



502-WGR-001-00

**SERVICE MANUAL**  
**AND**  
**REPAIR PARTS**  
**FOR**  
***L.H. and R.H. Worm***  
***Gear Reducer***  
***(4" Center Distance)***



**WARNING: Read this manual before any installation, maintenance or operation.**



**FORCE CONTROL INDUSTRIES, INC.**

**MANUFACTURERS OF MECHANICAL AND  
ELECTRICAL POWER TRANSMISSION EQUIPMENT**

***Worldwide Leader In Oil Shear Technology***

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# Section 1 - Description & Operation

## 1-1 THE OIL SHEAR PRINCIPLE

Conventional brakes and clutches depend on friction between solid surfaces operating in air to transmit torque. Friction can do the job, but produces a great amount of heat and wear, causing an increase in replacement parts, maintenance, and downtime.

In **Force Control Oil Shear Drive Systems** the friction surfaces operate in cooling and lubricating fluid. The oil molecules tend to cling to each other as well as the friction surfaces. As moving and stationary elements are brought together, a thin but positive film of oil is maintained between the friction surfaces, controlled by the clamping pressure and carefully designed grooves in the friction material.

Torque is transmitted from one surface to the other through the viscous shear of the oil film. The friction surfaces are protected by this film and therefore sur-

face wear is greatly reduced. The positive flow of fluid between the discs also effectively transmits heat away from the friction surfaces.

## 1-2 SYSTEM DESCRIPTION

The Gear Box is the worm gear reducer used in many palletizing Systems. There is a R.H. Gear Box, a L.H. Gear Box and a Shaft Mounted *Posistop* Brake. The Gear Boxes are identical except for Shaft Orientation. This manual covers both the L.H. and R.H. Gear Boxes. See Manual #502-210-SM-001-00 for the *Posistop* Shaft Mounted Brake. See *Figure 1.1* below.

## 1-3 UNIT FEATURES

The Worm Gear Reducer Cross Section (*Figure 1.2*) on the next page shows the Gear Box and it's many features.

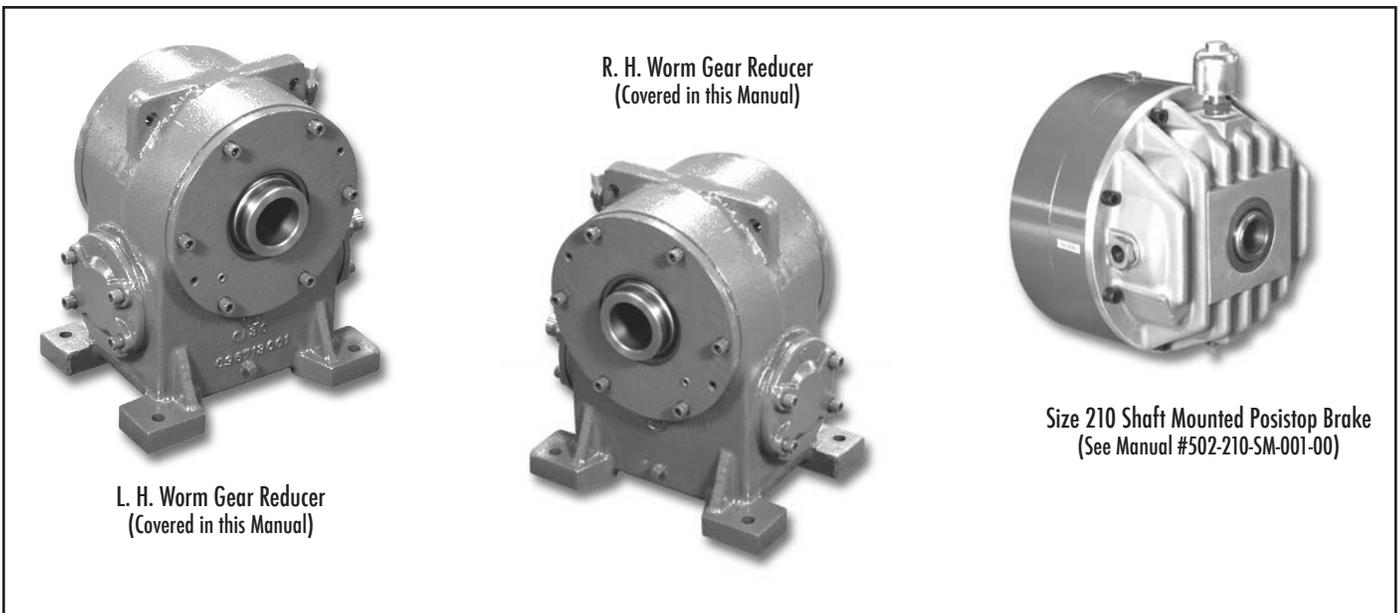


Figure 1.1 - Palletizer System Components

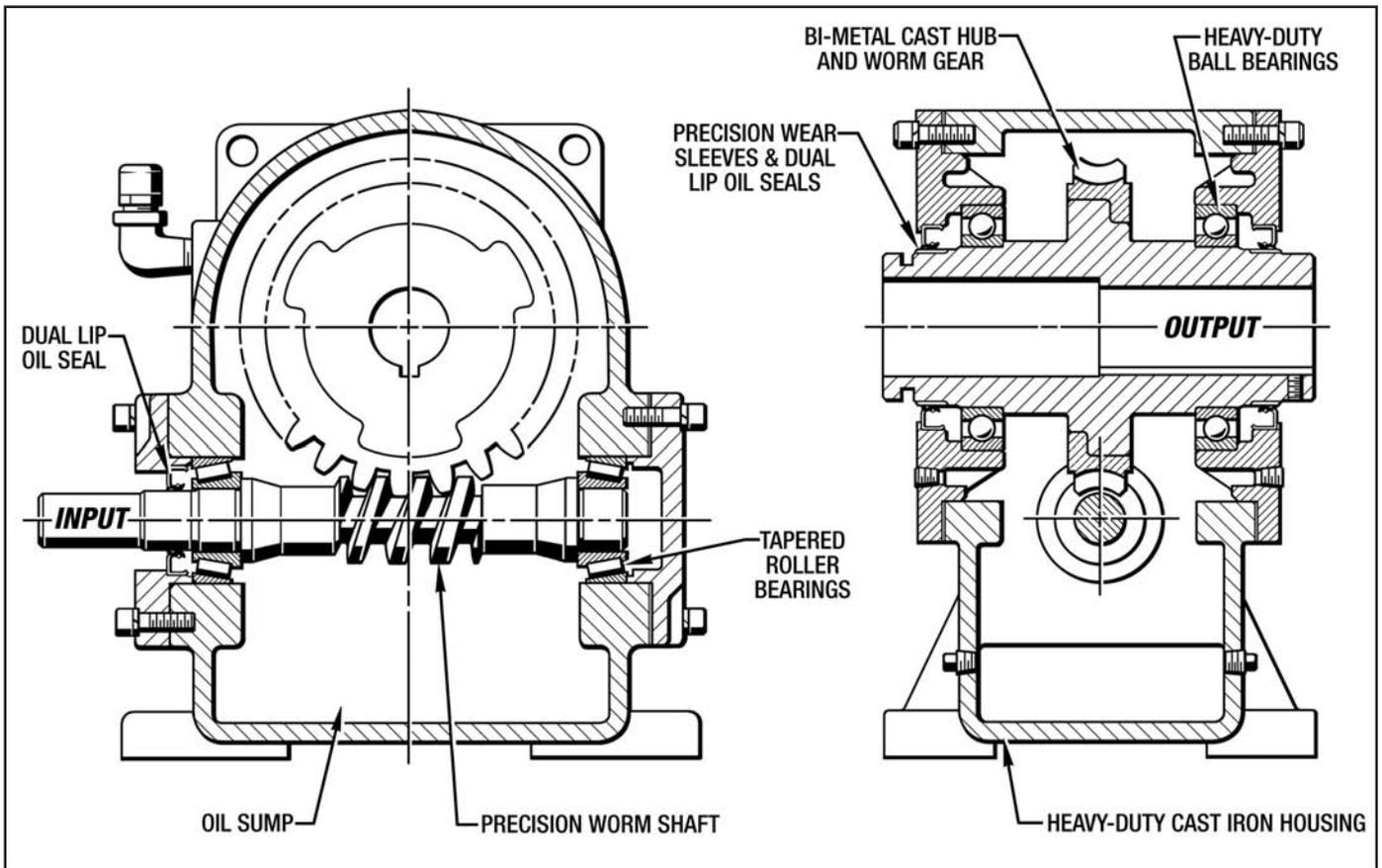


Figure 1.2 - Worm Gear Reducer Cross Section

# Section 2 - Operating Specifications & Dimensions

## 2-1 OPERATING SPECIFICATIONS

INPUT SPEED (RPM)	1750	1250	900	625
INPUT HP	5.77	5.05	4.28	3.40
OUTPUT HP	5.14	4.43	3.69	2.86
OPERATING TORQUE (In. Lbs.)				
TORQUE-INPUT	207	254	299	342
TORQUE-OUTPUT	3,702	4,468	5,168	5,768
EFFICIENCY	89%	88%	86%	84%

NOTE: Above estimated torque ratings are based on AGMA 440.04 Calculation Method. Additional values are available upon request.

Reducer Gear Lube Capacity - 3 Quarts Mobile 634 or 600W.

Gearbox Weight - 139 Lbs.

