

# **Geareducer<sup>®</sup>**

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# **Repair Manual**

**Series 27A – Series 27T – Series 27.1**

RM-27D



## General

Geareducers can be repaired in the field; however, major repairs require the use of a fully equipped machine shop. When field repair or replacement of parts is necessary, the following procedure is recommended for the disassembly and assembly of the units.

Marley recommends new oil seals, O-rings, and gaskets be installed if removed for any repair or overhaul.

## Disassembly

Refer to Figures 1, 2, 3A and 3B.

1. If an oil gage and drain line is used, drain oil through plug connection below sight glass. Disconnect piping from Geareducer. If there is no connecting piping, remove drain plug below fill plug and drain oil. Complete draining by removing plug from bottom case cap.
2. Remove key from fan shaft keyway and remove water slinger.

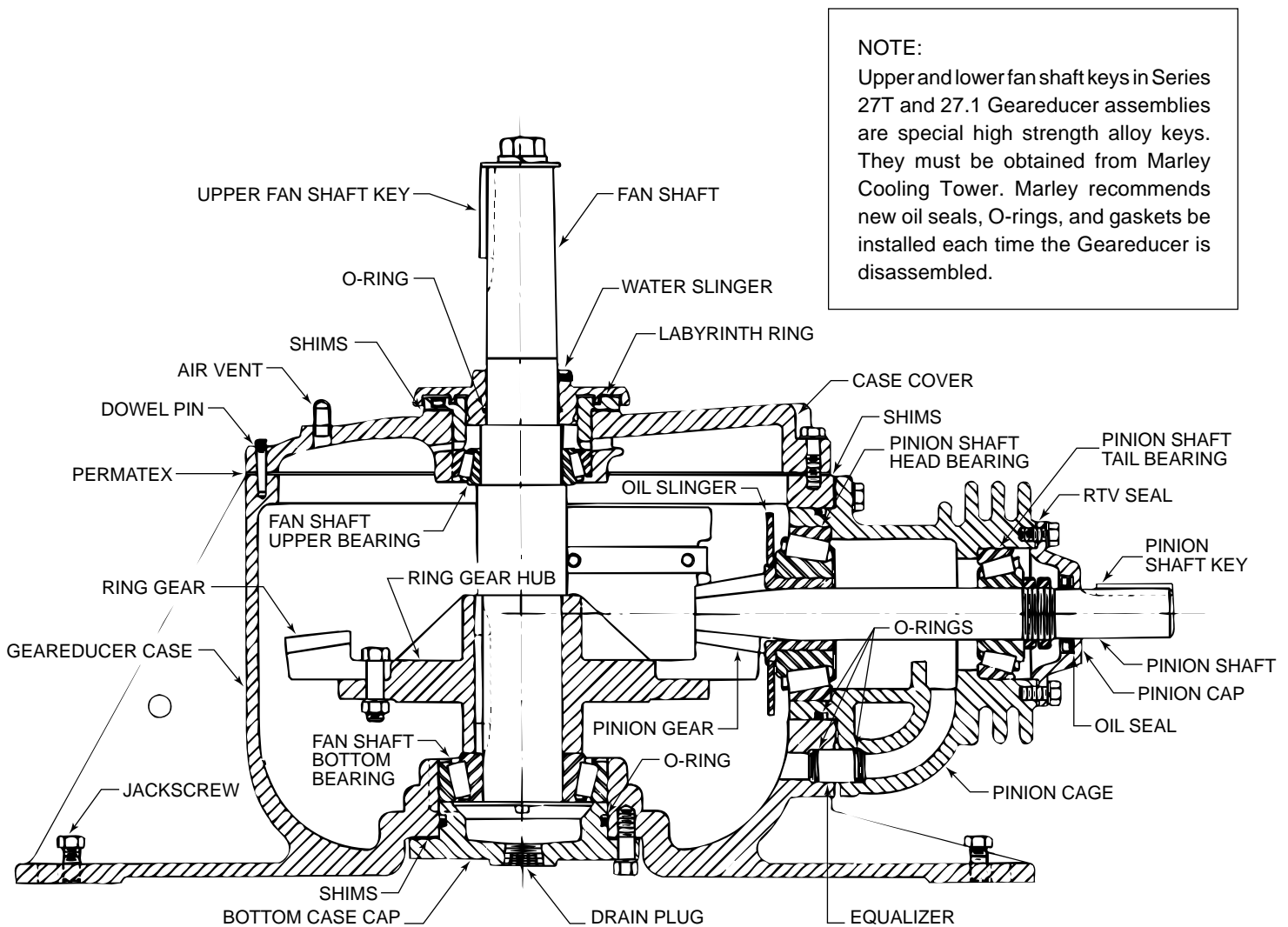


Figure 1. Cross Section Series 27A, 27T, and 27.1 Geareducer with Labyrinth Fan Shaft Seal

3. Fan shaft closure:

3a. Series 27A, 27T, and 27.1 Geareducers with labyrinth ring (refer to Figures 1 and 3A). Remove labyrinth ring and shims.

