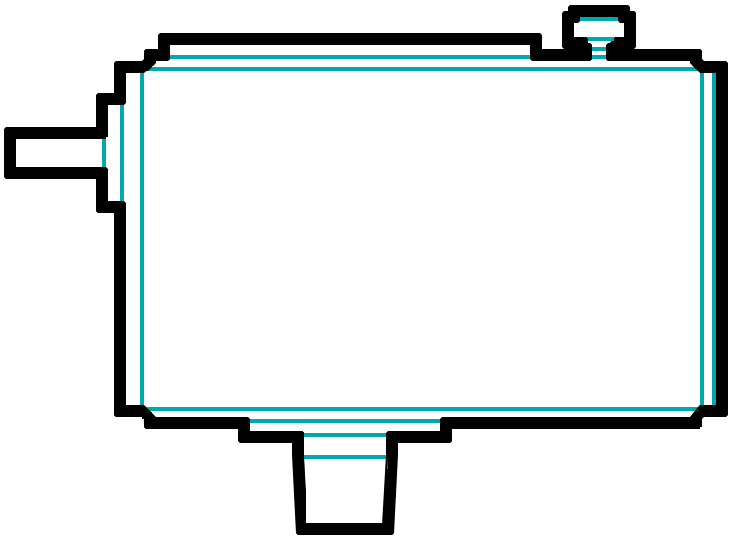
Chemineer

Manual 384

HT Gear Drive Maintenance Manual

C a s e S i z e s 11,12,13



Equipment Reference:

For Service and
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MAINTENANCE

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This manual contains instructions for HT gear drive disassembly and assembly. Refer to the agitator manual for all other information relative to the agitator.

Other than periodic lubrication as defined in the *Lubrication* section of the Agitator Manual, no routine operational gear drive maintenance is required.

In order to assure the longest life from your gear drive, annual shutdowns which can correspond with plant shutdowns should be planned. Gear tooth wear patterns, shaft/bearing end play, alignment, bolting and the condition of all seals should be checked. Worn parts should be replaced and any areas of general concern should be brought to the attention of your *local Chemineer office*.

GEAR DRIVE

Case Sizes 11,12,13

Disassembly

Gear Drive (*Figure 24, page ?*)

1. Remove change gear cover **[276]** and gasket **[277]**.

2. Remove pinion locknut **[217]** and change pinion washer **[216]**.

   NOTE: Case 13 only, gear ratios of 48.0 and numerically lower. The pinion locknut will be a locknut and keyed lockwasher. Loosen the setscrew in the locknut two turns. Disengage keyed lockwasher, remove locknut and lockwasher.

3. Remove change pinion **[215]**. All change pinions are spline-mounted.

4. Loosen change gear bolts **[218]** two turns. Apply a gear puller to disengage the taper. Remove the gear puller and the change gear bolts, lockwashers **[219]** and change gear washer **[220]**. All change gears are taper hub mounted with three 5/8-11 tapped holes, on 6.50" (165 mm) bolt circle diameter, provided for gear puller attachment.

   CAUTION! Release of taper fit can cause the change gear to jump off the shaft if not retained.

5. Remove change gear and key **[221, 222]**.

6. Remove spiral bevel pinion cartridge assembly **[223]** *(Figure 1, page 4)* and shim set **[236]**. Keep the shim set intact for reference at assembly.

7. Remove bolts **[244, 325]**, bearing cap assemblies **[239, 320]** and shim sets **[243, 324]**. Keep the shim sets intact for reference at assembly.

8. Remove cap screws **[268]** securing taper pins **[267]** to housing cover **[263]**. Insert cap screws into the jacking holes in the head of the taper pin. Remove the taper pins.

9. Remove bolts **[264]** securing the housing cover to housing **[262]**. Remove the housing cover.

GEAR DRIVE

Case Sizes 11,12,13

Disassembly (Cont'd)

10. Install an eyebolt in the end of output shaft **[247]**. Lift output shaft assembly **[246]** *(Figure 3, page 6)* out of the housing.

    Case Size 11: 5/8-11 eyebolt
    Case Size 12: 3/4-10 eyebolt
    Case Size 13: 1-8 eyebolt

    NOTE: When removing the output shaft assembly and/or the pinion shaft assembly, the recommended procedure is to lift both shaft assemblies out of the housing at the same time.

11. Install a 3/4-10 eyebolt in the end of pinion shaft **[318]**. Lift pinion shaft assembly **[311]** *(Figure 2, page 5)* out of the housing.

12. Remove input shaft bearing cap assembly and gasket **[201, 205]**.

13. Loosen the setscrew in locknut **[208]** two turns. Disengage keyed lockwasher **[209]** and remove locknut. Loosen setscrews **[309]** in oil slinger **[308]**. The oil slinger is removed as the input shaft is pushed out of the housing.

14. Press input shaft **[212]** out of bearing **[210]** cone through the change gear end of housing. Proceed slowly when removing the input shaft through the housing to avoid damage to the input shaft.

15. Remove bearing **[210, 213]** cups from the housing.

16. Remove bolts **[260, 306]**, bearing cap assemblies **[256, 301]** and shim set **[305]**. Keep the shim set intact for reference at assembly.

All bearing cups are mounted with interference fits and can be difficult to remove with a commercial bearing puller. Removal can be made easier by welding a 1/8" (3 mm) bead completely around the cup in the center of the roller race. Upon cooling, the cup will shrink allowing removal. Be sure to protect adjacent surfaces from weld spatter.

The gear drive is now disassembled into major subassemblies; input shaft, spiral bevel pinion cartridge, pinion shaft, output shaft and bearing caps.

NOTE: When the gear drive is fully disassembled, all bearings, lip seals, o-rings, shims and gaskets should be replaced with new parts. When replacing bearings, always replace both cup and cone. Replace gears in sets. Spiral bevel gears must always be replaced in matched sets.

GEAR DRIVE

Case Sizes 11,12,13

Disassembly (cont'd)

Spiral Bevel Pinion Cartridge

1. Remove the setscrew from locknut **[224]**. Remove the locknut and keyed lockwasher **[225]** from spiral bevel pinion shaft **[230]**.

2. Press the spiral bevel pinion shaft out of bearing **[226]** cone.

3. Remove bolts **[234]**, lockwashers **[235]** and pinion washer **[233]**.

4. Press spiral bevel pinion **[231]** and bearing **[228]** cone off the spiral bevel pinion shaft. Remove key **[232]**.

5. Remove bearing **[226, 228]** cups from the cartridge housing.

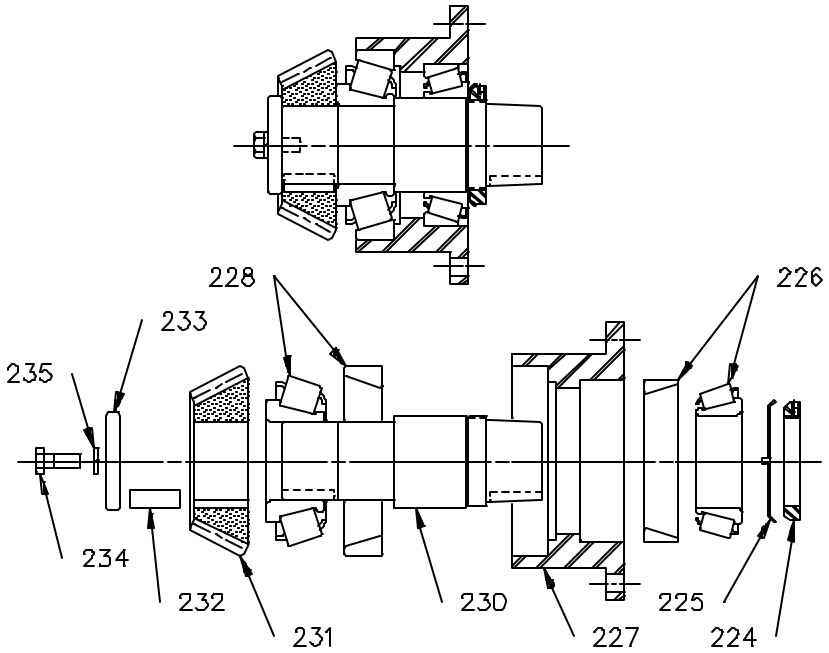

Figure 1: Spiral Bevel Pinion Cartridge Assembly [223]

GEAR DRIVE

Case Sizes 11,12,13

Disassembly (Cont'd)

Pinion Shaft

1. Remove gear mounting bolts **[313]** and spiral bevel gear **[312]**.

2. Set the pinion shaft assembly up in a large press and press off bearing **[322]** cone and grease retainer **[319]**.

3. Press bearing **[303]** cone off pinion shaft **[318]**.

4. Remove bearing **[322]** cone from the grease retainer.

CAUTION! Do not remove the spiral bevel gear hub from the pinion shaft. The hub is assembled at the factory and is not a replacement item. A new hub is available only on a new pinion shaft.

