(ADDENDUM)

DIFFERENTIAL SERVICE

(FOR REFERENCE ONLY)

DIFFERENTIAL ASSEMBLY SERVICE (LIMITED SLIP, NoSPIN, AND STANDARD)

DESCRIPTION OF THE LIMITED SLIP HIGH TORQUE BIAS DIFFERENTIAL

The Clark-Hurth POSI-TORQ limited slip differential is designed to prevent the severe loss of traction which occurs when one (1) wheel encounters adverse tractive conditions such as slippery, wet, muddy conditions and the uneven terrain often encountered in off-road vehicle operations. This terrain can cause the vehicle to become immobile because of the spinning of one (1) wheel.

The Clark-Hurth POSI-TORQ differential uses clutch plates (which may optionally be spring loaded) to inhibit spinning and send torque to the high-traction wheel. With the spring loaded POSI-TORQ, the wheel with the best traction can have up to five (5) times the torque of the wheel with poor traction (5:1 bias ratio) at low torque levels. The use of clutches in the differential provides high torque bias while maintaining a smooth differential action. This eliminates the drive line shock inherent in locking type differentials.

FEATURES:

- Increases traction in adverse driving conditions over a standard differential.
- Reduces tire wear.
- Eliminates shock loadings caused by locking differentials.
- Improves steering over a locking differential.
- Directs torque away from a slipping wheel to the wheel with the most traction.
- Provides up to five (5) times the torque to the tractive wheel as to the slipping wheel at low torque levels.
- Uses a quiet four (4)-pinion gear differential with each pinion backed by a replaceable thrust washer to reduce maintenance costs.
- Available in two (2) versions — without springs and with springs depending on application requirements.
- Available on many Clark-Hurth axle models.

DIFFERENTIAL ASSEMBLY SERVICE
(LIMITED SLIP, NoSPIN, AND STANDARD)

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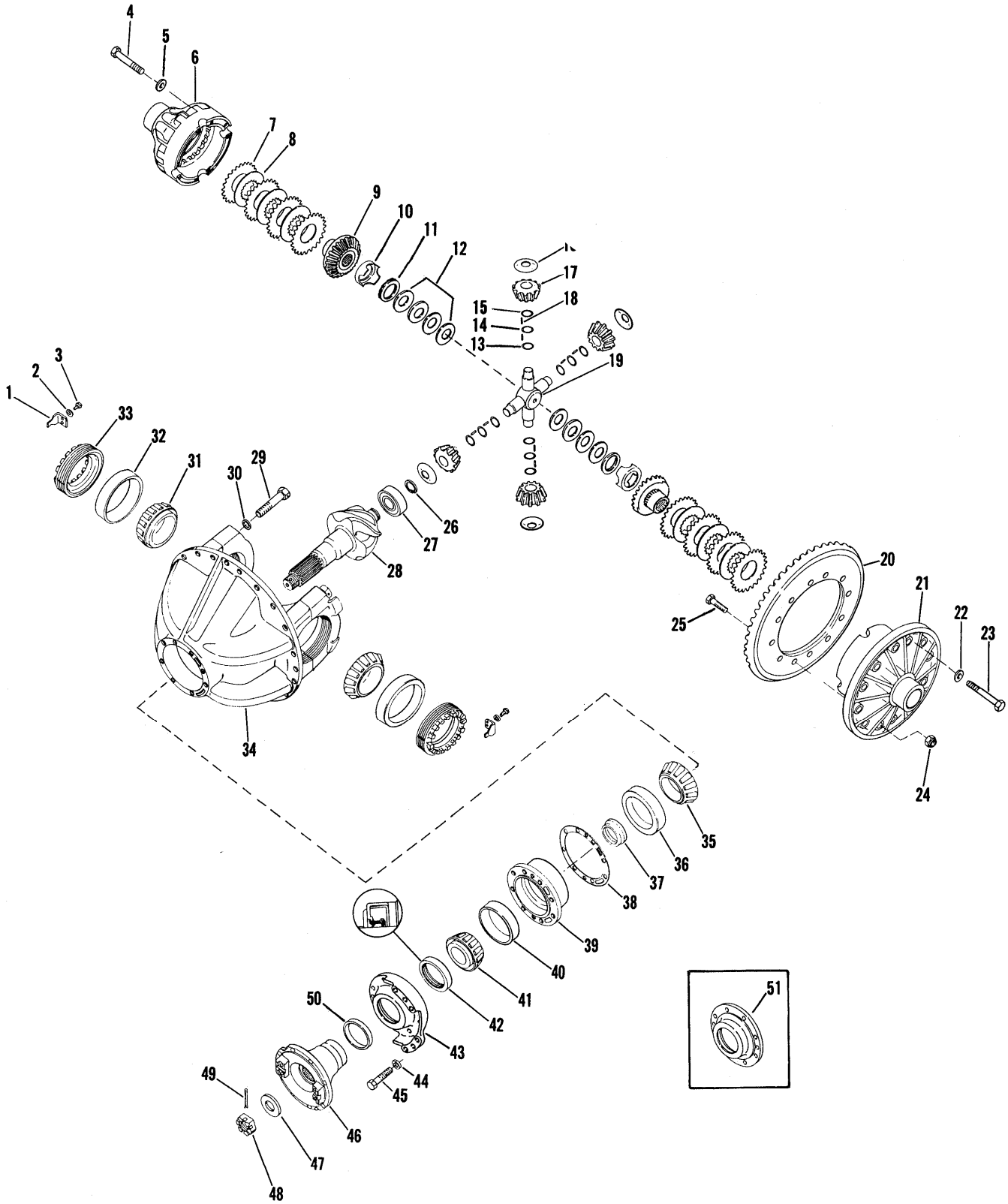
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2050 POSI-TORQ
DIFFERENTIAL AND CARRIER ASSEMBLY

Item	Description	Quantity
1	Differential Adjusting Nut Lock	2
2	Nut Lock Capscrew Lockwasher	2
3	Adjusting Nut Lock Capscrew	2
4	Differential Case Bolt	4
5	Differential Case Bolt Washer	4
6	Differential Plain Half Case	1
7	Outer Clutch Disc	8
8	Inner Clutch Disc	6
9	Differential Side Gear	2
10	Thrust Plate	2
11	Spring Spacer (select at assembly)	AR
12	Spring Pack	2
13	Inner Spacer	4
14	Middle Spacer	4
15	Outer Spacer	4
16	Pinion Gear Thrust Washer	4
17	Differential Pinion Gear	4
18	Needle Roller	216
19	Pinion Gear Spider	1
20	Ring Gear	1
21	Flange Half Case	1
22	Differential Case Bolt Washers	8
23	Differential Case Bolt	8
24	Ring Gear Bolt Nut	12
25	Ring Gear Bolt	12
26	Inner Pinion Bearing Retainer Ring	1
27	Inner Pinion Bearing	1
28	Pinion	1
29	Carrier Cap Capscrew	4
30	Carrier Cap Lockwasher	4
31	Differential Bearing Cone	2
32	Differential Bearing Cup	2
33	Differential Adjusting Nut	2
34	Differential Carrier	1
35	Center Pinion Bearing Cone	1
36	Center Pinion Bearing Cup	1
37	Pinion Bearing Spacer	1
38	Pinion Bearing Cage Shim	AR
39	Pinion Bearing Cage	1
40	Outer Pinion Bearing Cup	1
41	Outer Pinion Bearing Cone	1
42	Pinion Oil Seal	1
43	Oil Seal Retainer	1
44	Retainer Capscrew Lockwasher	8
45	Retainer Capscrew	8
46	Universal Joint Flange	1
47	Pinion Shaft Nut Washer	1
48	Pinion Shaft Nut	1
49	Pinion Shaft Nut Cotter	1
50	Wear Sleeve	1
51	Oil Seal Retainer (option)	1

AR - As Required

POSI-TORQ 2050 SERIES
LIMITED SLIP DIFFERENTIAL AND CARRIER ASSEMBLY
(with springs — optional)

Notes:
Grease seal seat journal of drive flange with E.P. Multi Purpose Grease Grade #2 prior to assembly.

Apply coating of E.P. Multi Purpose Grease Grade #2 between lips of oil seals.

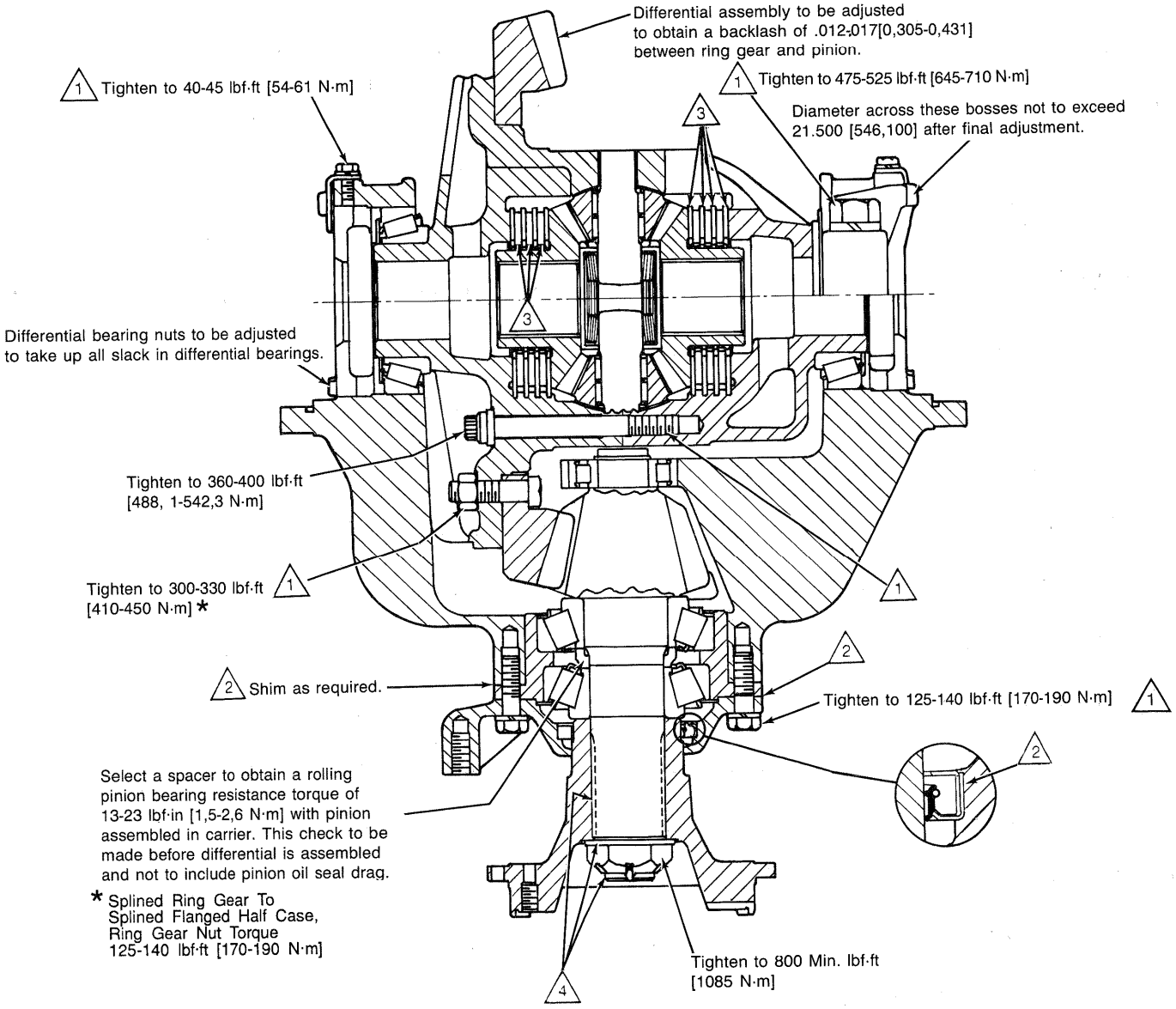
Boss provided on carrier has Serial No. & Carrier Ratio.

△1 Apply Loctite #262 Thread Locking Compound.
At reassembly, apply thread locking compound where noted,
Guidlines for application—Where to apply:
A. On bolts, cap screws and studs (anchor end) apply compound on female threaded component part,
B. On nuts, apply compound to the male thread of the mating fastener.
C. Apply compound to coat the full length and circumference of thread engagement.
D. Remove excess compound from mating parts after fastener application.

△2 Apply Loctite #515 to shims and joining surfaces.

△3 Coat all clutch plates and side gear surfaces with Dow-Corning Molykote G-N paste.

△4 Apply Dow-Corning RTV-Q3-7069 Sealant.



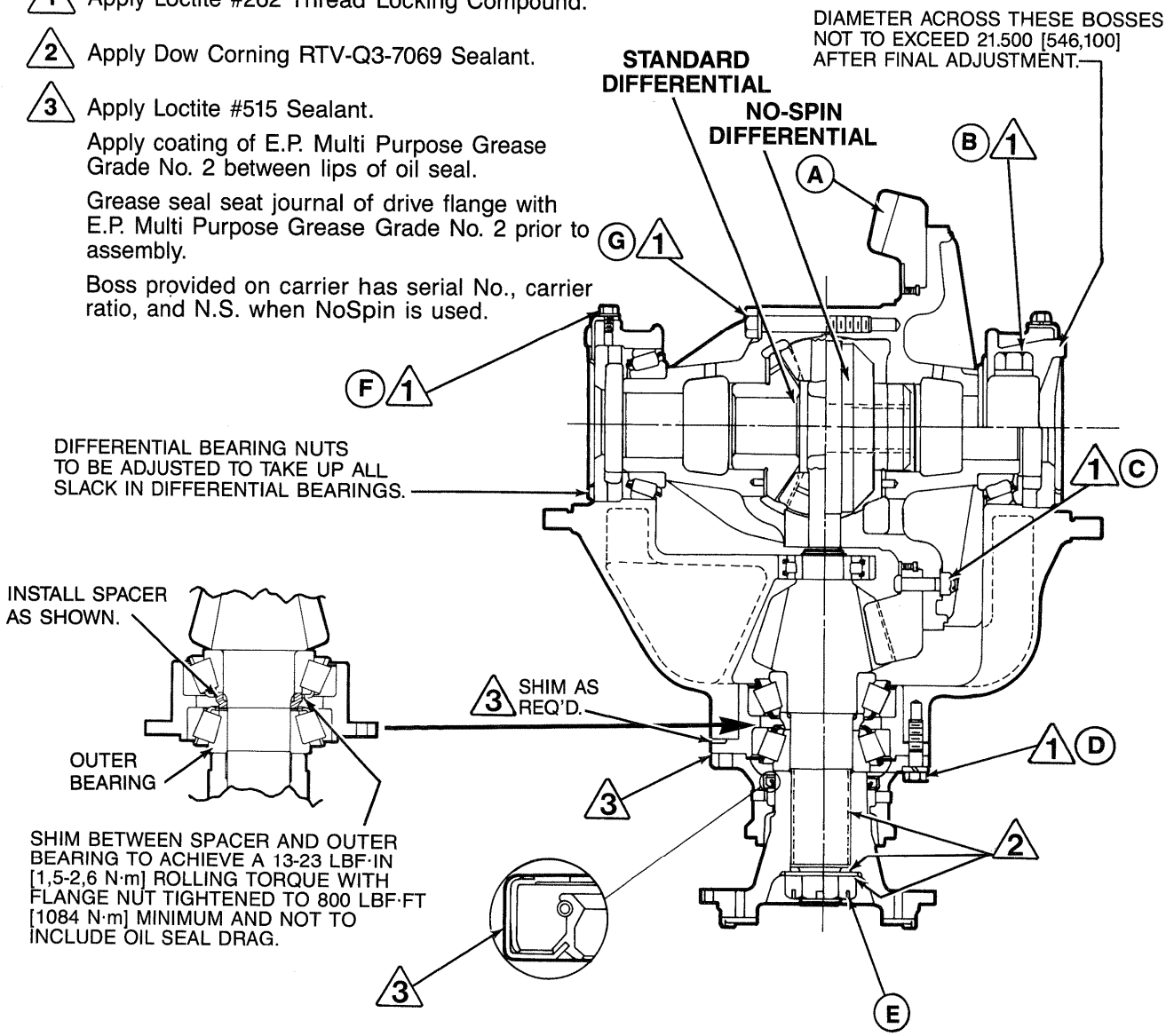
STANDARD AND NoSPIN
2050 SERIES DIFFERENTIAL INSTRUCTIONS

1. Apply Loctite #262 Thread Locking Compound.
2. Apply Dow Corning RTV-Q3-7069 Sealant.
3. Apply Loctite #515 Sealant.

   Apply coating of E.P. Multi Purpose Grease Grade No. 2 between lips of oil seal.

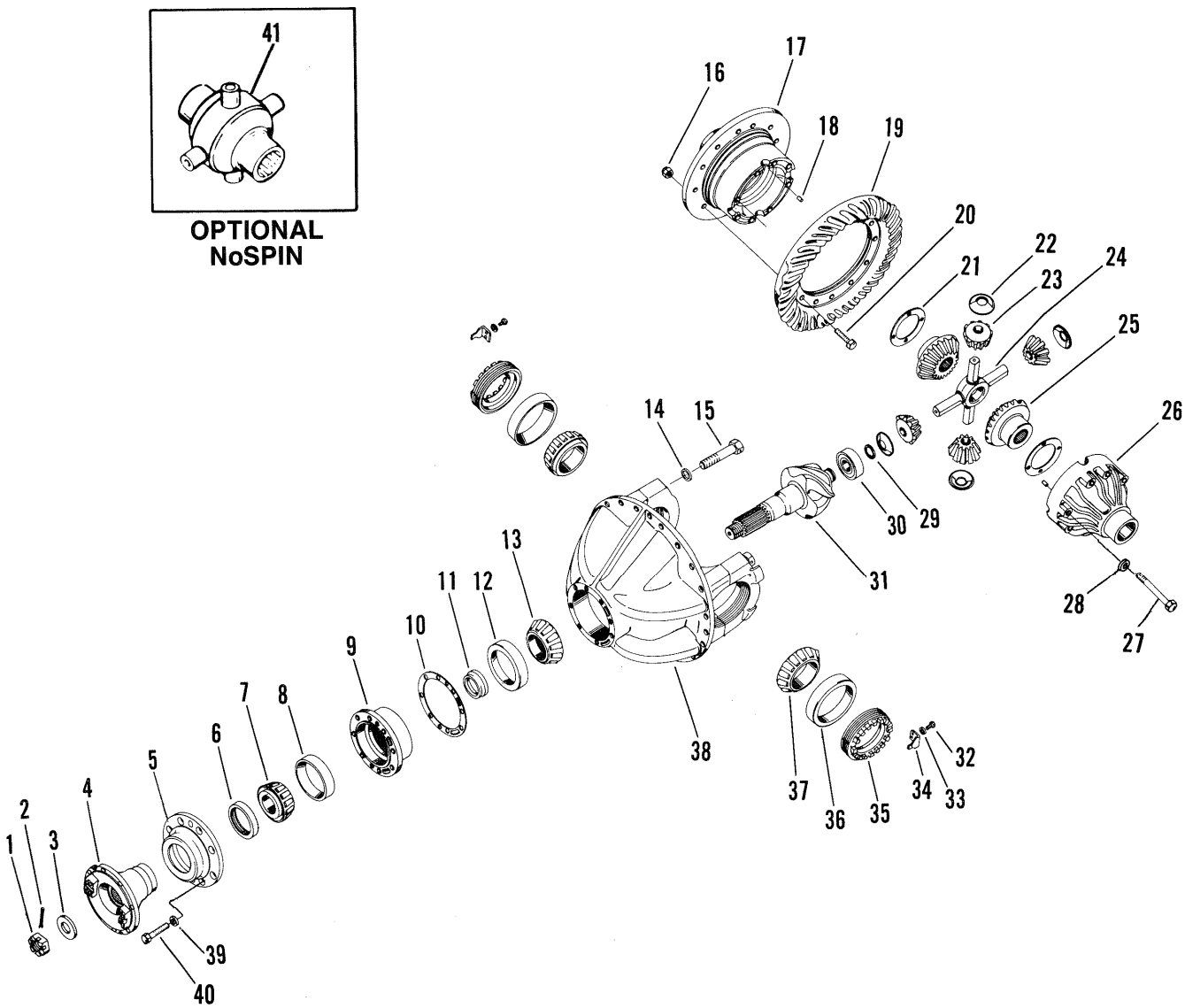
   Grease seal seat journal of drive flange with E.P. Multi Purpose Grease Grade No. 2 prior to assembly.

   Boss provided on carrier has serial No., carrier ratio, and N.S. when NoSpin is used.



