



Amarillo[®]

**PUMP DRIVES
(250 HP THROUGH 350 HP)**

**INSTRUCTIONS FOR REPAIRING
MODELS 250, 300, and 350**

Amarillo Right Angle Pump Drives, if properly installed and maintained, should provide years of service with a minimum amount of maintenance. Repairs, when required, usually involve bearing or gear replacement. While the job is not difficult, it should only be performed in an adequately equipped shop by capable personnel. It should be noted that any repairs made outside the factory without consent of the manufacturer will void the warranty.



Catalog 0215



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ATTENTION

Please note that gear drives with a serial number greater than 231989 have all joints sealed with Loctite Gasket Eliminator 515, instead of gaskets. Loctite 515 is a formed in place gasket material, which provides superior sealing over conventional gaskets. After disassembling for repair or inspection, we recommend resealing with Loctite 515. However, gasket may still be used. If a gasket is utilized between the horizontal carrier and the gear case for a gear drive originally built with Loctite, the thickness of the horizontal outer spacer (550) will have to be changed to maintain the proper position of the horizontal gear. To correct the horizontal gear position, increase the horizontal spacer thickness by the thickness of the gasket. If Loctite is used to re-seal the gear drive then no changes are required to the horizontal spacer.



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1.0 General Disassembly Instructions.

- 1.1 Refer to the appropriate cross sectional drawing during disassembly (Figures 1, 2 or 3).
- 1.2 Drain and dispose of the oil.
- 1.3 Remove the side inspection plate (not shown).
- 1.4 On models 300 and 350, loosen the two fittings on the heat exchanger (302) and remove the heat exchanger, and mounting brackets (if used).
- 1.5 Match mark the horizontal shaft carrier (15) and the gear case (10).
- 1.6 Remove the horizontal carrier (15) from the gear case (10) using the following procedure.
 - 1.6.1 Install guide pins in two bolt holes on opposite sides of the horizontal carrier.
 - 1.6.2 A quick jerk up and down on the end of the horizontal shaft (500) will usually pull the horizontal carrier out of the gear case. If the carrier remains in place, deliver a sharp blow using a soft mallet to the side of the shaft. This should loosen the horizontal carrier so that it can be pried out of the gear case. Take care not to damage the gasket.
 - 1.6.3 Guide the horizontal carrier assembly out of the gear case (10) using a hoist,
- 1.7 Reach through the horizontal opening left by the carrier and remove the oil line to the thrust bearing carrier (12).
- 1.8 On models with non-reverse (Figure 1 or 2), remove the top cover (11) and non-reverse clutch (24).
- 1.9 If the gear drive has a hollow shaft or solid shaft with non-reverse, match mark the thrust bearing cover (21) and the thrust bearing carrier (12), then remove the thrust bearing cover.
- 1.10 Reach through the horizontal opening in the gear case and remove the cap screws in the cup adjustment plate (480).
- 1.11 Lift the cup adjustment plate (480) and remove the shims (824). **Note:** The shims are in two halves and should be kept separate.
- 1.12 Match mark the thrust bearing carrier (12) and the gear case (10). Remove the cap screws and eye bolts in the thrust bearing carrier (12). Note the position of the two eyebolts.
- 1.13 Install two eyebolts in the thrust bearing carrier (12) in the two tapped holes. Using a hoist, slowly raise the vertical shaft assembly, taking care not to damage the oil tube (801) or remaining oil lines.
- 1.14 Carefully set the assembly on a clean work surface, taking care not to damage the lower bearing (601) or oil screw (19).



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- 1.15 If replacing the oil tube (801) remove the bottom plug (17) from the gear case (10) and replace with a new bottom plug/oil tube assembly.

