SPICER®

DANA

Service Manual

Spicer® Tandem Drive Axles

AXSM-0045

September 2007

Spicer Axle Service and Maintenance Instructions
Tandem Drive Axles
Dual Range and Planetary Double Reduction Gearing

Introduction

Dana Corporation, Axle & Brake Division, presents this publication to aid in maintenance and overhaul of Spicer tandem drive axles.

Service and Maintenance instructions cover Spicer Dual Range (2-Speed) and Planetary Double Reduction Tandem Axles. Instructions are applicable to both gearing types unless specified otherwise.

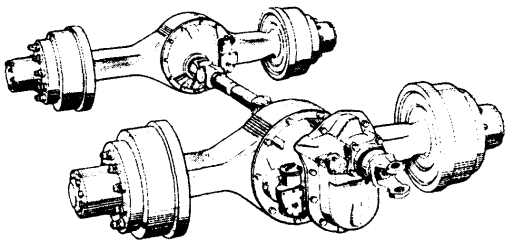
Five basic axle series are included in this book. Their design is common with differences in load capacity and two gearing types.

Load Capacity (lbs.)	Model Numbers: Dual Range	Model Numbers: Planetary Double Reduction
34,000	DT340, DT341	DP340, DP341
38,000	DT380(P)	DP380(P)
38,000	* DT381(P)	DP381(P)
40,000	DT400-P, DT401-P	DP400-P, DP401 -P
40,000	DT402(P)	DP402(P)
45,000	DT451 -P	DP451-P

The suffix letter "P" in the Model No. indicates the axle is equipped with a gear-driven Lube Pump, designed to provide additional lubrication to the inter-axle differential and related parts.

Instructions contained herein are applicable to all axle models unless specified otherwise.

For brake information and axle mounting suspension systems, refer to pertinent truck manufacturer's literature.



Typical Pmf bo Tandem Drive Axle (Dual Range illustrated).

Design Variations:
Two design variations of tandem axles are included in this manual. The major difference is in the shaft sp line design. Refer to page 5 for deails.

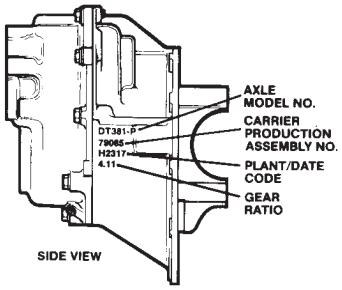
*NOTE: DS381 (P) axles manufactured after April 1985 are rated at 40,000 lbs,

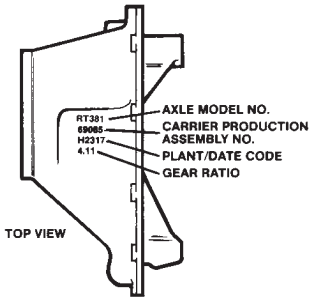
Contents

Price $3.50

Axle and Carrier Assembly Model Identification

Differential carrier identification is either stamped on the carrier itself or on a metal tag affixed to the carrier. Location on the carrier is the same.





DT381-P Forward Axle

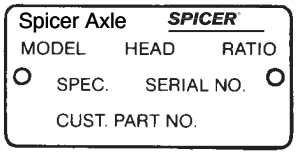
- Lube Pump
- Design Level
- Tandem Capacity
- Gearing Type
- "D" Series (w/inter-axle differential)

RT381 Rear Axle

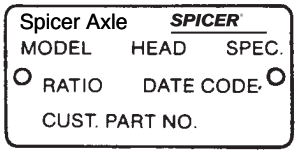
- Design Level
- Tandem Capacity
- Gearing Type
- Rear Axle

Metal Identification Tags

NEW STYLE TAG



OLD STYLE TAG



Spicer **identifies a tandem axle by the nomenclature assigned to the forward axle.**

"T" indicates Dual Range.
"P" is Planetary Double Reduction.
Suffix letter. "P" indicates gear-driven lube pump.

Axle Specification Number

The complete axle is identified by the specification number stamped on the rear right-hand side of the axle. housing. This number identifies all component parts of the axle as built by Spicer, including special OEM requirements such as yoke or flange.

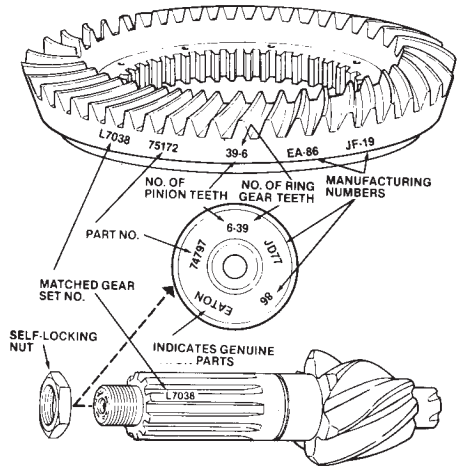
In addition, some axles may include a metal identification tag (see illustration).

Metal Identification Tag

Ring Gear and Pinion Identification

Ring Gear and Drive Pinion are matched parts and must be replaced in sets. Check the appropriate Spicer Axle parts book for part numbers and ordering instructions.

To aid in identifying gear sets, both parts are stamped with such information as number of pinion and ring gear teeth, individual part number and matched set number (refer to adjacent drawing).

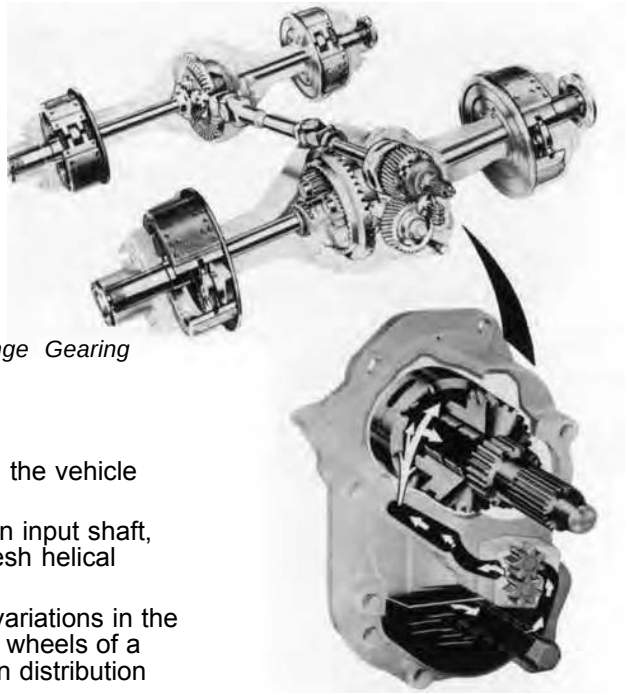


Spicer Dual Range Tandem Drive Axles

Description and Operation

Spicer Dual Range Tandems are basically 2-Speed, shiftable drive axles. They provide two gearing ratios (low and high ranges) and are designed for heavy-duty service in on-off highway operations. Low range for deep gear reduction and slow speed hauling off highway. High range for cruising speeds on highway.

The complete tandem axle assembly includes two axle units, each with double gear reduction capability coupled by a 2-gear power divider.



Smf bo Dual Range Gearing with Lube Pump

Power Divider

In operation, the power divider accepts the torque from the vehicle drivelne and distributes it equally to the two axles.

This assembly is of the two-gear design consisting of an input shaft, inter-axle differential, output shaft and two constant-mesh helical gears.

The inter-axle differential compensates for axle speed variations in the same way the wheel differential works between the two wheels of a single drive axle. This unit also acts as a central point in distribution of torque to the two axles.

The power divider also includes a driver-controlled, air-operated lockout. When lockout is engaged, it mechanically prevents inter-axle differentiation for better performance under poor traction conditions.

Lube Pump

Tandem Axles with suffix letter "P" in Model No. are equipped with a lube pump to provide positive lubrication to the inter-axle differential and other power divider parts. This pump is operated by a drive gear engaged with the input shaft splines. When vehicle is moving in a forward direction, pressurized lube is delivered to the vital power divider parts.

Lube Pump System

The pump lube system incorporates a magnetic strainer screen. To keep the system clean, the magnet traps minute particles and the screen blocks out large particles of foreign material.

Dual Range Tandem Shift System

Range selection is accomplished by an air shift system and is driver-controlled through a cab-mounted air control valve.

The control valve operates two shift units (one for each axle) which mechanically engages or disengages the planetary gearing.

For operation description, refer to Shift System section in this manual.

Forward Axle Shift Unit

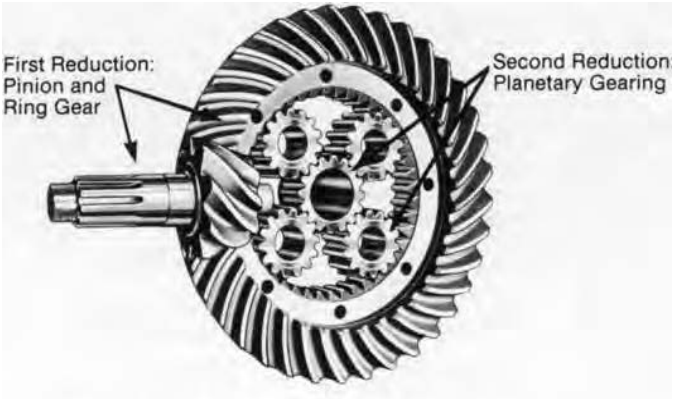
Rear Ax/e Shift Unit

Spicer Planetary Double Reduction Axles

Description and Operation

The Planetary Double Reduction Tandem Axle shares its basic design concepts and many components with the Dual Range Tandem. The principle variation is the permanent engagement of the double reduction feature. A stationary sun gear, fixed in engagement with the low-speed clutch plate, replaces the sliding clutch gear and provides continuous double reduction operation in the same manner as the dual range axle when in Low Range.

Torque distribution and power flow is same as Dual Range Gearing in Low Range (see page 7).



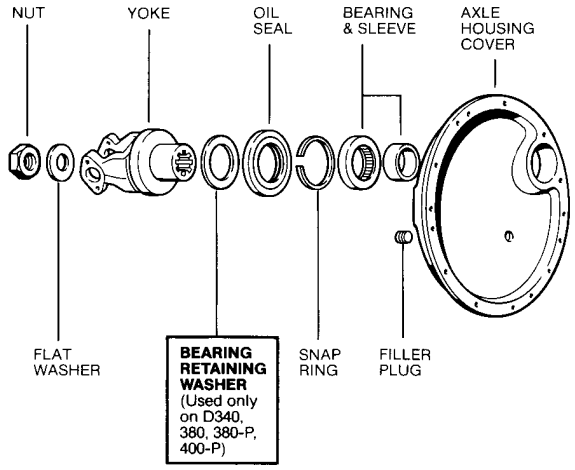
Planetary Double Reduction Gearing.

Design Variations (Dual Range and Planetary Double Reduction Axles)

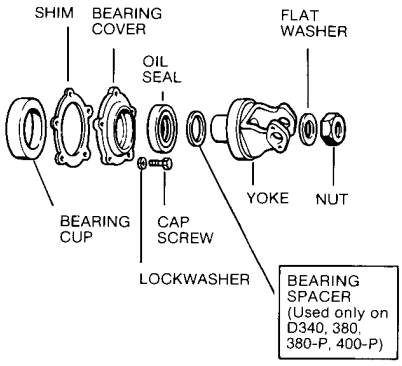
NOTE: To assist in identifying the axle being serviced, here are the major design variations within the axle series covered by this manual.

Axle Series	D340, 380(P) 400-P	D341, 381(P) 401-P, 402(P), 451-P
Output Shaft Splines		
Side Gear End	16	16
Output End	10	34
Input Shaft Splines		
Input End	16	44
Diff. End	36	36
Helical Gear	7 pitch	5 pitch
Drive Pinion Splines		
Forward Axle	10	41
Rear Axle	10	39
Drive Pinion Nut		
Forward Axle	1-1/2"-18 self-locking	1-5/8"-18 self-locking or slotted nut with roll pin M42 x 1.5 after 7/1 /95
Rear Axle	1-1/2"-18 self-locking	1-1/2"-18 self locking M36 x 1.5after 7/1/95
Axle Shaft & Side Gear Splines	D340,380(P)-16 D400-P-33	D341-39 D381(P), D402(P) -41 D401-R D451-P -33

Output Shaft Rear Bearing Retaining Washer. Used only on D340, 380, 380-P, 400-P.



Input Shaft Bearing Spacer. Used only on D340, 380, 380-P, 400-P.



Lube Pump Drive Shaft. The drive shaft on early pump models is equipped with a woodruff key. On late pump models, the key is eliminated. The drive shaft end has two machined flats and the drive gear mounting hole is shaped to accommodate these flats.

Gearing and Torque Distribution

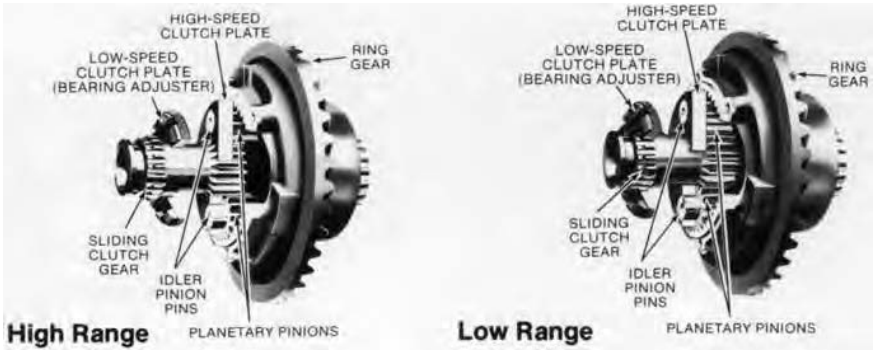
Dual Range Gearing

The gearing for each axle is a combination of a spiral bevel ring gear and pinion and a planetary unit.

First reduction (High Range) is provided by the spiral bevel gearing.

Second reduction (Low Range) is through the planetary gearing. Four planetary idler pinions are confined within the ring gear and mesh with the ring gear internal teeth. The planetary gears rotate around a sliding clutch gear.

Each axle is equipped with a shift unit, which operates the sliding clutch gear to provide means for selecting the axle range. Range selection is accomplished through the movement of the sliding clutch gear in and out of engagement with low and high-speed clutch plates.



The sliding clutch gear is locked into the high-speed clutch plate and rotates as part of the differential assembly. The planetary pinions are stationary and the axle uses only the single reduction of the ring gear and pinion. Power flow is through the drive pinion, ring gear, differential unit and axle shafts.

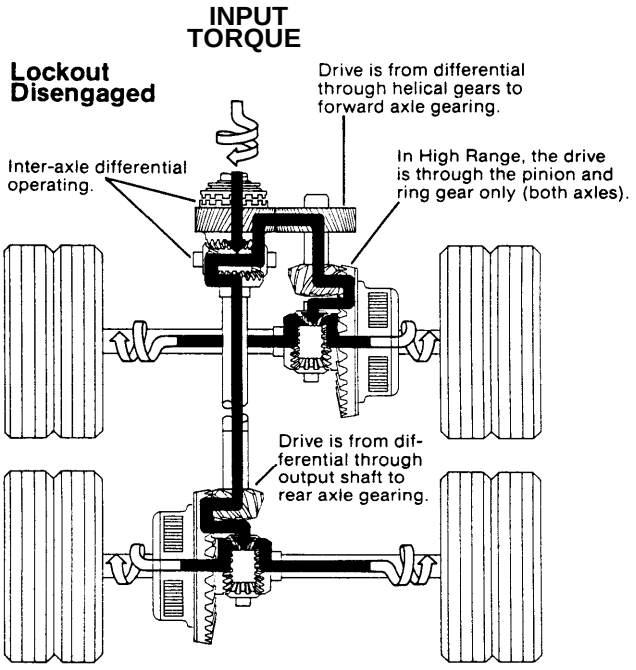
The sliding clutch gear is shifted into engagement with the low-speed clutch plate (an integral part of the bearing adjuster). The sliding clutch is held stationary and the planetary pinions are forced to rotate around it. Power flow is now through drive pinion, ring gear, planetary gearing, differential unit and axle shafts. The axle uses two reductions to multiply torque. The planetary unit adds approximately 36¡/0 more reduction to the primary gear set. Torque is multiplied on an equivalent basis.

Torque Distribution in High Range

Torque (power flow) from the vehicle driveline is transmitted to the input shaft and the inter-axle differential spider. At this point, the differential distributes torque equally to both sides.

For the forward axle, torque is transmitted from the helical-side gear to the pinion helical gear, drive pinion, ring gear, wheel differential and axle shafts.

For the rear axle, torque is transmitted from the output shaft side gear, through the output shaft, inter-axle driveline, to the drive pinion, ring gear, wheel differential and axle shafts.



Torque is transmitted to both axles through inter-axle differential action.

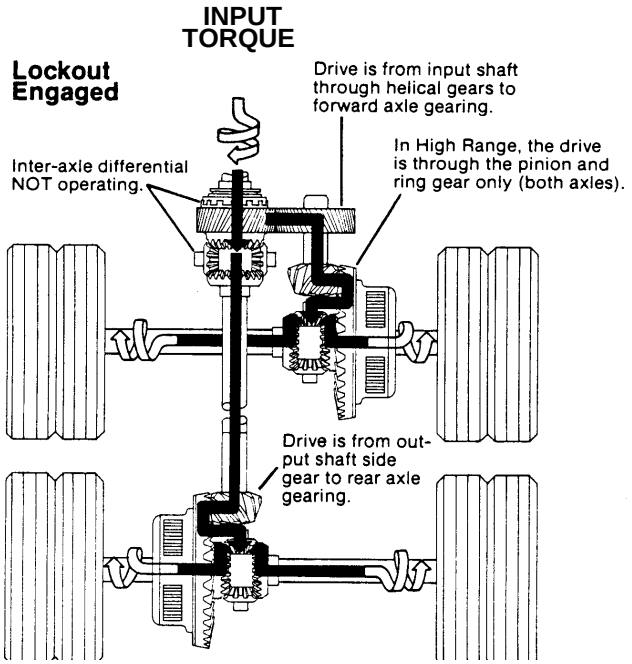
Torque Distribution in High Range (cent'd)

A lockout mechanism is incorporated in the power divider to enable the vehicle driver to lock out the inter-axle differential and provide maximum traction under adverse road conditions.

In operation, an air cylinder (controlled by a cab-mounted valve) shifts a sliding clutch. To lock out inter-axle differential action, the clutch engages the helical-side gear and causes this gear, the input shaft and differential to rotate as one assembly. This action provides a positive drive to both axles.

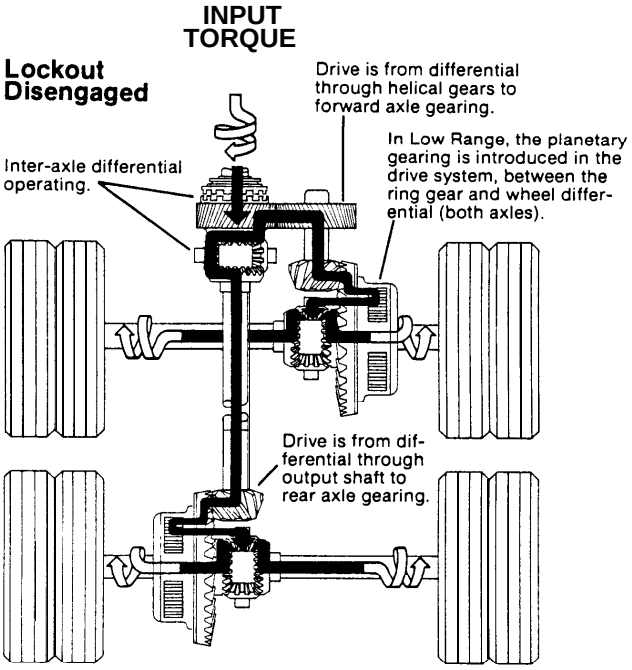
With lockout engaged, torque is distributed to both axles without differential action. The forward axle pinion and ring gear are driven by the helical-side gear. The rear axle gearing is driven from the output shaft side gear and inter-axle driveline.

NOTE: Varied road surface conditions can result in unequal torque distribution between the two axle assemblies.

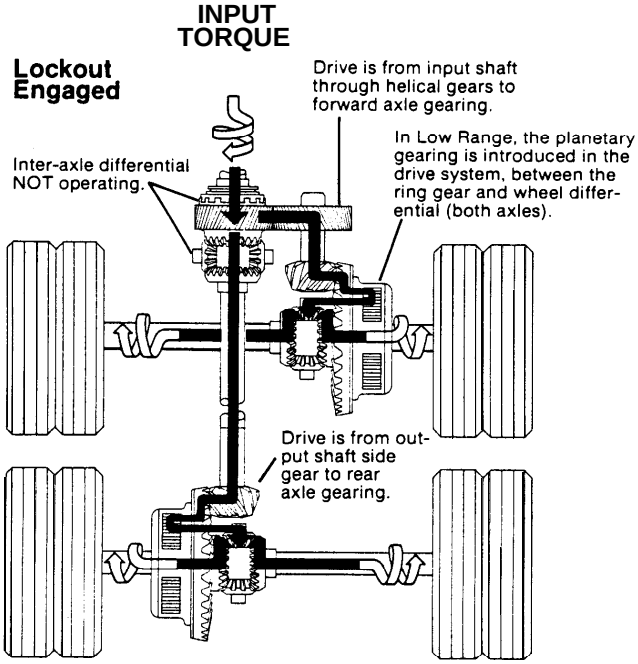


Torque is transmitted to both axles without inter-axle differential action.

Torque Distribution in Low Range



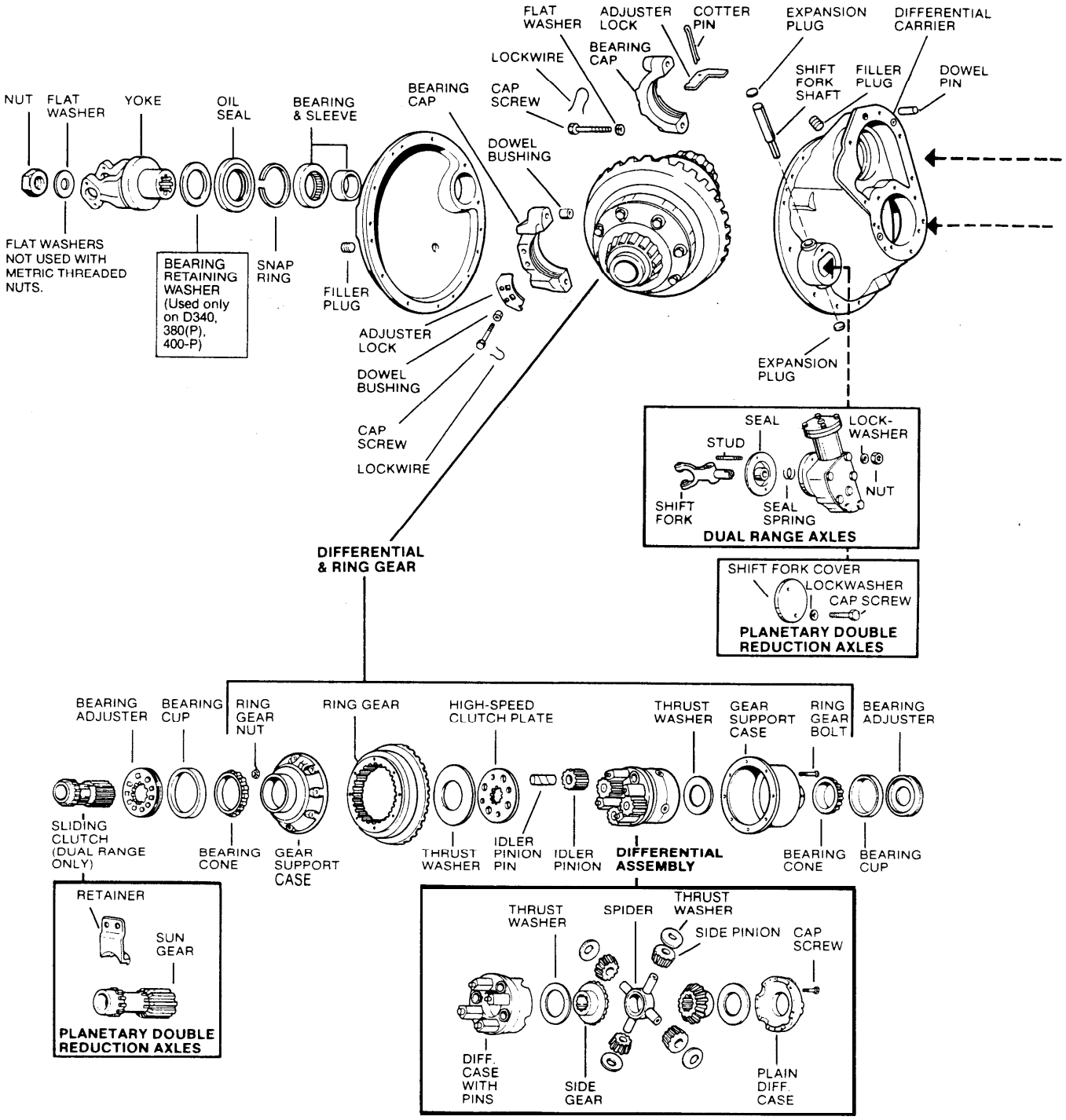
Torque is transmitted to both axles through inter-axle differential action.



Torque is transmitted to both axles without inter-axle differential action.

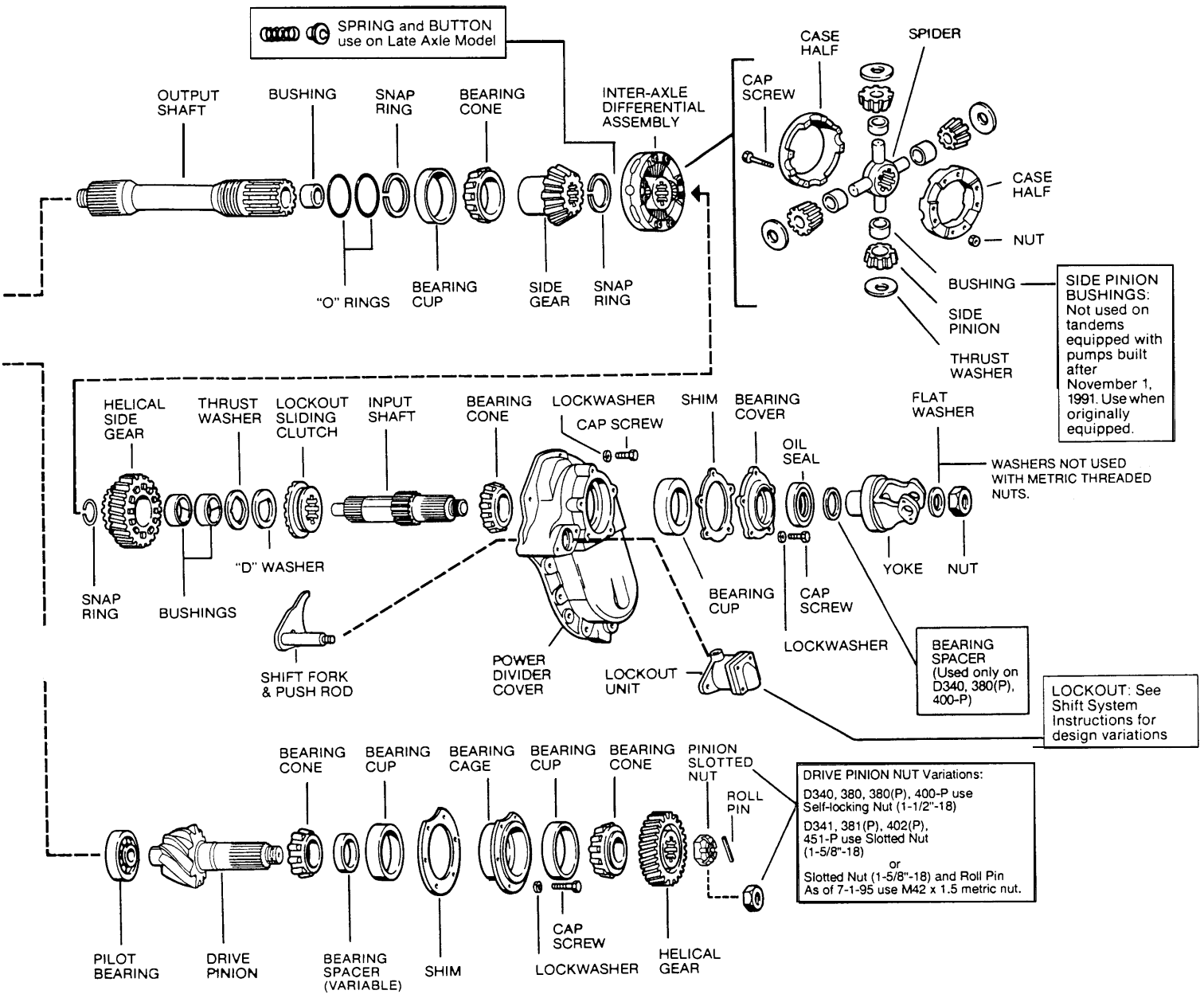
Spicer Tandem Drive Axles

Differential Carrier Assembly Forward Axle



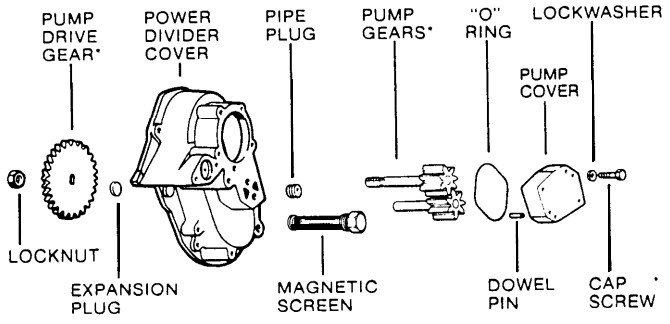
Dual Range
DT340, 310(P), 400-P
DT341, 381(P), 401-P
DT402(P), 451-P

Planetary Double Reduction
DP340, 380(P), 400-P
DP341, 381(P), 401-P
DP402(P), 451-P



IMPORTANT: Seals, Yokes and Slingers. Before replacing these parts, refer to Repair and Replacement Instructions for interchangeability information.

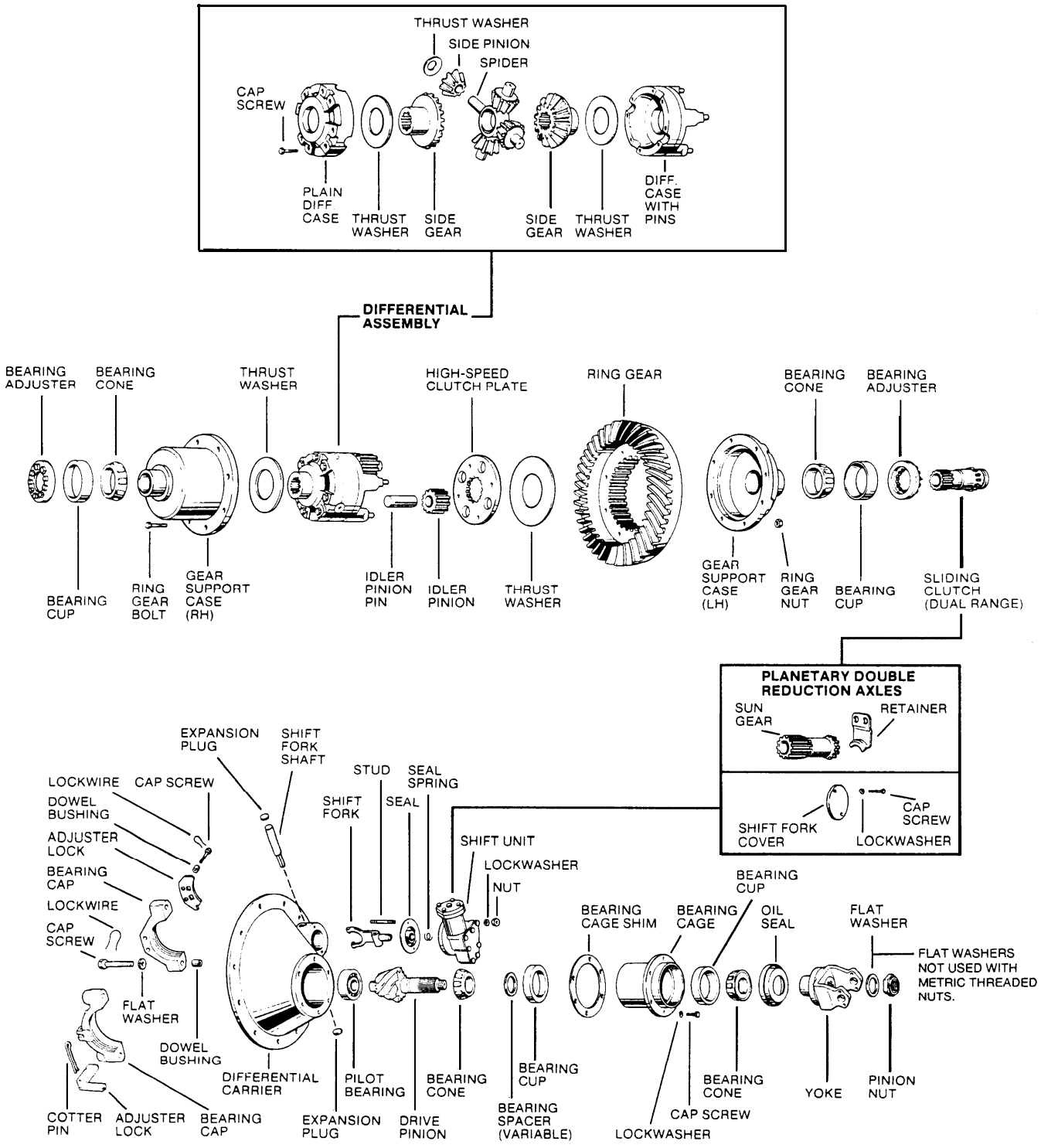
Power Divider Cover with Lube Pump



*NOTE: The drive shaft on early pump models is equipped with a woodruff key. On late pump models, the key is eliminated. The drive shaft end has two machined flats and the drive gear mounting hole is shaped to accommodate these flats.

