

Model 9800

# INSTRUCTIONS

INSTALLATION  
OPERATION  
MAINTENANCE



## WARNING

Your ITT A-C pump is carefully selected, sized, manufactured and inspected with the utmost care to provide safe and reliable service, at the best possible efficiency to suit your specific pumping requirements. In the interest of trouble free pump operation and safety of operating personnel, the following safety precautions should be strictly adhered to.

1. **READ AND FOLLOW CAREFULLY ALL RECOMMENDED PROCEDURES**, as described in your operator's manual, for storage, installation, start-up, operation and maintenance of your pump and related auxiliary equipment such as motor, variable speed drive, gear reducer, v-belt, coupling, etc.
2. **DRIVER ROTATION MUST BE CHECKED** before first start-up and before the v-belts are installed or the coupling halves are connected. Severe equipment damage and injury to personnel may occur if the pump is driven in the opposite direction to the arrow of rotation cast on the pump casing.
3. **DO NOT ALTER THE ORIGINAL OPERATING CONDITIONS** of the pump without first consulting with ITT A-C Pump representatives. The operation of the pump at conditions other than those for which it was designed may result in equipment damage and injury to operators.
4. **DO NOT OPERATE THE PUMP AT LOW OR ZERO FLOW CONDITIONS**. All operating conditions which could cause the pumped liquid to vaporize are dangerous, such as clogged suction and discharge piping, shut-off suction and discharge valves, etc. Vapour pressure build-up could cause the pump casing and system piping to explode resulting in severe equipment damage and personal injury.
5. **DO NOT USE HEAT TO ASSIST IN IMPELLER REMOVAL** from the shaft when servicing the pump. Heat can cause vaporization of fluid which may be trapped in the impeller hub resulting in an explosion which could cause personal injury and equipment damage.
6. **DO NOT OPERATE THE PUMP WITHOUT PROPERLY INSTALLED V-BELT OR COUPLING GUARD**. Failure to install guards may result in personal injury.

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The law requires that the belt drives and/or couplings on this equipment be covered by **SAFETY GUARDS** while in operation. Such guards must be provided by the owner if not specifically contracted to ITT A-C Pump.

## **READ BEFORE INSTALLING AND OPERATING PUMP**

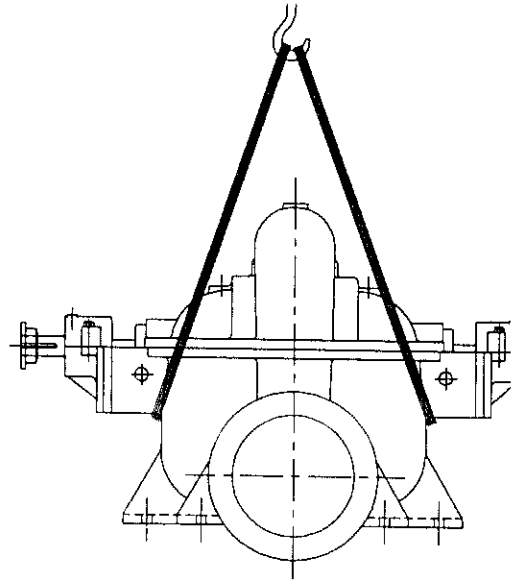
### INTRODUCTION

Your new ITT A-C Pump pump is one of the best designed units available for pumping a wide variety of liquids. In building your pump special attention was given to provide you with most efficient, long, trouble-free service. The unit was inspected at the factory and found to be in perfect condition - it will deliver the capacity and head for which it was rated. With reasonable care it will give you many years of low cost pumping and the following instructions and suggestions will outline the correct procedure for caring for your pump and serve as a timely guide for its maintenance.

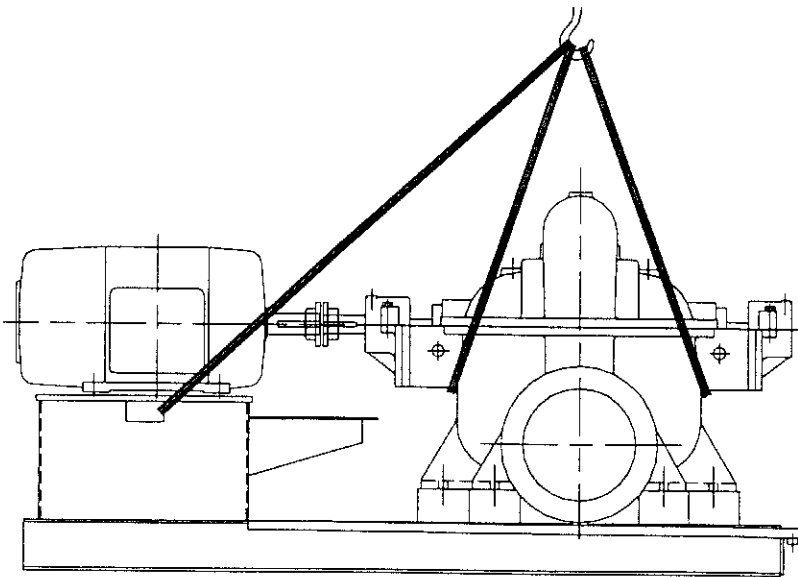
While it is attempted, in these instructions, to be general and cover as many conditions as possible; extraordinary conditions will arise for which we shall be glad to issue special instructions not covered herein.

## LIFTING INSTRUCTIONS

**BARE PUMP,** PLACE SLINGS AROUND BOTH  
CASINGS BODIES UNDER  
STUFFING BOXES AS SHOWN



**PUMP, BASEPLATE AND MOTOR,** PLACE MAIN SLINGS AROUND  
BOTH CASING'S BODIES UNDER STUFFING BOXES AND ADD BALANCE HITCH  
THROUGH HOLES IN THE MOTOR SUPPORT AS SHOWN.



**WARNINGS!!**

**DO NOT SLING UNDER BEARING HOUSINGS.**

## INSTALLATION

### LOCATION

In order to obtain the maximum performance from your Type S pump one must select the location of the pump with care. Consideration must be especially given to the following:

- a) The pump should be located as near as possible to the source of liquid and in such a position as to facilitate a most direct suction pipe.
- b) Minimum number of fittings (such as elbows, valves etc.) should be used in the suction piping to avoid unnecessary friction losses. In determining suction pipe size consideration should be given to the velocity of the liquid being handled in order that the pump will not be "starved" because of the inability of the liquid to flow into the pump impeller as quickly as the pump is attempting to handle it.
- c) Pump should be located so that it will be easily accessible for inspection and repairs. Also, sufficient head room should be provided for dismantling and assembling the pump perhaps with the aid of an overhead crane.
- d) Pump should be protected against floods and special care should be given an electric motor driven unit to locate it in a dry place if possible.
- e) When possible, it is advisable to locate the unit below the liquid level in the suction vessel, as this will greatly facilitate priming.

### FOUNDATION

It is of prime importance to provide a foundation permanent and rigid enough to absorb any vibration and maintain the true alignment of a direct connected unit. Usually a concrete foundation on a solid base with embedded foundation bolts of the proper size located with the aid of general arrangement drawings is quite satisfactory.

## **ALIGNMENT FOR TYPE S UNITS**

Regardless of how heavily the pump baseplate may be constructed, it is possible for it to be slightly sprung in shipment or by uneven support on the foundation or by uneven tightening of foundation bolts or by pull of pipe connections. This of course will cause misalignment with consequent rapid wear of coupling bushings and excessive heating of the bearings and possible loss of efficiency and finally seizure. To avoid trouble a careful check must be made to ascertain true alignment between the pump and the prime mover. Whenever the pump or driver or both are heated in operation (i.e. when the driver is a steam turbine or pumps are handling hot liquid), the unit should be properly aligned under these conditions. This is necessary due to change in alignment resulting from the expansion from the cold to the hot condition. Generally speaking, pumping unit should be aligned under operating conditions.

## **COUPLING ALIGNMENT**

Generally most pump users do not realize the importance of accurate alignment of flexible coupling as they depend on the coupling to compensate for misalignment. This is a fallacy as flexible coupling will not compensate for misalignment and instead will result in rapid wear of coupling parts, heating of the bearings and possible loss in efficiency.

