

"A Trusted Partner in Pump Solutions"

INSTALLATION, OPERATION & MAINTENANCE MANUAL



ANSI Low Flow Pump

1196 LF Series

WARRANTY CLAUSE | LIMITED LIABILITY

Rotech Pumps

Pumps manufactured & assembled by Rotech covered by warranty for free of manufacturing defects for a period not exceeding twelve months from the date of shipment from our Plant/warehouse. This warranty will be limited and subject to Rotech authorisation /approval.

1. Rotech will make good by repair or its option the replacement of faulty parts under warranty, providing always that:
 - (a) The equipment was correctly installed and properly used in accordance with Rotech Installation & Operating instruction manual and accepted codes of good engineering practice.
 - (b) The claims for goods under warranty arise solely from faulty design, material or workmanship. Rotech products don't offer warranty or guarantee for any pump application. The customer can't blame Rotech for selection of Material of constructions and other specifications. The customer can consult consulting engineers before purchase of pumps.
 - (c) The repair is carried on in the Rotech service department or by an authorized agent or distributor appointed by Rotech authorized repair agent must obtain written approval (WRA#) from Rotech before Completing repair under warranty.
 - (d) Authorized repair agents will be refunded with the amount of equivalent to a similar repair work in the Rotech service department.
 - (e) All freight costs to and from the service department or repair agents to be paid by the purchaser.
2. In the case of equipment or components which are not manufactured by Rotech, but supplied by Rotech.
For Example: Electric motors, engines, trade accessories etc. The warranty is limited of such equipment & subject to respective manufacturers.
3. Rotech Pumps warranty doesn't cover any of the following:
 - (a) Claims for third party liability, labor cost, transportation cost or damage caused by failure of any of the company's products.
 - (b) Damage caused by abnormal operating conditions, war, violence, storm, cataclysm or any other force.
 - (c) Damage caused by the equipment being used for an application for which it is not recommended.
 - (d) Damage caused by sand or abrasive materials, corrosion due to acid waters, electrolytic action, liquid temperature beyond the recommended range, cavitation, improper supply voltage or insufficient liquid to enable the pump to specification.
4. The decision of Rotech in relation to any claims or disputes over warranty is final.
5. This warranty is in lieu of all other warranties and conditions expressed or limited written or oral, statutory to the extent allowable by law or otherwise, which are hereby negated and excluded.

Limited Liability

Rotech shall not be liable for any damage, delays or personal injury caused by following improper or proper procedure of installation and maintenance of equipment being supplied by Rotech.

The pump and other equipment supplied by Rotech based on customer specification. Rotech can't be liable the installation of pump and equipment in any hazardous environment. Customer has to consult engineers before purchasing for proper pump application.

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INTRODUCTION OF PUMP

Rotech's 1196 SERIES ANSI chemical process centrifugal pumps are designed for pumping various types of chemicals, hydrocarbon, slurries and other liquid. This pump has back pull out design enable to pull out from operation without disturbing piping.

Pump Safety Tools & Procedure

Always wear SAFETY APPAREL

- Insulated work gloves when handling hot bearings or using bearing heater.
- Heavy work gloves when handling parts that have sharp edges, especially impellers
- Safety glasses (with side shields) to protect eyes, especially in machine shop areas.
- Steel-toed shoes to protect feet when handling parts heavy tools, etc.
- Any other equipment needed to protect against fluids.

COUPLING GAURDS

- Make sure OSHA type coupling Gaurd is being installed before operating a pump

FLANGED CONNECTIONS

- Do not try to adjust or match piping by applying force to make connection with a pump
- Use only fasteners of proper size & material
- Ensure there are no missing fasteners
- Beware of corroded or loose fasteners

Normal OPERATION

- Do not operate below minimum rated flow, or with suction / discharge valves closed
- Do not open vent or drain valves, or remove plugs while the system is pressurized

Be careful WHILE MAINTENANCE

Always Lockout Power

- Ensure pump is isolated from the system & pressure is relived before disassembling pump, removing plugs, or disconnecting piping.
- Use proper lifting & supporting equipment to prevent serious injury
- Observe proper decontamination procedures
- Know & follow company safety regulations

FOREWORD

Rotech ANSI pumps are designed and manufactured for optimum performance and long, trouble-free service. Preventive maintenance is a key factor for long life and safe operation of pump.. This manual is provided as a guideline for proper installation, operation and maintenance. THIS MANUAL MUST BE READ AND UNDERSTOOD BEFORE INSTALLING AND OPERATING ANY Rotech 1196 SERIES ANSI chemical process pumps.

Rotech pumps & systems Inc SHALL NOT BE LIABLE FOR PHYSICAL INJURY, DAMAGE OR DELAYS CAUSED BY A FAILURE TO OBSERVE THE INSTRUCTIONS FOR INSTALLATION, OPERATION, AND MAINTENANCE CONTAINED IN THIS MANUAL.

PRECAUTIONS

NEVER apply heat to remove impeller. It may explode due to trapped liquid.

NEVER use heat to disassemble pump. Explosion could occur due to trapped liquid.

NEVER operate pump without coupling guard correctly installed.

NEVER operate pump beyond the rated conditions to which the pump was sold.

NEVER start pump without proper prime (sufficient liquid in pump casing).

NEVER operate pump below recommended minimum flow or when dry.

ALWAYS lock out power to the motor before performing pump maintenance.

NEVER operate pump without safety devices installed.

NEVER operate pump with discharge valve closed.

NEVER operate pump with suction valve closed.

DO NOT change conditions of service without approval of an authorized Rotech representative.

! WARNING !

Rotech is not responsible for the Personal injury will result if procedures outlined in this manual are followed or not followed.

RECEIPT AND STORAGE

RECEIPT OF PUMP & EQUIPMENT

Receiving of Pump

Immediately after receipt of pump, please check following:

1. Check Name plate details on pump.
2. Please check name plate details on which Pump Model number, Size of pump, Flow , Head, Serial number, HP of Motor, RPM and compared with Purchase order just to make sure you have received right pump against order to avoid / any issue.
3. Check pump crate and pump & other equipment is in good condition and did not damage in transportation. If there is any damage, immediately report to shipper Rotech Distributor or your supplier.
4. Use proper procedure unloading pump and equipment from truck.

STORAGE OF PUMP AND EQUIPMENT

Store pump in a cool and dry area free from heat, dirt .Do not remove packing if not necessary. Rotate pump shaft at least once a week to maintain protective film of oil or grease on bearings.

If you intend to store for long term, use proper storage treatment for safeguard of pumps.

Please follow proper handling procedure as follows:

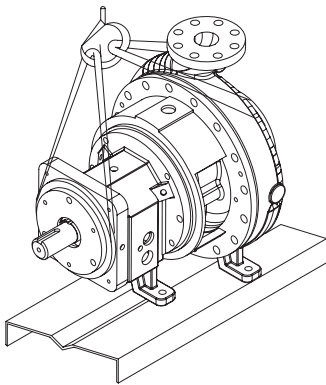


Fig. 1a

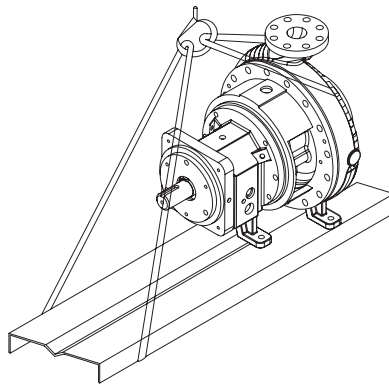


Fig. 1b

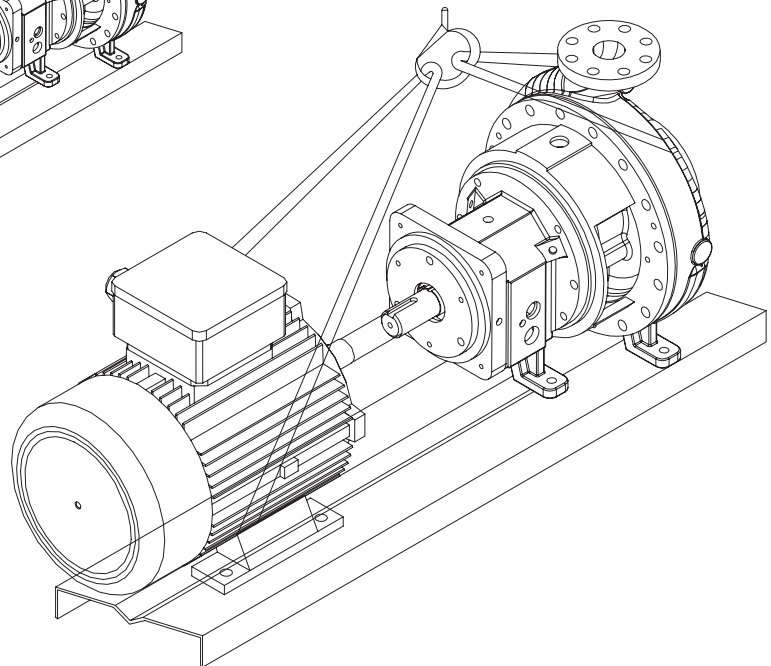


Fig. 1c

INSTALLATION

PREPARATION

When preparing your pump for installation, Please make sure the discharge and suction connections must be clean and free of anything that might prohibit a tight connection. This is especially important on the suction, air leaks can cause a pump to operate poorly or to lose prime completely.

If your pump has just been taken out of storage all of the grease or preservative must be removed from the ball bearing housing. The ball bearing housing must then be thoroughly cleaned with kerosene or carbon tetrachloride & re-lubricated. On packed pumps, it will be necessary to clean the shaft sleeve & stuffing box with kerosene or carbon tetrachloride & then repack.

FOUNDATION

Whenever possible locate pump near the source of supply as possible. Allow enough space for inspection & maintenance of pump. Baseplate mounted pumps are usually grouted on a concrete foundation that has been poured on a solid footing. The foundation should be of heavy construction to reduce vibration and must be rigid enough to resist the torque it may be subjected to. The foundation should be 2" to 6" larger than the base, depending on the size of the base. A space of approximately 2" should be left between the foundation and the bottom of the base for grouting. Use a pipe sleeved bolt as shown in Fig. 2 to within 1/2" of the base for a foundation bolt.

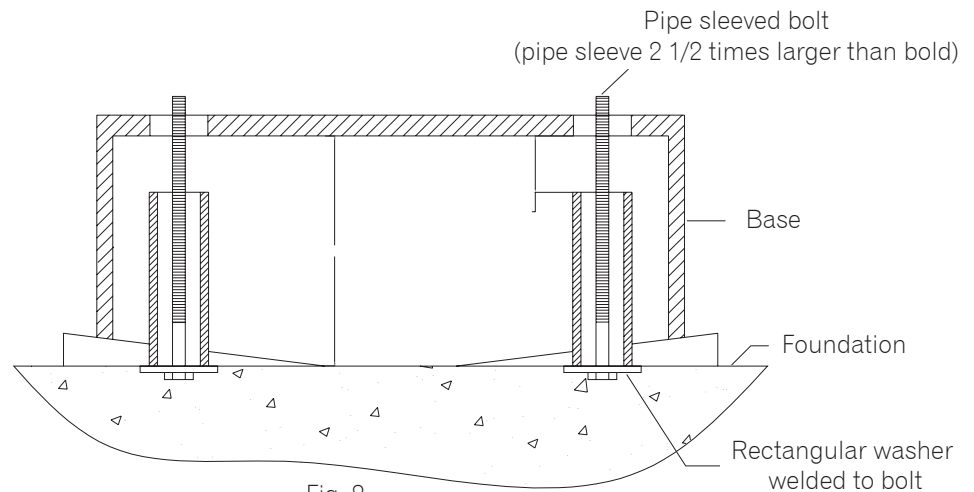


Fig. 2

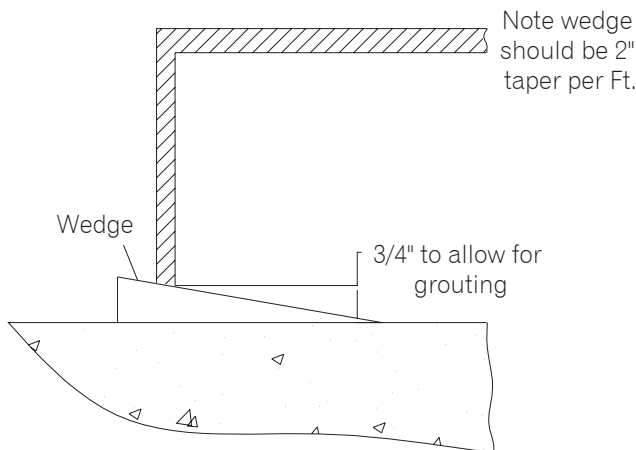


Fig. 3

LEVEL BASEPLATE

Pump alignment is very important and special care should be taken. Once the pump is set the only means of adjusting is by shimming.

1. Place 12 wedges on the foundation, one wedge on each side of every mounting bolt. Place wedges so that baseplate is 3/4" above foundation to allow for adequate grouting (Fig. 3).
2. Carefully lower the baseplate onto mounting bolts.
3. Level baseplate to within 1/8" over the length and to within .088 in over the width by adjusting the wedges.
4. Hand tighten bolts.

1. Apply Anti-seizing compound on jack screw to allow for easy removal after the grout has cured.
2. Cut 6 or 8 round plates from barstock to set the jack screws on. Chamfering the edges of the plate is recommended to reduce stress concentrations.
3. Set the baseplate on the foundation, then raise it 3/4" to 1 1/2" using the four corner jack screws. At this time, the two center jack screws should not be touching the foundation.
4. Place one machinist level lengthwise on a single motor pad, & another across the ends of both motor pads. (It is important that the surface being leveled is free of all contaminants, such as dust, to ensure that your reading is accurate.)
5. Adjust the four jack screws in order to level the motor

6. Turn down the center jack screws until they are resting on their metal plates.
7. Move the two levels to the pump pads. Place one level lengthwise on a single pad, and the other across the middle of both pump pads.
8. Adjust the jack screws to level the pump pads in both directions.
9. Install the anchor bolts until they are hand tight.
10. Recheck the motor pads for level measurements.
11. Continue adjusting the jackscrews & anchor bolts until all level measurements are within the requirement of 0.002 on in / ft.

COUPLING ALIGNMENT PROCEDURE

For trouble-free operation of this unit, proper alignment must be attained. Proper alignment is the responsibility of the installer and user of this pump.

! WARNING !

Before starting any alignment procedure, ensure that the motor power is locked out. Failure to do this will result in serious physical injury.

ALIGNMENT CHECKS

Initial Alignment (Cold Alignment)

- Before grouting baseplate to make certain alignment can be obtained
- After grouting baseplate to make sure no changes have occurred.
- After connecting piping to ensure that alignment hasn't been altered by pipe strain. If alignment has changed alter piping to remove strain.

Final Alignment (Hot Alignment)

- After first run to obtain correct alignment when equipment is at operating temperature.

ALIGNMENT CRITERIA

Good alignment is achieved when the differences between the readings is .010 or less when the pump is at operating temperature. However, during the installation phase it is necessary to set the parallel alignment in the vertical direction to a different criteria. This is due to the differences in the expansion rates of the pump and the motor. The recommended cold settings for electric motor driven pumps is shown in Table 1.0

ANGULAR ALIGNMENT

Check angular alignment with a micrometer or caliper. Measure from the outside of one flange to the outside of the other flange at intervals around the periphery of the coupling, DO NOT rotate the coupling. The difference between the maximum and the minimum must not exceed .010".

PARALLEL ALIGNMENT

Check parallel alignment by placing a straight edge across the two coupling flanges and measure the offset at various points around the periphery of the coupling. DO NOT rotate the coupling. If offset exceeds .010" realign the coupling.

