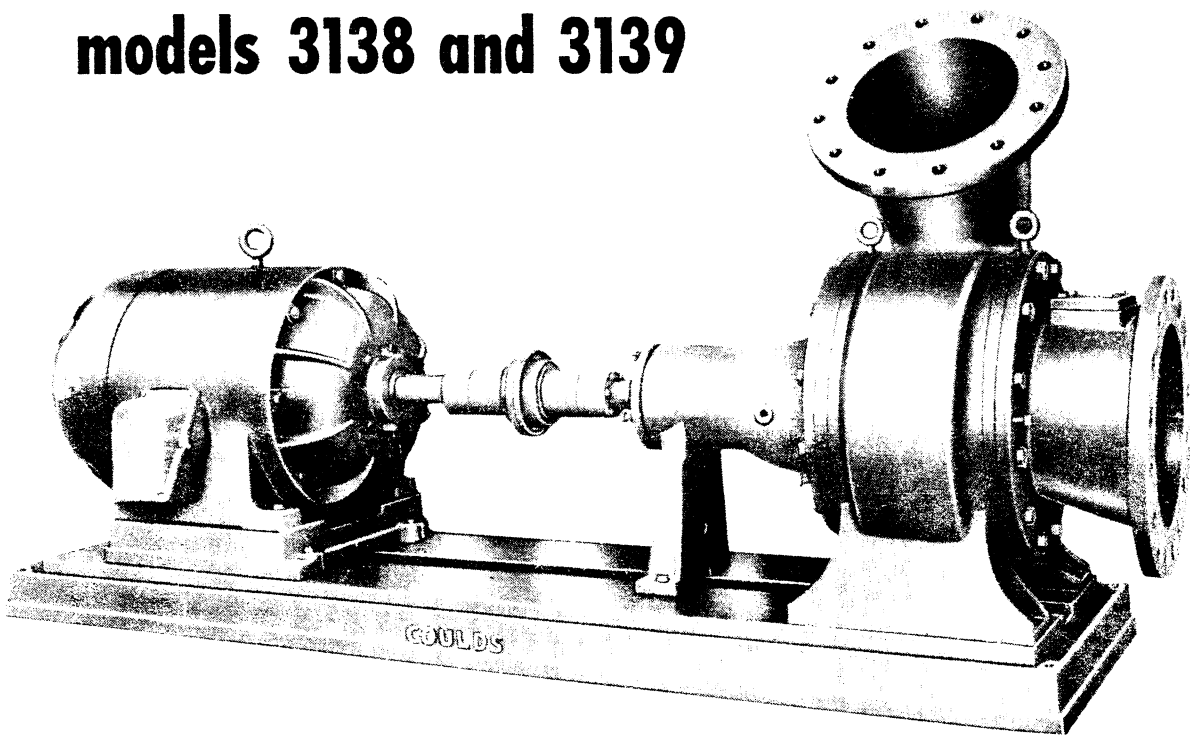
GOULDS PUMPS

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

models 3138 and 3139



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:

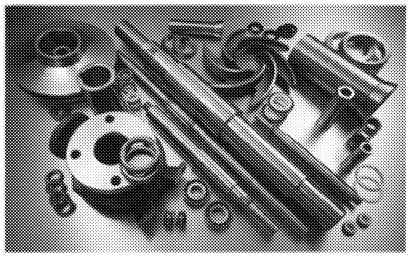
II = Group 2
2 = Category 2
G/D = Gas and Dust present
T4 = Temperature class, can be T1 to T6 (see Table 1)

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.

FOREWORD

The design, material and workmanship incorporated in the construction of Goulds Models 3138-3139 Heavy Duty Process Pumps make them capable of giving long, trouble-free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by correct application, proper installation, periodic inspection and maintenance. This instruction book was prepared so operators will understand the construction and the correct methods for installing, operating and maintaining these pumps.

Read thoroughly Sections I, II, III, and IV and be sure to follow the instructions for installation and operation. Sections V and VI are answers to trouble and maintenance questions. Keep this instruction book handy for reference. Kindly direct any questions or suggestions to the attention of the Engineering Application Division, Goulds Pumps, Inc., Seneca Falls, New York.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

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 and floor space for proper inspection and maintenance.

I—B. FOUNDATION.

1. Foundation:

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 concrete 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.

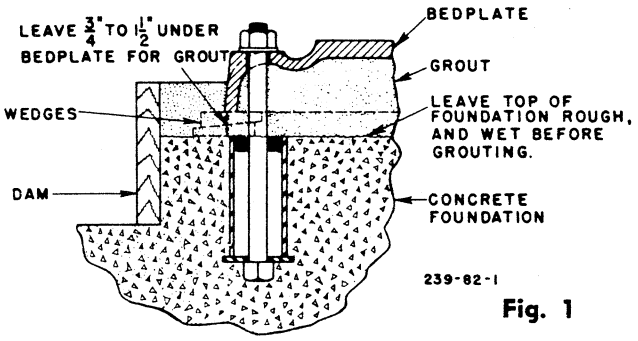


Fig. 1

3. Preparing 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

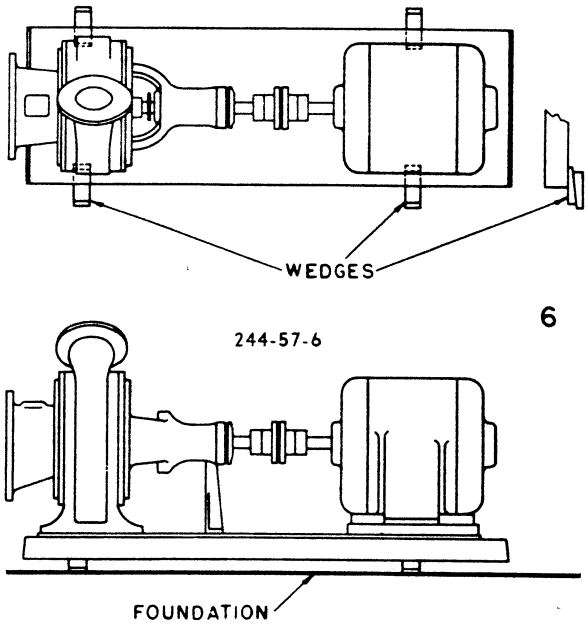


Fig. 2

as directed in Section I—C. Use additional wedges if required.

(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 the top of the bedplate. Use of a non-shrink 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—C. 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—B4 (page 4), 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-D AND MUST BE FOLLOWED).

1. Tighten foundation bolts.
2. Tighten casing hold down bolts.
3. Adjust bearing frame pedestal leveling bolts to just contact bedplate. Tighten ¼ of a flat. Tighten jam nuts to lock leveling bolts. Check to be sure pump turns freely by hand and does not bind. Insert and tighten pedestal hold down bolts. Check again to be sure shaft turns freely by hand.
4. Tighten driver hold down bolts.
5. In order to secure vertical parallel alignment under actual operating conditions, the driver shaft may have to be set higher or lower than the

pump shaft to compensate for vertical expansion. A suggested approximate cold setting for motor driven pumps is outlined below:

(a) When pumping cold liquids, set the motor shaft .006" below the pump shaft.

(b) When pumping hot liquids (200 to 350°F), set the motor and pump shafts at the same height.

Thin shim stock should be used under the driver feet to establish parallel alignment. (In some instances, shims may be required under the pump feet).

6. Any coupling manufacturer's instruction sheets sent with the pump should be studied and used when installing, aligning, or servicing coupling.

7. Align coupling, following manufacturer's instructions. If instructions are not available, the following procedure (steps 8, 9 and 10) may be used.

Fig. 3

8. For alignment, the coupling should be as shown in Fig. 3 with only shaft hubs in position. Units should be positioned for correct distance between shafts as shown on the dimension print sent with the pump and with minimum angular and parallel misalignment. Set screws should be tight if provided.

