KEWPUMP®

INSTALLATION OPERATION & MAINTENANCE INSTRUCTIONS

TÜV CERT
ISO 9001 : 2000
Certificate:04100 21779

QUALITY MANAGEMENT SYSTEM

▶ KS-SG2

PREFACE

This manual contains instructions for the Installation, Operation and Maintenance of the Kewpump Types KS-SG2. This manual covers the standard product plus common options that are available. For special options, supplemental constructions are supplies. This information is provided to insure the long life and safe operation of this pump, therefore, this manual must be read and understood before installation or start-up and kept in a safe place for future reference.

This instruction manual covers all models and design variants that are manufactured for a wide range of flow and head requirements and fully complies with ISO 2858 / DIN-24256 and ISO 5199 standards. Most assembly, disassembly, and inspection procedures are the same for all models and design variants. However, where there are differences, they are called out separately within the manual. The design, materials, and workmanship incorporated in the construction of Kewpumps make them capable of giving long, trouble-free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by correct application, proper installation, periodic inspection, condition monitoring and careful maintenance. This instruction manual was prepared to assist operators in understanding the construction and the correct methods of installing, operating, and maintenance of these pumps.

Kewpump (M) Sdn. Bhd. shall not be liable for physical injuries, damages, or delays caused by failure to observe the instructions for installation, operation, and maintenance contained in this manual.

Warranty is valid only when genuine Kewpump parts are used.

Use of the equipment on a service other than stated in the order will nullify the warranty, unless written approval is obtained in advance from Kewpump (M) Sdn. Bhd..

This manual contains: -

- ✓ Proper Installation
- ✓ Start-up Procedures
- ✓ Operation Procedures
- ✓ Routine Maintenance
- ✓ Troubleshooting
- ✓ Ordering Spare Parts

Pump Safety Tips

Safety Apparel:

- Insulated work gloves when handling hot bearings or using bearing heater
- Heavy work gloves when handling parts with sharp edges especially impellers
- Steel-toed shoes for foot protection when handling parts, heavy tools, etc.
- Other personal protective equipment to protect against hazardous/toxic fluids

Coupling Guards:

- Never operate a pump without a coupling guard properly installed

Flanged Connections:

- Never force piping to make a connection with a pump
- Use only fasteners of the proper size and material
- Ensure there are no missing fasteners
- Beware of corroded or loose fastener

Operation:

- Do not operate below minimum rated flow, or with suction /discharge valves closed
- Do not open vent or drain valves, or remove plugs while system is pressurised

Maintenance Safety:

- Always lock out power
- Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, or disconnecting piping
- Use proper lifting and supporting equipment to prevent serious injury
- Observe proper decontamination procedures
- Know and follow company safety regulations

Observe all cautions and warnings highlighted in pump Installation, Operation and Maintenance Instructions.

⚠ W A R N I N G

Observe extreme caution when venting and/or draining hazardous liquids. Wear protective clothing in the presence of caustic, corrosive, volatile, flammable, or hot liquids. Do not breathe toxic vapours. Do not allow sparking, flames, or hot surfaces in vicinity of the equipment.

Contents

1 INTRODUCTION

1.1 Safety-General

These pumps have been designed to provide safe and reliable service. However, a pump is both a pressure vessel and a piece of rotating machinery. Therefore, the operator(s) must exercise good judgement and proper safety practices to avoid damage to the equipment, surrounding areas, and to prevent personal injury. It must be understood that the information contained in this manual does not relieve operating and maintenance personnel of the responsibility of exercising normal good judgement in operation and care of these pumps and its components. The safety department at these pumps location must establish a safety program based on a thorough analysis of industrial hazards. This program should be reviewed before the installation and operation of these pumps.

In addition to the hazards of rotating equipment and pressure vessels, considerations must be given to hazards of electrical power, hot oil, high pressure and temperature liquids, toxic liquids and gases, and flammable liquids and gases. Proper installation and care of protective equipment should also be an essential part of any safety program.

Also essential are special precautionary measures to prevent the possibility of applying power to the equipment at any time that maintenance work is in process. In addition, the prevention of rotation due to reverse flow should not be overlooked.

In general, all personnel should be guided by all the basic rules of safety associated with the equipment and the process.

1.2 Definitions

Throughout this manual the words **WARNING**, **CAUTION**, and **NOTE** are used to indicate procedures or situations which require special operator attention:

⚠ W A R N I N G

Operating procedure, practice, etc. which, if not correctly followed, could result in personal injury or loss of life.

⚠ C A U T I O N

Operating procedure, practice, etc. which, if not correctly followed, could result in damage or destruction of equipment.

ⓘ N O T E

Operating procedure, condition, etc. which is essential to observe.

Examples:

⚠ W A R N I N G

Pump shall never be operated without coupling guard installed correctly.

⚠ C A U T I O N

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

ⓘ N O T E

Proper alignment is essential for longer pump life.

1.3 General Precautions

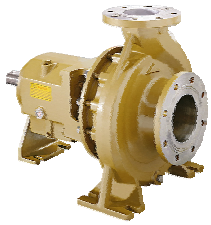
⚠ W A R N I N G

Personal injuries will result if procedures outlined in this manual are not followed.

- NEVER apply heat to remove impeller. It may explode due to trapped liquid.
- NEVER use heat to disassemble pump due to risk of explosion from trapped liquid.
- NEVER operate pump without coupling guard correctly installed.
- NEVER operate pump beyond the rated conditions to which pump was sold.
- NEVER start pump without proper prime (sufficient liquid in pump casing).
- NEVER run pump below recommended minimum flow or when dry.
- ALWAYS lock out power to the driver before performing pump maintenance.
- NEVER operate pump without safety devices installed.
- NEVER operate pump with discharge valve closed.
- NEVER operate pump with suction valve closed.
- DO NOT change conditions of service without approval of an authorised Kewpump representative.

2 GENERAL INFORMATION

2.1 Pump Description

Model	Pump Description
 KS-SGN  KS-SGK	Chemical Process Pump. Back pull-out, single stage, horizontal centrifugal pump, with axial end suction and radial centreline discharge, built to International Standard ISO 5199. Constructed in standardized dimensions according to ISO 2858 / DIN 24256. Flanges are machined and drilled according to ISO 7005-1:1992 – PN16. Standard mechanical seals dimensions according to DIN 24960. All standard pump components in contact with fluid are made of Stainless Steel 316 (CF-8M). Other materials are also available upon request. Normally driven by electric motor mounted on a baseplate standardized to ISO 3661.

2.2 Design Execution

2.2.1 Volute Casing

Highly efficient one-piece volute type casing with integrally cast feet at the side below.

Connections at the suction and discharge branch for pressure measuring instruments are possible; drain hole with screw plug exists below at the front of the volute casing.

Corrosion allowance in excess 3mm ensures long service life at difficult operating

conditions. For open type impellers design, volute casings are equipped with a stationary wear plate.

To be able to check at each time the correct sense of rotation, all volute casings have a cast-on direction of rotation arrow at the front.

For KS-SGK models, volute casings are equipped with heating chamber for special operating purposes.

2.2.2 Impeller

Enclosed type impeller cast in one piece with twisted vane design for low NPSH3% values and high efficiencies.

For special operating purposes, open type impellers are also available with the axial clearance between the impeller vanes and casing wear plate can be adjusted.

Compensation of the axial force will be reached by means of back-vanes or impeller running rings on both sides as well as balance holes in the impellers.

2.2.3 Frame Adaptor

The solid and resistant to bending designed frame adaptor guarantee a sturdy connection of volute casing and bearing frame to ensure a vibrationless and quiet run.

Designed with ample space and accessibility for fitting a complete range of mechanical seals and auxiliary system to suit every application.

2.2.4 Shaft Sealing

Standard stuffing box cover with heating chamber. Cast in one piece with large bore seal chamber on all pumps furnish with mechanical seal. Standard bore stuffing box cover can be fitted with a packed gland as an alternative.

Dependent on the operating requirement, available executions of mechanical seals including single acting (internal, external), double acting (back-to-back, tandem) and cartridge.

Equipped with hook type renewable shaft sleeve with a free end extends beyond the outer face of the stuffing box cover, seal cover or gland, for expansion under varying temperatures.

Teflon gasket between impeller nut and impeller, and between impeller and shaft sleeve, to prevent the pumped fluid for coming into contact with the shaft.

2.2.5 Power End Assembly

The shaft, designed with greatest possible diameters and resistant to bending, to achieve low shaft deflection by operational radial forces, is supported at the drive side with double rows angular contact ball bearing and at the pump side with cylindrical roller bearing to handle both radial and axial loads with life expectancy over 17500 hours of operation. The double rows angular contact ball bearing is fixed on the shaft by means of a self-locking standardized shaft nut to improve reliability.

Each bearing is protected by a cast iron cover with inbuilt oil seal. When open type impeller is required, an adjustable bearing box for the axial shaft adjustment will be used to enable impeller close running clearance to be preset to optimise performance.

The rigid single piece cast iron construction bearing frame is designed with large oil reservoir for better dissipation of heat, and standard oil level bulls-eye sight glass for easy monitoring. All bearing frames are predrilled for optional constant-level-oiler.

In particular cases, the bearing frame can be delivered as special design with oil bath cooling. The design of the cooling coil guarantees that the cooling liquid will not come into contact with the bearing lubricating oil.

All pumps are equipped as standard with a support foot on the bearing frame. The support foot is designed to reduce the effect of pipe loads on the pump to extend mechanical seal and bearings life.

2.3 Nameplate Information

Every pump has one Kewpump nameplate (Fig. 2-1). The nameplate is located on the frame adapter, and provides information about pump type, model, serial number and impeller size in mm (only stated when impeller is not full size).

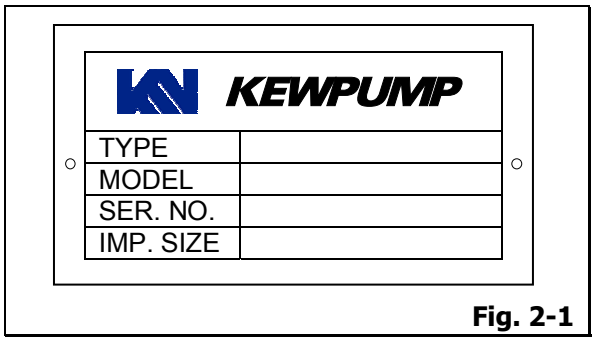


Fig. 2-1

The designation of the pump model, which is stated on the nameplate, is structured as follows:

SGN 65-200R DB OBC

Model Range
SGN: *Normal volute casing*
SGK: *Volute casing with heating chamber*

Model Size

Impeller Type	
Blank:	*Closed (Std.)*
S:	*Semi-Open*
R:	*Fully-Open*

Shaft Sealing Type	
Blank:	*Single internal (Std.)*
RQ:	*Single internal with rear quenching*
ES:	*Single external*
DB:	*Double back-to-back*
DT:	*Double tandem*
CT:	*Cartridge*
G:	*Gland Packing*

Bearing Frame Type	
Blank:	*Without oil bath cooling (Std.)*
OBC:	*With oil bath cooling*

When ordering spare parts you will need to identify pump type, model, serial number, and the part number of required parts. Information can be taken from the nameplate, while the part number can be found from the parts list in this manual.

2.4 Receiving the Pump

The complete pump unit should be inspected immediately upon arrival, and any irregularities arising due to shipment reported to the carrier.

Care must be taken during unpacking to avoid damage to the equipment.

2.4.1 Handling

⚠ WARNING

Pump and components are heavy. Failure to properly lift and support equipment could result in serious physical injury or damage to pumps. Steel-toed shoes must be worn at all times.

Use care when moving pump. Lifting equipment must be able to adequately support the entire assembly. Hoist bare pump using a suitable sling, under the suction flange and bearing frame. Complete pump, driver and motor units should be hoisted using slings under the suction flange and driver. Refer to Fig. 2-2 and 2-3 for examples of proper lifting techniques.

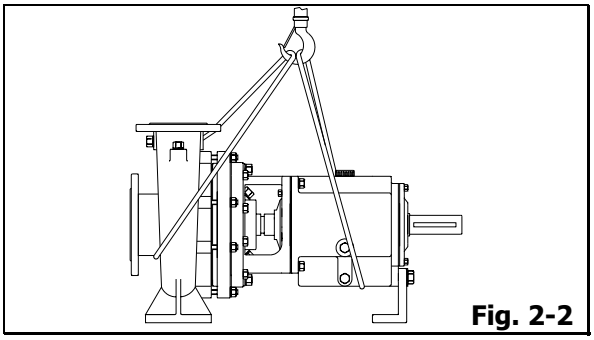


Fig. 2-2

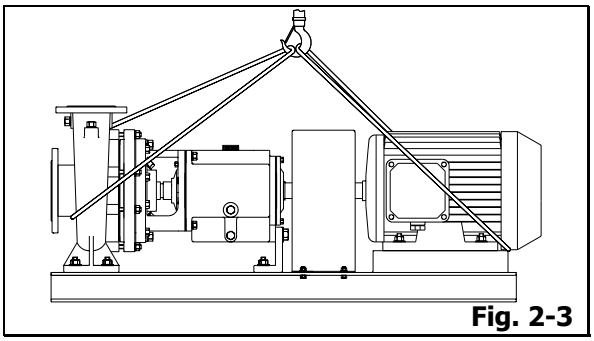


Fig. 2-3

2.4.2 Storage and Preservation

Short Term: (Less than 6 months) The standard shipping and preservation protection is suitable for the period of shipment and installation. Upon receipt, store in a covered, dry and clean location.

Long Term: (More than 6 months) Preservative treatment of bearings and machined surfaces will be required. Rotate shaft several times every 3 months. As a minimum the pump must be stored in a dry, clean and covered place. The unit should be stored in an approximately level position with no strains applied. Flange covers should be left in place. It is recommended to flush the pump and bearing frame with a suitable rust preventative. Refer to driver and coupling manufacturers for their long term storage procedures.

3 INSTALLATION

ⓘ N O T E

The design of piping systems, foundations and other areas of system design is the responsibility of others. Kewpump data and comments are offered as an aid, but Kewpump cannot assume responsibility for the design and operation.

It is recommended that the customer consult a specialist skilled in the design of foundations, piping, sumps and related systems so as to supplement and interpret Kewpump information and ensure a successful installation.

3.1 Cleaning the Pump and Baseplate

Before putting the pump into operation, the liquid end of the pump should be flushed out with water to remove any rust preventative as well as any foreign matter that may have accumulated during shipment, storage, or installation.

If the pump has been in storage for more than six months, it should be disassembled, inspected and cleaned, as required, before putting it into service.

The underside of the baseplate has to be completely cleaned. It is sometimes necessary to coat the underside of the baseplate with an epoxy primer.

The rust preventative solution from the baseplate can be removed with an appropriate solution.

3.2 Location

Install the pump in an accessible place, as close as possible to the source of the liquid to be pumped. Allow space for operation, inspection and maintenance, and sufficient floor space and headroom for the required crane or hoist service.

Consideration must be given to the environment when pumps are driven by an electric motor. Proper ventilation is necessary, and extremes of dampness and/or heat should be avoided.

3.3 Foundation

The foundation should be sufficiently rigid and substantial enough to absorb any pump vibration and to permanently support the entire pumping unit. Baseplate mounted pumps are normally grouted on a reinforced concrete foundation which is strong enough to support 1½ times the weight of the unit, including driver.

The foundation bolts commonly used are sleeve type (Fig. 3-1) and J Type (Fig. 3-2). Both designs permit movement for final bolt adjustment. It is suggested that the foundation bolts not be set rigidly until the equipment arrives.

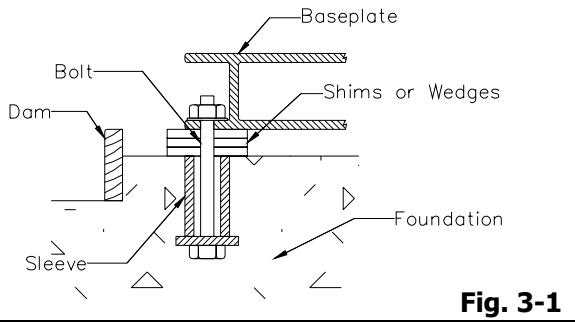


Fig. 3-1

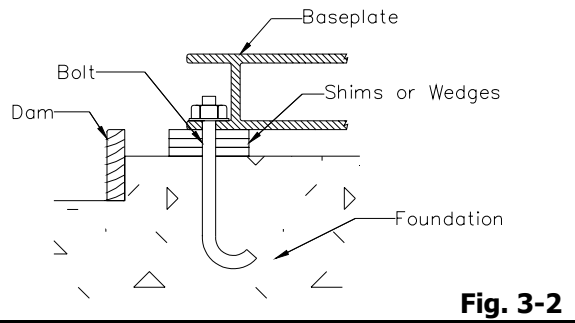


Fig. 3-2

1. Inspect foundation for dust, dirt, oil, chips, water, etc. and remove any contaminants. Do not use oil-based cleaners as grout will not bond to it.

2. Prepare the foundation in accordance with the grout manufacturer's recommendations.

3.4 Field Mounting of Driver

During the assembly of the pump at the factory the run-out of the rotating parts is checked.

Before the pump and driver are aligned as a unit the driver coupling run-out must be checked. Broken shafts sometimes result because of the failure in the field to check the driver shaft run-out.

ⓘ NOTE

On units supplied from the factory without driver, but with baseplate, it is required that the driver support be welded in place, in the field, once proper shaft spacing is obtained.

3.5 Level Baseplate

1. Check that the pump shaft is centred from side to side with the baseplate and tighten the pump hold down bolts.

2. Place two sets of wedges or shims on the foundation, one set on each side of every foundation bolts (Fig. 3-3). The wedges should extend 20mm to 40mm about foundation, to allow for adequate grouting. This will provide even support for the baseplate once it is grouted.

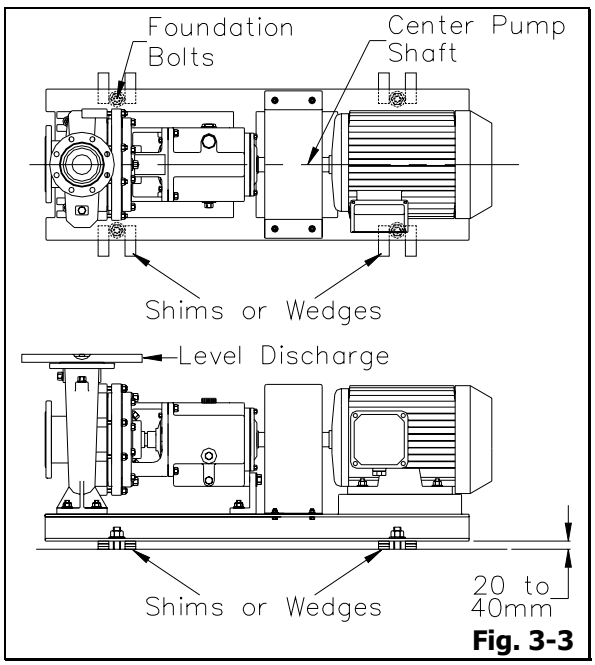


Fig. 3-3

3. Remove water or/and debris from anchor bolt holes/sleeves prior to grouting. If the sleeve type bolts are being used, fill the sleeves with packing or rags to prevent grout from entering.

4. Carefully lower baseplate onto foundation bolts.

5. Level baseplate to within 3mm over length of the baseplate and to within 1.3mm over width of the baseplate by adjusting wedges or changing the number of shims.

6. A level should be placed across the pump mounting pads, driver mounting pads discharge flange and plumb the suction flange to determine levelness.

7. Hand tightens the foundation bolts so that they are snug and recheck levelness. Adjust wedges or change the number of shims if necessary to maintain flatness.

8. Check to be sure the baseplate is not distorted and that accurate coupling alignment can be achieved.

3.6 Alignment

⚠ W A R N I N G

Before beginning any alignment procedure, make sure driver power is locked out. Failure to lock out driver power will result in serious physical injury.

Correct alignment of the pump and driver is of the utmost importance. In direct coupled drives, misalignment will cause unnecessary vibration and wear of the coupling.

Pump-Driver combinations are aligned at the factory, but baseplate may be distorted in shipment, and misalignment may occur due to unequal tightening of foundation bolts or pipe strain. It is therefore essential that alignment be checked before the pump is put in service.

The points at which alignment is checked and adjusted are:

- **Initial Alignment** is done prior to operation when the pump and the driver are at ambient temperature.

- **Final Alignment** is done after operation when the pump and driver are at operating temperature.

ⓘ N O T E

Proper alignment is the responsibility of the installer and user of the unit.

Accurate alignment of the equipment must be attained. Trouble-free operation can be accomplished by following the procedures showed in section *3.6.3 Alignment Procedures for Direct Coupled Baseplate Design*.

3.6.1 Alignment Checks

Initial Alignment (Cold Alignment)

- *Before Grouting Baseplate* – To ensure alignment can be obtained.
- *After Grouting Baseplate* – To ensure no changes have occurred during grouting process.
- *After Connecting Piping* – To ensure pipe strains haven't altered alignment. If changes have occurred, alter piping to remove pipe strains on pump flanges.