For good results, the following procedure should be carried out in coupling alignment

- a) Clean off all paint and burrs on the coupling before checking alignment
- b) Tighten the equipment bolts firmly to the base, then using straight-edge and a feeler gauge align the driver to the pump.
- c) Coupling halves should be separated to leave a gap as given on the certified general arrangement drawing supplied for the pump.
- d) Angular alignment is checked by inserting a feeler gauge between coupling faces at four points spaced at 90° intervals.

- e) A check for parallel alignment is made by placing a straight edge across the coupling rims at the top, bottom and both sides.
- f) Above aligning procedure should be repeated at each quarter turn of pump and driver turned simultaneously.
- g) Replace coupling drive element (bolts and bushings, grid etc.)

## PIPING

Both the **suction and the discharge pipe should be independently supported near the pump** so that, when the flange bolts are tightened, no strain will be transmitted to the pump casing.

### (a) SUCTION PIPE

The suction pipe should be made absolutely air leak proof. The presence of air will cause poor priming and erratic pumping. If at all possible suction pipe should slope upward to the pump nozzle. Use an eccentric reducer instead of concentric reducer and install with straight portion at top of pipeline. In general, make an effort to avoid any high points in the suction line which will tend to collect air and reduce capacity of the pump and possibly cause the pump to lose prime. For example, a gate valve installed vertically in pipe line will provide such an air pocket, which can be avoided by installing it horizontally.

Further, suction pipe opening in the suction vessel must be at all times flooded and have at least a minimum of submergence.

The pump **must never** be throttled by the use of a valve on the suction side of the pump. It is advisable to have a shut-off valve in the suction line, so the pump can be isolated while repairs or inspections are

being made. However, **the valve should never be used** to control the capacity of the pump by throttling.

(b) **DISCHARGE PIPING**

On long runs of pipeline it is desirable to maintain as even a grade as feasible. Also high spots, such as loops, should be avoided as much as possible to prevent collection of air and eventual erratic pumping. In long pipelines where high spots are unavoidable it is advisable to vent the high spot to release any trapped air or to prevent possible collapse of the pipe in case a high vacuum may develop.

A check valve and a gate valve can be installed in the discharge line. The first to protect pump from excessive pressures due to possible water hammer and to prevent water from running in reverse direction in the event of failure of driver, and the latter to be used in priming and starting and when the pump is shut down. Where very high heads are encountered the use of specially designed check valves or cone valves should be carefully considered to protect the pumping system from damages by water hammer or sudden stoppage due to failure of prime mover power.

**FOOT VALVE**

In cases where suction lift is moderate it is sometimes advisable to install a foot valve to facilitate priming. However foot valves should not be used where high static heads are involved as severe water hammer may be set up on failure of prime mover. Foot valves should not be used on liquids which contain solids and which can prevent the foot valve from seating properly.

**STARTING**

- 1) Pump **must not be started** without being fully primed.
- 2) Make certain the pump shaft rotates in the direction indicated by the arrow on the casing.
- 3) It is desirable to start all Type S pumps with discharge valve fully closed. This will prevent overloading of the motor.

- 4) Before starting the pump the flushing water should be adjusted to obtain the proper leakage from the stuffing box at all times. This leakage is necessary to prevent air from leaking into the casing when the pump is operating with a suction lift, to serve as a lubricant for the packing and to carry away any heat generated by friction of packing on shaft sleeve.

#### **NATURE OF LIQUID**

For pure water handling, bronze fitted pumps are supplied. However, if there is a change of liquid being either acidulous or alkaline the Company should be informed in detail as we do not guarantee the metals to withstand the corrosive and erosive action of all liquids. We will, however, be happy to advise special metals to give the longest pump life possible where corrosive and/or abrasive action may occur.

#### **MECHANICAL SEALS**

Mechanical seal is used in all the centrifugal pumps supplied under this portion of the Contract. General instructions for operation of the mechanical sealing arrangements are included below.

- a) Mechanical seals are precision products and should be treated with care. Use special care when handling seals. Clean parts are essential to prevent scratching the finely lapped sealing faces. Even light scratches on these faces could result in leaky seals.
- b) Normally, mechanical seals require no adjustment or maintenance except routine replacement of worn or broken parts.

A mechanical seal which has been used should not be put back into service until the sealing faces have been replaced or relapped. (Relapping is generally economical only in seals two inches in size and above.)

Four important rules which should always be followed for optimum seal life are:

1. Keep the seal faces as clean as possible.
2. Keep the seal as cool as possible.
3. Assure that the seal always has proper lubrication.
4. If seal is lubricated with filtered fluid, clean filter frequently.

### BEARING LUBRICATION

Oil Lubricated bearings are provided for pumps supplied under this portion of the Contract.

The oil lubricated bearings are installed with Trico oilers. The oilers keep the oil level in the bearing housings constant when they are properly adjusted. Refer to the Trico oiler manual for detail adjustment of the oiler.

After the pump has been installed, flush the housing to remove dirt, grit, and other impurities that may have entered the bearing housing during shipment or installation. Then refill the housing with proper lubricant. (The housing must be filled using the Trico oiler.) The oil level will be maintained by the Trico oiler.

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

- |     |                            |                |
|-----|----------------------------|----------------|
| (1) | Saybolt viscosity at 100°F | 215 to 240 SSU |
| (2) | Saybolt viscosity at 210°F | 49 SSU         |
| (3) | Viscosity index, minimum   | 95             |

(4)	API gravity	28-33
(5)	Pour point, maximum	+20°F
(6)	Flash point, minimum	400°F
(7)	Additives	Rust & Oxidation Inhibitors
(8)	ISO viscosity	46

Note: Oils from different suppliers should not be mixed. Engine oils are not recommended.

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

In installations with moderate temperature changes, low humidity, and a clean atmosphere, the oil should be changed after approximately 1000 hours of operation. The oil should be inspected at this time to determine the operating period before the next oil change. Oil change periods may be increased up to 2000-4000 hours based on an 8000 hour year. Check the oil frequently for moisture, dirt, or signs of “breakdown”, especially during the first 1000 hours.

Caution: Do not over oil; this causes the bearings to run hot. RTDs are provided on each bearing housing to allow monitoring of bearing temperatures. The recommended alarm and trip settings are 90 degrees C and 100 degrees C respectively.

### DISMANTLING PROCEDURE.

The numbers used in the following procedures are part numbers identified on the Pump Ass'y drawing. Use acceptable mechanical practices when working on pump to avoid unnecessary damage to parts.

- (1) Disconnect coupling. Refer to attached coupling supplier's Instructions.
- (2) Drain pump by opening vent plug and removing drain plug on discharge and suction nozzles.
- (3) Remove gland bolts, slide gland plates (14) away to disconnect mechanical seal faces.
- (4) Remove all casing main joint nuts and dowels. Use jacking screws in two tapped holes to break joint. Lift casing cover by cast lugs.
- (5) **GASKET**  
A strong GARLOCK 3000 gasket is placed between the pump half casings at the factory. The gasket may be readily replaced, when necessary, with the same or similar material of the same thickness as original and cut to proper shape. Heavier gaskets must not be used, as they hold the casing apart allowing leakage around the wearing rings. A lighter gasket will place undue stress on the casing rings.
- (6) Remove bolting holding bearing housings caps to bearing housings (30). Mark the caps to know to what end they belong. Lift up the caps. The entire rotating element may now be lifted out.
- (7) Pull coupling half and key off shaft. Remove bearing endplate (18).
- (8) Remove both casing rings (3).
- (9) Remove radial bearing (26C).

