



# *Pump and Lighting Company*

## ENGINEERED PRODUCTS DIVISION

926 2ND STREET N.E. • P.O. BOX 2504 • HICKORY, N.C. 28601  
704/324-9705

### OPERATION AND MAINTENANCE MANUAL

PROJECT: Utilities Improvements  
Project Number N62470-81-B-1478  
LOCATION: Marine Corps Base, Courthouse Bay Area  
Camp Lejeune, North Carolina  
CONTRACTOR: Wilson Construction Company  
Carolina Well and Pump  
ENGINEER: L.E. Wooten & Company  
SUBJECT: Section 11210 Paragraph 1.2.1.1  
Vertical Turbine Pump

#### DESCRIPTION:

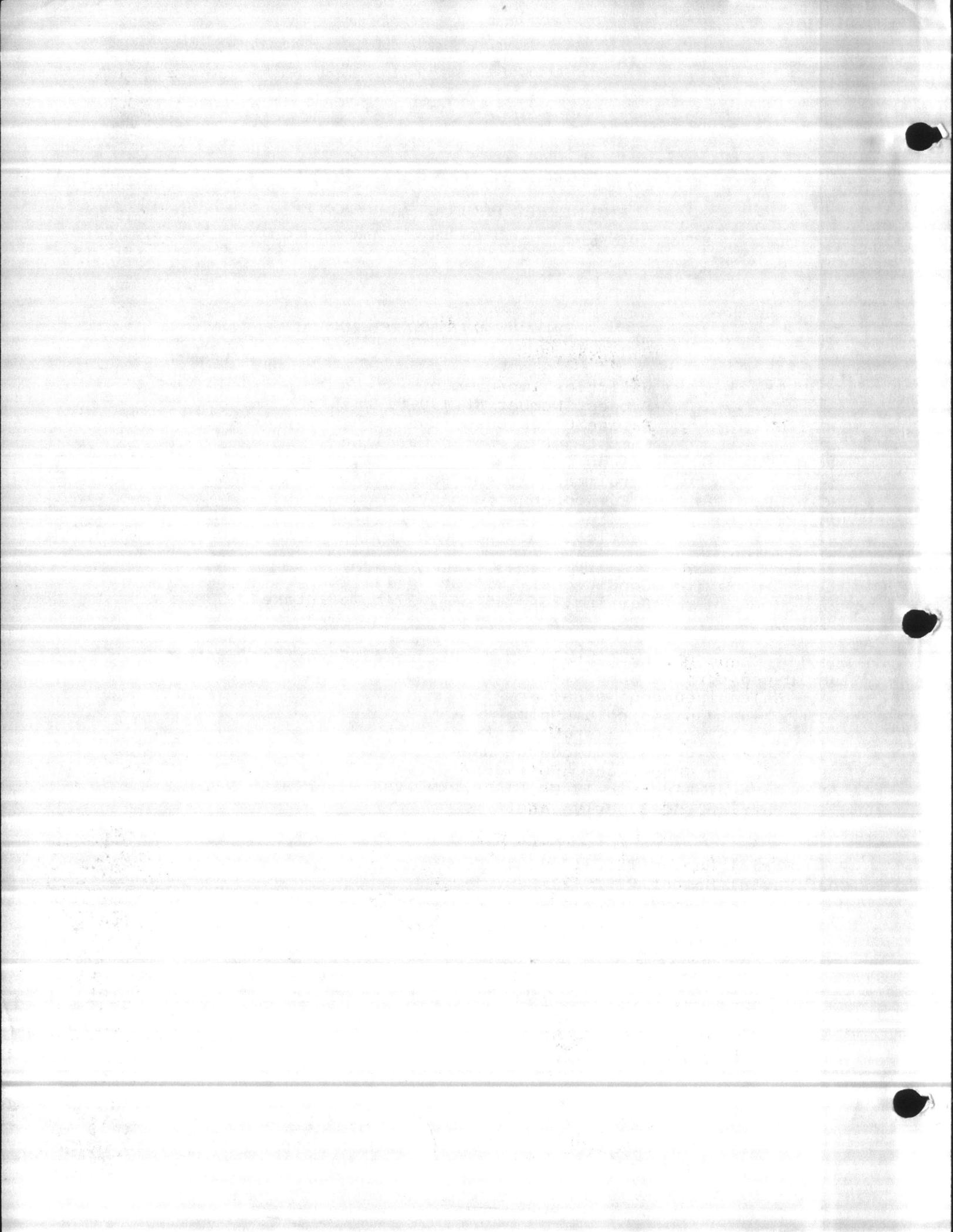
Conditions: 300 GPM @ 131' TDH  
Setting: 65' - 7 3/4" To Intake  
RPM: 1770

One (1) Crane Deming 6 stage, M-8, Figure 4700 vertical water lubricated turbine pump with:

- A. Galvanized cone strainer
- B. 6" galvanized column pipe
- C. 1" 416 stainless steel shaft
- D. SD66-12-0076678 discharge head
- E. Johnson CH20 right angle gear drive
- F. General Electric 15 HP, 1800 RPM, VHS motor with NRC
- G. Parrish, SC 37 drive shaft

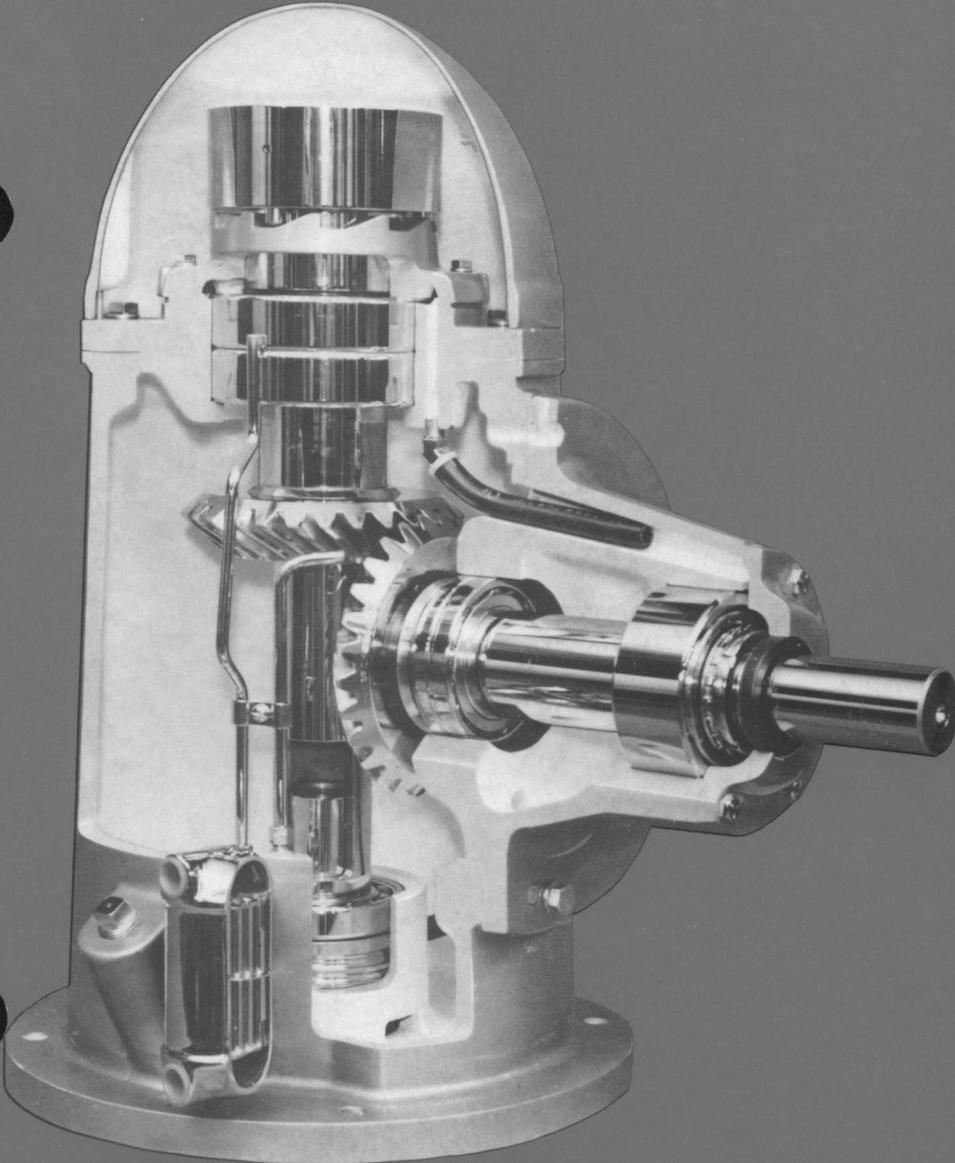
Pump Serial Number T82731  
Gear Serial Number R-92842  
Motor Serial Number L82873327

October 21, 1985





# OPERATOR'S MANUAL FOR THE JOHNSON GEAR RIGHT ANGLE DRIVE



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## FOUNDATION

A *solid level* foundation is necessary to prevent vibration and misalignment, both of which are detrimental to your gear drive. Width and length of the base will be governed by size of gear drive, size of engine, and specifications of the pump head.

**SHORT COUPLED INSTALLATIONS BETWEEN GEAR DRIVE AND ENGINE SHOULD HAVE A COMMON FOUNDATION.**

The depth of the foundation should extend down to a solid footing, if possible, and will depend on the type of soil, total weight of the installation, and the climate. Where freezing temperatures occur, the foundation should extend below the frost line.

## INSTALLATION

The base of every Johnson Right Angle Gear Drive is provided with a machined rabbet to insure centering on the pump head. Therefore, it is essential that the pump shaft be in the exact center of the corresponding rabbet in the pump base.

Since a faulty headshaft will cause vibration and ultimately destroy the bearings and gears, it must be thoroughly checked for straightness and alignment. The procedure for checking the headshaft, which is outlined below, requires removal of the dome cover from the drive. *While the dome is off, care must be taken to protect against grit and dirt as even a small amount might cause damage to the bearing located in the top of the drive.*

### Checking the Headshaft

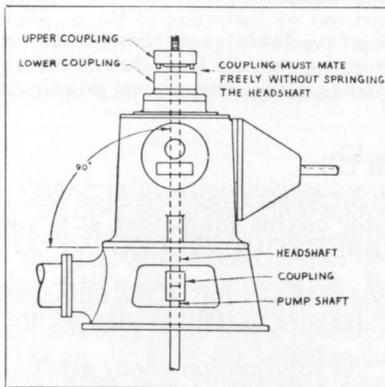


Figure 1

Before an alignment check can be made, it is necessary to ascertain that the headshaft is true to size, that diameters are concentric if shaft changes in diameter, and that it is absolutely straight throughout its length.

Combination drives are furnished with a steady bearing to prevent whipping of the headshaft under electric motor operation. The headshaft of such drives must therefore be tested for fit in the steady bearing.

Steady bearings are of the sealed ball bearing type and are mounted on adaptor sleeves through which the head shaft *must be a sliding fit* but not a press fit.

Headshafts are sometimes made with the pump coupling end larger than the hole in the hollow shaft of the gear drive. This makes it necessary to lower the drive on the pump head with the headshaft coupled in place. Particular care must be taken in such cases to avoid bending the headshaft or damaging the oil seal tube.

### Mounting the Drive

After the headshaft has been thoroughly checked, inspect the machine fit of both gear drive and pump head for burrs or obstructions. Install the drive on the pump head and bolt in place, tightening thoroughly and evenly.

With the headshaft in place, slip on the upper coupling and lower it carefully into position. **WHEN THE UPPER COUPLING POSITIONS ON THE LOWER COUPLING WITHOUT SPRINGING THE HEADSHAFT, IT INDICATES THAT THE UNIT IS CORRECTLY ALIGNED.** Correct the alignment if upper and lower couplings do not meet properly.

With the gear drive and headshaft correctly aligned, install the ratchet pins and gib head key in the upper coupling. This key should be a slide fit, permitting adjustment of the headshaft by means of the adjusting nut. Tighten the nut as directed by the pump manufacturer, and lock with screw provided for this purpose. **DO NOT OIL THE RATCHET PINS.**

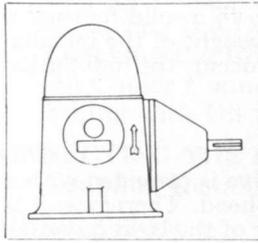


Figure 2

### Checking the Rotation

Check the rotation of the power unit and pump in relation to that of the drive, as shown by the arrow on the case. **DO NOT OPERATE IN THE REVERSE DIRECTION OF THE ARROW**, as the lubrication system will not function and the destruction of the drive will result. Rotate the drive by hand before applying the power as a precaution against a bound or locked installation. Figure 2 shows drive with standard rotation.

### Oil Cooler Connection

Models H-60 and larger are supplied with counter-flow oil coolers with water connections taped for  $\frac{1}{2}$ " standard pipe. These connections are arranged vertically, the top connection for the inlet and the bottom connection for the outlet. Use rubber hose or copper tubing for water supply. **DO NOT MAKE A RIGID PIPE CONNECTION.** A moderate amount of cold water should flow through the cooler when the drive is operating, and provision should be made in the piping to permit draining the cooler in localities subject to freezing weather conditions.

Under normal conditions with 70°F water available, requirements are approximately 1 to 3 gal/min (4 to 12 liters/min) for models H60 thru H200 and 4 to 6 gal/min (15 to 23 liters/min) for models H280 and above. Maximum allowable water pressure 75 psi.

### Filling with Oil

Correct lubrication of your Johnson Right Angle Gear Drive is a **MUST** for satisfactory operation. As the operator of this equipment, it is your responsibility to **KEEP THE OIL RESERVOIR FILLED AT ALL TIMES.**

Fill the oil reservoir until the oil is level with the top of the filling hole or the line on the gauge marked "Full." Be sure to tighten plug securely after filling or draining.

Look in the section on "Lubrication" for information about grades of oil, frequency of oil changes, and other data on the lubrication of the gear drive.

Oil reservoir capacities are as listed below:

<i>Models</i>	<i>Gallons—U.S.</i>	<i>Liters</i>
H20-H30	$\frac{1}{2}$	2
H40 (12)	$\frac{3}{4}$	3
H40-H60-H80	1	4
H110-H125	$1\frac{1}{2}$	6
H150-H200	3	12
H280	4	15
H350-H425-H500-H600	6	23

**OUR WARRANTY DOES NOT PROTECT YOU IN THE EVENT OF FAILURE FROM NEGLIGENCE IN MAINTAINING SUFFICIENT OIL OF RECOMMENDED GRADE IN THE GEAR DRIVE.**

## CONNECTING THE POWER UNIT

### Coupling Installation

Care should be taken in selecting the proper type and size of coupling. The great majority of installations will require a Universal joint of standard length, as this type is capable of absorbing the misalignment which may occur due to installation errors or settling of earth around the well. Installation should be preferably made as nearly in line as possible and it is extremely important that the center line of the engine be parallel to the center line of the drive shaft within 2 or 3 degrees. This precaution will prevent an unbalanced condition which would result in vibration and be detrimental to the gear drive bearings and drive shaft.

Certain types of flanged flexible couplings are suitable for close coupled drives, providing pump head and power unit are on the SAME RIGID FOUNDATION. Such couplings should be mounted and maintained according to the manufacturer's instructions. NEVER USE A RIGID FLANGED COUPLING.

IN FITTING THE UNIVERSAL JOINT OR FLEXIBLE COUPLING FLANGE TO THE DRIVE, IT SHOULD BE MACHINED FOR A PUSH FIT WITHOUT THE USE OF EXCESS POWER, AS HAMMERING ON THE DRIVE SHAFT WILL DAMAGE THE BEARINGS AND DESTROY THE ADJUSTMENT OF THE GEARS.

## LUBRICATION

### General Information

Careful attention to the lubrication requirements and use of the correct grade of oil is essential to continued and satisfactory operation of your Johnson Right Angle Gear Drive. *Gear drives should not be operated at speeds 15% above or below the nameplate RPM without consulting the Factory.* The operating speed of your drive is shown on the nameplate.

### Changing Oil

Proper lubrication requires that the oil be changed at least once every six months or after 2500 hours of operation, whichever occurs first. Should extreme changes of temperature or humidity cause condensation in the reservoir, the oil should be changed more frequently. Drain the oil when hot, inspecting for water. Be sure to change the oil at the end of the operating season to remove any moisture which would otherwise rust the bearings and other finely machined parts.

Oil changing at the recommended time interval aids in restricting the amount of acid which may form in oils under high temperature and pressure conditions. Acids are injurious impurities in lubricating oils, since they attack the machine parts.

Keep the "Lubrication Record" as a guide for making these oil changes at the proper intervals.

### Cold Weather

Close attention should be given the drive when starting under freezing conditions. The oil becomes very thick at low temperatures, which may result in flooding the thrust bearing (as evidenced by oil leak at top of drive). In such cases, providing the leak does not cease as the drive warms up, stop the drive and allow the oil to drain and then restart. Removal of dome on standard drives is required for above observations. CAUTION: *Be sure to check oil flow to gears* when starting under low temperature conditions.

### Recommended Oil

The high-grade oils approved for the Johnson Right Angle Gear Drives are less susceptible to emulsification (mixing with water) and oxidation than other oils.

## RECOMMENDED OILS

Ambient Temp °F	15-60	50-125
A.G.M.A. Grade	2	3
Visc. S.S.U. @ 100°F	284-347	417-510
I.S.O. Visc. (cSt) @ 40°C	68	100
Amoco	Ind. Oil 68	Ind. Oil 100
Cato Oil	AW/AL 20	AW/AL 30
Chevron—USA	A.W. Mach 68	A.W. Mach 100
Citgo	Pacemaker 68	Pacemaker 100
Exxon—USA	Teresstic 68	Teresstic 100
Getty—USA	Skelvis—MP 20	Skelvis—MP 30
Gulf—USA	Harmony 68	Harmony 90
Mobil Oil	Mobil Gear 626	Mobil Gear 627
Pacer	Thermal T315	Thermal T465
Phillips	Magnus 68	Magnus 100
Shell—USA	Turbo 68	Turbo 100
Sun Oil	Sunvis 931	Sunvis 951
Texaco	Regal R & O 68	Regal R & O 100
U.S. Navy		Mil-L-17335-F

S.A.E. Automotive oils are NOT satisfactory and *must not be used* in the gear drive. USE OF AUTOMOTIVE OILS WILL VOID OUR WARRANTY.

### OPERATION

The following operating recommendations are made to aid you in keeping your gear drive in the best possible condition. Careful attention to these details will prolong the useful life of your equipment.

#### Starting

Always check the oil level in the housing of the gear drive and add oil if needed. Inspection when starting and regular checks during the operating period will prevent failure of the gear drive due to poor oil circulation. Should the circulation appear to be lagging, check the oil level and the age of the oil in the drive. Oil tends to thicken with use and old oils will not circulate properly in the gear drive oiling system.

Turn by hand the drive shaft between pump and engine to check whether pump turns freely. (When the engine has no clutch, as in fire pump drives, it will be necessary to uncouple the shaft.)

When the drive is furnished with a non-reverse clutch, check to see that ratchet pins are clean and drop readily. Do not oil pins.

Before applying power replace dome and all covers and guards.

Apply power to drive gradually, but do not idle at low speed for a long period.

Observe carefully the entire installation during the starting period and do not leave until satisfied that all units are functioning properly.

#### Operating Temperatures

A standard drive operating at 1750 RPM pump speed under rated load and normal atmospheric conditions will reach a temperature of approximately 130-170°F depending on whether the unit is air or water cooled and local conditions peculiar to the installation. It is not possible to hold one's hand on the gear drive case except momentarily when temperatures exceed 135°F.

Increased speed, high loads, or lack of air circulation will cause the temperature to rise, but the oil temperature should not at any time exceed 200°F. A thermometer may be used at the oil filling hole of the drive to obtain actual temperatures if unusual conditions exist. When starting the drive at temperatures below 10°F, the oil should first be checked to see whether it is above the pour point. The drive must not be operated if the oil does not flow, which limiting condition exists at approximately 10°F.

### Shutdown Periods

When the installation is to be inoperative for a considerable time, such as after the completion of an irrigation period, the gear drive should be drained while hot and then replenished with new oil.

Occasional brief operation during extended shutdown periods will help prevent damage from condensation and will benefit the bearings by changing the position of the balls and races. This procedure is of equal benefit to the engine, as it spreads an oil film on the cylinder walls, rings, bearings, etc.

In localities where freezing conditions prevail, drain the water from the oil coolers of drives so equipped.

### Long Term Storage

1. Fill with oil in appropriate amount for storage period only. Replace oil when put into regular duty.
2. Spray exposed machined parts (i.e., base, shaft end, upper coupling) with rust-retarding oil.
3. Operate gear drive every month long enough to oil bearings and gears to prevent condensation and rusting.
4. Store in heated building if at all possible.
5. Cover with tarpaulin or other dust shield.

### General Precautions

The bearings furnished are of high quality and have been approved by the manufacturer for the rated loads and speeds of the gear drives in which they are used. Bearing life is directly affected by the care given in operating the equipment and adherence to the instructions given in this manual. Usually a bearing will become noisy and give adequate warning of impending failure. Do not operate the gear drive with noisy bearings as destruction of the gears will result if the bearing should fail.

Changes sometimes occur in the water level, or alterations may be made to the pump subsequent to selection and installation of the gear drive. Such changes will usually affect the operating conditions of the gear drive and should be thoroughly investigated.

As mentioned repeatedly in this manual, lubrication is the most important factor affecting the life of the drive, which, given ordinary care and properly operated, will give exceptionally trouble-free service.

### Special Instructions

Johnson Right Angle Hollow Shaft Gear Drives used for Factory Mutual and NPFA fire pump installations are not permitted to omit or disable the non-reverse ratched coupling. Nor is the use of disconnecting couplings or clutches permitted between the engine and gear drive, or to reset the engine from its pre-set speed.

## COMBINATION DRIVES

All the preceding operating instructions are applicable to the combination drive. There are also special instructions which must be followed according to the particular application.

### Standard Combination

In most installations, the gear drive and engine are required for standby service only. The installation is therefore made so that the electric motor drives the pump and also carries the thrust load. The coupling at the top of the gear drive is free to turn when the electric motor is driving the pump, running clearance being maintained by a compressible spacer. (Figures 3 & 4)

When pump operation by the engine through the gear drive is required the stainless steel bolts are used to fasten the coupling halves together (Figure 4). This procedure permits transmission of power through the right angle gear drive, but does not alter the setting of the pump. The pump thrust load is still carried by the electric motor.

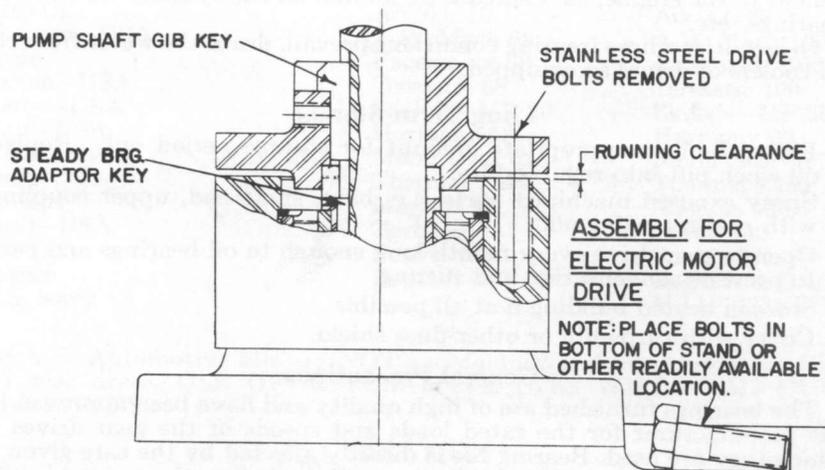


Figure 3

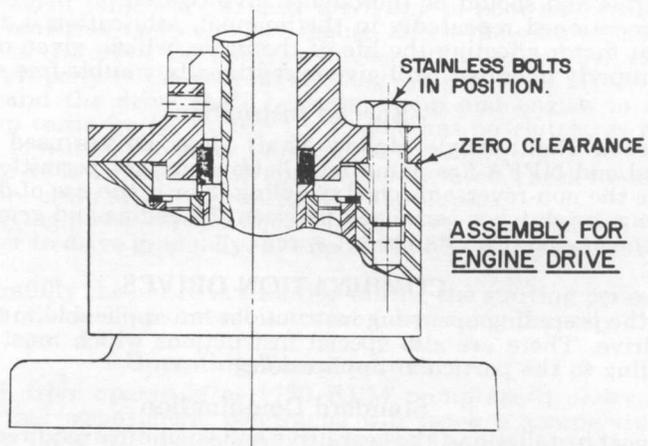


Figure 4

## Redi-Torq®

The Johnson Redi-Torq® Gear Drive is manufactured specifically for automatic installations and permits the use of standard flexible shafting between the gear drive and engine. If your gear drive is a Redi-Torq® you must read and comply with the supplementary instructions accompanying this manual. Contact the factory prior to making the installation if the pamphlet is missing.

### Solid Shaft

This type of drive is used with solid shaft electric motors. The gear drive and electric motor are connected together by a flexible coupling. Most installations using this drive are of dry pit design and flexible shafting is used between the pump and gear drive.

With solid shaft combination drives, the electric motor revolves when the engine is driving. Means of disconnecting the gear drive and engine must be provided.

## MAINTENANCE

### General

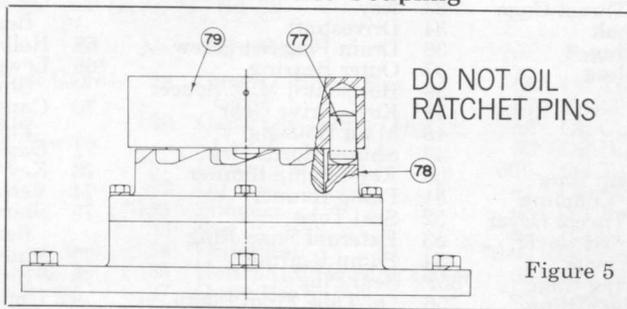
A Johnson Right Angle Gear Drive which has been properly installed and operated according to instructions furnished will give years of dependable service with a minimum of maintenance. Instructions included in this manual are to inform you of correct maintenance procedure.

Repairs should only be undertaken by a skilled mechanic, fully capable of doing the work; and when for any reason extensive maintenance beyond the scope of this manual is required, the drive should be returned to our factory with transportation charges prepaid. This allows our trained mechanics, aided by specialized tools and equipment, to reassemble and test your gear drive under controlled conditions. Factory reconditioning, wherein all worn parts which in our judgement require renewal are replaced, has the additional advantage of carrying a new drive warranty. No allowance is made for parts removed, and such parts are returned on request.

Alterations or repairs made outside the factory without our approval are at buyer's risk and void the warranty. We suggest that you read the terms of our warranty before undertaking any repair work on the drive. (See back cover.)

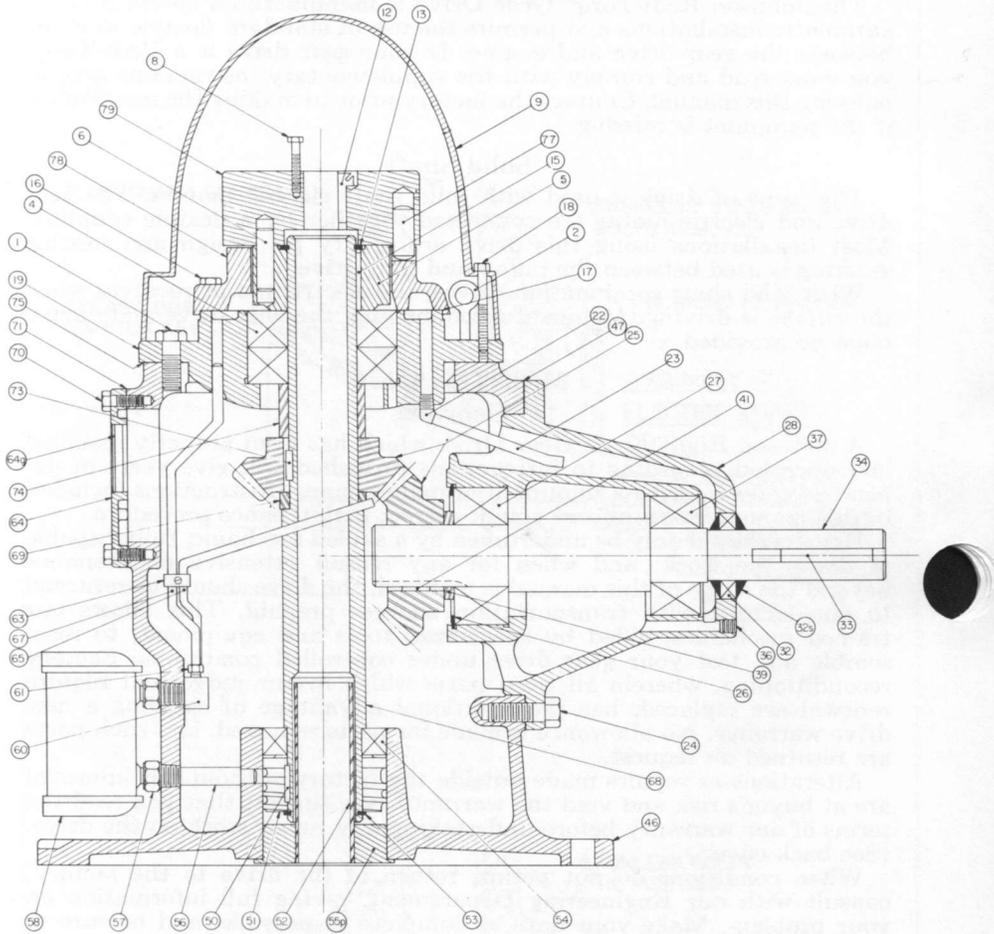
When conditions do not permit return of the drive to the factory, consult with our Engineering Department, giving full information on your problem. Make your data as complete as possible, and be sure to include the serial number of the drive and approximate length of service.

### Non-Reverse Coupling



The operation of a Johnson Non-Reverse Coupling is extremely simple and requires a minimum of maintenance. The ratchet pins must operate freely, and will therefore require an occasional cleaning. They must never be oiled as this would result in formation of a gummy film, preventing their dropping freely into position as forward rotation slows down.

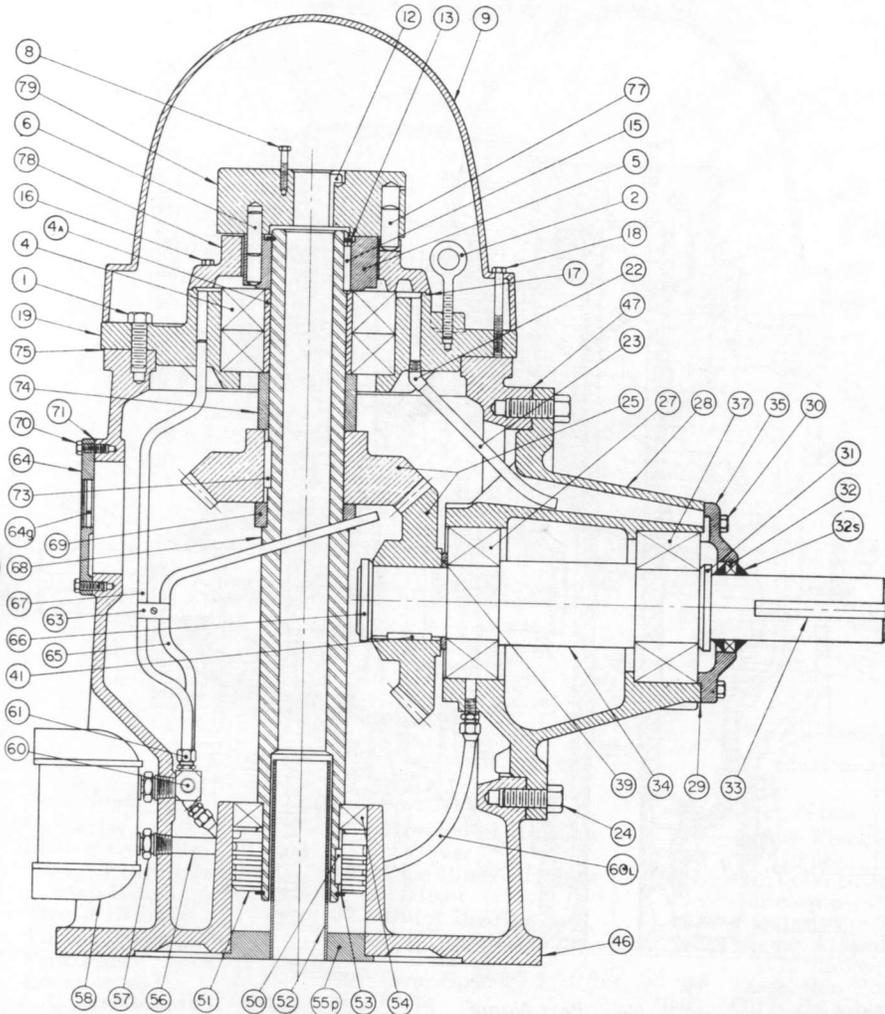
TYPICAL MODEL H-20 - H-60



No.	Part Name	No.	Part Name	No.	Part Name
1	Capscrew—Thrust Cage	33	Key	67	Oil Tube to Thrust Bearing
* 2	Lifting Eyebolt	34	Driveshaft	68	Hollow Shaft
4	Thrust Bearing	36	Drain Plug-Set Screw	68	Hollow Shaft
5	Lower Coupling	37	Outer Bearing	*69	Lower Hollow Shaft Spacer
6	Coupling Pin	39	Horizontal M.D. Spacer	70	Capscrew—Insp. Plate
8	Capscrew	41	Key—Drive Gear	71	Gasket—Insp. Plate
9	Dome	46	Main Housing	73	Key—Driven Gear
12	Gib Key	47	Shim—Horiz. Hsg.	74	Vertical M.D. Spacer
13	External Snap Ring	50	Key—Pump Runner	75	Shim—Thrust Bearing Cage
15	Key—Lower Coupling	51	Pump Runner	77	Ratchet Pins
16	Capscrew—Thrust Cover	52	Seal Tube	78	Thrust Bearing Cover
17	Gasket—Thrust Cover	53	External Snap Ring	79	Upper Clutch
18	Capscrew—Dome	54	Pump Bearing		
19	Thrust Bearing Cage	55P	Seal Plug		
*22	Flexible Tube Fitting	*56	Oil Tube From Pump		
*23	Flexible Tube	*57	Cooler Flexible Fittings		
24	Capscrew—Horiz. Hsg.	*58	Oil Cooler (H60 Only)		
25	Gears	60	Oil Distributor		
26	Internal Snap Ring	61	Compression Fitting		
27	Inner Bearing	63	Oil Tube Clamp		
28	Horizontal Housing	64	Inspection Plate		
32	Oil Seal	*64G	Oil Sight Glass		
* 32S	Slingers	65	Oil Tube to Gears		

\* These parts are not universal and are omitted in certain ratios and models.

