

Spicer® Tandem Drive Axles

SPICER®



Service Manual

Spicer® Tandem Drive Axles

AXSM-4001

September 2007

TABLE OF CONTENTS

Axle Identification	1
Model Identification Numbering System	2
Axle Lubricant Recommendations	3
General Precautions	4
Power Divider Components	5
Axle Components (Forward Rear)	6
Axle Components (Rear Rear)	7
Removal of Differential Carrier From Housing	8
Removal of Differential From Carrier	9
Differential Disassembly	10
Inter-Axle Differential Disassembly	12
Pinion Disassembly	14
Output Shaft Disassembly	15
Cleaning and Inspection	16
Output Shaft Assembly	17
Inter-Axle Differential Assembly	18
Pinion Assembly	20
Differential Assembly	22
Pinion Postion	23
Pinion Setting Chart	24
Differential Installation	26
Ring Gear and Pinion Tooth Contact Pattern	27
Installation of Differential Carrier Into Axle Housing	28
Axle/Torque Specifications	29
Recommended Service Tools	31

SPICER®



GENUINE SPICER SERVICE PARTS

Should an axle assembly require replacement component parts, it is recommended that Spicer Heavy Axle Service Parts be used. Spicer Heavy Axle Service Parts are manufactured under the same rigid specification as are original equipment axle components. This assures the customer who uses genuine Spicer service parts, maximum reliability for a Spicer Heavy Axle assembly. They may be obtained through your vehicle manufacturer. The use of

non-original Spicer service parts may cause premature component failure and may void the warranty.

The items included in this book are currently being offered as service parts at the time of printing. The part numbers and illustrations are provided specifically for reference purposes only. Therefore, Spicer reserves the right to update this manual without notice or liability.



AXLE IDENTIFICATION

All axle assemblies are identified with two tags. One located on the differential carrier, and the other located on the right hand side of the axle housing. Two types of tags may be found on the axle, an aluminum tag that is riveted on the assembly or a coated mylar tag.

The aluminum **axle assembly tag** contains the following items: serial number, according to the julian date, Dana part number, and the model. The mylar **axle assembly tag** contains the following items: Dana part number, julian date code, axle model, and ratio. Optional items include customer part number, line set number, and the last six digits of the vehicle serial number.

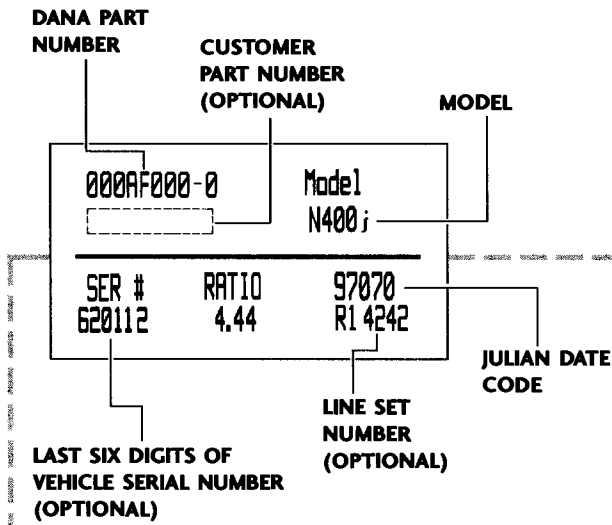
JULIAN DATE CODE

97 170

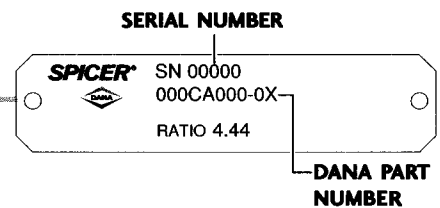
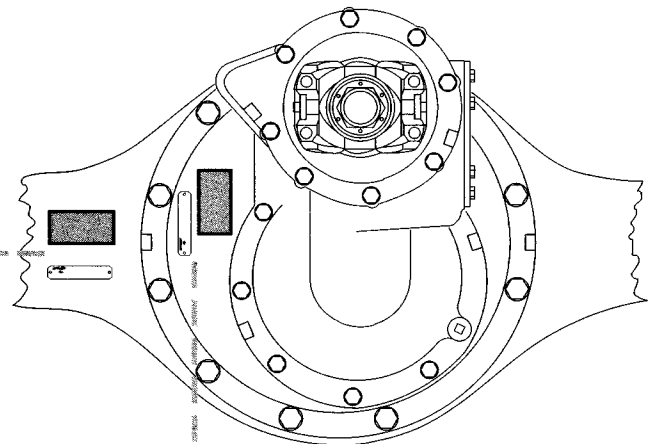
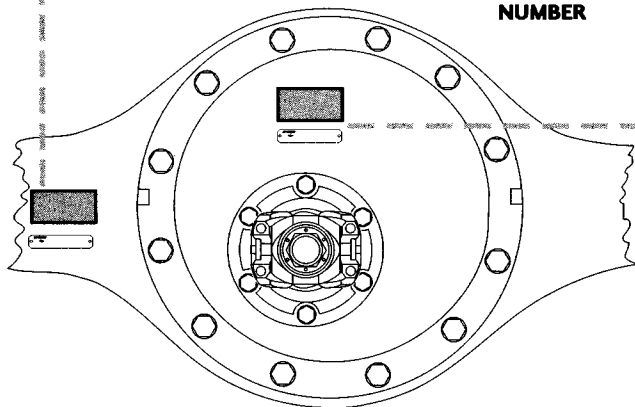
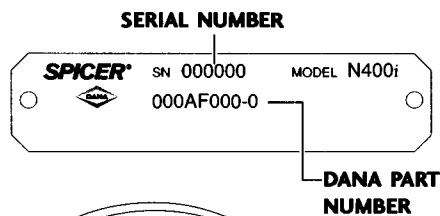
MODEL YEAR

DAY OF YEAR

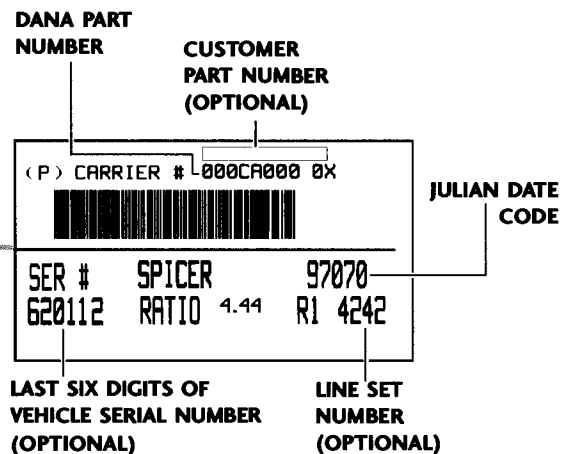
The aluminum **differential carrier tag** contains the following items: serial number, according to the julian date code, the Dana part number, and ratio. The mylar **differential carrier tag** contains the following: Dana part number, julian date code, and ratio. Optional items include customer part number, line set number, and the last six digits of the vehicle serial number.



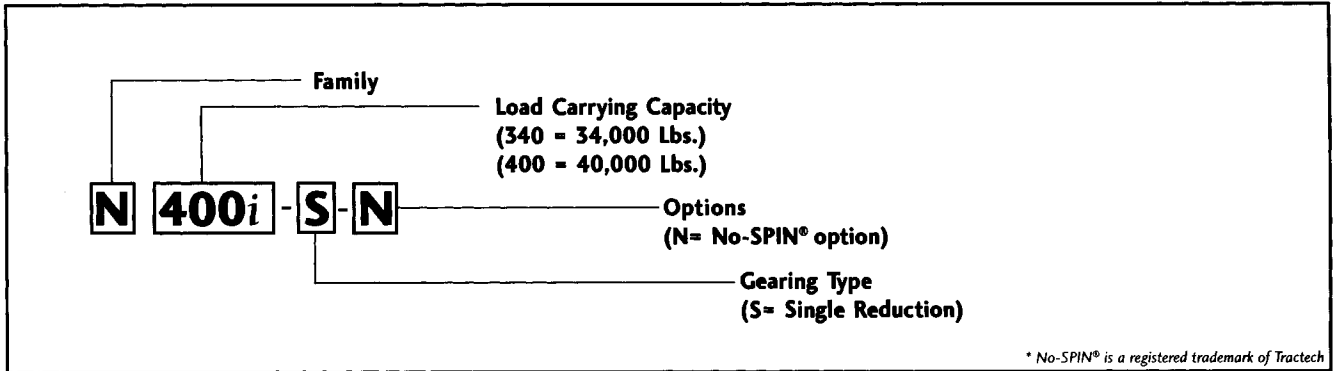
Axle Assembly Tags



Carrier Tags



MODEL IDENTIFICATION NUMBERING SYSTEM



GEAR SET IDENTIFICATION

Manufacturer's Date- Date gear set was made.

Spicer Trademark- Dana Diamond and location of manufacturing facility.

401 GP128- Part number of pinion. (TYPICAL)

401 GR128- Part number of ring gear. (TYPICAL)

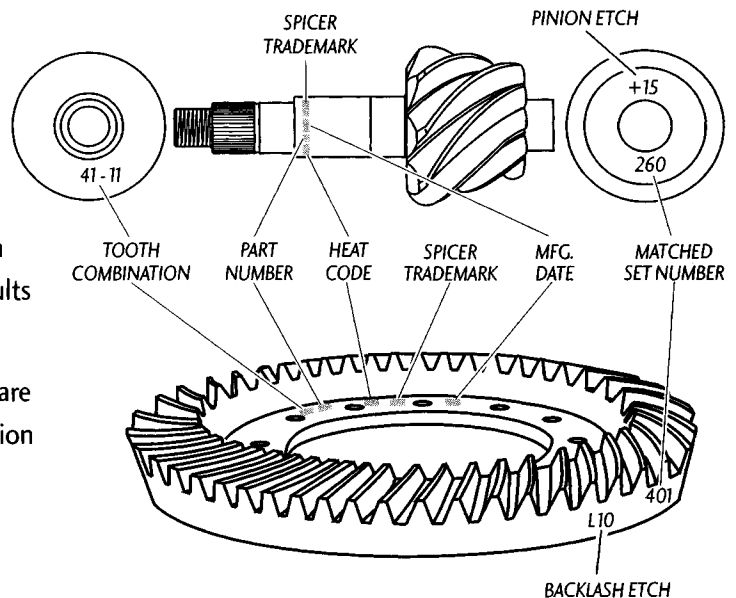
Tooth Combination(i.e. 41-11)- Indicates the pinion has 11 teeth and the ring gear has 41 teeth which results in a 3:73:1 ratio.

Matched Set Number- Spicer ring gears and pinions are manufactured as matched sets. Both ring gear and pinion are marked with a corresponding number (i.e. 401), which identifies them as a matched set.

A gear set that does not have the same match set numbers should not be run together. If either ring gear or pinion require replacement, *a new matched set must be used.*

Backlash Etch- Indicates backlash setting for assembly.

Pinion Etch- Indicator for proper pinion position shim stack up. **See Pinion Position Section.**



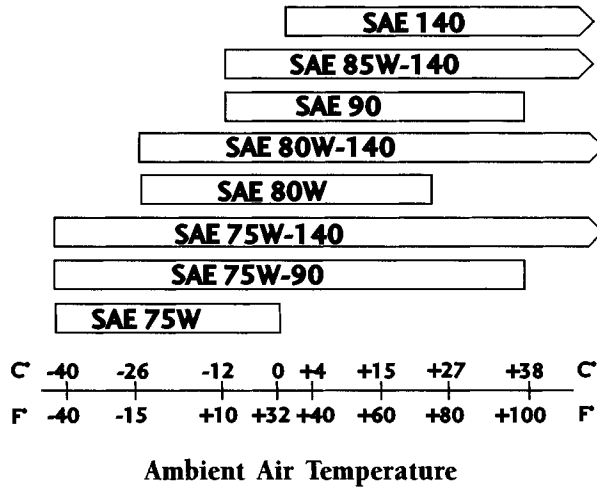
AXLE LUBRICANT RECOMMENDATIONS

To ensure proper lubrication and operating temperature, correct lubricants and lubricant levels must be obtained.

RECOMMENDED LUBRICANTS

Mineral or Synthetic based hypoid gear lubricants that meet or exceed military specification MIL-L-2105D, and API service classification GL-5, are the minimum requirements for use in Spicer Medium and Heavy Duty Drive Axles.

The table below indicates which SAE viscosities are recommended for various temperature ranges the vehicle will encounter.

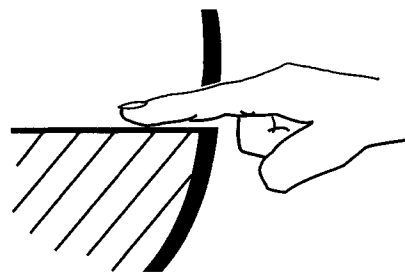


APPLICATION	PETROLEUM BASED		SYNTHETIC BASED**	
	MILES	INTERVAL	MILES	INTERVAL
On Highway	100,000	1 Year	250,000	3 Year
* Severe Service and On-Off Highway	50,000	1 Year	100,000	1 Year

- * Severe service includes any applications operating at or near maximum GVW or GCW ratings. This includes normally wet or dusty environments, or consistent heavy load and low speed applications.
- ** Includes Semi-Synthetic blends that meet MIL-L-2105D specifications.

AFTER OVERHAUL OR CHANGE INTERVALS

Fill the axle assembly to the bottom of housing fill hole as shown in the illustration below. It is recommended that following an overhaul, each side of the axle be jacked up separately to approximately six inches and held into position for one minute. This procedure will allow adequate lubricant to flow into the wheel ends and help eliminate the possibility of premature damage to wheel bearings and seals. Lower the vehicle to the floor and allow ten minutes for lube to return to normal level. Check and refill assembly to bottom of fill hole to replace the lubricant that was directed into the wheel ends.



NOTE: Lubricant close enough to the bottom of the fill hole to be seen or touched is not sufficient. Lubricant must be level with the fill hole.

SERVICE

Recommended lubricant change intervals are dependent on the application and operating environment. The following chart should be used to establish proper change intervals.

SUBMERSION OR DEEP WATER FORDING

In the event the axle assembly should become submerged in water, particularly if over the vent or breather, it is recommended that the lubricant be drained and all parts be inspected for water damage and/or contamination. Reassemble the carrier to the housing and refill with specified gear lubricant.

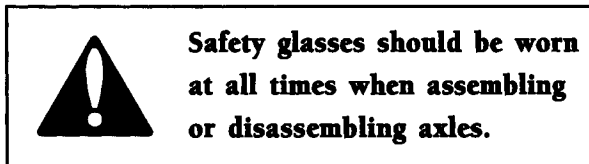
GENERAL PRECAUTIONS

IMPORTANT READ THIS SECTION BEFORE STARTING ANY SERVICE PROCEDURES

GENERAL AXLE DESCRIPTION

This manual covers maintenance and rebuild procedures for the Spicer N340 and N400i rear drive tandem axle assemblies.