CAUTION: The thickness of this shim pack is important in the resetting of the gears. The shim pack should either be saved or carefully measured with a micrometer. If the gears are to be replaced, record the pinion setting distance that is etched on the pinion gear.

3b. Series 27A Geareducers with case cover cap (refer to Figures 2 and 3B). Remove case cover cap and shims. Remove oil seal from case cover cap.

CAUTION: The thickness of this shim pack is important in the resetting of the gears. The shim pack should either be saved or carefully measured

with a micrometer. If the gears are to be replaced, record the pinion setting distance that is etched on the pinion gear.

4. Remove case cover. Upper fan shaft bearing cup will be removed with the cover.

5. Remove pinion cage subassembly, shims, and equalizer.

CAUTION: The thickness of this shim pack is important in the backlash setting of the gears. The shim pack should either be saved or carefully measured with a micrometer.

6. Remove fan shaft subassembly. Lower fan shaft bearing cup will remain in the case.

7. Remove bottom case cap and shims.

8. Remove bearing cups from case and cover.

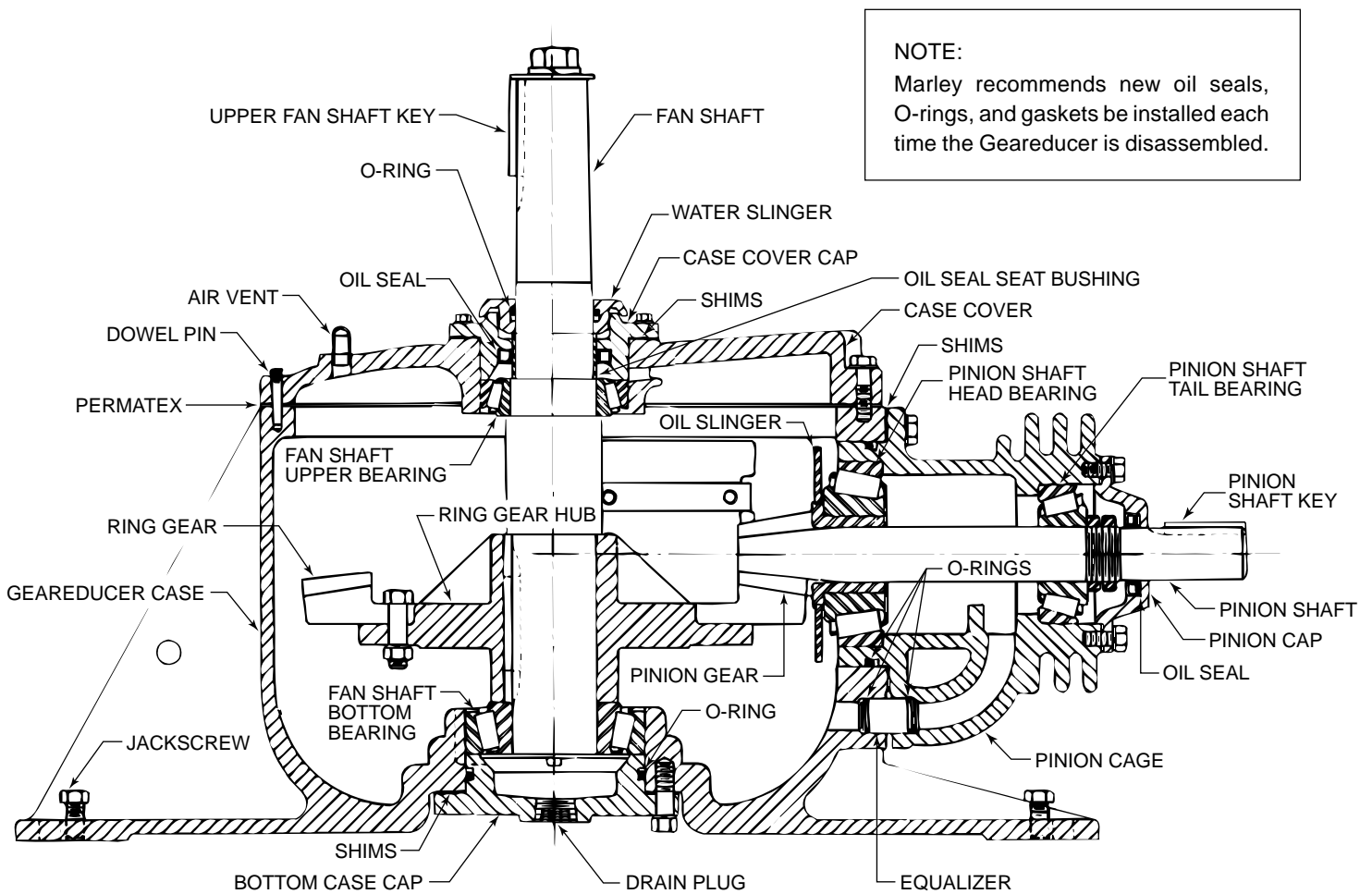


Figure 2. Cross Section of Series 27A Geareducer with Lip Type Fan Shaft Seal

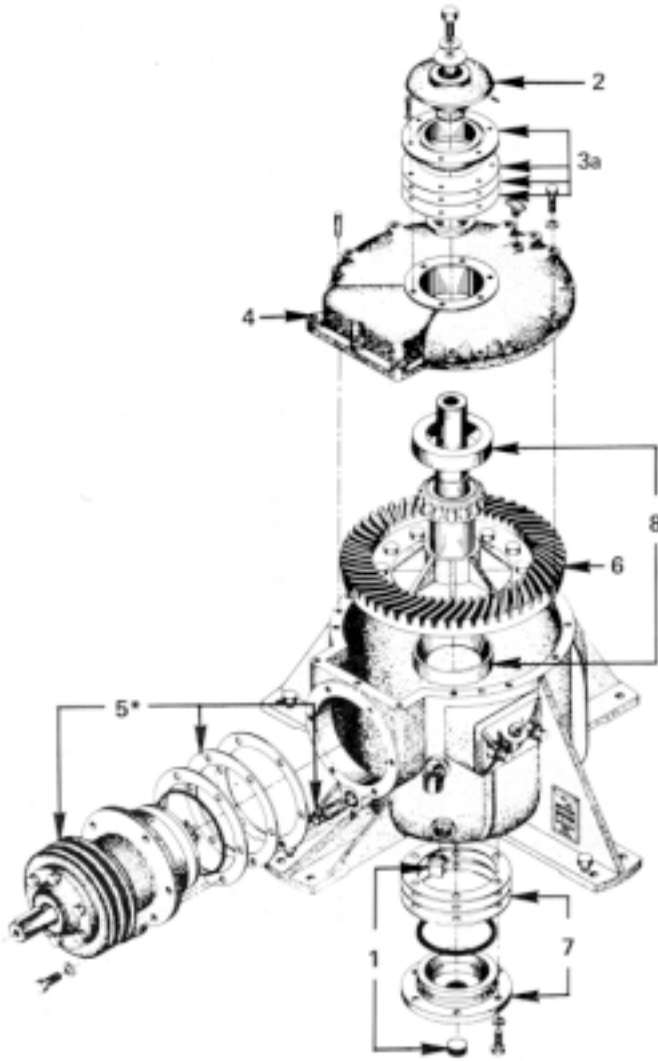


Figure 3A. Removal of Subassemblies  
27A, 27T, and 27.1 Geared Reducer with Labyrinth Fan Shaft Seal

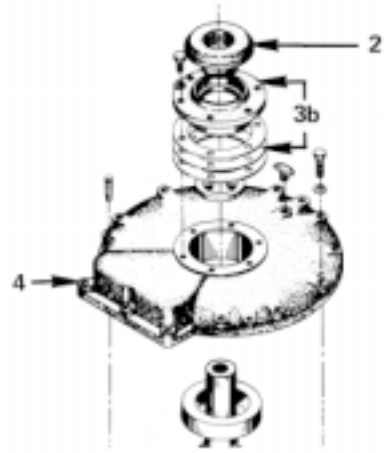


Figure 3B. Removal of Subassemblies  
27A Geared Reducers with Lip Type Fan Shaft Seal

### Pinion Cage Disassembly

Refer to Figure 4.

1. Remove key from keyway. Remove pinion cage cap and gasket.
2. Remove lock nuts and washer and press pinion shaft out of pinion cage. Do not drop tail bearing cone. A hydraulic press or jack is recommended for removing or assembling press fit parts.
3. Pull head bearing cone from pinion shaft. Bearings must not be exposed to dirt, dust, or moisture. If it is necessary to replace oil slinger, press off pinion shaft.
4. Pull bearing cups out of pinion cage.
5. Remove oil seal in pinion cap.

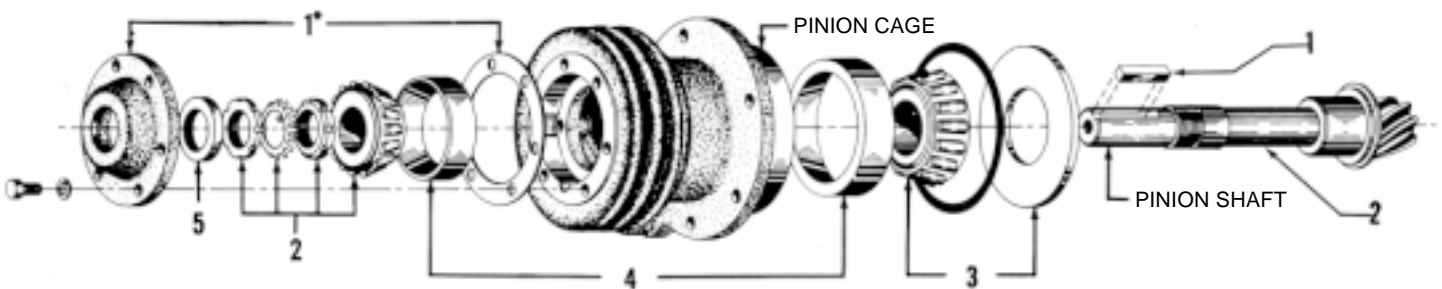


Figure 4. Disassembly of Pinion Cage Subassembly

## Fan Shaft Disassembly

Refer to Figure 5.

