MM6101-B
JULY 1998
INSTALLATION
LUBRICATION
OPERATION
MAINTENANCE INSTRUCTIONS
PRICE $2.00

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FIXED BASE WORM GEAR REDUCER

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⚠WARNING SAFETY

Rotary equipment is dangerous unless adequately guarded. The user is responsible for complying with all applicable safety regulations. Adequate safety instructions must be given by the user to personnel directly responsible for the installation, maintenance, and operation of the equipment. The gear unit must not be operated above its service rating.

DAMAGE IN SHIPMENT

⚠CAUTION The equipment should be inspected immediately upon receipt of shipment for indications of rough handling or damage. Report to the carrier any apparent or suspected damage. This may show up as scuffed paint, broken or cracked castings, bent shafts, metal deformation or a shift in alignment of components.

STORAGE

NORMAL PREPARATION

Prior to shipment, all gear units are tested with a rust inhibiting oil that covers all interior surfaces. Shaft extensions and external machined surfaces are coated with a drying-film rust-preventive material. These measures constitute the normal preparation for shipment and for temporary delays during installation, and will provide some protection, for some period of time, depending on the ambient conditions. **Outdoor, unprotected storage is not recommended.** The table below shows **approximate** storage periods.

APPROXIMATE STORAGE PERIODS		
Type of Preparation	Outdoor*	Indoor**
Normal	2 Months	6 Months
Long Term	12 Months	24 Months

* Unit stored on blocks and covered with a tarpaulin in a protected area.
** Dry building with reasonably constant temperature.

PREPARATION FOR LONG-TERM STORAGE

If the storage period provided by normal preparation is not adequate, the gear unit must be prepared for long term storage.

Protection of gear units against corrosion of internal surfaces during long-term storage is best accomplished by submerging the internals in oil and limiting the entry of air into any remaining space over the oil. The major problem in the preparation of the unit is to prevent leakage of the oil, which would (1) lower the oil level and leave surfaces exposed and (2) contaminate the storage area. Despite careful preparation by the manufacturer, some oil seepage can be expected. The gear unit should be located in the storage area so as to avoid damage to other equipment and the surroundings.

It is preferable that long-term preparation be done at the factory but, if this is not possible, the following procedure is recommended:

1. Place the gear unit on wooden blocks.

2. Tighten all bolts on the housing and all pipe connections such as plugs, standpipes, dipstick caps, and heaters. Replace the breather with a pressure-relief valve having a 1 PSI setting.

3. Clean the outside diameter surfaces of the bearing covers and the adjacent surfaces of the bearing blocks with solvent. Apply a fillet of adhesive sealant such as General Electric RTV-102 around the junction of these surfaces.

4. All exposed unpainted parts such as shafts should be coated thoroughly with a corrosion preventative compound, solvent cut back type, leaving a firm film. Use Nox Rust No. 369 (Daubert Chemical Co.) or equivalent.

5. Completely fill the gear unit with the type of lubricant specified for operation, and tighten the fill-hole plug.

6. Protect other Buyer's or Seller's vendor-furnished items in accordance with the manufacturer's recommended storage procedures.

7. Cover the gear unit with tarpaulins.

8. It is recommended that the input shaft of every reducer be rotated once a month enough turns to produce one complete turn on the output shaft to prevent Water Etching or False Brinelling of the bearings and seizure of the Elastomeric Seal Lip Material on the shaft.

INSTALLATION

FOUNDATION

The equipment should be mounted on a rigid foundation. This is to prevent flexing, vibration and/or misalignment of shafting under all conditions of normal loading. All components of the drive including the motor, the reducer and the driven load should be securely bolted in place after proper alignment and leveling of all elements.

If the above procedure is not followed, noise and unsatisfactory operation may result.

ERECTION

⚠CAUTION should be used in handling the equipment to prevent damage from striking another object. This could result in internal damage to gears or bearings, broken housings and bent shafting.

Lift only at eye bolts or lifting lugs provided on unit. Do not place sling around shafts.

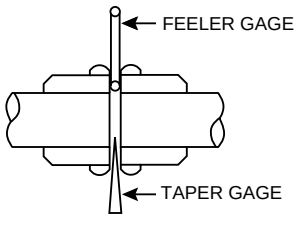
CARE should be taken in installation to insure that all components are properly shimmed or grouted in place. Failure to shim properly may result in deflection and misalignment when base mounting bolts are tightened.

If fitted base mounting bolts (bolts tight fitting in mounting holes) are not used, it is recommended that the components be doweled in place or shear blocks added at sides and ends of mounting flange. A dowel in each of two diagonally opposed corners provides adequate holding and an easy means of accurate realignment in the event of removal for repairs.

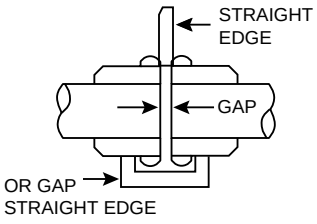
⚠CAUTION Base mounting bolts should be rechecked for alignment and coupling gap after installation, leveling, and permanent mounting of the bedplate. Then proceed as above.

CONNECTIONS

COUPLINGS - A gear-type flexible coupling is recommended. The correct coupling gap should be provided by shifting the most convenient drive element. This is most important in allowing the shafts of all components to float free, to center themselves without restriction and to prevent abnormal thrust loading. The gap (shown in coupling manufacturers catalog) should be set with the reducer input shaft in its neutral or loaded running position and the motor shaft and rotor at its magnetic center or running position.



Angular Alignment



Parallel Alignment

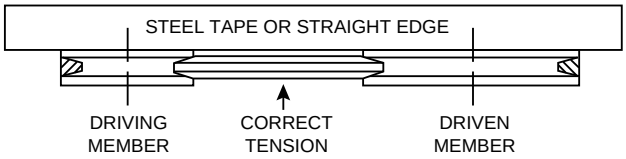
Proper alignment of coupling members is important in preventing undue loading of bearings and shafting of the coupled elements as well as undue wear in the coupling itself. It is desirable to maintain the alignment, both angular and parallel, within .005" (.127mm). This is obtained by checking from one coupling hub to the other. A dial indicator provides the most accurate as well as direct reading method of accomplishing the alignment. The views above show how the check can be made by means of a feeler gage and a straight edge measuring at four positions 90 degrees apart.

It is recommended that the angular misalignment be checked and corrected. This will facilitate parallel alignment.

SPROCKETS, SHEAVES AND EXTERNAL GEARING

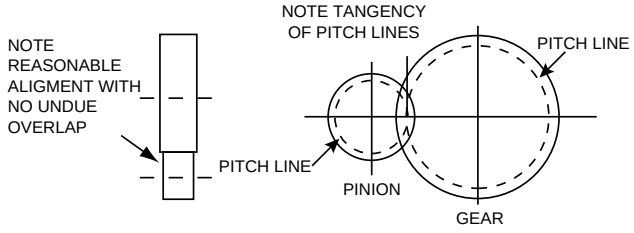
In mounting these items the center of the load should be located no farther out than the center of the shaft extension key seat. Otherwise, excessive overhung loading could exist resulting in early failures to bearings, gears or shafts. Refer to the product catalog for applicable overhung load rating capacity.

