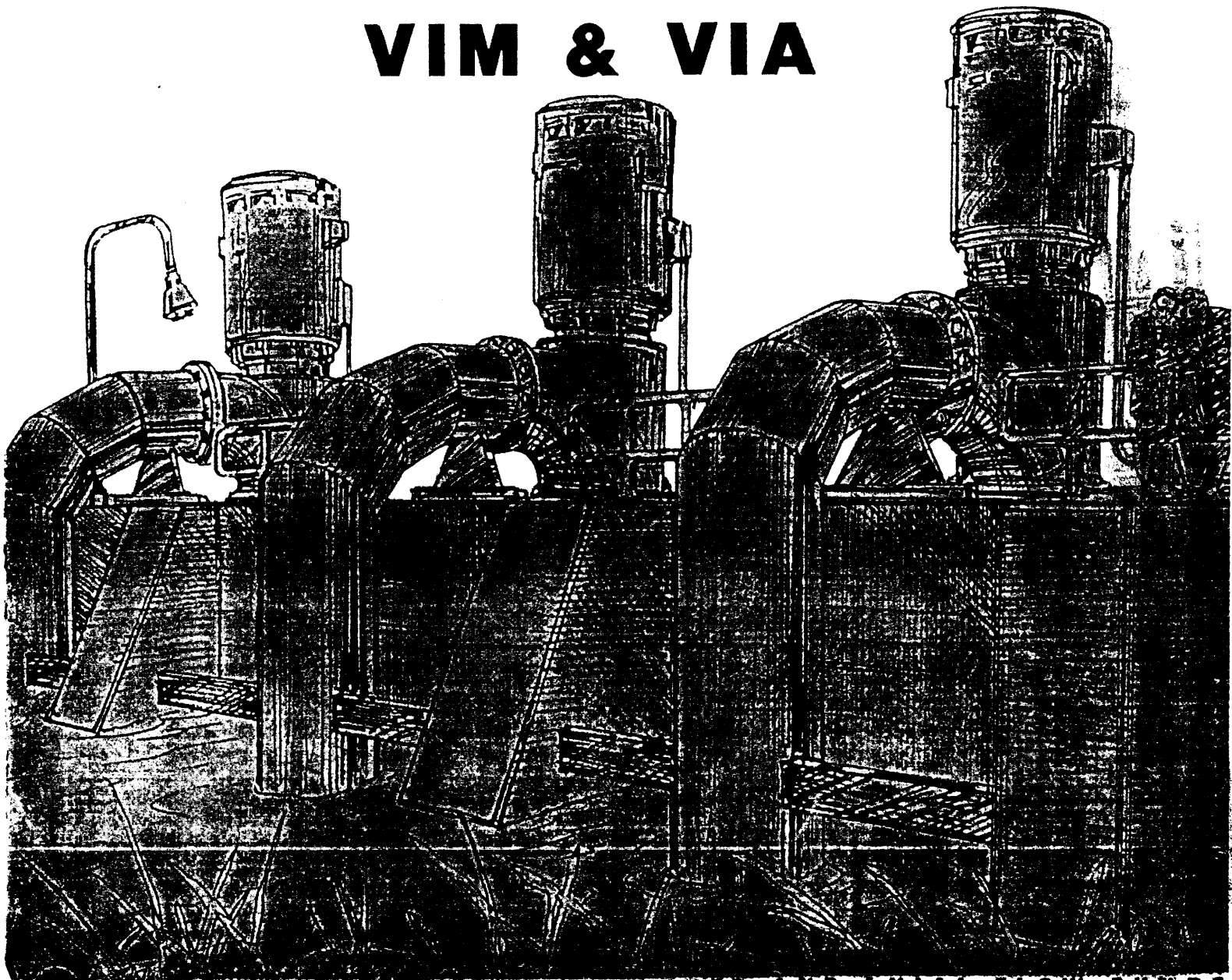


 **GOULDS PUMPS, INC.**

**INSTALLATION, OPERATION and  
MAINTENANCE INSTRUCTIONS**

MODEL

**VIM & VIA**



**VERTICAL INDUSTRIAL MIXED AND AXIAL FLOW PUMPS**

## 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](http://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](http://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](http://www.gouldspumps.com/literature).

# SAFETY

## DEFINITIONS

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

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



### **WARNING**

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

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

---



### **CAUTION**

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

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

---



### **ELECTRICAL HAZARD**


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

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

---



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







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














---



## GENERAL PRECAUTIONS

### WARNING

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

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

<b>General Precautions</b>		
<b>WARNING</b>		Before beginning any alignment procedure, make sure driver power is locked out. Failure to lock out driver power will result in serious physical injury.
<b>CAUTION</b>		<b>Piping:</b> 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.
<b>WARNING</b>		<b>Flanged Connections:</b> Use only fasteners of the proper size and material.
<b>WARNING</b>		Replace all corroded fasteners.
<b>WARNING</b>		Ensure all fasteners are properly tightened and there are no missing fasteners.
<b>WARNING</b>		<b>Startup and Operation:</b> When installing in a potentially explosive environment, please ensure that the motor is properly certified.
<b>WARNING</b>		Operating pump in reverse rotation may result in contact of metal parts, heat generation, and breach of containment.
<b>WARNING</b>		Lock out driver power to prevent accidental start-up and physical injury.
<b>WARNING</b>		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.
<b>WARNING</b>		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.
<b>WARNING</b>		The coupling used in an ATEX classified environment must be properly certified and must be constructed from a non-sparking material.
<b>WARNING</b>		Never operate a pump without coupling guard properly installed. Personal injury will occur if pump is run without coupling guard.
<b>WARNING</b>		Make sure to properly lubricate the bearings. Failure to do so may result in excess heat generation, sparks, and / or premature failure.
<b>CAUTION</b>		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.
<b>CAUTION</b>		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.
<b>WARNING</b>		Never attempt to replace packing until the driver is properly locked out and the coupling spacer is removed.
<b>WARNING</b>		Dynamic seals are not allowed in an ATEX classified environment.
<b>WARNING</b>		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.

<b>General Precautions</b>		
<b>WARNING</b>		Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, opening vent or drain valves, or disconnecting piping.
<b>WARNING</b>		<b>Shutdown, Disassembly, and Reassembly:</b> 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.
<b>WARNING</b>		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.
<b>WARNING</b>		Operator must be aware of pumpage and safety precautions to prevent physical injury.
<b>WARNING</b>		Lock out driver power to prevent accidental startup and physical injury.
<b>CAUTION</b>		Allow all system and pump components to cool before handling them to prevent physical injury.
<b>CAUTION</b>		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.
<b>WARNING</b>		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.
<b>CAUTION</b>		Wear heavy work gloves when handling impellers as sharp edges may cause physical injury.
<b>CAUTION</b>		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](http://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)

<b>Code</b>	<b>Max permissible surface temperature °F (°C)</b>	<b>Max permissible liquid temperature °F (°C)</b>
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.

---

## TABLE OF CONTENTS

SECTION		PAGE
1	INTRODUCTION.....	1-1
	1-1 INTRODUCTION.....	1-1
	1-3 RECEIVING AND CHECKING.....	1-2
	1-6 MATERIALS AND EQUIPMENT REQUIRED.....	1-2
2	STORAGE.....	2-1
	2-1 STORAGE.....	2-1
	2-3 STORAGE PREPARATION.....	2-1
	2-5 RECOMMENDED STORAGE PROCEDURES.....	2-1
	2-6 PREPARATIONS FOR UNCONTROLLED LONG TERM STORAGE	2-2
3	INSTALLING THE BOWL.....	3-1
	3-1 BOWL INSTALLATION.....	3-1
4	INSTALLING PRODUCT LUBRICATION COLUMN.....	4-1
	4-1 INSTALLING PRODUCT LUBRICATION COLUMN.....	4-1
5	INSTALLING OIL LUBRICATION COLUMN.....	5-1
	5-1 INSTALLING OIL LUBRICATION COLUMN.....	5-1
6	INSTALLING THE DISCHARGE ELBOW.....	6-1
	6-1 INSTALLING THE DISCHARGE ELBOW.....	6-1
7	STUFFING BOX INSTALLATION.....	7-1
	7-1 STUFFING BOX INSTALLATION.....	7-1
8	INSTALLING TUBE TENSION PLATE ASSEMBLY AND LUBRICATION SYSTEM.....	8-1
	8-1 INSTALLING THE TUBE TENSION NUT.....	8-1
	8-3 LUBRICATION SYSTEM.....	8-1
9	INSTALLING THE DRIVER (VHS).....	9-1
	9-1 INSTALLATION OF HOLLOW SHAFT DRIVER.....	9-1
	9-3 VIA AND VIM PUMPS.....	9-2
	9-4 ADJUSTMENT-VIA PUMPS.....	9-3
	9-5 ADJUSTMENT - VIM PUMPS.....	9-3
	9-6 GROUTING THE BASE.....	9-5
10	INSTALLING THE DRIVER (VSS).....	10-1
	10-1 INSTALLATION OF SOLID SHAFT DRIVER.....	10-1
	10-3 ADJUSTMENT - VIA PUMPS.....	10-2
	10-4 ADJUSTMENT -VIM PUMPS.....	10-4
	10-5 GROUTING THE BASE.....	10-4
11	INSTALLING THE GEARHEAD.....	11-1
	11-1 GEARHEAD DRIVE INSTALLATION.....	11-1
	11-3 GROUTING THE BASE.....	11-2

## TABLE OF CONTENTS

SECTION		PAGE
12	STARTING THE PUMP .....	12-1
	12-1 PRE-START PROCEDURE.....	12-1
	12-2 PUMP START-UP.....	12-1
13	PREVENTIVE MAINTENANCE.....	13-1
	13-3 PACKING ADJUSTMENT AND REPLACEMENT.....	13-2
	13-5 SEASONAL SHUTDOWN PROCEDURES.....	13-3
14	TROUBLESHOOTING.....	14-1
	14-1 CORRECTIVE MAINTENANCE.....	14-2
15	PUMP DISASSEMBLY.....	15-1
	15-1 PUMP DISASSEMBLY.....	15-1
	15-4 BOWL DISASSEMBLY-PRODUCT LUBRICATION.....	15-3
	15-6 BOWL DISASSEMBLY-PRODUCT LUBRICATION-VIA PUMP.....	15-3
	15-7 BOWL DISASSEMBLY-PRODUCT LUBRICATION-VIM PUMP.....	15-4
	15-8 BOWL DISASSEMBLY-OIL LUBRICATION.....	15-4
	15-10 BOWL DISASSEMBLY-OIL LUBRICATION-VIA PUMP..	15-4
	15-11 BOWL DISASSEMBLY-OIL LUBRICATION-VIM PUMP..	15-4
	15-12 CLEANING AND INSPECTION.....	15-4
16	PUMP DATA.....	16-1
	16-1 CALCULATING PUMP WEIGHT.....	16-1
17	RECOMMENDED LUBRICANTS.....	17-1
18	PARTS LIST.....	18-1

:

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE
4-1	VIM - PRODUCT LUBRICATION PUMP.....	4-4
4-2	PRODUCT LUBRICATION COLUMN HOISTING.....	4-5
5-1	VIM - ENCLOSED LINESHAFT PUMP.....	5-4
5-2	OIL LUBRICATION COLUMN HOISTING.....	5-5
5-3	KEYED SHAFT COUPLING ASSEMBLY.....	5-6
7-1	STUFFING BOX.....	7-2
8-1	OIL LUBRICATION SYSTEM.....	8-2
9-1	HOLLOW SHAFT ADJUSTING NUT.....	9-4
9-2	FOUNDATION BOLT DETAIL.....	9-5
10-1	FLANGED ADJUSTABLE COUPLING.....	10-4

SECTION 1  
INTRODUCTION

1-1. INTRODUCTION

1-2. The design, material, and workmanship incorporated in the construction of Goulds Pumps makes 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 careful maintenance. This instruction manual was prepared to assist operators in understanding the construction and the correct methods of installing, operating, and maintaining these pumps.

It is advisable that rotating components of the pump assembly be covered with a suitable rigid guard to prevent injury to personnel.

Study thoroughly Sections 1 thru 12 and carefully follow the instructions for installing and operating. Section 13 thru 15 are answers to trouble and maintenance questions. Keep this instruction manual handy for reference. Further information can be obtained by contacting the Vertical Pump Division, Goulds Pumps, Inc., City of Industry, California or your local branch office.

WARNING

GOULDS PUMPS, INC. WILL NOT BE  
LIABLE FOR ANY DAMAGES OR DELAY  
CAUSED BY FAILURE TO COMPLY  
WITH THE PROVISIONS OF THIS  
INSTRUCTION MANUAL.

SECTION 1  
INTRODUCTION

1-3. RECEIVING AND CHECKING

1-4. The pump shall be carefully supported prior to unloading from the carrier. Handle all components carefully. Inspection for damage of the shipping crate shall be made prior to unpacking the pump. After unpacking, visually inspect the pump, and check the following:

- A. Contents of the pump assembly against shipping list.
- B. All components against damage.
- C. The shaft is not bent.

