GOULDS PUMPS

Installation Operation Maintenance

Model 3299

ITT

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1 Introduction and Safety

1.1 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 https://www.gouldspumps.com/en-US/Tools-and-Resources/Literature/ 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 https://www.gouldspumps.com

1.2 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 http://www.gouldspumps.com/literature.

1.3 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 the 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:

WARNING:
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.

ATEX:

WARNING:
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.

1.4 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.

Table 1: 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		Safety Apparel: • 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		Receiving: 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.
WARNING		Alignment: 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.
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.
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.

WARNING		Noise: Sound pressure levels may exceed 80 dbA in operating process plants. Clear visual warnings or other indicators should be available to those entering an area with unsafe noise levels. Personnel should wear appropriate hearing protection when working on or around any equipment, including pumps. Consider limiting personnel's exposure time to noise or, where possible, enclosing equipment to reduce noise. Local law may provide specific guidance regarding exposure of personnel to noise and when noise exposure reduction is required.
WARNING		Temperature: Equipment and piping surfaces may exceed 130ºF (54ºC) in operating process plants. Clear visual warnings or other indicators should alert personnel to surfaces that may reach a potentially unsafe temperature. Do not touch hot surfaces. Allow pumps operating at a high temperature to cool sufficiently before performing maintenance. If touching a hot surface cannot be avoided, personnel should wear appropriate gloves, clothing, and other protective gear as necessary. Local law may provide specific guidance regarding exposure of personnel to unsafe temperatures.
WARNING		This product contains Carbon Black a chemical known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov

1.5 

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

Description of Ex-Directives

The Ex-directives are a specification enforced in Europe and the United Kingdom for electrical and non-electrical equipment installed in those locations. Ex-directives deal with the control of potentially explosive atmospheres and the standards of equipment and protective systems used within these atmospheres. The relevance of the Ex-requirements is not limited to Europe or the UK. You can apply these guidelines to equipment installed in any potentially explosive atmosphere.

Guidelines for compliance

Compliance is fulfilled only when you operate the unit within its intended use. Do not change the conditions of the service without the approval of an ITT representative. When you install or maintain explosion proof products, always comply with the directive and applicable standards (for example, IEC/EN 60079-14).

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

The Ex 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 https://www.gouldspumps.com/en-US/Tools-and-Resources/Literature/IOMs/ or from your local ITT Goulds Pumps Sales representative.

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

If applicable, your pump may have either a CE Ex (ATEX) tag or UKCA Ex tag affixed to the pump. See the Safety section for a description of the symbols and codes. Typical nameplate only shown below, the actual area classification may be different.

Figure 1: Typical Ex pump nameplate

Table 2: Temperature class definitions

Code	Maximum permissible pumpage temperature in °C | °F	Minimum permissible pumpage temperature in °C | °F
T1	450 | 842	372 | 700
T2	300 | 572	277 | 530
T3	200 | 392	177 | 350
T4	135 | 275	113 | 235
T5	100 | 212	Option not available
T6	85 | 185	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.

II = Group 2

2 = Category 2

G/D = Gas and Dust present

T4 = Temperature class, can be T1 to T6 (see Table)

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.

1.6 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.

2 Introduction

2.1 Purpose of manual

This manual is furnished to acquaint you with the easiest and most practical way to install, operate, and maintain this pump. Read it completely before doing any work on your unit and keep it handy for future reference.

Equipment cannot operate well without proper care. To keep the unit at top efficiency, follow the recommended installation and servicing procedures out lined in this manual. Goulds Pumps Sales and Service Parts Central is available to expertly guide the installation of the pump for maximum operating life and minimum downtime.

Goulds Model 3299 Plastic Lined Magnetic Drive pumps are frame mounted, volute type centrifugal pumps which are separately coupled to a driver such as an induction motor. Goulds Model 3299 Plastic Lined Magnetic Drive pumps are also available close coupled to a C-face motor; there is no separate pump bearing frame.

The magnet drive is a coaxial synchronous drive which utilizes permanent (passive) magnets on both the inner and outer carriers. The attraction between North and South pole pairs allows 100% speed transfer from the motor to the pump impeller. The drives have constant maximum torque ratings irrespective of speed.

The 3299 is available in five sizes and various liner materials. Throughout these instructions Group I and II sizes are referred to. These can be easily identified as follows:

Group	Pump size
I	l x l.5-6, 2x3-6, l x l.5-8
II	1.5 x 3-8, l x 2-10

2.2 Goulds pumps service organization

Experienced, factory trained servicemen offer prompt, efficient service at reasonable rates. These service men can find and correct costly errors such as poor grouting, misalignment, pipe stresses transmitted to the pump casing, or improperly sized piping. A serviceman may be requested through your nearest Goulds Pumps Sales Representative.

Replacement and spare parts, including special attention to your individual problems, may also be obtained through the same Sales Representative.

2.3 Warranty

Refer to your sales contract for coverages.

3 Pump Identification (Nameplate)

3.1 Pump identification (nameplate)

The pump has two nameplates mounted on the drive frame which contain the following information:

- Pump Size and ANSI Designation
- Serial Number
- Material of Wetted Components
- Drive Frame (see Note below)
- Maximum Design Pressure at 38ºC | 100ºF
- Impeller Diameter Maximum/ Installed
- Identification Number (User's I.D.)
- Year Built
- Customer P.O. Number
- Customer Item Number
- Customer Equipment Number
- GPM (Rated Point)
- Head, Ft. (Rated Point)
- Speed, RPM
- Lubrication for Anti-friction Bearings (Greased for Life, Oil, or Oil Mist)
- Bearing Manufacturer's Numerical Designation for Inboard and Outboard Anti-friction Bearings.

NOTICE:

There are five (5) basic drive frames available on the 3299. Drive frame designations are: A, B, C, D, E. Refer to Appendix A Engineering Information for torque ratings of these drives. Drive capability varies inversely with pumping temperature. However, the proper drive selection depends on many other considerations such as speed, magnet material, liquid viscosity, specific gravity, impeller diameter, bearing loads, etc. Always contact your nearest Goulds Pumps representative when changing service conditions.

WARNING:

Do not run unit dry; severe pump damage can occur. Failure to follow these instructions could result in property damage, severe personal injury, or death.

WARNING:

This unit contains high power magnets. Persons wearing pacemakers must no, be allowed near this equipment. Close location of watches, credit cards, computer tapes, disks, or memory devices must be avoided to prevent damage. Failure to follow these instructions could result in property damage, severe personal injury, or death.

WARNING:

- Follow the *Horizontal Pump Lifting Instruction Booklet* (52-328-427) attached to the pump. Unit weights are given on page 33. Failure to follow these instructions could result in property damage, severe personal injury, or death.

- Read all warning and caution decals on the pump. Do not operate without all guards in place.
- Never use motor lifting lugs or pump drive frame lifting eye to lift the entire pump-driver-baseplate unit.
- Disconnect and lock out power before servicing.

When field hydro-testing pump or system, do not exceed maximum design pressure given on pump nameplate. Vent all air from pump and piping.

CAUTION:
For frame mounted units, check rotation of driver with coupling disconnected. On close coupled units jog the pump and motor momentarily, about a half second, so that the motor rotation can be confirmed by observing the motor fan direction. The proper pump rotation is clockwise as viewed from the motor fan end. Failure to follow these instructions could result in severe personal injury or property damage.

WARNING:
Do not operate at or near zero flow (closed shutoff valve). Explosion could result due to large temperature rise in the fluid being pumped. Failure to follow these instructions could result in property damage, severe personal injury, or death.

WARNING:
If pump is to be used on process fluids above 120°F pump surface temperatures could be hot enough to cause burns. We recommend pump casing surfaces be insulated. Failure to follow these instructions could result in severe personal injury or death.

CAUTION:
When shipping bare magnet assemblies, especially by air, special precautions may be necessary. Usually the shipment of an assembled pump is not a problem. It is advisable to consult with the freight company.

4 Safety Information

4.1 Safety information

WARNING:

- Follow the Horizontal Pump Lifting Instruction Booklet (52-328427) attached to the pump. Unit weights are given on page 33. Failure to follow these instructions could result in property damage, severe personal injury, or death.
- Read all warning and caution decals on the pump. Do not operate without all guards in place.
- Never use motor lifting lugs or pump drive frame lifting eye to lift the entire pump-driver baseplate unit.
- Disconnect and lock out power before servicing.

When field hydro-testing pump or system, do not exceed maximum design pressure given on pump nameplate. Vent all air from pump and piping.

WARNING:

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- When shipping bare magnet assemblies, especially by air, special precautions may be necessary. Usually the shipment of an assembled pump is not a problem. It is advisable to consult with the freight company.

5 Installation

5.1 Receiving pump

Check pumps for shortages and damage immediately upon arrival. (An absolute must!) Prompt reporting to the carrier's agent, with notations made on the freight bill, will expedite satisfactory adjustment by the carrier.

Pumps and drivers are normally shipped from the factory mounted on a baseplate. Couplings may either be completely assembled or have the coupling hubs mounted on the shafts and the connecting members removed. When the connecting members are removed, they will be packaged in a separate container and shipped with the pump or attached to the baseplate.

Shafts are in alignment when the unit is shipped; however, due to shipping, the pumps may arrive misaligned and, therefore, final alignment must be established during installation. Goulds Pumps has determined that proper and correct alignment can only be made by accepted erection practices. Refer to the following paragraphs on 5.4 Foundation on page 15, 5.5 Setting baseplate on page 16, 5.6 Alignment procedure on page 19 and 5.7 Doweling on page 20. All pumps have been factory tested with water. If no special requirements have been specified, prior to shipping, a small quantity of water may remain inside the pump. This should be noted due to possible reactions with the pumped liquid or flushing liquid.

5.2 STORAGE

1. Temporary:

   Temporary storage is considered one month or less. If the pump is not to be installed and operated soon after arrival, store it in a clean, dry place having slow, moderate changes in ambient temperature. Rotate the shaft periodically to coat the bearings with lubricant and to retard oxidation, corrosion, and to reduce the possibility of false brinelling of the bearings.

   For complete details on temporary storage, consult Bulletin 52-130-372 in your submittal package or request a copy from your nearest Goulds Pumps Representative.

2. Long Term:

   Plastics are subject to *cold flow*, i.e., plastic parts may deform even when they are not in use. It is recommended to consult with Goulds Pumps if the pumps have been stored for a long period.

   Storage longer than one month is considered long term storage. Refer to Bulletin 52-130-373 in your submittal package or request a copy from your nearest Goulds Pumps Representative.

5.3 Location

The pump should be installed as near the suction supply as possible, with the shortest and most direct suction pipe practical. The total dynamic suction lift (static lift plus friction losses in suction line) should not exceed the limits for which the pump was sold.

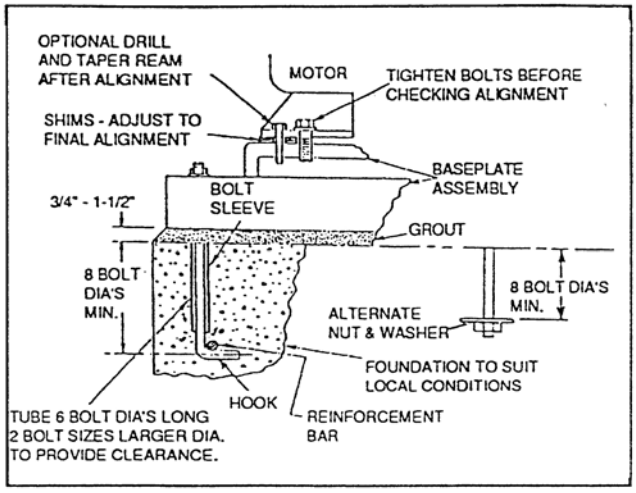

Figure 2: Foundation

The pump must be primed before starting. Whenever possible, the pump should be located below the fluid level to facilitate priming and assure a steady flow of liquid. This condition provides a positive suction head on the pump. It is also possible to prime the pump by pressurizing the suction vessel.

When installing the pump, consider its location in relation to the system to assure that sufficient Net Positive Suction Head (NPSH) at pump suction is provided. Available NPSH must always exceed the required NPSH of the pump.

The pump should be installed with sufficient accessibility for inspection and maintenance. A clear space with ample head room should be allowed for the use of an overhead crane or hoist sufficiently strong to lift the unit.

NOTICE:
Allow sufficient space to be able to dismantle pump without disturbing the pump inlet and discharge piping.

The pump should be located in a dry place above the floor level whenever possible. Take care to prevent the pump from freezing during cold weather when not in operation. Should the possibility of freezing exist during shut-down period, the pump should be completely drained, and all passages and pockets where liquid might collect should be blown out with compressed air.

Make sure there is a suitable power source available for the pump drive. If motor driven, electrical characteristics should be identical to those shown on motor data plate.

5.4 Foundation

The foundation must be substantial enough to absorb vibration. (Hydraulic Institute Standards recommend the foundation weight be at least five (5) times the weight of the pump unit) It must form a permanent and rigid support for the baseplate. This is important in maintaining the alignment of a flexibly coupled unit.

Foundation bolts 0.25" smaller in diameter than the clearance holes in the baseplate should be embedded in the concrete to a depth of eight (8) times the diameter of the bolt and locked with either a hook around a reinforcing bar or alternatively, a nut and washer at the bottom. The bolts should have a sleeve around them at least six (6) times the bolt diameter long and at least two (2) bolt sizes larger in I.D. If a nut and washer are used for locking, the washer should have an O.D. two (2) sizes larger than the sleeve.

The foundation should be poured within 0.75 - 1.5" of the finished height. (See Figure 2: Foundation on page 15). Freshly poured foundations should be allowed to cure for several days before the unit is set in place and grouted.

5.5 Setting baseplate

Pump units are checked at the factory for align ability to required tolerances. Due to flexibility of an ungrouted base and handling in shipment, it should not be assumed that the unit is in alignment when it is placed on the rough foundation. If these directions are followed, the required alignment should be readily achieved.

Initial or rough alignment must be done prior to grouting of baseplate. Rough alignment is designated as .020" TIR parallel alignment and .009" TIR per inch of radius angular alignment (Refer to 5.6 Alignment procedure on page 19). Use blocks at anchor bolts and midway between to position bottom of base at finished height (See Figure 3: Grouting on page 16) with foundation bolts extending through holes in the baseplate. Metal wedges with a small taper may be used in lieu of blocks and shims.

If the unit has a non-flexible coupling, the coupling halves should be disconnected; this is generally not necessary on flexible type couplings.

Tighten up all pump and motor bolts to assure they have not loosened or a *soft foot* has occurred due to base distortion in shipment.

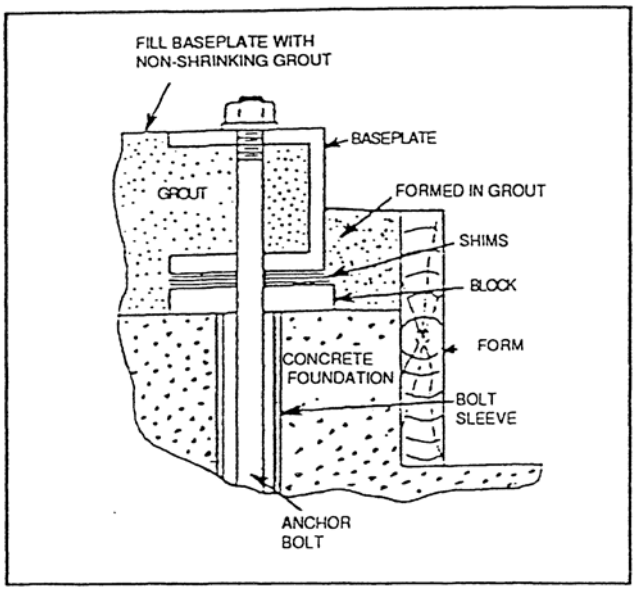

Figure 3: Grouting

If driver is being field installed, it should be centered in its bolt holes with shims added to bring the motor into rough alignment with the pump.

NOTICE:
Do not exceed six (6) shims, using as thick a shim as possible, otherwise, *sponginess* or *soft foot* will result

For 3299 frame mounted pumps, level and plumb the pump shaft, coupling faces and flanges by adding or removing shims between the blocks and bottom of the base. Hand tighten the anchor bolt nuts at first being very careful not to distort the base, snug down the nuts with a wrench. The non-flexible coupling should not be reconnected until the alignment operation has been completed.

For 3299 close coupled pumps, level and plumb the pump flanges, with the motor foot bolts loosened, by adding or removing shims between the blocks and bottom of the base. Hand tighten the anchor bolt nuts at first. Being careful not to distort the base, snug down the nuts with a wrench. Recheck that the pump flanges have remained level and plumb. Next tighten the motor foot bolts, being careful to recheck that the pump flanges remain level and plumb. Shimming of the motor may be required to maintain alignment.

NOTICE:
The baseplate does not have to be level.

After foundation bolts are lightly torqued, recheck alignment requirements once more. Follow requirements outlined at the beginning of this section. Add
or remove shims under the base and snug anchor bolts until rough alignment tolerances are met.

