Carriers
Single, Tandem, & Double-Reduction

RT & RP-180 Series
RT & RP-380 Series
RS-23/26/30/-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

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Service Notes

This service manual describes the service and repair procedures for the 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. The information contained in this manual is current at the time of publication and is subject to change without notice or liability.

Follow all company procedures when you service or repair equipment or components. Understand all instructions before performing any product service. Some procedures require the use of special tools for safe and correct service. Failure to use special tools when required can cause serious personal injury to service personnel, as well as, damage to equipment and components.

The instructions contained in this service manual are intended for use by skilled and experienced mechanics knowledgeable in the installation, repair, and replacement of the AxleTech product described herein.

⚠️ DANGER

Installation, maintenance, and replacement of such products requires a high degree of skill and experience. The consequences of improper installation, maintenance, or replacement (including the use of inferior or substandard components) are grave and can result in product failure and resulting loss of control of the vehicle, possible injury or death of persons, and/or possible future or additional product damage.

AxleTech does not authorize anyone, other than highly skilled and experienced individuals, to attempt to utilize the instructions contained in this manual for the installation, maintenance, or replacement of the product described herein, and AxleTech shall have no liability of any kind for damages arising out of (or in connection with) any other use of the information contained in this manual.

Updates

For the latest version of this manual, please visit AxleTech International’s web site at www.axletech.com.

Notations

AxleTech International uses the following notation to warn the user of possible safety problems and to provide information that will prevent damage to equipment and components:

⚠️ DANGER

A DANGER indicates a procedure that you must follow exactly or it will cause death or serious injury.

⚠️ WARNING

A WARNING indicates a procedure that you must follow exactly or it may cause death or serious injury.

⚠️ CAUTION

A CAUTION indicates a procedure that you must follow exactly to avoid damaging equipment or components.

NOTE

A NOTE indicates an operation, procedure, or instruction that is important for proper service. A NOTE can also supply information that will help to make service quicker and easier.
Asbestos and Non-Asbestos Fibers Warning

OSHA Toxic and Hazardous Substances 29 CFR 1910.1001

Work practices and engineering controls for automotive brake and clutch inspection, disassembly, repair and assembly -- Mandatory

This mandatory appendix specifies engineering controls and work practices that must be implemented by the employer during automotive brake and clutch inspection, disassembly, repair, and assembly operations.

Proper use of these engineering controls and work practices by trained employees will reduce employees' asbestos exposure below the permissible exposure level during clutch and brake inspection, disassembly, repair, and assembly operations. The employer shall institute engineering controls and work practices using either the method set forth in paragraph [A] or paragraph [B] of this appendix, or any other method which the employer can demonstrate to be equivalent in terms of reducing employee exposure to asbestos as defined and which meets the requirements described in paragraph [C] of this appendix, for those facilities in which no more than 5 pairs of brakes or 5 clutches are inspected, disassembled, reassembled and/or repaired per week, the method set forth in paragraph [D] of this appendix may be used:

[A] Negative Pressure Enclosure/HEPA Vacuum System Method

(1) The brake and clutch inspection, disassembly, repair, and assembly operations shall be enclosed to cover and contain the clutch or brake assembly and to prevent the release of asbestos fibers into the worker's breathing zone.

(2) The enclosure shall be sealed tightly and thoroughly inspected for leaks before work begins on brake and clutch inspection, disassembly, repair, and assembly.

(3) The enclosure shall be such that the worker can clearly see the operation and shall provide impermeable sleeves through which the worker can handle the brake and clutch inspection, disassembly, repair and assembly. The integrity of the sleeves and ports shall be examined before work begins.

(4) A HEPA-filtered vacuum shall be employed to maintain the enclosure under negative pressure throughout the operation. Compressed-air may be used to remove asbestos fibers or particles from the enclosure.

(5) The HEPA vacuum shall be used first to loosen the asbestos containing residue from the brake and clutch parts and then to evacuate the loosened asbestos containing material from the enclosure and capture the material in the vacuum filter.

(6) The vacuum’s filter, when full, shall be first wetted with a fine mist of water, then removed and placed immediately in an impermeable container, labeled according to paragraph (j)(5) of this section and disposed of according to paragraph (k) of this section.

(7) Any spills or releases of asbestos containing waste material from inside of the enclosure or vacuum hose or vacuum filter shall be immediately cleaned up and disposed of according to paragraph (k) of this section.

[B] Low Pressure/Wet Cleaning Method

(1) A catch basin shall be placed under the brake assembly, positioned to avoid splashes and spills.

(2) The reservoir shall contain water containing an organic solvent or wetting agent. The flow of liquid shall be controlled such that the brake assembly is gently flooded to prevent the asbestos-containing brake dust from becoming airborne.

(3) The aqueous solution shall be allowed to flow between the brake drum and brake support before the drum is removed.

(4) After removing the brake drum, the wheel hub and back of the brake assembly shall be thoroughly wetted to suppress dust.
(5) The brake support plate, brake shoes and brake components used to attach the brake shoes shall be thoroughly washed before removing the old shoes.

(6) In systems using filters, the filters, when full, shall be first wetted with a fine mist of water, then removed and placed immediately in an impermeable container, labeled according to paragraph (j)(4) of this section and disposed of according to paragraph (k) of this section.

(7) Any spills of asbestos-containing aqueous solution or any asbestos-containing waste material shall be cleaned up immediately and disposed of according to paragraph (k) of this section.

(8) The use of dry brushing during low pressure/wet cleaning operations is prohibited.

[C] Equivalent Methods

An equivalent method is one which has sufficient written detail so that it can be reproduced and has been demonstrated that the exposures resulting from the equivalent method are equal to or less than the exposures which would result from the use of the method described in paragraph [A] of CFR 1910.1001. For purposes of making this comparison, the employer shall assume that exposures resulting from the use of the method described in paragraph [A] of this appendix shall not exceed 0.016 f/cc, as measured by the OSHA reference method and as averaged over at least 18 personal samples.

[D] Wet Method

(1) A spray bottle, hose nozzle, or other implement capable of delivering a fine mist of water or amended water or other delivery system capable of delivering water at low pressure, shall be used to first thoroughly wet the brake and clutch parts. Brake and clutch components shall then be wiped clean with a cloth. Any wastewater generated must be captured and properly disposed of without allowing it to dry on any surfaces.

(2) The cloth shall be placed in an impermeable container, labeled according to paragraph (j)(4) of the standard and then properly disposed of as an asbestos waste, or the cloth shall be laundered in a way to prevent the release of asbestos fibers in excess of 0.1 fiber per cubic centimeter of air.

(3) Any spills of solvent or any asbestos containing waste material shall be cleaned up immediately according to paragraph (k) of this section.

(4) The use of dry brushing during the wet method operations is prohibited.

[59 FR 40964, Aug. 10, 1994; 60 FR 33972, June 29, 1995; 77 FR 17778, March 26, 2012]

For more information, visit www.osha.gov, or call OSHA at 1-800-321-OSHA(6742), TTY 1-877-889-5627.

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

⚠️ DANGER

- ALWAYS WEAR PROPER EYE PROTECTION AND OTHER REQUIRED PERSONAL PROTECTIVE EQUIPMENT TO PREVENT PERSONAL INJURY WHEN PERFORMING VEHICLE SERVICE.
- WORK IN A WELL-VENTILATED AREA.
- NEVER USE GASOLINE, OR SOLVENTS CONTAINING GASOLINE. GASOLINE CAN EXPLODE.
- DO NOT USE HOT SOLUTION TANKS OR WATER AND ALKALINE SOLUTIONS TO CLEAN GROUND OR POLISHED PARTS. DOING SO WILL CAUSE DAMAGE TO THE PARTS.
- USE HOT SOLUTION TANKS OR ALKALINE SOLUTIONS CORRECTLY. READ THE MANUFACTURER’S INSTRUCTIONS BEFORE USING HOT SOLUTION TANKS AND ALKALINE SOLUTIONS. THEN CAREFULLY FOLLOW THE INSTRUCTIONS.
- SOLVENT CLEANERS CAN BE FLAMMABLE, POISONOUS, AND CAUSE BURNS. EXAMPLES OF SOLVENT CLEANERS ARE CARBON TETRACHLORIDE, EMULSION-TYPE, AND PETROLEUM-BASED CLEANERS. READ THE MANUFACTURER’S INSTRUCTIONS BEFORE USING A SOLVENT CLEANER, THEN CAREFULLY FOLLOW THE INSTRUCTIONS. ALSO FOLLOW THE PROCEDURES BELOW.
- PLACE THE VEHICLE ON A LEVEL FLOOR AND CHOCK THE WHEELS TO HELP PREVENT THE VEHICLE FROM MOVING. NEVER WORK UNDER A RAISED VEHICLE SUPPORTED BY ONLY A FLOOR JACK. ALWAYS SUPPORT A RAISED VEHICLE WITH SAFETY STANDS. CHOCK THE WHEELS AND MAKE SURE THE UNIT WILL NOT ROLL BEFORE RELEASING BRAKES. A JACK CAN SLIP OR FALL OVER. SERIOUS PERSONAL INJURY CAN RESULT.
- IMPROPER JACKING AND SUPPORT METHODS CAN CAUSE STRUCTURAL DAMAGE THAT RESULTS IN LOSS OF VEHICLE CONTROL, SEVERE PERSONAL INJURY OR DEATH. REFER TO THE VEHICLE MANUFACTURER FOR PROPER JACKING AND SUPPORT METHODS.

⚠️ WARNING

FOLLOW THE SPECIFIED PROCEDURES IN THE INDICATED ORDER TO AVOID PERSONAL INJURY OR EQUIPMENT MALFUNCTION/DAMAGE.

BEFORE STARTING A VEHICLE:
- Sit in the driver’s seat
- Place the shift lever in neutral
- Set the parking brake

BEFORE WORKING ON A VEHICLE OR LEAVING THE CAB WITH ENGINE RUNNING:
- Place the shift lever in neutral
- Set the parking brake
- Chock the wheels

WHEN PARKING THE VEHICLE OR LEAVING THE CAB:
- Place the shift lever in neutral
- Set the parking brake

⚠️ CAUTION

- DO NOT RELEASE THE PARKING BRAKE OR ATTEMPT TO SELECT A GEAR UNTIL THE AIR PRESSURE IS AT THE CORRECT LEVEL.
- TO AVOID DAMAGE TO THE TRANSMISSION DURING TOWING:
  - Place the shift lever in neutral
  - Lift the drive wheels off of the ground or disconnect the driveline
- DO NOT OPERATE VEHICLE IF THE ALTERNATOR LAMP IS LIT OR IF THE GAUGES INDICATE LOW VOLTAGE.

Towing

Due to the wide range of environments and applications for AxleTech axles, it is recommended to follow the towing instructions from the vehicle Original Equipment Manufacturer (OEM).
Repair Warnings

⚠️ DANGER

USE OF OTHER THAN RECOMMENDED TOOLS, PARTS, AND INSTRUCTIONS LISTED IN THIS PUBLICATION MAY PLACE THE SAFETY OF THE SERVICE TECHNICIAN OR VEHICLE DRIVER IN JEOPARDY.

DO NOT WELD REPAIR, HEAT, BEND, OR RECONDITION AXLE COMPONENTS. THIS WILL REDUCE COMPONENT STRENGTH, VOID AXLETECH’S WARRANTY, AND CAN RESULT IN SERIOUS PERSONAL INJURY AND DAMAGE TO COMPONENTS. ALWAYS REPLACE DAMAGED OR OUT-OF-SPECIFICATION COMPONENTS.

• When disassembling various assemblies, lay all parts on a clean bench in the same sequence as removed to simplify assembly and reduce the possibility of losing parts.
• Provide a clean work area. Make sure no dirt or foreign material enter the unit during repair and assembly.
• Disconnect the vehicle’s battery before removing or installing electronic parts.
• The location of components varies with each OEM.
• The removal and installation procedure described for each component may vary between vehicles.
• Use a rubber mallet for disassembly and assembly procedures. NEVER hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.
• Remove nicks, marks, and burrs from parts having machined or ground surfaces. Use a fine file, India stone, emery cloth or crocus cloth for this purpose.

Cleaning

• Remove gasket material using a gasket scraper taking care not to damage machined surfaces.
• Steam clean or pressure wash the assembly after plugging all breathers, vents, and hydraulic inlets.

**NOTE:** NEVER direct full pressure at any of the seals (input shaft, wheel hubs, or brakes).

• Use solvent cleaners or alkaline solutions to clean all metal parts with rough surfaces. Parts must remain in hot solution tanks until completely cleaned and heated. Rinse alkaline solution off with water after cleaning.

• Use solvent cleaners and a brush to clean all metal parts that have ground or polished surfaces.

**NOTE:** NEVER clean ground or polished surfaces with water, steam, alkaline solution, or place in a hot tank.

• Dry all parts after washing using clean rags or paper towels.
• Apply a light oil film to all parts to be reused and reassembled.
• If parts are being stored after cleaning, apply a corrosion-preventive material to all machined surfaces. Store the parts in a special paper or other material that prevents corrosion.

