DANA SPICER®
Off-Highway Products

Service Manual

37R & 43R Hydraloc Differential Supplement

ASM-0147
August 2009

FOREWORD

This manual has been prepared to provide the customer and maintenance personnel with information and instructions on the maintenance and repair of Dana Products.

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, 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 mechanics study the instructions in this manual carefully and use it as a reference when performing maintenance and repair operations.

Whenever repair or replacement of component parts is required, only Dana 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. Dana does not warrant repair, replacement parts or failures resulting from the use of parts which are not supplied or approved by Dana. Important: Always furnish serial and model numbers when ordering parts.

SAFETY PRECAUTIONS

To reduce the chance of personal injury and/or property damaged, 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 a Dana specified replacement 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 purpose designed tools.

Accordingly, anyone who intends to use a replacement part, service procedure or tool which is not recommended must first determine that neither his safety or 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. Improper service or repair may damage the unit or render it unsafe. It is important to understand that these "Cautions and Notices' are not exhaustive. It is impossible to warn of all possible hazardous consequences that may result from following or failing to follow these instructions.

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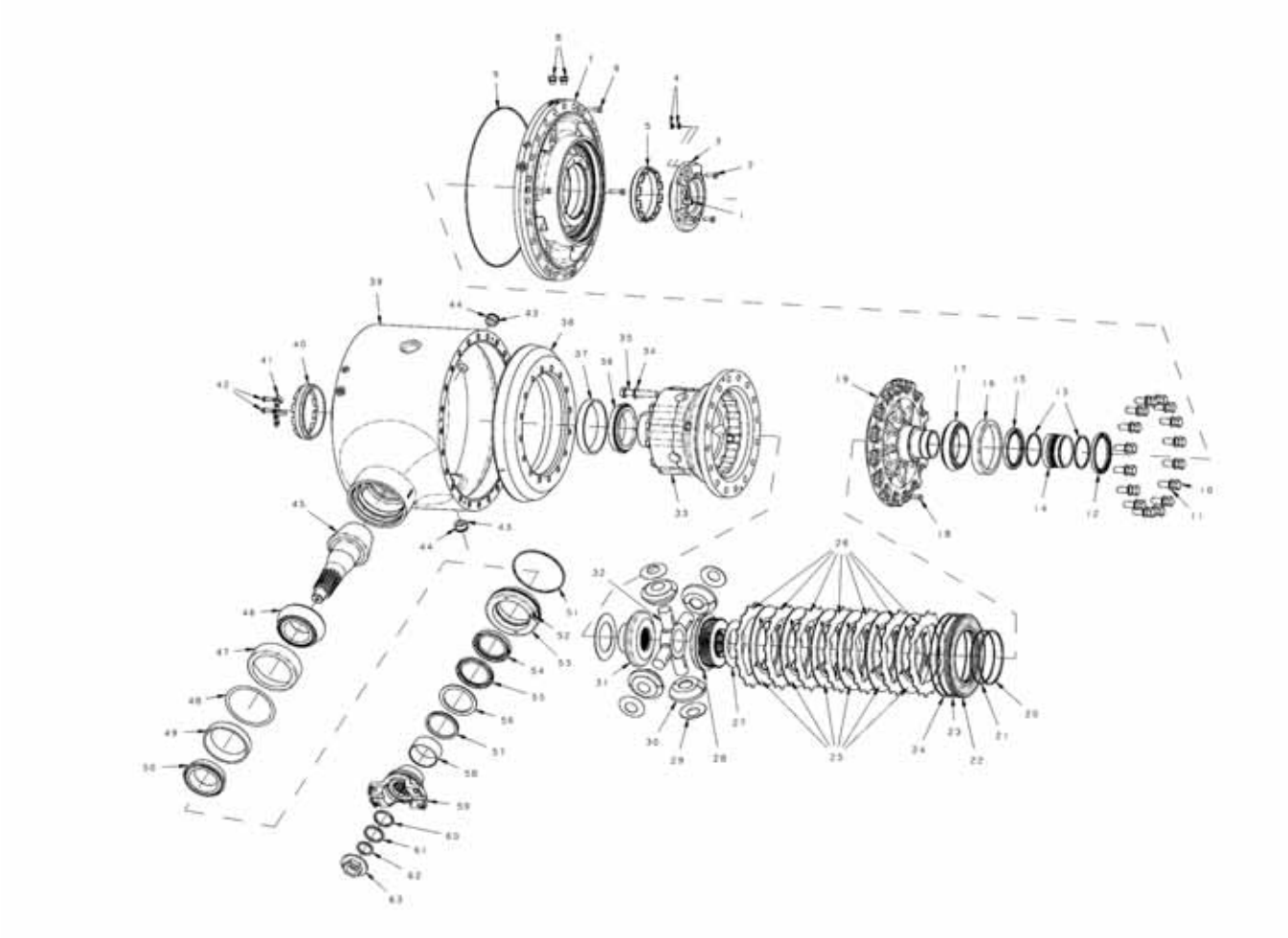
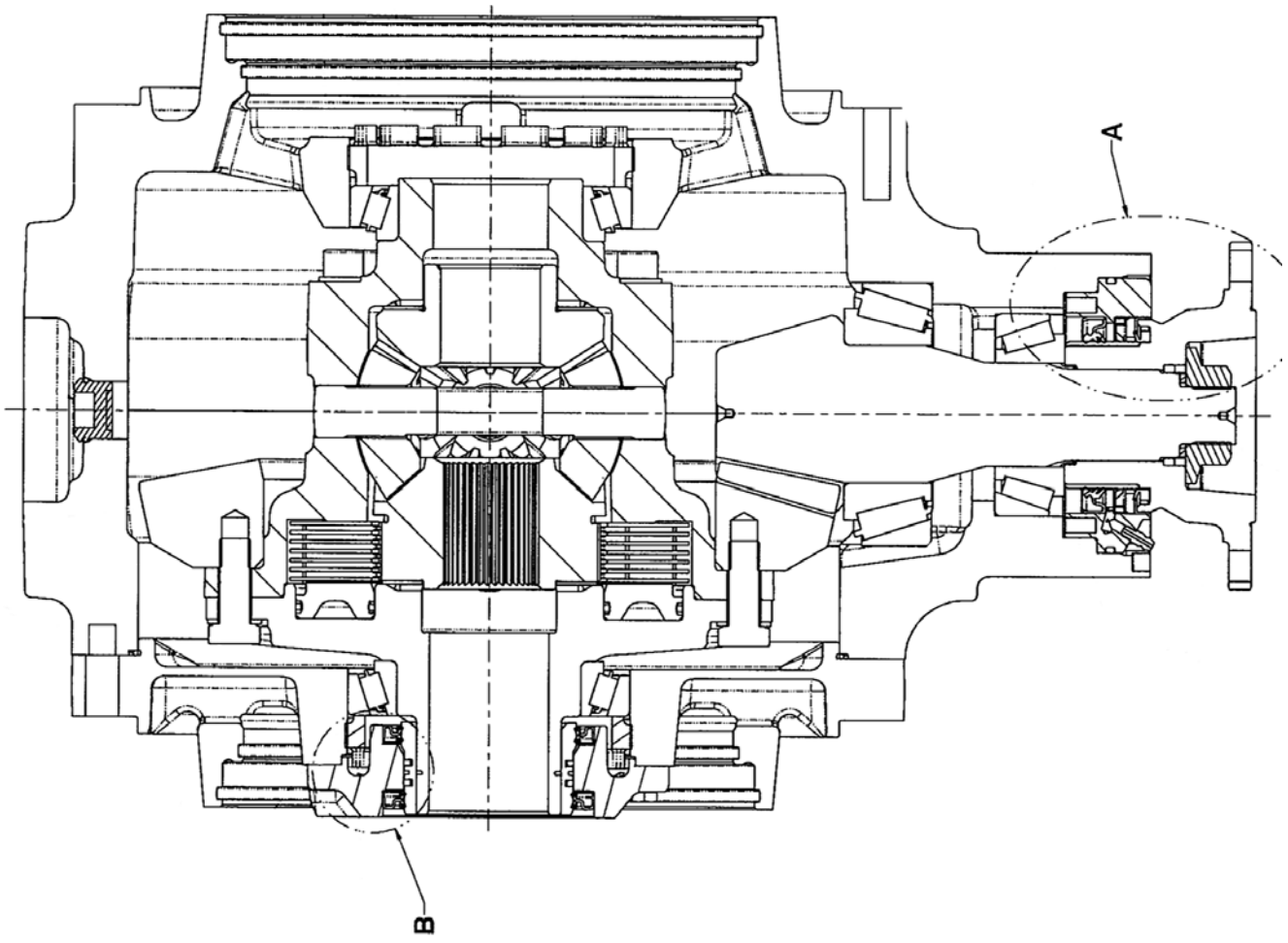
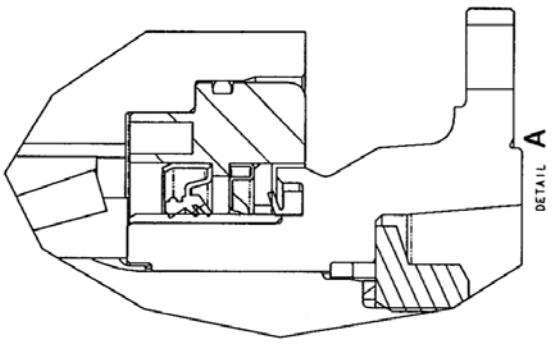
EXPLODED VIEW AND PARTS DESCRIPTION

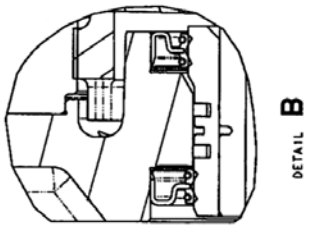


Item	Qty	Description	Item	Qty	Description	Item	Qty	Description
1	1	Screw-Socket Head	21	1	Seal-Inner Piston Backup	43	2	Plug-Magnetic
2	4	Capscrew	22	1	Piston	44	2	O-Ring-Plug
3	1	Retainer-Seal	23	1	Seal-Outer Piston	45	1	Gear-Pinion
3A	1	Plug-Seal Retainer 6mm	24	1	Seal-Outer Piston Backup	46	1	Cone-Pinion Inner Bearing
3B	1	Plug-Seal Retainer 3mm	25	6	Plate-Friction	47	1	Cup-Pinion Inner Bearing
4	2	Seal-Ring	26	7	Plate-Reaction	48	AR	Shim-Pinion Bearing
5	1	Nut-Differential Brg. Adj.	27	1	Washer-Side Gear Thrust	49	1	Cup-Pinion Outer Bearing
6	4	Capscrew	28	1	Gear-Side	50	1	Cone-Pinion Outer Bearing
7	1	Retainer-Differential	29	4	Washer-Pinion Gear Thrust	51	1	O-Ring
8	2	Plug-Differential Retainer	30	4	Gear-Pinion	52	1	Fitting-Grease
9	1	O-Ring	31	1	Gear-Side	53	1	Cartridge-Seal Retainer
10	16	Capscrew	32	1	Spider-Differential	54	1	Seal-Pinion
11	16	Washer	33	1	Assy-Cap & Clutch Hsng	55	1	Seal-Grease
12	1	Seal-Outer	34	12	Washer	56	1	Washer-Thrust
13	2	Ring-Piston	35	12	Capscrew	57	1	Seal-V Ring
14	1	Sleeve-Wear	36	1	Cone-Bearing	58	1	Sleeve-Wear
15	1	Seal-Inner	37	1	Cup-Bearing	59	1	Flange
16	1	Cup-Bearing	38	1	Gear-Ring	60	1	O-Ring
17	1	Cone-Bearing	39	1	Housing-Carrier	61	1	Seal-Spacer
18	2	Capscrew	40	1	Nut-Differential Brg. Adj.	62	1	Spacer-Pinion
19	1	Case-Diff Flange Half	41	1	Lock-Differential Adj. Nut.	63	1	Nut-Pinion
20	1	Seal-Inner Piston	42	2	Capscrew			

CROSS SECTION







HYDRALOC DIFFERENTIAL PRESSURE TEST INSTRUCTIONS

1. **Air Pressure Test**

   Air pressure test the pressure and tank port seals and system (Ports "P" & "T") :

   Apply 83 kpa [12 psi] to pressure and tank ports simultaneously and allow stabilization period of 20 seconds minimum.

   Lock off pressure and measure decay in 10 seconds.

   Maximum allowable decay is 23 pa [.0033 psi] in 10 seconds. Alternate decay / period is .69 kpa [.1psi] per 5 minutes.

2. **Hydraulic Pressure Test**

   Hydralic pressure test the pressure port seals and system (Port "P") :

   Apply 4137 kpa [600 psi] to pressure port, with open tank line back to tank. Allow stabilization period of 20 seconds minimum and release.

   Reapply 4137 kpa [600 psi] and monitor fluid for a (1) one minute period. Fluid flow rate should not exceed 2.83 lpm [.75 gpm]

BEARING HEATING AND FREEZING GUIDELINES

Bearings often must be cooled or heated to aid in assembly or removal. Since temperature extremes can cause permanent bearing metallurgical damage, it is important to take proper precautions and use correct methods when heating and cooling bearings.

Cups that are to be assembled in hubs or housings with a press fit may be shrunk in a deep freeze unit. Standard class bearings should not be cooled below -65° F (-54° C). In addition to cooling the bearing cup, in some instances it may be necessary to heat the housing.

To control temperature, is best to use a thermostat along with a freezer unit or a properly calibrated thermometer. If a suitable freezer or thermometer is not available, your Timken service representative can suggest liquid combinations that freeze the bearing cup at the optimal temperatures. Regardless of the method, check the cup's final seating against the housing shoulder with feeler gauges.

Take extreme care that standard product bearings are never heated above 149° C [300° F]. If bearings are heated above this temperature, their metallurgical structure may soften, rendering them unsuitable for use.

There are a number of recommended methods for heating bearings. Electric ovens or electrically heated oil baths may be used, but only when accompanied by proper thermostatic control. If you use a hot plate to heat the oil, never rest bearings directly on the bottom of the pan. Instead, protect bearings from the heat source with a simple wire screen holder or similar device.

Use heat-resistant gloves to handle heated cones. Hold the hot cone solid against the cold shoulder on the shaft until the cone grabs on to the shaft. The hot cone will pull away from the cold shoulder unless it is held in position. Use .002 [.05 mm] feeler gages to make sure the cone is fully seated against the shoulder after the parts are cooled. Many loose bearing settings (excessive end play) are caused by an unseated cone working back against the shoulder in service.

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 slowly 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 block 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. Dry bearings using moisture free compressed air. Be careful to direct air stream across bearings to avoid spinning. Bearings may be rotated slowly by hand to facilitate the drying process.

HOUSINGS, COVERS AND CAPS

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 thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly 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 lapping 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 lint free 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”.

CLEANING AND INSPECTION - CONT.

GEARS AND SHAFTS

If Magna-Flux or a dye penetrant process is available use process to check parts. Examine teeth and the ground/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 stone. Inspect shafts to make certain they are not sprung, bent or have twisted splines.

HOUSINGS, COVERS AND CAPS

Inspect housings and covers 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 conditions which can cause oil leaks or failures.

RECOMMENDED LUBRICANTS FOR DANA DRIVE AXLES

Recommendations: Extreme pressure gear lubricant is recommended for use in all drive-steer and rigid drive axles except where explicitly stated differently by Dana Off-Highway Products Engineering.

Mineral Based: Acceptable lubricants must meet **API GL-5/MT** or **MIL-PRF2105E** qualifications. The highest viscosity grade must be used given the prevailing ambient temperatures from the chart below. Limited slip designated GL-5 oil brands are preferred for quiet operating characteristics.

Universal Tractor Transmission Oils (UTTO Fluids): Acceptable lubricants must meet Dana MS266 or J. Deere J20C specifications. Use the highest viscosity grade for the ambient temperatures from the temperature chart below.

Synthetics: Synthetic lubricants are recommended providing they meet **API GL-5/MT-1** qualifications. The highest viscosity grade must be used given the prevailing ambient temperatures from the chart below. 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 point. 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 the issue of high-pressure lubricant applications.

