Tandem Axle Forward Carriers and Single Axle Carriers Including Double-Reduction Carriers

Maintenance Manual 5E

RT- and RP-180 Series
RT- and RP-380 Series
RS-23, -26, -30 and -38-380 Series
SR-170/270/280
ST-170/270/280
SU-170/270/280
SW-170/270/280
SPR-570
SPRC-1927
SPRC-4806
Before You Begin

This manual provides instructions for AxleTech’s heavy-duty large ring gear single and tandem axles, including the SR-, ST-, SU-, SW-170/270/280, RT, RP-180/380, SPR-570, SPRC-1927 and SPRC-4806 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. |
| NOTE | 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 is also available at www.axletech.com vehicle systems component lineup is also available at www.axletech.com.

To access information, click on Products & Services/Tech Library Icon/HVS Publications. The screen will display an index of publications by type.

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* video. Order T-95125V.
- *Splitting the Difference* video. Order T-87127V.
- *Driver-Controlled Full Locking Main Differential* video. Order T-9007V.
SR-, ST-, SU, SW-170/270/280 and RT-, RP-180/380 Forward Rear Axle
(SPR-570, SPRC-1927 and SPRC-4806 Carrier Only)
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Introduction

The SR/ST/SU/SW-170 and RT-, RP-180 single-reduction carriers are used in on-highway forward rear tandem axles. A single reduction exists between the ring gear and the drive pinion. Figure 1.1.

The SR/ST/SU/SW-270-280 and RT-, RP-380 double-reduction carriers are used in on-highway forward rear axles. The first reduction occurs between the helical drive gear on the input shaft and the helical driven gear on the drive pinion. The second reduction occurs between the ring gear and the drive pinion.

The SPR-570, SPRC-1927 and SPRC-4806 carriers are used in off-highway, forward rear tandem axles. The reduction for this axle series occurs between the ring gear and the drive pinion. An oil seal on the input shaft with a cast-iron outer protector and a “labyrinth-type,” one-piece, inner oil seal can be used in these carriers used in off-highway service.

The rear rear axles of the 170 and 180 Series tandem axles utilize the R-170 and R-180 single axle carrier. For more specific information, refer to Maintenance Manuals 5 (MM5) and 5A (MM5A) Single Reduction Rear Differential Carriers.

The rear rear tandem axles of the 270, 280, 380, 570, 1927 and 4806 Series tandems utilize the R-270 or R-280 single axle carrier. For maintenance information, refer to Maintenance Manual 6C, Model 270 Series Double Reduction Differential Carriers.
Axle and Carrier Identification Tags

The axle identification tag is located on the rear of the axle housing. The carrier identification tag is located on the differential carrier next to the fill plug. Use the model number and the ratio number from the identification tag located on the carrier when replacement parts are required. Figure 1.2 and Figure 1.3.

Refer to Figure 1.4 and Figure 1.5 for information about the model number.

Figure 1.2

**AXLE IDENTIFICATION TAG INFORMATION**

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Customer No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial No.</td>
<td>Plant</td>
</tr>
<tr>
<td>Ratio</td>
<td>Date</td>
</tr>
</tbody>
</table>

**LOCATION OF IDENTIFICATION TAG FOR AXLES**

The drawing illustrated below shows the location of the identification tag (or stamp number) for the axles. Location is determined from the LEFT (driver) side looking toward front of vehicle.

A — Front engine drive —
Right rear, next to cover.

B — Rear engine drive —
Left or right rear, next to drive unit.

Figure 1.3

Figure 1.4

**MODEL NUMBER INFORMATION — OFF-HIGHWAY AXLES**

S P R — 5 7 0
S P R C — 1 9 2 7
S P R C — 4 8 0 6
Section 1
Description

Figure 1.5

MODEL NUMBER INFORMATION — ON-HIGHWAY AXLES

SR - 280

LOAD CAPACITY
R 44,000 - 46,000 LBS.
T 50,000 LBS.
U 58,000 LBS.
W 70,000 LBS.

TYPE OF DRIVE
1. SINGLE REDUCTION
2. DOUBLE REDUCTION

SPECIAL SPECIFICATION
MODEL VARIATION T.8

FORWARD-REAR AXLE DESIGNATION — RR-170/270/280; UR-170/270/280; WR-170/270/280
FORWARD-REAR AXLE DESIGNATION WITHOUT OIL PUMP AND INTER-AXLE DIFFERENTIAL
CAN BE CENTER AXLE OF A TREDAM — RR-270/270/270; UR-270/270/270; WR-270/270/270
REAR-REAR AXLE DESIGNATION — RR-170/270/280; UR-170/270/280; WR-170/270/280


MODEL NUMBER INFORMATION
ON-HIGHWAY AXLES

MT - 70 - 380

CARRIER DESIGN SERIES OR VARIATION
1. ORIGINAL DESIGN
2. VARIATION SEQUENCE
3. FROM ORIGINAL DESIGN ETC.

CARRIER SERIES
IDENTIFIED BY RING GEAR SIZE (DIMENSION), LARGER NUMBER MEANS BIGGER RING GEAR (MORE CAPACITY AND RATING).

GEARING TYPE
1. SINGLE SPEED
2. TWO SPEED
3. HELICAL DOUBLE REDUCTION

GEARING TYPE
1. SINGLE SPEED
2. TWO SPEED
3. HELICAL DOUBLE REDUCTION

NOMINAL AXLE LOAD RATING (GAWR)
(TWO DIGITS)
THOUSANDS OF POUNDS TO THE NEAREST THOUSAND POUNDS FOR AXLES MADE IN U.S.A., MEXICO AND BRAZIL. ALL OTHERS IN METRIC TONNES.

AXLE TYPE
D. TANDEM FORWARD/REAR AXLE WITH INTER-AXLE DIFFERENTIAL
N - TANDEM FORWARD/REAR AXLE LESS INTER-AXLE DIFFERENTIAL
T - TANDEM FORWARD/REAR AXLE WITH INTER-AXLE DIFFERENTIAL AND PUMP
M - TANDEM SET (2 AXLE ASSEMBLIES)

NOTE: INDIVIDUAL FORWARD AND REAR AXLES OF A TANDEM SET (D, N, P, M) ARE RATED AS SINGLE AXLES. A TANDEM SET (T) IS RATED AS THE COMBINATION OF THE TWO AXLES.

MERITOR

1002405b
Section 2
Disassembly

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

**Preparing the Axle**
**Before Removing the Differential Carrier**

1. Use a jack to raise the end of the vehicle where the axle is mounted.

**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 and fall over. Serious personal injury can result.

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

3. Remove the plug from the bottom of the axle housing and drain the lubricant from the axle housing.

**CAUTION**
The filter contains approximately one pint of fluid. Make sure that you do not spill any fluid when the oil filter is removed.

4. On forward rear drive carriers, the oil filter can be removed at this time. Remove the bolts that hold the oil filter cover to the helical gear cover. Remove the oil filter cover. Use an oil filter wrench to remove the oil filter. Discard the oil filter. **Figure 2.1.**
5. Disconnect the driveline universal joint from the pinion input yoke or flange on the carrier. 
Figure 2.2.

6. Remove the capscrews and washers or stud nuts and washers from the flanges of both axle shafts.

7. Loosen the tapered dowels in the flanges of both axle shafts according to one of the following procedures.

---

**Figure 2.2**

1. FULL ROUND BEARING CUPS
2. END YOKE
3. YOKE SADDLE
4. WELD YOKE
5. BEARING STRAP
6. CAPSCREWS
7. EASY-SERVICE BEARING CUPS
8. U-JOINT CROSS
9. SLIP YOKE
10. CAPSCREWS
11. END YOKE
12. WELD YOKE
13. SLIP YOKE
14. U-JOINT CROSS
15. CAPSCREWS
16. END YOKE
17. WELD YOKE
18. SLIP YOKE
19. U-JOINT CROSS
20. CAPSCREWS
21. END YOKE
22. SLIP YOKE
23. TUBING
24. U-JOINT CROSS
25. WELD YOKE
Section 2
Disassembly

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.

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

2. Strike the end of the brass drift with a large hammer (five to six pounds) to loosen the axle shaft and the tapered dowels (if applicable). Figure 2.3.

3. Remove the tapered dowels (if applicable) and both axle shafts from the axle assembly. Figure 2.4.

🌟 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.

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

1. Use a round hammer bit and an air hammer such as Chicago Pneumatic CP-4181-Puller, or equivalent, to loosen tapered dowels and axle shaft.

---

Figure 2.3

1. BRASS HAMMER INSIDE LUGS
2. ROUND OR "C"-SHAPED DRIVING LUGS

Figure 2.4

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

2. Place the round hammer bit between the hub studs and against the axle shaft (flange). Operate the air hammer while pressing the round hammer bit at alternate locations between the studs to loosen the tapered dowels (if applicable) and axle shaft from the hub. **Figure 2.5.**

**Figure 2.5**

![Round hammer bit between hub studs](image)

1. **ROUND HAMMER BIT BETWEEN HUB STUDS**

3. Mark to identify each axle shaft before it is removed from the axle assembly.

**NOTE:** AxleTech recommends replacing the split tapered dowels with current design solid tapered dowels.

4. Remove the tapered dowels (if applicable) and separate the axle shaft from the main axle hub assembly. **Figure 2.4.**

**Figure 2.6**

![Thru-shaft and bearing cage assembly](image)

1. **THRU-SHAFT AND BEARING CAGE ASSEMBLY**

**Removing the Carrier from the Axle Housing**

1. Disconnect the air line to the DCDL shift unit.

2. Remove the nut and washer that fasten the output yoke on the thru-shaft. Use a puller to remove the yoke from the thru-shaft. Remove the spacer from the thru-shaft.

3. Remove the capscrews and washers that fasten the output bearing cage to the axle housing. Pull the cage, thru-shaft and bearing assembly from the housing. If necessary, tap on the thru-shaft and cage with a plastic or leather mallet to separate the cage from the housing. Make sure the oil seal is not damaged when the thru-shaft is removed. **Figure 2.6.**

4. Remove and discard the gasket between the output bearing cage and the RTV axle housing.
5. Place a hydraulic rollerjack under the differential carrier to support the assembly. Figure 2.7.

6. Remove all of the carrier-to-housing fasteners except for the top two carrier-to-housing fasteners. Figure 2.7.

7. Loosen the differential carrier in the axle housing. Use a leather or plastic mallet to hit the mounting flange of the carrier at several points.

8. After the carrier is loosened, remove the top two fasteners.

9. Use the hydraulic roller jack to remove the carrier from the axle housing. Use a pry bar with a round end to help remove the carrier from the housing.

10. Use a chain hoist and a lifting hook to lift the differential carrier by the input yoke. Place the carrier in a repair stand. Do not lift the carrier by hand.

Removing the Thru-Shaft, the Bearings and the Seal from the Output Cage

**WARNING**

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

**NOTE:** The diameter of the spacer used in the press, must be smaller than the outer diameter of the thru-shaft to prevent damage to the oil seal and the bearing.

1. Use a press and a spacer to remove the thru-shaft from the bearing and cage assembly. Place a spacer on the threaded part of the thru-shaft. Press the thru-shaft from the cage and bearing assembly. Figure 2.8 and Figure 2.9.
2. Use a press and a sleeve to remove the oil seal from the output bearing cage. Place the yoke side of the cage on the press. Place the sleeve on the oil seal and press the seal from the cage. **Figure 2.10.**

Discard old seal. Always replace seals that have been removed with a triple-lip seal.

**NOTE:** AxleTech recommends replacing all original seals with the current design unitized pinion (main) oil seal.

3. Remove the snap ring that holds the bearings in the cage. **Figure 2.11.**
NOTE: If either the bearing cup or the cone need replacement, both parts must be replaced in a fully-matched set from the same manufacturer.

4. Remove the inner and outer bearing cones from the bearing cage.
5. Remove the bearing cups from the cage. The cups should remain in the cage.

Removing the Helical Gear Cover Assembly — Current Design Helical Cover

NOTE: Do not remove helical gears without marking before disassembly. Refer to “Disassembling the Inter-Axle Differential” in this section.

1. Use a chain hoist to lift the helical gear cover assembly by the input yoke. Place the cover assembly in a repair stand. To make a repair stand, refer to Section 9.
2. Move the cover assembly so that the inside of the cover is toward the floor.
3. Place a yoke holding tool on the input yoke. Loosen but do not remove the nut that holds the yoke on the input shaft. Remove the yoke holding tool.
4. Remove the capscrews and the washers that retain the helical gear cover to the carrier assembly.

NOTE: The thrust washer, the helical drive gear, and the differential side gear are loosely installed in the differential carrier. Make sure the gears and the thrust washer do not fall from the carrier.

**CAUTION**

*Do not use pry bars, chisels or wedges to separate the helical cover from the carrier. Using these tools can cause damage to the mating surfaces between the helical gear cover and the differential carrier and result in oil leakage.*

5. Attach a chain hoist to the input yoke. Lift the helical gear cover from the differential carrier. Tap with a plastic or leather mallet to help separate the cover from the carrier. Figure 2.12.

6. Remove all gasket material from the cover-to-carrier surfaces. Do not score or gouge.
Removing the Oil Filter and the Adapter — Original Design Helical Cover

1. Remove the two capscrews that fasten the oil filter cover to the helical gear cover. Remove the cover.

2. Use a filter wrench to remove the oil filter. Discard the oil filter.

3. Remove the capscrews and washers that fasten the adapter to the helical gear cover. Remove the oil filter adapter. Figure 2.13.

4. Inspect the oil filter adapter threads and the adapter casting. Replace with a new adapter if the threads or the casting are damaged.

Removing the Oil Filter — Current Design Helical Cover

1. Remove the two capscrews that fasten the oil filter guard to the helical cover. Remove the guard.

2. Use a filter wrench to remove the oil filter. Discard the oil filter.

3. Inspect the oil filter adapter threads. If the adapter threads are damaged, remove and replace with a new adapter. Figure 2.14.
Removing the Oil Pump — Original Design Helical Cover

⚠️ **CAUTION**
Do not use a pry bar when pulling the oil pump from the helical cover. The pump must be removed carefully in a straight direction. If the pump is forcefully removed in a direction that is not straight, the pump driveshaft and gears will be damaged.

1. Remove the capscrews and washers that fasten the oil pump to the helical gear cover. Pull the oil pump in a straight line from the helical gear cover. If necessary, tap the pump with a leather or plastic mallet to loosen the pump from the cover. Do not use a pry bar to loosen the pump from the gear cover. **Figure 2.15**.

2. Remove and discard the gasket or the gasket material. Remove all gasket material from the mounting surfaces between the oil pump and the helical gear cover. Make sure the mounting surface and all oil pump passages are clean and free of obstructions.

**Disassembling the Oil Pump — Original Design Helical Cover**

Two different design oil pumps exist.
- Oil Pump with a Gear Pumping System. **Figure 2.16**.
- Oil Pump with a Rotor Pumping System. **Figure 2.17**.

**Gear Pump System Disassembly**

1. The pump cover is fastened to the pump plate by two dowels. Tap on the cover with a leather or plastic hammer to separate the plate from the cover. Remove and discard the gasket. Remove the spring and the check ball for the pressure relief valve from the cover. **Figure 2.16**.

NOTE: Place the cover on a flat surface so that the ball and spring for the pressure relief valve do not fall from the cover.

2. Remove the two pump gears from the plate.

**Figure 2.16**

1. PUMP DRIVEN GEAR AND GEAR SHAFT
2. PUMP PLATE
3. PUMP GEAR SHAFT
4. WASHER
5. SNAP RING
6. SPRING
7. BALL
8. PUMP GEARS
9. DOWEL
10. BALL (4) 2 SMALL — 2 LARGE
11. PLUG (4) 2 SMALL — 2 LARGE ASSEMBLY
12. GASKET
13. PUMP COVER
14. ATTACHING CAPSCREWS AND WASHERS (7)
**CAUTION**
The pipe plugs have depth pins that hold the check valve balls at the correct position in the oil passages. Do not bend or damage the pins.

3. Remove the two large and two small pipe plugs from the cover. Use a magnet to remove the two large and the two small check-valve balls from the pipe plug bores.

4. Remove the snap ring and washer from the driven gear shaft. Remove the shaft and driven gear from the pump plate.

5. Inspect the shaft and pump driven-gear assembly. Replace the shaft and gear as a complete assembly if the gear teeth are worn or damaged.

**Rotor Pump System Disassembly**

1. Remove the capscrews that hold the cap on the pump body. Remove the cap. Remove the O-ring seal from the cap. **Figure 2.17.**

2. Remove the retaining ring that holds the inner rotor on the shaft.

3. Remove the inner rotor, outer rotor and reversing ring from the oil pump body. Remove the inner rotor key from the shaft.

4. Remove the retaining ring that holds the gear and shaft assembly in the pump body. Remove the shaft and gear assembly.

5. Inspect the driven gear and shaft of the pump. Replace the shaft and gear as a complete assembly if the gear teeth are worn or damaged.

6. Use a punch to press down on the pressure relief valve cap. Remove the cotter pin. Slowly release pressure on the cap until the spring extends to its full length. Remove the cap and spring.

7. Use a magnet to remove the poppet from the relief valve bore.

**Removing the Input Shaft, the Forward Bearing and the Clutch Collar — Original Design Helical Cover**

**NOTE:** The input yoke must be removed before the inter-axle differential is disassembled.

1. Place a holding tool on the yoke.

2. Remove the yoke to input shaft nut. **Figure 2.18.**
**CAUTION**
Do not tap the yoke with a hammer to loosen from the input shaft. Tapping with a hammer:
- May damage the yoke and the splines.
- May cause the runout of the yoke to exceed specifications.
- May result in yoke-to-shaft imbalance or misalignment.

3. Using a puller tool, remove the yoke from the input shaft. **Figure 2.19.**

**NOTE:** The clutch collar will drop from the shift fork and shaft as the input shaft is removed from the assembly. The input bearing will be loose inside the cover.

4. Remove the capscrews and washers from the bearing cage to the helical gear cover. Remove the bearing cage, the bearing and the shim pack. The bearing cup should remain inside the cage.

**NOTE:** Keep all shims from the shim pack together. Replace any damaged shims with shims of the same size.

5. Use a press and a sleeve to remove the input shaft from the helical gear cover. Place the sleeve on top of the shaft and press the shaft from the bore in the cover. Do not damage the threads on the input shaft. **Figure 2.20.**

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

6. Use a press and a sleeve to remove the bearing cup from the cage. **Figure 2.21.**

**NOTE:** If either the bearing cup or the cone need replacement, both parts must be replaced in a fully-matched set from the same manufacturer.

7. Remove the bearing cage oil seal from the carrier using the following procedures:

**Figure 2.21**

1. CUP
2. PRESS
3. BEARING CAGE
Triple-Lip and Unitized Pinion (Main) Oil Seal

NOTE: AxleTech recommends replacing all original seals with the current design unitized pinion (main) oil seal.

A. Use a press and a sleeve to remove the triple-lip (main) oil seal from the bearing cage. If a press is not available, place a tool with a flat blade under the flange to remove the oil seal from the cage. Figure 2.22.

Figure 2.22

1. Following yoke removal, separate the POSE™ seal from the yoke hub by pulling it off by hand. Figure 2.23.

2. Use a press and a sleeve to remove the triple-lip (main) oil seal in the same manner as described earlier.

Figure 2.23
Section 2
Disassembly

One-Piece (Single Lip) Oil Seal

A. Use a press and a sleeve, or a drift and a hammer to remove the one-piece seal from the bearing cage. **Figure 2.24.**

**NOTE:** AxleTech recommends replacing all original seals with the current design unitized pinion (main) oil seal.

![Figure 2.24](image_url)

**Press and Sleeve Method**

**Hammer and Drift Method**

---

Cast-Iron Outer Protector and One-Piece (Labyrinth-Type) Inner Oil Seal

A. Pull the cast-iron outer protector from the bearing cage. **Figure 2.25.**

B. Use a press and a sleeve to remove the inner seal from the cage.

![Figure 2.25](image_url)

**Press and Sleeve Method**

**Hammer and Drift Method**
Disassembling the Input Shaft, the Bearing Cage and the Oil Pump — Current Design

1. Use the correct tool to remove the yoke or flange from the input shaft. Figure 2.28.

2. Install bearing puller onto input shaft. Make sure that oil pump rivets do not touch or contact the bearing puller. Figure 2.29.

3. Place the assembly on a press so that the assembly rests on the puller. Figure 2.30.

4. Place a protector on top of the threaded part of the shaft. Press the input shaft from the assembly. Remove the bearing puller. Figure 2.31.

5. Remove the capscrews that fasten the oil pump to the input bearing cage. Separate the oil pump from the cage. Figure 2.31.
Section 2
Disassembly

6. Replace the pump if the pump is worn or damaged. If the splines in the pump do not move, replace the entire pump assembly. This current design oil pump cannot be serviced.