The Spicer Heavy Duty Single Reduction rear drive axle is a full floating axle assembly, with a hypoid gear carrier assembly, using a High Strength Low Alloy (HSLA) steel axle housing. The hypoid pinion is straddle mounted with two tapered roller bearings behind the pinion teeth for thrust and radial loads. A pilot bearing is located on the nose of the pinion for radial load. The differential itself uses four precision forged pinion mate gears, a forged cross, and precision forged side gears.




SAFETY PRECAUTIONS

Proper service and repair of vehicle components is important to the safe and reliable operation of all motor vehicles. This applies particularly to driving axles such as the ones described in this manual. The procedures recommended and described in this manual are tested, effective methods for performing service operations. Follow each procedure closely, making use of both the text and illustrations. Some of these service procedures show the use of certain tools designed specifically for the operation being performed. They are shown as a preferred means of performing the operation. It is not practical to anticipate and advise the service trade of all possible alternative methods, and of all possible hazardous consequences that could occur.

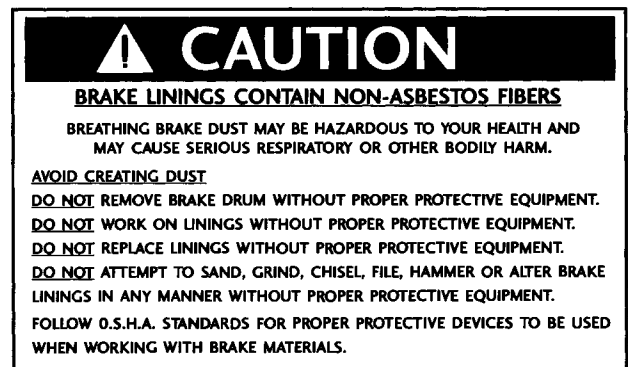
Accordingly, anyone who uses a service procedure or tool different than shown must insure that their safety, and the vehicle's safety, will not be jeopardized by the service method selected.

END YOKES AND FLANGES

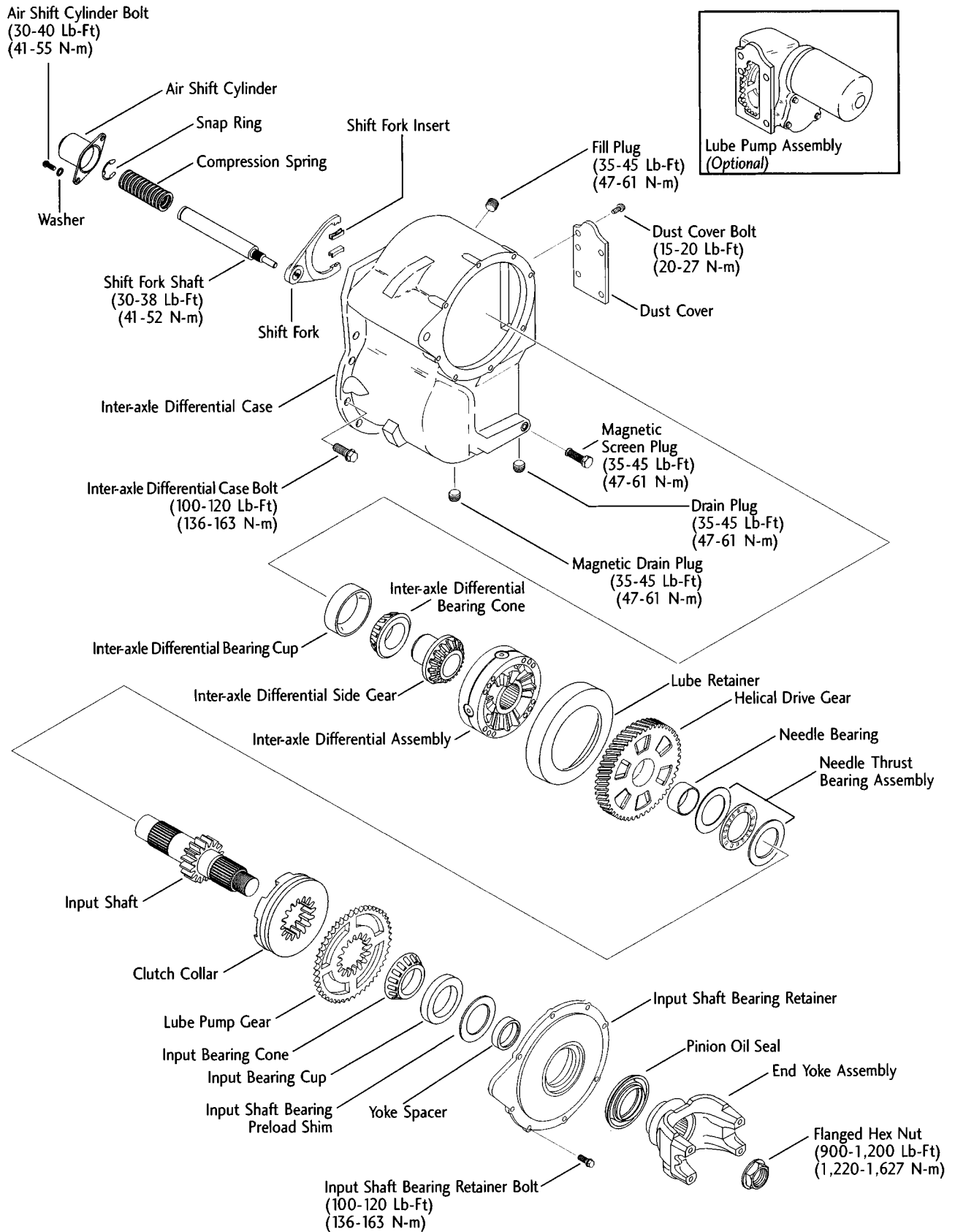
 **CAUTION:** Hammering on end yokes can close in the bearing bores or misalign yoke lugs and result in early failures of journal needle bearings or other driveline components. Serious damage can also be done internally to the ring and pinion set or pinion bearings by hammering on external parts. End yokes or companion flanges should be removed or installed using the recommended methods outlined in this manual.

CLEANLINESS

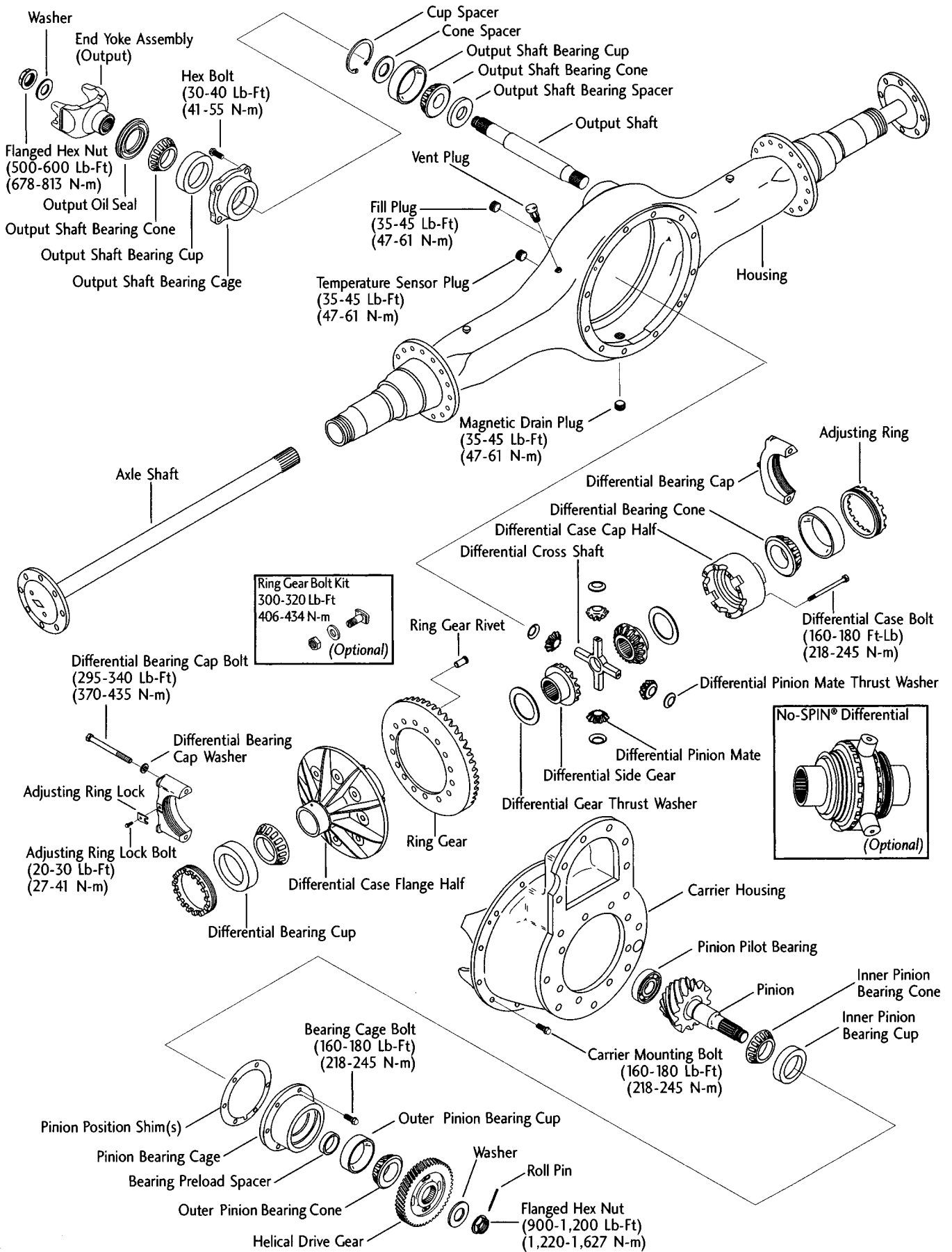
Axle components should be steam cleaned prior to removal from the vehicle. Dirt is abrasive and will cause premature wear of otherwise serviceable parts. Service personnel should use a wash tank for thorough cleaning of parts just prior to reassembly.



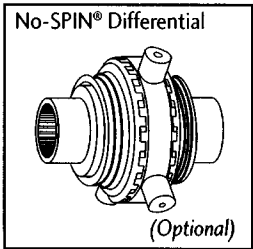
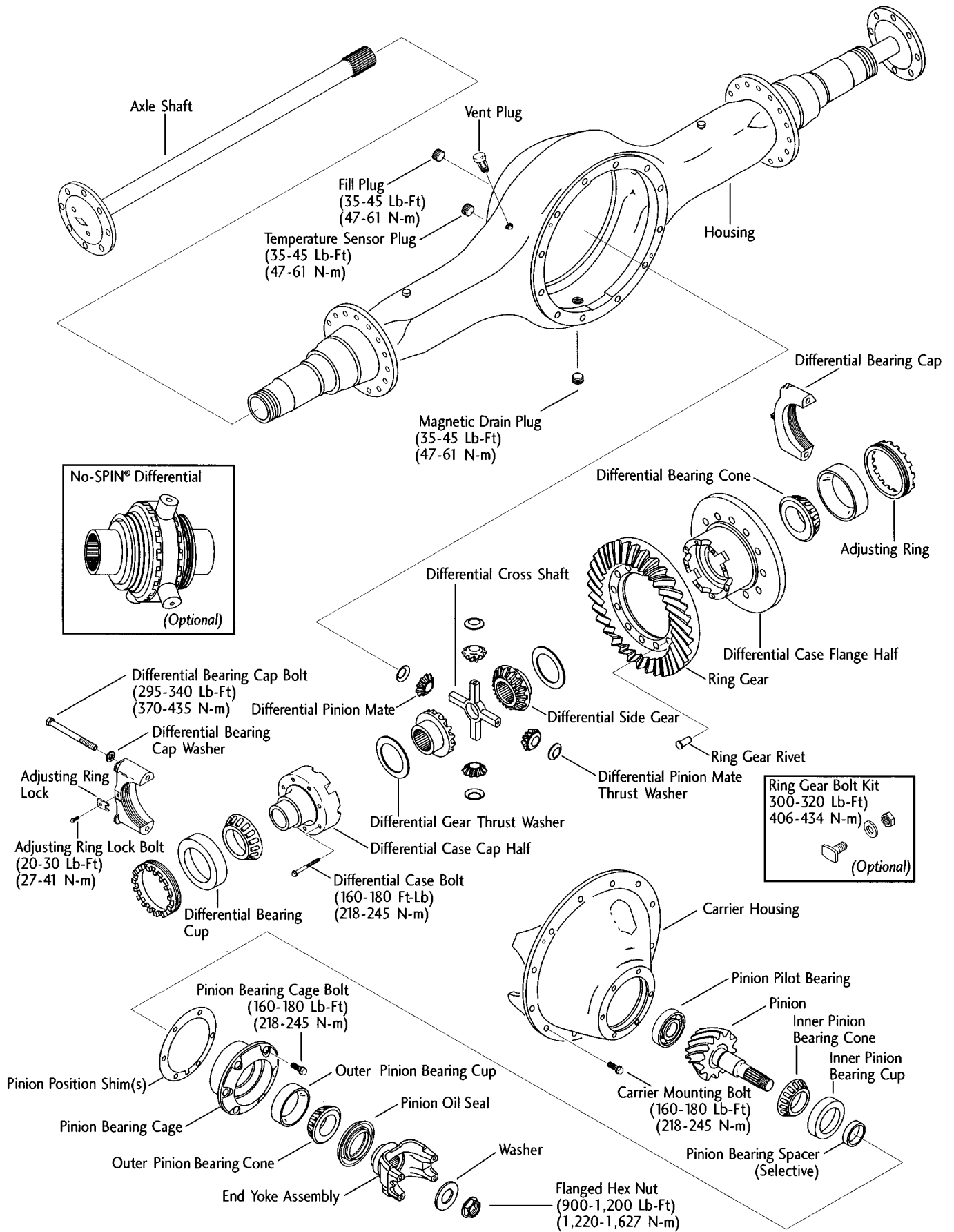
POWER DIVIDER COMPONENTS



FOWARD REAR AXLE COMPONENTS



REAR REAR AXLE COMPONENTS



REMOVAL OF DIFFERENTIAL CARRIERS

FORWARD REAR CARRIER (WITH POWER DIVIDER)

NOTE: Steam clean axle assembly.

1. Block wheels.
2. Remove axle housing drain plug and drain lubricant.
3. Disconnect drive shafts from input and output shaft end yokes.

NOTE: If end yoke and/or seal is to be replaced, loosen flanged hex nut at this time.

