Introduction

The following instructions for Sizes 2060 thru 2130 FC / gear drives also apply to Sizes M2060 thru M2130 FC/FZ (metric shaft extension) drives. This is a guide for inspection, disassembly, parts replacement, and reassembly of concentric shaft drives. Drawings are representative of this series of drives and may not agree in exact detail with all drive sizes. When ordering parts or requesting information, specify the M.O. number, the drive size, model number, rpm, ratio, and the date on the drive nameplate. Consult Factory before changing speed or ratio. Operate only at speeds shown on nameplate.

Recommendations

When replacing a pinion, replace the entire assembly (the pinion, bearings, shaft, spacers, etc.) and the mating gear. Parts will be assembled by Rexnord at no extra charge to reduce your assembly and down time. Replace oil seals, shim-gaskets and gaskets when reassembling drives. When replacing an internal backstop, the mating low speed pinion shaft also must be replaced.

CAUTION: *Remove all external loads from drive before servicing drive or accessories.*

Lifting Instructions

Disconnect all attached equipment, drain oil and lift the drive from its foundation by means of a sling wrapped around the shaft extensions on Sizes 2060–2090 and the lifting lugs of Sizes 2100–2130. Protect the shaft extensions from damage.

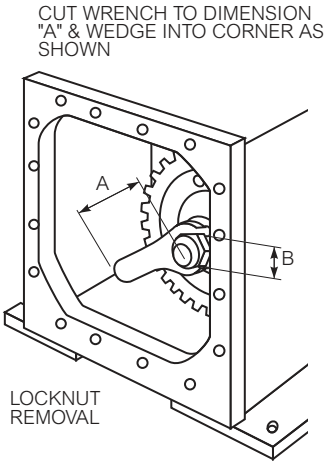
Required Equipment

In addition to standard mechanic's tools, the following equipment is required: hoist, sling, arbor press, wheel puller, torque wrench, feeler gauges, dial indicator with stand, inside and outside micrometers and the appropriate "short" open end wrench defined in Table 1 and Figure 1.

TABLE 1 — Dimensions

DRIVE SIZE	Inches		mm	
	A	B	A	B
2060	7.86	1.81	199,6	46,0
2070	9.12	2.18	231,6	55,4
2080	9.96	2.75	253,0	69,9
2090	11.18	2.75	284,0	69,9
2100	12.68	2.75	322,1	69,9
2110	13.98	2.75	355,1	69,9
2120	15.36	2.75	390,1	69,9
2130	16.88	2.75	428,8	69,9

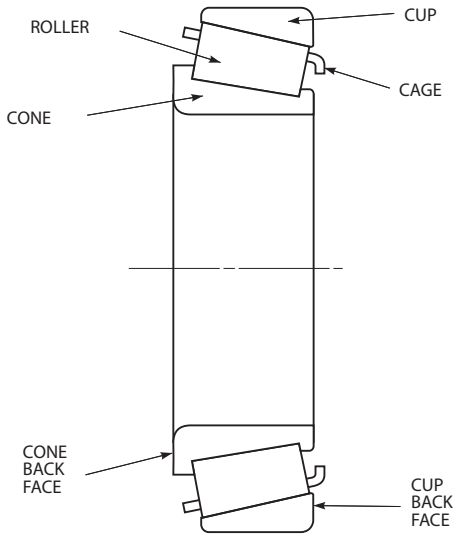
Figure 1



General Instructions

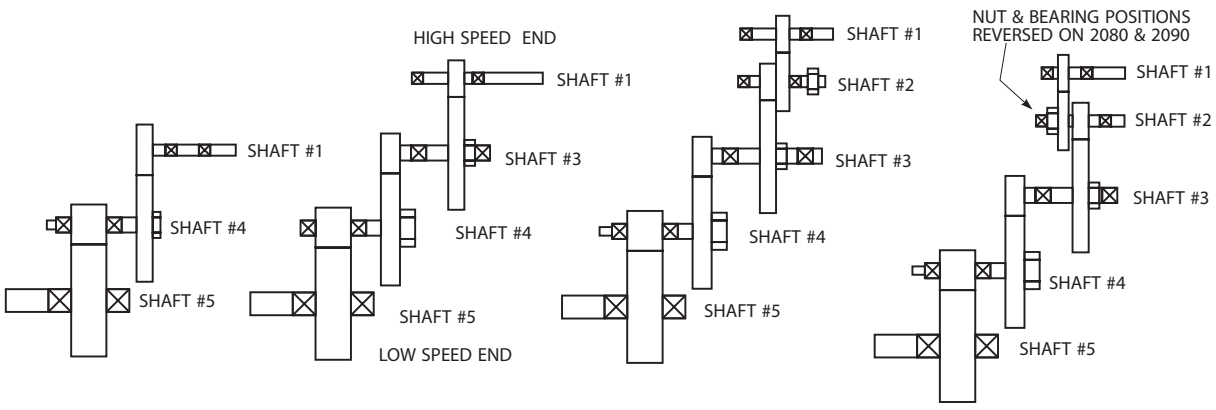
1. **PRE-DISASSEMBLY** — To prevent dirt from falling into the drive, clean all external surfaces before disassembly. Record mounting dimensions of couplings and accessories for reference when reassembling.
2. **SEALS** — Replacement is recommended. However, if seals are not being replaced, refer to Steps 8A and 8H before starting disassembly.
3. **SHIM-GASKETS** — During disassembly, wire or tie all shim-gaskets and metal shims to their respective end covers or seal cages for reference when reassembling.
4. ***CAUTION:*** *A number of bored pinions and their mating shafts are keyless. The high interference fit makes these assemblies "solid on shaft" and, for all practical purposes, inseparable. If there is no evidence of a key or keyway, replace the assembly.*
5. **BEARINGS** — All bearings are single row tapered roller bearings. Nomenclature used in these instructions referring to the various bearing parts is shown in Figure 2.

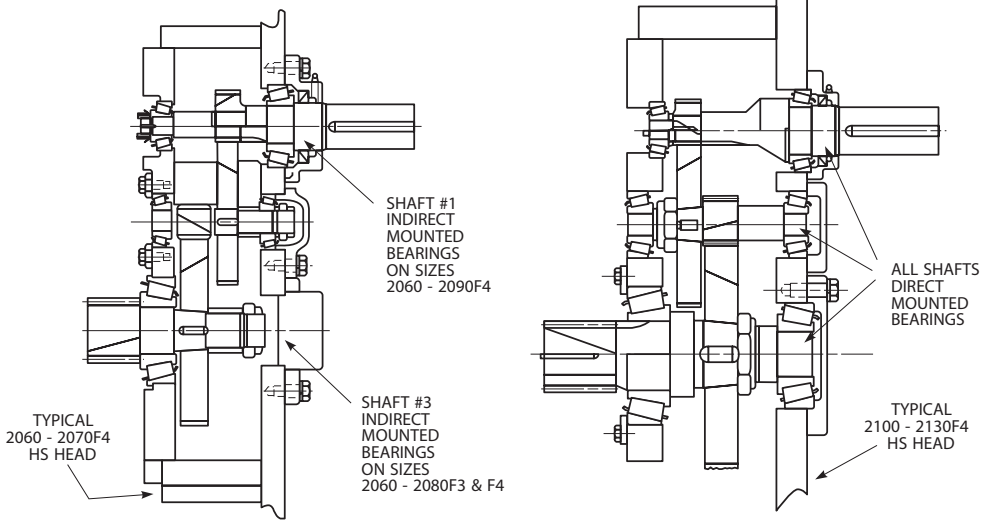
Figure 2



6. **INTERNAL BACKSTOP — DRIVE SIZES 2060–2090** (Figure 3, Page 2).
   A. Remove backstop cover. Note the direction of shaft rotation for reassembly purposes.
   B. Remove backstop and backstop cage assembly from drive.
7. **EXTERNAL BACKSTOP — DRIVE SIZES 2100–2130**.
   A. Note direction of shaft rotation indicated on backstop. Remove key and clean shaft extension. Remove fastener from torque arm pin and slide backstop off of shaft.

Figure 3





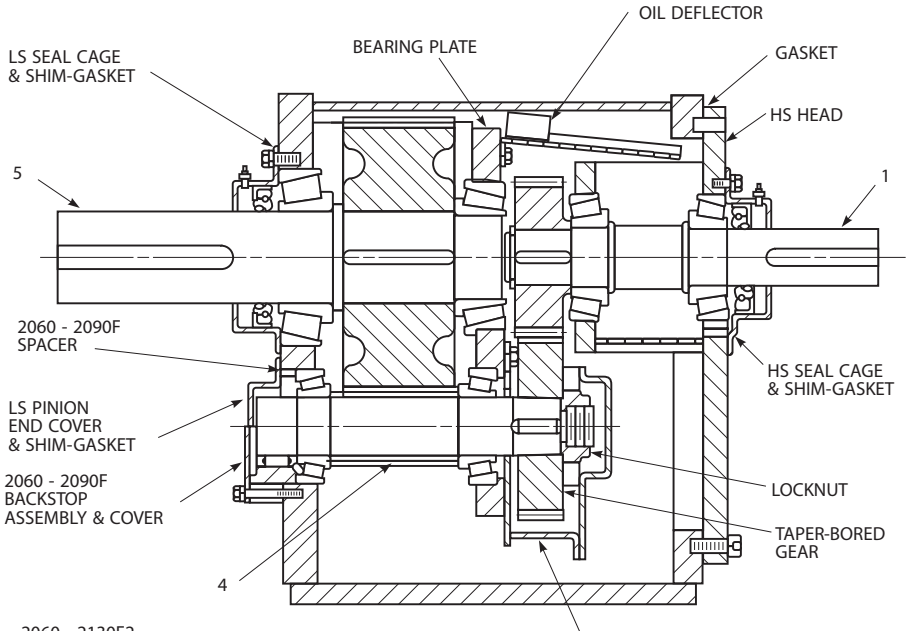


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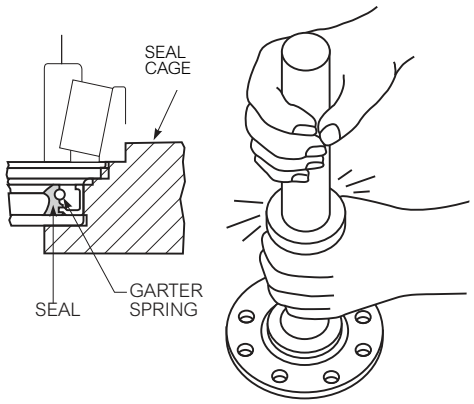
Figure 4



8. **SEAL REPLACEMENT ONLY** — Figure 4.

