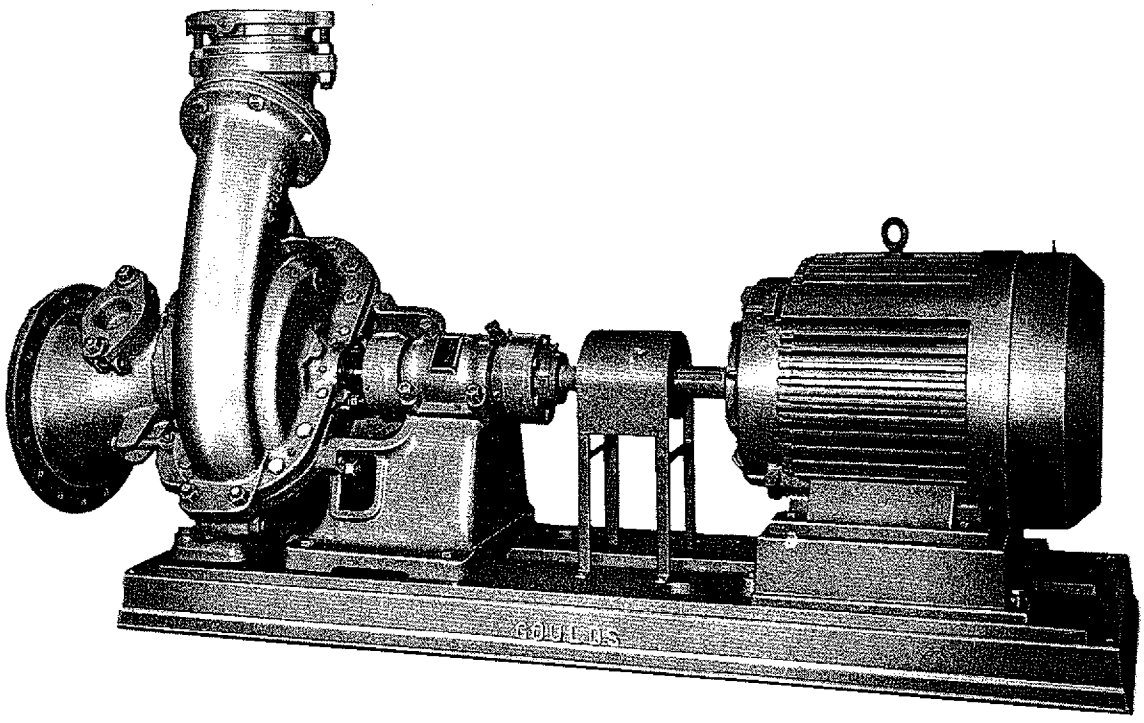
GOULDS PUMPS

model 3135



ITT

IMPORTANT SAFETY NOTICE

To: Our Valued Customers

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

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

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

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

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

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

SAFETY WARNINGS

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

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

SAFETY

DEFINITIONS

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

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

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

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

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

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

⚠ **ELECTRICAL HAZARD**
Indicates the possibility of electrical risks if directions are not followed.

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

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

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

GENERAL PRECAUTIONS

⚠ WARNING

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

General Precautions		
WARNING		NEVER APPLY HEAT TO REMOVE IMPELLER. It may explode due to trapped liquid.
WARNING		NEVER use heat to disassemble pump due to risk of explosion from tapped liquid.
WARNING		NEVER operate pump without coupling guard correctly installed.
WARNING		NEVER run pump below recommended minimum flow when dry, or without prime.
WARNING		ALWAYS lock out power to the driver before performing pump maintenance.
WARNING		NEVER operate pump without safety devices installed.
WARNING		NEVER operate pump with discharge valve closed.
WARNING		NEVER operate pump with suction valve closed.
WARNING		DO NOT change service application without approval of an authorized ITT Goulds Pumps representative.
WARNING		**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.

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

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

ATEX CONSIDERATIONS and INTENDED USE

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

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

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

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

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

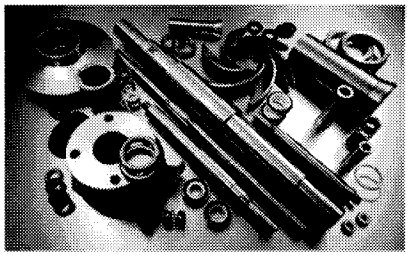
II = Group 2
2 = Category 2
G/D = Gas and Dust present
T4 = Temperature class, can be T1 to T6 (see Table 1)

Table 1

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

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

PARTS



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

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

SECTION I—INSTALLATION

I—A. LOCATION.

Pumping unit should be placed as close as practical to the source of supply. Always allow sufficient head room to remove the upper half casing of the pump and the rotating element. Floor space allotted to the pumping unit should be sufficient for inspection and maintenance.

I—B. SPACING.

The upper half casing is equipped with jacking bolts and is hinged to facilitate inspection. The pump should be set far enough from the nearest obstruction on the hinge side to allow the rotating element to be lifted without removing the hinge pin. Listed below are minimum recommended distances from pump centerline to nearest obstruction for each size of pump:

PUMP	DISTANCE
3x 6-14 3x 8-14	32″
4x10-14 4x12-14	36″
4x10-18 4x12-18	40″
6x12-16 6x14-16	44″
6x12-20 6x14-20	50″
8x14-20 8x16-20	52″

I—C. FOUNDATION.

1. The foundation should be substantial in order to absorb any vibration and to form a permanent rigid support for the bedplate. A concrete foundation poured on a solid footing, using a one-three-five mix, of a liberal thickness to support the pumping unit is satisfactory.

2. Foundation Bolts:

(a) The location and size of the foundation bolts is shown on the outline assembly drawing supplied for the pumping unit.

(b) Each bolt should be installed with a pipe sleeve around it—to allow for adjustment. The inside sleeve diameter should be 2½ to 3 times the diameter of the bolt. Place a washer between bolt head and sleeve to hold bolt in position. See Fig. 1.
Stuff waste around foundation bolts to prevent grout from entering between the bolt and pipe sleeve.

(c) The foundation bolts should be of sufficient length so that they project through the nut approximately ¼″ after allowance has been made for grouting (¾″ to 1½″), the thickness of the bedplate, and the thickness of the foundation bolt nut. See Fig. 1.

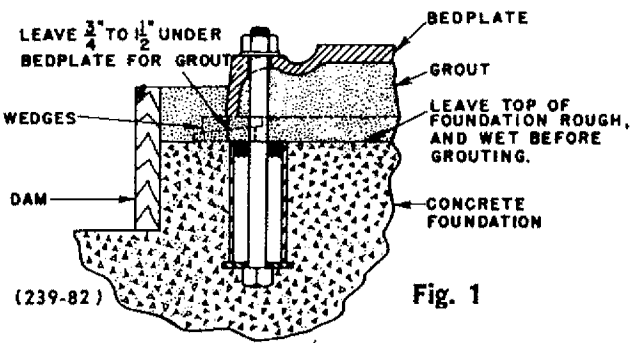


Fig. 1

3. Prepare Foundation for Mounting:

Prior to setting unit upon the foundation, clean the top surface of concrete.

4. Mounting Unit on Foundation:

(a) Put the pumping unit in place on the wedges furnished. The wedges should be placed at four points, two below the approximate center of the pump and two below the approximate center of the driver. (See Fig. 2.) Some installations may require additional wedges near the middle of the bedplate.

(b) Be sure that coupling is disconnected between pump and driver.

(c) Tighten pump and driver hold down bolts.

(d) Adjust wedges to level baseplate in both directions. Check by placing spirit level on machined surface near feet. Baseplate must be proper distance above foundation for grouting. (¾" to 1½").

(e) Bring coupling halves into reasonable alignment by adjusting wedges under baseplate. Check alignment as directed in Section I–C. Use additional wedges if required.

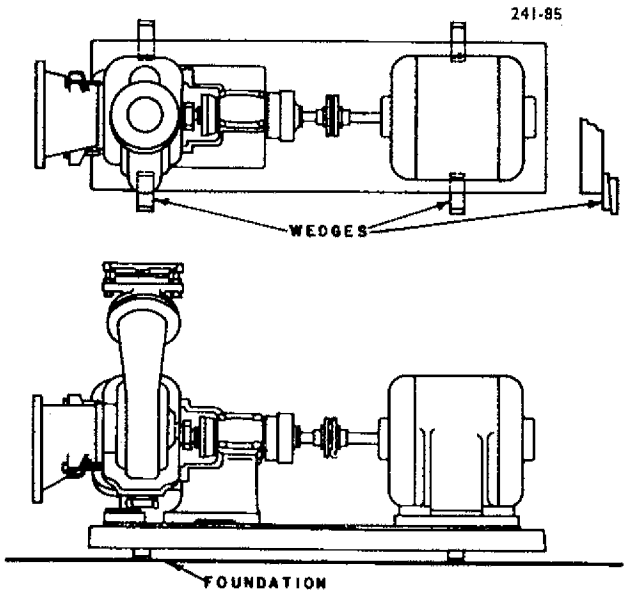


Fig. 2

(f) After the wedges have been adjusted, tighten foundation bolts evenly but only finger tight.
NOTE: Final tightening of foundation bolts is done after grout has set 48 hours.

5. Grouting Unit on Foundation:

(a) Build wood dam around foundation as shown in Fig. 1 and wet top surface of concrete foundation thoroughly.

(b) Pour grout in hole provided in top of the bedplate. Use of a non-shrinking grout is recommended. The grout should be thin enough to flow out under the bedplate. A mixture of one part Portland cement to three parts sharp sand may also be used. Cement grout should not be so thin that the cement will separate from the sand.

(c) The grout should be puddled continuously as it is poured to expel the air and completely fill the space under the bedplate, to the level of the grout hole in the top of the bedplate.

(d) With a trowel, strike along the top of the wood dam to give a neat, finished appearance at this point.

(e) Allow grout to harden at least 48 hours.

I—D. ALIGNMENT—INITIAL.

Alignment of the pump and driver through the flexible coupling is of extreme importance for trouble-free mechanical operation.

If the driver was mounted at the factory, the unit was in alignment before it left our assembly department. However, in transit and subsequent handling, this factory alignment was probably destroyed; and, IT

IS NOW NECESSARY TO RE-ESTABLISH THE ALIGNMENT. As directed in Section I–C 4 (d & e) (page 2), only *approximate* alignment was obtained by wedging under bedplate before grouting.

The following are suggested steps to establish the initial alignment of the pumping unit: (NOTE THAT THIS IS AN INITIAL ALIGNMENT. THE FINAL ALIGNMENT IS DONE AFTER THE UNIT HAS BEEN RUN UNDER ACTUAL OPERATING CONDITIONS. THE FINAL ALIGNMENT PROCEDURE IS OUTLINED IN SECTION III–E AND MUST BE FOLLOWED).

1. Be sure coupling halves are disconnected as instructed in Section I–C 4 (b) (page 2).
2. Tighten foundation bolts.
3. Tighten pump frame hold down bolts. Turn shaft several revolutions by hand. If pump is binding, loosen leveling screw jam nuts (420) and loosen leveling screws (419). Snug both leveling screws finger tight. Tighten each leveling screw with a small wrench not more than ¼ of a flat until shaft turns freely by hand. DO NOT TIGHTEN MORE THAN ½ OF ONE FLAT TOTAL. Snug jam nuts.

   Shim under pump casing foot about ¼" thick. Note these shims must be notched for leveling screw and drilled for hold down bolts. Insert and tighten hold down bolts. SHAFT MUST TURN FREELY BY HAND.
4. Tighten motor hold down bolts.
5. Check angular misalignment–shaft axis concentric but not parallel–by inserting a taper gauge or feeler at four points on the circumference of coupling halves at 90° intervals. See Fig. 3. The unit will be in angular alignment when the measurements show the coupling faces are the same distance apart at all points. The "gap" between the coupling halves should be checked at this time. This depends on the type of coupling used and this information will be found in the instructions for the specific make of coupling furnished. These instructions are furnished separately and also include directions for installing, lubrication, etc. Adjustment for obtaining angular alignment and "gap" is obtained by loosening the driver hold-down bolts and shifting or shimming driver as required. Tighten driver hold-down bolts after angular alignment and correct "gap" are secured.

