



2022

Series-8196 & 8175

ANSI STANDARD

PROCESS

INSTALLATION, OPERATION, AND MAINTANENCE



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GENERAL

READ THIS ENTIRE BOOK before attempting to install, operate or repair this pump. Properly installed, your pump will give you satisfactory, dependable service. We urge that you carefully read these step-by-step instructions, to eliminate any problems of installation, operation or repair.

Failure to read and comply with installation and operating instructions will void the responsibility of the manufacturer and may also result in bodily injury as well as property damage.

This book is intended to be a permanent part of your pump installation and should be preserved in a convenient location for ready reference. If these instructions should become soiled, obtain a new copy from Peerless Pump Company (Include pump model and/or serial number with your request.

WARRANTY

New equipment manufactured by Seller is warranted to be free from defects in material and workmanship under normal use and service for a period of one year from date of shipment; (Excluding Power Ends, which are covered for three (3) years). Seller's obligation under this warranty being limited to repairing or replacing at its option any part found to its satisfaction to be so defective provided that such part is, upon request, returned to Seller's factory from which it was shipped, transportation prepaid. This warranty does not cover parts damaged by decomposition from chemical action or wear caused by abrasive materials, nor does it cover damage resulting from misuse, accident, neglect, or from improper operation, maintenance, installation, modification or adjustment. This warranty does not cover parts repaired outside Seller's factory without prior written approval. Seller makes no warranty as to starting equipment, electrical apparatus or other material not of its manufacture, since the same are usually covered by warranties of the respective manufacturers thereof.

In the event, notwithstanding the terms of this agreement, it is determined by a court of competent jurisdiction that an express warranty has been given by Seller to Purchaser with respect to the head, capacity or other like performance characteristics of said equipment, Seller's liability for breach of the same shall be limited to accepting return of such equipment E.O.B. plant of manufacture, refunding any amount paid thereon by Purchaser (less depreciation at the rate of 15% per year if Purchaser has used equipment for more than thirty (30) days) and canceling any balance still owing on the equipment.

This warranty is expressly in lieu of any other warranties, expressed or implied, and Seller specifically disclaims any implied warranty of merchantability or fitness for a particular purpose



INTRODUCTION

This instruction manual is intended to assist those involved with the installation, operation and maintenance. of Peerless Pump Company ANSI Process Pumps. It is recommended that this manual be thoroughly reviewed prior to installing or performing any work on the pump or motor.

I-A. IMPORTANCE OF INSTRUCTIONS

The design, material and workmanship incorporated in the construction of pumps by Peerless Pump Company make them capable of giving long, trouble-free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by periodic inspection and careful maintenance. This instruction manual was prepared to assist operators in understanding the construction and correct methods of installing, operating, and maintaining these pumps. Thoroughly study Sections I, II, III and carefully follow the instructions for installation. Sections IV and V have answers to trouble and maintenance questions. Keep this instruction manual handy for reference. Further information can be obtained by contacting the local authorized distributor or the factory.

I-B. SPECIAL WARNINGS

Peerless Pump Company will not be liable for any damages or delay caused by failure to comply with the provisions of this instruction manual. This pump is not to be operated at speeds, working pressures, discharge pressures, or temperatures higher than, nor used with liquids other than, stated in the original order acknowledgment without written permission of Peerless Pump Company. For Pressure/Temperature limitations see page 46.

I-C. RECEIVING INSPECTION-SHORTAGES

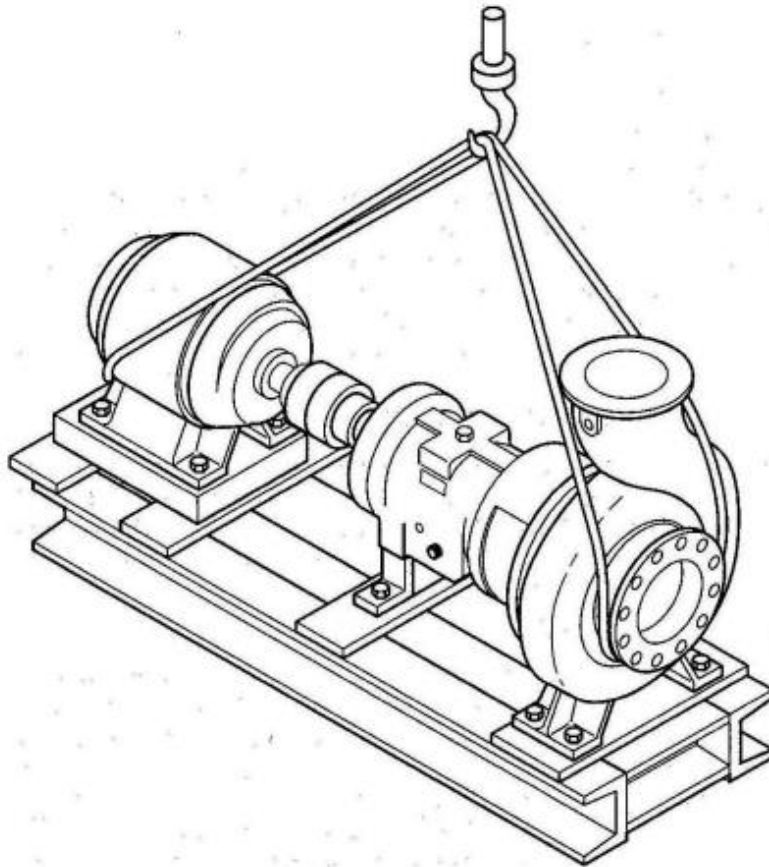
Care should be taken when unloading pumps. If shipment is not delivered in good order and in accordance with the Bill-of-Lading, note the damage or shortage on both receipt and freight bill. **MAKE ANY CLAIMS TO THE TRANSPORTATION COMPANY PROMPTLY.** Instruction sheets on various components as well as the Instruction Book for the pump are included in the shipment. **DO NOT DISCARD!**

I-D. PRESERVATION AND STORAGE

Peerless Pump Company normal domestic shipping and storage preparation is suitable for protecting the pump during shipment in covered trucks. It also provides protection during covered storage at the job site, and for a short period between installation and start-up. If the pump is to be idle and/or exposed to the elements for an extended period, either before or after installation, special precautions are required. One approach is to provide special preservatives and wrapping before shipment. However, after installation the protective wrappings will have been removed. Therefore, application of preservatives after installation is considered a good practice. Information about various long term preservation and storage options available can be obtained for the driver, coupling, mechanical seal, or other equipment supplied on your order. Contact the factory for further details.

I-E. HANDLING TECHNIQUES

Care should be used in moving pumps. Pumps should *not* be hoisted by eyebolts. These eyebolts are intended for removing the back pullout assembly for maintenance and inspection. An assembled pump should be hoisted using a sling under suction flange and under rear of bearing frame. Base plate mounted units should be hoisted using slings under suction flange of pump, and frame of motor as shown below.



INSTALLATION

II-A. LOCATION

Select a location for the pumping unit (pump, base plate, coupling and driver) which will:

- (a) Be clean, well ventilated, properly drained and provide accessibility for inspection and maintenance (see outline drawing for dimension). Outdoor installations may require protection from the elements, particularly freezing.
- (b) The suction supply system must provide the pump with Net Positive Suction Head (NPSH) equal to or greater than that required by the pump at any capacity over the expected operating range. Ask your representative for assistance if you do not understand how to calculate or measure suction supply system NPSH.

II-B. FOUNDATION

Concrete (reinforced as necessary or required) is most widely used for the foundation. In sufficient mass, it provides rigid support, which minimizes deflection and vibration. It may be located on soil, structural steel or building floors, provided the combined weight of the pumping unit and foundation does not exceed the allowable bearing load of the support. Allowable bearing loads of structural steel and floors can be obtained from engineering handbooks; building codes of local communities give the recommended allowable bearing loads for different types of soil.

II-C. FOUNDATION BOLTS

Before pouring the foundation, locate the foundation bolts using a template frame and provide anchorage as shown in Figure 1. See the outline drawings furnished with each pump for the exact location of the foundation bolts. When pouring, allow for a grout thickness of $\frac{1}{2}$ to 1-Yz inches between top of foundation and bottom of base. Roughen top surface to provide a good bond of the grout.

II-D. MOUNTING AND LEVELING THE UNIT

CAUTION

Use qualified personnel (riggers) to lift or move unit at any time. *Never* lift unit using hooks or slings on shafts. *Never* place eyebolts in tapped holes except for removal of a part to perform service work.

When the unit is received with the pump and the driver mounted on the base plate, it should be placed on the foundation and the coupling halves disconnected. The coupling should not be reconnected until the alignment operations have been completed. The base plate should be supported on rectangular metal blocks and shims or on metal wedges having a small taper. The support pieces should be placed close to the foundation bolts (Figure 2). On large units, small jacks made of cap screws and nuts are very convenient. In each case the supports should be directly under the part of the base plate carrying the greatest weight and spaced closely enough to give uniform support. A spacing of 24 inches is suggested on medium size units. A gap of about 0.75 inches to 1.50 inches should be allowed between the base plate and the foundation for grouting.

Adjust the metal supports or wedges until the shafts of the pump and driver are level. Check the coupling faces as well as the suction and discharge flanges of the pump for horizontal or vertical position by means of a level. Correct the positions, if necessary, by adjusting the supports or wedges under the base plate as required.

IMPORTANT

Pumps and drivers mounted on a common base plate were accurately aligned before shipment. *All base plates are flexible to some extent and, therefore, must not be relied upon to maintain the factory alignment.*

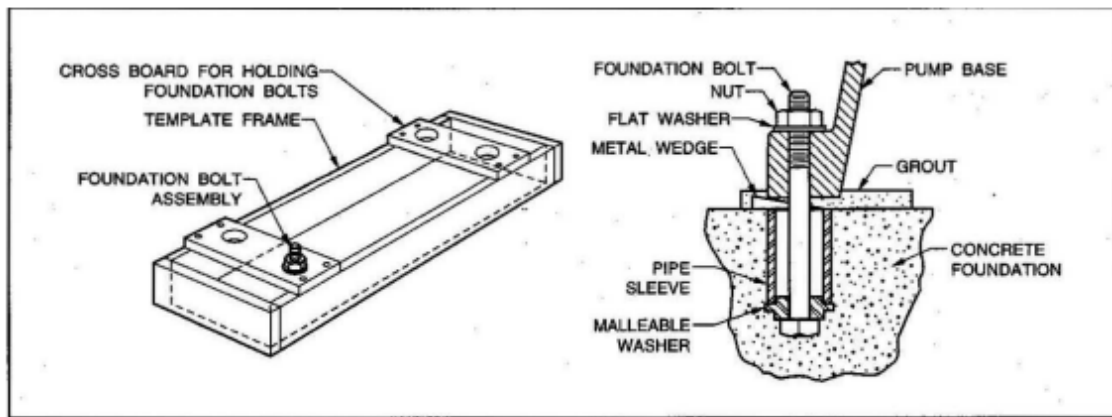


Figure 1. Foundation bolt location and anchorage

Realignment is necessary after the complete unit has been leveled on the foundation and again after the grout has set and foundation bolts have been tightened. The alignment must be checked after the unit is piped and rechecked periodically as outlined in the following paragraphs. To facilitate accurate field alignment, we do not dowel the pumps or drivers on the base plates before shipment.

II-E. ALIGNMENT

Reliable, trouble free and efficient operation of a pumping unit requires correct alignment of pump and driver shafts. Misalignment may be the cause of:

- (a) Noisy pump operation
- (b) Vibration
- (c) Premature bearing failure
- (d) Excessive coupling wear

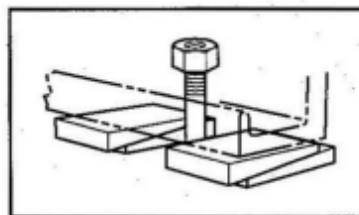


Figure 2. Adjusting wedges for mounting

Factors that may change the alignment of the pumping unit are: (a)

- Settling of the foundation
- (b) Springing of the base plate
- (c) Piping strains
- (d) Settling of the building
- (e) Shift of pump or driver on the base

II.F. ALIGNMENT CHECK

The following checking procedure applies to a pumping unit consisting of a pump, flexible coupling and driver mounted on a common base plate. Check alignment as follows:

- (a) Disconnect the coupling halves.
- (b) Set the coupling flange gap to the dimension shown in "Mounting Each Half Spacer" for Falk (page 151 Table 3 for Wood's (page 17) or refer to " Allowable Shaft Engagements" for Rexnord (page 18).
- (c) The preferred test for parallel and angular alignment may be made with a dial indicator mounted as Shown in Figure 3. Proceed as follows:
 - (1) Scribe the index lines on the coupling halves (as shown) or mark where the indicator point rests. (2) Set indicator dial to zero.
 - (3) Slowly turn *BOTH* coupling halves so that index lines match, or indicator point is always on the mark.
 - (4) Observe dial reading to determine whether pump or driver needs adjustment.
 - (5) Acceptable parallel and angular alignment occurs when total indicator reading (complete turn) does not exceed limits specified by the coupling manufacturer. Refer to pages 15 - 21.

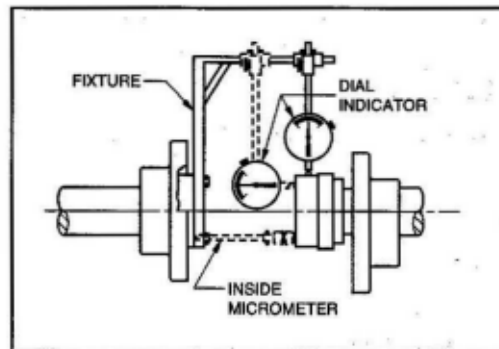


Figure 3. Testing alignment, dial indicator

- "(d) Test for parallel and angular alignment with a straight edge and feeler gauge as shown in manufacturer's instructions in Section II-N, 0, P. With coupling halves stationary, make trials at four places 90° apart. Perfect alignment occurs when a straight edge is level across the coupling halves and the same gauge just enters between the halves, both conditions at all points."

When significant operating temperature differential will exist between the pump and driver (i.e. steam turbine drive with pump handling cold liquid), thermal growth will cause the hotter unit to rise. Compensate for this growth by initially setting the hotter unit 0.003 inch to 0.005 inch low. When both units are at normal operating temperature, a final check of coupling alignment must be made. Correct the alignment if necessary.

NOTE

Check for correct electric motor rotation as described in paragraphs (a) and (b) under paragraph IIM while coupling halves are disconnected.

II-G. ALIGNMENT ADJUSTMENT

Since all base plates are flexible; they may be distorted from transportation or handling. Therefore, it may be necessary to correct excessive parallel and angular misalignment by slightly shifting the leveling wedges under the base plate. Tap lightly (in or out) with a hammer. Recheck alignment after each shifting of a wedge.

- (a) . In some instances, for factory aligned pumping units, it may be necessary to change the shims under the pump or driver, or even relocate these factory-positioned units on the base plate. Make such changes only after it is certain that alignment cannot be obtained by shifting of the wedges.
- (b) If wedges are shifted or shims changed a substantial amount to obtain proper alignment, recheck the piping alignment and level of the shafts.

NOTE

Pumping unit shafts must be level, have proper alignment and the piping must mate with the pump flanges without strain. All three conditions must be correct to provide proper performance and long life of the pumping unit

II-H. ALIGNMENT RECHECK

alignment, and correct as required, after:

- (a) Mounting,
- (b) The grout has hardened,
- (c) Foundation bolts are tightened, (d)
Piping is connected,
- (e) Pump, driver, or base plate is moved for any reason.

