Spicer® Single Drive Axles

SPICER®

DANA

Service Manual

Spicer® Single Drive Axles

AXSM-0043

September 2007

The description and specifications contained in this service publication are current at the time of printing.

Pmf`bo Corporation reserves the right to discontinue or modify its models and/or procedures and to change specifications at any time without notice.

Any reference to brand name in this publication is made as an example of the types of tools and materials recommended for use and should not be considered an endorsement. Equivalents may be used.

IMPORTANT NOTICE

This symbol is used throughout this manual to call attention to procedures where carelessness or failure to follow specific instructions may result in personal injury and/or component damage,

WARNINGS: FAILURE TO FOLLOW INDICATED PROCEDURES CREATES A HIGH RISK OF PERSONAL INJURY TO THE SERVICING TECHNICIAN,

Departure from the instructions, choice of tools, materials and recommended parts mentioned in this publication may jeopardize the personal safety of the service technician or vehicle operator,

Caution: Failure to follow indicated procedures may cause component damage or malfunction.

Note: Additional service information not covered in the service procedures.

Tip: Helpful removal and installation procedures to aid in the service of this unit.

Always use genuine Pmf`bo **replacement parts.**

Spicer Axle Service and Maintenance Instructions
Single Reduction Axles

Introduction

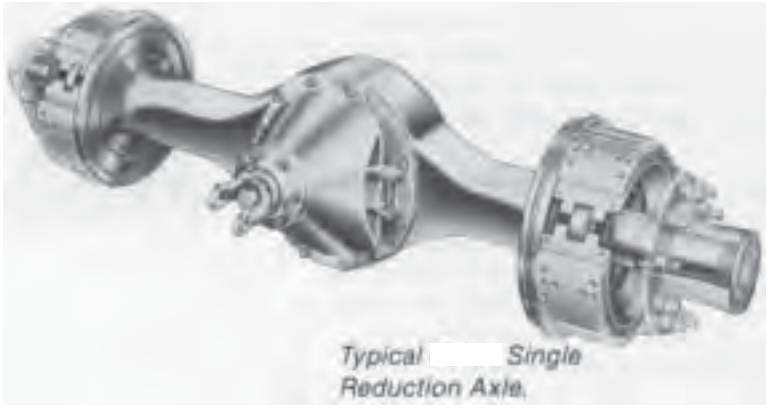
Spicer Corporation Axle & Brake Division, presents this publication to aid in maintenance and overhaul of Spicer single reduction, single drive axles.

The axle models contained in this manual are of common design. Physical variances occur in the axle housing, differential gearing and axle shafts because of varying load carrying capacities (see chart on page 4). For other variables refer to the exploded view on page 5.

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

For brake information and axle mounting or suspension systems, refer to pertinent truck manufacturerÕs literature.

Axle models covered in this publication:
13101
15101,15131
16121,16131
17101,17103,17121,17123,17131,17133
18101.18121.18123
19101,19121
20101,20121
21121,21131,21133
22121,22123,22131,22133
23121,23123,23133
26121
30127

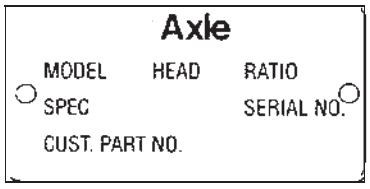

Typical Single Reduction Axle.

Contents

Price $3.50

Axle and Carrier Assembly Model Identification

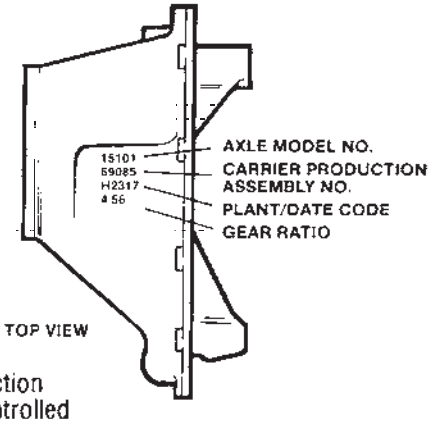
Differential carrier identification is either stamped on the carrier itself or on a metal tag affixed to the carrier, Location on the carrier is the same.



Metal Tag on Differential Carrier

1 5 1 0 1

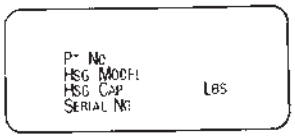
- 1 — Design Level
  - 0 - Head only
  - 1 - Axle Assy
  - 3 - Rolled over pinion
- 0 — Gear Size
- 1 — Gearing
  - 1 - Single Reduction
  - 2 - 2-Speed
  - 3 - Planetary Double Reduction
  - 4 - Single Reduction w/Controlled Traction Differential
- 15 — Axle Capacity (X 1,000 lbs.)



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.

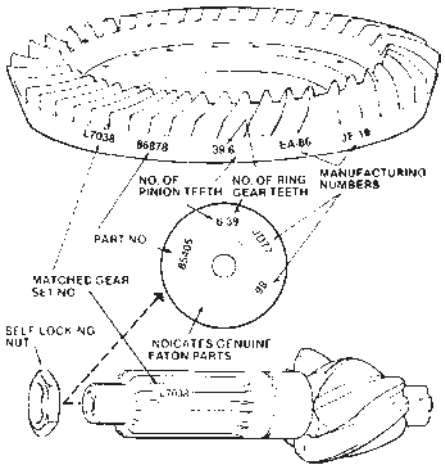
In addition, some axles may include a metal identification tag (see illustration).



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).



Pmf`bo Single Reduction Axles

Description and Operation

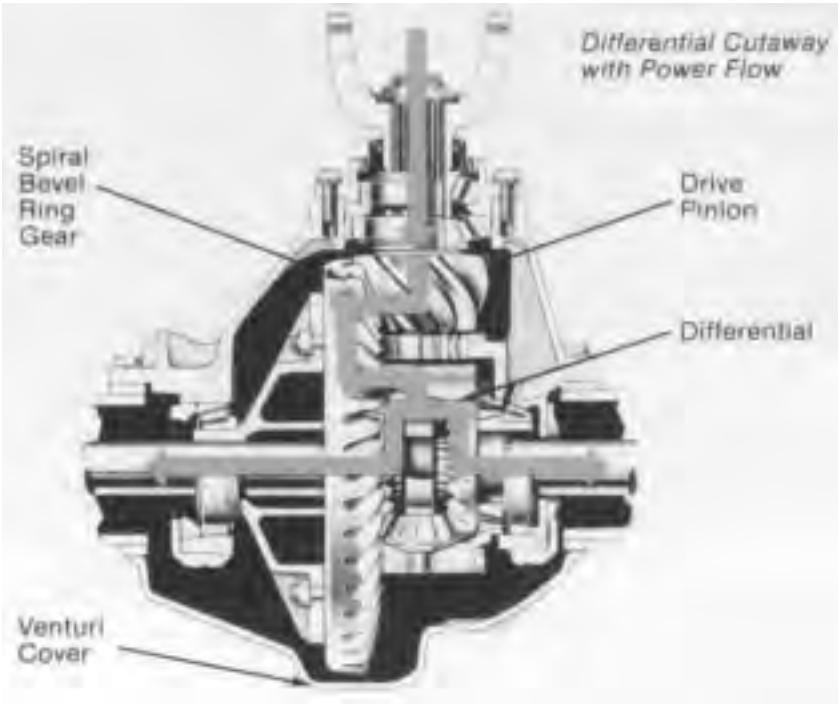
Spicer single reduction axles are of the full-floating type with a single-speed differential assembly.

The gearing is spiral bevel design with drive pinion positioned at centerline of the ring gear.

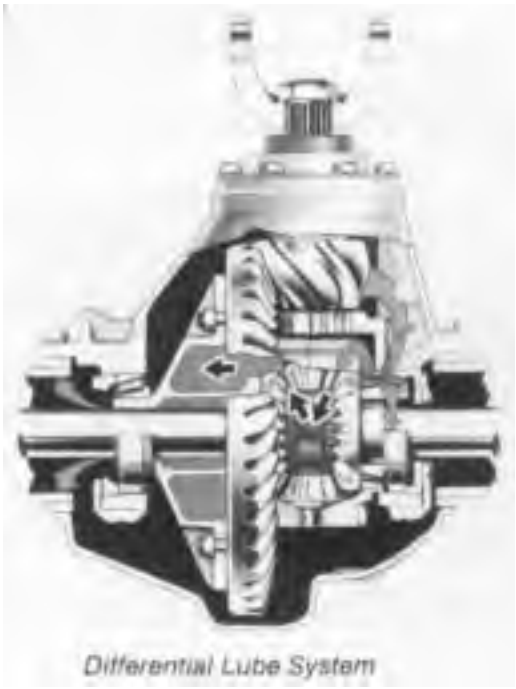
Drive pinion is straddle-mounted on two tapered roller bearings and a straight roller type pilot bearing. The differential assembly is mounted on two tapered roller bearings.