4. Remove axle shaft flange nuts.
5. Hold a large brass drift or a brass hammer against the center of the axle shaft flange. Strike the drift with sharp blows from a large hammer or sledge until the axle shaft separates from the hub.

⚠ CAUTION: Do not strike the flange directly with a steel hammer or sledge. This may crack and splinter material, possibly causing serious or fatal injury. Do not pry or chisel axle flange away from hub or damage to sealing surfaces could occur.

6. Remove axle shafts.
7. Disconnect air line from power divider control.
8. Remove output shaft bearing retainer bolts. Use a soft hammer to loosen bearing retainer from axle housing. Remove bearing cage and output shaft from axle housing.
9. Support the differential carrier assembly on a roller jack. Secure as necessary to prevent it from falling off the jack when removed from the housing.
10. Use a breaker bar to loosen the differential carrier-to-housing mounting bolts. Remove all bolts except top two. These two bolts will prevent the carrier assembly from falling.

NOTE: Removal slots are provided in the areas shown in the illustration (See Figures 1 & 2). Use suitable pry bar to separate components.

11. Separate differential carrier from the housing using removal slots. (See Figure 1) Be certain carrier is balanced properly on jack, and remove top two carrier-to-housing mounting bolts. Remove differential carrier assembly from the axle housing.
12. Remove carrier assembly from under the vehicle.
13. Mount carrier assembly in a suitable rebuild stand. (Refer to **Recommended Service Tools**, Pgs. 32-33).

Differential Carrier Removal Complete

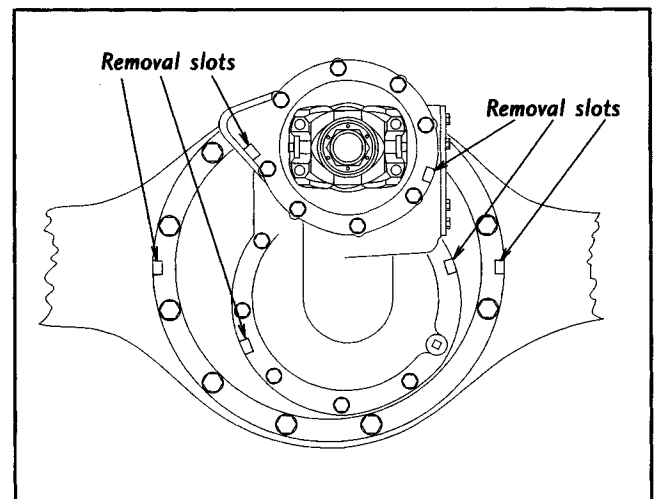


Figure 1

REAR REAR CARRIER

NOTE: Steam clean axle assembly.

1. Block wheels.
2. Remove axle housing drain plug and drain lubricant.
3. Disconnect drive shaft at rear U-joint.

NOTE: If end yoke and/or seal is to be replaced, loosen flanged hex nut at this time.

4. Remove axle shaft flange nuts.
5. Hold a large brass drift or a brass hammer against the center of the axle shaft flange. Strike the drift with sharp blows from a large hammer or sledge until the axle shaft separates from the hub.

Continued

REMOVAL OF DIFFERENTIAL CARRIERS

⚠ CAUTION: Do not strike the flange directly with a steel hammer or sledge. This may crack and splinter material, possibly causing serious or fatal injury. Do not pry or chisel axle flange away from hub as damage to sealing surfaces could occur.

6. Remove axle shafts.
7. Support the differential carrier assembly on a roller jack. Secure as necessary to prevent it from falling off the jack when removed from the housing.
8. Use a breaker bar to loosen the differential carrier-to-housing mounting bolts. Remove all bolts except top two. These two bolts will prevent the carrier assembly from falling.

NOTE: Removal slots are provided in the areas shown in the illustration (See Figure 1 & 2). Use suitable pry bar to separate components.

9. Separate differential carrier from the housing using removal slots. (See Figure 2) be certain carrier is

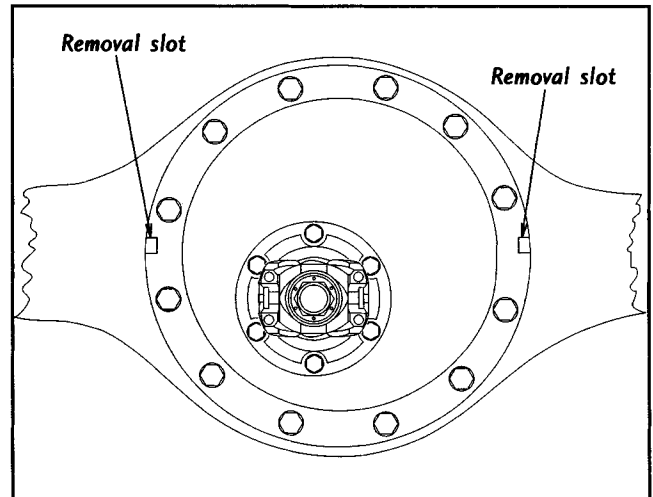


Figure 2

balanced properly on the jack, and remove top two carrier-to-housing mounting bolts. Remove differential carrier assembly from the axle housing.

10. Remove carrier assembly from under the vehicle.
11. Mount carrier assembly in a suitable rebuild stand. (Refer to **Recommended Service Tools**, Pgs. 31-32).

Differential Carrier Removal Complete

REMOVAL OF DIFFERENTIAL FROM CARRIER

NOTE: The following service procedures apply to both the forward rear and rear rear axles, unless otherwise noted.

1. Remove adjusting ring locks from bearing caps.
2. Match mark one differential bearing cap and leg of carrier with center punch or chisel for correct reassembly. (See Figure 3)
3. Loosen four bearing cap retaining bolts.
4. Loosen adjusting ring, relieving bearing preload.
5. Remove four bearing cap retainer washers and bolts.
6. Remove bearing caps.
7. Remove adjusting rings and bearing cups.

NOTE: The ring gear side of the subassembly must be tipped up for the ring gear to clear pinion roller bearing retainer.

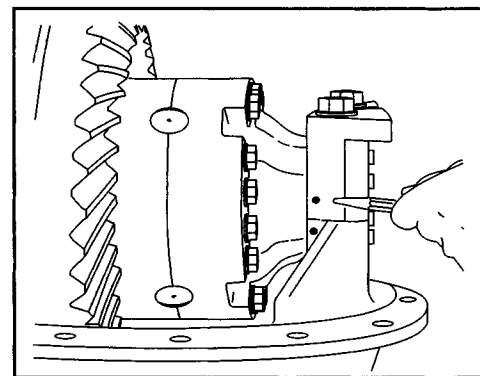
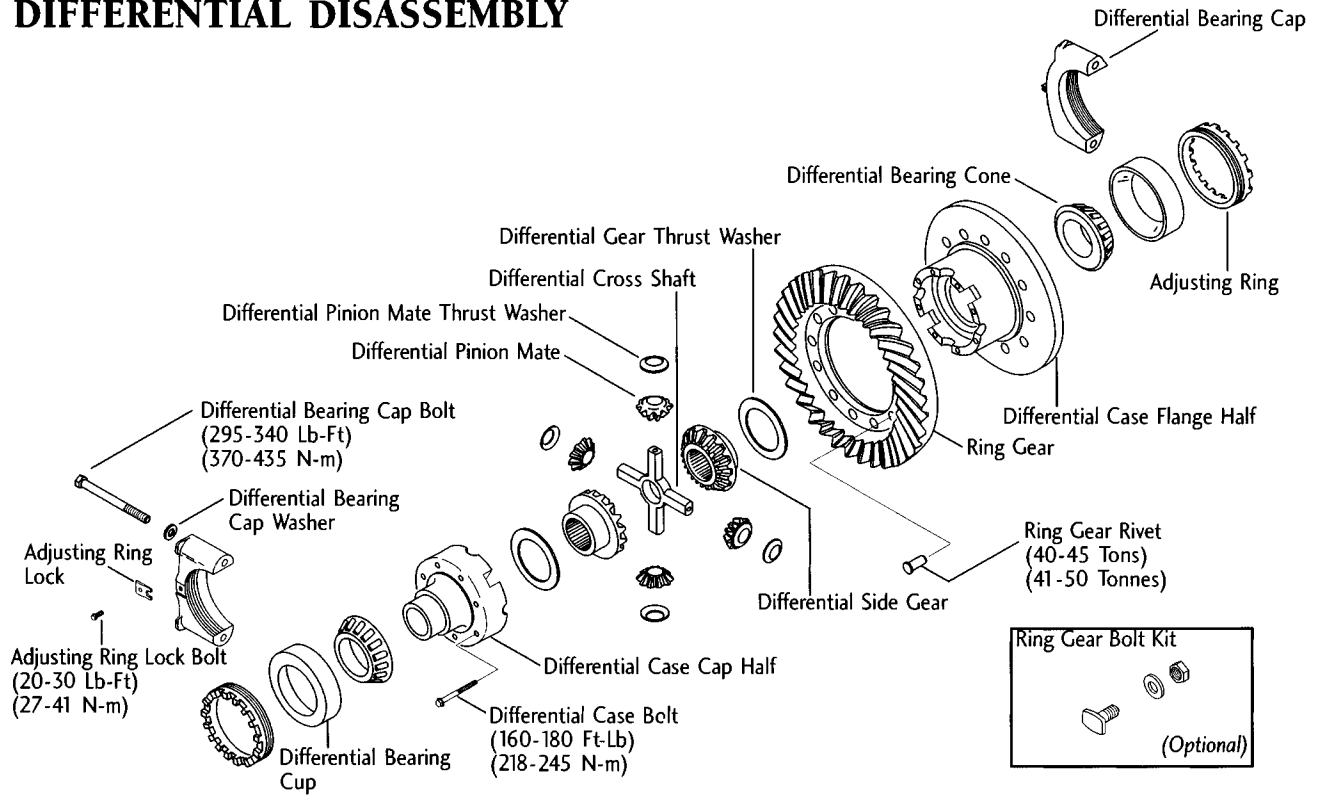


Figure 3

8. Carefully lift the ring gear and differential subassembly out of the carrier.

⚠ CAUTION: Use care not to damage the ring gear and pinion. If either ring gear or pinion show signs of damage, they must be replaced as a matched set.

DIFFERENTIAL DISASSEMBLY



1. Match mark differential case halves with punch or chisel for correct alignment during reassembly (See Figure 4).

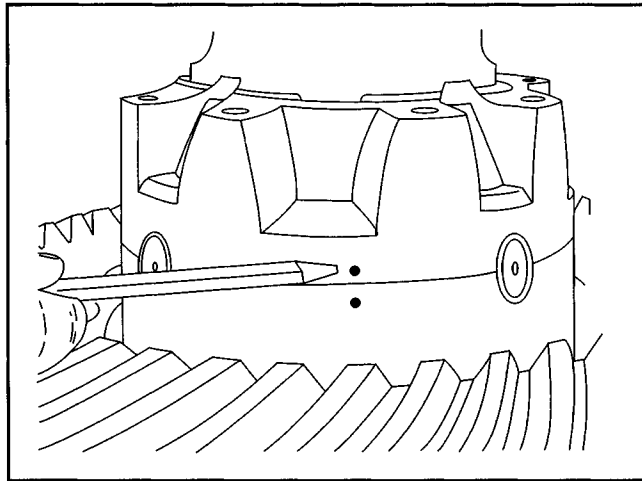


Figure 4

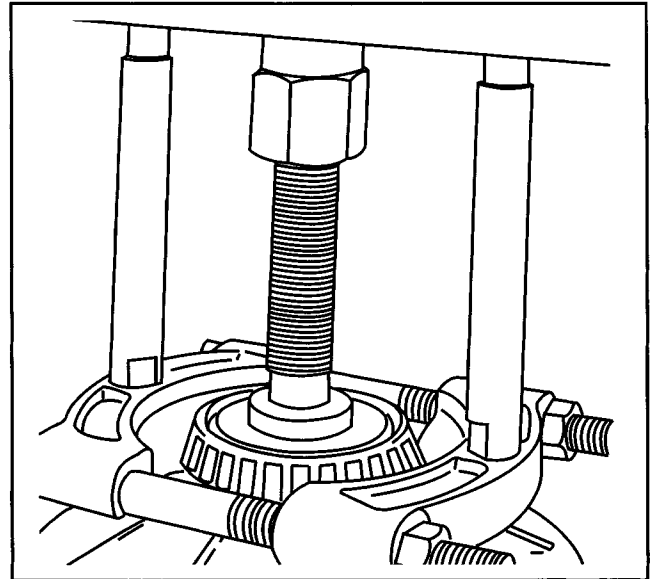


Figure 5

2. Remove differential case bolts and lift off the differential case half.
3. Remove thrust washer and differential side gear.
4. Lift out cross shaft, pinion mates and thrust washer.
5. Remove second differential side gear and thrust washers.

6. If differential side bearings are to be replaced, remove old bearings using suitable puller (See Figure 5).

NOTE: Inspect all parts, including the machined surfaces of the case itself.

IMPORTANT: If any gears are to be replaced, they must be replaced in sets. Inspect thrust washers for

DIFFERENTIAL DISASSEMBLY

scoring and excessive wear. Replace all worn or damaged parts.

7. When it is necessary to remove ring gear from differential case, carefully center punch each rivet head. Use a 9/16" drill bit and drill through rivet heads (See Figure 6).
8. Next, use a round type punch to drive out the remaining portion of the rivet.

⚠ CAUTION: Always use a soft hammer or H.D. plastic head hammer to strike punch.

