If you bench test, use a spacer the same thickness as the disc where the caliper will be installed.*
- *If caliper is already adjusted, proceed to step 4.*

Adjusting Caliper off Vehicle

1. Loosen the spring cap to give enough clearance and then install the caliper onto the disc or spacer. The chart below shows the specified thickness for a new disc for each brake model.
2. Tighten the spring cap until both linings just contact the disc or spacer.

NOTE:

If you use a spacer of the wrong thickness, you will have to adjust the lining clearance after you install the caliper.

Caliper Spec. No.	New Disc/Spacer	*No. of Turns	**Brake Release Pressure
PD1591-9	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
PD1591-10	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
PD1591-11	0.50 in. (12.7 mm)	5.50	2100 psi (145 bar))
PD1591-12	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
PD1591-13	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
PD1591-13-3	0.79 in. (20.1 mm)	5.75	1500 psi (104 bar)
PD1591-13-4	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
PD1591-13-5	0.79 in. (20.1 mm)	5.75	1500 psi (104 bar)
PD1591-14-1	0.79 in. (20.1 mm)	5.75	1500 psi (104 bar)
PD1591-15-1	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
PD1591-15-2	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
PD1591-15-3	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
PD1591-15-4	0.50 in. (12.7 mm)	5.50	2100 psi (145 bar)
PD1591-15-5	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
PD1591-15-6	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
PD1591-15-7	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
PD1591-16-1	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
PD1591-17-1	0.79 in. (20.1 mm)	5.75	1500 psi (104 bar)
PD1591-17-2	0.79 in. (20.1 mm)	5.75	1500 psi (104 bar)
PD1591-18-1	0.79 in. (20.1 mm)	5.75	1500 psi (104 bar)
PD1591-19-1	0.79 in. (20.1 mm)	5.75	1500 psi (104 bar)
PD 1591-20-1	0.50 in. (12.7 mm)	5.75	1500 psi (104 bar)
* On Meritor axles, or the number of turns specified by the equipment manufacturer.			
** Or the pressure specified by the equipment manufacturer.			

Section 5

Inspecting, Cleaning and Testing

3. Remove the caliper from the disc or spacer and then tighten the spring cap the additional number of turns specified in the chart. Doing this determines three important, interrelated items:

- The spring tension that will produce the correct clamp force on the disc when the brake is applied.
- The hydraulic pressure that will be needed to release the brake.
- The lining clearance when the brake is released.



WARNING

- ***Use only the type of hydraulic fluid specified by the equipment manufacturer. Do not use or mix different types of hydraulic fluid. The wrong hydraulic fluid will damage the rubber parts of the caliper and cause damage, loss of braking and serious personal injury.***
 - ***Do not reuse hydraulic fluid. Used fluid that is removed can be contaminated and can cause loss of braking which could result in serious personal injury.***
4. Connect the hydraulic line to the caliper and bleed all air from the caliper. Refer to page 9.

NOTE:

If you disconnect the hydraulic line after bleeding the caliper, you must bleed the caliper again when you install it.

5. After bleeding, apply hydraulic pressure as specified in chart, to make sure that the brake will release when required. If the piston does not retract into the housing at the specified pressure, readjust the brake. Refer to section 3.
6. Release the hydraulic pressure and make sure the springs expand and force the piston out to apply the brake. If not, disassemble the caliper, find and correct the cause of the problem.
7. To check for leaks, apply and release the hydraulic pressure three times. If there are any leaks, disassemble and repair or replace components as necessary.
8. To complete installation of the caliper, refer to page 7.

Section 6

Specifications

Torque Chart

Lining snap fastener screws	45-55 lb-in (5-6 N•m)
Caliper mounting bracket fasteners	Vehicle manufacturer's specification
Bleeder screws	100-120 lb-in (11.3-13.6 N•m)

Wear Dimensions*

Replace Disc:

- Wear exceeds maximum of 0.06 in. (1.524 mm) per side

Replace Housing:

- Large end of bore diameter exceeds 4.003 in. (101.68 mm)
- Small end of bore diameter exceeds 2.505 in. (63.63 mm)

Replace Linings:

- Thickness is less than 0.125 in. (3 mm) from piston or housing

Replace Piston:

- Large end diameter worn to less than 3.995 in. (101.47 mm)
- Small end diameter worn to less than 2.495 in. (63.37 mm)

*See specifications of vehicle manufacturer for wear limits that may be different from those shown above.

