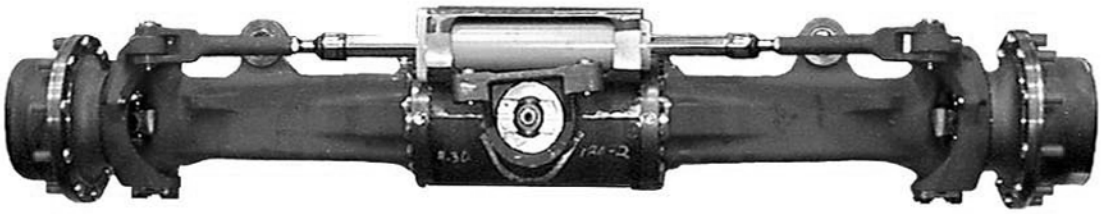
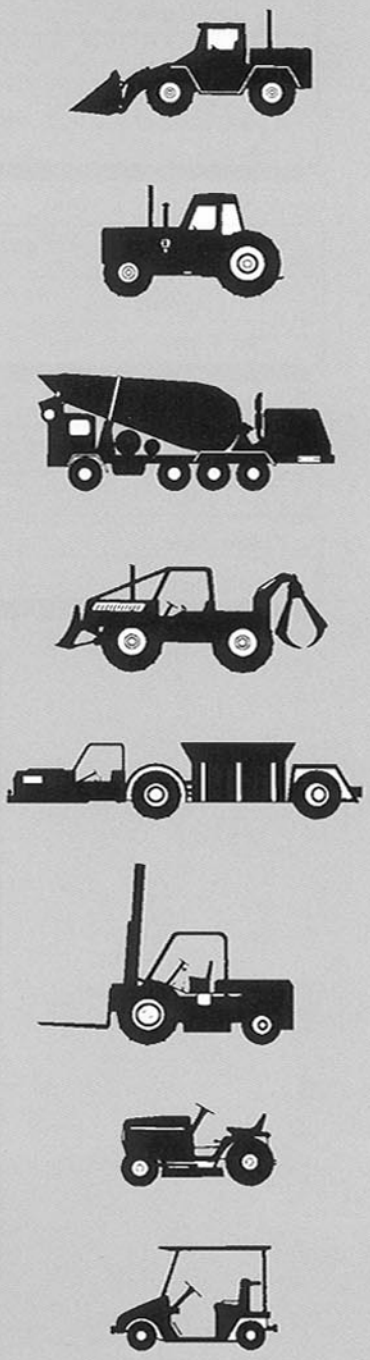
MAINTENANCE MANUAL
MODEL 6052HD
(25S34HD)





SPICER OFF-HIGHWAY COMPONENTS

DANA

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FOREWORD

This manual has been prepared to provide the customer and the maintenance personnel with information and instructions on the maintenance and repair of the Spicer Off-Highway Products Division axle.

Extreme care has been exercised in the design and selection of materials and manufacturing of these units. The slight outlay in personal attention and cost required to provide regular and proper lubrication and inspection at stated intervals, and such adjustments as may be indicated will be reimbursed many times in low cost operation and trouble free service.

In order to become familiar with the various parts of the product, it's principle of operation, troubleshooting and adjustments, it is urged that the mechanic study the instructions in this manual carefully and use it as a reference when performing maintenance and repair operations.

Whenever repair or replacement of components is required, only Spicer Off-Highway Products approved parts as listed in the applicable parts manual should be used. Use of "will fit" or non-approved parts may endanger proper operation and performance of the equipment. Spicer Off-Highway Products Division does not warrant repair or replacement parts, or failures resulting from the use of parts that are not supplied or approved by Spicer Off-Highway Products Division.

Important!! Always furnish the distributor with the serial number and model number when ordering parts.

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Safety Precautions

To reduce the chance of personal injury and/or property damage, the following instructions must be carefully observed.

Proper service and repair are important to the safety of the service technician and the safe, reliable operation of the machine. If replacement parts are required the part must be replaced with one of the same part number or with an equivalent part. Do not use a replacement part of lesser quality.

The service procedures recommended in this manual are effective methods of performing service and repair. Some of these procedures require the use of tools specifically designed for the purpose.

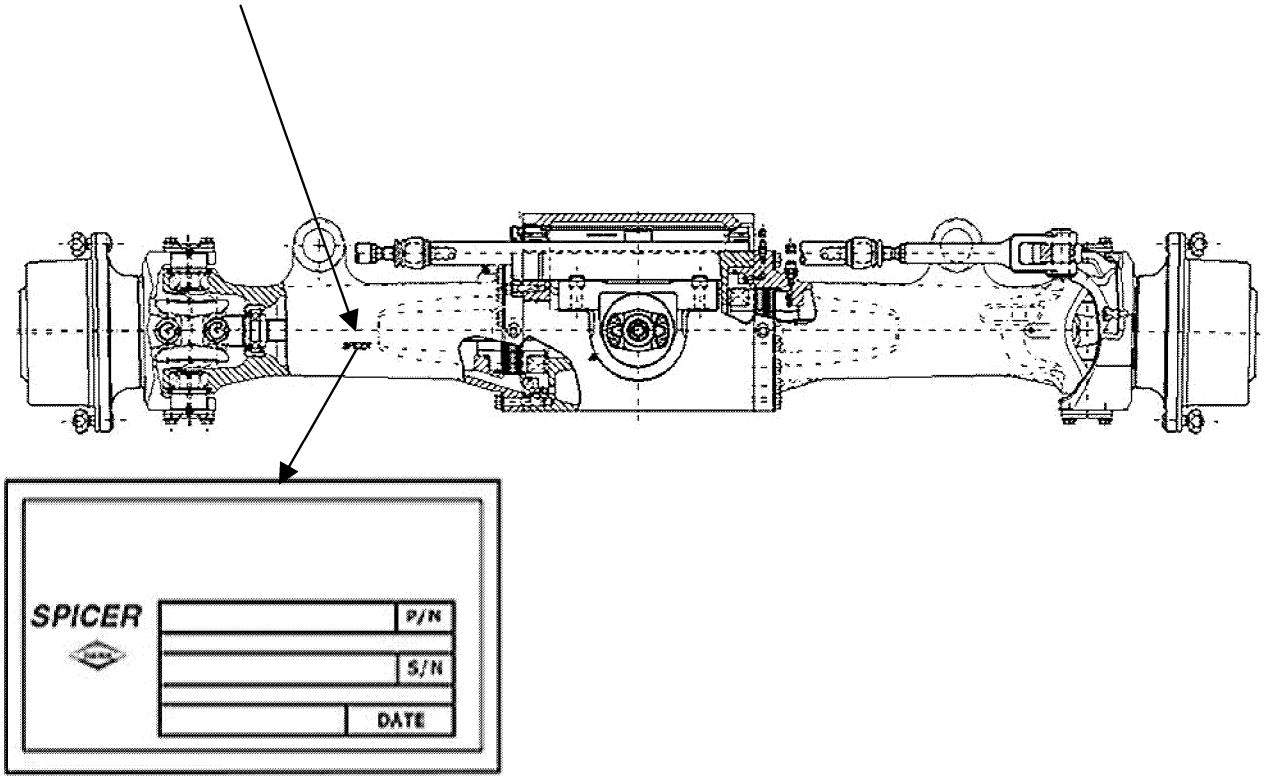
Accordingly, anyone who intends to use a replacement part, service procedure or tool which is not recommended must first determine that neither his safety nor the safe operation of the machine will be jeopardized by the replacement part, service procedure or tool selected.

It is important to note that this manual contains various 'Cautions' and 'Notices' that must be carefully observed in order to reduce the risk of personal injury during service or repair, and the possibility that improper service or repair may damage the unit or render it unsafe. It is also important to understand that these 'Cautions' and 'Notices' are not exhaustive, because it is impossible to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

Identification of Axle

Axle identification information is located on a riveted tag located on the rear, left side axle trumpet.
Axle part number, serial number, build date, and gear ratios are identified on this tag.

The tag is shown 180 degrees out of position in the sketch shown below.



Cleaning and Inspection

Cleaning

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and agitated slowy until parts are thoroughly cleaned of all old lubricants and foreign materials.

Caution

Care should be exercised to avoid skin rashes, fire hazards and inhalation of vapors when using solvent type cleaners.

Bearings

Remove bearings from cleaning fluid and strike larger side of cone flat against a bock of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. When drying bearings, use moisture-free compressed air, being careful to direct air stream across bearings as to avoid spinning. Bearings may be rotated slowly by hand to facilitate the drying process.

Housing

Clean interior and exterior of housings, bearing caps, etc., thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions, providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be throughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be throughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

Caution

Care should be exercised to avoid skin rashes and inhalation of vapors when using alkali cleaners.

Thoroughly dry all parts cleaned immediately by using moisture-free compressed air or soft lintless absorbent wiping rags free of abrasive materials such as metal filings, contaminated oil or laping compound.

Inspection

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

Bearings

Carefully inspect all rollers, cages, and cups for wear, chipping or nicks to determine fitness of bearings for further use. Do not replace a bearing without replacing the mating cup or cone at the same time. After inspection, dip bearings in clean light oil and wrap in clean lintless cloth or paper to protect them until installed.

Oil Seals, Gaskets and Retaining Rings

Replacement of spring loaded oil seals, gaskets, and snap rings is more economical when unit is disassembled than to risk premature overhaul to replace these parts at a future time. Loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing member should be handled carefully, particularly when being installed. Cutting, scratching, or curling under lip of seal seriously impairs its efficiency. At reassembly, lubricate lips of oil seals with Multipurpose Lithium grease. “Grade 2” (MS107C).

Cleaning and Inspection (Cont.)

Gears and Shafts

If magna-flux process is available, use process to check parts. Examine teeth and ground and polished surfaces of all gears and shafts carefully for wear, pitting, chipping, nicks, cracks, or scoring. If gear teeth are cracked or show spots where case hardening is worn through, replace with new gear. Small nicks may be removed with suitable hone. Inspect shafts to make certain they are not sprung, bent, or splines twisted, and that shafts are true. Differential pinions and side gears must be replaced as sets. Differential ring gear and spiral pinion must also be replaced as a set if either is damaged.

Housing and Covers

Inspect housing, covers, planet spider, and differential case to be certain they are thoroughly cleaned and that mating surfaces, bearing bores, etc., are free from nicks or burrs. Check all parts carefully for evidence of cracks or condition which cause subsequent oil leaks or failures.

Reassembly of Axle

The reassembly instructions describe the procedure to be followed when reassembling and installing components of axle. Instructions covering reassembly of opposite side is identical unless otherwise noted.

Important: Class 8.8 and 10.9 and 12.9 fastening hardware have been used in the production of the axle assemblies covered in the manual. A table of proper torque values for the fastener classes above are provided within this manual. The class of hardware may be determined by the markings contained on the head of each capscrew. Class 12.9 torque values needs to be used on all sockethead capscrew used with this assembly.

Torque values specified in text of this manual are for class 8.8, 10.9 hardware where presently used in production. On all axles being overhauled, bolts should be identified as described above and torque value chart consulted for correct torque.

At Reassembly Apply Thread Locking Compound Where Noted

Guidelines for application where to apply:

A. On bolts, capscrews, 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 installation.

Recommended Lubricants For Spicer PS6052 / 25S34HD Axle

Capacities

Each Wheel End	1.5 qts.	(1.42 ltrs.)
Axle Center Section	13.5 qts.	(12.8 ltrs.)
Axle Total capacity	16.5 qts.	(15.6 ltrs.)

Recommendations: Extreme pressure gear lubricant is recommended for use in all drive steer and rigid drive axles except wher explicitly specified differently by Spicer Off-Highway Engineering.
Mineral Based: Acceptable lubricants must meet API GL-5/MT-1 and MIL-PRF2105E qualifications. The highest viscosity grade should be used given the prevailing ambient temperatures.
Synthetics: Synthetic lubricants are recommended for use providing they meet API GL-5/MT-1 qualifications.

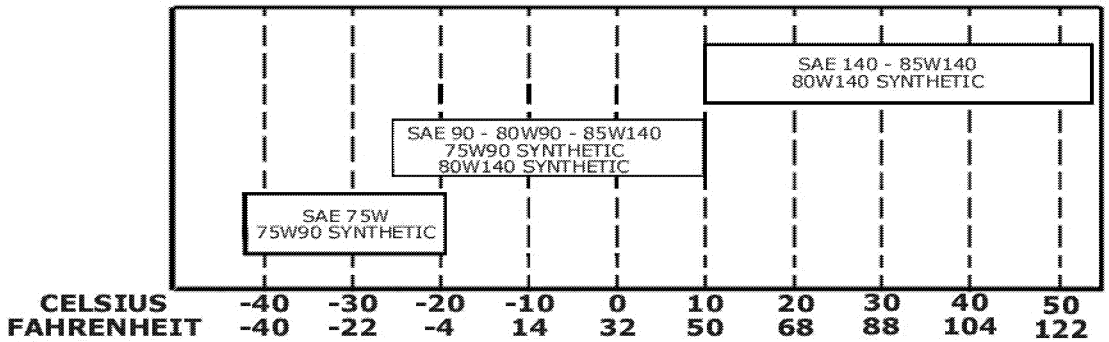
In general, synthetic oils have a lower pressure viscosity response than mineral oil lubricants. As the contact pressure between the gears increases, this produces a thickening of the mineral oil at the contact interface. This increase in viscosity helps to maintain lubricant film thickness reducing the possibility of surface and spalling fatigue. Synthetic lubricants do not thicken as much under pressure unless specifically formulated to do so. Before using a synthetic lubricant in heavy applications, the customer must check with the lubricant supplier on this issue of high pressure rheology.

Normal Oil Change Intervals: Oil change intervals for mineral based lubricants in normal environmental and duty cycle conditions is 2500 hours in all off-highway applications and 10,000 miles in on-highway applications. Severe or sustained high operating temperature or very dusty atmospheric conditions will result in accelerated deterioration or contamination. Judgement must be used to determine the required change intervals for extreme conditions.

Extended Oil Change Interval: Extended oil service may result when using synthetic lubricants. Appropriate change intervals must be determined for each application by measuring oxidation and wear metals, over time, to determine a baseline. Wear metal analysis can provide useful information but an axle should not be removed from service based solely on this analysis. Vehicles which are prone to high levels of ingested water in the axle or water as a result of condensation, should not use extended drain intervals.

Friction Modifiers: Friction modifiers may be used with the lubricant to reduce Posi-Torq (limited slip) differential noise or liquid cooled brake noise. If friction modifiers are used follow instructions on TSB USA 278E.
The use of aftermarket lubricant additives other than those specified is not recommended and may reduce the life of the axle and void warranty.

Viscosity Grade Based on Prevailing Ambient Temperature



Internal Liquid Cooled Brake Fluids

Actuator oils recommended for use in the liquid cooled brake circuit

1. Motor oil — API SE/CD
2. Transmission lubricants meeting the following specs:
   a) Caterpillar — TO-4
   b) John Deere — J20 C, D
   c) Military — MIL-PRF-2104G
   d) Allison — C-4
3. Hydraulic oil
4. Synthetic gear oils

Torque Limits and Specifications

Housing:

Housing Arm/Trumpet Bolts	175-190 ft\lbs (237-257Nm)
Carrier Cover	175-190 ft\lbs (237-257Nm)
Brake Port Fittings	7-10 ft\lbs (9.5-13.5Nm)
Bleeder Screws	7-10ft\lbs (9.5-13.5Nm)

Differential Torques:

Adjusting Ring Clip	15-17 ft\lbs (20.3-23Nm)
Drive Gear Capscrews	120-140 ft\lbs (163-190Nm)
Cap Bolts	75-90 ft\lbs (101-122Nm)
Pinion Nut	240-300 ft\lbs (325-400Nm)

Wheel End Assembly:

Hub Retainer Capscrews (with Loctite 271)	115-120 ft\lbs (156-162Nm)
Drive Flange retaining Screws	7-12 ft\lbs (10-16Nm)
Wheel End fill/Drain Plug	40-45 ft\lbs (54-61Nm)

Knuckles and Steer Cylinder

King Pin Retainer Bolts	90-100 ft\lbs (122-136Nm)
Steer Cylinder Mounting Bolts	90-100 ft\lbs (122-136Nm)
Tie Rod Socket Assembly (with Loctite 271)	313-367 ft\lbs (260-280Nm)
Tie Rod Lock Nut \ Steer Arm	192-207 ft\lbs (269-280Nm)

Torque For Bolts, Capscrews, Studs and Nuts as Supplied

Grade 5 Identification, 3 Radial Dashes 120 Apart on Head of Bolt

Grade 5

Grade 8 Identification, 6 Radial Dashes 60 Apart on Head of Bolt

Grade 8

Fastener Size	Lubricated and Plated		Lubricated and Plated	
1/4-20 1/4-28	80-90 Lbs. In.	[9-10 N.m]	110-120 Lbs. In.	[13-14 N.m]
5/16-18 5/16-24	180-200 Lbs. In.	[21-23 N.m]	215-240 Lbs. In.	[24-27 N.m]
3/8-16 3/8-24	25-28 Lbs. Ft.	[34-38 N.m]	35-40 Lbs. Ft.	[48-54 N.m]
7/16-14 7/16-20	40-45 Lbs. Ft.	[54-61 N.m]	60-65 Lbs. Ft.	[82-88 N.m]
1/2-13 1/2-20	65-70 Lbs. Ft.	[88-95 N.m]	90-100 Lbs. Ft.	[125-135 N.m]
9/16-12 9/16-18	90-100 Lbs. Ft.	[125-135 N.m]	125-140 Lbs. Ft.	[170-190 N.m]
5/8-11 5/8-18	125-140 Lbs. Ft.	[170-190 N.m]	175-190 Lbs. Ft.	[240-260 N.m]
3/4-10 3/4-16	220-245 Lbs. Ft.	[300-330 N.m]	300-330 Lbs. Ft.	[410-450 N.m]
7/8-9 7/8-14	330-360 Lbs. Ft.	[450-490 N.m]	475-525 Lbs. Ft.	[645-710 N.m]
1-8 1-12	475-525 Lbs. Ft.	[645-710 N.m]	725-800 Lbs. Ft.	[985-1085 N.m]
1-1/8-7 1-1/8-12	650-720 Lbs. Ft.	[880-975 N.m]	1050-1175 Lbs. Ft.	[1425-1600 N.m]
1-1/4-7 1-1/4-12	900-1000 Lbs. Ft.	[1220-1360 N.m]	1475-1625 Lbs. Ft.	[2000-2200 N.m]

Torque/Tension Charts

Coarse Threated Fasteners

Thread Size Class 8.8	Torque	
	Nm	Lb-Ft
M5X0.8	5-6	43-53
M6X1	8-10	71-88
M8X1.25	20-25	177-221
		Lb-In
M10X1.5	40-45	30-33
M12X1.75	70-78	52-59
M14X2	110-125	81-92
M16X2	170-190	125-140
M20X2.5	340-380	251-280
M24X3	580-650	428-479
M30X3.5	1150-1300	848-959
M36X4	2000-2250	1479-1660

Coarse Threated Fasteners

Thread Size Class 10.9	Torque	
	Nm	Lb-In
M5X0.8	7-8	62-71
M6X1	12-14	106-124
		Lb-Ft
M8X1.25	30-35	22-26
M10X1.5	60-65	40-48
M12X1.75	100-110	74-81
M14X2	155-180	114-133
M16X2	240-270	177-199
M20X2.5	450-500	332-369
M24X3	800-900	590-664
M30X3.5	1600-1800	1180-1328
M36X4	2800-3150	2065-2323

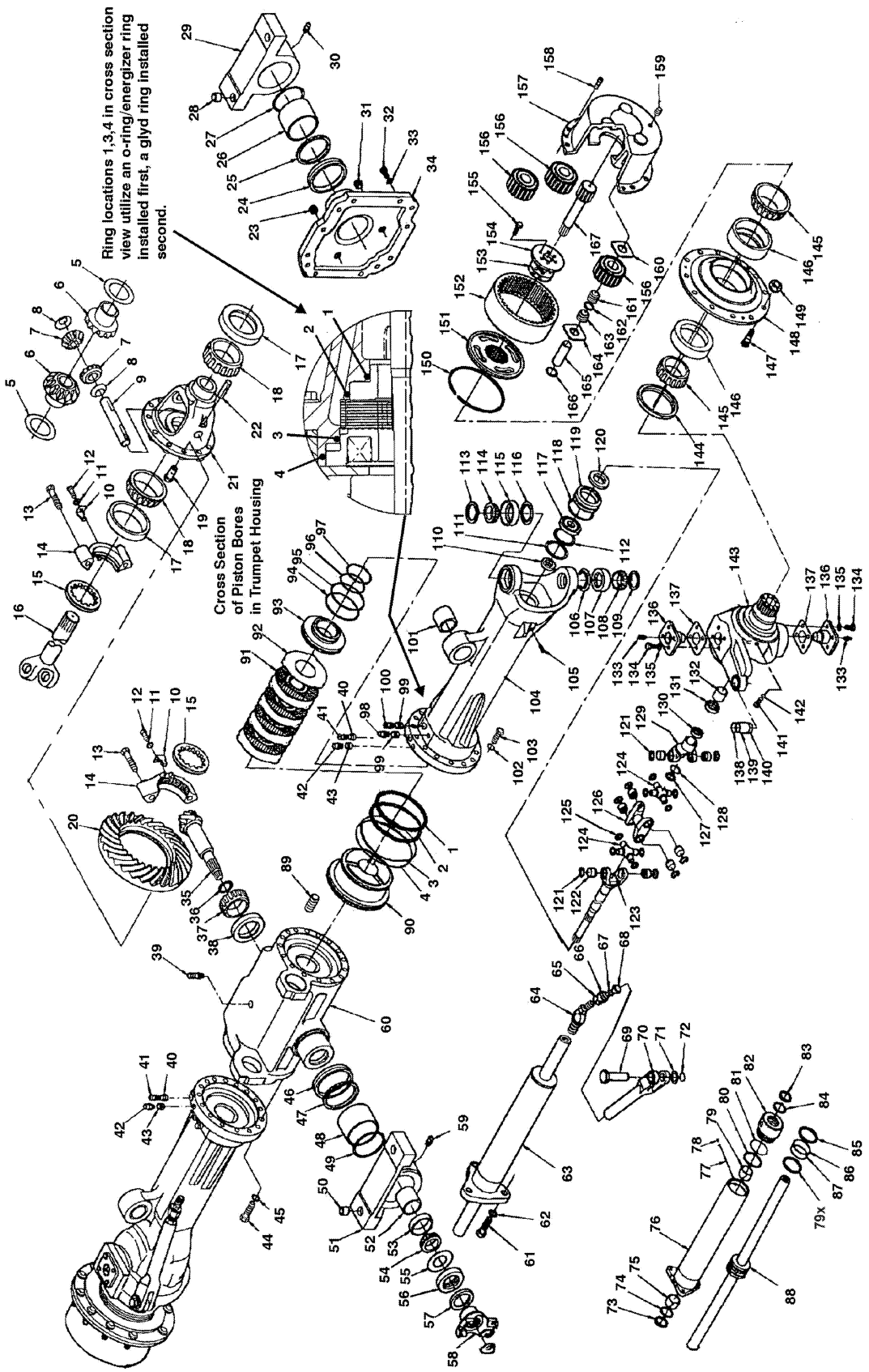
Coarse Threated Fasteners

Thread Size Class 12.9	Torque	
	Nm	Lb-In
M5X0.8	8-10	71-88
M6X1	14-16	124-142
		Lb-Ft
M8X1.25	34-40	26-30
M10X1.5	70-75	52-55
M12X1.75	115-130	85-96
M14X2	180-210	133-155
M16X2	280-320	207-236
M20X2.5	550-600	406-443
M24X3	900-1050	664-774
M30X3.5	1850-2100	1364-1549
M36X4	3250-3700	2397-2729

SAE "O" Ring Thread

Thread Size	Torque	
	Nm	Lb-Ft
.3125-24	4-7	3-5
.3750-24	7-11	5-8
.4375-20	9-13	7-10
.5000-20	14-18	10-13
.5625-18	16-20	12-15
.7500-16	27-34	20-25
.8750-14	41-47	30-35
1.0625-12	61-38	45-50
1.3125-12	88-102	65-75
1.6250-12	102-115	75-85
1.8750-12	102-115	75-85

NOTE: Socket head capscrews are all Class 12.9


Ring locations 1,3,4 in cross section view utilize an o-ring/energizer ring installed first, a glyd ring installed second.
Cross Section of Piston Bores in Trumpet Housing

Model PS6052HD (25S34HD)
Axle Parts Description

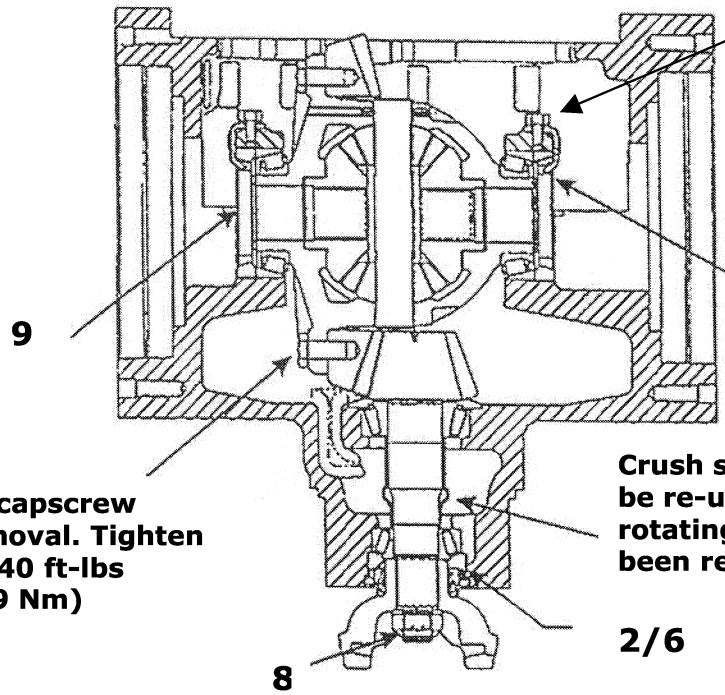
Item No.	Description	Qty
1)	Piston Rings and O-Rings	2
2)	O-Rings	2
3)	Piston Rings and O-Rings	2
4)	Piston Rings and O-Rings	2
5)	Thrust washers	2
6)	Differential Gear	2
7)	Differential Pinion	2
8)	Thrust Washer	2
9)	Shaft – Differential	1
10)	Adjusting Ring Clip	2
11)	Flat Washer	2
12)	Hex Bolt	2
13)	Capscrew	4
14)	Differential Bearing Cap	2
15)	Adjusting Ring	2
16)	Axle Shaft	2
17)	Bearing Cup – Roller	2
18)	Bearing Cone – Roller	2
19)	Drive Gear Screw	12
20)	Ring Gear	
21)	Differential Case – Standard	1
22)	Roll Pin	1
23)	Plug	1
24)	Wear Ring	2
25)	Thrust washer – Bearing	2
26)	Spindle Bushing	2
27)	O-Ring	2
28)	Locating Pin	4
29)	Trunnion Beam – Rear	1
30)	Grease Fitting	1
31)	Plug Pipe – Internal Drive	1
32)	Hex Bolt	14
33)	Flat Washer	14
34)	Carrier Cover	1
35)	Ring and Pinion Assy, incl. #20	1
36)	Shim	1
37)	Bearing Cone – Roller	1
38)	Bearing Cup – Roller	1
39)	Vent	1
40)	Seat Insert	See#99
41)	Bleeder Screw	See #100
42)	Brake Fitting	See #98
43)	Seat Insert	See #99
44)	Hex Bolt	36
45)	Flat washer	36
46)	Grease Seal	2
47)	Thrust Bearing – Bearing	2
48)	Trunnion Bushing	2
49)	"O"-Ring	2
50)	Locating Pin	4
51)	Trunnion Beam – Rear	1
52)	Spacer	1
53)	Bearing Cup – Roller	1
54)	Bearing Cone – Roller	1
55)	Thrust Washer – Bearing	1
56)	Oil Seal	1
57)	Deflector – Seal	1
58)	End Yoke	1
59)	Grease Fitting	2
60)	Carrier Sub Assy incl 17 & 18	1
61)	Hex Bolt	3
62)	Flat washer	3
63)	Cylinder Assembly – Steering	1
64)	Socket Assembly – Steering	2
65)	Large Retaining Wire	2
66)	Boot	2
67)	Small Retaining Wire	2
68)	Jam Nut	2
69)	Clevis Pin	2
70)	Steering Arm	2
71)	Washer	2
72)	Snap Ring	2
73)	Wiper	2
74)	U-Cup	2

75)	Wear Ring	1
76)	Case Assembly	1
77)	Retaining Wire	1
78)	Capscrew	1
79)	Wear Ring	1
80)	"O"-Ring	1
81)	Back Up Ring	1
82)	Cylinder Head	1
83)	Wiper	1
84)	U-Cup	1
85)	Wear Ring	1
86)	Piston Seal	1
87)	Expander	1
88)	Piston Shaft Assembly	1
89)	Spring - Compression	12
90)	Inner Piston	1
91)	Disc Assembly - Friction	8
92)	Plate – Lining Stop	10
93)	Service Piston	2
94)	Piston Rings & O-Rings	2ea.
95)	Piston Rings & O-Rings	2ea.
96)	O-Rings	2
97)	Piston Rings & O-Rings	2
98)	Hyd. Brake Fitting	4
99)	Seat Insert	8
100)	Bleeder Screw	4
101)	Bushing – Bronze	A/R
102)	Flat Washer –	See #4 5
103)	Bolt – Hex –	See #4 4
104)	Housing - Trumpet	2
105)	Screw – Set	2
106)	Grease Retainer	4
107)	Bearing Cup	4
108)	Bearing Cone	4
109)	Grease Seal	4
110)	Bearing Retainer Ring	2
111)	Snap Ring	2
112)	Oil Baffle	2
113)	Grease Seal – See #109	
114)	Bearing Cone – See #108	
115)	Bearing Cup – See #107	
116)	Grease Retainer – See #109	
117)	Bearing – Single Row Ball	2
118)	O-Ring	2
119)	Axle Shaft Retainer	2
120)	Oil Seal	2
121)	Snap Ring	16
122)	Bearing Race Assy- U-Joint	16
123)	Axle Shaft	2
124)	Cross, U-Joint	4
125)	Seal Assembly	16
126)	Yoke, Center	2
127)	Oil Seal	2
128)	Snap Ring	2
129)	End Yoke	2
130)	Oil Seal	2
131)	Oil Seal	2
132)	Spindle Bushing	2
133)	Grease Fitting	2
134)	Bolt, Hex	16
135)	Flat Washer	16
136)	King Pin Cap	4
137)	King Pin Shim	A/R
138)	O-Ring	4
139)	Bushing	2
140)	See #138	
141)	Stop Bolt	2
142)	Lock Nut	2
143)	Steer knuckle Rt & Lft Side	1ea.
144)	Oil Seal	2
145)	Bearing Cone	4
146)	Bearing Cup	4
147)	Wheel Bolt – RH	20
148)	Wheel Hub	2
149)	Wheel Nut	20
150)	Snap Ring	2