Power flow is through the drive pinion and ring gear, and a 4 side pinion, 2 side gear type differential to the axle shafts and wheels.

The majority of variances in axle models included in this manual is in ring gear size and capacities (see chart below). For detailed variances refer to exploded view of differential (page 5).



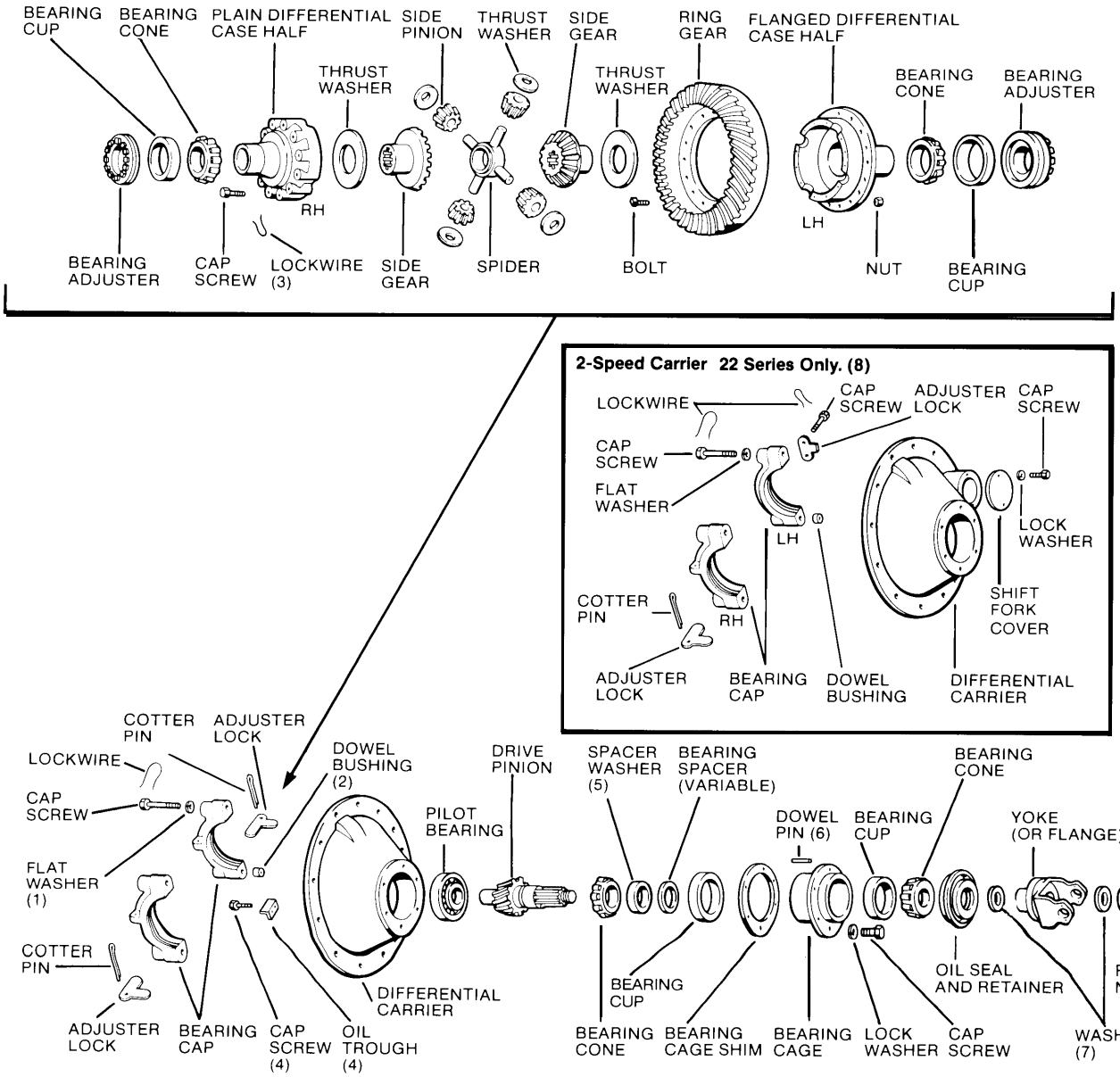

Spiral Bevel Ring Gear and Drive Pinion


Differential Lube System

Axle Models	Ring Gear Diameter	Capacities
13101	13-3/4"	15,000
15101, 15131	14-1/4"	15,000
16121, 16131	15"	17,500
17101, 103	16"	19,000
17101, 123, 131, 133	16-1/2"	19,000
*18101	16"	22,000
*18121, 123	16-1/2"	22,000
21121, 131, 133	16-1/2"**	21,000
22121, 123, 131, 133	17"	22,000
*19101, 20101	17"	23,000
*19121, 20121	18"	23,000
23121, 123, 133	18"	23,000
26121	18"	26,000
30127	18"	30,000

* No longer in production. **16" Ring Gear for 3.55 & 3.70 ratios.

Differential Carrier Assembly



(1) Flat Washer not used on 13, 15, 16 Series.
(2) Dowel Bushing not used on 13, 15, 16, 17, 18, 21 Series
(3) Lockwire not used on 17, 18, 21, 22, 23, 26 (late 30 Series.
(4) Oil Trough & Capscrew not used on 13, 15, 16, 17, 18, 21, 22, 23, 26 (late), 30 Series.
(5) Spacer Washer not used on 13, 15, 16, 17, 18, 21, 22 Series.
(6) Dowel Pin not used on 17, 18, 19, 20, 21, 22, 23,26, 30 Series.
(7) Flat Washer not used on 15130, 16130, 17130, 19121, 20121,23,26,30 Series.
(8) 2-Speed Differential Carrier is used on 22 Series. Axles so 17" gearing will fit.
(9) Yoke Spacer used only if retrofitting 17 Series Axles with current gear/ pinion sets built with 55200C Inner Pinion Bearings. Reference Instruction Sheet 129277.

Single Reduction Single Drive Axles

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 incorrect 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 Pmf`bo Corporation.

Approved Lubricants

General-Gear lubrications acceptable under military specification (MILSPEC) MIL-L-2105D (Lubricating Oils, Gear, Multipurpose) preapproved for use in Pmf`bo Drive Axles. The MIL-L-2105D specification defines performance and viscosity requirements for multigrade oils. It supersedes both MIL-L-2105B, MIL-L-2105C and cold weather specification Ml L-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) for MIL-L-2105D.

Note: The use of separate oil additives and/or friction modifiers are not approved in Pmf`bo 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 Pmf`er® 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 80W-140, have demonstrated superior performance in comparison to others qualified under the MINPEC, as demonstrated by extensive laboratory and field testing. For a complete list of Pmf`er® approved synthetic lubricants contact your local Pmf`bo representative. See back cover of this manual for appropriate phone number.

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

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 Pmf`er 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 Pmf`bo Corporation by contacting your local Pmf`bo 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 27°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	1O°F and above (-12°C and above)

Single Reduction Single Drive Axles

Lube Change Intervals

This product combines the latest manufacturing and part washing technology. **When filled with an** Pmf`bo **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 Pmf`**er approved synthetic 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

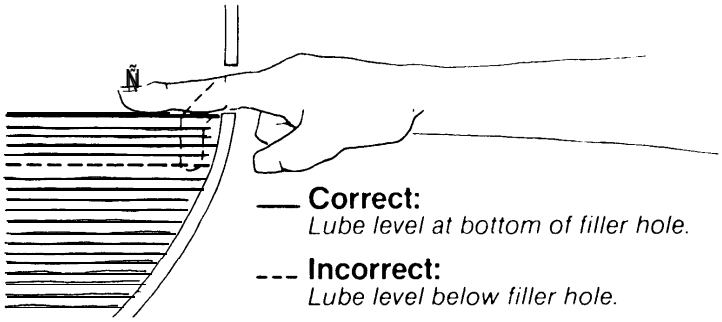
Lubricant Type	Maximum Change Interval	Maximum Change Interval	On/Off Highway Severe Service Miles	Maximum Change Interval
Petroleum Based	100,000	Yearly	40,000	Yearly
Pmf`bo - Approved Synthetic	250,000	3 Years	100,000	Yearly

Checking Lube Level

Remove the filler hole plug located in the axle housing cover. Lube should be level with the bottom of this hole.

IMPORTANT: Lube level close enough to the hole to be seen or touched is not sufficient, It must be level with the hole.

NOTE: When checking lube **level,** also check and clean housing breathers.



Correct:
Lube level at bottom of filler hole.

