

INTRODUCTION

The following instructions apply to standard Type YB, YBT, YBTT, YBN, YBNT and YBNTT horizontal right angle speed reducers. Unless otherwise stated, information for Sizes 2050 thru 2195 applies to Sizes 50 thru 195 respectively, i.e., 50 = 2050, 100 = 2100, 165 = 2165, etc. However, ratings differ. DO NOT use parts for a Size 50 in a 2050, 100 in a 2100, etc. Also, the use of oil wipers and oil pans may vary; consult Factory for details.

Drawings are representative of this series of single helical and spiral bevel geared reducers and may not agree in exact detail with all unit sizes. When ordering parts or requesting information, specify the M.O. number, the unit size, model number, rpm, ratio and the date stamped on the reducer nameplate. **CONSULT FALK BEFORE CHANGING SPEED. OPERATE ONLY AT SPEEDS SHOWN ON NAMEPLATE.**

NOTE: Bevel gearing is case hardened after cutting, and subsequently lapped in matched and marked sets to ensure proper tooth contact. Unless bevel pinions and gears are installed as matched sets, in accordance with the instructions in Falk service manuals, Falk cannot be responsible for the rating, life, noise or performance of the parts or the products receiving them.

CAUTION

Consult applicable local and national safety codes for proper guarding of rotating members.
Lock out power source and remove external loads from unit before servicing unit or accessories.

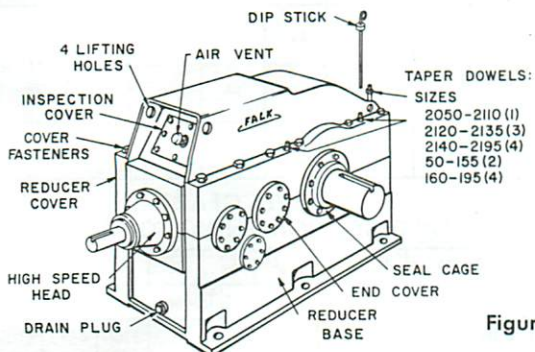


Figure 1

Figure 2

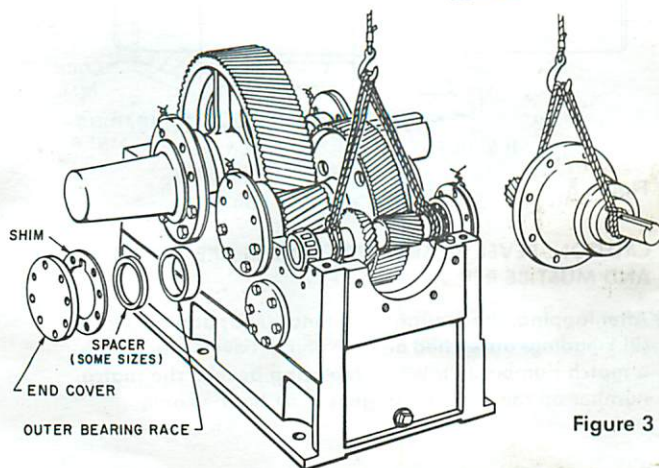
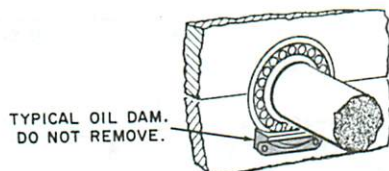


Figure 3

INPUT SPEED & RATIO CHANGE—When either is changed, consult Factory to determine whether an oil pan and/or oil wipers must be relocated or added.

REQUIRED EQUIPMENT

In addition to standard mechanics tools, the following equipment is required: hoist, sling, arbor press, wheel puller, torque wrench, feeler gauges, dial indicator with stand and both inside and outside micrometers.

GENERAL INSTRUCTIONS

HOUSING—Clean external surfaces of reducer before removing cover to prevent dirt from falling into unit. Record mounting dimensions of accessories for reference when reassembling. If it is necessary to remove the reducer from its operating area, disconnect all connected equipment and then lift the reducer from its foundation by means of the four lifting holes in the cover.

SEALS—To replace seals, refer to Manual 148-130.