- (10) Remove locknut and lockwasher (27T) and pull off thrust bearing (26T).
- (11) Remove bearing endplates (18 & 19) and deflectors (17C & 17T).
- (12) Remove gland plates (12) at both ends. Be careful as not to damage the static seal ring which is mounted inside the gland plate. Refer to mechanical seal supplier's drawing and instructions for details.
- (13) Before removing the rotating assembly of mechanical seal note and mark it's axial position on shaft sleeve. For mechanical seal to work properly, installation distance from the face of stuffing box is important. See mechanical seal drawing for dimension. Remove mechanical seals.
- (14) Remove sleeve nuts (15C, 15T) using a proper "C" wrench . Watch for LEFT HAND thread on one of them. Hand of the thread is decided by shaft rotation, refer to Pump Ass'y Pix drawing. For CCW rotation (15C) is RH thread, (15T) is LH thread. For CW rotation (15C) is LH thread, (15T) is RH thread.
- (15) Remove outboard sleeves and keys from each end. To remove the impeller and the inboard sleeves, hold the shaft vertically and allow it to drop on a block of wood a number of times. The weight of the impeller will force it and the shaft sleeves off. If this does not work, apply a light press. Before removing Impeller record Dimension "A" from Impeller hub face to thrust bearing shoulder (see Fig.1) to facilitate assembly

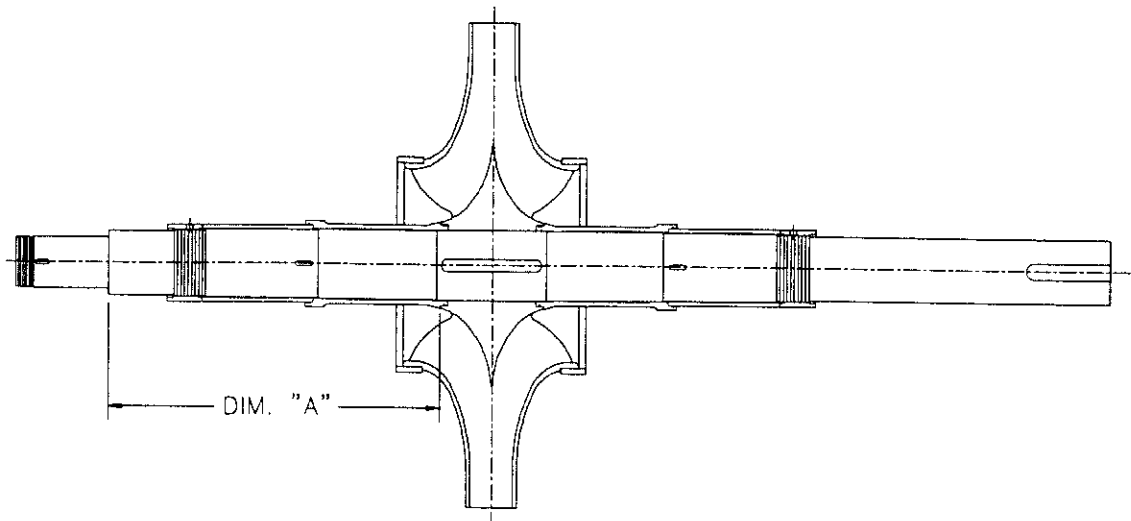


Fig. 1

(16) **WEARING RINGS**

When the rings are worn to twice the original clearance, they should be replaced. The rings on the impeller can be cut in two with a cold chisel and removed. Heat each new impeller wearing ring to 270°-300° F and slide it onto the impeller. Hold rings against the impeller shoulder until they cool.

**INSTRUCTIONS FOR ORDERING REPAIR PARTS**

When ordering repair parts give serial number and rating as stamped on pump nameplate. Itemize parts with names and numbers (from Pump Ass'y Pix drawing). Be specific as to number of parts required. Special care in following instructions will facilitate quicker shipment.

If repair parts are required of different materials than originally supplied, please outline exactly the requirement and the reason for change, in order that we may keep our records up to date. Unless notified otherwise, we will supply the same material as originally supplied or the same materials as supplied on your last repair order for this pump.

If the pump is on a critical service and down time is a concern, a complete rotating element is recommended as spare part.

For normal service, with repairs to be made in the field, the following spare parts are recommended to be stocked.

- 1 Complete set of bearings
- 2 Sets of Wearing rings
- 2 Shaft sleeves
- 2 Complete seals or at least new seal face pieces  
for pumps equipped with mechanical seals.

### **PUMP REASSEMBLY**

(Refer to Pump Assembly Pix Drawing)

- a) All “O” rings, seals and gaskets should be replaced with new parts during assembly. All reusable parts should be cleaned of all foreign matter before reassembling. The main casing joint gasket should be made using the upper half as a template. Lay the gasket material on the casing joint and mark it by pressing it against the edges of the casing. Trim the gasket so that it is flush with the inside edges of casing.
- b) Install Impeller key on shaft. Using Dimension “A” recorded when dismantling, (See Fig.1) install Impeller on shaft.
- c) Install Spacer Sleeves “O” rings, stuffing-box sleeves and shaft sleeve nuts. Install mechanical seals on shaft.

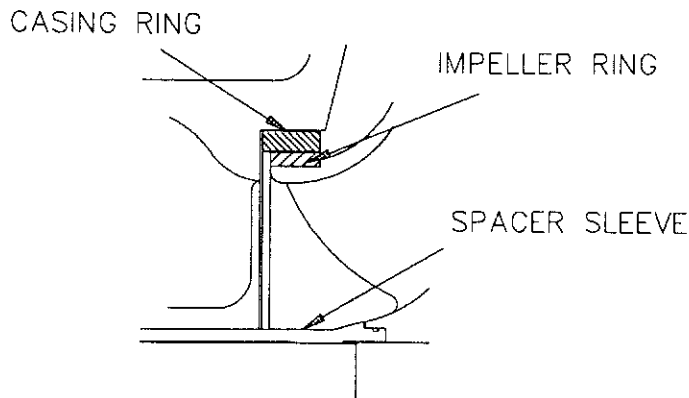


Fig.2

- d) Install casing rings (See Fig.2).
- e) Install deflectors (17C & 17T) and bearing endplates (19) onto shaft.
- f) Install thrust bearing (26T) on shaft complete with lock washer and locknut (27T).
- g) Install radial bearing (26C)
- h) Install pump coupling half and key per coupling suppliers instructions.
- i) Assemble rotating element in lower half casing. Locate casing rings over pins in lower half casing.
- j) Bolt down bearing housings caps.
- k) Lower upper half casing in place and locate using the taper dowels. Install casing main joint studs/nuts. Torque uniformly the casing main studs/nuts according to the torque values as indicated on the respective Section Assembly Pix drawing.
- m) Rotate shaft by hand to assure that it turns smoothly and is free from rubbing and binding.
- n) Tighten mechanical seal glands (13, 14).

- o) Install coupling, check alignment to driver and correct if necessary.

# General Pump Instruction

## SECTION I — Introduction

### I-A PURPOSE OF MANUAL

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

Equipment cannot operate well without proper care. To keep this unit at top efficiency, follow the recommended installation and servicing procedures outlined in this manual. The Industrial Pump Division's Customer Service Department is available to expertly guide the installation of the pump for maximum operating life and minimum downtime.

### I-B SERVICE ORGANIZATION

Experienced, factory-trained servicemen offer prompt, efficient service at reasonable rates. These servicemen can find and correct costly errors such as poor grouting,

misalignment, pipe stresses transmitted to the pump casing, or improperly cleaned piping. A serviceman may be requested through your nearest Allis-Chalmers Sales Representative.

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

### I-C WARRANTY

Refer to your sales contract for coverages.

### I-D PUMP IDENTIFICATION

All pumps are designated by Serial Number, Model Number, Size and Type. This information is stamped on an identification plate which is mounted on the pump. Refer to pump identification in specific instruction section of this manual for detailed information.

## SECTION II — Installation

### II-A RECEIVING PUMP

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

**WARNING: WHEN UNLOADING HORIZONTAL PUMPS, LIFT EQUALLY AT FOUR OR MORE POINTS ON THE BASEPLATE. DO NOT LIFT ON THE DRIVER OR PUMP. FOR VERTICAL PUMPS, USE THE LIFTING LUGS OR EYEBOLTS FOUND ON THE PUMP. DO NOT LIFT BY FLANGES OR BY THE EYEBOLTS FOUND ON THE MOTOR. BE VERY CAREFUL NOT TO DAMAGE ANY AUXILIARY PIPING OR CONTROLS WHEN MOVING PUMPS.**

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

Shafts are in alignment when unit is shipped; however, due to shipping, the pumps may arrive misaligned and, therefore, *alignment must be established during installation.* Allis-Chalmers has determined that proper and correct alignment can only be made by accepted erection practices. Refer to the following paragraphs on "Foundation", "Baseplate Setting", "Grouting Procedure", "Alignment Procedure" and "Doweling".