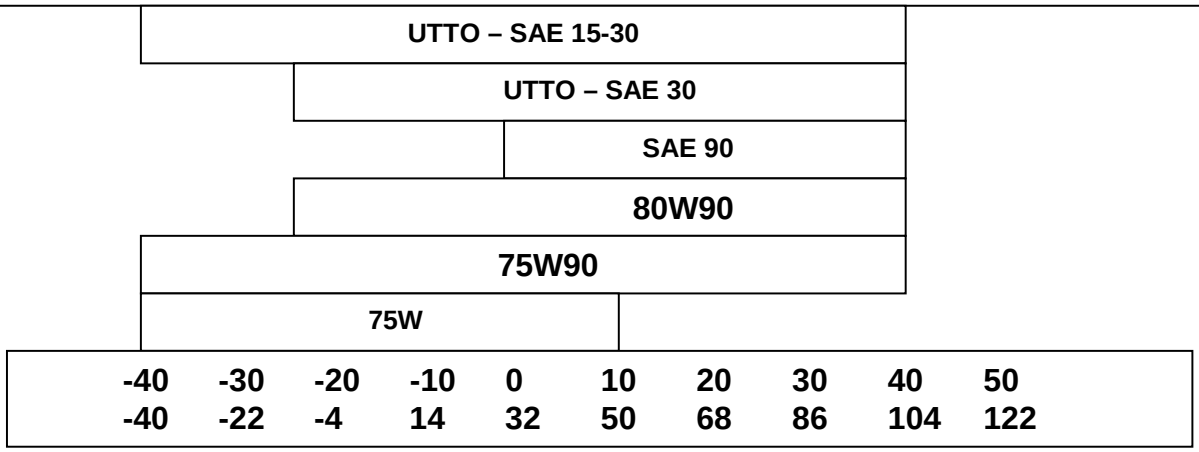
Normal Oil Change Intervals: Oil change intervals for mineral based lubricants in normal environmental and duty cycle conditions is 1000 hours in all off-highway applications and 10,000 miles in on-highway applications. Severe or sustained high operating temperature or very dusty atmospheric conditions 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 base line. 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 278E.**

The use of aftermarket lubricant additives other than those specified is not recommended and may reduce the life of the axle and void the warranty!

Viscosity Based on Prevailing Ambient Temperature



UNIVERSAL TRACTOR TRANSAXLE OILS (UTTO) RECOMMENDED FOR DANA DRIVE AXLES

Viscosity Class: SAE 30 / SAE 20-30 / SAE 15-30 Weights

MANUFACTURER	TRADE NAME
AMOCO	AMOCO1000
AQUIP	AQUIP Supertractor
Aral Lubricants GMBH, Bochum/D	Aral Fluid HGS
Avia Mineralol-AG, Munchen/D	Avia N56
BP	BP Eldoran UTH
BP Australia LTD, Silverwaters/AUS	Tractran TF-10
BP Oil International, London/GB	Tractran TF-9
BP Oil International, London/GB	Terrac Fluid 9
Caltrex Petroleum Corp., London/GB	Caltex Textran TDH Premium
Case New Holland	Hytrans
Castrol International, Swindon/GB	Castrol AGRI Powertrans
Cheveron	Chevron THF
Dea Mineralol AG, Hamburg/D	Deagear TDH OMV AG
ESSO Lubricants Europe, Brussel/B	ESSO Torque Fluid 56
Ford	Ford 134D UTF
Fuchs Dea Schnierstoffe, Mannhein/D	Titan Hydra J20C
Imperial Oil, Toronto/CDN	Torque Fluid N56
John Deere, Waterloo/USA	Deere Hydgard J20-C
John Deere Waterloo/USA	John Deere Hy-Gard (Europa)
Kuwait Petroleum, Europoor/NL	Q8 T 2000
Mobil Oil Company LTD, Coryton/GB	Mobilfluid 424
Mobil Oil Do Brasil, Sao Paulo/BR	Mobilfluid 424
Mobil	Mobil 424 UTF
Pakelo Motor Oil, San Bonifacio/I	Pakelo UTTO Fluid 4D
Panolin AG, Madetswil/CH	Panolin JD 303
Schwechat/A	OMV Austromatic IGB
Shell Aseol AG, Bern/CH	Aseol Multitrac 85W
Shell International, London/GB	Shell Donax TD 80W
Shell	Shell Donax TD
Texaco Belgium N.V., Brussels/B	Textran TDH Premium
Texaco	Texaco TDH
Total Fina	Trac Elf C4-1000

NOTES:

1) The above list of oils is not meant to be an all inclusive list of acceptable oils for use in Dana products.
2) It is the end users responsibility to select the best grades of oils available in the local area that provide proper viscosity and limited slip friction additives for long product life and noise free operation.

API GL5 CLASS GEAR LUBRICANTS WITH LIMITED SLIP ADDITIVES RECOMMENDED FOR DANA DRIVE AXLES

Viscosity Class: SAE 75W-90 / 80W-90 / 85W-90 / 90

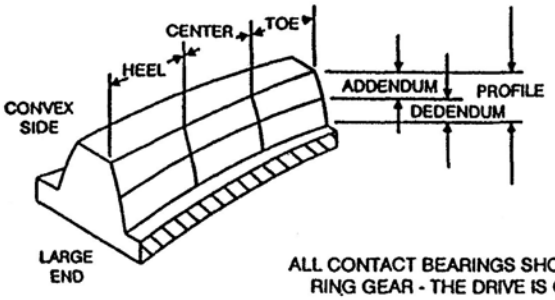
MANUFACTURER	TRADE NAME
Addinol Mineralol GMBH, Krump/A/D	Addinol Getriebeol 85W90 LS
Agip Petroli Spa, Rom/I	Agip Rotra, MP/S
Aral Lubricants GMBH, Bochum/D	Aral Degol 3216
Avia Mineraloi-AG, Munchen/D	Avia Hypoid 90 LS
Baywa AG, Munchen/D	Baywa Getriebeol Hypoid LS 90
Blaser Swisslube, Hasie-Ruegsau/CH	Hypoid-Getriebeol LS
BP Oil International, London/GB	Frontal Getriebeol LS
BP Oil International, London/GB	Energear Limslip 90
Bucher AG, Langenthal/CH	Motorex Gear Oil LS
Calpam GMBH, Aschaffenburg/D	Calpam Gear Oil LS 90
Castrol International Swindon/GB	Castrol Hypoy LS
Castrol International Swindon/GB	Castrol LSX
Citgo USA	Citgo Premium LS 80W-90
Citgo USA	Citgo Synthetic 75W-90
ELF Lubricants, Paris/F	Antar BLS
ELF Lubricants, Paris/F	HRD EP GL
ELF Lubricants, Paris/F	Tranself Typ BLS
ELF Lubricants, North America	Gear Elf BlS90
Eller-Montan-Comp-Duisburg/D	Elimo-Hypoid LS
ESSO Lubricants Europe, Brussel/B	Esso Getriebeoel LSA 85W90
ESSO Imperial Oil NA	Esso GX LS 80W-90
ESSO Imperial Oil NA	Esso Extra LS 75W-90
Fina Europe, SA Brussel/B	Fina Pontonic LS
Fina Europe, SA Brussel/B	Fina Dynatrans LS
Fuchs Dea Schmierstoffe, Mannheim/D	Dealear LS
Fuchs Dea Schmierstoffe, Mannheim/D	Titan Gear LS90
Fuchs Dea Schmierstoffe, Mannheim/D	Dealear AWB
Furukawa Co LTD, Japan	Kyoseki FK Axle 80W90
Genol GMBH, Wiena/A	Genol Hypolube LS 90
Ginouves Georges SA, LA Farieda/F	York 798 LS
HAFA, Paris/F	Hypoid PA
Igol France, Paris/F	Igol Hypoid BPA
Indian Oil Corp, Faridabad/Ind	Servp Gear Super LS 90

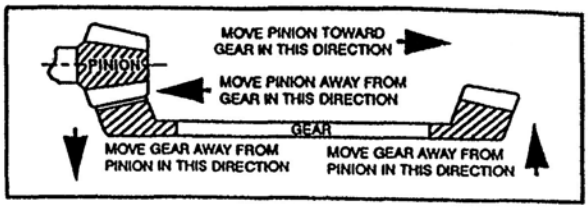
MANUFACTURER	TRADE NAME
Italiana Petroli, Genova A/I	IP Pontiax LS
Kompressol-OEL, Koin/D	Kompressol-Hypoid EW
Leprince + Siveke GMBH, Herford/D	Leprinxol LS
Liqui Moly GMBH, ULM/D	LM Hypoidgetriebeol GL
Meguin GMBH, Saariouis/D	Megol Hypoidgetriebeol
MIN.OL-Raffin Dollbergen, Uetza/D	Pennasol Sperrdiff-Getr
Mobil Oil, Wedel/D	Mobilube LS
Mobil USA	Mobilube HD 80W-90 LS
Mol Hungarian Oil, Komarom/H	Carrier Hykomol LS
Motul AS, Valres Sur Marne/F	Motul 90 PA
Nova Stilmoll SPA, Modena/I	Gearing Wonder LS 85W
Nova Stilmoll SPA, Modena/I	Gear G3 Lube Special L
Oest G. Min.Ol-Werk, Freudenstadt/D	Getriebeol Hypoid LS 90
OMV AG. Schwechat/A	OMV Gear Oil LS
Orfy International, Vieux-Thann/F	Orfy Tucana LS
Pakelo Motor Oil, San Bonifacio/I	Pakelo Universal Gear E
Panolin AG, Madetswil/CH	Panolin Super Duty LS
Pennzoil NA	4096 80W-90LS
Quaker State NA	HP 80W-90
Raiffeisen HG Nord AG, Hannover/D	HG Getriebeol LS 90
Repsol Distribucion SA, Madrid/E	S EP Autoblocante
SAEL Madrid/E	Gulf LS Rear Axle Oil
Schmierstoffraffinerie Saizbergen/D	Wintershall Wiolin RSH
Shell Aseol AG, Bern/CH	Aseol Topress LS
Shell International London/GB	Shell Getriebeol 90 LS
SK Corporation, Eeoul/Korea	SK G-LS 80W/90 Gear (
Texaco Belgium N.V. Brussels/B	Geartex LS
Texaco USA	Mutligear EP 80W-90
Total Raffinage Distr. Paris/F	Total Transmission DA
Turbotank Bosche+Bodeker, Bremen/D	Turbo Getriebeol LS
Unil Deutschland GMBH, Bremen/D	Unil Gear AB EP
Unil Opal, Rueil Maimaison/F	Unil Opal Gear AB-EP
Veedol International, Swindon/GB	Veedol Multigear L
Yacco SA, St Pierre-LES-Elbeuf/F	Yahypo BN 90

NOTES: 1) The above list of oils is not meant to be an all inclusive list of acceptable oils for use in Dana products. **2)** It is the end users responsibility to select the best grades of oils available in the local area that provide proper viscosity and limited slip friction additives for long product life and noise free operation. **3)** Intermixing of GL5 oils with UTTO GL4 oils is not recommended as they are not compatible.

LEFT HAND SPIRAL

SPIRAL BEVEL AND HYPOID TOOTH BEARING CHART





ALL CONTACT BEARINGS SHOWN BELOW ARE ON **LEFT HAND** SPIRAL RING GEAR - THE DRIVE IS ON THE CONVEX SIDE OF THE TOOTH.

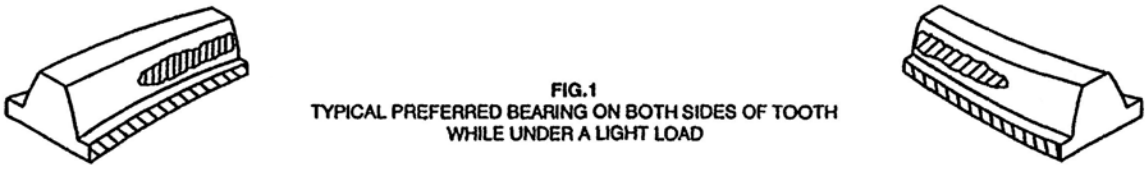


FIG.1
TYPICAL PREFERRED BEARING ON BOTH SIDES OF TOOTH WHILE UNDER A LIGHT LOAD

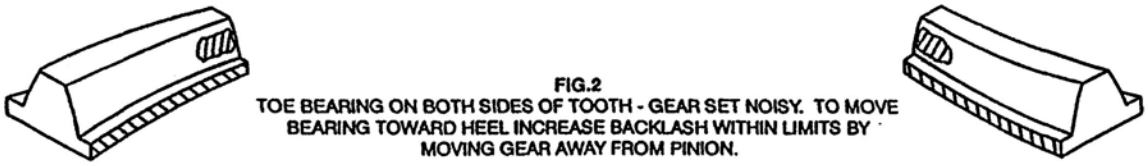


FIG.2
TOE BEARING ON BOTH SIDES OF TOOTH - GEAR SET NOISY. TO MOVE BEARING TOWARD HEEL INCREASE BACKLASH WITHIN LIMITS BY MOVING GEAR AWAY FROM PINION.

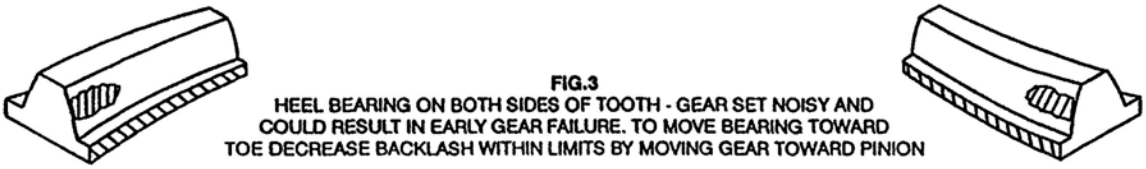


FIG.3
HEEL BEARING ON BOTH SIDES OF TOOTH - GEAR SET NOISY AND COULD RESULT IN EARLY GEAR FAILURE. TO MOVE BEARING TOWARD TOE DECREASE BACKLASH WITHIN LIMITS BY MOVING GEAR TOWARD PINION

FIG.4
LOW BEARING ON GEAR AND HIGH BEARING ON PINION. CORRECT BY PULLING PINION AWAY FROM GEAR (INCREASE MOUNTING DISTANCE)

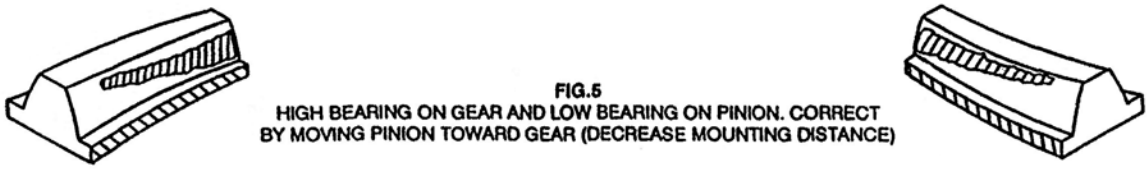


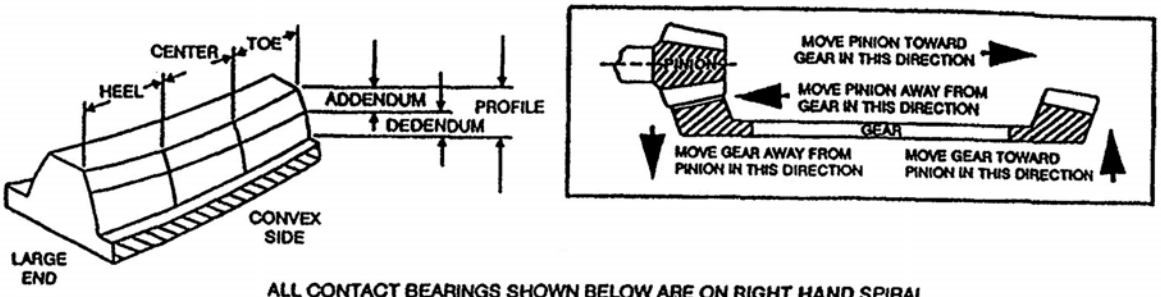
FIG.5
HIGH BEARING ON GEAR AND LOW BEARING ON PINION. CORRECT BY MOVING PINION TOWARD GEAR (DECREASE MOUNTING DISTANCE)

BACKLASH

BACKLASH SHOULD BE MEASURED WITH A DIAL INDICATOR RIGIDLY MOUNTED WITH THE STEM PERPENDICULAR TO THE TOOTH SURFACE AT THE EXTREME HEEL. SEE SHEET NO. 2 FOR BACKLASH VALUES.

