



MANUAL

Series 32.2 GEAREDUCER®

RM-32.2B



Field Repair Instructions

August, 1992

Manual 92-1414

FIELD REPAIR—SERIES 32.2 GEAREDUCER

MARLEY

SERIES 32.2 GEAREDUCER

FIELD REPAIR INSTRUCTIONS

GENERAL

Marley recommends that Geareducers in need of extensive repair be returned to its service facility at Needville, Texas for rebuilding to factory specifications. Obtain "Customer Return Material" tag from Marley sales office or representative to affix to the Geareducer for return. A factory reconditioned Geareducer carries the same one year guarantee against defects in material and workmanship as does a new unit.

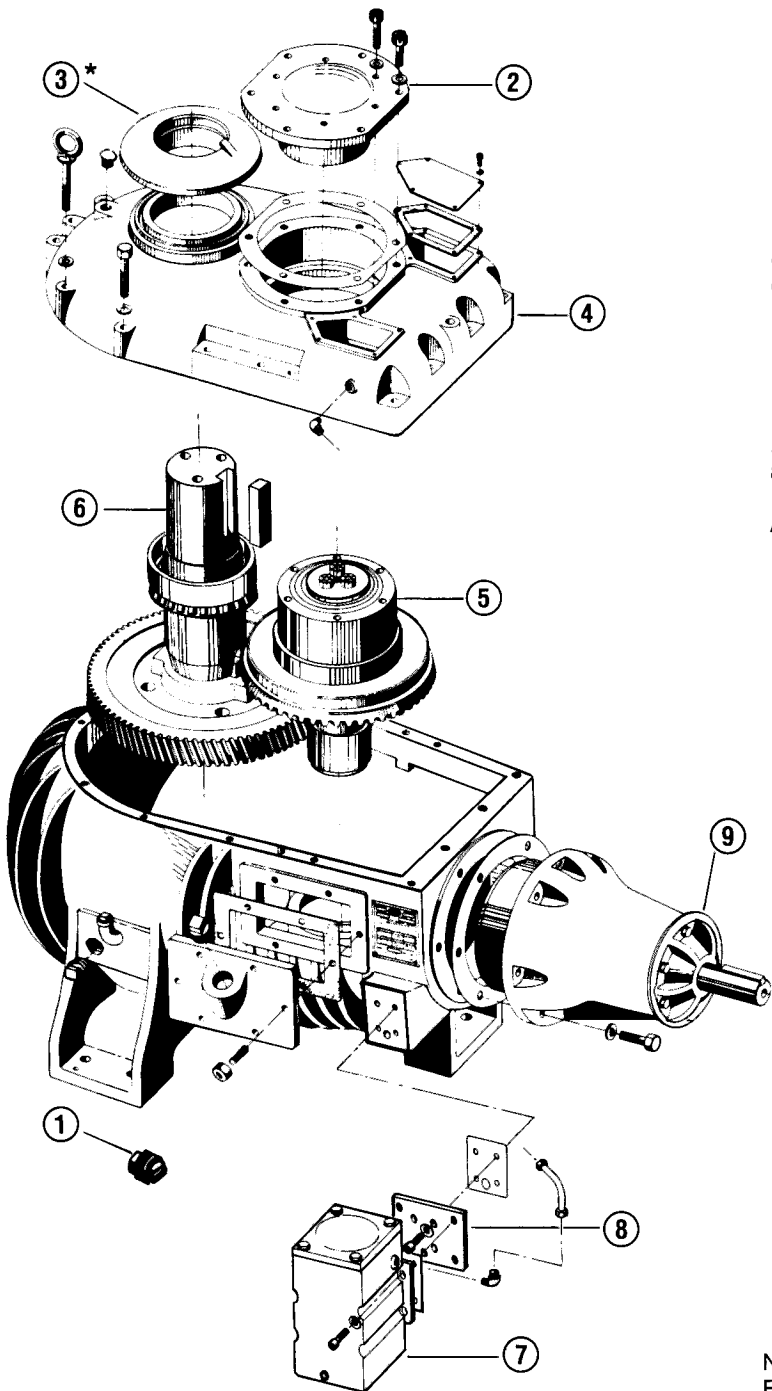
Geareducers can be repaired in the field; however, major repairs require the use of a fully equipped machine shop. When field repair or replacement of parts is necessary, the following procedure is recommended for the disassembly and assembly of the unit.