### II-B TEMPORARY STORAGE

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

**NOTE:** Oil lubricated pumps are shipped without lubricant. Fill the frame completely full with oil for storage. Oil must be drained to proper level before pump is put into operation. For storage of six months or longer, see bulletin 51x3963-01.

### II-C LOCATION

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

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

5. Check to make sure the piping can be aligned to the pump flanges without placing pipe strain on either flange.
6. Grout baseplate in completely (See "Grouting Procedure") and allow grout to dry thoroughly before attaching piping to pump. (24 hours is sufficient time with approved grouting procedure.)

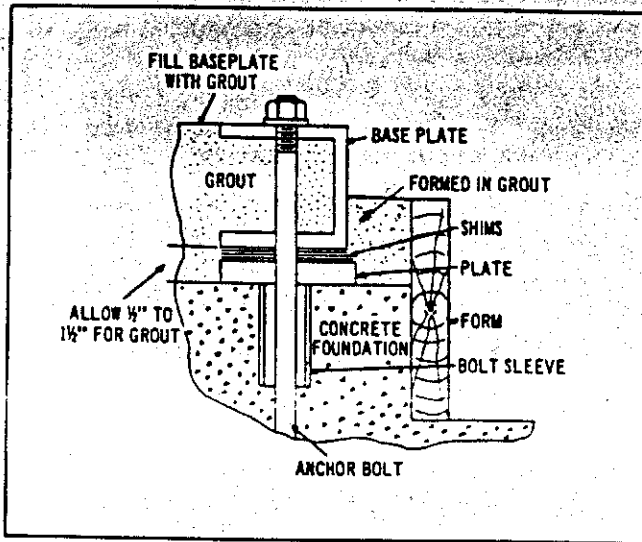


Fig. II - Setting Baseplate and Grouting

## II-F GROUTING PROCEDURE

Grout compensates for uneven foundation, distributes weight of unit, and prevents shifting. Use an approved, non-shrinking grout (such as Embeco 636 by Master Builders, Cleveland, Ohio or equivalent), as follows, after setting and leveling unit. (See Fig. II)

1. Build strong form around the foundation to contain grout.
2. Soak top of concrete foundation thoroughly, then remove surface water.
3. Baseplate should be completely filled with grout and if necessary, temporarily use air relief tubing or drill vent holes to remove trapped air.
4. After the grout has thoroughly hardened, check the foundation bolts and tighten if necessary.
5. Check the alignment after the foundation bolts are tightened.
6. Approximately 14 days after the grout has been poured or when the grout has thoroughly dried, apply an oil base paint to the exposed edges of the grout to prevent air and moisture from coming in contact with the grout.

## II-G ALIGNMENT PROCEDURE

**NOTE:** A flexible coupling will only compensate for small amounts of misalignment. Permissible misalignment will vary with the make of coupling. Consult coupling manufacturer's data when in doubt.

Allowances are to be made for thermal expansion during cold alignment so that the coupling will be aligned at operating temperature. In all cases, a coupling must be in alignment for continuous operation. Even though the coupling may be lubricated, misalignment causes excessive wear, vibration, and bearing loads that result in premature bearing failure and ultimate seizing of the pump. Misalignment can be angular, parallel, or a combination of these, and in the horizontal and vertical planes. Final alignment should be made by moving and shimming the motor on the baseplate until the coupling hubs are within the recommended tolerances measured in total run-out. All measurements should be taken with the pump and motor foot bolts tightened. The shaft of sleeve bearing motors should be in the center of its mechanical float.

**NOTE:** Proper alignment is essential for correct pump operation. This should be performed after baseplate has been properly set and grout has dried thoroughly according to instructions. Final alignment should be made by shimming driver only. Alignment should be made at operating temperatures.

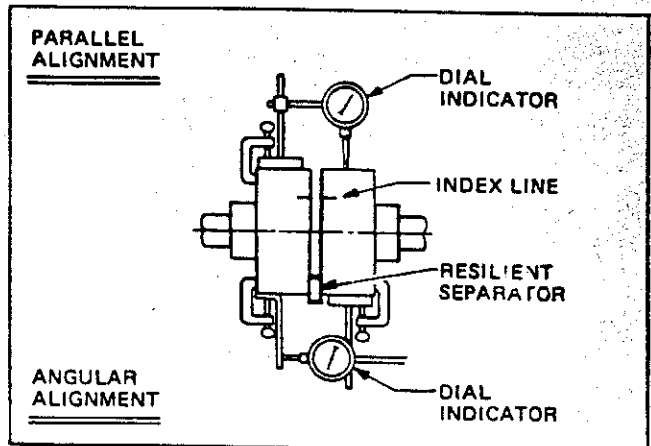


Fig. IIIa - Single Element Couplings See 9A on Page IV

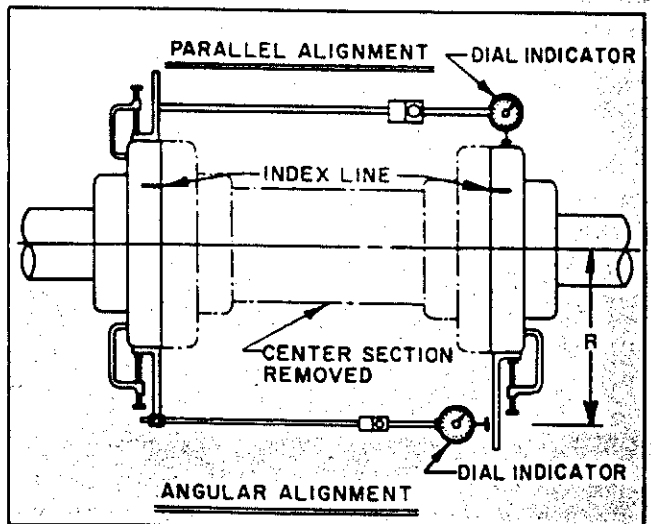


Fig. IIIb - Double Element Coupling See 9B on Page IV

installed beyond the piping supports closest to the pump. Tie bolts should be used with expansion joints to prevent pipe strain. Do not install expansion joints next to the pump or in any way that would cause a strain on the pump resulting from system pressure changes. It is usually advisable to increase the size of both suction and discharge pipes at the pump connections to decrease the loss of head from friction.

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

Make sure that all piping joints are air-tight.

Where flanged joints are used, assure that inside diameters match properly.

Remove burrs and sharp edges when making up joints.

Do not "spring" piping when making any connections.

Provide for pipe expansion when hot fluids are to be pumped.

### Suction Piping

When installing the suction piping, observe the following precautions (See Fig. IV).

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

Suction piping should be short in length, as direct as possible, and never smaller in diameter than the pump suction opening. If the suction pipe is short, the pipe diameter can be the same size as the suction opening. If longer suction pipe is required, pipes should be one or two sizes larger than the opening depending on piping length.

Suction piping for horizontal double suction pumps should not be installed with an elbow close to the suction flange of the pump except when the suction elbow is in the vertical plane. A suction pipe of the same size as the suction nozzle approaching at any angle other than straight up or straight down must have the elbow located 10 pipe diameters from the suction flange of the pump. Vertical mounted pumps and other space limitations require special piping.

There is always an uneven turbulent flow around an elbow and when it is in a position other than the vertical it causes more liquid to enter one side of the impeller than

the other. (See Fig. V) This results in high unequalized thrust loads that will overheat the bearings and cause rapid wear in addition to affecting hydraulic performance.