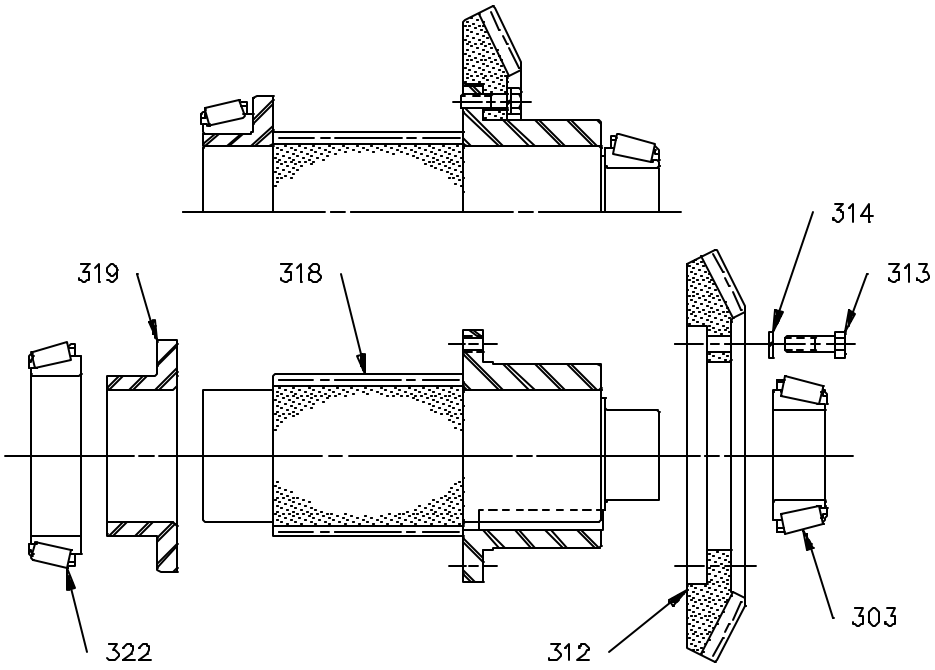

Figure 2: Pinion Shaft Assembly [311]

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Case Sizes 11,12,13

Disassembly (Cont'd)

Output Shaft

1. Set the output shaft assembly up in a large press and press off bearing **[241]** cone, grease retainer **[253]** and gear **[248]**.

2. Remove key **[252]** and drywell cover **[251]**.

3. Press bearing **[255]** cone off output shaft **[247]**.

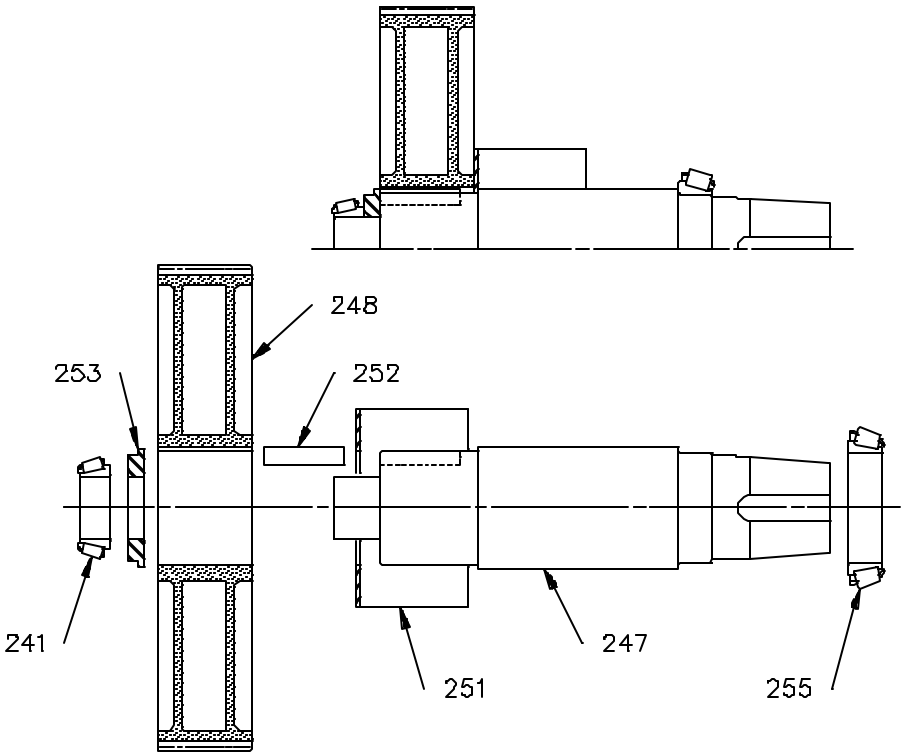

Figure 3: Output Shaft Assembly [246]

GEAR DRIVE

Case Sizes 11,12,13

Disassembly (Cont'd)

Upper and Lower Bearing Caps

1. Press lip seals **[242, 258]** out of bearing caps **[240, 257]**.

2. Remove bearing **[241, 255]** cups from the bearing caps.

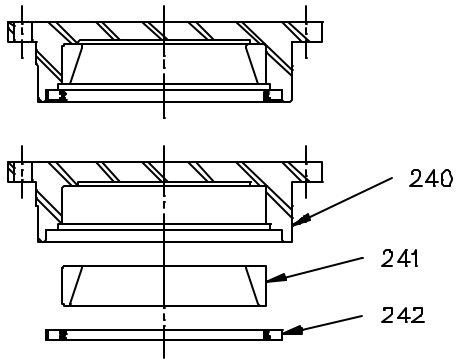

Figure 4: Upper Bearing Cap Assembly [239]

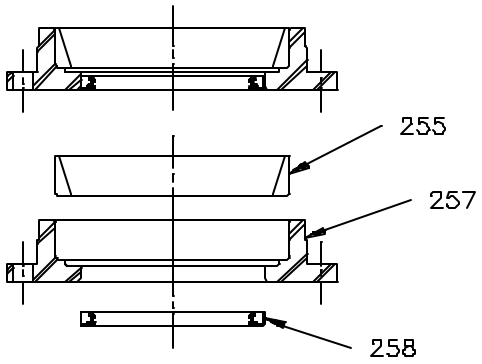

Figure 5: Lower Bearing Cap Assembly [256]

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Case Sizes 11,12,13

Disassembly (Cont'd)

Upper and Lower Pinion Shaft Bearing Caps

1. Press lip seal **[323]** out of upper pinion shaft bearing cap **[321]**.
2. Remove bearing **[303, 322]** cups from bearing caps **[302, 321]**.
3. Remove o-ring **[304]** from the lower pinion shaft bearing cap.

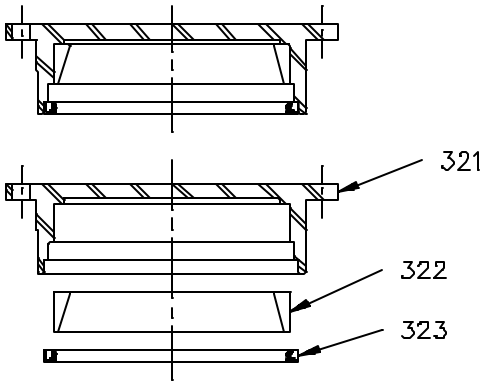

Figure 6: Upper Pinion Shaft Bearing Cap Assembly [320]

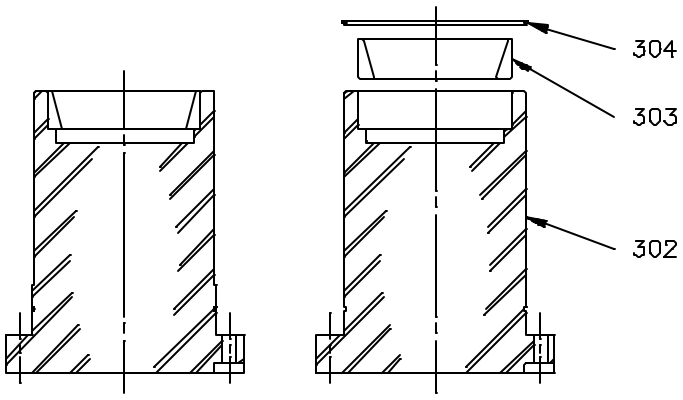

Figure 7: Lower Pinion Shaft Bearing Cap Assembly [301

GEAR DRIVE
Case Sizes 11,12,13

Disassembly (Cont'd)