Differential Carrier Assembly
Rear Axle

Dual Range RT340, 341, 380, 381, 400, 401,402, 451
Planetary Double Reduction RP340, 341, 380, 381, 400, 401, 402,451



Lubrication

The ability of a drive axle to deliver quiet, trouble-free operation over a period of years is largely dependent upon the use of good quality gear lubricant in correct quantity. The most satisfactory results can be obtained by following the directions contained in this manual.

The following lubrication instructions represent the most current recommendations from the Axle & Brake Division of Dana Corporation.

Approved Lubricants

General-Gear lubrications acceptable under military specification (MILSPEC) MIL-L-2105D (Lubricating Oils, Gear, Multipurpose) are approved for use in Spicer Drive Axles. The MIL-L-2105D specification defines performance and viscosity requirements for multigrade oils. It supersedes both MIL-L-21 056, MIL-L-2105C and cold weather specification MIL-L-l 0324A. This specification applies to both petroleum-based and synthetic based gear lubricants if they appear on the most current "Qualified Products List" (QPL-2105) forMIL-L-2105D.

Note: The use of separate oil additives and/or friction modifiers are not approved in Drive Axles.

Synthetic based-Synthetic-based gear lubricants exhibit superior thermal and oxidation stability, and generally degrade at a lower rate when compared to petroleum-based lubricants. The performance characteristics of these lubricants include extended change intervals, improved fuel economy, better extreme temperature operation, reduced wear and cleaner component appearance. The family of Spicer® gear lubricants represents a premium quality synthetic lube which fully meets or exceeds the requirements of MIL-L-2105D. These products, available in both 75W-90 and 80 W-1 40, have demonstrated superior performance in comparison to others qualified under the MILSPEC, as demonstrated by extensive laboratory and field testing. For a complete list of Spicerr® approved synthetic lubricants contact your local Spicer representative. See back cover of this manual for appropriate phone number.

Makeup Lube-Maximum amount of non-synthetic makeup lube is 100/o.

Viscosity/Ambient Temperature Recommendations-The following chart lists the various SAE Grades covered by MIL-L-2105D and the associated ambient temperature range from each. Those SAE grades shown with an asterisk (*) are available in the Spicer family of synthetic gear lubricants.

The lowest ambient temperatures covered by this chart are -40°F and -40°C. Lubrication recommendations for those applications which consistently operate below this temperature range, must be obtained through the Dana Corporation by contacting your local Spicer representative.

Grade	Ambient Temperature Range
75W	-40°F to -15°F (-40°C to -26°C)
75W-80	-40°F to 80°F (-40°C to 21°C)
75W-90*	-40°F to 100°F (-40°C to 38°C)
75W-140	-40°F and above (-40°C and above)
80W-90	-15°F to 100°F (-26°C to -38°C)
80W-140*	-15°F and above (-26°C and above)
85W-140	10°F and above (-12°C and above)

Lube Change Intervals

This product combines the latest manufacturing and part washing technology. **When filled with an approved synthetic lubricant at the factory, the initial drain is not required.**

Change the lubricant within the first 5,000 miles of operation when not using a approvedsynthetic lubricant in either a new axle or after a carrier head replacement. Base subsequent lubricant changes on a combination of the following chart and user assessment of the application and operating environment.

Severe Service Lubrication Change Intervals - Severe service applications are those where the vehicle consistently operates at or near its maximum GCW or GVW ratings, dusty or wet environments, or consistent operation on grades greater than 8%. For these applications, the ON/OFF HIGHWAY portion of the chart should be used. Typical applications are construction, logging, mining and refuse removal.

Note: Remove metallic particles from the magnetic filler plug and drain plugs. Clean or replace the breather at each lubricant change.

Guidelines - Lube Change Intervals for Drive Axles

Lubricant Type	On Highway Miles	Maximum Change Interval	On/Off Highway Severe Service Miles	Maximum Change Interval
Mineral Based	100,000	Yearly	40,000	Yearly
Spicer - Approved Synthetic	250,000	3 Years	100,000	Yearly

Lubrication

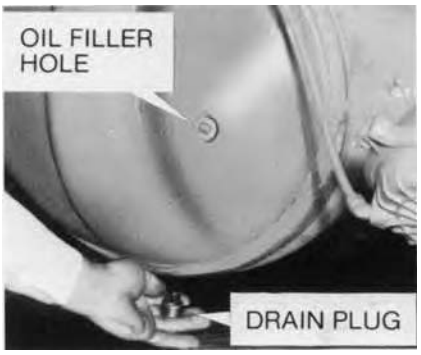
Changing Lube

Draining

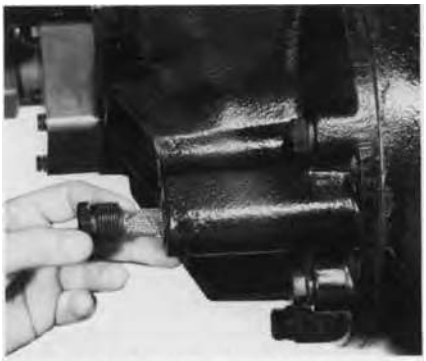
Drain when the lube is at normal operating temperature. It will run freely and minimize the time necessary to fully drain the axle.

Unscrew the magnetic drain plug on the underside of the axle housing and allow the lube to drain into a suitable container. Inspect drain plug for large quantities of metal particles. After initial oil change, these are signs of damage or extreme wear in the axle, and inspection of the entire unit may be warranted. Clean the drain plug and replace it after the lube has drained completely.

Axles with Lube Pump: Remove the magnetic strainer from the power divider cover and inspect for wear material in the same manner as the drain plug. Wash the magnetic strainer in solvent and blow dry with compressed air to remove oil and metal particles.



CAUTION: EXERCISE CARE TO DIRECT COMPRESSED AIR INTO SAFE AREA. WEAR SAFETY GLASSES.



Magnetic Strainer for Axles with Lube Pump.

Filling

Remove the filler hole plug from the center of the axle housing cover and fill the axle with approved lubricant until level with the bottom of the hole.

Forward axles: Add two pints (0.94 liters) of lubricant through filler hole at the top of the differential carrier near the power divider cover.

Oil Filler Hole at top of Differential Carrier.

NOTE: Lube fill capacities in the adjacent chart are good guidelines but will vary somewhat on the basis of the angle the axle is installed in a particular chassis.

Always use the filler hole as the final reference. If lube is level with the bottom of the hole, the axle is properly filled.

Axle Installation Angles

Axles installed at angles exceeding 10 degrees or operated regularly in areas of continuous and lengthy grades may require standpipes to allow proper fill levels.

For specific recommendations, contact your local Spicer representative.

Lube Capacities*
DO NOT OVERFILL AXLES

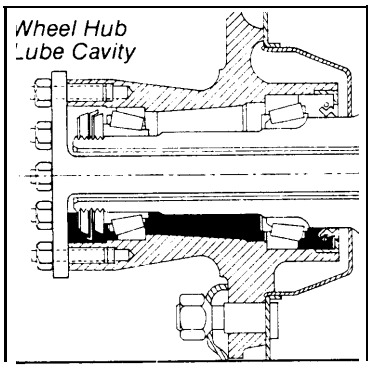
SPICER Housings (Rectangular Arm)

Dual Range and PDR Tandem Series	Forward Axle Pints (liters)	Rear Axle Pints (liters)
340, 341	38 (18.0)	35 (16.6)
380(P), 381 (P) 400-P, 401-P 402(P), 451-P	37 (17.5)	34 (16.1)

Forward Axles: Add an additional 2 pints (0.94 liters) axle lubricant through filler hole at the top of the differential carrier near the power divider cover. (See photo above.)

*Capacities listed are approximate. The amount of lubricant will vary with angle of axle as installed in vehicle chassis. Figures do not apply to housings not designed or manufactured by Spicer.

Wheel End Lubrication



IMPORTANT: In cases where wheel equipment is being installed, either new or after maintenance activity, the lube cavities are empty. Bearings and seals must be manually supplied with adequate lubricant or they will be severely damaged before the normal motion of the vehicle can supply lube to the hub ends of the housing.

To avoid the risk of premature damage to wheel bearings and seals, they must be "prelubed" any time the wheel equipment is being installed. There are three methods of doing this. The correct method will depend on the type of wheel equipment being used.

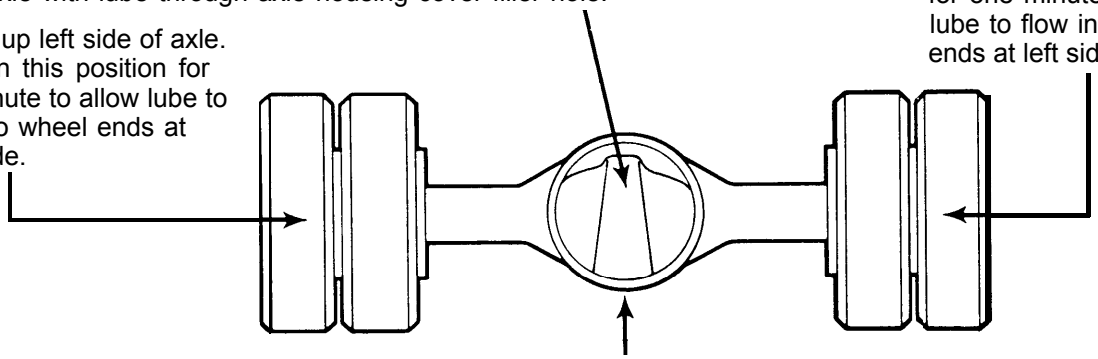
Lubrication When Hubs Have No Filler Holes (Preferred Method*)

(Follow procedure in numerical sequence.)

1. Fill axle with lube through axle housing cover filler hole.

2. Jack up left side of axle. Maintain this position for one minute to allow lube to flow into wheel ends at right side.

3. Jack up right side of axle. Maintain this position for one minute to allow lube to flow into wheel ends at left side.



4. With vehicle level again, add lube through axle housing cover filler hole. The axle should require two additional pints of lube to bring level up to bottom of filler hole.

*The above procedure is the preferred method since it optimizes the lube supply to the wheel end components and axle sump.

Alternate Method of Wheel End Lubrication

1. After the wheel hub seal has been installed, charge the hub cavity with as much axle lubricant as possible.

2. Prelube the bearings with clean axle lubricant at installation.

NOTE: If the hub has no cavity to accept a precharge of axle lube, the bearings can be prepacked with a good quality grease instead of axle lube. However, excess grease should be removed.

⚠ **CAUTION:** Exercise caution when mounting a precharged hub and drum assembly to prevent spilling lubricant on the brake linings.

Hubs Equipped with Lube Filler Holes

Pour a pint of standard axle lubricant into the hub through the cavity filler hole provided.

Cleaning, Inspection, Replacement

As the drive axle is disassembled, set all parts aside for thorough cleaning and inspection. Careful inspection will help determine whether parts should be reused. In many cases, the causes of premature wear or drive axle failure will also be revealed.

Cleaning

The differential carrier assembly may be steam-cleaned while mounted in the housing as long as all openings are tightly plugged. Once removed from its housing, do not steam clean differential carrier or any components. Steam cleaning at this time could allow water to be trapped in cored passages, leading to rust, lubricant contamination, and premature component wear. The only proper way to clean the assembly is to disassemble it completely. Other methods will not be effective except as preparatory steps in the process. Wash steel parts with ground or polished surfaces in solvent. There are many suitable commercial solvents available. Kerosene and diesel fuel are acceptable.

WARNING: GASOLINE IS NOT AN ACCEPTABLE SOLVENT BECAUSE OF ITS EXTREME COMBUSTIBILITY. IT IS UNSAFE IN THE WORKSHOP ENVIRONMENT.

Wash castings or other rough parts in solvent or clean in hot solution tanks using mild alkali solutions. If a hot solution tank is used, make sure parts are heated thoroughly, before rinsing.

Rinse thoroughly to remove all traces of the cleaning solution. Dry parts immediately with clean rags.

Lightly oil parts if they are to be reused immediately. Otherwise, coat with oil and wrap in corrosion-resistant paper. Store parts in a clean, dry place.

Inspection

Inspect steel parts for notches, visible steps or grooves created by wear. Look for pitting or cracking along gear contact lines. Scuffing, deformation or discoloration are signs of excessive heat in the axle, usually related to low lubricant levels or improper lubrication practices.

Before reusing a gear set, inspect teeth for signs of excessive wear. Check tooth contact pattern for evidence of incorrect adjustment (see Adjustment Section for correct pattern).

Inspect machined surfaces of cast or malleable parts. They must be free of cracks, scoring, and wear. Look for elongation of drilled holes, wear on surfaces machined for bearing fits and nicks or burrs in mating surfaces.

Inspect fasteners for rounded heads, bends, cracks or damaged threads.

The axle housing should be examined for cracks or leaks. Also look for loose studs or cross-threaded holes.

Inspect machined surfaces for nicks and burrs.

Repair and Replacement

IMPORTANT: To achieve maximum value from an axle rebuild, replace lower-cost parts, such as thrust washers, seals, etc. These items protect the axle from premature wear or loss of lubricants. Replacing these parts will not increase rebuild cost significantly.

It is also important to replace other parts which display signs of heavy wear even though not cracked or broken. A significant portion of such a part's useful life has been expended and the damage caused, should the part fail, is far in excess of its cost.

Steel Parts — Gear sets, differential parts and bearings are not repairable. Worn or damaged parts should be discarded without hesitation. Also discard mating parts in some cases. Gear sets for example, must be replaced in sets.

Miscellaneous Parts — Seals and washers are routinely replaced. None of these parts can be reused if damaged. Fasteners using self-locking nylon "patches" may be reused if not damaged, but should be secured by a few drops of Loctite #277 on the threaded surface of the hole during installation and carefully torqued during installation.

Axle Housings — Repairs are limited to removal of nicks or burrs on machined surfaces and the replacement of loose or broken studs.

CAUTION: ANY DAMAGE WHICH AFFECTS THE ALIGNMENT OR STRUCTURAL INTEGRITY OF THE HOUSING REQUIRES HOUSING REPLACEMENT. REPAIR BY WELDING OR STRAIGHTENING SHOULD NOT BE ATTEMPTED. THIS PROCESS CAN AFFECT THE HOUSING HEAT TREATMENT AND CAUSE IT TO FAIL COMPLETELY WHEN UNDER LOAD.

Silicone Rubber Gasket Compound — For more effective sealing, Spicer uses silicone rubber gasket compound to seal the majority of metal-to-metal mating surfaces.

Spicer includes gasket compound and application instructions in many repair parts kits.

It is recommended that this compound be used in place of conventional gaskets. The compound will provide a more effective seal against lube seepage and is easier to remove from mating surfaces when replacing parts.

Seals, Yoke & Slinger Service Information

During the 4th Quarter of 1990, Spicer began using new seals and yoke & slingers on the models in this publication. The new seals and slingers are noticeably different from the current seals and will affect interchangeability.

- The upgraded Seals **can** be used on axles originally equipped with the old seals.
- Spicer recommends the replacement of old yoke & slinger assemblies when the new seals are installed. The old yokes and slingers will work with the new seals, but new yoke and slinger assemblies provide maximum sealing protection and prevent premature seal wear due to poor yoke condition.
- New yoke and slinger assemblies **cannot** be used with the old seal design on the tandem forward axles.
- New yoke and slinger assemblies **can** be used with the old seal on the tandem rear pinions.
- Yoke Assembly & Oil Seal Kits contain oil seal, yoke & slinger and instructions.
- Most non-Spicer aftermarket seals **will not** be compatible with the new Spicer Yoke and Slinger assemblies.
- Sicer recommends the use of special installation tools conveniently packaged in a single kit (listed below).
- Refer to Spicer parts Book AXIP-0087 and Spicer Bulletin 90-06 for additional information.

Seal Driver Installation Kit 212139

Includes:

- 126917 Driver (Rear Axle Pinion)
- 127787 Adapter (use with 126917 Driver for Forward Axle Input)
- 127786 Driver (Forward Axle Output)

Adjustments

Wheel Bearing Adjustment

WARNING: Never work under a vehicle supported by only a jack. Always support vehicle with stands. Block the wheels and make sure the vehicle will not roll before releasing the brakes

Wheel bearings should be adjusted at regular intervals using the following procedure:

Wheel End Seal

Important: Wheel end seals can be easily damaged during handling. Leave the seal in its package until installation to prevent damage or contamination.

1. Remove:
   - The outer bearing and wheel.
   - The inner bearing.
   - The oil seal or grease retainer and discard.
   - The old wear sleeve (2-piece design only) with a ball peen hammer and discard.

Caution: Do not cut through the old wear sleeve. Damage to the housing may result.

2. Inspect:
   - The spindle journal and hub bore for scratches or burns. Recondition with emery cloth as required.
     Note: Deep gouges can be repaired by filling gouge with hardened gasket and smoothing with emery cloth.

3. Clean
   - The hub cavity and bearing bores before reassembly. Be sure to remove contaminants from all recesses and corners.
   - The bearings thoroughly with solvent and examine for damage. Replace damaged or worn bearings.

4. Before installation, lubricate with the same lubricant used in the axle sump.
   - The inner bearing.
   - The wheel seal following the directors provided by the seal supplier.

IMPORTANT: Always use the seal installation tool specified by the seal manufacturer. Using an improper tool can distort or damage the seal and cause premature seal failure.

Wheel Bearing Adjustment

1. Identify the wheel nut system being installed. Three systems are available:
   - Three piece Dowel-type wheel nut system-fig.1
   - Three piece Tang-type wheel nut system-Fig.2
   - Four piece Tang/Dowel type wheel nut system-Fig.3

Fig. 1 - Three piece Dowl-type wheel nut system

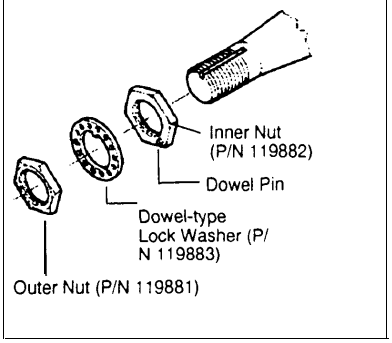


Fig. 2 - Three piece Tang-type wheel nut system

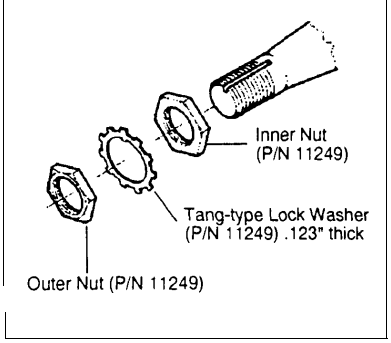
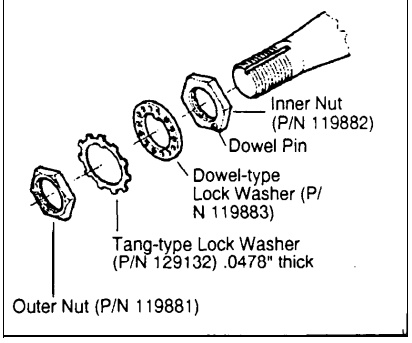


Fig. 3 - Four piece Tang/Dowel-type wheel nut system



WARNING: Do not mix spindle nuts and lock washers from different systems. Mixing spindle nuts and lock washers can cause wheel separation.

NOTE: The lock washer for a four piece-dowel-type wheel system is thinner than the lock washer for a three piece tang-type wheel nut system and is not designed to bear against the inner nut.

2. inspect the indle and nut threads for corrosion and ean thoroughly or replace as required.

Note: Proper assembly and adjustment is not possible if the spindle or nut threads are corroded.

.Inspect the tang-type washer (if used). Replace the washer if the tangs are broken, cracked, or damaged.

3. Install the hub and drum on the spindle with care to prevent damage or distortion to the wheel seal.

*** CAUTION: A wheel dolly is recommended during installation to make sure that the wheel seal is not damaged by the weight of the hub and drum. Never support the hub on the spindle with just the inner bearing and seal. This can damage the seal and cause premature failure.**

.Completely fill the hub cavity between the inner and outer bearing races with the same lubricant used in the axle sump.

4. Before installation, lubricate the outer bearing with the same lubricant used in the axle sump.

Note: Lubricate only with clean axle lubricant of the same type used in the axle sump. Do not pack the bearing with grease before installation. Grease will prevent the proper circulation of axle lubricant and may cause wheel seal failure.

5. .Install the outer bearing on the spindle.
.Install the inner nut on the spindle.
.Tighten the inner nut to 200 lbs. ft. (271 N. M.) while rotating the wheel hub.

* **CAUTION: Never use an impact Wrench to adjust wheel bearings. A torque wrench is required to assure that the nuts are property tightened.**

6. Back-off the inner nut one full turn. Rotate the wheel hub.

7. Re-tighten the inner nut to 50 lbs. ft. (68 N. M.) while rotating the wheel hub.

8. Back-off the inner nut exactly 1/4 turn.

Note: This adjustment procedure allows the wheel to rotate freely with 0.001”-0.005” (0.025mm to 0.1 27mm) end-play.

9. Install the correct lock washer for the wheel nut system being used.

THREE PIECE TANG-TYPE LOCK WASHER SYSTEM (see Fig. 2).

*Install the Tang-type lock washer on the spindle.

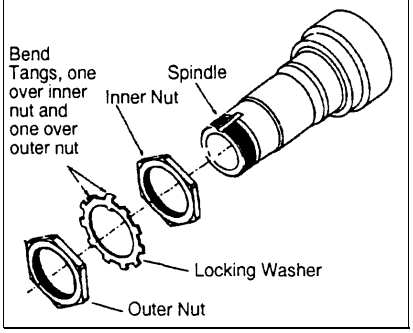
IMPORTANT: Never tighten the inner nut for alignment. This can preload the bearing and cause premature failure.

*Install the outer nut on the spindle and tighten to 250 lbs. ft. (339 N.M.).

*Verify end-play (see End Play Verification Procedure)

*After verifying end play, secure wheel nuts by bending one of the locking washer tangs over the outer wheel nut and another tang over the inner wheel nut as shown in Figure 4. (below)

Figure 4



THREE PIECE DOWEL-TYPE LOCK WASHER SYSTEM (see Fig.1)

*** Install the Dowel-type lock washer on the spindle.**

Note: If the dowel pin and washer are not aligned, remove washer, turn it over and reinstall. If required, loosen the inner nut just enough for alignment.

IMPORTANT: Never tighten the inner nut for alignment. This can preload the bearing and cause premature failure.

*Install the outer nut on the spindle and tighten to 350 lbs. ft. (475 N.M.).

*Verify end-play (see End Play Verification Procedure)

FOUR PIECE TANG/DOWEL-TYPE LOCK WASHER SYSTEM (see Fig. 3)

***** First, install the Dowel-type lock washer on the spindle.

Note: If the dowel pin and washer are not aligned, remove washer, turn it over and reinstall. If required loosen the inner nut just enough for alignment.

IMPORTANT: **Never tighten the inner nut for alignment. This can preload the bearing and cause premature failure.**

*** Install the Tang-type lock washer on the spindle.**

*** Install the outer nut on the spindle and tighten to 250** lbs. ft. (339 N m.)

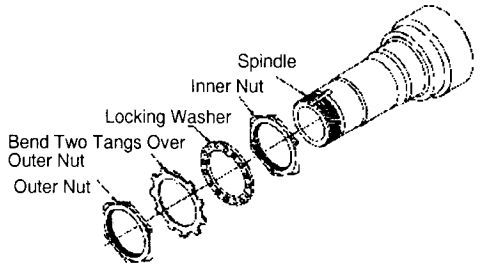
* Verify end-play (see End Play Verification Procedure)

* After verifying end play, secure the outer nut by bending two opposing (180ç apart) tangs of the locking washer over the outer nut as shown in Figure 5 (below).

10. Install
    * New gasket at axle shaft flange.
    * axle shaft.
    * Axle flange nuts and tighten to specified torque.

11. Lubricate axle wheel ends (see Wheel End Lubrication Procedure)

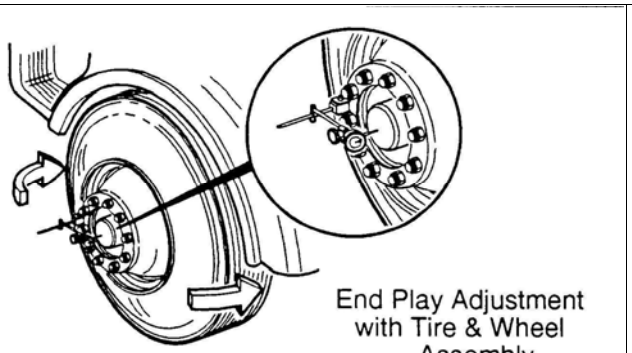
Figure 5



End Play Verification Procedure

Verify that end-play meets specification using a dial indicator. An indicator with 0.001" (0.03 mm) resolution is required. Wheel end play is the free movement of the tire and wheel assembly along the spindle axis.

a. Attach a dial indicator with its magnetic base to the hub or brake drum as shown below:



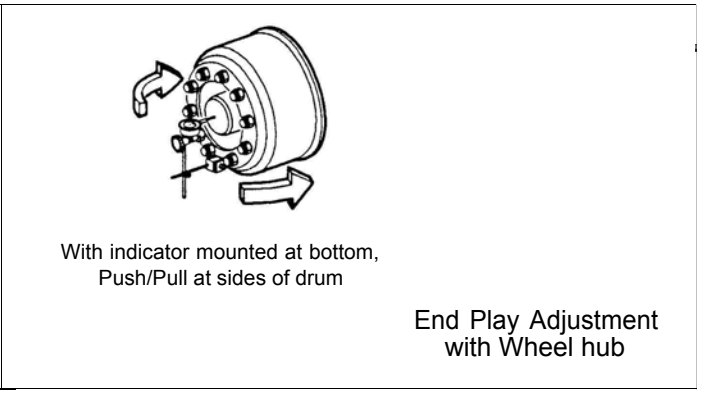


Fig. 4 End Play Measurement

b. Adjust the dial indicator so that its plunger or pointer is against the end of the spindle with its line of action approximately parallel to the axis of the spindle.

c. Grasp the wheel assembly at the 3 o'clock and 9 o'clock positions. Push the wheel assembly in and out while oscillating it to seat the bearings. Read bearing end play as the total indicator movement.

*** CAUTION: If end play is not within specification, readjustment is required.**

End Play Re-adjustment Procedure

Excessive End Play - If end play is greater than .005' (.127 mm), remove the outer nut and pull the lock washer away from the inner nut, but not off the spindle. Tighten the inner nut to the next alignment hole of the dowel-type washer (if used). Reassemble the washer and torque the outer nut. Verify end play with a dial indicator.

Insufficient End Play - If end play is not present, remove the outer nut and pull the lock washer away from the inner nut, but not off the spindle. Loosen the inner nut to the next adjustment hole of the dowel-type washer (if used). Reassemble the washer and re-torque the outer nut. Verify end play with a dial indicator.

Fine Tuning the End Play - If, after performing the readjustment procedures, end play is still not within the .001"-.005" (.025 mm to.127 mm) range, disassemble and inspect the components. If parts are found to be defective, replace the defective parts, reassemble and repeat wheel bearing adjustment procedure. Verify end play with a dial indicator.

Differential Carrier

Adjustments help provide optimum axle life and performance by correctly positioning bearings and gears under load.

The tandem axles covered in this manual require the following adjustments:

Bearing Preload: This adjustment is performed for both pinion and differential bearings. It maintains proper gear alignment by creating correct bearing cone and cup relationship for free rotation under load. The pinion pilot bearing does not require a preload adjustment.

Ring Gear Tooth Contact: This adjustent positions ring gear and pinion for best contact under load. Correct adjustment distributes torque evenly over gear teeth and helps maximize gear set life.

Input Shaft End Play (Forward Axles): This adjustment controls gear mesh in the inter-axle differential. Proper adjustment helps maximize life of all power divider parts.

Adjust Input Shaft End Play

Specifications: Input shaft end play requirements will vary with operating conditions, mileage and rebuild procedures. These variations are shown in the following chart.

Input Shaft End Play Chart

New or Rebuild with new parts 0.003" to 0.007"	**NOTE:** Because of manufacturing variations in individual parts, correctly adjusted end play could vary 0.010", after the unit is rotated.
Rebuild with reused parts 0.013" to 0.017"	

Acceptable End Play Tolerances when measuring as a regular maintenance procedure with axle in truck.

Up to 0.060" with over 100,000 miles or 1 year service off-road.	**NOTE:** If end play exceeds limits, disassemble power divider and replace worn parts.
Up to 0.040" with less than 100,000 miles or 1 year service on-road.	

Measure and Adjust End Play

IMPORTANT: In September 1988, Spicer added a Spring and a Thrust Button between the input and output shafts. End play tolerances are the same for axles with or without this Spring and Button. However, end play measurement procedure is different than-described below. Refer to Service Bulletin Supplement at back of this manual for procedure variances.

1. With power divider assembled to differential carrier, measure end pay with dial indicator positioned at yoke end of input shaft. Move input shaft axially and measure end play. If end play is not correct (see chart), adjust as follows.

2. Remove input shaft nut, flat washer and yoke. Remove bearing cover cap screws and lockwashers. Remove cover and shim pack.

3. To increase end play, add shims:

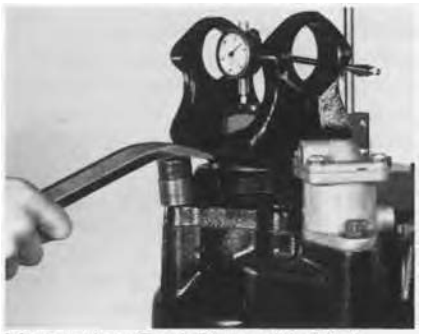
desired end play . . . . . 0.003" to 0.007"
pleasured endplay (Step)..... . . . . 0.001" - 0.001"
Add shims to provide desired end play . . . . . 0.002" to 0.006"

4. To decrease end play, remove shims:

Measured endplay (Step 1l) . . . . . 0.015" - 0.015"
desired end play . . . . . 0.003" to 0.007"
Remove shims to provide desired end play . . . . . 0.012" to 0.008"

5. To reassemble input shaft, install the adjusted shim pack and bearing cover. Install cap screws and lockwashers. Torque screws to 75-85 ft-lbs. (101-115 N.m).

NOTE: If difficulty is experienced in achieving correct torque on the input yoke nut, torque the nut with truck on the ground and axle shafts installed.



Measuring End Play with Dial Indicator.

6. Install yoke, flat washer and nut. Tighten nut snugly. Tap end of input shaft lightly to seat bearings.

7. Measure input shaft end play with dial indicator. If end play is still incorrect, repeat Steps 2 through 6.

8. With end play correct, seal shim pack to prevent lube leakage, then torque input shaft nut and cover cap screws (see chart).

NOTE: When power divider has been disassembled and reassembled, it may be desirable to adjust end play by measuring bearing cover clearance and calculating shim pack size. For procedures, see page 42.

Torque Chart

Input Shaft Nut	Ft-lbs.	N´m
1-5/8-18	780-960	1057-1301
*M42 X 1.5	840-1020	1140-1383
Bearing Cover Cap Screw		
1/2-13 (Grade 5)	75-85	101-115

*Metric Nut used on Axles produced after 7/1 /95

Adjustments

Pinion Bearing Preload

Most late model axles are provided with a “press-fit” outer bearing on the drive pinion. Some of the early model axles use an outer bearing which slips over the drive pinion. Procedures for adjusting both types of pinion bearing design are contained in this section.

Adjust Pinion Bearing Preload for Axles with “Press-fit” Outer Pinion Bearings

Trial Build-up

1. Assemble pinion bearing cage, bearings and spacer (without drive pinion or oil seal). Center bearing spacer between two bearing cones.

NOTE: When new gear set or pinion bearings are used, select nominal size spacer from the specification chart below. If original parts are used, use spacer removed during disassembly.

2. With the bearings well lubricated, place the assembly in the press. Position sleeve so that load is applied directly to the back-face of the outer bearing cone.

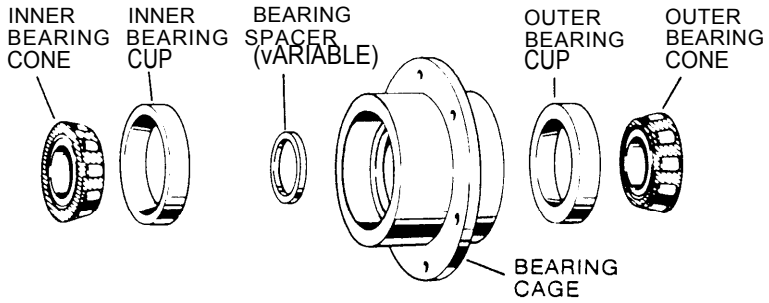
3. Apply press load (see chart below) to the assembly and check rolling torque. Wrap soft wire around the bearing cage, attach spring scale and pull. Preload is correct when torque required to rotate the pinion bearing cage is from 10-20 inch-pounds. This specification is translated into spring scale readings in the chart below.