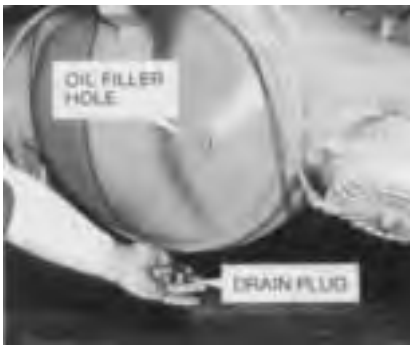
Incorrect:
Lube level below filler hole.

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 bowl section 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.



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.

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.

Axles installed at angles exceeding 6¡ or operated regularly in areas requiring negotiation of grades exceeding 12% may require standpipes to allow proper fill levels. For specific recommendations, contact your local Spicer representative. See back cover of this manual for phone numbers.

Lube Capacities*

DO NOT OVERFILL AXLES

Axle Series	Spicer Housing (Rectangular Arm) Pints (liters)	Vendor Housing (Round Arm) Pints (liters)
13,15	23 (11)	19 (9)
16	33 (16)	24 (11)
17,18	37 (18)	29 (14)
19,20		38 (18)
21,22	37 (18)	
23,26,30	41 (19)	34 (16)

*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

Following any servicing of wheel ends, the wheel hub cavities and bearings must be lubricated to prevent failure.

Caution: Make sure the wheel ends are well lubricated with the same axle lubricant used in the axle sump, Do not pack the bearings with grease before installation as grease will prevent the proper circulation of axle lubricant and may cause wheel seal failure.

Spicer axles may be equipped with either of two wheel end designs:

Wheel ends with an oil fill hole
Wheel ends without an oil fill hole

See Figure 1 for cutaway views of the two different designs.

Wheel ends with an oil fill hole

1. Rotate the wheel end hub until the oil fill hole is up.
2. Remove the oil fill plug.
3. Pour 1 pint of axle sump lubricant into each hub through the wheel end fill hole.
4. Install oil fill plug and tighten to specified torque.

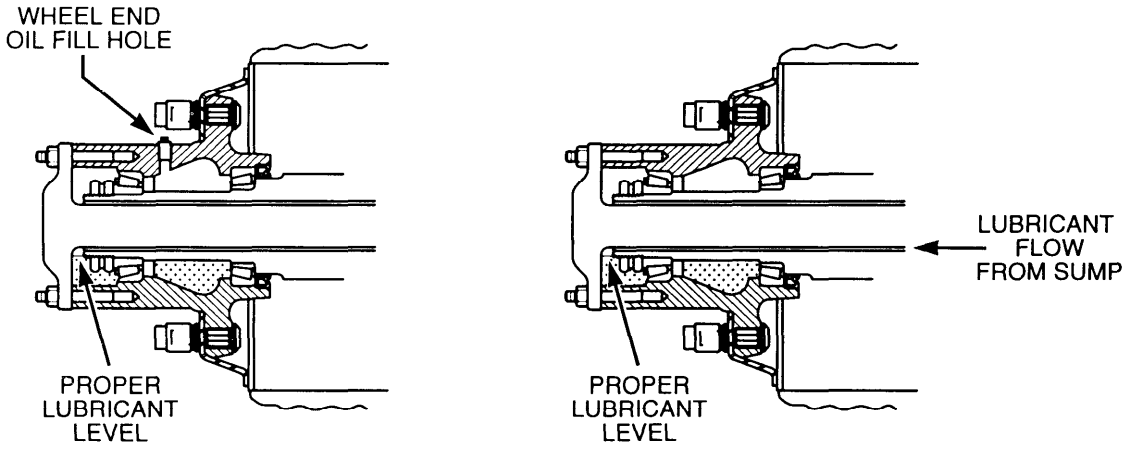


Figure 1 Cutaway Views of Typical Wheel End Assemblies

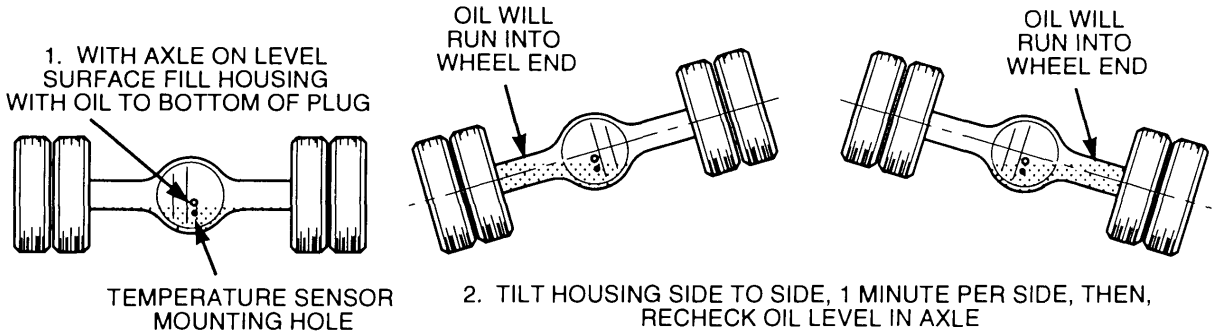
Single Reduction Single Drive Axles

Wheel ends without an oil fill hole

1. With axle level and wheel ends assembled, add lubricant through filler hole in axle housing cover until fluid is level with the bottom of filler hole.
2. Raise the left side of the axle 6 inches or more, Hold axle in this position for one minute.
3. Lower the left side.
4. Raise the right side of the axle 6 inches or more. Hold axle in this position for one minute.
5. Lower the right side.
6. With axle on a level surface, add additional lubricant through housing cover oil filler hole to raise lube to required level.

Note: Axles without wheel end fill holes will require approximately 2.5 additional pints of lubricant to bring the lube level even with the bottom of the fill hole.

Tip: The use of ramps or making a full lock figure eight turning maneuver at low speed will guarantee the wheel end is charged with lube. Refill axle to proper lube level, (Follow procedure on page 8).



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.

Adjustments

Wheel Bearing Adjustment

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

PREPARATION: Provide means to capture lubricant that will escape when axle shafts are removed. Remove axle shafts. Jack the wheel to be adjusted clear of the ground.
After securely blocking the vehicle to prevent rolling, release the parking brake, allowing the wheel to rotate freely.

1. Remove outer adjusting nut and doweled (or tanged) washer.

2. Visually inspect spindle for damage or wear. Inspect the nut and spindle threads for damage. Make certain that the nut turns without binding by cleaning the threads and applying a light coat of oil prior to adjusting the wheel bearings. Inspect tanged washer (if used). Replace washer if tangs are broken or badly misshaped.

3. Torque inner nut to 200 lbs.-ft. (272 N•m) while rotating the wheel. Loosen the nut one full turn. Re-torque to 50 lbs.-ft. (68 N•m). Back off nut exactly 1/4 of a turn.

4. Install doweled (or tanged) washer. If the dowel pin and washer (or washer tang and nut flat) are not aligned, remove washer, turn it over and reinstall. For further alignment, loosen the inner nut slightly.

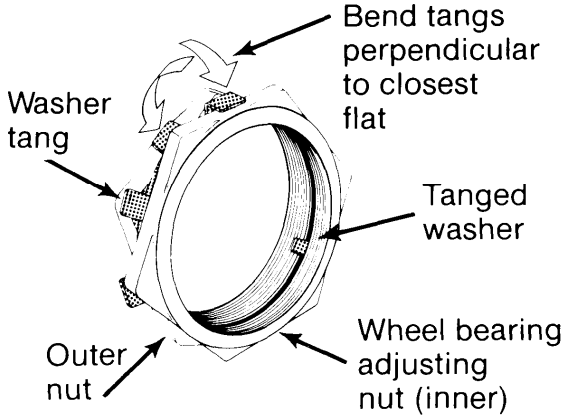
5. Install outer nut and torque as follows:
- Dowel type washer lock -300 lbs. -ft. (408 N•m)
- Tang type washer lock -250 lbs. -ft. (229 N•m)

This adjustment procedure should allow wheel to turn freely with 0.001''-0.005" (0.025mm to 0.250 mm) end-play.

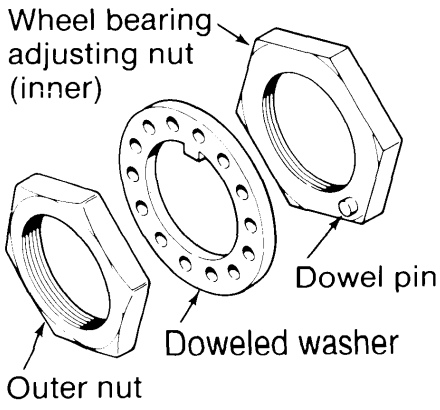
NOTE: The end-play should be measured using a dial indicator with a 0.001" resolution. With the tires and wheels on the hub, rock the wheel end back and fourth before making the end-play measurement. This will result in a more accurate reading.

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

WARNING: Never work under a vehicle supported only by a jack. Insure that the vehicle will not roll before releasing brakes.