9. To check angular alignment (Fig. 4) place dial indicator on one shaft hub and rotate the hub 360° while taking readings from the face of the other hub. If an indicator is not available, take readings between hub faces at 90° intervals with an inside micrometer.

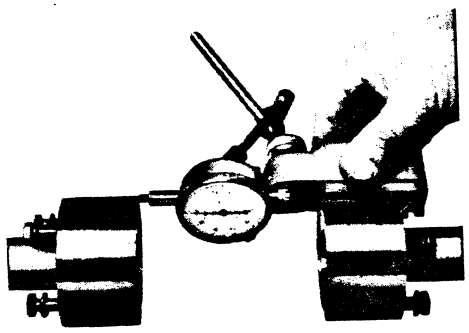
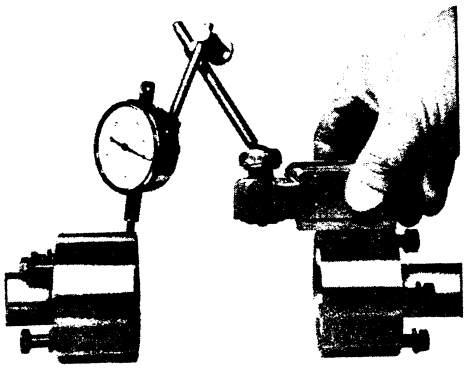


Fig. 4

10. To check parallel alignment (Fig. 5) place dial indicator on one shaft hub and rotate the hub 360° while taking readings from outside diameter of the other hub. Alignment can also be checked by laying a straight edge across the top of the shaft hubs and at 90° intervals checking with feelers.



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

I—D. 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 unneces-

sary 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—G.
4. Arrangements should be made to compensate for pipe expansion on elevated temperature installations.

I—E. PIPING — SUCTION.

1. General.

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. *KEEP THE DIRECTION OF FLOW IN A STRAIGHT LINE WHEREVER POSSIBLE, ESPECIALLY ON SERVICES SUCH AS PAPER STOCK.*

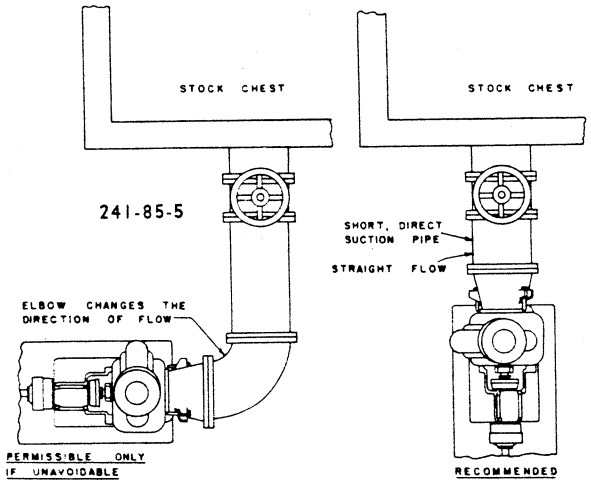


Fig. 6

(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, sloping side down.

(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 Suction:

(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. No portion of piping should extend below the pump suction nozzle.

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

(d) The suction pipe should be below the liquid surface at the source of supply as shown in Fig. 7.

3. Installation with Pump Above Source of Supply — Suction Lift:

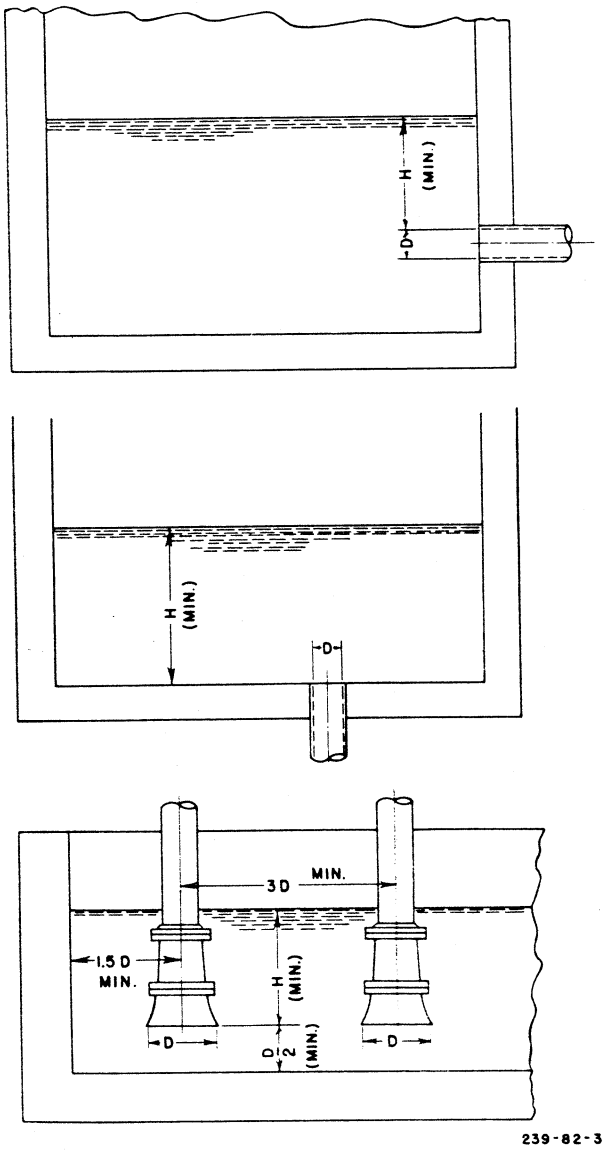
(a) Keep suction pipe free from air pockets.

1. Piping should slope upwards from source of supply.
2. No portion of piping should extend above the pump suction nozzle.

(b) All joints must be air tight.

(c) The suction pipe should always be submerged into the source of supply as shown in Fig. 7.

(d) A foot valve should only be used if necessary for priming, or, if the pump is to be used on intermittent service and is required to hold its prime.



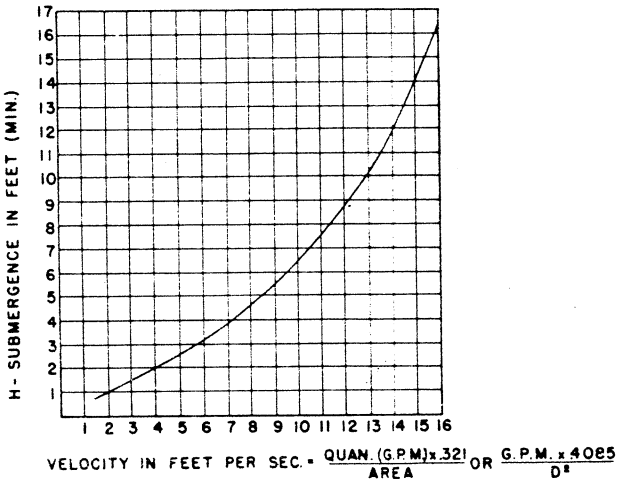


Fig. 7

(e) Suction strainers when used should have a net free area of at least three times the suction pipe area.

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

I—F. PIPING — DISCHARGE.

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—G. CONNECTION OF PIPING.

Connect 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—C. If the connection of the piping causes unit to be out of alignment, correct piping to relieve strain on the pump.

I—H. 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—J. CONNECTION OF COUPLING.

Connect coupling. Follow instructions supplied separately, giving complete instructions for connection, lubrication, alignment and maintenance.

SECTION II—PREPARATION FOR OPERATION

II—A. PUMP BEARINGS.

1. Grease Lubrication.

Sufficient lubricant is inserted at the factory for 2000 hours' operation.

2. Oil Lubrication.

Oil lubricated pumps are not lubricated at the factory.

