


# **amarillo**

**AMARILLO PUMP DRIVES  
MODEL 450A, 500A, 600A, 750A  
INSTRUCTIONS FOR REPAIRING  
FEBRUARY 9, 1998**

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**INSTRUCTIONS FOR REPAIRING  
AMARILLO RIGHT ANGLE GEAR DRIVES  
S & SH VERSIONS OF  
MODELS 450A, 500A, 600A AND 750A  
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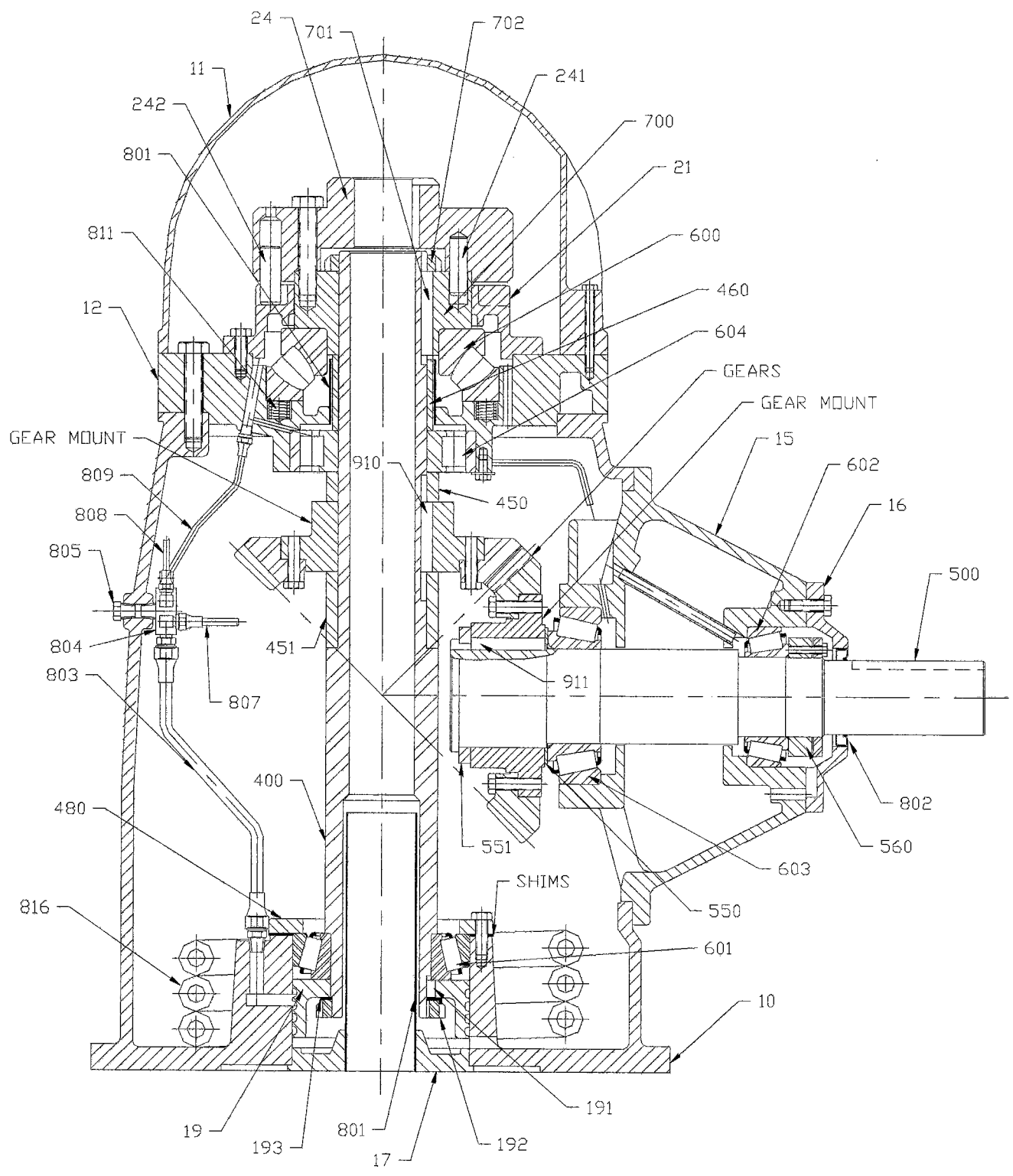
Amarillo Right Angle Pump Drives, if properly installed and maintained, should provide years of service, with a minimum amount of maintenance. Repairs, when required, usually involve bearing or gear replacement. While the job is not difficult, it should only be performed in an adequately equipped shop by capable personnel. It should be noted that any repairs made outside the factory without the consent of the manufacturer would void the warranty.

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## 1.0 General Disassembly Instructions.