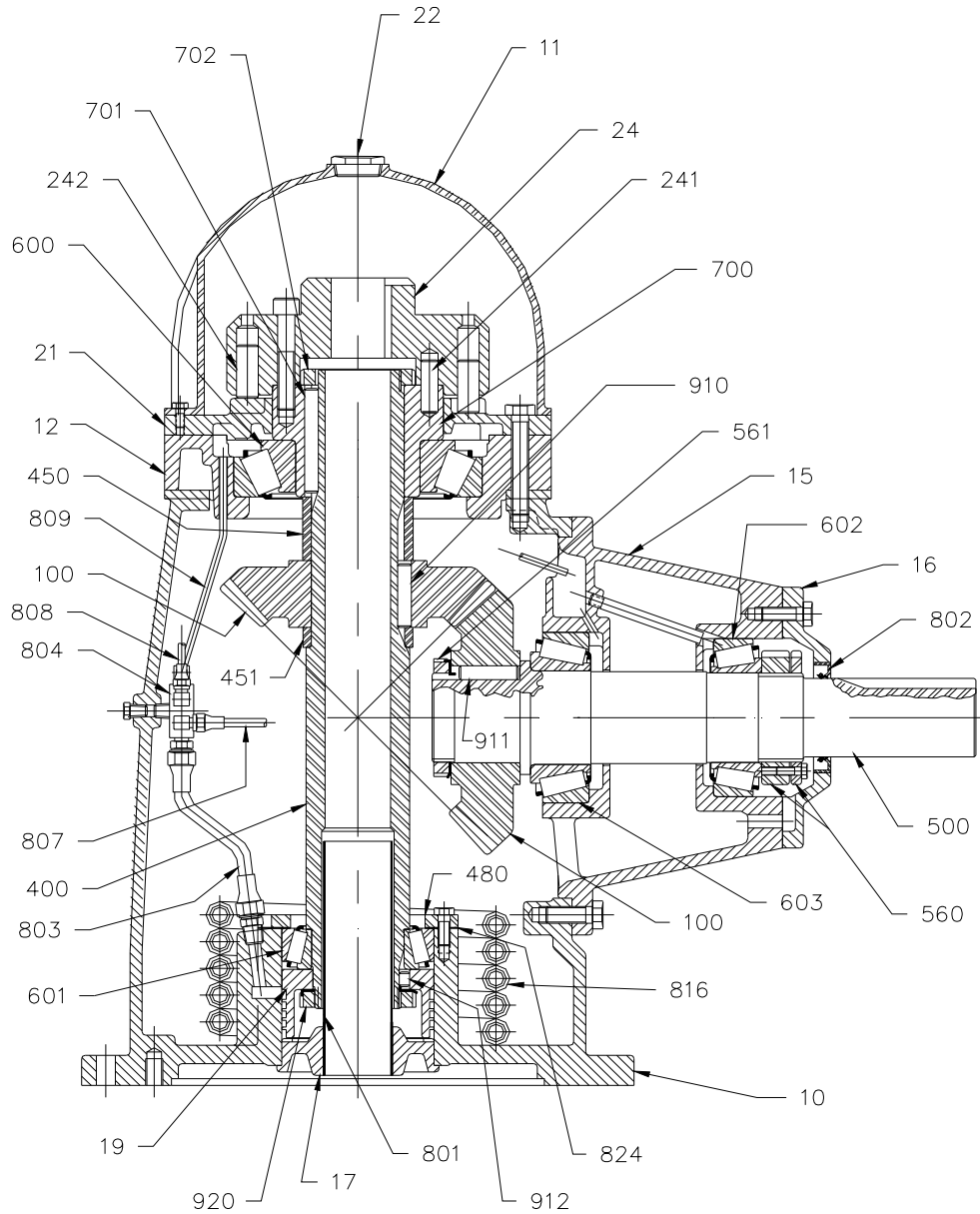


Figure 1 Vertical Hollow Shaft

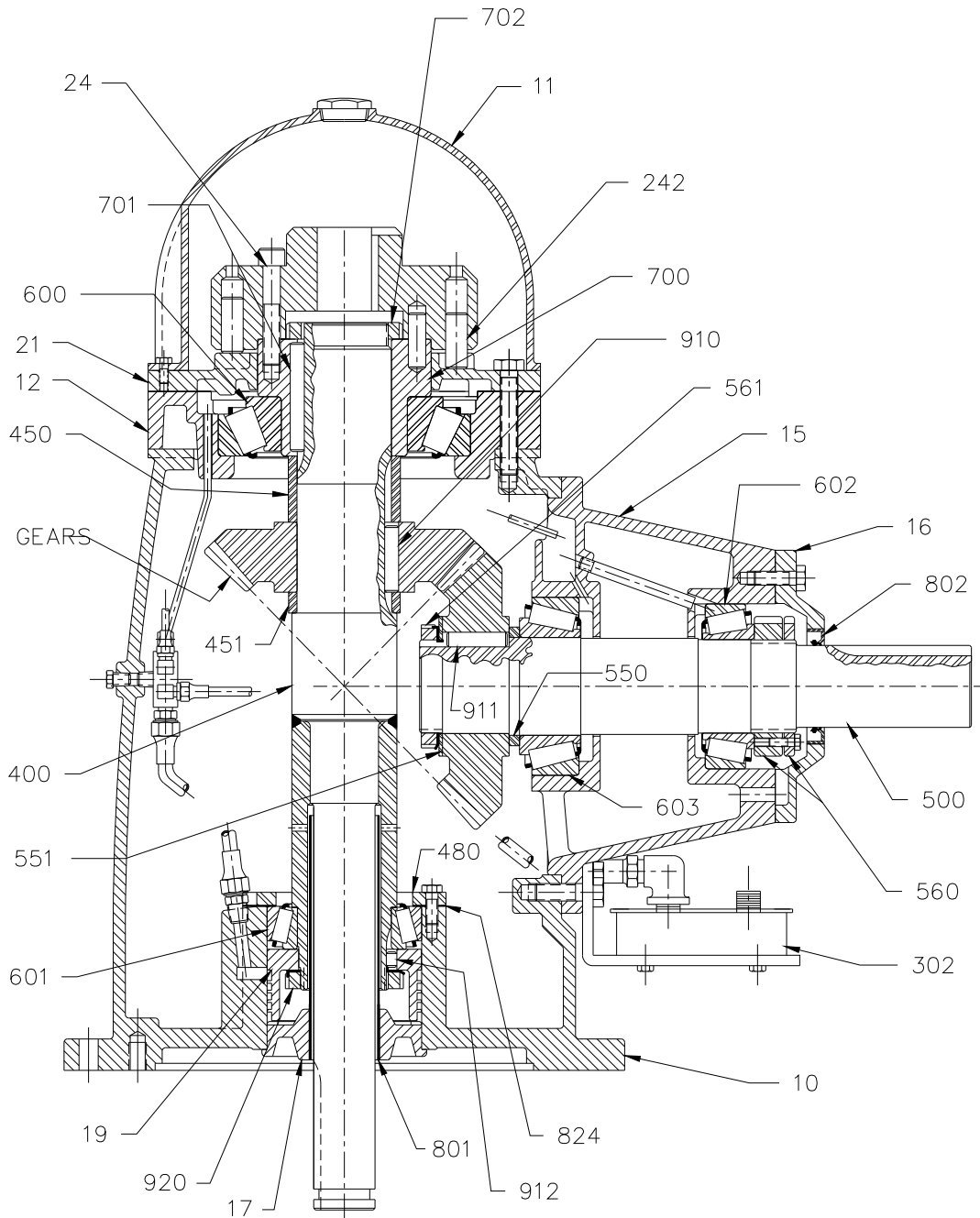


Figure 2 Vertical Solid Shaft with Non-Reverse

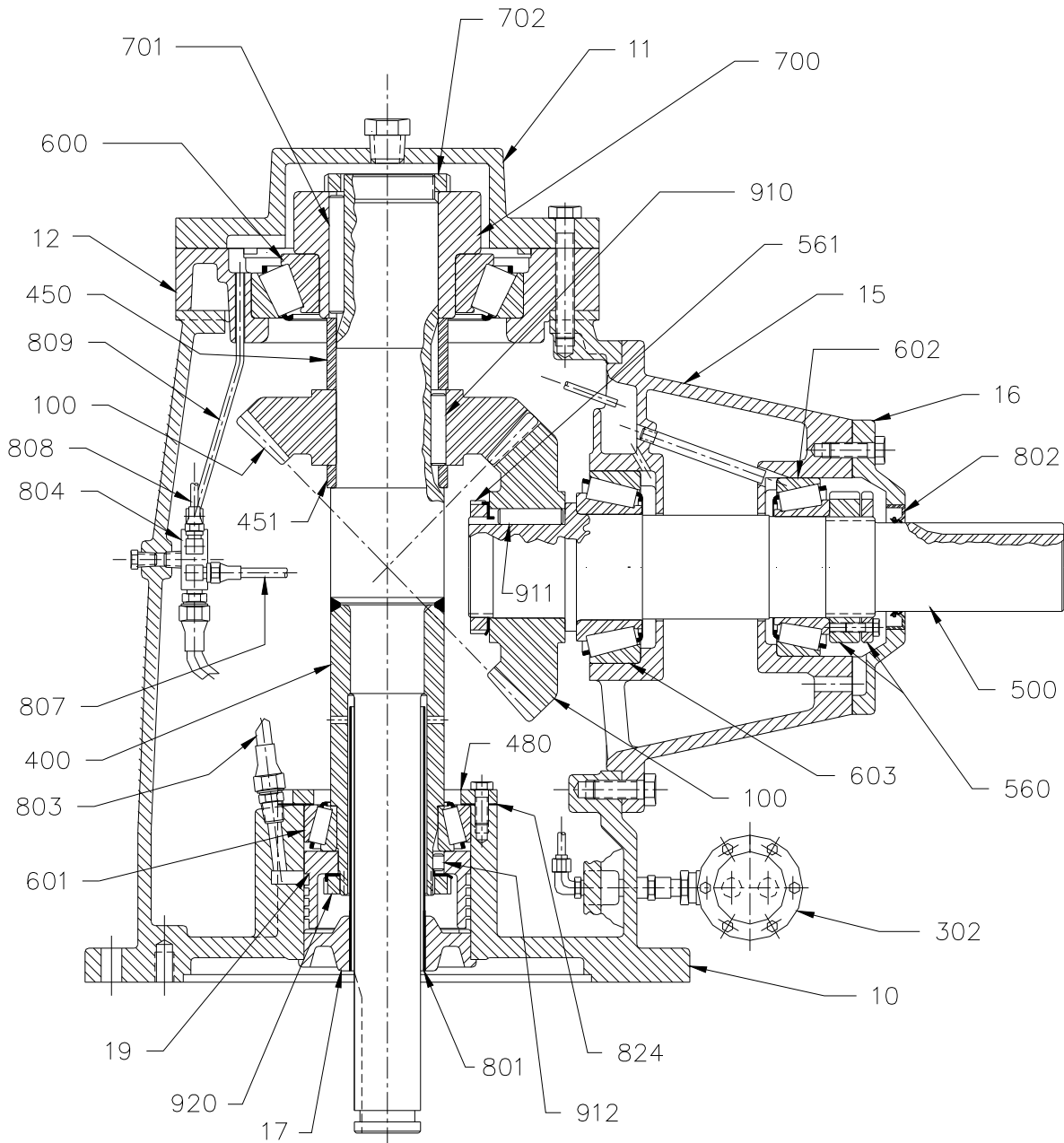


Figure 3 Vertical Solid Shaft without Non-Reverse



Disassembly of the Vertical Shaft Assembly.

NOTE: Each gear drive contains several spacers. These spacers are not interchangeable. Note the location of each spacer during disassembly to assure proper reassembly.

- 1.16 Clamp the vertical shaft assembly in a heavy vise directly under the gear. Use caution to avoid crushing the hollow vertical shaft.
- 1.17 Remove the drive sleeve locknut (702) using a spanner wrench or drift punch.
- 1.18 Bend the tab of the keyed washer out of the groove in the lower bearing locknut (920) and remove the locknut using a spanner wrench or drift punch. Remove the oil screw (19).
- 1.19 Install allthread in two holes, 180° apart, into the drive sleeve (700). Place a spreader bar above a Porta-Power and fasten to the allthread with washers and nuts. Pull the drive sleeve off of the shaft. Some heat may be required to make the drive sleeve easier to remove. Be careful not to overheat the drive sleeve. Remove the drive sleeve key.
- 1.20 The inner race of the thrust bearing (600) is pressed on the drive sleeve. The thrust bearing carrier (12) can now be lifted off of the vertical shaft.
