INSTRUCTIONS FOR INSTALLATION, OPERATION, MAINTENANCE AND LIST OF PARTS FOR

UNB PUMPS

MEMBER

HYDRAULIC INSTITUTE U.S.A.

WORTHINGTON

2131-E1D

FOREWORD

Worthington products are the result of more than a century of progressive study and development. Advanced design, proper selection of materials, and precision construction reflect this wide experience. Worthington products will give trouble-free efficient operation with minimum maintenance and repair.

This instruction book will familiarize management and operating personnel with pertinent details and proper procedures for the installation, operation, and maintenance of one of these products.

Designate below your identification of the equipment for which this book applies.

Unit Size	Identification No.

WARNING

Do not operate this equipment in excess of its rated capacity, speed, pressure and temperature, nor otherwise than in accordance with the instructions contained in this manual. This equipment (or a prototype) has been shop tested and found satisfactory for the conditions for which it was sold, but its operation in excess of these conditions will subject it to stresses and strains which it was not designed to withstand.

Failure to heed this warning may result in an accident causing personal injury.

STUDY THIS INSTRUCTION BOOK

The descriptions and instructions included in this book cover the standard design of the equipment and any common deviations when possible. This book does not cover all design details and variations nor does it provide for every possible contingency which may be encountered. When information cannot be found in this book, contact the nearest Worthington Sales Office.

TABLE OF CONTENTS

SECTION I

INTRODUCTION AND GENERAL DESCRIPTION

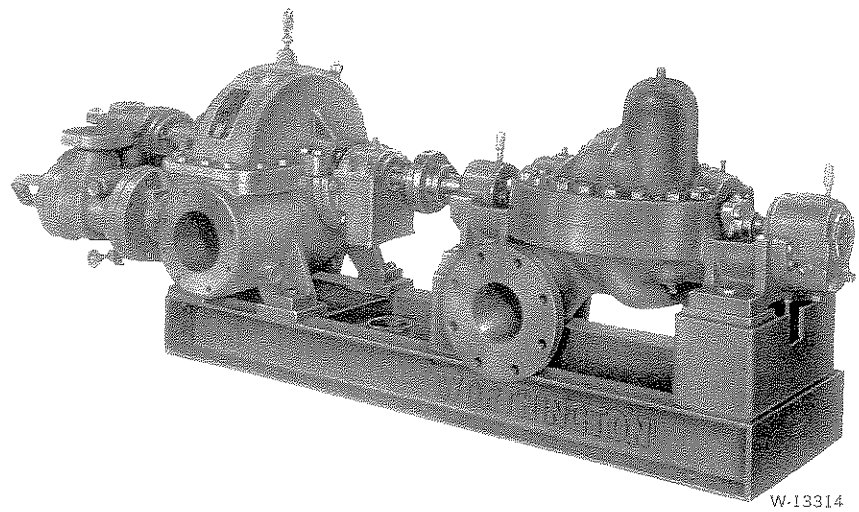
INTRODUCTION

The Worthington type UNB pumps are basically designed for low pressure boiler feed service and are adaptable to other services requiring two-stage centrifugal pumps.

Standard fitted pumps with cast iron casings and bronze impellers and trim are suitable for general service and low temperature boiler feed service up to 250F. For temperatures over 250F stainless steel fittings and water-cooled stuffing boxes are used.

Elastic seal rings are used on both the wearing rings and the center diaphragm. The prime purpose of the seal rings is to prevent interstage leakage and wear at the fitted joints in the casing. They are guarded to prevent their being disturbed during assembly of the casing upper half to the lower half.

All UNB pumps are provided with necessary vents, drain connections, pin and buffer couplings, and baseplates for either motor or turbine drive.

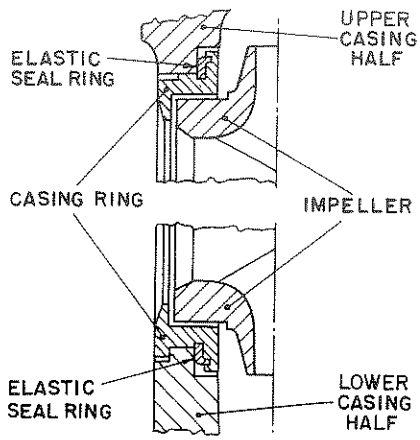


W-13314

Fig. 1—Type UNB Pump with Steam Turbine Drive—Sectional Drawing and Parts List on page 19

CASING

The volute type casing is horizontally split with the suction and discharge nozzles cast integral with the lower casing half to provide easy access for inspection or repair of the rotor. The interstage liquid passage is an integral part of the casing.



SK-163019

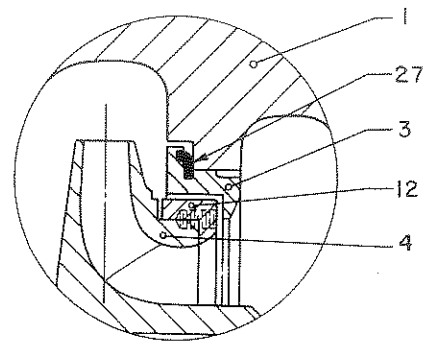
Fig. 2—Casing Ring Arrangement

IMPELLERS AND CASING RINGS

The impellers are of the single-suction closed type. They are arranged back-to-back to produce hydraulic balance at all capacities.

The UNB pumps are provided with elastic sealed casing rings as standard construction. These rings are carefully fitted to the casing to eliminate leakage at the ring joint. Ring rotation is prevented by a flange in the lower half of the ring.

Alternate ring construction with rings mounted on the impeller as well as in the casing can be furnished upon request.



REF. NO.	NO. OF PCS.	NAME OF PART
1	1	CASING
3	2	CASING RING
4	1	IMPELLER
12	2	IMPELLER RING
27	1	ELASTIC SEAL RING

SK-163010

Fig. 3—Alternate Ring Arrangement

SHAFT AND SHAFT SLEEVES

The pump shaft is carefully designed and machined to insure rigid support for the impellers. The shaft is protected at the stuffing box with removable sleeves keyed to the shaft and held in axial position with shaft sleeve nuts. The shaft nuts, in turn, are locked to the shaft with a nylon ring. The sleeves are recessed and fitted with "O" rings to prevent leakage along the shaft. A groove is machined into each shaft sleeve to permit the use of a pulling device when removal becomes necessary.

STUFFING BOXES

The stuffing box seals the pump against leakage along the shaft at the point where it passes through the casing. It should be packed with rings of braided, graphited asbestos packing and a split seal cage. A bronze split packing gland is provided. The stuffing box is not packed when the pump is shipped.

The suction-end stuffing box is provided with a seal cage and a connection for water sealing, the seal cage being used for cold water service only when the suction pressure is less than 15 psi. If the pump handles clean, cold water, the sealing water may be taken from the pump dis-

charge providing a pressure reducing device is installed in the sealing water line.

Independent sealing is used when the liquid pumped cannot be used to seal the stuffing box. Independent sealing should be provided from a supply of clean liquid at a positive pressure slightly higher than the pump suction pressure.

The stuffing box on the discharge side of the pump is under first stage pressure and requires no water seal.

Solid glands are provided as standard construction. Split smothering glands may be provided when specifically requested.

Water-Cooled Type—The UNB pump may be supplied with separately bolted-on water-cooled stuffing boxes for high temperature service or to comply with customer requirements.

SMOTHERING GLANDS

Split type smothering glands are used to prevent steam or vapor from escaping from the stuffing boxes into the atmosphere when a pump is used for hot water service. Cold water is fed into the top of the gland to condense the steam or vapor. The water escapes by gravity through an opening in the bottom of the gland.

Smothering glands may be purchased as a repair part (for pumps having solid glands) should they be required at a later date.

BEARINGS

The UNB pump is equipped with heavy duty, externally mounted anti-friction bearings arranged for oil lubrication.

The outboard or thrust bearing is a double row combined thrust and line bearing mounted back-to-back. It has a shrink fit on the shaft and is secured axially with a bearing nut and lockwasher. The outer races are contained between a shoulder in the bearing housing and a spigot on the thrust bearing cover to prevent end movement. All expansion due to heat is directed away from the thrust bearing. The lubricating oil reservoir is water cooled.

The inboard or line bearing also has a shrink fit on the shaft and is of the single row anti-friction type. Clearance in the bearing housing allows

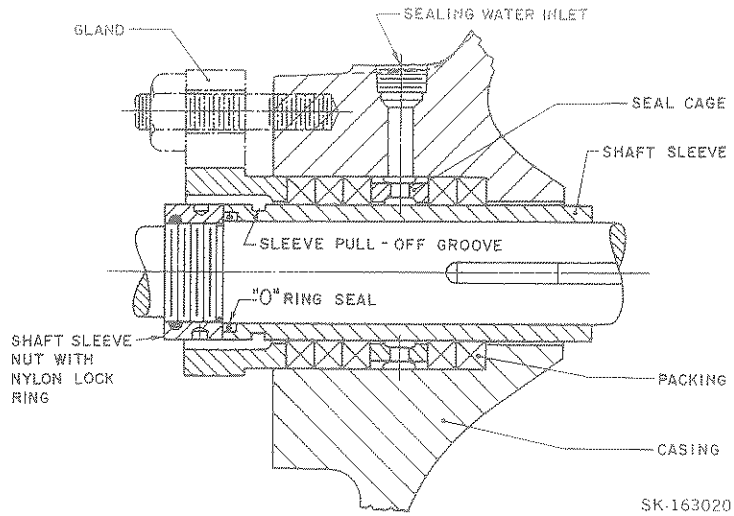


Fig. 4—Standard Stuffing Box Arrangement (Suction-End)