2050 Series Differential (Ring Gear Diameter) Assembly Instructions & Bolt Tightening Chart — lbf·ft Torque [N·m]

A - Ring Gear Backlash Adjustment .012-.017 [0,30-43 mm].
B - 475-525 lbf·ft [645-710 N·m]
C - 125-140 lbf·ft [170-190 N·m] For Splined Ring Gear To Splined Half Case
C - 300-330 lbf·ft [410-450 N·m] For Non-Splined Ring Gear To Non-Splined Half Case
D - 125-140 lbf·ft [170-190 N·m]
E - 800 lbf·ft [1084 N·m]
F - 40-45 lbf·ft [54-61 N·m]
G - 300-330 lbf·ft [410-450 N·m]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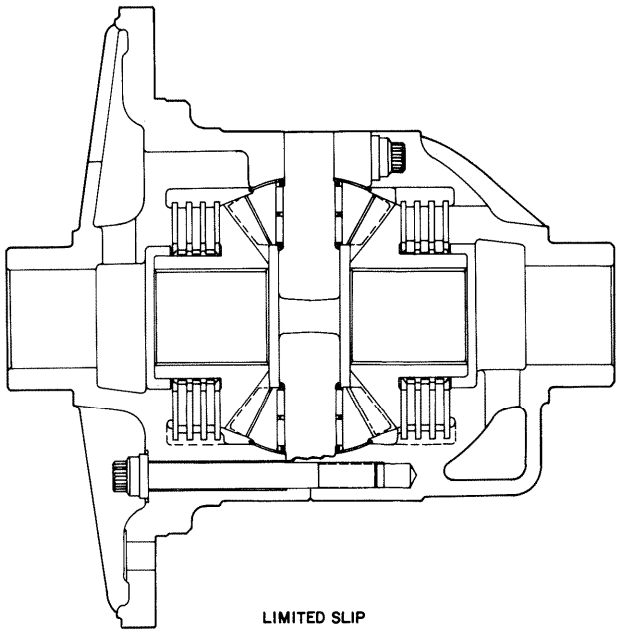
DIFFERENTIAL AND CARRIER ASSEMBLY (STANDARD)

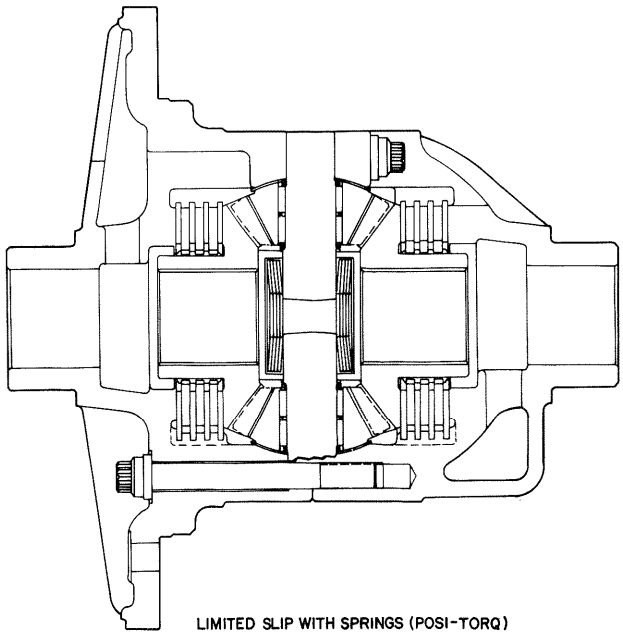
Item	Description	Quantity
1	Differential Pinion Shaft Nut	1
2	Pinion Shaft Cotter	1
3	Pinion Shaft Washer	1
4	Companion Flange	1
5	Pinion Oil Seal Retainer	1
6	Pinion Oil Seal	1
7	Outer Pinion Bearing Cone	1
8	Outer Pinion Bearing Cup	1
9	Bearing Cage	1
10	Pinion Bearing Cage Shim	AR
11	Pinion Bearing Spacer	1
12	Center Pinion Bearing Cup	1
13	Center Pinion Bearing Cone	1
14	Differential Carrier Cap Lockwasher	4
15	Differential Carrier Capscrew	4
16	Ring Gear Bolt Nut	12
17	Flange Half Case	1
18	Dowel Pin	4
19	Ring Gear	1
20	Ring Gear Bolt	12
21	Differential Side Gear Thrust Washer	2
22	Pinion Thrust Washer	4
23	Pinion Gear	4
24	Pinion Gear Spider	1
25	Side Gear	2
26	Plain Half Case	1
27	Case Bolt	8
28	Case Bolt Washer	8
29	Pinion Bearing Snap Ring	1
30	Inner Pinion Bearing	1
31	Pinion	1
32	Adjusting Nut Lock Capscrew	2
33	Adjusting Nut Lockwasher	2
34	Adjusting Nut Lock	2
35	Differential Adjusting Nut	2
36	Differential Bearing Cup	2
37	Differential Bearing Cone	2
38	Differential Carrier and Cap Assembly	1
39	Pinion Oil Seal Retainer Lockwasher	8
40	Pinion Oil Seal Retainer Capscrew	8
41	Differential NoSpin Assembly	1

AR — As Required

OVERHAUL OF DIFFERENTIAL AND CARRIER ASSEMBLY



LIMITED SLIP



LIMITED SLIP WITH SPRINGS (POSI-TORQ)

DIFFERENTIAL REMOVAL FROM AXLE HOUSING

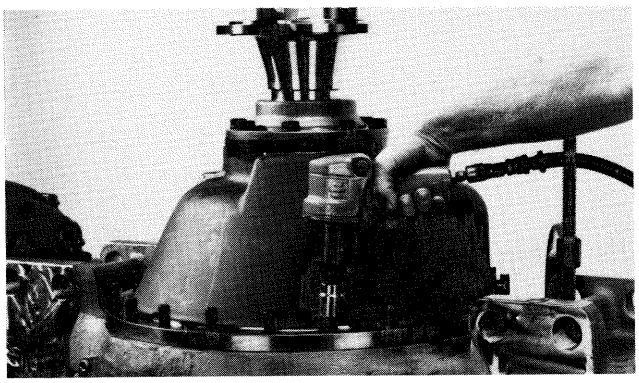


Figure 1
Remove differential stud nuts, washers, and taper dowels.

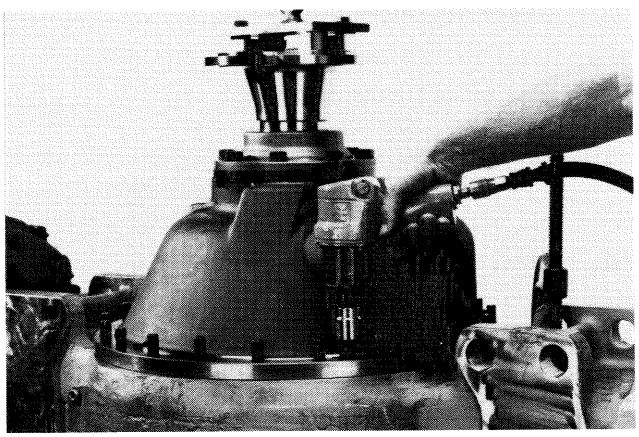


Figure 2
Remove threaded hole plugs from differential housing flange.

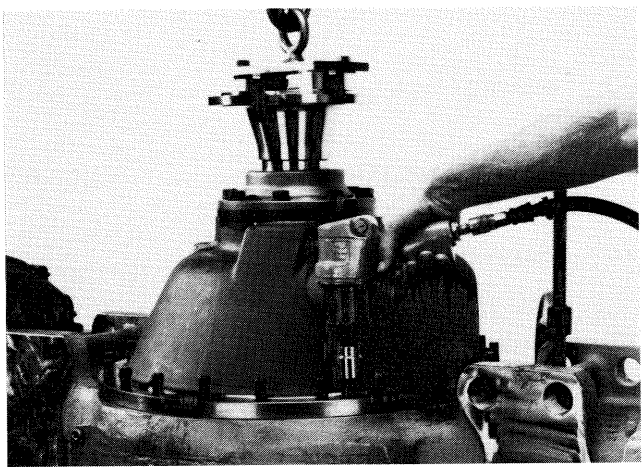


Figure 3
Install a longer capscrew in threaded holes and tighten evenly to facilitate differential removal.

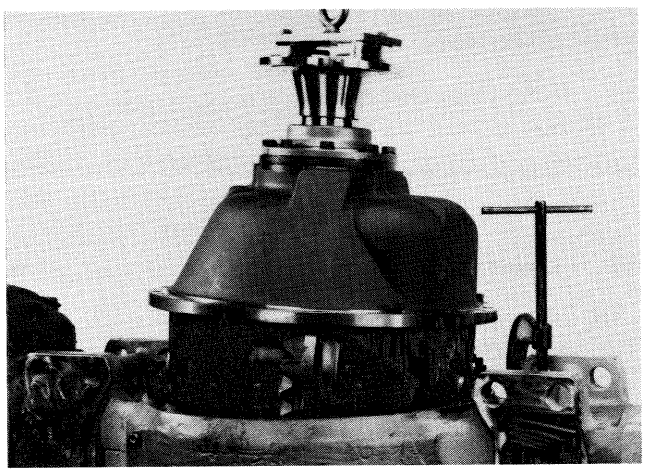


Figure 4
Remove differential and carrier assembly.

DISASSEMBLY AND REASSEMBLY OF THE SPRING LOADED LIMITED SLIP HIGH TORQUE BIAS DIFFERENTIAL

The instructions contained herein cover the disassembly and reassembly of the differential assembly in a sequence that would normally be followed after the unit has been removed from the axle housing and is to be completely overhauled.

CAUTION: Cleanliness is of extreme importance in the repair and overhaul of this unit. Before attempting any repairs, the exterior of the unit must be thoroughly cleaned to prevent the possibility of dirt and foreign matter entering the mechanism.

NOTE: SPRING LOADED DIFFERENTIALS ARE OPTIONAL. THE DIFFERENTIAL SHOWN IN THIS TEXT IS SPRING LOADED. DISASSEMBLY AND REASSEMBLY ARE IDENTICAL EXCEPT WHERE SPRINGS ARE SHOWN. ALSO INCLUDED ARE NoSPIN AND STANDARD DIFFERENTIAL SERVICE.

DISASSEMBLY

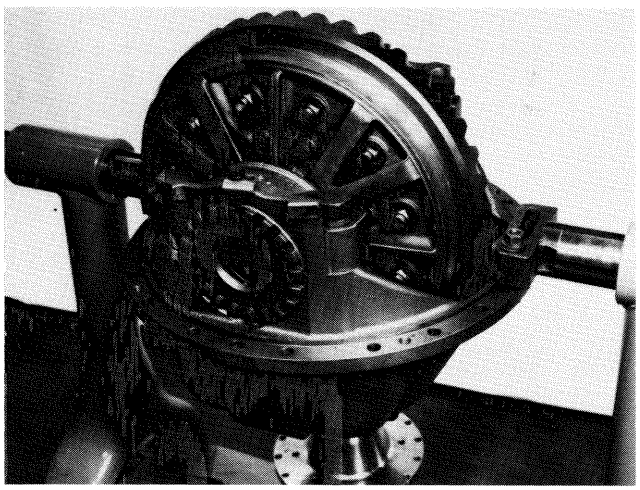


Figure 5
Mount differential on differential overhaul stand.

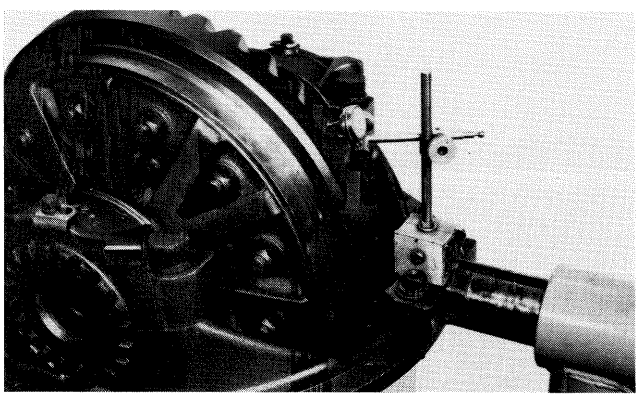


Figure 6
Check and record ring gear backlash with a dial indicator. This information is necessary for reassembly unless a new gear set is installed.

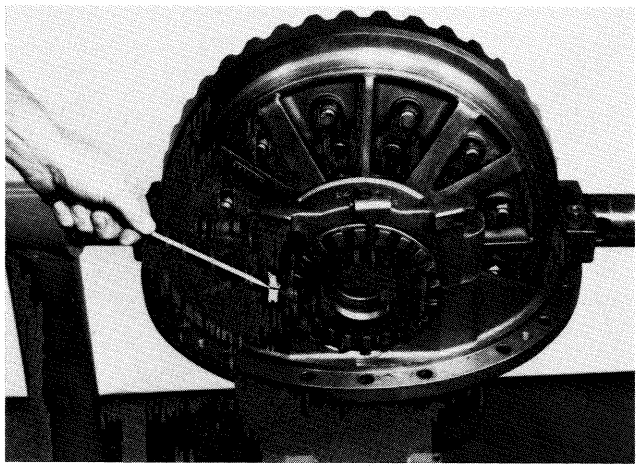


Figure 7
Mark carrier cap and carrier housing to insure correct match in reassembly.

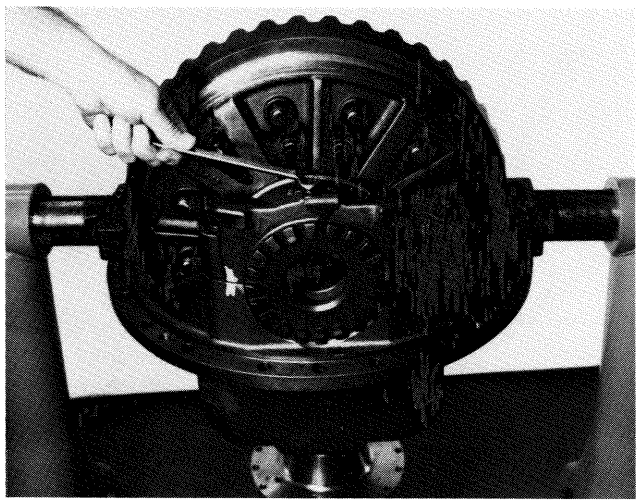


Figure 8
Remove adjusting nut lock capscrew and washer on both sides.

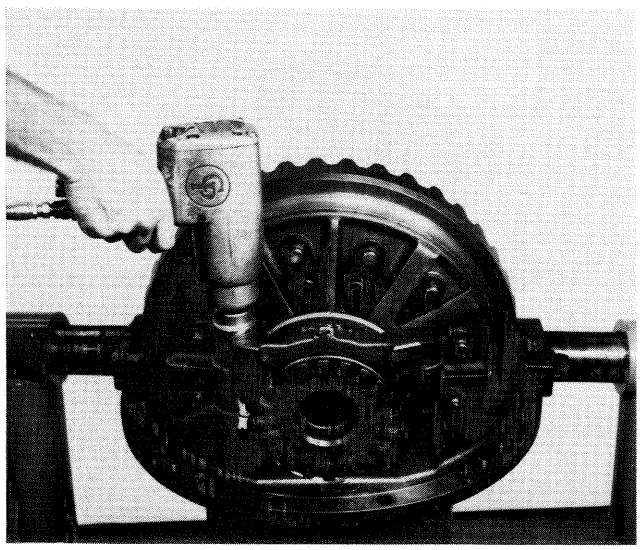


Figure 9
Remove carrier cap capscrews and washers on both sides.

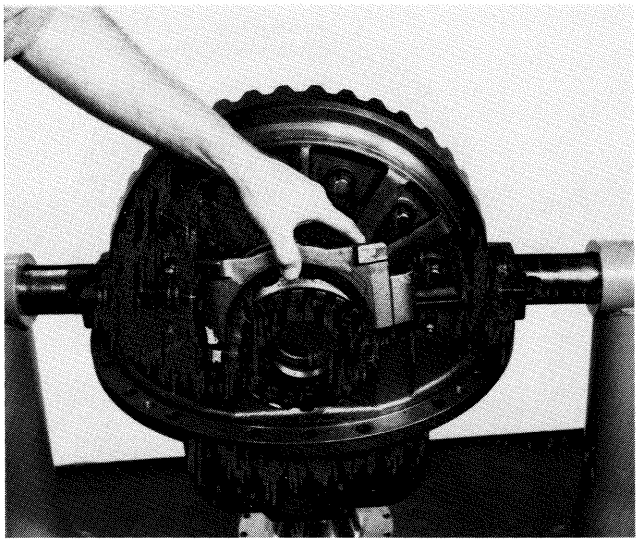


Figure 10
Remove carrier caps.

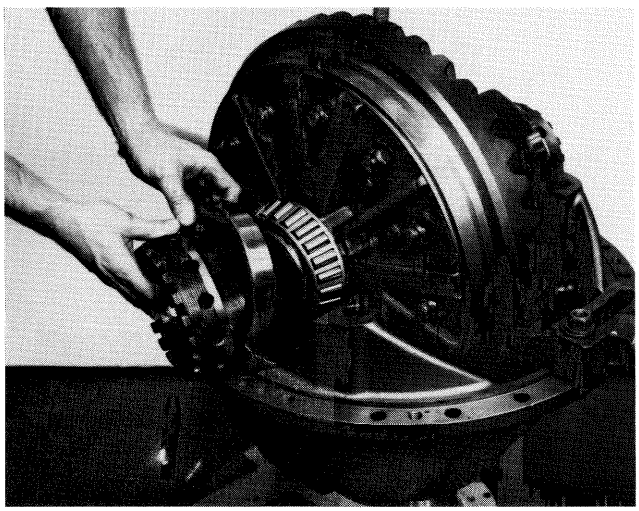


Figure 11
Remove adjusting nuts and taper bearing cups.

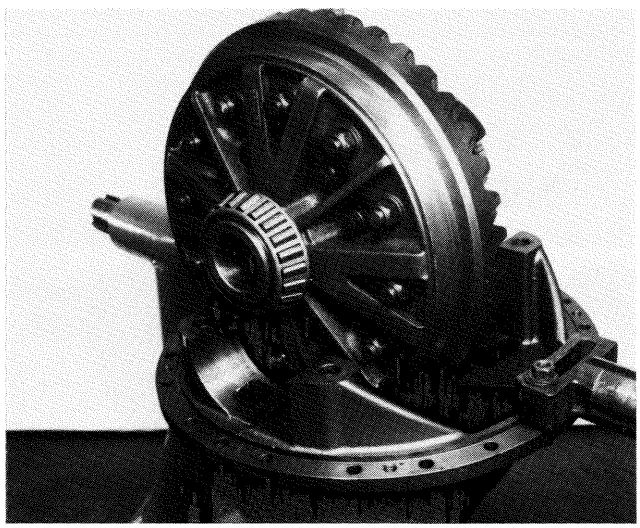


Figure 12
Remove differential assembly from carrier.

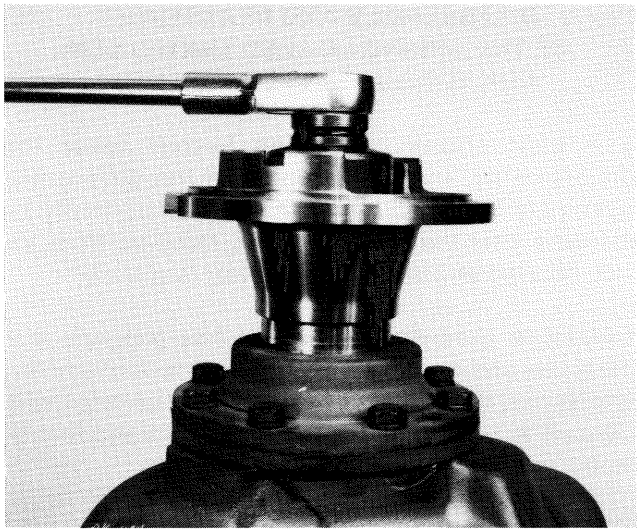


Figure 13
Remove companion flange nut.

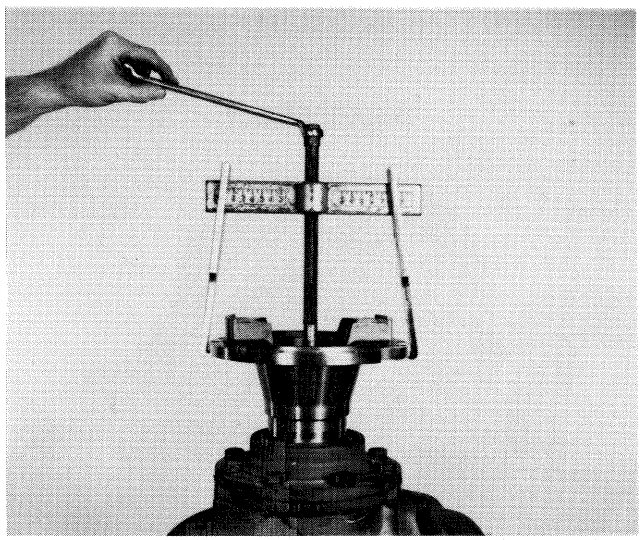


Figure 14
Remove flange.