- 1.21 Remove the vertical spacer (450) and orient the assembly with the top of the vertical shaft (400) up and place in a press.
- 1.22 If the gear is pressed on the shaft and is being replaced, press off the gear by blocking under the gear and pressing on the end of the shaft (400). Remove the vertical shaft gear key (910) and under gear spacer (451), if present.

If the gear is bolted to a gear mount, and the gear mount is being replaced, remove the gear mount/gear assembly by blocking under the gear mount and pressing on the end of the shaft (400). Remove the vertical shaft gear key (910) and under gear spacer (451), if present.

If the gear is bolted to a gear mount, and the gear only is being replaced, remove the bolts holding the gear to the gear mount. Do not press off the gear mount.

- 1.23 Remove the thrust bearing cup (600) from the thrust bearing carrier (12) with a brass punch or a bearing puller.
- 1.24 Remove the thrust bearing cone (600) from the drive sleeve (700).
- 1.25 Insert allthread in two holes, 180° apart, in the cup adjustment plate (480). Place a spreader bar, washers, and nuts on the allthread. Be sure to leave enough room to place a porta-power ram between the spreader bar and the end of the shaft (400).



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- 1.26 Ensure that the cup adjustment plate (480) is centered with the outer race of the lower bearing (601). Slowly apply pressure to the porta-power and pull the lower bearing off of the shaft (400).