Total Lining-to-Disc Clearance

Maximum: 0.100 inch (2.54 mm)

Minimum: 0.020 inch (0.5 mm)

Hydraulic Fluid*

- Petroleum Base Hydraulic Fluid (Mineral Oil). Example: Meets MIL-H-5606 specifications.
- Non-Petroleum Base Hydraulic Fluid (Automotive Brake Fluid). Example: Glycol DOT 3, meets SAE J-1703 specifications.

*See fluid and specification recommendations of equipment manufacturer.

NOTES

NOTES

NOTE:

For more information on parts and kits, see Meritor publication PB-9201, Hydraulic Dry Disc Brake Parts. This catalog is available from:

*Meritor Literature Distribution Center
c/o Vispac, Inc.
35000 Industrial Road
Livonia, MI 48150*

Or call (800) 535-5560



Meritor Heavy Vehicle Systems, LLC
2135 West Maple Road
Troy, MI 48064 U.S.A.
248-435-1085
800-535-5560 (North America only)
www.meritorauto.com

Meritor do Brasil Ltda.
Av. João Batista, 824
06097-900 Osasco-SP
BRAZIL
(55-11) 7084-6510
Fax: (55-11) 7084-6600

Meritor Heavy Vehicle Systems Saint-Etienne S.A.
4, Rue Jean Servanton
Boite Postale 656
42042 Saint Etienne Cedex 1
FRANCE
(33) 477.92.88.00 Fax: (33) 477.92.88.93

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Maintenance Manual UPDATE

Update For Maintenance Manual No. 4AA “PD 1591 Series Dry Disc Brake Calipers” Issued 8/95

This Maintenance Manual No. 4AA Update corrects two of the sequence numbers listed in the parts callout chart for the exploded view of Base Model PD 1591, first page of manual.

The Update also supplies warning information and corrects the bleeder screw torque value on page 9.

1. Observe the following changes in Base Model PD 1591 sequence numbers, first page:

ITEM	DESCRIPTION	QTY.	*SEQUENCE NUMBERS
1	Housing	1	00100
**2	Plug	As req'd.	00270 ←
3	Brake Lining	2	00130
****4	Screw	2	00115
****5	Snap Fastener	2	00120
6	Back-Up Ring	1	00170
7	O-Ring Seal	1	00180
8	Piston	1	00110
9	O-Ring Seal	1	00160
10	Back-Up Ring	1	00150
11	Flat Washer	2	00200
12	Spring	8	00210
13	Spring Cap	1	00190
14	Washer	1	00220
15	Stud	1	00140
16	Nut	1	00230
17	Cotter Pin	1	00240
***18	Bleeder Screw	As req'd.	00250 ←
* Sequence numbers as they appear in the Bill of Material available from the equipment manufacturer. ** 1/8-27 NPTE threaded inlet lifting and pipe plug bleeder. *** .4374-20-UNF threaded inlet lifting and bleeder screw. **** Lining retainers.			

→ Arrows denote change

2. Observe the following warning before Step 1 of Bleeding Brakes, page 9:



WARNING

- *Use only the type of hydraulic fluid specified by the equipment manufacturer. Do not use or mix different types of hydraulic fluid. The wrong type of hydraulic fluid will damage the rubber parts of the caliper and cause damage, loss of braking and serious personal injury.*
- *Do not reuse hydraulic fluid. Used fluid can be contaminated and can cause loss of braking which could result in serious personal injury.*

3. Observe the following torque value changes in Step 3, page 9:

For full hydraulic systems:

Slowly apply low hydraulic pressure to the brake. Loosen bleeder screw. Continue to apply pressure until no air bubbles appear in the container of fluid. Tighten the bleeder screw 100-120 lb-in (11.3-13.6 N.m), then release the pressure to the brake.



For air/hydraulic or mechanical actuator systems:

Apply the brake pedal, then loosen the bleeder screw. Tighten the bleeder screw 100-120 lb-in (11.3-13.6 N.m) before you release the brake pedal so that air is not pulled back into the system. Repeat this procedure until no air bubbles appear in the container of fluid when you apply the brake pedal.