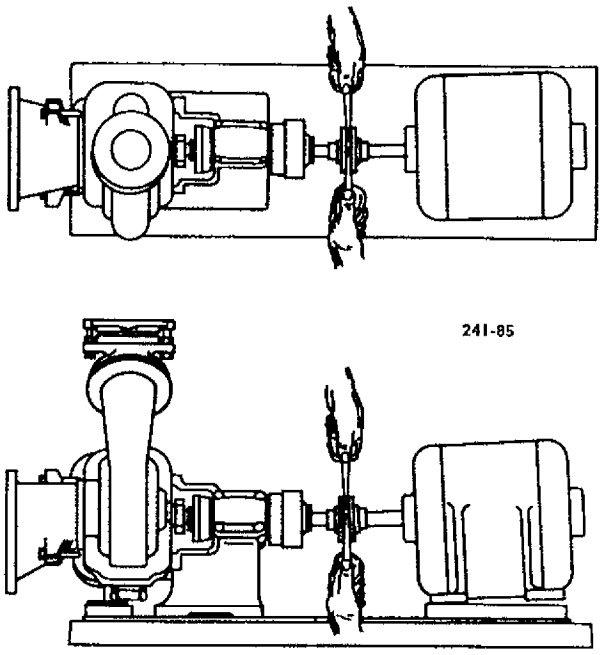


Fig. 3

6. Check parallel misalignment–shaft axis parallel but not concentric–by laying straight edge across both coupling rims at top, bottom and both sides. See Fig. 4.

   The unit will be in horizontal parallel alignment when the straight edge rests evenly on both halves of the coupling at each side.

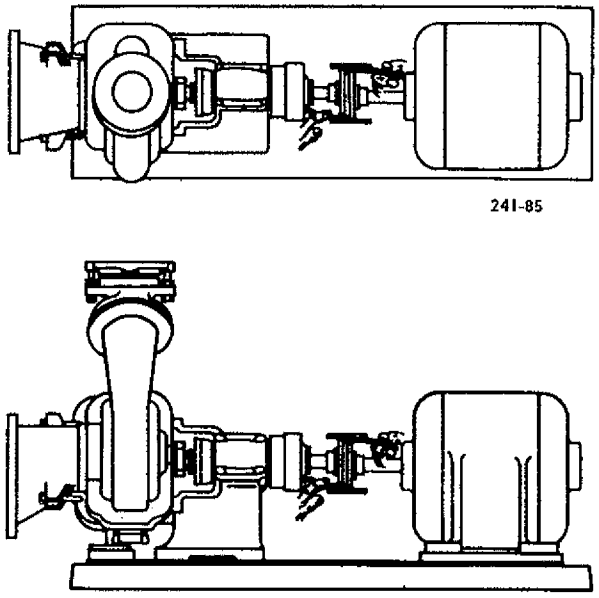


Fig. 4

Thin shim stock should be used to establish parallel alignment under the driver feet; however, in some instances, shims may be required under the pump feet.

7. Bear in mind always that alignment in one direction may alter the alignment in another. Check through each alignment procedure after making any alignment alteration.

I—E. PIPING—GENERAL.

1. All piping must be supported independently of the pump. The piping should always "line-up" naturally with the pump flanges. *NEVER DRAW THE PIPING INTO PLACE BY USE OF FORCE AT THE FLANGED SUCTION AND DISCHARGE CONNECTIONS OF THE PUMP!*

2. The piping, both suction and discharge, should be as short and direct as possible. Avoid all unnecessary elbows, bends and fittings, as they increase the friction losses in the piping. The size of pipe and fittings should be carefully selected and of sufficient size to keep the friction losses as low as practical.

3. Piping must not be connected to the pump until the grout has thoroughly hardened and the foundation bolts as well as driver and pump hold-down bolts have been tightened. Section I—H (page 5).

I—F. PIPING—SUCTION.

1. Properly installed suction piping is of extreme importance for trouble-free centrifugal pump operation.

(a) The suction pipe should be as short and direct as possible. ALWAYS KEEP THE DIRECTION OF FLOW IN A STRAIGHT LINE .

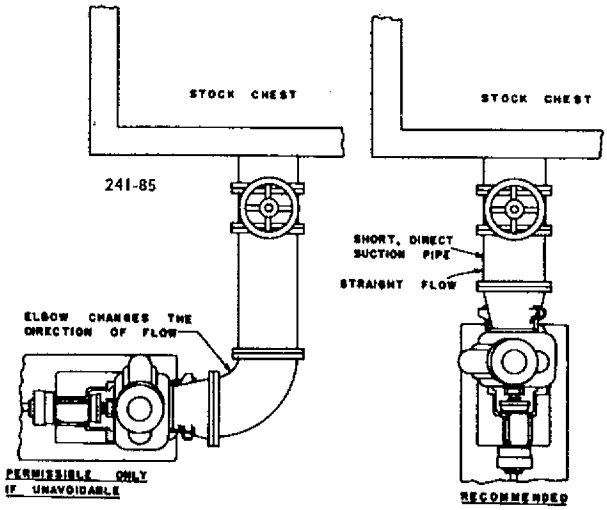


Fig. 5

(b) The suction pipe should be as large or larger than the pump suction.

(c) Increasers, if used, should be eccentric and preferably at the pump suction flange.

(d) A CENTRIFUGAL PUMP SHOULD *NEVER* BE THROTTLED FOR CAPACITY ADJUSTMENT ON THE SUCTION SIDE.

2. **Installations With Pump Below Source of Supply—Suction Head or Flooded Section:**

(a) A gate valve should be installed in the suction line to permit closing the line for pump inspection and maintenance.

(b) Keep suction pipe free from air pockets.

1. Piping should be level or slope gradually downward from the source of supply.
2. Always use eccentric increasers, not concentric.

(c) The size of entrance from the stock chest should be no smaller than the suction pipe.

3. **Installations With Pump Above Source of Supply—Suction Lift:**

A pump for paper stock should never be installed under a suction lift. The static head above the pump centerline must exceed the suction line friction by a sufficient amount to insure flow into the pump.

I—G. PIPING—DISCHARGE.

1. A gate valve should be installed in the discharge line. The gate valve is required for regulation of flow capacity and for inspection and maintenance of the pump.

I—H. CONNECTION OF PIPING.

Connect suction piping. Rotate the pump shaft by hand several complete revolutions to be sure that there is no binding and that all parts are free. Recheck alignment as described in Section I—D (page 2.) If the connection of the piping causes unit to be out of alignment, correct suction piping to relieve strain on the pump.

Loosen lower adjusting nuts (357) on telescopic discharge connector (411) and place 2 pieces of 2" long keystock (½" for standard dimensions) between machined surfaces under ½" plugged holes in discharge flange. Set upper adjusting nuts so keystock will just slip in. Leave keystock in place and tighten lower adjusting nuts (357).

Connect discharge pipe. When piping is completed, loosen upper and lower adjusting nuts and check for deflection of piping by removing keystock. Adjust pipe hangers to correct. *If piping sags, adjust pipe hangers until keystock can be removed by hand.* Use additional pipe supports if required. Adjusting units may be left loose allowing telescopic joint to act as an expansion joint on discharge line after piping is properly supported.

I—J. CHECK OF ROTATION.

The direction of rotation is marked on the pump casing. Make sure that driver rotates in the same direction. On electric motors, *jog* starting switch to be sure wiring is connected for correct rotation. Be sure that coupling is disconnected.

I—K. CONNECTION OF COUPLING.

Connect coupling, following instructions for the particular make of coupling furnished. This data is supplied separately, giving complete instructions for connection, lubrication, alignment and maintenance.

SECTION II—PREPARATION FOR OPERATION

II—A. PUMP BEARINGS.

The pump bearings in standard construction are grease lubricated. Sufficient lubricant is inserted at the factory for 2000 hours operation.

An alternate construction with oil lubricated ball bearings can also be furnished to order. Fill both bearings until the oil level is ⅛" from the top of the oil fitting. Use a good quality, clean SAE 10 oil.

II—B. DRIVER BEARINGS.

Check to be sure the driver bearings are properly lubricated.

II—C. STUFFING BOXES.

Pumps are furnished with packed type stuffing boxes. The standard packing is ½" square plaited braided asbestos thoroughly lubricated with mineral grease before braiding. The packing is recommended for hot and cold water, weak acids, mild chemicals and all general services.

The packing is included in the bag of fittings attached to the pump, and is cut to required length. The combination water seal ring and stuffing box bushing (125) is installed in the stuffing box at the factory. Check to be sure it is seated properly. Wipe out the stuffing box with a clean cloth to remove any dirt.

Insert 4 rings of packing against the stuffing box bushing (125). See Sectional Assembly Section VI—D. Fit each ring of packing carefully, trimming ends as required to insure a good joint without overlapping. Stagger the joints.

Place gland halves (107) in position and bolt gland halves together with gland bolts (328). Insert gland into stuffing box positioned to engage stuffing box gland swing bolts (229) in slots on ends of gland. Place washers on swing bolts, and tighten nuts finger tight.

Be sure gland is not cocked.

II—D. CONNECTION OF WATER SEAL PIPING.

All stock pumps should have the stuffing box sealed with clean water. A pressure of not less than 30 psi is sufficient to provide a supply of clean water to lubricate the packing and provide some flow from the stuffing box into the pump.

Pipe a line from plant clean water supply with valve to the upper ¼" pipe tap in the upper half casing at the stuffing box. See Fig. 6.

Pumps handling dirty liquids containing abrasives should be connected for "in and out" sealing. In addition to the clean water supply line above, a valved relief line should be connected from the lower ¼" pipe tap to drain. The relief line allows any abrasives that may enter the stuffing box to be flushed out before impigning on the packing and scoring the sleeve. See dotted lines on Fig. 6.

II—E. CONNECTION OF DRAIN PIPE.

Connect outlet from stuffing box (located in under side of pump casing in back) to drain. Connect overflow from bedplate (located at pump end of bedplate) to drain. Openings are tapped for ¾" pipe.

II—F. CONNECTION OF FLUSHING PIPE.

Pump casing is provided with bosses for flushing connections behind both sideplates. Bosses are tapped only if so ordered, or they can be tapped in the field for ¾" pipe. Flushing is sometimes required to remove sour stock after a prolonged shut down. Remove the upper and lower plugs and flush with clean water under normal pressure from the top on both sides until the discharge runs clear.

Pumps used on various color stocks may require frequent flushing between color runs and justify permanent flushing lines. A shut-off valve is required. Be sure to use unions between valve and pump to allow easy disassembly of top half casing.