A high quality turbine type oil, with rust and oxidation inhibitors, should be used. For the great majority of operating conditions, oil temperature will run between 50 and 180°F. In this range an oil of 300 SSU viscosity at 100°F. (approximately SAE 20) should be used. If oil temperature exceeds 180°F. for extended periods, use of cooling water in the bearing frame cooling jacket is recommended. For extreme conditions, refer to factory or a lubrication expert for a recommendation.

The constant level oiler (251) is in the box of fittings shipped with the pump. Oiler was adjusted to maintain proper oil level before leaving factory. If adjustment is lost, reset according to Fig. 8.

Install the constant level oiler (251) in the bearing frame.

Fill the oiler bottle with the proper grade of oil, and replace in the oiler. The frame is filled when an oil level remains in the bottle. Several fillings of the bottle may be required. Never fill the frame through the frame breather (113-A) or through the oiler without use of the bottle.

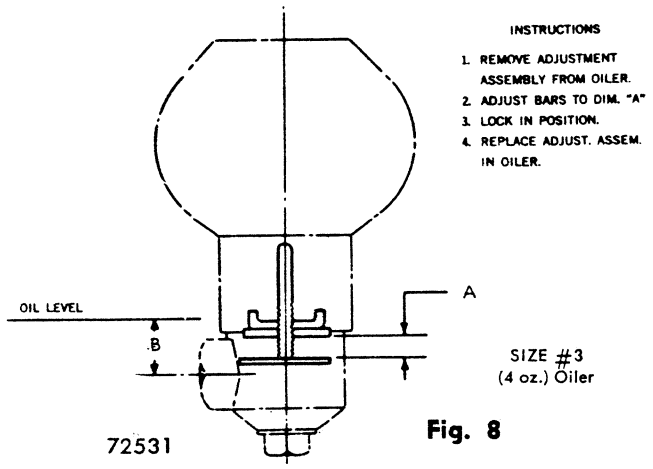


Fig. 8

GROUP	A	B
S	11/16	9/16
MX	19/32	1/2

II—B. DRIVER BEARINGS AND COUPLING.

Check to be sure the driver bearings are properly lubricated. Refer to coupling instructions supplied separately for coupling lubrication.

II—C. STUFFING BOX

1. Stuffing Box With Packing.

Pumps are furnished with packed stuffing boxes unless mechanical seals are ordered. 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 5 rings of packing against the stuffing box bushing (125). See Sectional Assembly Section VI—C. Fit each ring of

packing carefully, trimming ends as required to insure a good joint without overlapping. Stagger the joints.

NOTE: On special order an optional stuffing box construction, with a separate lantern ring, can be furnished. See Sectional Assembly Section VI-C. After two rings of packing have been installed against the stuffing box bushing, install the separate lantern ring, then three more rings of packing.

Place gland halves (107) in position and bolt gland halves together with gland bolts. Insert gland into stuffing box. Place washers on studs (353), and tighten nuts finger tight.

Be sure gland is not cocked.

2. Stuffing Box With Mechanical Seal.

When mechanical seals are furnished, they are installed and adjusted at the factory.

Seal manufacturer's drawings are shipped with the pump. They should be read for any special instructions. They should also be filed for use in maintaining the pump, since they give directions for adjusting the seal when the pump is being reassembled.

To properly prepare the seal for operation, various cooling and flushing flows may have to be connected. In some cases these flows are recirculated from the pump casing; in others, liquid from an outside source must be used. Connect cooling and flushing flows to the seal as directed.

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 lower ¼" pipe tap in the discharge sideplate at the stuffing box. See Fig. 10.

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 upper ¼" pipe tap to drain. The relief line allows any abrasives that may enter the stuffing box to be flushed out before impinging on the packing and scoring the sleeve. Use flexible lines or unions to allow easy removal of piping during disassembly.

II—E. CONNECTION OF DRAIN PIPE.

Connect outlet from drip pan (247) (located in under side of stuffing box) to drain. Use unions to allow easy removal of piping during disassembly. Connect overflow from bedplate (located at end of bedplate) to drain. Openings are tapped for ½" pipe.

II—F. CONNECTION OF FLUSHING PIPE.

Pump casings have ½" plugged holes to flush areas behind the sideplates and at the stuffing box. Flushing is sometimes required to remove an accumulation of solids 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 colored products may require frequent flushing between 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 casing.

II—G. CONNECTION OF PIPING TO QUENCHING GLAND.

A quench type gland is supplied with tapped holes (¼") in the top and lower gland halves. Quenching is suggested

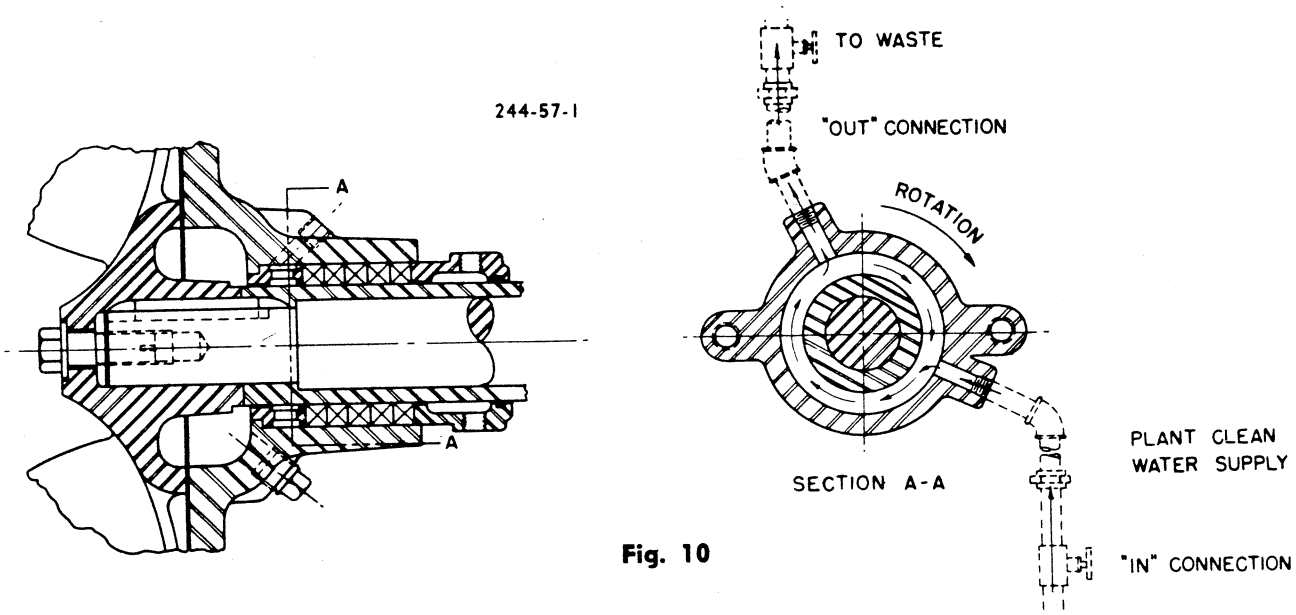


Fig. 10

on applications where the liquid pumped is at a temperature of 180° F. or higher, and also when the pump is handling volatile or toxic liquids in order to smother the gland leakage, which then can be piped away.

II—H. CONNECTION OF COOLING WATER PIPING.

On installations handling liquids over 180° F. without quenching, or over 250° F. with quenching, it is recommended that the bearing frame be water cooled. The inlet piping must be at the bottom and the outlet at the top as shown in the sectional assembly Section VI—C (page 18). (Pipe Tap size 1 inch.)

The cooling liquid must be supplied from an outside source and a shut-off valve should be installed in the supply line to regulate the flow of cooling liquid.

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 on paper stock pump since they should never be installed under a suction lift.