DISASSEMBLY OF GEAREDUCER

Proceed cautiously when removing parts noted by asterisk (*). These parts use oil seals which must not be damaged.

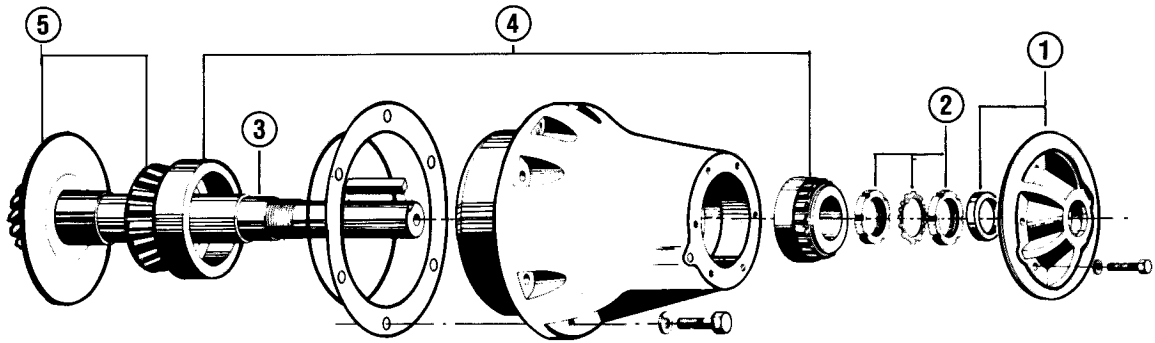
A. DISASSEMBLY OF MAJOR SUBASSEMBLIES

1. Drain oil by removing plug.
 2. Remove top interstage cap.
 3. Pull water slinger off of fan shaft.*
 4. Lift case cover off.
 5. Pull interstage subassembly out of case.
 6. Lift out fan shaft subassembly.
 - **7. Remove filter case assembly.
 - **8. Remove oil pickup assembly.*
 9. Remove pinion cage subassembly.*
- **Applicable only to units having oil filters.



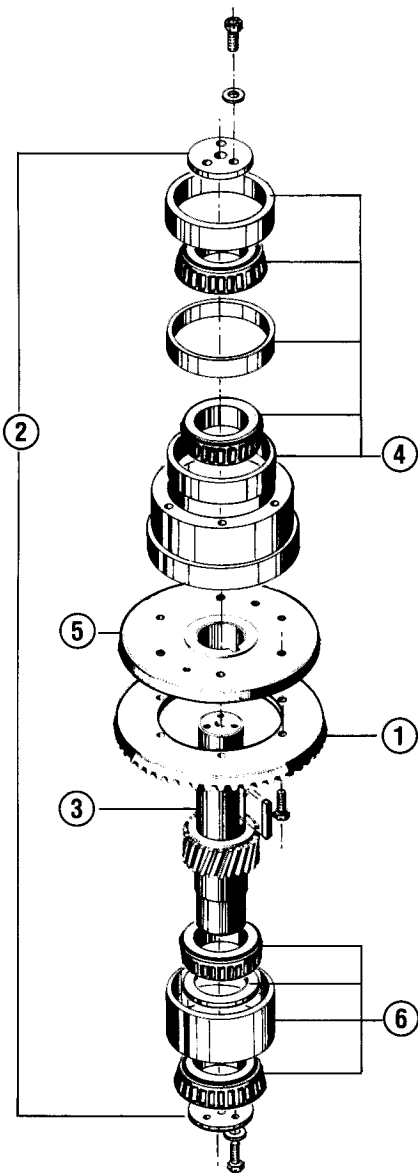
NOTE:

Fan shaft extension key on Series 32.2 Geareducer is a high strength, special alloy key. If replacement is required, it must be obtained from Marley.