Final Alignment (Hot Alignment)

- *After First Run* – To obtain correct alignment when both pump and driver are at operating temperature. Thereafter, alignment should be checked periodically in accordance with plant operating procedures.

> **NOTE**
> ***Alignment check must be made if process temperature changes, piping change and/or pump service is performed.***

3.6.2 Alignment Criteria

Good alignment is achieved when the dial indicator or gauge readings as specified in the alignment procedures are:

- 0.05mm Total Indicated Reading (T.I.R) or less when the pump and driver are at operating temperature (Final Alignment).
- 0.0127mm per 25.4mm of dial indicator separation for the reverse dial indicator or laser method when the pump and driver are at operating temperature (Final Alignment).

During the installation phase for direct coupled baseplate design, it is necessary to set the parallel alignment in the vertical direction to different criteria due to differences in expansion rates of the pump and driver. Table below shows the recommended preliminary (cold) settings for electric motor driven pumps based on the different pumped fluid temperatures:

Vertical Cold Alignment Setting for Direct Coupled Baseplate Design	
Pumped Fluid Temp.	Set Motor Shaft
Up to 95°C	*0.127mm below pump shaft*
95°C to 120°C	*Equal to pump shaft*
Above 120°C	*0.127mm above pump shaft*

Driver manufacturers should be consults for recommended cold setting for other types of drivers (steam turbines, engines, etc.).

3.6.3 Alignment Procedures for Direct Coupled Baseplate Design

3.6.3.1 Set Up

> **WARNING**
> ***Before assembly or disassembly of the coupling guard is performed, the driver must be deenergised, the driver controller/starter put in a locked out position and a caution tag placed at the starter indicating disconnect. Replace coupling guard before resuming normal operation of the pump. Kewpump assumes no liabilities for avoiding these practices.***

1. Remove four (4) nuts, bolts and washers from both sides of the coupling guard, and lift off the guard.
2. Check that the pump shaft is level and parallel to the baseplate. Use shims as necessary.
3. Check that the foundation and pump hold down bolts are tight.

For Pin-and-cushion or Spacer Coupling:

1. Disconnect the coupling halves by removing the coupling bolts or spacer.
2. Mount two dial indicators on one of the coupling half (X) so they contact the other coupling half (Y) (Fig. 3-4).
3. Check setting of indicators by rotating coupling halves X and Y together to ensure indicators stay in contact with coupling half Y but do not bottom out. Adjust indicators accordingly.

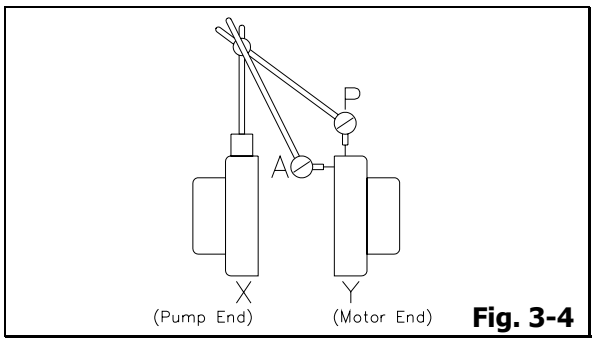


Fig. 3-4

4. Mark chalked on the coupling half Y at the point where the indicators rest. For any check (top, bottom, or sides), both pump and drivers shafts should be rotated the same amount, that is, all readings on the dial should be made with the indicators on the chalk mark.

For Rubber Bushing Coupling:

1. Place the straight-edge across both halves of the coupling parallel to the shaft (Fig. 3-5).

2. Use tapered gauge to check the spacing between the periphery of each half of the coupling (Fig. 3-5).

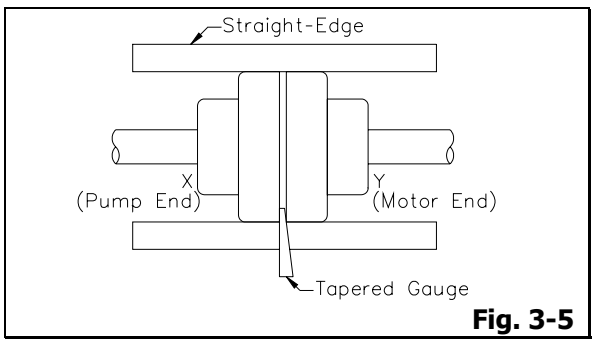


Fig. 3-5

3.6.3.2 Measurement

1. Take indicator or gauge measurement with driver feet hold-down bolts tightened. Loosen hold-down bolts prior to making alignment corrections.

2. Do not adjust the pump or bearing frame support foot to obtain alignment, move only the driver.

3. Take care not to damage indicators or gauge when moving driver during alignment corrections.

3.6.3.3 Angular Alignment

A unit is in angular alignment when indicator A (angular indicator) or tapered gauge readings do not vary by more than 0.05mm as measured at four points 90° apart.

For Pin-and-cushion or Spacer Coupling:

Vertical Correction (Top-to-Bottom)

1. Zero indicator A at top dead centre (12 o'clock) of coupling half Y.

2. Rotate coupling halves X and Y together to move indicator to bottom dead centre (6 o'clock). Observe needle and record reading.

3. **Negative Reading** – The coupling halves are further apart at the bottom than at the top. Correct by either raising the driver feet at the shaft end (add shims) or lowering the driver feet at the other end (remove shims).

   Positive Reading – The coupling halves are closer at the bottom than at the top. Correct by either lowering the driver feet at the shaft end (remove shims) or raising the driver feet at the other end (add shims) (Fig. 3-6).

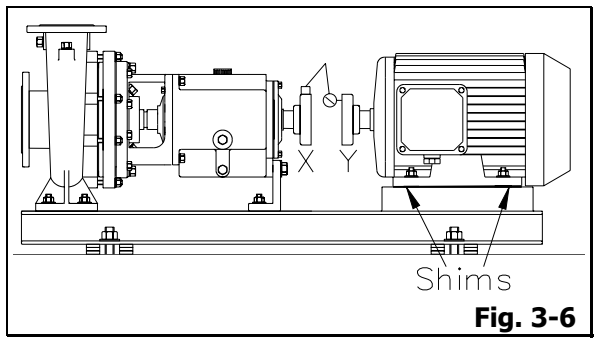


Fig. 3-6

4. Repeat steps 1 through 3 until indicator A reads 0.05mm or less.

Horizontal Correction (Side-to-Side)

1. Zero indicator A on the left side of coupling half Y, 90° from top dead centre (9 o'clock).

2. Rotate coupling halves X and Y together to move indicator through top centre to the right side, 180° from the start (3 o'clock). Observe needle and record reading.

3. **Negative Reading** – The coupling halves are further apart on the right side than the left. Correct by either sliding the shaft end of the driver to the left or the other end to the right.

   Positive Reading – The coupling halves are closer together on the right side than the left. Correct by either sliding the shaft end of the driver to the right or the other end to the left (Fig. 3-7).

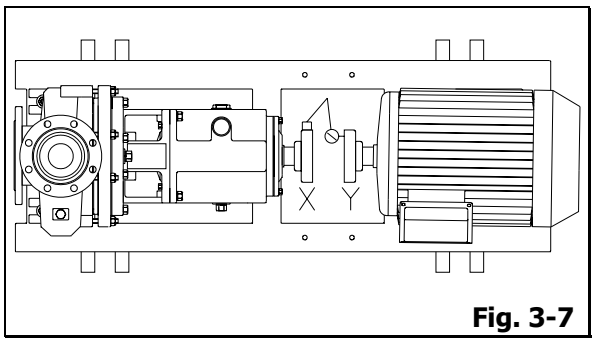


Fig. 3-7

4. Repeat steps 1 through 3 until indicator A reads 0.05mm or less.

5. Re-check both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary.

For Rubber Bushing Coupling:

Vertical Correction (Top-to-Bottom)

1. Place the tapered gauge between the coupling halves at top dead centre (12 o'clock). Record the reading on the gauge.

2. Move the tapered gauge to bottom dead centre (6 o'clock). Record the reading again.

3. **First Reading < Second Reading** – The coupling halves are further apart at the bottom than at the top. Correct by either raising the driver feet at the shaft end (add shims) or lowering the driver feet at the other end (remove shims).

   First Reading > Second Reading – The coupling halves are closer at the bottom than at the top. Correct by either lowering the driver feet at the shaft end (remove shims) or raising the driver feet at the other end (add shims) (Fig. 3-8).

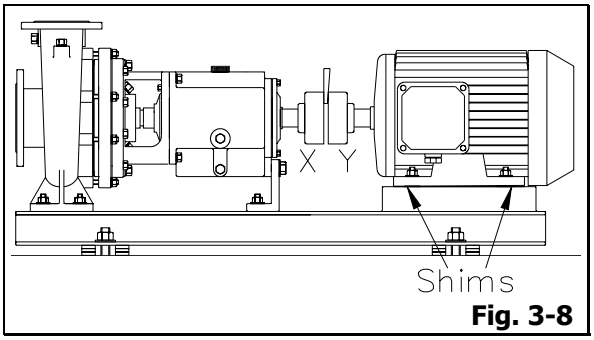


Fig. 3-8

4. Repeat steps 1 through 3 until the different between the first reading and the second reading is 0.05mm or less.

Horizontal Correction (Side-to-Side)

1. Place the tapered gauge between the coupling halves on the left side of coupling half Y, 90° from the top dead centre (9 o'clock). Record the reading on the gauge.

2. Move the tapered gauge to the right side, 180° from the start (3 o'clock). Record the reading again.

3. **First Reading < Second Reading** – The coupling halves are further apart on the right side than the left. Correct by either sliding the shaft end of the driver to the left or the other end to the right.

   First Reading > Second Reading – The coupling halves are closer together on the right side than the left. Correct by either sliding the shaft end of the driver to the right or the other end to the left (Fig. 3-9).

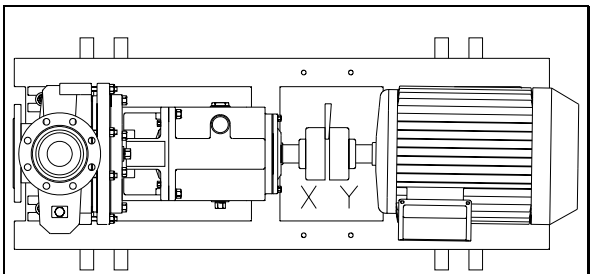


Fig. 3-9

4. Repeat steps 1 through 3 until the different between the first reading and the second reading is 0.05mm or less.

5. Re-check both horizontal and vertical readings to ensure adjustment of one did

not disturb the other. Correct as necessary.

3.6.3.4 Parallel Alignment

A unit is in parallel alignment when indicator P (parallel indicator) or gaps between the straight-edge and coupling do not vary by more than 0.05mm as measured at four points 90° apart at operating temperature. Note the preliminary vertical cold setting criteria in section *3.6.2 Alignment Criteria*.

For Pin-and-cushion or Spacer Coupling:

Vertical Correction (Top-to- Bottom)

1. Zero indicator P at top dead centre (12 o'clock) of coupling half Y.

2. Rotate coupling halves X and Y together to move indicator to bottom dead centre (6 o'clock). Observe needle and record reading.

3. **Negative Reading** – Coupling half X is lower than coupling half Y. Correct by removing shims of thickness equal to half of the indicator reading from each driver foot.

   Positive Reading – Coupling half X is higher than coupling half Y. Correct by adding shims of thickness equal to half of the indicator reading to each driver foot (Fig. 3-10).

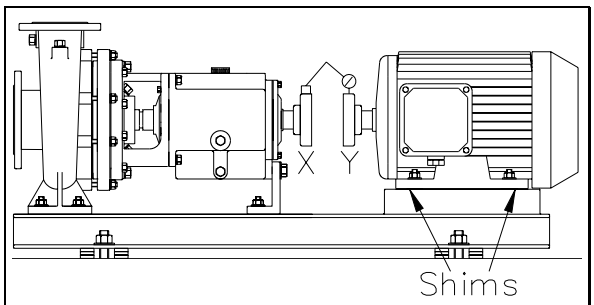


Fig. 3-10

NOTE
Equal amounts of shims must be added to or removed from each driver foot. Otherwise the vertical angular alignment will be affected.

4. Repeat steps 1 through 3 until indicator P reads 0.05mm or less when hot, or per table in section *3.6.2 Alignment Criteria* when cold.

Horizontal Correction (Side-to-Side)

1. Zero indicator P on the left side of coupling half Y, 90° from top dead centre (9 o'clock).

2. Rotate coupling halves X and Y together to move indicator through top centre to the right side, 180° from the start (3 o'clock). Observe needle and record reading.

3. **Negative Reading** – Coupling half Y is to the left of coupling half X. Correct by sliding driver evenly in the appropriate direction.

   Positive Reading – Coupling half Y is to the right of coupling half X. Correct by sliding driver evenly in the appropriate direction (Fig. 3-11).

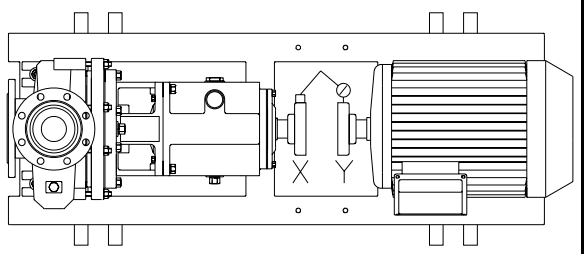


Fig. 3-11

NOTE
Failure to slide driver evenly will affect horizontal angular correction.

4. Repeat steps 1 through 3 until indicator P reads 0.05mm or less.

5. Re-check both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary.

For Rubber Bushing Coupling:

Vertical Correction (Top-to-Bottom)

1. Place the straight-edge on the coupling halves at top dead centre (12 o'clock). Record the distance of the gap, D_1 between the straight-edge and coupling

(D_1 is positive value if gap exists on coupling half Y, and vice versa).

2. Move the straight-edge to bottom dead centre (6 o'clock). Record the distance of the gap, D_2 between the straight-edge and coupling (D_2 is negative value if gap exists on coupling half Y, and vice versa).

3. **D_1+D_2 = Negative Value** – Coupling half X is lower than coupling half Y. Correct by removing shims of thickness equal to half of $|D_1+D_2|$ from each driver foot.

   D_1+D_2 = Positive Value – Coupling half X is higher than coupling half Y. Correct by adding shims of thickness equal to half of $|D_1+D_2|$ to each driver foot (Fig. 3-12).

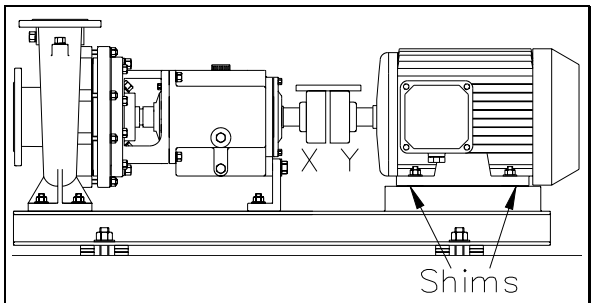


Fig. 3-12

N O T E

Equal amounts of shims must be added to or removed from each driver foot. Otherwise the vertical angular alignment will be affected.

4. Repeat steps 1 through 3 until $|D_1+D_2|$ is 0.05mm or less when hot, or per table in section *3.6.2 Alignment Criteria* when cold.

Horizontal Correction (Side-to-Side)

1. Place the straight-edge on the coupling halves on the left side of coupling half Y, 90° from top dead centre (9 o'clock). Record the distance of the gap, D_1 between the straight-edge and coupling (D_1 is positive value if gap exists on coupling half Y, and vice versa).

2. Move the straight-edge to the right side, 180° from the start (3 o'clock). Record the distance of the gap, D_2 between the straight-edge and coupling (D_2 is negative value if gap exists on coupling half Y, and vice versa).

3. **D_1+D_2 = Negative Reading** – Coupling half Y is to the left of coupling half X. Correct by sliding driver evenly in the appropriate direction.

   D_1+D_2 = Positive Reading – Coupling half Y is to the right of coupling half X. Correct by sliding driver evenly in the appropriate direction (Fig. 3-13).

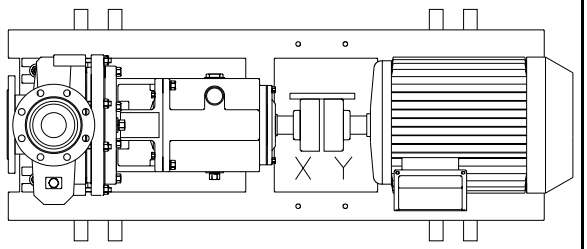


Fig. 3-13

N O T E

Failure to slide driver evenly will affect horizontal angular correction.

4. Repeat steps 1 through 3 until $|D_1+D_2|$ is 0.05mm or less.

5. Re-check both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary.

3.6.3.5 Complete Alignment

A unit is complete alignment when both indicators A (angular) and P (parallel) or both tapered gauge readings and gaps between the straight-edge and coupling do not vary by more than 0.05mm as measured at four points 90° apart.

For Pin-and-cushion or Spacer Coupling:

Vertical Correction (Top-to- Bottom)

1. Zero indicators A and P at top dead centre (12 o'clock) of coupling half Y.

2. Rotate coupling halves X and Y together to move indicators to bottom dead centre (6 o'clock). Observe needles and record readings.

3. Make corrections as outlined previously.

Horizontal Correction (Side-to-Side)

1. Zero indicators A and P on the left side of coupling half Y, 90° from top dead centre (9 o'clock).

2. Rotate coupling halves X and Y together to move indicators through top centre to the right side, 180° from the start (3 o'clock). Observe needles and record readings.

3. Make corrections as outlined previously.

4. Recheck both vertical and horizontal readings to ensure adjustment of one did not disturb the other. Correct as necessary.

For Rubber Bushing Coupling:

Vertical Correction (Top-to- Bottom)

1. Place the tapered gauge between the coupling halves and straight-edge on the coupling halves at top dead centre (12 o'clock). Record the reading on the gauge and distance of the gap, D_1 between the straight-edge and coupling (D_1 is positive value if gap exists on coupling half Y, and vice versa).

2. Move the tapered gauge between the coupling halves and straight-edge on the coupling halves to bottom dead centre (6 o'clock). Record the reading on the gauge again and distance of the gap, D_2 between the straight-edge and coupling (D_2 is negative value if gap exists on coupling half Y, and vice versa).

3. Make corrections as outlined previously.

Horizontal Correction (Side-to-Side)

1. Place the tapered gauge between the coupling halves and straight-edge on the coupling halves on the left side of coupling half Y, 90° from the top dead centre (9 o'clock). Record the reading on the gauge and distance of the gap, D_1 between the straight-edge and coupling (D_1 is positive value if gap exists on coupling half Y, and vice versa).

2. Move the tapered gauge between the coupling halves and straight-edge on the coupling halves to the right side, 180° from the start (3 o'clock). Record the reading on the gauge again and distance of the gap, D_2 between the straight-edge and coupling (D_2 is negative value if gap exists on coupling half Y, and vice versa).

3. Make corrections as outlined previously.

4. Recheck both vertical and horizontal readings to ensure adjustment of one did not disturb the other. Correct as necessary.

> **ⓘ NOTE**
> ***With experience, the installer will understand the interaction between angular and parallel and will make corrections appropriately.***

3.6.4 Alignment Troubleshooting

Cannot Obtain Horizontal (Side-to-Side) Alignment, Angular or Parallel

1. *Driver feet bolt bound* – Loosen pump hold down bolts and slide pump and driver until horizontal alignment is achieved.

2. *Baseplate not levelled properly, probably twisted* – Determine which corner(s) of the baseplate are high or low and remove or add shims at the appropriate corner(s) and realign.

3.7 Grout Baseplate

> **ⓘ NOTE**
> ***Do not grout until the unit has been properly levelled.***

1. Clean areas of baseplate that will contact grout. Do not use oil-based cleaners because grout will not bond to it. Refer to grout manufacturer's instruction.

2. Built dam around foundation. Thoroughly wet foundation (Fig. 3-14).

3. Pour grout through grout holes on baseplate, or through the ends, up to level of dam. Remove air bubbles from grout

as it is poured by pudding, using a vibrator, or pumping the grout into place. Non-shrink grout is recommended.