III—B. VALVE SETTINGS AT STARTING. (Flooded Suction)

Open the valve in the plant clean water supply line to the stuffing box to prevent pumpage 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. (Self-venting design of pump with top discharge 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 13) 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 10). 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—C (page 5). As cautioned in I—C11 (page 6), changing alignment in

one direction may alter the alignment in another. Check through 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.

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 "MX" 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—C (page 19).

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 pumpage 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 predetermined 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 reglutaing 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.

IV—D. OPERATING WITH SURGE CONDITIONS IN LINE.

If pump is installed with a quick closing valve in discharge line that closes when pump is running, dangerous pressure surges may be built up that can cause damage to the pump or line. In services of this kind, some cushioning arrangement must be provided to protect the pumping equipment.

IV—E. OPERATING UNDER FREEZING CONDITIONS.

When exposed to freezing conditions and pump is standing idle, liquid inside the pump and cooling jackets should be drained.

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 cover 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 cover 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 — BEARINGS.

1. Grease Lubrication.

(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, insert grease through "Alemite" fittings (193) until grease appears through relief fitting. *DO NOT ADD ADDITIONAL LUBRICANT AFTER GREASE APPEARS THROUGH RELIEF FITTING.*

(b) 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: Insert grease through "Alemite" fittings (193) into bearing housing until grease comes out the relief fitting. 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.*

(c) Grease should be of a sodium or lithium base NGLI No. 2 consistency. *DO NOT USE GRAPHITE.*

2. Oil Lubrication.

(a) Keep oiler bottle filled with correct grade of oil. (See Section II-A). Oiler will maintain constant oil level in bearing frame.

(b) Under normal operating conditions, a good grade of oil will be suitable for six months to one year between changes, as long as it is free from contaminants. A small sample of oil should be drained from the bearing frame periodically. Any cloudiness, turbidity, discoloration or presence of solids is evidence of contamination, and the oil should be changed immediately.

(c) If oiler adjustment is lost or disturbed, reset as directed in Section II-A.

3. 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. 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 placing a contact thermometer against the bearing housing, frame, or end cover. 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. On grease lubricated pumps, one shot of grease should be added to the bearing. If this does not reduce the temperature immediately, no additional grease should be added. Open grease relief fittings and allow excess grease to bleed off for a period of at least one hour. On oil lubricated pumps, check to see that oil is of proper viscosity, and is neither too high or low. 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 or oil seals, not the bearings. As soon as the seals are seated, the temperature will drop to a normal level.

VI—B. LUBRICATION—DRIVER AND COUPLING.

Follow manufacturer's recommendations.

VI—C. SECTIONAL AND PARTS LIST

See Pages 18 and 19.

VI—D. REPACKING STUFFING BOXES.

1. To remove stuffing box gland assembly:
   Back off nuts and washers flush with ends of studs (353). Remove nuts from gland bolts (328) joining gland halves, and lift the upper half gland out of the stuffing box. Remove lower half gland. This now affords unobstructed access to the stuffing box for repacking.
2. Remove all 5 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.

NOTE: Frequent repacking may be caused by deeply grooved shaft sleeves. 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.

VI—E. ADJUSTING IMPELLER CLEARANCE.

1. Loosen jam nuts and bolts (370D) in bearing housing (134). (See Sectional Assembly, Section VI—C).
2. Tighten (turn clockwise) bolts (370C) evenly a flat at a time while slowly rotating shaft, until impeller (101) just contacts suction cover (182) on Model 3138 or suction sideplate (176) on Model 3139.
3. Snug all bolts (370C) against bearing housing (134). Loosen (turn counterclockwise) each bolt (370C) until a .015" feeler gauge can be placed between bearing housing and underside of head of bolt (370C). (See Fig. 12).

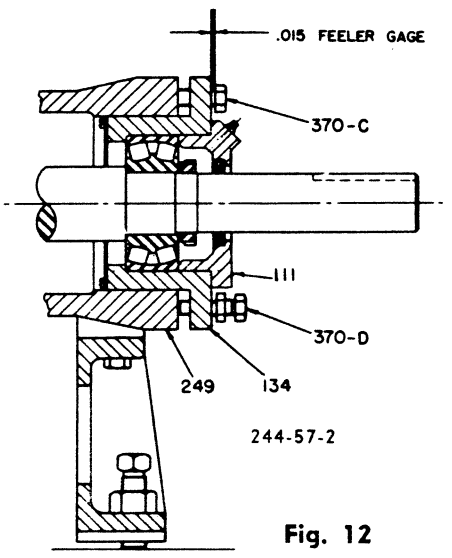
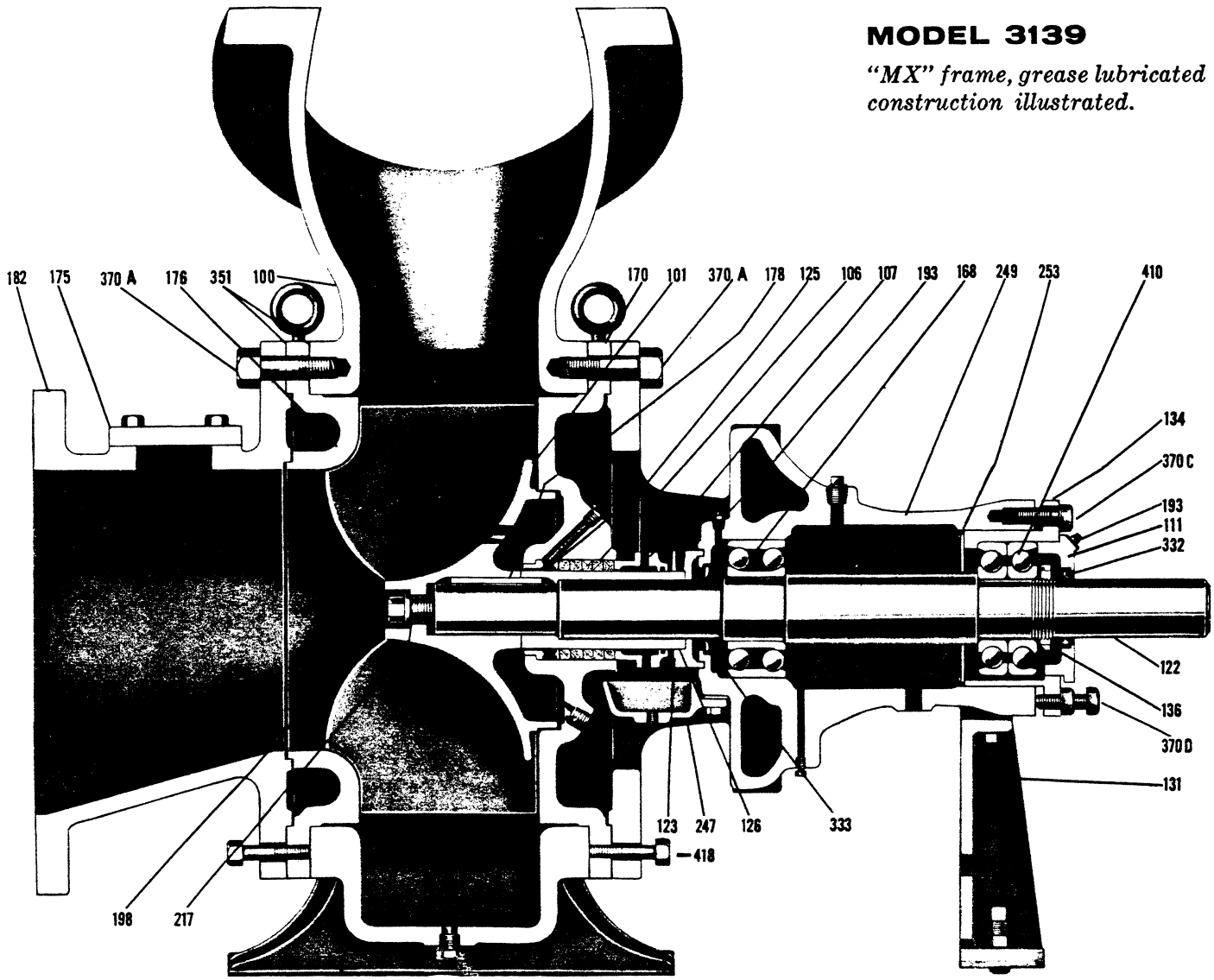