These elements should also be properly aligned. In the case of sprockets and sheaves, a steel straight edge or tape layed across the ends will aid in squaring up. See below.



The straight edge should lay evenly across both members with no gapping.

⚠CAUTION Belts or chains should not be too tight as this can place undue loading on the connected elements.



NOTE TANGENCY OF PITCH LINES

External gearing should be set to the correct center distance and alignment. In some cases gear tooth pitch lines are scribed in one or both end faces of the gear and pinion. It is intended that they be matched to a point of tangency. This can also be done by checking backlash with a feeler gage. Bluing in the teeth with prussian blue will check for squareness in alignment. Contact should be as close as possible to 100% across the tooth face. This should be done both a no load and under load to determine if proper alignment has been attained.

GENERAL

When couplings, sheaves, sprockets and external gearing are furnished with reducers, they are generally mounted at the factory.

If it is necessary to mount these items in the field, it is important that extreme care be used. It is quite easy to damage internal members by heavy blows used in trying to drive on one of these parts. It is recommended that a bore be selected to give a tapping or light driving fit. If necessary, the bore should be enlarged to provide this class of fit. If it is a requirement to have a press fit it is suggested that the external element be heated to insure an easy assembly. Heating beyond 250° F (121.1° C) is not recommended, as heat conducted along the shaft may damage the shaft seal.

⚠WARNING For safety, purchaser or user should provide protective guards over shaft extensions and any couplings, sheaves and belts, sprockets and chains, open gearing, etc., mounted thereon. The user is responsible for checking all applicable safety codes in his area and providing suitable guards.

OPERATION

START-UP

1. ⚠CAUTION After the installation has been completed, but before the initial startup, the following checks should be made.

   A. Verify the rating of the reducer, (indicated on the nameplate and certified print) to be sure the service rating, RPM or speed range, thermal rating, and any overhung or thrust loading are not exceeded in actual operation.

   B. Make sure reducer is filled with the correct lubricant to the proper level. Too much oil in the reducer causes churning and excessive heat generated by fluid friction. Likewise, an insufficient amount of oil will make the reducer operate at higher temperatures.

      Make sure all oil passages are clear and permit free flow of the lubricant. Refer to section of this bulletin on lubrication and/or the nameplate affixed to the reducer.

   C. On vertical units, check grease fittings for lubrication (unit shipped without grease in the L.S. bearings).

   D. Lubricate couplings with manufacturer's recommended lubricant.

   E. If backstop is used make sure it is filled to the oil level mark with the proper lubricant.

   F. Fan - On units equipped with a fan check the air supply for proper fan circulation. Avoid high surrounding ambient temperatures.

2. Check for free rotation of all elements. In many cases, the input shaft of the reducer can be turned by hand even with a connected load.

3. Check all bolts and capscrews to make sure they are tight. (See Fig. 1 on Page 6)

4. Check belts and/or chains for proper tension.

5. After energizing motive power, if any undue noise occurs, shut off power immediately.

6. Observe temperature rise. This may take up to two hours to stabilize. In some instances depending on ratio, size and input speed the temperature in the oil sump may rise as much as 100° F (55.6° C) above the ambient. Actual operating temperature will vary with the reducer size, ratio, type and operating conditions. Under no circumstances should the oil bath temperature exceed 200°F (93.3° C). If this should occur, consult the factory. The housing and shaft adjacent to the high speed seal may show temperatures significantly above 200° F (93.3° C). This will diminish as the seal and shaft sealing area wear in. Application of oil at this area during the break-in period will help in assisting this process.

   ⚠CAUTION Many times the reducer temperature is judged by the touch of hand and may be considered to be quite hot. The only positive method is to use a surface temperature measuring instrument such as a Pyrocon or by using a thermometer directly in the oil bath.

7. Bearings can produce localized heating from cramping either radial or axial. Check for insufficient end play.

8. ⚠CAUTION Do not operate this unit beyond its service rating as any failure resulting could cause damage to property or life and limb.

9. ⚠CAUTION The system of connected rotating parts must be free from critical speed, torsional or other type vibration, no matter how induced. The responsibility for this system analysis lies with the purchaser of the speed reducer.

MAINTENANCE CHECK POINTS

For optimum protection and preventative maintenance it is recommended that the reducer be inspected daily. Points to cover are:

1. OIL LEAKAGE at oil seal, housing split, bearing cap shims, pipe fittings. Tighten housing bolts, bearing cap bolts and pipe fittings and/or replace oil seal if leakage is sufficient to cause rapid drop in oil level. It may be necessary to add sealant between bearing cap shim packs and the housing.

2. OIL LEVEL - Any undue drop in oil level is an indication of oil leakage from some point on the reducer and should be corrected. If backstop is used, check oil level also.

3. TEMPERATURE - Check the actual temperature of the oil bath, gear case, and shafts at various points. This should be done after the unit has been in operation at least two hours. The average oil bath temperature is 140° F (60° C), however, the range can vary from 100° F to 200° F (37.8° to 93.3° C). Bearings can produce localized heating from cramping either radial or axial. Check for insufficient end play. Any undue rise in temperature above that normally encountered and not accountable for by a rise in the ambient should be investigated. Low oil level, abnormal loading, thickening of lubricant, bearing seizure are

possible sources. If in a particular bearing, the heat would be localized in the housing area adjacent to the bearing.

4. SOUND LEVEL - A sudden change in the sound level is a possible indication of low oil level, undue thinning out of lubricant, abnormal loading, worn coupling or deterioration of internal parts.

   Noise is usually difficult to isolate because sound can travel throughout the entire drive system. A noise can be pin-pointed to a specific area by determining its approximate frequency and if it is at accurate regular intervals.

5. LUBRICANT CONDITION - A change of color in the oil or thickening or unexplainable corrosion of internal parts is an indication that it has deteriorated and should be changed.

6. LOADING - Periodic load checks are valuable in making sure that reducer rating is not exceeded.

7. OIL BREATHER - Must be kept clean.

8. VIBRATION - A change in the vibration normally associated with the system can indicate worn couplings or internal reducer parts.

9. DIRT ACCUMULATION - Any undue accumulation of dirt on the reducer or in fan components where fans are used will affect proper cooling of the unit.

10. GREASE LUBRICATE - Grease should be applied once a month to the Alemite fitting on the L.S. bearing caps until it escapes from the Alemite relief fitting on the opposite side of the cap or from the outer seal lip, or from the labyrinth. Use a good Lithium base grease (NLGI No. 2 consistency).

11. COUPLINGS - If noisy, check for lubrication.

12. REPAIR PARTS - Keep recommended spare parts, oil seals, and bearings on hand to reduce down time.

LUBRICATION

⚠CAUTION This unit is shipped DRY! Oil must be added prior to operation. Any couplings attached are also DRY! and must be lubricated prior to operation. Manufacturer's recommendations should be followed.

The oil used should be a high quality product, having rust and oxidation inhibitors, anti-foaming agent, a high viscosity index (preferably above 90) and a low acid content. It should be neutral in reaction, free from girt or abrasives and non-corrosive to gears or bearings.

⚠CAUTION LOW TEMPERATURE OPERATION

1. The pour point of the oil should not exceed and preferably should be 5 to 10 degrees Fahrenheit (-15 – 12.2° C) below the lowest ambient starting temperature.