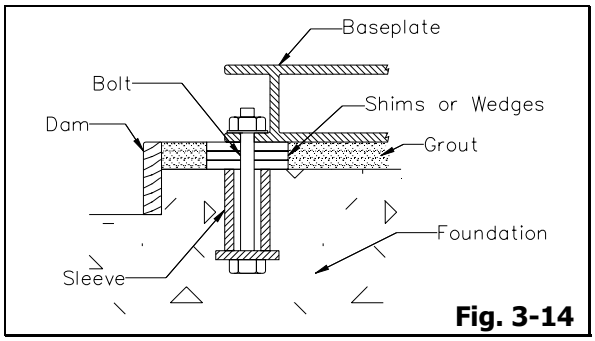


Fig. 3-14

4. Allow grout to set.

5. Fill remainder of baseplate with grout. Remove air as before (Fig. 3-15).

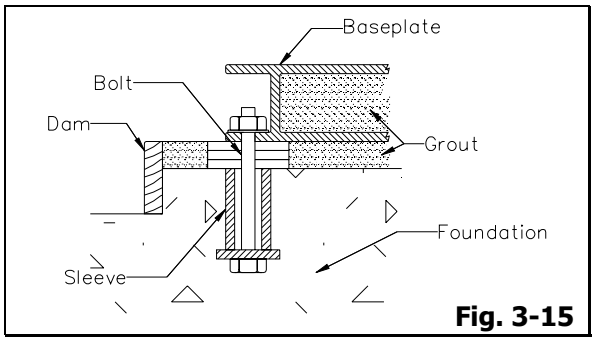


Fig. 3-15

6. Allow grout to set at least 48 hours.

7. Tighten foundation bolts.

8. Re-check alignment before continuing, using methods previously described.

3.8 Piping

3.8.1 General

⚠ W A R N I N G

Never draw piping into place by forcing at the flange connections of the pump. This may impose dangerous strains on the unit and cause misalignment between pump and driver. Pipe strain will adversely effect the operation of the pump resulting in physical injuries and damages to the equipment.

Guidelines for piping are given in the "Hydraulic Institute Standards" available from: Hydraulic Institute, 9 Sylvan Way, Parsippany, NJ 07054-3802 and must be reviewed prior to pump installation.

1. All piping must be supported independently of, and line up naturally with, the pump flanges.

2. Provision must be made to support suction and discharge piping to the pump to prevent excessive nozzle loads and maintain pump-driver alignment.

3. Piping runs should be as short as possible to minimise frictional losses.

4. **DO NOT** connect piping to pump until grout has hardened and pump and driver hold-down bolts have been tightened.

5. It is suggested that expansion loops or joints, if used, be properly installed in suction and/or discharge lines when handling liquids at elevated temperatures, so linear expansion of piping will not draw pump out of alignment.

6. The piping should be arranged to allow pump flushing prior to removal of the unit on services handling corrosive liquids.

7. Carefully clean all pipes parts, valves and fittings, and pump branches prior to assembly.

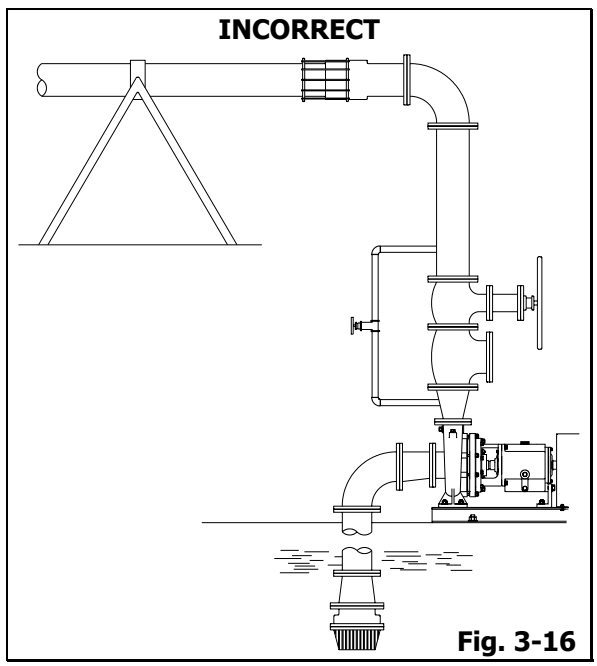


Fig. 3-16

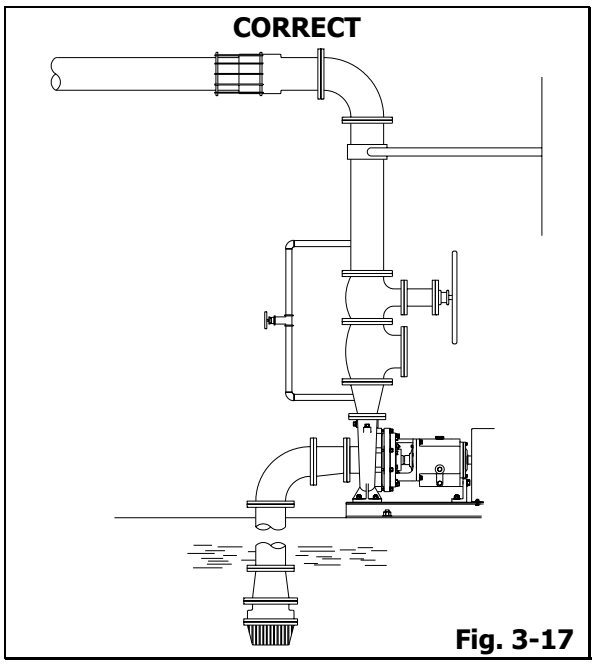


Fig. 3-17

3.8.2 Suction Piping

⚠ C A U T I O N

$NPSH_A$ must always exceed $NPSH_R$. Reference Hydraulic Institute for NPSH and pipe friction values needed to evaluate suction piping.

Properly installed suction piping is a necessity for trouble-free pump operation. Suction piping should be flushed **BEFORE** connection to the pump and is absolutely leakproof.

1. Use of elbows close to the pump suction flange should be avoided. There should be a minimum of two pipe diameters of straight pipe between the elbow and suction inlet. Where used, elbows should be long radius (Fig. 3-18).

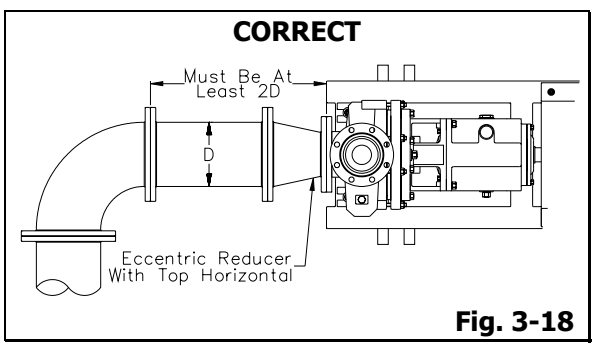


Fig. 3-18

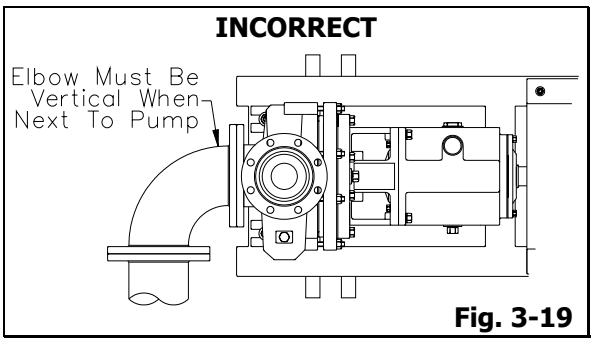


Fig. 3-19

2. Use suction pipe one or two sizes larger than the pump suction, with a reducer at the suction flange. **Suction piping should never be of smaller diameter than the pump suction**. The flow velocity should not exceed 2m/s at rated flow rate.

⚠ C A U T I O N

Pump must never be throttled on suction side.

3. Reducers should be eccentric at the pump suction flange with **sloping side down** (Figs. 3-20, 3-21 and 3-22).

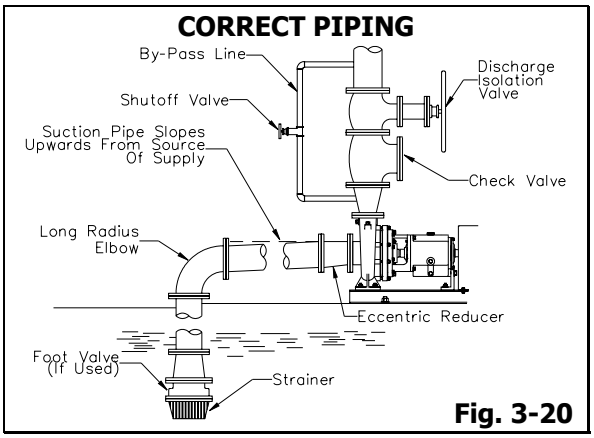


Fig. 3-20

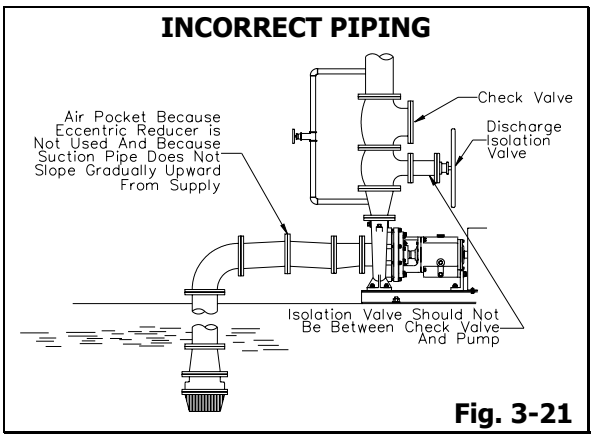


Fig. 3-21

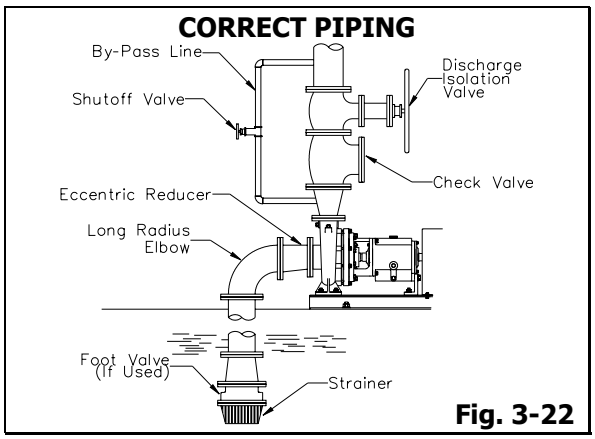


Fig. 3-22

4. Suction strainers, when used, must have a net "free area" of at least three times the suction pipe area.

5. A differential gauge can be used to monitor the strainer and allow the pump to be shut down before the debris blocks the strainer such that the pump is damaged. At this point the strainer should be cleaned and reinstalled, when the scale and dirt have been removed from the system by no further changes in pressure or pressure drops across the screen, the strainer may be removed.

6. The suction pipe must be adequately submerged below the liquid surface to prevent vortices and air entrapment at the supply.

7. Separate suction lines are recommended when more than one pump is operating from the same source of supply.

Suction Lift Conditions

1. Arrange the length and size of suction pipe so that the maximum suction lift, including all losses, will not exceed the $NPSH_R$ of the pump.

2. Hot liquids must flow to the pump under sufficient positive head to prevent vaporisation at the impeller inlet.

3. Suction pipe must be free from air pockets.

4. Suction piping must **slope upwards** to the pump suction flange from the source of supply.

5. Horizontal suction pipes should have a **gradual rise**. Do not install any part or section of a horizontal suction pipe **higher than** the pump suction flange.

6. Whenever another pipe or other obstruction requires bending from the natural slope, run the suction pipe under the obstruction rather than above it.

7. All joints must be **air tight**.

8. A means of priming the pump must be provided, such as a foot valve.

Suction Head / Flooded Suction Conditions

1. An **isolation valve should be installed in the suction line** at least two pipe diameters from the suction to permit closing of the line for pump inspection and maintenance.

2. Keep suction pipe free from air pocket.

3. Piping should be **level or slope gradually downward** from the source of supply.

4. No portion of the piping should extend **below** pump suction flange.

5. The size of entrance from supply should be one or two sizes larger than the suction pipe.

3.8.3 Discharge Piping

1. Use of elbows close to the pump discharge flange should be avoided.

2. Use discharge pipe one or two size larger than the pump discharge. **Discharge piping should never be of smaller diameter than the pump discharge**. The flow velocity in the delivery line should not exceed 3m/s.

3. **Isolation and check valves should be installed in discharge line**. Locate the check valve between isolation valve and pump; this will permit inspection of the check valve. The isolation valve is required for priming, regulation of flow, and for inspection and maintenance of pump. The check valve prevents pump or

seal damage due to reverse flow through the pump when the driver is turned off.

4. Increasers, if used, should be placed between pump and check valves.

5. Cushioning devices should be used to protect the pump from surges and water hammer if quick-closing valves are installed in system.

3.8.4 Auxiliary Piping

KS-SG2 pumps are furnished with standard stuffing box cover with heating chamber, flushing connections depend on flushing plan, optional casing with heating chamber (KS-SGK models), and optional bearing frame with oil bath cooling.

Cooling of stuffing box cover and bearing frame is recommended under these conditions:

- *Stuffing Box Cover* – With a mechanical seal when the pumping temperature is above 180°C. Specific application or liquids may require cooling at lower temperatures. With a gland packing when the temperature is above 120°C.

- *Bearing Frame* – When pumping temperatures is above 250°C causing bearing operating temperatures above 90°C. At pumping temperatures below 250°C, cooling is rarely necessary.

⚠ CAUTION

Excessive cooling of the bearing frame may lead to early bearing failure from moisture condensation contamination of the oil.

For pumps furnished with mechanical seals, flushing arrangement is depend on the pump service applications, liquids pumped, type of mechanical seal used and mechanical seal arrangement.

ⓘ NOTE

Kewpump will recommend appropriate mechanical seal flushing plan to customer based on mechanical seal manufacturer recommendation and accordance with ISO 5199:2002.

For gland packed pumps, external sealing liquid is required when:

- Abrasive particles in the pumping liquid could score shaft sleeve.

- Stuffing box pressure is below atmospheric pressure due to the pump operates with a small delivery head and a large suction lift. Under these conditions, packing will not be cooled and lubricated and air will be drawn into pump.

⚠ CAUTION

Most packing requires lubrication. Failure to lubricate packing may shorten the life of the packing and pump.

1. All auxiliary piping shall be designed and arranged to permit removal for maintenance and cleaning and shall be adequately supported to prevent damage due to vibration under normal operation and maintenance activities.

2. Steam services shall be "top in, bottom out". In general other services should be "bottom or side in, top out".

3. For the cooling liquid, clear, not corrosive fresh water can be used.

4. Use flow control valve on the cooling water or steam outlet piping to adjust the cooling water or steam flow rate. For shaft sealing flushing piping, refer to flushing plan for the location of flow control valve.

5. Stuffing box cover jacket cooling water flow rates are related to pumping temperature. A rate of 8l/m to 20l/m is advisable. For pumping temperature of 250°C, higher cooling water flow rate might be required.

6. Bearing frame oil bath cooling water flow rates are in the range to 8l/m. The rate should be adjusted to maintain the bearing operating temperature in the 60°C to 85°C range.

7. For mechanical sealing, if external flushing is required, the flushing liquid must be at a pressure of 0.35kg/cm^2 to 1kg/cm^2 greater than the sealing chamber pressure with an injection rate 2l/m to 8l/m.

8. For gland packing, if external sealing liquid is required, the external liquid source must be at a pressure of 0.5kg/cm^2 to 1kg/cm^2 greater than the suction pressure with a leakage rate 20 to 30 drops/minute through packing.

9. All outlet connections should be piped separately to an open sight drain or through separate flow metering devices to allow correct monitoring of the cooling water or steam flow rate.

10. Drains and leakage outlet shall be provided at all low points to allow complete drainage. Piping shall be designed to avoid gas pockets.

3.8.5 Final Piping Check

After connecting the piping to pump:

1. Rotate shaft several times by hand to be sure that there is no binding and all parts are free.

2. Check alignment, per alignment procedures outlined previously to determine absence of pipe strain. If pipe strain exists, correct piping.

4 OPERATION

4.1 Preparation for Start-Up

4.1.1 Checking Rotation

> ⚠ **C A U T I O N**
> ***Serious damage may result if pump is run in the wrong rotation. Therefore before connecting coupling halves, rotation of driver must be checked to make sure that it rotates in correct direction.***

1. Lock out power to driver.

> ⚠ **W A R N I N G**
> ***Lock out driver power to prevent accidental start-up and physical injury.***

2. Make sure coupling is securely fastened to driver shaft.

3. Unlock driver power.

4. Make sure everyone is clear. Jog driver just long enough to determine direction of rotation. **Rotation must correspond to arrow labelled either on adaptor extension ring (221) or frame adaptor (220).**

5. Lock out power to driver.

4.1.2 Check Impeller Clearance

Before starting a pump furnished with open type impeller, the clearance between the open impeller and casing wear plate must be checked. The pump efficiency is maintained when the proper impeller clearance is set. The optimum hydraulic performance is attained by setting the impeller front clearance with casing wear plate at the factory to a predetermined limit.

The maximum impeller clearance setting should not be set more than 0.25mm or significant performance degradation will result.

For impeller clearance adjustment procedures, see section *5.5 Impeller Clearance Setting*.

4.1.3 Couple Pump and Driver

> **⚠ W A R N I N G**
> ***Lock out driver power to prevent accidental rotation and physical injury.***

1. Connect coupling halves per manufacturer's instructions.

2. Install coupling guard.

> **⚠ W A R N I N G**
> ***Never operate a pump without coupling guard properly installed. Personal injury will occur if pump is run without coupling guard.***

4.1.4 Lubricating Bearings

> **⚠ C A U T I O N**
> ***The pumps are shipped with the bearing frames empty of oil. Bearings must be lubricated at the job site.***

> **⚠ W A R N I N G**
> ***Operation of the unit without proper lubrication can result in overheating of the bearings, causing bearing failures, pump seizures, and actual breakup of the equipment, and exposing operating personnel to personal injuries.***

Oil lubricated bearings are furnished in the pump. High quality turbine oil which is non-detergent, and has anti-rust and anti-oxidant additives should be used to fill the bearing frame. The grade of oil should be ISO viscosity grade 100 (between SAE grade 30 and 40).

1. Remove oil cover (330) from bearing frame (300).

2. Fill bearing frame (300) with proper lubricating oil through the oil connection hole until oil level is at the centre of the oil gauge (331).

3. If excessive amount of oil has been filled in, drain the excessive oil by removing the bearing frame drain plug (400) until the correct oil level is reached.

4. Replace oil cover (330) (Fig. 4-1).

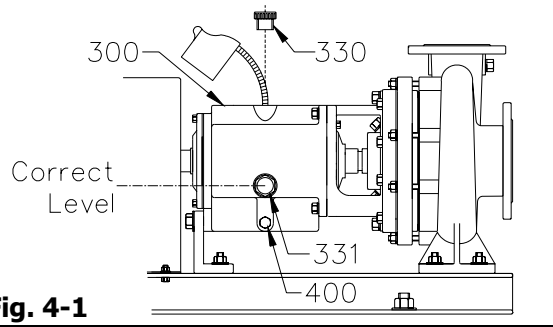


Fig. 4-1

5. If the pump is put into operation after a prolonged shut down, flush out the bearings (311 and 312) and bearing frame (300) with light oil to remove contaminants. During flushing, rotate the shaft (130) slowly by hand. After complete removal of the cleaning agent through bearing frame drain hole, flush the bearing frame (300) with proper lubricating oil to ensure oil quality after cleaning.

4.1.5 Shaft Sealing

Mechanical Sealing

On pumps supplied with mechanical seals a variety of seal types are available for the different types of service and application. When mechanical seals are supplied they have been installed and adjusted before the pump was shipped, therefore no attention is required.

> **⚠ C A U T I O N**
> ***All seals must not be run dry or in abrasives.***

Gland Packing

The gland packing is left only finger tight when the pump leaves the factory, and it must be possible to rotate shaft by hand. Under normal service conditions, the packing is lubricated by leakage of the liquid through the packing. Therefore, a packed gland must leak and leakage should take place as soon as the stuffing box cover is pressurised. Final adjustment of packing gland is made after pump is started.

⚠ C A U T I O N

Packing glands must never be tightened to the point where leakage from the packing is stopped. A small amount of leakage is required for lubrication of the packing. Shutting off leakage flow from the packing will result in burned packing and scored shaft sleeve.

4.1.6 Priming Pump

⚠ C A U T I O N

Never start the pump until it has been properly primed. Before starting or while operating the pump, the casing and suction line must be completely filled with the liquid being pumped. The rotating parts depend on this liquid for lubrication and the pump may seize if operated without liquid.

⚠ C A U T I O N

It is important that a pump should never be subjected to thermal or pressure shock. The liquid should therefore be allowed to flow into the casing slowly. A pump should never be started until all the parts are up to the temperature of the liquid to be pumped.

ⓘ N O T E

If a pump is equipped with cooling water piping this should be turned on before priming the pump.

Several different methods of priming can be used, depending upon type of installation and service involved.

Suction Head Conditions

1. Slowly open the suction valve (Fig. 4-2).
2. If the pump is to handle hot liquid, open the suction valve to allow a very slight flow of liquid into the pump, thereby heating the pump slowly and evenly.
3. Close the discharge valve and open air vent on the discharge piping until liquid flows out.
4. Rotate the shaft (130) a few revolutions to make sure no air is trapped in the impeller (120) and suction pipe.
5. Close the vent valve.
6. Open the suction valve wide before starting the pump.