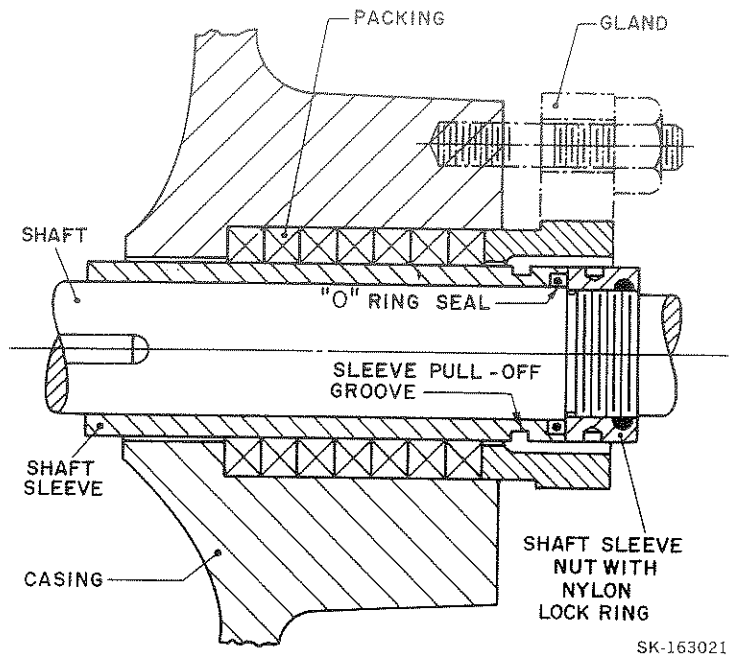


Fig. 5—Standard Stuffing Box Arrangement (Discharge-End)

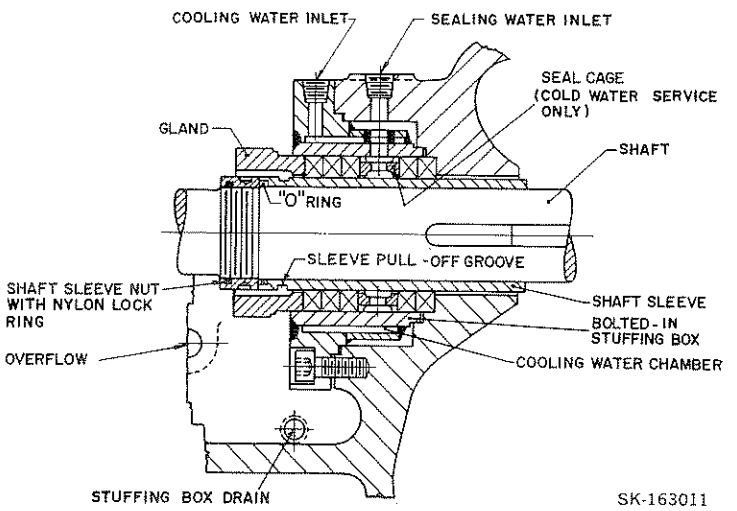


Fig. 6—Water-Cooled Stuffing Box

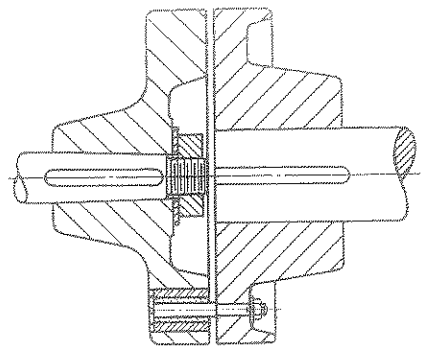
the outer race to move axially to prevent shaft bending or binding of internal parts as a result of axial shaft expansion due to heat. Slight rotation of the outer race in the housing is actually beneficial in extending bearing life should it occur. Since the single row anti-friction bearing runs cooler than the thrust bearing, no water jacket is provided in the housing.

COUPLINGS

A flexible pin and buffer coupling is standard for connecting pump and driver shafts for 2-inch, 2½-inch, and 6-inch UNB pumps only. The 3-inch, 4-inch, and 5-inch UNB pumps are supplied with all-metal flexible couplings.

The pin and buffer coupling is made up of two flanged hubs. Coupling pins are mounted in one half of the coupling, and bronze or steel bushed buffers are mounted in the mating half. The coupling pins are long enough to engage the metal bushing in the buffers when the coupling halves are properly spaced. The buffers are made of rubber to give flexibility and to compensate for shock. The driving pins have a sliding fit in the bushings to allow slight longitudinal movement.

When specifically requested, a spacer type coupling may be supplied to facilitate dismantling. For operating instructions for all-metal or spacer couplings, if supplied, refer to manufacturer's instructions.



SK-161952

Fig. 7—Pin and Buffer Coupling

For information on a limited-end-float coupling arrangement refer to the alignment procedure for sleeve bearing motors.

SECTION II

PRE-INSTALLATION

INSPECTION OF EQUIPMENT

Immediately on receipt of the equipment, inspect and check it against the shipping manifest. Examine the crates and wrappings before discarding them. Parts or accessories are sometimes wrapped individually or fastened to the crate. Report any damage or shortage to the transportation company's local agent.

STORAGE

Short Term Storage—When it is necessary to store a pump for a short time before it can be installed, place it in a dry location and protect it thoroughly against moisture. When protecting flanges are bolted to the suction and discharge nozzles at the factory, they should not be removed. Protect the bearings and couplings against the entry of sand, grit, or other foreign matter. Be sure there is no packing in the stuffing boxes.

To prevent rusting of the bearings, lubricate the unit according to the instructions under "Lubrication," Section V. Turn the rotor over by hand several times at least once a week to prevent rusting-in or seizing of running joints and to lubricate the bearings.

Long Term Storage: Long term storage in excess of 30 days is not recommended. However, if long term storage is unavoidable, more thorough precautions are required. Check the stuffing boxes to insure that they contain no packing which could cause corrosion of internal parts due to condensation. Since the stuffing box sleeves are usually made of stainless steel, the graphite in the packing (cold water service) in conjunction with a film of moisture can cause electrolytic action to occur which would result in pitting of the sleeves—this action does not occur under normal pump operation.

The removal of the packing will not eliminate condensation inside of the pump completely; therefore, it is recommended that the internal parts of the pump be given further protection by flushing the pump with a solution of 25 parts of water to 1 part of a water soluble oil (Special Mul as manufactured by the Dubois Co. or equal). It is suggested that the flushing be accomplished by blanking-off the suction and discharge flanges and then pouring the rust preventative solution into the vent holes at the top of the casing until the fluid appears at the stuffing box openings. Turn the rotor by hand to insure that the solution gets into all running joints. The protective fluid should then be drained from the casing by opening the lowermost drain holes in the bottom half of the casing. The coating formed by the protective fluid will protect internal parts against corrosion for a period of 3 months. **Do not dismantle the pump to apply protective coatings to internal parts.**

If storage is to exceed three months, the above procedure should be repeated at the end of the 90 day period since condensation will eventually wash away the protective coating.

As in the case of short term storage, the pump should also be lubricated, and the rotor should be turned over several times at least once a week.

CLEANING PRIOR TO INSTALLATION

If the pump has been flushed with rust preventative, it should be reflushed thoroughly with clean water at least twice before installation. Drain the oil from the bearing housings and relubricate according to lubrication instructions.

SECTION III

INSTALLATION

LOCATION OF EQUIPMENT

The pump should be placed so that it is easily accessible for inspection during operation while giving due attention to the desirability of simplifying the suction and discharge piping layout. The pump should always be located as near as possible to the suction source to keep suction losses and lift, if any, at a minimum. There should be ample head room to allow the use of an overhead crane or other lifting device with sufficient capacity to lift the heaviest part of the unit.

FOUNDATION

The foundation may consist of any material that will afford permanent, rigid support to the full area of the pump or driver supporting member and that will absorb expected strains and shocks that may be encountered in service.

Concrete foundations should be built on solid ground. Foundation bolts of the specified size should be located according to the elevation drawing. Each bolt should be surrounded by a pipe sleeve 2 to 3 times the diameter of the bolt. The sleeves should be held rigidly yet allowing the bolts to be moved to conform with the holes in the baseplate.

When the pump unit is mounted directly on structural steel framing, it should be located directly over or as near as possible to the main building members, beams, or walls. The baseplate should be bolted and doweled to the steel supports to avoid distortion, prevent vibration, and retain proper alignment.

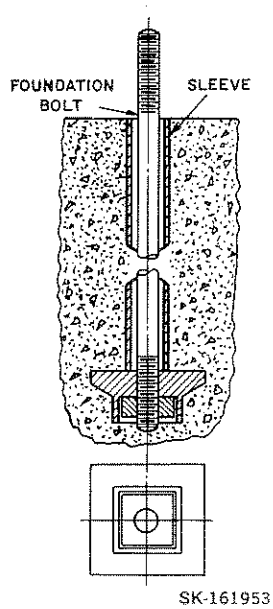


Fig. 8—Foundation Bolt

ALIGNMENT

All units are aligned at the factory. The baseplate is supported on an even surface and leveled by using the machined surfaces of the pads for the driver and pump supporting feet. The pump and driver are mounted on the base and are carefully aligned.

All bases are flexible and are subjected to strains during shipment. Therefore, it is necessary that all units be realigned in the field. Accurate alignment of pump and driver shafts is essential to successful operation regardless of the type of coupling used.

IMPORTANT — Alignment must be checked after a pump has been completely piped-up.

A flexible coupling is used to compensate for slight changes in alignment which occur during normal operation and is not used to correct for angularity.

NOTE: Coupling bolts must be left out of the coupling until after a final alignment check has been made prior to starting the unit.

To align the pump proceed as follows:

1. Disconnect the coupling halves by removing the coupling bolts. See the manufacturer's instructions if the coupling is other than the pin and buffer type.

2. Using wedges and shims under the baseplate at each foundation bolt, level the pump and driver mounting pads in both directions. Check to make sure that the suction and discharge flanges are level and plumb and at the proper elevation. Tighten the foundation bolts and pump hold down bolts.

3. Check the gap between the coupling halves (or coupling hubs where appropriate) against the dimensions shown on the elevation drawing or as stamped on the coupling hub. For any necessary adjustment move the driver rather than the pump.

NOTE: In the case of sleeve-bearing motors with no provision for limiting end float, the gap should be checked with the rotor at magnetic center. To locate magnetic center either run the motor uncoupled or take one half of the total end-float-travel of the rotor. Mark the shaft and clamp it at the motor frame to prevent axial movement. Move the motor as a unit until the necessary gap is realized.

