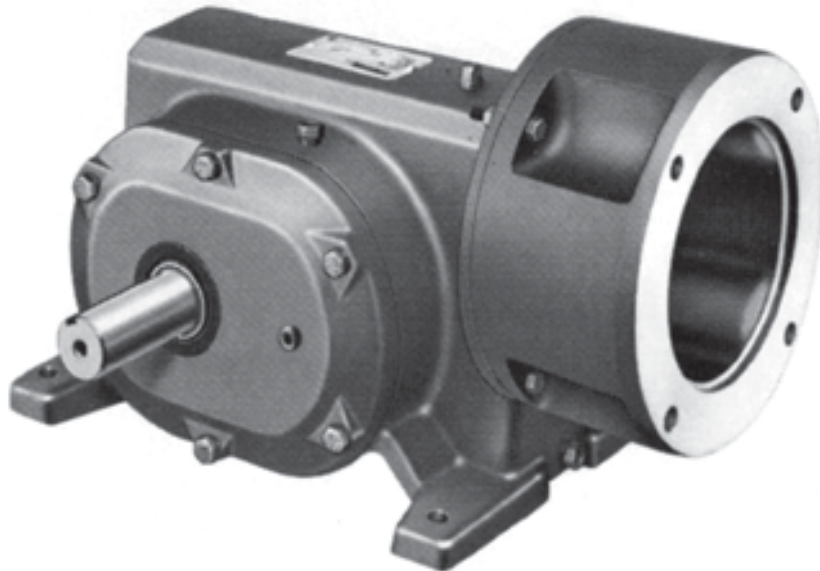


# MASTER XL<sup>®</sup> RIGHT ANGLE GEARMOTORS AND C-FACE REDUCERS

## SERVICE AND REPAIR FOR SIZES 12, 16, 21, 28



WARNING: Because of the possible danger to person(s) or property which may result from improper use of products, it is important that correct procedures be followed. Products must be used in accordance with the Engineering information specified in the catalog. Proper installation, operation and maintenance procedures must be observed. The instructions in the instruction manuals must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. Proper guards and other suitable safety devices or procedures as may be desirable or as may be specified in safety codes should be provided, and are neither provided by Master Power Transmission nor are the responsibility of Master Power Transmission. This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all the equipment in the system and the potential hazards involved. When risk to persons or property may be involved, a failsafe device must be an integral part of the driven equipment beyond the speed reducer output shaft.



3300 Tenth St. / Columbus, IN 47201 / (812) 376-1100  
[www.master-pt.com](http://www.master-pt.com)

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### DANGER

**Only qualified personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, and/or service this equipment. Read and understand this manual in its entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.**

## GENERAL INFORMATION

The MASTER right angle gear product line is composed of two basic reducers.

1. **THE GEARMOTOR**—uses a partial motor direct connected to the reducer input shaft by means of a semirigid coupling.
2. **THE C-FACE REDUCER**—utilizes a standard C-face motor, adapter and flexible coupling, connecting to the reducer.

Gearing is designed with a steel worm, integral to the input shaft, mating with a bronze worm gear. The second stage gears where used are helical, cut from steel, shaved to close tolerances and then case hardened.

The single reduction and combination gearmotor is designed with ball bearings on input shafts and tapered roller bearings on intermediate and final output shaft.

### WARRANTY

This equipment is warranted under DODGE's published "Standard Terms and Conditions of Sale of Electrical Apparatus."

Parts, service, and repairs, in or out of warranty may be arranged through any DODGE Authorized Service Shop, Distributor, or District Sales Office.

Damage in shipment, abuse, misuse, applicable maintenance and repair and periodic adjustments, as required, are not part of this warranty.

### STANDARD TERMS & CONDITIONS OF SALE

Company expressly warrants the equipment manufactured by it as set forth herein. Company makes no other warranties, either express or implied (including without limitation warranties as to merchantability or fitness for a particular purpose).

#### WARRANTY

**CAUTION: SERVICE AND REPAIR UNDER WARRANTY SHOULD BE PERFORMED ONLY BY A DODGE AUTHORIZED SERVICE SHOP. CALL WARRANTY ADMINISTRATION AT 812-378-2416 FOR THE NEAREST LOCATION.**

MASTER XL gear units are warranted under DODGE "Standard Conditions for Sale."

Warranty claims on any such apparatus must be submitted to the company within one year from date of installation or within three years from the date of manufacture, whichever comes first. The Seller's warranty applies insofar as the equipment is operated within the rating and service conditions for which it was specifically sold. The warranty does not extend to failures in-

duced by misuse, improper storage or handling, abuse or misapplication.

For warranty service, contact the nearest DODGE Sales Office or Authorized Distributor or call Warranty Administration at (812) 376-1100

### SERVICE FACTOR

Load conditions must be in accordance with service factor as listed on the nameplate. Refer to the DODGE Gear catalog or AMGA published ratings for definition of service conditions.

### INSTALLATION

The gear unit must be mounted on a sturdy base of sufficient strength to prevent distortion due to applied loads. To prevent the introduction of additional stresses in the gear unit, the base must be flat and any unevenness must be compensated for by the insertion of shims between the base and the feet of the gearcase. Hex head bolts of proper diameter and grade, together with flat washers, should be used to mount the gear unit to its base.

#### DANGER

THE USER IS RESPONSIBLE FOR CONFORMING WITH THE NATIONAL ELECTRICAL CODE AND ALL OTHER APPLICABLE LOCAL CODES. WIRING PRACTICES, GROUNDING, DISCONNECTS AND OVERCURRENT PROTECTION ARE OF PARTICULAR IMPORTANCE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

### ROTATION

#### WARNING

TO ENSURE THAT DRIVE IS NOT UNEXPECTEDLY STARTED, TURN OFF AND LOCK OUT OR TAG POWER SOURCE BEFORE PROCEEDING. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

To reverse the direction of rotation of a 3-phase A-C gearmotor, interchange any two of the lines going to the motor. If it is a 2-phase gearmotor, interchange the wires of one phase. Four-wire, 2-phase gearmotors have lead marking conforming to NEMA Standards.

D-C gearmotors may be reversed by interchanging the armature leads (A1 and A2 at the motor). In all cases connection diagrams are furnished with the motors.

## LUBRICATION FITTINGS AND PLUGS

This gearcase has been lubricated at the factory for only one mounting position. Before starting, check the mounting position diagrams on pages 5 through 8 to make sure that the oil level plug and oil level are in the correct location for which the unit is to be operated. This is extremely important, as insufficient lubricant will damage gears and bearings in a very short time. If any change is necessary, the vent plug must be relocated above the new oil level. When the unit is to be mounted in a position other than those shown in the diagrams, consult the factory.

Units mounted with output shafts in the vertical position require street ells to raise the oil level to the top edge of the bronze worm gear. On some sizes this street ell is shipped separately to avoid breakage in transit. The location for the street ell is indicated by an instruction tag wired to a throwaway plug (a throwaway plug can be recognized by the cross-drilled hole in the head of the plug). Before putting unit into operation turn the unit up so that oil will not drain out when the throwaway plug is removed. Remove and discard the throwaway plug and install the street ell in a vertical position as indicated on the mounting position diagrams on pages 5 through 8. The unit is factory-filled with the proper amount of lubricant to bring the oil level to the top of the street ell.

On some mounting positions zerk fittings are provided for grease lubricating bearings located above the operating oil level. Lubricate with a good grade of roller bearing grease when changing gear lubricant at the recommended change interval. Texaco Marfak No. 3 is a suitable grease. Do not overlubricate grease-packed bearings.

Single reduction worm gear units for output shaft down mounting have one pipe-tapped hole in the center of the closed bearing housing. Combination units for output shaft down mounting have two pipe-tapped holes

in line, one in the center of the output shaft, and one in the center of the second stage pinion shaft. Units are shipped from the factory with throwaway plugs in these tapped holes (a throwaway plug can be recognized by the cross-drilled hole in the head of the plug). Before putting units into operation remove and discard the throwaway plugs and install the zerk fittings.

Flanged units for the flange/output shaft up mounting have two pipe-tapped holes in the side of the flanged bearing housing. One of these holes is for a zerk fitting. Its location can be recognized by the throwaway plug. Remove and discard the throwaway plug and install the zerk fitting.

### CAUTION

PROPER OPERATION OF THIS UNIT REQUIRES VENTING. REPLACE THE THROWAWAY PLUG WITH VENT PROVIDED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN DAMAGE TO, OR DESTRUCTION OF, THE EQUIPMENT.

Vent plug locations can be recognized by a throwaway plug. The vent plug is wired to the throwaway plug to avoid mistaking it for a zerk location. The vent plug is designed to prevent dirt and water from entering the gearcase and also to release air pressure caused by heat generated in the case. Without proper air venting the increase in pressure may force lubricant through the oil seals and result in oil leakage and damage to the unit. Do not restrict the operation of the vent with paint or other obstructions.

**NOTE:** Standard vents are open. Optional spring loaded vents which open at approximately .50 P.S.I. are available. If sight gauges are installed on a gear unit, the vent must be a type which is open continuously.

## OPERATING TEMPERATURES

Heating is a natural characteristic of right angle gear units with a worm gear set. A maximum gearcase sump temperature approaching 200°F. is not uncommon for units operating in normal ambient temperatures. When operated at the rated capacity, no damage will result from this temperature, as this was taken into consideration in the design of the gearcase and the selection of the lubricant. The proper lubricant must be selected for the

operating ambient temperature range, with seasonal changes in lubricant viscosity grade whenever necessary. Output speeds above 300 RPM may require a lighter viscosity grade of lubricant. Select the lubricant from the proper column on page 3. Lubricants other than those listed should not be used without specific factory approval as performance or gear life may be adversely affected.

## MAINTENANCE

Gearmotors and reducers are accurately adjusted and tested at the factory. Care must be taken when the gearcase is disassembled and reassembled. This should be done according to this manual or by an authorized

service station as damage to internal parts may result if done improperly.

Whenever a partial motor is assembled to the gearcase of a gearmotor type unit, the spline on the reducer input



shaft must be lubricated with a molydisulfide-type lubricant, preferably Mobil-Temp No. 78 grease.

Whenever a C-face motor is assembled to a C-face type reducer, care must be taken to ensure that the flexible coupling hub on the motorshaft is spaced properly. See diagram on page 10 of this manual.

Lubrication is extremely important for satisfactory operation. The proper oil level must be maintained in the gearcase at all times. The correct level is indicated by the red head pipe plug. Frequent inspections with the unit not running (preferably when warm) should be made by removing the plug to see that the level is being maintained. If low (without replacing oil level plug), add lubricant through one of the proper holes until it comes out the oil level hole. Replace the oil level plug securely.

The satisfactory performance of gears and bearings in gearmotors and reducers depends on clean lubricant, free from dust, grit, sludge, and moisture. Depending

on operating conditions, the lubricant will eventually become contaminated and should be replaced periodically. When first put into operation, the lubricant in new gearcases becomes contaminated with grit and metal particles from the run-in period.

Lubricant should be drained, the gearcase flushed with mineral spirits and refilled after the first 250 hours of operation; then every 1500 hours or six months thereafter, whichever occurs first. (Normal operation is running 16 hours per day in 80°F. ambient.) More frequent oil changes may be necessary when running continuously at high temperatures. Use only recommended lubricants as listed in the table on page 3.

**NOTE:** If Mobil SHC-629 or SHC-634 are used for normal operation (viscosity group 318.62), the time for changing the lubricant may be extended. Drain, flush, and refill after the first 1500 hours of operation; then every 5000 hours thereafter. (SHC is a registered trademark of the Mobil Corporation.)