TANGED WASHER TYPE



DOWELED WASHER TYPE

6. If using the tanged washer type lock, secure adjusting nuts by bending one wheel nut washer tang over each nut. Bend tang over the closest flat perpendicular to the tang (see Illustration).

7. Install axle shaft gasket& axle shaft. Refill axle to proper lube level. (Follow procedure on page 8).

Adjustments

Differential/ Carrier Adjustments

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

Spicer single drive axles require two types of adjustments: Bearings must be preloaded and ring gear tooth contact must be set.

Bearing Preload — Both pinion and differential bearings require preloading. The adjustment procedures seat these bearings in their cups for good support and free rotation under load. The pinion pilot bearing does not require a preload adjustment.

Adjust Pinion Bearing Preload — Most Spicer axles will be found with a “slip-fit” outer pinion bearing, but recent design changes provide a “press-fit” on this bearing (in some axle models). 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 the pinion bearing cage, bearings and spacer (without drive pinion or oil seal).

NOTE: During assembly procedure, center bearing spacer (and spacer washer when used) between the two bearing cones.

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

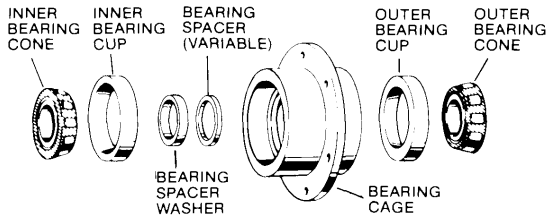
3. Apply press load to the assembly and check rolling torque. Wrap soft wire around the bearing cage, attach spring scale and pull. Preload is correct when torque required to rotate the pinion bearing cage is from 10-20 inch pounds. This specification is translated into spring scale readings in the chart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

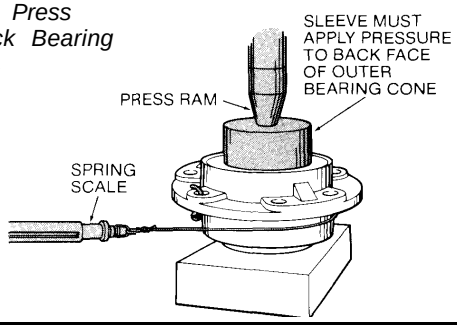
IMPORTANT: Do not assume that all assemblies will retain proper preload once bearings are pressed on pinion shank. FINAL PRELOAD TEST MUST BE MADE IN EVERY CASE.

Assemble these Parts for Trial Build-up.



NOTE: Only 19, 20, 23, 26, 30 Series Axles use Bearing Spacer Washer.

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 m-lbs. torque) (1.1-2.3 N•m)	
	Nominal Bearing Spacer Thickness		Press Loads			
Axle Series	in.	mm.	Tons	Metric Tons	lb.s	kgs.
	0.528	13.41	12-13	11-12	5-9	2.3-4.1
16	0.638	16.21	11-12	10-11	5-9	2.3-4.1
17/1 8/21	0.638	16.21	14-15	13-14	4-8	1.8-3.6
22	0.638	16.21	14-15	13-14	4-7	1.8-3.2
19/20/23/26/30	0.185	4.70	19-20	17-18	3-7	1.4-3.2

Final Pinion Bearing Preload Test

1. Assemble the complete pinion bearing cage unit as recommended in the assembly section of this manual (Page 25).

2. Apply clamp load to the pinion bearing cage assembly. Either install the yoke 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 Pinion in Press.

Specifications for Final Pinion Bearing Preload Test ("Press-fit" Outer Pinion Bearings)					Spring Scale Reading (without pinion seal) (for 15-35 in-lbs. torque) (1.7-4 N.m)	
	Nut Torque	Press Loads				
Axle Series	Ft-lbs.	N.m	Tons	Metric Tons	lb.s	kgs.
13/15/16	360-440	488-596	12-13	11-12	7-16	3.2-7.3
17/18+	480-600	650-813	14-15	13-14	6-14	2.7-6.4
17/18/19/20/21/22Ê	560-700	759-949	14-15	13-14	6-13	2.7-5.9
19/20/23/26/30ˆ	840-1020	1139-1383	19-20	17-18	5-12	2.3-5.4

+1 1/4-12 Pinion Nut Ê1 1/2-18 Pinion Nut ˆ1 3/4-12 Pinion Nut, *15130 & 16130 Models only use metric nut M30 X 1.5, 17130 models use metric nut M36 X 1.5,23130 models use metric nut M \42 X 1.5

Adjustments

Adjust Pinion Bearing Preload for Axles with "Slip-fit" Outer Pinion Bearings

1. Lubricate bearings and assemble the drive pinion, bearings, and pinion bearing cage as recommended in the assembly section of this manual (Page 25). 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: Bearing spacer washer is not used on 13, 15, 16, 17, 18, 21, 22 Series axles.

2. Apply clamp load to the pinion bearings. Install the yoke 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.

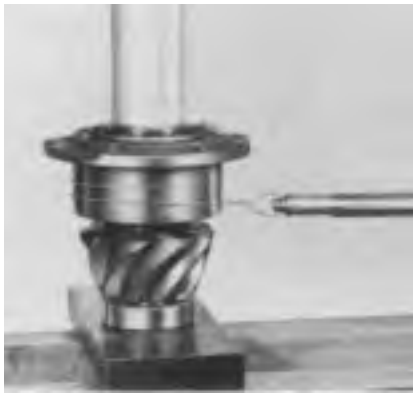
4. Adjust Pinion Bearing Preload - If necessary, adjust pinion bearing preload. Disassemble the pinion bearing cage as recommended in this manual and change the pinion bearing spacer. A thicker spacer will decrease preload. A thinner spacer will increase preload.

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.

Nominal Pinion Bearing Spacers

Axle Model	Spacer Thickness in.	mm
13/15	0.528	13 .41
16	0.638	16 .21
17/18/21/22	0.638	16.21
19/20/23/26/30	0.185	4.70

Measuring Bearing Preload with Pinion in Vise.



Measuring Bearing Preload with Pinion in Press.

Specifications for Pinion Bearing Preload Test ("Slip-fit" Outer Pinion Bearings)					Spring Scale Reading (without pinion seal) (for 15-35 m-lbs. torque) (1.7-4 N.m)	
	Nut Torque	Press Loads				
Axle Series	Ft-lbs.	N.m	Tons	Metric Tons	lb.s	k s.
13/15/16*	360-440	488-596	12-13	11-12	7-16	3.2-7.3
17*/18+	480-600	650-813	14-15	13-14	6-14	2.7-6.4
17*/18/19/20/21/22Ê	560-700	759-949	14-15	13-14	6-13	2.7-5.9
19/20/23*/26/30ˆ	840-1020	1139-1383	19-20	17-18	5-12	2.3-5.4

+1 1/4-12 Pinion Nut Ê1 1/2-18 Pinion Nut ˆ1 3/4-12 Pinion Nut, *15130 & 16130 Models only use metric nut M30 X 1.5, 17130 models use metric nut M36 X 1,5,23130 models use metric nut M42 X 1.5

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.)

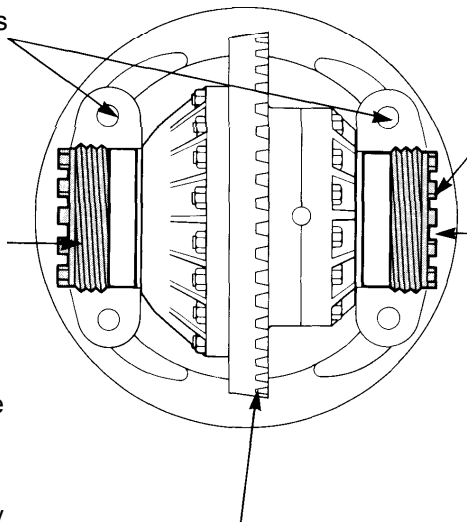
Adjust Diff. Bearing Preload

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.

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” on most models. Axles with 17” or 18” ring gears require 0.008” to 0.018” backlash.

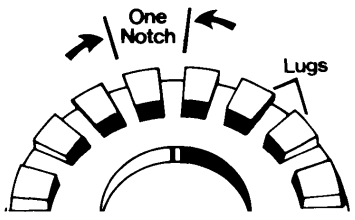
Adjust Ring Gear Backlash

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.



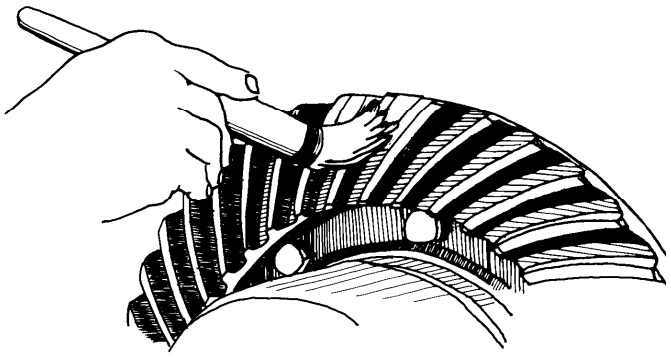
Moving adjuster one notch is the movement of the lead edge of one adjuster lug to the lead edge of the next lug past a preselected point.