- 1.1 Refer to the cross section drawing during disassembly. See Figure 1.
- 1.2 Drain and properly dispose of the oil.
- 1.3 Remove the side inspection plate (not shown).
- 1.4 Match mark the horizontal carrier (15) and the gear case (10).
- 1.5 Remove the horizontal shaft carrier (15) from the gear case (10) using the following procedure.
  - 1.5.1 Install guide pins in two bolt holes on opposite sides of the horizontal carrier.
  - 1.5.2 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.
  - 1.5.3 Guide the horizontal carrier assembly (15) out of the gear case (10) using a hoist.
- 1.6 Reach through the horizontal opening in the gear case (10) and remove the oil line(s) to the thrust bearing carrier (12).
- 1.7 Remove the top cover (11) and the non-reverse clutch (24).
- 1.8 Match mark the thrust bearing cover (21) and the thrust bearing carrier (12), and then remove the thrust bearing cover.
- 1.9 Install allthread, 180° apart, into two holes used to secure the thrust bearing cover (21). Place a draw bar, washers, and nuts over the allthread and tighten the draw bar until no movement in the vertical assembly is detectable.
- 1.10 Reach through the horizontal opening in the gear case (10) and remove the cap screws in the cup adjustment plate (480).
- 1.11 Lift the cup adjustment plate (480) and remove the shims. **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 eyebolts in the thrust bearing carrier (12). Note the position of the two eyebolts.



**FIGURE 1**

- 1.13 On large ratios, the vertical gear will not pass through the top opening in the gear case (10). Support the ring gear so that it will not fall to the bottom of the gear case and remove the cap screws.
- 1.14 Attach a hoist to the draw bar and slowly raise the vertical shaft assembly, taking care not to damage the oil tube (801), the remaining oil lines or the ring gear if it is unbolted from the gear amount.
- 1.15 Carefully set the assembly on a clean work surface, taking care not to damage the lower bearing (601) or oil screw (19). Remove the draw bar.
- 1.16 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.

## **2.0 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.

- 2.1 Remove the drive sleeve locknut (702) using a drift punch or spanner wrench. (Right Hand Threads)
- 2.2 The following steps will require the use a port-a-power between a spreader bar and the vertical shaft (400) and allthread to pull the components off of the vertical shaft.
  - 2.2.1 Thread the allthread into the drive sleeve (700), 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 (701).
  - 2.2.2 Thread the allthread into the threaded holes used to secure the thrust bearing cover (11). Lift the thrust bearing carrier (12) off of the shaft (400). Note: On some models, the outer race and rollers of the upper radial bearing (604) will be removed with the thrust bearing carrier.
- 2.3 Remove the between bearing spacer (460) and orient the assembly with the top of the vertical shaft (400) up and place in a press.
- 2.4 Press the gear (or gear / gear mount assembly), vertical spacer (450) and the inner race of the upper radial bearing (604) by blocking under the hub of the gear or gear mount and pressing on the end of the shaft (400). Remove the vertical shaft gear key (911) and under gear spacer (451) if present.
- 2.5 Remove the thrust bearing cup (600), and the pre-load springs (811) from the thrust bearing carrier (12). Drain the oil from the carrier.

- 2.6 Remove the two screws and washer retaining the upper radial bearing (604).
- 2.7 Pipe plugs are located on the topside of the thrust bearing carrier (12) in two of the raised surfaces between the springs. Remove the pipe plugs to expose the knockout holes, then remove the outer race of the radial bearing (604) using a drift punch.
- 2.8 Remove the thrust bearing cone (600) from the drive sleeve (700).
- 2.9 Bend the tab of the keyed washer (193) out of the groove in the oil screw locknut (192) and remove the locknut using a spanner wrench or drift punch. (Right Hand Threads)
- 2.10 Orient the vertical shaft assembly with the oil screw (19) up and place in a press.
- 2.11 Press off the lower bearing (601) and the oil screw (19) by blocking under the inner race of the bearing and pressing on the end of the shaft (400). **Note:** Be careful not to lose the oil screw key (191).
- 2.12 Slide the lower bearing cup (601) and the cup adjustment plate (480) off the vertical shaft (400).
- 2.13 If the gear is mounted on a gear mount and is being replaced, remove the bolts holding the gear to the gear mount. The gear may be removed from the gear mount by hitting lightly on the back of the gear with a soft mallet.