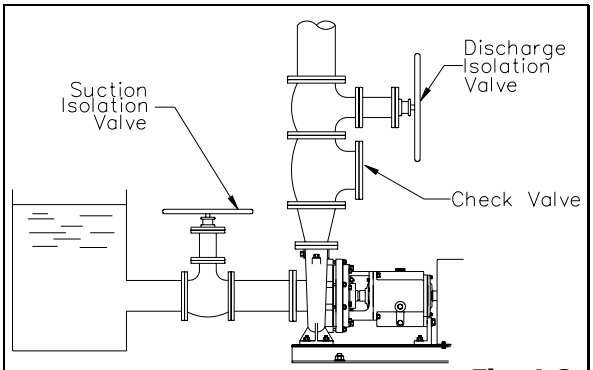


Fig. 4-2

Suction Lift Conditions

A foot valve and outside source of liquid may be used to prime the pump. Outside source of liquid can come from a self-priming pump, pressurised discharge line, or other outside supply (Figs. 4-3 and 4-4).

1. Close discharge valve and open air vent on the discharge piping.
2. Open valve in outside supply line until only liquid escapes from vent valve.
3. If the pump is to handle hot liquid, open the outside supply line valve to allow a very slight flow of liquid into the pump, thereby heating the pump slowly and evenly.
4. Rotate the shaft (130) a few revolutions to make sure no air is trapped in the impeller (120) and suction pipe.
5. Close the vent valve and then the outside supply line.

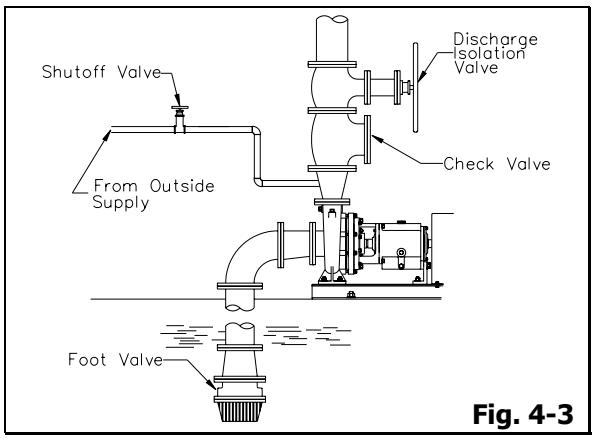


Fig. 4-3

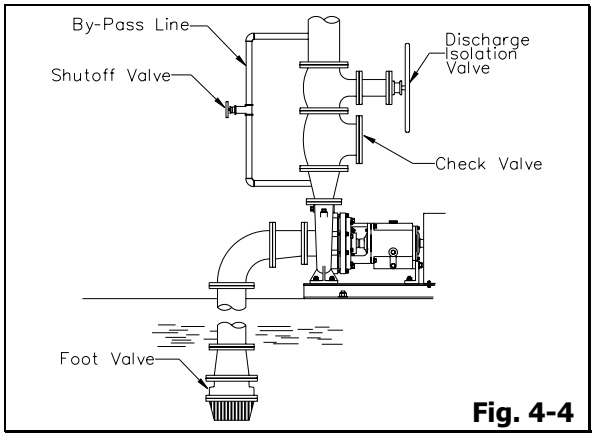


Fig. 4-4

4.2 Starting Pump

N O T E

When pump is handling heavy viscous liquid, the viscosity of the liquid must allow it to be pumped easily. Liquid may have to be heated prior to starting the pump.

1. Make sure suction valve is open.

2. All recirculation or cooling lines should be opened and verify its free discharge and flow rate. For recommended flow rates, see section *3.8.4 Auxiliary Piping*.

3. Fully close or partially open discharge valve as dictated by system conditions.

4. Start the driver. Bring pump up to speed quickly so internal parts receive lubrication.

C A U T I O N

Immediately observe pressure gauges. If discharge pressure is not quickly attained, stop driver, reprime and attempt to restart.

5. As soon as the pump is up to rated speed, open the discharge valve slowly until the desired flow is obtained to avoid abrupt changes in velocity and surging in the suction line.

W A R N I N G

Do not operate pump below minimum rated flows or with suction and/or discharge valve closed. These conditions may create an explosive hazard due to vaporisation of pumpage and can quickly lead to pump failure and physical injury.

6. With pumps that are gland packed it is important to keep the gland (213) as loose as possible without undue leakage, for packing lubrication. A normal leakage rate is between 20 to 30 drops/minute. A tight gland will cause excessive packing and shaft sleeve wear, and also increase power consumption.

7. After the unit has operated for a short time, all pressure bolting should be gone over for tightness.

4.3 Operation

4.3.1 General Considerations

If conditions required operating the pump at reduced capacity, always vary capacity with regulating valve in the discharge line. NEVER throttle flow from the suction side.

C A U T I O N

When operating for some time at reduced capacity, much of the pump horsepower will go into the liquid in the form of heat. A bypass must be provided under these conditions to prevent the liquid in the pump from becoming hot enough to vaporise.

Driver may overload if the pumpage specific gravity (density) is greater than originally assumed, or the rated flow rate is exceeded.

Always operate the pump at or near the rated conditions to prevent damage resulting from cavitation or recirculation.

Damage to the pump may occur if operating at reduced capacity due to:

- **Increase Vibration Levels** – Affects bearings, stuffing box cover, and mechanical seal.
- **Increase Radial Thrusts** – Stresses on shaft and bearings.
- **Heat Build Up** – Vaporisation causing rotating parts to score or seize.
- **Cavitation** – Damage to internal surfaces of pump.
- **Erosive Swirl** – Liquid recirculates through the pump causing localised damage by erosive action.

4.3.2 Operation Checks

1. Make certain that liquid is always being discharged from the pump. If not, the pump may seize. A discharge pressure gauge is the best method to check whether or not liquid is being pumped. If the gauge drops to zero or registers abnormal pressure, shut down the pump immediately and determine the cause.

2. For pump which is equipped with mechanical seal(s) (200 or 204 and 205), leakage usually indicates that the seal has been damaged or wrong fitted. If excessive leakage occurs, shut down the pump immediately and determine the problem of the seal. Refer to section *6 Disassembly & Reassembly* for dismantling and installing the mechanical seal(s) (200 or 204 and 205).

3. For gland packed pump, a slight amount of leakage through the packing (201) is required to cool and lubricate the packing. If insufficient or excessive leakage occurs, adjustment of the gland (213) has to be done per instructions in section *5.4.2 Gland Packing*.

4. Bearings (311 and 312) will run at a constant temperature, depending on the air temperature at the location (normal operating temperature will be 60°C to 85°C based on 27°C ambient temperature). Frequently check the oil level through the oil gauge (331). If bearing temperature exceeds 95°C, the pump should be shut down and the cause of the overheating located. If pump is equipped with bearing frame with oil bath cooling (300.OBC), adjust the cooling water flow rate to obtain the normal operating temperature.

> ⚠ **C A U T I O N**
>
> ***Excessive cooling of the bearing frame may lead to early bearing failure from moisture condensation contamination of the oil.***

5. Observe pump for vibration levels, and excessive noise. If normal levels are exceeded, shut down and resolve.

4.3.3 Operation Troubleshooting

If any of the following troubles are encountered, they may be due to the causes listed below:

No Liquid Delivered

1. *Pump not primed* – Reprime pump, check that the pump and suction line are full of liquid.

2. *Speed too low* – Check voltage and frequency.

3. *Air leak in suction or stuffing box cover* – Repair leak or readjust packing (201) or mechanical seal(s) (200 or 204 and 205).

4. *Discharge head too high* – Consult factory, reduce flow rate or shorten discharge pipe.

5. *Suction lift too high* – Shorten suction pipe.

6. *Impeller or discharge line plugged up* – Back flush pump to clean impeller (120) or remove obstruction from discharge pipe.

7. *Wrong direction of rotation* – Change rotation to concur with direction indicated by arrow labelled either on adaptor extension ring (221) or frame adaptor (220).

8. *Discharge valve closed* – Slowly open discharge valve until the desired flow is obtained.

9. *Foot valve or suction pipe opening not submerged enough* – Consult factory for proper depth. Use baffle to eliminate vertices.

Not Enough Liquid Delivered

1. *Air leaks in suction or stuffing box cover* – Repair leak or readjust packing (201) or mechanical seal(s) (200 or 204 and 205).

2. *Air leaks through gasket* – Replace stuffing box cover gasket (431).

3. *Speed too low* – Check voltage and frequency.

4. *Suction lift too high* – Shorten suction pipe.

5. *Impeller or discharge line partially plugged* – Back flush pump to clean impeller (120) or remove obstruction from discharge pipe.

6. *Not enough suction head for hot liquid* – Ensure that suction line valve is fully open and line is unobstructed.

7. *Total head too high* – Consult factory or shorten suction and discharge pipe.

8. *Excessive impeller running clearance* – Adjust impeller clearance.

9. *Damaged impeller or casing* – Inspect and replace if necessary.

10. *Foot valve or suction pipe opening not submerged enough* – Consult factory for proper depth. Use baffle to eliminate vertices.

11. *Wrong direction of rotation* – Change rotation to concur with direction indicated by arrow labelled either on adaptor extension ring (221) or frame adaptor (220).

Not Enough Pressure

1. *Speed too low* – Check voltage and frequency.

2. *Wrong direction of rotation* – Change rotation to concur with direction indicated by arrow labelled either on adaptor extension ring (221) or frame adaptor (220).

3. *Air or gas in liquid* – Rearrange piping to eliminate air or gas in liquid.

4. *Leaks in suction* – Repair leak.

5. *Excessive impeller running clearance* – Adjust impeller clearance.

6. *Impeller diameter too small* – Consult factory or increase driver speed if allowable.

7. *Damaged impeller or casing* – Inspect and replace if necessary.

8. *Impeller partially clogged* – Back flush pump to clean impeller (120).

Pump Works for a While, Then Loses Suction

1. *Air leaks in suction or stuffing box cover* – Repair leak or readjust packing (201) or mechanical seal(s) (200 or 204 and 205).

2. *Suction lift too high* – Shorten suction pipe.

3. *Air or vapour pockets in suction line* – Rearrange piping to eliminate air pockets.

4. *Improperly primed pump* – Reprime pump.

Motor Runs Hot

1. *Speed too high* – Check voltage and frequency.

2. *Head lower than rating allowing pump to handle too much liquid* – Consult factory, install throttle valve or trim impeller (120).

3. *Liquid heavier and more viscous than rating* – Check specific gravity and viscosity.

4. *Excessive impeller running clearance* – Adjust impeller clearance.

5. *Packing too tight* – Readjust packing (201), replace if worn.

6. *Rotor binding* – Check internal wearing parts for proper clearances.

7. *Defects in motor* – Consult driver manufacturer.

Pump Is Noisy and Vibrates

1. *Air or gas in liquid* – Rearrange piping to eliminate air or gas in liquid.

2. *Pump is cavitating* – Locate and correct system problem.

3. *Foot valve or suction pipe opening not submerged enough* – Consult factory for proper depth. Use baffle to eliminate vertices.

4. *Improper pump-driver alignment* – Align shafts.

5. *Worn or loose bearings* – Replace as required.

6. *Partly clogged impeller causing imbalance* – Back flush pump to clean impeller (120).

7. *Broken or bent impeller or shaft* – Replace as required.

8. *Foundation not rigid* – Tighten hold down bolts of pump and driver.

9. *Suction or discharge piping not anchored or properly supported* – Anchor per Hydraulic Institute Standards Manual recommendations.

Stuffing Box Cover Overheat

1. *Packing too tight* – Readjust packing (201), replace if worn.

2. *Packing not sufficiently lubricated* – Readjust packing (201) or/and external sealing liquid flow rate. Replace packing (201) if worn.

3. *Wrong grade of packing* – Consult factory.

4. *Packing not properly packed* – Check and repack packing (201).

Excessive Leakage from Stuffing Box Cover

1. *Gland improperly adjusted* – Tighten gland nuts.

2. *Excessive external sealing liquid flow rate* – Readjust external sealing liquid flow rate.

3. *Packing not properly packed* – Check and repack packing (201).

4. *Worn mechanical seal parts* – Replace worn parts.

5. *Shaft or shaft sleeve scored* – Remachine or replace as required.

Bearings Overheat

1. *Oil level too low or high* – Add or release lubricant until proper level is reached.

2. *Insufficient oil bath cooling water flow rate* – Increase cooling water flow rate.

3. *Improper or poor grade of oil* – Check lubricant for suitability.

4. *Dirt or water in bearings* – Clean the bearing frame (300) and add in proper lubricant.

5. *Improper alignment* – Realign pump and driver.

Bearings Wear Rapidly

1. *Improper alignment* – Realign pump and driver.

2. *Shaft bent* – Replace as required.

3. *Vibration* – Locate and correct problem.

4. *Lack of lubrication* – Add more lubricant until proper level is reached.

5. *Bearings improperly installed* – Reinstall bearings (311 and 312).

6. *Improper or poor grade of oil* – Check lubricant for suitability.

7. *Dirt or water in bearings* – Clean the bearing frame (300) and add in proper lubricant.

8. *Moisture condensation contamination due to excessive cooling of bearing frame* – Reduce cooling water flow rate or remove bearing frame (300) cooling water line if required.

4.4 Shutdown

1. Whenever possible, the pump should be allowed to operate on water only for a short period to clean any slurry through the system before shutdown.

2. If a check valve is installed in the discharge line, the pump may be shut down by merely stopping the driver. If a check valve is not installed, shut down the pump by slowly closing the discharge valve, after which the driver is to be stopped immediately.

3. Lock driver to prevent accidental rotation.

4. It is good practice to close the suction valve if the pump is to be shut down for an extended period of time.

5. Shut off all recirculation or cooling lines if any. If pumps are on hot service and are put on standby, keep cooling liquid on.

6. When the pump is idle and there is a possibility of freezing, the pump casing drain plug (401) should be removed and the casing drained.

⚠ W A R N I N G

When handling hazardous and/or toxic fluids, proper personal protective equipment should be worn. If pump is being drained, precautions must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.

4.5 Final Alignment

1. Run the unit under actual operating conditions for a sufficient length of time to bring the pump and driver up to operating temperature.

2. Check alignment while unit is still hot per alignment procedures in section *3.6.3 Alignment Procedures for Direct Coupled Baseplate Design*.

3. Reinstall coupling guard.

5 PREVENTIVE MAINTENANCE

5.1 General Comments

Kewpumps are ruggedly constructed, and with proper care will give years of satisfactory service.

A routine maintenance program can extend the life of your pump. Well maintained equipment will last longer and required fewer repairs. You should keep maintenance records, this will help pinpoint potential causes of problems.

Kewpump (M) Sdn. Bhd. assumes no responsibility or liability for damages caused by the use and failure of the pump which has been fitted with spare or repair parts not of Kewpump (M) Sdn. Bhd. manufacture. Only genuine parts from Kewpump (M) Sdn. Bhd. or an authorised distributor should be used.

⚠ W A R N I N G

Do not attempt any maintenance, inspection, repair or cleaning in the vicinity of operating rotating equipment. Such action could result in injury to operating personnel.

Before attempting any inspection or repair on the pump, the driver control must be in the "off" position, locked and tagged to prevent injury to personnel performing service on the pump.

5.2 Maintenance Schedule

Routine Maintenance

1. Bearing lubrication
2. Seal monitoring
3. Vibration analysis
4. Discharge pressure
5. Temperature monitoring

Routine Inspections

1. Check level and condition of oil through oil gauge (331) on bearing frame (300).
2. Check for unusual noise, vibration and bearings temperature.
3. Inspect pump and piping for leaks.
4. Check stuffing box cover (212) for leaks.
   - ➲ *Mechanical Sealing* – Should be no leakage.
   - ➲ *Gland Packing* – Insufficient or excessive leakage requires adjustment or possible packing (201) replacement. Refer to section *5.4.2 Gland Packing* for adjustment.

3 Months Inspections

1. Check the foundation and the hold-down bolts for tightness.

2. If the pump has been left idle, check the packing (201). Replace if require.

3. Oil should be changed at least every 3 months (2000 hours) or more often if there are any adverse atmospheric conditions or other conditions which might contaminate or break down the oil. If it is cloudy or contaminated as seen by inspection through the oil gauge (331), it should be changed immediately.

4. Check the coupling alignment. Realign if required.

Annual Inspections

1. Check the pump capacity, pressure and power. If pump performance does not satisfy your process requirements, and the process requirements have not changed, the pump should be disassembled, and all internal parts and passages be cleaned and inspected for wear. Foreign matter found in pump should be removed, and worn parts should be replaced. Otherwise, a system inspection should be done.

5.3 Maintenance of Bearings

1. Check the oil level and condition periodically to be sure there is an adequate supply of oil.

2. Change the oil after 200 hours for new bearings, thereafter every 2000 operating hours or 3 months (whichever comes first), or sooner if the operating conditions or pump environment dictates.

3. Before filling with new oil, flush the bearing frame (300) with hot, light oil, rotating the pump shaft (130) by hand to remove dirt and contaminants.

4. Refer to previous section *4.1.4 Lubricating Bearings* for proper procedures of refilling the bearing frame (300). High quality turbine oil which is non-detergent, and has anti-rust and anti-oxidant additive should be used. The grade of oil should be ISO viscosity grade 100 (between SAE grade 30 and 40).

5.4 Maintenance of Shaft Seals

5.4.1 Mechanical Sealing

The life of a mechanical seal depends on various factors such as cleanliness of the liquid handled and its lubricating properties. Due to the diversity of operating conditions it is, however, not possible to give definite indications as to its life.

⚠ W A R N I N G

Never operate the pump without liquid supplied to mechanical seal. Running a mechanical seal dry, even for a few seconds, can cause seal damage and must be avoided. Physical injury can occur if mechanical seal fails.

1. Mechanical seal(s) (200 or 204 and 205) should be checked, particularly during the first hours of operation. Minor leakage through the seal usually stops after a short time. However, if it continues, stop the pump and examine the seal. Excessive leakage past a mechanical seal(s) (200 or 204 and 205) usually indicates worn or broken parts, which require replacement.

2. Replace the mechanical seal(s) (200 or 204 and 205) as per instructions in section *6 Disassembly & Reassembly*. The same type of seal should be used for replacement and the instructions should be followed closely.

5.4.2 Gland Packing

1. Check the gland leakage periodically to be sure the leakage rate is acceptable. A normal leakage rate is between 20 to 30 drops/minute.

2. If the leakage is excessive, after the pump has been running for 10 minutes with steady leakage, tighten the two (2) gland nuts evenly by one sixth of a full turn at 10 minutes interval until the leakage is acceptable, ensuring overheating does not occur.

3. If the stuffing box cover (212) is overheated, the pump must be stopped and allowed to cool and when restarted, leakage should take place. If it does not, step 2 should be repeated.

4. If leakage is insufficient and shows sign of heating when the stuffing box cover (212) is pressurised, try to loosen the two (2) gland nuts evenly until adequate leakage rate is reached.

ⓘ NOTE

It is normal for gland leakage water to be hotter than the supply because it is conducting away the heat generated by friction in the gland.

At low pressure, very little leakage is required and it is possible to operate with only a small amount of water issuing from the gland. It is not essential to stop a pump because of gland heating unless steam or smoke is produced.

5. When packing (201) becomes worn to the extent that leakage cannot be controlled and heating persists, it is advisable to repack the pump as per instructions in section *6 Disassembly & Reassembly*.

5.5 Impeller Clearance Setting

A change in pump performance may be noted over time by a drop in head or flow or an increase in power required. Performance can usually be renewed by adjusting the open type impeller clearance, therefore pumps furnished with open type impeller are specially designed with adjustable bearing box to make open type impeller close running clearance adjustments easy and accurate to extend pump performance life.

1. Slowly close discharge valve.

2. Shut down and lock out power to driver.

⚠ WARNING

Lock out driver power to prevent accidental startup and physical injury.

3. Remove coupling guard.

4. Disconnect couplings.

5. For suction head conditions, close suction valve too.

6. Observe the discharge pressure gauge to make sure casing (100) is not pressurised. Slowly open discharge valve to release pressure in casing (100) if required. Close back the discharge valve after depressurisation of the casing (100) has been done.

⚠ WARNING

DO NOT proceed until the pump has been depressurised. Failure to do so could result in personal injury or loss of life.

Dial Indicator Method

1. Set indicator so that button contacts either the shaft end or against face of coupling (Fig. 5-1).

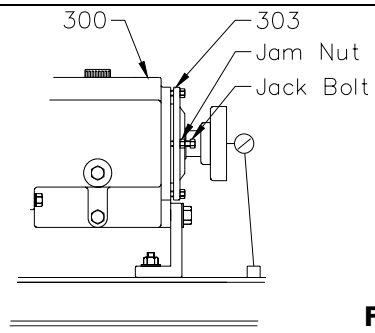


Fig. 5-1

2. Loosen two (2) jam nuts on two (2) jack bolts and back bolts out about two turns.

3. Tighten four (4) adjustable bearing box bolts evenly, drawing the adjustable bearing box (303) towards bearing frame (300) until impeller (120) touches the casing wear plate (104). Turn pump coupling by hand to ensure contact is made.