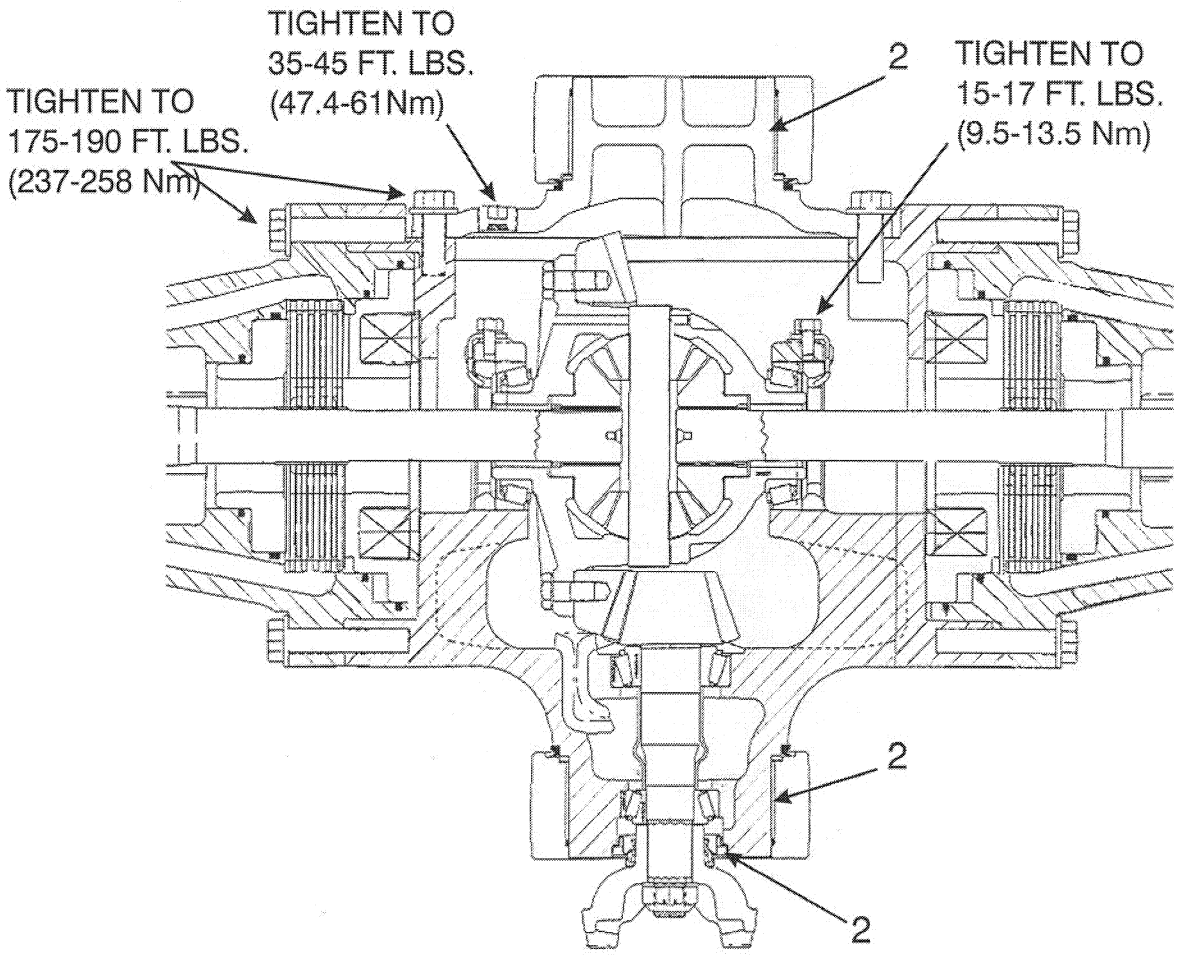
151)	Planetary Hub	2
152)	Planetary Ring Gear	2
153)	Shim Adj - .002	A/R
153A)	Shim Adj - .003	A/R
153B)	Shim Adj - .005	A/R
153C)	Shim Adj - .010	A/R
153D)	Shim Adj - .020	A/R
153E)	Shim Adj - .030	A/R
154)	Retainer Plate	2
155)	Bolt – Hex	12
156)	Planet Gear	6
157)	Planetary Drive Flange	2
158)	Socket Head Screw	4
159)	Pipe Plug	2
160)	Drive Flange Washers	12
161)	Needle Bearings	32
162)	Thrust Washers	6
163)	Needle Bearings	32
164)	See #160	
165)	Planet Gear Shaft	6
166)	Snap Ring	6
167)	Input Gear	2

AXLE ASSEMBLY INSTRUCTIONS

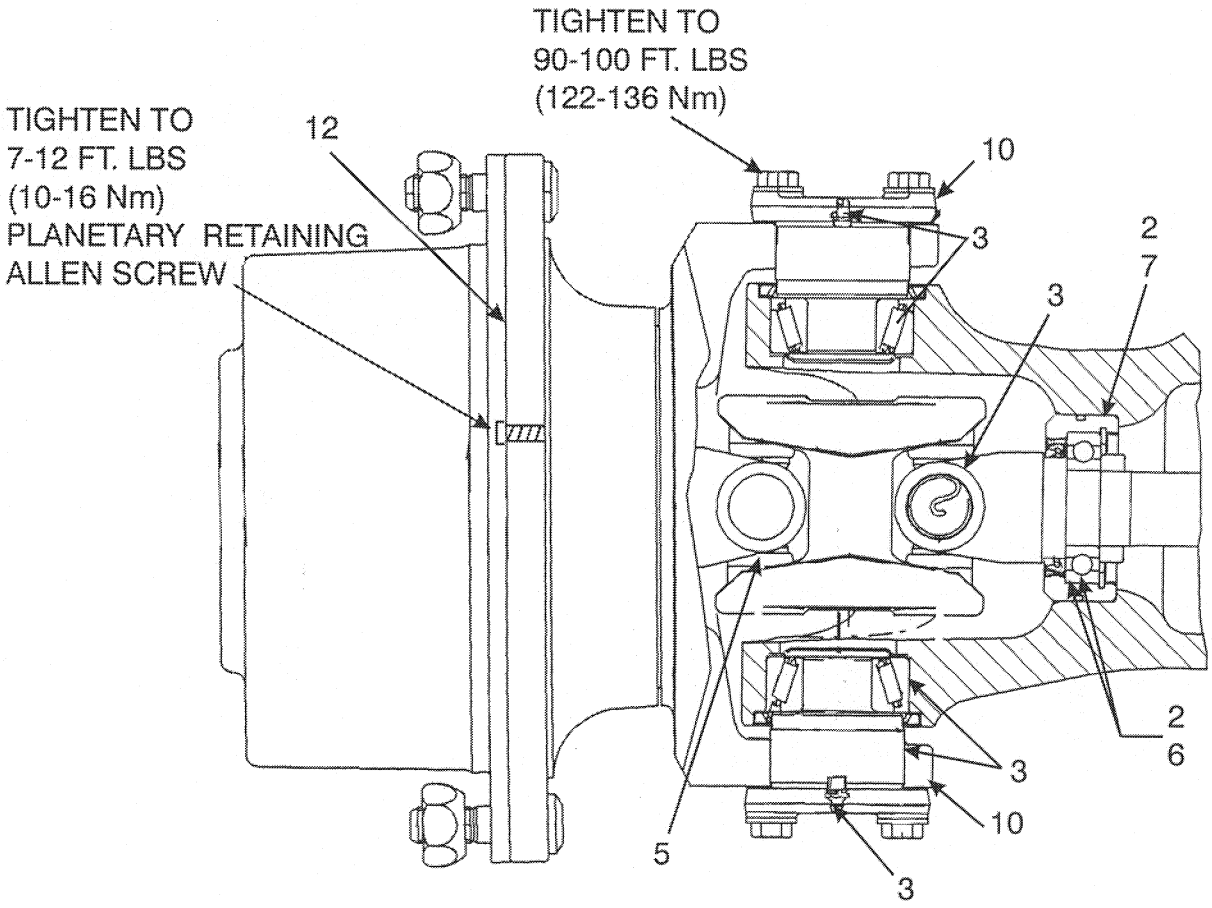
1. Surface must be dry and free from Sealing compounds, nicks, burrs, and rust.
2. Coat with EP lithium grease Grade 2 (MS107C)
3. Coat with EP lithium grease Grade 2 (MS107D)
4. Coat with EP lithium grease Grade 1 (MS107B)
5. Use with Loctite 271 threadlocker.
6. Use Permatex #2 sealer.
7. Apply Loctite 609 on bushing o.d.
8. Tighten pinion nut to 220/280 ft/lbs (298-380Nm) to obtain rolling torque of 20-40 in-lbs(2.25-4.5Nm). Rotate the pinion 3 complete revolutions to seat the bearings; during fourth revolution take highest reading as measured torque.
9. Adjust nuts to obtain proper differential case position -.004-.008 backlash. Torque nuts to 85 ft-lbs (115Nm) to preload bearings, install lock clip.
10. Shim top and bottom equally to obtain 8-15 ft-lbs (10.8-20 Nm) of effort required to rotate the knuckle at the king pin. With the tie rod assembly attached an effort of 15-25 ft-lbs (20-34Nm) is required.
11. Install shims between knuckle and retainer to achieve 50-90 in-lbs (5.6-10.1Nm) rotating torque without oil seal installed.
12. Apply continuous bead of Loctite 515 inside wheel bolt circle. Clamp wheel end assembly for at least 15 minutes in 4 locations around bolt circle.
13. Torque to 313-367 ft-lbs (424-497Nm)
14. Torque to 192-207 ft-lbs (268-280Nm)
15. If a thermal assembly aid is needed or is being used (expanding by heating to 275F (–25 /+0) [135C –3.90 /+0]) a check must be made after parts have reached the same temperature within 20F [-6.7C] of ambient to be sure the bearing is positioned solidly against it's respective shoulder. Check by attempting to slip a .002" feeler gage between the bearing and the mating part.



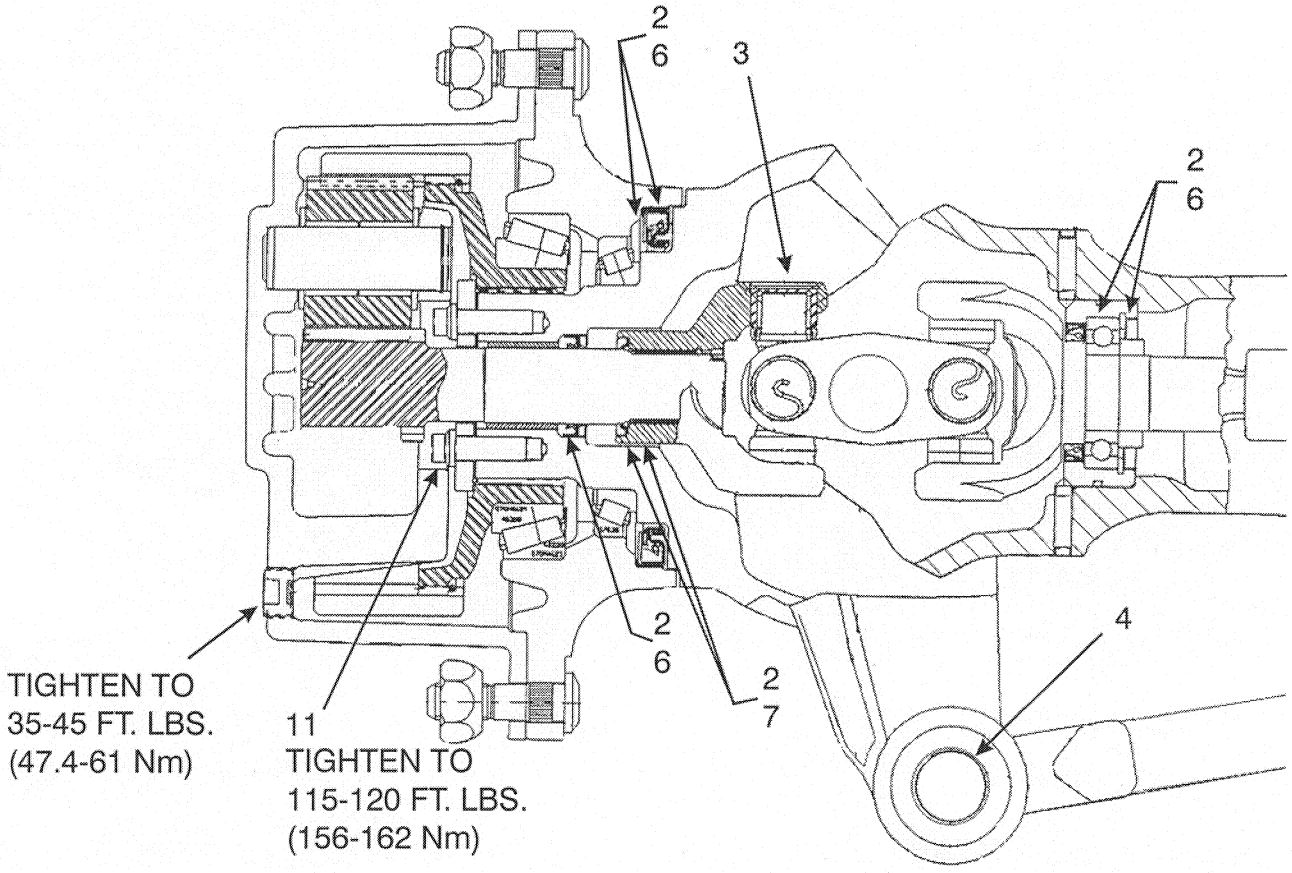
Refer to page 14 for reference number identification



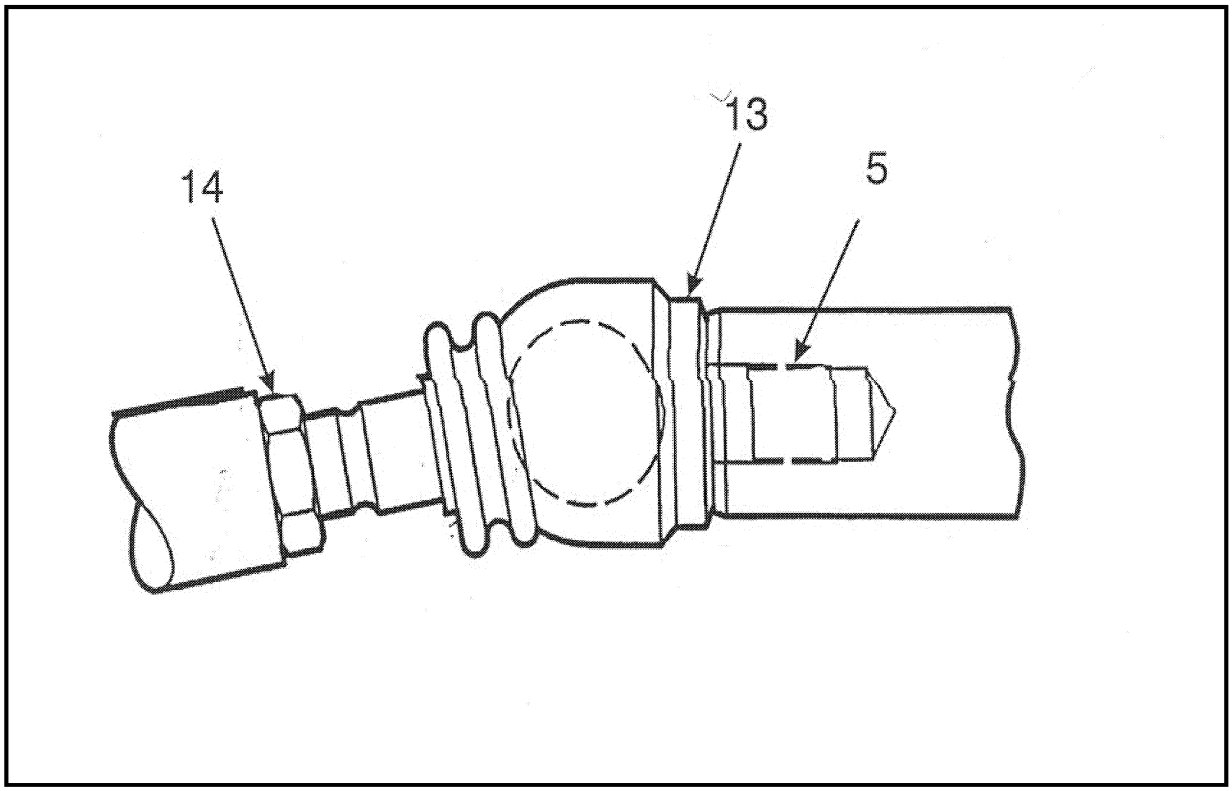
Refer to page 14 for reference number identification



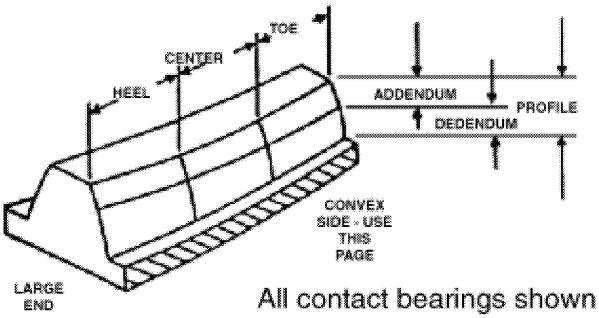
Refer to page 14 for reference number identification

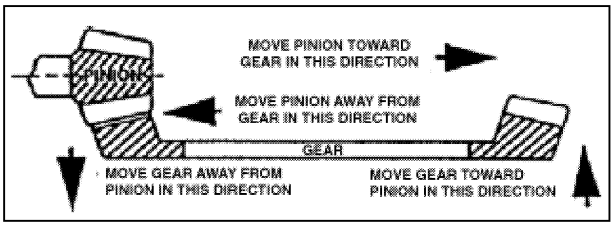


Refer to page 14 for reference number identification



Spiral Bevel and Hypoid Tooth Bearing Contact Chart





All contact bearings shown below are on **Right Hand** spiral ring gear - the drive is on the convex side of the tooth.

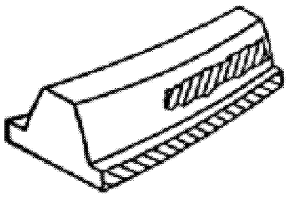
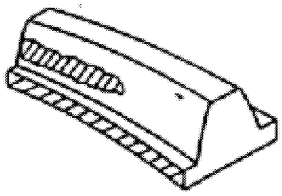


Fig. 1
Typical preferred bearing on both sides of tooth while under a light load.



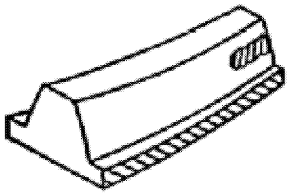
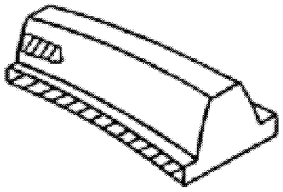


Fig. 2
Toe bearing on both sides of tooth - gear set noisy. To move bearing toward heel increase backlash within limits by moving gear away from pinion.



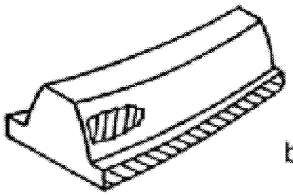
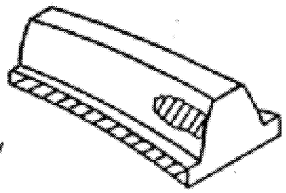


Fig. 3
Heel bearing on both sides of tooth - gear set noisy and could result in early gear failure. To move bearing toward toe decrease backlash within limits by moving gear toward pinion.



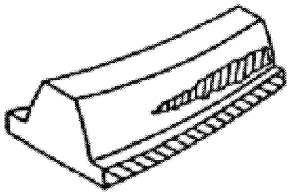
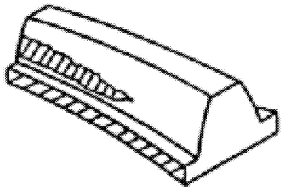


Fig. 4
Low bearing on gear and high bearing on pinion. Correct by pulling pinion away from gear (increase mounting distance).



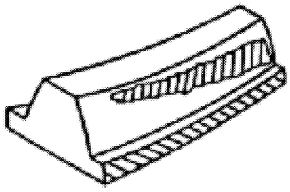
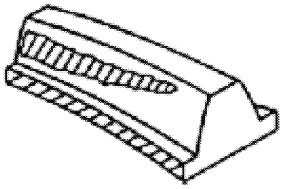


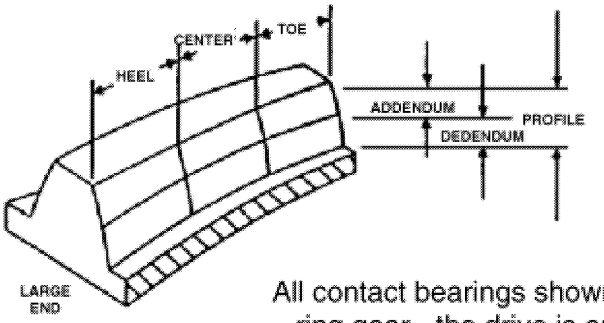
Fig. 5
High bearing on gear and low bearing on pinion. Correct by moving pinion toward gear (decrease mounting distance).

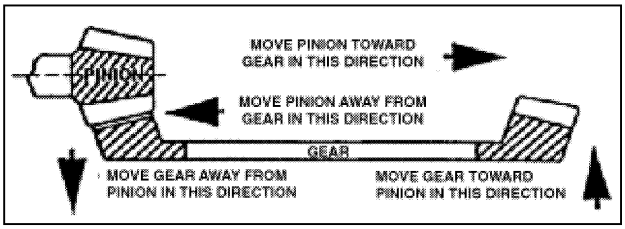


Backlash

Backlash should be measured with a dial indicator rigidly mounted with the stem perpendicular to the tooth surface at the extreme heel.

Spiral Bevel and Hypoid Tooth Bearing Contact Chart





All contact bearings shown below are on **Left Hand** spiral ring gear - the drive is on the convex side of the tooth.

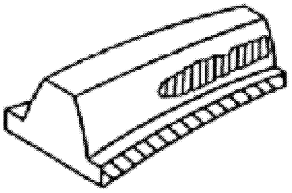


Fig. 1
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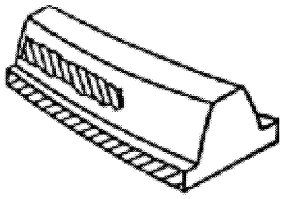


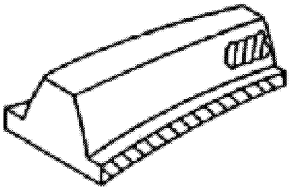
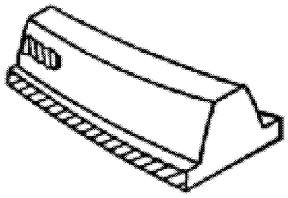


Fig. 2
Toe bearing on both sides of tooth - gear set noisy. To move bearing toward heel increase backlash within limits by moving gear away from pinion.



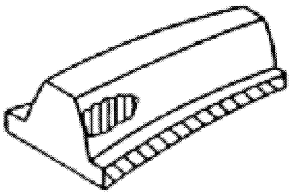
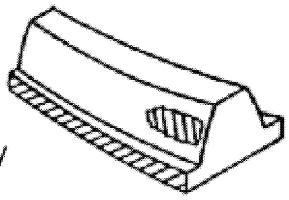


Fig. 3
Heel bearing on both sides of tooth - gear set noisy and could result in early gear failure. To move bearing toward toe decrease backlash within limits by moving gear toward pinion.



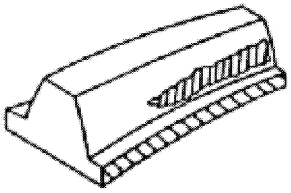
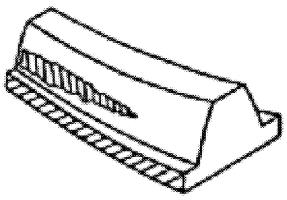


Fig. 4
Low bearing on gear and high bearing on pinion. Correct by pulling pinion away from gear (increase mounting distance).



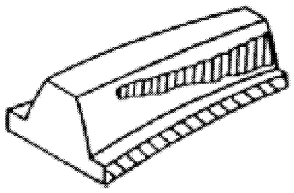
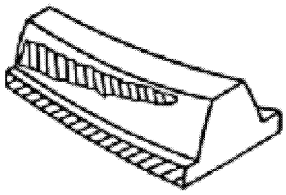


Fig. 5
High bearing on gear and low bearing on pinion. Correct by moving pinion toward gear (decrease mounting distance).



Backlash

Backlash should be measured with a dial indicator rigidly mounted with the stem perpendicular to the tooth surface at the extreme heel.

Maintanance Intervals and Procedures

Checking Oil Level in Drive Steer Axles

For off-highway operation, check lubricant level after each 250 hours of operation. Always maintain lubricant level to bottom of filler plug hole. Drain oil every 1000 operating hours or one year, whichever comes first.

To check oil levels in axles with differential drive and planetary wheel ends, the axles should be run first, then allowed to stand for a minimum of five minutes on a level surface. This procedure will allow the oil to drain back to it's normal level. After the five minute interval proceed as follows; remove oil filler plug in rear of axle housing for oil level inspection. If the oil level is not to the bottom of the filler hole add lubricant as needed.

Checking and Filling Planetary Wheel Ends

Always check lubricant level in the wheel end with the wheel hub filler/drain plug hole at 3 or 9 o'clock. Remove the filler/drain plug; if the oil level is below the fill hole add lubricant as necessary. Reinstall the plug.

Filling Drive Steer Axles

Fill axle housing through filler hole until lubricant is at bottom of filler hole. Axles with planetary wheel ends; follow procedure in "checking and filling planetary wheel ends."

Drive Steer Joint Lubrication

Lubricate the axle shaft universal joints every time the units are disassembled with E.P. lithium grease, Grade 2 – (MS107D) or equivalent. Grease king pins every 50 operating hours with the same type of lubricant..

Draining

Draining is best accomplished immediately after vehicle has been operated a short time or completed a short trip. The lubricant is then warm and will flow freely, allowing full drainage in minimum time. This is particularly desirable in cold weather.

Housing – remove lower plug on axle housing cover and allow sufficient time for lubricant to drain. Planetery wheel ends – rotate wheel until filler/drain hole is down. Remove plug and allow sufficient time for draining.

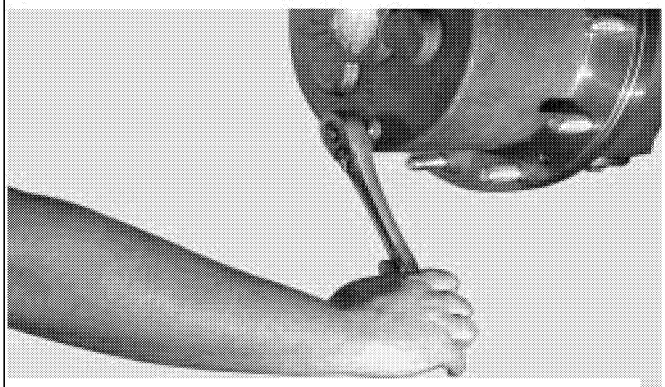
Flushing

After draining, axles should be flushed. Replace drain plug and fill axles to proper lever with a light fushing oil or fuel oil. Operate the axle for a short period of time in low gear at 1000 to 1500 rpm engine speed with the vehicle on a level surface. Be sure to drain all flushing oil before refilling with new oil. Inspect the magnetic drain plug for metal or other foreign matter indicative of wear or possible problems.

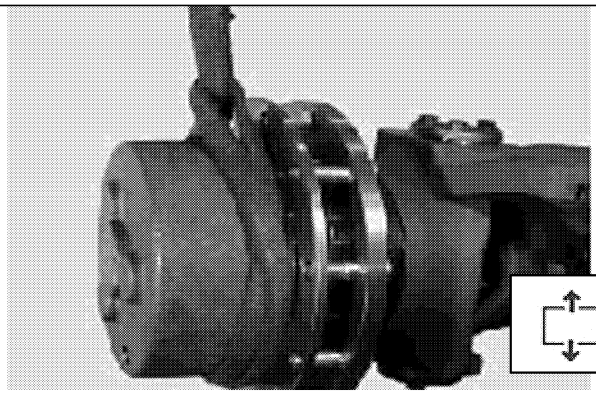
SYMBOLS

	Disassembly of assembly groups
	Reassemble to form assembly group
	Remove obstruction parts
	Reinstall - remount parts which had obstructed disassembly
	Attention! Important Notice
	Check - adjust e.g. torque, dimensions, pressures etc.
	T = Special tool P = Page
	Note direction of installation
	Visual inspection
	Possibly still serviceable, renew if necessary
	Renew at each reassembly
	Unlock - lock e.g. split pin, locking plate, etc.
	Lock - adhere (liquid sealant)
	Guard against material damage, damage to parts
	Mark before disassembly, observe marks when reassembled
	Filling - topping up - refilling e.g. oil, cooling water, etc.
	Drain off oil, lubricant
	Tighten - clamp; tightening a clamping device
	To clean

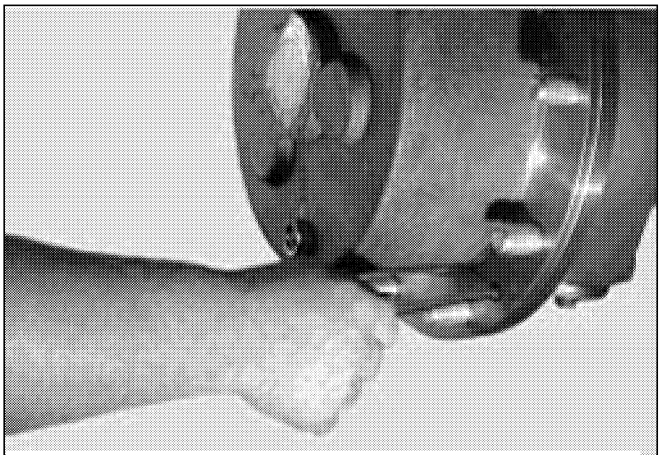
Removal of Wheel Ends



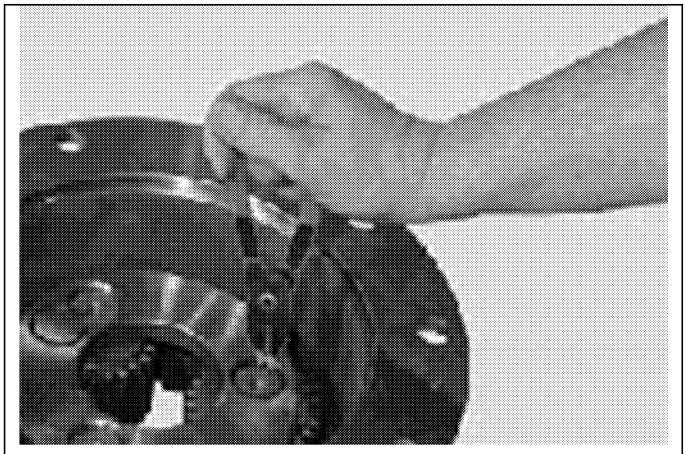
1a. Remove planetary drain plug and drain oil from axle.