II-I. GROUTING

Unless otherwise specified on the unit outline drawing, the base plate must be filled with grout and the leveling wedges grouted in place. The product warranty IS *VOID* if this instruction is not followed.

When the alignment is correct, the foundation bolts should be tightened evenly, but not too firmly. The unit can then be grouted to the foundation. Foundation bolts should not be fully tightened until the grout is hardened, usually about 48 hours after pouring. Installation without grout completely filling the base plate is acceptable only when recommended by specific notation on the unit outline drawing.

Grouting that completely fills a base plate is also necessary for minimum vibration levels, since a very stiff base is uneconomical and unnecessary except for portable units. Grout compensates for unevenness in the foundation and base plate and distributes the weight of the unit uniformly over the foundation. It also prevents the unit from shifting after mounting and alignment. It is essential that the pumping unit be expertly grouted by use of non-shrinking grout. The mix required varies with the type of unit to be grouted, location and amount of grout. The instructions included with the non-shrinking grout package will provide the required information for the proper mix for individual applications. Grout the unit as follows:

- (a) Build a form of plywood or thick planking around the foundation to contain the grout. Support adequately to prevent deformation.
- (b) Soak the top of the concrete pad thoroughly with water before grouting. Remove all surface water before pouring.
- (c) Pour the grout through the holes provided in the base plate or through open ends of steel channel base plates. While pouring, tamp liberally to fill all cavities and prevent air pockets.

NOTE

In pouring and tamping, the grout may trap air in some places. Drill small vent holes through the base surface.

- (d) After the grout has thoroughly hardened, tighten the foundation bolts and connect the piping.
Be certain piping does not strain pump flanges.
- (e) Check the alignment after the piping is connected and the foundation bolts are tightened. (f) Connect the coupling halves.
- (g) After the grout has thoroughly dried, apply an oil base paint to the exposed edges of the grout to prevent air and moisture from encountering the grout

NOTE

It is very important to support and restrain both the suction and discharge pipes near the pump to avoid application of the forces and moments to the pump casing. Failure to support the piping properly can cause excessive pipe strain on the casing which can affect alignment, cause vibration, and promote rapid wear of seals and bearings. Damage caused by pipe strain will void the warranty.

II-J. SUCTION PIPING-GENERAL

The suction piping, if not installed properly, is a potential source of faulty operation. To achieve best performance, provide for the following:

- (a) Avoid using elbows close to the pump suction flange. A minimum of six pipe diameters of straight pipe should always be located between the elbow and suction inlet. If elbows are used, they should be long radius type.
- (b) Suction pipe should be a minimum one size larger than the suction flange. Suction pipe should terminate at the suction flange of the pump through an "eccentric reducer". Never install suction piping that is smaller in diameter than the pump suction flange.
- (c) Suction throttling must never be attempted. This could cause cavitation and damage to the pump.
- (d) If a strainer is installed in the suction piping, it must have a net free area of at least three (3) times the area of the suction pipe. It should be checked and cleaned periodically. The openings in the screen must be smaller than the sphere size allowed for the impeller. Contact factory for maximum sphere size.
- (e) When the source of supply is feeding more than one pump, separate suction lines are recommended.

SUCTION LIFT INSTALLATIONS

- (a) Suction lines, when operating under lift conditions must be kept absolutely free from air leaks.
- (b) Suction piping should gradually slope upward toward the pump and all joints must be air tight.
- (c) Available NPSH must be greater than the NPSH requirement of the pump.
- (d) *Piping should be cleaned mechanically and chemically, and flushed prior to installing the pump. Several mechanical seal and seizure troubles are due to improperly cleaned systems,*
- (e) A means of priming the pump (i.e., foot valve), must be provided.

FLOODED SUCTION/POSITIVE HEAD INSTALLATIONS

- (a) The suction line must include an isolation valve to permit closing off the source of supply so that pump inspection and maintenance can be performed. The valve should be installed a minimum of two pipe diameters from the pump suction flange.
- (b) Piping should be level or slope gradually in a downward direction from the source of supply to avoid air pockets.
- (c) Piping should never extend below the pump suction flange. The piping entrance at the source of supply should always be one to two sizes larger than the pump suction flange.
- (d) To prevent eddies and vortices, the suction-pipe must be adequately installed below the surface of the liquid. A minimum of three times the pipe diameter is recommended.

II-K DISCHARGE PIPING

- (a) Check and isolation valves should be installed in the discharge line. The check valve must be placed between the pump and the isolation valve. This will protect the pump from reverse rotation and excessive back pressure. The isolation valve is used in priming, starting and when shutting down the pump. If increasers are used on the discharge side to increase the size of discharge piping, they should be placed between the check valve and pump. When expansion joints are used, they should be placed between the check valve and pump.

II-L. ENGINE DRIVEN UNITS

Safe and efficient operation of a pumping unit driven by an engine, whether diesel, or gasoline requires the installation to satisfy the following requirements:

- (a) Be well ventilated to keep the ambient temperature as low as possible. Taking 60° F as a datum point, every 100 F rise in temperature reduces the horsepower of the engine by approximately 1%.
- (b) Provide ample air for proper combustion.
- (c) Provide the engine with an efficient exhaust system so that the combustion gases discharge with a minimum of back pressure.
- (d) Provide for a fuel system of adequate capacity which meets the local codes. (e) Provide ample accessibility to service engine.
- (f) Provide correct rotation of the pump. Engine rotation is determined at the factory. No change of engine rotation can be made in the field.

It is recommended that the operator become familiar with the installation and service manual supplied by the engine manufacturer.

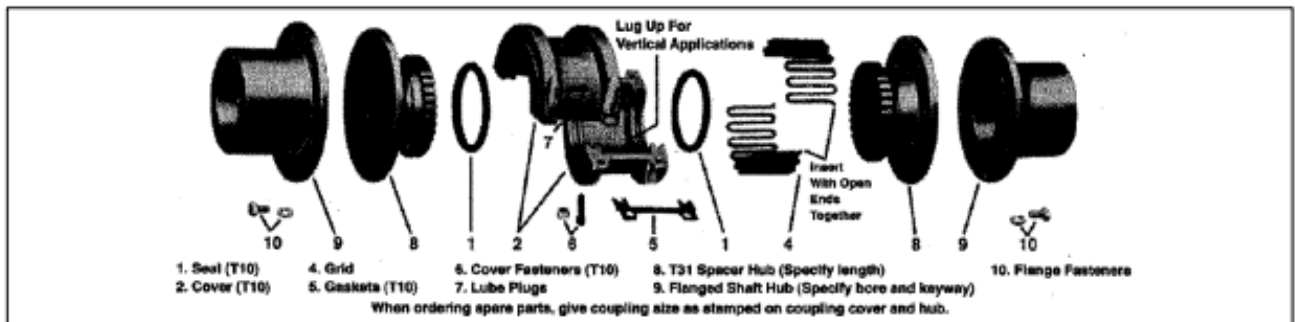
II-M. ELECTRIC MOTOR DRIVEN UNITS

For electric motor drives, connect power supply to conform with national and local codes. Line voltage and wire capacity must match the ratings stamped on the motor nameplate.

- (a) Only when the coupling halves are disconnected, momentarily energize the motor to check that rotation is in the same direction as the arrow on the pump,
- (b) If motor is three phase type, reverse rotation (if required) by interchanging any two of the three power leads. The rotation of most single phase motors is fixed by internal wiring and cannot be easily changed.

II-N. INSTALLATION FALK STEELFLEX® SPACER COUPLINGS

2.



INTRODUCTION - This manual applies to Sizes 20 through 140T31 and 1020 thru 1140T35 Falk Steelflex Tapered Grid Spacer Couplings. Unless otherwise stated, information for Sizes 1020 thru 1140 applies to Sizes 20 through 140 respectively, e.g. 1020 = 20, 1100 = 100, etc. The type T31 Steelflex Spacer Assembly permits installation or removal (as shown in Steps A and B below) without disturbing either the driving or driven unit. These couplings are designed to operate in either the horizontal or vertical position without modification. However, for vertical applications, the match mark shown on Page 2, must be up. The performance and life of the couplings depend largely upon how you install and service them. Carefully follow the instructions in this manual for optimum performance and trouble free service.

PARTS IDENTIFICATION - All coupling parts have identifying part numbers as shown above. Parts are interchangeable between the 10 Series and 1000 series spacer couplings. However, to utilize the higher 1000 series ratings, the 1000T - Blue Grid, Spacer Hubs, Shaft Hubs and Hardware must be used. When ordering parts, always SPECIFY SIZE and TYPE shown on the COVER. Sizes 80 thru 140T10 covers have been manufactured with two and three ribs; 00 NOT mix these cover halves.

LIMITED END FLOAT - When electric motors, generators, engines, compressors and other machines are fitted with sleeve or straight roller bearings, limited axial end float kits are recommended for protecting the bearings. Falk Steelflex couplings are easily modified to limit end float; refer to Manual 428-820 for instructions.

CAUTION: Remove the coupling cover, grid and gap disc before removing the Spacer T Hub(s) of limited end float couplings. Reassemble as instructed on Page 2.

LUBE FITTINGS - Cover halves have 1/8 NPT lube holes. Use a standard grease gun and lube fitting as instructed in Step 8 on Page 2.

LUBRICATION - Adequate lubrication is essential for proper operation of the coupling. Refer to Table 1 on Page 2 for the amount of lubricant required. It is recommended that the coupling be checked once a year and lubricant added if required. For extreme or unusual operating conditions, check more frequently.

CAUTION: Consult applicable local and national safety codes for proper guarding of rotating members. Observe all safety rules when installing or servicing couplings.

LUBRICATION SPECIFICATIONS - Refer to Manual 428-010 for recommended lubricants. The following specifications apply to lubricants for Falk couplings which are lubricated annually and operate within ambient temperatures of 0° to 150°F. (-18° to +66°C.). For temperatures beyond this range, consult the Factory.

Dropping Point - 300° F. (149° C.) or higher.

Consistency - NLGI No.2 with worked penetration value in the range of 250 to 300.

Separation and Resistance - Low oil separation rate and high resistance to separation from centrifuging.

Liquid Constituent - To possess good lubrication properties ... equivalent to a high quality, well refined petroleum oil. Inactive

Must not corrode steel or cause swelling or deterioration of synthetic seals.

Clean - Free from foreign inclusions.

Semi-Permanent Lubrication - Refer to Manual 428-012 for details.

INSTALLATION - Only standard mechanics tools, wrenches, a straight edge and feeler gauges are required to Install Falk Steelflex couplings. Couplings Sizes 1020 thru 1090 are generally furnished for CLEARANCE FIT with set screws. Sizes 1100 and larger are furnished for an INTERFERENCE FIT without set screws. Heat hubs with interference fit in an oil bath to a maximum of 275° F. (135° C.) to mount. The oil flashpoint must be 275° F. (135° C.) or higher. Refer to Page 2 for detailed mounting instructions.

REMOVAL AND INSTALLATION OF SPACER ASSEMBLY (SEE LIMITED END FLOAT "CAUTION")

REMOVE SPACER ASSEMBLY - Remove pipe plugs and all but two fasteners opposite each other in each hub. Loosen these about one-quarter inch and tap them with a mallet to disengage Steelflex Spacer from the shaft hubs. Remove fasteners and Spacer.

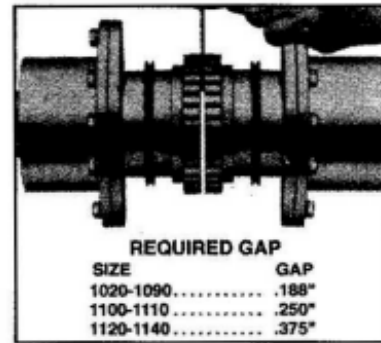
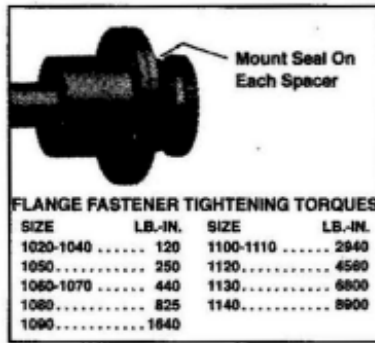
INSERT SPACER ASSEMBLY - Do not allow them to protrude beyond flange face. Compress spacer to eliminate its gap, and insert into space between shaft hubs. Carefully engage the hub registers and then alternately tighten fasteners. Torque to specifications in Step 2 on Page 2.



INSTALLATION OF DISASSEMBLED TYPE T31 STEELFLEX® COUPLINGS

1. MOUNT SHAFT HUBS - Lockout starting switch of prime mover. Mount shaft hubs on their respective shafts so that hub face is flush with the end of the shaft. If hub is furnished for an interference fit, heat in an-Oil bath as instructed on Page 1. Position units for approximate distance between shaft ends with minimum angular and offset misalignment.

2. MOUNT EACH HALF SPACER - Stretch the seal and carefully roll it over hub teeth into position. Carefully position each half spacer on register of flanged hubs and fasten parts together. Torque fasteners to value specified below left.



3. GAP AND ANGULAR ALIGNMENT - Use a spacer bar equal in thickness to the gap as specified. Insert bar, as shown above right, to same depth at 90° intervals and measure clearance between bar and hub face with feelers. The difference in minimum and maximum measurements must not exceed the ANGULAR limit specified in Table 1.

4. OFFSET ALIGNMENT - Align so that a straight edge rests squarely (or within the limits specified in Table 1) on both hubs and also at 90° intervals. Check with feelers. The clearance must not exceed the OFFSET limit specified in Table 1. Tighten all foundation fasteners and repeat Steps 3 and 4. Realign coupling if necessary. NOTE: Use a dial indicator for more accurate alignment.

5. INSERT GRID - Pack gap and grooves with lubricant before inserting grid. When grids are furnished in two segments, install them so that all cut ends extend in the same direction. This will assure correct grid contact with the lug in the cover and permit cover installation. Spread the grid slightly to pass it-over the coupling teeth and then seat it with a soft mallet. Pack additional grease between and around the grid and then wipe off the excess flush with top of grid.

6. COVER MATCH MARKS - Assemble the covers with the match marks on the same side. For vertical or inclined couplings, assemble the covers with the match marks (and lugs) UP, or on the high side.

7. INSTALL COVER - Align seals with rover grooves. Position covers per Step 6 and insert gaskets at both joints. For Sizes 1020 thru 1070, position nut in hex seats. insert all fasteners and torque to value Specified in Table 1. Insert pipe plugs.

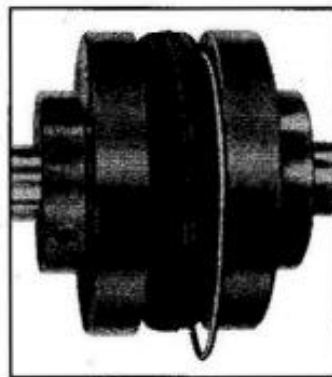
8. LUBRICATION - Lubricate annually. Refer to Page 1 for recommended lubricant specifications and to Table 1 for amount of lubricant required. When lubricating remove both pipe plugs and insert a standard lubrication fitting in one hole. When grease flows from the vent hole, replace both plugs. Wipe off excess grease.