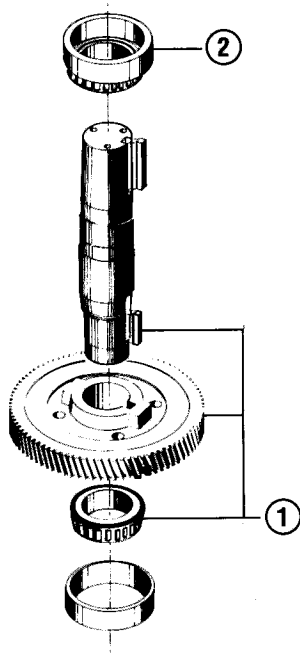
▲ B. DISASSEMBLY OF PINION CAGE

1. Remove pinion cage cap. Be especially careful to avoid damaging oil seal.
2. Remove locknuts and washer from pinion shaft.
3. Press pinion shaft with head bearing out of pinion cage. (This will free cone of tail bearing.)
4. Remove bearing cups from pinion cage.
5. If bearing cone on head of pinion shaft has to be replaced, it will be necessary to press off oil slinger and bearing cone at same time.



▲ C. DISASSEMBLY OF INTERSTAGE

1. Remove spiral bevel ring gear from hub.
2. Remove top and bottom interstage bearing discs.
3. Push shaft out of upper bearing cones, cups and retainer.
4. Remove upper two bearing cups, cones and spacer from top interstage retainer.
5. Pull spiral bevel ring gear hub off shaft. Key between ring gear hub and interstage shaft on Series 32.2 Geareducers is a high strength, special alloy key. If replacement is required, it must be obtained from Marley.
6. Remove bottom two bearing cups, cones and spacer.



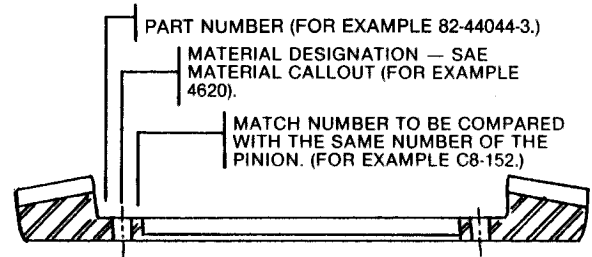
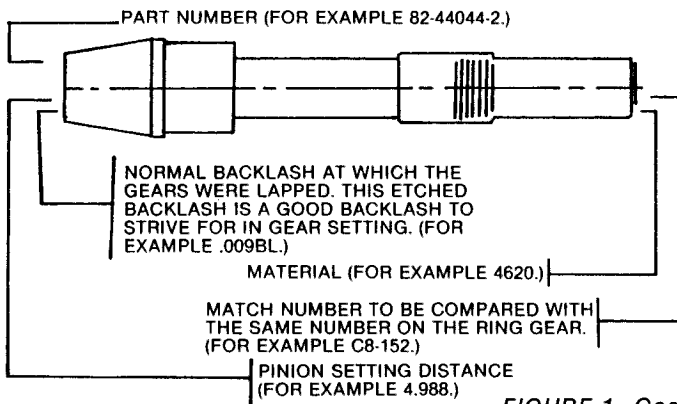
D. DISASSEMBLY OF FAN SHAFT

1. Press helical ring gear, and bearing cone from shaft. Press against gear hub only, not against ring gear. Key between ring gear hub and fan shaft on Series 32.2 Geareducer is a high strength, special alloy key. If replacement is required, it must be obtained from Marley.
2. Remove upper bearing cone.
3. Remove upper bearing cup from cover and lower bearing cup from case (not illustrated).