### APPROVED LUBRICANTS VS. AMBIENT CONDITIONS:

AMBIENT TEMPERATURE	LUBRICANT VISCOSITY GROUP VS. OUTPUT SHAFT SPEED				
	UP TO 300 RPM			OVER 300 RPM	
-65°F. TO 0°F. -45°F. TO +20°F. -5°F. TO +55°F. +15°F. TO +110°F. +100°F. TO +165°F.	318.59 318.60 318.61 318.62 318.63			318.59 318.60 318.62 318.63	
<b>VISCOSITY GROUP</b>	<b>318.59</b>	<b>318.60</b>	<b>318.61</b>	<b>318.62</b>	<b>318.63</b>
AMOCO OIL COMPANY AMOCO PERMAGEAR AMOCO				EP460 WORM GEAR OIL	
ATLANTIC RICHFIELD ARCO MINERAL GEAR OIL S.A.E.			90	140	
CARR OIL COMPANY LUB 733				EP140	
DARMEX INDUSTRIAL CORP. GEAR BOX OIL				DX-9140	
DUBOIS CHEMICAL CO. E.G.O.			EP90	EP140	
EXXON CYLESSTIC				TK460	
FISKE BROTHERS LUBRIPLATE APG			90	140	
GULF OIL COMPANY TRANSGEAR LUBE			EP90	EP140	
E.F. HOUGHTON CO. MP GEAR OIL			90	140	
KEYSTONE LUBE CO.				WG-A	
MOBIL OIL CORP. SHC-600 SERIES SHC-600 SERIES AVREX MOBILFLUID CYLINDER OIL EXTRA HECLA	904	423	SHC-629*	SHC-629* SHC-634 600W	SHC-634* SHC-636  SUPER CYLINDER
PHILLIPS PETROLEUM PHILUBE			90	140	
SHELL OIL CO. AEROSHELL FLUID	4	5-L			
TEXACO VANGUARD				460	
ULTRACHEM, INC. CHEMLUBE				140*	
ISO OR A.G.M.A. VISCOSITY GRADE	ISO 15	ISO 46 AGMA 1	ISO 320 AGMA 5	ISO 460 AGMA 7	ISO 680 AGMA 8

\*Viscosity of these oils is actually less than the listed ISO or A.G.M.A. grade.

## RECOMMENDED LUBRICANTS

It is impossible to select one gear lubricant of petroleum origin which is usable over a wide range of temperatures, such as minus (-)65°F. to plus (+)165°F., as is required for some installations. When such conditions

are encountered it is necessary to change the lubricant depending on the ambient (surrounding air) temperature at the time of operation. Use lubricants of the proper viscosity group as outlined in the previous table.

**Note 1.** Lubricants shipped in the gearcase from the factory are viscosity group 31X.62 oils for standard ambient conditions and continuous duty.

**Note 2.** If a USDA-H1 food grade lubricant is desired, Chevron FM lubricating oil 460X may be used in ambient temperatures of +15°F. to +110°F. Chevron FM lubricating oil is available as a factory fill, but if it becomes necessary to install this oil in the field by draining a gearcase which contains our standard nonfood grade lubricant the gearcase must be flushed thoroughly before installing the new oil.

Do not operate gear unit in ambient temperatures below -65°F. nor above +165°F. For temperatures below -10°F. special oil seals are required, and bearings in the gearcase must be packed with Aeroshell 7 grease instead of Marfak No. 3.

All group 318.63 lubricants, except Mobil SHC-634 must be changed after 300 hours of high temperature operation. Mobil SHC-634 must be changed after 1500 hours of high temperature operation. When changing oil from one viscosity group to another, flush the gearcase with mineral spirits before installing the new oil.

### FOR INTERMITTENT DUTY IN A WIDE TEMPERATURE RANGE

(Defined as not over 50% duty nor more than 30-minute operation continuously).

AMBIENT TEMPERATURE	VISCOSITY GROUP
-65°F. to +10°F.	318.59
-20°F. to +50°F.	318.60
+15°F. to +110°F.	318.62
+80°F. to +165°F.	318.63

## REPLACEMENT LUBRICANT

Only those lubricants listed in this manual have been tested and approved by engineering. The use of a lubricant not approved voids the reducer warranty. For your convenience we make available factory approved lubricant in small volume containers. Order by part number from your local DODGE Distributor.

### APPROXIMATE OIL CAPACITIES

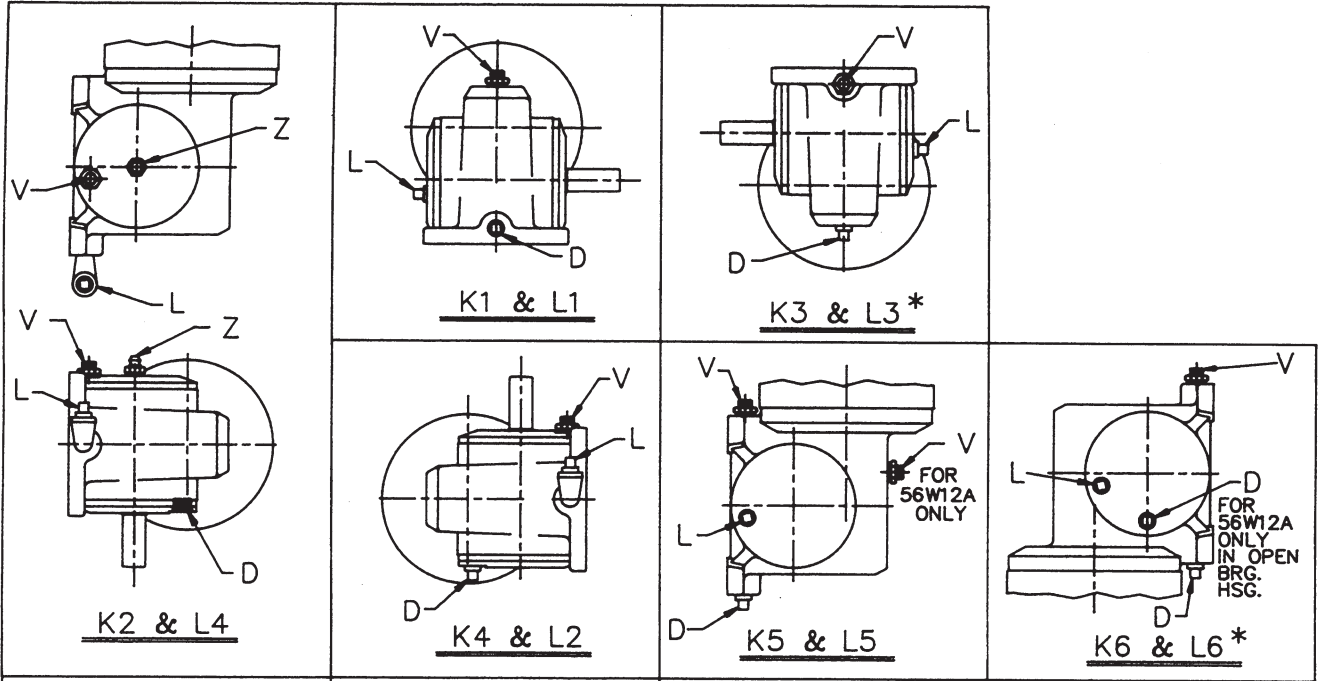
VOLUME	PART NUMBER (SHC-634)
12 OZ.	41170966AB
1 QT.	41170966AE
1 GAL.	41170966AF

VOLUME	PART NUMBER (SHC-629)
1 QT.	41170966AG
1 GAL.	41170966AH

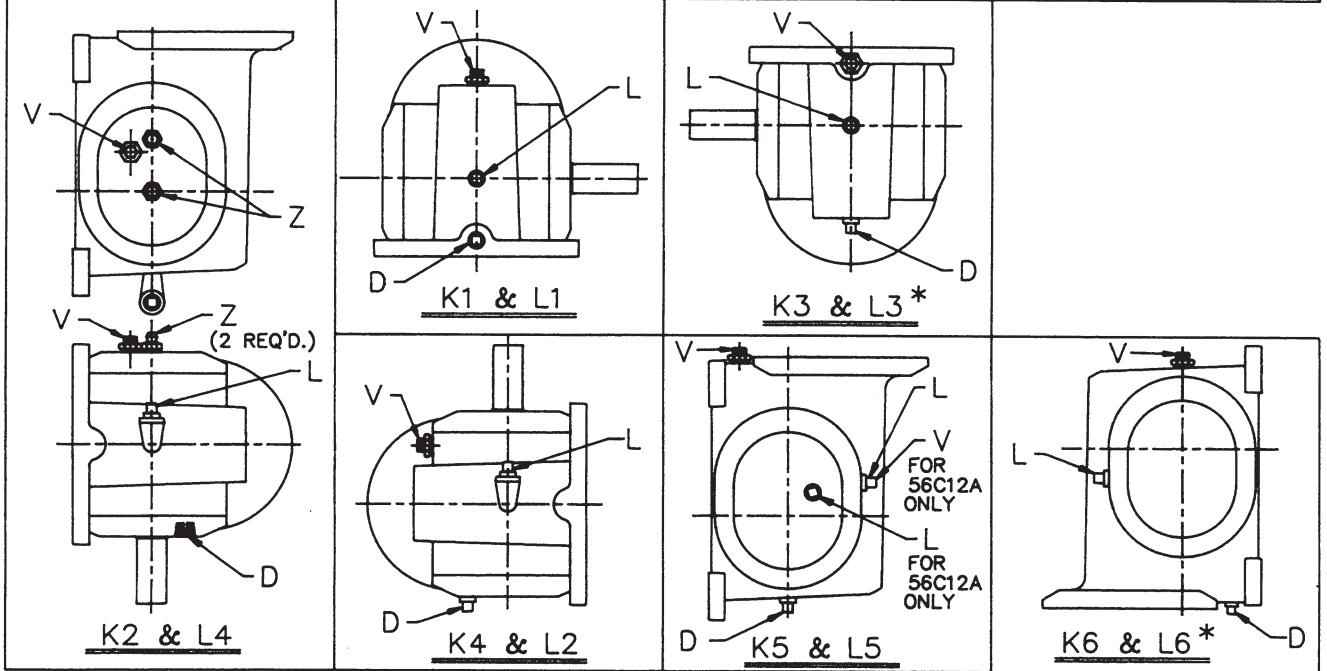
GEARCASE SIZE	VOLUME OF OIL	
	QTS.	GALLONS
WG12	.25	.062
WG16	.40	.100
WG21	.97	.242
WG28	1.93	.482
WG40	5.50	1.375
H419	4.82	1.205
CG12	.80	.200
CG16	1.38	.345
CG21	3.40	.850
CG28	7.50	1.875
CG40	14.00	3.500