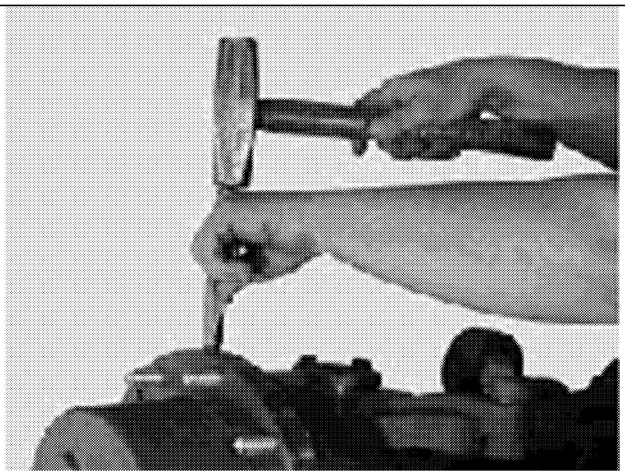
4a. use a strap and proper lifting device to support wheel end during removal.



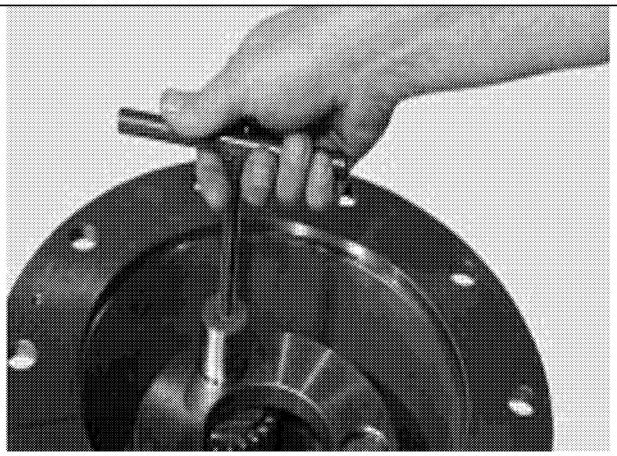
2a. Remove planetary retaining screws two (2) places.



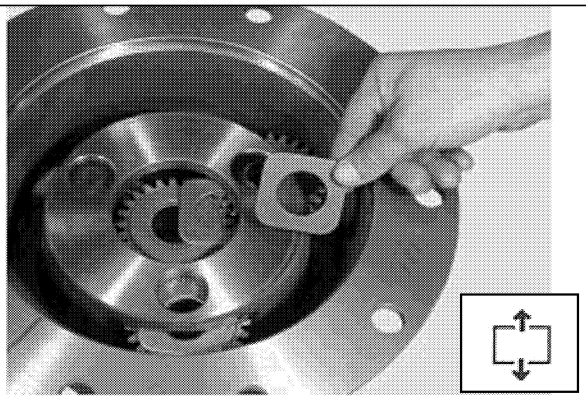
5a. Remove planet shaft retaining snap rings.



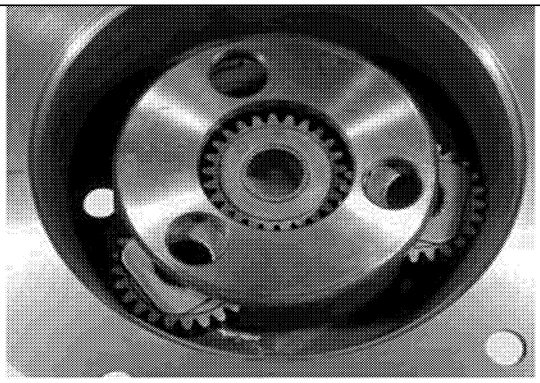
3a. Using proper tool, separate the drive flange from the hub.



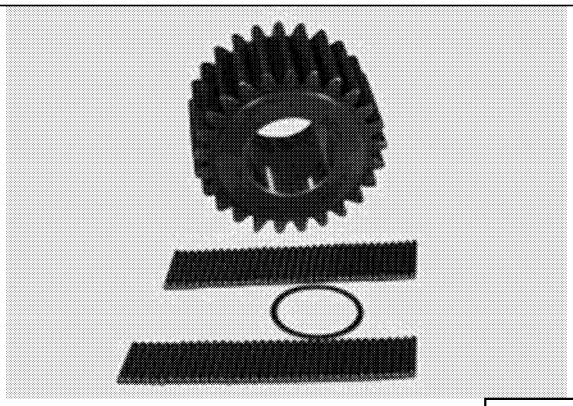
6a. Remove planet shafts using removal and installation tool. *Tool drawing shown on page 66.*



7a. Remove planet thrust washers.

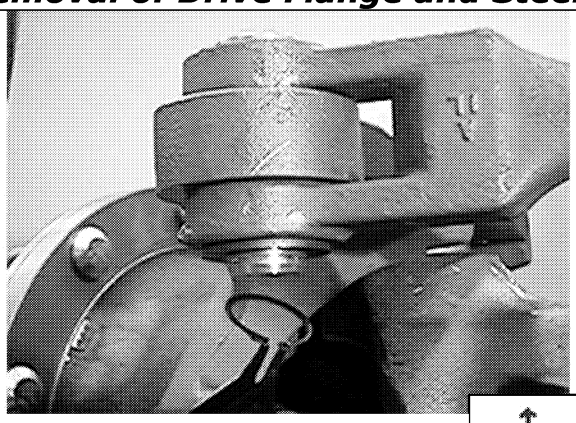


8a. Remove planet gear assemblies.



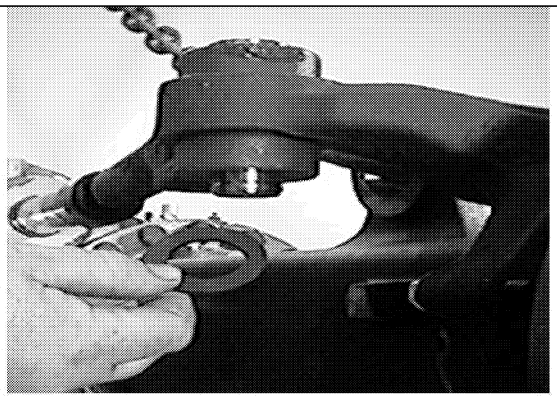
9a. Place planet gears on shop cloth to prevent damage to teeth.

Removal of Drive Flange and Steer Knuckle

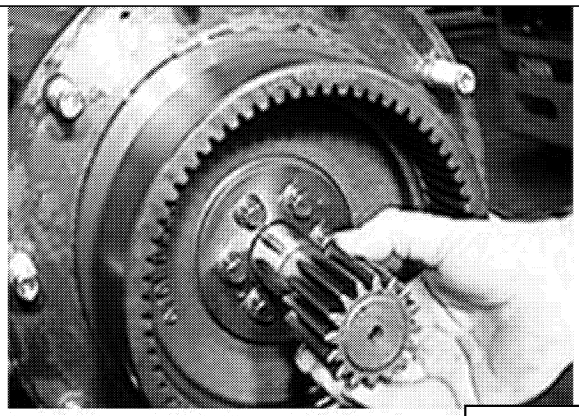


1b. Remove snap ring.

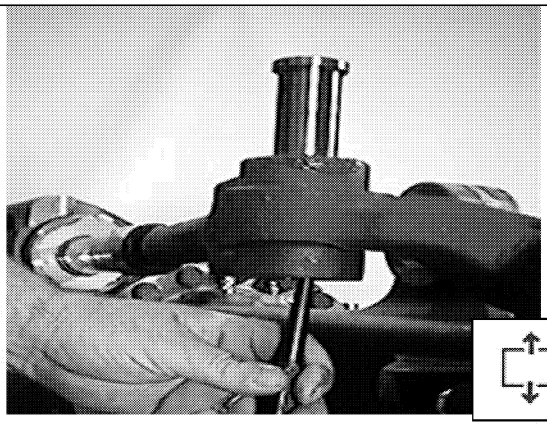
4b. Remove o-ring from steer arm.



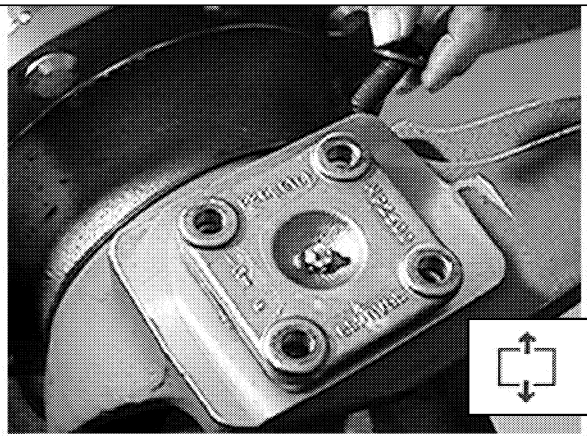
2b. Remove thrust washer.



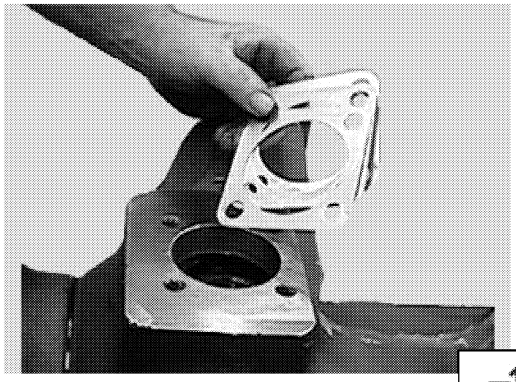
5b. Remove sun gear shaft.



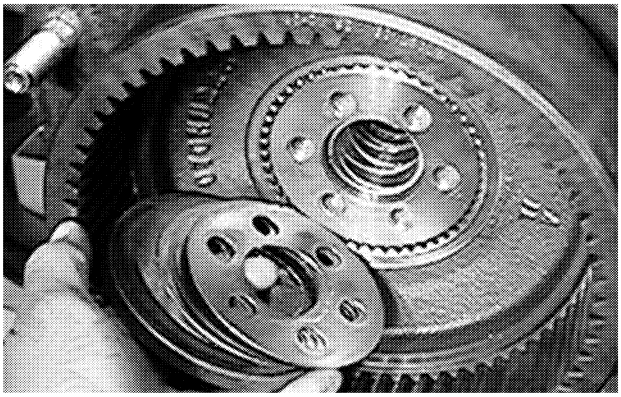
3b. Drive pin out of steer arm.



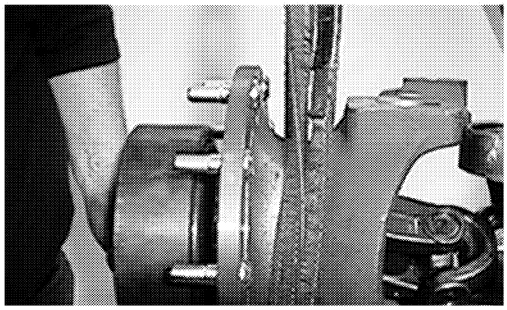
6b. Remove king pin capscrews and remove king pin.



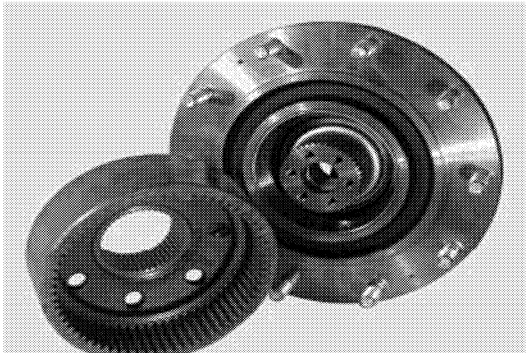
7b. Remove shims.



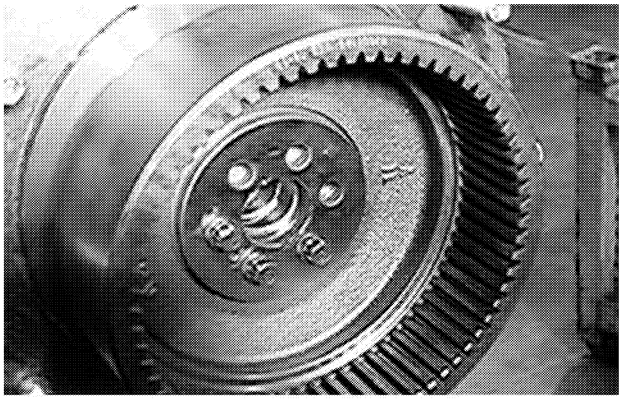
10b. Remove retaining plate and shims.



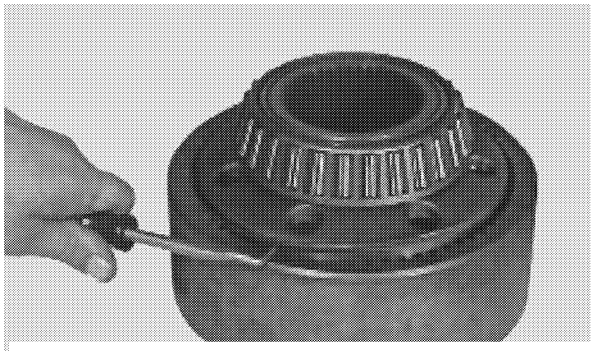
8b. Remove drive flange and knuckle assembly from axle housing.



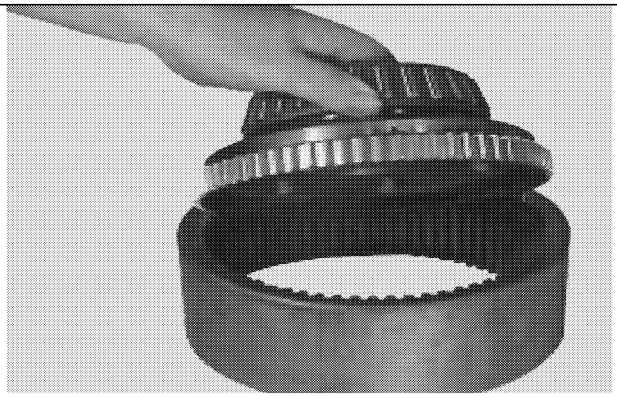
11b. Remove planetary ring gear assembly.



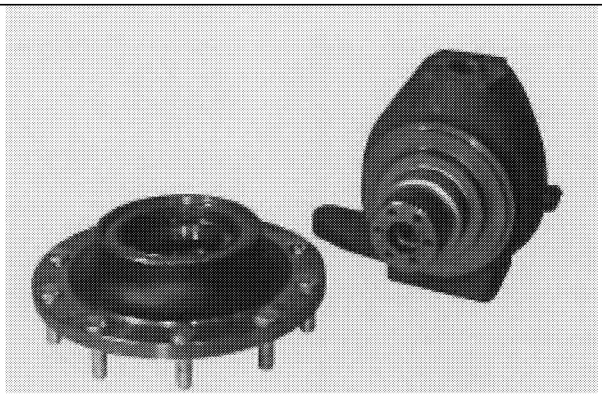
9b. Remove retainer capscrews.



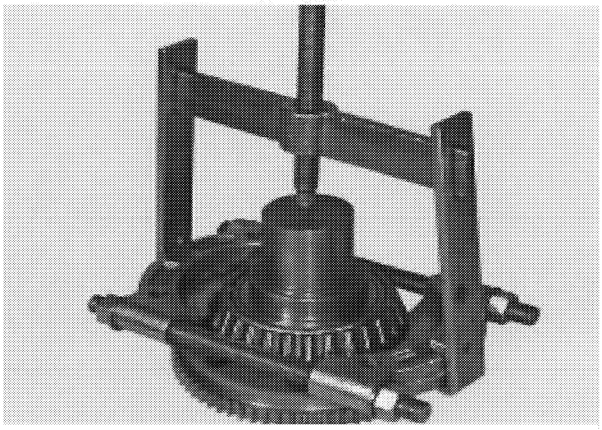
12b. Remove ring gear hub retaining snap ring.



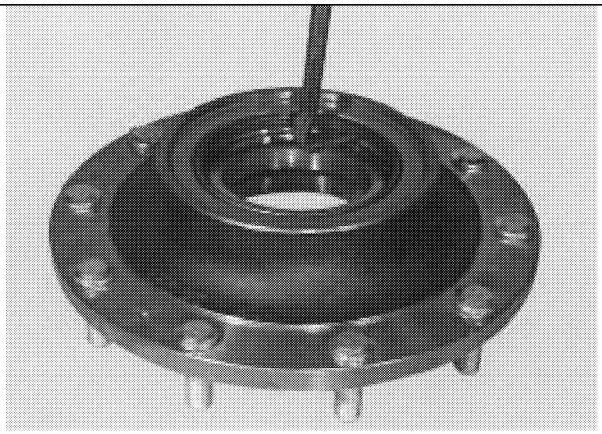
13b. Remove hub from planetary ring gear.



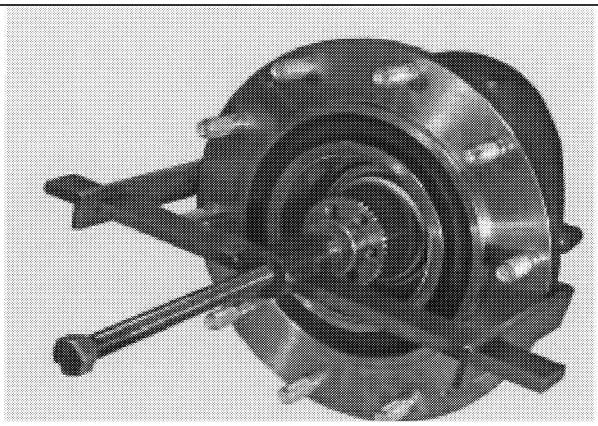
16b. Remove hub from steering knuckle assembly.



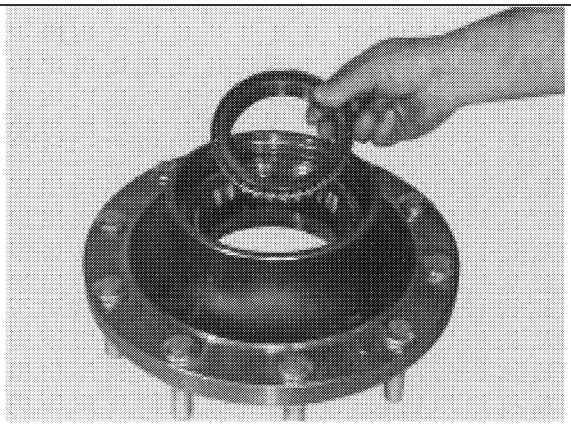
14b. Remove outer bearing cone from hub.



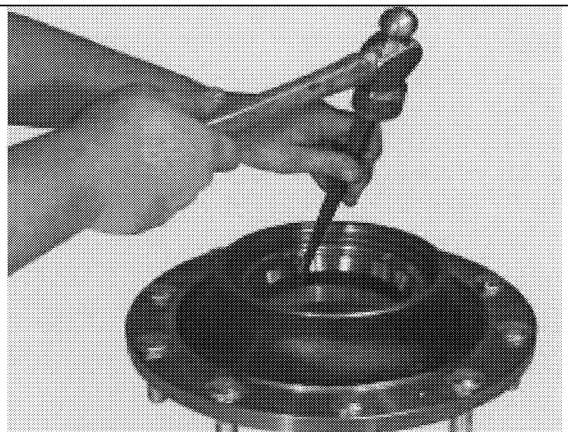
17b. Pry seal from hub and discard.



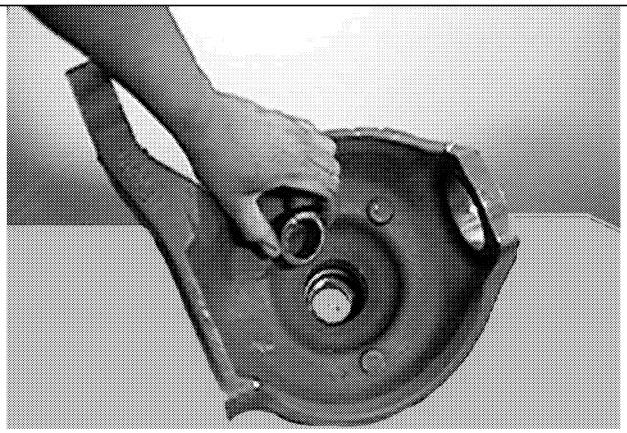
15b. Remove wheel hub from spindle using proper puller.



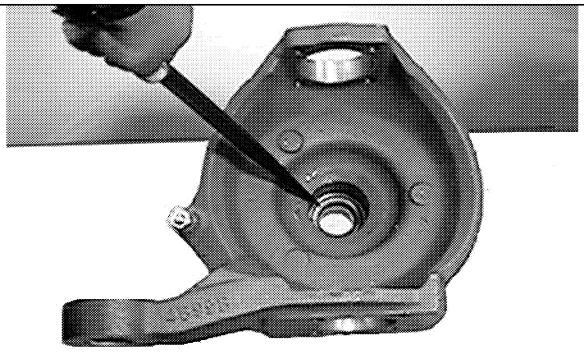
18b. Remove inner bearing cone.



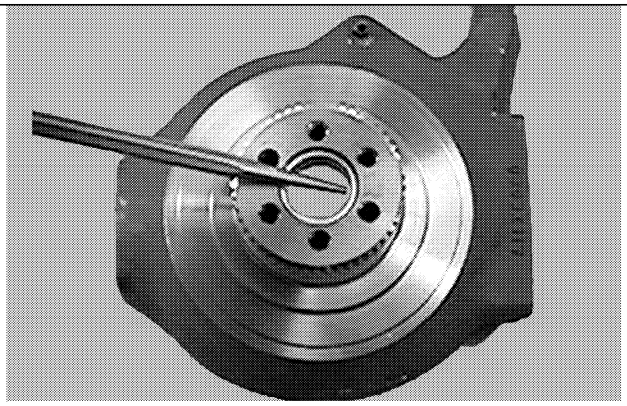
19b. Remove inner and outer bearing cups.



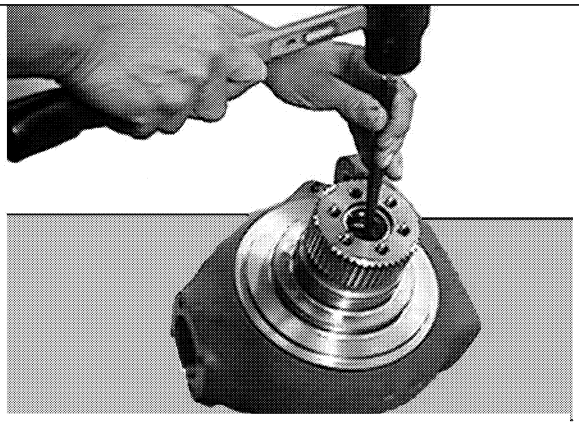
22b. Seal removed.



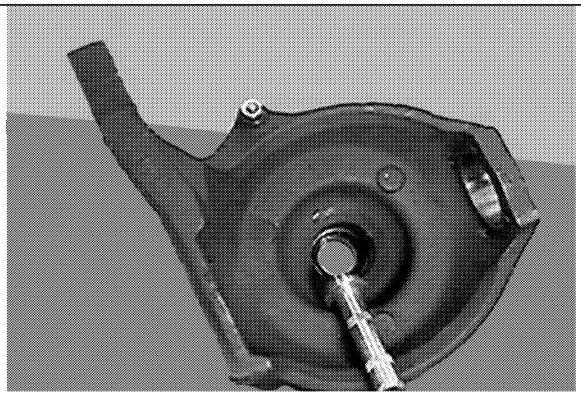
20b. Remove seal from steering knuckle.



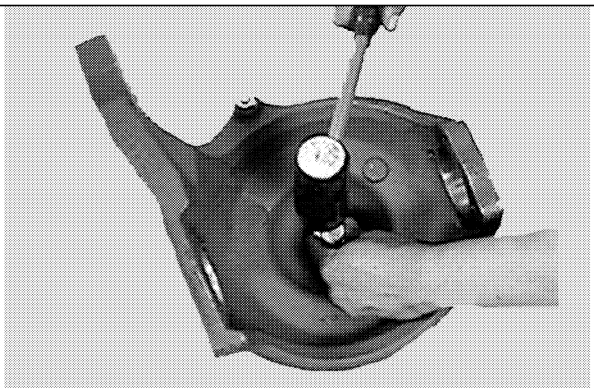
23b. Remove bushing.



21b. Drive seal out from spindle end.

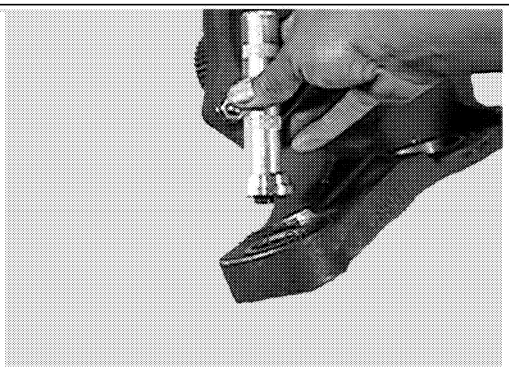


24b. Drive bushing out using proper sized tool.

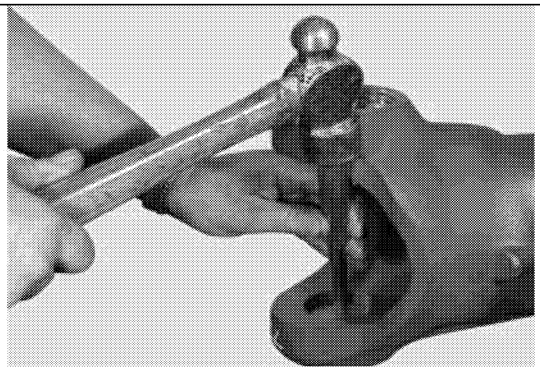


25b. Drive bushing out from inside knuckle.

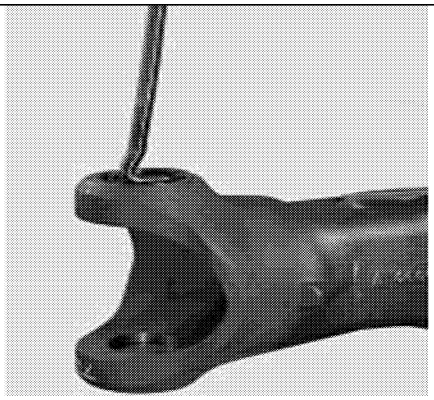
28b. Remove king pin bearing cones.



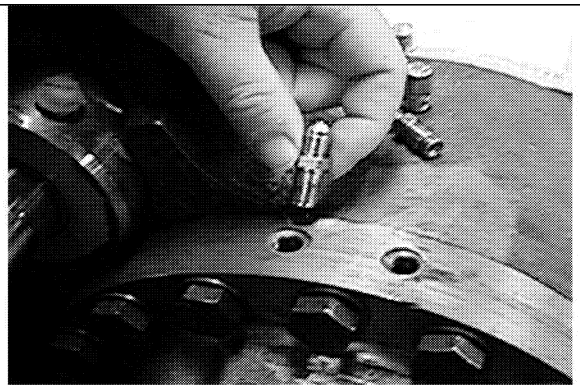
26b. Drive bushing out of steer arm using proper tool.



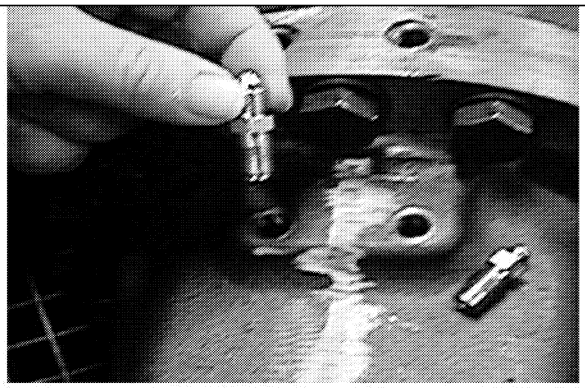
29b. Remove grease retainers and bearing cups.



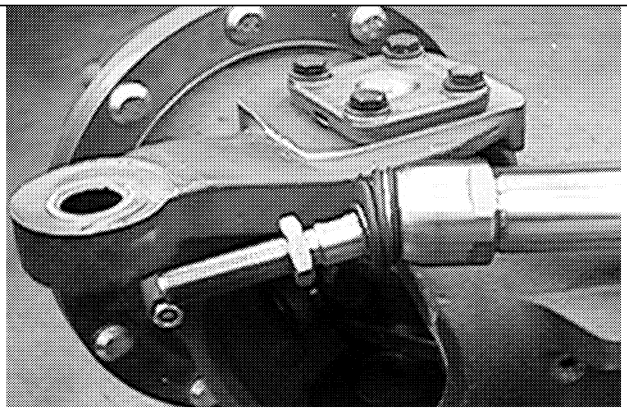
27b. Remove king pin grease seal and discard.



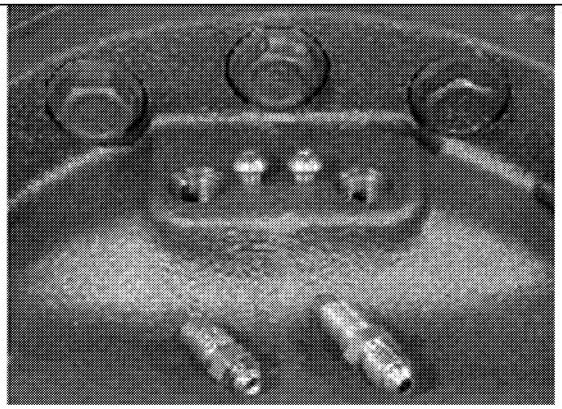
30b. Remove brake fittings and bleeders from trumpet flange.



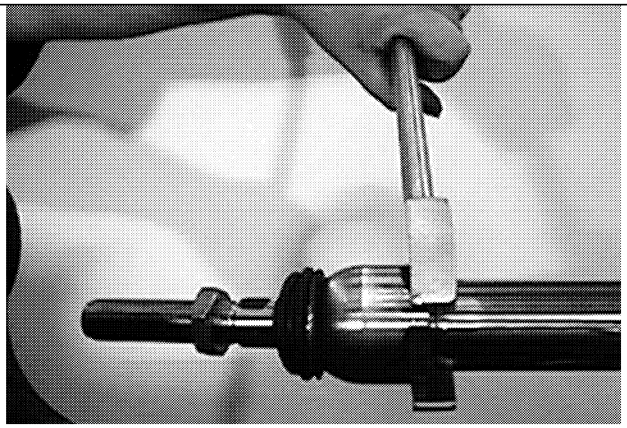
31b. Remove brake fittings and bleeders from trumpet housing.