ASSEMBLY OF GEAREDUCER

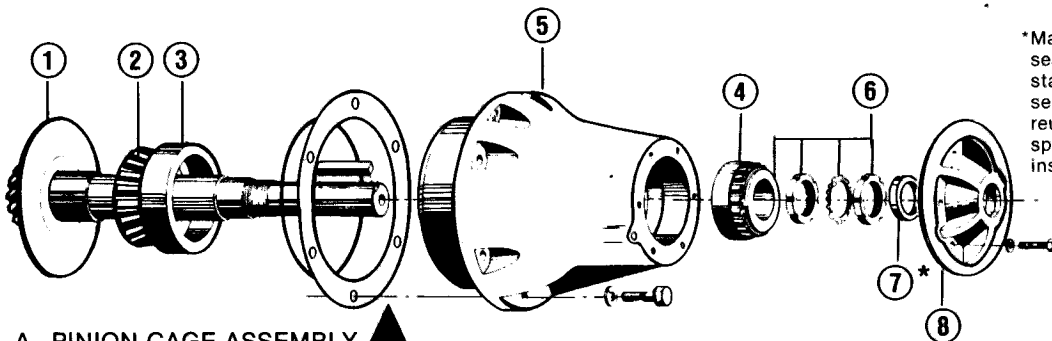
GEAR MATCH NUMBERS & SETTING DATA

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 1.



4.988 OR 5.010 IS THE THEORETICAL PINION SETTING DISTANCE. THE ACTUAL PINION SETTING DISTANCE IS ETCHED ON THE END OF THIS PINION. THIS IS THE DISTANCE THE END OF THE PINION SHOULD BE FROM THE CENTER LINE OF THE RING GEAR SHAFT.

FIGURE 1. Gear Match Numbers & Setting Data.

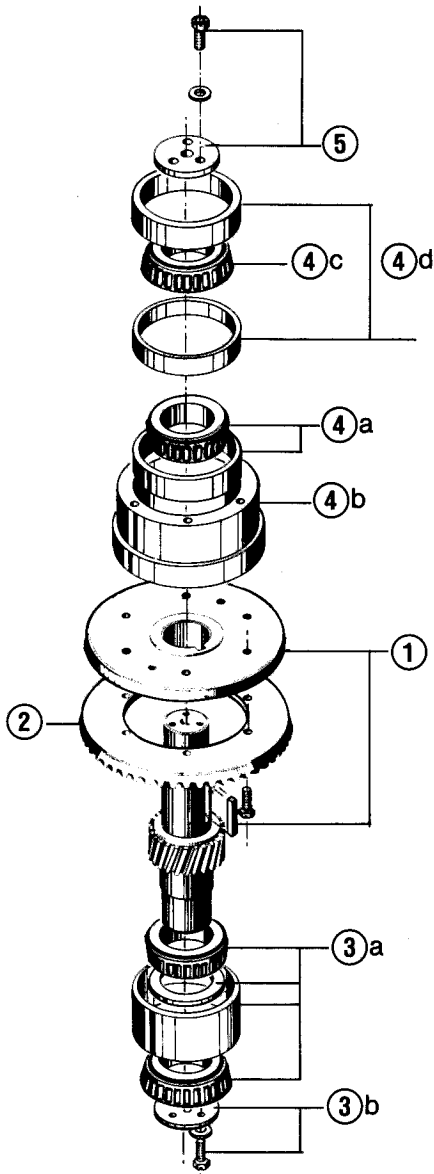


A. PINION CAGE ASSEMBLY

1. Install oil slinger on pinion shaft.
 - a. On some ratios the slinger must be pressed onto the shaft, up against the pinion gear.
 - b. On some ratios the slinger is a loose fit and will use the pinion head bearing cone to hold the slinger against the pinion gear.
2. Install pinion head bearing cone on pinion shaft. (See 1b above.)
3. Press pinion head bearing cup into pinion cage.
4. Press pinion tail bearing cup into pinion cage.
5. Lower pinion cage over pinion shaft until head bearing cone mates with cup.
6. Press tail bearing cone onto pinion shaft