2.0 Disassembly of the Horizontal Shaft Assembly.

- 2.1 Match mark the oil seal plate (16) and the horizontal carrier (15).
- 2.2 Remove the oil seal plate (16).
- 2.3 Loosen the horizontal locknut set (560) from the end of the horizontal shaft (500) by removing the socket head cap screws.
- 2.4 Remove the locknut set with a spanner wrench or drift punch. Remove the thinner portion first (Right Hand Threads).
- 2.5 Place the horizontal assembly in a press with the pinion down. Remove the horizontal carrier (15) and outer bearing (602) by blocking under the horizontal carrier and pressing on the end of the shaft (500).
- 2.6 For models with a locknut (561) retaining the gear proceed as follows:
 - 2.6.1 Bend the tab of the keyed washer out of the locknut groove. Remove the locknut using a drift punch or spanner wrench (Right Hand Threads).
 - 2.6.2 Orient the horizontal shaft (500) vertically with the pinion up. Remove the pinion by blocking under the pinion and pressing on the end of the shaft.
 - 2.6.3 Turn the horizontal shaft (500) over and remove the inner bearing cone (603) by blocking under the inner race and pressing on the end of the shaft.
- 2.7 For models without a gear retainer, use the following procedure.
 - 2.7.1 Orient the horizontal shaft (500) vertically with the pinion down.
 - 2.7.2 Remove the pinion and inner bearing cone (603) by blocking under the pinion and pressing on the end of the shaft (500).
- 2.8 Remove the horizontal shaft gear key (911).
- 2.9 Remove the inner and outer bearing cups (602 & 603) from the horizontal carrier (15) using a brass punch or bearing puller.



3.0 General Assembly Instructions.

- 3.1 Wash all disassembled parts and housings thoroughly with clean solvent. Clean out all oil lines.
- 3.2 Check the new gear set (if required) to make sure it is a matched set. Our gears are lapped in matched sets at the factory and must not be separated. Each set of gears is assigned a serial number which is etched on each member of a set. Along with the serial number, the mounting distance, part number, and minimum amount of backlash is etched on each member.
- 3.3 Do not remove bearings from their cartons until they are needed for use. To protect against contamination, cover any bearing that is not going to be used immediately.
- 3.4 Inspect new replacement parts to ensure that there are no burrs on shoulders that could cause assembly problems. Check for burrs on keys and keyways. Ensure that keys fit properly in keyways and have a chamfer or radius on the edges.
- 3.5 When pressing **ANY** component on a shaft or into a housing, **ALWAYS** use an antigalling compound.
- 3.6 The correct gear positions are obtained through the use of spacers (450 & 550). The required spacer lengths will vary with changes in the mounting distances (M.D.) of the gears. Spacer lengths should be changed if the M.D. of the new gear differs more than 0.003 inch from the M.D. of the old gear. Usually spacer changes are not required when replacing bearings only. If the gear case (10), thrust bearing carrier (12), drive sleeve (700), or horizontal carrier (15) is replaced, the assembled castings will have to be re-measured and the spacer changed accordingly.

Note: On some models the horizontal spacer (550) is integral with the horizontal shaft (500).



4.0 Assembly of Parts on the Vertical Shaft.

Note: If the gear or gear mount was not pressed off the vertical shaft, proceed to Step 5.4.

- 4.1 Slide the under gear spacer (451) onto the vertical shaft.
- 4.2 Insert the vertical gear key (910) into the vertical shaft keyway.
- 4.3 Press the gear or gear mount onto the shaft (400). Make sure that the gear or gear mount is pressed tightly against the under gear spacer (451).

Note: If a new gear mount was installed in Step 5.3, proceed to Step 11.

- 4.4 If the model has a gear mount, bolt the gear to the gear mount.
- 4.5 Slide the cup adjustment plate (480) and lower radial bearing cup (601) onto the vertical shaft (400) and press on the bearing cone. Take care not to damage the bearing roller cage.
- 4.6 Install the oil screw (19) and oil screw key (912).
- 4.7 Slide the keyed washer onto the end of the shaft (400) and thread on the locknut (920).
- 4.8 Tighten the locknut (920) securely using a spanner wrench and bend a tab of the keyed washer into a groove on the locknut.
- 4.9 Press the bearing cup (600) into the thrust bearing carrier (12).
- 4.10 Press the thrust bearing cone (600) onto the drive sleeve (700). Take care not to damage the bearing roller cage.
- 4.11 Turn the shaft (400) over, slide the vertical spacer (450) onto the shaft, and set the thrust bearing carrier on the gear or gear mount.
- 4.12 Insert the drive sleeve key (701) into the vertical shaft keyway.
- 4.13 Press the drive sleeve/thrust bearing cone (700/600) on the vertical shaft (400). Make sure the drive sleeve is pressed tightly against the vertical shaft.

Note: Make sure all components are pressed together tightly, shoulder to shoulder. Spacers should not spin freely on the shaft. If the assembly is not tightly pressed together, it will not be possible to obtain correct bearing and gear settings.

- 4.14 Thread the drive sleeve locknut (702) on the shaft (400) and tighten securely using a spanner wrench or drift punch.
- 4.15 Install two eyebolts, 180° apart, in the two tapped holes in the thrust bearing carrier (12).
- 4.16 Coat the top of the gear case (10) with Loctite Gasket Eliminator 515.
- 4.17 Using a hoist attached to the eyebolts, slowly lower the vertical assembly into the gear case (10). Take care not to damage the oil tube (801) or oil lines. Make sure the match marks on the thrust bearing carrier (12) and gear case are aligned.