Motors with sleeve bearings may be manufactured with ¼ or ½-inch movement or float in the motor rotor. For limited-end-float arrangement the gap between coupling halves must be set in a different manner. A gear type coupling having a limited-end-float arrangement is used since at higher speeds and horsepowers the lateral frictional force on the coupling gear teeth becomes greater than the axial force exerted by the motor as it seeks magnetic center. If the motor were to start with the shoulder of the motor rotor shaft against the end of the inboard or outboard motor sleeve bearing, the motor rotor would not be able to move away from the bearing. The bearing would burn out very quickly due to end friction. To properly set the coupling gap with a limited-end-float arrangement the following procedure must be observed:

a. Slide the motor rotor toward the outboard end of the motor as far as it will go and mark the shaft at the motor frame.

b. Next, slide the motor rotor toward the inboard end of the motor as far as it will go and mark the shaft again. The distance between marks should be either ¼ or ½-inch if the motor is arranged for limited-end-float travel.

c. Scribe a third mark on the motor shaft 1/32 inch for ¼-inch end float and ⅛ inch for ½-inch end float from the mark scribed on the shaft in step b (toward the coupling).

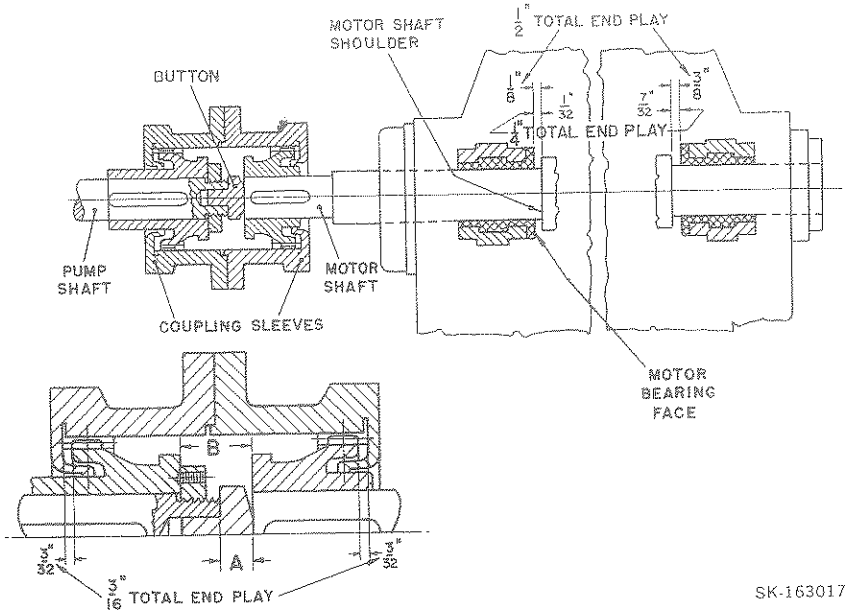


Fig. 9—Arrangement For Limiting Motor-End-Float

d. Slide the motor rotor toward the outboard end of the motor either 1/32 or 1/8-inch or until the last mark scribed on the shaft lines up with the motor frame.

e. The motor shaft should now be locked and clamped in position to prevent axial movement.

f. Move the motor as a unit toward the pump until the end of the motor shaft butts up against the button in the end of the pump shaft (see Figure 9). The distance from the end of the pump shaft to the top of the button has been predetermined by Worthington Corporation and will control the gap to be left between coupling halves.

4. Check angular and parallel alignment of coupling halves using a dial indicator and a feeler gauge. The dial indicator should be mounted on the pump-half-coupling with the probe resting on the outer diameter of the driver coupling. Rotate the pump shaft and take readings at every quarter turn to check parallel alignment.

For angular alignment rotate both the pump and motor shafts together and take feeler gauge readings at 90 degree intervals around the coupling. Move and shim the driver until all angular check readings are within 0.001 and all parallel readings are within 0.002.

IMPORTANT — Compensation for change in vertical elevation of the centerline of the pump shaft must be made if the pump is to handle hot liquid. Similarly, if the pump is to handle cool liquid but is to be driven by a steam turbine, compensation must be made for change in the vertical elevation of the turbine shaft. In the case where a steam turbine is to drive a pump handling hot liquid, compensation must be allowed in a vertical direction for the change in shaft elevation of the hotter of the two units.

5. Bolt the driver securely to the base and recheck alignment as in step 4.

6. Grout the baseplate to the foundation (refer to "Grouting").

7.—A. If the pump is to handle cool liquids, providing the driver is not a steam turbine, drill, ream, and dowel the pump and driver feet to the baseplate and recheck alignment as in

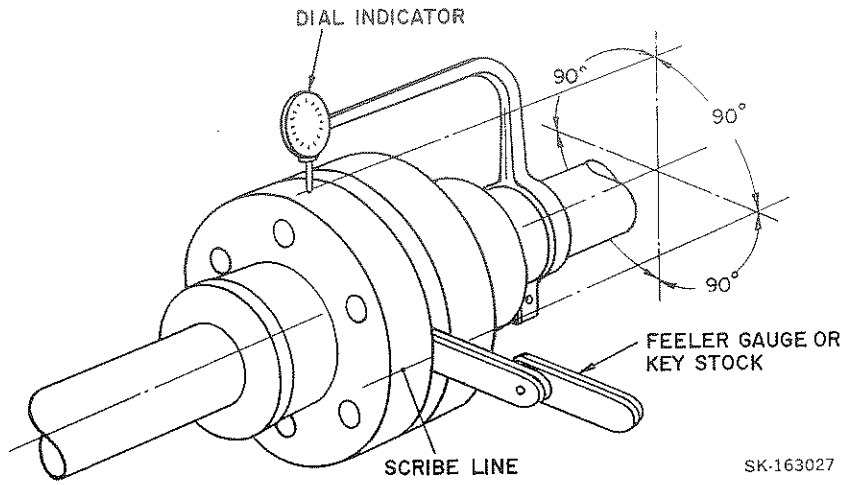


Fig: 10a—Method for Checking Angular and Parallel Alignment—Pin and Buffer Type Coupling

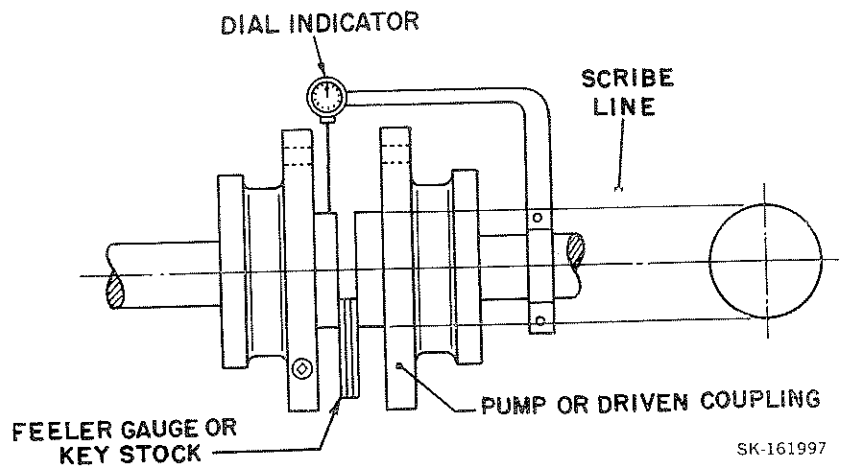


Fig. 10b—Method for Checking Angular and Parallel Alignment—Gear Type Coupling

step 4. Dowels should be located only at the coupling end of both the pump and driver feet.

7.—B. If the pump is to handle hot liquids or if the driver is a steam turbine, all piping should be installed and the pump or driver or both should be brought up to temperature prior to doweling and a final alignment check.

The pump may be started cold and gradually brought up to temperature without damage to the pump if reasonable temperature allowances have been made in the initial alignment. If the driver is a steam turbine, refer to the turbine instruction book for information relative to alignment and start-up procedures. Refer to Section IV.

If no further adjustments are necessary after the unit has been brought up to temperature, drill, ream, and dowel the pump and driver feet to the baseplate at the coupling end only. Recheck alignment as in step 4.

NOTE: If the pump is a stand-by unit for hot water service, refer to page 10 and Fig. 14 for the piping arrangement suggested for preheating the pump to approximate operating temperature to eliminate the need of initially starting the pump on the line in a cold condition.

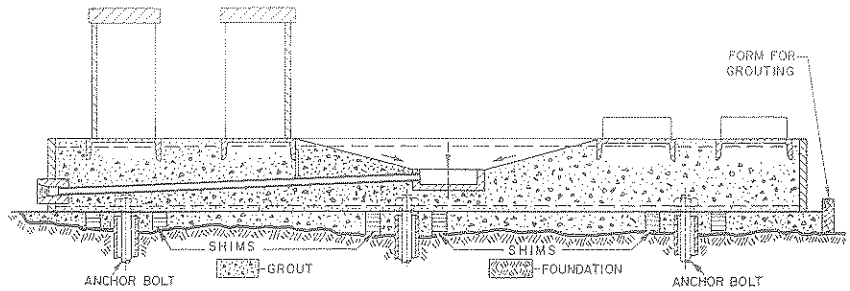
GROUTING

The purpose of grouting is to prevent lateral shifting of the baseplate, not to take up irregularities in the foundation. We recommend the following procedure:

The typical mixture for grouting-in a pump base is composed of one part pure portland cement and two parts building sand with sufficient water to cause the mixture to be worked freely under the base.

The top of the rough concrete foundation should be well saturated with water before grouting. A wooden form should be built around the outside of the baseplate to contain the grout. In some cases this form is placed tightly against the lower edge of the base, and in other cases it is placed a slight distance from the edge of the baseplate. Grout is added until the entire space under the base is filled.

The grout can be poured until it reaches its required level. Grout added into the section where the drain pocket is located should be poured to the level of the pocket, making certain that the pocket is plugged with paper or rags before pouring. Refer to Fig. 11 for final sloping and surface finishing. Slope may be started at any desirable point within the confines of the baseplate.



