

GOULDS PUMPS

Installation, Operation and Maintenance Instructions



Model 3296 EZMAG



ITT

IMPORTANT SAFETY NOTICE

To: Our Valued Customers

User safety is a major focus in the design of our products. Following the precautions outlined in this manual will minimize your risk of injury.

ITT Goulds pumps will provide safe, trouble-free service when properly installed, maintained, and operated.

Safe installation, operation, and maintenance of ITT Goulds Pumps equipment are an essential end user responsibility. This *Pump Safety Manual* identifies specific safety risks that must be considered at all times during product life. Understanding and adhering to these safety warnings is mandatory to ensure personnel, property, and/or the environment will not be harmed. Adherence to these warnings alone, however, is not sufficient — it is anticipated that the end user will also comply with industry and corporate safety standards. Identifying and eliminating unsafe installation, operating and maintenance practices is the responsibility of all individuals involved in the installation, operation, and maintenance of industrial equipment.

Please take the time to review and understand the safe installation, operation, and maintenance guidelines outlined in this Pump Safety Manual and the Instruction, Operation, and Maintenance (IOM) manual. Current manuals are available at www.gouldspumps.com/literature_ioms.html or by contacting your nearest Goulds Pumps sales representative.

These manuals must be read and understood before installation and start-up.

For additional information, contact your nearest Goulds Pumps sales representative or visit our Web site at www.gouldspumps.com.

SAFETY WARNINGS

Specific to pumping equipment, significant risks bear reinforcement above and beyond normal safety precautions.

 **WARNING**

A pump is a pressure vessel with rotating parts that can be hazardous. Any pressure vessel can explode, rupture, or discharge its contents if sufficiently over pressurized causing death, personal injury, property damage, and/or damage to the environment. All necessary measures must be taken to ensure over pressurization does not occur.

 **WARNING**

Operation of any pumping system with a blocked suction and discharge must be avoided in all cases. Operation, even for a brief period under these conditions, can cause superheating of enclosed pumpage and result in a violent explosion. All necessary measures must be taken by the end user to ensure this condition is avoided.

 **WARNING**

The pump may handle hazardous and/or toxic fluids. Care must be taken to identify the contents of the pump and eliminate the possibility of exposure, particularly if hazardous and/or toxic. Potential hazards include, but are not limited to, high temperature, flammable, acidic, caustic, explosive, and other risks.

 **WARNING**

Pumping equipment Instruction, Operation, and Maintenance manuals clearly identify accepted methods for disassembling pumping units. These methods must be adhered to. Specifically, applying heat to impellers and/or impeller retaining devices to aid in their removal is strictly forbidden. Trapped liquid can rapidly expand and result in a violent explosion and injury.

ITT Goulds Pumps will not accept responsibility for physical injury, damage, or delays caused by a failure to observe the instructions for installation, operation, and maintenance contained in this Pump Safety Manual or the current IOM available at www.gouldspumps.com/literature.

SAFETY

DEFINITIONS

Throughout this manual the words **WARNING**, **CAUTION**, **ELECTRICAL**, and **ATEX** are used to indicate where special operator attention is required.

Observe all Cautions and Warnings highlighted in this Pump Safety Manual and the IOM provided with your equipment.



WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

Example: Pump shall never be operated without coupling guard installed correctly.



CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Example: Throttling flow from the suction side may cause cavitation and pump damage.




ELECTRICAL HAZARD

Indicates the possibility of electrical risks if directions are not followed.

Example: Lock out driver power to prevent electric shock, accidental start-up, and physical injury.









When installed in potentially explosive atmospheres, the instructions that follow the Ex symbol must be followed. Personal injury and/or equipment damage may occur if these instructions are not followed. If there is any question regarding these requirements or if the equipment is to be modified, please contact an ITT Goulds Pumps representative before proceeding.














Example:  Improper impeller adjustment could cause contact between the rotating and stationary parts, resulting in a spark and heat generation.



GENERAL PRECAUTIONS

WARNING

A pump is a pressure vessel with rotating parts that can be hazardous. Hazardous fluids may be contained by the pump including high temperature, flammable, acidic, caustic, explosive, and other risks. Operators and maintenance personnel must realize this and follow safety measures. Personal injuries will result if procedures outlined in this manual are not followed. ITT Goulds Pumps will not accept responsibility for physical injury, damage or delays caused by a failure to observe the instructions in this manual and the IOM provided with your equipment.

General Precautions		
WARNING		NEVER APPLY HEAT TO REMOVE IMPELLER. It may explode due to trapped liquid.
WARNING		NEVER use heat to disassemble pump due to risk of explosion from tapped liquid.
WARNING		NEVER operate pump without coupling guard correctly installed.
WARNING		NEVER run pump below recommended minimum flow when dry, or without prime.
WARNING		ALWAYS lock out power to the driver before performing pump maintenance.
WARNING		NEVER operate pump without safety devices installed.
WARNING		NEVER operate pump with discharge valve closed.
WARNING		NEVER operate pump with suction valve closed.
WARNING		DO NOT change service application without approval of an authorized ITT Goulds Pumps representative.
WARNING		<p>Safety Apparel:</p> <ul style="list-style-type: none"> ♦ Insulated work gloves when handling hot bearings or using bearing heater ♦ Heavy work gloves when handling parts with sharp edges, especially impellers ♦ Safety glasses (with side shields) for eye protection ♦ Steel-toed shoes for foot protection when handling parts, heavy tools, etc. ♦ Other personal protective equipment to protect against hazardous/toxic fluids
WARNING		<p>Receiving:</p> <p>Assembled pumping units and their components are heavy. Failure to properly lift and support equipment can result in serious physical injury and/or equipment damage. Lift equipment only at specifically identified lifting points or as instructed in the current IOM. Current manuals are available at www.gouldspumps.com/literature_ioms.html or from your local ITT Goulds Pumps sales representative. Note: Lifting devices (eyebolts, slings, spreaders, etc.) must be rated, selected, and used for the entire load being lifted.</p>
WARNING		<p>Alignment:</p> <p>Shaft alignment procedures must be followed to prevent catastrophic failure of drive components or unintended contact of rotating parts. Follow coupling manufacturer's coupling installation and operation procedures.</p>

General Precautions		
WARNING		Before beginning any alignment procedure, make sure driver power is locked out. Failure to lock out driver power will result in serious physical injury.
CAUTION		Piping: Never draw piping into place by forcing at the flanged connections of the pump. This may impose dangerous strains on the unit and cause misalignment between pump and driver. Pipe strain will adversely effect the operation of the pump resulting in physical injury and damage to the equipment.
WARNING		Flanged Connections: Use only fasteners of the proper size and material.
WARNING		Replace all corroded fasteners.
WARNING		Ensure all fasteners are properly tightened and there are no missing fasteners.
WARNING		Startup and Operation: When installing in a potentially explosive environment, please ensure that the motor is properly certified.
WARNING		Operating pump in reverse rotation may result in contact of metal parts, heat generation, and breach of containment.
WARNING		Lock out driver power to prevent accidental start-up and physical injury.
WARNING		The impeller clearance setting procedure must be followed. Improperly setting the clearance or not following any of the proper procedures can result in sparks, unexpected heat generation and equipment damage.
WARNING		If using a cartridge mechanical seal, the centering clips must be installed and set screws loosened prior to setting impeller clearance. Failure to do so could result in sparks, heat generation, and mechanical seal damage.
WARNING		The coupling used in an ATEX classified environment must be properly certified and must be constructed from a non-sparking material.
WARNING		Never operate a pump without coupling guard properly installed. Personal injury will occur if pump is run without coupling guard.
WARNING		Make sure to properly lubricate the bearings. Failure to do so may result in excess heat generation, sparks, and / or premature failure.
CAUTION		The mechanical seal used in an ATEX classified environment must be properly certified. Prior to start up, ensure all points of potential leakage of process fluid to the work environment are closed.
CAUTION		Never operate the pump without liquid supplied to mechanical seal. Running a mechanical seal dry, even for a few seconds, can cause seal damage and must be avoided. Physical injury can occur if mechanical seal fails.
WARNING		Never attempt to replace packing until the driver is properly locked out and the coupling spacer is removed.
WARNING		Dynamic seals are not allowed in an ATEX classified environment.
WARNING		DO NOT operate pump below minimum rated flows or with suction and/or discharge valve closed. These conditions may create an explosive hazard due to vaporization of pumpage and can quickly lead to pump failure and physical injury.

General Precautions		
WARNING		Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, opening vent or drain valves, or disconnecting piping.
WARNING		Shutdown, Disassembly, and Reassembly: Pump components can be heavy. Proper methods of lifting must be employed to avoid physical injury and/or equipment damage. Steel toed shoes must be worn at all times.
WARNING		The pump may handle hazardous and/or toxic fluids. Observe proper decontamination procedures. Proper personal protective equipment should be worn. Precautions must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.
WARNING		Operator must be aware of pumpage and safety precautions to prevent physical injury.
WARNING		Lock out driver power to prevent accidental startup and physical injury.
CAUTION		Allow all system and pump components to cool before handling them to prevent physical injury.
CAUTION		If pump is a Model NM3171, NM3196, 3198, 3298, V3298, SP3298, 4150, 4550, or 3107, there may be a risk of static electric discharge from plastic parts that are not properly grounded. If pumped fluid is non-conductive, pump should be drained and flushed with a conductive fluid under conditions that will not allow for a spark to be released to the atmosphere.
WARNING		Never apply heat to remove an impeller. The use of heat may cause an explosion due to trapped fluid, resulting in severe physical injury and property damage.
CAUTION		Wear heavy work gloves when handling impellers as sharp edges may cause physical injury.
CAUTION		Wear insulated gloves when using a bearing heater. Bearings will get hot and can cause physical injury.

ATEX CONSIDERATIONS and INTENDED USE

Special care must be taken in potentially explosive environments to ensure that the equipment is properly maintained. This includes but is not limited to:

1. Monitoring the pump frame and liquid end temperature.
2. Maintaining proper bearing lubrication.
3. Ensuring that the pump is operated in the intended hydraulic range.

The ATEX conformance is only applicable when the pump unit is operated within its intended use. Operating, installing or maintaining the pump unit in any way that is not covered in the Instruction, Operation, and Maintenance manual (IOM) can cause serious personal injury or damage to the equipment. This includes any modification to the equipment or use of parts not provided by ITT Goulds Pumps. If there is any question regarding the intended use of the equipment, please contact an ITT Goulds representative before proceeding. Current IOMs are available at www.gouldspumps.com/literature_ioms.html or from your local ITT Goulds Pumps Sales representative.

All pumping unit (pump, seal, coupling, motor and pump accessories) certified for use in an ATEX classified environment, are identified by an ATEX tag secured to the pump or the baseplate on which it is mounted. A typical tag would look like this:



The CE and the Ex designate the ATEX compliance. The code directly below these symbols reads as follows:

- II = Group 2
- 2 = Category 2
- G/D = Gas and Dust present
- T4 = Temperature class, can be T1 to T6 (see Table 1)

Code	Max permissible surface temperature °F (°C)	Max permissible liquid temperature °F (°C)
T1	842 (450)	700 (372)
T2	572 (300)	530 (277)
T3	392 (200)	350 (177)
T4	275 (135)	235 (113)
T5	212 (100)	Option not available
T6	185 (85)	Option not available

The code classification marked on the equipment must be in accordance with the specified area where the equipment will be installed. If it is not, do not operate the equipment and contact your ITT Goulds Pumps sales representative before proceeding.

PARTS



The use of genuine Goulds parts will provide the safest and most reliable operation of your pump. ITT Goulds Pumps ISO certification and quality control procedures ensure the parts are manufactured to the highest quality and safety levels.

Please contact your local Goulds representative for details on genuine Goulds parts.

FOREWORD

This manual provides instructions for the Installation, Operation, and Maintenance of the Goulds Model 3296 EZMAG Magnetic Drive Process Pump. This manual must be read and understood before installation and start-up.

The design, materials, and workmanship incorporated in the manufacturing of Goulds pumps makes them capable of giving years of trouble-free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by correct application, proper installation, periodic inspection, condition monitoring and careful maintenance. This instruction manual was prepared to assist operators in understanding the construction and the correct methods of installing, operating, and maintaining these pumps.

ITT - Goulds Pumps 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.

Warranty is valid only when genuine ITT - Goulds Pumps parts are used.

Use of the equipment on a service other than stated in the order could nullify the warranty, unless written approval is obtained in advance from ITT - Goulds Pumps.

Supervision by an authorized ITT - Goulds Pumps representative is recommended to assure proper installation.

Additional manuals can be obtained by contacting your local ITT - Goulds Pumps representative or by calling 1-800-446-8537.

THIS MANUAL EXPLAINS

- **Proper Installation**
- **Start Up Procedures**
- **Operation Procedures**
- **Routine Maintenance**
- **Pump Overhaul**
- **Troubleshooting**
- **Ordering Spare or Repair Parts**

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SAFETY

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DEFINITIONS

These pumps have been designed for safe and reliable operation when properly used and maintained in accordance with instructions contained in this manual. A pump is a pressure containing device with rotating parts that can be hazardous. Operators and maintenance personnel must realize this and follow safety measures. ITT Industries Goulds Pumps shall not be liable for physical injury, damage or delays caused by a failure to observe the instructions in this manual.

Throughout this manual the words **WARNING**, **CAUTION**, **ELECTRICAL**, **ATEX**, and **NOTE** are used to indicate procedures or situations which require special operator attention:



WARNING

Operating procedure, practice, etc. which, if not correctly followed, could result in personal injury or loss of life.



CAUTION

Operating procedure, practice, etc. which, if not followed, could result in damage or destruction of equipment.



Particular care must be taken when electrical power source to the equipment is energized.



If equipment is to be installed in a potentially explosive atmosphere and these procedures are not followed, personal injury or equipment damage from an explosion may result.

NOTE: *Operating procedure, condition, etc. which is essential to observe.*

EXAMPLES



WARNING

Pump shall never be operated without coupling guard installed correctly.



CAUTION

Throttling flow from the suction side may cause cavitation and pump damage.



Lock out driver power to prevent electric shock, accidental start-up, and physical injury.



Improper impeller adjustment could cause contact between the rotating and stationary parts, resulting in a spark and heat generation.

NOTE: *Proper alignment is essential for long pump life.*

MEDICAL PRECAUTIONS



WARNING

Magnetic drive pumps contain very strong magnets which may pose health risks. The following guidelines shall always be observed.

1. Individuals with artificial cardiac pacemakers, implanted defibrillators, metallic prosthetic heart valves, internal wound clips (from surgery), prosthetic

joints, metallic wiring, or other metallic prosthetic devices shall avoid working with, being in proximity of, or handling the magnets contained in the pumps.

2. Individuals who have had previous surgeries (especially chest or head surgery) and who do not know if they have metallic clips internally should avoid work on this unit unless it can be firmly established by his or her physician that no metallic devices exist.

GENERAL PRECAUTIONS



WARNING

Personal injuries will result if procedures outlined in this manual are not followed.

	NEVER apply heat to remove impeller. It may explode due to trapped liquid.
	NEVER use heat to disassemble pump due to risk of explosion from 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 (all models), or proper liquid level in self-priming pumps (Model 3796).

		NEVER run pump below recommended minimum flow or when dry.
		ALWAYS lock out power to the driver 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 Goulds representative.

EXPLOSION PREVENTION



In order to reduce the possibility of accidental explosions in atmospheres containing explosive gases and/or dust, the instructions under the ATEX symbol must be closely followed. ATEX certification is a specification enforced in Europe for non-electrical and electrical equipment installed in Europe. The usefulness of the ATEX requirements is not limited to Europe. They are useful guidelines for equipment installed in any potentially explosive environment.



NOTE: When pumping unit is installed in a potentially explosive atmosphere, the instructions after the Ex symbol must be followed. Personal injury and/or equipment damage may occur if these instructions are not followed. If there is any question regarding these requirements or if the equipment is to be modified, please contact a Goulds representative before proceeding.

SPECIAL ATEX CONSIDERATIONS

All installation and operation instructions in this manual must be strictly adhered to. In addition, care must be taken to ensure that the equipment is properly maintained. This includes but is not limited to:

1. Monitoring the pump frame and liquid end temperature.

2. Maintaining proper bearing lubrication.
3. Ensuring that the pump is operated in the intended hydraulic range.

ATEX IDENTIFICATION

For a pumping unit (pump, seal, coupling, motor and pump accessories) to be certified for use in an ATEX classified environment, the proper ATEX identification must be present.

The ATEX tag would be secured to the pump or the baseplate on which it is mounted. A typical tag would look like this:



The CE and the Ex designate the ATEX compliance. The code directly below these symbols reads as follows:

- II = Group 2
- 2 = Category 2
- G/D = Gas and Dust present
- Tx = Temperature class, can be T1 to Tx
(see *Table 1*)

Table 1		
Code	Max permissible surface temperature °F (°C)	Max permissible liquid temperature °F (°C)
T1	842 (450)	700 (372)
T2	572 (300)	530 (277)
T3	392 (200)	350 (177)
T4	275 (135)	235 (113)
T5	212 (100)	Option not available
T6	185 (85)	Option not available

1

The code classification marked on the equipment should be in accordance with the specified area where the equipment will be installed. If it is not, please contact your ITT/Goulds representative before proceeding.

INTENDED USE

The ATEX conformance is only applicable when the pump unit is operated within its intended use. All instructions within this manual must be followed at all times. Operating, installing or maintaining the pump unit in any way that is not covered in this manual can cause serious personal injury or damage to the equipment. This includes

any modification to the equipment or use of parts not provided by ITT/Goulds. If there is any question regarding the intended use of the equipment, please contact an ITT/Goulds representative before proceeding.

CONDITION MONITORING

For additional safety precautions, and where noted in this manual, condition monitoring devices should be used. This includes, but is not limited to:

For assistance in selecting the proper instrumentation and its use, please contact your ITT/Goulds representative.

- ◆ Pressure gauges
- ◆ Flow meters
- ◆ Level indicators
- ◆ Motor load readings
- ◆ Temperature detectors
- ◆ Bearing monitors
- ◆ Leak detectors
- ◆ PumpSmart[®] control system

GENERAL INFORMATION

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PUMP DESCRIPTION

The Model 3296 EZMAG is a sealless centrifugal pump with an enclosed impeller that is driven by a synchronous magnetic coupling. It meets the dimensional standards outlined in ANSI B73.1.

Magnetic Coupling - is a coaxial synchronous type using rare earth magnets. This concept results in a compact design and allows the impeller to turn at the same speed as the motor, (i.e.) there is no slip between the drive and driven magnets.

Magnets - Two types of rare earth magnets are available. Neodymium Iron (NdFe), which is used when pumpage temperatures are less than 365°F (180°C). For liquid pumpage between 365°F (180°C) and 536°F (280°C) Samarium Cobalt (SmCo) magnets are used as part of the high temperature option.

Containment Shell - isolates the pumped liquid from the atmosphere. Standard material is Hastelloy-C which provides excellent corrosion and erosion resistance.

Sleeve Bearings and Thrust Bearings - Goulds standard bearing material is Pure Sintered Alpha Grade Silicon Carbide. Dryguard™ bearings are available for dry-run protection.

Impeller - Model 3296 EZMAG utilizes an enclosed impeller, hydraulically balanced and keyed to the shaft.

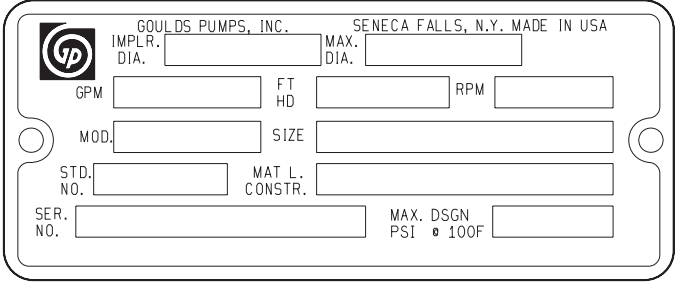
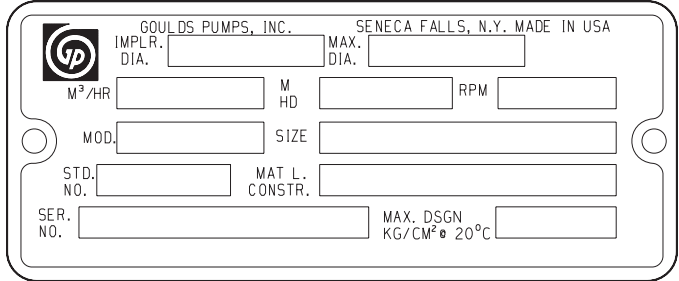
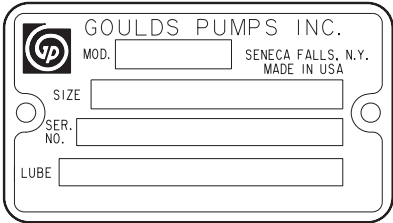

Bearing Frame - the standard configuration is cast iron with flood oil lubricated ball bearings. Greased-for-life bearings systems are available as an option. For protection and reliability of the bearings and the lubricant, bronze bearing isolators are provided as standard.

Casing - is top centerline discharge, self venting type incorporates a fully confined gasket. 150 lb. ANSI serrated raised face flanges are standard. The 3296 EZMAG has been designed such that there is a metal-to-metal fit between the casing and backplate.

NAMEPLATE INFORMATION

Every pump has two Goulds nameplates that provide information about the pump. The tags are located on the casing and bearing frame.

When ordering spare parts, you will need to identify pump model, size, serial number, and the item number of required parts. Information can be taken from the pump casing tag. Item numbers can be found in this manual.

Description	Fig. No.	Example
<p>Pump Casing Tag - provides information about the pump's hydraulic characteristics.</p> <p>Note the format of the pump size: Discharge x Suction - Nominal maximum Impeller Diameter in inches</p> <p>(Example: 2x3-8)</p> <p>(Figs. 1 & 2).</p>	<p>Fig. 1 English</p>	 <p>The English Pump Casing Tag includes fields for: IMPLR. DIA., MAX. DIA., GPM, FT HD, RPM, MOD., SIZE, STD. NO., MAT L. CONSTR., SER. NO., and MAX. DSGN PSI @ 100F.</p>
	<p>Fig. 2 Metric</p>	 <p>The Metric Pump Casing Tag includes fields for: IMPLR. DIA., MAX. DIA., M³/HR, M HD, RPM, MOD., SIZE, STD. NO., MAT L. CONSTR., SER. NO., and MAX. DSGN KG/CM² @ 20°C.</p>
<p>Bearing Frame Tag - provides information on the lubrication system used (Fig. 3).</p>	<p>Fig. 3</p>	 <p>The Bearing Frame Tag includes fields for: MOD., SIZE, SER. NO., LUBE, and the text: GOULDS PUMPS INC., SENECA FALLS, N.Y., MADE IN USA.</p>
<p>ATEX Tag - If applicable, your pump unit may have the following ATEX tag affixed to the pump and/or baseplate. See the <i>Safety</i> section for a description of the symbols and codes (Fig. 4).</p>	<p>Fig. 4</p>	 <p>The ATEX Tag features the CE and Ex symbols, and the code II 2 G/D Tx.</p>

RECEIVING THE PUMP

Inspect the pump as soon as it is received. Make notes of damaged or missing items on the receipt and freight bill. File any claims with the transportation company immediately.

STORAGE REQUIREMENTS

Short Term - (Less than 3 months) Goulds normal packaging procedure is designed to protect the pump during shipping. Upon receipt store in a covered and dry location.

Long Term - (More than 6 months) Preservative treatment of bearings and machined surfaces is required (can be purchased from Goulds). Rotate shaft several times every 3 months. Refer to driver and coupling manuals for their long term storage procedures. Store in a dry covered location.

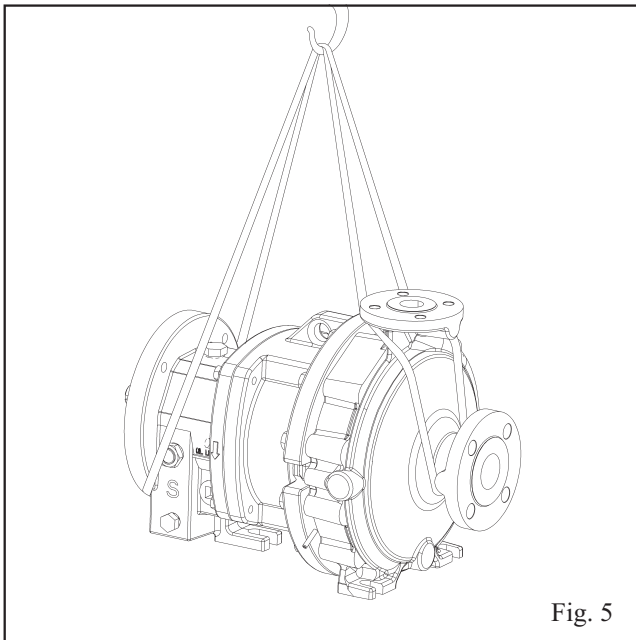
HANDLING



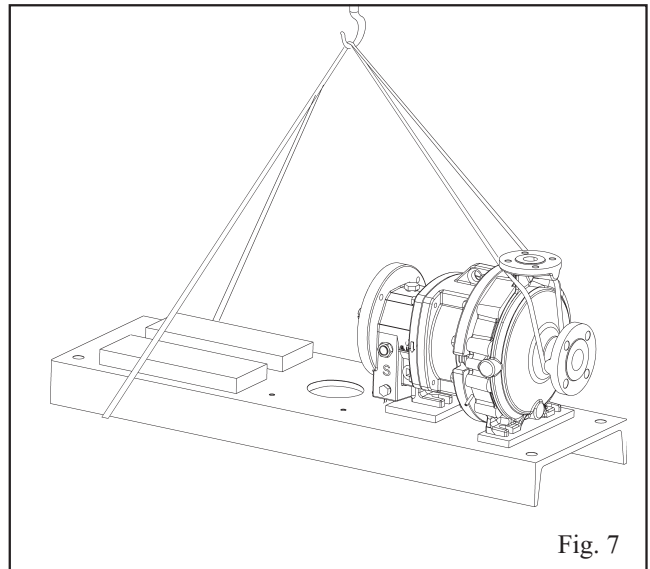
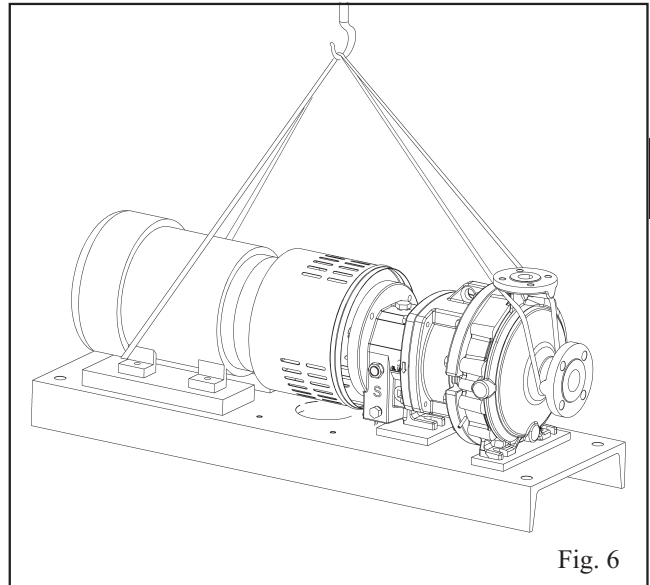
WARNING

Failure to properly lift and support equipment could result in serious injury or damage to pumps.