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- 4.18 Place the thrust bearing cover (21), if equipped, on the thrust bearing carrier (12). Install the cap screws and two eyebolts in the thrust bearing carrier and tighten securely. Make sure the eyebolts are placed in the same location noted in Step 1.12.
- 4.19 Place the shims under the cup adjustment plate (480). Make sure that the thickness of the shim set is the same on both sides.
- 4.20 Tighten the cup adjustment plate (480) to the hub in the gear case (10). Make sure that the register on the cup adjustment plate fits inside the hub and is on top of the lower bearing cup (601).
- 4.21 Install two eyebolts in the drive sleeve (700) or one eyebolt in the end of the vertical solid shaft (400) and rotate the shaft several revolutions in both directions to seat the bearing.
- 4.22 Attach a dial indicator on top of the thrust bearing carrier (12), so that the indicator reads off of the drive sleeve (700) or vertical shaft (400). While watching the indicator, pull up on the drive sleeve with a hoist. The indicator should read 0.0005 to 0.001 inch T.I.R. If the reading is outside the limits, add or subtract shims as required. A 0.001 inch change in shim pack thickness will change the axial movement of the shaft by 0.001 inch. If shims are changed, rotate the shaft several revolutions to seat the bearing and recheck the axial movement.
- 4.23 Connect the oil line to the thrust bearing carrier (12).
- 4.24 Rotate the vertical shaft (400) until the gear tooth (or teeth) marked with “X” are located at the horizontal opening of the gear case (10). For speed decreasing ratios, the vertical gear will have two “X”s. For speed increasing ratios, the vertical pinion will have one “X”.



5.0 Assembly of the Horizontal Shaft Assembly

- 5.1 Press the bearing cups (602 & 603) into the horizontal carrier (15).
- 5.2 Insert the horizontal shaft gear key (911) into the shaft keyway.
- 5.3 Use the following procedure if a gear retainer is used:
 - 5.3.1 Press the pinion on the horizontal shaft (500).
 - 5.3.2 Place the keyed washer on the end on the shaft and thread on the locknut.
 - 5.3.3 Tighten the locknut with a spanner wrench or drift punch. Bend one of the washer tabs into the locknut slot.
 - 5.3.4 Turn the shaft (500) over so that the pinion is down. Press the inner bearing cone (603) on the shaft. Take care not to damage the bearing roller cage.
- 5.4 Use the following procedure if the model does not use a gear retainer.
 - 5.4.1 Press the pinion on the horizontal shaft (500).
 - 5.4.2 Slide the horizontal outer spacer (550) on the shaft and press on the inner bearing cone (603). Take care not to damage the bearing roller cage. Ensure that the bearing seats tightly against the spacer (550).
- 5.5 Set the horizontal carrier (15) over the shaft and press the horizontal outer bearing cone (602) onto the shaft. **DO NOT** press the bearing on too tight. Leave a minimum of 0.015" axial play. Final axial bearing adjustment will be made using the locknut (560).
- 5.6 Thread the thicker portion of the locknut (560) on the horizontal shaft (500). **Note:** The ground surface on the thicker locknut should be installed against the outer bearing cone. Do not tighten.
- 5.7 Coat the machined surface of the horizontal carrier with Loctite Gasket Eliminator 515, making sure to coat completely around bolt holes (See note on inside front cover.) Using guide pins as an aid, insert the horizontal assembly into gear case (10). **Note:** Make sure that the timing mark on the pinion ("X") is aligned with the timing mark on the gear ("X-X"). Also make sure the match marks on the horizontal carrier and gear case are aligned. Install and tighten the cap screws.
- 5.8 Mount a dial indicator on the horizontal shaft (500) so that it reads off the horizontal carrier (15). Rotate the horizontal shaft (500) back and forth while applying inward pressure. Zero the indicator and pull the horizontal shaft out to measure the axial movement.
- 5.9 Tighten the locknut (560) with a spanner wrench or drift punch until the in and out movement (bearing clearance) is from 0.001 to 0.003 inch T.I.R. **Note:** The horizontal shaft should be rotated before each reading so the bearings will remain seated.
- 5.10 Remove the dial indicator and thread the thinner part of the locknut (560) to within 1/32 to 1/16 inch of the thicker locknut. **DO NOT** butt the two nuts together.
- 5.11 Align the holes in the locknut set (560) and insert the cap screws. Tighten the cap screws until the outer nut deflects and almost touches the inner nut.



Backlash check.

Backlash is the amount of clearance between the mating teeth of a gear set and is obtained by measuring the amount of movement of one member at the pitch diameter, when the other member is held stationary. Backlash is very difficult to measure directly in an assembled gear drive. Following is an indirect method of measuring backlash.

- 5.12 Place a spreader bar on top of the drive sleeve locknut (702) and attach it to the thrust bearing carrier (12) using allthread or cap screws. Tighten the spreader bar against the drive sleeve locknut to prevent the vertical shaft (400) from turning.
- 5.13 Place a key in the horizontal shaft (500) keyway and retain with a C-clamp to eliminate any movement between the key and shaft.
- 5.14 Place a dial indicator against the key and set to zero (Figure 4).
- 5.15 Measure the distance from the center of the shaft (500) to the contact point between the indicator and key (Figure 4). This is the “r” value in the equation in Step 7.6.
- 5.16 Rotate the horizontal shaft (500) back and forth and record the total indicator reading (T.I.R.). This is the “M” value in the equation in Step 7.6. **Note:** Make sure no movement occurs in the vertical shaft.
- 5.17 Calculate the backlash using the following equation. The “C” value is found in Table 1.

$$\text{Backlash} = \frac{(C \times M)}{r}$$

- 5.18 The amount of backlash must not be less than the amount etched on the gear set; however, the backlash may be as high as twice the etched value. If the backlash is not within the limits stated above, it must be corrected. Refer to Step 9 after performing the tooth contact pattern check. **NEVER** run the gears without backlash.