2. When temperatures are below 15 degrees Fahrenheit, (-9.4° C) please refer to the factory for recommendations giving ambient temperature expected and operating cycle.

CHANGE CYCLE

We recommend changing oil every 2,500 hours or six months whichever occurs first. Make certain to be guided by seasonal temperature variations and change oil accordingly. Operating conditions can vary this guide line. Abnormal temperatures and contamination can seriously affect the lubricant causing early sludging, oxidation and acid formation. Under these conditions, a sample of the lubricant should be submitted to the petroleum supplier at periodic intervals. This will enable the establishment of a change cycle which would provide for renewal of the oil prior to its degradation. After the initial fill, the first oil change should be made after two weeks, or 100 hours of operation.

FOOD AND DRUG INDUSTRY

Some operations in the Food and Drug Industry require special lubrication considerations in view of possible toxicity from contamination by the oil or grease used in the equipment. Some EP products contain Lead Naphthenate, Phosphorus, or Chlorine which are toxic and could be harmful.

⚠CAUTION In the Food (including animal food) and Drug Industry, consult the petroleum supplier for recommendation of lubricants which are acceptable to the Food and Drug Administration and/or other authoritative bodies having jurisdiction.

COUPLINGS

Each coupling shipped with a reducer is tagged with a list of the proper lubricants and an outline of the correct lubrication practice to follow. They should be relubricated at regular intervals and not allowed to go dry.

BREATHER

Each unit is equipped with a breather. This should be cleaned at intervals to insure that it is working.

GREASE LUBRICATION - VERTICAL REDUCER

Grease lubricate the upper and lower output shaft bearings once a month at the Alemite grease fitting. A good grade of antifriction bearing grease or its equivalent should be used. It should have neutral and channeling characteristics with a consistency of NLGI #2. It should not be subject to excessive bleeding or deterioration.

⚠WARNING **This unit is shipped without grease in the L.S. bearings.**

REDUCER SIZE AND TYPE	A G M A LUBRICANT NUMBER	
	AMBIENT TEMPERATURE RANGE	
	15 TO 60° F (-9.4 TO 15.6° C)	50 TO 125° F (10 TO 51.7° C)
	NORMAL SERVICE	NORMAL SERVICE
40, 50, 60, 70 80, 100, 120 U, O, V, HU, HV, VL, HVL, DVL, GO, GU, GV	7 COMP.	8 COMP.

VISCOSITY EQUIVALENTS FOR AGMA LUBRICANTS

Rust and Oxidation Inhibited Gear Oils	Equivalent ISO Grade	Viscosity Range	Synthetic Gear Oils
AGMA Lubricant No.		MM 2/S	AGMA Lubricant No.
		(cST) at 40 degree C	
7 Compounded	460	414 to 506	7S
8 Compounded	680	612 to 748	8S

APPROXIMATE OIL CAPACITIES – GALLONS (LITERS)

SIZE	U		O		V, VL	HU, MHU, HV	DU, DV, DVL
	HIGH LEVEL	LOW LEVEL	HIGH LEVEL	LOW LEVEL	ALL	HELICAL PREFIX	WORM PREFIX
40	1¼ (5)	¾ (3)	1½ (6)	¾ (3)	½ (2)	1/8 (1/2)	1/8 (1/2)
50	1¾ (7)	1 (4)	2¼ (9)	1 (4)	1 (4)	1/2 (2)	1/4 (1)
60	2¾ (11)	1¼ (5)	3½ (13)	1 (4)	1¼ (5)	1/2 (2)	1/4 (1)
70	3¼ (12)	1¾ (7)	5¼ (20)	1½ (6)	2¼ (9)	3/4 (3)	1/2 (2)
80	4¼ (16)	2¼ (9)	5¾ (22)	1¾ (7)	3 (12)	3/4 (3)	1/2 (2)
100	8 (31)	4¾ (18)	–	–	6½ (25)	3/4 (3)	3/4 (3)
120	11½ (44)	5¾ (22)	–	–	10 (39)	1¼ (5)	1¼ (5)

NOTE:
OIL CAPACITIES
These are only an approximation and should not be used as the exact figures for an oil fill. The high level is used on “U” and “O” housings when output speed is low or when prefix is used.

Fill to the oil level hole shown on the housing with an o-level plate.

CAUTION On double reduction units, the low speed and prefix units must be filled separately to the oil level indicated on the housing.

RECOMMENDED LUBRICANTS

MANUFACTURER	7 COMP (ISO460)	8 COMP (ISO680)	NLGI #2 GREASE
Amoco Oil Co.	Cylinder Oil	Cylinder Oil	Amolith EP2
	460 (+15)	680 (+15)	
BP Oil	Energol GR-XP	Energol GR-XP	Energrease LS EP2
	460 (+15)	680 (+15)	
Castrol Performance Lubes	Molub-Alloy	Molub-Alloy 170W	Molub-Alloy 860/150-2
	322 (+15)	(-12)	
Chevron USA, Inc.	Cylinder Oil	Cylinder Oil	Chevron Ultra-Duty EP2
	460 (0)	680 (+10)	
Citgo Petroleum	Cylinder Oil	Cylinder Oil	Lithoplex #2
	400-5 (+20)	680-7 (+35)	
Conoco Inc.	Inca 460	Inca 680	EP Conalith #2
	(+10)	(+30)	
Exxon Co. USA	Cylesstic	Cylesstic	Lidok EP2 or Unirex N2
	TK460 (+20)	TK680 (+20)	
Keystone Div. Penwalt Corp.	Keygear K-600	–	81EP2 or 84EP2
	(+45)		
Lubrication Engineers	–	Almasol Worm	Almaplex 1275
		Gear 680 (+15)	
Lubriplate	CP-7 (+10)	CP-8 (+22)	No. 1200-2
Mobil Oil Corp.	600W Super Cylinder Oil	Extra Hecla Super Cylinder	Mobilux EP-2
	(+20)	(+30)	
Pennzoil Co.	Cylinder Oil	Cylinder Oil	Premium Lithium Complex 2
	8NR (+40)	6NR)+36)	
Phillips Petroleum Co.	Hector 460S	Hector 630S	Philube L + EP
	(+5)	(+10)	
Shell Oil Co.	Valvata J 460	Valvata J 680	Alvania #2 or EP-2
	(+15)	(+25)	
Sun Oil Co.	Sun Gear 7C	Sun Gear 8C	Ultra Prestige EP2
	(+5)	(+10)	
Texaco Lubricants	Van Guard Cylinder Oil	Van Guard Cylinder Oil	Starflex 2
		680 (+20)	
Unocal		–	Unoba EP2
Numbers in parenthesis are pour points of the lubricant in degrees Fahrenheit.			

CANADIAN COMPANIES

* All companies, so marked, market in Canada under their own name and handle the products listed.

** ExxonMobil products are handled in Canada by Imperial Oil Ltd.

‡ These products or their equivalents are handled in Canada by British America.

BOLT TORQUES

CAUTION To prevent loosening under operating conditions, all bolts must be tightened, unless otherwise specified, to the torque values given in table.