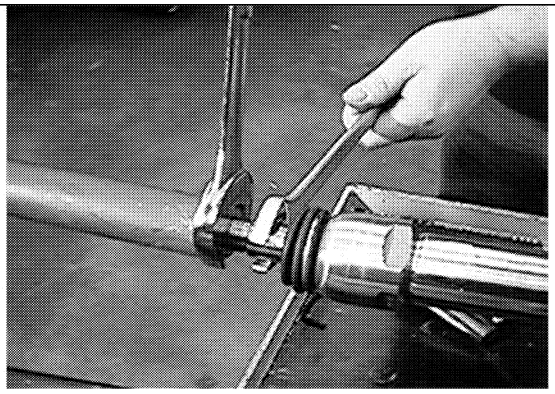
34b. Remove steering arm.



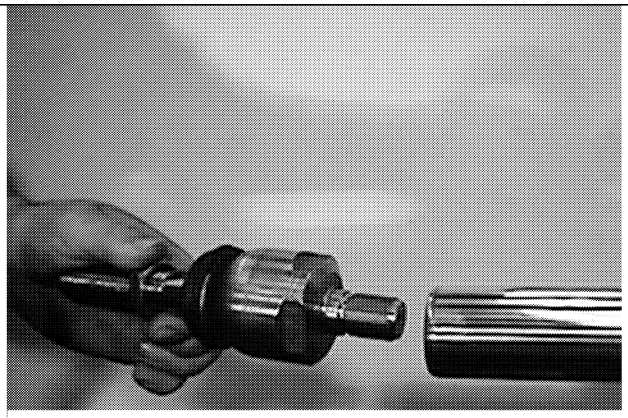
32b. Remove brake fitting and bleeder seats from bores in housing; this may require small picks or a screw and slide hammer.



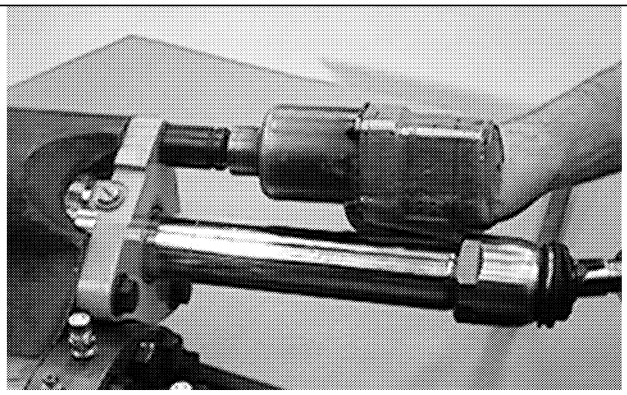
35b. Loosen socket assembly. *Do not scratch or damage steering shaft!*



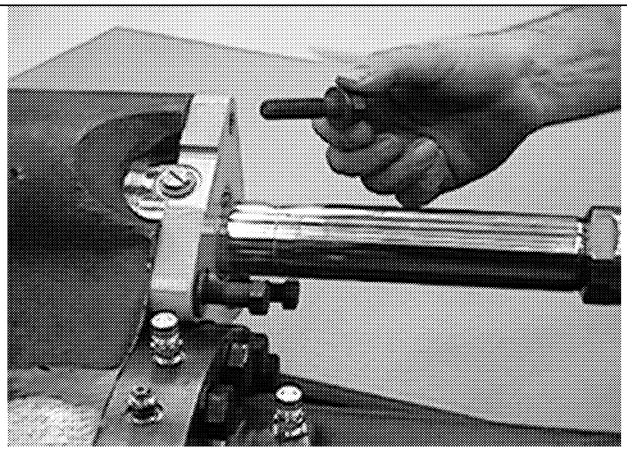
33b. Loosen jam nut on socket assembly to remove steering arm.



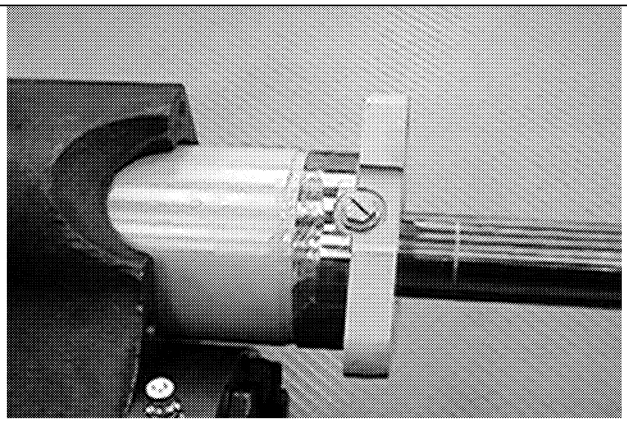
36b. Remove socket assembly.



37b. Loosen cylinder retainer capscrews.



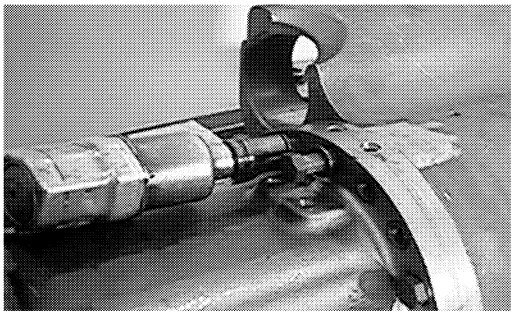
38b. Remove capscrews.



39b. Remove steer cylinder.

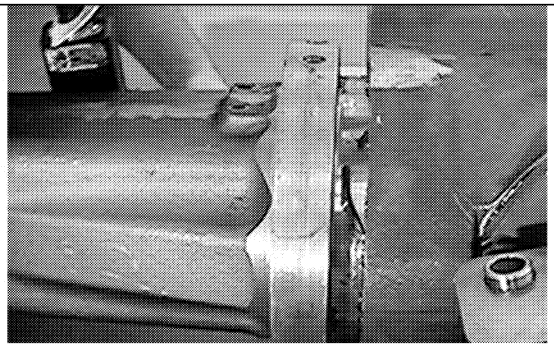
Trumpet Arm Removal

Note: To prevent personal injury and damage to axle housing a lift strap and proper lifting device must be used to support axle housing.

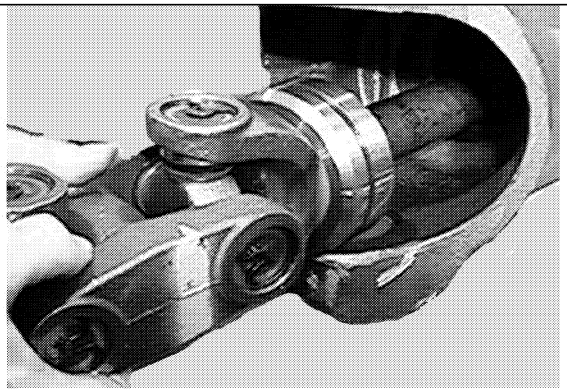


1c. Remove axle housing retaining capscrews.

4c. Remove the axle shaft retaining set screws.

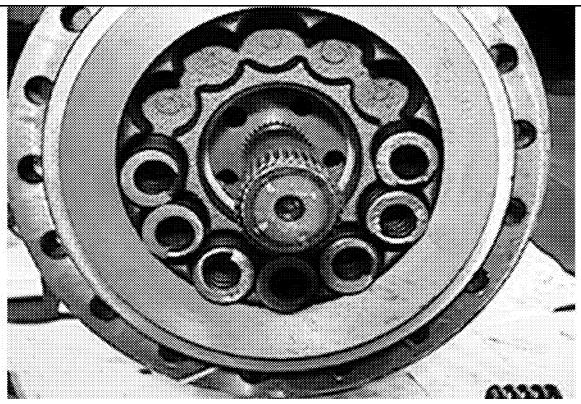


2c. Using a lifting device slowly separate axle housing from carrier housing. *Caution* - parking brake springs may be under pressure; springs may fall out.

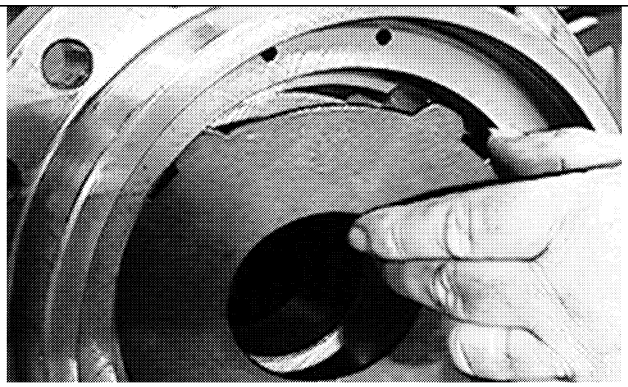


5c. Remove axle shaft assembly.

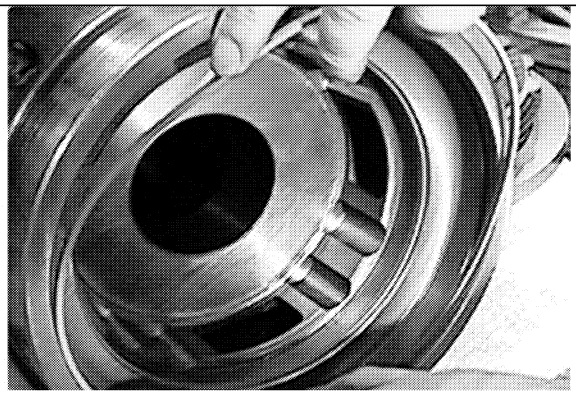
Brake Disassembly



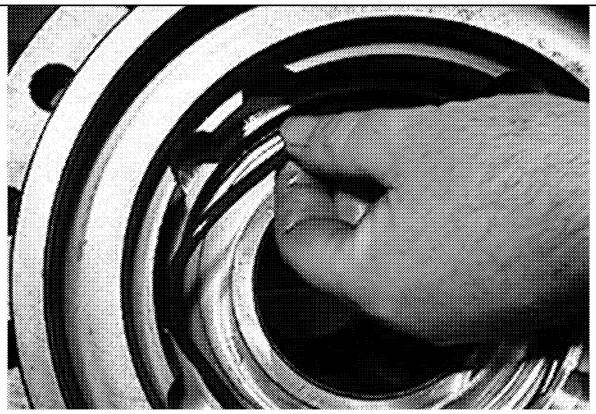
3c. Remove parking brake springs and inner piston.



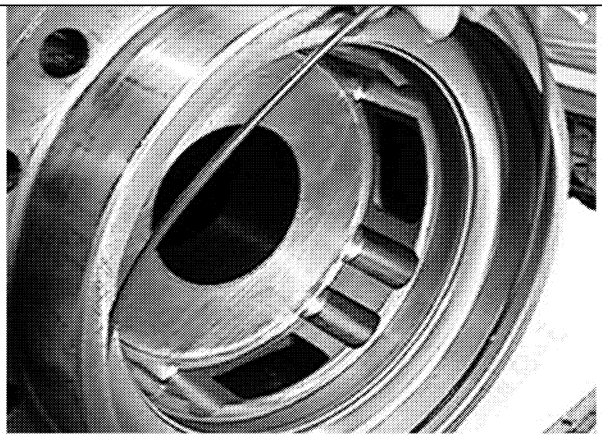
6c. Remove friction and reaction disc.



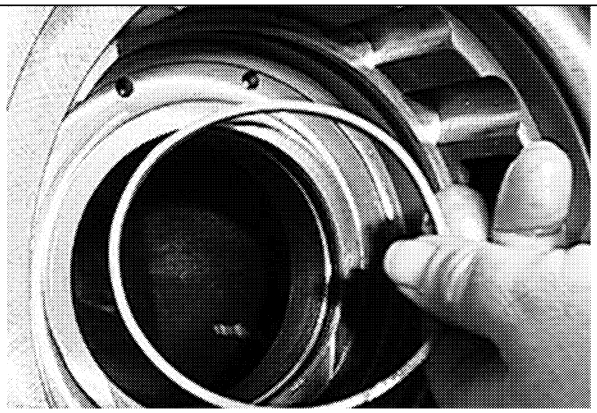
7c. Remove glyd .....



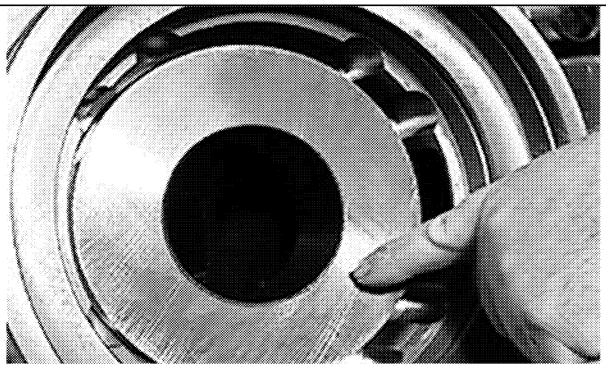
10c. Remove O - ring from 3rd groove



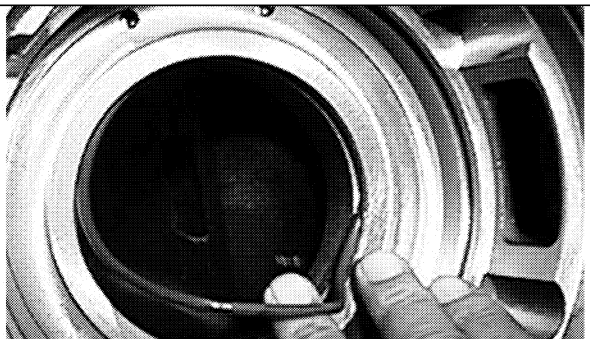
8c. and energizer rings from 1st and 2nd groove.



11c. Remove glyd ring from 4th groove.

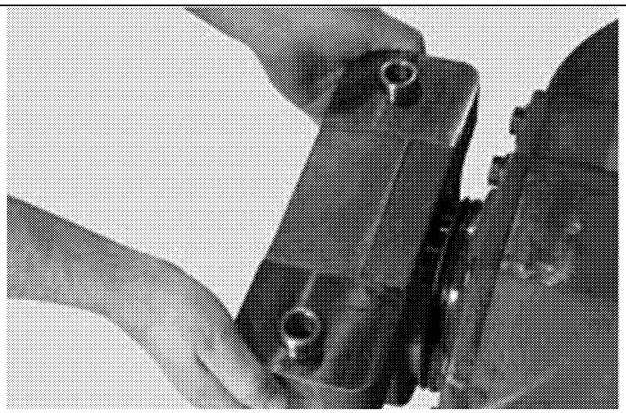


9c. Remove inner piston.

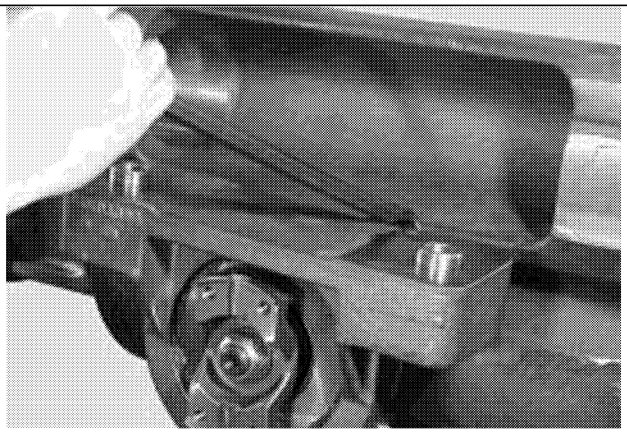


12c. Remove energizer ring from 4th groove.

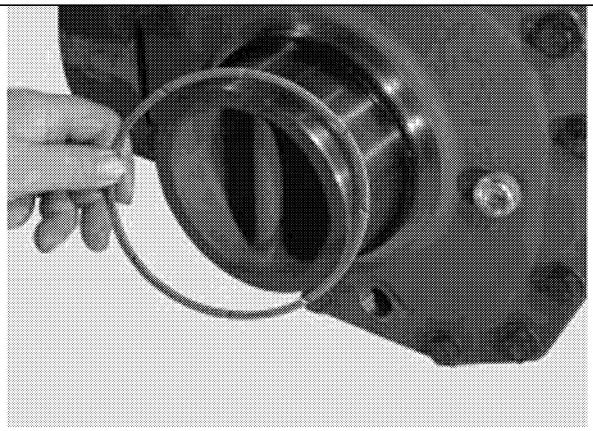
Trunnion Removal



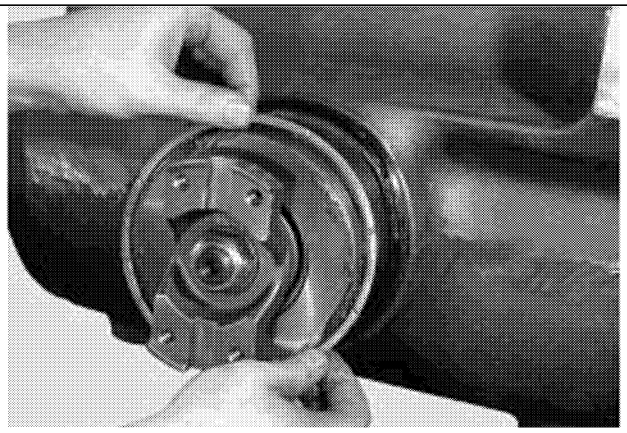
1d. Remove front trunnion beam.



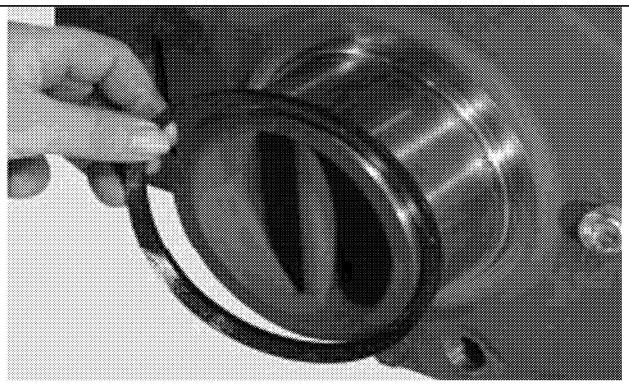
4d. Remove rear trunnion beam.



2d. Remove front trunnion beam thrust washer.

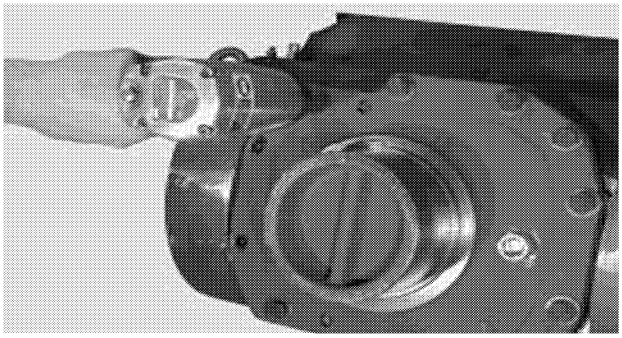


5d. Remove rear trunnion beam thrust washer and seal. Inspect and discard if damaged.

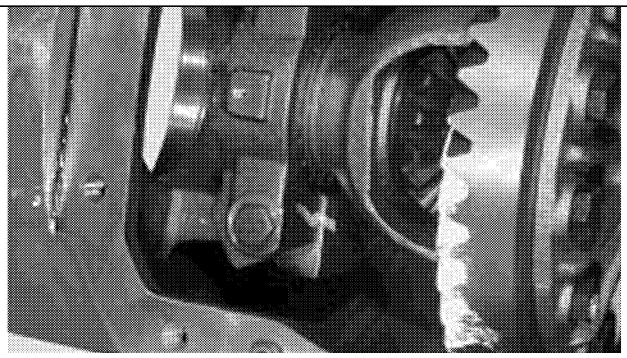


3d. Remove front trunnion grease seal. Inspect trunnion bushing and O-rings for damage. Remove and discard if damaged.

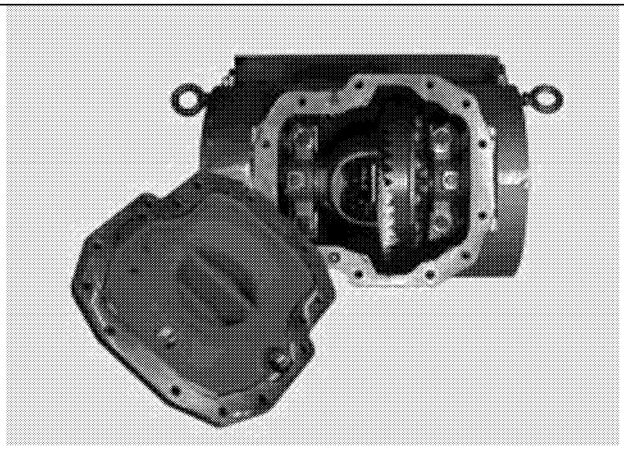
Disassembly of Carrier



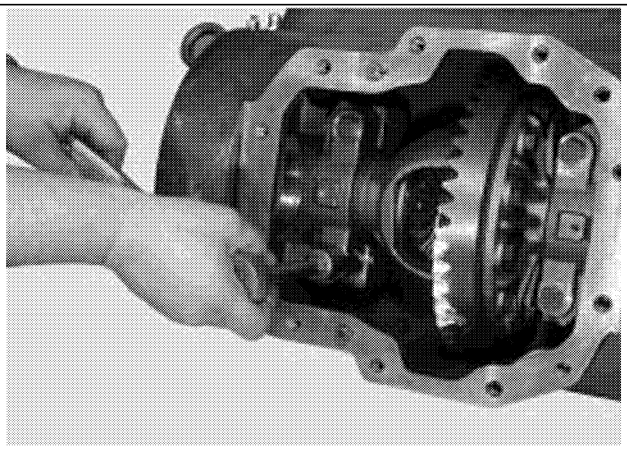
1f. Remove rear trunnion mount cover capscrews.



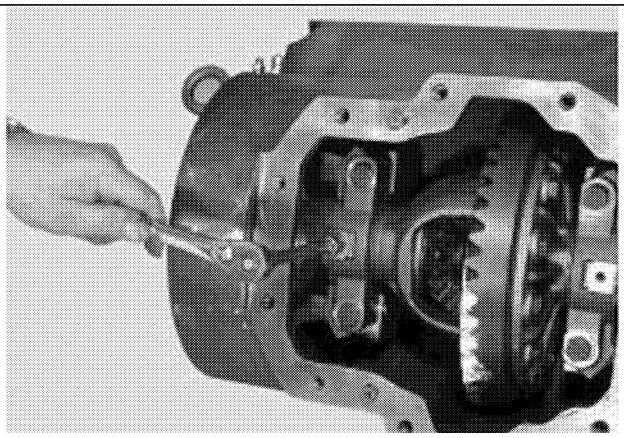
4f. Stamp or mark differential bearing caps before removal to ensure the correct position when reassembling.



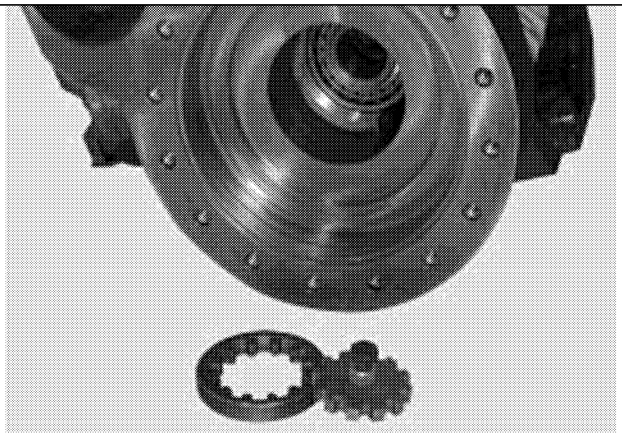
2f. Remove rear trunnion mount cover.



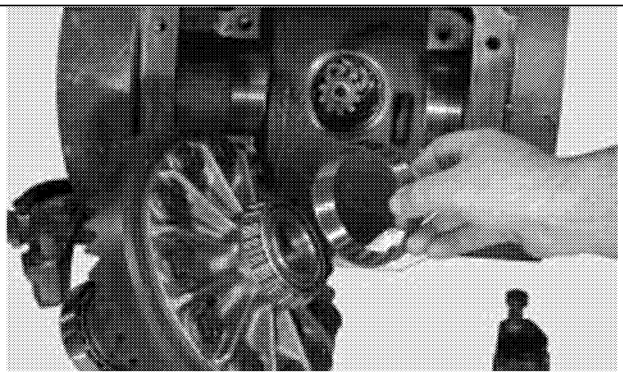
5f. Loosen differential cap bolts.



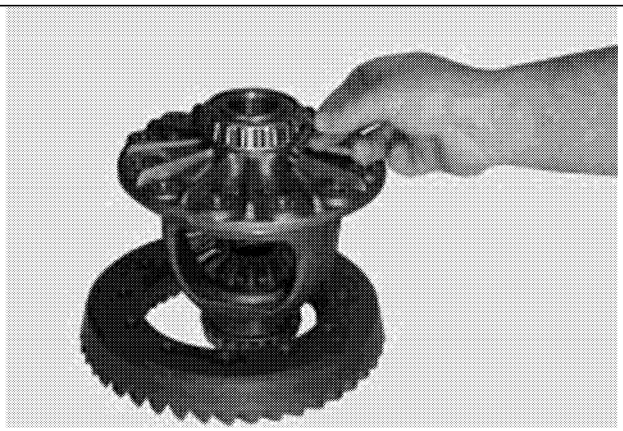
3f. Remove screw and locking clip.



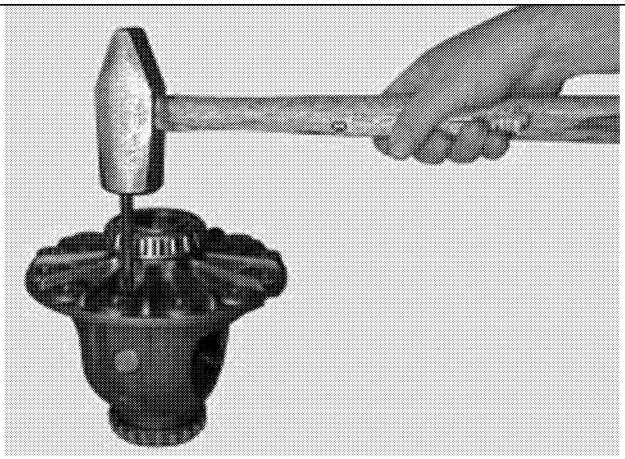
6f. Remove adjusting ring from both sides using proper tool.



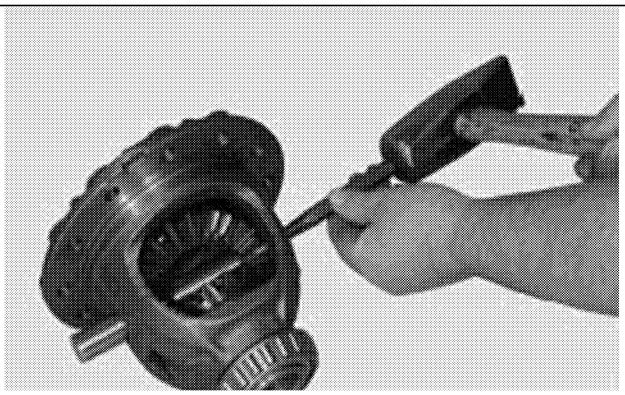
7f. Remove differential bearing cap bolts,caps,differential body assembly,and bearing cups.



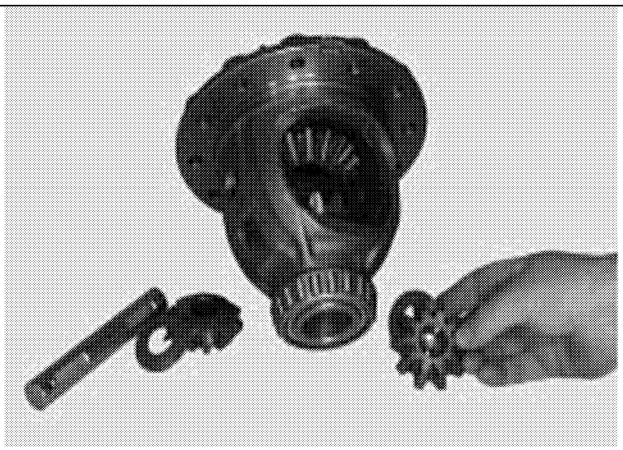
8f. Remove ring gear bolts and discard. Be careful not to damage ring gear teeth.



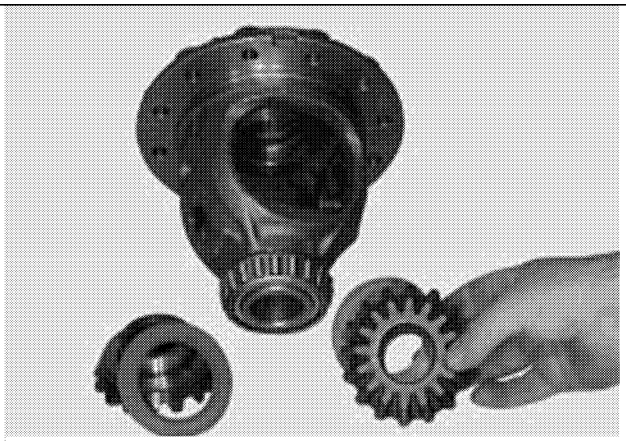
9f. Remove roll pin from shaft.



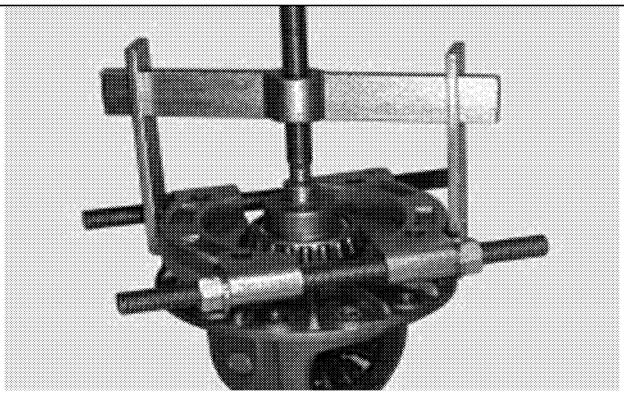
10f. Remove shaft from differential case.



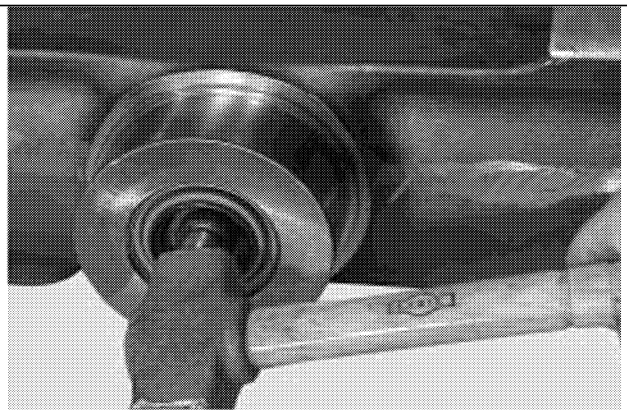
11f. Differential shaft, pinion gears and thrust washer removed.