NOTE: Do not use a chisel to remove rivet heads, damage to differential case may result. (See Figure 7)

Differential Disassembly Complete

CORRECT PROCEDURE

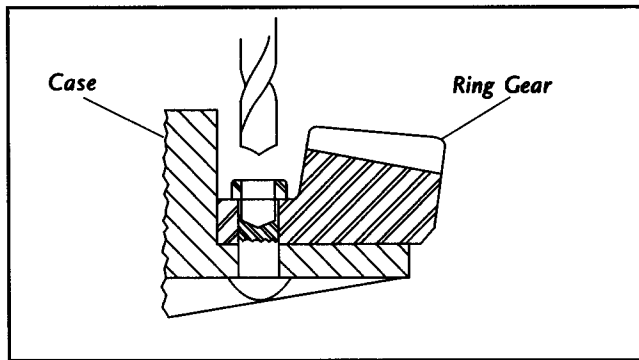


Figure 6

INCORRECT PROCEDURE

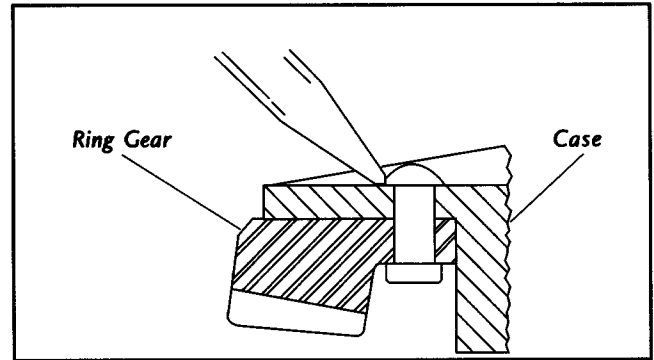
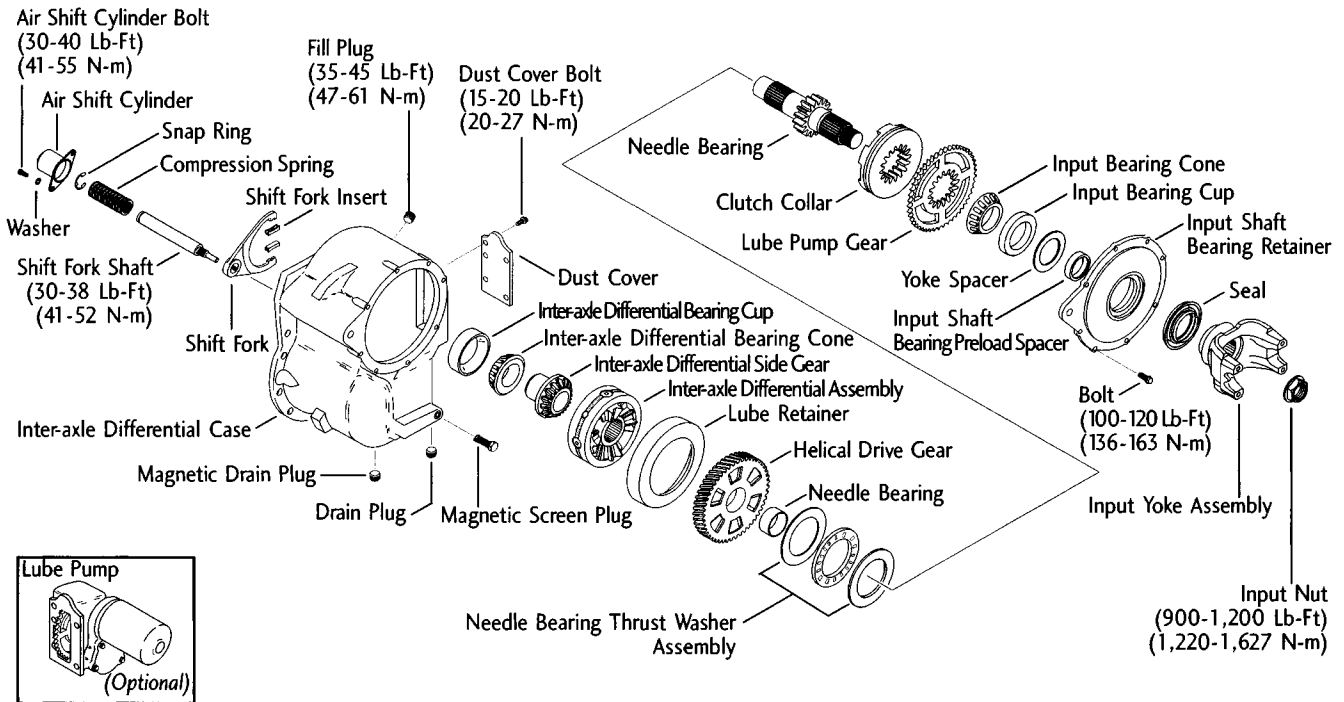


Figure 7

INTER-AXLE DIFFERENTIAL DISASSEMBLY



1. Remove lube pump on models with this option.
2. Remove inter-axle differential case bolts. Use removal slots to separate inter-axle differential assembly from intermediate case, and remove assembly.
3. With intermediate case on its side, remove air shift cylinder.
4. Remove shift fork shaft, spring, and retainer clip as an assembly.

NOTE: Shift fork shaft threads are coated with locking compound material, so screwdriver socket and ratchet should be used to remove shift fork shaft.

5. Remove input flanged hex nut.

NOTE: Use of torque multiplier is recommended as torque specification on the input nut is 900-1,200 Lb-Ft (1,220-1,627 N-m).

6. Remove input yoke using suitable puller. (See Figure 8)
7. Remove bolts from input shaft bearing retainer. Use removal slots (See Figure 9) to separate bearing retainer from inter-axle differential case, and remove retainer.

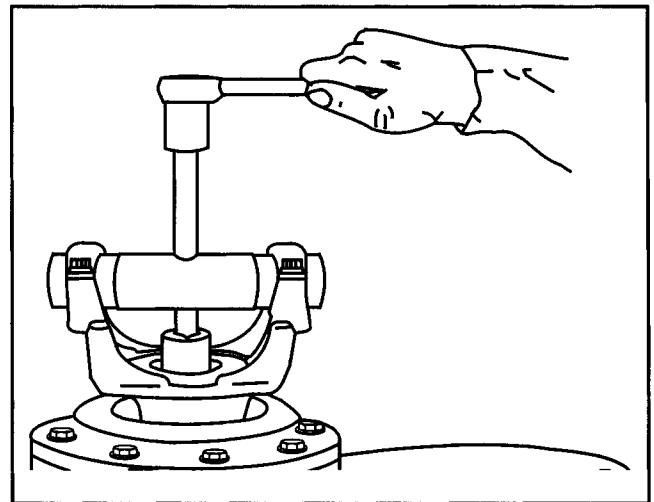


Figure 8

8. Remove input oil seal.
9. Press out input shaft bearing cup and shims from bearing retainer. Retain shims for possible use during reassembly. Early models were not a press fit.
10. Remove input shaft assembly. Remove input yoke spacer from input shaft.
11. Remove front bearing cone from input shaft using a suitable puller.

Continued

INTER-AXLE DIFFERENTIAL DISASSEMBLY

12. Remove lube pump drive gear, if attached.
13. Remove shift fork and clutch collar.
14. Remove drive gear from inter-axle differential case.

NOTE: Remove and discard rubber lube retainer if attached.

15. Position intermediate case on its side. Using a soft mallet, tap on inter-axle rear differential gear that extends through the rear of the intermediate case. This will dislodge lube retainer, allowing removal of inter-axle differential cage and rear differential gear.

NOTE: Remove and discard O-ring if attached.

16. Remove rear differential gear bearing cup from intermediate case.
17. Remove bearing cone from rear differential gear using a suitable puller.
18. Remove magnetic screen from intermediate case (See Figure 9) and inspect for abnormal particles. Magnetic screen found only on models with an optional lube pump.

Inter-Differential Disassembly Complete

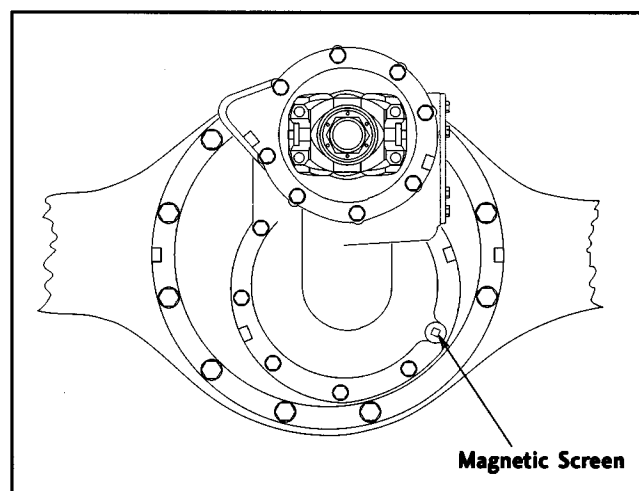
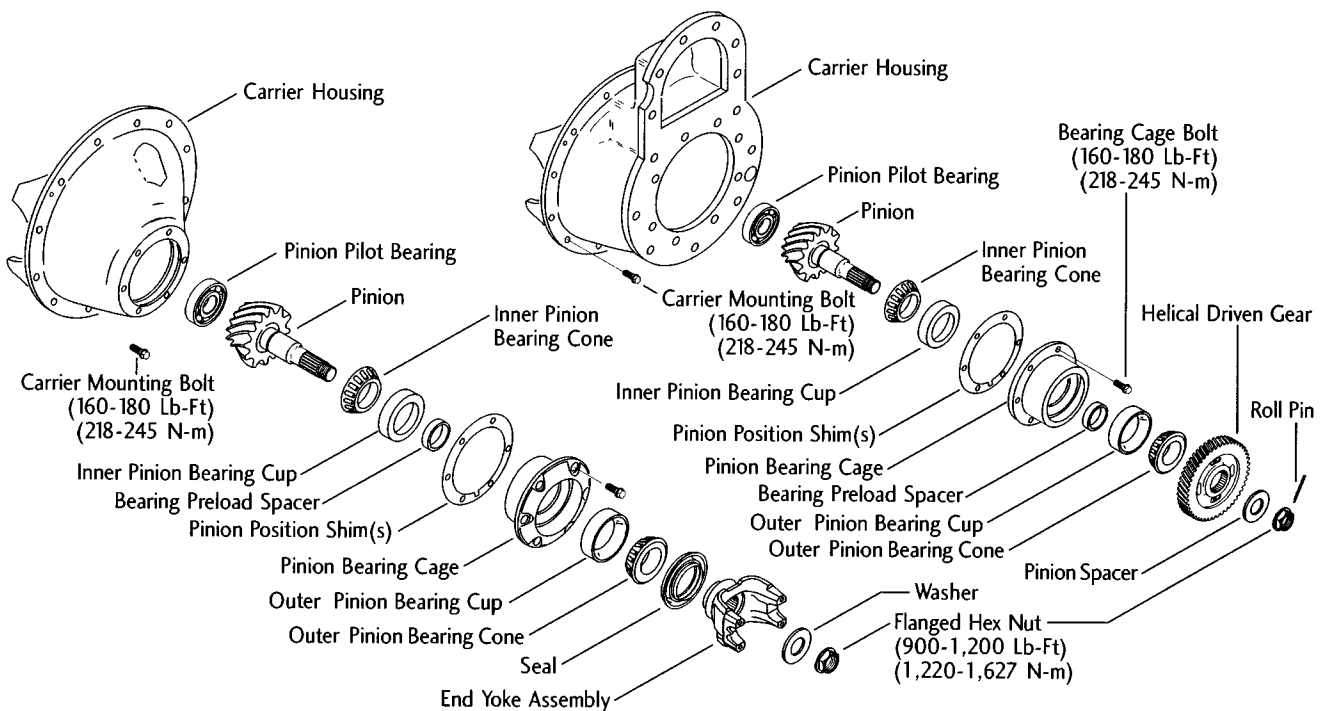


Figure 9

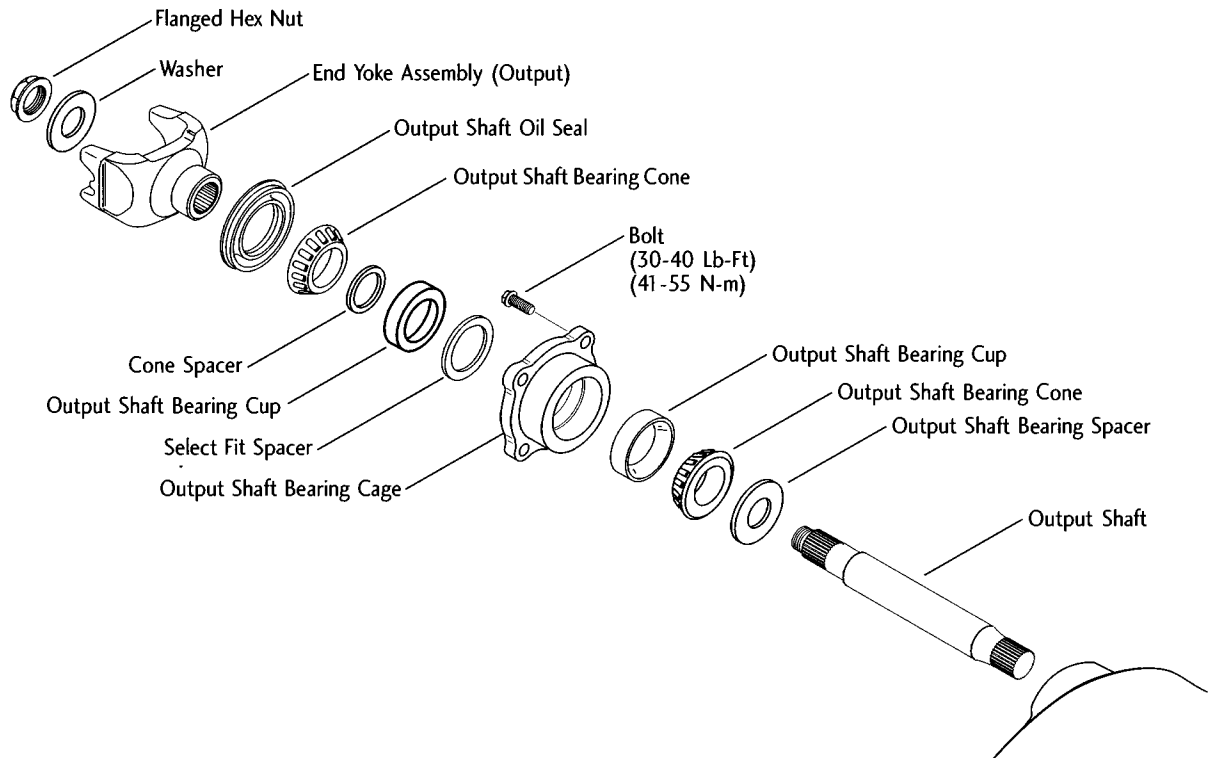
PINION DISASSEMBLY



1. Remove pinion bearing cage mounting bolts.
 2. Remove pinion bearing cage and cage assembly from carrier housing. If difficulty is encountered in removing pinion assembly from carrier, place a brass drift on inner end of pinion and tap lightly.
- NOTE: Retain shims for possible use during reassembly.**
3. Mount pinion assembly in a soft jawed vise or fixture, holding yoke or pinion stationary. Remove roll pin, nut, and spacer.
 4. Remove the end yoke or drive gear using a suitable press.
 5. Remove pinion from cage assembly.
 6. Located between pinion bearings is a selective spacer, used for pinion bearing preload. Retain this spacer for possible use in reassembly.
 7. Remove old pinion seal and discard. Always replace it with a new seal at time of reassembly.
 8. Lift out the outer pinion bearing cone.
 9. Remove inner pinion bearing cup, using a suitable adapter and press or puller.
 10. Remove roller bearing from end of pinion.
 11. Remove inner bearing cone from pinion.