### **3.0 Disassembly of the Horizontal Shaft Assembly.**

- 3.1 Match mark to the oil seal plate (16) and the horizontal carrier (15).
- 3.2 Remove the oil seal plate (16). Press the oil seal (802) out of the oil seal plate.
- 3.3 Loosen the horizontal locknut set (560) from the end of the horizontal shaft (500) by removing the cap screws.
- 3.4 Remove the locknut set with a spanner wrench or drift punch. Remove the thinner portion first. (Right Hand Threads)
- 3.5 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).
- 3.6 For models with a locknut retaining the gear proceed as follows:
  - 3.6.1 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)

- 3.6.2 Orient the horizontal shaft (500) vertically with the gear up. Remove the pinion (and gear mount if present) by blocking under the pinion (or gear mount) and pressing on the end of the shaft.
- 3.6.3 Turn the horizontal shaft (500) over and remove the inner bearing (603) by blocking under the inner race and pressing on the end of the shaft.
- 3.7 For models without the gear retainer, use the following procedure:
  - 3.7.1 Orient the horizontal shaft (500) vertically with the pinion down.
  - 3.7.2 Remove the pinion (and gear mount if present) and the inner bearing cone (603) by blocking under the pinion (or gear mount) and pressing on the end of the shaft (500). **Do Not** block under the inner spacer (551) (if applicable).
- 3.8 Remove the horizontal shaft gear key (911). If a horizontal inner spacer is used, slide it off the shaft (500).
- 3.9 Remove the inner and outer bearing cups (602 & 603) from the horizontal carrier (15) using a brass punch or bearing puller.
- 3.10 If the gear is mounted on a gear mount and is being replaced, remove the bolts holding the gear to the gear mount. The gear may be removed from the gear mount by hitting lightly on the back of the gear with a soft mallet.



#### 4.0 General Assembly Instructions.

- 4.1 Wash all disassembled parts and housing thoroughly with clean solvent. Clean out all oil lines. Replace any lines that have been damaged.
- 4.2 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 the set. Along with the serial number, the mounting distance, part number, and minimum amount of backlash is etched on each member.
- 4.3 Do not remove bearings from their cartons until they are needed for use. Wash all used bearings in clean solvent. **DO NOT** spin dry the bearings with pressurized air. Lubricate each bearing and roll the cone in its cup to check for any roughness. To protect against contamination, cover any bearing that is not going to be used immediately.
- 4.4 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 their edges.
- 4.5 When pressing **ANY** component on a shaft or into housing, **ALWAYS** use an antigalling compound.
- 4.6 The correct gear positions are obtained through the use of spacers (450 & 550). The required lengths of the spacers 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. If the gear case (10), horizontal carrier (15) or thrust bearing carrier (12) is replaced, the assembled castings will have to be remeasured and the spacers changed accordingly. **Note:** On some models, the horizontal spacer is integral with the horizontal shaft (500).

#### 5.0 Assembly of Parts on the Vertical Shaft.

- 5.1 Slide the under gear spacer (451) onto the vertical shaft. (If Required)
  - 5.2 Insert the vertical gear key (910) into the vertical shaft keyway.
  - 5.3 Press the gear or gear mount onto the shaft (400). Make sure that the gear mount is pressed tightly against the under gear spacer.
- Note:** If a new gear mount was installed in Step 5.3, proceed to step 11.
- 5.4 If the gear will pass through the top opening of the gear case (10), bolt the gear to the gear mount.

- 5.5 Invert the vertical shaft (400) and slide the cup adjustment plate (480) and bearing cup (601) on to vertical shaft (400).
  - 5.6 Press the bearing cone (601) onto the vertical shaft (400). Take care not to damage the bearing roller cage.
  - 5.7 Insert the oil screw key (191) and press on the oil screw (19).
  - 5.8 Slide the keyed washer (193) onto the end of the shaft (400) and thread on the locknut (192). (Right Hand Threads)
  - 5.9 Tighten the locknut securely using a spanner wrench and bend a tab of the keyed washer into a groove on the locknut.
  - 5.10 Slide the outer race of the upper radial bearing (604) into the thrust bearing carrier (12). Secure with two cap screws and washers.
  - 5.11 Install the pipe plugs removed in step 2.7.
  - 5.12 Turn the vertical shaft (400) over and slide on the vertical spacer (450). Press on the upper radial bearing (604).
  - 5.13 Place the pre-load springs (811) in the recessed areas of the thrust bearing carrier (12). Check the pre-load springs to ensure they still have the proper temper. The top of the spring should protrude approximately 1/4" above the outer race seating surface on the thrust bearing carrier.
  - 5.14 Set the outer race of the thrust bearing (600) on top of the pre-load springs (811).
  - 5.15 Press the inner race of the thrust bearing (600) onto the drive sleeve (700).
  - 5.16 Set the thrust bearing carrier (12) down over the radial bearing (604) while rotating the carrier back and forth. Slide the between bearing spacer (460) onto the shaft (400).
  - 5.17 Insert the drive sleeve key (701) into the keyway in the vertical shaft (400) and press on the drive sleeve / inner race assembly (700 / 600) onto the shaft.
- Note:** **Make sure** that 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.
- 5.18 Thread the drive sleeve locknut (702) on the shaft (400) and tighten securely using a spanner wrench or drift punch. (Right Hand Threads)
  - 5.19 Install allthread, 180° apart, into two holes used to secure the thrust bearing cover (21). Place a draw bar, washer and nuts over the allthread and tighten the draw bar

until the thrust bearing (600) has compressed the springs (811) and is seated in the thrust bearing carrier (12). This requires a force of approximately 5,000 lb.