If a correction is necessary to either the angular or parallel alignment, remember to recheck the other for proper alignment.

TABLE 1: COLD SETTING OF PARALLEL VERTICAL ALIGNMENT

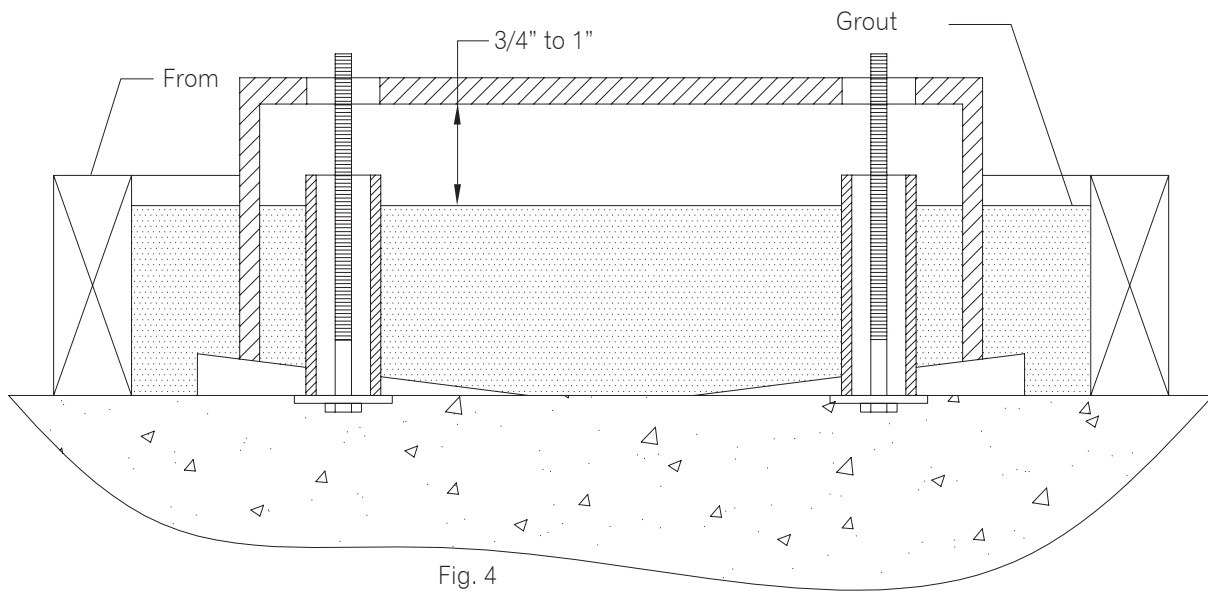
Pumpage Temperature	Set Driver Shaft
50°F (10°C)	.002 in. Low
150°F (65°C)	.001 in. High
250°F (120°C)	.005 in. High
350°F (175°C)	.009 in. High
450°F (218°C)	.013 in. High
550°F (228°C)	.017 in. High
650°F (343°C)	.021 in. High

ALIGNMENT TROUBLESHOOTING

Problem	Probable	Cause Solution
Cannot obtain horizontal alignment, angular or parallel	The bolts holding the driver feet are bound.	Loosen pump hold down bolts & slide pump & driver until horizontal alignment is achieved.
	Baseplate not leveled properly, probably twisted.	Determine which corner(s) of baseplate are high or low & adjust properly, then realign.

GROUT BASEPLATE

1. Clean the areas on the baseplate that will contact grout. Do not use oil-based cleaners because the grout will not bond to it.
2. Build a form around the base as illustrated in Fig. 4 Then thoroughly wet the foundation.
3. Pour grout into form being sure that it flows under the base. Fill to within 3/4" to 1" from the bottom of the base.
4. Allow grout to set for 48 hours.
5. Recheck coupling alignment, make any adjustments that may be necessary and tighten foundation bolts securely.



PIPING

Guidelines for piping follow given in the "Hydraulic Institute Standards" and must be reviewed before installing pump.

! WARNING !

Never force piping into position by pulling it in place with the pump suction & discharge flange bolts. This will cause misalignment between pump & driver which will adversely effect the operation of the unit resulting in physical injury and damage to the equipment.

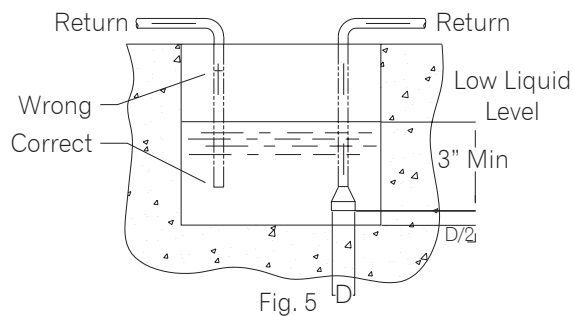
1. All piping must be supported independently of the pump.
2. Before connecting the piping to the pump, ensure that grout has hardened and the foundation bolts have been tightened.
3. When handling liquids at high temperatures, it is recommended that expansion loops or joints be properly installed in suction and/or discharge lines so that linear expansion of piping will not draw pump out of alignment.
4. On pumps handling corrosive liquids, the piping should be arranged to allow for flushing prior to removal.
5. Clean all pipe parts prior to installation.

SUCTION PIPING:

1. Properly installed suction piping is necessary for trouble-free pump operation. Flush suction piping before connection to the pump.
2. Never place a pipe line elbow in the horizontal plane directly at the pump suction. Use a straight pipe 4 to 6 pipe diameters long between the elbow & the pump suction.
3. Use suction pipe one or two sizes larger than the pump suction, with an eccentric reducer, sloping side down, at the suction flange (Fig. 7). Suction piping should never be smaller than the pump suction.
4. Never throttle pump on the suction side, always control flow by throttling on the discharge side of the pump. When using a strainer on the suction, install it as close to the pump as possible & select a strainer with a net area of at least four times that of the suction pipe.
5. Whenever possible the end of the suction should be a minimum of 3' below the liquid level (Fig 5). The liquid near the pump suction should be free from agitation to prevent air entering the suction line.
6. Liquid coming back into the reservoir should not enter near the pump suction pipe, & the liquid should not drop from a high level (Fig. 6).
7. If a foot valve is not used in the suction line, it is good practice to bell out the suction pipe to lower the entrance velocities at the inlet (Fig. 5).

! WARNING !

NPSHA must always exceed NPSHR as shown on performance curves. Reference Hydraulic Institute for NPSH and pipe friction values needed to evaluate suction piping.



SUCTION LIFT CONDITIONS

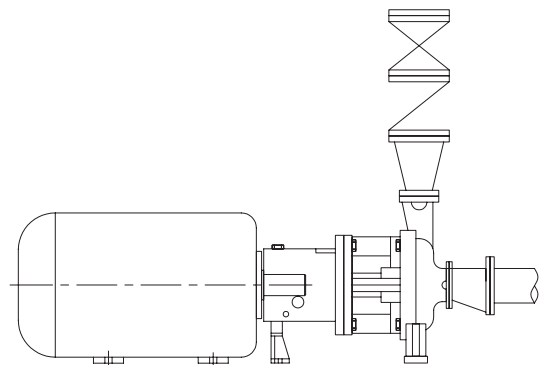
1. Pipe must be free from air pockets.
2. Pipe must slope upwards to pump.
3. All connections must be air tight.
4. Whenever possible avoid dynamic suction lifts of more than 12'.
5. A means of priming the pump must be provided.

SUCTION HEAD/SUCTION CONDITIONS

1. An isolation valve should be installed in the suction pipe at least four diameters from the suction to allow closing of the line for pump inspection and maintenance.
2. Pipe must be free from air pockets.
3. Piping should be level or slope gradually downward from the source.
4. No part of the piping should extend below pump suction flange.
5. The size of the entrance from the supply should be one or two sizes larger than the pipe.
6. To prevent vortices and air entrainment at the supply, the entrance from the supply must be adequately submerged below the liquid surface.

DISCHARGE PIPING

1. A gate valve & check valve should be installed in the discharge line. The check valve should be installed between the gate valve and the pump (Fig. 6) this will allow for inspection of the check valve. The gate valve is required for priming, flow regulation, & for maintenance of the pump. The check valve is required to prevent pump or seal damage from reverse flow through the pump when the motor is turned off.
2. Discharge pipe increasers should be connected between the pump & the check valve (Fig.7).
3. If quick closing valves are installed in the system, cushioning devices should also be installed to protect the pump from surges & water hammer.



FINAL PIPING CHECK

- After all piping connections have been made to the pump:
1. Rotate the shaft by hand to ensure that there is no binding and all parts are free.
 2. Recheck pump alignment to detect any pipe strain, if pipe strain exists correct piping.

OPERATION

PREPARATION FOR START-UP

Check Rotation

1. Please check wiring of motor as per motor manufacturer's specifications & according to local regulations.
2. Lock out power to driver
3. Disconnect motor/pump shaft coupling to prevent dry operation of the pump and reverse rotation.
4. Make sure everyone is clear. Jog motor starter, pump must rotate clockwise when viewing from the driving end looking over the motor. Direction arrows are cast in impeller housings.

Check Impeller Clearance

Before starting pump the impeller clearance must be checked. The pump efficiency is maintained when the proper impeller clearance is set. When pumping liquids under 200°F (93°C), the impeller front clearance for the STR, MTR, and LTR is between .010" and .015". If the impeller front clearance is not set between the above values significant performance degradation will result. When pumping liquids above 200°F (93°C) the front impeller clearance when cold must be set per Table 2. This is necessary to allow for differential expansion due to the higher operating temperature. See the Maintenance section for correct impeller adjustment procedure.

! WARNING !

Operating pump dry will cause damage to mechanical seal and may cause rotating parts to seize.

TABLE 2: IMPELLER CLEARANCES

Cold Temperature Clearances For	
Service Temperature	Clearance
Up to 200°F (93°C)	.010" - .015"
200°F to 250°F (121°C)	.012" - .017"
250°F to 300°F (149°C)	.014" - .019"
300°F to 350°F (177°C)	.016" - .021"
350°F to 400°F (204°C)	.018" - .023"

Coupling Of Pump And Motor

1. Lock out power to motor to prevent accidental rotation & physical injury.
2. Install and lubricate coupling per manufacturer's instructions.
3. Install coupling guard (see Appendix 3 Coupling Guard Installation instructions).

Priming Of Pump

Centrifugal pump will require to prime to operate satisfactorily. Do not try to prime pump when operating and DO NOT under any circumstances operate the pump without being completely primed. Some of the most common methods of priming are flooded suction, foot valve in suction line, ejector (steam, water, or air operated), and vacuum pump.

With Flooded Suction:

1. Slowly open the gate valve in the suction line.
2. Remove the air vent in the top of the pump casing to release entrained air.
3. Close the air vent once liquid starts to flow out of it.

With Foot Valve In Suction Line:

1. Open air vent on pump casing.
2. The pump and suction line must be filled with the liquid being pumped. It is recommended to fill the discharge pipe several feet above the pump discharge.
3. After filling pipe and pump close air vent.
4. The pump will remain primed unless the foot valve leaks or if the liquid is contaminated & does not allow foot valve to close tight.

With an Ejector:

1. Mount ejector at the highest point in the impeller housing to ensure removal of all the air in the casing & suction pipe.
2. Operate ejector with gate valve in discharge line closed.
3. Operate until ejector discharges a full steady flow of liquid.
4. On pumps using packing it may be necessary to tighten packing gland to prevent pulling of air through shaft clearances. After pump is primed properly loosen gland to achieve a slight trickle of liquid through stuffing box.

With a Vacuum Pump:

1. Mount vacuum pump at the highest point in the impeller housing to ensure removal of all the air in the casing and suction pipe.
2. Gate valve in discharge line must be closed.
3. After pump is primed, valves between vacuum pump & Gusher pump must be closed.
4. On pumps using packing it may be necessary to tighten packing gland to prevent pulling of air through shaft clearances. After pump is primed properly loosen gland to achieve a slight trickle of liquid through stuffing box.

INITIAL STARTING

1. The gate valve in the discharge line should be closed & gradually opened as the motor reaches full speed (approximately 5 to 10 seconds). After the pump has been in operation & the suction & discharge lines are filled with liquid, it is not necessary to close the gate valve when starting.
2. Start motor & immediately observe pressure gauges. If discharge pressure is not quickly attained stop pump, reprime, & attempt to restart.
3. If your pump is packed, loosen packing gland screws to allow free leakage. Then tighten screws uniformly on packing gland until leakage is reduced to approximately 30 drops per minute. Never tighten packing enough to stop all leakage, a slight leakage is required to lubricate packing and prevent scoring of shaft sleeve.
4. Check pump for vibration levels, bearing temperature, & excessive noise. If normal levels are exceeded, shut down & investigate.

! WARNING !

Never operate a pump without the coupling guard properly installed. Personal injury can occur if pump is run without coupling guard.

OPERATION

Always vary the capacity with gate valve in the discharge line. Never restrict intake flow.

If the specific gravity of liquid being pumped is greater than originally assumed or if the rated flow is exceeded, the motor may overload.

To prevent damage from cavitation or recirculation, always operate pump at or near the rated conditions.

! WARNING !

DO NOT operate pump below minimum rated flows or with suction or discharge valves closed. These conditions could create an explosive hazard due to vaporization or pumpage & can quickly lead to pump failure and physical injury.

Drain all liquid from inside pump if it will be exposed to freezing conditions while idle. The conditions could cause liquid to freeze and damage the pump. Liquid inside cooling coils, if supplied, should also be drained.

FINAL ALIGNMENT

1. Run the unit under actual operating conditions long

enough for the pump and motor to reach operating temperature.

2. Check alignment while unit is still hot.
3. Make any necessary adjustments and reinstall the coupling guards.

STUFFING BOX

Packed Box

Braided packing is supplied as standard equipment on all pumps. Install gland bolt nuts finger-tight only. Adjust the gland bolt nuts during start-up to achieve 40-65 drops of leakage per minute. Specific packing type is dependent on pH, temperature, etc. of the liquid being pumped.

Pump Model				
	STR	MTR	LTR	XLR
Packing Size	5/16"	3/8"	3/8"	7/16"

Clean and cool pumpage may be used to lubricate the packing. If the pumpage is not suitable, you must supply an external source of lubrication.

CAUTION

Do not allow packing to run dry. It must be lubricated. See ANSI/ASME B73.1 M-1984 for proper seal flush plans.

CARTRIDGE MECHANICAL SEAL

! WARNING !

Determine the effects that a failure of the mechanical seal might have on the environment and personnel and correct conditions to prevent personal injury.

! WARNING !

Only work on seal when the pump is locked out and the seal is depressurized.

Refer to the manufacture's installation, operating, and maintenance instructions. Failure to do so can result in environmental damage, personal injury, and seal malfunction and / or seal failure.

Start Up

Read, understand and follow the manufacture's installation, operation, and maintenance instructions.

Storage, Assembly & Disassembly of Mechanical Seal:

Read, understand & follow the manufacture's installation, operation and maintenance instructions.

Type 1: Installation of Mechanical Seal:

1. MTR, LTR, XLR Slide the stuffing box cover over the shaft/sleeve. Bolt the cover (184) to the frame adapter(108). STR Slide the 6" or 8" stuffing box cover (184) with adapter ring (108) over shaft and bolt to bearing.
2. Mark / scribe the shaft at the face of the stuffing box.
3. Unbolt and remove the stuffing box cover.
4. Locate the installation reference dimension on the seal installation drawing. Normally this is the dimension from the face of the stuffing box to the rear of the seal.
5. Mark the shaft with a felt marker or marking tool at the dimension (i.e. 1/32").
6. Lubricate the shaft with silicon grease or soapy water. Slide the seal onto the shaft. Line up the face of the seal with your mark and secure with set screw.
7. Reassemble the pump.