## 2-2 DIMENSIONS

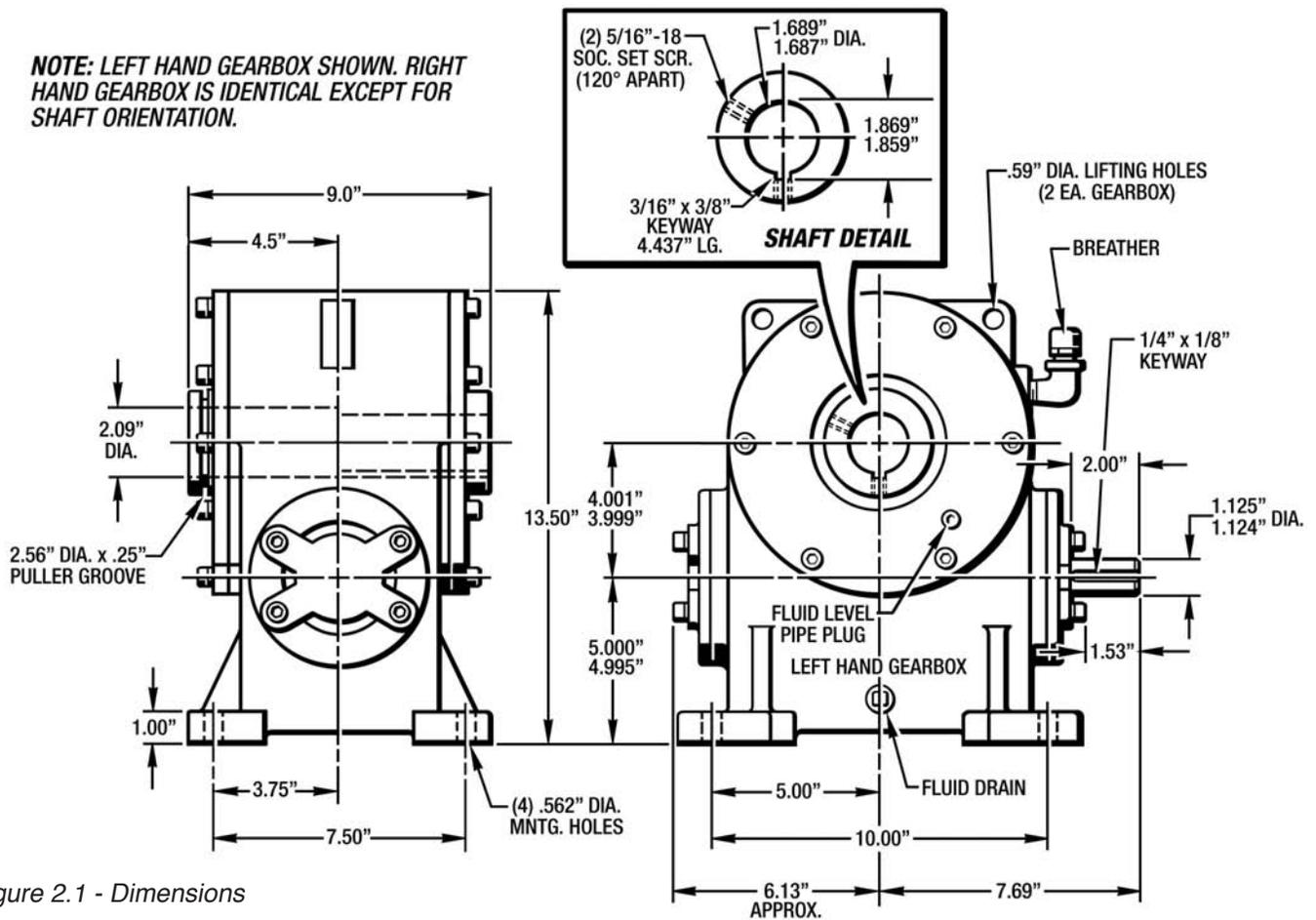


Figure 2.1 - Dimensions

Dimensions are subject to change without notice. Certified Installation Drawings are available upon request.

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## Section 3 - Important Safety Precautions

### THIS SECTION 3 ONLY PERTAINS TO PALLETIZER SYSTEMS.

#### WARNING:

THE GEAR REDUCER UNIT DESCRIBED IN THIS MANUAL MUST NOT BE INSTALLED IN ANY MANNER EXCEPT AS SPECIFIED HEREIN, AND MUST NOT BE OPERATED AT SPEEDS, TORQUE LOADS, OR TEMPERATURES OTHER THAN THOSE SPECIFIED IN THIS MANUAL. FAILURE TO LIMIT OPERATIONS OF THE GEAR REDUCER TO THE CONDITIONS SPECIFIED COULD DAMAGE THE UNIT, WILL VOID ANY WARRANTIES, AND MAY CAUSE MALFUNCTIONS OR DAMAGE TO INTERCONNECTING EQUIPMENT.

#### CAUTION: BEFORE PERFORMING ANY WORK ON THE GEAR BOX, TAKE THE FOLLOWING SAFETY PRECAUTIONS.

1. Lower the main hoist to the down position.
2. After the main hoist has been safely positioned, the machine must be made safe to enter.

Push one of the Emergency Stop buttons located at the following: A. Main Electrical Panel, B. Main Hoist Frame, C. Pallet Magazine Remote, D. Remote Control Panel on top of the palletizer.

#### CAUTION: DO NOT ENTER THE MACHINE YET.

If maintenance must be performed on the machine, the main power must be locked out at the main electrical control panel.

#### CAUTION: THE HOIST MUST BE IN THE DOWN POSITION.

### 3-1 MAIN PANEL LOCKOUT PROCEDURE

Turn the Main Power Disconnect switch to the OFF position at the Main Electrical Control Panel.

Insert a lock into the switch, and place an identifier tag at the lock to indicate the machine is being worked on by you and why.

#### NEVER REMOVE A LOCKOUT UNLESS YOU HAVE PERMISSION TO.

Now try to operate some of the controls. The machine should not operate. If the machine will operate call a qualified maintenance technician.

### REMEMBER TO “LOCKOUT & TRY OUT”

#### CAUTION: THE MAIN HOIST SHOULD BE IN THE DOWN POSITION.

If the palletizer will not operate it is safe to enter the machine.

3. Manually release the existing brake. The main hoist should move downward slightly and come to rest on the lower frame of the palletizer. If not, reset the brake and install cribbing to support the main hoist to prevent it from moving down.
4. The drive shaft connecting the motor and reducer high speed shafts must be removed to access the brake. Match mark the drive shaft couplings so that machine timing can be restored when the brake installation is complete. Remove the drive shaft and set aside.

## Section 4 - Lubrication

### 4-1 CHECKING THE OIL LEVEL

Check the oil level when the drive is installed and weekly thereafter (until experience dictates otherwise). Always check the oil level with the unit stationary (not running). The oil level should be at the bottom of the pipe plug hole. **NOTE** - The Oil Level Pipe Plugs (#835) are on both sides so the oil level is visible from either side. See *Figure 4.1*.

### 4-2 CHANGING THE OIL

Oil in the Worm Gear Reducer should be changed every twelve (12) months. More frequent oil change may be required for high kinetic energy applications or in extremely dirty environments.

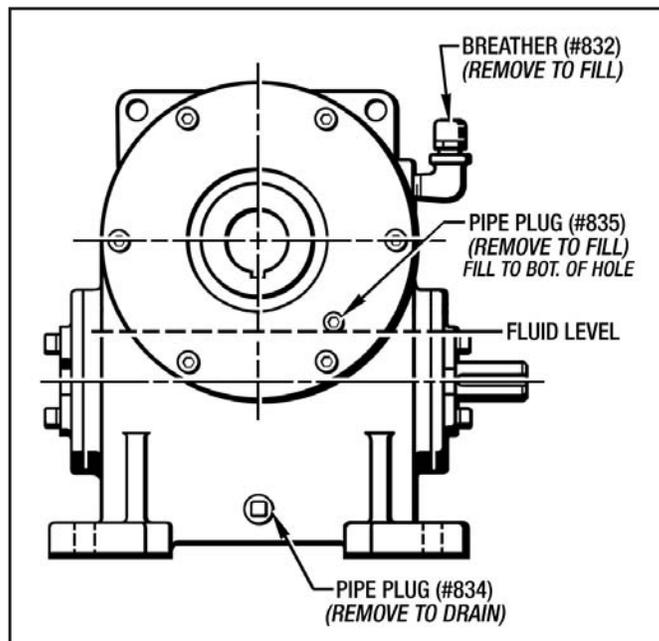
#### A. Worm Gear Reducer

Remove the Drain Plug (#834) at the bottom of the main housing. Drain all oil before refilling. Replace the drain plugs. Remove Breather (#832) and Oil Level Plug (#835). Refill unit with clean oil until oil comes up to the oil level hole and replace Pipe Plug (#835) and the Breather (#832).

**WARNING: Failure to install the Air Breather (#832) properly could cause damage to the unit and void the Warranty.**

#### CAUTION

**Do not over-fill. Excess oil will cause the unit to overheat.**



*Figure 4.1 - Lubrication*

### 4-3 TYPE OF OIL

#### A. Worm Gear Reducer

Use Mobilgear 634 or 600W Cylinder Oil ONLY (Unless otherwise specified on the unit nameplate).

## Section 5 - Installation

### 5-1 RECEIVING THE WORM GEAR REDUCER

1. Remove the red plastic pipe plug in the side of the Gear Reducer Housing and install the Street Elbow (#836) and the Air Breather (#832).

**WARNING: Failure to install the Air Breather (#832) properly could cause damage to the unit and void the Warranty.**

2. Check the fluid level as indicated in Section 4 - Lubrication. Add fluid if necessary.

### 5-2 MOUNTING THE WORM GEAR REDUCER

(See Figure 5.1)

Use 1/2"-13 SAE Grade 5 Hex Hd. Mounting Bolts and Lockwashers.

Make sure the mounting surface is thoroughly cleaned and free of any burrs or surface defects that would cause misalignment.

1. Check the fit for the Thru-shaft by sliding the Thru-Shaft back and forth through the hub bore to make sure that it is a smooth slip-fit.

Check the fit of the Thru-shaft with the Key installed. Make sure that there is no binding around the keyway.

**NOTE** - Use *Never-Seeze* or a good synthetic high temperature grease on the shaft and key.

2. Install the Gear Reducer on the machine. Only hand tighten the mounting bolts at this time.
3. Install the Thru-Shaft and tighten the Pillow Block Bearings.
4. Align the Input Shaft to the Power Source. Use an adequate non backlash coupling. Make sure the Axial, Parallel and Angular Alignment is correct as per the Couplings Manufacturers' Alignment Specifications.
5. Shim under the motor as needed to assure correct alignment.