1-5. Any shortages or damages should be immediately called to the attention of the local freight agent of the carrier by which the shipment arrived and proper notation made on the bill. This shall prevent any controversy when claim is made and facilitate prompt and satisfactory adjustment.

1-6. MATERIALS AND EQUIPMENT REQUIRED

1-7. The material and equipment necessary for installation of the pump will vary with the size of the pump and the type of installation.

SECTION I  
INTRODUCTION

The following list of standard tools and supplies is offered only as a guide.

A. BULK MATERIAL

Anti-Galling Lubricant such as ("MOLYKOTE" DOW CORNING)

Thread Compound

Lubrication Oil

Turbine Oil (See Section 17)

Grease (See Section 17)

Solvent, petroleum - base (Kerosene, distillate or unleaded gasoline)

Grouting material, non-shrinking

B. RIGGING EQUIPMENT

Mobile power hoist; or a traveling crane; or a derrick

Dragline and blocks

Elevator clamps

Clevises - for use with eyebolts

Timbers - size, length and quantity as required to support long pump parts on the floor

I-Beams or timbers to support pump over sump

Tail rope - size and length as required

C. HAND TOOLS

Pipe wrenches, clean rags

Chain tongs Feeler gages

Set of mechanic's tools including: files, wire brush, pliers, wire-cutters, pocket knife and pipe wrenches.

## SECTION 2

### STORAGE

#### 2-1. STORAGE

2-2. Goulds Pumps carefully preserves and protects its products for shipment. However, the effective life of the preservatives applied at the factory can vary 3 to 18 months depending on the severity of the environment in which the equipment is stored. This section provides procedures for preparation prior to storage and maintenance during storage of Goulds Pumps. These procedures are necessary to protect the precision parts of the pumps. Specific procedures for storing motors, gearheads, and engines, should be obtained from the equipment manufacturer. This section is intended to be of general assistance to users of Goulds Pumps. It shall not modify, amend and/or otherwise alter the scope of Goulds Pumps warranty responsibilities to the purchaser in anyway whatsoever.

#### 2-3. STORAGE PREPARATION

2-4. Goulds vertical pumps require proper preparation for storage, and regular maintenance during storage. The pump shall be considered in storage when it has been delivered to the job site and is waiting installation. If a pump has been installed but is not in regular operation, such as seasonal shutdown, see Section 13.

#### 2-5. RECOMMENDED STORAGE PROCEDURES

A. Controlled storage facilities should be maintained at an even temperature 10°F or more above the dew point with relative humidity less than 50% and little or no dust. (If these requirements cannot be met the pump is to be considered in uncontrolled storage).



## SECTION 2

### STORAGE

B. For uncontrolled storage periods of 6 months or less, the pump is to be inspected periodically to insure that all preservatives are intact.

C. All pipe threads and flanged pipe covers are to be sealed with tape.

D. The pump must not be stored closer than 6 inches to the ground.

#### 2-6. PREPARATIONS FOR UNCONTROLLED LONG TERM STORAGE

2-8. Storage periods over 6 months require the preceding uncontrolled storage procedure plus the following:

A. Inspect the lube oil and seal flush piping, and either fill the piping with rust preventative oil, or recoat the piping periodically to prevent corrosion.

B. Place 10 pounds of moisture absorbing dessicant or 5 pounds of vapor phase inhibitor crystals near the center of the pump. If the pump is assembled, place an additional one pound in the discharge nozzle securely fastened to the discharge elbow.

C. Install a moisture indicator near the perimeter of the pump. Cover the pump with 6 mil minimum thickness black polyethylene or equal and seal it with tape. Provide a small ventilation hole approximately 1/2 inch diameter.

D. Provide a roof or a shed shelter to protect from direct exposure to the elements.

SECTION 3  
INSTALLING THE BOWL

3-1. BOWL INSTALLATION. (See figures 4-1 and 5-1.)

3-2. Pumps that are 30 feet or less in length are usually shipped completely assembled with the exception of the driver and top driveshaft section.

The following installation instructions apply to pumps shipped disassembled.

WARNING

DO NOT WORK UNDER A HEAVY, SUSPENDED  
OBJECT UNLESS THERE IS A POSITIVE SUPPORT  
UNDER IT, WHICH WILL PROTECT PERSONNEL  
SHOULD A HOIST OR SLING FAIL.

3-3. Prior to installing the bowl assembly, which consists of diffuser case, suction bell, impeller and pumpshaft, remove all accumulated dust, oil, or other foreign matter from external surfaces of the bowl components and proceed as follows:

A. Position a suitable lifting device over the sump opening. Place two timbers or I-beams across the sump opening strong enough to safely support the weight of the entire pump assembly.

B. Place an elevator clamp just below the diffuser case (708) flange, or thread eyebolts through bolt holes in the flange and hoist into position over the sump, and attach strainer (698), if provided.

C. If pressure flush lines to the suction bearing are provided, attach the flush lines to suction bell (689) and along the length of the bowl assembly. Lubricate joints with thread compound.

SECTION 3  
INSTALLING THE BOWL

D. Lower the bowl assembly until the flanges on the elevator clamp or the diffuser case flange rests firmly on the supports.

E. Place a cover over bowl assembly to prevent entrance of dirt or other foreign matter.

CAUTION

DO NOT DROP ANY FOREIGN OBJECT INTO THE BOWL ASSEMBLY.  
SUCH AN OBJECT CAN CAUSE SERIOUS DAMAGE TO THE PUMP  
AND ANY DOWNSTREAM COMPONENTS. ANY FOREIGN OBJECT  
DROPPED INTO THE BOWL ASSEMBLY MUST BE RETRIEVED  
PRIOR TO CONTINUING ASSEMBLY.

## SECTION 4

### INSTALLING PRODUCT LUBRICATION COLUMN (OPEN LINESHAFT)

4-1. INSTALLING PRODUCT LUBRICATION COLUMN. (See figure 4-1.)

4-2. Install product lubrication column as follows:

A. Check that lineshaft (646) is not bent and insert into bottom column section.

B. Thread two eyebolts diametrically opposite in the upper flange of column.

C. Attach a sling to the eyebolts and to hoist hook. Tie bottom of lineshaft (646) to bottom column (644), using a clove hitch or double half hitch around the shaft in the threaded area. Pass the rope through the inside of the column and tie end of the rope to hoist hook. (See figure 4-2.)

D. For keyed shafts, the tail rope hitch shall be above the keyway.

E. Utilize the remaining tail rope to keep tension on the knots during hoisting. Lower end of column shall be guided by the dragline which is pulled by the hoist. A traveling block for the dragline shall be attached to lower end of column section by means of a clevis and a pin or eyebolt inserted in one of the bolt holes in the lower flange. (See figure 4-2.)

F. Hoist column section over bowl assembly, keeping tension on tail rope. With column in a vertical position, remove dragline and traveling block, lower column until lineshaft is properly aligned with threaded coupling (649).

G. KEYED SHAFTS - Install retainer (650) and insert key (730D) onto pumpshaft (675). Lower coupling sleeve (734) onto pumpshaft

SECTION 4  
INSTALLING PRODUCT LUBRICATION COLUMN  
(OPEN LINESHAFT)

K. Lift pump assembly high enough to allow rotation of the elevator clamps. Realign and lower assembly. Install and tighten remaining capscrews. Repeat rotation and tightening procedure until all capscrews are uniformly tight.

L. If required, attach the next section of pressure flush line and secure to column.

M. Lift pump assembly and remove the elevator clamp secured to diffuser case (708), and fasten the elevator clamp just below the column flange. Lower the pump assembly until column elevator clamp gently come to rest on timbers, remove sling and eyebolts.

N. Repeat the preceding procedures until all column sections required for the proper setting have been installed.

## SECTION 4

### INSTALLING PRODUCT LUBRICATION COLUMN

#### (OPEN LINESHAFT)

approximately one inch. Insert split ring (726), lower coupling sleeve until it bottoms against split ring. Secure retainer (650) with capscrews (759E). Insert key (730D) onto lineshaft (646) and lower lineshaft approximately one inch. Install split ring onto lineshaft. Lower lineshaft until split ring bottoms in the groove. Install retainer (650) and secure with capscrews (759E). (See figure 5-3.)

H. With lineshaft in proper position on coupling, remove tail rope, and start threading lineshaft into coupling. Clean any dirt which may have entered the threads underneath the tail rope, and apply a few drops of oil to shaft threads if non-galling material. Thread manually until resistance is felt. Complete the joint utilizing a pair of pipe wrenches. Use care not to apply wrenches on bearing journal areas.

#### CAUTION

USE "MOLYKOTE" DOW-CORNING OR  
EQUAL FOR ALL GALLING MATERIAL  
SUCH AS 316 STAINLESS STEEL.

#### NOTE

SHAFT THREADS  
ARE LEFT HAND.

J. Carefully lower column (644) with bearing retainer over lineshaft (646) until column flange engages the flanged diffuser case (708) register. Insert as many capscrews through both flanges as possible, a minimum of one-half the total. Tighten capscrews gradually in diametrically opposite pairs.