   All shafts have single row tapered roller bearings which require specific shaft axial float or preload settings. Bearing adjustment on the shafts affected by seal replacement is as follows:

   LOW SPEED SHAFTS — All low speed shaft bearings are adjusted via fiber shim-gaskets under the low speed shaft seal cage. On Sizes 2060–2080 the low speed pinion cover or backstop assembly is removed with the low speed seal cage requiring resetting the low speed pinion bearings after the low speed shaft bearings are set per Step 8M. Metal shims are used for low speed pinion bearing adjustment on Sizes 2060 and 2070 and fiber shim-gaskets are used on the Size 2080.

   HIGH SPEED SHAFTS — On all double reduction, all triple reduction and Sizes 2100–2130 quadruple reduction drives high speed shaft bearings are adjusted via shim packs at the high speed seal cage. Metal shims are used on Sizes 2060 and 2070 triple reduction drives. Bearing adjustment on the high speed shafts of Sizes 2060 and 2070 triple reduction drives should not be required if the original metal shim pack is reused. Sizes 2060–2090 quadruple reduction drive high speed shafts use indirect mounted bearings (Figure 3, Page 2) where bearing settings are not affected by removal and reinstallation of the high speed seal cage.

   If the drive is to be totally disassembled, start with Step 9. If only the seals are to be replaced, proceed as follows:

   A. Clean the shaft extensions, but DO NOT ALLOW abrasive material to mar the shaft surface polished by the seal.

   B. To replace the low speed shaft seal on Size 2060–2080 drives equipped with internal backstops, the backstop assembly must be removed before the low speed seal cage can be removed, refer to Step 6.

   C. Remove the seal cage assemblies, save the shim-gaskets and metal shims for reference when reassembling. The metal shims used for bearing adjustment on Sizes 2060 and 2070 triple reduction drive high speed shafts will be reused at reassembly.

   D. Drive out the seal and remove the old sealing compound and gasket material from the seal cages. Replace seal cages that are damaged or bent.

   E. Coat seal OD with Permatex® #3 or equivalent sealant.

   F. Figure 4: Position seal squarely in seal cage with garter spring toward bearing. Place a square ended cylindrical tool against the seal and press or lightly tap the tool (not the seal) until the seal is seated in the seal cage.

   G. Clean face of drive. Remove old gasket material. For high speed shafts, replace the old gasket with a new one of the same compressed thickness (bearings should not require adjustment with reuse of the metal shims). Low speed shaft bearings (and low speed pinion shaft bearings on Sizes 2060–2080) require adjustment for preload or float with low speed shaft seal replacement. Replace old low speed shaft shim-gaskets with new ones of the same total thickness and add additional .007" (0,18 mm) and .009" (0,23 mm) shim-gaskets to assure low speed shaft axial float on initial check. See Table 2 for shim-gaskets available from the factory. When only one .015" (0,38 mm) or .031" (0,79 mm) shim-gasket is provided in the new shim pack, place that shim-gasket against the seal cage when it is a stamping or against the housing when it is a casting.

TABLE 2 — Shim-Gasket Compressibility

Falk Shim-Gaskets	Thickness – Inches		Thickness – mm	
	New	Compressed	New	Compressed
Black	.007	.006	0,18	0,15
Black	.009	.008	0,23	0,20
Gray	.015	.013	0,38	0,33
Gray	.031	.026	0,79	0,66
Black	.031	.028	0,79	0,71

   H. ***CAUTION**: Protect seal lips from the sharp edges of the keyway by wrapping thin strong paper around the shaft and coating the paper and seal lips with bearing grease before sliding the seal on or off the shaft. Do not expand the seal lips more than .03" (0,8 mm) larger than shaft diameter.*

   J. Install seal cage. Install fasteners with lock washers and tighten finger tight.

   K. The low speed seal cages of all Size 2060–2090 drives and the high speed seal cages of the Size 2080 and 2090 double reduction drives are unregistered and require centering on the shaft. Use a feeler gauge to check clearance at 90° intervals between the shaft and seal cage bore. Lightly tap the cage and center it within .004" (0,10 mm).

   L. Cross tighten fasteners to torque specified in Table 3, Page 4.

   M. All shafts have single row tapered roller bearings that require specific axial float or preload settings after the seal cages have been installed with new shim-gaskets and fasteners tightened to specified torque. Refer to Table 6, Page 9, for bearing float and preload settings. To obtain accurate readings, turn the drive with the shaft being checked vertical and facing up. Attach a “C” clamp to the shaft extension to serve as a push-pull device and measure and adjust axial float or preload as instructed in Step 23 for low speed shafts.

TABLE 3 — Fastener Tightening Torques

Part Description		Fastener Size										
		.250-20	.3125-18	.375-16	.500-13	.625-11	.750-10	.875-9	1.000-8	1.125-7	1.250-7	1.500-6
CRITICAL JOINTS		**Fastener Tightening Torque – lb-ft ±5%**										
H.S. Seal Cage Sizes 2080F2 & 2090F2 L.S. Seal Cage Sizes 2060-2090F L.S. Pinion End Cover w/o Backstop Sizes 2060-2080F		. . .	12	22	54	108						
H.S. Seal Cage L.S. Seal Cage Sizes 2100-2130F L.S. Pinion End Cover w/o Backstop Sizes 2090-2130F L.S. Pinion End Cover with Backstop Sizes 2060-2090F F3/F4 Int. End Cover Sizes 2060-2130F F3/F4 Int. Thrust Plates Sizes 2060F, 2070F, 2090F & 2100F★ H.S. Head to Housing Sizes 2060-2130F Motor Mount to Housing Cover Motor Bracket to H.S. Head C-Face H.S. Seal Cage External Backstop Anchor Bracket Sizes 2100-2130F2 & F3		7.0	15	27	67	134	242	395	590	740		
F3/F4 Internal Thrust Plates Sizes 2110-2130F (Grade 8)★ #60 External Backstop Anchor Bracket with Fan Sizes 2100-2130F2 (Grade 8)		. . .	21	39	95	190	345	555	840			
L.S. Bearing Plate Sizes 2060-2130F (Self Locking)•		...	...	...	...	152	265	425	640			
NON-CRITICAL JOINTS (All Fasteners Grade 5)												
Oil Deflector (Nylon Pellet) Oil Pan to Bearing Plate (Nylon Pellet) Oil Pan Cover to Oil Pan Shaft Fan Misc. Fasteners Electric Fan Misc. Fasteners Motor Bracket Misc. Fasteners Motor Mount Misc. Fasteners Motor Plate Misc. Fasteners Slide Base Misc. Fasteners Coupling Guard Misc. Fasteners	**Without Locknut**	4.5	9.5	17	42	84	152	154	230	325	465	820
	With Locknut	6.0	13	21	50	100	172	188	275	375	520	890
CRITICAL JOINTS		**Fastener Tightening Torque – Nm ±5%**										
H.S. Seal Cage Sizes 2080F2 & 2090F2 L.S. Seal Cage Sizes 2060-2090F L.S. Pinion End Cover w/o Backstop Sizes 2060-2080F		. . .	16	30	73	146						
H.S. Seal Cage L.S. Seal Cage Sizes 2100-2130F L.S. Pinion End Cover w/o Backstop Sizes 2090-2130F L.S. Pinion End Cover with Backstop Sizes 2060-2090F F3/F4 Int. End Cover Sizes 2060-2130F F3/F4 Int. Thrust Plates Sizes 2060F, 2070F, 2090F & 2100F★ H.S. Head to Housing Sizes 2060-2130F Motor Mount to Housing Cover Motor Bracket to H.S. Head C-Face H.S. Seal Cage External Backstop Anchor Bracket Sizes 2100-2130F2 & F3		10,0	21	37	91	184	330	530	800	1000		
F3/F4 Internal Thrust Plates Sizes 2110-2130F (Grade 8)★ #60 External Backstop Anchor Bracket with Fan Sizes 2100-2130F2 (Grade 8)		. . .	29	52	130	260	465	750	1140			
L.S. Bearing Plate Sizes 2060-2130F (Self Locking)		...	...	...	...	206	360	575	860			
NON-CRITICAL JOINTS (All Fasteners Grade 5)												
Oil Deflector (Nylon Pellet) Oil Pan to Bearing Plate (Nylon Pellet) Oil Pan Cover to Oil Pan Shaft Fan Misc. Fasteners Electric Fan Misc. Fasteners Motor Bracket Misc. Fasteners Motor Mount Misc. Fasteners Motor Plate Misc. Fasteners Slide Base Misc. Fasteners Coupling Guard Misc. Fasteners Pump & Cooler Misc. Fasteners	**Without Locknut**	6,0	13	23	57	114	206	210	315	445	630	1100
	With Locknut	8,5	17	29	68	136	234	255	370	510	710	1200

★ Loctite® #242 or equivalent medium strength thread locking compound on threads.
• Apply Loctite #277 or equivalent high strength thread locking compound on threads of fasteners and mating tapped holes.

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TABLE 4 — Locknut Tightening Torques

(On Tapered Shafts with Taper Bore Gears from Figure 3, Page 2)

DRIVE SIZE	Shaft #4				Shaft #3		Shaft #2	
	Initial Torque	+Degrees Rotation	Full Torque	Hex Size	Torque	Hex Size	Torque	Hex Size
Torques (lb-ft ±5%), Hex Size (Inches)								
2060	95	60	225	1.812	96	1.438	25	.938
2070	120	60	320	2.187	133	1.812	29	.938
2080	185	60	460	2.750	200	2.000	42	1.062
2090	185	90	590	2.750	260	2.750	48	1.062
2100	150	75	750	2.750	380	2.750	110	1.812
2110	365	120	1220	2.750	510	2.750	155	2.000
2120	365	105	1220	2.750	500	2.750	210/190	2.500/2.000
2130	365	105	1270	2.750	670	2.750	210/190	2.500/2.000
Torques (Nm ±5%), Hex Size (mm)								
2060	129	60	305	46,02	130	36,53	34	23,83
2070	163	60	434	55,55	180	46,02	39	23,83
2080	251	60	623	69,85	271	50,80	57	26,97
2090	251	90	799	69,85	352	69,85	65	26,97
2100	203	75	1016	69,85	515	69,85	149	46,02
2110	495	120	1653	69,85	691	69,85	210	50,80
2120	495	105	1653	69,85	678	69,85	285/257	63,50/50,80
2130	495	105	1721	69,85	908	69,85	285/257	63,50/50,80

N. When replacing the low speed shaft seal on Sizes 2060–2080, adjust the low speed shaft bearings first per Steps 8M and 23 and then adjust the low speed pinion bearings as follows:

The low speed pinion bearings are adjusted with metal shims at the bearing cup back face on Sizes 2060 and 2070 and fiber shim-gaskets between the low speed seal cage and pinion cover (backstop cage) on Size 2080. Do not disturb the seal cage fasteners located around the low speed shaft after the low speed shaft bearings are adjusted.