BOLT SIZE	GRADES III & V	GRADE VIII, STUDS, & SOC. HD. SCREWS
1/4	9	13
5/16	18	28
3/8	31	46
7/16	50	75
1/2	75	115
9/16	110	165
5/8	150	225
3/4	250	370
7/8	380	590
1	585	895
1-1/8	780	1410
1-1/4	1100	1960
1-3/8	1460	2630
1-1/2	1750	3150
1-5/8	2390	4310

DISASSEMBLY & REASSEMBLY

DISASSEMBLY – TYPE "U" & "O"

⚠WARNING Make certain that the power supply is disconnected before disassembly. Lock out the power supply and tag it to prevent unexpected application of power.

1. Drain oil from reducer and remove breather.

2. Remove fan guard and fan.

3. Match mark upper and lower housing at the housing split to facilitate correct reassembly.

4. Remove the four hex nuts from the studs on the side of the housing and the cap screws at each end of the housing.

5. Remove the bearing cap bolts holding the caps at the housing split line to the upper housing. Back out the remaining bolts in the lower housing 3/16", move cap away from housing, do not damage shims. If shims stick to the housing, loosen with a sharp flat tool such as a knife or putty knife. Tie each shim pack to its respective cover to prevent damage. Mark each bearing cover to insure that it will be replaced in the same bore from which it was removed.

6. Lift off upper housing by securing sling onto lifting lugs or eye bolts. For safety, use a properly secured sling and hoist capable of handling the load.

   ⚠WARNING Overloading may result in personal injury and damage to the reducer. Care must be taken so that none of the housing machined surfaces exposed by disassembly are marred or dented in any way. Oil leakage may result.

   Remove the remaining bearing cap bolts and lift out the bearings caps. Note: All bearings are retained in the housing bore.

8. Lift low speed shaft and gear assembly with bearings from housing as a unit, using rope sling if necessary.

9. Remove worm gear and supporting bearings in accordance with instructions above.

10. All bearings are press fit on their respective shafts. If it is necessary to replace a bearing, a conventional bearing or gear puller can be used by gripping back of the inner race shoulder with the puller arms clearing the bearing assembly. A small press may also be used, supporting the shaft assembly on the inner race shoulder. Keep bearings off of floors and away from dirt. In handling the bearings, make sure that bearing assemblies are not resting on the ground or carrying the weight of their shafts.

11. The worm gear is press fit on its shaft. A press is desirable for its removal.

DISASSEMBLY – TYPE "V"

1. Drain oil from the reducer and remove breather and fan assembly. Do not damage the gasket under the breather.

2. Remove the low speed bearing cap screws holding the bearing cap to the low speed bearing retainer. Remove the bearing cap.

3. Remove the cap screws and eye bolts which fasten bearing retainer to housing. Remove bearing retainer using a properly secured sling and hoist capable of handling the load.

4. Follow Steps 8 through 11 in Type "U" and "O" disassembly.

CLEANING

All parts, including the housing, should be washed thoroughly with kerosene or a mineral solvent. Any accumulation of sludge deposits or corrosion should be removed. Do not use a wire brush on any bearing or gear tooth surfaces to avoid scratching. All old sealant should be scraped off of all mating flange surfaces of the housing and bearing caps.

REASSEMBLY

1. Reassembly is basically the reverse of the disassembly procedure.

2. Install new oil seals in the high speed and low speed open end bearing caps. (See special instructions under oil seals.)

3. Bearing cones may be heated to facilitate assembly. This can be done with an infra-red lamp, a heater oil bath or an oven. If an oil bath or oven is used, take care to support the bearing well off of the bottom and away from the sides of the container to avoid direct contact with an area of localized heat from the heating element or flame.

   ⚠CAUTION Do not exceed 250° Fahrenheit to prevent drawing back bearing hardness.

   If heating facilities are not available, it will be necessary to use a press. In pushing the cone on the shaft, make sure that no pressure is exerted on the cage or rollers, only on the cone shoulder and that the cone seats flush with the shaft shoulder. Before pressing on the shaft, check the shaft shoulder for butts or dirt. Remove them if present, otherwise the bearing will not seat squarely. Apply anti-seize compound to bearing seat prior to pressing. In supporting the shaft to press on a bearing, make certain that the point of support is on the shaft end and not on the cage and rollers.

4. The shafts with bearings and gears installed along with the bearing caps and shim packs should be placed back in the housing in the reverse order of disassembly. Coat bearings with film of oil prior to assembly into the housing. A sealant such as Dow Corning RTV 732 or equivalent should be applied to the bearing cap flange surfaces of the housing and the bearing cap flanges.

5. All bearing caps should be mounted with their original shim packs in position. In mounting the open end caps with oil seals, take care not to damage the seals. Wrap .005" plastic shim stock around the shaft shoulder to protect the seal lip. Do this gently to prevent dislocating the spring back of the lip. The housing bolts should be tightened before the bearing cap bolts. This should be done evenly to prevent warping the housing.

BEARING ADJUSTMENT

All units, except the helical prefix, have tapered roller type bearings and require a specific axial end play for each size. The helical prefix has ball bearings that are preset and require no adjustment. Tabulated below is the allowable axial end play for each shaft assembly. Before checking end play, rotate input shaft until output shaft has made two complete rotations. This is done to seat the bearing rollers.

To check end play, place a dial indicator pointer against end or face of gear mounted on shaft and wedge shaft to its extreme opposite positions. See Figure 1. The total dial variation is the shaft end play. If the measured end play does not fall within the limits specified, it will be necessary to alter shim packs accordingly. (Add shims to increase end play, remove shims to decrease end play). Rotate shafts each time shim packs are altered and recheck end play. Access to shim packs is gained by removing bearing covers.

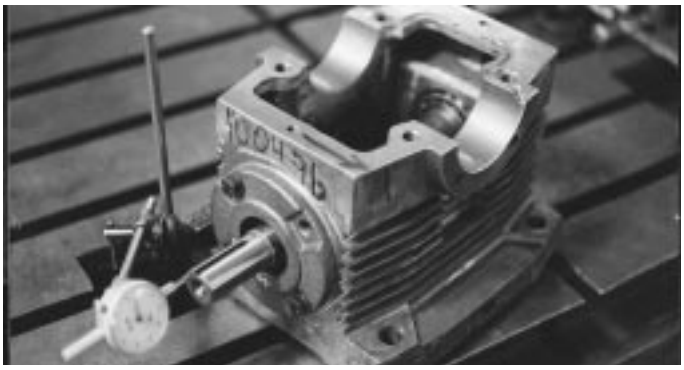


Figure 1

Unit Size	Allowable Bearing Axial End Play			
	Primary Housing*		Secondary Housing	
	Worm Shaft	Output Shaft	Worm Shaft	Output Shaft
40	‡ .002” - .003”	.002” - .003”	.003” - .005”	.001” - .003”
50	‡ .002” - .003”	.002” - .003”	.003” - .005”	.001” - .003”
60	.001” - .002”	.002” - .003”	.003” - .005”	.001” - .003”
70	.001” - .002”	.002” - .003”	.003” - .005”	.001” - .003”
80	.003” - .005”	.001” - .003”	.003” - .005”	.001” - .003”
100	.003” - .005”	.001” - .003”	.005” - .007”	.001” - .003”
120	.003” - .005”	.001” - .003”	.005” - .007”	.001” - .003”

*The table for primary housing is for worm gear prefix only. The helical prefix uses ball bearings which do not require shimming for axial end play.