Damaged Components

• All damaged components must be replaced by new components.
• 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.
• Replace any fastener if corners of the head are worn.
• Since the cost of a new part is generally a small fraction of the total cost of downtime and labor, avoid reusing a questionable part that could lead to additional repairs and expense.
• Always use genuine AxleTech replacement parts.
Repair Welding

⚠️ DANGER

THE HIGH TEMPERATURE CAUSED BY THE OPEN FLAME FROM A CUTTING TORCH CAN IGNITE THE OIL IN THE AXLE HOUSING AND CAN CAUSE SERIOUS PERSONAL INJURY.

In the interest of safety and preserving the service life of drive axle assemblies, AxleTech recommends that assemblies are not repair welded. Repair welding can detract from the structural integrity of a component, particularly to heat treated parts where the benefit of heat treatment may be nullified by welding.

Since it can be extremely hazardous and detrimental to repair weld components of any kind, repair welding can be approved only where stringent controls are imposed and equipment, customarily located at manufacturing facilities, is employed, so as to minimize the potentially detrimental effects of repair welding.

Please contact AxleTech if you believe that repair welding will work for your particular situation.

Omissions

Every effort has been made to ensure the accuracy of all information in this manual. However, AxleTech makes no expressed or implied warranty or representation based on the enclosed information. Any errors or omissions may be reported to AxleTech, 1400 Rochester Road, Troy, Michigan, 48083 USA.
General Assembly Instructions

Tapered Roller Bearings

⚠️ CAUTION

DRY BEARINGS WITH CLEAN PAPER OR RAGS. NEVER USE COMPRESSED AIR, WHICH CAN CAUSE ABRASIVE PARTICLES TO CONTAMINATE THE BEARINGS. DAMAGE TO COMPONENTS AND REDUCED LINING LIFE CAN RESULT.

If parts are clean and properly lubricated, it is rare for bearings to be damaged. Proper installation is also critical to avoid vibration, noise, and reduced bearing life.

Bearings should be replaced when:

- Bearing surfaces show abnormal wear
- Bearings are chipped (due to improper cleaning during assembly, improper lubrication, or a broken component inside the case)
- Centers of the large diameter end of the rollers are worn level with or below the surface
- Centers of the large diameter end of the rollers are worn to a sharp edge
- A roller groove is worn in the cup or cone inner race surfaces visible at the small or large diameter ends of both parts
- Deep cracks or breaks are present in the cup, cone inner race, or roller surfaces
- Bright wear marks are present on the outer surface of the roller cage
- Etching and pitting is present on the rollers and on surfaces of the cup and cone inner race that touches the rollers
- Spalling or flaking is present on the cup and cone inner race surfaces that touch the rollers

During disassembly:

- Remove bearings with pullers designed for this purpose to avoid damaging the bearing.
- Carefully wash and re-lubricate all bearings as removed and protectively wrap until ready for use.
- Store all bearings in a dry and clean area to minimize the possibility of corrosion, contamination, or other damage.

During assembly:

- Install bearings in a clean environment, free from dust, debris, moisture, and other contaminants.
- Machining, filing, soldering, grinding, etc. should be kept away from the assembly area to prevent contaminating the bearings.
- Check the cleanliness of the bearing:
  - If the bearing is new, unpack it immediately before assembly.
  - Used bearings should be cleaned with petrol or benzine and then oiled.
- Verify the bore is deburred and cleaned before installing the bearing. Use 180-grit emery cloth to remove small imperfections in the metal.
- Bearings are installed the easiest by cooling or heating (in hot oil to 80°C) instead of using a press. Do not apply any shock or impact techniques (like hammering) to install the bearings.
- When a bearing has been heated for assembly, apply a small amount of grease or oil after assembly.
- When installing on a tight shaft, force is to be applied to the inner ring only.

Castings

- Inspect for damage or cracking. Replace as required. NEVER weld to repair the casting.

Gears

- Inspect for pitting or damage. Replace as required.
- Replace beveled gear set, as required, with a matched set.
- Replace thrust washer, differential side gear, and pinion gear with a new matched set. Do not mix old and new parts. Damage to components can result.
Seals

WARNING

WHEN APPLYING SOME SILICONE GASKET MATERIALS, SMALL AMOUNTS OF ACID VAPOR ARE PRESENT. TO PREVENT POSSIBLE SERIOUS INJURY, THE WORK AREA MUST BE WELL-VENTILATED. IF THE SILICONE GASKET MATERIAL GETS INTO YOUR EYES, FLUSH THEM WITH WATER FOR 15 MINUTES. HAVE YOUR EYES CHECKED BY A DOCTOR AS SOON AS POSSIBLE.

Recommended Lubricant: Gear Oil

- O-rings: After removal, always replace with new ones.
- Lipped seals: All disassembled seals shall be discarded and replaced by a new seal.
- Gaskets: After disassembly, always install a new paper or silicone gasket.
  - Silicone Gaskets - Apply a 0.125" (3.18 mm) diameter continuous bead of silicone gasket material around one surface. Also apply the gasket material around the edge of all the fastener holes on that surface. Assemble immediately and wait 20 minutes before filling the assembly with lubricant.

CAUTION

TOO MUCH GASKET MATERIAL CAN BLOCK LUBRICATION PASSAGES. DAMAGE TO COMPONENTS CAN RESULT.

During assembly:

- Verify the seal bearing surface edges are free of burrs and nicks that may damage seals.
- Lubricate properly:
  - Lubricate the entire interior surface of the ring and primarily the seal lips.
  - Pack the space between the lips with grease.
  
  NOTE: Do not use an excessive quantity of lubricant since liquefaction may occur during operation and appear outside the housing. This could easily be mistaken for a leak.
- The ring shall be engaged in its housing perpendicularly and concentrically to the shaft.
- Do not damage the seal lips and turn them over during installation.

Mounting Surfaces

For all mounting surfaces that do not use an o-ring seal, use Loctite 5699 RTV Silicone Gasket.

Product characteristics:

- Color: Grey
- Adhesive power: Weak, nevertheless, do not use on centering; only on the faces.
- Temperature Resistance:
  -67 to 392°F (-55 to 200°C)
- TO BE USED WITH CARE:
  Avoid any contact with eyes and skin.

During disassembly:

- In the event of sticking, tap the parts to break the Loctite film.
- Remove particles of Loctite as thoroughly as possible.
- Clean and carefully degrease surfaces (any lubricant prevents setup therefore making the product ineffective) using a solvent or by washing the parts.
- Let all components dry completely.

During assembly:

- Apply a single bead to one of the mating surfaces well around the attachment holes.
- Assemble the parts and tighten to the required torque.
- Leave to dry: Parts can be handled after 30 minutes.
- Total setup time: 18 to 24 hours
Fasteners
When installing fasteners without pre-applied adhesive, Loctite 243 Blue Threadlocker must be used unless otherwise stated.

**NOTE:** Do not apply adhesives or sealants to fasteners with pre-applied adhesive, or to fastener holes.

Product characteristics:
- Color: Pale blue
- Temperature Resistance: -67 to 302°F (-55 to 150°C)
- TO BE USED WITH CARE:
  Avoid any contact with eyes and skin.

During disassembly:
- If the removal of a capscrew becomes difficult due to a worn head or unusually high breakaway torque, the locking strength can be reduced by heating the threaded area to approximately 300°F (150°C). Heat slowly to avoid thermal stresses on the differential case and gears.
- Clean excess material off all surfaces as thoroughly as possible.
- Clean and carefully degrease surfaces (any lubricant prevents setup therefore making the product ineffective) using a solvent or by washing the parts.
- Let all components dry completely.
- Replace any fastener if corners of the head are worn.
- Replace washers if damaged.
- Clean and repair threads of fasteners and holes. Use a die or tap of the correct size or a fine file for this purpose.

⚠️ CAUTION

THREADS MUST BE WITHOUT DAMAGE AND CLEAN SO THAT ACCURATE ADJUSTMENT AND CORRECT TORQUE VALUES CAN BE APPLIED TO FASTENERS AND PARTS.

During assembly:
- Apply one drop to the threads, preferably at the end of the screw, of Loctite 243 Blue Threadlocker.
- Assemble the parts and tighten to the required torque.
- All screws shall be tightened within 5 minutes following assembly of the parts. The unit can be used 10 minutes after assembling.

**NOTE:** To reduce setup time, spray Loctite 7649 Locquic Primer N activator on the threads, allow to evaporate, and then apply Loctite 243.

Tapered Ball Joint Removal
Carriage ball joints use a tapered attachment fit to their mating component. Often, it is not practical to procure a special tool to split the taper and separate the components. AxleTech Service recommends that ball joint tapered joints housed within steel or ductile iron components can be split using a “shock method”. The shock method involves impacting the component, with a steel hammer, close to the tapered location. (DO NOT directly impact the ball joint or stud directly.) This action tends to “shock” the tapered joint loose and is a common practice by AxleTech Service.
Introduction

Operation

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.

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 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 CSM-0063 - Double Reduction Differential Carriers Service Manual.
Identification Tag

All products are identified by the model and serial number. This information is stamped on the identification tag and affixed to the case. Have reference numbers handy when ordering replacement parts or requesting service repairs.

Model Nomenclature

SPRC - 20 5

Axle Setup
S - Tandem
E - Tridem

Gears
P - Planetary
N - No Planetary Gears

Axle Type
R - Rigid
S - Steer

Carrier Designation
(Basic Model Number)

Wheel End Designation
(Basic Model Number)

Housing Type
A - Pot or Split Carrier
C - Integral Cast
M - Modular Cast
S - Stamped
Lubrication

Refer to the following tables for standard information on lubricants, schedules, and capacities. For additional lubrication information, refer to LMT-0001 - Preventative Maintenance & Lubrication Service Manual.

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

<table>
<thead>
<tr>
<th>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</td>
<td>GL-5, S.A.E. 85W/140</td>
<td>+10°F (−12°C)</td>
<td>- - ^</td>
</tr>
<tr>
<td>0-76-B</td>
<td>Hypoid Gear Oil</td>
<td>GL-5, S.A.E. 80W/140</td>
<td>−15°F (−26°C)</td>
<td>- - ^</td>
</tr>
<tr>
<td>0-76-D</td>
<td>Hypoid Gear Oil</td>
<td>GL-5, S.A.E. 80W/90</td>
<td>−15°F (−26°C)</td>
<td>- - ^</td>
</tr>
<tr>
<td>0-76-E</td>
<td>Hypoid Gear Oil</td>
<td>GL-5, S.A.E. 75W/90</td>
<td>−40°F (−40°C)</td>
<td>- - ^</td>
</tr>
<tr>
<td>0-76-J</td>
<td>Hypoid Gear Oil</td>
<td>GL-5, S.A.E. 75W</td>
<td>−40°F (−40°C)</td>
<td>+ 35°F (+2°C)</td>
</tr>
<tr>
<td>0-76-L</td>
<td>Hypoid Gear Oil</td>
<td>GL-5, S.A.E. 75W/140</td>
<td>−40°F (−40°C)</td>
<td>- - ^</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Vocation or Vehicle Operation</th>
<th>Linehaul Motorhome Intercity Coach</th>
<th>City Delivery School Bus Fire Truck</th>
<th>Construction Heavy Haul Logging Mining Oil Field</th>
<th>Refuse Rescue Transit Bus Yard Tractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Oil Change</td>
<td>No longer required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Oil Level</td>
<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>
<td>**</td>
</tr>
<tr>
<td>Petroleum based oil change on axle WITH or WITHOUT pump and filter system</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>
<td>Every 25,000 miles (40 000 km) or annually, whichever comes first</td>
<td></td>
</tr>
<tr>
<td>Synthetic oil change on axle WITHOUT pump and filter system ***</td>
<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>
<td></td>
</tr>
<tr>
<td>Synthetic oil change on axle WITH pump and filter system ** ***</td>
<td>Every 500,000 miles (800 000 km)</td>
<td>Every 250,000 miles (400 000 km)</td>
<td>Every 100,000 miles (160 000 km)</td>
<td></td>
</tr>
<tr>
<td>Filter change on axle WITH pump and filter system</td>
<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>
<td></td>
</tr>
</tbody>
</table>

*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).