OPTIONAL EQUIPMENT—The oil wiper assembly in Figure 4, the oil dam in Figure 2 and the oil pan are considered part of the housing after Factory assembly and should not be removed. To add an oil pan, refer to Page 6 for instructions.

DOUBLE SHAFT EXTENSIONS—If pinion and gear teeth are worn or damaged on one flank (or if shaft extension is marred), the unused tooth surfaces (or shaft extension) can be utilized by turning ALL shaft assemblies end for end... provided the reducer shaft extensions are identical. **CAUTION:** When this is done, the low speed shaft will rotate in the opposite direction. Rewire the motor connections.

When shaft assemblies are turned, or the ratio is changed, relocate the oil pan as instructed on Page 6 if the unit is so equipped. Also relocate the oil wipers as outlined on Page 2 in Step 5 when the shaft assemblies are turned end for end.

COVER REMOVAL

1. REMOVE REDUCER COVER—Figure 1.

- A. Drain oil. Remove dip stick.
- B. Remove housing cover fasteners and all fasteners ABOVE housing split that hold end covers, shaft guard, seal cages and high speed head to housing cover. Loosen fasteners BELOW housing split three or four turns. DO NOT REMOVE these for they hold the high speed head and outer bearing races in position.
- C. Tighten nuts on taper dowels and lift out ALL dowels. Refer to Figure 1 for the number and approximate location of taper dowels.
- D. Hitch reducer cover to a hoist and lift it STRAIGHT UP. DO NOT DAMAGE GEAR TEETH.
- E. Wire shims to their mating seal cages, guards or end covers and the high speed head so that they will be available for reference when reassembling the unit.

REMOVAL OF SHAFT ASSEMBLIES

COMPLETE THE FOLLOWING PROCEDURE FOR EACH SHAFT ASSEMBLY. START WITH THE HIGH SPEED SHAFT AND WORK THROUGH TO THE LOW SPEED SHAFT.

2. HIGH SPEED HEAD REMOVAL—Figure 3.

Place a sling around the high speed head and take up the slack in the sling. Remove the balance of the fasteners holding the head to the housing. Lift shaft assembly out. DO NOT DAMAGE TEETH.

3. 1ST INT. THROUGH LOW SPEED—ALL REDUCTIONS.

(EXCEPTION: See Step 3C for quadruple reduction.)

- Place a sling around the shaft as illustrated in Figure 3 and take up the slack just enough to take the weight off the bearings. Remove the remaining fasteners, end cover (or seal cage and shaft guard), the spacer and adjacent taper roller bearing outer race. CAUTION: Do not drop bearing outer race.
- Lift shaft assembly out of base. DO NOT DAMAGE TEETH.
- 2ND INTERMEDIATE OF QUADRUPLE REDUCTION—Remove end cover, spacer and bearing outer race. Slide shaft assembly towards pinion side until other end clears housing. Then pivot shaft assembly and lift out.

PARTS REPLACEMENT

- HOUSING COVER AND BASE**—Remove sealing compound from housing split. Clean oil troughs, oil passages and oil sump with kerosene or solvent and then dry.
- OIL WIPER**—Figure 4. (When Required)
 - See Introduction and Input Speed & Ratio Change paragraphs on Page 1.
 - Reposition the oil wipers only if the shaft assemblies were turned end for end. Use existing holes in the tie bar.
 - Adjust oil wiper fasteners to give .010" to .015" clearance as shown in Figure 4 so wipers slide freely on gear rim.
- OIL PAN ADDITION OR RELOCATION**—Refer to Page 6.
- AIR VENT.**

- Wash in kerosene or solvent and squeeze filter element dry.
- When installing air vent, seal threads with Permatex #3 or equivalent sealer.
- SEALS**—Refer to Manual 148-130 for seal replacement. During unit disassembly note type of seal cage assembly, seal position and direction seal lips are facing. Seal lips must face the same way during reassembly.

CAUTION: New seals will leak if seal lips are cut or if seal's rubbing surface on the shaft has been altered. Protect seal lips at all times. Clean the shaft, but do not use any abrasive material on rubbing surface polished by the seal.