4. If necessary, Adjust Pinion Bearing Preload by changing the pinion bearing spacer. A thicker spacer will decrease preload. A thinner spacer will increase preload.

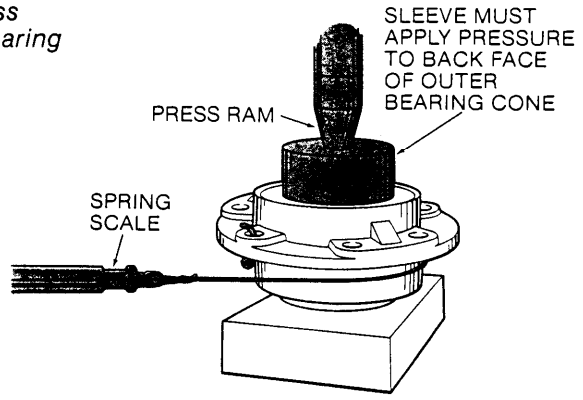
IMPORTANT: Once correct bearing preload has been established, note the spacer size used. Select a spacer 0.001” larger for use in the final pinion bearing cage assembly. The larger spacer compensates for slight “growth” in the bearings which occurs when they are pressed on the pinion shank. The trial build-up will result in proper pinion bearing preload in three of four cases.

IMPORTANT: Do not assume that all assemblies will retain proper preload once bearings are pressed on pinion shank. FINAL PRELOAD TEST MUST BE MADE IN EVERY CASE.

Assemble these Parts for Trial Build-up.



Cage in Press to Check Bearing Preload.



Specifications for Pinion Bearing Trial Build-up Preload Test (“Press-fit” Outer Pinion Bearings)					Spring Scale Reading (without pinion seal) (for 10-20 in-lbs. torque) (1.1-2.3 N•m)	
	Nominal Bearing Spacer Thickness		Press Loads			
Axle Models	in.	mm	Tons	Metric Tons	lbs.	kgs.
Forward Axles D340, 380(P), 400-P	0.638	16.21	13.5-15.5	12.2-14.0	3-7	1.4-3.2
D341, 381(P), 401-P, 402(P), 451-P	0.496	12.60	17-19	15.4-17.2	3-7	1.4-3.2
Rear Axles (ail models)	0.638	16.21	14-15	12.7-13.6	4-8	1.8-3.6

Final Pinion Bearing Preload Test

1. Assemble the complete pinion bearing cage unit as recommended in the assembly section of this manual.

NOTE: Forward axle pinion is equipped with helical gear. For easier disassembly during bearing adjustment procedure, use a dummy yoke if available) in place of helical gear.

2. Apply clamp load to the pinion bearing cage assembly. Either install the yoke (or helical gear) and torque the pinion nut to specifications or use a press to simulate nut torque (see chart below).

Vise Method - If the yoke and nut are used, mount the assembly in a vise, clamping yoke firmly.

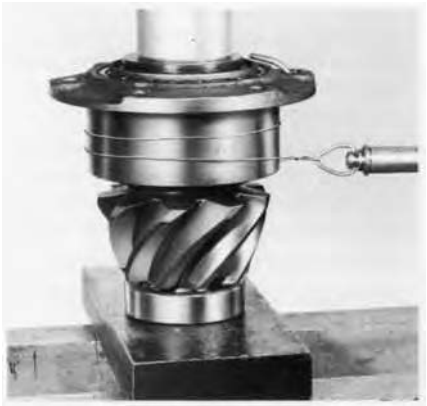
Press Method - If a press is used, position a sleeve or spacer so that load is applied directly to the back-face of the outer bearing cone.

3. Measure Pinion Bearing Preload - Use a spring scale to test the assembly rolling torque. To use the spring scale, wrap soft wire around the bearing cage, attach the scale and pull. Preload is correct when torque required to rotate the pinion bearing cage is from 15 to 35 inch pounds. This specification is translated into spring scale readings in the chart below.

4. Adjust Pinion Bearing Preload - If necessary, adjust pinion bearing preload. Disassemble the pinion bearing cage as recommended in this manual and change the pinion bearing spacer. A thicker spacer will decrease preload. A thinner spacer will increase preload.

IMPORTANT: Use the correctly sized spacer. Do not use shim stock or grind spacers. These practices can lead to loss of bearing preload and gear or bearing failure.

Measuring Bearing Preload with Pinion in Vise.



Measuring Bearing Preload with

Specifications for Final Pinion Bearing Preload Test ("Press-fit" Outer Pinion Bearing)					Spring Scale Reading (without pinion seal) (for 15-35 in-lbs. torque) (1.7-4 N.m)	
	Nut Torque		Press Loads			
Axle Models	**Ft-lbs.**	**N.m**	**Tons**	**Metric Tons**	**lbs.**	**kgs.**
Forward Axles D340, 380(P), 400-P	**SELF-LOCKING NUT** 560-700	759-949	13.5-15.5	12.2-14.0	5-12	2.3-5.4
D341, 381(P), 401-P, 402(P), 451 -P	**SELF-LOCKING NUT** 780-960	1057-1301	17-19	15.4-17.2	5-12	2.3-5.4
	SLOTTED NUT & ROLL PIN 840*	1139*	17-19	15.4-17.2	5-12	2.3-5.4
	METRIC NUT (After 7-1-95) 840-1020	1140-1383	17-19	15.4-17.2		
Rear Axles (all models)	560-700	759-949	14-15	12.7-13.6	6-14	2.7-6.4
	METRIC NUT (After 7-1-95) 575-703	774-955				

*Torque nut to 840 ft-lbs. (1139 N´m), then continue tightening nut to align nut slot to nearest hole in pinion shank.

Adjustments

Adjust Pinion Bearing Preload for Axles with ñSlip-fitî Outer Pinion Bearings

Nominal Pinion Bearing Spacers

Axle Model	Spacer Thickness in.	mm
Forward Axles		
D340, 380(P), 400-P	0.638	16.205
D341, 381(P), 401-P, 402(P), 451-P	0.492	12.497
Rear Axles (all models)	0.638	16.205

1. Lubricate bearings and assemble the drive pinion, bearings, and pinion bearing cage as recommended in the assembly section of this manual. Use the pinion bearing spacer removed from the axle during disassembly. If the original spacer cannot be used, install the nominal spacer recommended in the adjacent chart.

NOTE: Forward axle pinion is equipped with helical gear. For easier disassembly during bearing adjustment procedure, use a dummy yoke (if available) in place of helical gear.

2. Apply clamp load to the pinion bearings. Install the yoke (or helical gear) and torque the nut to specification or use a press to simulate nut torque by applying pressure to the assembly (see chart below).

Vise Method - If the yoke and nut are used, mount the assembly in a vise, clamping yoke firmly.

Press Method - If a press is used, position a sleeve or spacer so that load is applied directly to the back-face of outer pinion bearing.

3. Measure Pinion Bearing Preload - Use a spring scale to test the assembly rolling torque. To use the spring scale, wrap a soft wire around the bearing cage, attach the scale and pull. Preload is correct when torque required to rotate the pinion bearing cage is from 15 to 35 inch pounds. This specification is translated into spring scale readings in the chart below.

4. Adjust Pinion Bearing Preload - If necessary, adjust pinion bearing preload. Disassemble the pinion bearing cage as recommended in this manual and change the pinion bearing spacer. A thicker spacer will decrease preload. A thinner spacer will increase preload.

IMPORTANT: Use the correctly sized spacer. Do not use shim stock or grind spacers. These practices can lead to loss of bearing preload and gear or bearing failure.

Measuring Bearing Preload with Pinion in Vise.

Measuring Bearing Preload with Pinion in Press.

Specifications for Final Pinion Bearing Preload Test ("Press-fit" Outer Pinion Bearing)					Spring Scale Reading (without pinion seal) (for 15-35 in-lbs. torque) (1.7-4 N.m)	
	Nut Torque		Press Loads			
Axle Models	**Ft-lbs.**	**N.m**	**Tons**	**Metric Tons**	**lbs.**	**kgs.**
Forward Axles	**SELF-LOCKING NUT**					
D340, 380(P), 400-P	560-700	759-949	13.5-15.5	12.2-14.0	5-12	2.3-5.4
D341, 381 (P), 401-P, 402(P), 451-P	**SELF-LOCKING NUT**					
	780-960	1057-1301	17-19	15.4-17.2	5-12	2.3-5.4
	SLOTTED NUT & ROLL PIN					
	840*	11 39*	17-19	15.4-17.2	5-12	2.3-5.4
	METRIC NUT (After 7-1-95)					
	840-1020	1140-1383	17-19	15.4-17.2		
Rear Axles (all models)	560-700	759-949	14-15	12.7-13.6	6-14	2.7-6.4
	METRIC NUT (After 7-1-95)					
	575-703	774-955				

*Torque nut to 840 ft-lbs. (1.139 N´m), then continue tightening nut to align nut slot to nearest hole in pinion shank.

Differential Bearing Preload and Ring Gear Backlash Adjustment

Correct differential bearing preload insures proper location of these bearings under load and helps position the ring gear for proper gear tooth contact.

(Follow procedures in numerical sequence.)

Adjust Diff. Bearing Preload

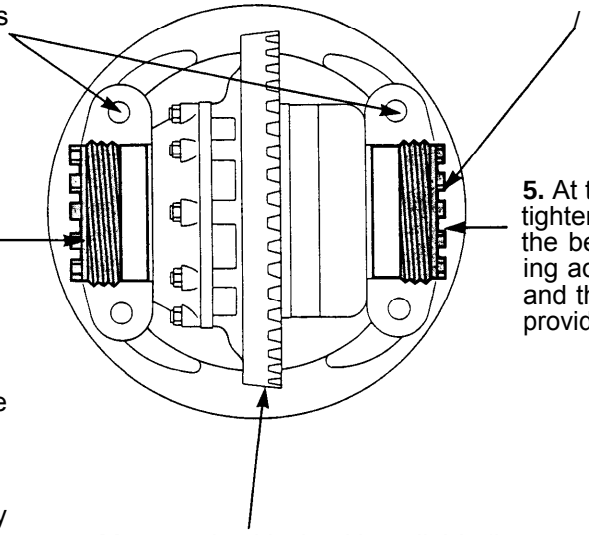
1. Lubricate differential bearings.

IMPORTANT: When installing bearing caps and adjuster, exert care not to cross threads.

2. Install adjusters and bearing caps. Tighten bearing cap screws finger-tight. If this is difficult, use a hand wrench.

NOTE: Ring gear position for rear axle is illustrated.

3. Loosen the bearing adjuster on the same side as the ring gear teeth until its first thread is visible.



4. Tighten the bearing adjuster on the back-face side of the ring gear until there is no backlash.

This can be tested by facing the ring gear teeth and pushing the gear away from the body while gently rocking the gear from side to side. There should be no free movement.

Rotate the ring gear and check for any point where the gear may bind. If such a point exists, loosen and retighten the back side adjuster. Make all further adjustments from the point of tightest mesh.

5. At teeth side of ring gear, tighten adjuster until it contacts the bearing cup. Continue tightening adjuster two or three notches and this will preload bearings and provide backlash.

6. Measure backlash with a dial indicator.

USED GEARING — Reset to backlash recorded before disassembly.

NEW GEARING — Backlash should be between 0.006” and 0.016”. If backlash is incorrect, proceed as described below to readjust.

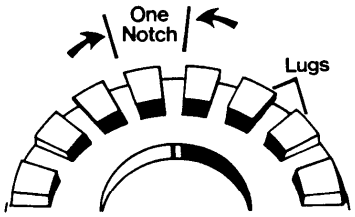
Adjust Ring Gear Backlash

To **add** backlash: Loosen the adjuster on the teeth side of the ring gear several notches. Loosen the opposite adjuster one notch.

Return to adjuster on teeth side of the ring gear and tighten adjuster until it contacts the bearing cup. Continue tightening the same adjuster 2 or 3 notches. Recheck backlash.

To **remove** backlash: Loosen the adjuster on the teeth side of the ring gear several notches. Tighten the opposite adjuster one notch.

Return to adjuster on teeth side of ring gear and tighten adjuster until it contacts the bearing cup. Continue tightening the same adjuster 2 or 3 notches. Recheck backlash.



Moving adjuster one notch is the movement of the lead edge of one adjuster lug to the lead edge of the next lug past a preselected point.

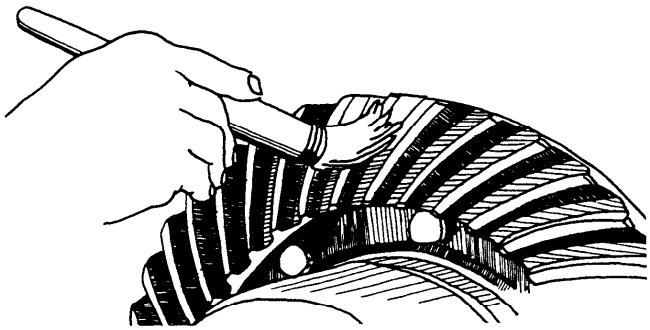
Adjustments

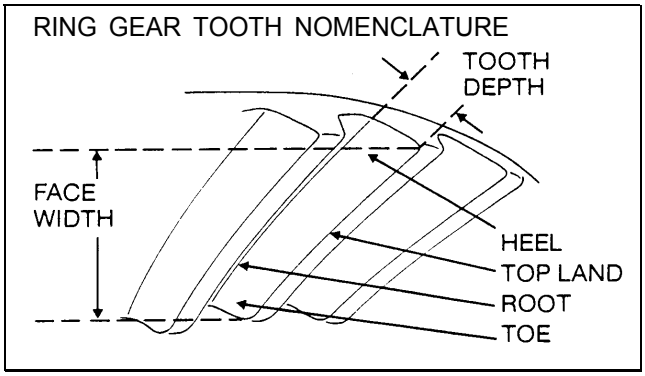
R ing Gear and Pinion Tooth Contact

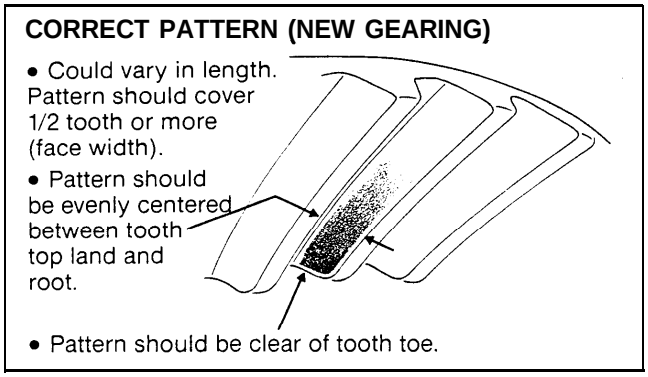
NOTE: Rear axle gearing is shown in the following instructions. Correct tooth contact patterns and adjustments are the same for forward and rear axles.

Check Tooth Contact Pattern (NEW GEAR)

Paint twelve ring gear teeth with marking compound and roll the gear to obtain a contact pattern. The correct pattern is well-centered on the ring gear tooth with lengthwise contact clear of the to the length of the pattern in an unloaded condition is approximately one-half to two-thirds of the ring gear tooth in most models and ratios.



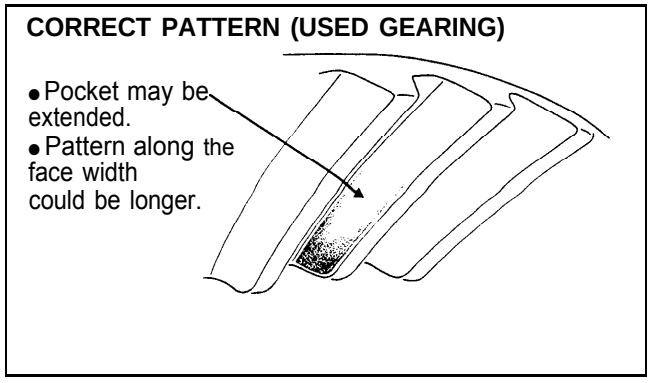




Check Tooth Contact Pattern (USED GEAR)

Used gearing will not usually display the square, even contact pattern found in new gear sets. The gear will normally have a “pocket” at the toward of the gear tooth which tails into a contact line along the root of tooth. The more use a gear has had, the more the line becomes the dominant characteristic of the pattern.

Adjust used gear sets to display the same contact pattern observed before disassembly. A correct pattern is clear of the toe and centers evenly along the face width between the top land and root. Otherwise, the length and shape of the pattern are highly variable and is considered acceptable as long as it does not run off the tooth at any point.



Adjust Tooth Contact Pattern

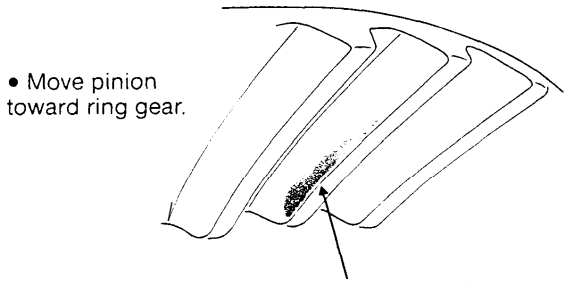
If necessary, adjust the contact pattern by moving the ring gear and drive pinion. Ring gear position controls the backlash. This adjustment moves the contact pattern along the face width of the gear tooth. Pinion position is determined by the size of the pinion bearing cage shim pack. It controls contact on the tooth depth of the gear tooth.

These adjustments are interrelated. As a result, they must be considered together even though the pattern is altered by two distinct operations. When making adjustments, first adjust the pinion, then the backlash. continue this sequence until the pattern is satisfactory.

Adjust Pinion Position

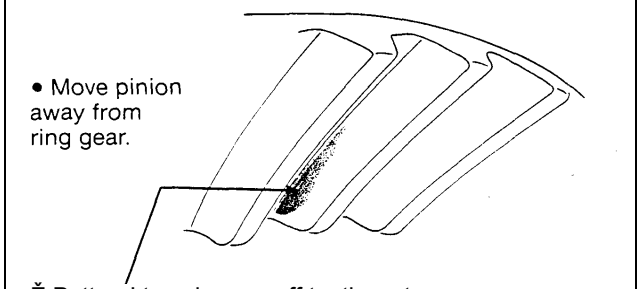
If the gear pattern shows incorrect tooth depth contact, change drive pinion position by altering the shim pack. Used gears should achieve proper contact with the same shims removed from the axle at disassembly.

INCORRECT PATTERN



If the pattern is too close to the top land of the gear tooth, remove pinion shims.

INCORRECT PATTERN

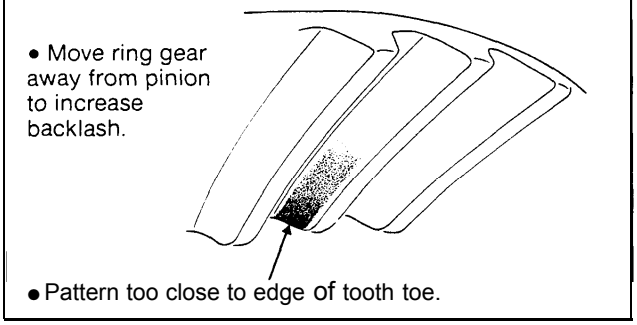


If the pattern is too close to the root of the gear tooth, add pinion shims.

NOTE: Check ring gear backlash after each shim change and adjust if necessary to maintain the 0.006" to 0.016" specifications.

If the gear pattern shows incorrect face width contact, change backlash.

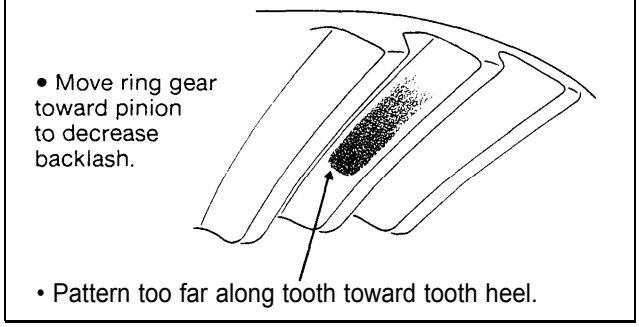
INCORRECT PATTERN



With the pattern concentrated at the toe (too far down the tooth), **add backlash** by loosening the bearing adjuster on the teeth side of ring gear several notches. Loosen the opposite adjuster one notch.

Return to adjuster on teeth side of ring gear and tighten adjuster until it contacts the bearing cup. Continue tightening the same adjuster 2 or 3 notches. Recheck backlash.

INCORRECT PATTERN



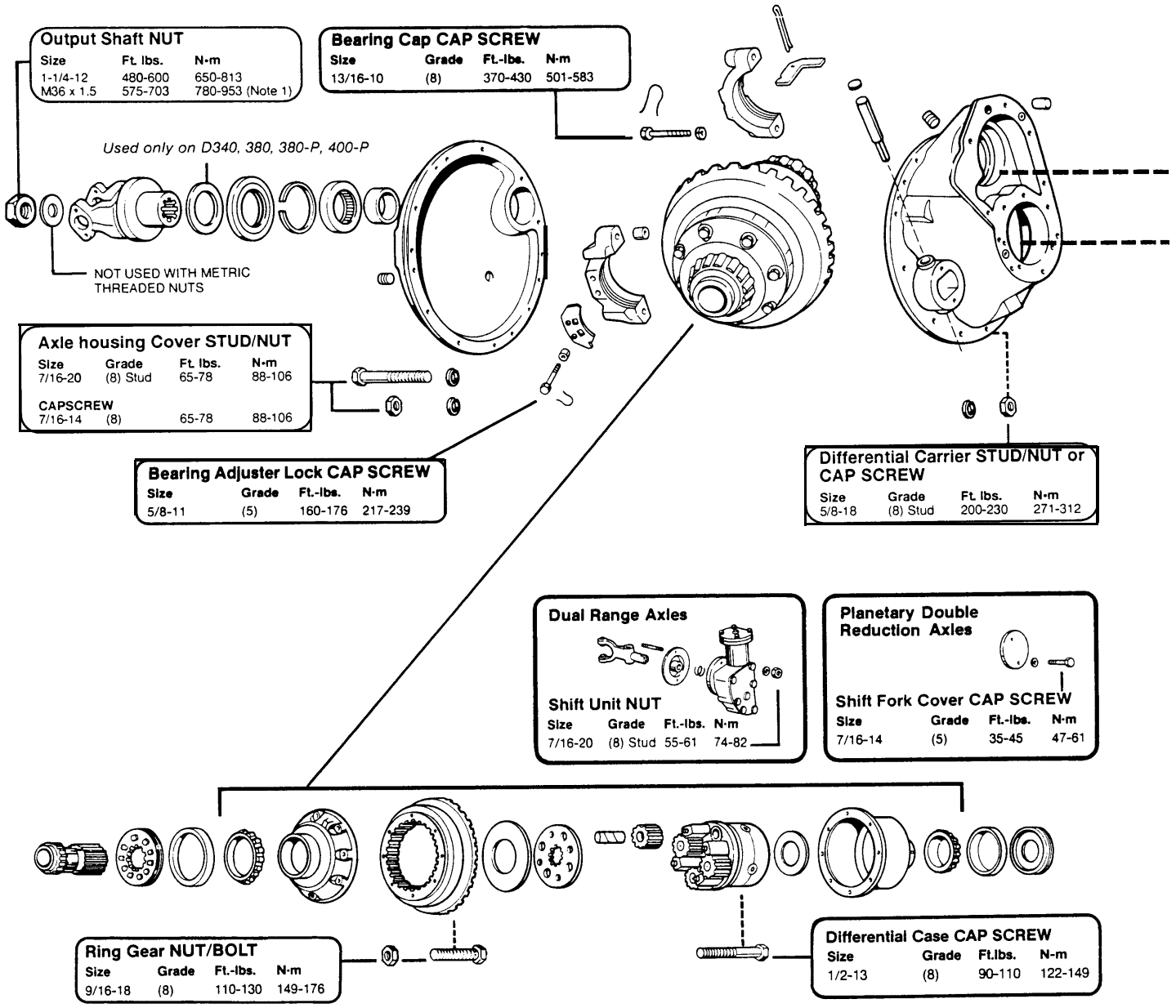
If the pattern is concentrated at the heel (too far up the tooth), **remove backlash** by loosening the bearing adjuster on the teeth side of ring gear several notches. Tighten the opposite adjuster one notch

Return to adjuster on teeth side of ring gear and tighten adjuster until it contacts the bearing cup. Continue tightening the same adjuster 2 or 3 notches. Recheck backlash.

Fastener Tightening Specifications

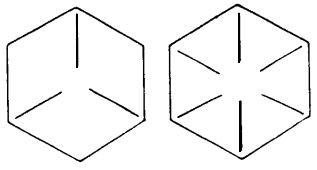
Specifications are for all axle models unless specified otherwise.

Forward Axles



- Correct tightening torque values are extremely important to assure long Spicer Axle life and dependable performance. Under-tightening of attaching parts is just as harmful as over-tightening.
- Exact compliance with recommended torque values will assure the best results.
- The data includes fastener size, grade and torque tightening values. Axle models are included to pinpoint identification of fasteners for your particular axle.
- To determine bolt or cap screw grade, check for designation stamped on bolt head (see illustration).

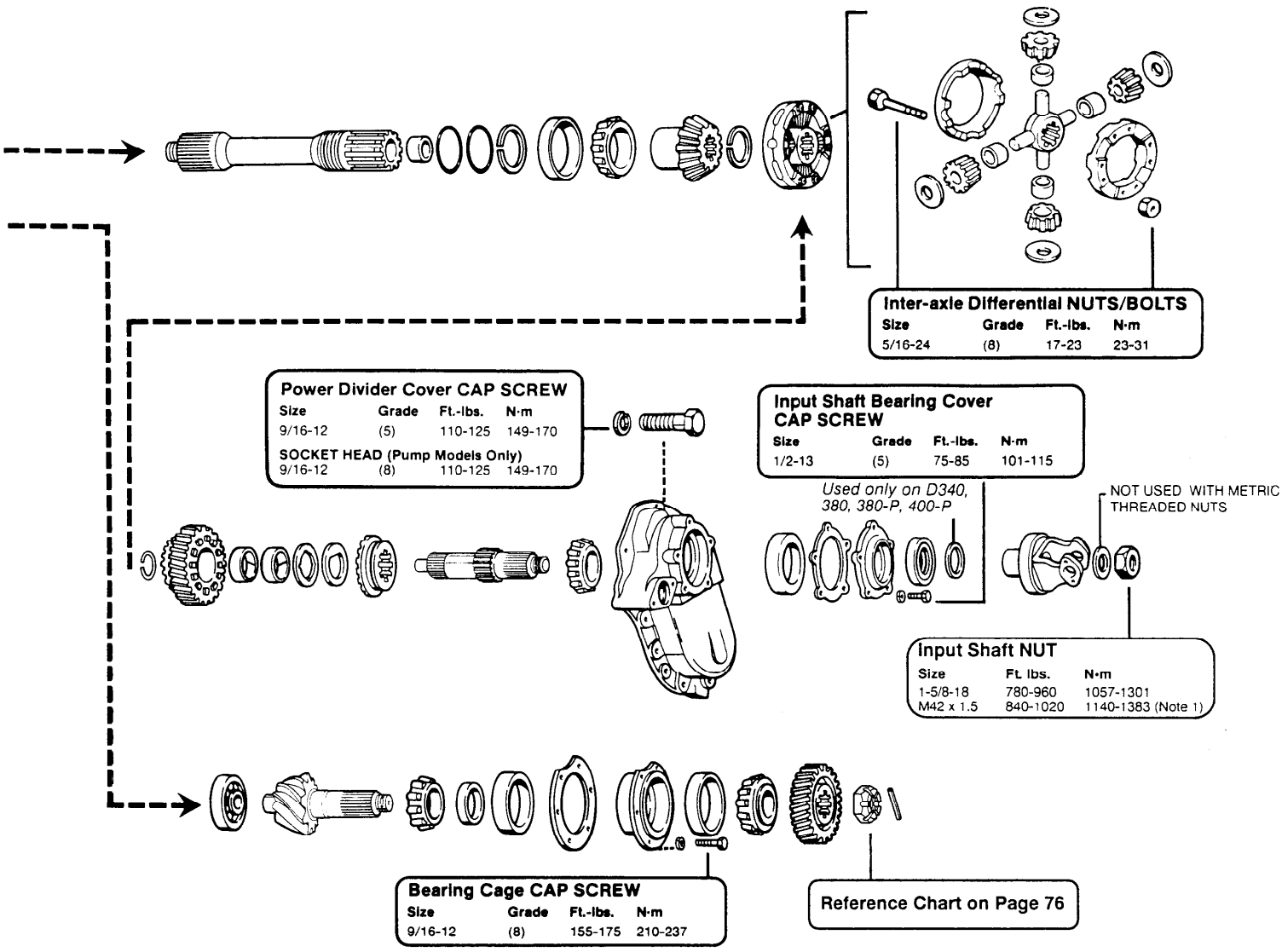
Bolt head markings for grade identification



Grade 5 **Grade 8**

REFERENCE MISC. TORQUE FASTENING CHART ON PAGE 76

NOTE 1: METRIC NUTS used on Axles produced after 7-1-95. Reference chart on page 76



Inter-axle Differential NUTS/BOLTS

Size	Grade	Ft.-lbs.	N·m
5/16-24	(8)	17-23	23-31

Power Divider Cover CAP SCREW

Size	Grade	Ft.-lbs.	N·m
9/16-12	(5)	110-125	149-170
SOCKET HEAD (Pump Models Only)			
9/16-12	(8)	110-125	149-170

Input Shaft Bearing Cover CAP SCREW

Size	Grade	Ft.-lbs.	N·m
1/2-13	(5)	75-85	101-115

Used only on D340, 380, 380-P, 400-P

NOT USED WITH METRIC THREADED NUTS

Input Shaft NUT

Size	Ft. lbs.	N·m
1-5/8-18	780-960	1057-1301
M42 x 1.5	840-1020	1140-1383 (Note 1)

Bearing Cage CAP SCREW

Size	Grade	Ft.-lbs.	N·m
9/16-12	(8)	155-175	210-237

Reference Chart on Page 76

Lockouts

	Size	Grade	Ft.-lbs.	N.m.
★ Current Model				
Housing Bracket Cap Screw	7/16-14	(5)	48-56	65-76
Push Rod Nut	3/8-24	—	13-17	18-23
★ Non-Current Model				
Body Cap Screw	7/16-14	(5)	48-56	65-76
Body Cover Cap Screw	1/4-20	(5)	96-108 (in.-lbs.)	10-12
Push Rod Nut	3/8-24	—	20-26	27-35

★ Service instructions, see 60 - 69.

Lube Pump

Cover CAP SCREW

Size	Grade	IN-LBS.	N·m
1/4-20	(5)	85-105	10-12

Drive Gear LOCKNUT

Size	Ft.-lbs.	N·m
7/16-20	35-45	47-61

Cover PIPE PLUG & Filter Screen

Size	Ft.-lbs.	N·m
3/4-14	40-60	54-81

***NOTE:** The drive shaft on early pump models is equipped with a woodruff key. On late pump models, the key is eliminated. The drive shaft end has two machined flats and the drive gear mounting hole is shaped to accommodate these flats.

REFERENCE MISC. TORQUE FASTENING CHART ON PAGE 76

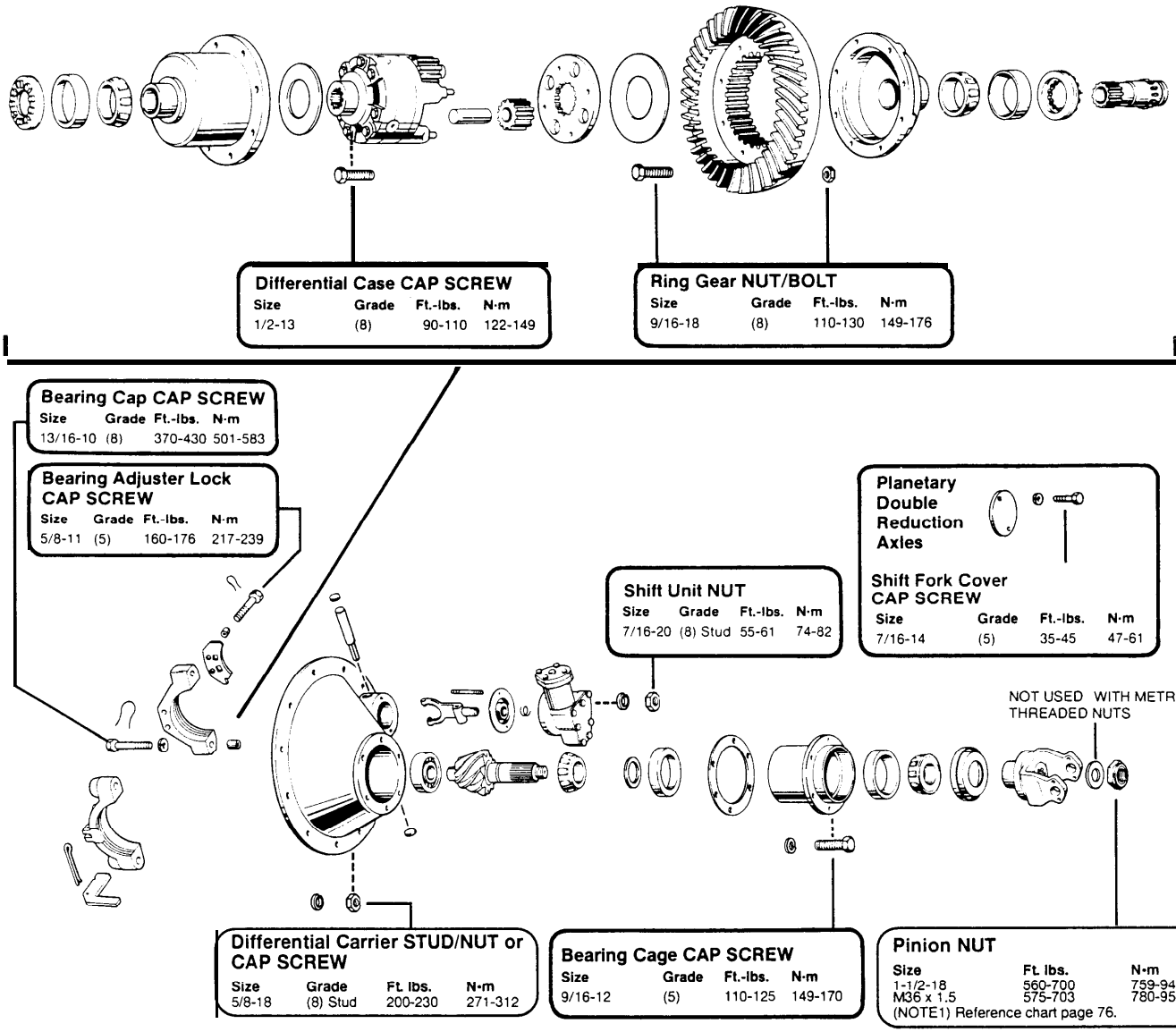
NOTE 1: METRIC NUTS used on Axles produced after 7-1-95. Reference chart on page 76

Fastener Tightening Specifications:

Specifications are for all axle models unless specified otherwise.