   Remove the O-rings from the bearing cage and the oil pump assembly.

   Remove the cone from the input bearing cage.

   **NOTE:** If either the bearing cup or cone need replacement, both parts must be replaced in a fully-matched set from the same manufacturer.

7. If necessary, use a press and a sleeve to remove the cup from the input bearing cage.

8. If necessary, remove the pressure-relief valve assembly from the front of the bearing cage. Remove the plug, the spring and the relief valve from the bore. **Figure 2.32.**

---

**Figure 2.30**

1. PRESS
2. PROTECTOR
3. BEARING CAGE
4. BEARING PULLER
5. OIL PUMP

**Figure 2.31**

1. OIL PUMP
2. BEARING CONE
3. BEARING CAGE

**Figure 2.32**

1. PLUG
2. SPRING
3. RELIEF VALVE
Section 2
Disassembly

Triple-Lip and Unitized Pinion (Main) Oil Seal

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

Use a press and a sleeve to remove the triple-lip (main) oil seal from the bearing cage. If a press is not available, place a tool with a flat blade under the flange to remove the oil seal from the cage. Figure 2.33.

**NOTE:**
If any parts of the shift unit are damaged, replace the shift unit as a complete assembly.

1. On units that have long capscrews with tab retainers, use a tool with a flat blade to bend back the retainer tabs. Each capscrew has a three-tab retainer. One tab of the retainer is bent against the head of the capscrew. The other two tabs are bent against the top of the shift unit. Remove the long capscrews.

2. On units that have Allen-head capscrews, remove the four capscrews.

3. Remove the shift unit from the helical gear cover. *Figure 2.34.*

4. From inside the helical gear cover, remove the roll pin that fastens the shift fork to the shift shaft. Use a small diameter drift and a hammer to tap the pin from the fork and the shaft.

5. Pull the shift shaft out from the shift unit bore. The fork and the spring fall when the shaft is removed. Remove the fork and spring. *Figure 2.35.*

6. Remove the jam nut and the adjusting screw for the shift shaft on the helical gear cover. *Figure 2.35.*

---

**Removing the Shift Unit, the Shift Fork and the Shift Shaft**

**NOTE:** Two types of shift are used:

- **Shift Units with Long Capscrews and Tab Retainers**
- **Shift Units with Allen-Head Capscrews**
Removing the Idler Gear of the Rotor Oil Pump from the Original Design Helical Gear Cover

**NOTE:** Remove the shift unit before you remove the idler gear of the oil pump.

- Ball Bearing. **Figure 2.36.**
- Cone and Roller Bearing with Idler Sleeve. **Figure 2.37.**
- Cone and Roller Bearing with Solid Idler Shaft. **Figure 2.38.**

**Oil Pump Idler Gear — Ball Bearing**

1. Remove the nut and the washer from the idler gear shaft on the outside of the helical gear cover. **Figure 2.36.**

2. Tap on the idler gear shaft with a brass drift and hammer to remove the shaft and gear assembly from the cover.

3. Remove the spacer from the idler gear shaft.

4. Remove the snap ring that holds the bearing in the idler gear bore. Remove the shaft and bearing assembly from the gear.

5. Support the bearing on the inner race. Use a press or tap with a brass drift and hammer on the shaft to separate the shaft from the bearing.
Section 2
Disassembly

Oil Pump Idler Gear — Cone and Roller Bearing with Idler Sleeve

1. Remove the nut and the washer from the idler gear bolt on the outside of the helical gear cover. Remove the bolt. Figure 2.37.
2. Remove the idler gear and sleeve assembly from the inside of the helical gear cover.
3. Remove the cone and roller bearings and the spacer from the idler gear.

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

4. Use a press and a sleeve to remove the idler sleeve from the helical gear cover.
5. Use a press and a sleeve to remove both bearing cones and the spacer from the gear.

Oil Pump Idler Gear — Cone and Roller Bearing with Solid Idler Shaft

1. Remove the nut and washer from the idler gear shaft on the outside of the helical gear cover. Remove the idler gear shaft. Figure 2.38.
2. Remove the idler gear and sleeve assembly from the inside of the helical gear cover.
3. Remove the cone and roller bearings and the spacer from the idler gear.
4. Use a press and a sleeve to remove both bearing cones and the spacer from the gear.

Figure 2.37

Figure 2.38
Disassembling the Inter-Axle Differential

1. Remove the oil filter screen from the carrier housing. The screen is in the lower left of the housing next to the helical driven gear. Figure 2.39.

2. Separate the screen from the seat. Inspect the screen for damage. If damaged, replace the screen. If the screen is in good condition, clean the screen. Figure 2.40.

**WARNING**

Do not use a punch and hammer or attempt to strike and mark the helical driven gears. Striking hardened steel gears with a hammer and punch can damage the gear and result in personal injury. Grind the marks on the gear or use a file to mark the gears.

3. Before removing the helical drive and the driven gears, rotate them until the alignment marks are opposite each other as shown. Figure 2.41.
Section 2
Disassembly

⚠️ **CAUTION**

*Do not apply pressure to the teeth of the side gear. Pressing on the teeth will damage the side gear.*

**NOTE:** Aligning the helical gear marks opposite one another before removal from carrier will facilitate the carrier reassembly operation.

4. Remove the forward side gear and the helical drive gear assembly and the thrust washer from the top of the differential case.

⚠️ **WARNING**

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

5. On some single-reduction carriers only, remove the side gear from the helical drive gear. Use a press and a sleeve to separate the side gear from the drive gear. The outer diameter of the sleeve must fit the front hub of the side gear. **Figure 2.42.**

When the gear is removed from the drive gear, the Woodruff key falls from the slot in the side gear. **Figure 2.43.**

6. Remove the inter-axle differential case from the carrier housing. **Figure 2.44.**
NOTE: On all double-reduction carriers and some single-reduction carriers, do not separate the side gear from the helical drive gear. The side gear and the drive gear are replaced as an assembly.

NOTE: The rear side gear and the rear input bearing remain loose in the carrier housing.

7. Use a punch and a hammer to alignment marks on the case halves for marking the inter-axle differential. The alignment marks permit correct assembly of the case halves. Figure 2.45.

8. Remove the bolts, nuts and washers that fasten the case halves together. Separate the case halves. Remove the spider, the four pinions and the thrust washers.

NOTE: If either the bearing cup or cone need replacement, both parts must be replaced in a fully-matched set from the same manufacturer.

9. Remove the side gear and the bearing cone from the carrier housing. The bearing cup stays in the housing. If the bearing cup needs to be replaced, use a bearing puller to remove the cup from the housing. Figure 2.46.

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

10. If the bearing cone needs to be replaced, use a press and a sleeve to remove the cone from the rear side gear. If a press is not available, use a bearing puller to remove the cone from the gear. Figure 2.47.
Removing the Main Differential Case and Ring Gear Assembly

1. Place the carrier in a repair stand. Move the carrier so that the helical drive and drive gears are toward you. Loosen the jam nut first and then loosen the thrust screw. **Figure 2.48.**

**NOTE:** To make a repair stand, refer to Section 9.

2. Turn the carrier upside down so that the ring gear is toward you.

3. Unless a new ring gear and drive pinion are being installed, inspect and record the ring gear backlash. Install a dial indicator on the carrier-to-housing surface. Move the ring gear so that the ring gear teeth fully engage the drive pinion teeth. Place the tip of the dial indicator against a tooth on the ring gear. Record the reading of the backlash. The backlash reading is required to correctly install the ring gear and the drive pinion in the carrier. **Figure 2.49.**

4. Use a punch and a hammer to mark the position of the bearing caps on the carrier legs. Mark each bearing cap. **Figure 2.49.**

**NOTE:** The bearing cap must be installed on the carrier leg from which it was removed. The cap is matched to the carrier leg. Do not mix bearing caps on carrier legs.

5. Remove the capscrews and the bearing adjusting ring locks. **Figure 2.49.**

6. Use a “T” bar wrench or equivalent tool to loosen the bearing adjusting rings. Do not remove the adjusting rings. **Figure 2.50.**

7. If used, remove the cotter pins from the bearing cap. Remove the capscrews and washers from the bearing caps. **NOTE:** If either the bearing cup or the cone need replacement, both parts must be replaced in a fully-matched set from the same manufacturer.

8. Remove the bearing caps, bearing cones and adjusting rings from the carrier. **Figure 2.50.**

9. Use a lifting device to remove the main differential case and ring gear assembly from the carrier. **Figure 2.51.**

10. If the bearing cones on the differential case need to be replaced, remove the bearings. Use a bearing puller tool to remove the bearings from the case. **Figure 2.53.**
Section 2
Disassembly

Figure 2.50
Figure 2.51
Figure 2.52
Figure 2.53

1 MATCH MARKS

1002454a
1002455a
1002456a
1002457a

MATCH MARKS
1 PULLER
2 PRESS
Disassembling the Main Differential Case and the Ring Gear

1. If the alignment marks on the case halves are not visible, use a punch and a hammer to mark each case half. The alignment marks permit correct assembly of the case halves. Figure 2.54.

2. On all single-reduction carriers and some double-reduction carriers, remove the capscrews and washers that fasten the case halves together. On some double-reduction carriers, remove the thru-bolts, washers and lock nuts that fasten the case halves together. Separate the differential case.

3. Remove the spider, the pinions, the side gear and the thrust washers from each case half. Figure 2.55.

4. If the ring gear needs to be replaced, remove the ring gear from the differential case. Remove the bolts, nuts or lock nuts and washers that fasten the ring gear to the differential case.

5. Use a press and a plate to remove the ring gear from the case half. Figure 2.56.
Removing the Drive Pinion and the Cage Assembly

1. Use the following suggested holding fixture to remove the pinion gear assembly from the carrier. **Figure 2.58.**
2. Weld an old helical gear to a steel plate. Mesh or engage the plate gear with the drive pinion gear.
3. Tighten down the plate to the carrier using six 1/2-13 capscrews to bolt the tool/fixture to the carrier. **Figure 2.58.**
4. Loosen the drive pinion shaft nut at this time.
5. On single-reduction carriers, remove the capscrews that fasten the cage to the main carrier housing.

**NOTE:** If the gear, the pinion and the cage assembly is difficult to remove, use a brass drift and a hammer. Place the brass drift on the pinion shaft and use a hammer to tap the assembly from the housing. **DO NOT** tap directly on the spigot bearing or the retaining ring or damage to the pinion cage may occur and result in drive pinion failure after carrier reassembly and while in service.

6. On double-reduction carriers, remove the capscrews that fasten the cage to the main carrier housing according to the following procedures:
   A. Loosen the capscrews until the head of each capscrew touches the helical driven gear.
   B. Evenly loosen each capscrew three turns. When the capscrews are loosened, the cage is pulled straight from out of the carrier. The capscrews become a puller when the heads are against the helical driven gear.
   C. Continue to evenly loosen the capscrews until the capscrews and the cage are removed from the housing.

**Figure 2.58**

1 3/8 STEEL PLATE
2 1/2-13 CAPSCREWS – 6 REQUIRED
3 ORIGINAL HELICAL DRIVE GEAR

1 SNAP RING
2 SPIGOT BEARING
3 DRIVE PINION
4 PINION BEARING CUP AND CONE
5 SPACER
6 SHIMS
7 PINION BEARING CAGE
8 PINION BEARING CUP AND CONE
9 CAPSCREW AND WASHER
10 HELICAL DRIVEN GEAR
11 PINION NUT AND WASHER
7. Remove the gear, the pinion and the cage as an assembly from the housing. **Figure 2.59.**

8. Remove the shims from under the cage. Keep the shims together for assembly. Replace any damaged shims with new shims of the same thickness.

9. Remove the nut and washer that fasten the helical driven gear to the drive pinion. **Figure 2.60.**

10. Use a press and a spacer to remove the pinion from the gear and the cage. Place the spacer on top of the threaded part of the pinion. The spacer must be larger than the outer diameter of the pinion shaft. Press the pinion from the gear and the cage. **Figure 2.61.**

11. Remove the spacer from the pinion shaft.

12. Remove the outer bearing cone from the cage.
13. If the inner bearing cone needs to be replaced, use a bearing puller to remove the cone from the pinion. Discard the cone. **Figure 2.62.**

**NOTE:** If either the bearing cup or the cone need replacement, both parts must be replaced in a fully-matched set from the same manufacturer.

14. If the bearing cups need to be replaced, use a bearing puller to remove the cups from the cage. Discard the cups. **Figure 2.63.**

15. If the spigot bearing needs to be replaced, remove the bearing from the pinion. Refer to the following procedures to remove the type of spigot bearing that is used on the right pinion.
One-Piece Spigot Bearing

A. Remove the snap ring that fastens the spigot bearing to the drive pinion. Figure 2.64.

B. Use a bearing puller to remove the spigot bearing from the drive pinion. Figure 2.65.

C. Discard the spigot bearing.

Two-Piece (Separable Race) Spigot Bearing — 280/380 Series Only

A. Remove the inner race if it is damaged, or the outer race and roller if damaged. Use a press, a bearing puller and a sleeve to remove the inner race from the drive pinion. Discard the inner race.

B. Remove the snap ring and outer race and roller assembly from the bore in the differential carrier. Remove the snap ring from the outer race and roller. Discard the outer race and roller when the inner race is removed.
Clean and Inspect Yokes

**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.

1. Clean the ground and polished surface of the yoke journal using a clean shop towel and a safe cleaning solvent. Do not use abrasive cleaners, towels, or scrubbers to clean yoke or flange surface. DO NOT USE GASOLINE.

2. Inspect the original yoke seal surface for any grooves.

   A. The rubber inner sleeve of the unitized pinion seal (UPS) allows the reuse of yokes with grooves unless the groove depths are excessively deep. If grooves are present, measure the groove diameters with calipers. Refer to Figure 3.1 to determine if the yoke is usable.

   B. If grooves are present on yoke hubs which are used with single or triple lip seals, then the yokes must be replaced.

3. If any of the yoke grooves measure less than the dimensions in Figure 3.1, replace the yoke. The rubber inner sleeve of the unitized pinion seal (UPS) is designed to seal on the yoke and rotate with the yoke.

---

**Figure 3.1**

<table>
<thead>
<tr>
<th>YOKE SEAL DIAMETER</th>
<th>MINIMUM YOKE DIAMETER AT GROOVE (INCHES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.000/3.005&quot;</td>
<td>2.990&quot;</td>
</tr>
<tr>
<td>3.250/3.255&quot;</td>
<td>3.240&quot;</td>
</tr>
</tbody>
</table>

---

**CAUTION**

Do not install a press on shaft excluder (or POSE™ seal) after installation of a unitized pinion seal. The use of a POSE™ seal will prevent correct seating of the unitized pinion seal on the yoke and will result in lubricant leakage at the seal. POSE™ seal installation is recommended only for triple lip and other previous design seals.

Do not use thin metal wear “sleeves” to refresh the yoke surface. Wear sleeves pressed onto the yoke will prevent correct seating of the pinion seal and damage the pinion seal assembly. Wear sleeve usage will cause the seal to leak.
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 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.

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 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.

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 the Axle Assembly

1. The axle assembly can be steam cleaned on the outside to remove dirt, and grease.
2. Before the axle is steam cleaned, 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 reused or 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.

Inspecting the Parts

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

1. Inspect the Tapered Roller Bearings:

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

   A. The center of the large diameter end of the rollers is worn level with or below the outer surface. **Figure 3.2.**

   B. The radius at the large diameter end of the rollers is worn to a sharp edge. **Figure 3.2.**

   C. A visible roller groove is worn in the inner race surfaces of the cup or cone. The groove can be seen at the small or large diameter end of both parts. **Figure 3.3.**

   D. Deep cracks or breaks in the surface of the roller cage. **Figure 3.3.**

   E. Bright wear marks on the outer surface of the roller cage. **Figure 3.4.**
F. Etching or pitting on rollers and on the surfaces of the cup and cone inner race that touch the rollers. Figure 3.5.

G. Spalling or flaking on the cup and cone inner race surfaces that touch the rollers. Figure 3.6.

**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 the ring gear and the drive pinion must be replaced at the same time.*

2. Inspect the Hypoid Drive Pinion and Ring Gear Sets. Check hypoid pinions and gears for wear or damage. Gears that are worn or damaged **must** be replaced.

3. Inspect the Main Differential Assembly.
   Carefully check the parts for wear. Parts that are worn or damaged **must** be replaced. Figure 3.7.
CAUTION
Always replace thrust washers, differential side gears and pinion gears in sets. A higher stress on parts and early failure of the assembly will occur if a new part is used with a worn part.

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. Inspecting the Helical Drive and the Driven Gears.
Inspect the helical drive and the driven gears for wear or damage. Replace gears that are worn or damaged. On double-reduction carriers, the helical drive gear and the helical driven gear must be replaced as a set. They are not serviced separately.

5. Inspecting the Axle Shafts.
Inspect axle shafts for wear, stress and cracks at the flange, shaft and splines. Replace axle shaft if required.

Repairing or Replacing Axle Components
Replace worn or damaged parts of the axle assembly. The following are some examples of checking the axle assembly for repair or replacement.

1. Replace any fastener if the corners of the head are worn.
2. Replace the washers if damaged.
3. Replace the gaskets, oil seals or grease seals at the time of axle or carrier repair.
4. Clean the parts and apply new silicone gasket material where required when the axle or carrier is assembled. Figure 3.8.

5. Remove nicks, mars and burrs from parts having machined or ground surfaces. Use a fine file, india stone, emery cloth or crocus cloth for this purpose.
6. Clean and repair the threads of fasteners and holes. Use a die or tap of the correct size or a fine file for this purpose.
Section 3
Prepare Parts for Assembly

**CAUTION**
Threads must be clean and undamaged so that accurate adjustments and correct torque values can be applied to fasteners and parts.

7. Tighten all fasteners to the correct torque values. Refer to Table H in Section 7, for torque values of fasteners. Figure 3.9.

**WARNING**
Repair of axle housings by bending or straightening will cause poor performance, early failure and unsafe operation of the axle.

8. Do not repair rear axle housings by bending or straightening.

**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 axle and early 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 in correct 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 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.

   D. Clean the damaged area inside and outside the housing. Cleaning solvent can be used.
   E. Grind the damaged weld to the base material.
   F. Warm the complete axle housing to a temperature of 70°F to 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).

Repairing the Axle Housing by Welding

1. AxleTech will permit welding on drive axle housing assemblies only in the following areas:
   A. Only RT-46-160 axles housing to cover weld joints. Refer to TP-9599.
   B. Snorkel welds.
   C. Housing seam welds between the suspension attaching brackets.
   D. Bracket welding to drive axle housing. Refer to TP-9421.
   E. Refer to Maintenance Manual 8 for approved axle welding procedures.

Figure 3.9
ALWAYS USE TORQUE WRENCHES

1002473a
CAUTION
If the E-7018 weld rod is used, the rod must be kept dry. Electrodes that are not stored in correctly sealed containers must be heated at 300°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.

H. Use a 70,000 psi tensile weld material and the correct voltage and amperage for the diameter weld rod used. Examples of weld rod that can be used are E-7018 or ER-70S-3.

I. Fill in the Weld Gap as follows:

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

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

1. The snorkel weld must be a 0.375-inch (9.500 mm) fillet.
2. The opening in cover welds must be filled level with the old weld.
3. 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 the housing.
4. Clean the new weld area. Carefully remove all rough weld material.
5. Fill the axle assembly with the correct amount of lubricant. Refer to Maintenance Manual 1, Lubrication, for information on using lubricants.

NOTE: To weld brackets or other components to the axle housing, use the procedure in Technical Bulletin, TP-9421.

Bending or Straightening Drive Axle Housings
AxleTech is emphatically opposed to 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 result in component damage or 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 3
Prepare Parts for Assembly

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

⚠️ CAUTION
Threads must be clean and undamaged so that accurate adjustments and correct torque values can be applied to fasteners and parts.

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.

NOTE: There is no drying time required for AxleTech Liquid Adhesive 2297-C-7049, Loctite680 or equivalent.

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 3.10.

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

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 3.11.

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 “Installation of the Main Differential Case and Ring Gear Assembly into the Carrier” in Section 4.

5. Adjust preload of the differential bearings and the ring gear backlash. Perform a tooth contact pattern check of the gear set, as required. Refer to “Adjusting the Preload on the Differential Side Bearings” in Section 4.

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 can be used for AxleTech components:
- Three Bond Liquid Gasket No. TB 1216 (Grey)
- Loctite® Ultra Grey Adhesive/Sealant #18581
- From AxleTech:
  - Ten-ounce tubes, Part No. 2297-F-7052
  - Three-ounce tubes, Part No. 2297-Z-7098

1. Remove all old gasket material from both surfaces. Figure 3.12.

2. Clean the surfaces where silicone gasket material will be applied. Remove all oil, grease, dirt and moisture without damaging the mating surfaces. Figure 3.12.
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.*

**NOTE:** AxleTech adhesive products are available from AxleTech International. Call 877-547-3907 for more information.

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 3.13.**

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 H** in Section 7.