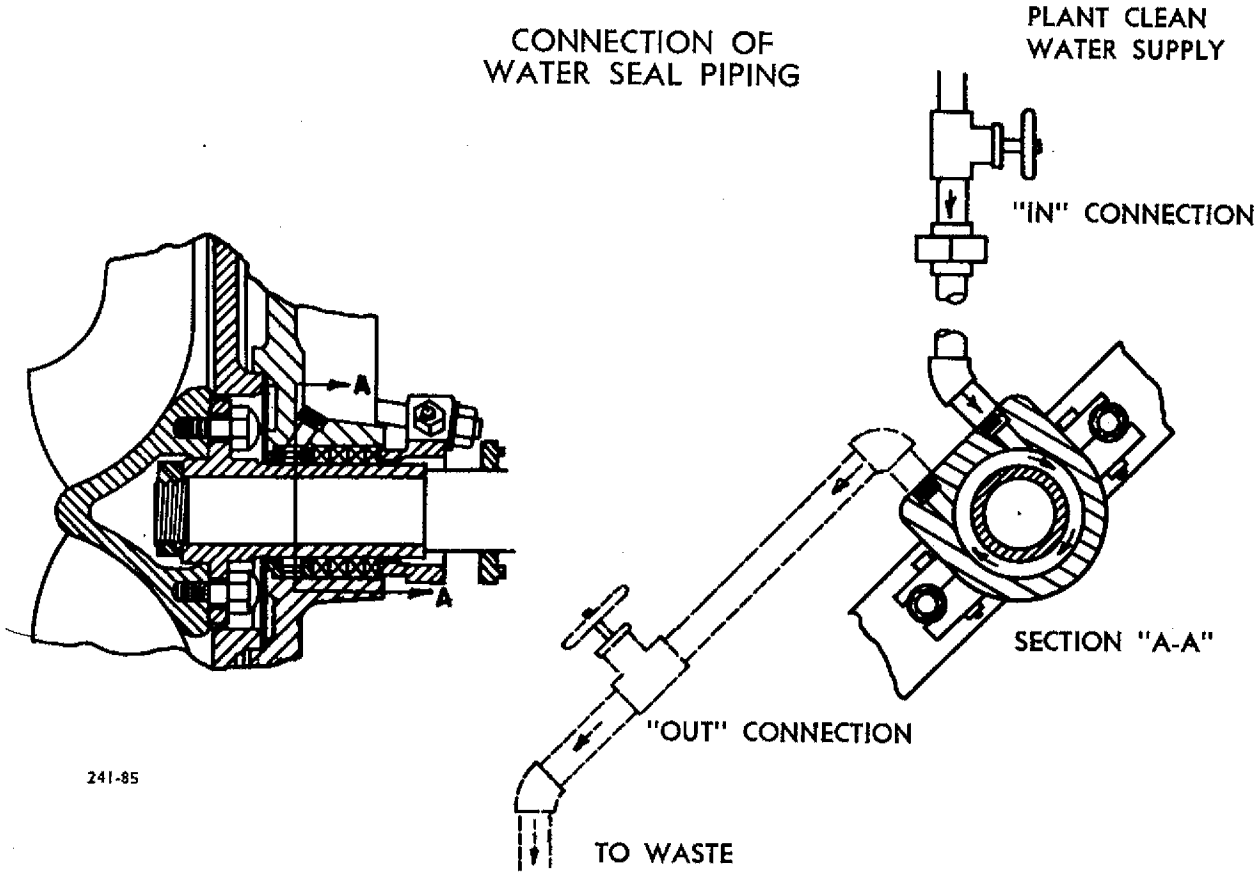


Fig. 6

SECTION III—STARTING PUMP

III—A. PRIMING.

The pump casing and suction pipe must always be full of liquid before the pump is started. No external air release is required, due to the self-venting design.

If pump is run dry, the rotating parts within the pump may seize to the stationary parts as they depend on the liquid being pumped for lubrication.

A priming system is not required as a paper stock pump should never be installed under a suction lift.

III—B. VALVE SETTINGS AT STARTING.

Open the valve in the plant clean water supply line to the stuffing box to prevent stock from entering. Open the gate valve in suction line. *SUCTION VALVE MUST ALWAYS BE FULLY OPEN WHENEVER PUMP IS OPERATING.* Open discharge gate valve about ¼, allowing air to be expelled from pump. Remove ½" plug from discharge flange to insure pump casing is full of liquid before starting. (Self-venting design of pump does not require additional venting on top of pump casing). Start pump and open discharge valve. *ALWAYS REGULATE CAPACITY WITH DISCHARGE VALVE.*

III—C. ADJUSTMENT OF STUFFING BOX GLAND.

On stock pumps open valve in plant clean water supply line before starting pump. See Section II—D. Some throttling may be required if pressure exceeds 30 psi. With pump running at rated speed, stuffing box glands can be adjusted. Draw gland nuts up evenly and only one-sixth of a turn at a time, allowing sufficient time between adjustments for the packing to adjust itself and the effect on the leakage to be observed. If any sign of heating is evident, shut off the pump and allow the boxes to cool. Leave plant water line open to aid in cooling. Several starts may be necessary before the boxes run cool. Do not back off the gland nuts on a hot box as this will usually result in liquid leaking between the outer edge of the packing and the stuffing box bore. It must be borne in mind that it takes newly-installed packing some time to "run in" and that during this period, frequent attention and careful adjustments are necessary. See IV—A (page 10) for final adjustments of gland.

If liquid pumped is dirty an "in and out" water seal is required to flush abrasives out of the stuffing box before they impinge on the packing and score the sleeve. See Section II—D page 6. Open valve in plant clean water supply line. Throttle valve in "out" line until a small, steady stream is observed. Follow procedure for adjusting packing as outlined above.

III—D. ALIGNMENT—FINAL.

Final alignment can only be accomplished after unit has been run under actual operating conditions for a sufficient length of time to bring the unit up to operating temperatures.

After this warm-up period has elapsed, stop the unit and immediately disconnect the coupling and check the alignment.

Follow the alignment procedure as outlined in I—D (page 2). As cautioned in I—D 7 (page 4), changing alignment in one direction may alter the alignment in another. Check thru each alignment procedure after making any alignment change.

Misalignment may be due to casing distortion from pipe strain. Correct suction piping to relieve strain on pump before checking alignment.

Check distortion in discharge pipe by inserting ½" keystock between machined surfaces in telescopic discharge, Section I—H, page 5. Adjusting nuts may be left loose allowing telescopic joint to act as an expansion joint after piping is properly supported.

III—E. DOWELING.

The pump and driver should be doweled to the baseplate after installation is complete and the unit is in correct final alignment. Four taper dowel pins with a taper of ¼" to the foot are included in the bag of fittings attached to the pump.

Group "S" pumps use four No. 6 taper dowel pins. The diameter at the large end is approximately 11/32" and the recommended drill size 9/32".

Group "M" pumps use four No. 8 taper dowel pins. The diameter at the large end is approximately ½" and the recommended drill size 13/32". Drill through two diagonally opposite feet of the pump and driver into the bedplate. Use a reamer with a taper of ¼" to the foot. Ream out the drilled holes so that dowels extend well into the bedplate but project above the pump and driver feet. Tighten jam nuts on leveling screws in foot under pump casing. No doweling is required.

To determine the group of a particular size pump, see interchangeability list, Section VI—D (page 16).

SECTION IV—OPERATION

IV—A. STUFFING BOX.

1. Stuffing Boxes With Packing Rings—

Periodically inspect stuffing box to see that there is sufficient leakage to lubricate the packing and maintain a cool box. Never draw up packing so that the stuffing box heats, as this will cause damage to both packing and sleeve. Always draw up gland nuts evenly and when pump is running.

After pump has been in operation for some time and the packing has been completely run in, at least 40 to 60 drops per minute of the liquid should be allowed to trickle from the stuffing box at all times for cooling and lubricating the packing and shaft sleeve.

2. Stuffing Boxes With Packing Rings—With Clean Water Seal:

The same precautions described above apply. In some cases throttling of the plant clean water supply line may be required (if the pressure exceeds 30 Psi.) Never throttle the clean water supply into the stuffing box as a substitute for proper adjustment of packing—a steady flow from the seal cage into the pump is required to prevent entrance of stock into the packing.

3. Stuffing Boxes With Packing Rings—"In" And "Out" Connection:

The same precautions as described in 1 above apply. A leakage of 40 to 60 drops per minute is required to cool and lubricate the packing and shaft sleeve. The valve on the "out" connection should be opened sufficiently to allow a steady stream of liquid to flow to waste, flushing out dirt and abrasives before they can impinge on the packing and score the sleeve. The valve in the plant clean water supply line should not be throttled unless the pressure is considerably above 30 psi.

IV—B. OPERATING AT REDUCED CAPACITIES.

Do not operate a centrifugal pump at greatly reduced capacities or with discharge gate valve closed, because the energy required to drive the pump is converted into heat. If this condition exists over a long period, the temperature of the liquid in the pump may increase until the boiling point is reached. If this occurs, the rotating parts are exposed to vapor with no lubrication and they may score or even seize to the stationary parts; and furthermore, if running clearances have enlarged due to wear, seizure may not take place. Continued operation under these conditions may create an explosive hazard due to the confined vapor under high pressure and temperature.

To guard against possible damage, protective devices are available, such as:

1. Liquid temperature relay or thermostat which will shut-off the unit if the liquid temperature in the pump exceeds a pre-

determined maximum. This device guards against possible damage due to running the pump against a closed valve.

2. Constant open by-pass orifice between the pump discharge and any check or regulating valve in the discharge line. The liquid through the orifice is returned to the suction source. The amount of liquid by-passed is a function of input horsepower and the allowable temperature rise. This device also is insurance against damage due to running the pump against a closed discharge valve or very low flow conditions.

3. Bearing temperature relay which will shut the unit down if the bearing temperature exceeds a predetermined maximum.

4. Low suction pressure control which will shut off the unit should the suction pressure drop below a pre-established minimum.

A centrifugal pump should *never* be throttled for capacity adjustment on the suction side.

IV—C. OPERATING AT REDUCED HEAD.

On motor driven pumps, when discharge head or pressure is allowed to drop considerably below the rated point for any length of time, the motor should be watched for heating because the pump capacity increases rapidly with reduced head, as does horsepower consumption. If this condition is likely to persist, arrangements should be made either to manually or automatically throttle the discharge valve to build up head to a safe point.

SECTION V—TROUBLE CHECK LIST

V—A. NO LIQUID DELIVERED.

1. Priming—Casing and suction pipe not completely filled with liquid.
*2. Speed too low.
3. Discharge head too high. Check total head (particularly friction loss).
4. Impeller or suction pipe opening completely plugged.
5. Wrong direction of rotation.
6. Air pocket in suction line.
7. Suction piece packing not tight—allowing leakage of air into pump casing.
8. Air leak in suction line.
9. Not enough suction head for % stock.

V—B. NOT ENOUGH LIQUID DELIVERED.

1. Priming—casing and suction pipe not completely filled with liquid.
*2. Speed too low.
3. Discharge head higher than anticipated. Check total head (particularly friction loss).
4. Impeller or suction pipe opening partially plugged.
5. Wrong direction of rotation.
6. Air pocket in suction line.
7. Suction piece packing not tight—allowing leakage of air into pump casing.
8. Air leak in suction line.
9. Not enough suction head for % stock.
10. Mechanical defects:
    Impeller clearance too great.
    Impeller damaged.

V—C. NOT ENOUGH PRESSURE.

*1. Speed too low.
2. Air or gases in liquid.
3. Impeller diameter may be too small.
4. Mechanical defects:
    Impeller clearance too great.
    Impeller damaged.
5. Wrong direction of rotation.

V—D. PUMP WORKS A WHILE AND THEN QUITS.

1. Leaky suction line.
2. Stuffing box packing worn—or water seal plugged—allowing leakage of air into pump casing.
3. Air pocket in suction line.
4. Air or gases in liquid.
5. Not enough suction head for % stock.
6. Impeller plugged.
7. Excessive amounts of additives in chest ahead of pump may cause gas formation on stock fibres.
8. Excessive regulation of discharge valve —check total dynamic head against pump design head. Cut impeller diameter to correct over-design of impeller.

V—E. PUMP TAKES TOO MUCH POWER.

1. Speed too high.
2. Head lower than rating, pumps too much liquid.
3. Mechanical defects:
    Shaft bent.
    Rotating element binds.
    Stuffing box too tight.
    Pump and driving unit misaligned.
4. Wrong direction of rotation.

V—F. PUMP LEAKS EXCESSIVELY AT STUFFING BOX.

1. Packing is worn or not properly lubricated.
2. Packing is incorrectly inserted or not properly run in.
3. Packing is not right kind for liquid handled.
4. Shaft sleeve scored.

*When connected to electric motors, check whether motor wiring is correct and receives full voltage.

SECTION VI—CARE AND MAINTENANCE

VI—A. LUBRICATION—GREASE LUBRICATED BEARINGS.