# FOOT MOUNTED UNITS

SINGLE REDUCTION WORM UNITS



COMBINATION UNITS



\* MOUNTING POSITIONS NOT RECOMMENDED

V = VENT PLUG

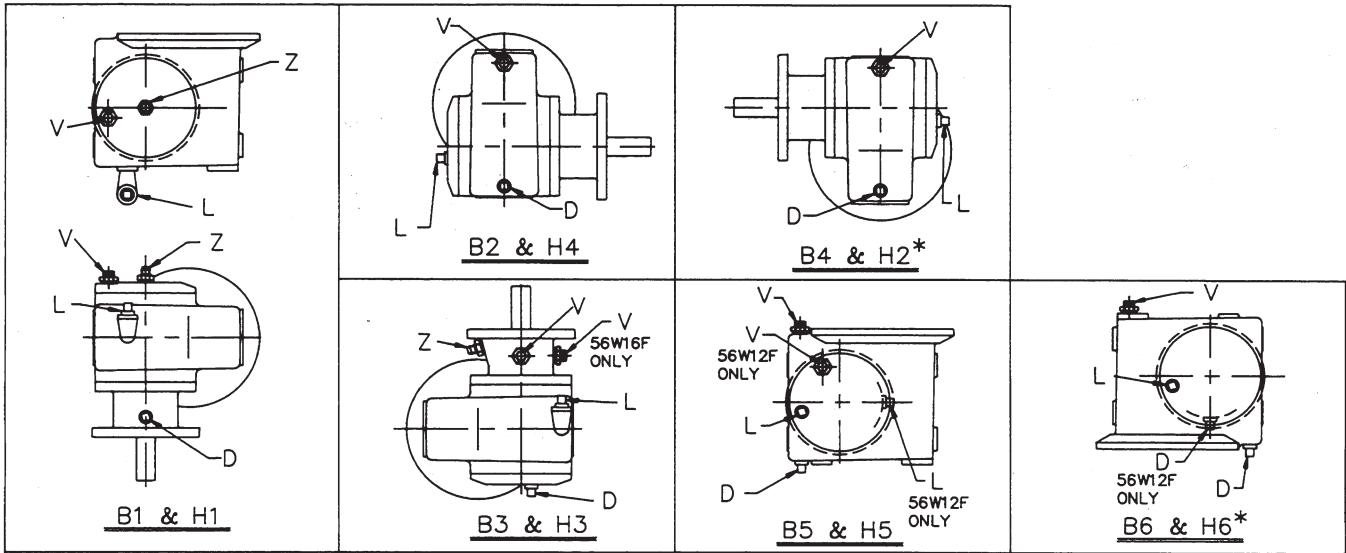
D = DRAIN PLUG

L = OIL LEVEL PLUG

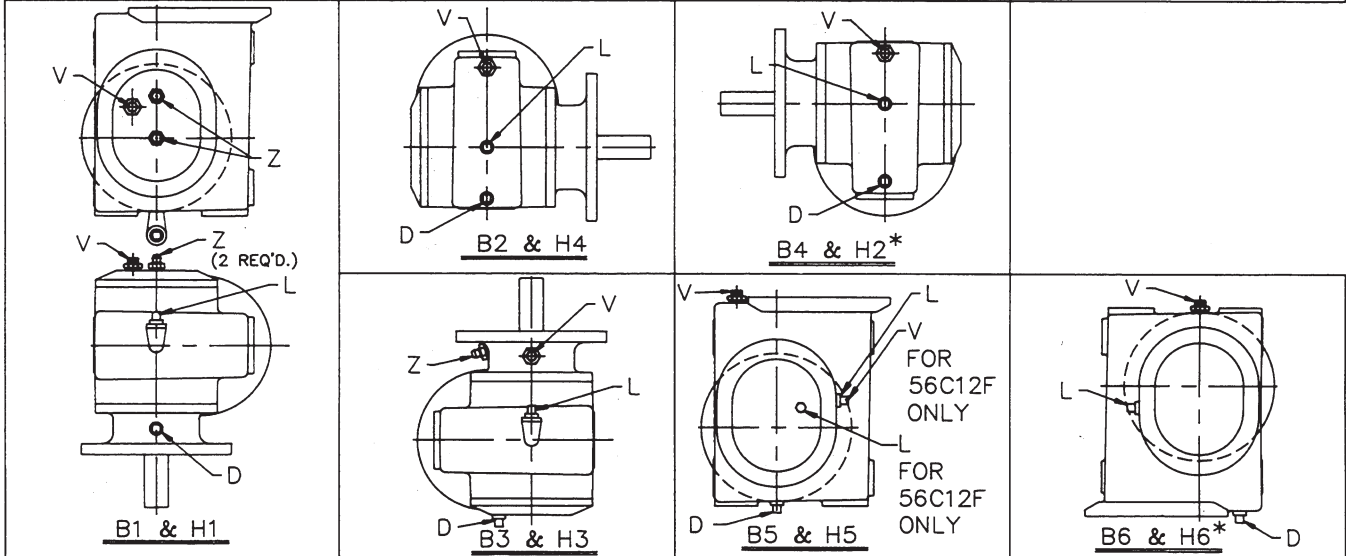
Z = ZERK FITTING

# FLANGE MOUNTED UNITS

SINGLE REDUCTION WORM UNITS



COMBINATION UNITS



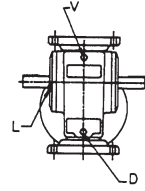
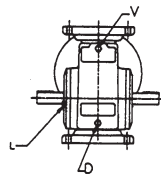
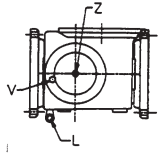
\* MOUNTING POSITIONS NOT RECOMMENDED

V = VENT PLUG                      D = DRAIN PLUG  
 L = OIL LEVEL PLUG              Z = ZERK FITTING



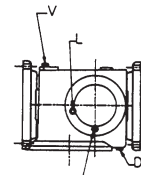
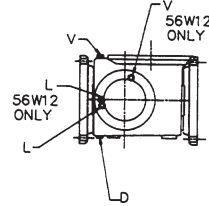
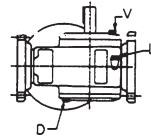
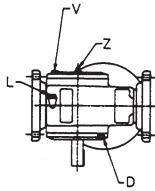
# MULTI-MOUNT UNITS

SINGLE REDUCTION WORM UNITS



POSITIONS  
K1, L1, A3, E3

POSITIONS  
K3, L3, A1, E1\*



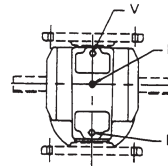
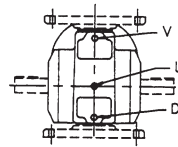
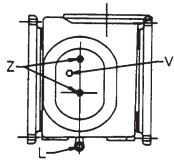
POSITIONS  
K2, L4, A2, E4

POSITIONS  
K4, L2, A4, E2

POSITION 5

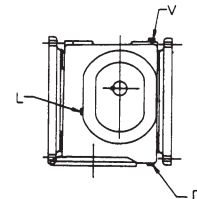
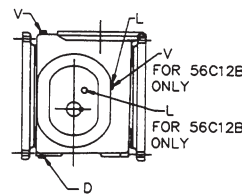
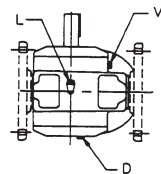
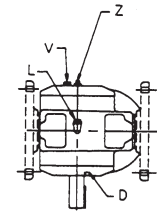
POSITION 6\*

COMBINATION UNITS



POSITIONS  
K1, L1, A3, E3

POSITIONS  
K3, L3, A1, E1\*



POSITIONS  
K2, L4, A2, E4

POSITIONS  
K4, L2, A4, E2

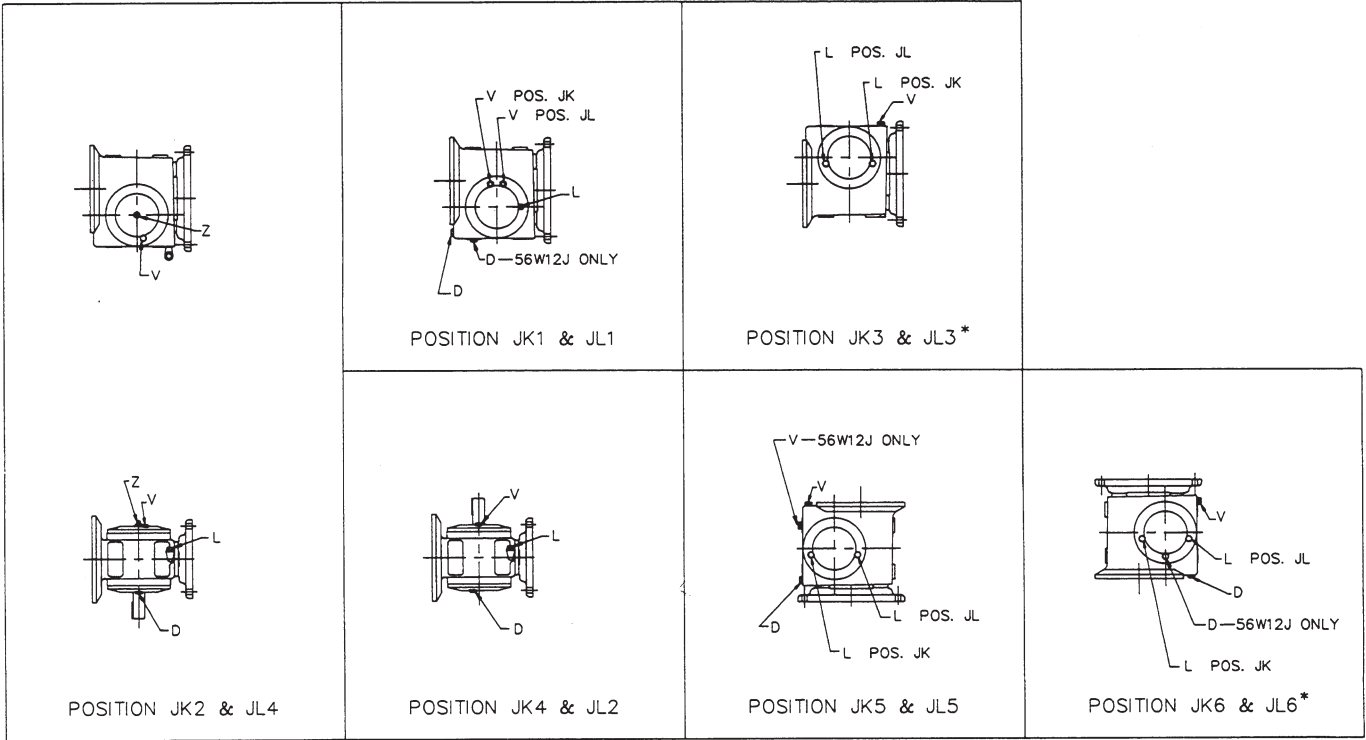
POSITION 5

POSITION 6\*

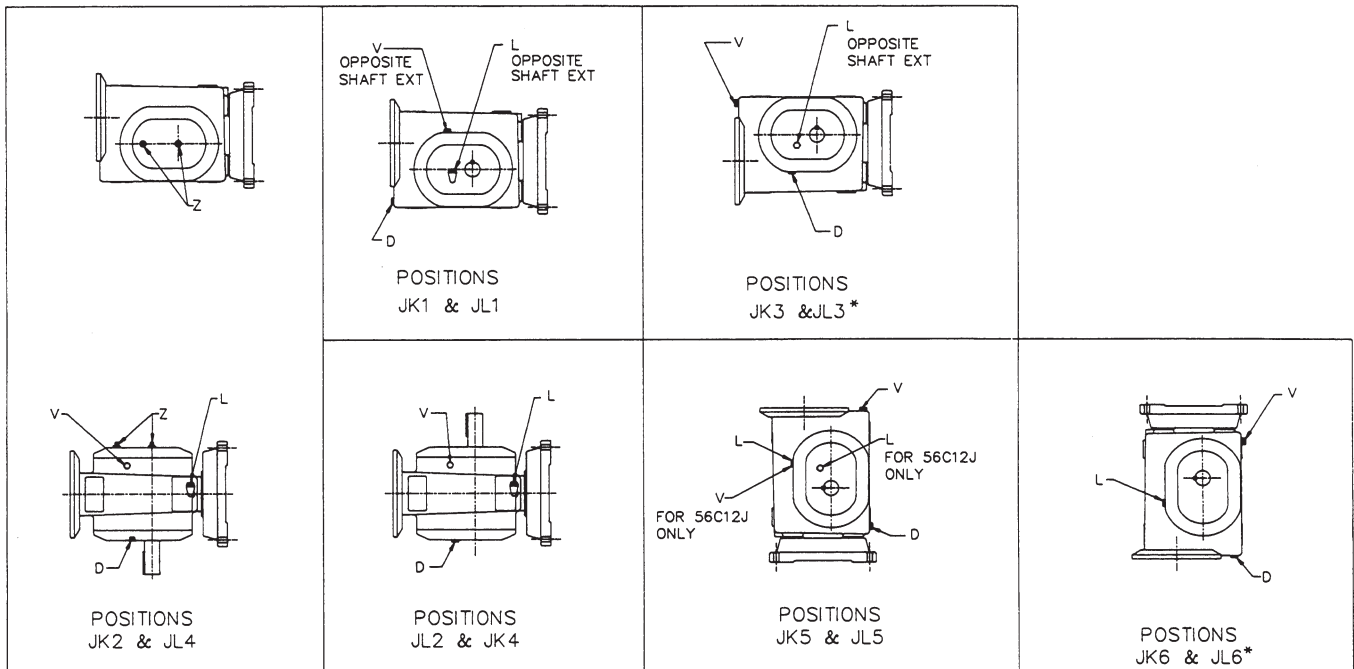
\* MOUNTING POSITIONS NOT RECOMMENDED  
 V = VENT PLUG      D = DRAIN PLUG  
 L = OIL LEVEL PLUG      Z = ZERK FITTING