IMPELLER CLEARANCE

! WARNING !

Lock out motor power to prevent accidental startup and physical injury.

Over time a change in pump performance may be noticed. Performance can usually be renewed by resetting the impeller clearance.

Impeller Clearance Setting

A gradual loss in head &/or capacity can occur. You may restore performance by adjusting the impeller clearance, which is the measurement between the impeller vanes and the surface of the casing.

Pumpage Temperature	STR	MTR / LTR
-20 to 150° F (-29-66° C)	0.005 (.13)	.008 (.20)
Up to 175° F (80° C)	0.005 (.13)	.008 (.20)
Up to 200° F (93° C)	0.005 (.13)	.008 (.20)
Up to 225° F (107° C)	0.006 (.16)	.009 (.23)
Up to 250° F (121° C)	0.007 (.18)	.010 (.26)
Up to 275° F (135° C)	0.008 (.21)	.011 (.28)
Up to 300° F (149° C)	0.009 (.23)	.012 (.30)
Up to 350° F (177° C)	0.011 (.28)	.014 (.36)
Up to 400° F (204° C)	0.013 (.33)	.016 (.41)

FEELER GAUGE TECHNIQUE

1. Lock out power to the pump driver.
2. Remove the coupling guard.
3. Loosen jacking bolts (370D) and jam nuts (423).
4. Tighten bearing housing bolts (370C) evenly, while slowly rotating the shaft until the impeller starts to rub on the casing (100).
5. Using a feeler gauge, set the gap between the 3 housing bolts (370C) and the bearing housing (134). (Refer to Table 6 for settings.)
6. Tighten jack bolts (370D) evenly until bearing housing backs out and contacts the bearing housing bolts (370C).
7. Tighten jam nuts (423) evenly, rotating the shaft to make sure the assembly turns freely.
8. Reinstall the coupling guard.
9. Unlock power to the pump driver.

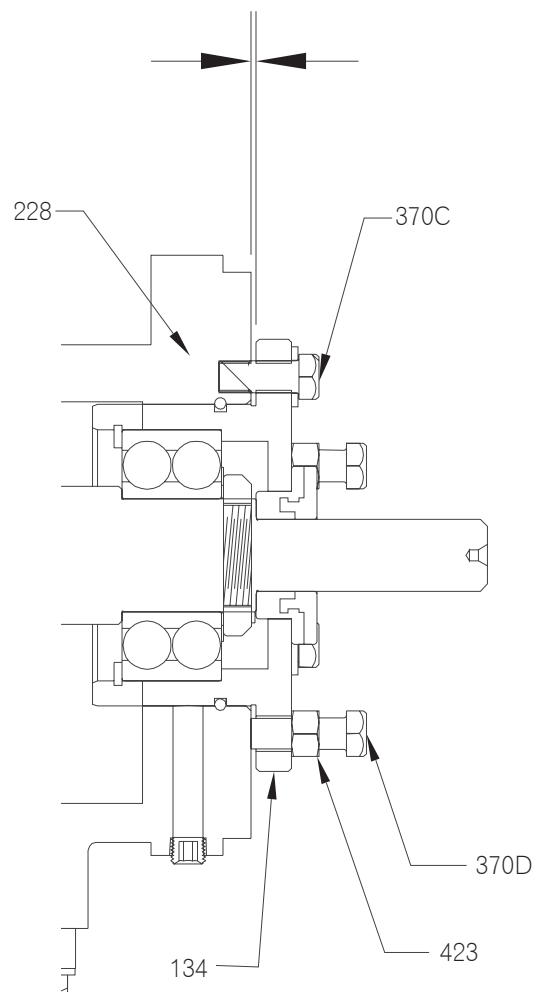


Fig. 7

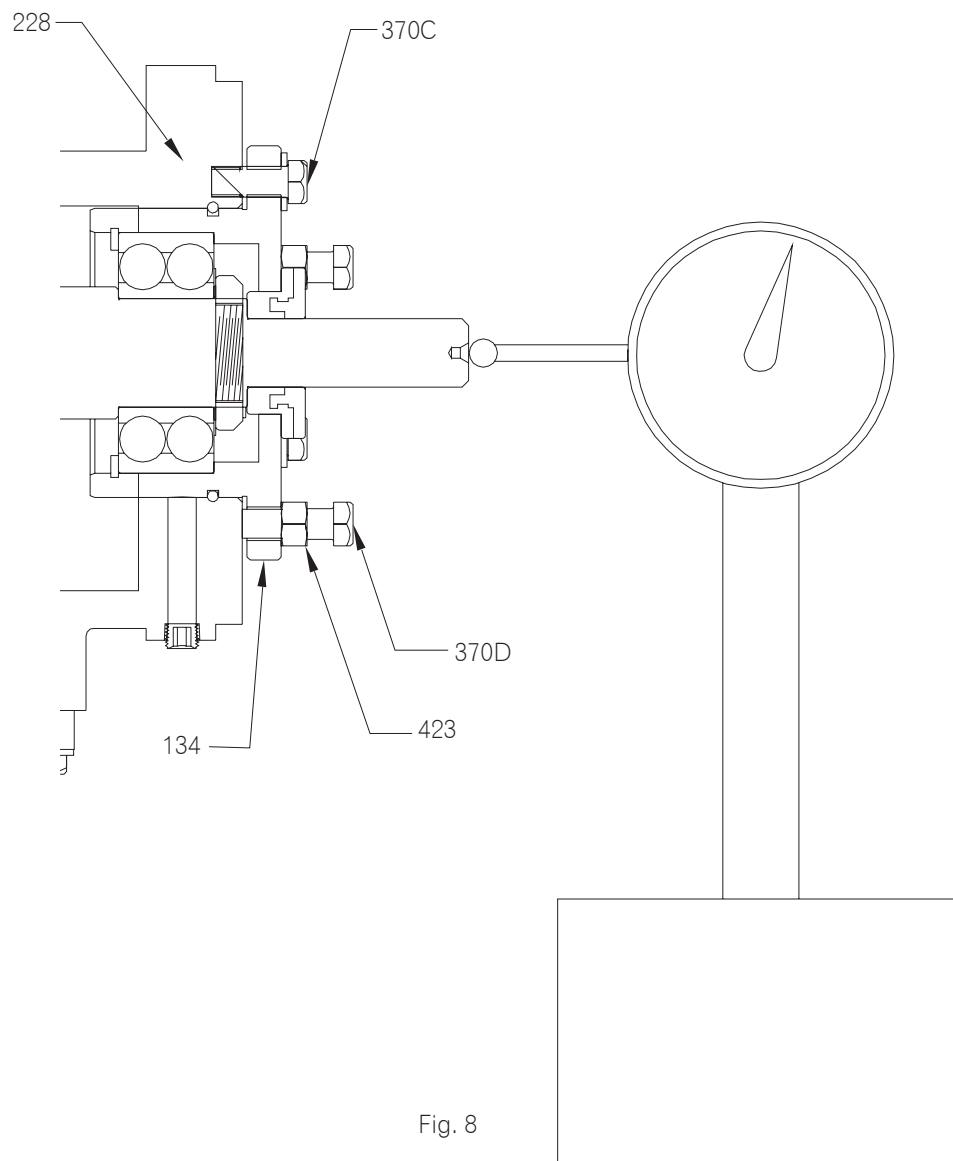


Fig. 8

DIAL INDICATOR TECHNIQUE

1. Lock out power to the pump driver.
2. Remove the coupling guard.
3. Place a dial indicator with a magnetic base on the pump base plate. Place the indicator against the end of the pump shaft or coupling face.
4. Loosen jack bolts (370D) and jam nuts (423).
5. Tighten bearing housing bolts (370C) evenly while slowly rotating the shaft until the impeller starts to rub on the casing (100).
6. Set the dial indicator to zero.
7. Tighten the jack bolts (370D) evenly until they contact the frame. Continue to tighten until the dial indicator reads the proper clearance.
8. Tighten bearing housing bolts (370C) evenly; then tighten jack bolts (370D) evenly. Be sure the dial indicator does not move from the proper setting.
9. Rotate the shaft to be sure it turns freely.
10. Reinstall the coupling guard.
11. Unlock power to the pump driver.

Priming

Prior to starting a centrifugal pump, it is imperative that you prime the pump by flooding the suction piping and casing with fluid. Priming will occur when you open the suction isolation valve and the packing sealing liquid valve.

CAUTION

Do not operate the pump without liquid in the casing.

Start Up

1. Rotate the pump by hand; making sure that the rotating element is spinning freely.
2. Be sure the suction valve is open.
3. Partially close the discharge valve.

CAUTION

Do not operate the pump with the discharge valve closed for an extended period of time.

4. Unlock power to the pump driver.
5. Slowly open the discharge valve as soon as the motor reaches operating speed.
6. Check stuffing box leakage and adjust, if necessary, to achieve leakage of 40-65 drops per minute.

7. Adjust the discharge valve as needed while checking piping for leaks.

8. Check mechanical operation of the pump and motor.

! WARNING !

Do not operate the pump without the proper guard.
See ANSI/ASME B15.1-1996.

Shut Down

1. Gradually close the discharge valve and turn off the power to the motor.
2. Lock out power to the pump driver.

MAINTENANCE

BEARINGS

All pumps are lubricated at the Gusher plant and should not require additional lubrication for approximately 1200 hours of operation. A well planned maintenance schedule can only be devised after the first six months of operation and the lubrication record review at that time. Each pump installation is unique and requires individual attention to set up the proper lubrication schedule for each specific installation. About once every year it is recommended that the bearings be cleaned and flushed with carbon tetrachloride and then relubricated.

Oil Lubricated

A high quality turbine oil with rust and oxidation inhibitors, such as Mobil DTE 26 (300 SSU) or its equivalent, should be used. Fill bearing frame with oil until level is at the center of the sight glass.

TABLER 3: OIL CAPACITY

Frame	Pints
STR	0.55 Approx
MTR	1.25 Approx

TABLER 4: LUBRICATING OIL DETAILS

Manufacturer	Oil
Atlantic Richfield	DURO 68
Chevron Turbine Oil	GST 68
EXXON	TERESSTIC 68
Texaco INC	Regal R & O 68
Mobil	DTE Heavy - Medium
Amoco Oil	Amoco Industrial Oil # 68

or any SAE 30 Non-Detergent oil.

Grease Lubricated

1. When regreasing ensure the grease container, greasing device, and the grease fittings are clean to prevent impurities from entering the bearing housing.
2. Remove the 2 grease relief plugs from the bottom of the bearing frame.
3. Fill both grease cavities with Chevron SRI #2 or equivalent until fresh grease comes out of relief holes.
4. Reinstall the grease relief plugs.
5. Check the frame seals to ensure they are seated in the bearing housing. If not, press into place with drains located at the bottom.

The bearing temperature will usually rise after regreasing due to an excess of grease. Temperatures should return to normal after the pump has purged the excess grease. Never mix greases of different consistency or thickener. If it is necessary to change, remove all of the old grease from the housing.

SHAFT SEALS

Packed Pumps

DO NOT STOP LEAKAGE! Packed glands drawn up too tight increases power consumption, increases wear on shaft, and shortens life of packing. When leakage can no longer be controlled by drawing up on the packing gland add another ring of packing to the stuffing box. After further operation and leakage again can no longer be controlled replace the packing by using the following procedure:

1. Remove all old packing from the stuffing box. Clean box and shaft sleeve thoroughly and examine for wear. Replace shaft sleeve if wear is excessive. Check bearing by lifting shaft up and down; do not expect packing to act as a bearing.
2. Use the right cross section of packing, Gusher uses Non-Asbestos packing as our standard for general purpose applications. Packing for special applications available, consult factory.
3. When using coil or spiral packing always cut the packing into separate rings. Never wind a coil of packing into a stuffing box. Rings can either be cut with butt (square) joint or diagonal joints. (Fig. 9) The best way to cut packing is on a mandrel the same diameter as the

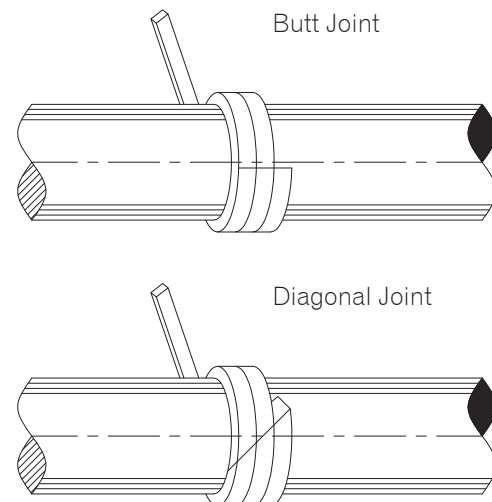


Fig. 9

shaft sleeve. Hold the coil packing tightly and firmly on the mandrel but do not stretch excessively. Cut the ring and try it in the stuffing box to make certain it fills the packing space properly with no gap in the joint at the O.D. of the ring. It is necessary that the rings be cut to the correct size, otherwise service life is reduced.

4. Install one ring at a time. Make sure it is clean and has not picked up any dirt in handling. If clean oil is available, lubricate the shaft and inside of the stuffing box. Seat rings firmly. (Except for TFE filament and graphite 19 yarn packings which should be snugged up very gently. Then wrench in gradually.. .after the pump is back in operation.) Joints of successive rings should be staggered and kept at least 90° apart. Each individual ring should be firmly seated with a tamping tool. When enough rings have been individually seated so the nose of the gland will reach them, individual tamping should be supplemented by the gland. Never depend entirely on the gland to seat a set of rings properly-this practice will jam the last rings installed, but leave the bottom rings loose in the box.

5. After the last ring is installed, take up bolts finger tight or very slightly snugged up. Do not jam the packing into place by excessive gland loading. Start pump, and take up bolts until leakage is decreased to a minimum. Make sure gland bolts are taken up evenly, stopping leakage entirely at this point will cause packing to burn up.

6. Allow packing to leak freely when starting up a newly packed pump. Excessive leakage during the first hour of operation will result in a better packing job over a longer period of time. Final adjustment should allow approximately 30 drops per minute to leak from the packing.

7. When specified, Gusher can provide means of lubricating the shaft and packing through a lantern ring by supplying water, oil, grease, or liquid handled in the pump.

8. If the stuffing box has a lantern ring, make sure the lantern ring, as installed, is slightly behind the fluid inlet as gland pressure is applied. (Fig 10)

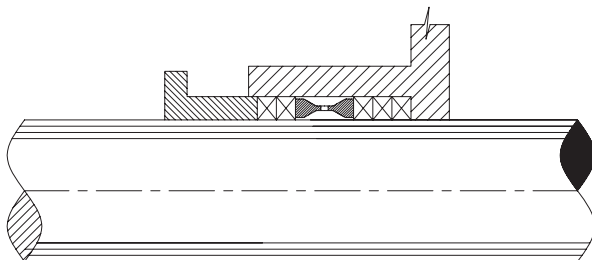


Fig. 10

9. Replace packing when leakage cannot be controlled by further take up on the gland.

Some of the most common reasons for packing failure are:

- Improper installation
- Uneven gland adjustment
- Shaft misalignment and shaft whip
- Improper selection of packing for liquid
- Improper selection for pressure and temperature
- Contaminated liquid (dirt, abrasives, etc.)
- Operation without fluid

MECHANICAL SEALS

1. Blue the shaft sleeve Scribe a mark at the face of stem plate to use as reference for installation of mechanical seal.