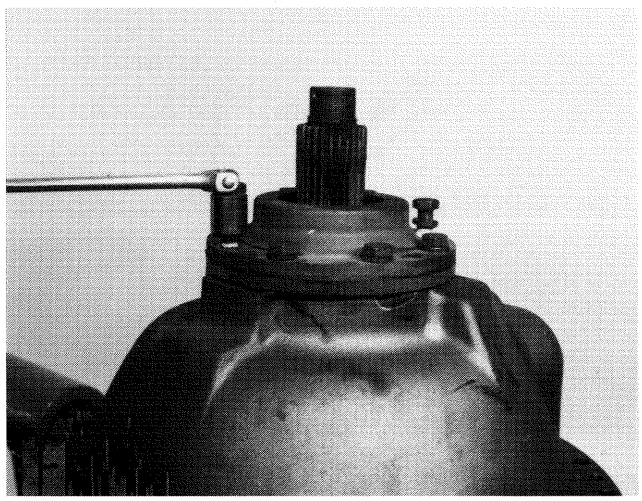


Figure 15
Remove oil seal retainer bolts.

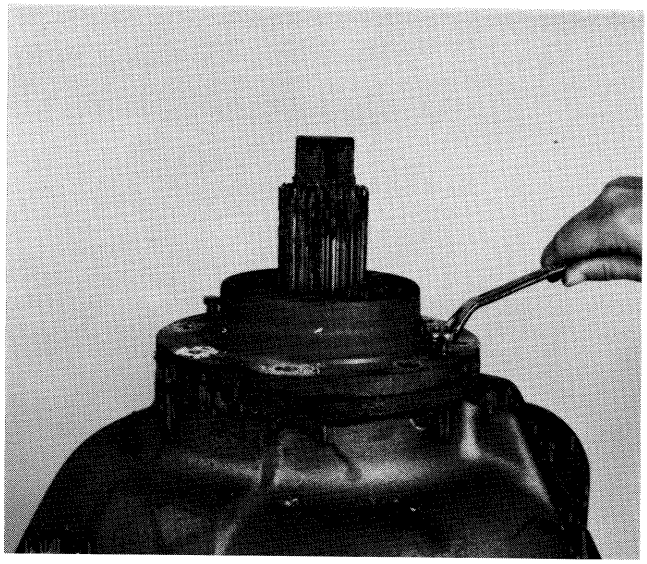


Figure 16
Use threaded holes and bolts to remove retainer.

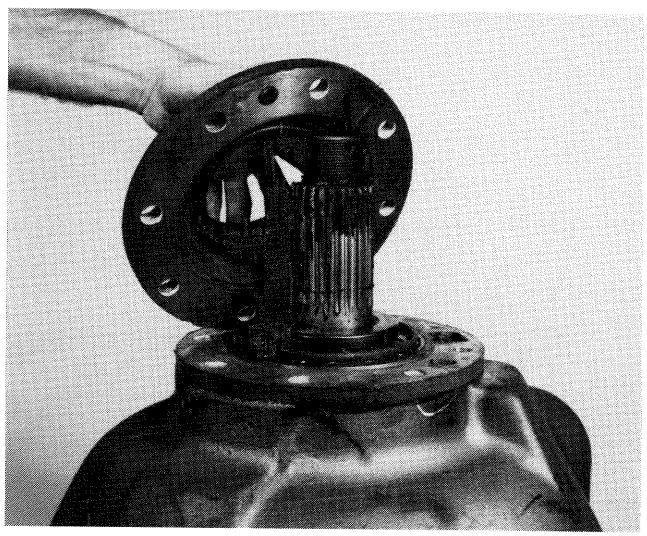


Figure 17
Remove oil seal retainer.

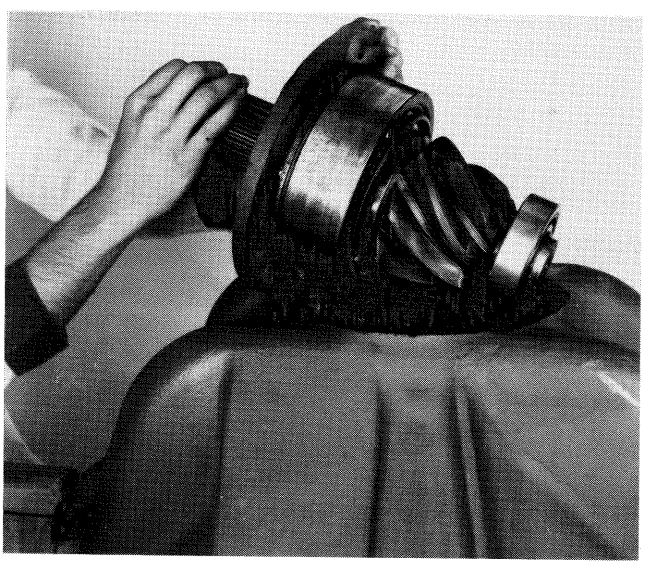


Figure 18
Remove pinion and bearing cage assembly. Retain shim pack for possible reuse at reassembly.

PINION AND BEARING CAGE DISASSEMBLY

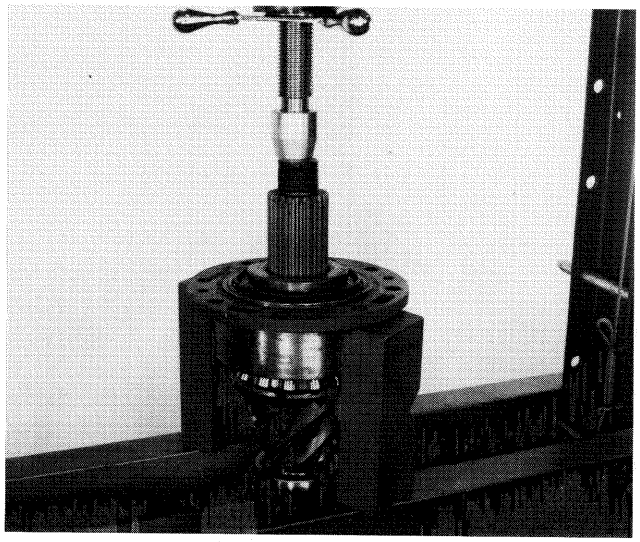


Figure 19
Press pinion shaft and center bearing from outer bearing and bearing cage.

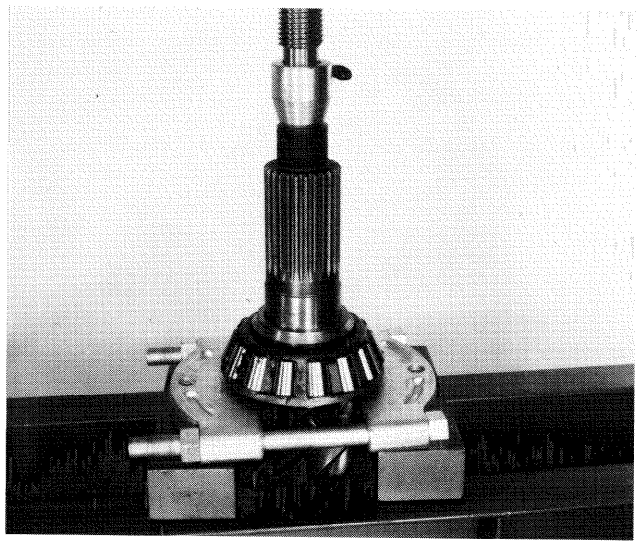


Figure 20
Press center bearing from pinion shaft.

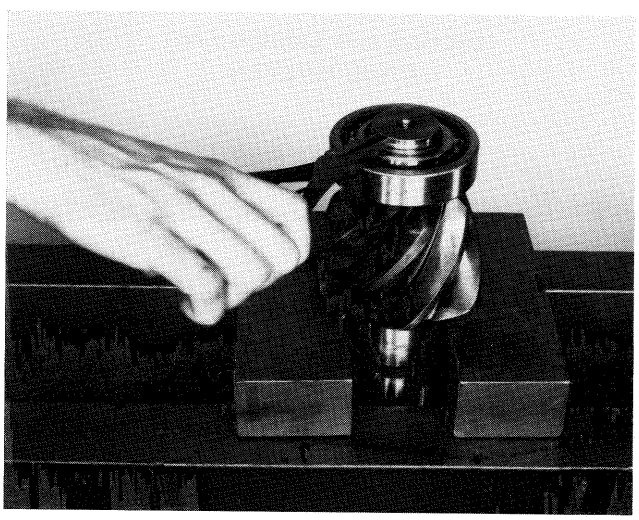


Figure 21
Remove inner pinion bearing retainer ring.

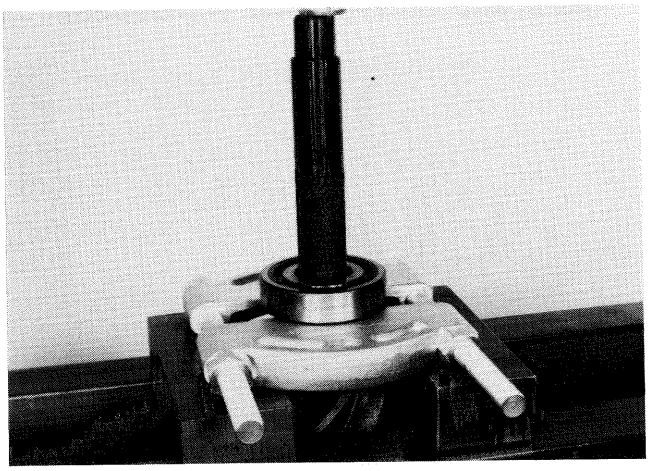


Figure 22
Press inner bearing from pinion shaft.

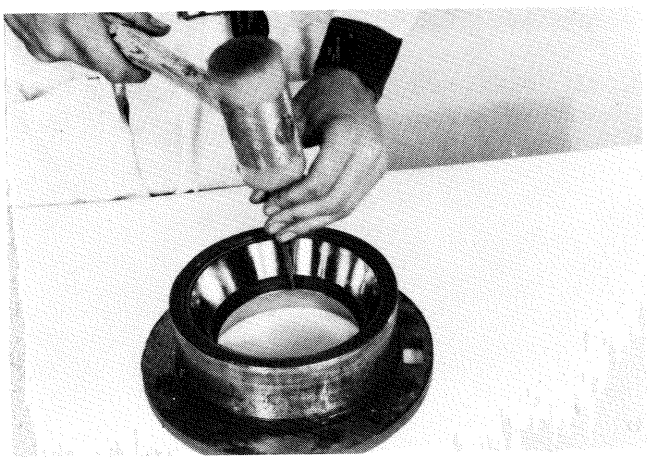


Figure 23
Remove pinion bearing cups only if they are to be replaced or if the bearing cage is damaged.

FOR DISASSEMBLY OF THE STANDARD DIFFERENTIAL CASE HALVES SEE PAGE 62. FOR DISASSEMBLY OF THE NoSPIN DIFFERENTIAL CASE HALVES SEE PAGE 63.

DISASSEMBLY OF POSI-TORQ (Spring and Limited Slip) CASE HALVES

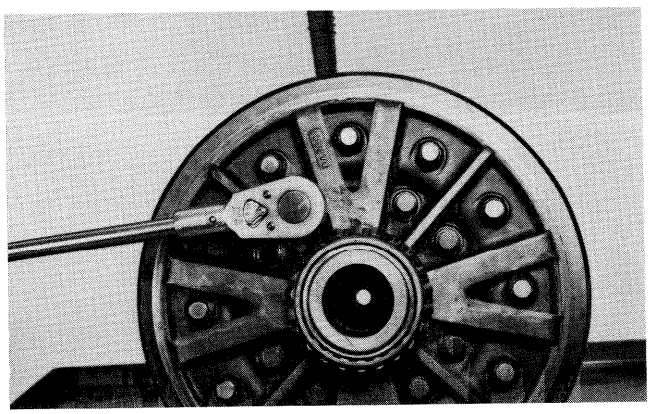


Figure 24
Remove body bolts from flange half.

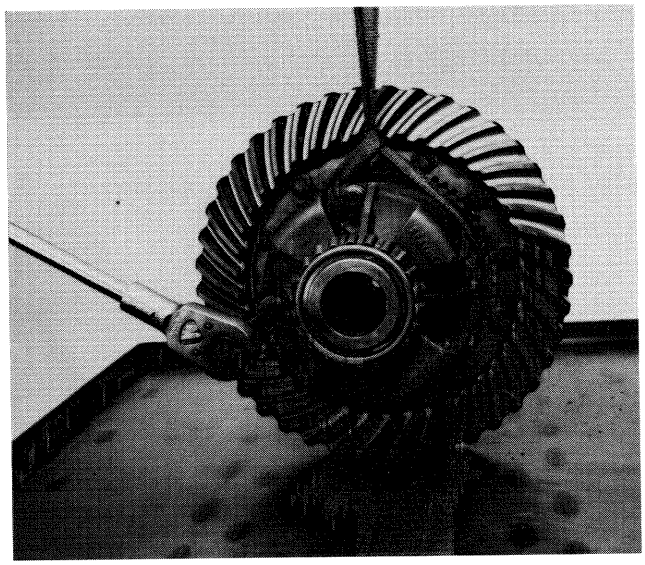


Figure 25
Remove body bolts from plain half.

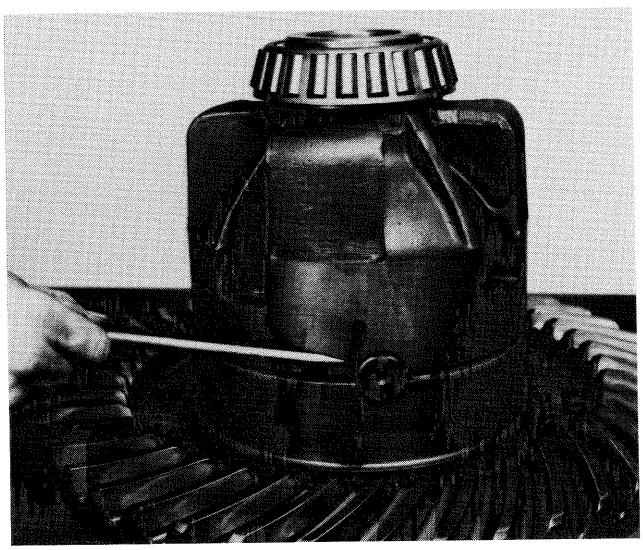


Figure 26
Mark plain and flange half case to insure correct reassembly.

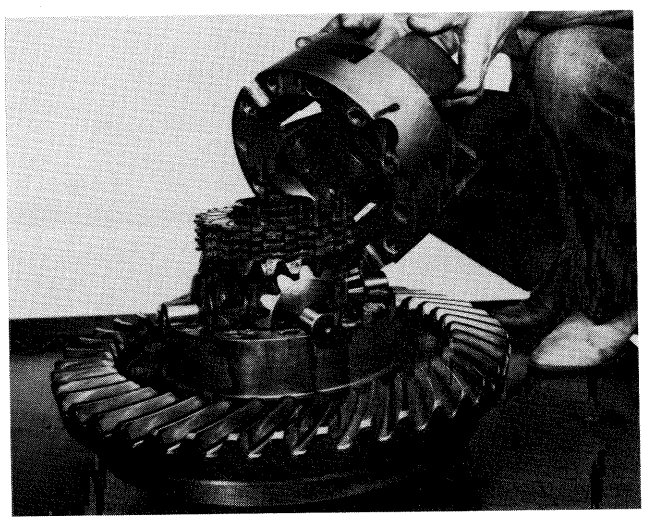


Figure 27
Remove plain half case.

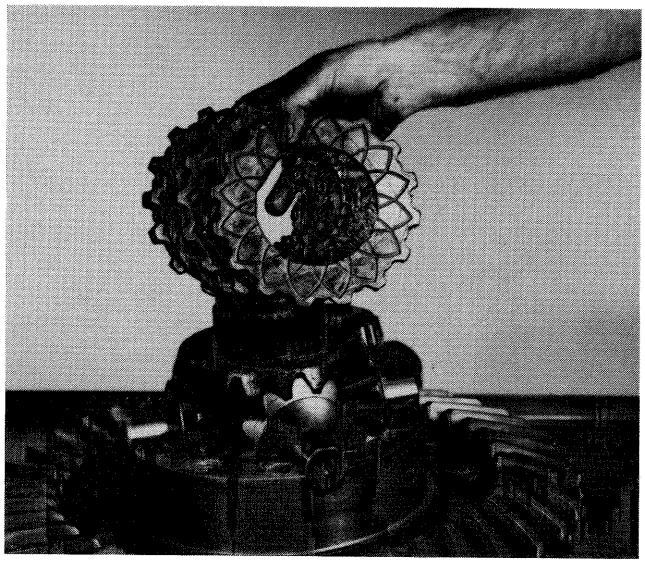


Figure 28
Remove inner and outer clutch discs.

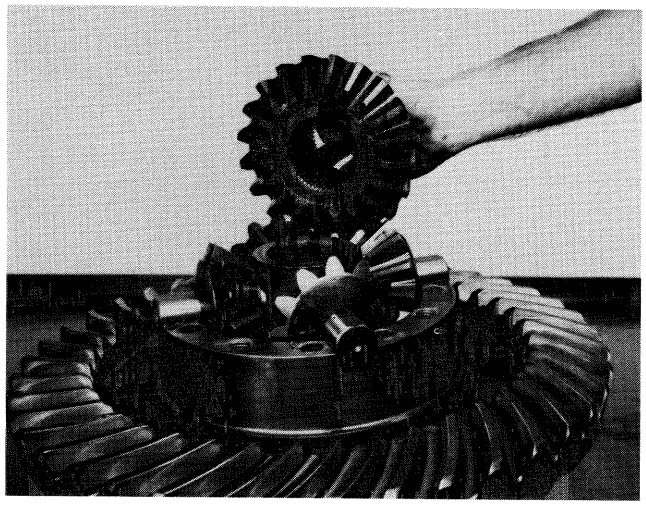


Figure 29
Remove side gear.

NOTE: If spring pack is not used, proceed to Figure 33.

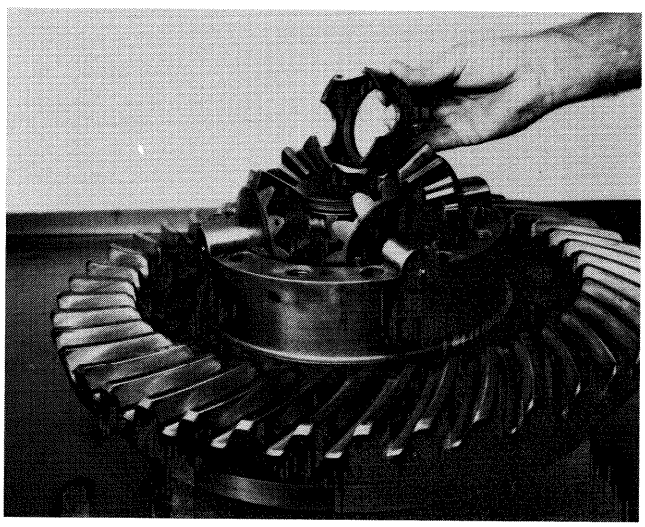


Figure 30
Remove thrust plate.

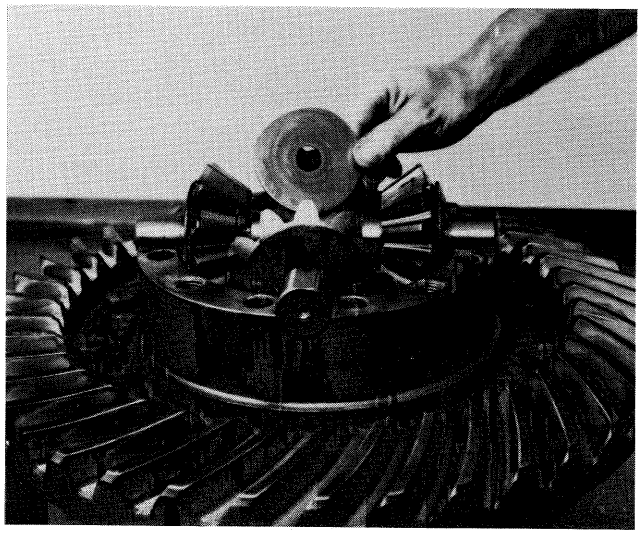


Figure 31
Remove spring pack spacer (not as shown).