Adjustments

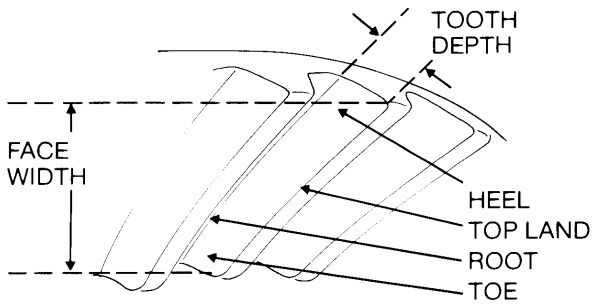
Ring Gear and Pinion Tooth Contact

Check Tooth Contact Pattern (NEW GEAR)

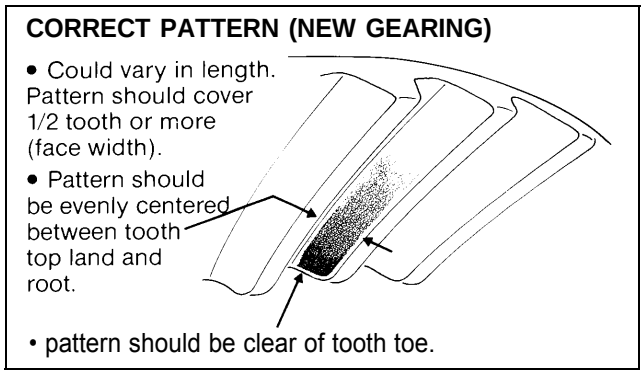
Paint twelve ring gear teeth with marking compound and roll the gear to obtain a contact pattern. The correct pattern is well-centered on the ring gear tooth with lengthwise contact clear of the toe. The length of the pattern in an unloaded condition is approximately one-half to two-thirds of the ring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



RING GEAR TOOTH NOMENCLATURE



CORRECT PATTERN (NEW GEARING)

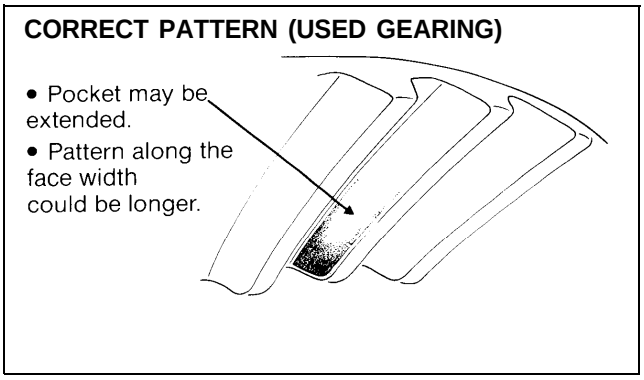


Check Tooth Contact Pattern (USED GEAR)

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 toe-end 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.

CORRECT PATTERN (USED GEARING)



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.

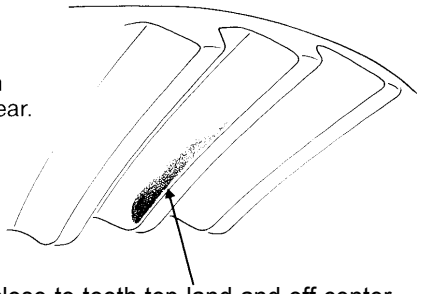
These adjustments are interrelated. As a result, they must be considered together even though the pattern is altered by two distinct operations. When making adjustments, first adjust the pinion, then the backlash. Continue this sequence until the pattern is satisfactory.

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

• Move pinion toward ring gear.

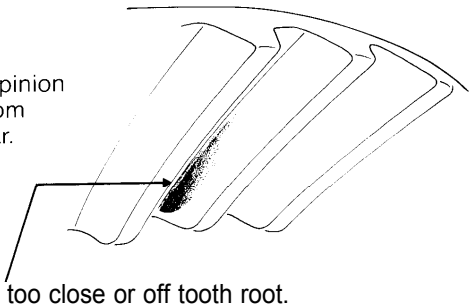


•Pattern too close to tooth top land and off center.

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

INCORRECT PATTERN

• Move pinion away from ring gear.



Pattern too close or off tooth root.

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

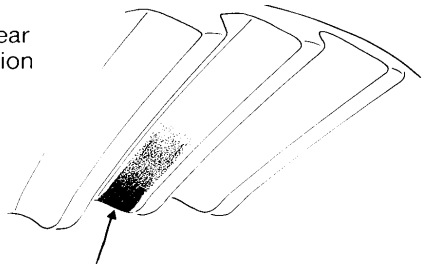
NOTE: Check ring gear backlash after each shim change and adjust if necessary to maintain the .006¡ to .016¡ specifications. Axles with 17¡ or 18¡ ring gears require .008¡ to .018¡ backlash.

Adjust Backlash

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

INCORRECT PATTERN

• Move ring gear away from pinion to increase backlash.



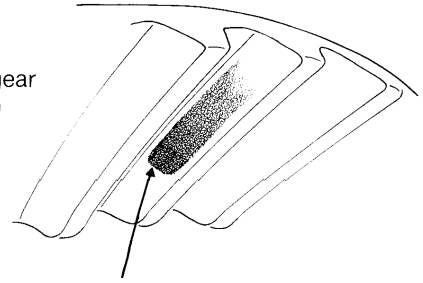
• Pattern too close to edge of tooth toe.

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

• Move ring gear toward pinion to decrease backlash.



• Pattern too far along tooth toward tooth heel.

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

Axle Series: 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 30

Specifications are for all axle models unless specified otherwise.

Bearing Cap CAP SCREW

Axle Series	Size	Grade	Ft.-lbs.	N·m
13,15	5/8-11	(8)	170-190	230-258
16	11/16-11	(8)	240-280	325-379
17,18,21	3/4-10	(8)	360-440	488-596
19,20,22, 23,26,30	13/16-10	(8)	370-430	501-583

Differential Case CAP SCREW

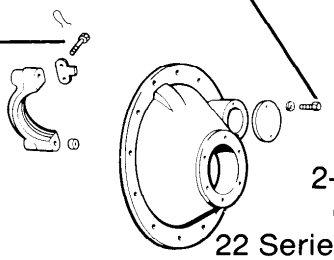
Axle Series	Size	Grade	Ft.-lbs.	N·m
13,15	7/16-14	(5)	45-55	61-74
16	1/2-13	(8)	95-115	128-155
17,18,21,22 ..	9/16-12	(8)	116-130	157-176
19,20, 23,26,30	5/8-11	(8)	165-195	223-264

Cover CAP SCREW

Size	Grade	Ft.-lbs.	N·m
7/16-14	(5)	45	47-61

Bearing Adjuster Lock CAP SCREW

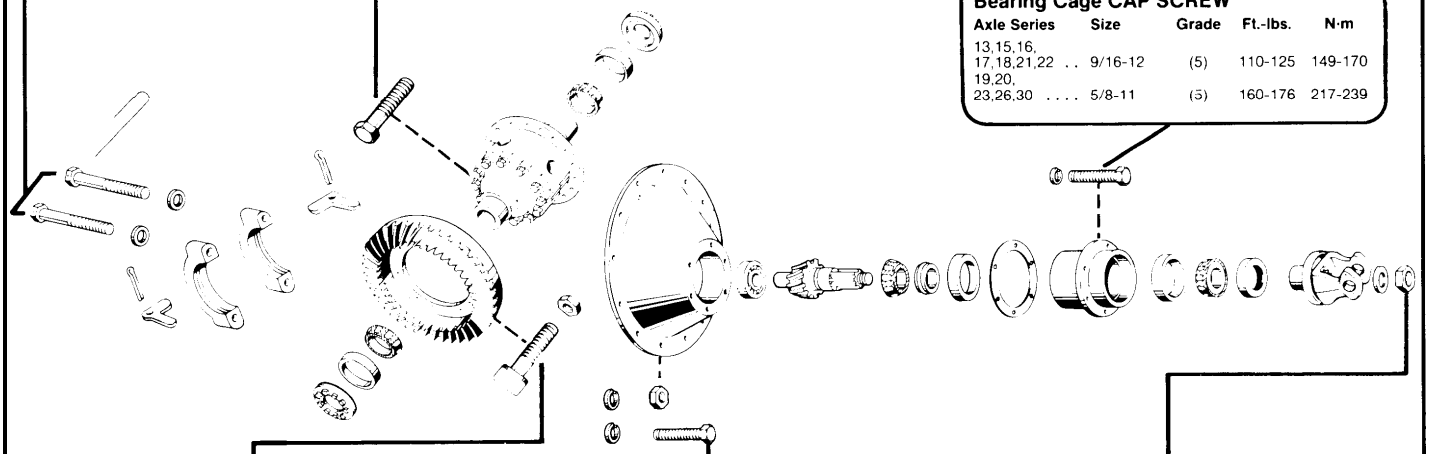
Size	Grade	Ft.-lbs.	N·m
5/8-11	(5)	160-176	217-239



2-Speed Carrier 22 Series Only.