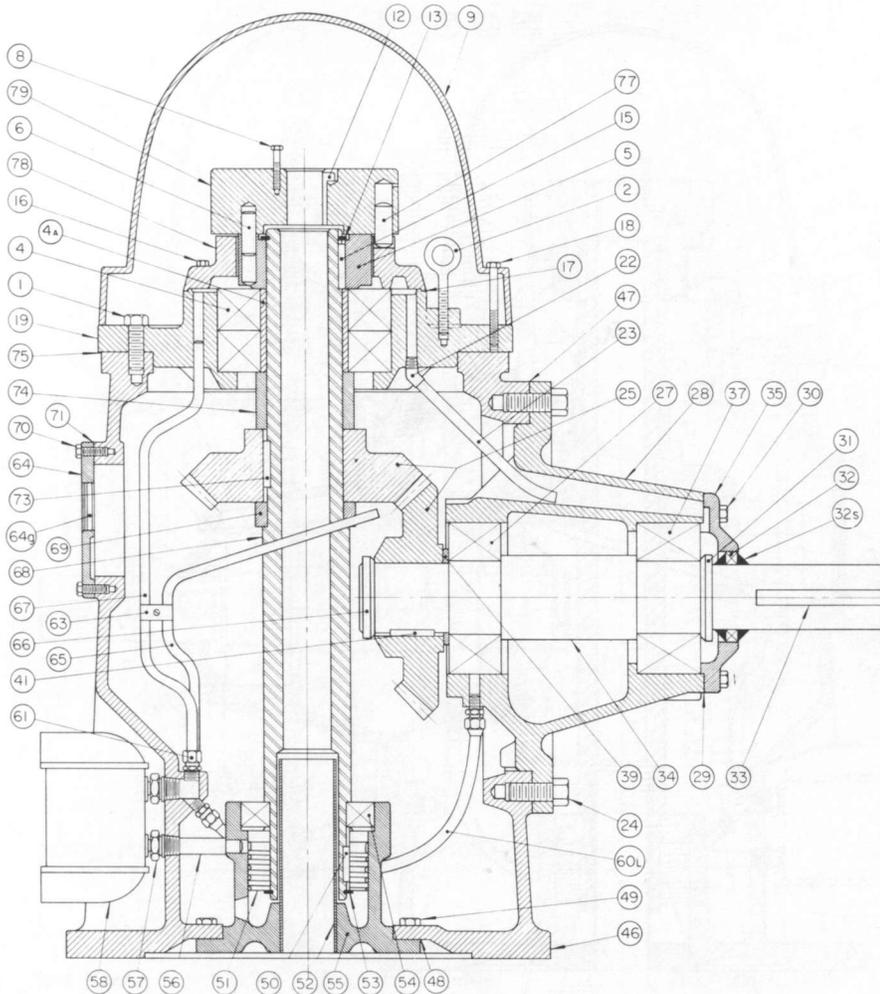
TYPICAL MODEL H-80 - H-200



No. 1	Part Name	No. 29	Part Name	No. 56	Part Name
2	Capscrew—Thrust Cage	30	Gasket—Horiz. Hsg. Cover	57	Oil Tube From Pump
3	Lifting Eyebolt	31	Capscrew—Horiz. Hsg. Cover	58	Cooler Flexible Fittings
4	Thrust Bearing	32	Locknut & Washer	59	Oil Cooler
*4A	Thrust Bearing Sleeve	32S	Oil Seal	60	Oil Distributor
5	Lower Coupling	33	Slings	60L	Oil Tube to Inner Bearings
6	Coupling Pin	34	Key	61	Compression Fittings
8	Capscrew	35	Driveshaft	63	Oil Tube Clamp
9	Dome	37	Horizontal Housing Cover	64	Inspection Plate
12	Gib Key	39	Outer Bearing	*64G	Oil Sight Glass
13	External Snap Ring	41	Horizontal M.D. Spacer	65	Oil Tube to Gears
15	Key—Lower Coupling	46	Key—Drive Gear	*66	Locknut & Washer
16	Capscrew—Thrust Cover	47	Main Housing	67	Oil Tube to Thrust Bearing
17	Gasket—Thrust Cover	50	Shim—Horiz. Hsg.	68	Hollow Shaft
19	Capscrew—Dome	51	Key—Pump Runner	*69	Lower Hollow Shaft Spacer
24	Thrust Bearing Cage	52	Pump Runner	70	Capscrew Insp. Plate
25	Flexible Tube Fitting	53	Seal Tube	71	Gasket—Insp. Plate
25	Flexible Tube	54	External Snap Ring	73	Key—Driven Gear
24	Capscrew—Horiz. Hsg.	55P	Pump Bearing	74	Vertical M.D. Spacer
25	Gears		Seal Plug	75	Shim—Thrust Bearing Cage
27	Inner Bearing			77	Ratchet Pins
28	Horizontal Housing			78	Thrust Bearing Cover
				79	Upper Clutch

\* These parts are not universal and are omitted in certain ratios and models.

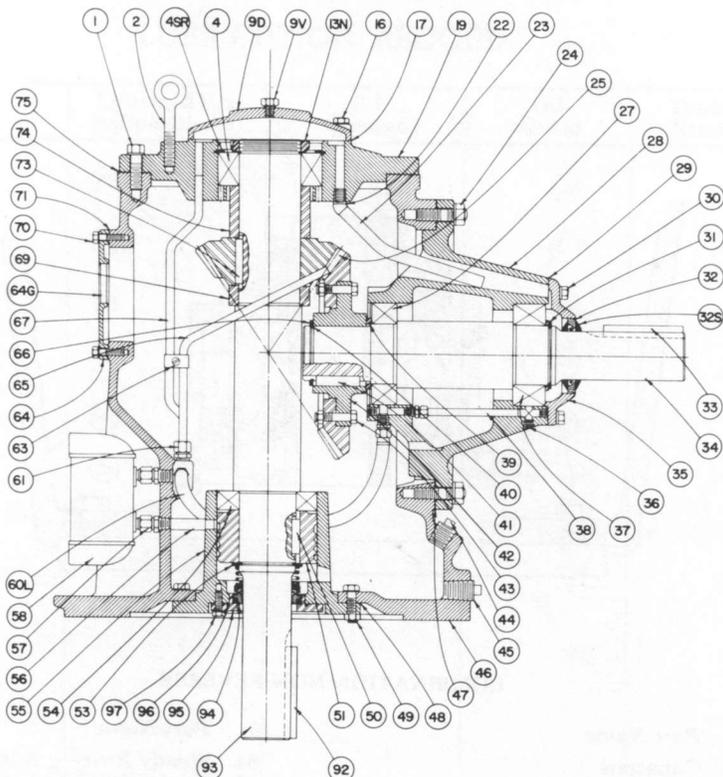
TYPICAL MODEL H-280 and LARGER



No.	Part Name	No.	Part Name	No.	Part Name
1	Capscrew—Thrust Cage	30	Capscrew—Horiz. Hsg. Cover	56	Oil Tube From Pump
2	Lifting Eyebolt	*31	Locknut & Washer	57	Cooler Flexible Fittings
4	Thrust Bearing	32	Oil Seal	58	Oil Cooler
*4A	Thrust Bearing Sleeve	*32S	Slings	60L	Oil Tube to Inner Bearings
5	Lower Coupling	33	Key	61	Compression Fittings
6	Coupling Pin	34	Driveshaft	63	Oil Tube Clamp
8	Capscrew	35	Horizontal Housing Cover	64	Inspection Plate
9	Dome	37	Outer Bearings	*64G	Oil Sight Glass
12	Gib Key	39	Horizontal M.D. Spacer	65	Oil Tube to Gears
13	External Snap Ring	41	Key—Drive Gear	*66	Locknut & Washer
15	Key—Lower Coupling	46	Main Housing	67	Oil Tube to Thrust Bearing
16	Capscrew—Thrust Cover	47	Shim—Horizontal Housing	68	Hollow Shaft
17	Gasket—Thrust Cover	48	Gasket—Pump Housing	*69	Lower Hollow Shaft Spacer
18	Capscrew—Dome	49	Capscrew—Pump Housing	70	Capscrew—Insp. Plate
19	Thrust Bearing Cage	50	Key—Pump Runner	71	Gasket—Insp. Plate
*22	Flexible Tube Fitting	51	Pump Runner	73	Key—Driven Gear
*23	Flexible Tube	52	Seal tube	74	Vertical M.D. Spacer
24	Capscrew—Horiz. Hsg.	53	External Snap Ring	75	Shim—Thrust Bearing Cage
25	Gears	54	Pump Bearing	77	Ratchet Pins
27	Inner Bearing	55	Pump Housing	78	Thrust Bearing Cover
28	Horizontal Housing			79	Upper Clutch
29	Gasket—Horizontal Housing Cover				

\* These parts are not universal and are omitted in certain ratios and models.

## TYPICAL SOLID SHAFT

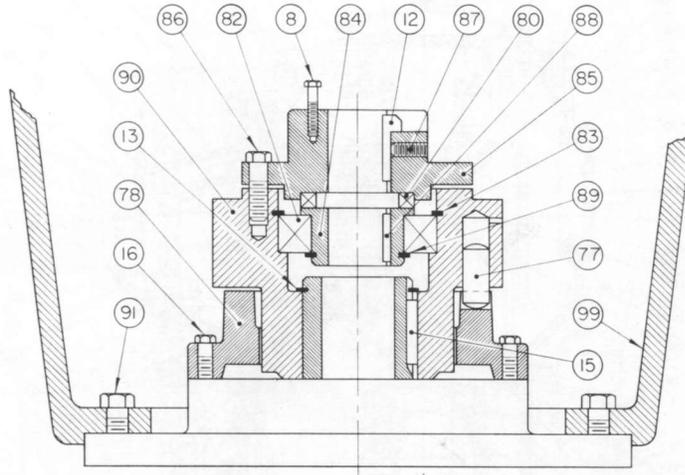


No.	Part Name	No.	Part Name	No.	Part Name
1	Capscrew	35	Horizontal Housing Cover	*57	Cooler Flexible Fittings
2	Lifting Eyebolts	36	Pipe Plugs—Hollow Head	*58	Oil Cooler
*4SR	Thrust Bearing Internal Snap Ring	37	Outer Bearing	*60L	Oil Tube to Inner Bearing
4	Thrust Bearing	38	Oil Tube to Outer Bearing	*61	Compression Fittings
9D	Thrust Bearing Dome	*39	Gear Spacer	*63	Clamp Assembly (Oil Tubes)
9V	Vent Plug	40	Shim	64	Inspection Plate
13N	Locknut and Lockwasher	41	Key	*64G	Oil Sight Glass
16	Capscrew	*42	Drive Gear Hub	65	Oil Tube to Gears
17	Gasket—Thrust Bearing Dome	*43	Capscrew	66	External Snap Ring or Locknut & Washer
19	Thrust Bearing Cage	44	Pipe Plug	67	Oil Tube to Thrust Bearing
*22	Flexible Tube Fitting	45	Pipe Plug	*69	Driven Gear Spacer
*23	Flexible Tube	46	Main Housing	70	Capscrew
24	Capscrew	47	Shim—Horizontal Housing	71	Gasket—Inspection Plate
25	Gears	48	Gasket—Pump Housing	73	Key
27	Inner Bearing	49	Capscrew	74	Pinion Spacer
28	Horizontal Housing	50	Key	75	Shim—Thrust Bearing Cage
29	Gasket—Horizontal Housing Cover	51	Pump Runner	92	Key
30	Capscrew	53	External Snap Ring	93	Vertical Shaft
31	Snap Ring and Washer	54	Pump Bearing	94	Mechanical Seal
32	Oil Seal	*54W	Pump Bearing Spacer (Fig. 2 or 3)	95	Seal Cage
33	Slinger	*55	Pump Housing	*96	"O" Ring
34	Key	*56	Oil Tube from Pump	*97	Capscrew
35	Driveshaft				

\*These parts not universal and are omitted in certain ratios and models. Lock washers furnished when fastening is not self-locking.

When ordering parts, the serial number, ratio, and size of drive stamped on the nameplate **MUST** be furnished.

## COMBINATION



### COMBINATION NON-REVERSE

*No. Part Name*

- 8 Capscrew
- 12 Gib Key
- 13 External Snap Ring
- 15 Key (Lower Coupling)
- 16 Capscrew
- 77 Ratchet Pins
- 78 Thrust Bearing Cover
- 80 Wave Spring
- 82 Steady Bearing
- 83 Internal Snap Ring

*No. Part Name*

- 84 Steady Bearing Adaptor
- 85 Upper Coupling Combination
- 86 Stainless Steel Capscrews
- 87 Set Screw
- 88 Key (Steady Bearing Adaptor)
- 89 External Snap Ring
- 90 Lower Coupling Combination  
Non Reverse
- 91 Capscrew
- 99 Motor Stand



Serial No. \_\_\_\_\_

Model \_\_\_\_\_

Ratio \_\_\_\_\_

\_\_\_BHP at \_\_\_RPM of vertical shaft

This manual contains information which will assist you to obtain the maximum service. Keep it readily available for reference in the event any question arises as to the proper care of your right angle gear drive.

Communications with your dealer or the manufacturer having reference to your gear drive, should state the SERIAL NUMBER and approximately how long the drive has been operated.

Filed under the SERIAL NUMBER, Johnson Right Angle Gear Drive keeps complete data on every gear drive manufactured. This service is maintained for the customer so that replacement parts can be furnished by the factory to fit each individual drive, once the serial number is known. The SERIAL NUMBER and rating of each drive is stamped on the nameplate fastened to the inspection hole coverplate. If the nameplate is missing or illegible remove the inspection coverplate and gasket. The SERIAL NUMBER is stamped on the machined surface of the inspection opening of the main housing.

#### WARRANTY

1. The Johnson Right Angle Gear Drive is warranted to be free from defects in material and workmanship under normal use and service for a period of one year from the date of factory shipment by us for the original purchaser and then only when operated within the rated capacity for which it was sold and in accordance with recognized usage and practice. Our obligation under this warranty is limited to the replacement of any part or parts which shall be returned to us with transportation charges prepaid, within one year after shipment for the original purchaser; and, which it is determined by the company, to have proven defective under normal and proper use. This warranty shall not apply to any drive which shall have been altered or repaired outside our factory without our written consent and approval, nor any drive which has been subject to misuse, neglect, accident, improper oiling or mounted on foundations which are not vibration proof.

2. We make no warranty of any kind

whatever, express or implied, in regard to bearings, trade accessories, machinery, or other articles of merchandise not manufactured by us. The bearings which we have selected for the thrust position will cover most installations, but there are many cases which will require special treatment.

3. No warranty or guarantee is binding upon the company and no asserted breach thereof can be claimed against the company unless the company has been notified in detail and in writing of any alleged defect within seven (7) days after the discovery thereof.

4. The express warranties and guarantees contained herein are exclusive and are made in lieu of any other representation by the company or its agents, and any implied warranty of Merchantability or Fitness for a Particular Purpose are hereby expressly disclaimed. It is agreed that the language contained herein shall be the final and exclusive expression of the agreement with respect to sale of equipment by the company.



**JOHNSON**

RIGHT ANGLE GEAR DRIVE

A Division of Arrow Gear Company

Sales Office and Manufacturing Plant:  
1401 West Bond Circle, Lincoln, NE 68521 U.S.A.  
Phone: (402) 474-5285 Telex: 48 4307

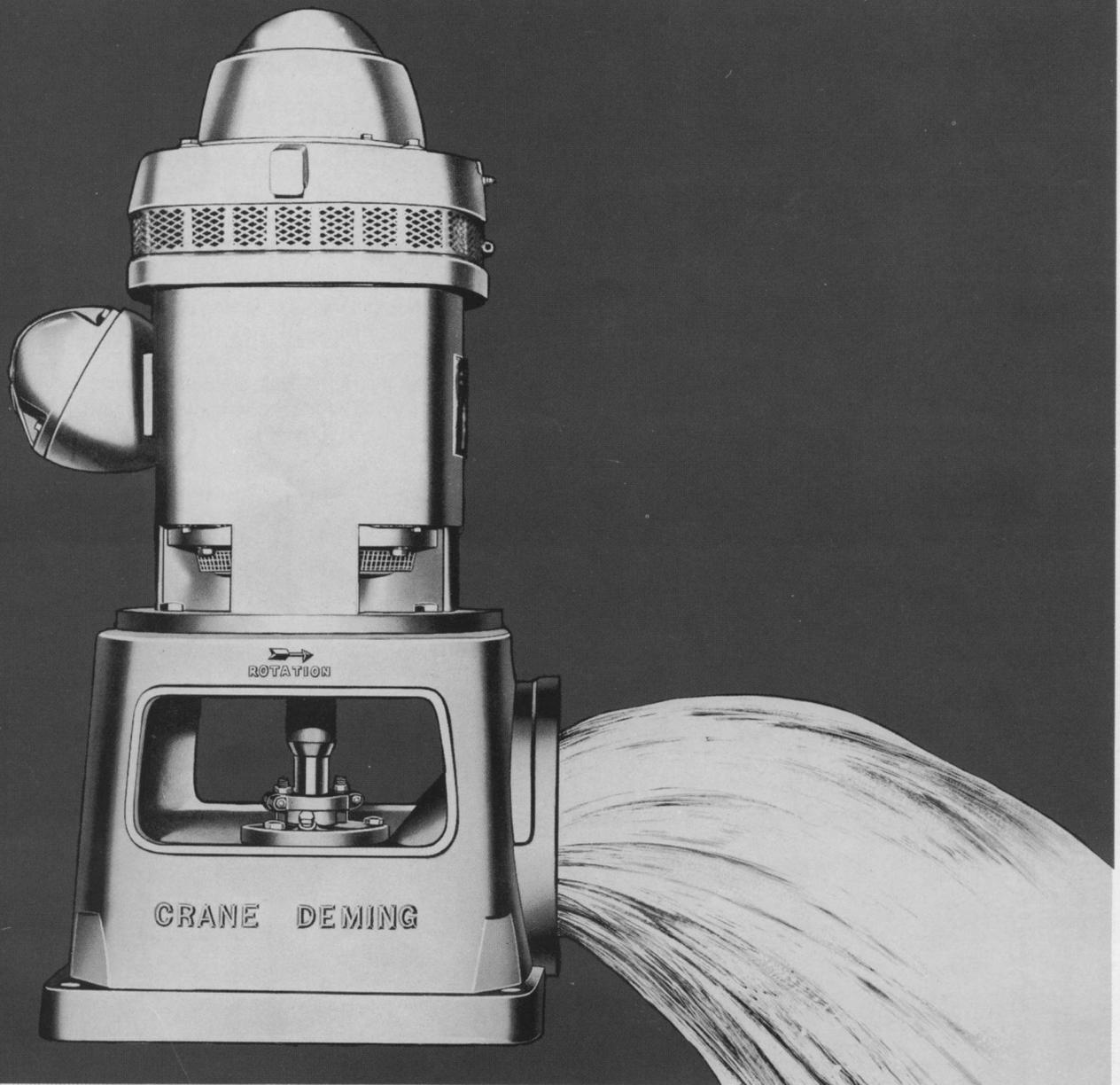
PUMP & LIGHTING CO.  
ENGINEERED PRODUCTS DIV.  
P. O. BOX 2504  
HICKORY, NC 28603

CRANE DEMING

BULLETIN NO. 4700C

Water and Oil Lubricated

# VERTICAL TURBINE PUMPS



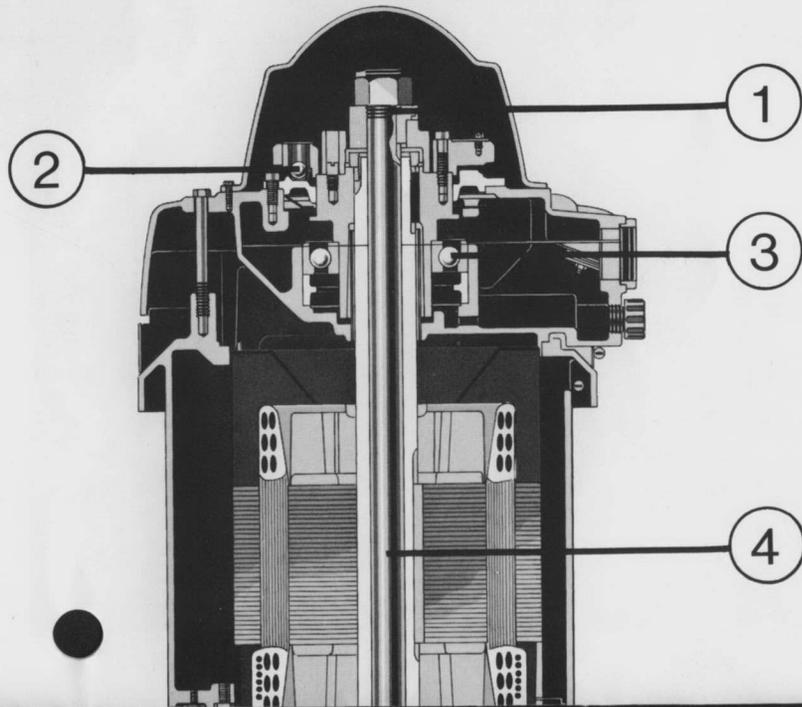
PRECISION ENGINEERED TO FILL EVERY MUNICIPAL, INDUSTRIAL & AGRICULTURAL REQUIREMENT

CRANE DEMING

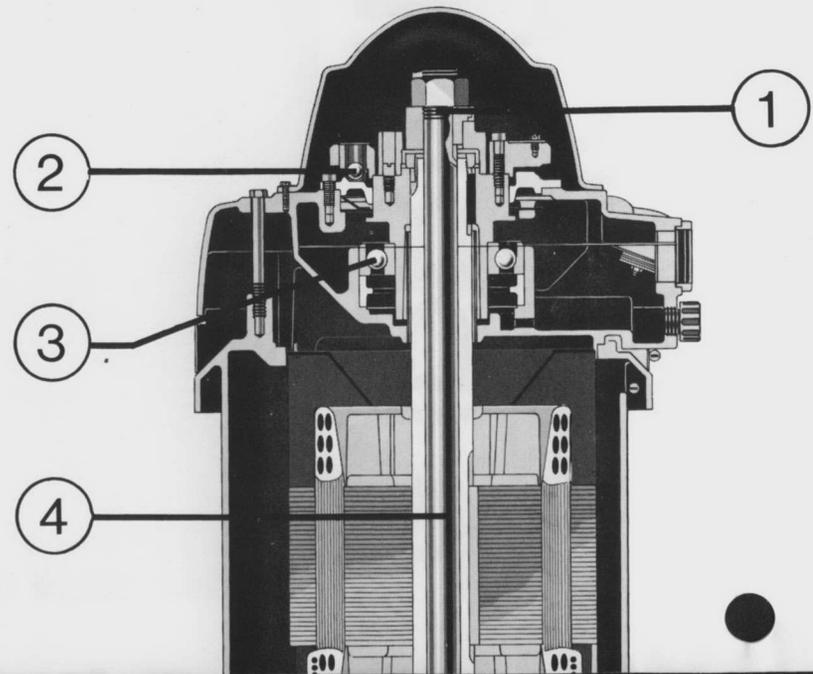
# VERTICAL TURBINE PUMPS

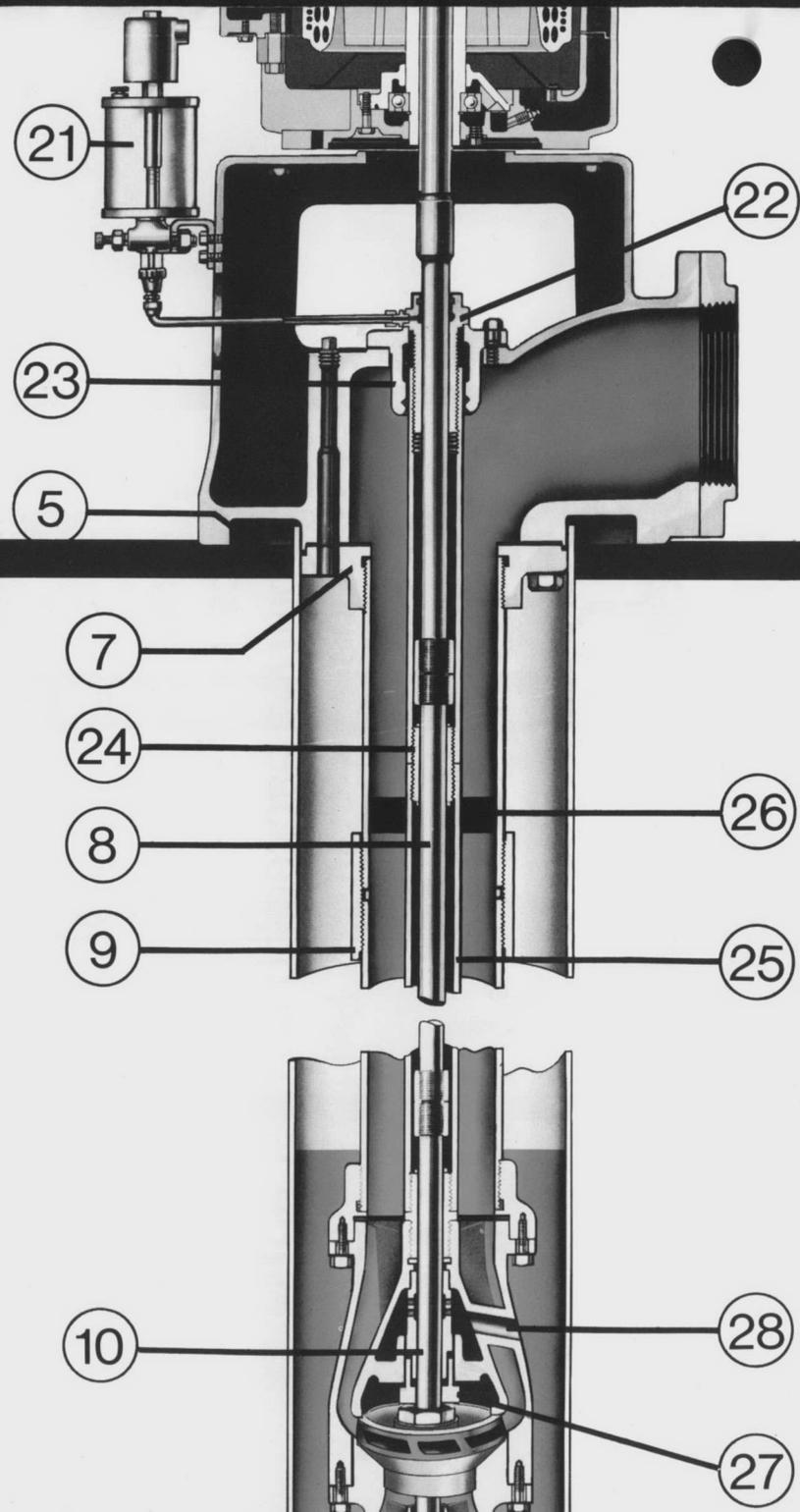
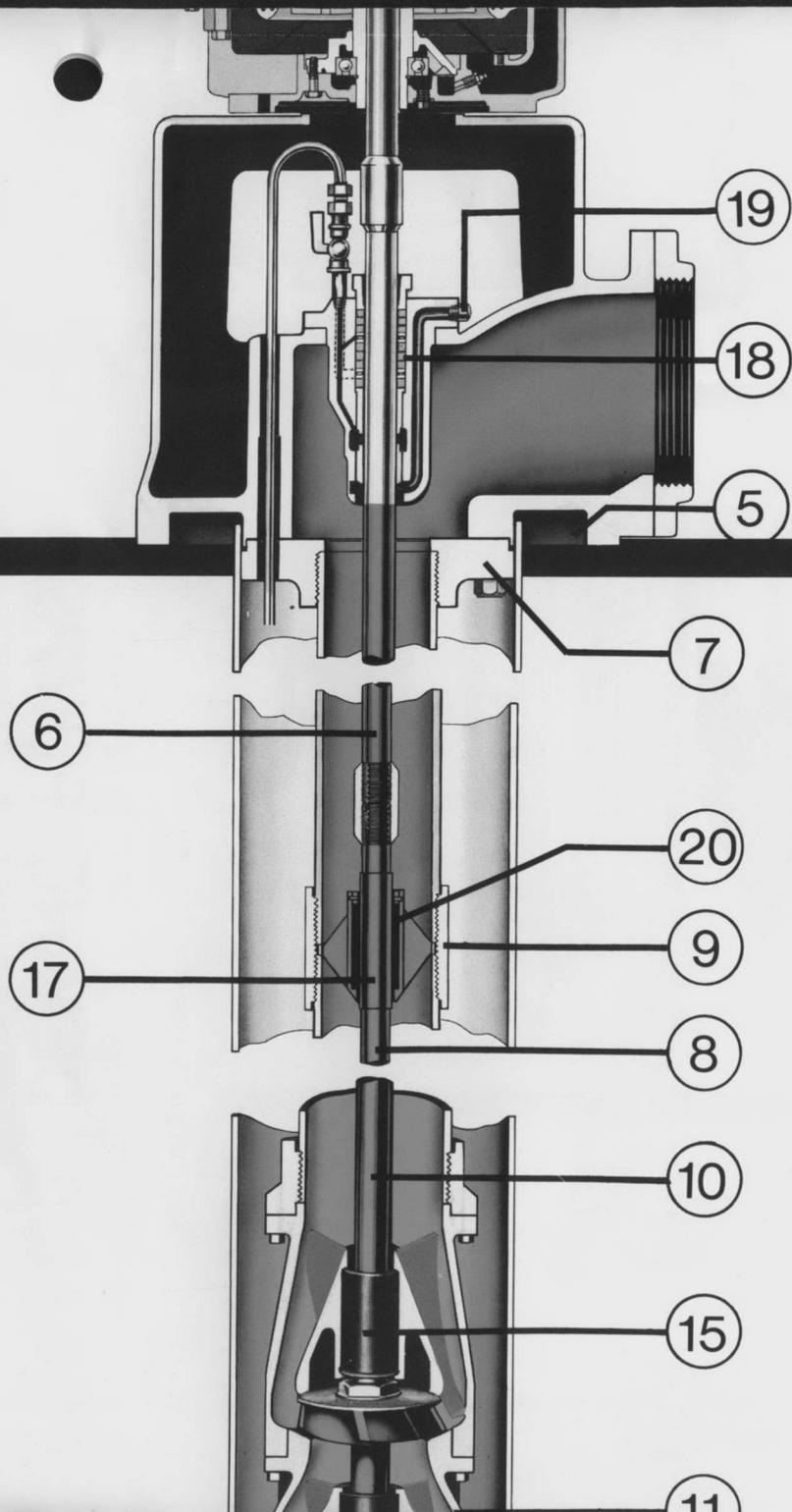
precision engineered to fill every municipal, industrial & agricultural requirement