6. Wait 20 minutes before filling the assembly with lubricant.

**Figure 3.13**

1 0.125” (3 MM) DIAMETER SILICONE GASKET BEAD
Gear Set Information — Markings on the Drive and the Ring Gear

**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.*

**NOTE:** Before a new gear set is installed in the carrier, read the following information. ALWAYS INSPECT THE GEAR SET FOR CORRECT MARKS TO MAKE SURE THE GEARS ARE A MATCHED SET.

The location of the marks are shown in Figure 4.1.

**Figure 4.1**

1  1, 2  
2  3, 4  
3  1, 2, 3  
4  1, 2, 3, 4

1. **Part Number**
   A. **Examples of gear set part numbers:**
      - Conventional ring gear, 36786.
      - Conventional drive pinion, 36787.
      - Generoid ring gear, 36786 K.
      - Generoid drive pinion, 36787 K.

   **NOTE:** The last digit in part numbers for Generoid gears is a letter.

2. **Tooth Combination Number**
   A. **Example of a tooth combination number:**
      - 5-37. The “5-37” number indicates that the drive pinion has five teeth and the ring gear has 37 teeth.
   B. **Location on drive pinion:** end of pinion shaft.
   C. **Location on ring gear:** front face or outer diameter of ring gear.

3. **Gear Set Match Number**
   AxelTech drive pinions and ring gears are available only in matched sets. The ring gear and the drive pinion in 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 letter and a number.
   B. **Location on drive pinion:** on the end of the gear head on the drive pinion.
   C. **Location on ring gear:** front face or outer diameter of ring gear.
NOTE: The pinion cone variation number is not used when checking for a matched gear set. The number is used when you adjust the depth of the pinion in the carrier. Refer to “Adjusting the Thickness of the Shim Pack for the Pinion Cage (Depth of Pinion)” in this section.

4. Pinion Cone Variation Number

A. Examples of pinion cone variation numbers:
   - PC+3
   - PC–5
   - +2
   - +1
   - +.01 mm
   - −.02 mm Figure 4.2.

B. Location on gear set: on the end of the gear head of the drive pinion or the outer diameter of the ring gear. Figure 4.2.
1. Lubricate all bearings and cups with the fluid that is used in the axle housing.

**NOTE:** Use this procedure to install both bearing cups in the cage.

2. If the bearing cups were removed from the cage, replace the bearing cups and cones in a matched set from the same manufacturer. Use the following procedure:
   A. Place the bearing cage in a press.
   B. Support the bearing cage with metal or wood blocks.
   C. Place a sleeve on the outer face of the bearing cup.
   D. Press the bearing cup into the bore of the bearing cage until the cup is flat against the cage shoulders. Figure 4.4.

**NOTE:** If either the bearing cup or the cone need replacement, both parts must be replaced in a fully-matched set from the same manufacturer.

3. If the inner bearing cone was removed, install a new cone on the drive pinion and a new cup in the cage. Install the inner bearing cone on the drive pinion according to the following procedure:
   A. Place the drive pinion in a press with the head of the gear (teeth) toward the bottom.
   B. Place a new bearing cone on the shaft of the drive pinion.
   C. Place a sleeve on the inner race of the bearing cone.
   D. Press the inner bearing cone on the shaft of the drive pinion until the cone is flat against the head of the gear. Figure 4.5.

**Figure 4.4**

1 PRESS
2 SLEEVE
3 BEARING CUP
4 DRIVE PINION BEARING CAGE

**Figure 4.5**

1 SLEEVE
2 INNER BEARING CONE
4. Install the spacer on the shaft of the drive pinion. Figure 4.6.

5. Install the drive pinion and bearing assembly in the cage. Figure 4.6.

NOTE: The helical driven gear and the drive pinion nut and washer are installed during the preload adjustment of the drive pinion bearings.

Adjusting the Bearing Preload on the Drive Pinion

Specification:

• New drive pinion bearings:
  — 5 to 25 lb-in (0.56-2.82 N•m) rotational torque.

• Used drive pinion bearings:
  — 5 to 15 lb-in (0.56-1.69 N•m) rotational torque.

There are two methods of adjusting the preload on the drive pinion:

• Press Method
• Drive Pinion Nut Method

Use the drive pinion nut method to adjust preload, if a press is not available or if the press does not have a pressure gauge.

Setting Preload — Press Method

1. Place the drive pinion and the cage assembly in a press so that the gear head (teeth) of the drive pinion is toward the bottom of the press.

2. Place a sleeve against the inner race of the outer bearing. Figure 4.7.

3. Apply the press and hold 25 tons of pressure on the bearings. Apply pressure and rotate the bearing cage several times so that the bearings make normal contact.

4. While pressure is held against the assembly, wind a cord around the bearing cage several times. Figure 4.7.

5. Attach a spring scale to the end of the cord. Figure 4.7.

NOTE: Do not read the torque when the cage starts to rotate. Read the torque after the cage starts to rotate. Reading the starting torque gives a false measurement.

6. On a horizontal line, pull the scale so that the bearing cage rotates. Read and record the rotational torque of the bearing cage. Figure 4.7.
7. Measure the outer diameter of the bearing cage where the cord was wound. Measure in inches or centimeters. Figure 4.8.

8. Divide the diameter of the bearing cage by two to get the radius of the bearing cage. Make a note of the radius dimension.

9. Use the following procedure to calculate the bearing preload (torque):
   - Pounds pulled x Cage Radius in inches = lb-in preload.
   - Kilograms pulled x Cage Radius in centimeters = kg-cm preload
     To convert kg-cm to N•m, multiply kg-cm preload by 0.098.

   **NOTE:** To change the lb-in preload to N•m preload, multiply the lb-in preload by 0.113.

**Examples:**

<table>
<thead>
<tr>
<th>Reading from spring scale:</th>
<th>7.50 pounds (3.40 kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of bearing cage:</td>
<td>6.62 inches (16.80 cm)</td>
</tr>
<tr>
<td>Radius of bearing cage:</td>
<td>3.31 inches (8.40 cm)</td>
</tr>
</tbody>
</table>

\[
7.50 \text{ lb} \times 3.310 \text{ inches} = 24.80 \text{ in-lb preload} \times 0.113 = 2.800 \text{ N•m preload}
\]

\[
3.400 \text{ kg} \times 8.400 \text{ cm} = 28.60 \text{ kg-cm preload} \times 0.098 = 2.800 \text{ N•m preload}
\]

10. If the preload (torque) of the pinion bearings is not within specifications:
   A. Install a different spacer on the drive pinion shaft. To increase preload, install a thinner bearing spacer. To decrease preload, install a thicker bearing spacer. Figure 4.9.
   B. Repeat the preload reading as described in Steps 1-9.

11. Inspect the bearing preload after the drive pinion and cage assembly are installed in the carrier. Follow the procedures to adjust the preload of the pinion bearings.
Section 4
Assembly

Helical Gear to Drive Pinion Press Method

1. Place the helical driven gear on the drive pinion so that the mark on the gear is away from the bearing cage. Use a press and a sleeve to install the driven gear on the drive pinion. Apply pressure until the gear is against the outer bearing cone. Figure 4.10.

2. Install by hand the washer and the nut on the shaft of the drive pinion.

Helical Gear to Drive Pinion Heat Method

1. Expand the helical gear by heating the gear in a tank of water to a temperature of 160 to 180°F (71-82°C) for 10 to 15 minutes. Do not use an open flame such as a torch for this procedure.

![Figure 4.10](image1)

**WARNING**

_Wear safe clothing such as gloves and a shop coat for protection from personal injury in case accidental contact with the hot ring gear does occur._

2. Use a lifting tool to safely lift the helical gear from the tank of water.

3. Immediately install the helical driven gear onto the drive pinion. Figure 4.11. If the helical gear does not fit easily on the flange, heat the gear again in a tank of hot water. Repeat Step 1.

4. Install by hand the drive pinion nut.

**NOTE:** If the transfer drivetrain has a 1:1 ratio, replace both the helical drive and driven gears as a newly-matched set.

![Figure 4.11](image2)

Setting Preload — Drive Pinion Nut Method

1. Place the drive pinion and cage assembly in the differential carrier. Install and hand tighten the capscrews that fasten the cage to the differential carrier.

2. Using the holding fixture shown in Figure 2.58, mesh or engage the plate gear with the drive pinion gear.

3. Tighten down the plate to the carrier using six 1/2-13 capscrews to bolt the tool/fixture to the carrier. Figure 2.58.

4. Tighten the drive pinion shaft nut at this time.

5. On single-reduction carriers, remove the capscrews that fasten the cage to the main carrier housing.
6. On double-reduction carriers, remove the capscrews that fasten the cage to the main carrier housing according to the following procedures:

A. Loosen the capscrews until the head of each capscrew touches the helical driven gear.

B. Evenly loosen each capscrew three turns. When the capscrews are loosened, the cage is pulled straight from out of the carrier. The capscrews become a puller when the heads are against the helical driven gear.

C. Continue to evenly loosen the capscrews until the capscrews and the cage are removed from the housing.

7. Using a torque wrench with a torque multiplier, tighten the holding tool into the carrier and tighten the nut on the shaft of the drive pinion from 1200 to 1500 lb-ft (1627-2033 N•m). Figure 4.12.

8. Place an inch-pound torque wrench and a socket on the pinion nut. Rotate the drive pinion and read the value indicated on the torque wrench. Figure 4.13.

**Figure 4.12**

**Figure 4.13**

**NOTE:** The preload or rotational torque of the pinion bearings can be increased or decreased by tightening or loosening the pinion nut within the torque range from 1200 to 1500 lb-ft (1627-2033 N•m).

9. If the preload or rotational torque of the bearings on the drive pinion is not within specifications:

A. Remove the nut and washer from the drive pinion.

B. Use a press and a sleeve to remove the helical drive gear from the drive pinion, or heat the assembly in a hot solution tank from 160 to 180°F (71-82°C) for 10 to 15 minutes. Do not use a torch or an open flame for this procedure.
C. Remove the spacer from the shaft of the drive pinion and install a different spacer. Install a thinner bearing spacer to increase preload or rotational torque. Install a thicker bearing spacer to decrease preload or rotational torque. Figure 4.14.

D. Repeat Steps 1-9 of this procedure.

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.

E. Partially install the seal onto the yoke to 1/4- to 1/2-inch but not snug against yoke flange.

NOTE: Do not install seal against shoulder. Seal is designed to position itself as yoke is installed.

F. Before installing the yoke onto the drive pinion, lubricate the yoke again with the same lubricant used in the axle housing.

10. If preload or rotational torque is within the specified range, go to “Adjusting the Thickness of the Shim Pack for the Pinion Cage (Depth of Pinion)” in this section.

Spigot Bearing Installation

If the spigot bearing was removed, install a new spigot bearing. Refer to the following procedure for the spigot bearing that is used on the drive pinion.

One-Piece Spigot Bearing

1. Use a press and a sleeve to install the spigot bearing.

2. Place the sleeve on the inner race of the spigot bearing. Press the bearing onto the head of the drive pinion. Figure 4.15.

3. Install the snap ring on the spigot bearing. Figure 4.15.
Two-Piece (Separate Race) Spigot Bearing 280/380 Series Only

1. Remove any old adhesive from the nose of the pinion. Then, apply a thin layer of Loctite 635 (AxleTech part No. 1199-A-3250) to the outer diameter of the nose of the pinion. Figure 4.16.

2. Press the inner race on the nose of the drive pinion until the race is against the shoulder of the pinion. Figure 4.16.

3. Install the snap ring on the outer race and roller assembly. Figure 4.16.

4. Push the other race and roller assembly into the bore in the carrier until the snap ring is against the shoulder of the carrier. Figure 4.16.

5. Lubricate the rollers in the inner race with the lubricant that is used in the axle housing.

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

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

1. Use a micrometer to measure the thickness of the shim pack that was removed from the bearing cage. Record the measurement for later use. Figure 4.17.
2. Look at the pinion cone (PC) variation number on the drive pinion that is being replaced. Refer to Step 4 under “Gear Set Information — Markings on the Drive and the Ring Gear” in this section for examples and location of the number. Record the number for later use. Figure 4.18.

4. If the old pinion cone number is a minus (−), add the cone number to the thickness of the old shim pack that was measured in Step 2.

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 (+), add the number to the standard shim pack thickness that was calculated in Step 3 or 4. Make a shim pack of new shims to the determined thickness. For an example, refer to Table A.

7. If the new pinion cone number is a minus (−), subtract the number from the standard shim pack thickness that was calculated in Step 3 or 4. Make a shim pack of new shims to the determined thickness. For an example, refer to Table A.

NOTE: The pinion cone number can be either 1,000ths of an inch (0.000-inch) or 100ths of a millimeter (0.00 mm). Refer to the following examples:

- PC +3, PC–3, +3 or −3 equal 0.003-inch.
- PC +.03, PC −.03 mm, +.03 mm or −.03 equal 0.03 mm.

NOTE: To change inches to millimeters, multiply inches by 25.400.

- To change millimeters to inches, multiply millimeters by 0.039.

3. If the old pinion cone number is a plus (+), subtract the cone number from the thickness of the old shim pack that was measured in Step 2.
### Table A

<table>
<thead>
<tr>
<th>Examples:</th>
<th>Inches</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old PC Number, PC +2</td>
<td>+ .005 = .033</td>
<td>+ .130 = .840</td>
</tr>
<tr>
<td>Standard Shim Pack Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New PC Number, PC +5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Shim Pack Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Old Shim Pack Thickness</td>
<td>.030 + .002 = .032</td>
<td>.760 + .050 = .810</td>
</tr>
<tr>
<td>Old PC Number, PC –2</td>
<td>+ .005 = .037</td>
<td>+ .130 = .940</td>
</tr>
<tr>
<td>Standard Shim Pack Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New PC Number, PC +5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Shim Pack Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Old PC Number, PC +2</td>
<td>– .005 = .023</td>
<td>– .130 = .580</td>
</tr>
<tr>
<td>Standard Shim Pack Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New PC Number, PC –5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Shim Pack Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Old Shim Pack Thickness</td>
<td>.030 + .002 = .032</td>
<td>.760 + .050 = .810</td>
</tr>
<tr>
<td>Old PC Number, PC –2 (–.05 mm)</td>
<td>– .005 = .027</td>
<td>– .130 = .680</td>
</tr>
<tr>
<td>Standard Shim Pack Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New PC Number, PC –5 (–.13 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Shim Pack Thickness</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** Drive pinions and ring gears must be replaced as matched sets.
Installation of the Drive Pinion and the Bearing Cage Assembly

1. Place the drive pinion and cage assembly in the pinion bore of the differential carrier. Use a plastic or leather hammer and tap on the cage to install the cage against the carrier. Make sure that the capscrew holes in the cage are aligned with the holes in the carrier. Make sure the cage is installed flat against the carrier. Figure 4.19.

NOTE: AxleTech recommends use of Loctite on fastener retention. Refer to Section 3.

NOTE: The capscrews that fasten the cage to the carrier were installed in the cage during the preload adjustment of the drive pinion bearings.

2. Apply Loctite 680 and tighten each capscrew three turns according to the progressive torque sequence shown in Figure 4.20. Continue to tighten in this sequence until the cage is flat against the carrier, loosen the capscrews and tighten from 85 to 115 lb-ft (115-156 N.m).

Assembling the Main Differential Case and the Ring Gear

⚠️ CAUTION

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

1. If the bearing cones on the main differential case were removed, install a new cone and new cup in a fully matched set from the same manufacturer. Use a press and a sleeve to install the cones on the case. Press on the inner race of the bearing. Figure 4.21.
2. Expand the ring gear by heating the gear in a tank or oven of water to a temperature of 160 to 180°F (71-82°C) for 10 to 15 minutes. Do not use an open flame such as a torch for this procedure.

**WARNING**

*Wear safe clothing such as gloves and a shop coat for protection from personal injury in case accidental contact with the hot ring gear does occur.*

3. Use a lifting tool to safely lift the ring gear from the tank of water.

4. Immediately install the ring gear on the flanged half of the differential case. If the ring gear does not fit easily on the flange, heat the gear again in a tank of hot water. Repeat Step 2. Rotate the ring gear to align the fastener holes in the case with the holes in the gear case.

5. Replace with new bolts, new washers and new nuts to fasten the ring gear to the flange. Refer to the following procedure.

A. Install the bolts from the gear side of the assembly. The heads of the bolts must be installed through the tooth side of the ring gear. **Figure 4.22.**

B. Install the washers on the bolts from the flange side of the assembly.

C. Install the nuts and tighten to the specified torque. Refer to Table H.

6. Lubricate the following parts with the lubricant used in the axle housing:

- Inner Walls of the Differential Case
- Thrust Washers
- Side Gears
- Spider
- Pinions
- Bearing Cups and Cones

7. Place a thrust washer and a side gear in each half of the differential case. **Figure 4.23.**

**Figure 4.22**

1 DIFFERENTIAL CASE — FLANGE
2 WASHER
3 NUT
4 RING GEAR
5 BOLT — INSTALL FROM RING GEAR SIDE

**Figure 4.23**

1 SIDE GEAR
2 THRUST WASHER
3 FLANGE CASE HALF
8. Install the four pinions and four thrust washers on the spider. Figure 4.24.

9. Install the spider and pinion assembly in the plain half of the differential case. Figure 4.24.

10. Assemble the halves of the differential case together. Make sure the original match marks on each case half are aligned prior to differential case disassembly. Figure 4.25.

**NOTE:** AxleTech recommends the application of Loctite® to the fasteners to ensure differential assembly integrity. Refer to “Installing Fasteners with Pre-applied Adhesive, AxleTech Liquid Adhesive 2297-C-7049, Loctite® 680 Liquid Adhesive or Equivalent” in Section 3.

11. Install one center capscrew into each quadrant of differential case assembly first. Tighten the four capscrews in progressive steps to evenly pull the case halves together.

12. Install the remaining capscrews and tighten all the capscrews to the specified torque. Refer to Table H.

13. Inspect the rotating resistance of the side gears in the main differential case as described below.

---

**Inspecting the Rotating Resistance of the Side Gears on the Main Differential Case**

**Specification:**
- 50 lb-ft (67 N•m) maximum torque applied to one side gear.

**NOTE:** Make a tool for inspecting the rotating resistance of the side gears in the main differential case. The tool can be made from an axle shaft that matches the spline size of the differential side gear. Figure 4.26.

1. Install soft metal covers over the vise jaws to protect the ring gear.

2. Place the differential and ring gear assembly in the vise.
3. Install the tool into the differential until the splines of the tool and one side gear are engaged. Figure 4.27.

4. Attach a torque wrench to the nut of the tool and rotate the gears in the differential case. When the gears rotate, read the value indicated on the torque wrench. Figure 4.28.

5. If the torque value exceeds the specification, separate the halves of the differential case. Check the following for the problem that caused the torque value to be exceeded:
   - Thrust Washers
   - Side Gears
   - Differential Pinions
   - Spider
   - Case Halves

6. After the parts are repaired or replaced, assemble the main differential case and repeat Steps 1-5.
Installation of the Main Differential Case and Ring Gear Assembly into the Carrier

1. Lubricate the bearing cups and cones with the lubricant used in the axle housing.
2. Install the cups over the bearing cones.
3. Place the main differential case and ring gear assembly in the carrier. **Figure 4.29.**

<table>
<thead>
<tr>
<th>Figure 4.29</th>
</tr>
</thead>
</table>

**CAUTION**
*The bearing caps must be correctly installed or the adjusting rings will be damaged by cross-threading. Forcing the caps into position damages the caps and the carrier housing.*

4. Install the bearing caps on the correct legs in the carrier. The caps must be installed in the position marked during removal. If necessary, use a plastic or leather hammer to tap the caps in position. **Figure 4.30.**

**Figure 4.30**

- MARKS

**NOTE:** The capscrews and locks for the bearing adjusting rings are installed after the preload for the differential side bearings is adjusted.

5. Install the capscrews that fasten the bearing caps to the carrier housing. Tighten the capscrews from 290 to 350 lb-ft (393-474 N•m). *

6. Install and hand tighten the adjusting rings in the housing. **Figure 4.31.**

**Figure 4.31**

- MARKS
Adjusting the Preload on the Differential Side Bearings

**Specification:**
- Preload of Differential Side Bearings: from 15- to 35 lb-in (1.7-3.9 N•m) torque
- Expansion Between Bearing Caps: 0.006- to 0.013-inch (0.152-0.330 mm)

There are two methods for inspecting and adjusting the preload on the differential side bearings:
- Dial Indicator Method
- Micrometer Method

**Dial Indicator Method**

1. Attach a dial indicator on the mounting flange of the carrier.
2. Adjust the dial indicator so that the plunger or the pointer is against the back surface of the ring gear. **Figure 4.32.**

**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 4.33.**

3. Loosen the bearing ring that is opposite the ring gear so that a small amount of end play shows on the dial indicator. Move the differential and the ring gear to the left and right with pry bars while you read the dial indicator. Use one of the following methods:
A. Use two pry bars that fit between the bearing adjusting rings and the ends of the differential case. The pry bars must not touch the differential bearings. **Figure 4.34.**

B. Use two pry bars between the differential case or the ring gear and the carrier at locations other than those described in Step A. The pry bars must not touch the differential bearings. **Figure 4.35.**

4. Tighten the same bearing adjusting ring so that no end play shows on the dial indicator. Move the differential with the pry bars to the left and right as needed to measure end play. Repeat Steps A and B.