Reassemble the low speed pinion cover or backstop assembly (removed in Step 6) to the drive with a shim pack of equal compressed thickness to that removed, use two .015" (0,38 mm) shim-gaskets under the backstop cover on Size 2060 drives. Install and torque fasteners to values specified in Table 3, Page 4).

Remove the pipe plug from the center of the low speed pinion cover or backstop cover and thread a .375-16UNC fastener into the tapped hole in the end of the pinion shaft to serve as a push-pull device. Measure and adjust axial float as instructed in Steps 23 and 28. Low speed pinion shaft axial float is increased by removing metal shims on Sizes 2060 and 2070 and by adding shim-gaskets on Size 2080. Remove fastener and reinstall pipe plug with Permatex®#3 coated threads in end cover.

Disassembly

Start with the high speed end of the drive and work through to the low speed end.

High Speed End Removal

9. **ALL REDUCTIONS** — Figure 3, Page 2.

A. Support the drive on its low speed end with the high speed shaft extension up. Remove the two threaded dowels from the high speed heads of triple and quadruple reduction drives. Remove the mounting fasteners from the high speed head flange. The single dowel in the high speed head flange of double reduction drives remains in the high speed head on Sizes 2060F-2090F and in the main housing on Sizes 2100F-2130F at disassembly.

B. Install three or four eyebolts in the tapped fastener holes in the high speed head. Sling head from eyebolts and while lifting, tap edges of head with a brass bar to free the head from the housing gasket and dowels.

C. If only the high speed head assembly is to be serviced, protect the seal lips per Steps 8A and 8H if the high speed seal is to be reused before removing the high speed seal cage in Steps 11, 12, and 13.

Low Speed End Removal

10. **REMOVE TAPER BORE GEAR LOCKNUT** — Figure 3, Page 2.

A. If drive has an oil pan, remove the pan cover. DO NOT damage oil pan when removing gear.

B. Use one of the following methods (listed in recommended order) to loosen the taper bore gear locknut. For best results, use an impact wrench (do not use impact wrench on drives with internal backstop installed). For Sizes 2060–2100, use a wrench with a .750" (19,1 mm) drive and Sizes 2110–2130, a 1" (25 mm) drive wrench. Refer to dimension "B" in Table 1 and Figure 1, Page 1, for socket sizes.

1. Remove locknut with a socket wrench.
Sizes 2060–2080 — Refer to Figure 5A.
Sizes 2090–2130 — Refer to Figure 5B.

Figure 5A

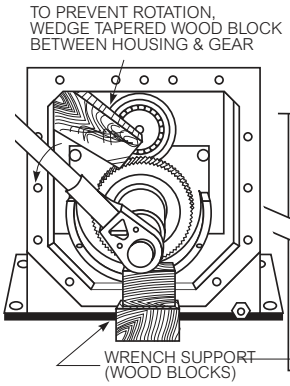


Figure 5B

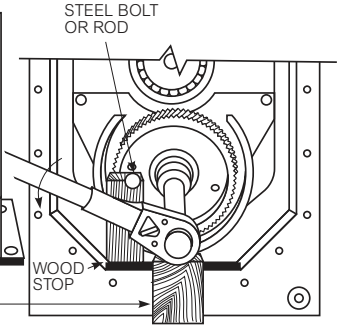


Figure 6A

LEAVE LOCKNUT ON SHAFT AS SHOWN TO PREVENT GEAR FROM POPPING OFF WHEN FREED

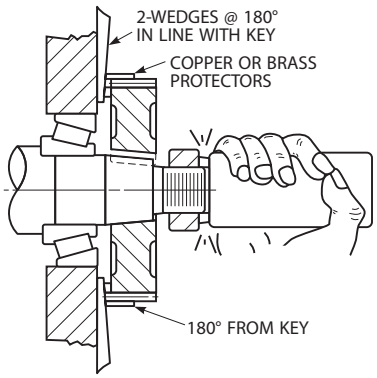


Figure 6B

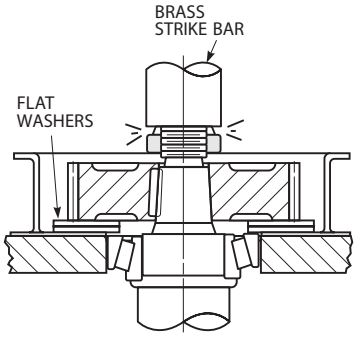


Figure 6C

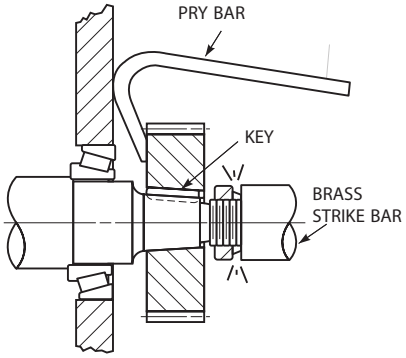


Figure 6D

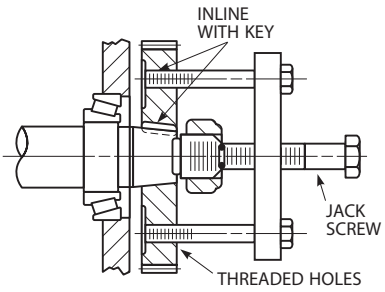
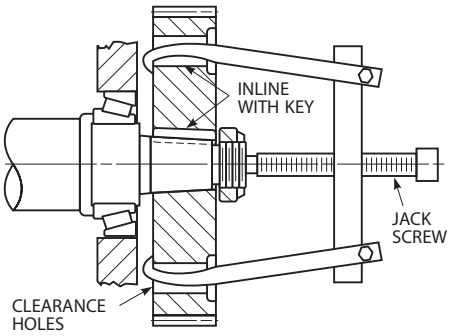


Figure 6E



2. Remove locknut with a “short” open end wrench. DO NOT use this method if gear teeth are broken or with internal backstop installed with locking direction same as shaft rotation required to loosen locknut.

   For All Sizes — place “short” open end wrench on locknut with handle in corner of housing (Figure 1, Page 1) and reassemble the high speed head to the housing per Step 47.

   Turn the high speed shaft counterclockwise with a spanner wrench on double reduction and quadruple reduction drives or clockwise on triple reduction drives to loosen the locknut. The number of revolutions required at the high speed shaft to loosen the nut is equal to the drive total ratio divided by 10. DO NOT damage shaft extension or keyway. When the nut is loose, remove the high speed head and wrench.

C. Remove taper bore gear (Figure 3, Page 2). DO NOT reuse the gear if the teeth are damaged. Always leave the locknut on the shaft as shown in Figure 6, to prevent the gear from popping out of the drive when released from the shaft taper. If the gear does not break loose using one of the following methods, refer to Step 10C-3.

1. Sizes 2060–2080 — Loosen the low speed pinion cover fasteners to provide a .25" (6,4 mm) gap between the cover and housing. If the gear is to be reused, protect the gear teeth with brass or copper sheets. Using wedges or pry bar, tap wedges behind gear or pry gear away from housing inner wall as shown in Figure 6A or 6C. While holding pressure on gear, strike locknut on shaft with brass bar until gear breaks loose. On drives with pans, lift gear, place flat washers under gear rim and then loosen gear as shown in Figure 6B.
2. *Sizes 2090–2130* — Loosen the low speed pinion cover fasteners to provide a .25" (6,4 mm) gap between the cover and housing.
   a. Gear with threaded holes in web — follow Figure 6D. Use an Armstrong-Bray Press Puller #2 or equivalent.
   b. Gear with cast holes in web — follow Figure 6E. Use heavy duty Armstrong-Bray Standard Two-Arm Puller #1004 or equivalent.

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3. Sizes 2060–2130 — Heat Method.

   If the gear did not break loose using the above methods, mark the gear hub with a 325°F (163°C) temperature sensitive crayon and heat the hub with an oxyacetylene torch with excess acetylene mixture to reduce the temperature of the flame. ***CAUTION:*** *DO NOT use an open flame in a combustible atmosphere or near combustible materials.*

   a. Sizes 2060–2080 — Apply pressure behind gear with wedges or pry bar, as shown in Figures 6A and 5C, while applying heat around the hub diameter. If necessary, tap around gear web area with a hammer.

   b. Sizes 2090–2130 — Align puller arms at 90° to the keyway and tighten the puller to its maximum capacity. Apply heat around the gear hub diameter. While heating the gear hub, strike the end of the puller jack screw sharply with a bar or hammer until gear breaks loose.

   DO NOT reuse gear if it was heated over 325°F (163°C).

D. Remove oil pan if so equipped.

E. Remove bearing plate fasteners with hand tools and heat, then remove bearing plate.

F. Lift out the low speed #4 pinion and #5 gear assemblies. If the low speed seal is to be reused, refer to Steps 8A and 8H. Then lift out the low speed shaft assembly.

G. Turn housing over and remove the low speed pinion end cover, low speed seal cage and bearing cups.

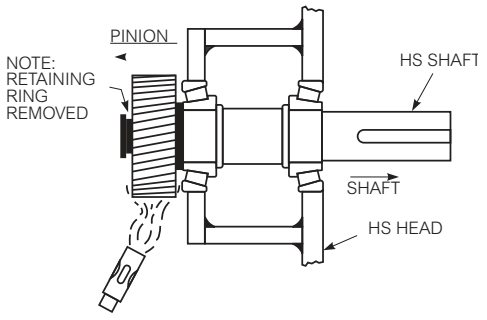
High Speed End Disassembly

11. **DOUBLE REDUCTION** — Figure 3, Page 2.