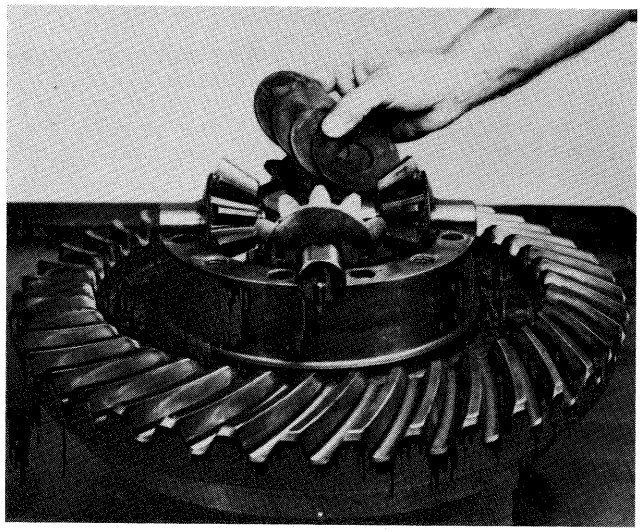


Figure 32
Remove spring pack.

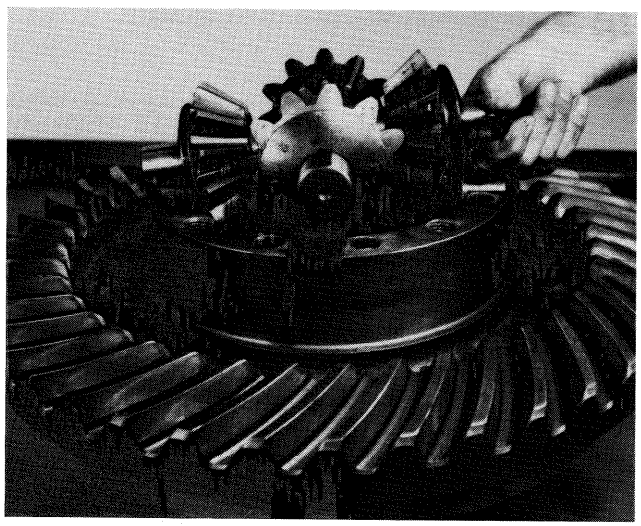


Figure 33
Remove differential pinions, washers, and cross as an assembly. **NOTE**: There are two rows of needle rollers under each pinion gear. Do not lose these rollers. If spring pack is not used, proceed to Figure 37.

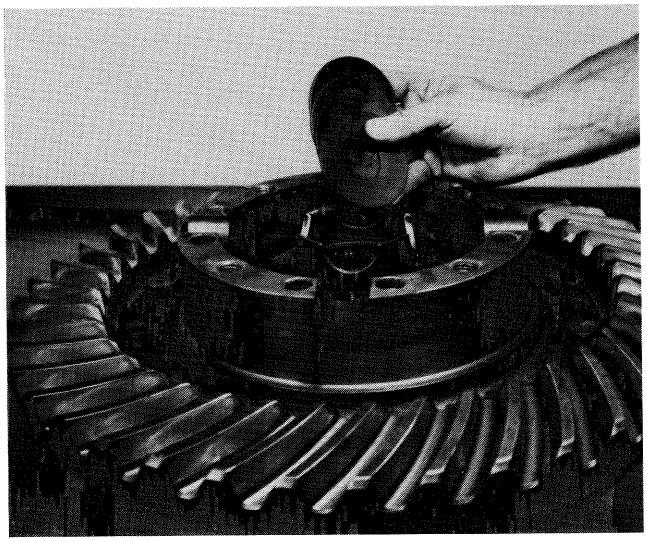


Figure 34
Remove flange half spring pack.

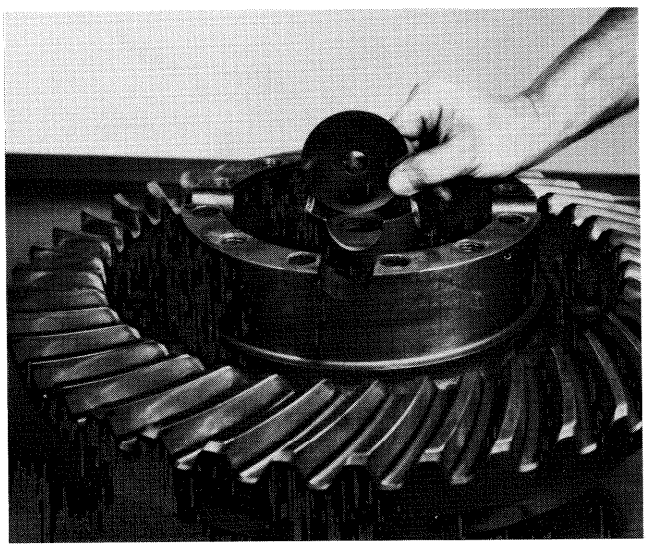


Figure 35
Remove spring pack spacer (not as shown).

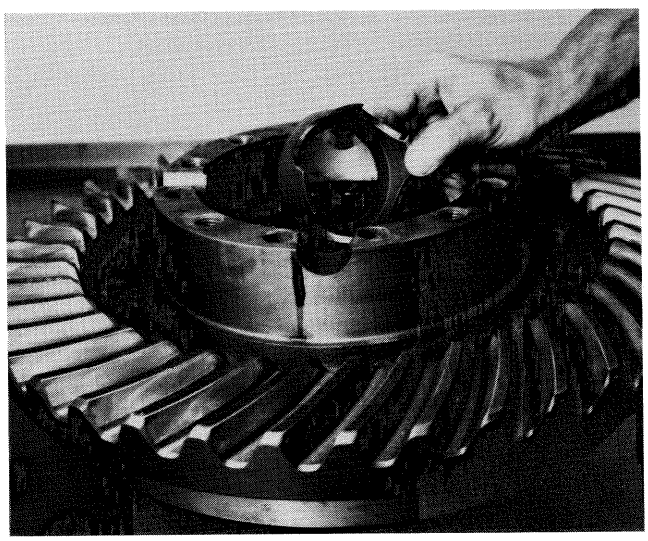


Figure 36
Remove thrust plate.

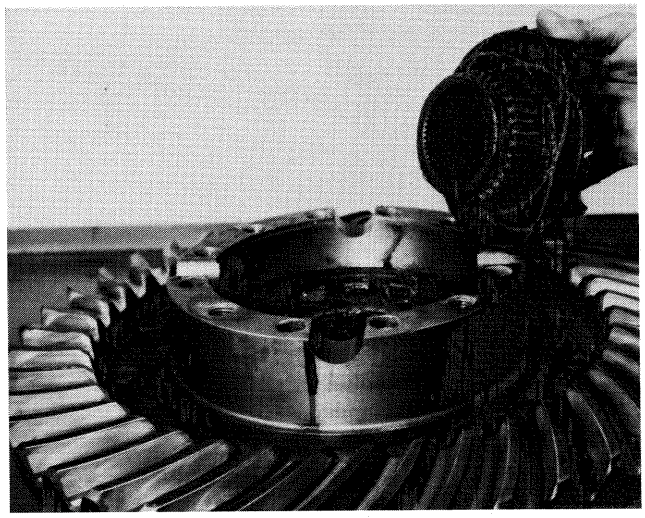


Figure 37
Remove side gear.

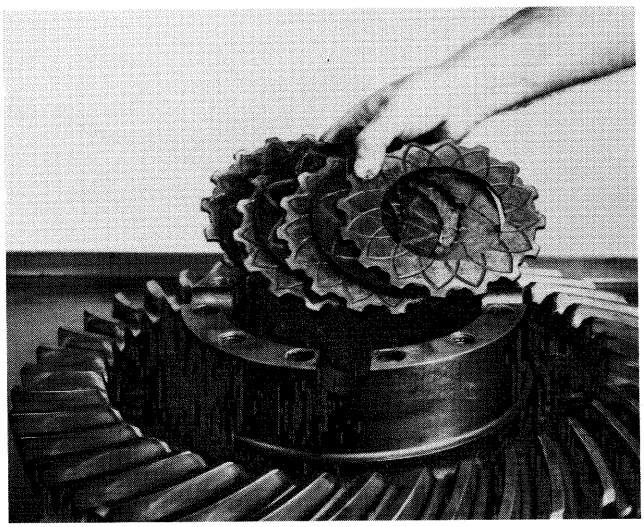


Figure 38
Remove inner and outer clutch discs.

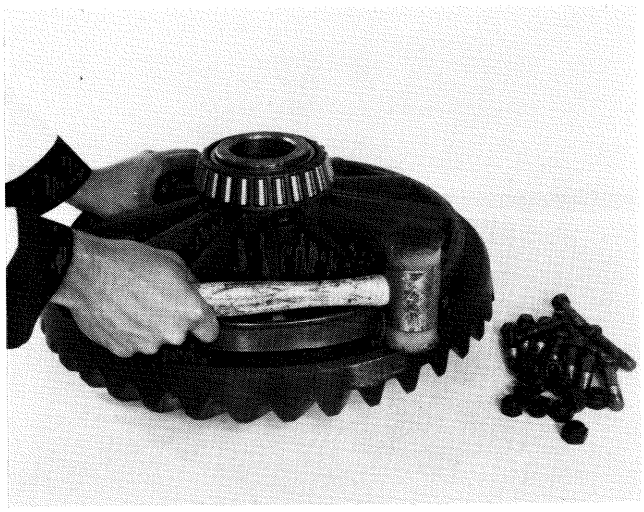


Figure 39
Remove ring gear bolts and nuts. Remove ring gear.

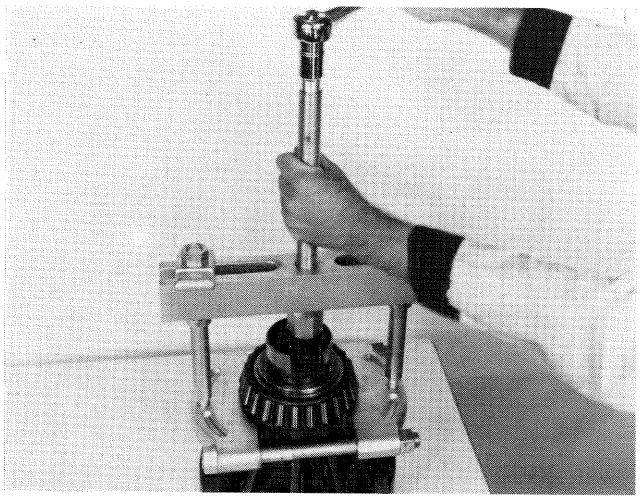


Figure 40
If replacement is required, remove differential bearing cones with a suitable puller.

DIFFERENTIAL REASSEMBLY

NOTE: All parts must be lubricated with Clark-Hurth recommended axle lubricant when reassembling. No part should be reassembled dry.

PINION SHAFT AND BEARING CAGE REASSEMBLY

(See Cleaning and Inspection Page)

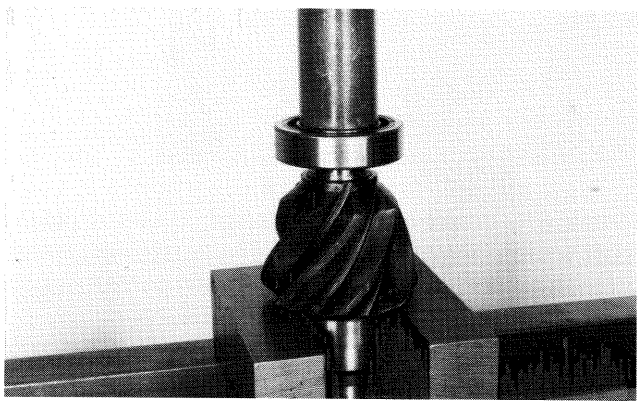


Figure 41
Press inner pinion bearing on pinion shaft.

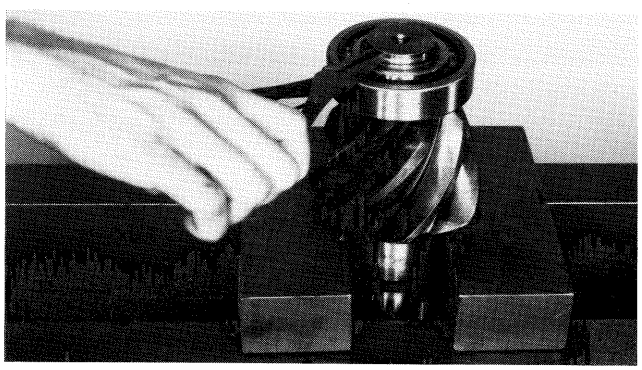


Figure 42
Install inner bearing to pinion shaft retainer ring.

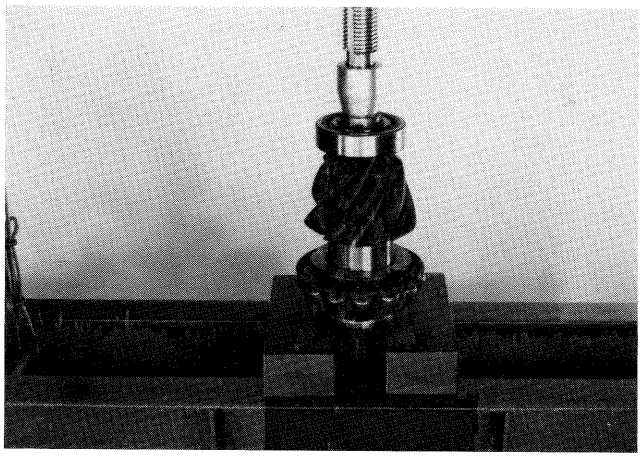


Figure 43
Press center taper bearing on shaft with large diameter of taper toward pinion gear.

NOTE: A pinion bearing spacer and shim kit is provided for repair of carrier assemblies. This kit consists of a spacer and quantity of shims. If pinion, pinion bearings, or housing was not changed, use original bearing spacer for reassembly.

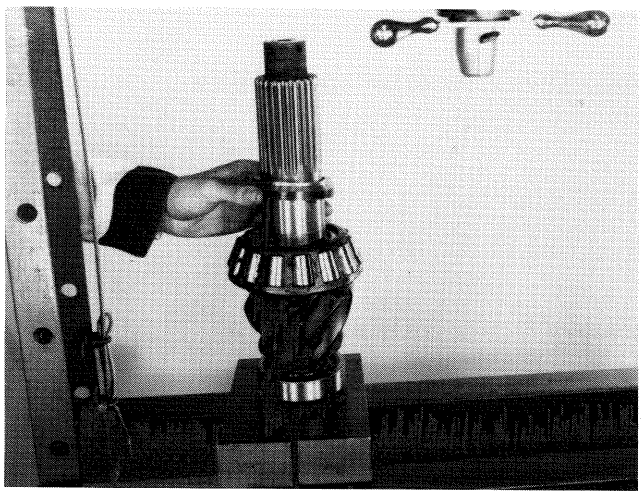


Figure 44
Add one .010 [0,25] shim and pinion bearing spacer.

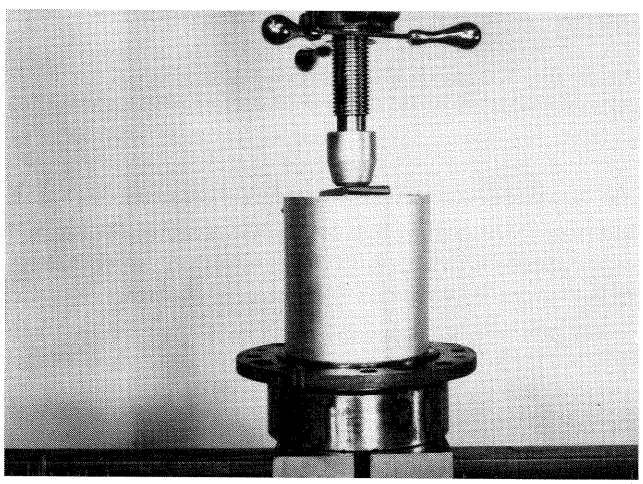


Figure 45
Install inner and outer taper bearing cups in pinion bearing cage.

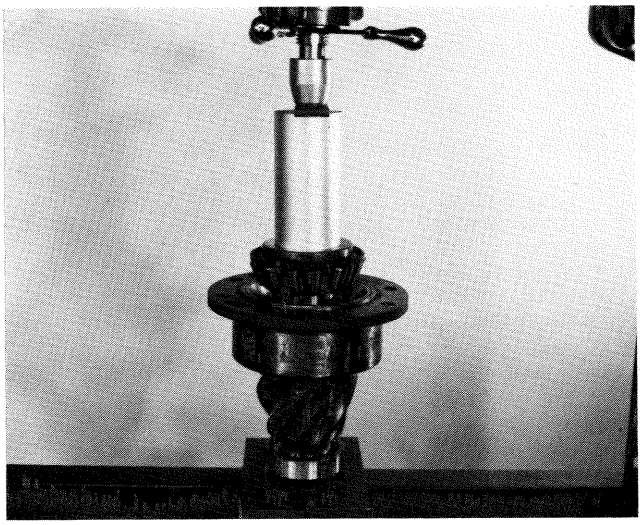


Figure 46

Position pinion bearing cage assembly on pinion shaft. Position outer pinion bearing cone on pinion shaft and press into place.

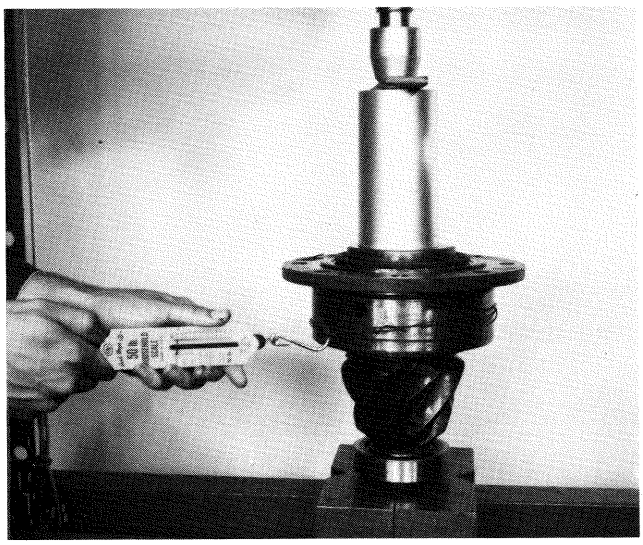


Figure 47

Keep pinion and cage assembly in press with approximately 500 lbf. [226,796 kgf] of press pressure exerted on driver. Wrap several turns of soft wire or cord around pinion cage and pull in horizontal line with spring scale. While pulling in straight line, (90 degrees from centerline of shaft), read spring scale and measure rotating torque. Multiply reading on spring scale by one-half diameter of bearing cage to obtain preload torque. Correct preload torque is 13 to 23 lbf•in [1-3 N•m]. If preload is not within these limits, remove shims to increase preload or add shims to decrease preload.

NOTE: This is a preliminary check. Final bearing preload check must be made with pinion shaft and bearing cage assembly in differential carrier housing.

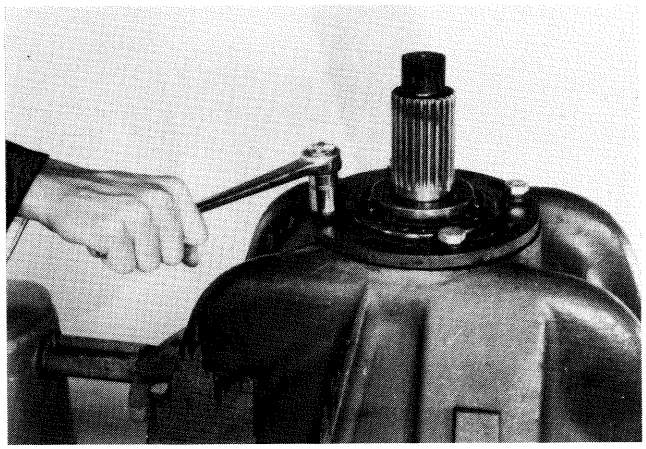


Figure 48

Install bearing cage and pinion shaft assembly in differential carrier assembly without bearing cage shims. Use four (4) pinion oil seal retainer bolts with flat washers to pull pinion shaft assembly fully into carrier assembly. Make sure oil passages are aligned. Install three (3) flat washers on each bolt to prevent them from bottoming.

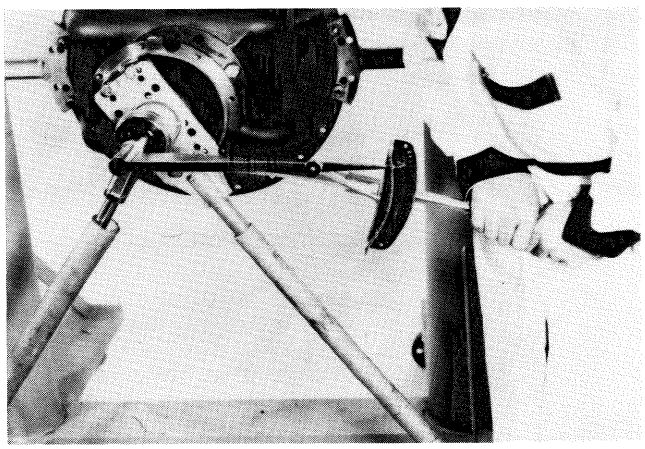


Figure 49

Temporarily install companion flange on end of pinion shaft without installing pinion oil seal retainer. Install companion flange retaining tool on companion flange and torque flange nut to 800 lbf•ft [1084,7 N•m].