5. Tighten each adjusting ring one notch from the zero end play measured in Step 4. The side bearings of the differential now have a preload from 15 to 35 lb-in (1.7-3.9 N•m). **Figure 4.36.**

6. Continue by checking runout of the ring gear.

**Micrometer Method**

A second method of checking preload is to measure the expansion between the bearing caps after you tighten the adjusting rings. 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. Make a note of the measurement. Figure 4.37 and Figure 4.38.

**Figure 4.37**

![Diagram showing measurement X and Y](image)

**Figure 4.38**

![Diagram showing measurement X and Y](image)

---

**CAUTION**

*When turning 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 ring notches, damage to the lugs will occur.

3. Tighten each adjusting ring one notch. Figure 4.36.

4. Measure the distance X or Y again. Compare the dimensions 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:**

- Distance X or Y
  - before tightening adjusting rings = 17.498-inch (444.450 mm)
  - after tightening adjusting rings = 17.509-inch (389.230 mm)

  \[
  17.507\text{-inch} - 17.498\text{-inch} = 0.009\text{-inch difference} \\
  444.680\text{ mm} - 444.450\text{ mm} = 0.230\text{ mm difference}
  \]

5. 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.
Inspecting the Runout of the Ring Gear

Specification:
- 0.008-inch (0.200 mm) maximum

1. Attach a dial indicator on the mounting flange of the carrier. Figure 4.39.
2. Adjust the dial indicator so that the plunger or the pointer is against the back surface of the ring gear. Figure 4.39.
3. Adjust the dial of the indicator to zero (0).
4. Rotate the differential and ring gear assembly while you read the dial indicator. The runout of the ring gear must not exceed 0.008-inch (0.020 mm).

If the runout of the ring gear exceeds specification, as in the example, remove the differential and ring gear assembly from the carrier. Refer to the procedure under “Removing the Main Differential Case and Ring Gear Assembly” in Section 2.
5. Inspect the differential parts, including the carrier, for the problem that caused the runout of the ring gear to exceed specifications. Repair or replace parts.
6. After the parts are repaired or replaced, install the main differential case and ring gear assembly into the carrier. Refer to the procedure under “Installation of the Main Differential Case and Ring Gear Assembly into the Carrier” in this section.
7. Repeat the preload adjustment of the differential side bearings, starting under “Adjusting the Preload on the Differential Side Bearings” in this section.

Adjusting the Backlash of the Ring Gear

Specification:
- **Range of Backlash Setting:** 0.008- to 0.020-inch (0.200-0.510 mm)
- **Backlash Setting for New Gear Sets:** 0.014-inch (0.355 mm)

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.

During the inspection of the tooth contact patterns, the backlash can be adjusted within specification limits, if needed, to change the location of the pattern.

1. Attach a dial indicator on the mounting flange of the carrier. Figure 4.40.
2. Adjust the dial indicator so that the plunger or the pointer is against a tooth surface. Figure 4.40.
3. Adjust the dial indicator to zero (0).

4. Hold the drive pinion in position.

5. While you read the dial indicator, rotate the differential and ring gear a small amount in both directions, against the teeth of the drive pinion. If the backlash reading is within specifications, continue by inspecting tooth contact patterns. If the backlash reading is not within specifications, adjust backlash as needed.

6. Loosen one bearing adjusting ring one notch, then, tighten the opposite ring the same amount. Figure 4.41 and Figure 4.42.

   Backlash is increased by moving the ring gear away from the drive pinion.
   Backlash is decreased by moving the ring gear toward the drive pinion.

   **NOTE:** When you adjust backlash, only move the ring gear. Do not move the drive pinion.

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

**Inspecting the Tooth Contact Patterns of the Gear Set**

**General Information**

AxleTech carrier 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 4.1 for the location of part numbers.

**Examples:**

- Part numbers for conventional gear sets
  - 36786 for the ring gear
  - 36787 for the drive pinion
- Part numbers for generoid gear sets
  - 36786-K for the ring gear
  - 36787-K 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 4.43.
Always inspect tooth contact patterns on the drive side of the gear teeth. Figure 4.44.

1. Adjust the backlash of a new gear set to 0.014-inch (0.355 mm). Adjust the backlash of an old gear set to the setting that was measured before the carrier was disassembled. Refer to Step 3 under “Removing the Main Differential Case and Ring Gear Assembly” in Section 2.

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 4.45.

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.

Conventional Gears

Figure 4.46

GOOD HAND-ROLLED PATTERN

Figure 4.47

HIGH PATTERN

Figure 4.48

LOW PATTERN
Generoid Gears

4. Look at the contact patterns on the ring gear teeth. Compare the patterns to the patterns above.

The Location of Good Hand-Rolled Contact Patterns

New Conventional Gear Sets — toward the toe of the gear tooth and in the center between the top and bottom of the tooth. Figure 4.46.

New Generoid Gear Sets — between the center and toe of the tooth and in the center between the top and bottom of the tooth. Figure 4.49.

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. Figure 4.52 or Figure 4.53.

The location of a good hand-rolled pattern for a used 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 pattern requires 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.
5. Change the thickness of the shim pack under the bearing cage to move the contact patterns between the top and the bottom of the gear teeth. Use the following procedure:

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.

A. Remove the drive pinion and the bearing cage from the carrier. Refer to the procedure under “Removing the Drive Pinion and the Cage Assembly” in Section 2.

B. To correct a high contact pattern, decrease the thickness of the shim pack under the bearing cage. When you decrease the thickness of the shim pack, the drive pinion will move toward the ring gear. Figure 4.54. To correct a low contact pattern, increase the thickness of the shim pack under the bearing cage. When you increase the thickness of the shim, the drive pinion will move away from the ring gear. Figure 4.55.

C. Install the drive pinion, bearing cage and shims into the carrier. Refer to the procedure under “Installation of the Drive Pinion and the Bearing Cage Assembly” in this section.

D. Repeat Steps 2-4 until the contact patterns are in the center between the top and bottom of the gear teeth.

6. Adjust the backlash of the ring gear with the specification range to move the contact patterns to the correct location in the length of the gear teeth. Refer to the procedure under “Adjusting the Backlash of the Ring Gear” in this section.

A. Decrease backlash to move the contact patterns toward the toe of the ring gear teeth. Figure 4.56.
B. Increase backlash to move the contact patterns toward the toe of the ring gear teeth. Figure 4.57.

C. Repeat Steps 2-4 until the contact patterns are at the correct location in the length of the gear teeth.

7. Install the lock plate on the bearing cap so that the tab is between the lugs of the adjusting ring. Install the two capscrews that fasten the lock plate to the adjusting ring. Tighten the capscrews from 20 to 30 lb-ft (28-40 N•m). Install the lock plate on the opposite bearing cap.

Installing and Adjusting the Thrust Screw for the Ring Gear

Specification:
- Clearance between the ring gear and the thrust screw
  - 0.025 to 0.045-inch (0.635-1.143 mm)

1. If the thrust screw is installed in the differential carrier, remove the thrust screw and the jam nut.
2. Lubricate the end of the thrust screw that touches the ring gear with grease.
3. Install the thrust screw and the jam nut in the carrier.
4. Loosen the jam nut on the thrust screw.
5. Tighten the thrust screw until the end of the screw touches the ring gear. If necessary, loosen the jam nut. Figure 4.58.
6. Loosen the thrust screw 1/4 turn. Place a feeler gauge between the thrust screw and the ring gear. Inspect for a clearance of 0.025 to 0.045-inch (0.635-1.143 mm). If necessary, adjust the thrust screw to get the specified clearance. Figure 4.59.
7. Tighten the jam nut from 150 to 190 lb-ft (204-257 N•m).
Assembling the Inter-Axle Differential

Figure 4.60

1  INPUT REAR BEARING CUP AND CONE
2  OIL FILTER SCREEN
3  DIFFERENTIAL SIDE GEAR
4  DIFFERENTIAL PINION THRUST WASHER
5  CAPSCREW AND WASHER
6  DIFFERENTIAL PINION
7  DIFFERENTIAL SPIDER
8  DIFFERENTIAL CASE HALF
9  WASHER AND NUT
10  HELICAL DRIVE GEAR AND DIFFERENTIAL SIDE GEAR ASSEMBLY
11  THRUST WASHER

1. Place the carrier in a repair stand so that the ring gear is away from you.
2. Lubricate the following parts with the lubricant that is used in the axle housing:
   - Inner Walls of the Inter-Axle Differential Case
   - Spider
   - Differential Pinions
   - Thrust Washers
   - Rear Side Gear
   - Bearing Cup and Cone of the Rear Side Gear
3. If the bearing cup for the rear side gear was removed, install a new cup in the differential carrier. Use a press and a sleeve to install the cup in the carrier. Make sure the cup touches the bottom of the bore in the carrier. Figure 4.61.
4. If the bearing cone on the rear side gear was removed, install a new cone on the gear. Use a press and a sleeve to install the cone on the gear. Make sure the bottom of the cone touches the hub on the gear. Figure 4.62.

NOTE: If either the bearing cup or the cone need replacement, both parts must be replaced in a fully-matched set from the same manufacturer.
NOTE: If either the bearing cup or the cone need replacement, both parts must be replaced in a fully-matched set from the same manufacturer.

5. Place the rear side gear and bearing cone assembly in the differential carrier.

6. Install the pinions and the thrust washers on the spider.

7. Place the spider and pinion assembly in one of the case halves of the inter-axle differential.

8. Install the other case half over the case half and spider assembly. Make sure the marks on each case half are aligned with each other. Figure 4.63.

9. Loctite and install the bolts, washers and nuts that fasten the case halves together. Install a washer under each nut and bolt head. Tighten the bolts and nuts from 35 to 50 lb-ft (48-67 N•m). Figure 4.64.

10. Install the inter-axle differential assembly in the case so that the nuts are toward the case. Make sure the pinion gears engage the rear side gear. Figure 4.64.

NOTE: On single-reduction carriers, the helical drive gear, the helical driven gear and the forward side gear are replaced as an assembly.

11. On single-reduction carriers, install the helical drive gear on the forward drive gear as follows:
   A. Expand the helical drive gear by heating the gear in a tank of hot water to a temperature of 160 to 180°F (71-82°C) for 10-15 minutes. Do not use an open flame like a torch for this procedure.
   
   WARNING
   Wear safe clothing such as gloves that will protect you from injury when you touch the hot helical drive gear.
   
   B. Use a lifting tool to remove the helical drive gear from the tank of hot water. Place the gear on a press so that the flat side of the gear is against the press.
   C. Install the Woodruff key in the side gear.
Section 4
Assembly

D. Place side gear in the helical drive gear so that the Woodruff key is aligned with the slot in the drive gear. Figure 4.65.

E. Use a press to install the side gear in the helical drive gear. Make sure the side gear touches the bottom of the drive gear. Figure 4.66.

NOTE: The replacement helical drive gear and helical driven gears are replaced as a one-piece assembly.

12. Place the helical drive gear and forward side gear assembly in the inter-axle differential case. Make sure the marks on the helical drive gear and the helical driven gear are aligned. Make sure the pinions of the inter-axle differential engage the forward side gear. Make sure all the gears rotate freely. Figure 4.67.

13. Install the oil filter screen in the differential carrier. Figure 4.68.
Installing the Oil Pump Idler Gear — Original Design

There are three types of oil pump idler gears:

- Ball Bearing. Figure 4.69.
- Cone and Roller Bearing with Idler Sleeve. Figure 4.70.
- Cone and Roller Bearing with Solid Idler Shaft. Figure 4.71.

**NOTE:** If a rotor-type oil pump is being installed on a cover that uses the gear-type oil pump, refer to Section 5 of this manual.

**Oil Pump Idler Gear — Ball Bearing**

1. Support the bearing on the inner race. Use a press to install the idler gear shaft in the bearing. Make sure the bearing rotates freely. Figure 4.69.

2. Install the shaft and bearing assembly in the gear. Install the snap ring that holds the bearing in the idler gear bore.

3. Install the spacer on the idler gear shaft.

4. Place the idler gear and shaft assembly in the helical gear cover.

5. Install the washer and the nut on the idler gear shaft. Tighten the nut according to specifications. Refer to Table H.

---

**Figure 4.68**

1 OIL FILTER SCREEN

**Figure 4.69**

1 SNAP RING
2 IDLER GEAR SHAFT
3 BEARING
4 PUMP IDLER GEAR
5 WASHER
6 LOCK NUT

---

**Figure 4.68**

1 OIL FILTER SCREEN

**Figure 4.69**

1 SNAP RING
2 IDLER GEAR SHAFT
3 BEARING
4 PUMP IDLER GEAR
5 WASHER
6 LOCK NUT
Oil Pump Idler Gear — Cone and Roller Bearing with Idler Sleeve

1. Place the spacer in the center slot of the idler gear bore. Figure 4.70.
2. Place the bearing cone in the gear bore. Use a press and a sleeve to install the cone in the bore. Press the cone until it touches the spacer. Make sure the spacer remains in the center slot of the gear bore. Repeat this procedure for the other bearing cone.
3. Use a press and a sleeve to install the idler sleeve in the helical gear cover.
4. Install the cone and roller bearings and spacer in the idler gear. Make sure the spacer is between the bearing cones.
5. Place the idler gear and shaft assembly in the helical gear cover.
6. Install the bolt that fastens the gear and sleeve assembly to the cover. Install the nut and washer. Tighten the nut according to specifications. Refer to Table H.

Oil Pump Idler Gear — Cone and Roller Bearing with Solid Idler Shaft

1. Place the spacer in the center slot of the idler gear bore. Figure 4.71.
2. Place the bearing cone in the gear bore. Use a press and a sleeve to install the cone in the bore. Press the cone until it touches the spacer. Make sure the spacer remains in the center slot of the gear bore. Repeat this procedure for the other bearing cone.
3. Install the cone and roller bearings and spacer in the idler gear. Make sure the spacer is between the bearing cones.
4. Place the idle gear assembly in the helical gear cover.
5. Install the idler gear shaft through the gear and cover. The threaded part of the shaft must extend outside the cover.
6. Install the nut and washer. Tighten the nut according to specifications. Refer to Table H.
Assembling the Input Shaft, Bearing Cage, Oil Pump and Yoke — Current Design

1. Apply axle lubricant to the parts as they are being assembled.

2. If removed, install the bearing cup in the input bearing cage. Use a press and a sleeve to install the cup in the cage. The cup is correctly installed when the bottom of the cup is fully seated in the cage bore. Figure 4.72.

3. If removed, install the oil seal in the input bearing cage according to the following procedure:

   Triple Lip Seal
   A. Apply axle lubricant to the inner bore of the bearing cage.
   B. Place the oil seal in the bearing cage so that the flange is parallel to the top of the cage.
   C. Use a press and a driver or a flat metal plate to install the oil seal in the bearing cage. Figure 4.73.
   D. Apply pressure until the metal flange of the seal is seated to the top of the cage.
   E. After the seal is installed, a gap of 0.015- to 0.030-inch (0.381-0.762 mm) can exist between the flange and the cage. The gap is a normal condition because of the flexible coating on the flange of the seal. Use a feeler gauge to measure the gap between the complete flange-to-cage area. If the gap varies more than 0.010-inch (0.254 mm) between the highest and lowest measurement, remove and again install the seal. Figure 4.74.

   Figure 4.72

   Figure 4.73

   Figure 4.74

CAUTION
Hold the seal only on the outer diameter. Do not touch the lips in the inner diameter of the seal. If you touch the lips on the inner diameter of the seal, you will contaminate the lips and could cause a leak between the shaft and the seal.

B. Place the oil seal in the bearing cage so that the flange is parallel to the top of the cage.

   Figure 4.72

   Figure 4.73

   Figure 4.74

CAUTION
Do not apply pressure after the seal flange touches the top of the cage, or you will damage the cage.

D. Apply pressure until the metal flange of the seal is seated to the top of the cage.

E. After the seal is installed, a gap of 0.015- to 0.030-inch (0.381-0.762 mm) can exist between the flange and the cage. The gap is a normal condition because of the flexible coating on the flange of the seal. Use a feeler gauge to measure the gap between the complete flange-to-cage area. If the gap varies more than 0.010-inch (0.254 mm) between the highest and lowest measurement, remove and again install the seal. Figure 4.74.
Unitized Pinion Seal (UPS)

A. Remove the replacement unitized seal from the package. Avoid particle contamination to the seal surfaces. Handle the seal by the outside edges only. Take care and avoid touching the inside area of the seal. Figure 4.75.

B. Select the proper seal driver for seal installation from the table below. Each driver is designed to properly install a specific diameter seal. To determine yoke seal diameter, measure the yoke journal. Refer to the table below.

![Figure 4.75](image)

**UNITIZED SEAL**

<table>
<thead>
<tr>
<th>Single Models</th>
<th>Tandem Models</th>
<th>AxleTech Unitized Pinion Seal</th>
<th>Seal Installation Location</th>
<th>AxleTech Seal Driver</th>
<th>Yoke Seal Diameter Inches</th>
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To obtain AxleTech seal driver KIT 4454, call 888-725-9355.

* Forward and rear input only.
C. Position the driver and seal on the bearing cage seat. Refer to Figure 4.76.

NOTE: On the forward tandem axle output position the R4422401 driver tool outer spokes or fins MUST fit between the bearing cage bolts. Be sure that the bolts on the bottom of the bearing cage are not in the path of the driver spokes. If the driver spokes contact the bearing cage bolts, the driver will not properly install the seal into the bearing cage seat and will also result in damage to driver tool. The reference mark on the driver tool should be in the 12 o’clock or the 6 o’clock positions when installing the new seal.

D. Drive the seal into the bearing cage using a soft head mallet to seat the seal into the bearing cage. The seal must be fully seated into or against the bearing cage. Figure 4.77.

E. Use a .010-inch shim to feel for a gap between the flange of the seal and the bearing cage. If the .010-inch shim slides into a gap between the seal flange and bearing cage, this indicates that the seal is not fully seated into the bearing bore. Reinstall the seal driver and seat the seal into the bore until a .010-inch shim cannot slide into a gap between the seal flange and the bearing cage. Figure 4.78.
CAUTION
Do not install a press on shaft excluder (or POSE™ seal) after installation of a unitized pinion seal. The use of a POSE™ seal will prevent correct seating of the unitized pinion seal on the yoke and will result in lubricant leakage at the seal. POSE™ seal installation is recommended only for triple lip and other previous design seals.

NOTE: If either the bearing cup or the cone need replacement, both parts must be replaced in a fully-matched set from the same manufacturer.

4. Install the input bearing cage and oil pump according to the following procedure:
   A. Place the input shaft so that the threads are toward you. Install the oil pump on the shaft, making sure the splines in the pump are aligned with the splines on the shaft. Figure 4.79.

   B. Place supports under the input shaft.

   C. Use a press and a sleeve to install the bearing cone on the input shaft. The cone is correctly installed when the bottom of the cone touches the shoulder on the shaft. Figure 4.80.

   D. Install the input bearing cage over the input shaft on the oil pump. If dowel pins are used, make sure that the dowel pins in the cage are aligned with the holes in the oil pump.

   E. Apply Loctite® to the capscrews and install the oil pump to the input bearing cage. Tighten the capscrews from 22 to 33 lb-ft (30-45 N•m).

   F. Install the O-rings on the oil pump and the input bearing cage.

---

**Figure 4.79**

1. OIL PUMP
2. SPLINES
3. INPUT SHAFT

“SPLINE-DRIVE” DESIGN OIL PUMP

**Figure 4.80**

1. PRESS
2. SLEEVE
3. BEARING CONE
4. OIL PUMP
5. If removed, install the pressure relief valve assembly in the input bearing cage. Install the relief valve, the spring and the plug in the bore. Tighten the plug from 20 to 40 lb-ft (27-54 N•m). Figure 4.81.

⚠️ **CAUTION**

*Never use a hammer or a mallet to install the yoke or the flange. Using a hammer or mallet can damage the yoke or flange.*

6. Use a press and a sleeve or an installation tool to install the yoke or the flange on the input shaft. If a press and a sleeve are used, make sure that the input shaft is well supported. Figure 4.82.