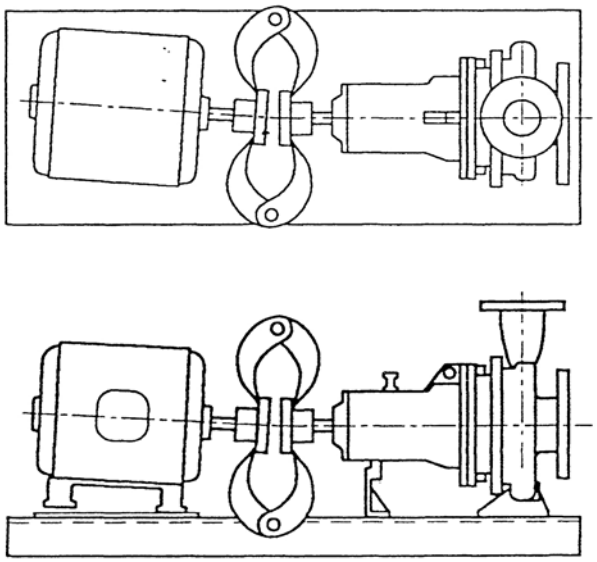

Figure 4: Checking angular alignment

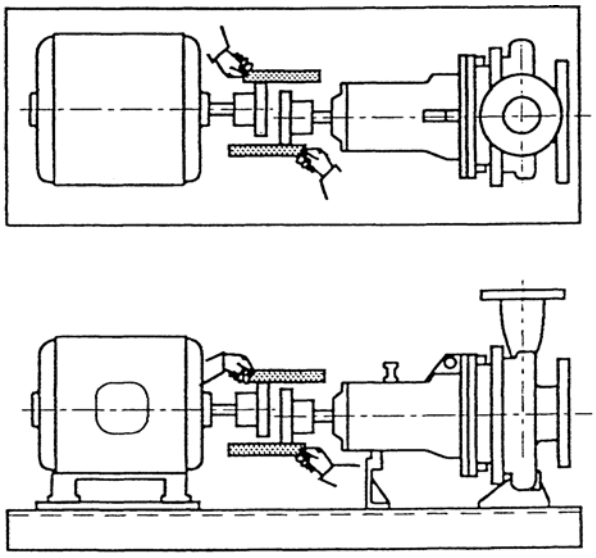

Figure 5: Checking parallel alignment

Then the unit can be grouted in (See Figure 3: Grouting on page 16).

Grout compensates for the uneven foundation. Together with the baseplate, it makes a very rigid interface between the pump and foundation distributing the weight over the length of the base and prevents shifting.

Use an approved, non-shrinking grout such as Embeco 636 or 885 by Master Builders, Cleveland, Ohio or equivalents. This is an *iron filings* style grout.

Grouting procedure

1. Build a strong form around the foundation to contain the grout.
2. Soak the top of the foundation thoroughly, then remove surface water.
3. The baseplate should be completely filled with grout and if necessary, temporarily use air relief tubing or drill vent holes to remove trapped air.

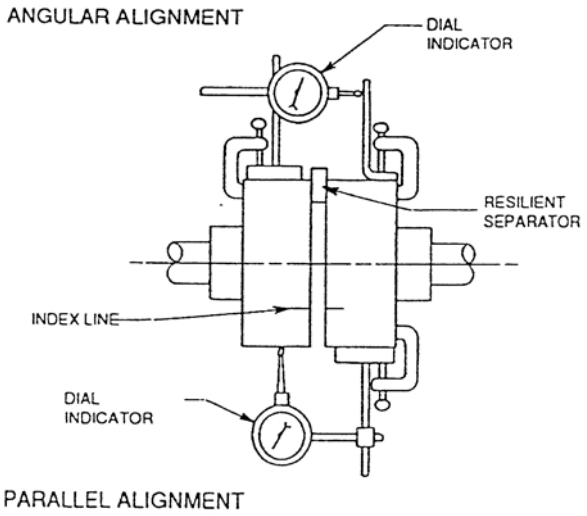

Figure 6: Single element coupling

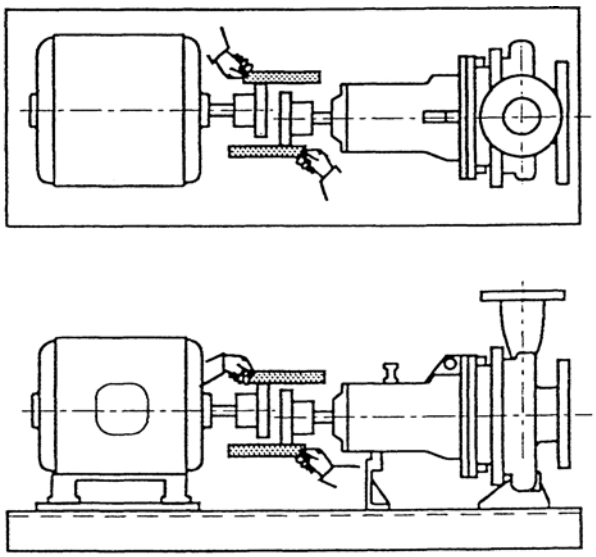

Figure 7: Alternate alignment method

4. After the grout has thoroughly hardened (approximately 24 hours) tighten the foundation bolts fully.
5. Check the alignment after the foundation bolts are tightened.

6. Approximately fourteen (14) days after the grout has been poured and the grout has thoroughly dried, apply an oil base paint to the exposed edges of the grout to prevent air and moisture from coming in contact with the grout.

Epoxy style grouts are now also available such as *Escoweld 7505E/7530* from ITW Philadelphia Resins, Montgomeryville, PA. These grouts do not require painting and cure within 24 hours. Follow manufacturer's instructions.

5.6 Alignment procedure

1. Standard couplings

   Proper rough alignment must be made during unit setting and grouting. See previous section.

   There are two forms of misalignment between the pump shaft and the driver shaft as follows:

   1. Angular misalignment - shafts have axis concentric at intersection, but not parallel.
   2. Parallel misalignment - shafts have axis parallel, but offset.

The necessary tools for checking alignment are:

1. a straight edge and caliper or micrometer, or
2. a dial indicator with mounting magnet and extension bars. More modern methods make use of laser beams and computers and are simple to use.

Method 1 - Straight Edge

Proceed with this method only if satisfied that face and outside diameters of the coupling halves are square and concentric with the coupling bores. If this condition does not exist or elastomeric couplings do not make this method convenient, use Method 2.

Check for angular alignment with micrometer or caliper at 90° intervals. The unit is in angular alignment when these four (4) measurements are the same, see

Check for parallel alignment by placing a straight edge across both the coupling rims on all four sides. The unit is in parallel alignment when the straight edge rests evenly across both coupling rims in all four (4) positions. (Figure 5: Checking parallel alignment on page 17.)

Method 2 - Dial Indicators

A dial indicator can be used to attain more accurate alignment.

Fasten the indicator to the pump half of the coupling and adjust the assembly until the indicator button is resting on the other half coupling periphery.

The following steps are used to measure indicator assembly sag:

Take indicator assembly as is and mount it on any short section of the pipe. Holding the pipe horizontally with indicator assembly on top, set the dial to zero. Rotate the pipe 180° so the indicator assembly is on the bottom and read the dial. This reading represents indicator assembly sag and must be considered in the alignment readings.

Set the indicator back on the pump as before. Set the dial to zero and chalk mark the coupling half where the button rest (Chalk is not necessary on elastomeric couplings that have not been disconnected.) Rotate both shafts by the same amount; i.e., all readings must be made with the button on the chalk mark.

The dial readings will indicate whether the driver has to be raised, lowered or moved to either side. After each adjustment, recheck both parallel and angular alignments. Accurate alignment of shaft centers can be obtained with this method even where faces or outside diameters of the coupling are not square or concentric with the bores. For angular alignment, change the indicator so it bears against the face of the same coupling half and proceed similarly to above. See Figure 6: Single element coupling on page 18Figure IVa and Figure 7: Alternate alignment method on page 18.

NOTICE:
Gross deviation in squareness or concentricity may cause unbalance problems and if so must be corrected.

NOTICE:
Permissible misalignment will vary with the type of coupling. Typical values for parallel and angular misalignment are shown below. Consult coupling manufacturer's data.

Parallel: .004" TIR (4 mils)

Angular: 0.004"/ inch of Radius

Check and correct for angular misalignment before correcting parallel alignment. Final alignment should be made by moving and shimming the motor on its base until the coupling hubs are within the recommended tolerances measured in total run out. All measurements should be taken with the pump and motor bolts tightened. The shaft of a sleeve bearing motor should be in e center of its mechanical float.

NOTICE:
If a pump is on hot service or driven by a steam turbine, compensation must be made for the change in vertical rise of the pump or turbine shaft.

5.7 Doweling

Pump units may, if desired, (or required in specification) be dowelled on diagonally opposite feet. This should not be done until the unit has been run for a sufficient length of time and alignment is within the TIR tolerance previously stated.

5.8 Suction and discharge piping

Pipe flanges should not impose excessive strain on the pump as this can cause rubbing of internal components, coupling misalignment, and ultimately nozzle failure. Excessive strain must be corrected by adjustments in the piping system.

Suction and discharge piping should be anchored, supported and restrained near the pump to avoid imposing forces and moments to the pump in excess of those advised as allowable by Goulds Pumps, Inc. Consult your submittal package for allowable nozzle loads on the 3299 or request this information from your nearest Goulds Pumps Representative. In calculating forces and moments, the weight of the liquid filled pipes and insulation as well as thermal contraction and expansion must be considered. When using rubber expansion joints, follow the recommendations of the Technical Handbook on Rubber Expansion Joints and Flexible Pipe Connectors, published by the Fluid Sealing Association, 2017 Walnut Street, Philadelphia, PA. 19103.

The introduction of pumpage into a piping system which is not well designed or adjusted may cause strain on the pump, leading to misalignment or even impeller rubbing. Since slight strain may go unnoticed, final alignment should be done with the system full.

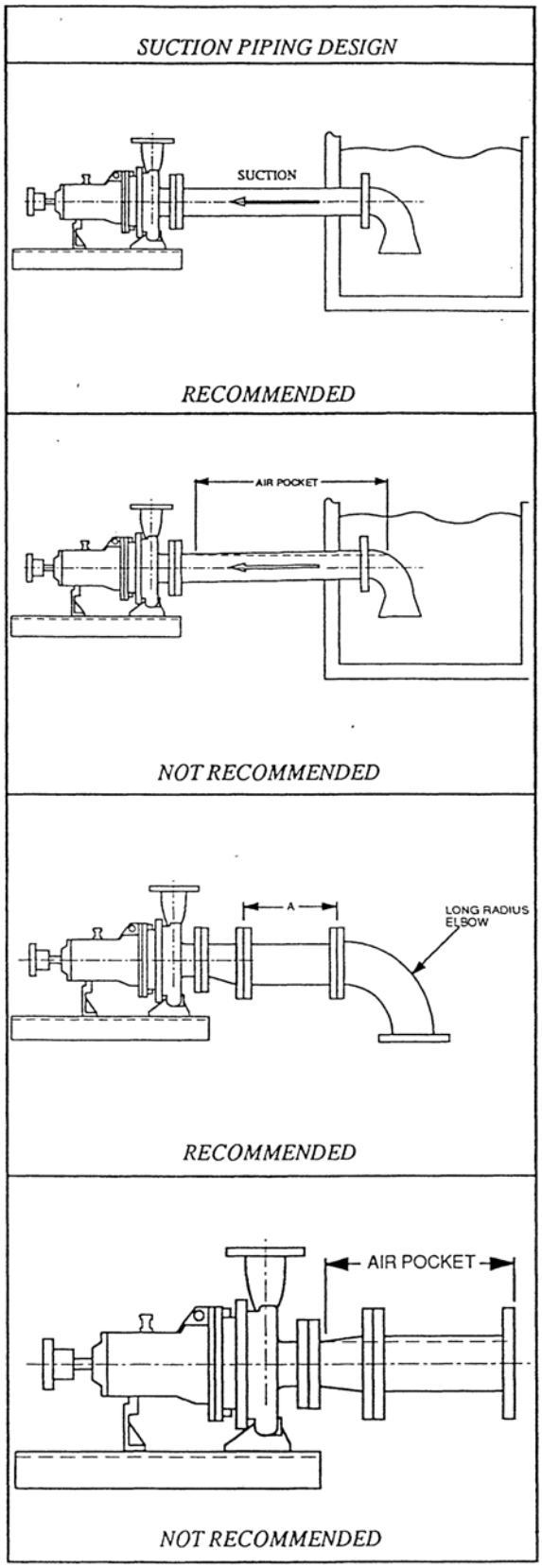

Figure 8: Suction piping design

When installing the pump piping, be sure to observe the following precautions:

The 3299 pump has a thick plastic lining. If connecting pipes or valves have uneven sealing surfaces, damage may occur. It is recommended that lined steel insert gaskets be used. These are available from Goulds Pumps.

Piping should always be run to the pump.

Do not move pump to pipe. This could make final alignment impossible.

Both the suction and discharge piping should be independently anchored near the pump and properly aligned so that no strain is transmitted to the pump when the flange bolts are tightened. Use pipe hangers or other supports at necessary intervals to provide support. When expansion joints are used in the piping system they must be installed beyond the piping supports closest to the pump. Tie bolts should be used with expansion joints to prevent pipe strain. Do not install expansion joints next to the pump or in any way that would cause strain on the pump resulting from system pressure changes. It is usually advisable to increase the size of both suction and discharge pipes at the pump connections to decrease the loss of head from friction.

Install piping as straight as possible, avoiding unnecessary bends. Where necessary, use 45' or long sweep 90" fitting to decrease friction losses.

Make sure that all piping joints are airtight.

Where flanged joints are used, assure that inside diameters match properly and that flange gaskets do not overlap inside diameter of piping.

Remove burrs and sharp edges when making up joints.

Do not *spring* piping when making any corrections. Provide for pipe expansion when hot fluids are to be pumped.

Suction piping:

A centrifugal pump can perform properly only if it is supplied with a steady flow of liquid arriving at the pump suction flange with sufficient pressure to provide adequate NPSH to the pump. The liquid velocity profile should be uniform and swirl should be negligible. The consequences of not delivering the liquid to the pump in this condition can lead to noisy operation, random axial oscillations of the rotor, premature bearing failure, and cavitation damage to the impeller and inlet portions of the casing.

When installing the suction piping, observe the following precautions (See Figure 8: Suction piping design on page 21).

The sizing and installation of the suction piping is extremely important. It must be selected or installed so that pressure losses are minimized and sufficient liquid will flow into the pump when started and operated. Many NPSH (Net Positive Suction Head) problems can be directly attributed to improper suction piping systems.

Suction piping should be short in length, as direct as possible, and never smaller in diameter than the pump suction opening. A minimum of five (5) pipe diameters (distance A) between any elbow or tee and the pump is required. If a long suction pipe is required, it should be one or two sizes larger than the suction opening, depending on its length.

Reducers should be limited to one pipe size reduction each to avoid excessive turbulence and noise. When reducing the piping to the suction opening diameter, use an eccentric reducer with the eccentric side down to avoid air pockets. Contour reducers are not recommended.

NOTICE:
When operating on suction lift never use a straight taper reducer in a horizontal suction line, as it tends to form an air pocket in the top of the reducer and the pipe.

For pumps operating with suction pressure below atmospheric pressure or handling liquids near their vapor pressure or operating on a suction lift, the suction line must slope constantly upwards toward the pump to avoid vapor traps.

For units in critical NPSH service, a continuous vent line should be installed from the suction pipe, adjacent to the pump suction flange, to the vapor phase of the suction source. Even though the unit is self venting, the vent line will help prevent inadvertent vapor locking and subsequent dry running. The vent line must be continuously rising to preclude air or vapor pockets.

When installing valves in the suction piping, observe the following precautions:

1. It is not recommended that a check valve be installed in the suction line even if a check valve is used in the discharge line. A suction line check valve may close before the discharge line check valve closes. The resulting *water hammer* can potentially burst the containment shell.
2. If foot valves are used, or where there are other possibilities of *water hammer*, close the discharge valve slowly before shutting down the pump. Install a check valve in the discharge line to prevent water hammer of the containment shell and reverse rotation of the pump.
3. Where two or more pumps are connected to the same suction line, install gate or full port ball valves so that any pump can be isolated from the line. Gate or full port ball valves should be installed on the suction side of all pumps with a positive pressure for maintenance purposes. Install valves in such a manner that gas or air pockets area voided. Globe valves should not be used, particularly where NPSH is critical.
4. The pump must never be throttled by the use of a valve on the suction side of the pump. Suction valves should be used only to isolate the pump for maintenance purposes, and should always be installed in positions to avoid air pockets.

Inlet bells, pipe size, and wet well (sump) dimensions should conform to the recommendations of the Hydraulic Institute Standards current edition.

In order to keep unwanted solids out of the pump, strainers may be installed in the pump suction piping. The strainer itself only introduces a moderate pressure drop, but as it accumulates debris the pressure drop will increase. Therefore, it is recommended that strainers be installed with upstream and downstream pressure taps and that the pressure drop be monitored. For ferrous solids removal, a magnetic trap may be used. Magnetic solids must not be allowed to enter the pump.

Discharge piping

If the discharge piping is short, the pipe diameter can be the same as the discharge opening. If the piping is long, pipe diameter should be one or two sizes larger than the discharge opening. On long horizontal runs, it is desirable to maintain as even a grade as possible. Avoid high spots, such as loops, which will collect air and throttle the system or lead to erratic pumping.

A check valve and gate valve should be installed in the discharge. The check valve, placed between pump and gate valve, protects the pump from excessive back pressure, and prevents liquid from running back through the pump in case of power failure. The gate valve is used in priming, starting, and when shutting the pump down or to isolate the pump for maintenance.

Pressure gauges

Properly sized pressure gauges should be installed in suction and discharge piping near the pump flanges. The gauges will enable the operator to easily observe the operation of the pump, and also determine if the pump is operating in conformance with its performance curve. If cavitation, vapor binding, or other unstable operation should occur, widely fluctuating discharge pressure will be noted.

5.9 Dry run warning

The 3299 must not be allowed to run dry and must be filled with liquid prior to start-up. Refer to 6.2 Priming on page 27 for further details. The 3299 offers only silicon carbide product lubricated bearings for maximum life, reliability and chemical resistance. The silicon carbide bearings are furnished standard

with Safeglide™ coating and will provide short term dry run protection, even under bone-dry conditions. This should allow adequate time for monitoring devices to safely shut down the pump before damage can occur. It should be understood that the 3299 Safeglide™ coated silicon carbide bearings are intended to provide dry run protection in the event of system upsets or occasional operator error; under no circumstances should the pump be intentionally run dry. Severe damage can occur to the plastic lining, product lubricated bearings and pump internals if the unit is allowed to run dry for prolonged periods. It is recommended that instrumentation be provided to protect against dry running conditions in order that the pump can be safely shut down before damage can occur. Refer to 5.10 Condition monitoring and instrumentation on page 24 for further details on instrumentation.