9. BEARINGS.

- Wash all bearings in clean kerosene and then dry. DO NOT spin bearings for they may score due to lack of lubricant.
- Inspect bearings carefully and replace all those that are worn or questionable.
- Use a wheel puller or press to remove bearings. Apply force to the inner race only... not to the cage.
- To replace bearings, heat them in an oil bath or an oven to a maximum of 275°F (135°C) and then slide or press onto the shaft tight against the shaft shoulder. When heating bearings, DO NOT apply flame directly to bearings or rest bearings on bottom of heated container.
- Thoroughly coat all bearings with lubrication oil.

10. HELICAL GEAR AND PINION.

- PINION AND SHAFT**—Replace pinion shaft assemblies as a unit if pinion or shaft is worn or damaged.
- STRAIGHT BORED GEARS**—Where gears have only one side of the bore chamfered, assemble to the shaft from the chamfered side. Seat tight against shaft shoulder and check with feeler gage to see that there is no clearance.
- TAPER BORED GEARS**—Remove lock nuts (for sizes shown in Table 1) and then press off gear. When lock nuts are removed, replace them with new lock nuts and pre-torque to 1000 pound-inches. IMPORTANT: Complete the nut tightening procedure by rotating the nut to the degrees of rotation specified in Table 1. To do this, scribe a line on the gear hub and then one

on the nut to the degrees of rotation required as illustrated in Figure 5.

- Tighten nut until scribed lines are in alignment.

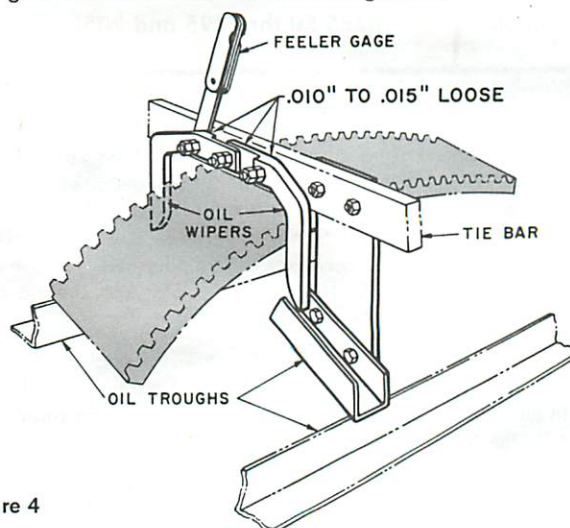


Figure 4

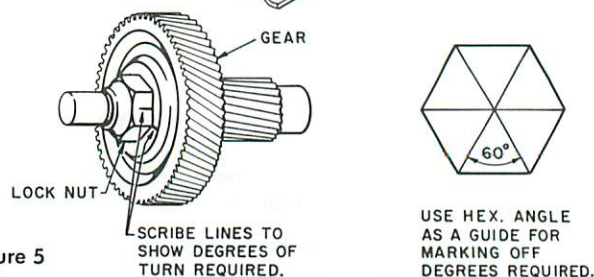


Figure 5

DEGREES OF LOCKNUT ROTATION

Table 1 (for nuts pretightened to 1000 lb-in.)

UNIT SIZE	50	60	70	80	90	100	110
2nd Int. YB3	30	45	60	...	...	...	...
2nd Int. YB4	15	15	15	30	30	45	45
3rd Int. YB4	45	60	60	...	...	...	...

BEVEL GEAR

Table 2 FASTENER TIGHTENING TORQUE*

FASTENER DIA.	5/16	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4
UNIT SIZE	Torque, lb-in.								
120 thru 195	120	220	560	1120	2000	3100	4640	6100	8600
2120 thru 2195	...	...	...	...	2700	4300	6400	9100	12900

* Torque values are for fasteners coated with SAE 20 or heavier mineral oil.