Rear Axles

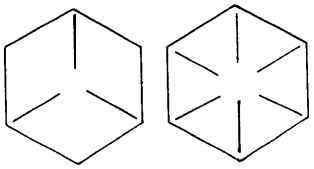
Dual Range RT340, 341,380, 381,400,401,402,451
Planetary Double Reduction RP340, 341, 380, 381,400, 401, 402, 451



- Correct tightening torque values are extremely important to assure long Spicer Axle life and dependable performance. Under-tightening of attaching parts is just as harmful as over-tightening.
- Exact compliance with recommended torque values will assure the best results.
- The data includes fastener size, grade and torque tightening values. Axle models are included to pinpoint identification of fasteners for your particular axle.
- To determine bolt or cap screw grade, check for designation stamped on bolt head (see illustration).

REFERENCE MISC. TORQUE FASTENING CHART ON PAGE 76

Bolt head markings for grade identification

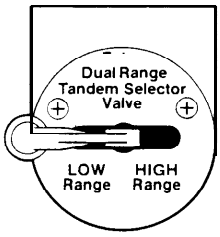


Grade 5 **Grade 8**

NOTE 1: METRIC NUTS used on Axles produced after 7-1-95. Reference chart on page 76

Rear Axle Differential Carrier Replacement

Remove Differential Carrier Assembly from Axle Housing



1. Dual Range Axle Only — Shift Axle to Low Range.

2. Drain axle lubricant.

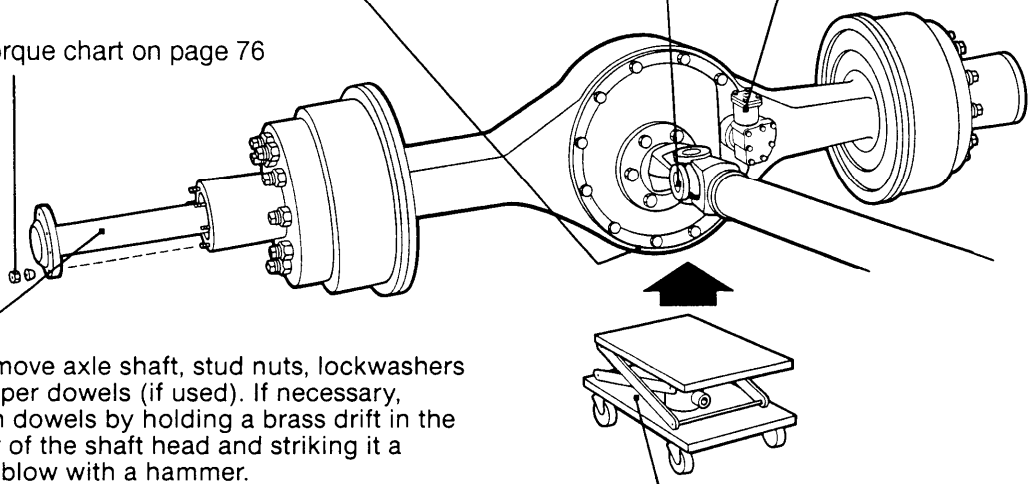
3. Disconnect drive shaft.

NOTE: For easier disassembly, the drive pinion nut can be loosened after drive shaft is disconnected.

5. Dual Range Axle Only — Disconnect shift unit air lines. Remove shift unit.

NOTE: When shift unit is removed, provide container to catch oil that escapes from reservoir.

See torque chart on page 76



4. Remove axle shaft, stud nuts, lockwashers and taper dowels (if used). If necessary, loosen dowels by holding a brass drift in the center of the shaft head and striking it a sharp blow with a hammer.

IMPORTANT: Do not strike the shaft head with a hammer. Do not use chisels or wedges to loosen shaft or dowels.

⚠ **6. WARNING:** DO NOT LIE UNDER CARRIER AFTER FASTENERS ARE REMOVED. USE TRANSMISSION JACK TO SUPPORT AND REMOVE DIFFERENTIAL CARRIER ASSEMBLY.

Remove nuts and washers fastening carrier to axle housing.

Remove differential carrier assembly.

Install Differential Carrier Assembly

IMPORTANT: Before installing carrier assembly, inspect and thoroughly clean interior of axle housing.

NOTE: Use silicone rubber gasket compound on axle housing mating surface as shown in the illustration. Compound will set in 20 minutes. Install carrier before compound sets or reapply.

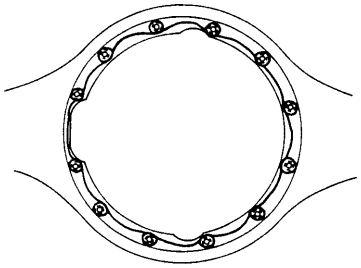
1. Install differential carrier assembly in axle housing. Install stud nuts and lockwashers. Tighten to correct torque **(see chart pg. 76).**

2. Install axle shafts and stud nuts. (If used, also install lockwashers and taper dowels.)

3. Connect inter-axle driveline.

4. Fill axle with correct lube (see Lubrication Section).

5. Dual Range Axle Only. Install shift unit, nuts and lockwashers. Torque nuts to 55-61 ft.-lbs. (74-82 N•m). Connect air line.



Axle Housing Silicone Gasket Compound Pattern.

IMPORTANT: When axle has been disassembled or housing, gears, axle shafts or wheel equipment replaced, check axle assembly for proper differential action before operating vehicle. Wheels must rotate freely and independently.

Forward Axle Differential Carrier Replacement

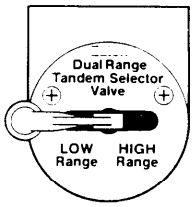
Remove Differential Carrier Assembly from Axle Housing

IMPORTANT:
D341, 381(P), 401-P, 402(P), 451-P models do NOT use an output shaft Rear Bearing Retaining Washer

WARNING: THE OUTPUT SHAFT REAR BEARING RETAINING WASHER IS FREQUENTLY LOST WHEN THE DIFFERENTIAL CARRIER ASSEMBLY IS REMOVED. IT MAY ADHERE TO THE YOKE, TO THE FACE OF THE OUTPUT SHAFT BEARING, FALL ON THE FLOOR OR INTO THE HOUSING. LOCATE THIS WASHER BEFORE CONTINUING! IF IT IS NOT REINSTALLED, THE END OF THE YOKE WILL WEAR THE OUTPUT SHAFT BEARING VERY QUICKLY. IF IT IS LEFT IN THE HOUSING, IT CAN BE PICKED UP BY THE RING GEAR MOTION AND CAUSE PREMATURE AXLE FAILURE.

(Follow procedure in numerical sequence.)

1. Dual Range Axle only — shift axle to Low Range.

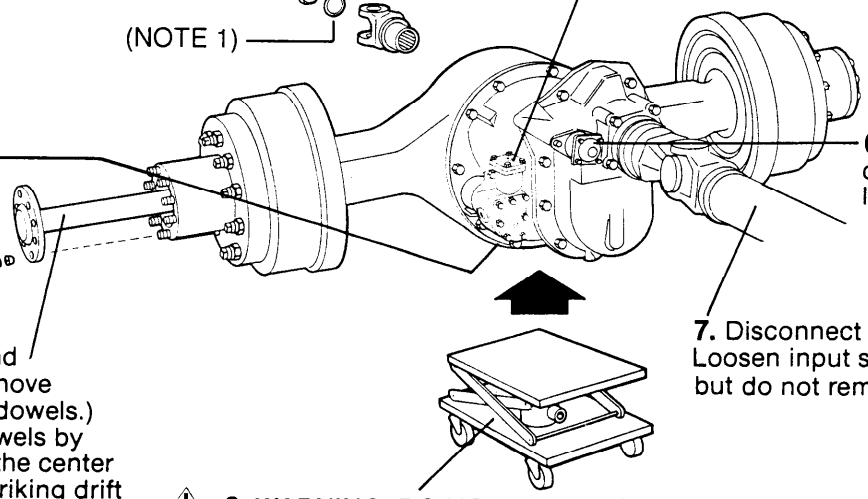


3. Disconnect inter-axle driveline.

4. Remove output shaft nut, flat washer and yoke.

5. Dual range axle only — Disconnect shift unit air line. Remove shift unit.

(NOTE 1)



2. Drain axle lubricant.

6. Disconnect differential lockout air line.

See torque chart pg. 76

7. Disconnect main driveline. Loosen input shaft yoke nut but do not remove.

8. Remove stud nuts and axle shafts. (If used, remove lockwashers and taper dowels.) If necessary, loosen dowels by holding a brass drift in the center of the shaft head and striking drift a sharp blow with a hammer.

IMPORTANT: Do not strike the shaft head with a hammer. Do not use chisels or wedges to loosen shaft or dowels.

⚠ **9. WARNING:** DO NOT LIE UNDER CARRIER AFTER FASTENERS ARE REMOVED. USE TRANSMISSION JACK TO SUPPORT DIFFERENTIAL CARRIER ASSEMBLY.

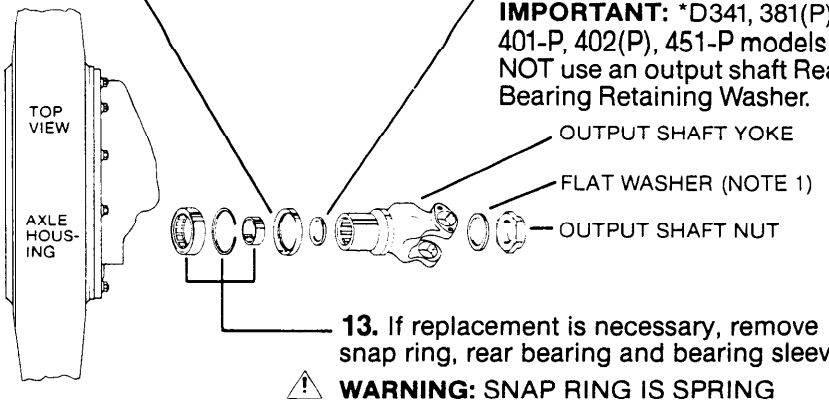
Remove nuts and lockwashers fastening carrier to axle housing. Remove differential carrier assembly.

10. Axle Housing Cover and Output Shaft Bearing Parts.
The bearing parts can be replaced with cover removed or installed. If necessary, remove axle housing cover. It is fastened with cap screws, nuts and lockwashers.

11. Remove oil seal and discard.

12. Remove bearing retaining washer.*

IMPORTANT: *D341, 381(P), 401-P, 402(P), 451-P models do NOT use an output shaft Rear Bearing Retaining Washer.



13. If replacement is necessary, remove snap ring, rear bearing and bearing sleeve.

⚠ **WARNING:** SNAP RING IS SPRING STEEL AND MAY POP OFF. WEAR SAFETY GLASSES WHEN REMOVING.

NOTE 1: Flat washer not used on axles with metric threaded nuts.

Install Differential Carrier Assembly

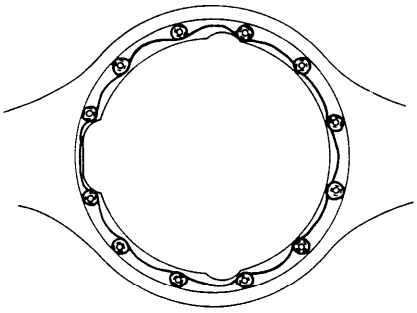
IMPORTANT:
D341, 381(P), 401-P, 402(P), 451-P models do NOT use an output shaft Rear Bearing Retaining Washer

WARNING: WHEN INSTALLING DIFFERENTIAL CARRIER ASSEMBLY, IT IS IMPORTANT TO FOLLOW CORRECT PROCEDURES TO ASSURE USEFUL LIFE. FAILURE TO CORRECTLY INSTALL REAR BEARING AND RETAINING WASHER COULD RESULT IN PREMATURE AXLE FAILURE.

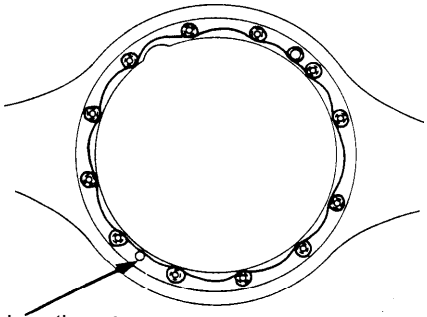
IMPORTANT: Before installing carrier assembly, inspect and thoroughly clean interior of axle housing.

NOTE: Use silicone rubber gasket compound on axle housing mating surface as shown in the illustrations. Compound will set in 20 minutes. Install carrier and axle housing cover before compound sets or reapply.

SILICONE GASKET COMPOUND PATTERN. DIFFERENTIAL CARRIER MATING SURFACE.



SILICONE GASKET COMPOUND PATTERN. HOUSING COVER MATING SURFACE.

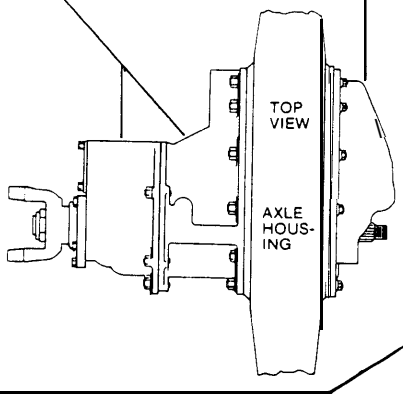


Location of hole in rear cover.

(Follow procedure in numerical sequence.)

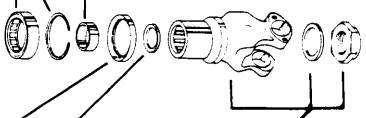
1. Apply silicone gasket compound. Install differential carrier assembly in axle housing. Install nuts and " lockwashers. Tighten to correct torque. **Reference torque chart page 76.**

2. **Axle Housing Cover and Output Shaft Bearing Parts.** If removed, install cover and fasten with nuts, cap screws and lockwashers. Tighten to correct torque. If removed install bearing parts (see steps 3 through 6).



3. Install output shaft rear bearing. Tap the outer race (with a sleeve or drift) until it is seated firmly in the machined pocket of the cover. Secure with snap ring.

4. Lubricate and install the rear bearing sleeve on the output shaft. Make certain it fits snugly against the shoulder at the forward edge of the shaft splines.



5. Install a new output shaft' seal in the axle housing cover * until flush with chamfer in bore. Lubricate the seal inner diameter to prevent damage during yoke installation.

6. Slide the rear bearing retaining washer over the splines of the outer shaft until it seats flush against the output shaft bearing.

IMPORTANT: *D341, 381 (P), 401-P, 402(P), 451-P models do NOT use an output shaft Rear Bearing Retaining Washer.

7. Install output yoke, flat washer and self-locking nut. Tighten to correct torque. Ref. chart on page 26, 76.

NOTE: Flat washer not used with metric threaded nuts.

8. Install axle shafts, and stud nuts (if used, also install lock-**washers and taper dowels).**

9. Connect main and inter-axle drivelines.

10. Fill axle with correct lubricant (see Lubrication Section).

11. Connect differential lockout air line.

12. Dual Range Axle only — Install shift unit, nuts and lockwashers. Torque nuts to 55-61 ft.-lbs. (74-82 N.m). Connect air line.

IMPORTANT: When axle has been disassembled or housing, gears, axle shafts or wheel equipment replaced, check axle assembly for proper differential action before operating vehicle. Wheels must rotate freely and independently.

***IMPORTANT See page 15** for service information on Seals, Yokes & Slingers.

Power Divider Replacement

(with differential carrier assembled to axle housing)

Removing and Installing Power Divider.

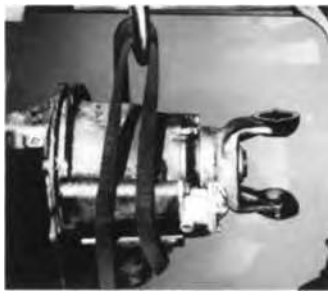
The power divider can be replaced with the axle assembly in or out of chassis and with differential carrier assembled to axle housing.

WARNING: DURING REMOVAL AND INSTALLATION, THE POWER DIVIDER ASSEMBLY MUST BE SUPPORTED AS A SAFETY PRECAUTION. DURING REMOVAL OR INSTALLATION, THE INTER-AXLE DIFFERENTIAL MAY FALL FROM CARRIER. EXERCISE CAUTION TO PREVENT DAMAGE OR INJURY.

With axle out of chassis, use chain hoist. Fasten chain to input yoke to remove power divider.

NOTE: Lifting mechanism may create nicks and burrs on input yoke. Remove if present.

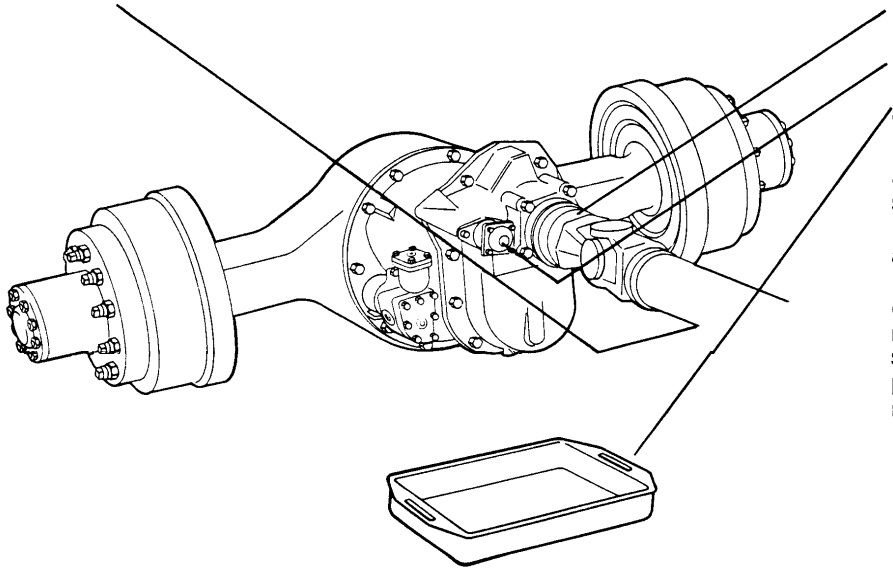
With axle installed in chassis, use a transmission jackãor a chain hoist and a sling. Wrap sling strap around power divider and attach to chain hoist hook as shown in photos.



Removing Power Divider with Chain Hoist and Sling.

Remove Power Divider from Differential Carrier

1. Disconnect main driveline.



2. Loosen, but do not remove input yoke nut.

3. Disconnect lockout air line.

4. Position drain pan under power divider cover.

5. To remove power divider assembly, remove cover cap screws and lockwashers. Support power divider (see instructions above). Then, tap back-face of input yoke to dislodge cover from differential carrier. If cover does not dislodge easily, strike the sides of the cover near the dowel pin locations (see illustration). Drain lube.

CAUTION: DURING REMOVAL of POWER DIVIDER, THE INTER-AXLE DIFFERENTIAL MAY FALL FROM CARRIER. EXERT CAUTION TO PREVENT DAMAGE OR INJURY.

6. Pull power divider assembly forward until it is completely free of carrier, then remove the assembly.

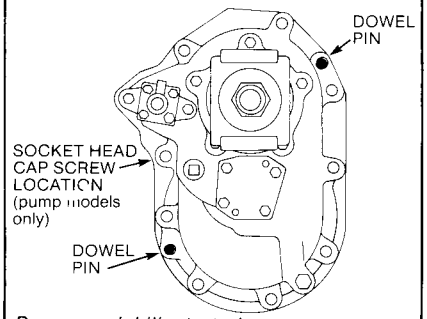
7. Inter-axle Differential. With power divider removed, the inter-axle differential can be lifted off output shaft side gear (see photo on page 33).

NOTE: Late Model Axles may be equipped with a Spring and Thrust Button mounted between input and output shafts (see Service Bulletin Supplement at back of this manual).

8. Output Shaft. If necessary, remove output shaft as follows: Disconnect inter-axle driveline. Remove nut, flat washer and output shaft yoke. Pull output shaft assembly out of carrier (see photo on page 33).

9. Axle Housing Cover and Output Shaft Bearing Parts. If necessary, remove these parts following instructions on page 30.

Power Divider Cover Dowel Pin Locations



Pump model illustrated

Install Power Divider on Differential Carrier

ïwith carrier assembled to axle housing)

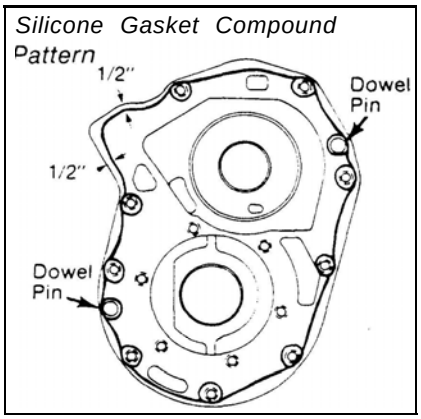
NOTE: Lubricate all parts before installation.

1. Axle Housing Covet and Output Shaft Bearing Parts. If removed, install these parts following instructions on page 31.

2. Output Shaft. If removed, lubricate "O" rings, then install shaft assembly in differential carrier and housing cover. Lubricate seal lip. Make sure yoke is clean and dry, then install yoke, flat washer and self-locking nut. Torque nut to 480-600 ft.-lbs. (650-813 Nm),

NOTE: Late Model Axles may be equipped with a spring and thrust button mounted in end of output shaft. (see page 74).

3. Inter-axle Differential. Install this assembly on output shaft side gear (with nuts facing away from side gear).



4. Power Divider Assembly. Use silicone rubber gasket compound on differential carrier mating surface as shown in the illustration.

NOTE: Compound will set in 20 minutes. Install power divider before compound sets or reapply.

⚠ **CAUTION:** DURING INSTALLATION OF POWER DIVIDER, THE INTER-AXLE DIFFERENTIAL MAY FALL FROM CARRIER. EXERT CAUTION TO PREVENT DAMAGE OR INJURY.

5. Make certain dowel pins are installed in carrier (see drawing above), then install power divider assembly.

Use a transmission jack or a chain hoist and sling (see photo).

During installation, rotate input shaft to engage input shaft splines with inter-axle differential. After installation, again rotate input shaft to check for correct assembly. Output shaft should turn when input shaft is rotated.

6. Install power divider cover cap screws and lockwashers. On pump models only, install socket-head cap screw in correct location (see drawing on preceding page). Torque cap screw to 110-125 ft.-lbs. (149-170 Nm).

7. Check and Adjust Input Shaft Play. With power divider assembled to differential carrier. Check end play with dial indicator. If necessary adjust end play (see page 19 or Service Bulletin Supplement Page 74). After input shaft end play is within specifications complete assembly procedure follows:

8. Connect drivelines. Connect lockout air line.

9. Fill axle to proper lube level (see Lubrication Section).

IMPORTANT: When axle has been disassembled or housing, gears, axle shafts or wheel equipment replaced, check axle assembly for proper differential action before operating vehicle. Wheels must rotate freely and independently.

Installing Power *Divider Assembly with Chain Hoist and Sling.*

Measuring Input Shaft End Play with Dial Indicator.

Power Divider Overhaul

Remove Power Divider from Differential Carrier

(with carrier removed from axle housing)

NOTE: It is assumed that the differential carrier and power divider assembly have been removed from axle housing (see page 30) prior to starting the following procedures:

1. Mount differential carrier in repair stand. Loosen input shaft nut.

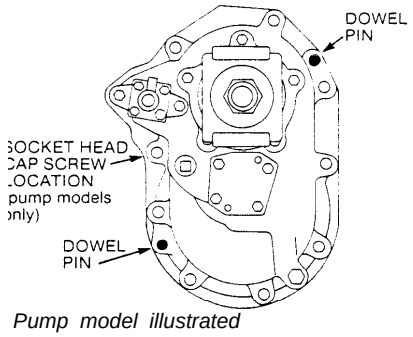
2. Remove power divider cover cap screws and lockwashers.

CAUTION: DURING REMOVAL OF POWER DIVIDER, THE INTER-AXLE DIFFERENTIAL MAY FALL OFF INPUT SHAFT FROM DIFFERENTIAL CARRIER. EXERT CAUTION TO PREVENT DAMAGE OR INJURY.

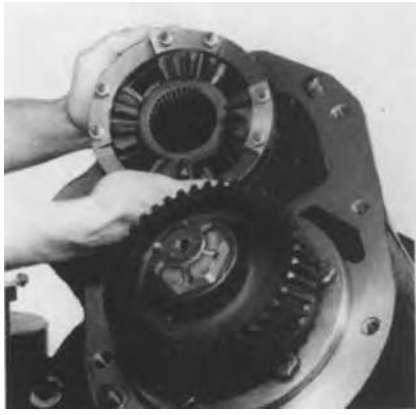
3. Attach chain hoist to input yoke and lift power divider off carrier. If power divider does not separate easily, strike the cover near the dowel pin locations with a mallet (see illustration).

NOTE: Lifting mechanism may create nicks or burrs on input yoke. Remove if present.

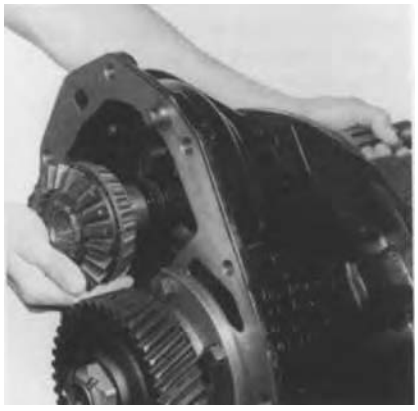
Power Divider Cover Dowel Pin Location.



Pump model illustrated



4. Inter-axle Differential. Lift differential assembly off output shaft side gear.



5. Output Shaft. Tilt carrier and remove the output shaft assembly.

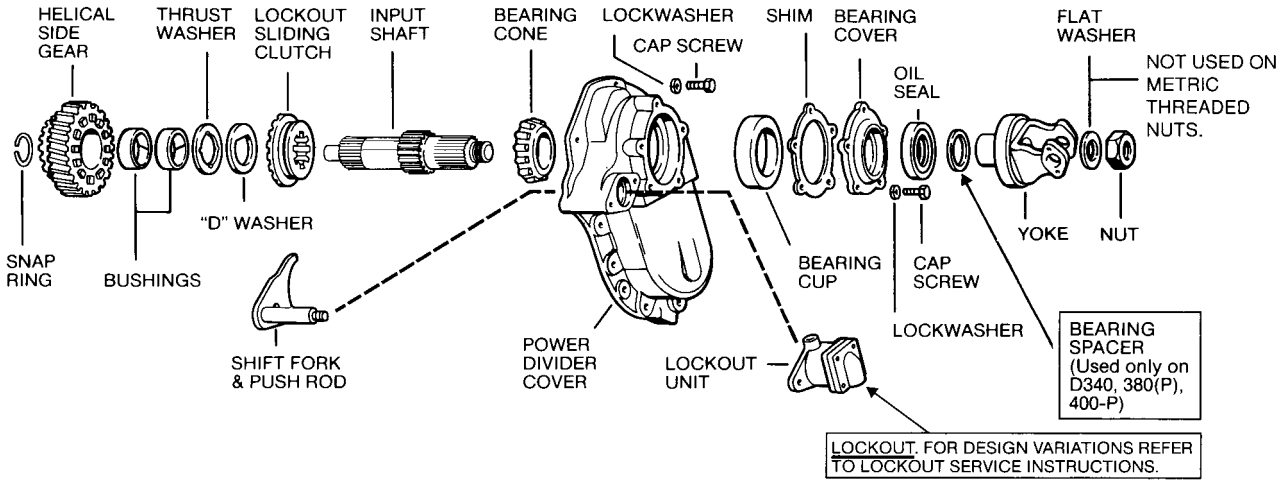
6. **Output Shaft Side Gear Bearing Cup.** If replacement is necessary, use puller to remove bearing cup from carrier.

NOTE: Late Model Axles may be equipped with a Spring and Thrust Button mounted between input and **output shafts (see Service Bulletin at back of this manual).**

NOTE: For instructions on removing axle housing cover and output shaft rear bearing parts, see page 30.

Disassemble Power Divider Cover

Power Divider Cover and Input Shaft (without Lube Pump)



1. Remove snap ring from machined groove at rear of input shaft.

WARNING: SNAP RING IS SPRING STEEL AND MAY POP OFF WEAR SAFETY GLASSES WHEN REMOVING. WITH SNAP RING REMOVED, THE HELICAL SIDE GEAR MAY FALL OFF SHAFT. EXERT CARE TO PREVENT DAMAGE OR INJURY.

Slide helical-side gear off input shaft, then remove bronze thrust washer and "D" washer from shaft.

2. Axles with Lube Pump. At this point in disassembly, it is desirable to remove lube pump drive gear nut. Hold input shaft yoke to secure drive gear, then loosen and remove drive gear nut.

3. Remove nut, flat washer and yoke from input shaft.

NOTE: Axles with metric threaded nuts do not use a flat washer.

4. Remove cap screws, lock-washers and input bearing cover and shim pack.

5. Slide input shaft assembly out of cover. Remove bearing spacer from shaft (used only on D340, 380, 380-P, 400-P).

6. NOTE: Remove Lockout, Sliding Clutch and Shift Fork. Starting with axles built early in 1991, the sliding clutch and helical slide gear curvic teeth diameter was increased to provide g rester tooth engagements. For additional parts and service information, refer to Spicer Bulletin 91-01.

Power Divider Overhaul

Disassemble Power Divider Cover (Cont'd)

Step 6 *(cont'd).*

To remove the "larger-diameter" sliding clutch, first remove the lockout (see Shift System Section). Then remove the sliding clutch and shift fork (with the two parts engaged). Grasp the assembly by hand and maneuver the assembly past restrictions in the power divider cover.

To remove the "smaller-diameter" sliding clutch, (used on earlier model axles), the clutch can be disengaged and removed without removal of the lockout and shift fork.

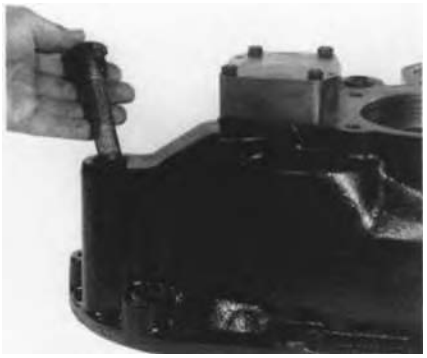
7. Remove oil seal from input bearing cover. Remove bearing cup from cover.

8. Remove input shaft bearing cone. Temporarily place lockout sliding clutch over rear of input shaft, teeth toward bearing cone. Place shaft in press and remove bearing cone.

9. Axles with Lube Pump: With drive gear locknut previously removed (step 2) and working through power divider cover input shaft bore, gently pry oil pump drive gear from its shaft. See steps 10 thru 12 for pump disassembly.

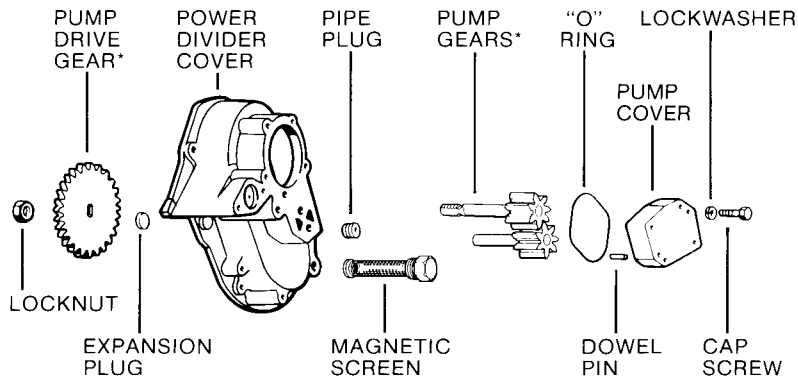
10. Remove oil pump cover cap screws and lockwashers. Remove pump cover and "O" ring.

11. *NOTE: When used, remove woodruff key from gear shaft, Remove pump gears from power divider cover.