Input Shaft

1. Press bearing **[213]** cone off input shaft **[212]**.

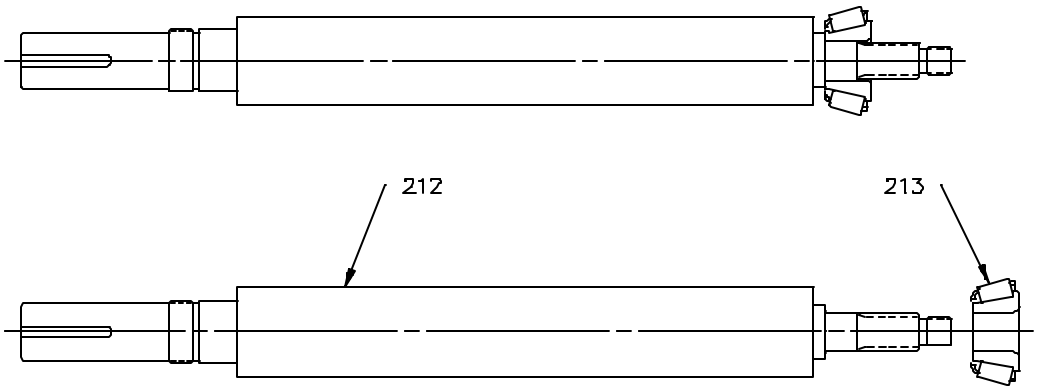

Figure 8: Input Shaft Assembly [211]

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Disassembly (Cont'd)

Input Shaft Bearing Cap

1. Press lip seal **[204]** out of bearing cap **[203]**.

2. Remove gasket **[205]**.

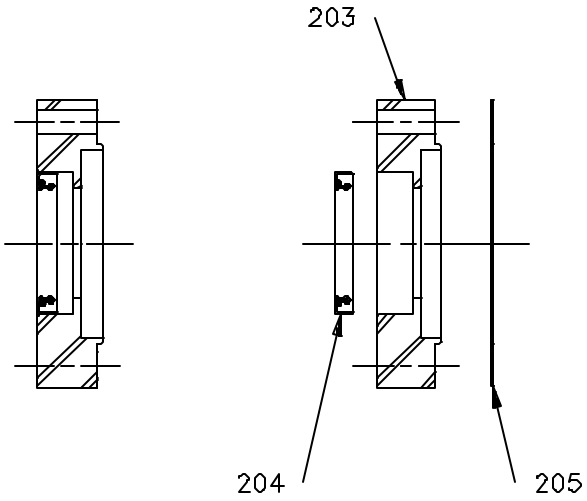

Figure 9: Input Shaft Bearing Cap Assembly [201]

The gear drive is now fully disassembled. Clean all parts and inspect for wear. Replace worn parts as required.

GEAR DRIVE

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Assembly

Inspect all bolts and setscrews for damage after cleaning (threads, shank and head). If replacement is required, replace with the equivalent type and strength grade.

Inspect and clean all tapped holes. If threads are damaged, chase with an appropriate tap.

CAUTION! The setscrew holes in oil slinger **[308]** *are a special locking thread form. Do not chase threads.*

NOTE: The following assembly procedures require the use of a torque wrench. The values listed in Table 1, page 12 are proper tightening torques as a function of thread size.

All bearing cones are mounted with interference fits. Heat the cones and press onto the shaft. Heat the bearings in oven or oil bath.

NOTE: Do not heat parts in excess of 275°F (135°C). Do not apply direct flame. Do not allow parts to touch the bottom or sides of the oven or oil bath.

All bearing cups are mounted with interference fits. Press bearing cups into their housings cold. *Placing the cups in dry ice will cause them to shrink and ease installation.*

Before installing lip seals, clean the cap bore and apply Permatex #2 or equal to the outside of the lip seal. Install lip seal with the seal lip toward the bearing. Before installation on a shaft, coat the shaft and seal lip with bearing grease.

GEAR DRIVE

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TABLE 1: BOLT TIGHTENING TORQUE[(1),(2)]

Bolt Size	CARBON STEEL[(3)]			
	Grade 2		Grade 5	
	ft lb	Nm	ft lb	Nm
8-32	1.2	1.6	1.9	2.5
10-24	1.7	2.3	2.7	3.6
10-32	1.9	2.6	3.1	4.1
1/4-20	4.1	5.6	6	8.1
5/16-18	8.3	11	13	17
5/16-24	-	-	14	19
3/8-16	15	20	23	31
3/8-24	-	-	26	36
1/2-13	38	51	56	76
1/2-20	-	-	68	92
5/8-11	68	92	113	153
5/8-18	-	-	135	161
3/4-10	120	163	200	271
3/4-16	-	-	225	305
7/8-9	105	143	296	401
1-8	165	224	443	601
1 ! 1/8-7	225	305	596	808
1 ! 1/4-7	315	428	840	1139
1 ! 3/8-6	417	566	1103	1495
1 ! 1/2-6	555	752	1463	1983

(1) Tighten all fasteners to values shown in the table unless specifically instructed to do otherwise.

(2) Lubricate all fasteners at assembly with grease, oil or an anti-seize material. Bolt threads and contact surfaces of bolt heads and nuts should be lubricated.

(3) If fasteners cannot be lubricated, multiply table values by 1.33.

GEAR DRIVE

Case Sizes 11,12,13

Assembly (Cont'd)

Most gear drive bolt patterns are circular with four, six, eight, twelve or sixteen hole spacings. Install all bolts finger tight, then tighten in sequential order (see below) to 50% of the prescribed torque values. Repeat the sequence, tightening the bolts to full torque values.

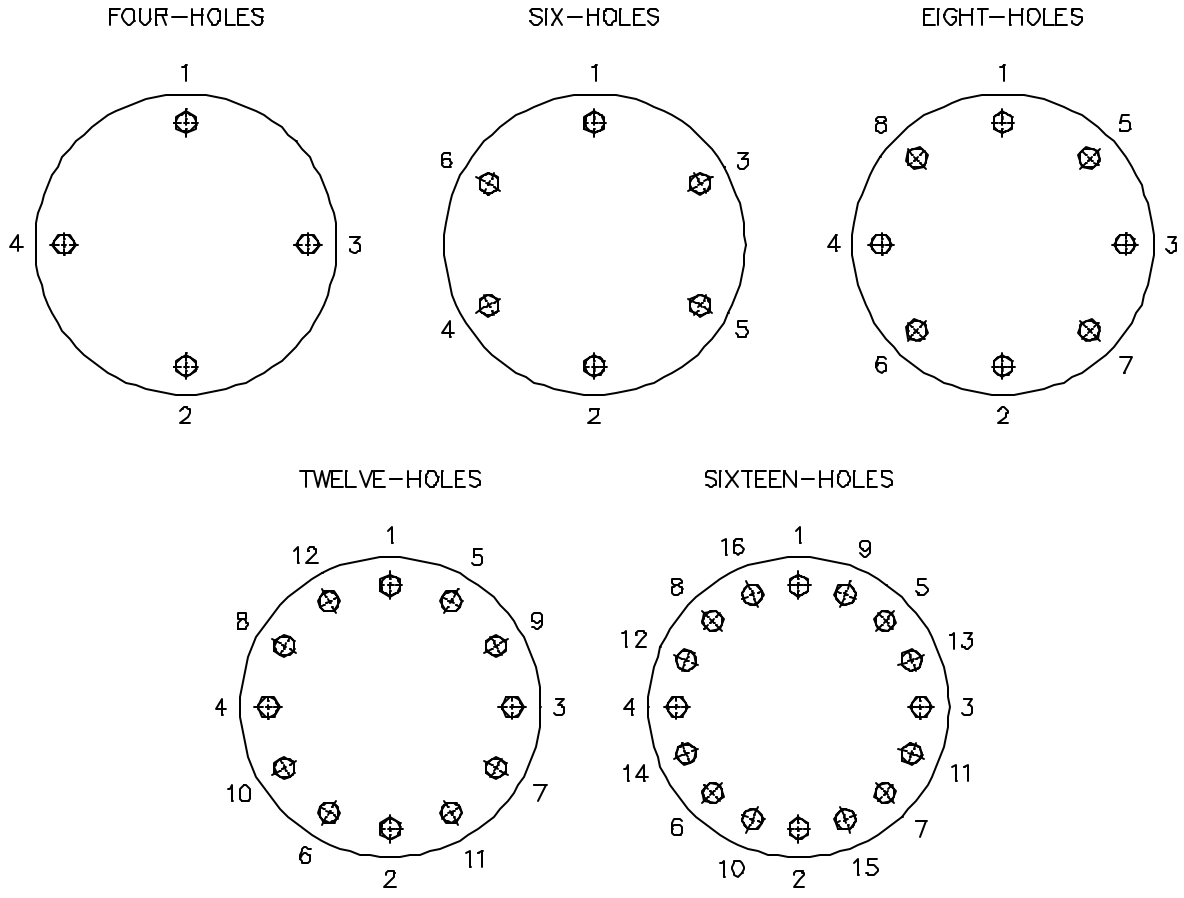

Figure 10: Sequential Tightening

When tighte ning two or more setscrews which retain a collar, flange, or sleeve to a shaft, tighten alternately, working back and forth or around the shaft. Tighten in several steps to full torque values.