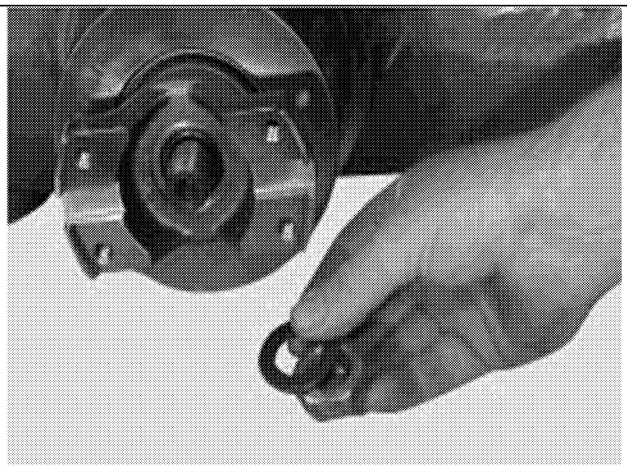
12f. Remove side gears and thrust washers.



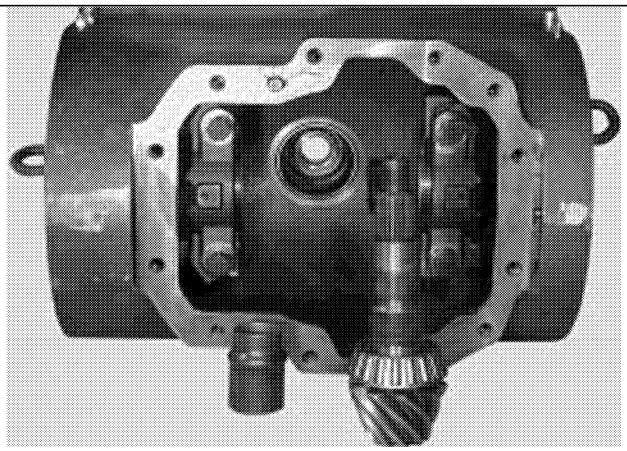
13f. If replacement is required remove either or both bearing cones.



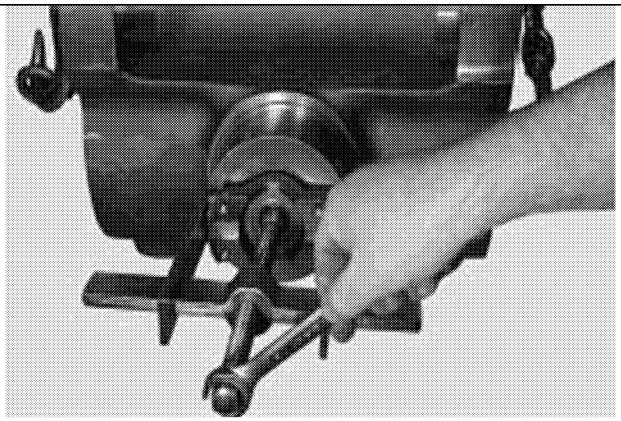
16f. Using soft faced hammer or mallet, remove pinion shaft.



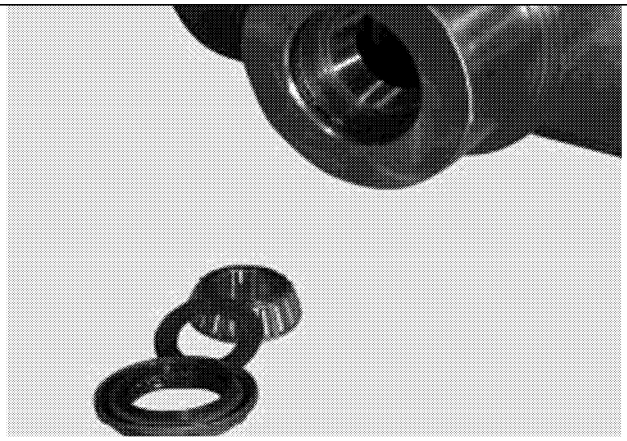
14f. Remove pinion nut and washer.



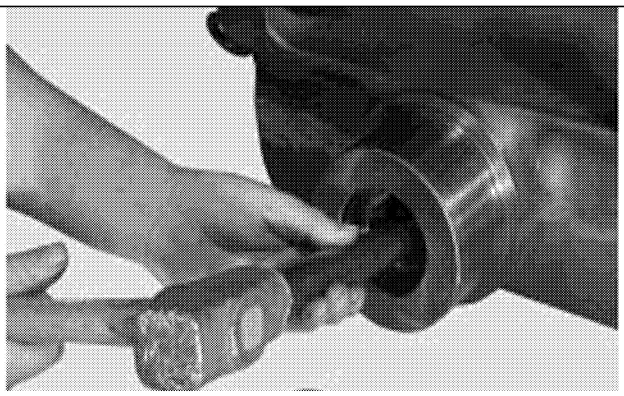
17f. Pinion and spacer removed, discard spacer.



15f. Remove drive yoke. Pullers may be required.

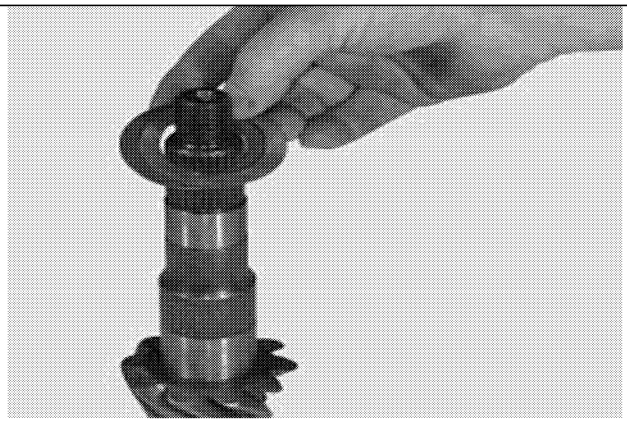


18f. Remove oil seal, thrust washer and outer bearing cone.



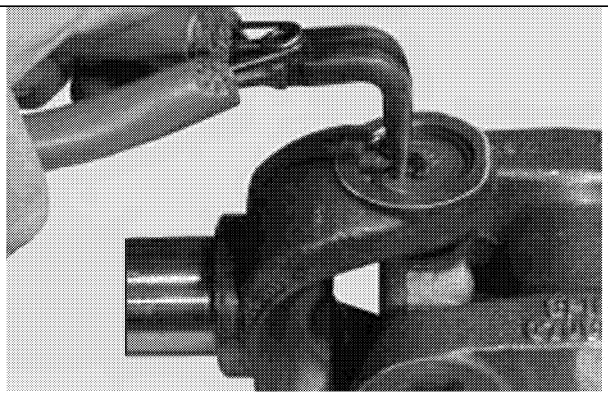
19f. Remove inner and outer bearing cups.

20f. Remove inner bearing cone from pinion gear.

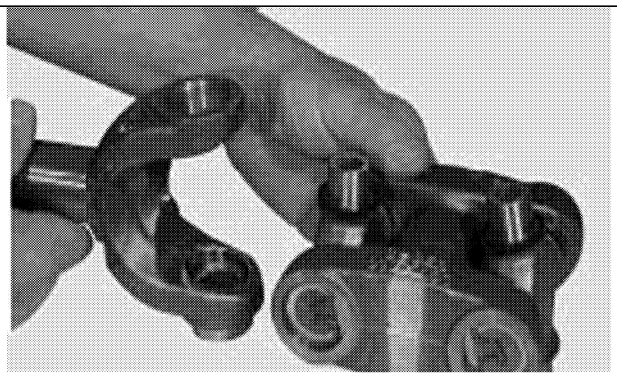


21f. Remove pinion mounting height shims.

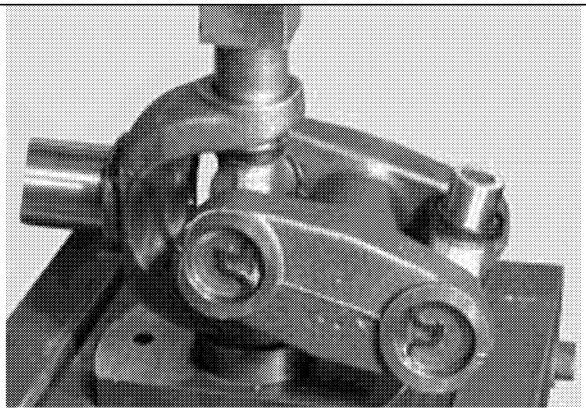
Axle Shaft and Inner Yoke Disassembly and Assembly



1. Remove retaining rings.

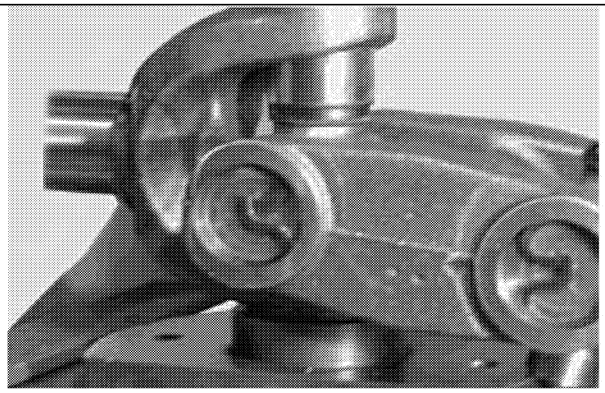


4. Separate the axle shaft from the center yoke. Repeat the previous steps separating the outer yoke from the center yoke.

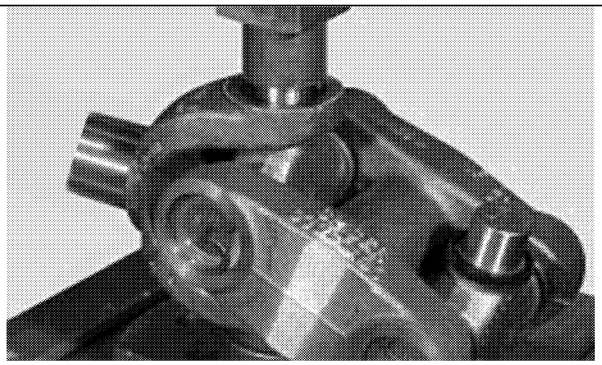


2. Place shaft in assembly fixture. Press bearing cup down until bearing cup on bottom side can be removed. Make sure there is clearance for the bottom bearing.

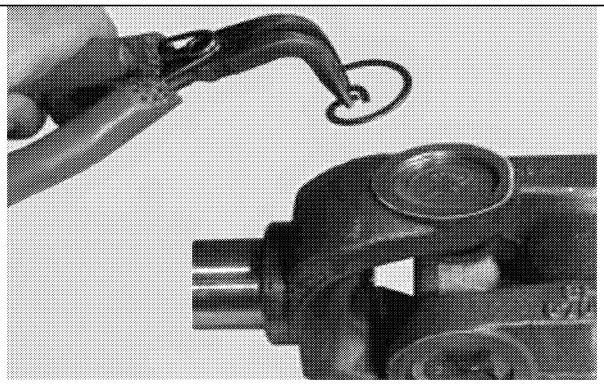
NOTE: Once outer yoke is removed, replace inner and outer seals. Note direction of seal installation before removing seals.



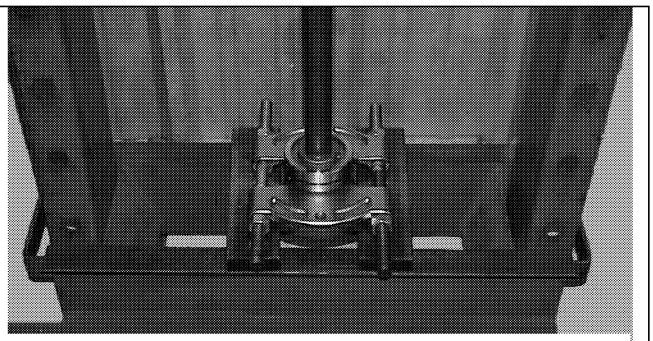
5. Installation is the reverse of disassembly. Use a press and drive the bearings to the surface of the yoke. Grease bearings necessary.



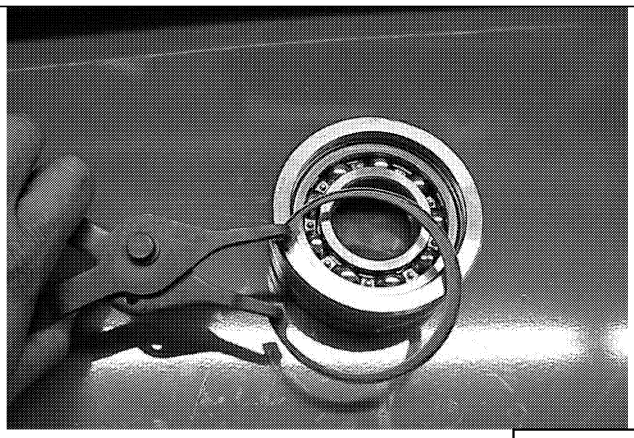
3. Turn over the axle shaft assembly. Supporting the center yoke, press on the shaft ear to drive up the bearing cup. Make sure there is clearance for bearing cup beyond the surface of the yoke.



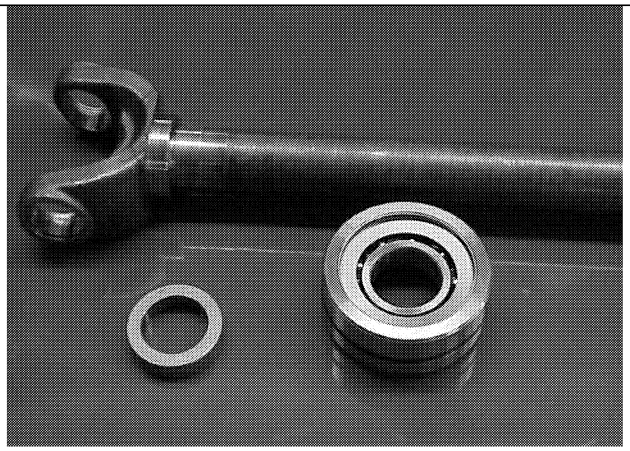
6. Use a driver to press the bearing cup below the retaining ring groove and install retaining ring. Do this procedure one side at a time until complete.



1. Press axle bearing assembly off of the shaft using the proper tools and equipment. Note: Be sure to follow proper safety precautions for the equipment used.

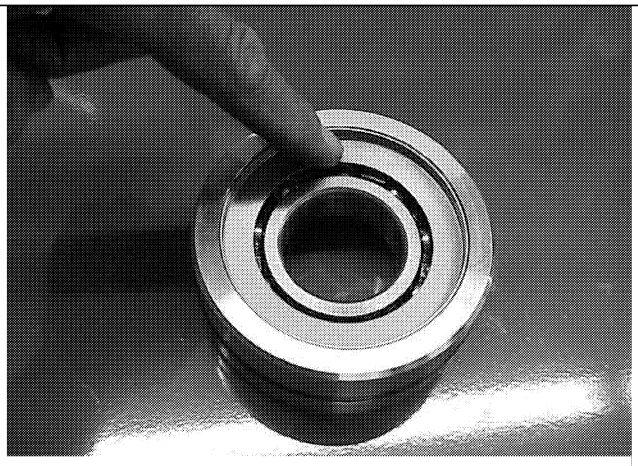


4. Remove the snap ring.

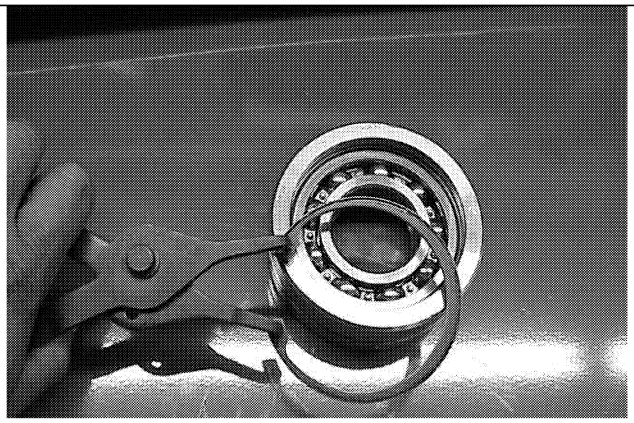


2. Axle shaft, bearing retainer assembly, and retaining ring.

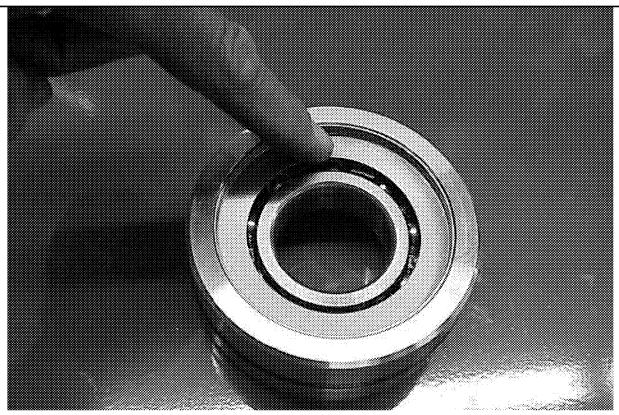
5. Remove the bearing and drive the seal out of the retainer.



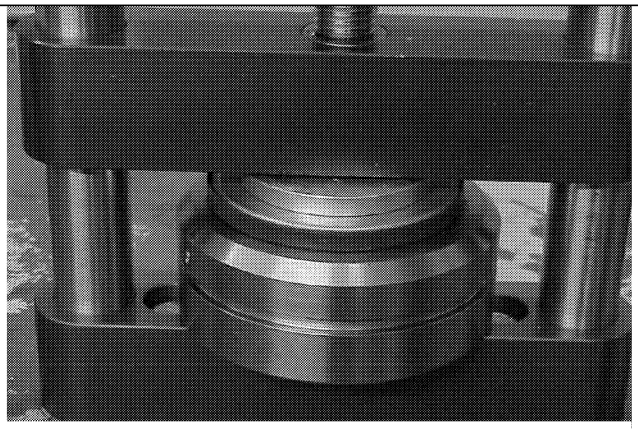
3. Carefully remove the oil baffle ring.



6. After cleaning the retainer install the new bearing. Install snap ring.

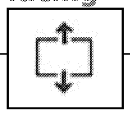


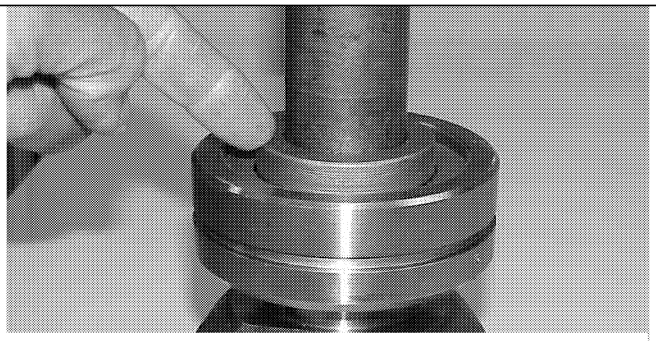
7. Carefully reinstall the oil baffle.



8. Using proper equipment and drivers press new seal into bearing retainer assembly.

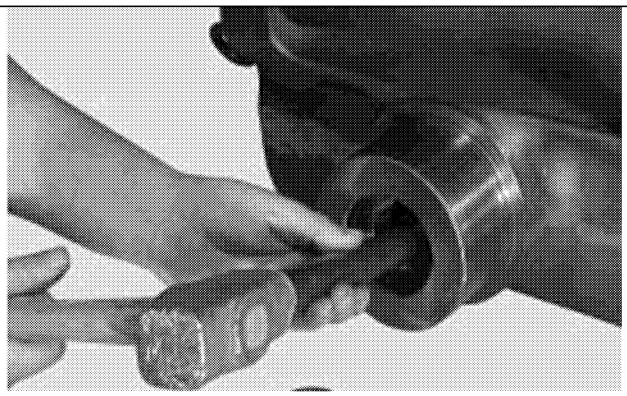
9. Install bearing retainer assembly on axle shaft with large chamfer facing yoke.



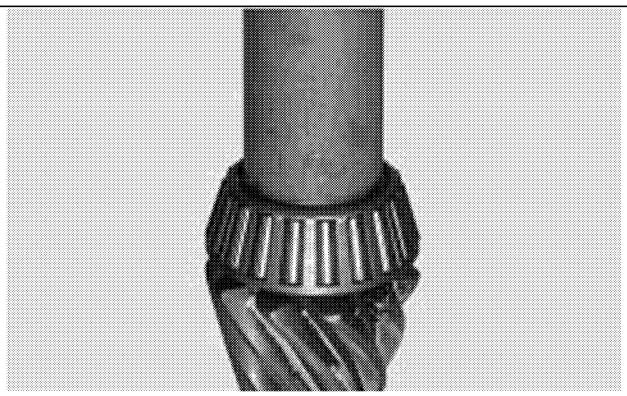


10. Place retaining ring on shaft. Using press and proper tooling press retaining ring and bearing retainer assembly into place. *Reinstall o-ring on bearing retainer before installation in trumpet housing*.

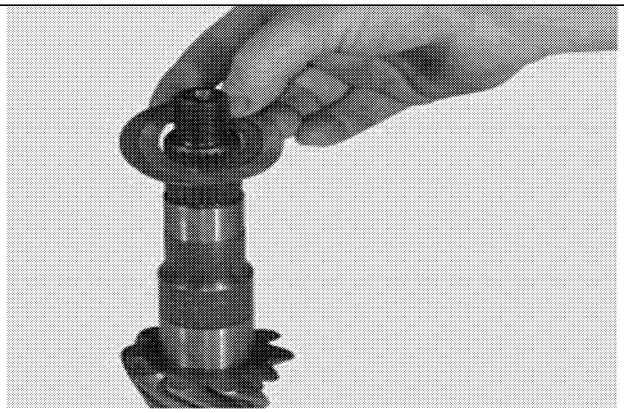
Reassembly of Carrier Housing



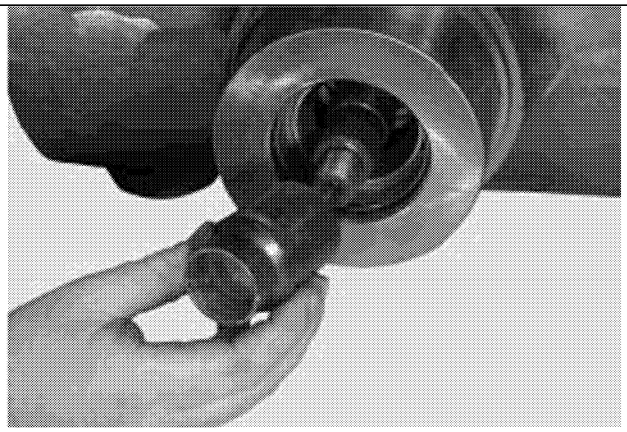
1g. Install new inner and outer bearing cups.



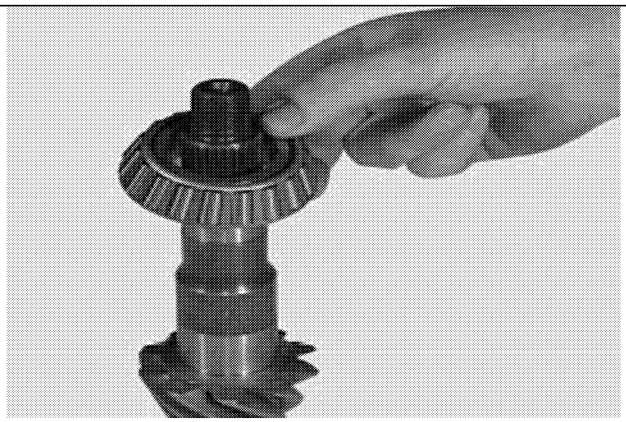
4g. Press new inner bearing cone on pinion gear shaft.



2g. Install mounting distance shim(s) on pinion shaft. If new ring and pinion are to be installed refer to Pinion Shim Selection Instructions/Chart on pages 42/43.



5g. Install pinion from rear of carrier housing and install the preload (crush) spacer. Install new spacer at each overhaul.



3g. Install new inner bearing cone on pinion shaft.

Pinion Shim Selection

- ✔ Carrier housing pinion measurement is written inside the carrier housing.
- ✔ The nominal pinion measurement is 6.426 inches.
- ✔ On the pilot end of the pinion several numbers are listed.
- ✔ Gearset i.d. numbers – to insure the ring and pinion are matched. If the numbers on the new gearset do not match – **DO NOT** use this gearset! The i.d. numbers **MUST** match to insure compatibiity.
- ✔ Etched on the pinion will be a plus (+) sign and a number, a minus (–) sign and a number or a zero (0). This number represents the amount in thousandths of an inch added or subtracted from the nominal pinion measurement to properly locate the pinion shaft.
- ✔ (+) 2 requires a .002 thicker shim be added between the inner bearing cone and the pinion shaft than a shaft marked 0.
- ✔ (–) 2 requires a .002 thinner shim be added between the inner bearing cone and pinion shaft than a shaft marked 0.
- ✔ The required thickness shim will be selected from the pinion shim selection chart listed in the specifications section.

Using the Pinion Shim Selection Chart

1. Locate the gage room measurement written inside the carrier housing.
2. Determine the pinion nominal measurement (on chart).
3. Locate the pinion adjustment number on the pinion pilot – listed as a plus number, minus number, or a 0.
4. Scan across from the gage room measurement to the appropriate pinion adjustment column.
5. The shim thickness listed at this location should be installed between the inner pinion bearing and the pinion shaft.
6. Follow the pinion reloading instructions listed under Assembly Instruction Notes #8.

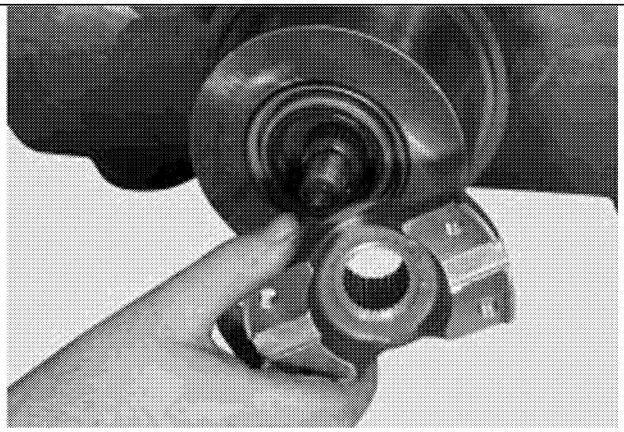
Pinion Shim Selection Chart

Gage Room Measurement	Pinion Nominal & Bearing	Pinion Adjustment (-2)	Pinion Adjustment (-1)	Pinion Adjustment (+0)	Pinion Adjustment (+1)	Pinion Adjustment (+2)	Pinion Adjustment (+3)
		Pinion Shim	Pinion Shim	Pinion Shim	Pinion Shim	Pinion Shim	Pinion Shim
6.468	6.426	0.044	0.043	0.042	0.041	0.04	0.039
6.469	6.426	0.045	0.044	0.043	0.042	0.041	0.04
6.47	6.426	0.046	0.045	0.044	0.043	0.042	0.041
6.471	6.426	0.047	0.046	0.045	0.044	0.043	0.042
6.472	6.426	0.048	0.047	0.046	0.045	0.044	0.043
6.473	6.426	0.049	0.048	0.047	0.046	0.045	0.044
6.474	6.426	0.05	0.049	0.048	0.047	0.046	0.045
6.475	6.426	0.051	0.05	0.049	0.048	0.047	0.046
6.476	6.426	0.052	0.051	0.05	0.049	0.048	0.047
6.477	6.426	0.053	0.052	0.051	0.05	0.049	0.048
6.478	6.426	0.054	0.053	0.052	0.051	0.05	0.049
6.479	6.426	0.055	0.054	0.053	0.052	0.051	0.05

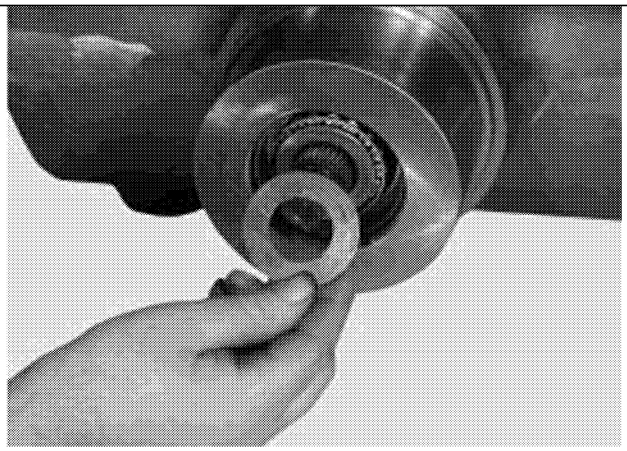
Pinion Shim Selection Chart

Gage Room Measurement	Pinion Nominal & Bearing	Pinion Adjustment (+4)	Pinion Adjustment (+5)	Pinion Adjustment (+6)	Pinion Adjustment (+7)	Pinion Adjustment (+8)	Pinion Adjustment (+9)
		Pinion Shim	Pinion Shim	Pinion Shim	Pinion Shim	Pinion Shim	Pinion Shim
6.468	6.426	0.038	0.037	0.036	0.035	0.034	0.033
6.469	6.426	0.039	0.038	0.037	0.036	0.035	0.034
6.47	6.426	0.04	0.039	0.038	0.037	0.036	0.035
6.471	6.426	0.041	0.04	0.039	0.038	0.037	0.036
6.472	6.426	0.042	0.041	0.04	0.039	0.038	0.037
6.473	6.426	0.043	0.042	0.041	0.04	0.039	0.038
6.474	6.426	0.044	0.043	0.042	0.041	0.04	0.039
6.475	6.426	0.045	0.044	0.043	0.042	0.041	0.04
6.476	6.426	0.046	0.045	0.044	0.043	0.042	0.041
6.477	6.426	0.047	0.046	0.045	0.044	0.043	0.042
6.478	6.426	0.048	0.047	0.046	0.045	0.044	0.043
6.479	6.426	0.049	0.048	0.047	0.046	0.045	0.044

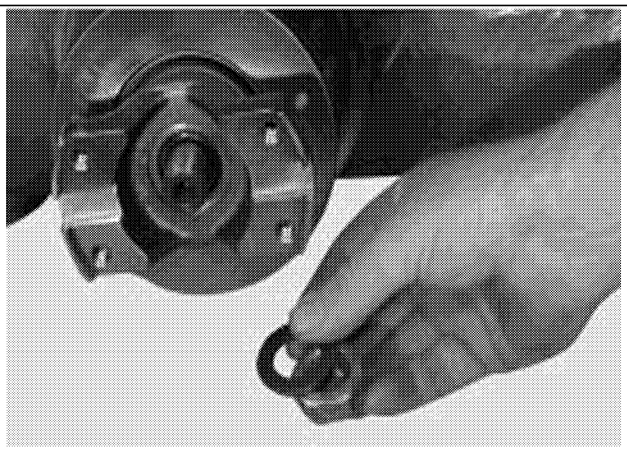
6g. Install new bearing cone on pinion shaft.