‡On later models the worm gear prefix will have ball bearings on the worm shaft and will not require shimming.

Note: Plastic/Aluminum shims are used in original assembly. Use no substitutes.

METRIC EQUIVALENTS

.001 – .0254mm
.002 – .0508mm
.003 – .0762mm
.005 – .127mm
.007 – .1778 mm

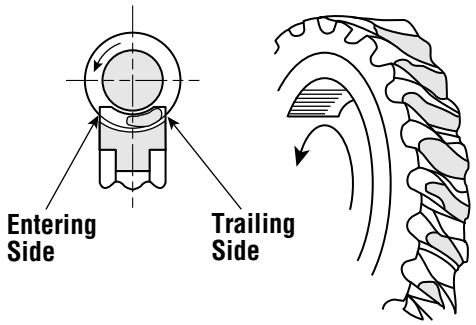
CONTACT PATTERN ON WORM GEARS

To insure optimum capacity of worm gearing, the correct contact pattern must be maintained. The desired tooth contact is shown in Figure 2. To achieve this contact, the following procedure is recommended.

1. Coat worm with prussian blue.

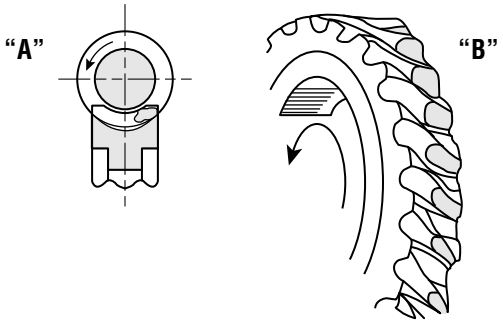
2. Rotate worm shaft while applying a slight drag to the worm gear shaft. This will cause coating in the areas of contact to rub onto mating gear leaving a clearly defined contact pattern.

Typical conditions that might be encountered in worm gear assemblies are shown in Figures 3 & 4. The corrective action to be taken when these conditions are encountered is also indicated. When it is desired to shift the worm gear, shims from between the bearing cover and housing must be removed from one side of the reducer and added to the opposite side.



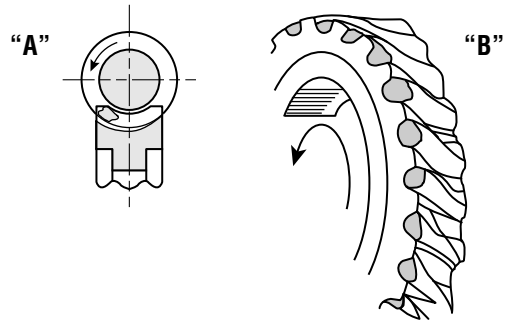
Correct Marking.
Contact clear on entering side to provide lead in for oil when running under load.

Figure 2



Move gear this ➔ way to get desired pattern by shifting shims from under bearing cover “A” to bearing cover “B”.

Figure 3



Move gear this ← way to get desired pattern by shifting shims from under bearing cover "B" to bearing cover "A".

Figure 4

"K" PINION DISASSEMBLY (Types HU, HV, & HVL)

Removal –

1. Remove set screws (if any) from locking nut. On newer models which have no set screws, heat the locking nut to about 250° F., with a blow torch to weaken the Loctite retaining compounds in the threads.

CAUTION Alignment between pinion shank and shaft must be maintained while pinion is being removed or assembled.

2. Grip pinion with hard wood or brass clamp to prevent rotation, taking care not to damage gear teeth. When looking at end of pinion, turn locking nut counterclockwise until shaft and pinion shank threads no longer engage nut threads. Pinion will now be jacked partially out of shaft.

3. Turn nut clockwise onto shaft as far as possible. Do not engage shank threads in the process.

4. Place spacers, such as open end wrenches or similarly constructed "C" washers, between the inner face of the pinion and the face of the nut, and again turn the nut counterclockwise until the threads disengage. Repeat Nos. 3 and 4 until pinion becomes loose enough to withdraw from shaft.

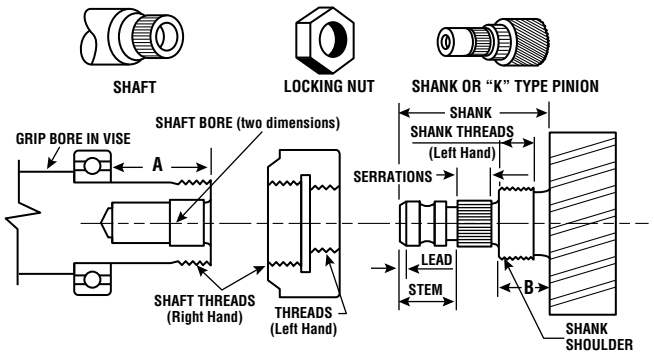


Figure 5

Assembly –

1. Before starting the assembly procedure, it is advisable to record some data which can be used later to determine whether the pinion shank shoulder is properly seated against the shaft shoulder. These data are dimensions A and B as shown in Figure 5.

2. Install the inner shaft bearings on the shaft.

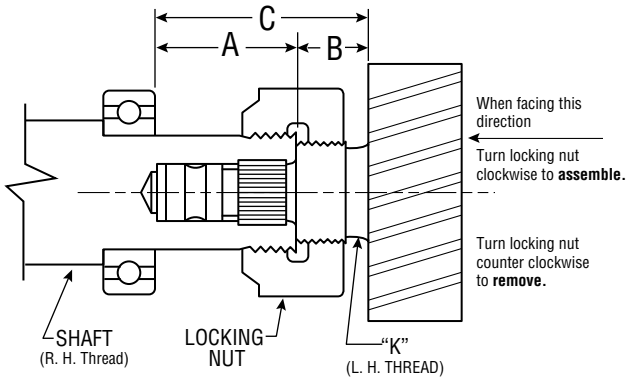
3. Coat the shaft bore, the shaft thread, the pinion shank, and the pinion thread with Loctite Retaining Compound No. 35.

4. Assemble the locking nut two turns onto the shaft.

5. Mark the starting point of the pinion shank thread and the starting point of the locking nut thread.

6. With the starting points aligned, insert the pinion shank through the nut and into the shaft bore until the threads on the shank bear against the threads in the nut, i.e., are in initial engagement position.

7. Grip the pinion with a clamp to prevent rotation of the pinion relative to the shaft. Turn the locking nut, tapping the end of the pinion with a soft hammer to facilitate seating the spline, until the shoulder on the shank bears firmly against the end of the shaft. Total engagement is measured by distance C (or A - B) as shown in Figure 6.



SHANK TYPE PINION
Figure 6

8. Check the gap between the bearing face and the pinion face. If it is equal to the sum of dimensions A and B which were previously recorded, the shoulders are in proper contact.

OIL SEALS

All oil seals used in these units have a synthetic elastomer dual lip seal. They are provided with a spring back of the inner lip which exerts constant pressure and keeps the lip in contact with the shaft.