**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.

***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.
### Table E: Lubricant Specifications

<table>
<thead>
<tr>
<th>Gear Oil Type</th>
<th>A.P.I. Specification</th>
<th>SAE Grade</th>
<th>Specification</th>
<th>Military Specification</th>
<th>Outside Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Extended Drain Lubricants</td>
<td>Petroleum with EP Additives</td>
<td>GL-5</td>
<td>85W/140</td>
<td>O-76A</td>
<td>MIL-L-2105D or MIL-PRF-2105E</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>80W/90</td>
<td>O-76D</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>75W/90</td>
<td>O-76E</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>75W</td>
<td>O-76J</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>75W/140</td>
<td>O-76L</td>
<td></td>
</tr>
<tr>
<td>Extended Drain Lubricants</td>
<td>Petroleum with Extended Drain Additives</td>
<td>GL-5</td>
<td>80W/90</td>
<td>—</td>
<td>MIL-L-2105D or MIL-PRF-2105E</td>
</tr>
<tr>
<td>Semi-Synthetic</td>
<td></td>
<td></td>
<td>75W/140</td>
<td>O-76M</td>
<td></td>
</tr>
<tr>
<td>Full Synthetic</td>
<td></td>
<td></td>
<td>75W/90</td>
<td>O-76N</td>
<td></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>Wheel Ends</th>
<th>Axle Housing Bowl</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>U.S. Pints Each</td>
<td>Liters Each</td>
</tr>
<tr>
<td>SPR-570</td>
<td>Forward</td>
<td>32.0</td>
<td>15.0</td>
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<tr>
<td></td>
<td>Rear</td>
<td>32.0</td>
<td>15.0</td>
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<tr>
<td>SPRC-4806</td>
<td>Forward</td>
<td>32.0</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>32.0</td>
<td>15.0</td>
</tr>
</tbody>
</table>

* For correct lubrication, each wheel end and the axle housing bowl must be filled with the specified amount of lubricant. NEVER fill the axle only through the wheel ends or the axle housing bowl.
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nut</td>
</tr>
<tr>
<td>2</td>
<td>Washer</td>
</tr>
<tr>
<td>3</td>
<td>Output Yoke</td>
</tr>
<tr>
<td>4</td>
<td>Oil Seal</td>
</tr>
<tr>
<td>5</td>
<td>Spacer</td>
</tr>
<tr>
<td>6</td>
<td>Snap Ring</td>
</tr>
<tr>
<td>7</td>
<td>Cup</td>
</tr>
<tr>
<td>8</td>
<td>Cone</td>
</tr>
<tr>
<td>9</td>
<td>Output Bearing Cage</td>
</tr>
<tr>
<td>10</td>
<td>Gasket</td>
</tr>
<tr>
<td>11</td>
<td>Thru-Shaft</td>
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<tr>
<td>12</td>
<td>Capscrew</td>
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<tr>
<td>13</td>
<td>Washer</td>
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<tr>
<td>14</td>
<td>Breather</td>
</tr>
<tr>
<td>15</td>
<td>Axle Housing</td>
</tr>
<tr>
<td>16</td>
<td>Gasket - Axle Housing</td>
</tr>
<tr>
<td>17</td>
<td>Axle Shaft</td>
</tr>
<tr>
<td>18</td>
<td>Gasket - Axle Shaft</td>
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<tr>
<td>19</td>
<td>Drain Plug</td>
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<td>20</td>
<td>Capscrew</td>
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<tr>
<td>21</td>
<td>Adjusting Ring Lock</td>
</tr>
<tr>
<td>22</td>
<td>Bearing Adjusting Ring</td>
</tr>
<tr>
<td>23</td>
<td>Main Differential Bearing Cup</td>
</tr>
<tr>
<td>24</td>
<td>Main Differential Bearing Cone</td>
</tr>
<tr>
<td>25</td>
<td>Bolt</td>
</tr>
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<td>26</td>
<td>Washer</td>
</tr>
<tr>
<td>27</td>
<td>Nut</td>
</tr>
<tr>
<td>28</td>
<td>Differential Case - Plain Half</td>
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<td>29</td>
<td>Thrust Washer</td>
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<tr>
<td>30</td>
<td>Side Gear</td>
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<tr>
<td>31</td>
<td>Spider</td>
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<tr>
<td>32</td>
<td>Pinion Gear</td>
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<tr>
<td>33</td>
<td>Thrust Washer</td>
</tr>
<tr>
<td>34</td>
<td>Capscrew</td>
</tr>
<tr>
<td>35</td>
<td>Washer</td>
</tr>
<tr>
<td>36</td>
<td>Ring Gear</td>
</tr>
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<td>37</td>
<td>Differential Case - Flange Half</td>
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<td>38</td>
<td>Capscrew</td>
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<td>39</td>
<td>Washer</td>
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<td>Differential Bearing Cap</td>
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<table>
<thead>
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<td>Nut</td>
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<td>42</td>
<td>Drive Gear Thrust Screw</td>
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<td>43</td>
<td>Differential Carrier</td>
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<td>45</td>
<td>Washer</td>
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<tr>
<td>46</td>
<td>Bolt</td>
</tr>
<tr>
<td>47</td>
<td>Screen</td>
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<td>48</td>
<td>Fill Plug</td>
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<td>Dowel</td>
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<td>Rear Bearing Cup</td>
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<td>51</td>
<td>Rear Bearing Cone</td>
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<tr>
<td>52</td>
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<td>55</td>
<td>Nut</td>
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<td>56</td>
<td>Thrust Washer</td>
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<td>Pinion Gear</td>
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<td>Spider</td>
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<td>Case Halves</td>
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<td>Helical Drive Gear</td>
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<td>Front Side Gear</td>
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<td>Thrust Washer</td>
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<td>Input Shaft</td>
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<td>Snap Ring</td>
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<td>One-Piece Spigot Bearing</td>
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<td>Drive Pinion</td>
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<td>Drive Pinion Bearing Cone</td>
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<td>68</td>
<td>Drive Pinion Bearing Cup</td>
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<td>69</td>
<td>Shim Spacer</td>
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<td>70</td>
<td>Shims</td>
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<td>71</td>
<td>Drive Pinion Bearing Cage</td>
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<td>Washer</td>
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<td>Helical Driven Gear</td>
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<td>77</td>
<td>Roll Pin</td>
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<td>Shift Fork</td>
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Cover Assembly
<table>
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<tr>
<th>Item</th>
<th>Description</th>
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<tbody>
<tr>
<td>65A</td>
<td>Snap Ring</td>
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<tr>
<td>65B</td>
<td>Outer Race</td>
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<tr>
<td>65C</td>
<td>Inner Race</td>
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<tr>
<td>80</td>
<td>Spring</td>
</tr>
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<td>81</td>
<td>Push Rod</td>
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<tr>
<td>82A</td>
<td>Bolt-on DCDL Air Shift Assembly Cover</td>
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<td>Bolt-on DCDL Air Shift Assembly Cover</td>
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<td>Screw-in DCDL Air Shift Assembly Cover</td>
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<td>Non-DCDL Threaded Assembly Plug</td>
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<td>Washer</td>
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<td>84A</td>
<td>Bolt-on Cover Allen-Head Capscrew</td>
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<td>Stop Screw</td>
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<td>94</td>
<td>Gasket</td>
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<td>95A</td>
<td>Helical Gear Cover - Older Models</td>
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<td>95B</td>
<td>Helical Gear Cover - Current Models</td>
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<td>Plug</td>
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<td>Washer</td>
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<td>98</td>
<td>Capscrew</td>
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<td>Oil Pump - Rotor Type</td>
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<td>O-ring</td>
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<td>Input Shaft Forward Bearing Cone</td>
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<td>Input Shaft Forward Bearing Cup</td>
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<td>Shims</td>
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<td>Input Bearing Cage</td>
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<td>109</td>
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<td>Oil Deflector</td>
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<td>Input Yoke</td>
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<td>Washer</td>
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<td>Nut</td>
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<td>Oil Filter Adapter</td>
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<td>116</td>
<td>Washer</td>
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<td>117</td>
<td>Capscrew</td>
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Disassembly

**WARNING**

- TO PREVENT SERIOUS EYE INJURY, ALWAYS WEAR EYE PROTECTION WHEN PERFORMING VEHICLE MAINTENANCE OR SERVICE.

- BLOCK THE WHEELS TO PREVENT THE VEHICLE FROM MOVING. SUPPORT THE VEHICLE WITH SAFETY STANDS. NEVER WORK UNDER A VEHICLE SUPPORTED ONLY BY JACKS. JACKS CAN SLIP OR FALL OVER CAUSING SERIOUS PERSONAL INJURY.

**CAUTION**

THE FILTER CONTAINS APPROXIMATELY ONE PINT OF FLUID. MAKE SURE FLUID DOES NOT SPILL WHEN THE OIL FILTER IS REMOVED.

1. Use a jack to raise the end of the vehicle where the axle is mounted.
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.
4. On forward rear drive carriers, the oil filter can be removed at this time. Remove the bolts holding 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.
5. Disconnect the driveline universal joint from the pinion input yoke or flange on the carrier.
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.

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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
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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
**Brass Drift Method**

**WARNING**

NEVER 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" diameter brass drift inside the round driving lugs and against the center of the axle shaft.

**CAUTION**

NEVER 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" diameter brass hammer can be used as a drift.

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).

3. Remove the tapered dowels (if applicable) and both axle shafts from the axle assembly.
Air Hammer Vibration Method

**CAUTION**

NEVER USE A CHISEL OR WEDGE TO LOOSEN THE AXLE SHAFT AND TAPERED DOWELS. USING A CHISEL OR WEDGE CAN RESULT IN DAMAGE TO THE AXLE SHAFT, THE GASKET AND SEAL, AND/OR THE AXLE HUB.

1. Use a round hammer bit and an air hammer or equivalent, to loosen tapered dowels and axle shaft.
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.

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.

Removing the Carrier from the Axle Housing

1. Disconnect the air line to the DCDL shift unit.
2. Remove the nut and washer fastening 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 fastening 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. Ensure the oil seal is not damaged when the thru-shaft is removed.

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

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

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

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

**CAUTION**

DO NOT DAMAGE THE MATING SURFACES BETWEEN THE AXLE HOUSING AND THE DIFFERENTIAL CARRIER FLANGE. DAMAGE TO THESE SURFACES CAN RESULT IN OIL LEAKS.

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. Using a hoist and a lifting hook, lift the differential carrier by the input yoke. Place the carrier in a repair stand. NEVER lift the carrier by hand.

---

**Removing the Thru-Shaft, Bearings, and 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.
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.


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

4. Remove the snap ring holding the bearings in the cage.

**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. Remove the inner and outer bearing cones from the bearing cage.

6. 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. See "Disassembling the Inter-Axle Differential" on page 26.

1. Use a 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, see "Carrier Repair Stand Specifications" on page 100.

2. Move the cover assembly so 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 holding the yoke on the input shaft. Remove the yoke holding tool.

4. Remove the capscrews and washers retaining the helical gear cover to the carrier assembly.

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

CAUTION

NEVER 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 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.

6. Remove all gasket material from the cover-to-carrier surfaces. Do not score or gouge.
Disassembly

CAUTION
NEVER REMOVE THE HELICAL GEARS WITHOUT MARKING THEIR POSITIONS. SEE "DISASSEMBLING THE INTER-AXLE DIFFERENTIAL" ON PAGE 26.

Removing the Oil Filter & Adapter - Original Design Helical Cover
1. Remove the two capscrews fastening the oil filter cover to the helical gear cover. Remove the cover.

CAUTION
THE FILTER CONTAINS APPROXIMATELY ONE PINT OF FLUID. MAKE SURE FLUID DOES NOT SPILL WHEN THE OIL FILTER IS REMOVED.

2. Use a filter wrench to remove the oil filter. Discard the oil filter according to location disposal ordinances.
3. Remove the capscrews and washers fastening the adapter to the helical gear cover.
4. Remove the oil filter adapter.

5. 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 fastening the oil filter guard to the helical cover. Remove the guard.

CAUTION
THE FILTER CONTAINS APPROXIMATELY ONE PINT OF FLUID. MAKE SURE FLUID DOES NOT SPILL WHEN THE OIL FILTER IS REMOVED.

2. Use a filter wrench to remove the oil filter. Discard the oil filter according to location disposal ordinances.
3. Inspect the oil filter adapter threads. If the adapter threads are damaged, remove, and replace with a new adapter.
Disassembly

Removing the Oil Pump - Original Design Helical Cover

**CAUTION**

NEVER 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 fastening 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. NEVER use a pry bar to loosen the pump from the gear cover.

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. Ensure the mounting surface and all oil pump passages are clean and free of obstructions.

Disassembling the Oil Pump - Original Design Helical Cover

Two different oil pump designs exist:
- Oil Pump with a Gear Pumping System
- Oil Pump with a Rotor Pumping System

**Gear Pump System Disassembly**

The pump cover is fastened to the pump plate by two dowels.

1. Tap on the cover with a leather or plastic hammer to separate the plate from the cover.
2. Remove and discard the gasket.
3. Remove the spring and the check ball for the pressure relief valve from the cover.
4. Place the cover on a flat surface so the ball and spring for the pressure relief valve do not fall from the cover.
5. Remove the two pump gears from the plate.

![Oil Pump Diagram]

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 HOLDING THE CHECK VALVE BALLS AT THE CORRECT POSITION IN THE OIL PASSAGES. DO NOT BEND OR DAMAGE THE PINS.

6. Remove the two large and two small pipe plugs from the cover.

7. Use a magnet to remove the two large and two small check-valve balls from the pipe plug bores.

8. Remove the snap ring and washer from the driven gear shaft.

9. Remove the shaft and driven gear from the pump plate.

10. 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 holding the cap on the pump body.

2. Remove the cap.

3. Remove the o-ring seal from the cap.

4. Remove the retaining ring holding the inner rotor on the shaft.

5. Remove the inner rotor, outer rotor, and reversing ring from the oil pump body.

6. Remove the inner rotor key from the shaft.

7. Remove the retaining ring holding the gear and shaft assembly in the pump body.

8. Remove the shaft and gear assembly.

9. 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.

10. Use a punch to press down on the pressure relief valve cap.

11. Remove the cotter pin.

12. Slowly release pressure on the cap until the spring extends to its full length.

13. Remove the cap and spring.

14. Use a magnet to remove the poppet from the relief valve bore.
Removing the Input Shaft, Forward Bearing, & 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.