A. Remove the high speed seal cage and remove the high speed pinion assembly from the head through the bearing bores toward the extension end. EXCEPTIONS: On the following drive ratios, heat the pinions (pinion OD larger than inner bearing cup ID) to 325°F (163°C) maximum and press or pull pinion off of shaft and withdraw the shaft assembly from the head (Figure 7).

2060F2 — Ratios 1.548–3.759 & 4.998–9.269
2070F2 — Ratios 1.590–2.542 & 4.996–6.155
2080F2 — Ratios 1.561–2.504 & 5.161–6.290
2090F2 — Ratios 1.504–2.503, 3.137 & 5.050–7.581
2100F2 — Ratios 5.071–9.218
2110F2 — Ratios 4.960–7.575

Figure 7



2120F2 — Ratios 5.201–9.349
2130F2 — Ratios 6.069–11.85

12. **TRIPLE REDUCTION** — Figure 3, Page 2.

Remove the intermediate shaft assembly #3 first and then remove the high speed shaft assembly. On Sizes 2060–2080 the intermediate shaft #3 is supported in indirectly mounted bearings with locknut adjustment at the outboard bearing.

A. **DRIVE SIZES 2060–2080**.

1. Remove intermediate shaft cover.
2. Hold the taper bore gear locknut on the intermediate shaft with an open end wrench and rotate the high speed shaft counterclockwise with a spanner wrench to loosen the gear locknut.
3. Loosen the outer bearing locknut several turns. Support shaft assembly #3 with wedges between the gear rim and the head inner wall (Figure 6A, Page 6) and strike shaft end with a brass bar to loosen gear on shaft — Do not damage shaft threads if shaft is to be reused. Remove outer bearing locknut and lock washer, continue pushing shaft assembly out of outer bearing cone while unthreading gear locknut.
4. Remove high speed seal cage and remove the high speed shaft assembly from the head. Keep the metal shims (Sizes 2060 & 2070) and fiber shim-gaskets (Size 2080) with the seal cages for reference when reassembling.

B. **DRIVE SIZES 2090–2130**.

1. Hold the taper bore gear locknut on the intermediate shaft with an open end wrench and rotate the high speed shaft counterclockwise with a spanner wrench to loosen the gear locknut.
2. Remove the inner bearing thrust plate and outer bearing end cover, keep the shim-gaskets with the end cover for reference at reassembly.
3. Place two spacer blocks between the gear face and the inner wall of the high speed head. Place a brass bar on the outboard shaft end and strike the bar a sharp blow with a hammer to loosen the gear on the shaft. Unthread the gear locknut from the shaft threads.
4. Press the shaft assembly out of the outer bearing cone and remove the shaft assembly and gear from the head.
5. Remove high speed seal cage and remove the high speed shaft assembly from the head. Keep the shim-gaskets with the seal cages for reference when reassembling.

13. **QUADRUPLE REDUCTION** — Figure 3, Page 2. Shaft assemblies are removed in the following order, 2nd intermediate shaft #3 first, 1st intermediate shaft #2 second and the high speed shaft last. Nut adjusted indirect mounted bearings are used on the 2nd intermediate shafts of Sizes 2060–2080 and the high speed shafts of Size 2020–2090 quadruple reduction drives.

A. **2ND INTERMEDIATE SHAFTS** — These shaft assemblies are the same as the 1st intermediate shafts in triple reduction drives, refer to Step 12A and 12B for removal; Rotate high speed shaft clockwise to loosen gear locknut.

B. **1ST INTERMEDIATE SHAFTS**.

The gear locknut is located outside of the outer bearing on Sizes 2060 and 2070, outside of the inner bearing on Sizes 2080 and 2090, and between the inner bearing and gear on Sizes 2100 thru 2130. The high speed shaft is rotated counterclockwise on Sizes 2060 and 2070 and clockwise on Sizes 2080 thru 2130 to loosen the locknut. 1st intermediate shaft assemblies are removed from the high speed heads away from the nut end of the shaft.

1. On Sizes 2060 and 2070, remove the 1st intermediate shaft end cover to provide access to the locknut. Keep the metal shims with the end cover for reference at reassembly.
2. Hold the locknut with a socket wrench on Sizes 2060 thru 2090 or open end wrench on Sizes 2100 thru 2130 and rotate the high speed shaft with a spanner wrench to loosen the locknut.
3. On Sizes 2060 and 2070, remove the inner bearing thrust plate. On Sizes 2080 thru 2130, remove the 1st intermediate shaft end cover, keep the metal shims (Sizes 2080 and 2090) or fiber shim-gaskets (Sizes 2100 thru 2130) with the end cover for reference at reassembly.
4. Place two spacer blocks between the gear face and the inner wall of the high speed head on Sizes 2060 and 2070 or between the gear face and outer wall of the high speed head on Sizes 2080 thru 2130. Place a brass bar on the shaft end nearest the locknut and strike the bar a sharp blow with a hammer to free the gear.
5. On Sizes 2060 thru 2090, remove the locknut from the shaft and withdraw the shaft from the high speed head. On Sizes 2080 and 2090, the inner bearing cone and bearing sleeve are removed with the gear when the shaft is withdrawn. On Sizes 2100 thru 2130, unthread locknut from shaft threads (nut partially removes inner bearing cone from shaft) and while supporting gear, tap shaft assembly out of high speed head. Remove remaining bearing cups if required.

C. **HIGH SPEED SHAFT**.

1. **DRIVE SIZES 2060–2090** — Remove high speed seal cage. Remove locknut and lock washer at inboard end of shaft assembly. With a small brass bar applied to the inboard shaft end, drive the shaft assembly out of the inner bearing cone and remove the shaft assembly from the drive, on some low ratio drives the outer bearing cup is removed from the head with the shaft assembly.

TABLE 5 — Shafts with Keyless Bored Pinions & Trapped Bearings

Reduction	Shaft	Ratio	DRIVE SIZE			
			2060	2070	2080	2090
Quadruple	High Speed	194.6 238.4 291.9 357.5 437.9 536.3	. . . Keyless★ Keyless★ Keyless★ Keyless★. . . .	. . . Keyless★ Keyless★ Keyless★ Keyless★ Keyless★	Keyless★ Keyless★ Keyless★ Keyless★ Keyless★ Keyless★	... Keyless★ Keyless★ Keyless★ Keyless★ Keyless★
Double	Low Speed Pinion	1.5 thru 4.57	Keyless	Keyless	Keyless	Keyless

★Trapped outer bearing.

2. **DRIVE SIZES 2100–2130** — Remove high speed seal cage and high speed shaft assembly, keep shim-gaskets with seal cage for reference at reassembly.

Cleaning, Inspection & Replacement of Parts

14. Table 5 lists quadruple reduction high speed shaft assemblies and double reduction low speed pinion assemblies (less bearings) that require replacement as complete assemblies and not individual parts. The following instructions apply to servicing of reusable parts.

15. **CLEAN HOUSING, HEAD & ATTACHMENTS** — Remove remaining bearing cups if required. Remove gasket material and sealing compound from sealing surfaces. Remove dried thread locking compound from tapped holes by running tap into hole. Remove all burrs. Clean oil chamber and all internal revolving elements with kerosene or solvent. Coat pipe plug threads with Per matex® #3 or equivalent sealant before installing.

16. **SEALS** — Drive out old seals and remove old sealing compound from seal cage bores. DO NOT replace seals at this time.

17. **BEARINGS**

A. Wash the bearings in clean kerosene or solvent and then dry.
CAUTION*: Do not spin bearings with an air nozzle as they may score or roller cage assemblies explode causing injury.*

B. Inspect bearings carefully and replace those that are worn or damaged.

C. Use a press or wheel puller to remove the bearings. Apply force directly to the cup or cone back face only. On Size 2090, 2100, 2120 and 2130 triple and quadruple reduction drive shaft #3 assemblies with bored pinions, the pinion must be removed before the inner bearing cone can be removed from the shaft. On Size 2090 low speed pinion with internal backstop, the backstop inner ring and key are removed with the adjacent bearing cone. The backstop inner ring and key are reinstalled in Step 48C.

D. DO NOT mount bearings next to intermediate shaft locknuts until the shaft assembly is installed in the head, then mount bearings per Step 17E.

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TABLE 6 — Bearing Adjustment (Shaft reference number & drive reduction from Figure 3, Page 2)

DRIVE SIZE	Total Shaft Axial Float							Preload
	Shaft #1 Double Reduction	Shaft #1 Triple Reduction	Shaft #1 Quadruple Reduction	Shaft #2 Quadruple Reduction	Shaft #3 Triple & Quad. Reduction	Shaft #4 All Reductions	Shaft #5 Ratios 1.45thru 4.75	Shaft #5 Ratios 4.90& Greater
Inches								
2060	.004-.006	.004-.006	.001-.003■	.003-.005	.000-.002■	.003-.005†	.002-.005	.003-.005‡
2070	.004-.006	.004-.006	.001-.003■	.003-.005	.000-.002■	.003-.005†	.002-.005	.004-.006‡
2080	.004-.006	.004-.006	.001-.003■	.003-.005	.000-.002■	.003-.005†	.002-.005	.006-.008‡
2090	.004-.006	.004-.006	.001-.003■	.003-.005	.003-.005	.003-.005†	.002-.005	.006-.008‡
2100	.005-.008	.005-.008	.005-.008	.003-.005	.003-.005	.003-.005	. . .	.006-.008‡
2110	.005-.008	.005-.008	.005-.008	.003-.005	.003-.005	.003-.005	. . .	.008-.010‡
2120	.005-.008	.005-.008	.005-.008	.003-.005	.003-.005	.003-.005	. . .	.010-.012‡
2130	.005-.008	.005-.008	.005-.008	.003-.005	.003-.005	.003-.005	. . .	.011-.013‡
Millimeters								
M2060	0,10-0,15	0,10-0,15	0,03-0,08	0,08-0,13	0,00-0,05	0,08-0,13	0,05-0,13	0,08-0,13
M2070	0,10-0,15	0,10-0,15	0,03-0,08	0,08-0,13	0,00-0,05	0,08-0,13	0,05-0,13	0,10-0,15
M2080	0,10-0,15	0,10-0,15	0,03-0,08	0,08-0,13	0,00-0,05	0,08-0,13	0,05-0,13	0,15-0,20
M2090	0,10-0,15	0,10-0,15	0,03-0,08	0,08-0,13	0,08-0,13	0,08-0,13	0,05-0,13	0,15-0,20
M2100	0,13-0,20	0,13-0,20	0,13-0,20	0,08-0,13	0,08-0,13	0,08-0,13	. . .	0,15-0,20
M2110	0,13-0,20	0,13-0,20	0,13-0,20	0,08-0,13	0,08-0,13	0,08-0,13	. . .	0,20-0,25
M2120	0,13-0,20	0,13-0,20	0,13-0,20	0,08-0,13	0,08-0,13	0,08-0,13	. . .	0,25-0,30
M2130	0,13-0,20	0,13-0,20	0,13-0,20	0,08-0,13	0,08-0,13	0,08-0,13	. . .	0,28-0,33

† .001-.003" (0,08-0,08 mm) axial float when internal backstop is installed.