1. As specified in Section II—A, Bearings are lubricated at the factory for 2000 hours or three months service. *DO NOT ADD GREASE AT TOO FREQUENT INTERVALS.* It is suggested that additional or replacement lubricant be added only after 2000 hours operation or three month intervals.

   While shaft is revolving, remove relief plugs and insert grease through "Alemite" fittings (193) into bearing housings until grease appears through relief holes. *DO NOT ADD ADDITIONAL LUBRICANT AFTER GREASE APPEARS THROUGH RELIEF FITTING.* Pump should run 30 minutes before replacing relief plugs.

2. The lubricant should be renewed in the housings at least once annually.
   Following an overhaul operation and when bearing housings contain no lubricant, proceed to grease the bearings as follows: Remove relief plugs and insert grease through "Alemite" fittings (193) into bearing housing until grease comes out the relief holes. Turn shaft by hand several revolutions in both directions during the greasing operation. *DO NOT ADD ADDITIONAL LUBRICANT AFTER GREASE APPEARS THROUGH THE RELIEF FITTING.*
   Pump should run 30 minutes before replacing relief plugs.

3. The ball bearing grease should be of a sodium or lithium base, NGLI #2 consistency. *D O N O T U S E GRAPHITE.*

4. Bearing Temperatures – All bearings operate at some temperature above that of the surrounding atmosphere, unless cooled. Heat is generated within the bearing due to rolling friction, and the drag of the race. Roller bearings tend to operate at a somewhat higher temperature than ball bearings.

   Do not use the human hand as a thermometer. A temperature which feels "hot" varies from 120° to 130°F. depending on the individual. Above this temperature, the human hand is worthless in estimating temperature. Grease lubricated bearings can be operated safely at temperatures up to at least 200°F. Bearing temperatures up to 160°F. are extremely safe. Determine the temperature accurately by inserting a thermometer into one of the grease relief

holes. This temperature should be recorded in a convenient location. A stable temperature, no matter how hot it may feel to the human hand, is not necessarily an indication of danger so long as it does not exceed the upper limit of the lubricant.

A sudden increase in temperature is an indication of danger and a signal to investigate. One shot of grease should be added to the bearing, but if this does not reduce the temperature immediately, no additional grease should be added. Remove all three grease relief plugs and allow excess grease to bleed off for a period of at least one hour. The unit should also be checked for unnecessary loads, such as coupling misalignment or improper packing adjustment.

Occasionally when pumps are first started, the bearings seem to run extremely hot. This high temperature is frequently caused by grease seals, not the bearings. As soon as the seals are seated, the temperature will drop to a normal level.

VI—B. LUBRICATION—OIL LUBRICATED BEARINGS.

1. As specified in Section II—A, an alternate construction with oil lubricated ball bearings can also be furnished to order. Both bearings should be filled with a good quality clean SAE 10 oil to within ⅛" from the top of the oil fitting.
2. Oil level should be checked daily and oil added to maintain a level within ⅛" from the top of the fittings.
3. Oil should be drained and replaced every 600 hours or not less than every 4 weeks. Remove drain plugs from both ends of bearing shell. Turn shaft by hand several revolutions in both directions to dislodge oil from retainer pockets. Replace plugs and fill with good quality clean SAE 10 oil as instructed above.

VI—C. REPACKING STUFFING BOXES.

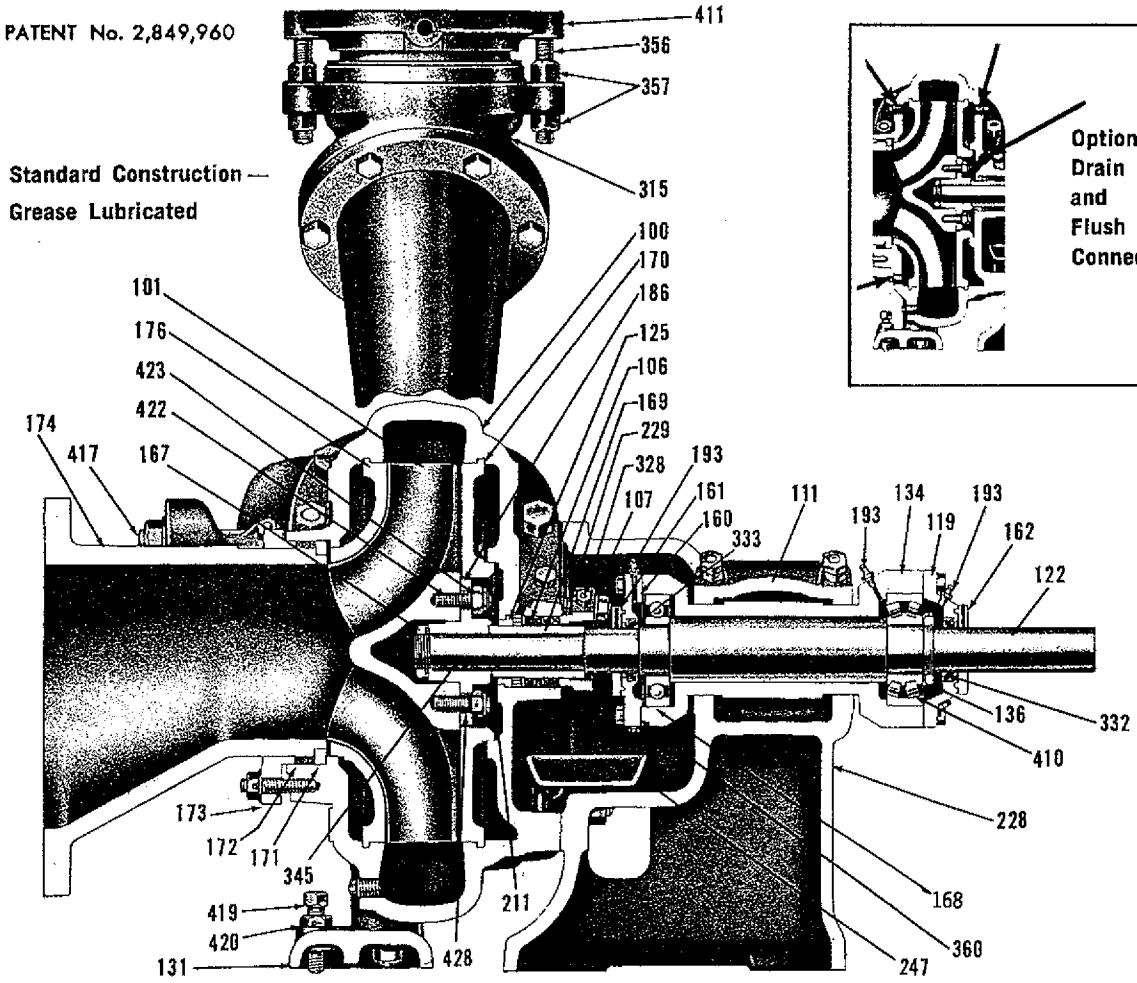
1. To remove stuffing box gland assembly: Back off nuts and washers flush with ends of gland swing bolts (229), and swing bolts out of slots in gland (107). Remove nuts from gland bolts (328) joining gland halves, and lift the upper half gland out of the stuffing box. Remove lower half gland bolts (328). This now affords unobstructed access to the stuffing box for repacking.
2. Remove all 4 rings of packing with the aid of a packing hook.
3. Remove all foreign matter from stuffing box.
4. Install stuffing box packing as described in II—C (Page 6).

NOTE: Frequent repacking may be caused by deeply grooved shaft sleeves. Remove the upper half casing as described in VI—F and remove the packing from the stuffing box. If the shaft sleeves are found to be deeply grooved in the packing area, they should be replaced as it is only possible for the packing to do an efficient job when the sleeve surface is relatively smooth.