CUT THROUGH LONGITUDINAL CENTERLINE OF BASEPLATE SHOWING RECOMMENDED METHOD OF FILLING BASE WITH GROUT AND FOR LEVELING BASE.

SK-161970

Fig. 11—Placing Form for Grouting

After the grout is poured, the exposed surfaces should be covered with wet burlap to effect slow drying in order to prevent cracking. When the grout is set remove the forms and smooth the exposed surfaces, if desired.

Drain piping may be directed to the nearest sloped surface or directly to the drain pocket. All drainage will flow through the grout encased pipe from the pocket to the 1 in. pipe coupling connector at the pump end of the baseplate. The drainage can be picked up at this point and directed to a convenient disposal area.

If desired, the grout surface in the area of the drain pocket may be treated and painted to resist oil and grease. One accepted procedure for treating grout for receiving paint is to brush on a solution of muriatic acid and allow it to work. After the reaction is complete, wash the surface down with clean water and allow to dry before applying a good oil resistant paint.

SUCTION AND DISCHARGE PIPING

Piping Strains — Satisfactory operation cannot be maintained when piping imposes a force on the pump. Pumps can be sprung and pulled out of position by drawing up on the bolts in the piping flanges. Flanges must be brought squarely together before the bolts are tightened.

Suction and discharge pipes and associated equipment should be supported and anchored near but independent of the pump so that no strain will be transmitted to the pump casing. Pipe strains are a common cause of misalignment, hot bearings, worn couplings, and vibration.

In the case where the pump is to handle hot liquid, the suction and discharge piping must be firmly anchored as close as possible to the pump suction and discharge nozzles. It is recommended that if elbows are required next to the suction or discharge flanges, they should be of the base elbow type to permit firm anchorage and to allow pipe expansion to be transmitted away from the pump. Pipe supports at intermediate points on either the suction or discharge piping should allow for movement due to expansion.

It is recommended that after the piping has been bolted to the supports, the pump and piping be brought up to temperature. The pipe anchor bolts should then be loosened to permit lateral movement and then retightened. It is also recommended that base elbows or other fittings with support feet attached to the suction or discharge of the pump be doweled to their soleplates to insure no further pipe expansion after tightening of the bolts.

Suction Piping — Experience indicates that a major source of trouble in centrifugal pump installations other than misalignment is traceable to a faulty suction line. The utmost attention must be given to this portion of the installation. The suction piping should be as direct as possible and its length held to a minimum.

If a long suction line is required, increase the pipe size in order to reduce friction losses. The piping should be run without high spots to prevent air pockets which inevitably cause trouble. Use only eccentric reducers with the straight side on top.

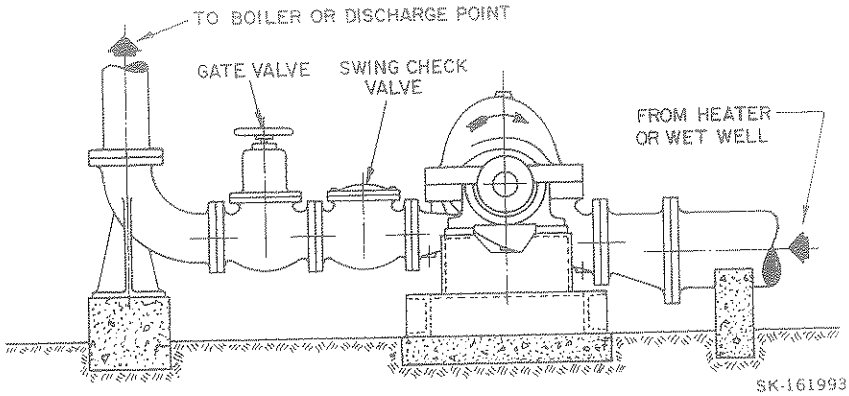


Fig. 12—Typical Piping Installation

Prior to start-up the suction piping should be blanked off and hydrostatically tested for air leaks and should be thoroughly flushed before connecting it to the pump.

It is recommended that a gate valve be installed in the suction pipe.

Strainers — It is recommended that a temporary strainer be placed in the suction pipe to prevent lodging of foreign material in the impellers and to prevent foreign matter from being pumped to the boiler on initial start-up on boiler feed service.

On cold water service a basket type strainer should be installed at the entrance to the suction pipe in the wet well to prevent lodgement of foreign material in the impellers if only occasional pieces of debris are to be expected.

NOTE: The net area of the strainer in either case should be three to four times the area of the suction pipe, the net area meaning the free and clear total opening area through the strainer.

If considerable foreign material is expected in the water or if it proves to be present in excess after start-up, a large fine or medium screen should

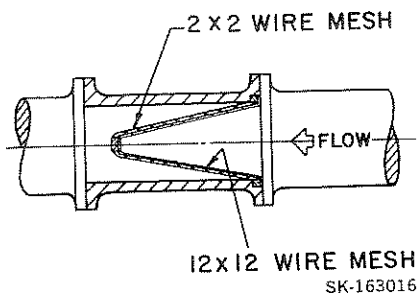


Fig. 13—Typical Temporary Suction Strainer

be placed at the entrance to the wet well. The size of the openings will depend on the character of the debris.

Discharge Piping — On many applications a check valve and a gate valve are required in the discharge line. The check valve, placed between the pump and the gate valve, is to protect the pump from any possible excessive back pressure or from reverse rotation caused by the liquid running back through the casing during driver or power failure.

On hot water application a gate valve in the discharge pipe plus other standard boiler controls which will depend on the design of the system may be required.

OTHER PIPING

Drain Piping — All drain and drip connections should be piped to a convenient disposal point.

Vent Piping — A casing vent is provided at the suction side of the first stage impeller for relieving or extracting vapors which would interfere with operation when the pump handles hot liquids. Usually this vent (if required) is piped back to the vessel from which the liquid is being extracted; but under special circumstances, the vent may be piped to another point in the system according to Worthington Corporation recommendations. All other casing vents necessary for priming and extracting air from the casing should be piped and valved.

Jacket Piping — All UNB pumps employ jacketed or cooled thrust bearings. When the pump handles hot liquid, make certain that independent cooling water piping is installed.

Preheating Piping — If a new pump is being installed as a stand-by unit or as a supplementary unit to be used only part time, the suction and discharge piping may be arranged as shown in Fig. 14 to keep the idle pump at or to bring the new pump up to operating temperature. It is recommended that in installations of two pumps the piping be arranged in the below manner so that it would never be necessary to put a cold pump on the line without first bringing it up to temperature should an emergency arise. It is recommended that valves before and after the by-pass orifices be left open to permit automatic switching of pumps.

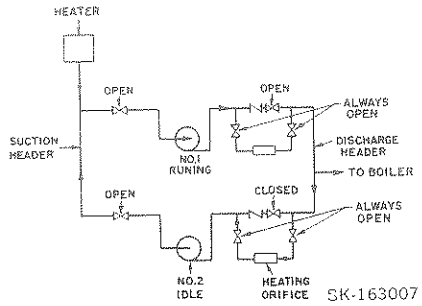


Fig. 14—Pre-Heating Arrangement of Stand-By Pump

By-Pass Piping — In order to safely operate a UNB pump at reduced capacity on boiler feed service the piping arrangement as shown in Fig. 15 is recommended. If such operation is contemplated, refer to your nearest Worthington Sales Office for specific recommendations for pipe size and pressure-reducing orifice dimensions.

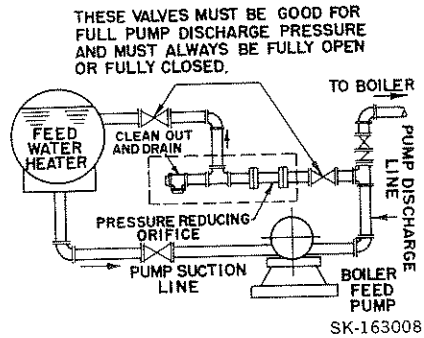


Fig. 15—By-Pass Arrangement

Instrumentation — Pressure gages should be connected to the suction and discharge of the pump. Use the pressure taps supplied in the suction and discharge flanges. Mount the gages at a convenient location as they are necessary for any adequate check on pump performance.

SECTION IV

OPERATION

The following procedures are presented to outline the most important steps involved in pump operation.

Any modifications of these procedures due to particular installation peculiarities should conform to good engineering practices.

SUCTION CONDITIONS

Sometimes the suction conditions imposed on a centrifugal pump are extremely unfavorable and lead to a complete breakdown of the operation of the pump. The suction head or pressure must be kept within the limitations for which the pump was sold. If the original operating conditions must be changed for any reason, consult your nearest Worthington Sales Office.

Care should also be exercised to keep the suction piping air tight and sealed against leakage. Refer to "Suction Piping," Section III.

PRIMING

CAUTION—Prime your pump before starting.

Priming a centrifugal pump means removing the air, gas, or vapor from the suction piping and pump casing.

Internal pump parts depending on liquid for lubrication may seize if the casing is not completely filled with liquid prior to starting.

Priming a pump can be accomplished by one of the following methods, depending on operating conditions:

A. Positive Suction Head (Pressure):

With a positive suction head on the pump priming is accomplished in the following manner:

a. Open all suction valves to allow liquid to enter the suction piping and pump casing.

b. Open all vent valves located on the highest points of the pump casing in order to release all entrapped air.

c. When liquid appears as a steady stream (no air bubbles) the pump is primed and may be started.

B. Negative Suction Head (Vacuum or Lift):

1. Priming by Ejector or Exhauster— When steam, high-pressure water, or compressed air is available, the pump may be primed by attaching an ejector to the highest venting point on the pump casing. Proceed as follows:

a. Open the suction valve.

b. Start the ejector in order to exhaust the air from the pump and suction line.

c. When the ejector waste pipe exhausts liquid continuously, the pump is primed and may be started.

d. In order to insure that the prime is not lost, allow the ejector to operate until the pump is started and is up to operating speed. A continuous stream of liquid will indicate that the prime is being held.