⚠️ **CAUTION**

*Do not use the nut to draw the yoke onto the input shaft. Possible thread damage and probable incorrect yoke seating will result.*

7. Install the nut that fastens the yoke or the flange to the input shaft. Tighten the nut by hand. Do not tighten the nut to the specified torque until the bearing cage and pump assembly is installed in the helical gear cover.

---

**Figure 4.81** CURRENT DESIGN

1. PLUG
2. SPRING
3. RELIEF VALVE

**Figure 4.82**

1. PRESS
2. SLEEVE
3. YOKE (SHOWN)
4. INPUT BEARING CAGE
5. INPUT SHAFT
Installing the Shift Unit, Shift Fork and Shift Shaft

1. Inspect the shift shaft for damage. Remove any small damage with an emery cloth. If necessary, replace the shift shaft.

2. Install the adjusting screw for the shift shaft in the helical gear cover. Adjust the screw until there is a 5.300- to 5.360-inch (13.462-13.614 mm) clearance between the end of the adjusting screw and the end of the shift shaft bore. Install the jam nut and tighten from 40 to 55 lb-ft (55-74 N•m). Figure 4.83.

3. Measure the shift shaft to determine the smaller side of the shaft. Measure from the roll pin hole to the end of the shaft. Figure 4.84.

4. Place the small side of the shift shaft in the bore. Install the shaft until the small side of the shaft comes out of the bore inside the cover. If necessary, use a plastic or leather hammer to install the shift shaft. Figure 4.84.

5. Place the shift fork in the cover so that the long boss and the roll-pin hole are toward the rear (open side) of the cover. Align the bore in the fork with the shift shaft. Figure 4.85.
6. Hold the shift fork in position and rotate the shift shaft to align the roll-pin hole in the shaft with the roll-pin hole in the fork. Use a plastic or leather hammer to tap the shaft into the fork. Continue to tap on the shaft until the shaft supports the fork. Do not tap the shaft through the fork.

7. Place the return spring of the shift shaft between the fork and the rear bore of the shaft in the cover. Make sure the inner diameter of the spring coils are aligned with the bores of the fork and the gear cover. Figure 4.86.

8. Use a plastic or leather hammer to tap the shift shaft into position in the helical gear cover. Make sure the roll-pin hole in the shaft is aligned with the roll-pin hole in the fork.

9. Use a hammer and a small drift to install the roll pin in the hole in the fork and the shaft.

10. Install the shift unit over the shift shaft and onto the helical gear cover.

11. On units that have Allen-head capscrews, install the four capscrews that fasten the shift unit to the helical gear cover. Tighten the capscrews from 7 to 11 lb-ft (10-14 N·m). Figure 4.87.

12. On units that have long capscrews and tab retainers, use the following procedure: Figure 4.87.

A. Loctite and install the four capscrews and the tab retainers that fasten the shift unit to the helical gear cover.

B. Place the tab retainers so that two of the tabs are over the sides of the shift unit.

C. Apply Loctite® to the capscrews and tighten from 7 to 11 lb-ft (10-14 N·m). ™

D. Bend the two tabs over the side of the shift unit against the top plate. Bend the third tab against the head of the capscrew.
Installing the Input Shaft, the Clutch Collar and the Bearings in the Helical Gear Cover — Original Design

1. Engage the clutch collar on the shift fork.
2. Install the input shaft through the clutch collar. Rotate the input shaft to engage the splines in the clutch collar. At the same time, rotate the oil pump idler gear to engage the splines of the input shaft.

NOTE: If either the bearing cup or the cone need replacement, both parts must be replaced in a fully-matched set from the same manufacturer.

3. Install the front bearing cone on the input shaft.

NOTE: If either the bearing cup or the cone need replacement, both parts must be replaced in a fully-matched set from the same manufacturer.

4. If the bearing cup was removed from the cage, install a new cup. Use a press and sleeve to install the cup in the cage. Make sure the cup touches the bottom of the bore in the cage. Figure 4.89.

5. If the oil seal was removed, a new seal must be installed. Refer to the following procedures for the seal used on the axle.

CAUTION
Do not use a sharp instrument like a drift or a punch to install the oil seal. Using these tools damages the lip of the seal retainer and causes the seal to leak. Do not apply pressure to the seal after the seal touches the bottom of the bore or the seal will be damaged.

5. If the oil seal was removed, a new seal must be installed. Refer to the following procedures for the seal used on the axle.
6. If the original input shaft, bearing cup and cone assemblies and rear side gear are installed, refer to the following procedure:
   
   A. Place the shim pack and the bearing cage assembly on the helical gear cover. 
   Figure 4.90.
   
   B. Install the capscrews and the washers that fasten the cage to the cover. Tighten the capscrews from 85 to 115 lb-ft (116-155 N•m).
   
   C. Inspect the bearing end play according to "Inspecting and Adjusting the End Play of the Input Bearing — Original Design" in this section.

7. If a new input shaft, bearing cup and cone assemblies (front and rear) or rear side gear is installed, refer to the following procedure:

   A. Place the bearing cage assembly on the helical gear cover. Do not install the shim pack.
   
   B. Install the capscrews and the washers that fasten the cage to the cover. Tighten the capscrews by hand while rotating the input shaft to make sure the bearing cups and cones are correctly installed.
   
   C. Inspect the bearing end play according to "Inspecting and Adjusting the End Play of the Input Bearing — Original Design" in this section.

---

**One-Piece Oil Seal**

![Figure 4.91](image)

A. Apply Lubriplate or equivalent to the lip of the seal.

B. Apply a non-hardening sealant such as Permatex or equivalent to the outer diameter of the bearing cage.

C. Use a press and the correct seal driver to install the seal in the cage. If a press is not available, use a hammer and the correct seal driver. The seal driver must be smaller than the outer diameter of the seal. The driver touches the retainer (metal part) of the seal.

D. Press the seal in the bore to depth of 0.515- to 0.545-inch (13.081-13.843 mm) from the top of the bearing cage.
Section 4
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Cast-Iron Outer Protector and One-Piece Inner Oil Seal

Figure 4.92

1 INPUT BEARING CAGE
2 ONE-PIECE INNER OIL SEAL
3 CAST-IRON OUTER PROTECTOR

A. Install the inner seal according to Steps A through D of the “One-Piece Oil Seal” installation procedure in this section.
B. Place the cast-iron outer protector in the bore of the bearing cage.
C. Use a press and a sleeve to install the protector in the cage. Make sure the flange on the protector touches the outer surface of the cage at all areas. Figure 4.93.

Figure 4.93

1 PRESS
2 SLEEVE
3 CAST-IRON OUTER PROTECTOR
4 INNER OIL SEAL

Triple-Lip (Main) Oil Seal

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

A. Apply Lubriplate or equivalent, or the grease for the wheel bearings, to the seal lips and the cavities between the lips. The AxleTech specification for the grease is 0-617-A, 0-617-B or equivalent.
B. Apply axle lubricant to the seal bore of the bearing cage. Use the same type of lubricant that is used in the axle housing.
C. Place the drive pinion and cage assembly in a press so that the seal bore in the cage is toward the top.
D. Press the seal into the bearing cage until the flange of the seal is flat against the top of the bearing cage. Use a sleeve or a seal driver of the correct size that fits against the metal flange of the seal. The diameter of the sleeve or the driver must be larger than the diameter of the flange. Figure 4.94.

Figure 4.94

1 PRESS
2 SLEEVE
3 CAST-IRON OUTER PROTECTOR
4 INNER OIL SEAL

E. After the seal is installed, a gap of 0.015- to 0.030-inch (0.380-0.760 mm) between the flange and the bearing cage is normal. Inspect the gap with a feeler gauge at several points around the seal. The difference between the largest and smallest gap measurement must not be more than 0.100-inch (0.254 mm). Figure 4.95.
Unitized Pinion Seal (UPS)

A. Remove the replacement unitized seal from the package. Avoid particle contamination to the seal surfaces. Handle the seal by the outside edges only. Take care and avoid touching the inside area of the seal. Figure 4.96.

B. Select the proper seal driver for seal installation from the table below. Each driver is designed to properly install a specific diameter seal. To determine yoke seal diameter, measure the yoke journal. Refer to the table below.

<table>
<thead>
<tr>
<th>Single Models</th>
<th>Tandem Models</th>
<th>AxleTech Unitized Pinion Seal</th>
<th>Seal Installation Location</th>
<th>AxleTech Seal Driver</th>
<th>Yoke Seal Diameter Inches</th>
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* Forward and rear input only.

To obtain AxleTech seal driver KIT 4454, call 888-725-9355.
C. Position the driver and seal on the bearing cage seat. Refer to Figure 4.97.

**NOTE:** On the forward tandem axle output position the R4422401 driver tool outer spokes or fins MUST fit between the bearing cage bolts. Be sure that the bolts on the bottom of the bearing cage are not in the path of the driver spokes. If the driver spokes contact the bearing cage bolts, the driver will not properly install the seal into the bearing cage seat and will also result in damage to driver tool. The reference mark on the driver tool should be in the 12 o’clock or the 6 o’clock positions when installing the new seal.

D. Drive the seal into the bearing cage using a soft head mallet to seat the seal into the bearing cage. The seal must be fully seated into or against the bearing cage. Figure 4.98.

E. Use a .010-inch shim to feel for a gap between the flange of the seal and the bearing cage. If the .010-inch shim slides into a gap between the seal flange and bearing cage, this indicates that the seal is not fully seated into the bearing bore. Reinstall the seal driver and seat the seal into the bore until a .010-inch shim can not slide into a gap between the seal flange and the bearing cage. Figure 4.99.
CAUTION
Do not install a press on shaft excluder (or POSE™ seal) after installation of a unitized pinion seal. The use of a POSE™ seal will prevent correct seating of the unitized pinion seal on the yoke and will result in lubricant leakage at the seal. POSE™ seal installation is recommended only for triple lip and other previous design seals.

Installing the Input Shaft and the Clutch Collar in the Helical Gear Cover — Current Design

1. Engage the clutch collar on the shaft fork.
2. Install the input shaft assembly in the helical gear cover according to the following procedure: Figure 4.101.
   A. Connect the lifting device to the input yoke. Lift the input shaft assembly over the bore in the helical gear cover.
   B. Lubricate the O-rings with axle oil.
   C. Lower the input shaft assembly into the differential carrier. Figure 4.101.

---

Figure 4.100

<table>
<thead>
<tr>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>CLUTCH COLLAR</td>
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<td>2</td>
<td>THRUST WASHER</td>
</tr>
<tr>
<td>3</td>
<td>INPUT SHAFT</td>
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<tr>
<td>4</td>
<td>OIL PUMP</td>
</tr>
<tr>
<td>5</td>
<td>O-RING</td>
</tr>
<tr>
<td>6</td>
<td>FORWARD INPUT SHAFT BEARING CUP &amp; CONE</td>
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<tr>
<td>7</td>
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<td>8</td>
<td>O-RING</td>
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<td>9</td>
<td>BEARING CAGE</td>
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<tr>
<td>10</td>
<td>CAPSCREW &amp; WASHER</td>
</tr>
<tr>
<td>11</td>
<td>OIL SEAL</td>
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<tr>
<td>12</td>
<td>SLINGER</td>
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<tr>
<td>13</td>
<td>YOKE</td>
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<tr>
<td>14</td>
<td>WASHER</td>
</tr>
<tr>
<td>15</td>
<td>NUT</td>
</tr>
</tbody>
</table>

Figure 4.101
Assembling the Oil Pump — Original Design

Assembling the Oil Pump with a Rotor Pumping System

1. Clean the pump shaft bore and the lubrication passages in the pump cap and the pump body.

2. Assemble the relief valve into the bore in the pump body as follows:
   A. Install the small diameter end of the poppet into its seat inside the bore.
   B. Push the coil spring into the hole in the poppet.
   C. Install the relief valve cap into the spring and fasten the assembly in its bore with the cotter pin.

3. Install the shaft of the pump gear and shaft assembly through the back of the pump body.

4. Install a snap ring in the pump shaft groove next to the pump body.

5. Place the key in the slot in the pump shaft. Align the keyway on the inner part of the rotor and the key in the pump shaft. Slide the inner part of the rotor set over the shaft and the key until the rotor is against the snap ring.

6. Install the second snap ring in the groove in the pump shaft.

7. Assemble the outer part of the rotor set over the inner part of the set.

8. Place the reversing ring in position in the pump body. Make sure that the notch in the reversing ring is toward the front of the axle.


NOTE: Apply axle lubricant to the faces of the rotor and to the end of the pump shaft. Use the same type of axle lubricant that is used in the housing.

10. Install the pump cap with the pump shaft in the bore in the cap. Make sure that the pin in the cap fits into the notch in the reversing ring.

Disassembling the Oil Pump with a Gear Pumping System

1. Clean the pump shaft bore and the lubrication passages in the pump cap and the pump body.

2. Assemble the relief valve into the bore in the pump body as follows:
   A. Install the small diameter end of the poppet into its seat inside the bore.
   B. Push the coil spring into the hole in the poppet.
   C. Install the relief valve cap into the spring and fasten the assembly in its bore with the cotter pin.

3. Install the shaft of the pump gear and shaft assembly through the back of the pump body.

4. Install a snap ring in the pump shaft groove next to the pump body.

5. Place the key in the slot in the pump shaft. Align the keyway on the inner part of the rotor and the key in the pump shaft. Slide the inner part of the rotor set over the shaft and the key until the rotor is against the snap ring.

6. Install the second snap ring in the groove in the pump shaft.

7. Assemble the outer part of the rotor set over the inner part of the set.

8. Place the reversing ring in position in the pump body. Make sure that the notch in the reversing ring is toward the front of the axle.


NOTE: Apply axle lubricant to the faces of the rotor and to the end of the pump shaft. Use the same type of axle lubricant that is used in the housing.

10. Install the pump cap with the pump shaft in the bore in the cap. Make sure that the pin in the cap fits into the notch in the reversing ring.
1. Clean the pump shaft bore and the lubrication passages in the pump cap and the pump body.

2. Inspect the bushing for the pump shaft in the pump plate. If necessary, use a press and a sleeve to remove and replace the bushing in the plate.

3. Inspect the pump gear shaft on the suction (lower) side of the pump. To replace the shaft:
   A. Support the pump plate so that the shaft is away from you.
   B. Use a brass drift and a hammer to drive the shaft from the plate.
   C. Turn the pump plate over so that the rear of the plate is away from you.
   D. Use a press and a disc to install the shaft in the pump plate.

4. Install the pump driven gear and driveshaft assembly in the pump plate. Install the washer and snap ring that fasten the shaft to the plate.

5. Place a gear on the gear shaft of the pump and the gear shaft of the pump driven gear.

6. Place the spring for the relief valve into the bore in the pump plate. The large end of the spring must be installed in the bottom of the bore.

7. Place a new gasket and the two dowels on the pump plate. Install the pump cover on the pump plate.

8. Install the two large check valve balls and two large pipe plugs in the correct bores on the cover. Install the two small check valve balls and the two small pipe plugs in the correct bores. Refer to Figure 4.106 for the correct identification of the bores for the check valve balls and pipe plugs.

**Installing the Oil Pump — Original Design**

1. Make sure all oil passages in the pump and the helical gear cover are lean and free of obstructions.

2. Install a new gasket between the oil pump and the helical gear cover.

3. Install the oil pump into the helical gear cover. Make sure the teeth of the driven gear on the oil pump engage the teeth of the idler gear. Figure 4.104.

4. Install the capscrews that fasten the oil pump to the helical gear cover. Tighten the capscrews from 35 to 50 lb-ft (48-67 N•m).
Installing the Adapter and the Oil Filter — Original Design

1. If removed and undamaged, install the adapter for the oil filter in the bore of the helical gear cover. Install the capscrews and washers that fasten the adapter to the cover. Tighten the capscrews from 20 to 30 lb-ft (28-40 N•m). Figure 4.105.

   ![Figure 4.105](image)

   **CAUTION**

   Use of an AxleTech filter is highly recommended to ensure a filter with a drain back design. Lubrication drain back is required to maintain correct equipment operation.

   NOTE: If a steel cover for the oil filter is replacing a plastic cover for the oil filter, refer to Section 5 in this manual. This section describes the modifications that are necessary to replace the plastic cover with the steel cover for the oil filter.

2. Lubricate the gasket of the new oil filter with the lubricant that is used in the axle housing. Install the oil filter on the adapter. Tighten the oil filter one turn after the gasket on the filter touches the adapter. Do not overtighten. If necessary, use an oil filter wrench to tighten the filter. Figure 4.107.

   ![Figure 4.107](image)

   **NOTE:** Install a new-style filter, lubricate the gear cavity and the pump passages to prevent damaging the axle during start-up. The replacement filter should have a peroxide-cured seal for synthetic lubrication compatibility and should not have an anti drain-back design.

3. Place the cover over the oil filter. Install the washers, apply Loctite™ to the capscrews. Tighten the capscrews from 35 to 50 lb-ft (48-67 N•m). Figure 4.106.

   ![Figure 4.106](image)

   **CAUTION**

   If the filter is tightened more than one complete turn after it touches the gasket, the oil filter will be damaged and leak fluid.

   **NOTE:** On oil pumps with a gear pumping system, remove the two large pipe plugs from the oil pump. Lubricate the oil passages sealed by the large pipe plugs with the lubricant used in the axle housing. Install the two large pipe plugs in the oil pump. Figure 4.106.
Installing the Yoke

Three types of yokes are used: a slip-fit, a tight-fit and a loose-fit. Refer to the procedure for the yoke that is used on the carrier.

- The input yoke is installed before the helical gear cover is installed on the differential carrier.
- The output yoke is installed after the end play of the output bearing is inspected and adjusted.
Section 4
Assembly

CAUTION
Do not use thin metal wear “sleeves” to refresh the yoke surface. Wear sleeves pressed onto the yoke will prevent correct seating of the pinion seal and damage the pinion seal assembly. Wear sleeve usage will cause the seal to leak.

Slip-Fit Yoke
1. Apply the axle lubricant that is used in the housing to the oil seal.
2. Inspect all surfaces of the yoke hub for damage. Replace with new yoke assembly, if required.
3. On the input shaft, install the oil slinger over the input shaft in the helical gear cover. On the thru-shaft (output shaft) yoke, install the wiper sleeve over the thru-shaft.

CAUTION
Do not use a hammer or mallet to install the yoke. Using a hammer or mallet will damage the yoke and result in driveline misalignment.

4. Align the yoke with the splines on the shaft and install the yoke.
5. Install the washer and the nut that fasten the yoke to the shaft. Tighten the nut so that there is not any end play between the yoke and the bearing. If the bearing end play adjustment is not required, place a holding tool on the yoke and tighten the nut to the correct torque. Refer to Table H in Section 7.

Tight-Fit Yokes
1. Apply the axle lubricant that is used in the housing to the oil seal.
2. Inspect all surfaces of the yoke hub for damage. Replace with new yoke assembly if required. Figure 4.109.
3. Align the yoke splines with the shaft splines and slide the yoke over the shaft spline.

NOTE: Anytime the yoke is removed or partially removed the unitized pinion seal (UPS) must be replaced. This includes yokes removed for driveline phasing adjustments or any other reason for yoke removal.

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 and result in driveline misalignment.

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. A yoke installation tool is required to fully seat the yoke against the output bearing.

Figure 4.109

1  INSPECT YOKE HUB SURFACES
2  YOKE
3  NUT

5. On the input shaft, install the slinger over the yoke hub. On the thru-shaft (output shaft) yoke, install the wiper sleeve over the yoke hub.
6. Install the nut (and washer if required) that fasten the yoke to the shaft. Tighten the nut to remove any end play between the yoke and the bearing. If the bearing end play adjustment is not required, place a holding tool on the yoke and tighten the nut to the correct torque. Refer to Table H in Section 7.
Installing Tight-Fit Yokes with POSE™ Seal

1. Apply the same lubricant used in 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 seal (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 4.110.

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

4. Before installing the yoke or flange on the shaft, again 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.

When Installing Any Type Yoke with a Unitized Pinion Seal (UPS)

⚠️ CAUTION

Once the yoke is partially or fully installed and then removed for any reason, the unitized pinion seal will be damaged and unusable. If the yoke and unitized pinion seal are removed after partial or full installation, remove and discard the original unitized pinion seal and replace it with another new unitized pinion seal.

If the inner sleeve of the seal is removed, the seal is not usable. A new seal is required. This will occur if a yoke is installed into the seal and then removed.

Loose-Fit Yoke

1. Apply the axle lubricant that is used in the housing to the oil seal. Do not apply lubricant to input shaft threads.

2. Inspect all surfaces of the yoke hub for damage. Replace with new yoke assembly if required.

3. On the input shaft, install the oil slinger over the input shaft in the helical gear cover. On the thru-shaft (output shaft) yoke, install the wiper sleeve over the thru-shaft.

4. Align the yoke splines with the shaft splines and slide the yoke over the shaft.

⚠️ CAUTION

Do not use a hammer or mallet to install the yoke. Using a hammer or mallet will damage the yoke and result in driveline misalignment.