**NOTE** - If the Thru-Shaft determines the vertical position of the gear box, you may also have to shim under the gear box feet to accommodate for any vertical space to the mounting surface.

6. Tighten down mounting bolts. **Torque to 60 Lb. Ft.**
7. After the Worm Gear Reducer has been in operation for a few hours, make sure the mounting bolts are tight and re-check alignment.
8. After the Worm Gear Reducer has been in operation for 40 hours, make sure the mounting bolts are still tight. Tighten if necessary.

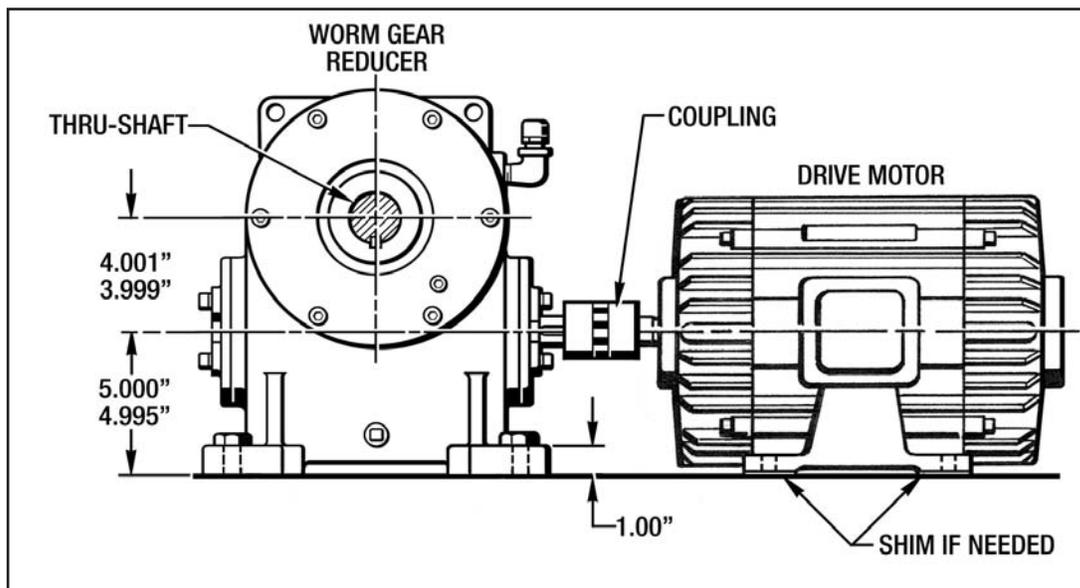


Figure 5.1 - Worm Gear Reducer Installation

# Section 6 - Troubleshooting

## 6-1 TROUBLESHOOTING CHART

PROBLEM	POSSIBLE CAUSE	CORRECTION
A. Noise and vibration.	Improper or loose mounting of gear reducer.  Worm Gear worn causing excessive backlash.	Check mounting and correct if necessary. If partial disassembly is required refer to Section 7.  See <i>Figure 6.1</i> below to check backlash. If partial disassembly is required refer to Section 7.
B. Unit overheats	Improper oil level	Check oil level & add or drain if necessary.
C. Oil leakage	Oil seal lip damaged.  O-Ring seals.	Check for leakage around shaft. Replace oil seal or wear sleeve if necessary.  Tighten all external bolts. If leak continues, check for damage.
D. Leakage at breather.	Oil level too high.	Drain excess oil.

## 6-2 CHECKING WORM GEAR FOR EXCESSIVE BACKLASH

1. Lock the Worm Gear and Hub in place so that it can't turn.
2. Install a key into the Worm Shaft.
3. Mount a Magnetic Mounted Dial Indicator to the side of the gear box as shown in *Figure 6.1*.
4. Rotate the Worm Shaft back and forth by hand.

Normal backlash should read between .020" and .030" TIR. If the Dial Indicator TIR reads .040" to .050", that indicates Excessive Backlash and possible replacement of the Worm Gear & Hub. (See Section 8 for further measurement.)

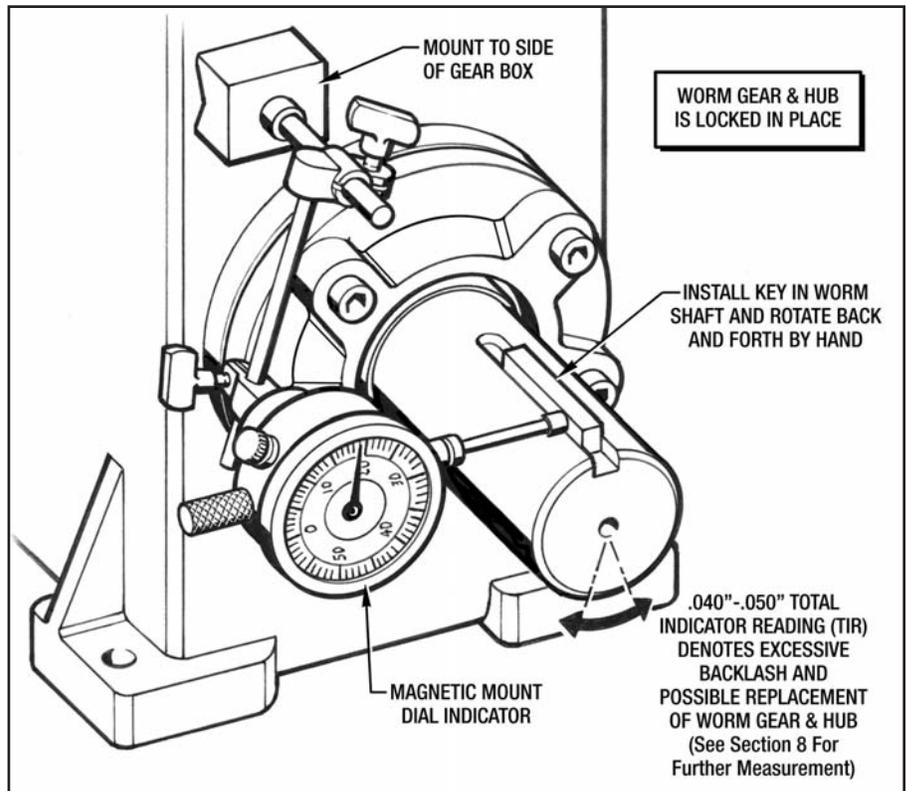


Figure 6.1 - Measuring Worm Gear Backlash

## Section 7 - Disassembly

Only disassemble the Worm Gear Reducer to the extent necessary to replace the worn or damaged parts.

Refer to *Figure 10.1* for a visual reference to all parts described in this Disassembly Section.

**Turn-Off and Lock-Out all pneumatic and electrical power to the Palletizer or any Connecting Machinery before attempting any repairs. (See Section 3 - Important Safety Precautions)**

Remove the Worm Gear Reducer from the Operating Machinery and move it to a suitable work bench.

### 7-1 MAJOR DISASSEMBLY PROCEDURE

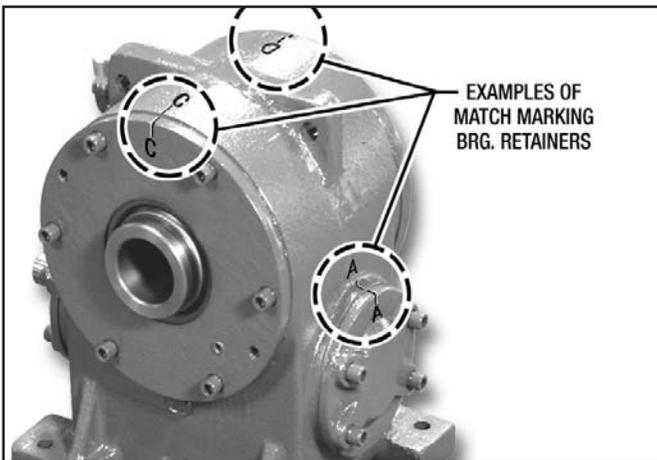


Figure 7.1 - Match-Marking Bearing Retainers

1. First Match-Mark all (4) Bearing Retainers for Orientation and Location. See *Figure 7.1* for examples. Use whatever method suits you best. Stamping, painting or marker. Just so they get reassembled back in the correct location and orientation.
2. Remove Drain Plug (#834) and drain all the fluid out of the Gear Box. Save or discard fluid as condition warrants.
3. Remove the Bearing Retainer (#805) and discard the O-Ring (#105).

**CAUTION - If the Oil Seal (#825) is not to be replaced, be very careful not to damage the lip of the Oil Seal (#825) when removing the Bearing Retainer (#805).**

4. Remove the Bearing Retainer (#804) from the other side and any Shims (#860, #861 & #862).

**IMPORTANT - Keep these Shims and in the same order as they were removed. Put them aside with the Bearing Retainer (#804).**

5. Tap out the Worm Shaft (#816) or (#817) from the opposite end of the input end. Pull the Worm Shaft out of the Main Housing (#800). (See *Figure 7.2*)