2. Maintaining a Prime by Foot Valve — A foot valve should be used at the lowest point on the suction line. The foot valve will retain liquid in the suction pipe and pump casing after the pump has been initially primed.

a. Fill the the suction pipe and casing with liquid from an independent source of supply.

b. Open the vent valves at the highest points on the casing to allow air to escape.

c. When liquid appears as a steady stream (no air bubbles) the pump is primed and may be started.

3. Priming by Vacuum Pump—Priming may be accomplished by the use of a wet type vacuum pump. The procedure is the same as priming by ejector.

STARTING AND OPERATING PUMPS

Preliminary Instructions — Test the driver for rotation with the coupling bolts removed. The arrow on the pump casing will show the correct rotation. Replace the coupling bolts. Lubricate the bearings. Refer to "Lubrication," Section V.

IMPORTANT: Be sure the stuffing box has been properly packed with the packing, supplied in a separate package with the pump.

Open the valves on the cooling water supply to the thrust bearing housing. Once the pump has been put into operation, the cooling water flow should be regulated to keep the lubricating oil temperature between 100 to 150F., preferably above 120F. Cooling water pressure must not exceed 75 psi.

The valves on the liquid supply line to the suction side stuffing box should now be opened. Also open the valves on the lines to the smothering glands, if provided, when the pump is to be used for hot water service. If water-cooled stuffing boxes have been supplied, also open the valves on these lines.

The pump should now be primed according to instructions given under "Priming." **Do not operate the pump**

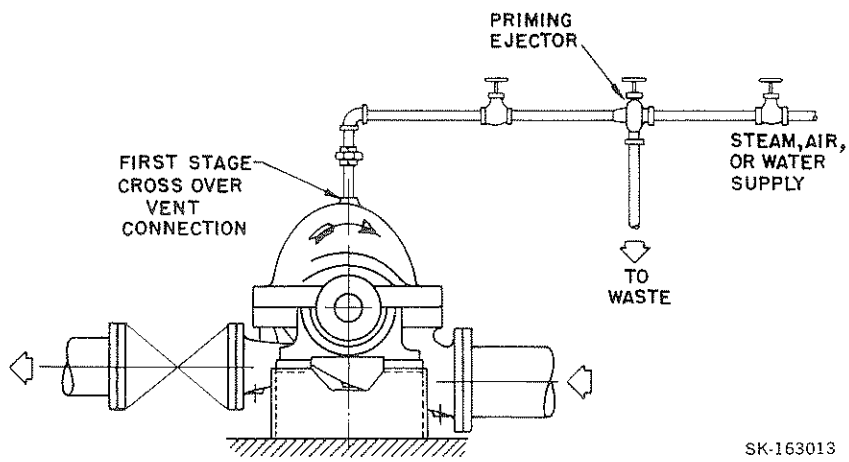


Fig. 16—Arrangement for Priming with an Ejector

unless it is primed as there is danger of damaging interior parts which depend on the pumped liquid for lubrication.

It must be possible to turn the rotor by hand whether the pump is cold or hot. If the rotor is bound, do not operate the pump until the cause of the trouble is found.

Starting Pumps—Turn the rotor several times by hand to lubricate the bearings.

Start the driver according to the driver manufacturer's instructions.

Open the discharge valve slowly as soon as the pump attains full speed.

During the routine operation of the pump, the bearings should be occasionally checked for temperature and proper lubrication.

The amount of valve opening on the liquid seal supply lines to the stuffing box must be controlled. The stuffing box glands should be adjusted to permit a slight seepage of liquid out of the stuffing box at all times during operation to prevent excessive wear of the shaft sleeves due to lack of lubrication.

Flow of water to the thrust bearing oil-cooling-jacket and to the smothering glands (if used) should also be regulated to give proper bearing oil temperatures and to properly smother vapor escaping from the stuffing box.

OPERATING AT LOW CAPACITY

Do not operate the UNB pump at low or reduced capacity on hot water service since overheating due to churning will result with ultimate damage to the pump. If reduced capacity operation is required on occasion, a permanent by-pass system should be installed according to Worthington Corporation recommendations. Refer to Fig. 15 and description on page 10.

The UNB pump usually can be operated at reduced capacity on cold water service for short periods of time without endangering the pump, providing all internal parts of the pump are in good condition.

STOPPING PUMPS

Normally, there should be a check valve in the discharge line close to the pump. In such cases the pump can be shut down by stopping the motor or driver according to the driver manufacturer's instructions. The remaining valves should then be closed in the following order: discharge, suction, cooling water supply, and other connections leading to the pump or system. If a preheating arrangement is used, refer to Fig. 14 for instructions on opening and closing valves to make the preheat system function.

In some installations, however, the use of a check valve is not feasible due to the creation of pressure surges or water hammer as a result of the sudden closing of the valve under high discharge pressure. In such cases the discharge valve should be closed slowly to eliminate the possibility of water hammer.

A pump will partly drain through the glands if left standing for some time. For this reason it is recommended that the pump always be primed before start-up.

SECTION V
LUBRICATION

OIL LUBRICATED ANTI-FRICTION BEARINGS

Oil used for lubricating ball or roller bearings should be a high quality, well refined mineral oil which will not readily oxidize or gum. Vegetable or animal oils should not be used as they tend to become rancid with the result that bearing surfaces will corrode. Oils must be clean and free of any abrasive matter.

Generally an SAE 10 or 20 oil should be used depending on the installation and severity of service. For abnormal conditions refer to a reputable lubricant supplier for proper recommendations.

It is important that the oil level be maintained. The proper level will be indicated by the setting of the oiler and will be shown on the elevation drawing previously submitted. An excessive level may create a high operating temperature and cause the oil to leak out along the shaft.

It is recommended that the lubricating oil be kept between a minimum of 100F. and a maximum of 150F., preferably above 120F.

Continuously rising temperatures or an abrupt temperature rise are indicative of trouble. These symptoms require immediate stopping of the pump and a thorough investigation to determine the cause of the trouble.

OIL CHANGE

Operating conditions and severity of service will determine the intervals

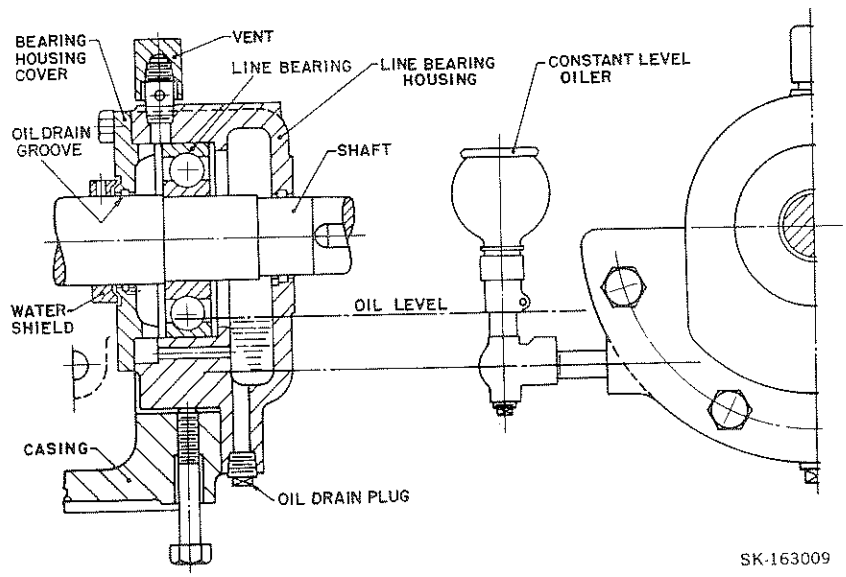


Fig. 17—Line Bearing and Oil Lubrication System

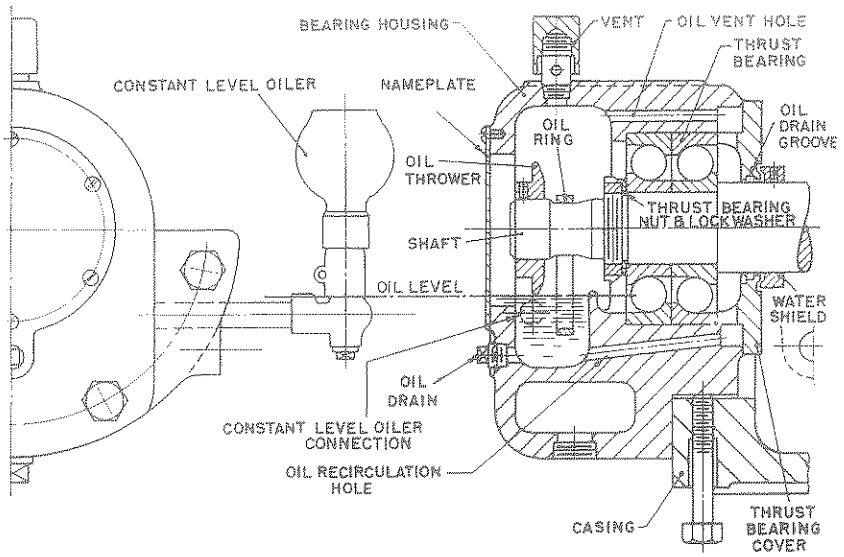


Fig. 18—Thrust Bearing and Oil Lubrication System

between oil changes. If the bearings maintain their normal temperature and there has been no contamination of the oil, the interval between changes may be prolonged. It is recommended that the oil be changed every six months. If the bearing temperature increases, check immediately for improper lubrication or a faulty bearing.

CONSTANT LEVEL OIL CONTROL

The constant level oil control maintains a constant level of oil in the bearing housing. The control feeds only enough oil to maintain the required level in the bearing housing. As long as oil is visible in the glass bottle, additional oil need not be added.

The control operates on the liquid seal principal, feeding only when the level in the bearing housing is low enough to break the liquid seal at the end of the shank thus permitting air to enter the bottle. It will not feed as long as oil covers the hole in end of shank.

To adjust the constant level oiler, loosen the lock screws and slide the outer sleeve upward along the inner sleeve. The bottom of the outer sleeve marks the oil level which will be maintained; therefore, be sure it is adjusted to the dimension shown on the elevation drawing previously submitted. Once the setting is determined, tighten the lock screw in place to permanently establish the proper oil level.