# J-MOUNT UNITS

SINGLE REDUCTION WORM UNITS



COMBINATION UNITS



\* MOUNTING POSITIONS NOT RECOMMENDED  
 V = VENT PLUG      D = DRAIN PLUG  
 L = OIL LEVEL PLUG      Z = ZERK FITTING

## REMOVAL AND REPLACEMENT OF MOTOR

### DANGER

TO ENSURE THAT DRIVE IS NOT UNEXPECTEDLY STARTED, TURN OFF AND LOCK OUT OR TAG POWER SOURCE BEFORE PROCEEDING. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

### WARNING

EQUIPMENT BEING REMOVED MAY BE TOO HEAVY TO CONTROL MANUALLY. SUPPORT IT BY EXTERNAL MEANS. FAILURE TO OBSERVE THE PRECAUTIONS COULD RESULT IN BODILY INJURY.

7. After other repairs are made to the reducer, the motor can be assembled in reverse order.

Whenever a partial motor is assembled to the gearcase of a gearmotor-type unit, the spline on the reducer input shaft must be lubricated with a molydisulfide-type lubricant, preferably Mobil-Temp No. 78 grease.

### WARNING

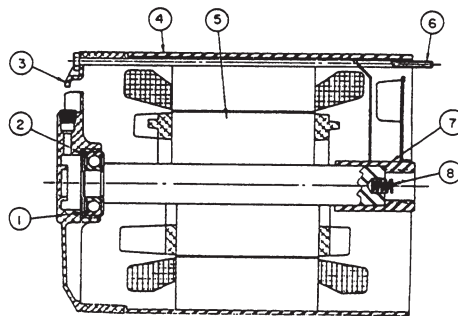
TO ENSURE THAT DRIVE IS NOT UNEXPECTEDLY STARTED, TURN OFF AND LOCK OUT OR TAG POWER SOURCE BEFORE PROCEEDING. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

#### For the Gearmotor Configuration:

1. Disconnect all electrical wire and conduit.
2. Remove the four motor bolts (6).
3. Tap the side of the end shield (3) to loosen and remove.
4. Remove stator and frame assembly (4).
5. Rotor and shaft assembly (5) will now slide off of the splined input shaft. Be careful to not lose the coupling spring (8) which is in the coupling bore.
6. The semi-rigid coupling in gearmotors requires a small amount of Mobil-Temp 78 lubricant added to the splines.

#### For the C-face Configuration:

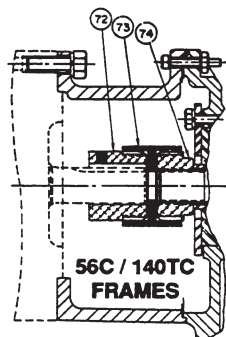
1. Disconnect all electrical wire and conduit.
2. Remove four motor mounting bolts (76).
3. Pull motor from reducer.
4. Remove flexible coupling hub from motor shaft.
5. Refer to applicable motor instruction manual if further disassembly is required.
6. Whenever a C-face motor is assembled to a C-face-type reducer, care must be taken to ensure that the flexible coupling hub on the motor shaft is spaced properly. See diagram on page 10 of this manual.
7. After other repairs are made, the motor can be assembled in reverse order.



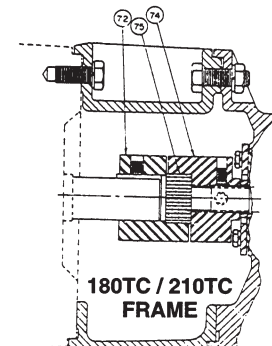
**PARTIAL MOTOR USED ON GEARMOTORS**

#### MOTOR PARTS IDENTIFICATION

1. Thrust Spring
2. Ball Bearing
3. F.E. Shield
4. Stator and Frame
5. Rotor
6. Motor Bolts
7. Motor Shaft and Semi-Rigid Coupling Assembly
8. Spring (Coupling)
72. Half Coupling for Motor Shaft
73. & 75. Coupling Sleeve or Spider
74. Half Coupling for Reducer Input Shaft
76. Motor Mounting Bolts



**MOTOR ADAPTER USED ON C-FACE REDUCERS**



## INSTALLATION OF MOTOR FOR THE C-FACE CONFIGURATION

### WARNING

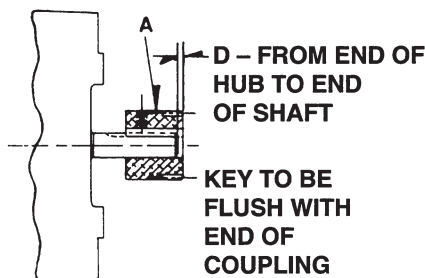
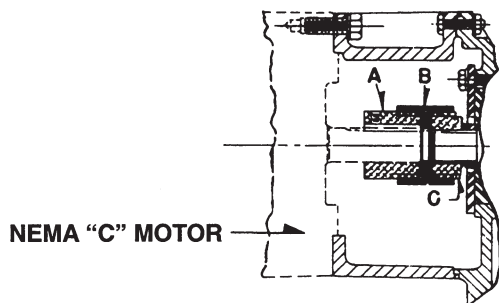
TO ENSURE THAT DRIVE IS NOT UNEXPECTEDLY STARTED, TURN OFF AND LOCK OUT OR TAG POWER SOURCE BEFORE PROCEEDING. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

When the C-face MASTER Speed Reducer is received, the adapter is bolted to the gearcase. The flexible coupling assembly and bolts for attaching the motor to the adapter are packaged separately. To assemble the C-face motor to the C-face reducer, proceed as follows:

### MOTOR FRAMES 48Y, 56C AND 140TC

Shown in Figure 1 below is the C-FACE ASSEMBLY for mounting Nema C-face motor frames 48Y, 56C, and 140TC.

1. Locate motor coupling hub "A" on the motor shaft as shown in Figure 2 below. Once located, tighten coupling hub set screw.
2. Slip reducer coupling hub "C" on reducer input shaft until it shoulders on the reducer seal sleeve as shown in Figure 1.
3. Slip coupling sleeve "B" over reducer coupling hub "C" until shouldered.
4. Guide motor shaft coupling hub "A" into the coupling sleeve as shown in Figure 1.
5. Rotate motor to line up C-face tapped holes with bolt holes on the adapter; insert bolts and tighten securely.

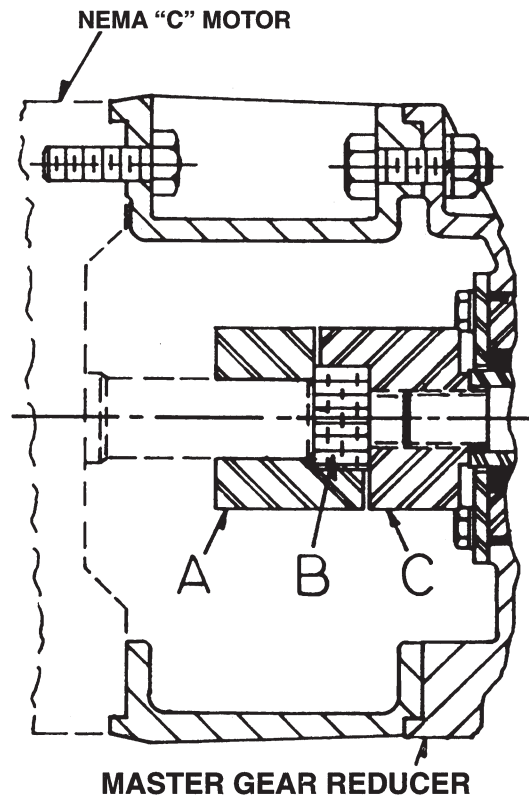


"C" FACE FR.	D
56 FR. OR 48 FR. WITH 56 FR. "C" FACE	1/8
140TC	1/8

### MOTOR FRAMES 180TC-210TC

Shown in the figure below is the C-face assembly for mounting Nema C-face motor frames 180TC and 210TC.

1. Slip reducer coupling hub "C" on the reducer input shaft until it shoulders on the reducer seal sleeve. Once located, tighten set screws.
2. Slip motor coupling hub "A" on motor shaft till the end of the motor shaft is flush with the inner face of the coupling hub. Once located, tighten set screws.
3. Slip coupling spider onto reducing coupling hub "C".
4. Guide motor shaft with coupling hub "A" into spider as shown below.
5. Rotate motor to line up C-face tapped holes with bolt holes on adapter; insert bolts and tighten securely.



### LUBRICATION AND MAINTENANCE

The C-face MASTER speed reducer flexible coupling is lubrication free and requires no maintenance.

## INSTRUCTIONS FOR THE DISASSEMBLY AND REASSEMBLY OF SINGLE REDUCTION GEARMOTORS AND REDUCERS

### WARNING

TO ENSURE THAT DRIVE IS NOT UNEXPECTEDLY STARTED, TURN OFF AND LOCK OUT OR TAG POWER SOURCE BEFORE PROCEEDINGS. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

### WARNING

EQUIPMENT BEING REMOVED MAY BE TOO HEAVY TO CONTROL MANUALLY. SUPPORT IT BY EXTERNAL MEANS. FAILURE TO OBSERVE THE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Gearmotors and reducers are accurately adjusted and tested at the factory. Care must be taken when the gearcase is disassembled and reassembled. This should be done according to this manual or by an authorized service station, as damage to internal parts may result if done improperly.

Remove motor if complete disassembly is to be made. (See page 9.)

1. Remove the drain plug and drain oil from gearcase.
2. Remove screws holding the bearing housing (8), tap housing to loosen at the gasketed joint, then remove from the gearcase (6).
3. Lift out the output shaft assembly (17) which includes bronze worm gear.
4. To remove input shaft (46), remove seal clamp screws. Pull input worm shaft assembly including seal (4) and bearings (5A-B) from gearcase.

**NOTE:** The input shaft oil seal in the gearmotor was an assembly in early manufacture held together with a lockring. Once removed it cannot be reused. In present design, the seal and sleeve are separate items and individually removable. Because of the bearing lockring (48), the seal assembly (4) and bearing (5A) cannot be removed at the same time.