GEAR DRIVE

Case Sizes 11,12,13

Assembly (Cont'd)

Input Shaft Bearing Cap

1. Press lip seal **[204]** into input shaft bearing cap **[203].**

2. Coat the gasket surface of the input shaft bearing cap with Permatex #2 or equal. Apply gasket **[205]** and align with all the holes in the cap.

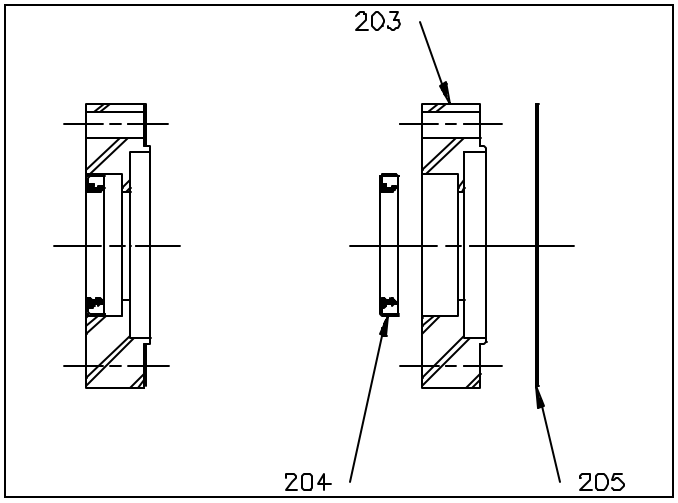

Figure 11: Input Shaft Bearing Cap Assembly [201]

GEAR DRIVE
Case Sizes 11,12,13

Assembly (Cont'd)

Input Shaft

1. Heat bearing **[213]** cone and press onto the spline end of input shaft **[212]**.

2. Assemble change pinion **[215]**, change pinion washer **[216]**, and pinion locknut **[217]**. Tighten the locknut to retain the bearing cone. The bearing cone must be firmly seated against the shaft shoulder. Check with a feeler gage.

   NOTE: Counter-bored side of the change pinion goes against the bearing face.

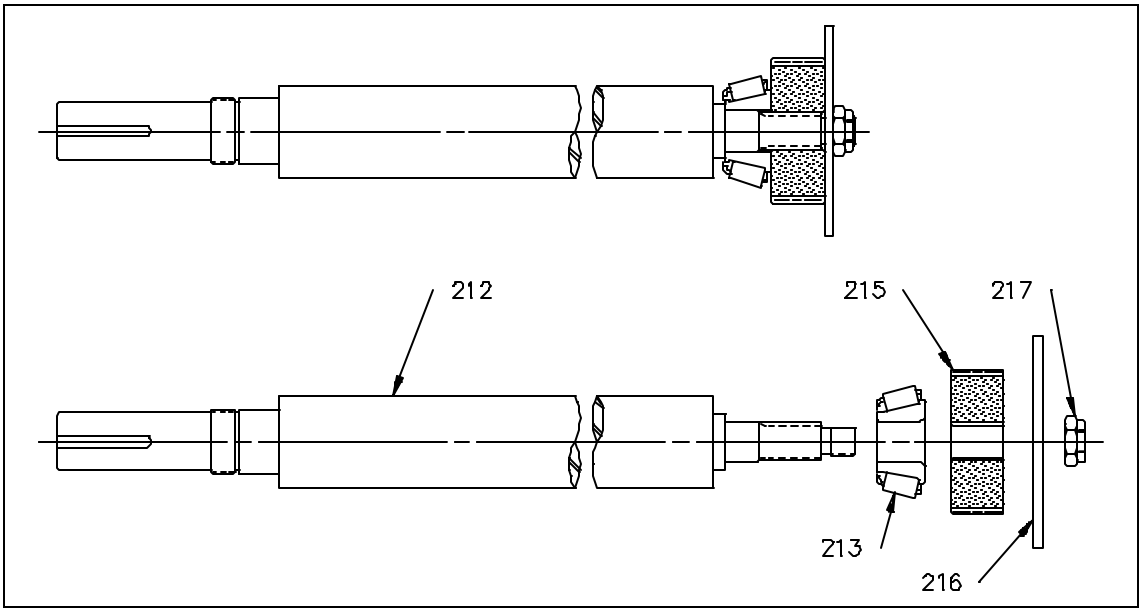

Figure 12: Input Shaft Assembly [211]

GEAR DRIVE

Case Sizes 11,12,13

Assembly (Cont'd)

Upper and Lower Bearing Caps

1. Press bearing **[241, 255]** cups into bearing caps **[240, 257]**.
2. The bearing cups must be firmly seated against the cap shoulders. Check with a feeler gage.
3. Press lip seals **[242, 258]** into the bearing caps.

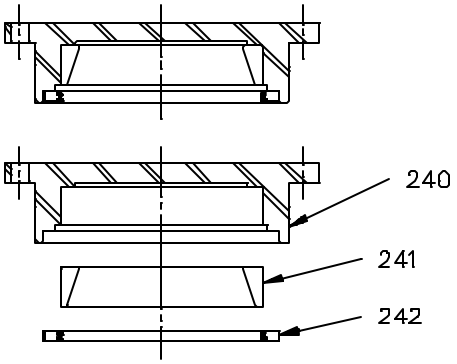

Figure 13: Upper Bearing Cap Assembly [239]

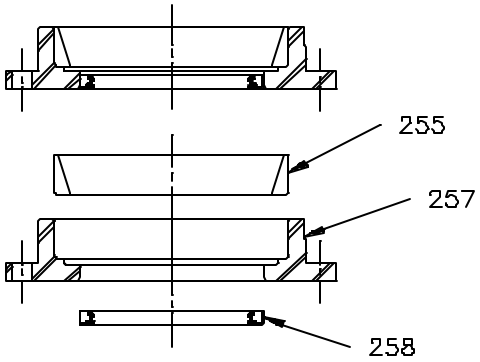

Figure 14: Lower Bearing Cap Assembly [256]

GEAR DRIVE

Case Sizes 11,12,13

Assembly (Cont'd)

Upper and Lower Pinion Shaft Bearing Caps

1. Press bearing **[303, 322]** cups into bearing caps **[302, 321]**.
2. The bearing cups must be firmly seated against the cap shoulders. Check with a feeler gage.
3. Press lip seal **[323]** into upper pinion shaft bearing cap **[321]**.
4. Install o-ring **[304]** into o-ring groove on lower pinion shaft bearing cap **[302]**.

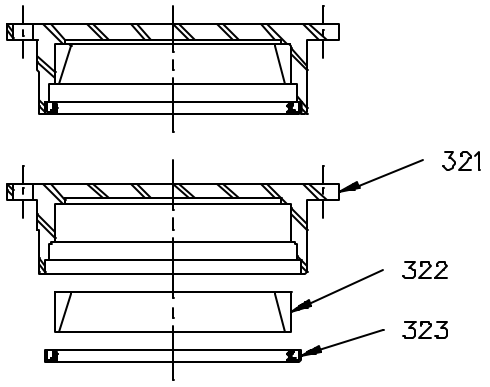

Figure 15: Upper Pinion Shaft Bearing Cap Assembly [320]

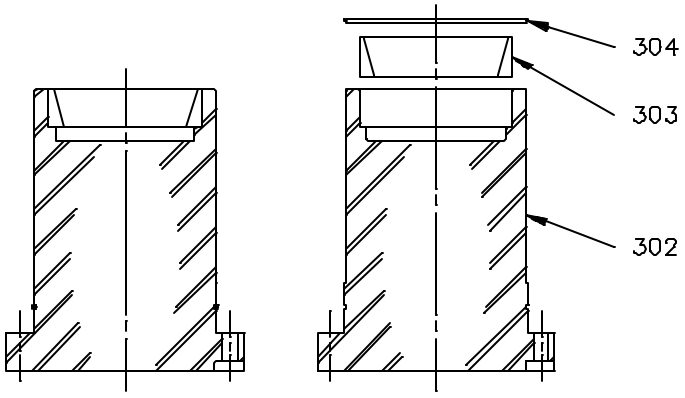

Figure 16: Lower Pinion Shaft Bearing Cap Assembly [301]

GEAR DRIVE

Case Sizes 11,12,13

Assembly (Cont'd)

Output Shaft

1. Install drywell cover **[251]** onto output shaft **[247]**.

2. Install key **[252]** in the output shaft.

3. Press gear **[248]** onto the output shaft. *NOTE: Heating the gear hub to approximately 100°F (40°C) over the ambient temperature will ease the installation of the gear. Continue to press the gear onto the output shaft until it cools.*

4. Heat grease retainer **[253]** and bearing **[241]** cone. Press onto the output shaft.

   NOTE: Install the grease retainer i.d. chamfer towards the gear.