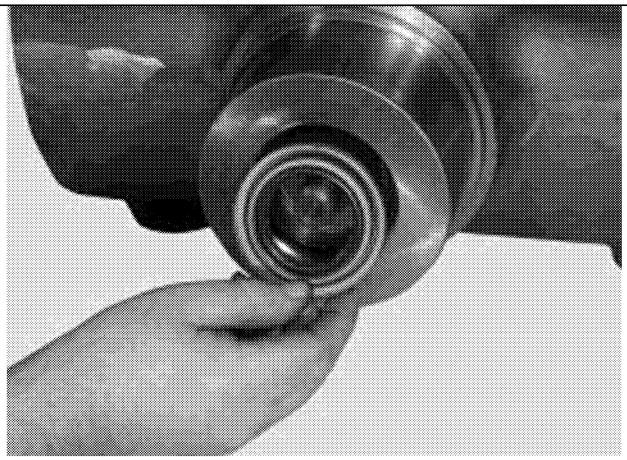
9g. Install end yoke.



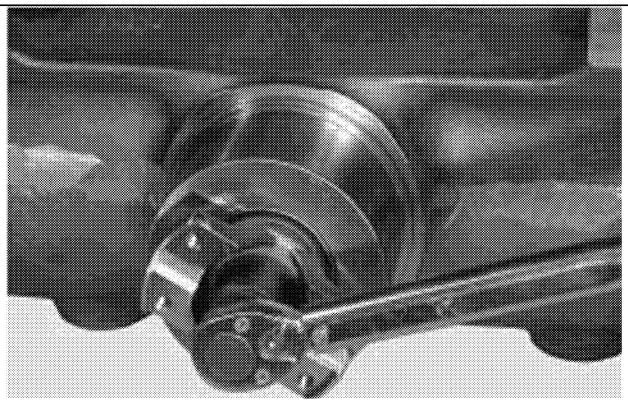
7g. Install thrust washer on pinion shaft.



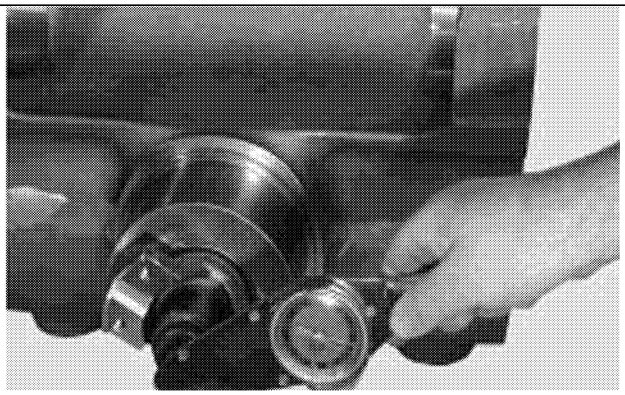
10g. Install the retaining washer and nut.



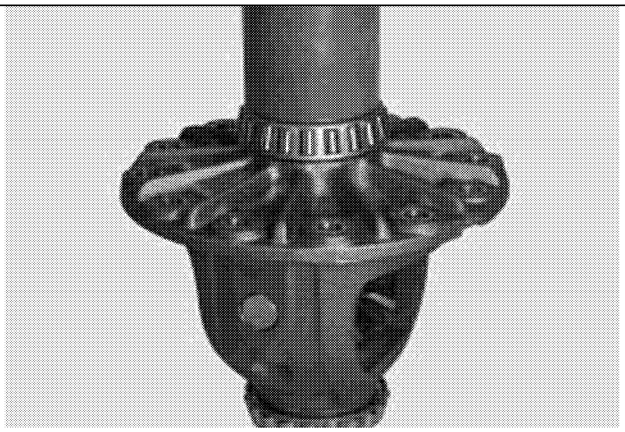
8g. Install new end yoke seal.



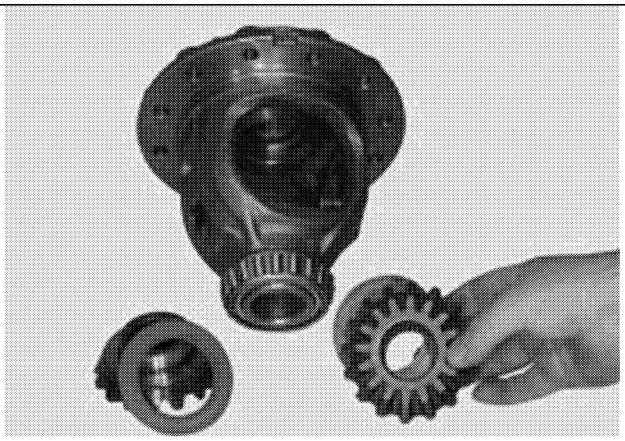
11g. Tighten the retaining nut to specified torque 240-300 ft/lbs (325-400 Nm) See Assembly Instruction Note 8.



12g. Using an inch/pound torque wrench take a reading to determine rolling torque – 20-40 in\lbs. (2.25-4.5Nm).

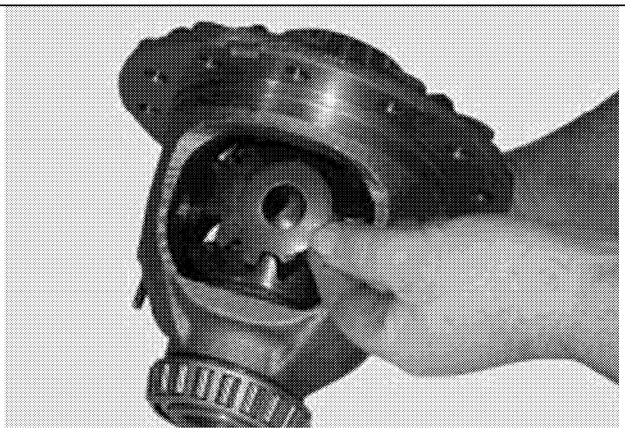


13g. Press new bearing cones onto differential case.

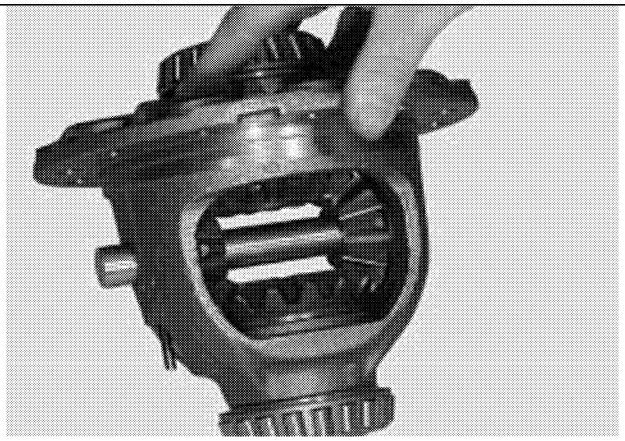


14g. Install thrust washers, top and bottom side gears into differential case.

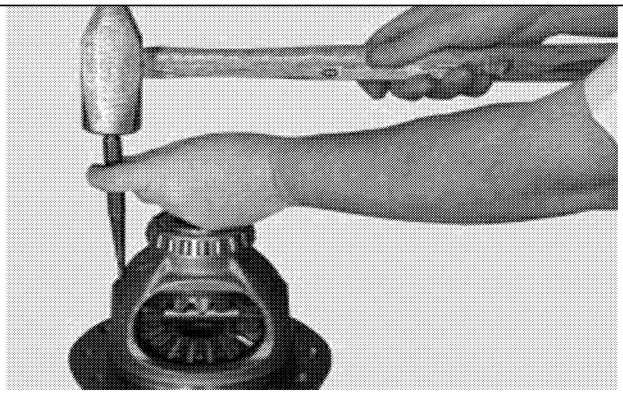
15g. Side gears and thrust washers installed.



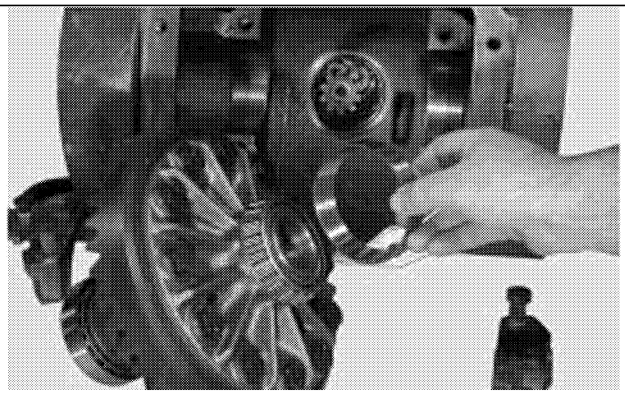
16g. Install both pinion gears and thrust washers then rotate to align to align shaft bore with gears and washers.



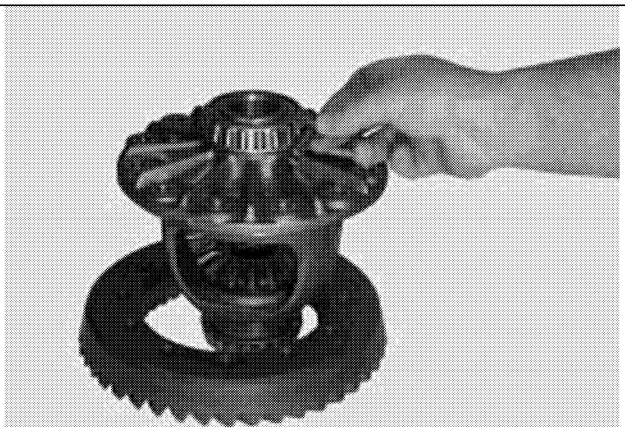
17g. Install pinion gear shaft, aligning hole in shaft with roll pin hole in differential case.



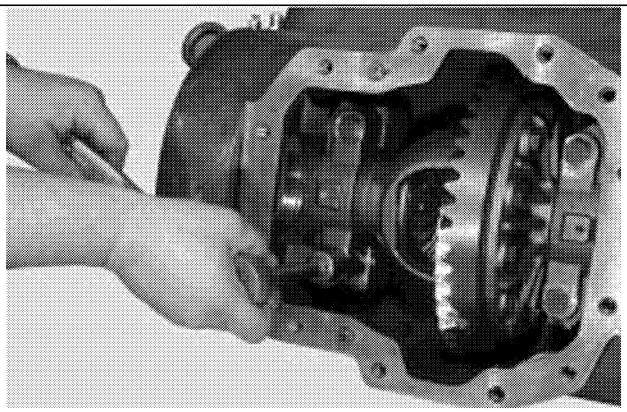
18g. With holes aligned drive roll pin into shaft.



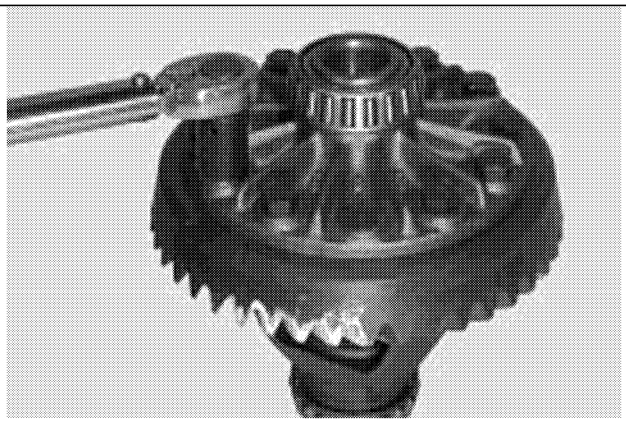
21g. Assemble bearing cups on differential bearing cones.



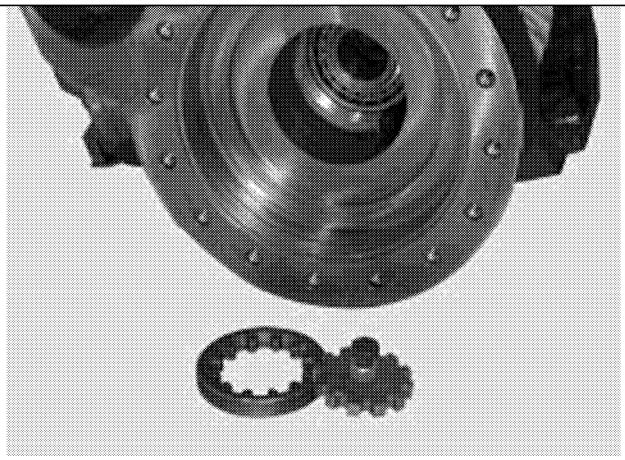
19g. Clean differential case and ring gear mounting surfaces. Position ring gear and install new retaining bolts.



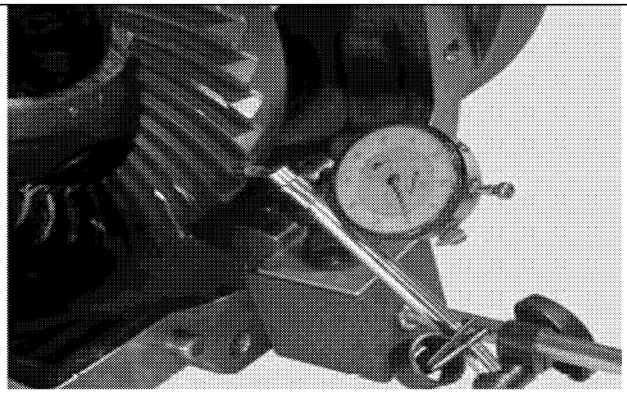
22g. Install differential case into carrier housing and install retaining caps, torque to 75-90 ft/lbs. (101-122Nm)



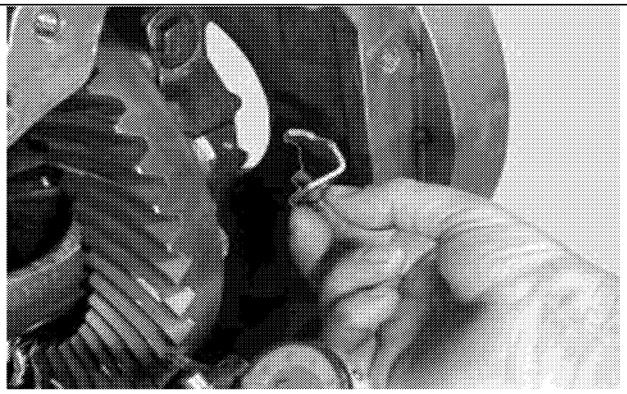
20g. Torque bolts to to 120-140 ft/lbs. (163-190Nm)



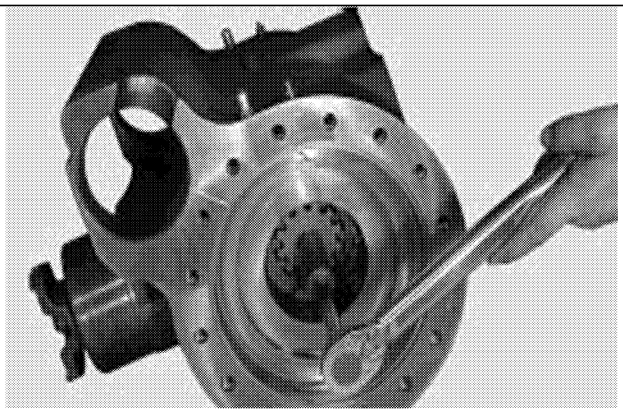
23g. Install adjusting rings.



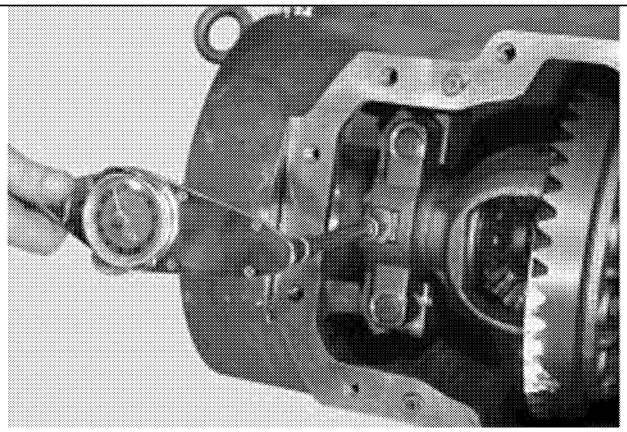
24g. Position dial indicator to adjust ring gear backlash.



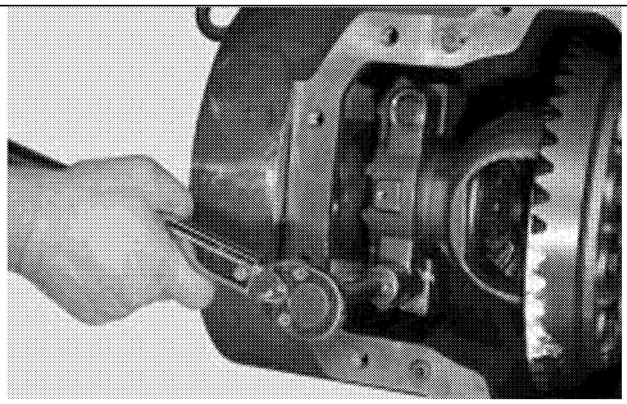
27g. Install adjusting ring lock clip and bolt.



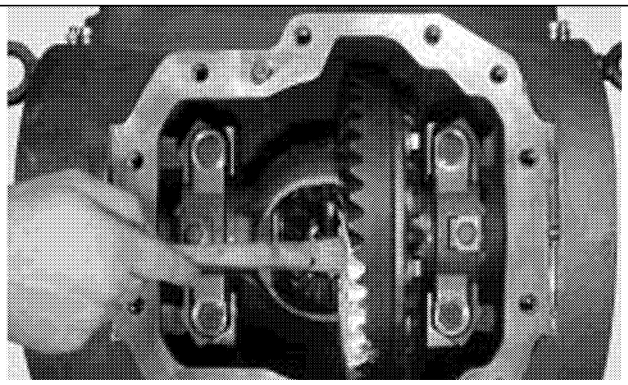
25g. Turn adjusting ring clockwise to add backlash; turn opposite side to decrease backlash. See Assembly Instruction Note #9.



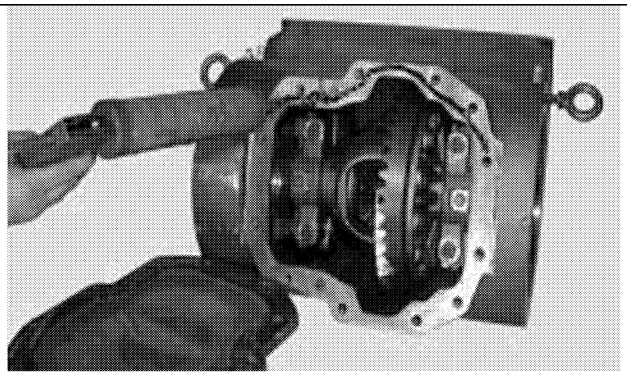
28g. Apply Loctite 271 to adjusting ring lock clip bolts and torque to 15-17 ft/lbs. (20-23Nm).



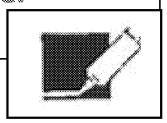
26g. Apply Loctite 271 to bearing cap retaining bolt threads and torque to 75-90 ft/lbs. (102-122Nm). Recheck backlash.

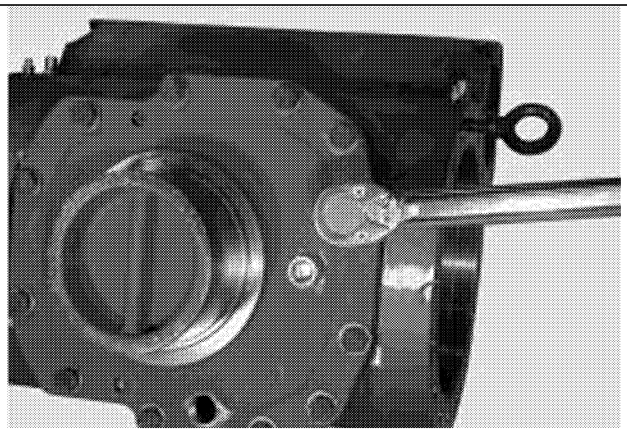


29g. Apply paste or compound to allow ring and pinion gear contact pattern to be inspected. Refer to Tooth Contact chart for correct pattern.

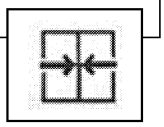


30g. Apply Loctite 515 sealer to rear cover mounting surface of carrier housing.

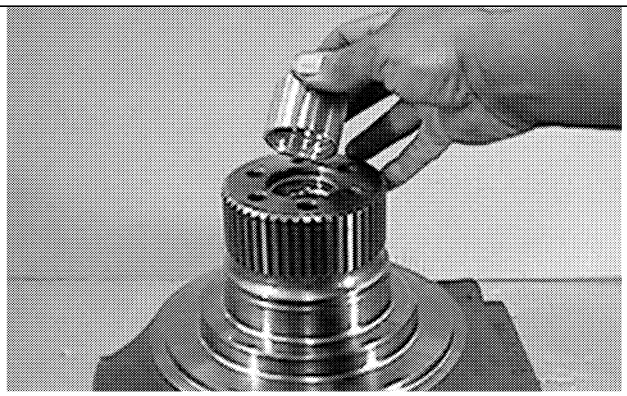




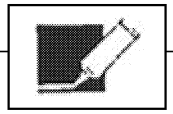
31g. Install carrier housing cover housing and retaining bolts. Torque to 175-190ft/lbs. (238-258Nm).

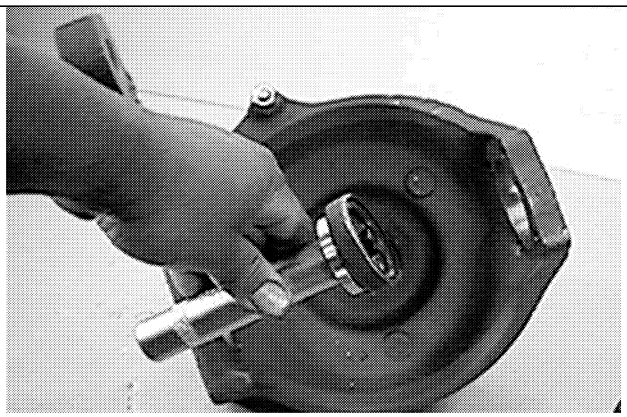


Knuckle Assembly

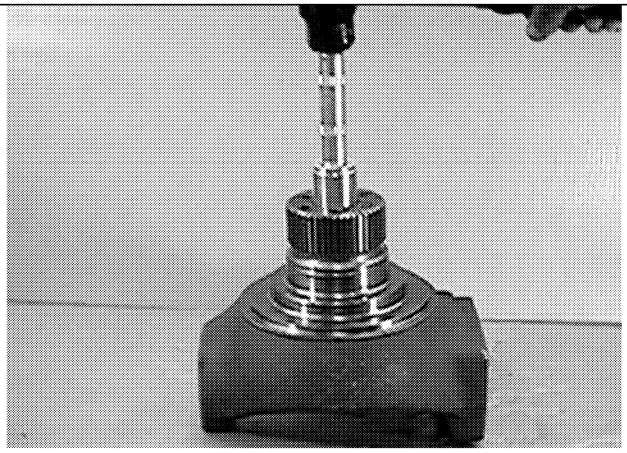


1h. Apply Loctite 609 to new bushing and install in bore.

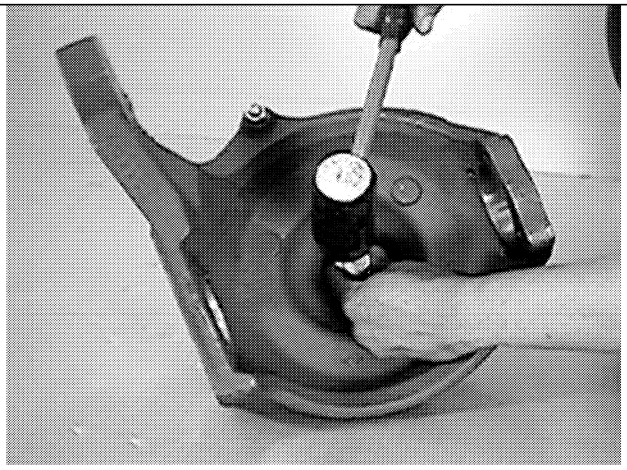




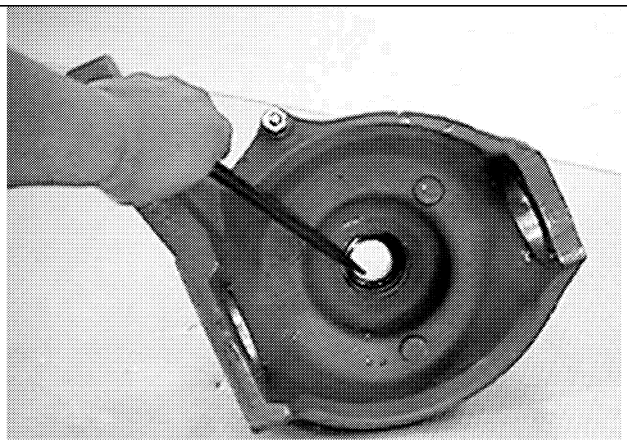
4h. Install seal with proper tool.



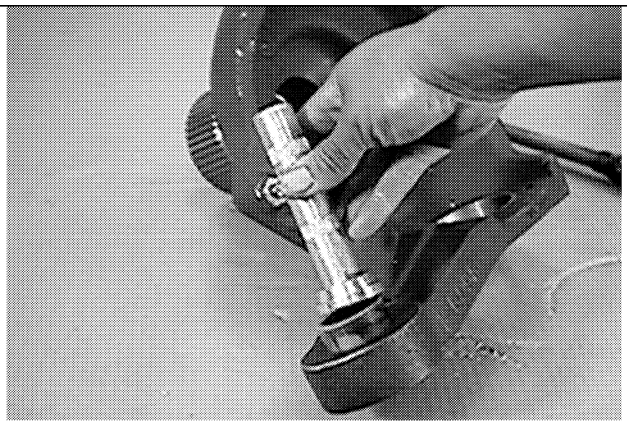
2h. Drive or press bushing into bore until .125" (3.175mm) below surface.



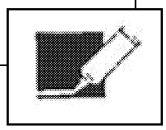
5h. Drive seal into bore.

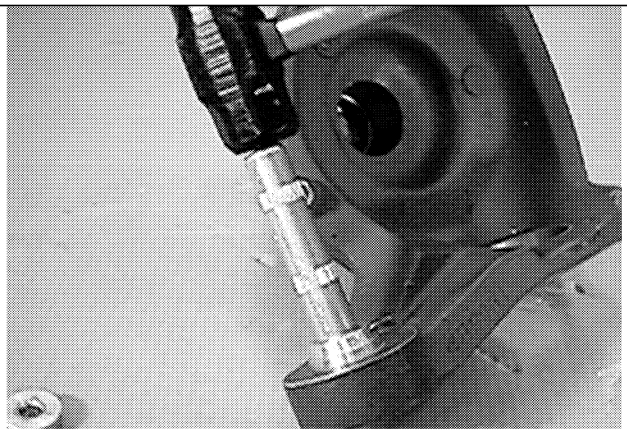


3h. Install seal in bore.

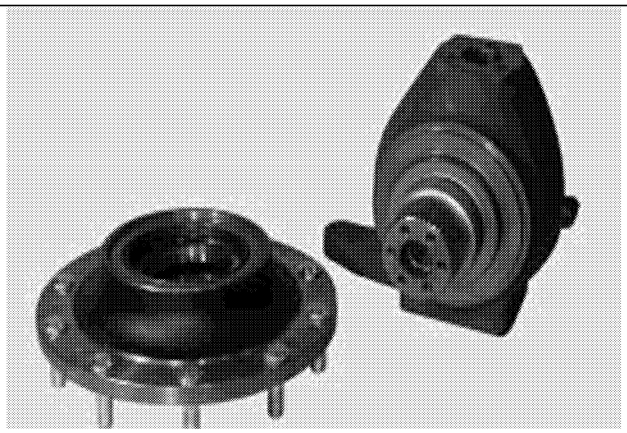


6h. Install new bushing in steer arm using Loctite 609 on bushing o.d.



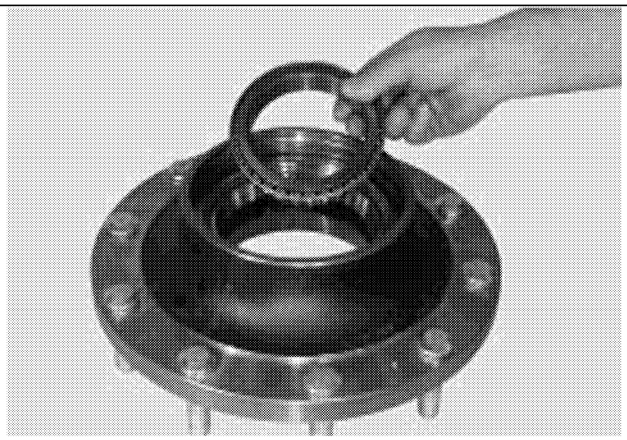


7h. Drive busing into steer arm bore.

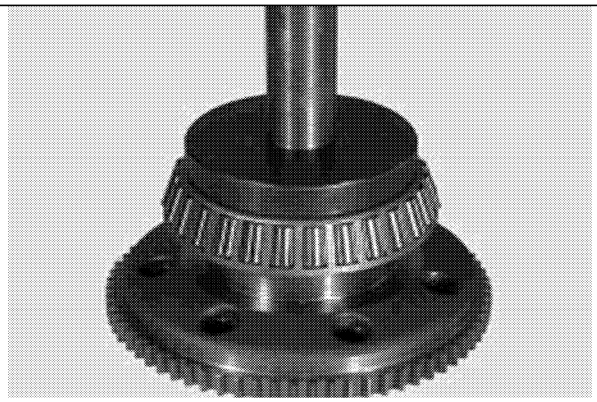


3i. Install wheel end on knuckle.

Wheel End Assembly

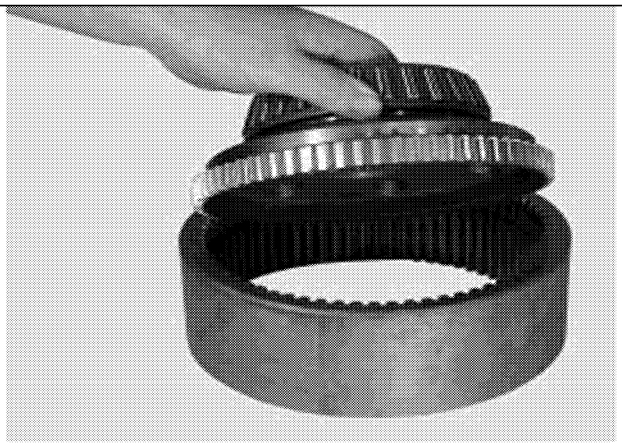


1i. Install new inner and outer bearing cups, and inner bearing cone in hub.