5.10 Condition monitoring and instrumentation

The 3299 will provide long trouble free operation when correctly applied and can be supplied with key protective devices to guard against misoperation and damage to the unit. Many sealless pump failures are directly attributed to some degree of dry running. Monitoring equipment can detect a dry run condition and safely shut-down the pump before damage occurs.

The main causes of dry running are:

- Loss of liquid to the pump suction
- Blocked lubrication/ circulation paths in the product lubricated bearing area
- Cavitation at the impeller inlet due to insufficient NPSHA
- Excessive entrained air or gasses in the pumped liquid
- Prolonged operation under closed discharge valve
- Liquid flashing in the cooling / lubrication paths due to system transients or operation below thermal minimum flow

If any of these conditions occur the unit should be shut down immediately. Dry running can be detected by power monitors, flow switches or pressure switches. A filling level indicator will detect liquid level in the suction line prior to operation of the pump and prevent dry startups. For nonconductive shells in plastic lined pumps, a power monitor is a widely used method for detecting dry running. Dual trip power settings enable the pump to be automatically shutdown during an under load or overload condition. A power monitor is preferred over a current sensor since it senses volts x amps x power factor rather than just current. Since the measurement of power is linear as load is varied, power monitor can offer up to a 10x increase in sensitivity over current measurement for low load conditions.

For cases where cooling paths are blocked or inadequate cooling flow is provided to the drive area, a temperature probe can be furnished to sense an increase in temperature inside the containment shell area. The temperature monitor should be set to shut down the unit at 25°F above maximum pumping temperature. If the pumping temperature varies widely this may not be a satisfactory way of monitoring dry running.

An optional leakage sensor can be fitted between the inner and outer containment shell to provide an early warning for detecting the presence of pumped liquid past the inner containment shell. The pump can then be safely shut down thereby preventing potential leakage to the environment. A thin foil with electronic circuitry will short circuit if the liquid is conductive. If the liquid is nonconductive but corrosive, the circuitry will be interrupted by chemical attack. In both cases a relay will close and shut down the pump and/or sound an alarm via an intrinsically safe control system. The dual containment shell system will provide standard and secondary containment in case of leakage past the inner shell. The duration of the containment will depend on the corrosiveness of the liquid being pumped.

WARNING:
If leakage is detected when pumping hazardous liquids the trip switch must be set to shut down the pump. In order to protect against escape of liquid to atmosphere, the unit should be drained

as soon as possible. Failure to follow these instructions may result in property damage, severe personal injury, or death.

A 1/4 NPT leakage detector connection is provided as standard in the pump bracket which can be monitored for leakage past both containment shells with conductivity or capacitance probes.

Other optional instrumentation connections available on the 3299 are:

- A vibration probe connection can be furnished on the bearing frame to detect excessive vibration due to ball bearing wear, misalignment or an out of balance condition.
- Temperature probe connections can be furnished on the bearing frame to sense the condition of the antifriction bearings,

  Refer to Appendix A Engineering Information for size and location of all instrumentation connections. Typical instrumentation specifications are also given in Appendix A Engineering Information. All control and alarm settings should be checked for proper installation in accordance with the manufacturer's installation instructions. All alarm and trip point settings should be verified.

5.11 Solids in suspension

Magnetic drive pumps with their product lubricated bearings are not suitable for large concentrations of solids in suspension. However, solids less than or equal to .012" diameter and 2% by volume can be safely handled without additional consideration. Solids must be non-magnetic, must not have a tendency to coagulate nor be fibrous. Additionally, solids must also be non-abrasive to avoid damage to the plastic liner and must not scale wetted surfaces.

For applications which require the handling of solids content in excess of those stated above, other circulation plans are available as follows:

- Plan 111 - this filtered discharge flush arrangement is suitable for crystalline solids with a particle diameter under 0.078" but is only suitable for solids which do not have a tendency to agglomerate or form crusts. This flush arrangement is suitable for handling solids in suspension from 3-10% by volume.
- Plan 132 - used when pumping non-abrasive solids above 10% by volume, by introducing a clean compatible external flush liquid into the drive section. As a general guide, external flush requirements are: Group I 1 GPM, Group II 2 GPM. The external flush pressure requirement is shown below:

  P_{flush} = (PD-PS)/2

  where:

  P_{flush} = required flushing pressure

  PS = suction pressure

  PD = discharge pressure

  Lower flow requirements than those above can be used; however, the temperature rise of the external flush liquid will be increased. This is normally not a problem if the flush liquid is non-volatile. External flush requirements less than those above should be referred to the factory to assure proper cooling /
  lubrication.

5.12 Operating limits

The pump which has been shipped has been built with materials and drive frame intended for the originally specified conditions of service. Factors such as liquid pumped, speed, temperature, impeller diameter, specific gravity, bearing loads, viscosity, magnet material, etc. must all be considered when changing

service conditions. Larger than originally intended motors may create excessive start-up torques which could cause decoupling of the magnetic drive. This will eventually lead to overheating and damage to internal parts.

WARNING:
Misapplication of this equipment may result in property damage, severe personal injury, or death. Always contact your nearest Goulds Pumps Representative when changing service conditions. Refer to Appendix "A" for data regarding operating limits.

6 Operation

6.1 Pre-start checks

Before initial start of the pump, make the following inspections:

1. Check alignment between the pump and motor. See 5.6 Alignment procedure on page 19, for alignment requirements.
2. Check all connections to motor and starting device with wiring diagram. Check voltage, phase, and frequency on motor nameplate with line circuit.
3. Check suction and discharge piping and pressure gauges for proper operation.
4. Tum shaft by hand to ensure that it rotates freely. On close couple units the shaft can be turned by rotating the motor fan.
5. Assure that pump is full of liquid (refer to 6.2 Priming on page 27) and all valves are properly set and operational, with the suction valve open. Purge all air from top of casing.
6. Check external flush piping, if applicable.

NOTICE:
Liquids with entrained air or gas may cause vapor pockets to form in the containment shell, leading to lack of lubrication, heat buildup and bearing failure. In addition to proper venting, an external flush of clean, vapor free liquid must be applied to the bearings and containment shell when the pumped liquid contains entrained air or gas.

7. Check driver lubrication.
8. Assure that pump bearings are properly lubricated.
9. Assure that coupling is properly lubricated, if required.
10. For frame mounted units check rotation with coupling disconnected. On 3299 close coupled units, jog the pump and motor momentarily, about a half second, so that the motor rotation can be confirmed by observing the motor fan direction. Be sure that the driver operates in the direction indicated by the arrow on the pump casing as serious damage can result if the pump is operated with incorrect rotation. Check rotation each time the motor leads have been disconnected.

6.2 Priming

If the pump is installed with a positive head on the suction, it can be primed by opening the suction and vent valve and allowing the liquid to enter the casing. For hazardous liquids the vent valve should be piped back to the suction source.

If the pump is installed with a static suction lift, priming must be done by other methods such as foot valves or ejectors.

WARNING:
The pump must not be run unless it is completely filled with liquid prior to starting. Damage and/or seizure may occur to internal sleeve and thrust bearings which depend on liquid for their lubrication. Failure to follow these instructions could result in property damage, severe personal injury, or death.

Flushing

Prior to installing the pump, new and old systems should be flushed to eliminate all foreign matter. Heavy scale, welding splatter and wire or other large foreign matter can clog the pump impeller and cause damage to the plastic liner and plastic parts.

This is particularly important in magnetic drive pumps due to the close internal clearances involved. Small size foreign matter can jam between close clearances or erode them open. Initially the system should be flushed to waste, then a temporary strainer with a finer mesh followed by a permanent strainer should be put in place for additional flushing. For ferrous solids
removal, a magnetic trap may be used. Magnetic solids must not be allowed to enter the pump.

Filling

Vents should be located at the highest point so entrained gases and air can escape.

WARNING:
If the gases are flammable, toxic, or corrosive they should be vented to an appropriate place to prevent harm to personnel or other parts of the system.

When handling very cold or hot liquids, it is necessary to gradually bring the unit and piping to near pumping temperature prior to start-up. Shocking the pump with very cold or hot liquid may cause thermal shock resulting in seizure and/or damage to the silicon carbide bearings. Pipe hangers and anchors should be checked to make sure they are properly set to take the additional weight of the pumpage.

All drains should be closed when filling the system. Filling should be done slowly so that excessive velocities do not cause rotation of the pumping elements which may cause damage to the pump. The adequacy of the anchors and hangers may be checked by mounting a dial indicator off of any rigid structure not tied to the piping and setting the indicator button on the pump flange in the axial direction of the nozzle. If the indicator moves, as the filling proceeds, the anchors and supports are not adequate or set properly and should be corrected.

6.3 Parallel or series operation

Pumps should not be operated in series or parallel unless specifically procured for this purpose, since serious equipment damage may occur. For parallel operation the pumps must have approximately matching head characteristics. Otherwise the system operating head may exceed the shut-off head of one or more pumps, resulting in the latter operating with zero output flow. This would have the same effect as operating against a closed discharge valve. In series operation the pumps must have approximately the same flow characteristics. Since each pump will take suction from the preceding pumps, the casing must be designed for the higher pressure, and the thrust bearing requirements may also increase.

6.4 Starting

1. Close drain valves.
2. Open fully all valves in the suction. Discharge valve can be fully open if a check valve is installed. Otherwise the discharge valve should be closed. However, as soon as the unit has reached full speed, the discharge valve should be opened, since prolonged operation with closed valve may prove harmful to the structural integrity of the pump and plastic pans. Do not operate the pump continuously at closed valve. The unit must never be operated with the suction valve closed.
3. Turn on liquid to the external flush piping if so equipped. This line should always be left open if the pumped liquid is dirty or has excessive solids content. If Plan 132 (external flush) or Plan 111 (filtered discharge flush) is used it must be ensured that the containment shell area is properly vented. In these flushing plans there are no lubrication holes in the bearing carrier (refer to Appendix F ● External flush arrangement on page 65 and venting is achieved solely between the flushing connection and diametrical clearance of the silicon carbide bearings. The pump should not be started sooner than five (5) minutes after opening the suction and pressure sided valves. Venting of the containment shell can be improved by rotating the pump shaft several times by hand.
4. Prime the pump.

NOTICE:
If the pump does not prime properly, or loses prime during start-up, it should be shut down and the condition corrected before the procedure is repeated.

5. Start the pump drive (turbines and engines may require warming up; consult the manufacturer's instructions).
6. When the pump is operating at full speed, check to see that the check valve has opened up. Check valve must open 5 seconds or less after start-up to prevent damage to pump by operating at zero flow.
7. Adjust the external flush valve to produce the recommended pressure if so equipped.
8. The torque on the casing bolts should be rechecked after the pump has come up to normal operating temperature. If operating temperatures fluctuate widely the torque on the casing bolts should be checked periodically.

6.5 Minimum flow

All centrifugal pumps have limitations on the minimum flow at which they can be operated continuously without affecting the service life of the machine. Some causes of problems are as follows:

- Temperature build up from operation close to shut-off.
- Radial thrust on impellers which cause shaft bending and high bearing loads. This can be serious in single volute pumps below 50% of the best efficiency point.
- Suction recirculation flow in the impeller eye when operated below 50 to 75% of the best efficiency flow. However, physical damage to the pump results only when energy levels associated with this recirculation are high.

Refer to your local Goulds Pumps Representative on appropriate minimum flow for your specific machines.

If it is necessary to operate a pump at flows below those specified by Goulds Pumps as minimum, then a by-pass line should be installed from the pump discharge to the suction source. The by-pass line should be sized so that the system flow plus the continuous by-pass flow is equal to or larger than the specified minimum flow.

6.6 Operational checklist

1. Flow:

   An accurate measurement of flow rate(volume/time) is difficult in the field. Venturi meters, flow nozzles, orifice plates, or timing the draw down in the sump are all possible methods. Record any reading for future reference.
2. Pressure:

   Check and record both suction and discharge pressure gauge readings for future reference. Also record voltage, amperage per phase, and kilowatts if an indicating watt meter is available.
3. Temperature:

   Check and record bearing temperatures using a thermometer. Bearing frame temperature should not exceed 180°F. See 5.3 Location on page 14 for further information.
4. Vibration and Sound:

   The acceptable vibration level of a centrifugal pump depends on the rigidity of the pump and the supporting structure. Recommended values for vibration at rated condition can vary between .20 IPS velocity to .30 IPS velocity depending on the operating characteristics and the structure. Operation at off design conditions can produce significantly higher vibration. Refer to the current

edition of the *Hydraulic Institute Standards* for a complete description and charts on various pumps.

Field sound levels are difficult to measure because of background noise from piping, valves, driver, gears, etc. Follow recommendations in the *Hydraulic Institute Standards*, current edition.

6.7 Shutdown

The following steps will take care of most normal shutdowns of the pump. Make any further adjustments of process piping, valves, etc., as required If the pump is to be removed from service for an extended period of time, refer to 5.2 STORAGE on page 14, and 6.8 Freeze protection on page 30.

1. Close discharge valve slowly to prevent water hammer.
2. Immediately, shutdown the driver. (Consult manufacturer's instructions for special operations.)
3. Close suction valve. The suction valve should be closed immediately upon shutdown to prevent solids from accumulating in the pump casing while the pump is not in operation. This will avoid damage when the pump is restarted.
4. Close external flush valve if so equipped. (If pumped liquid has excessive solids or is dirty, or if in leakage is to be prevented, this line should always be left open, except when the pump is completely drained.)
5. Open drain valves as required.
6. To avoid potential collapse of the inner containment shell, when the pump is idle, do not subject the unit to vacuum conditions lower than those shown in Appendix A Engineering Information. A bonded inner and outer containment shell which is suitable for hard vacuum conditions is available as an option from Goulds Pumps.

6.8 Freeze protection

Pumps that are shutdown during freezing conditions should be protected by one of the following methods.

1. Flush and drain the pump; remove all liquid from the casing and magnetic drive area.
2. Keep fluid moving in the pump and insulate or heat the pump to prevent freezing.

NOTICE:

If heat is used to keep the pump from freezing, do not let the temperature rise above 150ºF.

6.9 Field tests

Performance curve

A typical performance curve for a specific pump can be obtained from a Goulds Pumps Sales Representative. This can be used in conjunction with a field test, if one is required. All Goulds Pumps tests and curves are based on the *Hydraulic Institute Sealless Pump Standards*. Any field test must be conducted according to these Standards.

Unless otherwise specifically agreed, all capacity, head, and efficiencies are based on shop test when handling, clear, cold, fresh water at a temperature not over 85°F.

7 Maintenance

7.1 General maintenance and periodic inspection

Operating conditions vary so widely that to recommend one schedule of preventive maintenance for all magnetic drive centrifugal pumps is not possible. Yet, some sort of regular inspection must be planned and followed. We suggest a permanent record be kept of the periodic inspections and maintenance performed on your pump. This recognition of maintenance procedure will keep your pump in good working conditions, and prevent costly breakdowns.

One of the best rules to follow in the proper maintenance of your magnetic drive centrifugal pump is to keep a record of actual operating hours. Then, after a predetermined period of operation has elapsed, the pump should be given a thorough inspection. The length of this operating period will vary with different applications, and can only be determined from experience. New equipment, however, should be examined after a relatively short period of operation. The next inspection period can be lengthened somewhat if all is well. This system can be followed until a maximum period of operation is reached which should be considered the operating schedule between inspections. Refer to 7.4 Maintenance timetable on page 33.

7.2 Maintenance of flood damaged pumps

The servicing of centrifugal pumps after a flooded condition is a comparatively simple matter under normal conditions.

Bearings are a primary concern on pumping units. First, dismantle the frame, clean and inspect the bearings for any rusted or badly worn surfaces. If bearings are free from rust and wear, reassemble and relubricate them with one of the recommended pump lubricants. Greased for life bearings do not require relubrication. However, if subjected to ingress of water past the shields the bearings should be replaced. Depending on the length of time the pump has remained in the flooded area, it is unlikely that bearing replacement is necessary; however, in the event that rust or worn surfaces appear, it will be necessary to replace the bearings.

Next, inspect the inside of the bearing frame, clear any debris, and clean rusted areas. Also clean and inspect the outer carrier magnet assembly. There is no need to dismantle the containment shell since the inside should not be subject to flood damage. However, the outside of the containment shell should be visually inspected and cleaned.

Couplings should be dismantled and thoroughly cleaned. Lubricate the coupling with one of the coupling manufacturer's recommended lubricants where required.

Any pump that is properly sealed at all joints and connected to both the suction and discharge should exclude outside liquid. Therefore, it should not be necessary to go beyond the bearings, bearing frame, outer carrier assembly, and coupling when servicing the pump after flood damage.

7.3 Lubrication

Bearings

Bearing lubrication on 3299 pumps can be provided in either greased for life, oil bath, or oil mist arrangements. Check the pump nameplate for the specific type of lubrication provided.

Bearing lubrication - greased for life

Greased for life bearings are fitted with two shields rather than seals to reduce heat generation and are supplied from the factory with a special synthetic lubricant which is suited for normal operating temperatures as well as applications requiring high temperature service. The SKF grease designation is *UX*. The

specific type of grease is *Mobil Mobilith SHC 220* or equal which provides effective lubrication up to bearing temperatures of 245°F. A lithium soap grease having a temperature range of -30 to 110°C (grease designation *LGEP2*) may also be used.

These type of bearings are not regreaseable and ordinarily will require no attention before or after starting, provided the pump has been stored in a clean, dry place prior to its first operation. The bearings should be watched the first hour or so after the pump has been started to see that they are operating properly. If the pump is used for continuous operation it is recommended that these bearings be changed after three years of operation.