5. Heat bearing **[255]** cone and press onto the output shaft. The gear, grease retainer and bearing cones must be firmly seated. Check with a feeler gage.

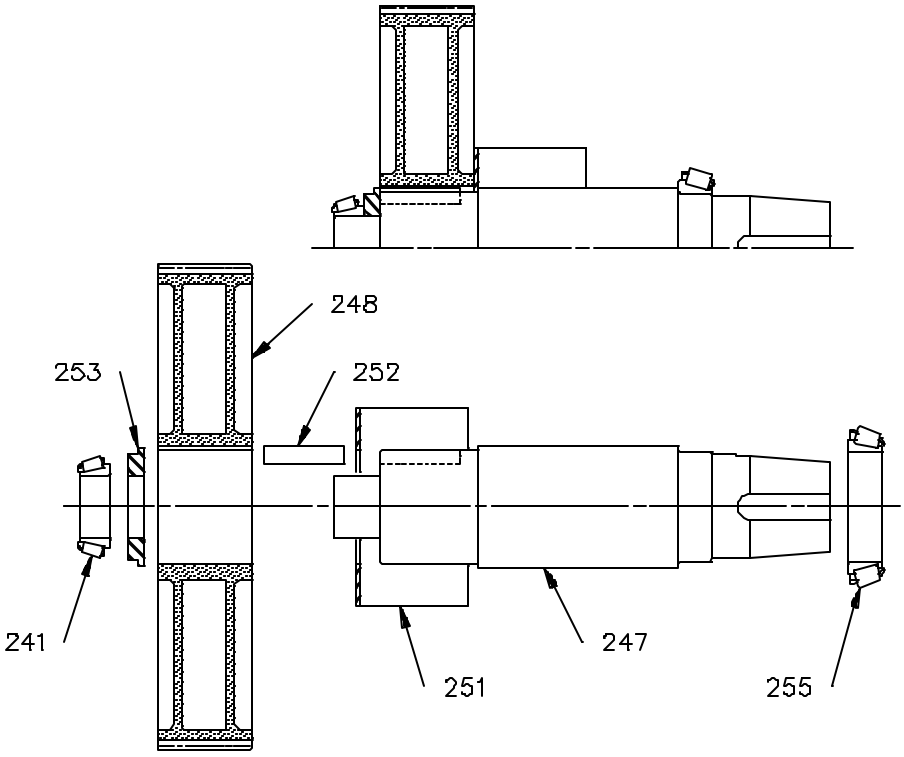

Figure 17: Output Shaft Assembly [246]

GEAR DRIVE

Case Sizes 11,12,13

Assembly (Cont'd)

Pinion Shaft

1. Heat grease retainer **[319]** and press onto pinion shaft **[318]**. *NOTE: Install the grease retainer i.d. chamfer towards the pinion. Continue to press the grease retainer onto the pinion shaft until it cools.*

2. Heat bearing **[322]** cone and press onto the pinion shaft.

3. Install spiral bevel gear **[312]** onto the pinion shaft. Install bolts and lockwashers **[313, 314]**. Torque to the value shown in *Table 1, page 12*.

4. Heat bearing **[303]** cone and press onto the pinion shaft. The grease retainer and bearing cones must be firmly seated against the shaft shoulders. Check with a feeler gage.

5. Using a paint stick, highlight the "X" match marks on the outside of the spiral bevel gear.

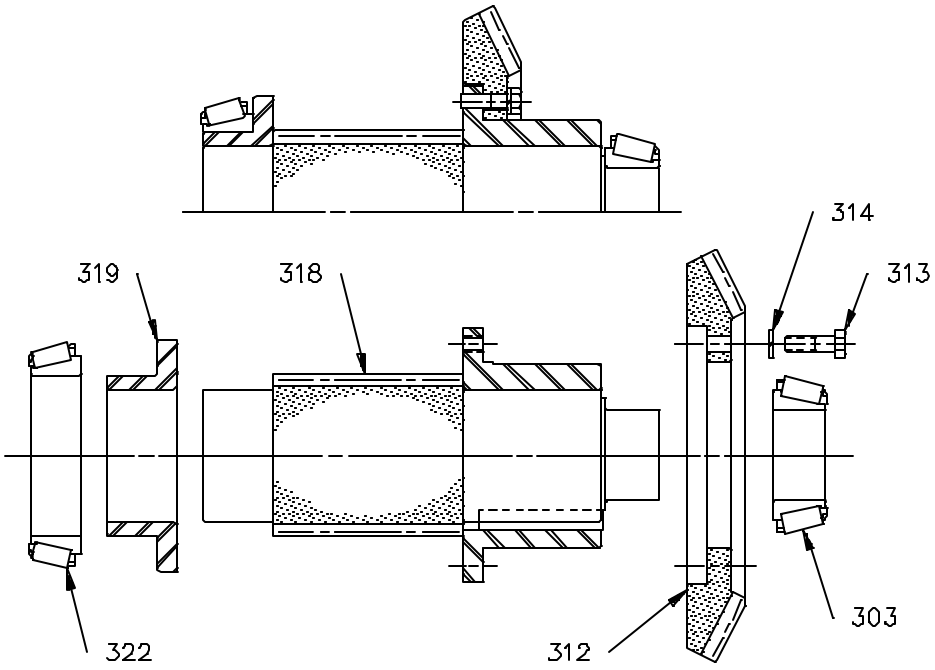

Figure 18: Pinion Shaft Assembly [311]

GEAR DRIVE

Case Sizes 11,12,13

Assembly (Cont'd)

Spiral Bevel Pinion Cartridge

1. Press bearing **[226, 228]** cups into cartridge housing **[227]**. The bearing cups must be firmly seated against the housing shoulders. Check with a feeler gage.

2. Heat bearing **[228]** cone and press onto spiral bevel pinion shaft **[230]**. Continue to press these parts together as they cool. The bearing cone must be firmly seated against the shaft shoulder. Check with a feeler gage.

3. Install key **[232]**. Heat spiral bevel pinion **[231]** to 275°F (135°C) and press onto the spiral bevel pinion shaft. Continue to press these parts together as they cool. The spiral bevel pinion must be firmly seated against the bearing face. Check with a feeler gage.

   NOTE: Do not heat parts in excess of 275°F (135°C). Do not apply direct flame. Do not allow parts to touch the bottom or sides of the oven or oil bath.

4. Install bolts, lockwashers and pinion washer **[234, 235 and 233]**. Torque to the value shown in *Table 1, page 12*.

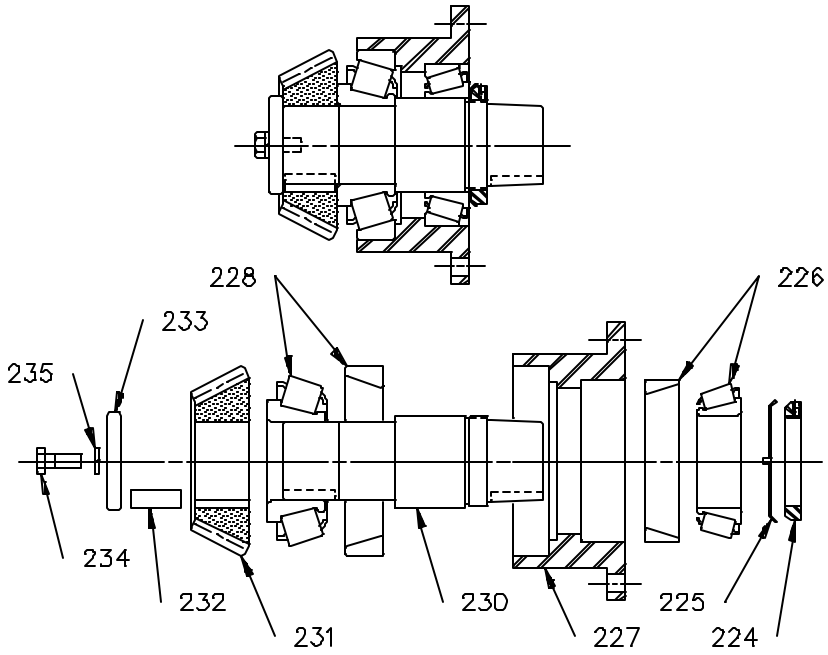

Figure 19: Spiral Bevel Pinion Cartridge Assembly [223]

GEAR DRIVE

Case Sizes 11,12,13

Assembly (Cont'd)

5. Insert the spiral bevel pinion shaft **[230]** *(Figure 19, page 20)* into cartridge housing **[227]**.

6. Heat bearing **[226]** cone and press it onto the spiral bevel pinion shaft while turning the cartridge housing by hand. The cartridge housing should show slight resistance to turning. Maintain this pressure while the bearing cone cools.