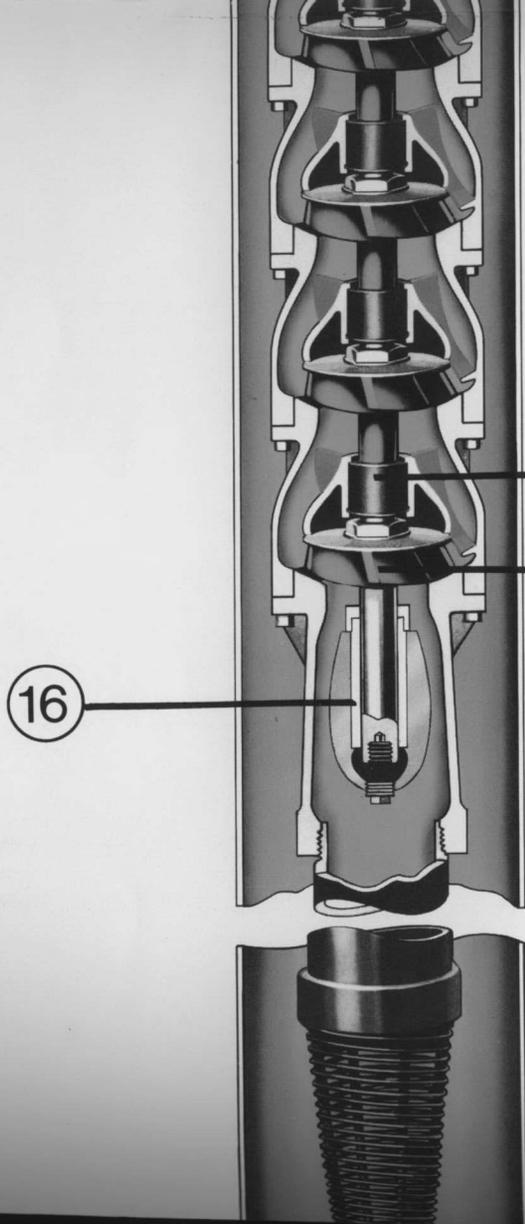
WATER LUBRICATED



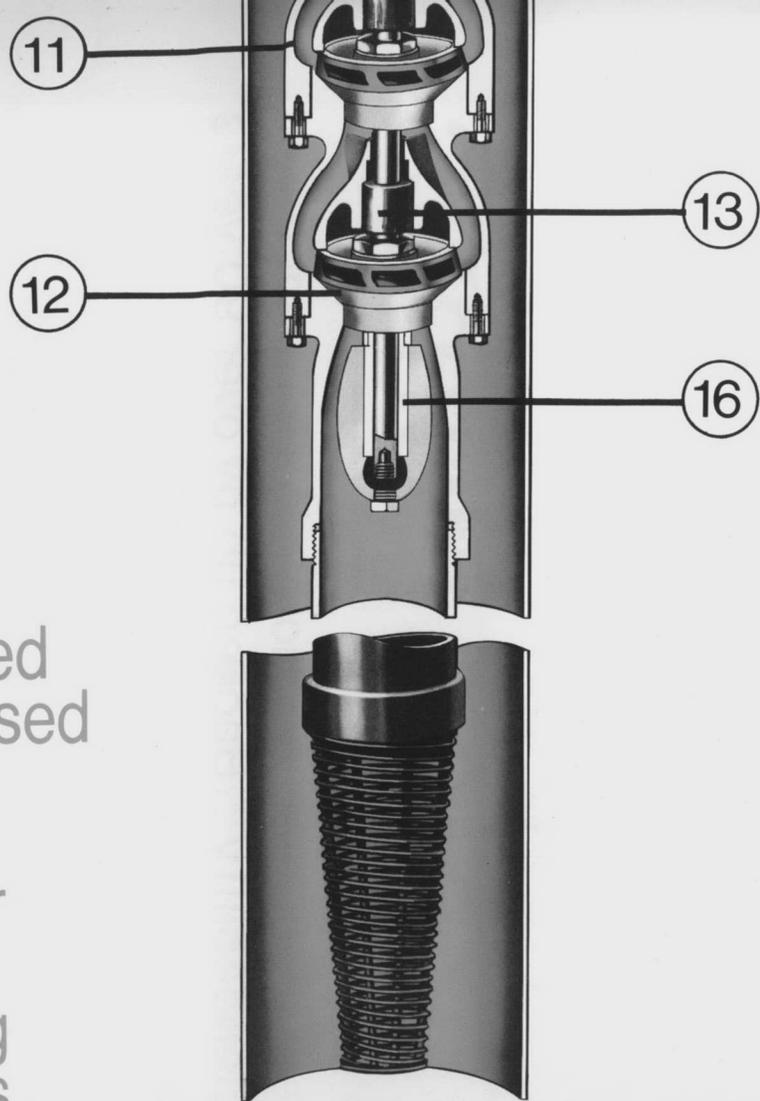
OIL LUBRICATED







NOTE: Enclosed or Semi-Enclosed Impellers are available on either Water or Oil Lubricated Crane-Deming Turbine Pumps





## Crane Deming quality design features provide longer life...lower operating costs

### OIL AND WATER LUBRICATED

1. **IMPELLERS EASILY ADJUSTABLE** — with adjusting nut located at top of motor.
2. **RATCHET PREVENTS BACKSPIN** — and avoids damage to pump in case of phase reversal.
3. **HEAVY-DUTY THRUST BEARING** — cooled by air entering motor.
4. **SEPARATE HEADSHAFT** — with coupling in pump head facilitates installation. Permits changing drives without raising pump.
5. **BASE OF HEAD RECESSED** — permits casing or sleeve to extend above foundation as required by many Public Health Departments.
7. **FLANGED HEAD CONSTRUCTION** — facilitates assembly of column and discharge head. Maintains accurate alignment between motor and column shaft assembly. (Some discharge heads feature threaded column connections. Refer to Factory.)

8. **HIGH STRENGTH LINE SHAFT** — of heat treated steel, ground and polished — one-third stronger than ordinary shaft.

9. **COLUMN COUPLINGS** — machined with 8 pitch threads for tight fitting butt joints. (Flanged column available.)

10. **STAINLESS STEEL IMPELLER SHAFT** — specially heat treated, ground and polished for longer life.

\*11. **STREAMLINED BOWL PASSAGEWAYS** — enameled to reduce friction and give greater pump efficiency.

12. **ENCLOSED BRONZE IMPELLERS** — have completely finished surfaces for maximum efficiency.

13. **BRONZE BOWL BEARINGS** — on all enclosed impeller pumps.

14. **SEMI-ENCLOSED BRONZE IMPELLERS** — have completely finished surfaces for greater efficiency.

15. **RUBBER BOWL BEARINGS** — on all semi-enclosed impeller pumps.

+16. **ENCLOSED BRONZE BEARING** — in suction bowl, protected with sand cap and packed with non-soluble grease.

### WATER LUBRICATED ONLY

6. **STAINLESS STEEL STUFFING BOX SHAFT** — may be inverted to renew wearing surface.

17. **STAINLESS STEEL SHAFT SLEEVES** — welded to shaft. Specially heat treated, ground and polished for maximum resistance to wear and corrosion. Replaceable in the field.

18. **ACCESSIBLE EXTRA-DEEP STUFFING BOX** — with controlled lubrication for long packing life.

19. **PRE-LUBRICATION CONNECTION** — through stuffing box distributes water around shaft for proper lubrication before start up.

20. **WATER LUBRICATED SHAFT BEARINGS** — fluted, resilient rubber shaft bearings are lubricated by water flowing through the pump. Bearings are held in place by a machined bronze bearing retainer secured between two pipe ends.

### OIL LUBRICATED ONLY

21. **AUTOMATIC LINE SHAFT LUBRICATOR** — on motor driven units — opens when pump starts, closes when it stops.

22. **BRONZE TUBING TENSION NUT** — is easily accessible for placing tube under proper tension — also provides close fitting bearing in pump head.

23. **TUBING HEAD ADAPTER WITH "O" RING** — assures water tight seal around shaft enclosing tube.

24. **BRONZE LINESHAFT BEARINGS** — provide accurate alignment for lineshaft and a coupling for enclosure tube. A spiraling internal oil groove permits uniform bearing lubrication and by-pass of oil to bearings below.

25. **HEAVY-DUTY TUBULAR STEEL SHAFT ENCLOSURE TUBE** — protects lineshaft. Specially machined for accurate bearing alignment.

26. **ENCLOSURE TUBE STABILIZERS** — reinforced rubber "spiders" are regularly spaced to maintain enclosure tube alignment.

27. **BEARING PROTECTING SLINGER** — prolongs bearing life by preventing entrance of sand into top bowl bearing.

28. **RELIEF PORTS IN TOP BOWL** — prevent water from rising in tube above water level in well.

\*Some bowl sizes feature threaded construction. Refer to Factory. †Semi-enclosed impellers 4" to 10" bowl sizes. Feature open rubber bearing construction.

Specifications subject to change without notice

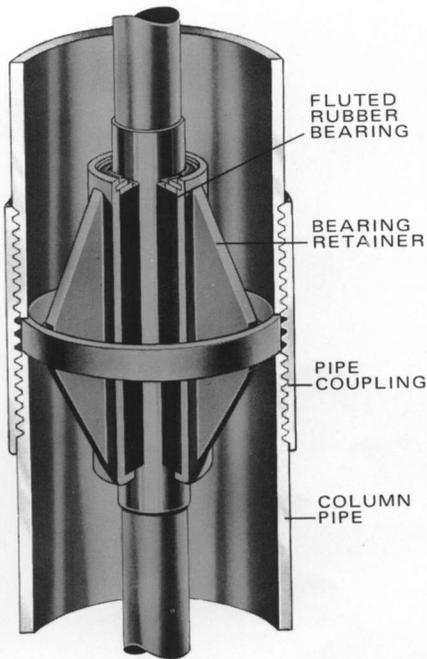
## CRANE DEMING VERTICAL TURBINE PUMPS

# WATER OR OIL LUBRICATED

Crane Deming Vertical Turbine Pumps are available with either oil or water lubrication. The basic difference is in the construction of the lineshaft, its supporting mechanism and the bearings supplied with each. Either type may be furnished with semi-enclosed or enclosed impeller design.

### WATER LUBRICATED CONSTRUCTION

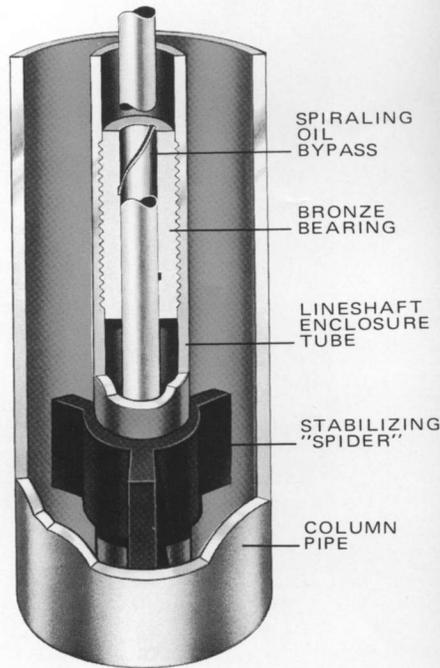
Crane Deming water lubricated pumps are lubricated by the water that is being pumped, and require no supplemental lubricants or maintenance. Water lubricated construction includes high strength steel lineshaft and rubber bearings throughout.



Bronze lineshaft bearing retainers are centered in each pipe coupling — tightly secured between the two pipe ends. Retainers are precision cast and machined to house the water lubricated, resilient rubber bearings and assure perfect vertical alignment of pump lineshaft. Rubber bearings are fluted to provide adequate lubrication and permit sand and other abrasive particles to flow through.

### OIL LUBRICATED CONSTRUCTION

Oil lubricated construction has an enclosed lineshaft with bronze bearings used throughout. A heavy-duty steel enclosure tube contains the lubricating oil around the lineshaft and bearings, and shields both from foreign matter and corrosion.

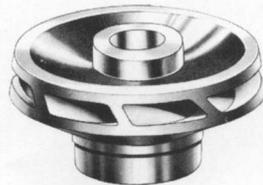


In standard construction, machined bronze bearings are spaced every five feet to assure true pumpshaft alignment and smooth, quiet operation. Bearings are threaded and also serve as a coupling for lineshaft enclosure tubing. A spiraling groove in the bearing inner wall provides uniform oil distribution over the lineshaft surface and permits oil passage through the bearing to each succeeding bearing below. Reinforced rubber "spiders" are spaced at regular intervals to center the enclosure tube in the column pipe.

### IMPELLERS



Corrosion-resistant bronze semi-enclosed impellers are easily adjustable at the top of the driver to handle changes in well capacity or ground conditions. Impellers can be temporarily adjusted upward to avoid pump wear when clearing a sandy well. Top pump efficiency can easily be maintained.



Enclosed impellers are high quality corrosion-resistant bronze with completely finished surfaces. The hydraulic design developed from years of engineering experience assures maximum efficiency with minimum operating costs in Crane Deming Vertical Turbine Pumps.

# CRANE DEMING

precision engineered

# Vertical Turbine Pumps

offer Unequaled Economy, Performance and Dependability...Backed up by over 90 years experience in the development and manufacture of quality pumps.

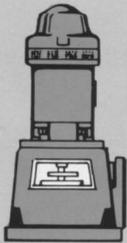
Crane Deming vertical turbine pumps are scientifically engineered and constructed of top quality materials to provide years of dependable service.

Close tolerance machining to increase operating efficiency — precision balancing of moving parts to eliminate vibration — special heat treating to reduce maintenance — using bronze to combat corrosion — stainless steel at critical wear points . . . Crane Deming has expended every effort to design

and build a pump that runs smoother, lasts longer and yet stays in line with competition. The pumps described in this bulletin are the result of this manufacturing philosophy — no short cuts — no sacrificing of quality.

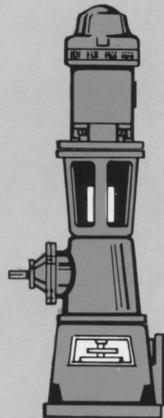
Over 90 years of research, engineering and manufacturing experience stand behind your selection of a Crane Deming Vertical Turbine Pump. It will prove a wise choice.

## Top Performance With All Types of Drives



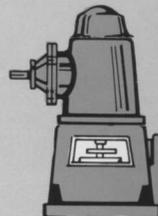
### Unit Drive Head

For installations where electric power is available the Unit Drive with hollowshaft motor is compact, quiet and efficient.



### Combination Motor — Right Angle Drive

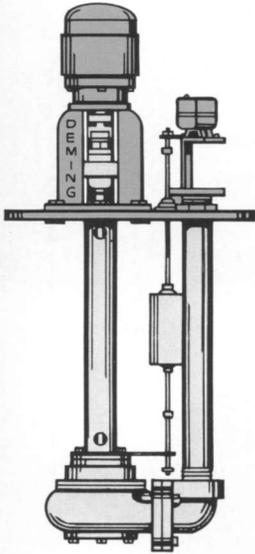
For municipal waterworks and installations where an auxiliary source of power must be available at a moment's notice.



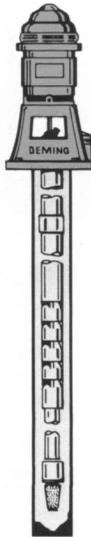
### Right Angle Drives

For direct connection to gasoline or diesel power unit. Gear ratio permits unit to operate at the most economical speed.

# For Maximum operating efficiency Specify **CRANE** DEMING For all your pumping requirements



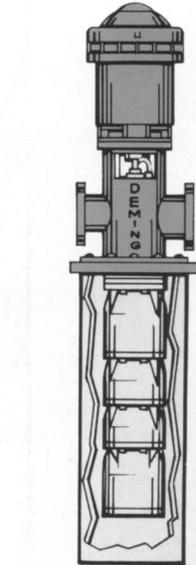
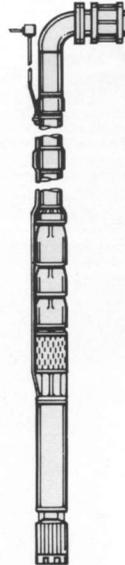
Sewage Pumps and  
Cellar Drainers



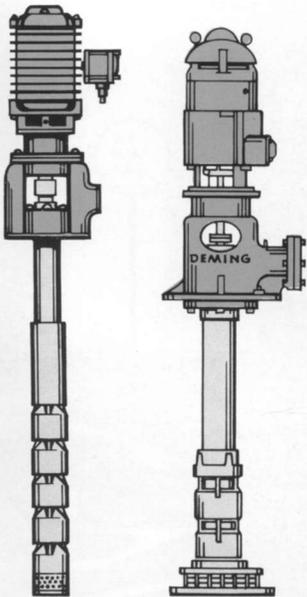
Close-Coupled  
Vertical Turbine Pumps



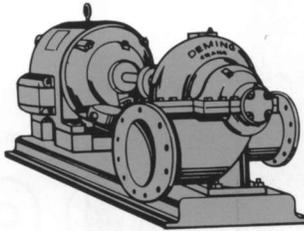
Submersible Pumps



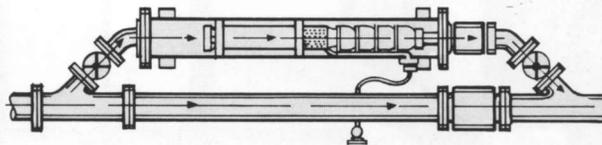
Tee Head Booster Pumps



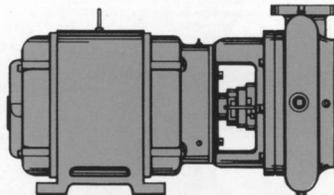
Gasoline, Fuel Oil and  
Industrial Solvent Pumps



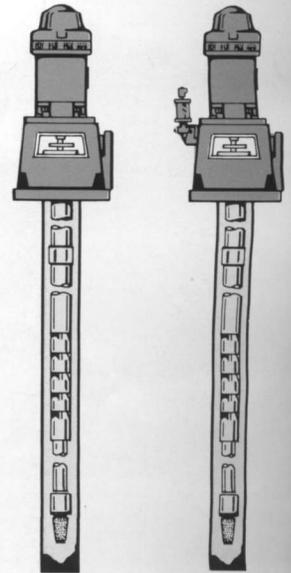
Split Case Centrifugal Pumps



Horizontal Submersible Pumps



Horizontal Motor Mount Pumps



Water Lubricated, Oil Lubricated  
Vertical Turbine Pumps

CRANE DEMING PUMPS ARE SOLD AND SERVICED BY:

VALVES • PUMPS • FITTINGS • WATER TREATMENT • PLUMBING

**CRANE**

®

**DEMING PUMPS**

CRANE CO. DEMING DIV. • 884 SOUTH BROADWAY • SALEM, OHIO 44460



PARRISH INTERMEDIATE DRIVE SHAFTS

# PARTS LIST AND PRICES

PARTS DIAGRAMS

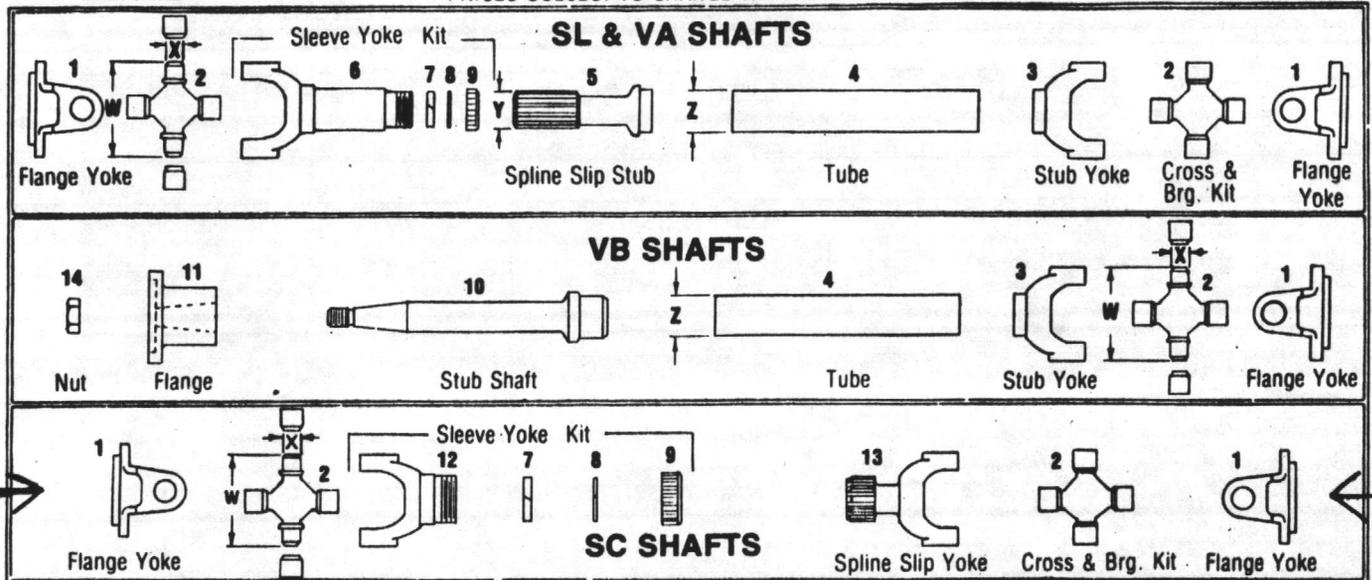
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

PRICE LIST PL-579

Dated May 1, 1979

Supersedes PL-875

F.O.B. Shipping Point



## IDENTIFYING DIMENSIONS

Dimen.	27	31	37	41	48	55	61	71	81	88	91	95
W†	2 <sup>31</sup> / <sub>32</sub>	2 <sup>31</sup> / <sub>32</sub>	3 <sup>3</sup> / <sub>8</sub>	3 <sup>15</sup> / <sub>16</sub>	3 <sup>7</sup> / <sub>8</sub>	4 <sup>21</sup> / <sub>32</sub>	5	5 <sup>25</sup> / <sub>32</sub>	7 <sup>1</sup> / <sub>4</sub>	7 <sup>19</sup> / <sub>32</sub>	8	9 <sup>5</sup> / <sub>32</sub>
X†	1 <sup>9</sup> / <sub>32</sub>	2 <sup>1</sup> / <sub>32</sub>	4 <sup>9</sup> / <sub>64</sub>	4 <sup>9</sup> / <sub>64</sub>	5 <sup>7</sup> / <sub>64</sub>	5 <sup>7</sup> / <sub>64</sub>	1 <sup>9</sup> / <sub>32</sub>	1 <sup>5</sup> / <sub>16</sub>	1 <sup>19</sup> / <sub>64</sub>	1 <sup>3</sup> / <sub>4</sub>	1 <sup>3</sup> / <sub>4</sub>	2
Y**	1 <sup>1</sup> / <sub>2</sub> "-16	1 <sup>9</sup> / <sub>16</sub> "-16	1 <sup>3</sup> / <sub>4</sub> "-16	2"-16	2 <sup>1</sup> / <sub>2</sub> "-16	3-16	3-16	3 <sup>5</sup> / <sub>32</sub> -36	4 <sup>5</sup> / <sub>32</sub> -24			
Z Std.	2 <sup>1</sup> / <sub>2</sub>	3	3	3 <sup>1</sup> / <sub>2</sub>	3 <sup>1</sup> / <sub>2</sub>	3 <sup>1</sup> / <sub>2</sub>	3 <sup>1</sup> / <sub>2</sub>	4	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	6
Z Spec.	3 <sup>1</sup> / <sub>2</sub>	3 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	—	—	—	—	—	—

† Dimensions "W" and "X" are without bearings assembled to cross.

\*\* Dimension "Y" is spline diameter and number of splines.

## PARTS LIST AND PRICES

Note 1. Items not shown in SPECIAL TUBING sections or SC SHAFTS sections are the same as STANDARD TUBING.

Note 2. When ordering tubing, Item 4, specify length required. Price is per inch.

Note 3. Parts 7, 8 & 9 are available in Kit Form only.

No.	Description	SHAFT SERIES							
		27		31		37		41	
		Part Number	Price	Part Number	Price	Part Number	Price	Part Number	Price
<b>SL AND V SHAFTS STANDARD TUBING</b>									
1	Flange Yoke	923220000	20.00	923220000	20.00	911230000	24.00	951230000	24.00
2	Cross & Brg. Kit	002500000	16.00	351500000	16.00	871500000	21.00	061500000	23.00
3	Stub Yoke	763822000	18.00	763822000	18.00	758230000	15.00	755823000	18.00
4	Tube (Per Inch)	380520000	POA	380520000	POA	380300000	POA	380530000	POA
5	Spline Slip Stub	117104200	32.00	117104200	32.00	116104300	46.00	194104300	69.00
6	Sleeve Yoke	122532000	40.00	122532000	40.00	884330000	44.00	805330000	59.00
7	Cork Washer	346130000	See Note 3	346130000	See Note 3	356130000	See Note 3	356130000	See Note 3
8	Steel Washer	335130000	See Note 3	335130000	See Note 3	355153000	See Note 3	355153000	See Note 3
9	Dust Cap	934139000	See Note 3	934130000	See Note 3	934153000	See Note 3	934153000	See Note 3
10	Stub Shaft	462200000	45.00	462200000	45.00	562200000	65.00	562200000	108.00
11	Flange	130200000	33.00	130200000	33.00	230200000	41.00	330200000	45.00
14	Nut	580000000	1.00	580000000	1.00	580000000	1.00	860000000	2.00
<b>SL AND V SHAFTS SPECIAL TUBING</b>									
3	Stub Yoke	724822000	POA	724822000	POA	704823000	POA	775823000	POA
4	Tube (Per Inch)	380530000	POA	380530000	POA	590540000	POA	590540000	POA
5	Spline Slip Stub	149104200	POA	149104200	POA	153043000	POA	194104300	POA
10	Stub Shaft	160010000	POA	160010000	POA	260010000	POA	360010000	POA
<b>SC SHAFTS</b>									
2	Cross & Brg. Kit	002500000	16.00	351500000	—	871500000	21.00	061500000	23.00
12	SC Sleeve Yoke	159332000	POA	159332000	—	883330000	75.00	864330000	59.00
13	Spline Slip Yoke	112282000	POA	112282000	—	162830000	61.00	182830000	56.00



FOR APPROVAL

FABRICATION PENDING

DEMING PUMP CO.

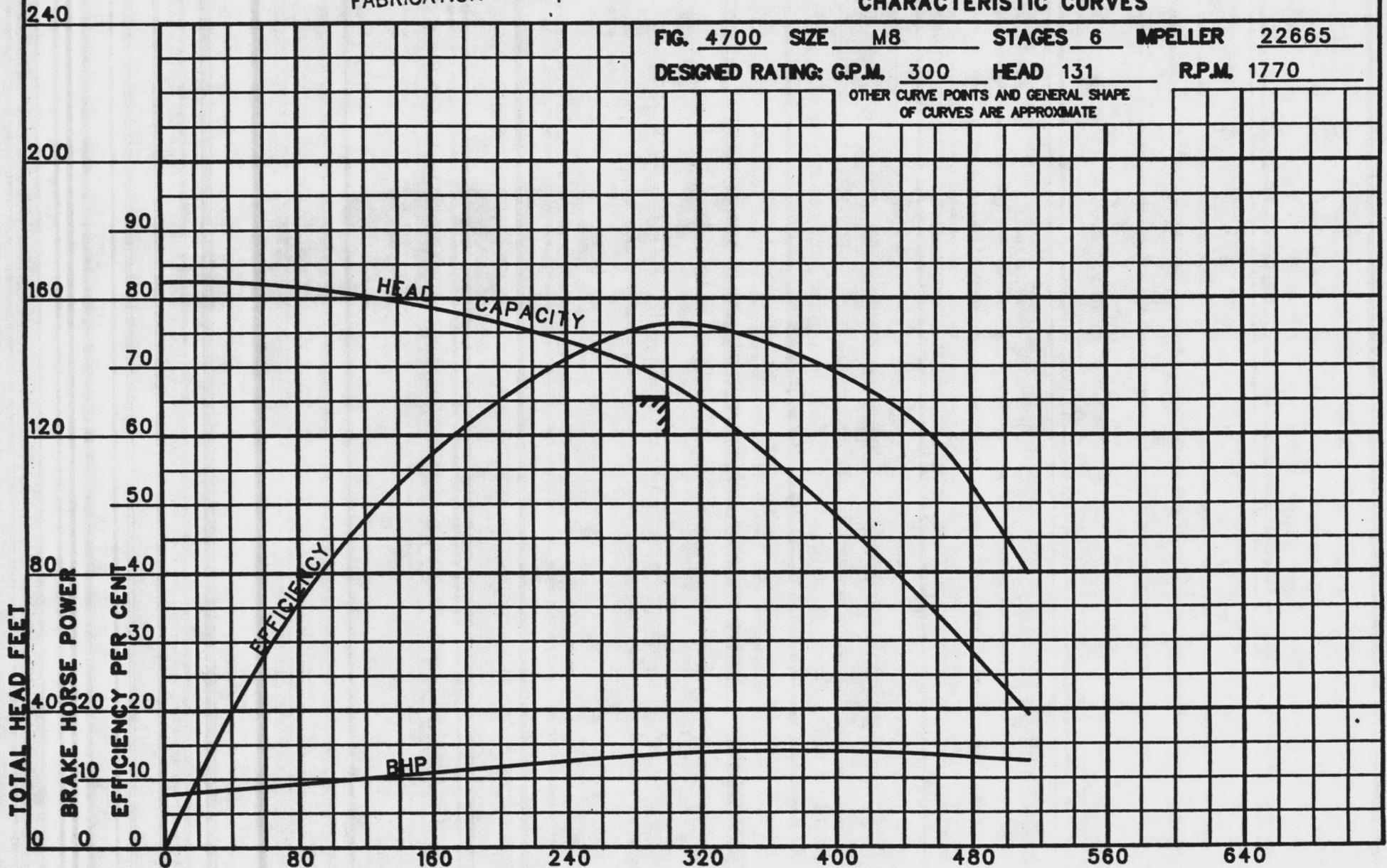
SALEM, OHIO, U.S.A.