Use care when moving pumps. Lifting equipment must be able to adequately support the entire assembly. Hoist bare pumps, using a sling under the suction flange and bearing housing.



Baseplate mounted units are moved with slings under the pump and driver.



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BASEPLATE INSPECTION



Equipment that will operate in a potentially explosive environment must be installed in accordance with the following instructions.

1. Remove all equipment.
2. Completely clean the underside of baseplate. It is sometimes necessary to coat the underside of the baseplate with an epoxy primer. This may have been purchased as an option.
3. Remove the rust preventative solution from the machined pads with an appropriate solution.

SITE/FOUNDATION

A pump should be located near the supply of liquid and have adequate space for operation, maintenance, and inspection.

Baseplate mounted pumps are normally grouted to a concrete foundation, which has been poured on a solid footing. The foundation must be able to absorb any

vibration and to form a permanent, rigid support for the pumping unit.

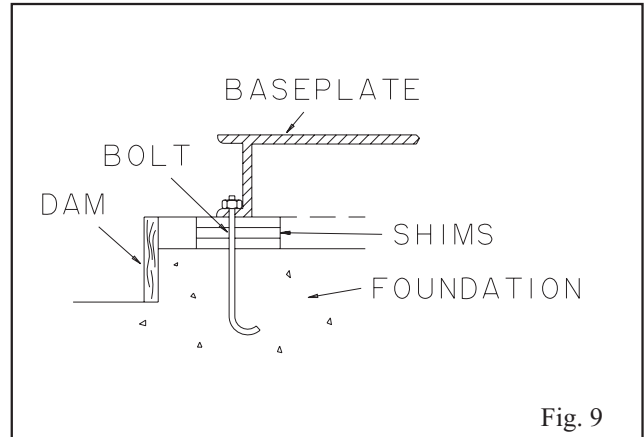
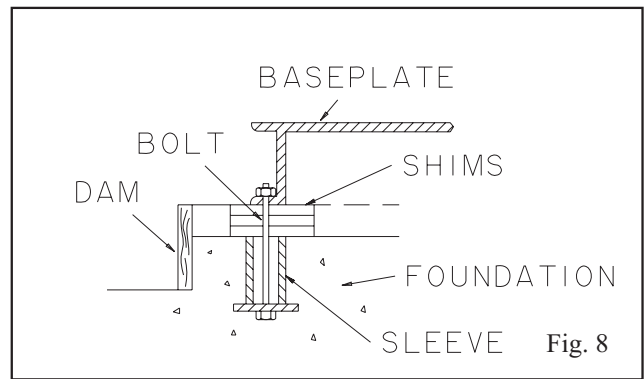
The location and size of the foundation bolts are shown on the outline assembly drawing, provided with the pump data package.



All equipment being installed must be properly grounded to prevent unexpected static electric discharge.

Foundation bolts commonly used are sleeve type (Fig. 8) and J type (Fig. 9). Both designs permit movement for final bolt adjustment.

1. Inspect foundation for dust, oil, chips, water, etc. and remove any contaminants. Do not use oil-based cleaners as grout will not bond to it
2. Prepare the foundation in accordance with the grout manufacturer's recommendations.



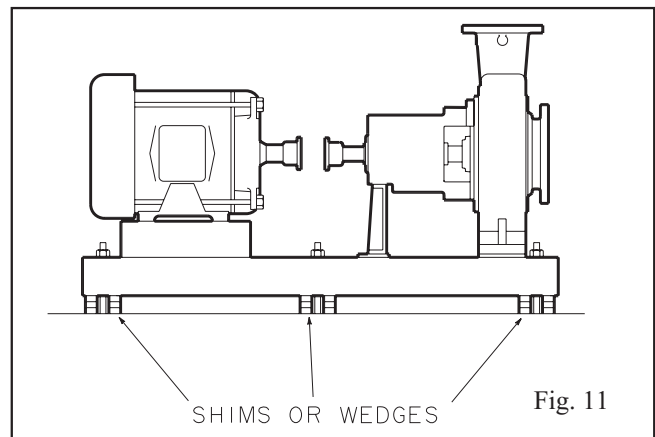
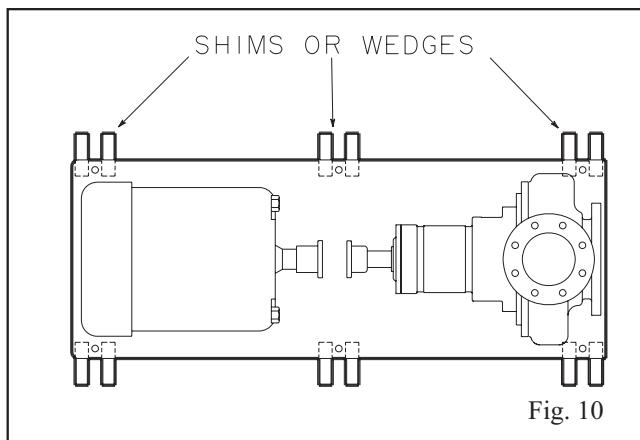
LEVEL BASEPLATE

CAST IRON/CHEMBASE/FAB. STEEL

1. Place 2 sets of wedges or shims on the foundation, one set on each side of every foundation bolt. The wedges should extend .75 in. (20 mm) to 1.5 in. (40 mm) above the foundation, to allow for adequate grouting. This will provide even support for the baseplate once it is grouted.
2. Remove water and/or debris from anchor bolt holes/sleeves prior to grouting. If the sleeve type bolts

are being used, fill the sleeves with rags to prevent grout from entering.

3. Carefully lower baseplate onto foundation bolts.
4. Level baseplate to within .125 in. (3mm) over the length of the base and .062 in. (1.5 mm) over the width of the base by adjusting shims or wedges.
5. Hand tighten bolts.



FEATURE FAB. STEEL/API STYLE
(Baseplates provided w/vertical leveling adjustors)

1. Coat the jack screws with an anti seizing compound to allow for easy removal after the grout has been cured.
2. Cut round circular plates from bar stock to set the jack screws on. The edges of the plates should be chamfered to reduce stress concentrations.
3. Set the baseplate on the foundation and use the four corner jackscrews to raise the baseplate off the foundation 0.75" to 15". The center jack screws should not be touching the foundation.

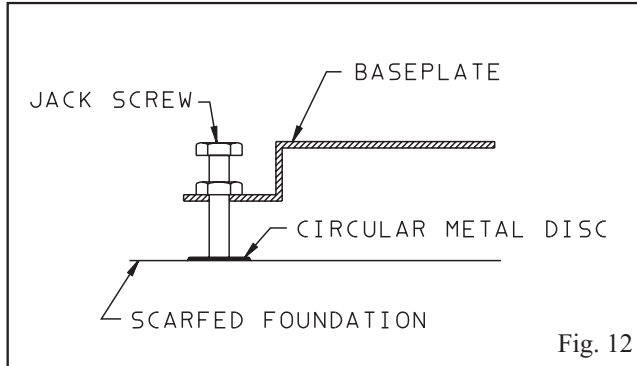


Fig. 12

4. Place two machinist levels on the motor pads, one lengthwise on a single motor pad, and another across the ends of both motor pads. See diagram below.

NOTE: When using a machinist level, it is important that the surface being leveled is free of all contaminants, such as dust, to ensure an accurate reading.

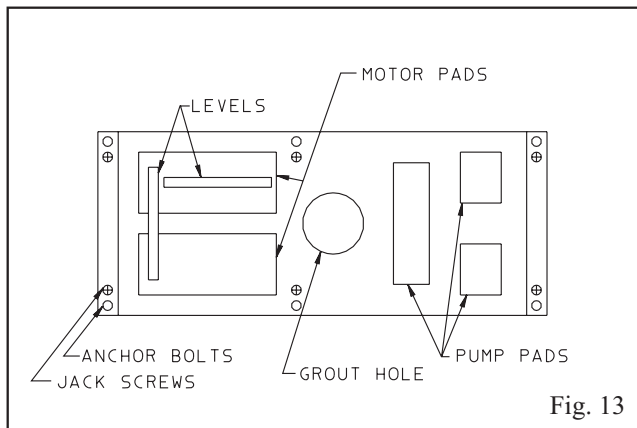


Fig. 13

5. Level the motor pads to zero, in both directions, by adjusting the four jack screws.
6. Next, turn down the center jack-screws so that they are resting on their metal discs on the foundation.
7. Place the two levels on the pump pads, one lengthwise on a single pump pad, and another across the middle of both pump pads. See diagram below.

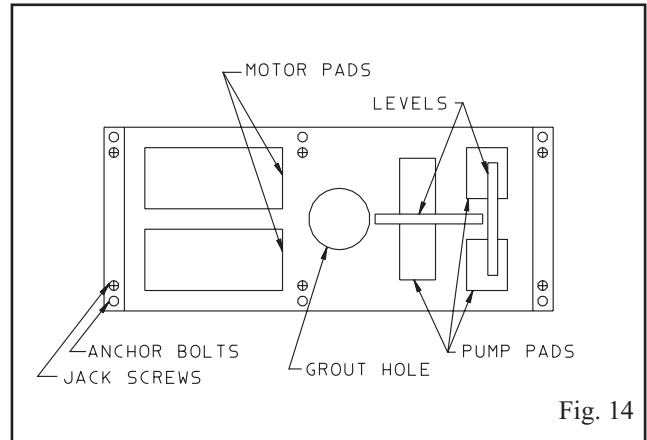
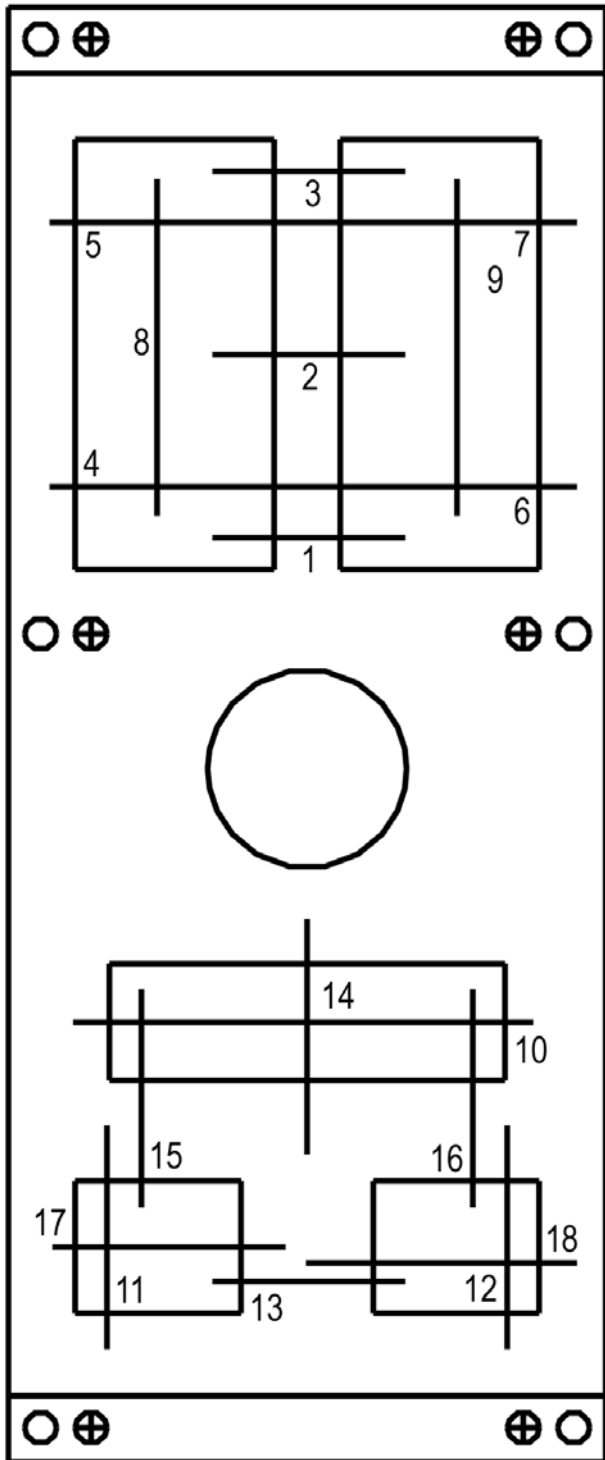


Fig. 14

8. Level the pump pads to zero, in both directions, by adjusting the jack screws.
9. Install the anchor bolts until they are hand tight.
10. Return the levels to the motor pads and check the level measurements.
11. Adjust the jack screws and anchor bolts, if necessary, until all level measurements are within the design requirements of 0.002 in/ft.
12. When taking readings, center the level over the pad being measured.

NOTE: The Baseplate Leveling Worksheet provided may be used when taking readings.

BASEPLATE LEVELING WORKSHEET



LEVEL MEASUREMENTS

- 1) _____
- 2) _____
- 3) _____
- 4) _____
- 5) _____
- 6) _____
- 7) _____
- 8) _____
- 9) _____
- 10) _____
- 11) _____
- 12) _____
- 13) _____
- 14) _____
- 15) _____
- 16) _____
- 17) _____
- 18) _____

PUMP EQUIPMENT #: _____

PUMP S/N: _____

LEVELED BY: _____

DATE: _____

ALIGNMENT AND ALIGNMENT PROCEDURE



WARNING

Before beginning any alignment procedure make sure driver power is locked out. Failure to lock out driver power can result in serious personal injury.



Alignment procedures must be followed to prevent unintended contact of rotating parts. Follow coupling manufacturer's installation and operation procedures.

The points at which alignment is checked and adjusted are:

- **Initial Alignment** is done prior to operation when the pump and the driver are at ambient temperature.
- **Final Alignment** is done after operation when the pump and driver are at operating temperature.

Alignment is achieved by adding or removing shims from under the feet of the driver and shifting equipment horizontally as needed.

NOTE: *Proper alignment is the responsibility of the installer of the unit.*

Accurate alignment of the equipment must be attained. Trouble-free operation can be accomplished by following these procedures:

ALIGNMENT CHECKS

Initial Alignment (Cold Alignment)

- Before Grouting Baseplate - To ensure alignment can be obtained.
- After Grouting Baseplate - To ensure no changes to alignment have occurred during grouting process.
- After Connecting Piping - To ensure that pipe strains haven't altered alignment. If changes have occurred, alter piping to remove pipe strains on pump flanges.

Final Alignment (Hot Alignment)

- After First Run - To obtain correct alignment when both pump and driver are at operating temperature. Thereafter, alignment should be checked periodically in accordance with plant operating and maintenance procedures.

ALIGNMENT CRITERIA

Good alignment is achieved when dial indicator readings as specified in the alignment procedure are .002 in. (.05 mm) Total Indicated Reading (T.I.R.) or less when the pump and driver are at operating temperature (Final Alignment).

During the installation phase, however, it is necessary to set the parallel alignment in the vertical direction to a different criteria due to differences in expansion rates of the pump and driver. *Table 2* below shows recommended cold settings for electric motor driven pumps based on different pumpage temperatures. Driver manufacturers should be consulted for recommended cold settings for other types of drivers (steam turbines, engines, etc.)

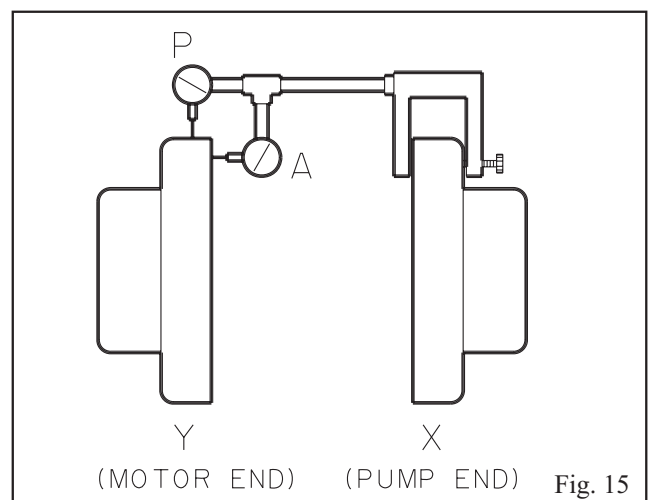
Table 2
Cold Settings of
Parallel Vertical Alignment

Pumpage Temperature	Set Driver Shaft
50°F (10°C)	.002in. (.05mm) LOW
150°F (65°C)	.001in. (.03mm) HIGH
250°F (120°C)	.005in. (.12mm) HIGH
350°F (175°C)	.009in. (.23mm) HIGH
425°F (218°C)	.013in. (.33mm) HIGH

3

SET UP

1. Mount two dial indicators on one of the coupling halves (X) so they contact the other coupling half (Y) (Fig. 15).
2. Check setting of indicators by rotating coupling half X to ensure indicators stay in contact with coupling half Y but do not bottom out. Adjust indicators accordingly.



MEASUREMENT

1. To ensure accuracy of indicator readings, always rotate both coupling halves together so indicators contact the same point on coupling half Y. This will eliminate any measurement problems due to runout on coupling half Y.
2. Take indicator measurements with driver feet hold down bolts tightened. Loosen hold down bolts prior to making alignment corrections.
3. Take care not to damage indicators when moving driver during alignment corrections.

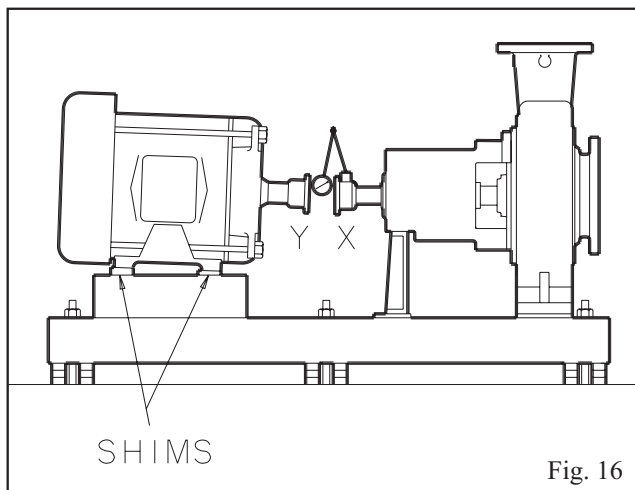
ANGULAR ALIGNMENT

A unit is in angular alignment when indicator A (Angular indicator) does not vary by more than .002 in. (.05 mm) as measured at four locations 90° apart.

Vertical Correction (Top to Bottom)

1. Zero indicator A at top dead center (12 o'clock) of coupling half Y.
2. Rotate indicators to bottom dead center (6 o'clock). Observe needle and record reading.
3. **Negative Reading** - The coupling halves are further apart at the bottom than at the top. Correct by either raising the driver feet at the shaft end (add shims) or lowering the driver feet at the other end (remove shims) (Fig. 16).

Positive Reading - The coupling halves are closer at the bottom than at the top. Correct by either lowering the driver feet at the shaft end (remove shims) or raising the driver feet at the other end (add shims).

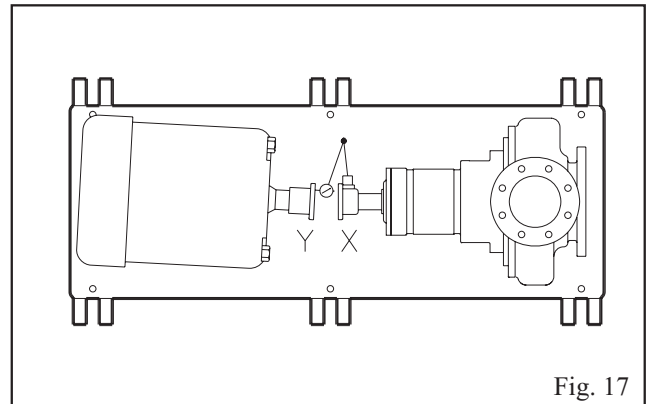


4. Repeat steps 1-3 until indicator A reads .002 in (.05 mm) or less.

Horizontal Correction (Side to Side)

1. Zero indicator A on left side of coupling half Y, 90° from top dead center (9 o'clock).
2. Rotate indicators through top dead center to the right side, 180° from the start (3 o'clock). Observe needle and record reading.
3. **Negative Reading** - The coupling halves are further apart on the right side than the left. Correct by either sliding the shaft end of the driver to the left or the other end to the right.

Positive Reading - The coupling halves are closer together on the right side than the left. Correct by either sliding the shaft end of the driver to the right or the other end to the left (Fig. 11).



4. Repeat steps 1 through 3 until indicator A reads .002 in. (.05 mm) or less.
5. Re-check both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary.

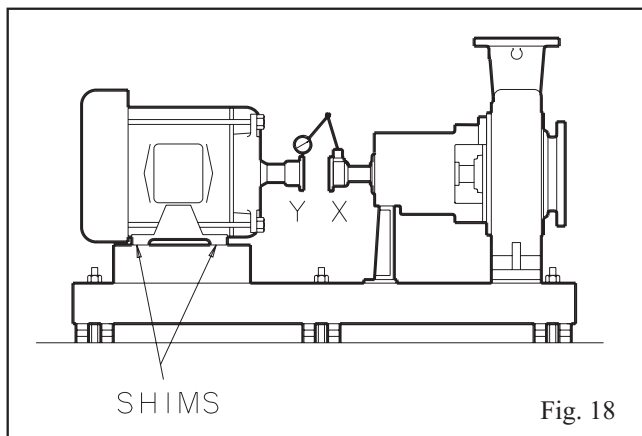
PARALLEL ALIGNMENT

A unit is in parallel alignment when indicator P (parallel indicator) does not vary by more than .002 in. (.05 mm) as measured at four points 90° apart at operating temperature. Note the preliminary cold setting criteria, See Table 2.

Vertical Correction (Top to Bottom)

1. Zero indicator P at top dead center of coupling (12 o'clock) half Y (Fig. 15).
2. Rotate indicator to bottom dead center (6 o'clock). Observe needle and record reading.
3. **Negative Reading** - Coupling half X is lower than coupling half Y. Correct by removing shims of thickness equal to half of the indicator reading under each driver foot.

Positive Reading - Coupling half X is higher than coupling half Y. Correct by adding shims of thickness equal to half of the indicator reading from each driver foot (Fig. 18).



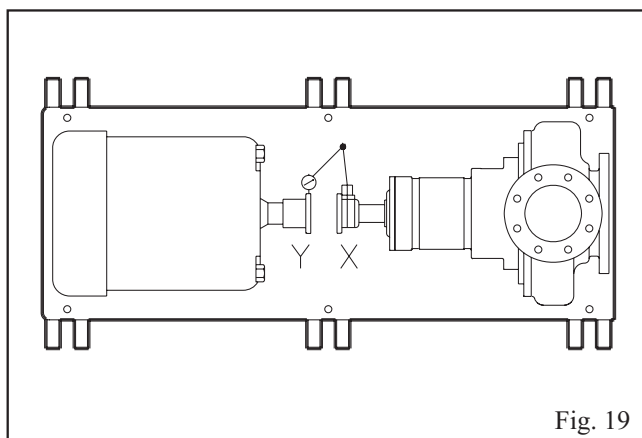
NOTE: Equal amounts of shims must be added to or removed from each driver foot. Otherwise the vertical angular alignment will be affected.

- Repeat steps 1 through 3 until indicator P reads within .002 in. (.05 mm) or less when hot, or per Table 2 when cold.

Horizontal Correction (Side to Side)

- Zero indicator P on the left side of coupling half Y, 90° from top dead center (9 o'clock).
- Rotate indicators through top dead center to the right side, 180° from the start. Observe needle and record reading (3 o'clock).
- Negative Reading** - Coupling half Y is to the left of coupling half X. Correct by sliding driver evenly in the appropriate direction (Fig. 19).

Positive Reading - Coupling half Y is to the right of coupling half X. Correct by sliding driver evenly in the appropriate direction.



NOTE: Failure to slide motor evenly will affect horizontal angular correction.

- Repeat steps 1 through 3 until indicator P reads .002 in. (.05 mm) or less.
- Re-check both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary.

COMPLETE ALIGNMENT

A unit is in complete alignment when both indicators A (angular) and P (parallel) do not vary by more than .002 in. (.05 mm) as measured at four points 90° apart.

Vertical Correction (Top to Bottom)

- Zero indicators A and P at top dead center (12 o'clock) of coupling half Y.
- Rotate indicator to bottom dead center (6 o'clock). Observe the needles and record the readings.
- Make corrections as outlined previously.

Horizontal Correction (Side to Side)

- Zero indicators A and P on the left side of coupling half Y, 90° from top dead center (9 o'clock).
- Rotate indicators through top dead center to the right side, 180° from the start (3 o'clock). Observe the needle, measure and record the reading.
- Make corrections as outlined previously.
- Recheck both vertical and horizontal readings to ensure adjustment of one did not disturb the other. Correct as necessary.

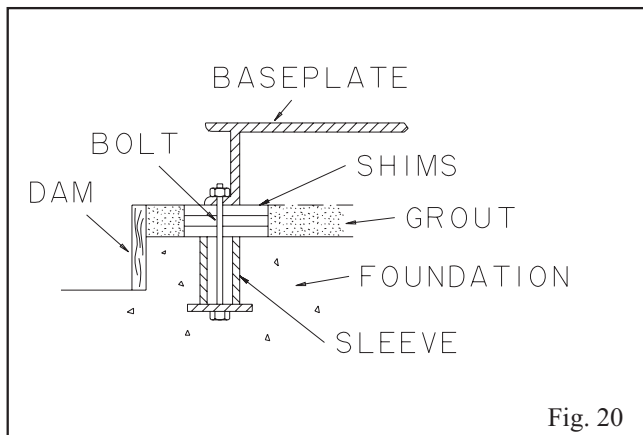
NOTE: With experience, the installer will understand the interaction between angular and parallel and will make corrections appropriately.

ALIGNMENT TROUBLESHOOTING

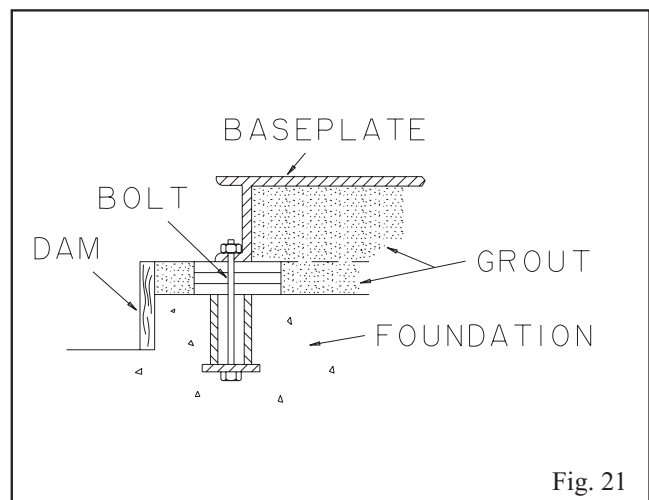
Table 3 Alignment Troubleshooting		
PROBLEM	PROBABLE CAUSE	REMEDY
Cannot obtain horizontal (Side-to-Side) alignment, angular or parallel	Driver feet bolt bound	Loosen pump hold down bolts and slide pump and driver until horizontal alignment is achieved.
	Baseplate not leveled properly, probably twisted.	Determine which corner(s) of the baseplate are high or low and remove or add shims at the appropriate corner(s) and realign.
Cannot obtain vertical (Top to Bottom) alignment, angular or parallel	Baseplate not leveled properly, probably bowed.	Determine if center of baseplate should be raised or lowered and correct by evenly adding or removing shims at the center of the baseplate.