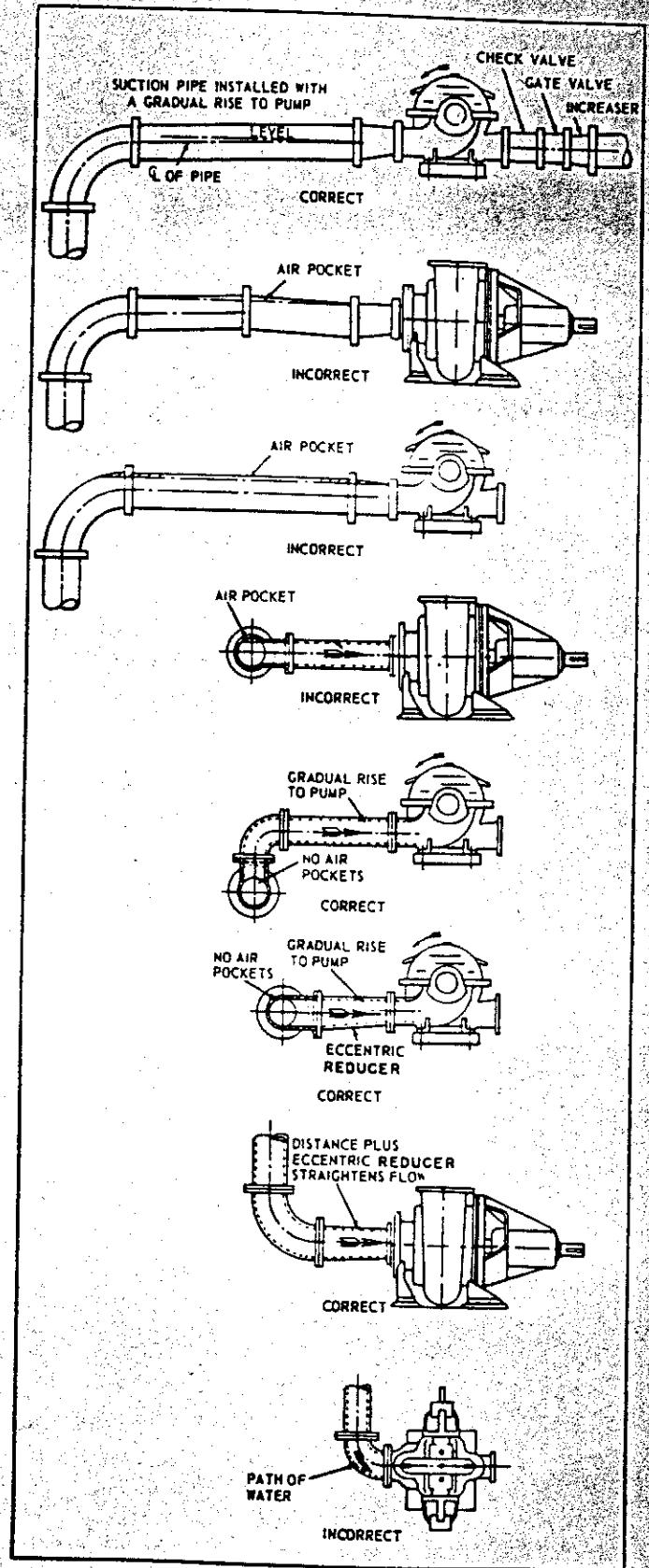


Fig. IV - Suction Pipe Installations  
(Piping Supports Not Shown)

packing deterioration; they can even plug the stuffing box flushing and lubrication system. The stuffing box must be supplied at all times with a source of clean, clear liquid to flush and lubricate the packing. The most important consideration is to establish the optimum flushing pressure that will eliminate contaminants from the packing. If this pressure is too low, fluid being pumped may enter the stuffing box. If the pressure is too high, excessive packing wear will result; and extreme heat may develop in the shaft causing higher bearing temperatures. The most desirable condition, therefore, is to use the lowest possible flushing pressure which the operating conditions will permit. If the pump system pressure conditions vary during the day, the packing problem becomes difficult. Consideration should be given to using a mechanical seal. (See "Mechanical Seals".)

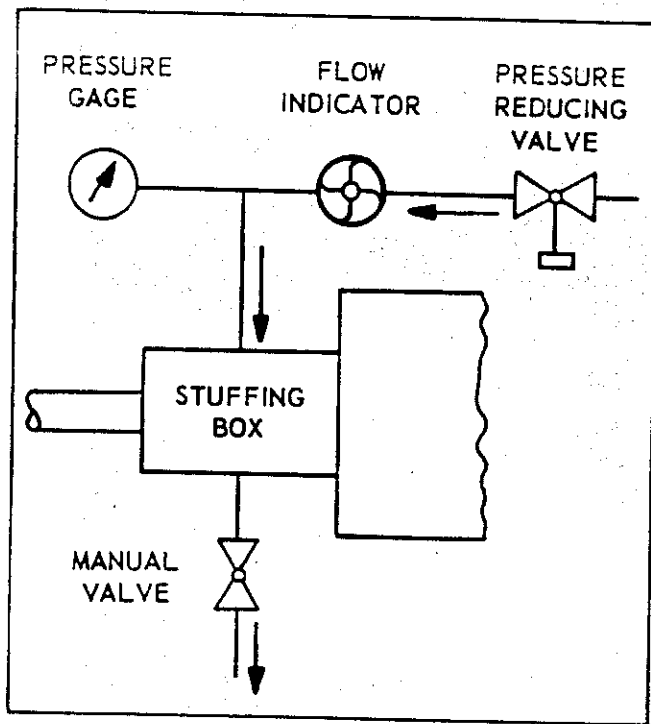


Fig. VI - Controlled Pressure System for Stuffing Box

One recommended method to minimize error in regulating flushing water is a "Controlled Pressure System" (Fig. VI). Most important is the pressure reducing valve adjusted to a value slightly exceeding the maximum stuffing box operating pressure (assuming it is reasonably constant). A flow indicating device will serve to indicate a failing of the bottom packing rings allowing leakage into the pump. With this arrangement, the packing gland need be tightened only against the lowest necessary pressure. Longer packing life and less frequent adjustments are possible with the "Controlled Pressure System" if properly installed and operated. (See "Stuffing Box Operating Pressure".)

## II-K PACKING

Standard pumps are normally packed before shipment. If the pump is installed within 60 days after shipment, the packing will be in good condition with a sufficient supply of lubrication. If the pump is stored for a longer period, it may be necessary to repack the stuffing box. In all cases, however, inspect the packing before the pump is started.

*NOTE: Packing adjustment is covered under section V-D.*

## II-L PACKING LUBRICATION

### Internal Liquid Lubricant

Pumped liquid may be used to lubricate the packing when the following conditions prevail:

1. Liquid is clean, free from sediment and chemical precipitation and is compatible with seal materials.
2. Temperature is above 32°F and below 160°F.
3. Suction pressure is below 75 psig.
4. Liquid has lubricating qualities.
5. Liquid is non-toxic and non-volatile.

### External Liquid Lubricant

When the liquid being pumped contains solids or is otherwise not compatible with packing materials, an outside supply of seal liquid should be furnished. In general, external-injection liquid (from an outside source) is required when the following conditions prevail:

1. Liquid being pumped contains dirt, grit, or other impurities.
2. Temperature of the pumped liquid is below 32°F or above 160°F.
3. Liquid being pumped has non-lubricating properties.
4. Liquid is toxic or volatile.
5. Suction pressure is above 75 psig, vacuum, or high lift.

## II-M STUFFING BOX OPERATING PRESSURE

The actual stuffing box operating pressure may be obtained by installing a pressure gauge on the box. This is done with an extra seal cage temporarily replacing the two rings of packing in the bottom of the box to obtain accurate gauge readings. Take gauge readings with the pump running under various head and capacity conditions. Then set the pressure of flushing or lubrication liquid at a value 5 to 10 psi above the maximum expected stuffing box operating pressure.

10. Assure that pump is full of liquid. (See Priming III-B) and all valves are properly set and operational, with the discharge valve closed, and the suction valve open.
11. Check rotation. Be sure that the driver operates in the direction indicated by the arrow on the pump casing as serious damage can result if the pump is operated with incorrect rotation. Check rotation each time the motor leads have been disconnected.

**CAUTION: ROTATION SHOULD BE CHECKED WITH COUPLING DISCONNECTED ON COUPLED UNITS.**

### III-B PRIMING

If the pump is installed with a positive head on the suction, it can be primed by opening the suction and vent valve and allowing the liquid to enter the casing.