**NOTE - This will remove both Bearing Cones (#809) and (1) Bearing Cup (#808).**

6. The other Bearing Cup (#808) will have to be removed with an appropriate punch.

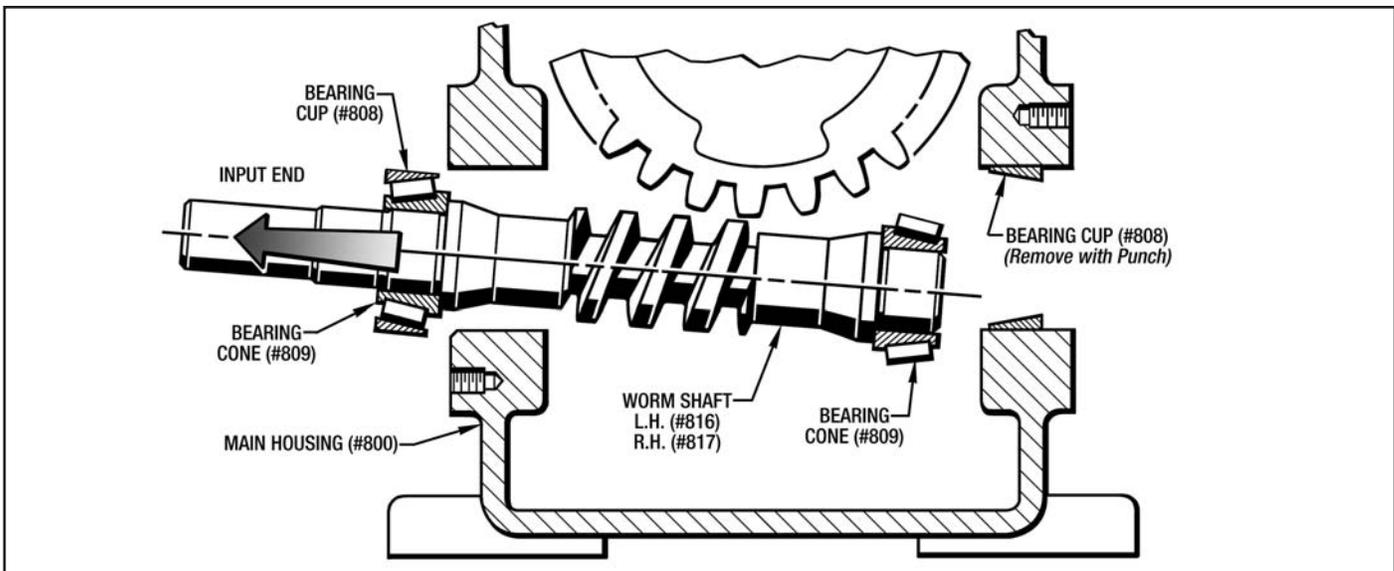


Figure 7.2 - Removing the Worm shaft

7. Remove the (6) Screws (#848) and (6) Lockwashers (#853) from either one of the Large Bearing Retainers (#803).
8. Set the gear box with this bearing retainer in an up-right position.
9. There are (2) 3/8"-16 jacks crew holes in the bearing retainer. Insert (2) 3/8"-16 Jack Screws and separate the bearing retainer from the gear box.

Carefully lift the Bearing Retainer (#803) off the gear box along with any Shimms (#865, #866 & #867). Put the shimms aside for reassembly. Keep any shimms with that bearing retainer.

**CAUTION - Be very careful not to damage the lip of the Oil Seal (#824) if it is not to be replaced.**

10. Carefully lift the Hub (#818) or (#819) straight up and out of the gear box.

**CAUTION - Be very careful again not to damage the lip of the other Oil Seal (#824) if it is not to be replaced.**

11. Stand the Main Housing (#800) upright on its feet and remove the other Bearing Retainer (#803) using the (2) 3/8"-16 Jack Screws.
12. Remove any Shimms (#865, #866 & #867) and set them aside for reassembly.

**IMPORTANT - Keep each set of shimms with the appropriate bearing retainer.**

## 7-2 HUB DISASSEMBLY

(See Figure 7.3)

Inspect the Hub thoroughly and only disassemble it if the Wear Sleeves (#875) or the Bearing (#807) needs replaced.

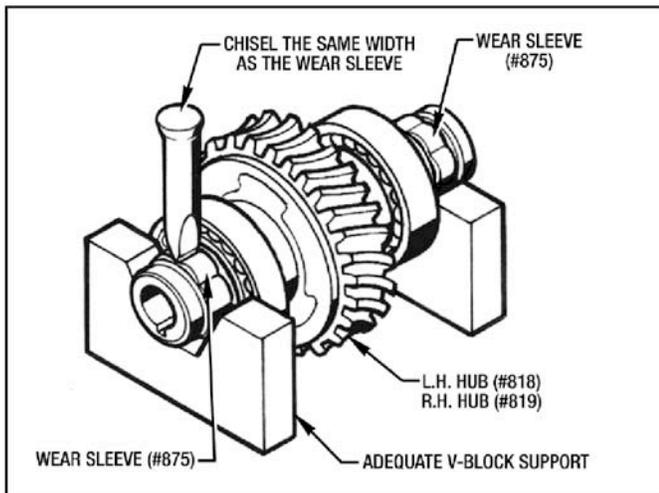


Figure 7.3 - Removing Wear Sleeves (#875)

1. Wear Sleeves (#875) can be removed from the Hub with the following procedure:
  - a. Set the Hub (#818) or (#819) in an appropriate V-Block support as shown in Figure 7.3.
  - b. With a hammer and chisel the same width as the Wear Sleeve (#875), make approx. 8 to 10 notches in the Wear Sleeve.
  - c. The Wear Sleeves (#875) can now be removed by hand.
2. Thoroughly clean-off any old Loctite from the Hub.
3. Use a standard 3-Jaw Bearing Puller to remove the (2) Ball Bearings (#807) from the Hub as shown in Figure 7.4.

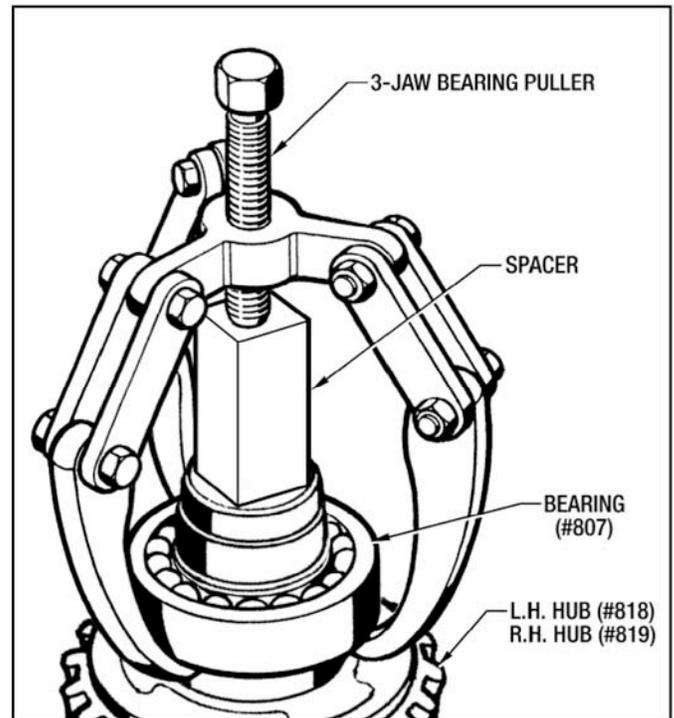


Figure 7.4 - Removing Bearings (#807)

4. Thoroughly clean off any old Loctite residue from the Hub.

## 7-3 WORM SHAFT DISASSEMBLY

1. If the Roller Bearing Cones (#809) need to be replaced, they can be removed from the Worm Shaft (#816) or (#817) by a suitable sized Bearing Splitter and Arbor Press as shown in Figure 7.5 on the next page.
2. Thoroughly clean off any old Loctite residue from the Worm shaft.

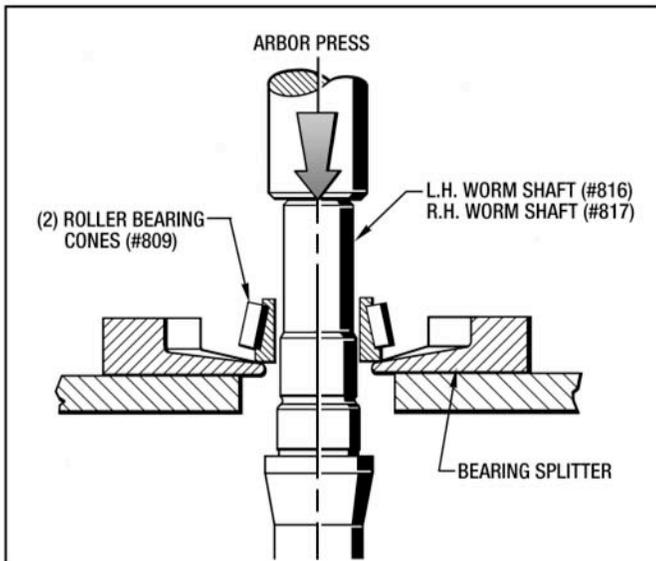


Figure 7.5 - Removing Roller Bearings From Worm Shaft

## 7-4 REMOVING OIL SEALS

(See Figure 10.1)

All (3) Oil Seals can be removed from their prospective Bearing Retainer with an Arbor Press.

1. Press the (2) Large Oil Seals (#824) out of the (2) Bearing Retainers (#803) with an Arbor Press.
2. Press the small Oil Seal (#825) out of the Bearing Retainer (#805) with an Arbor Press.
3. After removing the oil seals, thoroughly clean any Permatex residue from the oil seal bores in the bearing retainer.

**The Disassembly Procedure is Complete for the Worm Gear Reducer.**

# Section 8 - Cleaning and Inspection

## 8-1 CLEANING AND INSPECTION

Clean metal parts in a suitable solvent and dry in a stream of low pressure compressed air. After cleaning, inspect parts for cracks, distortion, scoring, nicks, burrs or other damage would affect serviceability. Pay particular attention to the following:

1. Pay particular attention to the Wear Sleeves (#875) located on the Hub (#818) and (#819) and the (3) Oil Seals (#824) and (#825). Check for nicks or scratches which would cause leakage. Replace any damaged parts.
2. Inspect the bronze gear closely for any perceptible wear, grooving, scoring and porosity. Use a feeler gauge to determine the amount of actual wear there is in the bronze gear. If the amount of wear is .005" or more, the bronze worm gear needs replaced. (See Figure 8.1)

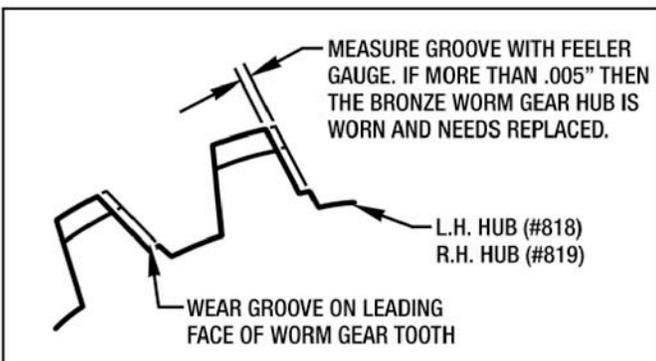


Figure 8.1 - Determining Worm Gear Wear

3. It is not necessary to remove the Ball Bearings (#807) to check the operation. Slowly rotate the free race of the bearing by hand checking to see if it turns freely without any rough or flat spots.
4. Periodically remove the Air Breather (#832) located on the side of the Main Housing (#800) and clean it with a suitable solvent.