GROUT BASEPLATE

1. Clean areas of baseplate that will contact grout. Do not use an oil-based cleaner because grout will not bond to it.
2. Build a dam around foundation (Fig. 20). Thoroughly wet foundation.
3. Pour grout slowly through grout holes in baseplate, until level with the top of the dam. The use of non-shrink epoxy grout is recommended, follow manufacturers recommendations. If cementitious grout is used, remove air by puddling or with a vibrator (Fig. 20).



4. Allow grout to set.
5. Fill remainder of baseplate with grout. Remove air as before (Fig. 21).



6. Allow grout to set at least 48 hours.
7. Tighten foundation bolts.

Alignment Check

Re-check alignment before continuing, using methods previously described.

PIPING

Guidelines for piping are given in the “Hydraulic Institute Standards” (Edition 14, Centrifugal Pump section) and should be reviewed prior to pump installation.



WARNING

Never draw piping into place by forcing at the flanged connections of the pump. This will impose dangerous strains on the unit and cause misalignment between pump and driver. Pipe strain can adversely effect the operation of the pump. That could result in serious personal injury and damage to equipment.



Flange loads from the piping system, including those from thermal expansion of the piping, must not exceed the limits of the pump. Casing deformation can result in contact with rotating parts and result in excess heat generation, sparks and premature failure.



Ensure that pump and systems are free of foreign objects before operating and that objects cannot enter the pump during operation. Foreign objects in the pumpage or piping system can cause blockage of flow which can result in excess heat generation, sparks and premature failure

1. All piping must be supported independently and must line up naturally with the pump flanges.
2. Piping runs shall be designed to minimize friction losses.
3. DO NOT make final connection of piping to pump until grout has hardened and pump and driver hold-down bolts have been tightened.

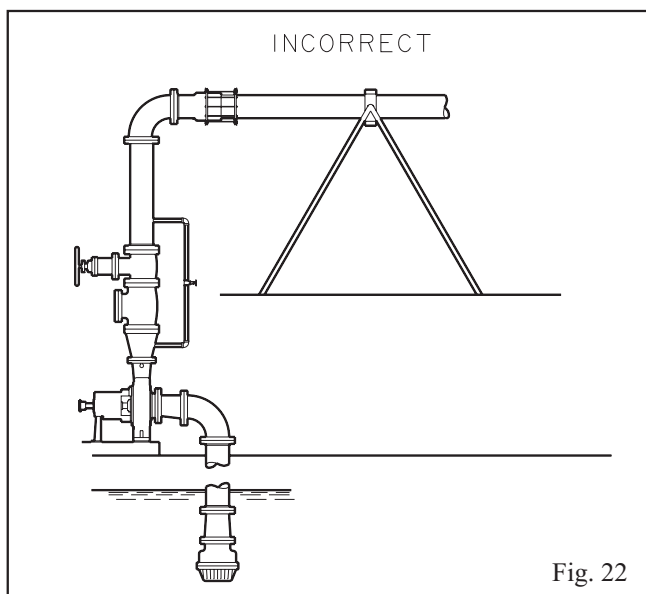


Fig. 22

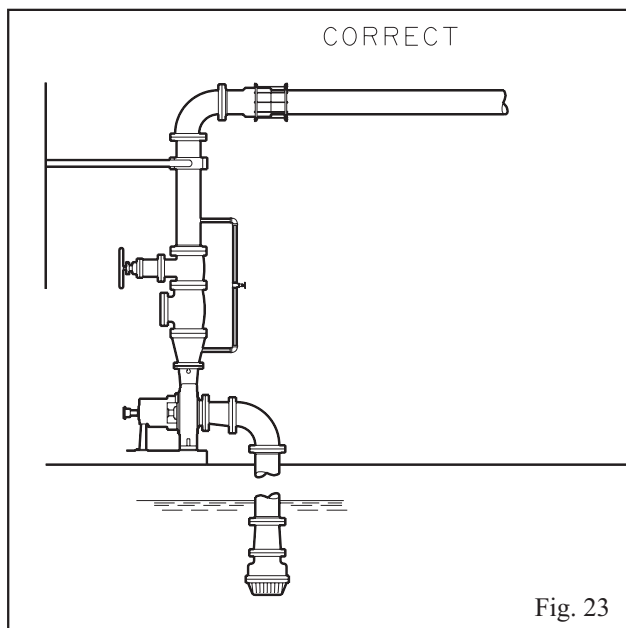


Fig. 23

4. It is suggested that expansion loops or joints, if used, be properly installed in suction and/or discharge lines when handling liquids at elevated temperatures, so linear expansion of piping will not draw pump out of alignment (Fig. 22 & 23).
5. The piping should be arranged to allow pump flushing prior to removal of the unit on services handling corrosive liquids.
6. System should be thoroughly cleaned prior to installation.

SUCTION PIPING

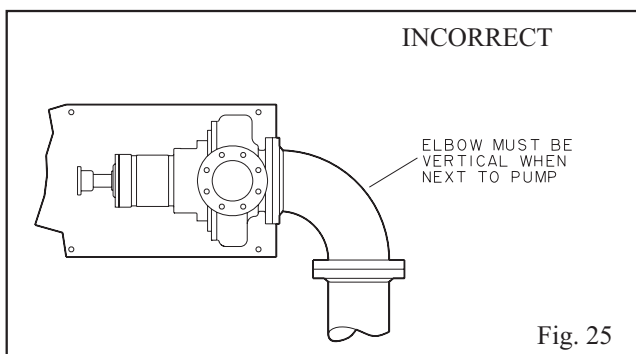
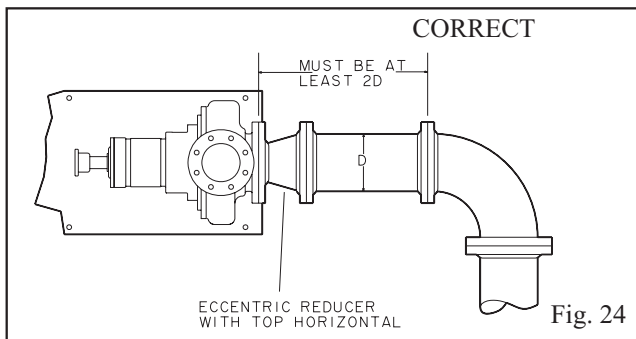


WARNING

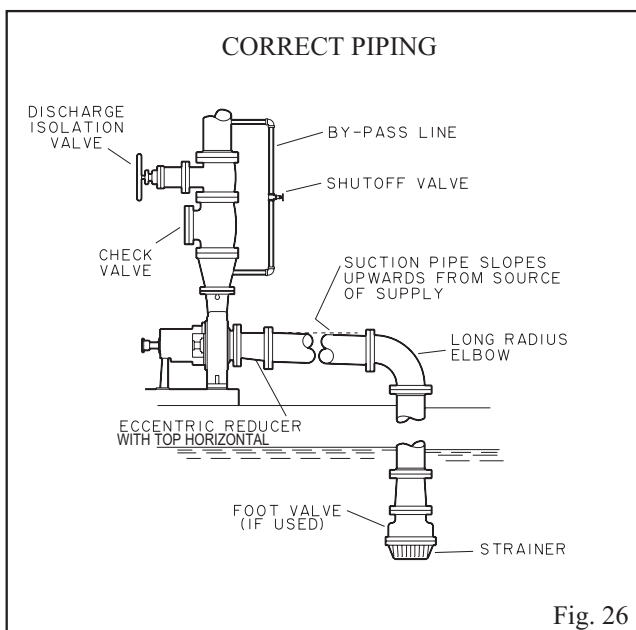
$NPSH_A$ must always exceed $NPSH_R$ as shown on Goulds performance curves received with order. Reference Hydraulic Institute for $NPSH$ and pipe friction values needed to evaluate suction piping.

Properly installed suction piping is a necessity for trouble free pump operation. Suction piping should be flushed **BEFORE** connection to the pump.

1. Use of elbows close to the pump suction flange should be avoided. There should be a minimum of 2 pipe diameters of straight pipe between the elbow and suction inlet. Where used, elbows should be long radius (Fig. 24).



2. Use suction pipe one or two sizes larger than the pump suction, with a reducer at the suction flange. **Suction piping should never be of smaller diameter than the pump suction.**
3. Reducers should be eccentric at the pump suction flange with sloping side down and horizontal side at the top (Figs. 26, 27, 28).



CAUTION

Pump must never be throttled on suction side.

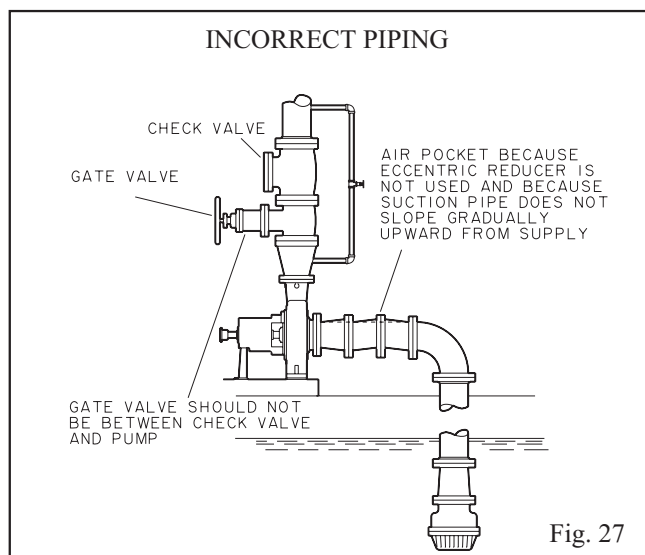
4. Suction strainers, when used, must have a net “free area” of at least three times the suction pipe area.
5. Separate suction lines are recommended when more than one pump is operating from the same source of supply.

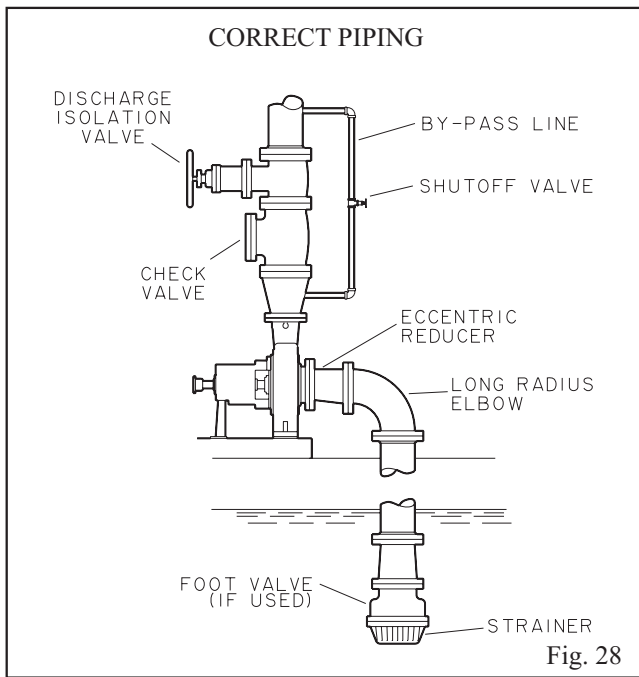
Suction Lift Conditions

1. Suction pipe must be free from air pockets
2. Suction piping must slope upwards to pump.
3. All joints must be air tight.
4. A means of priming the pump must be provided, such as a foot valve.

Suction Head/Flooded Suction Conditions

1. An isolation valve should be installed in the suction line at least two pipe diameters from the suction to permit closing of the line for pump inspection and maintenance.





2. Keep suction pipe free from air pockets.
3. Piping should be level or slope gradually downward from the source of supply
4. No portion of the piping should extend below pump suction flange.
5. The size of entrance from supply should be one or two sizes larger than the suction pipe.
6. The suction pipe must be adequately submerged below the liquid surface to prevent vortices and air entrainment at the supply..

DISCHARGE PIPING

1. Isolation and check valves should be installed in discharge line. Locate the check valve between isolation valve and pump, this will permit inspection of the check valve. The isolation valve is required for priming, regulation of flow, and for inspection and maintenance of pump. The check valve prevents pump or seal damage due to reverse flow through the pump when the driver is turned off.
2. Increases, if used, should be placed between pump and check valves.
3. Cushioning devices should be used to protect the pump from surges and water hammer, if quick-closing valves are installed in system.

FINAL PIPING CHECK

After Connecting Piping to the Pump



Rotate shaft by hand to ensure it rotates smoothly and there is no rubbing which could lead to excess heat generation and or sparks.

1. Rotate shaft several times by hand to be sure that there is no binding and all parts are free.
2. Check alignment, per the alignment procedure outlined previously to determine absence of pipe strain. If pipe strain exists, correct piping.



A build up of gases within the pump, sealing system and or process piping system may result in an explosive environment within the pump or process piping system. Ensure process piping system, pump and sealing system are properly vented prior to operation.


OPERATION

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PREPARATION FOR START-UP

EZMAG



 **WARNING**
Failure to properly lift and support equipment could result in serious injury or damage to pumps.

 *When installing in a potentially explosive environment, ensure that the motor is properly certified.*

CHECKING ROTATION

 **CAUTION**
Serious damage may result if pump is run in the wrong rotation.

1. Lock out power to driver.

  **WARNING**
Lock out driver power to prevent accidental start-up that could result in serious personal injury.

2. Make sure coupling spacer is removed and coupling hubs are fastened tightly to the shafts and are not loose.

NOTE: Pump is shipped with coupling spacer removed.


3. Unlock driver power.
4. Make sure everyone is clear. Jog driver just long enough to determine direction of rotation. Rotation must correspond to arrow on bearing frame.
5. Lock out power to driver.

CHECKING ROTATION - Close Coupled

 **CAUTION**
Serious damage may result if pump is run in the wrong rotation.

1. Unlock driver power.
2. Make sure everyone is clear. Jog driver just long enough to determine direction of rotation. Rotation of motor fan must correspond to arrow on close coupled frame.

COUPLE PUMP AND DRIVER

  **WARNING**
Lock out driver power to prevent accidental start-up that could result in serious personal injury.

Lubricate coupling per manufacturer's instructions and install coupling spacer.

INSTALL COUPLING GUARD

Install coupling guard as defined in the appendix.



WARNING

Never operate a pump without a coupling guard properly installed. Operating pump without a properly installed coupling guard can result in serious personal injury.

LUBRICATING BEARINGS



WARNING

Operation of the unit without proper lubrication will cause bearing failure and pump seizure.

Flood Oil Lubrication - Pumps are shipped without oil. Fill bearing frame with oil, through filler connection until oil level reaches center of sight-glass (Fig 29). A high quality turbine type oil, with rust and oxidation inhibitors should be used as specified in *Table 6*.

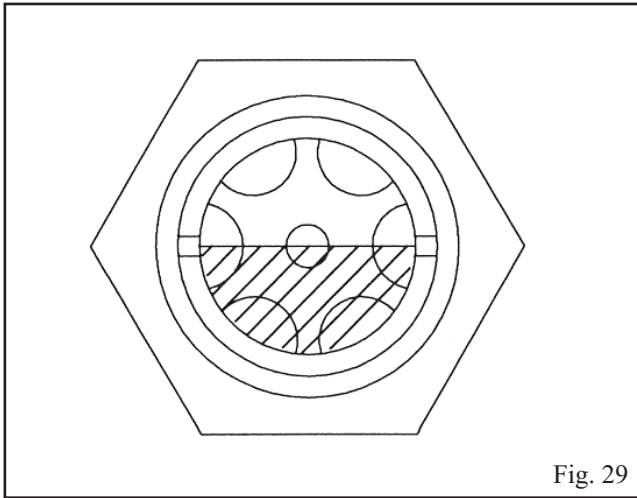


Fig. 29

CONNECT CONDITION MONITORING DEVICES



When installing in a potentially explosive environment, ensure that the condition monitoring devices are properly certified.

Always connect thermocouple to control panel and/or temperature switch in driver starter. If unit is also equipped with a power monitor, leak detector, or vibration monitoring system, these must also be connected.

PRIMING PUMP



Bearings must be lubricated properly in order to prevent excess heat generation, sparks and premature failure.

Never start pump until properly primed (pump casing and suction piping are full of liquid). Components such as internal sleeve bearings depend on liquid for lubrication and will quickly fail if run dry.

Your particular system conditions will dictate method used to prime pump.

STARTING PUMP

1. Make sure suction valve and any recirculation or cooling lines are open.
2. Fully close or partially open discharge valve as dictated by system conditions.
3. Start driver.



CAUTION

Immediately observe pressure gauges. If discharge pressure is not quickly attained - stop driver, reprime and attempt to restart.

4. Slowly open discharge valve until the desired flow is obtained.



CAUTION

Continuous operation against closed discharge valve will cause pump to overheat. Overheating the magnetic drive assembly will weaken or ruin the magnets.



WARNING

Continuous operation against closed discharge valve may vaporize liquid creating an explosive hazard due to confined vapor under high pressure and temperature.

OPERATION

4

GENERAL CONSIDERATIONS

Always vary capacity with valve in discharge line. **NEVER** throttle flow from suction side.

Driver may overload or magnets de-couple if pumpage specific gravity (density) is greater than originally assumed, or rated flow rate is exceeded.

Always operate the pump at or near the rated conditions to prevent damage resulting from cavitation or recirculation.



CAUTION

Do not operate above rated temperature range of magnets as this will weaken or ruin the magnets.

OPERATING AT REDUCED CAPACITY



WARNING

Do NOT operate pump below minimum rated flows or with discharge valve closed. These conditions may vaporize liquid creating an explosive hazard due to confined vapor under high pressure and temperature.



Service temperature in an ATEX classified environment is limited to the area classification specified on the ATEX tag affixed to the pump (reference Table 1 in the Safety section for ATEX classifications).

OPERATING UNDER FREEZING CONDITIONS

Exposure to freezing conditions, while pump is idle, could cause liquid to freeze and damage the pump. Liquid inside pump should be drained. Liquid inside cooling coils, if supplied, should also be drained.

**Table 4
Temperature Ratings**

Magnetic Types	Drive Designation	Rated Temperature
Neodymium Iron NdFe	A,B,C,D,E,F,G,H,I,J,K	356°F (180°C)
Samarium Cobalt SmCo	AA,BB,CC,DD,EE,FF,GG,HH,II,JJ,KK	536°F (280°C)

**Table 5
Minimum Flow GPM (m³/hr)
at Speed (rpm)**

Group	Pump Size	3500	2900	1750	1450
S	1x1 1/2 -6	23 (5)	15 (4)	11 (3)	8 (2)
	1 1/2 x 3 -6	30 (7)	25 (6)	15 (4)	13 (3)
	2 x 3 -6	56 (12.5)	47 (11)	28 (6)	23 (5)
	1 x 1 1/2 -8	10 (2.5)	7 (2)	3 (1)	2 (1)
	1 1/2 x 3 -8	34 (8)	29 (7)	17 (4)	14 (3)
S/M	2 x 3 -8	74 (17)	61 (14)	37 (9)	20 (5)
8" M	3 x 4 -7	157 (36)	127 (29)	78 (18)	64 (15)
	3 x 4 -8G	159 (36)	129 (30)	79 (18)	65 (15)
10" M	1 x 2 -10	21 (5)	13 (3)	9 (2)	7 (2)
	2 x 3 -10	78 (18)	65 (15)	38 (9)	31 (7)
	3 x 4 -10	173 (40)	144 (33)	86 (20)	72 (16)

* Based on water with a specific Gravity of 1.0 and Specific Heat of 1.0

SHUTDOWN

1. Slowly close discharge valve.
2. Shut down and lock out driver to prevent accidental rotation.



WARNING

When handling hazardous and/or toxic fluids, skin, eye and respiratory protection are required. If pump is being drained, precautions must be taken to prevent injury or environmental contamination. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.

FINAL ALIGNMENT



Alignment procedures must be followed to prevent unintended contact of rotating parts. Follow coupling manufacturer's installation and operation procedures.


1. Run the unit under actual operating conditions for a sufficient length of time to bring the pump and driver up to operating temperature.
2. Check and reset alignment per alignment procedure outlined earlier.
3. Reinstall coupling guard per instruction in appendix.

PREVENTIVE MAINTENANCE

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MAINTENANCE SCHEDULE 33
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GENERAL COMMENTS

A routine maintenance program can extend the life of your pump. Well maintained equipment will last longer and require fewer repairs. You should keep maintenance records, this will help pinpoint potential causes of problems. A sample form is in the appendix that can be copied and used for this purpose.

 *The Preventive Maintenance section must be adhered to in order to keep the applicable ATEX classification of the equipment. Failure to follow these procedures will void the ATEX classification for the equipment.*

MAINTENANCE SCHEDULE

ROUTINE MAINTENANCE

- Bearing lubrication
- Temperature monitoring
- Vibration analysis
- Discharge pressure

ROUTINE INSPECTIONS

- Check level and condition of oil through sight glass on bearing frame.
- Check for unusual noise, vibration, and bearing temperatures.
- Inspect pump and piping for leaks.

3 MONTH MAINTENANCE

- Check foundation hold down bolts of motor and pump for tightness.
- Change oil per section 5.
- Check alignment per section 3.

YEARLY INSPECTIONS

- Check pump capacity, pressure, and power. If the pump performance does not satisfy your process requirements, the pump should be disassembled and inspected. Worn parts should be replaced.

INSPECTION INTERVALS

Inspection intervals should be shortened appropriately if the pumpage is abrasive and/or corrosive,

 *or if the environment is classified as potentially explosive.*

MAINTENANCE OF BEARINGS

OIL LUBRICATED BEARINGS

Oil level is measured through the sight glass. Oil level must not fall below center of sight glass. An increase in level may be noted after start up due to oil circulation within the bearing frame. Change oil after 200 hours for new bearings, thereafter every 4000 operating hours or 6 months, whichever period is shorter. Change oil every 2000 operating hours under severe operating conditions, such as high temperature services [pumpage temperatures in excess of 325°F (160°C)].

We recommend using *Table 5* to help determine your lubricating oil needs.



Throughout this section on bearing lubrication, different pumpage temperatures are listed. If the equipment is ATEX certified and the listed temperature exceeds the applicable value shown in Table 1 under Safety, then that temperature is not valid. When this situation occurs, please consult with your ITT/Goulds representative.

STANDARD CLOSE-COUPLED PUMP



Some 3296s ARE CLOSE-COUPLED MOUNTED AS STANDARD. Close-coupled pumps do not have bearings which require lubrication.

OIL LUBRICATED BEARINGS



WARNING

Pumps are shipped without oil. Oil lubricated bearings must be lubricated at the job site.

Remove fill plug (113A) and add oil until level is at the center of the sight glass (319). Replace fill plug (Fig. 30) (See *Table 6*).

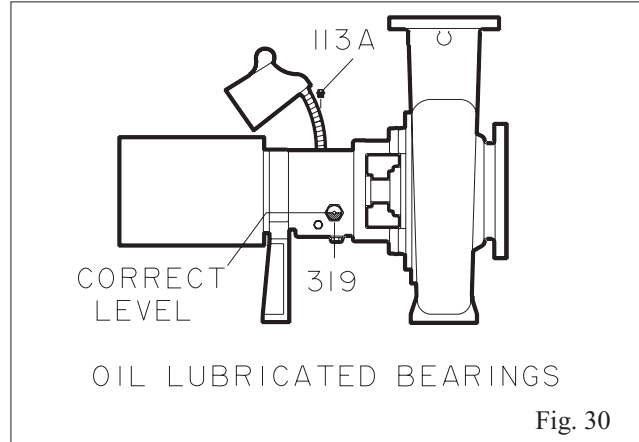


Fig. 30

**Table 6
Bearing Frame Lubrication Requirement**

	Pumpage Temperature of less than 356°F (180°C)	Pumpage Temperature of greater than 356°F (180°C) with bearing frame cooling
Oil Grades		
ISO Grade	VG 68	Synthetic VG 68
Approximate SSU 100°F (38°C)	300	Synthetic 300
DIN 51517	C 68	Synthetic C68
Kinematic Viscosity at 40°C (105°F) (mm ² /sec)	68	Synthetic 68
Acceptable	Exxon Terasstic EP 68 Chevron GTS Oil 68 Mobil DTE 26 Gulf Harmony 68 Shell Tellus Oil 68 Phillips Mangus Oil 315 Phillips MM SAE 20-20W Phillips HDS SAE 20-20W	Royal Purple Synfilm 68

Note: This is a list of oils that meet the lubrication requirements of this pump. It is not intended to be an endorsement of products listed nor exclude other oils that meet these requirements.

TROUBLESHOOTING PUMP

**Table 7
Troubleshooting Pump**

No liquid delivered	Pump not primed	Reprime pump, check that pump and suction line are full of liquid.
	Suction line clogged	Check suction line pressure. If low, locate and remove obstructions.
	Impeller clogged with foreign material	Disassemble and remove blockage.
	Magnet de-coupling	Shut down. Check temperature and viscosity of pumpage. Check magnets with breakaway torque test.
Pump not producing rated flow or head	Air leak in suction line	Check for leakage and correct.
	Impeller partly clogged	Back flush pump to clean impeller.
	Worn impeller rings	Replace defective part as required.
	Insufficient suction head	Ensure that suction line shutoff valve is fully open and line is unobstructed. Check suction pressure.
	Worn or broken impeller	Inspect and replace if necessary.
Pump starts then stops pumping	Improperly primed pump	Reprime pump.
	Air leak in suction line	Check for leakage and correct.
	Magnet de-coupling	Shut down. Check temperature and viscosity of pumpage. Check magnets with breakaway torque test.
	Air or vapor pockets in suction line	Rearrange piping as necessary to eliminate air pockets.
Bearings run hot	Improper lubrication	Check lubricant for suitability and level.
	Lube cooling	Check cooling system.
	Improper alignment	Check pump alignment.
Pump is noisy or vibrates	Improper pump/driver alignment	Align shafts.
	Partly clogged impeller causing imbalance	Disassemble and remove blockage.
	Broken or bent impeller or shaft	Replace as required.
	Base not rigid enough	Tighten hold down bolts of pump and motor or adjust stilts. Check grout.
	Worn bearings	Replace.
	Suction or discharge piping not anchored or properly supported	Anchor per Hydraulic Institute Standards recommendations (Edition 14, Centrifugal pump section).
	Pump is cavitating	Increase NPSH available.
Motor requires excessive power	Head lower than rating. Pumps too much liquid	Install throttle valve.
	Liquid heavier than expected.	Check specific gravity and viscosity.
	Head higher than rating, capacity at rating	Check impeller diameter.
	Rotating parts binding or severely worn	Check internal wearing parts for proper clearances.