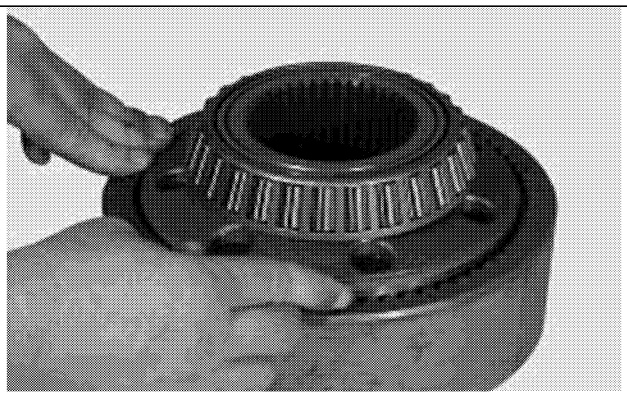


4I Press new outer cone on ring gear hub. Using thermal aid may ease installation. Do not exceed 275 degrees F. *See Assembly Instruction Note #15*

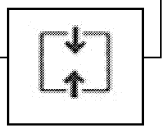
2i. Install new hub seal using proper driver. *See Assembly Instruction Note # 11.*

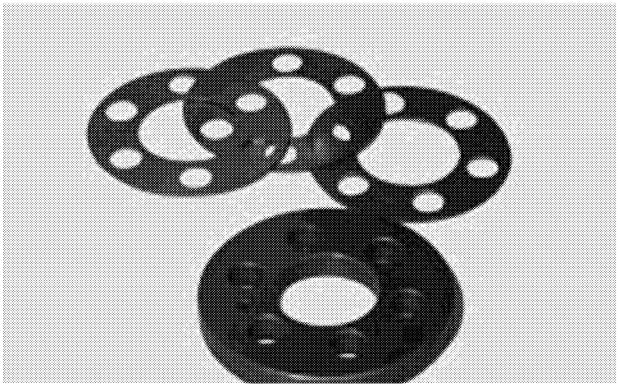


5i. Install ring gear hub in ring gear.

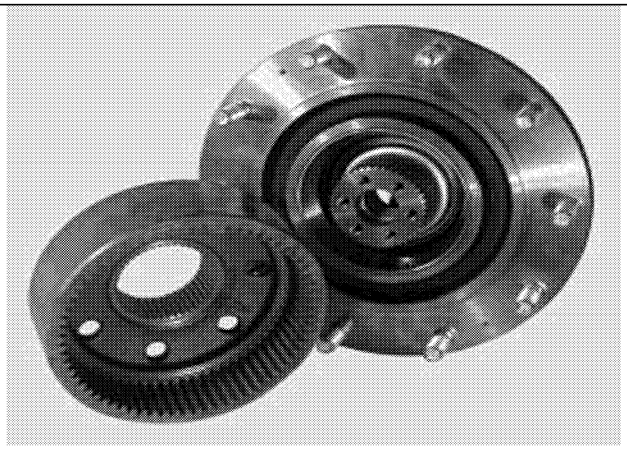


6i. Install hub retaining ring in gear assembly.

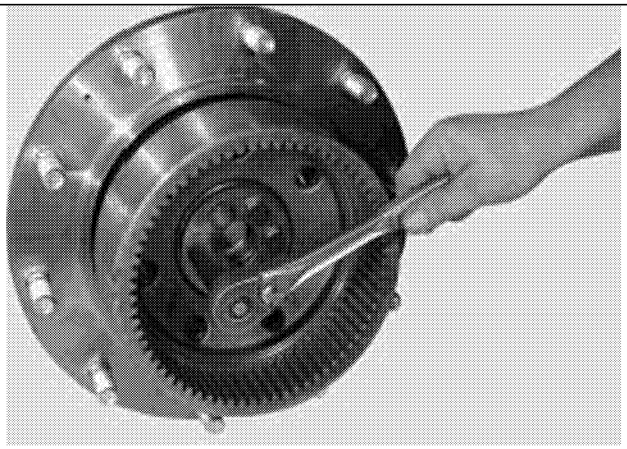




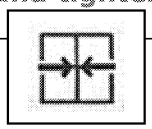
9i. Install shims and retaining plate. *See Assembly instruction Note #11.*

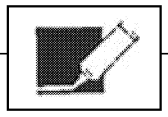


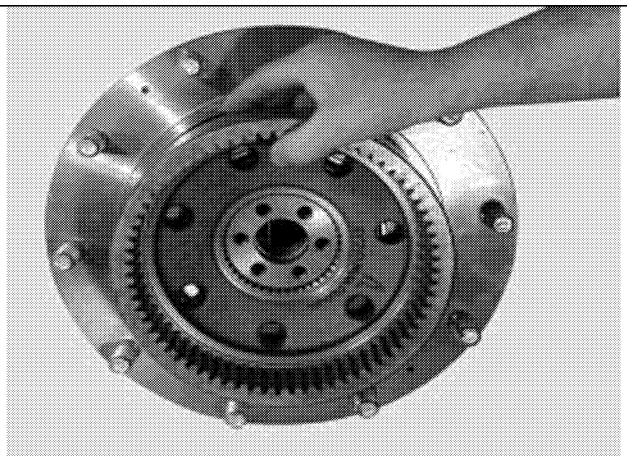
7i. Install planetary ring gear hub on knuckle.



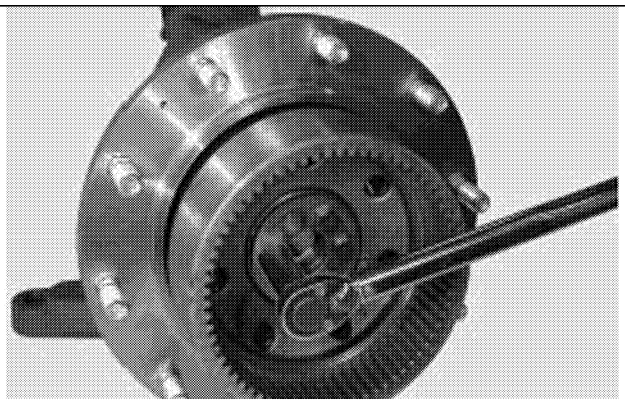
10i. Install retaining plate capscrews with Loctite 271 and tighten.



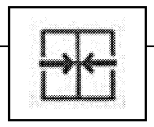


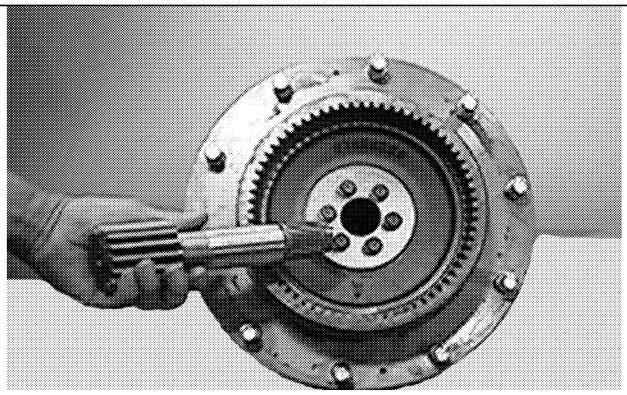


8i. Place hub on splines.

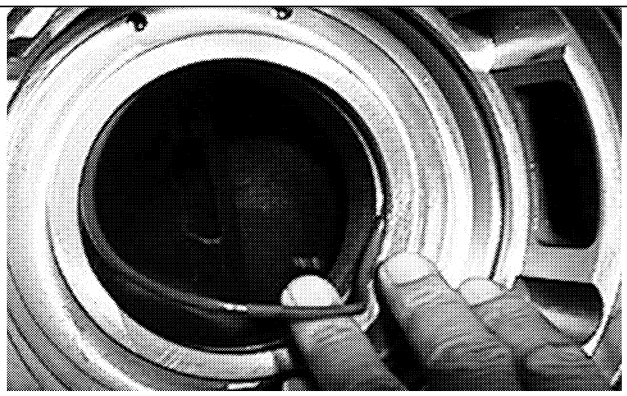


11i. Check rolling torque on wheel after torquing capscrews to 115-120 ft/lbs. (156-162Nm)

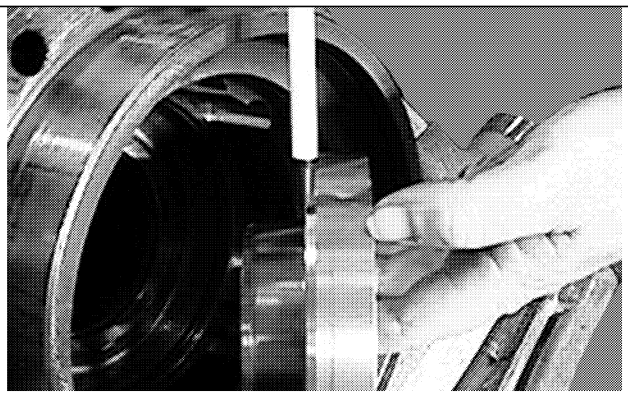




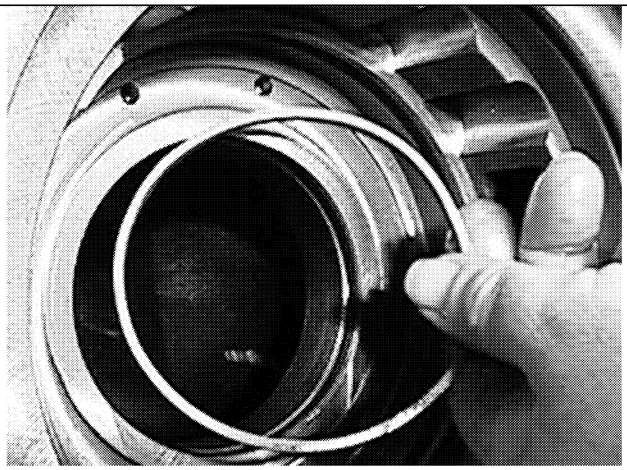
12i. Install sun gear shaft in hub assembly.



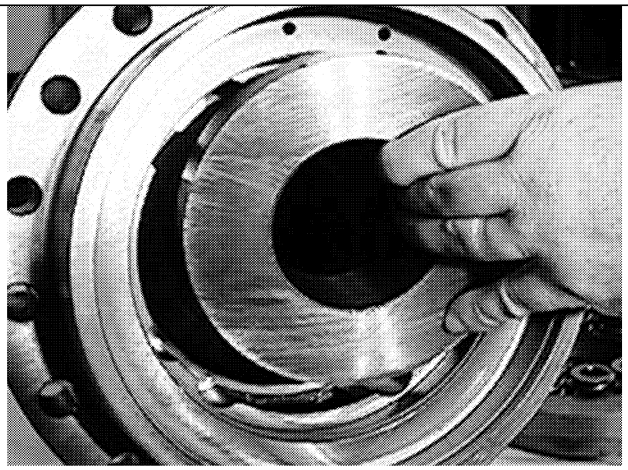
1j. Install energizer ring in 4th ring groove.



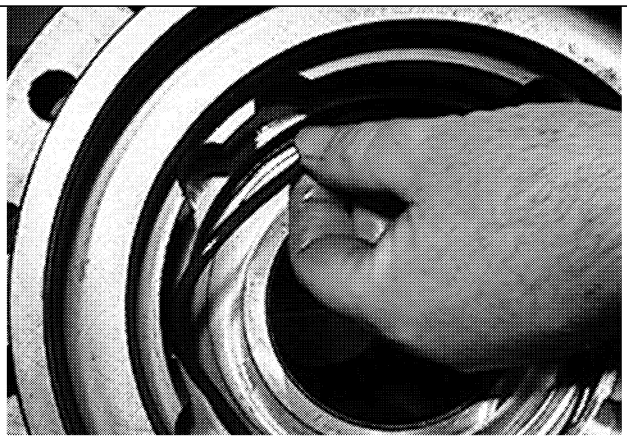
4j. Check piston chamfer for nicks and damage. Lubricate piston.



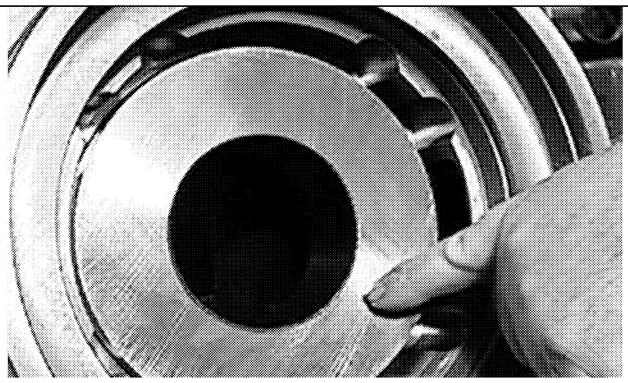
2j. Install glyd ring in 4th ring groove.



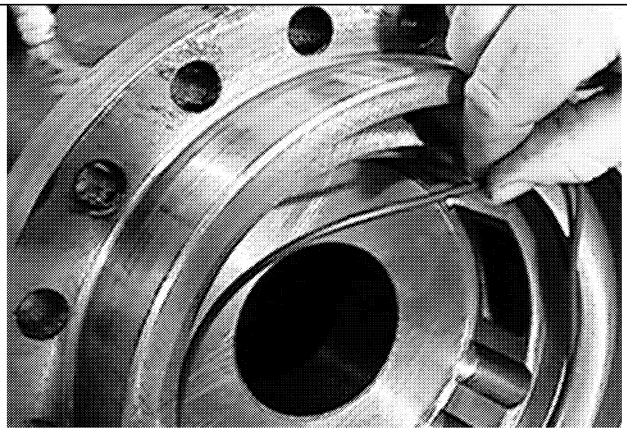
5j. Insert lubricated piston in bore.



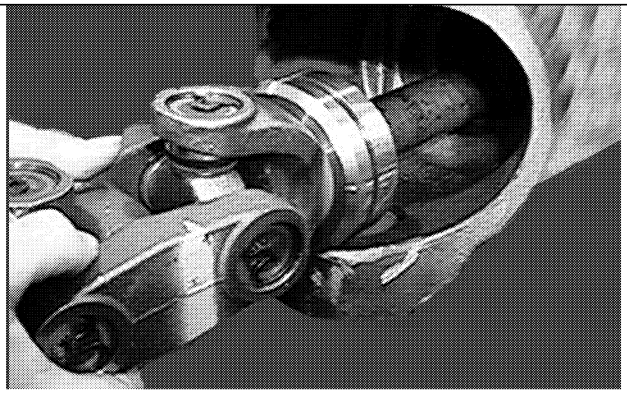
3j. Install O-ring in 3rd ring groove.



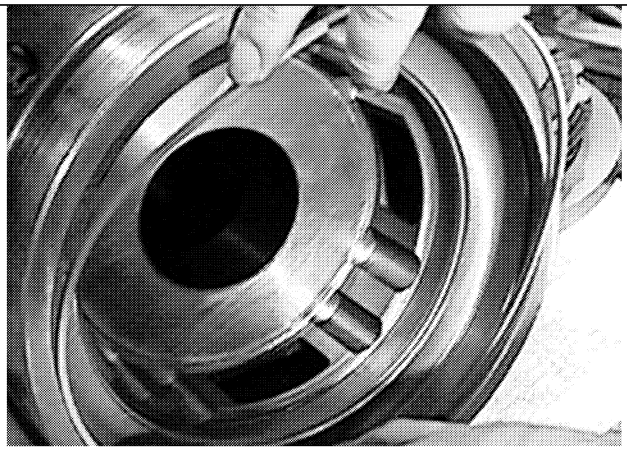
6j. Use installation tool to squarely press into bore. Tool drawing inside rear of manual.



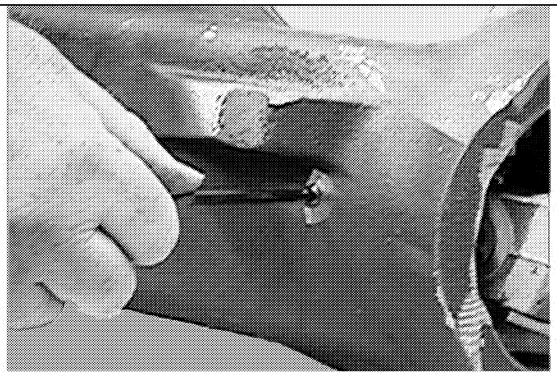
7j. Install energizer rings in 2nd and 1st ring grooves.



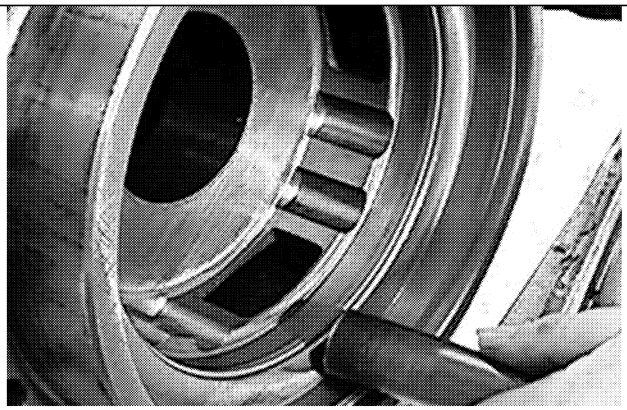
10j. Install axle shaft assembly into trumpet housing.



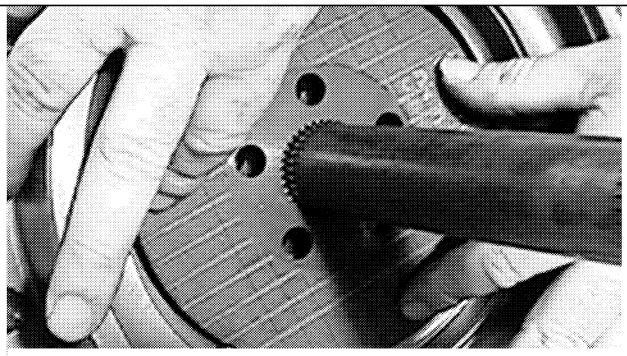
8j. Install glyd rings in 2nd and 1st ring grooves.



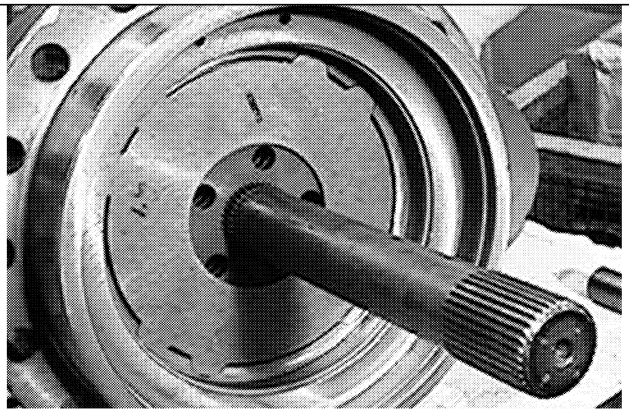
11j. Insert set screws in housing being sure they contact the axle shaft bearing on the chamfer. Apply Loctite 242, tighten to 5-7 ft\lbs (6.7–9.5 Nm).



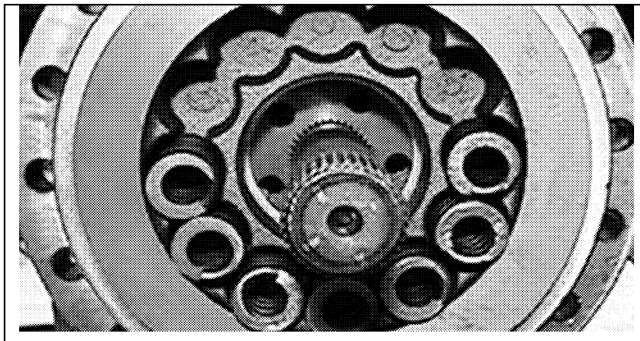
9j. A nick free, polished and lubricated cylindrical sizing tool may be used to ease piston installation.



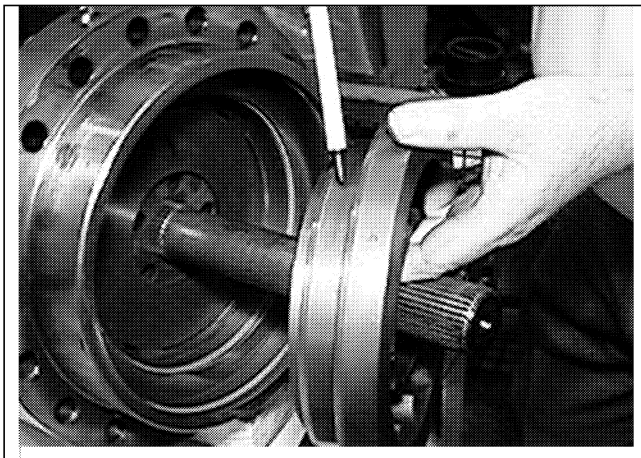
12j. Install friction disc and alternate with reaction disc; 4 friction disc and 5 reaction disc required per end. *Be sure holes in all disc are aligned!!*



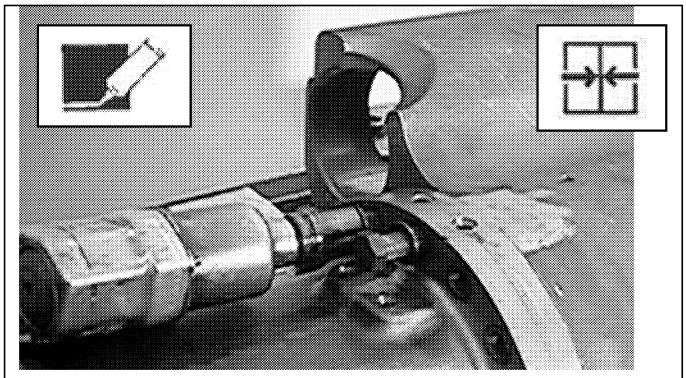
13j. Reaction disc installed.



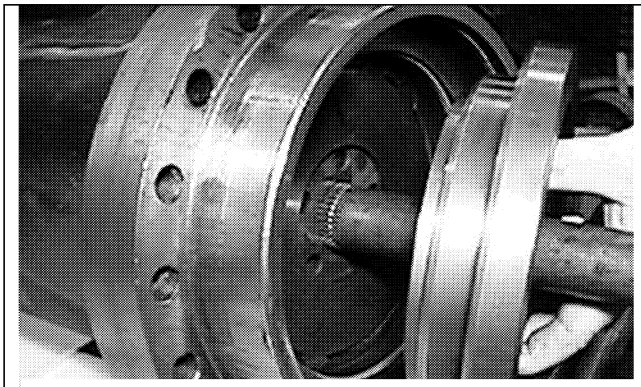
16j. Insert 12 parking brake springs after piston has been installed. After springs have been installed apply a bead of Loctite 515 to trumpet housing flange inboard of bolt circle.



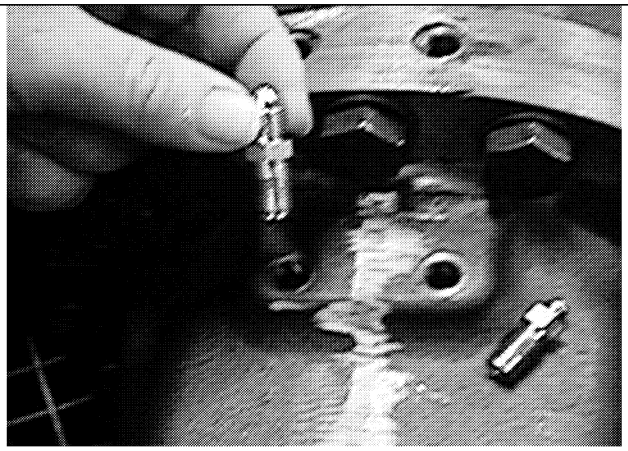
14j. Inspect piston for nicks, scratches, and other damage.



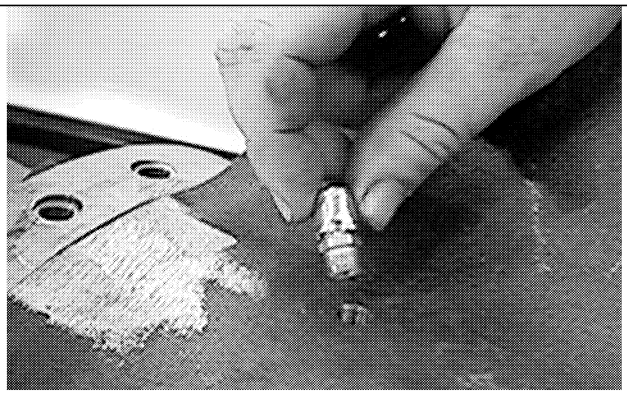
17j. Using proper lifting device install trumpet arm on housing center section and install capscrews being careful not to drop or knock brake springs out of place. Alternately tighten capscrews. Torque capscrews to 175-190 ft/lbs. (237-257Nm)



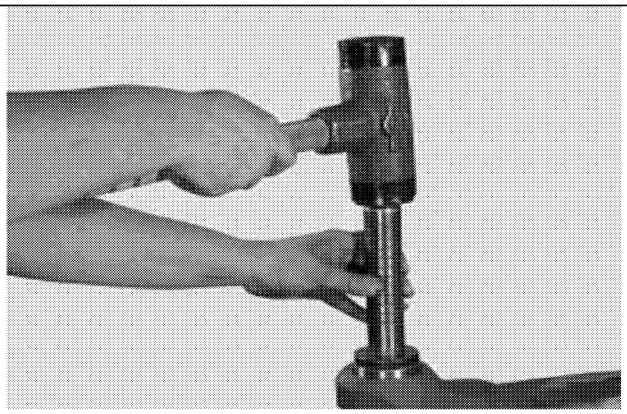
15j. Lubricate piston and seals before installing in bore. Use piston installation tool to assist in installation. *Refer to inside of rear cover for example.*



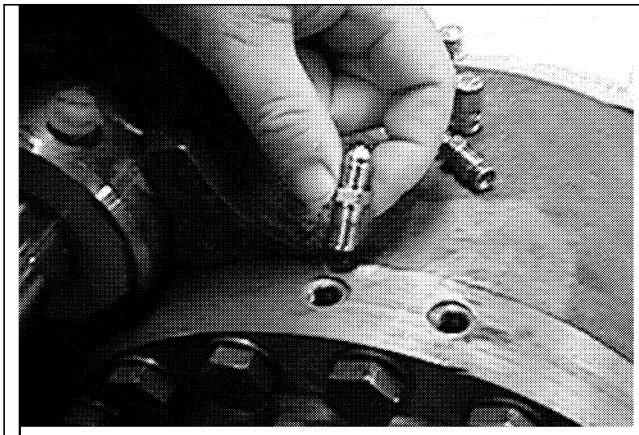
18j. Insert fitting and bleeder seats if required. Thread fitting and bleeder screws into place.



19j. Install vent in housing and torque to 7-10 ft/lbs. (9.5-13.5Nm)

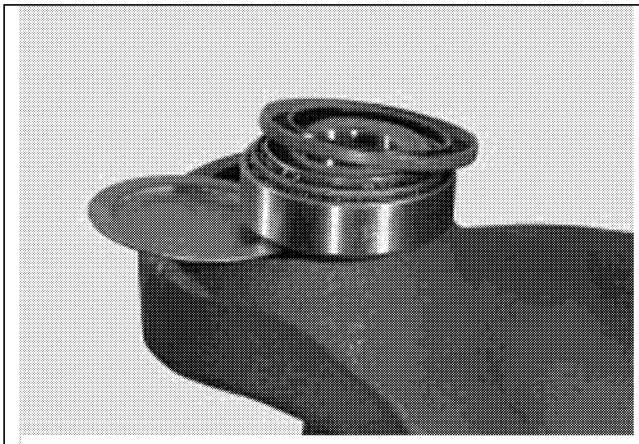


22j. Using proper tool install grease seal being careful not damage seal.

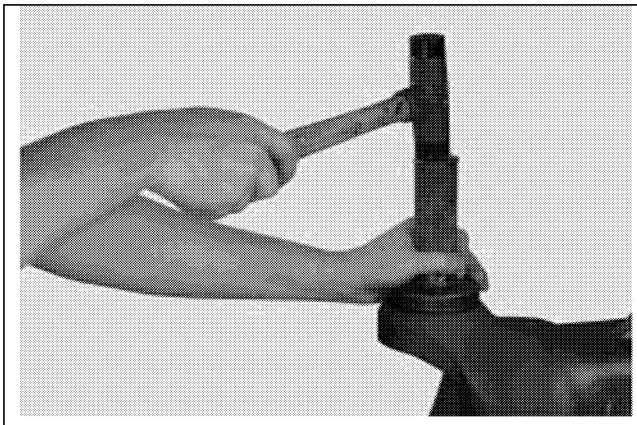


20j. Install the fitting and bleeder screws and torque to 7-10 ft/lbs. (9.5-13.5 Nm)

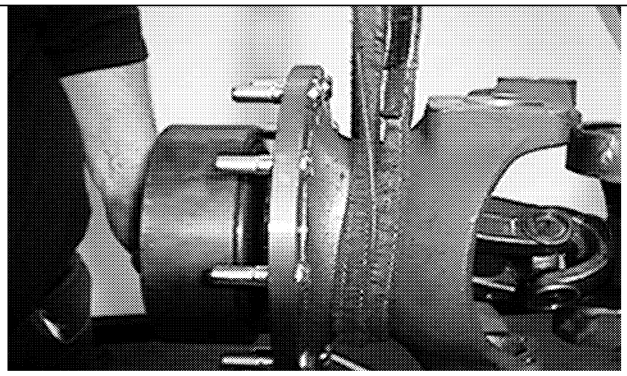
23j. Apply grease to cups and cones prior to installation.



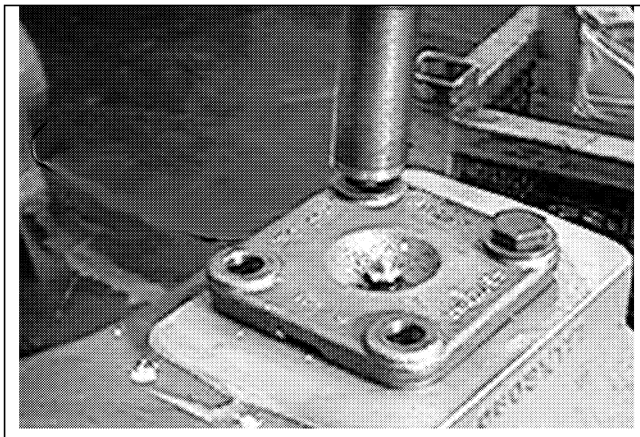
21j. Install grease retainers, cups, cones and seals.



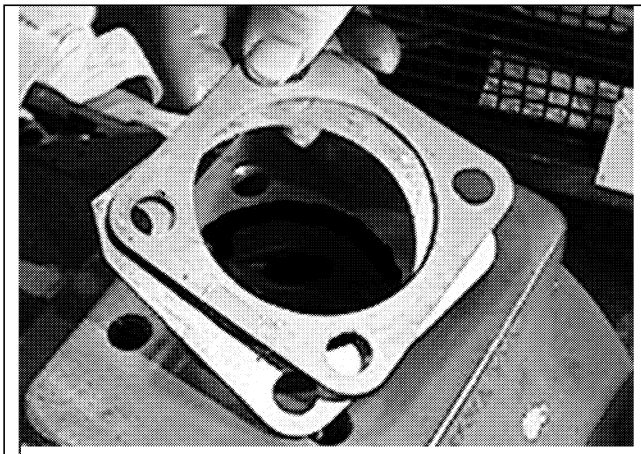
24j. Using proper tool install grease seal being careful not damage seal.