1. Press or pull upper bearing cone from fan shaft.
2. Remove ring gear from ring gear hub.
3. Press or pull ring gear hub and bottom bearing cone from fan shaft. Remove key from keyway.
4. Replace oil seal seat bushing if worn. This step required only for Series 27A Geareducers with lip type fan shaft seal (Figure 2).

All reused parts should be thoroughly cleaned before being installed.

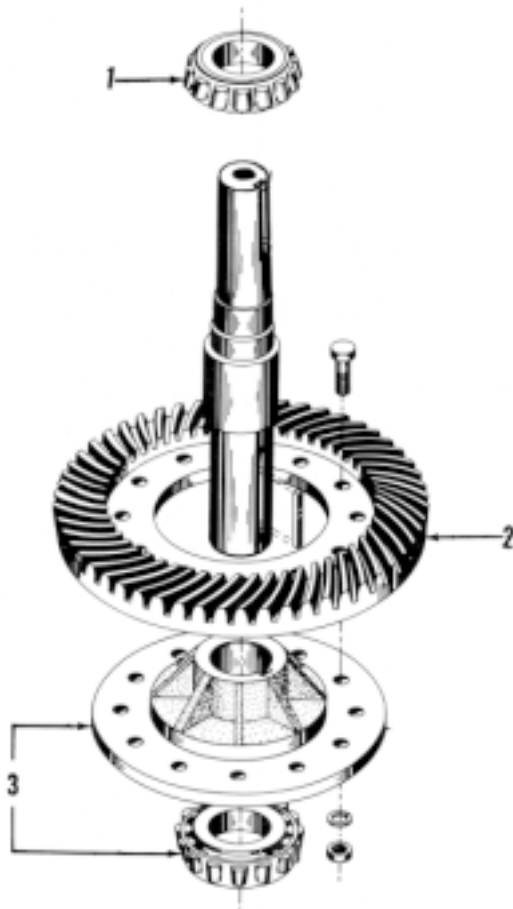


Figure 5. Disassembly of Fan Shaft Subassembly

## Assembly

Refer to Figures 6 through 12.

Before assembling a new pinion gear in the pinion cage, check match numbers on pinion gear and spiral bevel ring gear to be certain that they are a matched set. Gears are lapped in matched sets at the factory and should not be separated. Numbers are etched on both the pinion and ring gear as illustrated in Figure 6.

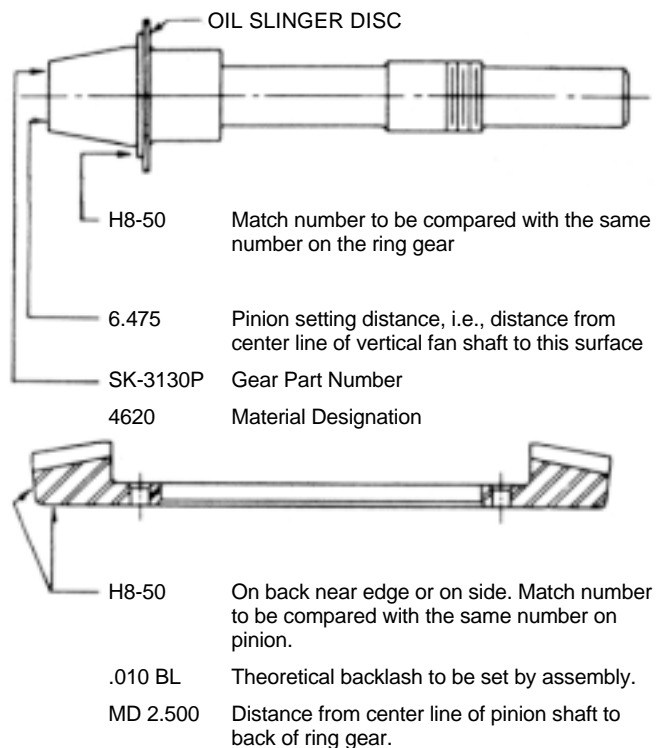


Figure 6. Gear Matched Numbers

## Pinion Cage Subassembly

Refer to Figure 7.