12. Unscrew and remove magnetic screen from power divider cover.

Power Divider Cover with Lube Pump



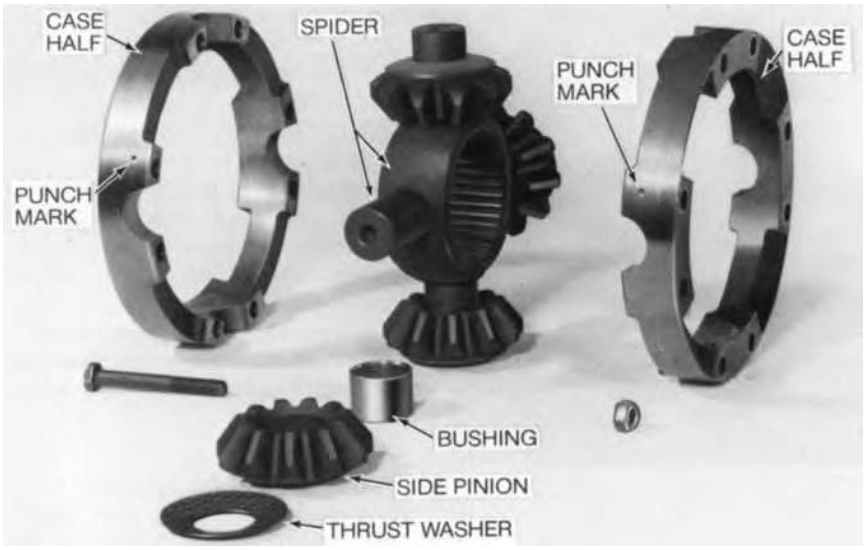
***NOTE:** The drive shaft on early pump models is equipped with a woodruff key. On late pump models, the key is eliminated. The drive shaft end has two machined flats and the drive gear mounting hole is shaped to accommodate these flats.

Disassemble Inter-axle Differential

1. Punch mark differential case halves for correct position during reassembly.

2. Remove locknuts and bolts. Separate case halves and remove thrust washers, side pinions, bushings, and spider.

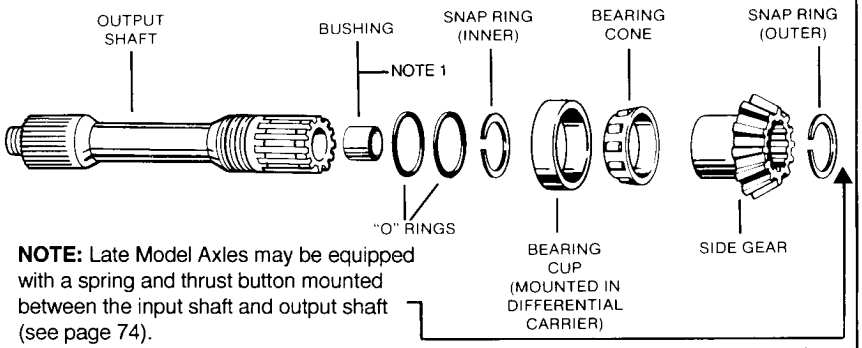
NOTE: Side Pinion Bushings. Not used on tandems built after November 1, 1991. Use when originally equipped. Current production Inter-Axle Differential Assemblies are only serviced as a complete assembly.



"Non-Current Production" Inter-Axle Differential.

Disassemble Output Shaft

Output Shaft Assembly



NOTE: Late Model Axles may be equipped with a spring and thrust button mounted between the input shaft and output shaft (see page 74).

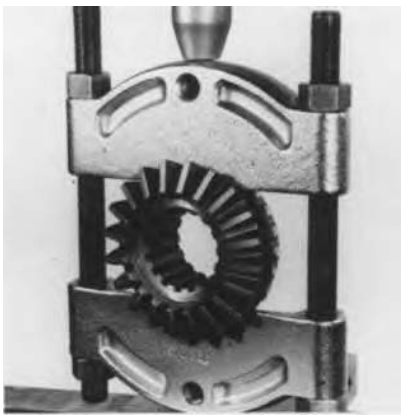
1. Mount shaft assembly in vise, using brass vise jaw protectors. Remove outer snap ring, side gear and bearing cone assembly. If replacement is necessary, remove inner snap ring.

⚠ **WARNING:** SNAP RING IS SPRING STEEL AND MAY POP OFF. WEAR SAFETY GLASSES WHEN REMOVING.

2. Remove output shaft "O" rings. If replacement is necessary, remove bushing mounted in end of output shaft. (NOTE 1)

3. Remove bearing cone from side gear using press and split-type puller.

NOTE: For instructions covering output shaft rear bearing parts, see page 30.



Removing Bearing Cone from Output Shaft Side Gear.

NOTE 1: Starting in June 1993, production axles were made with bushing less output shaft 128736. Do not attempt to install bushings in shafts with P/Nos 128736 or 129194* stamped into them. Ref. bulletin AXIB-93-06 *(output shaft w/metric threads used in axles after 1-3-95)

Power Divider Overhaul

Assemble Output Shaft

NOTE: Lubricate parts with gear lube during assembly.

1. Press bearing cone on output shaft side gear.

IMPORTANT: Provide protection against possible gear teeth damage during press operation.

2. Mount output shaft in vise. Lubricate and install "O" rings. If removed, install bushing in end of output shaft.

3. If removed, install inner snap ring on shaft, then install side gear and bearing cone assembly, and outer snap ring.

WARNING: SNAP RING IS SPRING STEEL AND MAY POP OFF. WEAR SAFETY GLASSES WHEN INSTALLING.

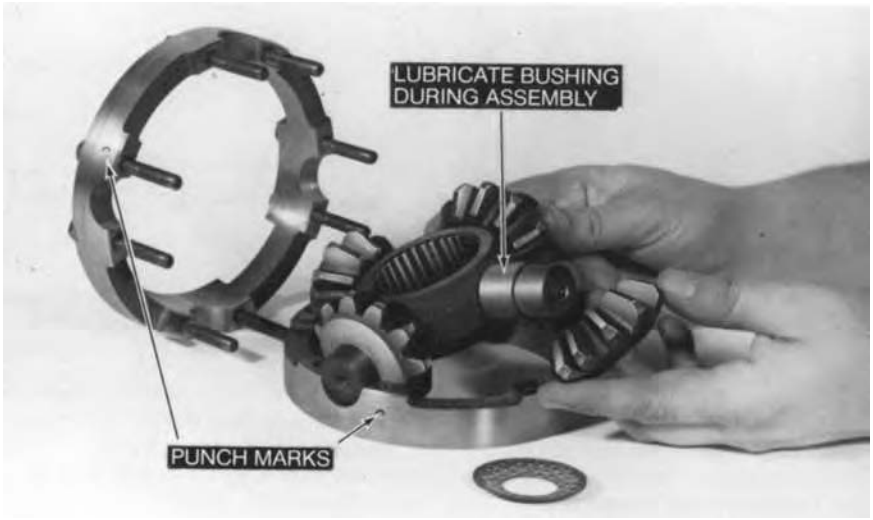
NOTE: Late Model Axles may be equipped with a spring and thrust button mounted between the input shaft and output shaft (see page 74).

Assemble Inter-axle Differential

1. Install bushings, side pinions and thrust washers on inter-axle differential spider.

2. Install spider assembly in one differential case half, align punch marks and install other case half. Secure assembly with bolts and locknuts. Tighten to correct torque (17-23 ft-lbs., 23-31 N´m).

NOTE: Side Pinion Bushings. Not used on tandems built after November 1, 1991. Use when originally equipped.

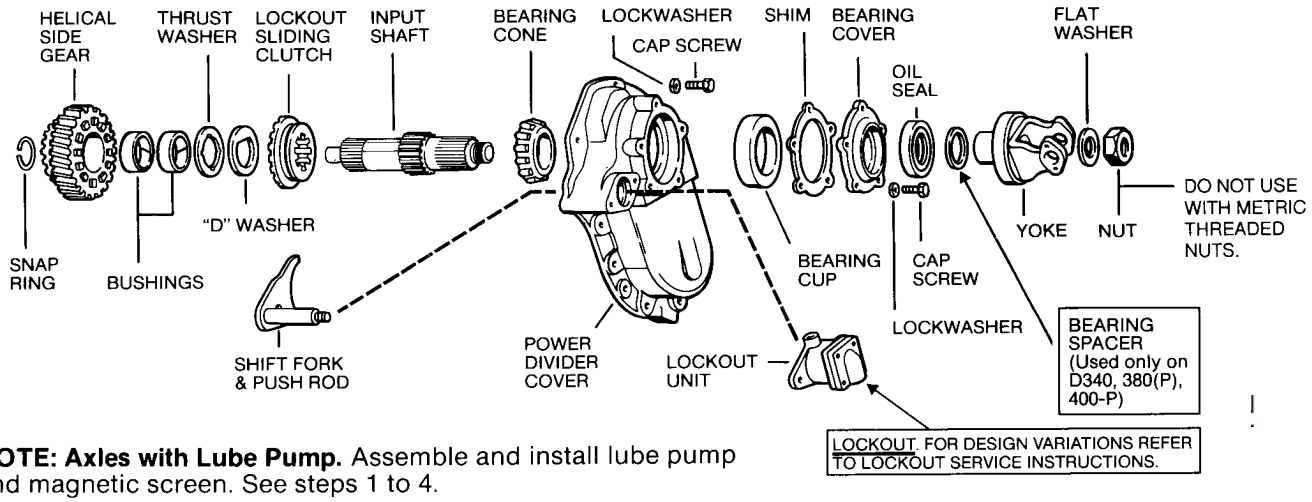


Assembling Non-Current Production Inter-Axle Differentials.

NOTE 1: Starting in June 1993, production axles were made with bushingless output shaft 128736. Do not attempt to install bushings in shafts with P/Nís 128736 or 129194* stamped into them. Ref. bulletin AXIB-93-06 *(output shaft w/metric threads used in axles after 1-3-95)

Assemble Power Divider Cover

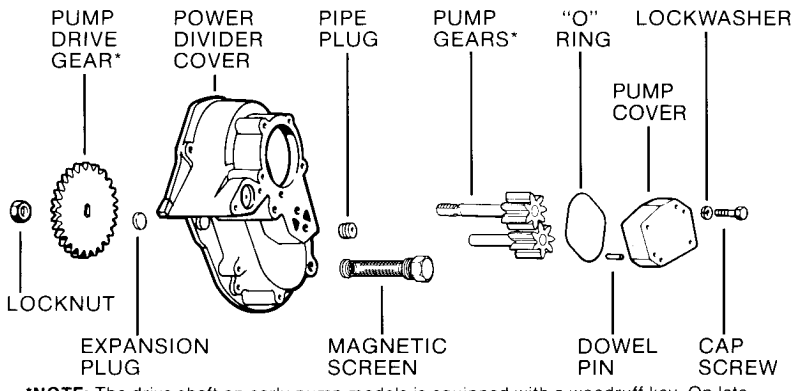
Power Divider Cover and Input Shaft (without Lube Pump)



NOTE: Axles with Lube Pump. Assemble and install lube pump and magnetic screen. See steps 1 to 4.

1. *See note on exploded view. Install pump gears in power divider cover (position gear with long shaft in opening adjacent to input shaft).

Power Divider Cover with Lube Pump.



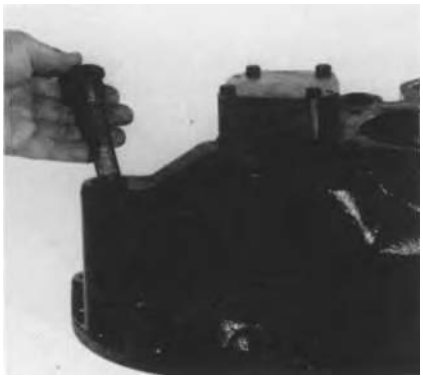
***NOTE:** The drive shaft on early pump models is equipped with a woodruff key. On late pump models, the key is eliminated. The drive shaft end has two machined flats and the drive gear mounting hole is shaped to accommodate these flats.

2. Install "O" ring in pump cover, making sure "O" ring is seated firmly in cover. If removed, install dowel pins. Install pump cover on power divider cover and secure with cap screws and lockwashers. Tighten to correct torque (85-105 IN-LBS., 10-12 Nm).

3. Install Pump Drive Gear. Install drive gear on pump shaft end.

NOTE: Some pump drive shafts use a woodruff key. When key is used. place key in shaft slot. Position gear on shaft engaging key. Then install gear with driver and hammer.

NOTE: Install and tighten drive gear nut after input shaft is assembled to power divider cover (see step 10).



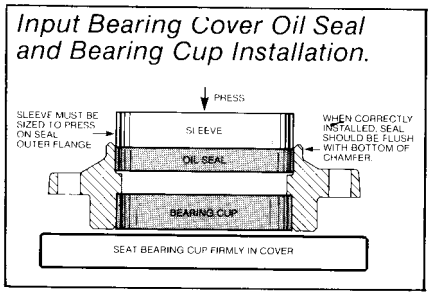
4. Install magnetic screen in power divider cover. Tighten to correct torque (40-60 Ft-lbs., 54-81 Nm).

Power Divider Overhaul

Assemble Power Divider (Cont'd)

5. Press bearing cone on input shaft.

IMPORTANT: To prevent bearing damage, be careful to use sleeve that only contacts the inner race of bearing cone.



SEAL INSTALLATION

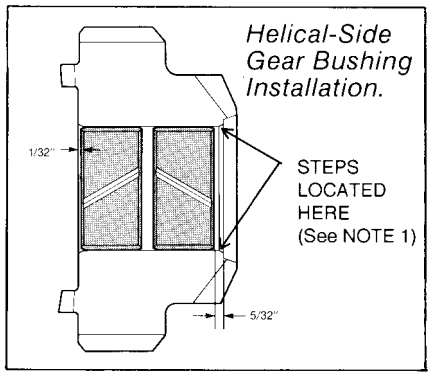
IMPORTANT: Before installing seal, refer to page 15 for service information on Seals, Yokes & Slingers.

6. Press oil seal in cover using a seal driver or suitable sleeve.

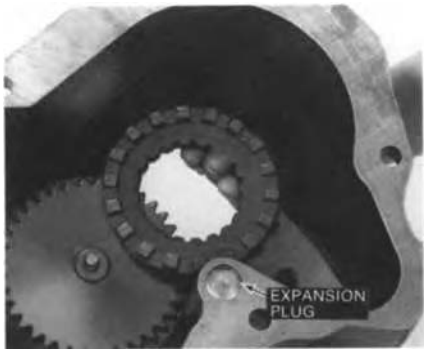
Press bearing cup in input bearing cover.

IMPORTANT: For correct cup installation, use appropriate sleeve. Take care to make sure cup is not cocked and is firmly seated all around.

NOTE 1: Helical Gears made after 1/3/95 have a "step" at the end of Inner Bore. Bushings must be installed from the Curvic Tooth side of the Helical Gear inward towards this step. Press bushing flush against the shoulder of the step.



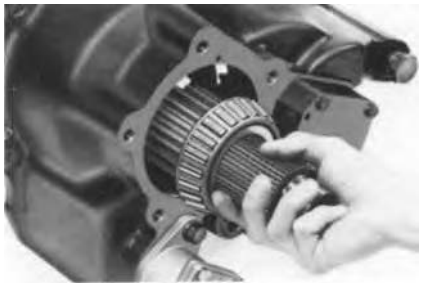
7. Install bronze bushings in helical-side gear.



8. NOTE: Check expansion plug in power divider cover (see photo above) to make sure it is in place and firmly seated. If loose, seat by tapping with a hammer. Replace plug if necessary.

Assemble lockout shift fork and sliding clutch with clutch teeth facing the helical-side gear, then install this assembly in power divider cover.

NOTE: At this point in reassembly, assemble and install lockout (see Shift System Section).



9. Slide input shaft and bearing assembly into power divider cover from the front side. Engage shaft splines in lockout clutch.

Install bearing spacer on input shaft (used only on D340, 380, 380-P, 400-P). Temporarily install input bearing cover assembly, cap screws and lockwashers.

NOTE: Do not install any shims under bearing cover at this time. Correct shim pack will be determined after the power divider is installed on differential carrier (Refer to "Adjust Input Shaft End play" page 42).

IMPORTANT: For Axles with Spring and Thrust Button between input shaft and output shaft: For preliminary adjustment of input shaft end play, install a 0.045" (0.024 mm) shim pack under bearing cover (see Service Bulletin Supplement, page 74).

Tighten bearing cover cap screws finger-tight. Install input yoke, flat washer and nut. Temporarily tighten nut snugly.

10. IMPORTANT - Axles with Lube Pump: Install and tighten lube pump drive gear locknut, holding input shaft to secure gear. Torque nut to 35-45 ft-lbs, (47-61 Nm).

11. Slide "D" washer over input shaft up to base of sliding clutch splines.

NOTE: Make sure flat part of washer inside diameter engages shaft properly.

Install bronze washer, Install helical gear. Secure with snap ring.

⚠ **WARNING:** SNAP RING IS SPRING STEEL AND MAY POP OFF. WEAR SAFETY GLASSES WHEN INSTALLING.

12. Install power divider cover assembly on differential carrier (see page 41).

Install Power Divider on Differential Carrier

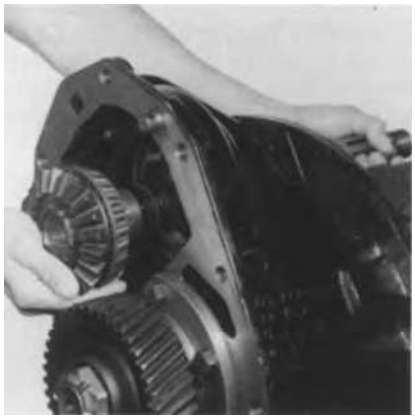
(with carrier removed from axle housing)

NOTE: The following instructions pertain to installation of power divider on differential carrier with carrier removed from axle housing.

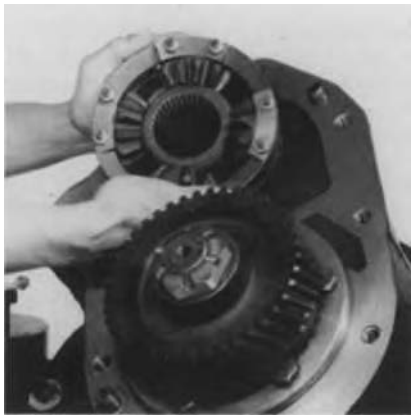
NOTE: Before installing power divider, install related parts as follows:

1. Output Shaft Side Gear Bearing Cup. If removed, press bearing cup in carrier. Use a press and appropriate sleeve or use a brass drift and a mallet. Tap bearing cup into its' bore making certain cup is evenly and firmly seated.

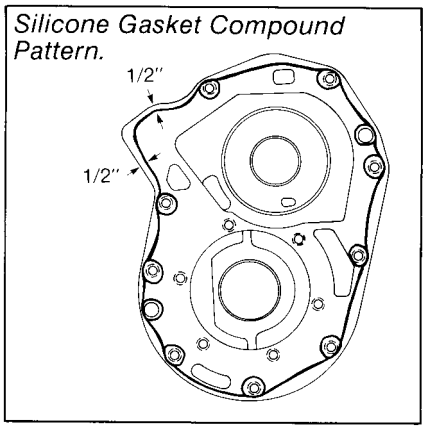
NOTE: Late Model Axles may be equipped with a spring and thrust button mounted between the input shaft and output shaft (see page 74).



2. Output Shaft. Lubricate "O" rings, then install output shaft assembly in carrier.



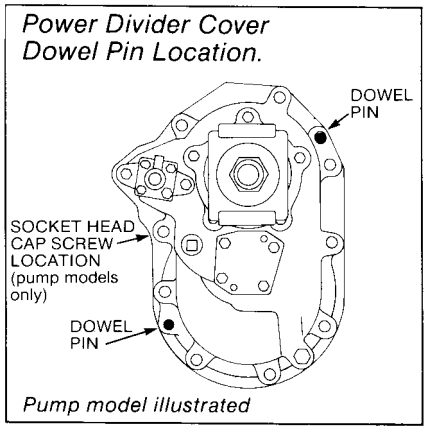
3. Inter-axle Differential. Install differential assembly on output shaft side gear (with nuts facing away from output shaft side gear).



4. Apply silicone gasket compound on carrier mating surface (see illustration).

5. Install Power Divider. Attach chain hoist to input yoke and install power divider assembly. During installation, rotate input shaft to engage input shaft splines with inter-axle differential. After installation, again rotate input shaft. Output shaft should turn when input shaft is rotated if assembly is correct.

NOTE: Lifting mechanism may create nicks and burrs on input yoke. Remove if present.



6. If removed, install dowel pins in carrier. Install power divider cover cap screws and lockwashers. (On pump models only, place socket-head cap screw at location shown on drawing. Torque cap screws to 110-125 ft-lbs. (149-170 Nm).

7. Adjust Input Shaft End Play. Adjust end play with the power divider assembled to the differential carrier. (See page 42.)

Power Divider Overhaul

Adjust Input Shaft End Play

NOTE: After power divider overhaul and installation in power divider, check and adjust input shaft end play.

Correct end play when new parts are used in overhaul is 0.003î to 0.007î, with reused parts 0.01 3ñ to 0.01 7ñ. Refer to page19 for other variations.

Measure and Adjust End Play

IMPORTANT: In September 1988, Spicer added a Spring and a Thrust Button between the input and output shafts. End play tolerances are the same for axles with or without this Spring and Button. However, end play measurement procedure is different than described below. Refer to Service Bulletin Supplement at back of this manual for procedure variances.

Measuring Bearing Cover Clearance.

1. Remove input shaft nut, fiat washer and yoke. Remove input bearing cover cap screws and lockwashers. Remove bearing cover (and shim pack if installed).

2. Reinstall bearing cover without shims. Hold in position with hand pressure and measure clearance between power divider cover and bearing cover, using a feeler gauge.

3. The bearing cover clearance measured in Step 2 plus 0.005" will equal shim pack thickness required for desired end play (rebuild with new parts). Add 0.015" to shim pack for rebuild with used parts.

4. Install shim pack and bearing cover. Install cap screws and lock-washers. Torque screws to 75-85 ft-lbs. (101-115 Nm).

5. Install yoke, flat washer and nut. Tighten nut snugly. Tap end of input shaft lightly to seat bearings.

6. Check input shaft end play with dial indicator positioned at yoke end of input shaft. Move input shaft axially and measure end play. If end play is correct, seal shim pack to prevent lube leakage then torque input shaft nut and cover cap screws (see chart).

Installing Bearing Cover and Shim Pack.

7. If end play is incorrect, change shim pack size, as follows:

Add shims to increase end play.

Example: Desired end play (New Parts) . . . . . 0.003" to 0.007"
Measured end play (Step 6) . . . . . 0.001" - 0.001"
Add shims to provide desired end play . . . . . 0.002" to 0.006"

Remove shims to decrease end play.

Example: Measured end play (Step 6) . . . . . 0.015" - 0.015"
Desired end play (New Parts) . . . . . 0.003" to 0.007"
Remove shims to provide desired end play . . 0.012" to 0.008"

Measuring End Play with Dial Indicator.

8. To add or remove shims, remove input shaft nut, flat washer and yoke. Remove cap screws, lockwashers and bearing cover. Add or remove shims as required.

9. Install bearing cover, cap screws and lockwashers. Install yoke, flat washer and nut. Seal shim pack to prevent lube leakage then torque input shaft nut and cover cap screws (see chart).

Tightening Yoke Nut.

Torque Chart

	Ft-lbs.	Nm
Input Shaft Nut		
1-5/8-18	780-960	1057-1301
*M42 X 1.5	840-1020	1140-1383
Bearing Cover Cap Screw		
1/2-13 (Grade 5)	**75-85**	101-115

ñMetric Nut used on Axles produced after 7/1 /95

NOTE: If difficulty is experienced in achieving correct torque on the input yoke nut, torque the nut with truck on the ground and axle shafts installed.

Differential Carrier Overhaul *(Forward and Rear Axles)*

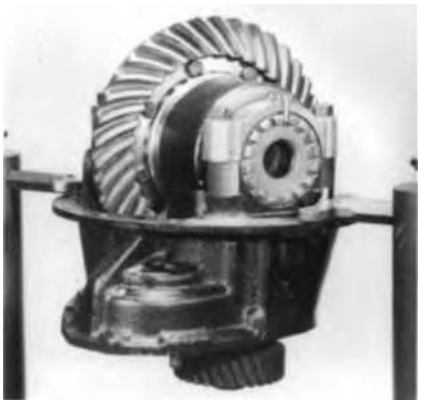
Disassemble Differential Carrier *(with power divider removed)*

NOTE: If the gear set is to be reused, check tooth contact pattern and ring gear backlash before beginning disassembly. Best overhaul results are obtained when used gearing is adjusted to run in established wear patterns. Omit this step if the gear set is to be replaced.

When reusing the gear set, remove the left-hand bearing cap, adjuster and lock as a unit. This will help return the gear set to its original adjustment during reassembly.

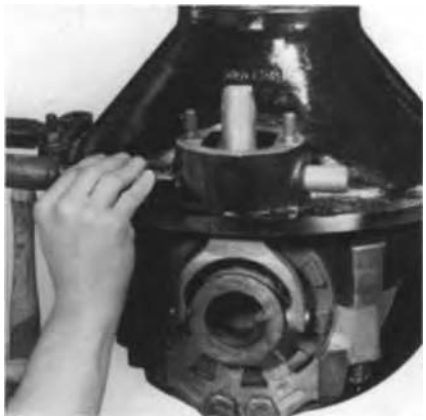
1. Mount the differential carrier in a repair stand.

Rear Axle



Forward Axle

NOTE: For easier disassembly, loosen but do not remove pinion self-locking nut. When forward axle pinion is equipped with slotted nut, remove roll pin with a pin punch then loosen nut.



2. Dual Range Axles Only: Remove shift fork seal and spring. Remove expansion plugs, then working at the lower (or small) plug hole, drive out the shift fork shaft.

⚠ **WARNING:** WHEN USING A DRIFT, PUNCH OR SIMILAR TOOL, WEAR SAFETY GLASSES.

3. Dual Range Axles Only: Disengage shift fork yoke from sliding collar. Then remove clutch and shift fork.

Planetary Double Reduction Axles: A sun gear is used in place of sliding clutch gear. To remove sun gear, remove cap screws and the retainer which holds gear in position, then remove sun gear.

4. If reusing gear set, punch mark bearing adjusters for reference during assembly.

5. On teeth-side of ring gear, cut lockwire and remove bearing cap screws. Remove cap, adjuster and lock.

Differential Carrier Overhaul *(Forward and Rear Axles)*

Disassemble Differential Carrier (Cont'd)

6. On back-side of ring gear, cut lockwire and remove bearing cap screws. If the gear set is to be reused, remove bearing cap, adjuster and lock as an assembly. This will facilitate correct positioning of ring gear during reassembly.

7. Remove bearing cups, then lift ring gear and differential assembly out of carrier.

8. Rear Axle: Remove pinion bearing cage cap screws, then drive pinion, cage and yoke assembly out of carrier.

IMPORTANT: Do not allow pinion to drop on hard surface. Remove shim pack.

IMPORTANT: Forward and Rear Axle: If gear set is to be reused, keep pinion bearing cage shim pack intact for use in reassembly. If the original shims cannot be reused, record the number and size of shims in the pack.

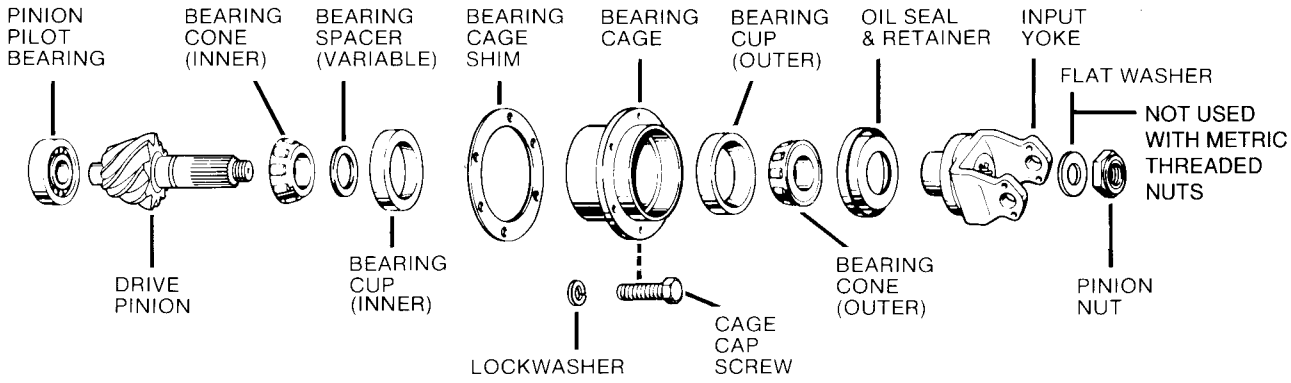
9. Forward Axle: Remove pinion nut. When pinion is equipped with a slotted nut, remove roll pin with a pin punch then remove nut. Remove helical drive gear, using suitable puller if necessary.

NOTE: Remove outer pinion bearing cone if "slip-fit" type.

10. Forward Axle: Remove pinion bearing cage cap screws and lockwashers. Remove pinion and cage assembly from carrier. Remove shim pack.

Disassemble Drive Pinion

Rear Axle Pinion Illustrated.



NOTE: Sicer drive axles may be equipped with either "slip-fit" or "press-fit" outer pinion bearings. procedures are contained in this section for disassembly of both types.

IMPORTANT: During the following yoke removal procedure, the drive pinion may fall out of bearings and cage. Do not allow pinion to drop on hard surface.

1. Rear Axle Pinion Yoke: Remove yoke. If pinion nut was not loosened during earlier disassembly, clamp assembly in vise jaws, use brass pads to prevent damage.

Loosen and remove pinion nut and flat washer.

NOTE: Flat washers are not used with metric threaded nuts. Metric nuts went into production on 7-1-95.

2. Forward and Rear Axle Pinion Bearing Cage: For pinion with "press-fit" bearing cone, support cage and press pinion out of bearing cage and bearing cone.

For pinion with "slip-fit" bearing cone, the cage, outer bearing and pinion can usually be disassembled easily without a press. If difficulty is experienced, use a press.

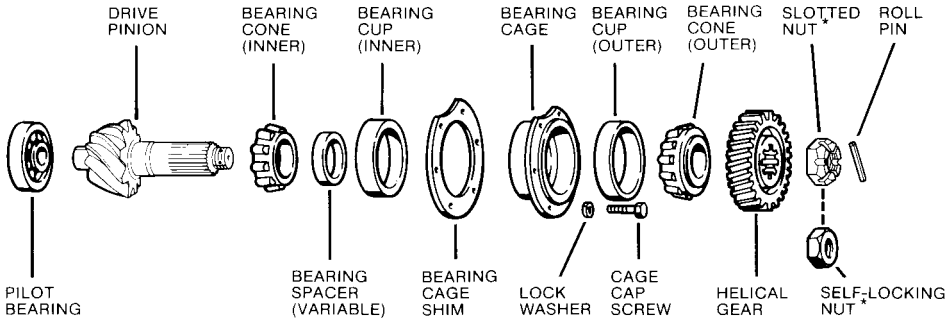
3. Rear Axle Pinion Oil Seal and Outer Bearing Cone: Remove oil seal and bearing cone from cage. Discard oil seal. Remove bearing cups with suitable puller.

Removing "Slip-Fit" Outer Bearing Cone (Rear Axle illustrated).

Removing Bearing Cage (Rear Axle illustrated).

Disassemble Drive Pinion (Cont'd)

Forward Axle Pinion Illustrated.



*D341, 381(P), 401-P, 402(P), 451-P use self-locking or slotted nut and roll pin.
Metric threaded nuts used on axles starting 7-1-95
D340, 380(P), 400-P use self-locking nut only.

4. Remove and retain bearing spacer from pinion.

5. Remove pilot bearing and inner bearing cone from pinion, using a split-type puller. Use two procedure steps-to remove each bearing (see photos above).

First, mount puller vertically to split the bearing.

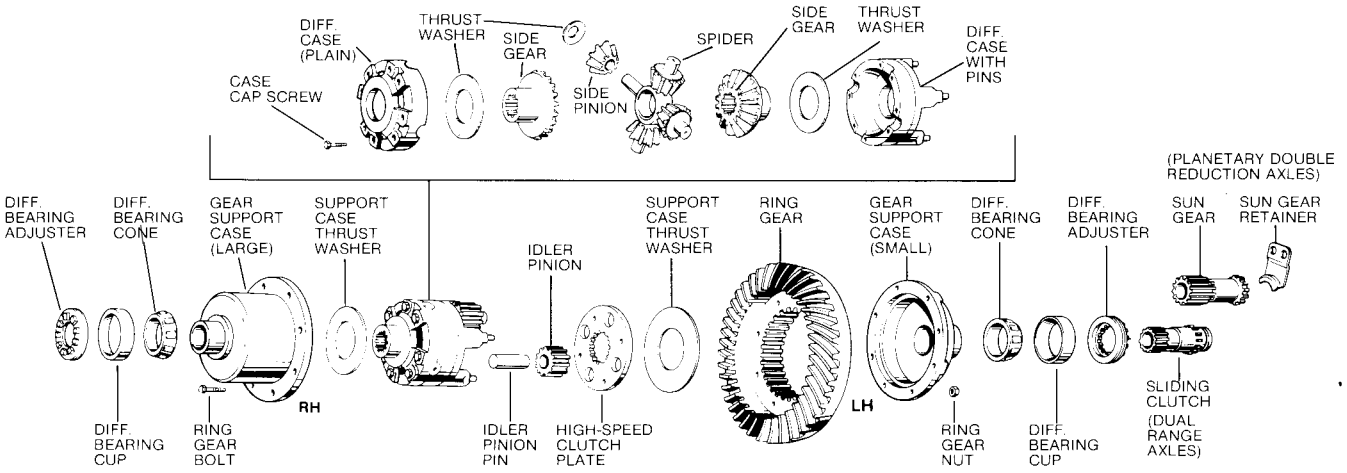
Second, mount puller horizontally to press pinion out of bearing.