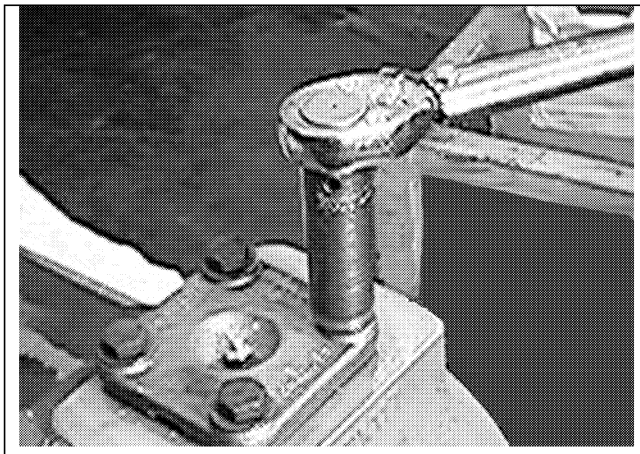
25j. Using a secure lifting device install the wheel end on the trumpet. Insert the sun shaft into the universal yoke.



28j. Install capscrews in kingpin.



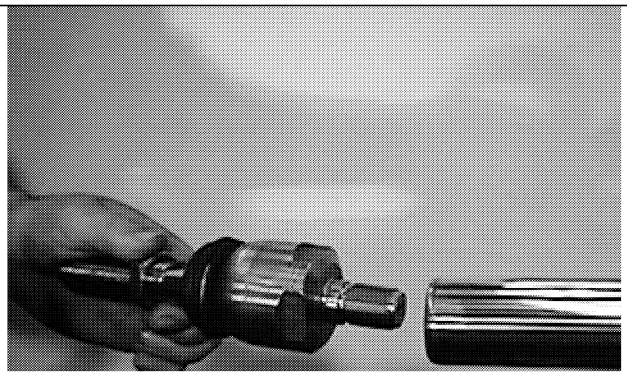
26j. Install proper thickness shims.
See Assembly Instruction Note #10.



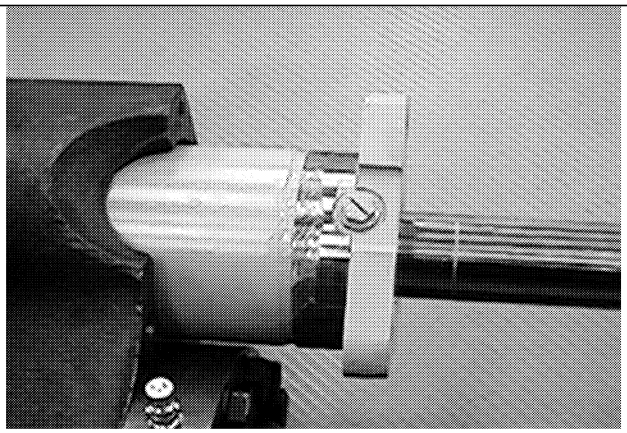
29j. Torque to 90-100 ft/lbs. (122-136 Nm).

27j. Insert king pin in bore.

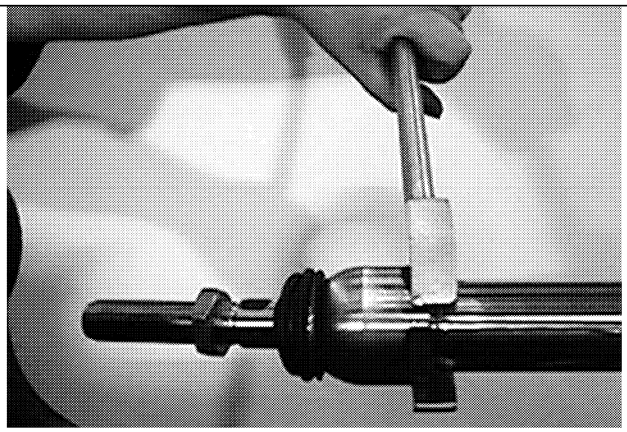
Steer Cylinder Reassembly



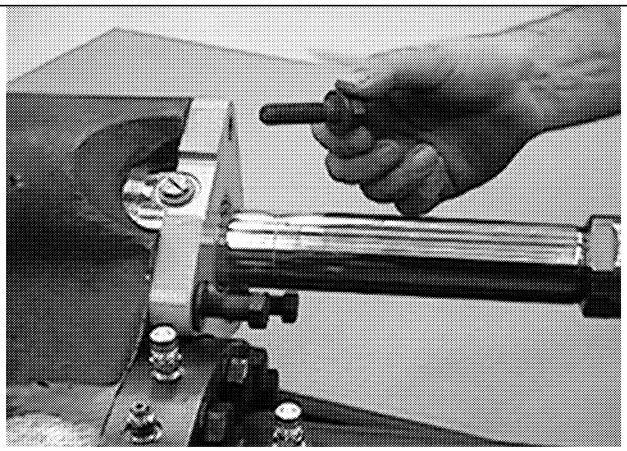
1k. Apply Loctite 271 to socket assembly threads. Install socket assembly on steer cylinder shaft.



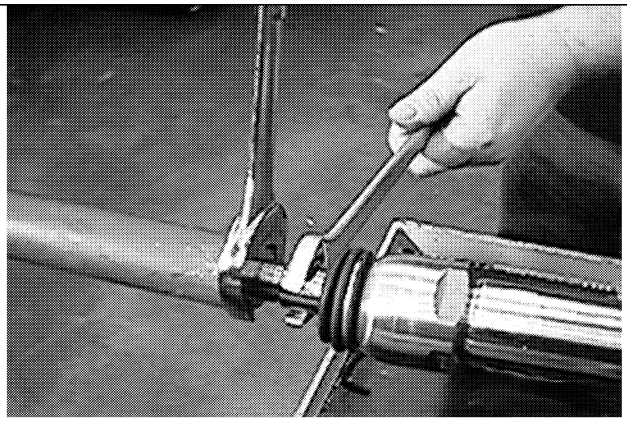
4k. Install steer cylinder in housing.



2k. Tighten to 313-367 ft/lbs. (424-497 Nm)

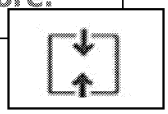


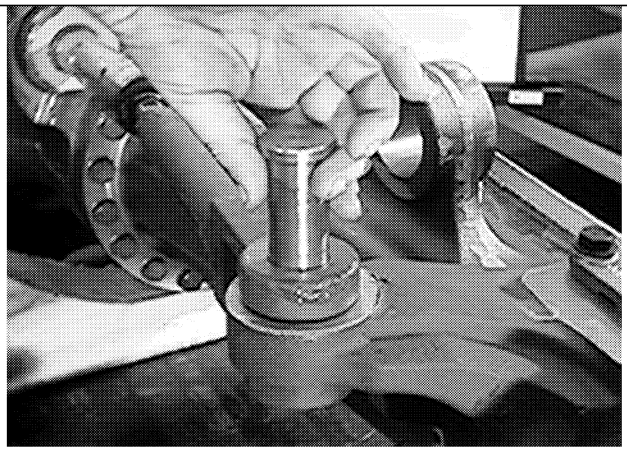
5k. Install capscrews and torque to 90-100 ft/lbs. (122-136 Nm)



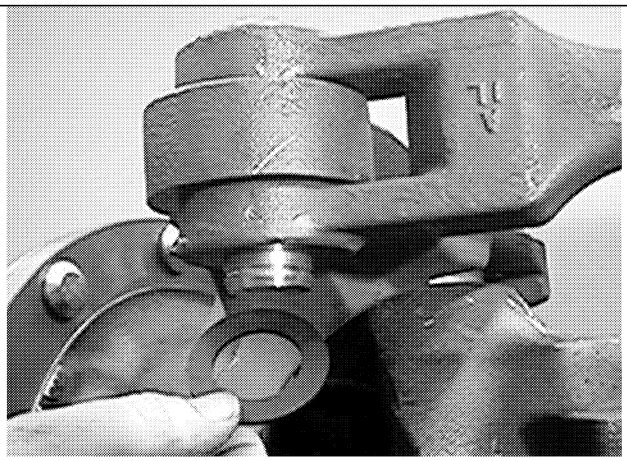
3k. Install steering arm and torque to 192-207 ft/lbs. (269-280 Nm)

1I. Install new O-rings in clevis bore.

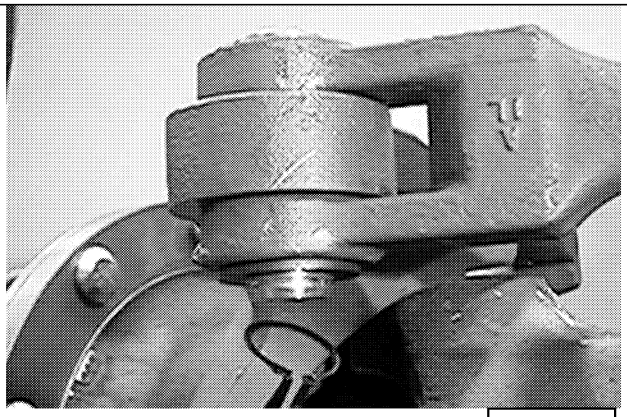




2I. Install the steering arm on the knuckle and insert the clevis pin.

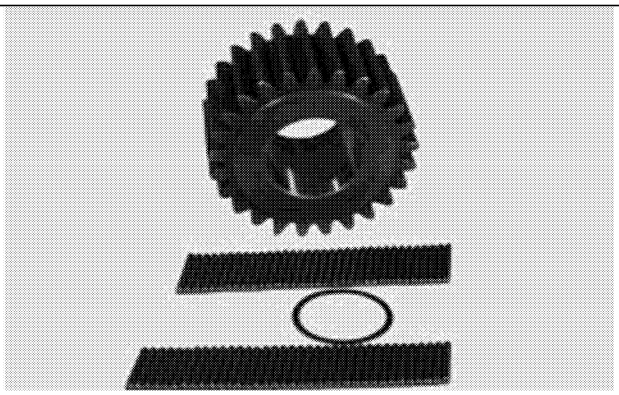


3I. Install thrust washer.

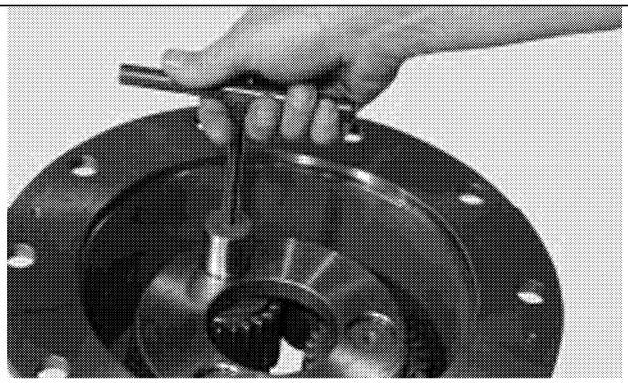


4I. Install snap ring

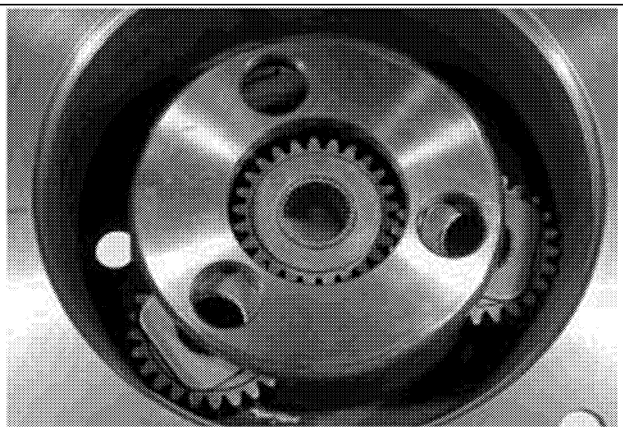
Note: Axle toe – in to be set to zero +/- .060” (1.5mm). Threads on socket to be centered within one (1) thread.



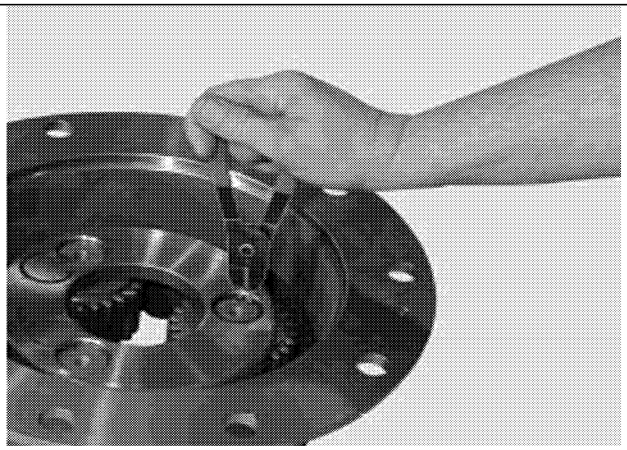
1m. Assemble the rollers and spacer using grease to retain rollers.



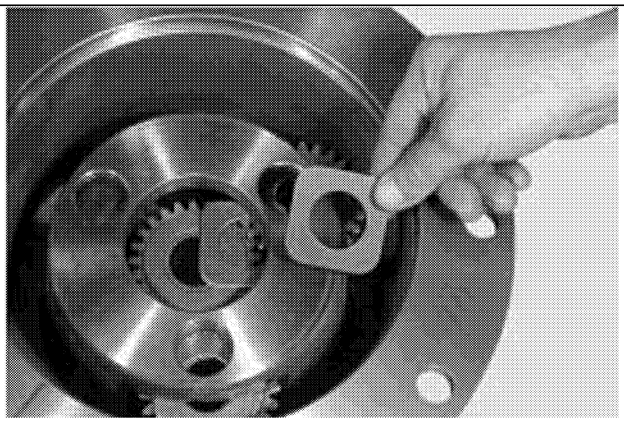
4m. Install planet gear shafts using removal and installation tool. *Tool drawing shown on page 66*



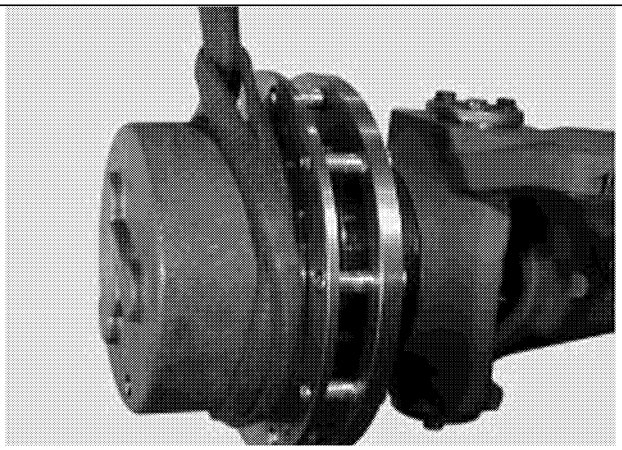
2m. Install planet gear assemblies into housing.



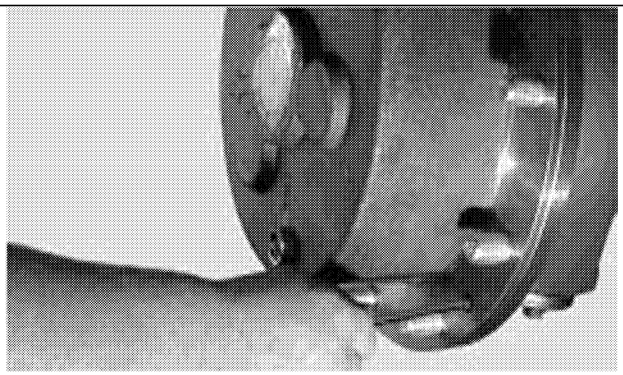
5m. Install planet shaft retaining rings.



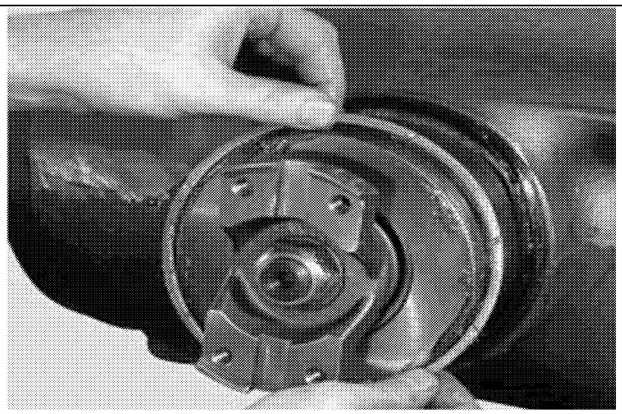
3m. Install planet gear thrust washers, position gears for shaft installation.



6m. Apply Loctite 515 on face of hub and install drive flange assembly. See *Assembly Instruction Note #12.*

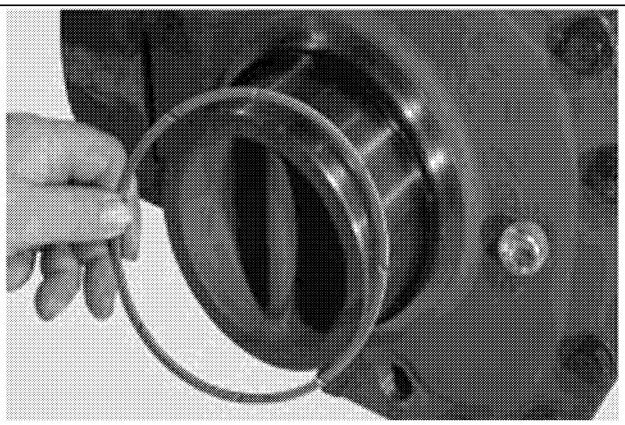


7m. Install drive flange retaining bolts two (2) places. Torque to 7-12 ft/lbs. (10-16 Nm)

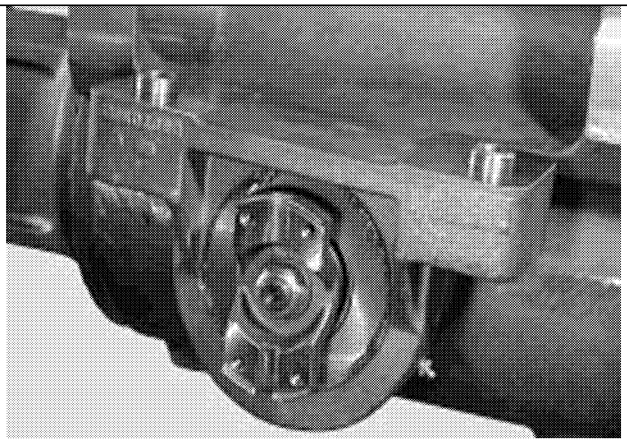


3n. Install rear trunnion V-ring and thrust washer. Grooves face out.

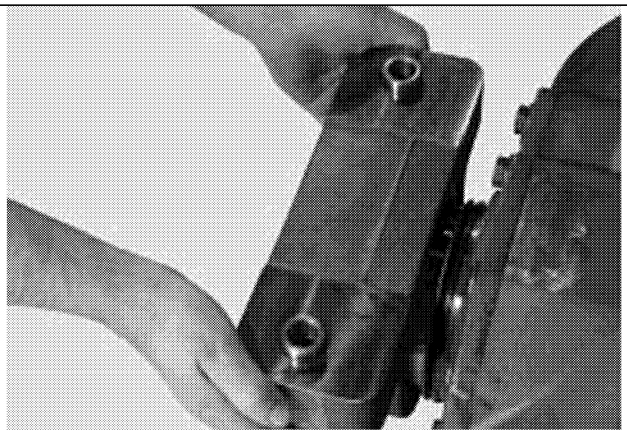
Installation of Front and Rear Trunnions



1n. Install V-ring seal and thrust washer on front trunnion mount. Grooves face out.



4n. Install rear trunnion mount on carrier housing.



2n. Install front trunnion assembly on housing.

Bleeding The Brake System

1. Fill the master cylinder reservoir with approved fluid before starting the bleeding operation. Keep the reservoir at least half full of fluid at all times during the bleeding operation. (**Note:** if the master cylinder is drained at any time during the bleeding operation, air will enter the system and rebleeding will be necessary).

2. Start the brake bleeding operation at the brake head with the **longest** line to the master cylinder.

3. While applying pressure from the pressure bleeder tank (or when mechanically bleeding, depress the brake pedal) open the bleeder screw and observe the flow of fluid. The pressure will move the fluid through the system and out the open bleeder screw carrying with it any air (evidenced by bubbles in the flow of fluid) that was trapped in the line and cylinder.

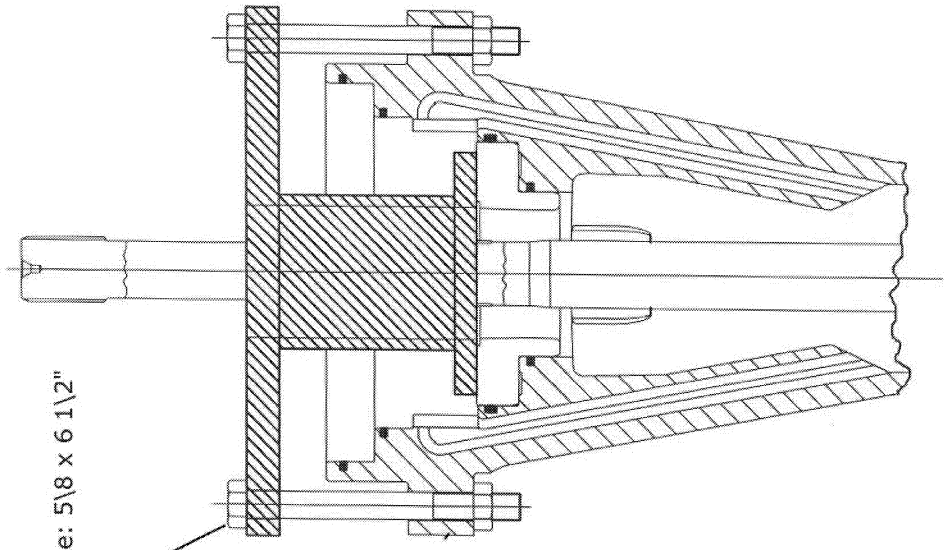
   NOTE: The bleeder screw must remain closed until the brake pedal has been fully depressed to prevent air from entering the system. After bleeding, the bleeder screw must be closed before the pedal is released.

4. Close the bleeder screw when the flow of fluid appears free of bubbles and flows solid. Reopen screw momentarily, then tighten.

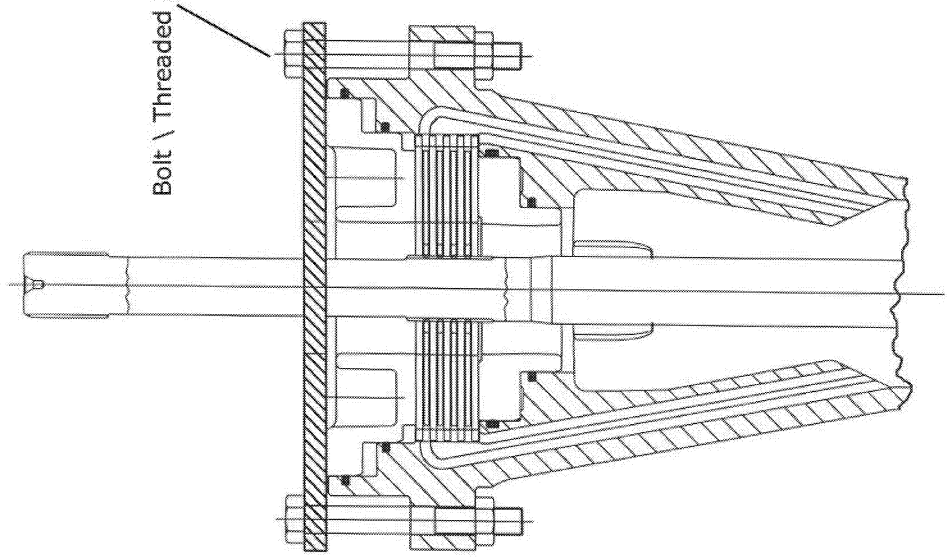
   NOTE: Fluid drained during the bleeding operation shall not be re-used because of possible contamination during the bleeding operation. The fluid level in the master cylinder should be replenished after each bleeding sequence.

5. Repeat procedure for each remaining brake. Work progressively from the brake with the **longest** line.

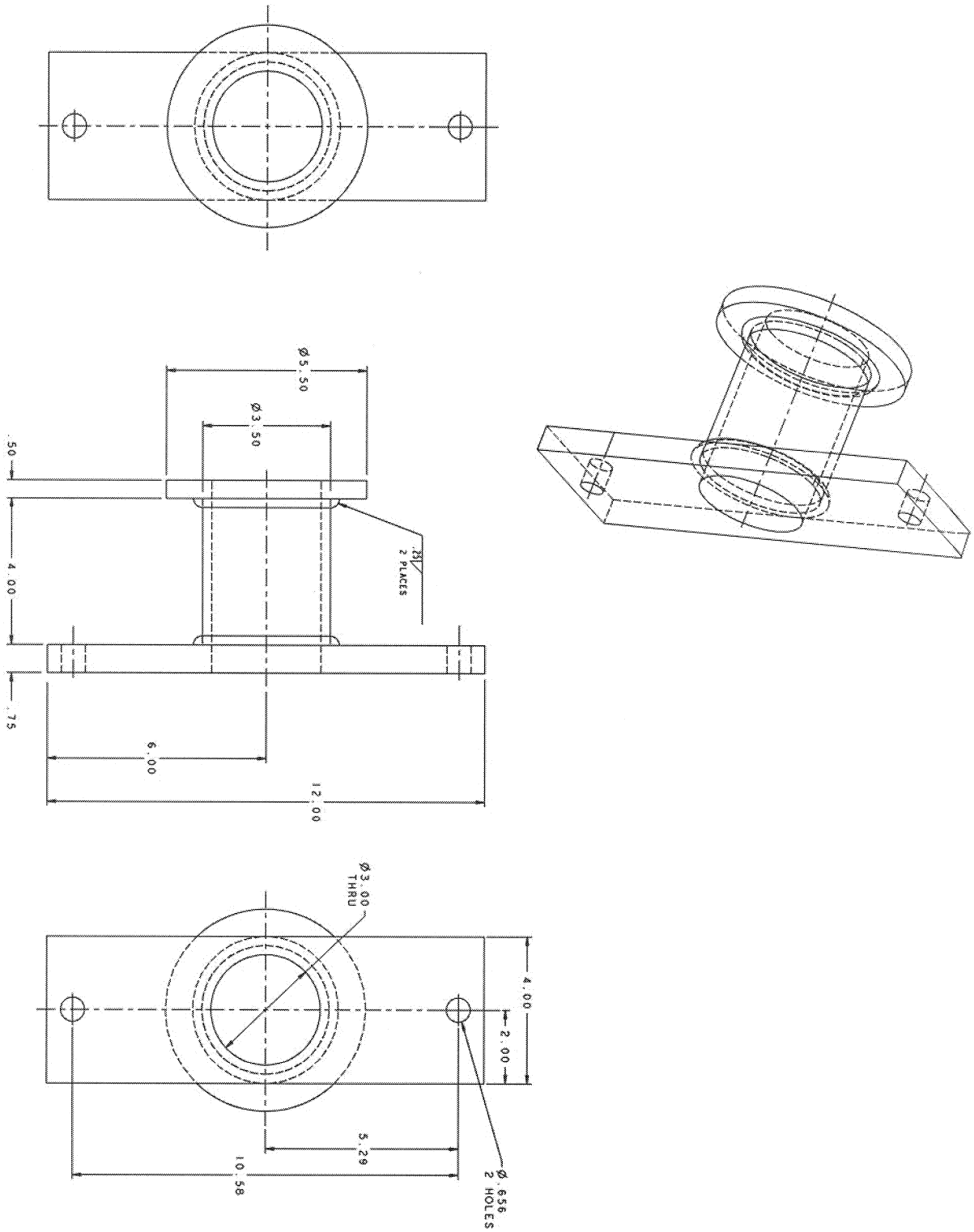
Service Brake Piston Installation



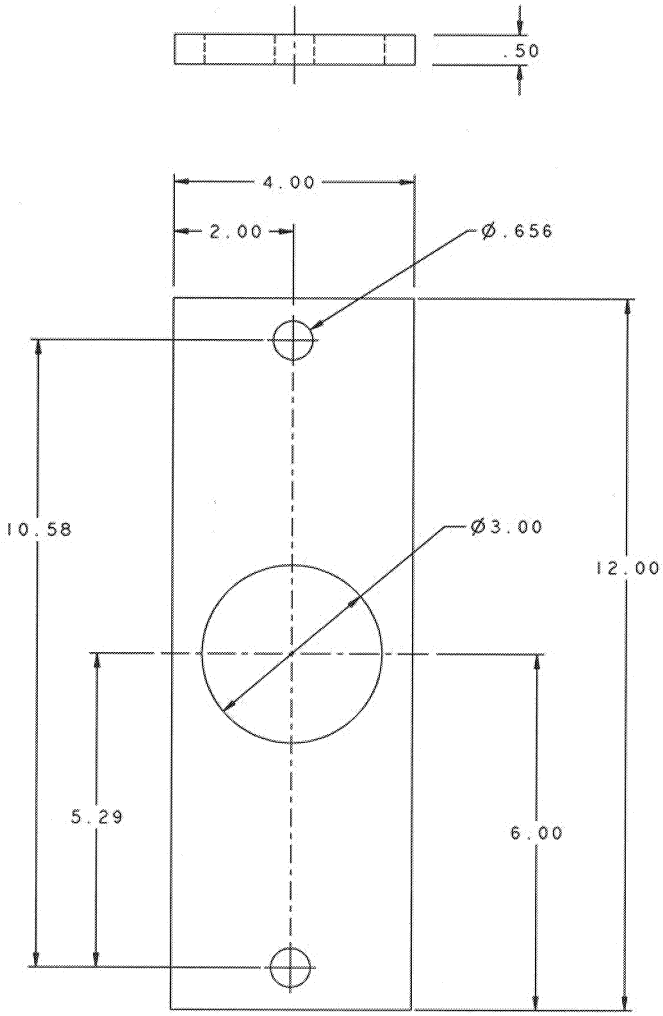
Park Brake Piston Installation

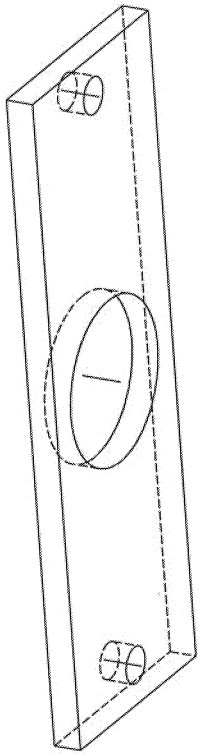


Service Brake Installation Tool



Park Brake Installation Tool





APPLICATION POLICY

Capability ratings, features and specifications vary depending upon the model type of service. Applications approvals must be obtained from Spicer Off-Highway Products Division. We reserve the right to change or modify our product specifications, configurations, or dimensions at any time without notice.

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