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Bearing lubrication - oil

Oil lubricated pumps have a slinger which picks up the oil and creates a shower of fine droplets over the entire interior of the bearing housing cavity.

After the pump has been installed, flush the frame to remove dirt, grit, and other impurities that may have entered the bearing housing during shipment or erection. Then fill the frame with proper lubricant. The oil level must be maintained at the center of the sight glass.

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A Mobil DTE Medium turbine oil, or equal, meeting the following specification will provide satisfactory lubrication. The oils can be furnished by all major oil companies. It is the responsibility of the oil vendor to supply a suitable lubricant.

1	Saybolt viscosity at 100ºF	215 SSU-240 SSU
2	Saybolt viscosity at 210ºF	49 SSU
3	Viscosity index, minimum	95
4	API gravity	30.6
5	Pour point, maximum	+20°F
6	Flash point, minimum	400ºF
7	Additives	Rust and Oxidation inhibitors
8	ISO viscosity	46

NOTICE:
Oils from different supplier should not be mixed. Engine oils are not recommended.

The oil should be non-foaming, well refined, good grade, straight cut, filtered mineral oil. It must be free from water, sediment, resin, soaps, acid and fillers of any kind.

In installations with moderate temperature changes, low humidity, and a clean atmosphere, the oil should be changed after approximately 1000 hours of operation. The oil should be inspected at this time to determine the operating period before the next oil change. Oil change periods may be increased up to 4000 hours based on an 8000 hour year. Check the oil frequently for moisture, dirt, or signs of *breakdown*, especially during the first 1000 hours.

NOTICE:
Do not over oil; this causes the bearings to run hot.

Bearing lubrication - oil mist

Oil mist lubrication on 3299 pumps is optional. After the pump has been installed, flush the frame to remove dirt, grit, and other impurities that may have entered the bearing housing during shipment or erection. Oil mist would normally enter the bearing housing at the top (oil breather connection) mist thru each bearing and exit thru 1/4 NPT vent connections located on the top of the bearing frame.

The type of oil lubricant used with oil mist systems would be the same as previously specified under . Oil mist systems provide a continuous clean/cool source of lubricant to the bearings and provides an excess pressure within the bearing housing to exclude contaminants from entering.

Bearing temperature

Normally the maximum desirable operating temperature for ball bearings is 180°F as measured on the bearing housing. Should the temperature of the bearing frame rise above the limit, the pump should be shut down to determine the cause. A bearing frame which feels hot to the touch of the hand is not necessarily running hot. Check with an accurate temperature measuring device to be sure.

Couplings

Flexible couplings (Wood's or Falk Torus coupling for instance) provide smooth transmission of power. There is no rubbing action of metal against rubber to cause wear. Couplings are not affected by abrasives, dirt, or moisture. This eliminates the need for lubrication or maintenance, and provides clean and quiet performance.

Grid or gear tooth couplings (Falk Grid Steelflex
or Falk Crowned Tooth coupling for instance) are initially lubricated with Falk Long Term Grease (LTG) and do not require relubrication for up to three years. If couplings leak grease are exposed to extreme temperatures, or excessive moisture more frequent lubrication may be required.

Use coupling manufacturer's recommended grease to provide trouble free performance.

If other types of couplings are used, follow maintenance instructions of coupling manufacturer.

7.4 Maintenance timetable

Initial baseline Measurements	Shortly after start-up, measure and record baseline readings for antifriction bearing temperature, bearing frame vibration, motor power, and total dynamic suction and discharge head. This data will provide a useful comparison for subsequent readings and the need for future maintenance.
Every 3 months	For oil lubricated units check the oil for signs of moisture, dirt, or signs of breakdown. For greased for life bearings remove the thrust bearing cover and visually inspect the outside bearing shields for signs of water infiltration past the outboard bearing seal. Refer to 7.3 Lubrication on page 31 for recommended frequency of oil changes. Recheck measurements taken shortly after startup and compare to baseline readings, if significant changes have occurred it is recommended that the pump be dismantled for inspection. Depending on the result of this inspection, next inspection will be after six or twelve months operation. If abrasive particles are present in the pumped liquid, the plastic liner and plastic parts should be inspected for signs of premature wear.
Every 6 months	Check alignment of pump and motor. Re-shim motor if necessary. If misalignment recurs frequently, inspect the entire piping system. Unbolt piping at suction and discharge flanges to see if piping springs away, thereby indicating excessive strain on the casing. Inspect all piping supports for soundness and effective support of load. Refer to 7.3 Lubrication on page 31 for recommended frequency of lubrication changes. Recheck previous measurements taken and compare to baseline readings, if significant changes have occurred it is recommended that the pump be dismantled for inspection. Depending on the result of this inspection, the next inspection will be after nine or twelve months operation. If abrasive particles are present in the pumped liquid, the plastic liner and plastic parts should be inspected for signs of premature wear.

Every year	Refer to 7.3 Lubrication on page 31 for recommended frequency of lubrication changes. The 3299 has been designed for long trouble free operation with proper application.. Since operating conditions vary widely, actual user experience will also vary. It is, therefore, recommended that careful attention be given to notable deviations in baseline measurements before scheduling maintenance. In particular significant changes in anti-friction bearing temperature and vibration could indicate excessive bearing wear. Hot spots on the outside of the bracket in the area of the periphery of the bumper ring may indicate rubbing of the outer carrier. Large changes in motor power may indicate internal rubbing. A drop off in total head given the same flow point may indicate cavitation or excessive impeller wear. Also inspect foot valves and check valves, especially the check valve which safeguards against water hammer when the pump stops. A faulty foot or check valve will reflect also in poor performance of the pump while in operation. If any of these warning signs are observed, the unit should be shutdown and inspected for cause in order to avoid a major repair expense.

NOTICE:
The above timetable is based on the assumption that after start-up, the unit had been regularly monitored and such a schedule was found to be consistent with operation, as shown by stable readings. Extreme or unusual applications or conditions should be taken into consideration and may require shorter maintenance intervals.

7.5 Operating problems

Troubleshooting

Between regular maintenance inspections, be alert for signs of motor or pump trouble. Common symptoms are listed below. Correct any trouble immediately and avoid costly repair and shutdown.

Symptom	Cause	Remedy
No Liquid Delivered	1. Lack of prime.	Fill pump and suction pipe completely with liquid.
	2. Loss of prime or vapor lock.	Check for leaks in suction pipe joints and fittings; vent casing to remove accumulated air or vapor.
	3. Suction lift too high.	If no obstruction at inlet, check for pipe friction losses. However, static lift may be too great. Measure with mercury column or vacuum gauge while pump operates. If static lift is too high, liquid to be pumped must be raised or pump lowered.
	4. Discharge system head too high.	Check pipe friction losses. Larger discharge piping may correct condition. Check that valves are wide open.
	5. Speed too low.	Check whether motor is directly across-the-line and receiving full voltage. Or frequency may be too low; motor may have an open phase.
	6. Wrong direction of rotation.	Check motor rotation with directional arrow on pump casing. Wrong rotation will cause pump damage.
	7. Impeller completely plugged.	Dismantle pump or use piping handhole to clean impeller.
	8. Closed suction valve.	Open suction valve.

Symptom	Cause	Remedy
	9. Magnet rotors decoupled.	May be due to excessive power consumption. Pump must be shutdown and cause corrected prior to restarting.
Not Enough Liquid Delivered	10. Air leaks in suction piping.	Suction line can be tested by shutting off or plugging inlet and putting line under pressure. A gauge will indicate a leak with a drop of pressure.
	11. Speed too low.	See item 5.
	12. Discharge system head too high.	See item 4.
	13. Suction lift too high.	See item 3.
	14. Impeller partially plugged.	See item 7.
	15. Cavitation; insufficient NPSH (depending on installation).	a. Increase positive suction head on pump by lowering pump or increasing suction pipe size or raising fluid level. b. Sub-cool suction piping at inlet to lower entering liquid temperature. c. Pressurize suction vessel.
	16. Defective impeller.	Inspect impeller. Replace if damaged or if vane sections badly eroded.
	17. Suction valve partially closed.	Open suction valve.
	18. Foot valve too small or partially obstructed.	Area through ports of valve should be at least as large as area of suction pipe, preferably 1-1/2 times. If strainer is used, net clear area should be 3 to 4 times area of suction pipe.
	19. Suction inlet not immersed deep enough.	If inlet cannot be lowered, or if eddies through which air is sucked persist when it is lowered, put an anti vortex baffle in the suction pipe.
	20. Wrong direction of rotation.	See item 6.
	21. Too small impeller diameter (probable cause if none of above).	Check with factory to see if a larger impeller can be us; otherwise, cut pipe losses.
Not Enough Pressure	22. Speed too low.	See item 5.
	23. Air leaks in suction piping.	See item 10.
	24. Mechanical defects.	See items 16 and 18.
	25. Obstruction in liquid passages.	Dismantle pump and inspect passages of impeller and casing. Remove obstruction.
	26. Air or gases in liquid. (Test in laboratory, reducing pressure on liquid to pressure in suction line. Watch for bubble formation).	May be possible to over rate pump to point where it will provide adequate pressure despite condition. Better to provide gas separation chamber on suction line near pump. and periodically exhaust accumulated gas. See item 15. **Notice:** This type of application will require a clean external source of non-volatile liquid to the liquid bearings and containment shell to avoid lack of lubrication/cooling which can result in failure.
	27. Excessive impeller front hub radial clearance.	Replace impeller.
	28. Wrong direction of rotation.	See item 6.

Symptom	Cause	Remedy
	29. Too small impeller diameter. (Probable cause if none of above).	See item 21.
Pump Operates For Short Time, Then Stops	30. Incomplete priming.	Free pump, piping and valves of all air. If high points in suction line prevent this, they need correcting. Refer to 5.8 Suction and discharge piping on page 20.
	31. Suction lift too high.	See item 3.
	32. Air leaks in suction piping.	See item 10.
	33. Air or gases in liquid.	See item 26.
Pump Takes Too Much Power	34.Head lower than rating; thereby pumping too much liquid.	Machine impeller's O.D. to size advised by factory. Refer to E.1 Returning parts on page 57.
	35. Cavitation.	See item 15.
	36. Mechanical defects.	See items 16 and 18.
	37. Suction inlet not immersed enough.	See item 19.
	38.Liquid heavier (in either viscosity or specific gravity) than allowed for.	Use larger driver. Consult factory for recommended size. Test liquid for viscosity and specific gravity. This may require a larger magnetic drive size.
	39. Wrong direction of rotation.	See item 6.
	40. Casing distorted by excessive strains from suction or discharge piping.	Check alignment. Examine pump for friction between impeller and casing. Replace damaged parts. Check for pipe strain.
	41.Shaft bent due to damage - through shipment, operation, or overhaul.	Dismantle pump and inspect shaft.
	42. Mechanical failure of critical pump parts.	Check bearings and impeller for damage. Any irregularity in these parts will cause a drag on shaft.
	43. Misalignment	Realign pump and driver.
	44. Speed may be too high (brake hp of pump varies as the cube of the speed; therefore, any increase in speed means considerable increase in power demand).	Check voltage and frequency on motor.
	45. Electrical defects.	The voltage and frequency of the electrical current may be lower than that for which motor was built; or there may be defects in motor. The motor may not be ventilated properly due to a poor location.
	46. Mechanical defects in turbine, engine, or other type of drive exclusive of motor.	If trouble cannot be located, consult factory.

WARNING:
Excessive power consumption may cause the magnets to decouple. If this happens the pump must be shutdown immediately and cause corrected prior to restarting. Failure to do this could result in damage to internal parts. Failure to follow all instructions could result in property damage, severe personal injury, or death.

Decoupling

Decoupling can be caused by jamming of the impeller, overloading due to rubbing, viscosity, high inertia load at start-up, or product lubricated bearing failure. In addition, decoupling can occur if an oversize motor accelerates too quickly for the magnetic coupling. If prolonged, decoupling can cause distortion and melting of internal plastic components. A power sensor on the motor can detect and shutoff the pump in these cases. The driver must be stopped for the magnets to realign themselves and cause corrected prior to restarting.

Vibration and noise

There are a number of factors which may cause vibration in a pump. Imbalance, misalignment, debris in impeller, looseness or bad bearings are some of the common causes of vibration. In some cases, minor vibrations become major problems because their frequency coincides with a structural resonance. In this case, it might be necessary to change the Reed frequency of the structure by stiffening it. Imbalance is the most common source of vibration and is also one which can be controlled through more precise balancing of the rotating element

Vibration can also be a cause of pump noise. Noise is undesired sound energy, and a vibrating structure will excite the air surrounding it resulting in noise. Windage noise is another problem with regards to undesired sound. Fans, couplings or any rotating elements which cause air movement are sources of windage noise. Still another noise source is the liquid flow. The interaction of the liquid with the pump casing or piping will cause them to vibrate and in tum excite the air surrounding them. The more turbulent the flow, the greater the vibratory excitation and the louder the noise. Many cures for vibration problems likewise cure a noise problem. For example, a vibrating steel plate can be felt as a vibration, and heard as noise. Eliminating or reducing the vibration has the same effect on the noise associated with it.

For expert field service assistance contact your nearest Goulds Pumps Representative.

8 Servicing

8.1 Servicing

(Refer to parts list and assembly sections pages 40 through 48 for catalog numbers contained in these procedures.

Page number	Pump Size	Construction
40	1x1.5-6, 2x3-6, 1x1.5-8	Frame Mounted· Group 1
42	1.Sx3-8, 1x2-10	Frame Mounted - Group II
44	1x1.5-6, 2x3-6, 1x1.5-8	Close Coupled 143 - 145TC
46	1xt.5-6, 2x3-6, 1xt.5-8	Close Coupled 182TC - 284TSC
48	t.Sx3-8, 1x2-10	Close Coupled 182TC - 326TSC

8.2 Disassembly

Safety

NOTICE:
The internals of these drives contain high power magnets. The following precautions should always be taken:

WARNING:
Persons wearing pace makers must not be allowed near this equipment. Close location of watches, credit cards. computer tapes, disks, or memory devices must be avoided to prevent damage. Failure to follow these instructions could result in property damage, severe personal injury, or death.

Repair work should always be carried out in a clean environment to prevent the pick up of ferrous particles.

CAUTION:
Extreme care should be exercised when disassembling/assembling these units because of the very high forces which can be created by the magnets. Jacking screws are safety features which have been included in the design and should always be used to prevent personal injury or damage to the unit. The bench top should be of non-magnetic material. Non-magnetic tools are recommended. Refer to B.1 Special tools on page 53 for manufacturers of these tools.

Drive assembly removal

The 3299 has been designed with double back pullout capability without the need to disturb the casing, main piping, or driver. When repair
work is only necessary on the antifriction bearings the bearing frame/outer magnet assembly can be separated from the liquid end by removing capscrews (5-904-1) which hold the bearing frame to the bracket. The close coupled con figuration has also been designed with double back pullout capability. If repair work is required on the motor the close coupled / outer magnet assembly can be separated from the liquid end by removing cap screws (5-904-1) which hold the adapter to the bracket. This has the advantage of not disturbing the liquid containment boundary; however, it is recommended that the system first be depressurized.

Alternately, the entire drive assembly can be removed from the pump casing without disturbing the main piping by removing cap screws (2- 904-1) which hold the bearing carrier to casing.

The following dismantling procedure is based on separation of the entire drive assembly from the pump casing:

1. For oil lubricated pumps remove drain plug (5-910-2) and drain all oil from the bearing frame (5-025-0).
2. Remove socket head capscrew (1-904-2) and lockwasher (1-917-0) which hold the outer magnet rotor assembly (1-842-4) to the end of the outer shaft (5-007-4). The outer magnet rotor assembly can now be withdrawn by pulling it forward. There is a machined flat on the OD of the outer magnet rotor assembly which can aide in
pulling it from the outer shaft.
3. Next remove socket head capscrews (5- 904-2) which hold the bearing cover (5- 018-4) in place. After removing the bearing cover the outboard bearing seal (5- 052-4) can be pressed out. The bearing cover gasket (5-913-2) and spring washer (5-921-0) can now be removed.
4. The outer shaft assembly consisting of inboard ball bearing (5-026-3), outboard ball bearing (5-026-4) and oil slinger (5- 485-0 oil lubricated units only) can be withdrawn from the coupling end of the bearing frame. A standard bearing puller can be used to remove the bearings from both ends of the shaft. Remove oil slinger (5-485-0) if applicable. The inboard bearing seal (5-052-3) can be pressed from its mounting in the bearing frame.

Disassembly of bearing frame/ outer magnet rotor assembly

1. For oil lubricated pumps remove drain plug (5-910-2) and drain all oil from the bearing frame (5-025-0).
2. Remove socket head capscrew (1-904-2) and lockwasher (1-917-0) which hold the outer magnet rotor assembly (1-842-4) to the end of the outer shaft (5-007-4). The outer magnet rotor assembly can now be withdrawn by pulling it forward. There is a machined flat on the OD of the outer magnet rotor assembly which can aide in
pulling it from the outer shaft.
3. Next remove socket head capscrews (5- 904-2) which hold the bearing cover (5- 018-4) in place. After removing the bearing cover the outboard bearing seal (5- 052-4) can be pressed out. The bearing cover gasket (5-913-2) and spring washer (5-921-0) can now be removed.
4. The outer shaft assembly consisting of inboard ball bearing (5-026-3), outboard ball bearing (5-026-4) and oil slinger (5- 485-0 oil lubricated units only) can be withdrawn from the coupling end of the bearing frame. A standard bearing puller can be used to remove the bearings from both ends of the shaft. Remove oil slinger (5-485-0) if applicable. The inboard bearing seal (5-052-3) can be pressed from its mounting in the bearing frame.