1. Press oil slinger on pinion shaft.
2. Press head bearing cone on pinion shaft. Make sure bearing cone is against shoulder of pinion shaft bushing.
3. Press bearing cups into pinion cage. Make sure cups are seated against the backing shoulders.
4. Push pinion shaft into pinion cage until head bearing cone and cup mate.
5. Press tail bearing cone on pinion shaft until mated with bearing cup.
6. Install lock nuts and lock washer. Tighten nuts and lock washer on bearing cone until 4-7 inch pounds of bearing pre-load is obtained. "Bearing pre-load" is the resistance in the bearing to shaft rotation measured in inch pounds torque required to rotate the shaft at uniform velocity. Pre-load is necessary to insure the stability of the gear engagement. Crimp the lock washer to lock the two nuts in place.
7. Install oil seal in pinion cap. Sealing lip must point inward. Tape over keyway in pinion shaft to protect seal lip during installation of pinion cage cap. Lubricate shaft lightly to ease installation.
8. Install pinion cap with gasket.
9. Do not install O-ring in groove of pinion cage at this time.

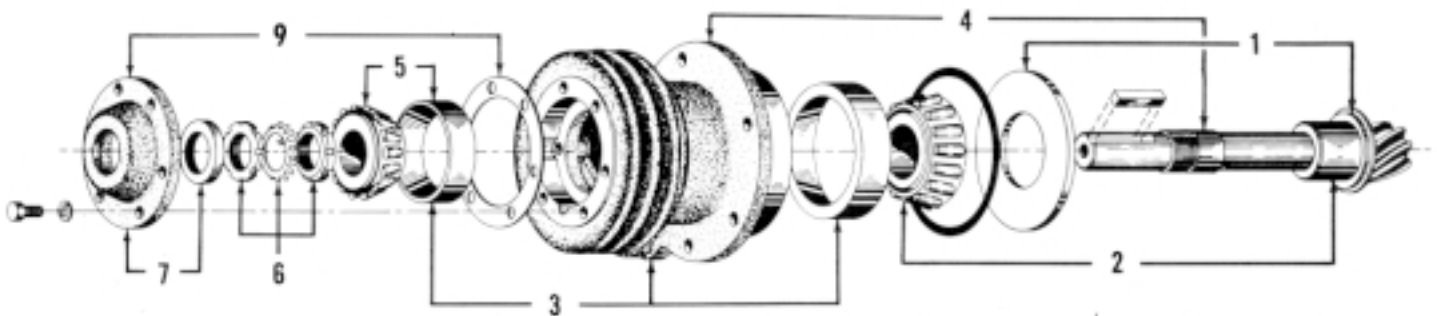


Figure 7. Assembly of Pinion Cage Subassembly

## Fan Shaft Subassembly

Refer to Figure 8.

1. Press oil seal seat bushing on fan shaft. This step not required for Series 27A, 27T, and 27.1 Geareducer assemblies with labyrinth fan shaft seal.
2. Place key in keyway of fan shaft, and press ring gear hub on fan shaft.
3. Press bottom bearing cone on fan shaft.
4. Bolt ring gear to ring gear hub.
5. Press upper bearing cone on fan shaft.

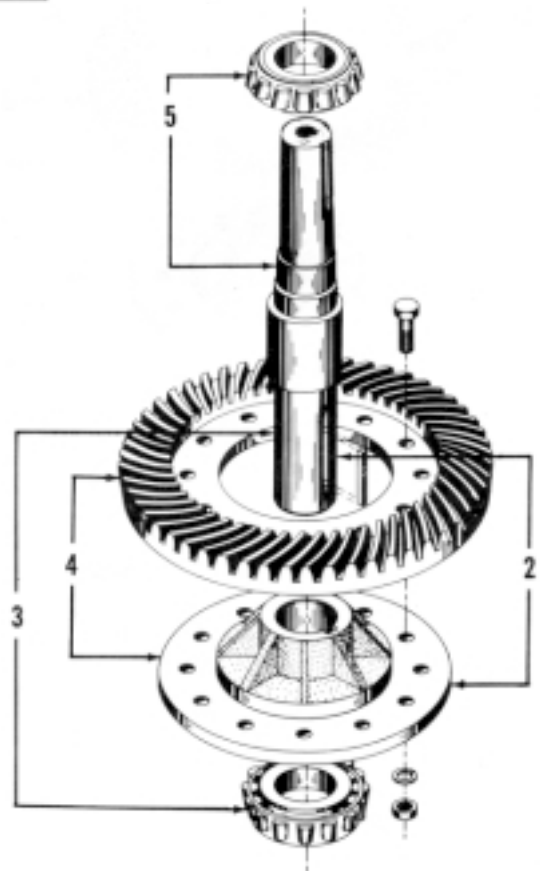


Figure 8. Assembly of Fan Shaft Subassembly

## Installation of Fan Shaft and Pinion Cage Subassemblies

Refer to Figure 9.