SIZE	Max Speed rpm	Operating Alignments Limits - Inches		Lube Wt (lb)	Cover Fastner Torque lb-in.
		Offset (Max)	Angular (Max)		
1020	3600	.005	.005	.06	100
1030	3600	.005	.005	.06	100
1040	3600	.005	.005	.12	100
1050	3600	.005	.005	.12	200
1060	3600	.010	.010	.19	200
1070	3600	.010	.010	.25	200
1080	3600	.010	.010	.38	200
1090	3600	.012	.012	.56	200
1100	2440	.012	.012	.94	260
1110	2250	.012	.012	1.1	260
1120	2025	.012	.012	1.6	650
1130	1800	.012	.012	2.0	650
1140	1650	.015	.015	2.5	650

II-O. INSTALLATION WOOD'S SURE-FLEX® SPACER COUPLINGS

Sure-Flex flanges (outer metallic parts) and sleeves (inner elastomeric members) come in many sizes and types. All rubber sleeves (EPDM) and Neoprene) have the same ratings for a given size and may be used interchangeably. Hytrel sleeves, however, has completely different ratings. Rubber sleeves must not be substituted for Hytrel... or Hytrel for rubber. First, determine the size and type of components being used. Remove all components from their boxes, and loosely assemble the coupling on any convenient surface. (Do not attempt to install the wire ring on the two-piece E or N sleeve at this time.)

1. Inspect all coupling components and remove any protective coatings or lubricants from bores, mating surfaces and fasteners. Remove any existing burrs, etc. from the shaft
3. Slide one coupling flange onto each shaft, using snug-fitting keys.
4. Position the flanges on the shafts so that each shaft extends into each flange a minimum length equal to the shaft diameter. Tighten one flange in its final position. Slide the other far enough away to install the sleeve. With a two-piece sleeve, do not move the wire ring to its final position; allow it to hang loosely in the groove adjacent to the teeth, as shown.



4. Slide the loose flange on the shaft until the sleeve is completely seated in the teeth of each flange. Tighten all fasteners to the values given in Table 2.

Table 2		FASTENER TORQUE VALUES (ft.-lbs.)		
Coupling Size	TYPE J	TYPE S	TYPE SC	
	2 Setscrews at 90°	2 Setscrews at 90°	2 Setscrews at 90°	2 Setscrews at 90°
3	3
4	3	...	5 1/2	13
5	7	13	4	13
6	13	13	9	13
7	13	13	9	13
8	23	23	18	23
9	...	23	31	23
10	...	23	50	50
11	...	23	75	50
12	...	50	150	100
13	...	100	150	165
14	...	100	150	165
16	...	100	150	165

Coupling size is marked on flanges.

Different coupling sleeves require different degrees of alignment precision. Locate the earing failure (0) Excessive coupling wear

SURE-FLEX" SPACER COUPLINGS, continued

5. Check parallel alignment by placing a straightedge across the two coupling flanges and measuring the maximum offset at various points around the periphery of the coupling. **DO NOT** rotate the coupling. If the maximum offset exceeds the figure shown under "Parallel" in Table 3, realign the coupling.

6. Check angular alignment with a micrometer or caliper. Measure from the outside of one flange to the outside of the other at intervals around the periphery of the coupling. Determine the maximum and minimum dimensions. **DO NOT** rotate the coupling. The difference between the maximum and minimum must not exceed the figure given under "Angular" in Table 3. If a correction is necessary, be sure to recheck the parallel alignment. (Note: For maximum life, keep misalignment values as near to zero as possible.)

NOTE: Periodically check elastomeric coupling sleeves for any visible evidence of deterioration. If deterioration is apparent, the coupling sleeve must be replaced.

Table 3		MAXIMUM ALLOWABLE MISALIGNMENT			
Sleeve Size	G DIMENSION	TYPES JES, JNS, E & N		TYPE H & HS*	
		PARRALLEL	ANGULAR	PARRALLEL	ANGULAR
3	3/8	.010	.035	-	-
4	5/8	.010	.043	-	-
5	3/4	.015	.056	-	-
6	7/8	.015	.070	.010	.016
7	1	.020	.081	.012	.020
8	1-1/8	.020	.094	.015	.025
9	1-7/16	.025	.109	.017	.028
10	1-5/8	.025	.128	.020	.032
11	1-7/8	.032	.151	.022	.037
12	2-5/16	.032	.175	.025	.042
13	2-11/16	.040	.195	.030	.050
14	3-1/4	.045	.242	.035	.060
16	4-3/4	.062	.330	-	-

(Dimension are Inches)

NOTE: Values shown above apply if the actual torque transmitted is more than 1/4 the coupling rating. For lesser torque, reduce the above values by 1/2. *Type H sleeves (orange) should not be used as direct replacements for EPDM or Neoprene sleeves (black) or with J or B flanges.

7. If the coupling employs the two-piece sleeve with the wire ring, force the ring into its groove in the center of the sleeve. It may be necessary to pry the ring into position with a blunt screwdriver.

8. Check safety codes and install protective guards or shields as required.

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II-P. INSTALLATION REXNORD REX OMEGA SPACER TYPE COUPLINGS

WARNING	
<ul style="list-style-type: none"> • Because of the possible danger to person(s) or property from accidents which may result from improper use or installation of products, it is extremely important to follow the proper installation and operational procedures. 	
<ul style="list-style-type: none"> • All rotational power transmission products are potentially dangerous and can cause serious injury. They must be properly guarded and in compliance with OSHA standards for the speeds and applications in which they are used. It is the responsibility of the user to provide proper guarding. 	
<ul style="list-style-type: none"> • Failure to secure cap screws properly could cause coupling component(s) to become dislodged during operation, resulting in PERSONAL INJURY. Do not start motor or job without the complete coupling being properly secured to driving and driven equipment shafts. 	
<ul style="list-style-type: none"> • Before installing this coupling on any system containing sleeve bearings, herringbone gear sets or other devices sensitive to axial thrust, consult Rexnord. 	
<ul style="list-style-type: none"> • It is the responsibility of the user to consider the coupling's stiffness (available from Rexnord) as it relates to the drive system frequency. 	

STEP 1: Inspect both driving and driven shafts and hub bores making sure they are free from dirt and burrs. Be sure the keys fit shafts properly. Mount both hubs to the shafts securing only one hub; the other hub should be loose for minor adjustment of spacing. Where tapered bushings are used, follow bushing manufacturer's instructions. If hub is bored for an interference fit, we recommend heating the hub – water, oil bath* or an oven and quickly positioning it on the shaft. Do not spot heat hub as it may cause distortion.

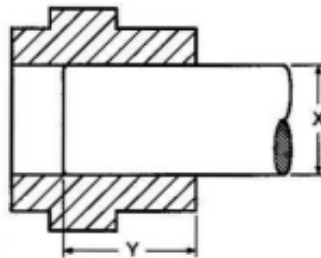
STEP 2: Place half of the elastomer element around hubs and secure with self-locking capscrews. The elastomer element will space the other hub. It is important to have cap screws properly tightened. See Table 1 below for recommended capscrew torques and instructions. Now secure the other hub to the shaft.

STEP 3: Mount other half of the elastomer element to hubs. Be sure to secure rings to the spacer element if provided. Tighten all capscrews to the recommended cap screw torques in Table 1 and you're done!

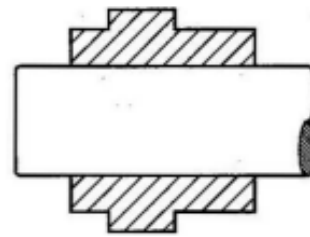
HELPFUL HINT: If the cap screw holes in the element do not line up properly with the hubs due to equipment misalignment, rotate the shafts (if possible) slightly as you install each cap screw. On larger coupling sizes, first install the cap screws that are located in the center of the half element.

ALLOWABLE SHAFT ENGAGEMENTS

Shafts can be flush with the hub (not shown), recessed below the face of the hub, or extended beyond the hub face.



Dimension Y should be equal to, or greater than .8 times dimension X.



The shaft may extend beyond the hub face, as long as there is sufficient keyway length available.

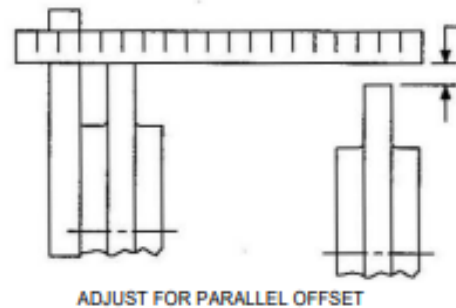
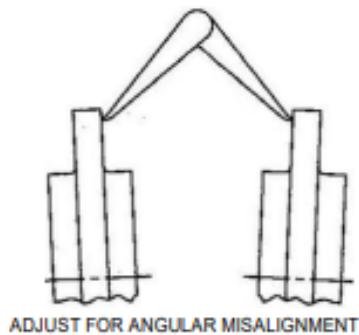
TABLE 1

RECOMMENDED CAPSCREW TORQUES FOR PROPER INSTALLATION	CPLG SIZE	TORQUE - DRY		
		IN. LBS.	FT. LBS.	Nm
<p style="text-align: center;">- IMPORTANT - Capscrews have self-locking patches which should not be reused more than twice.</p> <p style="text-align: center;">Capscrews can be further used with application of a thread-locking adhesive.</p> <p style="text-align: center;"><i>Do Not Lubricate Capscrew Threads</i></p>	2	204	17	23
	3			
	4			
	5			
	10			
	20	360	30	40
	30			
	40			
	50			
	60			
	70	900	75	100
	80			
	100			
	120	3240	270	370
140				
140	7080	590	800	

EQUIPMENT ALIGNMENT

Although Omega couplings can withstand gross misalignment, care should be taken for best possible alignment to assure optimum performance. The caliper/straightedge alignment procedure is described below. If greater alignment accuracy is desired, a dial indicator method is recommended. There are occasions when equipment manufacturers require more specific alignment tolerances, in which case, the manufacturer's recommendations should be followed.

1. To correct for angular misalignment, use calipers to check the gap between hubs. Adjust or shim equipment until the gap is the same at all points around the hubs.
2. To correct parallel offset, place a straightedge across the hub flanges in two places at 90° to each other. Adjust or shim equipment until the straightedge lays flat on both sides.
3. Tighten down connected equipment and recheck alignment.
4. Install elastomer element, tightening all cap screws to the values shown in Table 1 as described on the reverse side.
5. If practical, recheck and tighten cap screws after several hours of operation.



II-Q. STUFFING BOX

1. Packing: Stuffing box packing is installed at the factory. Gland bolt nuts should be installed finger tight only. Packing cannot run dry; it must be lubricated. If the pumped liquid is clean, cool fluid, it may be used through a bypass off the discharge to the lantern ring connection to lubricate the packing. If the pumped liquid is dirty or hot, it is not suitable to lubricate the packing. An external source must be utilized, unless the bypass is equipped with proper separator, filter, and/ or cooling system. This must also be piped into the lantern ring connection (refer to packing recommendations).
2. Mechanical Seals: When mechanical seals are supplied, they are installed and adjusted at the factory. They must not run dry or encounter abrasives in the pumped liquid. Connect recirculation, flush, and/ or cooling lines as required, following instructions on the seal drawing supplied. On the cartridge type seals installed at the factory, the centering clips are removed. Follow instructions on the seal drawing supplied.

PACKING RECOMMENDATIONS

1. General Service Packing- This is an Aramid-PTFE synthetic packing. It is best suited for cold water and general service applications. It has a PH range of 0 to 12 and a maximum operating temperature of 500 degrees F. This packing is like Crane type 1345 or equal.
2. Chemical and Solvent Packing - This is a PTFE-Synthetic packing. It is used for severe chemical and solvent applications. It has a PH range of 0 to 14 and a maximum operating temperature of 500 degrees F. This packing is like Crane type C1065 or equal.
3. High Pressure and Temperature Packing - Often called Graphoil, it is used in high pressure and temperature applications. It has a PH range of 0 to 14 and a maximum operating temperature of 750 degrees F.

PACKING SIZE

The following is a list of the standard packing size for all process pump models.

Frame Size	Packing Size	Approx. Length	No. of Rings	Lantern Ring Width
STP	5/16 x 5/16	4.75	5	7/16
MTP	3/8 x 3/8	5.75	5	5/8
LTP	3/8 x 3/8	7.0	5	5/8
XLTP	7/16 x 7/16	8.0	5	5/8

OPERATION

III-A START-UP CHECK LIST

(a) Checking shaft rotation

1. With power, off and locked out, remove spacer between coupling hubs.
2. Restore power, and momentarily energize motor to determine rotation. Motor shaft must rotate in direction of arrow on the pump bearing frame.
3. Shut off power and lock out.
4. Check impeller clearance. Pumps assembled at the factory are set at .015-inch clearance. Do not rely on factory setting which could be affected by piping connections, or if high temperature liquids are to be pumped, the impeller setting must be corrected. See appendix for adjustment procedure.
5. Reinstall coupling spacer. Make sure coupling hubs are secured to the shafts. Lubricate coupling as required per manufacturer's instructions. **RECHECK ALIGNMENT.**
6. Install coupling guard.

(b) Bearing Lubrication

Oil Lubrication: PUMPS ARE NOT SHIPPED FROM THE FACTORY WITH OIL.

1. Remove item 113A (oil fill plug) and fill frame with oil to the center of the sight glass. A high quality turbine oil with rust and oxidation inhibitors should be used. See Appendix for oil recommendations and instructions for filling frame with oil when Trico oilers are installed.

Pure Oil Mist Lubrication: The power frames have, as standard, drilled and tapped connections for oil mist systems. The connections are located on the top of the bearing frame. Follow instructions from the manufacturer of the oil mist generator system. If you are already using flood oil lubrication, instructions for converting to oil mist are in the Appendix.

Grease Lubrication: Pumps shipped from factory contain some grease but it is not sufficient for placing the pump into continuous service. Refer to instructions in the appendix.

Greased for Life Bearings: These bearings are greased and permanently sealed by the bearing manufacturer.

See appendix for recommended lubrication schedules.

- (c) **Shaft Sealing** - Refer to section II-Q page 20.

WARNING:

Never allow pump to run dry, or operate pump without liquid in the seal chamber. Seal faces must always be lubricated. Operating a pump without liquid in the casing or seal chamber, even for a few moments, can cause seal failure, pump damage and or personal injury.

- (D) **Priming:** A centrifugal pump must be primed before it can be operated. If run dry, damage can occur to close-clearance rotating parts and will destroy mechanical seals. If not primed properly, it will not deliver fluid. Prime in one of the following methods:
1. If system has suction pressure, slowly open the suction valve. Open air vents on the pump casing and suction and discharge piping until fluid runs out. Rotate shaft a few times if possible to evacuate any trapped air in the impeller passages. Close all vent valves.
 2. If the system has suction lift and there is a foot valve in the suction pipe, fill the pump casing and suction pipe with the liquid to be pumped. At the same time let any trapped air escape.
 3. If the system has a suction lift but no foot valve, use a vacuum pump or ejector operated by air, steam, water, engine exhaust, etc., to evacuate the air from the pump case and suction pipe. Connect the ejector to the gauge connection at the top of the discharge nozzle, if provided.
- (E) **Starting the Pump:** Turn the pump shaft by hand to ensure that the rotating element is free. If the rotating element rubs or binds, check for any abnormal piping strain or other loads on the pump causing misalignment. A slight drag from the mechanical seal is normal.
1. Check that the voltage and frequency on the motor nameplate match the current supply. Be sure the motor is wired for correct voltage. Check that all thermal overload relays are of the proper size and "set" for operation.
 2. Be sure the valve in the suction line is open. Never use the suction line valve to control flow. The discharge valve should be dosed or partially open. See that all pipe connections are tight. Make sure all flushing and cooling lines are open.
 3. Restore power supply and start the pump motor/driver. As soon as pump reaches full speed, slowly open the discharge valve.