RIGHT HAND SPIRAL

SPIRAL BEVEL AND HYPOID TOOTH BEARING 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

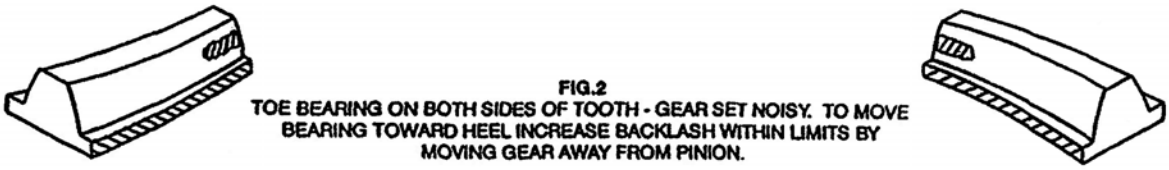


FIG.2
TOE BEARING ON BOTH SIDES OF TOOTH - GEAR SET NOISY. TO MOVE BEARING TOWARD HEEL INCREASE BACKLASH WITHIN LIMITS BY MOVING GEAR AWAY FROM PINION.

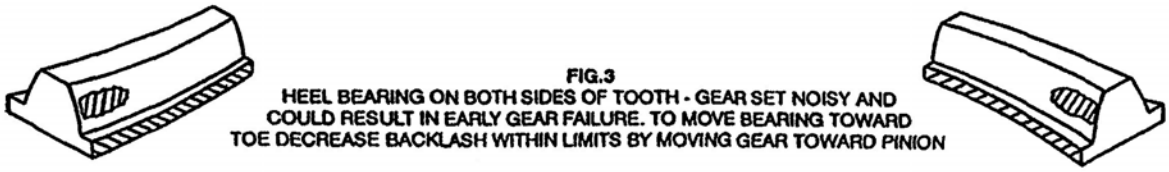


FIG.3
HEEL BEARING ON BOTH SIDES OF TOOTH - GEAR SET NOISY AND COULD RESULT IN EARLY GEAR FAILURE. TO MOVE BEARING TOWARD TOE DECREASE BACKLASH WITHIN LIMITS BY MOVING GEAR TOWARD PINION

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. SEE SHEET NO. 2 FOR BACKLASH VALUES.

FASTENER TORQUE CHART

STANDARD FASTENERS Lubricated and Plated Bolts, CapScrews, and Studs				
	Grade 5		Grade 8	
	3 Radial Dashes On Bolt Head		6 Radial Dashes On Bolt Head	
Size	LBF/FT	[Nm]	LBF/FT	[Nm]
1/4-20	10	14	11	15
1/4-28	11	15	13	18
5/16-18	16	22	30	41
5/16-24	20	27	32	43
3/8-16	25	34	36	49
3/8-24	29	39	41	56
7/16-14	41	56	57	77
7/16-20	45	61	64	87
1/2-13	63	85	88	119
1/2-20	70	95	99	134
9/16-12	90	122	127	172
9/16-18	100	136	141	191
5/8-11	124	168	175	237
5/8-18	141	191	198	268
3/4-10	220	298	310	420
3/4-16	245	332	347	470

METRIC FASTENERS Lubricated and Plated Bolts, CapScrews, and Studs						
	Class 8.8		Class 10.9		Class 12.9	
	8.8 on Bolt Head		10.9 on Bolt Head		12.9 on Bolt Head	
Size	LBF/FT	[Nm]	LBF/FT	[Nm]	LBF/FT	[Nm]
M4	2.2	3	3.2	4.4	7.4	10
M5	4.4	5.9	6.4	8.7	7.4	10
M6	7.4	10	11	15	13	18
M8	18	25	26	36	32	43
M10	36	49	51	72	62	84
M12	63	85	92	125	107	145
M14	100	135	147	200	173	235
M16	155	210	229	310	269	365
M18	221	300	317	430	369	500
M20	313	425	450	610	524	710
M22	428	580	605	820	708	960
M24	538	730	774	1050	900	1220

PLUG & ELASTIC STOP NUT TORQUE CHARTS

O-RING PLUGS			
P/N	Size	LBF/FT	[Nm]
5/16-24	24K-1	5	7
3/8-24	24K-2	8	11
7/16-20	24K-3	10	14
1/2-20	24K-4	13	18
9/16-18	24K-5	15	20
3/4-16	24K-6	25	34
7/8-14	24K-7	35	47
1 1/16-12	24K-8	50	68
1 3/16-12	24K-9	60	81
1 5/16-12	24K-10	75	102
1 5/8-12	24K-11	85	115
1 7/8-12	24K-12	85	115

PIPE PLUGS		
Size (NPTF)	LBF/FT	[Nm]
1/16-27	7	9
1/8-27	10	14
1/4-18	20	27
3/8-18	30	41
1/2-14	35	47
3/4-14	45	61
1-11 1/2	55	75
1 1/4-11 1/2	65	88

ELASTIC STOP NUTS		
Size	LBF/FT	[Nm]
1-20	200	270
1 1/4-18	250	340
1 1/2-18	350	475
1 3/4-12	450	610

Hydraloc Differential Disassembly

Figure 1

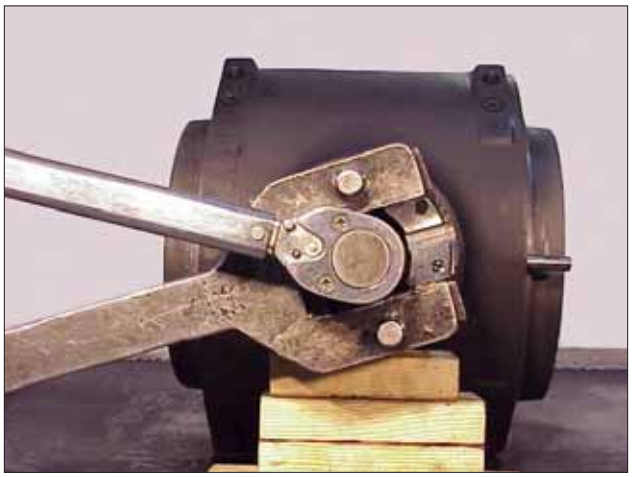


Figure 4
Loosen pinion nut.

Figure 2
Position unit on bench, support with blocks as shown.

Figure 5
Remove pinion nut.

Drive Flange V-Ring and Wear Sleeve Removal

Figure 3
Heat pinion nut to release thread locking compound.

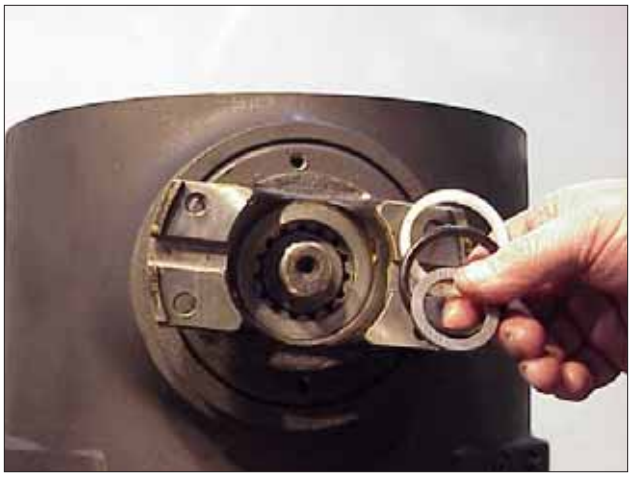


Figure 6
Remove pinion spacer, spacer seal ring and o-ring.

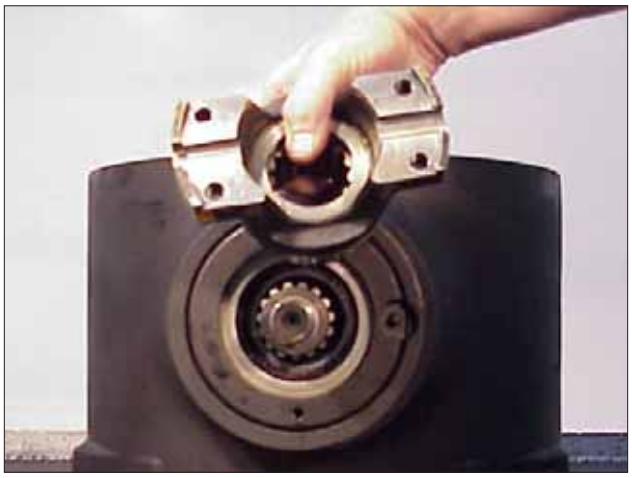


Figure 7
Remove flange.

Figure 8
Remove v-ring seal from flange.

Figure 9
Mark flange wear sleeve in three equally spaced locations as shown across the full width of sleeve.

Figure 10
Grind the cutting edge of a chisel to a radius as shown.

Figure 11
Use rounded tip chisel to expand and remove wear sleeve by striking evenly across the width of the sleeve in the three marked locations. **IMPORTANT:** Do not cut through wear sleeve as damage to the flange will occur.

Pinion Seal Retainer Cartridge and Seal Removal

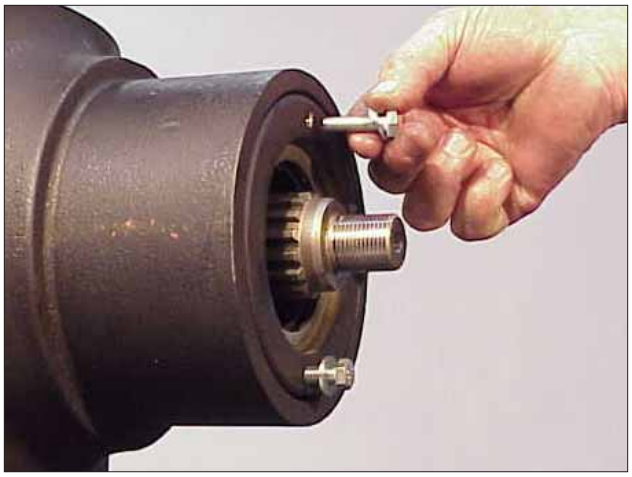


Figure 12
Install (2) M8 screws and flat washers in puller holes.

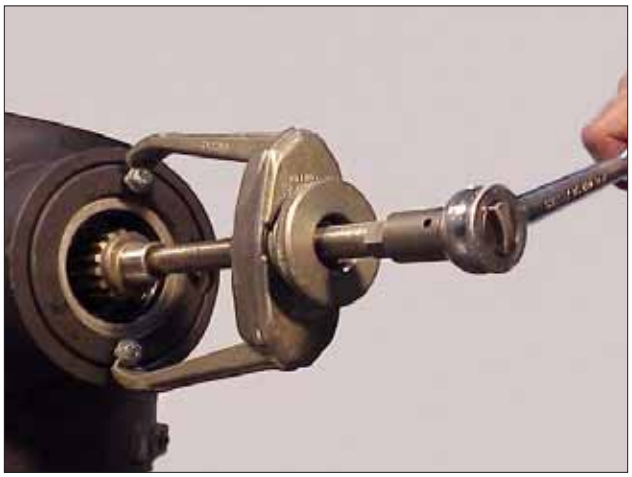


Figure 13
Remove seal retainer cartridge.

Figure 16
Remove o-ring.

Figure 14
Remove pinion seal from cartridge.

Figure 17
Remove grease fitting.

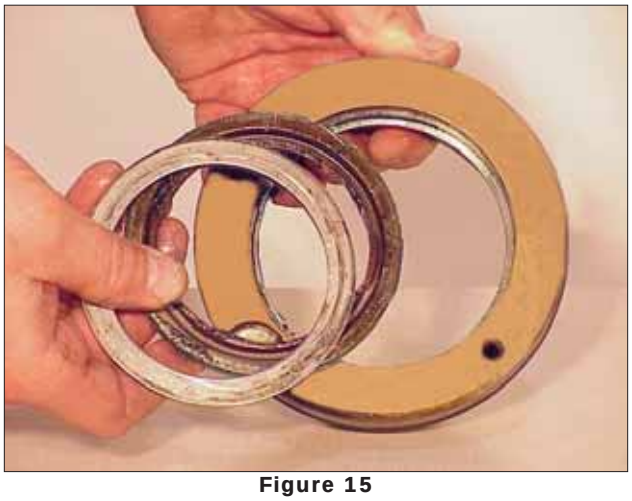


Figure 15
Remove grease seal and thrust washer.

Differential Retainer and Adjuster Removal

Figure 18
Remove differential adjusting nut screw and lock.

Figure 19
Remove adjusting nut lock screw.

Figure 22
Remove (2) seal retainer seal rings.

Figure 20
Remove (4) seal retainer screws.

Figure 23
Remove seal retainer inner oil seal.

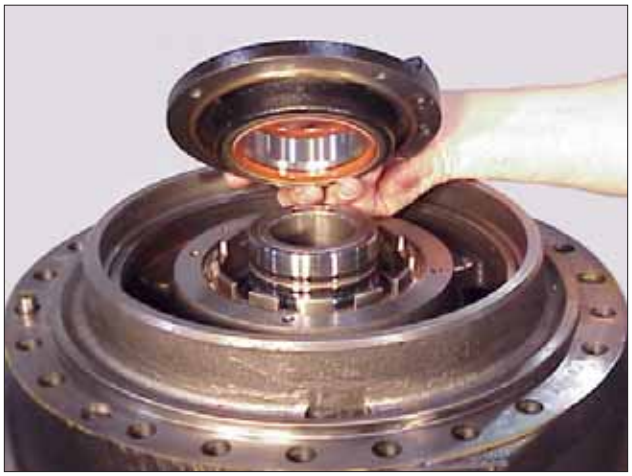


Figure 21
Remove seal retainer.

Figure 24
Remove seal retainer outer oil seal.

Figure 25
Remove (4) differential retainer screws.

Figure 28
Install (2) M8 eye bolts.

Figure 26
Loosen differential adjusting nut.
Refer to tool drawing on page 54.

Figure 29
Install (2) chain clevises, attach hoist.

Figure 27
Remove differential adjusting nut.

Figure 30
Remove differential retainer.

Differential Assembly Removal

Figure 31
Remove seal rings.

Figure 32
Remove (2) ring gear mounting screws and washers 180° from each other.

Figure 33
Install (2) M16 eye bolts.

Figure 34
Attach hoist and remove differential assembly and ring gear.

Ring Gear Removal

Figure 35
Remove (14) ring gear screws and washers.

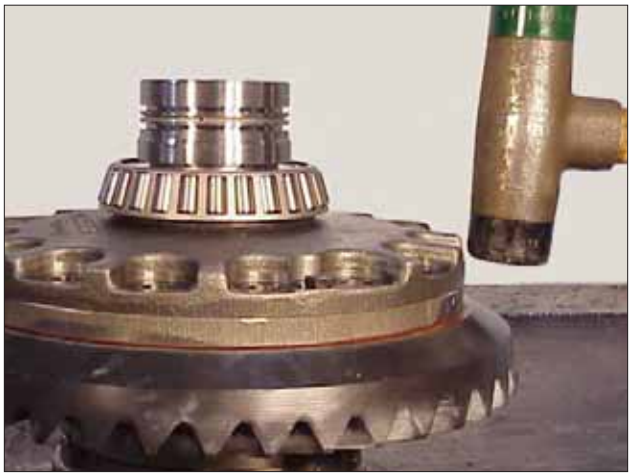


Figure 36
Position wood blocks or equivalent under ring gear and tap with mallet to remove from differential body.
Refer to figure 37

Figure 37
Wood blocks or equivalent placed under ring gear to prevent ring gear damage.

Differential Body Disassembly

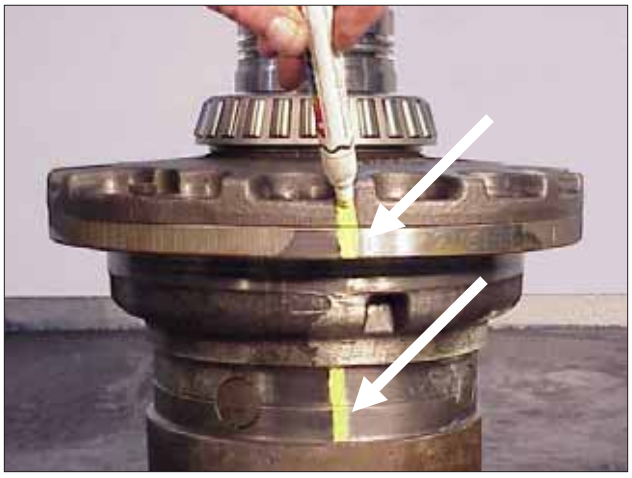


Figure 38
Mark case as shown in (2) places for proper alignment during reassembly.