2. Remove the impeller, shaft sleeve, and stem plate.

3. Install stationary seat of mechanical seal into seal gland per seal manufacturer's instructions.

4. Slide seal gland with stationary seat and seal gland gasket onto shaft.

5. Install mechanical seal and locking collar onto shaft sleeve per seal manufacturer's instructions.

6. Install shaft sleeve with mechanical seal onto shaft.

7. Then mount stem plate to stem.

8. Reinstall impeller following same method previously used.

9. Mount seal gland to stem plate.

Some of the most common reasons for seal failure are:

- Improper installation
- Shaft misalignment and shaft whip
- Wrong selection for liquid pumped
- Dirt or grit between faces
- Seal gland tightened unevenly so stationary seat is not perpendicular to shaft
- Operation without fluid

ALL MODELS

1. Clean fits between rotating assembly and impeller housing (26).
2. Place stem plate gasket 24 number stem.
3. Loosen locking and jacking screws in the bearing frame.
4. Install rotating assembly in impeller housing (26). Torque bolts according to values in Table on page 13. (Fig. 7)
5. Replace shims under frame feet and tighten frame to baseplate. A dial indicator should be mounted to measure the distance between the top of the frame and the baseplate. This measurement shouldn't change as bolts are tightened.

6. Check total travel of impeller in the casing, if it is more than .030 in. improper parts or installation or too much pipe strain is present. Determine cause and correct before proceeding.
7. Adjust impeller clearance using procedures in the Maintenance section of this manual.
8. Replace any auxiliary piping, and fill pump with proper lubricant as outlined in the Maintenance section of this manual.
9. Check to see that it is possible to rotate the shaft easily by hand, if so continue with startup of pump in Operation section of this manual. If shaft does not turn easily determine cause and correct

! WARNING !

Pump and components are heavy. Serious physical injury or damage to equipment could occur from failure to properly lift and support pump. Steel-toed shoes must be worn at all times.

ASSEMBLY TROUBLESHOOTING

Problem	Cause	Solution
Excessive shaft end play.	Bearing internal clearance too great. Snap ring loose in housing groove.	Replace bearings with correct type. Reseat.
Excessive shaft runout.	Sleeve worn. Shaft bent.	Replace. Replace.
Excessive bearing frame runout.	Shaft bent. Bearing frame flange distorted.	Replace. Replace.
Excessive stem runout.	Corrosion.	Replace.
Excessive stem plate runout.	Stem plate not properly seated in stem. Corrosion or wear.	Reseat. Reseat.

APPENDIX

APPENDIX 1

Centrifugal pump troubleshooting

The following table provides possible solutions for symptoms that you may encounter with your centrifugal pump.

! WARNING !

- Before attempting to service the pump:
1. Follow the shut down procedures.
 2. Lock out the power source.
 3. Allow the pump to cool.
 4. Close the suction and discharge valves.
 5. Drain the pump.

TABLE 5: CENTRIFUGAL PUMP TROUBLESHOOTING

Symptom	Cause	Solution
Pump not delivering liquid	<ul style="list-style-type: none"> • Pump not primed • Suction lift too high • Wrong direction of rotation • Impeller clogged • Suction line plugged 	<ul style="list-style-type: none"> • Re-prime pump • Install shorter suction pipe • Change motor wiring • Back-flush pump • Remove debris
Low flow and low head	<ul style="list-style-type: none"> • Air leak in stuffing box • Worn suction side plate • Impeller worn or damaged • Air leak in suction line • Impeller clogged • Wrong direction of rotation 	<ul style="list-style-type: none"> • Replace or adjust packing • Replace defective part • Inspect and replace impeller, if needed • Replace gasket • Back-flush pump • Change motor wiring
Pump loses prime	<ul style="list-style-type: none"> • Pump not primed correctly • Air leak in suction line • Lantern ring in wrong location 	<ul style="list-style-type: none"> • Re-prime pump • Replace gasket or pipe plug • Repack moving lantern ring to correctly align with flush hole
Bearings are running hot	<ul style="list-style-type: none"> • Misalignment • Low or insufficient lubricant 	<ul style="list-style-type: none"> • Realign drive coupling • Check oil level and or grease
Motor requires excessive amperage	<ul style="list-style-type: none"> • Stuffing box gland is too tight • Total dynamic head is too low • Rotary part rubbing stationary part • Liquid is heavier than specified 	<ul style="list-style-type: none"> • Readjust or replace packing • Install throttle or reduce impeller diameter • Adjust part or replace parts • Check specific gravity of liquid

MAINTENANCE AND REPAIR

Disassembly Procedures

1. Lock out power supply at the motor starter.
2. Close off discharge, suction, sealing fluid, and cooling fluid.
3. Drain casing and flush, if needed.

! WARNING !

WEAR EYE PROTECTION
Failure to do so can result in serious personal injury.

! WARNING !

Pump parts are heavy. Use proper lifting methods to avoid personal injury.

4. Place lifting sling through frame to ensure safe handling during disassembly / assembly.
5. Remove bolts (370) holding the frame adapter (108) to casing (100).
6. Pull the frame adapter back from casing by tightening jack bolts (418).
7. Take the frame assembly to bench and secure for further work.
8. Scribe the location of coupling half on the shaft (122) and remove the coupling.

! WARNING !

Never use heat to remove impeller. Heat combined with trapped fluid could cause an explosion, which can result in personal injury.

9. Remove the impeller (101) from the shaft (122) while holding the shaft with a strap wrench or suitable tool that will not mark the shaft.

NOTE: Threads are right-handed.

XLR – Remove impeller plug (428Y) from the impeller (101). Do not save impeller gasket (428D).

FOR A PACKED PUMP:

- a. Remove the packing gland nuts (353A).
- b. Slide gland toward frame (228).
- c. Remove seal chamber nuts (423B).
- d. Slide off stuffing box cover (184).
- e. Remove packing (106) and lantern ring (105).

FOR A MECHANICAL SEAL:

- a. Remove seal gland nuts (353A).
- b. Slide gland toward frame (228), exercising care so as to not drop stationary set from gland.
- c. Remove seal chamber nuts (423B).
- d. Slide off stuffing box cover (184).
- e. Remove mechanical seal rotating element (383) and sleeve (128) from pump shaft.
- f. Loosen set screws if present. Refer to cartridge seal manufacturer's instructions.
- g. Slide off seal gland with stationary seal and o-ring gasket.

10. Remove the frame adapter by removing two dowel pins and four adapter bolts and then separate the adapter from the bearing frame.

NOTE: This step does not apply to the 6" STR Model.

11. Remove the bearing housing bolts and loosen the jam nuts.
12. Tighten the jack-bolts evenly to push the bearing housing out of frame.

13. Slide shaft assembly, with housing, out of bearing frame.
14. On the STR and MTR, remove the bearing housing snap ring. On the LTR and XLR, remove bearing cover screws and remove bearing cover. Then remove the bearing housing by tapping with a rubber hammer.
15. Remove bearing lock nut and bearing lock washer.
16. Remove inboard bearing and outboard bearing. Use an arbor press or bearing puller to facilitate. On LTR models only, do not remove oil ring unless it is damaged.

NOTE: Do not use a hammer, which may cause damage to the shaft.

17. Complete disassembly of bearing frame. Remove oil plug (not shown), oil sight glass, oil cooler inlet, outlet plugs, and frame foot attachment bolt and foot, where applicable.
18. Inspect all parts for cracks, erosion, pitting, rusting, damaged threads, corrosion, and groove worn shaft/sleeve. Replace casing if grooves and pits are greater than 1/8" deep. Replace impeller if grooves are greater than 1/16" or even wear exceeds 1/32". Inspect shaft sleeve if grooved or pitted. Shaft run out or bearing shoulder damage is cause for replacement.

ASSEMBLY PROCEDURES

Refer to Bolt Torque Values when assembling pump.

Bolt Torque Values, Ft-Lbs (N-m)			
Description	Frame	Model 1196	
		Lube	Dry
Bolt, Casing to adaptor	STR 6"	30 (40)	45 (60)
	STR 8"	20 (27)	30 (40)
	MTR, LTR	30 (40)	45 (60)
	XLR	30 (40)	45 (60)
Bolt, frame to adaptor	All	20 (27)	30 (40)
Bolt, clamp ring	STR, MTR	10* (1.1)	17* (1.9)
	LTR	55* (6.2)	83* (9.4)
Bolt, bearing end cover	XLR	9 (12)	12 (16)

*Values are in inch-lbs (N-m)

1. Clean the bearing frame and inspect all tapped holes. Chase as needed.
2. Install oil fill plug, oil sight glass, and frame lubrication plugs.
3. Attach bearing frame foot with bolts, where applicable.
4. On the LTR model, install oil ring on shaft, if removed. Oil ring is a press fit onto shaft.

NOTE: Use proper size drive tool to prevent damage.

5. On the LTR model, install bearing cover over shaft.
6. Install outboard bearing on shaft.
 - If grease lubricated, install with shield away from impeller end.
 - If oil lubricated, there should be no seals or shields.
 - The recommended bearing installation method is heating the bearing using an induction heater.

! WARNING !

WEAR INSULATED GLOVES when using heater.
Failure to do so can result in serious personal injury
while handling hot bearings.

7. Install a bearing lock washer on the shaft.
 - a. Place tang of lock washer in shaft keyway.
 - b. Install lock-nut on shaft.
 - c. Using a spanner wrench, tighten the nut until snug; then bend any one of the tangs into a lock-nut slot.
8. Install inboard bearing on shaft.
 - If grease lubricated, install with shield toward impeller end.
 - If oil lubricated, there should be no seals or shields.
9. Install the outboard labyrinth oil seal in the bearing housing. Follow
 - Maintenance instructions in Appendix 3.

NOTE: LTR frames use duplex angular contact bearings.
Make sure bearings are mounted in the correct order, back to back.

10. Apply a thin coating of lubricant to the inside of the bearing housing.
11. Slide the bearing housing over the outboard bearing assembly and shaft. Place the coupling end of the shaft into the bearing housing through the labyrinth oil seal.
 - On the XLR model, install the bearing cover gasket.
 - On the STR and MTR models, install the bearing housing snap ring into the groove on the bore of the bearing housing. Make sure the flat side is toward the bearing.
 - On the LTR and XLR models, install bearing cover and bolts.

NOTE: Make sure drain slots face down.

12. Install a new O-ring over the O.D. of the bearing housing.
13. Apply a thin coating of lubricant to the outside of the bearing housing and slide the assembly into the bearing frame.
14. Install bearing housing bolts into bearing frame and install jack bolts and jam nuts. Hand-tighten evenly.
15. Attach frame to adapter.
 - a. Align dowel pins, adapter bolts and frame to adaptor gasket.
 - b. Tighten using criss-cross pattern.

c. Rotate shaft 360 degrees. It should be free.

NOTE: These steps do not apply to the 6" STR Model.

16. Set frame and adapter upright. Clamp to bench for safety as assembly continues.

17. Install inboard bearing labyrinth seal in adapter frame. Make sure that the seal's drain slots face down. Follow Maintenance instructions in Appendix 5.

18. Put anti-seize compound on the shaft and, if equipped, install shaft sleeve onto shaft.

19. Align anti-rotation pin with notch in sleeve.

- For mechanical seal pumps, read manufacturer's instructions for assembly. (See STUFFING BOX on page 11.)

20. Install stuffing box cover onto adapter with studs and nuts.

21. Install impeller with new O-ring.

22. Using an impeller wrench or strap wrench on the coupling end of the shaft, tighten by rotating clockwise. Make sure coupling is tight to the shaft.

23. For packed pumps, install the appropriate packing in the stuffing box cover according to fluid being pumped.

a. First, insert two packing rings into bottom of box.

b. Next, insert the lantern ring. Make sure to stagger packing joints and lantern ring joint by 90 and be sure lantern ring lines up with flushing connection. Install gland halves.

c. Hand-tighten nuts. You must make final adjustments after the pump has begun operation.

24. For mechanical seal pumps, continue by following manufacturer's instructions noted in Step 19.

Install casing gasket onto stuffing box cover. At this point, the power end is ready for reinstallation into the casing or for storage for future use.

25. If returning to service, slide assembly into casing.

26. Install casing bolts into frame to pull assembly into casing.

27. Rotate the shaft to ensure that no rubbing exists.

28. Adjust impeller clearance according to the instructions beginning on page 13.

29. Align drive coupling according to the instructions beginning on page 7, in addition to coupling manufacturer instructions.

30. If the motor was replaced, check rotation prior to reconnecting coupling halves. (See rotation instructions on page 15).

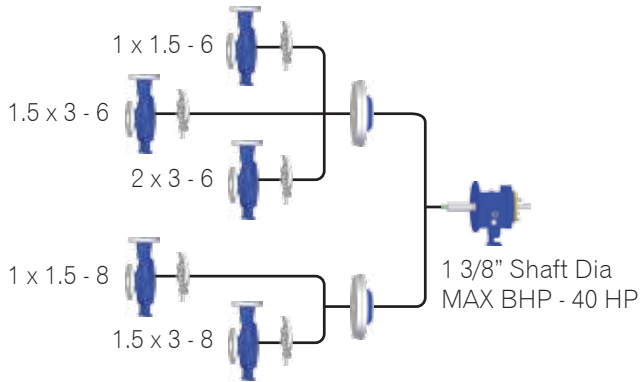
CAUTION

Check that motor rotation agrees with pump rotation.

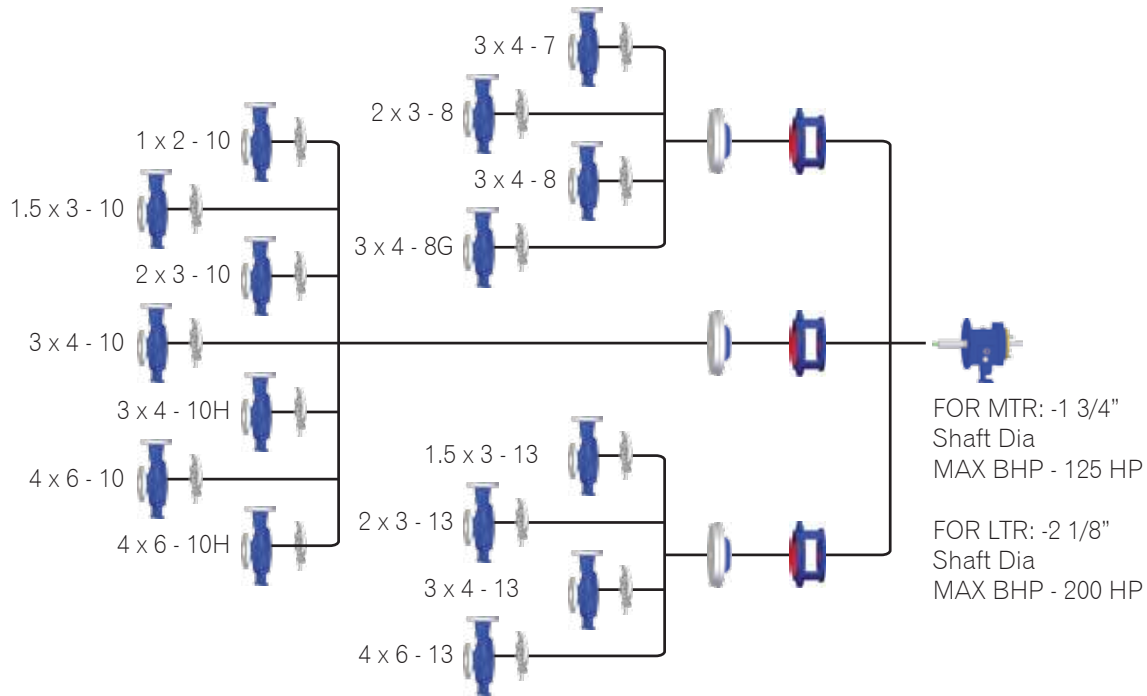
31. Reinstall coupling guard.