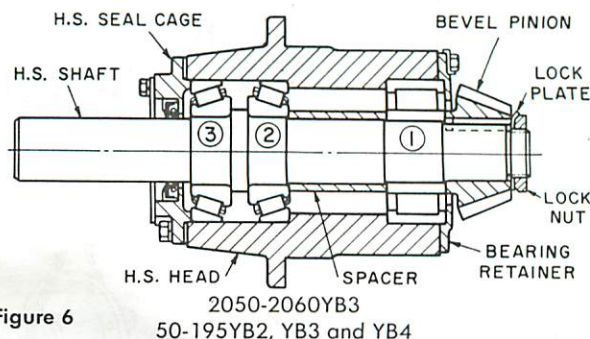


Figure 6

2050-2060YB3
50-195YB2, YB3 and YB4

CAUTION: BEVEL GEARS AND PINIONS ARE LAPPED IN SETS AND MUST BE REPLACED AS SETS.

After lapping, the mounting distance (MD) and backlash (BL) readings are etched on each pair of bevels along with a match number (#). When replacing bevels, the match number on the pinion and gear must be the same.

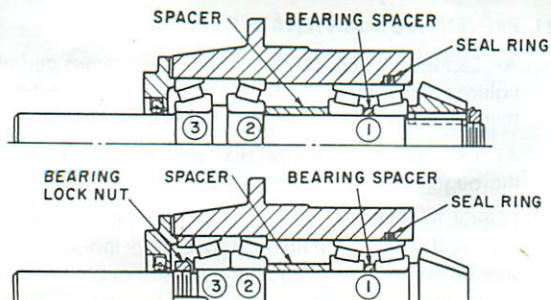


Figure 7 2050-2195YB2 and 2070-2195YB3

CAUTION: The components of Bearing ① in Figure 7 are not interchangeable. Each part is match marked with a serial number and must be assembled accordingly.

11. BEVEL GEAR.

After replacing bevel gear, torque fasteners to values shown in Table 2 on Page 2. Bend lock plates into position.

12. BEVEL PINION—Figures 6 and 7.

- Wrap shim stock around shaft extension and key to prevent damage to shaft. Hold the shaft with a wrench, turn off the bevel pinion lock nut and press off bevel pinion.
- Remove high speed seal cage and bearing retainer. Remove the high speed shaft by pulling on the shaft extension or tapping the threaded end lightly with a brass bar. **CAUTION: DO NOT DAMAGE SCREW THREADS.**
- Refer to Step 9 for bearing instructions. Mount spacer and inner races of bearings on shaft as illustrated in Figure 6 or Figure 7; also outer races of Bearings 1 and 2 in Figure 7.
- Insert outer race of Bearing 2 into high speed head for assemblies shown in Figure 6. Install seal ring in high speed head on assemblies shown in Figure 7.
- Stand the high speed head upright with the seal cage end up. Slide the shaft assembly into the high speed head and insert the outer race of Bearing 3.
- Refer to Step 13C for precautionary steps required to protect seal and then mount seal cage assembly. Draw fasteners up evenly until the shaft begins to bind when rotated (zero end float). Final adjustments will be made after the high speed head assembly is installed in the reducer.
- Turn high speed head so that the bevel pinion end of the head is up and press the outer race of Bearing 1 into the head. For assemblies shown in Figure 6, fasten the bearing retainer to the head with fasteners coated with an SAE 20 or heavier mineral oil. Use lock plates. Tighten fasteners to torques shown in Table 6. Bend lock plates over the inner bearing retainer and fastener heads. For assemblies shown in Figure 7 fasten oil dam and gasket to the head with flat head fasteners. Stake each fastener in three spots to lock.
- Heat bevel pinions in an oven or oil bath from 250° to 275°F (121° to 135°C) and shrink onto shaft. To prevent distortion when heating pinion, do not apply flame directly to pinion or rest the pinion on the bottom of the heated container.
- Tighten bevel pinion lock nut and secure lock plate.

REDUCER ASSEMBLY

13. PRELIMINARY.

- Check to see that all spacers and worn parts have been replaced, lock nuts tightened to specifications, gears and bearings coated with oil and all parts cleaned. Replace all lockwashers during assembly. Remove all foreign matter from reducer base.
- Before starting to assemble reducer, replace old shims wired to the low speed seal cage and the end covers on the reducer output side with new shims of equal thickness. Replace other

old shims during assembly of reducer. Shims with minimum compressibility (see Table 3) are available from the Factory in thicknesses of .007, .009, .015 and .031 inches. Always place one .015 inch shim next to the reducer housing for positive sealing. Also use one .015 inch shim to seal the unused bore on double reduction units. If the inspection cover has been removed, replace gasket if torn or damaged.