Figure 39
Remove (2) screws.

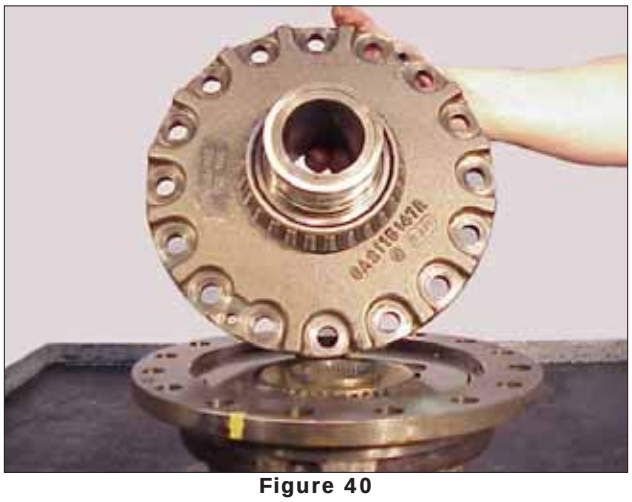


Figure 40
Remove case flanged half.

Figure 41
Remove side gear thrust washer.

Figure 42
Remove reaction and friction discs.

Figure 43
Remove side gear.

Figure 46
Remove side gear thrust washer.

Figure 44
Remove (12) screws and washers.

Figure 47
Remove side gear.

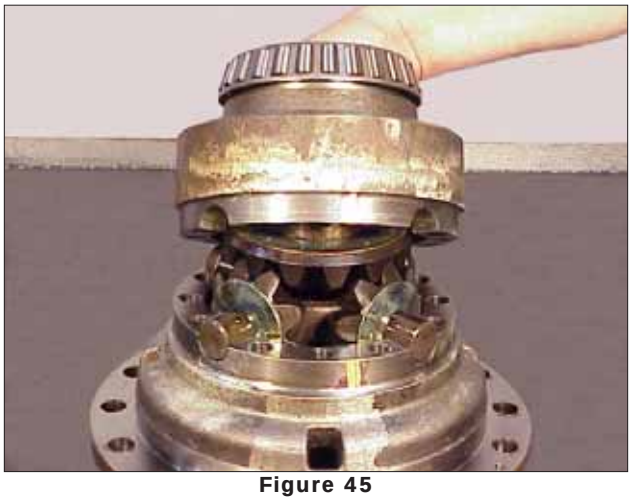


Figure 45
Remove differential cap.

Figure 48
Remove spider with pinion gears and thrust washers.

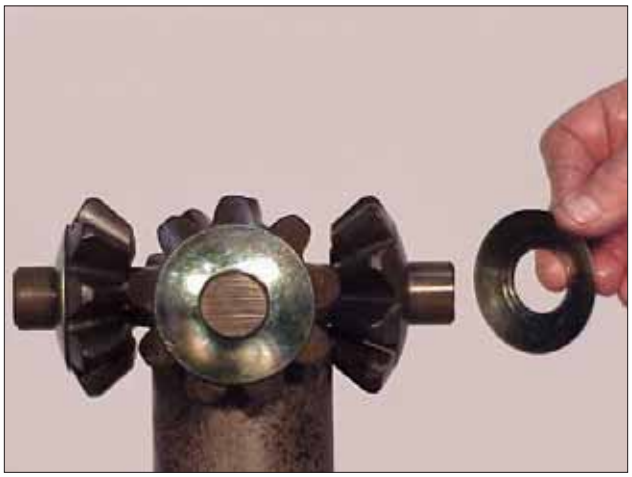


Figure 49
Remove (4) pinion gear thrust washers.

Figure 50
Remove (4) pinion gears.

Figure 51
Apply heat and remove differential bearing cone.
Refer to bearing heating and freezing guidelines.

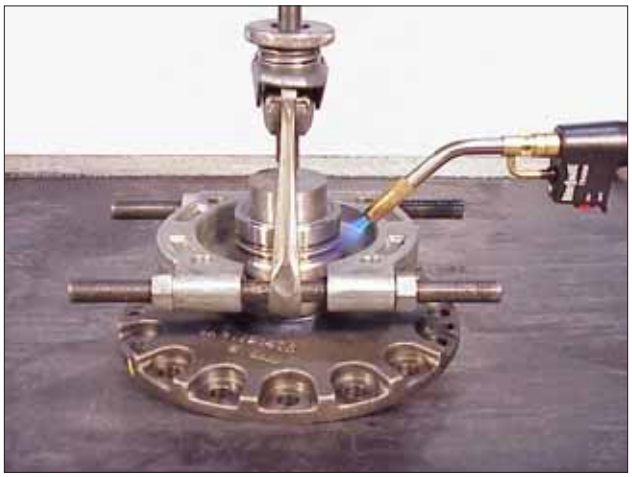


Figure 52
Apply heat and remove wear sleeve.

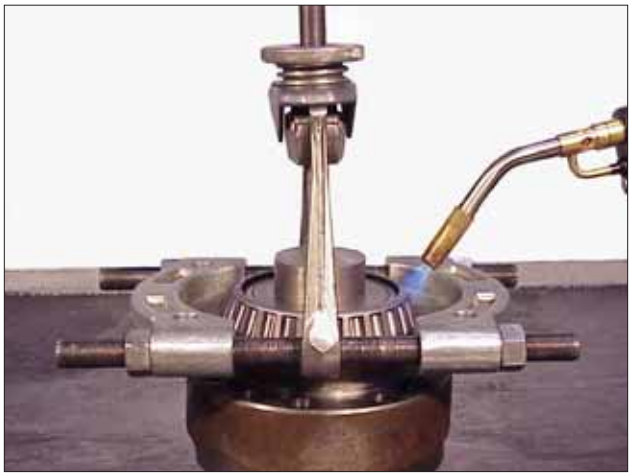


Figure 53
Apply heat and remove differential bearing cone.

Piston Removal

Figure 54
Position differential flange half on bench as shown.
Use compressed air to push piston out of bore.

Figure 55
Remove piston.

Figure 56
Remove outer piston seal and back up ring.

Figure 57
Remove inner piston seal and back up ring.

Pinion Removal

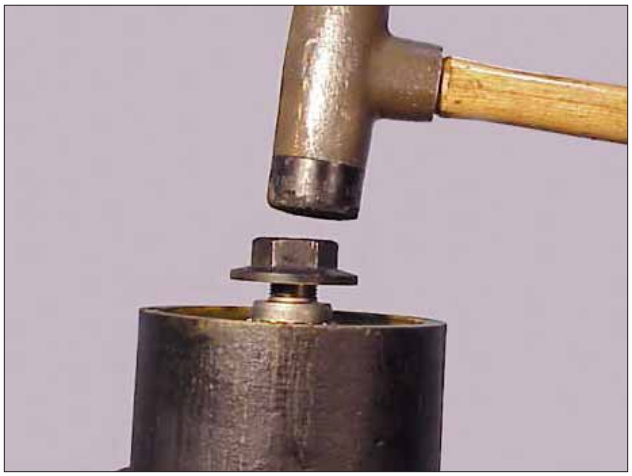


Figure 58
Install pinion nut to protect threads and tap pinion through outer bearing cone.

Figure 59
Remove pinion assembly. Remove pinion nut.

Figure 60
Remove pinion inner bearing cone.

Figure 61
Remove pinion outer bearing cone.

Figure 64
Remove pinion outer bearing cup.

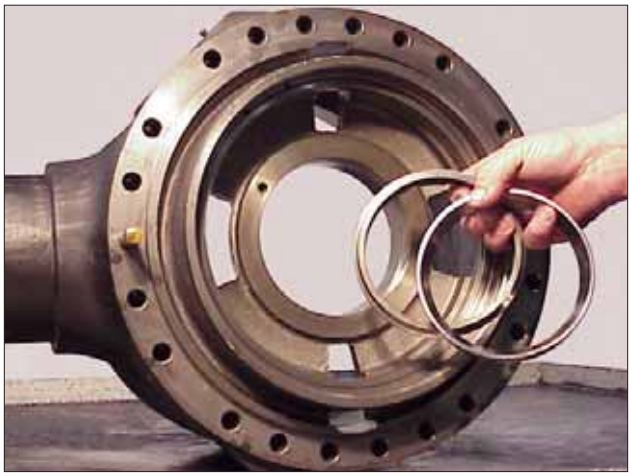


Figure 62
Remove differential bearing adjusting nut and cup.

Figure 65
Remove bleeder screw and seat.

Figure 63
Remove pinion inner bearing cup and shim.

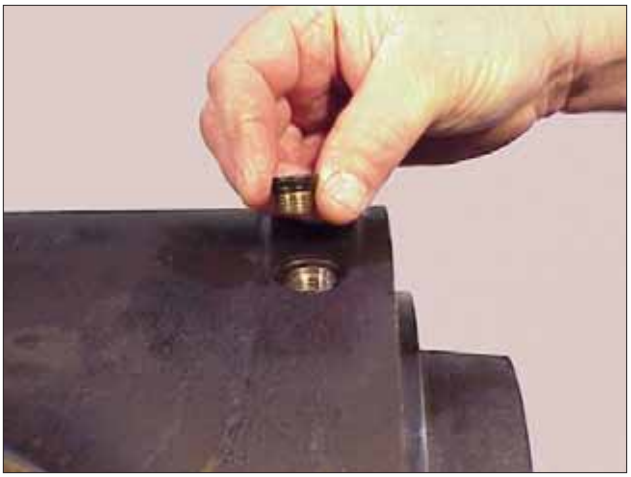


Figure 66
Remove plug and o-ring.

Figure 67
Remove plug and o-ring.

Hydraloc Differential Reassembly

Figure 68
Apply thin, continuous coat of Loctite 620 or equivalent to wear sleeve mounting surface.

Figure 69
Apply thin, continuous coat of Loctite 620 or equivalent to inside diameter of wear sleeve.

Figure 70
Install wear sleeve on flange half.
NOTE: End of sleeve should be flush with end of journal.
Refer to tool drawing on page 55.

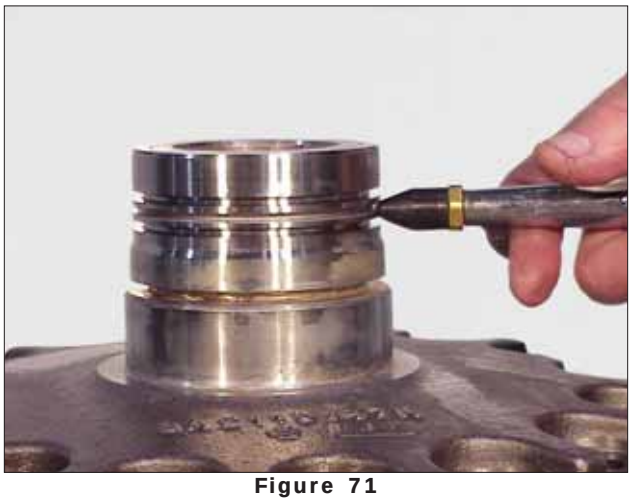


Figure 71
Use compressed air to blow excess sealant from oil passage.

Figure 74
Lubricate spider with axle lubricant and install (4) pinion gears.

Figure 72
Clean cured thread locking compound from tapped holes with M14x2 tap. Remove remaining residue from holes.

Figure 75
Lubricate and install (4) thrust washers.

Figure 73
Heat and install differential bearing cone on cap half. Refer to bearing heating and freezing guidelines.

Figure 76
Install assembly in clutch housing.

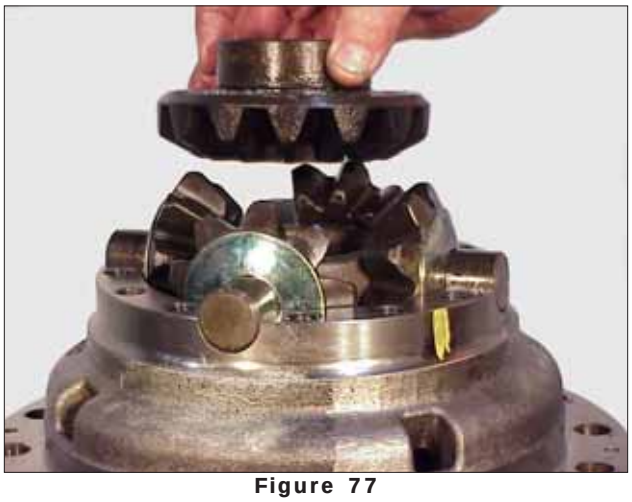


Figure 77
Install side gear.

Figure 78
Lubricate side gear.

Figure 79
Install thrust washer.

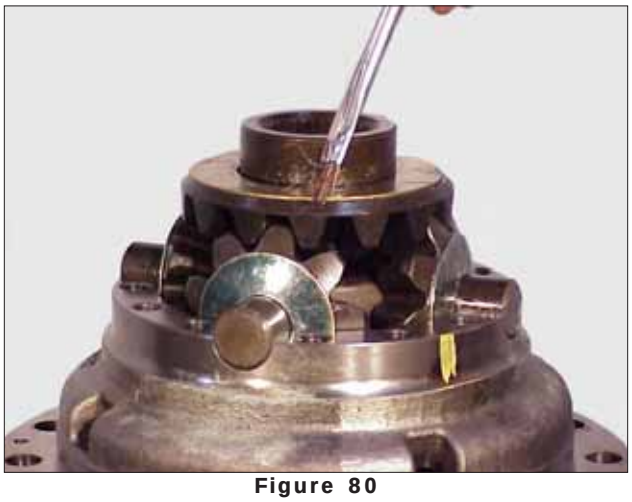


Figure 80
Lubricate thrust washer.

Figure 81
Install differential cap.
NOTE: Align identification marks.

Figure 82
Install (12) socket head screws and washers.

Figure 83
Tighten screws in a star pattern to 183-202 Nm [135-149 LBF/FT].

Figure 86
Lubricate both sides of friction disc and install. Alternately install remaining reaction and friction discs. Align lube grooves with each other.

Figure 84
Install side gear.

Figure 87
Lubricate sun gear.

Figure 85
Lubricate both sides of reaction disc and install.

Figure 88
Install thrust washer.

Figure 89
Install piston outer seal back up ring.

Figure 92
Install piston inner seal ring.
NOTE: Back up ring must be installed prior to seal ring.

Figure 90
Install piston outer seal ring.
NOTE: Back up ring must be installed prior to seal ring.

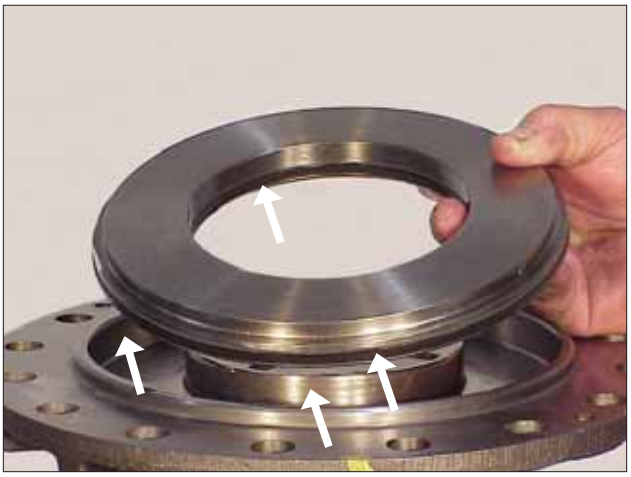


Figure 93
Lubricate piston seals and bore, position piston in bore.

Figure 91
Install piston inner seal back up ring.