4. Set indicator to zero and back four (4) adjustable bearing box bolts out about one turn.

5. Thread two (2) jack bolts in until they evenly contact the bearing frame (300). Tighten the two (2) jack bolts evenly (about one flat at a time) backing the adjustable bearing box (303) away from

the bearing frame (300) until the indicator shows the proper clearance of 0.13mm.

6. Evenly tighten four (4) adjustable bearing box bolts, then two (2) jam nuts keeping indicator reading at proper setting.

7. Check shaft (130) for free turning. Now the clearance between impeller (120) and casing wear plate (104) is just about 0.13mm.

8. Check shaft alignment as per alignment procedures in section *3.6.3 Alignment Procedures for Direct Coupled Baseplate Design.* Realign as required.

9. Reconnect couplings.

10. Reinstall coupling guard.

Dial Indicator Method

1. Loosen two (2) jam nuts on two (2) jack bolts and back bolts out about two turns.

2. Tighten four (4) adjustable bearing box bolts evenly, drawing the adjustable bearing box (303) towards bearing frame (300) until impeller (120) touches the casing wear plate (104). Turn pump coupling by hand to ensure contact is made.

3. Using a feeler gauge, set the gap between four (4) adjustable bearing box bolts and adjustable bearing box (303) evenly to 0.13mm (Fig. 5-2).

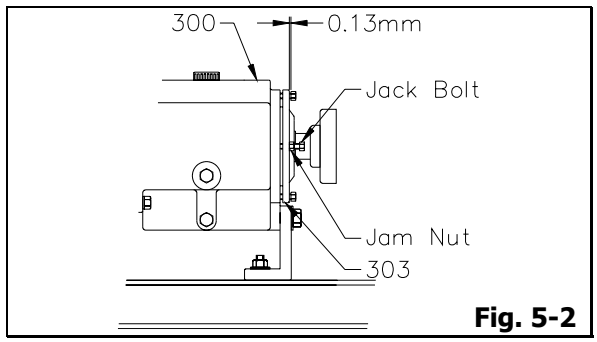


Fig. 5-2

4. Evenly back out the adjustable bearing box (303) using two (2) jack bolts until it contacts the four (4) adjustable bearing box bolts. Evenly tighten two (2) jam nuts.

5. Check shaft (130) for free turning. Now the clearance between impeller (120) and casing wear plate (104) is just about 0.13mm.

6. Check shaft alignment as per alignment procedures in section *3.6.3 Alignment Procedures for Direct Coupled Baseplate Design.* Realign as required.

7. Reconnect couplings.

8. Reinstall coupling guard.

6 DISASSEMBLY & REASSEMBLY

6.1 Disassembly

> **⚠ W A R N I N G**
> ***Pump components can be heavy. Proper methods of lifting must be employed to avoid physical injury and/or equipment damage. Steel toed shoes must be worn at all times.***

> **⚠ W A R N I N G**
> ***The pump may handle hazardous and/or toxic fluids. Proper personal protective equipment should be worn. Precautions must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.***

> **ⓘ N O T E**
> ***Before disassembling the pump for overhaul, ensure all replacement parts are available.***

> **⚠ W A R N I N G**
> ***Lock out power supply to driver to prevent accidental startup and physical injury.***

6.1.1 Removal of Pump from Base Plate

1. Shut off all valves controlling flow to and from pump.

> **⚠ W A R N I N G**
> ***Operator must be aware of pumpage and safety precautions to prevent physical injury.***

2. Drain liquid from piping, casing heating chamber and stuffing box cover heating chamber. Flush pump and heating chambers if necessary.
3. Disconnect all auxiliary piping and tubing.
4. Remove coupling guard.
5. Disconnect couplings.
6. If rubber bushing coupling is used, remove driver foot hold down bolts and nuts and move driver backward away from the pump.
7. Drain oil from bearing frame (300) by removing bearing frame drain plug (400). Replace plug after oil is drained (Fig. 6-1).

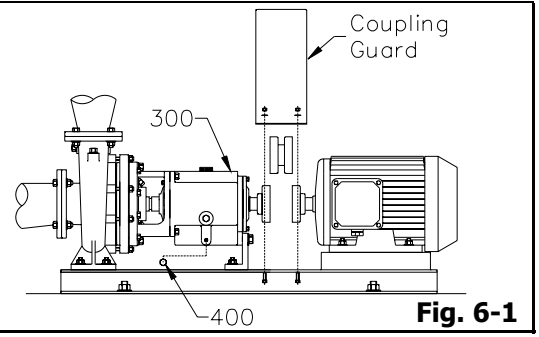


Fig. 6-1

> **ⓘ N O T E**
> ***Oil analysis should be part of a preventive maintenance program and is helpful to determine cause of a failure. Save oil in a clean container for inspection.***

8. Place sling from hoist through frame adaptor (220).
9. Remove support foot (410) hold down bolts and nuts.
10. Remove casing nuts (Fig. 6-2).

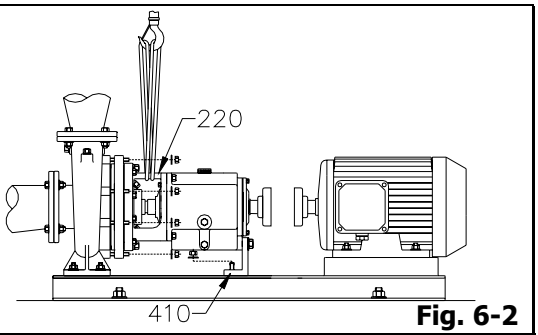


Fig. 6-2

> **⚠ W A R N I N G**
> ***Never apply heat to remove parts. Use of heat may cause an explosion due to trapped fluid, resulting in severe physical injury and properly damage.***

11. Jack out the back pull-out assembly from casing (100). Make sure stuffing box cover gasket (431) is not damaged (Fig. 6-3).

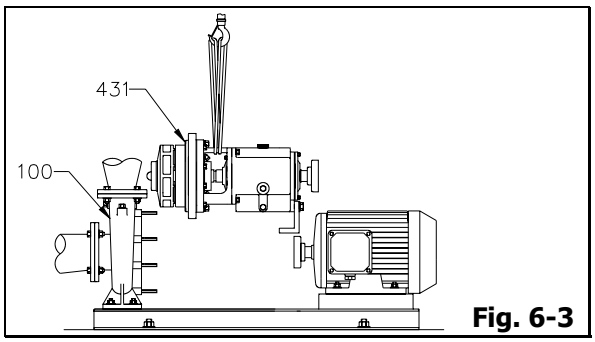


Fig. 6-3

NOTE
Stuffing box cover gasket may partially adhere to casing due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

NOTE
Penetrating oil can be used if stuffing box cover to casing joint is excessively corroded.

NOTE
Remove and then mark shims (if used) under bearing frame support foot. Save for reassembly.

WARNING
Never remove the back pull-out assembly unassisted, physical injury can occur.

12. Move back pull-out assembly to clean workbench.

13. Support frame adaptor (220) securely to workbench. Jack out coupling (Fig. 6-4).

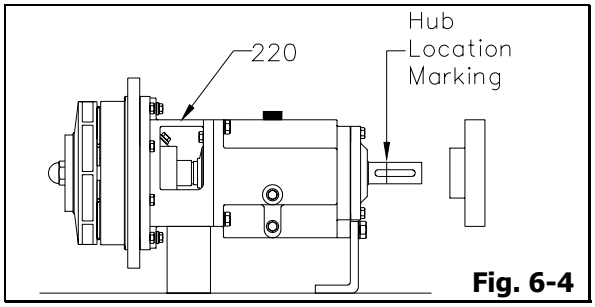


Fig. 6-4

NOTE
Mark and scribe shaft for relocating coupling hub during reassembly.

CAUTION
Coupling must not be hammered off the shaft, since this will damage the bearings of the pump.

6.1.2 Removal of Impeller

WARNING
Never apply heat to remove an impeller. The use of heat may cause an explosion due to trapped fluid, resulting in severe physical injury property damage.

WARNING
Wear heavy work gloves when handling impellers as sharp edges may cause physical injury.

NOTE
It is recommended that the bearing frame support foot be clamped to the workbench when removing impeller.

1. Slide spanner over the shaft (130) and shaft end key (136). Hold spanner on the workbench or a solid block and make sure the power end is secure on the work surface.

2. Place another spanner over the impeller nut (134) and unscrew the nut counterclockwise (viewed from the impeller end of the shaft). Remove impeller nut (134) and impeller nut gasket (445), and lift off impeller (120) (Fig. 6-5).

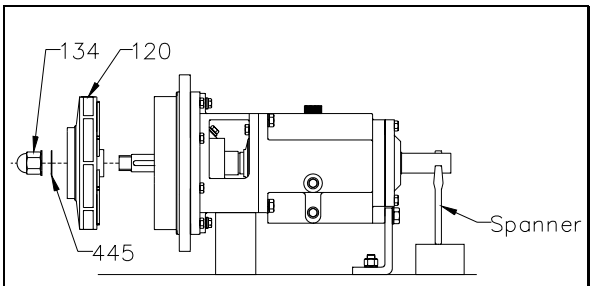


Fig. 6-5

3. Lift out key for impeller (135) and remove shaft sleeve gasket (437) from shaft (130) (Fig. 6-6).

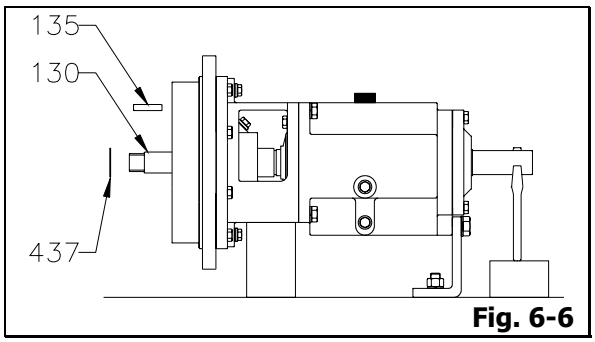


Fig. 6-6

N O T E

If impeller cannot be removed from shaft, cut shaft after shaft sleeve, remove impeller, stuffing box cover assembly, shaft sleeve and shaft end as a unit. Do not use heat.

6.1.3 Removal of Stuffing Box Cover

6.1.3.1 Single Internal without/with Rear Quenching

1. Remove shaft sleeve (133), abutment ring (463) (where applicable) and rotary portion of mechanical seal (200) as a unit from shaft (130) (Fig. 6-7).

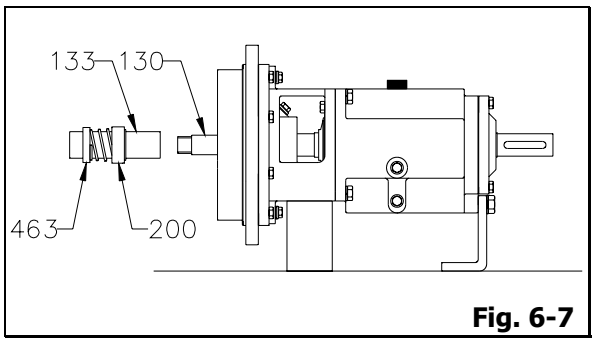


Fig. 6-7

2. Remove two (2) abutment ring jam nuts from abutment ring (463). Remove rotary portion of mechanical seal (200) and abutment ring (463) from shaft sleeve (133) (Fig. 6-8).

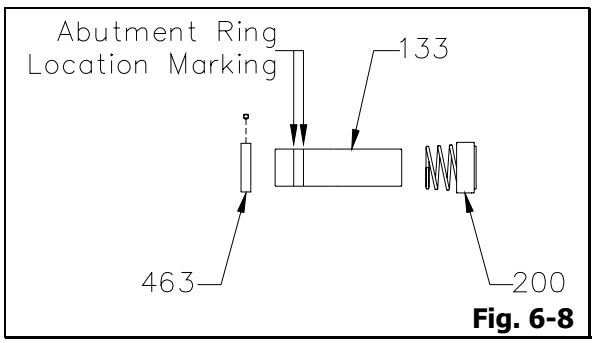


Fig. 6-8

3. For mechanical seal (200) furnish with jam nuts, where abutment ring (463) is not available, unscrew the mechanical seal jam nuts, and remove rotary portion of mechanical seal (200) from shaft sleeve (133) (Fig. 6-9).

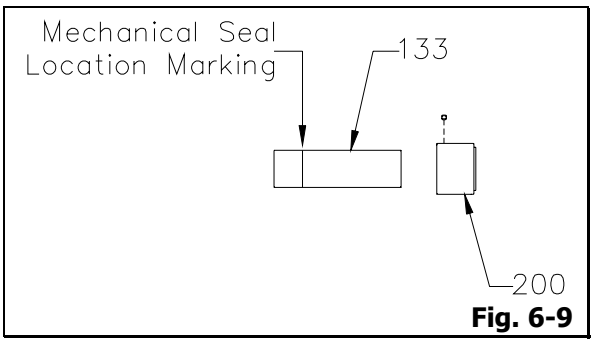


Fig. 6-9

N O T E

Mark and scribe shaft sleeve for relocating abutment ring and mechanical seal during reassembly.

4. Remove all connection plugs (409) or/and piping adaptors from stuffing box cover (212.IS/RQ) (Fig. 6-10).

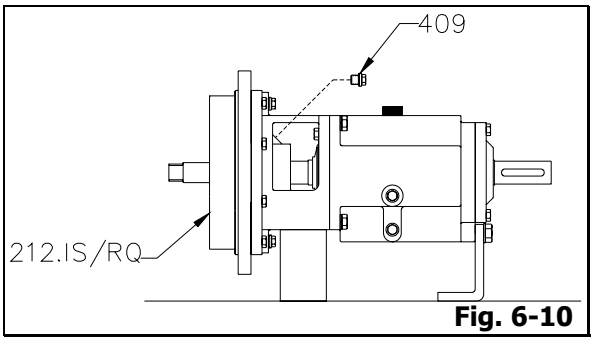


Fig. 6-10

5. Remove all stuffing box cover bolts (where applicable). Lift off stuffing box cover (212.IS/RQ) assembly from frame adaptor (220) or adaptor extension ring (221) (Fig. 6-11).

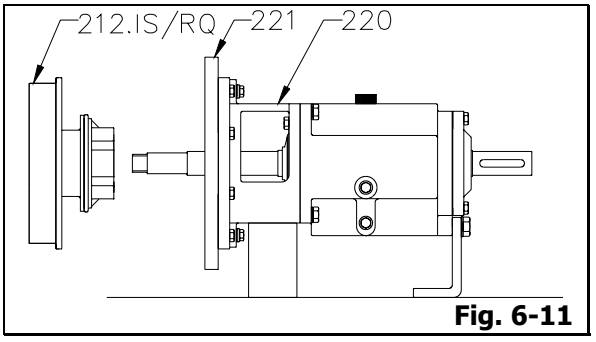


Fig. 6-11

⚠ C A U T I O N

Be careful not to damage the stationary portion of mechanical seal seated on stuffing box cover while removing stuffing box cover from frame adaptor or adaptor extension ring.

ⓘ N O T E

Frame adaptor gasket or adaptor extension ring gasket may partially adhere to stuffing box cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

6. Remove stuffing box cover "O" ring (420) and stuffing box cover gasket (431) from stuffing box cover (212.IS/RQ).

ⓘ N O T E

Stuffing box cover gasket may partially adhere to stuffing box cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

7. Remove stationary portion of mechanical seal (200) gently from stuffing box cover (212.IS/RQ).

8. For single internal with rear quenching, remove v-seal (202) from stuffing box cover (212.RQ) (Fig. 6-12).

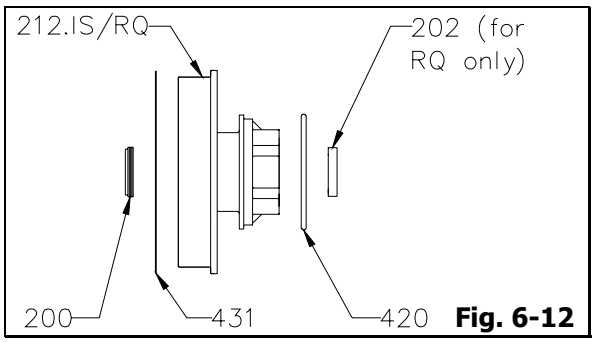


Fig. 6-12

6.1.3.2 Single External

1. Remove all end ring bolts and lift off end ring for mechanical sealing (214.M) assembly from stuffing box cover (212.ES) (Fig. 6-13).

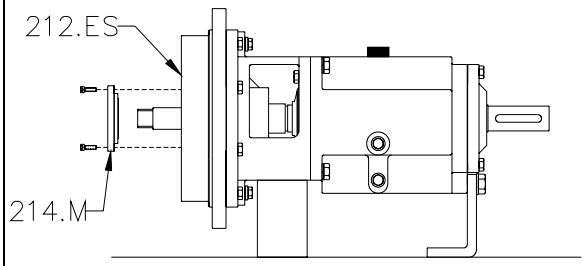


Fig. 6-13

⚠ C A U T I O N

Be careful not to damage the stationary portion of mechanical seal seated on end ring for mechanical sealing while removing end ring from stuffing box cover.

ⓘ N O T E

End ring gasket may partially adhere to stuffing box cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

2. Remove end ring gasket (448) and stationary portion of mechanical seal (200) gently from end ring for mechanical sealing (214.M) (Fig. 6-14).

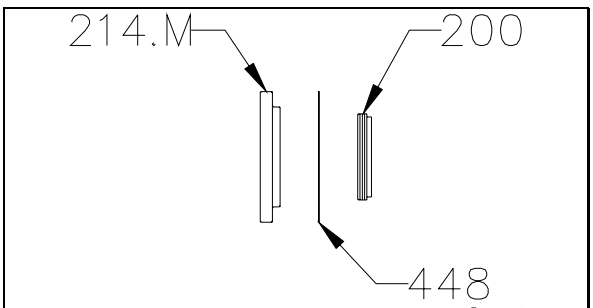


Fig. 6-14

ⓘ N O T E

End ring gasket may partially adhere to end ring due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

3. Remove shaft sleeve (133), abutment ring (463) (where applicable) and rotary portion of mechanical seal (200) as a unit from shaft (130) (Fig. 6-15).

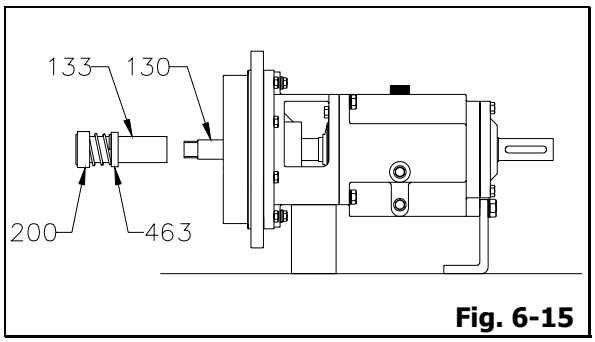


Fig. 6-15

4. Remove two (2) abutment ring jam nuts from abutment ring (463). Remove rotary portion of mechanical seal (200) and abutment ring (463) from shaft sleeve (133) (Fig. 6-16).

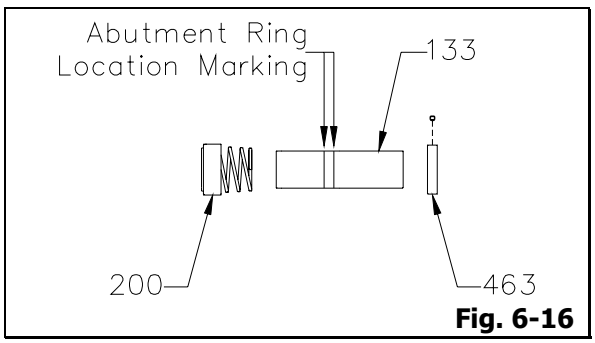


Fig. 6-16

5. For mechanical seal (200) furnish with jam nuts, where abutment ring (463) is not available, unscrew the mechanical seal jam nuts, and remove rotary portion of mechanical seal (200) from shaft sleeve (133) (Fig. 6-17).

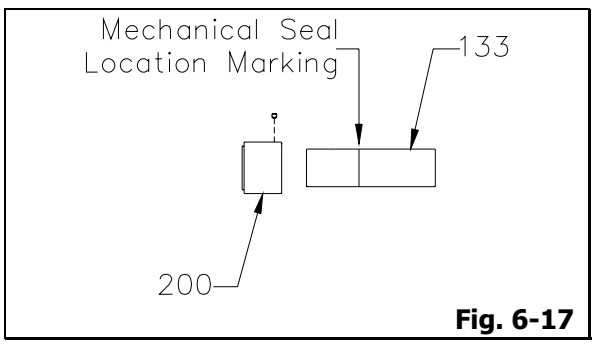


Fig. 6-17

NOTE

Mark and scribe shaft sleeve for relocating abutment ring and mechanical seal during reassembly.