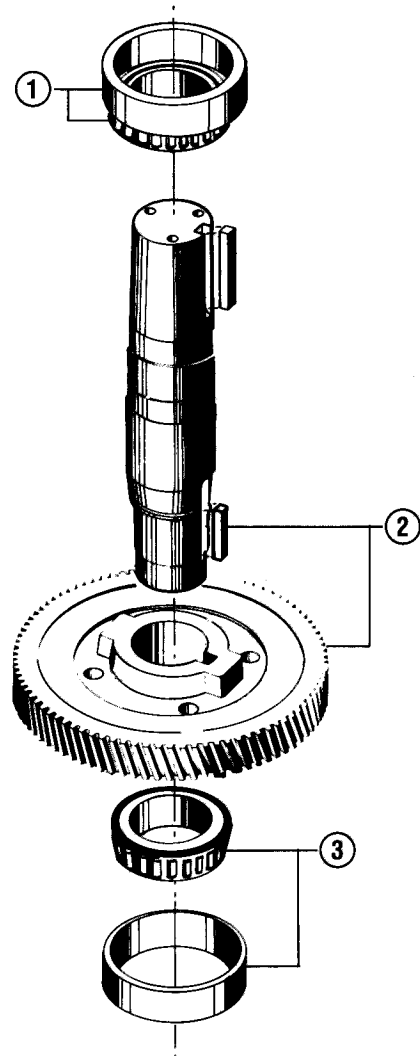
*Marley recommends that new oil seals, "O" rings and gaskets be installed during a major overhaul. If oil seals, "O" rings or gaskets are to be reused, they should be carefully inspected for damage before being re-installed.

- a. Lock with locknuts and lockwasher to 10-18 inch pounds of bearing preload. "Bearing preload" is the resistance in the bearing to shaft rotation measured in inch pounds torque required to rotate the shaft at uniform velocity. Preload is necessary to insure the stability of the gear engagement.
- b. Crimp ears of lockwasher to locknuts after obtaining proper preload.
7. Install pinion shaft oil seal* in pinion cage cap.
8. Assemble pinion cage cap using sealer between cage and cap.