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

**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.

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

5. Remove the bearing cage, bearing, and shim pack. The bearing cup should remain inside the cover.

---

**CAUTION**

NEVER 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
**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 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.

7. Use a press and a sleeve to remove the bearing cup from the cage.

**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 cage oil seal from the carrier using the following procedures:

---

**Triple-Lip & 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.

---

**Triple-Lip Plus POSE™ Seal**

a. Following yoke removal, separate the POSE seal from the yoke hub by pulling it off by hand.

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

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

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

a. Pull the cast-iron outer protector from the bearing cage.

b. Use a press and a sleeve to remove the inner seal from the cage.
Disassembling the Input Shaft, Bearing Cage, and Oil Pump - Current Design

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

2. Install a bearing puller onto the input shaft. Ensure the oil pump rivets do not touch or contact the bearing puller.

3. Place the assembly on a press so the assembly rests on the puller.

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

5. Remove the capscrews fastening the oil pump to the input bearing cage. Separate the oil pump from the cage.

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. The oil pump cannot be serviced; only replaced.
7. Remove the o-rings from the bearing cage and the oil pump assembly.
8. 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.

9. If necessary, use a press and a sleeve to remove the cup from the input bearing cage.
10. If necessary, remove the pressure-relief valve assembly from the front of the bearing cage. Remove the plug, spring, and relief valve from the bore.

**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.
Removing the Shift Unit, Shift Fork, & Shift Shaft

NOTES:

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

- Two types of shift units are used:
  - Shift Units with Long Capscrews and Tab Retainers
  - Shift Units with Allen-Head Capscrews

1. On units with long capscrews and 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 with Allen-head capscrews, remove the four capscrews.

3. Remove the shift unit from the helical gear cover.

4. From inside the helical gear cover, remove the roll pin fastening 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.

6. Remove the jam nut and the adjusting screw for the shift shaft on the helical gear cover.
Removing the Idler Gear of the Rotor Oil Pump from the Original Design Helical Gear Cover

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

- Ball Bearing
- Cone and Roller Bearing with Idler Sleeve
- Cone and Roller Bearing with Solid Idler Shaft

**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.
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 holding 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.

---

**Oil Pump Idler Gear - Cone & 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.
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 & 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.

2. Remove the idler gear and sleeve assembly from the inside of the helical gear cover.

3. Remove the cone, roller bearings, and spacer from the idler gear.

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

**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.

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.
**WARNING**

NEVER 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.

![Diagram of helical gears with marks](image)

**CAUTION**

NEVER 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, helical drive gear assembly, and thrust washer from the top of the differential case.

![Diagram of inter-axle differential](image)

**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.

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

**NOTE:** Service these components as an assembly.
6. Remove the inter-axle differential case from the carrier housing.

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

7. Use a punch and a hammer to make alignment marks on the case halves. The alignment marks permit correct assembly of the case halves.

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

**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.
Removing the Main Differential Case & Ring Gear Assembly

1. Place the carrier in a repair stand. Move the carrier so the helical drive and drive gears are upward. Loosen the jam nut first and then loosen the thrust screw.

   ![Jam Nut, Thrust Screw, Open End Wrench](image)

   **NOTE:** To make a repair stand, see "Carrier Repair Stand Specifications" on page 100.

2. Turn the carrier upside down so the ring gear is facing upward.

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 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.

   ![Bearing Adjusting Ring Lock Marks](image)

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

   **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.
6. Use a “T” bar wrench or equivalent tool to loosen the bearing adjusting rings. DO NOT remove the adjusting rings.

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.

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

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.
Disassembling the Main Differential Case & 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.

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

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

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 fastening the ring gear to the differential case.

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

1. Use the following suggested holding fixture to remove the pinion gear assembly from the carrier.

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.

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

5. On single-reduction carriers, remove the capscrews fastening the cage to the main carrier housing.

6. On double-reduction carriers, remove the capscrews fastening 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.

   NOTE: If the gear, pinion, and 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. NEVER tap directly on the spigot bearing or retaining ring or damage to the pinion cage may occur and result in drive pinion failure after carrier reassembly and while in service.

7. Remove the gear, pinion, and cage as an assembly from the housing.

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 fastening the helical driven gear to the drive pinion.

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.

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.

NOTE: If either the bearing cup or cone need replacement, both parts must be replaced with 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.

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 used.
One-Piece Spigot Bearing

a. Remove the snap ring fastening the spigot bearing to the drive pinion.

b. Use a bearing puller to remove the spigot bearing from the drive pinion.

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, bearing puller, and sleeve to remove the inner race from the drive pinion. Discard the inner race.

b. Remove the snap ring, 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.
Prepare Parts for Assembly

Clean and Inspect Yokes

**WARNING**

**TO PREVENT SERIOUS EYE INJURY, ALWAYS WEAR EYE PROTECTION WHEN PERFORMING 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 USING SOLVENT CLEANERS, CAREFULLY FOLLOW THE MANUFACTURER’S PRODUCT INSTRUCTIONS AND THESE PROCEDURES:**

- Wear eye protection.
- Wear clothing to protect the skin.
- Work in a well-ventilated area.
- **NEVER** use gasoline, or solvents containing gasoline. Gasoline can explode.
- **ALWAYS** use hot solution tanks or alkaline solutions correctly, follow the manufacturer's instructions carefully.

1. Using a gasket scraper and/or appropriate solvent, remove excess gasket material being careful not to damage ground surfaces.
2. Clean the ground and polished surface of the yoke journal using a clean shop towel and a safe cleaning solvent. **NEVER** use abrasive cleaners, towels, or scrubbers to clean yoke or flange surface. **NEVER USE GASOLINE.**
3. 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 the following table 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.
4. If any of the yoke grooves measure less than the dimensions in the following table, 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.

<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**

**NEVER INSTALL A PRESS ON THE 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.**

**NEVER 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.**
Parts Inspection

Carefully inspect all disassembled parts before assembly and replace any worn, cracked, or damaged parts. Check for cracks using dye penetrant, magnetic flux, or fluorescent particle testing methods.

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

See AMT-0445 - Failure Analysis Service Manual for further information on parts inspection.

Assembly

Assembling the Drive Pinion & Cage

1. Lubricate all bearings and cups with the same fluid 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.

   **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.

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

4. Install the spacer on the shaft of the drive pinion.

5. Install the drive pinion and bearing assembly in the cage.
Adjusting the Bearing Preload on the Drive Pinion

**Specification:**
- New drive pinion bearings: 5 to 25 lbs. in. (0.56-2.82 N·m) rotational torque
- Used drive pinion bearings: 5 to 15 lbs. 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 cage assembly in a press so 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.
3. Apply the press and hold 25 tons of pressure on the bearings. Apply pressure and rotate the bearing cage several times so the bearings make normal contact.
4. While pressure is held against the assembly, wind a cord around the bearing cage several times.
5. Attach a spring scale to the end of the cord.

**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 the bearing cage rotates. Read and record the rotational torque of the bearing cage.
7. Measure the outer diameter of the bearing cage where the cord was wound. Measure in inches or centimeters.

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 = lbs. in. preload.

   or

   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 lbs. in. preload to N-m preload, multiply the lbs. 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>
<tr>
<td>7.500 lb x 3.310 inches</td>
<td>24.80 in-lb preload x 0.113 = 2.800 N·m preload</td>
</tr>
<tr>
<td>3.400 kg x 8.400 cm</td>
<td>28.60 kg-cm preload x 0.098 = 2.800 N·m preload</td>
</tr>
</tbody>
</table>

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.

   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.
Helical Gear to Drive Pinion Press Method

1. Place the helical driven gear on the drive pinion so 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.

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 160-180°F (71-82°C) for 10 to 15 minutes. NEVER use an open flame such as a torch for this procedure.

WARNING

WEAR PROTECTIVE CLOTHING SUCH AS GLOVES AND A SHOP COAT TO AVOID 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. 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.
**Setting Preload - Drive Pinion Nut Method**

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

2. Using the holding fixture shown below, 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.

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

5. On single-reduction carriers, remove the capscrews fastening the cage to the main carrier housing.

6. On double-reduction carriers, remove the capscrews fastening the cage to the main carrier housing according to the following procedures:
   a. Loosen the capscrews until the head of each cap screw touches the helical driven gear.
   b. Evenly loosen each cap screw 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 lbs. ft. (1627-2033 N·m).

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.

**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 lbs. 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 160-180°F (71-82°C) for 10 to 15 minutes. **NEVER** 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.
d. Repeat Steps 1-9 of this procedure.

**CAUTION**

ENSURE 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" - 1/2" but not snug against yoke flange.

**NOTE:** NEVER install seal against shoulder. The 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. Make sure preload or rotational torque is within the specified range, see "Adjusting the Thickness of the Shim Pack for the Pinion Cage (Depth of Pinion)" on page 43.

---

**Spigot Bearing Installation**

If the spigot bearing was removed, install a new spigot bearing. Refer to the following procedure for the spigot bearing type 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.
3. Install the snap ring on the spigot bearing.
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 to the outer diameter of the nose of the pinion.

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

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

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.

5. Lubricate the rollers in the inner race with the same lubricant 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 removed from the bearing cage. Record the measurement for later use.

2. Look at the pinion cone (PC) variation number on the drive pinion being replaced. Record the number for later use.
NOTE:
The pinion cone number can be either 1,000ths of an inch (0.000") or 100ths of a millimeter (0.00 mm). Refer to the following examples:
- PC +3, PC –3, +3 or –3 equal 0.003”.
- 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 measured in Step 2.

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

5. Look at the pinion cone (PC) variation number on the new drive pinion being 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 calculated in Step 3 or 4. Make a shim pack of new shims to the determined thickness. For examples, see the table below.

7. If the new pinion cone number is a minus (−), subtract the number from the standard shim pack thickness calculated in Step 3 or 4. Make a shim pack of new shims to the determined thickness. For examples, see the table below.

**Table A: Calculating Shim Thickness**

<table>
<thead>
<tr>
<th>Examples:</th>
<th>Inches</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Old Shim Pack Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Old PC Number, PC +2</td>
<td>.030 – .002 = .028</td>
<td>.760 – .050 = .710</td>
</tr>
<tr>
<td>Standard Shim Pack Thickness</td>
<td>+ .005 = .033</td>
<td>+ .130 = .840</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></td>
<td></td>
</tr>
<tr>
<td>Old PC Number, PC –2</td>
<td>.030 + .002 = .032</td>
<td>.760 + .050 = .810</td>
</tr>
<tr>
<td>Standard Shim Pack Thickness</td>
<td>+ .005 = .037</td>
<td>+ .130 = .940</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>3. Old Shim Pack Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Old PC Number, PC +2</td>
<td>.030 – .002 = .028</td>
<td>.760 – .050 = .710</td>
</tr>
<tr>
<td>Standard Shim Pack Thickness</td>
<td>– .005 = .023</td>
<td>– .130 = .580</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></td>
<td></td>
</tr>
<tr>
<td>Old PC Number, PC –2 (~.05 mm)</td>
<td>.030 + .002 = .032</td>
<td>.760 + .050 = .810</td>
</tr>
<tr>
<td>Standard Shim Pack Thickness</td>
<td>– .005 = .027</td>
<td>– .130 = .680</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 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. Ensure the capscrew holes in the cage are aligned with the holes in the carrier. Make sure the cage is installed flat against the carrier.

NOTE: Loctite is recommended for fastener retention.

NOTE: The capscrews fastening 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 below. Continue to tighten in this sequence until the cage is flat against the carrier, loosen the capscrews and tighten from 180-230 lbs. ft. (244-311 N·m).

Assembling the Main Differential Case & Ring Gear

⚠️ CAUTION

NEVER 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 TO EXCEED THE 0.008" (0.200 MM) SPECIFICATION.

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.

2. Expand the ring gear by heating the gear in a tank or oven of water to a temperature of 160-180°F (71-82°C) for 10 to 15 minutes. NEVER use an open flame such as a torch for this procedure.
WARNING

WEAR PROTECTIVE CLOTHING SUCH AS GLOVES AND A SHOP COAT TO AVOID 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.
   b. Install the washers on the bolts from the flange side of the assembly.
   c. Install the nuts and tighten to the specified torque. See "Torque Specifications" on page 95.

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.

8. Install the four pinions and four thrust washers on the spider.

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

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.
**NOTE:** Loctite is recommended for fastener retention to ensure differential assembly integrity.

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. See "Torque Specifications" on page 95.

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

---

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

**Specification:** 50 lbs. 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 with the same spline size of the differential side gear.

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.
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.

5. If the torque value exceeds the specification, separate the halves of the differential case. Check the following to determine what caused the torque value excess:
   • 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 & 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.
**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. Apply Loctite 609 between the bearing cups and bearing caps. 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.

**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 fastening the bearing caps to the carrier housing. Tighten the capscrews from 290-350 lbs. ft. (393-474 N·m).

6. Install and hand-tighten the adjusting rings in the housing.

### Adjusting the Preload on the Differential Side Bearings

**Specification:**
- Preload of Differential Side Bearings: 15 to 35 lbs. in. (1.7-3.9 N·m)
- Expansion Between Bearing Caps: 0.006 to 0.013" (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 the plunger or the pointer is against the back surface of the ring gear.

3. Loosen the bearing ring opposite the ring gear so 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 reading 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.
   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.