Pinion Disassembly Complete

OUTPUT SHAFT DISASSEMBLY



1. Remove rear drive shaft.
2. Remove output shaft bearing cage assembly from forward rear axle housing.
3. Mount output shaft in vise by clamping yoke in jaws of vise.
4. Remove nut, washer and yoke.
5. It will be necessary to fabricate an adapter (See Figure 10) to clear the lube trough portion of the bearing retainer while pressing the bearings from the shaft. Fabricate the adapter out of 2 5/8" x 1/4" wall steel tubing.
6. Position the adapter onto the output shaft assembly. Taking care not to damage threads, press the output shaft out of the bearing assembly (See Figure 11).

Output Shaft Disassembly Complete

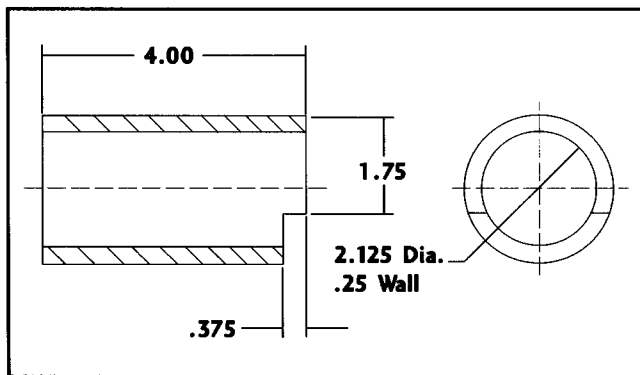


Figure 10

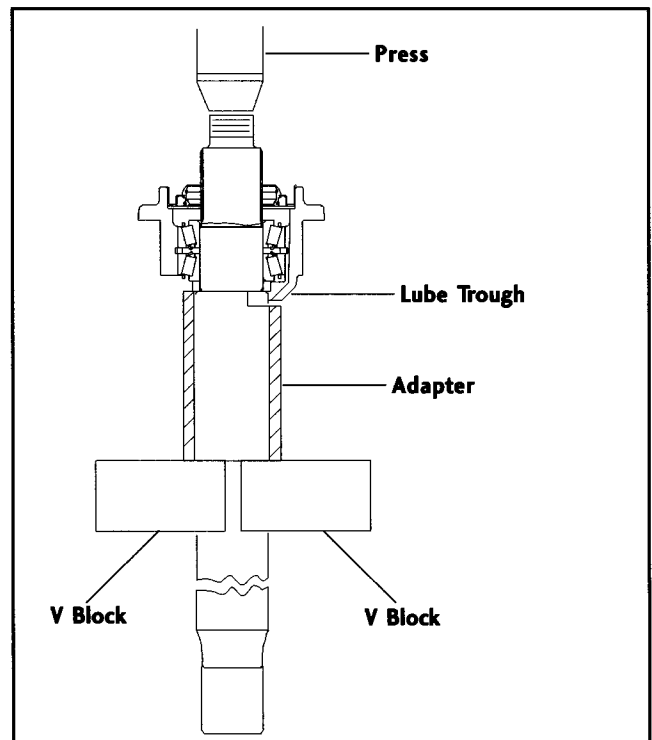


Figure 11

CLEANING AND INSPECTION

CLEANING

1. Parts should be cleaned with emulsion cleaners or petroleum base cleaning solvent.

NOTE: Alkaline type solutions may cause damage to machined surfaces and should be avoided.

2. Make sure interior of axle housing is clean prior to reassembly.
3. Clean all gasket surfaces of old material.

DRYING

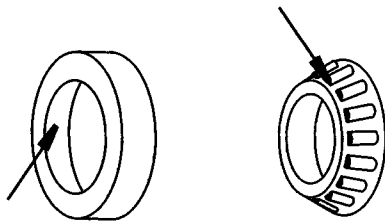
Use soft, clean, lintless towels or rags to dry components after cleaning. Bearings should **NOT** be dried by spinning with compressed air. This can damage mating surfaces due to the lack of lubrication.

After drying, parts should be coated with a light coat of lubricant or rust inhibitor to prevent damage from corrosion. If parts are to be stored for a prolonged period, they should be wrapped in wax paper.

INSPECTION

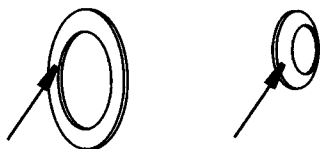
Prior to reassembly, inspect parts for signs of excessive wear or damage. Replacement of these parts can prevent premature failure and costly downtime.

BEARINGS



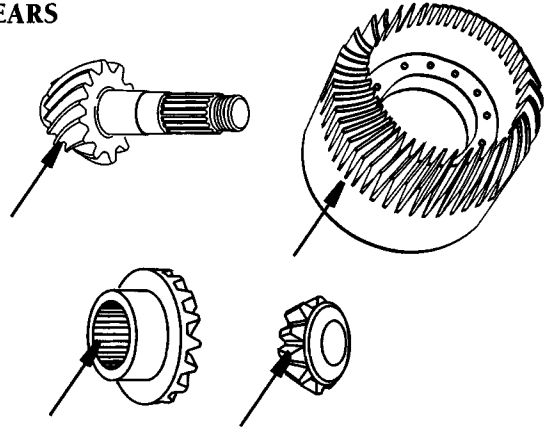
Bearing surfaces should be inspected for pitting, excessive wear, or overheating.

THRUST WASHERS



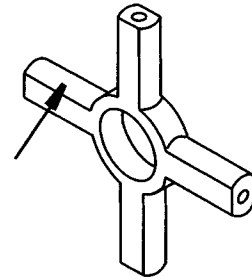
Inspect thrust washers for scoring and cracking.

GEARS



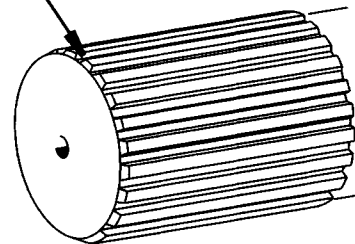
Inspect gears for excessive wear or damage. Replace gears that are pitted, scored, broken, or worn.

SHAFTS



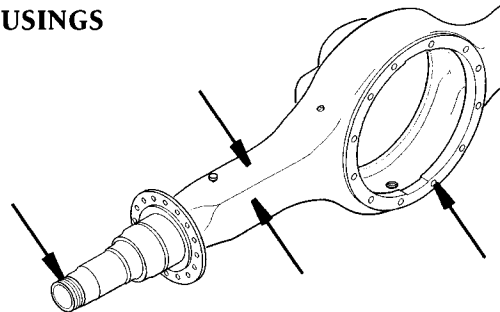
Inspect shafts for nicks or scoring.

SPLINES



Inspect all splines for excessive wear, distortion from twisting, and cracking.

HOUSINGS



Inspect housing for stripped threads and bending fatigue.

OUTPUT SHAFT ASSEMBLY

1. Position thick spacer onto the shaft against the machined shoulder.
2. Brush grease on new bearing cups and cones for prelube and place both into bearing retainer with the split inner spacer between them.

NOTE: To insure proper end play, both inner and outer bearings are in matched sets with spacers. Do not mix separate bearings.

3. Install subassembly onto the output shaft, using a press and the adapter. (See Figure 12)

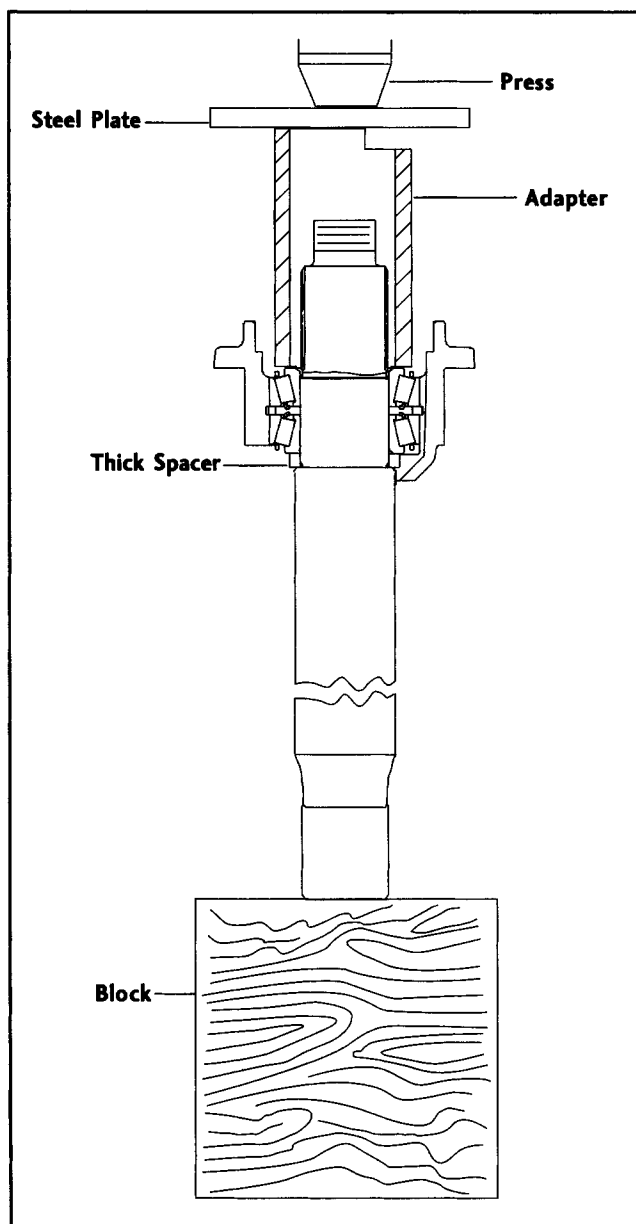


Figure 12

⚠ CAUTION: Use only enough pressure to lightly seat bearings against the thick spacer. Excessive pressure could damage the assembly.

4. Install new seal using seal installer tool (See Recommended Service Tools, Pgs. 31-32).
5. Install end yoke using yoke installer tool (See Recommended Service Tools, Pgs. 31-32) and place washer onto shaft. Clean and dry threads, then coat with Loctite #680 and torque to 500-600 Lb-Ft (678-813 N-m).
6. Clean mating surface on axle housing and output shaft bearing retainer. Apply a 1/16 in. bead of Loctite #518 gasket eliminator on housing mounting flange and around bolt holes. Install output shaft, with lube trough to bottom (See Figure 13). Tighten mounting bolts evenly to 30-40 Lb-Ft (41-55 N-m).
7. Install rear drive shaft.

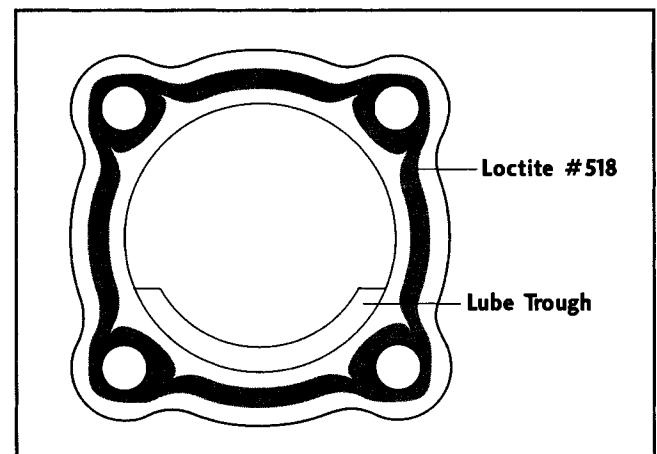


Figure 13

INTER-AXLE DIFFERENTIAL ASSEMBLY

1. Position inter-axle differential case on two 4" x 4" blocks for reassembly.
2. Install new rear differential gear bearing cup into case.

IMPORTANT: New input shaft and rear differential gear, designed to help prevent excessive end play, were released to production September 1, 1991. These components have mated machined surfaces (See Figure 14) that do not use inter-axle gears to control end play.

CAUTION: These changes are not "stand alone" product improvements, they must be used together for proper service of N model axles built before September 1, 1991.

3. Press new bearing cone onto rear differential gear.
NOTE: Be certain both cup and cone are properly seated or false reading on end play of inter-axle may occur.

4. Apply light coating of gear lube to rear side gear bearing and hub surface and install.
5. Install and lubricate inter-axle differential assembly, with large rivet heads to rear of case.
6. Install steel lube retainer plate.

NOTE: Use Installation Tube Handle and Lube Retainer Installer in combination so surface of lube retainer is not damaged. (See Recommended Service Tools, Pgs. 31-32)

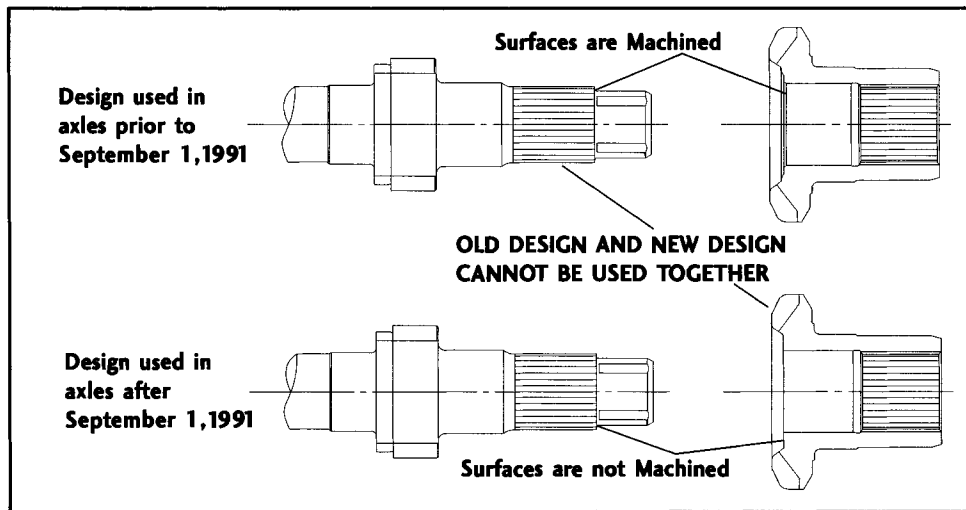


Figure 14

7. Press new needle bearing into I.D. of drive gear.
NOTE: Needle bearing must be pressed from flat end of bearing (where part numbers are located) using Needle Bearing Installer (See Recommended Service Tools, Pgs. 31-32).
8. Lubricate needle bearing and carefully lower drive gear into intermediate case until integral differential gear is engaged in inter-axle differential.

NOTE: Rubber lube retainer is no longer required.

9. If equipped with optional lube pump, install lube pump drive gear into position on stepped portion of the large splines.

10. Press new input shaft front bearing cone onto shaft until it seats completely against shoulder.
11. Lube the needle thrust bearing lightly and place on front drive gear. Ensure that thin spacer is seated against drive gear and the inner race is seated between the two spacers.