- 5.20 Coat the top of the gear case (10) with plastic lead seal (or equivalent).
  - 5.21 If the gear will not pass through the top opening of the gear case (10) set the gear inside the gear case through the horizontal opening. Support the gear as a position where the gear mount will just start into the register on the gear.
  - 5.22 Using a hoist attached to the draw bar, slowly lower the vertical assembly into the gear case (10). Take care not to damage the oil tube (801) oil lines or gear (if applicable). Make sure the match marks on the thrust bearing carrier (12) and the gear case are aligned.
  - 5.23 Install the cap screws and two eyebolts in the thrust bearing carrier (12) and tighten securely. Make sure the eyebolts are placed in the same location noted in step 1.12.
  - 5.24 If applicable, bolt the gear to gear mount.
  - 5.25 Place the shims under the cup adjustment plate (480). Make sure that the thickness of the shim set is the same on both sides.
- Note:** Do not attempt to remove or install the cup adjustment plate without compressing the thrust bearing pre-load springs (811).
- 5.24 Insert the cap screws into the cup adjustment plate (480) and securely tighten. Make sure that the plate is resting on the top of the lower bearing cup (601).
  - 5.25 Attach a dial indicator on top of the thrust bearing carrier (12), so that the indicator reads off of the drive sleeve (700). While watching the dial indicator, loosen the nuts on the draw bar. The indicator should read 0.001 to 0.003 inch T.I.R.
  - 5.26 If the reading is outside the limits, tighten the nuts on the draw bar to compress the pre-load springs (811) and 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, loosen the draw bar nuts and rotated the shaft several revolutions to seat the bearing. Tighten the draw bar nuts and repeat step 5.25.
  - 5.27 Connect the oil line(s) to the thrust bearing carrier (12).
  - 5.28 Rotate the vertical shaft (400) until the two gear teeth marked with "X" are located at the horizontal opening of the gear case (10).

## 6.0 Assembly of the Horizontal Shaft Assembly

- 6.1 Press the bearing cups (602 & 603) into the horizontal carrier (15).

- 6.2 Use the following procedure if a gear retainer is used:
- 6.2.1 Insert the horizontal shaft gear key (911) into the shaft keyway.
  - 6.2.2 Press the pinion on the horizontal shaft (500).
  - 6.2.3 Place the keyed washer on the end of the shaft and thread on the locknut. (Right Hand Threads)
  - 6.2.3 Tighten the locknut with a spanner wrench or drift punch. Bend one of the washer tabs into a groove in the locknut.
  - 6.2.4 Turn the shaft (500) over so that the pinion is down. Slide on the horizontal outer spacer (550) (if it is not part of the shaft).
  - 6.2.5 Press the inner bearing cone (603) on the shaft. Take care not to damage the bearing roller cage. Ensure that the bearing seats tightly against the spacer (550).
- 6.3 Use the following procedure if the model does not use a gear retainer:
- 6.3.1 Slide on the horizontal inner spacer (551), if applicable, onto the shaft and insert the horizontal gear key (911) into the shaft keyway.
  - 6.3.2 Press pinion or gear mount if applicable, on the horizontal shaft (500).
- Note:** If a new gear mount was installed in step 6.3.2, proceed to step 11.
- 6.3.3 Slide the horizontal outer spacer (550) over the shaft and press on the inner bearing cone (603). Take care not to damage the gear roller cage. Ensure that the bearing seats tightly against the spacer (550).
- 6.4 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 adjustments will be made using locknut (560).
- 6.5 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 cup. Do not tighten. (Right Hand Threads).
- 6.6 Insert the horizontal assembly into the gear case (10). A non-compressible gasket approximately 0.015 inch thick should be placed between the horizontal carrier (15) and the gear case (10). **Note:** Make sure that the timing mark "X" on the pinion is aligned with the timing marks on the gear. Also make sure the match marks on the horizontal carrier and gear case are aligned. Install and tighten the cap screws.
- 6.7 Mount a dial indicator between the horizontal carrier (15) and the end of the

- horizontal shaft (500) so that the axial movement of the shaft can be measured.
- 6.8 Tighten the locknut (560) with a spanner wrench or drift punch until the in and out movement (bearing clearance) is from 0.005 to 0.006 inch T.I.R. **Note:** The horizontal shaft should be rotated before each reading so the bearings will remain seated.
  - 6.9 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.
  - 6.10 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.

## 7.0 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.

- 7.1 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.
- 7.2 Place a key in the horizontal shaft (500) keyway and retain with a C-clamp to eliminate any movement between the key and shaft.
- 7.3 Place a dial indicator against the key and set to zero.
- 7.4 Measure the distance from the center of the shaft (500) to the contact point between the indicator and the key (see Figure 2). This is the “r” value in the equation in step 7.6.
- 7.5 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.
- 7.6 Calculate the backlash using the following equation. The “C” value is found in Table 1.