APPENDIX 2

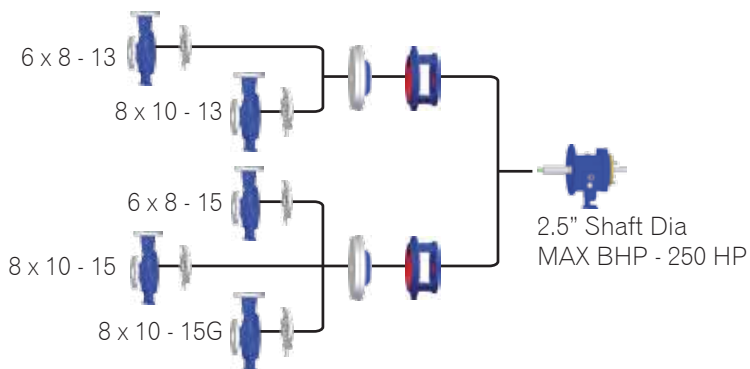
INTERCHANGEABILITY OF ANSI 1196 SERIES PUMP



MODEL 1196
STR

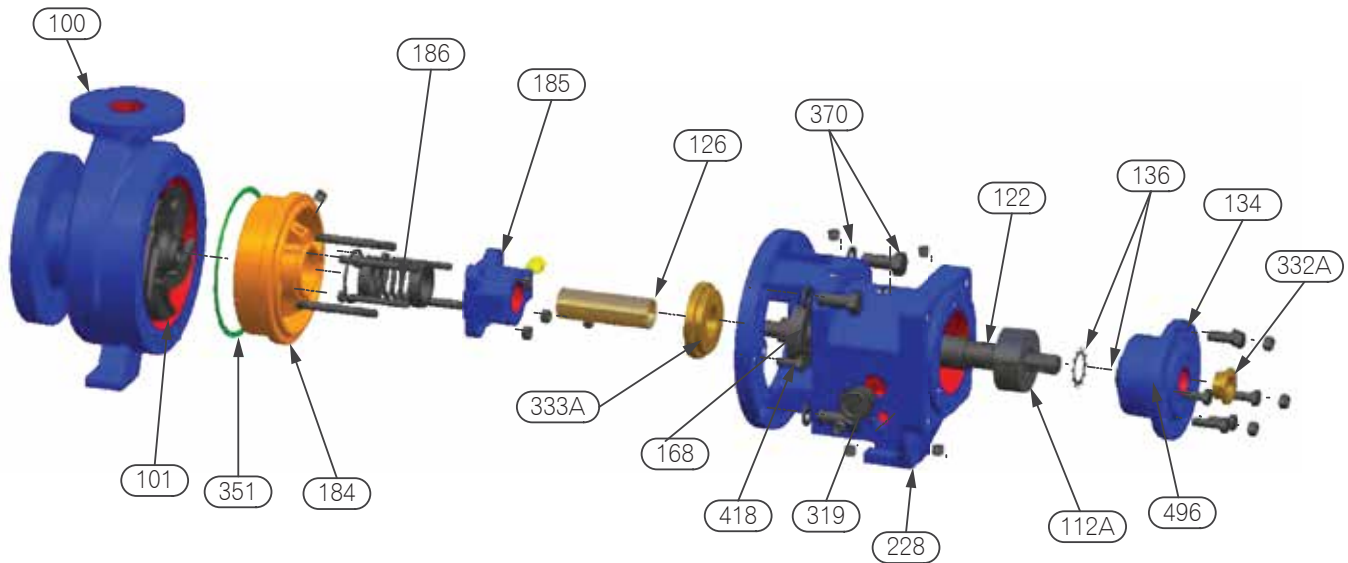


MODEL 1196
MTR / LTR

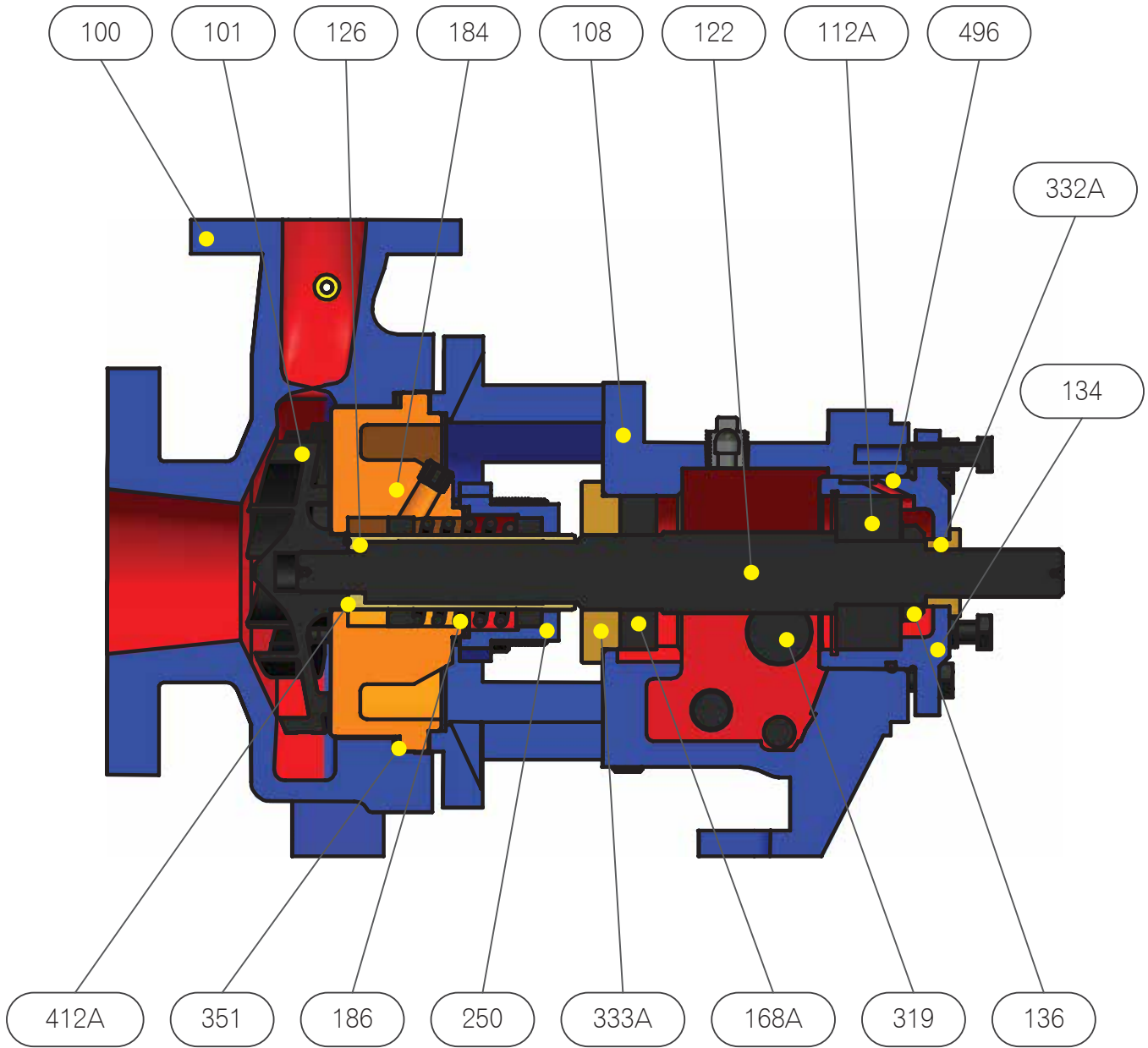


MODEL 1196
XLR

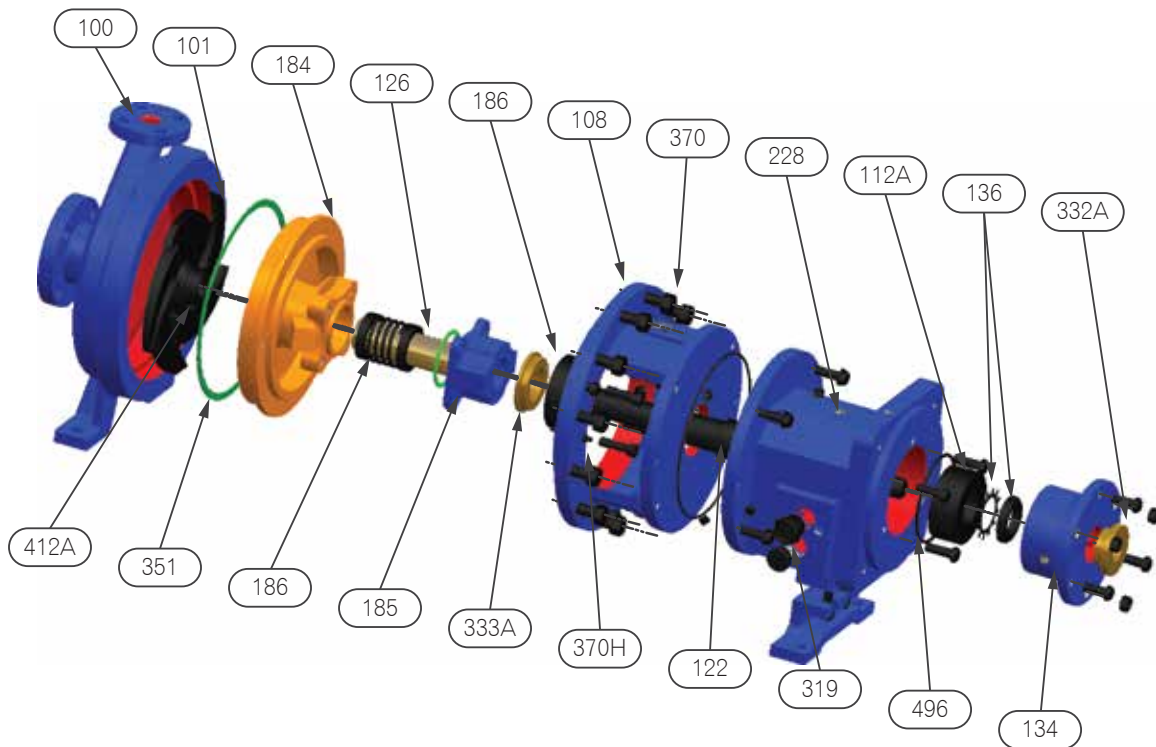
STR EXPLODED VIEW AND PART LIST



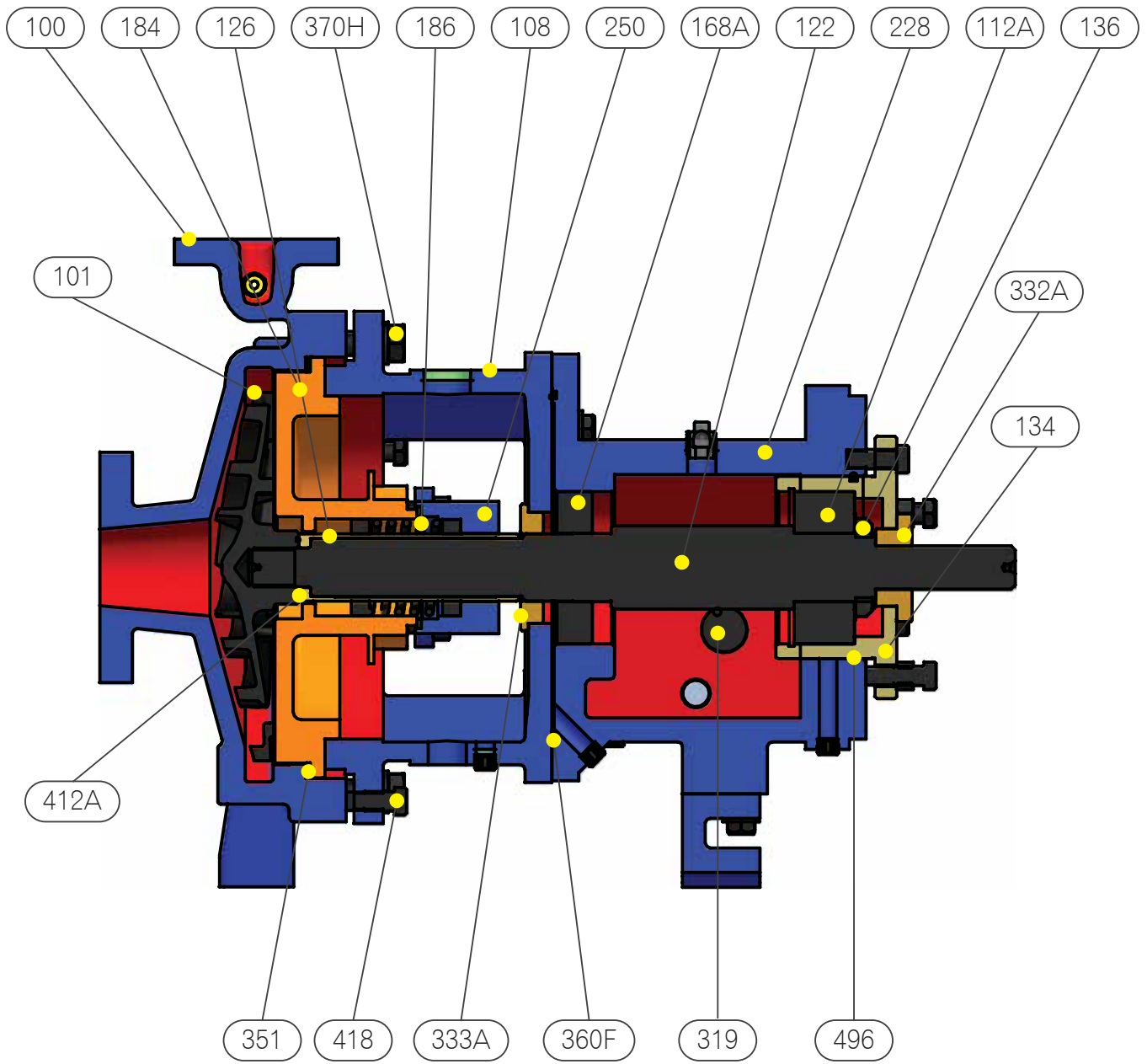
PART Nos.	PART DESCRIPTION	MATERIAL OF CONSTRUCTIONS					
		WCB / Carbon Steel	SS304	316SS	CD4MCu	Alloy20	Hastelloy B & C
100	Casing	WCB / Carbon Steel	SS304	316SS	CD4MCu	Alloy20	Hastelloy
101	Impeller	WCB / Carbon Steel	SS304	316SS	CD4MCu	Alloy20	Hastelloy
105	Lantern Ring	Glass-Filled TEFLON*					
106	Stuffing Box Packing	TEFLON* Impregnated Fibers					
108	Frame Adapter	Cast Iron / Ductile Iron					
112A	Thrust Bearing	Double Row					
122	Shaft Less Sleeve (Optional)	SS316	SS316	316SS	Alloy20	Hastelloy	
122	Shaft with Sleeve	SS316	SS316	Shaftless Sleeve, Solid Shaft (Optional)		SS 316	
126	Shaft Sleeve	SS316		316SS	Alloy20		Hastelloy
136	Bearing Locknut & Lockwasher	Steel					
168	Radial Bearing	Single Row					
184	Stuffing Box Cover	WCB / Carbon Steel	SS304	316SS	CD4MCu	Alloy20	Hastelloy
185	Seal Chamber		SS304	316SS	CD4MCu	Alloy20	Hastelloy
250	Gland	SS316		316SS	Alloy20		Hastelloy
134	Bearing Housing	Cast Iron / Ductile Iron					
186	Mechanical Seal						
228	Bearing Frame	Cast Iron / Ductile Iron					
370H	Stud / Nut, Cover to Adapter	Not Applicable					
319	Sight Glass	Glass / Aluminum					
332A	Labyrinth (Outboard)	Bronze					
333A	Labyrinth (Inboard)	Bronze					
351	Casing Gasket	Aramid Fibre with EPDM Rubber or PTFE					
370	Cap Screw, Adapter-to-Casing	Steel					
412A	O-Ring, Impeller	Glass-Filled TEFLON*					
418	Jacking Bolt	304 SS					
496	O-Ring, Bearing Housing	Buna Rubber					