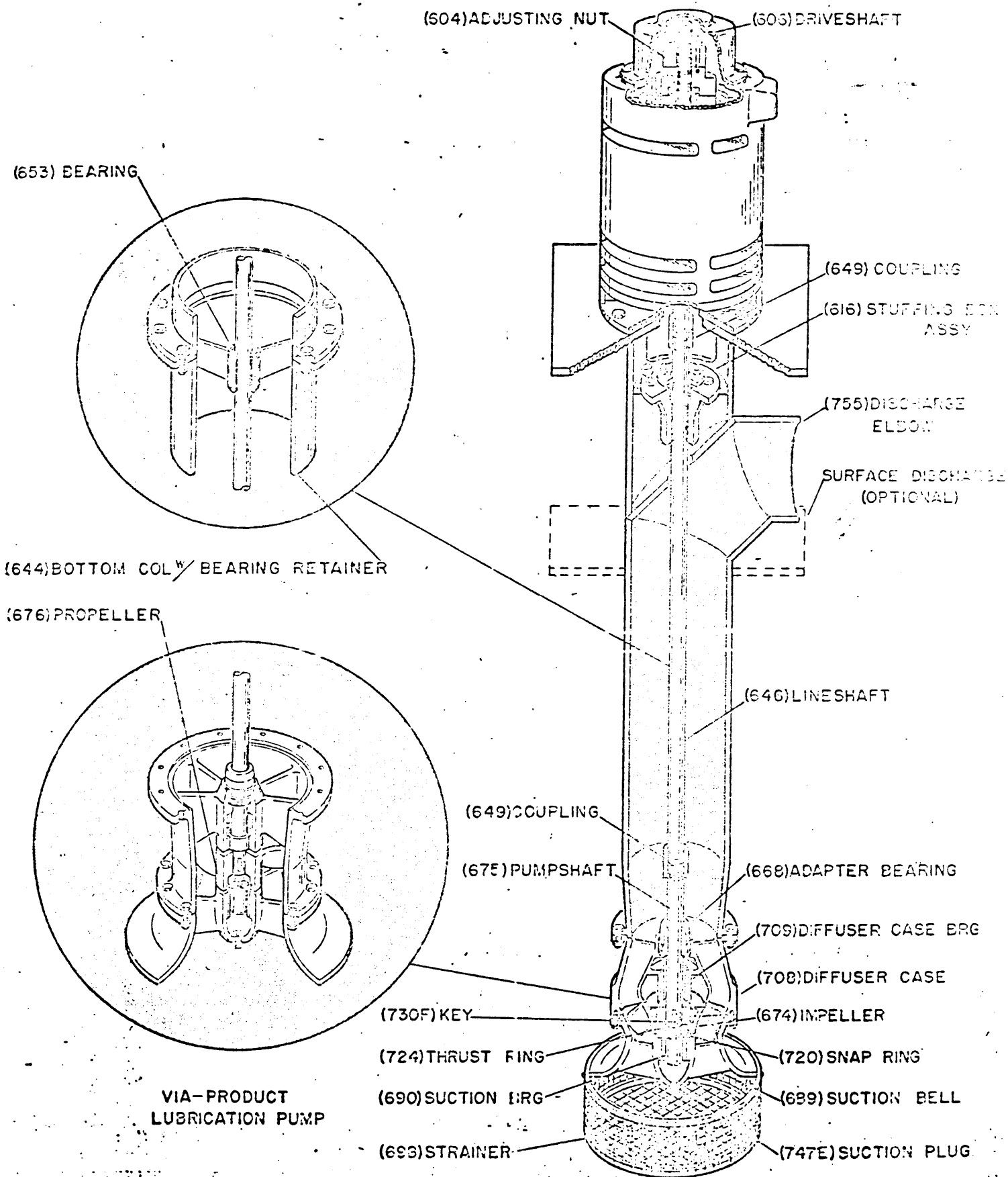


FIGURE 4-1 VIM-PRODUCT LUBRICATION PUMP

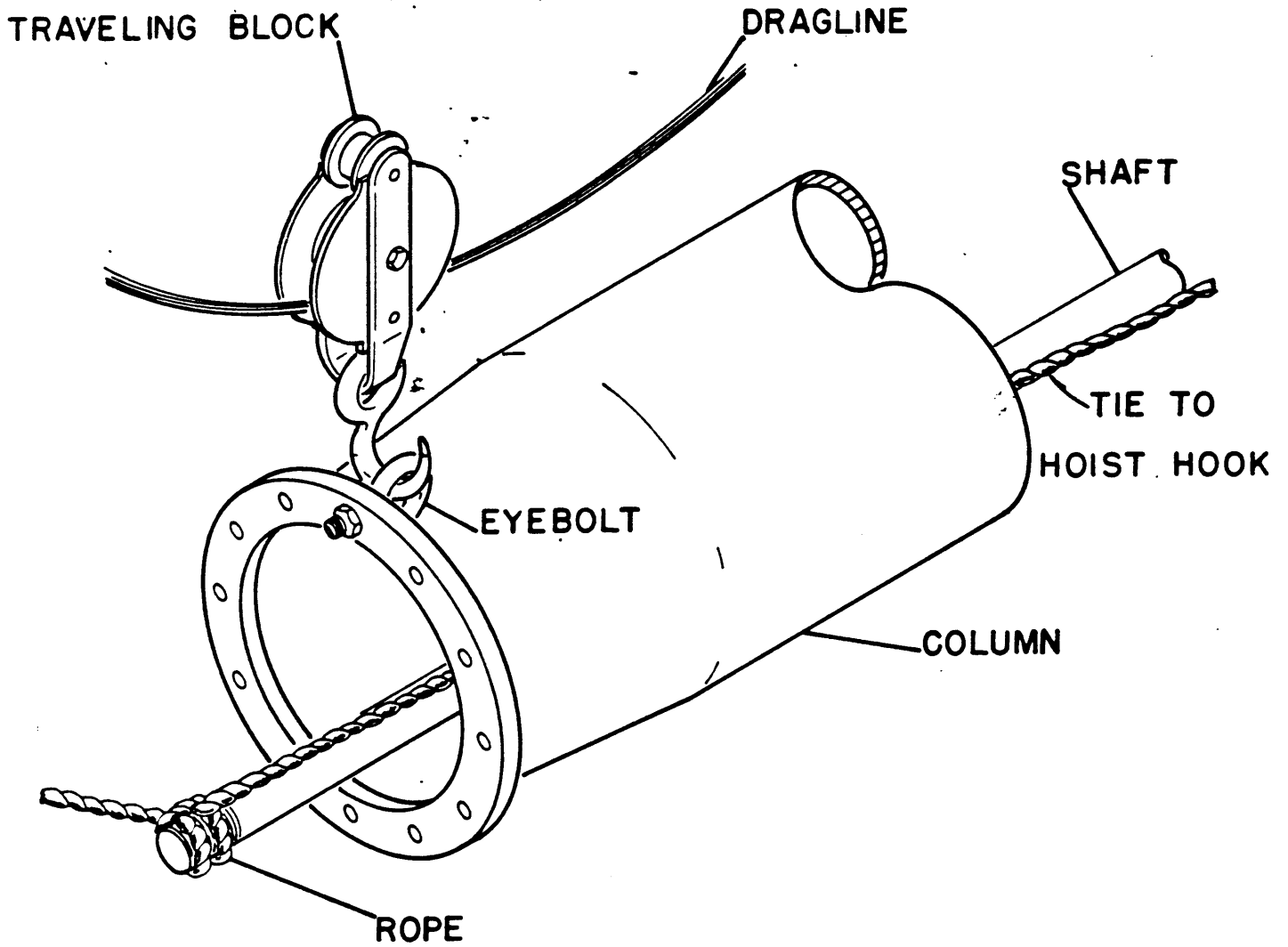


FIGURE. 4-2 PRODUCT LUBRICATION COLUMN HOISTING



SECTION 5  
INSTALLING OIL LUBRICATION COLUMN  
(ENCLOSED LINESHAFT)

5-1. INSTALLING OIL LUBRICATION COLUMN. (See figure 5-1.)

5-2. Install oil lubrication column as follows:

A. Check that lineshaft (646) is not bent, and insert enclosing tube (654), and lineshaft into bottom column section.

B. Thread two eyebolts diametrically opposite in the upper flange of column.

C. Attach a sling to the eyebolts and to hoist hook. Tie bottom of lineshaft (646) to column by tying a tail rope to column, using a clove hitch or double half hitch around the enclosing tube and then around the shaft in threaded area. Pass the rope through the inside of the column and tie end of the rope to hoist hook. (See figure 5-2.)

D. For keyed shafts the tail rope hitch shall be above the keyway.

E. Utilize the remaining tail rope to keep tension on the knots during hoisting. Lower end of column section shall be guided by a dragline which is pulled by the hoist. A traveling block for the dragline shall be attached to lower end of column section by means of a clevis and a pin or eyebolt inserted in one of the bolt holes in the lower flange. (See figure 5-2.)

F. Hoist column section over bowl assembly keeping tension on tail rope. With column in a vertical position, remove dragline and traveling block, lower column until lineshaft is properly aligned with threaded coupling (649).

G. KEYED SHAFTS- Install retainer (650) and insert key (730D) onto pumpshaft (675). Lower coupling sleeve (734) onto pumpshaft approximately one inch. Insert split ring (726), lower coupling

sleeve until it bottoms against split ring. Secure retainer (650) with capscrews (759E). Insert key (730D) onto lineshaft (646) and lower lineshaft approximately one inch. Install split ring onto lineshaft. Lower lineshaft until split ring bottoms in the groove. Install retainer (650) and secure with capscrews (759E). (See figure 5-3.)

H. With lineshaft in proper position on coupling, remove tail rope and start threading lineshaft into coupling. Clean any dirt which may have entered the threads underneath the tail rope and apply a few drops of oil to shaft threads (if non-galling material). Thread manually until resistance is felt. Complete the joint utilizing a pair of pipe wrenches. Use care not to apply wrenches on bearing journal areas.

CAUTION

USE "MOLYKOTE" DOW-CORNING OR EQUAL  
FOR ALL GALLING MATERIALS SUCH AS 316  
STAINLESS STEEL.

NOTE

SHAFT THREADS ARE LEFT  
HAND

J. Carefully lower column section until lower end of the tube section rests on adapter bearing (668). Remove tail rope, clean adapter bearing threads and lubricate with thread compound. Thread tube section onto adapter bearing manually, until resistance is felt. Complete tube joint by utilizing a pair of pipe wrenches.

NOTE

ENCLOSING TUBE THREADS  
ARE RIGHT HAND.

## SECTION 5

### INSTALLING OIL LUBRICATION COLUMN (ENCLOSED LINESHAFT)

K. Lower column (644) with tube stabilizer, (658), over lineshaft (646) until column flange engages the flanged diffuser case (708) register. Insert as many capscrews through both flanges as possible, a minimum of one-half the total. Tighten capscrews gradually in diametrically opposite pairs.

#### NOTE

POUR A SMALL AMOUNT OF OIL  
BETWEEN BEARING AND SHAFT  
OR SHAFT SLEEVE. (METAL  
BEARINGS ONLY.)

L. Lift pump assembly high enough to allow rotation of the elevator clamps. Realign and lower assembly. Install and tighten remaining capscrews. Repeat rotation and tightening procedure until all capscrews are uniformly tight.

M. If required, attach the next section of pressure flush line and secure to the column.

N. Lift pump assembly and remove the elevator clamp secured to diffuser case (708) and fasten the elevator clamp just below the column flange. Lower the pump assembly until column elevator clamp gently comes to rest on timbers, remove sling and eyebolts.