‡ Values are preload, preload is shim removal from a no float/no preload condition.

★ Values are for shafts with nut adjusted indirect mounted bearings.

E. Before mounting tapered roller bearing cones, heat in an oven or oil bath to 275°F (135°C) and then slide or press tight against the shaft shoulder. Shafts with indirect mounted bearings, the bearing cone at the threaded end of the shaft is mounted after the shaft is installed in the head.
CAUTION: *Do not apply flame directly to bearing cones or rest them on the bottom of the heated container.*

F. After cooling, thoroughly coat all bearings with lubricating oil.

18. **GEAR & PINION REPLACEMENT**.

A. Wash the pinions and gears in clean kerosene or solvent and inspect for damaged or worn teeth.

B. DO NOT mount pinions that had to be heated and removed to permit removal of the high speed shaft from the high speed head. Install the assembled shaft (less pinion) into the head and then mount the pinion per Step 18C.

C. **KEYED ELEMENTS** — Assemble straight-bored pinions (with keys) to the shaft from the chamfered side. Preheat pinion in an oil bath or oven to 325°F (163°C) maximum and then press tight (less than .001" or 0,03 mm clearance) against shaft shoulder. Check with feeler gage.

D. **KEYLESS ELEMENTS** — *Replace keyless bored pinion shaft assemblies listed in Table 5, Page 8, as a Factory assembly if either the pinion, shaft or non-removable bearing is worn or damaged. Keyless bored pinions are used on Sizes 2060–2090F2 low ratio drive low speed pinion shafts and on Sizes 2060–2090F4 high speed shafts.*

19. **FASTENERS**.

A. Remount lock washers on external fasteners during reassembly. When replacing fasteners, use the identical grade, type and size as furnished in the original assembly. Note that the bearing plate fasteners have an adhesive coating, but will also require the addition of Loctite #277 thread locker to the threads.

B. Replace used elastic collar locknuts with new ones to ensure maximum holding capacity. Before mounting, dip the locknut in SAE 20 or heavier oil.

20. **SHIMS & SHIM-GASKETS**.

A. Replace the used shim-gaskets with new ones. Metal shims are reusable if undamaged. Shim packs composed of shim-gaskets with minimum compressibility (Table 2, Page 3) are available from the Factory. Shim sets of metal shims in thicknesses of .002" (0,05 mm), .005" (0,13 mm), .010" (0,25 mm) and .030" (0,76 mm) are available from the Factory.

B. Always place the one .015" (0,38 mm) or one .031" (0,79 mm) (gray) sealing shim-gasket against the seal cage or end cover when the seal cage or end cover is a stamping or against the housing when the seal cage or end cover is a casting for positive sealing.

21. **CLEAN & OIL PARTS**.

All parts must be clean. Pay particular attention to the inside of the housing to see that all foreign matter has been removed. Check to see that all worn parts have been replaced and that all gears and bearings are coated with oil.

TABLE 7 — Gear Locknut Tightening Torque at High Speed Shaft •

Ratio	DRIVE SIZE — Torque – lb-ft ±5%								DRIVE SIZE —Torque – Nm ±5%							
	2060	2070	2080	2090	2100	2110	2120	2130	M2060	M2070	M2080	M2090	M2100	M2110	M2120	M2130
Gear on Ref. Shaft #4 (Figure 3, Page 2)																
1.50	220	315	445	480	. . .	. . .	. . .	. . .	298	427	603	650	. . .	. . .	. . .	. . .
1.84	186	260	370	415	. . .	. . .	. . .	. . .	252	352	501	562	. . .	. . .	. . .	. . .
2.03	186	260	370	480	. . .	. . .	. . .	. . .	252	352	501	650	. . .	. . .	. . .	. . .
2.25	149	210	305	320	. . .	. . .	. . .	. . .	202	285	413	434	. . .	. . .	. . .	. . .
2.49	149	210	305	415	. . .	. . .	. . .	. . .	202	285	413	562	. . .	. . .	. . .	. . .
2.76	121	174	250	265	. . .	. . .	. . .	. . .	164	236	339	359	. . .	. . .	. . .	. . .
3.05	121	174	250	320	. . .	. . .	. . .	. . .	164	236	339	434	. . .	. . .	. . .	. . .
3.38	100	145	215	210	. . .	. . .	. . .	. . .	136	196	291	285	. . .	. . .	. . .	. . .
3.74	100	145	215	265	. . .	. . .	. . .	. . .	136	196	291	359	. . .	. . .	. . .	. . .
4.13	83	118	171	174	. . .	. . .	. . .	. . .	112	160	232	236	. . .	. . .	. . .	. . .
4.57	83	118	171	210	. . .	. . .	. . .	. . .	112	160	232	285	. . .	. . .	. . .	. . .
5.06	86	260	370	480	615	1000	980	1040	252	135	501	650	833	1355	1328	1409
6.20	149	210	305	415	485	820	810	840	202	285	413	562	657	1111	1098	1138
7.59	121	174	250	320	410	655	665	690	164	236	339	434	556	888	901	935
9.30	100	145	215	265	340	525	545	580	136	196	291	359	461	711	738	786
11.39	83	118	171	210	270	435	445	445	112	160	232	285	366	589	603	603
13.95	68	97	139	174	225	355	365	365	92	131	188	236	305	481	495	495
17.09	54	75	110	145	181	290	295	310	73	102	149	196	245	393	400	420
20.93	44	64	91	116	145	240	240	250	60	87	123	157	196	325	325	339
25.63	36	52	76	95	122	196	197	210	49	70	103	129	165	266	267	285
31.39	29	42	61	78	100	160	160	171	39	57	83	106	136	217	217	232
38.44	24	35	49	62	78	129	130	134	33	47	66	84	106	175	176	182
47.08	20	28	40	51	65	107	107	112	27	38	54	69	88	145	145	152
57.66	16.4	23	33	42	54	88	90	92	22	31	45	57	73	119	122	125
70.62	13.2	18.4	27	35	44	72	75	77	17,9	25	37	47	60	98	102	104
86.50	10.9	15.1	22	29	35	58	58	65	14,8	20	30	39	47	79	79	88
105.9	8.7	12.9	17.7	24	30	47	48	50	11,8	17,5	24	33	41	64	65	68
129.7	7.1	10.1	14.6	18.8	23	39	40	41	9,6	13,6	20	25	31	53	54	56
158.9	5.9	8.7	12.2	15.5	20	32	32	34	8,0	11,8	16,6	21	27	43	43	46
194.6	4.9	7.1	9.9	12.6	15.4	26	26	27	6,6	9,6	13,4	17,1	21	35	35	37
238.4	3.9	5.8	8.0	10.3	12.8	21	21	22	5,3	7,9	10,8	14,0	17,3	28	28	30
291.9	3.1	4.6	6.5	8.6	10.2	17.4	17.5	18.4	4,2	6,2	8,8	11,7	13,8	24	24	25
357.5	2.6	3.8	5.3	6.9	8.4	14.1	14.2	15.1	3,5	5,1	7,2	9,3	11,4	19,1	19,2	20
437.9	2.1	3.1	4.4	5.6	7.1	11.4	11.5	12.2	2,8	4,2	6,0	7,6	9,6	15,4	15,6	6,5
536.3	1.71	2.4	3.6	4.6	6.0	9.3	9.5	9.9	2,3	3,3	4,9	6,2	8,1	12,6	12,9	13,4
656.8	1.43	2.1	3.0	3.8	4.7	7.6	7.8	8.2	1,94	2,8	4,1	5,1	6,4	10,3	10,6	11,1
804.5	1.17	1.73	2.5	3.1	3.7	6.3	6.5	6.7	1,59	2,0	3,4	4,2	5,0	8,5	8,8	9,1
985.3	.96	1.36	2.1	2.6	3.1	5.1	5.3	5.6	1,30	1,84	2,8	3,5	4,2	6,9	7,2	7,6
Gear on Ref. Shaft #3 (Figure 3, Page 2)																
38.44	53	72	89	137	205	275	270	360	72	98	121	186	278	373	366	488
47.08	53	72	73	137	171	225	220	360	72	98	99	186	232	305	298	488
57.66	43	48	60	115	171	187	185	295	58	65	81	156	232	253	251	400
70.62	29	38	60	115	115	153	155	245	39	51	81	156	156	207	210	332
86.50	29	32	40	78	94	123	120	210	39	43	54	106	127	167	163	285
105.9	19	27	32	78	94	101	99	160	26	37	43	106	127	137	134	217
129.7	15.4	21	32	51	62	101	82	132	21	28	43	69	84	137	111	179
158.9	12.9	18.1	32	51	62	83	82	109	17,4	25	43	69	84	112	111	148
194.6	12.9	18.1	18.0	42	41	55	53	85	17,4	25	24	57	56	75	72	115
238.4	8.5	11.6	14.6	28	34	45	44	71	11,5	15,7	20	38	46	61	60	96
291.9	6.8	9.4	11.9	23	27	37	36	59	9,2	12,7	16	31	37	50	49	80
357.5	5.6	7.6	9.6	18.8	22	30	29	48	7,6	10,3	13,0	25	30	41	39	65
437.9	4.5	6.2	9.6	15.4	18.9	24	24	39	6,1	8,4	13,0	21	26	33	33	53
536.3	3.7	6.2	9.6	12.4	18.9	24	19.7	32	5,0	8,4	13,0	16,8	26	33	27	43
656.8	3.1	4.3	5.4	10.3	14.8	19.7	19.7	26	4,2	5,8	7,3	14,0	20	27	27	35
804.5	2.5	3.5	5.4	10.3	9.8	13.3	13.5	22	3,4	4,7	7,3	14,0	13,3	18,0	18,3	30
985.3	2.5	3.5	5.4	7.0	9.8	13.3	13.5	18.0	3,4	4,7	7,3	9,5	13,3	18,0	18,3	24
Gear on Ref. Shaft #2 (Figure 3, Page 2)																
194.6	. . .	. . .	23	. . .	47	70	94	113	. . .	. . .	31	. . .	64	95	127	153
238.4	13.7	16.0	18.5	26	39	58	78	94	18,6	22	25	35	53	79	106	127
291.9	11.1	12.9	15.1	26	31	47	64	78	15,0	17,5	20	35	42	64	87	106
357.5	9.0	10.5	12.2	21	26	38	52	64	12,2	14,2	16,5	28	35	51	70	87
437.9	7.3	8.5	12.2	17.2	22	31	42	52	9,9	11,5	16,5	23	30	42	57	70
536.3	6.0	8.5	12.2	13.9	22	31	35	42	8,1	11,5	16,5	18,8	30	42	47	57
656.8	5.1	5.9	6.9	11.5	17.2	25	35	35	6,9	8,0	9,3	15,9	23	34	47	47
804.5	4.1	4.8	6.9	11.5	17.2	25	31	38	5,6	6,5	9,3	15,9	23	34	42	51
985.3	4.1	3.5	6.9	7.8	7.2	25	31	31	5,6	4,7	9,3	10,6	23	34	42	42