1. In any disassembly of the reducer or removal of bearing caps it is recommended that all oil seals be replaced.

2. Examine the new oil seal for cuts or imperfections in the lip. The lip should have a smooth and uninterrupted edge with

no flashes from moulding. The O.D. of the seal should be free of scratches and burrs. Test the seal for grip on the shaft upon which it is to run; it should not be loose but should offer some drag to axial movement. If the seal is not satisfactory, discard it and try another one.

3. Clean the bearing cap seal bore and remove any burrs; coat the cap bore and the seal O.D. with an adhesive sealant such as General Electric RTV-102 or Permatex No. 2.

4. The shaft in the seal area should be examined for score marks, scratching or grooving. First try polishing out the imperfections with a fine grade of Emery (No. 240). The polishing motion should not be axial or spiral in direction but circumferential. If the shaft surface can not be reconditioned sufficiently by polishing to remove all imperfections, it may be possible to shift the seal position sufficiently to escape this area. The inner lip with the spring in back of it is the important one to consider. The other alternative is to metallize the shaft and regrind to a surface finish of 10 to 20 RMS. If the surface imperfections are not too deep, a simple plunge grind to no more than .010" (.254mm) undersize on the diameter may clean up the shaft. In fact, plunge grinding is preferable to polishing to remove any possibility of spiral marks on the shaft which can cause oil leakage.

5. Wrap .005" (.127mm) plastic shim stock around the shaft to cover up the keyway and any shoulders. Wipe oil or grease on the seal lip to facilitate assembly. Slip the seal on the shaft up to the bearing cap with the lip and spring facing in toward the reducer. Using the end of a piece of wood about 1 x 2", drive the seal in tapping first on one side then the other. (See Fig. 7) The seal should be flush with bearing cap outer face and square with the shaft. Remove the shim stock. If steel or brass shim stock is used, make sure all burrs on the edge are removed to avoid cutting the seal. For maximum protection, lay a strip of scotch tape along the exposed edge.

6. On those units using two seals, the inner seal should be pressed in until the open depth remaining is the thickness of one seal. The outer seal is pressed down on top o it and should come flush with the bearing cap outer face. Pack grease between the two seals. Use a high quality Lithium base grease NLGI consistency No. 2.

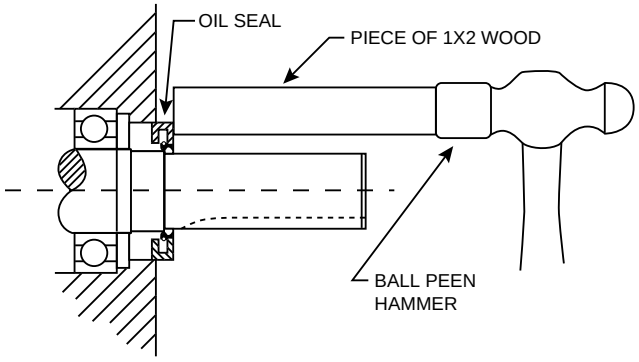


Figure 7

7. CHANGING SEALS ON THE UNIT

   A. It will be necessary to shift the driving motor and remove coupling if coupling is used. If belt drive, only the sheave need be removed.

   B. Drill two holes in the seal face 180° apart. Insert large sheet metal screws and leave about 3/16" (4.76mm) length of screw under the head protruding. Use a pry bar with the notch at one end under the screw head to lift the seal out. (See Fig. 8)

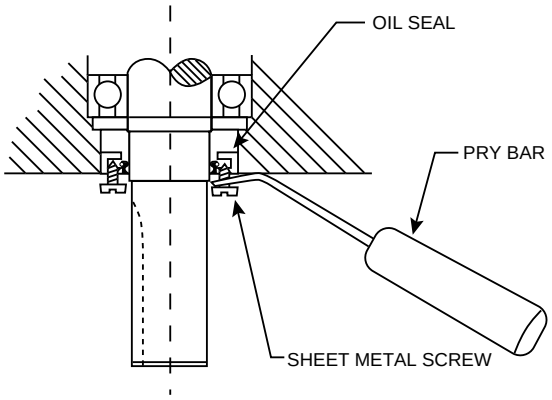


Figure 8

   C. Take care not to damage the seal bore in the bearing cap or the shaft surface.

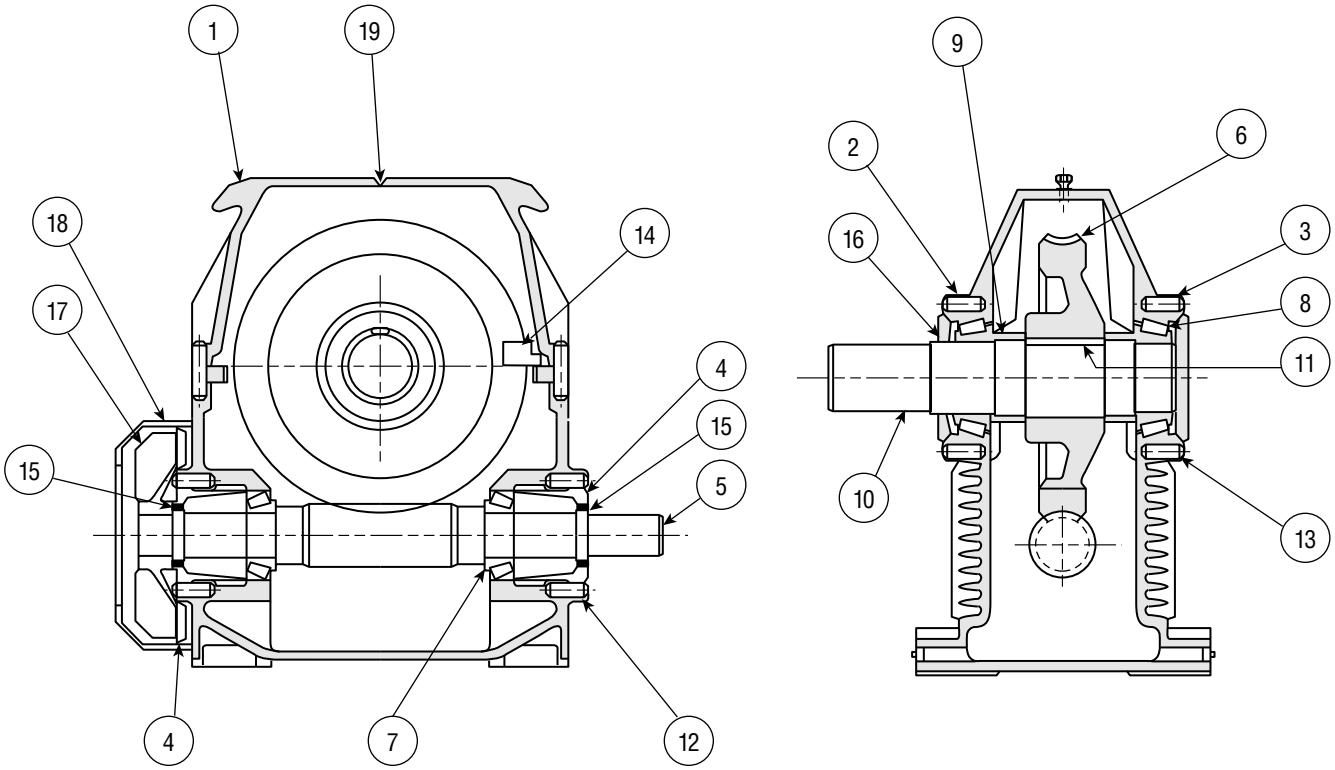
   D. Proceed as outlined previously in Paragraphs 2, 3, 4, 5, & 6.