7. Clamp the housing flange of the cartridge assembly in a soft jawed bench vise.
8. Spray the bearings and shaft threads with light machine oil and install locknut and keyed lockwasher **[224, 225]** finger tight.

9. Install bolt **[218]** and tighten securely.

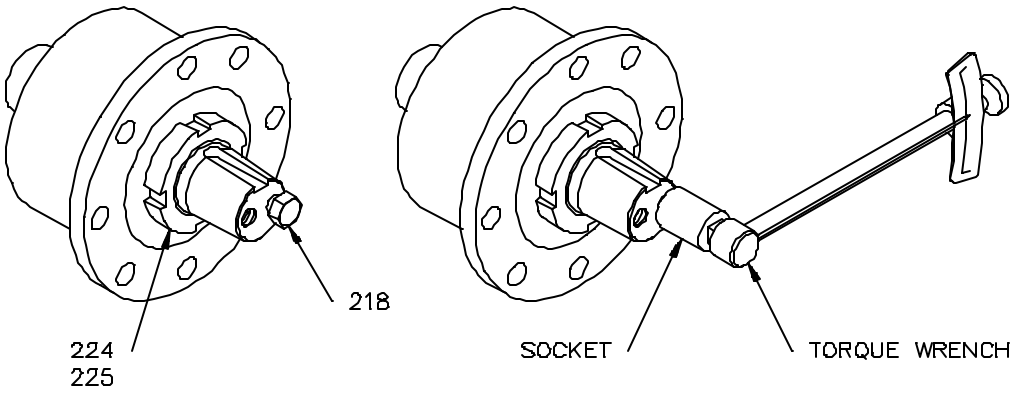

Figure 20: Torque Reading

10. Apply a torque wrench and measure the shaft turning torque. The torque reading is to be taken while rotating the pinion shaft at about 3 rpm. Increase turning torque by tightening locknut **[224]**. Turn shaft one complete revolution between adjustments. Adjust to 70 in lb (7.91 Nm).

GEAR DRIVE
Case Sizes 11,12,13

Assembly (Cont'd)

11. Engage keyed lockwasher **[225]** and torque locknut **[224]** setscrew to the value shown in *Table 1, page 12*. Precision measure and record the assembled height "A" of the spiral bevel pinion cartridge assembly. This measurement will be required to set the mounting distance of the spiral bevel pinion. Delete the original dimension stamped on the cartridge housing.

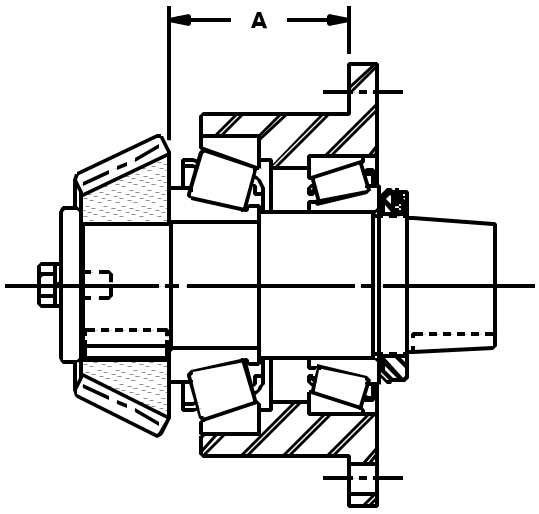

Figure 21: Cartridge Measurement

GEAR DRIVE
Case Sizes 11,12,13

Assembly (Cont'd)

Gear Drive

1. Calculate required pinion cartridge shim set **[236]** thickness as follows:

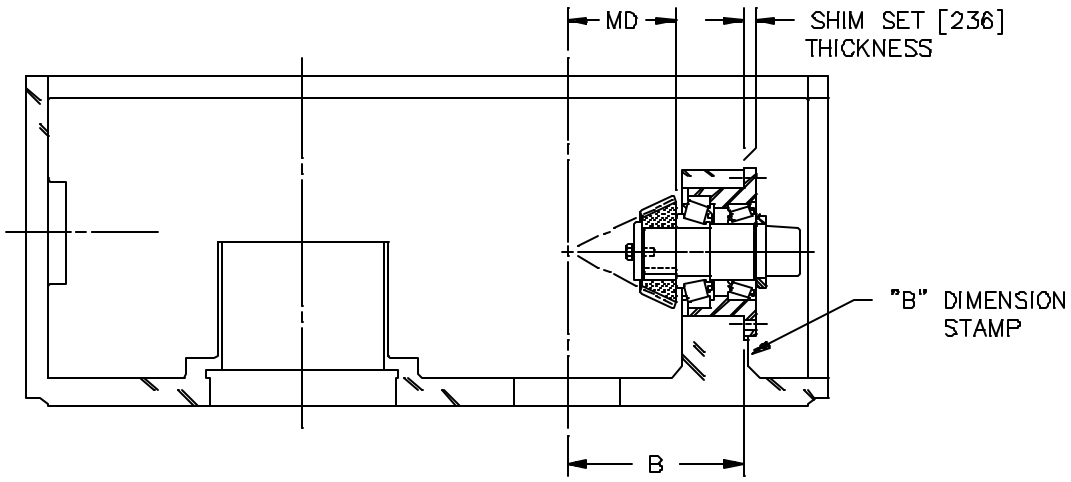

Figure 22: Shim Calculation

A+MD ! B = Shim set **[236]** thickness

MD = Pinion mounting distance (MD X.XXX) etched on the small end of the pinion.

B = Dimensional value marked on the housing.

A = Assembled cartridge height measurement *(Figure 21, page 22.)*

2. Using a paint stick, highlight the top edge of the tooth marked with an "X" on the spiral bevel pinion.

3. Install spiral bevel pinion cartridge assembly **[223]** and shim set **[236]** into the housing.

GEAR DRIVE

Case Sizes 11,12,13

Assembly (Cont'd)

4. Install bolts and lockwashers **[237, 238]** and torque to the value shown in *Table 1, page 12*.

5. Measure with a micrometer the thickness of original shim set **[305]** for lower pinion shaft bearing cap assembly **[301]** and duplicate the thickness with new shims.

Example:

If the thickness of the old shim set was .062", use (12) blue shims and (1) red shim to equal .062" when compressed.

Red = .002" (.051 mm) thick
Blue = .005" (.127 mm) thick

6. Install lower pinion shaft bearing cap assembly **[301]** and new shim set **[305]** into housing **[262]**. Install bolts and lockwashers **[306, 307]**. Torque to the value shown in *Table 1*.

7. Coat the flange face of the lower bearing cap with Permatex #2 or equal. Install lower bearing cap assembly **[256]**. Install bolts and lockwashers **[260, 261]**. Torque to the value shown in *Table 1*.

8. Position the housing so the lower bearing cap is down. Rotate the spiral bevel pinion shaft until the tooth marked "X" is on top center.

9. Press bearing **[210, 213]** cups into the housing. The bearing cups must be firmly seated against the housing shoulders. Check with a feeler gage.

10. Install input shaft assembly **[211]** into the housing through the change gear end. Install oil slinger **[308]** onto the input shaft as the shaft is being installed into the housing.

11. Heat bearing **[210]** cone and press onto the input shaft.

12. Spray locknut **[208]** threads and face, and bearings **[210, 213]** with light machine oil. Install and tighten the locknut against the bearing cone face.

13. Apply a torque wrench to pinion locknut **[217]** and measure the turning torque while rotating the input shaft at approximately 3 rpm.