P. Repeat the preceding procedure until all column sections required for the proper setting have been installed.

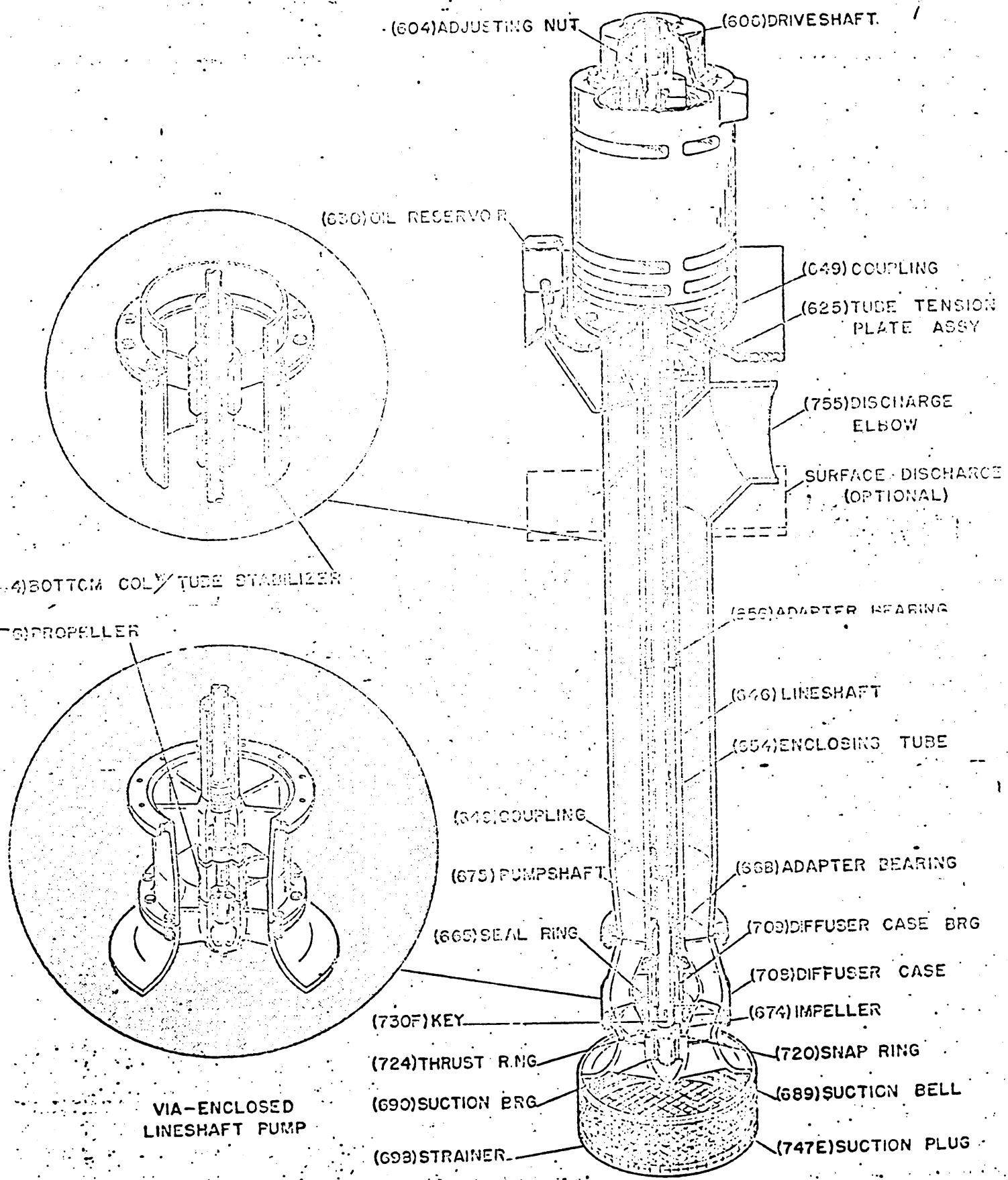


FIGURE 5-1 V.M-ENCLOSED LINESHAFT PUMP

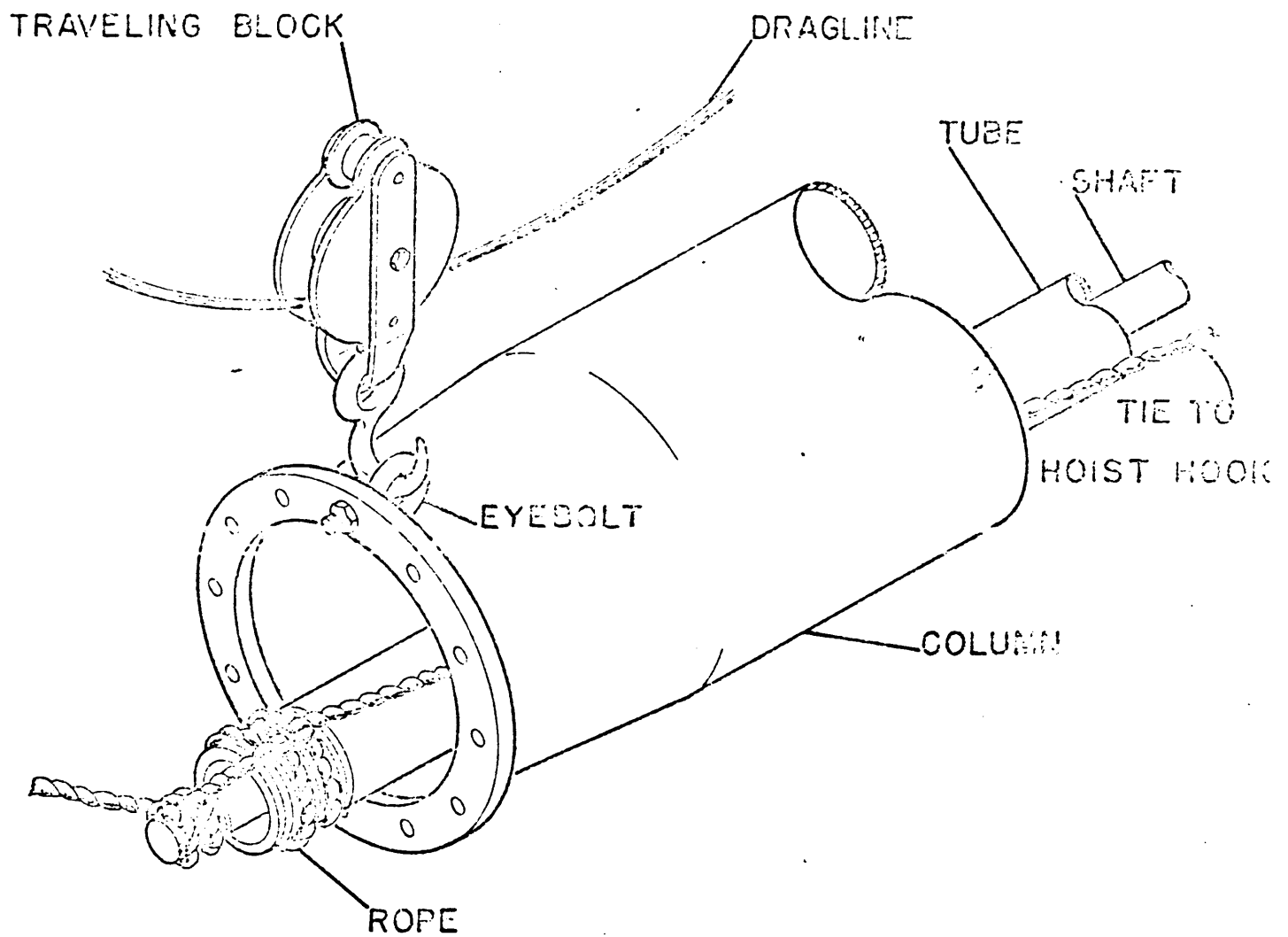
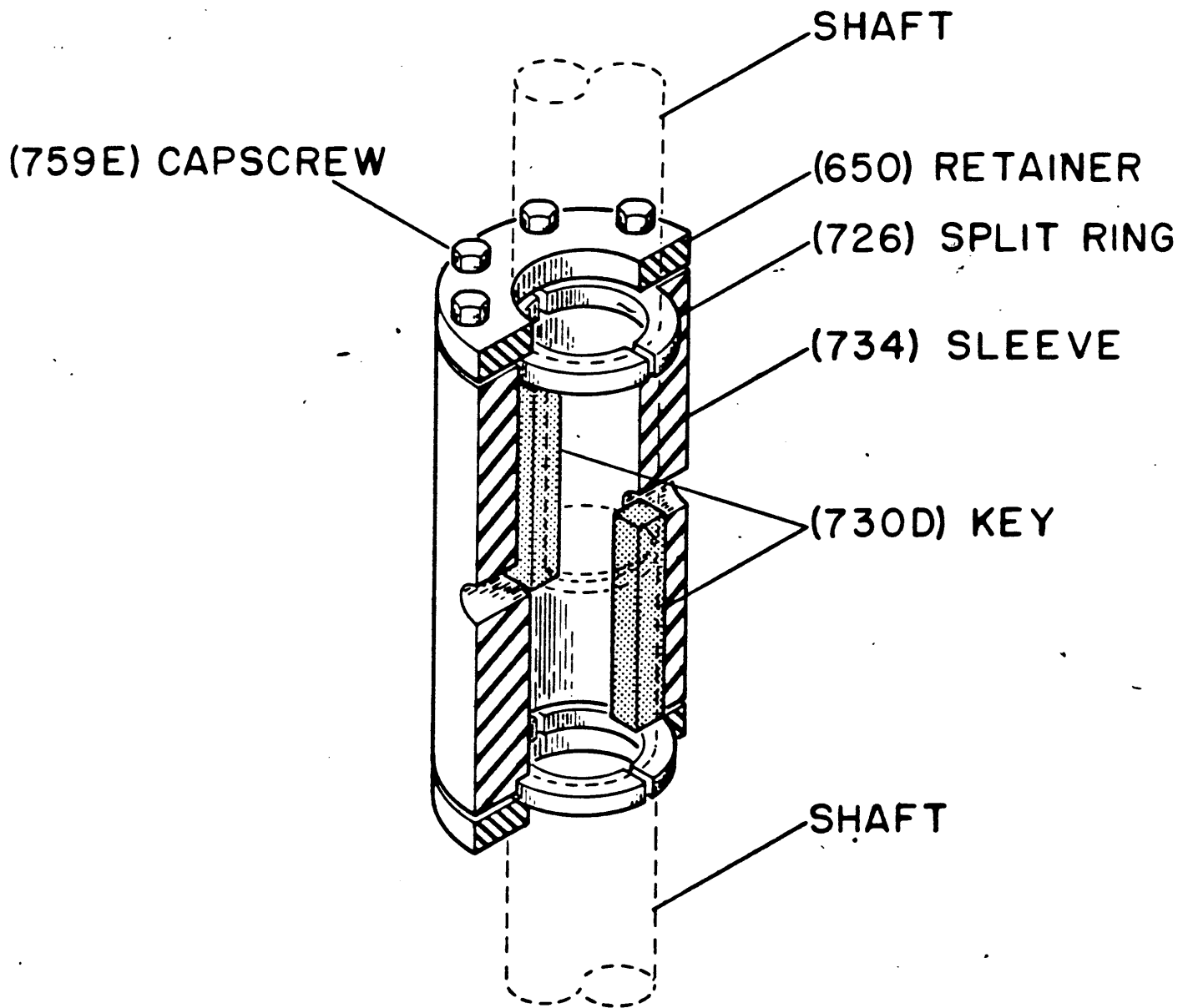


FIGURE. 5-2 OIL LUBRICATION COLUMN HOISTING



**FIGURE 5-3 KEYED SHAFT COUPLING ASSEMBLY**

## SECTION 6

### INSTALLING THE DISCHARGE ELBOW

#### 6-1. INSTALLING THE DISCHARGE ELBOW

#### 6-2. Install the discharge elbow as follows:

A. When the discharge outlet of the pump is a plain cylinder (no threads or flange) and a flexible discharge coupling is to be used, the parts of the coupling must be installed on the pump discharge piping before the discharge elbow is in its final position.

B. Attach a sling to lifting lugs or through windows and hoist the discharge elbow over the shaft and enclosing tube, if provided. Use care not to bump or scrape protruding shaft or tube. Carefully lower the discharge elbow, aligning the vertical hole in the center with the top shaft and tube if provided, protruding above the column. Continue to lower the discharge elbow until discharge elbow flange engages the column or diffuser case flange register. Install and tighten capscrews gradually in diametrically opposite pairs.

C. If a pressure flush line is being installed, terminate above the discharge elbow base.

D. Hoist the pump assembly and remove elevator clamp attached below the column flange. Remove the supporting timbers or I-beams and clean the top of foundation area. Orient the discharge elbow in the required direction. Lower the pump assembly until the base of the discharge elbow engages the foundation bolts. If a concrete foundation is used place leveling wedges near the foundation bolts. In case of a structural foundation or pump which will not be grouted to the foundation use shims for leveling the pump.

## SECTION 6

### INSTALLING THE DISCHARGE ELBOW

E. Continue to lower the pump until base of discharge elbow rests firmly on the wedges or shims.

F. Check the levelness of the discharge elbow in all directions, utilizing a spirit level across the driver mounting surface of the discharge elbow. The discharge elbow must be level with all the wedges or shims butting tightly against the base of discharge elbow and against the foundation. Install nuts on foundation bolts, tighten them gradually and uniformly. Check to see that pump has remained level in all directions after final tightening.



SECTION 7.  
STUFFING BOX INSTALLATION  
(PRODUCT LUBRICATION)

7-1. STUFFING BOX INSTALLATION. (See figure 7-1.)

7-2. Install stuffing box as follows:

A. Position gasket (779A) on discharge elbow. Slide stuffing box (616) down over the lineshaft (646) into position on the gasket. Secure with capscrews (758B).

B. Grease the packing rings (620A) for easier installation.

C. Using the fingers, start the first ring into the stuffing box. When the entire ring is worked in flush with the stuffing box, tamp it down with a split wooden bushing or equal and push the packing to the bottom of the stuffing box. Seat this bottom ring hard, it must seal on shaft and the bore. Install the required packing rings in this manner. Stagger packing ring joints 90 degrees apart. The gland (728) may be used as a tamper for the topmost ring.

D. Install gland (728) and insert studs (739A) through gland and into stuffing box. Install nuts (735B) and tighten with a wrench and relieve the gland and take up only finger tight.

E. Turn shaft manually a few times if possible, a properly packed stuffing box should be loose enough to be turned manually.

CAUTION

DO NOT OVER-TIGHTEN STUFFING BOX.

IT CAN WEAR OUT PACKING PREMATURELY AND

SERIOUSLY DAMAGE THE SHAFT.

7-3. Instructions for installing the mechanical seal are provided by the manufacturer of the seal. Consult the seal manufacturer's instruction manual, which is furnished with the pump for information on the type of mechanical seal used. These instructions must be carefully followed to prevent leakage or premature wear of the seal or the pump shaft.

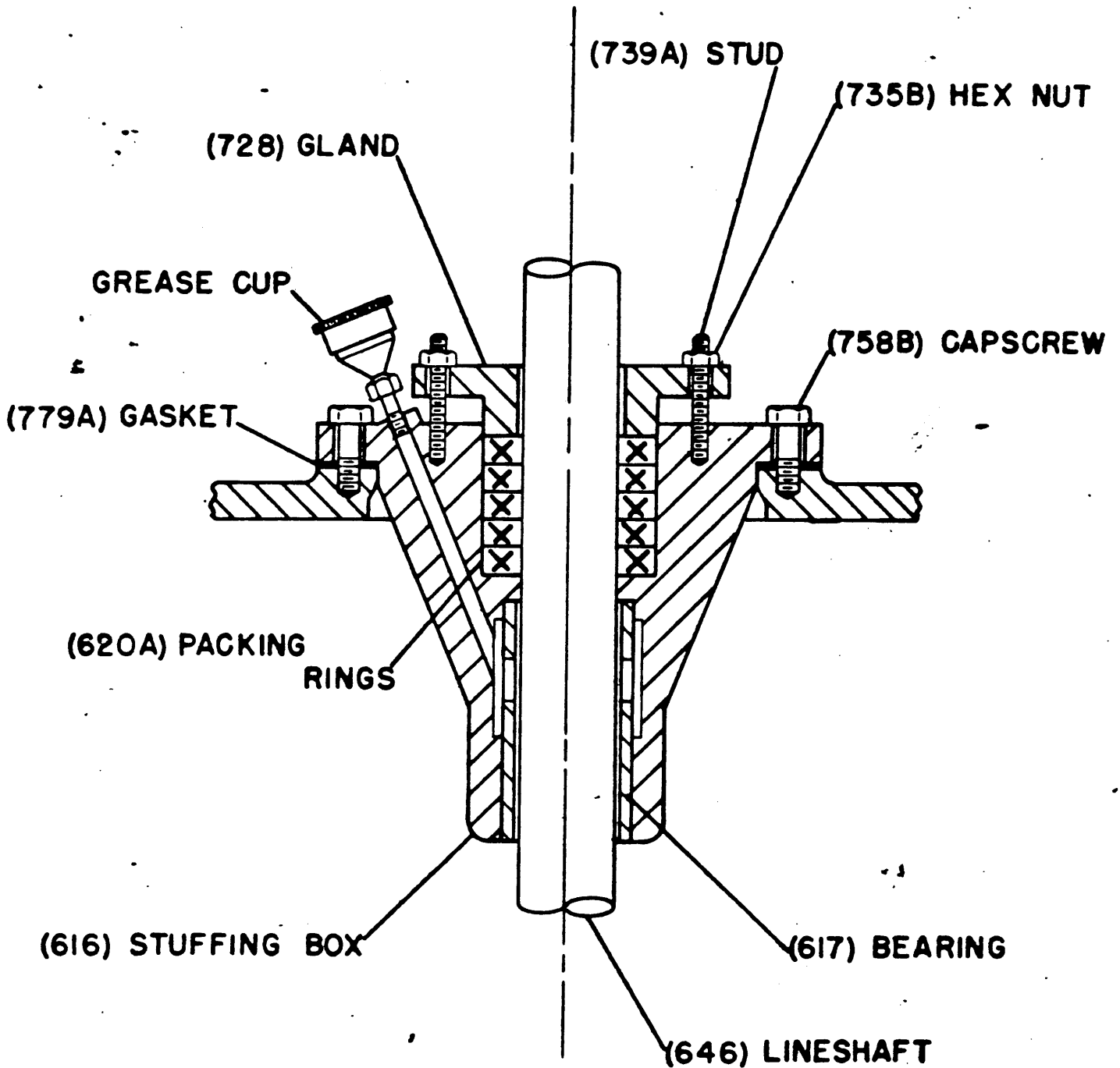


FIGURE 7-1. STUFFING BOX

## SECTION 8

### INSTALLING TUBE TENSION PLATE ASSEMBLY AND LUBRICATION SYSTEM (OIL LUBRICATION)

8-1. INSTALLING THE TUBE TENSION NUT. (See figure 8-1.)