CHARACTERISTIC CURVES

FIG. 4700 SIZE M8 STAGES 6 IMPELLER 22665

DESIGNED RATING: G.P.M. 300 HEAD 131 R.P.M. 1770

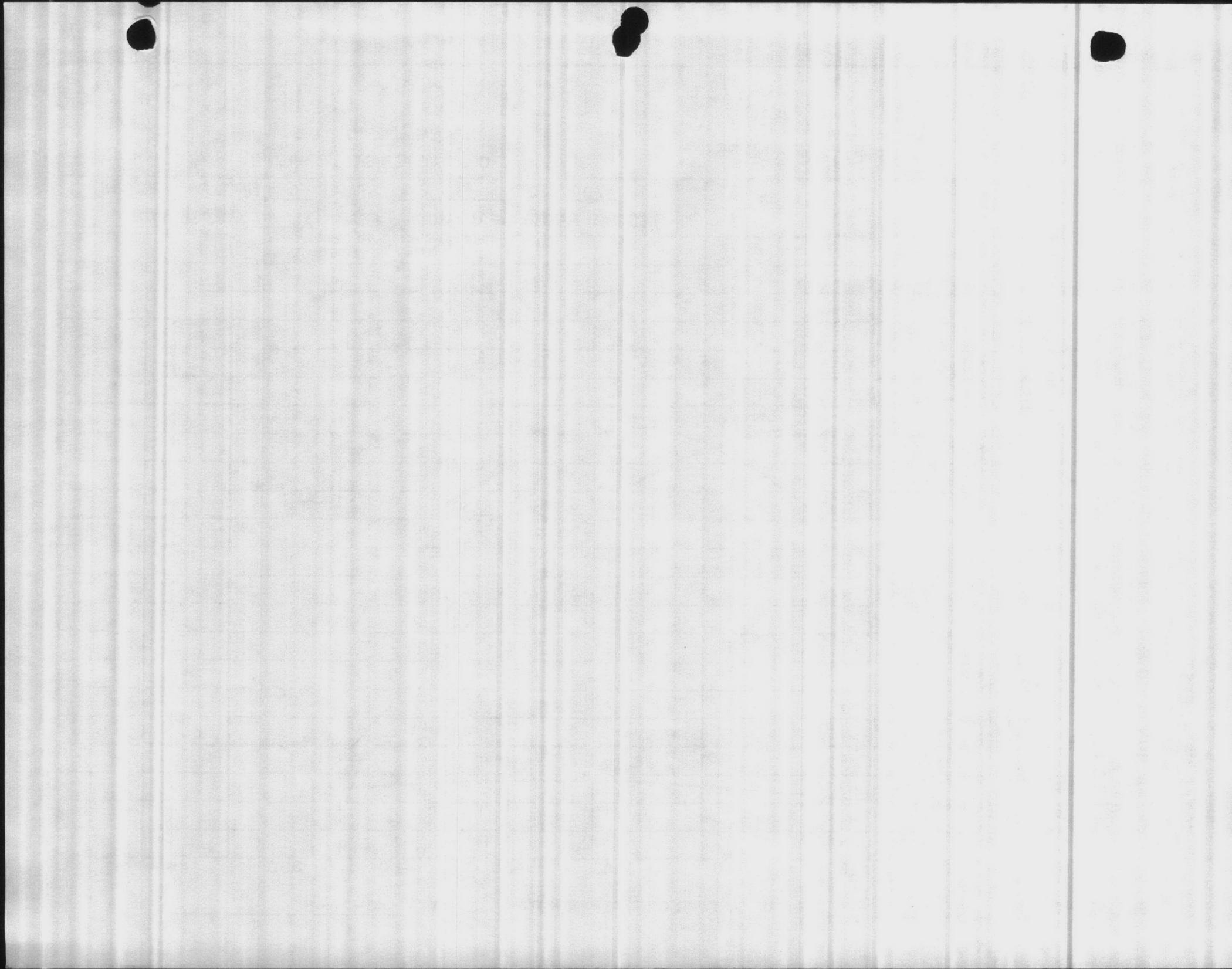
OTHER CURVE POINTS AND GENERAL SHAPE OF CURVES ARE APPROXIMATE



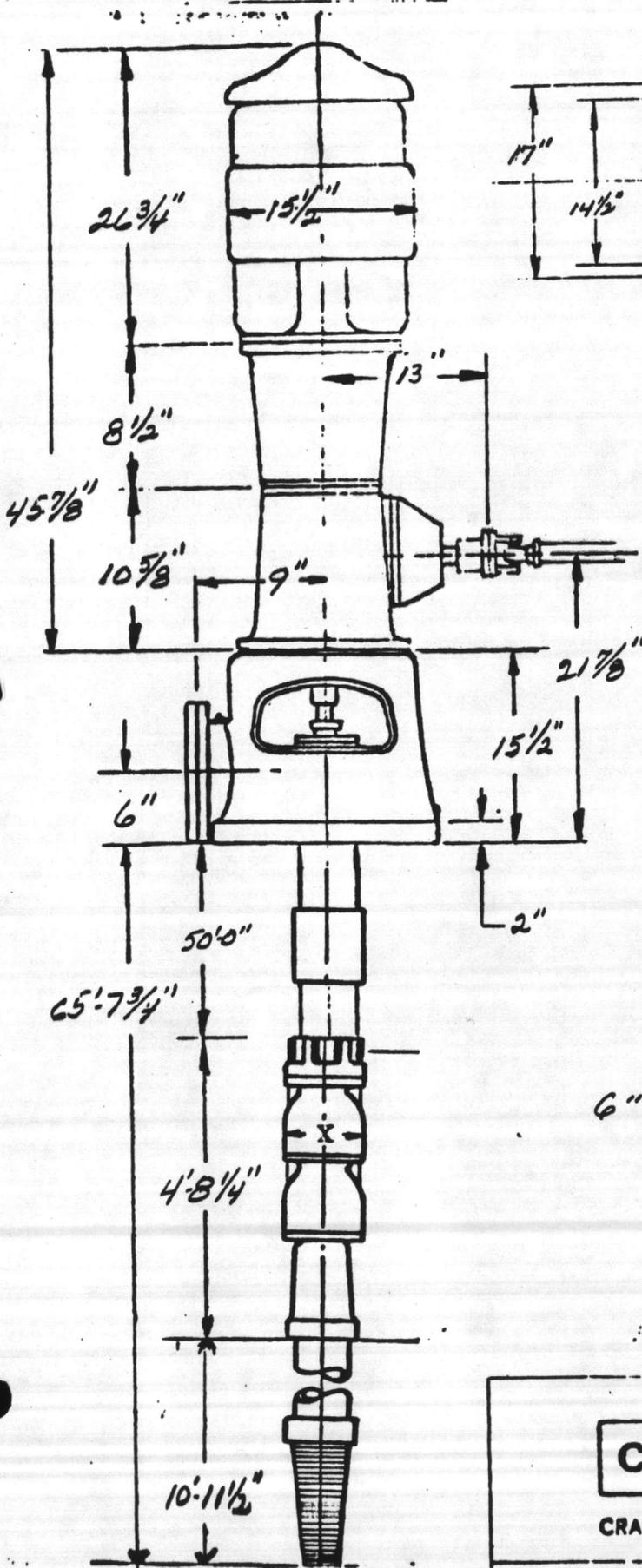
SERIAL NO. \*\*\* \_\_\_\_\_

U. S. GALLONS PER MINUTE

DATE 3-26-85 \_\_\_\_\_



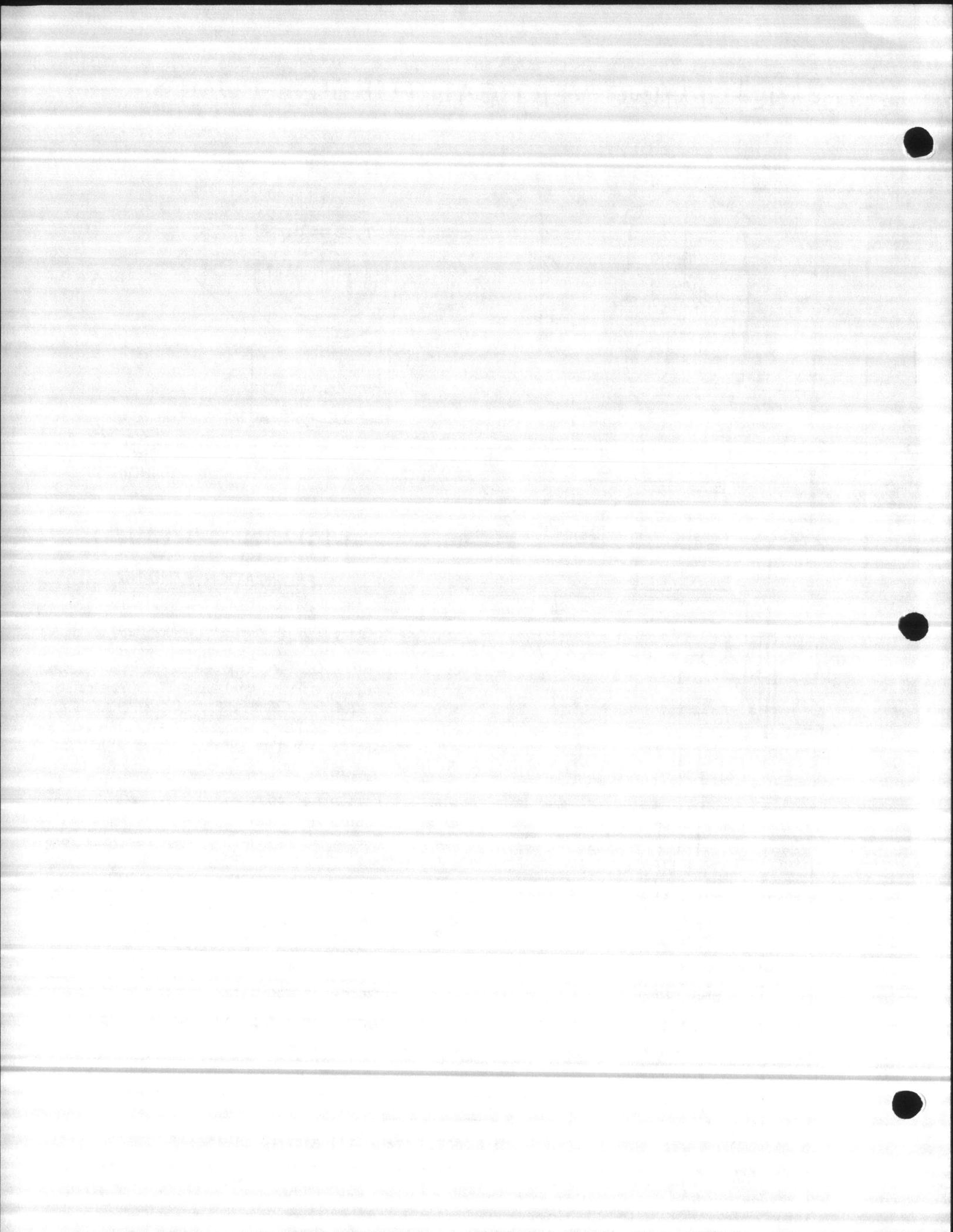
# CRANE DEMING VERTICAL TURBINE PUMPS



**FOR APPROVAL**  
FABRICATION PENDING ✓

1-4700 Crane-Deming Vertical Turbine Pump designed  
300 GPM at 131 feet head, including:  
15 HP 1770 RPM 230/460 Volt 3  
 Phase 60 Hertz (1-1) G.E. Vertical Half-  
 shaft Motor CUSTOMERS w/ MODEL CH-2  
1:1 RATIO JOHNSON COMPR. RIGHT ANGLE DR  
 SD 50-66-12 Surface Discharge Head with 6 in  
 discharge  
50 feet 6 x 1 Column and sh  
 with (5) RUBBER Bearings on 10 f  
 centers 6 Stage 18 inch STANDARD Bowl Assem  
 using Impeller # 22665 from Curve Page 81 and  
10' 5" GALV. SUCTION PIPE  
5" GALV. KEYSTONE STRAINER  
6" GALV. PIPE  
416 ST. STL. SHAFTING w/ MODEL CALG'S,  
 When properly endorsed this print is correct for:  
PUMP & LIGHTING COMPANY  
 Customer's P.O. 39246-12 Turbine No. T-  
 Date 4/1/84 By w. Hahn SD # 03268.00  
 For: CAROLINA WELL & PUMP  
 PROJECT: N 62470-81-B-1478

**CRANE DEMING PUMPS**  
 CRANE CO • 884 SOUTH BROADWAY • SALEM, OHIO 44460



# 4700

# INSTRUCTIONS

**INSTALLATION  
and CARE  
of  
WATER  
LUBRICATED  
VERTICAL  
TURBINE  
PUMPS**

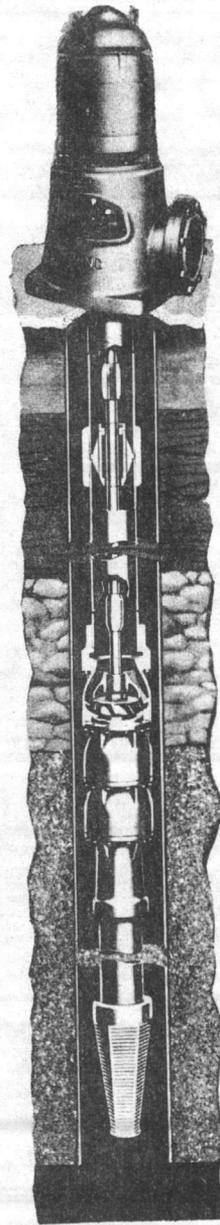


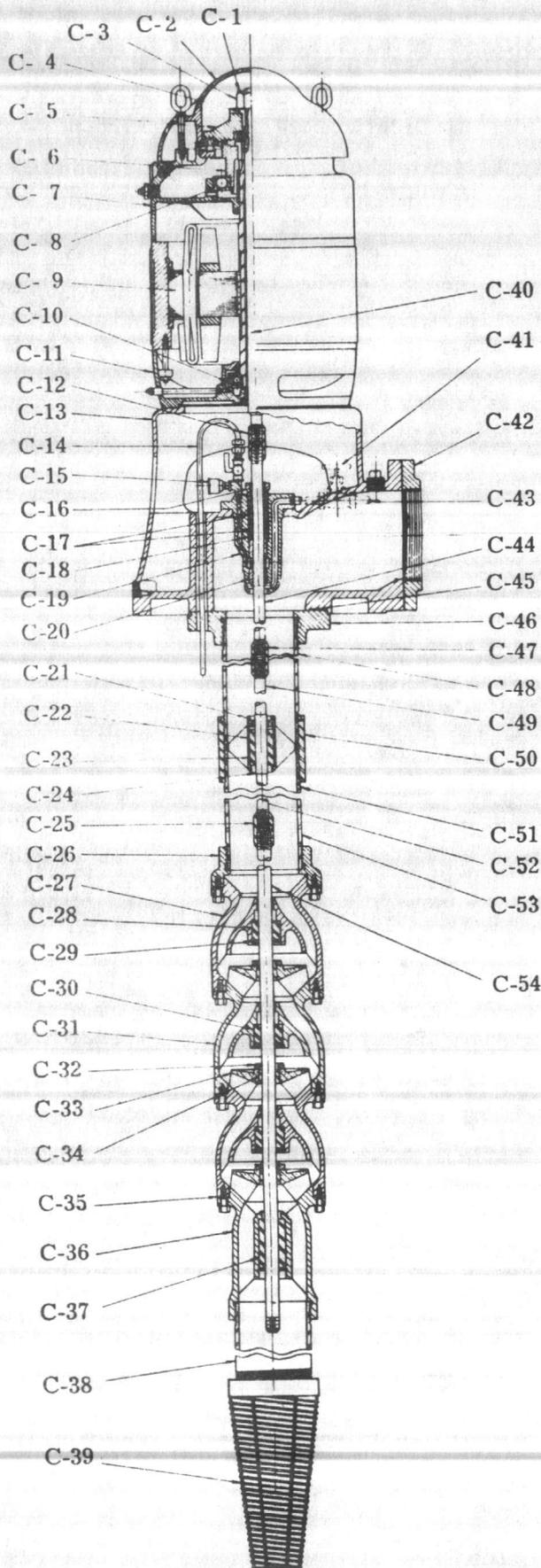
FIG. 4700

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**CRANE CO.**  
SALEM, OHIO 44460

# DEMING VERTICAL TURBINE PUMPS

Parts List No. 50 - Fig. 4700 Water Lubricated Pumps



- C- 1 Adjusting Nut Lock Screw
- C- 2 Canopy
- C- 3 Impeller Adjusting Nut
- C- 4 Gib Key
- C- 5 Motor Coupling or Pawl Disc Assembly
- C- 6 Upper Bearing Mounting
- C- 7 Upper Motor Bearing
- C- 8 Upper Motor Bearing
- C- 9 Motor Stator
- C-10 Lower Motor Bearing
- C-11 Lower Motor Bracket
- C-12 Head Shaft Coupling
- C-13 Discharge Head
- C-14 Stuffing Box Relief Assembly
- C-15 Grease Cup
- C-16 Stuffing Box Gland
- C-17 Lantern Rings
- C-18 Stuffing Box Packing
- C-19 Stuffing Box
- C-20 Stuffing Box Bushing
- C-21 Bearing Retaining Cup
- C-22 Bearing Housing
- C-23 Column Bearing — Cutless Rubber
- C-24 Shaft Sleeve
- C-25 Impeller Shaft Coupling
- C-26 Column Adapter
- C-27 Discharge or Top Intermediate Bowl
- C-28 Discharge or Intermediate Bowl Bearing
- C-29 Snap Ring and Cover Plate
- C-30 Bowl Bearing
- C-31 Intermediate Bowl
- C-32 Impeller Nut
- C-33 Impeller
- C-34 Impeller Sleeve
- C-35 Bowl Gasket
- C-36 Suction Bowl
- C-37 Suction Bowl Bearing
- C-38 Suction Pipe
- C-39 Strainer
- C-40 Head Shaft
- C-41 Pre-lubricating Valve
- C-42 Discharge Flange
- C-43 Pre-lubricating Pipe
- C-44 Stuffing Box Shaft
- C-45 Top Column Flange Gasket
- C-46 Top Column Flange
- C-47 Shaft Coupling
- C-48 Top Column Pipe
- C-49 Intermediate Shaft
- C-50 Column Coupling
- C-51 Intermediate Column
- C-52 Bottom Shaft
- C-53 Bottom Column
- C-54 Impeller Shaft

## NOTE

Specify pump serial number when ordering replacement parts. This will be found on the nameplate attached to the discharge head casting or to the bowl assembly.

## WELL

Measure the well to make sure it is of ample size and depth to receive the pump. The well must be sufficiently straight to allow the pump to hang freely with no misalignment.

## FOUNDATION

A concrete foundation should be constructed before the pump is installed to permit aligning the pump head with the well while lifting equipment is available. Provide an opening in the foundation large enough for the top column flange with ample clearance. If the well is out of plumb, the pump head must be placed so that the drive shaft will be on the same inclination as the well casing. This is important. The foundation should be large enough to carry the weight of the pump without settling.

## TOOLS

The following tools and equipment are required for satisfactory installation:

Derrick, gin pole with chain hoist, winch truck, well rig or similar equipment with at least 12 foot clearance (more for long bowl assemblies) and sufficient capacity to safely handle the weight of the complete unit.

Two pipe clamps or pipe elevators of proper size for pump column.

Two chain pipe tongs (if column has screwed couplings).

Two small pipe wrenches for screwing shaft together.

Small tools including wire brush, three-cornered file, wrenches, can of pipe compound, etc.

## PREPARATION

Immediately on receipt of pump check carefully with packing list. Report any loss or damage to transportation company and to factory. Keep all parts in good dry storage. When ready to install, unpack material and lay out on skids or boxes near well.

Place the column pipe with the coupling end toward the well. Check shafts for straightness. Roll on ways if any question as shafts must be almost perfectly straight. Place a shaft inside each length of column with the bearing sleeve toward the well. Screw a shaft coupling on the opposite end.

Note — Short-coupled turbine pumps are usually shipped assembled except for mounting motor. To install these pumps it is only necessary to raise the pump over the sump or reservoir and lower it on foundation. Then mount motor or drive as explained later.

## IMPORTANT NOTES

1. Column pipe threads are right hand; shaft threads are left hand.
2. Protect all parts from dirt; especially column and shaft threads, couplings, and all machined surfaces. Any dirt or foreign material between

ends of shafts or other parts may cause misalignment and unsatisfactory operation.

3. Handle shaft with extreme care to avoid bending.
4. All shaft and column must butt solidly in couplings; otherwise, differences in length may develop during installation. Ends of shafts should be even with small hole in side of shaft coupling.

## INSTALLING BOWL ASSEMBLY

If headroom permits, screw strainer on suction pipe and suction pipe into bowl assembly before raising bowl assembly from ground. Where headroom is limited or assembly is long, lower suction pipe into well with strainer attached and hold with clamp. Then if headroom permits, assemble the bottom section of shaft, and column pipe on the top of the bowl assembly. Raise the complete assembly, taking particular care not to place too much strain on the bowls, and screw the bowl assembly on the suction pipe. If necessary to place clamp on bowl assembly, make sure this is located over joint and not on the shell of a bowl.

Loosen clamp on suction pipe and lower assembly into the well until the upper clamp or elevator rests on top of casing or foundation.

## INSTALLING COLUMN

Place clamp or elevator under coupling on upper end of the bottom section of column and raise over the well. Support the shaft by hand or with a rope sling, taking particular care not to bend the shaft. On larger pumps a small clamp to fit the shaft or a length of manila rope will assist in supporting the shaft. Carry the lower end of the column or slide it on a plank so as not to damage threads. Make sure all threads are perfectly clean. Paint outside pipe threads with a good thread lubricant. Oil shaft threads and wipe off excess oil.

Screw the bottom shaft into the impeller shaft coupling and tighten. Then screw the column into the column adapter or if the adapter is flanged, bolt it to the top bowl. Lower the complete assembly into the well and hold with clamp.

Place a bearing assembly over the shaft with the retaining cup at the top and screw it firmly in place in the column coupling. Use the bearing housing wrench furnished as the bearing housing must butt against the end of the column.

Repeat this procedure until all of the column has been installed. Each section must butt rigidly in the couplings. Intermediate column lengths are regularly 10 feet for pumps up to 2200 RPM and 5 feet for pumps to operate over 2200 RPM. Rubber bearing should center in bearing sleeve in each column coupling. The top section of column has a flange for attaching to the discharge head. The top shaft which goes through the stuffing box is regularly of stainless steel, several inches longer than the top pipe.

## INSTALLING HEAD ASSEMBLY

Hold the pump with clamps under the upper column coupling. This will support the top column flange several feet above the foundation where it is convenient to attach the discharge head. Remove the stuffing box assembly from the head. It may be necessary to bump it lightly with a wooden block. Place a double chain sling through the head and raise it over the pump. Make sure flange on lower side of head is clean and that studs are not damaged. Clean the top column flange and place paper gasket on it. Line up studs and the opening through the head with holes in top flange and lower the head carefully onto the top flange. Make sure the register fits and tighten stud nuts securely.

Then raise the complete pump assembly and remove the clamps. Rotate the unit until the discharge flange is in the desired direction and lower onto foundation. If the head does not rest evenly on the foundation, lift the unit and place metal shims under each corner. The head must be supported on the foundation so that it is in line with the column and shaft. Never level a pump head on the foundation with a spirit level.

Place paper gasket over stuffing box studs. Make sure the flange is clean and lower the stuffing box over the shaft using care not to damage packing. Tighten stud nuts securely and tighten gland nuts finger tight. Run stuffing box relief tube down through opening in head to return by-pass water to well; or place tube through drain opening in back of head and pipe to drain. If pump is to operate under pressure; leave relief valve partially open to relieve the pressure on the upper packing. Give grease cup several turns to lubricate packing and stuffing box bearing. Screw headshaft coupling on upper end of stuffing box shaft. Place a cloth over coupling to avoid any possibility of dirt or foreign material dropping into it while motor is being mounted.

## INSTALLING MOTOR OR DRIVE

Check motor nameplate to make sure it is suitable for the electric current available and the proper speed for the pump. Use eye bolts in top of motor for lifting motor only. Do not use these eye bolts for lifting motor and pump together. Set motor on pump head making sure that base of motor and top of head are clean and that register fits properly. Bolt motor in place with bolts or cap screws furnished. Remove motor canopy and top drive coupling. Lower headshaft through hollowshaft of motor with end of shaft having keyway at the top. Tighten in headshaft coupling. It is important that shafts butt in coupling but do not use excessive force which might cause misalignment.

## ALIGNING PUMP

Check alignment of pump head on foundation by noting the clearance around the headshaft at top of motor. If the headshaft stands to one side in hollowshaft, place metal shims between the head and foundation on the opposite side so that the headshaft will stand exactly in the center. The straightness of the headshaft, stuffing box shaft and coupling may be

checked by installing the top drive coupling, raising the impellers and turning the rotating assembly 180°. Then remove the top drive coupling and the shaft should remain in the center of the hollowshaft. Raise the complete pump assembly and without moving the shims, spread a layer of cement on the foundation. Then let the pump down until it rests in exactly the same position as before. Recheck position of top shaft. After cement sets tighten foundation bolts.

## CHECKING ROTATION

Have the motor wired and check rotation before installing the top drive coupling. Rotation must be counter-clockwise when looking at top of motor. (See arrow on pump head.) Motors with built-in non-reverse ratchet may be energized momentarily without injury to the ratchet assembly. If rotation is incorrect, reverse two leads on three phase motor. Refer to diagram on single phase motor.

## ADJUSTING IMPELLERS

Place top drive coupling over shaft and insert gib key. Tighten adjusting nut until impellers are raised off bowl seats and shaft just turns freely by hand. Then raise approximately one-half turn for each 100 feet of setting. It is better to raise more than necessary for starting and then make closer adjustment gradually. Install lock screw and tighten before starting pump. For maximum performance, impellers should be adjusted so that they run as close as possible and yet do not rub at maximum pressure. If there is any unusual noise or vibration, stop the pump and recheck impeller adjustment. A watt meter or ammeter may be used to obtain very close adjustment. If well may contain sand, raise impellers about twice normal amount when first starting pump and then readjust after well has cleared up. If the well does not produce sufficient water to supply the pump, the capacity of the pump should be reduced by raising the impellers.

## PRELUBRICATING AND STARTING PUMP

Before starting deep well pumps the Cutless Rubber bearings above the static water level must be prelubricated with water. Connect pre-lube tank to opening in stuffing box assembly with fittings provided and fill tank with clean water. Allow at least half the tank of water to run down the shaft before starting pump. Then leave valve open and allow pre-lube water to continue to flow until the water from the pump reaches the surface. Allow tank to refill before closing valve. On large pumps with deep static water level refill tank from another source to provide ample prelubrication while the pump is coming up to speed. If such pumps are to be operated manually, it may be more convenient to install a 30 or 50 gallon barrel for prelubrication.

Pumps discharging into pressure systems are normally prelubricated by connecting a line around the check valve and installing the globe valve in this line. A small "V" groove should be filed in the valve seat so that the valve cannot be closed accidentally. Four to five gallons of water per hour is generally sufficient

to keep the bearings moist and in condition for automatic operation. Where pumps operate frequently and the water level is less than 50 feet from the surface, the bearings will normally remain sufficiently moist for smooth starting without prelubrication. Where pumps are started infrequently or the amount of water available for prelubrication is limited or on large installations to be operated automatically an electric solenoid operated valve should be installed in the pre-lube line with a timing relay to delay the starting of the pump until the bearings have been properly lubricated.

A gate valve should be placed in the discharge line. Leave this valve about three quarter closed when the pump is started. After the water reaches the surface, open the valve slowly to avoid over pumping the well and to maintain normal discharge pressure on the pump. Check the stuffing box and tighten gland, if necessary, with a small wrench, until there is only a small trickle of water to keep the packing lubricated.

## LUBRICATION

### PUMP LINE SHAFT AND BOWL BEARINGS

On Fig. 4700 Water Lubricated Pumps all bearings below ground are lubricated by the water flowing through the pump. Prelubrication during the starting period should be provided where necessary as explained on Page 4.

The water level in the well should be checked occasionally while the pump is in operation. If the water level draws down below the bowls, additional column and shaft should be installed, or the capacity of the pump should be reduced by either raising the impellers or throttling the discharge. The pump must not be allowed to operate if the water level drops to the strainer and the pump breaks suction.

### STUFFING BOX

Apply a small amount of a good water resistant lubricant to the grease fitting on the stuffing box each time the pump is started or once a day if the pump is operated continuously. Special turbine stuffing box grease may be obtained from Deming Division, Crane Co. in 1 lb. cans. If necessary, an automotive water pump grease may be used.

### MOTOR WITH GREASE LUBRICATED BEARINGS (Lubricated at factory before shipment)

- A. Motor with grease fitting and drain plug in each bearing housing.

Once each six months or once a year, depending on operating conditions, the motor should be relubricated as follows:

1. Remove drain plug or grease ejector.
2. Apply pressure gun to grease fitting and inject new grease until all old grease has been forced out of the bearing through the grease drain. If a grease ejector is supplied, assist flushing of old grease by slowly working the

plunger back and forth several times to remove grease from the drain.

3. Run motor for approximately five minutes to relieve bearing of excess grease using ejector immediately upon starting to assist removal of grease from drain.
4. Replace drain plug or ejector.

- B. Motor with grease fitting only in each bearing housing.

Once each six months or once a year, depending upon operating conditions, add a small amount of grease. Then remove grease fitting and operate the motor about one-half hour before replacing the fitting to allow any excess grease to be expelled. The bearing may run warm (without injury) until the excess grease has been expelled. An approval motor bearing grease may be obtained from Deming Division, Crane Co., in 1 lb. cans.

### MOTOR WITH OIL LUBRICATED BEARINGS, BELT DRIVE OR FLEXIBLE COUPLING DRIVE (Fill with oil before starting)

Oil lubricated motors and drives are shipped without oil and should be filled with proper grade oil before starting. Check oil level once a week with pump idle. Change oil once a year or every 2000 hours operation, whichever occurs first. Change oil more frequently for continuous operation or under dusty conditions. For proper turbine oils refer to table. While special turbine motor oil is preferred, if necessary a SAE10 or SAE20 non-detergent pure paraffin base motor oil may be used temporarily.

### MOTOR WITH OIL LUBRICATED TOP BEARING AND GREASE LUBRICATED LOWER BEARING

(Fill top oil reservoir before starting. Lower bearing greased at factory.)

Relubricate according to instructions outlined above.

### RIGHT ANGLE DRIVE (Fill before starting)

Refer to manufacturer's instructions which usually recommend changing oil once a year or after 2000 hours of operation, whichever occurs first. Use only an approved turbine oil as recommended by the drive manufacturer; SAE automotive oils are Not satisfactory for Right Angle Drives.

### NOTE

See Page 6 for list of recommended oils and greases for motors.

## RECOMMENDED OILS AND GREASES FOR MOTORS

<u>Manufacturer</u>	<u>Trade Name of Grease</u>	<u>Trade Name of Oil</u>
Continental Oil Co.	Conoco Race Lube	Conoco Turbine Oil Light
Eso Standard Oil Co.	Andok Lubricant B	Teresso 43
Magnolia Petroleum Co.	Mobilux Grease #2	Mobil DTE 797
Shell Oil Company	Alvania Grease #2	Tellus 27
Socony-Mobil Oil	Mobilux Grease #2	Mobil DTE 797
Standard Oil of California	Chevron Industrial Grease, Medium	Chevron OC Turbine 9
Standard Oil of Ohio	Sohio #78 or Lubtec Grease	Sohivis 43
Sun Oil Company	Sun N-52X	Sunvis 916
The Texas Company	Regal Starfak #2	Regal A (R & O)
Tidewater Oil Co.	Veedol All-Purpose	Tycol Aturbrio 50

### CAUTION

Due to the high speed at which the smaller size units may operate, and since most of the pumping unit is underground, extreme care must be used in assembling and installing it and thoroughly checking the entire installation before it is put into operation.

If, after the well has been drilled and cased, it is crooked, the water supply is doubtful, the water level has dropped, or the water contains considerable sand, gravel or gas, the Crane Deming sales office from whom the unit was purchased should be consulted before it is started.

Under no circumstances will the Company guarantee the pump against the effects of corrosion, erosion or electrolytic action, those being entirely beyond the control of the Company.

In case any unusual vibration appears when starting the unit, or if vibration develops later, the unit should not be continued in operation, but Crane-Deming or authorized representative, should be requested to service the installation to place it in proper running condition.

If the above instructions are not followed or if the pump is operated without the proper submergence recommended by the Company, all guarantees are withdrawn and Crane-Deming will not assume any responsibility for the proper operation of the unit or the life of any of its parts.

Form 914



VALVES • PUMPS • FITTINGS • WATER TREATMENT

• CONTROLS • PLUMBING • HEATING

# DEMING PUMPS

CRANE CO. DEMING DIV., 884 SOUTH BROADWAY, SALEM, OHIO 44460



# INSTRUCTIONS

## **TRI/CLAD<sup>®</sup> VERTICAL INDUCTION MOTORS**

### HIGH THRUST, HOLLOW AND SOLID SHAFT, "P" BASE

### FRAMES C324-C405, D324-D405, K324-K405

### OPEN ENCLOSURES

#### INTRODUCTION

General Electric standard high-thrust vertical motors (Fig. 1) covered by these instructions are carefully constructed of high-quality materials and are designed to give long periods of trouble-free service when properly installed and maintained. They are of either hollow- or solid-shaft construction, and are generally used to drive pumps. Figure 2 shows a typical hollow-shaft motor. Figure 4 shows the alternate lower end furnished on some hollow-shaft motors. The solid-shaft construction is similar except that the top-half coupling is omitted, and the motor shaft extends out the bottom of the motor. This standard construction is for high continuous down-thrust and is good for momentary up-thrust only in the magnitude of 30 percent of the rated down-thrust.

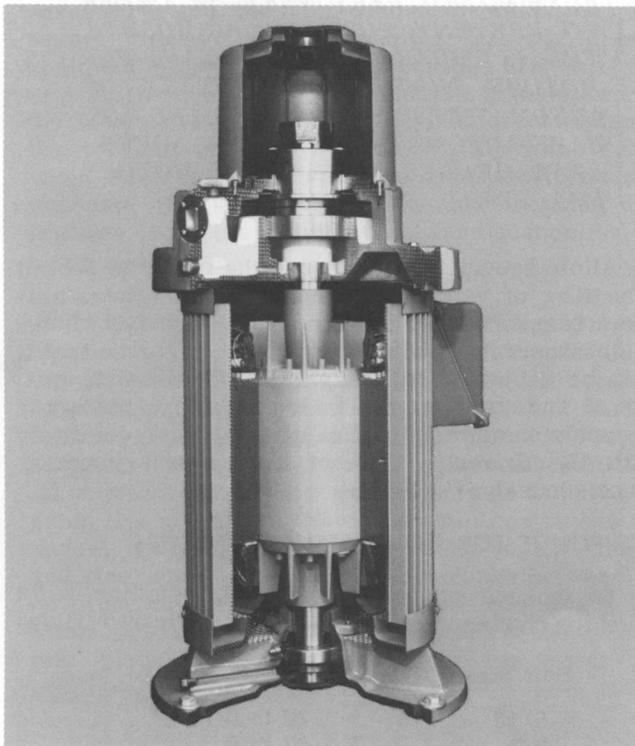


Fig. 1. Typical high-thrust induction motor

These motors may be supplied with bearing arrangements for various external thrust conditions imposed by the pump such as different magnitudes of down-thrust and either momentary or continuous up-thrust. Since overloading greatly reduces bearing life, the amount of thrust applied should not exceed the recommended values.