Bearing Cage CAP SCREW

Axle Series	Size	Grade	Ft.-lbs.	N·m
13,15,16, 17,18,21,22 ..	9/16-12	(5)	110-125	149-170
19,20, 23,26,30	5/8-11	(5)	160-176	217-239



Ring Gear BOLT/NUT

Axle Series	Size	Grade	Ft.-lbs.	N·m
13,15	7/16-20	(9)	60-70	81-94
16	1/2-20	(8)	90-100	122-135
17,18,19,20,21, 22,23,26,30 ..	5/8-18	(8)	180-220	244-298

Differential Carrier CAP SCREW

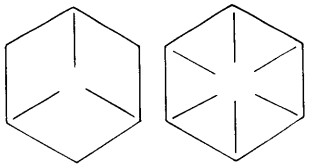
Axle Series	Size	Grade	Ft.-lbs.	N·m
13,15	7/16-14	(5)	48-56	65-75
16	1/2-13	(5)	75-85	101-115
17,18,19, 20,21,22, 23,26,30	5/8-11 NUT	(5)	160-176	217-239
17,18,19, 20,21,22, 23,26,30	5/8-18		220-240	298-325

Pinion NUT

Axle Series	Size	Ft.-lbs.	N•m
13, 15	1-20	360-440	488-596
15130, 16130	M30 X 1.5	360-440	488-596
16	1-1/8-18	360-440	488-596
17, 18	1-1/4-12	480-600	650-813
17130 Series only	M36 X 1.5	575-703	775-965
17, 18, 19 20, 21, 22	1-1/2-18	560-700	759-949
19, 20, 23 26, 30	1-3/4-12	840-1020	1139-1383
23130 Series only	M42 X 1.5	790-970	1070-1310

- 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**

Differential Carrier Replacement

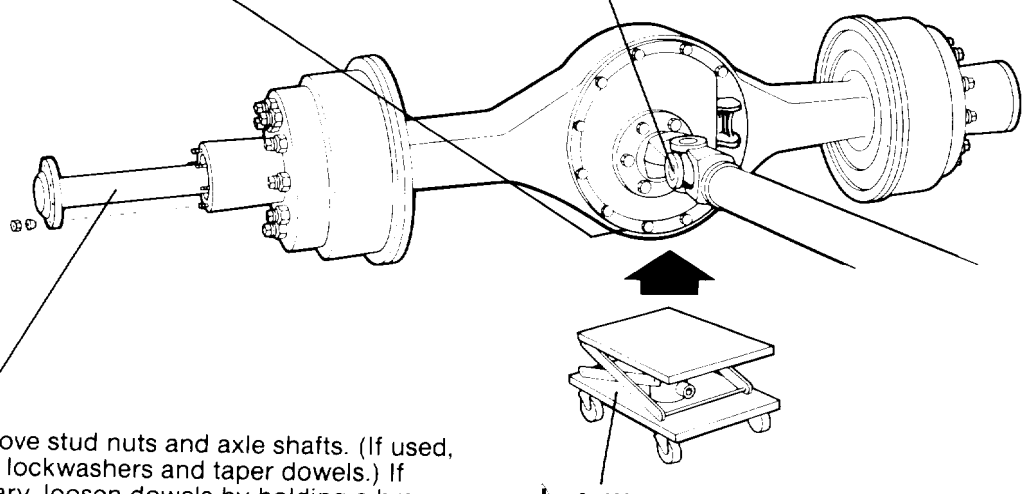
Remove Differential Carrier Assembly from Axle Housing

(Follow procedure in numerical sequence.)

2. Disconnect driveline.

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

1. Drain axle lubricant.



3. 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 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.

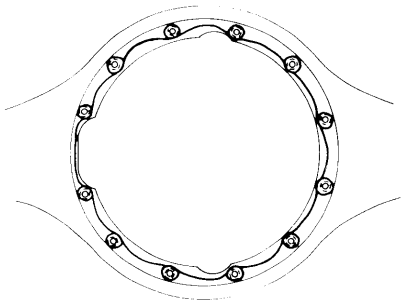
4. WARNING: DO NOT LIE UNDER CARRIER AFTER FASTENERS ARE REMOVED. USE TRANSMISSION JACK TO SUPPORT AND REMOVE DIFFERENTIAL CARRIER ASSEMBLY.

Remove nuts, cap screws and lockwashers fastening carrier to axle housing.

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. Gasket compound will set in 20 minutes. Install carrier before compound sets or reapply.



Axle Housing Gasket Compound Pattern.

1. Install differential carrier assembly in axle housing. Install stud nuts, cap screws and lockwashers. Tighten to correct torque (see chart).

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

3. Connect driveline.

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

Torque Chart
Differential Carrier CAP SCREW

Axle Series	Size	Grade	Ft.-lbs.	Nm
13,15	..7/16-14	(5)	48-56	65-75
16, ...	1/2-13	(5)	75-85	101-115
17,18,19, 20,21,22, 23,26,30	5/8-11	(5)	160-176	217-239
	5/8-18	(8)	200-230	271-312
	NUT			
17,1819,20, 21,22,23, 26,30	5/8-18		220-240	298-325

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.

Differential Carrier Overhaul

Disassemble Differential Carrier

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

1. Mount Differential Carrier Assembly in repair stand. Loosen but do not remove pinion nut.

2. Punch mark differential bearing caps. If reusing gear set, also punch mark bearing adjusters for reference during assembly.

3. Cut lockwire. Remove cap screws, flat washers and bearing caps.

4. Using a chain hoist, lift ring gear and differential assembly out of carrier.

5. Remove pinion bearing cage cap screws, then drive pinion, cage and yoke assembly out of carrier.

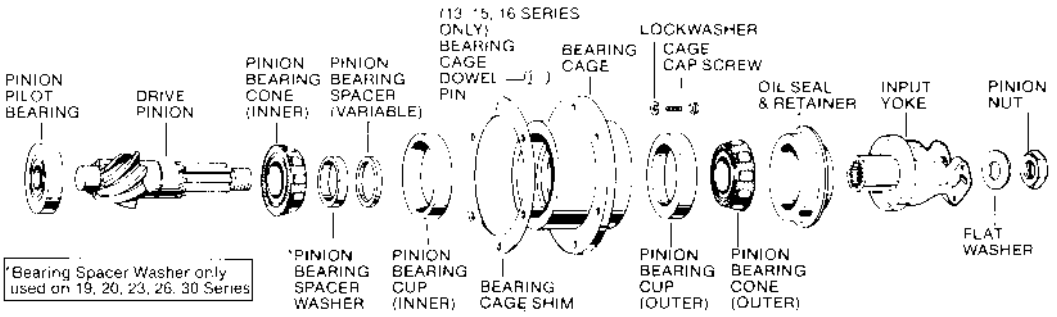
IMPORTANT: Do not allow pinion to drop on hard surface. Remove shim pack.

IMPORTANT: 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.

Disassemble Drive Pinion

NOTE: 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.

NOTE: Lubricate parts with gear lube during reassembly.



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. 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. Remove yoke from pinion.

2. 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. Remove oil seal and bearing cone from cage. Discard oil seal. Remove bearing cups with suitable puller.

4. Remove and retain bearing spacer from pinion (for 19, 20, 23, 26, 30 Series Axles, remove and retain bearing spacer washer).

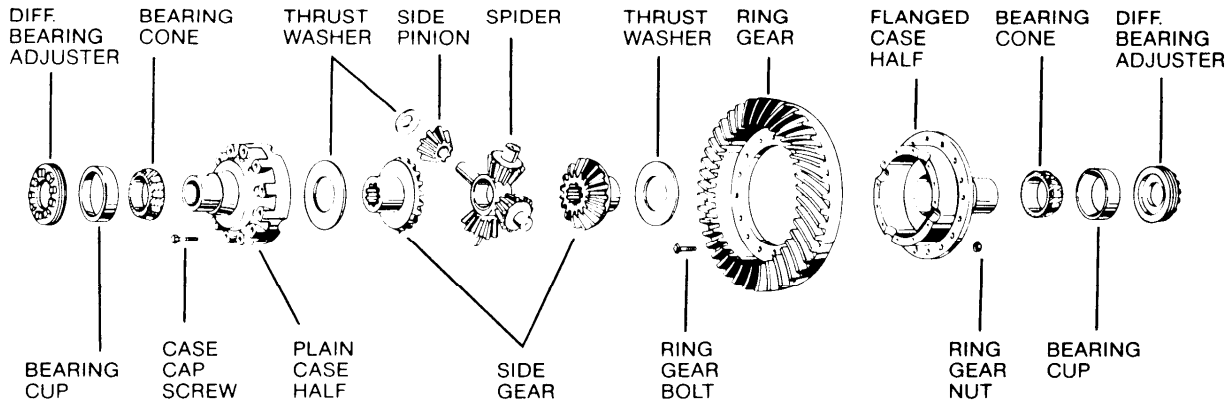
First, mount puller vertically to split bearing.