1. Press lower bearing cup into case.
2. Bolt bottom bearing cap in place, using same shims as were used originally. Do not install O-ring at this time.
3. Lower fan shaft assembly into case until bottom bearing cone mates with bearing cup.
4. The ring gear has the end of two teeth marked "X", and the pinion gear has one tooth so marked. The "X" marked pinion and gear teeth should be clearly identified with chalk or other markings which can be seen from the inspection opening.
5. Find the difference between the pinion setting distance of the old and the new pinion gear and adjust the old pinion cage shim pack or make a new shim pack to compensate for the different setting distances.

Example:

Pinion setting distance of old gear 6.505  
Pinion setting distance of new gear 6.500  
Difference .005  
Remove .005 from shim gap.

6. Install shims and pinion cage subassembly. Do not install pinion cage O-ring or equalizer until pinion cage shim gap has been determined. The gears should be engaged with the "X" marked pinion tooth between those marked on the ring gear. Attach pinion cage assembly to case. (CARE MUST BE TAKEN NOT TO DAMAGE the pinion gear teeth by forcing them into the ring gear teeth.)

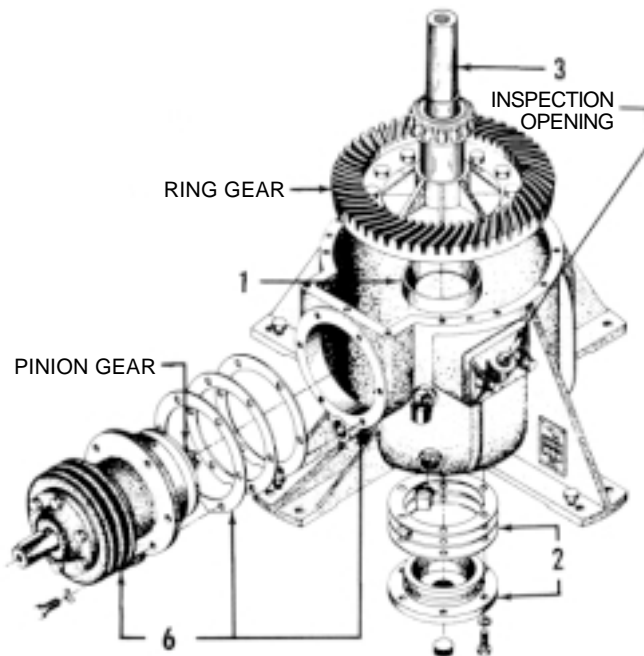


Figure 9. Installation of Fan Shaft and Pinion Cage Subassemblies

## Gear Setting Procedure

Refer to Figures 10 through 12.

1. Press upper bearing cup into case cover.
2. Apply permatex to top flange of case. Position and install cover. Use dowel pins for aligning cover with case. Bolt cover to case.
3. Install labyrinth ring without shims (Figure 1 and 10A) or case cover cap without new oil seal, if required, and without shims (Figures 2 and 10B). Tighten bolts to obtain zero fan shaft end play and not more than 35 inch-pound bearing pre-load. This is necessary in order to check gear backlash.
4. It is essential that the gears be properly positioned to obtain long life and smooth operation of Geareducer. Correct gear position is determined by measuring backlash and tooth bearing.

Check backlash with marked teeth engaged with a dial indicator as shown in Figure 11. Lock the pinion shaft against rotation. The amount of rotation of the fan shaft measured at a distance equal to the outside radius of the ring gear is the backlash. Check the backlash at three other points around the ring gear to be sure the backlash is within the specified limits.

Proper 27A, 27T, and 27.1 Geareducer backlash is between .010 inches and .018 inches: If backlash is not within these limits, adjust the ring gear position with shims between the bottom bearing cap and the Geareducer case. Add shims to increase backlash and remove shims to decrease backlash.

5. With gears adjusted for approximate backlash, blue (Prussian blue in oil) the pinion teeth. (By using a long handled brush or swab, the pinion teeth can be reached through the inspection opening.) Drive the pinion by turning the fan shaft in both directions for several revolutions. Observe the markings on both gears on both sides of the teeth. Compare the markings with the contact pattern shown in Figure 12.

If contact pattern is incorrect, adjust the pinion position with shims between the pinion cage and Geareducer case.

6. When tooth contact is correct, recheck backlash. If necessary, change shims at bottom bearing cap to obtain proper backlash, and recheck bearing pattern. Proper tooth bearing is more important of the two. On a used set of gears it may be necessary to set the gears with slightly greater backlash in order to obtain proper tooth bearing. Should a condition be encountered where correct bearing cannot be obtained, contact your local Marley sales representative for information on factory repair service.

7. Install pinion cage O-ring and equalizer with its O-rings. Install bottom bearing cap O-ring. (See Figures 1 or 2 for location of O-rings and equalizer.)
8. Check fan shaft endplay with a dial indicator. Endplay must be between .003 inch and .005 inch. Change cover cap or labyrinth ring shims to obtain this endplay.
9. For Series 27A Geareducers with lip type fan shaft seal, remove case cover cap (do not disturb shims) and press in new seal, if required, with lip pointing upward. Replace cap.