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

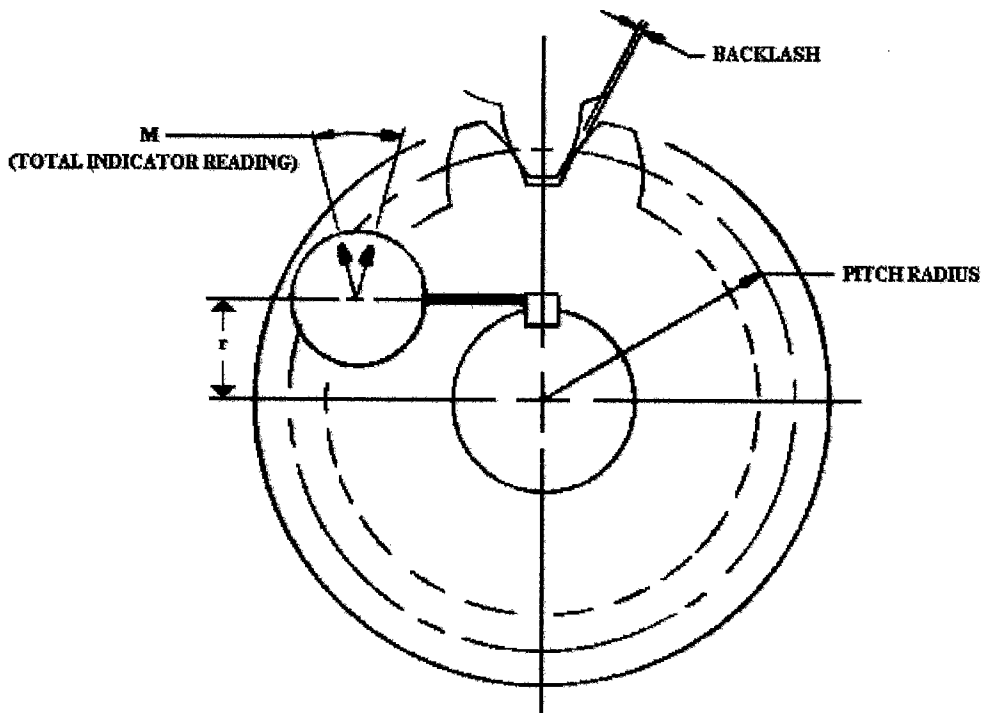
- 7.7 The amount of backlash must not be less than the amount etched on the gear set; however, the backlash may be as high as twice the etched value. If the backlash is not within the limits stated above, it must be corrected. Refer to Step 10 after performing the tooth contact pattern check. **NEVER** run the gears without backlash.

**Table 1**  
**Vaules of "C" Used In Backlash Caclulations**

<u>Ratio</u>	<u>450A</u>	<u>500A</u>	<u>600A</u>	<u>750A</u>
1:1	6.000	6.125	6.125	6.500
10:11	5.666	6.500	6.500	7.500
5:6	6.167	6.167	6.750	7.991
4:5	6.750	6.750	6.750	7.250
3:4	6.492	6.492	7.834	7.834
2:3	7.273	7.273	8.333	8.333
4:7	8.500	8.500		10.000
1:2	8.703	8.703		10.000

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11:10	5.167	5.898	5.898	6.731
6:5	5.333	5.333	5.333	5.333
5:4	5.000	5.000	5.400	5.400
4:3	4.912	4.912	4.912	4.912
3:2	4.286	4.909	4.909	4.909
8:5	4.688	4.688	4.688	4.688
7:4	3.764	4.833	4.833	4.833
2:1	3.425	3.425	3.425	3.425
9:4	3.760	3.759	3.759	3.759
5:2	3.512	3.512	3.512	3.512
3:1	2.786	2.786	2.786	2.786