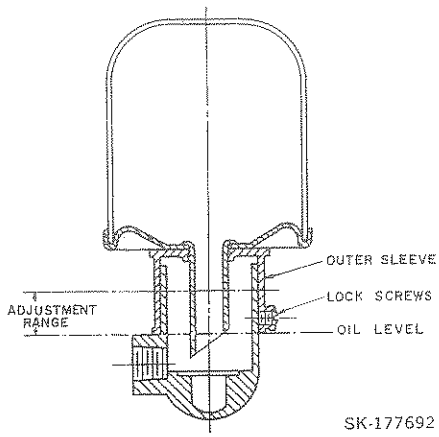


Fig. 19—Constant Level Oiler

COUPLING LUBRICATION

All-metal flexible couplings require lubrication. Follow the coupling manufacturer's recommendations. Check couplings periodically for the presence of the proper amount of lubricant.

SECTION VI
MAINTENANCE

INSPECTIONS

Hourly or daily observations should be made of pump operations to avert trouble. Whether or not you consider a log of these inspections necessary, the operator must be alert for irregularities in the operation of the pumps. He should immediately report any trouble symptoms which he detects. Stuffing box operation and bearing temperatures should be checked periodically. An abrupt change in bearing temperatures is much more indicative of trouble than a constant high temperature. A change in the sound of a running pump is also a warning of possible trouble. Refer to "Locating Troubles."

Semi-Annual and Annual Inspections — Check for free movement of the stuffing box glands and clean and oil the gland bolts and nuts. Closely observe the stuffing box for excessive leakage which cannot be reduced by gland adjustment and replace packing if necessary. Check the pump for capacity and discharge pressure to determine if new rings, seals, etc. may be required.

Complete Overhauls — Frequency of a complete overhaul depends upon the hours of pump operation, the severity of the conditions of service, the materials used in the pump construction, and the care the pump receives in operation.

Do not open your pump for inspection unless there is definite evidence that the capacity has fallen off excessively or unless there is indication of trouble inside the pump or in the bearings.

DISMANTLING PROCEDURE

Care must be exercised in the dismantling operation to prevent damage to internal parts of the pump. For convenience at reassembly lay out all parts in the order in which they are removed. Protect all machined faces against metal-to-metal contact and corrosion. Do not remove ball bearings unless absolutely necessary due to complete dismantling being required.

Close the suction and discharge valves and shut off the cooling and sealing water. Drain all water from

Size and Type	Bearings†		Stuffing Box Data						Ring Clearance Diametral Bronze — Mat.*	Gasket	
	Inboard	Outboard	O.D. Sleeve	I.D. Box	Depth of Box	Size of Packing	⊛Rings Per Box	⊛Width Seal Cage		Thickness	Material
1½ UNB-11	SKF-6307 or equal	SKF-7405-BG or equal	2¼	3¼	3¾	½	7	1	.014 — .018	1/32	Goodyearite
2 UNB-9	SKF-6307 or equal	SKF-7405-BG or equal	2¼	3¼	3¾	½	7	1	.014 — .018	1/32	Goodyearite
2½ UNB-10	SKF-6307 or equal	SKF-7405-BG or equal	2¼	3¼	3¾	½	7	1	.014 — .018	1/32	Goodyearite
3 UNB-11	SKF-6308 or equal	SKF-7406-BG or equal	2⅜	3⅜	3¾	½	7	1	.014 — .018	1/32	Goodyearite
4 UNB-12	SKF-6310 or equal	SKF-7408-BG or equal	2¾	3¾	3¾	½	7	1	.016 — .020	1/32	Goodyearite
5 UNB-13	SKF-6311 or equal	SKF-7409-BG or equal	3	4	3¾	½	7	1	.016 — .020	1/32	Goodyearite
6 UNB-17	SKF-6311 or equal	SKF-7409-BG or equal	3	4	3¾	½	7	1	.018 — .024	1/32	Goodyearite

* For materials other than bronze the clearance may be greater. Check with your Worthington Sales Office for ring clearance on non-bronze materials.

⊛ If no seal cage is used, replace it with two (2) additional rings of packing per box. The packing supplied with the pump for the original conditions of service is in a separate container. If the operating conditions change, packing should be selected by consultation with a packing vendor. **NOTE:** If the pump is equipped with mechanical seals, refer to manufacturer's instructions.

† "Or Equal" refers to dimensions and class of bearing.

the casing. See sectional drawing on page 19.

Proceed as follows for complete dismantling: (Not always required)

NOTE: The pump rotor can only be dismantled half way from either end.

1. Remove all vent and independent seal water piping from the upper half of the casing.

2. Drain the oil from the bearing housings and remove the constant level oilers.

3. Disconnect the coupling halves. Couplings which are oil lubricated must be drained before disconnecting.

4. Unbolt the inboard and outboard bearing housings from the casing and remove the dowels. Unbolt both stuffing boxes if water-cooled. DO NOT TOUCH THE ADJUSTING BOLTS.

5. Break the casing joint using the four forcing-off bolts provided in the upper casing half. Unscrew the forcing-off bolts and replace them with the eye bolts provided with the pump. Using slings, carefully lift the upper casing half off the pump by lifting as straight up as possible.

6. Lift out the rotor assembly including the bearing housings. Use care in slinging and handling the rotor. Support the rotor on "V" blocks on a level surface.

7. Remove the coupling nut, coupling half, and coupling key.

8. Loosen the set screw in the water shields and unbolt the bearing covers. Slide them along the shaft toward the stuffing boxes.

9. Remove the bearing housings.

10. Remove the bearings (see "Maintenance of Bearings").

11. Remove the bearing covers and water shields.

12. Remove the glands, the outer shaft nuts, and the packing.

13. Remove the stuffing boxes, if water-cooled.

14. Utilizing the circumferential groove in the shaft sleeves, remove the shaft sleeves with a puller. Remove the "O" ring seals.

15. Remove the casing rings.

16. Slide the outboard impeller as far as it will go toward the outboard end of the shaft then slide it back into its original position—this action will position the impeller key for removal. Remove the impeller key and the impeller.

17. Remove the center diaphragm, the distance sleeve, and the shaft key.

18. Remove the inboard impeller and the impeller key.

As the pump and rotor are dismantled, all individual parts, all important joints, and all wearing surfaces should be carefully examined.

As a general rule, regardless of the performance of the unit, parts appreciably worn should be renewed if it is not the intent to examine the pump until the next overhaul period. It should be remembered that when parts with metal seats in new or good condition are assembled in contact with dirty or worn parts, the new parts are very likely to wear out rapidly.

ASSEMBLY PROCEDURE

To assemble the pump reverse the dismantling procedure previously described except for packing and seal cage instructions.

NOTE: When reassembling the impeller on the shaft, it is important to mount the impeller so that the vane tips point away from the apparent flow direction. The rotor always rotates toward expanding sections of the volute.

Install the rotor in the lower casing half and check to see that the rotor turns freely by hand. Wearing surfaces at the impeller must not touch.

NOTE: The UNB pump rotor is designed to have a total accumulated clearance of 1/32-inch between the shaft sleeves, the impellers, and the distance sleeve over the shaft length after the shaft sleeve nuts have been

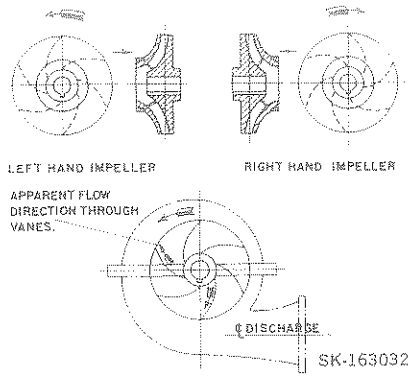


Fig. 20—Direction of Impeller Rotation

firmly tightened against the shaft shoulders. This clearance is to prevent kinking of the shaft by excessive tightening of the shaft nuts. Refer to the sectional drawing on page 19. The distribution of the total clearance is not important since the parts will adjust themselves due to pressure variations between stages once the pump is put into operation.

Continue to assemble the pump according to reversed dismantling procedure being careful not to damage the elastic seal rings when lowering the upper casing half onto the lower casing half.

Align the pumps carefully and install packing.

INSTALLATION OF NEW BEARING HOUSINGS

As a result of unusual circumstances, it is sometimes necessary to replace either one or both bearing housings. If replacement is necessary, the following procedure should be observed for replacement of both bearing housings:

1. Follow steps 1 through 10 of the dismantling procedure.

2. Remove the glands, packing, and the seal cage (if used).

3. Reassemble the pump until the rotor has been reinstalled in the casing lowerhalf, using new bearings and bearing housings. The gland and packing should not be reinstalled.

4. Back-off all six adjusting bolts at least ⅛-inch. The rotor is now as low as it can go vertically.

5. Bolt the new bearing housings to the casing so that the housings can be moved about on their flanges.

6. Using two dial indicators attached to the casing lowerhalf—one at each end—adjust the probes against the top of the inboard and outboard casing rings.

7. Using the two bottom adjusting bolts—one under each bearing housing—gradually turn both bolts until the tops of the outer impeller hubs touch the bore at the top of the casing rings without disturbing the dial indicators set against the top of the rings.

8. Remove the dial indicator probes from the tops of the casing rings and relocate them on the top of the pump shaft—one at each end between the bearing housing and the stuffing box. Lower both ends of the rotor with the bottom adjusting bolts until it cannot be lowered further. Record the indicator movements.

9. Using the two adjusting bolts as in step 8, raise the rotor until the dial indicators set on the shaft read one half of the travel recorded in step 8. The rotor is now centered vertically.

10. Using two dial indicators—one attached to each end of the casing lowerhalf—adjust the probes against the side of the inboard and outboard casing rings. Using two side adjusting bolts move the rotor toward the dial indicators until the outer impeller hubs touch the bore of the rings without disturbing the dial indicators.

11. Remove the dial indicator probes from the side of the casing rings and relocate them on the side of the pump shaft—one at each end between the bearing housing and the stuffing box. By alternately backing-off the tightened adjusting bolts and tightening the adjusting bolts on the indicator side of the shaft, move the rotor toward the pump centerline until the rotor has moved one half of the travel recorded in step 8. The rotor is now centered laterally.