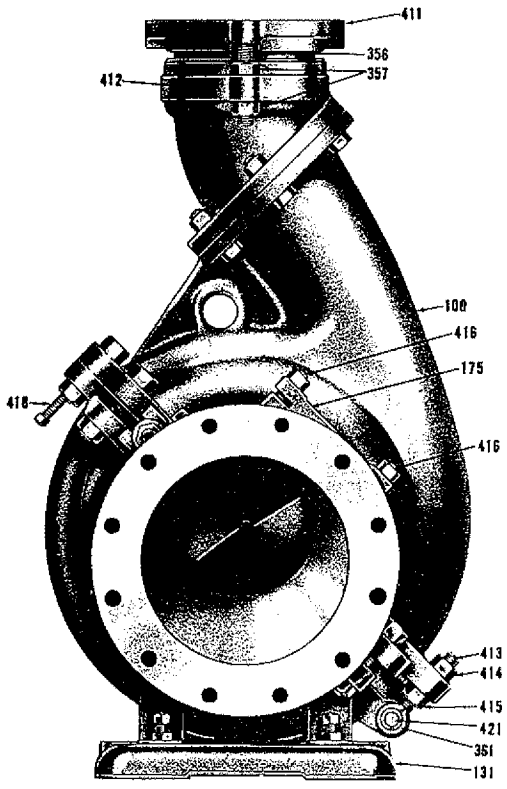
SECTIONAL VIEWS VI–D

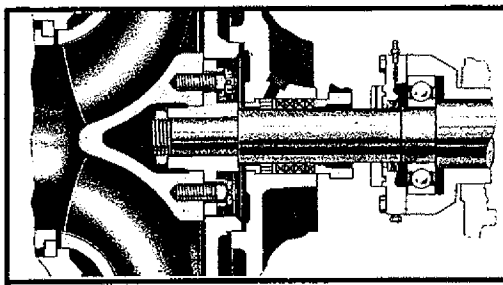
PATENT No. 2,849,960

Standard Construction — Grease Lubricated

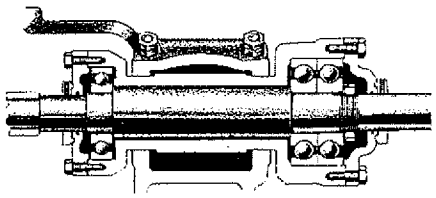


Optional Drain Holes and Flush Connection

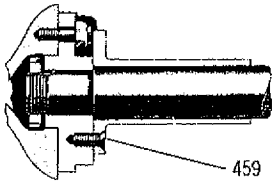




Less Shaft Sleeve Construction "M" Group Only



Ball Bearings, Oil Lubricated



Group "S" Shaft Sleeve Construction

PARTS LIST

Item No.	Per Pump No. Req'd.	PART NAME	MATERIAL						INTERCHANGEABILITY BY GROUP AND CASING CLASS							
									Group-S				Group-M					
			Brz. Ftd.	All Iron	All Brz.	All 316 S.S.	All Iron S.S. Trim	All Brz. S.S. Trim	3" x 6"-14	3" x 8"-14	4" x 10"-14	4" x 12"-14	4" x 10"-18	4" x 12"-18	6" x 12"-16	6" x 14"-16	6" x 12"-20	6" x 14"-20	8" x 14"-20	8" x 16"-20
100	1-up																			
100	1-low	Casing	1003	1003	1103	316	1003	1103												8, 8S, 8L
101	1	Impeller	1106	1000	1106	316			S	S	S	S	M	M	M	M	M	M	M	M
106	1 set	Stuffing Box Packing	1/2" x 1/2" ASBESTOS						S	S	S	S	M	M	M	M	M	M	M	M
107	1	Stuffing Box Gland (Split)	1103	1000	1103	316	1000	1103	S	S	S	S	M	M	M	M	M	M	M	M
111	1	Bearing Cap	1000																	
119	1	Bearing End Cap (Outer)	1000						S	S	S	S	M	M	M	M	M	M	M	M
122†	1	Shaft	SAE 4140		AISI 303		SAE 4140	AISI 303	S	S	S	S	6	6	8	8	8	8	8	8
125	1	Stuffing Box Bushing	1103	1000	1103	316	1000	1103	S	S	S	S	6	6	8	8	8	8	8	8
131	1	Pump Foot	1000						S	S	S	S	M	M*	M	M	M	M	M	M
134	1	Bearing Shell	1000						S	S	S	S	M	M	M	M	M	M	M	M
136	1	Bearing Lock Nut	STEEL						S	S	S	S	M	M	M	M	M	M	M	M
160	1	Bearing End Cap (Inner)	1000						S	S	S	S	M	M	M	M	M	M	M	M
161	1	Water Thrower (Inner)	1000						S	S	S	S	M	M	M	M	M	M	M	M
162	1	Water Thrower (Outer)	1000						S	S	S	S	M	M	M	M	M	M	M	M
167	1	Impeller Lock Nut	AISI 303						S	S	S	S	M	M	M	M	M	M	M	M
168	1	Ball Bearing (Inboard)	STEEL						S	S	S	S	M	M	M	M	M	M	M	M
169	1	Shaft Sleeve	1106	1000	1106	316			S	S	S	S	6	6	8	8	8	8	8	8
170	1	Discharge Sideplate	1106	1000	1106	316	1000	1106	S	S	S	S	4	6	8L	8L	8L	8L	8L	8L
171	1	Suction Piece Ring	1000		1103	316	1000	1103	3	3	4	4	4	6	6	6	8	8	8	8
172	1 set	Suction Piece Packing	3/8" x 3/8" ASBESTOS						3	3	4	4	4	6	6	6	8	8	8	8
173	1	Suction Piece Gland	1000		1103	316	1000	1103	3	3	4	4	4	6	6	6	8	8	8	8
174	1	Suction Piece	1000		1103	316	1000	1103	306	308	410	412	410	412	612	614	612	634	814	816
175	1	Hand Hole Cover	1000		1103	316	1000	1103	M	M	M	M	M	M	M	M	M	M	M	M
176	1	Suction Sideplate	1106	1000	1106	316	1000	1106	3	3	4	4	4X	6	6X	6X	8, 8S, 8L			
186	1	Shaft Flange	1106	1000	1106	316			S	S	S	S	6	6	8	8	8	8	8	8
193	3	Grease Fitting	STEEL						M	M	M	M	M	M	M	M	M	M	M	M
211	1	Gasket (Shaft Sleeve to Shaft Flange)	1/64" ASBESTOS						S	S	S	S	M	M	M	M	M	M	M	M
228	1	Frame	1000						S	S	S	S	M	M*	M	M	M	M	M	M
229	2	Stuffing Box Swing Bolt	STEEL		316		STEEL	316	M	M	M	M	M	M	M	M	M	M	M	M
247	1	Drip Basin	NONE		1103	316	NONE	1103	S	S	S	S	4	8	8	8	8	8	8	8
315	1	Discharge Elbow	1000		1103	316	1000	1103	3	3	4	4	4	6	6	6	8	8	8	8
328	2	Gland Bolt (for Joining Gland Halves)	STEEL		BRASS		AISI 303	STEEL BRASS	M	M	M	M	M	M	M	M	M	M	M	M
332	1	Grease Seal (Outer)							S	S	S	S	M	M	M	M	M	M	M	M
333	1	Grease Seal (Inner)							S	S	S	S	M	M	M	M	M	M	M	M
345	1	Shaft Flange Key	AISI 303						S	S	S	S	M	M	M	M	M	M	M	M
351	2 Halves	Gasket (Casing Parting)	0.0145" DUPLEX PAPER																	
356	2	Disch. Connector Adjusting Stud	STEEL						S	S	S	S	S	M	M	M	M	M	M	M
357	4	Hex Nut (Disch. Connector Adjust. Stud)	STEEL						S	S	S	S	S	M	M	M	M	M	M	M
359	2	Bearing Shell Adjust. Screw (Hex. Hd Tap Bolt)	STEEL						M	M	M	M	M	M	M	M	M	M	M	M
360	1	Gasket (Inner Bearing End Cap)	0.0145" DUPLEX PAPER						S	S	S	S	M	M	M	M	M	M	M	M
361	2	Snap Ring	STEEL						S	S	S	S	M	M	M	M	M	M	M	M
410	1	Roller Bearing (Thrust Bearing)	STEEL						S	S	S	S	M	M	M	M	M	M	M	M
411	1	Discharge Connector	1000		1103	316	1000	1103	3	3	4	4	4	6	6	6	8	8	8	8
412	1	O-Ring	HYCAR-BUNA "N"						3	3	4	4	4	6	6	6	8	8	8	8
413	2	Casing Hinge Bolt	STEEL						S	S	S	S	M	M	M	M	M	M	M	M
414	2	Hex. Nut (Casing Hinge Bolt)	STEEL						S	S	S	S	M	M	M	M	M	M	M	M
415	2	Hex. Jam Nut (Casing Hinge Bolt)	STEEL						S	S	S	S	M	M	M	M	M	M	M	M
416	2	Hand Hole Cover — Swing Bolt	STEEL						M	M	M	M	M	M	M	M	M	M	M	M
417	2	Suction Piece — Swing Bolt	STEEL						M	M	M	M	M	M	M	M	M	M	M	M
418	1	Casing — Jack Bolt	STEEL						M	M	M	M	M	M	M	M	M	M	M	M
419	2	Levelling Screw	STEEL						S	S	S	S	M	M	M	M	M	M	M	M
420	2	Jam Nut (Levelling Screw)	STEEL						S	S	S	S	M	M	M	M	M	M	M	M
421	1	Casing Hinge Pin	STEEL						S	S	S	S	M	M	M	M	M	M	M	M
422	4-6	Impeller Stud	BRASS	STEEL	BRASS	316			S	S	S	S	6	6	8	8	8	8	8	8
423	4-6	Nut (Impeller Stud)	BRASS	STEEL	BRASS	316			S	S	S	S	6	6	8	8	8	8	8	8
428	1	Gasket (Shaft Flange to Impeller)	1/64" ASBESTOS						S	S	S	S	6	6	8	8	8	8	8	8
432	1	Gasket (Hand Hole Cover)	1/8" RUBBER						M	M	M	M	M	M	M	M	M	M	M	M
459	4	Flat Hd. Mach. Screw (Shaft Sleeve to Shaft Flange)	BRASS	STEEL	BRASS	316			S	S	S	S	Not Required							

NOTES

† On Brz. Ftd. and all Iron less sleeve construction shaft is of SAE 4150, flame hardened thru stuff. Box to 550 Brinell. On AISI 316 and S.S. Trim less sleeve construction shaft is of AISI 316.

* These parts differ on "G" series to provide 14" from shaft CL to bottom of frame.

METALS ANALYSIS

1000 — Cast Iron. Conforms to ASTM A 278-59T Class 25.

1003 — Cast Iron. Conforms to ASTM A 278-59T Class 30.

316 — Conforms to AISI Type 316 Stainless Steel (Wrought) or ASTM A 296-60 CF-8M and ACI CF-8M (Cast).

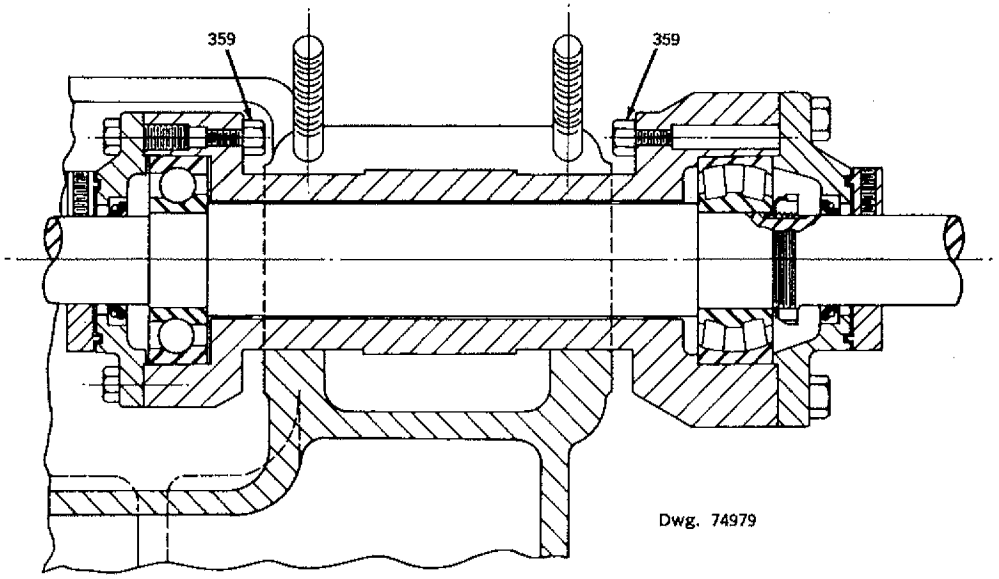
NO	Cu%	Sn%	Pb%	Zn%	Ni%	P%
1103	86-88	5.5-6.5	3.5-5.5	1.0-2.5	0.6-1.0	—
1106	84	8	8	—	—	0.10-0.15

CONSTRUCTION DETAILS

Weight — Bronze Fitted Bare Pump	780	795	920	950	1200	1230	1525	1560	1600	1635	1925	2000
Casing Thickness — Volute	11/16"		3/4"		13/16"		7/8"		1"		1"	
Casing Thickness — Sidewalls	5/8"				11/16"		3/4"		7/8"		7/8"	
Maximum Diameter Solids	1-1/16"		2"		1-1/2"		3"		2"		1 7/8", 3", 4"	
Stuffing Box — Bore	3-1/4"				3-3/4"							
Stuffing Box — Depth (to Stuffing Box Bushing)	2-1/8"											
Stuffing Box — Packing Size	1/2" x 1/2"											
Stuffing Box — No. of Packing Rings	4											
Shaft Dia. at Impeller	1-9/16"				2"							
Shaft Dia. in Shaft Sleeve	1-7/8"				2"							
Shaft Dia. at Coupling End	1.8755"				2.3755"							
	1.8750"				2.3750"							
Outside Dia. of Shaft Sleeve (or Shaft less Sleeve M-Group Only)	2-1/4"				2-3/4"							
Roller Bearing (Thrust Bearing)	Torr. 50SD23F2				Torr. 70SD23F2							
Ball Bearing (Inboard)	MRC-310S or Equal				MRC-314R or Equal							
Ball Bearing (Thrust Bearing Optional)	MRC-7410DB or Equal				MRC-7414DB or Equal							
Maximum Suction Pressure	100 PSI											
Maximum Total Pressure	150 PSI											

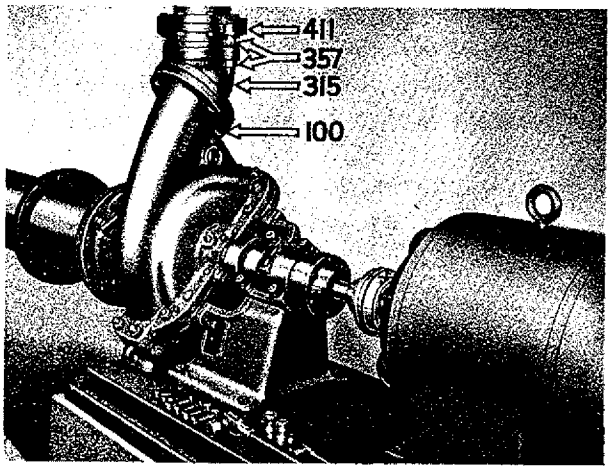
VI—E. ADJUSTING IMPELLER CLEARANCE.