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

**CAUTION: UNDER EITHER CONDITION, THE PUMP MUST BE COMPLETELY FILLED WITH LIQUID BEFORE STARTING. THE PUMP MUST NOT BE RUN DRY IN THE HOPE IT WILL PRIME ITSELF. SERIOUS DAMAGE TO THE PUMP MAY RESULT IF IT IS STARTED DRY.**

### III-C STARTING

1. Close drain valves and valve in discharge line.
2. Open fully all valves in the suction line.
3. Turn on seal water to the stuffing box. (If pumped fluid is dirty or if leakage of air is to be prevented, these lines should be always left open.)
4. Prime the pump.

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

5. (Pumps moving high temperature liquids.) Open the warm-up valve to circulate liquid for preheating. Consult the instructions that cover such specially designed heating system.

6. Start the pump driver (turbines and engines may require warming up; consult the manufacturer's instructions).
7. When the pump is operating at full speed, open the discharge valve slowly. This should be done promptly after start-up to prevent damage to pump by operating at zero flow.
8. Adjust the liquid seal valves to produce the recommended pressure for either the mechanical seal or packed stuffing box.

### III-D OPERATING CHECKS

1. Check the pump and piping to assure that there are no leaks.
2. Check and record pressure gauge readings for future reference.
3. Check and record voltage, amperage per phase, and kw if an indicating wattmeter is available.
4. Check bearings for lubrication and temperature. Normal temperature is 180° maximum.
5. Check and adjust stuffing box for correct operation. (See Section V-D).
6. Check sealing water lines and valves.

**CAUTION: MAKE ALL PUMP OUTPUT ADJUSTMENTS WITH THE DISCHARGE VALVE. DO NOT THROTTLE THE SUCTION LINE TO ADJUST THE PUMP OUTPUT.**

### III-E SHUTDOWN

The following steps of procedure will take care of most normal shutdowns of the pump. Make any further adjustments of process piping, valves, etc., as required. If the pump is to be removed from service for an extended period of time, refer to "Temporary Storage" and "Freezing Protection."

1. Close the discharge valve slowly.

**NOTE: When stopping pump, always close discharge valve first.**

2. Shut down the driver (Consult manufacturer's instructions for special operations.)

## Horsepower

1. The formula for horsepower required at the pump shaft is:

$$\text{Bhp} = \frac{\text{Total head} \times \text{GPM}}{3960 \times \text{Eff.}} \times \text{specific gravity}$$

2. The true motor brake horsepower, once the efficiency is determined from dynamometer tests, can also be calculated from the following formula:

$$\text{Bhp} = \frac{\text{kw input} \times \text{Eff.}}{0.746}$$

Where Bhp = Brake horsepower delivered

kw input = Real input power (kw)

Eff. = Motor efficiency

## Pump Efficiency

Pump efficiency can be calculated by the formula:

$$\text{Pump efficiency} = \frac{\text{Total head} \times \text{GPM}}{3960 \times \text{Bhp}} \times \text{specific gravity}$$

## III-H VIBRATION

The acceptable vibration level of a centrifugal pump depends on the rigidity of the pump and the supporting structure. Recommended values for vibration can vary between .20 ips velocity to .60 ips velocity depending on the operating characteristics and the structure. Refer to the standards of the "Hydraulic Institute" for the complete description and charts on various structures.

## III-I ELECTRICAL REQUIREMENTS

Motor (Also See Separate Motor Instructions)

If the motor is sized to operate near full load at the rated head and capacity of the pump, a watt-meter should be installed to record input power to the motor. If motor efficiency is known, the shaft horsepower may be calculated and checked against the motor rating.

A motor operating outside its service factor will overheat and could possibly burn out. Motors are usually rated with normal temperature requirements stamped on the data plate.

**NOTE:** A motor which feels hot to the touch of the hand is not necessarily running hot. Check with an accurate temperature measuring device to be sure. A motor operating outside its service factor will overheat and could possibly burn out. Motors are usually rated with normal temperature requirements stamped on the data plate.

## Conduit Box

Conduit boxes are mounted on the motors at lead access openings. Conduit boxes are normally provided for main power leads and other special accessories, such as space heaters, temperature alarms and control features.

The conduit box openings are sized as shown on the motor dimension drawing, and threaded for using standard rigid or flexible conduit. They may be assembled with conduit openings at any of four (4) 90° positions.

## Motor Controls - General

Motor controls should conform to all the electrical data stamped on the motor data plate. Complete instructions for installation, operation, and maintenance are included with the controlling device.

## External Wiring

Wiring to the motor should be installed in conformance with the National Electrical Code and any local codes.

CAUSES	CURES
<p>17. Foot valve too small or partially obstructed.</p> <p>18. Suction inlet not immersed deep enough.</p> <p>19. Wrong direction of rotation.</p> <p>20. Too small impeller diameter (probable cause if none of above).</p>	<p>Area through ports of valve should be at least as large as area of suction pipe - preferably 1-1/2 times. If strainer is used, net clear area should be 3 to 4 times area of suction pipe.</p> <p>If inlet cannot be lowered, or if eddies through which air is sucked persist when it is lowered, chain a board to suction pipe. It will be drawn into eddies, smothering the vortex.</p> <p>Symptoms are an overloaded drive and about 1/3 rated capacity from pump. Compare rotation of motor with directional arrow on pump casing.</p> <p>Check with factory to see if a larger impeller can be used; otherwise, cut pipe losses or increase speed - or both, as needed. But be careful not to seriously overload drive.</p>
Not Enough Pressure	
<p>21. Speed too low.</p> <p>22. Air leaks in suction piping.</p> <p>23. Mechanical defects.</p> <p>24. Obstruction in liquid passages.</p> <p>25. Air or gases in liquid. (Test in laboratory, reducing pressure on liquid to pressure in suction line. Watch for bubble formation.)</p> <p>26. Too small impeller diameter. (Probable cause if none of above.)</p>	<p>See item 5.</p> <p>See item 8.</p> <p>See items 15, 16 and 17.</p> <p>Dismantle pump and inspect passages of impeller and casing. Remove obstruction.</p> <p>May be possible to over rate pump to point where it will provide adequate pressure despite condition. Better to provide gas separation chamber on suction line near pump, and periodically exhaust accumulated gas. See item 14.</p> <p>See item 20.</p>
Pump Operates For Short Time, Then Stops	
<p>27. Incomplete priming.</p> <p>28. Suction lift too high.</p> <p>29. Air leaks in suction piping.</p> <p>30. Air leaks in stuffing box.</p> <p>31. Air or gases in liquid.</p>	<p>Free pump, piping and valves of all air. If high points in suction line prevent this, they need correcting. See page V.</p> <p>See item 3.</p> <p>See item 8.</p> <p>See item 9.</p> <p>See item 25.</p>

## SECTION V — Maintenance

### V-A GENERAL MAINTENANCE

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

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

### V-B MAINTENANCE OF PUMP DUE TO FLOOD DAMAGE

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

Bearings are a primary concern on pumping units. First, dismantle the bearings; clean and inspect them for any rusted or badly worn surfaces. If bearings are free from rust and wear, reassemble and relubricate them with one of the recommended pump lubricants. Depending on the length of time the pump has remained in the flooded area, it is unlikely that bearing replacement is necessary; however, in the event that rust or worn surfaces appear, it may be necessary to replace the bearings.

Next, inspect the stuffing box, and clean out any foreign matter that might clog the box. Packing that appears to be worn, or no longer regulates leakage properly should be replaced. Mechanical seals should be cleaned and thoroughly flushed.

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

Any pump that is properly sealed at all joints and connected to both the suction and discharge should exclude outside liquid. Therefore, it should not be necessary to go beyond the bearings, stuffing box, and coupling when servicing the pump.

### V-C BEARING LUBRICATION — GREASE

Grease lubricated ball bearings are packed with grease at the factory and ordinarily will require no attention before starting provided the pump has been stored in a clean, dry place prior to its first operation. The bearings should be watched the first hour or so after the pump has been started to see that they are operating properly.

The importance of proper lubrication cannot be over emphasized. It is difficult to say how often a bearing should be greased, since that depends on the conditions of operation. It is well to add one ounce of grease at regular intervals, but it is equally important to avoid adding too much grease. For average operating conditions, it is recommended that 1 oz. of grease be added at intervals of three to six months, and only clean grease be used. It is always best if unit can be stopped while grease is added to avoid overloading.