• The complete nut must be coated with SAE 20 or heavier mineral oil.

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Drive Assembly — Preliminary

Steps 22 through 24 are set forth here to reduce repetition. As necessary, the assembly instructions will refer back to these steps.

22. **BEARING AXIAL FLOAT & PRELOAD**— All bearings require specific axial float or preload settings as listed in Table 6, Page 9.
23. **BEARING AXIAL FLOAT MEASUREMENT** — Before checking axial float on shafts with direct mounted bearings, torque fasteners to the appropriate value listed in Table 3, Page 4. Determine the shaft axial float with a dial indicator. Rotate shaft while applying axial force in both directions and measure axial float. Add or subtract shim-gaskets or metal shims from the shim pack until measured axial float is within the limits shown in Table 6, Page 9. Low speed shaft axial preload is shim removal from a "0" axial float condition.
24. **TIGHTEN TAPER SHAFT LOCKNUT**.
    A. After dipping locknut in oil and mounting, torque as follows:
    B. Hold the locknut with an open end wrench and turn the high speed shaft extension with a spanner wrench to the torque specified in Table 7, Page 10. If the nut is accessible for a torque wrench, torque to value shown in Table 4, Page 5.

Low Speed End Assembly — Preliminary

25. **ALL REDUCTIONS** — Figure 3, Page 2.
    A. After completing Steps 14 through 21, position housing upright and proceed as follows.
    B. Seat the low speed shaft and low speed pinion shaft bearing cups in their respective housing and housing bearing plate bores.
    C. Mount the low speed seal cage (without seal) with a sufficient amount of shim-gaskets to ensure bearing float. Install seal cage fasteners with lock washers and tighten finger tight.

    SIZES 2060–2080 — Include only one .031" (0,79 mm) shim-gasket in the final shim pack and place it against the low speed seal cage.

    SIZES 2090–2130 — Include only one .015" (0,38 mm) shim-gasket in the final shim pack. Place the .015" (0,38 mm) shim-gasket against the seal cage on the Size 2090 drive and against the housing on the Size 2100–2130 drives.

Low Speed End Assembly — Drive Without Internal Backstop

26. Mount the low speed pinion end cover as follows:
    A. **SIZES 2060 & 2070** — Install spacer into the low speed pinion bore. Assemble low speed pinion cover to drive with one .015" (0,38 mm) shim-gasket. Install low speed pinion cover fasteners with lock washers and tighten finger tight.
    B. **SIZES 2080 & 2090** — Install spacer into the low speed pinion bore. Assemble low speed pinion cover to drive with one .015" (0,38 mm) and a sufficient amount of .007" (0,18 mm) and .009" (0,23 mm) shim-gaskets to ensure bearing float. Place the .015" (0,38 mm) shim-gasket against the end cover. Install low speed pinion cover fasteners with lock washers and tighten finger tight.
    C. **SIZES 2100–2130** — Install low speed pinion end cover with a sufficient amount of shim-gaskets to ensure bearing float. Include only one .015" (0,38 mm) shim-gasket in the final shim pack and place that shim-gasket against the housing. Install end cover fasteners with lock washers and torque to value specified in Table 3, Page 4.
27. **INSTALL LOW SPEED GEAR SET & BEARING PLATE**.
    A. Place housing on its low speed face with high speed end up.
    B. Install low speed gear #5 and low speed pinion #4 assemblies.
    C. Sling low speed bearing plate from eyebolts and lower into housing, tap into place over housing post dowels. Install bearing plate fasteners and torque to value specified in Table 3, Page 4. Note the following:
        1. Threads of new replacement fasteners from Falk are coated with an adhesive. Please note that Loctite #277 is to be applied to either the fasteners with the pre-applied adhesive or to plain fasteners if used. Coat the first eight threads of fastener as well as the threads of the tapped holes with Loctite #277 or equivalent.
        2. If reusing old fasteners, clean old adhesive from tapped holes and fastener threads with solvent and/or wire brush. Coat the first eight threads with high strength liquid Loctite #277 or equivalent and apply to tapped hole threads as well.
    D. Turn the drive upright. For Sizes 2060–2090, center the low speed seal cage so that it clears the low speed shaft, refer to Step 8J.
    E. Cross tighten the low speed seal cage and low speed pinion cover fasteners to torque specified in Table 3, Page 4.
    F. Turn drive over with high speed end up.
28. **LOW SPEED SHAFT BEARING PRELOAD MEASUREMENT & ADJUSTMENT.**
    A. Determine the total axial float of the low speed shaft by lifting on an eyebolt screwed into the end of the shaft. Measure shaft float with a dial indicator.
    B. Add the measured axial float to the high and low preload limits listed in Table 6, Page 9.
    C. Turn drive upright and remove shim-gaskets from the low speed seal cage that will total to a value within the limits established in the previous step. Do not remove the one .015" (0,38 mm) or .031" (0,79 mm) sealing shim-gasket as explained in step 8G.

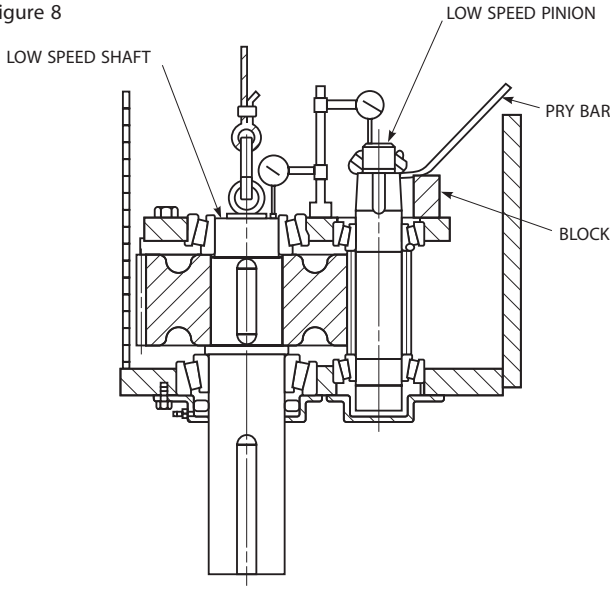
D. **EXAMPLE IN INCHES:**

1. A size 2060F2 6.256 ratio drive low speed (#5) shaft has a measured axial float of .008". From Table 6, Page 9 the specified preload is .003" to .005".
2. Total required shim removal is .011" to .013" or (.008"+.003") to (.008"+.005").
3. Remove two .007" shim-gaskets (.012" compressed thickness).
4. Therefore, .008" axial float minus .012 shim removal results in .004" preload.

E. Install seal in seal cage per Steps 8D through 8L before assembling seal cage to drive for the last time.

29. **LOW SPEED PINION SHAFT AXIAL FLOAT MEASUREMENT & ADJUSTMENT — DRIVE WITHOUT INTERNAL BACKSTOP — Figure 8.**

Figure 8



A. **SIZES 2060 & 2070** — Turn drive so the high speed end is facing up. Partially assemble the locknut onto the low speed pinion shaft. Use a pry bar under the locknut and check axial float per Step 23. Turn drive upright and remove the low speed pinion end cover. Add metal shims to reduce shaft axial float to value specified in Table 6, Page 9, locate shims between the bearing cup back face and spacer. Do not remove the one .015" (0,38 mm) sealing shim-gasket next to the low speed pinion end cover. Reinstall pinion end cover and torque fasteners to value specified in Table 3, Page 4. Recheck shaft axial float and reshim if necessary.

B. **SIZES 2080 & 2090** — Turn drive so the high speed end is facing up. Partially assemble the locknut onto the low speed pinion shaft. Use a pry bar under the locknut and check shaft axial float per Step 23. Turn drive upright and remove the low speed pinion end cover. Subtract or add shim-gaskets to obtain the shaft axial float value specified in Table 6, Page 9. Do not remove the one .015" (0,38 mm) sealing shim-gasket next to the low speed pinion cover. Reinstall pinion end cover and torque fasteners to value specified in Table 3, Page 4. Recheck shaft axial float and reshim if necessary.

C. **SIZES 2100–2130** — Turn drive so the high speed end is facing up. Partially assemble the locknut onto the low speed pinion shaft. Use a pry bar under the locknut and check axial float per Step 23. Turn drive upright and remove the low speed pinion cover. Subtract or add shim-gaskets to obtain the shaft axial float value specified in Table 6, Page 9. Do not remove the one .015" (0,38 mm) sealing shim-gasket next to the housing. Reinstall pinion end cover and torque fasteners to value specified in Table 3, Page 4. Recheck shaft axial float and reshim if necessary.