Motors driving pumps in pressure systems where the pressure is maintained after shutdown should be protected from overspeeding by check valves.

#### RECEIVING, HANDLING AND STORAGE

Each motor should be carefully examined upon arrival and any damage reported promptly to the carrier and to the nearest office of the General Electric Company.

**WARNING:** LIFTING DEVICES ARE NORMALLY INTENDED TO BE USED IN HANDLING THE MOTOR ONLY, AND ARE NOT INTENDED TO LIFT THE COMBINED WEIGHT OF THE MOTOR AND ITS CONNECTED LOAD. HOWEVER, IF A SPREADER BAR IS USED TO PROVIDE PARALLEL LIFTING FORCES IN LINE WITH THE AXIS OF THE MOTOR AND PRECAUTION IS USED TO AVOID SHOCK LOADING, CONNECTED LOADS NOT EXCEEDING 200 PERCENT OF THE MOTOR WEIGHT CAN NORMALLY BE SAFELY HANDLED WITH THE MOTOR LIFTING DEVICES.

If the motor is not to be installed immediately, it should be stored in a clean, dry location. Precautions should be taken to prevent the entrance of moisture, dust, or dirt during storage and installation. If the storage period is to exceed three months, the reservoirs of oil-lubricated bearing housings should be filled. It is suggested that such oil-filled motors be tagged in a fashion so as to be readily discernible in order to prevent mishandling, which would cause oil spillage and subsequent damage to the internal parts of the motor.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

GENERAL  ELECTRIC

## SAFETY PRECAUTIONS

### WARNING

High voltage and rotating parts can cause serious or fatal injury. The use of electric machinery, like all other utilization of concentrated power and rotating equipment, can be hazardous. Installation, operation, and maintenance of electric machinery should be performed by qualified personnel. Familiarization with NEMA Publication MG2, *Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators*, the National Electrical Code, and sound local practices is recommended.

For equipment covered by this instruction book, it is important to observe safety precautions to protect personnel from possible injury. Among the many considerations, personnel should be instructed to:

- avoid contact with energized circuits or rotating parts,
- avoid by-passing or rendering inoperative any safeguards or protective devices,
- avoid extended exposure in close proximity to machinery with high noise levels, and
- use proper care and procedures in handling, lifting, installing, operating and maintaining the equipment.

Safe maintenance practices with qualified personnel are imperative. Before initiating maintenance procedures, be sure that *all* power sources are disconnected from the machine and accessories to avoid electric shock. High potential insulation test for this equipment is not recommended; however, should it be required, procedures and precautions outlined in NEMA Standards MG-1 should be followed.

Failure to properly ground the frame of this machine may cause serious injury to personnel. Grounding should be in accordance with the National Electrical Code and consistent with sound local practice.

During storage, windings should be protected from excessive moisture absorption by some safe and reliable method of heating. Space heaters, if supplied, may be used for this purpose. The temperature of the windings should always be maintained a few degrees above the temperature of the surrounding air. It is recommended that motors in storage be inspected, the windings meggered, and a log of insulation resistance and temperature kept. Any significant decrease in insulation resistance should be investigated.

The oil and grease should be replaced at the end of the storage period per the Relubrication instructions on page 7.

If a motor is to be in storage for over one year, it is recommended that competent technical inspection service be contracted for, such as General Electric Installation and Service Engineering Department, to ensure that the storage has been adequate and that the motor is suitable for service.

### INSTALLATION

#### LOCATION AND MOUNTING

*WARNING: MOTORS SHOULD BE LOCATED IN A SUITABLE ENCLOSURE TO PREVENT ACCESS TO THE MOTOR BY CHILDREN OR OTHER UN-*

*AUTHORIZED PERSONNEL IN ORDER TO PREVENT POSSIBLE ACCIDENTS. THIS IS ESPECIALLY IMPORTANT FOR MOTORS THAT ARE REMOTELY OR AUTOMATICALLY CONTROLLED OR HAVE AUTOMATIC RE-SETTING OVER-LOAD RELAYS SINCE SUCH MOTORS MAY START UNEXPECTEDLY.*

Allow enough space around the motor to permit free flow of ventilating air and to maintain an ambient temperature not over 40°C. Where a choice of locations is possible, install the motor so that it will be subjected to the least amount of dirt, dust, liquid, and other harmful materials. Mount the motor securely on a level, firm foundation, align accurately with the driven equipment, and tighten mounting bolts securely.

#### COUPLINGS FOR HOLLOW-SHAFT MOTORS

To ensure proper functioning, coupling bolts must be tightened to torque values indicated below:

Bolt Size	Torque
5/16	20 lb ft
3/8	37 lb ft
1/2	90 lb ft
5/8	180 lb ft
3/4	320 lb ft
1	710 lb ft



**CAUTION:** *IT SHALL BE THE INSTALLER'S RESPONSIBILITY IN ALL CASES TO ASCERTAIN THAT THESE TORQUE VALUES HAVE BEEN ADHERED TO. THIS SHALL INCLUDE THOSE INSTANCES WHEN COUPLING COMES MOUNTED IN MOTOR. FAILURE TO COMPLY MAY RESULT IN COUPLING BOLTS SHEARING AND EXTENSIVE DAMAGE TO EQUIPMENT.*

Vertical hollow-shaft motors are designed for driving deep-well, turbine-type pumps and can be equipped with either self-release, bolted, or non-reverse couplings. The type of coupling is specified by the pump manufacturer. Remove the top cap to gain access to the coupling.

Two slots are provided in the outside rim of the coupling so that a bar can be inserted to keep the assembly from turning while the adjustment of pump impeller clearance is being made. A coupling bolt can be screwed into one of the extra tapped holes in the top end shield to provide a stop for the bar.

#### Self-release Coupling

Should the motor accidentally operate in the reverse direction, the pump line-shaft joints may unscrew. The self-release coupling (see Fig. 3) acts to limit the amount of this unscrewing. In normal operation, torque from the motor is transmitted by the lower-half coupling through the driving pins to the top-half coupling and thus to the pump shaft. When reversal occurs and the pump shaft starts to unscrew, the self-release top-half coupling disengages from the driving pins, thus uncoupling the pump and motor.

Proper functioning of the self-release coupling depends upon several factors. The pump shaft adjusting nut must be securely attached to the top-half coupling, and the top-half coupling must not bind on the lower half. Otherwise the adjusting nut lock screw may break instead of the coupling halves separating. As a result the motor would continue to drive the pump line shaft, and the joints would continue to unscrew. Serious damage may result to both motor and line shaft. To check the clearance between the coupling halves, place the top-half coupling in position prior to installing the motor. It should drop into place, and rest solidly on the lower-half coupling, without forcing.

Proper alignment of the pump head-shaft within the motor hollow shaft is also important. After the coupling releases, it no longer holds the pump shaft centered. If the alignment is not good, the motor shaft which is still rotating may rub the pump shaft which has stopped, and damage will result.

A third requirement is that the distance between the top of the pump shaft and the inside of the top cap be at least enough to allow the top-half coupling, when it releases, to clear the pins before the shaft hits the cap. Check this clearance after the adjusting nut has been drawn up to its final position. To facilitate making the check, the motor outline print shows a maximum dimension "XH" from the top of the coupling to the top of the shaft. Adhering to this design limit will allow the shaft and coupling to lift in order to clear the pins and still leave a small clearance between the shaft and cap. For standard motors, dimension "XH" is 4 1/2 inches for frames C, D, and K 324-326; and 3 1/2 inches for frames C, D, and K 364-405.

Depending upon the circumstances causing reversal and upon which line-shaft joint unscrews, there may be enough energy stored in the rotating parts, at the time the coupling clears the pins, to cause the pump shaft to continue to rise and strike the top cap. However, if the above conditions are met, damage, even in the most severe cases, should be limited to a broken cap.

It is expected that the self-release coupling will be called upon to operate only at infrequent intervals. Operation from the usual cause, application of single-phase power after an interruption, can be minimized by proper selection of control. When power is removed from the motor, the reverse flow of water through the pumps tends to cause reverse rotation or "back-spin." If single-phase power is applied during the back-spin, the motor will continue to run in the reverse direction. It will drive the pump and tend to unscrew the line-shaft joints. The selection of control which prevents automatic restarting after a power interruption or which employs a back-spin timer to delay restarting until the motor comes to rest will reduce the frequency of such occurrences.

#### Bolted Coupling

The bolted coupling allows up-thrust from the pump to be taken by the motor bearings. (See END-PLAY ADJUSTMENT under MAINTENANCE.) This coupling is similar to a self-release coupling except that the driving pins are replaced by bolts, which should be securely tightened to hold the two halves of the coupling solidly together. See torque requirements on page 2. This type of coupling does not have the self-release feature.

#### Non-reverse Coupling

The non-reverse coupling (see Fig. 2) is also a bolted type, and it keeps the pump and motor from

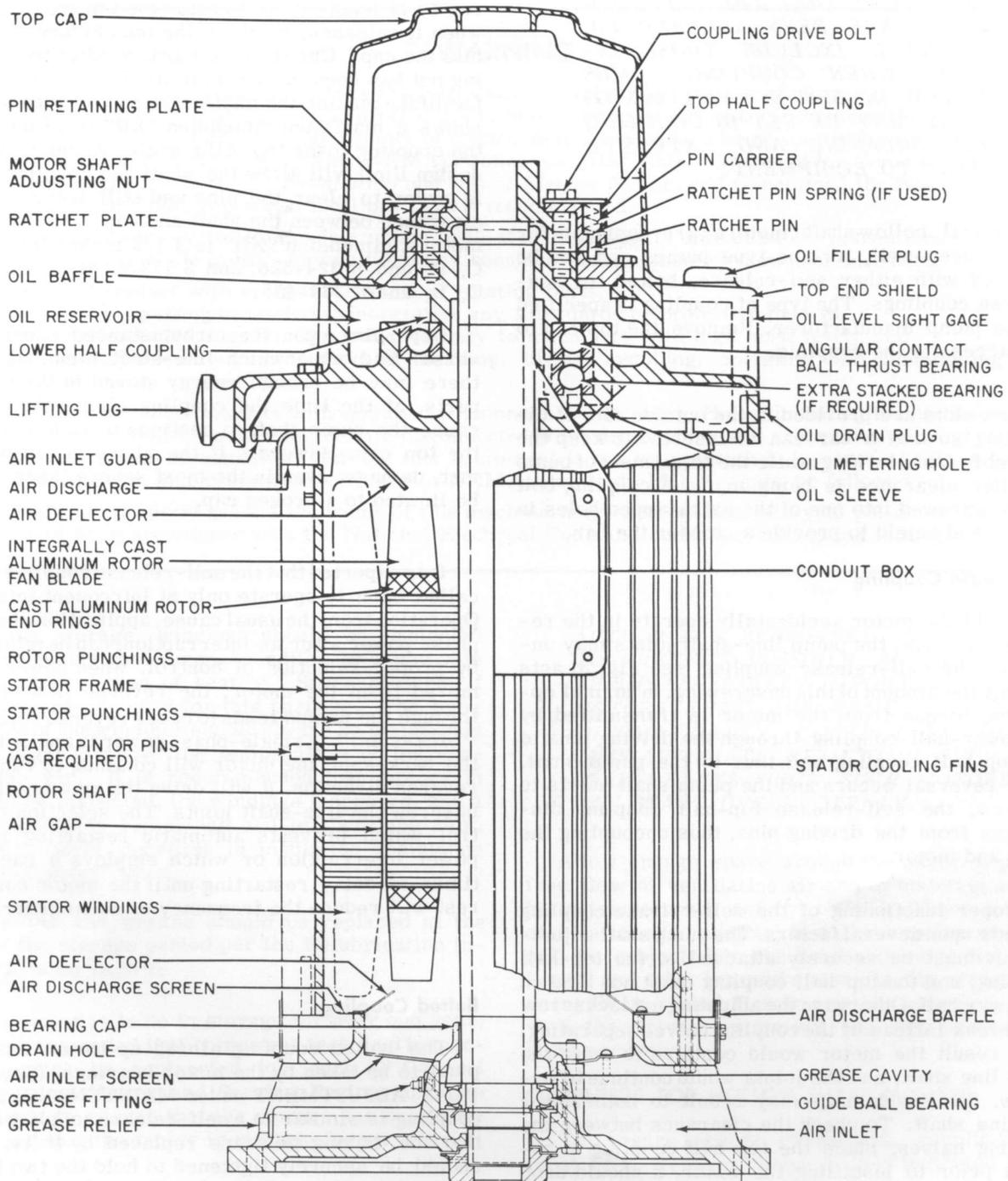


Fig. 2. Typical high-thrust, hollow-shaft motor with non-reverse coupling.

rotating in the reverse direction. Thus, it not only prevents the pump shaft from unscrewing, but it also prevents damage from overspeeding and damage to water-lubricated pump shaft bearings when, on shutdown, the falling water column tends to drive the pump in the reverse direction. In normal operation, motor torque is transmitted to the pump shaft through the two halves of the coupling which are bolted together. The ratchet pins are lifted by the ratchet teeth, and are held clear by centrifugal force and friction as the motor comes up to speed. When power is removed, the speed decreases, and the pins fall. At the instant of reversal, a pin will catch in a ratchet tooth and prevent backward rotation. The number of pins differs from the number of teeth to multiply the number of stopping positions.

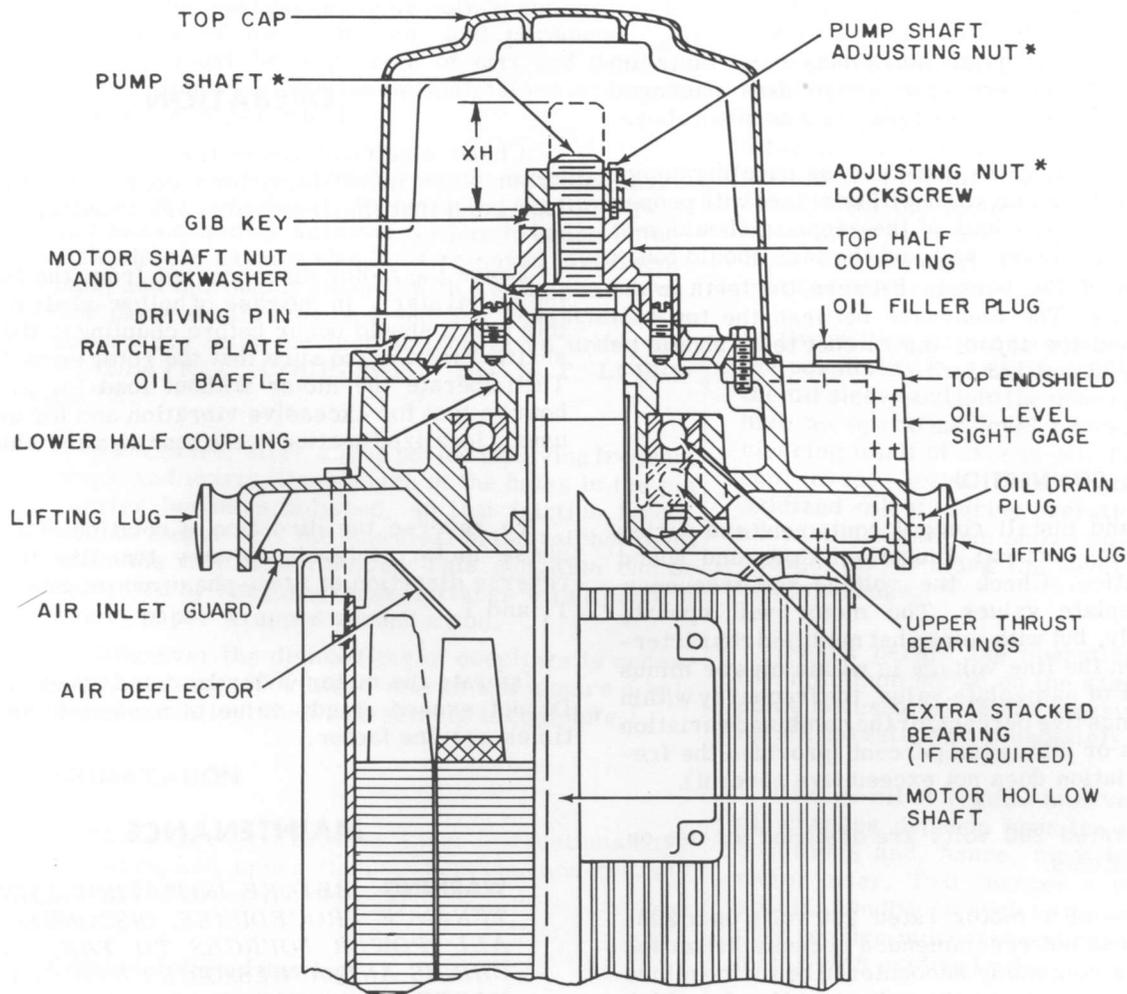
Too rapid a decrease in speed can result in inertia forces great enough to prevent the pins from drop-

ping. This condition is further aggravated when the pins become dirty, and their action sluggish. If the time from shutdown (the instant the stop button is pressed) to zero speed is greater than two seconds, operation will be satisfactory.

To permit operation, where stopping time is less than two seconds, the pins are spring-loaded. For those cases involving cycling (frequent starting and stopping) and stopping times greater than two seconds, the springs should be removed to decrease wear on the ratchet plate.

Pins and springs are made of heat-treated stainless steel.

A complete non-reverse top coupling, as shown in Fig. 2, consists of a self-release coupling plus



\* SUPPLIED BY PURCHASER

Fig. 3. Upper end of typical hollow-shaft motor with self-release coupling

a non-reverse assembly, which includes ratchet plate, pin carrier, pins, springs, pin retaining plate, and cap screws. A self-release or a bolted coupling can be converted to a non-reverse coupling without disturbing the adjustment of the pump shaft nut.

To make the conversion, remove the drive pins or bolts from the lower-half coupling. Make sure the ratchet plate is securely bolted in place.

Slide the pin carrier down over the top coupling, insert the pins, and set the pin retaining plate in place. Insert the long cap screws through the plate, pin carrier, and top coupling and into the lower coupling. Tighten them securely.

The retaining plate is secured to the pin carrier with small cap screws. These screws may need to be loosened when this assembly is placed over the top coupling in order to center the plate. Tighten these screws after the three larger bolts are secured.

Motors shipped from stock may have their top couplings and non-reverse assemblies packaged separately. They can be installed as described above.

When installing the non-reverse coupling do not use lubricant. Lubrication will interfere with proper operation. The top half of the coupling should seat solidly on the lower half and the pins should touch the bottom of the pockets between the teeth in the ratchet plate. The clearance between the top-half coupling and the top of the ratchet teeth should be between 1/32 and 1/8 inch.

### ELECTRICAL CONNECTIONS

Select and install control equipment and wiring according to National Electrical Code and sound local practice. Check the voltage and frequency with nameplate values. The motor will operate successfully, but with somewhat modified characteristics, when the line voltage is within plus or minus ten percent of nameplate value, the frequency within plus or minus five percent, or the combined variation within plus or minus ten percent (provided the frequency variation does not exceed five percent).

Motors rated 200 volts are designed for use on 208-volt systems.

Operation of a motor rated 230 volts on a 208-volt system is not recommended because utilization voltages are commonly encountered below the minus 10 percent tolerance on the voltage rating for which the motor is designed. Such operation will generally result in excessive overheating and serious reduction in torques. (National Electrical Manufacturers Association.)

### LUBRICATION

Motors with oil-lubricated bearings are shipped without oil. Before starting the motor, fill each reservoir to the standstill level shown on the sight gage. Use only the oil specified on the lubrication nameplate or the lubrication instructions supplied with each motor. Exercise care to keep dirt out of the lubricant and bearing housing. When filling for storage, fill to the maximum level shown on the gage. Before operating the motor, drain this oil and refill as instructed above.

All grease-lubricated bearing housings are packed with the proper amount of General Electric grease before leaving the factory and will not require regreasing until they have been in service for a time.

See instructions under MAINTENANCE for re-lubrication recommendations.

### OPERATION

Check electrical connections. Be sure that the drain plugs of oil-lubricated bearing housings are tight, and that the reservoirs are filled with oil.

Leave the motor disconnected from the load for the initial start. In the case of hollow-shaft motors, this check should occur before coupling to the pump shaft. First, make sure that the rotor turns freely. Then operate the motor without load for about an hour to test for excessive vibration and for any unusual, localized heating in the bearings and windings.

To reverse the direction of rotation of a three-phase motor, interchange any two line leads; to reverse direction of a two-phase motor, interchange  $T_1$  and  $T_3$ .

Operate the motor under load and check current. Do not exceed steady value of nameplate amperes times service factor.

### MAINTENANCE

**WARNING:** BEFORE INITIATING MAINTENANCE PROCEDURES, DISCONNECT ALL POWER SOURCES TO THE MACHINES AND ACCESSORIES AND COMPLETELY DISCHARGE ALL PARTS AND ACCESSORIES WHICH MAY RETAIN ELECTRIC CHARGE. FAILURE TO COMPLY MAY RESULT IN SEVERE PERSONAL INJURY OR DEATH.

## INSPECTION

A systematic inspection should be made at regular intervals, depending on service and operating conditions.

## CLEANLINESS

Keep both the interior and exterior of the motor free from dirt, oil, and grease. Open motors should be kept dry and, if operating in dirty places, they should be disassembled periodically and thoroughly cleaned.

Motors may be blown out with dry, compressed air of moderate pressure. However, cleaning by suction is preferred due to the possibility of water in the compressed air lines and the danger of blowing metal chips into the insulation with compressed air.

Screens and covers are provided as necessary for protection of the equipment and personnel. All screens must be kept free of dirt and debris to ensure proper ventilation and maintained in place for protection of personnel.

The condition of the non-reverse coupling should be checked periodically by removing the top cap. If dirt has caused the action of the pins to become sluggish, the pin carrier should be removed, disassembled, and thoroughly cleaned with a suitable solvent. The parts should then be dried and reassembled in accordance with the instructions given under INSTALLATION, COUPLINGS. DO NOT LUBRICATE.

Sometimes, after a long period involving frequent stops and starts, the surface of the holes in the pin carrier becomes polished, so that friction forces will no longer hold the pins clear of the ratchet teeth when the motor is running. This condition can be remedied by roughing these surfaces with a piece of emery paper wrapped around a rod.

Whenever the dismantling of couplings is necessary, the use of witness marks will assure a balanced condition when reassembly is complete.

## RELUBRICATION

The motors covered by these instructions have oil-lubricated upper (thrust) bearings and grease-lubricated lower (guide) bearings.

### Grease-lubricated Bearings

The housings of grease-lubricated bearings are packed at the factory with long-life grease. The oil in this grease will ultimately become depleted, and it will be necessary to regrease at an interval dictated by the severity of service.

Since under normal conditions guide bearings in vertical motors carry relatively light loads, the initial grease pack will usually last for many years. Then a small amount of grease can be added through the fitting located in the lower bearing cap.

Whenever the motor is disassembled for general cleaning and reconditioning, clean the housing of old grease with a suitable solvent and dry thoroughly. Refer to the mixture described under "Insulation Care." Pack the cavity above the bearing with new grease until approximately two-thirds full before reassembling.

For best results use GE long-life grease (No. D6A2C5) and take care to exclude dirt from the bearing housing and lubricant.

### Oil-lubricated Bearings

Maintain proper lubrication by checking the oil level periodically and adding oil when necessary. Because of the initial clearing action of the bearing and the expansion of the oil as it comes up to operating temperature, the oil level will be higher after the motor has been in operation for a while than it is with the motor at standstill. The normal level, with the motor stopped and the oil cold, is one-eighth inch below the center of the sight gage. Both the standstill level and operating range are marked on the gage.

Overfilling should be avoided not only because of the possibility that expansion may force the oil over the oil sleeve and into the motor, but also because too high an operating level prevents the bearing from clearing itself of excess oil. The resultant churning can cause extra loss, high temperatures, and oxidized oil. If, during operation, the oil level goes above the maximum shown on the sight gage, drain enough oil to bring the level back within the operating range.

Do not permit the operating level to fall below the minimum shown on the gage. Should it ever become necessary to add excessive amounts of make-up oil, investigate immediately for oil leaks.

Change oil at regular intervals. The time between oil changes depends upon the severity of operating conditions and, hence, must be determined by the motor user. Two changes a year is average, but special conditions such as high ambient temperature may require more frequent changes. Avoid operating motor with oxidized oil.

Select the proper grade of oil from the lubrication nameplate or the special lubrication instructions which accompany each motor. A good grade, oxidation-corrosion inhibited turbine oil having a viscosity of 150 SUS at 100 F and 45 SUS at 210 F is usually

specified for ball bearings and is covered by GE Specification D6B6A. A tag attached to the motor lists specific recommendations.

Operation in ambient temperatures that are near or below freezing may require preheating the oil or the use of a special oil.

Oil-lubricated bearing housings are provided with a settling chamber in which dust, dirt, and sludge collect. Unless the oil has been permitted to oxidize, the draining of the old oil during regular changes will usually provide sufficient cleaning action.

Whenever the motor is disassembled for general cleaning and reconditioning, the bearing housing may be washed out with a suitable cleaning solvent. Refer to the mixture described under "Insulation Care." Be sure that the oil metering hole is clear, and then dry the housing thoroughly before reassembly.

### END-SHIELD ASSEMBLY

Add a thin coating of a non-conducting grease on end-shield rabbet and to threads of end-shield cap screws when assembling end shields to the aluminum frame. (GE Grease D6A2C5 is excellent for this purpose.)

### END-PLAY ADJUSTMENT

Standard high-thrust motors are designed to withstand only momentary up-thrust. This up-thrust, which can exist for a few seconds during starting, is taken by the guide bearing. To prevent the thrust bearing from losing radial stability during this time, the motor end-play is limited to a small amount by adjusting the motor shaft nut. This adjustment is made at the factory and need not be disturbed on a new motor. However, should the motor be disassembled for any reason, the adjustment must be made upon reassembly to avoid damaging the bearings. The procedure depends upon the type of thrust bearing.

Refer to Fig. 2. When the motor shaft nut is tightened, the rotor, shaft, and lower bearing are drawn up until the outer ring of the lower bearing bears against its cover. Note that the shoulder on the shaft under the lower-half coupling is purposely located so that the coupling does not seat against it. Further tightening of the nut preloads the bearings.

The best way to position the nut is by trial, using an indicator between the lower-half coupling and top end shield, and lifting the rotor to check the end-play after each setting of the nut until between 0.002 and 0.005 inch is obtained. The nut should then be locked with its lockwasher.

If equipment is not available to use this method, the following procedure may be employed. Tighten the motor shaft nut carefully until all end-play is removed and the rotor just fails to turn freely. Then back the nut off one-sixth turn and lock with its washer. An assembly nameplate giving this information is mounted on the motor.

Motors which must withstand continuous up-thrust have a somewhat different construction. The upper (thrust) bearing is arranged to take this up-thrust, and it consists of angular-contact thrust bearings arranged for face-to-face (DF) mounting. (See Fig. 5.) The inner rings are locked on the lower-half coupling with a nut and the outer rings are clamped in the end shield with a ring.

The shaft shoulder under the lower-half coupling is so located that the coupling seats on it before the lower bearing comes up against its cover. No special adjustment is necessary when reassembling this type of motor, and the motor shaft nut can be pulled down tight and locked. The end-play of motors using DF-mounted bearings will then be very small.

### BEARING REPLACEMENT

Replacement bearings should be of the same type and installed in the same relative position as the original bearings.

When removing bearings, apply steady, even pressure parallel to the shaft or lower-half coupling and at a right angle to the bearing. Apply this pressure to the inner race whenever possible. Angular-contact bearings which have failed, and are especially tight on the coupling, will sometimes yield to the following procedure. Separate the bearing by forcing the outer race over the balls. Then with a torch apply quick heat to the inner race while also applying pulling pressure.

Angular-contact bearings which are to be stacked together should have their high points of eccentricity (indicated by a burnished spot on the inner race) lined up. All bearings should be of same manufacture and of the type that permits stacking.

Some motors are supplied with removable spacer rings under the outer race of the thrust bearing so that the thrust capacity can be increased by adding an extra bearing or bearings. When these bearings are installed, the high points of eccentricity should be lined up with the keyway in the lower-half coupling. If the original bearings have been in service, they should be replaced at the time this conversion is made.

### INSULATION CARE

Whenever the motor is disassembled, the windings should be given a thorough inspection and the in-

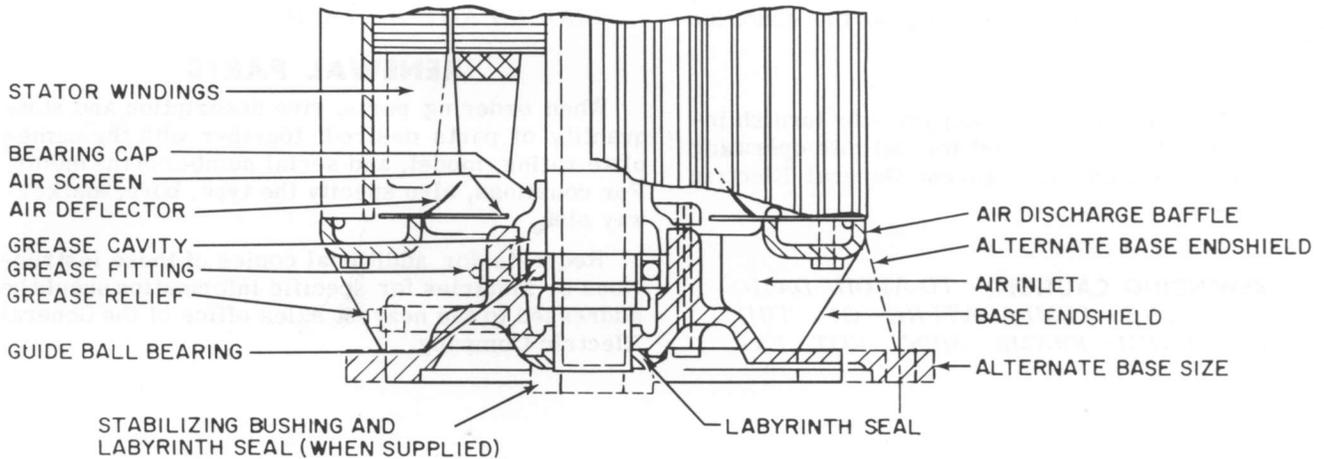


Fig. 4. Alternate lower end on some vertical hollow-shaft motors.

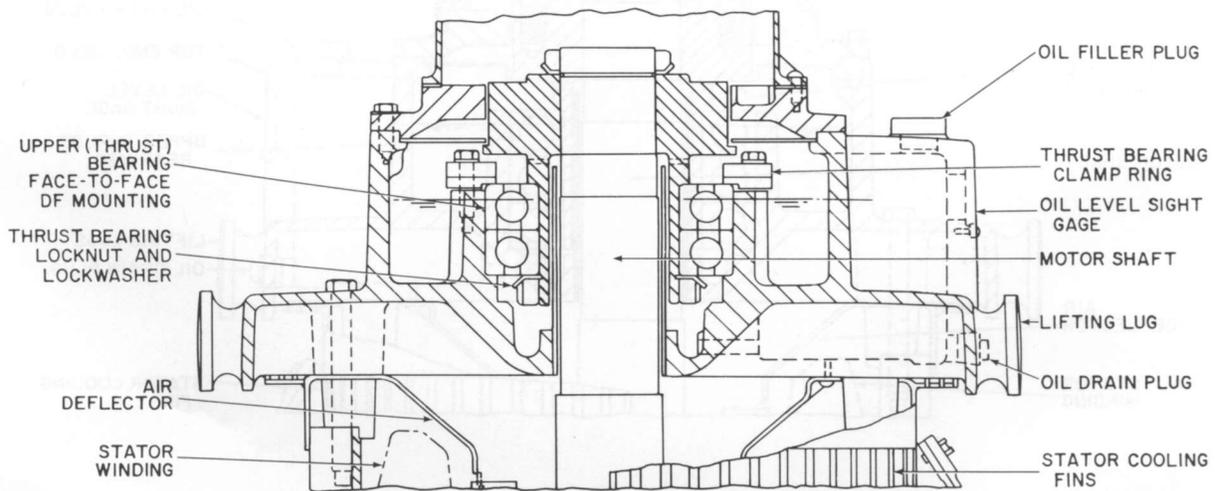


Fig. 5. Upper end of a typical solid-shaft motor which must withstand continuous up-thrust with DF-mounted bearings. Available on 364 frames and above.

sulation cleaned, if necessary, using a cloth or brush wet with a suitable cleaning solvent.