## 8-2 REPAIR AND REPLACEMENT

A fine stone or crocus cloth may be used to remove minor surface defects from parts so long as the operating or sealing action of the part is not affected. The use of coarser abrasives or other machining methods should not be attempted. Otherwise, damaged parts should be replaced.

Replacement is recommended also for the following, as applicable:

1. Replace all O-Rings, Bearings, Wear Sleeves and Oil Seals removed during the course of disassembly.

# Section 9 - Reassembly

## 9-1 GENERAL REASSEMBLY INFORMATION

1. Basically the Reassembly Procedure is just the reverse of the Disassembly Procedure described in Section 7.
2. Refer to *Figure 10.1* for a visual reference to all parts described in this section.
3. Make sure all parts to be reassembled are thoroughly cleaned and free from any defects that would cause leakage or that would cause the Worm Gear Reducer not to function properly.

Especially make sure that all the Shims removed at Disassembly are not damaged and were kept with the appropriate bearing retainer. **This is very important if the Worm Gear Reducer is to operate properly when reassembled.**

4. **Special Assembly Tools** are required for reassembly of the Worm Gear Box. Dimensions are given in Section 11 if you prefer to make your own or they can be ordered from Force Control with the following part numbers:

- Wear Sleeves (#875)..... #601-13-029
- Oil Seals (#824)..... #601-13-027
- Oil Seal (#825) ..... #601-13-054
- Roller Bearing (#809)
  - (Input End of Worm Shaft).....#601-13-050
  - (Opposite End of Worm Shaft).....#601-13-051
- Bearings (#807).....#601-13-052

## 9-2 INSTALLING OIL SEALS

1. Apply Permatex 3D to the clean oil seal bores in both Bearing Retainers (#803).
2. Install both Oil Seals (#824) into Bearing Retainers (#803) with an Arbor Press and Assembly Tool #601-13-027 as shown in *Figure 9.1*. Clean off any excess Permatex.

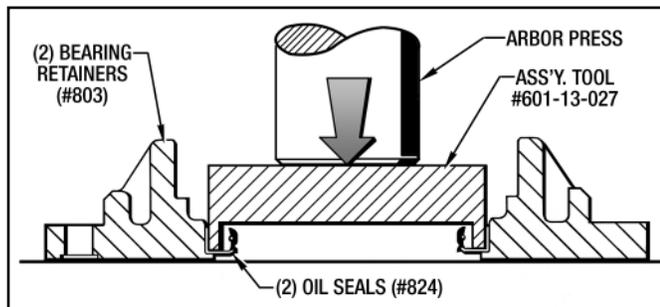


Figure 9.1 - Installing Oil Seal (#824)

3. Apply Permatex 3D to the clean oil seal bores in the Bearing Retainer (#805).

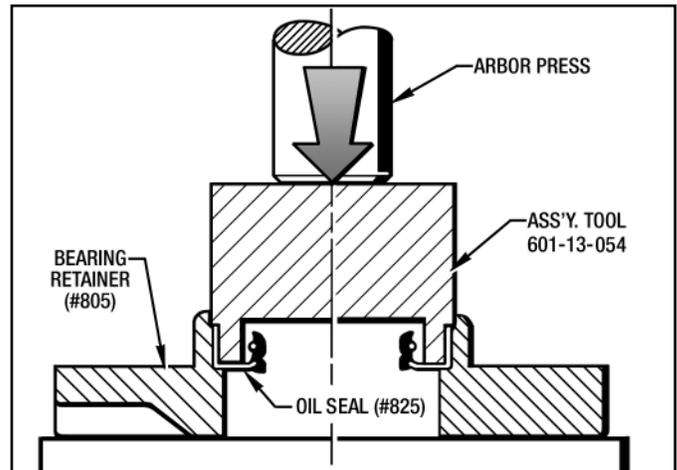


Figure 9.2 - Installing Oil Seal (#825)

4. Install Oil Seal (#825) into the Bearing Retainer (#803) with an Arbor Press and Assembly Tool #601-13-054 as shown in *Figure 9.2*. Clean off any excess Permatex.

## 9-3 INSTALLING ROLLER BEARINGS

1. Thoroughly clean the surfaces of the Worm Shaft (#816) or (#817) where the bearings will be seated.
2. Use Ass'y. Tool #601-13-050 and an Arbor Press to install the 1st. Roller Bearing Cone (#809) onto the input end of the worm shaft as shown in *Figure 9.3* below.

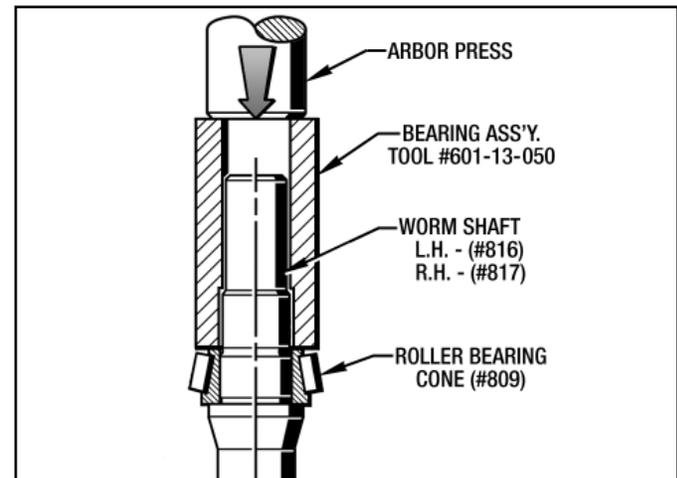


Figure 9.3 - Installing 1st. Roller Bearing

3. Use Ass'y. Tool #601-13-051 and an Arbor Press to install the 2nd. Roller Bearing Cone (#809) onto the other end of the worm shaft as shown in *Figure 9.4* on the next page.

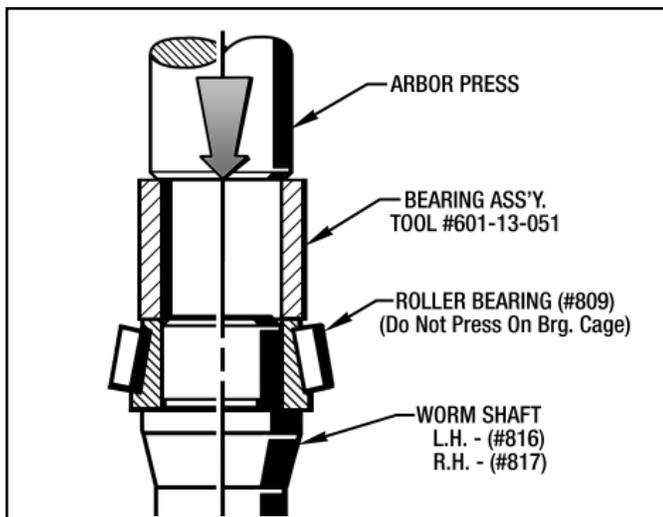


Figure 9.4 - Installing 2nd. Roller Bearing (#809)

## 9-4 INSTALLING BALL BEARINGS

The (2) Ball Bearings can be installed on the Hub (#818) or (#819) one of two ways. One way would be to heat the bearings to 250° F. and drop them onto the hub. Just make sure that they are completely seated on the hub shoulder.

**CAUTION - Always use suitable work gloves when handling heated parts.**

The other way is to use the Bearing Ass'y. Tool #601-13-052 and an Arbor Press to install them as shown in Figure 9.5 below.

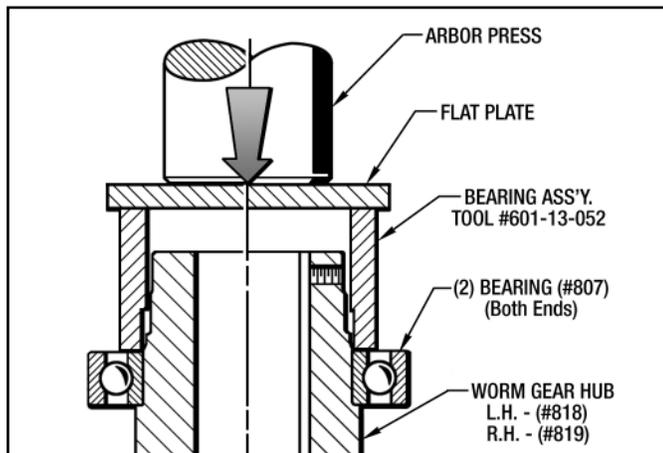
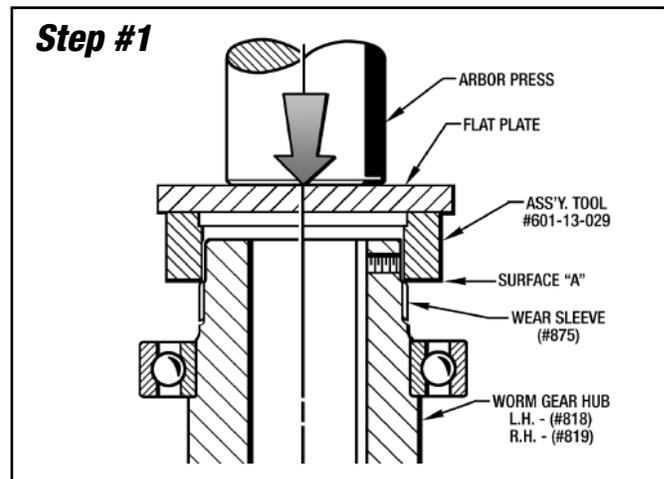


Figure 9.5 - Installing Bearings (#807)

## 9-5 INSTALLING WEAR SLEEVES

1. Apply **Primer T** and **Red Loctite #271** to the Hub (#818) or (#819) where the Wear Sleeve (#875) will fit.
2. With an Arbor Press install the Wear Sleeve (#875) with **Surface "A"** of Ass'y. Tool #601-13-129 as shown in **Step 1** of Figure 9.6.