Low Speed End Assembly — Drive With Internal Backstop

30. **PRELIMINARY ASSEMBLY** — Follow Step 25.

31. **MOUNT THE BACKSTOP CAGE & LOW SPEED PINION END COVER AS FOLLOWS:**

A. **SIZE 2060** — Assemble backstop cage (without backstop) to drive with one .015" (0,38 mm) shim-gasket between the backstop cage and the low speed seal cage. Install end cover with two .015" (0,38 mm) shim-gaskets. Install fasteners with lock washers and tighten finger tight.

B. **SIZE 2070** — Assemble backstop cage (with backstop installed without key) to drive with one .015” (0,38 mm) shim-gasket between the backstop cage and the low speed seal cage. Install end cover with one .015” (0,38 mm) shim-gasket. Install fasteners with lock washers and tighten finger tight.

C. **SIZE 2080** — Assemble backstop cage (with backstop installed without key) to drive with sufficient shim-gaskets to ensure shaft axial float, locate shim-gaskets between the backstop cage and the low speed seal cage. Install end cover with one .015” (0,38 mm) shim-gasket. Install fasteners with lock washers and tighten finger tight.

D. **SIZE 2090** — Assemble backstop cage with integral backstop to drive in correct direction of free shaft rotation with sufficient shim-gaskets to ensure shaft axial float, locate shim-gaskets between backstop cage and housing. Install spacer and pinion cover with one .015" (0,38 mm) shim-gasket on each side of spacer. Install fasteners with lock washers and tighten finger tight.

32. **INSTALL LOW SPEED GEARSET & BEARING PLATE** — Follow Step 27.

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33. **LOW SPEED SHAFT BEARING PRELOAD MEASUREMENT & ADJUSTMENT** — Follow Step 28. All low speed pinion cover (backstop cover) fasteners should be properly torqued at completion of this step.

34. **GENERAL INTERNAL BACKSTOP INSTALLATION INSTRUCTIONS FOR USE WITH STEPS 35 & 48.**

DO NOT HAMMER BACKSTOP ONTO SHAFT.

DO NOT USE EP LUBRICANTS.

A. Coat backstop and low speed pinion shaft extension with SAE 20 oil.

B. Install backstop and key into backstop cage and slide backstop assembly onto shaft while rotating shaft.

C. Check low speed shaft rotation. If incorrect, remove and reverse backstop. Check backstop operation by rotating the shaft in the overrunning direction and reversing to lock the backstop several times **after the low speed pinion bearings are properly set.**

D. All internal backstops used in the drives covered by these instructions have caged sprags to maintain sprag alignment.

35. **LOW SPEED PINION SHAFT AXIAL FLOAT MEASUREMENT & ADJUSTMENT — DRIVES WITH INTERNAL BACKSTOPS**

A. **SIZES 2060** — Turn drive so the high speed end is facing up. Partially assemble the locknut onto the low speed pinion shaft. Use a pry bar under the locknut and check axial float per Step 23. Turn drive over and remove the backstop cover and backstop cage. Add metal shims to reduce shaft axial float to value specified in Table 6, Page 9, for backstop equipped drives, locate shims between the bearing cup back face and backstop cage. Do not remove the one .015" (0,38 mm) sealing shim-gasket between the backstop cage and the drive low speed seal cage. Reinstall the backstop cage and cover with the same shim-gaskets used in Step 31A. Reinstall and torque fasteners to value specified in Table 3, Page 4. Recheck shaft axial float and reshim if necessary. Do not install backstop until after assembly of drive is complete, refer to Step 48A.

B. **SIZE 2070** — Turn drive so the high speed end is facing up. Partially assemble the locknut onto the low speed pinion shaft. Use a pry bar under the locknut and check axial float per Step 23. Turn drive over and remove the backstop cover and backstop cage assembly. Add metal shims to reduce shaft axial float to value specified in Table 6, Page 9. For backstop equipped drives, locate shims between the backstop and the bearing cup back face. Do not remove the one .015" (0,38 mm) sealing shim-gasket between the backstop cage and the drive low speed seal cage. reinstall the backstop cage assembly and cover with the same shim-gaskets used in Step 31B. Reinstall and torque fasteners to value specified in Table 3, Page 4. recheck shaft axial float and reshim if necessary. Do not install backstop key until after drive assembly is complete, refer to Step 48A.

C. **SIZE 2080** — Turn drive so the high speed end is facing up. Partially assemble the locknut onto the low speed pinion shaft. Use a pry bar under the locknut and check axial float per Step 23. Turn drive over and remove the backstop cover and backstop cage assembly. Subtract or add shim-gaskets as necessary to obtain the shaft axial float value specified in Table 6, Page 9, for backstop equipped drives, locate shim-gaskets between the backstop cage and low speed seal cage. Reassemble the backstop cage assembly and backstop cover to the drive. Install fasteners and torque to value specified in Table 3, Page 4. Recheck shaft axial float and reshim if necessary, do not install backstop key until drive is completely assembled, refer to Step 48B.

D. **SIZE 2090** — Turn drive so the high speed end is facing up. Partially assemble the locknut onto the low speed pinion shaft. Use a pry bar under the locknut and check axial float per Step 23. Turn drive over and remove the backstop cover and backstop cage assembly. Subtract or add shim-gaskets as necessary to obtain the shaft axial float value specified in Table 6, Page 9, for backstop equipped drives, locate shim-gaskets between the backstop cage and the drive housing. Reassemble the backstop cage assembly and backstop cover with spacer to the drive. Install fasteners and torque to value specified in Table 3, Page 4. Recheck shaft axial float and reshim if necessary. Do not assemble backstop inner ring to low speed pinion until drive is completely assembled, this will require removal of the backstop cage assembly from the drive, refer to Step 48C.

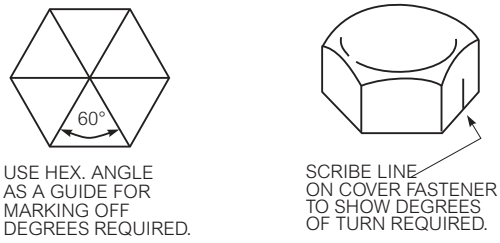
36. **MOUNT GEAR ON LOW SPEED PINION SHAFT**

A. Install oil pan if drive is so equipped.

B. Insert gear key in shaft keyseat.

C. Mount gear on shaft. On Sizes 2100–2130 mount the nut spacer on the threaded end of the shaft next to the gear.

Figure 9



E. Tighten the locknut. After initial tightening of nut per Table 4, Page 5, scribe a line on the gear hub and one on the locknut to the degrees specified in Table 4, Page 5, and as illustrated in Figure 9. Then continue tightening the nut until the scribed lines are in line. Use an impact wrench of sufficient capacity or a socket wrench as used for nut removal as shown in Figure 5, Page 5. Use nut tightening torques from Table 4, Page 5.

F. Install oil pan cover after gear is installed on shaft and locknut properly tightened.

G. Install oil deflector on double reduction drives if removed.

High Speed Head Assembly

37. **DOUBLE REDUCTION — SIZES 2060–2130.** A. For high speed shafts with pinion solid on shaft or shank pinion — install the inner bearing cup in the inner wall of the high speed head. Install the high speed shaft assembly and outer bearing cup.

    B. For high speed shafts with bored pinions — install the inner bearing cup in the inner wall of the high speed head. Install the high speed shaft assembly and outer bearing cup. Mount the bored pinion per Step 18A or 18C.

    C. Install high speed seal cage without seal and at least .062" (1,57 mm) of shim-gaskets using one .015" (0,38 mm) shim-gasket. Install fasteners with lock washers and torque to values specified in Table 3, Page 4.

    D. Measure and adjust high speed shaft axial float per Step 23 and Table 6, Page 9. Use only one .015" (0,38 mm) sealing shim-gasket in the final shim pack. On drives with stamped seal cages, place the .015" (0,38 mm) shim-gasket against the seal cage. On drives with cast seal cages, place the .015" (0,38 mm) shim-gasket against the drive high speed head face.

    E. At last assembly, remove seal cage and install seal per Steps 8E through 8L. Size 2080 and 2090 high speed seal cages are unregistered and require centering per Step 8K.

Triple Reduction High Speed Head Assembly

38. **SIZES 2060–2130 HIGH SPEED SHAFT ASSEMBLY.**

    A. Install inner high speed shaft bearing cup in inner wall of high speed head. Insert high speed shaft assembly into head and install outer high speed shaft bearing cup.

    B. Install high speed seal cage without seal and sufficient shim pack to assure axial float. Metal shims are used between the outer bearing cup back face on Sizes 2060 and 2070 with one .015" (0,38 mm) sealing shim-gasket at the seal cage face. Fiber shim-gaskets are used on the Size 2080–2130 drives. Install seal cage fasteners with lock washers and torque to values specified in Table 3, Page 4.

    C. Measure and adjust high speed shaft axial float per Step 23 and Table 6, Page 9. On Size 2080 and larger drives, use only one .015" (0,38 mm) sealing shim-gasket in the final shim pack, place the .015" (0,38 mm) shim-gasket against the drive high speed head face.

    D. At last assembly, remove seal cage and install seal per Steps 8E through 8L.

39. **SIZES 2060–2080 INTERMEDIATE SHAFT #3** — These shafts use the indirect bearing mounting arrangement with the bearing cone back faces toward the shaft ends.

    A. Install inner bearing cup in head back face. Install retaining ring in outer intermediate shaft bore in head (if removed). Install outer bearing cup in head bore with cup back face tight against retaining ring. Insert intermediate shaft (with gear key installed) into the head from the inside while holding the taper bore high speed gear, spacer on Size 2060, and gear locknut (dipped in oil) in place between the head walls. Thread the gear locknut onto the shaft as far as practical without damaging components.

    B. Heat and assemble outer bearing cone to shaft with cone back face out, use press or driver as an aid. On Size 2060, be sure that the outer bearing roller cage does not contact the gear locknut during bearing installation. Install outer bearing lock washer and locknut. Tighten bearing locknut until shaft axial float listed in Table 6, Page 9, is achieved and then lock locknut with lock washer tangs.

    C. Place open end wrench on gear locknut and rotate high speed shaft clockwise with a spanner wrench to torque specified in Table 7, Page 10.

    D. Assemble end cover with sealing shim-gasket to outer intermediate shaft bore. Install fasteners with lock washers and torque to value specified in Table 3, Page 4.