*NOTE: Excess grease is the most common cause of overheating.*

The bearing frame should be kept clean, since any contamination of foreign matter which gets into the housing will destroy bearings in a short time. When cleaning bearings, use a bearing cleaning solvent, or an industrial cleaning solvent. Do not use gasoline. Use lint free cloths. Do not use waste rags.

A regular ball bearing grease should be used, but a standard commercial vaseline can be substituted if necessary.

Do not use graphite. A No. 1 or 2 grease is generally satisfactory for operation at ordinary temperatures, the lighter grease for operation at high speed or low room temperature.

Mineral greases with a soda soap base are recommended. Grease made from animal or vegetable oils are not recommended due to the danger of deterioration and forming of acid. Most of the leading oil companies have special bearing greases which are satisfactory. For specific recommendations, consult the factory.

The maximum desirable operating temperature for ball bearings is 180°F. Should the temperature of the bearing frame rise above 180°F, the pump should be shut down to determine the cause.

Grease lubricated bearings should not be used where temperature of the pumped liquid exceeds 350°F.

## Packing

All pumps are packed before shipment, unless otherwise requested. All packings used are the highest grade material. Before pump is put into operation, check the condition of the packing. If pump is installed within 60 days after shipment, the packing will be in good condition with a sufficient supply of lubrication. If pump is stored for a longer period, it may be necessary to repack the stuffing box. In all cases, however, we recommend an inspection of the packing before pump is started.

## Fiber Packing

The standard packing is a soft, square asbestos, impregnated with oil and graphite. A soft well-lubricated packing reduces stuffing box resistance, and prevents excessive wear on the shaft or shaft sleeve. Many brands of packing on the market have the desired qualities. For specific recommendations, consult the factory.

When a pump with fiber packing is first started, it is advisable to have the packing slightly loose without causing an air leak. As pump runs in, gradually tighten the gland bolts evenly. The gland should never be drawn to the point where packing is compressed too tightly, and no leakage occurs. This will cause the packing to burn, score the shaft or shaft sleeve, and prevent liquid from circulating through the stuffing box, cooling the packing. The stuffing box is improperly packed or adjusted if friction in the box prevents turning the rotating element by hand. A properly operated packed stuffing box should run lukewarm with a slow drip of sealing liquid. After the pump has been in operation for some time and the packing has been completely run-in, drippage from the stuffing box should be at least 40 to 60 drops per minute. This will indicate proper packing and shaft sleeve lubrication and cooling.

*NOTE: Eccentric operation of the shaft, or sleeve, through the packing could result in excess leakage that cannot be compensated for. Correction of this defect is very important.*

Packing should be checked frequently and replaced as service indicates. Six months might be a reasonable expected life, depending on operating conditions. It is impossible to give any exact predictions. A packing tool may be used to remove all old packing from the stuffing box. Never reuse old and lifeless packing or merely add some new rings. Make sure that the stuffing box is thoroughly cleaned before new packing is installed. Also check the condition of the shaft or sleeve for possible scoring or eccentricity, making replacements where necessary.

New packing should be placed carefully into the stuffing box. If molded rings are used, the rings should be opened sideways, and the joints pushed into the stuffing box first. The rings are installed one at a time, each ring seated firmly, and the joints staggered so they are not in line. The joints should be kept toward the upper side of the shaft and should be at about a 90 degree angle from each preceding joint.

If coil packing is used, cut one ring to accurate size with either a butt or mitered joint. An accurately cut butt joint is superior to a poor fitting mitered joint. Fit the ring over the shaft to assure proper length. Then remove and cut all other rings to the first sample. When the rings are placed around the shaft, a tight joint should be formed. Place the first ring in the bottom of the stuffing box. Then install each succeeding ring, staggering the joints as described above, making sure each ring is firmly seated.

Make sure the seal cage is properly located in the stuffing box under the sealing water inlet. The function of the seal cage is to establish a liquid seal around the shaft, prevent leakage of air through the stuffing box, and lubricate the packing. If it is not properly located, it serves no purpose.

## V-E MECHANICAL SHAFT SEALS

### General

A mechanical shaft seal is supplied in place of a packed stuffing box where specifically requested. Mechanical seals are preferred over packing on some applications because of better sealing qualities and longer serviceability. Leakage is eliminated when a seal is properly installed, and normally the life of the seal is much greater than that of packing on similar applications.

General instructions for operation of the various mechanical sealing arrangements are included below. It is not feasible to include detailed instructions for all mechanical seals in this booklet because of the almost unlimited number of possible combinations and arrangements. Instead, seal manufacturer's instructions will be included as a separate supplement to this book where required.

1. Mechanical seals are precision products and should be treated with care. Use special care when handling seals. Clean oil and clean parts are essential to prevent scratching the finely lapped sealing faces. Even light scratches on these faces could result in leaky seals.

V.G MAINTENANCE TIME TABLE

<p>Every Month</p>	<p>Check bearing temperature with a thermometer, not by hand. If bearings are running hot (over 180°), it may be the result of too much lubricant. If changing the lubricant does not correct the condition, disassemble and inspect the bearings.</p>
<p>Every 3 Months</p>	<p>Check grease lubricated bearings for saponification. This condition is usually incurred by the infiltration of water or other fluid past the bearing shaft seals and can be noticed immediately upon inspection, since it gives the grease a whitish color. Wash out the bearings with a clean industrial solvent and replace the grease with the proper type as recommended.</p>
<p>Every 6 Months</p>	<p>Check the packing and replace if necessary. Use the grade recommended. Be sure the seal cages are centered in the stuffing box at the entrance of the stuffing box piping connection.</p> <p>Check shaft or shaft sleeve for scoring. Scoring accelerates packing wear.</p> <p>Check alignment of pump and motor. Shim up units if necessary. If misalignment recurs frequently, inspect the entire piping system. Unbolt piping at suction and discharge flanges to see if it springs away, thereby indicating strain on the casing. Inspect all piping supports for soundness and effective support of load.</p>
<p>Every Year</p>	<p>Remove the rotating element. Inspect thoroughly for wear, and order replacement parts if necessary.</p> <p>Check wearing clearances.</p> <p>Remove any deposit or scaling. Clean out stuffing box piping.</p> <p>Measure total dynamic suction and discharge head as a test of pipe connection. Record the figures and compare them with the figures of the last test. This is important especially where the fluid being pumped tends to form a deposit on internal surfaces. Inspect foot valves and check valves, especially the check valve which safeguards against water hammer when the pump stops. A faulty foot or check valve will reflect also in poor performance of the pump while in operation.</p>



## Temporary Storage Of Equipment

**ITT A-C Pump**  
A unit of ITT Corporation

This procedure applies to horizontal and vertical dry pit pumps only for storage of one month or less. For longer periods, refer to Form No. 5621-0085, Long Term Storage. Outside purchased accessories such as motors, steam turbines, gears, etc. must be handled in accordance with the respective manufacturer's recommendations.

### 1. CONSIDER A UNIT IN STORAGE WHEN:

- a) It has been delivered to the jobsite and is awaiting installation.
- b) It has been installed, but operation is delayed pending completion of planned construction.
- c) There are long periods (30 days) between operation cycles.
- d) The plant or department is shut down.

### 2. OIL LUBE FRAMES

Storage requirements vary depending on length of storage and the climatic environment.

If the equipment is not to be installed and operated soon after arrival, store in a clean, dry, well ventilated place; free from vibration and rapid or wide variations in temperatures.

On all rotating equipment, rotate the shaft several revolutions every week to coat the bearings with lubricant, retard oxidation or corrosion and prevent possible brinelling. Shaft extensions and other exposed machine surfaces should be coated with an easily removable rust preventative such as Tectyl No. 502C, Valvoline Oil Company, Division of Ashland Petroleum Company.

NOTE: Oil lubricated pumps are shipped without lubricant. Fill the frame completely with oil. Before putting equipment into operation, drain the oil to proper level on sight gauge.

### 3. GREASE LUBE FRAMES

Storage requirements vary depending on length of storage and the climatic environment.

If the equipment is not to be installed and operated soon after arrival, store in a clean, dry, well ventilated place, free from vibration and rapid or wide variations in temperatures.