Second, mount puller horizontally to remove bearing.

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).

Differential Carrier Overhaul

Disassemble Wheel Differential



IMPORTANT: During following procedure, place differential assembly on malleable surface to prevent damage when ring gear falls off its mounting position.

1. Remove nuts and bolts fastening ring gear to differential cases, allowing gear to fall free. If gear does not fall, tap outer diameter with soft mallet to loosen.

2. Punch mark differential cases for correct location during assembly. Remove cap screws and lift off plain differential case half.

3. Lift out side gear and thrust washer.

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

5. Remove side gear and thrust washer.

6. Remove bearing cones from case halves using suitable puller (see photos).

7. Remove bearing cone from plain case half in two steps: **First,** mount puller vertically to split bearing (see photo). This action will start moving bearing off case. **Second,** mount puller vertically to remove cone.

8. Remove bearing cone from flanged case half using suitable puller.

Puller Mounted Vertically to Split Bearing.

Removing Bearing Cone from Flanged Case Half.

Assemble Wheel Differential

NOTE: Lubricate differential parts with gear lube during assembly.

1. Press bearing cone on flanged differential case.

2. Press bearing cone on plain differential case.

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

4. Assemble side pinion and thrust washers on spider. Place this assembly in flanged differential case. Rotate gears and check for proper mesh.

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

NOTE: Fasteners using self-locking nylon "patches" may be reused if not damaged, but should be secured by a few drops of Loctite #277 on threaded surface of differential case during following assembly procedures.

6. Align punch marks and install plain case half. Install cap screws and tighten to correct torque (see chart).

Lockwire cap screws on 13, 15 and 16, 19, 20 Series axles.

Check differential for free rotation by turning side gear hub. Differential may require up to 50 ft-lbs. (68 N´m) torque to rotate.

7. Install ring gear. Secure with bolts and nuts and tighten to correct torque (see chart).

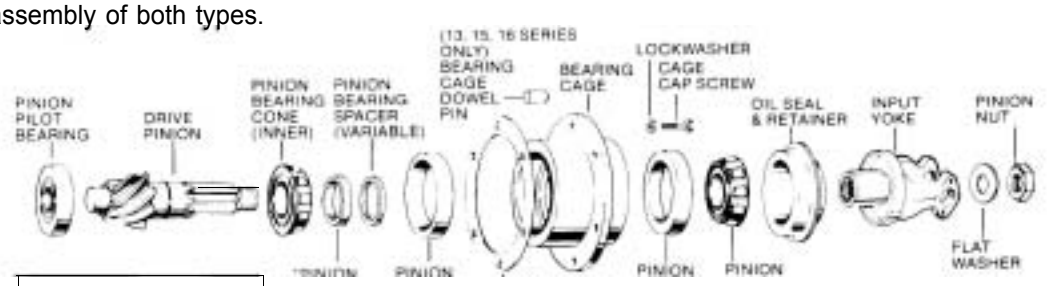
Torque Chart

Ring Gear BOLT/NUT Axle Series	Size	Grade	Ft.-lbs.	N.m
13,15	7/16-20	(9)	60-70	81-94
16	1 /2-20	(8)	90-100	122-135
17,18,19,20,21, 22,23,26,30	5/8-1 8	(8)	180-220	244-298
Differential Case CAP SCREW				
13,15	7/16-14	(5)	45-55	61-74
16	1/2-13	(8)	95-115	128-155
17,18,21,22	9/16-12	(8)	116-130	157-176
19,20, 23,26,30	5/8-1 1	(8)	165-195	223-264

Assemble Drive Pinion ("Press-fit" outer pinion bearing).

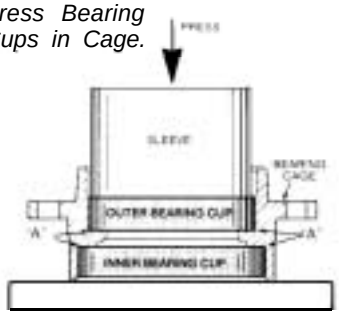
NOTE: drive axles may be equipped with either "slip-fit" or "press-fit" outer pinion bearings. Procedures are contained in this section for assembly of both types.

NOTE: Lubricate parts with gear lube during reassembly.



ïBearing Spacer Washer only used on 19, 20, 23, 26, 30 Series

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

1. Press bearing cups in cage.

IMPORTANT: At this point, select pinion bearing spacer by using the "trial build-up" procedure described in the Adjustments Section of this manual (Page 13).

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.

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

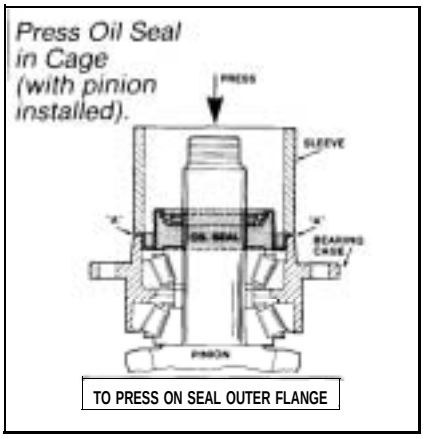
5. Install bearing spacer selected during "trial build-up" (and spacer washer for 19, 20, 23, 26, 30 Series Axles) on pinion.

6. Install bearing cage on drive pinion.

Assemble Drive Pinion ("Press-fit" outer pinion bearing) *(Cont"d)*

7. Press outer bearing cone on pinion.

IMPORTANT: To prevent bearing damage, use suitable sleeve that only contacts inner race of bearing cone. At this stage of assembly, "final-check" pinion bearing preload. See Adjustment Section of this manual.



8. With pinion installed and bearing preload adjustment complete, install oil seal with a press. Use properly sized sleeve to fit seal to prevent distortion during installation.

NOTE: Prior to installation of flange (or yoke), lubricate oil seal lip and make sure flange (or yoke) is clean and dry.

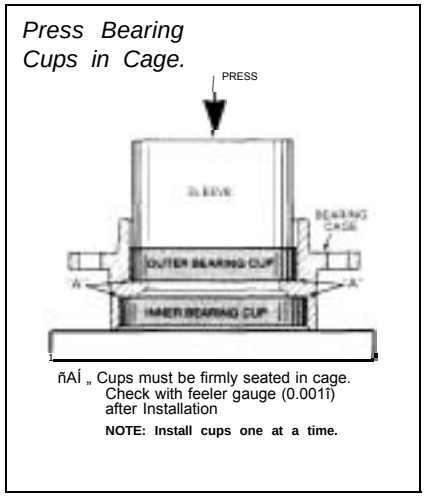
9. Install flange, flat washer and nut (flat washer is used only on 13, 15, 16, 17, 18, 20, 21, 22 Series axles). Tighten nut to correct torque (see chart).

NOTE: 15130, 16130, 17130 series axles do not use flat washers.

Torque Chart

Pinion NUT Axle Series	Size	Ft.-lbs.	N•m
13, 15	1-20	360-440	488-596
15130, 16130	M30 X 1.5	360-440	488-596
16	1-1/8-18	360-440	488-596
17130 Models only	M36 X 1.5	575-703	775-965
17, 18	1-1/4-12	480-600	650-813
17, 18, 19 20, 21, 22	1-1/2-18	560-700	759-949
19, 20 23130 Models only	M42 X 1.5	790-970	1070-1310
23, 26, 30	1-3/4-12	840-1020	1139-1383

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



1. 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. This is essential to retain the bearing.

Differential Carrier Overhaul

Assemble Drive Pinion ("Slip-fit" outer pinion bearing) (con't)

4. Press inner bearing cone on pinion.

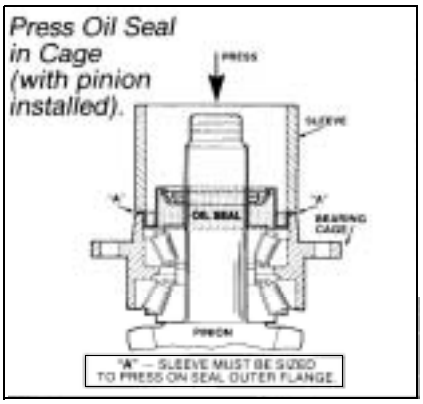
IMPORTANT: To prevent bearing damage, use suitable sleeve that only contacts inner race of bearing cone.