WARNING:

Do not operate the pump below minimum rated flow levels or against a closed discharge valve for prolonged periods of time. This can cause increased vibration levels which will affect seal and bearing life. It can also cause cavitation damage to the internal surfaces of the pump.

4. If hot liquid is pumped, control opening of discharge valve to allow pump temperature to stabilize before reaching full capacity. Observe the operation of the pump. If excessive vibration or noise is evident, the unit should be stopped immediately and a thorough check made of the installation to determine the cause. Correct any fault before restarting the pump.
5. Listen for rubbing or binding which may have been caused by piping strains. If present, shut down the pump immediately. Investigate and correct the cause before restarting the pump.
6. Check the packing/mechanical seal for proper operation. Packing should have a leakage rate between 40 to 60 drops per minute. Never force the packing into a leakproof position since this will create excessive friction and premature damage to the packing and shaft or shaft sleeve. If leakage is excessive, tighten the gland bolts evenly, about 1/4 turn at a time. Allow the packing to seat in its new position. Packing must be "run-in" and this could take several hours or days to achieve the desired results. Mechanical seals are installed and adjusted at the factory. No further adjustment is required except for a short run-in period.

7. After the pump, has been operating for a sufficient length of time to bring it up to operating temperatures, the final alignment should be checked. Once the pump has reached operating temperature, stop the pump, lock out the power source, and immediately remove coupling guard. Disconnect coupling and check the alignment. Make any necessary adjustments at this time. Reconnect coupling and replace coupling guard.

WARNING

NEVER RUN PUMP WITHOUT THE COUPLING GUARD. DISREGARD OF THIS WARNING CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

- (F) Pump Shutdown: Slowly close discharge valve and shut off power to the motor. Lock out motor power supply to prevent accidental restart when performing inspection or routine maintenance.

PREVENTIVE AND CORRECTIVE MAINTENANCE

A planned program of routine inspection and preventive maintenance can increase the service life of your pump. Maintenance records should be kept for each pump in a data base which will be beneficial in developing long term maintenance planning. Regular check ups of the following items will help keep your pump running trouble free and keep costly downtime to a minimum.

IV-A. DAILY/WEEKLY ROUTINE INSPECTION AND MAINTENANCE

- (a) Observe oil level and condition through sight glass or Trico oiler if provided. Oil level should be visible and at the level indicated on the sight glass. Slight foaming under operation is normal. Contaminated oil should be changed immediately.
- (b) Grease lubricated bearings should be re-greased at start-up and approximately every 2000 hours of operation. Refer to Appendix, page 36, for recommended grease manufactures.
- (c) Check mechanical seal chamber for leaks. Mechanical seals should not leak. Visible signs of leakage should be investigated immediately.
- (d) Visually inspect pump and piping for leaks. Inspect all tapped and plugged connections. Check for unusual noise or vibrations. Check for high bearing temperatures.
- (e) Periodically; check foundation bolts, pipe supports and pump to motor alignment.
- (f) If performance deteriorates, refer to troubleshooting, Appendix.

STP/MTP POWER FRAMES

V-A. DISASSEMBLY AND REASSEMBLY INSTRUCTIONS

REQUIRED TOOLS

Torque Wrenches* (ft. lbs)	Dial Indicator
Impeller Wrench, Part # 96A3038 F-056	Micrometer
Allen Wrenches	Snap Ring Pliers
Open End Wrenches 9/16", 3/4", 7/8", 15/16"	Feeler Gauges
Induction Bearing Heater	Drift Punch
Spanner Wrench	Hoist

WARNING

Proper methods to handle pump components must always be used to avoid physical injury or damage to parts.

Lock out power supply to motor, dose off suction and discharge valves. Drain liquid from casing and flush if required. Carefully, disconnect all accessory piping, remove coupling guard and disconnect coupling. Remove complete pump assembly or back pull out, (power frame with adapter, box cover and impeller attached), by removing frame adapter to casing bolts, (item 370). Using suitable lifting device, place pump, or back pull out assembly, on dean work surface of adequate strength to support the weight.

STP/MTP PUMP. FRAMES

- (a) Secure pump/back pullout assembly, to work bench.
- (b) Drain oil from bearing frame by removing oil drain plug (408A). Replace drain plug and dispose of. used oil in an environmentally appropriate manner.
- (c) Scribe line on pump shaft at end of coupling hub and proceed to remove hub from shaft.
- (d) Remove impeller (101), do not apply heat. Use impeller shaft wrench #96A3038F-056 for STP and MTP frames. For LTP and XLTP frames use a spanner wrench or another suitable tool that will not mark the shaft. Slide wrench over shaft (122) and key (400). Turn impeller clockwise (viewed from impeller end of shaft), to raise wrench off work bench. Abruptly, turn impeller counterclockwise to impact wrench against workbench or block of wood. Repeat as necessary until impeller loosens on shaft threads. Spin off impeller and discard O-ring seal (496A).

REMOVAL OF STUFFING BOX COVER-MECHANICAL SEAL PUMPS

- (e) Remove seal gland stud nuts (353A). Separate seal gland (250), and slide gland toward bearing isolator (333A).
Remove seal chamber stud nuts (423B).
To remove seal chamber (184), slide chamber forward and off pump shaft.

- (f) Remove mechanical seal rotary (non-partridge type) from pump shaft sleeve by loosening set screws and sliding assembly off of pump sleeve.
- (g) Slide shaft sleeve forward and remove from shaft (126).
- (h) Slide seal gland with stationary seat and O-ring gasket off of pump shaft.

REMOVAL OF STUFFING BOX COVER-PACKED PUMPS

- (i) Remove packing gland studs (353) and nuts (353A).
- (j) Remove stuffing box cover stud nuts (423B).
- (k) Remove box cover by sliding cover forward and off of pump shaft. (l)

Remove packing rings (106) and lantern ring (105).

- (m) On MTP, LTP and XLTP pump models, remove frame adapter (108) from power frame as follows:

1. Remove dowel pins (469B)
2. Remove frame to adapter bolts (370B)
3. Separate adapter from frame and discard O-ring gasket (360D)
4. **DO NOT REMOVE LABYRINTH SEAL ASSEMBLY FROM FRAME ADAPTER.**

POWER END DISASSEMBLY-STP AND MTP MODELS

- (a) Remove cap screws (370C), loosen jam nuts (423). Tighten jack bolts (370D) evenly. Bearing housing will begin to back out of frame.
- (b) Slide shaft assembly, with bearing, housing out of bearing frame.
- (c) Remove all jack screws and nuts, items (370D) and (423).
- (d) Remove and discard bearing housing a-ring (496).
- (e) Using snap ring pliers, remove bearing retaining ring, (361A).
- (f) Remove bearing housing (134) from shaft by tapping the shaft with a rubber mallet, driving the thrust bearings and shaft assembly through the housing.

DO NOT ATTEMPT TO REMOVE THE LABYRINTH SEALS, (333A) and (332B). THESE ARE ONE PIECE ISOLATORS THAT ARE NOT DESIGNED FOR FIELD DISASSEMBLY. UNLESS DAMAGED, THE ISOLATOR O-RINGS DO NOT REQUIRE SERVICE OR REPLACEMENT.

- (g) Remove bearing lock nut (136) and lock washer, (382).
- (h) Using an arbor press, remove inboard and outboard bearings. Slide snap ring off shaft after bearings have been removed.
- (i) Complete disassembly of bearing frame (228). Remove oil fill plug, (113A), oil sight glass (408N), Oil mist/grease plugs four (4), (408H). Remove oil cooler inlet and outlet plugs, (408L) and (408M). On MTP models, remove frame foot attachment bolts (370F).

POWER END DISASSEMBLY-LTP FRAMES

- (a) Remove bearing housing bolts (370C), loosen jam nuts (423). Tighten jack bolts (3700) evenly. Bearing housing will begin to back out of frame.
- (b) Slide shaft assembly, with bearing, housing out of bearing frame.
- (c) Remove all jack screws and nuts, items (3700) and (423). Remove bearing housing O-ring (496).
- (d) Remove bearing cover screws (370G) and remove cover.
- (e) Remove bearing housing (134) from shaft by tapping the shaft with a rubber mallet, driving the thrust bearings and shaft assembly through the housing.

DO NOT ATTEMPT TO REMOVE THE LABYRINTH SEALS, (333A) and (332B). THESE ARE ONE PIECE ISOLATORS THAT ARE NOT DESIGNED FOR FIELD DISASSEMBLY. UNLESS DAMAGED, THE ISOLATOR O-RINGS DO NOT REQUIRE SERVICE OR REPLACEMENT.

- (f) Remove bearing lock nut (136) and lock washer, (382).
- (h) Using an arbor press, remove inboard and outboard bearings. Remove bearing cover. **DO NOT REMOVE OIL RING (248A) FROM SHAFT UNLESS IT IS DAMAGED.**

POWER END DISASSEMBLY-XLTP FRAMES

- (a) Remove bearing frame foot bolts (370F), and remove foot (241).
- (b) Remove bearing housing bolts (370C), loosen jam nuts (423). Tighten jack bolts (370D) evenly. Bearing housing **will** begin to back out of frame.
- (c) Slide shaft assembly, with bearing housing, out of bearing frame.
- (d) Remove all jack screws and nuts, items (370D) and (423). Remove bearing housing O-ring (496).
- (e) Remove bearing cover bolts (370G) and bearing cover (109C). Discard O-ring gasket (360C). **DO NOT REMOVE LABYRINTH SEAL.**
- (f) Using an arbor press, remove inboard bearing (168A).
- (g) Remove bearing housing (134), by sliding housing over the bearing and removing housing from impeller end of shaft.
- (h) Remove bearing locknut (136) and lock washer (382).
- (i) Press outboard bearing (112) off of shaft.

PARTS INSPECTION

ALL PARTS MUST BE INSPECTED BEFORE REASSEMBLY TO ENSURE THAT THE REBUILT PUMP WILL PERFORM PROPERLY. EACH PART SHOULD BE EXAMINED FOR SIGNS OF FATIGUE, EXCESSIVE WEAR AND CRACKS. REPLACE ANY WORN PARTS IF THEY DO NOT MEET THE FOLLOWING TOLERANCE STANDARDS.

BEARING FRAME AND FOOT - Visually inspect for cracks, roughness, rust or scale. Check machined surfaces for pitting or erosion. **BEARING FRAME** - INSPECT TAPPED CONNECTIONS FOR DIRT, CLEAN AND CHASE THREADS AS NECESSARY. Remove all loose or foreign material. Inspect lubrication passages to be sure that they are open. Inspect inboard bearing frame bore.

SHAFT AND SLEEVE - Visually inspect, check for grooves or pitting. Check bearing fits and shaft runout. Replace shaft and sleeve if worn, or if tolerances are outside the limits listed below.

SECTION VI

INSPECTION AND OVERHAUL

1. Impeller

Replace if impeller shows excessive erosion (especially on ejector vanes on back side of impeller), corrosion, extreme wear or vane breakage. "O" ring groove and impeller hub must be in good condition. Impeller has a push fit on shaft (.000" to .0015" loose). Check impeller balance.

2. Sideplate

To maintain maximum efficiency, the clearance between sideplate and impeller should be 0.015". Overall travel in casing is between 0.059" and 0.085". Sideplates should be inspected for erosion, pitting or excessive wear. Replacement is required when distance between impeller and suction sideplate cannot be held to 0.015" with the axial adjustment.

3. Shaft

Check for runout to see that the shaft is not bent. Bearing seats and oil seal areas must be in perfect condition and free of scratches and grooves. O.D. and finish in these areas must be within bearing manufacturer's specifications. Check that the keyway is free of corrosion. Replace shaft if necessary.

4. Shaft Sleeve

The shaft sleeve is a push fit and is bored: ("5" -0.000" to 0.002"); ("M" & "L" -0.001" to 0.003") larger than the shaft and should tap easily on the shaft. If the sleeve does not tap on easily, the bore and shaft should be inspected to see that they are free from foreign matter or burrs. The fit of the key in the keyway should also be checked to see that it is not causing binding. The key should have a sliding fit on the sides and should have clearance at the top. Sleeve surface in stuffing box must be smooth and free of grooves. If grooved, replace. "O" ring groove must be in good condition. The original diametric clearance between shaft sleeve and stuffing box bushing is 0.025" to 0.032". If this clearance has increased to more than 0.050", the shaft sleeve, and at times, the stuffing box bushing should be replaced.

""-""

5. Mechanical Seal

Lapped seal faces, gaskets, and shaft sealing members must be in perfect condition or excess leakage may result. Replace worn or damaged parts.

6. Ball Bearing

Always replace ball bearings whenever the bearing frame is dismantled. Replacement bearings must be proper size and type as specified in the Construction Details. New bearings should not be unwrapped until ready for use.

7. Oil Seals and Gaskets

Always replace oil seals, gaskets, and O-rings at reassembly. Seals are held by a press fit. The sizes are given in Table 5.

Table 5		
COUPLING END/OB		
GROUP	LABYRINTH OIL SEAL INPRO (OPT)	NEOPRENE OIL SEALS
S	2696389-000	9942361-000
M	2696388-000	9942879-000
L	2696392-000	9943339-000
INBOARDIIB		
GROUP	LABYRINTH OIL SEAL INPRO (OPT)	NEOPRENE OIL SEALS
S	2696390-000	9942450-000
M	2696391-000	9942997-000
L	2696393-000	9943409-000

Lips on seals should face out (away from bearings). One side of bored hole for oils seal is chamfered so that the seal will start easily when pressed in.

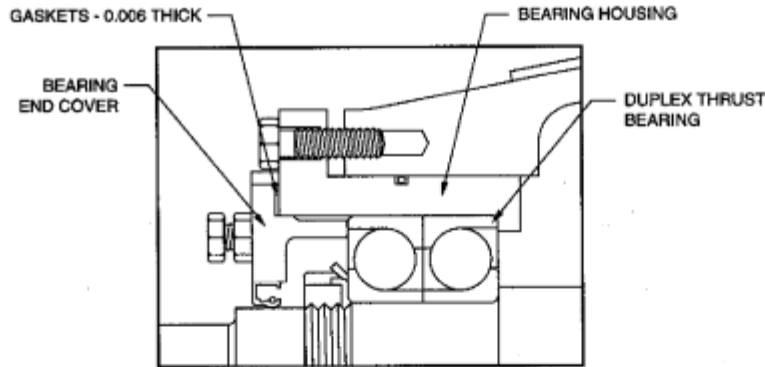
8. All parts should be clean before assembly. This is especially important at 110" ring grooves, threads, lock fits, gasket surfaces, and bearing areas. Any burrs should be removed with crocus cloth.

SECTION VII

RE-ASSEMBLY OF PUMP

This procedure covers reassembly of the pump after complete disassembly. Be sure all directions in Section VI Inspection and Overhaul have been followed.