12. Tighten the bearing housing bolts. Drill and ream holes for new dowels, and dowel the housings to the casing.

13. Complete the remaining assembly and replace the glands, seal cage, if used, and packing.

14. Check the pump alignment with the driver carefully.

If only the thrust bearing housing is to be replaced, the pump need not be dismantled. The following procedure applies:

1. Back-off all the adjusting bolts ⅛-inch on the thrust bearing housing only.

2. Remove the thrust bearing housing and the thrust bearing.

3. Remove the split gland and the packing—thrust end only.

4. Install the new thrust bearing and loosely bolt the new bearing housing into position on the casing.

5. Using a dial indicator mounted on the casing, adjust the probe against the top of the pump shaft between the bearing housing and the stuffing box. Raise the rotor with the bottom adjusting bolt as far as it will go without using force. Record the indicator reading.

6. Lower the rotor with the bottom adjusting bolt until the dial indicator reads one half of the value recorded in step 5. The rotor is now centered vertically.

7. Using one side adjusting bolt and with the dial indicator probe against the side of the shaft, move the rotor as far as it will go toward the dial indicator probe without using force. By alternately backing-off the tightened adjusting bolt and tightening the adjusting bolt on the opposite side of the casing, move the shaft toward the pump centerline until the dial indicator shows one half the travel distance recorded in step 5. The rotor is now centered laterally.

8. Tighten the bearing housing bolts and drill and ream holes for new dowels. Dowel the housing to the casing.

9. Install remaining parts, including the gland, seal cage, and packing.

10. Check the pump alignment with the driver carefully.

If only the line bearing housing needs to be replaced, the procedure outlined for replacing both bearing housings must be followed unless a spacer coupling has been used which will allow removal of the coupling half, bearing housing, etc. without necessitating complete dismantling of the pump. Do not remove the old thrust bearing housing from the rotor should it be necesary to remove the rotor assembly.

MAINTENANCE OF CASING

The casing waterways must be kept clean and clear of rust. Whenever a unit has been dismantled, clean and paint the waterways of the casing

with a suitable paint which will adhere firmly to the metal. To give best results an enamel-like finish is desirable.

Casings made from 5% chrome steel generally will not require painting maintenance.

CASING GASKET INSTALLATION

A new casing gasket should always be installed in the pump after the pump has been dismantled. The gasket should be of the same material and of the same thickness as the original gasket so it will compress to the original thickness.

The gasket material should be cut in one piece to fit the outside edges of the upper casing half. It should then be glued in place with quick drying gasket shellac. The internal cutting of the gasket should be done to insure that the gasket fits all bore contours accurately. NOTE: Cut inside edges with a sharp knife or razor blade.

The upper surface of the gasket need not be coated with gasket shellac.

MAINTENANCE OF WEARING RINGS

The casing wearing rings are held in place without screws or bolts by machined and fitted grooves in the casing. The lower half of the ring has a tongue and groove fit or a flange which prevents rotation in the casing whereas the upper half of the ring has an "L" shape (see Fig. 2). The pump must be dismantled to remove the rings for replacement or repair.

NOTE: Generally, it is recommended that the rings should be replaced or overhauled when the original clearance has doubled or when the capacity has fallen below an acceptable minimum as a result of ring wear.

Single Ring Construction — In UNB pumps using standard ring construction, wear of the casing rings can be remedied by turning down the impeller hub at the running joint until a good surface is obtained and then boring a spare undersize (small internal diameter) casing ring to suit. Clearance at the running joint should be the same as that provided between the original ring and the impeller. Refer to "Service Parts," Section VII.

Another remedy would be to bore out the casing rings sufficiently to eliminate the worn surface imperfections and then turn down the impeller hubs at the running joint to receive an oversize (large outer diameter) ring.

The first of the above remedies is recommended for initial running joint restoration.

Double Ring Construction — Rings are sometimes provided in both the casing and on the impellers if specifically requested on the original order—this construction is not standard. See Fig. 3 for alternate ring construction.

On double ring units renewal of the proper ring clearance can be accomplished by turning down the impeller rings to a slightly smaller diameter and by replacing the casing rings with undersize rings. The next repair should be made boring out the casing rings and by replacing the impeller rings with oversize rings. By alternately renewing or remachining the ring sets, each ring can be used two or more times. Refer to "Service Parts," Section VII.

MAINTENANCE OF ELASTIC SEAL RINGS

In order to replace elastic seal rings for the center diaphragm and the casing rings on assembled rotors proceed as follows:

1. Remove the rotor assembly from the pump—follow the first 6 steps under "Dismantling Procedure."

2. Remove the elastic seal rings requiring replacement.

3. Cut the new solid elastic seal rings in a mitre box.

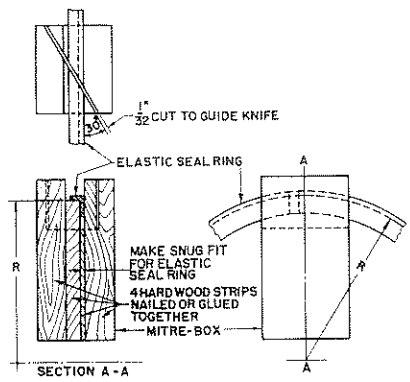


Fig. 21—Method for Cutting Elastic Seal

4. Place the new split seal rings in the proper position taking care to place the split so it will be located at the lowest point of the lower casing half when the rotor is replaced in the pump.

5. Apply two medium heavy coats of Fairprene Cement No. 5128 or equal to each cut surface. Allow 5 to 15 minutes (or more) drying time between coats. The time interval may vary according to existing atmospheric conditions. Cementing in the open on wet days and in sunlight should be avoided.

6. After the last coat has been applied and the proper degree of tackiness is reached, join the cut ring edges together and hold them until the joint shows no indication of parting.

NOTE: It is not recommended that the Fairprene Cement No. 5128 be stocked as it only has a shelf life of 90 days. Fairprene Cement No. 5128 with a separate activator to be added before using can be obtained from E. I. DuPont De Nemours and Co., Inc., Fabrikoid Division, Fairfield, Connecticut.

MAINTENANCE OF SHAFT AND SHAFT SLEEVES

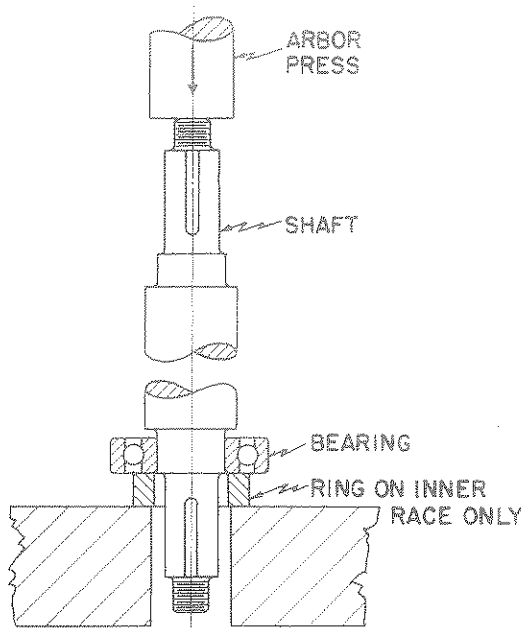
When the pump is dismantled, examine the shaft carefully. Its condition should be checked at the impeller hub fit, under the shaft sleeves, and at the bearings. The shaft may become damaged by rusting or pitting due to leakage along the shaft at the impeller or shaft sleeves. Antifriction bearings improperly fitted to the pump shaft will result in the inner race rotating on the shaft thus causing undue damage. Check the shaft keyway for distortion. Excessive thermal stresses or corrosion may loosen the impeller on the shaft and subject the keyway to excessive shock. Replace a shaft that is bent or distorted. After a shaft has been repaired, check it for possible runout (maximum .002).

The shaft sleeve is subject to wear and may require replacement, depending on the severity of service. When the sleeve has become worn appreciably, it becomes impossible to adjust the packing to prevent leakage and it should be replaced. Excessively grooved and scored sleeves will tear and score new packing as soon as it is inserted in the stuffing box.

MAINTENANCE OF BEARINGS

Anti-friction bearings are usually pressed or shrunk on the shaft and a pulling device must be used to remove them. The pulling jaws or fingers must be located behind the shoulder of the inner race. When other parts on a shaft do not interfere, the bearing may be supported by a split ring and the shaft pressed out using an arbor press.

NOTE: Unless extreme care is used when removing an anti-friction bearing, the bearing may be damaged to the extent that it is no longer useable. Always check the bearing immediately after removal for any imperfections or any play between the races. It is recommended that new bearings be used for replacement of removed bearings since very often bearing damage due to removal cannot be detected until the pump is put into operation.



SK-177699

Fig. 22—One Method of Mounting an Anti-Friction Bearing on a Shaft

When mounting anti-friction bearings on the pump shaft, remember that the satisfactory operation of anti-friction bearings requires that the inner race be firmly held on the shaft so that it cannot turn on the shaft. It is also important that the fit of the outer race prevent its free rotation in the housing.

There are two methods in general use for mounting a bearing on a pump shaft:

1. Heating the bearing to expand the inner race and shrinking it on the shaft.

2. Forcing the bearing onto the shaft.

The first method is preferred. Heat the bearing in an oil bath or electric oven to a uniform temperature of 200F. When heated, quickly mount it on the shaft. This heating is best done by submerging the bearing in a bath of 10% to 15% soluble oil in water heated to 200F. This mixture cannot be overheated and is not flammable.

If the alternate method is used, apply the force by means of an arbor press. Use a tubular sleeve, a ring, or small blocks of equal thickness to apply the force to the inner race.

In forcing a bearing onto a shaft care must be exercised to see that the race is never cocked. Check the position of the bearing on the shaft with a feeler gage to make sure it is pressing firmly against the shaft shoulder.

With duplex mounted thrust bearings, it is important to be sure that the thrust bearing locknut is tight enough to insure contact between the inner races of both bearings.