The cleaning fluid used to clean the coils must have grease-dissolving properties, but must not affect the electric insulation or varnish. Many cleaning fluids in common use, which are suitable with respect to the foregoing, may be extremely hazardous because of their toxicity, inflammability, or both. The following mixture is a suitable solvent for cleaning windings, bearings, and the bearing housing:

- 25 percent methylene-chloride (if unavailable, trichlorethylene may be substituted)
- 70 percent Stoddard solvent (petroleum spirits)
- 5 percent perchlorethylene

**WARNING:** WHEN USING THE ABOVE CLEANING FLUID, THE AREA MUST BE WELL VENTILATED AND SMOKING OR OPEN FLAMES PROHIBITED. FAILURE TO COMPLY CAN RESULT IN PERSONAL INJURY OR DEATH.

For best results, the windings should then be varnished with an air-drying varnish. More than one coat may be required, depending on the condition of the winding.

The General Electric Company can furnish insulating varnish best suited for definite operating conditions. Consult the nearest General Electric sales office.

**REWINDING CAUTION:** TO AVOID DAMAGE, THE TEMPERATURE OF THE ALUMINUM FRAME MUST NOT EX-

CEED 200C DURING THE STRIPPING OR BAKING PROCESS. AN OPEN FLAME SHOULD NOT BE USED.

### RENEWAL PARTS

When ordering parts, give description and state quantity of parts desired, together with the name-plate rating, model, and serial number of the motor. For couplings, also specify the type, bore, and key-way size.

Requests for additional copies of these instructions or inquiries for specific information should be addressed to the nearest sales office of the General Electric Company.

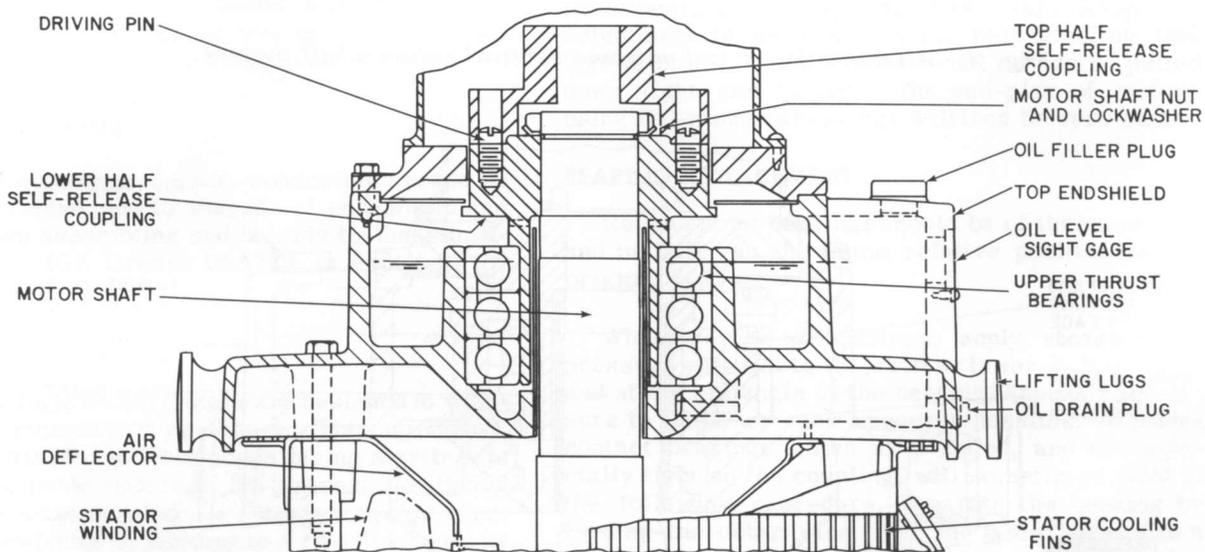


Fig. 6. Alternate end-shield construction for extra-thrust capacity on Frames 364 through 405.

GENERAL ELECTRIC COMPANY  
MILWAUKEE, WISCONSIN  
SAN JOSE, CALIFORNIA

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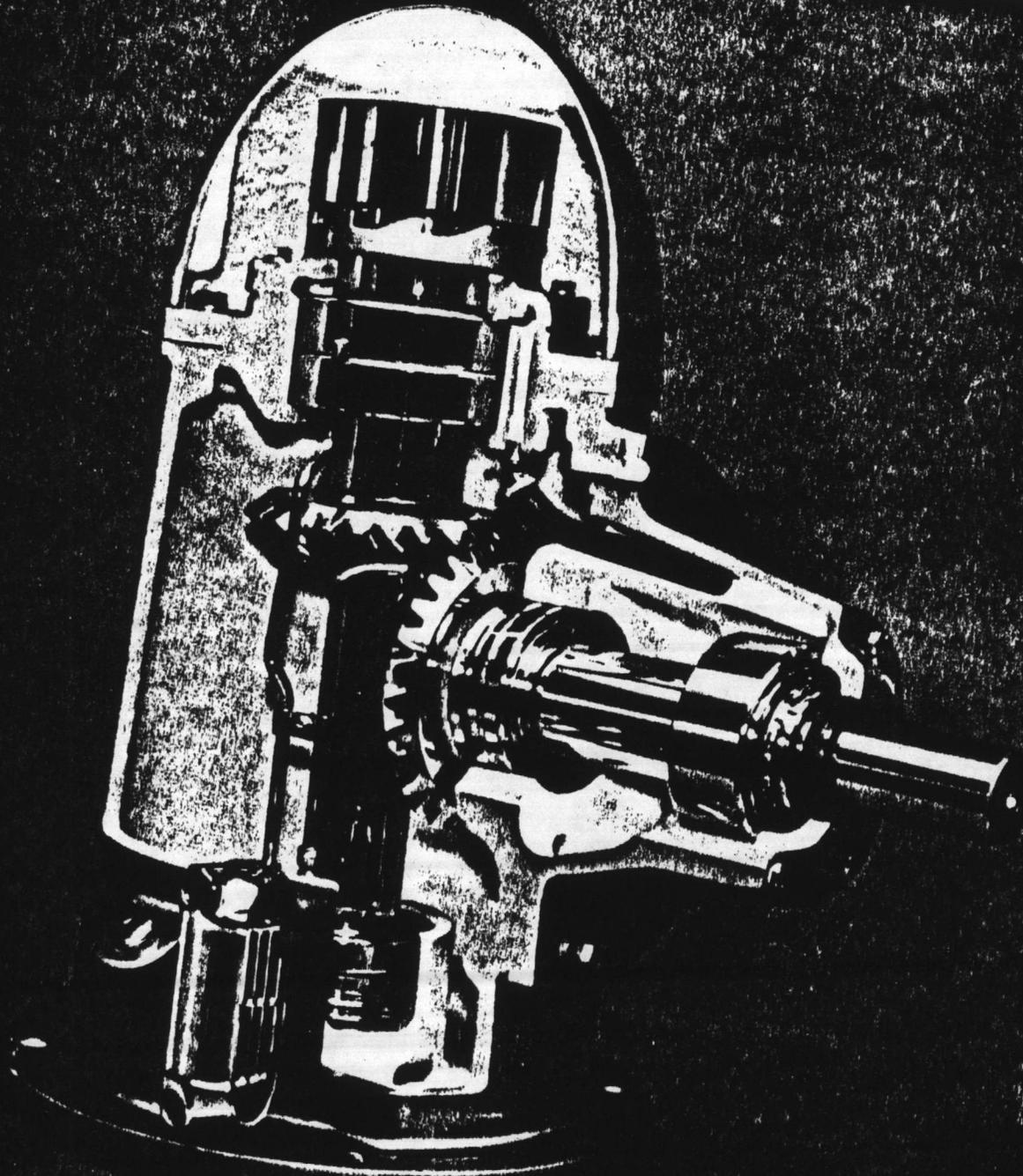
GENERAL ELECTRIC COMPANY  
VERTICAL MOTOR PRODUCTS SECTION  
SAN JOSE MOTOR PLANT  
SAN JOSE, CALIFORNIA 95114

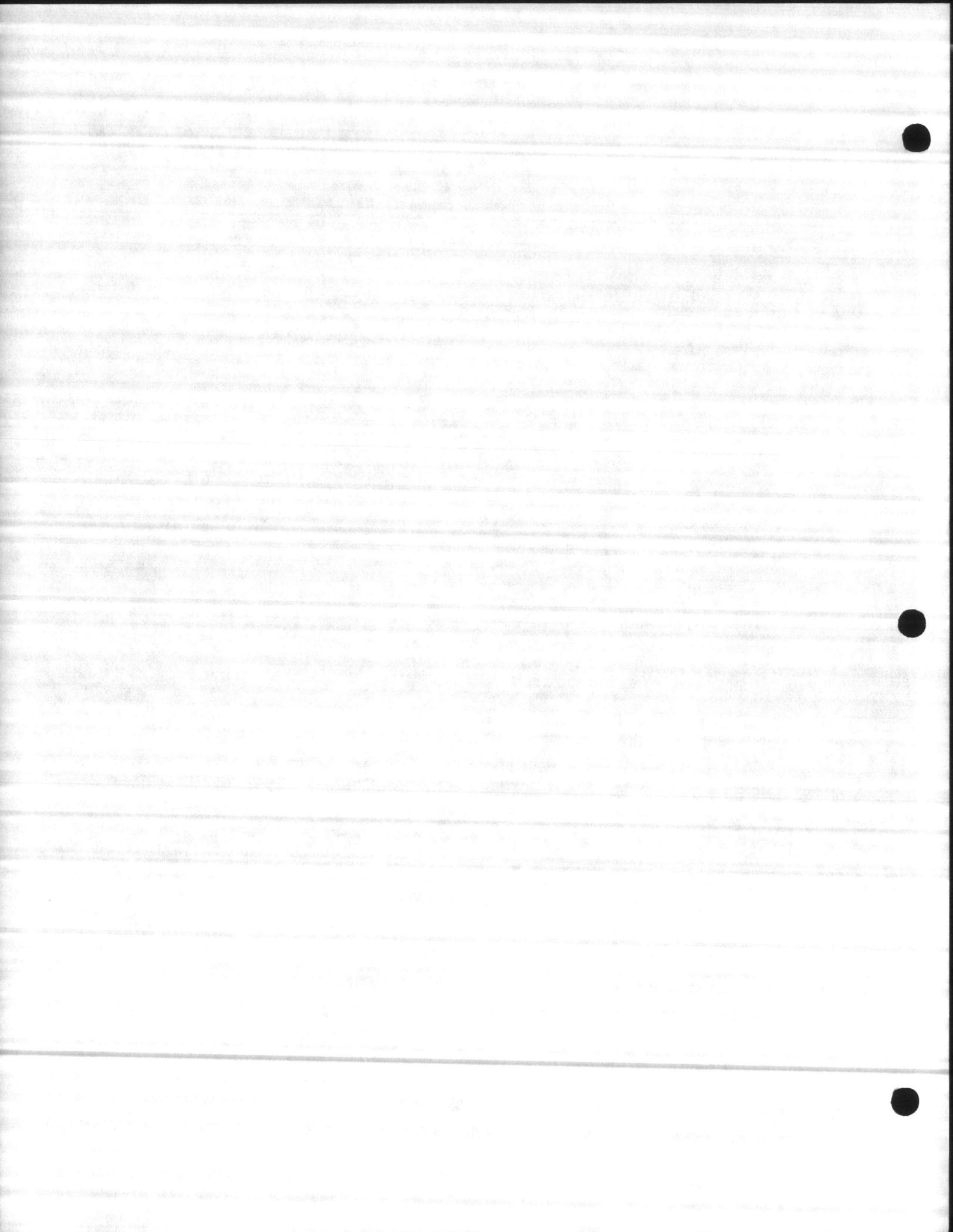
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GENERAL  ELECTRIC

# JOHNSON GEAR

Right angle drives for irrigation, industrial, and municipal pumping service





# Johnson Right Angle Gear Drive

These features mean continuous on-stream performance,  
low maintenance and dependability

**NON-REVERSE  
COUPLING,**  
standard on hollow-  
shaft drives

high tensile strength  
cast iron **HOUSING**

quick visual inspection  
of gear lubrication with  
**OIL SIGHT WINDOW**  
(not shown)

**HOLLOW OR SOLID  
SHAFT**

externally mounted **OIL  
COOLER** with top and  
bottom cooling water  
connections

weatherproof light weight  
**COVER**

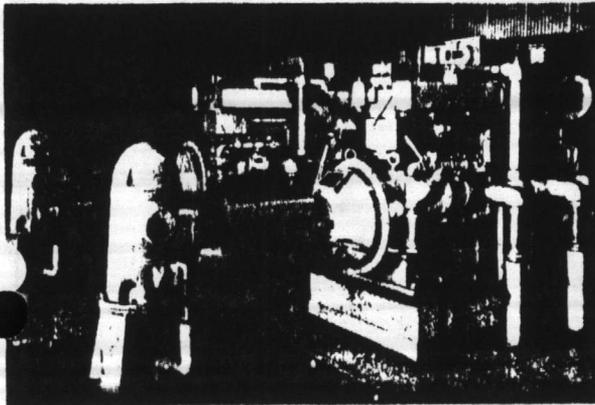
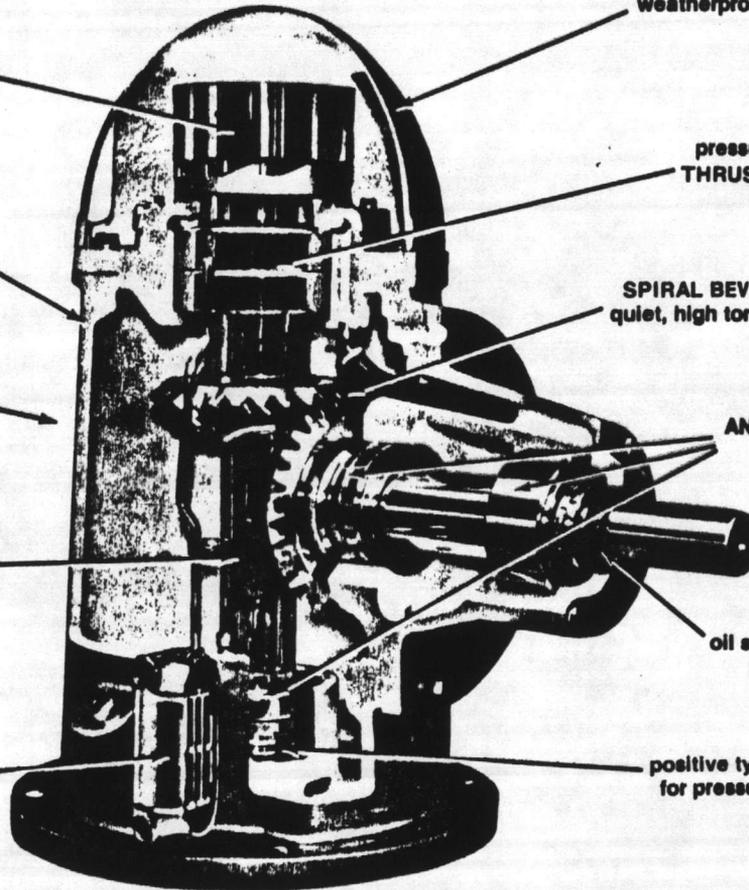
pressure-lubricated  
**THRUST BEARINGS**

**SPIRAL BEVEL GEARS** for  
quiet, high torque operation

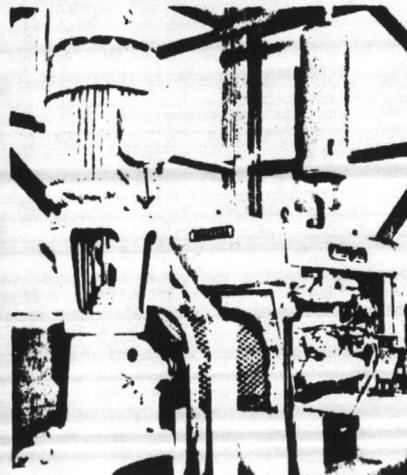
**ANTI-FRICTION  
BEARINGS**

oil seal protection  
by **SLINGERS**

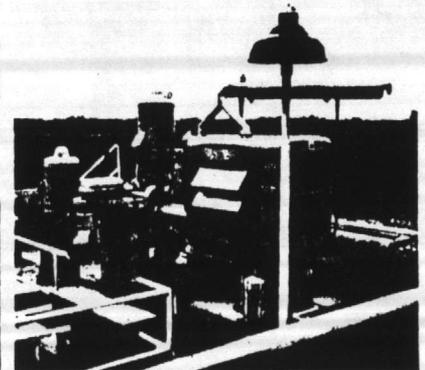
positive type **OIL PUMP**  
for pressure lubrication  
of bearings



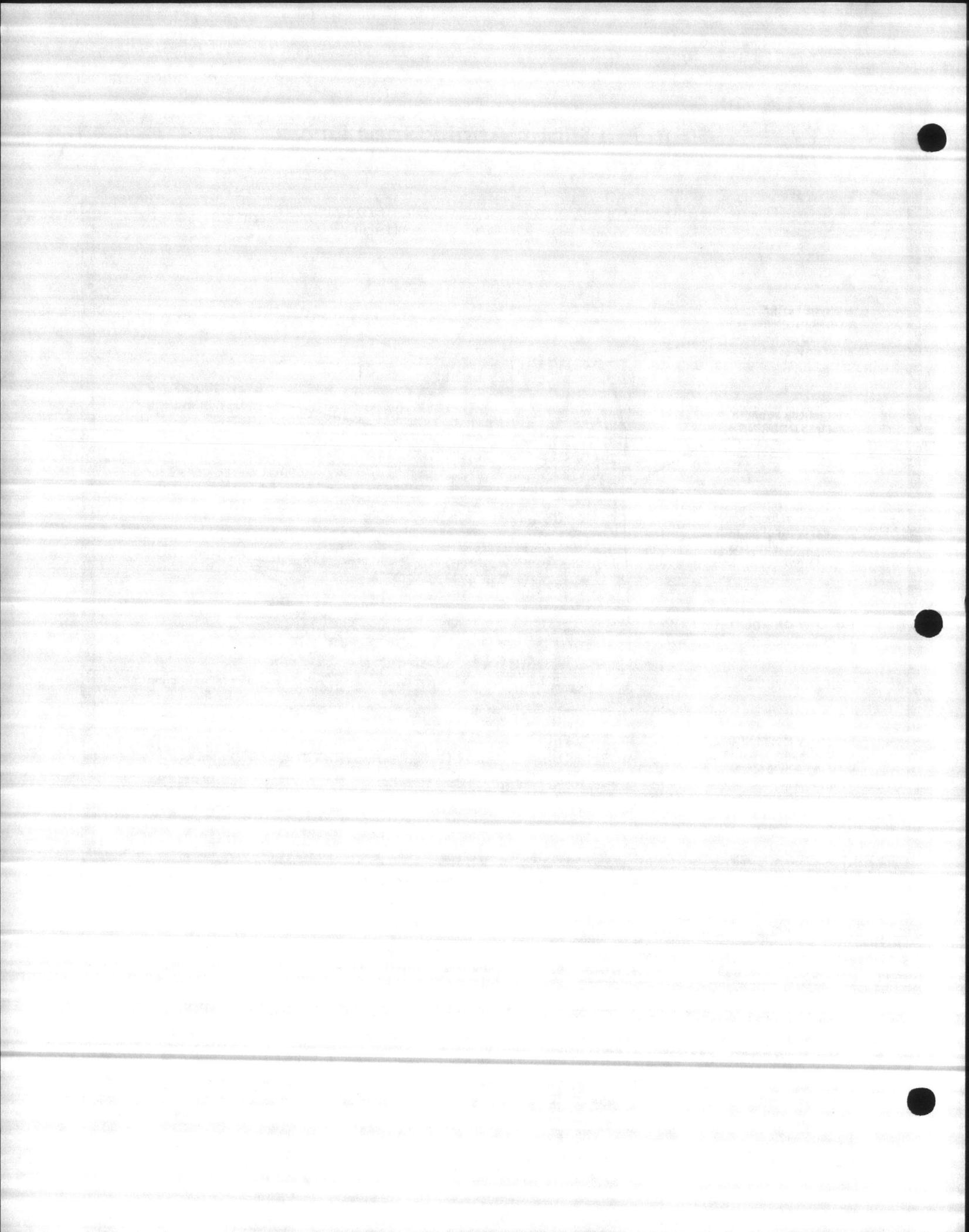
Standard right angle gear drive



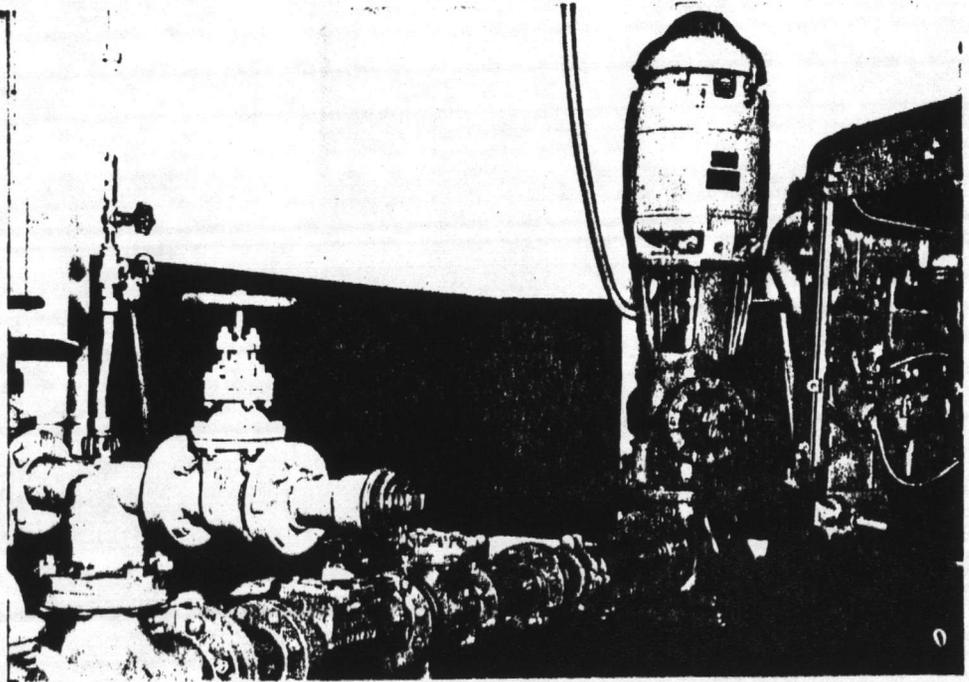
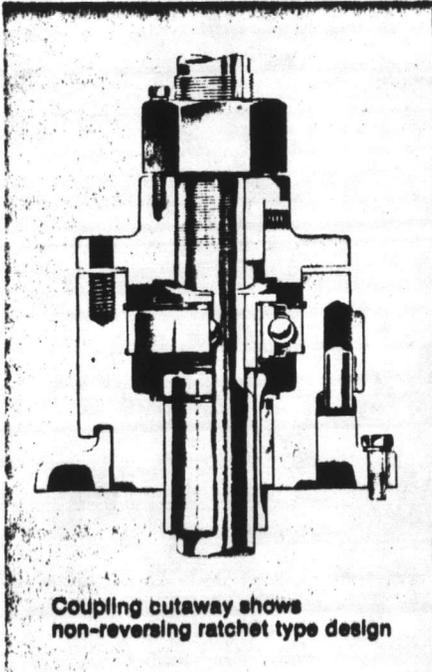
Combination Drive



Redi-Torq gear drive



## Combination Drives



**Fast changeover prevents costly downtime in emergencies**

The Combination Drive—widely preferred by municipalities, waterworks corporations, and those responsible for fire and flood protection—provides pumping assurance when emergencies occur. Either a motor or a mechanical power unit can drive the pump to prevent costly service interruptions. When one of the driving units is down the pump can be operated by the other.

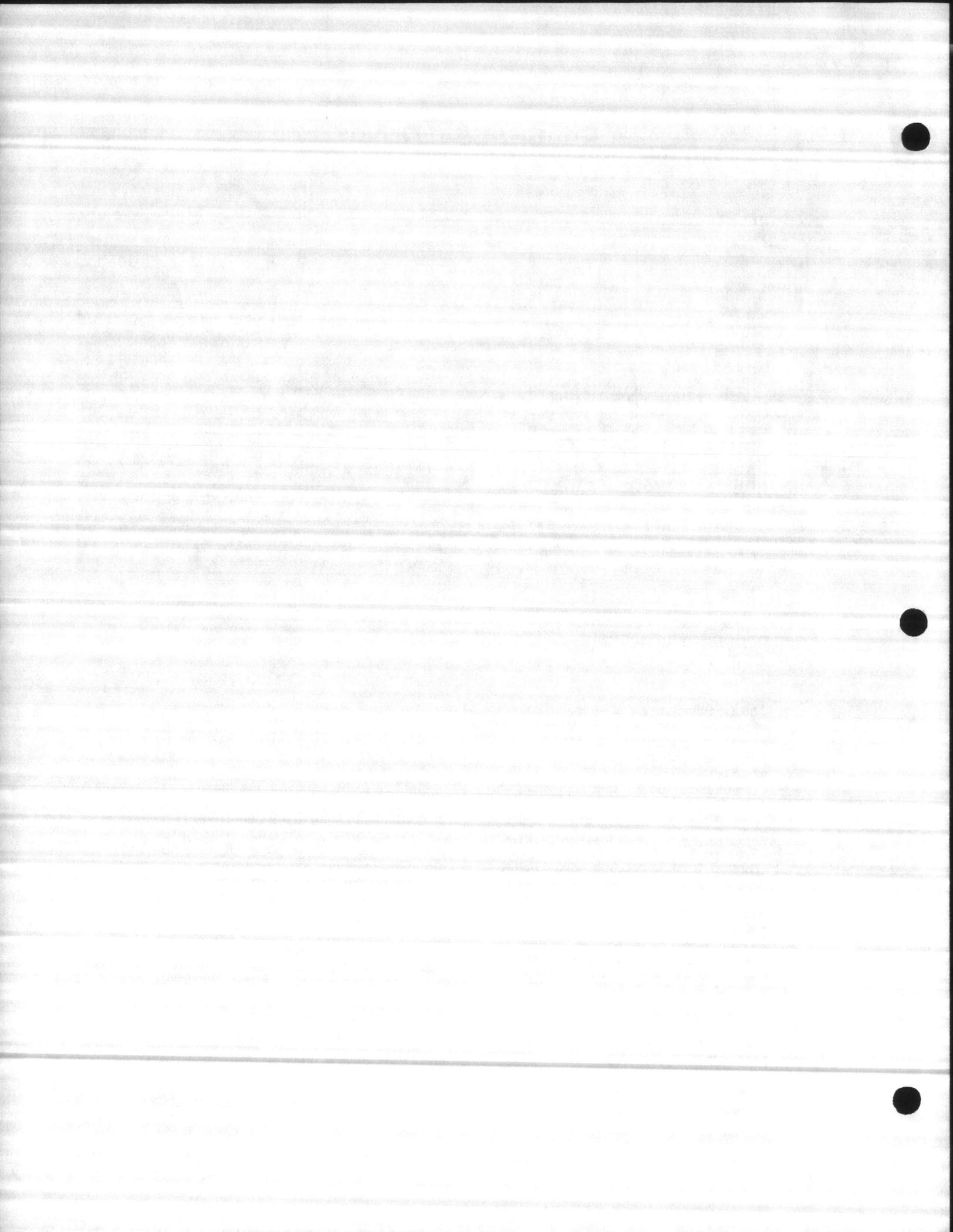
**Hollow-Shaft Motor.** In a normal hollow-shaft motor application either a through-shaft or a coupling and shaft combination can be used between the electric motor and the right angle gear drive. When the electric motor is doing the driving, the upper half of the gear drive coupling is free to rotate with the pump headshaft and the gears do not revolve. In case of electric motor or power failure the pump can be driven by a mechanical power unit by simply installing stainless steel bolts, supplied with the gear drive.

The improved coupling design gives better protection to the sealed steady bearing and eliminates the possibility of accidental engagement.

**Thrust Load Transfer.** If the electric motor has to be removed, the thrust load of the pump can be transferred from the motor thrust bearing to the gear drive. This simply requires adjusting a nut on the pump headshaft to bring the pump impellers to the proper setting.

**Solid-Shaft Motor.** With this type of motor the gear drive carries the thrust load of the pump. The gears revolve when either the electric motor or horizontal drive unit is being used. The recommendation is to use a standard over-running clutch coupling between the engine and the gear drive, and a flexible coupling between the electric motor and the gear drive. (See page 9 for dimensions.)

For various combination drive arrangements consult the factory.



# Thrust Capacity

## Hollow Shaft Drives

Large capacity thrust bearings are provided to handle a wide range of pump equipment and heads of water. In most instances, the natural thrust of the gears is used to reduce the load on the bearings. This condition necessitates a minimum downthrust requirement to prevent a bearing separation. Unless otherwise specified, Johnson Gear drive units are furnished with a thrust bearing arrangement DT. Ratings shown in the STANDARD column apply.

When there are conditions of sustained upthrust or the minimum downthrust is not available in the installation, other bearing arrangements can be furnished. The TWO-WAY column shows the ratings for bearing arrangement DF. Upthrust and downthrust can be accommodated with this configuration.

When the downthrust exceeds the values of the STANDARD column, select a suitable size from the HEAVY THRUST column. These ratings are for bearing arrangement DT/DT.

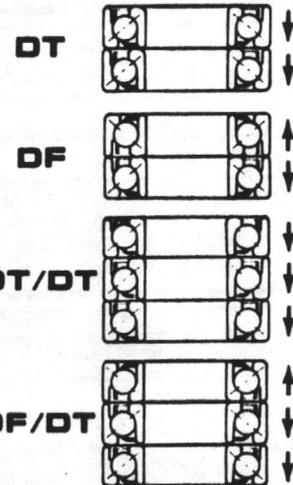
The heavy duty model can also be furnished with bearing arrangement of DF/DT. The downthrust ratings are taken from the STANDARD column. The upthrust ratings are taken from the TWO-WAY column.

## Other Drives

Ratings for Combination, Solid Shaft, and Redi-Torq® drives are taken from the TWO-WAY column. Consult the factory when there are conditions not covered by the following table.