NOTE: To establish proper end play, input shaft will be installed into inter-axle differential prior to installing shift collar, fork, and shift shaft.

12. Lube and install input shaft, turning slightly to engage splines.

INTER-AXLE DIFFERENTIAL ASSEMBLY

13. Install new input shaft front bearing cup into input shaft bearing retainer without shims.

NOTE: Bearing cup is press fit on units manufactured after July 1991.

14. Install bearing retainer onto intermediate housing and bolt into place.
15. Thread input nut onto input shaft until resistance is felt from locking compound. Tap nut lightly with soft hammer.
16. Position dial indicator onto end of input shaft (See Figure 15). Using suitable pry bar and spacer, Pry input shaft out and record end play.

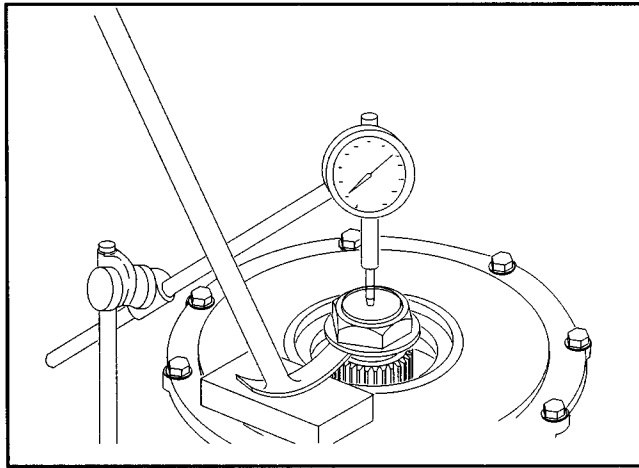


Figure 15

17. Proper end play for inter-axle is .001-.003 in. (.025-.076 mm). Subtract .003 in. from recorded end play and assemble combination of shims that total proper thickness to establish correct end play.

EXAMPLE

.080 in. (2.032 mm) Dial indicator measurement

-.003 in. (.076 mm) Preferred end play

.077 in. (1.956 mm) Shims required

18. Remove input shaft bearing retainer and install shim pack between bearing retainer and input shaft bearing cup. Remove input shaft.
19. Check composite pads on shift fork for excessive wear. Replace if necessary.

20. Check shift collar for excessive wear or damage in groove, on drive lugs, and splines. Replace if necessary.
21. Assemble fork and shift collar with drive lugs toward drive gear and raised section of fork toward front of carrier assembly. Install into intermediate case. Lock drive lugs into drive gear lugs.
22. Install "C" clip snap ring into groove in shift shaft. Slide spring into place on shift shaft.
23. Clean thread on shift shaft and apply a small amount of Loctite #290 (medium strength, green).
24. Install shift shaft into bore and thread into shift fork. Tighten to 30-38 Lb-Ft (41-52 N-m) with screw-driver socket.
25. Again, be certain that thrust washer is in place on front of drive gear with I.D. radius of large chamfer toward front and reinstall input shaft.

NOTE: It may be necessary to rotate drive gear to align all splines and drive lugs.

26. Install new oil seal into input shaft bearing retainer.
27. Apply 1/16" bead of Loctite #518 gasket eliminator to mating surface on rear side of input shaft bearing retainer (See Figure 16). Position retainer onto intermediate case. Install bolts and tighten to 100-120 Lb-Ft (136-163 N-m). Again check end play to assure proper setting.

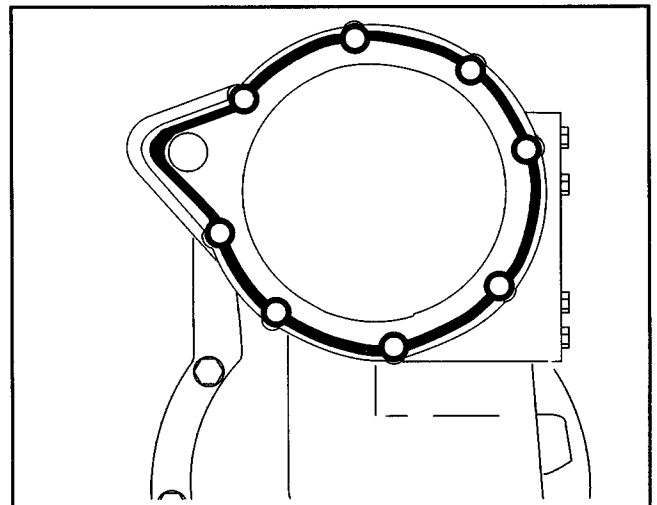


Figure 16

INTER-AXLE DIFFERENTIAL ASSEMBLY

28. Check seal surface on input yoke. Replace if grooved or damaged.
29. Install yoke using yoke installer tool (See Recommended Service Tools, Pgs. 32-33).
30. Install new torque prevailing nut, and tighten to 900-1,200 Lb-Ft (1,224-1,632 N-m).
31. Clean and install magnetic screen filter on models equipped with lube pump. Tighten to 15-20 Lb-Ft (20-27 N-m).
32. Clean mating surfaces and place 1/16" bead of Loctite #518 gasket eliminator onto intermediate case (See Figure 16).

33. Install lube pump (on models with this option) or cover plate and tighten bolts evenly to 15-20 Lb-Ft (20-27 N-m).
34. Install air shift cylinder onto intermediate case. Be certain metal piston support washer is in position, and white cylinder seal is in place. Tighten bolts evenly to 30-40 Lb-Ft (41-55 N-m).

Inter-axle Differential Assembly Complete

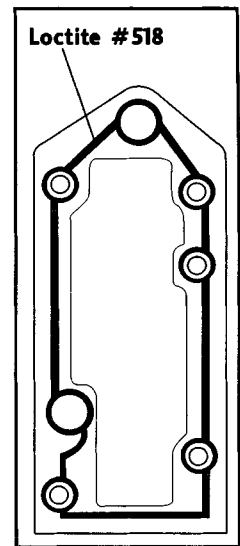


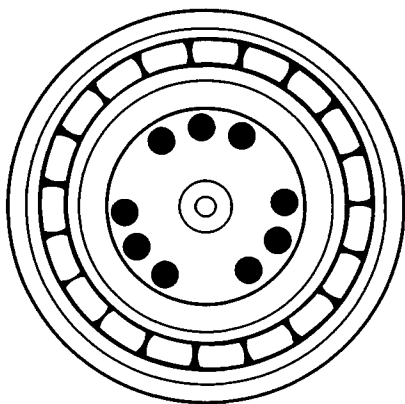
Figure 17

PINION ASSEMBLY

1. Press inner pinion bearing cone onto the pinion.
2. Press roller bearing onto nose of pinion.

NOTE: Bearing must be installed with radius in bearing bore toward pinion.

3. Stake roller bearing in nine places (See illustration below), using a center punch or equivalent tool. This operation will move gear shaft material outward into bearing chamfer.



NOTE: Make sure all cage bores are free of nicks, dirt, or any other contaminants.

4. Install inner pinion bearing cup into pinion cage.
5. Install outer pinion bearing cup into pinion cage.

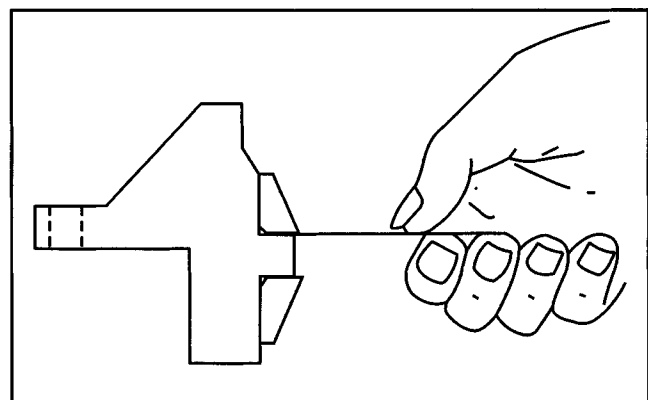


Figure 18

6. Use a feeler gauge or shim stock .0015 in. (.0381 mm) to ensure bearing cups are completely seated in bearing bores (See Figure 18). This is necessary for proper pinion position.
7. Place selective preload spacer that was removed during disassembly onto pinion.
8. Place pinion cage onto pinion inner bearing.
9. Install outer pinion bearing cone onto pinion.
10. Inspect rear carrier end yoke seal surface for grooves caused by lip of seal. If grooves can be detected with fingernail, it should be replaced.
11. Install gear onto pinion of forward rear carrier.

PINION ASSEMBLY

If hole in pinion does not align with slots in nut, tighten nut until they are aligned. Do not install roll pin at this time.

On rear carriers, install end yoke onto pinion using yoke installer service tool, (See Figure 19 and Recommended Service Tools Pgs. 31-32), without seal to allow proper setting of bearing preload. Tighten pinion nut to 900-1200 Lb-Ft (1,220-1,627 N-m).

NOTE: Pinion cage should be rotated while tightening pinion nut to seat and align the pinion bearings.

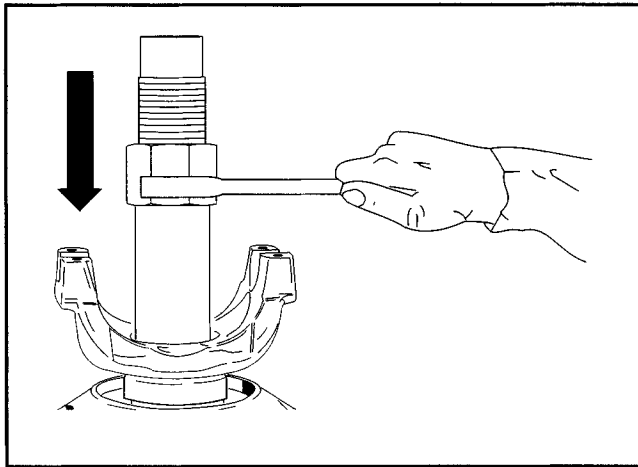


Figure 19

There are two methods of measuring pinion bearing preload and both are acceptable. Mechanic's preference and available tools should determine which method is used.

Method A uses a pull scale and a strong cord approximately 8 ft. long. (See Item 12). **Method B** uses a Lb-in torque wrench. Both methods measure torque to rotate. (See Item 13).

12. **Method A:** To measure torque-to-rotate with the spring scale, clamp the end yoke horizontally in a soft-jawed vise. Attach one end of the cord to a bolt hole in the pinion cage, wrap cord around pinion cage and attach the outer end of the cord to the spring scale. Rotate pinion cage by pulling scale. Read scale during fourth revolution. Scale reading must be between 3-10 Lbs (1.4-4.5 Kg). (See Figure 20)

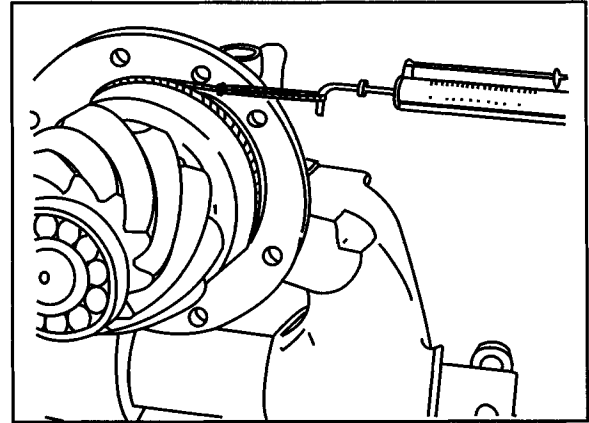


Figure 20

13. **Method B:** To measure torque to rotate with the torque wrench, assemble pinion cage into the carrier housing and install two mounting bolts to anchor the unit.

Rotate pinion with the torque wrench. (See Figure 21) Torque measurement will be taken during fourth revolution and must be between 10-40 Lb-in (1.1-4.5 N-m) without pinion seal.

NOTE: When torque to rotate reading does not fall within allowable limits, bearing preload can be increased by using a thinner spacer or decreased by using a thicker spacer. A .001 in. (.025 mm) change in preload spacer thickness, changes scale reading by approximately 10 lbs, .001 in. change in preload spacer will change torque to rotate by approximately 30 Lb-in. This is only a guide, individual carriers may vary slightly.

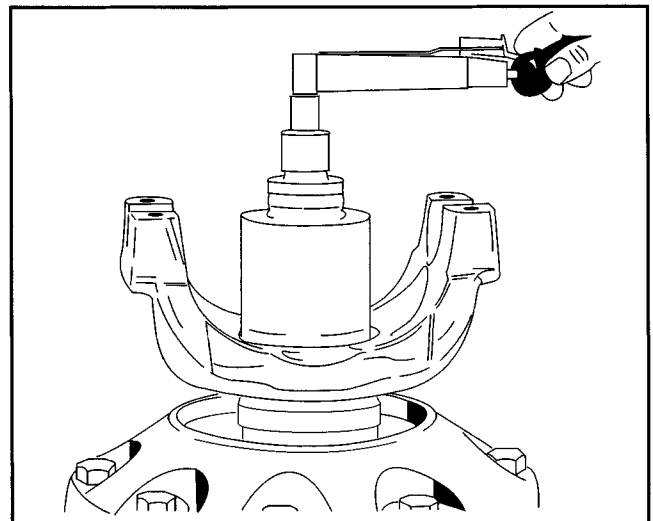


Figure 21

PINION ASSEMBLY

The pinion bearing spacers are available in the following thicknesses. Measure spacer with micrometers before assembly to ensure correct thickness.

<u>Inches</u>	<u>MM</u>
.718	18.24
.719	18.26
.720	18.29
.721	18.31
.722	18.34
.723	18.36
.724	18.39
.725	18.41
.726	18.44
.727	18.47
.728	18.49
.729	18.52
.730	18.54
.731	18.57
.732	18.60
.733	18.62
.734	18.64
.735	18.67
.736	18.69
.737	18.72
.738	18.75
.739	18.77
.740	18.80

NOTE: Closer adjustment can be made by sanding next thicker spacer to desired thickness using emery cloth on a flat surface. Surfaces must be parallel to each other and square to bore diameter.

⚠ CAUTION: Wash spacer thoroughly of emery cuttings before installing on pinion.

14. After proper preload is achieved, install new roll pin into forward carrier pinion. If roll pin cannot be installed, tighten pinion nut until roll pin can be installed. Pinion and cage assembly are now ready to be installed into the carrier housing.
15. After proper preload is achieved on rear carriers, remove end yoke, and install new seal.
16. Clean and dry threads on pinion.
17. Install pinion oil seal. (See Recommended Service Tools, Pgs. 31-32)
18. Install end yoke using yoke installer service tool. (See Figure 19) Coat threads with Loctite #680 adhesive compound.
19. Use torque multiplier and tighten pinion nut to 900-1,200 Lb-Ft (1,220-1,627 N-m).