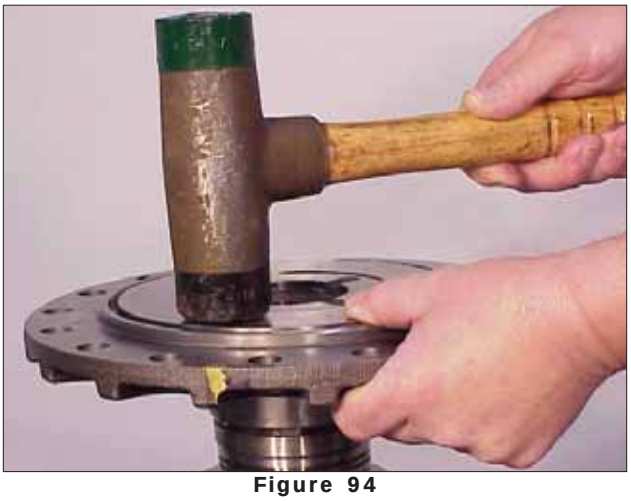


Figure 94
Carefully tap piston into bore evenly with mallet.

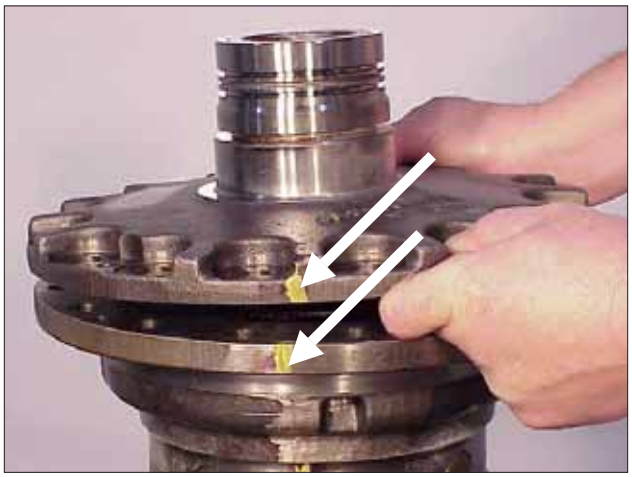


Figure 95
Install differential flange half.
NOTE: Align identification marks as shown.

Figure 96
Apply Loctite 262 or equivalent to (2) screws and install.

Figure 97
Tighten (2) screws to
24-27 Nm [18-20 LBF/FT].

Ring Gear Installation

Figure 98
Clean foreign material and/or cured thread locking compound from holes with M16x2 tap. Remove remaining residue from holes.

Figure 99
Use hone stone or file to remove nicks or burrs from mounting face.
NOTE: Be sure to remove all abrasive residue.

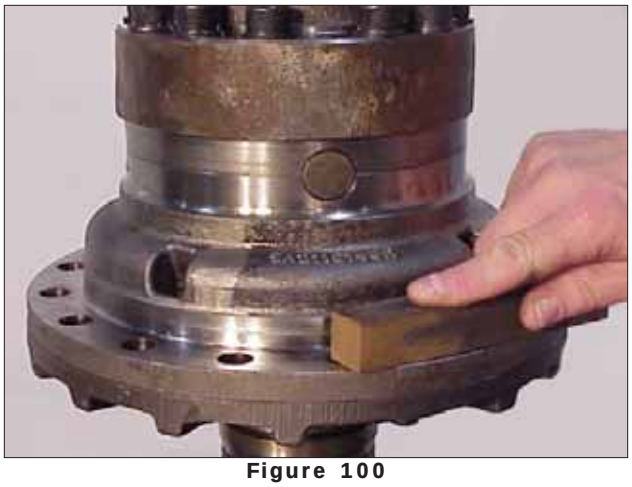


Figure 100
Use hone stone or file to remove nicks or burrs from mounting face.
NOTE: Be sure to remove all abrasive residue.

Figure 101
Heat ring gear to 93-100°C [200-212°F] and Install.
Caution: Use gloves to avoid injury.

Figure 102
Temporarily install (2) ring gear mounting screws 180° apart and tighten to 135 Nm [100 LBF/FT].
Allow assembly to cool before installing additional screws.
IMPORTANT: Using a .05 mm [.002"] feeler gauge check several locations around ring gear to be sure there is no gap between the ring gear and differential body mounting faces.
NOTE: Assembly is shown with ring gear down for clarity. This procedure should be performed with assembly in same position as shown in ***figure 101***.

Figure 103
Heat and install differential bearing cone. Refer to bearing heating and freezing guidelines.

Pinion Installation and Adjustment

Figure 104
Locate ring gear mounting distance dimension located in this area and record.

Figure 105
Number as it appears in ***figure 104***.

Figure 106
Locate ring gear mounting distance dimension on ring gear and record.

Figure 107
Measure height of pinion inner bearing cup and cone and record. Calculate ring and pinion mounting distance shim as follows:

Step #1

Number from ring gear	186.106 mm [7.3270”]
Bearing height	+ 45.974 mm [1.8100”]
Total	232.080 mm [9.1370”]

Step #2

Number from housing	232.560 mm [9.1559”]
Total from step #1	- 232.080 mm [9.1370”]
Shim thickness required	.480 mm [.0189”]

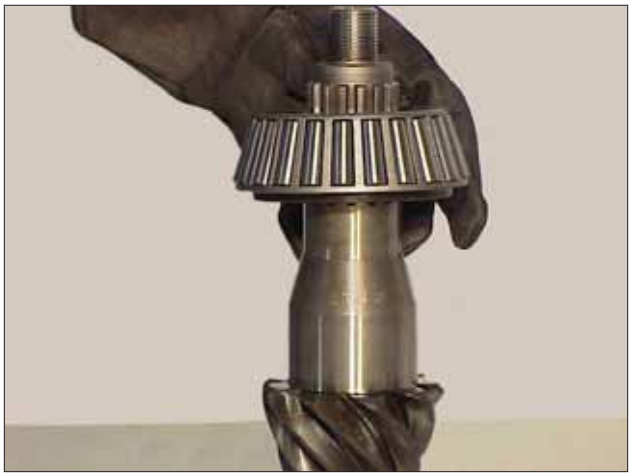


Figure 108
Heat and install pinion inner bearing cone. Refer to bearing heating and freezing guidelines.

Figure 109
Install pinion outer bearing cup.

Figure 110
Install mounting distance shim as determined in ***figure 107.***

Figure 111
Freeze and install pinion inner bearing cup.

Figure 112
Check for proper seating of pinion inner and outer bearing cups. Refer to bearing and freezing guidelines.

Figure 113
Lubricate pinion inner bearing cone.

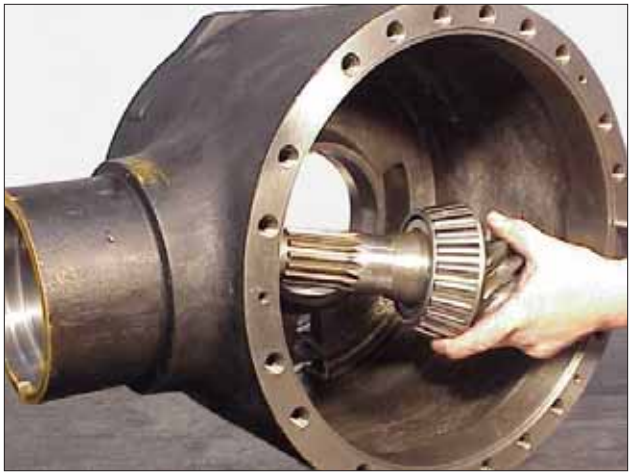


Figure 114
Install pinion.

Figure 115
Lubricate pinion outer bearing cone.

Figure 116
Heat and install pinion outer bearing cone.

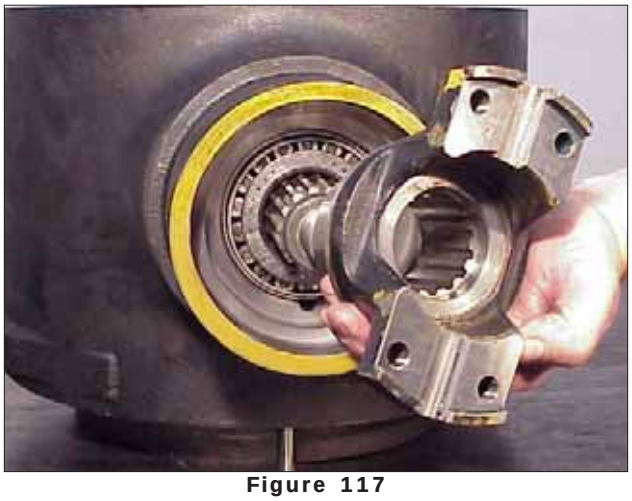


Figure 117
Install flange.

Figure 118
Install pinion spacer.

Figure 119
Install pinion nut and tighten to 1261-1396 Nm [930-1030 LBF/FT].

Figure 120
Check pinion bearing rolling resistance and record.

Pinion rolling resistance recorded in ***figure 120*** should be:
37R - 1.13-3.95 Nm [10-35 LBF/IN].
43R - 1.13-4.52 Nm [10-40 LBF/IN].

If within specification remove nut, spacer and flange.

If not within specification repeat steps in ***figures 118-120*** making appropriate spacer substitution.

If rolling resistance is too low reduce spacer thickness. If rolling resistance is too high increase spacer thickness.

Figure 121

Pinion Seal Installation

Figure 122
Apply thin continuous coat of Loctite 620 or equivalent to pinion seal bore.

Figure 123
Using appropriate driver, install pinion seal.
Refer to tool drawing on page 51.

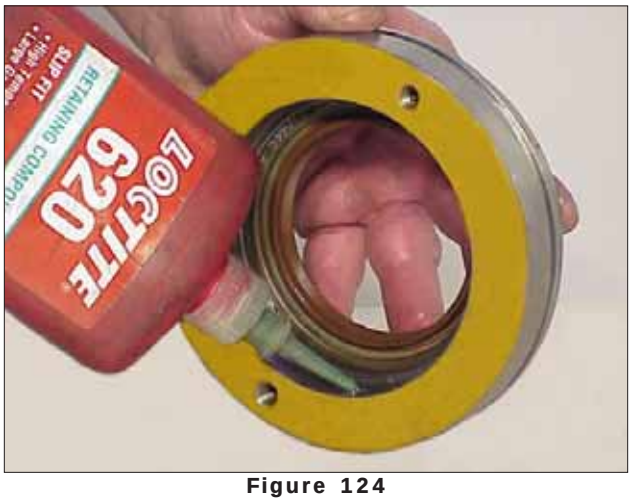


Figure 124
Apply thin continuous coat of Loctite 620 or equivalent to grease seal bore.

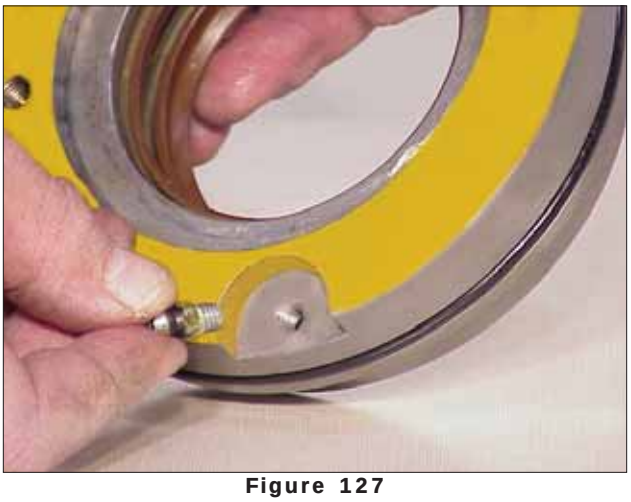


Figure 127
Install grease fitting.

Figure 125
Using appropriate driver install grease seal and thrust washer. ***Refer to tool drawing on page 51.***

Figure 128
Apply grease to seal retainer bore.

Figure 126
Install o-ring.

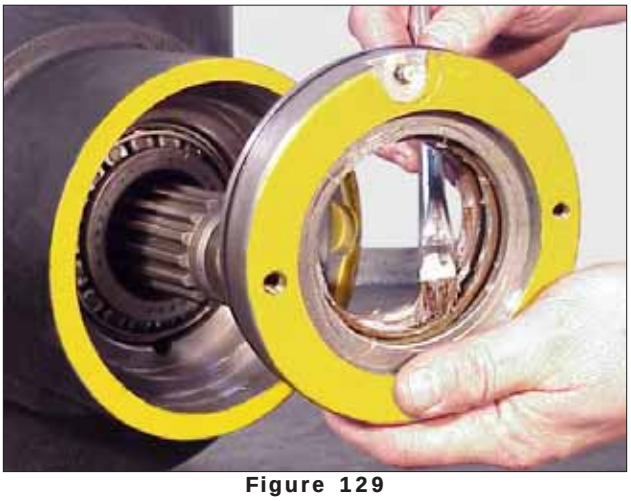


Figure 129
Apply grease to pinion and grease seal lips.

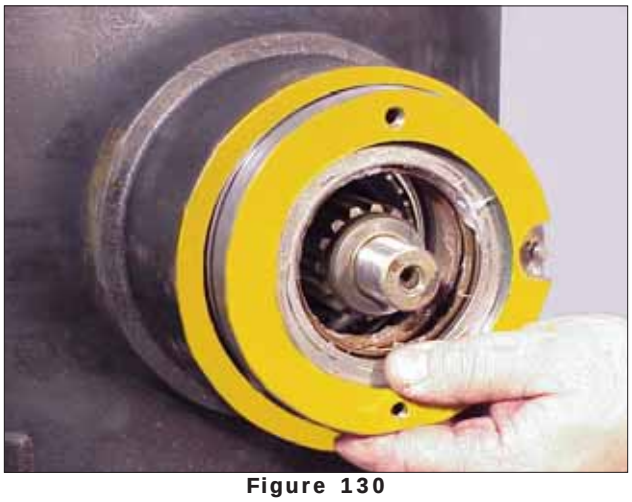


Figure 130
Position seal retainer in bore.

Figure 131
Index retainer so eye brows align.

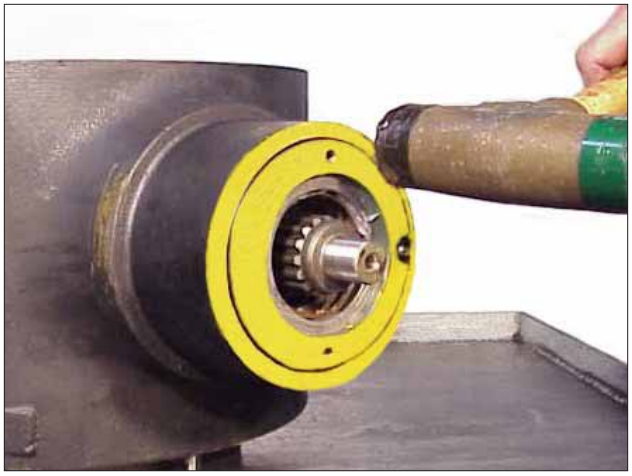


Figure 132
Carefully tap retainer with a soft mallet evenly around diameter to install.

Wear Sleeve Installation

Figure 133
Apply continuous coat of Loctite 620 or equivalent to wear sleeve I.D.

Figure 134
Using appropriate driver install wear sleeve.
Refer to tool drawing on page 56.

Pinion Flange Installation

Figure 135
Install v-ring seal.

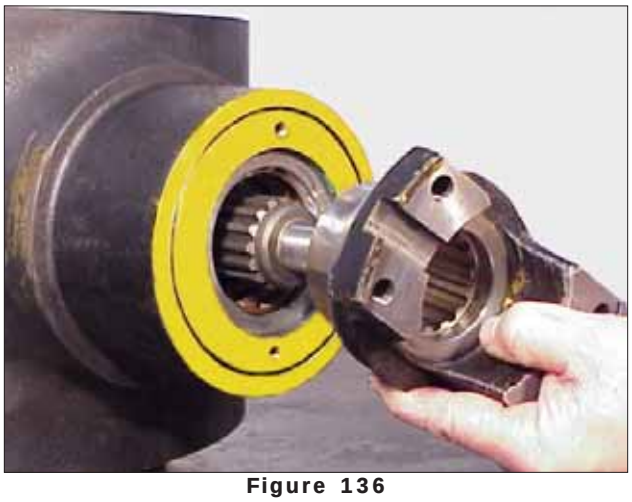


Figure 136
Install input flange.

Figure 137
Install o-ring and o-ring spacer.

Figure 138
Install pinion spacer identified in ***figures 118-120***.