### Step #2

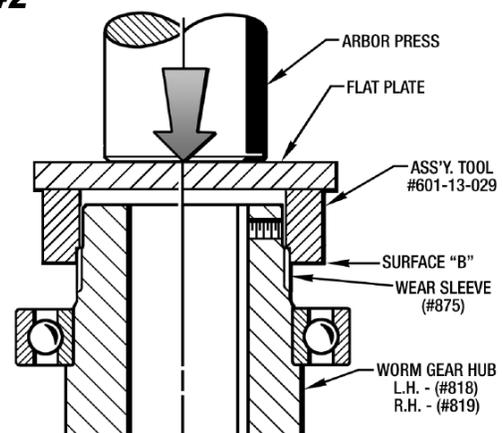


Figure 9.6 - Installing Wear Sleeves (#875)

3. Turn the **Ass'y. Tool #601-13-029** over and use **Surface "B"** to seat the Wear Sleeve (#875) completely on the Hub as shown in **Step 2** of Figure 9.6.
4. Clean off any excess Loctite.
5. Install the other Wear Sleeve (#875) with exactly the same procedure.

## 9-6 REASSEMBLY OF THE HUB AND WORM SHAFT INTO THE GEAR BOX (With Saved Shims)

It was recommended in the Disassembly Procedure that the (4) Bearing Retainers were to be "Matched Marked" with the main housing and all Shims were to be saved with each respective Bearing Retainer. This Section assumes that is what you did, so any information needed for determining complete End Play is not covered in this section. (See Section 9-7 and 9-8 for that procedure.)

To facilitate Reassembly of the Bearing Retainers and Shims, take (2) 3/8"-16 x 5" Lg. Hex Hd. Bolts, cut-off the heads and cut a slot in the end of each bolt for a screw driver to be used as guide pins.

Make sure all mating surfaces on the Main Housing and all (4) Bearing Retainers are thoroughly cleaned and free from any defects.

### A. Hub and Large Bearing Retainers

1. Insert the (2) 3/8"-16 Guide Pin Bolts into one side of the gear box 180° apart as shown in Figure 9.7.
2. Spray a light coating of "Copper Coat" to both sides of the Shims. Let it get tacky.

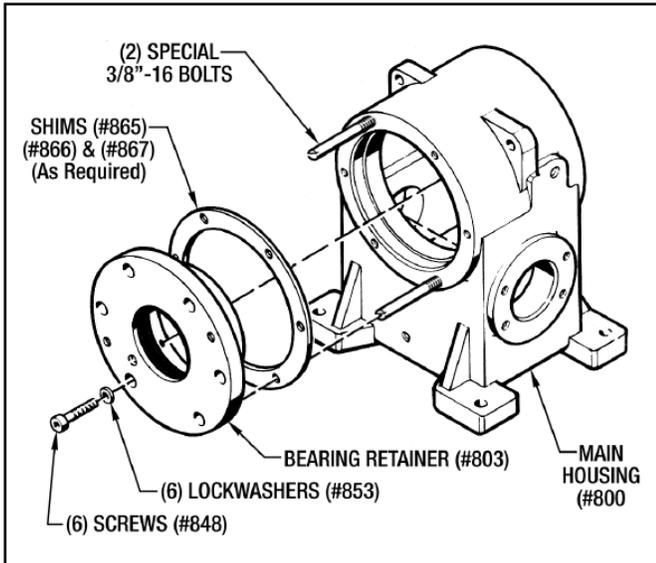


Figure 9.7 - Attaching Bearing Retainer (#803) & Shims

3. Place the Shims over the (2) Guide Pin Bolts in place on the face of the Housing (#800).
4. Slide the Bearing Retainer (#803) over the (2) Guide Pin Bolts and attach with (4) Lockwashers (#853) and (4) Screws (#848).
5. Remove the (2) Guide Pins and install the other (2) mounting screws and lockwashers. **Evenly torque all (6) Screws to 25 Lb. Ft.**
6. Lubricate the lip of the Oil Seal, which is in the Bearing Retainer (#803), with a little white grease. Also lubricate the Wear Sleeve (#875), which is on the Hub (#818) or (#819) with a little white grease.
7. Turn the Main Housing (#800) over with the Bearing Retainer (#803) in a down position.
8. Carefully insert the Hub (#818) or (#819) straight down into the Oil Seal (#824) until the Bearing (#807) is completely seated in the housing bore.

**CAUTION - Be very careful not the damage the Oil Seal Lip when inserting the Hub.**

9. Screw in the two Guide Pins 180° apart as before.
10. Spray a light coating of "Copper Coat" to both sides of the Shims and position them in place on the face of the Main Housing (#800).

11. Lubricate the other Oil Seal (#824) lip and the Wear Sleeve (#875) with a little white grease.
12. Carefully position the Bearing Retainer (#803) down over the Guide Pins, guiding the Oil Seal over the end of the Hub. (See Figure 9.8)

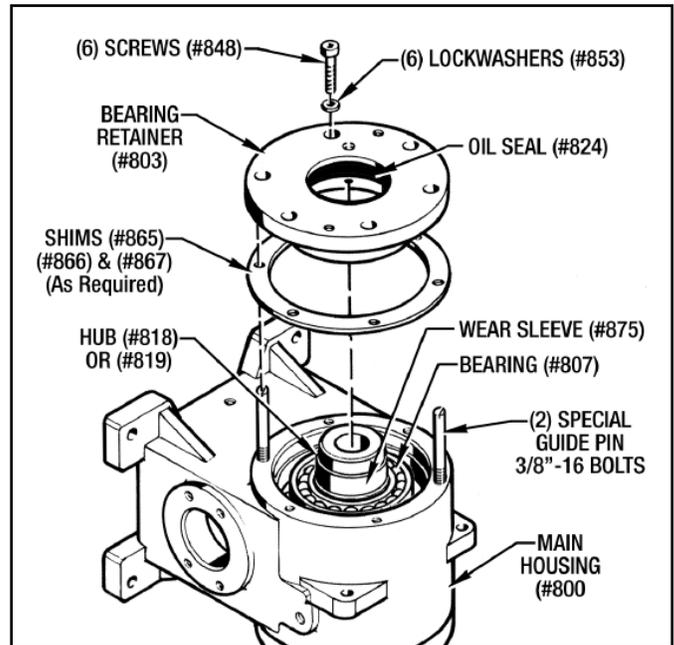


Figure 9.8 - Attaching The Other Bearing Retainer (#803)

Remove the (2) Guide Pins and attach the Bearing Retainer (#803) with (6) Lockwashers (#853) and (6) Screws (#848). **Torque the screws in an even manner to 25 Lb. Ft.**

### B. Worm Shaft and Small Bearing Retainers

1. Stand the gear box upright on the (4) mounting feet.
2. Apply a light coat of white grease to the two Roller Bearing bores in the Main Housing (#800) to ease installation of the (2) Roller Bearing Cups (#808).
3. Slide the Worm Shaft (#816) or (#817) along with the (2) Roller Bearing Cones (#809) into the Main Housing (#800).

Let the Worm Shaft and Bearings just rest in the bearing bores.

4. Tap a Bearing Cup (#808) into one of the bearing bores so that it is flush with the outside face of the Main Housing (#800).

Do the same for the other Bearing Cup (#808) on the other side. (See Figure 9.9 on the next page.)

5. Lubricate the O-Ring (#105) with a little white grease and install it on the Bearing Retainer (#805).

Also lubricate the lip of the Oil Seal (#825) and the mating diameter of the Worm Shaft.

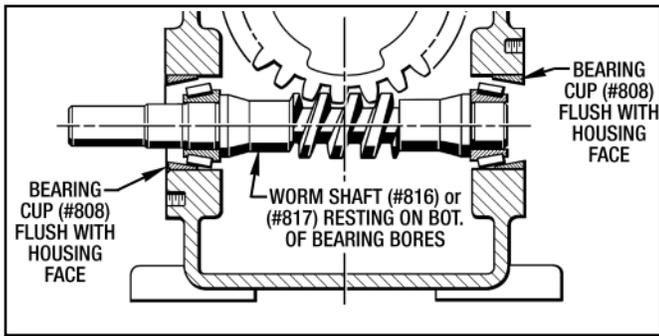


Figure 9.9 - Installing Worm Shaft

- Carefully slide the Bearing Retainer (#805) over the Worm Shaft and attach with (4) Lockwashers (#854) and (4) Screws (#849). **Torque to 25 Lb. Ft.**

**NOTE** - Attaching the Bearing Retainer (#805) will properly position the Bearing Cup (#808) in the bearing bore.

- Spray a light coating of "Copper Coat" to both sides of the required Shim.
- Place the Shims (#865), (#866) and (#867), as they were required before disassembly, back on the other Bearing Retainer (#804).
- Attach this Bearing Retainer (#804) with (4) Lockwashers (#854) and (4) Screws (#849). **Torque to 25 Lb. Ft.**

**NOTE** - Attaching the Bearing Retainer (#804) will properly position the other Bearing Cup (#808) in the bearing bore.

## 9-7 SETTING END PLAY FOR THE HUB

If you saved your existing Shims at Disassembly, then this Section will not be necessary.

- Mount one of Bearing Retainers (#803) on the Main housing (#800) with a couple Screws (#848). Tighten screws, but do not torque at this time. No Shims are installed at this time.
- Lubricate the lip of the Oil Seal, which is in the Bearing Retainer (#803), with a little white grease. Also lubricate the Wear Sleeve (#875), which is on the Hub (#818) or (#819) with a little white grease.
- Turn the Main Housing (#800) over with the Bearing Retainer (#803) in a down position.
- Carefully insert the Hub (#818) or (#819) straight down into the Oil Seal (#824) until the Bearing (#807) is completely seated in the housing bore.