Output Shaft Disassembly Complete

DIFFERENTIAL ASSEMBLY

1. If ring gear was removed from differential case, reinstall at this time. Clean mating surfaces and bolt ring gear to differential case at 3 locations, 120 deg. apart to help eliminate ring gear runout. Use hydraulic press and suitable riveting fixture, as shown. Pressure requirement per rivet is 45-50 tons (41-45 metric tonnes).

The ring gear is properly installed when a .0015 (.038 mm) feeler gauge cannot be inserted between the differential case flange and the ring gear backface (See Figure 22).

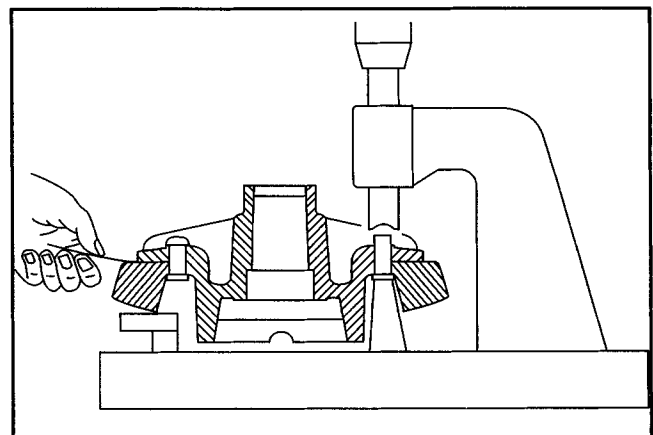


Figure 22

NOTE: Ring gear and pinion must be replaced as a match set only.

DIFFERENTIAL ASSEMBLY

2. Install bearing cones to differential case halves. Place bearing cups on cones during remainder of assembly to prevent damage to bearings.

NOTE: Use of press and proper adapter is required to eliminate possible damage to bearings.

3. Apply a small amount of lubricant to all mating surfaces. This will keep thrust washers in place during assembly and provide initial lubrication.
4. Place thrust washer and side gear in flange half of differential case. Dimples in thrust washers go against side gear.

5. Assemble differential pinions and thrust washers on cross shaft. Place assembly in flange half differential case.
6. Place remaining side gear and thrust washers in position on differential pinions.
7. Assemble case halves, making sure that both match marks are lined up.
8. Install differential case bolts. Tighten alternately and evenly. (See Torque Specifications)

Differential Assembly Complete

PINION POSITION

Ring gears and pinions are supplied in matched sets only. Matching numbers on both the pinion and ring gear are etched for verification. If a new gear set is being used, verify the numbers of each pinion and ring gear before proceeding with assembly. (See Gear Set Identification, Page 2)

Pinion position is based on the nominal mounting distance measured from the centerline of the ring gear to the nose of the pinion. This dimension is controlled by selectively shimming between the pinion cage assembly and the carrier housing. The nominal dimension is 3.976 in. (100.990 mm).

NOTE: Be sure mounting surfaces and shims are free of burrs and dirt prior to assembly as they will affect pinion position.

1. To establish the correct nominal dimension by using a pinion setting gauge, install pinion and cage assembly into the carrier housing without shims. Tighten pinion cage bolts to correct torque specifications. (See Torque Specification Chart, Pgs. 31 -32) Failure to tighten properly may result in incorrect gear adjustment.
2. Attach the step plate clamp assembly to the carrier mounting flange. Locate step plate clamp screw over

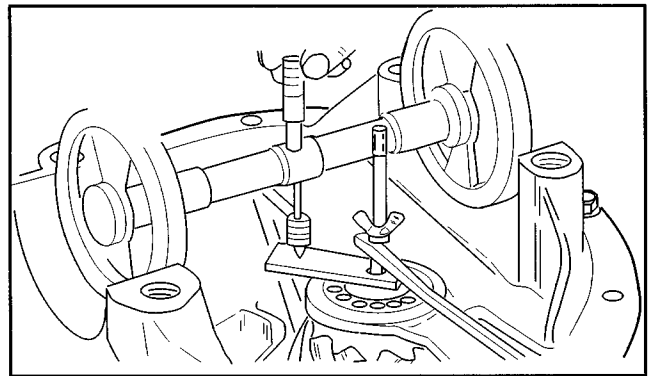


Figure 23

center of pinion. Install step plate under clamp screw and tighten to hold step plate securely in position.

NOTE: Be sure lugs on bottom of step plate straddle the bearing staking indentions on end of pinion, or false reading may occur. Also, make sure differential side bearing bores are clean and free of nicks.

3. Remove any burrs and wipe clean differential bearing bore I.D.'s. Turn micrometer 90 deg. to step plate. Install assembled pinion setting gauge into bearing bores of carrier housing until fully seated. Adjust micrometer so it is directly over end of step plate. Run the micrometer thimble down to measure the distance between the center of the ring gear and the step plate. (See Figure 23) **Make a note of this dimension.**

PINION POSITION

NOTE: Because the step plate must be taken into consideration, the thickness of the step plate (.400 in. (10.16 mm)) needs to be added to the measured value for the correct micrometer distance.

4. On the machined end of each pinion either a plus (+), minus (-), or a zero (0) will be etched. (See Gear Set Identification, Page 2) This number represents the amount in thousandths of an inch (.001) to be added or subtracted from the nominal dimension for the best running position for that particular gear set.

EXAMPLE:

If pinion is etched +3, the required mounting distance is more than nominal by .003 in. (.076 mm). This means the pinion would require .003 in. (.076 mm) thicker shim between pinion bearing cage assembly and carrier housing that a pinion etched with "0". If the pinion is marked -3, the shim required between pinion gearing cage assembly and carrier housing would be .003 in (.076 mm) thinner than if pinion was etched "0".

5. Pinion shims are available in the following thicknesses.

Inches	MM
.005	.127
.010	.254
.030	.762

6. Position shims on carrier housing so oil return holes align properly. Use a minimum of three shims in a pack. If the pack is made of different shim thicknesses, install the thinnest shims on both sides of the pack for maximum sealing.

NOTE: Be sure mounting surfaces and shims are free of dirt and nicks prior to assembly or leaks will occur and pinion position can be affected.

7. Install pinion and pinion cage assembly into carrier.

NOTE: Studs can be used to assist in alignment.

8. Tighten pinion cage to carrier bolts. (See Torque Specifications Chart, Pgs. 29-30)
9. An alternative to using the pinion setting gauges is to follow the procedure described in the following section.

Pinion Position Complete

PINION SETTING CHART

When a new gear set is being installed, use a micrometer to measure the thickness of the old pinion position shims. Measure each shim separately and add together to get the total thickness of the original build-up.

NOTE: If old shims are bent or mutilated they should be replaced.

If a new gear set is being used, notice the (+), (-) or "0" etching on both the old and the new pinions, and adjust the thickness of the shims to compensate for the difference of these two figures (as shown in table on next page).

For example, if the old pinion is etched +2, and the new pinion is -2, subtract .004 in. from the thickness of the

original shims used to position the pinion.

If either or both the pinions are etched beyond the values on this chart, follow the same procedure to establish correct pinion position.

For example if the old pinion is etched -12 and the new pinion is etched +9, add .021 inch to the thickness of the original shims.

After determining the new total build up of pinion position shims, round the figure off to the nearest multiple of .005 inch.

Use the Pinion Setting Chart on the next page as a guideline to set the pinion.



DIFFERENTIAL INSTALLATION

1. Install ring gear and differential assembly into carrier housing. Tilt differential slightly so ring gear clears straddle bearing support.

CAUTION: Care should be used when installing ring gear and differential into carrier housing so damage to ring gear, pinion, bearings, or bearing bores does not occur.

2. Be sure side bearing cups are seated on bearing cones. Assemble differential bearing caps, with match marks in proper location (See Figure 24). Clean bearing cap bolts and washers and coat threads with Loctite #277 (Red). Install bearing cap bolts and tighten enough to eliminate visible space between differential bearing cap and carrier. Do not torque at this time.

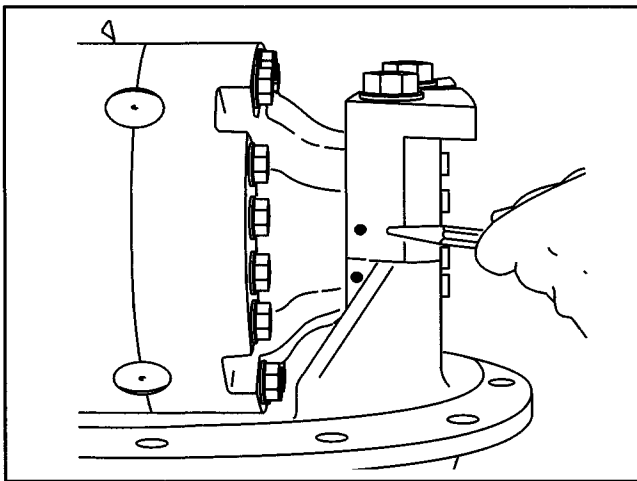


Figure 24

3. Install adjusting rings. Tighten both adjusting rings until end play is eliminated, and there is backlash between ring gear and pinion.
4. Loosen adjusting ring on tooth side of ring gear, and tighten adjusting ring on flange side of ring gear, equal amounts until backlash is eliminated. Tighten adjusting ring on tooth side of ring gear 2-3 notches or until proper backlash and side bearing preload are established. Ring gear to pinion backlash is .008-.012 in. (.20-.30 mm). (See Figure 25)
5. Check ring gear and pinion backlash in four equally spaced positions around the ring gear with a dial indicator (See Figure 26).

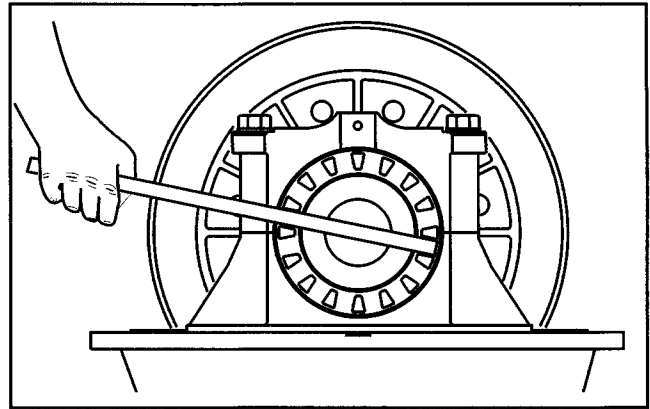


Figure 25

NOTE: If the backlash tolerance does not vary more than .003 in. (.076 mm), the setting is acceptable. If backlash does vary more than .003 in. (.076 mm), remove differential and determine the cause.

6. Once backlash is set, tighten the differential bearing cap bolts to 275-320 Lb-Ft (370-435 N-m). Check backlash after tightening cap bolts.

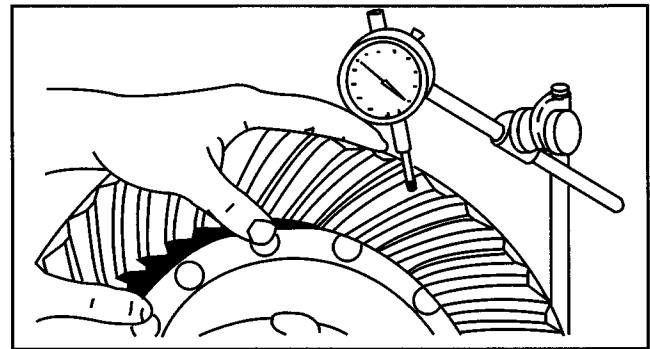
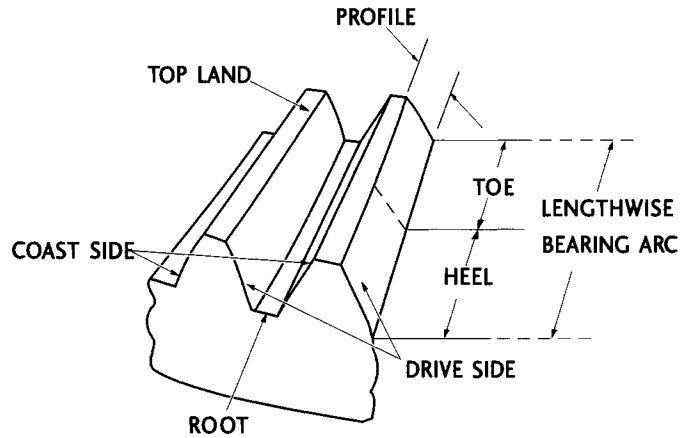


Figure 26

RING GEAR AND PINION TOOTH CONTACT PATTERN

The following procedures are to be used to establish proper gear tooth pattern after assembly of the carrier is complete.

NOTE: If matched sets are being reused, measure and record backlash before disassembly, and reassemble to the same backlash. This will match ring gear and pinion to the established wear patterns. Hand rolled patterns will cover less area than the gear pattern established by previous service.

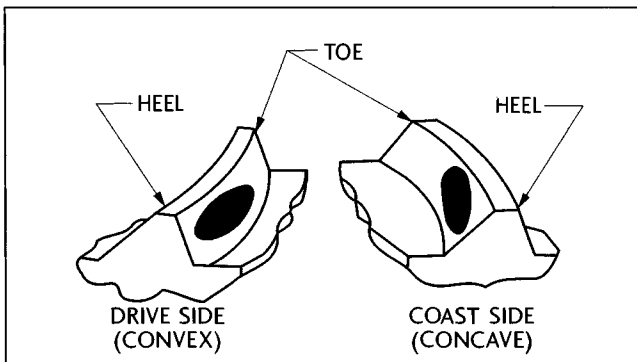


STEP 1. Paint 1/4 ring gear with marking compound on both the drive and coast side.

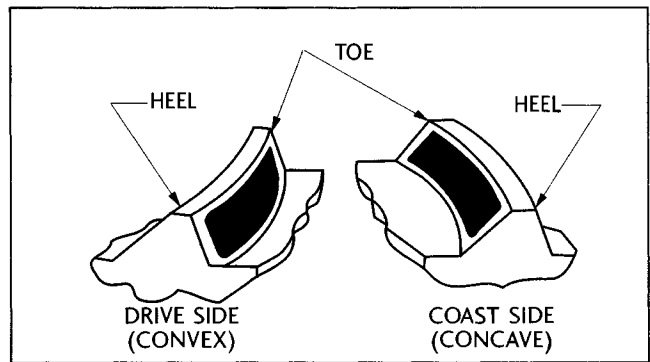
STEP 2. Apply drag load to ring gear and rotate pinion so that ring gear completes one revolution in each direction.