Disassembly of close coupled motor/outer magnet rotor assembly

1. Remove socket head capscrew (1-904-2) and lockwasher (1-917-0) which hold the outer magnet rotor assembly (1-842-4) to the end of the stub shaft (5-282-0). The outer magnet rotor assembly can now be withdrawn by pulling it forward. There is a machined flat on the OD of the outer magnet rotor assembly which can aide in pulling it from the stub-shaft. Alternately, the outer magnet rotor assembly and stub shaft can be pulled form the motor shaft by removing two (2) setscrews (1-902-0) from the stub shaft. These can be accessed through the top of the adapter after removing plug (5-910-7). Next, the adapter (5-536-0) can be removed from the TC motor after removing capscrews (5-904-3).

Disassembly of bearing carrier/ inner magnet rotor assembly

1. Remove capscrews (1-904-1) which secure the bracket (5-193-0) to the bearing carrier (1-850-0). Next remove the bracket and inner (1-843-3) and outer (1-843-4) containment shells from their mountings on the bearing carrier. The inner and outer containment shells can be removed from

the bracket by pushing out from the end of the outer containment shell. The bracket spacer (1-913-0) can be removed by slipping past the OD of the outer containment shell. The inner and outer containment shells may be separated, if desired, provided they do not have the optional vacuum resistant bonding feature.

2. To separate the inner magnet rotor assembly and impeller it is first necessary to clamp one of the untapped ears of the bearing carrier (1-850-0) in a vise. Using two strap wrenches, one on the impeller OD (4-005-0) and the other on the inner magnet rotor OD (1-842-3) tum the inner magnet rotor (right hand thread) until it loosens. It should be noted that the inner magnet rotor is secured to the shaft with adhesive and it may take approximately 90 ft-lb. of torque to loosen it. This torque can adequately be transmitted via strap wrenches. Caution: do not attempt to insert a screwdriver or other device between the impeller vanes during the loosening procedure. The impeller's plastic vanes will deform or break. Finish removing the inner magnet rotor assembly by unscrewing it from the end of the integral impeller/ shaft. Take care that the outboard journal sleeve bearing (1- 020-4) does not fall out.
3. Carefully remove the outboard journal sleeve bearing (1-020-4) from the shaft. Next withdraw the integral impeller/ shaft from the bearing carrier. Remove the inner shaft O-ring(1-914-0), bearing spacer (1-078-0), and inboard journal sleeve bearing (1-020-3) from the shaft.
4. The inboard (1-020-2) and outboard (1- 020-5) bushing bearings can be removed from the bearing carrier, if desired. Note, the silicon carbide bearings come as a matched set between bearing bushing and journal sleeve bearing. Match marks are etched on the non-contacting surfaces of each bearing.

8.3 Parts inspection

When the pump is dismantled for any reason, it is recommended that all parts be inspected for wear or damage. Inspect the following components and replace where necessary:

1. Casing (2-001-0)

   All surfaces should be cleaned. The main casing joint should be checked for nicks or gouges. The liner should be checked for excessive abrasion or cuts. Visually inspect for signs of permeation or corrosion of the metal under the liner. Check for signs of impeller rubbing.

2. Integral impeller/shaft (4-005-0)

   Check impeller vanes for blockage by debris. abrasive wear, bending, breakage, or corrosion. Measure impeller hub diametrical clearance and compare to value given in Appendix A Engineering Information. Replace if clearance has increased by 25%. Check the shaft lining for cuts and·threads for burrs. If excessively worn or eroded the integral impeller/shaft must be replaced. Check the bearing seating surface for signs of distortion or melting.

3. Bearing carrier (1-850-0)

   Clean and inspect all sealing surfaces. Remove any dirt or scale from cavities. Check that all lubrication paths are clear and free of debris. Check surfaces for signs of rubbing by the impeller or inner magnet rotor assembly. The liner should be checked for excessive abrasion or cuts. Visually inspect for signs of permeation or corrosion of metal under the liner.

4. Product lubricated bearings (1-020-2 through 5)

   The as new diametrical clearance between the sleeve journal and bearing bushing is .003". -.005". The bearings should be replaced when this clearance reaches .010" or if surfaces are scored or chipped or if the total axial rotor float has increased to .060".

NOTICE:

The sleeve journal bearings and bearing bushings are furnished as matched sets. When replacing bearing always replace both rotating and stationary bearings.

5. Gaskets, 0-rings and spacers (1- 078-0, 1-913-0, 1-914-0, 2-123-1, 5-913-1 and 2):

   Replace all gaskets, o-rings, and spacers.

6. Inner magnet rotor assembly (1- 842-3)

   Check that the magnet encapsulation is clean, undamaged, and free of any magnetic particles. Also check the plastic lining for excessive abrasive wear. Be careful not to drop this assembly or otherwise cause damage to the brittle magnets. Check that all lubrication paths are clear and free of debris.

7. Inner and outer containment shells (1-843-3 and 4)

   Inspect sealing surfaces, remove any dirt or buildup from the inside of the shell. Check for signs of rubbing by the magnet rotors on either the inner or outer containment shells. Check the inside surface of the inner containment shell for excessive abrasive wear or liquid permeation.

   Check the outer containment shell for signs of leakage or cracks.

8. Outer magnet rotor assembly (1- 842-4) outer shaft (5-007-4) and stub shaft (5-282-0)

   Check that the outer magnet assembly magnet surfaces are clean and free of magnetic particles. Inspect inner and outer surfaces for rubbing contact with containment shell or bracket. Normal radial clearance between the bumper ring and bracket is .028". If there is any reason to suspect a bent shaft or misalignment problem the shaft runout should be checked. Maximum shaft TIR is .00 l". Check tongue and groove drive for distortion.

9. Bearing frame (5-025-0)

   Check machined bores, clean interior of oil reservoirs. For oil lubricated units replace oil sight gauge if damaged or discolored. Check for damage to gasket surfaces. Also check for any corrosion due to leakage.

10. Bearing seals (5-052-3 and 4)

    Replace.

11. Antifriction bearings (5-026-3 and 4)

    It is recommended that new ball bearings be used for replacement of removed bearings since very often damage caused by removal cannot be detected until after pump is put back into operation.

    If bearings have not been removed from the shaft check to see if they are noisy or rough when rotated. On greased for life bearings replace if there is any sign of dirt or water infiltration past the shields.

    Clean oil lubricated bearings using an approved bearing cleaning solvent or other nonflammable industrial solvent. Replace bearings if there is any indication of wear or pitting in the bearing raceways or on the balls.

WARNING:

Under no circumstances should a combustible solvent such as gasoline be used to clean bearings or any other part of the pump. The use of such solvents could lead to fire and explosion. Failure to follow all instructions may result in property damage, severe personal injury, or death.

8.4 Assembly

Follow all installation precautions covered in this
manual. Always ensure that components are scrupulously clean before assembly. The inner and outer magnet carriers are magnetic and will pick up any ferrous debris.

Refer to following table for recommended torques for tightening threaded fasteners. Values given assume no lubricant is used. These values should be reduced by 1/3 if a lubricant such as anti-seize compound is used.

Table 3: Recommended torques

Thread Size	Torque Ft lbs.
5/16-18	6
3/8-16	10
·1/2-13	28
5/8-11	55

1. Assembly of bearing frame/outer magnet rotor assembly

   a) For oil lubricated bearings assemble oil slinger (5-485-0) on outer shaft (5-007- 4).

   b) Assemble the inboard ball bearing (5- 026-3) and outboard ball bearing (5-026-4 to each end of the shaft. It is recommended that an arbor press be used to press the bearings on the shaft Greased for life bearings should not be heated to avoid harming the lubricant. Oil lubricated bearings can be assembled to the shaft by uniformly heating the bearing to 240°F maximum using a clean oil bath or dry oven. Once heated, the bearings should be quickly slipped on the shaft. Be sure that bearings are pressed firmly against their locating shoulders by checking with a feeler gauge.

WARNING:
Use insulated gloves when handling hot bearings. Failure to follow all instructions may result in property damage, severe personal injury, or death.

   c) Press inboard oil seal (5-052-3) into its mounting on the bearing frame (5-025-0). Also press the outboard oil seal (5-052-4) into bearing cover (5-018-4). The bearing seals must be positioned with the lip facing outward as shown in the sectional assembly drawings. The bearing seals are positioned in this fashion to exclude contaminants.

NOTICE:

Lip seal must be square to housing and must be pre-lubricated with oil.

   d) Insert the outer shaft with mounted bearings into the bearing frame from the outboard end. Note: There is a slight interference between the oil slinger and bearing frame (oil lubrication only) and care must be exercised to avoid popping the slinger out of its groove on the shaft.

   e) Install the spring washer(5-921-0) against the outboard ball bearing. Next install the bearing cover gasket (5-913-2) over the sealing surface of the bearing frame. Place the bearing cover (5-018-4) in position and fasten with four (4) socket head cap screws (5-904-2).

   f) Install the outer magnet rotor assembly (1-842-4) onto shaft (5-007-4). Be sure that the tab on the outer magnet rotor assembly engages the slot at the end of the outer shaft (5-007-4). After cleaning parts to be bonded with *Loctite Kleen N' Prime* or equal, apply *Loctite Threadlocker 243* Adhesive or equal to the screw threads of socket head cap screw (1-904-2). Secure the outer rotor magnet assembly to the shaft with internal tooth lockwasher (1- 917-0) and socket head capscrew (1-904- 2).

   g) On Group II units install rear foot support (1-248-0) and secure to the bearing frame with two (2) capscrews (1-904-3).

h) On oil lubricated units install breather (5- 907-0) and breather reducing bushing (5- 922-0 Group II units only). For greased-for-life bearings this connection should be plugged. For oil lubricated units, install two (2) oil sight glass (5-949-1). For greased for life bearings these connections should be plugged.

i) Insert coupling key (5-911-4) into the outer shaft keyway and plug all remaining connections.

2. Assembly of close coupled motor / outer magnet rotor assembly

a) Install the stub shaft (5-282-0) onto the TC/TSC motor shaft; checking first that the motor key is in place. Slide the stub shaft all the way forward until it bottoms out on the motor shaft. Secure the stub shaft to the motor shaft with two (2) socket
headless setscrews (1-902-0).

b) Place the adapter (5-536-0) over the Cface motor register and secure with four (4) capscrews (5-904-3). Note the adapter for the 143/145TC motor has an integral foot and the motor is footless. All other adapters are footless and the TC/TSC motor frames are foot supported.

c) Install the outer magnet rotor assembly (1-842-4) onto the stub shaft (5-282-0). Be sure that the tab on the outer magnet rotor assembly engages the slot at the end of the stub shaft. After cleaning parts to be bonded with *Loctite Kleen N Prime* or equal, apply *Loctite Threadlocker 243* Adhesive or equal to the screw threads of socket head cap screw (1-904-2). Secure the outer rotor magnet assembly to the stub shaft with internal tooth lockwasher (1-917-0) and socket head cap screw (1- 904-2).

3. Assembly of bearing carrier / inner magnet rotor assembly

a) Clamp one of the untapped ears of the bearing carrier (1-850-0) into a vise. Be sure to check that the bearing bushing seating surfaces are clean and free of grit prior to assembly. Install the inboard (I-020-2) and outboard (I-020-5) bearing bushings in the corresponding bores of the bearing carrier. Be sure that the bearing bushing is seated evenly against the bearing carrier shoulder and that the bearing bushing anti-rotation tabs are located properly in the corresponding slots of the bearing carrier.

b) Place the inboard sleeve journal bearing (1-020-3) over the shaft and into its mounting at the rear of the impeller being careful that the sleeve bearing anti-rotation tabs are positioned properly in the slots at the rear of the impeller. Next slide the bearing spacer (1-078-0) over the shaft until it meets the inboard sleeve journal bearing. Place the inner shaft O-ring (1-914-0) over the end of the inner shaft until it meets the plastic lined shoulder.

NOTICE:

The bushing bearings and sleeve journal bearings are match marked. Be sure to install the correct sleeve journal bearing with its match marked bearing bushing.

---

c) Carefully insert the integral impeller/shaft into the casing side of the bearing carrier. Next slide the outboard sleeve journal bearing (1-020-4) far enough onto the inner shaft so that the anti-rotation tabs are still visible. After cleaning the shaft threads and corresponding threads on the inner magnet rotor assembly (1-842-3) with *Loctite Kleen N' Prime* or equal, apply three (3) strips of *Loctite Threadlocker 243 Adhesive* or equal in the tapped hole of the inner magnet rotor assembly. Begin to thread the inner magnet rotor assembly over the end of the shaft (right hand threads), be sure that the anti-rotation tabs of the outboard sleeve journal bearing engage the slots in the inner rotor magnet assembly. Tighten the shaft assembly by applying a strap wrench around the OD of the impeller while wrapping another strap wrench around the inner magnet rotor assembly. Tighten to 75 ft-lb. torque. This torque can adequately be transmitted via strap wrenches.

CAUTION:

Do not attempt to insert screwdriver or other device between the impeller vanes during the tightening procedure. The impeller's plastic vanes will deform or break.

CAUTION:

After tightening, check that the shaft assembly rotates freely without binding. The axial bearing float should measure between .020"-.040". Remove the assembly from the vise and place it on a workbench.

d) Insert the inner containment shell (1-843-3) into the outer containment shell (1- 843-4). Next place the bracket spacer (1- 913-0) over the OD of the outer containment shell until it meets the flanged surface. Prior to installing the containment shell, check to be sure that the inner magnet rotor assembly is clean and free of magnetically attracted particles. Also check to be sure that the bearing carrier containment shell sealing surfaces are clean and undamaged. Install the nested containment shells over the inner magnet rotor assembly until it rests on the containment shell sealing surface of the bearing carrier.

e) Place the bracket (5-193-0) over the outer containment shell and secure the bracket to the bearing carrier at the two (2) tapped ears with capscrews (1-904-1).

f) Secure the drain cover gasket (2-193-2) and drain cover (2-137-0) to the casing (2- 001-0) with two (2) capscrews (2-904-0). Place the casing gasket (2-123-1) onto the sealing surface of the casing. Be sure that the sealing surface is clean and undamaged. Place the bearing carrier/ inner magnet rotor assembly into the casing and secure with casing capscrews (2-904-1).

4. Final assembly

a) Set-up the bearing frame/outer magnet carrier assembly with rear foot support (or close coupled motor/outer magnet rotor-assembly) on a work bench of convenient height.

b) Thread jacking screws to their full length (5-902-0) into the bearing frame flange or close coupled adapter.

c) Install bracket gasket (5-913-1) into the recess in the bracket (5-193-0) after lightly coating gasket with non-retaining sealant. Check to be sure that the outer magnet rotor assembly is clean and free of magnetically attracted particles.

d) Use a partner to hold the casing/inner magnet rotor assembly (with containment shell) steady. Slowly and evenly move the outer rotating assembly toward the bracket until the magnetic attraction pulls it forward.

CAUTION:

High magnetic forces can trap fingers and cause personal injury.

Move the bearing frame or adapter forward to its final position by unscrewing jacking screws uniformly to prevent cocking. Once the assembly is in place secure the bearing frame or adapter to the bracket with cap screws (5-904-1).

Once the assembly is complete turn the pump shaft by hand and check for any binding or rubs. Any such condition must be corrected before the pump is operated. Plug all remaining external NPT connections on the pump.

Appendix A

A.1 General data

Temperature Limits: -20°F minimum 356°F maximum

Maximum Viscosity: 200 CSt

Maximum Suction Pressure = Max. work Pressure (at operating Temp.) -.433 (s.g.) (TDH)

Where	Max. working pressure is as shown in the maximum working pressure limit chart for the material selected at operating temperature.
s.g. =	specific gravity of liquid
TDH =	pump head at closed valve

Minimum Suction Pressure (with pump at standstill):

Standard Arrangement-7.25 psig @ 68°F and below, -3.6 psig @ 140°F, 0 psig @ 250°F and higher

Optional Arrangement -14.7 psig @ all temperatures·

Table 4: Bearing Frame Data - Anti Friction Bearings

	Drive	Shaft Dia. at Coupling (in)	Keyway Size / Length (in)	Shaft Dia. Between Bearings (in)	Bearing Span (in)
Group I	(A/B/C)	7/8	3/16 X 3/32 X 1.75	1.63	2.00
Group II	(D/E)	1-1/8	1/4 X 1/8 X 2.25	2.38	4.45

Table 5: Bearing Symbols (SKF or Equal)

		Line or Thrust Bearing	Line or Thrust Bearing
	Drive	Greased for Life	Oil
Group I	(A/B/C)	6207J2ZC3	6207JC3
Group II	(D/E)	6210J2ZC3	6210JC3

Table 6: Magnetic Drive Torque Rating

Drive Size	Breakaway Static Torque Ft-Lbs	Allowable Torque Starting Ft-Lbs	Allowable Torque Running Ft-Lbs
A Group I	10.1	8.4	8.1
B Group I	31.7	26.4	25.4
C Group I	45.7	38.1	36.6
D Group II	47.9	39.9	38.3
E Group II	103.3	86.1	82.6

Table 7: Containment Shell Data - Thickness and Pressure Data

	Inner Shell			Outer Shell				
Group	Shell, in.	End, in.	Material	Shell, in.	End, in.	Material	Max Working Press., Psig	Hydro Test Press., Psig
I	0.12	0.16	PTFE	.06	.20	CFRP	275	413
II	0.12	0.16	PTFE	.06	.20	CFRP	275	413

Table 8: Internal Clearance Data

	Group I	Group II
SIC Brg Diametrical Clearance, in.	0.003 - 0.005	0.003 - 0.005
Inner Rotor to Shell Radial Clearance, In.	0.088	0.088
Outer Rotor to Shell Radial Clearance, in.	0.059	0.059
Bumper Ring to Outer Rotor Radial Clearance, in.	0.028	0.028
Impeller Ring Diametrical Clearance, in.	0.080 - 0.090	0.080 - 0.090