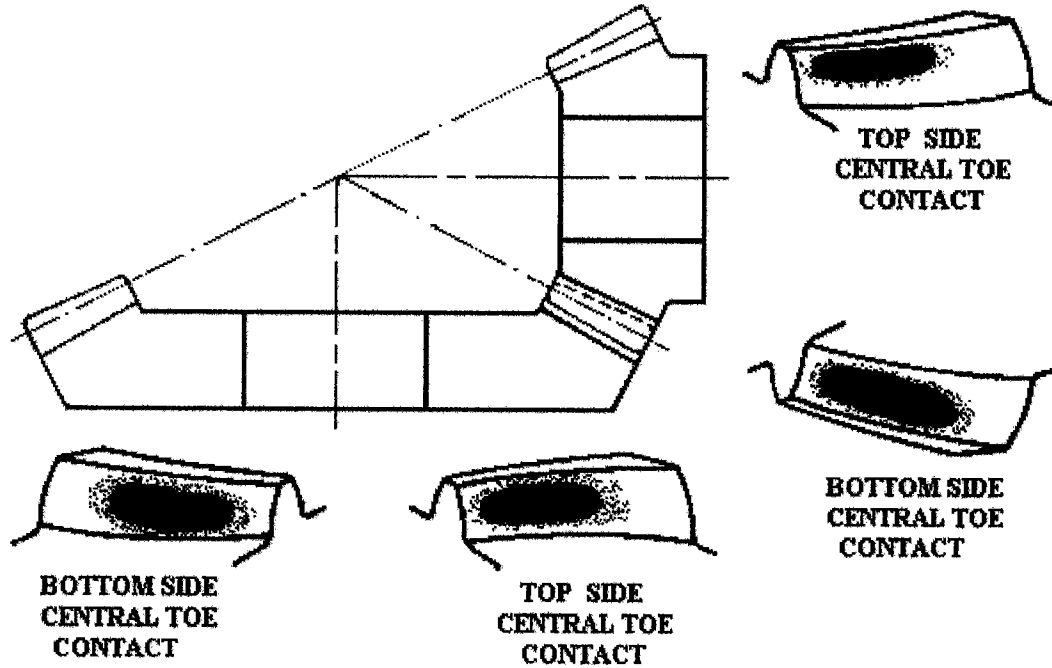
**FIGURE 2**

## 8.0 Tooth Contact Pattern Check.

- 8.1 Remove the spreader bar from the top of the gear drive.
- 8.2 Apply a suitable marking compound to the teeth of the gears and rotate the horizontal shaft.
- 8.3 The correct tooth contact for a gear set is shown in Figure 3. If the tooth contact is correct and the backlash is within limits, proceed to step 10.0. If the tooth contact is correct and backlash need to be corrected, proceed to step 9.0.
- 8.4 Figure 4 shows the two most common forms of incorrect tooth contact. When a tooth contact occurs as shown in Figure 4A, check the following items.
  - 8.4.1 Make sure the horizontal shaft carrier (15) is pulled up tightly to the gear case (10).
  - 8.4.2 Make sure that only one gasket was used between the horizontal carrier (15) and the gear case (10).
  - 8.4.3 Make sure that the gasket used between the horizontal carrier (15) and the gear case (10) is 0.015 inch thick.
  - 8.4.4 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 outer spacer (550).
- 8.5 When tooth contact occurs as shown in Figure 4B, check the following items.
  - 8.5.1 Make sure that a gasket was installed between the horizontal carrier (15) and the gear case (10).
  - 8.5.2 Make sure that the gasket used between the horizontal carrier (15) and the gear case (10) is 0.015 inch thick.
  - 8.5.3 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 outer spacer (550). **Note:** Removal of stock from the spacer must be done on a surface grinder or in lathe with the spacer mounted on an expanding mandrel.
- 8.6 When the tooth contact occurs as shown in Figure 5 or 6, refer to the following instructions.
  - 8.6.1 The most probable cause of cross contact or shaft angle error is that the horizontal carrier (15) is cocked in the register of the gear case (10).
  - 8.6.2 To correct, remove the horizontal assembly and check for burrs, chips, a

folded gasket or any condition that will prevent the horizontal carrier from seating flat and square on the gear case (10). Contact the factory if the problem cannot be corrected.

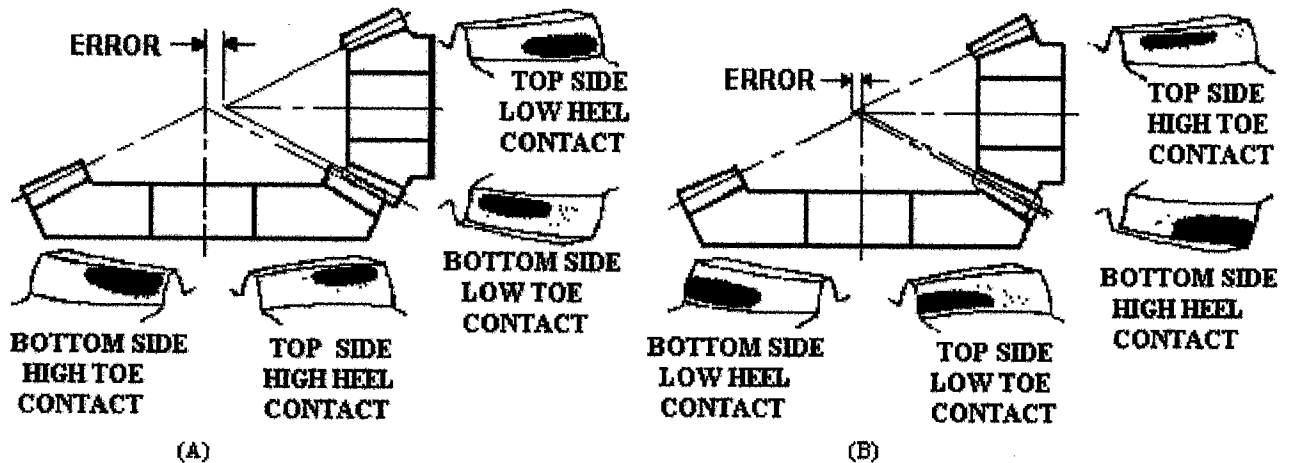
**SPIRAL BEVEL GEARS -- Typical Preferred Tooth Contact**  
 (Pinion Member Left Hand in All Cases Shown)



**FIGURE 3**

**PROFILE ERROR--To Correct: move in on pinion cone.**

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



**FIGURE 4**



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.