TROUBLESHOOTING PUMP, con't

**Table 7
Pump Troubleshooting**

Condition monitoring device shuts down pump	Damaged sleeve & thrust bearings	Replace as required.
	Plugged recirculation circuit	Disassemble and remove blockage. Determine and correct cause of blockage.
	Recirculation liquid vaporization	Check actual liquid temperature versus design temperature. Check actual NPSH available versus design. Check minimum flow requirement for pump size. Check recirculation circuit and flush screen for blockage. Correct all as necessary.
	Damaged containment shell	Replace as required.
	Magnets decoupled	Check temperature and viscosity of pumpage. Check magnets with breakaway torque test.
	Pump run dry	Check control device for proper operation. Check suction line for blockage. Reprime pump.
	Excessive motor power	System head lower than rating. Pumps too much liquid. Check rotating parts for binding and wear. Liquid heavier than expected.

DISASSEMBLY & REASSEMBLY

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REQUIRED TOOLS

 **WARNING**
This pump contains extremely strong magnets. Keep magnetic tools away from magnets.

- Assorted metric open end or socket sizes 13, 17, 18, 19 and 24 mm.
- Assorted Allen Head wrenches, sizes 2.5, 3, 5, 6mm with 4.75" minimum reach and 8mm with 6" minimum reach.
- Torque Wrench
- Strap Wrench
- 3/8" Eye-Bolt

PREPARATION FOR DISASSEMBLY



A build up of gases within the pump, sealing system and or process piping system may result in an explosive environment within the pump or process piping system. Ensure process piping system, pump, and sealing system are properly vented prior to operation.



WARNING

The 3296 pump often handles hazardous and/or toxic fluids. Skin, eye and respiratory protection required. Precautions must be taken to prevent injury or environmental contamination. Drain and decontaminate pump in accordance with all federal, state, local, and company regulations.



Leakage of process liquid may result in creating an explosive atmosphere. Follow all pump and seal assembly procedures.

1. Lock out power to driver.
2. Shut off all valves controlling flow to and from pump.
3. The pump should be drained and flushed before it is removed from the piping. After isolating the pump from the system, flush the pump using a compatible liquid.



WARNING

Failure to properly lift and support equipment could result in serious injury or damage to pumps.



WARNING

Ensure pump is isolated from system and pressure is relieved before any plugs are removed or piping disconnected.

4. Disconnect all piping and auxiliary equipment.
5. Remove coupling guard (For frame mounted version).
6. Remove coupling (For frame mounted version).
7. Remove casing foot and frame / C-face motor support foot bolts.
8. Remove pump from baseplate.
9. Drain Oil from frame mounted pump.

Decontamination Procedure

10. Connect clean flush liquid supply to discharge nozzle.
11. Devise a means of collecting flush liquid as it drains out the drain connection.
12. Flush to remove residue.

DISASSEMBLY (Frame Mounted)



WARNING

Each component must be individually decontaminated using procedures in accordance with all federal, state, local and company environmental regulations.



WARNING

The magnets contained in this unit are extremely powerful. Keep magnetic drive components and magnetic tools apart from each other by a minimum of six (6) feet [two (2) meters]. Serious injury to fingers and hands will result.

NOTE: *When working on pump, use a bench with a non-magnetic work surface such as wood with a brass surface.*



CAUTION

The shop area must be clean and free of any substances that would contaminate the magnets, ex. ferrous metals.

1. Secure pump on a workbench or worktop with the suction nozzle facing down.
2. Screw “eye-bolt,” size 3/8 inch into the drive shaft.



CAUTION

MAGNETIC FORCES: *Strong axial forces are produced when pulling the bearing frame out of the frame adapter. These forces diminish abruptly once the assembly has been removed.*

3. Remove screws holding the bearing frame to the frame adapter (370B) (Fig. 31).

4. If required, jacking screws can be used to separate the parts using the two threaded holes in the bearing frame. S-Group: M12; M-Group: M14.
5. Lift the bearing frame assembly off the adapter using a crane if available.
6. Remove the frame-to-adapter gasket (360W) (Fig. 31).
7. Secure the drive shaft so it is not able to rotate.

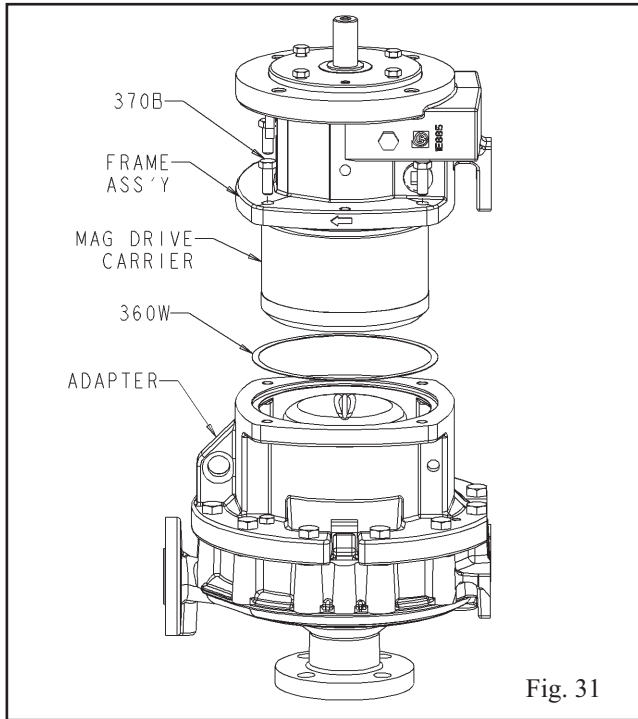


Fig. 31

8. Remove hex screw (791D) and lockwasher (382) from the drive shaft (Fig. 32).
9. Remove drive magnet assembly (740B) (Fig. 32).

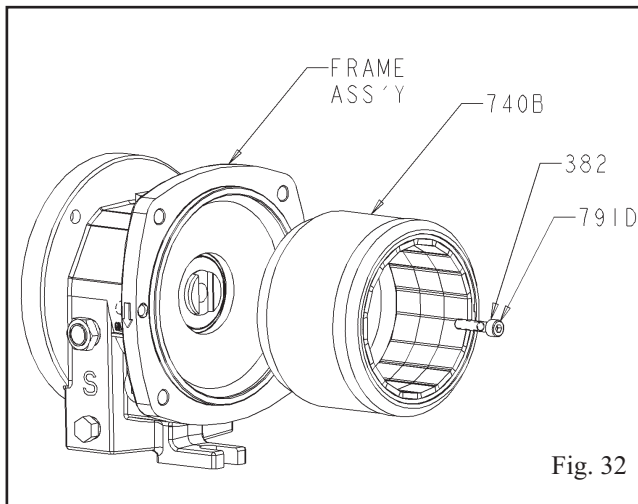


Fig. 32

10. Remove bearing end cover screws (370C) and bearing end cover (109A) (Fig. 33).

11. Remove wavy spring washer (529) and end cover gasket (360A) (Fig. 33).

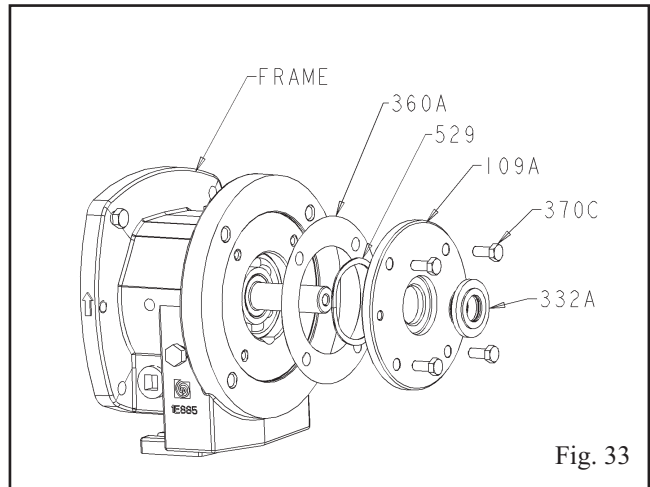


Fig. 33

12. Remove drive shaft with both bearings attached (Fig. 34).
13. Remove labyrinth oil seals (332A and 333D) (Fig. 33 and 34).

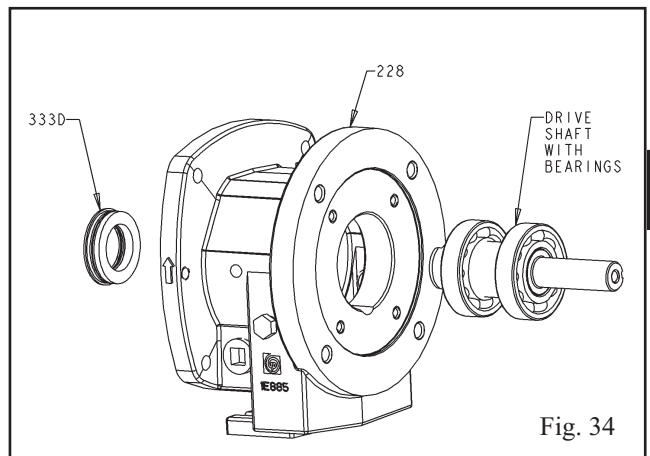
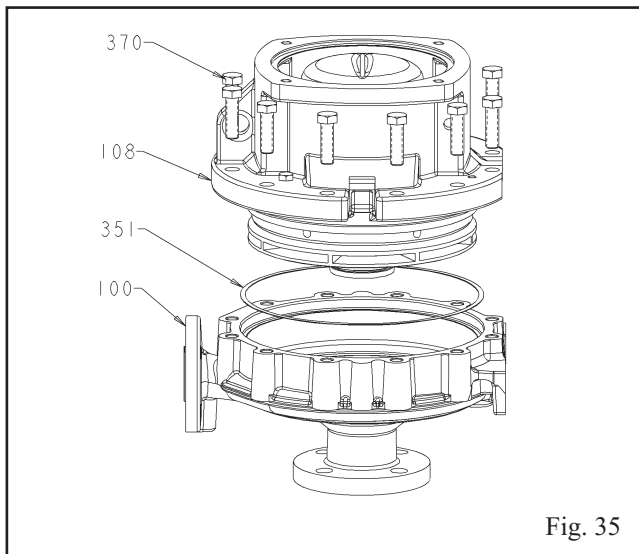


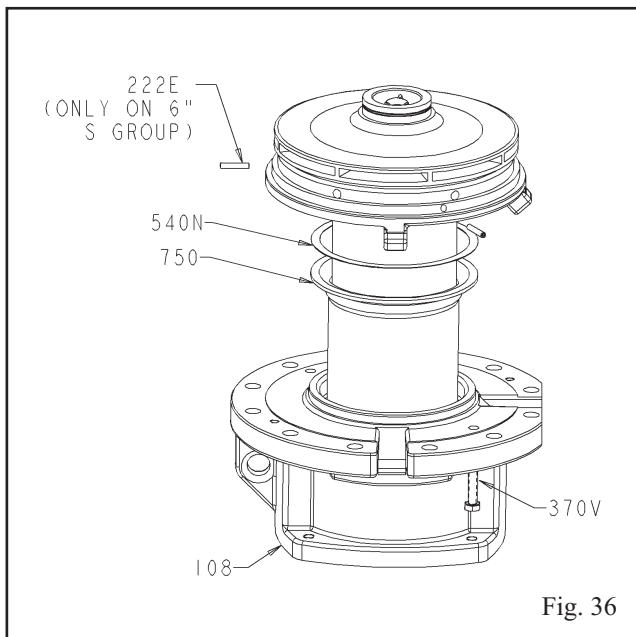
Fig. 34

14. Both radial ball bearings lie against the shaft collar so remove them using a press (Fig. 34).

- Remove hex cap screws, adapter to case (370) (Fig. 35).

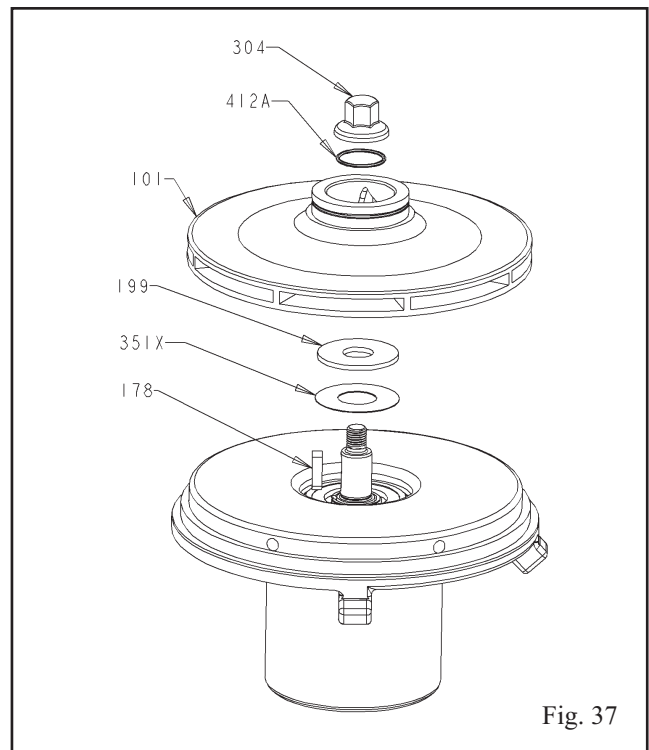


- Do not remove the three set screws (222E on the 6" S-Group) or two hex screws (370V on all other sizes). They hold the adapter (108), backplate (444) and containment shell (750) (Fig. 36).

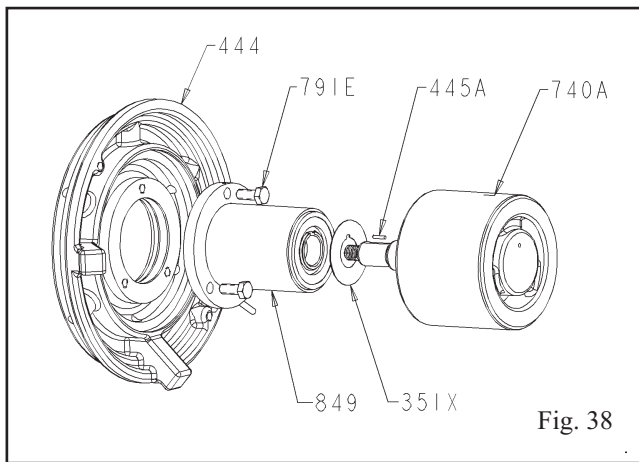


- Remove this entire assembly from the casing (100) (Fig. 35).
- If required to remove this assembly from the casing, jacking screws can be used through the threaded holes in the adapter (108). S and M Groups: M8.
- Place adapter, backplate, impeller assembly on the bench with the impeller facing upwards (Fig. 36).

- Remove the three set screws, (222E) (6" S-Group) or two hex screws, 370V (all other sizes) (Fig. 36).
- Remove adapter (108) and containment shell (750) (Fig. 36).
- Place remaining unit on the workbench with the driven magnet facing downwards (Fig 37).
- Place strap-wrench on the impeller and remove the impeller nut (304) and o-ring (412A) (Fig. 37).
- Slide the impeller (101) off the shaft (Fig. 37).
- Remove the impeller key (178), distance washer (199) and gasket (351X) (Fig. 37).



- Pull the backplate (444) and bearing cartridge (849) from the shaft (Fig. 38).
- Remove second gasket (351X) (Fig. 38).
- Undo screws (791E) and remove the bearing cartridge (849) from the backplate (444) (Fig. 38).



29. The driven magnet assembly (740A) is a two-piece assembly on S-group pumps held with a drive-key. Item 740A is a single-piece component on M-Group pumps, with a parallel pin (445A) to drive the bearing cartridge.

30. The bearing cartridge (849) is one unit which, if necessary, is replaced completely.

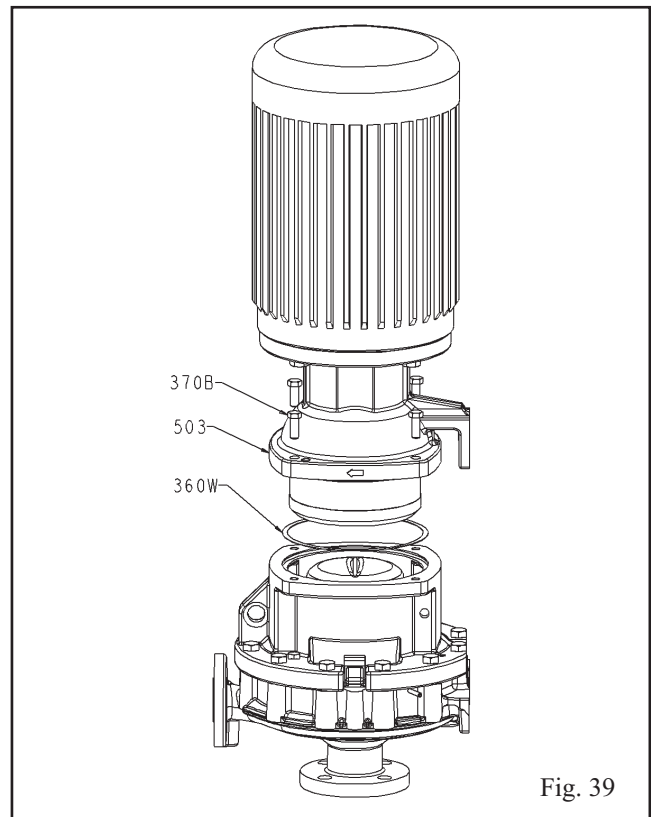
DISASSEMBLY (Close-Coupled)



CAUTION

MAGNETIC FORCES: Strong axial forces are produced when pulling the drive section out of the frame adapter. These forces diminish abruptly once the assembly has been removed.

1. Secure the complete pump on a workbench in either horizontal or vertical position.
2. Remove hex screws (370B) holding the motor adapter (503) to the frame adapter (108) (Fig. 39).
3. If necessary, remove the motor adapter (503) from the frame adapter (108) using two levers or pry-bars. There are also two threaded holes (size M12) in the close-coupled motor adapter (503) for the use of jacking screws.
4. Lift the motor and motor adapter assembly off the frame adapter with a crane if necessary (Fig. 39).
5. Remove gasket (360W) (Fig. 39).
6. Remove hex screw (791D) and lockwasher (382) from the drive magnet (740B) (Fig. 39).



7. Remove the drive magnet (740B) from the stub shaft (122A) (Fig. 40).
 8. Remove the hex screws (371) holding the motor to the motor adapter (503) (Fig. 40).
 9. Pull the motor adapter (503) off the motor flange (Fig. 40).
 10. Undo the set-screw (222L) that holds the stub shaft onto the motor shaft (Fig. 40).
 11. Remove the stub shaft (122A) from the motor (Fig. 40).
- Refer to Step 15 from above for disassembly of the remaining pump.

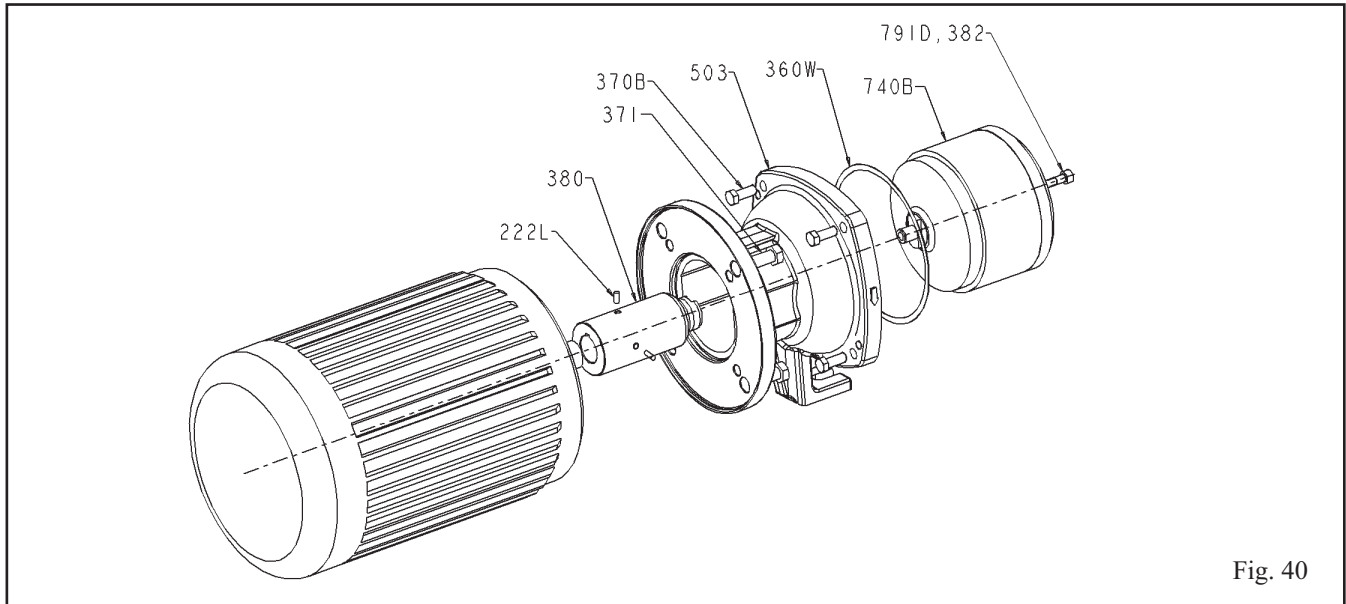


Fig. 40

INSPECTIONS

The pump parts must be inspected to the following criteria before they are reassembled to insure the pump will run properly. Any part not meeting the required criteria should be replaced.

NOTE: Clean parts in solvent to remove oil, grease or dirt. Protect machined surfaces against damage during cleaning.

Casing (100)

The casing (100) should be inspected for cracks and excessive wear or pitting. It should be repaired or replaced if it exceeds the following criteria (Fig. 41).

1. Localized wear or grooving greater than 1/8 in. (3.2 mm) deep.
2. Pitting greater than 1/8 in. (3.2 mm) deep.
3. Inspect case gasket seat surface for irregularities.

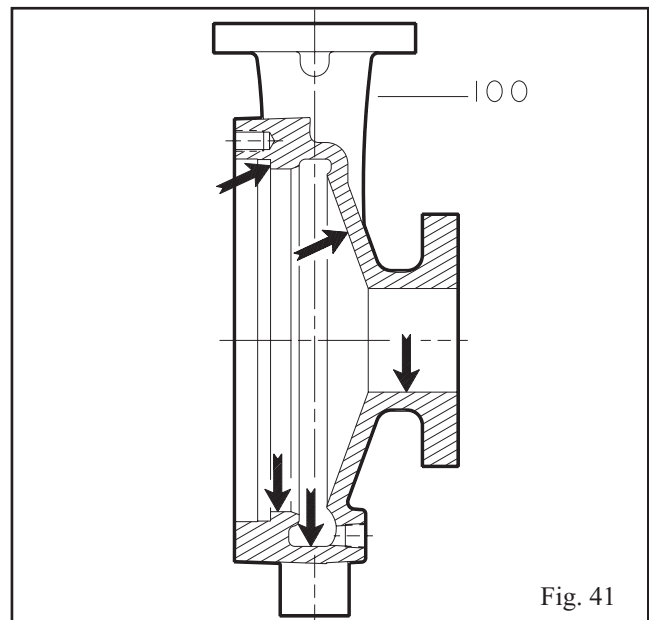


Fig. 41

- Refer to *Table 8* to check wear ring clearances.

Table 8			
Radial Wear Ring Clearance Impeller to Casing in (mm)			
Group	Size	New	Replace
S	1x1.5-6	.010—.013 (.25—.32)	0.018 (0.44)
	1.5x3-6		
	2x3-6		
	1x1.5-8		
	1.5x3-8		
M	2x3-8	.014—.016 (.35—.42)	0.022 (0.59)
	3x4-7		
	4x4-8G		
	3x4-10		
	1x2-10		
	2x3-10		

Impeller (101)

- Inspect wear ring surface for signs of pitting.
- Inspect front wear ring clearance per wear ring clearance *Table 8*.
- Inspect leading and trailing edges of vanes for pitting, and erosion or corrosion damage.

Frame Adapter (108)

- Check frame adapter (108) for cracks or excessive corrosion damage. Replace if any of these conditions exist.
- Make sure gasket surface is clean.

Silicon Carbide Bearings (849)

(Bearing Cartridge)

- Inspect bearings for cracks, chips, or excessive wear.
- Replace cartridge if any of these conditions exist.

Containment Shell (750)

- Wall thickness 0.039 in. minimum.
- Must be free from pitting or cracks.
- Grooves in excess of .005 in. require containment shell replacement.

Magnets (740A & 740B)

Driven Magnet Assembly (740A)



WARNING

The magnets contained in this unit are extremely powerful. Keep magnetic drive components and magnetic tools apart from each other by a minimum of six (6) feet [two (2) meters]. Serious injury to fingers and hands will result otherwise.

- Must be free from bulges.
- Must be free of pits and scratches exceeding .005 in. deep.
- Must be free of erosion or corrosion exceeding .005 in. deep.
- Check pump-out vanes for cracks or corrosion.
- Ensure circulation holes are open.

Drive Magnet Assembly (740B)



WARNING

The magnets contained in this unit are extremely powerful. Keep magnetic drive components and magnetic tools apart from each other by a minimum of six (6) feet [two (2) meters]. Serious injury to fingers and hands will result otherwise.

NOTE: *The magnets are extremely brittle. It is normal to have chips (up to 10% of the magnet surface) per MMPA Standard No. 0100-90.*

- Magnets must be free of major cracks (extending over 50% of surface) and also free of imperfections that create loose particles.
- If magnets and drive magnet carrier were exposed to product, they should be replaced.
- Inspect drive magnet carrier for cracks and replace if any are found.
- Drive magnet carrier hub O.D. must be free from grooves and scratches greater than .005 in.
- Inspect magnets for proper bonding to metal carrier.

Bearing Frame (228)

1. Visually inspect frame and frame foot for cracks.
2. Inspect for corrosion or pitting if frame has been exposed to pumpage.
3. Inspect frame bearing bores. The maximum acceptable bore is 2.836 in. (S-Group) and 3.544 in. (M-Group).
4. Inspect ball bearings for containment and damage.

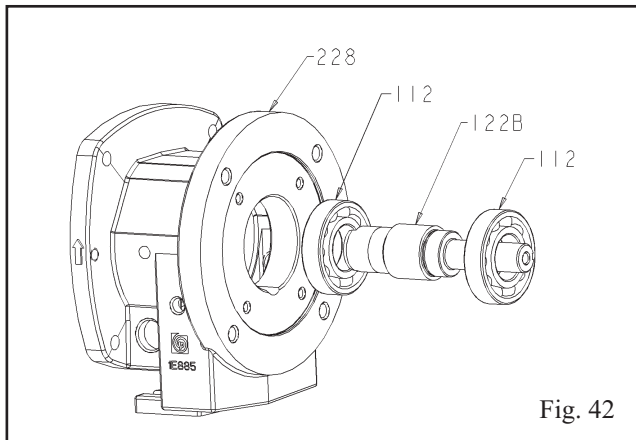
5. Make sure gasket surfaces are clean.
6. Visually inspect bearing end cover (109A) for cracks and pits. Gasket surface must be clean.
7. Inspect labyrinth seal O-rings (332A, 333D) for cuts and cracks.
8. Replace labyrinth seals if needed.