GEAR DRIVE

Case Sizes 11,12,13

Assembly (Cont'd)

14. Increase turning torque by tightening locknut **[208]**. To decrease torque, loosen the locknut and drive the input shaft axially (using a rawhide mallet). Turn the input shaft one complete revolution between adjustments. Adjust to:

    Case Size 11: 35 in lb (3.95 Nm)
    Case Size 12: 70 in lb (7.90 Nm)
    Case Size 13: 100 in lb (11.3 Nm)

15. Remove the bearing locknut and install keyed lockwasher **[209]**. Reinstall the bearing locknut and tighten against the bearing. Check the turning torque.

16. Torque locknut **[208]** setscrew to the value shown in *Table 1, page 12*. Engage the keyed lockwasher.

17. Position oil slinger **[308]** at the scribe line on the high speed shaft. Torque setscrews **[309]** to the value shown in *Table 1*.

18. Place input shaft bearing cap assembly **[201]** over the end of the input shaft. Align the four cap bolt holes with the four housing bolt holes. The fifth hole orients at the 6 o'clock position.

19. Assemble the input shaft bearing cap assembly to the housing with bolts and lockwashers **[206, 207]**. Torque the bolts to the value shown in *Table 1*.

20. Install pinion shaft assembly **[311]**. Spray bearings **[322, 303]** with light machine oil and lower the assembly into the housing. *CAUTION: Make sure the spiral bevel gear teeth marked "X" straddle the pinion shaft tooth marked "X".*

    NOTE: When installing pinion shaft assembly and/or output shaft assembly, the recommended procedure is to install both shaft assemblies into the housing at the same time.

21. Install output shaft assembly **[246]**. Spray bearings **[241, 255]** with light machine oil and lower the assembly into the housing.

22. Coat the housing/housing cover mating surfaces with Permatex #2 or equal. Install housing cover **[263]**. Align taper pin holes and install taper pins **[267]**. Install cap screws and lockwashers **[268, 269]**. Torque to the value shown in *Table 1*.

23. Install housing cover bolts and lockwashers **[264, 265]**. Torque to the value shown in *Table 1*.

GEAR DRIVE

Case Sizes 11,12,13

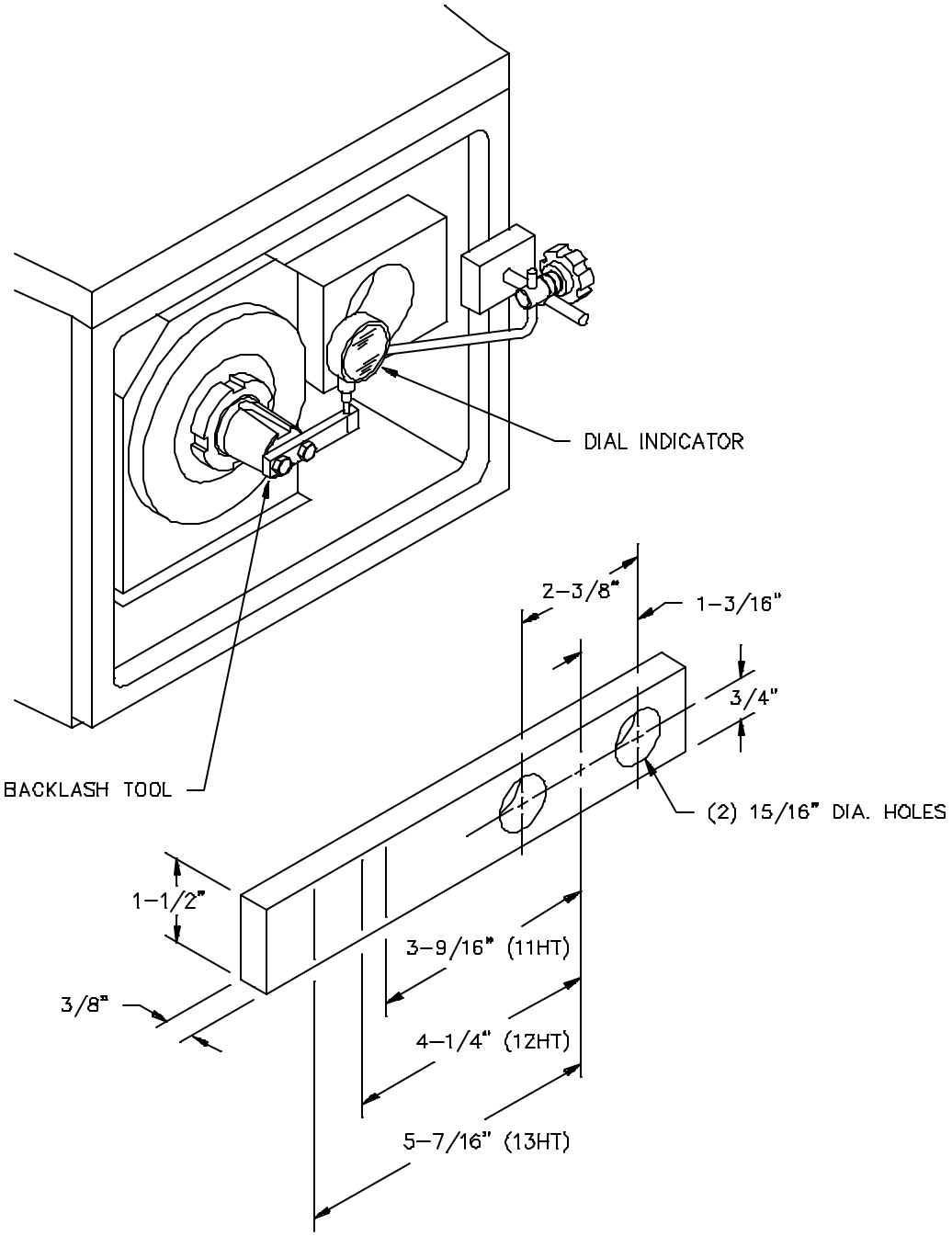

Figure 23: Backlash Setting

GEAR DRIVE

Case Sizes 11,12,13

Assembly (Cont'd)

24. Install upper pinion shaft bearing cap assembly **[320]**. Bolt in place using three or four equally spaced bolts **[325]**. Alternately tighten bolts until the bearing cap is seated on the bearing. *Do not torque the bolts; snug-up only*.

25. Install a backlash tool (supplied by others) *(Figure 23, page 26)* on the spiral bevel pinion shaft and measure the backlash by placing a dial indicator against the backlash tool at a right angle to the rotation. Restrain the pinion shaft from turning and rotate the spiral bevel pinion shaft back and forth to measure the free movement.

    The Backlash Setting (Full Indicator Movement) is etched on the spiral bevel gear.

26. Take four consecutive backlash readings. Rotate the spiral bevel pinion shaft one half turn counterclockwise after each reading. Turn the spiral bevel pinion shaft back to the position of the lowest backlash reading.

27. Add shims **[305]** to lower pinion shaft bearing cap assembly **[301]** to decrease backlash; remove shims to increase backlash.

    NOTE: Before each shim adjustment, the bolts on the upper pinion shaft bearing cap should be loosened. After changing the shims, the bolts on the lower pinion shaft bearing cap should be torqued to the value shown in Table 1 and then the bolts on the upper pinion shaft bearing cap should be snugged-up.

28. Measure the gap between upper pinion shaft bearing cap **[321]** and housing cover. Count out new shims equal to the gap plus .003" to .004" to provide a bearing setting of .003" to .004" (.076 mm to .102 mm) endplay.

29. Install upper pinion shaft bearing cap assembly **[320]** with new shim set **[324]**. Install bolts and lockwashers **[325, 326]** and torque to the value shown in *Table 1*.

30. Check the pinion shaft endplay. If adjustment is required, add or subtract from shim set **[324]** to obtain .003" to .004" (.076 mm to .102 mm) endplay.

31. Install upper bearing cap assembly **[239]**. Bolt in place using four equally spaced bolts **[244]**. Alternately tighten bolts until the upper bearing cap is seated on the bearing. *Do not torque the bolts; snug-up only*.

32. Measure the gap between upper bearing cap **[240]** and the housing cover. Count out new shims equal to the gap plus .003" to .004" to provide a bearing setting to .003" to .004" (.076 mm to .102 mm) endplay.

GEAR DRIVE

Case Sizes 11,12,13

Assembly (Cont'd)

33. Install upper bearing cap assembly **[239]** with new shim set **[243]**. Install bolts and lockwashers **[244, 245]** and torque to the value shown in *Table 1, page 12*.

34. Check the output shaft endplay. If adjustment is required, add or subtract from shim set **[243]** to obtain .003" to .004" (.076 mm to .102 mm) endplay.

35. Remove pinion locknut **[217]**, change pinion washer **[216]** and change pinion **[215]**.

36. Slide change gear **[221]** (taper bore) into place on spiral bevel pinion shaft **[230]**. The change gear bore and spiral bevel pinion shaft taper must be clean and dry prior to assembly.