On all rotating equipment, rotate the shaft several revolutions every week to coat the bearings with lubricant, retard oxidation or corrosion and prevent possible brinelling. Shaft extensions and other exposed machine surfaces should be coated with an easily removable rust preventative such as Tectyl No. 502C, Valvoline Oil Company, Division of Ashland Petroleum Company.



The following procedure applies to horizontal and vertical dry pit pumps only. Outside purchased accessories such as motors, steam turbines, gears, etc. must be handled in accordance with the respective manufacturer's recommendations.

Storage longer than one month is considered long term storage.

Pumps should be prepared for storage using the following procedure.

## 1. BEARING FRAMES

### A. Oil Lubrication:

Pumps with oil lubrication are shipped from the factory without oil in the bearing frame.

Two methods may be used to prepare these frames for storage:

- 1) Fill the bearing frame full with a lubricating oil containing a rust preventative such as Mobilarna 500 Series oil. If this oil is to be used for initial operation of the equipment, care should be taken to select an oil suited to the intended operating temperature of the pump. Check the supplier's technical data and the pump instruction book for this information.
- 2) Fill the bearing frame to the proper level using the oil sight glass. Use the correct oil specified in the instruction book (Mobile DTE Medium or equal). Then add 1/2 ounce of a corrosion inhibiting concentrated oil such as Cortec's VCI-329.

For both methods, seal all vents and apply a waterproof tape around the oil seals in the bearing frames.

Method #1 is recommended for oil lubricated 9000 Series and S Series pumps. Method #2 is recommended for all other oil lubricated pumps as the least cost method.

**CAUTION:** Prior to using, drain all oil from the frame in case any moisture has accumulated. Then refill to proper level using the correct oil specified in the instruction book.

### B. Grease Lubrication:

Pumps are shipped from the factory with the bearings pre-greased and should require no further lubrication.

It is recommended, however, that if the pumps are to be stored in a humid environment or outside, add 1/2 ounce of corrosion inhibiting concentrated oil such as Cortec's VCI-329 to the frame. Seal all vents and apply a waterproof tape around the grease seals in the bearing frame.

## 2. STUFFING BOX

### A. Packing:

Remove gland, lantern ring, packing base ring (if applied), and packing from stuffing box. If the packing is in good condition, it may be saved; otherwise, it should be discarded. Thoroughly clean and dry interior of the stuffing box and shaft sleeve. Coat all interior parts of the stuffing box, except for stainless materials with a soft film rust preventative such as Valvoline TECTYL 502C or Cortec's VCI-369.



Seal end of stuff box with waterproof tape.

**NOTE:** This tape will have to be removed and replaced when the shaft is rotated.

Store gland, packing base ring, packing and lantern ring until pump is ready to be put into service.

### B. Mechanical Seal and Dynamic Seal

#### 1) Double Face Seal:

Open uppermost flushing tap on stuffing box and fill cavity with a lightweight (#10-#20) rust preventative oil such as Mobilama 500 (see note).

#### 2) Single Face Seal and Dynamic Seals

Remove flushing water plug to stuffing box and spray an oil base volatile corrosion inhibitor such as Cortec's VCI-329 into the stuffing box cavity. Be sure to coat as much of the interior of the cavity as possible.

The above procedures are not required if the seal box is of a stainless material.

For both types of mechanical seals, regardless of material, seal all vent and drain lines. Seal the point where the shaft exits the box using waterproof tape. **NOTE:** This tape will have to be removed and replaced when the shaft is rotated.

**NOTE:** The majority of mechanical seals provided have elastomer materials made of Buna-N, Neoprene, or Viton which are not affected by hydrocarbon based lubricants. If your pump has seals with materials other than the above, it will be necessary to check the compatibility of that material with the manufacturer of the rust preventative used.

### 3. FINAL PREPARATION - PUMPS OF NON-STAINLESS MATERIALS

Coat all exposed machined surfaces (flanges, faces, shafts, exposed locating fits, etc.) with a firm rust preventative such as Valvoline TECTYLE 890. Place a volatile corrosion inhibitor device in the pump casing such as Cortec's VCI 309, 101, or 110, depending on the pump size and application.

**WARNING:** For potable water, food, beverage, etc. pumps, the corrosion inhibitor must be non-toxic.  
**FAILURE TO FOLLOW INSTRUCTIONS COULD RESULT IN INJURY OR DEATH.**

Regardless of material, cement rubber diaphragm flange covers over the suction and discharge flanges. Protect these rubber diaphragm covers with hardboard material. Make sure all vents, drains, or plugs are tightly sealed.

The pump is now ready to be placed in storage.

**NOTE:** Storage locations that are near a source of vibration such as railroad or truck traffic, heavy machinery, or impacting machinery must be avoided to prevent false brinelling of the pump bearings.

### 4. INDOOR STORAGE

Little extra preparation is needed if indoor storage area is dry and clean. Care should be taken to



prevent extremes in temperature (below 32°F and above 110°F). Also, keep the pump out of direct sunlight and covered to protect it from dust and dirt. Care should be taken to prevent moisture build-up around the pump, either by allowing proper ventilation or tightly sealing the pump in the cover with a suitable amount of desiccant to ensure dryness.

If indoor storage area is humid or dirty, such as an unfinished building, treat the pump as if it were to be stored outdoors.

## 5. OUTDOOR STORAGE

Pump should be covered to protect it from weather and direct sunlight. All coverings should be properly secured to withstand high wind. Care must be exercised in covering pumps to prevent moisture build-up under the cover. This can be done either by allowing proper ventilation or tightly sealing cover with suitable amount of desiccant to ensure dryness.

Extreme heat and cold are to be avoided, as rubber parts and seals could age prematurely (below 32°F and above 110°F).

## 6. INSTALLED BUT NOT IN SERVICE

Preparation for storage under these conditions is the same as for indoor and outdoor, except the suction and discharge piping will serve as flange covers.

The suction and discharge valves must be tightly closed and all water removed from the pump and attached piping. The interior of the pump and piping must be thoroughly dried.

## 7. MAINTENANCE

### A. Indoor:

The only maintenance required will be to rotate the pump shaft 10-15 times twice a month. This operation is to recoat the bearings with grease or oil and to prevent false brinelling. Be sure the shaft comes to rest in different positions.

Preparations procedures should be repeated every 12 months.

### B. Outdoor:

Storage area should be inspected weekly, and after storms, for damage to protective covers. Shafts should be rotated 10-15 turns three times a month.

Preparation procedure should be repeated every six months for normal environments, and every two months for corrosive environments (such as salt air).

## 8. INSTALLED, NOT OPERATING

Follow same procedures as for indoor storage, except inspect the casing area once a month for moisture build-up, replacing volatile corrosion inhibitor at that time.



## 9. PREPARATION FOR OPERATION

- a. Remove all rust inhibitor from exposed machined surfaces using the method described by the supplier.
- b. Remove all corrosion protection devices or material from pump casing.
- c. If the pump has packing, repack pump using the method described in the instruction book.
- d. If the pump has mechanical seals, drain protective oil from seal cavity. Flush cavity with clean water or seal lubricant for five minutes before start-up.
- e. Remove flange covers, tape, and all unnecessary pipe plugs.
- f. Oil lubricated frames.

Drain rust preventative oil from frames and replace with fresh oil. Note some rust preventative oils such as the Mobilarna 500 can be used in the bearing frame for start-up and initial running. Check the supplier's technical data and the pump instruction book to ensure the oil used is of suitable viscosity and grade for the intended application. If this is the case, drain the oil from the bearing frame to the level indicated on the sight gauge. When the oil used to protect the bearing frame is used to run the pump on start-up, this oil should be changed initially at half the recommended time for oil changes (see instruction manual). Remove tape from breather and seals.

- g. Grease lubricated frames.

No special methods are required to prepare for start-up. The corrosion inhibitor oil can be left in the frame. Remove tape from breather and seals.

If the pumps are started with the factory supplied grease, it is recommended that they be re-greased initially at half the recommended grease interval.

## 10. MANUFACTURERS OF RECOMMENDED PRODUCTS:

- a. The Cortec Corporation  
310 Chester Street  
St. Paul, MN 55107
- b. Valvoline Oil Company  
Division of Ashland Petroleum Company  
Contact Local Sales Officer or Ashland, Kentucky
- c. Mobile Oil Corporation  
Contact Local Sales Office