Fig. 12

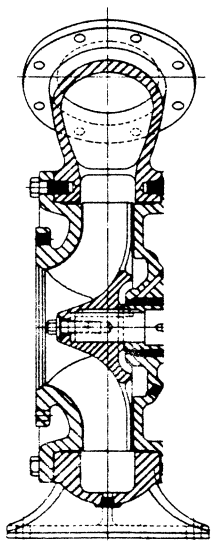
SECTIONAL VIEWS

MODEL 3139

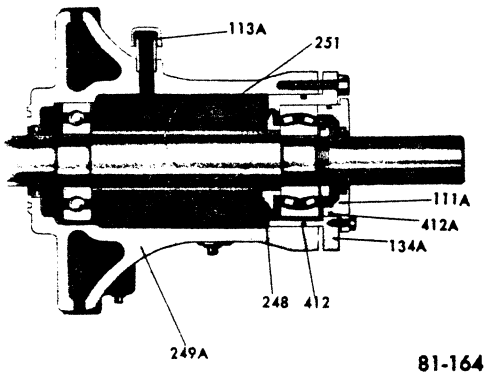
"MX" frame, grease lubricated construction illustrated.



MODEL 3138

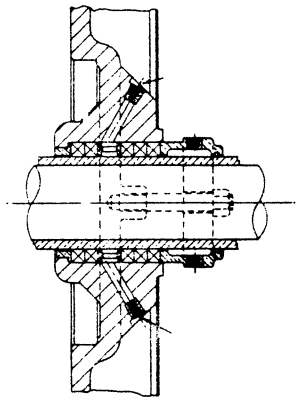


"S" Frame, Optional Oil Lubricated Construction



81-164

Optional Stuffing Box Construction



81123

Typical Analysis of Materials of Construction

MATERIAL	Cu %	Sn %	Pb %	Zn %	Ni %	P %
1102	84-86	4-6	4-6	4-6	—	—
1103	87	6	4.5	1.75	0.75	
1106	84	8	8	—	—	0.10-.15

1000—CAST IRON—CONFORMS TO ASTM A-48-56 CLASS 25
ASTM A-278-59T CLASS 25
1003—CAST IRON—CONFORMS TO ASTM A278-59T CLASS 30
1012—DUCTILE IRON HEAT TREATED CONFORMS TO ASTM A 395-56T TYPE 60-45-15

303—DESIGNATES AISI TYPE 303 STAINLESS STEEL
316—DESIGNATES AISI TYPE 316, STAINLESS STEEL (WROUGHT) OR ASTM A296-59 GRADE CF-8M AND ACI-CF-8M (CAST)

PARTS LIST

Item No.	No. Reqd. Per Pump	PART NAME	MATERIAL							INTERCHANGEABILITY BY GROUP & CASING CLASS				
										Group S		Group MX		
			All Iron	All Iron Ductile Iron Case	Bronze Fitted	All Bronze	All 316 S.S.	All Iron S.S. Trim	All GA-20	4x6-14	6x8-14	8x10-20	10x12-20	14x14-20 Mod. 3138 14x16-20 Mod. 3139
100	1	Casing	1003	1012	1000	1103	316	1000	GA-20	S		MX		
101	1	Impeller	1000	1000	1106	1106	316	316	GA-20	S		MX		
106	1 set	Stuffing Box Packing	Braided Asbestos							S		MX		
107	1	Stuffing Box Gland (Split)	1000	1012	1103	1103	316	1000	GA-20	S		MX		
111	1	Bearing End Cover (Grease Lub.)	1000							S		MX		
111A	1	Bearing End Cover (Oil Lub.)	1000							S		MX		
113	2	Grease Relief Fittings (Not Illus.)	Steel									MX		
113A	1	Bearing Housing Breather (Oil Lub.)	Steel							S		MX		
122	1	Shaft	SAE 4140			303		SAE 4140	303	S		MX		
123	1	Deflector	1102							S		MX		
125	1	Stuffing Box Bushing	1000	1000	1103	1103	316	1000	GA-20	S		MX		
126	1	Shaft Sleeve	1000	1000	1106	1106	316		GA-20	S		MX		
131	1	Pedestal	1000							S		MX		
134	1	Bearing Housing (Grease Lub.)	1000							S		MX		
134A	1	Bearing Housing (Oil Lub.)	1000							S		MX		
136	1	Bearing Lock Nut	Steel							S		MX		
168	1	Radial Bearing	Steel							S		MX		
170	1	Discharge Sideplate	1003	1012	1000	1103	316	1000	GA-20	S		MX		
175	1	Hand Hole Cover (Model 3139 Only)	1000	1012	1000	1103	316	1000	GA-20			MX		
176	1	Suction Sideplate (Model 3139 Only)	1003	1012	1000	1103	316	1000	GA-20	4	6	8	10	14
178	1	Key-Impeller	303							S		MX		
182	1	Suction Cover	1003	1012	1000	1103	316	1000	GA-20	4	6	8	10	14
193	2	Grease Fittings	Steel									MX		
198	1	Impeller Screw	316						C-20	S		MX		
217	1	Impeller Screw Gasket	Long Fibre Asbestos							S		MX		
247	1	Drip Basin		1000		316		1000	316			MX		
248	1	Oil Thrower	Steel							S		MX		
249	1	Bearing Frame (Grease Lub.)	1000							S		MX		
249A	1	Bearing Frame (Oil Lub.)	1000							S		MX		
251	1	Constant Level Oiler	Steel & Glass									MX		
253	1	Grease Retainer Plate	Steel							S		MX		
332	1	Grease or Oil Seal (Outer)								S		MX		
333	1	Grease or Oil Seal (Inner)								S		MX		
351	3-3139—2-3138	Gasket	1/64" Thick Asbestos							S		MX		
353	2	Stud-Gland	303									MX		
362	1	Insert-(Impeller Screw) (Not Illus.)	Red Fibre							S		MX		
370A	16 "S"—24 "M"	Hex. Hd. Mach. Bolts—Casing Disch. Side	Steel							S		MX		
370B	16 "S"—24 "M"	Hex. Hd. Mach. Bolts—Casing Suct. Side	Steel							S		MX		
370C	4	Hex. Hd. Mach. Bolts—Brg. Shell	Steel							S		MX		
370D	4	Hex. Hd. Mach. Bolts—Brg. Shell	Steel							S		MX		
410	1	Thrust Bearing	Steel							S		MX		
412	1	"O" Ring (Bearing Shell) (Oil Lub.)	Buna							S		MX		
412A	1	"O" Ring (Bearing End Cover) (Oil Lub.)	Buna							S		MX		
418	6	Jacking Bolts—Casing	Steel							S		MX		