This action will force puller halves under bearing and start moving bearing off pinion.

The same procedure can be used to remove pilot bearing and pinion inner bearing cone.

Disassemble Wheel Differential

Rear Axle Wheel Differential Illustrated



1. Remove nuts and bolts fastening ring gear and support cases.

2. Remove small support case and thrust washer.

3. Remove ring gear.

NOTE: A soft-faced hammer or mallet may be required to dislodge gear from its mounting.

4. To remove differential assembly, place support case assembly on a bench or on the floor. Position case on its side, then slowly roll the case and slide differential assembly out of the case.

5. Remove thrust washer from support case.

6. Invert differential assembly to remove idler pins, then remove idler pinions.

7. Punch mark differential cases for correct location in reassembly. Remove cap screws and separate case halves.

Differential Carrier Overhaul (Forward and Rear Axles)

Disassemble Wheel Differential (Cont'd)

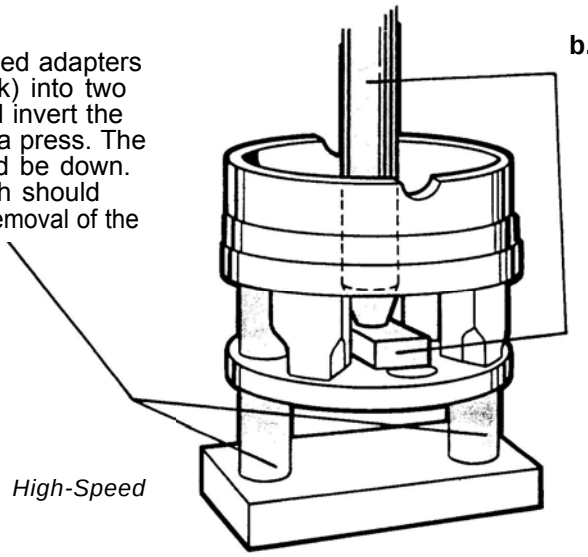
8. Lift out thrust washer and side gear.

9. Lift out spider, side pinions and thrust washers.

10. Remove side gear and thrust washer.

11. First, try to lift off high-speed clutch plate by hand. If it cannot be removed easily, press off plate as follows:

a. Insert properly sized adapters (round metal stock) into two idler pin holes and invert the case assembly in a press. The clutch plate should be down. The adapter length should provide space for removal of the plate.



Setup for Removing High-Speed Clutch Plate

b. Use bar stock to block the center hole in the clutch plate and press against it with the press ram.

c. Continue to press until the plate breaks loose from the plate dowel pins.

12. Remove bearing cones from support cases using suitable puller (see photo).

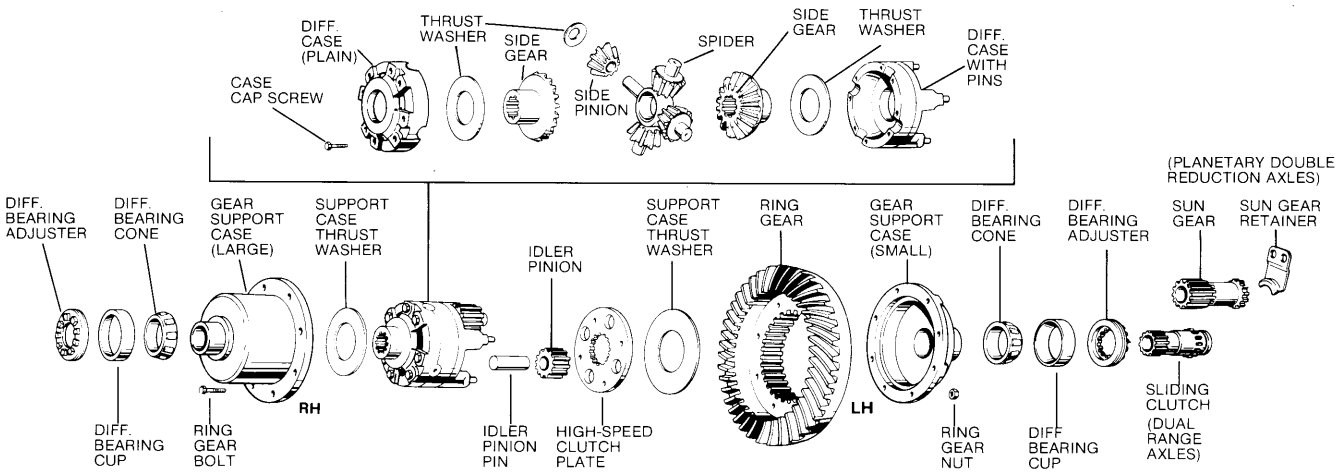
NOTE: Holes are provided in case to enable removal of bearing cone with a pin punch (see photo). Tap alternately through each hole until cone is removed.

⚠ **WARNING:** WHEN USING A DRIFT, PUNCH OR SIMILAR TOOL, WEAR SAFETY GLASSES.

Removing Bearing from Small Support Case using Puller.

Assemble Wheel Differential

Rear Axle Wheel Differential Illustrated.

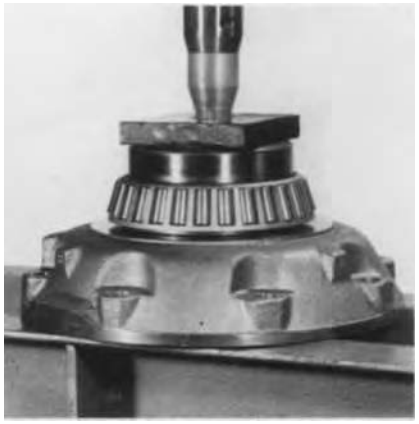


NOTE: Lubricate internal parts with gear lube during reassembly.

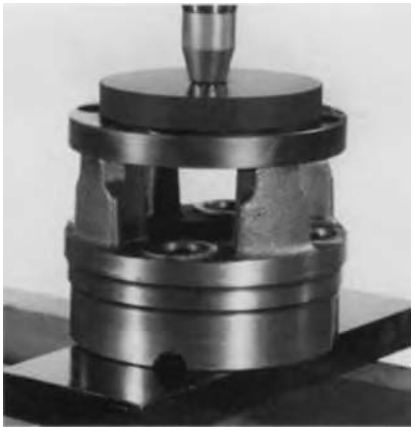
1. Press bearing cones on support cases (see photos).

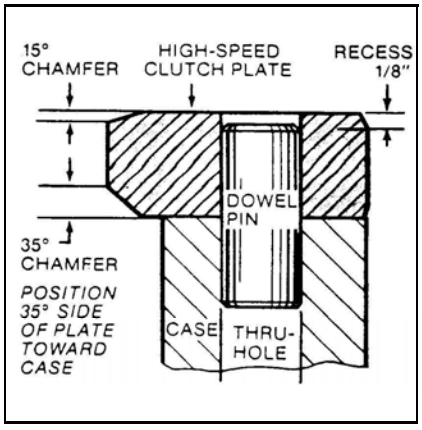
IMPORTANT: To prevent bearing cone damage, use suitable sleeve that only contacts the inner race of the cone.

Pressing Bearing Cone on Large Support Case



Pressing Bearing Cone on Small Support Case





2. Position high-speed clutch plate with chamfered end of clutch teeth toward idler pinions. Press clutch plate on case.

IMPORTANT: It is important that the ends of the dowel pins are recessed 1/8" below surface of the clutch plate. If pins extend beyond plate surface, press pins to proper depth. Don't press them in too far.

3. Place thrust washer and side gear in differential case.

Differential Carrier Overhaul *(Forward and Rear Axles)*

Assemble Wheel Differential (Cont'd)

4. Assemble side pinions and thrust washers on spider. Place this assembly in differential case.

5. Place side gear and thrust washer in position on side pinions.

6. Align punch marks and place plain case on case (with pins). install cap screws and torque to 90-110 ft-lbs. (122-149 Nm).

NOTE: Turn side gear hub to check for free differential rotation. Rotation may require up to 50 ft-lbs. (65 Nm).

7. Install idler pins and pinions.

8. Place thrust washer in support case.

9. During installation of ring gear, temporarily use two bolts in mounting holes to assure bolt hole alignment. Place ring gear on support case (see photo), then remove the two bolts.

11. Install thrust washer and small support case over differential assembly.

10. To install differential assembly, place support case and ring gear assembly on a bench or the floor. Position case on its side. Carefully lift and slide differential assembly into case. Engage idler pinions with ring gear teeth to complete the installation.

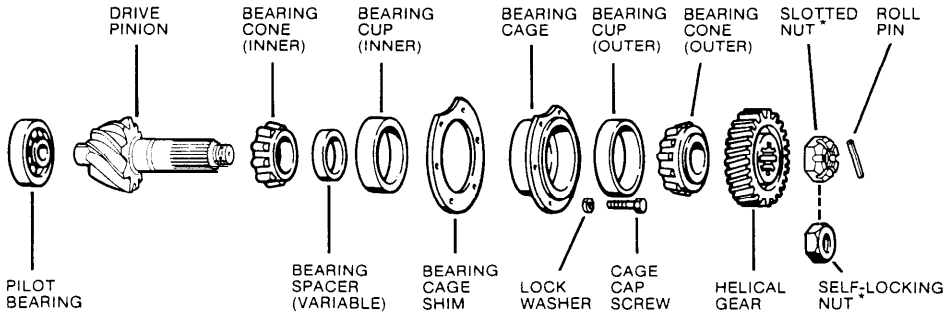
NOTE: During differential installation, be sure thrust washer stays in its proper mounting position.

12. Carefully install ring gear bolts, making certain flat on bolt head is seated against the outside diameter of the support case. Install nuts and torque to 110-130 ft-lbs. (149-176 Nm).

NOTE: Temporarily install sliding clutch (or sun gear) and check planetary for free rotation.

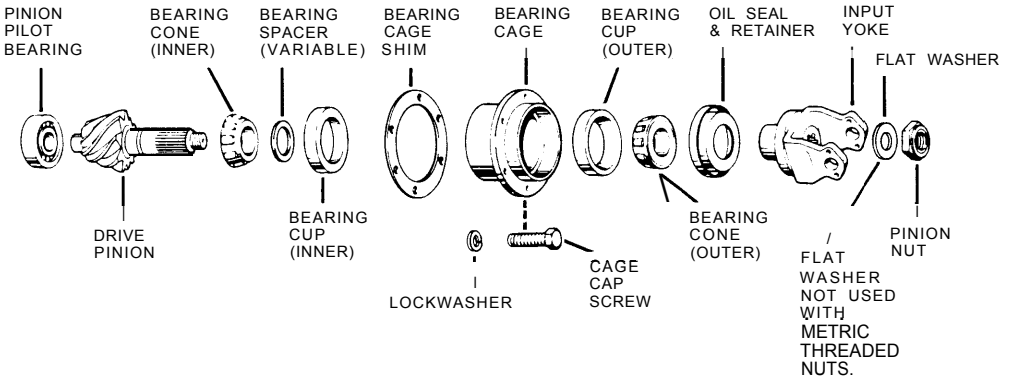
Assemble Drive pinion *("press-fit" outer pinion bearing)*

Forward Axle Pinion Illustrated.



*D341, 381 (P), 401-P, 402(P), 451-P use self-locking or slotted nut and roll pm.
Metric threaded nuts used on axles starting 7-1-95
D340, 380(P), 400-P use self-lockIng nut only.

Rear Axle Pinion Illustrated.



NOTE: Spicer drive axles may be equipped with either "slip-fit" or "press-fit" outer pinion bearings. Procedures are contained in this section for assembly of both types.

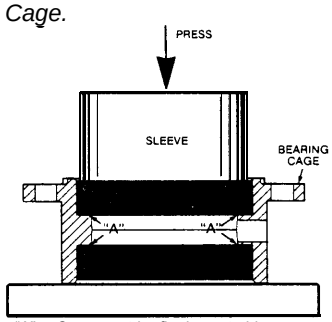
NOTE: Lubricate parts with gear lube during reassembly.

1. Using appropriate sleeve, press bearing cups in cage (see adjacent drawings).

NOTE: On rear axles, do not install oil seal in cage until bearing preload is correctly adjusted.

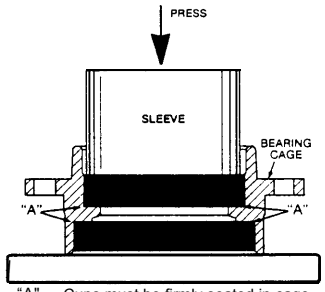
IMPORTANT: After bearing cups are installed, preselect pinion bearing spacer using the "trial build-up" procedure described in the Adjustments Section of this manual.

Forward Axle Pinion. Press Bearing Cups in Cage.



"A" Cups must be firmly seated in cage Check with feeler gauge (0.001") after installation.
NOTE: Install cups one at a time

Rear Axle Pinion. Press Bearing Cups in Cage.



"A" - Cups must be firmly seated in cage. Check with feeler gauge (0.001") after installation.
NOTE: Install cups one at a time

Differential Carrier Overhaul (Forward and Rear Axles)

Assemble Drive Pinion ("press-fit" outer pinion bearing) (Cont'd)

2. Press pilot bearing on pinion.

IMPORTANT: To prevent bearing damage, use suitable sleeve that only contacts inner bearing race.

3. Stake pilot bearing using staking tool. This is essential to retain the bearing.

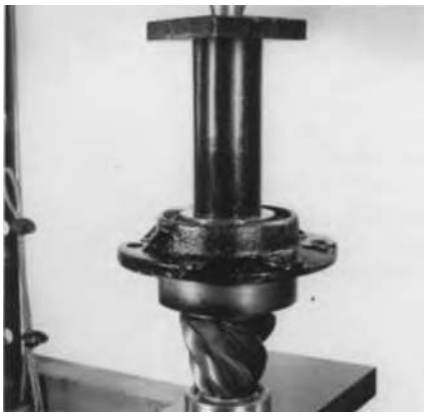
NOTE: During pinion bearing installation, locate each part in same position that was used in "Trial Build-up" Preload Test.

4. Press inner bearing cone on pinion.

IMPORTANT: To prevent bearing damage, use suitable sleeve that only contacts inner race of bearing cone.

5. Install preselected bearing spacer on pinion.

6. Install bearing cage on drive pinion.

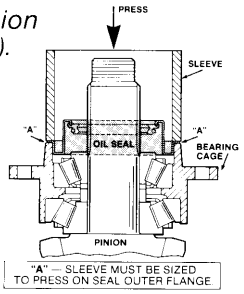


7. Press outer bearing cone on pinion.

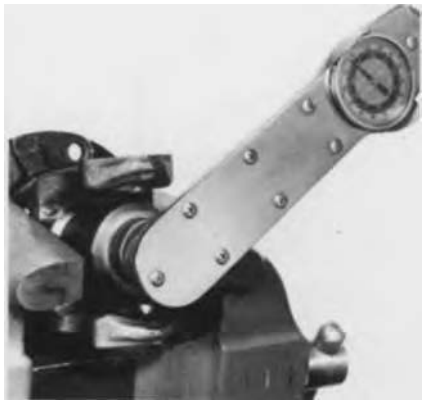
IMPORTANT: To prevent bearing damage, use suitable sleeve that only contacts inner race of bearing cone.

IMPORTANT: At this stage of assembly, "final-check" pinion bearing preload. See Adjustment Section of this manual.

Rear Axle Pinion. Press Oil Seal in Cage (with pinion installed).



8. Rear Axle Only. With pinion installed and bearing preload adjustment complete, install oil seal with a press. **



9. Rear Axle Only. Prior to installation of yoke, lubricate oil seal and make sure yoke is clean and dry. Install yoke, flat washer* and nut. Torque nut to correct specification.

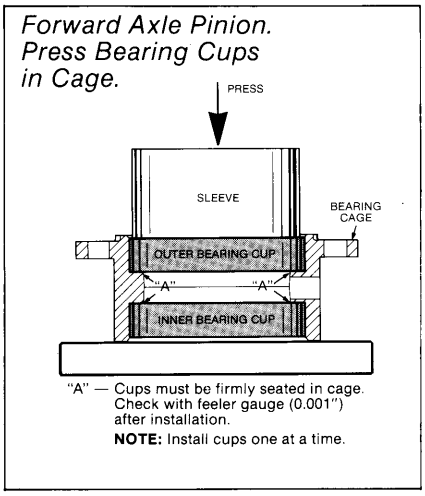
NOTE: After tightening pinion nut, recheck pinion bearing rolling torque. See Adjustment Section for "Press-fit' outer pinion bearing.

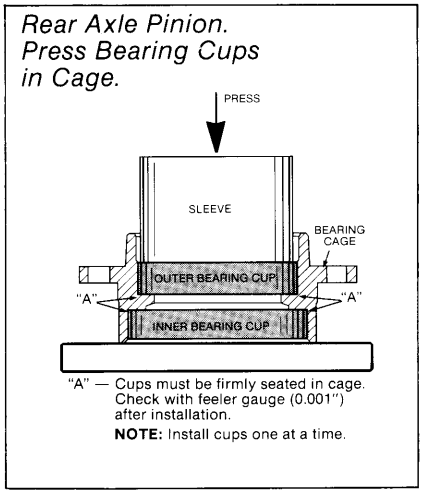
10. Forward Axle Pinion Helical Gear and Nut: These parts are installed during pinion installation (see page 54).

**** IMPORTANT:** Refer to page 15 for service information on Seals, Yokes & Slingers.

* Flat washer not used on axles with metric threaded nuts.

Assemble Drive Pinion *(*"Slip-fit" outer pinion bearing)*

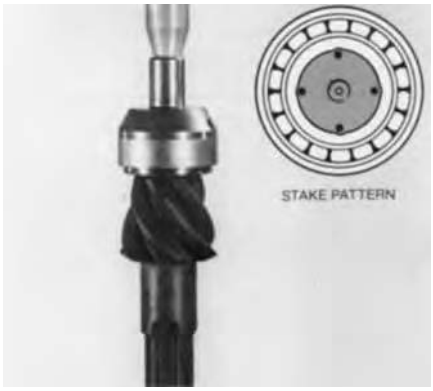




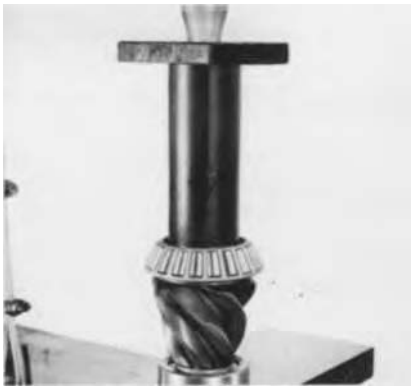
1. Using appropriate sleeve, press bearing cups in cage.

2. Press pilot bearing in pinion.

IMPORTANT: To prevent bearing damage, use suitable sleeve that only contacts inner bearing race.



3. Stake pilot bearing using staking tool and press. This is essential to retain the bearing.



4. Press inner bearing cone on pinion.

IMPORTANT: To prevent bearing damage, use suitable sleeve that only contacts inner race of bearing cone.

5. Install bearing spacer on pinion.

NOTE: When new gear set or pinion bearings are used, select nominal size spacer (see chart page 22). If original parts are used, use spacer removed during disassembly.

6. Install bearing cage on drive pinion.

7. Install pinion outer bearing cone.

NOTE: At this stage in assembly, check pinion bearing preload described in Adjustment Section of this manual for "slip-fit" outer pinion bearing. **Rear Axle:** Do not install oil seal until adjustment is complete.

8. Rear Axle Oil Seal and Yoke: Installation of these parts is the same for "slip-fit" and "press-fit" bearings. See page 52 (step 8 and 9) for instructions.

NOTE: For "slip-fit" bearings, pinion may be temporarily removed to simplify seal installation.

9. Forward Axle Helical Gear and Nut: See page 54 for instructions.

Differential Carrier Overhaul

Forward Axle - Install Pinion

1. Output Shaft Side Gear Bearing Cup. If removed, press bearing cup in carrier.

Torque Chart
Bearing Cage Cap Screw

Size	Ft-lbs.	N.m
9/16-12 (Grade 8)	155-175	210-237

Nominal Shim Pack

In.	mm
0.024	0.609

2. Place shim pack on carrier, making certain that holes in shims are aligned with carrier holes.

NOTE: If gear set is to be reused, install same quantity and size of shims removed during disassembly. When installing a new gear set, use nominal shim pack (see chart).

3. Install drive pinion assembly. Install bearing cage cap screws and lockwashers. Torque cap screws (see chart).

NOTE: The forward axle pinion is equipped with a helical gear. For easier disassembly during carrier adjustment procedure, use a dummy yoke (if available) in place of helical gear.

Forward Axle - Install Helical Gear

1. Install helical gear on pinion, positioned as shown in the illustration. Install self-locking nut or slotted nut. Torque nut properly (see chart), using a suitable fixture to hold helical gear.

NOTE: On axles equipped with slotted nut and roll pin, do not install roll pin until carrier adjustments are completed.

Torque Chart
Pinion SELF-LOCKING NUT

Size	Ft-lbs.	Nm
(D340, 380(P), 400-P)		
1-1/2-18	560-700	759-949
(D341 ,381 (P), 401-P, 402(P), 451-P)		
1-518-18	780-960	1057-1301
(D341 , 402(P), 451(P) produced after 7-1-95		
M42 x 1.5	840-1020	1140-1383

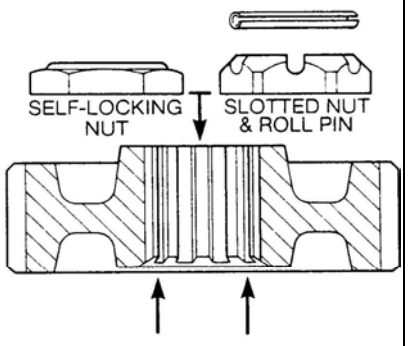
Pinion SLOTTED NUT & ROLL PIN

(D341, 381(P), 401-P, 402(P), 451-P)		
1-518-18	840*	1139*

***IMPORTANT:** Torque to 840 ft-lbs. (1139 Nm), then continue tightening nut to align slot with the nearest hole in pinion shank. Install roll pin.

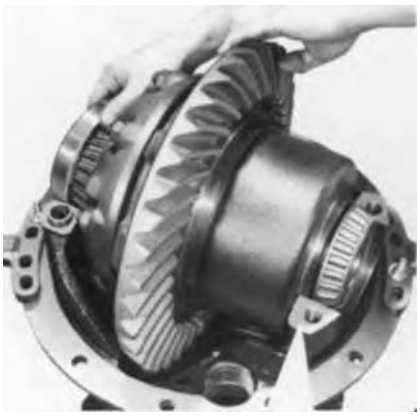
Pinion Helical Gear Mounting Position

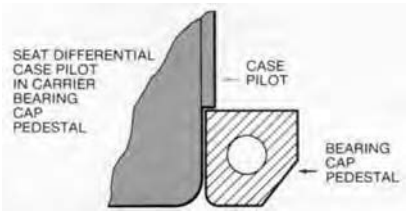
NOTE: See Torque Chart for Pinion Nut Variations



Installing Pinion Helical Gear.

Forward Axle -- Install Differential Assembly in Carrier





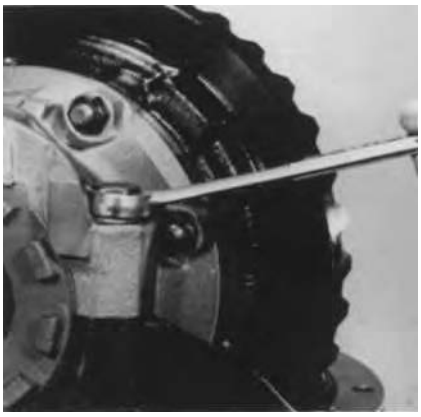
1. Lubricate bearings during the following assembly procedure: Place ring gear and differential assembly in carrier. Insure that ring gear and drive pinion mesh properly.

During installation, tilt carrier to allow support case pilot to rest in carrier bore, then install bearing cup as shown in photo, Also install bearing cup on opposite side of differential.

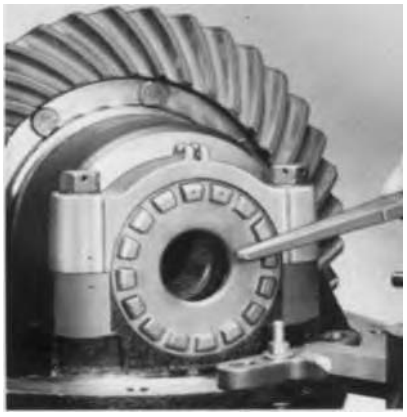
2. If the same gear set is used, install the assembled bearing cap, adjuster and lock on the backface side of the ring gear. Otherwise install adjuster and cap separately.

NOTE: When installing cap, it may be necessary to tap it lightly with a hammer. Be sure cap is fully seated and threads are aligned properly. If trouble is encountered, check for cross-threading of bearing adjuster and carrier threads.

On teeth side of ring gear, install the other adjuster and bearing cap, observing same precautions to avoid cross-threading.



3. Install and tighten bearing cap screws finger-tight. If this is difficult, use hand wrench.



4. At the teeth-side of ring gear, position bearing adjuster until its first thread is visible.

At the back-side of ring gear, tighten adjuster until there is no backlash.

NOTE: With bearing adjusters and caps assembled to carrier, the carrier assembly is now ready for adjustment of bearing preload, ring gear backlash and gear toothe contact (see page 57).

Differential Carrier Overhaul

Rear Axle - Install Pinion

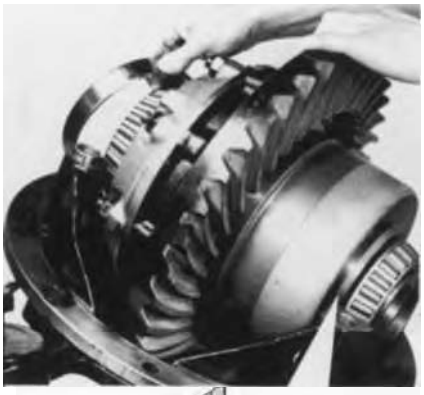
1. Place shim pack on carrier making sure lube hole is clear (see photo).

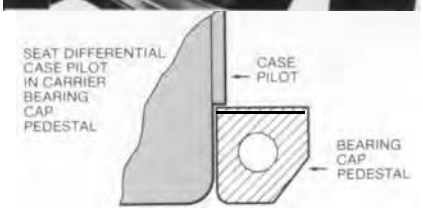
NOTE: If the gear set is to be re-used, use same quantity and size shims removed during disassembly. If a new gear set is to be installed, install a nominal shim pack (see chart).

Nominal Shim Pack	
in	mm
0.023	0.584

2. Install drive pinion assembly. NOTE: Make certain lube holes in carrier, shims and cage are aligned. install bearing cage cap screws and lockwashers. Torque cap screws to 110-125 ft-lbs. (149-170 Nm).

Rear Axle - Install Differential in Carrier





NOTE: Lubricate bearings during the following assembly procedure:

1. Place ring gear and differential assembly in carrier. Insure that ring gear and drive pinion mesh properly.

During installation, tilt carrier to allow support case pilot to rest in carrier bore, then install bearing cup as shown in photo. Also install bearing cup on opposite side of differential.

2. If the same gear set is used, install the assembled bearing cap, adjuster and lock on the backface side of the ring gear. Otherwise install adjuster and cap separately.

NOTE: When installing cap, it may be necessary to tap it lightly with a hammer. Be sure cap is fully seated and threads are aligned properly, If trouble is encountered, check for cross-threading of bearing adjuster and carrier threads.

On teeth side of ring gear, install the other adjuster and bearing cap, observing same precautions to avoid cross-threading.

3. Install and tighten bearing cap screws finger-tight. If this is difficult, use hand wrench.

NOTE: The assembly is now ready for adjustment of differential bearing preloan, ring gear backlash and gear tooth contact (see page 57).

Forward and Rear Axle -- Adjust Differential Bearing Preload:

1. At the teeth-side of ring gear, position bearing adjuster until its first thread is visible.

2. At the back-face side of ring gear, tighten adjuster until there is no backlash.

3. At the teeth-side of ring gear, tighten adjuster until it contacts the bearing cup. Continue tightening adjuster two or three notches. This will preload bearings and provide backlash.

4. Check Ring Gear Backlash. Measure backlash with a dial indicator. Specifications are listed below. Refer to page 23 for detailed instructions on adjusting backlash.

Ring Gear Backlash Specifications
USED GEARING - Reset to backlash recorded before disassembly.
NEW GEARING - Backlash should be between 0.006" and 0.016".

5. Check Ring Gear Tooth Contact. Pain ring gear teeth and check toothe contact pattern. Correct toothe patterns are illustrated below. For checking and adjusting procedures, see page 24.

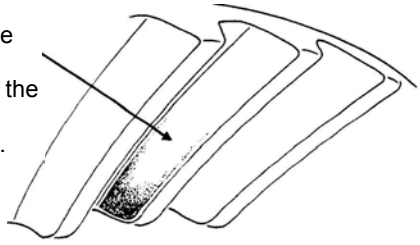
Adjusting Bearing Adjuster.

Checking Ring Gear Backlash.

CORRECT PATTERN (USED GEARING)

- Pocket may be extended.

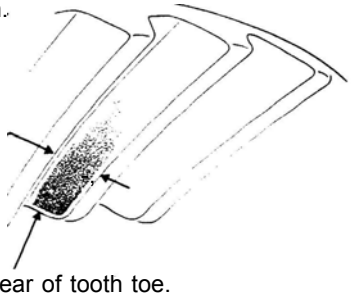
¥pattern along the face width could be longer.



CORRECT PATTERN (NEW GEARING)

¥Could vary in length. Pattern should cover 1/2 tooth or more (face width).

- pattern should be evenly centered between tooth top land and root.



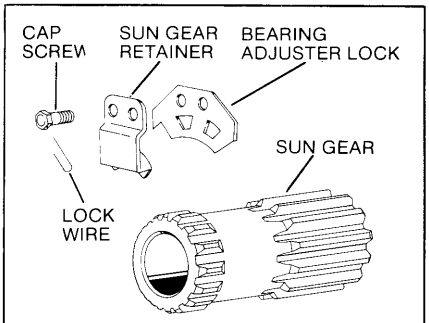
- Pattern should be clear of tooth toe.

6. With ring gear and pinion adjusted correctly, align adjusters and locks, then tighten differential bearing cap screws to correct torque (see chart page 58). Install cotter pin in one adjuster lock. Install cap screws in opposite adjuster lock and tighten to correct torque (see chart page 58). Lockwire bearing and adjuster lock cap screws.

Differential Carrier Overhaul

Adjust Differential Bearing Preload (Cont'd)

7. For planetary double reduction axles (on backface side of ring gear), install sun gear and retainer, then install cap screws that fasten both retainer and adjuster lock cap screws. Tighten screws to correct torque (see chart), and lockwire all cap screws.

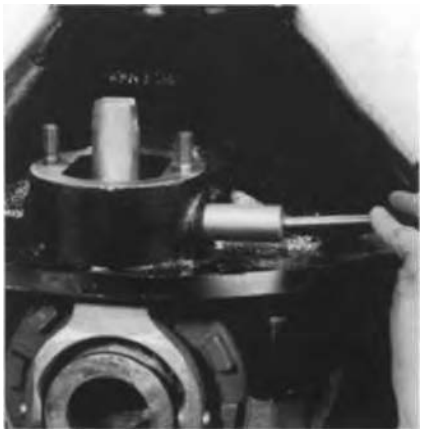


Planetary Double Reduction Axle

8. For dual range axles: Position shift fork in carrier opening, then install sliding clutch.

9. With clutch installed, engage shift fork yoke with clutch collar. Then install shift fork shaft. Install expansion plugs to seal openings.

10. Install shift unit seal and spring.



Installing Shift Fork Shaft.

Torque Chart

Differential Bearing Cap Cap Screw			
Size	**Grade**	**Ft.-lbs.**	**Nm**
13/16-10	(8)	370-430	501-583
Bearing Adjuster Lock and Sun Gear Retainer Cap Screw			
Size	**Grade**	**Ft.-lbs.**	**Nm**
5/8-1 1	(5)	160-176	217-239

Dual Range Axle Shift Systems

There are two shift system designs predominantly used to select range of an Spicer dual range tandem axle.

1. Standard System. For range selection, a cab-mounted air shifter valve operates two air shift units mounted on the axles.

The inter-axle differential lockout is of the straight-air type and air-operated to engage lockout and spring-released to disengage lockout.

2. Axle Range Interlock System. This system has an added feature to prevent axle shifting when the inter-axle differential is locked out. The axle range air shifter valve for this system includes an Interlock Pin Assembly to provide the interlock feature.