4. Tighten the same bearing adjusting ring so 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 lbs. in. (1.7-3.9 N·m).

6. Continue by checking ring gear runout.

Micrometer Method

A second method of checking preload is to measure the expansion between the bearing caps after tightening 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.
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.

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" (444.450 mm)
- After tightening adjusting rings = 17.509" (389.230 mm)

17.507" – 17.498" = 0.009" difference

444.680 mm – 444.450 mm = 0.230 mm difference

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

Inspecting Ring Gear Runout

Specification: 0.008" (0.200 mm) maximum

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

2. Adjust the dial indicator so the plunger or the pointer is against the back surface of the ring gear.

3. Adjust the dial of the indicator to zero (0).

4. Rotate the differential and ring gear assembly while reading the dial indicator. The runout of the ring gear must not exceed 0.008" (0.20 mm).

If the runout of the ring gear exceeds specification, as in the example, remove the differential and ring gear assembly from the carrier. See "Removing the Main Differential Case & Ring Gear Assembly" on page 29.

5. Inspect the differential parts, including the carrier, for the cause of the ring gear runout 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. See "Installation of the Main Differential Case & Ring Gear Assembly into the Carrier" on page 48.

7. Repeat the preload adjustment of the differential side bearings, starting under "Adjusting the Preload on the Differential Side Bearings" on page 49.
Adjusting Ring Gear Backlash

**Specification:**

- Range of Backlash Setting:
  0.008" - 0.020" (0.200-0.510 mm)

- Backlash Setting for New Gear Sets:
  0.014" (0.355 mm)

If the old gear set is installed, adjust the backlash to the setting 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.

2. Adjust the dial indicator so the plunger or the pointer is against a tooth surface.

3. Adjust the dial indicator to zero (0).

4. Hold the drive pinion in position.

5. While reading 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.

   - 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 adjusting backlash, only move the ring gear. NEVER move the drive pinion.

7. Repeat Steps 2-6 until the backlash is within specifications.
Inspecting the Gear Set Tooth Contact Pattern

General Information

AxleTech carriers have a hypoid gear set. The tooth contact pattern indicates where the ring gear and pinion are touching. 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.

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

Tooth Contact Patterns

1. Adjust the backlash of a new gear set to 0.014” (0.355 mm). Adjust the backlash of an old gear set to the setting measured before the carrier was disassembled. See "Removing the Main Differential Case & Ring Gear Assembly" on page 29.

2. Apply a marking compound to approximately 12 gear teeth of the ring gear. Rotate the ring gear so the 12 gear teeth are next to the drive pinion.

3. Rotate ring gear forward and backward so the 12 gear teeth go past the drive pinion six times to get the contact patterns. Repeat if needed to get a more clear pattern.

4. Look at the contact patterns on the ring gear teeth. Compare the patterns to the following patterns.
The Location of Good Hand-Rolled Contact Patterns

New gear sets will have a pattern toward the toe of the gear tooth and in the center between the top and bottom of the tooth.

Good Hand-Rolled Pattern

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.

Good Pattern in Operation

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 the drive pinion was not installed deep enough into the carrier.
- A low contact pattern indicates the drive pinion was installed too deep in the carrier.

a. Remove the drive pinion and the bearing cage from the carrier. See "Removing the Drive Pinion and the Cage Assembly" on page 32.
b. To correct a high contact pattern, decrease the thickness of the shim pack under the bearing cage to move the drive pinion toward the ring gear.

c. Install the drive pinion, bearing cage and shims into the carrier. See "Installation of the Drive Pinion and Bearing Cage Assembly" on page 45.
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. See "Adjusting Ring Gear Backlash" on page 53.

a. Decrease backlash to move the contact patterns toward the toe of the ring gear teeth.

b. Increase backlash to move the contact patterns away from the toe of the ring gear teeth.

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 the tab is between the lugs of the adjusting ring. Install the two capscrews fastening the lock plate to the adjusting ring. Tighten the capscrews from 20 to 30 lbs. ft. (28-40 N·m). Install the lock plate on the opposite bearing cap.
Installing & Adjusting the Thrust Screw for the Ring Gear

**Specification:**
Clearance between the ring gear and the thrust screw: 0.025 to 0.045" (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 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.
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" (0.635-1.143 mm). If necessary, adjust the thrust screw to get the specified clearance.
7. Tighten jam nut to 150-190 lbs. ft. (204-257 N·m).

Assembling the Inter-Axle Differential

1. Place the carrier in a repair stand so the ring gear is facing away.
2. Lubricate the following parts with the same lubricant 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.

**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 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.

**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.

9. Loctite and install the bolts, washers, and nuts fastening the case halves together. Install a washer under each nut and bolt head. Tighten the bolts and nuts from 35 to 50 lbs. ft. (48-67 N·m).

10. Install the inter-axle differential assembly in the case with the nuts toward the case. Make sure the pinion gears engage the rear side gear.
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. NEVER use an open flame like a torch for this procedure.

   b. Use a lifting tool to remove the helical drive gear from the tank of hot water. Place the gear on a press so the flat side of the gear is against the press.

   c. Install the Woodruff key in the side gear.

   d. Place the side gear in the helical drive gear so the Woodruff key is aligned with the slot in the drive gear.

   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.

   WARNING

WEAR GLOVES TO AVOID INJURY WHEN TOUCHING 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 the flat side of the gear is against the press.

   c. Install the Woodruff key in the side gear.

   d. Place the side gear in the helical drive gear so the Woodruff key is aligned with the slot in the drive gear.

   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.

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.
   • The pinions of the inter-axle differential engage the forward side gear.
   • All the gears rotate freely.

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

There are three types of oil pump idler gears:

- Ball Bearing
- Cone and Roller Bearing with Idler Sleeve
- Cone and Roller Bearing with Solid Idler Shaft

**NOTE:** If a rotor-type oil pump is being installed on a cover that uses the gear-type oil pump, see the "Retrofit" section starting on page 90.

**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.
2. Install the shaft and bearing assembly in the gear. Install the snap ring holding 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. See "Torque Specifications" on page 95.

**Oil Pump Idler Gear - Cone and Roller Bearing with Idler Sleeve**

1. Place the spacer in the center slot of the idler gear bore.
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 fastening the gear and sleeve assembly to the cover. Install the nut and washer. Tighten the nut according to specifications. See "Torque Specifications" on page 95.
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.
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. See "Torque Specifications" on page 95.

Assembling the Input Shaft, Bearing Cage, Oil Pump, & 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.
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.

**CAUTION**


b. Place the oil seal in the bearing cage so 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.

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" - 0.030" (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" (0.254 mm) between the highest and lowest measurement, remove and install the seal again.
**Unitized Pinion Seal (UPS)**

f. Remove the replacement unitized pinion 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.

![UNITIZED SEAL](image)

UNITIZED SEAL

g. 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.

**NOTE:** On the forward tandem axle output position, the driver tool outer spokes or fins MUST fit between the bearing cage bolts. The bolts on the bottom of the bearing cage cannot be 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 the driver tool. The reference mark on the driver tool should be in the 12:00 or the 6:00 positions when installing the new seal.

<table>
<thead>
<tr>
<th>Single Models</th>
<th>Tandem Models</th>
<th>Unitized Pinion Seal</th>
<th>Seal Installation Location</th>
<th>Seal Driver</th>
<th>Yoke Seal Diameter Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-17-145</td>
<td>RT-34-144 /P</td>
<td>A-1205-R-2592</td>
<td>Tandem Forward Input</td>
<td>R4422402</td>
<td>3.250 3.255</td>
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<tr>
<td>RS-19-145</td>
<td>RT-34-145 /P</td>
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<tr>
<td>RS-21-145</td>
<td>RT-40-145 /A /P</td>
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<tr>
<td>RS-21-160</td>
<td>RT-40-149 /A /P</td>
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<tr>
<td>RS-23-160 /A</td>
<td>RT-44-145 /P</td>
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<tr>
<td>RS-23-161 /A</td>
<td>RT-40-160 /A /P</td>
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<tr>
<td>RS-25-160 /A</td>
<td>RT-40-169 /A /P</td>
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<tr>
<td>RS-23-186</td>
<td>RT-46-160 /A /P</td>
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<tr>
<td>RS-26-185</td>
<td>RT-46-169 /A /P</td>
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<tr>
<td>RS-30-185</td>
<td>RT-46-164EH /P</td>
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<td>RT-46-16HEH /P</td>
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<td>RT-50-160 /P</td>
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<td></td>
<td>RT-52-185*</td>
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<td>RT-58-185*</td>
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</tbody>
</table>

| RS-17-145     | RT-36-145 /P  | A-1205-P-2590        | Tandem Forward Output     | R4422401   | 3.000 3.005               |
| RS-19-145     | RT-40-145 /A /P |                    |                            |            |                          |
| RS-21-160     | RT-40-149 /A /P |                    |                            |            |                          |
| RS-23-160 /A  | RT-44-145 /P  |                      |                            |            |                          |
| RS-23-161 /A  | RT-40-160 /A /P |                    |                            |            |                          |
| RS-25-160 /A  | RT-40-169 /A /P |                    |                            |            |                          |
| RS-23-186     | RT-46-160 /A /P |                    |                            |            |                          |
| RS-26-185     | RT-46-169 /A /P |                    |                            |            |                          |
| RS-30-185     | RT-46-164EH /P |                    |                            |            |                          |
|               | RT-46-16HEH /P |                    |                            |            |                          |
|               | RT-50-160 /P  |                    |                            |            |                          |
|               | RT-52-185*   |                    |                            |            |                          |
|               | RT-58-185*   |                    |                            |            |                          |

h. Position the driver and seal on the bearing cage seat.

![Positioning the seal driver](image)

**NOTE:** To obtain seal driver kit 4454, call 888-725-9355.

* Forward and rear input only.
CAUTION

USE A BRASS OR LEATHER MALLET FOR ASSEMBLY AND DISASSEMBLY PROCEDURES. NEVER STRIKE STEEL PARTS WITH A STEEL HAMMER. PIECES OF A PART CAN BREAK OFF AND CAUSE SERIOUS PERSONAL INJURY.

i. 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.

j. Use a .010" shim to feel for a gap between the flange of the seal and the bearing cage. If the .010" shim slides into a gap between the seal flange and bearing cage, this indicates the seal is not fully seated into the bearing bore. Reinstall the seal driver and seat the seal into the bore until a .010" shim can not slide into a gap between the seal flange and the bearing cage.

CAUTION

NEVER INSTALL A PRESS ON THE 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 the threads are facing upward. Install the oil pump on the shaft, making sure the splines in the pump are aligned with the splines on the shaft.
**CAUTION**

WHEN THE BEARING CONE AND THE OIL PUMPS ARE INSTALLED ON THE INPUT SHAFT, PLACE SUPPORTS UNDER THE INPUT SHAFT. NEVER PLACE SUPPORTS UNDER THE OIL PUMP. THE OIL PUMP WILL BE DAMAGED IF PRESSURE IS APPLIED TO THE BODY OF THE PUMP.

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.

d. Install the input bearing cage over the input shaft on the oil pump. If dowel pins are used, make sure 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 lbs. ft. (30-45 N·m).

f. Install the o-rings on the oil pump and the input bearing cage.

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 lbs. ft. (27-54 N·m).

**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 the input shaft is well supported.

**CAUTION**

NEVER 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 fastening 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.
Installing the Shift Unit, Shift Fork, & 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" - 5.360" (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 lbs. ft. (55 - 74 N·m).

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.

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.

5. Place the shift fork in the cover so 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.

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. NEVER 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.
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 with Allen-head capscrews, install the four capscrews fastening the shift unit to the helical gear cover. Tighten the capscrews from 7-11 lbs. ft. (10-14 N·m).

12. On units with long capscrews and tab retainers, use the following procedure:
   a. Loctite and install the four capscrews and the tab retainers fastening the shift unit to the helical gear cover.
   b. Place the tab retainers so two of the tabs are over the sides of the shift unit.
   c. Apply Loctite to the capscrews and tighten from 7-11 lbs. 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.

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 with 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.

![Diagram of press, sleeve, bearing cup, and cage with supports]

**CAUTION**

NEVER 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. NEVER 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.
   b. Install the capscrews and the washers fastening the cage to the cover. Tighten the capscrews from 85-115 lbs. ft. (116-155 N·m).
   c. Inspect the bearing end play according to "Inspecting & Adjusting the End Play of the Input Bearing - Original Design" on page 80.

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 fastening 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 & Adjusting the End Play of the Input Bearing - Original Design" on page 80.
**One-Piece Oil Seal**

1. **Press Seal 0.515-0.545” (13.081-13.843 mm) from Top of Cage**

   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 0.515-0.545” (13.081-13.843 mm) from the top of the bearing cage.

**Cast-Iron Outer Protector & One-Piece Inner Oil Seal**

1. a. Install the inner seal according to Steps A through D of the "One-Piece Oil Seal" on page 69.
   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.
Triple-Lip (Main) Oil Seal

**WARNING**

Use a brass or leather mallet for assembly and disassembly procedures. Never strike 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 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 used in the axle housing.

c. Place the drive pinion and cage assembly in a press with the seal bore in the cage 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 to fit against the metal flange of the seal. The diameter of the sleeve or the driver must be larger than the diameter of the flange.

e. After the seal is installed, a gap of 0.015” - 0.030” (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” (0.254 mm).
Unitized Pinion Seal (UPS)

a. Remove the replacement unitized pinion 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.