CONSTRUCTION DETAILS

GENERAL	Weight, Bare Pump, Lbs.	Model 3138	900	1175	1700	1840	2200
		Model 3139	1050	1375	1860	2000	2300
	Casing Thickness—Volute		¾"	¾"	⅞"	⅞"	¾"
	Casing Thickness—Side Walls		¾"	¾"	⅞"	⅞"	¾"
	Maximum Diameter Spherical Solids		1¼"	1⅞"	2¾"	3⅜"	3⅛"
STUFFING BOX	Stuffing Box—Bore		3¾"		4⅜"		
	Stuffing Box—Depth to Stuffing Box Bushing		2⅜"		2⅜"		
	Stuffing Box—Packing Size		½" Sq.		½" Sq.		
	Stuffing Box—Number of Packing Rings		5		5		
	Stuffing Box—Outside Diameter of Sleeve		2¾"		3⅜"		
	Stuffing Box—Width of Seal Ring		1"		1"		
SHAFT	Shaft Diameter at Impeller		1¾"		2⅞"		
	Shaft Diameter in Sleeve		2⅛"		2⅞"		
	Shaft Diameter in Between Bearings		2⅜"		3¼"		
	Shaft Diameter at Coupling End		1.8750"—1.8745"		2.6250"—2.6245"		
BEARINGS	Thrust Bearing (Roller—Gp "S"; Duplex Ball—Gp "MX")		Tor. 50 SD 23F2		MRC 7314 PD DB		
	Radial Bearing (Ball. Single Row—Gp "S"; Double Row—Gp "MX")		MRC 311-S		MRC 5315		
	Radial Bearing (Optional, Cylindrical Roller—Gp "S" only)		Nor.-Hoff.R-355-LL		—		
LIMITS	*Maximum Total Working Pressure—Model 3139		150 lbs.				
	*Maximum Total Working Pressure—Model 3138 with 150 lb. Flanges		150 lbs.				
	*Maximum Total Working Pressure—Model 3138 with Ductile Iron or Steel Casing & 400 lb. Flanges		400 lbs.				
	Maximum Liquid Temperature—Without Cooling		250°F				
	Maximum Liquid Temperature—With Bearing Cooling		350°F				
	Maximum Liquid Temperature—With Jacketed Stuffing Box and Cooled Oil Lube Bearings		450°F‡				

*Any part of which may be suction pressure. ‡For temperatures above 450°F, refer to factory with complete details.

4. Be sure jam nuts on bolts (370D) are loose. Tighten (turn clockwise) each bolt (370D) a flat at a time until bearing housing is tight against bolts (370C). Be sure all bolts (370C and 370D) are tight. Tighten jam nuts on bolts (370D).

5. The rotating element and consequently the impeller has been moved .015" away from the suction cover (182) on Model 3138 or suction sideplate (176) on the Model 3139 thus giving the required clearance between these two parts.

VI—F. DISMANTLING OF PUMP.

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

1. Shut off all valves controlling the flow of liquid to or from the pump.
2. Drain liquid from pump. (See Sectional Assembly, Section VI—C.) Drain plug is located on bottom of casing at lowest point.
3. Disconnect spacer coupling.

   Refer to separate instructions supplied for the specific make to remove spacer section of coupling.

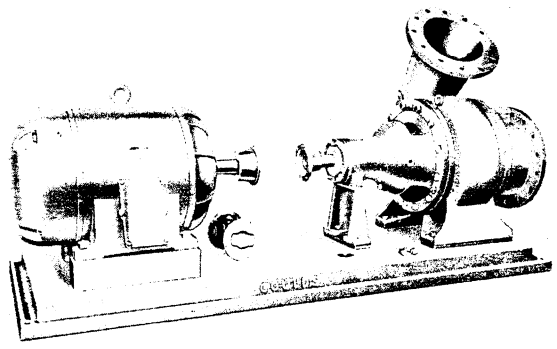


Fig. 14

4. Remove pedestal (131) hold down bolts.
5. Place chain or rope sling from crane through eye bolts in discharge sideplate (170) (Fig. 15). Balance point is approximately above the deflector (123).

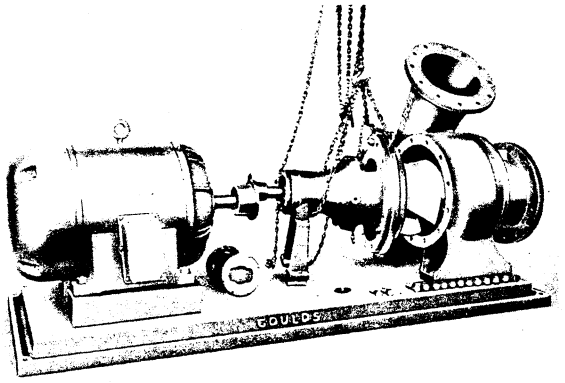


Fig. 15

6. Remove bolts (370A) which hold bearing frame and discharge sideplate to the casing.
7. Adjust tension on sling to support the weight of the "pull-out assembly." Complete "pull-out assembly" can be jacked back by tightening the jacking bolts (Fig. 16). Jacking

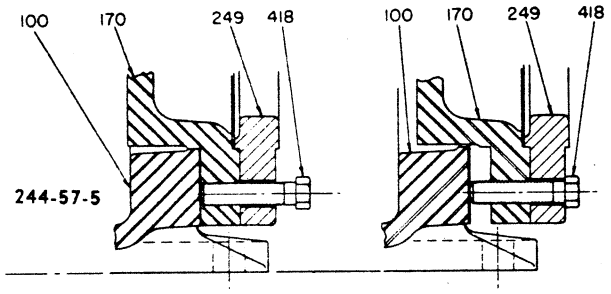


Fig. 16

bolts are proper length to jack discharge sideplate out of its lock fit in casing and also hold the discharge sideplate to the bearing frame flange as the "pull-out assembly" is removed. Once the lock fits are separated the complete "pull-out assembly" can be pulled back and angled to right or left until impeller clears casing.

8. If working space is available to the sides of the bedplate the "pull-out assembly' can be turned perpen-

dicular to the bedplate (Fig. 18).

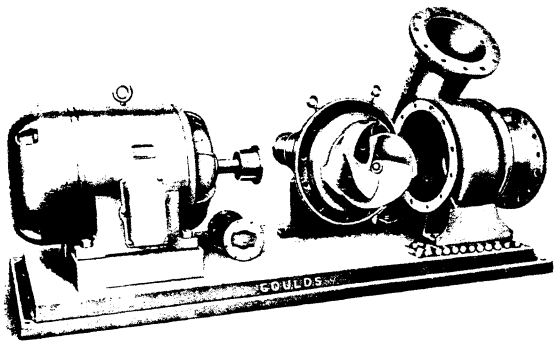


Fig. 18

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

9. Remove the impeller screw (198) with a socket head wrench 15/16" for Group "S" and 1" for Group "MX" across flats.
10. Remove impeller screw gasket (217) and save for reuse.
11. To remove the impeller, thread the impeller puller stud, furnished in the box of fittings, into the end of the impeller. This stud pushes against the end of the shaft and pulls the impeller as the stud is turned clockwise (Fig. 19).
12. Remove key — (impeller 178) from shaft (122).
13. Remove the two bolts which hold the gland halves (107) together and remove gland halves from sleeve.
14. Unscrew jacking bolts (418) in bearing frame flange and discharge sideplate.
15. Discharge sideplate (170) can now be pulled from bearing frame flange. Remove old stuffing box packing (106). The stuffing box bushing (125) is not locked to allow easy removal from box. Remove bushing from box.
16. Loosen set screws in deflector (123).
17. Slide shaft sleeve (126) from shaft. If shaft sleeve can not be removed easily — remove bolts (370C) in bearing housing (134) and tighten bolts (370D). This moves the complete rotating element toward the coupling end allowing the deflector (125) and sleeve (126) to butt against the bearing frame. As the bolts (370D) are tightened further, the action will jack the