8-2. Install the tube tension nut as follows:

A. Lubricate tube threads and underside of tension plate with thread compound. Thread tension nut (626) into position, on tube (654) and tighten until shoulder of tension nut bottoms on enclosing tube.

B. Thread tension plate (625) until register engages and shoulder rests on the discharge elbow. Tighten one-half to one turn to place the tube in tension.

C. Install one packing ring in lock ring and thread onto tension nut and secure tightly.

8-3. LUBRICATION SYSTEM

A. Install oil reservoir on the bracket using capscrews furnished.

B. Connect solenoid valve (634) if provided , and sight feed valve (633) as shown in figure 8-1.

C. Connect copper tubing from valve (633) to nearest opening in the tension nut. Plug opening on opposite side of tension nut. Slope tubing downward, with no kinks, which could cause an air lock.

8-4. Install solenoid valve if provided , as follows:

A. Make sure solenoid valve is mounted between oil reservoir and valve (633). Opening labeled "IN" shall be nearest the reservoir.

B. Leads are usually wired across two of the motor leads at the junction box. Make sure the voltage stamped on top of the solenoid valve agrees with the power supply, within plus or minus 10%. Set the proper drops per minute on the valve. Table 8-1 shows recommended valve setting. Fill oil reservoir with high quality turbine oil. See Section 17 for list of acceptable oils.

SECTION 8  
 INSTALLING TUBE TENSION PLATE ASSEMBLY AND LUBRICATION SYSTEM  
 (OIL LUBRICATION)

DROPS PER MINUTE	SHAFT SIZE (INCH)
8	3/4 to 1
16	1 3/16 to 1 15/16
20	2 3/16 and larger

TABLE 8-1. SIGHT FEED VALVE SETTING

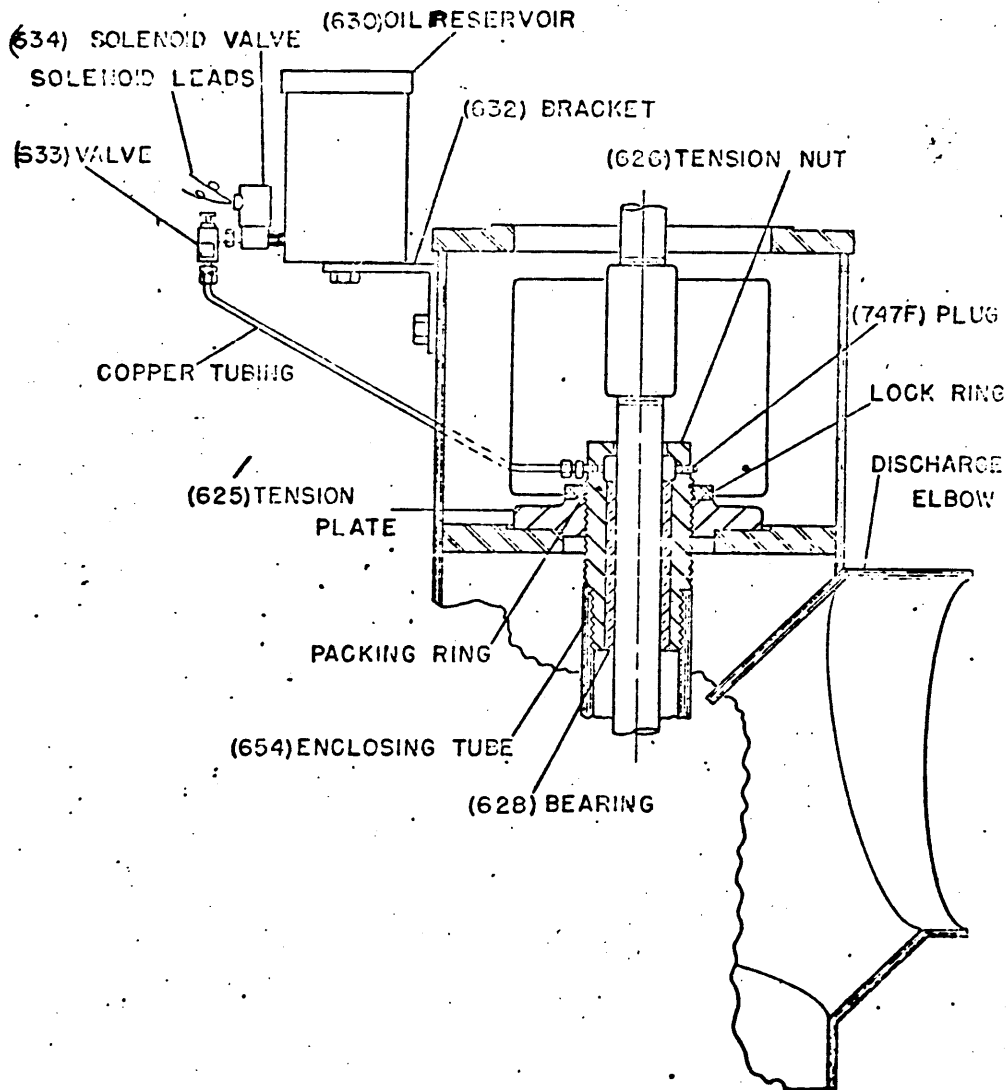


FIGURE 8-1. OIL LUBRICATION SYSTEM

SECTION 9  
INSTALLING THE DRIVER  
(VHS)

9-1. INSTALLATION OF HOLLOW SHAFT DRIVER

WARNING

DO NOT WORK UNDER A HEAVY SUSPENDED  
OBJECT UNLESS THERE IS A POSITIVE  
SUPPORT UNDER IT WHICH WILL PROTECT  
PERSONNEL SHOULD A HOIST OR SLING FAIL.

9-2. Install hollow shaft driver as follows:

- A. Remove driver cover and drive coupling. (See figure 9-1.)
- B. Attach a sling to the lifting lugs on driver. Hoist driver, inspect the mounting surfaces and register, and clean these surfaces thoroughly. If any burrs are found, remove burrs with a smooth mill file.
- C. Slowly lower the driver onto driver mounting flange, orient the driver conduit box in the required position and align the mounting holes with the mating tapped holes in the discharge head.
- D. Apply a thin film of oil to lineshaft threads (if non-galling material), install coupling (649) to lineshaft utilizing a strap wrench below the coupling. (See figure 4-1.)

CAUTION

DO NOT DAMAGE DRIVESHAFT OR COMBINATION HEADSHAFT. ANY  
BURRS RAISED ON SHAFTING SHALL MAKE IT DIFFICULT TO  
REMOVE SEAL, SLEEVE, OR STUFFING BOX.

SECTION 9  
INSTALLING THE DRIVER  
(VHS)

E. Slide the driveshaft (606) downward through the hollow shaft of the driver to meet the lineshaft coupling. Apply a thin film of oil to the shaft threads (if non-galling material) and screw into coupling. Make sure the shaft is not damaged in any way.

CAUTION

USE "MOLYKOTE" DOW-CORNING OR EQUAL  
FOR ALL GALLING MATERIALS SUCH AS  
316 STAINLESS STEEL.

9-3. VIA AND VIM PUMPS. The following information applies to VIA and VIM pumps.

A. On drivers having non-reverse ratchet, manually turn the driver shaft clockwise viewed from above until the non-reverse ratchet fully engages.

B. Lubricate the driver bearings in accordance with the instructions given on the lubrication plate attached to the driver case.

WARNING

THE MOTOR MUST NOT BE TESTED FOR  
DIRECTION OF ROTATION WHEN COUPLED TO  
THE PUMP. IF PUMP SHOULD ROTATE IN  
THE WRONG DIRECTION, SERIOUS DAMAGE TO  
THE PUMP AND DRIVER AND SERIOUS INJURY  
TO NEARBY PERSONNEL COULD RESULT.

C. Make temporary electrical connections according to tagged leads or diagram attached to the driver. The driver must rotate counterclockwise when viewed from above.

SECTION 9  
INSTALLING THE DRIVER  
(VHS)

See arrow on pump name plate. If driver does not rotate counterclockwise, change driver rotation by interchanging any two leads, for three phase only. For single phase, see driver manufacturer's instructions.

D. Slip on driver coupling (See figure 9-1). See that the drive coupling is properly seated. Apply a thin film of oil on gib key (730 A) and install key. Key shall be a slide fit allowing adjustment of the drive shaft by means of the adjusting nut. Install adjusting nut (604).

9-4. ADJUSTMENT - VIA PUMPS

A. Mechanical seal if provided, must be disengaged prior to pump adjustment. Shaft must move freely up or down within seal assembly.

B. Turn the adjusting nut (604) clockwise until the shaft is lifted to its highest position. Reverse the adjusting nut until the shaft is midway between the high and low positions. Lock the adjusting nut as near to this position as possible, with capscrew (757 J).

9-5. ADJUSTMENT - VIM PUMPS

A. Mechanical seal if provided, must be disengaged prior to impeller adjustment. Shaft must move freely up or down within seal assembly.

B. With impeller touching bowl faces, turn the adjusting nut (604) clockwise until the impeller breaks free and the shaft can be turned by hand. Tighten adjusting nut to first locking position and lock in place.

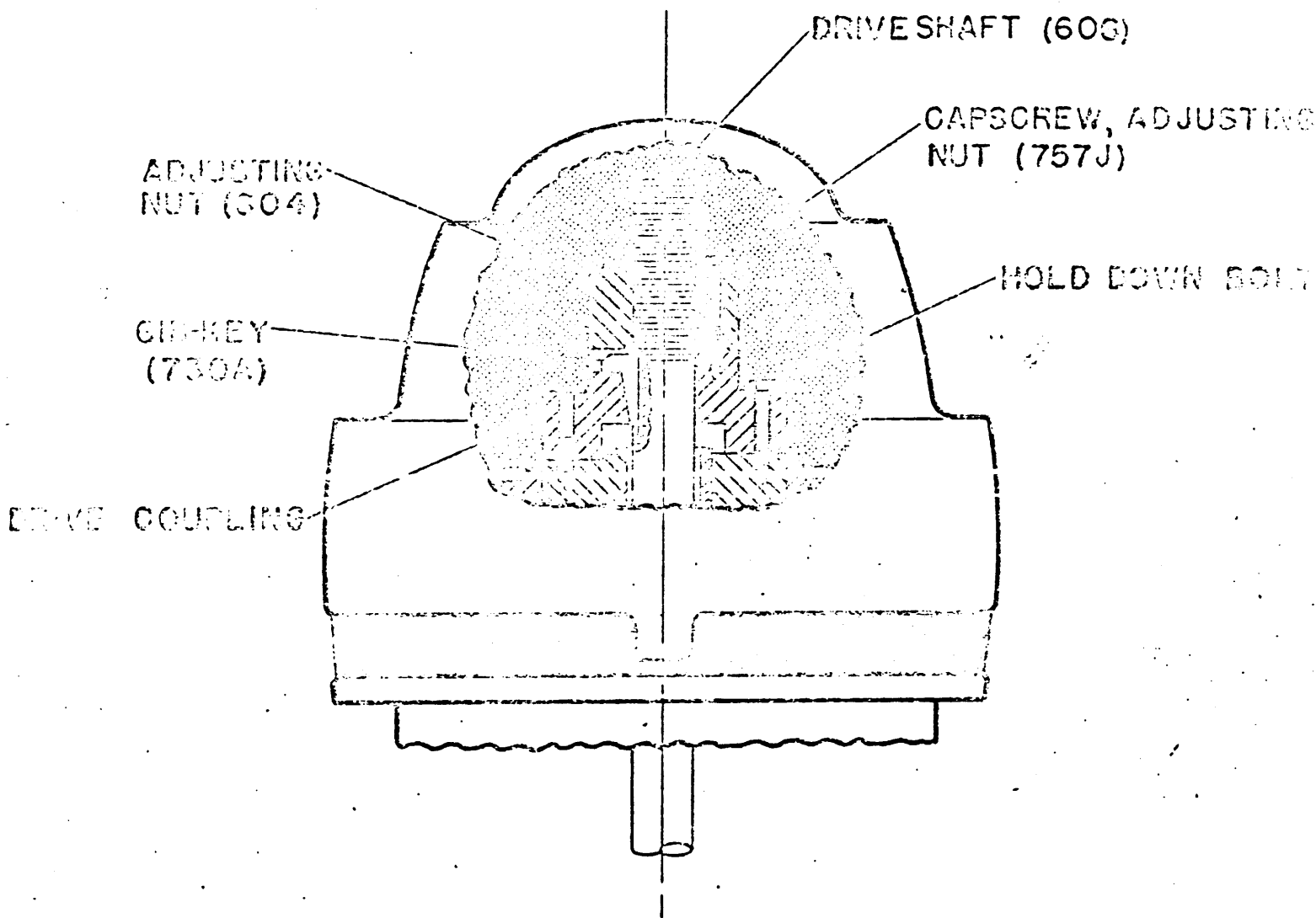


FIGURE 9-1 HOLLOW SHAFT ADJUSTING NUT.