5. Apply Loctite® No. 277 to the input shaft threads of all forward carriers, prior to installation of the nut.

6. Install the washer and nut that fasten the yoke to the shaft. Tighten the nut so that there is not any end play between the yoke and the bearing. If the bearing end play adjustment is not required, place a holding tool on the yoke and tighten the nut to the correct torque. Refer to Table H.

NOTE: Loose fit yokes can be used with any of the three seal types: triple lip, triple lip plus POSE™ and unitized pinion seals (UPS).
Installing the Helical Gear Cover on the Differential Carrier

1. Place the differential carrier in a repair stand so that the helical drive gear and the driven gear are toward you.
2. Use petroleum jelly or equivalent to hold the thrust washer on the forward side gear that is inside the helical drive gear. The lubricant holds the thrust washer in position when the input shaft is installed.
3. Apply RTV gasket material to the cover mounting surface on the differential case. Refer to “Application of AxleTech Adhesive 2297-T-4180 in Bearing Bores for the Differential” in Section 3. Do not apply RTV gasket material if the end play of the input bearing is being inspected and adjusted.
4. Install the helical gear cover on the differential case as follows:
   A. Use a lifting device to lift the helical gear cover assembly by the input yoke.
   B. Lower the helical gear cover onto the differential case and align the input shaft with the bore in the inter-axle differential. When the input shaft enters the differential, rotate the input shaft so that the splines on the shaft and the spider are aligned.
   C. Remove the lifting device from the input yoke.
5. Install the capscrews and the washers that fasten the cover to the carrier. Tighten the capscrews from 85 to 115 lb-ft (116-155 N•m).

Inspecting and Adjusting the End Play of the Input Bearing — Original Design

Specification:
- End Play of the Input Bearing: 0.002- to 0.008-Inch (0.0508-0.2032 mm)

1. The end play of the input bearing is adjusted with the carrier in the horizontal position or the vertical position.
2. Before the end play is inspected, make sure of the following:
   A. The forward side gear, helical drive gear and the inter-axle differential assembly are removed from the differential case.
   B. The shim pack between the bearing cage and the helical gear cover is removed.
   C. The capscrews that fasten the bearing cage to the helical gear cover are hand-tight.
3. Use a feeler gauge to measure the gap between the bearing cage and the helical gear cover. Record the measurement of the gap. Figure 4.112.
4. Add 0.005-inch (0.127 mm) to the measurement of the gap between the bearing cage and the helical gear cover. Add this number to the original shim pack and make a new shim pack. Use a minimum of three shims for the shim pack. The thinnest shims must be installed on each side of the shim pack.

5. Remove the input yoke. Refer to “Removing the Input Shaft, the Forward Bearing and the Clutch Collar — Original Design Helical Cover” in Section 2.

6. Remove the capscrews and the washers that fasten the bearing cage to the helical gear cover. Remove the cage and install the new shim pack. Place the cover on the cage and install the washers and the capscrews. Tighten the capscrews from 60 to 75 lb-ft (82-101 N•m).

7. Use a dial indicator with a base to inspect the end play of the input bearing. Make sure the pointer of the dial indicator is against the top of the input shaft. Figure 4.113.

8. Push the yoke against the input bearing and turn the yoke from side to side to make sure the cup is installed in the cone. Adjust the dial indicator to zero (0).

9. Pull the yoke out and rotate the yoke from side to side. Read the dial indicator. The end play measurement must be 0.0020 to 0.0080-inch (0.0508-0.2032 mm).

NOTE: Use a minimum of three shims to make the shim pack.

10. If the end play measurement is not 0.002- to 0.008-inch (0.0508-0.2032 mm), add or remove shims from the shim pack. Remove the capscrews and washers and remove the bearing cage and the shim pack. Add shims to the shim pack to increase the end play. Remove shims from the shim pack to decrease the end play. Repeat Steps 6-9 of this procedure. Figure 4.114.
Section 4
Assembly

11. Install the inter-axle differential assembly, the helical drive gear and the forward side gear. Refer to the procedure under “Assembling the Inter-Axle Differential” in this section.

12. Install the yoke. Refer to the procedure under “Installing the Yoke” in this section.

13. Install the helical gear cover on the differential case. Refer to the procedure under “Installing the Helical Gear Cover on the Differential Carrier” in this section.

Inspecting and Adjusting the End Play of the Input Bearing — Current Design

Figure 4.115

1 INPUT BEARING CAGE
2 SHIM PACK CONTROLS END PLAY OF INPUT BEARING

Specification:
- End Play of the Input Shaft: 0.002- to 0.008-inch (0.050-0.200 mm)

1. Install capscrews, but not the washers, that fasten the input bearing cage to the carrier. Rotate the input shaft in each direction to make sure the bearings are correctly installed while hand tightening the capscrews. Do not tighten the capscrews to the specified torque value at this time.

2. Use a feeler gauge to measure the gap between the input bearing cage and the helical gear cover. Inspect the gap at four equally spaced locations on the cage. Figure 4.116.

3. Add up the four measurements and determine the average gap between the cage and the carrier. Add 0.005-inch (0.130 mm) to the average gap measurement to determine the size of the shim pack between the cage and the carrier.

4. Use at least three shims when building a shim pack. Always place the thickest shims in the middle of the shim pack.

5. Remove the capscrews (from Step 1) that fasten the input bearing cage to the carrier.

6. Install the shim pack according to the following procedure:
   A. Connect a lifting device to the input yoke. Lift the input shaft assembly until there is a distance of 1/4 to 1/2-inch (6-12 mm) between the cage and carrier mounting surface.

Figure 4.116

1002574a
CAUTION
If pinion cage has an O-ring-type seal, do not use any type of sealant (Loctite®, etc.). Sealant may be used except in cases where an O-ring exists between the pinion bearing cage and the carrier bore.

B. Install the shim pack under the bearing cage. Make sure that the hole pattern of the shim pack matches the hole pattern of the cage. Figure 4.117.

C. Place the shield for the oil filter in position on the bearing cage.

D. Install the capscrews and washers into the carrier cage. Make sure that the capscrews are aligned with the holes in the shim pack. Tighten the capscrews without stripping the threaded bores. Make sure that the capscrew threads turn into the original holes in the carrier.

E. Lower the input shaft assembly so that the cage and the shim pack are installed against the carrier. Remove the lifting device from the yoke or flange.

F. Tighten the capscrews from 75 to 95 lb-ft (100-127 N•m) while rotating the input shaft in each direction to make sure that the bearings are correctly installed.

7. Place a holding tool on the input yoke or flange and tighten the nut to the specified torque. Refer to Table H.

8. Inspect the end play of the input shaft according to the following procedure:

A. Rotate the input shaft in each direction and push the yoke or flange toward the bearing cage. This makes sure that the input shaft assembly is at the bottom of its travel.

B. Use a dial indicator with a magnetic base or a C-clamp base to inspect the end play of the input bearing. Make sure the pointer of the dial indicator is against the top of the input shaft. Set the dial indicator to zero (0). Figure 4.118.

C. Use a pry bar and a support to push the yoke or the flange away from the carrier. Read the dial indicator. The reading must be in the 0.002- to 0.008-inch range (0.050-0.200 mm). Figure 4.119.
Section 4
Assembly

9. If the end play of the input bearing is not within the 0.002- to 0.008-inch range (0.050-0.200 mm), add or remove shims from the shim pack. Repeat Steps 4-8 of this procedure.

Installing the Differential Carrier in 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 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.

1. Clean the inside of the 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 the Axle Assembly” in Section 3.

2. Inspect the axle housing for damage. Repair or replace the axle housing. Also refer to “Repairing or Replacing Axle Components” in Section 3.

3. If used, inspect for loose studs in the mounting surface of the housing where the carrier fastens. Remove and clean the studs that are loose.

4. If studs are used, apply liquid adhesive to the threaded holes. Install the studs in the axle housing. Refer to “Installing Fasteners with Pre-applied Adhesive, AxleTech Liquid Adhesive 2297-C-7049, Loctite® 680 Liquid Adhesive or Equivalent” in Section 3. Tighten the studs to the correct torque value. Refer to Table H.

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 3. Figure 4.120.

![Figure 4.120](image)

**CAUTION**
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.

6. Install the carrier into the axle housing. Use a hydraulic roller jack or a listing tool. Figure 4.121.

![Figure 4.121](image)
Section 4
Assembly

7. Install the nuts and the washers or the capscrews and the 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 4.122.

8. Carefully push the carrier into position. Tighten the four fasteners two or three turns each in a pattern opposite each other.

9. Repeat Step 8 until the four fasteners are tightened to the correct torque value. Refer to Table H.

10. Install the other fasteners and the washers that hold the carrier in the axle housing. Tighten the fasteners to the correct torque value. Refer to Table H.

11. Connect the driveshaft to the input yoke on the carrier.

**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.*

12. Clean the mating surfaces of the axle shaft and the wheel hub.

13. If silicone gasket material is used, apply a 1/8-inch-diameter bead of the silicone gasket material around the mating surface of the hub and around the edge of each fastener hole in the surface.

14. If a gasket is used, install the gasket and the axle shaft into the housing. The gasket and flange of the axle shaft MUST fit flat against the wheel hub. Refer to Figure 4.123.

---

*Figure 4.122*

![Diagram showing assembly components](image)

* (UNDER HELICAL GEAR COVER)

---

*Figure 4.123*

![Diagram showing assembly components](image)

1. TAPERED DOWEL RETENTION
2. STUD NUT
3. WASHER
4. TAPERED DOWEL
5. GASKET-RTV
6. STUD
7. SHAFT HUB AXLE
8. AXLE SHAFT (FLANGE)
9. WASHER
10. CAPSCREW
11. NON-TAPERED DOWEL RETENTION
15. 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. If split tapered dowels were used originally, replace with solid tapered dowels.

16. Install the Grade 8 nuts and hardened washers on the stud. (Lock washers are an acceptable alternative.) Tighten the stud nuts or bolts to the torque specified in Table B.

Table B: Torque Fastener Chart

<table>
<thead>
<tr>
<th>Fastener</th>
<th>Thread Size</th>
<th>Torque Value — Grade 8 Nuts lb-ft (N•m)</th>
<th>Plain Nut</th>
<th>Lock Nut</th>
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</thead>
<tbody>
<tr>
<td>Stud Nut (Axle Shaft)</td>
<td>0.44-20</td>
<td>50 to 75 (68-102)</td>
<td>40 to 65 (54-88)</td>
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</tr>
<tr>
<td></td>
<td>0.50-20</td>
<td>75 to 115 (102-156)</td>
<td>65 to 100 (88-136)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.56-18</td>
<td>110 to 165 (150-224)</td>
<td>100 to 145 (136-197)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.62-18</td>
<td>150 to 230 (204-312)</td>
<td>130 to 190 (176-258)</td>
<td></td>
</tr>
<tr>
<td>Studs All</td>
<td>All</td>
<td>Install the course thread end of stud into hub and tighten to last thread.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

17. Install the bearing cage, the thru-shaft and the bearing assembly in the housing and adjust the end play of the output bearing. Refer to the following procedures.

Assembling the Output Bearings, the Thru-Shaft and the Oil Seal

1. Lubricate the bearing cups and cones with the lubricant that is used in the axle housing.

2. If the bearing cones were removed from the thru-shaft, install new bearing cones. When a bearing cone is replaced, always replace the cup. Replace the cup and the cone in a matched set from the same manufacturer. Place both cones back to back on the thru-shaft. Use a press and a sleeve to install both cones. Apply pressure until the inner cone touches the shoulder of the thru-shaft.

3. Place the output bearing cage in a vise. Make sure the jaws of the vise are covered with soft metal shields to prevent damage to the cage.

4. Place the inner bearing cup in the cage. Place the thru-shaft and bearing assembly in the cage.

5. Place the outer bearing cup into the cage over the thru-shaft.

6. Install the snap ring that fastens the outer cone in the cage. The snap ring controls the end play of the output bearing. Figure 4.125.

7. Inspect and adjust the end play of the output bearing. Refer to the following procedure.
Inspecting and Adjusting the End Play of the Output Bearing

**Specification:**
- 10 lb-in (1.13 N·m) preload to 0.003-inch (0.076 mm) bearing end play.

The end play of the output bearing is controlled by the size of the snap ring that holds the bearings in the output cage. The snap rings are available in a range of 0.088- to 0.112-inch (2.235-2.844 mm) in sizes of 0.003-inch (0.076 mm). Install the correct snap ring to get an end play from 0.001- to 0.0030-inch (0.0025-0.0762 mm).

1. Place the thru-shaft and the bearing cage assembly in a vise.
2. Pull on the differential end of the thru-shaft and turn the shaft from side to side to make sure the cones are installed in the cups.
3. Install a dial indicator so that the base of the indicator is on the flange of the cage and the pointer of the indicator touches the yoke end of the thru-shaft. Adjust the dial indicator to the zero (0) setting. **Figure 4.126.**
4. Push on the differential end of the thru-shaft while turning the shaft from side to side. Record the reading on the dial indicator. The reading should be 0.003-inch (0.076 mm). This reading is the measurement of the end play on the output bearing.
5. If the end play reading is more than 0.003-inch (0.076 mm), remove and replace the snap ring that fastens the bearings in the cage. Install a thinner snap ring to increase end play. Install a thicker snap ring to decrease end play. **Figure 4.127.**

**Figure 4.126**

**Figure 4.127** OUTPUT BEARING END PLAY

To increase end play, install a thinner snap ring.
To decrease end play, install a thicker snap ring.
6. If the end play reading is zero (0), measure the preload of the output bearings. Wind a wire around the output shaft. Attach a spring scale to the end of the wire. Pull the scale to rotate the output shaft and record the reading. If the rotating force is more than 10 lb-in (1.13 N•m), remove and replace the snap ring that fastens the bearings in the cage. Install a thinner snap ring to decrease output bearing preload. Install a thicker snap ring to increase output bearing preload. **Figure 4.128.**

7. Install the output yoke and spacer on the thru-shaft. Refer to “Installing the Yoke” in this section. Do not install the oil seal at this time.

8. Install the nut that fastens the output yoke on the thru-shaft. Place a holding tool on the yoke and tighten the nut to the specified torque. Refer to **Table H.**

9. Inspect the end play of the output bearing with the yoke installed. Refer to Steps 1-6 of this procedure.

10. Remove the yoke and the spacer from the thru-shaft. Refer to “Removing the Carrier from the Axle Housing” in Section 2.

---

**Installing the Oil Seal, the Yoke, the Thru-Shaft and the Bearing Cage**

1. Install the oil seal in the bearing cage. Refer to the procedure under “Installing the Input Shaft, the Clutch Collar and the Bearings in the Helical Gear Cover — Original Design” in this section.

2. Squirt axle lubricant through the inner and outer openings of the bearing cage to lubricate the bearings.

3. After the bearings are oiled, pack the inner and outer bearings with AxleTech Specification 0-622 grease or equivalent. Use a grease gun with a flexible nozzle to pack the bearing cavities through the inner and outer openings of the bearing cage.

4. Install the gasket between the bearing cage and the axle housing.

5. Place the thru-shaft and bearing cage assembly in the axle housing. Rotate the thru-shaft to align the splines of the thru-shaft with the splines of the rear side gear. **Figure 4.129.**
6. Install the washers and the capscrews that fasten the output bearing cage to the axle housing. Tighten the capscrews from 35 to 50 lb-ft (48-67 N•m).

7. Install the spacer on the thru-shaft. **Figure 4.130.**

8. Install the output yoke on the thru-shaft. Refer to the procedure under “Installing the Yoke” in this section.

**Figure 4.130**

1 SNAP RING  
2 SPACER  
3 BEARING CAGE

3. Place the specified axle lubricant in through the fill plug hole. Fill the axle with lubricant until the lubricant level is to the bottom of the fill plug hole. Refer to **Table C** for the specified axle lubricant.

4. Install the fill plug and tighten to a minimum torque of 35 lb-ft (47 N•m). When correctly installed, one complete thread of the fill plug is visible.

5. On axles with an inter-axle differential, remove the plug on the top of the axle housing. Place two U.S. pints (0.946 liters) of the specified lubricant in the axle housing. Refer to **Table C** for the specified lubricant.

6. Drive the vehicle in an unloaded condition for 1 to 2 miles (1.6-3.2 km) at speeds not more than 25 mph (40 km/h). Operating the vehicle makes sure that the lubricant flows through the complete axle assembly.

**Figure 4.131**

1 DIFFERENTIAL FILL PLUG

---

**Filling the Axle with Lubricant — On-Highway Axles**

**NOTE:** For additional lubrication information, refer to Maintenance Manual 1, *Lubrication*.

1. Make sure the vehicle is parked on a level surface. The drive pinion must be in the horizontal position. When the angle of the drive pinion changes, the lubricant capacity of the axle will change.

2. Remove the fill plug from the side of the differential carrier. **Figure 4.131.**
Filling the Axle with Lubricant — Off-Highway Axles

1. Rotate each wheel end so that the lubricant level hole is even with the horizontal position of the drive pinion.

2. On wheel ends with a bolted cover, remove the fill/drain plug from the top of the wheel hub and oil level plug from cover on the wheel end. Figure 4.132.

3. For SPR-570 and SPRC-4806 axles, remove the fill/level plug from the axle housing bowl. Figure 4.133.

   For SPRC-1927 axles, remove the fill/level plug from the side of the differential carrier.

   NOTE: For SPR-570 and SPRC-4806 axles, the axle and the wheel ends have the same lubricant level because an axle shaft seal is not used. For SPRC-1927 axles, each wheel end and the axle housing have different lubricant levels because an axle shaft seal is used.

4. For SPR-570 and SPRC-4806 axles, do the following:
   A. Remove the fill plug from the axle housing bowl.
   B. Add lubricant through the fill plug hole and the fill/drain plug hole in each wheel end.
   C. Give enough time for the lubricant to flow through the complete axle assembly.
   D. Continue to add lubricant until the lubricant flows from the bottom of the oil level hole in each wheel end and the bottom of the fill hole in the axle housing.

   For SPRC-1927 axles, do the following:
   - Add lubricant through the fill plug holes in each wheel end and the side of the differential carrier.
   - Continue to add lubricant until lubricant flows from the bottom of the fill plug holes.

5. Install and tighten all the plugs. Refer to Table H. 1

1. Fill Plug
2. Oil Level Plug
NOTE: This section describes the necessary requirements to install components of a recent design on older carriers.

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

**Shift Unit**
Shift units with Allen-head capscrew retainers are installed on carriers that have shift units with long capscrew and retainers without changing the helical gear cover. **Figure 5.1.**

**Rotor-Type Oil Pump**
If a rotor-type oil pump is installed on a helical gear cover that uses the gear-type oil pump, the helical gear cover and the idler gear assembly must be replaced. **Figure 5.2.**

**NOTE:** The helical gear cover (Part Number A-3266-W-881) that uses a hollow sleeve for the idler gear of the oil pump can use a solid shaft (Part Number A-3266-N-1080) for the idler gear. Drill the 0.531-inch (13.487 mm) hole to a larger diameter of 0.656-inch (16.662 mm). The bore does not have to be made larger if Kit 3301-A is used on the A-3266-W-881 carrier. **Figure 5.3.**
Steel Oil-Filter Cover

If a steel oil-filter cover is installed on a helical gear cover that uses a plastic oil-filter cover, a 2.0-inch capscrew (Part Number S-2616-1 or equivalent) is necessary. Place the steel cover over the existing studs. Install the new capscrew through the long arm of the cover, the pump assembly and into the helical gear cover. Figure 5.4.

Two-Piece (Separable Race) Spigot Bearing — 280/380 Series Only

To install a two-piece (separable race) spigot bearing in a carrier that uses the one-piece spigot bearing, some parts are replaced and the carrier must be matched. Figure 5.5.

The parts that must be replaced are:
- Differential Case Halves
- Differential Case Fasteners (Bolts, Washers and Lock Nuts)
- Spigot Bearing Snap Ring
- Ring Gear
- Drive Pinion
- Ring Gear-to-Differential Case Fasteners (Bolts, Washers and Lock Nuts)

The bore in the differential carrier for the snap ring of the spigot bearing is machined to a diameter of 4.380-inch (11.124 cm) at a depth of 0.030-inch (0.762 mm). Figure 5.6.

The bore depth is important because there must be a distance of 5.738- to 5.748-inch (14.574-14.599 mm) from the bottom of the bore for the snap ring to the mounting surface of the bearing caps on the carrier. The bottom of the snap ring bore must be perpendicular within 0.003-inch (0.076 mm) to the 3.9370- to 3.9384-inch (9.9999-10.0035 cm) bore diameter for the spigot bearing in the carrier.
A triple-lip (main) oil seal can be installed in bearing cages that are used in one-piece oil seals if the chamfer of the bearing cage is changed. The 45° chamfer angle in the cage must be grounded to a 30° angle. Changing the chamfer angle permits the triple-lip (main) oil seal to be installed correctly in an input bearing cage that uses the one-piece oil seal.