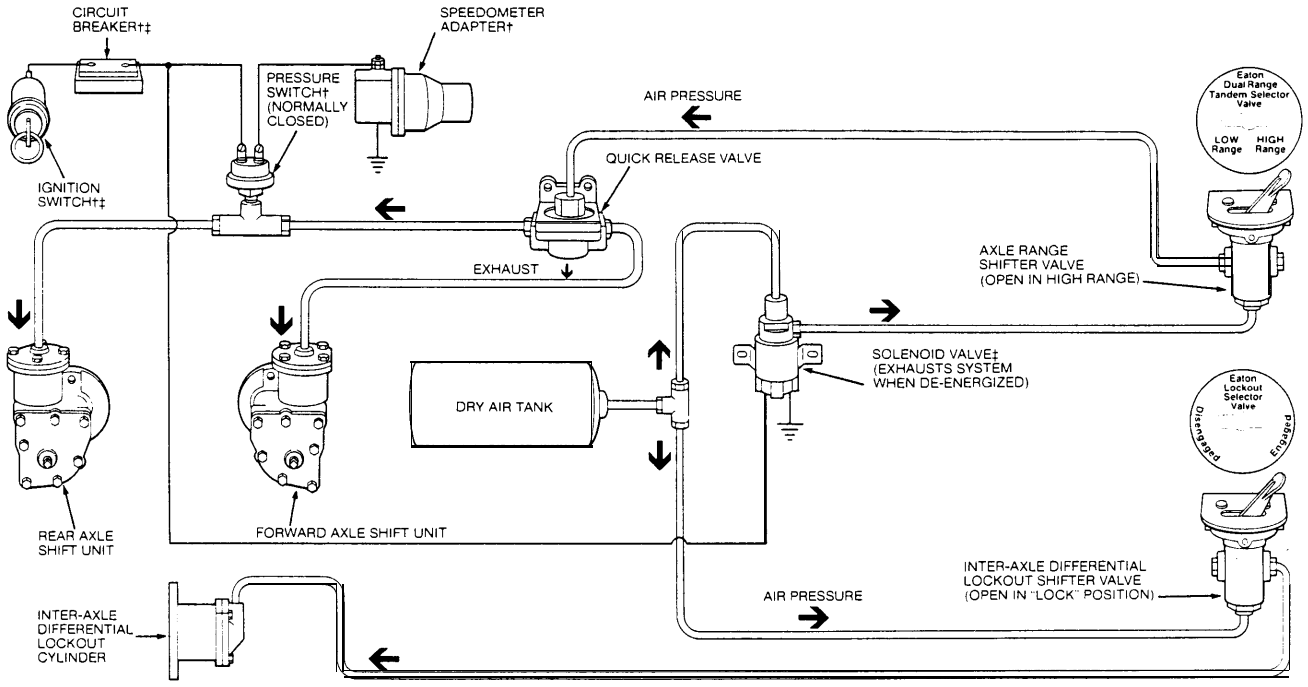
The inter-axle differential lockout is of the straight-air type. It is equipped with an Interlock Control Valve which controls air pressure delivery to the shifter valve Interlock Pin,

Detailed information on these systems is included in this manual.

"Reverse-Air" Type Inter-axle Differential Lockout. Some shift systems may include this lockout design. It is spring-operated to engage or "Lock" the differential and air-operated to disengage or "Unlock" the differential.

Dual Range Axle Shift Systems

Standard System for Axle Range Selection and Inter-Axle Differential Lockout (straight-air type)



← Air pressure with axle in High Range, Inter-Axle Differential Engaged.

†Pressure switch and speedometer adapter required for vehicles with transmission drive speedometers.

‡Solenold valve required for vehicles not equipped with automatic safety brakes.

Description

The standard dual range shift system consists of:

1. A manually-operated, air shifter valve to change axle range.

2. A quick release valve which provides for fast release of air pressure from the axle shift units.

3. Two air shift units mounted on the axles. These shift units are mechanically connected to the axle shift forks and sliding clutches which, in turn, shift axles into Low or High Range.

For vehicles not equipped with automatic safety brakes, an ignition-controlled solenoid valve exhausts the system and downshifts the axles when the ignition switch is turned off. The electrical circuit is protected by a circuit breaker.

For vehicles equipped with transmission-drive speedometers, the system includes a speedometer adapter which compensates speedometer readings when axle is in Low Range. The adapter is operated by an electrical switch mounted on or near the quick-release valve. The switch is normally-closed and is opened by air pressure. With axles in Low Range, the switch is closed and the adapter is energized. The adapter operates with a ratio compatible with the axle Low Range for proper speed readings. With axle in High Range, the air lines are pressurized and the pressure switch is open. The adapter now operates with 1:1 ratio for proper speed readings in High Range.

Axle Shift System Operation

High Range. When shifter valve is moved to the High position, the valve is opened and air pressure is supplied through the quick release valve to both axle shift units. When driveline torque is interrupted, the shift units will shift both axles to High Range.

Low Range. When shifter valve is moved to the Low position, the valve is closed. Air pressure in the shift units is exhausted through the quick release valve. When driveline torque is interrupted, both axles are shifted to Low Range and held in this position by shift unit return springs.

Inter-Axle Diff. Lockout System

The lockout air shift system consists of:

1. A manually-operated air shifter valve which controls engagement or disengagement of the inter-axle differential.

2. A lockout cylinder which operates under air pressure. This cylinder is mechanically-connected to a shift fork and sliding clutch. The clutch engages or disengages a differential helical-side gear to "Lock" or "Unlock" the differential.

Lockout System Operation. For operation description, refer to the following page.

Dual Range Axle Shift Systems

"Standard" Lockout *(straight-air type)*

Description: The “standard” lockout unit is of the straight-air type and is air-operated to engage lockout and spring-released to disengage lockout.

The piston is mechanically connected to the shift fork and sliding clutch. The clutch engages or disengages the helical-side gear to lock or unlock the inter-axle differential.

Disengage Lockout (Unlock Differential)

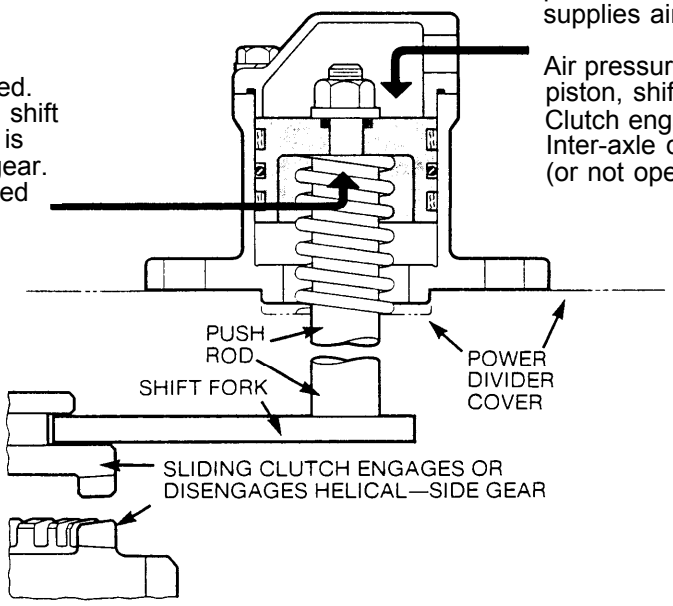
When the air shifter valve lever is moved to the disengaged or “Unlock” position, the valve is closed and air pressure in the cylinder is exhausted.

Air pressure at piston is released. Spring pressure moves piston, shift fork and sliding clutch. Clutch is disengaged from helical-side gear. Inter-axle differential is unlocked and functions normally.

Engage Lockout (Lock Differential)

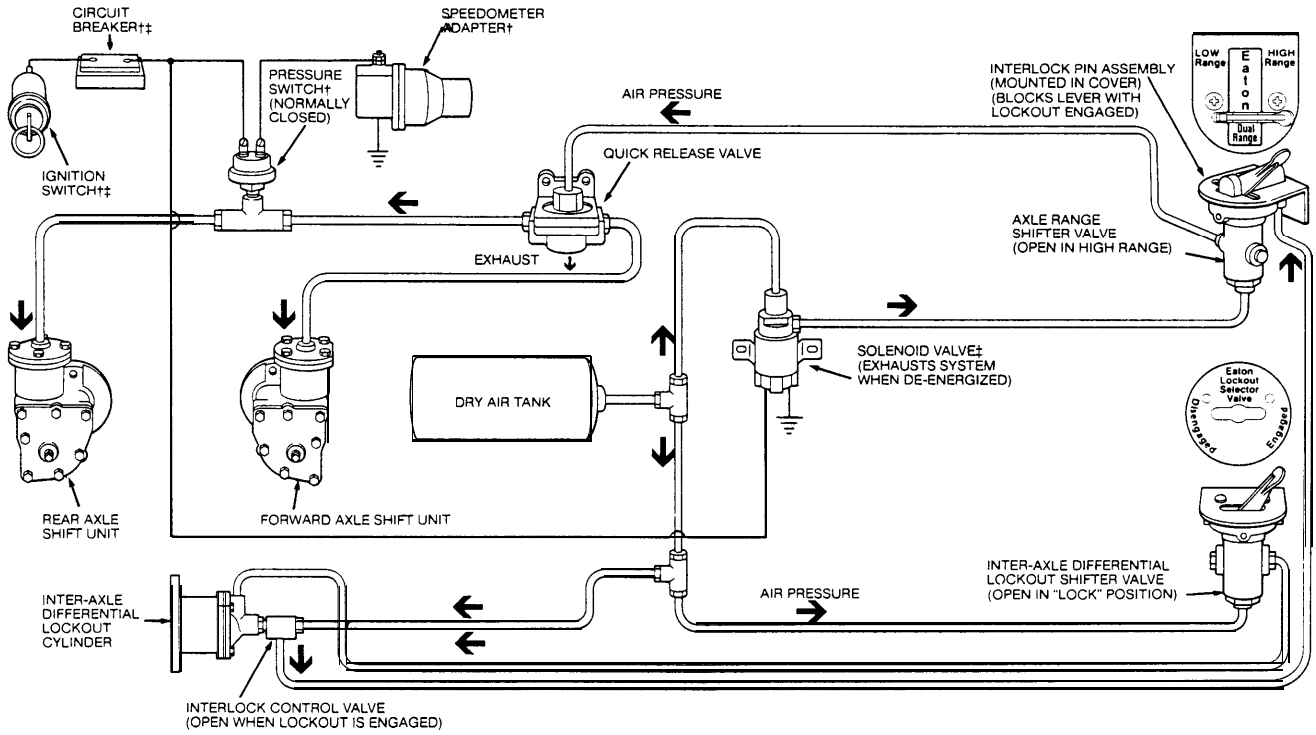
When the air shifter valve lever is moved to the engaged or “Lock” position, the valve is opened and supplies air to the lockout cylinder.

Air pressure enters cover—moves piston, shift fork and sliding clutch. Clutch engages helical-side gear. Inter-axle differential is locked out (or not operating).



Axle Range Selection and Inter-Axle Differential Lockout System

(with Axle Range Interlock and Straight-air type Lockout)



← Air pressure with axle in High Range, Inter-Axle Differential Engaged, and Axle Shifter Valve Lever Blocked.

† Pressure switch and speedometer adapter required for vehicles with transmission drive speedometers.

‡ Solenoid valve required for vehicles not equipped with automatic safety brakes.

Description and Operation

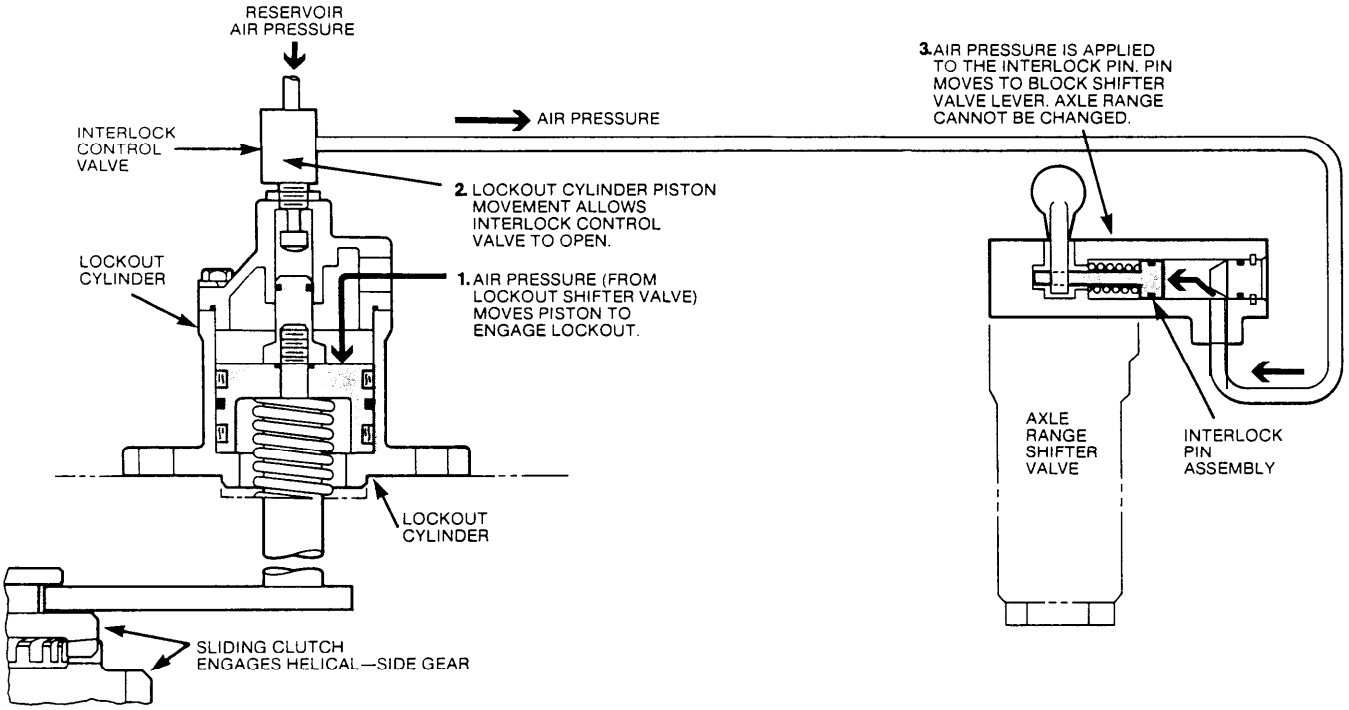
The Axle Range Interlock feature in this system is designed to prevent axle shifting when the inter-axle differential is locked out (or when lockout is engaged).

The basic shift system operates the same as the standard shift system to shift axle and engage or disengage lockout. However, it varies by adding an Interlock Pin Assembly to the axle range shifter valve and an Interlock Control Valve to the lockout cylinder. These two components are interconnected with air lines (see illustration above). In operation, the Interlock Pin Assembly blocks movement of the axle range shifter valve lever when air pressure is present. Refer to the following page for operation description.

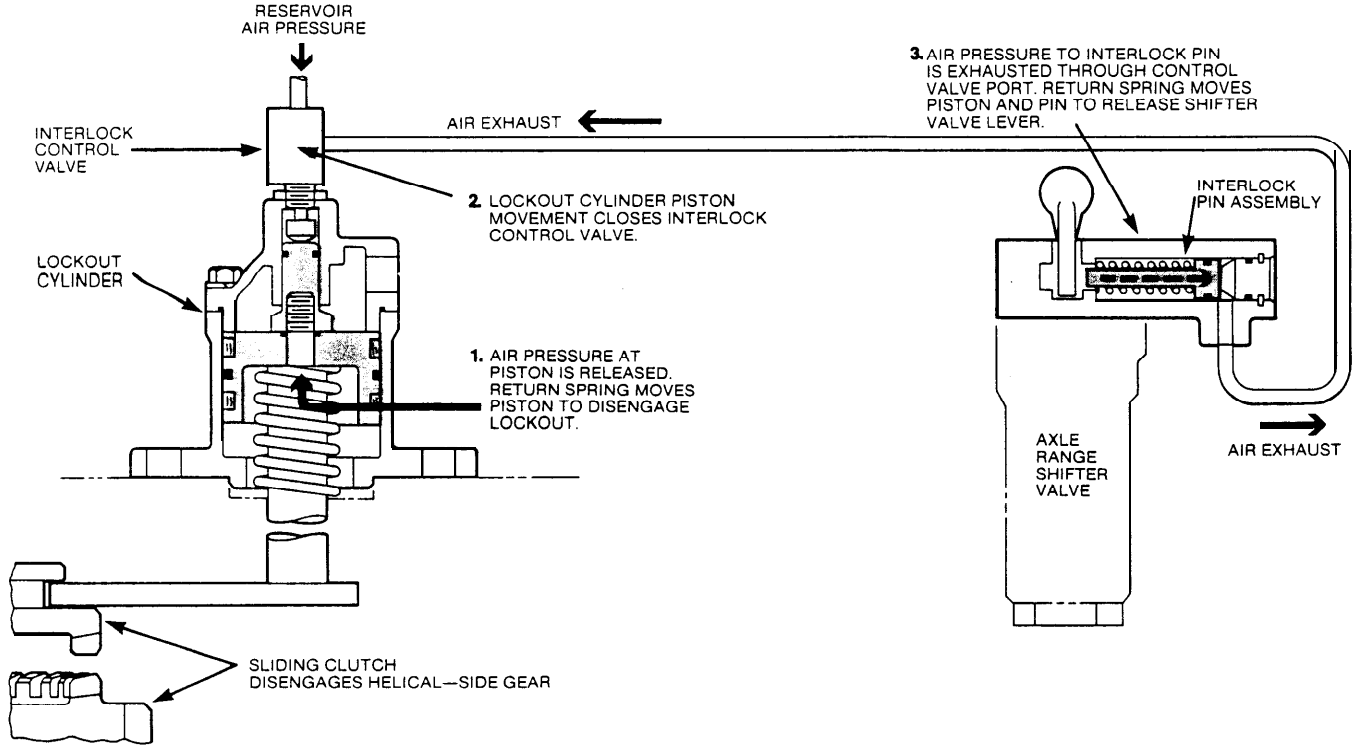
Dual Range Axle ShiFt Systems

Axle Range Interlock Operation

Engage Lockout (Lock Differential) (Axle in High or Low Range)



Disengage Lockout (Unlock Differential) (Axle in High or Low Range)



Check for Air Pressure and Air Leaks

A simple method for quickly locating troubles in a shift system can be accomplished by listening for possible air leaks and for sound which would indicate mechanical shifting.

Axle Shift System

1. When system includes a solenoid valve, turn ignition “ON” to energize and open the solenoid valve.

If electrical system is functioning, air pressure should be present at valve outlet connection.

2. Move axle shifter valve lever to High Range. In this position, air pressure should be present in the entire system. Check for air leaks.

3. Move axle shifter valve lever to Low Range. In this position, air pressure should be present only up to axle shifter valve.

4. To check axle for shifting, operate shifter lever back and forth from “LO” to “HI”. If the shift unit is operating, a definite reaction will be evident by sound of parts movement.

5. If air pressure is satisfactory and shift unit does not operate, disassemble and inspect shift unit.

Check Pressure Switch.

In Low Range, the pressure switch is closed and electrical circuit is complete to the speedometer adapter. In High Range, air pressure opens the pressure switch, breaks the electric circuit to the speedometer adapter.

To check pressure switch operation, shift to High Range and probe switch terminals. No voltage should be present. Replace a faulty pressure switch as an assembly.

Check Quick Release Valve.

The quick release valve provides a means of quickly exhausting air from system when axle is shifted from High to Low Range.

To check valve operation, listen for audible air exhaust from valve when shifting axle from High to Low Range. Replace a faulty quick release valve as an assembly.

Check Lockout (standard).

With shifter valve in the “Lock” position, air pressure is present in the entire lockout system. Check for air leaks with lockout engaged. Repair leaks.

NOTE: If lockout will not engage with air pressure present at cover connection, remove and check lockout cylinder.

Check Lockout (with axle range interlock).

With shifter valve in “Lock” position, lockout is engaged and air pressure is present in all lines and components of the lockout and interlock system. Check for air leaks with lockout engaged. Repair leaks.

If lockout will not engage with air pressure present at cylinder cover side connection, remove and check cylinder.

Check Interlock Control Valve

Air pressure is present at the inlet connection at all times.

With lockout engaged, the valve should open and air pressure should be present at the valve side connection.

With lockout disengaged, valve should be closed, blocking air at the side connecton.

Check valve operation in both lockout positions. If valve operation is faulty, replace the assembly.

Check Interlock Pin Assembly

Air pressure is present at the axle range shifter valve cover connection when lockout is engaged. Air pressure should operate locking pin to block movement of the axle shifter valve lever.

To check operation, move the lockout shifter lever to the “Lock” position. If lever operation is not blocked, check for air pressure at the Interlock Pin connection. If air pressure is present, repair Interlock Pin Assembly.

Check Electrical System

Check Solenoid Valve

1. When ignition switch is "ON"; solenoid valve is energized and air pressure is available to operate the system. When ignition switch is “OFF; solenoid valve is de-energized and exhausts the system which downshifts axle to low range. Check wiring and circuit breaker for defects that would cause shorts or open circuits.

2. Make sure valve has a good ground connection to the frame. With power at valve, check operation as follows: Disconnect lead wire and air line outlet at valve and install air pressure gauge.

Apply power to valve and observe air gauge reading. Operating pressure should be approximate reservoir pressure.

If gauge indicates approximate pressure, valve is okay.

If gauge indicates low or no pressure, valve is faulty. Replace valve assembly.

Check Speedometer Adapter

1. Make sure adapter is grounded to vehicle chassis.

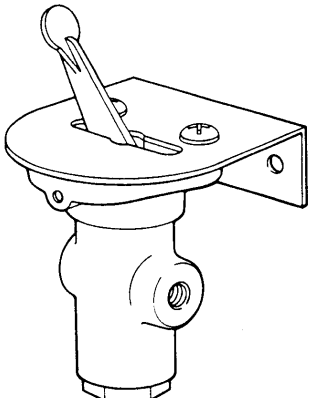
2. Check wiring for shorts or grounds and trace electrical circuit from ignition switch through circuit breaker, pressure switch to adapter.

3. Check for power supply at adapter terminal. With axle shifter valve in High Range, pressure switch is open and power is not delivered to adapter. With shifter valve in Low Range, the pressure switch is closed and power is delivered to operate the speedometer adapter. If power supply is okay, adapter is faulty. Replace adapter assembly.

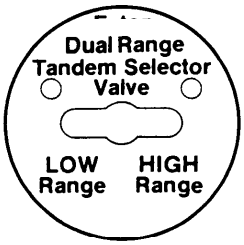
Axle Shift System Components

Air Shifter Valves (Standard System)

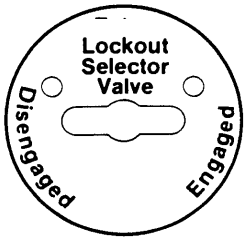
NOTE: For air shifter valve repair instruction, refer to pertinent manufacturer's literature. See instructions below for Interlock Pin Assembly repair.



Typical Air Shifter Valve for Standard System, Axle Range Selection and Inter-axle Differential Lockout.

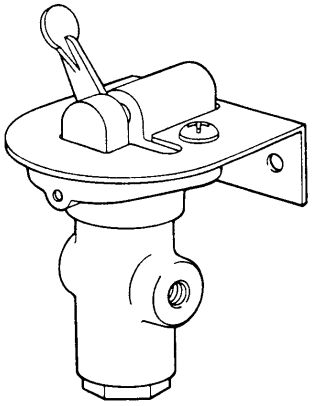


Ax/e Range Selector Name Plate (Standard System)

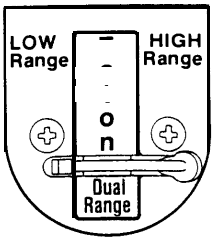


Inter-Axle Differential Lockout Name Plate

Air Shifter Valve (Axle Range Interlock System)

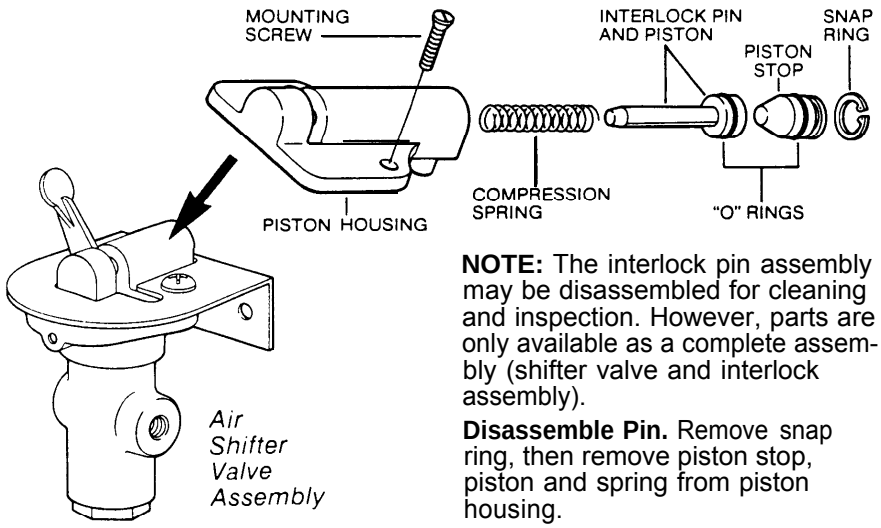


Axle Range Interlock Air Shifter Valve. The Valve for the Inter-ax/e Differential/ Lockout is the same as the Standard System.



Ax/e Range Selector Name P/ate (System with Axle Range Interlock)

Axle Range Shifter Valve Interlock Pin Assembly



Air Shifter Valve Assembly

NOTE: The interlock pin assembly may be disassembled for cleaning and inspection. However, parts are only available as a complete assembly (shifter valve and interlock assembly).

Disassemble Pin. Remove snap ring, then remove piston stop, piston and spring from piston housing.

NOTE: Before reassembly, lubricate "O" rings with a high-viscosity silicone oil or barium grease "O" ring lubricant.

Assemble Pin. Install "O" rings on piston and piston stop. Insert spring, piston and piston stop in housing and secure with snap ring.

NOTE: Interlock pin and piston must reciprocate freely in the piston housing when compressed against the compression return spring.

NOTE: For ease of assembly, insert a pin or drill bit (5/64" max. diameter) into the piston stop to guide the piston stop as it is installed into the piston housing.

"Standard" Lockouts.

- Planetary Double Reduction Tandem Axles
- Dual Range Tandem Axles with "standard" Axle Range Selection System.

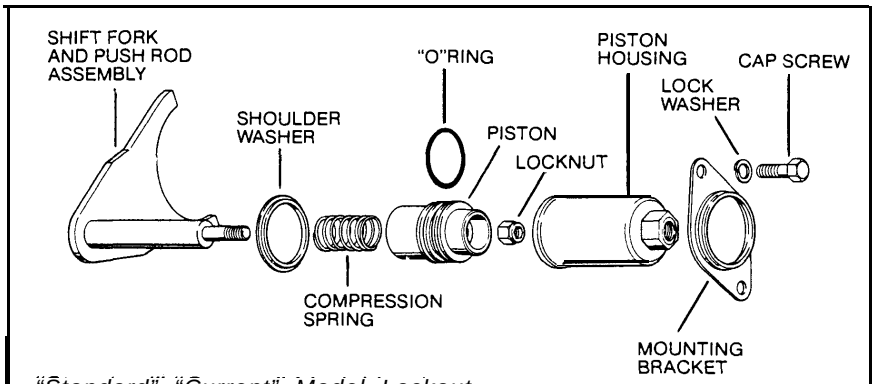
Two "Standard" designs are used on these axles and are identified as "Standard" "Current" or "Standard" "Non-Current" Models. Both designs are air-operated to engage the lockout and spring-released to disengage the lockout. Spicer Axles may be equipped with either of these lockouts. The "Current" model is interchangeable with the "Non-Current" model as an assembly. For service information, refer to the following page.

"Reverse-Air" Lockout. The "Reverse-Air" lockout is spring-operated to engage the lockout and air-operated to disengage the lockout. This model is similar to the "non-current" "standard" lockout. It is not available in the new "current" lockout.

"Standard" "Current" Model Lockout Overhaul

Disassemble and Remove Lockout.

NOTE: With axle installed in vehicle, place differential lock selector valve in the disengaged (or unlocked) position. Disconnect the air line at the lockout piston housing.



"Standard" "Current" Model Lockout

1. Remove cap screws and lockwashers fastening mounting bracket to power divider cover. Remove bracket and piston housing.

2. Remove locknut, Piston with "O" ring, compression spring and shoulder washer from push rod.

NOTE: The shift fork and Push rod cannot be removed with power divider cover installed (see Power Divider instructions).

Assemble and Install Lockout

1. With shift fork and sliding clutch installed, place the shoulder washer (white plastic) over push rod. The large diameter side of the washer must face the power divider cover.

2. Install compression spring on push rod.

3. Lubricate "O" ring with silicone-based lubricant and install "O" ring on piston.

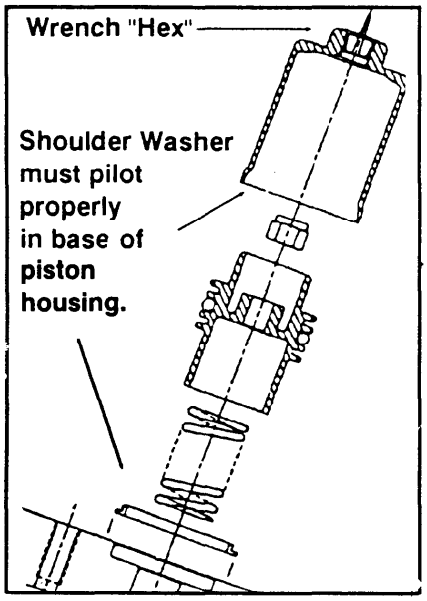
4. Place piston assembly on push rod. The large diameter end of piston must face power divider cover.

5. Install locknut on push rod and tighten to 13-17 lbs. -ft. (18-23 N•m).

6. Install piston housing, making sure the housing IS correctly seated and piloted in the shoulder washer,

7. Place mounting bracket over housing and position on power divider cover. Install. cap screws and lockwashers and tighten to 48-56 lb.-ft. (65-76 N•m).

NOTE: If axle is installed in vehicle, apply sealant to air line fitting and connect air line. When tightening air line, hold piston housing in mounting position using a wrench applied to the hexagon configuration at outer end of housing.



NOTE: A new style "Inter-Axle Differential Lockout" was being released as this publication was being printed. If the Inter-Axle Differential Lockout Assembly on your axle is not shown in this publication, call your local Spicer representative.

Axle Shift Components.

Retrofit "Non-Current" to "Current" Model Lockout

The "current" model (only as an assembly) is interchangeable with the "non-current" lockout. The original shift fork and push rod can be used for either model lockout and need not be replaced.

Retrofit Kits are available to convert the "non-current" model to the "current" lockout. Parts (except the shift fork), included in these kits are shown in the illustration on the preceding page. For additional information, refer to Spicer Parts Books (see inside back cover).

1. Disassemble and remove "non-current" lockout. Refer to instructions below.

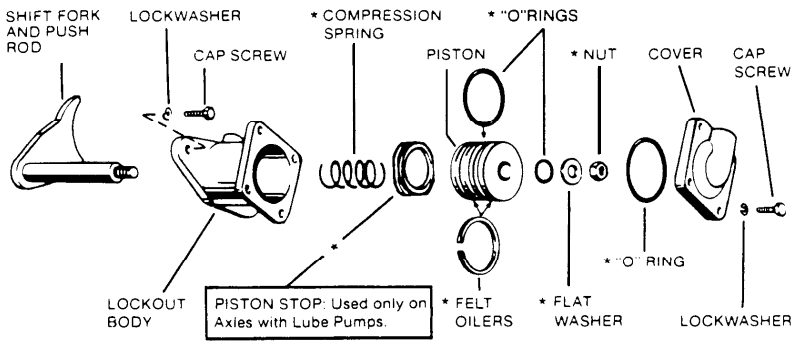
2. Assemble and install "current" lockout following instructions on preceding page.

NOTE: Do not use mounting screws from "non-current" model. They are too long to use with the new "current" model.

"Standard" "Non-Current" Model Lockout Overhaul

Service Parts Availability. The "non-current" lockout assembly, body, piston and body cover are no longer available. If any of these items are not serviceable, replace lockout with the new "current" model per instructions above. For other parts, a Service Parts Kit (see illustration) is available to service the "non-current" lockout.

"Standard" "Non-Current" Model Lockout



**Asterisk Identifies parts included in Service Kit 277207*

NOTE: Axles with Lube Pumps: These axle models are equipped with a piston stop located at base of piston. It is important that this stop be reinstalled in reassembly.

Disassemble and Remove Lockout

1. Remove cap screws and lockwashers fastening cover to the body. Remove cover and "O'' ring.

2. Remove nut, flat washer and "O'' ring from push rod.

3. Remove body cap screws and lockwashers, then remove body and piston as an assembly. Remove "O'' ring and felt oilers from the piston.

NOTE: The shift fork and push rod cannot be removed with power divider cover installed (see Power Divider instructions).

Assemble and Install Lockout

With shift fork and sliding clutch installed in power divider cover, assemble and install lockout as follows.

1. Apply silicone gasket compound to mounting surface on power divider cover. See illustration.

2. Install lockout body. Secure with cap screws and lockwashers. Torque cap screws to 48-56 lbs.-ft. (65-76 N•m).

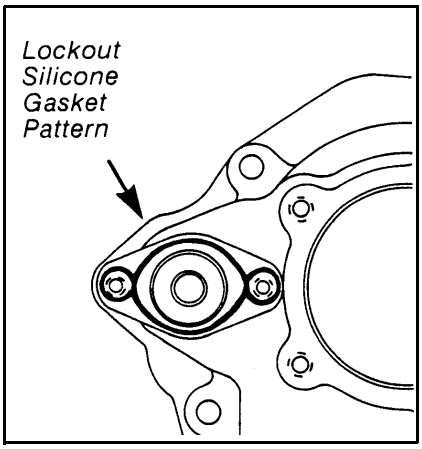
NOTE: Before installation, soak piston felt oilers in SAE 30 engine oil and lubricate "O'' rings with a high-viscosity silicone oil or barium grease "O'' ring lubricant.