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.

c. Position the driver and seal on the bearing cage seat.

**NOTE:** On the forward tandem axle output position, the driver tool outer spokes or fins MUST fit between the bearing cage bolts. The bolts on the bottom of the bearing cage cannot be 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 the driver tool. The reference mark on the driver tool should be in the 12:00 or the 6:00 positions when installing the new seal.

<table>
<thead>
<tr>
<th>Single Models</th>
<th>Tandem Models</th>
<th>Unitized Pinion Seal</th>
<th>Seal Installation Location</th>
<th>Seal Driver</th>
<th>Yoke Seal Diameter Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-17-145</td>
<td>RT-34-144 /P</td>
<td>A-1205-R-2592</td>
<td>Tandem Forward Input (145 models from 11-93 to present)</td>
<td>R4422402</td>
<td>3.250 3.255</td>
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<td>RS-19-145</td>
<td>RT-34-145 /P</td>
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<td>RS-21-145</td>
<td>RT-40-145 /A /P</td>
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<tr>
<td>RS-23-161 /A</td>
<td>RT-40-160 /A /P</td>
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<td>RS-25-160 /A</td>
<td>RT-40-169 /A /P</td>
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<td>RT-46-164 /A /P</td>
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<td>RS-30-185</td>
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<td>RT-50-160 /P</td>
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<td>RT-52-185*</td>
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<td>RT-58-185*</td>
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<tr>
<td>A-1205-P-2590</td>
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<td></td>
<td>Tandem Forward Output (Tandem Forward Input 145 models before 11-93 with seal A-1205-F-2424)</td>
<td>R4422401</td>
<td>3.000 3.005</td>
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<tr>
<td>A-1205-N-2588</td>
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<td></td>
<td>Tandem and Single Rear Input (145 models)</td>
<td>R4422401</td>
<td>3.000 3.005</td>
</tr>
</tbody>
</table>

To obtain seal driver kit 4454, call 888-725-9355.

* Forward and rear input only.
**CAUTION**

USE A BRASS OR LEATHER MALLET FOR ASSEMBLY AND DISASSEMBLY PROCEDURES. NEVER STRIKE STEEL PARTS WITH A STEEL HAMMER. PIECES OF A PART CAN BREAK OFF AND CAUSE SERIOUS PERSONAL INJURY.

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.

e. Use a .010" shim to feel for a gap between the flange of the seal and the bearing cage. If the .010" shim slides into a gap between the seal flange and bearing cage, this indicates the seal is not fully seated into the bearing bore. Reinstall the seal driver and seat the seal into the bore until a .010" shim can not slide into a gap between the seal flange and the bearing cage.

**CAUTION**

NEVER INSTALL A PRESS ON THE 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 & 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:
   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.

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 assembly 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 the notch in the reversing ring is toward the front of the axle.

9. Install a new o-ring seal in the pump cap. **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 used in the housing.

10. Install the pump cap with the pump shaft in the bore in the cap. Make sure 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. 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 the shaft is facing outward.
   b. Use a brass drift and a hammer to drive the shaft from the plate.
   c. Turn the pump plate over so the rear of the plate is facing outward.
   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 fastening 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 the figure below for the correct identification of the bores for the check valve balls and pipe plugs.

---

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.

4. Install the capscrews fastening the oil pump to the helical gear cover. Tighten the capscrews from 35 to 50 lbs. 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 fastening the adapter to the cover. Tighten the capscrews from 20 to 30 lbs. ft. (28-40 N·m).

**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:** 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.

2. 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.

**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.**

3. Lubricate the gasket of the new oil filter with the same lubricant 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.

**NOTE:** If a steel cover for the oil filter is replacing a plastic cover for the oil filter, see the "Retrofit" section starting on page 90. This section describes the modifications necessary to replace the plastic cover with the steel cover for the oil filter.

4. Place the cover over the oil filter. Install the washers, apply Loctite to the capscrews. Tighten the capscrews from 35 to 50 lbs. ft. (48-67 N·m).
Installing the Yoke

Three types of yokes are used: a slip-fit, a tight-fit, and a loose-fit. Refer to the correct procedure for the yoke type 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.

CAUTION

NEVER 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 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

NEVER USE A HAMMER OR A 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 fastening the yoke to the shaft. Tighten the nut so there is no 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. See "Torque Specifications" on page 95.
Tight-Fit Yokes

1. Apply the axle lubricant 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. Align the yoke splines with the shaft splines and slide the yoke over the shaft spline.

**CAUTION**

NEVER 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.

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) fastening 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. See "Torque Specifications" on page 95.

**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.

---

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"- 0.50" (6.4 -12.7 mm) from the end of the hub. NEVER INSTALL THE POSE SEAL AGAINST THE SHOULDER.

**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 the 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 used in the housing to the oil seal. NEVER 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

NEVER USE A HAMMER OR MALLET TO INSTALL THE YOKE TO AVOID DRIVELINE MISALIGNMENT.

5. Apply Loctite 277 to the input shaft threads of all forward carriers, prior to installation of the nut.
6. Install the washer and nut fastening the yoke to the shaft. Tighten the nut so 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. See "Torque Specifications" on page 95.

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

NOTE: If the end play on the input bearing is inspected and adjusted, remove the forward side gear, helical drive gear, and inter-axle differential.

1. Place the differential carrier in a repair stand with the helical drive gear and the driven gear facing upward.
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.

NOTE: NEVER 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 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 fastening the cover to the carrier. Tighten the capscrews from 85-115 lbs. ft. (116-155 N·m).
Inspecting & Adjusting the End Play of the Input Bearing - Original Design

**Specification:**
- End Play of the Input Bearing:
  0.002 - 0.008" (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, confirm:
   a. The forward side gear, helical drive gear, and 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 fastening 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.

4. Add 0.005" (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. See "Removing the Input Shaft, Forward Bearing, & Clutch Collar - Original Design Helical Cover" on page 19.

6. Remove the capscrews and washers fastening 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 capscrews. Tighten the capscrews from 60 to 75 lbs. 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.

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.

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" - 0.0080" (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” - 0.008” (0.0508-0.2032 mm), add or remove shims from the shim pack. Remove the capscrews and washers, bearing cage, and shim pack then:
   • 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.

Inspecting & Adjusting the End Play of the Input Bearing - Current Design

11. Install the inter-axle differential assembly, the helical drive gear and the forward side gear. See “Assembling the Inter-Axle Differential” on page 57.

12. Install the yoke. See "Installing the Yoke" on page 77.

13. Install the helical gear cover on the differential case. See "Installing the Helical Gear Cover on the Differential Carrier" on page 79.

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

1. Install capscrews, but not the washers, fastening 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.
3. Add up the four measurements and determine the average gap between the cage and the carrier. Add 0.005" (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) fastening 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" - 1/2" (6-12 mm) between the cage and carrier mounting surface.
   b. Install the shim pack under the bearing cage. Verify the hole pattern of the shim pack matches the hole pattern of the cage.
   c. Place the shield for the oil filter in position on the bearing cage.
   d. Install the capscrews and washers into the carrier cage. Align the capscrews with the shim pack holes. Tighten the capscrews without stripping the threaded bores.
   e. Lower the input shaft assembly so 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 - 95 lbs. ft. (100-127 N·m) while rotating the input shaft in each direction to make sure the bearings are correctly installed.

7. Place a holding tool on the input yoke or flange and tighten the nut to the specified torque. See "Torque Specifications" on page 95.

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 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. Place the dial indicator pointer against the top of the input shaft. Set the dial indicator to zero (0).
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" - 0.008" range (0.050-0.200 mm).

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

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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 USING SOLVENT CLEANERS, CAREFULLY FOLLOW THE MANUFACTURER’S PRODUCT INSTRUCTIONS AND THESE PROCEDURES:

• Wear eye protection.
• Wear clothing to protect the skin.
• Work in a well-ventilated area.
• NEVER use gasoline or solvents containing gasoline. Gasoline can explode.
• ALWAYS 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. Dry the cleaned areas with air. See "Mounting Surfaces" on page xi.

2. Inspect the axle housing for damage. Repair or replace the axle housing. See "General Assembly Instructions" on page x.

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

4. If studs are used, apply liquid adhesive to the threaded holes. Install the studs in the axle housing. See "Fasteners" on page xii.

5. Tighten the studs to the correct torque value. See "Torque Specifications" on page 95.
6. Apply silicone gasket material to the mounting surface of the housing where the carrier fastens. See "Seals" on page xi.

8. Install the nuts and washers or the capscrews and washers in the four corner locations around the carrier and the axle housing. Tighten the fasteners by hand. DO NOT tighten to the specified torque.

CAUTION

USE A BRASS OR LEATHER MALLET FOR ASSEMBLY AND DISASSEMBLY PROCEDURES. NEVER STRIKE STEEL PARTS WITH A STEEL HAMMER. PIECES OF A PART CAN BREAK OFF AND CAUSE SERIOUS PERSONAL INJURY.

7. Using a hydraulic roller jack or a similar lifting tool, install the carrier into the axle housing.

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

10. Repeat Step 8 until the four fasteners are tightened to the correct torque value. See "Torque Specifications" on page 95.

11. Install the other fasteners and washers attaching the carrier in the axle housing. Tighten the fasteners to the correct torque value. See "Torque Specifications" on page 95.

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

WARNING

USE A BRASS OR LEATHER MALLET FOR ASSEMBLY AND DISASSEMBLY PROCEDURES. NEVER STRIKE STEEL PARTS WITH A STEEL HAMMER. PIECES OF A PART CAN BREAK OFF AND CAUSE SERIOUS PERSONAL INJURY.

13. Clean the mating surfaces of the axle shaft and wheel hub.
14. If silicone gasket material is used, apply a 1/8" 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.

15. 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.

16. 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.

17. 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 the table below.

**Table B: Torque Fastener Chart**

<table>
<thead>
<tr>
<th>Fastener</th>
<th>Thread Size</th>
<th>Torque Value — Grade 8 Nuts lbs ft (N·m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Plain Nut</td>
</tr>
<tr>
<td>Stud Nut</td>
<td>0.44-20</td>
<td>50 to 75 (68-102)</td>
</tr>
<tr>
<td>(Axle Shaft)</td>
<td>0.50-20</td>
<td>75 to 115 (102-156)</td>
</tr>
<tr>
<td></td>
<td>0.56-18</td>
<td>110 to 165 (150-224)</td>
</tr>
<tr>
<td></td>
<td>0.62-18</td>
<td>150 to 230 (204-312)</td>
</tr>
<tr>
<td>Studs</td>
<td>All</td>
<td>Install the course thread end of stud into hub and tighten to last thread.</td>
</tr>
</tbody>
</table>

18. Install the bearing cage, thru-shaft, and bearing assembly in the housing and adjust the end play of the output bearing. Refer to the following procedures.
Assembling the Output Bearings, Thru-Shaft, & the Oil Seal

1. Lubricate the bearing cups and cones with the lubricant 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 fastening the outer cone in the cage. The snap ring controls the end play of the output bearing.

7. Inspect and adjust the end play of the output bearing. Refer to the following procedure.

Inspecting & Adjusting the End Play of the Output Bearing

**Specification:**

- 10 lbs. in. (1.13 N·m) preload to 0.003" (0.076 mm) bearing end play

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

1. Place the thru-shaft and 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 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.

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" (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" (0.076 mm), remove and replace the snap ring fastening the bearings in the cage.
   - Install a thinner snap ring to increase end play.
   - Install a thicker snap ring to decrease end play.

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 lbs. in. (1.13 N·m), remove and replace the snap ring fastening 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.

7. Install the output yoke and spacer on the thru-shaft. See "Installing the Yoke" on page 77. DO NOT install the oil seal at this time.

8. Install the nut fastening the output yoke on the thru-shaft. Place a holding tool on the yoke and tighten the nut to the specified torque. See "Torque Specifications" on page 95.

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. See "Removing the Carrier from the Axle Housing" on page 12.
Installing the Oil Seal, Yoke, Thru-Shaft, & Bearing Cage

1. Install the oil seal in the bearing cage. See "Installing the Input Shaft, Clutch Collar, & Bearings in the Helical Gear Cover - Original Design" on page 67.

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 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.

6. Install the washers and the capscrews fastening the output bearing cage to the axle housing. Tighten the capscrews from 35 to 50 lbs. ft. (48-67 N·m).

7. Install the spacer on the thru-shaft.

8. Install the output yoke on the thru-shaft. See "Installing the Yoke" on page 77.
Filling the Axle with Lubricant - On-Highway Axles

For additional lubrication information, refer to LMT-0001 - Preventative Maintenance & Lubrication Service Manual.

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.

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. See "Table C: Lubricant Cross Reference (Viscosity) and Temperature Chart" on page 3.

4. Install the fill plug and tighten to a minimum torque of 35 lbs. 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 1 qt. (0.946 liters) of the specified lubricant in the axle housing. See "Table C: Lubricant Cross Reference (Viscosity) and Temperature Chart" on page 3.

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 ensures the lubricant flows through the complete axle assembly.