To change the chamfer angle from 45° to 30°:
- Remove the input bearing cage from the helical gear cover.
- Remove and discard the one-piece oil seal. Make sure that the outer face and the inner diameter of the bearing cage are not damaged.
- Remove the bearing cones from the cages.
- Grind the chamfer of the bearing cage from the 45° angle to the 30° angle. Figure 5.7.
- Clean the bearing cage and cup assembly. Make sure all metal particles are removed from the assembly.
- Install the triple-lip (main) oil seal as described under “Triple-Lip (Main) Oil Seal” in Section 4.
- Place the bearing cones in the cage. Install the cage on the helical gear cover as described under “Triple-Lip (Main) Oil Seal” in Section 4.
Output Shaft on Forward-Rear Differential Carriers
The triple-lip (main) oil seal cannot be installed in a bearing cage that uses the one-piece oil seal. The bearing cage must be replaced with a cage that uses the triple-lip (main) oil seal.

Input Shaft on Rear-Rear Differential Carriers
The triple-lip (main) oil seal cannot be installed in a bearing cage that uses the one-piece oil seal. The bearing cage must be replaced with a cage of the design that uses the triple-lip (main) oil seal. On 270-280 series carriers, the oil deflector and the bearing cage are replaced when a triple-lip (main) oil seal is used to replace a one-piece oil seal.
NOTE: For complete information on lubricating drive axles and carriers, refer to Maintenance Manual 1, *Lubrication*.

NOTE: Refer to the following tables for standard information on lubricants, schedules and capacities.

### Table C: Lubricant Cross Reference (Viscosity) and Temperature Chart

<table>
<thead>
<tr>
<th>AxleTech Lubricant Specification</th>
<th>Description</th>
<th>Cross Reference</th>
<th>Minimum Outside Temperature</th>
<th>Maximum Outside Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-76-A</td>
<td>Hypoid Gear Oil GL5, S.A.E. 85W/140</td>
<td>–12.2°C (+10°F)</td>
<td>- - *</td>
<td></td>
</tr>
<tr>
<td>0-76-B</td>
<td>Hypoid Gear Oil GL5, S.A.E. 80W/140</td>
<td>–26.1°C (–15°F)</td>
<td>- - *</td>
<td></td>
</tr>
<tr>
<td>0-76-D</td>
<td>Hypoid Gear Oil GL5, S.A.E. 80W/90</td>
<td>–26.1°C (–15°F)</td>
<td>- - *</td>
<td></td>
</tr>
<tr>
<td>0-76-E</td>
<td>Hypoid Gear Oil GL5, S.A.E. 75W/90</td>
<td>–40°C (–40°F)</td>
<td>- - *</td>
<td></td>
</tr>
<tr>
<td>0-76-J</td>
<td>Hypoid Gear Oil GL5, S.A.E. 75W</td>
<td>–40°C (–40°F)</td>
<td>+ 1.6°C (+ 35°F)</td>
<td></td>
</tr>
<tr>
<td>0-76-L</td>
<td>Hypoid Gear Oil GL5, S.A.E. 75W/140</td>
<td>–40°C (–40°F)</td>
<td>- - *</td>
<td></td>
</tr>
</tbody>
</table>

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

### Table D: Oil Change Intervals and Specifications for All Rear Drive Axles

<table>
<thead>
<tr>
<th>Vocation or Vehicle Operation</th>
<th>Linehaul</th>
<th>Motorhome</th>
<th>Intercity Coach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Oil Change</td>
<td>No longer required as of January 1, 1993</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Check Oil Level</th>
<th>City Delivery</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 25,000 miles (40 000 km) or the fleet maintenance interval (whichever comes first)</td>
<td>Every 10,000 miles (16 000 km), once a month or the fleet maintenance interval (whichever comes first)</td>
<td>Every 5,000 miles (8000 km), once a month or the fleet maintenance interval (whichever comes first)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Petroleum based oil change on axle WITH or WITHOUT pump and filter system</th>
<th>City Delivery</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 100,000 miles (160 000 km) or annually, whichever comes first</td>
<td>Every 50,000 miles (80 000 km) or annually, whichever comes first</td>
<td>Every 25,000 miles (40 000 km) or annually, whichever comes first</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Synthetic oil change on axle WITHOUT pump and filter system</th>
<th>City Delivery</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 250,000 miles (400 000 km) or annually, whichever comes first</td>
<td>Every 100,000 miles (160 000 km) or annually, whichever comes first</td>
<td>Every 50,000 miles (80 000 km) or annually, whichever comes first</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Synthetic oil change on axle WITH pump and filter system</th>
<th>City Delivery</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 500,000 miles (800 000 km) or annually, whichever comes first</td>
<td>Every 250,000 miles (400 000 km) or annually, whichever comes first</td>
<td>Every 100,000 miles (160 000 km)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Filter change on axle WITH pump and filter system</th>
<th>City Delivery</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 100,000 miles (160 000 km)</td>
<td>Every 100,000 miles (160 000 km)</td>
<td>Every 100,000 miles (160 000 km)</td>
</tr>
</tbody>
</table>

1. If a No-Spin differential is installed, change the oil (petroleum or synthetic) at a minimum interval of 40,000 miles (64 000 km) or a maximum interval of 50,000 miles (80 000 km).

2. For continuous heavy-duty operation, check the oil level every 1,000 miles (1600 km). Add the correct type and amount of oil as required.

3. This interval applies to approved semi-synthetic and full synthetic oils only. For a list of approved extended-drain axle oils, refer to TP-9539, Approved Rear Drive Axle Lubricants. To order this publication, call AxleTech’s Customer Service Center at 877-547-3907.
### Section 6
Lubrication

#### Table E: Lubricant Specifications

<table>
<thead>
<tr>
<th>Gear Oil Type</th>
<th>A.P.I. Specification</th>
<th>SAE Grade</th>
<th>AxleTech Specification</th>
<th>Military Specification</th>
<th>Outside Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum With EP Additives</td>
<td>GL-5</td>
<td>85W/140</td>
<td>O-76A</td>
<td>MIL-L2105D or MIL-PRF-2105E</td>
<td>Above +10°F (−12°C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80W/90</td>
<td>O-76D</td>
<td></td>
<td>Above −15°F (−26°C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75W/90</td>
<td>O-76E</td>
<td></td>
<td>Above −40°F (−40°C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75W</td>
<td>O-76J</td>
<td></td>
<td>From −40°F (−40°C) to 35°F (2°C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75W/140</td>
<td>O-76L</td>
<td></td>
<td>Above −40°F (−40°C)</td>
</tr>
<tr>
<td>Petroleum With Extended Drain Additives</td>
<td>GL-5</td>
<td>80W/90</td>
<td>—</td>
<td>MIL-L2105D or MIL-PRF-2105E</td>
<td>Above −15°F (−26°C)</td>
</tr>
<tr>
<td>Semi-Synthetic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Above −15°F (−26°C)</td>
</tr>
<tr>
<td>Full Synthetic</td>
<td></td>
<td>75W/140</td>
<td>O-76M</td>
<td></td>
<td>Above −40°F (−40°C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75W/90</td>
<td>O-76N</td>
<td></td>
<td>Above −40°F (−40°C)</td>
</tr>
</tbody>
</table>

#### Table F: Lubricant Capacities — On-Highway Axles

<table>
<thead>
<tr>
<th>Model</th>
<th>Carrier</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>U.S. Pints</td>
</tr>
<tr>
<td>SR-170, RT, RP-48-180</td>
<td>Forward</td>
<td>55.0</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>43.0</td>
</tr>
<tr>
<td>SR-270/280 RT, RP-48-380</td>
<td>Forward</td>
<td>55.0</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>55.0</td>
</tr>
<tr>
<td>ST-170, RT, RP-52-180</td>
<td>Forward</td>
<td>55.0</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>43.0</td>
</tr>
<tr>
<td>ST-270/280 RT, RP-52-380</td>
<td>Forward</td>
<td>55.0</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>55.0</td>
</tr>
<tr>
<td>SU-170 RT, RP-52-180</td>
<td>Forward</td>
<td>55.0</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>43.0</td>
</tr>
<tr>
<td>SU-270/280, RT, RP-58-380</td>
<td>Forward</td>
<td>55.0</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>55.0</td>
</tr>
<tr>
<td>SW-170</td>
<td>Forward</td>
<td>55.0</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>43.0</td>
</tr>
<tr>
<td>SW-270/280, RT, RP-70-380</td>
<td>Forward</td>
<td>55.0</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>55.0</td>
</tr>
</tbody>
</table>

#### Table G: Lubricant Capacities — Off-Highway Axles

<table>
<thead>
<tr>
<th>Model</th>
<th>Carrier</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Wheel Ends</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U.S. Pints per Wheel End</td>
</tr>
<tr>
<td>SPR-570</td>
<td>Forward</td>
<td>32.0</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>32.0</td>
</tr>
<tr>
<td>SPRC-4806</td>
<td>Forward</td>
<td>32.0</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>32.0</td>
</tr>
</tbody>
</table>

For correct lubrication, each wheel end and the axle housing bowl must be filled with the specified amount of lubricant. Do not fill the axle only through the wheel ends or the axle housing bowl.
Torque Values for Fasteners

General Information

1. The torque values in Table H 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 0.50-13.00.
  — 0.50 is the diameter of the fastener in inches or dimension X.
  — 13.00 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.
5. Compare the size of fastener measured in Step 4 to the list of fasteners in Table H to find the correct torque value.
Figure 7.3

TORQUE LOCATIONS

CURRENT STYLE OIL PUMP

OIL PUMP — GEAR TYPE — VIEW A

OIL PUMP — ROTOR TYPE — VIEW A
## Table H: Torque Specifications

<table>
<thead>
<tr>
<th>Position</th>
<th>Description</th>
<th>Thread Size</th>
<th>Torque Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Output Yoke-to-Thru-Shaft Nut</td>
<td>1-1/2&quot;-12</td>
<td>450-650</td>
</tr>
<tr>
<td>2</td>
<td>Output Bearing Cage-to-Axle Housing Capscrew</td>
<td>7/16&quot;-14</td>
<td>60-75</td>
</tr>
<tr>
<td></td>
<td>3/8&quot;-16 x 1-1/4&quot;</td>
<td>35-50</td>
<td>48-67</td>
</tr>
<tr>
<td>4</td>
<td>Bearing Cap-to-Axle Housing Capscrew</td>
<td>3/4&quot;-10 x 4-3/4&quot;</td>
<td>290-350</td>
</tr>
<tr>
<td></td>
<td>7/8&quot;-14</td>
<td>375-435</td>
<td>509-589</td>
</tr>
<tr>
<td>5</td>
<td>Adjusting Ring Lock-to-Bearing Cap Capscrew</td>
<td>5/16&quot;-18</td>
<td>20-30</td>
</tr>
<tr>
<td>5A</td>
<td>Differential Case Halves Bolts</td>
<td>5/8&quot;-11</td>
<td>180-230</td>
</tr>
<tr>
<td></td>
<td>1/2&quot;-13</td>
<td>40-55</td>
<td>55-75</td>
</tr>
<tr>
<td>7</td>
<td>Ring Gear-to-Differential Case Nut and Bolt</td>
<td>5/8&quot;-18</td>
<td>180-230</td>
</tr>
<tr>
<td></td>
<td>7/8&quot;-14</td>
<td>600-700</td>
<td>810-950</td>
</tr>
<tr>
<td>8</td>
<td>Thrust Screw Jam Nut</td>
<td>1-18&quot;-16</td>
<td>150-190</td>
</tr>
<tr>
<td></td>
<td>7/8&quot;-14</td>
<td>150-190</td>
<td>204-257</td>
</tr>
<tr>
<td>9</td>
<td>Differential Carrier-to-Axle Housing Capscrew or Nut</td>
<td>5/8&quot;-11 x 1&quot;</td>
<td>180-230</td>
</tr>
<tr>
<td>10</td>
<td>Fill Plug (①)</td>
<td>3/4&quot;-14</td>
<td>35 Min.</td>
</tr>
<tr>
<td>11</td>
<td>Inter-Axle Differential Case Halves Nut and Bolt</td>
<td>3/8&quot;-16</td>
<td>30-40</td>
</tr>
<tr>
<td></td>
<td>3/8&quot;-16 x 2-7/8&quot;</td>
<td>35-50</td>
<td>48-67</td>
</tr>
<tr>
<td>12</td>
<td>Drive Pinion Bearing Cage-to-Differential Carrier Capscrew</td>
<td>1/2&quot;-13</td>
<td>85-115</td>
</tr>
<tr>
<td></td>
<td>5/8&quot;-11 x 1-1/2&quot;</td>
<td>180-230</td>
<td>245-311</td>
</tr>
<tr>
<td>13</td>
<td>Helical Driven Gear-to-Drive Pinion Nut</td>
<td>2&quot;-12</td>
<td>1200-1500</td>
</tr>
<tr>
<td>14</td>
<td>Oil Shield Bolt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Input Yoke-to-Input Shaft Nut</td>
<td>Refer to Table I.</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Input Bearing Cage-to-Differential Carrier Capscrew</td>
<td>1/2&quot;-13</td>
<td>85-115</td>
</tr>
<tr>
<td>17</td>
<td>Oil Pump to Bearing Cage Capscrew — New Designs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Air Filter Cover-to-Helical Gear Cover Capscrew</td>
<td>1/4&quot;-20</td>
<td>7-10 (②)</td>
</tr>
<tr>
<td>19</td>
<td>Oil Filter Cover-to-Helical Gear Cover Capscrew (③)</td>
<td>5/16&quot;-18</td>
<td>15</td>
</tr>
<tr>
<td>20</td>
<td>Oil Filter Adapter-to-Helical Gear Cover Capscrew</td>
<td>5/16&quot;-18 x 1</td>
<td>20-30</td>
</tr>
<tr>
<td>21</td>
<td>Drain Plug (①)</td>
<td>3/4&quot;-14</td>
<td>35 Min.</td>
</tr>
<tr>
<td>22</td>
<td>Helical Gear Cover-to-Differential Carrier Capscrew</td>
<td>1/2&quot;-13</td>
<td>85-115</td>
</tr>
<tr>
<td>23</td>
<td>Oil Pump Idler Gear-to-Helical Gear Cover Nut</td>
<td>1/2&quot;-13 — Lock Nut</td>
<td>75-100</td>
</tr>
<tr>
<td></td>
<td>1/2&quot;-13, Gr. 8 — Plain Nut</td>
<td>85-115</td>
<td>116-155</td>
</tr>
<tr>
<td></td>
<td>1/2&quot;-13, Gr. 5 — Plain Nut</td>
<td>65-85</td>
<td>88-115</td>
</tr>
<tr>
<td></td>
<td>5/8&quot;-11 — Plain Nut</td>
<td>110-145</td>
<td>145-197</td>
</tr>
<tr>
<td>24</td>
<td>Shift Fork Adjusting Screw Jam Nut</td>
<td>1/2&quot;-13</td>
<td>40-55</td>
</tr>
<tr>
<td>25</td>
<td>Oil Pump to Helical Cover Capscrew — Rotor Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Oil Pump Pipe Plug — Small (④)</td>
<td>1/4&quot;-18</td>
<td>15 Min.</td>
</tr>
<tr>
<td>27</td>
<td>Oil Pump Pipe Plug — Large (④)</td>
<td>1/2&quot;-14</td>
<td>25 Min.</td>
</tr>
<tr>
<td>28</td>
<td>Oil Pump-to-Helical Cover Capscrew — Gear and Rotor Types</td>
<td>3/8&quot;-16</td>
<td>35-50</td>
</tr>
<tr>
<td>29</td>
<td>Cap-to-Oil Pump Capscrew (Rotor-Type Pump Only)</td>
<td>5/16&quot;-18</td>
<td>15-20</td>
</tr>
</tbody>
</table>

① Minimum torque. Tighten until one thread is visible.
② 75-100 lb-in.
③ On steel oil filter covers, tighten the capscrew that fastens lower, longer leg of the cover to 30 lb-ft (41 N•m).
④ To install the stud, place the coarse end of the stud into the hub. Tighten the stud to the last thread.
# Table I: Input and Output Yoke Pinion Nut Fastener Torque Specifications

## Single Axles

<table>
<thead>
<tr>
<th>Axle Model</th>
<th>Pinion Nut Location</th>
<th>Carrier Input Yoke</th>
<th>Tandem Axle Yoke</th>
<th>Second Carrier Input Yoke</th>
<th>Tridem Axle Yoke</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-120, RS-125, RS-140</td>
<td>740-920 lb-ft (1000-1245 N•m)</td>
<td>M32 X 1.5</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>920-1130 lb-ft (1250-1535 N•m)</td>
<td>920-1130 lb-ft (1250-1535 N•m)</td>
</tr>
<tr>
<td>RS-145</td>
<td>920-1130 lb-ft (1250-1535 N•m)</td>
<td>M39 X 1.5</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>1000-1230 lb-ft (1350-1670 N•m)</td>
<td>1000-1230 lb-ft (1350-1670 N•m)</td>
</tr>
<tr>
<td>RS-160, RS-161, RS-185, RS-186</td>
<td>1000-1230 lb-ft (1350-1670 N•m)</td>
<td>M45 X 1.5</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>740-920 lb-ft (1000-1245 N•m)</td>
<td>740-920 lb-ft (1000-1245 N•m)</td>
</tr>
<tr>
<td>RS-210, RS-220, RS-230</td>
<td>740-920 lb-ft (1000-1245 N•m)</td>
<td>M39 X 1.5</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>740-920 lb-ft (1000-1245 N•m)</td>
<td>740-920 lb-ft (1000-1245 N•m)</td>
</tr>
<tr>
<td>RS-240</td>
<td>740-920 lb-ft (1000-1245 N•m)</td>
<td>M39 X 1.5</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>800-1100 lb-ft (1085-1496 N•m)</td>
<td>800-1100 lb-ft (1085-1496 N•m)</td>
</tr>
<tr>
<td>RS-380</td>
<td>800-1100 lb-ft (1085-1496 N•m)</td>
<td>1-1/2 - 12 UNF</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>800-1100 lb-ft (1085-1496 N•m)</td>
<td>800-1100 lb-ft (1085-1496 N•m)</td>
</tr>
</tbody>
</table>

## Tandem Axles

<table>
<thead>
<tr>
<th>Axle Model</th>
<th>Pinion Nut Location</th>
<th>First Carrier Input Yoke</th>
<th>Second Carrier Input Yoke</th>
<th>Third Carrier Input Yoke</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT-140</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>M45 X 1.5</td>
<td>920-1130 lb-ft (1250-1535 N•m)</td>
<td>M32 X 1.5</td>
</tr>
<tr>
<td>RT-145, RT-149</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>M45 X 1.5</td>
<td>1000-1230 lb-ft (1350-1670 N•m)</td>
<td>M45 X 1.5</td>
</tr>
<tr>
<td>RT-160, RT-164, RT-169</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>M45 X 1.5</td>
<td>740-920 lb-ft (1000-1245 N•m)</td>
<td>M32 X 1.5</td>
</tr>
<tr>
<td>RT-185</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>M45 X 1.5</td>
<td>1000-1230 lb-ft (1350-1670 N•m)</td>
<td>M32 X 1.5</td>
</tr>
<tr>
<td>RT-380 With IAD</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>1-3/4 - 12 UN</td>
<td>1000-1230 lb-ft (1350-1670 N•m)</td>
<td>1-1/2 - 12 UNF</td>
</tr>
<tr>
<td>RT-380 Without IAD</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>1-3/4 - 12 UN</td>
<td>1000-1230 lb-ft (1350-1670 N•m)</td>
<td>1-1/2 - 12 UNF</td>
</tr>
</tbody>
</table>

## Tridem Axles

<table>
<thead>
<tr>
<th>Axle Model</th>
<th>Pinion Nut Location</th>
<th>First Carrier Input Yoke</th>
<th>Second Carrier Input Yoke</th>
<th>Third Carrier Input Yoke</th>
</tr>
</thead>
<tbody>
<tr>
<td>RZ-164</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>M45 X 1.5</td>
<td>1000-1230 lb-ft (1350-1670 N•m)</td>
<td>M32 X 1.5</td>
</tr>
<tr>
<td>RZ-166</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>M45 X 1.5</td>
<td>1000-1230 lb-ft (1350-1670 N•m)</td>
<td>M39 X 1.5</td>
</tr>
<tr>
<td>RZ-186</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>M45 X 1.5</td>
<td>1000-1230 lb-ft (1350-1670 N•m)</td>
<td>M45 X 1.5</td>
</tr>
<tr>
<td>RZ-188</td>
<td>600-800 lb-ft (815-1085 N•m)</td>
<td>1-3/4 - 12 UN</td>
<td>1000-1230 lb-ft (1350-1670 N•m)</td>
<td>1-1/2 - 12 UNF</td>
</tr>
</tbody>
</table>

## Fastener Sizes

- M32 X 1.5
- M39 X 1.5
- M45 X 1.5
- 1-1/2 - 12 UN
- 1-3/4 - 12 UN
- 1-1/2 - 12 UNF
- 1-3/4 - 12 UNF
NOTE: Refer to Section 4 for further information.