3. Install felt oilers and large "O" ring on piston.

Axles with Lube Pump. Before installing piston, place piston stop at base of lockout body.

4. Install compression spring over shift fork push rod. Install piston in body and secure with "O" ring, flat washer and nut. Torque nut to 20-26 lbs.-ft. (27-35 N•m).

5. install "O'' ring in lockout body cover. Install cover and secure with cap screws and lockwashers. Torque cap screws to 96-108 LBS.-IN (10-12 N•m).



Inter-Axle Differential Lockout *(with Interlock Control Valve)*

(straight-air type)

Lockout Cylinder

Disassemble Cylinder.

1. Remove cap screws, lockwashers, cover assembly and "O" ring,

2. Remove hex-nut piston and "O" rings.

3. Remove body cap screws and lockwashers, then remove body and piston as an assembly.

Assemble Cylinder.

1. Apply gasket compound to mounting surface on power divider cover.

2. Install lockout body. Secure with cap screws and lockwashers. Torque cap screws to 48-56 ft-lbs. (65-76 Nm).

NOTE: Before installation, soak piston felt oilers in SAE 30 engine oil and lubricate "O" rings with a high-viscosity silicone oil or barium grease "O" ring lubricant.

3. Install felt oilers and "O" ring on piston.

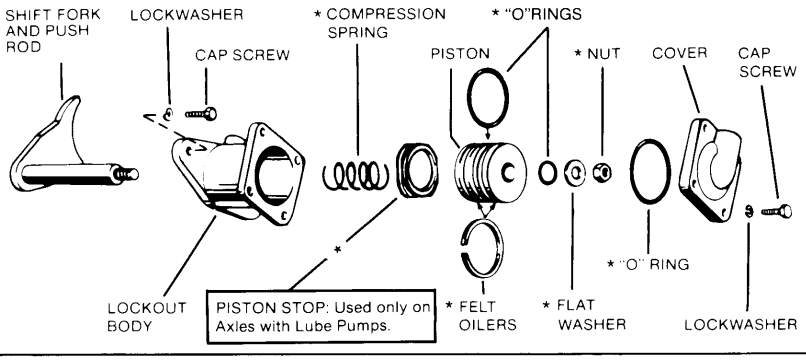
Axles with Lube Pump: Before installing piston, place piston stop at base of lockout body.

4. Install compression spring over shift fork push rod. Install piston in body. Install "O" ring over push rod and in piston. Install hex-nut piston and tighten to 20-26 ft-lbs. (27-35 N«m). Install "O" ring on piston.

5. Install "O" ring in lockout body cover. Install cover assembly and secure with cap screws and lockwashers. Torque cap screws to 96-108 IN-LBS. (10-12 N«m).

6. Adjust interlock control valve.

"Standard" "Non-Current" Model Lockout



Interlock Control Valve

Replace faulty valve as an assembly,

Repair and Replacement.

Remove Valve.

1. Loosen locknut and unscrew valve body from cylinder cover.

Install and Adjust Valve.

NOTE: If button is not assembled to valve stem, install as follows: Insert valve stem to full depth of the button. Lock in place with set screw. Torque set screw to 6 IN-LBS. (0.7 Nm).

1. With button assembled to valve, install locknut and lockwasher on valve body. With lockout cylinder exhausted, screw the valve assembly into the lockout cylinder cover until the valve is seated on hex-nut piston.

2. To adjust, unscrew control valve until the valve air-delivery port is aligned with the lockout cylinder air-inlet port.

NOTE: Do not unscrew valve more than 360°.

Lock the valve in place with locknut. Torque locknut to 35 IN-LBS. (3.9 Nm).

Speedometer Adapter

The speedometer adapters are lubricated and sealed for life of the unit. No maintenance is required. Replace a faulty unit.

Solenoid Valve

Replace solenoid valve as an assembly. The valve should not be serviced.

Quick Release Valve

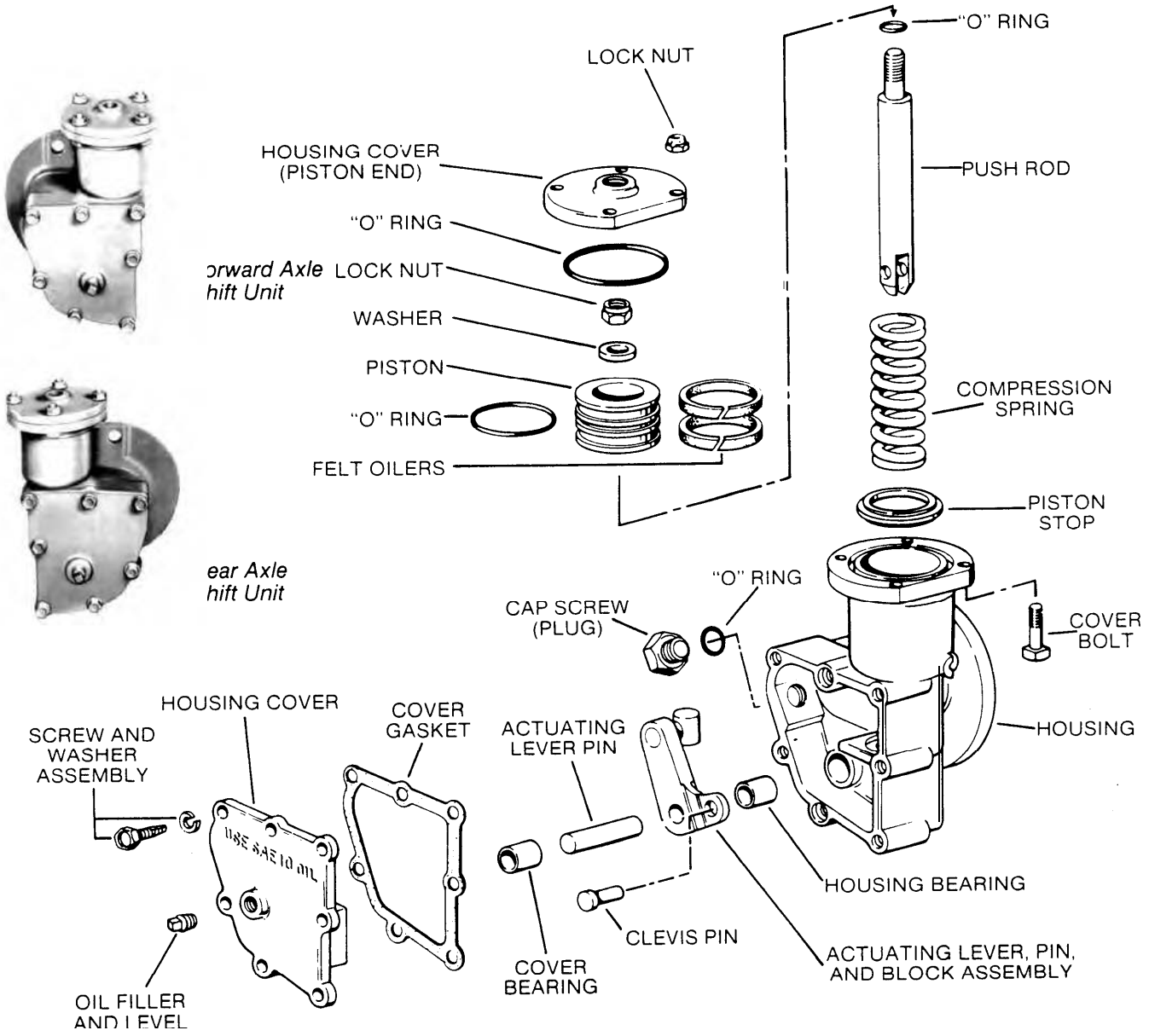
If quick release valve fails to operate properly, it may be repaired as follows: Disassemble valve. Inspect valve body, valve seat and spring (if used) for evidence of faulty operation. Replace faulty parts, then reassemble valve.

Pressure Switch

Replace pressure switch as an assembly.

Axle Shift System Components

Air Shift Unit



Air Shift Unit-Exploded View (Forward Axle Unit Illustrated)

Description and Operation

The Piston Air-Shift Units are engineered for efficient performante and built for reliable, service-free operation.

Operation of each unit is as follows: The shift units are mechanically connected to the axle shift forks and shift axles into Low or High range.

The unit consists of an air chamber, piston, compression spring and mechanical linkage. When air is admitted to the chamber or cylinder, the piston travels downward against a compression spring, transferring motion through a push rod and actuating lever to the shift fork, shifting the axle into High range. Exhaust of air pressure permits the heavy-duty spring to return the axle gearing to Low range.

Air Shift Unit Replacement

Remove Unit

Disconnect air line at shift unit cover. Remove nuts, flat washers and piston air-shift unit from differential carrier.

NOTE: When shift unit is removed, provide container to catch oil that escapes from reservoir. Remove shift fork seal and spring.

Install Unit

1. Lubricate shift fork. Slide seal and spring assembly over fork and seal on differential carrier studs. Shift axle into Low Range.

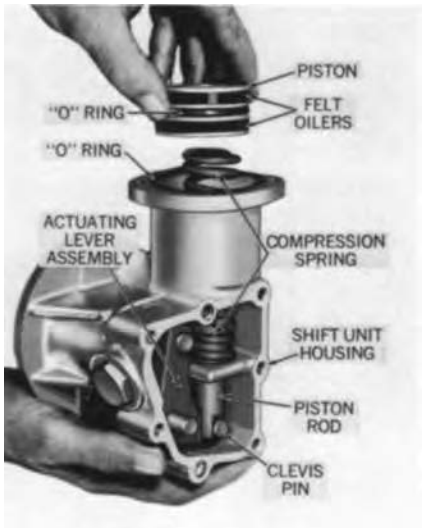
2. Place shift unit on mounting studs and make certain shift fork actuating lever engages slot in shift fork. Install flat washers and stud nuts. Tighten nuts to 55-61 ft-lbs. (74-82 Nm).

3. When axle is installed in vehicle, fill shift unit housing to level of filler plug with SAE 10 oil or automatic transmission fluid (see **Lubrication on** following page). Coat threads of filler plug with sealer and install plug.

4. Connect air lines to shift unit cover.

Air Shift Unit Overhaul

Disassemble Unit

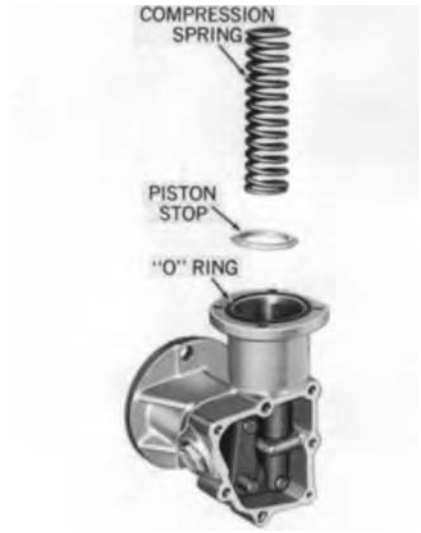


1. Remove cap screws, lock washers, cover and gasket from housing. Drain lubricant.

2. Remove bolts, locknuts, cover at piston end of housing. Remove "O" ring.

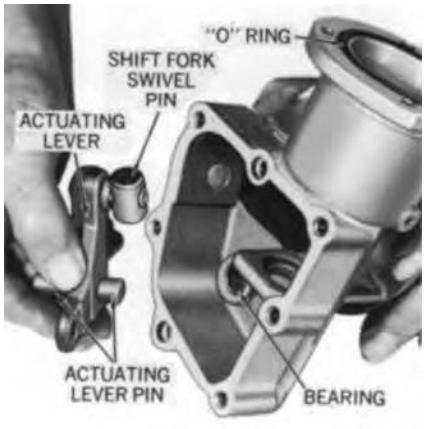
⚠ **CAUTION:** DURING THE FOLLOWING PROCEDURE, THE PISTON WILL POP OUT OF HOUSING UNDER SPRING PRESSURE. EXERCISE CAUTION TO PREVENT POSSIBLE INJURY.

3. Remove locknut, flat washer, and piston from push rod. Remove "O" ring and felt oilers from piston.



4. Remove compression spring and piston stop from bore of shift unit housing.

5. Remove clevis pin, then remove push rod from shift unit housing. Remove "O" Ring from push rod.



6. Remove actuating lever and pin assembly from shift unit housing. Do not disassemble actuating lever.

Parts Inspection

Shift Fork Seal - Inspect shift fork seal for defects and tight fit on shift fork. A spring is used to assure a closer fit of seal around shift fork. If this spring is not present on axle being serviced, install one when reassembling unit.

"O" Rings, Felt Oilers and Gasket - Replace "O" rings, felt oilers and cover gasket when piston air-shift unit is disassembled for repair.

Compression Spring - Inspect spring for distortion, cracks, or other visual defects, Replace a faulty spring.

Actuating Lever and Pins - Inspect lever pins and bearings for worn or grooved condition. Inspect actuating lever and push rod for worn or elongated holes at point where they are connected. Replace faulty parts.

Piston - inspect piston friction surface for worn, grooved or damaged condition which will affect the piston movement in cylinder. Replace a faulty piston.

Axle Shift System Components

Air Shift Unit Overhaul *(Cont'd)*

Assemble Unit

NOTE: Prior to assembly, the piston felt oilers should be soaked in SAE 10 oil for one hour. Lubricate "O" rings with a high-viscosity silicone oil or barium grease "O" ring lubricant.

1. Assemble pin to actuating lever and install this assembly in shift unit housing.

2. Assemble "O" ring and piston to push rod and fasten with flat washer and locknut. Tighten nut to a torque of 120-150 IN-LBS. (14-17 Nm). Install felt oilers and "O" ring in piston.

⚠ **CAUTION:** DURING THE FOLLOWING PROCEDURE USING A PRESS, MAKE CERTAIN COMPONENTS ARE PROPERLY ALIGNED IN PRESS TO PREVENT POSSIBLE PERSONAL INJURY OR DAMAGE TO PARTS.

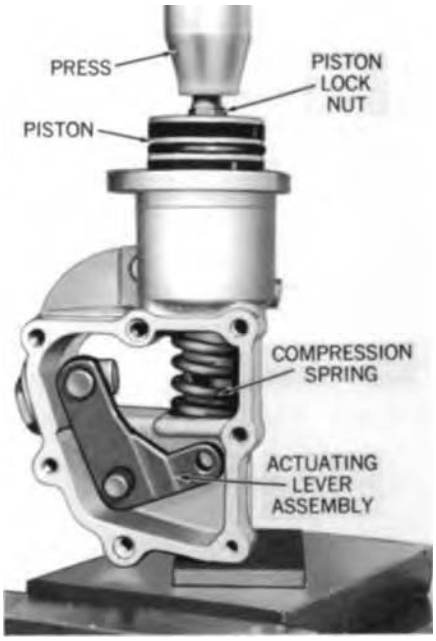
3. Insert piston stop and compression spring in shift unit housing. Place piston and push rod assembly in housing. Position housing assembly in arbor press.

4. Apply pressure to piston until actuating lever is in alignment with push rod end. Install clevis pin. Release press.

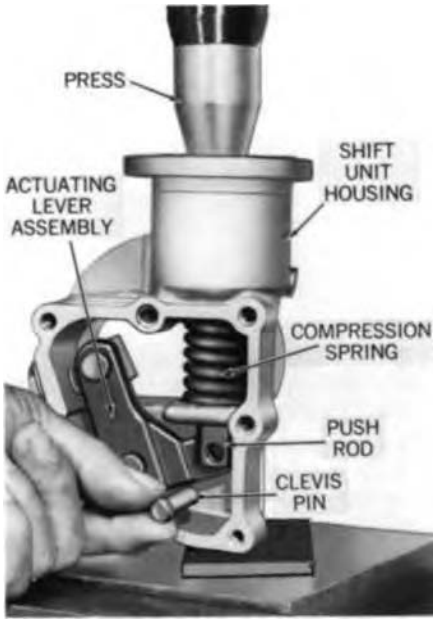
5. Place cover gasket in position on shift unit housing then install cover and bearing assembly and fasten with cap screw and lockwashers. If necessary, use a sealer on threads of cap screws to prevent any leaking. Tighten screws to a torque of 90-110 IN-LBS. (10-12 N.m).

6. Place "O" ring in groove of shift unit housing, then install housing cover and secure with bolts and locknuts. Tighten locknuts evenly to a torque of 108-132 IN-LBS. (12-15 N.m).

7. Fill shift unit with SAE 10 oil or automatic transmission fluid (see Lubrication) when axle is installed in vehicle.



Shift Unit Housing in Press.



Installing Push Rod Clevis Pin.

Lubrication

Lubricant-Use SAE 10 motor oil* for temperature above 0ºF (-18ºC). For temperatures below 0ºF (-18ºC), mix three parts of SAE 10 motor oil with one part of kerosene. This cold weather mixture can be safely used up to 32ºF (0˚C).

***NOTE:** Commercially available automatic transmission fluid may be used in place of SAE 10 motor oil. Automatic transmission fluid can be used for all temperatures. Do not mix kerosene with automatic transmission fluid.

Lubricant Check and Level - Each 20,000 miles or six months, remove pipe plug in shift unit housing cover to check lubricant level. Lube should be level with bottom of filler hole.

Lubricant Change - At least once a year remove shift unit housing cover and drain old lubricant. Wash parts thoroughly and air dry. Reinstall cover. Remove pipe plug in cover. Fill through pipe plug opening until lube is level with bottom of filler hole.

Air Shifter Valve

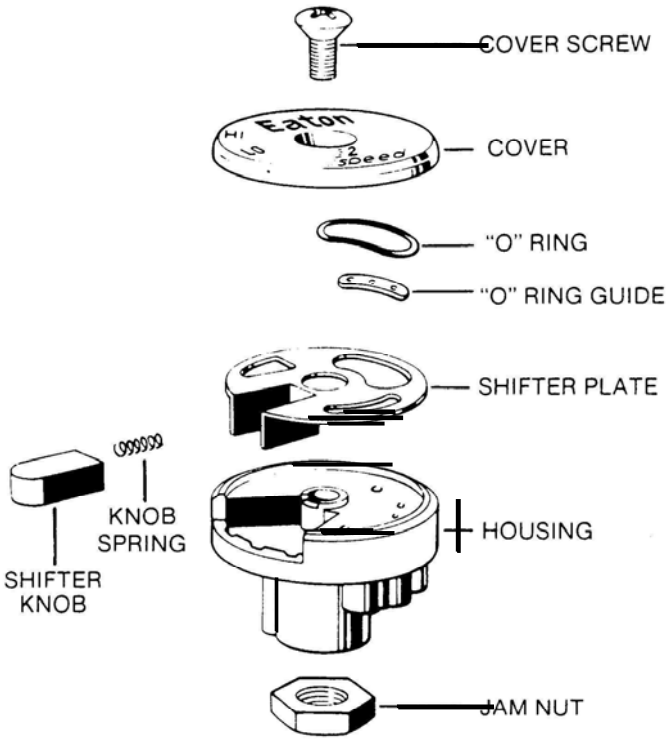
(Optional Axle Range Shifter Valve Mounted on Gear Shift Lever).

⚠ **CAUTION:** AIR SUPPLY TO VALVE MUST BE SHUT OFF BEã FORE THE VALVE IS SERVICED.

The shifter valve can be disassembled for service without removing the assembly from the gear shift lever.

1. Remove screw from cover, then lift off cover and remove shifter knob, knob spring, shifter plate, "O" ring guide and "O" ring from valve housing,

2. If housing requires replacement, disconnect air lines, loosen jam nut, then unscrew housing from shift lever.



Inspection and Lubrication

Each 50,000 miles, disassemble, inspect and clean, then lubricate moving parts with barium-base grease. No other type lubricant should be used.

Assemble and Install Valve

1. If housing was removed, install jam nut on shift lever. Thread housing on shift lever and tighten jam nut. Connect air lines. Air shift valve knob should be positioned at 9:00 o'clock. Lubricate moving parts with barium-base grease during assembly.

2. Place shifter plate in mounting position on valve housing.

3. Pre-assemble guide and "O" ring, then place this assembly in mounting position in shifter plate.

4. Hold shifter plate in position with one hand, then install spring and shifter knob. Install cover and fasten with screw.

Service Bulletin Supplement.

Input Shaft End Play for Axle Models equipped with an Input Shaft Axial Spring and Thrust Button.

In September 1988, Spicer added an Axial Spring and Thrust Button between the input and output shafts. The addition of these parts reduces shaft end play movement by loading the shafts axially in the direction of the yoke.

End play tolerances are the same for axles with or without the new Spring and Thrust Button. However, end play measurement procedure is different as described below.

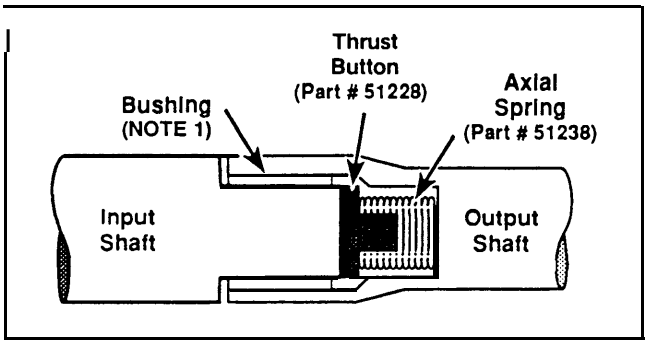
Measure and Adjust Input Shaft End Play.

NOTE: The addition of the Spring and Thrust Button between the input and output shafts necessitates the fabrication of a "U" bracket to assist in measuring the shaft end play. Proceed as follows:

1. Fabricate a "U" bracket from 1" flat stock (minimum thickness 0.125") as specified in the illustration.

2. If axle is disassembled, build up a 0.045" (0.024 mm) thick shim pack and place shim pack and bearing cover on power divider cover. Then proceed with Step 3.

If axle is assembled, remove input shaft nut, flat washer and yoke. (NOTE: Axles built with metric threaded nuts do not use flat washers.) Then proceed with Step 3.



Location of Axial Spring and Thrust Button.

Input Shaft End Play Chart

New or Rebuild with new parts 0.003" to 0.007"

Rebuild with reused parts 0.013" to 0.017"

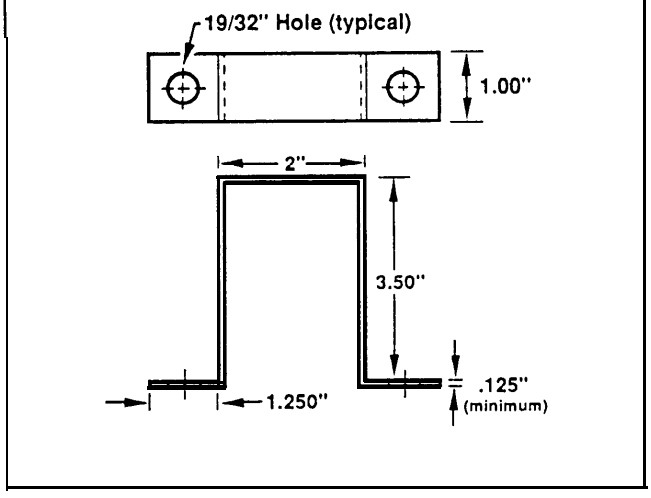
NOTE: Because of manufacturing variations in individual parts, correctly adjusted end play could vary 0.010," after the unit is rotated.

Acceptable End Play Tolerances when measuring as a regular maintenance procedure with axle in truck.

Up to 0.060" with over 100,000 miles or 1 year service off-road.

Up to 0.040" with less than 100,000 miles or 1 year service on-road.

NOTE: If end play exceeds limits, disassemble power divider and replace worn parts.



"U" Bracket Specifications.

NOTE 1: Bushing no longer used in current production axles, see pages 37 & 38.

Measure and Adjust Input Shaft End Play *Cont'd.*

3. Install the "U" bracket on bearing cover, using two bearing cover cap screws (see illustration). install all other cover cap screws and torque to 75-85 lbs.-ft. (101-115 N•m).

4. Position a dial indicator on the end of the input shaft (see illustration).

5. Insert a pry bar through the "U" bracket with the end of the bar resting on the end of the input shaft. (see illustration).

6. Zero the dial indicator and lift up on the pry bar to move the input shaft axially until it bottoms out within the bearing cover. Measure the end play.

7. If end play is acceptable (see chart), remove "U" bracket and bearing cover. Seal shim pack to prevent lube leakage. Reinstall bearing cover and cap screws. Torque cap screws to 75-85 lbs.-ft. (101-115 N.m). Continue axle assembly as necessary.

8. If end play is incorrect, change shim pack size as follows:

Add shims to increase end play.

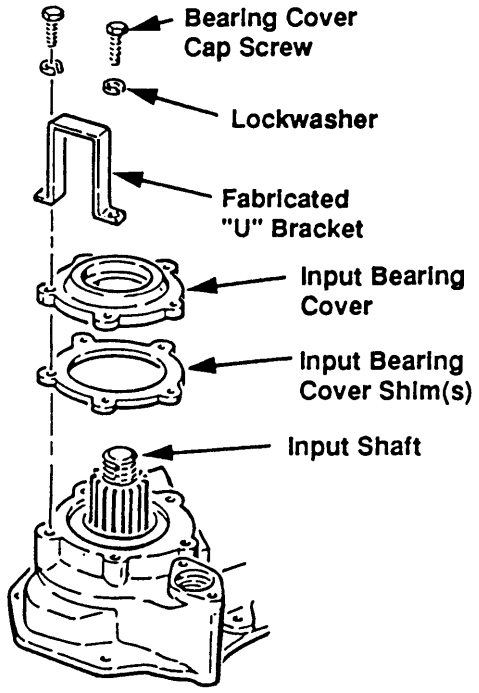
Desired end play	0.003" to 0.007"
Measured end play (Step 6)	0.001" - 0.001"
Add shims to provide desired end play	0.002" to 0.006"

Remove shims to decrease end play.

Measured endplay (Step 6)	0.015" - 0.015"
Desired end play	0.003" to 0.007"
Remove shims to provide desired end play	0.012" to 0.008"

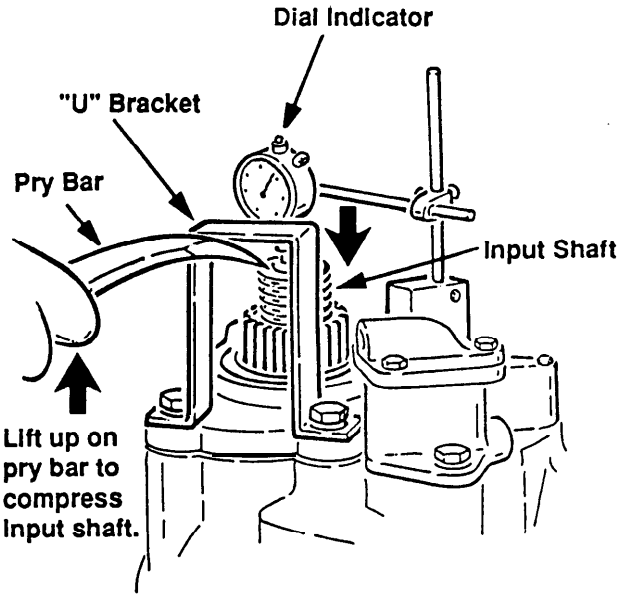
9. Recheck end play and adjust as necessary until end play is within acceptable tolerance.

10. When end play is correct, remove "U" bracket and bearing cover. Seal shim pack to prevent lube leakage. Reinstall bearing cover and cap screws. Torque cap screws to 75-85 lbs.-ft. (101-115 N.m). Continue axle assembly as necessary.



Note: Air lockout unit not shown.

"U" Bracket Installation



Dial Indicator Mounting Position and Checking Input Shaft End Play.

MISC TORQUE FASTENING REFERENCE CHART

FASTENER	SIZE	GRADE	LBS-FT	N.m
Axle Hsg Breather	809560	Finger Tight, plus 1/4 of a turn		
Axle Hsg Drain Plug	varies		40-60	54-81
Axle Hsg Filler Plug	varies		40-60	54-81
Axle Hsg Cover Cap Screw	7/16 - 14	5	65-78	88-106
	5/8 - 18	8	200-230	271-312
Axle Hsg Cover Stud/Nut	7/16 - 20	8	65-78	88-106
Axle Shaft Nuts	.500 -20		55-71	75-96
	.626 -18		170-190	230-258
	.750 -16		170-190	230-258
Diff Carrier to Hsg Stud - F/R	5/8 - 18	8	200-230	271-312
Diff Carrier to Hsg Nut - F/R	5/8 - 18	8	200-230	271-312
Diff Carrier to Hsg Cap Screw - F/R	5/8 - 18	8	200-230	271-312

GEAR & PINION NUT REFERENCE CHARTS

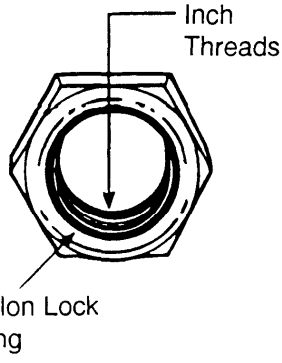
English Threaded Nuts			
Self-Locking Pinion Nut - F axles **Models: D340, 380, 400**	1 1/2 - 18	560-700	759-949
Self-Locking Pinion Nut - F axles **Models: D341, 381, 401, 402, 451**	1 5/8 - 18	780-960	1057-1301
Slotted Nut & Roll Pin - F axles **Models: D341, 381, 401, 402, 451**	1 5/8 - 18 * IMPORTANT: Torque to 840 ft-lbs (1139 N.m) then continue tightening nut to align slot with the nearest hole in pinion shank.	840*	1139*
Self-Locking Pinion Nut - R axles **Models: All REAR Models**	1 1/2 - 18	560-700	759-949

Metric Threaded Nuts			
Axles produced after 7-1-95			
Self-Locking Pinion Nut - F axles **Models: D341, 402, 451**	M42 x 1.5	840-1020	1140-1383
Self-Locking Pinion Nut - R axles **Models: R341, 402, 451**	M36 x 1.5	575-703	780-953

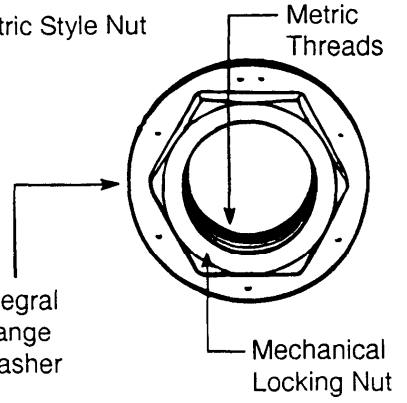
Pinion Nut Part No.	Threads	Size	Socket Size	Location
95206	English	1 1/2 - 18	2.25"	R- Pinion
118806	English	1 5/8 - 18	2.50"	D- Pinion
127589	Metric	M36 X 1.5	55mm	R- Pinion
126182	Metric	M42 X 1.5	65mm	D- Pinion

CAUTION: Metric nuts have an integral flange washer built into them. Do not use separate washer in conjunction with these nuts.

English (Inch) Style Nut



Metric Style Nut



Parts Books

Single Reduction Tandem Drive Axles

- 34,000 — 45,000 lbs. (340, 380,400, 341, 381, 401, 402, 403, 451) AXIP-0089
- 34,000 — 45,000 lbs. (344, 404, 454) AXIP-0200
- 34,000 — 52,000 lbs. (With Controlled Traction Differentials) AXIP-0084

Dual Range, Planetary Double Reduction Tandem Drive Axles

- 34,000 — 45,000 lbs. AXIP-0087

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  (Diff. Lock Models 461,521, 581) AXIP-0085A

Spicer Axle Brakes

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Spicer Steer Axles

- All Models AXIP-0074

Service Manuals

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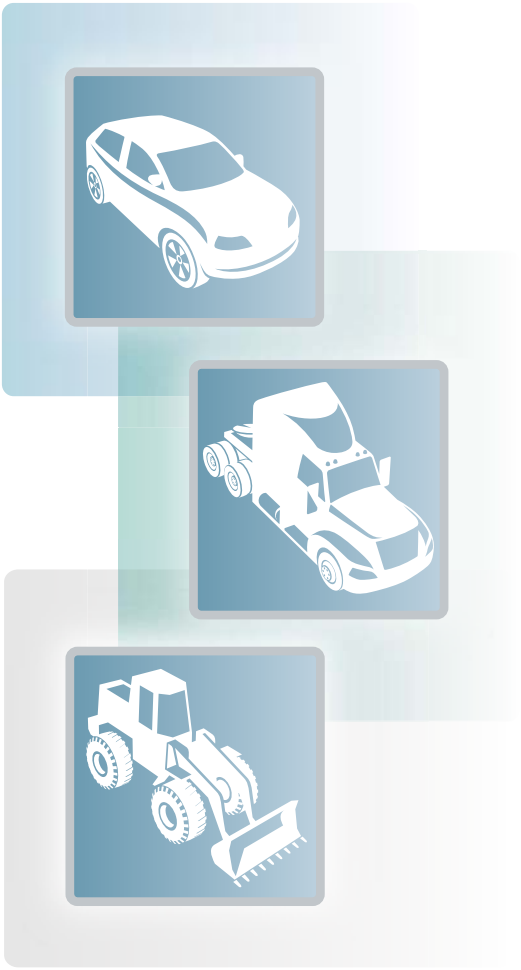

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