**CAUTION** - Be very careful not to damage the Oil Seal Lip when inserting the Hub.

- Lubricate the other Oil Seal (#824) and the other Wear Sleeve (#875) with a little white grease.

- Carefully tap the Bearing Retainer (#803) in place over the Hub until the Bearing (#807) is seated well in the Bearing Retainer (#803). It is not necessary to use any mounting screws at this time.

- Measure the gap between the Bearing Retainer (#803) and the Main Housing with a feeler gauge as shown in Figure 9.10

Add .002" to .004" to the gap measurement to determine the total amount of shims required.

### Example:

Measured Gap = .020" + (.002" to .004")

= **.022"-.024" (Total Amount of Shims Required)**

Split this up and put half on each side of the Gear Box.

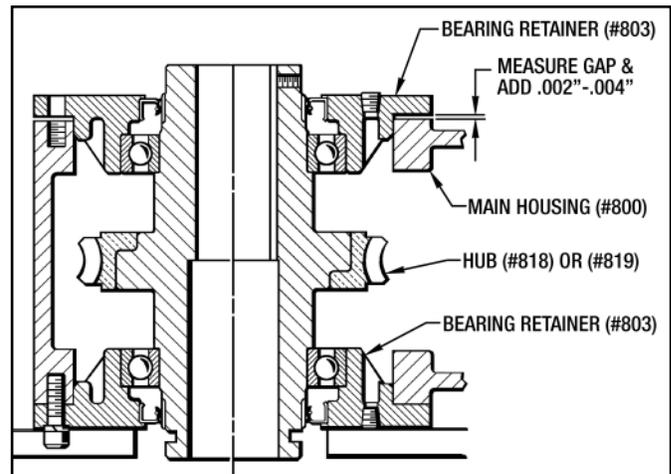


Figure 9.10 - Setting End Play for the Hub.

- Disassemble the Hub and both Bearing Retainers from the Gear Box.
- Reassemble the Hub, Required Shims and both Bearing Retainers with the same procedure as given in the previous **Section 9-6-A**.

## 9-8 SETTING END PLAY FOR THE WORM SHAFT

Duplicate Steps 1 thru 6 given in Section 9-6-B

- Attach a magnetic mounted Dial Indicator to the end of the Worm shaft (#816 or #817) as shown in Figure 9.11 on the next page.
- Pull the other Bearing Retainer (#804) up slowly and in an even manner.

Tighten the screws until .005"-.007" End Play is indicated on the Dial Indicator.

- Measure the gap between the Bearing Retainer (#804) and the Main Housing (#800) with a feeler gauge as shown in Figure 9.11. (**This Gap will be the amount of Shims Required.**)

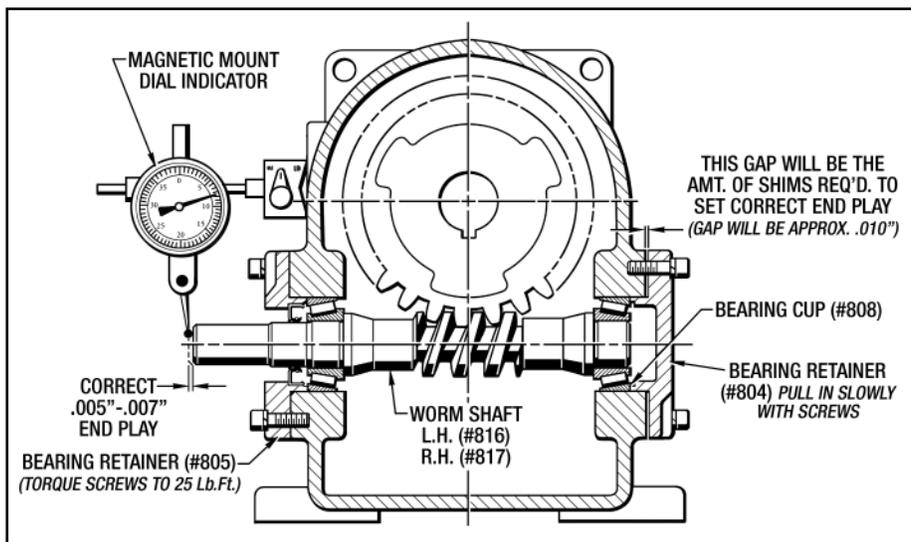


Figure 9.11 - Setting End Play for the Worm Shaft

Duplicate Steps 7 thru 9 as described in **Section 9-6-B**.

## 9-9 FINAL REASSEMBLY PROCEDURE

1. Replace the Street Elbow (#836) and all other pipe plugs removed at disassembly.

2. Fill with fresh oil as indicated in the **Section 4 - Lubrication**.

3. Reinstall the Air Breather (#832) into the Elbow (#836).

Reassembly is complete for your Worm Gear Reducer. Refer to **Section 5 - Installation** to put it back in service.

# Section 10 - Ordering Repair Parts

## 10-1 ORDERING REPAIR PARTS

When ordering any repair parts, please specify all of the following information.

1. COMPLETE MODEL NUMBER (On Name Plate)
2. SERIAL NUMBER (On Name Plate)
3. PART REFERENCE NUMBER (From Parts List and Exploded View Drawing)
4. PART NAME (From Parts List)
5. QUANTITY (As Required)
6. COMPLETE SHIPPING INFORMATION

**IMPORTANT** - Failure to include all of the above information will delay your parts order. Unless another method is specified for shipping information, parts weighing less than 70 lbs. will be shipped United Parcel Service. Parts weighing over 70 lbs. will be shipped motor freight. Airfreight and other transportation services are available, but only if specified on your order

## 10-2 FACTORY REBUILD SERVICE

Reconditioning Service is offered by Force Control Industries at the factory. Before returning a unit for this service, be sure to first contact the Service Sales Department at Force Control Industries for authorization and shipping instructions. Force Control cannot be responsible for any units returned to the factory without prior notice and authorization.

Care must be given to the packaging of returned units. Always protect mounting feet and flanges by attaching to a suitable skid. Damaged units always delay repairs. It is usually impossible to recover damage costs from the carrier.

Whenever possible describe the problems you are having with your unit on your shipping papers.

Return to:

**Force Control Industries, Inc.**  
**3660 Dixie Highway**  
**Fairfield, Ohio 45014**  
**Telephone: 513-868-0900**  
**Fax: 513-868-2105**  
**E-Mail: info@forcecontrol.com**

## 10-3 NAME PLATE

Located on the Main Gear Box Housing.

MODEL NO.	<input type="text"/>
SERIAL NO.	<input type="text"/>
<b>FORCE CONTROL INDUSTRIES, INC.</b>	
FAIRFIELD, OHIO	
USE ONLY	
MOBIL 600W® CYLINDER OIL	
DO NOT SUBSTITUTE	

## Repair Parts List

### L.H. and R.H. Worm Gear Reducer

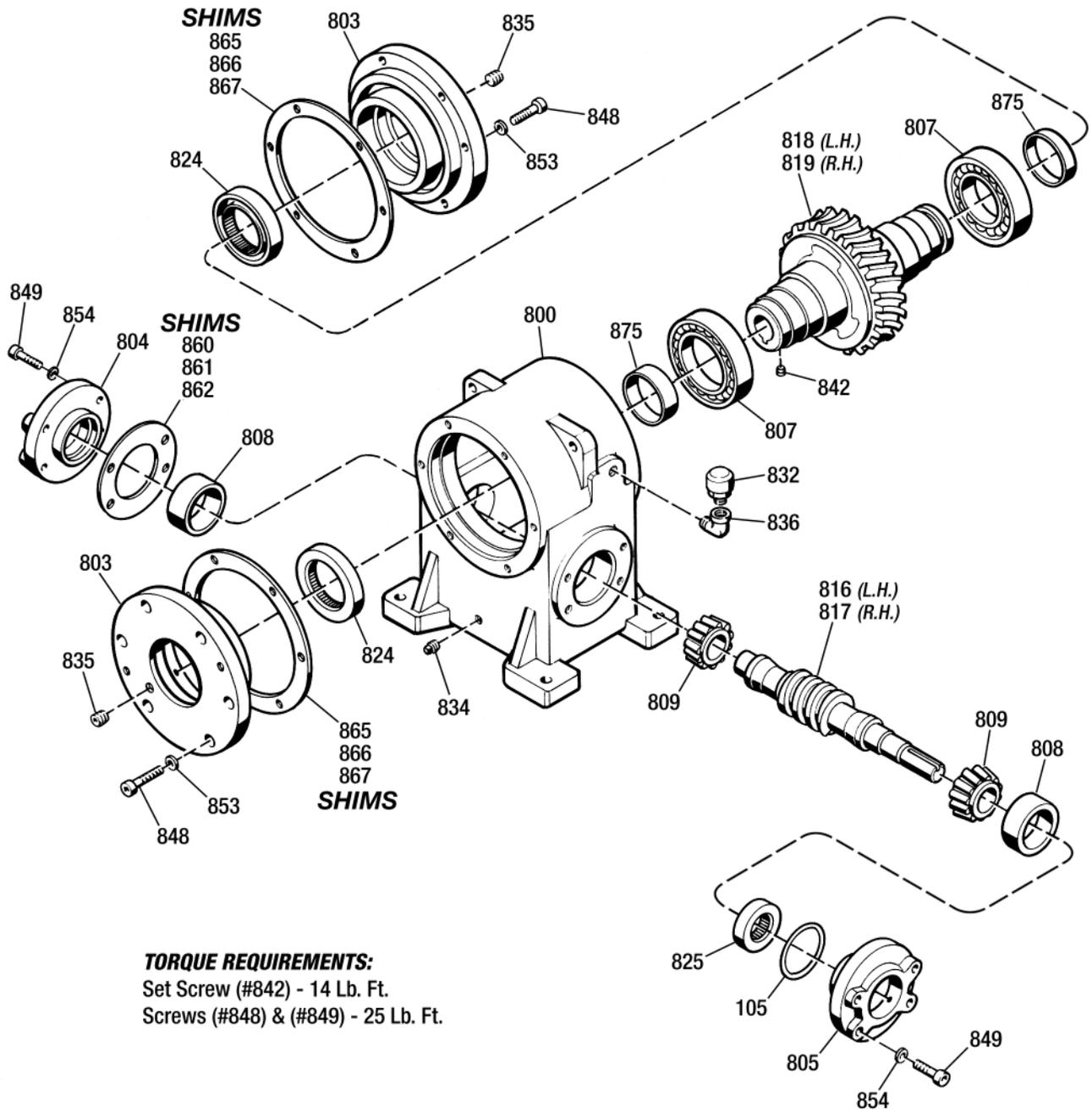
REF. No.	PART NAME	QTY.	REF. No.	PART NAME	QTY.
105	O-Ring .....	1	*832	Air Breather.....	1
800	Main Housing.....	1	834	Pipe Plug, Mag. Sq. Hd., 3/8" NPT .....	2
803	Bearing Retainer, Low Speed .....	2	835	Pipe Plug, C'Sunk, 1/8" NPT .....	2
804	Bearing Retainer .....	1	836	90° Street Elbow, 3/8" NPT .....	1
805	Bearing Retainer .....	1	842	Soc. Set Screw, Cone Pt., 5/16"-18 x 1/2"	2
806	Bearing Retainer, Low Speed .....	2	848	Soc. Hd. Screw, 3/8"-16 x 1-1/4" Lg.....	12
*807	Bearing .....	2	849	Soc. Hd. Screw, 3/8"-16 x 1-1/4" Lg.....	8
*808	Roller Bearing Cup .....	2	853	Lockwasher .....	12
*809	Roller Bearing Cone.....	2	854	Lockwasher .....	8
816	Worm Shaft, L.H. ....	1	*860	Shim (Red .002").....	AR
817	Worm Shaft, R.H.....	1	*861	Shim (Blue .005") .....	AR
818	Hub, L.H. ....	1	*862	Shim (Brown .010").....	AR
819	Hub, R.H. ....	1	*865	Shim, Low Speed (Red .002") .....	AR
*824	Oil Seal .....	2	*866	Shim, Low Speed (Blue .005").....	AR
*825	Oil Seal .....	1	*867	Worm Low Speed Brown .010") .....	AR
830	Dowel Pin, 3/8" x 1" .....	4	*875	Wear Sleeve.....	2