1. Oil bearing seat on coupling end of shaft. Slight heating of bearing either by hot oil or induction would allow easy installation. Slide coupling end bearing (duplex, mounted back-to-back) on shaft as far as possible by hand. Place pipe or driving sleeve over shaft, making sure it rests against inner race only. Make sure bearing is "Square" on shaft. Press evenly until bearing is seated firmly against the shaft shoulder. Do not mark the shaft, especially where it contacts oil seal. The duplex bearing arrangement depends on the type of construction used by the manufacturer. Refer to the manufacturer's instructions packed with the bearings for duplex mounting arrangement.
2. Insert the bearing lock washer, pressing tange into shaft keyway until it is firmly against the bearing.
3. Oil shaft threads lightly and snug the bearing locknut against the lock washer. Tighten firmly with a spanner wrench. Seat tang securely into slot in locknut with drift pin. If necessary, tighten locknut slightly to match tange with slot. Do not loosen locknut to position.
4. Slide bearing housing with "0" ring in place, over impeller end of shaft and over outboard bearing.
5. Tap outboard oil seal in place on bearing end cover (coupling end).
6. Place bearing end cover end .006" white manila gasket over coupling end of shaft and fit into bearing housing. If oil seal is dry, oil lightly before sliding over shaft. Be sure to position "TOP" (cast on cover) in line with "TOP" on housing. Bolt end cover firmly to housing.
7. Oil inboard bearing seat on shaft. Slide inboard ball bearing on shaft as far as possible by hand. Place pipe or sleeve (such as the one shown in Item 1) over shaft, making sure bearing is seated firmly against shaft shoulder. Do not mark shaft, especially where it contacts the oil seal or in stuffing box area.
8. Place a small amount of "0" ring lubricant on inside of bearing frame at bearing housing and inboard bearing seats, on "0" ring, and on inboard oil seal. Slide shaft assembly into the bearing frame as far as possible. When the bearing housing is properly installed (oil return hole at the bottom), the word "TOP" located on the flange of the bearing housing will line up with the top of bearing frame. Be sure bearing housing "0" ring (496) is in place in groove on housing. Insert bearing housing bolts into bearing housing and screw about 1/2" into frame to hold shaft during further assembly.
9. Tap oil seal into the bearing end cover (front/inboard).
10. Slide gasket and inboard bearing end cover over shaft and bolt to bearing frame.
11. Slide deflector on shaft with flat side facing inboard, in until it rests against the bearing frame.



FIGURES

12. Bearing end play may be determined at this point as follows: Clamp dial indicator to the pump so that the button rests against the end of the shaft. Push the shaft back and forth as far as possible. Total end play must be at least 0.001" and not more than 0.008". If end play is less than 0.001" add coupling end bearing end cover gaskets made from 0.006" thick manila paper. If end play is greater than 0.008" remove gaskets. Because of matching tolerances, duplex thrust bearings may vary in width by up to 0.030". A correctly assembled pump may require as few as one, or as many as three 0.006" thick gaskets. Refer to Figure 5.
13. Install and position coupling hub at scribe mark on shaft.
14. Bolt bearing frame to frame adapter.
15. To install shaft sleeve and stuffing box cover:
 - (a) On units with a PACKED STUFFING BOX, tap stuffing box bushing into place. Lift stuffing box cover into position at impeller end of shaft. Guide stuffing box cover over shaft and sleeve to prevent contact to these surfaces. Bolt the stuffing box cover to the frame adapter.
 - (b) On units with a MECHANICAL SEAL, refer to the order acknowledgement and seal drawing (supplied with the pump) to determine seal type and mounting dimensions.

THE FOLLOWING INSTRUCTIONS REFER TO PUMPS EQUIPPED WITH MECHANICAL SEALS. See Figure 6.

Setting Mechanical Seals.

- (a) With the bearing frame-shaft assembly completed, install shaft sleeve.
 - (b) Carefully slide the stuffing box cover over the sleeve and bolt to the bearing frame. Install impeller with bearing cartridge pushed all the way forward. (See page 36) Set a clearance of .030" between impeller and back side of stuffing box cover.
 - (c) Scribe the shaft sleeve at the face of the stuffing box cover. (See Figure 6) (d)
- Unbolt and remove the impeller and stuffing box cover. Remove sleeve.
- (e) For ease of installing rubber gaskets and to help avoid cutting of gaskets, lubricate prior to installation with lubricant compatible with media and gasket material. EXAMPLE: Only use silicone lubricant on ethylene propylene rubber compounds.

(f) Lapped seal faces must not be scratched or nicked during handling. Lint free tissues should be used to clean lapped faces prior to installation. Dirt and dust particles left on faces can scratch and cause unsatisfactory seal performance.

<::

(g) Check seal assembly drawing before installing seal on shaft sleeve. Seal setting dimension (Installation Reference) is shown on the seal assembly drawing, and should be used locate the seal on the sleeve together with the scribe mark made earlier.

(h) Install rotary part of the seal on the shaft sleeve and tighten set screws then install seal flange with stationary seat assembly and gland gasket. Carefully install this assembled unit over the shaft.

(i) Be sure gland gasket is in place and that pipe taps of the seal gland are in position as shown on the applicable assembly drawing. Then carefully slide the stuffing box cover over the shaft sleeve and seal assembly. Bolt the stuffing box cover to the frame adapter. Then bolt up seal flange progressively, tightening bolts using uniform torque. Be sure seal gland gasket is in place.

NOTE

BE CAREFUL NOT TO DAMAGE SEAL ON UNITS WITH DOUBLE SEALS, MAKE SURE INBOARD STATIONARY SEAT IS PROPERLY POSITIONED.

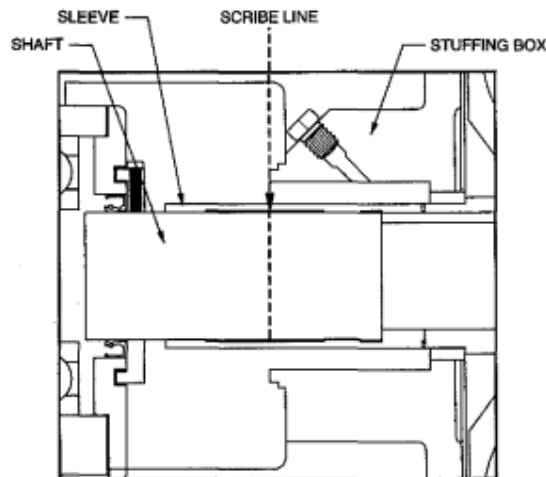


FIGURE 6

16. Place stuffing box cover-to-casing gasket against shoulder of stuffing box cover. Small amounts of "0" ring lube may be used on both sides of gasket to seal and secure gasket in place.
17. Lubricate shaft keyway and insert impeller key in shaft and shaft sleeve. Install impeller "0" ring replace if worn. Lubricate shaft and slide impeller on shaft as far as possible. Pull impeller on shaft the remainder of distance with impeller screw. Be sure impeller screw "0" ring is in good condition. Prevent shaft from rotating by using a spanner or strap wrench.

18. Place "O" ring in outer groove of suction side plate. Install the side plate-to-casing studs in tapped holes in side plate. Place side plate to casing gasket into bottom of casing. Place suction side plate in casing, making sure not to damage the side plate "O" ring. Liberal amounts of "O" ring lube may be used to assist in sliding in place. Install and tighten four nuts on side plate to casing studs.
19. Tighten casing hold-down bolts to side plate.
20. Connect suction and discharge pipe (if in the system). Care should be taken to prevent excessive pump flange loading.
21. Slide the completely assembled "back-pull-out" unit into the casing. Tighten the frame adapter-to-casing bolts evenly to assure that gap between adapter and casing is even. Check with a feeler gauge at 4 points 90° apart around the adapter.
22. Install pedestal hold-down bolts.
23. Set impeller clearance as outlined in Appendix. Clearance between impeller and side plate should be set at 0.015" to maintain optimum efficiency. Overall travel must be 0.059" to 0.084" dependent on tolerances. If not, check casing gasket to be sure it is 1/16" thick
24. If unit requires stuffing box packing, refer to section II-Q and pack as directed. (Refer also to Fig. 7 for alternate methods of packing.)
25. Replace auxiliary piping.

ADDITIONAL DETAILS

1. Stuffing Box

The standard stuffing box cover has four pipe taps for sealing or flushing liquid to the packing or mechanical seal. Two are used for in and out connections to the throat of the stuffing box for paper stock services with the lantern ring positioned next to the stuffing box throat bushing. Two are alternately used for evaporator or chemical services as in and out connections. Figure 7 shows a stuffing box and location of holes, and the holes used for evaporator services and paper stock service.

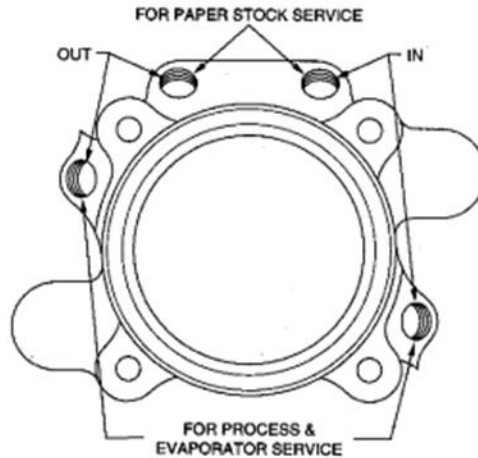


FIGURE 7

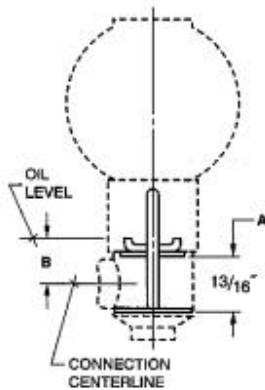
APPENDIX

OIL LUBRICATED BEARINGS

NOTE

Pumps are not shipped from the factory with oil. Responsibility for filling the bearing frame with the proper type and amount of oil is the responsibility of the user.

Remove item (113A) oil fill plug/breather and fill frame with oil to the center of the sight glass. If a Trico oiler is used, follow instructions below in Figure 8.



1. Remove adjustment assembly from oiler.
2. Adjust bars to dimension "An.
3. Lock into position.
4. Replace adjustment assembly in oiler.

Pump Group	Oiler Size	A	B
S	8 oz	.1875	0.7
M	8 oz	.1875	0.5
L	8 oz	.1875	0.89

FIGURE 8 - OIL LUBRICATED BEARINGS, TRICO OILER ONLY

A high-quality turbine oil with rust and oxidation inhibitors should be used. Under normal operating conditions, an oil of 300 SSU viscosity at 100° F should be used where pumping temperatures do not exceed 350° F. (177°C.). See table below for recommended oil types. Fill oiler bottle and replace in oiler housing. We recommend a breather to be installed in the location of the oil fill plug when a Trico oiler is used.

Change oil after 200 hours of operation for new bearings, then every 2000 hours or three months whichever occurs first.

BEARING FRAME OIL APPX. CAPACITY

Frame	Pints	Liters
STP	6	2.8
MTP	8	3.8
LTP	10	4.7

12.

RECOMMENDED OIL MANUFACTURERS

Atlantic Richfield	DURO 68
Chevron	CHEVRON TURBINE OIL GST 68
Exxon	TERESSTIC 68
Texaco Inc.	Regal R&O 68
Mobil	DTE Heavy-Medium
Amoco Oil	Amoco Industrial Oil #68

GREASE LUBRICATED BEARINGS

NOTE:

Grease lubricated ball bearings are optional on the ANSI series. These units can be identified by grease fittings located on the bearing frame. Pumps ordered with regreaseable bearings from the factory will contain some grease, but not a sufficient amount for placing the pump into continuous service. It is necessary to completely grease the bearings as described below before placing the pump on line. Failure to do this may result in repairs not covered by the product warranty.

- (a) Clean any dirt or foreign matter from the grease fittings. Remove grease relief plugs from bottom of frame. Pump grease through the fittings and into each bearing cavity until fresh grease comes out of the relief ports. REG REASE BEARINGS EVERY 2000 HOURS OF OPERATION OR 3 MONTHS, WHICHEVER OCCURS FIRST. For pumping temperatures, less than 350⁰ F, use a lithium based mineral oil grease of NLGI consistency equal to NO.2. NEVER MIX GREASES OF DIFFERENT CONSISTENCIES OR OF DIFFERENT TYPES. WHEN CHANGING FROM ONE TYPE GREASE OR CONSISTENCY TO ANOTHER, ALWAYS REMOVE THE BEARINGS AND CLEAN OUT ALL THE OLD GREASE.

ACCEPTABLE GREASE MANUFACTURERS

NGLI GRADE 2	(350 Degrees F. MAX.)
Mobil	Mobilux EP2
Exxon	Unirex N2
Sunoco	Multipurpose EP
SKF	LGMT 2

NGLI GRADE 3	(500 Degrees F. MAX.)
Exxon	Unirex 3
SKF	LGMT 3



APPENDIX

IMPELLER CLEARANCE ADJUSTMENT

If a gradual loss in head and/ or capacity occurs, performance may be restored by adjusting the impeller. If performance cannot be restored by adjustment, the pump should be disassembled and impeller and casing inspected for wear. Impeller clearance is the measurement between the edge of the impeller vanes and the surface of the casing side plate. The following table should be used as a guide for setting the impeller clearance under various operating temperatures.

Temperature	Impeller Clearance
up to 200°F (93°C)	.015 in. (0.38mm)
201°F to 250°F (121°C)	.017 in. (0.43mm)
251°F to 300°F (149°C)	.019 in. (0.48mm)
300°F to 399°F (177°C)	.021 in. (0.53mm)
400°F to 450°F (218°C)	.023 in. (0.58mm)
451°F to 500°F (246°C)	.025 in. (0.64mm)

FEELER GAUGE ADJUSTMENT OF IMPELLER CLEARANCE

- (a) LOCK OUT POWER SUPPLY TO MOTOR.
- (b) Remove coupling guard. Loosen jack bolts (370D) and jam nuts (423). Tighten bearing housing bolts (370C) evenly, while slowly rotating the shaft until the impeller just starts to rub on the casing side plate. Using a feeler gauge, set the gap between the four housing bolts (370C) and the bearing housing. SEE FIGURE 10. Set the gap according to the above table as required.

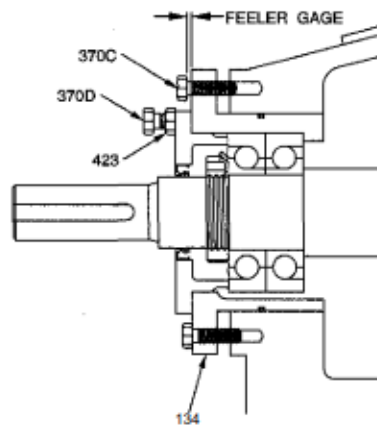


FIGURE 10

- (c) Tighten jacking bolts (370D) evenly, until bearing housing backs out and contacts the bearing housing bolts (370C). Tighten jam nuts (423) evenly. Rotate shaft to make sure that it turns freely.
- (d) Reinstall coupling guard.

DIAL INDICATOR ADJUSTMENT OF IMPELLER CLEARANCE

- (a) LOCK OUT POWER SUPPLY TO MOTOR.
- (b) Remove coupling guard and coupling.
- (c) Place a dial indicator with a magnetic mounting base on the surface of the pump baseplate. Position indicator against face of pump shaft. SEE FIGURE 11.