5. All parts and castings should now be cleaned and inspected for possible replacement. If bearing or gears are to be replaced, a suitable set of bearing pullers or an arbor press must be utilized.

**NOTE:** Shimming of the tapered roller bearings and centering of the worm gear on the output shaft is accomplished by placing shims (14) behind the bearing cups (31A or 31B) and shifting as needed. If bearings, gears, collar, or output shaft have not been changed, then reshimming should not be necessary; but a check for end play or preload should be made.

6. A new seal sleeve (16) should be installed on the output shaft (where applicable). Some sealer should first be applied on the shaft at the sleeve location. Do not use so much that it gets on the sleeve O.D. or seal lip, as this will result in seal leakage.
7. Reassemble by installing closed bearing housing (45) and gasket using sealer on this gasket, then insert the output shaft assembly (17) into the gearcase. Install open bearing housing gasket without using sealer, bearing housing (8), and screws.
8. Check output shaft for looseness or preloading of the bearing. It is recommended that bearing be shimmed to .000" to .003" end play.
9. Again, remove the bearing housing screws, bearing housing (8), and output shaft assembly (17) and put to one side.
10. New input worm shaft bearings (5A-B) should now be pressed into place. The Tru-Arc lockring (48) is placed between the bearing (5A) and oil seal (4) to accept one-way thrust.
11. First apply a small amount of sealer around the shaft at the sleeve location, then press seal sleeve into place. Do not get sealer on the sleeve O.D. or seal lip.
12. Install the input shaft assembly (46) in the gearcase (6). Install the oil seal assembly (4), seal clamp (3), and screws. The input shaft should turn freely but have no end movement other than bearing internal clearance.
13. In order to check gear centering or alignment, you must "blue" the gears. Apply Prussian Blue lightly but evenly to six (6) teeth of the bronze gear (47). Install the output shaft and the gear assembly into the gearcase so that the gears do not mesh to the teeth coated with Prussian Blue. Install gasket without using sealer. Install bearing housing (8) and secure with several screws.
14. Rotate input shaft (46) to provide one-half of a revolution of the bronze gear in one direction through the "blued area," then in the opposite direction again through the "blued area." This will provide marks of contact on both sides of the gear teeth (47).
15. Remove bearing housing screws, bearing housing (8), and output shaft assembly. You can now see if worm gear is centered by means of contact pattern.
16. If the tooth contact pattern shows an off centered condition, it means that the output assembly needs to be moved in the direction where contact shows heaviest. This is accomplished by removing the required amount of bearing shims (14) from under the bearing cup on the side where contact is heaviest then placing them under the opposite bearing cup.



17. Reassemble and follow steps 13 thru 16 until the gears are centered properly, washing and re-bluing each time.

**NOTE:** When grease retainer (34) is supplied, pack bearing (31A) with Texaco Marfak No. 3 grease or equivalent.

18. Install new output shaft seal (15) after its O.D. is coated lightly with sealer. Take a tube of proper dimensions so as to be able to press or tap the seal squarely into place in the bearing housing (8) flush with the casting face. **DO NOT** cock or bend. Install open bearing housing.

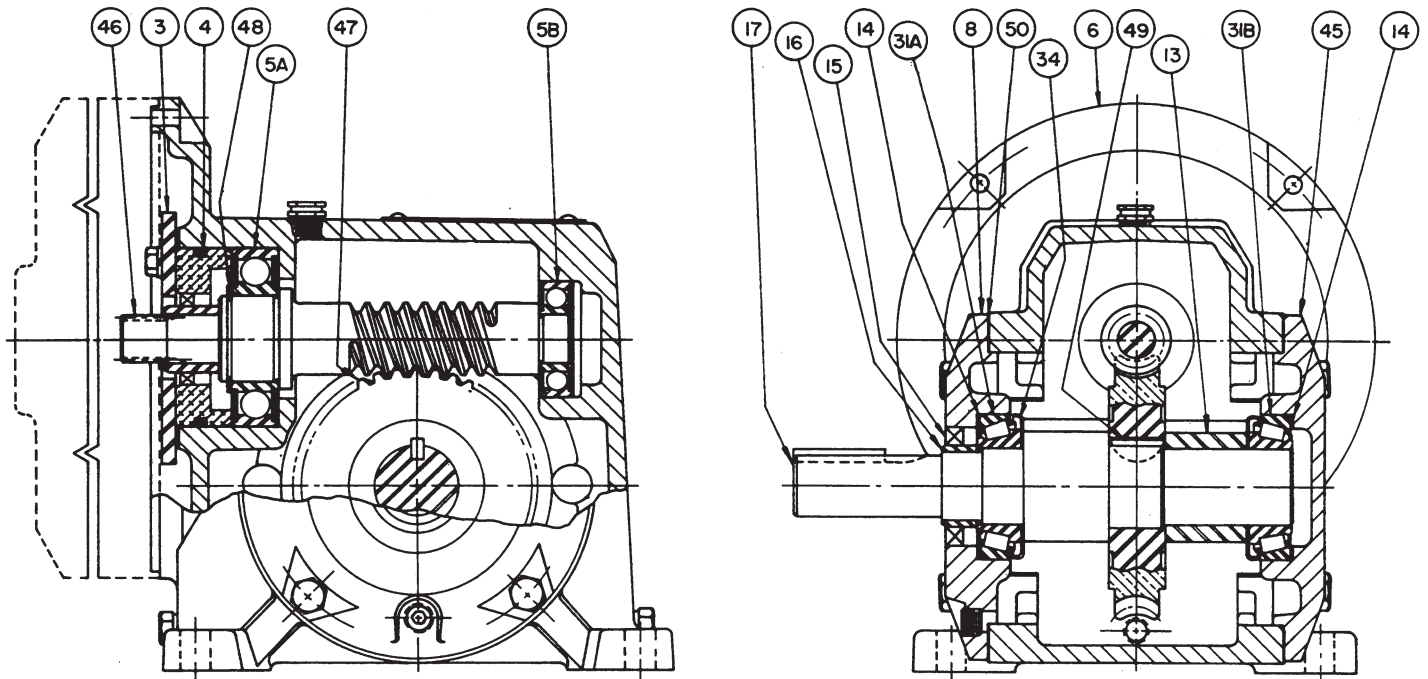
19. Bearings being set properly and gears aligned correctly, sealer can now be applied to gasket. Sealer should also be applied to all threads on screws, plugs, etc.

20. Install vent plugs in correct location. Fill the gearcase with the proper lubricant to the correct oil level for test.

21. If the unit is a gearmotor, check motor shaft bearings, replacing if necessary. Pack the semi-rigid steel coupling with Mobil-Temp 78 lubricant prior to installing the drive motor. Reinstall motor to gearbox, see motor disassembly and reassembly directions.

22. Test unit for performance.

## RIGHT ANGLE — SINGLE REDUCTION



Ref. No.	Part Description	Unit Qty.	Part Numbers ■			
			W12	W16	W21	W28
3	Oil Seal Clamp	1	411625-12A	411625-03A	411625-04A	411625-08A
*4	Oil Seal Assembly (1)	1	411620-01F	411620-04F	411620-06F	411620-17F
*5a	Bearing	1	79147-02K	79147-02AD	79147-02AL	79147-03V
*5b	Bearing	1	79147-02B	79147-02K	79147-02K	79147-02P
6	Gear Case	1	79029-10A	79027-04A	86852-02A	86864-02A
8	Bearing Housing—Open	1	602020-10A	602022-03A	602035-02A	602075-02A
13	Spacer—Worm Gear	1	411622-07A	411622-10A	411622-12B	411622-16A
14	Shim Kit	1	411642-46A	411642-46F	411642-46B	411642-46C
*15	Oil Seal (1)	1	411627-02FR	411627-02FR	411627-02EN	411627-03X
*16	Oil Seal Sleeve (1)	1	411621-09A	411621-09A	411621-10A	411621-15D
17	Output Shaft	1	602026-11A	602027-01A	602040-01A	602040-05A
*31a	Bearing	1	411626-01BE	411626-01C	411626-01A	411626-01R
*31b	Bearing	1	411626-01D	411626-01C	411626-01A	411626-01R
34	Grease Retainer—When Req'd.	2	411624-01Y	411624-01C	411624-01E	411624-01R
45	Bearing Housing—Closed	1	602020-04A	602022-04A	602035-04A	602075-04A
*46	Worm Shaft	1	SEE GEAR CHART PAGE 21			
*47	Worm Gear	1	SEE GEAR CHART PAGE 21			
48	Lock Ring	1	0082P001	053594	056044	411637-02A
49	Key—Worm Gear	1	411688-10A	411688-10B	053180	050999
*50	Gasket (1)	2	602028-01B	602028-01A	602028-01C	602028-12A
	Oil Seal & Gasket Kit	1	79019-38AA	79019-38AC	79019-38AE	79019-38AG

(1) Can use oil seal & gasket kit

\* Recommended spare parts

■ Note: These part numbers apply to standard units only.

For part numbers not shown, contact Renewal Parts Customer Service: (864) 297-4160 FAX: (864) 281-2364

## CHANGING THE OUTPUT SHAFT OF THE SINGLE REDUCTION UNIT FROM K-1 MOUNTING TO L-1 MOUNTING (AND VICE-VERSA)

See Page 13 for illustration.

1. Loosen the open bearing housing bolts.
2. Place the reducer, open bearing housing (8) up, over a clean container to catch oil.
3. Remove the bearing housing bolts. Use a hammer and a soft punch to rotate the bearing housing around the output shaft. This will shear the bearing housing gearcase seal.
4. Remove the open bearing housing (8).
5. Lift out the output shaft assembly (17) which includes the bronze worm gear (47), turn the gearcase over, and drain the oil into the container.
6. Remove the output shaft seal (15), taking care not to damage the machined bore in the bearing housing. Discard the old seal.
7. Remove the closed bearing housing (45) in the same manner used to remove open bearing housing (8).
8. Remove the roller bearing cups and shims from both bearing housing bores and switch them. (Place the cups and shims from the closed bearing housing into the bore of the open bearing housing and the cups and shims from the open bearing housing into the bore of the closed bearing housing.)

A stiff wire hook worked evenly around the bearing cups will assist their removal. Avoid cocking and jamming the cups in their bores.
9. Centering the bronze worm gear:

Worm gear sets must be properly adjusted or "centered" so the worm is contacting the center of the tooth on the worm gear. Failure to make this adjustment can cause reduced efficiency and life of the gearset, overheating, and tooth breakage.
10. Install the closed bearing housing—apply sealer to the gasket (if so equipped). Sealer should also be applied to all threads on screws, plugs, etc. If your unit did not come equipped with gaskets, apply a  $1/16$ " bead of Loctite #515 sealant around the bearing housing tenon and set the bearing housing in place. Tighten the bearing housing bolts to the torques shown on page 20. Lay the unit on a workbench with the closed bearing housing down.

Proceed with the gear centering as follows:
11. Apply Prussian Blue lightly, but evenly, to both sides of five adjacent teeth on the bronze worm gear on the output shaft assembly.
12. Install the output shaft assembly into the gearcase so that the gears mesh with the uncoated teeth. Install the open bearing housing and secure with two screws at diagonal corners.
13. Rotate the input shaft so the "blued" teeth are rotated through the gear mesh. Then rotate in the opposite direction to bring the outer side of the "blued" teeth through the gear mesh. Marks of contact will be made by the worm in the bluing on the worm gear teeth.