1. Disconnect coupling.
2. Remove bearing cap nuts. Jack and remove 2 dowel pins from bearing cap (111). Lift off bearing cap.
3. Rotate bearing shell counter clockwise (opposite to direction of pump rotation) until bearing shell adjusting screws (359) clear shoulders of frame (228). (See dwg. 74979 below). Remove coupling end adjusting screw (359).
4. Replace bearing cap (111) and snug nuts to hold shaft in correct position.
5. Rotate bearing shell back clockwise until pump end adjusting screw just passes parting. Push bearing shell into pump until rotor is firmly against suction sideplate (176). Measure distance between adjusting screw and side of bearing shell seat with a feeler gauge.
6. Cut and place washers of 0.004″ to 0.005″ shim stock under adjusting screw until clearance between screw and bearing shell support is 0.012″ to 0.015″. Tighten adjusting screw firmly before using feeler gauge.
7. Pull bearing shell back (toward coupling end) until head of adjusting screw is firmly against side of support head bearing shell seat.
   Turn shaft several turns by hand. Impeller must not rub against suction sideplate.
8. Remove bearing cap (111) and replace and tighten coupling end bearing adjusting screw (359). File head off coupling end adjusting screw until bearing shell can be rotated back past the parting of bearing shell seat. Heads of both adjusting screws must fit snugly against sides of bearing support seat.
9. Replace bearing cap on studs and position with dowel pins. Tighten one nut on each stud finger tight.
10. Snug the nuts with wrench, tightening evenly and alternately.
11. Snug lock nuts on bearing cap studs evenly with a wrench.

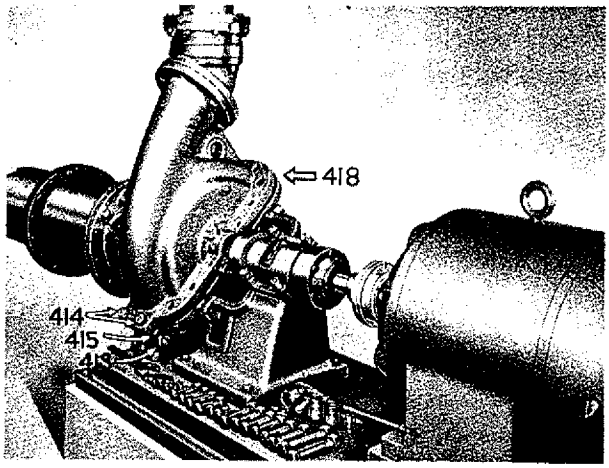


VI—F. DISMANTLING OF PUMP.

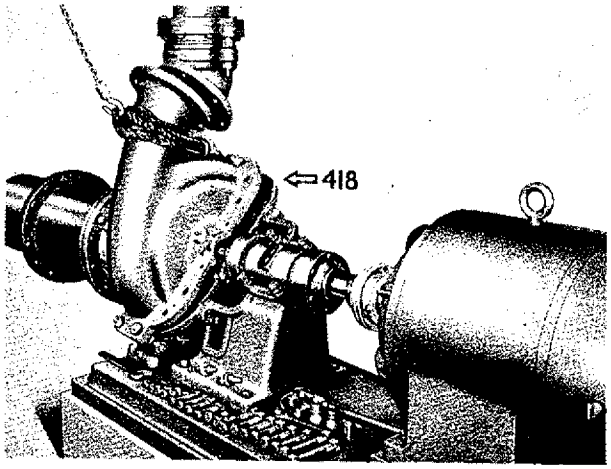
1. Drain pump.
2. Shut off and disconnect any auxiliary piping.
3. Disconnect coupling.
4. Remove gland assembly from stuffing boxes. See VI–C.
5. Remove bolts connecting discharge elbow (315) and upper half pump casing.
6. Telescope discharge elbow (315) into discharge connector (411) by loosening upper nuts (357) on both sides and then tightening lower nuts (see photo below). Remove and preserve the gasket.



7. Remove parting bolts connecting upper and lower half casing.
8. Jack and remove taper dowel pins. Remove upper half casing gland bolt from suction piece gland (173).
9. Loosen top nuts (414) on hinge bolts (413) until they are flush with end of bolts (see photo below). Raise upper half casing off sideplate locks by tightening lower hex nuts (415) evenly. Raise upper half casing until snug against top nuts (414). Use a knife to carefully separate the parting gasket from the upper half casing flange. Preserve gasket.

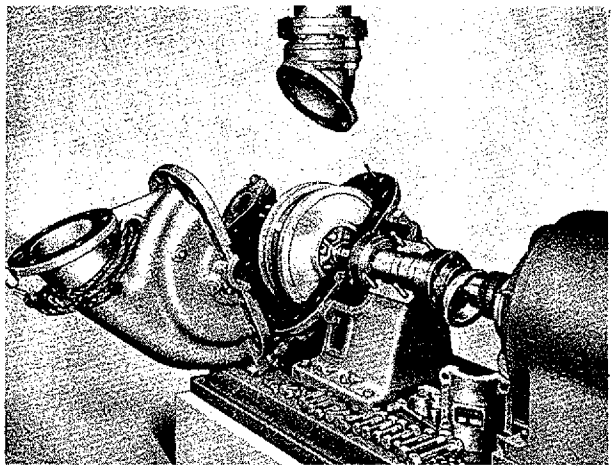


10. Loosen jam nut on jacking screw (418) and tighten screw to complete breaking flange, giving 3 point suspension.
11. Attach chain fall thru cored hole in web under discharge flange and continue raising by means of jacking screw (418), (see photo below). On smaller size pumps, upper half casing may be hinged back by inserting a rod or pipe thru cored hole in web of upper half casing instead of using a chain fall.



12. Continue raising upper half casing with chain fall until free, then lower on hinge until pump is completely open.
13. Jack and remove 2 dowel pins from bearing cap (111) by use of hex nuts provided on top of pins. Remove nuts from bearing cap parting studs.

Lift off bearing cap. Photo below shows unit ready for removal of rotating assembly.



14. Lift rotating assembly from pump carefully. Suction sideplate (176) is not attached to rotor. Lift rotating element off bearing shell seat. Grasp suction sideplate (176) firmly and pivot on edge of lower half casing, rolling rotating element out. Suction sideplate may be left in pump while lowering rotating element. Place rotating element on padded supports which will not injure shaft sleeves or jam discharge sideplate.

15. Note the distance from the end of the shaft to the face of the pump half coupling so that the coupling half can be correctly positioned when reassembled. Pull the coupling half from pump shaft.

16. Remove coupling key.

17. Slide discharge sideplate (170) back to bearing shell and remove cotter pins or stainless steel locking wire from castellated impeller stud nuts (423).

NOTE: On Group "S" pumps 4 flat head machine screws (459) must be removed and shaft sleeve (169) pushed against bearing shell to provide access to impeller stud nuts.

18. Remove impeller stud nuts. Impeller can now be removed. Preserve gaskets.

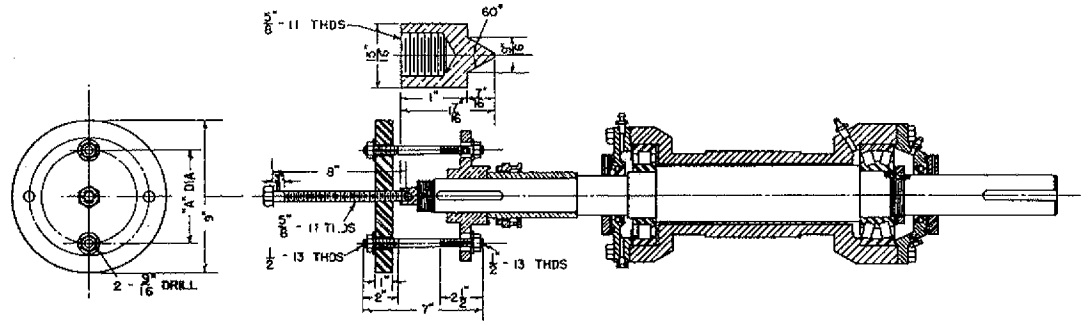
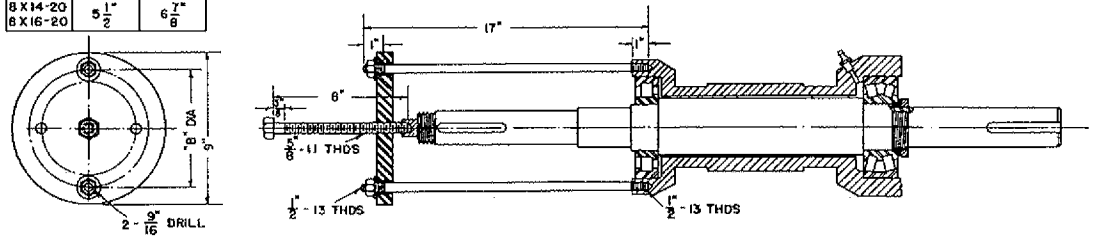


PLATE DRILLING

PUMP	"A" DIA	"B" DIA
3X6-14 3X8-14	4"	5 1/8"
4X10-14 4X12-14	4"	5 1/8"
4X10-18 4X12-18	4 3/4"	6 7/8"
6X12-16 6X14-16	4 3/4"	6 7/8"
6X12-20 6X14-20	5 1/2"	6 7/8"
8X14-20 8X16-20	5 1/2"	6 7/8"

Fig. 7



19. Inspect the condition of the impeller for excessive erosion, especially on the vane faces and ejector vanes on the backside of the impeller.

20. Remove the discharge sideplate (170) by slipping it over the shaft flange (186).

21. Inspect the surface of both the discharge (170) and suction (176) sideplates for erosion, pitting or excessive wear.

22. Replace worn parts with new ones where needed. NOTE:—replacement is always required when capacity as observed at overflow box cannot be restored to normal by readjustment of impeller clearance as directed in VI—E (page 17).

23. Bend retaining tang of impeller lock nut washer back with screw driver, and remove impeller nut (162) with spanner wrench.

24. By use of a suitable puller, one which pushes against shaft (see Fig. 7 page 19), remove shaft flange (186). Slide shaft sleeve (169) off shaft.

25. Remove key from keyway.

26. Slide stuffing box bushing (125) off shaft.

27. Loosen set screws and remove inner (161) and outer (162) water slingers.

28. Remove cap screws on each bearing end cap (160 and 162) and remove end caps from shaft, being careful not to injure grease seals (332 and 333).

29. Push radial ball bearing (409) off impeller end of shaft by pulling pump end of bearing shell evenly with impeller puller. Details of a recommended puller, capable of removing impeller sleeve flange and radial bearings on both groups of pumps is shown in Fig. 7 page 19. Care should be used. Puller bar must be square with shaft so that pressure is applied evenly to the circumference of the inner race of the bearing. A steady pressure must be applied to the puller screw. NEVER USE HAMMER BLOWS TO DRIVE SHAFT THROUGH BEARINGS. Protect bearings from dirt or other contamination.

30. Bend tang of thrust bearing lock nut washer back with screw driver. Remove bearing lock nut (136) with spanner wrench.

31. Slide bearing lock washer from shaft.

32. Drive thrust bearing (410) off coupling end of shaft with a suitable driving sleeve which contacts inner race only, keeping bearing square at all times.

VI—G. REASSEMBLY OF PUMPS.

The following directions are for use when the pump is completely dismantled and it is desirable to reassemble.

1. Check shaft to see that it is not bent or otherwise damaged, and that it is also smooth and clean. If shaft is bent it must be straightened or replaced.

2. Bearings should spin smoothly and evenly. If bearings are not in first class condition, they should be replaced. If new bearings are being used, they should not be unwrapped until ready for installation and should not be cleaned or washed unless the protective wrapper has been broken and dirt allowed to enter the bearing.

If old bearings, or new ones that have been allowed to become dirty, are being used, clean thoroughly before installing as follows: Use a clean pail or receptacle. Pour into it one or two quarts of clean, water-free kerosene. Dip the bearing into the kerosene and spin slowly. Repeat until all traces of grease or oil have been removed. Now blow dry with clean filtered compressed air, holding the two races together so that they do not rotate but allowing the inner race to rotate a few turns now and then to dislodge the kerosene from the retainer pockets. If the bearing is very dirty, it is advisable to rinse it in a second bath of clean kerosene. When the bearing has been blown dry, oil it immediately with a good grade of clean machine oil; especially the race grooves and balls or rollers to prevent corrosion or rust.