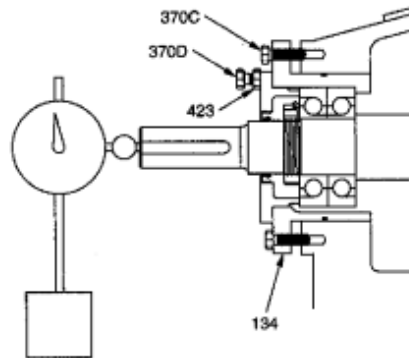


FIGURE 11

- (d) Loosen jacking bolts (3700) and jam nuts (423).
- (e) Tighten bearing housing bolts (370C) evenly, while slowly rotating the shaft until the impeller just starts to rub on the casing wear plate. Set dial indicator to zero.
- (f) Tighten the jacking bolts (3700) evenly, until they contact the bearing frame. Continue to tighten the jacking bolts evenly, about one flat at a time, drawing the bearing housing away from the frame until the dial indicator shows the proper clearance. SEE TABLE ON PAGE 36.
- (g) Tighten bearing housing bolts (370C) evenly, then tighten jam nuts (423) evenly. Make sure dial indicator reading does not move from the proper setting. Rotate shaft to make sure that it turns freely.
- (h) Reinstall coupling and coupling guard.

ASSEMBLY CHECKS SHAFT END PLAY

Frame	Double Row
S	0.0010 in (.026 mm)
	0.0015 in (.038 mm)
M	0.0013 in (.032 mm)
	0.0017 in (.044 mm)
L	0.0013 in (.032 mm)
	0.0017 in (.044 mm)

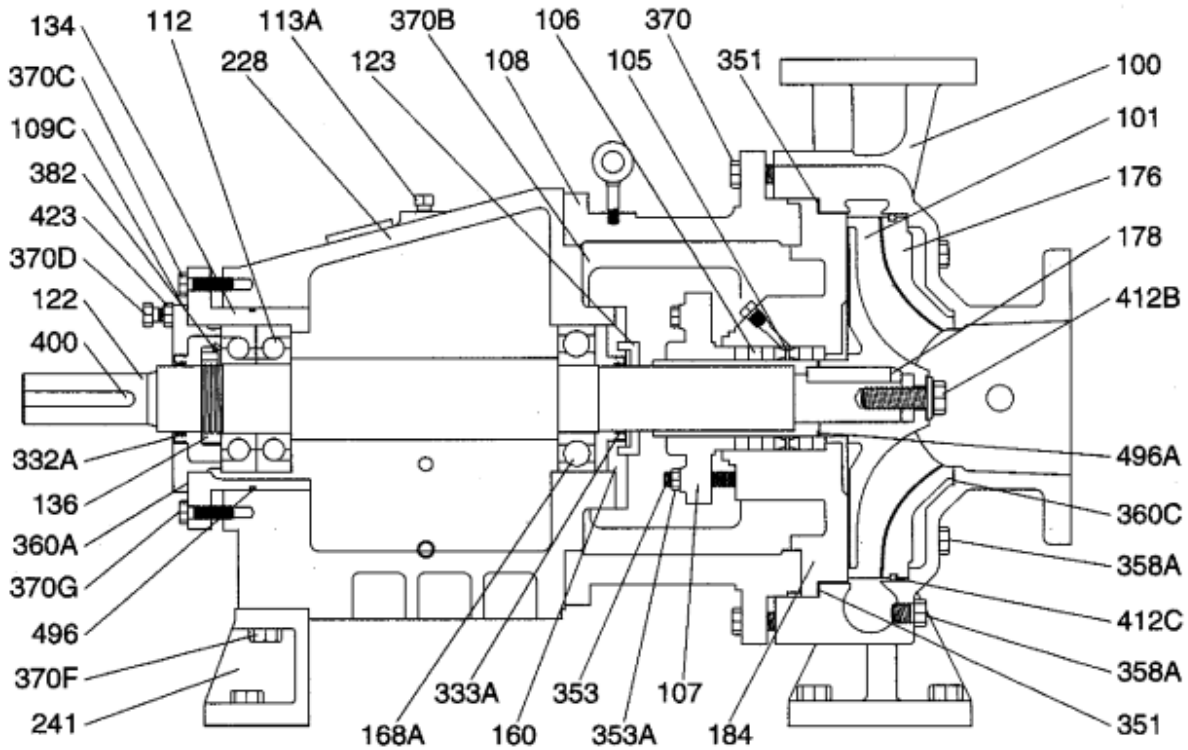
APPENDIX

BOLT TORQUE VALUES

Type	Frame Size	Threads Dry	Threads Lubricated
Casing Bolts Item 370	S/M/L	45 Ft Lbs (60nm)	30 Ft Lbs (40nm)
Frame To Adapter Bolts Item 370 B	S/M/L	30 Ft Lbs (40nm)	20 Ft Lbs (27nm)
Bearing Cover Bolts Item 370G	S/M/L	83 In Lbs (9.4nm)	55 In Lbs (6.2nm)
Bearing End Cover Bolts Item 370G	S/M/L	12 Ft Lbs (16nm)	9 Ft Lbs (12nm)

APPENDIX

S FRAME Cross Sectional Drawing

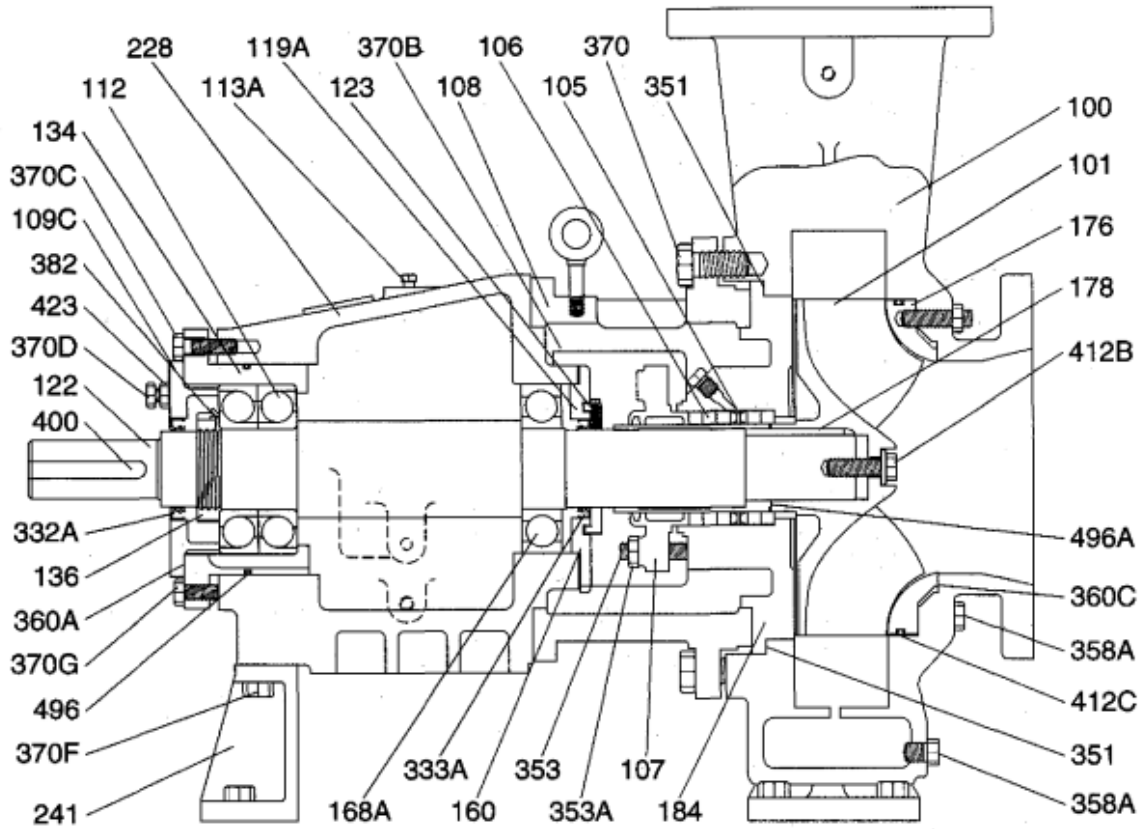


ITEM #	QTY	DESCRIPTION
100	1	Casing
101	1	Impeller
NA	1	Foot, Casing
NA	2	Bah, Casing Foot
105	1	Ring, Lantern
106	1	Packing
107	1	Gland, Packing
108	1	Adapter
109C	1	Cover, Bearing, Outboard
112	1	Bearing, Outboard
113A	1	Plug, Oil Fill
NA	1	Pin, Sleeve
122	1	Shall
123	1	Deflector
126	1	Sleeve, Shall
134	1	Housing, Bearing, Outboard
136	1	Locknut, Bearing
160	1	Bearing COYer, Inboard
168A	1	Bearing, Inboard
178	1	Impeller Key
184	1	Cover, Stuffing Box
228	1	Frame
241	1	Foot, Frame
24M	1	Ring, Oil
295	1	Flanet, Mechanical Seal
332A	1	Labyrinth, Outboard Frame
333A	1	Labyrinth, Inboard Frame

ITEM#	QTY	DESCRIPTION
351	1	Gasket, Case
358A	1	Plug, Casing Drain
353	4"	Stud, Gland
353A	4"	Nut, Gland Stud
360A	1	Gasket - Bearing End Cover - Coupling End
360C	1	Gasket, Side plate to Casing
3600	1	Gasket, Gland, Mechanical Seal
370	3	Bah, Casing
370B	4	Bah, Frame/Adapter
370C	3	Bah, Bearing Housing
3700	3	Jack Bah, Bearing Housing
370F	2	Bolt, Frame Foot to Frame
370G	6	Bah, Bearing Cover
370H	2	Box Cover /Adapter Stud
382	1	Lock Washer, Bearing
400	1	Key, Coupling
408M	1	Plug, Oil Cooler Outlet (Not Shown)
4126	1	O-ring Impeller Screw
412C	1	O-ring Suction Side Plate
423	3	Jam Nut, Bearing Housing Jack Bolt
496	1	Gasket, Bearing Housing/Frame
496A	1	O-Ring, Impeller - Sleeve
-	1	O-ring
-	1	O-ring
-	1	O-ring
-	1	O-ring

*Packing Gland has only 2 Studs & Nuts

M FRAME Cross Sectional Drawing



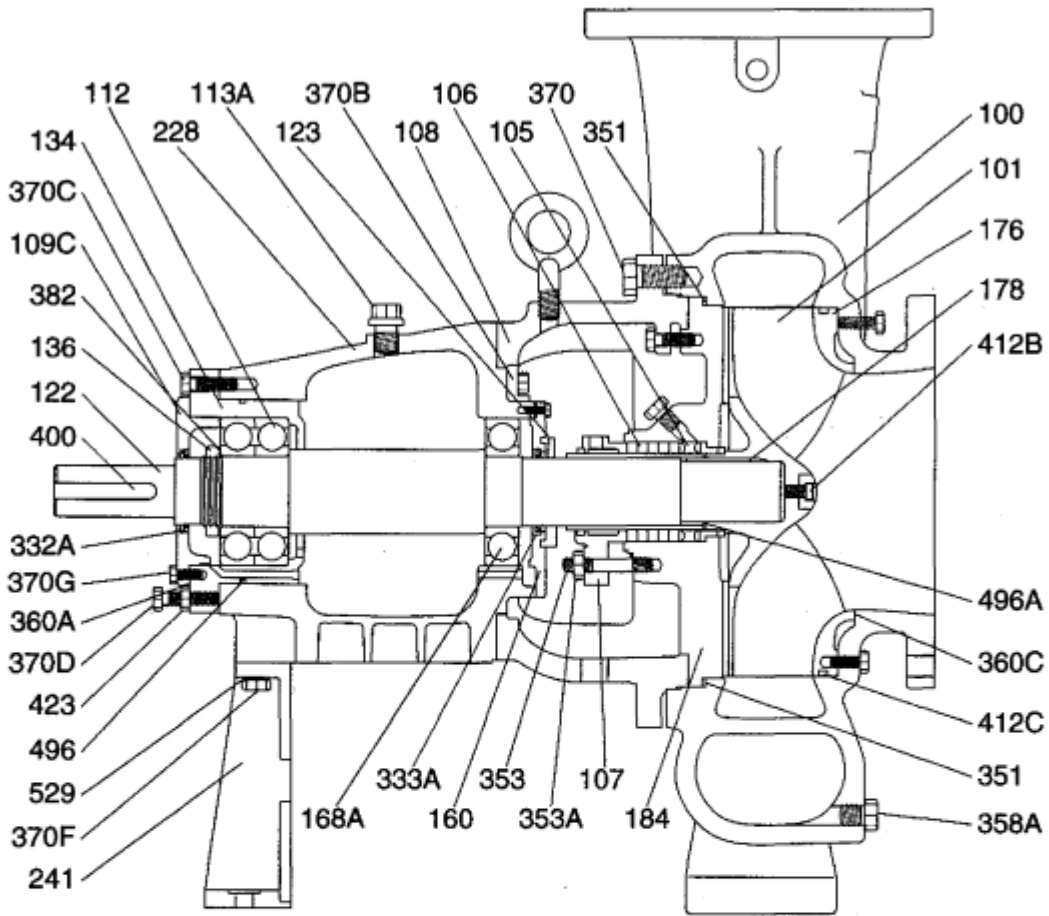
ITEM #	QTY	DESCRIPTION
100	1	Casing
101	1	Impeller
NA	1	Fool, Casing
NA	2	Bolt, Casing Foot
105	1	Ring, Lantern
106	1	Packing
107	1	Gland, Packing
108	1	Adapter
109C	1	Cover, Bearing, Outboard
112-	1	Bearing, Outboard
113A	1	Plug, Oil Fill
NA	1	Pin, Sleeve
122	1	Shaft
123	1	Deflector
126	1	Sleeve, Shaft
134	1	Housing, Bearing, Outboard
136	1	Locknut, Bearing
160	1	Bearing Cover, Inboard
168A	1	Bearing, Inboard
178	1	Impeller Key
184	1	Cover, Stuffing Box
228	1	Frame
241	1	Fool, Frame
248A	1	Ring, Oil
250	1	Gland, Mechanical Seal
332A	1	Labyrinth, Outboard Frame
333A	1	Labyrinth, Inboard Frame

ITEM #	QTY	DESCRIPTION
351	1	Gasket, Case
358A	1	Plug, Casing Drain
353	4"	Stud, Gland
353A	4"	Nut, Gland Stud
360A	1	Gasket - Bearing End Cover - Coupling End
360C	1	Gasket, Side Plate to Casing
3600	1	Gasket, Gland, Mechanical Seal
370	3	Bolt, Casing
370B	4	Bolt, Frame/Adapter
370C	3	Bolt, Bearing Housing
370D	3	Jack Bolt, Bearing Housing
370F	2	Bolt, Frame Foot to Frame
370G	6	Bolt, Bearing Cover
370H	2	Box Cover/Adapter Stud
382	1	Lock Washer, Bearing
400	1	Key, Coupling
408M	1	Plug, Oil Cooler Outlet (Not Shown)
412B	1	O-ring Impeller Screw
412C	1	O-ring Suction Side Plate
423	3	Jam Nut, Bearing Housing Jack Bolt
496	1	Gasket, Bearing Housing/Frame
496A	1	O-ring, Impeller - Sleeve
-	1	O-ring
-	1	O-ring
-	1	O-ring
-	1	O-ring