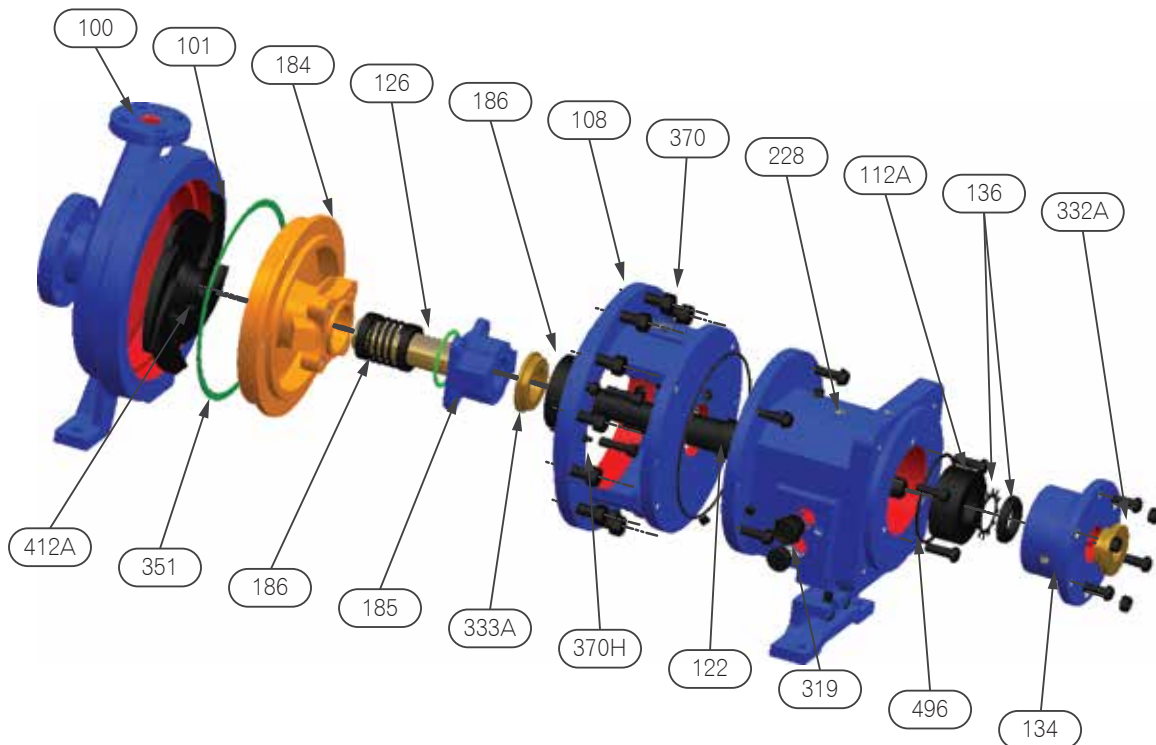
MTR EXPLODED VIEW AND PART LIST



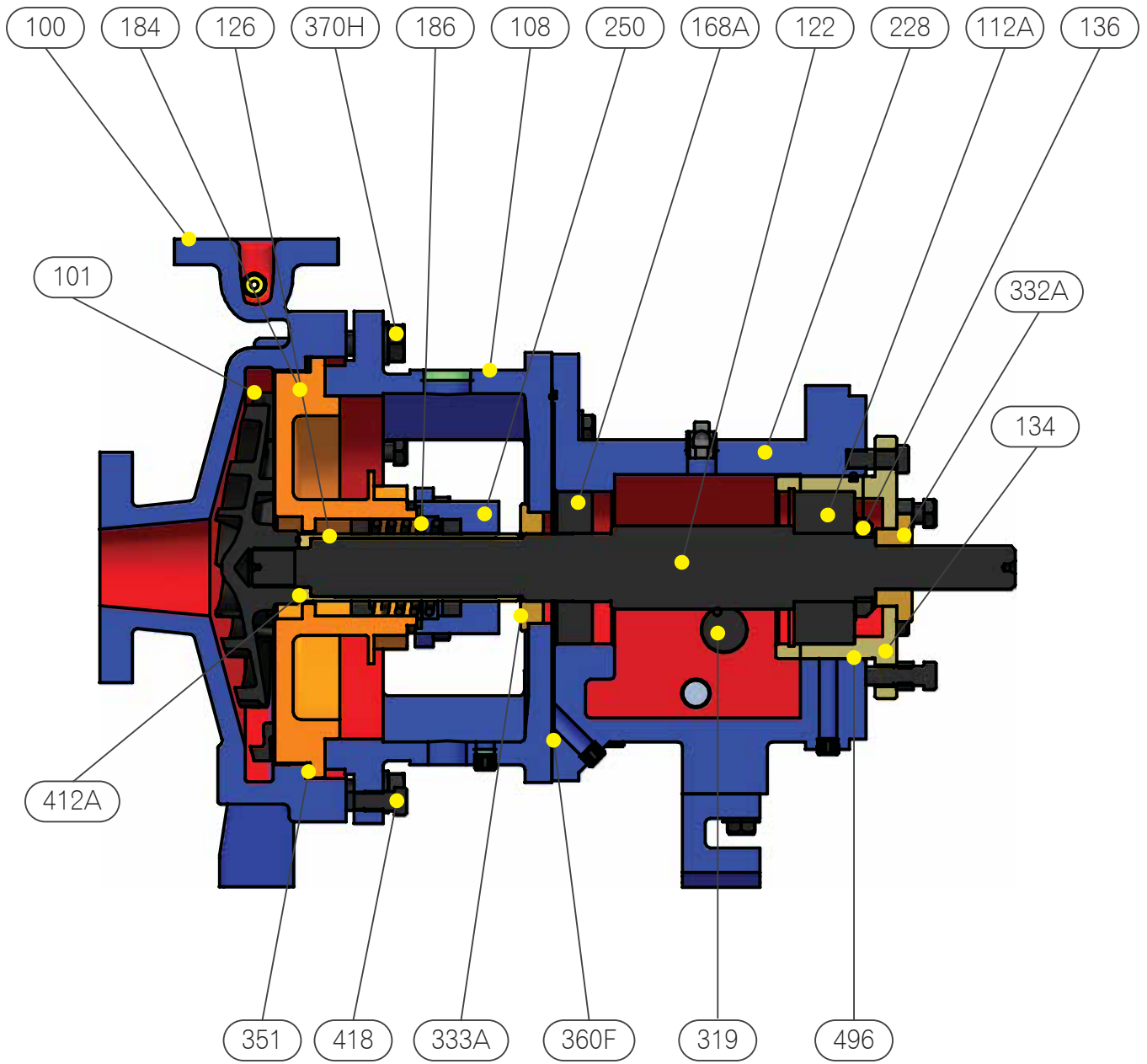
PART Nos.	PART DESCRIPTION	MATERIAL OF CONSTRUCTIONS					
		WCB / Carbon Steel	SS304	SS316	CD4MCu	Alloy20	Hastelloy B & C
100	Casing	WCB / Carbon Iron	SS304	SS316	CD4MCu	Alloy20	Hastelloy B & C
101	Impeller	WCB / SS316	SS316				
105	Lantern Ring	Glass-Filled TEFLON*					
106	Stuffing Box Packing	TEFLON* Impregnated Fibers					
108	Frame Adapter	Cast Iron / Ductile Iron					
112A	Thrust Bearing	Double Row					
122	Shaft Less Sleeve (Optional)	SS316	SS316	SS316		Alloy20	Hastelloy
122	Shaft with Sleeve	SS316	SS316	Shaftless Sleeve, Solid Shaft (Optional)			SS316
126	Shaft Sleeve	SS316		SS316	Alloy20		Hastelloy
136	Bearing Locknut & Lockwasher	Steel					
168	Radial Bearing	Single Row					
184	Stuffing Box Cover	WCB / Carbon Steel	SS304	SS316	CD4MCu	Alloy20	Hastelloy
185	Seal Chamber		SS304	SS316	CD4MCu	Alloy20	Hastelloy
250	Gland	SS316		SS316	Alloy20		Hastelloy
134	Bearing Housing	Cast Iron / Ductile Iron					
186	Mechanical Seal						
228	Bearing Frame	Cast Iron / Ductile Iron					
370H	Stud / Nut, Cover to Adapter	SS304					
319	Sight Glass	Glass / Aluminum					
332A	Labyrinth (Outboard)	Bronze					
333A	Labyrinth (Inboard)	Bronze					
351	Casing Gasket	Aramid Fibre with EPDM Rubber or PTFE					
370	Cap Screw, Adapter-to-Casing	Steel					
412A	O-Ring, Impeller	Glass-Filled TEFLON*					
418	Jacking Bolt	SS304					
469B	Dovel Pin, Frame to Adapter	Steel					
496	O-Ring, Bearing Housing	Buna Rubber					



XLR EXPLODED VIEW AND PART LIST



PART Nos.	PART DESCRIPTION	MATERIAL OF CONSTRUCTIONS						
		WCB / Carbon Steel	SS304	SS316	CD4MCu	Alloy20	Hastelloy B & C	
100	Casing	WCB / Carbon Iron	SS304	SS316	CD4MCu	Alloy20	Hastelloy B & C	
101	Impeller	WCB / SS316	SS316					
105	Lantern Ring	Glass-Filled TEFLON*						
106	Stuffing Box Packing	TEFLON* Impregnated Fibers						
108	Frame Adapter	Cast Iron / Ductile Iron						
112A	Thrust Bearing	Double Row						
122	Shaft Less Sleeve (Optional)	SS316	SS316	SS316		Alloy20	Hastelloy	
122	Shaft with Sleeve	SS316	SS316	Shaftless Sleeve, Solid Shaft (Optional)			SS316	
126	Shaft Sleeve	SS316		SS316	Alloy20		Hastelloy	
136	Bearing Locknut & Lockwasher	Steel						
168	Radial Bearing	Single Row						
184	Stuffing Box Cover	WCB / Carbon Steel	SS304	SS316	CD4MCu	Alloy20	Hastelloy	
185	Seal Chamber			SS304	SS316	CD4MCu	Alloy20	Hastelloy
250	Gland	SS316		SS316	Alloy20		Hastelloy	
134	Bearing Housing	Cast Iron / Ductile Iron						
186	Mechanical Seal							
228	Bearing Frame	Cast Iron / Ductile Iron						
370H	Stud / Nut, Cover to Adapter	SS304						
319	Sight Glass	Glass / Aluminum						
332A	Labyrinth (Outboard)	Bronze						
333A	Labyrinth (Inboard)	Bronze						
351	Casing Gasket	Aramid Fibre with EPDM Rubber or PTFE						
370	Cap Screw, Adapter-to-Casing	Steel						
412A	O-Ring, Impeller	Glass-Filled TEFLON*						
418	Jacking Bolt	SS304						
469B	Dovel Pin, Frame to Adapter	Steel						
496	O-Ring, Bearing Housing	Buna Rubber						



APPENDIX 3

MAINTENANCE INSTRUCTIONS FOR INPRO/SEAL® "VBX" BEARING ISOLATORS

Details of Operations

The Inpro Bearing Isolator is a Labyrinth type seal, which performs two functions:

1. Maintains the clean oil in the bearing housing.
2. Keeps contaminants from entering the bearing housing.

The unit is comprised of three major components: the rotor, the stator, and the "VBX" ® ring.

The rotor fits over the shaft and is held in place by an elastometric drive ring. The drive ring causes the rotor to turn with the shaft and also provides a positive static seal on the shaft. There is no metal-to-metal contact between the shaft and rotor, thus no wear and friction concerns.

The stator is held in the housing by a nominal .002" interference fit. An o-ring gasket on the outside diameter of the stator secures a positive seal between the stator and the housing bore. The designed Labyrinth grooves and lube return trough on the stator inside diameter retains the lubricant inside the bearing housing.

The rotor and stator act together to keep contamination out of the bearing housing.

The "VBX" ® ring, stator, and rotor are a unit and must not be pulled apart. If the unit is pulled apart or comes apart, it must be replaced with a new unit. The "VBX" ® is intended to be an inseparable design.

Repairs or replacement of seals are only necessary if excessive oil leakage is visible. If or when the bearing housing is disassembled, it is recommended that the rotor orings be replaced.

DISASSEMBLY PROCEDURES

1. Remove shaft assembly (122) per instructions for pump disassembly. (See page 18)

2. STR removal. Insert a bar (wood or plastic) through the outboard bearing housing end of the bearing frame (228). Contact the inboard bearing isolator (333A). Remove by tapping the bar or pushing with an arbor press.

MTR and XLR removal. Disassemble the bearing frame adapter (108) per pump disassembly instructions. Remove the inboard bearing isolator (333A) with a bar (wood or plastic) by tapping or by pushing with an arbor press.

3. STR, MTR, and XLR outboard bearing isolator (332A) removal. Block up the outboard bearing housing (134) on the bench, coupling the end toward the bench top. Tap the isolator out of the housing or use an arbor press.

4. Inspect the bearing isolators. If the unit pulls apart, a new isolator is needed for reassembly.

5. Replace the rotor O-rings and stator O-rings each time the units are removed from the pump assembly.

INSTALLATION PROCEDURES

1. STR, MTR, and XLR Inboard Isolator. Position the bearing frame (228) or adapter (108) inboard bearing side up. Place the isolator seal (333A) stator side in the bore. THE EXPULSION PORT MUST BE IN THE 6 O'CLOCK POSITION. While using a block large enough to cover the entire flange of the isolator, use an arbor press to press the stator into the bore. Press into place until the location

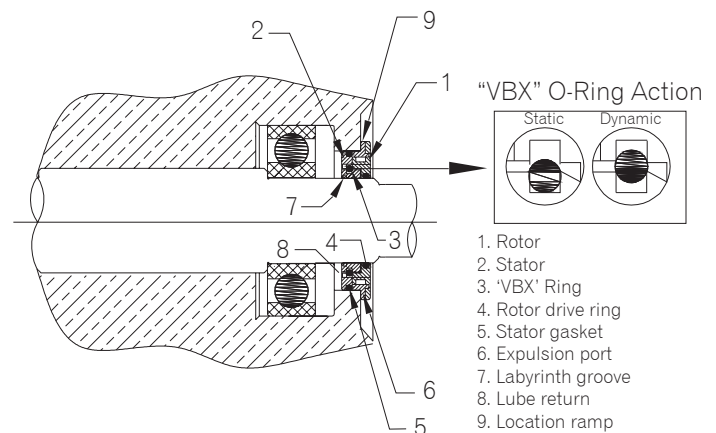


Fig. 13

ramp begins. (See Figure 13)

2. Outboard Isolator (332A). Position the bearing housing (134) outside flange up. Place the isolator in the bore and press into place using the same technique as in Step 1 above.