\* Indicates parts in Overhaul Kit.

Quantities given for each Gear Reducer.

AR - As Required

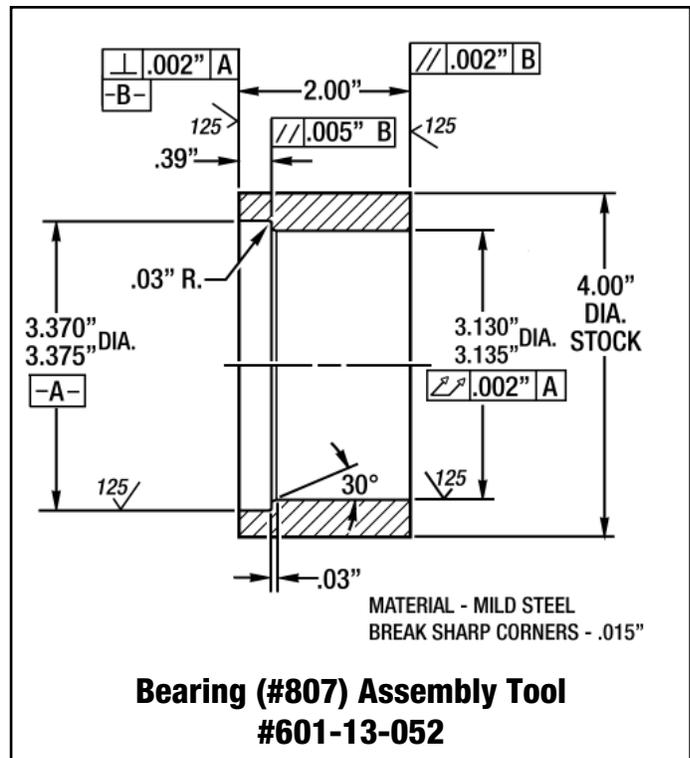
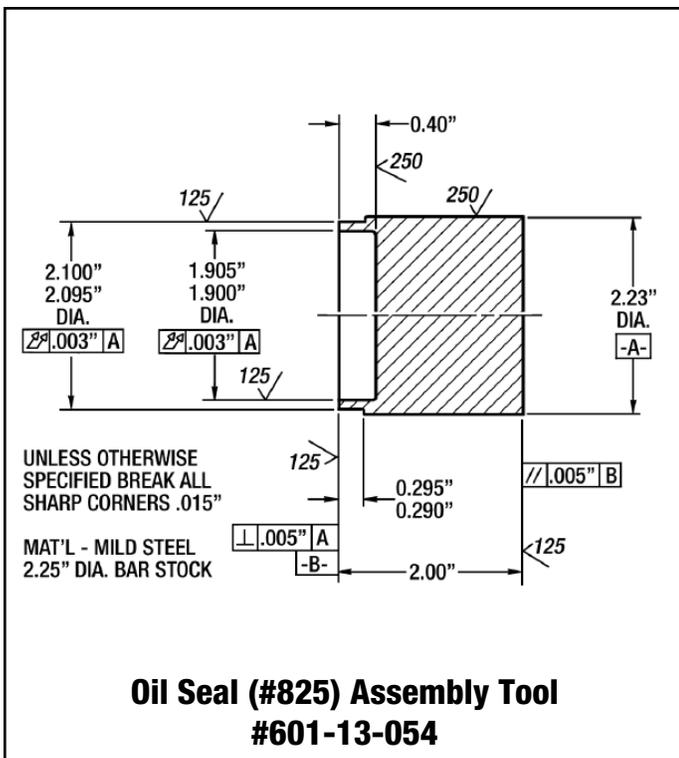
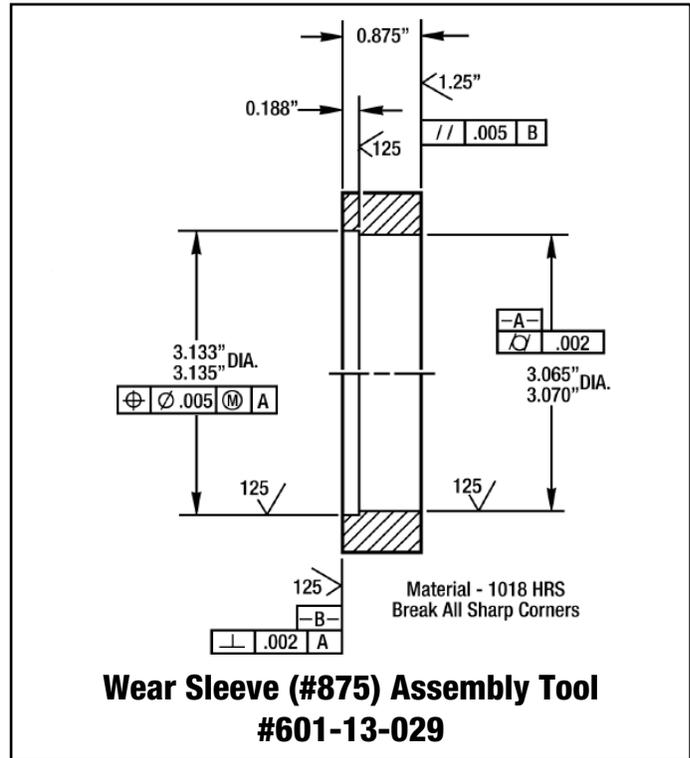
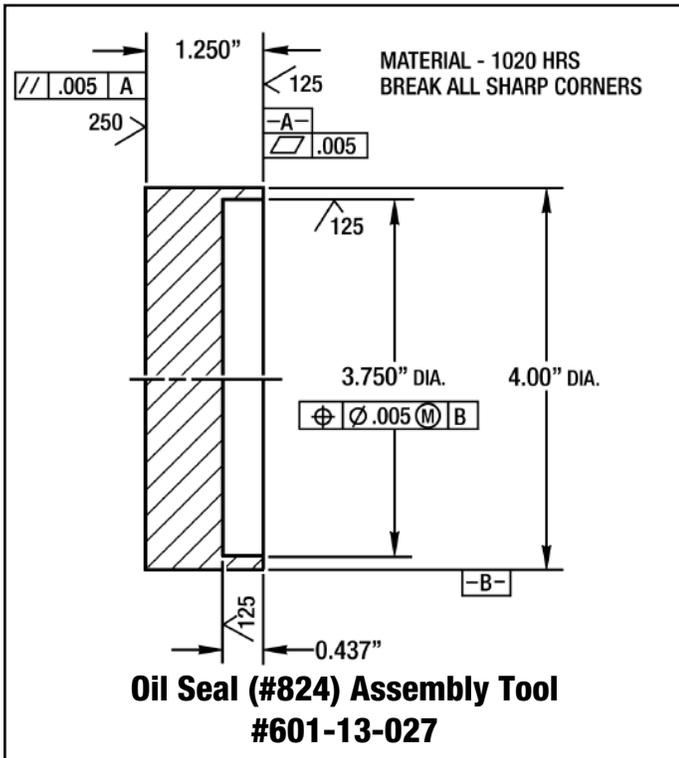
# L.H. and R.H. Worm Gear Reducer



**TORQUE REQUIREMENTS:**  
 Set Screw (#842) - 14 Lb. Ft.  
 Screws (#848) & (#849) - 25 Lb. Ft.

Figure 10.1 - L.H. and R.H. Worm Gear Reducer

# Section 11 - Special Assembly Tools





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*Providing today's industries with  
Oil Shear Clutch/Brake Drives  
and Servo Systems  
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