*Packing Gland has only 2 Studs & Nuts

APPENDIX

L FRAME Cross Sectional Drawing



ITEM #	CTY	DESCRIPTION
100	1	Casing
101	1	Impeller
NA	1	Foot, casing
NA	2	Bolt, Casing Foot
105	1	Ring, lantern
106	1	Packing
107	1	Gland, Packing
108	1	Adapter
1090	1	Cover, Bearing, Outboard
112	1	Bearing, Outboard
113A	1	Plug, Oil Fill
NA	1	Pin, Sleeve
122	1	Shaft
123	1	Deflector
126	1	Sleeve, Shaft
134	1	Housing, Bearing, Outboard
136	1	Locknut, Bearing
160	1	Bearing Cover, Inboard
168A	1	Bearing, Inboard
178	1	Impeller Key
184	1	Cover, Stuffing Box
228	1	Frame
241	1	Foot, Frame
24M	1	Ring, Oil
250	1	Gland, Mechanical Seal
332A	1	labyrinth, Outboard Frame
333A	1	Labyrinth, Inboard Frame

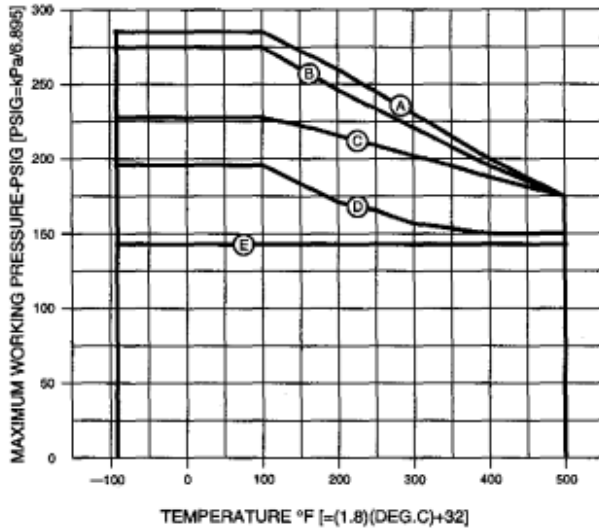
ITEM #	CTY	DESCRIPTION
351	1	Gasket, Case
358A	1	Plug, Casing Drain
353	4	Stud, Gland
353A	4	Nut, Gland Stud
360A	1	Gasket - Bearing End Cover - Coupling End
360C	1	Gasket, Side Plate to Casing
3600	1	Gasket, Gland, Mechanical Seal
370	3	Bolt, Casing
3708	4	Bolt, Frame/Adapter
3700	3	Bolt, Bearing Housing
3700	3	Jack Bolt, Bearing Housing
370F	2	Bolt, Frame Foot to Frame
3700	6	Bolt, Bearing Cover
370H	2	Box Cover/Adapter Stud
382	1	Lock Washer, Bearing
400	1	Key, Coupling
408M	1	Plug, 1/11 Cooler Outlet (Not Shown)
412B	1	O-ring Impeller Screw
412C	1	O-ring Suction Side Plate
423	3	Jam Nut, Bearing Housing Jack Bolt
496	1	Gasket, Bearing Housing Frame
496A	1	O-ring, Impeller - Sleeve
	1	O-ring
-	1	O-ring
-	1	O-ring
	1	O-ring

*Packllig Gland has only 2-Studs * Nuts

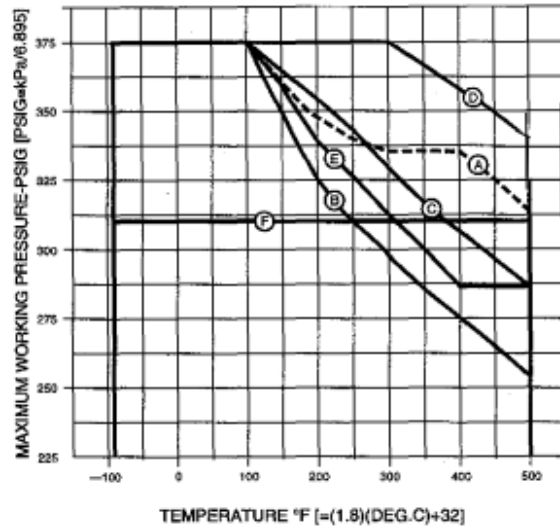
Process Pumps Engineering Data

PRESSURE / TEMPERATURE RATINGS

150 LB. FLANGES



300 LB. FLANGES



CURVE	MATERIAL
A	DUCT. IRON
A	CAST STEEL
A	CD4MCu
A	HAST. B
A	HAST.C
A	TITANIUM
B	316 S.S.
B	317 S.S.
C	ALLOY 20
D	MONEL
E	NICKEL

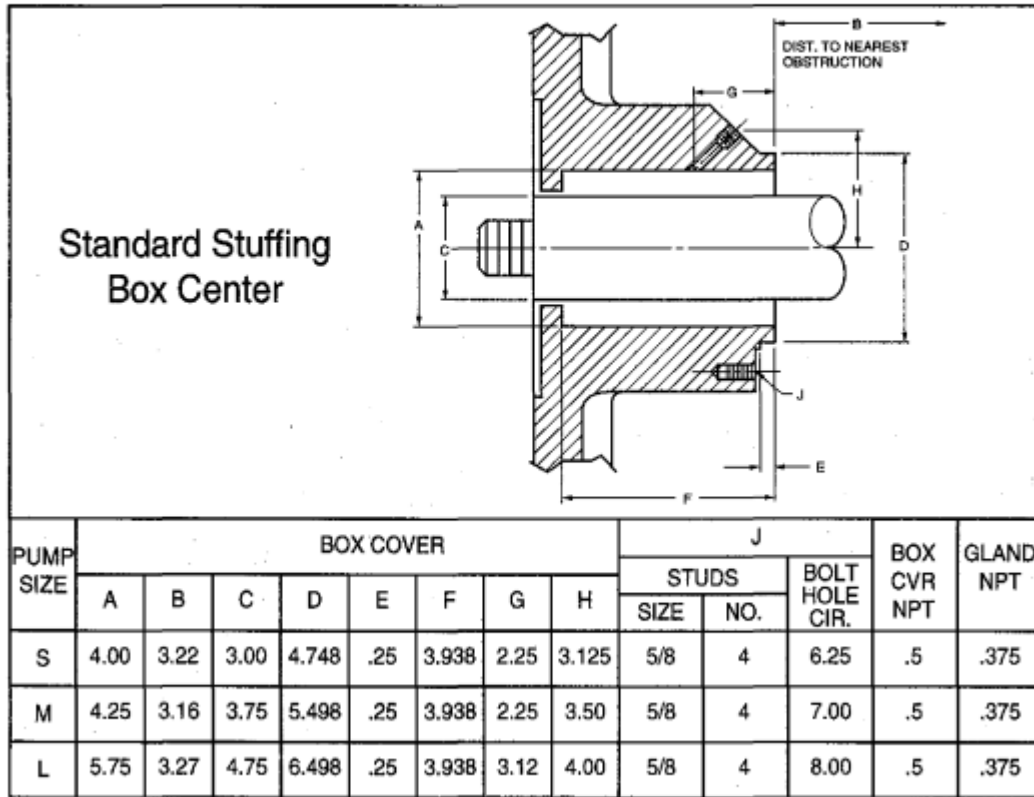
CURVE	MATERIAL
A	DUCT. IRON
A	CAST STEEL
A	316 S.S.
A	317 S.S.
A	ALLOY 20
A	HAST.S
B	HAST.C
B	CD4MCu
C	TITANIUM
D	MONEL
E	NICKEL

CONTACT FACTORY FOR SUCTION PRESSURES OVER 160 PSIG.



APPENDIX

Process Pumps Engineering Data



Pump Trouble-Shooting

Common Pump Operational Problems

Problem	Probable Cause	Remedy
Pump is noisy or vibrates.	Improper pump/driver alignment.	Align shafts.
	Partly clogged impeller causing imbalance.	Back-flush pump to clean impeller.
	Broken or bent impeller or shaft.	Replace as required.
	Foundation not rigid.	Tighten hold down bolts of pump and motor or adjust stilts.
	Worn bearings.	Replace.
	Suction or discharge piping not anchored or properly supported.	Anchor per Hydraulic Institute Standards Manual recommendations.
	Pump is cavitating.	System problem.
Pump not producing rated flow or head.	Air leak thru gasket.	Replace gasket.
	Air leak thru stuffing box.	Replace or readjust packing/mechanical seal.
	Impeller partly clogged.	Back-flush pump to clean impeller.
	Worn suction sideplate or wear rings.	Replace defective part as required.
	Insufficient suction head.	Ensure that suction line shutoff valve is fully open and line unobstructed.
	Worn or broken impeller.	Inspect and replace if necessary.
Pump starts then stops pumping.	Improperly primed pump.	Reprime pump.
	Air or vapor pockets in suction line.	Rearrange piping to eliminate air pockets.
	Air leak in suction line.	Repair (plug) leak.
No liquid delivered.	Pump not primed.	Reprime pump, check that pump and suction line are full of liquid.
	Suction line clogged.	Remove obstructions.
	Impeller clogged with foreign material.	Back-flush pump to clean impeller.
	Wrong direction of rotation.	Change rotation to concur with direction indicated by arrow on bearing housing or pump casing.
	Foot valve or suction pipe opening not submerged enough.	Consult factory for proper depth. Use baffle to eliminate vortices.
	Suction lift too high.	Shorten suction pipe.
Excessive leakage from stuffing box.	Packing gland improperly adjusted.	Tighten gland nuts.
	Stuffing box improperly packed.	Check packing and repack box.
	Worn mechanical seal parts.	Replace worn parts.
	Overheating mechanical seals.	Check lubrication and cooling lines.
	Shaft sleeves scored.	Remachine or replace as required.
Bearings run hot.	Improper alignment.	Re-align pump and driver.
	Improper lubrication.	Check lubricant for stability and level.
	Lube cooling.	Check cooling system.
Motor requires excessive power.	Head lower than rating. Pumps too much liquid.	Consult factory. Install throttle valve, trim impeller.
	Liquid heavier than expected.	Check specific gravity and viscosity.
	Stuffing packing too tight.	Readjust packing. Replace if worn.
	Rotating parts bind.	Check internal wearing parts for proper clearances.

APPENDIX

Ordering Spare Parts

To insure against possible long and costly downtime periods, especially on critical services, it is advisable to have spare parts on hand. <:»

1. For critical services: It is recommended that a "back pull-out assembly" be kept on hand. This is a group of assembled parts which includes all parts except the casing and the coupling.
2. An alternative, though not as desirable as that stated above, can be used on noncritical services. This involves having on hand parts that are most likely to wear and can be used as needed. See list below for these recommended spares.

Recommended Spare Parts

Shaft	Item 122	Rear Bearing Cover Gasket	Item
Shaft Sleeve	Item 126	Bearing Lock Washer	360A
Outboard Bearing	Item 112	Bearing Lock Nut	Item 382
Inboard Bearing	Item	Impeller	Item 136
Case Gasket	168A	Impeller jSleeve O Ring	Item 101
Front Bearing Cover Gasket	Item 351	Lantern Ring (packed box)	Item
Bearing Housing O-ring	Item 360	Impeller Screw O Ring	496A
Sideplate Gasket	Item 496	Sideplate O Ring	Item 105
	Item 360P		Item 412B
			Item 412C

Instructions for Ordering Spare Parts

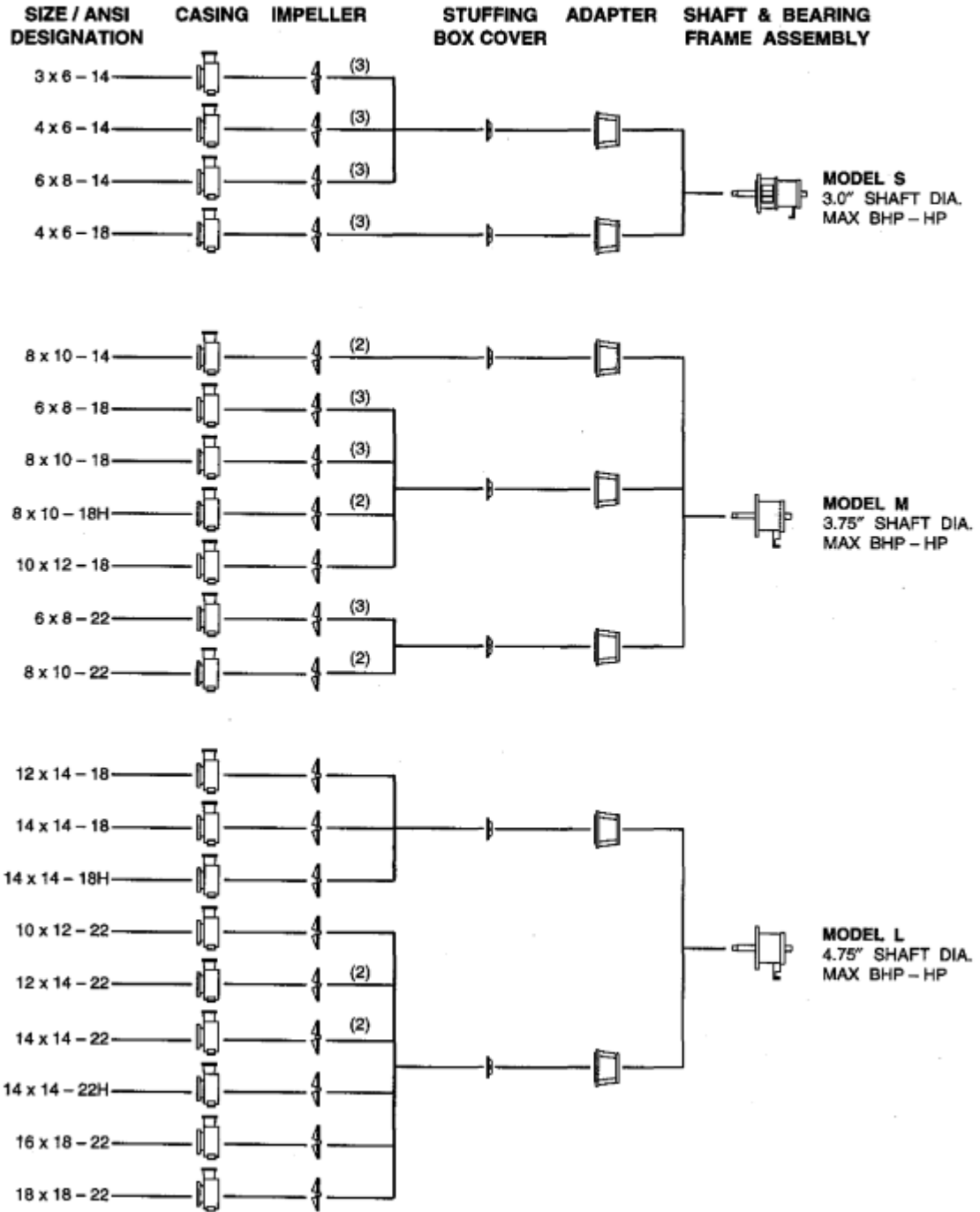
Repair orders will be handled with a minimum of delay. Contact your local authorized representative and provide the following:

1. Give model number, size of pump, and serial number. These can be obtained from the nameplate on the pump.
2. Write plainly the name, part number, and material of each part required. These names and numbers should agree with those on the sectional drawing on pages 39, 41, 42 and 43.
3. Give the number (quantity) of parts required.
4. Give complete shipping instructions.

NOTICE:

Materials of construction, specifications, dimensions, design features and application information, where shown in this bulletin, are subject to change without notice by Sterling Fluid Systems (USA), Inc. at their option.