CORRECT GEAR PATTERNS

LIGHTLY LOADED

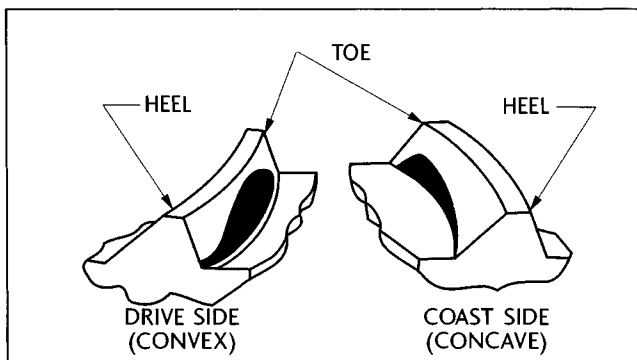


HEAVILY LOADED

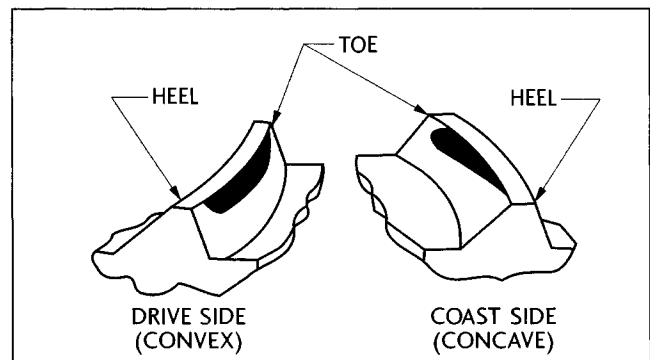


INCORRECT GEAR PATTERNS

LIGHTLY LOADED



HEAVILY LOADED



INSTALLATION OF DIFFERENTIAL CARRIER INTO AXLE HOUSING

1. Thoroughly clean the inside of the carrier housing and inspect the housing mounting surface for nicks and general cleanliness. Stone the surface if necessary to remove burrs or nicks. Bolt holes must also be checked, to see that they are free of contaminants.

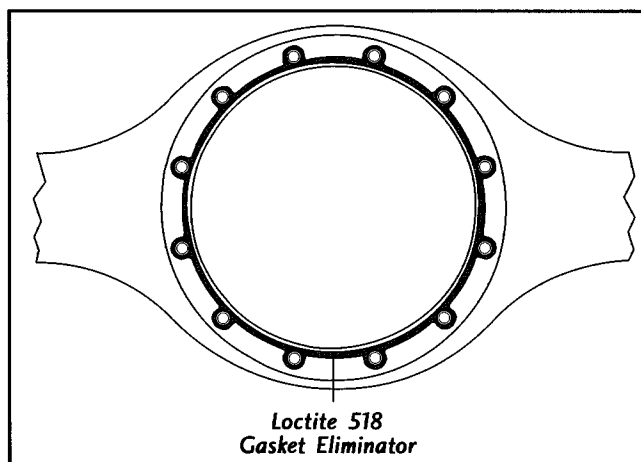
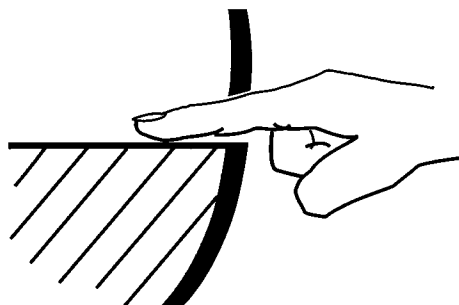


Figure 27

2. Apply an .125 inch (3.175 mm) diameter bead of Loctite # 518 gasket eliminator onto the axle housing mounting flange and around each bolt hole. (See Figure 11)
3. Thread two studs into the axle housing 180° apart. This will eliminate rotation of the carrier assembly after it makes contact with the gasket material.
4. Install the carrier assembly into the axle housing. If reinstalling used bolts, clean the mounting bolts, and coat with Loctite # 277, and install. Tighten bolts evenly in a crossing pattern. Torque bolts 240-260 Lb-Ft (325-352 N-m).
5. Allow one hour cure time for gasket material before adding hypoid gear lubricant.

6. Remove the old axle flange gasket and clean mating surfaces of the hub and axle flange.
7. Install the new axle flange gasket.
8. Install the axle shafts to proper location. Torque the axle flange nuts to vehicle manufacturers specifications.
9. Clean drain plug and install. Torque drain plug to 35-45 Lb-Ft (47-61 N-m). Fill unit to proper level with hypoid gear lubricant.
10. Install fill plug and torque to 35-45 Lb-Ft (47-61 N-m).



NOTE: Lubricant close enough to bottom of fill hole to be seen or touched is not sufficient. Lubricant must be level with the fill hole.

Model	Pints	Liters
Forward Rear Axle**	32.5	15.6
Rear Rear Axle	44.6	21.3

* Lube capacity will vary depending upon the housing angle in each vehicle. Capacities given above are for an angle of 4 degrees. Fill to the lower edge of the fill hole in the axle housing as shown above.

** Pour 1 Pint (0.5 Liter) of gear lube into the filler hole in top of Inter-axle Differential cover.

AXLE/TORQUE SPECIFICATIONS

Axle Specifications

Position	U.S.	Metric
Pinion		
Nominal Dimension	3.976 in.	100.990 mm
Bearing Preload (Torque Wrench)*	10 - 40 Lb-in	1.1 - 4.5 N-m
Bearing Preload (Pull Scale)*	3 - 9 Lbs.	1.4 - 4.5 Kg
Differential		
Ring Gear to Pinion Backlash	.008 - .012 in.	.20 - .30 mm
Ring Gear Rivet Pressure	45 - 50 tons	41 - 45 tonnes
Power Divider		
Inter-Axle Differential End Play	.001 - .003 in.	.025 - .076 mm
Lubrication (Approx.**)		
Forward Rear Axle	32.5 Pts. †	15.6 Liters †
Rear Rear Axle	44.6 Pts.	21.3 Liters

* Pinion bearing preload is established prior to installation of pinion seal.

** Capacity will vary depending on the housing angle in each vehicle. Fill to lower edge of fill hole in rear of axle housing as shown on Page 22.

† Pour 1 Pint (0.5 Liter) of gear lube into filler hole in top of inter-axle differential cover.

Axle Shaft Torque Specifications

Position	Model	Thread	Grade	Lb-Ft	N-m
Axle Flange to Wheel Hub Nuts	N340-S	5/8 - 18	5 Nylok	125-145	170-195
	N400i	3/4 - 16	5 Nylok	217-240	290-325
Axle Flange to Wheel Hub Nuts	N340-S	5/8 - 18	8 Steel	160-185	220-250
	N400i	3/4 - 16	8 Steel	275-320	370-435

NOTE: Refer to vehicle manufacturer specifications for axle Flange-Wheel Nut fastener torque.

AXLE/TORQUE SPECIFICATIONS

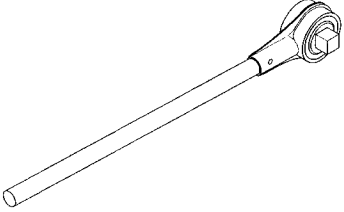
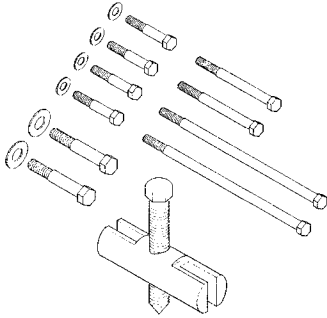
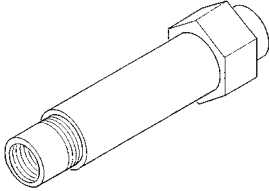
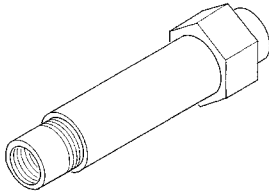
Power Divider Fasteners				
Position	Thread	Grade	Lb-Ft	N-m
Input Nut	1 3/4 – 12		900-1,200	1,220-1,627
Flanged Hex Nut, Output Shaft	1 1/4 – 12		500-600	680-816
Input Shaft Bearing Retainer (Hex)	1/2 – 13	5	55-70	75-95
Input Shaft Bearing Retainer (Flange)	1/2 – 13	8	100-120	136-163
Intermediate Case Bolts (Hex)	1/2 – 13	5	55-70	75-95
Intermediate Case Bolts (Flange)	1/2 – 13	8	100-120	136-163
Output Shaft Retainer Bolts	3/8 – 16	8	30-40	41-55
Shift Fork Shaft	1/2 – 13	8	30-38	41-52
Air Shift Cylinder Bolts	3/8 – 16	8	30-40	41-55
Dust Cover Bolts	5/16 – 18	5	15-20	20-27
Lube Pump Retainer Bolts [§]	5/16 – 18	5	15-20	20-27
Flanged Hex Nut, Forward Axle	1 3/4 – 12	8	900-1,200*	1,220-1,627*

[§] Used only when optional Lube Pump is in use on the axle assembly.

* If roll pin cannot be installed after minimum torque is attained, the nut must be advanced until roll pin can be installed.

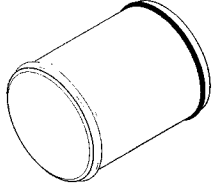
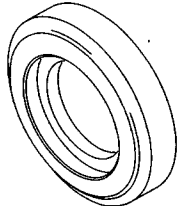
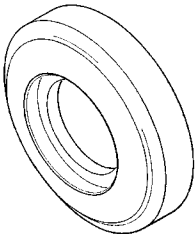
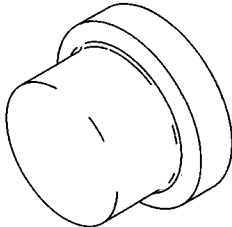
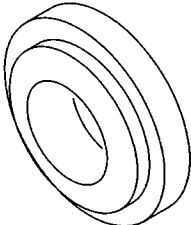
Forward and Rear Axle Common Fasteners				
Position	Thread	Grade	Lb-Ft	N-m
Flanged Hex Nut, Rear Axle	1 3/4 – 12		900-1,200	1,220-1,627
Pinion Bearing Cage Bolts (Hex)	9/16 – 12	8	115-135	155-183
Pinion Bearing Cage Bolts (Flange)	9/16 – 12	8	160-180	218-245
Differential Bearing Cap Bolts	3/4 – 10	8	295-340	400-460
Differential Case Bolts (Hex)	9/16 – 12	8	150-170	202-229
Differential Case Bolts (Flange)	9/16 – 12	8	160-180	218-245
Carrier Mounting Bolts (Hex)	9/16 – 12	8	115-135	155-183
Carrier Mounting Bolts (Flange)	9/16 – 12	8	160-180	218-245
Adjusting Ring Lock Bolt	3/8 – 16	8	20-30	27-41
Oil Pipe Plugs	3/4 – 14	8	35-45	47-61
Ring Gear Bolt Kit	13mm – 16M	6	300-320	406-434

RECOMMENDED SERVICE TOOLS

ORDER NUMBER	DESCRIPTION	ILLUSTRATION
<p>DST1002 DST1003 DST1004 DST1005</p> <p>DST1011 DST1012 DST1013 DST1014</p>	<p>TORQUE MULTIPLIERS Maximum 1,000 Lb-Ft Maximum 2,000 Lb-Ft Maximum 4,000 Lb-Ft Maximum 12,000 Lb-Ft</p> <p>DRIVE ADAPTERS 3/4 in. Female x 1/2 in. Male 3/4 in. Female x 1 in. Male 1/2 in. Female x 3/4 in. Male 1 in. Female x 3/4 in. Male</p>	
<p>DST1006</p>	<p>YOKE REMOVER, BAR TYPE</p>	
<p>DST1009</p>	<p>YOKE INSTALLER (1-1/2"-12) (1-1/4"-12)</p>	
<p>DST1007</p>	<p>YOKE INSTALLER (1-3/4"-12) (1-1/2"-18)</p>	



RECOMMENED SERVICE TOOLS

DST1010 N340-S, N400i TANDEM AXLE KIT		
ORDER NUMBER	DESCRIPTION	ILLUSTRATION
DST1000-1	SEAL INSTALLATION HANDLE (To be used with seal installers listed below)	
DST1000-2	INPUT/OUTPUT SHAFT SEAL INSTALLER	
DST1000-3	LUBE RETAINER & REAR PINION OIL SEAL INSTALLER	
DST1010-1	NEEDLE BEARING INSTALLER	
DST1010-2	OUTPUT SHAFT SEAL INSTALLER	

ALL SERVICE TOOLS AVAILABLE FROM OTC DIVISION:

Service Tools
655 Eisenhower Drive
Owatonna, MN 55060
Telephone: 1-800-533-0492
Fax Number: 507-455-7011





SPICER®

Drivetrain Products

Axles
Driveshafts
Off-Highway Transmissions

LONG®

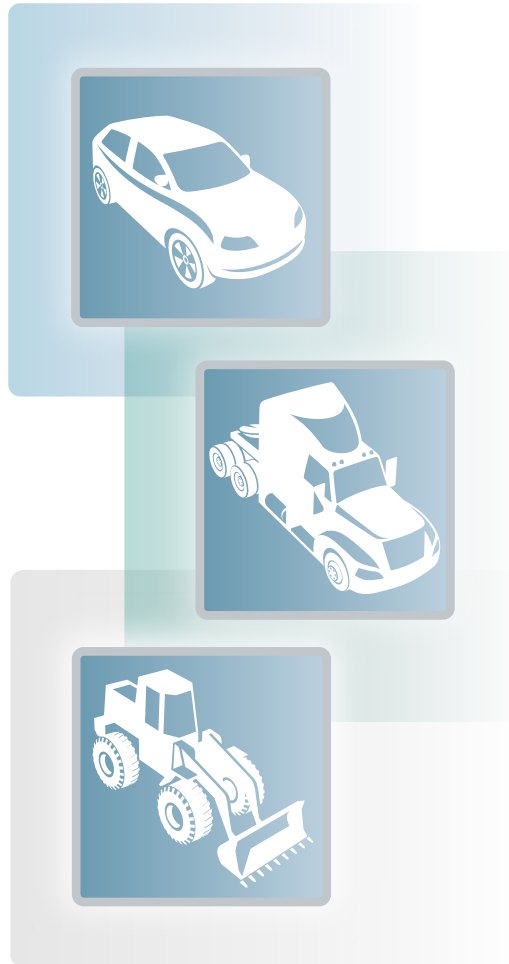
Thermal Products

Transmission Oil Coolers
Engine Oil Coolers

VICTOR REINZ®

Sealing Products

Gaskets and Seals
Cylinder-Head Cover Modules
Thermal-Acoustic Protective Shielding



Dana Aftermarket Group
PO Box 321
Toledo, Ohio 43697-0321

Warehouse Distributor: 1.800.621.8084
OE Dealers: 1.877.777.5360

www.spicerparts.com

SPICER®