3. The bearing shell (134) and the bearing end caps (119 and 160) should be flushed and cleaned. Inspect grease seals (332 and 333) in bearing end caps and replace if worn.

4. It is important that all parts are free from dust and dirt. This is extremely important, as the life of a ball or roller bearing can be drastically reduced if contaminated with even a small amount of dirt. All bearing operations should be done in as dust-free an atmosphere as possible.

   All tools, as well as the hands should be kept clean.

5. To replace the double row coupling-end thrust bearings (410), oil shaft at bearing seat and slide bearing over shaft as far as possible by hand.

   Place a pipe or sleeve against the bearing, being sure that it rests only on the inner race. Tap evenly until the bearing is seated firmly against the shaft shoulder. Care should be taken not to mar the shaft.

6. Insert the bearing lock washer, pressing tang into shaft keyway until firmly against bearing.

7. Oil shaft threads lightly and snug bearing lock nut (136) against lock nut washer. Tighten firmly with spanner wrench. Rotate shaft to locate lockwasher tang which is positioned exactly opposite slot on lock nut. Seat tang securely into slot with drift pin. If necessary, tighten lock nut slightly to match tang with slot. *Do not loosen lock nut to position.*

8. Place bearing shell (134) on shaft from impeller end and slide over outer race of thrust bearing. Be sure the bearing outer race is started squarely and does not bind.

9. To replace radial bearing (409) oil shaft at bearing seat and slide bearing on shaft as far as possible by hand. Place bearing on shaft with raised shoulder on inner race inward. Start bearing squarely on shaft and tap against inner race with sleeve as described in 5 above. Slip the outer race into the bearing shell (134) and guide in evenly to prevent binding. Seat inner race securely against shoulder on shaft.

10. Wipe a small amount of grease on the grease seal lips (332 and 333) in bearing end caps (119 and 160).

11. Oil shaft extension and slide bearing end caps (119 and 160) with gasket in place, being careful not to injure grease seals (332 and 333). [Gasket used on inner bearing end cap (160) only]. With both lugs on bearing shell (134) pointing diagonally up-

ward, turn end cover so that the alemite grease fitting is at the top. The grease relief plugs should be slightly below horizontal centerline on left side when facing coupling end of shaft for accessibility. Tighten bolts snugly and evenly.

12. Slide water throwers (161 and 162) on shaft with tongue in to about 1/32" from bearing caps. Lock in place with set screws.

13. Slide stuffing box bushing (125) on shaft with drilled water seal passage towards the bearing and machined tongue toward impeller end of shaft.

14. Oil shaft extension and insert impeller key (345) in shaft keyway. A silicone base grease is recommended when stainless steel sleeves are used.

15. Slide shaft sleeve (169) on shaft. Slide shaft flange (186) and gasket on shaft and tap in place with lead maul. Tap evenly around the hub near the shaft. DO NOT TAP AGAINST SEALING SURFACE ON THE FLANGE.

16. Insert impeller nut lock washer, pressing tang into shaft keyway until firmly against shaft sleeve hub.

17. Oil shaft threads lightly and snug impeller lock nut (167) against lock nut washer. Tighten firmly with spanner wrench. Rotate shaft to locate lock washer tang which is exactly opposite slot on lock nut and seat tang firmly in slot with drift pin as described in 7 (page 21).

18. Slide discharge sideplate (170) onto shaft over shaft sleeve (169) with fully machined surface facing outwards.

19. If impeller diameter has been cut in the field, the impeller should be statically balanced, and if possible, dynamically balanced. Balancing can be effected by grinding on the under side of impeller vane near periphery.

20. Position gasket over impeller studs and place impeller (101) on shaft by pushing impeller studs (422) thru drilled holes in shaft sleeve or flange (169 or 186).

21. Snug castellated impeller stud nuts (423) evenly to avoid "cocking" impeller. Tighten securely and drill one 9/64" hole thru each stud between slots in nuts for ⅛" cotter pins, or stainless steel locking wire. On Group "S", position gasket and bolt securely shaft sleeve (169) to shaft flange (186) with flat head machine screws (459).

22. To replace pump half coupling on shaft, screw a ½"-13 stud approximately 1¼" longer than the length of the coupling hub into the end of the shaft. Insert the coupling key in shaft. Put oil or white lead on the shaft end and in the coupling bore. Place the complete pump half coupling in position over the stud and align the key with the keyway.

    Place washers over the stud and against the coupling hub and pull coupling half on with nut placed on the stud. Locate the coupling half in the same position on the shaft as it was before dismantling.

23. Smooth up and clean sideplate, stuffing box bushing and bearing shell seats in upper and lower half casing. The casing and bearing housing are precision bored so that hand scraping and fitting of the sideplates, stuffing

box bushing or bearing shells are not required. Inspect parting and discharge piece gaskets and if torn or otherwise damaged cut new gaskets of plain duplex paper 0.0145" thick. Do not use asbestos gaskets as graphite binder will bleed and discolor stock. The gaskets should be removed while assembling rotating element.

24. Support rotating element in a level position in sling and lower carefully into lower half casing. Be sure that discharge sideplate and stuffing box bushing line up with recesses in the lower half casing. Locks on bearing shell and sideplates should be upward.

    Grasp suction sideplate firmly and roll outwards by pivoting on edge of lower half casing. Lower rotating element until impeller is correctly positioned against suction sideplate, then roll evenly into casing and lower complete rotor into place.

25. Rotate sideplates downward until locks seat against projection in lower half casing near hinge bolts. When the upper half casing is bolted in place locks will be held against rotation. Seat stuffing box bushing firmly against shoulder in bottom of stuffing box.

26. Check the rotating element for free turning by rotating slowly in one direction and then the other.

    The sideplates and the stuffing box bushing should be seated in the lower half casing, and should remain stationary when the shaft is rotated. If they ride on the impeller or sleeve, it may indicate that the bearing seat, bushing or sideplate surfaces in the lower half casing have not been properly cleaned of scale or other foreign matter, or that there is too much eccentricity in the element, due to a bent shaft or other causes. If any of the above are evident, correct the cause and continue to assemble as follows:

27. Remove coupling end bearing shell adjusting screw (359) and set clearance approximately between impeller (101) and suction sideplate (176), as described in VI—E page 17. Do not replace coupling end adjusting screw until pump is completely assembled and final adjustment has been made.

28. Place the parting gaskets in position on the lower half casing with the edges flush with the stuffing box bore and tight against the sideplates, the stuffing box bushings and the suction piece ring (171). A small amount of grease on the lower half casing will hold the gaskets in place.

29. Hinge bolts (413) should be in place before upper half casing (100) is raised into position. Top nuts (414) should be flush with end of hinge bolts and hex jam nuts (415) should be tightened snugly against lower flange of upper half casing. Casing-jack bolt (418) should project well above parting.

30. Attach chain fall thru cored hole in web under discharge flange and raise upper half casing (100) on casing hinge. Continue raising until it hangs freely on hinge. Lower carefully the upper half casing, guiding by suction and discharge sideplates until in place against casing jack bolt (418). Casing should settle into position without resistance as jack bolt is backed off.

Back-off hex jam nut (415) from underside of casing hinge pin (413) until upper-half casing rests evenly on parting and slip dowel pins in place.

Check the rotating element for free turning and, if no binding is apparent, tighten casing parting bolts alternately on each side of the pump starting from the center. The shaft should turn freely, after all bolts are tightened.

31. Insert and bolt stuffing box swing bolts (229) with threaded stem offset toward shaft. Replace and snug upper half casing bolt in suction piece gland (173).
32. Place gasket on pump discharge flange and position discharge elbow (315) by loosening lower hex nuts (357) on discharge connector stud (356). Tighten bolts firmly on alternate sides.
33. Back off upper and lower hex nuts (357) allowing discharge connector (411) to function as an expansion joint.
34. Check clearance between impeller and suction sideplate and complete assembly as outlined in VI–E Page 17. Shaft must turn freely by hand without rubbing.
35. Repack stuffing box and replace gland assembly as outlined in II–C page 6.
36. Check coupling alignment as outlined in I–D Page 2.
37. Connect coupling as outlined in I–K page 5.
38. Grease pump bearings as outlined in VI–A page 13.
39. Connect water seal and auxiliary piping as outlined in II–D thru F page 6.
40. Follow directions in Section III for initial operating conditions and for starting pump.

VI—H. CHANGING LIQUID END MATERIALS OR REPLACING CASING.

Pump liquid end parts are available in various materials suitable for most liquids. Parts are available in cast iron, bronze and AISI 316 stainless steel. Parts can also be furnished on order in other sand cast, machinable alloys.

It is not necessary to replace the complete pump when a change in process requires different materials. Only the liquid end need be replaced with parts precision machined to fit with existing standard frame.

When liquid end parts are to be replaced, the complete pump should be unbolted from the bedplate and moved to a machine shop for maximum convenience.

A. Disassembly of Liquid End.

1. Follow instructions 1 thru 6 VI–F Dismantling of pump.
2. Loosen and remove hold down bolts from frame (228) and pump foot (131).
3. Jack and remove 2 dowel pins from frame.
4. Remove bolts connecting suction piece (174) flange to suction piping.
5. Sling pump securely and raise pump from bedplate with a chain fall, sliding sideways out from under discharge pipe. Move pump to machine shop where proper tools are most convenient.
6. Complete disassembly of pump as described in VI–F as required.
7. Free suction piece gland (173) by removing hex nuts from studs in lower half casing.
8. Sling suction piece (174). Loosen nuts on suction piece swing bolts (417) and swing back against casing. Re-

move suction piece by pulling horizontally out of lower half casing.

9. Jack and remove straight dowel pins aligning frame (228) with lower half casing (100). Use ½"-20 bolt, washer and spacer piece.
10. Remove nuts from studs and pull casing from frame.
11. With lower half casing on side remove bolts holding pump foot (131) to casing and remove.

B. Reassembly of Liquid End.

1. Bolt pump foot (131) to lower half casing.
2. Place new lower half casing on frame (228) by pushing studs thru drilled holes. Fasten nuts or studs finger tight, and locate by inserting straight dowel pins with tapped ends outward. Tighten nuts securely.
3. Insert drip basin (247) into frame recess under stuffing box. Down snout seats into hole in rear of lower half casing. (Drip basin required only when liquid end material is all-bronze or alloy).
4. Place suction sideplate (176) into recess in suction side of lower half casing with locking lug visible.
5. Lower complete rotating element into lower half casing as outlined in VI—G Reassembly of Pump. Rotor must turn freely by hand. Set suction sideplate clearance approximately as outlined in VI—E before completing assembly of upper half casing.
6. Place suction piece swing bolt (417) on studs, place washer on top of swing bolt and tighten nuts securely.
7. Complete assembly of upper half casing. Push suction piece swing bolt (417) back against casing.
8. Seat suction piece ring (171) on suction piece (174). Ring must be started evenly and driven squarely by tapping with a lead maul alternately on opposite sides until seated squarely against shoulders. Be sure to place suction piece gland (173) on suction piece before driving ring.
9. Sling suction piece and push squarely into place, guiding suction piece gland onto 2 studs in lower half casing. Suction piece gland is positioned with 2 drilled holes opposite studs in lower half casing and slot opposite tapped hole in upper half casing.
10. Position suction piece swing bolts (417) in slots and tighten nuts against washers finger tight.
11. Start nuts on suction piece gland studs in lower half casing.
12. Seat suction piece firmly and squarely by tightening nuts on 2 suction piece swing bolts.
13. Insert 3 rings of ⅜" square packing, seating each ring as it is installed and staggering the joints.
14. Insert hex head gland bolt into upper half casing and draw gland up evenly but not tight.
15. Check clearance between impeller and suction sideplate and complete assembly as outlined in VI—E page 17. Shaft must turn freely by hand without rubbing.
16. Position pump on baseplate with dowel pins and tighten hold down bolts.
17. Align pump and motor as directed in Section I—D, adjusting leveling screws if required.
18. If casing material is changed replace discharge elbow (315) on discharge piping. Install gasket and bolt discharge elbow (315) to discharge nozzle.