5. Select existing or nominal bearing spacer and install on pinion. On 19, 20, 23, 26, 30 Series axles, also install spacer washer.

6. Install bearing cage on drive pinion.

7. Install pinion outer bearing cone. Do not install oil seal until bearing adjustment is complete.

NOTE: At this stage in assembly, check pinion bearing preload described in Adjustment Section of this manual for "slip-fit" outer pinion bearing (Page 15).



8. With pinion installed and bearing preload adjustment complete, install oil seal with a press. Use properly-sized sleeve to fit seal to prevent distortion during installation.

NOTE: Prior to installation of flange (or yoke), lubricate oil seal lip and make sure flange (or yoke) is clean and dry.

9. Install flange, flat washer and nut (flat washer is used only on 13, 15, 16, 17, 18, 20, 21, 22 Series axles). Tighten nut to correct torque (see chart).

NOTE: 15130.16130.17130 series axles do not use flat washers.

Torque Chart

Pinion NUT Axle Series	Size	Ft.-lbs.	N•m
13, 15	1-20	360-440	488-596
15130, 16130	M30 X 1.5	360-440	488-596
16	1-1/8-18	360-440	488-596
17130 Models only	M36 X 1.5	575-703	775-965
17, 18	1-1/4-12	480-600	650-813
17, 18, 19 20, 21, 22	1-1/2-18	560-700	759-949
19, 20 23130 Models only	M42 X 1.5	790-970	1070-1310
23, 26, 30	1-3/4-12	840-1020	1139-1383

Install Drive Pinion

1. Place shim pack on carrier making sure lube hole is clear.

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 indicated below.

2. Install pinion assembly. Install bearing cage cap screws and lockwashers.

Torque cap screws (see chart).

Torque Chart

Bearing Cage CAP SCREW				
Axle Series	**Size**	**Grade**	**Ft.-lbs.**	**N¥m**
13,15,16 17,18,21,22 . . .	9/16-12	(5)	110-125	149-170
19,20, 23,26,30	5/8-11	(5)	160-176	217-239

Nominal Shim Pack

Axle Series	in.	mm
13/15/16	0.022	0.558
17/18/21/22 . . .	0.023	0.584
19/20	0.024	0.609
23/26/30	0.024	0.609

Install Differential and Ring Gear Assembly (13, 75, 16, 17, 18, 19, 20, 21, 23, 26, 30 Series)

NOTE: Lubricate bearings during the following assembly procedures.

1. Place ring gear and differential assembly in carrier. Carefully lower the assembly until bearing cones rest on carrier.

2. Install bearing cups at both sides of differential case. Install bearing adjusters and caps.

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 preload, ring gear backlash and gear tooth contact (see page 30).

Differential Carrier Overhaul

Install Differential and Ring Gear Assembly (22 Series Axles)

NOTE: Lubricate bearings during the following assembly procedures.

1. Place ring gear and differential assembly in carrier. Carefully lower the assembly until bearing cones rest on carrier.

2. At teeth-side of ring gear, install bearing cup, bearing adjuster and bearing cap.

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

NOTE: Tighten bearing adjuster until its first thread is visible.

4. At back-face side of gear, install bearing cap and cap screws. Tighten cap screws finger-tight. If this is difficult, use hand wrench.

NOTE: If removed, install bearing cup in adjuster, using a press.

Place bar stock through opening in differential. Place bearing adjuster and cup assembly on bar stock (see photo).

Raise and lower differential assembly while threading adjuster into proper position.

NOTE: Make sure adjuster threads are well-lubricated.

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 tooth contact (see page 30).

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.

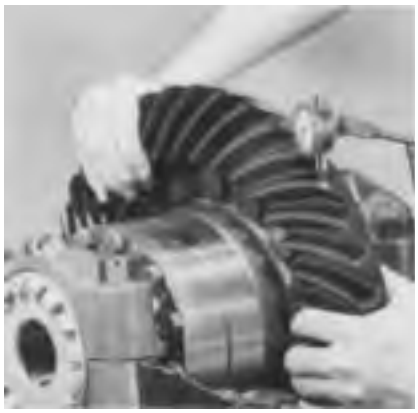
4. Check Ring Gear Backlash. Measure backlash with a dial indicator. Specifications are listed below. Refer to page 21 for detailed instructions on adjusting backlash.

Adjusting Bearing Adjuster.

Ring Gear Backlash Specifications

USED GEARING „ Reset to backlash recorded before disassembly.
NEW GEARING „ Note: Check ring gear backlash after each shim change and adjust if necessary to maintain the .006" to .016" specifications. Axles with 17" or 18" ring gears require .008" to .018" backlash.

5. Check Ring Gear Tooth Contact. Paint ring gear teeth and check tooth contact pattern. Correct tooth patterns are illustrated below. For checking and adjusting procedures, see page 21.



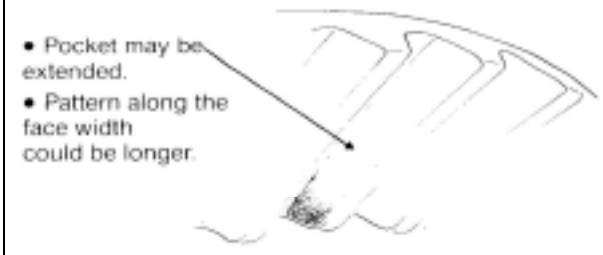
Checking Ring Gear Backlash.

6. With ring gear and pinion adjusted correctly, align adjusters and locks, then tighten differential bearing cap screws to correct torque (see chart).

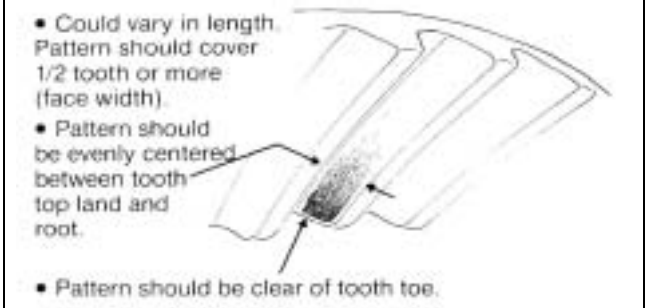
All Axles, except 22 Series: Install adjuster locks and cotter pins. Lockwire differential bearing cap screws.

22 Series Axles Only: On teeth-side of ring gear, install lock and cotter pin. On back-face side of ring gear, install "T" shaped lock and cap screws. Torque screws to 160-176 ft-lbs. (217-239 N.m). Lockwire all cap screws (both sides of ring gears).

CORRECT PATTERN (USED GEARING)



CORRECT PATTERN (NEW GEARING)



Torque Chart

Bearing Cap	CAP SCREW			
Axle Series	Size	Grade	Ft.-lbs.	N´m
13,15	5/8-11	(8)	170-190	230-258
16. . . . . 11/16-11		(8)	240-280	325-379
17,18,21	3/4-10	(8)	360-440	488-596
19,20,22, 23,26,30	13/16-10	(8)	370-430	501-583

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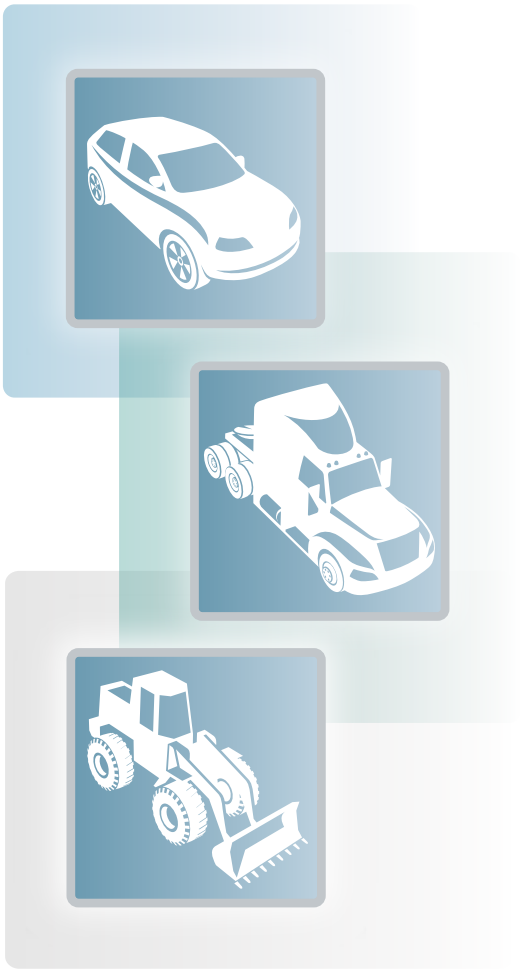

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