37. Install key, bolts, lockwashers, and change gear washer **[222, 218, 219 and 220]**. Torque the bolts to the value shown in *Table 1*.

38. Reinstall change pinion **[215]**, change pinion washer **[216]**, and pinion locknut **[217]**. *NOTE: Counter-bored side of the change pinion goes against the bearing face.* Torque the locknut to 600 ft lb (813 Nm).

    NOTE: Case Size 13 only, gear ratios of 48.0 and numerically lower. The pinion locknut will be a locknut and keyed lockwasher. Tighten the locknut securely and engage the keyed lockwasher. Torque the pinion locknut **[217]** *setscrew to the value shown in Table 1.*

39. Coat the gasket surface of change gear cover **[276]** with Permatex #2 or equal. Align holes and apply a new gasket **[277]** to change gear cover.

40. Install the change gear cover with bolts and lockwashers **[278, 279]**. Torque the bolts to the value shown in *Table 1*.

41. Rotate the input shaft by hand until the output shaft makes at least one turn. Check for any binding.

42. Add grease to bearings **[241, 255 and 322]** and fill the gear housing with oil. See *Agitator IOM Manual, Lubrication, Gear Drive*.

43. Reinstall gear drive coupling half **[351]**. See *Agitator IOM Manual, Installation, Rigid Shaft Coupling*.

44. Reinstall motor bracket **[131]** and motor **[100]**. See *Agitator IOM Manual, Installation.*

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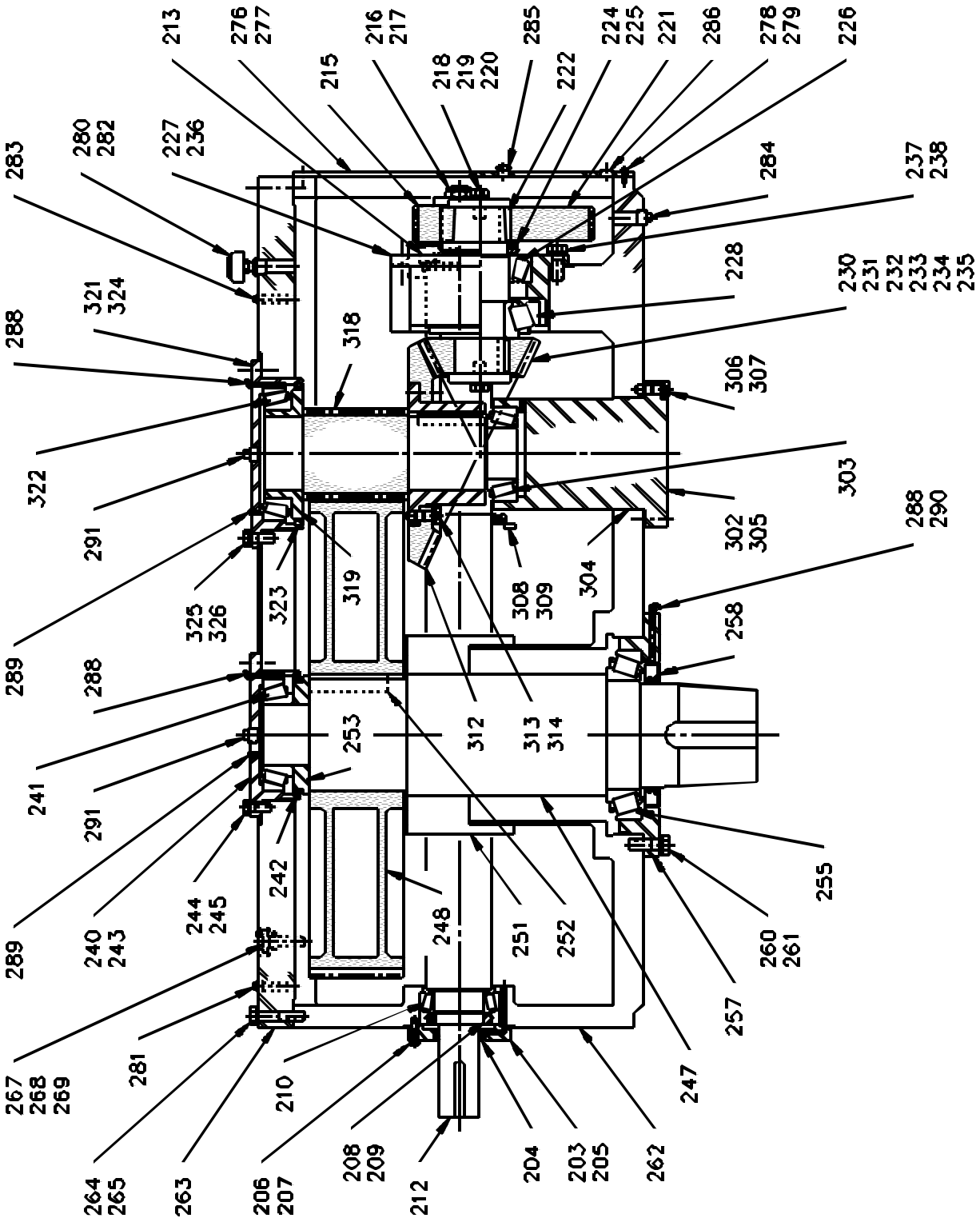

Figure 24: HT Gear Drive: Case Sizes 11,12,13

GEAR DRIVE ITEM LIST
Case Sizes 11,12,13

Item #	Description	Qty.
200	**gear drive assembly**	**1**
201	**input shaft bearing cap assembly**	**1**
203	bearing cap	1
204-002	lip seal	1
205	gasket	1
206	bolt	4
207	lockwasher	4
208-002	locknut with setscrew	1
209	keyed lockwasher	1
210-001	bearing	1
211	**input shaft assembly**	1
212	input shaft	1
213-001	bearing	1
215	change pinion	1
216	change pinion washer	1
217-001	pinion locknut	1
-002	pinion locknut with setscrew	1
-003	keyed lockwasher	1
218	bolt	2
219	lockwasher	2
220	change gear washer	1
221	change gear	1
222	key	1

Item #	Description	Qty.
223	**spiral bevel pinion cartridge assembly**	**1**
224-001	locknut with setscrew	1
225	keyed lockwasher	1
226	bearing	1
227	cartridge housing	1
228	bearing	1
230	spiral bevel pinion shaft	1
231	spiral bevel pinon	1
232	key	1
233	pinion washer	1
234	bolt	2
235	lockwasher	2
236	shim set	1
237	bolt	
238	lockwasher	
239	**upper bearing cap assembly**	**1**
240	upper bearing cap	1
241	bearing	1
242	lip seal	1
243	shim set	1
244	bolt	8
245	lockwasher	8
246	**output shaft assembly**	**1**
247	output shaft	1
248-002	gear	1
251	drywell cover	1
252	key	1
253	grease retainer	1
255	bearing	1

Item #	Description	Qty.
256	**lower bearing cap assembly**	**1**
257	lower bearing cap	1
258-002	lip seal	1
260	bolt	8
261	lockwasher	8
262	housing	1
263	housing cover	1
264	bolt	31
265	lockwasher	31
267	taper pin	2
268	cap screw	4
269	lockwasher	4
276	change gear cover	1
277	gasket	1
278	bolt	
279	lockwasher	
280-001	breather	1
281	pipe plug, NPT	1
282	hex bushing	1
283	pipe plug, NPT	1
284	magnetic drain plug, NPT	1
285	oil level sight glass	1
286	pipe plug, NPT	1
288	grease fitting	3
289	relief fitting	2
290	elbow fitting	1
291	pipe plug, NPT	2

GEAR DRIVE ITEM LIST
Case Sizes 11,12,13

Item #	Description	Qty.
301	lower pinion shaft bearing cap assembly	1
302	**lower pinion shaft bearing cap**	**1**
303	**bearing**	**1**
304	**o-ring**	**1**
305	**shim set**	**1**
306	**bolt**	
307	**lockwasher**	
308	**oil slinger**	**1**
309	**setscrew, square head**	**2**
311	pinion shaft assembly	1
312	**spiral bevel gear**	**1**
313	**bolt**	
314	**lockwasher**	
318	**pinion shaft**	**1**
319	**grease retainer**	**1**
320	upper pinion shaft bearing cap assembly	1
321	**upper pinion shaft bearing cap**	**1**
322	**bearing**	**1**
323	**lip seal**	**1**
324	**shim set**	**1**
325	**bolt**	**8**
326	**lockwasher**	**8**