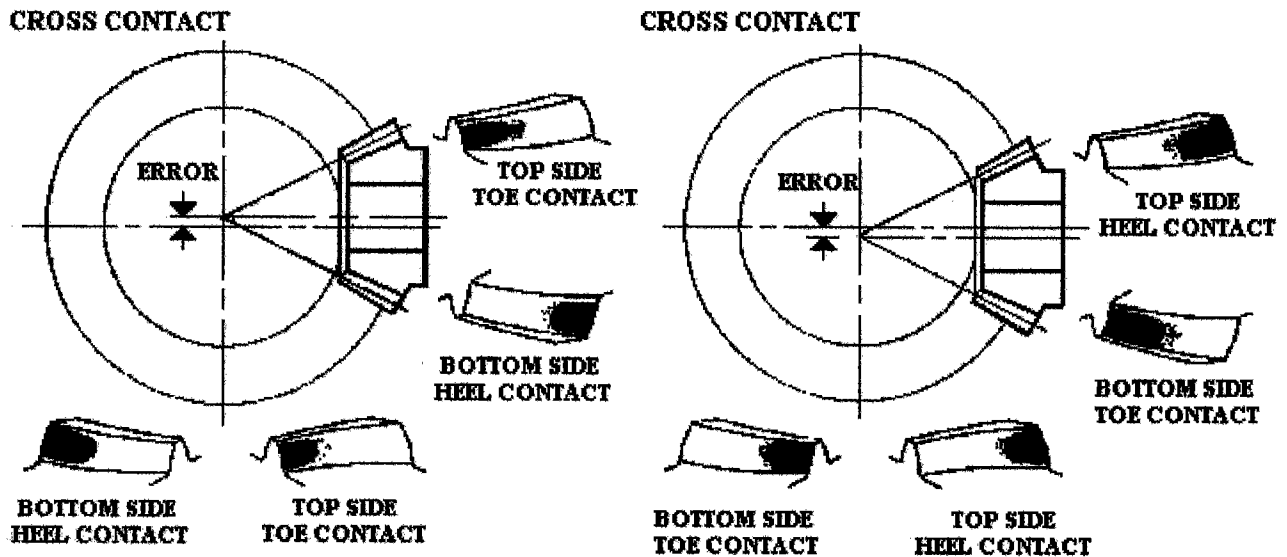


FIGURE 5

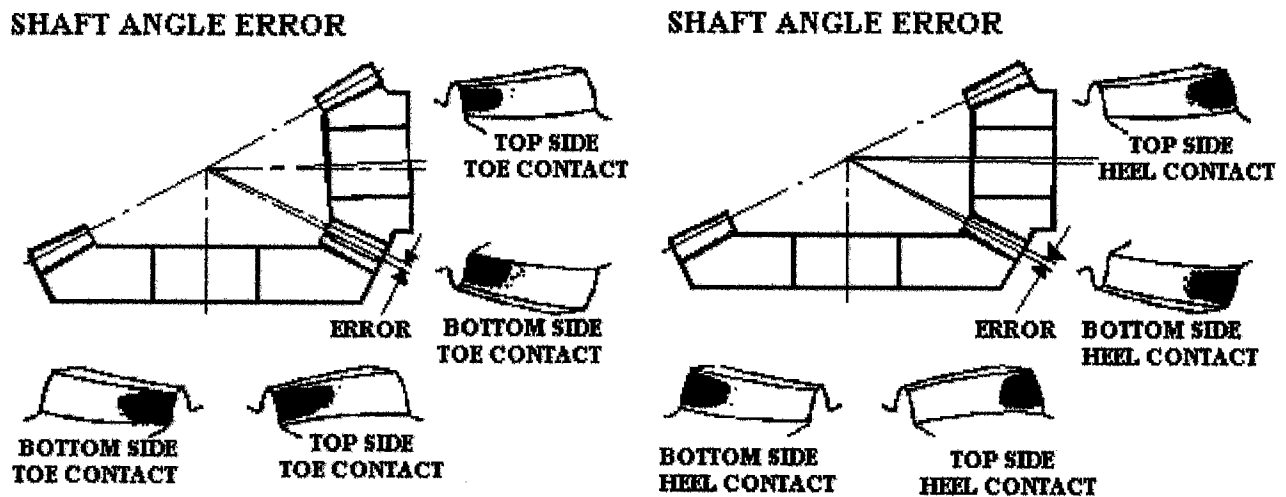


FIGURE 6

## 9.0 Backlash Adjustment

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

- 9.1 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. This is accomplished by removing stock from the vertical spacer (450). **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 inch.
- 9.2 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. This is accomplished by increasing the length of the vertical spacer (450). **Note:** When making a new spacer, make sure that the ends of the spacer are parallel to each other and perpendicular to the bore.
- 9.3 Use the following table to determine how much to change the appropriate spacer length. **The values given will change the backlash 0.001 inch.**