ASSEMBLY (Frame Mounted)

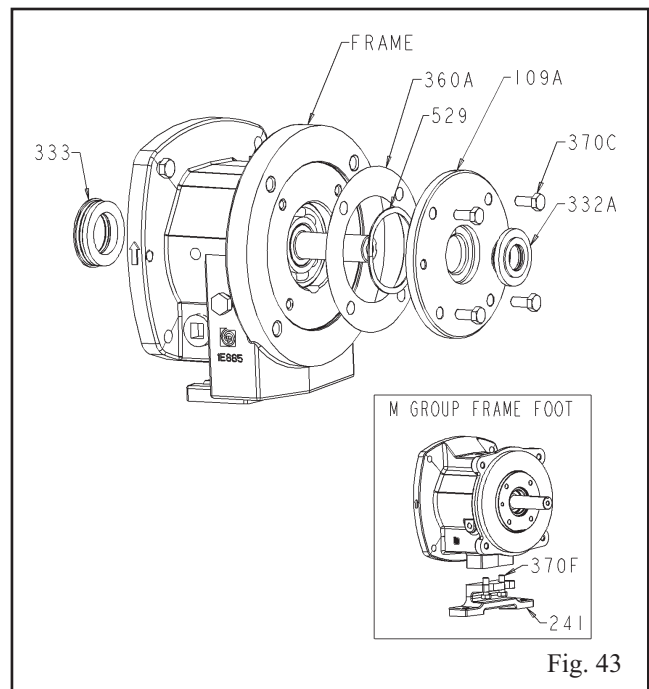
1. Press both radial ball bearings (112) onto the drive shaft (122B) (Fig. 42).

NOTE: There are several methods used to install bearings. The preferred method is to use an induction heater that heats as well as de-magnetizes the bearings.

2. Install the pre-assembled drive shaft into the bearing frame (228) from the motor side (Fig. 42).

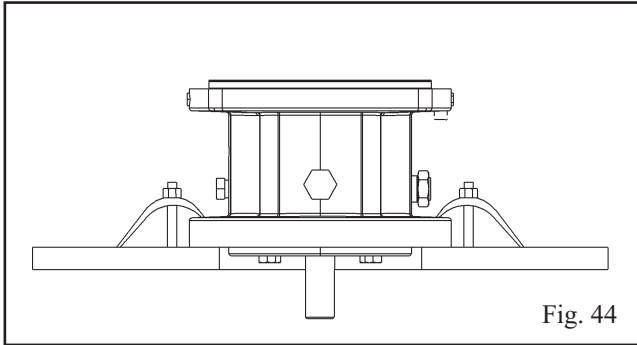


3. Insert wavy washer (529) (Fig. 43).
4. Insert end cover gasket (360A) into the bearing frame (Fig. 43).
5. Mount bearing end cover (109A) using the hex screws (370C) (Fig. 43).

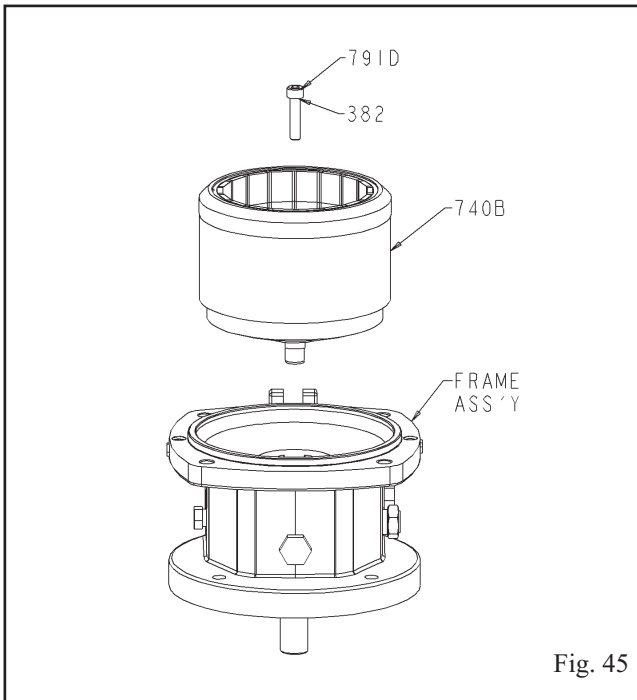


6. Press inboard labyrinth seal (333D) and outboard labyrinth seal (332A) into the corresponding bores on the bearing frame. Press them until they are fully seated in the bore. Make sure to keep the oil return slot on the inside of the seal at the 6 o'clock position (Fig. 43).
7. Mount bearing frame foot (241) with hex screws (370F) and lock-washers (M-Group only) (Fig. 43).

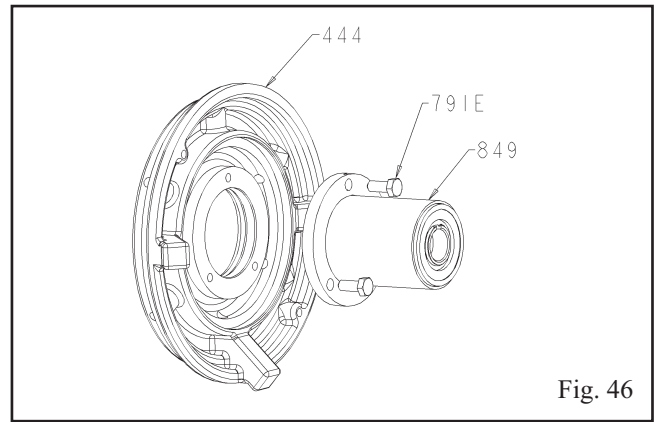
- Clamp the pre-assembled bearing frame assembly in a vice with the motor end of the shaft facing downwards (Fig. 44).



- Mount the drive magnet assembly (740B) onto the drive shaft so that the driver cams engage. Secure the drive magnet assembly using the lock-washer (382) and hex screw (791D) (Fig. 45).



- Insert the bearing cartridge (849) into the backplate (444) (Fig. 46).



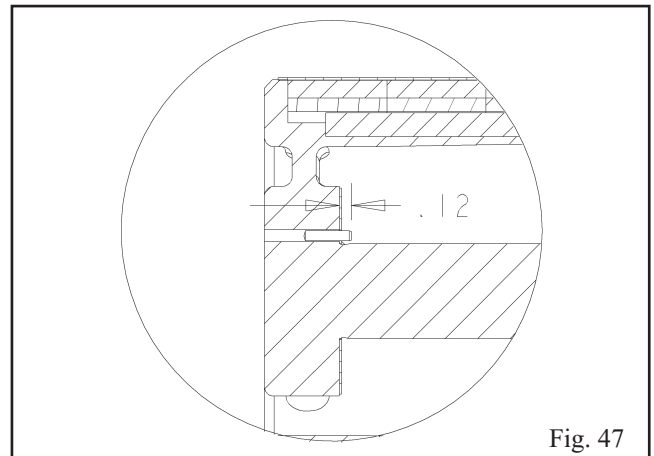
- Rotate the bearing cartridge until all three holes line up and secure with hex screws (791E) (Fig.46). Recommended torque values are shown in Table 9.

Description	Group	Ft-lbs (Nm) Dry	Ft-lbs (Nm) Std. Lube
Adapter to casing screws (Item 370)	S/M (M12)	65 (88)	49 (66)
	10" M (M16)	161 (219)	120 (164)
Impeller Nut (Item 304)	S	47 (64)	26 (35)
	M	116 (158)	52 (70)
Cartridge to Backplate Screws (Item 791E)	S/M	12 (16)	9 (12)

*Tighten in diametrically opposite sequence.

6

- If the driven carrier pin (445A) in the driven magnet assembly (740A) has to be replaced, drive it in carefully until it protrudes approximately 0.12" towards the impeller (M-Group only) (Fig. 47). The S-Group has a drive key, which is automatically positioned when installed.



- Cut out a small notch on the inside diameter of the intermediate ring gasket (351X) so that a recess for the driven carrier pin (445A) or key (depending on size) is produced (Fig. 48)

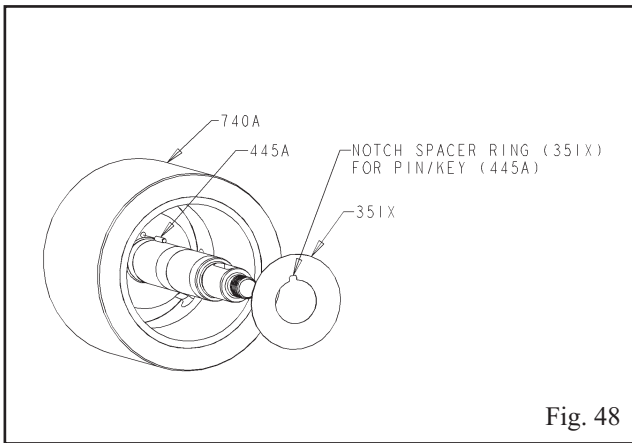


Fig. 48

- Apply some anti-seizing compound to the shaft and shaft threads.
- Mount the intermediate ring gasket (351X) on to the shaft of the driven magnet assembly (740A) (Fig. 49).
- Place the driven magnet assembly (740A) on the workbench and mount the pre-assembled bearing cartridge (849) and backplate (444) assembly onto the driven magnet assembly from above. Make sure the driven carrier pin or key (445A) engages the carrier groove in the bearing cartridge (849). The backplate can be turned slightly to help with alignment (Fig. 49).

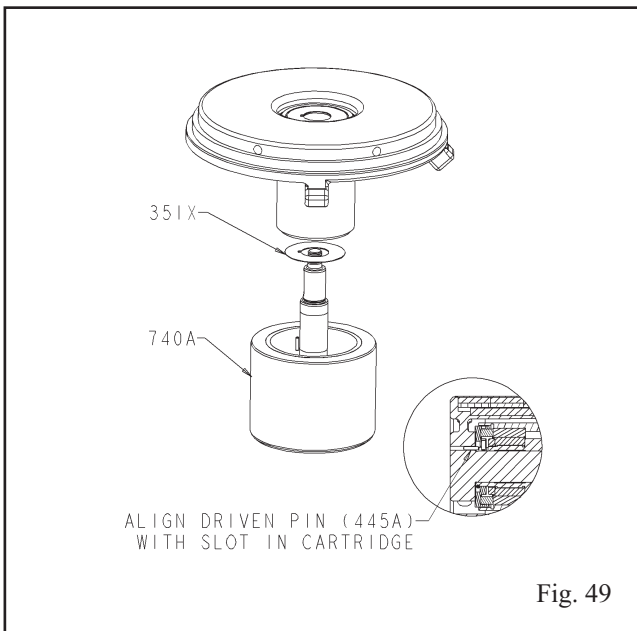


Fig. 49

- Mount the second intermediate ring gasket (351X) and distance washer (199) onto the drive shaft as shown (Fig. 50).
- Insert impeller key (178) into the key-slot on the shaft (Fig. 50).

- Mount the impeller (101) onto the shaft (Fig. 50).
- Insert the impeller nut o-ring (412A) into the groove on the backside of the impeller nut (304) (Fig. 50).

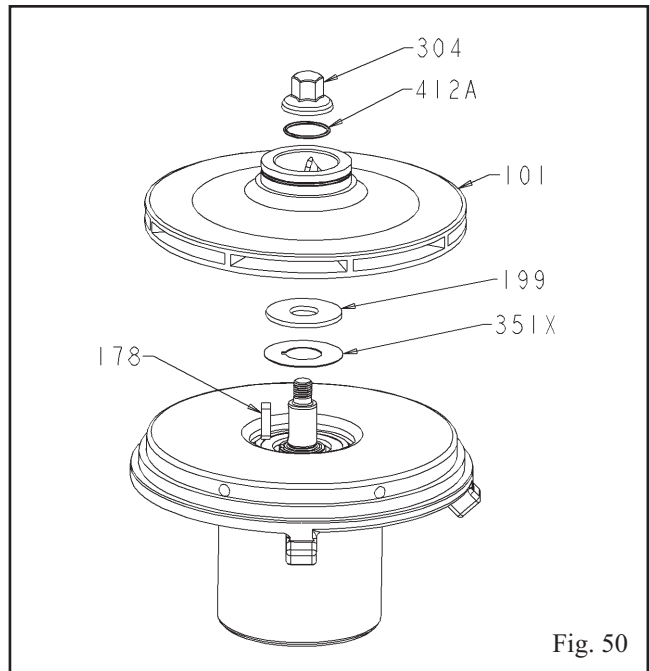


Fig. 50

- Secure the driven magnet assembly with a strap wrench and tighten the impeller nut to the torque rating specified in Table 9.

NOTE: At this point, the backplate (444) should rotate freely and easily by hand. When raising the backplate, a slight amount of axial play (up to approximately 0.040in) must be felt to ensure proper assembly. The axial play of the plain bearings is automatically set during assembly.

- Place the containment shell gasket (540N) and containment shell (750) onto the backplate (444) (Fig. 51).
- Screw either the three set screws (222E for the S-Group) or two connection screws (370V for the M-Group) of the adapter (108) into the backplate and tighten (Fig. 51). This holds the containment shell in place.
- Secure the casing (100) to the workbench with the suction flange facing downwards (Fig. 52).

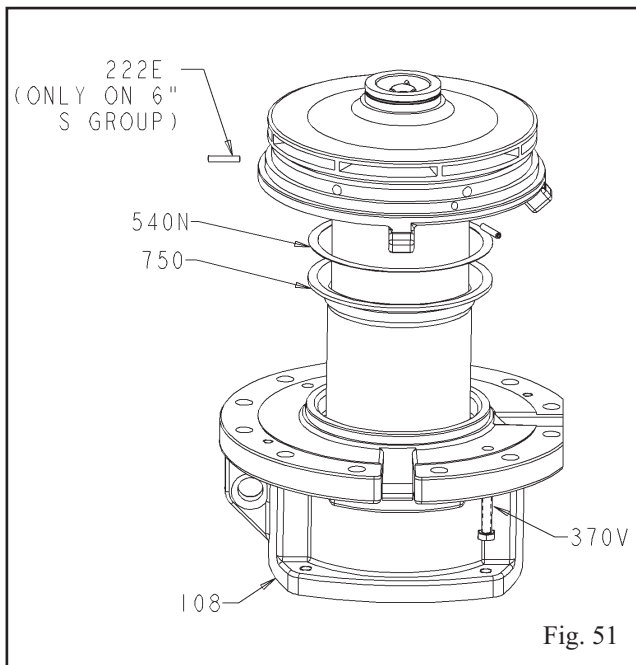


Fig. 51

25. Insert the casing gasket (351) into the casing (Fig. 52).
26. Insert the pre-assembled unit described above into the casing so that the crane hook of the adapter (108) faces the center of the discharge nozzle (Fig. 52).
27. Secure the adapter to the casing using hex cap screws (370) to the recommend torque rating specified in Table 9 (Fig. 52).

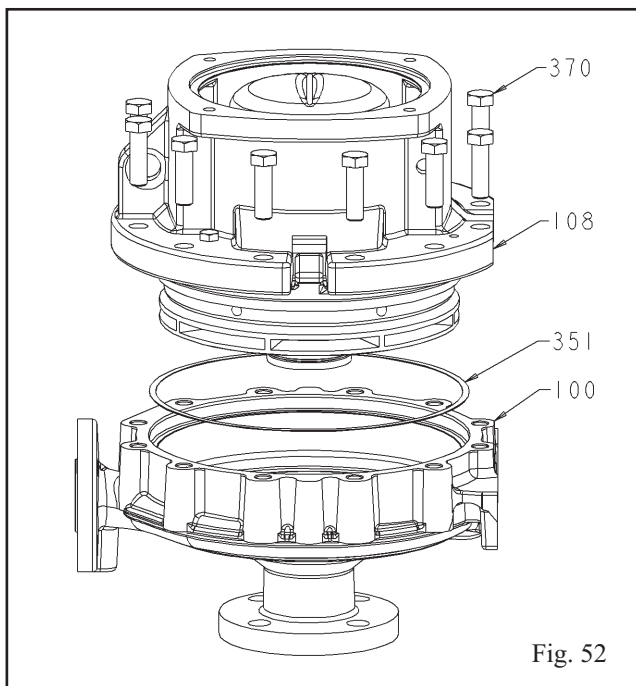


Fig. 52

28. Insert the gasket (360W) into the adapter (Fig. 53).
29. Place the bearing frame – drive magnet assembly already assembled on the workbench with the drive magnet facing downwards.
30. Screw a commercially available eye-bolt into the end of the drive shaft, size 3/8 inch.
31. Place the bearing frame assembly onto the adapter using a crane (Fig. 53).
32. Screw in hex cap screws (370B) to secure the bearing frame to the adapter (Fig. 53).
33. Turn the drive shaft by hand to ensure free rotation. Check by looking into the suction nozzle to make sure the impeller is rotating.

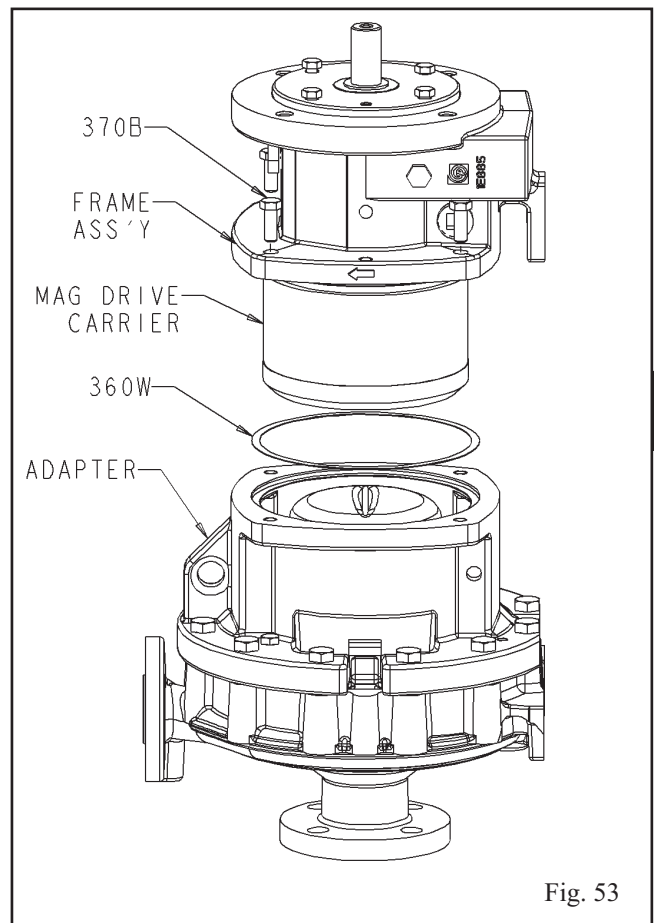
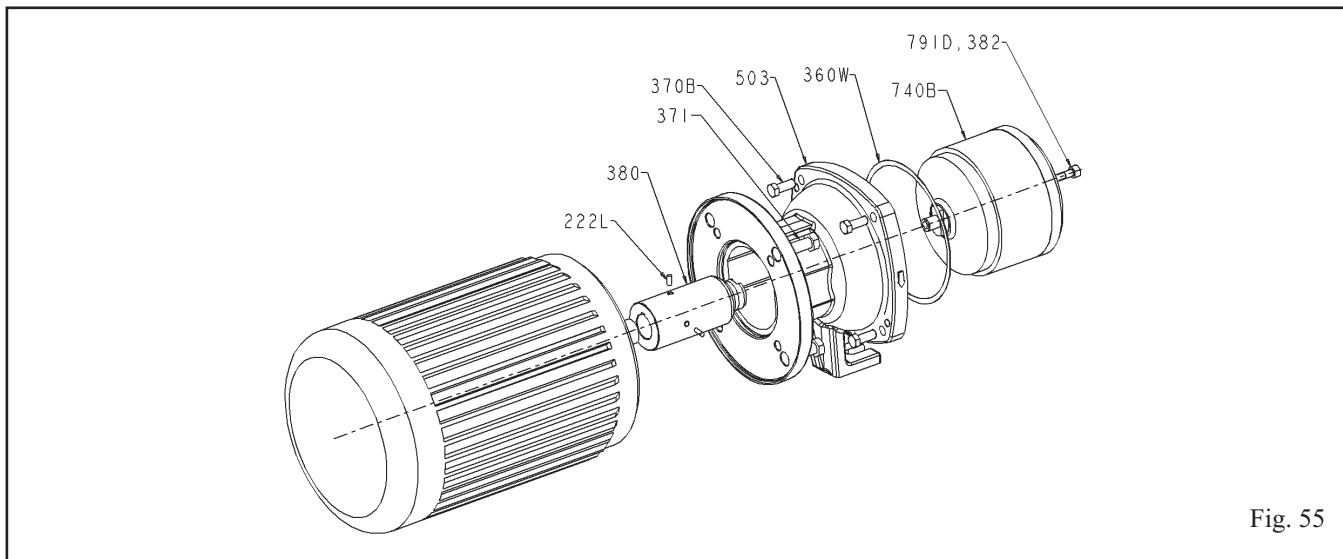
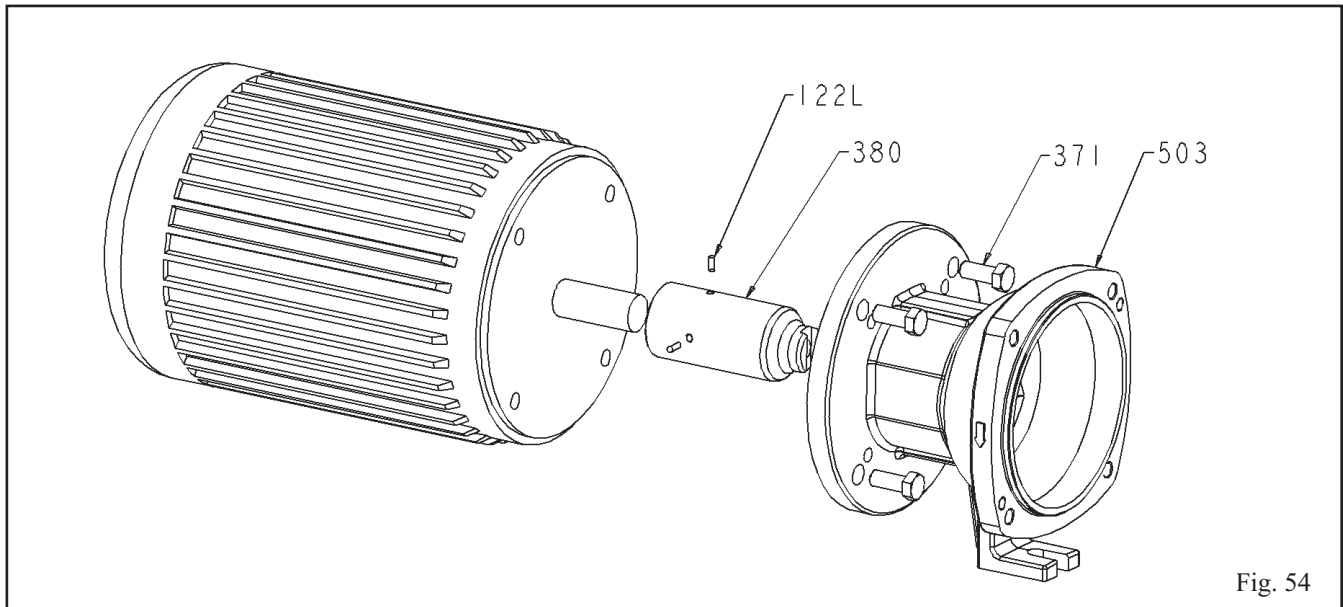


Fig. 53

ASSEMBLY (Close-Coupled)

1. Slide the stub shaft (122A) onto the motor shaft and secure it with the set screw (222L) (Fig. 54).
2. Mount the motor adapter (503) onto the motor using hex screws (371) (Fig. 54).
3. Mount the drive magnet (740B) onto the stub shaft (122A) so that the driver cams are fully engaged (Fig. 55).
4. Insert the lock-washer (382) and cap screw (791D) to secure the magnet to the shaft (Fig. 55).



Refer to Step 10 from above for assembly of the remaining pump.

Fig. 56 shows the final close-coupled pump assembly.