## Bearing

### Arrangements



**Table 2. THRUST CAPACITY (in pounds)**

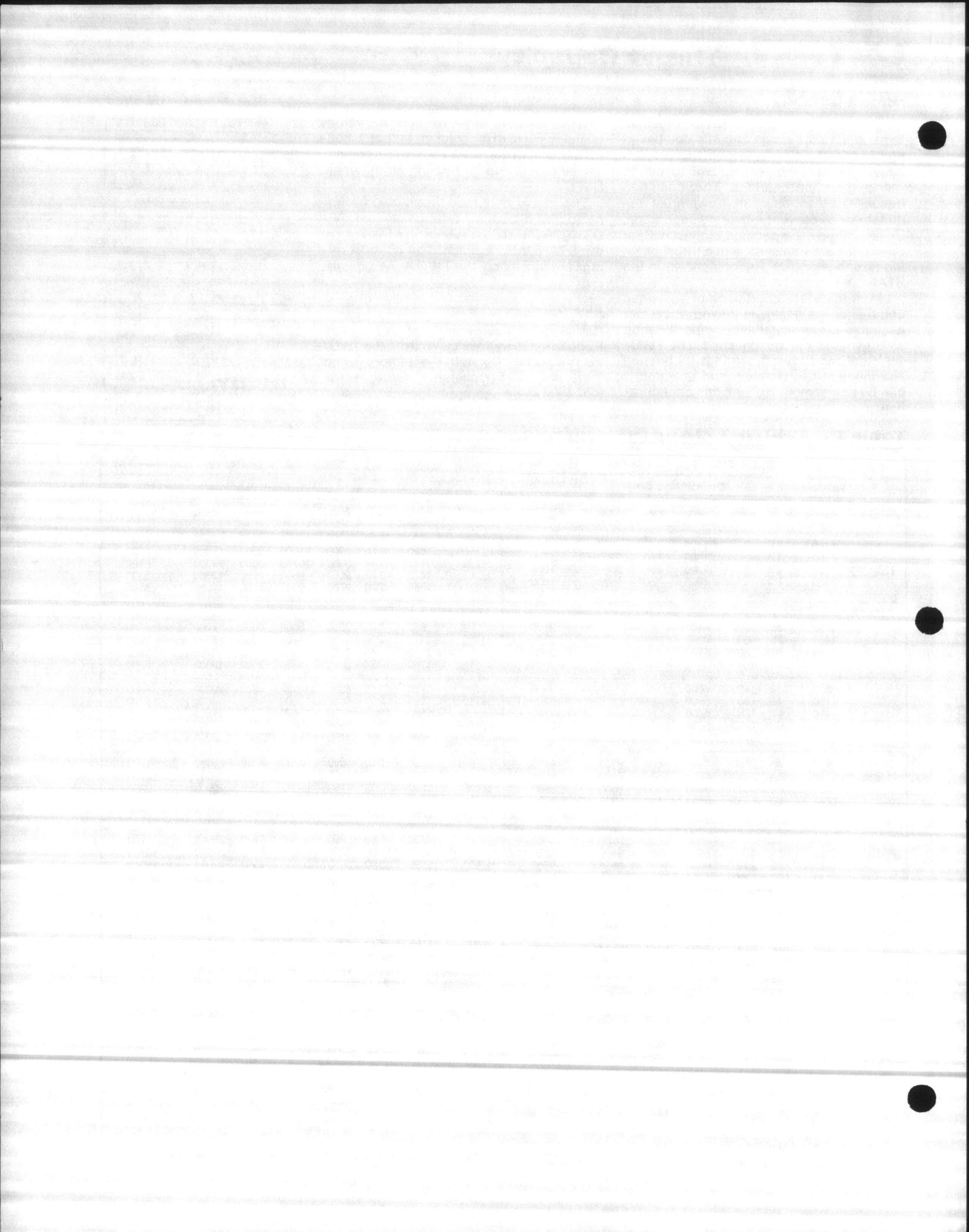
Model	Vertical Shaft RPM	H.P.	Standard		Heavy		Two-Way		Model	Vertical Shaft RPM	H.P.	Standard		Heavy		Two-Way		
			Downthrust Only		Downthrust Only		Downthrust or Upthrust Max.					Downthrust Only		Downthrust Only		Downthrust or Upthrust Max.		
			Min.	Max.	Min.	Max.						Min.	Max.	Min.	Max.			
H200	1160	15		1400	750	2300	1400	H200	720	100	3600	12000	3400	16200	8750			
	1460	17		1300	750	2200	1300		860	116	3300	11000	3200	15300	8300			
	1760	20		1200	750	2000	1200		1160	144	3050	10200	3000	14300	5700			
	3460	30		1000	750	1600	1000		1460	172	2850	9500	2850	13500	5300			
H40	1160	30	900	4400			2600	H280	720	140	3750	13700	3750	18800	8200			
	1460	35	850	4200			2500		860	162	3550	13000	3600	17900	7800			
	1760	40	800	4000			2400		1160	202	3350	12200	3350	16700	7300			
									1460	241	3150	11500	3150	15700	6900			
H80	860	34	1450	6000			3600	H350	720	175	4250	16300	4200	20000	9800			
	1160	43	1300	5500			3300		860	203	4050	15500	4000	19000	9300			
	1460	52	1250	5200			3100		1160	252	3750	14400	3750	17800	8600			
	1760	60	1200	5000			3000		1460	301	3550	13600	3500	16700	8200			
H80	860	46	2050	7400	1500	9700	4400	H425	720	213	4650	18700	4750	25000	11200			
	1160	58	1950	6900	1500	9100	4100		860	246	4450	17900	4550	24000	10700			
	1460	69	1800	6400	1500	8300	3800		1160	306	4150	16600	4200	22000	10000			
	1760	80	1700	6000	1500	8000	3000		1460	366	3900	15700	4000	21000	9400			
H110	860	63	2350	7400	1800	9700	4400	H500	720	250	5250	18700	5250	25000	11200			
	1160	80	2200	6900	1800	9100	4100		860	290	5000	17900	5050	24000	10700			
	1460	95	2050	6400	1800	8500	3800		1160	360	4650	16600	4600	22000	10000			
	1760	110	1900	6000	1800	8000	3000		1460	430	4400	15700	4400	21000	9400			
H125	720	63	2900	8500	2800	12200	5100	H600	720	300	5500	20000	5450	26000	12000			
	860	72	2700	8000	2650	11600	4800		860	348	5200	19000	5250	25000	11400			
	1160	90	2550	7500	2500	10800	4500		1160	432	4900	17800	4850	23000	10700			
	1460	108	2400	7000	2300	10100	4200		1460	518	4600	16700	4600	22000	10000			
H150	720	75	3050	9800	3150	15000	5900	H750	720	375	6200	20000	6250	26000	12000			
	860	87	2950	9400	3000	14300	5600		860	435	5900	19000	6000	25000	11400			
	1160	108	2750	8800	2800	13300	5300		1160	540	5500	17800	5500	23000	10700			
	1460	129	2600	8300	2600	12500	5000		1460	645	5200	16700	5300	22000	10000			
	1760	150	2500	8000	2500	12000	4800		1760	750	5000	16000	5000	21000	9600			

Ratings shown are for fig. 1, rotation only. Consult factory for other figure ratings.

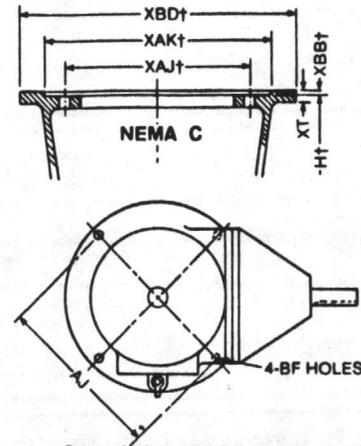
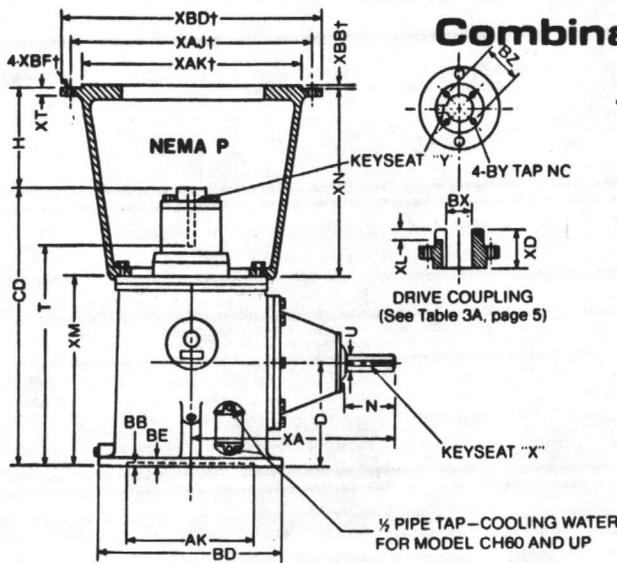
**Table 2A. HORSEPOWER AND THRUST BEARING RATINGS**

Vertical Shaft RPM	430	580	690	720	860	960	1160	1460	1760	2000*	2200*	2400*	2800*	3000*	3520*
% of HP at 1760 RPM	34	43	48	50	58	63	72	86	100	105	111	116	128	133	150
% of Thrust at 1760 RPM	160	144	136	134	126	122	115	106	100	96	92	90	85	83	79

\*Consult factory when vertical shaft speed exceeds 1760 RPM.



# Combination Drives - Hollow Shaft



Speed decreasing ratios in Models CH150 and up are subject to change in dimensions: U-XA-N-X. Contact factory for certified print.

**Table 4. COMBINATION DRIVE DIMENSIONS (Hollow Shaft) in inches**

Model	CD	D	U	XA	N	XM	H	BE	BD	AJ	AK	BB	BF	Keyseat X
CH20	16	6 3/4	1 1/2	13	2 3/4	11 1/4	7 3/4	3/8	10	9 1/2	8 1/4	7/16	7/16	1/4 x 1/8 x 2 1/4
CH40 (12)	22 1/4	9	1 1/2	16	3 1/2	15 1/4	9	3/8	12	9 1/2	8 1/4	7/16	7/16	3/8 x 7/16 x 2 3/4
CH40	22 1/4	9	1 1/2	16	3 1/2	15 1/4	9	3/8	16 1/2	14 3/4	13 1/2	7/16	1 1/16	3/8 x 7/16 x 2 3/4
CH60	22 1/4	9	1 1/2	16	3 1/2	15 1/4	9	3/8	16 1/2	14 3/4	13 1/2	7/16	1 1/16	3/8 x 7/16 x 2 3/4
CH80	22 1/4	9	1 1/2	16 1/2	3 1/2	15 1/4	9	3/8	16 1/2	14 3/4	13 1/2	7/16	1 1/16	1/2 x 1/4 x 2 3/4
CH110	26 3/4	11 3/4	2	17 1/2	3 1/2	19 3/4	9 3/4	1	16 1/2	14 3/4	13 1/2	7/16	1 1/16	1/2 x 1/4 x 2 3/4
CH125	26 3/4	11 3/4	2	17 1/2	3 1/2	19 3/4	9 3/4	1	16 1/2	14 3/4	13 1/2	7/16	1 1/16	1/2 x 1/4 x 2 3/4
CH150	31 3/4	13 3/4	2 7/16	20 1/2	4 3/4	23 1/2	10 3/4	1	20	14 3/4	13 1/2	7/16	1 1/16	5/8 x 7/16 x 3 3/4
CH200	31 3/4	13 3/4	2 7/16	20 1/2	4 3/4	23 1/2	10 3/4	1	20	14 3/4	13 1/2	7/16	1 1/16	5/8 x 7/16 x 3 3/4
CH280	36	15	2 3/4	24	5 1/2	26 3/4	12 3/4	1 1/8	20	14 3/4	13 1/2	7/16	1 1/16	5/8 x 7/16 x 4 3/4
CH350	40 1/2	16 1/2	2 3/4	29	5 1/2	29 3/4	12 3/4	1 1/4	24 1/2	22*	13 1/2	3/8	1 5/16	5/8 x 7/16 x 4 3/4
CH425	41 3/4	16 1/2	3	30	5 3/4	29 3/4	12 3/4	1 1/4	24 1/2	22*	13 1/2	3/8	1 5/16	3/4 x 3/8 x 4 3/4
CH500	41 3/4	16 1/2	3 1/2	31	6 3/4	29 3/4	12 3/4	1 1/4	24 1/2	22*	13 1/2	3/8	1 5/16	7/8 x 7/16 x 5 1/2
CH600	45 3/4	16 1/2	3 3/4	33	7 1/2	31 3/4	10 1/2	1 1/4	24 1/2	22*	13 1/2	3/8	1 5/16	7/8 x 7/16 x 5 1/2
CH750	49	19	4	36	7 1/2	37	12	1 1/2	30 1/2	26	22	3/8	1 5/16	1 x 1/2 x 6 3/4

**Table 4A. MAX. DRIVE COUPLING BORE SIZE AVAILABLE MOTOR STAND**

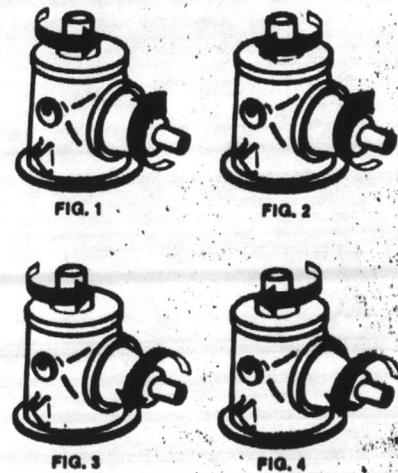
H as determined using maximum XN  
\*Also 5/8-11 Tap on 14-3/4 Bolt Circle 1" Deep

Model	XD	Max. BX		T	XN Available Motor Stand		XT	Top Flange
		Fig. 1 & 4	Fig. 2 & 3					
CH20	1 3/4	1	3/4	13 1/4	8 1/2	10	12 1/2	7/16
CH40	2 3/8	1 1/2	1 1/4	18 3/4	12 1/2	16		3/8
CH60	2 3/8	1 1/2	1 1/4	18 3/4	12 1/2	16		3/8
CH80	2 3/8	1 1/2	1 1/4	18 3/4	12 1/2	16		3/8
CH110	2 3/8	1 1/2	1 1/2	23	12 1/2	17		3/8
CH125	2 3/8	1 1/2	1 1/2	23	12 1/2	17		3/8
CH150	2 3/8	1 5/16	1 3/4	27 1/2	15	19		3/4
CH200	2 3/8	1 5/16	1 3/4	27 1/2	15	19		3/4
CH280	2 3/8	2	2	31 1/2	15	22		3/4
CH350	3 1/2	2 7/16	2 7/16	35 1/2	15	24		1
CH425	3 3/8	2 7/16	2 7/16	35 3/4	15	24		1
CH500	3 3/8	2 7/16	2 7/16	35 3/4	15	24		1
CH600	4	2 1/2	2 1/2	38 1/4	19	24		1
CH750	4	3 3/16	3 3/16	41 3/4	**	24		1 1/4

MACHINED TO SUIT\*\*

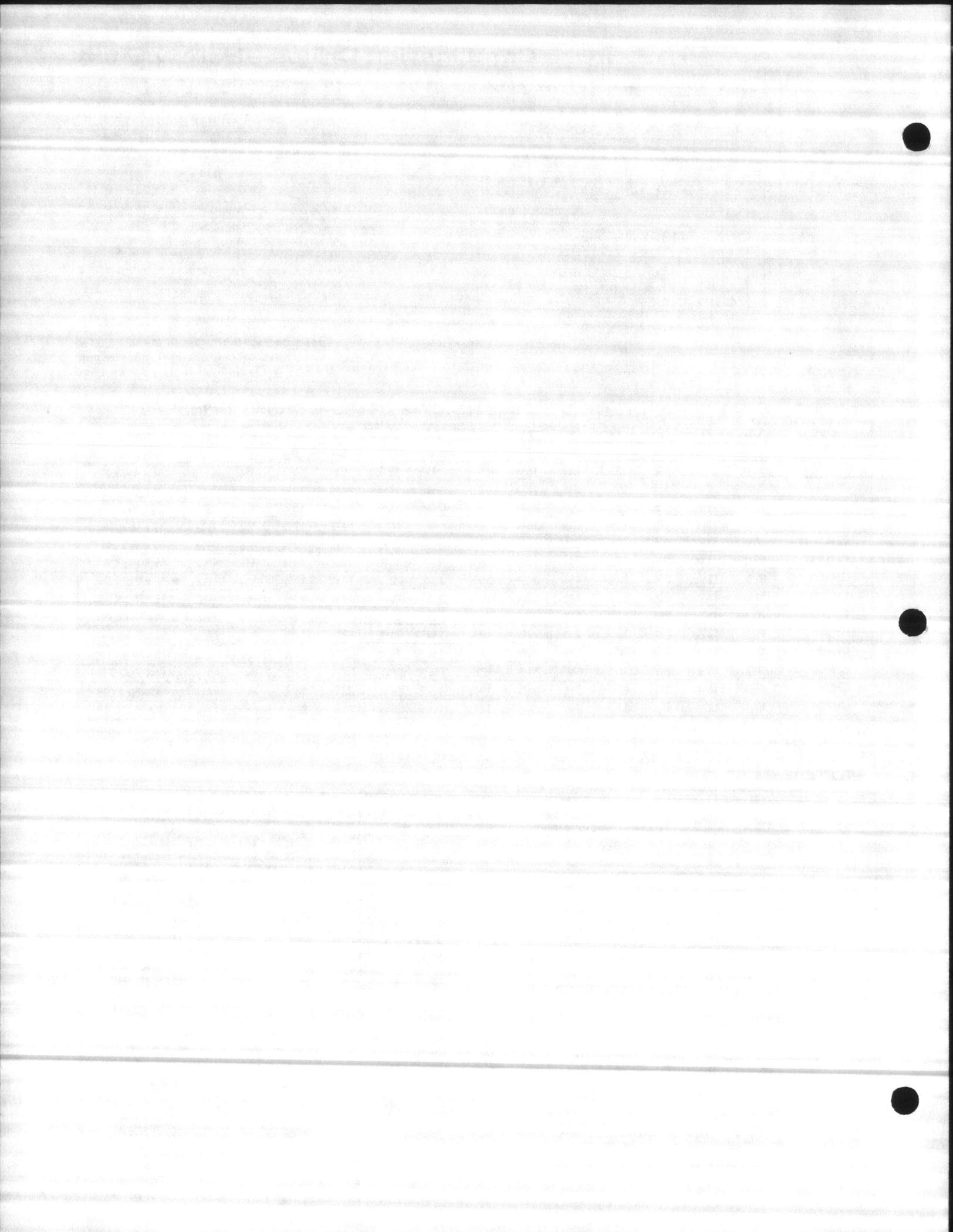
Dimensions XBD, XAJ, XAK, XBB, and XBF to suit electric motor

## ROTATION



Tolerances: Shaft Extensions plus .000 minus .001; Base Rabbet AK plus .002 plus .005; Coupling Bore BX plus .0005 plus .0015. The combination drive is desirable where 24-hour service is mandatory and is preferred by municipalities and waterworks corporations. Electric motor or engine may be used to drive the pump, permitting removal of either for repairs without interrupting service. As with the standard drive, combination applications are also available with solid shaft construction. See page 8.

Gear drives with special rotation (Figs. 2, 3 and 4) and gear drives with speed decreasing of 7:4 or higher ratios are manufactured to order, and such orders are not subject to cancellation without charge for parts processed.

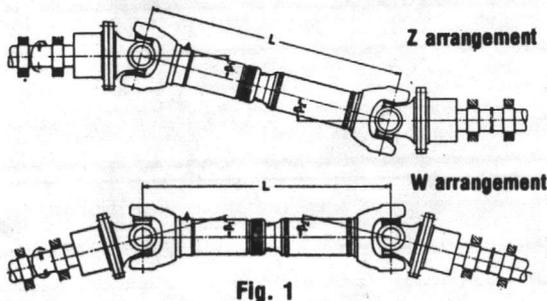


# INSTALLATION and MAINTENANCE INSTRUCTIONS

For Parrish Universal Joint/Intermediate Industrial Shafting

## PRE-INSTALLATION INSPECTION

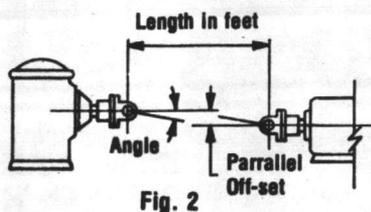
- Even though drive shafts have the unique capability of accepting both axial and offset movements, the following precautions must be taken:
  1. WORKING ANGLES ( $B_1$  and  $B_2$ ) of both the driver and driven equipment MUST BE EQUAL to one another within plus or minus 1 degree.



An offset of  $\frac{1}{8}$  to  $\frac{3}{16}$  of an inch per foot or a working angle of 1 degree is preferred to provide needle bearing rolling action. Use Table 1 to approximate offset and/or working angle. NOTE: Working angle MUST BE HELD to within  $8^\circ$  on standard shafting,  $5^\circ$  on short coupled shafting. Where working angle exceeds these recommendations, contact Parrish Engineering.

Length In Feet	1°	2°	3°	4°	5°	6°	7°	8°
	OFFSET IN INCHES							
1	.209	.419	.625	.839	1.049	1.261	1.473	1.686
2	.418	.838	1.250	1.678	2.098	2.522	2.946	3.372
3	.627	1.257	1.875	2.517	3.147	3.783	4.419	5.058
4	.836	1.676	2.500	3.356	4.196	5.044	5.892	6.744
5	1.045	2.095	3.125	4.195	5.245	6.305	7.365	8.430
6	1.254	2.514	3.750	5.034	6.294	7.566	8.838	10.116
7	1.463	2.933	4.375	5.873	7.343	8.827	10.311	11.802
8	1.672	3.352	5.000	6.712	8.392	10.088	11.784	13.488
9	1.881	3.771	5.625	7.551	9.441	11.349	13.257	15.174
10	2.090	4.190	6.250	8.390	10.490	12.610	14.730	16.860

Table 1



2. Check flange bores and shaft diameters for PROPER FIT.

## 3. SUPPORTING STRUCTURES:

- FOUNDATIONS for all installations must be adequate since most power units will vibrate to some extent. Proper steel beams or concrete foundation, with hold down bolts, are necessary to maintain alignment and to eliminate damaging vibrations. INADEQUATE foundations will VOID the Parrish warranty.

- STEADY BEARING SUPPORTS must have enough rigidity to avoid vibrations. It is recommended that the following suggestions be observed:

1. Keep SPANS as short as possible.
2. Make end CONNECTIONS rigid.
3. Use rigid beams and install so that the principle section modulus OPPOSES the horizontal forces.
4. Beam selection should be sized so that the horizontal and vertical NATURAL FREQUENCY of the beam is 4 times the maximum system RPM.

## TRANSPORTATION and STORAGE

- Drive shafts which have been stored for a long period of time, should be re-greased in working position prior to start up. See LUBRICATION section.

- Generally, drive shafts should be transported in a HORIZONTAL position. Fig. 3

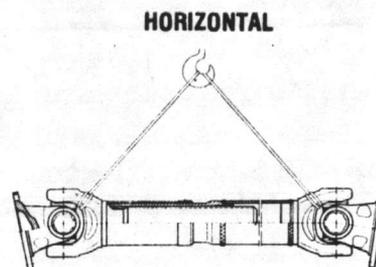


Fig. 3

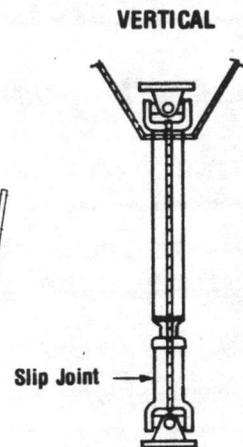


Fig. 4

- For VERTICAL INSTALLATIONS additional protection must be provided in order to eliminate the possibility of drive shaft from coming apart at the Spline connection (SLIP JOINT). Fig. 4

CAUTION: The dust cap and spline seal could be damaged by incorrectly hanging the drive shaft in a vertical position.

- SHOCKS, BUMPS, and MISHANDLING must be avoided to assure proper performance. Abuse could result in bending the drive shaft causing WHIPPING and UNBALANCE problems. Damage of this nature will VOID the warranty.

- Damage to cartons or crates during shipping becomes the responsibility of the freight carrier and consignee and must be noted or reported at time of receipt of shipment.

## COMPANION FLANGE INSTALLATION

- STOCK BORED flanges are bored with a plus .001 minus .000 tolerance and should be a slip fit over the mating shaft. Align keyways in both the flange and shaft and gently tap flange on.

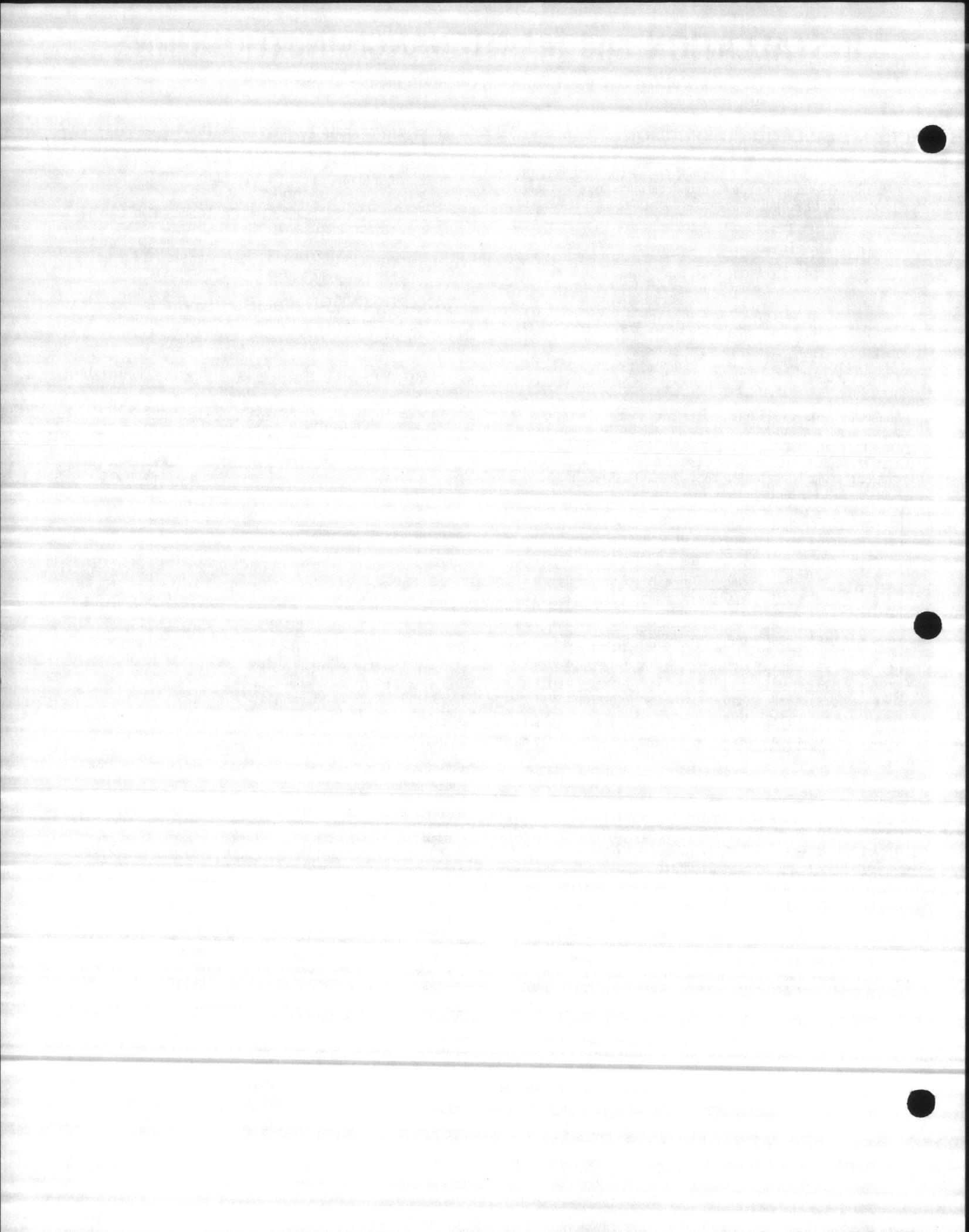
- INTERFERENCE or SHRINK FITS require heating the flange uniformly (preferably submerged in oil not exceeding 350°F) to expand the bore. Align the keyways in both the shaft and flange, slide flange onto shaft and allow to cool. CAUTION: DO NOT attempt to hammer an undersize flange on without heat.

MANUFACTURED BY:

Parrish Power Products Inc.

6151 American Rd., Toledo, Ohio 43612

• Phone 419/729-1601 • Telex No. 28-6045



- TAPER BORED flanges require great care to insure proper interference fit between shaft and bore. GRAPH 1 shows the amount the flange has to be advanced to maintain a given interference (use dial indicator to measure advancement).

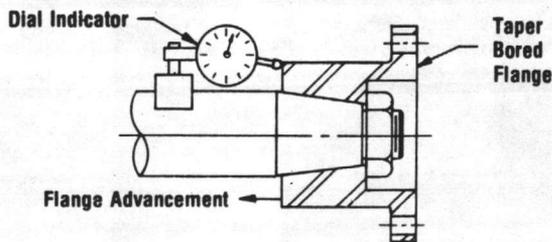
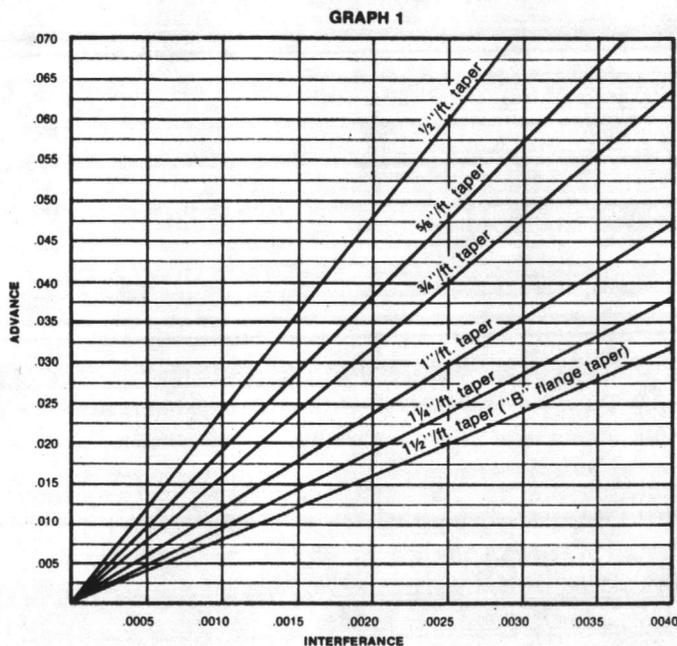


Fig. 5

NOTE: To facilitate installation and future removal, it is recommended that a light grease be used on shaft and threads. Install tapered flange onto shaft. Tighten retaining nut until firmly seated against flange and flange is firmly seated against shaft. Attach dial indicator (Fig. 5) to shaft and begin tightening nut until proper advancement is obtained.

REFERENCE: All Parrish "B" Flanges are SAE TAPERS (1 1/2" / ft) and require an interference fit of .001 to .002 for light or medium duty shafting and .002 to .004 for heavy duty shafting.

- In VERTICAL applications, most of the shafting weight is supported from the upper companion flange. We RECOMMEND that when a drive shaft or multiple section drive shaft installation weighs over 150 lbs., it should be supported in one of the following ways:

1. Ordering flanges with an EXTRA SET SCREW 90° from the keyway (DO NOT use with drive shafts weighing over 300 lbs.).
2. Ordering special bored flanges with the bore machined UNDER-SIZED for a SHRINK FIT (refer to above for proper installation of shrink fits).
3. Ordering flanges with a COUNTER BORE for a split ring adapter.
4. Ordering flanges with a TAPER BORE (consult with motor manufacturer).

- After installing companion flange, check runout of companion flange pilot (.003 T.I.R. maximum permissible).
- There are four types of flanges as shown in Fig. 6

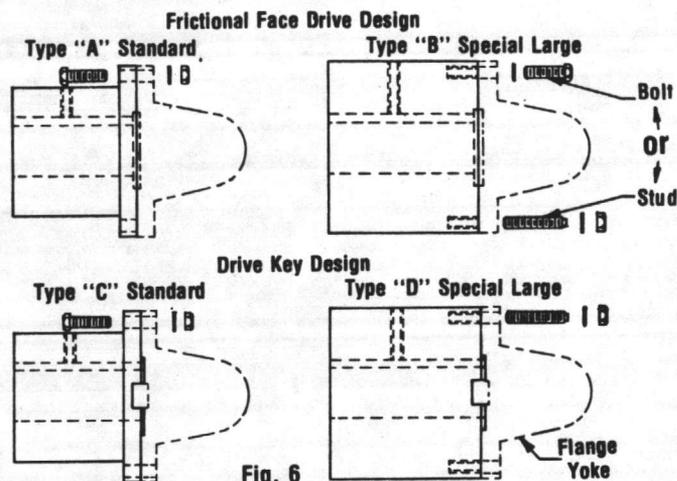


Fig. 6

Types A, C and some B utilize bolt, nut, and lockwasher which are installed after positioning drive shaft.

Type D and some B utilize a special stud, nut, and lockwasher which must be installed before positioning drive shaft. Insert SQUARE end of STUD through hole in flange yoke. Slide lockwasher over STUD and thread NUT onto STUD until the square portion of stud is showing.

Install drive shaft (see drive shaft installation section).

Screw STUD into COMPANION.FLANGE until firmly seated. Tighten nut to specified torque indicated in Table 2.

### INSTALLATION OF DRIVE SHAFT

- HORIZONTAL APPLICATION (single section).

Lower drive shaft into position and extend ends so that the pilot is seated firmly into mating companion flange and bolt holes are lined up. Insert bolts or studs, nut, and lockwashers and tighten to specified torque indicated in Table 2.