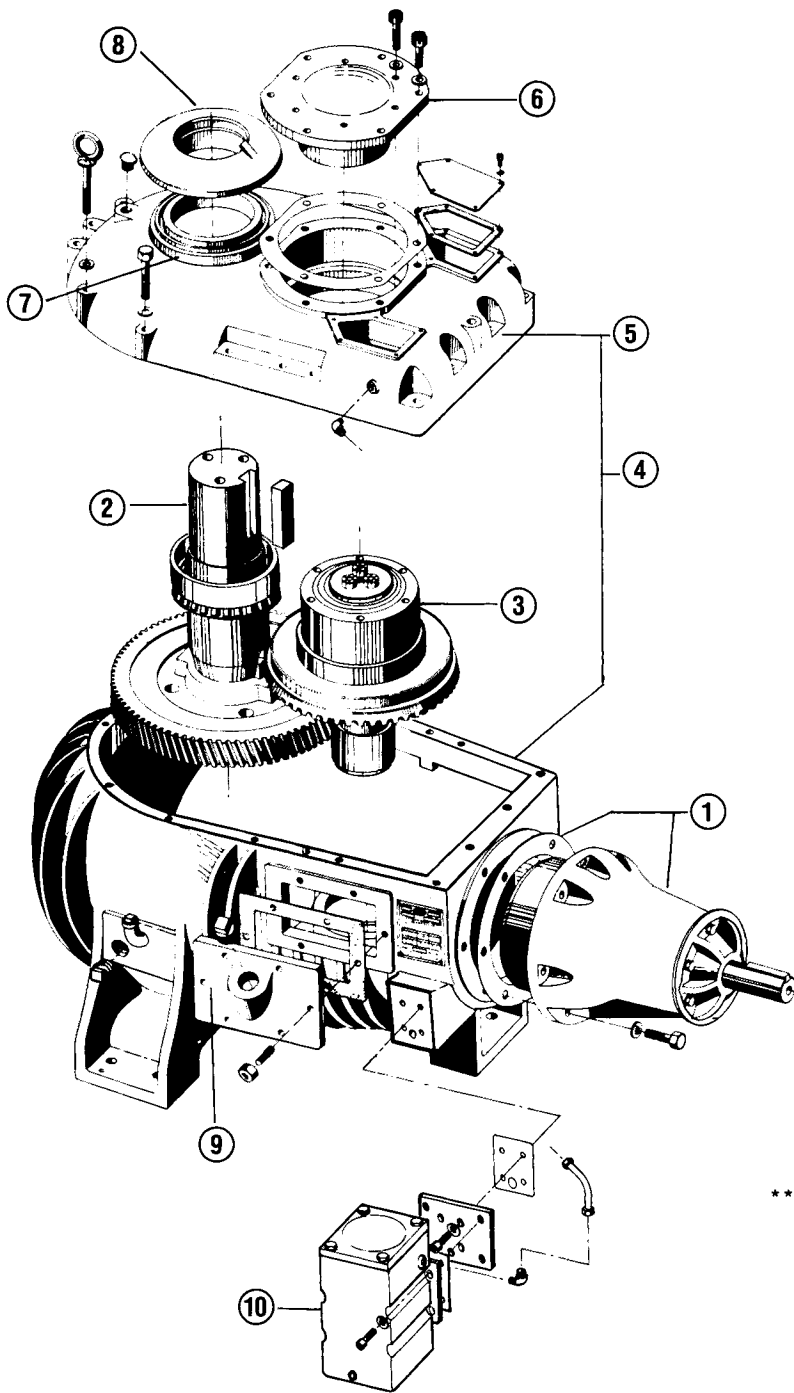
◀ B. INTERSTAGE ASSEMBLY

1. Install key and spiral bevel ring gear hub on inter-stage shaft.
2. Attach ring gear to ring gear hub with place bolts (tighten to 85-90 ft./lbs torque).
3. a. Press upper cone of lower interstage bearing onto shaft. Install spacer and cup, then press lower cone onto the shaft.
b. Install disc with place bolts. (Tighten to 30-35 ft./lbs. torque.)
4. a. Press lower cup of upper interstage, bearing into bearing retainer.
b. Lower bearing retainer onto interstage shaft.
c. Press lower cone and upper cone onto inter-stage shaft.
d. Install cup spacer and then press upper cup into retainer.
5. Install disc with place bolts (tighten to 140-150 ft./lbs. torque).



C. FAN SHAFT ASSEMBLY ▶

1. Press cone of upper fan shaft bearing on fan shaft.
2. Install key and helical gear on fan shaft. Press against gear hub only, not against ring gear.
3. Press cone of bottom bearing onto fan shaft.
4. Install lower fan shaft bearing cup into case (not illustrated).
5. Install upper fan shaft bearing cone into cover (not illustrated).



Final Assembly

4. a. Apply Permatex No. 2 to case flange, and lower case cover onto case.
- b. Pilot both shaft subassemblies into their respective bores.
5. a. Install taper pins.
- b. Fasten case cover to case with capscrews. (Tighten to 35-45 ft./lbs. torque.)
6. a. Position top interstage cap shims and install cap with place bolts.
- b. Adjust shims to give proper backlash (.006-.012 normal) between spiral bevel gears. See "Gear Setting Procedure" on next page.
- c. When proper backlash has been set, tighten place bolts to 85-90 ft./lbs torque.
7. a. Coat labyrinth recess in case cover with Permatex No. 2.
- b. Install labyrinth ring with shims.
- c. Rotate fan shaft several revolutions to seat bearings.
- d. Check fan shaft endplay with a dial indicator. Endplay must be between .002 and .004 inch.
- e. Add or subtract shims as required to obtain proper endplay. Rotate fan shaft each time prior to checking endplay to insure that bearings are seated.
8. a. Fill grooves of labyrinth ring and water slinger with lithium-base grease.
- b. Install water slinger and its "O" ring on fan shaft.
9. Install inspection cover, gasket and drain plug.
10. FOR ASSEMBLY WITH INTEGRAL OIL FILTER
- ** a. Install oil return assembly with gasket into case. If cap screws are black socket head, tighten to 30-35 ft./lbs. torque. If stainless steel socket head cap screws are used, tighten to 20 ft./lbs. torque.
- b. Install oil filter case assembly. Tighten cap screws to 30-40 ft./lbs. torque. Install oil supply lines and fitting.
11. FOR ASSEMBLY WITHOUT OIL FILTER (not illustrated)
- Install oil return cover with gasket. Install pipe plug in oil supply opening in case cover.