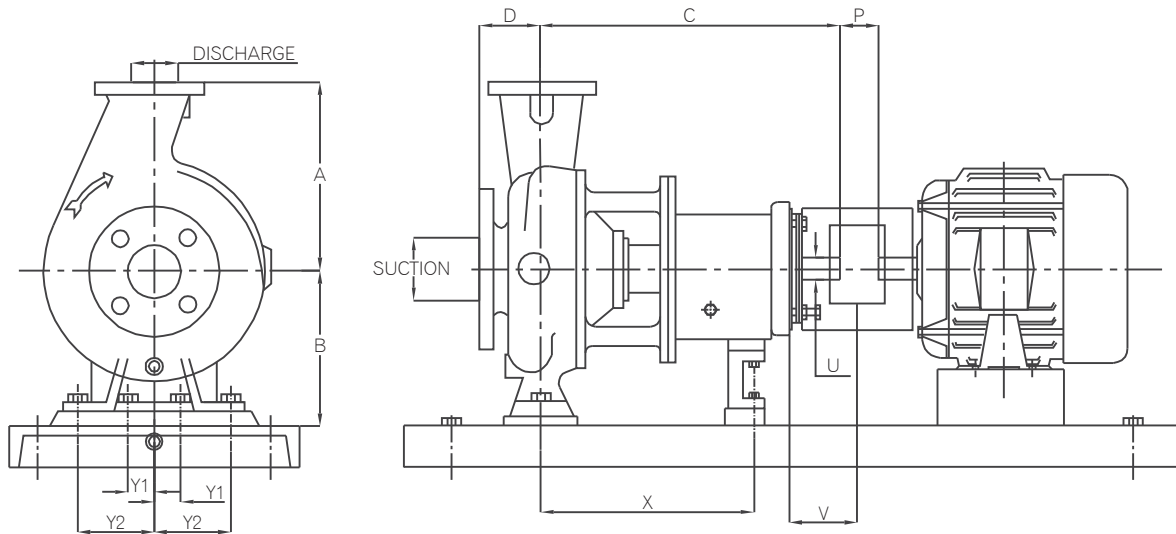
3. Lightly lube the sleeve end of the shaft and rotor drive ring. Slide the bearing frame (228) or adapter (108) over the shaft per assembly instructions.

4. To assemble the outboard end, tape the shaft (122) keyway with black tape. Lube the tape and rotor drive ring. Slide the bearing housing (134) over the shaft (122) end and continue per assembly instructions.

Make sure expulsion port and lube return are in the 6 o'clock position in final assembly.

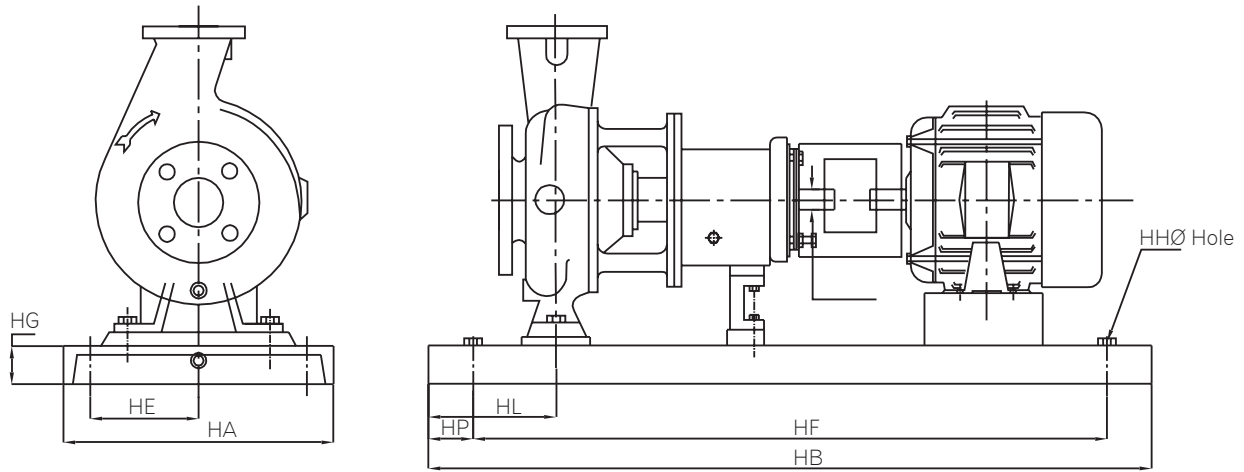
APPENDIX 4

DIMENSION DATA



Pump Frame	Pump Size	ANSI Designation	Discharge Size	Suction Size	A	B	C	D	Y1	Y2	X	H	P	U	V	Bare Pump Weight LBS.	
STR	1x1.5-6	AA	1	1.5	6.5 (165)	5.25 (133)	13.5 (343)	4 (102)	0	3	7.25	5/8	3.75 (95)	0.875	2	85	
	1.5x3-6	AB	1.5	3												94	
	2x3-6		2	3												96	
	1x1.5-8	AA	1	1.5												102	
	1.5x3-8	AB	1.5	3												110	
MTR	3x4-7	A70	3	4	11 (280)	8.25 (210)	19.5 (495)	4 (102)	3.625	4.875	12.5	5/8	3.75 (95)	OR	2.625	222	
	2x3-8	A60	2	3	9.5 (242)											222	
	3x4-8	A70	3	4	11 (280)											222	
	3x4-8G	A70	3	4	11 (280)											222	
	1x2-10	A05	1	2	8.5 (216)											204	
	1.5x3-10	A50	1.5	3	8.5 (216)											222	
	2x3-10	A60	2	3	9.5 (242)											232	
	3x4-10	A70	3	4	11 (280)											266	
	3x4-10H	A40	3	4	12.5 (318)											276	
	4x6-10	A80	4	6	13.5 (343)											308	
OR	4x6-10G	A80	4	6	10 (254)	14.5 (368)	27.875 (708)	6 (152)	4.5	8	18.75	7/8	5.25 (135)	2.375	4	248	
	4x6-10H	A80	4	6												278	
	1.5x3-13	A20	1.5	3												10.5 (267)	334
	2x3-13	A30	2	3												11.5 (292)	410
	3x4-13	A40	3	4												12.5 (318)	410
LTR	4x6-13	A80	4	6	13.5 (343)	10 (254)	19.5 (495)	4 (102)	3.625	4.875	12.5	5/8	3.75 (95)	OR	2.625	308	
	1.5x3-13	A20	1.5	3	10.5 (267)	10 (254)	19.5 (495)	4 (102)	3.625	4.875	12.5	5/8	3.75 (95)	OR	2.625	248	
	2x3-13	A30	2	3	11.5 (292)	10 (254)	19.5 (495)	4 (102)	3.625	4.875	12.5	5/8	3.75 (95)	OR	2.625	278	
	3x4-13	A40	3	4	12.5 (318)	10 (254)	19.5 (495)	4 (102)	3.625	4.875	12.5	5/8	3.75 (95)	OR	2.625	334	
	4x6-13	A80	4	6	13.5 (343)	10 (254)	19.5 (495)	4 (102)	3.625	4.875	12.5	5/8	3.75 (95)	OR	2.625	410	
XLR	6x8-13	A90	6	8	16	14.5 (368)	27.875 (708)	6 (152)	4.5	8	18.75	7/8	5.25 (135)	2.375	4	560	
	8x10-13	A100	8	10	18											670	
	6x8-15	A110	6	8	18											610	
	8x10-15	A120	8	10	19											740	
	8x10-15G	A120	8	10	19											710	

BASEPLATE RELATED DIMENSIONS



Pump Frame	Baseplate No.	Max Motor Frame	HA	HB	HE	HF	HP	HG	HH	HL
STR	1	145	10	35	4	32 1/2	1 1/4	3	3/4	4 1/2
	2	215	12	39	4 1/2	36 1/2	1 1/4	3 1/4	3/4	4 1/2
	3	286	15	46	6	43 1/2	1 1/4	4 1/8	3/4	4 1/2
MTR OR LTR	4	215	12	45	4 1/2	42 1/2	1 1/4	3 3/4	3/4	4 1/2
	5	286	15	52	6	49 1/2	1 1/4	4 1/8	3/4	4 1/2
	6	365	18	58	7 1/2	55 1/2	1 1/4	4 3/4	1	4 1/2
	7	444	18	60	7 1/2	57 1/2	1 1/4	4 3/4	1	4 1/2
XLR	8	286	26	62	9 1/2	59 1/2	1 1/4	4 3/4	1	6 1/2
	9	365	26	68	9 1/2	65 1/2	1 1/4	4 3/4	1	6 1/2
	10	444	26	74	9 1/2	77 1/2	1 1/4	4 3/4	1	6 1/2

APPENDIX 5

CONSTRUCTION DETAILS

#	#	STR		MTR		LTR		XLR	
Shaft	Diameter at Impeller	.75	(19)	1	(25)	1.25	(32)	1.5	(38)
	Diameter in Stuffing Box (Solid Shaft Const.)	1.375	(35)	1.75	(45)	2.125	(54)	2.5	(64)
	Diameter between Bearings	1.5	(38)	2.125	(54)	2.5	(64)	3.125	(79)
	Diameter at Coupling	.875	(22)	1.125	(29)	1.875	(48)	2.375	(60)
	Overhang	6.125	(156)	8.375	(213)	8.375	(213)	9.969	(253)
	Maximum Shaft Deflection	0.002 (0.05)							
	Shaft Deflection Index (L3/D4)								
	(With Sleeve)	143		116		48		62	
(Less Sleeve)	64		63		29		25		
Sleeve		1.375	(35)	1.75	(45)	2.125	(54)	2.5	(64)
Bearings	Radial	SKF 6207		SKF 6309		SKF 6311		SKF 6313	
	Thrust	SKF 5306 A/C3		SKF 5309 A/C3		SKF 7310 BECBM		SKF 5313 A/C3	
	Bearing Span	4.125	(105)	6.75	(171)	6.875	(164)	9.25	(225)
Stuffing Box	Bore	2	(51)	2.5	(64)	2.875	(73)	3.375	(86)
Power Limits	HP (kW) per 100 RPM	1.1	(.82)	3.4	(2.6)	5.6	(4.2)	14	(10.5)

All dimensions in inches and (mm)

Shaft Runout Tolerances

At Stuffing Box	At Coupling
.002 (.051)	.001 (.026)

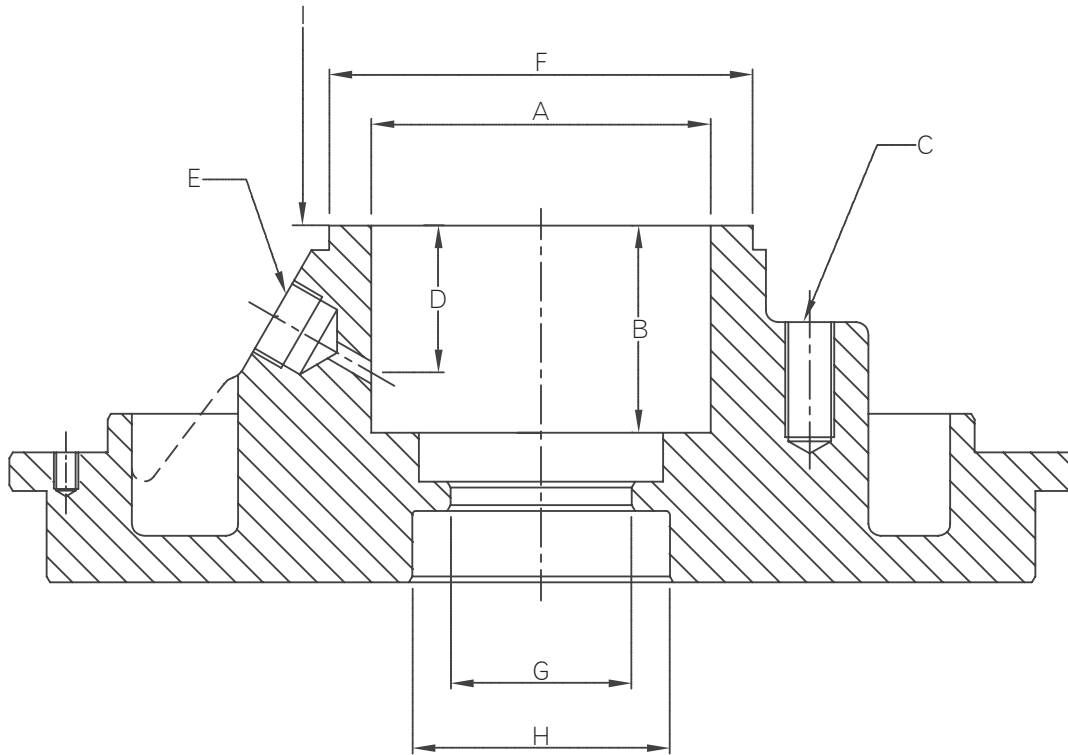
All dimensions in inches and (mm)

Shaft End Play

	STR	MTR	LTR	XLR
Double Row	.0011/.0019 (.028/.047)	.0013/.0021 (.033/.054)	NA	.0014/.0023 (.036/.058)
Duplex	.0007/.0010 (.018/.026)	.0009/.0012 (.022/.030)	.0010/.0015 (.026/.038)	.0010/.0015 (.026/.038)

All dimensions in inches and (mm)

Stuffing Box Related Dimensions



Pump Frame	A	B	C		D	E	F	G	H	I Obstruction	Packing		Lantern Ring width
			B.C.	TAP							Size	# of Rings	
STR	2.00	2.12	3.25	3/8-18 UNC	0.97	1/4-18 NPT	2.39	1.40	-	2.18	5/16	5	7/16
MTR	2.50	2.62	4.12	1/2-13 UNC	1.56	3/8-18 NPT	3.01	1.78	2.65	3.00	3/8	5	5/8
LTR	2.78	2.62	4.50	1/2-13 UNC	1.56	3/8-18 NPT	3.52	2.15	2.63	3.00	3/8	5	5/8

Bearing Fits & Tolerances

	STR	MTR	LTR	XLR
Shaft O. D. Inboard	1.3785 (35.013) 1.3781 (35.002)	1.7722 (45.013) 1.7718 (45.002)	2.1660 (55.015) 2.1655 (55.002)	2.5597 (65.015) 2.5592 (65.002)
Clearance	0.0010 (0.025) tight 0.0001 (0.002) tight	0.0010 (0.025) tight 0.0001 (0.002) tight	0.0012 (0.030) tight 0.0001 (0.002) tight	0.0012 (0.030) tight 0.0001 (0.002) tight
Bearing I.D. inboard	1.3780 (35.000) 1.3775 (34.988)	1.7717 (45.000) 1.7712 (44.988)	2.1654 (55.000) 2.1648 (54.985)	2.5591 (65.000) 2.5585 (64.985)
Frame I. D. Inboard	2.8346 (72.000) 2.8353 (72.019)	3.9370 (100.000) 3.9379 (100.022)	4.7244 (120.000) 4.7253 (120.022)	5.5118 (140.000) 5.5128 (140.025)
Clearance	0.0012 (0.032) loose 0.0000 (0.000) loose	0.0015 (0.037) loose 0.0000 (0.000) loose	0.0015 (0.037) loose 0.0000 (0.000) loose	0.0017 (0.043) loose 0.0000(0.000) loose
Bearing O. D. Inboard	2.8346 (72.000) 2.8341 (71.987)	3.9370 (100.000) 3.9364 (99.985)	4.7244 (120.000) 4.7238 (119.985)	5.5118 (140.000) 5.5111 (139-982)
Shaft O. D. Outboard	1.1815 (30.011) 1.1812 (30.002)	1.7722 (45.013) 1.7718 (45.002)	1.9690 (50.013) 1.9686 (50.002)	2.5597 (65.015) 2.5592 (65.002)
Clearance	0.0008 (0.021) tight 0.0001 (0.002) tight	0.0010 (0.025) tight 0.0001 (0.002) tight	0.0010 (0.025) tight 0.0001 (0.002) tight	0.0012 (0.030) tight 0.0001 (0.002) tight
Bearing I.D. Outboard	1.1811 (30.000) 1.1807 (29.990)	1.7717 (45.000) 1.7712 (44.988)	1.9685 (50.000) 1.9680 (49.988)	2.5591 (65.000) 2.5585 (64.985)
Housing I. D. Outboard	2.8346 (72.000) 2.8353 (72.019)	3.9370 (100.000) 3.9379 (100.022)	4.3307 (110.000) 4.3316 (110.022)	5.5118 (140.000) 5.5128 (140.025)
Clearance	0.0012 (0.032) loose 0.0000 (0.000) loose	0.0015 (0.037) loose 0.0000 (0.000) loose	0.0015 (0.037) loose 0.0000 (0.000) loose	0.0017 (0.043) loose 0.0000(0.000) loose
Bearing O. D. Outboard	2.8346 (72.000) 2.8341 (71.987)	3.9370 (100.000) 3.9364 (99.985)	4.3307 (110.000) 4.3301 (109.985)	5.5118 (140.000) 5.5111 (139-982)

All dimensions in inches and (mm)

APPENDIX 6

ANSI 1196 COUPLING GAURDS

Installation instructions for Rotech ANSI 1196 Pumps Coupling Guards

! WARNING !