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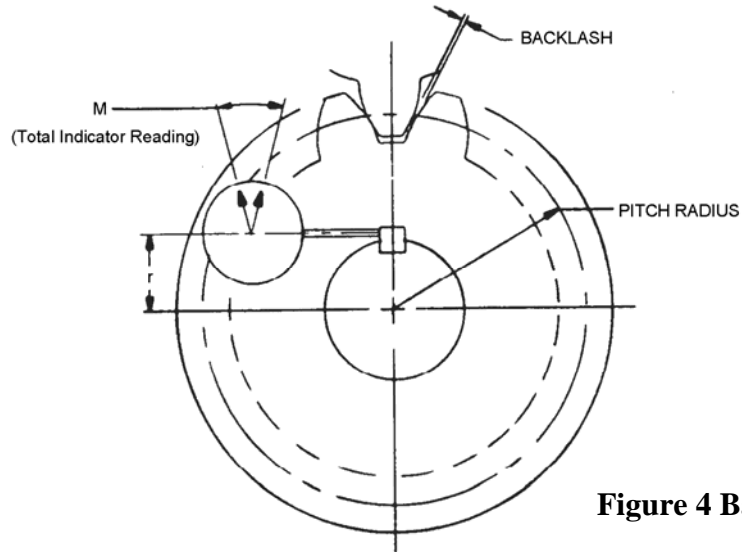


Figure 4 Backlash Check

Table 1 Values of “C” Used in Backlash Calculations

<u>Ratio</u>	<u>“C”</u>
1:1	4.86
10:11	5.20
5:6	5.65
4:5	6.25
3:4	6.00
2:3	6.45
4:7	6.65
1:2	6.75
----	-----
11:10	4.74
6:5	4.14
5:4	4.00
4:3	3.86
3:2	3.50
8:5	3.45
7:4	3.13
2:1	3.00
9:4	3.00
5:2	2.75
3:1	2.25



6.0 Tooth Contact Pattern Check

- 6.1 Remove the spreader bar from the top of the gear drive
- 6.2 Apply a suitable marking compound to the teeth of the gears and rotate the horizontal shaft.
- 6.3 The correct tooth contact for a gear set is shown in Figure 5. If the tooth contact is correct, and the backlash is within limits, proceed to Step 10.0. If the tooth contact is correct, and the backlash needs to be corrected, proceed to Step 9.0.
- 6.4 Figure 6 shows the two most common forms of incorrect tooth contact. When a tooth contact occurs as shown in Figure 6A, check the following items.
 - 6.4.1 Make sure the horizontal carrier (15) is pulled up tightly to the gear case (10).
 - 6.4.2 Make sure there is only one gasket (if used) between the horizontal carrier (15) and the gear case (10).
 - 6.4.3 Make sure the gasket (if used) between the horizontal carrier and the gear case is 0.015" thick.
 - 6.4.4 If the above steps do not correct the tooth contact, then the pinion will have to be moved toward the gear by increasing the thickness of the horizontal inner spacer (550).
- 6.5 When tooth contact occurs as shown in Figure 6B, check the following items.
 - 6.5.1 Make sure the horizontal assembly is pressed tightly together. The spacer 550 should not be able to spin freely.
 - 6.5.2 If a gasket is used, make sure it was installed between the horizontal shaft carrier (15) and the gear case (10).
 - 6.5.3 Make sure that the gasket (if used) between the horizontal carrier and the gear case is 0.015" thick.
 - 6.5.4 If the above steps do not correct the tooth contact, then the pinion will have to be moved away from the gear by decreasing the thickness of the horizontal inner space (550). **Note:** Removal of stock from the spacer must be done on a surface grinder or in a lathe with the spacer mounted on an expanding mandrel.
- 6.6 When a tooth contact occurs as shown in Figure 7 or 8, refer to the following instructions.
 - 6.6.1 The most probably cause of cross contact or shaft angle error is that the horizontal carrier is cocked in the register of the gear case.
 - 6.6.2 To correct, remove the horizontal assembly and check for burrs, chips, a folded gasket (if used), or any condition that will prevent the horizontal carrier (15) from seating flat and square on the gear case (10). Contact the factory if the problem cannot be corrected.



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SPIRAL BEVEL GEARS—Typical Preferred Tooth Contact
 (Pinion Member Left Hand in All Cases Shown)

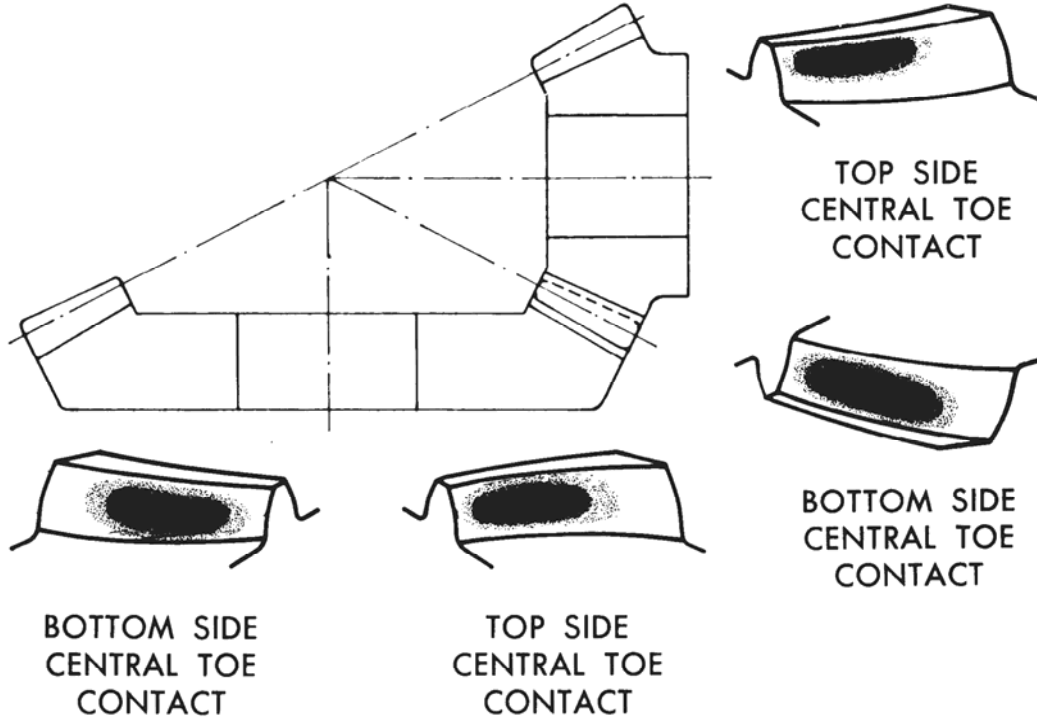
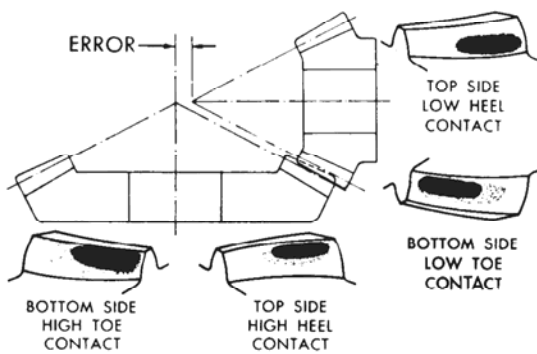