SECTION 9  
INSTALLING THE DRIVER  
(VHS)

9-6. GROUTING THE BASE. If the pump is on a concrete foundation, it is recommended that the discharge elbow be grouted to the foundation. (See figure 9-2.) If desired, this may be delayed until the pump installation has been tested. Use a non-shrinking grout such as Embecco, or Ceilcote or equal, following manufacturer's recommendations. Pour the grout into the foundation and force it between the discharge elbow and the dammed-in area. Snug down nuts on foundation bolts while grout is hardening. Allow ample time for the grout to cure before starting the pump.

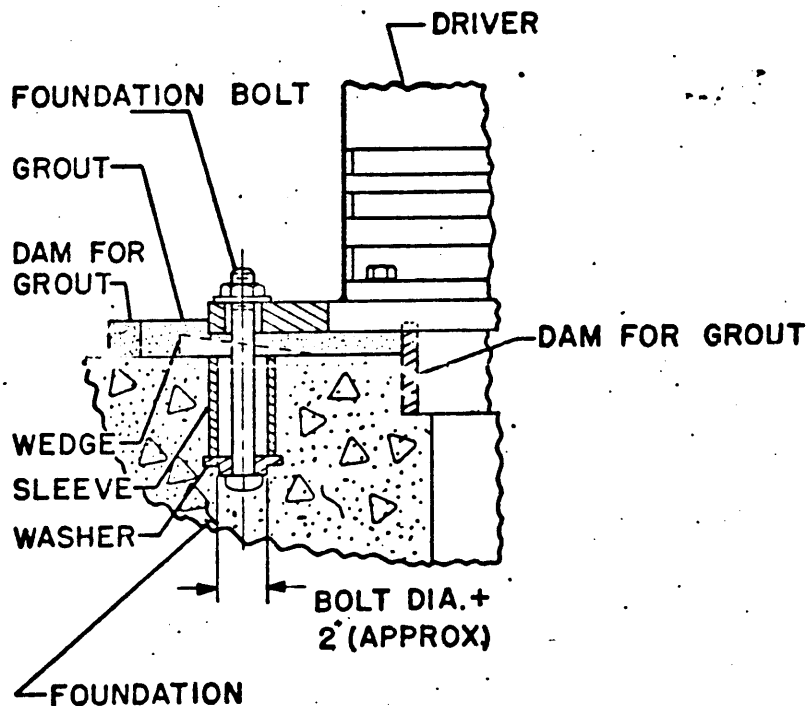


FIGURE 9-2  
FOUNDATION BOLT DETAIL

SECTION 10  
INSTALLING THE DRIVER  
(VSS)

10-1. INSTALLATION OF SOLID SHAFT DRIVER

WARNING

DO NOT WORK UNDER A HEAVY SUSPENDED  
OBJECT UNLESS THERE IS A POSITIVE  
SUPPORT UNDER IT, WHICH WILL PROTECT  
PERSONNEL SHOULD A HOIST OR SLING FAIL.

10-2. In the case of a pump having a solid shaft driver proceed as follows:

A. Apply a thin film of oil on headshaft key (730C) and insert key into headshaft keyseat. (See figure 10-1.)

B. Gently lower pump hub (614) over headshaft.

C. Install adjusting plate (613) on headshaft.

D. Attach a sling to the lifing lugs of driver. Hoist driver, inspect the mounting surface, the register, and shaft extension, and clean these surfaces thoroughly. If any burrs are found, remove burrs with a smooth mill file, cleaning thoroughly afterward.

E. Apply a thin film of oil to driver key (730B) and insert it into the driver shaft keyseat. Place the driver hub (610) over the driver shaft and key, sliding it up the shaft until the groove near the end of shaft is exposed. Install split ring (722) in the groove, and slide the driver hub down over the split ring to capture it.

F. Orient the driver conduit box in the required position, and align the mounting holes with the mating tapped holes in the discharge elbow. Lower the driver until the registers engage and driver rests firmly on the discharge elbow. Secure driver with capscrews provided.

SECTION 10  
INSTALLING THE DRIVER  
(VSS)

G. Lubricate driver bearings in accordance with instructions given on the lubrication plate attached to the driver case.

WARNING

THE MOTOR MUST NOT BE TESTED FOR  
DIRECTION OF ROTATION WHEN COUPLED TO  
THE PUMP. IF PUMP SHOULD ROTATE IN THE  
WRONG DIRECTION, SERIOUS DAMAGE TO THE  
PUMP AND DRIVER AND SERIOUS INJURY TO  
NEARBY PERSONNEL COULD RESULT.

H. Make temporary electrical connections according to tagged leads or diagram attached to the driver. Driver must rotate counterclockwise when viewed from above. See arrow on pump name plate. If driver does not rotate counterclockwise, change driver rotation by interchanging any two leads, for three phase only. For single phase see driver manufacturer's instructions.

J. On drivers having a non-reverse ratchet, manually turn the driver shaft clockwise viewed from above until the non-reverse ratchet fully engages.

10-3 ADJUSTMENT - VIA PUMPS

A. Mechanical seal if provided, must be disengaged prior to pump adjustment. Shaft must move freely up or down within the seal assembly.

B. Thread adjusting plate (613) down on the shaft until it is flush with top of shaft.

C. Raise pump hub (614) and adjusting plate (613) to its highest position. If capscrews furnished with coupling are too short to draw halves together, use two jackscrews through the coupling assembly and draw coupling up.

SECTION 10  
INSTALLING THE DRIVER  
(VSS)

D. Lower pump hub (614) and adjusting plate (613) and remove capscrews or jackscrews.

E. Thread adjusting plate up to half of the distance obtained in Step C.

F. Insert capscrews furnished with coupling or use jackscrews. Draw pump hub to mate with driver hub and tighten capscrews gradually and uniformly.

10-4. ADJUSTMENT - VIM PUMPS

A. Mechanical seal if provided, must be disengaged prior to pump adjustment. Shaft must move freely up or down within the seal assembly.

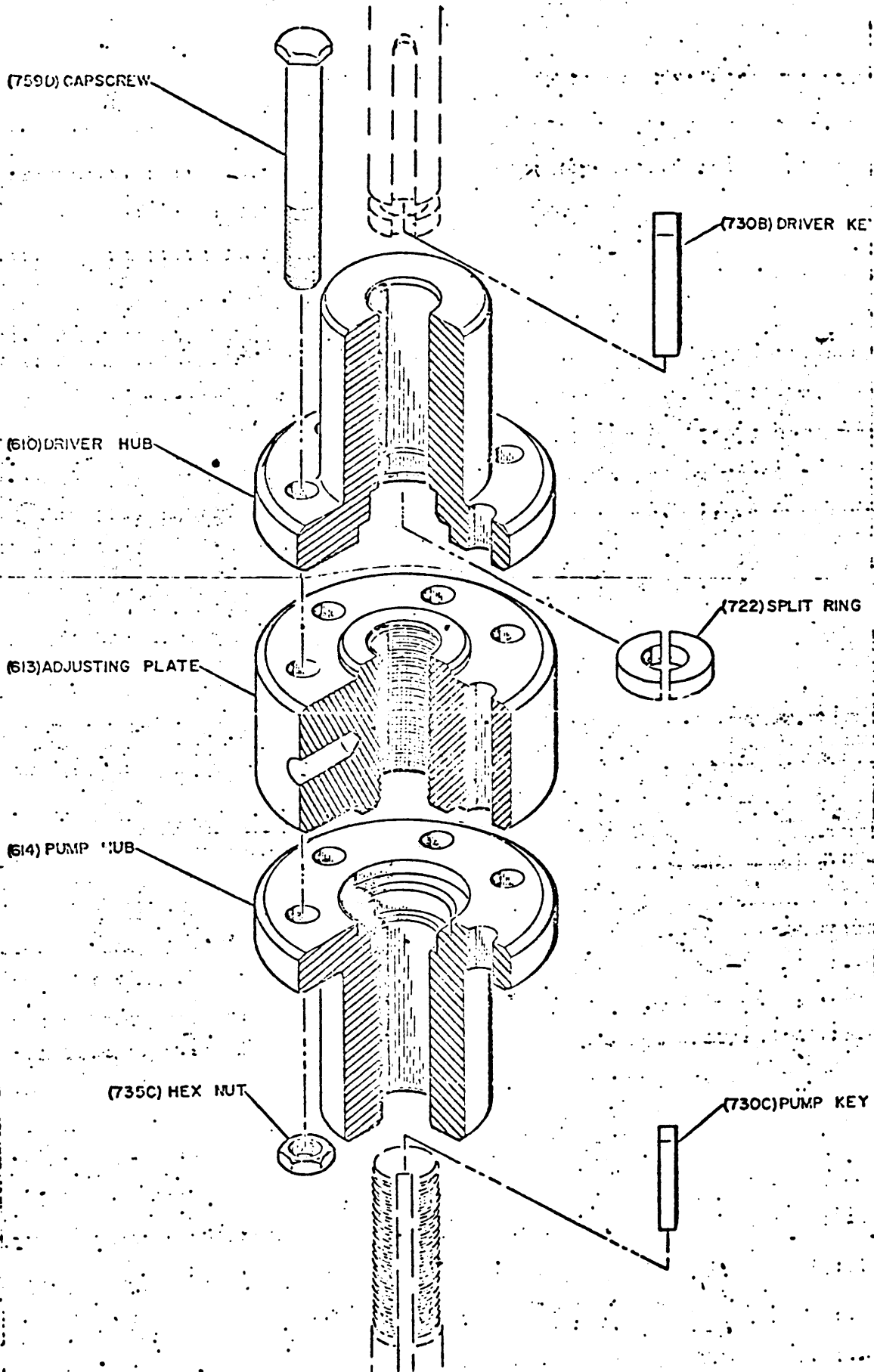
B. Thread adjusting plate (613) all the way on the shaft.

\ C. Same as paragraph 10-3 step C.

D. Raise adjusting plate (613) toward driver hub (610). Obtain .015 inch clearance between adjusting plate and motor hub for the first 10 feet of column. Add 0.010 for each additional 10 feet of column.

E. Align adjusting plate holes with pump hub (614) holes, insert capscrews (759D), and draw pump hub to mate with driver hub. Tighten capscrews gradually and uniformly.

10-5. GROUTING THE BASE. If the pump is on a concrete foundation, it is recommended that the discharge elbow be grouted to the foundation. (See figure 9-2.) If desired, this may be delayed until the pump installation has been tested. Use a non-shrinking grout such as Embeco, or Ceilcote or equal, following manufacturer's recommendations. Pour the grout into the foundation and force it between the discharge elbow and the dammed-in area. Snug down nuts on foundation bolts while grout is hardening. Allow ample time for the grout to cure before starting the pump.



**FIGURE 10-1 FLANGED ADJUSTABLE COUPLING**

## SECTION 11

### INSTALLING THE GEARHEAD

#### 11-1. GEARHEAD DRIVE INSTALLATION

11-2. Installation procedures for gearhead drives are similar to those for electric drivers except as follows:

A. Slowly lower the gearhead and orient with the in-put shaft. Align mounting holes with the mating tapped holes in the discharge elbow. Lower the gearhead until the registers engage and the gearhead rests firmly on the discharge elbow. Install capscrews in the mounting holes and tighten them gradually and uniformly.

B. Some gearheads are equipped with an oil cooling system which is supplied with cooling fluid from the pump or from an external source. Make cooling connections with tubing or rubber hose. If pump fluid is to be used, connect a length of tubing and a flow-regulating valve between the inlet on the gearhead and a pipe tap hole in the discharge head. Attach another tube or a rubber hose to the outlet on the gearhead. This may be used to conduct the fluid back to the sump or to any convenient drain.

#### CAUTION

DO NOT USE RIGID PIPE FOR THIS  
PURPOSE. RIGID PIPE IS SUSCEPTIBLE  
TO LEAKING AT THE JOINTS, DUE TO  
VIBRATION.

C. Assemble the flexible shaft flanges on gearhead drive and engine. The prime mover (engine or steam turbine) must be mounted on a firm foundation in alignment with the gearhead. The flexible shafts shall be within two degrees parallel. Offset angle shall be one to five degrees for maximum coupling life. Keep the lugs on flange yokes in the same position as shipped from the factory. If slip joint is moved, be sure lugs are realigned. Consult the applicable manufacturer's instruction manual for detailed information for the prime mover (engine or steam turbine) and coupling, or driveshaft, and gearhead.