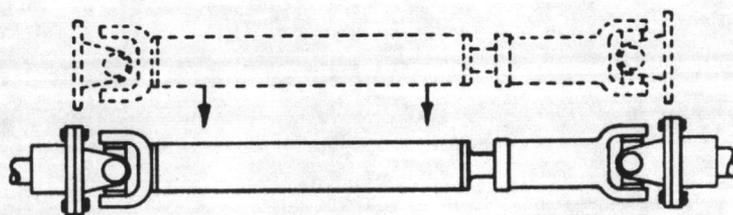
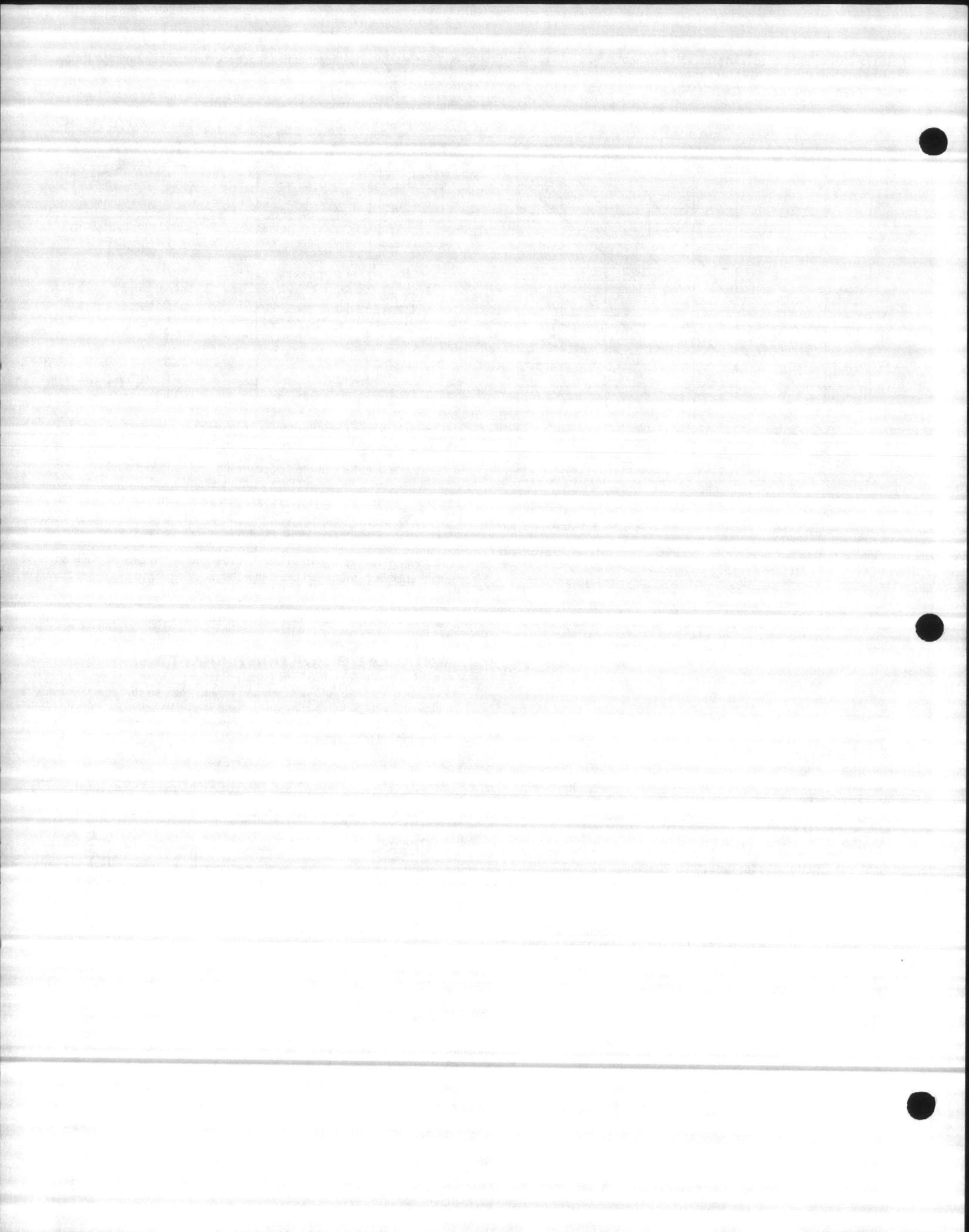


Fig. 7

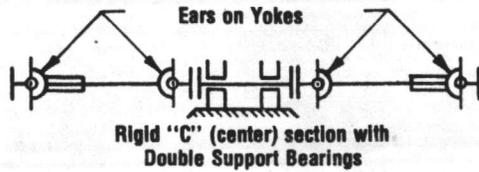
- HORIZONTAL APPLICATION (multiple sections).

Where a single section drive shaft can not be used because of length or other restrictions, multiple drive shafts of two or more sections may be used.

In this type of installation, it is important that the EARS on the YOKES are in LINE after assembly as shown in Fig. 8 (also referred to as PHASING).



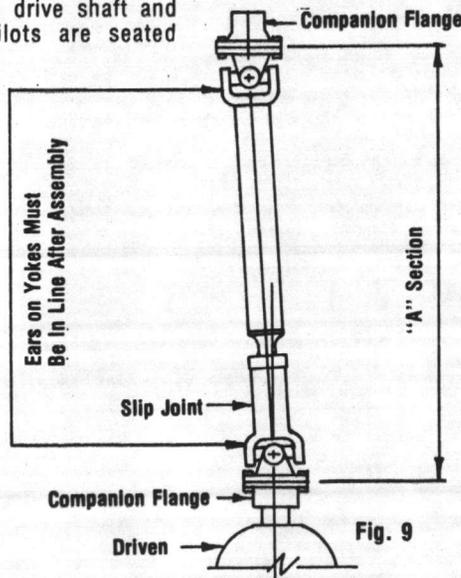
## Basic Horizontal Arrangements



Lower drive shafts into position and extend ends so that the pilots are seated firmly into mating companion flanges and bolt holes are lined up. Insert bolts or studs, nut, and lockwashers and tighten to specified torque indicated in Table 2.

### • VERTICAL APPLICATION (single section).

Raise drive shaft into a vertical position (CAUTION: Make sure that slip joint is secured to drive shaft — see TRANSPORTATION SECTION). Position drive shaft and extend ends so that pilots are seated firmly into mating companion flange and bolt holes are lined up. Insert bolts or studs, nuts, and lockwashers and tighten to specified torque indicated in Table 2.



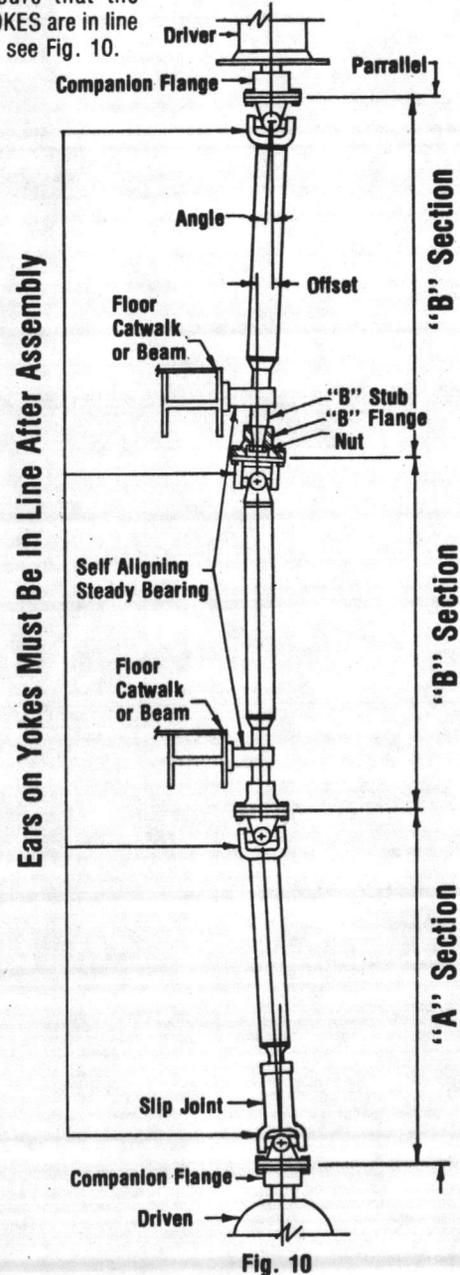
### • VERTICAL APPLICATION (multiple sections).

In multiple section installations, start with the upper most "B" section of shafting:

1. Laying the "B" section out on the floor, slide steady bearing over neck of the "B" stub followed by the TAPERED "B" FLANGE, NUT, AND COTTER PIN. NOTE: NUT must be tightened so that there is approximately .001 to .004 diametral interference between bore and shaft — refer to TAPER BORE FLANGE section on page 2.
2. Attach universal end of shafting to upper companion flange so that pilot is seated firmly and holes are lined up. Insert bolts or studs, nuts, and lockwashers and tighten to specified torque indicated in Table 2.

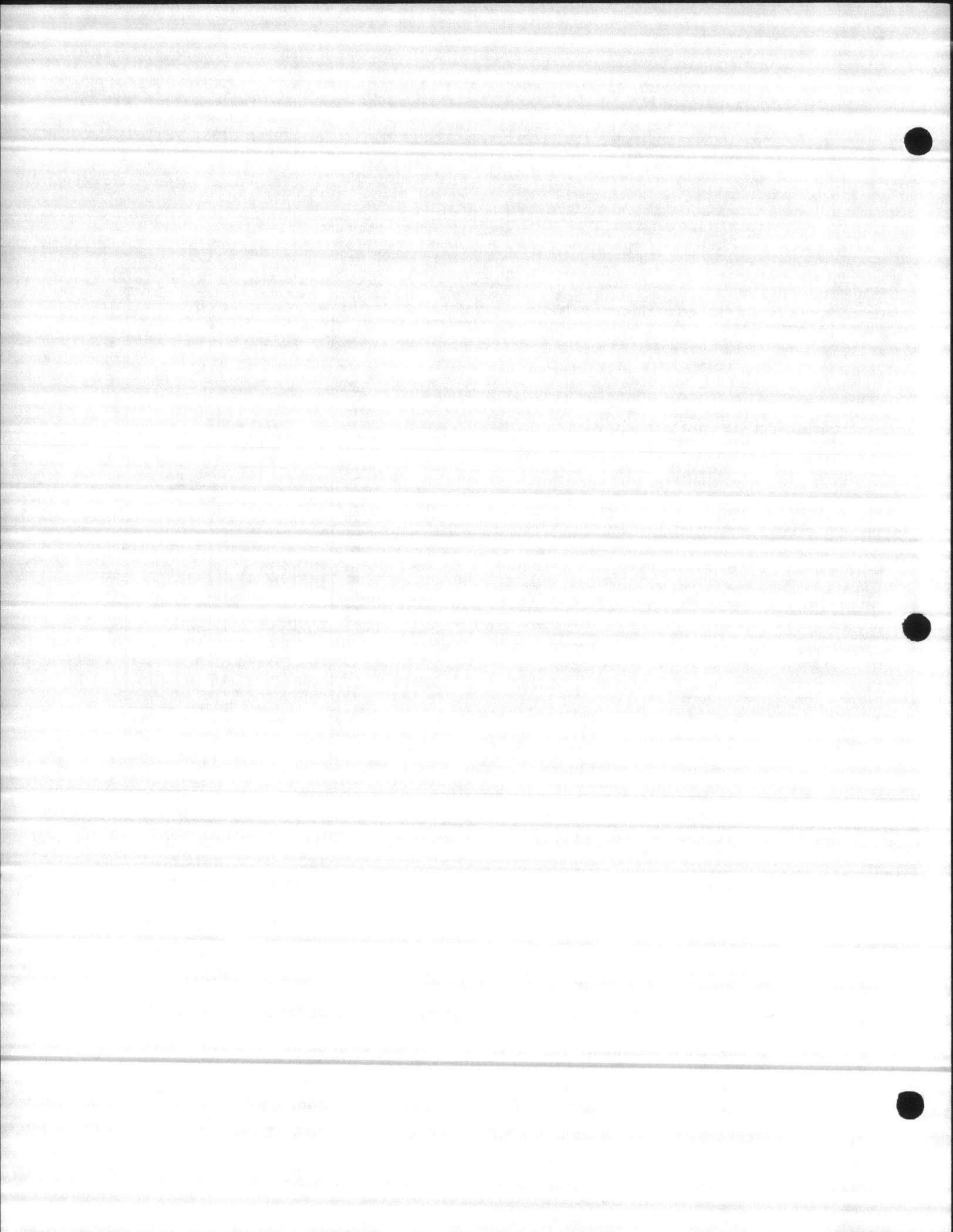
3. Attach STEADY BEARING to support beams and secure steady bearing to "B" stub. NOTE: Steady bearing must be self-aligning type. Steady bearings supplied by Parrish are designed for 1½ degrees misalignment. Shim if necessary.
4. Repeat Steps 1 thru 3 for each "B" Section.
5. The bottom or "A" Section is installed with the SLIP JOINT mounted to COMPANION FLANGE on the driven unit. Position drive shaft so that the pilots are seated firmly and bolt holes are lined up. Insert bolts or studs, nuts, and lockwashers and tighten to specified torque indicated in Table 2.

NOTE: Make sure that the EARS on the YOKES are in line after assembly, see Fig. 10.



## GENERAL MAINTENANCE

- Maintenance and lubrication should be carried out at regular intervals and it is advisable to coordinate this with the maintenance work of the other machine parts.
- Lubrication cycles should be 500 hours of normal service and 200 hours of continuous service.
- Noise testing — any deviation from normal levels of noise should be located and corrected immediately.
- Check of bolts for tightness should be carried out at regular intervals.



## LUBRICATION

• Cross and bearing and sliding splines contain only enough grease to provide protection during storage. It is necessary to completely lubricate them prior to start-up to avoid premature failure.

• Points of lubrication:

1. Cross and bearing (Point "A" - Fig. 11) and steady bearing — lubricate with a good quality lithium soap base or equivalent E.P. grease for speeds over 500 RPM or SAE 140 to 250 oil for speeds under 500 RPM. NOTE: Lubricant MUST APPEAR at all four bearing seals to assure removal of dirt and contaminants. It may be necessary to move drive shaft from side to side while applying gun pressure to allow greater clearance on the thrust end of bearing that is not purging.
- 1A. Cross and bearing lubrication for Series 200, 201, 211, 221, 231, 241, 251, 261, and 271. To lubricate, rotate drive shaft so that the oil plug is at a 45° position, Fig. 12. Remove oil plug and fill with SAE 140 GEAR OIL.

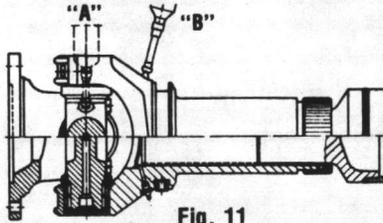


Fig. 11

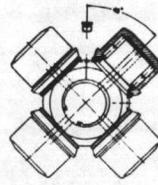


Fig. 12.

2. Sliding splines in slip joint - lubricate with only good grade of long fiber grease ("B" Fig. 11).

• Greases having acceptable properties: Cross and bearing: Shell Alvania EP2, Molyvis ST-200 grease, or Texaco PASR #629 oil or equal. Sliding splines: Texaco Marfac "O" EP or equal.

## BOLT SPECIFICATIONS

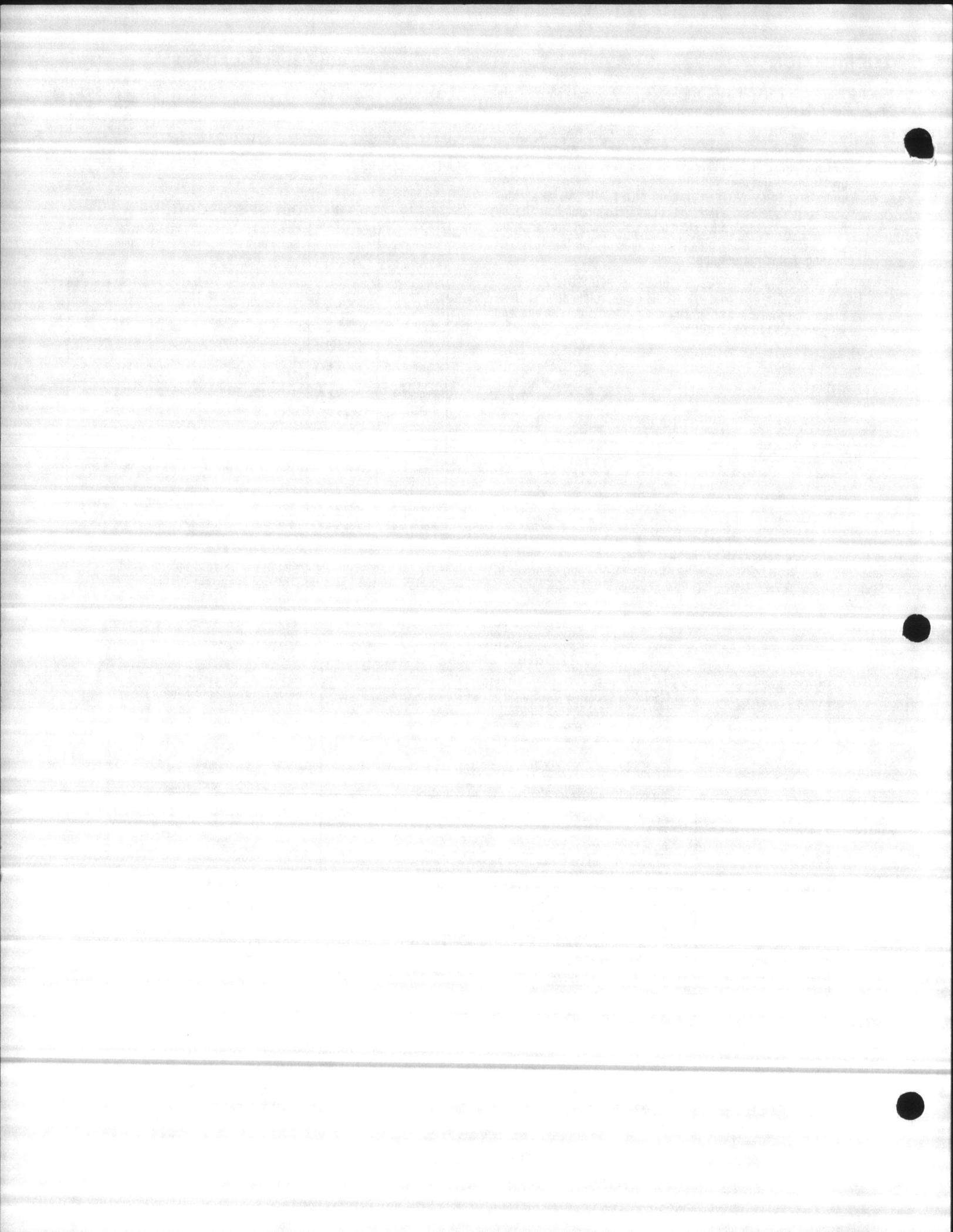
Bolt Size	Series Used In	Wrench Torque Grade	
3/8 - 24	27, 31, 61, 71	31' # 5	
7/16 - 20	37, 41, 81	49' # 5	
1/2 - 20	48, 55	76' # 5	
5/8 - 18	88, 91	213' # 8	
3/4 - 16	95	375' # 8	
METRIC BOLT SPECIFICATIONS			
Metric Size	Inch	Series Used In	Wrench Torque Grade
12mm x 1.75	.472 x 14.5	92, 93	83' # 8
14mm x 2	.551 x 12.7	87, 94, 96	132' # 8
16mm x 2	.630 x 12.7	97, 98, 101, 200	205' # 8
18mm x 2.5	.709 x 10.2	99, 101S, 115, 201	283' # 8
20mm x 2.5	.787 x 10.2	115S, 125, 211	401' # 8
22mm x 2.5	.866 x 10.2	125S, 135, 135S, 145, 221, 231	545' # 8
24mm x 3	.945 x 8.5	145S, 155, 241	693' # 8
27mm x 3	1.063 x 8.5	155S, 165, 251	1013' # 8
30mm x 3.5	1.181 x 7.2	261, 271	1376' # 8
36mm x 4	1.417 x 6.2	308, 408	2405' # 8
48mm x 3	1.890 x 8.5	318	6300' # 8
56mm x 4	2.205 x 6.2	428	9800' # 8
64mm x 4	2.520 x 6.4	338, 358	14,325' # 8
72mm x 4	2.835 x 6.4	348, 368	21,275' # 8

Table 2.

NOTE: Bolts must be tightened in a crisscross pattern and tightened to specified torque to insure proper mating face contact.

## TROUBLE SHOOTING GUIDE

PROBLEM	CAUSE	SOLUTION
<b>VIBRATIONS</b>	1. Operating in or near the critical or half-critical speed. Refer to critical speed graphs.	Reduce speed or rework using special tubing.
	2. Operating in or near the driver or driven equipment natural frequency.	Consult with equipment manufacturer.
	3. Inadequate foundations, floors, or steady bearing beams. Refer to supporting structure section.	Reinforce structure.
	4. Driver or driven components out of balance.	Consult with equipment manufacturer.
	5. Variable frequency controller inducing torsional surges into system.	Consult with equipment manufacturer.
	6. Pump Cavitating.	Consult with equipment manufacturer.
	7. Ears on yoke are not in line with each other. Refer to drive shaft installation section.	Disassemble and align yokes.
	8. Drive shaft may be out of balance due to shafting being bent during shipment or balancing not specified.	Return for straightening and balancing.
	9. Cross and bearing, steady bearing, or spline wore out.	Replace defective components.
	10. U-joints are stiff due to damaged bearing.	Replace bearing.
	11. Pilots not seated at companion flange or "B" shaft connections.	Reseat flanges.
	12. If operating in conjunction with a reciprocating engine, a torsional problem may exist.	A torsional analysis should be performed.
	13. Steady bearings are not self-aligning and are binding.	Replace.
	14. Thrust bearings binding up in either the driver or driven equipment.	Replace bearings.
	15. Exceeding recommended angular misalignments.	Reduce angle.
	16. Input and output shafts are not parallel.	Shim if necessary.
	17. Runout on driver or driven shafts.	Consult with equipment manufacturer.
<b>FLANGES SLIPPING OFF SHAFT</b>	1. Exceeding weight limitations for stock bored flanges. 2. Set screw not tightened.	Add additional set screw. Tighten set screw.
<b>PREMATURE FAILURE OF BEARING</b>	1. Lack of proper maintenance.	See lubrication recommendations.
	2. Exceeding recommended angular misalignment or Max. RPM.	Reduce either or both.
	3. Excessive vibrations (See vibrations sec. above).	See above.
	4. Shafting under specified.	Refer to catalog.



*Helps prevent drive shaft injuries and liability!*

**REQUIRED BY OSHA**

**Bodyguard®**

**SHAFT  
SHIELD**

**Bodyguard**

*Easily  
Installed*

simply attach the four mounting brackets to existing bolts on the engine & right angle gear.

*A loose shirt sleeve, a mis-step . . . and a spinning drive shaft can quickly inflict injury.*

*Protect the people on your farm and your property with an affordable, built-to-last, Parrish Bodyguard shaft shield.*

*It's an ideal way to complete any irrigation pumping installation.*

- Rugged construction of heavy-gauge galvanized steel.
- Easy to lubricate u-joint via underside opening.
- Complete shaft coverage via telescoping construction.
- All mounting hardware included.

**HORIZONTAL SHAFT GUARDS**

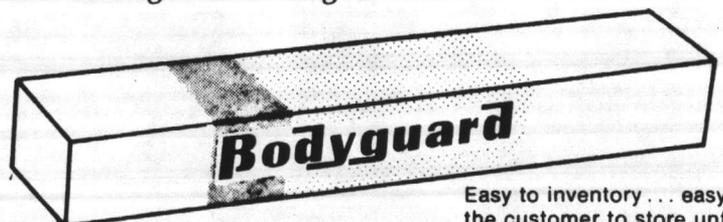
Bodyguard® Models	Lengths Available	For Shafting Series	List Price
*HG-18	10" to 18"	27 thru 55	\$ 50
*HG-24	14" to 24"	61 thru 81	\$ 54
HG-42	24" to 42"	27 thru 55	\$ 56
HG-54	36" to 54"	27 thru 55	\$ 56
HG-66	35" to 66"	27 thru 55	\$ 58
*HG-70	35" to 66"	61 thru 81	\$ 80
*HG-91	28" to 54"	88 thru 95	\$180

All Parrish Horizontal Bodyguards® are 7" in diameter except the HG-24 & 70 which are 12" in diameter and the HG-91 which is 15" in diameter, of telescoping construction in 1" increments. All Nuts and Bolts necessary for installation are furnished together with complete instructions.

•Special lengths and diameter guards

**Consumer Boxed Complete**

*... including all mounting hardware*

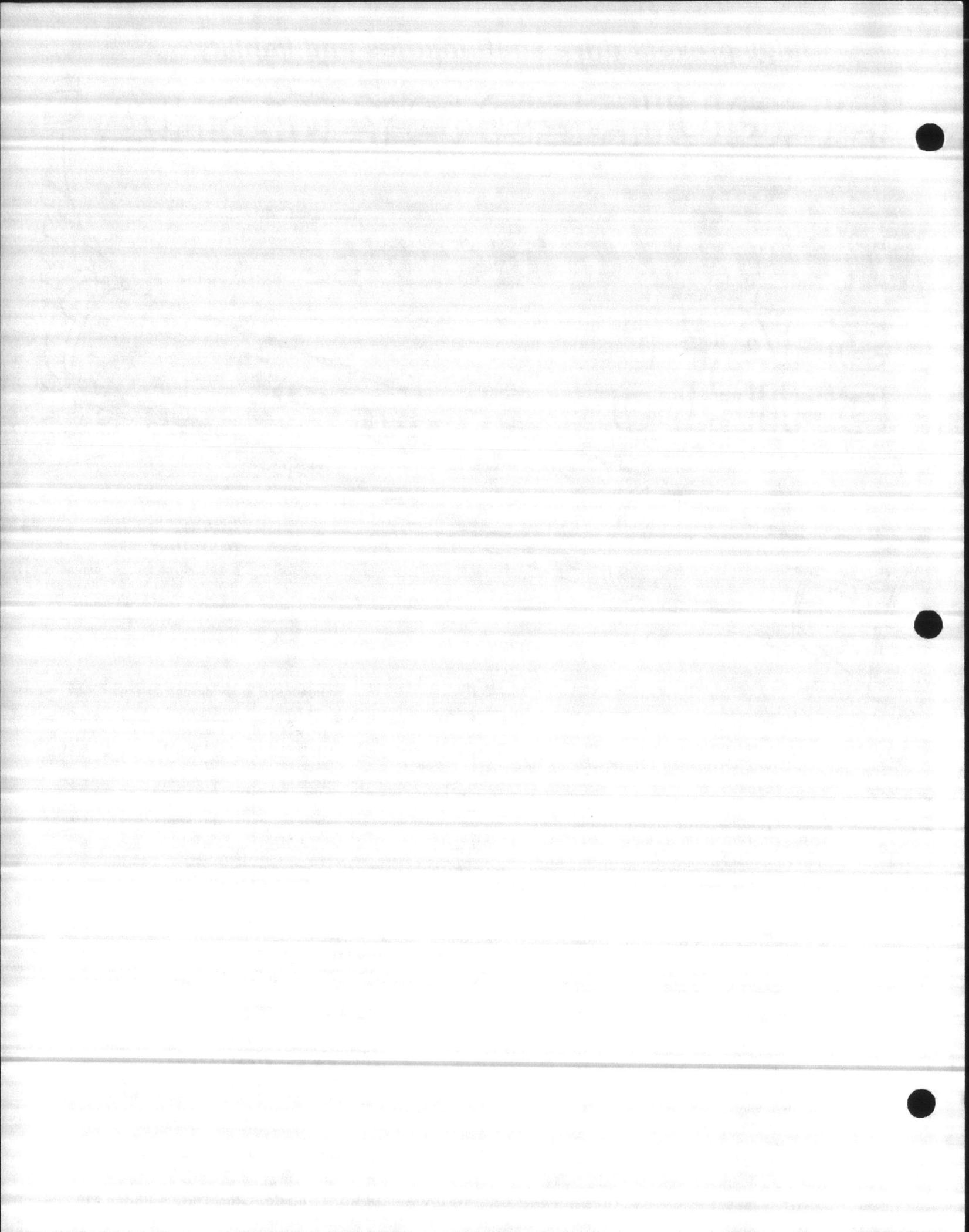


Easy to inventory . . . easy the customer to store until installation.

**Parrish**

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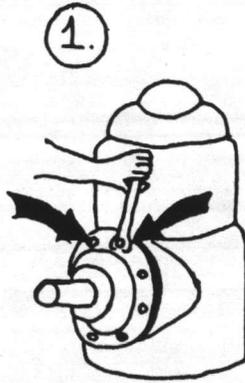
WE STRONGLY RECOMMEND THE USE OF SHAFT GUARDS WITH ALL DRIVE SHAFTS



Remove indicated bolts from the gear head.



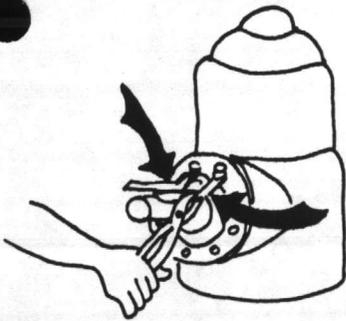
2. Install the brackets, using the bolts removed in Step No. 1.



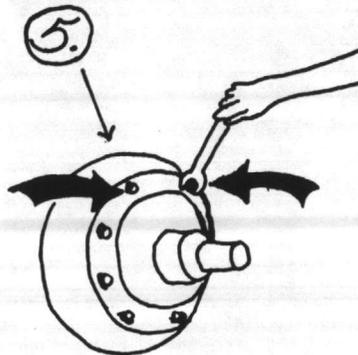
3. Form the brackets to fit the housing.



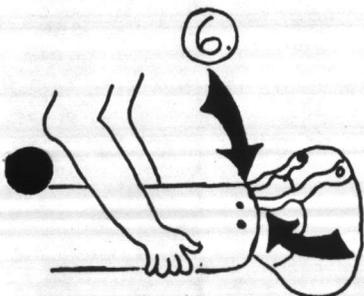
4. With a pair of pliers, bend the outer end of the brackets so that the guard will be centered around the shaft.



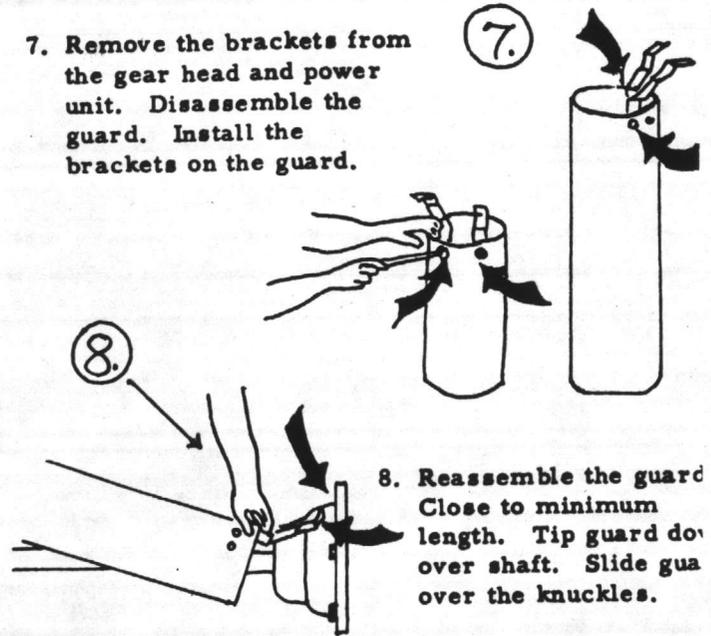
5. Remove indicated bolts from the power unit. Repeat Steps 2 through 4.



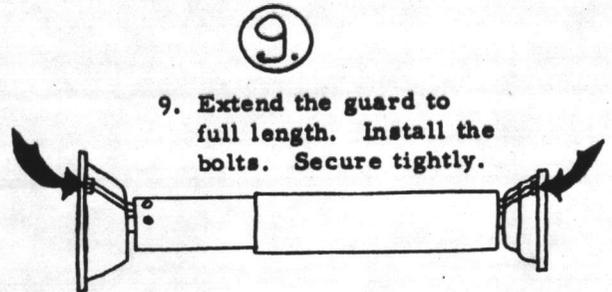
6. Check each end of guard for fit as indicated.



7. Remove the brackets from the gear head and power unit. Disassemble the guard. Install the brackets on the guard.

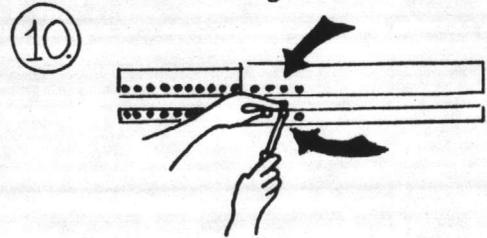


8. Reassemble the guard. Close to minimum length. Tip guard down over shaft. Slide guard over the knuckles.



9. Extend the guard to full length. Install the bolts. Secure tightly.

10. Install the two bolts on each side of the opening on the underneath side of the guard.



11. Install the clips on each end of the underneath side of the guard.