This step not required for Series 27A, 27T, and 27.1 Geareducers with labyrinth fan shaft seal.

10. Fan shaft closure:

- 10a. Series 27A, 27T, and 27.1 Geareducers with labyrinth fan shaft seal: Place O-ring in groove of water slinger, fill grooves of labyrinth ring and water slinger with lithium base grease, and install water slinger.
- 10b. Series 27A Geareducers with lip type fan shaft seal: Place O-ring in groove of water slinger and install water slinger.

11. Replace drain plugs.

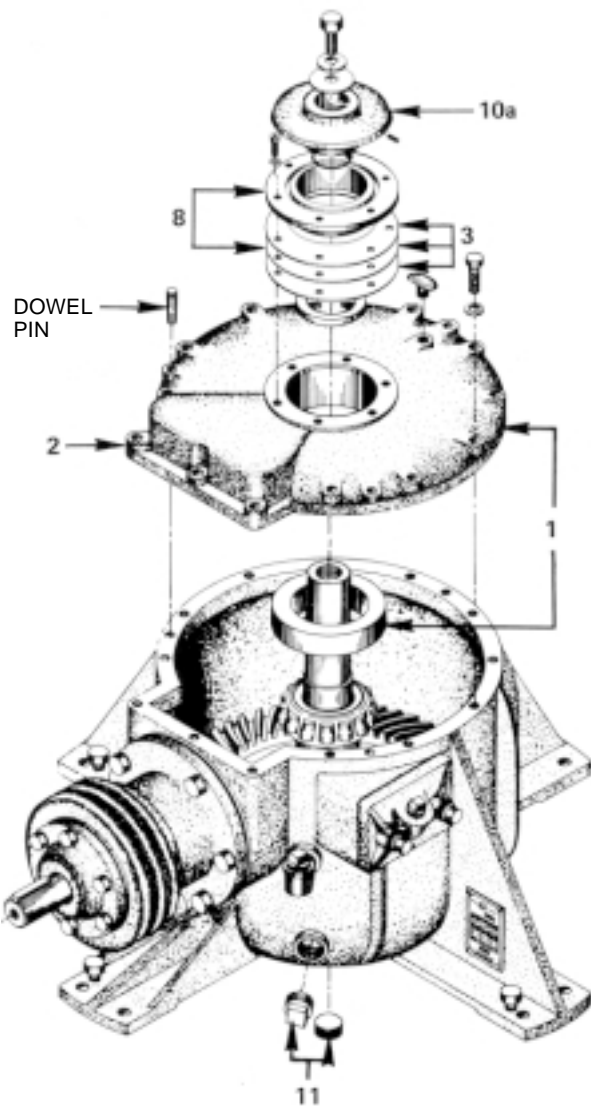


Figure 10A. Installation of Case Cover  
27A, 27T, and 27.1 Geareducers with Labyrinth Ring Fan Shaft Seal

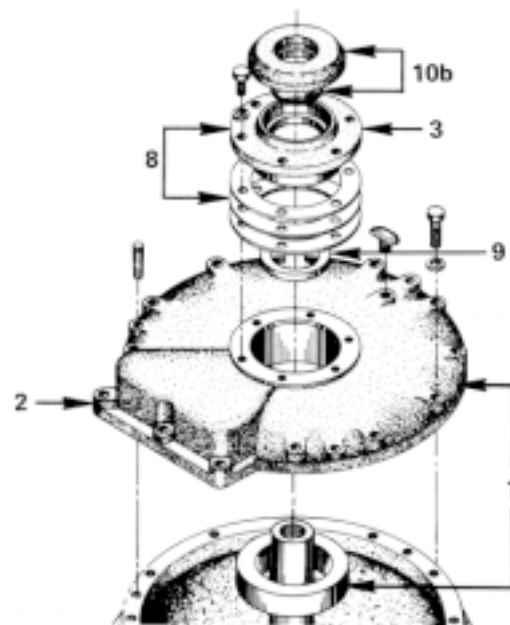


Figure 10B. Installation of Case Cover  
27A Geareducers with Lip Type Fan Shaft Seal