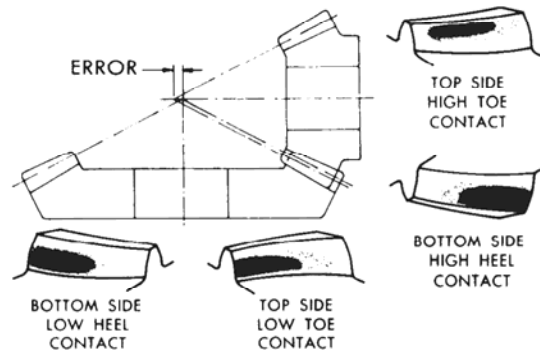
Figure 5

PROFILE ERROR—To Correct: move in on pinion cone.



(A)

PROFILE ERROR: To Correct: move out on pinion cone.



(B)

Figure 6



Proper profile contact and backlash must be obtained first before an attempt is made to correct for any of the following conditions if they should exist.

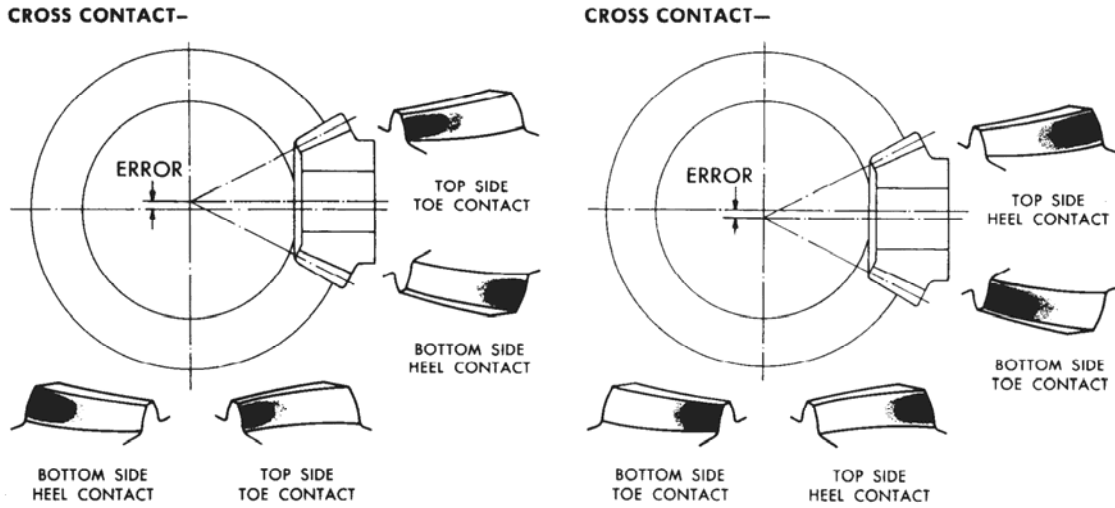


Figure 7

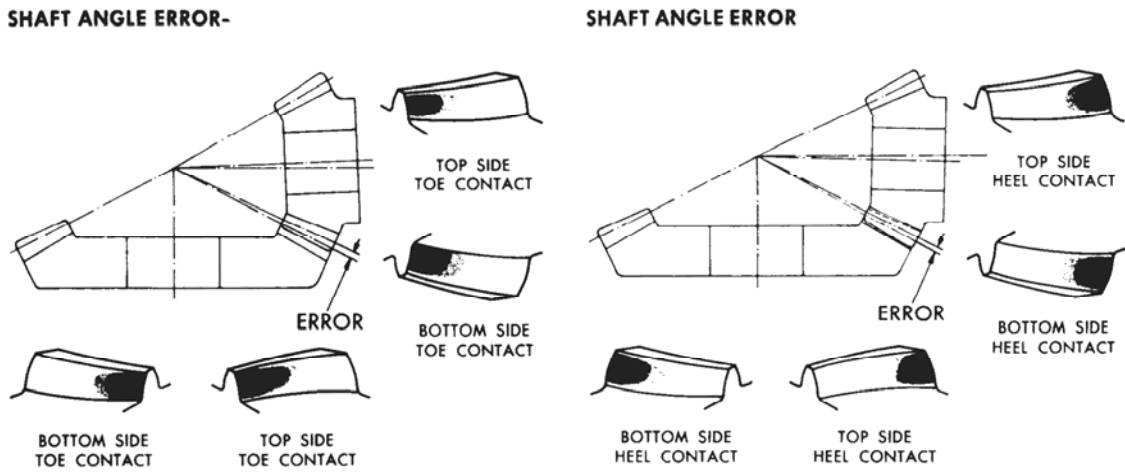


Figure 8



7.0 Backlash Adjustment

After correct tooth contact is obtained, the backlash must be rechecked according to the procedure outlined in Step 7.0

7.1 If the backlash is less than the amount etched on the gear set, the vertical gear will have to be moved away from the pinion (or for a speed increasing drive, the horizontal gear to be moved away from the vertical pinion). This is accomplished by removing stock from the vertical spacer (450) or horizontal outer spacer (550). **Note:** Removal of stock from the spacer must be done on a surface grinder or in a lathe with the spacer mounted on an expanding mandrel. This ensures that the ends of the spacer remain parallel to each other and perpendicular to the bore within 0.0002”.