NOTE: USE ONLY FALK SHIMS AND GASKETS!

Table 3 FALK SHIM-GASKET COMPRESSIBILITY—Inches

Thickness	New	.007	.009	.015	.031
	Compressed	.006	.008	.013	.028

- If the reducer has been serviced in its operating area, mount the seal cage assembly and shims, coupling hubs, sprockets, etc. on the shaft extension before lowering this assembly into the reducer base. **CAUTION:** Protect seal lips from sharp edges of keyway by wrapping a thin, strong paper around the shaft and coating it with grease before sliding the seal assembly into position. Do not expand the seal lips more than 1/32" diameter.
- IMPORTANT:** During assembly, position all seal cages, end covers and shaft guards with the word "TOP" upright to permit circulation of lubricant.
- Coat all fasteners with an SAE 20 or heavier mineral oil. All torque values are for fasteners that have been coated with oil. Replace all lockwashers when reassembling.
- Coat all pipe plug and inspection cover fastener threads with Permatex #3 or equivalent sealer.

14. BEARING ADJUSTMENT—Figure 8.

Use the following procedure for each shaft assembly as it is lowered into the base. Start with the low speed shaft and work through to the high speed shaft. (EXCEPTIONS: See Step 14E for quadruple reduction. See Steps 15 and 16 for bevel gear set bearing adjustments.)

- As each assembly is lowered into the housing base, fasten the seal cage (or the end cover) to housing using new shims equal in total thickness to the old shims.
- Mount the shaft guard (or end cover) and draw up fasteners evenly until shaft axial float is .001" to .004".
- Measure the gap as illustrated in Figure 8.

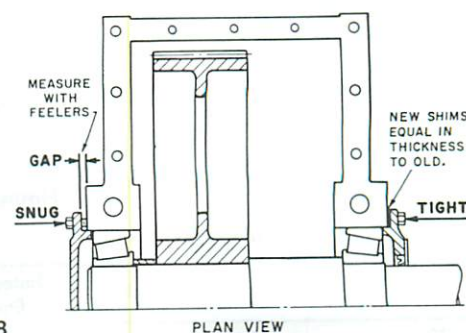


Figure 8

- To obtain minimum and maximum shim limits, add GAP measurement to the high and low axial float limits specified in Table 5 for the required unit. Select shim gaskets with the required COMPRESSED thicknesses from Table 3 following Paragraph 13B.

EXAMPLE: Assume that a 2140YB reducer has a .006" GAP. Add the .006" to the .060" and .065" float limits shown in table 5 to get .066" and .071". Use two .031" and one .015" shims (.069" compressed total) to be within the calculated limits.

(Step 14 continued on Page 4)

EXCEPTION: For the low speed shaft assembly of the 50 thru 135 Type YB2, YB3 and YB4 and 2050 thru 2135 YB2 and YB3, **SUBTRACT** the high and low limits in Table 4 from gap measurement.

L.S. BEARING SHIM REMOVAL
Table 4

SIZE	Remove (Inches)
2050-2070	.000-.006
2080-2135	.015-.021

- E. **QUADRUPLE REDUCTION UNITS**—Install the second intermediate shaft assembly of the quadruple reduction reducer first. Lower the shaft, with pinion end down, into the base and partially through the bore. Then draw the shaft back into the opposite bore. Install the taper roller bearing outer races and spacers. Shim as outlined in Step 14D, Page 3 and then install the low speed shaft assembly.

BEVEL GEAR SET ADJUSTMENT

15. **TAPER ROLLER BEARINGS, 1ST INT.**—Figure 9.
(See Step 16 for Spherical Roller Bearings.)