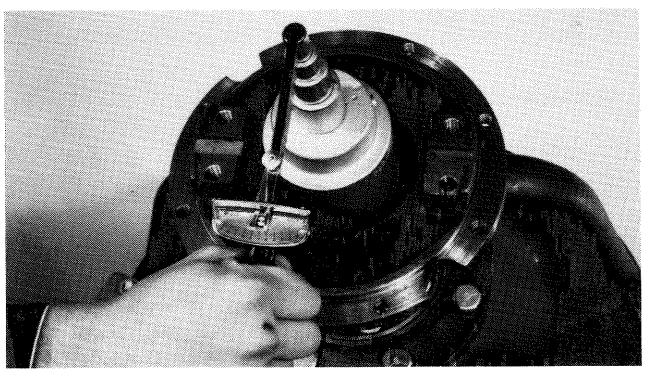


Figure 50

Remove companion flange retaining tool and use "inch-pound" torque wrench to check bearing preload. If bearing preload is not between 13 and 23 lbf•in [1-3 N•m], disassemble parts and add shims to decrease preload or remove shims to increase preload.

REASSEMBLY OF POSI-TORQ
(Spring and Limited Slip)
CASE HALVES
(See Cleaning and Inspection Page)

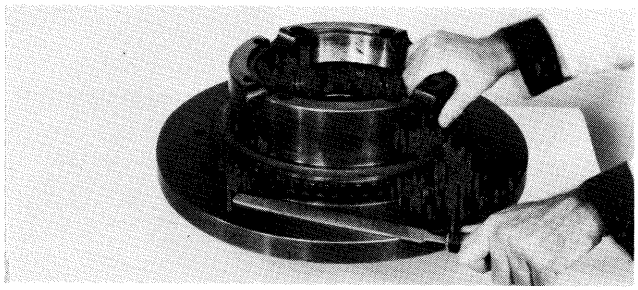


Figure 51
Check ring gear mounting surface of flanged half of differential case for burrs. Remove burrs with file. Clean thoroughly of any metal dust.

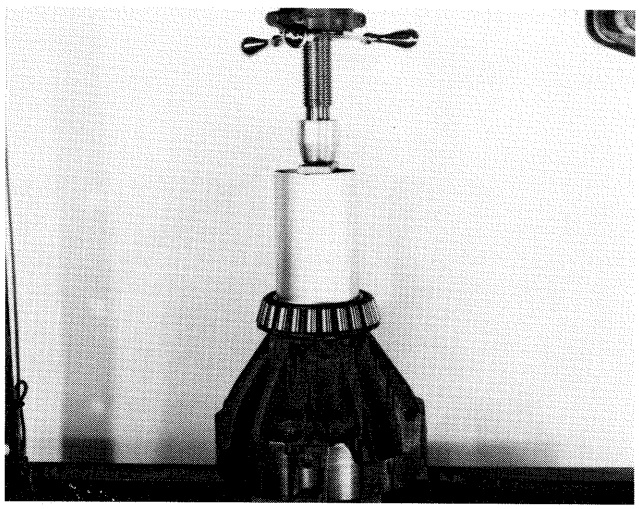


Figure 52
Press differential bearing cones on case halves.

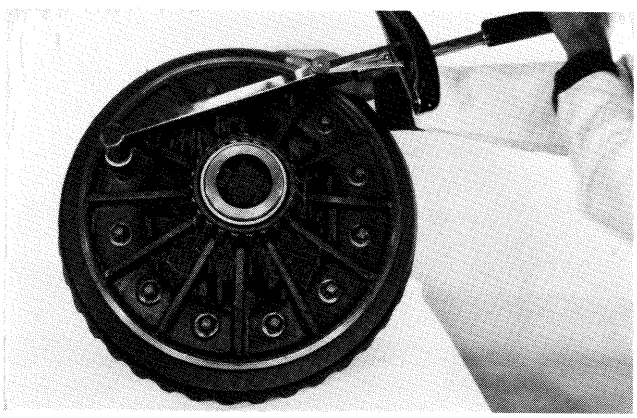


Figure 53
Check ring gear mounting surface of flanged half of differential case for burrs, being certain surface is smooth and clean. Install ring gear. Install bolts so internal diameter of ring gear prevents turning of hex head. Install ring gear bolt nuts and tighten to specified torque. See torque chart.

NOTE: Coat all clutch plates and side gear surfaces with Dow-Corning Molykote G-N Paste.

SEE PAGE 62 FOR STANDARD DIFFERENTIAL REASSEMBLY.

SEE PAGE 64 FOR NoSPIN DIFFERENTIAL REASSEMBLY.

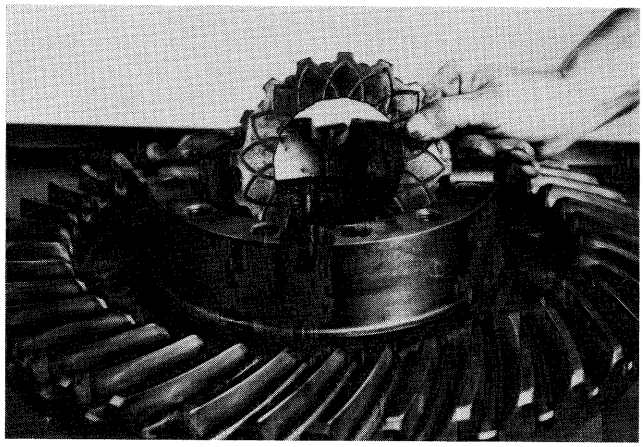


Figure 54
Install one (1) outer clutch plate (teeth on the outer diameter).

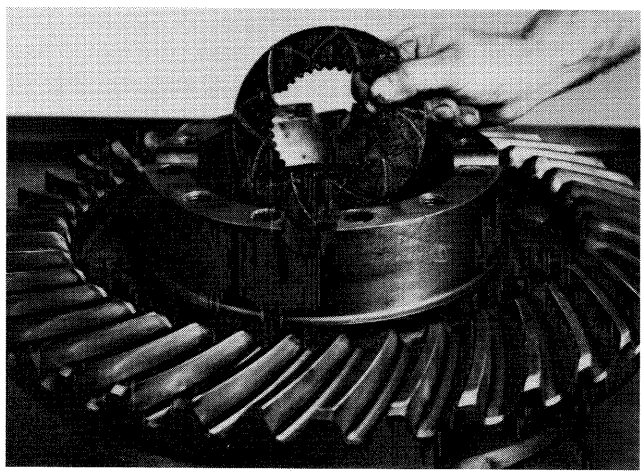


Figure 55
Install one (1) inner clutch plate (teeth on the inner diameter). Alternate inner and outer clutch plates until four (4) outer and three (3) inner plates are installed. You start with an outer plate and end with an outer plate.

NOTE: Some limited slip differentials will have three (3) outer and two (2) inner clutch plates.

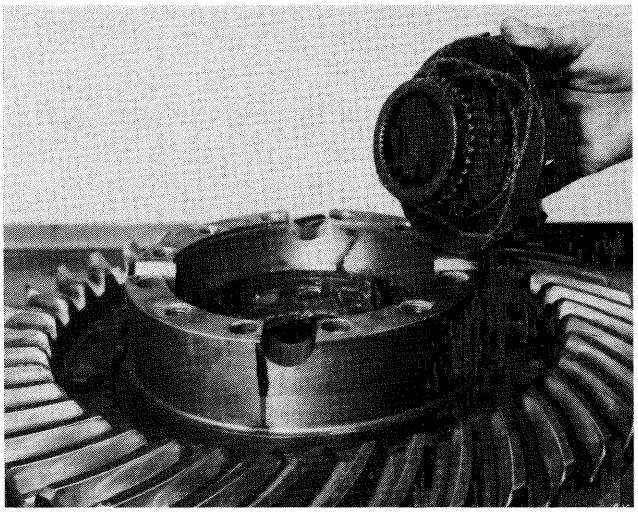


Figure 56

Install side gear, aligning outer splines with inner clutch plate splines. If spring pack is not used proceed to Figure 61.

NOTE: A check must be made to determine the distance between the side gear and the flat surface of the half case. This distance is the "A" dimension shown in Figure 57. A 1000 lbs. force [4448 N•m] must be applied to the side gear to flatten the clutch plates. A press can be used, or as shown in Figure 57, a 1/2"-13 [12,7 mm] bolt and 1/2" [12,7 mm] thick washer top and bottom are used. Install as shown and tighten nut 30 to 50 lbf•ft [40,7-67,7 N•m] torque. This is equivalent to 1000 lbs. [4448 N•m] force. A flat bar is used to support the depth micrometer. Measure the distance as shown and subtract the thickness of the support bar to get dimension "A." If dimension "A" is between 1.4510 and 1.4605 [36,856-37,096 mm] use a .0650 thickness spring pack spacer. If dimension "A" is between 1.4606 and 1.4710 [37,099-37,363 mm] use a .0750 [1,905 mm] spring pack spacer. This procedure is used on both flanged and plain half cases. Keep selected spring pack spacer with its respective half case for reassembly. See Figure 57 for flanged half case and Figure 72 for plain half case.

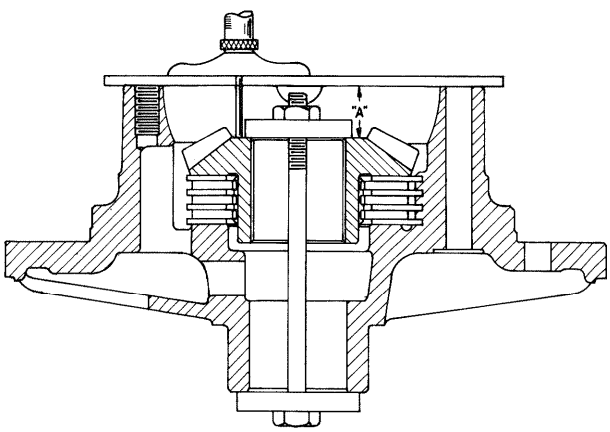


Figure 57

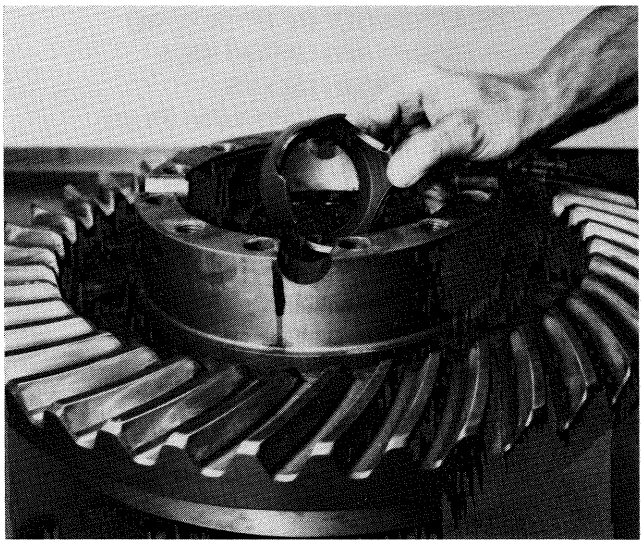


Figure 58

Install spring pack thrust plate.

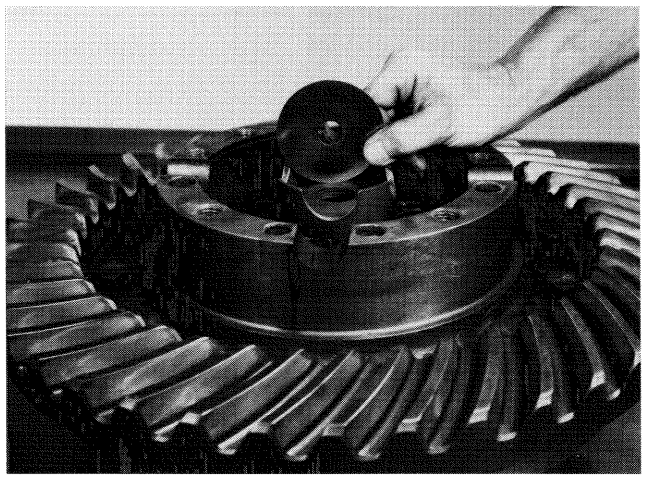


Figure 59

Install selected spring pack spacer.

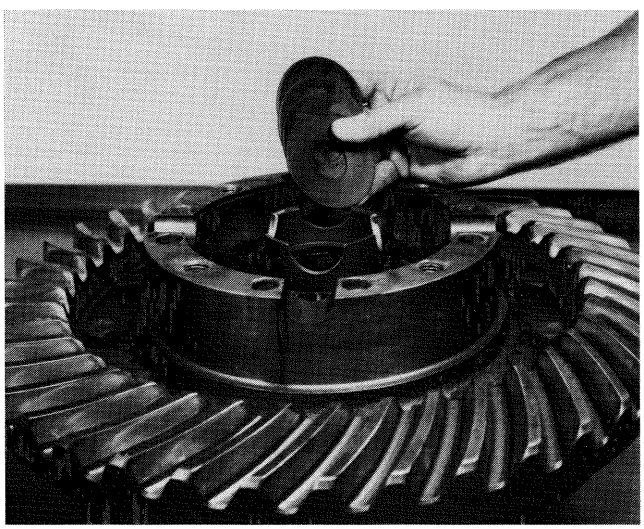


Figure 60

Install spring pack with all bevels in the same direction and with the large diameter of the bevel against the spring pack spacer.

NOTE: Four (4) springs per pack.

DIFFERENTIAL PINIONS, NEEDLES AND CROSS REASSEMBLY

NOTE: All parts must be lubricated with Clark-Hurth recommended axle lubricant when reassembling. No part should be reassembled dry.

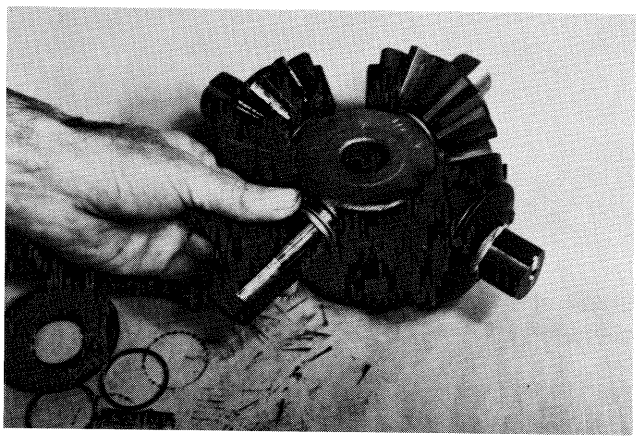


Figure 61
Position inner needle roller bearing spacer on differential spider. See Figure 67 for cross section reference.

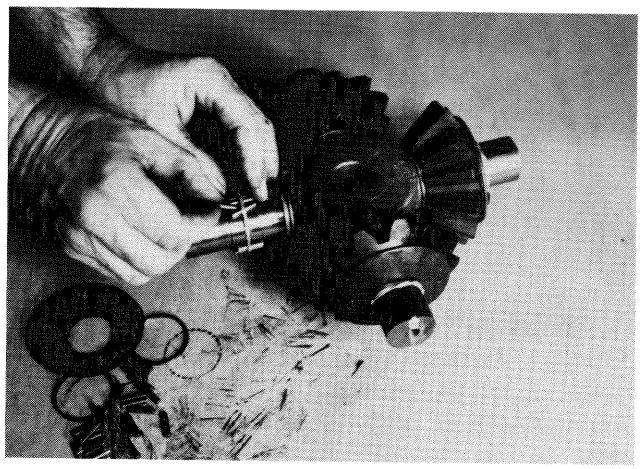


Figure 62
Using a rubber band to facilitate reassembly, install one row of needle roller bearings.

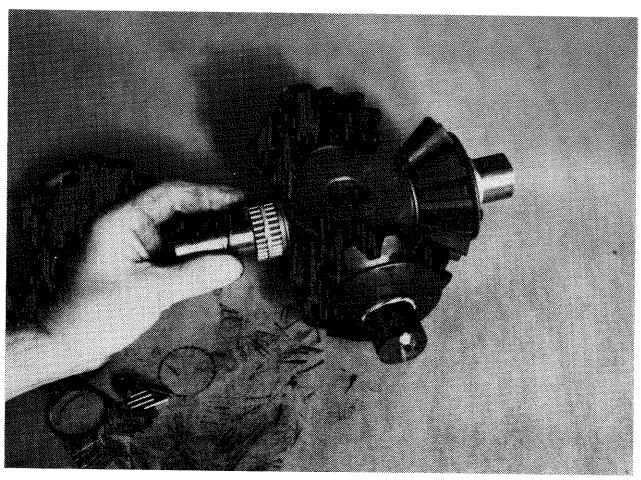


Figure 63
Install center roller bearing spacer.

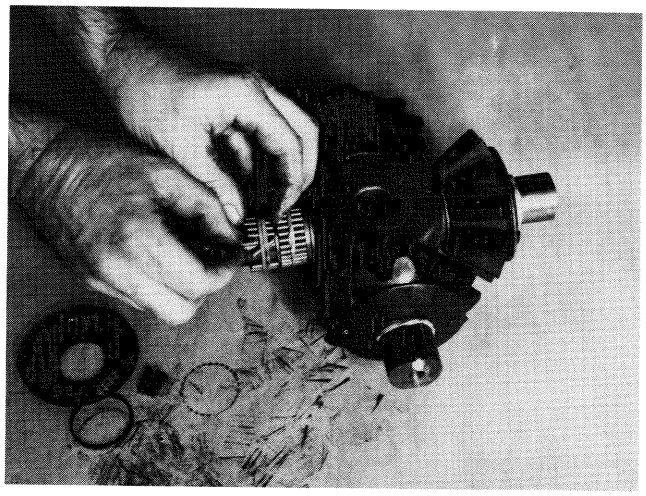


Figure 64
Using another rubber band, install outer row of needle roller bearings.

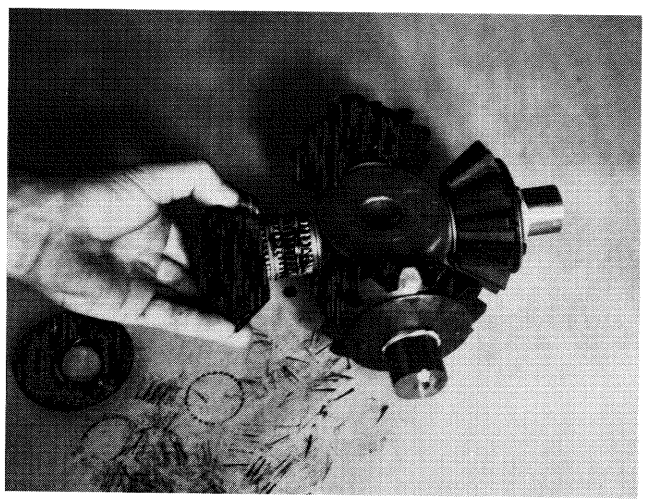


Figure 65
Position pinion gear on needles as shown. Remove first rubber band. Slide pinion gear over second row of needles, remove second rubber band.

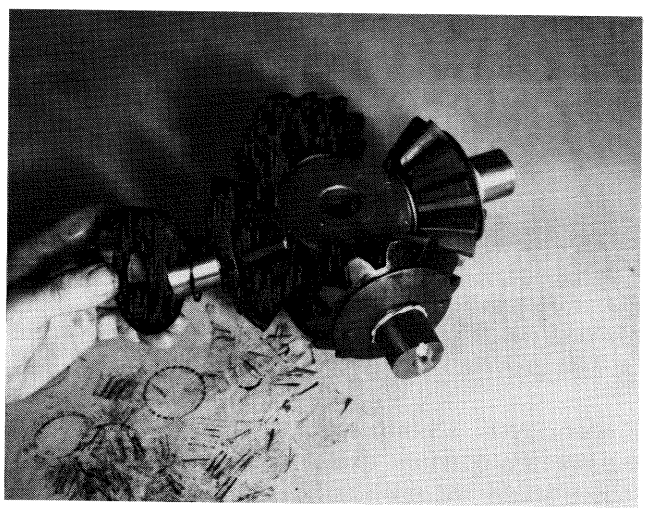


Figure 66
Install outer roller bearing spacer and pinion thrust washer. A rubber band was used on each end of the spider after pinion installation to keep pinion gear in place until assembly into flange half case.