Filling the Axle with Lubricant - Off-Highway Axles

1. Rotate each wheel end so 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.

3. For SPRC-1927 axles, remove the fill/level plug from the side of the differential carrier. For SPR-570 and SPRC-4806 axles, remove the fill/level plug from the axle housing bowl.

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. See "Torque Specifications" on page 95.

Retrofit

This section describes the necessary requirements to install components of a recent design on older carriers.

⚠️ WARNING

TO PREVENT SERIOUS EYE INJURY, ALWAYS WEAR EYE PROTECTION WHEN PERFORMING 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.
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.

![Diagram of Rotor-Type Oil Pump]

1. CAP
2. BUSHING
3. O-RING
4. REVERSING RING
5. 2-PIECE ROTOR SET
6. SNAP RINGS
7. KEY
8. PUMP BODY
9. RELIEF VALVE ASSEMBLY
10. POPPET
11. SPRING
12. COTTER PIN
13. CAP
14. GEAR AND SHAFT ASSEMBLY

NOTE: The helical gear cover (A-3266-W-881) that uses a hollow sleeve for the idler gear of the oil pump can use a solid shaft (A-3266-N-1080) for the idler gear.

Drill the 0.531" (13.487 mm) hole to a larger diameter of 0.656" (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.

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" 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, pump assembly, and into the helical gear cover.

![Diagram of Steel Oil Filter Cover]

Install Long Capscrews Here

Enlarge Idler Shaft Hole from 0.531" (13.487 mm) to 0.656" (16.662 mm) [Not Required if Kit 3301-A is used]
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.

The parts that must be replaced are:

- Differential Case Halves
- Differential Case Fasteners (Bolts, Washers, & Lock Nuts)
- Spigot Bearing Snap Ring
- Ring Gear
- Drive Pinion
- Ring Gear-to-Differential Case Fasteners (Bolts, Washers, & Lock Nuts)

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

The bore depth is important because there must be a distance of 5.738" - 5.748" (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" (0.076 mm) to the 3.9370" - 3.9384" (9.9999-10.0035 cm) bore diameter for the spigot bearing in the carrier.

1. SPIGOT BEARING BORE: 3.9370-3.9384" (9.9999-10.0035 mm)
2. 0.060" (0.762 mm) COUNTERSINK
3. 0.060" (1.524 mm) RADIUS
4. SNAP RING BORE DIAMETER: 4.38" (11.125 mm)
5. BOTTOM OF SNAP RING BORE TO BEARING CAP MOUNTING SURFACE: 5.738-5.748" (14.574-14.599 mm)
**Triple-Lip (Main) Oil Seal**

**Input Shaft on Forward-Rear Differential Carriers**

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. Verify 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. (See the illustration in the previous column.)
- 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" on page 93.
- Place the bearing cones in the cage. Install the cage on the helical gear cover as described under "Triple-Lip (Main) Oil Seal" on page 93.

**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.
Appendix

Torque Values for Fasteners

1. The torque values are for fasteners with a light application of oil on the threads. See "Torque Specifications" on page 95.

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 the size of the fastener being installed is unknown, measure the fastener using the procedures in the following section.

5. Compare the size of fastener measured in Step 4 to the list of fasteners to find the correct torque value. See "Torque Specifications" on page 95.

Measuring American Standard Fasteners

- Measure the diameter of the threads in inches, dimension X.
- Count the amount of threads there are in 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 1"

Measuring Metric Fasteners

- Measure the diameter of the threads in millimeters (mm), dimension X.
- Measure the distance of ten (10) threads, point to point in millimeters (mm), dimension Y. Make a note of dimension Y.
- 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
Appendix

Torque Specifications

See View A

OIL PUMP - CURRENT STYLE

OIL PUMP - GEAR TYPE

OIL PUMP - ROTOR TYPE

VIEW A
<table>
<thead>
<tr>
<th>Position</th>
<th>Description</th>
<th>Thread Size</th>
<th>Torque Value</th>
<th>lbs. ft.</th>
<th>N·m</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>
<td>610-881</td>
<td></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>
<td>82-101</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3/8&quot;-16 x 1-1/4&quot;</td>
<td>35-50</td>
<td>48-67</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Wheel Hub-to-Axle Shaft Flange Nut ***</td>
<td>5/8&quot;-18</td>
<td>150-230</td>
<td>203-312</td>
<td></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>
<td>394-474</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7/8&quot;-14</td>
<td>375-435</td>
<td>509-589</td>
<td></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>
<td>28-40</td>
<td></td>
</tr>
<tr>
<td>5A</td>
<td>Differential Case Halves Bolts</td>
<td>5/8&quot;-11</td>
<td>180-230</td>
<td>245-311</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/2&quot;-13</td>
<td>40-55</td>
<td>55-75</td>
<td></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>
<td>245-311</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7/8&quot;-14</td>
<td>600-700</td>
<td>810-950</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Thrust Screw Jam Nut</td>
<td>1-1/8&quot;-16</td>
<td>150-190</td>
<td>204-257</td>
<td></td>
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<td></td>
<td></td>
<td>7/8&quot;-14</td>
<td>150-190</td>
<td>204-257</td>
<td></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>
<td>245-311</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Fill Plug *</td>
<td>3/4&quot;-14</td>
<td>35 Minimum</td>
<td>48 Minimum</td>
<td></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>
<td>41-54</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3/8&quot;-16 x 2-7/8&quot;</td>
<td>35-50</td>
<td>48-67</td>
<td></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>
<td>116-155</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>5/8&quot;-11 x 1-1/2&quot;</td>
<td>180-230</td>
<td>245-311</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Helical Driven Gear-to-Drive Pinion Nut</td>
<td>2&quot;-12</td>
<td>1200-1500</td>
<td>1627-2033</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Oil Shield Bolt</td>
<td>Refer to Table I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Input Yoke-to-Input Shaft Nut</td>
<td></td>
<td></td>
<td></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>
<td>116-155</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Oil Pump to Bearing Cage Capscrew - New Designs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Air Shift Unit-to-Helical Gear Cover Long Capscrew and Allen-head Capscrew</td>
<td>1/4&quot;-20</td>
<td>7-10 **</td>
<td>10-14</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Oil Filter Cover-to-Helical Gear Cover Capscrew ***</td>
<td>5/16&quot;-18</td>
<td>15</td>
<td>20</td>
<td></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>
<td>28-40</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Drain Plug *</td>
<td>3/4&quot;-14</td>
<td>35 Minimum</td>
<td>48 Minimum</td>
<td></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>
<td>116-155</td>
<td></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>
<td>102-135</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/2&quot;-13, Gr. 8 — Plain Nut</td>
<td>85-115</td>
<td>116-155</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/2&quot;-13, Gr. 5 — Plain Nut</td>
<td>65-85</td>
<td>88-115</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5/8&quot;-11 — Plain Nut</td>
<td>110-145</td>
<td>145-197</td>
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<tr>
<td>24</td>
<td>Shift Fork Adjusting Screw Jam Nut</td>
<td>1/2&quot;-13</td>
<td>40-55</td>
<td>55-74</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Oil Pump to Helical Cover Capscrew - Rotor Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Oil Pump Pipe Plug - Small *</td>
<td>1/4&quot;-18</td>
<td>15 Minimum</td>
<td>20 Minimum</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Oil Pump Pipe Plug - Large *</td>
<td>1/2&quot;-14</td>
<td>25 Minimum</td>
<td>33 Minimum</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Oil Pump-to-Helical Cover Capscrew - Gear &amp; Rotor Types</td>
<td>3/8&quot;-16</td>
<td>35-50</td>
<td>48-67</td>
<td></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>
<td>21-27</td>
<td></td>
</tr>
</tbody>
</table>

* Minimum torque. Tighten until one thread is visible.
** 75-100 lbs. in.
*** On steel oil filter covers, tighten the capscrew fastening the lower, longer leg of the cover to 30 lbs. ft. (41 N·m).
**** 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>Pinion Nut Location</th>
<th>Axle Model</th>
<th>Carrier Input Yoke</th>
<th>Axle Model</th>
<th>Carrier Input Yoke</th>
<th>Axle Model</th>
<th>Carrier Input Yoke</th>
<th>Axle Model</th>
<th>Carrier Input Yoke</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>740-920 lbs. ft.</td>
<td>920-1130 lbs. ft.</td>
<td>1000-1230 lbs. ft.</td>
<td>740-920 lbs. ft.</td>
<td>800-1100 lbs. ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1000-1245 N•m)</td>
<td>(1250-1535 N•m)</td>
<td>(1350-1670 N•m)</td>
<td>(1000-1245 N•m)</td>
<td>(1085-1496 N•m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fastener Size: M32 X 1.5</td>
<td>Fastener Size: M39 X 1.5</td>
<td>Fastener Size: M45 X 1.5</td>
<td>Fastener Size: M32 X 1.5</td>
<td>Fastener Size: 1-1/2 - 12 UNF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Tandem Axles

<table>
<thead>
<tr>
<th>Pinion Nut Location</th>
<th>Axle Model</th>
<th>First Carrier Input Yoke</th>
<th>Axle Model</th>
<th>First Carrier Input Yoke</th>
<th>Axle Model</th>
<th>First Carrier Input Yoke</th>
<th>Axle Model</th>
<th>First Carrier Input Yoke</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>600-800 lbs. ft.</td>
<td>600-800 lbs. ft.</td>
<td>1000-1230 lbs. ft.</td>
<td>600-800 lbs. ft.</td>
<td>900-1200 lbs. ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(815-1085 N•m)</td>
<td>(815-1085 N•m)</td>
<td>(1350-1670 N•m)</td>
<td>(815-1085 N•m)</td>
<td>(1224-1632 N•m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fastener Size: M45 X 1.5</td>
<td>Fastener Size: M45 X 1.5</td>
<td>Fastener Size: M45 X 1.5</td>
<td>Fastener Size: M45 X 1.5</td>
<td>Fastener Size: 1-3/4 - 12 UN</td>
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<td></td>
</tr>
</tbody>
</table>

### Tridem Axles

<table>
<thead>
<tr>
<th>Pinion Nut Location</th>
<th>Axle Model</th>
<th>First Carrier Input Yoke</th>
<th>Axle Model</th>
<th>First Carrier Input Yoke</th>
<th>Axle Model</th>
<th>First Carrier Input Yoke</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>600-800 lbs. ft.</td>
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<td>1000-1230 lbs. ft.</td>
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<td>900-1200 lbs. ft.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(815-1085 N•m)</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Fastener Size: M45 X 1.5</td>
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<td>Fastener Size: M45 X 1.5</td>
<td>Fastener Size: M45 X 1.5</td>
<td>Fastener Size: 1-3/4 - 12 UN</td>
</tr>
</tbody>
</table>
NOTE: Refer to "Assembly" on page 36 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 lbs. in. (0.56 to 2.82 N·m) torque</td>
</tr>
<tr>
<td></td>
<td><strong>Used bearings in good condition:</strong></td>
</tr>
<tr>
<td></td>
<td>From 5 to 15 lbs. 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><strong>To increase preload:</strong></td>
<td>Install a thinner spacer</td>
</tr>
<tr>
<td><strong>To decrease preload:</strong></td>
<td>Install a thicker spacer</td>
</tr>
</tbody>
</table>

## Drive Pinion — Depth in Carrier

<table>
<thead>
<tr>
<th>Specification</th>
<th>Install the correct amount of shims between the bearing cage and carrier.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>To calculate, use old shim pack thickness and new and old pinion cone number.</td>
</tr>
</tbody>
</table>

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

## Input Bearing — End Play

<table>
<thead>
<tr>
<th>Specification</th>
<th>0.002 - 0.008&quot; (0.0508 - 0.2032 mm)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Adjustment</th>
<th>End play is controlled by the size of the shim pack</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To increase end play:</strong></td>
<td>Add shims to the shim pack</td>
</tr>
<tr>
<td><strong>To decrease end play:</strong></td>
<td>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 lbs. in. (1.7 to 3.9 N·m) torque</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>or</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Expansion between bearing caps:</strong></td>
</tr>
<tr>
<td></td>
<td>0.006&quot; to 0.013&quot; (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 lbs. ft. (68 N·m) torque applied to one side gear |
Output Bearing — End Play and Preload

<table>
<thead>
<tr>
<th>Specification</th>
<th>10 lbs. in. (1.13 N·m) bearing preload to 0.0030&quot; (0.0762 mm) bearing end play</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustment</td>
<td>End play and preload are controlled by the size of the snap ring in the output bearing cage</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Specification</th>
<th>Range of Backlash Setting: 0.008&quot; - 0.020&quot; (0.200-0.510 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backlash Setting for New Gear Sets:</td>
<td>0.014&quot; (0.355 mm)</td>
</tr>
</tbody>
</table>

| 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" (0.200 mm) maximum |

Thrust Screw — Clearance

<table>
<thead>
<tr>
<th>Specification</th>
<th>0.025&quot; to 0.045&quot; (0.65 to 1.14 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>or</td>
<td>Loosen the thrust screw 1/4 turn after tightening the thrust screw, hand tight, against the ring gear</td>
</tr>
</tbody>
</table>

Tooth Contact Patterns (Hand Rolled)

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

| Adjustment                     | Tooth contact patterns are controlled by the thickness of the shim pack between the pinion bearing cage and carrier and by ring gear backlash |