- A. Lower the 1st intermediate shaft assembly into the housing base. Fasten cover nearest the helical pinion with new shims equal in total thickness to the old shims. Mount the opposite end cover without shims and draw up the fasteners evenly until shaft axial float is .001" to .004". Measure the GAP as illustrated in Fig. 8. Add shims whose compressed thickness is equal to this amount under the bevel gear side end cover.
- B. Record the mounting distance (MD) etched on the bevel pinion for reference in the steps that follow. The mounting distance is the distance from the ground end of the pinion teeth to the center line of the shaft of the mating bevel gear assembly as shown in Figure 9.
- C. Fasten the high speed head assembly to the housing. Make certain teeth are free in mesh and do not bind.
- D. With a micrometer, measure the outside diameter "A" of the helical pinion having an even number of teeth. To measure the outside diameter "A" of a helical pinion with an odd number of teeth, wrap a wire approximately .062 in. in diameter around the periphery of the pinion teeth and at right angles to the pinion centerline. Twist the wire ends together to ensure a tight fit over the teeth. Measure the distance over the wire and subtract two times the wire diameter to obtain the pinion diameter "A". Remove wire after measurement is taken. Subtract half the dimension "A" ($A \div 2$) from the recorded mounted distance (MD) to get the "Required B" dimension.
- E. Position the helical pinion so that one of the teeth is exactly opposite the horizontal center of the bevel pinion. Then measure the "Actual B" dimension with an inside micrometer. The required thickness of shims for the high speed head assembly is equal to "Required B" minus "Actual B".
- F. Remove the high speed head assembly and add head shims equal to the required thickness determined in the previous step. Replace high speed head assembly and tighten fasteners to torques specified in Table 6 on Page 5. Recheck mounting distance (MD). Add or subtract head shims until the "Actual B" dimension is within .000" to +.004" of the "Required B" dimension.

- G. Wedge a key into the keyseat of the bevel pinion shaft extension as shown in View A-A of Figure 9. Place a dial indicator squarely against the side of key at a distance of approximately one-half of the bevel pinion pitch diameter.
- H. Rotate the bevel pinion shaft back and forth while holding the bevel gear shaft immobile. Read the backlash (tooth clearance) on indicator. Required backlash is etched on outer diameter of the bevel gear.
- J. Final backlash at the mesh must equal etched backlash within .000" to +.002" with end covers fastened in place and torqued as specified in Table 6 on Page 5. Transfer end cover shims from one side to the other side to obtain the correct backlash. Do not add shims.
- K. When correct backlash is obtained, add shims on bevel gear side of intermediate shaft end cover to obtain .005" to .008" axial float.
- L. Insert shims between high speed seal cage and head to obtain .005" to .008" high speed shaft end float.

16. **SPHERICAL ROLLER BEARINGS, 1ST INT.**
(See Step 15 for Taper Roller Bearings.)

- A. Install bevel gear shaft assembly in housing base and fasten on either end cover. Clamp the outer race of the bearing to the end cover and obtain the mounted axial float of the bearing by measuring the end float of the shaft. Repeat this procedure for the other bearing. Add these figures to get the total end float.
- B. Shim end covers to obtain .001" to .004" axial shaft float. Then add shims to the shim pack equal to one-half the total axial float determined in the preceding step.
- C. Install high speed bearing cage as outlined in Steps 15B through 15J. Before measuring backlash, move and hold the bevel gear into mesh with the bevel pinion until all bearing float on the helical pinion side is taken up.
- D. Adjust the bevel gear shaft assembly to obtain the backlash as marked on the bevel gear by moving shims from one side to the other. Do not add additional shims.
- E. When correct backlash is obtained, add .003" shims to each end cover shim pack.
- F. Insert shims between high speed seal cage and head to obtain .005" to .008" high speed shaft end float.

17. **ASSEMBLE REDUCER COVER TO BASE**—Figure 11

- A. Use thin wire to hold the upper portion of shims to their adjoining parts. Loosen fasteners holding seal cages, shaft guards and end covers to provide clearance for reducer cover when it is lowered.
- B. Coat base split, air vent and oil drain threads with Permatex #3 or equivalent sealer. Do not deposit excessive quantities near bearings.
- C. Carefully lower cover onto base. Do not bump gear teeth with cover or oil wipers. Remove all wires holding shims.

(Step 17 continued on Page 5)