FANS

Most units are equipped with a fan or fans for cooling. The fan guard is bolted to the housing opposite the input extension on single and double reduction worm reducers. In reassembly, make sure the fan is in its original position and does not rub against the fan guard, mounting plate or bolt heads. To allow sufficient air flow to fan, mounting should not encroach on fan.

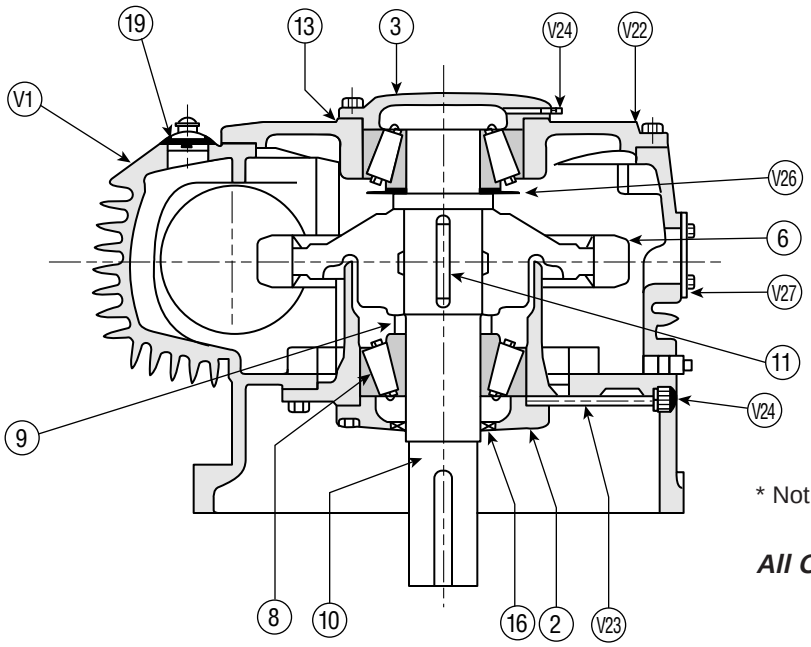
⚠CAUTION Allow 3/8" between fan guard and the nearest object. Openings in the fan guard and support plate should be kept free of dirt accumulation to permit proper air flow.

WORM GEAR REDUCER
* TYPE “U” or “O”



PARTS LIST	
Item	**Description**
1.	Housing
2.	L.S. Bearing Cap (Open)
3.	L.S. Bearing Cap (Closed)
4.	H.S. Bearing Cap
5.	Worm & Shaft
6.	Worm Gear
7.	H.S. Bearing
8.	L.S. Bearing
9.	L.S. Bearing Spacer
10.	Worm Gear Shaft
11.	Worm Gear Key
12.	H.S. Bearing Shims
13.	L.S. Bearing Shims
14.	Oil Deflector
15.	H.S. Oil Seal
16.	L.S. Oil Seal
17.	Fan
18.	Fan Cover
19.	Breather

WORM GEAR REDUCER



PARTS LIST	
Item	**Description**
V1.	Housing
V22.	L.S. Bearing Retainer (Upper)
V23.	L.S. Brg. Retainer (Lower*)
V24.	Alemite Fitting
V26.	Grease Baffle
V27.	Inspection cover

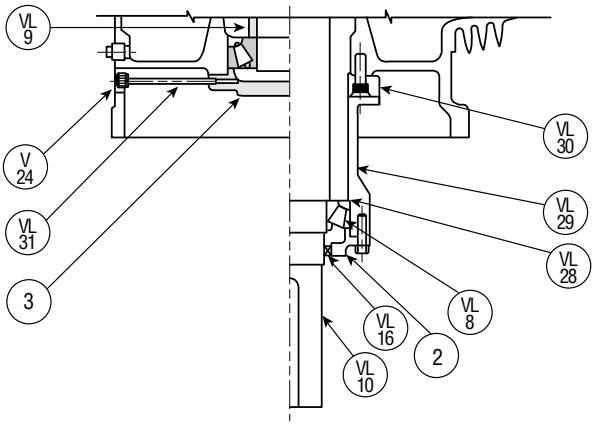
V69 Oil Slinger (Not Shown)

* Not applicable to sizes 100 & 120

All Other Parts Same As Type "U" (Horizontal)