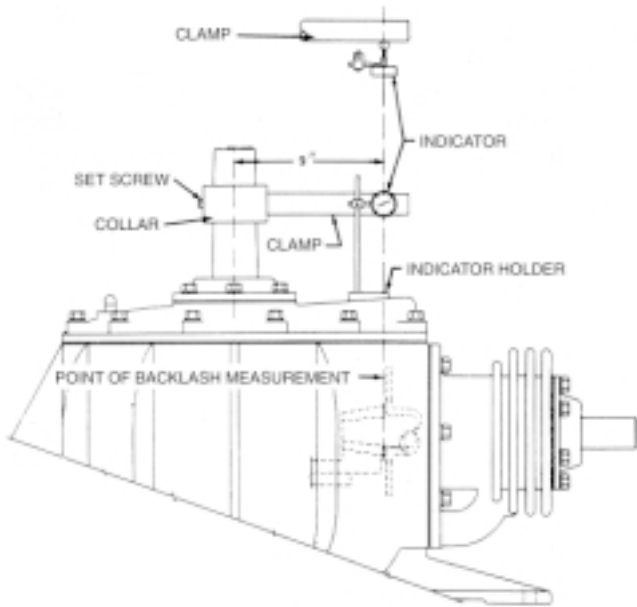


Figure 11. Geareducer Backlash Measurement

## Installation, Alignment And Lubrication

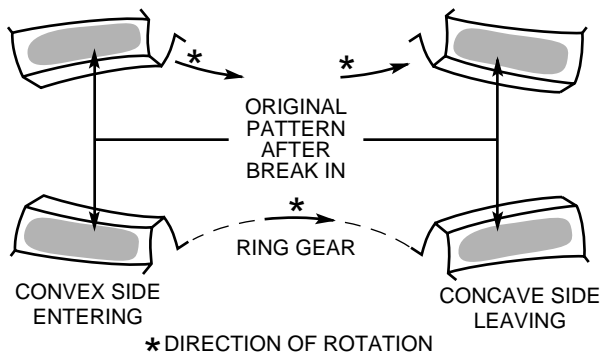
The Geareducer must be leveled and properly aligned with drive shaft and motor shaft. Jackscrew holes are provided in each foot for raising or lowering of the Geareducer. Slotted shims may be inserted under Geareducer feet with the jackscrews in place to assist in leveling and alignment. Remove jackscrews and bolt the Geareducer firmly in place after verifying alignment.

If an oil gage and drain line is used, connect it so the horizontal part of the line is level or sloping down slightly toward the sight glass. Coat any exposed threads at piping joints to prevent corrosion.

Fill Geareducer with oil to the oil level mark on the side of the case. The oil capacity is 8 gallons for Series 27A, 27T, and 27.1 Geareducers identified as #53-4236 (on top of rear mounting foot). Oil capacity is 11 gallons for Series 27T and 27.1 Geareducers identified as #87-41120. One or two gallons more will be required where an oil gage and drain line is used. Check oil lines to be sure all joints are tight and free from leaks.

For more instructions on alignment, installation, and lubrication of Geareducer, refer to the appropriate Marley Drive Shaft Service Manual and Marley Geareducer Service Manual.

### Correct Pinion and Gear Tooth Contact Patterns



### Incorrect Ring Gear Tooth Contact Patterns

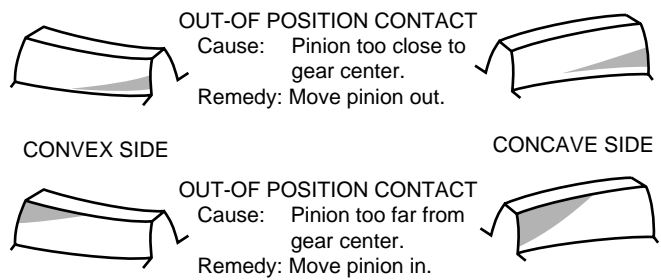


Figure 12. Tooth Pattern, Correct and Incorrect

## Lubricants for Marley Geareducers

To insure maximum performance and service life, Marley Cooling Tower Company recommends Marley factory lubricants be used in all Marley spiral bevel Geareducers. Marley lubricants can be purchased through your local Marley sales office in one-gallon and five-gallon containers.

If lubricants other than Marley factory lubricants are used, they must not contain any additives (such as detergents or EP additives) which are adversely affected by moisture and could reduce the service life of the Geareducer. The responsibility for use of lubricants other than Marley factory lubricants rests with the customer/owner and the lubricant supplier.

Seasonal temperature changes may require one viscosity of oil for summer operation and another for winter operation. Refer to the tables below for the seasonal selection information.

Winter	Winter or Summer	Severe Duty/High Temperature
Air Temperature At Geareducer		
Below 32°F (0°C) (Heat Exchangers Only)	32°F to 110°F (0°C to 43°C)	Above 110°F (43°C)
<b>Marley Gearlube SAE30</b>	<b>Marley Gearlube SAE30</b>	<b>Marley Gearlube SAE40</b>
Mobil SHC 629	Mobil SHC 629	Mobil SHC 630

Table I. Synthetic oil

Winter	Winter or Summer	Summer
Air Temperature At Geareducer		
Below 32°F (0°C) (Heat Exchangers Only)	32°F to 110°F (0°C to 43°C)	Above 110°F (43°C)
<b>SAE 20 (ISO 68)</b>	<b>SAE 30 (ISO 100)</b>	<b>SAE 40 (ISO 150/220)</b>
Viscosity S.U.S at 100°F 230-310	Viscosity S.U.S at 100°F 450-610	Viscosity S.U.S at 100°F 750-1000

Table II. Turbine-type oil





## **Marley Cooling Tower**

A United Dominion Company

The Marley Cooling Tower Company

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Printed in USA