PACKING

For packing the stuffing box use a good grade of graphited, braided asbestos packing for cold water service and a combination plastic and metallic packing for hot water service. Do not under any circumstances use flax packing in the pump since it tends to swell and can cause the rotor to lock should the pump remain idle for short periods of time. Flax packing also will cause rapid wear of the sleeves.

The following procedure should be followed in repacking a stuffing box:

1. Loosen the stuffing box gland.

2. Remove the old packing with a packing puller and clean the stuffing box.

3. Make sure the packing to be used is of correct type and size. Measure the stuffing box to determine the proper length of packing.

Packing should be cut slightly shorter than measured to prevent butting of the ends and buckling.

4. Insert each ring of packing separately, pushing it as far as possible into the stuffing box and seating it firmly. Stagger the rings so that the joints are 90 degrees or 180 degrees apart.

5. After inserting the required number of rings of packing, the seal cage can be inserted. It is important to make sure it is located directly under the sealing connection and that the insertion of successive rings will not displace it.

6. Continue adding more rings of packing. When the required number of packing rings has been inserted, install the gland and tighten the gland nuts by hand; then back-off the nuts until the gland is loose. In tightening the gland the nuts should be brought up uniformly so that the gland will not be cocked and so that the packing is subjected to uniform pressure.

7. New packing has to be run-in. It is good practice to start the pump with the stuffing box gland quite loose. After the pump has been running for approximately 10 to 15 minutes, gradually tighten the stuffing box gland until leakage is reduced to a constant drip. Packing that is too tight in the box will cause undue friction creating heat which will glaze the packing and possibly score the shaft sleeves. Packing must remain soft and pliable.

Precaution: It may be impossible to add the last ring of packing in the stuffing box and still insert the gland.

When this occasion arises, omit the last ring of packing and tighten the gland. Continue to tighten the gland at periodic intervals (daily), allowing for proper leakage, until the packing has seated itself well enough to allow the final ring to be inserted.

MAINTENANCE OF PUMP NOT IN USE

If a pump is a stand-by pump or if it is out of service for extended periods of time, turn the rotor over several times once a week to prevent seizing of parts.

PERFORMANCE TESTS

When the installation is new, a test run of the pump should be conducted with calibrated gauges to determine system head values for known capacities to provide information for use in checking performance as wear takes place. This data will prove invaluable when selecting service parts to be kept on hand at a later date.

LOCATING TROUBLES

The troubles which may occur with your pump and their causes are listed below. The operator can often avoid unnecessary expense by careful consideration of the points outlined.

Failure to Deliver Liquid

(a) Pump not primed.

(b) Insufficient speed.

(c) Discharge head too high (greater than that for which the pump is rated).

(d) Suction lift too high.

(e) Impeller passages partially clogged.

(f) Wrong direction of rotation.

Insufficient Capacity

(a) Air leaks in suction piping.

(b) Speed too low.

(c) Total head higher than that for which pump is rated.

(d) Suction lift too high.

(e) Impeller passages partially clogged.

(f) Mechanical defects:
Impeller damaged.
Wearing rings worn.
Internal leakage due to defective gasket.

(g) Foot valve too small or restricted by trash.

(h) Foot valve or suction pipe not immersed deep enough.

Insufficient Discharge Pressure

(a) Speed too low.

(b) Air or vapor in liquid.

(c) Mechanical defects:
Impeller damaged.
Wearing rings worn.

Pump Loses Prime After Starting

(a) Leaky suction line.

(b) Suction lift too high.

(c) Air or gases in the liquid.

(d) Water seal not functioning.

Pump Overloads Driver

(a) Speed too high.

(b) Mechanical defects.

(c) Packing gland too tight causing excessive friction loss in the stuffing box.

Pump Vibrates

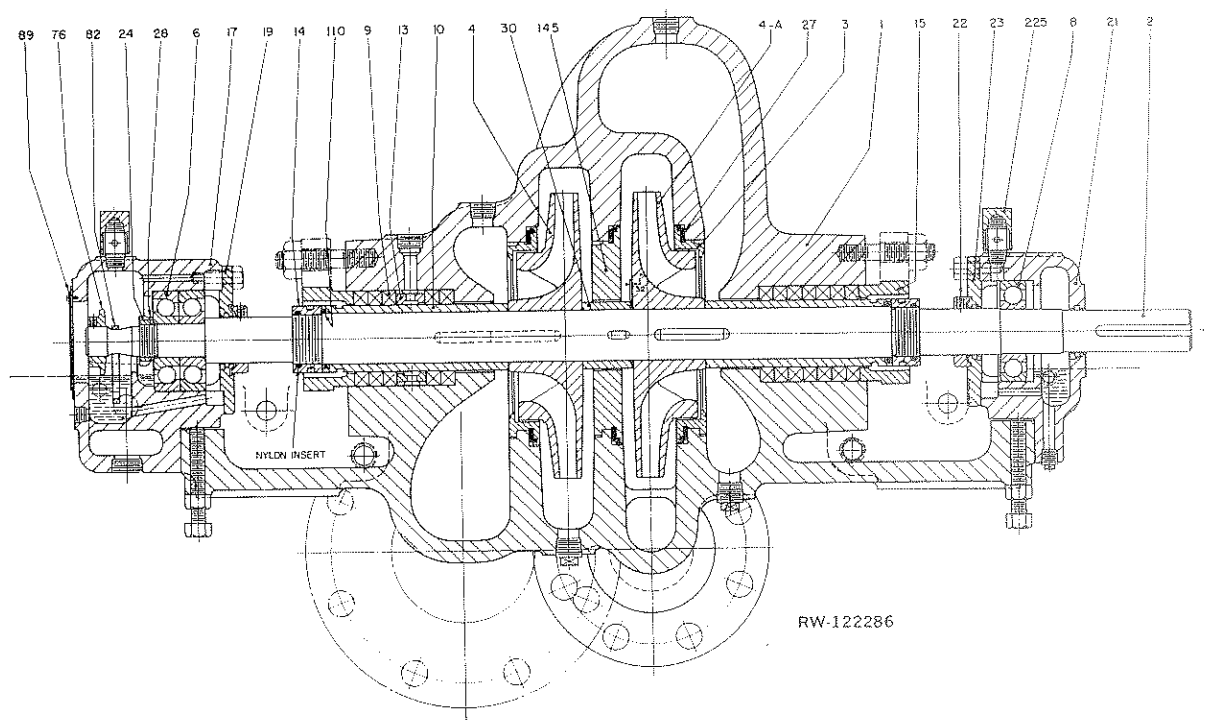
(a) Misalignment.

(b) Foundation not rigid.

(c) Impeller partially clogged, causing unbalance.

(d) Mechanical defects:
Bent shaft.
Rotating element binds.
Worn bearings.

(e) Air or vapor in liquid.



STATIONARY PARTS

REF. NO.	NO. OF PIECES	NAME OF PARTS	REF. NO.	NO. OF PIECES	NAME OF PARTS
1	1	CASING	23	1	LINE BR'G HS'G COVER
3	2	CASING RING	27	3	ELASTIC SEAL RING
9	2 SETS	PACKING	89	1	NAME PLATE
13	1	SEAL CAGE	145	1	DIAPHRAM
15	2	GLAND	225	2	BEARING VENT
17	1	THRUST BR'G HS'G			
19	1	THRUST BR'G HS'G COVER			
21	1	LINE BR'G HOUSING			

ROTATING PARTS

REF. NO.	NO. OF PIECES	NAME OF PARTS	REF. NO.	NO. OF PIECES	NAME OF PARTS
2	1	SHAFT W/KEYS	24	1	BEARING NUT
4	1	1st STG. IMPELLER	28	1	BEAR'G LOCKWASHER
4-A	1	2nd STG. IMPELLER	30	1	DISTANCE SLEEVE
6	1	THRUST BEARING	76	1	OIL THROWER
8	1	LINE BEARING	82	1	OIL RING
10	2	SHAFT SLEEVE	110	2	"O" RING
14	2	OUTER SHAFT NUT			
22	2	WATER SHIELD			

When ordering replacement parts be sure to give Serial Number of Pump (as stamped on name plate) also name, reference number and quantity of parts required.

SERVICE PARTS

The severity of the conditions of service, the extent to which repairs can be carried out in the field, and the number of units installed will determine to a great extent the minimum number of service parts which should be carried in stock at the site of the installation.

The minimum service parts for a UNB pump should include the following:

1. A set of bearings.
2. Two shaft sleeves with "O" ring shaft seals.
3. *A complete set of casing rings (and impeller rings, if used).
4. A complete set of elastic seal rings.
5. One diaphragm.
6. One automatic oiler.
7. Sufficient stock of spare packing for the stuffing boxes and material for a casing gasket.

***NOTE:** If rings are ordered as service parts after the pump has been put into service, undersized stationary rings or oversized impeller rings will not be furnished unless specifically requested by the customer. If undersize or oversize rings are desired, the amount of undersize or oversize will be 1/8 in. on the I.D. or the O.D. It is recommended as insurance against delays that service parts be purchased at the time the order for the complete unit is placed or as soon after receiving the pump as possible.

HOW TO ORDER SERVICE PARTS

When ordering service parts, the pump serial number, size, and type of pump must be given. Refer to the nameplate. This information is essential in order that Worthington may identify the pump and furnish the correct service parts. Give the name and number of the part as listed in the parts list of the sectional elevation applicable to the pump, the quantity required, and where possible, the complete symbols stamped on the old part. Orders for service parts should be sent to the nearest Worthington Sales Office.

RETURNING PARTS

All materials returned to the factory must have a shipping label attached. Consult the nearest Sales Office or Regional Customer Service (R.C.S.) Office for shipping instructions. Unnecessary delays are avoided when parts or equipment are returned to the proper factory using the correct procedure.

Contact your nearest Sales Office or R.C.S. Office, listing the material to be returned and the reasons for returning it.

Worthington Pump International
Taneytown, Maryland 21787
A division of Worthington Corporation

WORTHINGTON

2131-E1D 7110 TC
Supersedes 2131-E1C

Printed in U.S.A.