**Applicable only to units having oil filters

D. FINAL ASSEMBLY

1. a. Slip "O" ring onto pinion cage subassembly.
- b. Bolt pinion cage subassembly to case subassembly using proper number of shims to give indicated pinion setting distance which is etched on front face of pinion gear. Tighten bolts to 70-75 ft./lbs. (See Fig. 1, page 4.)
2. Lower fan shaft subassembly into case subassembly.
3. a. Lower interstage subassembly into case subassembly.
- b. Engage marked spiral bevel ring gear teeth with marked spiral bevel pinion tooth.

GEAR SETTING PROCEDURE

The proper mounting of the gear set is essential to obtain long life and smooth operation of the gears. The pinion cage position adjustment is obtained by shims under the flange of the pinion cage. Shims are placed under the top interstage bearing cap to adjust ring gear position. The gear setting may require several attempts before obtaining the proper backlash and tooth contact pattern.

The gear and pinion are match-marked when lapped and must be assembled the same way. The ring gear has the end of two teeth marked "X" and the pinion has one tooth so marked; the gears should be engaged with the X-marked pinion tooth between those marked on the ring gear. Match marks can be checked through the inspection opening.

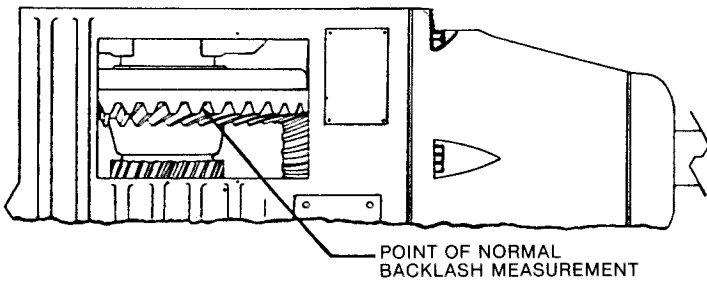


FIGURE 2. Gear Backlash Measurement

With the marked teeth of the gear engaged, check backlash with dial indicator (see Fig. 2). The indicator can be installed through the inspection cover opening. Change shims under top interstage bearing cap until backlash is between .006 to .012" normal to ring gear tooth.

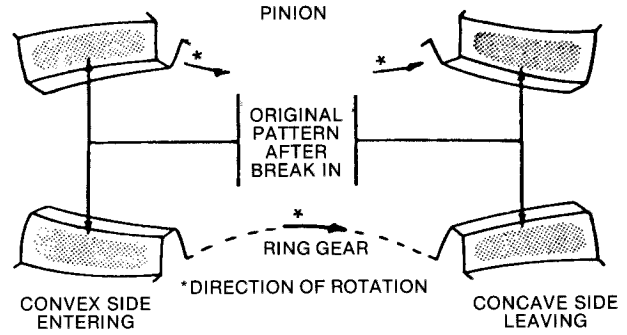
With gears adjusted for proper backlash, blue (Prussian Blue in oil) the gear teeth. Drive the pinion by turning ring gear in both directions for several revolutions. Observe the contact pattern on both gears on both sides of the teeth. The contact pattern should be as shown at the top of Fig. 3.

If correct tooth contact pattern is not obtained on first trial, refer to sketches at bottom of Fig. 3; these sketches show the two cases of "out-of-position contact" in the extreme. One of the remedies indicated will correct the out-of-position contact; compare the tooth contact pattern with sketches shown in Fig. 3, and choose the required remedy.