40. **SIZES 2090–2130 INTERMEDIATE SHAFT #3** — These shafts are installed in the high speed head with the inner bearing cone and taper bore gear key installed.

    A. Insert shaft into head from inboard side while holding gear, spacer on Size 2130, and gear locknut in place, thread locknut onto shaft threads. On Size 2090 thread nut onto shaft far enough to clear shaft shoulder and to seat outer bearing cone. Heat and assemble outer bearing cone to shaft. Assemble both bearing cups to high speed head intermediate bores. Install inner intermediate shaft thrust plate. Install thrust plate fasteners (hex socket flat head cap screws on Size 2090) and torque to values specified in Table 3, Page 4. Use Loctite #242 on thrust plate fastener threads.

    B. Install intermediate shaft end cover with sufficient shim-gaskets to ensure shaft axial float. Install end cover fasteners with lock washers and torque to values specified in Table 3, Page 4.

    C. Measure and adjust intermediate shaft axial float per Step 23 and Table 6, Page 9. Use only one .015" (0,38 mm) sealing shim-gasket in the final shim pack, place the .015" (0,38 mm) shim-gasket against the drive high speed head face.

    D. Place open end wrench on gear locknut and rotate high speed shaft clockwise with a spanner wrench to torque specified in Table 7, Page 10.

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Quadruple Reduction High Speed Head Assembly

41. **SIZES 2060–2090 HIGH SPEED SHAFT ASSEMBLY** — These shafts use indirectly mounted bearings with some shaft assemblies that have outer bearing cones and cups trapped between the keyless bored pinion and outer shaft shoulder. Replacement shaft assemblies with trapped bearing components are supplied factory assembled as the keyless bored pinions are considered non-removable. (Table 5, Page 8.)
    A. Install inner high speed shaft bearing cup in inner high speed head bore. Install outer high speed shaft bearing cup in outer head bore (when not trapped on shaft). Insert high speed shaft into head; on shaft with trapped outer bearing cup, tap cup into bore. Heat and assemble inner bearing cone to shaft; aid assembly with press or bearing driver.
    B. Install bearing lock washer and locknut on shaft at inner bearing. Tighten locknut until shaft axial float specified in Table 6, Page 9, is achieved, then lock locknut with lock washer tang.
    C. Install seal cage (with seal installed per Steps 8E through 8H) with one .015" (0,38 mm) sealing shim-gasket. Install fasteners with lock washers and torque to values specified in Table 3, Page 4.
42. **SIZES 2100–2140 HIGH SPEED SHAFT ASSEMBLY**.
    A. Install high speed shaft assembly per Steps 38A through 38E; fiber shim-gaskets are used on these shaft assemblies for bearing adjustment.
43. **SIZES 2060 & 2070 1ST INTERMEDIATE SHAFT #2 ASSEMBLY**.
    A. Assemble inner bearing cone to shaft if not previously installed. Install gear key in tapered shaft keyway. While holding high speed gear and inner spacer in place, insert shaft into high speed head from the inner wall side. With the threaded end of the shaft protruding through the head outer wall, heat and install the outer bearing cone. Install short spacer and locknut, tighten locknut until inner spacer is clamped between gear and bearing cone. Install inner bearing cup and thrust plate. Coat threads of thrust plate fasteners with Loctite #242 or equivalent thread locking compound and install, torque to values specified in Table 3, Page 4. Install outer bearing cup; push tight against bearing cone.
    B. While holding high speed shaft stationary, tighten locknut to torque specified in Table 4, Page 5, or hold locknut stationary and rotate high speed shaft to tighten nut to high speed shaft torque specified in Table 7, page 10. Install end cover (without metal shims) with one .015" (0,38 mm) sealing shim-gasket. Install end cover fasteners and torque to values specified in Table 3, Page 4. Measure shaft axial float per Step 23, be sure that the bearing cups are seated against the end cover and thrust plate. Add metal shims at the outer bearing cup back face to obtain the shaft float specified in Table 6, Page 9.
44. **SIZES 2080 & 2090 1ST INTERMEDIATE SHAFT #2 ASSEMBLY**.
    A. Assemble outer bearing cone to shaft if not previously installed. Install inner bearing cup in inner wall of head, and place inner bearing cone (with sleeve in cone bore) in inner bearing cup. Install gear key in tapered shaft keyway. While holding high speed gear in position between head walls, insert shaft into high speed head from the outer wall side and into inner bearing sleeve. Install outer bearing cup and loosely install end cover with fasteners finger tight. Install locknut (dipped in oil) and tighten per Step 43 to torque vales specified in Table 4, Page 5, (direct torque) or Table 7, Page 10, (torque at high speed shaft).
    B. Remove end cover and reinstall with sufficient shim-gaskets to ensure shaft axial float. Install and torque fasteners to values specified in Table 3, Page 4. Measure shaft axial float per Step 23 and adjust to value specified in Table 6, Page 9, by adding or removing shim-gaskets.
45. **SIZES 2100–2130 1ST INTERMEDIATE SHAFT ASSEMBLY**.
    A. Assemble outer bearing cone to shaft if not previously installed. Install inner bearing cup in inner wall of head, and place inner bearing cone in inner bearing cup. Install gear key in tapered shaft keyway. While holding high speed gear and gear locknut (dipped in oil) in position between head walls, insert shaft into high speed head from the outer wall side and thread locknut onto shaft threads far enough to expose shaft threads at nut collar end of nut. On Size 2120 and 2130 drive 6.077 ratio pinions install retaining ring next to shaft threads. Tap shaft into inner bearing cone to seat against shaft shoulder or retaining ring. Install outer bearing cup and loosely install end cover with fasteners finger tight. Tighten locknut (dipped in oil) per Step 43 to torque value specified in Table 7, Page 10, (torque at high speed shaft).
    B. Remove end cover and reinstall with sufficient shim-gaskets to ensure shaft axial float. Install and torque fasteners to values specified in Table 3, Page 4. Measure shaft axial float per Step 23 and adjust to value specified in Table 6, Page 9, by adding or removing shim-gaskets.
46. **SIZES 2060–2130 2ND INTERMEDIATE SHAFT #3 ASSEMBLY**.
    A. These shaft assemblies are the same as the 1st intermediate shaft assemblies in the triple reduction drives, refer to Step 39 for Sizes 2060–2080 and Step 40 for drive sizes 2090–2130.

High Speed End Installation

47. **ALL REDUCTIONS** — Figure 3, Page 2. A. Stand drive on end with low speed shaft down.
    B. Install large head gasket.
    C. Install three or four eye bolts into the tapped holes around the high speed head flange.
    D. On triple and quadruple reduction drives, thread nuts onto the threaded dowels with dowel threads slightly exposed at the outboard side of the nut and install dowels in upper and lower high speed head dowel holes with the grooved dowel in the lower head dowel hole. Position dowel end flush with inboard side of high speed head flange. On double reduction drives, the single high speed head dowel remained with the high speed head on Sizes 2060F-2090F and with the main housing on Sizes 2100F-2130F at high speed head removal.
    E. Sling and carefully lower the high speed head into position onto the main housing and tap into place. Triple and quadruple reduction drives have gears that protrude from the high speed heads and must be hooked around the housing front wall at installation which requires some juggling – **DO NOT DAMAGE GEAR TEETH.** Double reduction high speed head is installed with single dowel in place.
    F. On triple and quadruple reduction drives, drive threaded dowels into housing wall with nuts flush with high speed head flange face. Double reduction drives have a single dowel (not removed in Step 9A) located at the upper dowel position. ***Caution: Installation of the high speed head without dowels will cause improper gear mesh and ultimately premature gear damage.***
    G. Remove eyebolts and install high speed head flange fasteners with lock washers and tighten to torque specified in Table 3, Page 4.
48. **INTERNAL BACKSTOP INSTALLATION — SIZES 2060–2090**.
    A. On Size 2060, remove backstop cover and install backstop key and backstop (backstop must be in place in backstop cage bore) in backstop cage while rotating drive shafts in the correct direction of free rotation. Install backstop cover with two .015" (0,38 mm) sealing shim-gaskets. Install backstop cage/cover fasteners and torque to values specified in Table 3, Page 4.
    B. On Sizes 2070 and 2080, remove backstop cover, align backstop and backstop cage keyways and install key (be sure that backstop is installed in correct direction of shaft free rotation). Reinstall backstop cover with the one .015" (0,38 mm) shim-gasket. Install fasteners and torque to values specified in Table 3, Page 4.
    C. On Size 2090, remove backstop assembly. Install backstop key in low speed pinion shaft. Heat backstop inner ring to 275°F (135°C) maximum and assemble to shaft. Stake shaft keyway end to keep key in position. Reinstall backstop assembly with same shim pack as removed, rotate drive shafts in correct direction of free rotation while sliding backstop onto shaft. Install backstop cover with spacer and one .015" (0,38 mm) shim-gasket on each side of spacer. Install fasteners and torque to value specified in Table 3, Page 4.
49. **EXTERNAL BACKSTOP INSTALLATION — SIZES 2100–2130**.

Refer to Manual 318-814 for detailed external backstop installation instructions.

    A. Install backstop anchor bracket. Install fasteners with lock washers and torque to values specified in Table 3, Page 4.
    B. Install shaft key and slide backstop onto high speed shaft. DO NOT HAMMER BACKSTOP ONTO SHAFT.
    C. Check shaft rotation. If incorrect, remove and remount backstop with opposite face toward drive.
    D. Lock backstop to torque arm pin with spring pins. Allow clearance at the torque arm pin for the extreme float limits of the shaft.
50. **GREASE LUBRICATED SEALS** — Refer to Manual 318-100.

Installation

51. **DRIVE INSTALLATION**.
    A. Turn gear train over by hand as a final check.
    B. Reinstall drive and accessories per Manual 318-100.
    C. Fill drive with oil to the oil level indicated on the dipstick, stand pipe or oil level plug. Refer to Manual 318-100 for recommended lubricants.

    CAUTION: *Consult applicable local and national safety codes for proper guarding of rotating members.*

    D. Run drive without load. If drive temperature rises more than 65°F (36°C) above ambient temperature in four hours, recheck shimming of bearings.
    E. After drive runs satisfactorily, apply load. Inspect periodically until operation is deemed satisfactory. Follow maintenance instructions in Manual 318-100.

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