### Drive Pinion Bearings — Preload

<table>
<thead>
<tr>
<th>Specification</th>
<th>New bearings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>— From 5 to 25 lb-in (0.56 to 2.82 N•m) torque</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specification</th>
<th>Used bearings in good condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>— From 5 to 15 lb-in (0.56 to 1.69 N•m) torque</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adjustment</th>
<th>Preload is controlled by the thickness of the spacer between bearings.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>— To increase preload, install a thinner spacer</td>
</tr>
<tr>
<td></td>
<td>— To decrease preload, install a thicker spacer</td>
</tr>
</tbody>
</table>

### Drive Pinion — Depth in Carrier

| 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 number. |

| Adjustment | Change the thickness of the shim pack to get a good gear-tooth contact pattern. |

### Hypoid Gear Set — Tooth Contact Patterns (Hand Rolled)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Conventional gear set</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>— Toward the toe of the gear tooth and in the center between the top and bottom of the tooth</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adjustment</th>
<th>Tooth contact patterns are controlled by the thickness of the shim pack between the pinion bearing cage and carrier and by ring gear backlash</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>— To move the contact pattern lower, decrease the thickness of the shim pack under the pinion bearing cage</td>
</tr>
<tr>
<td></td>
<td>— To move the contact pattern higher, increase the thickness of the shim pack under the pinion bearing cage</td>
</tr>
<tr>
<td></td>
<td>— To move the contact pattern toward the toe of the tooth, decrease backlash of the ring gear</td>
</tr>
<tr>
<td></td>
<td>— To move the contact pattern toward the heel of the tooth, increase backlash of the ring gear</td>
</tr>
</tbody>
</table>

### Input Bearing — End Play

| Specification | 0.002 to 0.008-inch (0.0508-0.2032 mm) |

<table>
<thead>
<tr>
<th>Adjustment</th>
<th>End play is controlled by the size of the shim pack.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>— To increase end play, add shims to the shim pack</td>
</tr>
<tr>
<td></td>
<td>— To decrease end play, remove shims from the shim pack</td>
</tr>
</tbody>
</table>

### Main Differential Bearings — Preload

<table>
<thead>
<tr>
<th>Specification</th>
<th>From 15 to 35 lb-in (1.7 to 3.9 N•m) torque</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>or Expansion between bearing caps</td>
</tr>
<tr>
<td></td>
<td>— 0.006 to 0.013-inch (0.15 to 0.33 mm)</td>
</tr>
</tbody>
</table>

| Adjustment | Preload is controlled by tightening both adjusting rings after zero end play is reached |
### Main Differential Gears — Rotating Resistance

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

### Output Bearing — End Play and Preload

| Specification | 10 lb-in (1.13 N\cdot m) bearing preload to 0.0030-inch (0.0762 mm) bearing end play |
| Adjustment | End play and preload are controlled by the size of the snap ring in the output bearing cage.  
  — Increase end play and decrease preload by installing a thinner snap ring  
  — Decrease end play and increase preload by installing a thicker snap ring |

### Ring Gear — Backlash

| Specification | 0.008 to 0.020-inch (0.020-0.510 mm) 0.014-inch (0.350 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

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

### Thrust Screw — Clearance

| Specification | 0.025 to 0.045-inch (0.65 to 1.14 mm) |
| Or | Loosen the thrust screw 1/4 turn after tightening the thrust screw, hand tight, against the ring gear |
1. PLATES 8 INCHES LONG X 3/4 INCH THICK x 1-1/4 INCHES WIDE WITH A TONGUE TO FIT SLOT IN BAR WELD PLATES TO BAR.
2. HANDLE 7 INCHES LONG WITH SLOT IN ONE END TO FIT CLAMP SCREW.
3. BAR 2 INCHES DIAMETER x 9 INCHES LONG WITH ONE END SLOTTED TO FIT PLATE.
4. WELD ALL AROUND AFTER PRESSING PLUG IN PIPE.
7. 29-1/4 INCHES
8. WELD
9. 2-1/4 INCHES
10. 16 INCHES
11. 2-1/4 INCHES
12. CHAMFER END OF PIPE FOR WELDING.
13. 6 INCHES
14. 25-1/2 INCHES
15. 6 INCHES
16. 4 INCHES DIAMETER PIPE
17. PLUG 4 INCHES DIAMETER x 7 INCHES LONG WITH ONE END TURNED 3 INCHES LONG TO FIT PIPE. DRILL 2-INCH HOLE AND MILL 3/16-INCH WIDE SLOT 2 INCHES FROM TOP.
18. SCREW 3-1/2 INCHES LONG x 5/8-INCH DIAMETER WITH FLATS ON END TO FIT HANDLE AND 2-1/2-INCH LENGTH OF THREAD ON OTHER END.
19. DRILL 3/8-INCH HOLE THROUGH HANDLE AND SCREW.
Section 10
Vehicle Towing Instructions

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

SINGLE AXLE
With Driver Controlled Main Differential Lock (DCDL — Screw-In [threaded] shift assembly)

TANDEM AXLE
With Driver Controlled Main Differential Lock (DCDL — Screw-In [threaded] shift assembly) and 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 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 DCDL and the IAD to the unlocked (disengaged) positions using the switches inside the cab of the vehicle. The indicator lights in the cab will go off.
4. Stop the engine.

Table J

<table>
<thead>
<tr>
<th>Single Axles</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove the left-hand (road side) axle shaft</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tandem Axles</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Axle:</td>
<td></td>
</tr>
<tr>
<td>Remove the right-hand (curb side) axle shaft</td>
<td></td>
</tr>
<tr>
<td>Rear Axle:</td>
<td></td>
</tr>
<tr>
<td>Remove the left-hand (road side) axle shaft</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Remove only the axle shaft(s), shown in Table J at this time, from the axle(s) that will remain on the road when the vehicle is transported. Continue with Step 5.

5. Remove the stud nuts or capscrews and the washers from the flange of the axle shaft. Figure 10.1.

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 10.1.
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 10.2.**

B. Hit the end of the drift with a large hammer (5 to 6 pounds, 2.3 to 2.7 kg) to loosen the axle shaft and tapered dowels from the hub. **Figure 10.2.**

Air Hammer Vibration Method:

⚠️ **WARNING**

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

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 10.3.**

7. 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.)

8. Remove the tapered dowels, gasket (if used) and the axle shaft from the axle assembly. **Figure 10.1.**
9. Disconnect the air hose from the shift cylinder. Figure 10.4.

10. Remove the manual engaging capscrew from the storage hole. The storage hole of threaded shift assemblies is located in the shift tower of the carrier, next to the cylinder. Figure 10.4.

11. Lock (engage) the main differential using the Manual Engaging Method.

**CAUTION**

When you turn the capscrew in Step B and you feel a high resistance, STOP TURNING THE CAPSCREW. A high resistance against the capscrew indicates that the splines of the shift collar and differential case are not aligned. Damage to the threads of the cylinder and capscrew will result. To align the splines, continue with Steps C, D and E.

B. Turn the capscrew to the right until the head is approximately 0.25- to 0.50-inch (6.4-12.7 mm) from the cylinder. The capscrew is now in the service position and the main differential is locked (engaged). Figure 10.6. When turning the capscrew you will feel a small amount of resistance. This is normal. If you feel a high resistance before achieving the 0.25- to 0.50-inch distance between the capscrew head and cylinder, stop turning the capscrew and continue with Steps C, D and E.

C. Rotate the main driveline or the IAD a small amount by hand.

D. Turn the manual engaging capscrew again to the right. If you still feel a high resistance, stop turning the capscrew.

E. Repeat Steps C and D until you feel a low resistance on the capscrew. Continue with Step B.

---

**Manual Engaging Method**

A. Install the manual engaging capscrew into the threaded hole in the center of the cylinder. Figure 10.5.

---

**Figure 10.4**

1 STORAGE HOLE
2 CYLINDER
3 SHIFT TOWER
4 MANUAL ENGAGING CAPSCREW
5 AIR HOSE

**Figure 10.5**

1 MANUAL ENGAGING CAPSCREW

**Figure 10.6**

1 0.25" TO 0.50" (6.4 TO 12.7 MM)
2 CYLINDER
Section 10
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12. Remove the remaining axle shaft(s) from the axle(s) that will remain on the road when the vehicle is transported. Follow Steps 5 through 8 found previously.

13. 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.

NOTE: If an air supply will be used for the brake system of the transported vehicle, continue with Steps 14 and 15, otherwise continue with Step 16.

14. 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 16.

15. When the correct amount of air pressure is in the brake system, release the parking brakes of the vehicle that is being transported. Step 16 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.

16. 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.

Table K

<table>
<thead>
<tr>
<th>Single Axles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install the right-hand (curb side) axle shaft</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tandem Axles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Axle:</td>
</tr>
<tr>
<td>Install the left-hand (road side) axle shaft</td>
</tr>
<tr>
<td>Rear Axle:</td>
</tr>
<tr>
<td>Install the right-hand (curb side) axle shaft</td>
</tr>
</tbody>
</table>

NOTE: Install only the axle shaft(s) shown in Table K at this time. These axle shafts have a double row of splines that engage with splines of the side gear and shift collar in the main differential. Figure 10.7. Continue with Step 5.
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 10.1.**

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 L** below.

**Table L**

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

8. Unlock (disengage) the DCDL by removing the manual engaging capscrew from the shift assembly.

9. Install the manual engaging capscrew into the storage hole. The storage hole of threaded shift assemblies is located in the shift tower of the carrier next to the cylinder. Tighten to 15 to 25 lb-ft (20-35 N•m). **Figure 10.4.**

10. Connect the air hose to the shift cylinder. Tighten to 22 to 30 lb-ft (30-40 N•m). 

11. Install the remaining axle shaft into the axle housing and carrier. Follow Steps 5 through 7 found previously.

12. Check 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 the Maintenance Manual 1, *Lubrication,* or refer to the Lubrication Section of the Maintenance Manual for the axle model you are working with.
Figure 10.7

1. LEFT-HAND (ROAD SIDE) AXLE SHAFT
2. SHIFT ASSEMBLY
3. SHIFT COLLAR
4. RIGHT-HAND (CURB SIDE) AXLE SHAFT
5. DOUBLE ROW OF SPLINES
6. SHIFT COLLAR AND DIFFERENTIAL CASE SPLINES ENGAGED (LOCKED)
7. SIDE GEAR
8. DIFFERENTIAL CASE

SINGLE AXLE OR REAR AXLE OF TANDEM:
Shown with Screw-In Shift Assembly and in the Locked (Engaged) Position
Section 10
Vehicle Towing Instructions

SINGLE AND TANDEM AXLE

With Driver Controlled Main Differential Lock (DCDL — Bolt-On shift assembly) and 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 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 DCDL and the IAD to the unlocked (disengaged) positions using the switches inside the cab of the vehicle. The indicator lights in the cab will go off.
4. Stop the engine.

Table M

<table>
<thead>
<tr>
<th>Single Axle</th>
<th>Tandem Axles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove the left-hand (road side) axle shaft</td>
<td>Forward Axle: Remove the right-hand (curb side) axle shaft</td>
</tr>
<tr>
<td></td>
<td>Rear Axle: Remove the left-hand (road side) axle shaft</td>
</tr>
</tbody>
</table>

NOTE: Remove only the axle shaft(s), shown in Table M at this time, from the axle(s) that will remain on the road when the vehicle is transported. Continue with Step 5.

5. Remove the stud nuts or capscrews and the washers from the flange of the axle shaft Figure 10.8.

⚠️ 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 10.8.

Figure 10.8

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
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 10.9.

B. Hit the end of the drift with a large hammer (5 to 6 pounds, 2.3 to 2.7 kg) to loosen the axle shaft and tapered dowels from the hub. Figure 10.9.

---

Air Hammer Method:

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

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 10.10.

7. 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.)

8. Remove the tapered dowels, gasket (if used) and the axle shaft from the axle assembly. Figure 10.11.
9. Remove the manual engaging capscrew from the storage hole. The storage hole of bolted-on shift assemblies is located in the top side of the shift cylinder cover. Figure 10.11.

![Figure 10.11](image)

<table>
<thead>
<tr>
<th>1</th>
<th>MANUAL ENGAGING CAPSCREW</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>TOP STORAGE HOLE FOR MANUAL ENGAGING CAPSCREW</td>
</tr>
<tr>
<td>3</td>
<td>AIR LINE</td>
</tr>
<tr>
<td>4</td>
<td>CYLINDER COVER</td>
</tr>
<tr>
<td>5</td>
<td>WIRE</td>
</tr>
<tr>
<td>6</td>
<td>SERVICE POSITION CAPSCREW HOLE</td>
</tr>
<tr>
<td>7</td>
<td>BOTTOM STORAGE HOLE FOR PLUG AND GASKET</td>
</tr>
<tr>
<td>8</td>
<td>PLUG AND GASKET</td>
</tr>
</tbody>
</table>

10. Remove the plug and gasket from the center of the shift cylinder cover. Install the plug and gasket into the bottom side storage hole of the shift cylinder cover (opposite end of the storage hole for the manual engaging capscrew). Tighten to 15 to 25 lb-ft (20-35 N·m) torque. Figure 10.11.

11. Lock (engage) the main differential using one of the two following methods: Air Pressure Method or Manual Engaging Method.

**Air Pressure Method:**

A. Install the manual engaging capscrew into the threaded hole in the center of the cylinder cover. Turn the capscrew to the right 3 to 5 turns. Figure 10.12.

B. Shift the transmission into neutral and start the vehicle’s engine. Let the engine idle to increase the pressure in the air system. **Do not release the parking brakes.**

C. Shift the main differential to the locked (engaged) position using the switch inside the cab of the vehicle. When the differential is locked, the indicator light in the cab will go on. If the light does not go on it will be necessary to rotate the main driveline or the IAD by hand until the main differential is locked and the indicator light goes on.

**NOTE:** When the shift collar is completely engaged with the splines of the main differential case, the differential is locked and the driveline cannot be rotated. Figure 10.14.

D. While the differential is held in the locked position by air pressure, turn the manual engaging capscrew to the right until you feel resistance against the piston. **Stop turning the capscrew.**

E. Place the main differential lock switch in the unlocked (disengaged) position.

F. Stop the engine. Continue with Step 12.

**Manual Engaging Method:**

A. Install the manual engaging capscrew into the threaded hole in the center of the cylinder cover. Figure 10.12.

![Figure 10.12](image)

| 1  | MANUAL ENGAGING CAPSCREW |

**BOLT-ON SHIFT ASSEMBLY**
Section 10
Vehicle Towing Instructions

CAUTION
When you turn the capscrew in Step B and you feel a high resistance, STOP TURNING THE CAPSCREW. A high resistance against the capscrew indicates that the splines of the shift collar and differential case are not aligned. Damage to the threads of the cylinder cover and capscrew will result. To align the splines, continue with Steps C, D and E.

B. Turn the capscrew to the right until the head is approximately 0.25- to 0.50-inch (6.4-12.7 mm) from the cylinder cover. The capscrew is now in the service position and the main differential is locked (engaged). Figure 10.13. When turning the capscrew you will feel a small amount of resistance. This is normal. If you feel a high resistance before achieving the 0.25- to 0.50-inch distance between the capscrew head and cylinder, stop turning the capscrew and continue with Steps C, D and E.

C. Rotate the main driveline or the IAD a small amount by hand.

D. Turn the manual engaging capscrew again to the right. If you still feel a high resistance, stop turning the capscrew.

E. Repeat Steps C and D until you feel a low resistance on the capscrew. Continue with Step B.

Figure 10.13

12. Remove the remaining axle shaft(s) from the axle(s) that will remain on the road when the vehicle is transported. Follow Steps 5 through 8 found previously.

13. 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.

NOTE: If an air supply will be used for the brake system of the transported vehicle, continue with Steps 14 and 15, otherwise continue with Step 16.

14. 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 16.

15. When the correct amount of air pressure is in the brake system, release the parking brakes of the vehicle that is being transported. Step 16 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.

16. 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.

**Table N**

<table>
<thead>
<tr>
<th>Single Axles</th>
<th>Tandem Axles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install the right-hand (curb side) axle shaft</td>
<td>Install the left-hand (road side) axle shaft</td>
</tr>
</tbody>
</table>

**Forward Axle:**

Install the left-hand (road side) axle shaft

**Rear Axle:**

Install the right-hand (curb side) axle shaft

**NOTE:** Install only the axle shaft(s) shown in Table N at this time. These axle shafts have a double row of splines that engage with splines of the side gear and shift collar in the main differential. Continue with Step 5. Figure 10.14.

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 10.8.

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 O below.

8. Unlock (disengage) the DCDL by removing the manual engaging capscrew from the shift assembly.

9. Install the manual engaging capscrew into the storage hole. The storage hole of bolted-on shift assemblies is located in the top side of the shift cylinder cover. Tighten to 15 to 25 lb-ft (20-35 N•m). Figure 10.11.

10. Remove the plug and gasket from the storage hole. Install the plug and gasket into the threaded hole in the center of the shift cylinder cover. Tighten from 15 to 25 lb-ft (25-30 N•m).

11. Install the remaining axle shaft into the axle housing and carrier. Follow Steps 5 through 7.

**Table O**

<table>
<thead>
<tr>
<th>Thread Size</th>
<th>Torque Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capscrews:</td>
<td></td>
</tr>
<tr>
<td>0.31”-24</td>
<td>18-24 (24-33)</td>
</tr>
<tr>
<td>0.50”-13</td>
<td>85-115 (115-156)</td>
</tr>
<tr>
<td>Stud Nuts:</td>
<td></td>
</tr>
<tr>
<td>(plain nuts)</td>
<td></td>
</tr>
<tr>
<td>0.44”-20</td>
<td>50-75 (68-102)</td>
</tr>
<tr>
<td>0.50”-20</td>
<td>75-115 (102-156)</td>
</tr>
<tr>
<td>0.56”-18</td>
<td>110-165 (149-224)</td>
</tr>
<tr>
<td>0.62”-18</td>
<td>150-230 (203-312)</td>
</tr>
<tr>
<td>0.75”-16</td>
<td>310-400 (420-542)</td>
</tr>
<tr>
<td>(lock nut)</td>
<td></td>
</tr>
<tr>
<td>0.44”-20</td>
<td>40-65 (54-88)</td>
</tr>
<tr>
<td>0.50”-20</td>
<td>65-100 (88-136)</td>
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<td>0.62”-18</td>
<td>130-190 (176-258)</td>
</tr>
<tr>
<td>0.75”-16</td>
<td>270-350 (366-475)</td>
</tr>
</tbody>
</table>
12. Check 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 the Maintenance Manual 1, *Lubrication*, or refer to the Lubrication Section of the Maintenance Manual for the axle model you are working with.

**Figure 10.14**

1. LEFT-HAND (ROAD SIDE) AXLE SHAFT
2. SHIFT ASSEMBLY
3. SHIFT COLLAR
4. RIGHT-HAND (CURB SIDE) AXLE SHAFT
5. DOUBLE ROW OF SPLINES
6. SHIFT COLLAR AND DIFFERENTIAL CASE
7. SPLINES ENGAGED (LOCKED)
8. SIDE GEAR
9. DIFFERENTIAL CASE

SINGLE AXLE OR REAR AXLE OF TANDEM:
Shown with Bolted On Shift Assembly and in the Locked (Engaged) Position
Section 10
Vehicle Towing Instructions

SINGLE AXLE
Without Driver Controlled Main Differential Lock (DCDL)

TANDEM AXLE
Without Driver Controlled Main Differential Lock (DCDL) and 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 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.

NOTE: Single Axle continue with Step 5. Tandem Axle continue with Step 2.

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 10.15.

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 10.15.

Figure 10.15

| 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 |
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 10.16.

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 10.16.

Air Hammer Vibration Method:

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

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 10.17.

7. 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.)

8. Remove the tapered dowels, gasket (if used) and the axle shaft from the axle assembly. Figure 10.15.

9. 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.

**NOTE:** If an air supply will be used for the brake system of the transported vehicle, continue with Step 10 and 11, otherwise continue with Step 12.

10. 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 12.
Section 10
Vehicle Towing Instructions

11. When the correct amount of air pressure is in the brake system, release the parking brakes of the vehicle that is being transported. Step 12 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.

12. 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 10.15.

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 P below.

8. Check the lubricant level in the axles and hubs where the axle shafts were removed. Add the correct type and amount of lubricant if necessary. Refer to Maintenance Manual 1, Lubrication, for additional information.