The input shaft may be rotated by:

  - A) Gearmotors—Manually rotating the motor fan or brake shaft, when the motor is so equipped.
  - B) C-face reducers—rotating the input shaft (46) by means of:
    - I. A splined adaptor rotated by an impact wrench.
    - II. Manually rotating the motor fan or brake shaft, when the motor is so equipped.
14. Remove the open bearing housing and output shaft assembly. Examine the contact pattern on the blued teeth of the bronze worm gear.
15. If the contact pattern is off center, the output shaft assembly must be moved in the direction where contact shows the heaviest. This is accomplished by removing shims from beneath the bearing cup on the side where the contact is heaviest and placing them under the opposite bearing cup.
16. Repeat steps 10 through 14, cleaning and rebuilding each time, until the contact pattern is in the center of the bronze worm gear.
17. With gears properly centered, the gearbox can be closed up, and sealer applied to the gaskets (if so equipped). Sealer should also be applied to all threads on screws, plugs, etc. If your unit did not come equipped with gaskets, apply a  $1/16$ " bead of Loctite #515 sealant around the bearing housing tenon and set the bearing housing in place. Tighten the bearing housing mounting bolts to the torques shown on page 20.
18. Lubricate the seal sleeve on the output shaft liberally with SHC-629 oil or other lube. Coat the seal bore in the bearing housing with a thin layer of Loctite #515 sealant. Install a new seal, taking care not to cut the lip or pop the seal spring out of position. Suitable sleeve-type seal tools should be used. Seat the seal flush with the outside of the bearing housing.
19. Fill the gearcase with the proper amount of lubricant from the list on page 3. Apply sealant to the fill plug and tighten securely.
20. Test unit for performance.

## INSTRUCTIONS FOR DISASSEMBLY AND REASSEMBLY OF COMBINATION GEARMOTORS AND REDUCERS

### WARNING

TO ENSURE THAT DRIVE IS NOT UNEXPECTEDLY STARTED, TURN OFF AND LOCK OUT OR TAG POWER SOURCE BEFORE PROCEEDING. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

### WARNING

EQUIPMENT BEING REMOVED MAY BE TOO HEAVY TO CONTROL MANUALLY. SUPPORT IT BY EXTERNAL MEANS. FAILURE TO OBSERVE THE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Gearmotors and reducers are accurately adjusted and tested at the factory. Care must be taken when the gearcase is disassembled and reassembled. This should be done according to this manual or by an authorized service station, as damage to internal parts may result if done improperly.

\*The removal and replacement of motor (See page 9).

1. Remove the drain plug and drain all oil from the gearcase.
2. Remove the screws holding the closed bearing housing (45) and tap with a mallet to loosen at the gasketed joint, then remove bearing housing.
3. Lift the output shaft assembly (17) with gear (20) from gearcase (6). Be careful. Do not damage the gear teeth. At this time, the intermediate countershaft (19) with bronze worm gear (47) may also be removed.
4. Remove the screws holding the open bearing housing (8). Tap housing with a mallet to loosen the gasketed joint, then remove.
5. Remove the seal clamp screws and the seal clamp (3) at the input shaft (46). Pull the input worm shaft assembly complete with seal (4) and bearings (5A & B) out of the gearcase.

**NOTE:** The input shaft oil seal in the gearmotor was an assembly in early manufacture, held together with a lockring. Once removed, it cannot be reused. In present design, the seal and sleeve are separate items and individually removable. Because of bearing lockring (48), the input seal assembly (4) and bearing (5A) in gearmotors cannot be removed at the same time.

6. All parts and castings should be cleaned and inspected for possible replacement. If bearings or gears are to be replaced, a suitable set of bearing pullers or an arbor press should be utilized.

**NOTE:** The shimming of roller bearings on intermediate shaft (19) and output shaft (17) and centering of the bronze worm gear (47) is done by means of steel shims placed behind the roller bearing cups in the bearing housing bores, shifting as necessary from one side to the other. If bearings, gears, collars, and shaft are not to be changed, no re-shimming is necessary, but a check for end play or preload should be made.

7. If necessary, install new bearings on input shaft (46) and put lockring (48) in place. Place some sealer on the shaft where seal sleeve will go. Do not add so much as to get on seal or outside of sleeve. Press on seal sleeve.
8. Place input shaft assembly into gear housing with balance of seal assembly and O-rings. Install clamp and screws. Check for preload or end play.
9. Install open bearing housing gasket, open bearing housing (8), and secure with screws. DO NOT put lip seal in at this time.
10. Install the intermediate counter shaft (19) with bronze worm gear (47). Place closed bearing housing gasket, closed bearing housing (45) on the gearcase and secure with screws.

**NOTE:** To check for looseness or preloading of bearings on the intermediate shaft, a tapped hole is provided in the end of the shaft (19), and bearing housing (8). This hole is located underneath the 1/8" pipe plug in the open bearing housing. Insert 1/4" x 20 bolt (long enough to be gripped) into the tapped hole in the shaft (19) to check for looseness or preloading of the intermediate shaft (19). If the bearings are loose, then shims are required. Place shims behind the bearing cups. If preloaded, remove those necessary. Shim to .000" to .003" end play.

**NOTE:** If new intermediate shaft or output shaft bearing or gears are used, proceed as follows:

11. Remove the closed bearing housing (45), lift out the intermediate shaft assembly (19). Apply Prussian Blue to six (6) teeth of the bronze gear (47). Install the intermediate shaft assembly back into gearcase so that the gears do not mesh in the area that has been coated with Prussian Blue. Install gasket without using sealer, closed bearing housing and secure all screws.
12. By rotating the input worm shaft (46) in one direction through the "blued area" (then in the opposite direction again through the "blued area") you will get a mark of contact on both sides of the gear teeth (47).
13. Remove the closed bearing housing screws, bearing housing (45), and intermediate shaft assembly (19). You can now see if the worm gear is centered



by means of a contact pattern. If the tooth contact shows an off centered condition, it means that the assembly needs to be moved. This is accomplished by removing the required amount of bearing shims from behind the bearing cup on the side where contact is heaviest, placing them underneath the bearing cup in the opposite side. Re-blue, reassemble, and check again.

14. With the intermediate worm gear shaft set up properly, the final output shaft (17) with gear (20) can now be installed and checked. Remove the closed bearing housing screws and bearing housing (45). Lift out the intermediate shaft assembly (19) with worm gear (47).

15. Install a new seal sleeve (16) (where applicable) on the final output shaft (17) after placing a small amount of sealer around the shaft at sleeve location.

**NOTE:** When grease retainer (34) is supplied, pack bearings (9A and 31A) with Texaco Marfak No. 3 grease or equivalent.

16. With worm gear (47) and shaft (19) removed, place the output shaft assembly (17) into the gearcase—shaft protruding through the open bearing housing (8). Replace the closed bearing housing gasket, without sealer, closed bearing housing (45) and secure all screws. Check the shaft (17) for looseness or preloading of bearings. If additional shims are required, they should be placed behind the bearing cup (31A or 31B) in the open bearing housing (8). If preloaded, remove those necessary. Shim to .000" to .003" end play.

17. Remove the closed bearing housing and install the intermediate counter shaft and worm gear assembly (19) (leaving final stage gear and output shaft still in place), apply sealer to the gasket area—replace and secure with screws.

18. Remove the open bearing housing, apply sealer to the gasket area, replace and secure with screws.

19. Install a new output shaft seal (15), after coating O.D. of seal lightly with sealer. Using a tube of the same dimensions as the lip seal housing, tap or press the seal squarely into place in the bearing housing, flush with the casting face. Do not cock or bend.

20. Install a vent plug in the proper location. Fill the gear case with the proper lubricant to the correct oil level and test.

**NOTE:** Pack the motor shaft steel coupling with Mobil-Temp 78 lubricant prior to installing the drive motor to gear case (refer to Page 10).

21. If the unit is a gearmotor, check motor shaft bearing, replacing if necessary. Slide the splined coupling end of motor shaft on to the splined worm shaft, making sure that the coil spring is still properly in place in the coupling.

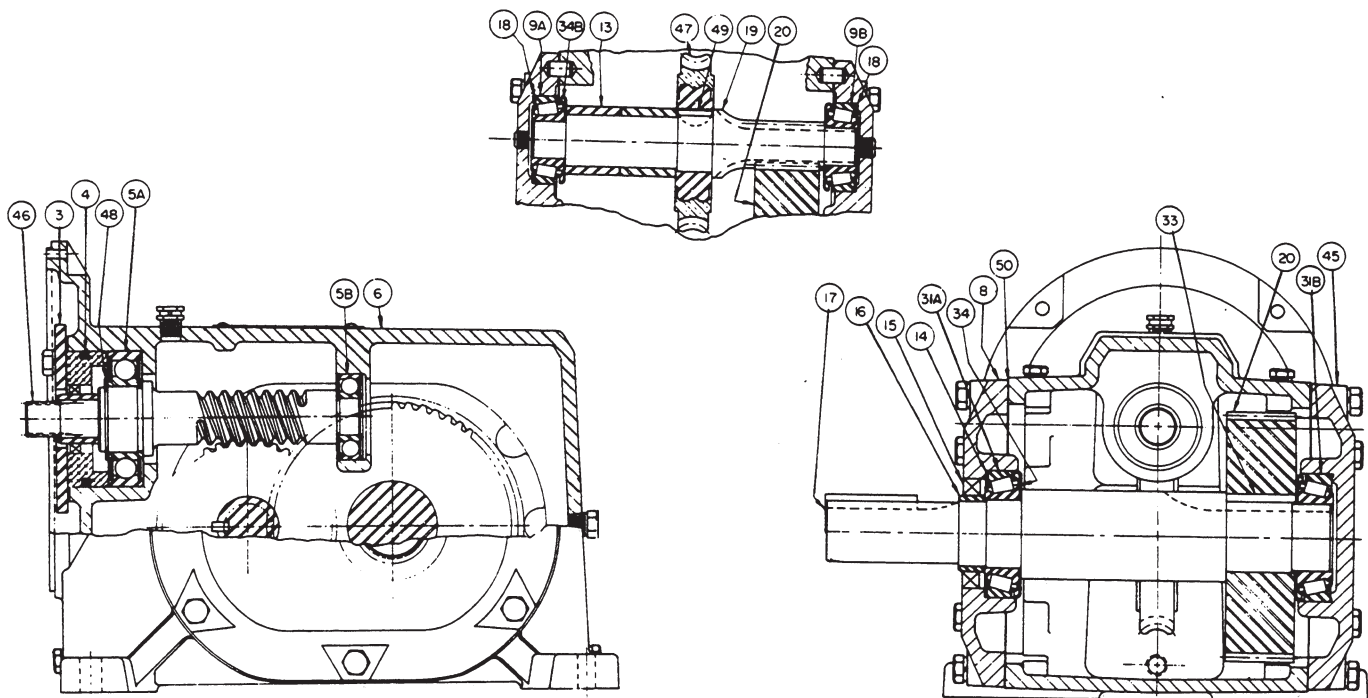
22. Place motor frame and stator over the rotor with thru bolts in place. Do not damage stator winding.

23. Check motor end cover to be sure that any thrust springs or shims are properly in place, add a small amount of good bearing lube and place end cover over bearing and into place on the frame.

24. Add nuts to all four (4) thru bolts and tighten evenly.

25. Test unit for performance.

## RIGHT ANGLE COMBINATION





## CHANGING THE OUTPUT SHAFT OF THE DOUBLE REDUCTION UNIT FROM K-1 MOUNTING TO L-1 MOUNTING (AND VICE-VERSA)

See Page 16 for illustration.