SECTION 11  
INSTALLING THE GEARHEAD

WARNING

MOVING PARTS OF THE PRIME MOVER,  
COUPLING DEVICE, AND GEARHEAD MUST  
BE COVERED WITH A SUITABLE RIGID  
GUARD IN COMPLIANCE WITH LOCAL  
REGULATIONS TO PREVENT INJURY TO  
PERSONNEL.

11-3. GROUTING THE BASE. If the pump is on a concrete foundation, it is recommended that the discharge elbow be grouted to the foundation. (See figure 9-2.) If desired, this may be delayed until the pump installation has been tested. Use a non-shrinking grout such as Embecco, or Ceilcote or equal, following manufacturer's recommendations. Pour the grout into the foundation and force it between the discharge elbow and the dammed-in area. Snug down nuts on foundation bolts while grout is hardening. Allow ample time for the grout to cure before starting the pump.

## SECTION 12

### STARTING THE PUMP

12-1. PRE-START PROCEDURE. Consult the applicable manufacturer's instruction manual for detailed information for the prime mover (engine or steam turbine), coupling, or driveshaft, driver or gearhead. Before starting the pump check the following:

A. ALL PUMPS

1. Wiring of driver (IF APPLICABLE).
2. Driver must rotate counterclockwise when viewed from above.
3. Pressure flush system (IF APPLICABLE).
4. Lubrication to suction bearing (IF APPLICABLE).
5. Lubrication of driver.

B. OPEN LINESHAFT PUMPS

1. All bearings are lubricated.
2. Grease to stuffing box (IF APPLICABLE).
3. All piping and gages.

C. ENCLOSED LINESHAFT PUMPS

1. Oil lubrication piping connected (IF APPLICABLE).
2. Drip rate.

D. Valve must be open prior to starting pump. Start the flow of lubricating fluid prior to starting the pump. Open lineshaft pumps are self-lubricating.

12-2. PUMP STARTUP

12-3. Start the pump. IF PUMP DOES NOT DISCHARGE FLUID IMMEDIATELY, SHUT OFF THE PUMP. IF DRIVER OVERHEATS OR THERE IS EXCESSIVE VIBRATION STOP THE PUMP, and correct the problem before restarting.

See Section 14.



## SECTION 12

### STARTING THE PUMP

12-4. On oil lube pumps in which the enclosing tube was tensioned by wrenching the tension tube nut, check for leakage at the tube tension nut gasket (packing ring). If the gasket does not seal properly, the tube tension nut (626) must be tightened. Stop the pump. Disconnect the tubing to the tube tension nut and loosen the lock ring. Tighten the tube tension nut to ensure an adequate seal at the gasket. If the lock nut is not accessible through the discharge opening (such as in underground discharge pumps), it shall be necessary to partially disassemble the pump in order to tighten the tube nut. (See figure 8-1)

12-5. With product lube pump in operation, there shall be some leakage at the stuffing box packing. The correct leakage is a rate which keeps the shaft and stuffing box cool (approximately one drop per second). Refer to Section 13 for packing adjustment.

## SECTION 13

### MAINTENANCE

#### 13-1. PREVENTIVE MAINTENANCE

13-2. Preventive maintenance includes periodic inspection, adjustments, lubrication and tightening procedures presented in Table 13-1.

Systematic inspection of the pump shall be made at regular intervals.

The frequency required depends upon the operating conditions of the

pump and its environment. See Section 17 for recommended lubricants.

Consult the applicable manufacturer's instructions for detailed information on maintenance for the prime mover (engine or steam turbine) and coupling, driveshaft, electric motor, and gearhead.

TABLE 13-1 PREVENTIVE MAINTENANCE PROCEDURES

PROCEDURE	TIME INTERVAL (HOURS)
Clean dirt, oil, and grease from the driver and discharge head.	As required.
Driver ventilation passages shall be cleaned to prevent overheating.	As required.
Check oil level in reservoir. It should never be less than one-quarter full. Refill, check drip rate. See Table 8-1 for correct drip rate	24
Pumps utilizing a high pressure flush system, the pressure shall be 10 psi higher than maximum, pump discharge pressure plus 2% of the maximum discharge pressure.	Periodically
Pumps equipped with a lubrication line to conduct grease, oil, or other fluid to suction bearing, replenish supply through lubrication fitting, usually located at the base of the discharge head.	100
Check the level in sight gage, for oil-drip lubrication.	Periodically
Open line shaft pumps, check stuffing box for correct leakage, see Section 13-4. If packing is supplied with grease add through fitting on side of packing container.	100

SECTION 13  
MAINTENANCE

13-3. PACKING ADJUSTMENT AND REPLACEMENT

13-4. Pumps equipped with adjustable packing at top of shaft, shall be adjusted whenever the leakage rate exceeds two drops per second.

Adjust the stuffing box as follows:

A. With the pump in operation, tighten the gland nuts one-quarter turn for each adjustment. Allow packing to equalize against the increased pressure and leakage to gradually decrease to a steady rate, before making another adjustment.

CAUTION

DO NOT OVER-TIGHTEN THE STUFFING BOX

EXCESSIVE PRESSURE CAN WEAR OUT PACKING

PREMATURELY AND SERIOUSLY DAMAGE THE SHAFT.

B. With the pump shutdown and when packing has been compressed to the point that the gland is about to contact the upper face of stuffing box, remove the gland, add one extra packing ring, and readjust. If this fails to reduce leakage to one drop per second remove all packing rings and replace with new rings.

C. If the replacement packing is in the form of a continuous coil or rope, it must be cut into rings before installing. Tightly wrap one end of the packing material around the top shaft like one coil of a coil spring, and cut through the coil with a sharp knife. For repacking sequence, refer to Section 7.

SECTION 13  
MAINTENANCE

13-5. SEASONAL SHUTDOWN PROCEDURES

WARNING

MANUALLY ROTATE SHAFT SEVERAL  
TIMES PRIOR TO RESTARTING PUMP,  
WHICH HAS BEEN SHUTDOWN.

A. For oil lubricated pumps that are shutdown for an extended period of time, it is suggested that the pump be operated for at least 15 minutes every two weeks with the oil feed wide open 2 hours before and during startup in order to maintain a film of oil on the shafting and shaft bearings. This practice is also desirable to restore a film of oil on driver bearings.

B. Bearings on product lubricated pumps are lubricated by the liquid being pumped. If pump is to be shut down for an extended period of time, operate it, for at least 15 minutes with adequate prelubrication every two weeks. Before resuming normal operations oil should be changed on drivers, gearheads and lubricating oil system. See Section 17 for list of recommended lubricants.

SECTION 14  
TROUBLESHOOTING

14-1. CORRECTIVE MAINTENANCE

14-2. Corrective maintenance procedures include troubleshooting for isolating and remedying malfunctions of the pump during operation.

TABLE 14-1 TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
No liquid delivered	1. Discharge valve closed.	Check that discharge valve is in full open position.
	2. Wrong rotation.	Check for CCW rotation when viewed from above. Check engagement of motor coupling.
	3. Speed too low.	Check if driver is directly across the line and receiving full voltage.
	4. Driver does not come up to speed.	Consult factory.
	5. Improper lateral adjustment.	Reset lateral, see Section 9 or 10.
	6. Lack of prime or breaks suction.	Check standing and pumping water level.
	7. Standing water level is below 1st stage or pumping water level is below suction.	Increase pump setting, by adding column.
	8. Suction lift is too high.	Check NPSH required by pumps against NPSH available. Increase pump setting by increasing column length, if insufficient NPSH available.
	9. Strainer, bowl, impeller plugged.	Pull pump and clean.

SECTION 14  
TROUBLESHOOTING

TABLE 14-1 TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
No liquid delivered	10. Damaged bowl assembly; broken or disconnected shaft.	Pull pump and reapiir all damaged components
Not enough liquid delivered.	11. Same as steps 1 thru 6.	Same as Steps 1 thru 6.
	12. Field head requirement greater than design head.	Check system friction losses. Increase discharge piping. Lower head required. Consult factory for adding bowl stages or increase impeller diameter.
	13. Same as steps 8 thru 12.	Same as steps 8 thru 12.
Not enough pressure.	14. See-not enough liquid delivered.	See-not enough liquid delivered.
Pump worked for while and quits.	15. See-not enough liquid delivered.	See-not enough liquid delivered.
Excessive vibrations.	16. Coupling Misalignment, bent shaft, impeller unbalance, worn bearings, cavitation, piping strain, and/or resonance.	Determine cause utilizing vibration frequency analyzer and/or pump disassembl Complex problem may require factory service assistance.

## SECTION 15

### PUMP DISASSEMBLY

#### 15-1. PUMP DISASSEMBLY

15-2. Clear a large area adjacent to the pump as a storage space for pump parts as they are disassembled. If the pump has a long column arrange parallel timbers on the ground to support the pump column and shaft sections horizontally.

#### WARNING

DO NOT ATTEMPT TO LIFT THE ENTIRE PUMP BY THE LIFTING LUGS OF THE DRIVER THESE LUGS AND BOLTS CAN NOT SUPPORT THE WEIGHT OF THE ENTIRE PUMP.

15-3. In the following pump disassembly procedures, references are made to assembly sections of this manual, these sections will aid in the disassembly of the pump (reverse the assembly procedure). Consult the applicable manufacturer's instructions for detailed information for the prime mover and coupling or driveshaft and driver.

A. On pumps which are driven through a gearhead, remove coupling or driveshaft between the gearhead and prime mover. Pumps equipped with an electric motor drive, remove the electrical connection at the conduit box.

#### WARNING

BEFORE OPENING THE CONDUIT BOX OF AN ELECTRICAL MOTOR, BE SURE THAT THE CURRENT TO THE MOTOR IS SHUT OFF. SEVERE INJURY TO PERSONNEL COULD RESULT IF CONTACT WITH LIVE MOTOR LEADS IS MADE.

#### NOTE

MATCH MARK PARTS IN SEQUENCE OF DISASSEMBLY TO AID IN THE REASSEMBLY PROCEDURE.

B. Disconnect discharge and lubrication piping. Remove all external piping, and related hardware attached to the pump.

SECTION 15  
PUMP DISASSEMBLY

C. Uncouple driver from pump shaft. The procedure depends upon the type of driver used. Refer to Section 9 Hollow Shaft Driver, Section 10 Solid Shaft Driver, and Section 11 Gearhead Driver.

D. Remove capscrews holding driver and lift driver off discharge elbow (755). (See figure 4-1.)

WARNING

DO NOT WORK UNDER A HEAVY SUSPENDED  
OBJECT UNLESS THERE IS A POSITIVE  
SUPPORT UNDER IT WHICH WILL PROTECT  
PERSONNEL SHOULD A HOIST OR SLING FAIL.

E. If the pump has an open lineshaft, remove capscrews and slide stuffing box (616) off the lineshaft (646). In the case the pump has an enclosed lineshaft, remove tube tension plate assembly (625). If pump is equipped with a mechanical seal, see the seal manufacturer's instructions (furnished with the pump) for removal of seal.

F. Attach a sling to lifting lugs or windows and lift the entire pump straight upward to bring the flanged column joint about two feet above the foundation. Place an elevator clamp just below the flanged column and lower the pump, allowing it to rest on the foundation.

G. For removal of the discharge elbow, see Section 6.

H. For removal of the column section refer to Section 4, Product Lubrication Column, and Section 5, Oil Lubrication Column.

J. Pull bowl assembly, using elevator clamps and hoist in the same manner as for the column. Refer to Section 3.

K. KEYED SHAFTS- Remove capscrews (759E), slide retainer (650) upward. Raise shaft and remove split ring (726). Raise shaft high enough to clear sleeve (734) and remove retainer (650) off the shaft



## SECTION 15

### PUMP DISASSEMBLY

#### 15-7. BOWL DISASSEMBLY - PRODUCT LUBRICATION - VIM PUMP

A. On 6, 8, and 10 inch pumps a setscrew is located at right angle to the shaft, between the impeller blades, remove setscrew prior to removing impeller.

B. Remove snap ring (720) in hub of impeller, slide impeller (674) forward and remove thrust ring (724) from pumpshaft.

C. Slide impeller (674) to clear pumpshaft (660) and remove. Take out impeller key (730F).

D. Reassemble in the reverse order of disassembly.

#### 15-8. BOWL DISASSEMBLY - OIL LUBRICATION. (See figure 5-1.)

#### 15-9. The following information is the same for VIA and VIM pumps.

A. Remove suction strainer (698), and remove grease line to suction bearing (690), if provided.

B. Remove the two piece enclosing tube (654) from adapter bearings (656), and (668) on pump sizes 20 inch, and smaller.

#### NOTE

ENCLOSING TUBE THREADS

ARE RIGHT HAND

C. On pumps 24 inch and larger the enclosing tube is flanged to diffuser case (708) hub, remove capscrews and remove enclosing tube.