6. Remove all stuffing box cover bolts (where applicable). Lift off stuffing box cover (212.ES) assembly from frame adaptor (220) or adaptor extension ring (221) (Fig. 6-18).

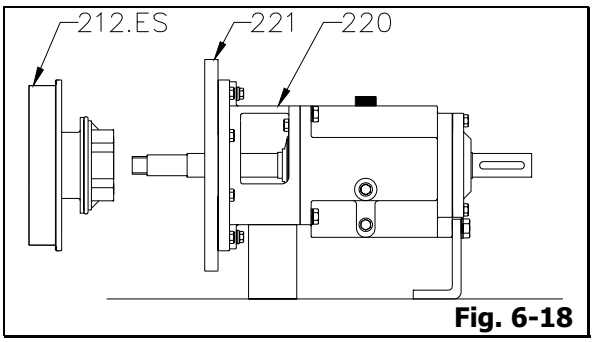


Fig. 6-18

NOTE

Frame adaptor gasket or adaptor extension ring gasket may partially adhere to stuffing box cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

7. Remove stuffing box cover "O" ring (420) and stuffing box cover gasket (431) from stuffing box cover (212.ES) (Fig. 6-19).

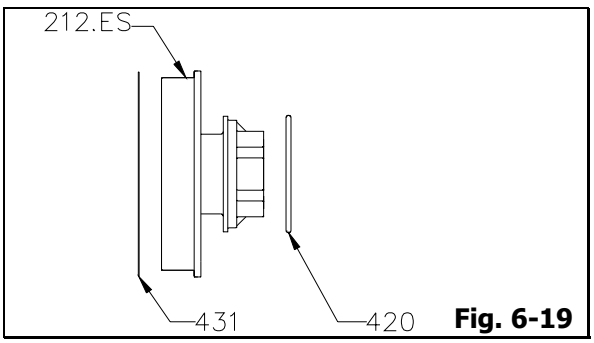


Fig. 6-19

NOTE

Stuffing box cover gasket may partially adhere to stuffing box cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

6.1.3.3 Double Back-to-Back

1. Remove all end ring bolts and lift off end ring for mechanical sealing (214.M) assembly from stuffing box cover (212.DB) (Fig. 6-20).

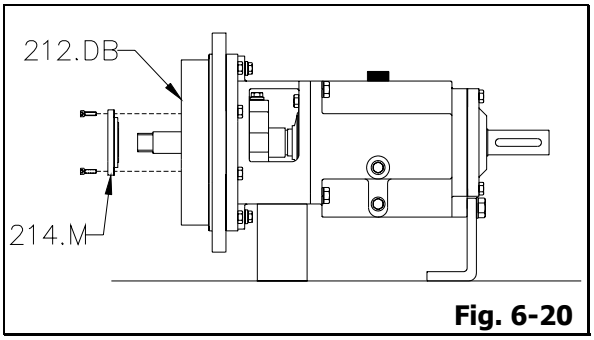


Fig. 6-20

⚠ CAUTION

Be careful not to damage the stationary portion of pump end mechanical seal seated on end ring for mechanical sealing while removing end ring from stuffing box cover.

ⓘ NOTE

End ring gasket may partially adhere to stuffing box cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

2. Remove end ring gasket (448) and stationary portion of pump end mechanical seal (204) gently from end ring for mechanical sealing (214.M) (Fig. 6-21).

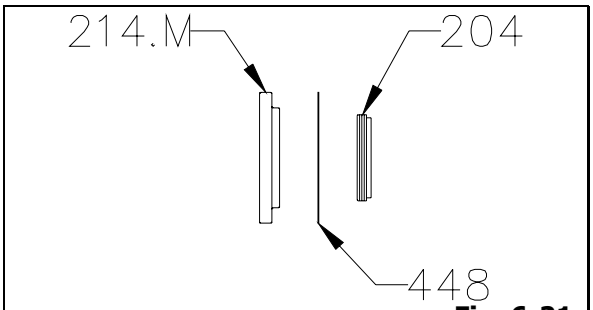


Fig. 6-21

ⓘ NOTE

End ring gasket may partially adhere to end ring due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

3. Remove shaft sleeve (133), abutment ring (463) (where applicable) and rotary portion of pump end and atmospheric end mechanical seal (204 and 205) as a unit from shaft (130) (Fig. 6-22).

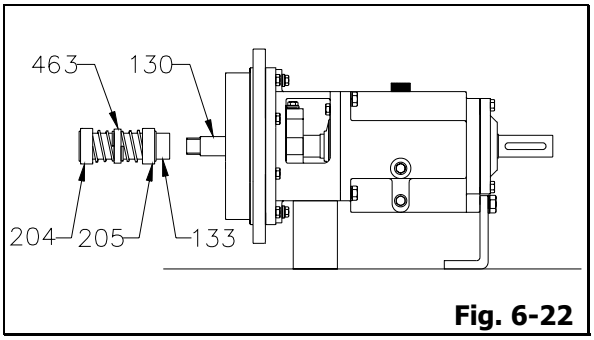


Fig. 6-22

4. Remove two (2) abutment ring jam nuts from abutment ring (463). Remove rotary portion of pump end and atmospheric end mechanical seal (204 and 205) and abutment ring (463) from shaft sleeve (133) (Fig. 6-23).

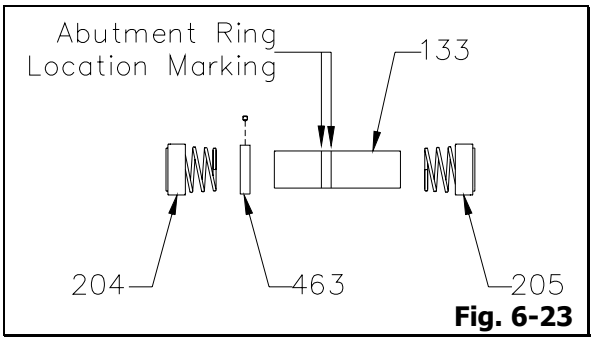


Fig. 6-23

5. For mechanical seals (204 and 205) furnish with jam nuts, where abutment ring (463) is not available, unscrew the mechanical seals jam nuts, and remove rotary portion of pump end and atmospheric end mechanical seal (204 and 205) from shaft sleeve (133) (Fig. 6-24).

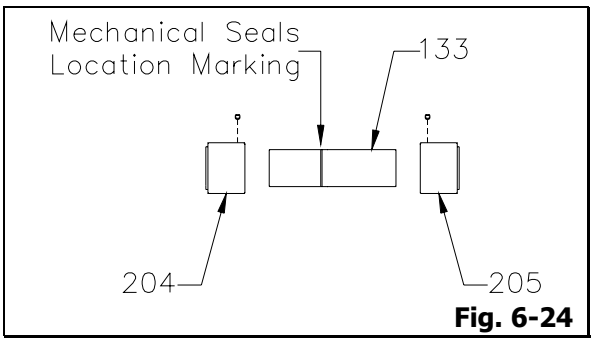


Fig. 6-24

ⓘ NOTE

Mark and scribe shaft sleeve for relocating abutment ring and mechanical seal during reassembly.

6. Remove all connection plugs (409) or/and piping adaptors from stuffing box cover (212.DB) (Fig. 6-25).

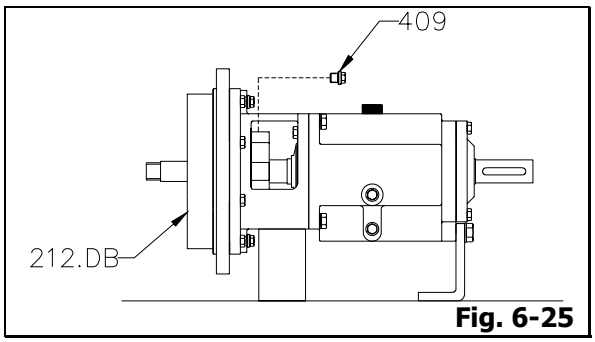


Fig. 6-25

7. Remove all stuffing box cover bolts (where applicable). Lift off stuffing box cover (212.DB) assembly from frame adaptor (220) or adaptor extension ring (221) (Fig. 6-26).

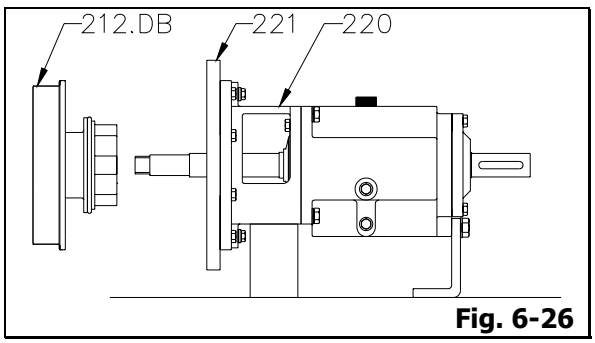


Fig. 6-26

⚠ C A U T I O N

Be careful not to damage the stationary portion of atmospheric end mechanical seal seated on stuffing box cover while removing stuffing box cover from frame adaptor or adaptor extension ring.

ⓘ N O T E

Frame adaptor gasket or adaptor extension ring gasket may partially adhere to stuffing box cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

8. Remove stuffing box cover "O" ring (420) and stuffing box cover gasket (431) from stuffing box cover (212.DB).

ⓘ N O T E

Stuffing box cover gasket may partially adhere to stuffing box cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

9. Remove stationary portion of atmospheric end mechanical seal (205) gently from stuffing box cover (212.DB) (Fig. 6-27).

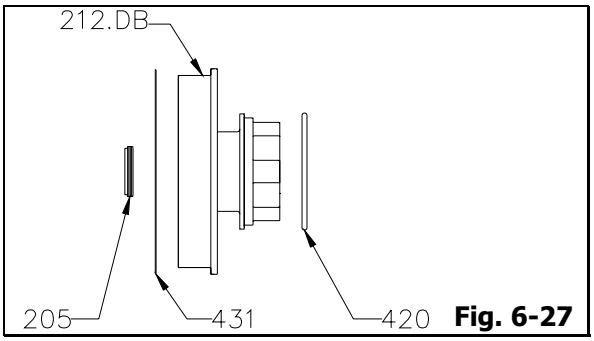


Fig. 6-27

6.1.3.4 Double Tandem

1. Remove all connection plugs (409) or/and piping adaptors from stuffing box cover (212.DT).

2. Remove two (2) seal cover nuts from seal cover studs (Fig. 6-28).

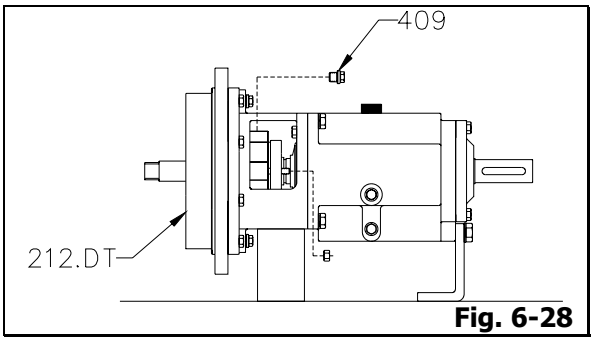


Fig. 6-28

3. Remove all stuffing box cover bolts (where applicable). By holding seal cover (215) and seal cover extension (218) in place, slowly lift off stuffing box cover (212.DT) assembly from frame adaptor (220) or adaptor extension ring (221) (Fig. 6-29).

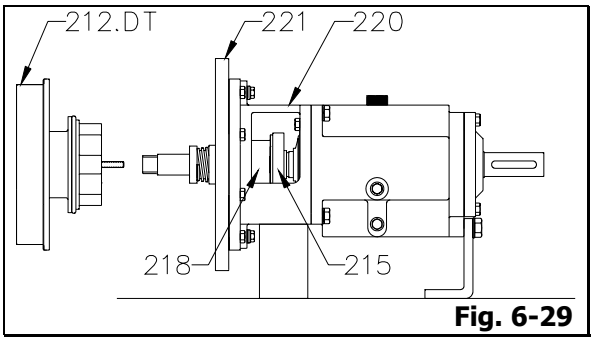


Fig. 6-29

NOTE

Frame adaptor gasket, adaptor extension ring gasket or seal cover extension gasket may partially adhere to stuffing box cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

4. Remove stuffing box cover "O" ring (420), stuffing box cover gasket (431) and two (2) seal cover studs from stuffing box cover (212.DT) (Fig. 6-30).

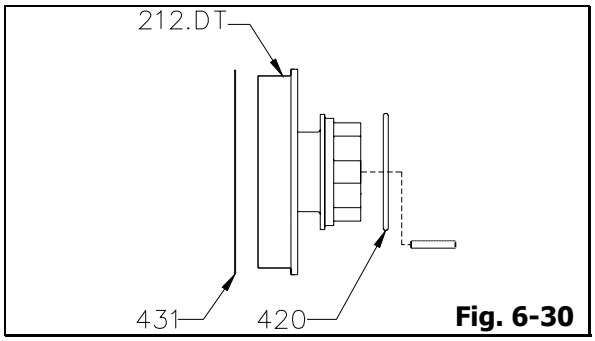


Fig. 6-30

NOTE

Stuffing box cover gasket may partially adhere to stuffing box cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

5. Remove two (2) abutment ring jam nuts from abutment ring (463). By holding shaft sleeve (133) in place, remove rotary portion of pump end mechanical seal (204) and abutment ring (463) from shaft sleeve (133) (Fig. 6-31).

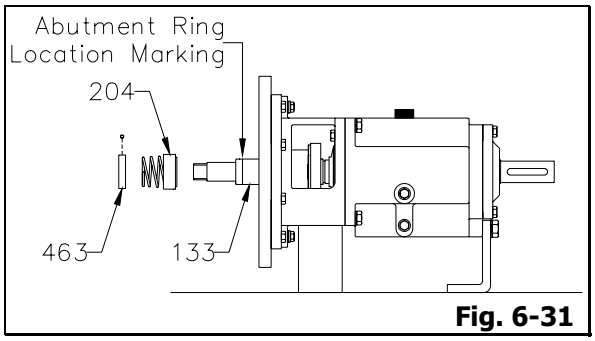


Fig. 6-31

6. For pump end mechanical seal (204) furnish with jam nuts, where abutment ring (463) is not available, unscrew the mechanical seal jam nuts, hold shaft sleeve (133) in place and remove rotary portion of pump end mechanical seal (204) from shaft sleeve (133) (Fig. 6-32).

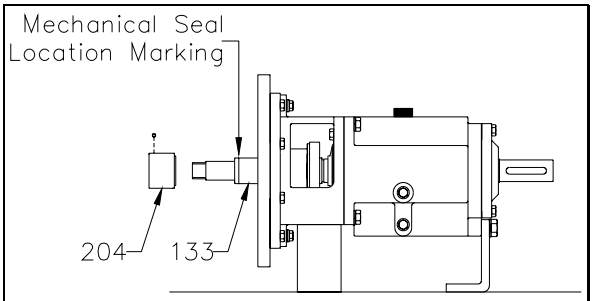


Fig. 6-32

NOTE

Mark and scribe shaft sleeve for relocating abutment ring and mechanical seal during reassembly.

7. Lift off seal cover extension (218) assembly from seal cover (215) (Fig. 6-33).

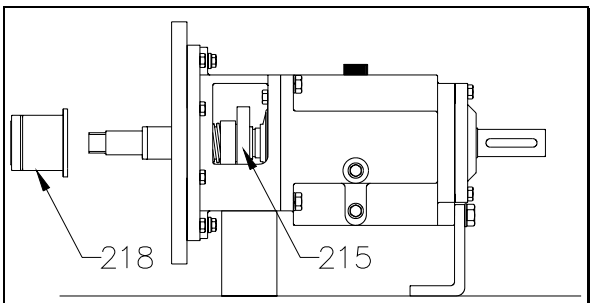


Fig. 6-33

CAUTION

Be careful not to damage the stationary portion of pump end mechanical seal seated on seal cover extension while removing seal cover extension from seal cover.

NOTE

Seal cover gasket may partially adhere to seal cover extension due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

8. Remove seal cover extension gasket (449), seal cover extension "O" ring (429) and stationary portion of pump end mechanical seal (204) gently from seal cover extension (218) (Fig. 6-34).

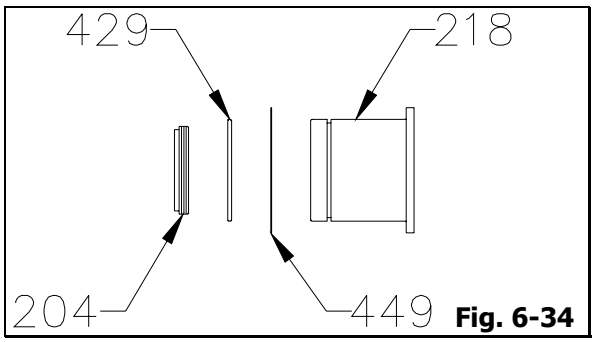


Fig. 6-34

ⓘ NOTE

Seal cover extension gasket may partially adhere to seal cover extension due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

9. Remove shaft sleeve (133), abutment ring (463) (where applicable) and rotary portion of atmospheric end mechanical seal (205) as a unit from shaft (130) (Fig. 6-35).

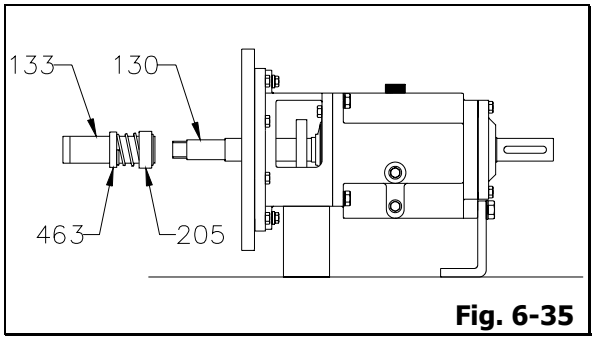


Fig. 6-35

10. Remove two (2) abutment ring jam nuts from abutment ring (463). Remove rotary portion of atmospheric end mechanical seal (205) and abutment ring (463) from shaft sleeve (133) (Fig. 6-36).

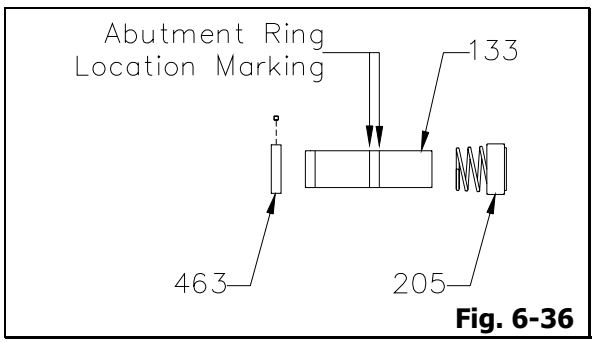


Fig. 6-36

11. For atmospheric end mechanical seal (205) furnish with jam nuts, where abutment ring (463) is not available, unscrew the mechanical seal jam nuts, and remove rotary portion of atmospheric end mechanical seal (205) from shaft sleeve (133) (Fig. 6-37).

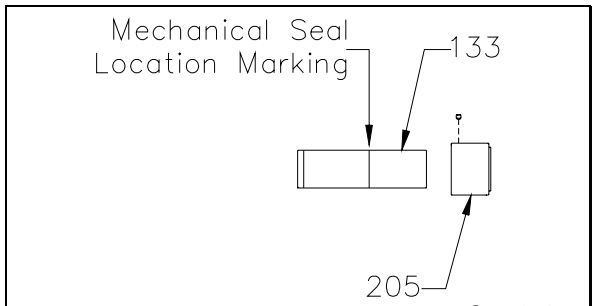


Fig. 6-37

ⓘ NOTE

Mark and scribe shaft sleeve for relocating abutment ring and mechanical seal during reassembly.

12. Lift off seal cover (215) assembly from shaft (130) (Fig. 6-38).

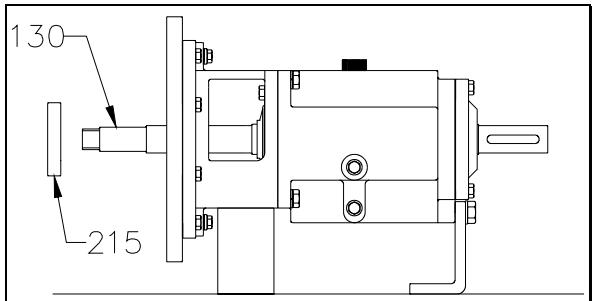


Fig. 6-38

⚠ CAUTION

Be careful not to damage the stationary portion of atmospheric end mechanical seal seated on seal cover while removing seal cover from shaft.

13. Remove seal cover gasket (438) and stationary portion of atmospheric end mechanical seal (205) gently from seal cover (215) (Fig. 6-39).