**To move the contact pattern lower:**
Decrease the thickness of the shim pack under the pinion bearing cage

**To move the contact pattern higher:**
Increase the thickness of the shim pack under the pinion bearing cage

**To move the contact pattern toward the toe of the tooth:**
Decrease backlash of the ring gear

**To move the contact pattern toward the heel of the tooth:**
Increase backlash of the ring gear
Carrier Repair Stand Specifications

1. Plates - 8" long x 3/4" thick x 1-1/4" wide with a tongue to fit slot in bar weld plates to bar.
2. Handle - 7" long with slot in one end to fit clamp screw.
3. Bar - 2" diameter x 9" long with one end slotted to fit plate.
4. Weld all around after pressing plug into pipe.
5. Plug - 4" diameter x 7" long with one end turned 3" long to fit pipe. Drill 2" hole and mill 3/16" wide slot 2" from top.
6. Screw - 3-1/2" long with 5/8" diameter with flats on end to fit handle and 2-1/2" length of thread on other end.
7. Drill 3/8" hole through handle and screw.
TSB-03-06

Disassembly & Assembly Procedures for SPRC 1927 Planetary Axle Wheel Ends Containing A1 3298E1201 and 884231015 A02 Covered Planetary Spider Assemblies with Tapered Roller Bearings

A1 3298E1201

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Planetary Gear (3892R5738)</td>
<td>8</td>
<td>Spacer (K158598R)</td>
<td>15</td>
<td>Ball (1898E57)</td>
</tr>
<tr>
<td>2</td>
<td>Snap Ring (K158597R)</td>
<td>9</td>
<td>Bearing Cup (JL69310D)</td>
<td>16</td>
<td>O-ring (5X1300)</td>
</tr>
<tr>
<td>3</td>
<td>Bearing Cup (JL69310B)</td>
<td>10</td>
<td>Spacer (K158596RA)</td>
<td>17</td>
<td>Plug (1250V1322)</td>
</tr>
<tr>
<td>4</td>
<td>Bearing Cup (JL69310A)</td>
<td>11</td>
<td>Bearing Cone (JL69349A)</td>
<td>18</td>
<td>Planetary Spider Assembly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(A 3298E1201)</td>
</tr>
<tr>
<td>5</td>
<td>Bearing Cone (JL69349B)</td>
<td>12</td>
<td>Spacer (K158596RC)</td>
<td>19</td>
<td>Spacer (JY6307R)</td>
</tr>
<tr>
<td>6</td>
<td>Bearing Cone (JL69349C)</td>
<td>13</td>
<td>Bearing Cone (JL69349D)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Bearing Cup (JL69310C)</td>
<td>14</td>
<td>Planetary Shaft (3198A1119)</td>
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<td></td>
</tr>
</tbody>
</table>

884231015 A02

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Planetary Gear (883601001E)</td>
<td>8</td>
<td>Spacer (K158598R)</td>
<td>15</td>
<td>Ball (1898E57)</td>
</tr>
<tr>
<td>2</td>
<td>Snap Ring (K158597R)</td>
<td>9</td>
<td>Bearing Cup (JL69310D)</td>
<td>16</td>
<td>O-ring (5X1300)</td>
</tr>
<tr>
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<td>10</td>
<td>Spacer (K158596RA)</td>
<td>17</td>
<td>Plug (1250V1322)</td>
</tr>
<tr>
<td>4</td>
<td>Bearing Cup (JL69310A)</td>
<td>11</td>
<td>Bearing Cone (JL69349A)</td>
<td>18</td>
<td>Planetary Spider Assembly</td>
</tr>
<tr>
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<td></td>
<td>(884231015 A01)</td>
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<tr>
<td>5</td>
<td>Bearing Cone (JL69349B)</td>
<td>12</td>
<td>Spacer (K158596RC)</td>
<td>19</td>
<td>Spacer (JY6307R)</td>
</tr>
<tr>
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<td>Bearing Cone (JL69349C)</td>
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<td>Bearing Cone (JL69349D)</td>
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<td>Bearing Cup (JL69310C)</td>
<td>14</td>
<td>Planetary Shaft (3198A1119)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Planetary Spider Disassembly

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

2. Remove the plug from each planetary shaft location. Discard the o-ring and replace with a new o-ring at assembly.

3. Place the planetary spider assembly in a press with the flange side DOWN.
   **NOTE:** If a press is not available, use a brass drift and mallet to remove the planetary shafts.

4. Support the planetary spider assembly as required.

5. Place a container of cushioning material under the press to catch the planetary shafts and balls as they are pressed out of the planetary spider and planetary gears.

6. Press each planetary shaft out of the planetary spider and planetary gear.

7. Remove the planetary gears from the planetary spider. Two bearing cones and two spacers will be loose in each gear. Do not lose these components. The bearing cones and spacers must stay in the correct location of the correct planetary gear.

8. Inspect the planetary gears.
   - **If the planetary gears are not being reused:** Discard the entire planetary gear and tapered roller bearing assembly.
   - **If the bearing assemblies are being reused:** Disassemble to keep the bearing components together as an assembly. Refer to Planetary Spider Assembly at the end of the bulletin. Bearing components 11, 10, 4, 2, 3, 5, 19, 6, 7, 8, 9, 12 & 13 must remain a set in the sequence shown.

9. Set the complete bearing assembly on a flat surface. It does not matter which side of the gear is UP.

10. Remove the bearing cone and spacer.

11. Use a bearing puller to remove the bearing cup.

12. Verify if the part located on the next bearing cup is a spacer or a snap ring.
   - **If the part is a spacer:** Remove the spacer and turn the gear over. Proceed to Step 13.
   - **If the part is a snap ring:** Proceed to Step 18.

13. Remove the bearing cone and spacer.

14. Using a bearing puller, remove the bearing cup.

15. Place the planetary gear in a press with the snap ring side UP.
**WARNING**

USE A BRASS OR LEATHER MALLET FOR ASSEMBLY AND DISASSEMBLY PROCEDURES. NEVER STRIKE STEEL PARTS WITH A STEEL HAMMER. PIECES CAN BREAK OFF AND CAUSE SERIOUS PERSONAL INJURY.

**CAUTION**

BEARING COMPONENTS ARE MATCHED SETS. IT IS VERY IMPORTANT TO PUT THE BEARING COMPONENTS WITH THE CORRECT ASSEMBLY AS THE COMPONENTS ARE REMOVED.

16. Support the planetary gear as required.

**NOTES:**

- If a press is not available, use a brass drift or leather mallet to remove the bearing components.
- The driver diameter should be slightly smaller than 2.25" (57.15 mm) with a minimum undercut relief diameter of 2.040" (51.82 mm) and a minimum depth of 0.250" (6.35 mm).

17. Use a driver to press out the bearing components. Proceed to the two bullet points before Step 23.

18. Turn the gear over and remove the bearing cone and spacer.

19. Use a bearing puller to remove the bearing cup. Remove the spacer.

20. Place the planetary gear in a press with the snap ring side UP.

21. Support the planetary gear as required.

**NOTES:**

- If a press is not available, use a brass drift or leather mallet to remove the bearing components.
- The driver diameter should be slightly smaller than 2.25" (57.15 mm) with a minimum undercut relief diameter of 2.040" (51.82 mm) and a minimum depth of 0.250" (6.35 mm).

22. Use a driver to press out the bearing components.

- **If the bearing components are being reused**: Leave the snap ring in the gear.
- **If the bearing components are not being reused**: Carefully remove the snap ring from the gear.

23. Repeat Steps 9-22 for the remaining two gears.
Planetary Spider Assembly

For maximum planetary gear life, replace the planetary shafts and tapered roller bearing sets on both wheel ends at the same time.

1. Apply approved O-617-A or -B, NLGI Grade 1 or 2 grease to the bearing cones, o-ring, and ball during assembly.

   **NOTE:** If a press is not available, use a brass drift or leather mallet to assemble the bearing components.

2. When assembling the bearing components into the gear, do not exceed 10,000 lbs (4536 kg) press force.

   **CAUTION**

   **BEARING ASSEMBLIES ARE MATCHED “ASSEMBLIES.”** THE COMPONENTS WITHIN EACH ASSEMBLY CANNOT BE MIXED OR MATCHED WITH ANY COMPONENTS FROM ANOTHER ASSEMBLY. IF ANY COMPONENTS OF THE ASSEMBLY ARE DAMAGED DURING ASSEMBLY, THE COMPLETE ASSEMBLY MUST BE DISCARDED.

3. If required, assemble the K158597R snap ring into the planetary gear.

**NOTES:**

- Identify and mark the end of the gear closest to the snap ring. Identification will aid in later assembly.
- Refer to the Planetary Spider Assembly at the end of the bulletin for the number identification of parts. The components in the assembly must be kept in the same order as received from the vendor or as removed during disassembly. Each component (except spacers and snap ring) is labeled A, B, C or D and is assembled in the same order as shown in the planetary spider assembly. Individual components cannot be serviced separately.

4. Place the planetary gear on a flat surface with the snap ring side DOWN.

5. Using a driver, press the (3) JL69310B bearing cup to the snap ring.

   **NOTE:** The following step requires the use of a fabricated shaft. The shaft diameter should be 2.35” – 2.45” (59.7 – 62.2 mm). The length should be longer than 1.750” (44.45 mm). This will ensure the (3) bearing cup does not move during assembly.

6. Place the gear on the fabricated shaft, snap ring side UP. The (3) bearing cup will rest on the shaft.

7. Using a driver, press the (4) JL69310A bearing cup to the snap ring.
8. Remove the gear from the shaft and turn it over, (3) bearing cup facing UP. Place the (5) JL69349B bearing cone into the bearing cup. Place (14) JY6307R spacer on (5) bearing cone.

9. Place the (6) JL69349C bearing cone onto the (5) bearing cone.

10. Using a driver, press the (7) JL69310C bearing cup into the gear approximately 0.250” (6.35 mm).

11. Place the (8) K158598R spacer (thin) onto the (7) bearing cup.

12. Using a driver, press the (9) JL69310D bearing cup, the (8) K158598R spacer, and the (7) bearing cup to the (14) JY6307R spacer.

13. Place the (12) K158596RC spacer onto the (6) bearing cone.

14. Place the (13) JL69349D bearing cone into the (9) bearing cup.

15. Turn the gear over so that the (4) bearing cup faces UP. The spacer and the bearing cone are loose components that can fall out when you turn over the gear if care is not taken. Place the (10) K158596RA spacer onto the (5) bearing cone.

16. Place the (11) JL69349A bearing cone into the (4) bearing cup.

17. Apply a load to the gear/bearing assembly through the bearing cones. Rotate the gear to ensure that it spins freely.

**NOTES:**

- The bearing is designed to always spin freely if the cups were correctly seated against spacers and snap ring. If the gear does not spin freely after completing Step 17, disassemble the bearings (including the snap ring) from the gear and reassemble with a new bearing assembly.
• If the gear does not spin freely, remove the (13) bearing cone and lightly tap on the (9) bearing cup. Place the (13) bearing cone on the (9) bearing cup. Reapply load and spin gear. If the gear does not spin freely, turn over the gear and remove the (11) JL69349A bearing cone. Lightly tap on the (4) bearing cup. Place the (11) bearing cone on the (4) bearing cup, reapply load and spin gear. If gear does not spin freely, disassemble the bearings (including the snap ring) from the gear and reassemble with a new bearing assembly.

18. Repeat Step 17 until the gear spins when a load is applied through the bearing cones.

19. Repeat the assembly procedure (Steps 1-18) with the two remaining gears.

20. Place the planetary spider flange side UP on an assembly fixture. Position the spider under a press.

   **NOTE:** If a press is not available, a suitable driver and mallet can be used to assemble the planetary shafts. Position the spider so that the planetary shaft can protrude through the bottom of the spider.

21. Slide the gear-bearing assembly into the spider. The orientation of the gear and snap ring with respect to the planetary spider is not critical.

   **NOTES:**
   • Be careful not to lose any bearing cones or spacers.
   • The following step requires the use of a fabricated shaft. The shaft diameter should be just under 1.496” (38.00 mm) and the length should be longer than 3.00” (76.2 mm).

22. Use a fabricated alignment shaft to correctly align all components in the gear/bearing assembly.

23. Apply grease to the ball and place it into the planetary shaft.

24. Press the shaft into the spider, making sure the ball is correctly lined up with the notch in the spider. Continue pressing until the shoulder of the shaft touches the bearing cone.

**WARNING**

TAKE CARE WHEN USING LOCTITE TO AVOID SERIOUS PERSONAL INJURY. FOLLOW THE MANUFACTURER’S INSTRUCTIONS TO PREVENT IRRITATION TO THE EYES AND SKIN.

25. Apply grease to the o-ring and assemble it onto the plug. Take care not to get grease on the plug threads. Apply one thin bead of Loctite 243 around the threaded portion of the plug only. Take care not to get Loctite on the o-ring or o-ring groove.

26. Assemble the plug into the spider, being careful not to cut the o-ring. Tighten the plug to 230-250 lbs. ft. (312-339 N·m).

27. Rotate the gear to ensure that it spins.

28. Repeat assembly Steps 20-27 with the two remaining gear locations.

29. Refer to “Lubrication” on page 3 for correct wheel end oil fill procedures.