Before assembling or disassembling the coupling guard, de-energize the motor, lock out the motor controller/starter, and place a caution tag at the starter indicating that it is disconnected. Before resuming normal pump operation, replace the coupling guard. Rotech Pump assumes no liability when these procedures are avoided.

Assembly Procedures

NOTE: If the end plate (pump end) was previously installed, make any necessary adjustments to the coupling and skip to Step 2.

1. On the STR, MTR, and LTR, align the end plate (pump end) to the bearing frame. (Impeller adjustment is not required.)
 - On the XLR, align the end plate (pump end) to the pump bearing housing with the small slots on the end plate aligned to the impeller adjusting bolts and the large slots clearing the bearing housing tap bolts. Then attach the end plate to the bearing housing using the jam nuts on the impeller adjusting bolts as shown in Figure A.
 - After attaching the end plate to the bearing housing, check and reset the impeller clearance as detailed in IMPELLER CLEARANCE SETTING (Page 13).

NOTE: Complete the coupling adjustments before proceeding with the coupling guard assembly.

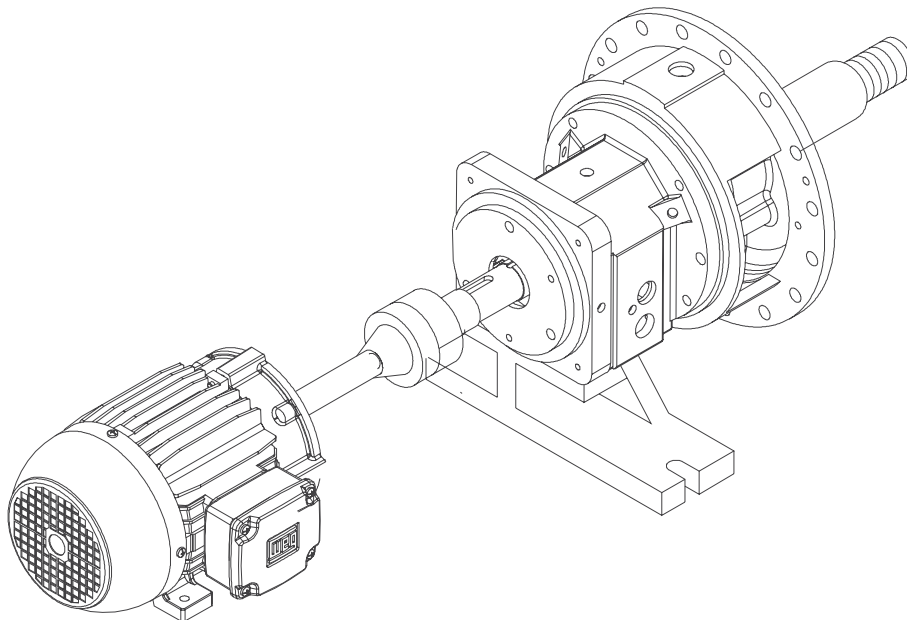
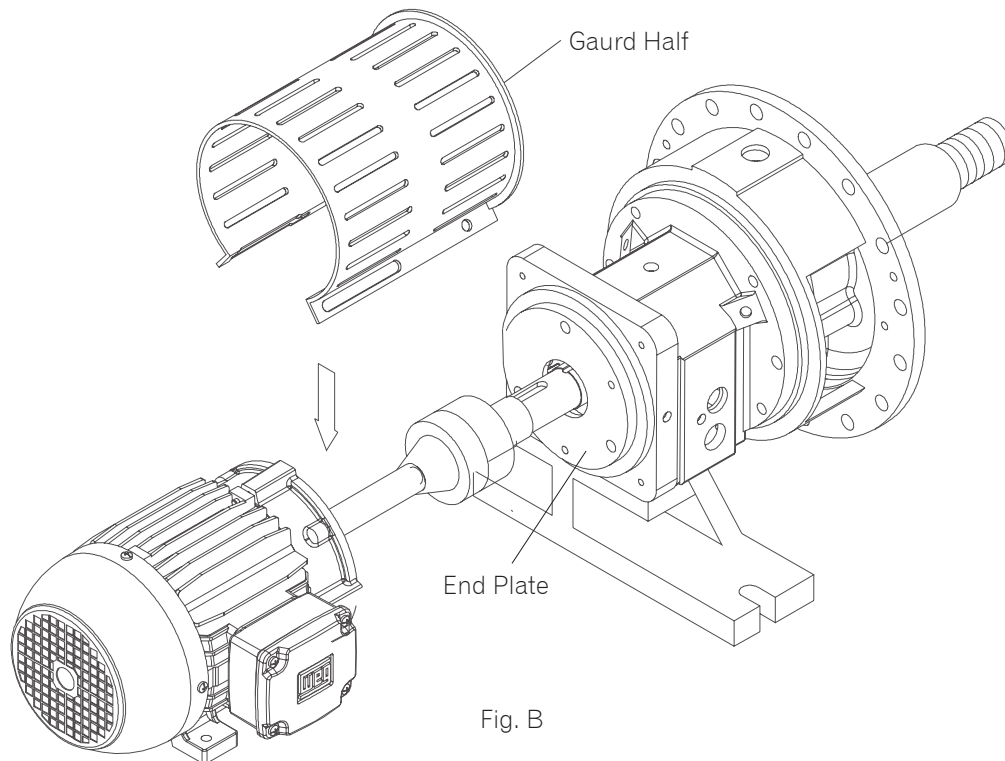
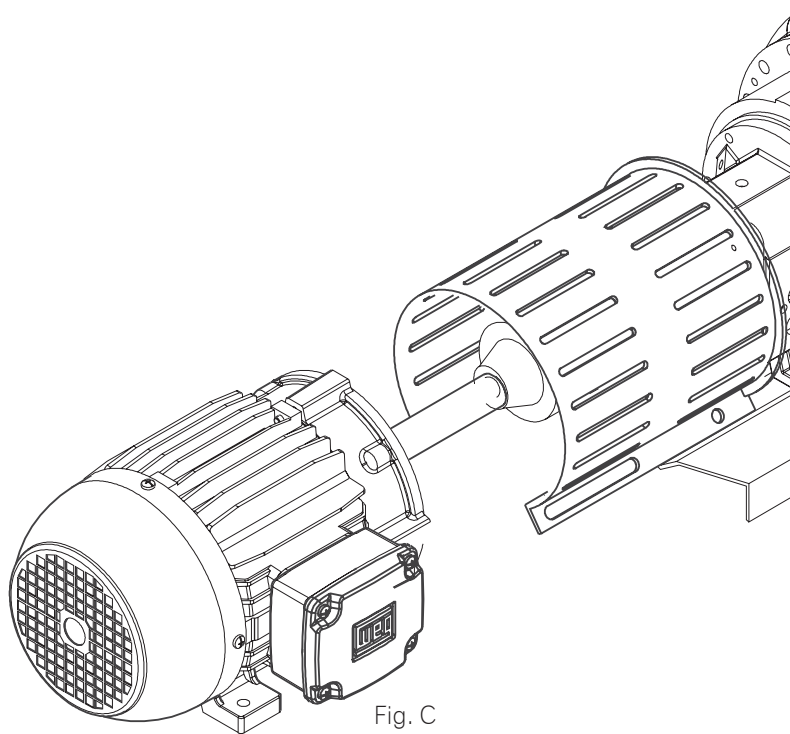


Fig. A (STR, MTR & LTR)

2. Slightly spread the bottom of the coupling guard half (pump end) and place it over the pump end plate as shown in Figure D. The annular groove in the guard half is located around the end plate. (See Figure B.)



3. After placing the coupling guard half (pump end) around the pump end plate, secure it with a bolt, nut and two (2) washers through the round hole in the front end of the guard half as shown in Figure C. Tighten securely.



4. Slightly spread the bottom of the coupling guard half (driver end) and place it over the coupling guard half (pump end) so that the annular groove in the coupling guard half (driver end) faces the motor as shown in Figure D.

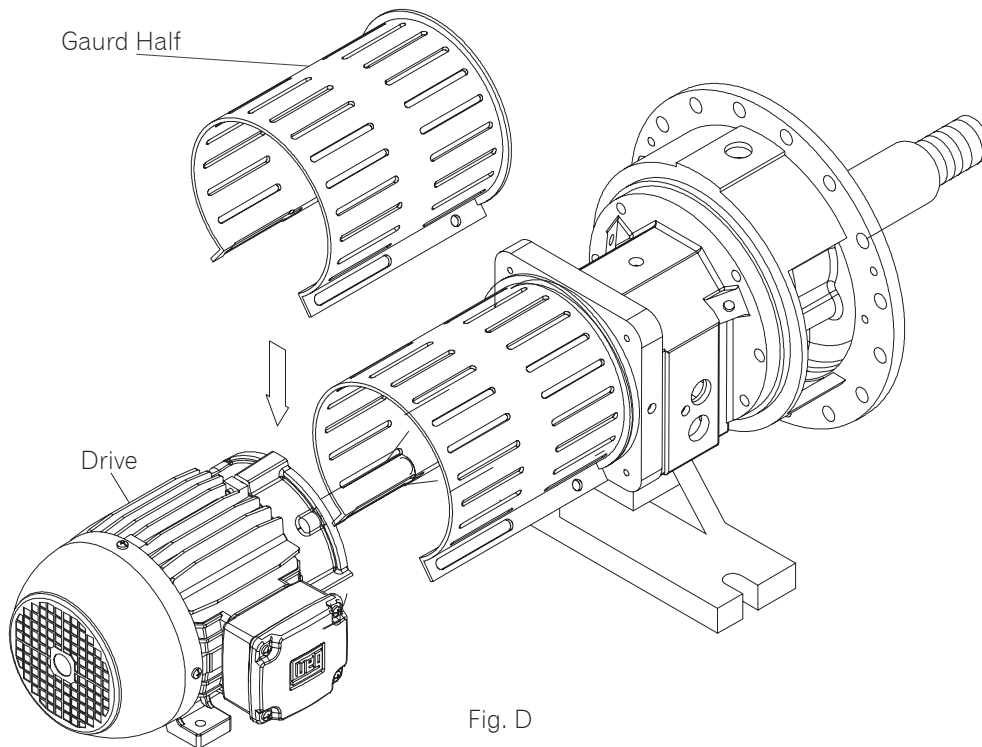


Fig. D

5. Place the end plate (driver end) over the motor shaft as shown in Figure E. Position the end plate in the annular groove at the rear of the coupling guard half (driver end) & secure it with a bolt, nut, & two (2) washers through the round hole at the rear of the guard half. Finger-tighten only.

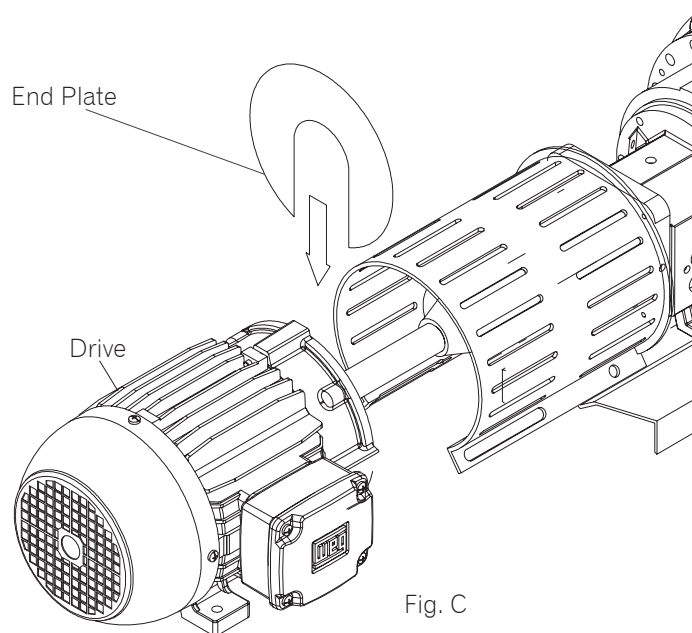


Fig. C

6. Adjust the length of the coupling guard to completely cover the shafts and coupling as shown in Figure F, by sliding the coupling guard half (driver end) toward the motor. After adjusting the length, secure the guard with a bolt, nut & two (2) washers through the slotted holes at the center of the guard & tighten. Check tightness on all of the nuts on the guard assembly.

! WARNING !

Before assembling or disassembling the coupling guard, de-energize the motor, lock out the motor controller/starter, and place a caution tag at the starter indicating that it is disconnected. Before resuming normal pump operation, replace the coupling guard. Rotech Pump assumes no liability when these procedures are avoided.

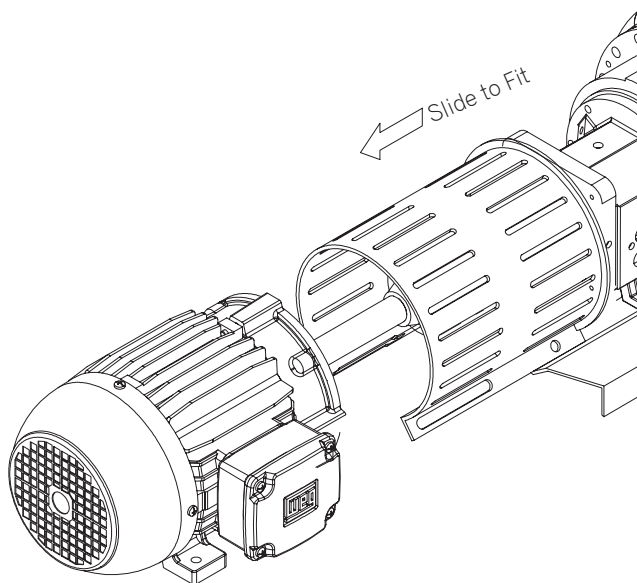


Fig. F

Disassembly Procedures

It is necessary to remove the coupling guard for certain pump maintenance and adjustments, such as coupling adjustment, impeller clearance adjustment, and so forth. Replace the coupling guard after completing maintenance. DO NOT resume normal pump operation while the coupling guard is removed.

1. Remove the nut, bolt and washers from the center-slotted hole on the coupling guard. Slide the motor end of the coupling guard half toward the pump. (See Figure F.)
2. Remove the nut, bolt and washers from the driver end of the coupling guard half and remove the end plate. (See Figure E.)
3. Slightly spread the bottom of the coupling guard half and lift it off. (See Figure D.)
4. Remove the remaining nut, bolt and washers from the pump end of the coupling guard half. Slightly spread the coupling guard half and lift it off. (See Figure B.)

This concludes the coupling guard disassembly procedures.

NOTE: It is unnecessary to remove the end plate (pump end) from the bearing housing. If internal pump part maintenance is necessary, the bearing housing tap bolts are accessible without removing the end plate. Refer to MAINTENANCE (Page 15) before removing the pump bearing housing.



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1320 Britannia Road East, Mississauga, Ontario, Canada. L4W 1C8

Phone: (905) 461 - 9617 | Fax: (905) 461 - 9618

Toll Free: 1-866-217-PUMP (7867)

Email: sales@rotechpumps.com | www.rotechpumps.com