Figure 139
Apply Loctite 262 or equivalent to pinion nut threads.

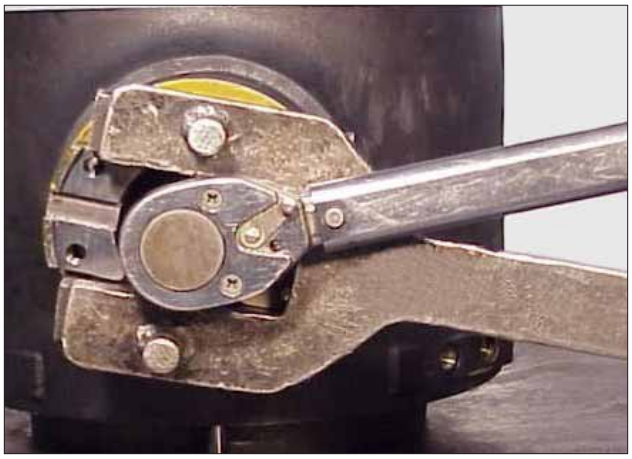


Figure 140
Tighten pinion nut to 1261-1396 Nm [930-1030 LBF/FT]. Refer to ***Figure 131*** for fitting location and apply grease to input seals until it comes out from around the dust lip. **NOTE**: Seals should be greased at every normal servicing interval. Machines in conditions where the axle routinely becomes submerged should be serviced more often.

Carrier Housing Assembly

Figure 141
Install differential bearing cup.

Figure 142
Install differential bearing adjusting nut.

Differential Assembly Installation

Figure 143
Paint 5 to 6 ring gear teeth with contact checking compound.

Figure 144
Install differential assembly in housing.

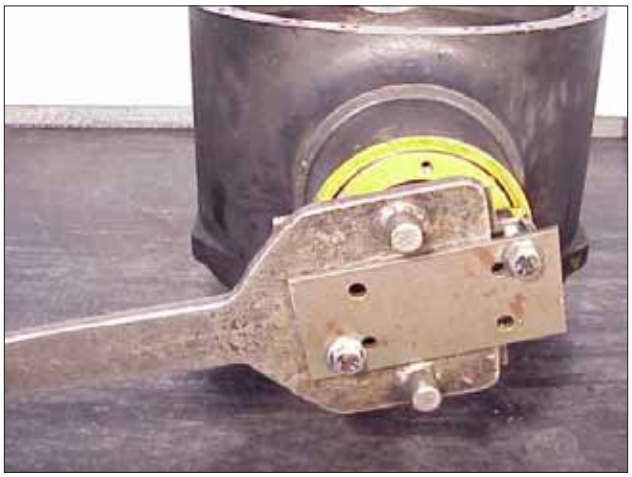


Figure 145
Lock or hold pinion shaft from turning.

Figure 146
Remove (1) of (2) ring gear screws and mark head of remaining screw for identification purposes.

Figure 147
Apply Loctite 262 or equivalent to (15) ring gear mounting screws and install with washers. Run down but do not tighten. **IMPORTANT: Perform the procedures shown in *figures 147-149* in a timely manner before the Loctite begins to cure.**

Figure 148
Remove marked screw, apply Loctite 262 or equivalent and install with washer.

Figure 149
Tighten (16) ring gear mounting screws in a star pattern to 286-316 Nm [211-233 LBF/FT]. Using a brass bar or equivalent sharply shock assembly in several locations around the bolt circle. Immediately retighten all screws in a star pattern to 286-316 Nm [211-233 LBF/FT].

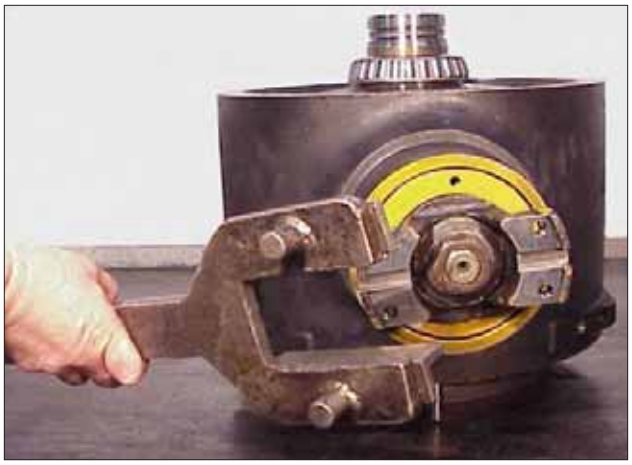


Figure 150
Release pinion shaft.

Differential Retainer Installation

Figure 151
Install differential bearing cup.

Figure 152
Install differential retainer o-ring and lubricate with grease.

Figure 153
Install differential bearing adjusting nut.

Figure 154
Lubricate differential bearing cone with axle lubricant.

Figure 157
Install differential retainer.

Figure 155
Install (2) piston rings and coat with grease.

Figure 158
Install (4) retainer screws and tighten (4) to 24-27 Nm [18-20 LBF/FT].

Figure 156
Install (2) alignment pins located 180° apart.

Backlash and Contact Pattern Setup and Adjustment

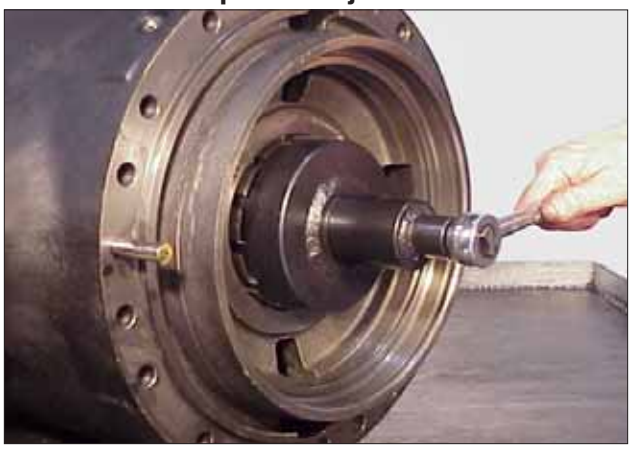


Figure 159
Tighten differential adjusting nuts to a minimum of 41 Nm [30 LBF/FT]. Rotate pinion back and forth while performing this step to assure that detectable backlash exists and ring gear is not being forced into pinion gear.
Refer to tool drawing on page 54.

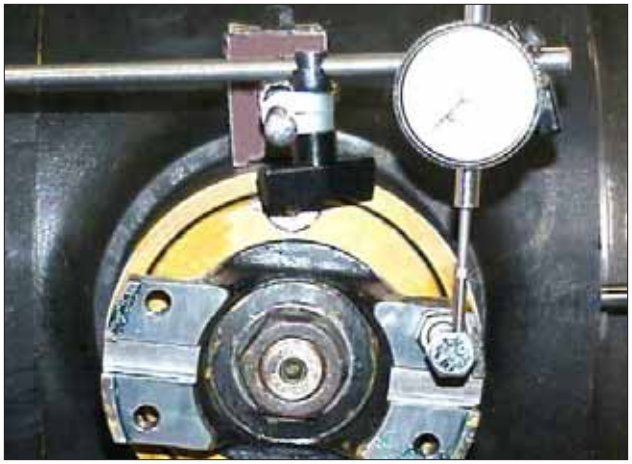


Figure 160
Set up magnetic base dial indicator as shown to measure ring and pinion back lash.

Figure 162
Install differential adjusting nut lock. **IMPORTANT: Advance** adjusting nut if necessary to line up mounting holes. **Do Not** loosen/back off nut.

Figure 163
Apply Loctite 262 or equivalent to (2) nut lock screws and install. Tighten to 24-27 Nm [18-20 LBF/FT].

With ring gear being held stationary, rock the pinion flange back and forth gently while watching the reading on dial indicator.
Backlash specifications are as follows:
37R 4.100 ratio with DIN 180 Flange .56-.88 mm [.022-.035”]
37R 4.100 ratio with DIN 150 Flange .46-.74 mm [.018-.029”]
43R 4.100 ratio with DIN 180 Flange .53-.89 mm [.021-.035”]
43R 4.364 ratio with 8.5 CTP Flange .48-.79 mm [.019-.031”]
43R 4.556 ratio with 8.5 CTP Flange .53-.89 mm [.021-.035”]
43R 5.429 ratio with DIN 150 Flange .53-.94 mm [.021-.036”]
If the readings are out of specification, move the differential adjusting nuts inward or outward together. **IMPORTANT:** Recheck differential bearing preload after the proper backlash reading is achieved. ***Refer to Figure 159.***
NOTE: If checking the backlash with an indicator on the ring gear tooth while holding the pinion the specifications are as follows:
37R .25-.33 mm [.010-.013”]
43R .23-.38 mm [.009-.015”]

Figure 161

Differential Load Test

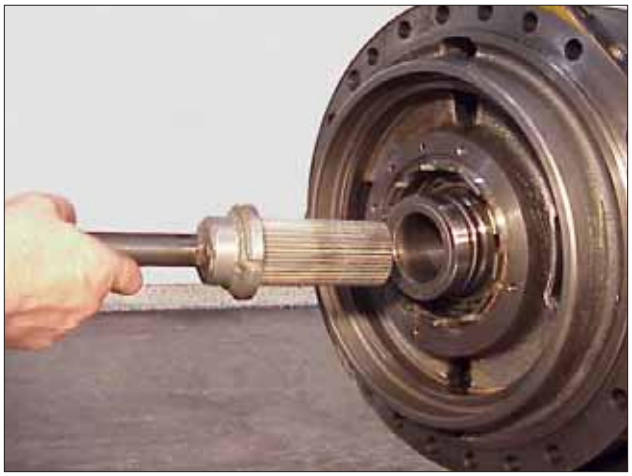


Figure 164
Install stub shaft. **NOTE:** The axle shaft and a socket can be used to perform this procedure.

Figure 165

Step #1
Hold pinion and rotate side gear five turns in each direction. Differential clutch must turn freely with a maximum torque of 34 Nm [25 LBF/FT].

Step #2
Hold side gear and rotate pinion in both directions to make several passes through the gear contact checking compound on the ring gear.

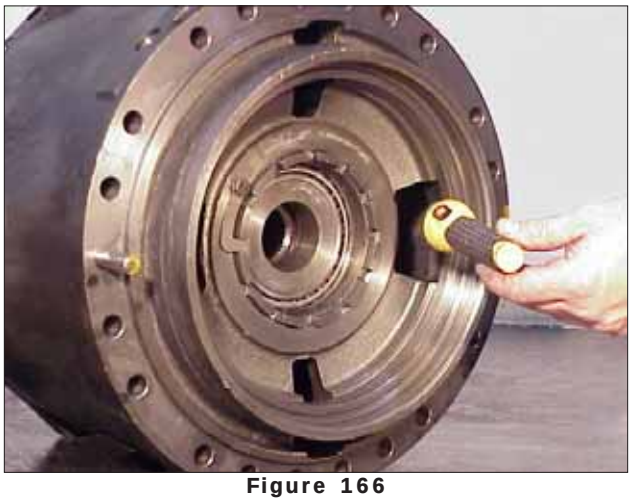


Figure 166
Inspect tooth contact pattern on ring gear.
Refer to charts on pages 13 & 14.

Hydraloc Seal Retainer Assembly and Installation

Figure 167
Apply continuous coat of Loctite 620 or equivalent to outside diameter of inner Hydraloc seal.

Figure 168
Using appropriate driver install inner Hydraloc seal.
NOTE: Seal is installed with sealing lip down or towards center of seal retainer.
Refer to tool drawing on page 51.

Figure 169
Apply continuous coat of Loctite 620 or equivalent to outside diameter of outer Hydraloc seal.

Figure 170
Using appropriate driver install outer Hydraloc seal.
NOTE: Seal is installed with sealing lip down or towards center of seal retainer.
Refer to tool drawing on page 53.

Figure 171
Apply Loctite 262 or equivalent to seal retainer plug.

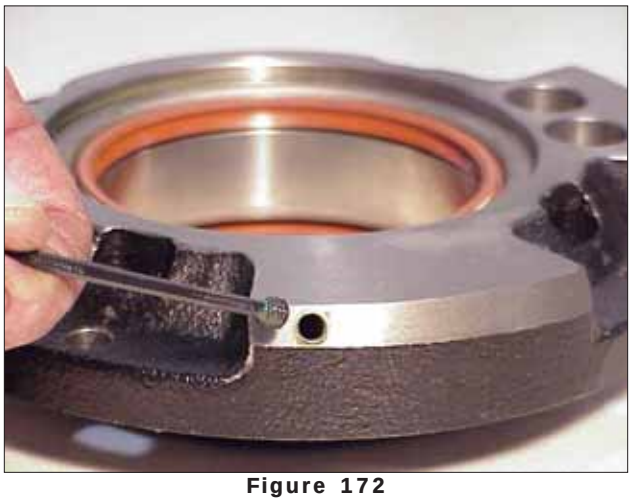


Figure 172
Install seal retainer plug.
NOTE: Plug end to be flush with mating surface.

Figure 173
Coat with grease, to hold in position and install (2) seal rings in seal retainer.

Figure 174
Insert seal retainer installation tool.
Refer to tool drawing on page 57.

Figure 175
Coat inner and outer Hydraloc seal lips with grease.

Figure 176
Carefully install seal retainer.

Figure 177
Install (4) seal retainer screws.

Figure 178
Tighten seal retainer screws to
24-27 Nm [18-20 LBF/FT].

Figure 179
Apply Loctite 262 or equivalent to
differential adjusting nut lock screw.
Install adjusting nut lock screw in one of the two holes
that allow it to clear the lugs on the adjusting nut.

Figure 180
Tighten adjusting nut lock screw to
48-50 Nm [35-37 LBF/FT].

Air Pressure Test

Figure 181
Air pressure test per procedure on page 6.

Hydraulic Pressure Test

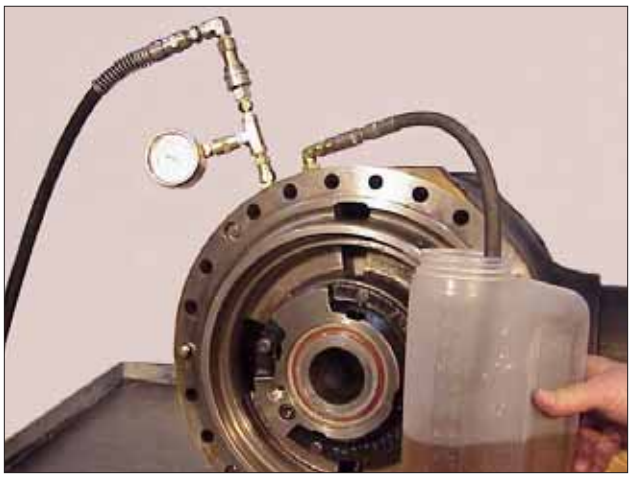


Figure 182
Hydraulic pressure test per procedure on page 6.

Figure 183
Install (2) bleeder valves and seats.
Tighten to 24-27 Nm [18-20 LBF/FT].

Figure 184
Install (2) brake supply port plugs and tighten to 18 Nm [13 LBF/FT].