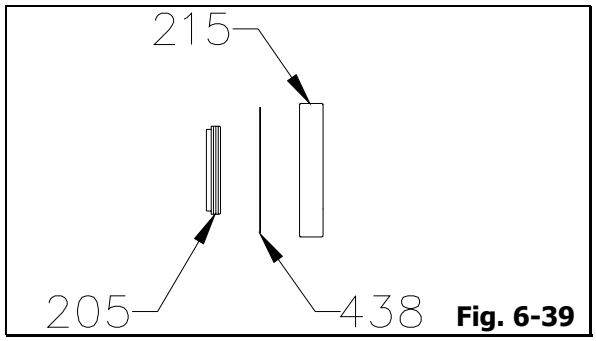


Fig. 6-39

ⓘ N O T E

Seal cover gasket may partially adhere to seal cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

6.1.3.5 Gland Packing

1. Remove all connection plugs (409) or/and piping adaptors from stuffing box cover (212.G).

2. Remove two (2) gland nuts from gland studs and remove gland (213) from stuffing box cover (212.G) (Fig. 6-40).

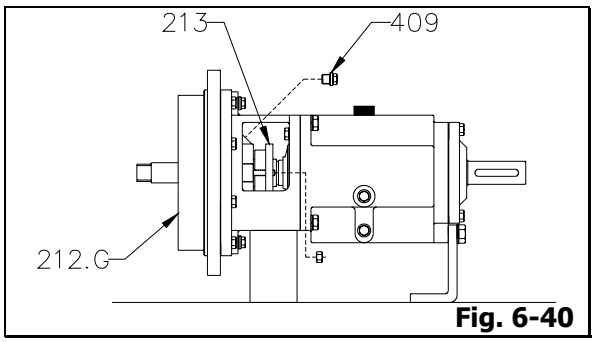


Fig. 6-40

3. Remove all stuffing box cover bolts (where applicable). By holding shaft sleeve (133) in place, slowly lift off stuffing box cover (212.G) assembly from frame adaptor (220) or adaptor extension ring (221) (Fig 6-41).

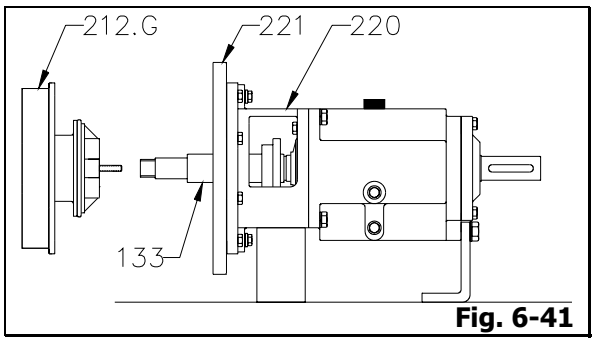


Fig. 6-41

ⓘ N O T E

Frame adaptor gasket or adaptor extension ring gasket may partially adhere to stuffing box cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

4. Remove shaft sleeve (133) and gland (213) from shaft (130) (Fig. 6-42).

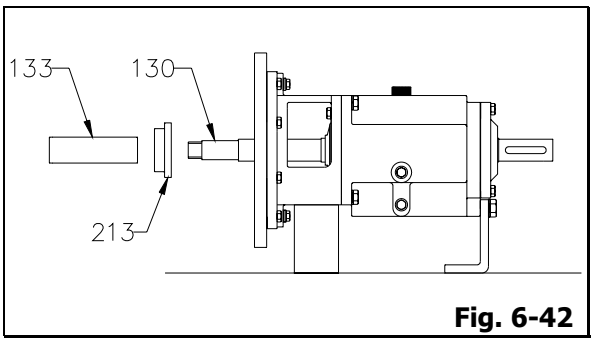


Fig. 6-42

5. Remove stuffing box cover "O" ring (420), stuffing box cover gasket (431) and two (2) gland studs from stuffing box cover (212.G) (Fig. 6-43).

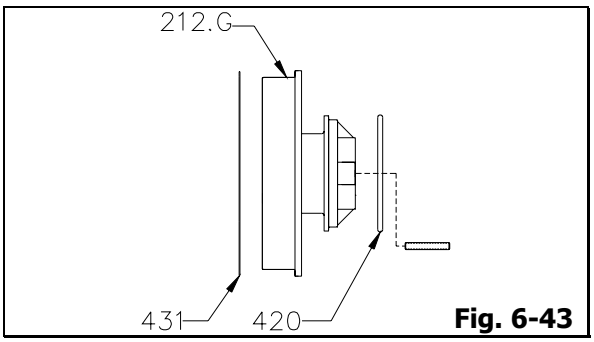


Fig. 6-43

ⓘ N O T E

Stuffing box cover gasket may partially adhere to stuffing box cover due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.

6. Remove packings (201) and lantern ring (206) from stuffing box cover (212.G).

7. Remove all end ring bolts and lift off end ring for gland packing (214.G) from stuffing box cover (212.G) (Fig. 6-44).

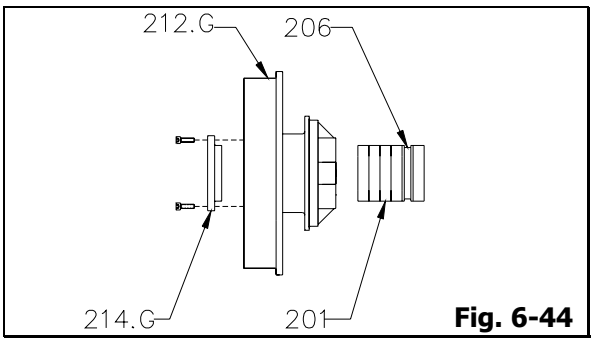


Fig. 6-44

6.1.4 Removal of Adaptor Extension Ring

1. For pumps furnished with adaptor extension ring (221), remove eight (8) or twelve (12) adaptor extension ring bolts and lift off adaptor extension ring (221) from frame adaptor (220).

> **NOTE**
> ***Frame adaptor gasket may partially adhere to adaptor extension ring due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.***

2. Remove adaptor extension ring gasket (436) from adaptor extension ring (221) (Fig. 6-45).

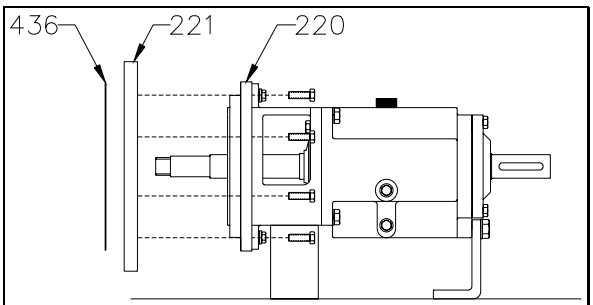


Fig. 6-45

> **NOTE**
> ***Adaptor extension ring gasket may partially adhere to adaptor extension ring due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.***

6.1.5 Removal of Frame Adaptor

1. Remove deflector (440) from shaft (130) (Fig. 6-46).

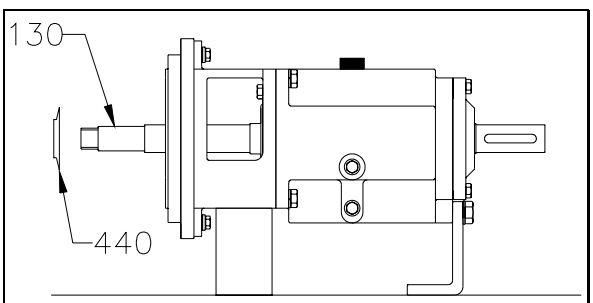


Fig. 6-46

2. Support bearing frame (300) securely to workbench. Remove four (4) frame adaptor bolts and lift off frame adaptor (220) from bearing frame (300).

3. Remove frame adapter gasket (434), all connection plugs (409) or/and piping adaptors from frame adaptor (220) (Fig. 6-47).

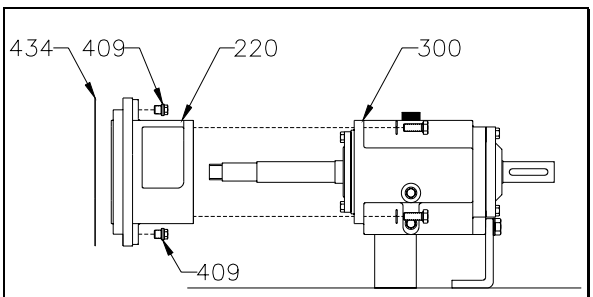


Fig. 6-47

> **NOTE**
> ***Frame adaptor gasket may partially adhere to frame adaptor due to binders and adhesives in gasket material. Remove carefully to make sure gasket is not damaged.***

6.1.6 Disassembly of Power End and Bearing Frame

1. Lift out shaft end key (136) from shaft (130).

2. Remove eight (8) (for closed impeller) or four (4) (for open type impeller) bearing cover bolts.

3. Remove drive end bearing cover (322) (not available for open type impeller) and pump end bearing cover (323) from bearing frame (300) (Fig. 6-48).

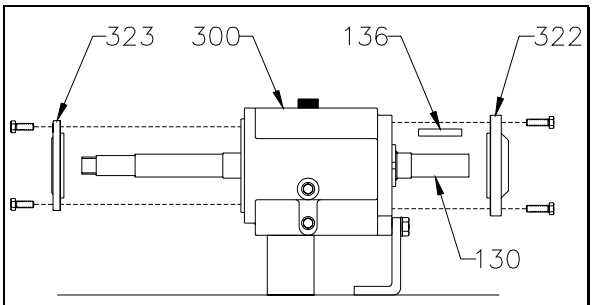


Fig. 6-48

4. Remove oil seal(s) (321) from drive end bearing cover (322) (not available for open type impeller) and pump end bearing cover (323).

5. Remove and discard drive end (not available for open type impeller) and pump end bearing cover gasket (446 and 447) from drive end bearing cover (322) (not available for open type impeller) and pump end bearing cover (323). Replace new gasket(s) during reassembly (Fig. 6-49).

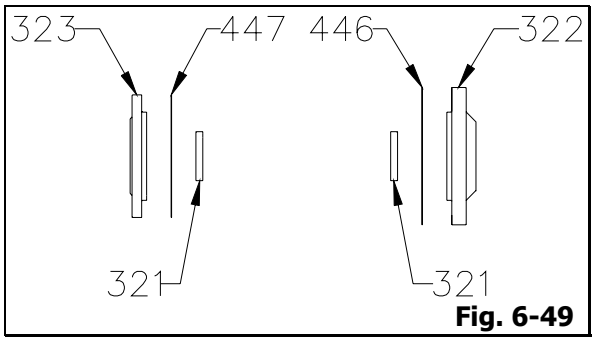


Fig. 6-49

6. For open type impeller, remove four (4) adjustable bearing box bolts and two (2) jack bolts and jam nuts from adjustable bearing box (303) (Fig. 6-50).

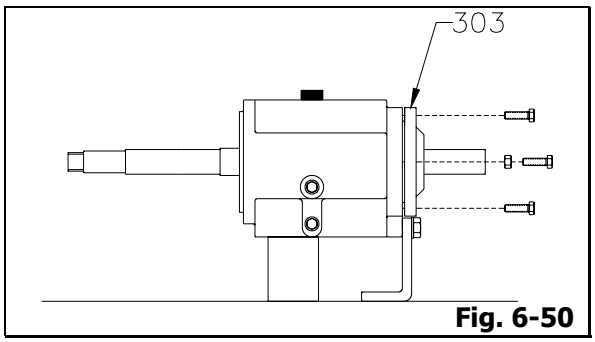


Fig. 6-50

7. Remove shaft (130) assembly together with adjustable bearing box (303) (for open type impeller), pump end bearing (311) inner ring, drive end bearing (312), bearing nut (468) and bearing washer (469) as a unit from bearing frame (300) by tapping with a piece of tubing placed against the inner ring of pump end bearing (311).

8. Remove pump end bearing (311) outer ring from bearing frame (300) (Fig. 6-51).

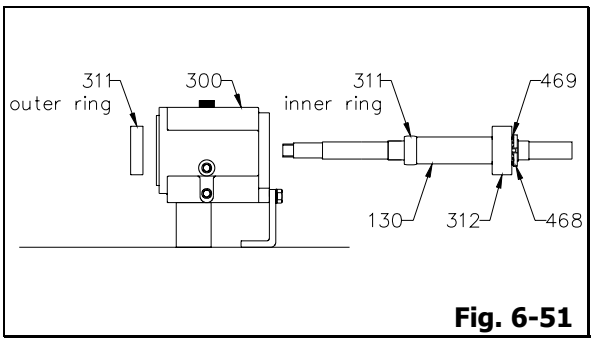


Fig. 6-51

9. For open type impeller, remove cir clip (460) from adjustable bearing box (303) assembly. Jack off adjustable bearing box (303) from drive end bearing (312). Remove oil seal (321) and bearing box "O" ring (428) from adjustable bearing box (303) (Fig. 6-52).

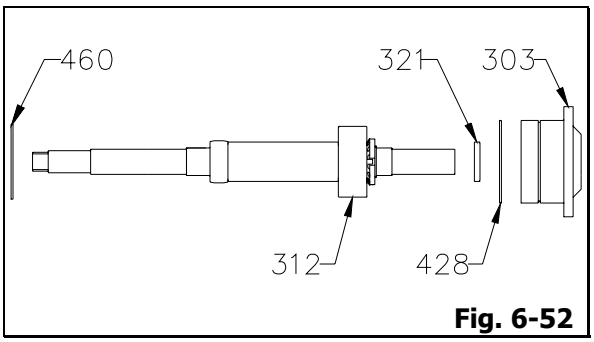


Fig. 6-52

10. Remove bearing nut (468) and bearing washer (469) from shaft (130).

11. Jack off drive end bearing (312) and pump end bearing (311) inner ring from shaft (130) (Fig. 6-53).

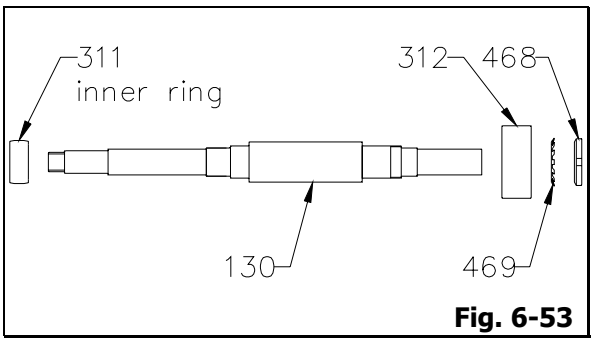


Fig. 6-53

NOTE

When pressing bearings off shaft, use force on inner ring only.

NOTE

Save bearings for inspection.

6

12. Remove cir clip(s) (460) from bearing frame (300). For open type impeller, cir clip (460) only available on pump end side (Fig. 6-54).

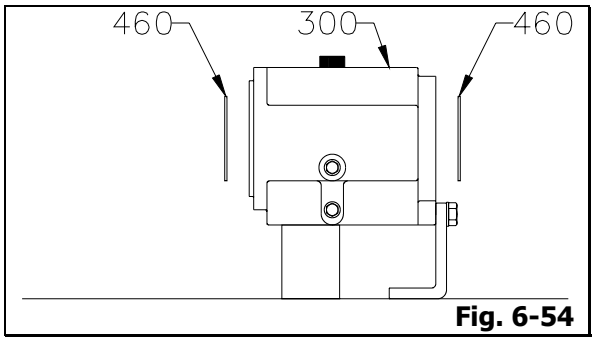


Fig. 6-54

13. Remove oil cover (330), oil gauge (331), bearing frame drain plug (400) and all connection plugs (409) or/and piping adaptors from bearing frame (300).

14. Remove support foot (410) from bearing frame (300) (Fig. 6-55).

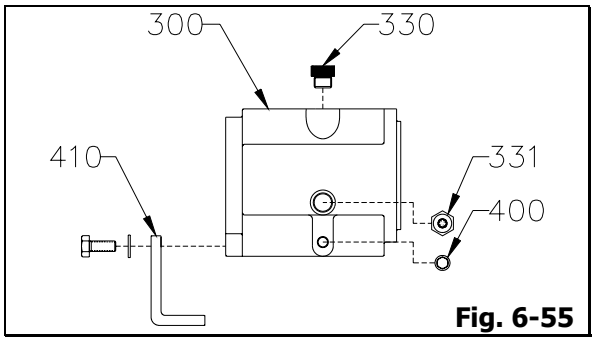


Fig. 6-55

15. For bearing frame with oil bath cooling (300.OBC), unscrew two (2) cooling coil adaptors (481) and remove two (2) cool coil "O" rings (491) from bearing frame (300.OBC). Carefully remove bearing frame cooling coil (340) from bearing frame (300.OBC) (Fig. 6-56).

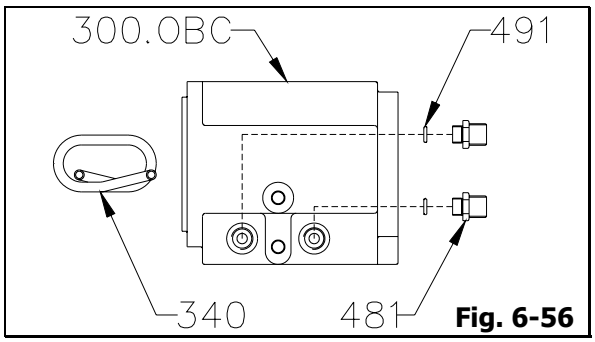


Fig. 6-56

6.2 Inspections

The pump parts must be inspected before they are reassembled to insure the pump will run properly. Any part that is damaged and cannot be repaired should be replaced.

Kewpump (M) Sdn. Bhd. assumes no responsibility or liability for damages caused by the use and failure of the pump which has been fitted with spare or repair parts not of Kewpump (M) Sdn. Bhd. manufacture. Only genuine parts from Kewpump (M) Sdn. Bhd. or an authorised distributor should be used.

All parts must be clean before reassembly. This is especially important at "O" ring grooves, threads, radial fit contact areas, and gasket surface.

ⓘ N O T E

Clean parts in solvent to remove oil, grease or dirt, dry with compressed air or lint free cloths. Protect machined surfaces against damage during cleaning.

6.2.1 Casing and Casing Wear Plate

1. Inspect casing (100) and casing wear plate (104) (for open type impeller) thoroughly, remove all burrs and foreign matter.

2. Check casing (100) hydraulic passages for cleanliness.

3. Inspect casing (100) gasket seat surface for irregularities and cleanliness.

4. Inspect casing (100) and casing wear plate (104) for cracks and excessive wear or pitting. It should be repaired or replaced if any of these conditions exist.

6.2.2 Impeller

1. Inspect impeller (120) vanes, back vanes and ribs for cracks, wear, erosion, corrosion, pitting, burrs, or scoring. Large nicks and deep pitting will unbalance the impeller (120) and may cause vibration and excessive wear on other parts of the pump. Replace impeller (120) as required.

2. Check and clean the impeller (120) bore.

6.2.3 Stuffing Box Cover

1. Make certain that the stuffing box cover (212) seat surface for stationary portion of mechanical seal (200 or 205) and v-seal (202) is clean and smooth.

2. Make sure all flushing passages are clear, and inspect gasket and "O" ring seat surface for cleanliness and irregularities.

3. Inspect stuffing box cover (212) surface for wear, erosion, corrosion, pitting, burrs, or scoring. Replace as required.

4. Stuffing box cover (212) bore must be inspected and thoroughly cleaned. Make certain that there are no deep scratches. Replace as required.

6.2.4 Frame Adaptor

1. Check frame adaptor (220) for cracks or excessive corrosion damage. Replace if any of these conditions exist.

2. Make sure gasket seat surface is clean.

6.2.5 Shaft and Shaft Sleeve

Shaft

1. Check shaft (130) for straightness (on rollers positioned at bearing diameters). Shaft (130) run out should be no more than 0.025mm. Replace shaft if run out exceeds this value.

2. Check that surfaces are free from scores, wear, corrosion, grooves and pitting. The shoulder against shaft sleeve (133) should be carefully checked. Replace as required.

3. Keyways on both ends of the shaft should be undamaged, key for impeller (135) and shaft end key (136) should fit snugly.

4. Check shaft threads with impeller nut (134) and bearing nut (468) for cleanliness and wear. Replace as required.

Shaft Sleeve

1. Check surface of shaft sleeve (133) for scoring, grooves, pitting and scratches. Replace as required.

2. Make certain that the sleeve end is clean where the impeller (120) and shaft sleeve gasket (437) are located.

6.2.6 Bearing Frame and Support Foot

1. Visually inspect bearing frame (300) and support foot (410) for cracks. Check frame inside surfaces for rust, scale or debris. Remove all loose and foreign material.

2. Make sure all lubrication passages are clear, and gasket seat surfaces must be clean.

3. If frame has been exposed to pumpage, inspect for corrosion or pitting.

4. Inspect inboard bearing bore. Replace bearing frame (300) as required.

6.2.7 Bearings

1. Clean bearings with petroleum solvent (not paraffin) to remove all sludge and deposits, follow by light lubricating oil to remove solvent and protect them for moisture and dust.

2. Pump end bearing (311) and drive end bearing (312) should be inspected for contamination and damage. The condition of the bearings will provide useful information on operating conditions in the bearing frame (300). Lubricant condition and residue should be noted, oil analysis is often helpful. Bearing damage should be investigated to determine cause and replace bearings. If cause is not normal wear, it should be corrected before pump is returned to service.