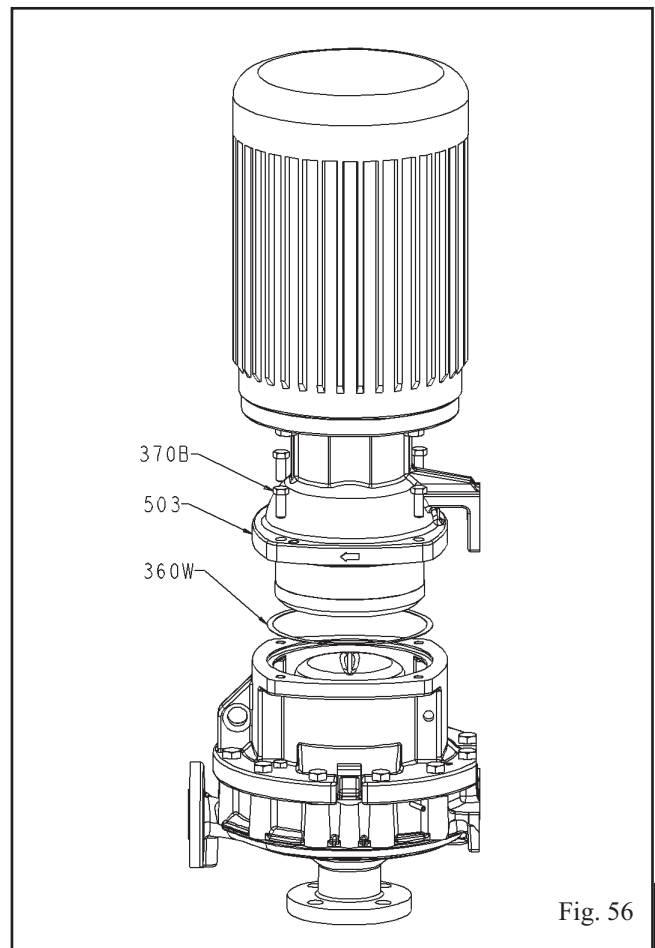
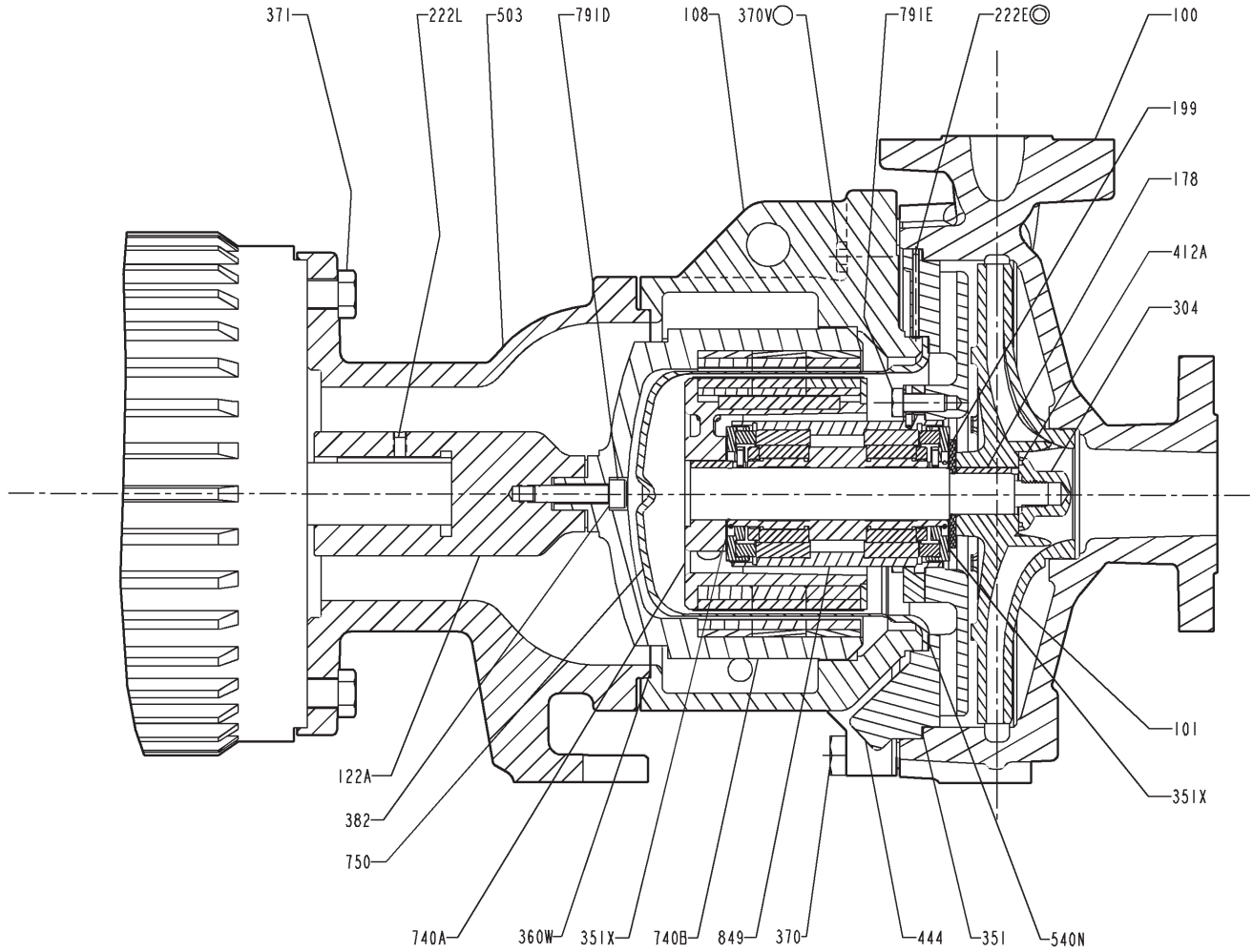


Fig. 56

**Cross Sectional Assembly Model 3296 EZMAG
Close Coupled S Group & 2x3-8 M Group
Stainless Steel Construction**



Parts List With Materials Of Construction

Model 3296 EZMAG Close Coupled S Group & 2x3-8 M Group

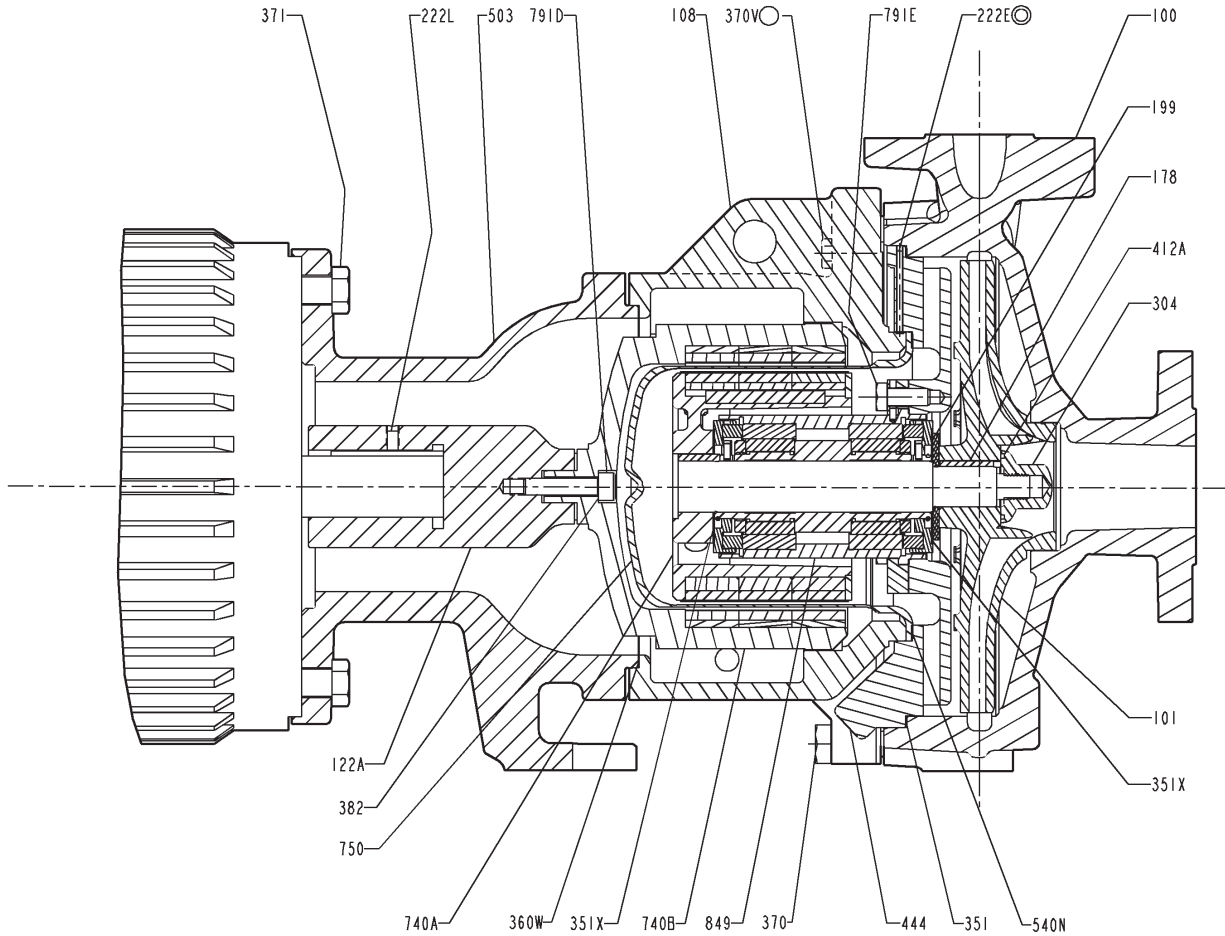
Stainless Steel Construction

Item No.	Qty	Part Name	Material
100	1	Casing	Stainless Steel (1.4408)
101	1	Impeller	Stainless Steel (1.4408)
108	1	Adapter, Frame	Ductile Iron
122A	1	Shaft, Stub	Steel 420 (1.4021)
178	1	Key, Impeller	303SS
199	1	Washer, Distance	Stainless Steel (1.4571)
222E	3	Screw, Set - Adapt to Backplate ⊗	Stainless Steel
222L	2	Screw, Set - Stub Shaft to Motor	Steel
304	1	Impeller Nut	Stainless Steel (1.4417)
351	1Ⓢ	Gasket, Backplate to Case	▲
351X	2Ⓢ	Spacer, Intermediate ring	Viton
360W	1Ⓢ	Gasket - Frame to Adapter	Aramid Fiber/EPDM
370	●	Hex Cap Scr - Adapt. to Case	Stainless Steel
370B	4	Hex Cap Scr - Frame to Adapt ⊕	Steel
370V	2	Hex Cap Scr - Adapt to Backplate ○	Stainless Steel
371	4	Hex Cap Scr - Motor to Adapter	Steel
382	1	Lockwasher, Internal Tooth	Steel
412A	1	O-ring, Impeller Nut	Teflon
444	1	Backplate	Stainless Steel (1.4408)
503	1	Adapter, Close Coupled	Cast Iron
540N	1	Gasket, Containment Shell	▲
740A	1Ⓢ	Carrier Assy, Driven	Duplex SS/NdFeB (1.4517)
740B	1Ⓢ	Carrier Assy., Drive	Ductile Iron/NdFeB (0.7043)
750	1Ⓢ	Shell, Containment	Hastelloy C (2.4610)
791D	1	Soc Hd. Cap Scr - Drive to Shaft	Steel
791E	3	Hex Cap Scr - Cart. To Backplate	Stainless Steel
849	1Ⓢ	Bearing Cartridge Assembly	Duplex SS/SSiC
		□ (Standard) Silicon Carbide	
		□(Optional) Dryguard Silicon Carbide	
High Temperature Option Components			
740A	1Ⓢ	Carrier Assembly, Driven	Duplex SS/SmCo (1.4517)
740B	1Ⓢ	Carrier Assembly, Drive	Ductile Iron/SmCo (0.7043)
849	1Ⓢ	High Temp Bearing Cartridge Assembly	Duplex SS/SSiC
		□(Standard) Silicon Carbide	
		□(Optional) Dryguard Silicon Carbide	

6

- ⊗ Only on 6" Size Pumps
- Only on 8" Size Pumps
- ⊕ Items Not Illustrated
- Qty. 8 for 6" Pumps
- Qty. 12 for 8" Pumps
- ▲ Optional Gasket Material
 - Aramid Fiber / EPDM (Standard)
 - White Gylon (Optional)
 - Fawn Gylon (Optional)
- Ⓢ Recommended Spare Parts

Cross Sectional Assembly Model 3296 EZMAG Close Coupled S Group & 2x3-8 M Group Hastelloy-C



Parts List With Materials Of Construction

Model 3296 EZMAG Close Coupled S Group & 2x3-8 M Group

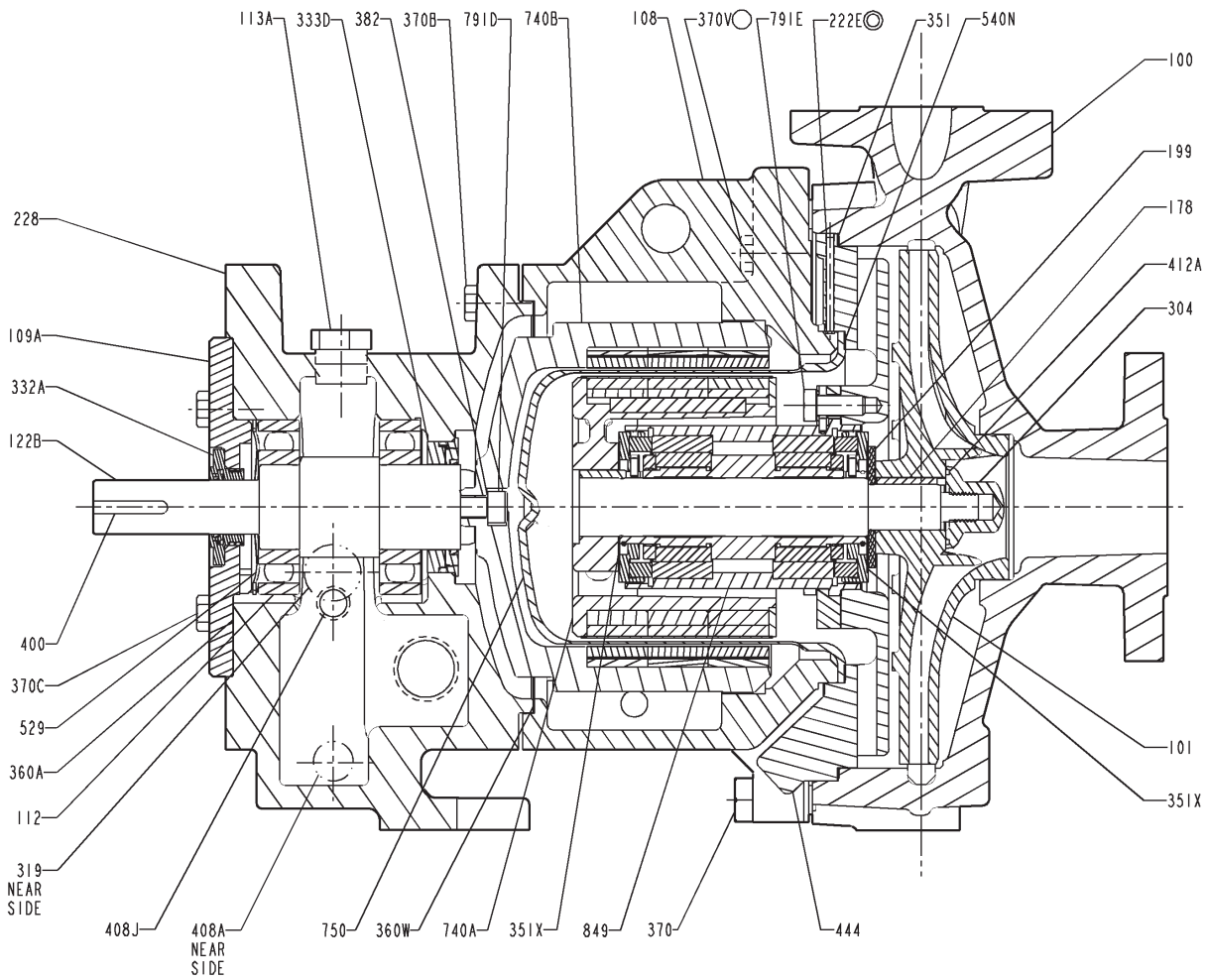
Hastelloy-C

Item No.	Qty	Part Name	Material
100	1	Casing	Hastelloy-C(2.4686)
101	1	Impeller	Hastelloy-C (2.4686)
108	1	Adapter, Frame	Ductile Iron
122A	1	Shaft, Stub	Steel 420 (1.4021)
178	1	Key, Impeller	Hastelloy-C
199	1	Washer, Distance	Hastelloy-C (2.4610)
222E	3	Screw, Set - Adapt to Backplate ⊗	Stainless Steel
222L	2	Screw, Set - Stub Shaft to Motor	Steel
304	1	Impeller Nut	Hastelloy-C (2.4610)
351	1 ⊗	Gasket, Backplate to Case	▲
351X	2 ⊗	Spacer, Intermediate ring	Viton
360W	1 ⊗	Gasket - Frame to Adapter	Aramid Fiber/EPDM
370	●	Hex Cap Scr - Adapt. to Case	Stainless Steel
370B	4	Hex Cap Scr - Frame to Adapt ⊕	Steel
370V	2	Hex Cap Scr - Adapt to Backplate ○	Stainless Steel
371	4	Hex Cap Scr - Motor to Adapter	Steel
382	1	Lockwasher, Internal Tooth	Steel
412A	1	O-ring. Impeller Nut	Teflon
444	1	Backplate	Hastelloy-C (2.4686)
503	1	Adapter, Close Coupled	Cast Iron
540N	1	Gasket, Containment Shell	▲
740A	1 ⊗	Carrier Assy, Driven	Hast-C/NdFeB (2.4686)
740B	1 ⊗	Carrier Assy., Drive	Ductile Iron/NdFeB (0.7043)
750	1 ⊗	Shell, Containment	Hastelloy C (2.4610)
791D	1	Soc Hd. Cap Scr - Drive to Shaft	Steel
791E	3	Hex Cap Scr - Cart. To Backplate	Hastelloy-C
849	1 ⊗	Bearing Cartridge Assy	Hast-C/SSiC
		□(Standard) Silicon Carbide	
		□(Optional) Dryguard Silicon Carbide	
High Temperature Option Components			
740A	1 ⊗	Carrier Assembly, Driven	Hast-C/SmCo (2.4686)
740B	1 ⊗	Carrier Assembly, Drive	Ductile Iron/SmCo (0.7043)
849	1 ⊗	High Temp Bearing Cartridge Assembly	Hast-C/SSiC
		□(Standard) Silicon Carbide	
		□(Optional) Dryguard Silicon Carbide	

6

- ⊗ Only on 6" Size Pumps
- Only on 8" Size Pumps
- ⊕ Items Not Illustrated
- Qty. 8 for 6" Pumps
- Qty. 12 for 8" Pumps
- ▲ Optional Gasket Material
 - Aramid Fiber / EPDM (Standard)
 - White Gylon (Optional)
 - Fawn Gylon (Optional)
- Ⓢ Recommended Spare Parts

Cross Sectional Assembly Model 3296 EZMAG S Group w/ Bearing Frame — Stainless Steel



Parts List With Materials Of Construction

Model 3296 EZMAG S Group w/ Bearing Frame — Stainless Steel

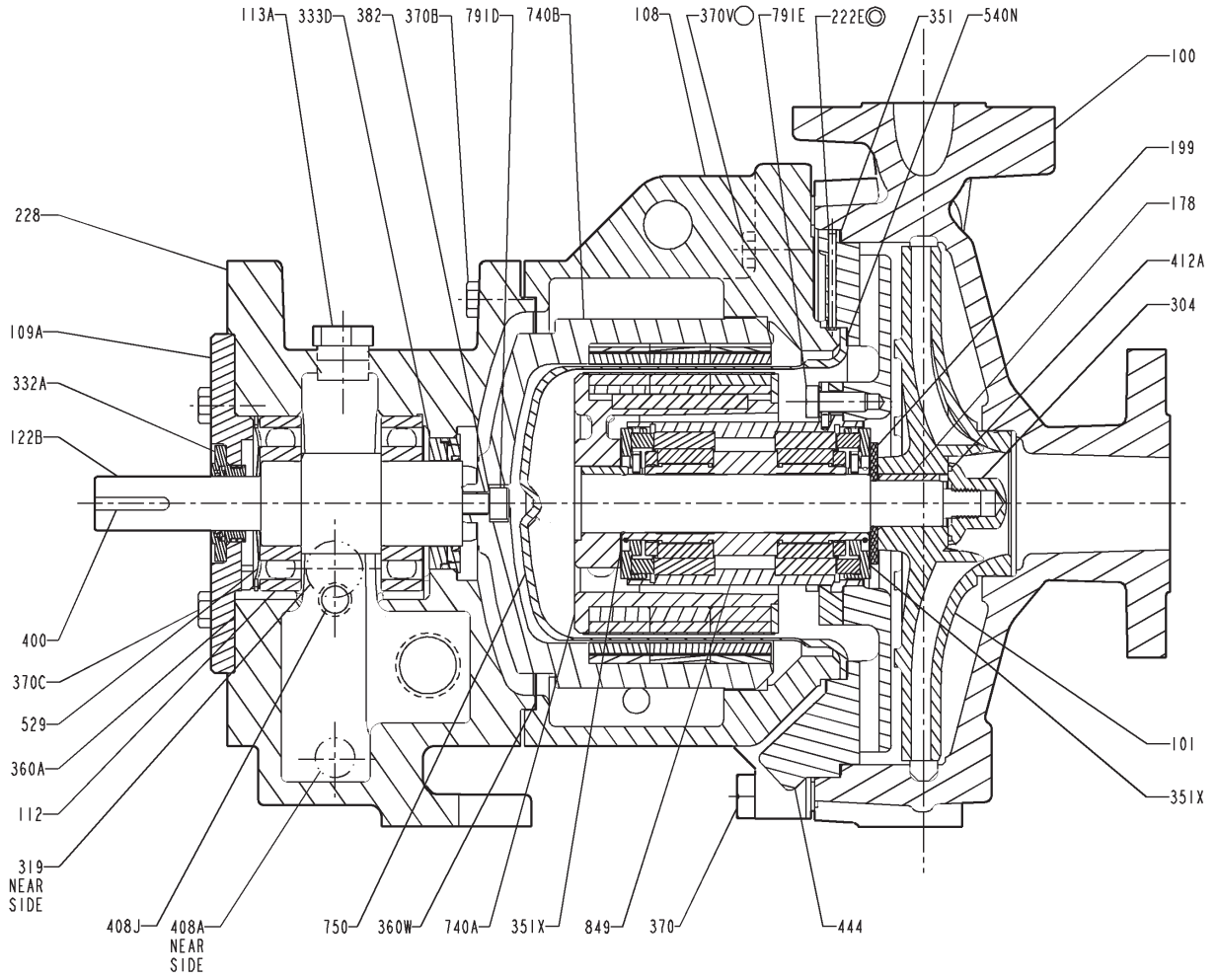
Item Number	Qty	Part Name	Material
100	1	Casing	Stainless Steel (1.4408)
101	1	Impeller	Stainless Steel (1.4408)
108	1	Adapter, Frame	Ductile Iron
109A	1	End Cover, Frame	Ductile Iron
112	2⊙	Ball Bearing	Steel
113A	1	Plug, Fill	Steel
122B	1	Shaft, Drive	Steel 4140
178	1	Key Impeller	303SS
199	1	Washer, Distance	Stainless Steel (1.4571)
228	1	Frame, Bearing	Cast Iron
222E	3	Screw, Set - Adapt to Backplate ⊙	Steel
304	1	Impeller Nut	Stainless Steel (1.4417)
319	1	Sight Window	Steel/Glass
332A	1	Seal, Labyrinth Oil - Coupling end	Bronze
333D	1	Seal, Labyrinth Oil - Radial end	Bronze
351	1⊙	Gasket, Backplate to Case	▲
351X	2⊙	Spacer, Intermediate ring	Viton
360A	1⊙	Gasket End Cover	Vellumiod
360W	1⊙	Gasket - Frame to Adapter	Aramid Fiber/EPDM
370	●	Hex Cap Scr - Adapt. to Case	Steel
370B	4	Hex Cap Scr - Frame to Adapt	Steel
390C	4	Hex Cap Scr - End Cover	Steel
370V	2	Hex Cap Scr - Adapt to Backplate ○	Steel
382	1	Lockwasher, Internal Tooth	Steel
400	1	Key Coupling	Steel
408A	1	Plug, Drain	Steel
408J	1	Plug, Oiler	Steel
412A	1	O-ring, Impeller Nut	Teflon
444	1	Backplate	Stainless Steel (1.4408)
529	1	Washer, Wave	Steel
540N	1	Gasket, Containment Shell	▲
740A	1⊙	Carrier Assy, Driven	Duplex SS/NdFeB (1.4517)
740B	1⊙	Carrier Assy., Drive	Ductile Iron/NdFeB (0.7043)
750	1⊙	Shell, Containment	Hastelloy C (2.4610)
791D	1	Soc Hd. Cap Scr - Drive to Shaft	Steel
791E	3	Hex Cap scr - Cart. To Backplate	Stainless Steel
849	1⊙	Bearing Cartridge Assy	Duplex SS/SSiC
		□(Standard) Silicon Carbide	
		□(Optional) Dryguard Silicon Carbide	

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High Temp Components			
740A	1⊙	Carrier Assy., Driven	Duplex SS/SmCo (1.4517)
740B	1⊙	Carrier Assy., Drive	Ductile Iron/SmCo (0.7043)
849	1⊙	High Temp Bearing Cartridge Assy	Duplex SS/SSiC
		□(Standard) Silicon Carbide	
		□(Optional) Dryguard Silicon Carbide	

⊙	Only on 6" Size Pumps	▲	Optional Gasket Material
○	Only on 8" Size Pumps	□	Aramid Fiber / EPDM (Standard)
●	Qty. 8 for 6" Pumps	□	White Gylon (Optional)
●	Qty. 12 for 8" Pumps	□	Fawn Gylon (Optional)
⊙		⊙	Recommended Spare Parts

Cross Sectional Assembly Model 3296 EZMAG S Group w/ Bearing Frame — Hastelloy-C



Parts List with Materials of Construction Cross Sectional Assembly Model 3296 EZMAG S Group w/ Bearing Frame — Hastelloy-C

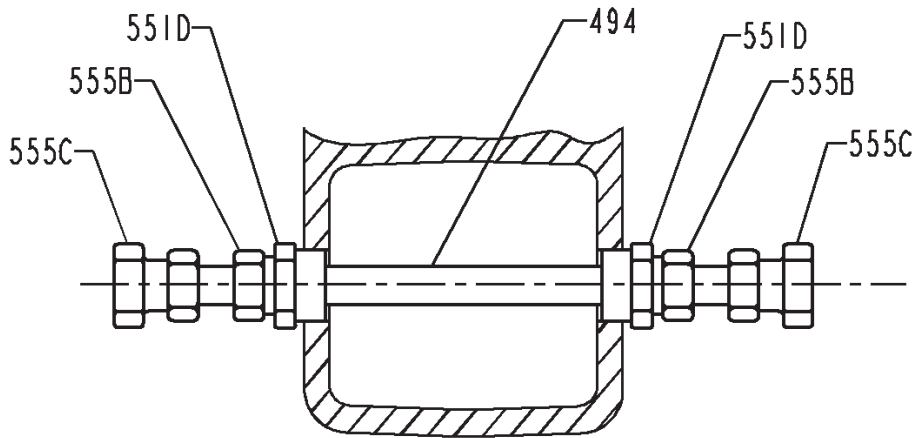
Item Number	Qty	Part Name	Material
100	1	Casing	Hastelloy-C(2.4686))
101	1	Impeller	Hastelloy-C (2.4686)
108	1	Adapter, Frame	Ductile Iron
109A	1	End Cover, Frame	Ductile Iron
112	2 [Ⓢ]	Ball Bearing	Steel
113A	1	Plug, Fill	Steel
122B	1	Shaft, Drive	Steel 4140
178	1	Key, Impeller	Hastelloy-C
199	1	Washer, Distance	Hastelloy-C (2.4610)
228	1	Frame, Bearing	Cast Iron
222E	3	Screw, Set - Adapt to Backplate ¥	Steel
304	1	Impeller Nut	Hastelloy-C (2.4610)
319	1	Sight Window	Steel/Glass
332A	1	Seal, Labyrinth Oil - Coupling end	Bronze
333D	1	Seal Labyrinth Oil - Radial end	Bronze
351	1 [Ⓢ]	Gasket, Backplate to Case	▲
351X	2 [Ⓢ]	Spacer, Intermediate ring	Viton
360A	1 [Ⓢ]	Gasket - End Cover	Vellumiod
360W	1 [Ⓢ]	Gasket - Frame to Adapter	Aramid Fiber/EPDM
370	●	Hex Cap Scr - Adapt. to Case	Steel
370B	4	Hex Cap Scr - Frame to Adapt	Steel
370C	4	Hex Cap Scr - End Cover	Steel
370V	2	Hex Cap Scr - Adapt to Backplate ϕ	Steel
382	1	Lockwasher, Internal Tooth	Steel
400	1	Key, Coupling	Steel
408A	1	Plug, Drain	Steel
408J	1	Plug, Oiler	Steel
412A	1	O-ring, Impeller Nut	Teflon
444	1	Backplate	Hastelloy-C (2.4686)
529	1	Washer Wave	Steel
540N	1	Gasket, Containment Shell	▲
740A	1 [Ⓢ]	Carrier Assy, Driven	Hast-C/NdFeB (2.4686))
740B	1 [Ⓢ]	Carrier Assy., Drive	Ductile Iron/NdFeB (0.7043)
750	1 [Ⓢ]	Shell, Containment	Hastelloy C (2.4610)
791D	1	Soc Hd. Cap Scr - Drive to Shaft	Steel
791E	3	Hex Cap Scr - Cart. To Backplate	Hastelloy-C
849	1 [Ⓢ]	Bearing Cartridge Assy	Hast-C/SSiC
		□(Standard) Silicon Carbide	
		□(Optional) Dryguard Silicon Carbide	
High Temperature Option Components			
740A	1 [Ⓢ]	Carrier Assembly, Driven	Hast-C/SmCo (1.4517)
740B	1 [Ⓢ]	Carrier Assembly, Drive	Ductile Iron/SmCo (0.7043)
849	1 [Ⓢ]	High Temp Bearing Cartridge Assembly	Hast-C/SSiC
		□(Standard) Silicon Carbide	
		□(Optional) Dryguard Silicon Carbide	