#### 15-10. BOWL DISASSEMBLY - OIL LUBRICATION - VIA PUMP

A. Follow preceding steps found in paragraph 15-6 steps A through D, for complete disassembly of bowl assembly.

B. Remove seal ring (665) from diffuser case(708).

#### 15-11. BOWL DISASSEMBLY - OIL LUBRICATION - VIM PUMP

A. Follow preceding steps found in paragraph 15-7 steps A through D, for complete disassembly of bowl assembly.

B. Remove seal ring (665) from diffuser case (708).

SECTION 15  
PUMP DISASSEMBLY

15-4. BOWL DISASSEMBLY - PRODUCT LUBRICATION. (See figure 4-1.)

15-5. The following information is the same for VIA and VIM pumps.

A. Remove section strainer (698), and remove grease line to suction bearing (690), if provided.

B. Unscrew pumpshaft coupling (649), and lineshaft (646), take out capscrews that secure diffuser case (708) to suction bell (689), and remove suction bell.

NOTE

SHAFT THREADS ARE LEFT HAND.

CAUTION

IF THREADED COUPLING WILL NOT  
READILY UNSCREW, APPLY HEAT TO  
COUPLING (NOT TO SHAFT), FOR  
APPROXIMATELY 30 SECONDS, AT  
THE SAME TIME APPLYING TORQUE  
TO THE SHAFT.

15-6. BOWL DISASSEMBLY - PRODUCT LUBRICATION - VIA PUMP

A. On 6, 8, and 10 inch pumps a setscrew is located at right angle to the shaft, between the propeller blades, remove setscrew prior to removing propeller.

B. Remove snap ring (720) in hub of propeller and slide propeller (676) forward, and remove thrust ring (724) from pumpshaft.

C. Slide propeller to clear pumpshaft (660) and remove. Take out propeller key (730F).

D. Reassemble in the reverse order of disassembly.

## SECTION 15

### PUMP DISASSEMBLY

#### 15-12. INSPECTION AND REPLACEMENT

A. Clean all parts thoroughly with a suitable cleaner. Inspect all parts for indication of excessive wear, corrosion, pitting, cracks, breaks and all threaded surfaces for damage.

B. Replace all badly worn or damaged parts with new parts. In addition, replace all gaskets, seats and packing as required.

C. Apply a thin film of turbine oil to all mating and threaded surfaces. See Section 17 for list of recommended lubricants.

D. Reassemble in the reverse order of disassembly and reinstall the pump as described in Sections 3 through 11. See Section 12 for starting and adjusting procedures of the pump.

SECTION 16

PUMP DATA

16-1. CALCULATING PUMP WEIGHT. Weight data is given on the Certified Pump Outline Drawing if provided, or may be calculated from data given in the following tables.

16-2. The following tables contain approximate components weights, to be used in estimating the entire pump weight.

SIZE	APPROX WEIGHT
6 INCH	275 LB
8	375
10	690
12	1000
14	1500
16	1950
20	2400
24	3400

TABLE 16-1 \*PUMP WEIGHT - VIA

SIZE	APPROX WEIGHT
6 INCH	750 LB
8	925
10	1170
12C	1505
12H	1850
14	2175
16	3000
20	4275
24	6000

TABLE 16-2 \* PUMP WEIGHT-VIM

\* DRIVER NOT INCLUDED

SECTION 16  
PUMP DATA

TABLE 16-3 BOWL (ONLY) - VIA

SIZE	APPROX WEIGHT
6 INCH	50 LB
8	100
10	140
12	195
14	320
16	470
20	700
24	1100

TABLE 16-4 BOWL (ONLY) - VIM

SIZE	APPROX WEIGHT
6 INCH	180 LB
8	200
10	310
12C	425
12H	520
14	625
16	1150
20	1200
24	2500

TABLE 16-5 WEIGHT OF WATER IN PUMP COLUMN

NOM PIPE SIZE	WT OF WATER PER FT OF PIPE
3IN.	3.0 LB.
4	5.0
5	8.0
6	12.0
8	20.0
10	23.0
12	48.0
14	57.0
16	76.0
18	97.0
20	120.0
24	177.0

NOTE: For liquids other than water multiply the above by the specific gravity of the liquid.

SECTION 16  
PUMP DATA

TABLE 16-6 ELECTRIC DRIVER - VIA (WPI) 220/400V

SIZE	HORSE POWER	RPM	APPROX WEIGHT
6 INCH	3	1750	160 LB
8	7 1/2	1760	260
10	15	1760	300
12	30	1760	460
14	30	1170	600
16	50	1175	705
20	100	1175	1300
24	125	880	1950

TABLE 16-7 ELECTRIC DRIVER - VIM (WPI) 220/440V

SIZE	HORSE POWER	RPM	APPROX WEIGHT
6 INCH	15	1770	300 LB
8	30	1770	460
10	40	1760	640
12C	75	1760	930
12H	60	1175	900
14	100	1175	1300
16	150	1175	1900
20	200	880	3750
24	250	700	4150

SECTION 16

PUMP DATA

TABLE 16-8 ADDITIONAL COLUMN, TUBE & SHAFT - VIA

SIZE	APPROX WEIGHT PER FOOT
6 INCH	27 LB
8	35
10	44
12	50
14	56
16	66
20	78
24	100

TABLE 16-9 ADDITIONAL COLUMN, TUBE & SHAFT - VIM

SIZE	APPROX WEIGHT PER FOOT
6 INCH	35 LB
8	44
10	50
12C	50
12H	56
14	66
16	72
20	100
24	143

16-3. The following example is given to calculate approximately the entire pump weight.

1. PUMP WEIGHT (MINUS DRIVER).
2. ADDITIONAL COLUMN, TUBE AND SHAFT (IF REQUIRED).
3. DRIVER WEIGHT.
4. LIFTING WEIGHT = TOTAL OF 1 & 3 or TOTAL OF 1 + 2 + 3.

# SECTION 17

## RECOMMENDED LUBRICANTS

MANUFACTURER	GREASES FOR LINE SHAFTS, SUCTION BOWL BEARINGS AND SHAFT PACKINGS	TURBINE OILS FOR LINE SHAFT, SUCTION BOWL BEARINGS AND SIMILIAR APPLICATIONS		TURBINE OILS FOR GEAR DRIVES VERTICAL PUMPS	
	TEMPERATURE —32°F TO 120°F	TEMPERATURES BELOW 32°F	TEMPERATURE ABOVE 32°F	TEMPERATURE BELOW 32°F	TEMPERATURE ABOVE 32°F
American Oil Co.	Amoco Lithium Grease All-Weather	Rykon Industrial Oil No. 11	Rykon Industrial Oil No. 31	Rykon Industrial Oil No. 21	Rykon Industrial Oil No. 51
Atlantic Richfield Co.	Arco Multipurpose Grease	Duro S-150 LP	Duro S-150 or Duro S-150 LP	Duro AWS-315	Duro 600
Cato Oil & Grease	Mystik JT-6	2107 Water Well Turbine Oil or 1872 Antiwear Hyd./Ind. Oil A.5	2107 Water Well Turbine Oil or 1872 Antiwear Hyd./Oil A.5	1875 Antiwear Hyd./Ind Oil C or 1837 R & O Gearhead C	Mystik JT-7 SAE 80/90 Antiwear Ind. Oil F, or 1855 R & O Gearhead F
Cities Service Oil Co.	Citgo H-2	Citgo Pacemaker 15	Citgo Packemaker 15	Citgo Pace-maker 20	Citgo Pace-maker 60
Gulf Oil Co.	Gulfcrown Grease No. 2 or Gulf Supreme Grease No. 2	Paramount 39	Harmony 44	Paramount 45	Harmony 69
Humble Oil & Refining Co.	Lidok No. 2	Nuto 43 or Esstic 42	Teresstic 43 or Nuto 43	Nuto 43 or Esstic 42	Terresstic 65 or Nuto 63
Mobil Oil Corp.	Mobilux No. 2	DTE 23	DTE BB	DTE 23	DTE Extra Heavy or DTE AA
The Pennzoil Co.	Pennzoil 705 HDW	Pennbell No. 1	Pennbell No. 2	Pennbell No. 2	Pennbell No. 5
Shell Oil Co.	Alvania EP Grease 2 or Alvania EP Grease 1 (for prolonged ambient below 0°F.)	Tellus Oil 23	Tellus Oil 27	Tellus Oil 29	Tellus Oil 41
Texaco, Inc.	Novatex Grease No. 2	Regal Oil A (R & O)	Regal Oil A (R & O)	Regal Oil C (R & O)	Regal Oil F (R & O)
Fiske Bros. Refining Co.	Lubriplate 130AA (0° to 120°F)	Lubriplate 3V	Lubriplate 3V	Lubriplate APG 90	Lubriplate APG 90

TABLE 17 - LUBRICANTS



## SECTION 18

### PARTS LIST

#### 18-1. GENERAL

18-2. The requirement for a stock of spare parts shall vary with the severity of conditions of service, and the extent of field maintenance anticipated, and the number of pumps installed. A minimum of one spare of each moving part should be stocked, as well as a complete set of bearings and seals.

#### 18-3. ORDERING PARTS

18-4. When ordering spare and replacement parts the pump serial number, type and size of pump must be given. Refer to nameplate. This is essential in order that Goulds Pumps may identify the pump and furnish the correct replacement part. Give the name and item number of the part as listed in parts list and applicable pump (figures 4-1 and 5-1.) Orders for replacement parts should be sent to Sales Department, Goulds Pumps, Vertical Pump Division, Inc., City of Industry, California.

#### 18-5. RETURN PARTS

18-6. All materials returned to factory must have a Return Material Order (R.M.O.) tag attached. Consult the nearest factory representative or Sales Office for shipping instructions and an R.M.O. tag. Articles being returned should be carefully packed to prevent damage in handling.

## SECTION 18

## PARTS LIST

FIGURE & PART NO.	DESCRIPTION
4-1	VIM-VIA PRODUCT LUBRICATION PUMP
604	Nut-Adjusting
606	Driveshaft
616	Stuffing Box Assembly
644	Column-Bottom Assembly
646	Lineshaft
649	Coupling-Threaded Lineshaft
653	Bearing-Open Lineshaft
668	Bearing-Adapter
674	Impeller-Mixed Flow
675	Pumpshaft-Mixed Flow
676	Propeller-Axial Flow
689	Bell-Suction
690	Bearing-Suction
698	Strainer-Suction
708	Case-Diffuser
709	Bearing-Diffuser
720	Ring-Snap
724	Ring-Thrust Mixed Flow Impeller
730F	Key-Mixed Flow Impeller
747E	Pipe Plug-Suction
755	Elbow-Discharge

## SECTION 18

## PARTS LIST

FIGURE & PART NO.	DESCRIPTION
5-1  604 606 625 630 644 646 649  654 656 665 668 674 675 676 689 690 696 698 708 709 720 724 730F  747E 755	VIM-VIA ENCLOSED LINESHAFT PUMP  Nut-Adjusting Driveshaft Tube Tension Plate Assembly Reservoir-Oil Assembly Column-Bottom Assembly Lineshaft Coupling-Threaded Lineshaft  Tube-Shaft Enclosing Bearing-Adapter Ring-Seal Bearing-Adapter Impeller-Mixed Flow Pumpshaft-Mixed Flow Propeller-Axial Flow Bell-Suction Bearing-Suction Flushline Strainer-Suction Case-Diffuser Bearing-Diffuser Ring-Snap Ring-Thrust Mixed Flow Impeller Key-Mixed Flow Impeller  Pipe Plug-Suction Elbow-Discharge

FIGURE & PART NO.	DESCRIPTION
5-3  650 726 730D 734 759E	KEYED SHAFT COUPLING ASSEMBLY  Retainer Ring-Split Key Sleeve-Coupling Capscrew

## SECTION 18

## PARTS LIST

FIGURE & PART NO.	DESCRIPTION
7-1  616 617 620A 728 735B 739A 758B 779A	STUFFING BOX ASSEMBLY  Box-Stuffing Bearing-Stuffing Box Rings-Packing Gland-Solid Nut-Gland Stud Stud Capscrews Gasket
8-1  625 626 628 630 632 633 634  654 747F	OIL LUBRICATION SYSTEM ASSEMBLY  Plate-Tube Tension Nut-Tube Tension Bearing-Tube Tension Reservoir-Oil Bracket-Oil Reservoir Valve-Sight Feed Valve-Solenoid  Tube-Shaft Enclosing Pipe Plug-Tube Tension Nut
9-1  604 606 730A 757J	HOLLOW SHAFT ADJUSTING NUT  Nut-Adjusting Driveshaft Key-Gib Capscrew-Adjusting Nut
10-1  610 613 614 722 730B 730C 735C 759D	FLANGE ADJUSTABLE COUPLING ASSEMBLY  Hub-Driver Plate-Adjusting Hub-Pump Ring-Split Driver Key-Driveshaft Key-Pumpshaft Nut Capscrew