1. Loosen the open bearing housing bolts.
2. Place the reducer, open bearing housing (8) up, over a clean container to catch oil.
3. Remove the bearing housing bolts. Use a hammer and a soft punch to break the bearing housing loose from the gearcase. This will shear the bearing housing/gearcase sealed joint.
4. Remove the open bearing housing (8).
5. Lift out the output shaft assembly (17) and the intermediate shaft assembly (19). Turn the gearcase over and drain the oil into the container.
6. Remove the output shaft seal (15), taking care not to damage the machined bore in the bearing housing. Discard the old seal.
7. Remove the closed bearing housing (45) in the same manner used to remove open bearing housing (8).
8. Remove the roller bearing cups and shims from both bearing housing bores and switch them. (Place the cups and shims from the closed bearing housing into the bore of the open bearing housing and the cups and shims from the open bearing housing into the bore of the closed bearing housing.)

A stiff wire hook worked evenly around the bearing cups will assist their removal. Avoid cocking and jamming the cups in their bores.
9. Centering the bronze worm gear:

Worm gear sets must be properly adjusted or “centered” so the worm is contacting the center of the tooth on the worm gear. Failure to make this adjustment can cause reduced efficiency and life of the gearset, overheating, and tooth breakage.
10. Install the closed bearing housing—apply sealer to the gasket (if so equipped). Sealer should also be applied to all threads on screws, plugs, etc. If your unit did not come equipped with gaskets, apply a  $\frac{1}{16}$ " bead of Loctite #515 sealant around the bearing housing tenon and set the bearing housing in place. Tighten the bearing housing bolts to the torques shown on page 20. Lay the unit on a workbench with the closed bearing housing down.

Proceed with the gear centering as follows:
11. Apply Prussian Blue lightly, but evenly, to both sides of five adjacent teeth on the bronze worm gear on the intermediate shaft assembly.
12. Install the intermediate shaft assembly into the gearcase so that the gears mesh with the uncoated teeth. Install the open bearing housing and secure with two screws at diagonal corners.

13. Rotate the input shaft so the “blued” teeth are rotated through the gear mesh. Then rotate in the opposite direction to bring the outer side of the “blued” teeth through the gear mesh. Marks of contact will be made by the worm in the bluing on the worm gear teeth.

The input shaft may be rotated by:

- A) Gearmotors—Manually rotating the motor fan or brake shaft, when the motor is so equipped.
  - B) C-face reducers—rotating the input shaft (46) by means of:
    - I. A splined adaptor rotated by an impact wrench.
    - II. Manually rotating the motor fan or brake shaft, when the motor is so equipped.
14. Remove the open bearing housing and intermediate shaft assembly. Examine the contact pattern on the blued teeth of the bronze worm gear.
  15. If the contact pattern is off center, the intermediate shaft assembly must be moved in the direction where contact shows the heaviest. This is accomplished by removing shims from beneath the bearing cup on the side where the contact is heaviest and placing them under the opposite bearing cup.
  16. Repeat steps 10 through 14, cleaning and rebuilding each time, until the contact pattern is in the center of the bronze worm gear.
  17. With gears properly centered, install the intermediate and output shaft assemblies and close up the gearbox. Apply sealer to the gasket (if so equipped). Sealer should also be applied to all threads on screws, plugs, etc. If your unit did not come equipped with gaskets, apply a bead of Loctite #515 sealant around the bearing housing machined face and set the bearing housing in place. Tighten the bearing housing mounting bolts to the torques shown on page 20.
  18. Lubricate the seal sleeve on the output shaft liberally with SHC-629 oil or other lube. Coat the seal bore in the bearing housing with a thin layer of Loctite #515 sealant. Install a new seal, taking care not to cut the lip or pop the seal spring out of position. Suitable sleeve-type seal tools should be used. Seat the seal flush with the outside of the bearing housing.
  19. Fill the gearcase with the proper amount of lubricant from the list on page 3. Apply sealant to the fill plug and tighten securely.
  20. Test unit for performance.

## RIGHT ANGLE COMBINATION

Ref. No.	Part Description	Unit Qty.	Part Numbers ■				
			C12	C16	C21	C28	
3	Oil Seal Clamp	1	411625-12A	411625-03A	411625-04A	411625-08A	
*4	Oil Seal Assembly	1	411620-01F	411620-04F	411620-06F	411620-17F	
*5a	Bearing	1	79147-02K	79147-02AD	79147-02AL	79147-03V	
*5b	Bearing	1	79147-02B	79147-02K	79147-02K	79147-02P	
6	Gear Case	1	79029-10A	86850-04A	86854-02A	86866-02A	
8	Bearing Housing—Open	1	79031-03A	79033-03A	79036-02A	79061-02A	
*9a	Bearing	1	411626-01D	411626-01E	411626-01B	411626-01AC	
*9b	Bearing	1	411626-01D	411626-01E	411626-01B	411626-01AC	
13	Spacer	1	411622-07B	411622-10T	411622-29A	411622-15B	
14	Shims	1	41164246F	41164246B	41164246C	41164246H	
*15	Oil Seal (1)	1	411627-02FR	411627-02EN	411627-03X	411627-02EK	
*16	Oil Seal Sleeve (1)	1	411621-09A	411621-10A	411621-15B	411621-18A	
17	Output Shaft	1	602026-02A	602027-02A	602040-02A	602040-06A	
18	Shims	1	41164246D	41164246E	41164246F	41164246G	
*19	Pinion Shaft	1	SEE GEAR CHART PAGE 22				
20	Gear, Driven	1	SEE GEAR CHART PAGE 22				
*31a	Bearing	1	411626-01C	411626-01A	411626-01R	411626-01AB	
*31b	Bearing	1	411626-01C	411626-01A	411626-01R	411626-01AB	
33	Key—Gear	1	055037	055668	053552	055157	
34	Grease Retainer—When Req'd.	2	411624-01C	411624-01E	411624-01R	411624-01X	
34b	Grease Retainer—When Req'd.	2	411624-01A	411624-01D	411624-01B	411624-01W	
45	Bearing Housing—Closed	1	79031-04A	79033-04A	79036-04A	79061-04A	
*46	Worm Shaft	1	SEE GEAR CHART PAGE 22				
*47	Worm Gear	1	SEE GEAR CHART PAGE 22				
48	Lock Ring	1	0082P001	053594	056044	411637-02A	
49	Key—Worm Gear	1	411688-10A	411688-10B	053180	050999	
*50	Gasket (1)	2	602028-03A	602028-04A	602028-02A	602028-13A	
	Oil Seal & Gasket Kit	1	79019-38AB	79019-38AD	79019-38AF	79019-38AH	

(1) Can use oil seal & gasket kit

\* Recommended spare parts

■ Note: These part numbers apply to standard units only.

For part numbers not shown, contact Renewal Parts Customer Service: (864) 297-4160 FAX: (864) 281-2364

## LONG-TERM STORAGE GUIDELINES FOR GEAR REDUCERS

Care must be taken to ensure that gear reducers are placed in service in the best possible condition. During periods of long storage (six months or longer) special procedures must be followed which will protect the reducer and make certain that it will be in good condition when ready to be put into service.

By taking special precautions, problems such as seal leakage and reducer failure due to lack of lubrication, improper lubrication quantity, or contamination can be avoided. The following precautions will protect reducers during periods of long-term storage:

### A. Preparation:

1. Select a clean, dry, protected storage area free of vibration and temperature extremes. Set the drive level on its feet with no load on either the input or output shafts. Block as needed to keep weight off the motor fan shroud and motor conduit box (if unit has a motor).

2. Fill the gearbox to the highest designated oil level with a recommended lubricant blended with 2% by volume of Daubert Chemical Co. Nox-Rust VCI-105 Oil. Do not fill the gearbox completely full of oil. Expansion space is needed to avoid pressurizing the gearbox during temperature variations. Rotate the input at least 60 revolutions to ensure a full distribution of the lubricant.
3. Replace the gearbox vent plug with a solid pipe plug. Wire or tie the vent plug to the gearbox to prevent losing it.
4. All condensate drains and breathers (on motors so equipped) are to be fully operable to allow breathing through points other than bearing fits. Remove the condensate drain plugs located in the motor end shield. Position the motor so the drain is at its lowest point. Totally enclosed fan cooled XT motors are

equipped with automatic drains which should be left in place.

5. All units equipped with heaters must have the heaters connected and operational if the storage conditions are in any way like anticipated service conditions.
  6. Motor windings are to be checked with a megohmmeter when the equipment is put into storage. The resistance must be recorded and saved for future reference. See "To Put The Stored Unit Into Service" for the megohmmeter check required upon removal from storage.
  7. Apply a thick coating of chassis-type grease, Cosmoline or equivalent protective coating \*(Daubert Chemical Co. Nox-Rust X-110 is a suitable coating) on unpainted surfaces including threads, bores, keyways and shafts.
  8. Apply a thick coating of chassis-type grease to all exposed shaft seals.
  9. If the unit must be stored outdoors or in damp or unheated areas indoors, cover the entire exterior with a rust preventive. Seal the unit in a moisture-proof container or in an envelope of heavy polyethylene film with a desiccant inside. Shade the enclosure from direct sunlight.
  10. Rotate the input shaft at least 60 revolutions once a month to redistribute the lubricant and to prevent brinelling of bearings and drying of seals.
  11. Instructions manuals and tags are paper and must be kept dry. Remove these documents and store them in a safe, dry place for future reference at start up.
- B. To Put the Stored Unit into Service:
1. Remove all protective coatings added for storage.
  2. Drain and refill the gearbox with a recommended type and amount of lubricant. Regreaseable assemblies and bearings must be purged and filled with new grease.
  3. Install the vent and oil level plugs in the proper locations for the mounting position to be used. Check the motor condensate drain locations to assure the motors will drain properly when mounted in the proposed position. Rotate the motor on the gearhead and rotate the motor end shields on the motor frame if necessary to get the drains in the proper positions.
  4. Check all hardware for proper tightness.
  5. If the gear unit has been stored for more than three years or in an area with high ambient temperatures, the oil seals must be replaced before being put into service.
  6. Check the motor stator insulation resistance with a megohmmeter. Resistance less than one megohm or

less than 50% of the resistance reading taken when the motor was put into storage (whichever is the higher resistance) requires the motor winding to be dried in one of the two ways described below. If drying does not restore the winding insulation resistance to the values listed above, the motor must be repaired or rewound.