Table 9: Silicon Carbide Bearing Data

	Impeller Overhang, in.	
Pump Size	**Group I**	**Group II**
1x1.5-6	1.61	NIA
2x3-6	1.81	NIA
1x1.5-8	1.61	NIA
1.5x3-8	NIA	1.93
1x2-10	NIA	1.93
Bearing Span, in.	1.42	1.89
Sleeve Brgs Dia x Length, in.	1.69 X 1.05	1.97 X 1.47
Thrust Brgs OD x ID, in.	2.28 X 1.69	2.68'"x 1 .97

A.2 Casing and impeller design data

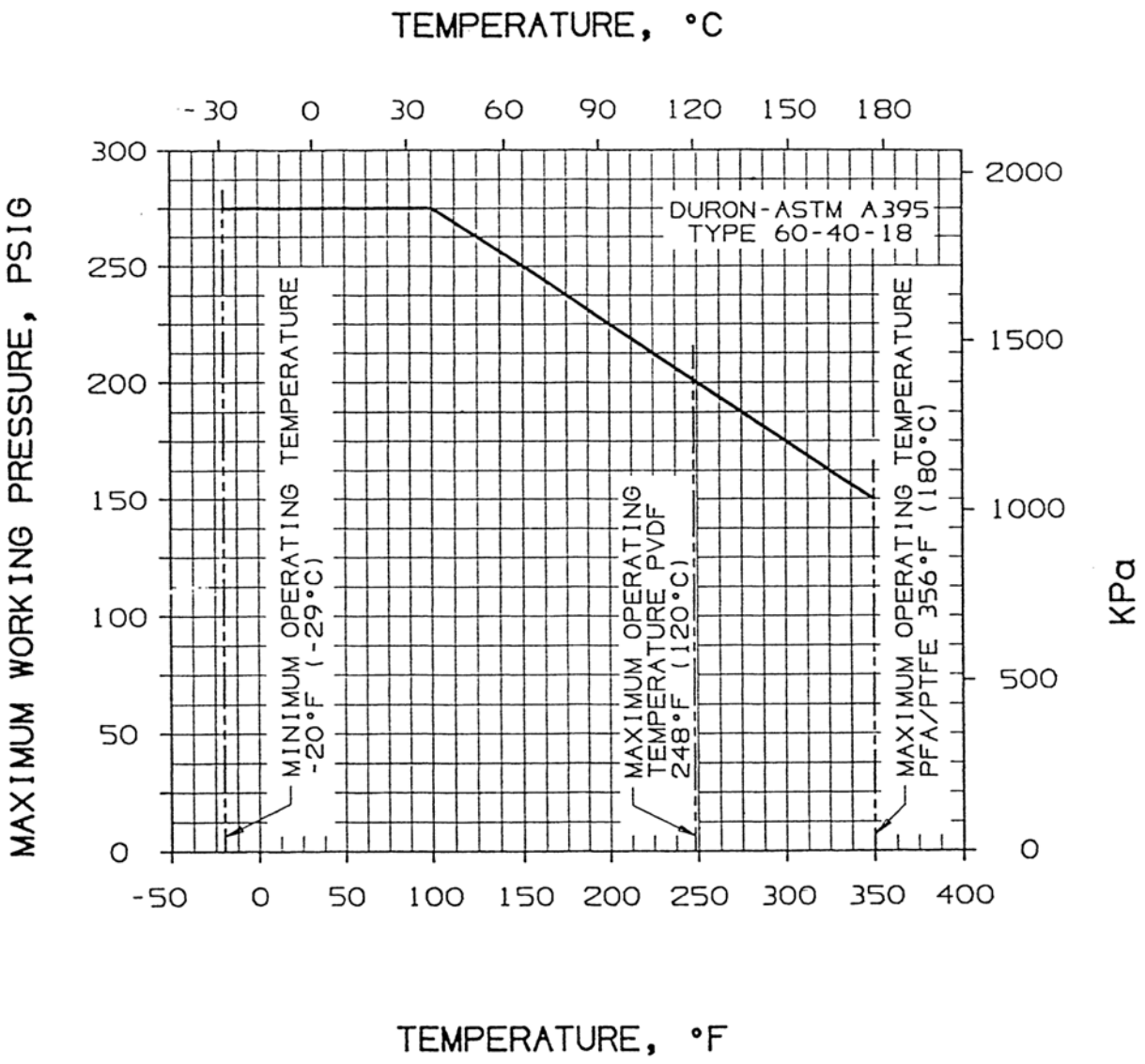
Table 10: Casing Design Data

Pump Size	Frame Group	Suction Size 150# RF	Discharge Size 150# RF	Max. Work. Press at 100ºF (Psig)	Hydrostatic Test Press (Psig)	Liner Thick-ness (in.)	Casing Thickness (in.)
1x1.5-6	I	1.5	1	275	413	0.20	0.31
2x3-6	I	3	2	275	413	0.20	0.31
1x1.5-8	I	1.5	1	275	413	0.20	0.31
1.5x3x-8	II	3	1.5	275	413	0.20	0.31
1x2-10	II	2	1	275	413	0.20	0.31

Table 11: Impeller Design Data

Pump Size	Frame Group	Dia. Max Qn)	Dia. Min Qn)	No. of Vanes	Max. Sphere Size (in)	Drive Max Dia Solids (in)	Inlet Area (Sq in)	Inlet Ve-locity Ft/Sec/ 100 GPM	Dia Ring Clear Qn)	Imp WR^2 (Wet) lb-in^2
1x1.5-6	I	6.0	4.0	7	0.25	0.012	3.64	8.82	.080- .090	8.07
2x3-6	I	6.0	4.0	6	0.30	0.012	7.07	4.54	.080- .090	13.24
1x1.5-8	I	8.0	6.0	7	0.21	0.012	3.42	9.39	.080- .090	43.66
1.5x3-8	II	8.0	6.0	7	0.40	0.012	7.59	4.23	.080- .090	45.07
1x2-10	II	10.0	7.0	6	0.30	0.012	4.29	7.48	.080- .090	96.94

Maximum working pressure limits class 150 lb flanges



A.3 Auxiliary and instrumentation connections

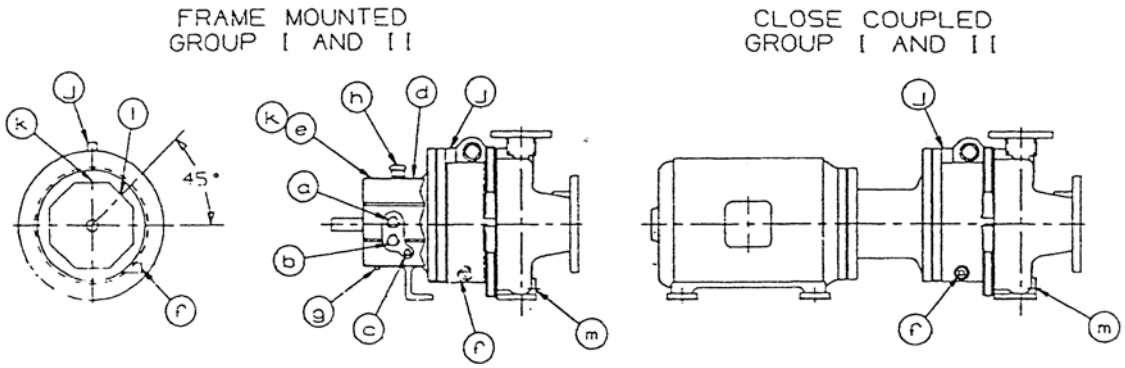


Figure 9: Group I and Group II frame mounted

CCN N.	Ident. (Std NPT when Furnished)	Conn. size	
		Group I	Group II
a	Vibration probe, bearing frame	½ (two) opt	½ (two) opt
b	Sight glass, bearing frame oil	½ (two) std	¾ (two) std
c	Oiler conn, bearing frame	¼ (two) std	¼ (two) std
d	Oil mist vent, inboard	¼ opt	¼ opt
e	Oil mist vent, outboard	¼ opt	¼ opt
f'	Vapor-leak detector/decontamination drain	¼ std	¼ std
g	Oil drain, bearing frame	¼ std	¼ std
h	Oil fill/vent, bearing frame	3/8 std	1/2 std
j	Inlet, decontamination flush	¼ opt	¼ opt
k	Bearing temperature, outboard	¼ opt	¼ opt
l	Bearing temperature, inboard	¼ opt	¼ opt
m	Casing drain	* opt	* opt

* ANSI ISO# RF flange (not shown) - orientation as specified

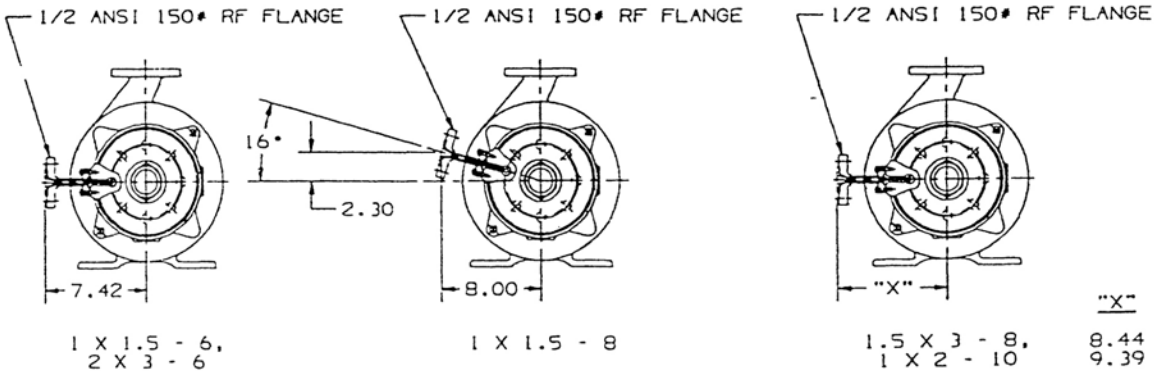


Figure 10: Optional external flushing arrangement

Instrumentation specifications

- Power Sensor
  - Load Sentinel or Equal, Model 2200-40 (Dual Setpoint) 60Hz Operation

    - Load Sentinel or Equal, Model 2200-40 (Dual Setpoint) with 2092 Modification for 50Hz operation
- Current Sensor
    - Diversified Electronics Inc. or Equal, Model CBA-120-ALE-30 Dual Trip AC Current Sensor
- Richter® Temperature Sensor
- 1. RTD 100 OHM Platinum, .00385 Temperature Coefficient, two wire construction, three or four wire construction is optional.
  2. NEMA 4 Aluminum die cast head, NEMA 7 explosion proof is optional.
  3. Wetted components to suit application.
- Vibration Sensor - Accelerometer
    - Wilcox Research or Equal, Model 793
    - Wilcox Research or Equal, Model 793E (intrinsically safe option)
- Leak Detector
    - Richter® Double Containment Shell Interstitial Leak Monitor
    - Liquid Level Switch: Cosense model LL101 or equal
        - Housing: Nema 4 / Nema 7 Water Tight, Explosion Proof, Class I, Groups C & D,
        - Class II, Groups E, F, & G, Class III, Div I & 2
    - Pressure Switch: Rating Nema 7 explosion proof switch
        - 1/4" NPT process connection, 3 I6ss wetted parts, preset to trip on 5 psig increasing pressure.
        - Ambient temperature range - 20 to 150°F
        - Switch element: SPDT 125/250 VAC

A.4 Pump weights

Table 12: Frame Mounted

lbs.					
Size	Drive A	Drive B	Drive C	Drive 0	Drive E
1x1 .5-6	150	154	157	-	-
2x3-6	162	166	169	-	-
1x1 .5-8	-	168	171	-	-
1.5x3-8	-	-	-	234	243
1x2-10	-	-	-	254	263

Table 13: Close Coupled Less Motor

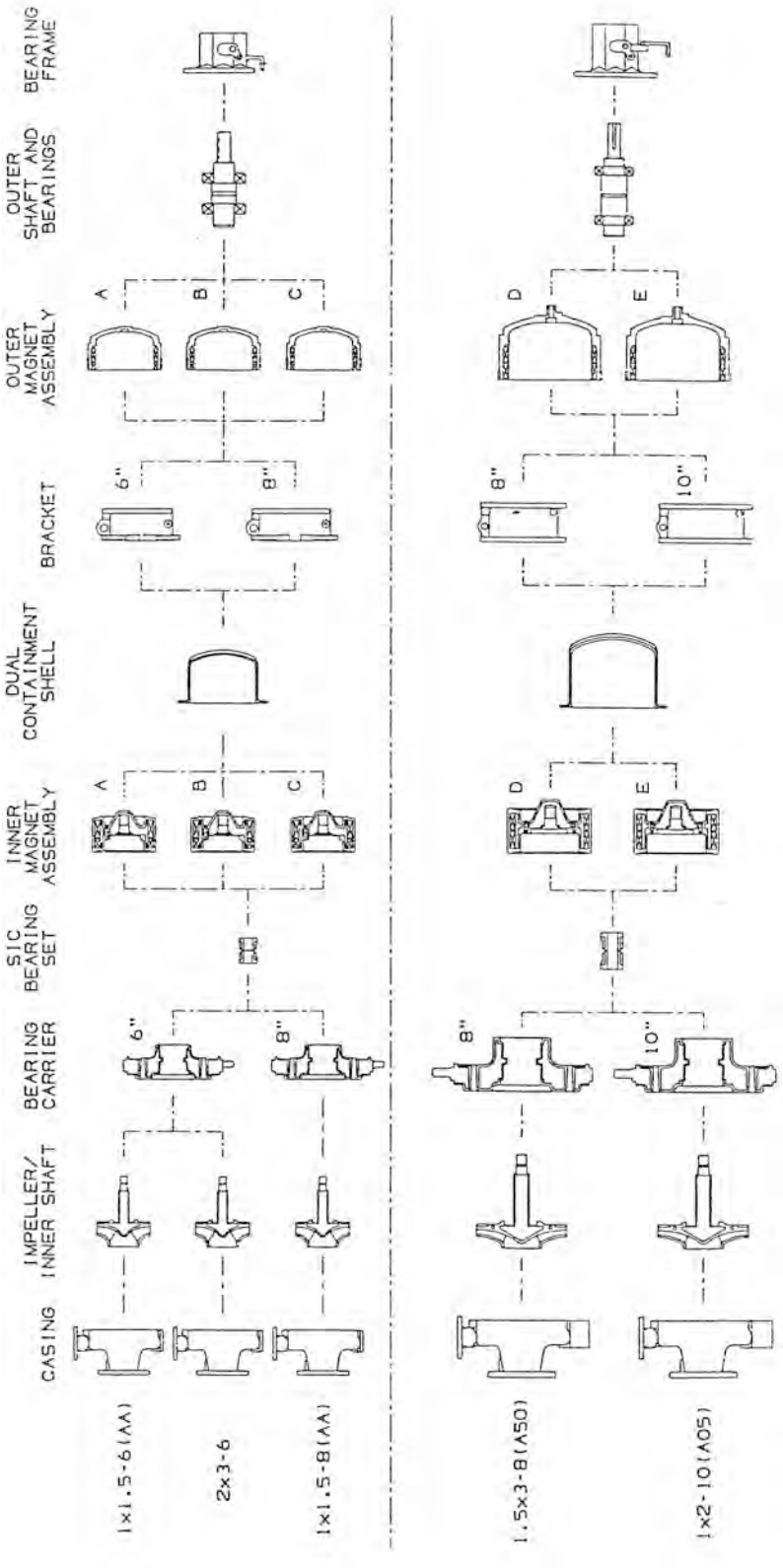
lbs.							
Size	**Drive A 143/145 TC**	**Drive A 182/184 TC**	**Drive 8 182/184 TC**	**Drive 8 213/215 TC**	**Drive 8 254TC**	**Drive C 254/256TC**	**Drive C 284TSC**
1 x1.5-6	137	147	151	151	152	155	161
2x3-6	149	159	163	163	164	167	173
1 x1.5-8	.	-	165	165	166	169	175

Table 14: Close Coupled Less Motor

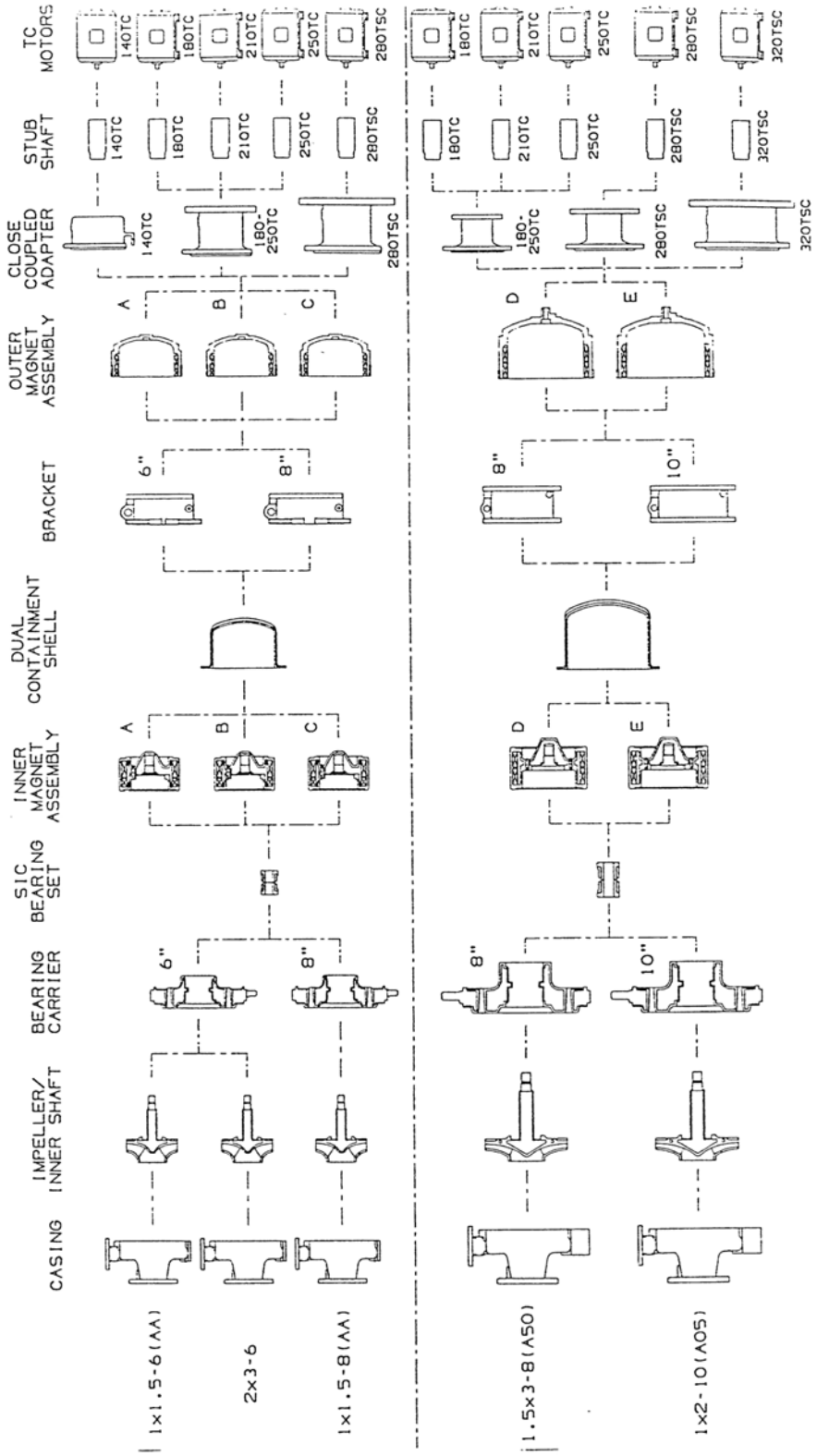
LBS.						
Size	**Drive D 182/184 TC**	**Drive D 213/215 TC**	**Drive D 254/256 TC**	**Drive D 284 TSC**	**Drive E 284/286TSC**	**Drive E 324/326TSC**
1.5x3-8	204	204	205	211	220	225
1x2-10	224	224	225	231	240	245