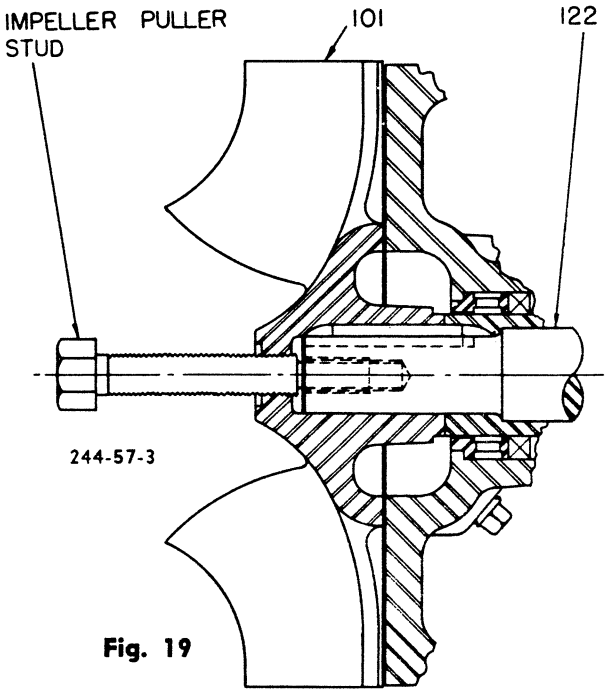


Fig. 19

sleeve (126) off from the shaft (122). The removal of the "pull-out assembly" provides free access to the pump interior for inspection and maintenance of the liquid end without disturbing suction and discharge piping. Removal of impeller and discharge sideplate enables maintenance of stuffing box area including mechanical seals if furnished or to be installed.

18. To disassemble remainder of the liquid end; casing (100), suction sideplate (176, Model 3139 only) and

suction cover (182) disconnect suction and discharge flanges.

19. Remove casing hold down bolts and move casing toward driver. If preferred, casing can be removed from bedplate for further disassembly.
20. Hook overhead hoist to eye bolt located at top of suction sideplate (176, Model 3139) or suction cover (182, Model 3138).
21. Remove casing bolts (370B).
22. Tighten jacking bolts (418) until lock fit between casing (100) and suction sideplate (176 on Model 3139) or suction cover (182 on Model 3138 is parted.
23. Tighten hoist and pull suction cover or suction assembly back from casing. Lay in a horizontal position with suction flange side down.
24. On Model 3139 remove jacking bolts (418). Place eye bolts (eye up) in jacking bolt tapped holes and lift suction sideplate (176) from suction cover (182).

VI—G. DISASSEMBLY POWER END.

1. Follow steps 1 through 17 in Section VI—F to remove "pull-out assembly" from casing and the further removal of the impeller (101), discharge sideplate (170) and shaft sleeve (126).
2. Remove bolts (370C) located in bearing housing (134).
3. Shaft assembly consisting of shaft (122) radial bearing (168) and bearing housing (134) can be removed from bearing frame (134) by using bolts (370D) (with jam nuts removed) as jacking bolts.
4. Remove pump half coupling hub.
5. Remove machine screws holding grease retainer plate (253) to bearing housing (134).
6. Remove bolts which hold bearing end cover (111) to bearing housing. Slide bearing end cover off shaft (122). Slide bearing housing off outer race of thrust bearing (410).
7. Bend retaining tang of bearing lock nut washer (136) back with a screw driver and using a spanner wrench on the lock nut remove it and the lock nut washer.
8. Remove thrust bearing (410) with the use of a suitable bearing puller, which rests evenly on the inner race only, or with a press. Protect bearing from damage and dirt at all times.
9. Drive radial bearing (168) off liquid end of shaft with a suitable driving sleeve which rests evenly against inner race only, or with a press, keeping bearing square at all times. Protect bearing from damage and dirt.

VI—H. REASSEMBLY OF PUMP.

The following directions are for use when the pump is completely dismantled and it is desired to reassemble. Fig. 22 shows an exploded view of the assembly.

1. Check shaft to see that it is not bent or otherwise damaged and that it is 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 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 to be used, clean thoroughly before installing, as follows: Use a

clean pail or receptacle. Pour one or two quarts of clean, water-free kerosene into it. 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 frame (249), bearing end cover (111) and bearing housing (134) should be flushed and cleaned. Be sure grease fittings (193) and relief fitting are clean. Inspect grease or oil seals (332 and 333) and replace if worn or damaged.
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 radial bearing (168), oil shaft at bearing seat and slide bearing over shaft as far as possible by hand. Place a pipe or sleeve against 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. Slide grease retainer plate (253) and then bearing housing (134) over coupling end of shaft to radial bearing (168).
7. To replace thrust bearing (410), oil

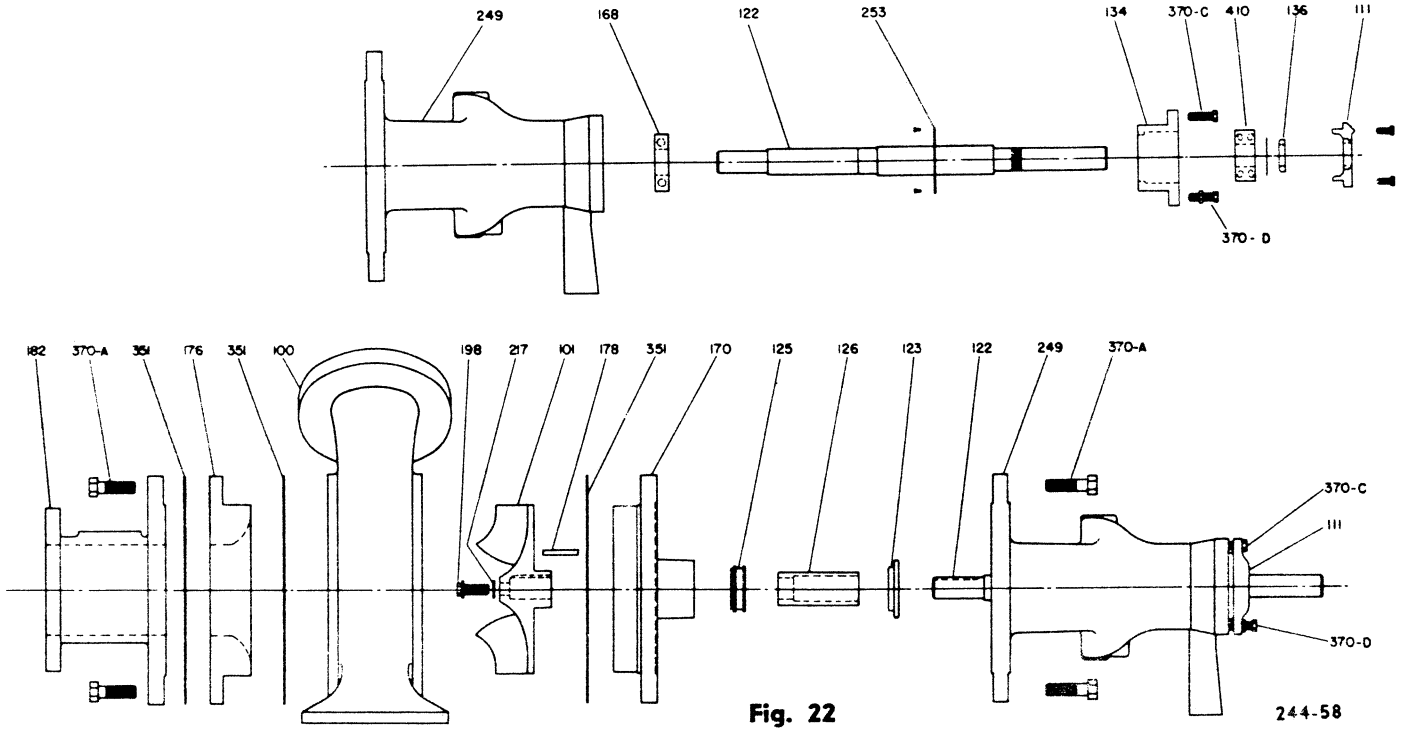


Fig. 22

244-58

shaft at the 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, especially the threads.