When proper tooth contact has been obtained, recheck the backlash at marked teeth. If it is within the desired range (.006 to .012"), check backlash with dial indicator at 2 additional points 120° apart (with inspection cover removed), and as shown in Fig. 2. All backlash readings must be within the specified range. If backlash is not within the limits, adjust ring gear height with shims until it is, checking again as described.

The tooth contact pattern should again be checked to determine if adjusting the backlash has produced any

CORRECT PINION & RING GEAR TOOTH CONTACT PATTERNS



INCORRECT RING GEAR TOOTH CONTACT PATTERN

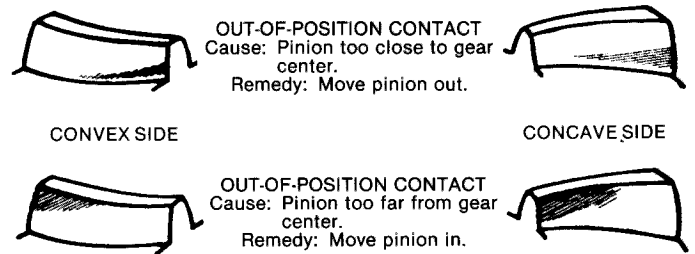


FIGURE 3. Tooth Contact Pattern, Correct and Incorrect.

shift. If it has shifted, move the pinion in the opposite direction the gear was moved with respect to the cone center. If the gear mounting distance is reduced, increase pinion setting distance, and vice versa, (see Fig. 1, page 4) an amount proportional to the number of teeth in the respective members. For example: on a 10 to 1 gear set, if the ring gear was moved 0.010", the pinion should be moved 0.001". This would be necessary only if the contact pattern had visually shifted due to movement of the ring gear while adjusting backlash.

When setting a used set of gears, follow the method outlined above. However, depending upon the amount of wear, it may be necessary to set the gears up with slightly greater backlash in order to obtain proper contact. *Proper tooth contact pattern is the most important factor of correct installation.*

Should a condition be encountered where correct contact cannot be obtained as described in this manual, the Geareducer should be returned to Marley's Olathe, Kansas plant in exchange for a factory reconditioned unit.

INSTALLATION AND LUBRICATION

The Geareducer must be installed level and properly aligned with the motor shaft. Connect drain line and vent line. Fill Geareducer with recommended oil (Table I) to full mark on case. Refer to Marley Geareducer and Drive shaft service manuals for complete instructions.

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.

Turbine-type mineral lubricants conforming to the viscosity requirements outlined in Table I may be used. These lubricants will provide service life of up to six months.

Marley Gearlube™ is a premium quality synthesized hydrocarbon lubricant that is specially formulated to deliver extended life without oxidation or loss of lubricity. It is free of undesirable elements that can produce sludge, deposits and corrosion—and a much better extended life lubricant than turbine-type lubricants. Gearlube will provide service life of up to five years and is available in viscosities for all climatic condition. Approved alternate synthetic lubricants as outlined in Table II may also be used.

| Winter | Winter or Summer | Summer |
|--------------------------------------|-------------------------------------|--------------------------------------|
| Air Temperature At Geareducer | | |
| Below 32°F (Heat Exchangers Only) | 32°F to 110°F | Above 110°F |
| SAE 20 | SAE 30 | SAE 40 |
| 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 I. Synthetic oil.

| Winter | Winter or Summer | Severe Duty/High Temperature |
|--------------------------------------|------------------------------|------------------------------|
| Air Temperature At Geareducer | | |
| Below 32°F (Heat Exchangers Only) | 32°F to 110°F | Above 110°F |
| Marley Gearlube SAE30 | Marley Gearlube SAE30 | Marley Gearlube SAE40 |
| Mobil SHC 629 | Mobil SHC 629 | Mobil SHC 630 |

Table II. Turbine-type oil.



Marley Cooling Tower

A United Dominion Company

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