A.5 Interchangeability

Group I Model 3299 frame mounted interchangeability



Group I Model 3299 close coupled interchangeability



Appendix B

B.1 Special tools

Extreme caution should be used when dismantling or reassembling magnetic drive pumps. The magnets can cause parts and tools to slam together with force enough to injure the parts handler or damage parts. The use of nonmagnetic tools, while not absolutely necessary, is advised to prevent injury to workers and/or pump parts. It is also recommended that a nonmagnetic work bench be used. Typical manufacturers of nonmagnetic tools are:

Snap-On Tools Corp., Kenosha, WI

Ampco Metal, Inc., Milwaukee, WI

NSK Metals Inc., Athens, IN

WARNING:
Failure to follow these instructions could cause personal injury or equipment damage.

Appendix C

C.1 Recommended spare parts list and parts ordering instructions

Recommended spare parts have been grouped into three (3) categories as follows:

Category I:	Normal maintenance parts such as gaskets, keys, and fasteners.
Category II:	Major overhaul parts which may need replacing during a major repair. These are in addition to Category I spares.
Category III:	Insurance spares which can reduce downtime during a major overhaul. These typically are recommended. for export installations.

Category I		
Quantity	**Catalog Number**	**Part Name**
2	1-078-0	Spacer. Bearing
2	1-913-0	Spacer, Bracket
2	1-914-0	0-Ring. Inner Shaft
1	5-026-3	Bearing. Ball-Inboard
1	5-026-4	Bearing, Ball-Outboard
1	5-052-3	Seal. Bearing-Inboard
1	5-052-4	Seal, Bearing-Outboard
1	5-911-4	Key. Coupling
2	5-913-1	Gasket, Bracket
2	5-913-2	Gasket, Bearing Cover
2	2-123-1	Gasket. Casing
1	1-904-2	SH Cap Screw (Outer Carrier to Shaft)
1	1-917-0	Lockwasher, Internal Tooth
1	5-921-0	Washer, Spring
1	2-913-2	Gasket, Drain Cover

Category II		
Quantity	**Catalog Number**	**Part Name**
1	1-020-2	Bushing, Bearing-Inboard
1	1-020-3	Journal, Sleeve Bearing-Inboard
1	1-020-4	Journal, Sleeve Bearing-Outboard
1	1-020-5	Bushing, Bearing-Outboard
1	1-843-3	Containment Shell, Inner
1	4-005-0	Impeller/Shaft, Integral

Category III		
Quantity	**Catalog Number**	**Part Name**
1	1-842-3	Magnet Rotor Assembly, Inner
1	1-842-4	Magnet Rotor Assembly, Outer
1	1-843-4	Containment Shell, Outer
1	1-850-0	Carrier, Bearing
1	2-001-0	Casing

Category III		
Quantity	**Catalog Number**	**Part Name**
1	2-137-0	Cover, Drain (Casing)
1	5-007-4	Shaft, Outer
1	5-282-0	Shaft, Stub

Instructions for ordering parts

When ordering parts for 3299 Pumps, be sure to furnish the following information to Goalds Pumps stocking distribu tor in your area:

- Serial Number
- Pump Size
- Pump Model 3299
- Drive Frame Size
- Impeller Diameter Installed
- Description of Part
- Catalog Code
- Quantity Required
- Definite Billing and Shipping Information
- Date Required

Parts should be ordered as far in advance of their need as possible, since circumstances beyond the control of the company may reduce existing stock. All parts are not carried in stock. Some are made for each order. Recommended spare parts to be carried on hand are included in the paragraph above and should be given definite consideration. If replacement parts required are to be made of different materials than originally specified, give exact requirements and the reason for changing. Special care in furnishing the above information with the original order for parts will facilitate shipment.

Appendix D

D.1 Impeller trimming

When reducing the impeller diameter of 3299 integral impeller/shafts do not chuck directly on the plastic coated surfaces. Impeller trim sleeves are available from Goulds Pumps which will prevent damage to the shaft by the lathe jaws. For impeller trimming use a cobalt steel tool (not carbide tipped) and adjust the lathe speed to 500-600 rpm, slowly begin to take cuts using a forward feed of 0.010 inches across the impeller OD (including back vanes). When completing a cut across the impeller be careful to remove all trimmed plastic chips in order to provide for a clean cut on the next pass. As the final impeller diameter is neared begin to take smaller and slower cuts for a smoother finish. Once the desired impeller diameter is reached, remove the integral impeller/shaft assembly from the lathe and clean up any loose material with a knife.

Appendix E

E.1 Returning parts

Since magnetic drive pumps are typically used to pump toxic, corrosive, explosive, flammable, carcinogenic, ar, other hazardous liquids, it is essential that our repair personnel be protected from exposure to residues left from these liquids. Therefore, it is necessary that any pump/part which has been used in hazardous liquid service be properly decontaminated and identified before we can accept it. Certain OSHA Hazard Communication Standard requirements must be followed when returning the pump/part as noted below. Reference is made to the Goulds Pumps Hazard Identification Label shown on page 39.

1. Non-hazardous material

   If the material that the pump/part has been pumping is non-hazardous, check off the non-hazardous box on the Hazard Identification Label. Complete the certification section of Part 3 and fill in the information requested in Part 1. Attach the label to the outside of each container the pump/part is placed in.

   Ship only one pump/part per labeled box or container.

2. Hazardous material

   1. When the pump/part has been in a hazardous liquid application it must be disassembled and decontaminated prior to being returned or transported to the factory or repair facility. After decontamination, package all parts and attach a Hazard Identification Label. Sign your name in Part 3 of the label certifying that the pump has been decontaminated and print or type your company name and title.
   2. Check off the hazardous box and complete all sections of Part 2 of the label as appropriate. Write in the chemical name or identifier.· Attach a material Safety Data Sheet (MSDS) for material the pump/part was in contact with. The chemical name or identifier must match the MSDS that you will supply with the returned pump/part. Place the pump/part inside a plastic bag and seal before packing. The pump/part should be in a reasonably clean condition when returned.
   3. Attach the label to the outside of each container the pump/part is placed in.
   4. Ship only one pump/part per labeled box or container.

      The original Goulds Pumps Box or any other box may be used to place your pump/part in. Attach the Hazard Identification Label to this box. Articles being returned should be carefully packed to prevent damage from handling or from exposure to weather.

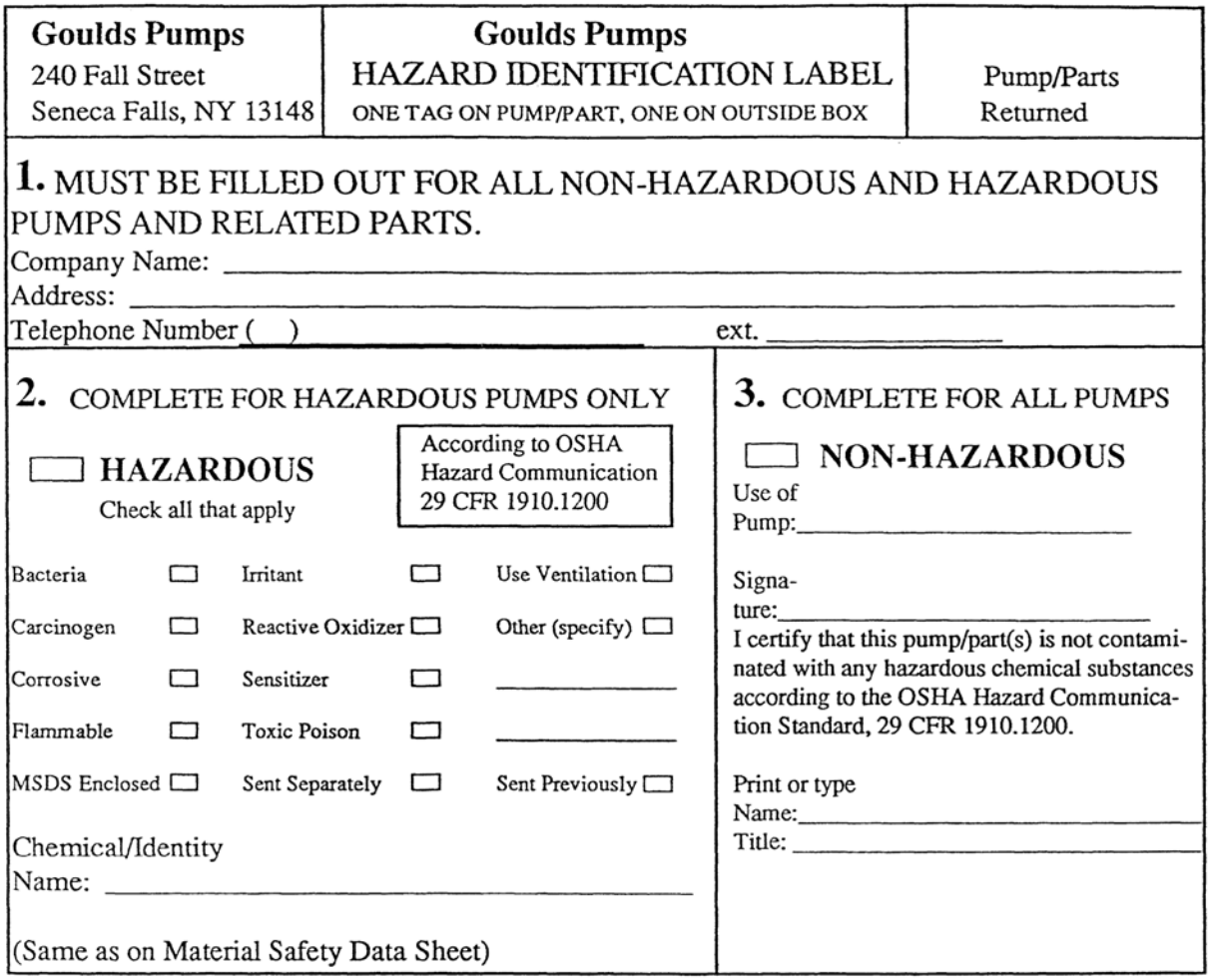
      Several boxed/labeled pump/parts can be put into one shipping container.

The following materials will not be accepted unless the pump/part is disassembled, cleaned, and decontaminated:

- Radioactive Materials***
- Bio-hazards, Level 2, 3, 4
- Toxics: Polychlorinated Biphenyl (PCB's), Dichlorodiphenyltrichloroethane (DDT), and DIOXIN.
- Any chemical material referenced in the Department of Transportation (DOT) Hazardous Materials Table 49 CFR 172.101, Column 3, (Hazard Class) marked "Forbidden" or Poison A, C, and D.
- Explosive Material (including Azides)

*** Radioactive material will not be accepted even if decontaminated or cleaned.

Any returned material which has been received by Goulds Pumps or an authorized Goulds Pumps distributor which is not in compliance with the above instructions will be returned to the "ship from address.



Goulds Pumps
240 Fall Street
Seneca Falls, NY 13148

Goulds Pumps
HAZARD IDENTIFICATION LABEL
ONE TAG ON PUMP/PART, ONE ON OUTSIDE BOX

Pump/Parts Returned

1. MUST BE FILLED OUT FOR ALL NON-HAZARDOUS AND HAZARDOUS PUMPS AND RELATED PARTS.

Company Name: _____

Address: _____

Telephone Number ( ) _____ ext. _____

2. COMPLETE FOR HAZARDOUS PUMPS ONLY

☐ **HAZARDOUS**
Check all that apply

According to OSHA Hazard Communication 29 CFR 1910.1200

Bacteria	☐	Irritant	☐	Use Ventilation	☐
Carcinogen	☐	Reactive Oxidizer	☐	Other (specify)	☐
Corrosive	☐	Sensitizer	☐	_____	
Flammable	☐	Toxic Poison	☐	_____	
MSDS Enclosed	☐	Sent Separately	☐	Sent Previously	☐

Chemical/Identity Name: _____

(Same as on Material Safety Data Sheet)

3. COMPLETE FOR ALL PUMPS

☐ **NON-HAZARDOUS**

Use of Pump: _____

Signature: _____

I certify that this pump/part(s) is not contaminated with any hazardous chemical substances according to the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Print or type Name: _____