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

9. Oil shaft threads lightly and snug bearing lock nut (136) against lock nut washer. Tighten firmly with spanner wrench. Rotate shaft to locate lock washer 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.*

10. Slide bearing housing (134) over thrust bearing (410).

11. Bolt bearing end cover (111) to bearing housing (134).

12. Place grease retainer plate (253) in position against bearing housing (134) and replace machine screws.

13. Shaft assembly consisting of shaft (122) radial bearing (168) and thrust bearing (410) complete with bearing end cover (111) and bearing housing (134) in position over bearing (410) can now be inserted in bearing frame (249). Be careful not to damage grease seal (333) located in bearing frame. Grease and relief fittings should be on horizontal center line. If pumps are oil lubricated, be sure O-rings (412 and 412A) are in place.

14. Replace four bolts (370C) through bearing housing (134) into bearing frame to hold shaft assembly during further assembly.

15. Slide deflector (123) on impeller end of shaft with flat side in until it rests against bearing frame.

16. Lightly oil exposed portion of shaft. Slide shaft sleeve (126) on shaft (122) until sleeve is sealed against shaft shoulder. If necessary to tap sleeve be careful not to mar hub. Be sure shaft keyway and shaft sleeve keyway are in line. Shaft sleeve (126) must be in perfect condition for good packing life. Surface to operate under packing (106) must be free of grooves or scratches.

17. Slide stuffing box bushing (125) over shaft sleeve (126), with drilled water seal passages toward bearings, to deflector (123). Be sure bushing is clean and not eroded or corroded. Inside diameter of bushing should be checked for excessive wear. (See Section VI—J3.)

18. The discharge sideplate (170) was inspected on disassembly and found in good condition or replaced by a new one. See Section VI — J1. Using a hoist hooked through the eye bolts, lift the discharge sideplate (170) into position at impeller end of shaft. Be sure openings to the stuffing box bushings are clear. Guide discharge sideplate (170) carefully over shaft and sleeve preventing contact with them. Female lock fit on sideplate matches male lock fit on bearing frame flange (249). Discharge sideplate (170) should be rotated so that jacking bolt holes are in line. This will position the gland studs on the horizontal center line.

19. Insert and tighten jacking bolts (418).

20. Oil shaft keyway and insert impeller key (178) in shaft (122) and shaft sleeve (126).

21. Oil shaft (122) and place impeller (101) on shaft as far as possible. If it is necessary to tap impeller on, loosen bolts (370C) and brace end of shaft to prevent damage to thrust bearing (410).

22. Pull impeller (101) on shaft the remainder of distance with impeller screw (198). Be sure impeller screw gasket (217) is *not* on impeller screw.

23. Remove impeller screw (198), place impeller screw gasket (217) on screw and replace in shaft (122).

24. Loosen bearing housing bolts (370C) and jam nuts on bolts (370D). Tighten bolts (370D) until impeller contacts discharge sideplate (170).

25. To replace pump half coupling hub on shaft, screw a stud (¾"-10 on Group "S" and a 1"-8 on Group "MX") approximately 1¼" longer than the length of the coupling hub into the end of the shaft. Insert the coupling key in shaft keyway. Put oil or white lead on the shaft end and in the coupling bore. Place the complete 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.

26. Inspect casing gasket.

27. If casing assembly of casing (100), suction sideplate (176 on Model 3139 only) and suction cover were disassembled proceed as follows:

FOR MODEL 3139 only:

28. Place suction cover (182) in vertical position, suction flange side down. Using hoist hooked through eye bolts placed in jacking bolt holes, with curved side up, swing suction side plate (176) in position above suction cover (182).

29. Insert gasket (351) in position on suction cover (182).

30. Lower suction sideplate (176) on suction cover (182). Precision machined male and female locks align the two parts. Tapped eye bolt holes in edge of sideplate should be in line with the hand hole.

31. Remove hoist hooks and eye bolts and place eye bolts in tapped holes in edge of suction sideplate (176).

32. Place jacking bolts (418) through suction cover (182) and into suction sideplate. Tighten jacking bolts.

33. Using hoist with sling hooked in eye bolt in suction sideplate or slung around suction cover (182) lift suction cover and sideplate assembly in position in front of casing (100). Insert casing gasket (351) on sideplate flange.

34. Adjust hoist carefully and place suction sideplate in casing until jacking bolts contact casing (see Fig. 16).

35. Insert casing bolts (370B) tightening gradually and evenly while unscrewing jacking bolts. Continue until sideplate flange contacts casing parting flange. (See Fig. 16, page 20.) Adjusting jacking bolts (418) and casing bolts (370B) simultaneously maintains suction cover and sideplate locks in position during assembly.

FOR MODEL 3138 only:

36. Using hoist hooked through suction cover (182) eye bolts, place in position in front of casing (100).
37. Place gasket (351) on suction cover (182) flange and guide cover into matching lock fit in casing.
38. Insert and tighten casing bolts (370B).
39. Place rope or chain sling in eye bolts and under bearing frame (249) with balance point approximately over deflector (123). Guide "pull-out assembly" into position on back side of casing (100). (See Fig. 15, page 20).
40. By careful adjustment of hoist, guide impeller and discharge sideplate into back side of casing until jacking bolts (418) contact casing. (See Figs. 15 and 16, page 20).
41. Insert casing bolts (370A) tightening gradually and evenly while unscrewing jacking bolts (418). Continue until sideplate flange contacts casing parting flange. (See Fig. 16, page 20). Adjusting jacking bolts (418) and casing bolts (370A) simultaneously maintains discharge sideplate (170) and bearing frame flange (249) locked in position during assembly.
42. Adjust impeller (101) clearances as directed in Section VI—E, (page 17).
43. Adjust deflector (123) on end of shaft sleeve (126) and tighten dog point set screws which fit drilled hole in sleeve.
44. Slide stuffing box bushing (125) into bottom of stuffing box being sure it is properly seated.
45. Pack stuffing box as directed in Sec- II—C (page 10).
46. Place pump in position on bedplate, insert and tighten hold down bolts.
47. Follow procedure outlined in Sections I, II and III on installation, preparation and operation and 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 20, for disassembly and Section VI—H, page 22, for reassembly of pump.

The following items should be checked:

1. Sideplate and Suction Cover Clearance.

The clearances between the impeller and the sideplates or suction cover 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 cannot be restored by readjustment of impeller clearance.

2. Fit of Sleeve on Shaft.

These parts are machined for a push fit. The shaft sleeve (126) is bored 0.000" to 0.0015" larger than the shaft and should tap easily on the shaft. If the sleeve 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 (126) 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 Sleeve.**

   If the surface of 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.

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 discharge sideplates, impeller, shaft, shaft sleeve, stuffing box bushing, bearing, bearing housing, end cover, and water slingers assembled, less pump half coupling.

   It is not necessary to duplicate spare parts inventory where both right and left hand pumps are used. All parts are interchangeable except impellers.

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—C.
3. Give the number of parts required.
4. Give complete shipping instructions.

GOULDS PUMPS

INCORPORATED

Seneca Falls, New York, U.S.A.

specialists in pumps

MODERN MANUFACTURING EQUIPMENT AND METHODS + 1,000 PUMP-MINDED PEOPLE = GOULDS PUMPS, a company with 116 years of experience

As manufacturers of pumps . . . AND PUMPS ONLY . . . Goulds is able to provide the pump user with a highly specialized service. Unencumbered with other products, Goulds research and design engineers, application engineers and field sale representatives are truly pump specialists.

Goulds Pumps are produced in this large plant, again, one which is devoted exclusively to pump manufacturing (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 they were too hot, corrosive, abrasive, or thick.

ITT

7834-EL Sup 7232-EL

Printed in U.S.A.

Form I3138-39 5-08