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- Ⓢ Only on 6" Size Pumps
- Only on 8" Size Pumps
- Qty. 8 for 6" Pumps
- Qty. 12 for 8" Pumps
- ▲ Optional Gasket Material
 - Aramid Fiber / EPDM (Standard)
 - White (Optional)
 - Fawn Gylon (Optional)
- Ⓢ Recommended Spare Parts

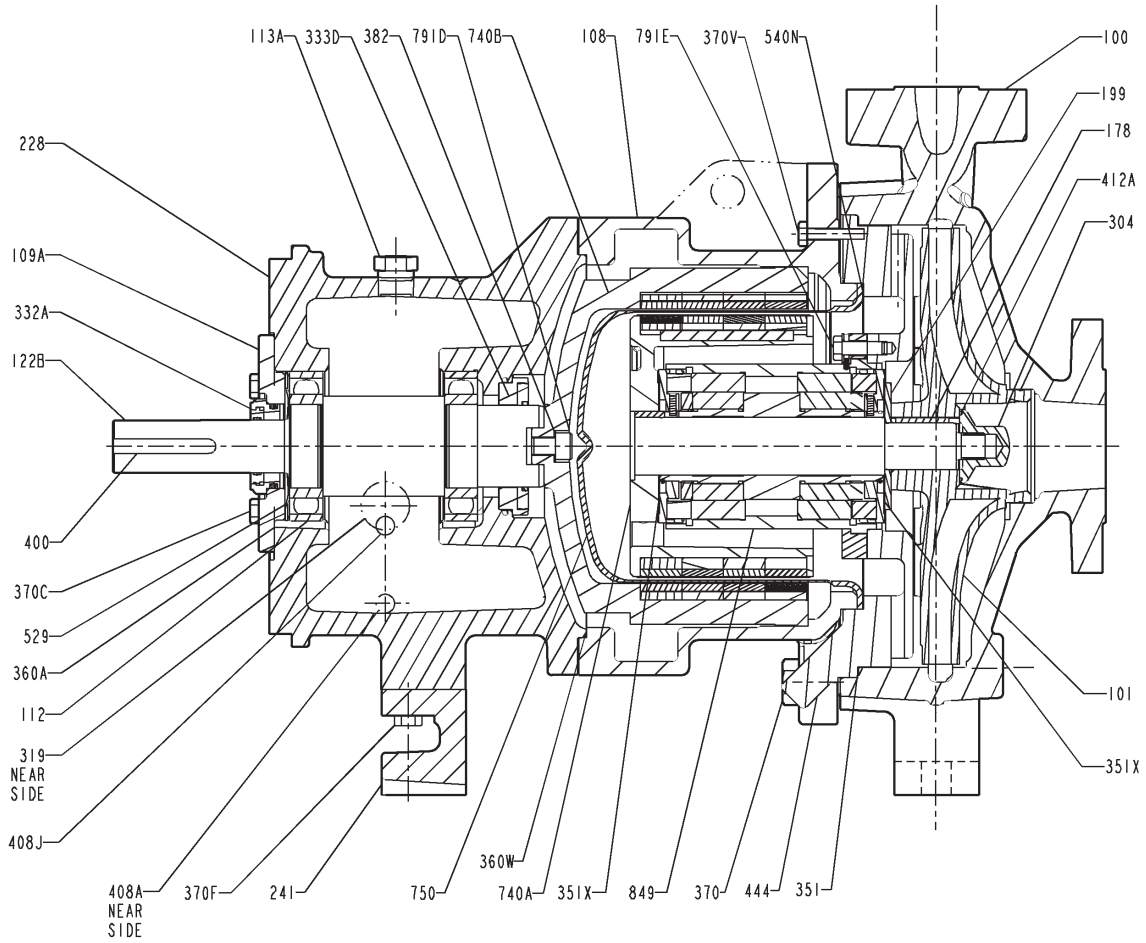
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Cross Sectional Model 3296 EZMAG Frame Cooling Options



Item	Qty	Part Name	Material
494	2	Tube, Cooling	Stainless Steel
555B	2	Tube, Thermocouple Fitting	Stainless Steel
555C	2	Tube Fitting Str	Brass
551D	1	Hex Bushing	Iron

Cross Sectional Assembly Model 3296 EZMAG M Group, w/ Bearing Frame Stainless Steel



Parts List with Materials Of Construction

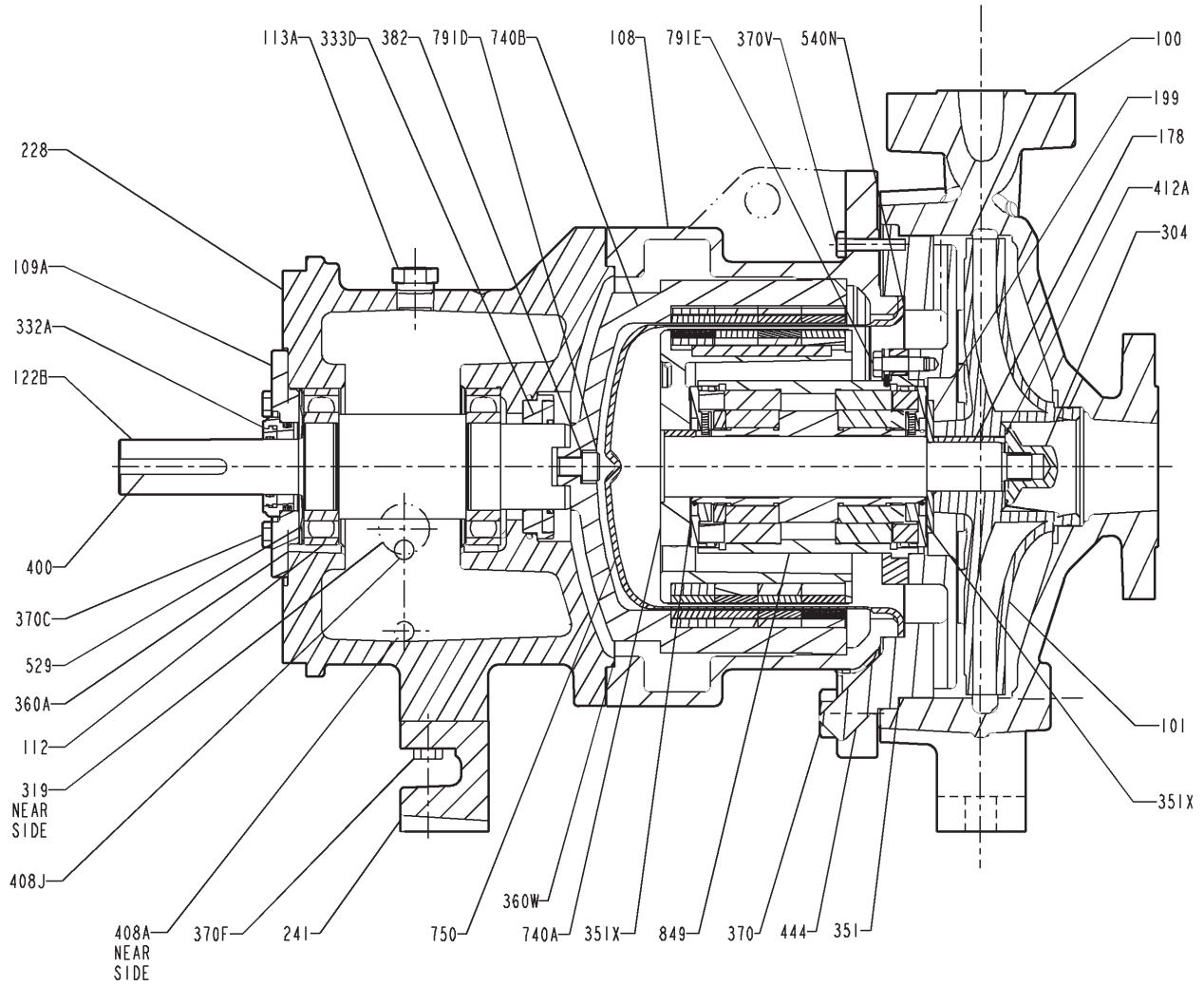
Model 3296 EZMAG M Group w/ Bearing Frame — Stainless Steel

Item No.	Qty	Part Name	Material
100	1	Casing	Stainless Steel (1.4408)
101	1	Impeller	Stainless Steel (1.4408)
108	1	Adapter, Frame	Ductile Iron
109A	1	End Cover, Frame	Ductile Iron
112	2 [Ⓢ]	Ball Bearing	Steel
113A	1	Plug, Fill	Steel
122B	1	Shaft, Drive	Steel 4140
178	1	Key, Impeller	303SS
199	1	Washer, Distance	Stainless Steel (1.4571)
228	1	Frame, Bearing	Cast Iron
241	1	Foot, Frame	Cast Iron
304	1	Impeller Nut	Stainless Steel (1.4417)
319	1	Sight Window	Steel/Glass
332A	1	Seal, Labyrinth Oil - Coupling end	Bronze
333D	1	Seal, Labyrinth Oil - Radial end	Bronze
351	1 [Ⓢ]	Gasket, Backplate to Case	▲
351X	2 [Ⓢ]	Spacer, Intermediate ring	Viton
360A	1 [Ⓢ]	Gasket End Cover	Vellumiod
360W	1 [Ⓢ]	Gasket - Frame to Adapter	Aramid Fiber/EPDM
370	●	Hex Cap Scr - Adapt. to Case	Steel
370B	4	Hex Cap Scr - Frame to Adapt	Steel
370C	4	Hex Cap Scr - End Cover	Steel
370F	2	Hex Cap Scr - Foot to Frame	Steel
370V	2	Hex Cap Scr - Adapt to Backplate	Steel
382	1	Lockwasher, Internal Tooth	Steel
400	1	Key Coupling	Steel
408A	1	Plug, Drain	Steel
408J	1	Plug, Oiler	Steel
412A	1	O-ring, Impeller Nut	Teflon
444	1	Backplate	Stainless Steel (1.4408)
529	1	Washer, Wave	Steel
540N	1	Gasket, Containment Shell	▲
740A	1 [Ⓢ]	Carrier Assy, Driven	Duplex SS/NdFeB (1.4517)
740B	1 [Ⓢ]	Carrier Assy., Drive	Ductile Iron/NdFeB (0.7043)
750	1 [Ⓢ]	Shell, Containment	Hastelloy C (2.4610)
791D	1	Soc Hd. Cap Scr - Drive to Shaft	Steel
791E	3	Hex Cap Scr - Cart. To Backplate	Stainless Steel
849	1 [Ⓢ]	Bearing Cartridge Assy	Duplex SS/SSiC
		<input type="checkbox"/> Silicon Carbide (Standard)	
		<input type="checkbox"/> Dryguard Silicon Carbide (Optional)	
High Temperature Option Components			
740A	1 [Ⓢ]	Carrier Assembly, Driven	Duplex SS/SmCo (1.4517)
740B	1 [Ⓢ]	Carrier Assembly, Drive	Ductile Iron/SmCo (0.7043)
849	1 [Ⓢ]	High Temp Bearing Cartridge Assembly	Duplex SS/SSiC
		<input type="checkbox"/> Silicon Carbide (Standard)	
		<input type="checkbox"/> Dryguard Silicon Carbide (Optional)	

6

- Qty. 12 for 2x3-8, 3x4-7 & 3x4-8G
- Qty. 8 for 1x2-10, 2x3-10 & 3x4-10
- ▲ Optional Gasket Material
 - Aramid Fiber / EPDM (Standard)
 - White Gylon (Optional)
 - Fawn Gylon (Optional)
- Ⓢ Recommended Spare Parts

Cross Sectional Assembly Model 3296 EZMAG M Group, w/Bearing Frame Hastelloy-C



Parts List with Materials Of Construction 3296 EZMAG M Group, w/ Bearing Frame — Hastelloy-C

Item No.	Qty	Part Name	Material
100	1	Casing	Hastelloy-C(2.4686)
101	1	Impeller	Hastelloy-C (2.4686)
108	1	Adapter, Frame	Ductile Iron
109A	1	End Cover, Frame	Ductile Iron
112	2 [Ⓢ]	Ball Bearing	Steel
113A	1	Plug, Fill	Steel
122B	1	Shaft, Drive	Steel 4140
178	1	Key Impeller	Hastelloy-C
199	1	Washer, Distance	Hastelloy-C (2.4610)
228	1	Frame, Bearing	Cast Iron
241	1	Foot Frame	Cast Iron
304	1	Impeller Nut	Hastelloy-C (2.4610)
319	1	Sight Window	Steel/Glass
332A	1	Seal, Labyrinth Oil - Coupling end	Bronze
333D	1	Seal Labyrinth Oil - Radial end	Bronze
351	1 [▲]	Gasket, Backplate to Case	▲
351X	2 [Ⓢ]	Spacer, Intermediate ring	Viton
360A	1 [Ⓢ]	Gasket - End Cover	Vellumiod
360W	1 [Ⓢ]	Gasket - Frame to Adapter	Aramid Fiber/EPDM
370	●	Hex Cap Scr - Adapt. to Case	Stainless Steel
370B	4	Hex Cap Scr - Frame to Adapt	Steel
370C	4	Hex Cap Scr - End Cover	Steel
370F	2	Hex Cap Scr - Foot to Frame	Steel
370V	2	Hex Cap Scr - Adapt to Backplate	Stainless Steel
382	1	Lockwasher, Internal Tooth	Steel
400	1	Key, Coupling	Steel
408A	1	Plug, Drain	Steel
408J	1	Plug, Oiler	Steel
412A	1	O-ring, Impeller Nut	Teflon
444	1	Backplate	Hastelloy-C (2.4686)
529	1	Washer Wave	Steel
540N	1	Gasket, Containment Shell	▲
740A	1 [Ⓢ]	Carrier Assy, Driven	Hast-C/NdFeB (2.4686)
740B	1 [Ⓢ]	Carrier Assy., Drive	Ductile Iron/NdFeB (0.7043)
750	1 [Ⓢ]	Shell, Containment	Hastelloy C (2.4610)
791D	1	Soc Hd. Cap Scr - Drive to Shaft	Steel
791E	3	Hex Cap scr - Cart. To Backplate	Hastelloy-C
849	1 [Ⓢ]	Bearing Cartridge Assy	Hast-C/SSiC
		<input type="checkbox"/> (Standard) Silicon Carbide	
		<input type="checkbox"/> (Optional) Dryguard Silicon Carbide	
High Temperature Option Components			
740A	1 [Ⓢ]	Carrier Assembly, Driven	Hast-C/SmCo (2.4686)
740B	1 [Ⓢ]	Carrier Assembly, Drive	Ductile Iron/SmCo (0.7043)
849	1 [Ⓢ]	High Temp Bearing Cartridge Assembly	Hast-C/SSiC
		<input type="checkbox"/> (Standard) Silicon Carbide	
		<input type="checkbox"/> (Optional) Dryguard Silicon Carbide	

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- Qty. 12 for 2x3-8, 3x4-7 & 3x4-8G
- Qty. 8 for 1x2-10, 2x3-10 & 3x4-10
- ▲ Optional Gasket Material
 - Aramid Fiber / EPDM (Standard)
 - White Gylon (Optional)
 - Fawn Gylon (Optional)
- Ⓢ Recommended Spare Parts

SPARE AND REPAIR PARTS

RECOMMENDED SPARES 63
INTERCHANGEABILITY 64
RETURN OF MATERIALS 66

When ordering parts, always refer to part name, Goulds Serial No., and indicate Item No. from the sectional drawing.

RECOMMENDED SPARES

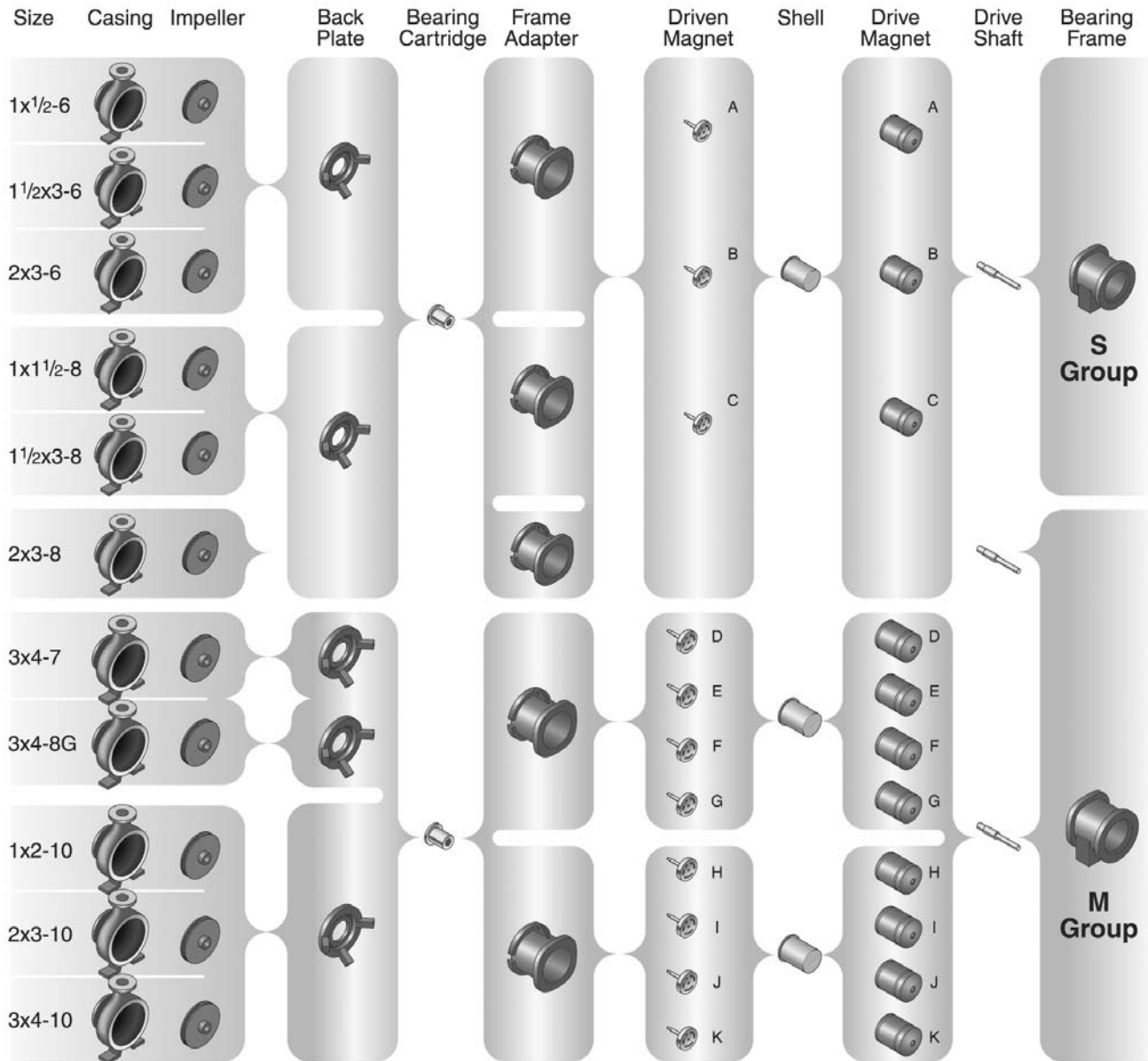
Part	Material	Item	Qty.
Gasket, Backplate to Case	Aramid Fiber with EPDM Rubber	351	1
Ball Bearing	Steel	112	2
Spacer, Intermediate Ring	Grafoil	351X	2
Gasket, End Cover	Vellumoid	360A	1
Gasket, Frame to Adapter	Aramid Fiber with EPDM Rubber	360W	1
Carrier Assembly, Driven	Duplex SS/NdFeB	740A	1
Carrier Assembly, Drive	Ductile Iron/NdFeB	740B	1
Containment Shell	Hast-C	750	1
Bearing Cartridge Assembly	Duplex SS/SSiC	849	1

PARTS

- Impeller (101)
- Impeller Nut and O-Ring (304, 412A)
- Impeller Key (178)
- Driven Magnet Assembly (740A)
- Drive Magnet Assembly (740B)
- Containment Shell (750)
- Driven Shaft (122B)
- Labyrinth Oil Seals (332A, 333D)

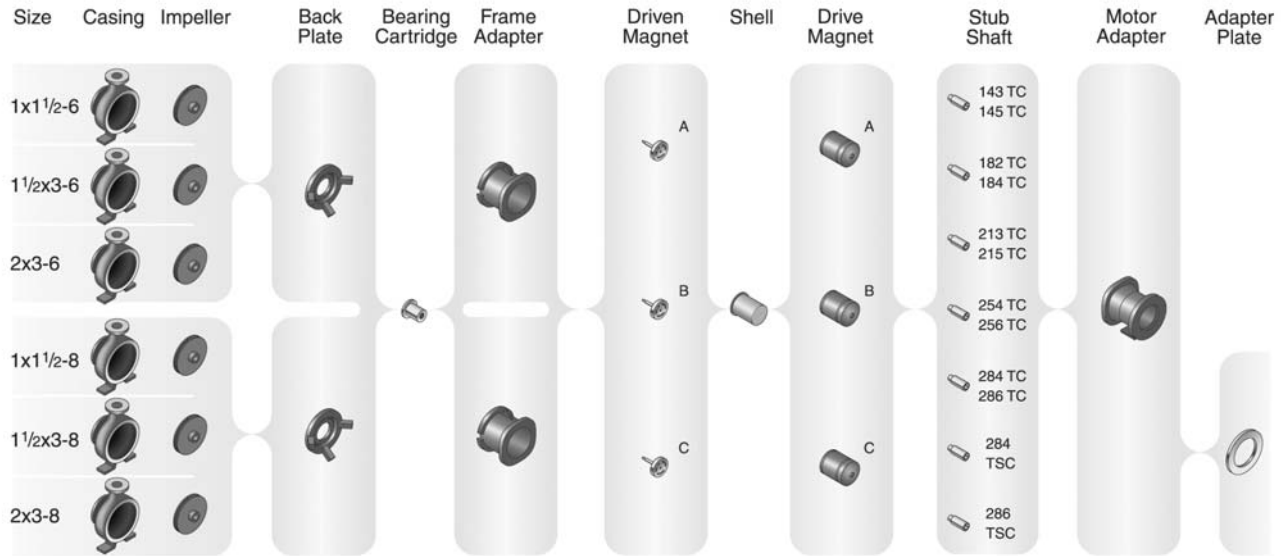
INTERCHANGEABILITY - Frame Mounted

3296 EZMAG



INTERCHANGEABILITY - Close Coupled

3296 EZMAG



RETURN OF MATERIALS

If it is necessary to return the pump to a Goulds factory or repair facility for service, certain procedures must be followed.

Do not return any parts without authorization from the warranty engineer, a warranty claim number, and the preprinted shipping label supplied by Goulds. In rare instances because of the pumpage, ITT Goulds Pumps Warranty Services may, at their option, decide not to have the parts returned.

The parts being returned must be decontaminated prior to shipment. The decontamination must be verified in writing. The correct Material Safety Data Sheet (MSDS)

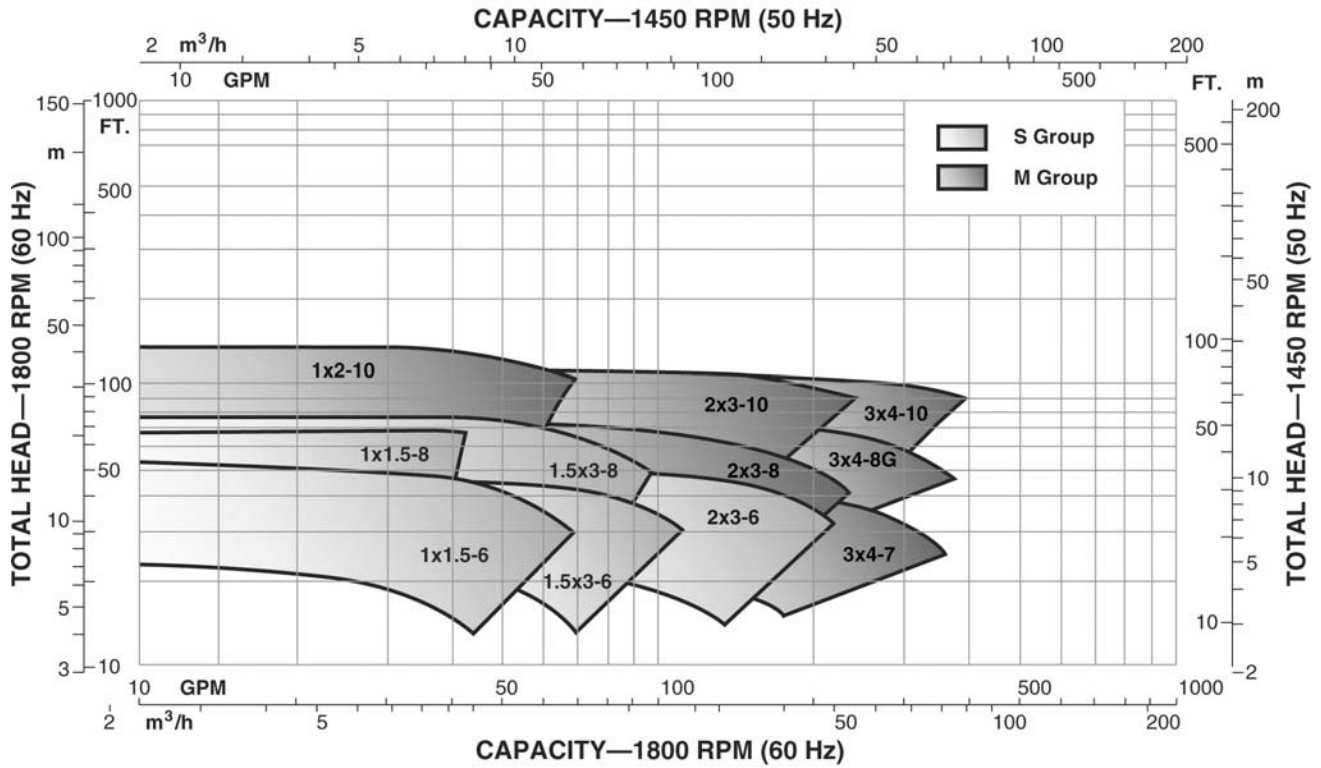
must accompany the parts along with decontamination "sign off." This information is stated within the ITT Goulds Pumps "decontamination procedure." The warranty service engineer will send a copy of this procedure to the customer. Please remember that inspection of the parts cannot be started until we receive the proper documentation. This is a safety and legal issue and consequently strict adherence to procedure is mandatory — there will be no exceptions.