Title: _____

Figure 11: Return Material Form

Appendix F

F.1 Assembly Section Group I, Frame Mounted

Frame mounted 52-462-000

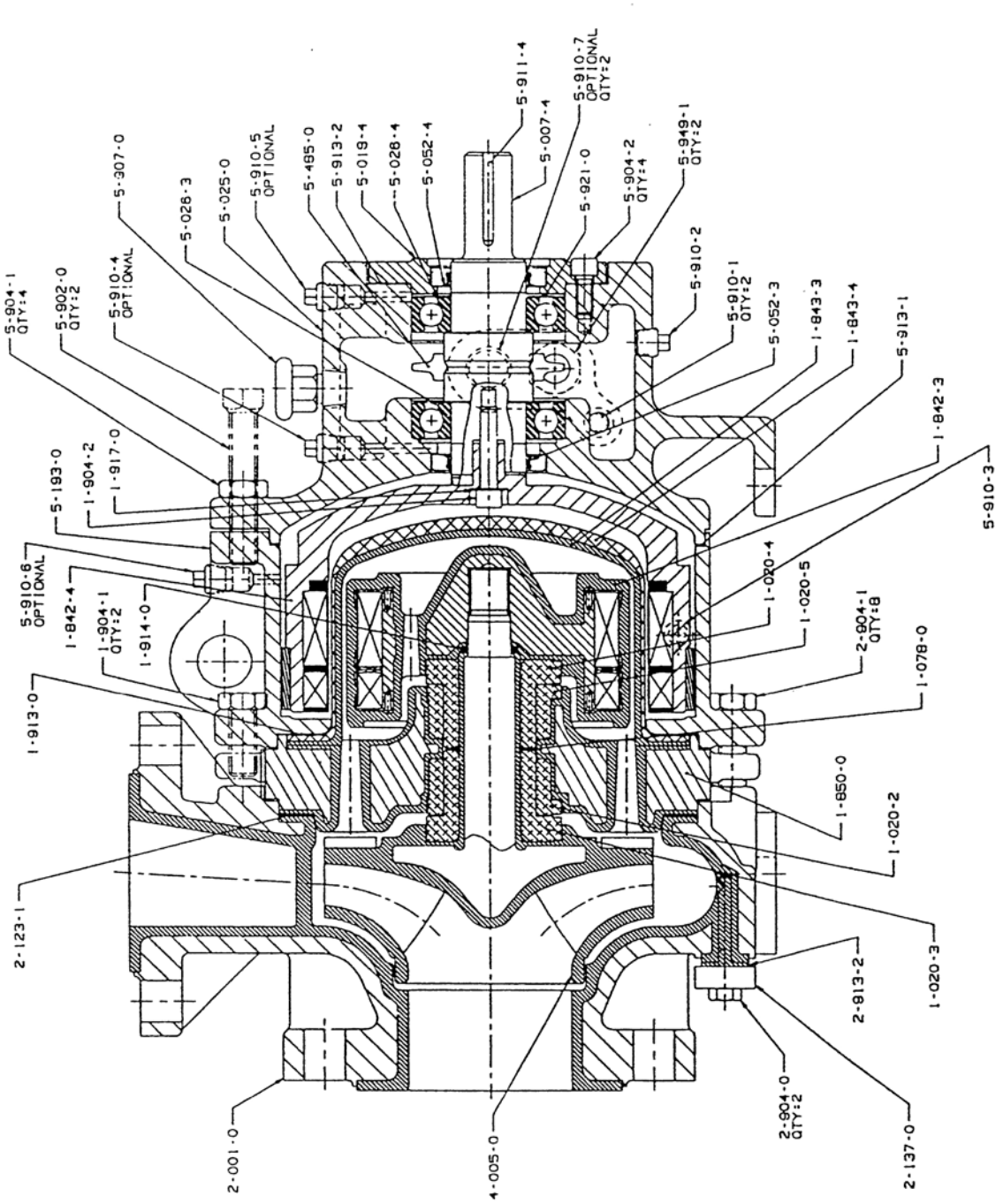
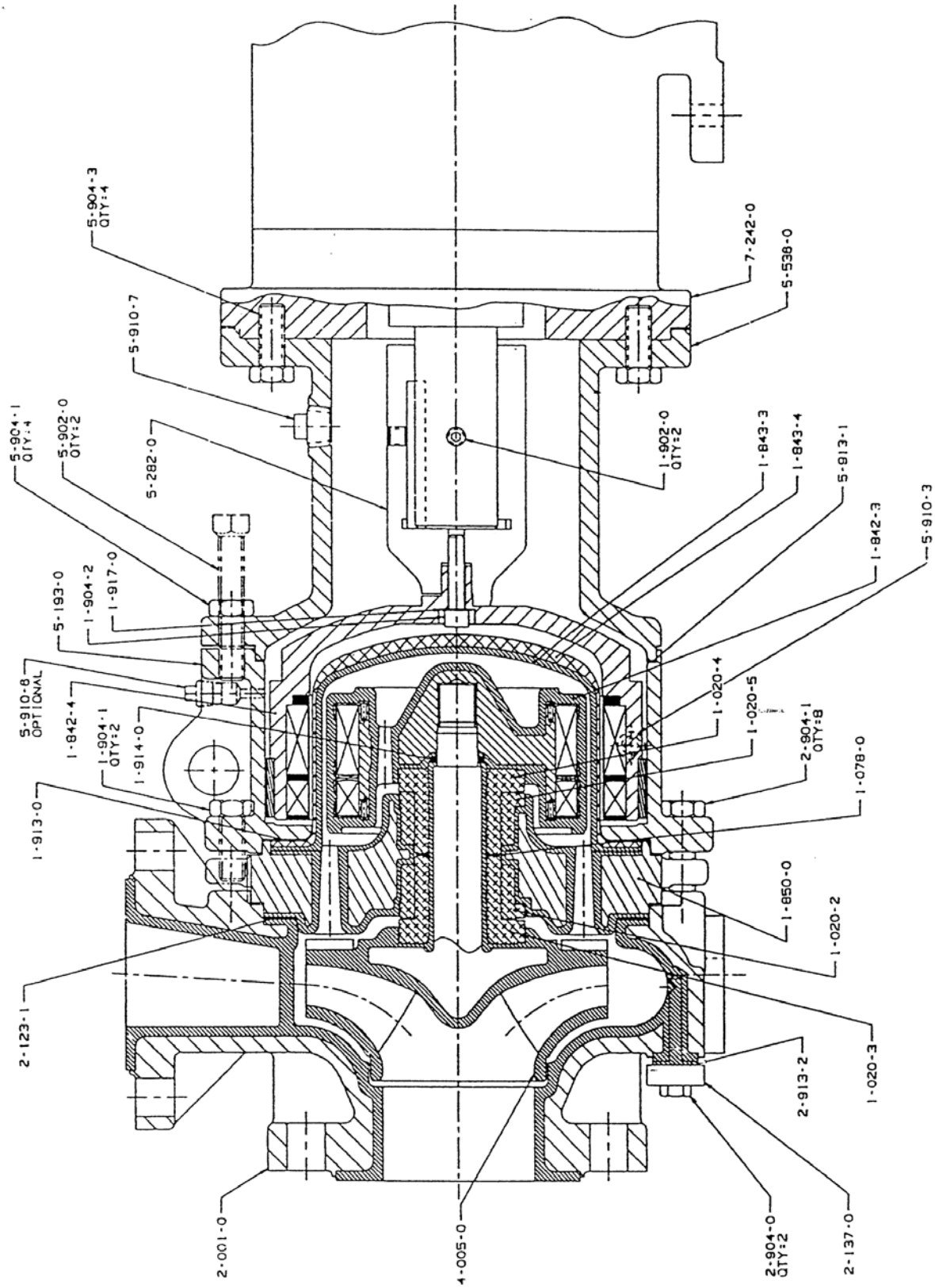


Table 15: Frame mounted catalog codes and descriptions

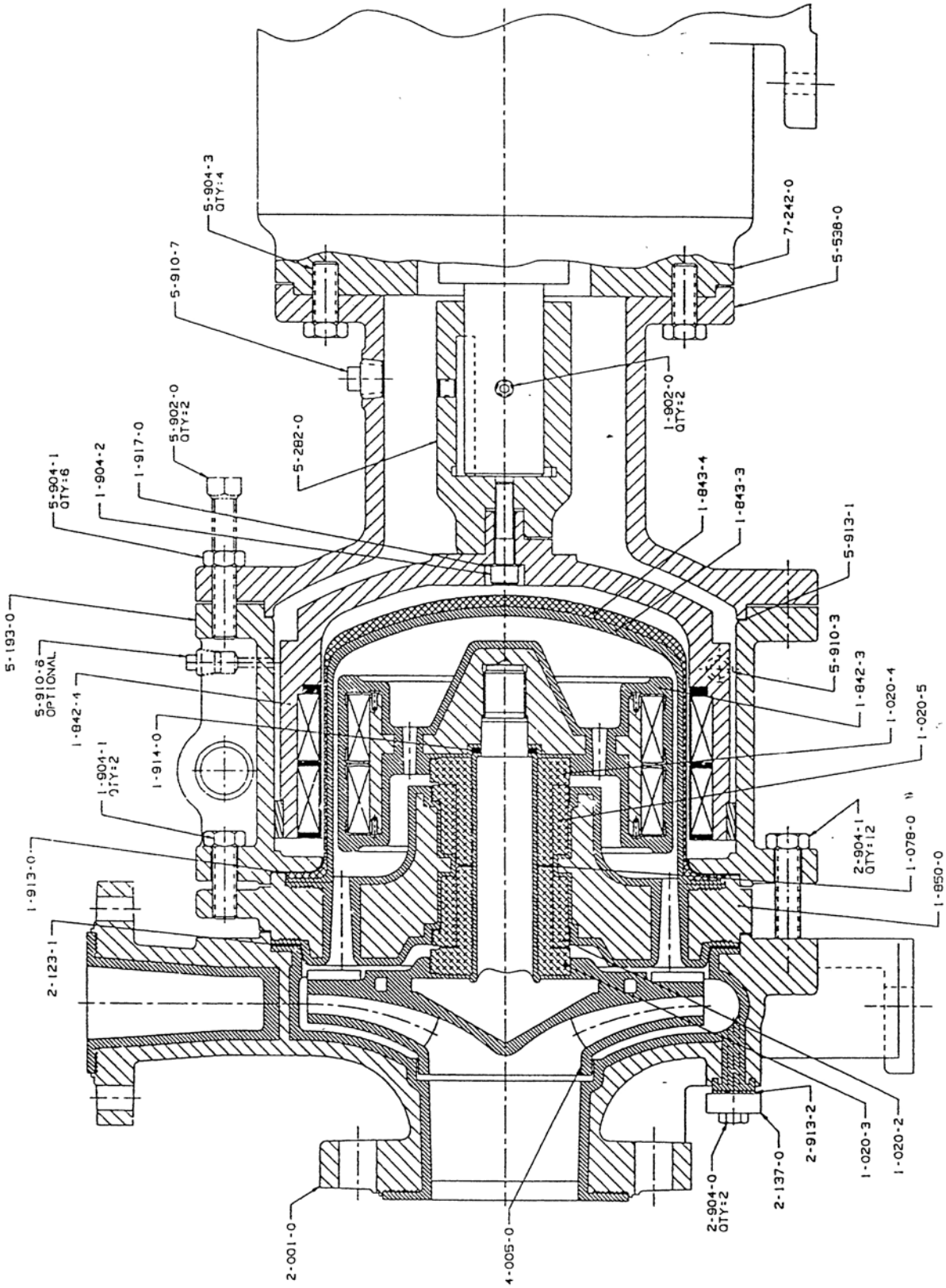
Catalog Number	Part Name	Catalog Number	Part Name
1-020-2	Bushing, Bearing-Inboard	5-025-0	Bearing, Frame
1·020-3	Journal, Sleeve Bearing-Inboard	5-026-3	Bearing, Ball-Inboard
1-020-4	Journal, Sleeve Bearing-Outboard	5-026·4	Bearing, Ball-Outboard
1-020-5	Bushing, Bearing-Outboard	5-052-3	Seal, Bearing-Inboard
1-078·0	Spacer, Bearing	5-052-4	Seal, Bearing-Outboard
1-842·3	Magnet Rotor Assembly, Inner	5-193·0	Bracket
1-842·4	Magnet Rotor Assembly, Outer	5-485-0	Slinger, Oil (With Oil Lube Only)
1-843·3	Containment Shell, Inner	5-902-0	Screw, Jacking (Bearing Frame)
1·843·4	Containment Shell, Outer	5-904·1	HH Cap Screw (Bearing Frame to Bracket)
1-850-0	Carrier, Bearing	5-904-2	SH Cap Screw (Bearing Cover)
1-904·1	HH Cap Screw (Bracket to Bearing Carrier)	5-907-0	Breather (With Oil Lube Only)
1-904·2	SH Cap Screw (Outer Carrier to Shaft)	5-910-1	Pipe Plug, Oiler
1-913·0	Spacer, Bracket	5-910-2	Pipe Plug, Oil Drain
1-914·0	0-Ring, Inner Shaft	5-910-3	Pipe Plug, Vapor/Leak Detector
1-917-0	Lockwasher, Internal Tooth	5-910·4	Pipe Plug, Oil Mist Vent-Inboard
2-001-0	Casing	5-910-5	Pipe Plug, (?ii ist Vent -Outboard
2-123·1	Gasket, Casing	5-910-6	Pipe Plug, Decontamination
2-137·0	Cover, Drain (Casing)	5-910-7	Pipe Pl,ug, Vibration Probe
2-904·0	HH Cap Screw (Casing Drain Cover)	5-911·4	Key, Coupling
2-904-1	HH Cap Screw (Casing)	5-913-1	Gasket, Bracket
2-913-2	Gasket, Drain Cover	5-913-2	Gasket, Bearing Cover
4-005-0	Impeller/Shaft, Integral	5-921-0	Washer, Spring
5-007-4	Shaft, Outer	5-949·1	Sight Gauge (With Oil Lube Only)
5-018·4	Cover, Bearing		

Close coupled 182TC - 284TSC



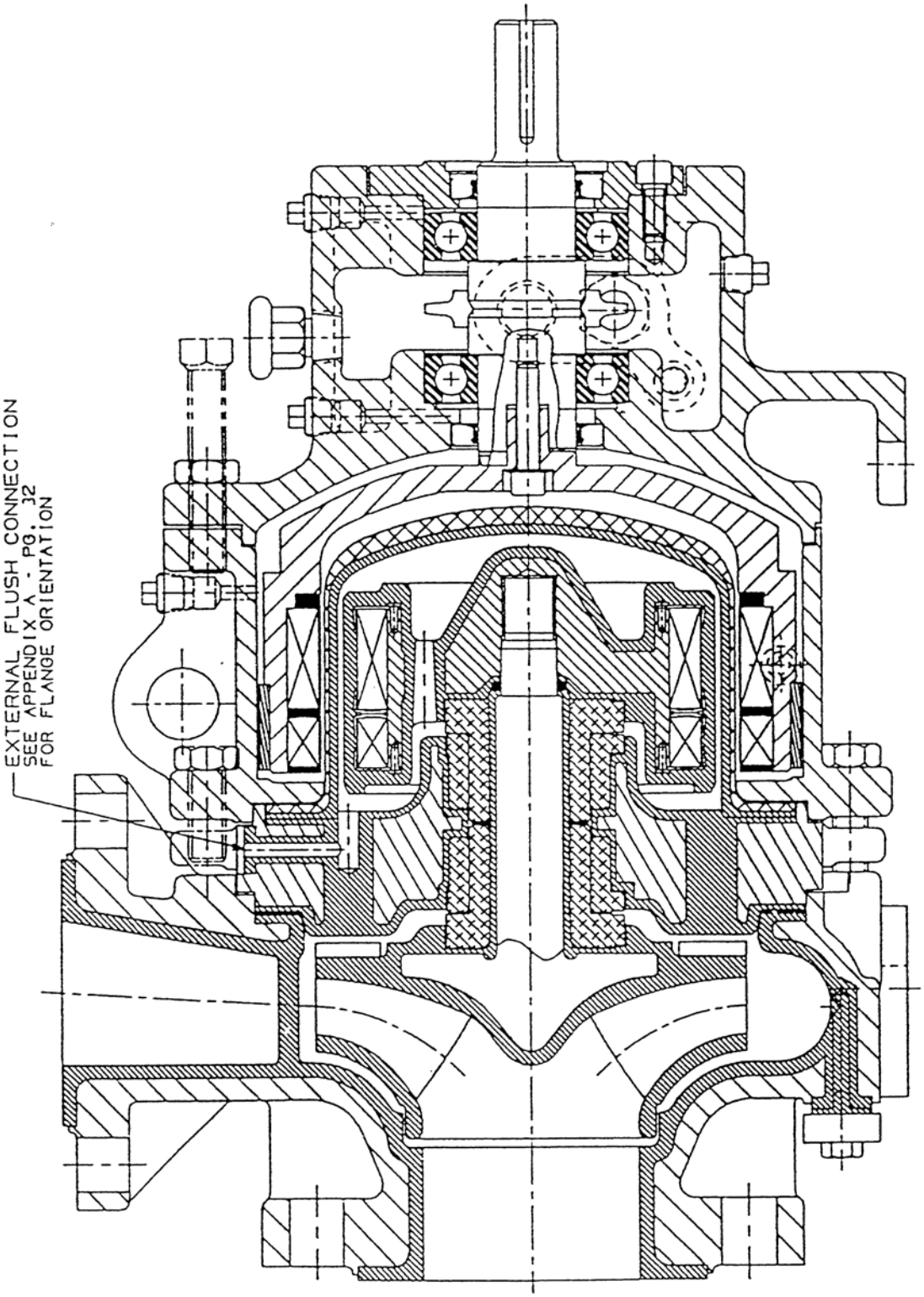
Catalog Number	Part Name	Catalog Number	Part Name
1-020-2	Bushing, Bearing-Inboard	2-123-1	Gasket, Casing
1-020-3	Journal, Sleeve Bearing-Inboard	2-137-0	Cover, Drain (Casing)
1-020-4	Journal, Sleeve Bearing-Outboard	2-904-0	HH Cap Screw (Casing Drain Cover)
1-020-5	Bushing, Bearing-Outboard	2-904-1	HH Cap Screw (Casing)
1-078-0	Spacer, Bearing	2-913-2	Gasket, Drain Cover
1-842-3	Magnet Rotor Assembly, Inner	4-005-0	Impeller/Shaft, Integral
1-842-4	Magnet Rotor Assembly, Outer	5-193-0	Bracket
1-843-3	Containment Shell, Inner	5-282-0	Shaft, Stub
1-843-4	Containment Shell, Outer	5-536-0	Adapter
1-850-0	Carrier, Bearing	5-902-0	Screw, Jacking (Adapter)
1-902-0	SH Set Screw	5-904-1	HH Cap Screw (Adapter to Bracket)
1-904-1	HH Cap Screw (Bracket to Bearing Carrier)	5-904-3	HH Cap Screw (Adapter to Motor)
1-904-2	SH Cap Screw (Outer Carrier to Shaft)	5-910-3	Pipe Plug, Vapor/Leak Detector
1-913-0	Spacer, Bracket	5-910-6	Pipe Plug, Decontamination
1-914-0	0-Ring, Inner Shaft	5-910-7	Pipe Plug, Adapter
1-917-0	Lockwasher, Internal Tooth	5-913-1	Gasket, Bracket
2-001-0	Casing	7-242-0	Motor, C-Face

Close coupled 182TC- 326TSC



Catalog Number	Part Name	Catalog Number	Part Name
1-020-2	Bushing, Bearing-Inboard	2-123-1	Gasket, Casing
1-020-3	Journal, Sleeve Bearing-Inboard	2-137-0	Cover, Drain (Casing)
1-020-4	Journal, Sleeve Bearing-Outboard	2-904-0	HH Cap Screw (Casing Drain Cover)
1-020-5	Bushing, Bearing-Outboard	2-904-1	HH Cap Screw (Casing)
1-078-0	Spacer, Bearing	2-913-2	Gasket, Drain Cover
1-842-3	Magnet Rotor Assembly, Inner	4-005-0	Impeller/Shaft, Integral
1-842-4	Magnet Rotor Assembly, Outer	5-193-0	Bracket
1-843-3	Containment Shell, Inner	5-282-0	Shaft, Stub
1-843-4	Containment Shell, Outer	5-536-0	Adapter
1-850-0	Carrier, Bearing	5-902-0	Screw, Jacking (Adapter)
1-902-0	SH Set Screw	5-904-1	HH Cap Screw (Adapter to Bracket)
1-904-1	HH Cap Screw (Bracket to Bearing Carrier)	5-904-3	HH Cap Screw (Adapter to Motor)
1-904-2	SH Cap Screw (Outer Carrier to Shaft)	5-910-3	Pipe Plug, Vapor/Leak Detector
1-913-0	Spacer, Bracket	5-910-6	Pip Plug, Decontamination
1-914-0	0-Ring, In er Shaft	5-910-7	Pipe Plug, Adapter
1-917-0	Lockwasher, Internal Tooth	5-913-1	Gasket, Bracket
2-001-0	Casing	7-242-0	Motor, C-Face

External flush arrangement



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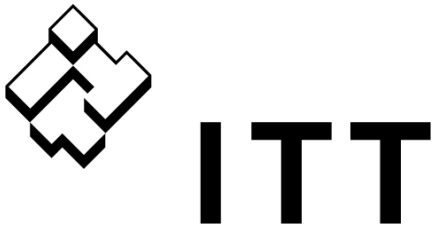

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