Modular Interchangeability Chart

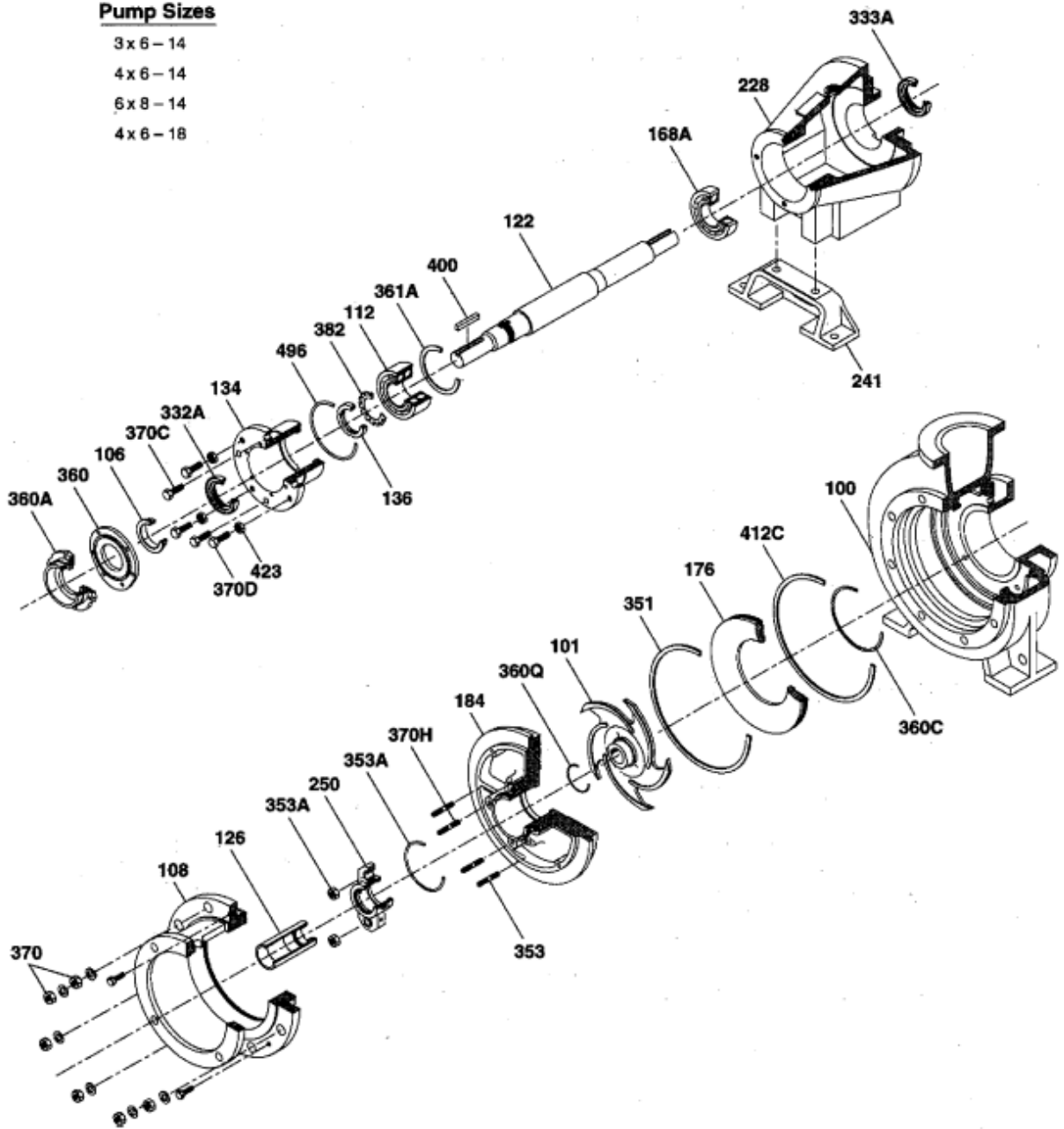


APPENDIX

S Exploded Isometric View

Pump Sizes

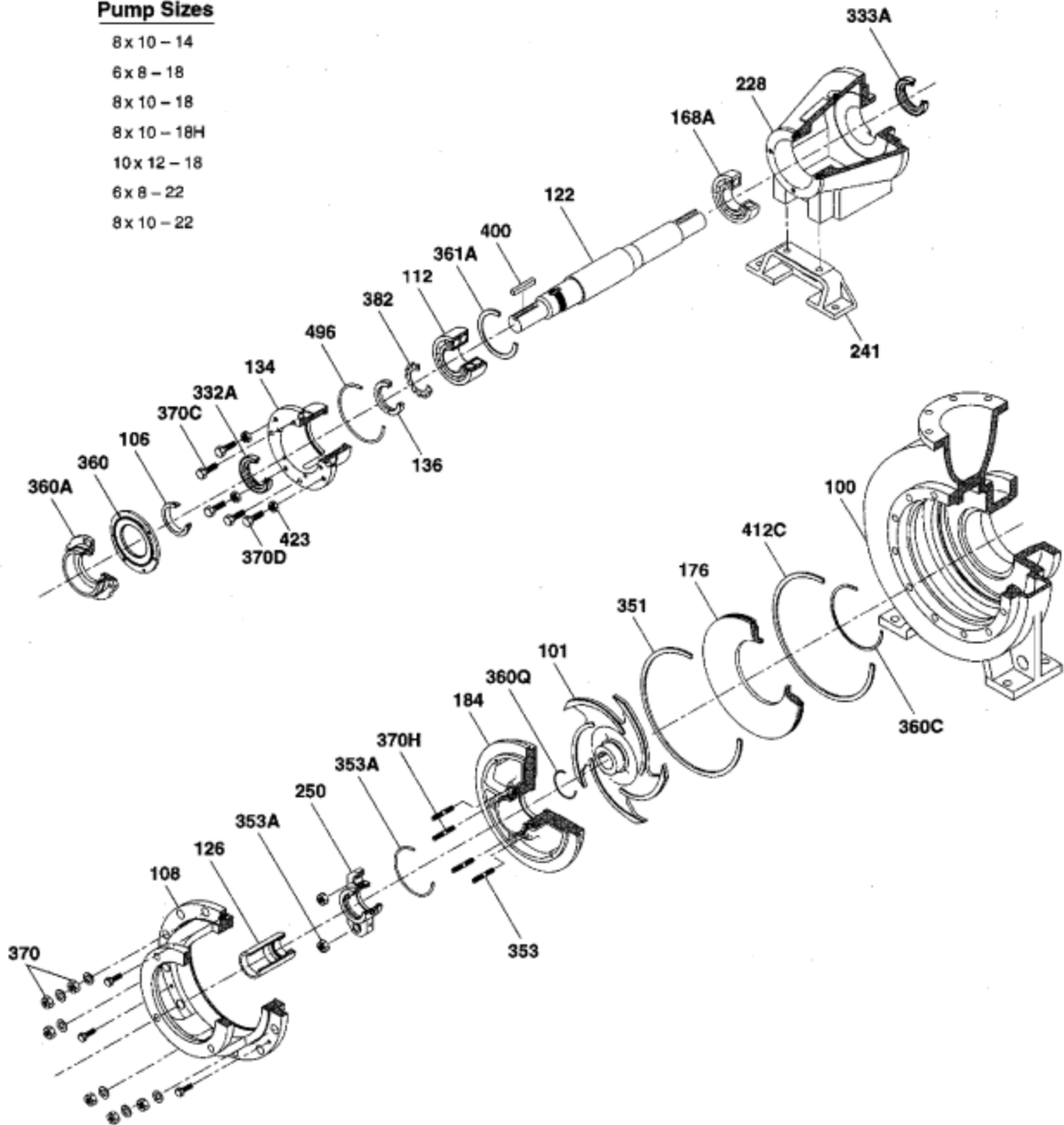
- 3 x 6 - 14
- 4 x 6 - 14
- 6 x 8 - 14
- 4 x 6 - 18



M Exploded Isometric View

Pump Sizes

- 8 x 10 - 14
- 6 x 8 - 18
- 8 x 10 - 18
- 8 x 10 - 18H
- 10 x 12 - 18
- 6 x 8 - 22
- 8 x 10 - 22

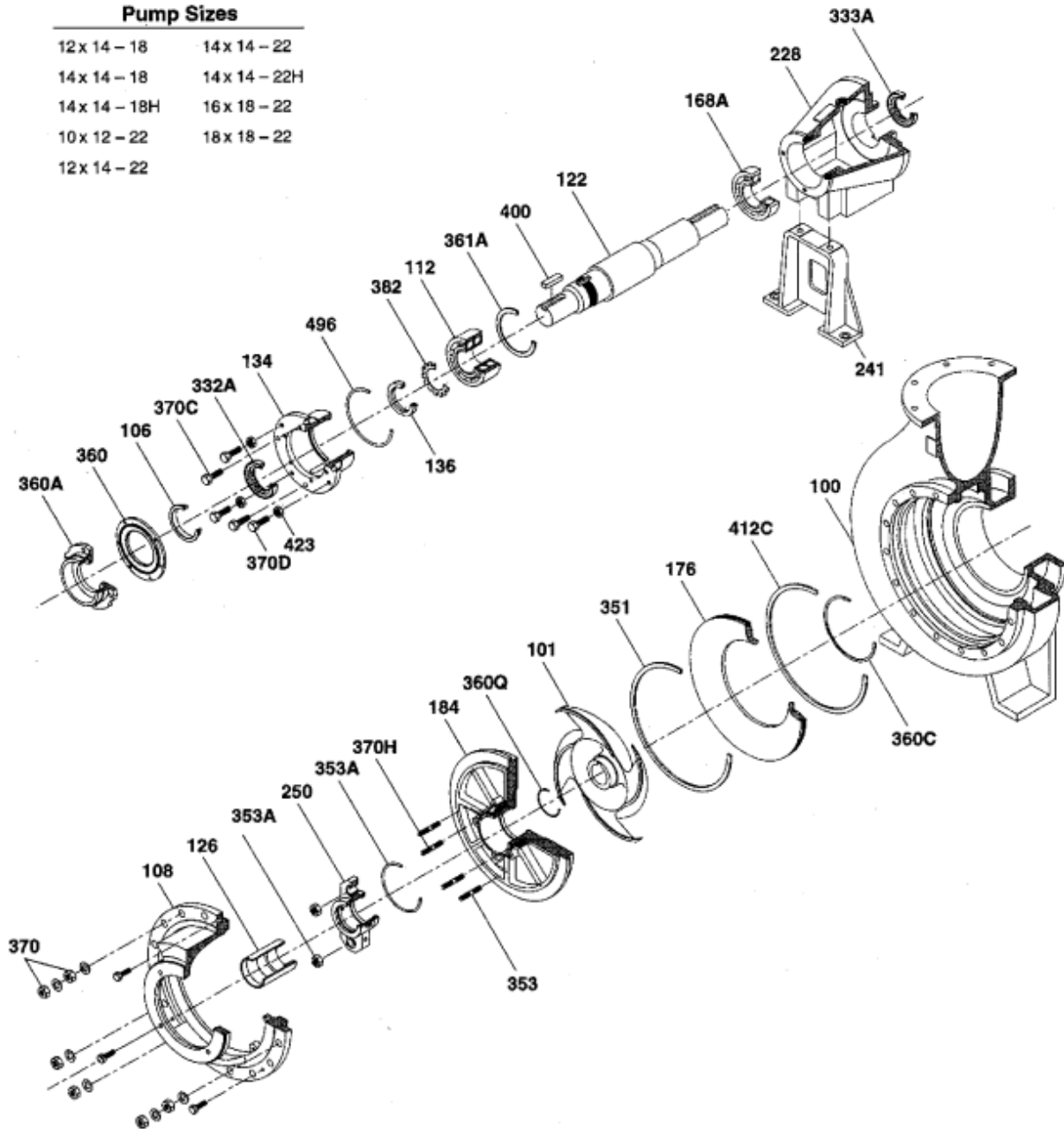


APPENDIX

L Exploded Isometric View

Pump Sizes

12 x 14 - 18	14 x 14 - 22
14 x 14 - 18	14 x 14 - 22H
14 x 14 - 18H	16 x 18 - 22
10 x 12 - 22	18 x 18 - 22
12 x 14 - 22	



PREVENTIVE AND CORRECTIVE MAINTENANCE

A planned program of routine inspection and preventive maintenance can increase the service life of your pump. Maintenance records should be kept for each pump in a data base which will be beneficial in developing long term maintenance planning. Regular checkups of the following items will help keep your pump running trouble free and keep costly downtime to a minimum.

IV-A. DAILY/WEEKLY ROUTINE INSPECTION AND MAINTENANCE

- (a) Observe oil level and condition through sight glass or Trico oiler if provided. Oil level should be visible and at the level indicated on the sight glass. Slight foaming under operation is normal. Contaminated oil should be changed immediately.
- (b) Grease lubricated bearings should be re-greased at start-up and approximately every 2000 hours of operation. Refer to Appendix, page 35, for recommended grease manufacturers.
- (c) Check mechanical seal chamber for leaks. Mechanical seals should not leak. Visible signs of leakage should be investigated immediately.
- (d) Visually inspect pump and piping for leaks. Inspect all tapped and plugged connections. Check for unusual noise or vibrations. Check for high bearing temperatures.
- (e) Periodically, check foundation bolts, pipe supports and pump to motor alignment. (f) If performance deteriorates, refer to troubleshooting, Appendix.

DISASSEMBLY

The back-pull-out feature of this pump allows the complete back pull-out assembly (bearing frame and rotating element) to be removed without disturbing suction or discharge piping or driver.

The Sectional and Parts List in the appendix contains a complete sectional view of the pump and parts list with the proper identification numbers. Refer to this section as required during maintenance procedures and when ordering spare or repair parts. All gaskets, oil seals, and O-rings should be replaced once the joint they seal as been parted.

Preparing pump for disassembly:

- (a) Lock out power supply to motor.
- (b) Shut off all valves controlling flow to and from the pump.
- (c) Drain liquid from pump. Removing casing drain plug located on bottom of casing at lowest point (d) Remove all auxiliary tubing and piping.
- (e) Flush the pump to remove corrosive or toxic pumpage if required.
- (f) Disconnect coupling and remove coupling spacer (refer to coupling instructions). (g) Drain oil (remove drain plug) and remove bottle oiler from the bearing frame.
- (h) If unit has stuffing box packing, remove the gland stud nuts. The gland is in two halves and can be removed.
 1. Place chain or sling from crane or hoist through eye bolt in adapter.
 2. Remove frame foot hold-down bolts.
 3. Remove bolts which hold frame adapter to casing.
 4. Adjust sling tension to support back pull-out assembly.
 5. Slide the back-pull-out assembly from the casing. Use jacking bolts to assist disassembly. Screw the jacking bolts into the tapped holes in the frame adapter. Tighten bolts evenly, a flat at a time, to jack back pull-out assembly from casing.

If working space is available to the side of the bedplate, the "pull-out assembly" can be turned perpendicular to the bedplate. Replace one pedestal hold-down bolt in bedplate and support the bearing frame flange with blocks. Complete disassembly of the "pull-out assembly" can be accomplished on the job site. If preferred, it can be removed to an available work area.

6. Remove casing gasket.
7. Remove the impeller screw. Prevent the shaft from rotating by using a spanner wrench or strap wrench. Thread an impeller puller stud into the end of the impeller (not supplied). This stud pushes against the shaft and pulls the impeller as the stud is turned clockwise. See Figure 4.

WARNING:

DO NOT APPLY HEAT TO IMPELLER AS SEVERE PHYSICAL INJURY MAY RESULT!

Rev 7-2022