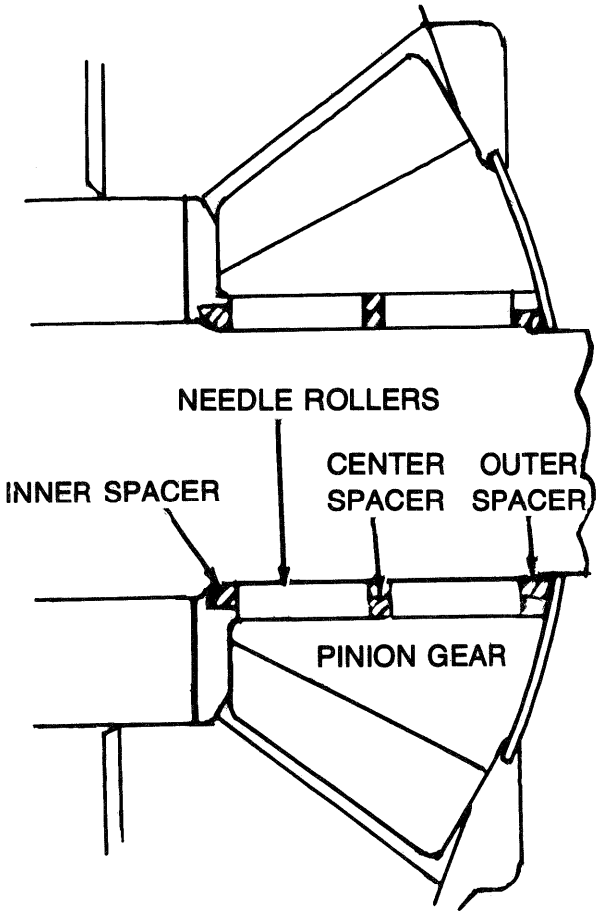


Figure 67

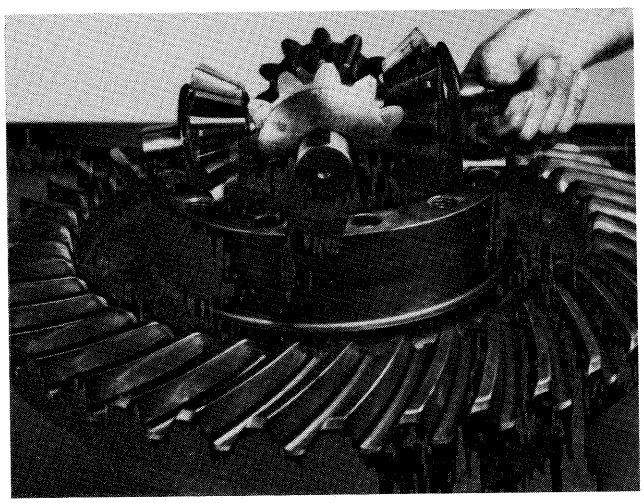


Figure 68

Remove rubber bands holding pinion gears into position on differential spider. Place spider assembly on side gear.

If spring pack is not used proceed to Figure 76. Use the same procedure explained in the note following Figure 56 for the plain half case clutch plate and side gear measurement to select proper spring pack spacer.

NOTE: Coat all clutch plates and side gear surfaces with Dow-Corning Molykote G-N Paste.

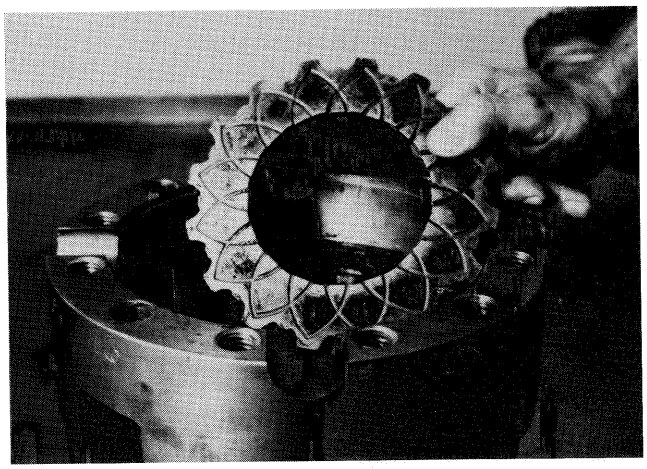


Figure 69

Install one (1) outer clutch plate (teeth on the outer diameter) in the plain half case.

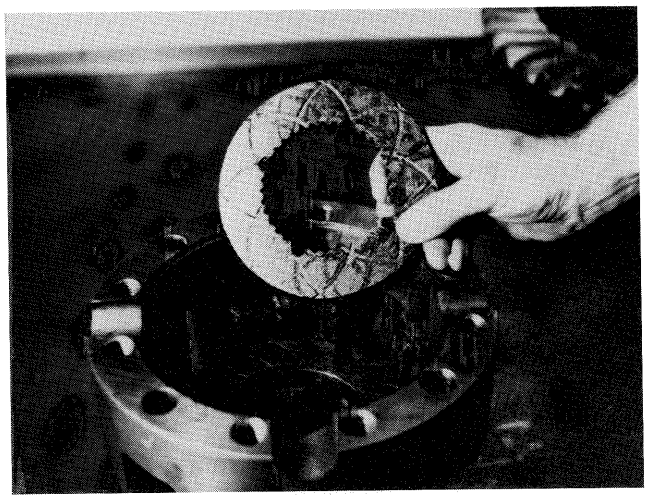


Figure 70

Install one (1) inner clutch plate (teeth on the inner diameter). Alternate inner and outer clutch plates until four (4) outer and three (3) inner plates are installed. You start with an outer plate and end with an outer plate.

NOTE: Some limited slip differentials will have three (3) outer and two (2) inner clutch plates.

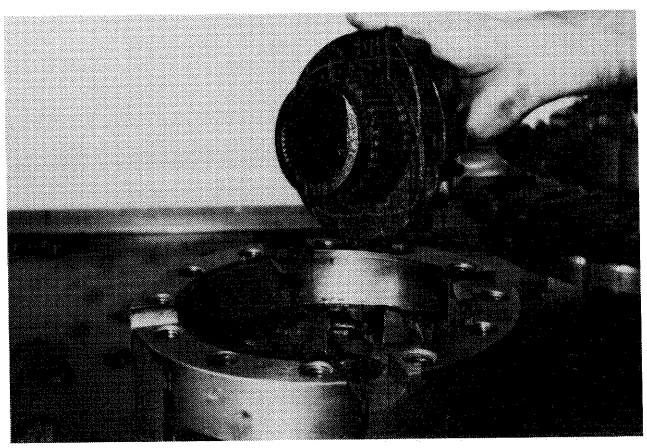


Figure 71

Install side gear aligning outer splines with inner clutch plate splines.

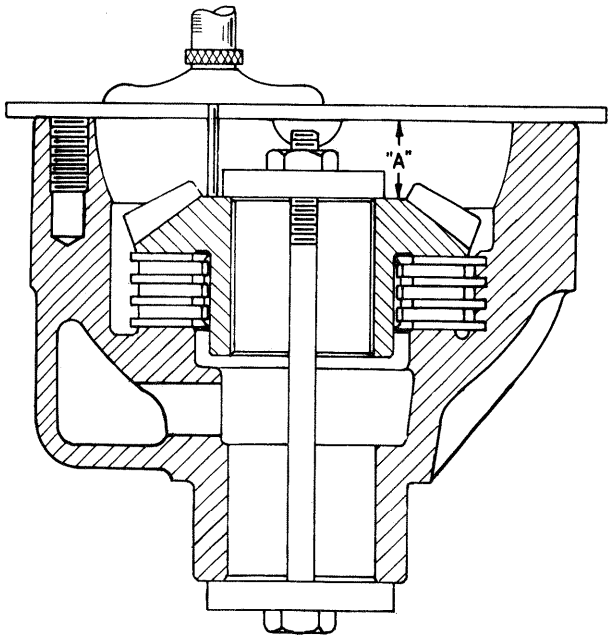


Figure 72
See note following Figure 56.

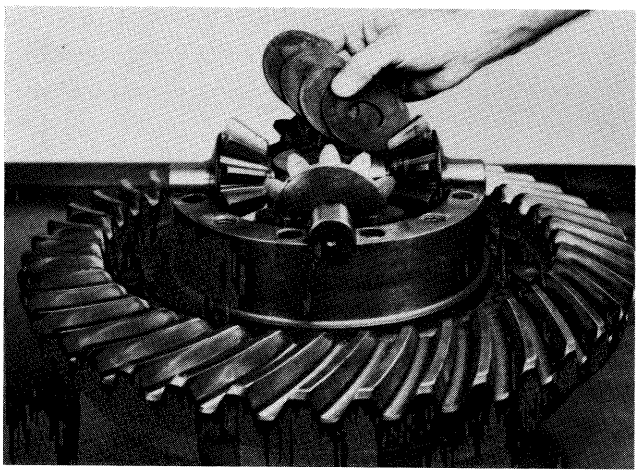


Figure 73
Install spring pack with all bevels in the same direction on the pinion cross. **NOTE**: Large diameter of bevel up. Four (4) springs per pack.

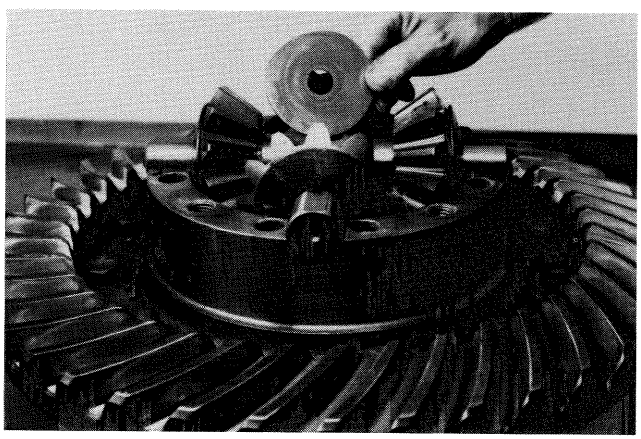


Figure 74
Install selected spring pack spacer on spring pack (not as shown).

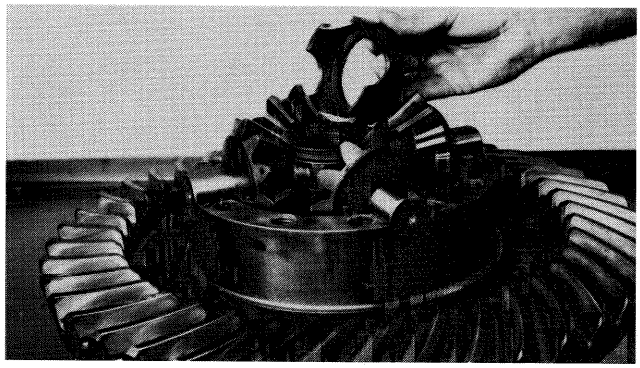


Figure 75
Install spring pack thrust plate.

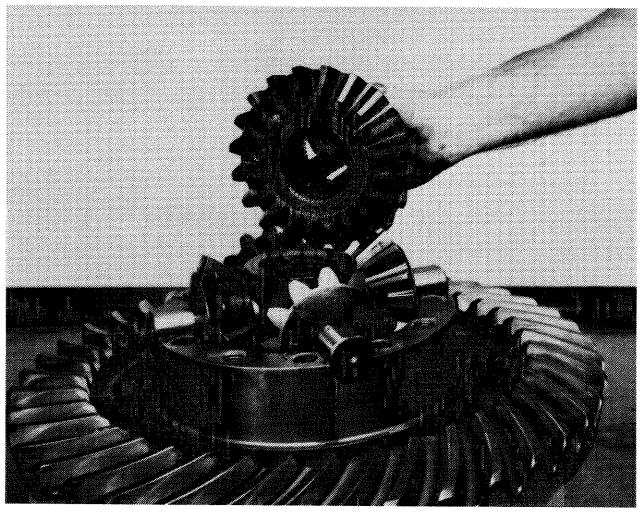


Figure 76
Position side gear on differential pinions.

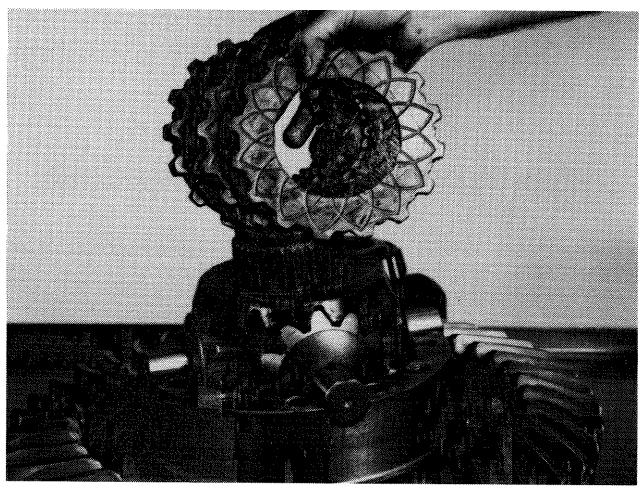


Figure 77
Install one (1) outer disc and one (1) inner disc on side gear. Alternate discs until a quantity of four (4) outer discs and three (3) inner discs are installed. Start with an outer disc and end with an outer disc.

NOTE: Some limited slip differentials will have three (3) outer and two (2) inner clutch plates. Align outer clutch disc teeth to facilitate assembly into plain half case. Apply Loctite #262 to threaded holes in case halves.

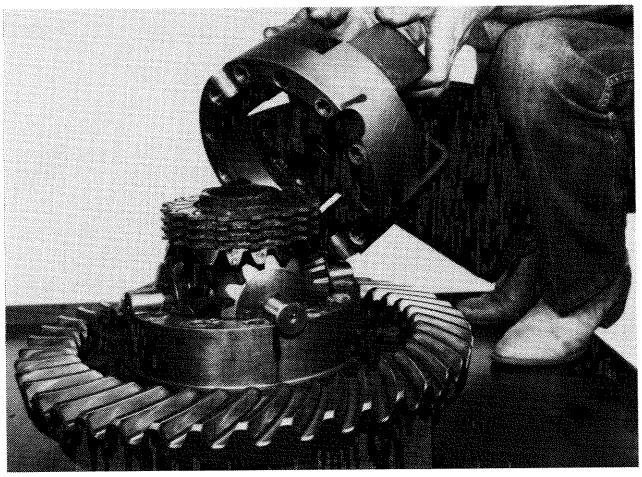


Figure 78

Align match mark on plain half case with mark on flanged half case. Install plain half case over clutch plates and side gear.

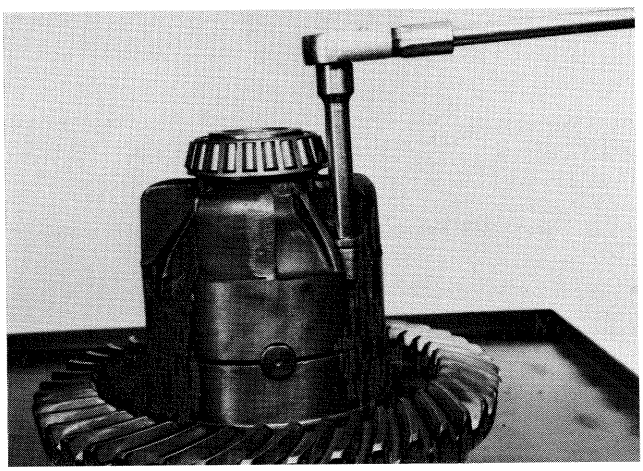


Figure 79

Install case half bolts and tighten 360 to 400 lbf•ft [488,1-542,3 N•m] torque.

DISASSEMBLY OF STANDARD DIFFERENTIAL CASE HALVES

Figure 80

Match mark case halves to insure correct reassembly. Remove differential bolts securing case halves together. Lift off plain case half. Use soft mallet if necessary to aid removal.

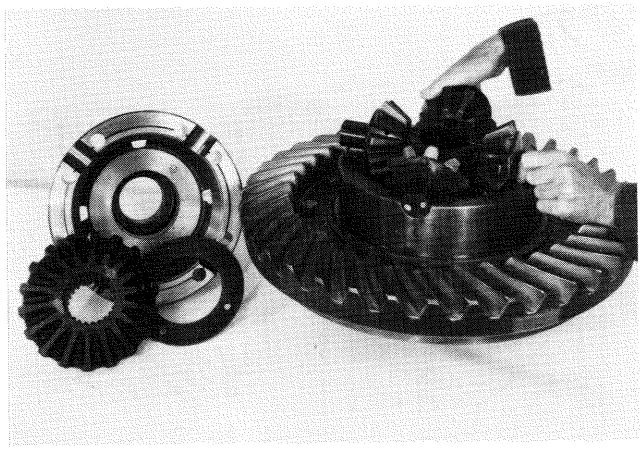


Figure 81

Remove spider, pinions, and thrust washers.

SEE FIGURES 39 AND 40 FOR RING GEAR AND CONE BEARING REMOVAL.

REASSEMBLY OF STANDARD DIFFERENTIAL CASE HALVES

(See Cleaning and Inspection Page)

SEE FIGURES 51, 52, AND 53 FOR RING GEAR AND CONE BEARING INSTALLATION.

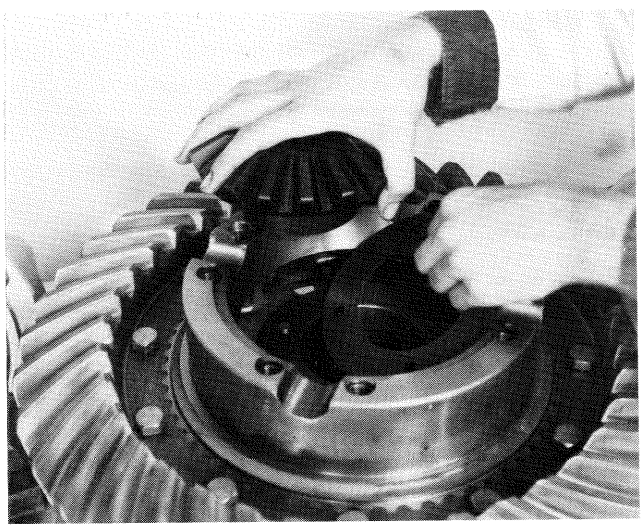


Figure 82

Lubricate and install thrust washer and side gear in differential case and ring gear assembly. Engage holes in thrust washer on dowels projecting from thrust washer bearing surface in differential case.

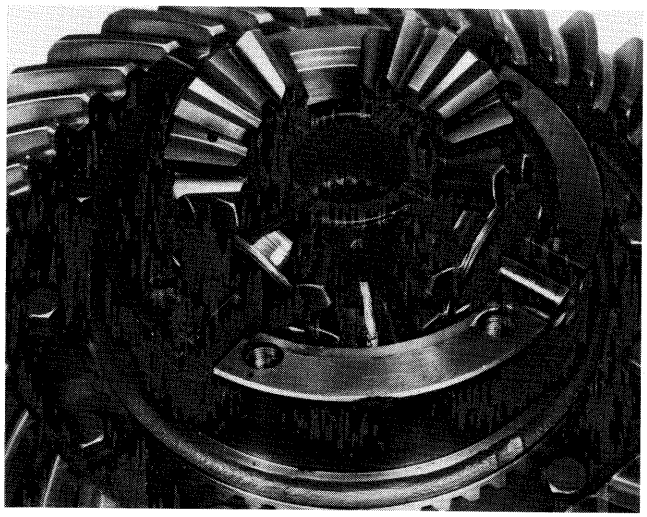


Figure 83

Place pinions and thrust washers on differential spider, lubricate, and set in position on installed side gear.

NOTE: It is very important that tang on each pinion thrust washer engages groove in case halves as shown. Position other side gear on pinion gears. Apply heavy grease to the other side gear thrust washer and position washer on dowel pin in plain half case.

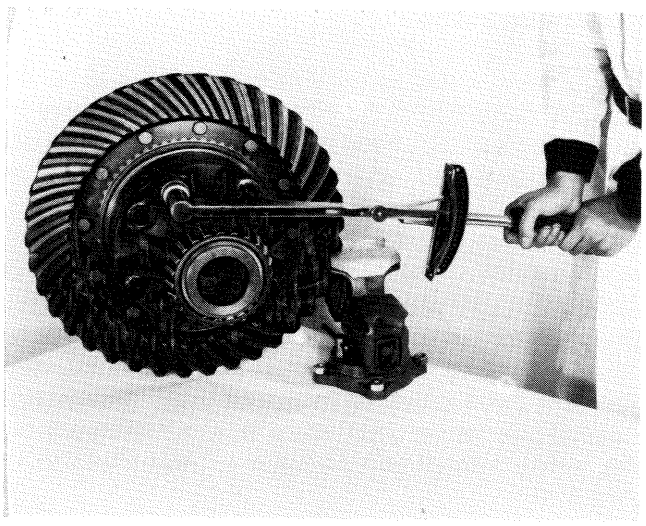
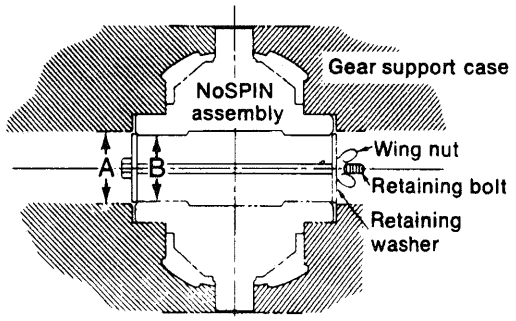


Figure 84

Align match marks and install plain case half on flanged case half assembly, making sure of full gear engagement. Install bolts and tighten to specified torque. See torque chart.