Before shipping check with your carrier for special procedures that may be required when shipping highly magnetic materials.

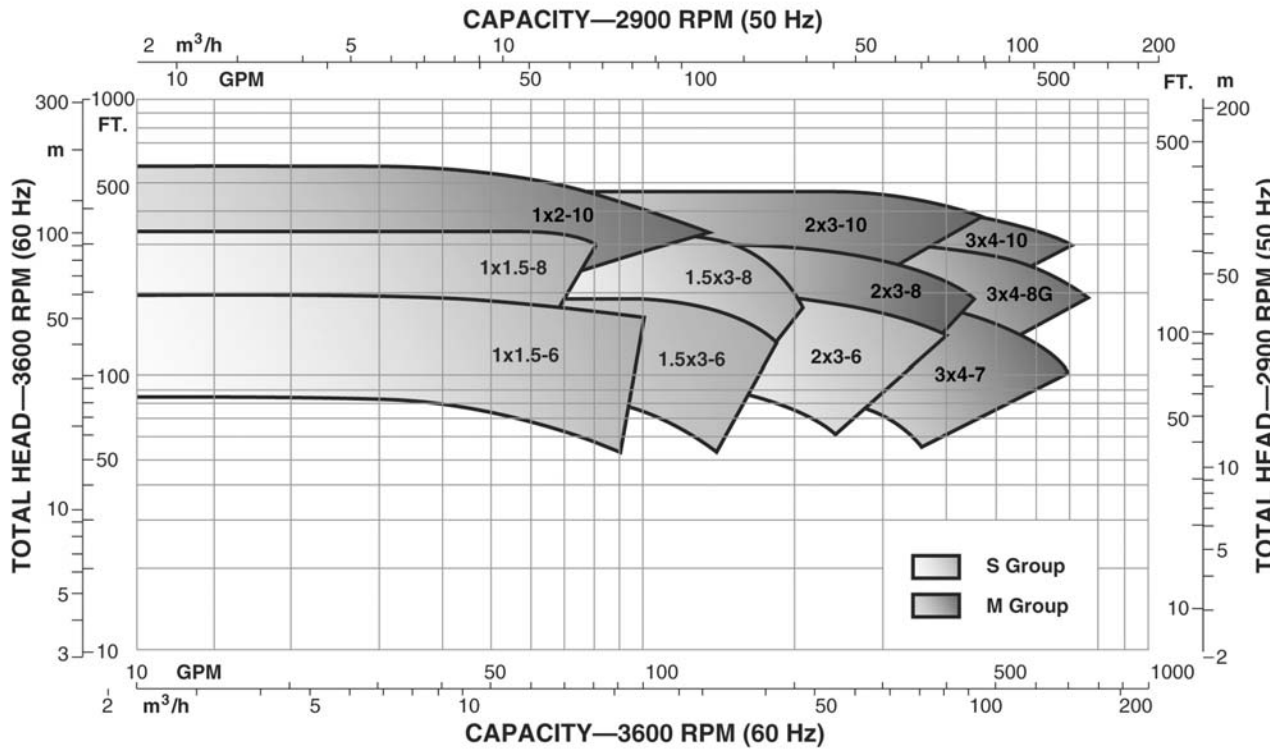
All pumps must be decontaminated prior to return. Reference *Operation Section's Preparation for Disassembly and Decontamination Procedure*.

APPENDIX I

HYDRAULIC COVERAGE CHARTS



HYDRAULIC COVERAGE CHARTS



APPENDIX II

COUPLING GUARD INSTALLATION - Frame-Mounted Only



WARNING

Before assembly or disassembly of the coupling guard is performed, the motor must be de-energized, the motor controller/starter put in a locked-out position, and a caution tag placed at the starter indicating the disconnect. Replace coupling guard before resuming normal operation of the pump. Goulds Pumps assumes no liability for avoiding this practice.



The coupling guard used in an ATEX classified environment must be constructed from a non-sparking material.

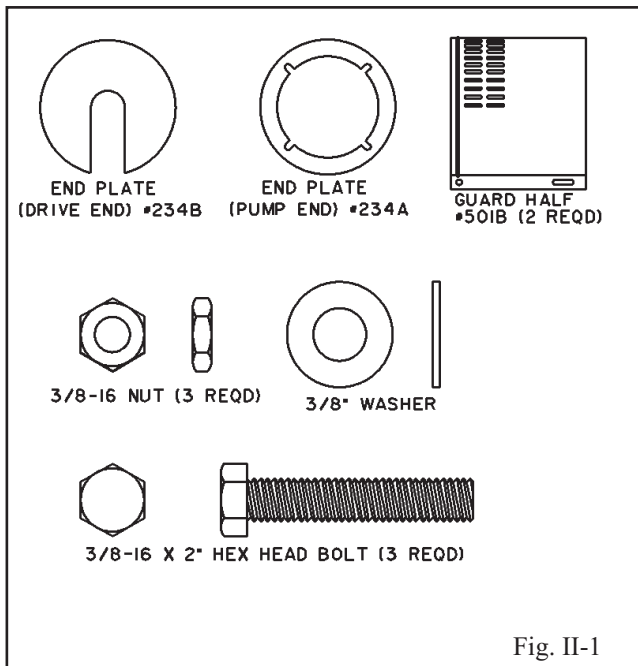


Fig. II-1

Simplicity of design allows complete assembly of the coupling guard, including the end plate (pump end), in about fifteen minutes. If the end plate is already in place, assembly can be accomplished in about five minutes.

Assembly:

NOTE: If end plate (pump end) is already installed, make any necessary coupling adjustments and then proceed to Step 2.

1. **STX, MTX, LTX** - Align end plate (pump end) to the Bearing Frame. (No impeller adjustment required.)

XLT-X Align the end plate (pump end) to the pump bearing housing so that the large slots on the end plate clear the bearing housing tap bolts and the small slots are aligned to the impeller adjusting bolts. Attach the end plate to the bearing housing using the jam nuts on the impeller adjusting bolts as shown in Fig. II-3.

After the end plate is attached to the bearing housing, the impeller clearance must be checked and reset as explained in *Preventive Maintenance* Section.

NOTE: Coupling adjustments should be completed before proceeding with coupling guard assembly.

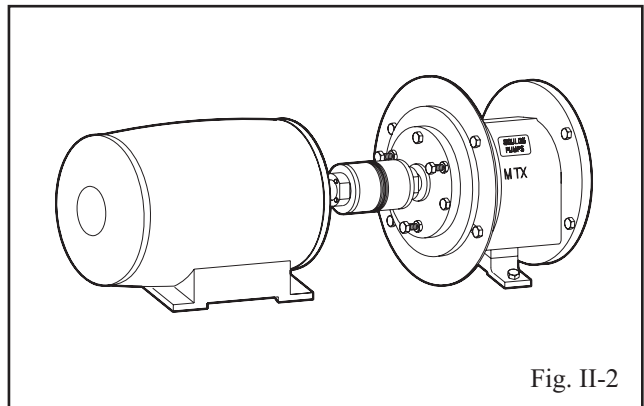


Fig. II-2

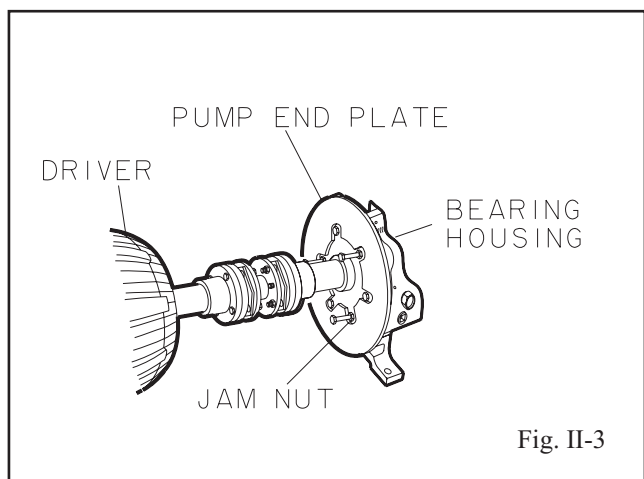
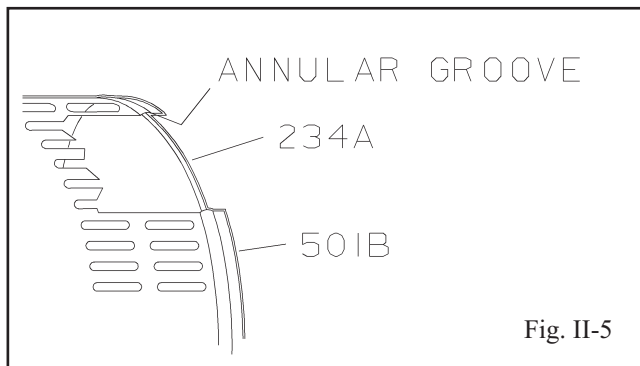
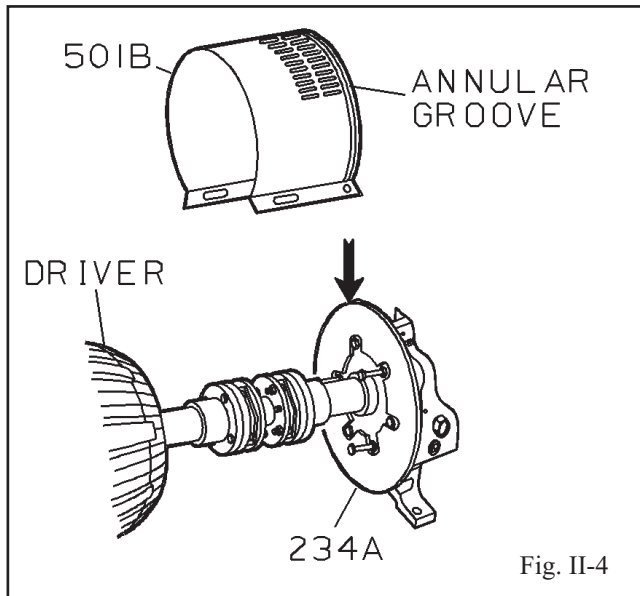
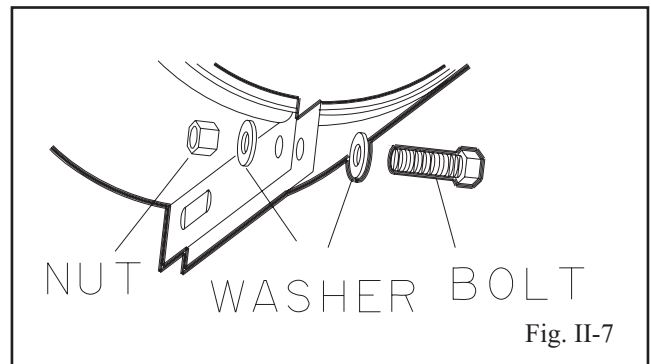
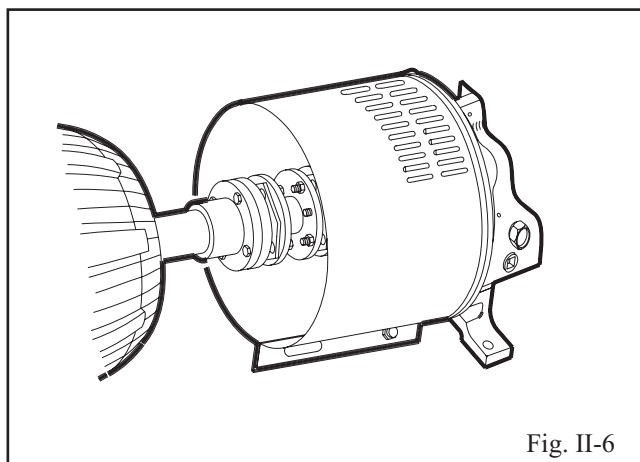


Fig. II-3

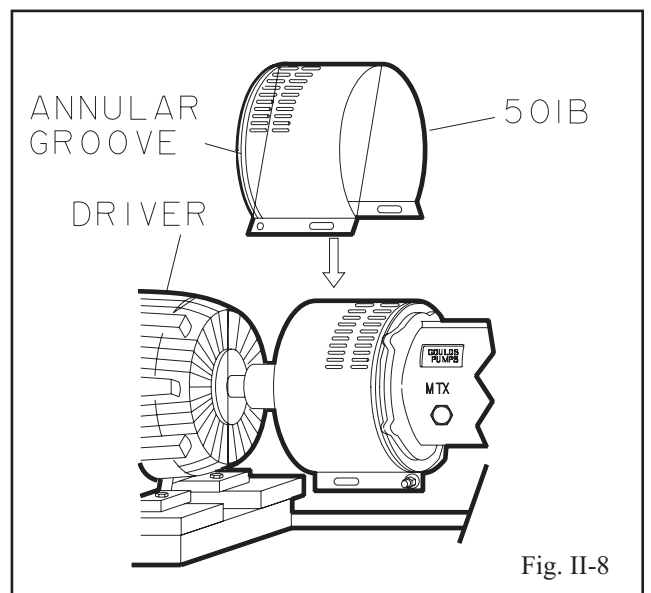
- Spread bottom of coupling guard half (pump end) slightly and place over pump end plate as shown in Fig. II-4. The annular groove in the guard half is located around the end plate (Fig. II-5).



- After the coupling guard half (pump end) is located around the end plate, secure it with a bolt, nut and two (2) washers through the round hole at the front end of the guard half as shown in Fig. II-6. Tighten securely (Fig. II-7).



- Spread bottom of coupling guard half (driver end) slightly and place over coupling guard half (pump end) so that annular groove in coupling guard half (driver end) faces the motor as shown in Fig. II-8.



- Place end plate (driver end) over motor shaft as shown in Fig. II-9. Locate the end plate in the annular groove at the rear of the coupling guard half (driver end) and secure with a bolt, nut, and two (2) washers through the round hole at the rear of the guard half. Finger tighten only.

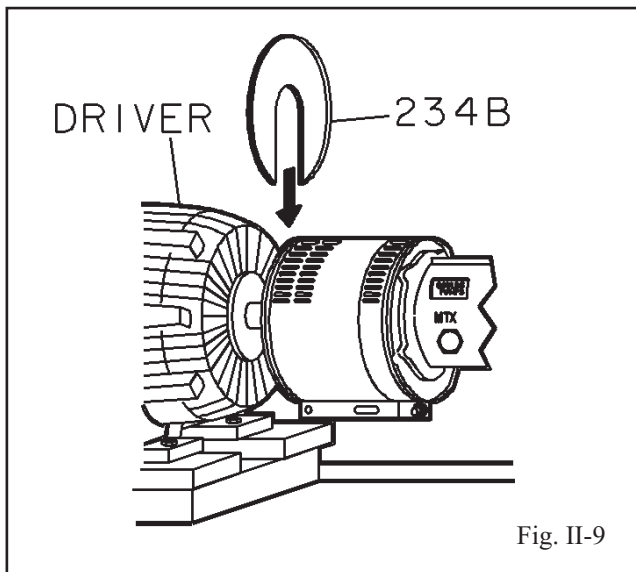


Fig. II-9

6. Adjust length of coupling guard to completely cover shafts and coupling as shown in Fig. II-10 by sliding coupling guard half (driver end) towards motor. After adjusting guard length, secure with bolt, nut and two (2) washers through the slotted holes at the center of the guard and tighten. Check all nuts on the guard assembly for tightness.



WARNING

Before assembly or disassembly of the coupling guard is performed, the motor must be de-energized, the motor controller/starter put in a locked-out position, and a caution tag placed at the starter indicating the disconnect. Replace coupling guard before resuming normal operation if the pump. Goulds Pumps assumes no liability for avoiding this practice.

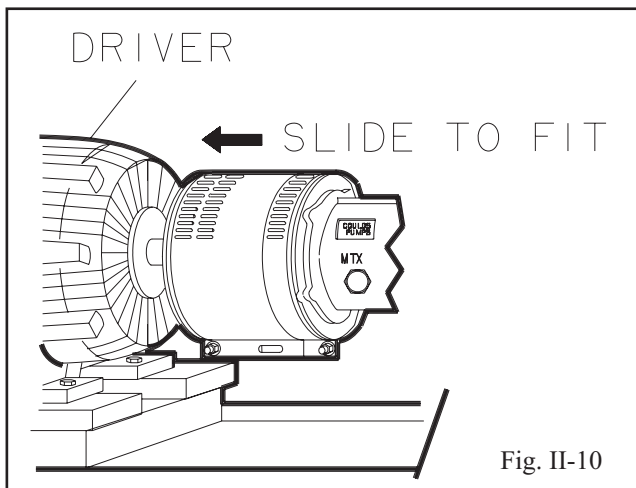


Fig. II-10

Disassembly

The coupling guard must be removed for certain maintenance and adjustments to the pump, such as adjustment of the coupling, impeller clearance adjustment, etc. The coupling guard should be replaced after maintenance is completed.

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DO NOT resume normal pump operation with the coupling guard removed.

NOTE: Refer to illustrations for assembly in reverse order.

1. Remove nut, bolt, and washers from center slotted hole in the coupling guard. Slide motor end coupling guard half towards pump. Fig. II-10.
2. Remove nut, bolt, and washers from coupling guard half (driver end), and remove end plate. Fig. II-9.
3. Spread bottom of coupling guard half slightly and lift off. Fig. II-8.
4. Remove remaining nut, bolt, and washers from coupling guard half (pump end). Spread bottom of coupling guard half slightly and lift off. Fig. II-4.

This completes disassembly of the coupling guard.

NOTE: It is not necessary to remove the end plate (pump end) from the pump bearing housing. The bearing housing tap bolts are accessible without removing the end plate in case maintenance of internal pump parts is necessary. Before removing the pump bearing housing, refer to Disassembly & Reassembly.

APPENDIX III

POWER MONITORS



When installing in a potentially explosive environment, ensure that condition monitoring devices are properly certified.

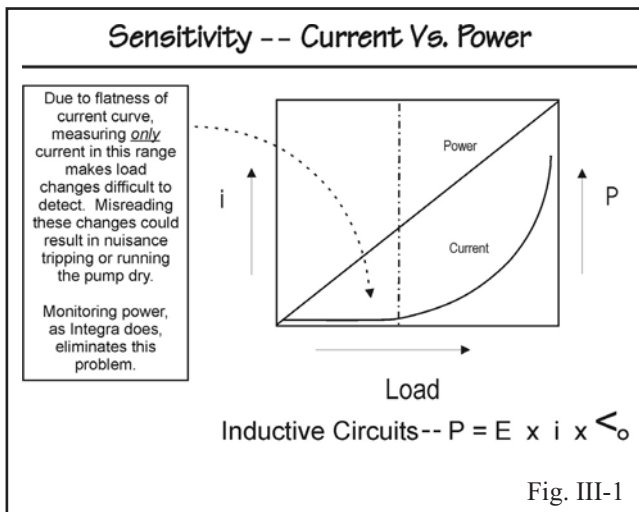
CONDENSED POWER MONITOR USER GUIDE

ITT Goulds Pumps offers various power monitoring devices which have been designed to protect pumps from dry-running, running against a closed discharge valve, and running outside of the recommended operating region for specific pump sizes, speeds, and impeller diameters. Power monitors were designed to detect power relative to load which is a linear function as opposed to measuring amperage relative to load which is a parabolic function. The linear characteristic of measuring power vs. load enhances sensitivity at low power conditions where increments in power are critical. See Fig. IV-1 for comparison of power measurements vs. amperage measurements. Quite simply, a properly adjusted and installed power monitor is an insurance policy for securing extended pump life.

The following summarized concepts will assist in effectively selecting and properly calibrating power monitors used to protect pumps.

1. Read your power monitor installation instructions and wiring diagram before attempting to calibrate the unit.
2. Understand your pump's recommended operating envelope as provided by ITT Goulds Pumps.
3. Understand your systems requirements and limitations.

4. Understand the full range of your operating duty, including power requirements at the rated, minimum and maximum flow conditions.
5. Understand the relationship and limitations of item numbers 2, 3, and 4 as an integrated functional system.
6. Identify potential failures that would most likely be characteristic of your specific process and the pump type selected.
7. Understand the power scope and torque scope of the selected electric motor.
8. A complete analysis of the above concepts will define a safe operating range for your specific system.
9. When feasible, further define your operating range to run as close to BEP (best efficiency point) as practical.
10. Select single trip unit or dual trip unit as practical for your specific system. A dual trip unit is recommended for the 3296 EZMAG. A low setting should always be used to protect against dry run. A high setting will detect if an upset condition has occurred resulting in bearing damage.
11. Set **low power trip point** at the power draw required when operating at the manufacturer's recommended minimum flow or higher, yet less than the normal operating point.
12. Set the **high trip point** at the power draw required when operating at the manufacturer's recommended maximum flow or lower, or at flow rate that will prevent cavitation.
13. When using dual trip power monitors, select high and low trip points designed to protect your specific system within the recommended pump operating region defined by ITT Goulds Pumps. This method will create boundaries for a safe pump operating envelope.



POWER MONITORS, (cont'd)

14. Set nuisance trip feature for each power trip. The nuisance trip device should be set at an appropriate interval that will allow the system to experience momentary fluctuations in power draw. However, the nuisance trip device should also be set at an appropriate time frame that will prevent the pump from experiencing excessive heat or dangerous operating conditions.
15. Set the delay timer for start-up conditions that will appropriately allow the system to come to normal operating power within a time frame that will maximize protection of your pump.
16. For variable speed operation, consult ITT Goulds Pumps or the power monitor manufacturer for appropriate auxiliary devices designed for operating at multiple speeds or fluctuating frequencies.
17. Select electrical enclosure that is suitable for the operating environment or install the unit in an appropriate electrical panel.
18. Do not activate the power monitor's manual override until a thorough examination of the source of the problem is defined and corrected.
19. Investigate and select power monitor features that are most suitable for your particular application and plant safety.

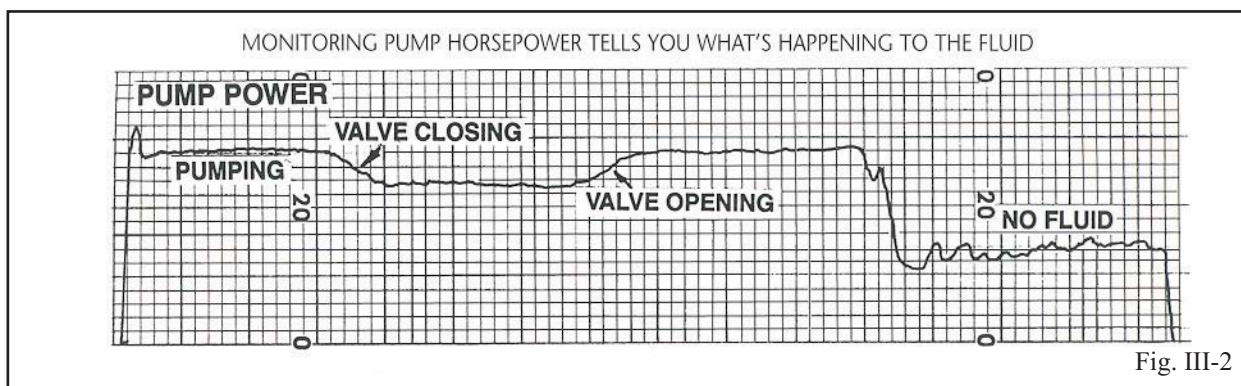
Power monitors can be strategically calibrated to protect your pump from any of the following conditions by appropriately determining the power draw at any of these individual conditions.

- Dry Running
- Closed Discharge Valve
- No Prime
- Inadequate Suction Conditions/Plugged Suction
- Cavitation
- Air Lock
- Decoupled Magnets
- Solidified, Plugged, or Frozen Discharge Line
- Fluctuating Viscosities, Precipitation, or Coagulation
- Broken or Damaged Shaft
- Broken or Damaged Coupling
- Jammed Impeller
- Bad Bearings
- Rapid Cycling

The power draw at each of these conditions can be simulated in a plant test or estimated through calculations or interpolations from the pump performance curve. By defining these dangerous power fluctuations, appropriate calibration of the power monitoring unit will prevent avoidable pump failures. See Fig. IV-2 for a typical power evaluation recorded from a common centrifugal pump electric motor.

Contact ITT Goulds Pumps or your regional distributor for assistance and power analysis for your specific system.

For further details and evaluation of power monitoring units, a comprehensive power monitor user guide is available from ITT Goulds Pumps distribution network.



APPENDIX IV

Reliability Tips for Operating Magnetically-Driven Sealless Pumps

QUICK REFERENCE SUMMARY

These summarized reliability guidelines outline recommendations for creating an optimal environment for operating mag-drive pumps. For further details on the subject of operating a mag drive pump with superior reliability, please contact your ITT Goulds Pumps' representative.

- Do not operate mag-drive pumps under no flow conditions.
- Do not operate mag-drive pumps against a closed discharge valve.
- Do not operate mag-drive pumps with solids that exceed the manufacturer's maximum limits in particle size or concentration.
- Before operating mag-drive pumps, confirm chemical compatibility of process liquid with all wetted pump components in an effort to reduce corrosion, permeation, or erosion.
- Do not operate mag-drive pumps with process liquids that may exceed the maximum temperature limits or fall below the minimum temperature limits defined by the pump manufacturer.
- Do not operate mag-drive pumps outside of the manufacturer's recommended operating range. Otherwise, recirculate adequate flow through bypass lines when operating near or below the manufacturer's recommended mechanical and thermal operating flow to prevent excessive temperature rise or recirculation cavitation.
- Consider the inner and outer magnet assemblies' material temperature limits and recoverable flux density losses due to increased temperatures.
- Do not operate mag-drive pump without considering the process liquid's vapor pressure characteristics over the temperature range of the application. Adequate NPSHa as well as vapor pressure is mandatory to prevent cavitation or vaporization in localized low pressure regions within the pump.
- Use power monitoring devices when potentially operating near or outside of the manufacturer's recommended operating envelope.
- Consider temperature controlling devices such as heat jackets or steam tracing for pumps that are subject to process fluids that transform characteristics such as viscosity, specific gravity, crystallization, coagulation, solidification, or vaporization with variable process temperatures.
- Use temperature monitoring devices such as thermocouples, RTDs, temperature controllers, or thermometers when process fluid is susceptible to critical variations in temperature.
- Use leak detectors such as fiber optic sensing devices or pressure monitoring devices when fluid is prohibited from entering the atmosphere.
- Ensure selected motor torque at maximum power and start-up conditions for corrected hydraulic and magnetic loss power at worst case fluid specific gravity and viscosity is less than the magnet break-away torque at maximum temperature.
- Keep process liquid in liquid form. Prevent the liquid from flashing.
- Do not exceed the manufacturer's maximum viscosity limits as internal fluid circulation velocities will be inadequate to properly cool and lubricate sleeve bearings.

HOW TO ORDER

**When ordering parts call
1-800-446-8537
or your local Goulds Representative**

EMERGENCY SERVICE

**Emergency parts service is available
24 hours/day, 365 days/year . . .
Call 1-800-446-8537**

Visit our website at gouldspumps.com



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