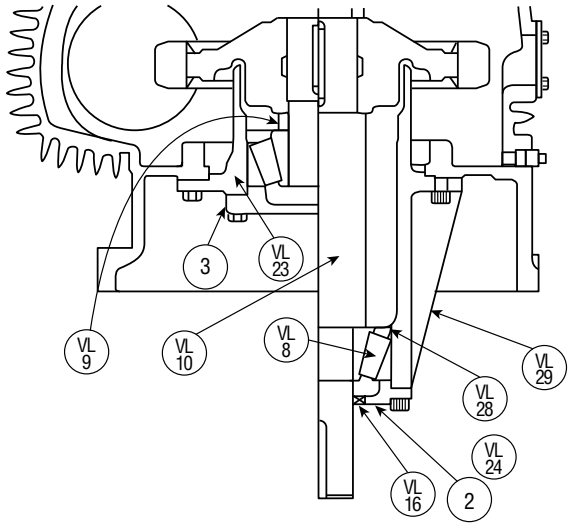
WORM GEAR REDUCER

SIZES 100 and 200



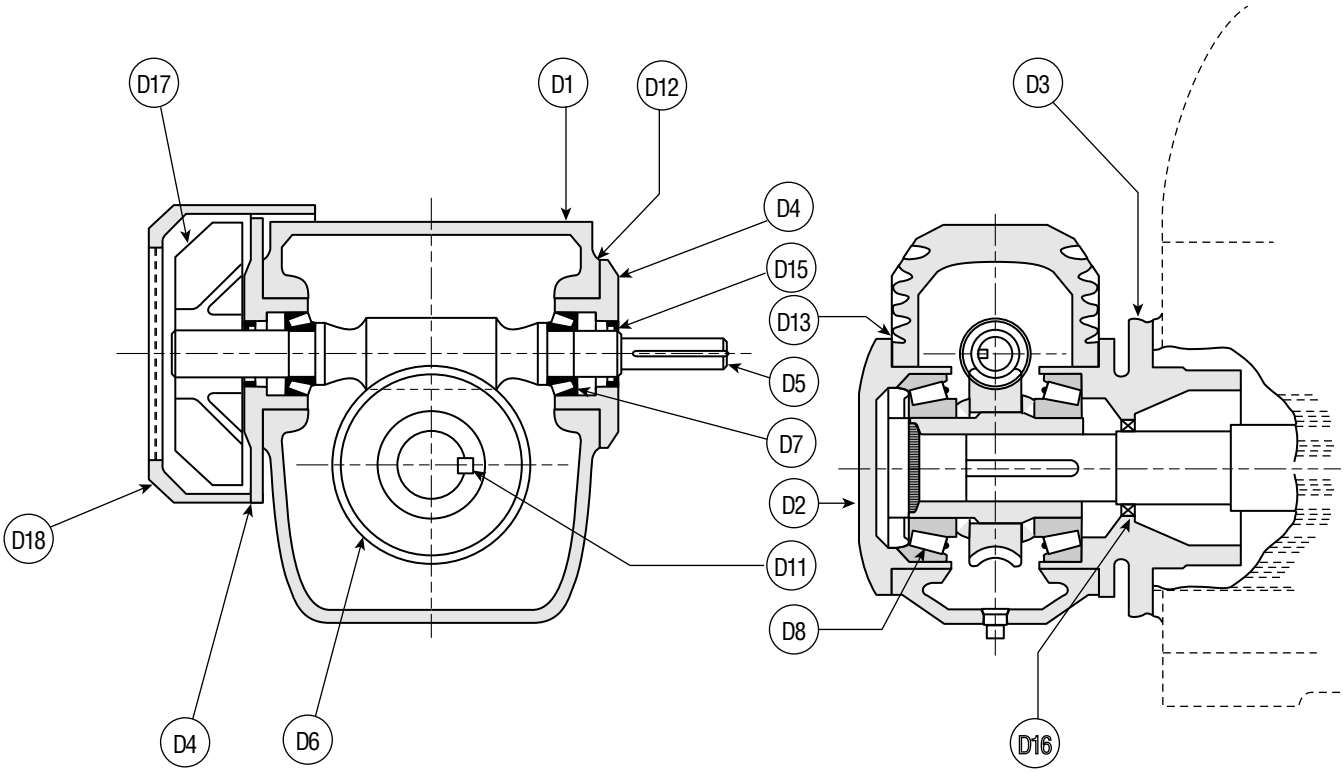
PARTS LIST	
Item	**Description**
2.	L.S. Bearing Cap (Open)
3.	L.S. Bearing Cap (Closed)
9.	L.S. Bearing Spacer
V23.	L.S. Brg. Retainer (Lower*)
V24.	Alemite Fitting
VL9.	L.S. Bearing Spacer
VL10.	Worm Gear Shaft
VL16.	L.S. Oil Seal
VL28.	Grease Baffle
VL29.	Housing Extension
VL30.	Adaptor Plate
VL31.	Pipe Nipple

SIZES 40 and 80



All other parts same as type "V"

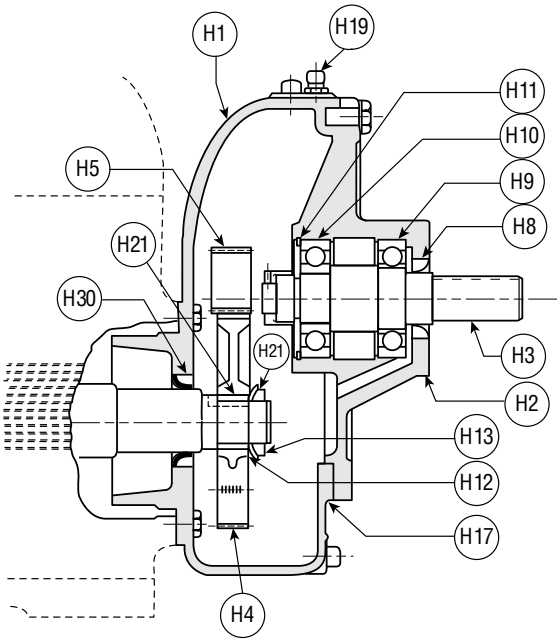
WORM GEAR PREFIX
FOR TYPE “DU” & “DV” REDUCERS
SIZE 80, 100, 120



PARTS LIST	
Item	**Description**
D1.	Housing
D2.	L.S. Bearing Cap
D3.	Housing Adaptor
D4.	H.S. Bearing Cap
D5.	Worm & Shaft
D6.	Worm Gear.
D7.	H.S. Bearings
D8.	L.S. Bearings
D11.	L.S. Shaft Key
D12.	H.S. Bearing Cap Shims
D13.	L.S. Bearing Cap Shims
D15.	H.S. Oil Seal
D16.	L.S. Oil Seal
D17.	Fan
D18.	Fan Cover

NOTES

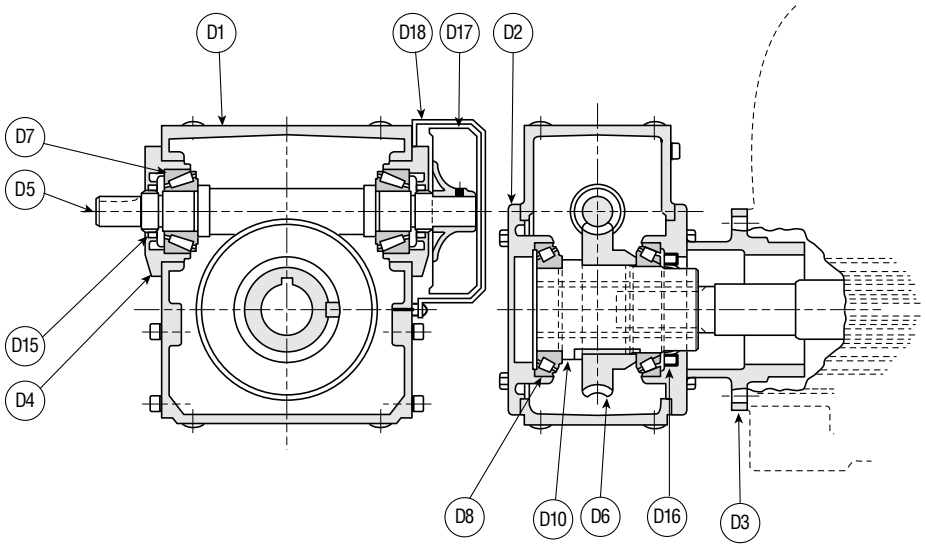
HELICAL PREFIX FOR TYPES "HU", "HV" & "HVL" WORM REDUCERS



PARTS LIST			
Item	**Description**	**Item**	**Description**
H1.	Housing	H11.	Snap Ring
H2.	Input End Bell	H12.	Lockwasher
H3.	Input Shaft	H13.	Locknut
H4.	H.S. Gear	H17.	Gasket
H5.	H.S. Pinion With Nut	H19.	Breather
H8.	H.S. Oil Seal	H20.	Oil Seal
H9.	H.S. Bearing outboard	H21.	Key
H10.	H.S. Bearing inboard	H22.	Keeper Plate

WORM GEAR PREFIX FOR TYPE "DU", "DV" REDUCERS SIZES 40, 50, 60, 70

PARTS LIST	
Item	**Description**
D1.	Housing
D2.	L.S. Bearing Cap
D3.	Housing Adaptor
D4.	H.S. Bearing Cap
D5.	Worm & Shaft
D6.	Worm Gear.
D7.	H.S. Bearings
D8.	L.S. Bearings
D10.	Worm Gear Hollow Shaft
D11.	Key
D15.	H.S. Oil Seal
D15A.	H.S. Oil Seal Sleeve
D16.	L.S. Oil Seal
D16A.	L.S. Oil Seal Sleeve
D17.	Fan
D18.	Fan Cover



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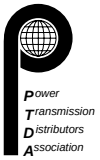

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