DISASSEMBLY OF NoSPIN DIFFERENTIAL CASE HALVES

NOTE: NoSpin can be removed as an assembly as follows or proceed to Figure 85.



1. Mark the mating halves of the differential case with a center punch so they can be reassembled in the original position when repair or inspection is completed.
2. Insert a retaining bolt and washer assembly, (as shown), threading the nut finger-tight against the washer.
3. Separate the case halves and lift out the NoSpin assembly.

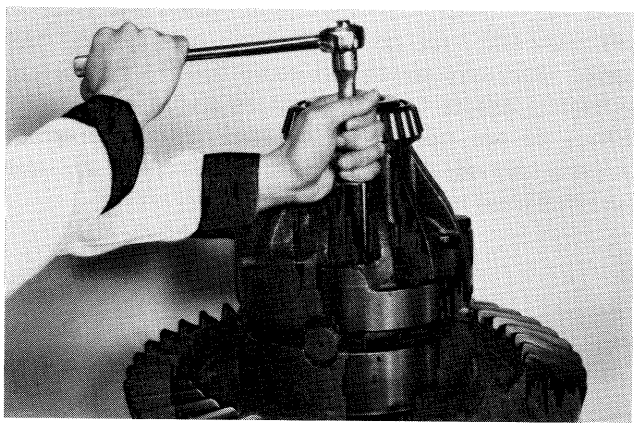


Figure 85

Remove every other differential case half bolt. Back off remaining bolts slowly and evenly, turning each a few turns at a time.This will release spring load of NoSpin unit.

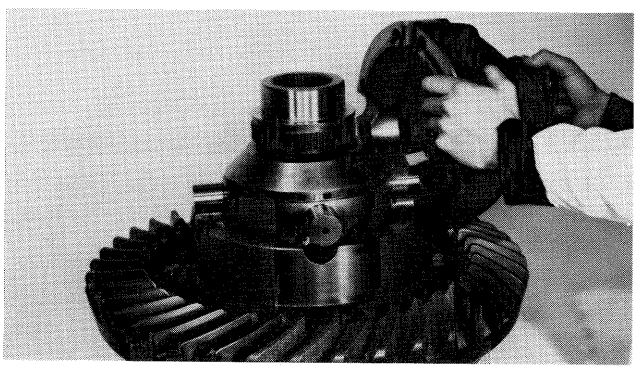


Figure 86

Remove plain half case. Remove NoSpin parts.

SEE FIGURES 39 AND 40 FOR RING GEAR AND HALF CASE CONE BEARING REMOVAL.

REASSEMBLY OF NoSPIN DIFFERENTIAL CASE HALVES

(See Cleaning and Inspection Page)

SEE FIGURES 51, 52, AND 53 FOR CONE BEARING AND RING GEAR INSTALLATION.

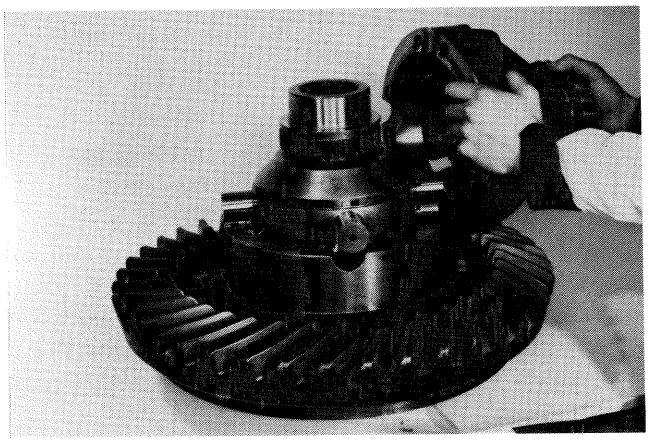


Figure 87

If a retainer bolt was used to hold the NoSpin assembly together, position assembly in the flanged half case. If retainer bolt was not used, carefully position and align all NoSpin parts in the flange half case. Align match marks on case halves and position the plain half case on the NoSpin and flanged half case. Manually press on case half to compress springs to assure that case halves seat fully together. If they do not, splines in the NoSpin parts are not properly aligned. Align parts and again check to make sure that case halves seat fully.

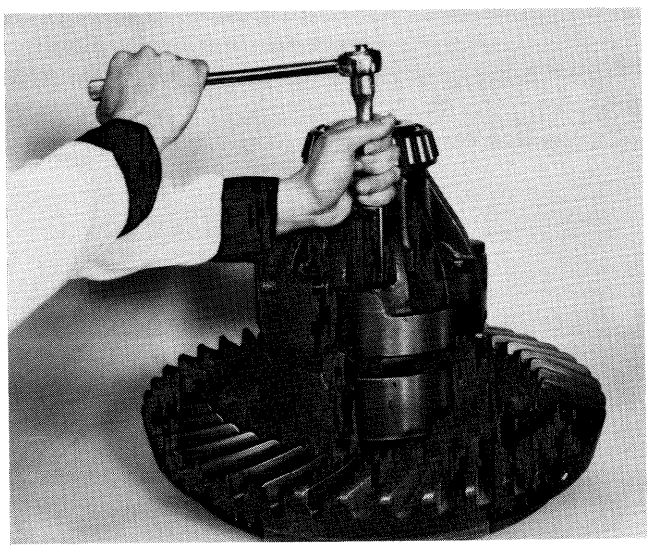


Figure 88

Install every other case bolt and tighten evenly until all are tightened and case halves are fully positioned together. Install remaining case bolts and tighten all to specified torque. See torque chart.

RING GEAR TO PINION MOUNTING DISTANCE PROCEDURE

A pinion setting gauge must be used to achieve a precise mounting distance between the ring gear, differential carrier housing, and pinion.

The gauge should be used if either carrier housing and/or ring and pinion is changed.

The use of the gauge will determine the amount of shims to be used under the pinion bearing cage to achieve an exact mounting distance between the ring gear and pinion.

By using the gauge and adding the proper thickness of shims, an optimum tooth contact will be obtained.

Setting the ring and pinion mounting distance without the gauge will require a trial and error procedure. A shim must be installed under the pinion bearing cage and then the unit must be completely assembled per service manual instructions.

The procedure must be repeated until proper tooth contact is obtained.

THE FOLLOWING PROCEDURE IS USED TO ACHIEVE A PROPER RING GEAR TO PINION MOUNTING DISTANCE USING A PINION SETTING GAUGE.

Locating position of the pinion as described will produce a proper tooth contact with the ring gear when it and the differential assembly are assembled and adjusted to proper backlash setting.

Pinion setting gauge can be purchased from Service Tools, 2013 4th Street, N.W., Owatonna, Minn. 55060. Kit No. VME 10004-2.

The function of the gauge is to measure the distance from the centerline of the differential bearing bores to the ground surface on the gear end of the pinion gear. This measurement, when subtracted from the value etched on the ring gear will indicate the size of the shim pack required to position the pinion gear in proper relation to the ring gear.

On the outer diameter of the ring gear, a ring gear to pinion mounting distance value will be etched, add .469 to it. (.469 is half the thickness of the gauge bar.) Record this value. This value may be different on each ring and pinion set due to manufacturing variations.

Insert a 4" base 5/32" diameter, 5"-6" extension depth micrometer into the guide bore of the micrometer arbor, slide clamps over base of micrometer. With the thumb screws reacting on base, secure micrometer.

IMPORTANT: The micrometer extension must pass freely through the micrometer bar guide bore and the base of the micrometer must rest on the micrometer arbor when mounted.

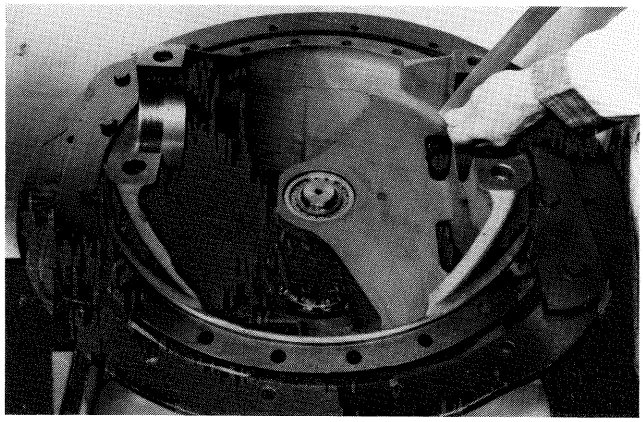


Figure 89

Use a file and emery cloth to remove all burrs and nicks from machined bearing surfaces of differential carrier housing.

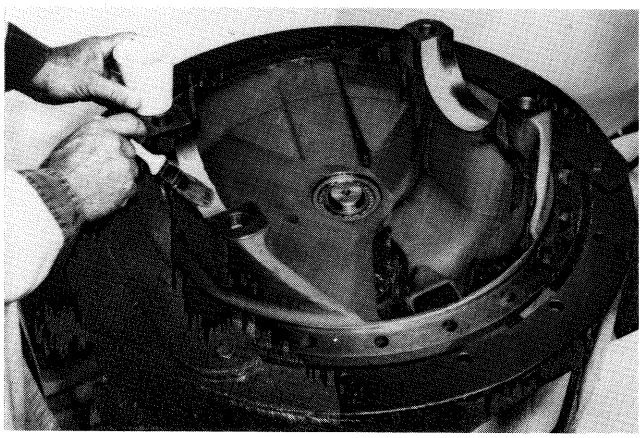


Figure 90

Paint bearing surfaces of carrier housing with gear tooth marking compound.

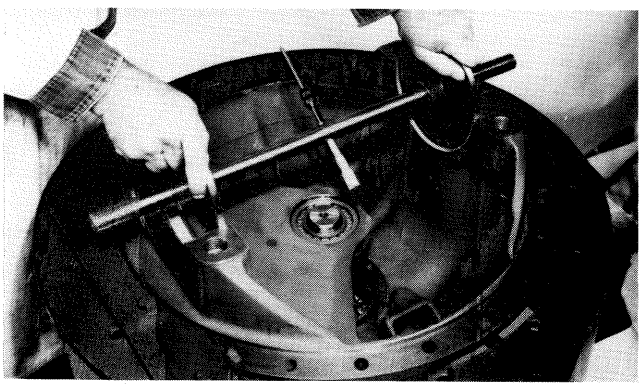


Figure 91

Mount adaptor discs on micrometer arbor and set in position in carrier housing as shown in Figure 91. Exercise care to be sure that micrometer and extension do not contact any part of the carrier in this operation. Apply pressure by hand and rotate adaptor discs slightly to obtain a contact with bearing surfaces.

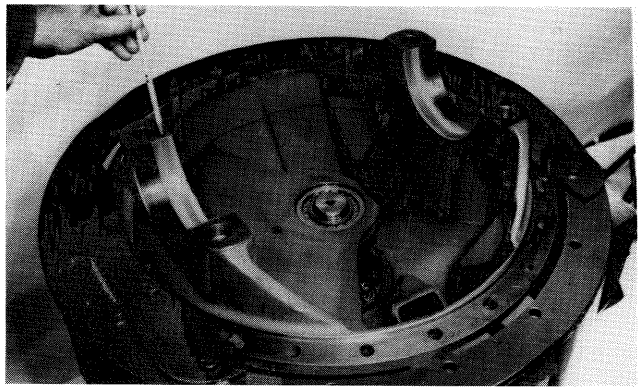


Figure 92

Remove checking gauge assembly and check for full bearing contact on bearing surfaces.

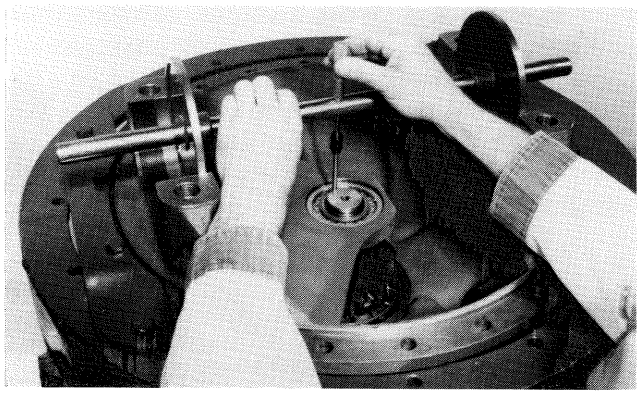


Figure 93

If contact is full and proper, again position checking gauge assembly in carrier and check distance to ground surface on pinion (Figure 93). **DO NOT** apply **PRESSURE** to arbor or micrometer. Turn micrometer carefully and evenly until tip of extension contacts the ground surface of the pinion. In the assembly shown, the distance measures 5.728 inches, the reading on the micrometer being .728 inch. Subtract this reading from the value etched on the ring gear plus half the thickness of the gauge bar .469, and this equals the amount of shims to be added between the pinion bearing cage and the carrier housing.

Example:	5.289	Value etched on ring gear
	+ .469	One half thickness of gauge bar
	5.758	Total
	5.728	Initial micrometer reading
	.030	Add this value in shims

Remove bolts holding pinion bearing cage and pinion in differential carrier and remove bearing cage and pinion assembly. Install required shim pack and reinstall cage and pinion assembly in carrier. Tighten cage screws 125 to 140 lbf•ft [170-190 N•m] torque temporarily.

After adding required amount of shims, again mount checking gauge assembly and take a check reading. The reading should now be 5.758 inches plus or minus .002 inch. In other words, the reading should be equal to the value etched on the ring gear plus .469 half the thickness of gauge bar, within .002 inch.

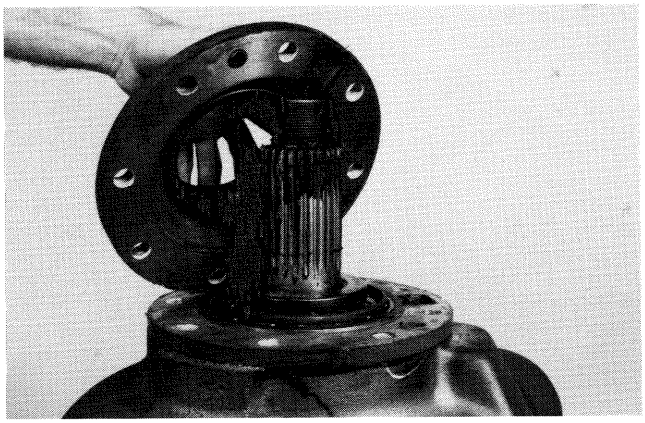


Figure 94

Remove bolts holding pinion cage in housing. Remove pinion and cage assembly. Apply Loctite #515 to shims and joining surfaces, reinstall pinion and cage assembly being sure all oil passages are aligned. Apply a light coat of Loctite #515 to the outer diameter of the pinion shaft oil seal. Press seal in retainer with lip of seal toward pinion bearing. Coat outer bearing cage surface with Loctite #515 and install oil seal retainer.

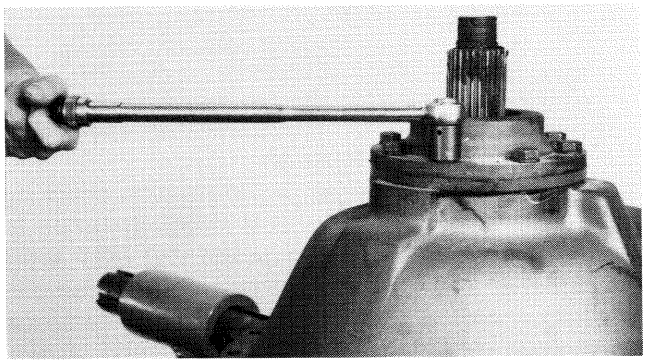


Figure 95

Apply Loctite #262 thread locking compound to threaded holes and install retainer bolts and washers. Tighten bolts to specified torque. See torque chart.

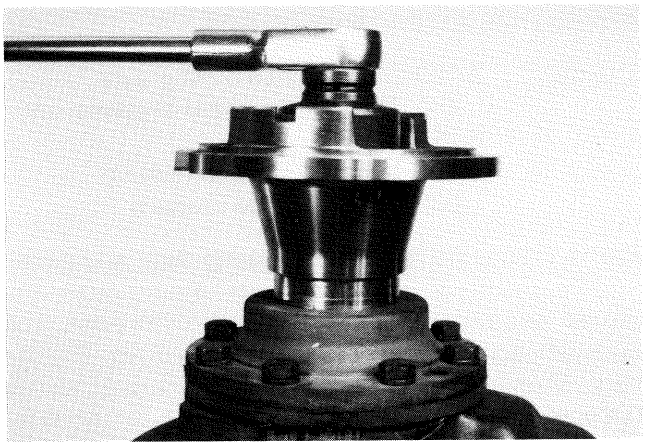


Figure 96

Apply Dow Corning RTV-Q3-7069 Sealant to pinion spline locations shown on assembly instruction page. Install flange, washer, and nut. Tighten nut to 800 lbf•ft torque (min.) [1085 N•m]. Tighten nut until cotter pin hole is exposed. Install nut cotter pin.

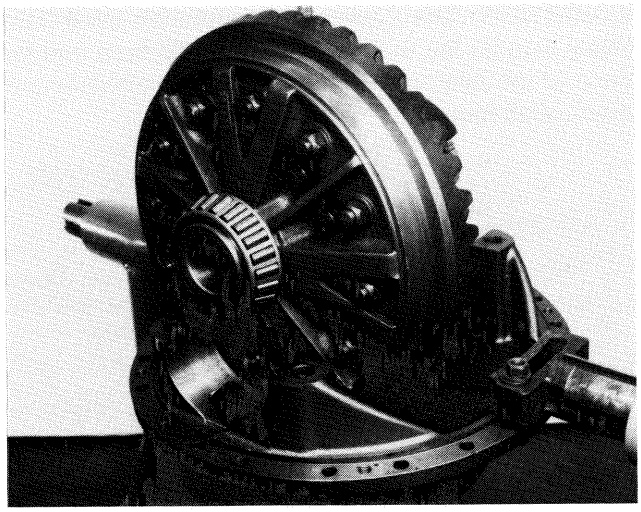


Figure 97

Position differential assembly into carrier.

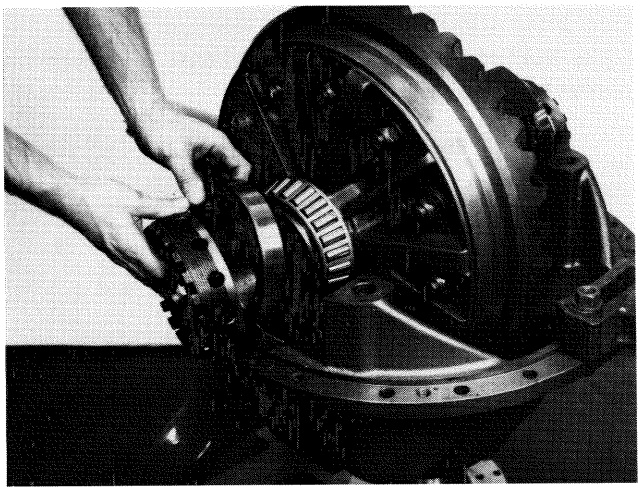


Figure 98

Position differential bearing cup and adjusting nut on one side of differential and lift slightly with hoist. Position bearing cup and adjusting nut on carrier. Repeat procedure and install opposite bearing cup and adjusting nut. Turn adjusting nuts by hand to be sure of proper thread alignment. Coat internal threads in housing with Loctite Sealer #262.

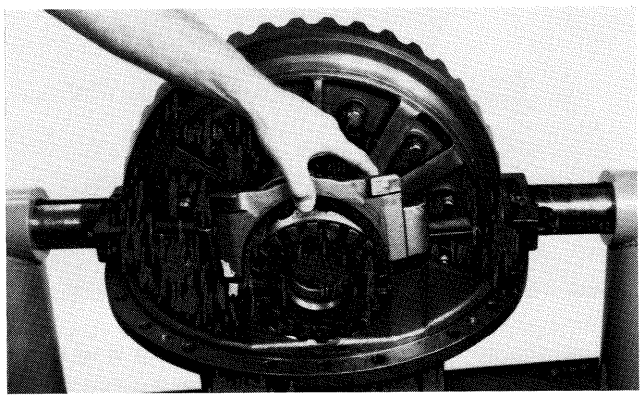


Figure 99

Position bearing caps on bearings and adjusting nuts, making sure match marks made during disassembly are properly aligned. Install cap bolts, and tighten lightly. Do not torque at this time.