19. Connect suction and discharge piping as directed in Section I—H page 5.

20. Repack stuffing box as directed in Section II—C page 6.

21. Connect auxiliary piping and drains as directed in II—D thru F page 6.

22. Follow directions in Section III for starting pump.

VI—J. OVERHAUL OF PUMP.

The pump should be opened and the interior inspected for wear and excessive clearances approximately once each year. The period may vary, depending on operating conditions and severity of service. See Section VI—F page 18, for disassembly and Section VI—G page 20, for reassembly of pump.

The following items should be checked:

1. Sideplate Clearance:

The clearances between the impeller and the sideplates are set approximately at 0.012" to 0.015" on the suction side and an equal clearance on the discharge side. There are no set rules on maximum clearances, as long as the above clearance is maintained on the suction side of the pump by readjustment as described in VI—E.

Sideplates should be replaced whenever surface inspection indicates erosion, pitting or excessive wear. Replacement is always required when capacity as observed at overflow box cannot be restored by readjustment of impeller clearance.

2. Fit of Impeller Flange on Shaft.

These parts are machined for a push fit. The shaft sleeve (169) or shaft flange (186) is bored 0.000" to 0.0015" larger than the shaft and should tap easily on the shaft. If the sleeve or flange does not tap on readily, the bore and shaft should be inspected to see that they are free from foreign matter or burrs.

The fit of the key in the keyway should also be checked to see that it is not causing binding. The key should have a sliding fit on the sides and should have clearance at the top.

3. Clearance Between Shaft Sleeve (169) and Stuffing Box Bushing (125).

The original diametric clearance is 0.023" to 0.032". If this clearance has increased to more than 0.050", the shaft sleeve, and at times, the stuffing box bushing should be replaced.

4. Condition of Shaft Sleeve.

If the surface at the packing area is deeply grooved, the sleeve should be replaced.

5. Condition of Shaft.

Check shaft for straightness. If bent, it should be straightened. If otherwise damaged, it should be replaced.

6. Condition of Impeller.

Check the impeller and replace if any of the following conditions exist:

(a) Excessive erosion, especially on the inlet of vanes.

(b) Excessive wear on sides of impeller due to rubbing against sideplate.

7. Condition of Roller or Ball Bearings.

If the bearings are worn or damaged so that they become loose or are noisy or rough when rotated, they should be replaced.

VI—K. SPARE PARTS.

To insure against possible long and costly "down-time" periods, especially in critical services, it is advisable to have spare pumps or spare parts on hand.

1. When spare pumps are not available, one complete rotating element should

be maintained for every one to three pumps of each size in operation.

(a) The rotating element consists of suction and discharge sideplates, impeller, shaft, shaft flange and sleeve, stuffing box bushing, bearing, bearing shell, end caps, and water slingers assembled, less pump half coupling.

It is not necessary to duplicate spare parts inventory where both Model 3135 and Model 3105 pumps are used. For Model 3105 right hand pumps Model 3135 rotating elements are completely interchangeable except stuffing box bushing and stuffing box gland. For Model 3105 left hand pumps correct rotation impellers are also required.

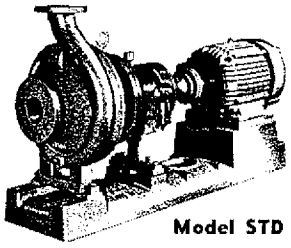
VI—L. INSTRUCTIONS FOR ORDERING SPARE PARTS.

Repair orders will be handled with the minimum of delay if the following directions are followed:

1. Give the Model No., Size of the pump and serial number. These can all be obtained from the name plate.
2. Write plainly the names, part numbers and materials of the parts required. These names and numbers should agree with those in the parts list, (Section VI—D page 16).
3. Give the number of parts required.
4. Give complete shipping instructions.

a brief look at a few of GOULDS PUMPS

The largest plant of its kind in the world *plus* over 100 years' experience in pump manufacturing—that's what equips us to answer all your liquid-handling needs. You have a wide line of Goulds pumps to choose from. Complete details on any pump are available in the Bulletins indicated. Write for your copy.

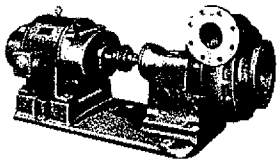


Model STD

Standardized Chemical Pumps

19 pump sizes with same overall length, 23½ in. Capacities to 1600 GPM, heads to 750 ft. TDH. Working pressures to 375 PSIG. Standard in Ductile Iron, 316 stainless steel, Gould-A-Loy 20. Handles liquids to 500° F. Maximum interchangeability of parts and dimensional interchangeability of models give you greatest flexibility and coverage.

BULLETIN 725.1

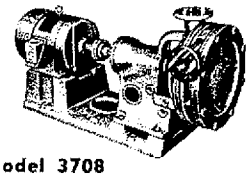


Model 3755

Frame Mounted Centrifugals

Built in 25 sizes, with capacities up to 3800 GPM and heads up to 400 ft. Designed for standard electric motor drive; readily adaptable for belt drive. A substantially built line for general and special applications with many new improvements.

BULLETIN 715.1

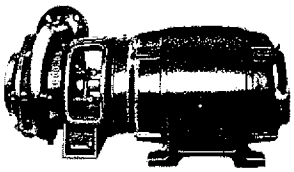


Model 3708
Model 3706 (not illustrated)

Goulds-Pfaudler Glassed Pump

Revolutionary new pump designed for handling corrosive liquids. All parts in contact with liquid are glass-fused to metal. Handles all acids except hydrofluoric, and all alkalies to pH 12. Five sizes, with capacities to 700 GPM, heads to 150 ft.

BULLETIN 725.2

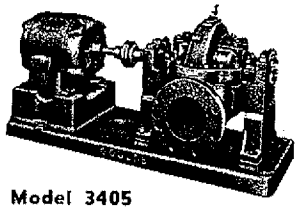


Model 3655

Close-Cupld Centrifugals

Single-stage pumps built in 25 sizes with a capacity range from 5 to 3800 GPM and heads up to 400 ft. Embody top horizontal discharge, closed impeller, machined stuffing box, fully protected shaft. Wearing parts easily renewable.

BULLETIN 710.1

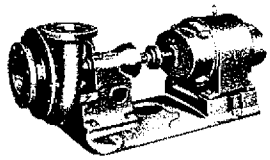


Model 3405

Double-Suction Centrifugals

Capacities from 100 to 6400 GPM. Heads up to 575 ft. Three shaft and rotating parts assemblies provide for 40 sizes and 144 pump combinations. Horizontally split casing.

BULLETIN 721.6

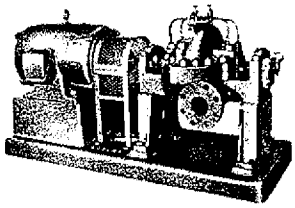


Model 3189

Open Impeller Centrifugals

Highly efficient open impeller pumps available in 13 sizes for both motor and belt drives. Capacities up to 3180 GPM, with heads up to 290 ft. at 1750 RPM. Well suited for irrigation, general industrial processes, and slurries.

BULLETIN 720.4

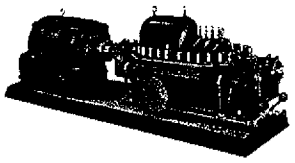


Model 3316

Two-Stage Centrifugals

Ten sizes provide heads up to 1000 ft., capacities to 3000 GPM, depending on heads. Horizontally split casing. Opposed impellers.

BULLETIN 722.6

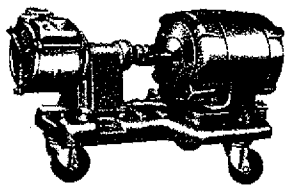


Models 3330-3360

Multi-Stage Centrifugals

Medium- and high-pressure multi-stage pumps. Model 3330 is furnished in sizes from 3 to 8 in., 2 to 6 stages, with capacities ranging from 40 to 2100 GPM, heads to 1000 ft. Model 3360 furnished in 3, 4, 6, and 8 in. sizes, up to 8 stages, with capacities ranging from 50 to 2600 GPM, heads up to 3400 ft.

BULLETIN 722.1 and 722.4



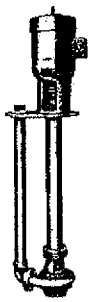
Model 2520

Centripetal Scavenger Pump

Centripetal action lets it pump liquid, air, liquid and air. Use it for transfer, cleaning-up, or pilot plant operations. Compact, light-weight, portable. All-iron or stainless steel construction. Capacities to 60 GPM, heads to 80 ft.

BULLETIN 725.6

Vertical Pumps



SUMP (Model 3171)

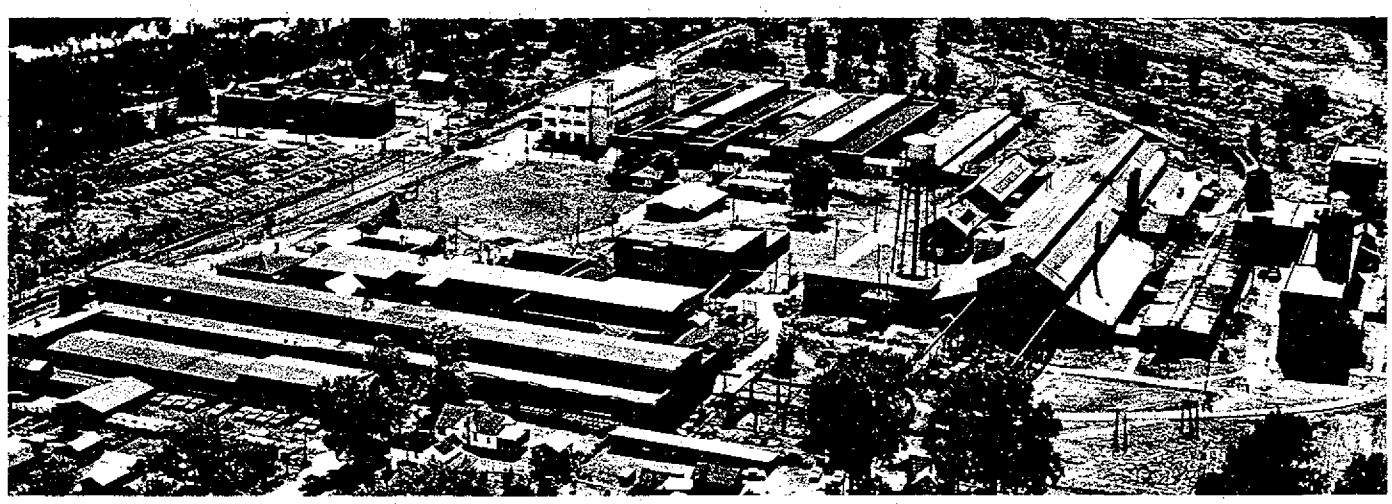
For pit depths to 20 ft. in 6 inch increments. Both wet and dry pit types available in capacities up to 3180 GPM, heads to 190 ft. Single and duplex units. Full automatic control. Modern design using standard parts permits quick shipment at most economical cost.

BULLETIN 726.2

PROCESS (Model 3171-PR)

Especially designed for handling corrosive liquids in the chemical process and allied industries. Normally supplied in 316 stainless steel constructions, but materials to suit user's requirements can be furnished on application.

BULLETIN 726.1



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Goulds Pumps are produced in this large plant, again, one which is devoted exclusively to pump manufacture (more than 544,000 square feet of plant floor space). Keeping pace with changes in industrial processes, new designs, sizes, and materials are continuously being introduced. This is particularly true in the field of corrosive liquids handling. Through the use of modern stainless steels, glassed metal, ductile iron and other alloys, liquids are being handled by Goulds Pumps that a few years ago were considered impractical to pump because of their high temperature, corrosive or abrasive factors, or their heavy consistency or density characteristics.

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