### **DANGER**

**SUBSEQUENT STEPS REQUIRE ROTATING PARTS AND/OR ELECTRICAL CIRCUITS TO BE EXPOSED. STAY CLEAR IF UNIT MUST BE RUNNING OR DISCONNECT AND LOCK-OUT OR TAG POWER SOURCE IF CONTACT MUST BE MADE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.**

- a. Remove the motor from the reducer. Place the motor in a ventilated oven at not more than 90 degrees Celsius (194 degrees F). Check the insulation resistance every 30 minutes. Bake until the resistance becomes constant.
  - b. Lock the motor rotor. Insert a thermocouple in the winding or set up to measure rise by resistance. Apply low voltage. Gradually increase the current through the winding until the winding temperature reaches 90 degrees Celsius (194 degrees F). Do not exceed this temperature. Check the winding insulation resistance with a megohmmeter. Repeat if necessary. After drying, briefly run the motor not connected to any load to further dry the motor and to check the bearings for noise and smooth operation.
7. When stored motors are found to be wet, a more detailed inspection should be made by removing the motor end shields and visually inspecting for water in the grease or rust on the bearings. If either is found, replace the bearings, clean the end shields thoroughly and relubricate.
- \*NOTE:** Daubert Nox-Rust VCI-105 Oil and Nox-Rust X-110 Protective Coating can be procured in bulk quantity from:
- Daubert Chemical Company, Inc.  
4700 S. Central Ave.  
Chicago, Illinois 60638  
Telephone (708) 496-7350
- or in 5 gallon pails from their distributor:
- Rock Island Lubricants and Chemicals  
1320 First Street  
Rock Island, Illinois 61204-5015  
Telephone (309) 788-5631

## HARDWARE TORQUES

### TORQUES FOR GEARCASE BOLTS (GRADE 5 HEX HEAD SCREWS)

Case Size	Bearing Housing Screws		Bearing Clamp Screws	
	Screw Size	Torque (Lb. In.)	Screw Size	Torque (Lb. In.)
W12 C12	1/4 - 20	75	#10 - 32	36
W16 C16	1/4 - 20	75	1/4 - 20	75
W21 C21 W28 C28	5/16 - 18	156	1/4 - 20	75

### TORQUES FOR PARTIAL GEARMOTOR MOUNTING HARDWARE

Motor Frame Size	Thread Size	Torque (Lb. In.)
56P	#10-32	23
140P	Thru Bolt	23
180TY 210TY	1/2 - 13 Stud	420

### TORQUES FOR GEARCASE BOLTS TO ATTACH BOLT-ON BASE AND J-MOUNT BASE TO GEARCASE (SOCKET HEAD CAP SCREWS)

Case Size	Screw Size	Torque (Lb. In.)
W12 C12 W16 C16	3/8 - 16	545
W21 C21 W28 C28J	1/2 - 13	1300

### TORQUES FOR NEMA C-FACE BOLTS (GRADE 5 HEX HEAD SCREWS)

Motor Frame Size vs. Case	C-face Adaptor to Gearcase		Motor to C-face Screws	
	Screw Size	Torque (Lb. In.)	Screw Size	Torque (Lb. In.)
56C 140TC vs. 12-16 21-28	3/8 - 16	276	#10 - 32	36
180TC 210TC vs. 21-28	1/2 - 13	660	1/2 - 13	660

### TORQUES FOR PIPE PLUGS

Case Size	Plug Size	Torque (Lb. In.)
W12 C12 W16 C16	1/8 - 27 NPT	100
W21 C21 W28 C28	1/4 - 18 NPT	200
	3/8 - 18 NPT	400

### TORQUES FOR SETSCREWS WHICH ATTACH COUPLING HUBS TO C-FACE MOTORSHAFTS AND TO SPLINED INPUT SHAFT OF GEARCASE

Motor Frame Size vs. Case Size	Screw Size	Torque (Lb. In.)
56C & 140TC vs. 12-16-21-28 Motor Hub	1/4-20	50
180TC 210TC vs. 21-28 Motor Hub	5/16 - 18	96
180TC 210TC vs. 21-28 Splined Shaft Gearcase Hub	3/8 - 16	180



**WORM GEAR CHARTS**  
**Right Angle Single Reduction Size WG/WM12**

Ratio	Bronze Worm Gear		
	Steel Worm Shaft	Dbl. Ext. Shaft	Standard
5	602406-101	602411-90	602411-91
7.5	602406-04	602411-19	602411-04
10	602406-05	602411-20	602411-05
12.67	602406-06	602032-60	602032-08
15	602406-87	602411-22	602411-07
18	602406-08	602032-62	602032-10
20	602406-09	602411-24	602411-09
25	602406-10	602032-64	602032-12
30	602406-11	602411-26	602411-11
40	602406-13	602411-28	602411-13
50	602406-14	602411-29	602411-14
60	602406-15	602411-30	602411-15

**Right Angle Single Reduction Size WG/WM16**

Ratio	Steel Worm Shaft	Bronze Worm Gear
5	602034-55	602412-02
7.5	602409-04	602412-04
10	602409-05	602412-05
12.67	602409-06	602412-06
15	602409-07	602412-07
18	602409-08	602412-08
20	602409-09	602412-09
25	602409-94	602412-10
30	602409-11	602412-11
40	602409-13	602412-13
50	602409-14	602412-14
60	602409-15	602412-15

**Right Angle Single Reduction Size WG/WM21**

Ratio	Steel Worm Shaft	Bronze Worm Gear
5	602036-56	602413-02
7.5	602410-04	602413-04
10	602410-05	602413-05
12.67	602410-06	275592
15	602410-07	602413-07
18	602410-08	602037-10
20	602410-09	602037-11
25	602410-10	602037-12
30	602410-11	602413-11
40	602410-13	602413-13
50	602410-14	602413-14
60	602430-08	602413-15

**Right Angle Single Reduction Size WG/WM28**

Ratio	Steel Worm Shaft	Bronze Worm Gear
5	602076-56	602077-67
7.5	602076-32	602077-63
10	602426-02	602424-03
12.67	602076-06	602077-08
15	602426-04	602424-04
18	602076-08	602077-10
20	602426-06	602424-05
25	602426-11	275593
30	602426-07	275594
40	602426-08	602424-07
50	602426-09	602424-08



**COMBINATION GEAR CHARTS**  
**Right Angle Combination Size CG/CM12**

Ratio	First Stage Worm		Second Stage—Helical	
	Worm Shaft	Worm Gear	Driver	Driven
20	602406-02	602411-88	602024-02	602029-02
25	602406-02	602411-88	602024-03	602029-03
30	602406-04	602411-04	602024-02	602029-02
36	602406-04	602411-04	602024-03	602029-03
40	602406-05	602411-05	602024-02	602029-02
50	602406-06	602032-08	602024-02	602029-02
60	602406-06	602032-08	602024-03	602029-03
70	602406-87	602411-07	602024-03	602029-03
86	602406-08	602032-10	602024-03	602029-03
101	602406-10	602032-12	602024-02	602029-02
121	602406-11	602411-11	602024-02	602029-02
144	602406-11	602411-11	602024-03	602029-03
162	602406-13	602411-13	602024-02	602029-02
192	602406-13	602411-13	602024-03	602029-03
240	602406-14	602411-14	602024-03	602029-03
288	602406-15	602411-15	602024-03	602029-03
336	602406-16	602032-18	602024-03	602029-03

**Right Angle Combination Size CG/CM16**

Ratio	First Stage Worm		Second Stage—Helical	
	Worm Shaft	Worm Gear	Driver	Driven
20	602034-55	602412-02	602025-09	602030-02
25	602034-55	602412-02	602025-10	602030-03
30	602409-04	602412-04	602025-09	602030-02
36	602409-04	602412-04	602025-10	602030-03
40	602409-05	602412-05	602025-09	602030-02
50	602409-06	602412-06	602025-09	602030-02
60	602409-06	602412-06	602025-10	602030-03
70	602409-07	602412-07	602025-10	602030-03
86	602409-08	602412-08	602025-10	602030-03
101	602409-94	602412-10	602025-09	602030-02
121	602409-11	602412-11	602025-09	602030-02
144	602409-11	602412-11	602025-10	602030-03
162	602409-13	602412-13	602025-09	602030-02
192	602409-13	602412-13	602025-10	602030-03
240	602409-14	602412-14	602025-10	602030-03
288	602409-15	602412-15	602025-10	602030-03

**Right Angle Combination Size CG/CM21**

Ratio	First Stage Worm		Second Stage—Helical	
	Worm Shaft	Worm Gear	Driver	Driven
20	602036-56	602413-02	602038-02	602039-02
25	602036-56	602413-02	602038-03	602039-03
30	602410-04	602413-04	602038-02	602039-02
36	602410-04	602413-04	602038-03	602039-03
40	602410-05	602413-05	602038-02	602039-02
50	602036-06	602037-08	602038-02	602039-02
60	602036-06	602037-08	602038-03	602039-03
70	602410-07	602413-07	602038-03	602039-03
86	602410-08	602037-10	602038-03	602039-03
101	602410-10	602037-12	602038-02	602039-02
121	602410-11	602413-11	602038-02	602039-02
144	602410-11	602413-11	602038-03	602039-03
162	602410-13	602413-13	602038-02	602039-02
192	602410-13	602413-13	602038-03	602039-03
240	602410-14	602413-14	602038-03	602039-03
288	602430-08	602413-15	602038-03	602039-03

### Right Angle Combination Size CG/CM28

Ratio	First Stage Worm		Second Stage—Helical	
	Worm Shaft	Worm Gear	Driver	Driven
10	602076-56	602077-67	602078-12	602079-05
12.7	602076-56	602077-67	602078-14	602079-06
15	602076-32	602077-63	602078-12	602079-05
18	602076-32	602077-63	602078-14	602079-06
20	602076-56	602077-67	602078-02	602079-02
25	602076-56	602077-67	602078-03	602079-03
30	602076-32	602077-63	602078-02	602079-02
36	602076-32	602077-63	602078-03	602079-03
40	602426-02	602424-03	602078-02	602079-02
50	602076-06	602077-08	602078-02	602079-02
60	602076-06	602077-08	602078-03	602079-03
70	602426-04	602424-04	602078-03	602079-03
86	602076-08	602077-10	602078-03	602079-03
101	602426-11	275593	602078-02	602079-02
121	602426-07	275594	602078-02	602079-02
144	602426-07	275595	602078-03	602079-03
162	602426-08	602424-07	602078-02	602079-02
192	602426-08	602424-07	602078-03	602079-03
240	602426-09	602424-08	602078-03	602079-03

### BEARING KITS XL RIGHT ANGLE SIZES 12-28 INCLUDES ALL REDUCER BEARINGS

Size	Part Number	Size	Part Number
W12	41164248A	C12	41164245F
W16	41164245B	C16	41164245G
W21	41164245C	C21	41164245H
W28	41164245D	C28	41164245J

## RENEWAL PARTS

CONTACT YOUR NEAREST RELIANCE PARTS DISTRIBUTOR IN THE YELLOW PAGES UNDER THE HEADINGS SPEED REDUCERS, POWER TRANSMISSION EQUIPMENT, OR VARIABLE SPEED DRIVES.

OR

CONTACT DODGE-MASTR-REEVES RENEWAL PARTS QUOTATIONS FOR ASSISTANCE AT PHONE NUMBER 1-864-297-4160 OR FAX NO. 1-864-281-2364. IDENTIFICATION NUMBER FROM UNIT NAMEPLATE WILL BE REQUIRED FOR PARTS ASSISTANCE.

### SERVICE ENGINEERS

FOR RATES AND AVAILABILITY OF SERVICES CALL 1-864-284-5514.

## REBUILD KITS FOR MASTER XL GEARMOTORS

Rebuild kits consist of the internal components of a MASTER XL Reducer that are routinely replaced during maintenance overhaul.

- Bearing Kit
- Seal & Gasket Kit
- Shim Kit
- Gear Lubricant

### RIGHT ANGLE MASTER XL REDUCERS

SIZE	REBUILD KIT	CONSISTS OF:					LUBE QTY.
		BEARING KIT	SEAL KIT	SHIM KIT	SHIM KIT	LUBRICANT	
W12	41164246BM	41164245A	07901938AA	41164246A		41170966AG	1
C12	41164246BT	41164245F	07901938AB	41164246F	41164246D	41170966AG	1
W16	41164246BN	41164245B	07901938AC	41164246F		41170966AG	1
C16	41164246BV	41164245G	07901938AD	41164246B	41164246E	41170966AG	2
W21	41164246BP	41164245C	07901938AE	41164246B		41170966AG	1
C21	41164246BW	41164245H	07901938AF	41164246C	41164246F	41170966AH	1
W28	41164246BR	41164245D	07901938AG	41164246C		41170966AG	2
C28	41164246BX	41164245J	07901938AH	41164246H	41164246G	41170966AH	2