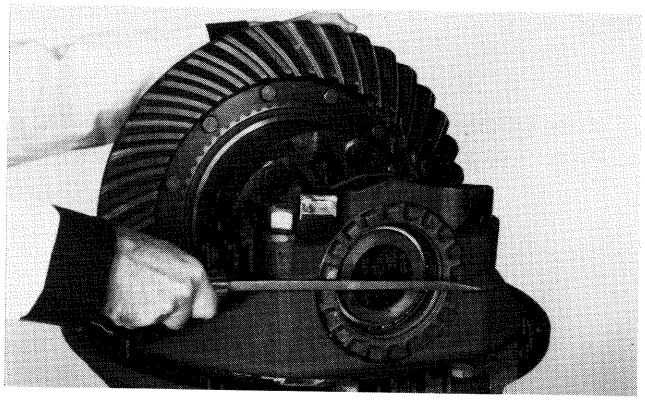


Figure 100

Tighten bearing adjusting nuts to adjust bearings to zero end play.

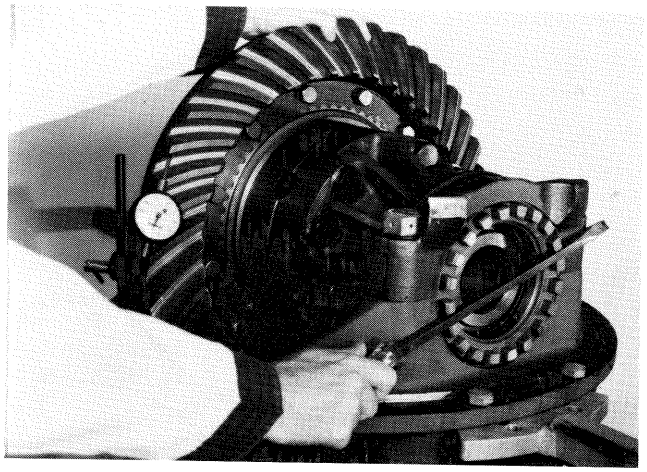


Figure 101

Use a dial indicator as shown. Move ring gear by loosening one adjusting nut and tightening opposite adjusting nut. Adjust position until gear backlash is to backlash specifications (see new gear set), or adjust to backlash noted at disassembly for used gears. When proper backlash is achieved, tighten opposite adjusting nut to set preload on taper bearings. Using only thumb and forefinger, move ring gear. When ring gear becomes difficult to move, preload on bearing is set.

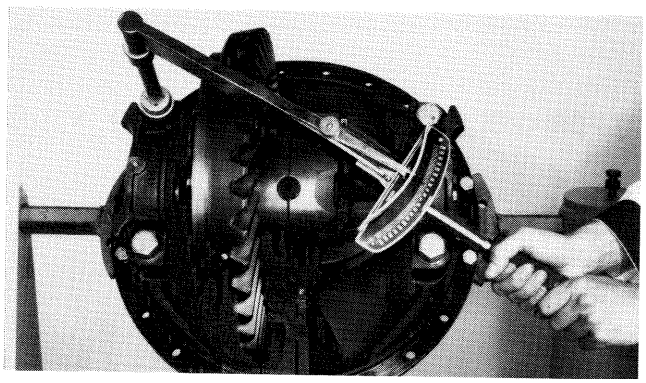


Figure 102

Tighten differential cap bolts to specified torque. See torque chart. Recheck ring and pinion backlash and bearing preload as explained in Figure 101 to be sure backlash is within specifications. Install adjusting nut lock and capscrews. Tighten to specified torque. See torque chart.

DIFFERENTIAL ASSEMBLY INSTALLATION

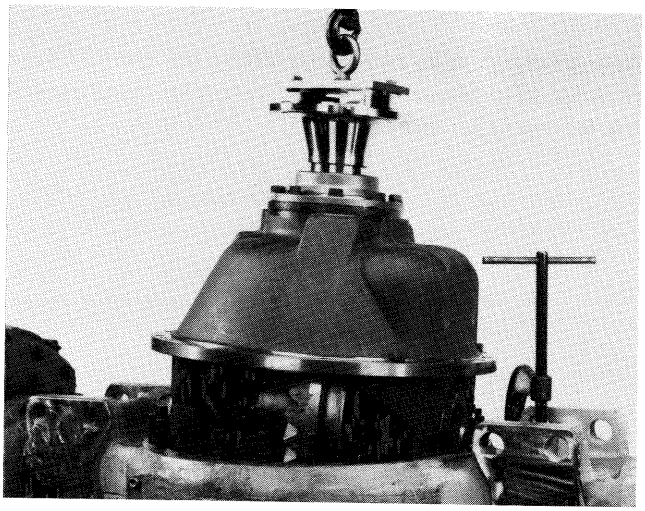


Figure 103

Install a new differential to axle housing "O" ring on differential carrier. Check differential mounting flange of axle housing to be sure it is free of dirt and burrs. Align differential assembly with axle housing studs. Lower into position. Use caution as not to damage studs. Apply Loctite #262 to threads of studs.

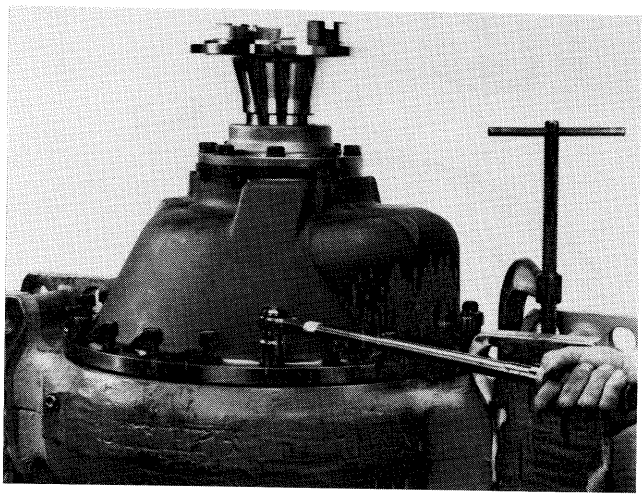
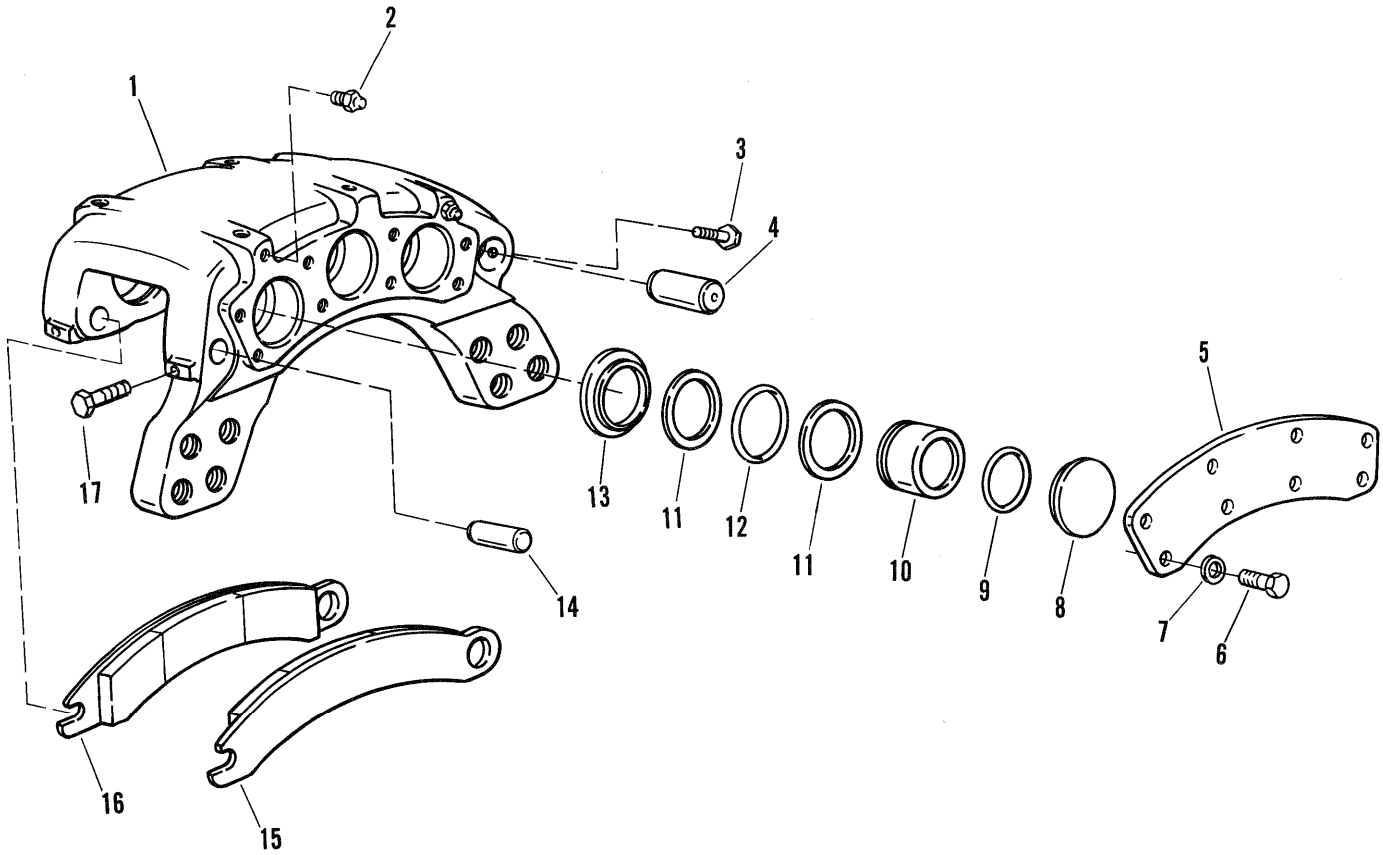


Figure 104

Install taper dowels on studs. Install lockwashers and stud nuts. Tighten taper dowel stud nuts first. Tighten to specified torque. See torque chart.

BRAKE SERVICE
(Dry Disc)

The series of brake head assemblies covered by this section are of the caliper type and are designed for use with mineral oil hydraulic fluid only. The brake head assembly is bolted to a mounting flange on the axle, and consists of the following components.



PART QUANTITY SHOWN FOR ONE (1) BRAKE HEAD ONLY

Item	Description	Quantity
1	Torque Plate	1
2	Bleeder Screw	1
3	Pin Locking Bolt	2
4	Lining Pin	2
5	Cover Plate	1
6	Cover Plate Bolt	8
7	Cover Plate Bolt Washer	8
8	Piston Plug	3
9	Piston Plug Preformed Packing	3

Item	Description	Quantity
10	Piston	6
11	Backup Ring	12
12	Preformed Packing	6
13	Piston Boot	6
14	Lining Pin	2
15	Lining and Carrier Assembly	1
16	Lining and Carrier Assembly	1
17	Pin Locking Bolt	1

WARNING

USE ONLY MINERAL OILS TO SPECIFICATIONS OUTLINED IN THE VEHICLE MANUFACTURER'S SERVICE AND MAINTENANCE MANUAL. USE OF IMPROPER FLUIDS IS DESTRUCTIVE TO RUBBER COMPONENTS OF BRAKES AND MASTER CYLINDERS, RESULTING IN LOSS OF BRAKING AND POSSIBLE CATASTROPHIC FAILURE.

A torque plate with four bores contains a corresponding number of pistons. Half of the bores have a blind closure. The other half are closed and sealed against fluid leakage by piston plugs with packings installed on the O.D. secured in place by a cover plate. The cover plate is attached to the torque plate with bolts and washers.

Backup rings and packings are installed in piston bore grooves in the torque plate. Protective boots are installed in grooves in front of the packing grooves in the torque plate and snapped into a groove in the pistons.

Lining and carrier assemblies are retained in the torque plate by four pins. The pins are locked into position with bolts tightened 32 to 38 lbf•ft [43,4-51,5 N•m] dry thread torque.

NOTE: Installed torque of pin locking bolts will vary depending upon the amount of locking compound on the bolt threads. If torque required to install bolts exceeds 20 lbf•ft [27,1 N•m], bolt should be tightened until it bottoms against pin, then backed out two full turns and tightened to specified torque.

Internally drilled passageways connect the two sides of the torque plate for fluid passage between the piston bores. Bleeder valves installed in top ports provide bleed facilities for the brake head.

OPERATION

WARNING

FLUID MAY CAUSE IRRITATION. AVOID CONTACT WITH EYES OR PROLONGED CONTACT WITH SKIN. DO NOT OPERATE BRAKE AT MORE THAN 2300 P.S.I. OVER-PRESSURIZATION OF BRAKE MAY RESULT IN SEAL DAMAGE CAUSING LOSS OF BRAKING AND POSSIBLE CATASTROPHIC FAILURE.

The brake is actuated by fluid which enters through one of the bleeder ports located in the bosses on top of the torque plate. All piston bores are interconnected by internal passages to allow for free flow of hydraulic fluid. When the brake is actuated, the hydraulic pressure forces the pistons against the lining and carrier assemblies which in turn are forced against the disc creating a braking action. The reaction to the braking action is supplied by the torque pins which also retain the lining and carrier assemblies when the brake pressure is released.

INSTALLATION

WARNING

USE OF IMPROPER FLUIDS WILL AFFECT RUBBER COMPONENTS, RESULTING IN LOSS OF BRAKING AND POSSIBLE CATASTROPHIC FAILURE.

NOTE: Brake heads must be mounted to vehicle with one of the bleeder valves positioned above the fluid inlet port.

Mount the brake to the mounting flange of the axle housing. Shims should not be required since the brake head is designed with enough lining clearance to be axially mislocated in respect to the disc as much as 0.50 [1,27] in either direction. If any of the lining and carrier pins touch the disc, loosen the bolt and adjust pin to clear disc by 0.060 to 0.125 [1,52 - 3,17]. Check to make sure that bolt fully engages the groove in pin and tighten bolt 32 to 38 lbf•ft [43,4 - 51,5 N•m] dry thread torque.

Brake mounting bolts must be SAE Grade 8 and be torqued to the maximum value for the bolt size. Hardened steel washers must be used between the bolt head and mounting flange. DO NOT USE LOCKWASHERS.

See text in axle overhaul manual for brake disc service.

Install the brake supply line connecting the actuation device to the brake head.

BLEEDING THE VEHICLE BRAKE SYSTEM

WARNING

FLUID MAY CAUSE IRRITATION. AVOID ANY CONTACT WITH EYES OR PROLONGED CONTACT WITH SKIN.

Bleed the brake system to remove trapped air as follows:

NOTE: Use bleeder hose on bleeder valves during bleeding operation to keep fluid away from linings.

Keep master cylinder filled during bleeding process.

Actuate brake several times.

Apply brake and open bleeder valve. After fluid flow stops, close bleeder valve and release brake.

Repeat above procedure until no air bubbles are observed in fluid from bleeder valve.

MAINTENANCE

Inspect brake periodically to insure that all boots are tight and that there are no leaks. Inspect for boot deterioration and excessive lining wear.

WARNING

VARIOUS LINING MATERIALS, INCLUDING SINTERED METALLIC TYPES, ARE OFFERED IN THE AFTERMARKET FOR USE ON OFF-HIGHWAY DISC BRAKES. THE USE OF MATERIALS WHICH HAVE NOT BEEN TESTED AND APPROVED CAN LEAD TO PROBLEMS SUCH AS BURNED BOOTS, PISTON SEAL HEAT DETERIORATION, AND POSSIBLE VAPORIZATION OF THE BRAKE SYSTEM HYDRAULIC FLUID. ALSO, THE FRICTION COEFFICIENTS OF THESE MATERIALS MAY NOT BE SUFFICIENT TO PROVIDE THE BRAKE CONTROL AND STOPPING ABILITY REQUIRED AND THE STRUCTURAL INTEGRITY OF THE BOND BETWEEN THE LINING MATERIAL AND CARRIER MAY BE INADEQUATE. THE ULTIMATE RESULT COULD BE A CATASTROPHIC LOSS OF BRAKING LEADING TO PROPERTY DAMAGE OR EVEN LOSS OF LIFE.

Linings and carriers should be replaced when the friction material is worn to 1/8 inch thickness. Remove tire and rim and proceed as follows.

WARNING

FAILURE TO REPLACE LINING WHEN WORN TO LIMITS WILL RESULT IN LOSS OF BRAKING AND POSSIBLE CATASTROPHIC FAILURE.

Loosen the two bolts securing the large torque pins at the end of the brake head. It is not necessary to loosen or remove the two smaller torque pins at the opposite end of the brake head.

Move the two unlocked torque pins away from the disc.

Attach a bleeder hose and open bleeder valve. Use a screwdriver or pry bar inserted between the disc and carrier and lining assembly to press the pistons back into the torque plate piston bores as far as possible. Close bleeder valve.

Rotate the carrier and lining assemblies out of the opened end of the brake.

Install new carrier and lining assemblies, by placing friction material next to the disc and rotating into position in the brake head.

Push the two unlocked pins toward the disc.

Thread the two loosened bolts in until bolts seat in grooves of pins. This can be checked by limited axial movement of pins as the bolts are being seated. Torque bolts 32 to 38 lbf•ft [43,4-51,5 N•m] dry torque.

Pump brake pedal until linings contact the disc. KEEP FLUID RESERVOIR FULL AT ALL TIMES

When new or relined brakes are installed on a machine the brake linings should be burnished in accordance with the following procedure to achieve maximum braking performance:

1. Drive machine at 5 to 10 mph with brake applied at just enough pressure to produce a noticable drag. Heavy smoke and foul odor from the brake lining is normal during this procedure.
2. Continue cycle until disc achieves a temperature of 600°F to 700°F. A surface pyrometer applied to disc after stopping will determine temperature.
3. Permit disc to cool to less than 200° F.
4. Repeat sets 1 and 2.
5. Allow brake to cool within 50° of ambient temperature.
6. Repeat steps 1 and 2 until full braking performance (per applicable government regulations or machine manufacturer's specifications) is achieved.

Inspect disc used with brake head assembly for damage and wear. Replace if disc is 0.125 [3,17] under original thickness. Thickness should be checked at thinnest (most worn) area.

WARNING

CONTINUED USE OF DISC BEYOND MINIMUM THICKNESS MAY RESULT IN LOSS OF BRAKING AND POSSIBLE CATASTROPHIC FAILURE.

OVERHAUL

NOTE: Use only approved parts for brake overhaul.

Remove fluid connection (brake supply line) and remove brake head assembly from the axle. It is usually required that the wheel rim be removed before the brake head assembly is removed.

WARNING

HYDRAULIC FLUID MAY CAUSE IRRITATION. AVOID SKIN AND EYE CONTACT.

Replace all rubber parts if the brake head has had extended use. Otherwise, replace damaged parts as needed.

Inspect carrier and lining assemblies.

Clean torque plate making sure no solvent remains in fluid passages or grooves. Inspect seal grooves and land area between grooves for damage or cracks. Minor nicks and scratches may be blended with crocus cloth. Replace torque plate if corrosion is excessive or if seal grooves are damaged prohibiting proper rebuild of brake.

Inspect pistons for minor scratches and nicks and blend with crocus cloth. If piston is badly nicked or scratched or if the chrome plate is worn off, replace piston.

Lining pins that are deeply grooved should be replaced.

Lubricate packings and pistons with fluid used in brake head or vaseline.

Install backup rings, packings, and boots in the torque plate piston bores.

Install pistons in torque plate as follows:

Position lubricated piston into dust boot and piston bore, holding piston at a slight angle. Insert forefinger between piston and dust boot and rotate fore-finger around piston OD lifting dust boot ID over OD of piston. Make sure OD lip of dust boot remains in the groove in the piston bore.

After piston is through dust boot, center piston by feel over the packings. Apply by hand a turning, thrusting pressure, working piston into and through packings and backup rings.

When assured pistons are through packings and backup rings, pressure other than hand pressure may be used to press pistons the remainder of the way into the piston bores. Snap open end of boot into groove on the pistons.

Lubricate piston plug packings. Install packings and piston plugs in open end of piston bores of torque plate.

Attach cover plate to torque plate with bolts and washers. Torque bolts 145 to 155 lbf•ft [197,0-210,1 N•m] dry threads.

When installing lining pins and bolts, make sure the groove in the pin is directly under the bolt so the bolt can perform its locking and retaining function.

NOTE: Lubricate pins with a corrosion resistant lubricant prior to installation to facilitate next pin removal.

INTENTIONALLY BLANK