<u>Incr.</u> <u>Ratio</u>	<u>Change in Horizontal</u> <u>Spacer Length (in.)</u>	<u>Decr.</u> <u>Ratio</u>	<u>Change in Horizontal</u> <u>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

- 9.4 When the backlash is within limits, proceed to Step 10.0.

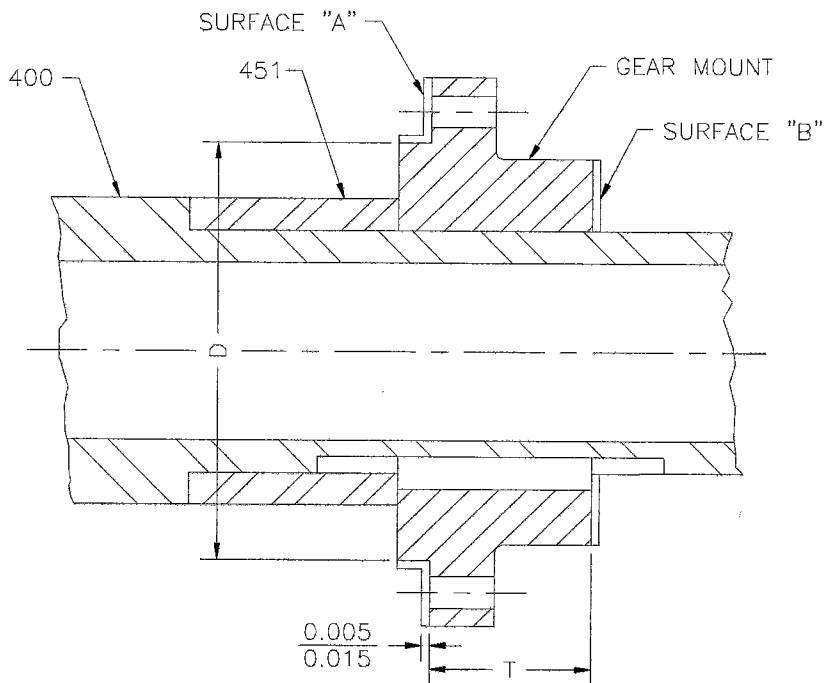
## 10.0 Final Assembly.

- 10.1 Cover the horizontal shaft keyway with tape to prevent the oil seal (802) from being cut as it slides over the keyway.
- 10.2 Replace to horizontal shaft seal (802) in the oil seal plate (16.)
- 10.3 Align the match mark on the horizontal carrier and oil seal plate (15 & 16) and install the seal plate.
- 10.4 Fill the thrust bearing carrier (12) with oil. The oil level should be just below the oil drain holes located around the outside diameter of the thrust bearing (600). Refer to the Operation and Maintenance Instructions for the proper type of oil.
- 10.5 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.
- 10.6 Using feeler gauges, ensure that equal clearance on all sides is maintained between the thrust bearing cover (21) and the drive sleeve (700).
- 10.7 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.
- 10.8 Make sure that the oil line to the gears is located so that it is pointing toward the lower 1/3 of the tooth face and 3/4" away for the gear mesh.
- 10.9 Install the side inspection place on the gear case (10).
- 10.10 Fill the gear drive with the proper oil. See the Operating and Maintenance Instructions for the proper type of oil.
- 10.11 If possible, test the drive before installation or observe the initial operation after overhaul. The installation of a pressure gauge in the oil test port at the initial start up will help in determining that the lubrication system is operating properly. Normally during cold start-ups, the oil pressure will range from 5 to 10 psi.
- 10.12 Return the drive to service.

## 11.0 Machining of New Gear Mount. (Refer to Figure 7)

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 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.

- 11.1 Place the shaft with the gear mount (400 or 500) between the centers on the lathe.
- 11.2 Machine surface "A", taking 0.005 to 0.015 inch cut.
- 11.3 Machine diameter "D" to the same diameter as on the original gear mount or for a tight fit with the gear. Normally, this fit is 0.0005" loose to 0.0005" tight.
- 11.4 Machine surface "B", holding dimension "T" to the same thickness as the original gear mount.
- 11.5 Clean the cast iron dust from the shaft and gear mount.
- 11.6 Proceed to Step 5.3 or Step 6.3.3, whichever is applicable.



**FIGURE 7**