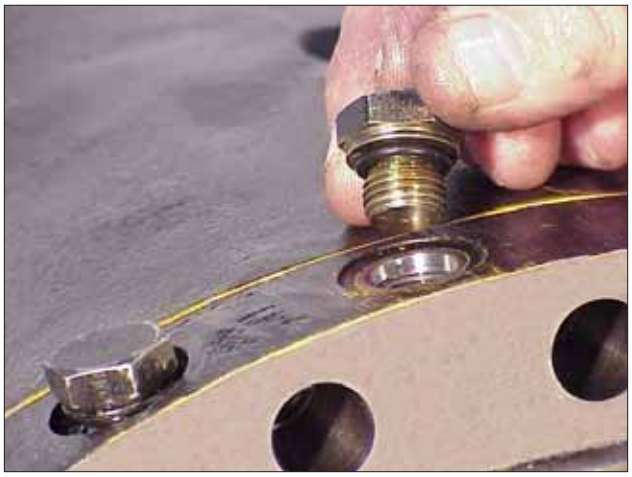
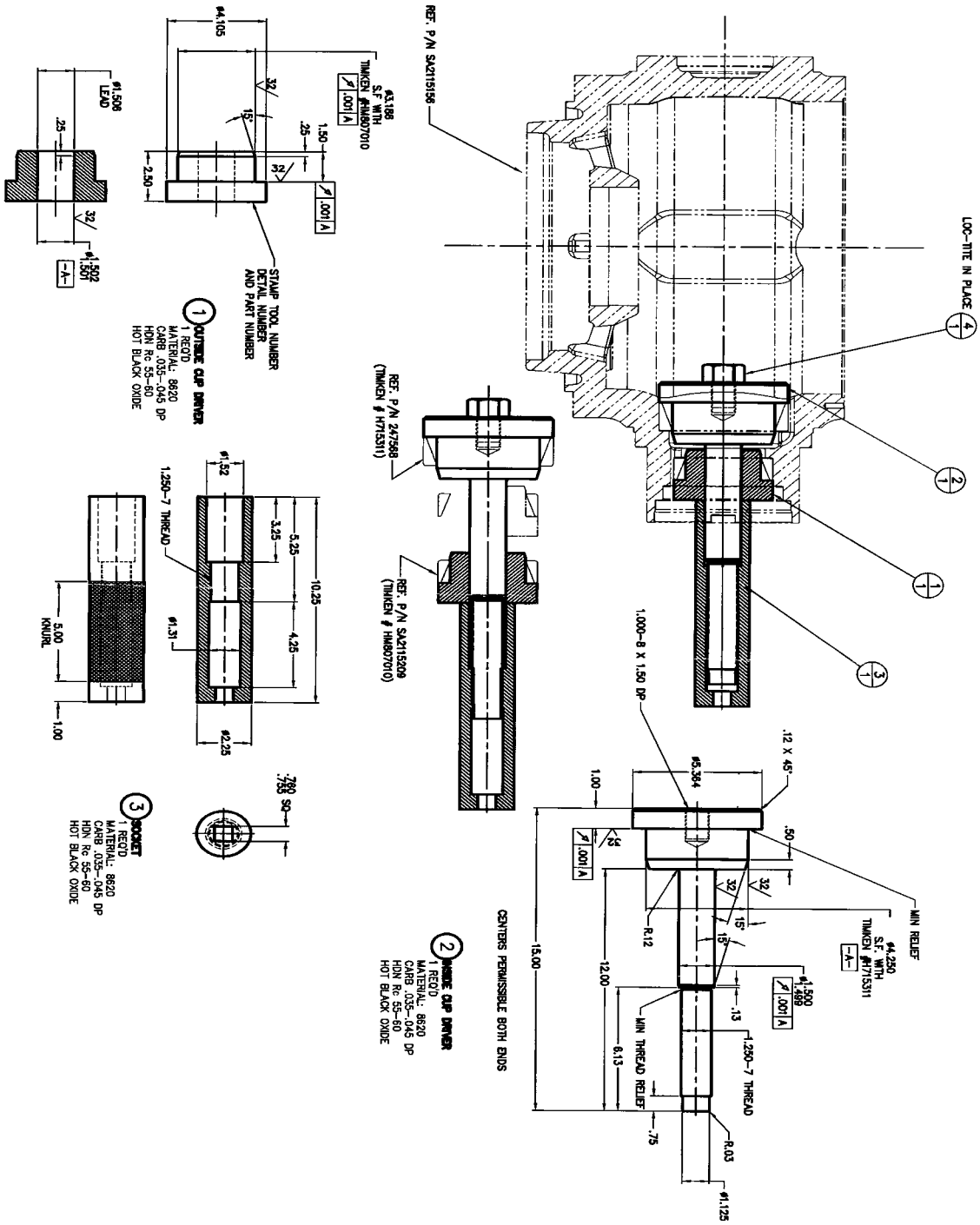


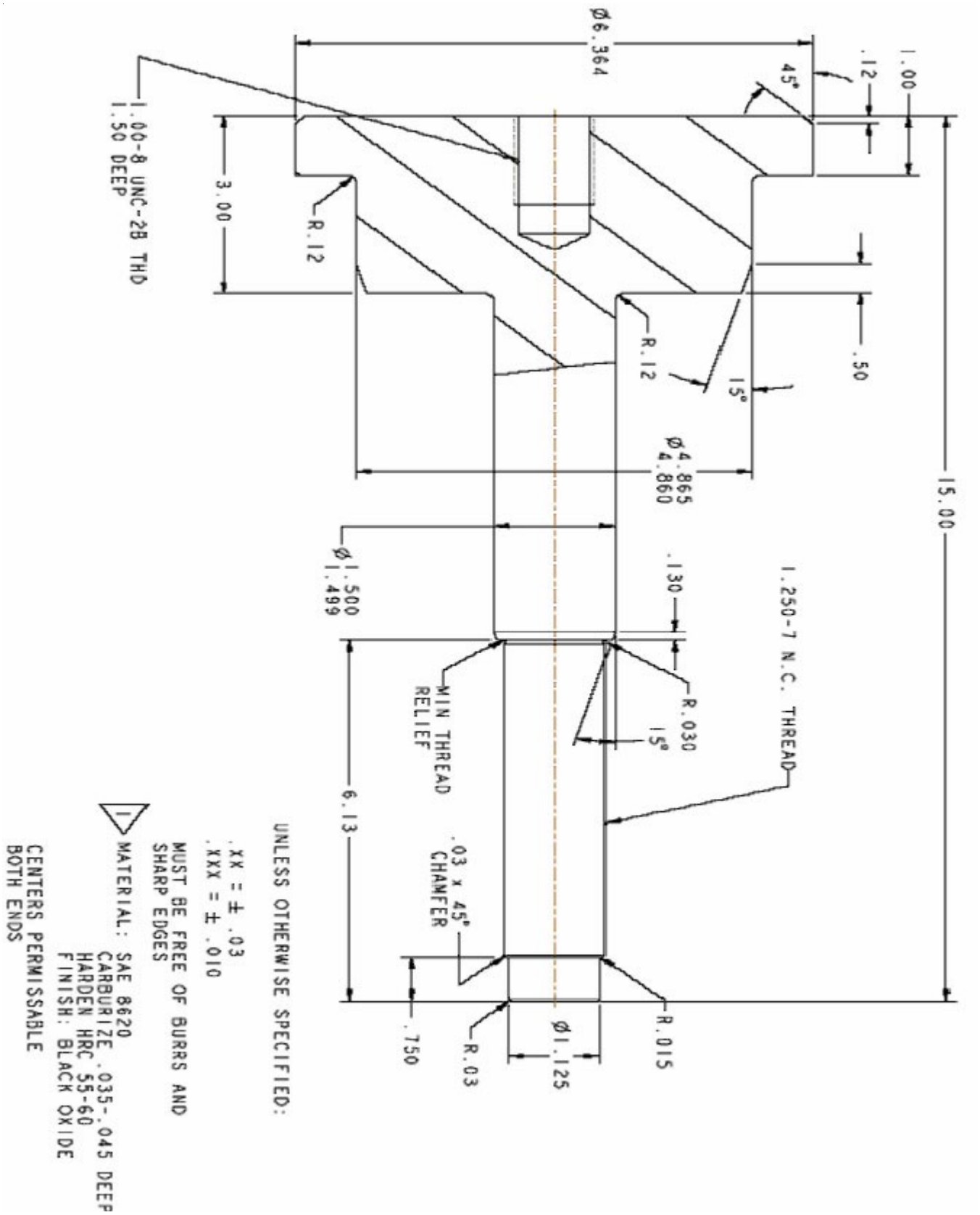
Figure 185
Install (2) Hydraloc port plugs and tighten to:
Port “T” 20 Nm [15 LBF/FT]
Port “P” 18 Nm [13 LBF/FT].

Figure 186
Install drain and oil level plugs.
Tighten to 18 Nm [13 LBF/FT].