7.2 If the backlash is more than twice the amount etched on the gear set, the vertical gear will have to be moved toward the pinion (or for a speed increasing drive, the horizontal gear to be moved toward the pinion). This is accomplished by increasing the length of the vertical spacer (450) or horizontal outer spacer (550). **Note:** When making a new spacer, make sure that the ends of the spacer are parallel to each other and perpendicular to the bore.

7.3 Use the following table to determine how much to change the appropriate spacer length. **The values given will change the backlash 0.001”.**

<u>Incr. Ratio</u>	<u>Change in Horizontal Spacer Length (in.)</u>	<u>Decr. Ratio</u>	<u>Change in Vertical Spacer Length (in.)</u>
1:1	0.0020	11:10	0.0019
10:11	0.0019	6:5	0.0018
5:6	0.0018	5:4	0.0018
4:5	0.0018	4:3	0.0017
3:4	0.0017	3:2	0.0017
2:3	0.0017	8:5	0.0017
4:7	0.0017	7:4	0.0017
1:2	0.0015	2:1	0.0015
9:4	0.0015		
5:2	0.0014		
3:1	0.0014		

7.4 When the backlash is within limits, proceed to Step 10.



8.0 Final Assembly

- 8.1 Cover the horizontal shaft keyway with tape to prevent the oil seal (802) from being cut as it slides over the keyway.
- 8.2 Replace the horizontal shaft oil seal (802).
- 8.3 Align the match marks and install the oil seal plate (16).
- 8.4 Align the match marks on the thrust bearing cover (21) and the thrust bearing carrier (12). Tighten all eight of the cap screws in the thrust bearing cover.

Note: On models without a non-reverse clutch, proceed to Step 10.7.

- 8.5 Using a 0.003 inch feeler, ensure that clearance exists between the thrust bearing cover (21) and drive sleeve (700).
- 8.6 Install the non-reverse clutch (24) on the drive sleeve (700). The drive pins (241) in the clutch must line up with the holes in the drive sleeve.
- 8.7 Align the match marks and install the cover (11) on the thrust bearing carrier (12).
- 8.8 Make sure that the oil line to the gears is located in the middle of the face width and $\frac{3}{4}$ " away from the gear mesh.
- 8.9 Coat the machined surface of the side inspection plate with Loctite 515 and install the plate on the gear case.
- 8.10 If equipped, mount the heat exchanger (302), with its brackets, on the gear drive and tighten the pipe fittings.
- 8.11 Fill the gear drive with the proper oil. See the Operating and Maintenance instructions for the proper type and amount of oil.
- 8.12 If possible, test the drive before installation or observe the initial operation after overhaul. Rotate the drive slowly until the heat exchanger and other lubrication system components are filled with oil. Ensure that the lubrication system is operating correctly.
- 8.13 Return the gear drive to service.



9.0 Machining of New Gear Mount (Refer to Figure 9)

Gear mounts as supplied by the factory are not finish machined on the gear mounting surfaces. These features are machined after the gear mount is assembled on the vertical shaft to assure that the ring gear will be perfectly centered. This operation will require a lathe with the ability to drive the shaft between centers.

- 9.1 Place the vertical shaft (400) between the centers on the lathe.
- 9.2 Machine surface "A", taking a 0.005" to 0.015" cut.
- 9.3 Machine diameter "D" to the same diameter as on the original gear mount or for a tight fit with the gear.
- 9.4 Machine surface "B", holding dimension "T" to the same thickness as the original gear mount.
- 9.5 Clean the cast iron dust from the shaft and gear mount.
- 9.6 Proceed to Step 5.4.

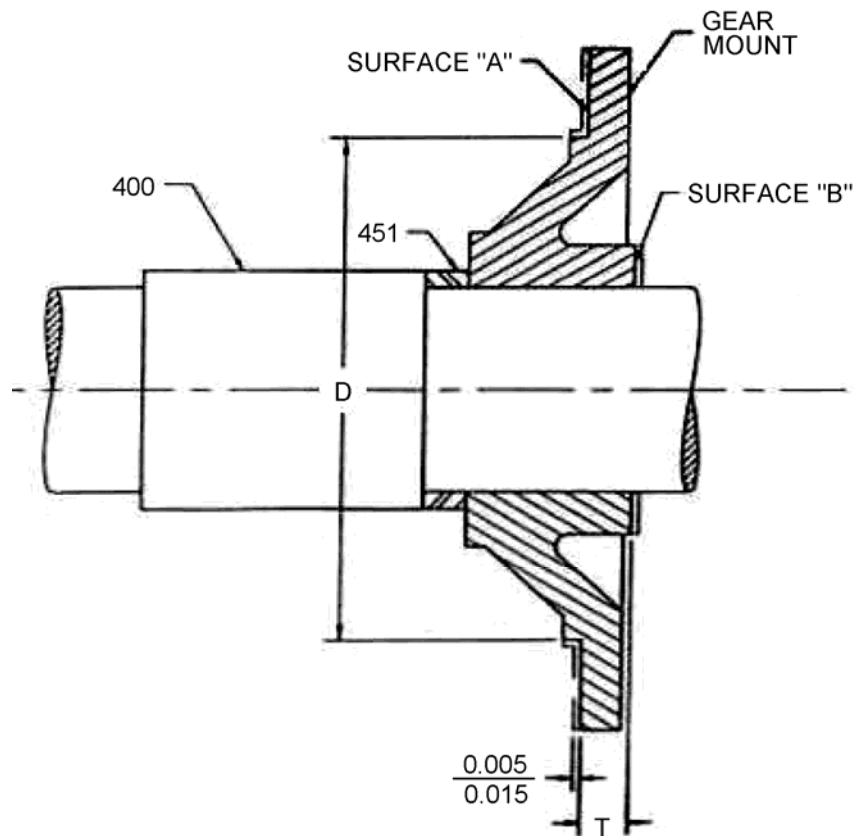


Figure 9 Gear Mount Machining