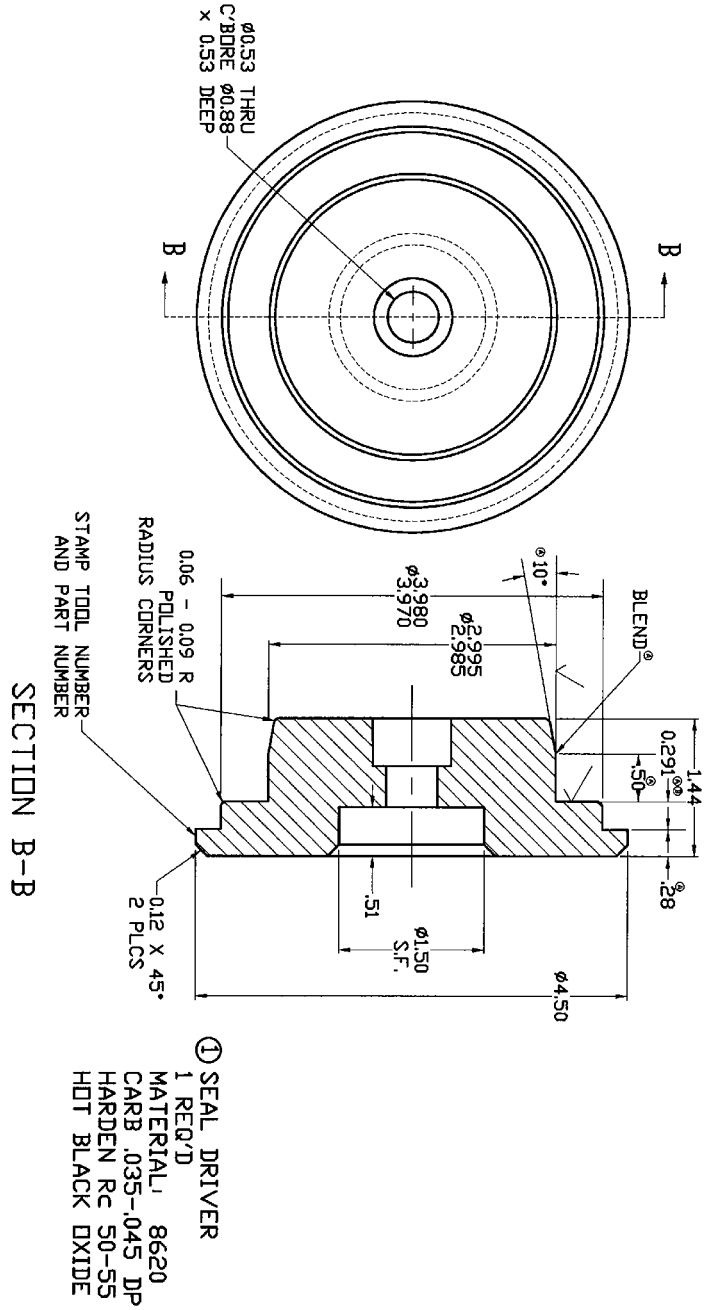
DIFFERENTIAL CARRIER CUP DRIVERS



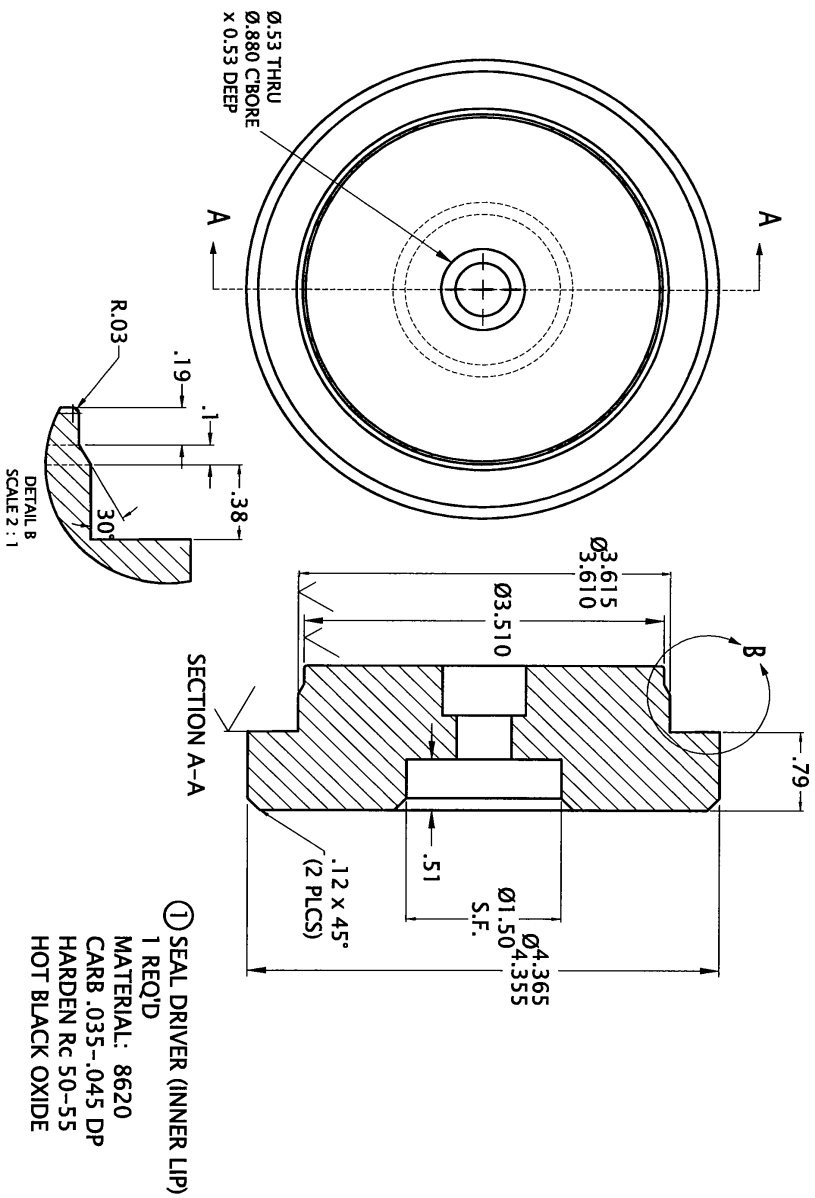
PINION BEARING CUP DRIVER - HEAVY DUTY BEARING



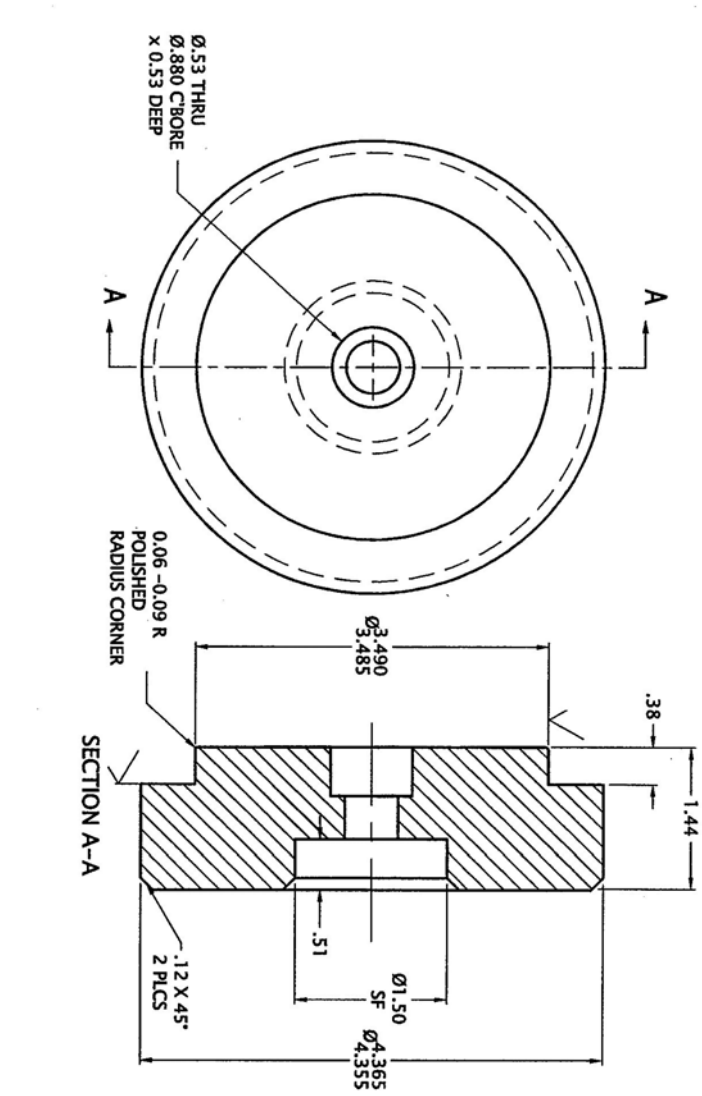
GREASE AND OIL SEAL DRIVER

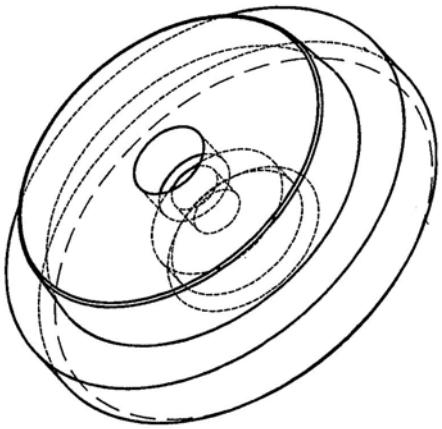


INNER LIP SEAL DRIVER



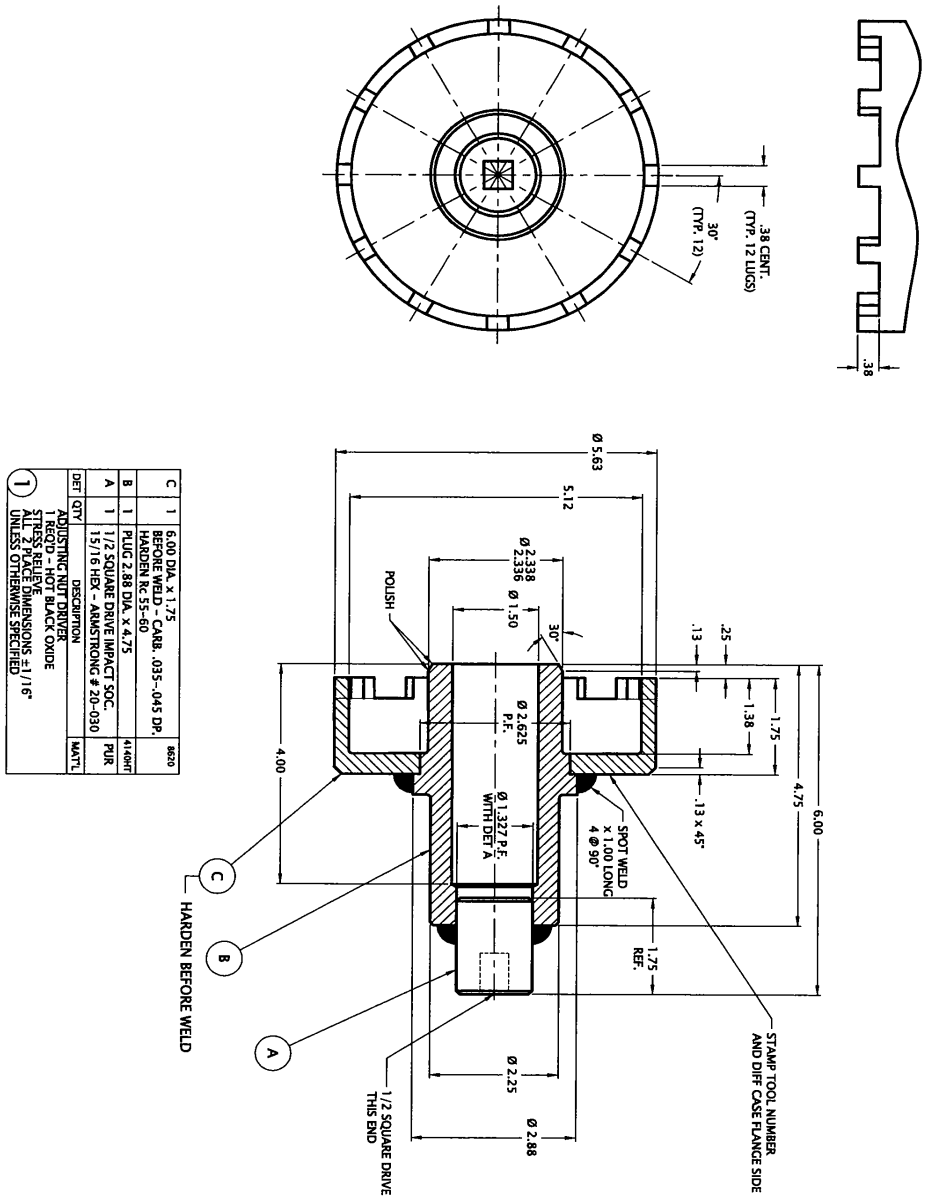
OUTER LIP SEAL DRIVER



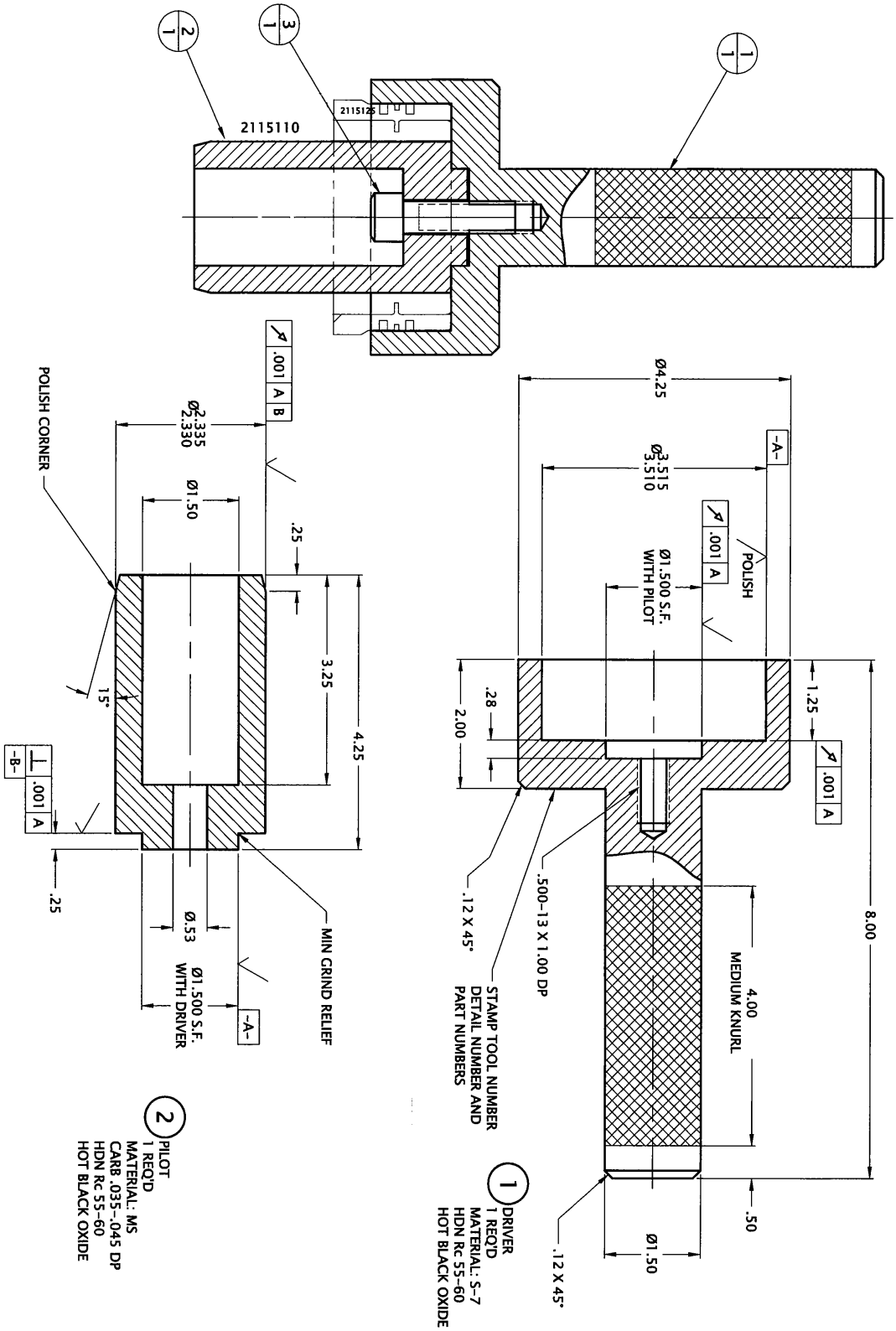


1 SEAL DRIVER (OUTER LIP)
1 REQ'D
MATERIAL: 8620
CARB .035–.045 DP
HARDEN Rc 50–55
HOT BLACK OXIDE

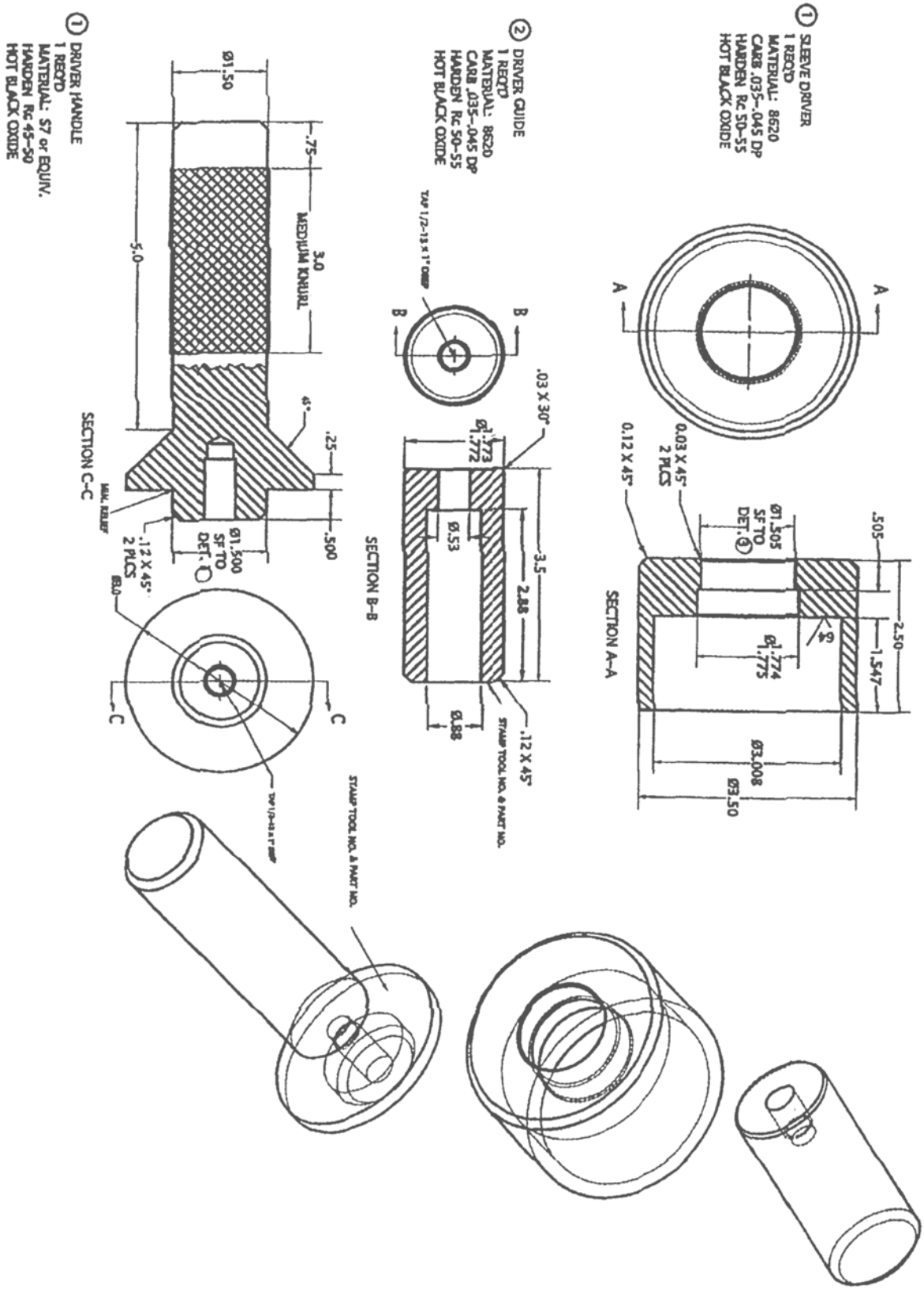
ADJUSTING NUT DRIVER



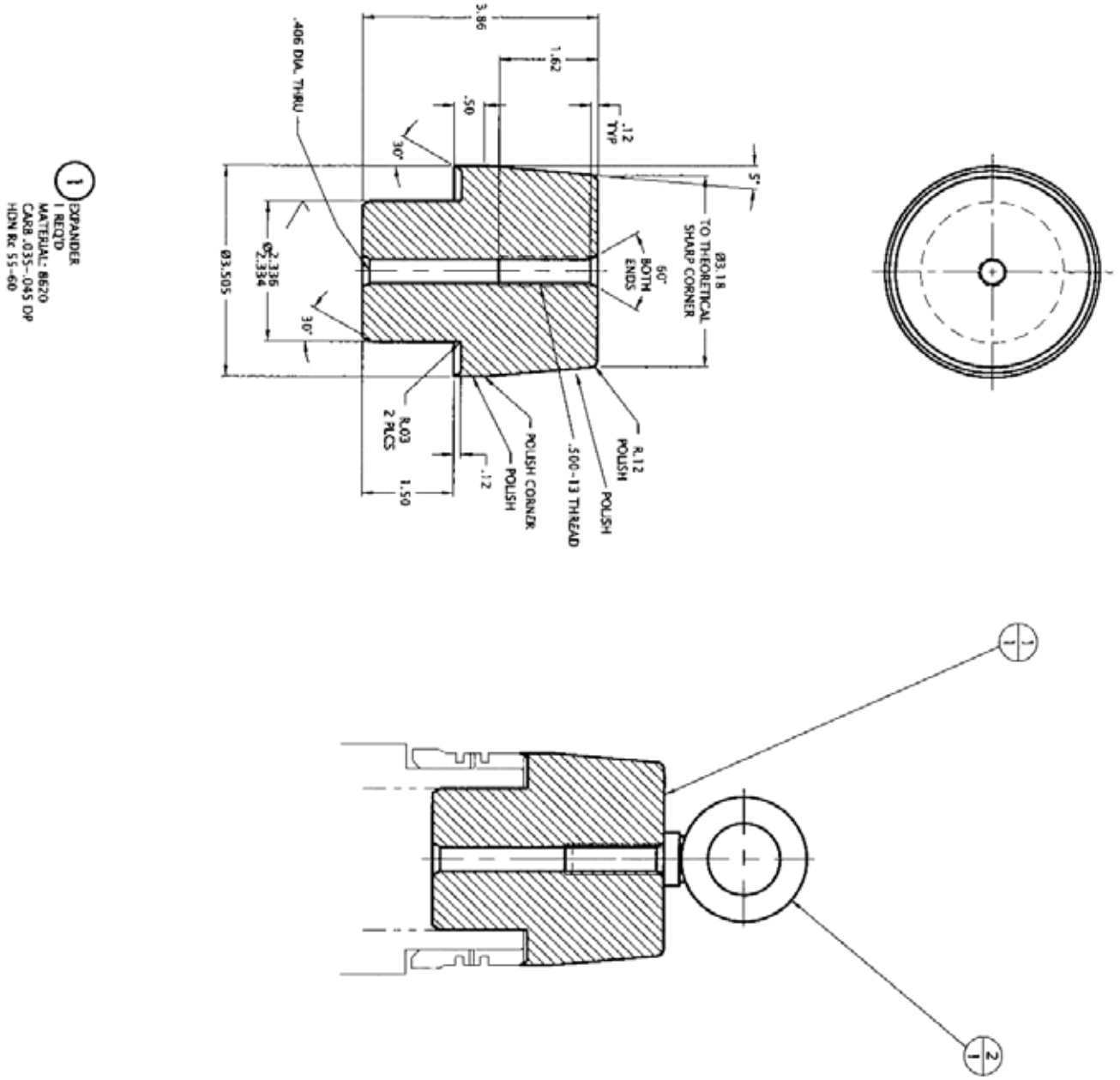
HYDRALOC SLEEVE DRIVER



FLANGE WEAR SLEEVE DRIVER



SEAL RETAINER INSTALLATION TOOL



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