6.2.8 Bearing Frame Cooling Coil and Cooling Coil Adaptor

1. Inspect bearing frame cooling coil (340) for leakage. Make sure cooling liquid passage is clear. Replace as required.

2. Check cooling coil adaptor (481) thread and "O" ring seat surface for cleanliness and irregularities.

6.2.9 Seal Cover, Seal Cover Extension, End Ring, Gland, Seals, Gaskets and "O" Rings

Seal Cover, Seal Cover Extension and End Ring for Mechanical Sealing

1. Make certain that the seal cover (215), seal cover extension (218) and end ring for mechanical sealing (214.M) seat surface for stationary portion of mechanical seal (200, 204 and 205) is clean and smooth.

2. Inspect gasket and "O" ring seat surface for cleanliness and irregularities.

3. Check that surfaces are free from scores, wear and corrosion. Replace as required.

Gland and End Ring for Gland Packing

1. Inspect surface of gland (213) and end ring for gland packing (214.G) that contacts packing (201) to be sure that it is clean and smooth.

2. Check that surfaces are free from scores, wear and corrosion. Replace as required.

Mechanical Seal

> ⚠ **C A U T I O N**
> ***The mechanical seal faces must be handle with care, ensuring clean and free from scratches, otherwise they are unfit for use.***

1. Clean sliding faces on both rotary and stationary portions of mechanical seal(s) (200, 204 and 205) to be sure that those faces are in a completely dry, dust free and clean state.

2. Inspect seal faces for cracks, wear, scoring and scratches. Replace mechanical seal(s) (200, 204 and 205) as required.

3. Inspect secondary seal components (bellow, rubber cap, etc.) and other parts (spring, spring cap, etc.) for damage. Replace mechanical seal(s) (200, 204 and 205) as required.

Packing, Gaskets and "O" Rings

1. Discard all packings (201), drive end bearing cover gasket (446) (not available for open type impeller) and pump end bearing cover gasket (447) since new parts are recommended for reassembly.

2. Inspect all other gaskets and "O" rings for cuts, cracks and elasticity. Replace as required.

6.3 Reassembly

> ⓘ **N O T E**
> ***Make sure that all threads are clean and apply thread sealant to pipe threads and fittings when reassembling.***

6.3.1 Assembly of Power End and Bearing Frame

1. For bearing frame with oil bath cooling (300.OBC), install bearing frame cooling coil (340) into bearing frame (300.OBC). Install two (2) cooling coil "O" rings (491) and cooling coil adaptors (481) into bearing frame (300.OBC) (Fig. 6-57).

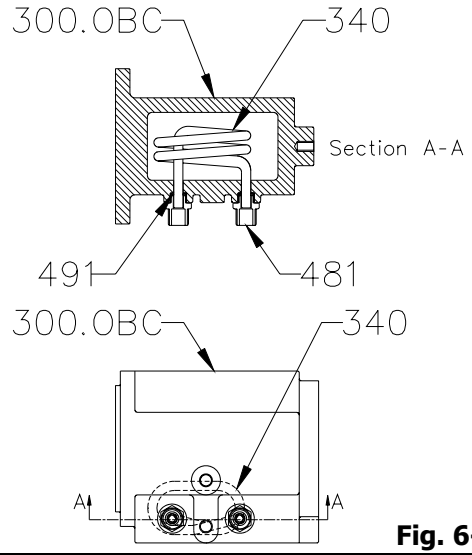


Fig. 6-57

> ⚠ **C A U T I O N**
> ***Make sure the sealing of bearing frame cooling coil is tight enough where no cooling liquid will penetrate into bearing frame when operating, otherwise will contaminate bearing lubricant and cause damage on bearings.***

NOTE

It is recommended to let cooling liquid flow through bearing frame cooling coil for sometimes before installing shaft assembly into bearing frame to make sure no leakage of cooling liquid from cooling coil into bearing frame.

2. Install oil cover (330), oil gauge (331), bearing frame drain plug (400) and all connection plugs (409) or/and piping adaptors to bearing frame (300). Attach support foot (410) with bolts to bearing frame (300). Tighten bolts (Fig. 6-58).

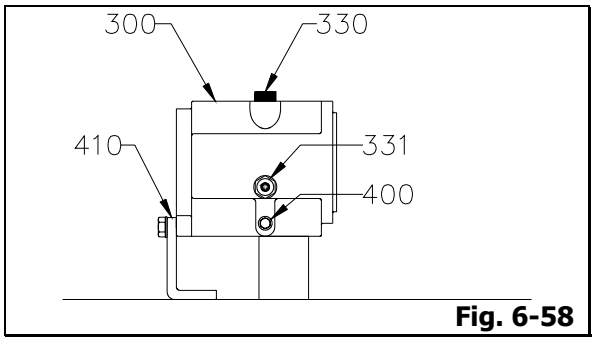


Fig. 6-58

3. Install cir clips (460) into bearing frame (300). For open type impeller, cir clip (460) only available on pump end side (Fig. 6-59).

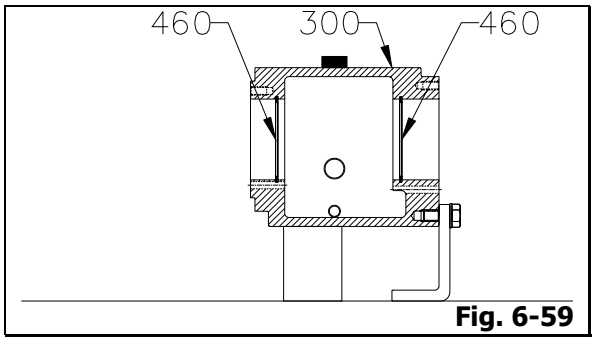


Fig. 6-59

4. Install pump end bearing (311) inner ring, drive end bearing (312), bearing washer (469) and bearing nut (468) onto shaft (130) (Fig. 6-60).

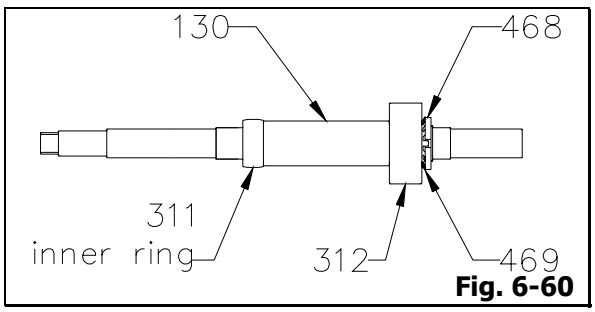


Fig. 6-60

NOTE

There are several methods used to install bearings. The recommended method is to use an induction heater to heat as well as demagnetise the bearings, coat internal surfaces of bearings with lubricant to be used in service, and then drive bearings fully on to the shaft shoulder with the aid of a piece of tubing placed against the inner race of bearings.

WARNING

Wear insulated gloves when using a bearing heater. Bearings will get hot and can cause physical injury.

5. Coat external surface of drive end bearings (312) with oil.

6. For open type impeller, coat oil seal (321) seat surface on adjustable bearing box (303) with oil. Press oil seal (321) into adjustable bearing box (303) by hand until the shoulder of the seal is fully seated against the adjustable bearing box (303).

7. Coat internal surface of adjustable bearing box (303) with oil. Install adjustable bearing box (303) assembly onto drive end bearing (312) until the bearing is fully seated on adjustable bearing box (303). Install cir clip (460) and bearing box "O" ring (428) into adjustable bearing box (303) (Fig. 6-61).

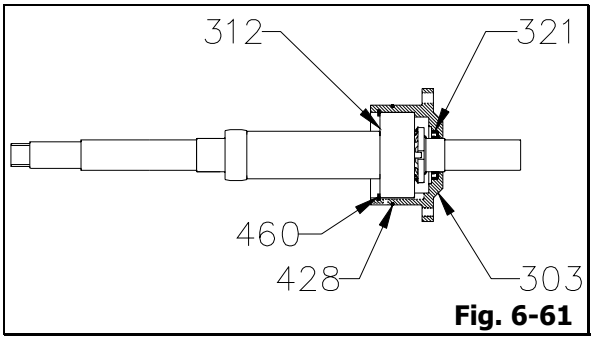


Fig. 6-61

8. Coat all internal surfaces of bearing frame (300) with oil.

9. Install shaft (130) assembly into bearing frame (300) in drive end to pump end direction by tapping with a piece of tubing placed against the adjustable bearing box (303) (for open type impeller) or bearing nut (468) (for closed impeller). Insert

shaft (130) assembly until the adjustable bearing box (303) is fully seated on bearing frame (300) (for open type impeller) or the drive end bearing (312) is fully seated on cir clip (460) inside bearing frame (300) (for closed impeller).

10. Coat external and internal surfaces of pump end bearings (311) outer ring with oil and install into bearing frame (300) until the bearing is fully seated on cir clip (460) inside bearing frame (300). Check shaft (130) for free turning (Fig. 6-62).

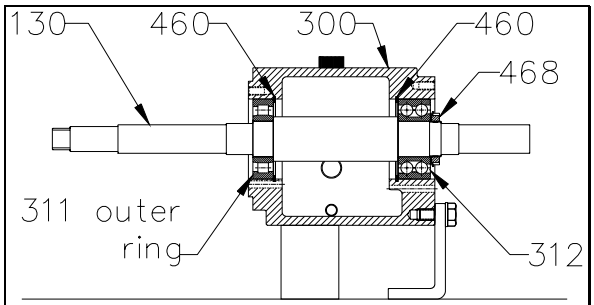


Fig. 6-62

NOTE

Make sure the keyway edges are free of burrs.

11. For open type impeller, install two (2) jack bolts and jam nuts into adjustable bearing box (303). Evenly back out adjustable bearing box (303) using two (2) jack bolts until the distance between adjustable bearing box (303) and bearing frame (300) surface is about 3mm. Evenly tighten two (2) jam nuts.

12. Align lubrication passages and bolts holes and install four (4) adjustable bearing box bolts into adjustable bearing box (303). Tighten bolts evenly (Fig. 6-63).

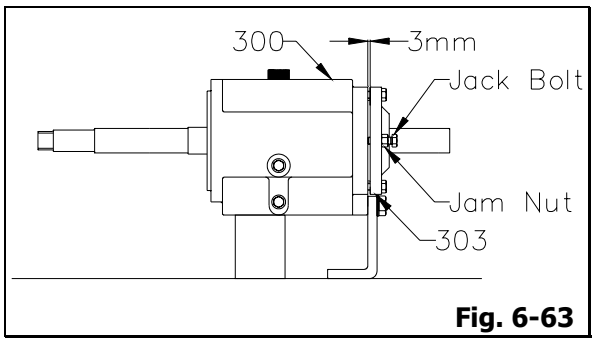


Fig. 6-63

13. Place a new drive end (not available for open type impeller) and pump end bearing cover gasket (446 and 447) on drive end bearing cover (322) (not available for open type impeller) and pump end bearing cover (323).

14. Coat oil seal(s) (321) seat surface with oil. Press oil seal(s) (321) into drive end bearing cover (322) (not available for open type impeller) and pump end bearing cover (323) by hand until the shoulder of the seal(s) is fully seated against the cover(s) (Fig. 6-64).

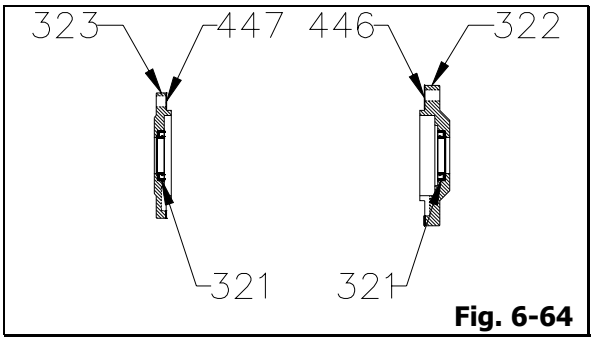


Fig. 6-64

15. Install drive end bearing cover (322) assembly (not available for open type impeller) and pump end bearing cover (323) assembly into bearing frame (300). Align lubrication passages and bolt holes and install eight (8) (for closed impeller) or four (4) (for open type impeller) bearing cover bolts into bearing cover(s). Tighten bolts evenly.

16. Install shaft end key (136) on shaft (130) (Fig. 6-65)

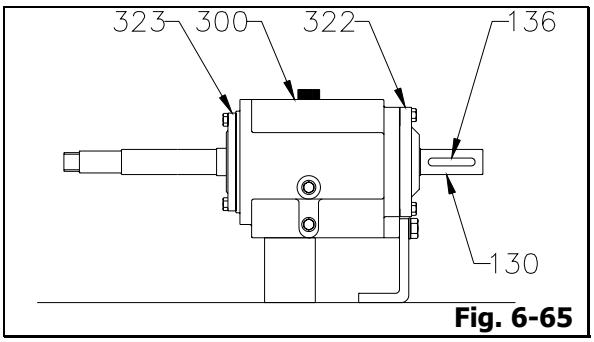


Fig. 6-65

17. Support power end assembly in horizontal position.

18. Check bearings (311 and 312) axial clearance. Move shaft (130) forward then backward by hand, noting indicator movement. If total indicator reading is greater than 0.05mm, disassemble and determine cause (Fig. 6-66).

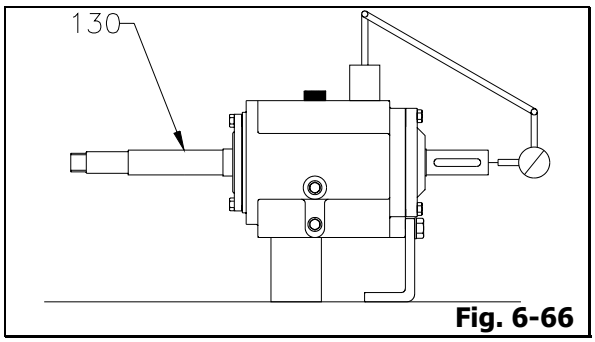


Fig. 6-66

19. Check shaft and shaft sleeve (133) run out. Put on shaft sleeve (133), key for impeller (135), impeller (120), and thread on impeller nut (134), hand tight. Rotate shaft (130) 360°. If total indicator reading is greater than 0.05mm, disassemble and determine cause. Remove impeller nut (134), impeller (120), key for impeller (135) and shaft sleeve (133) (Fig. 6-67).

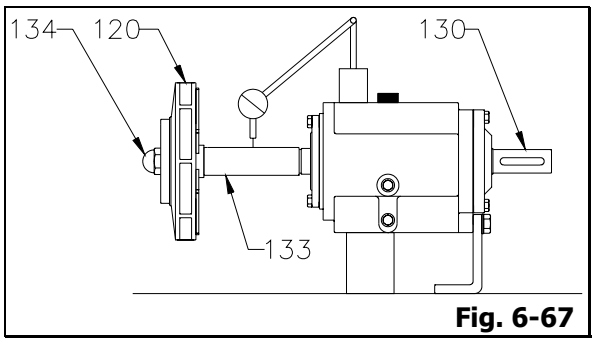


Fig. 6-67

20. Check bearing frame (300) face run out. Rotate shaft (130) so indicator rides along the face for 360°. If total indicator reading is greater than 0.05mm, disassemble and determine cause (Fig. 6-68).

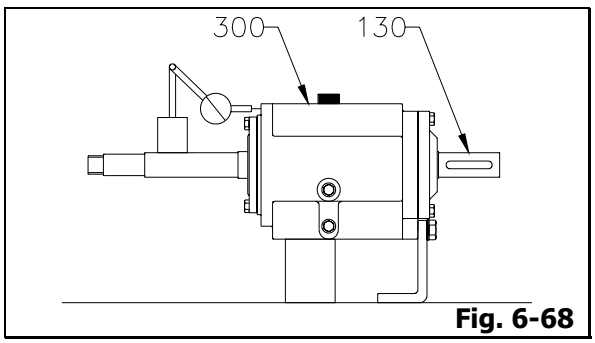


Fig. 6-68

6.3.2 Reinstallation of Frame Adaptor

1. Install frame adapter (220) onto bearing frame (300). Align bolt holes and install four (4) frame adaptor bolts. Tighten bolts evenly (Fig. 6-69).

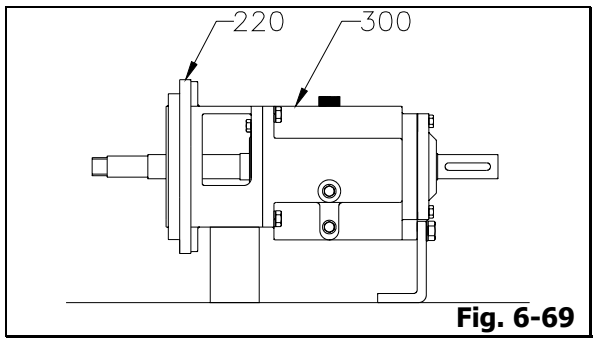


Fig. 6-69

2. Install frame adapter gasket (434), all connection plugs (409) or/and piping adaptors into frame adaptor (220).

3. Install deflector (440) to shaft (130) (Fig. 6-70).

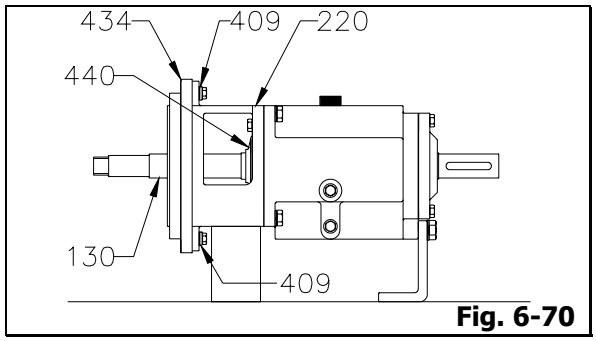


Fig. 6-70

6.3.3 Reinstallation of Adaptor Extension Ring

1. For pumps furnished with adaptor extension ring (221), install adaptor extension ring (221) onto frame adaptor (220). Align bolt holes and install eight (8) or twelve (12) adaptor extension ring bolts. Tighten bolts evenly (Fig. 6-71).

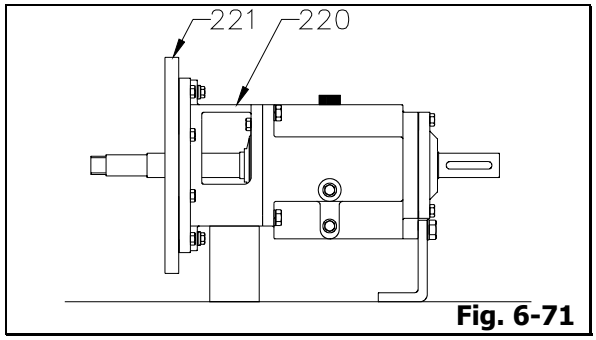


Fig. 6-71

2. Check frame adaptor (220) and adaptor extension ring (221) fits. Rotate shaft (130) through 360°. If total indicator reading is greater than 0.13mm, determine the cause and correct before proceeding (Fig. 6-72).

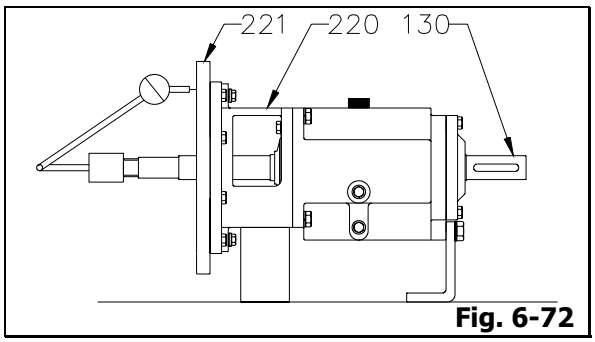


Fig. 6-72

3. Install adaptor extension ring gasket (436) onto adaptor extension ring (221) (Fig. 6-73).

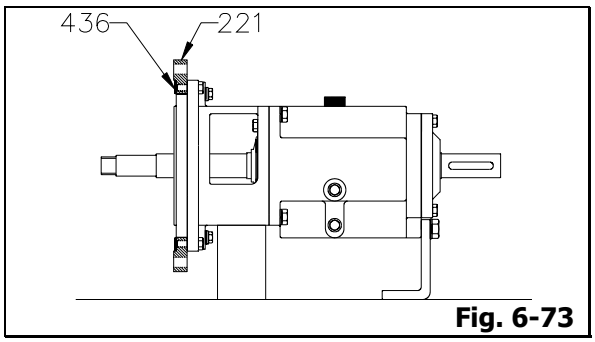


Fig. 6-73

6.3.4 Reinstallation of Stuffing Box Cover

6.3.4.1 Single Internal without/with Rear Quenching

1. Coat mechanical seal (200) seat surface in stuffing box cover (212.IS/RQ) with oil. Carefully place the stationary portion of mechanical seal (200) into position and press gently by hand until the shoulder of the seal is fully seated against the stuffing box cover (212.IS/RQ). Make sure that the lapped face of seal is facing outside (Fig. 6-74).

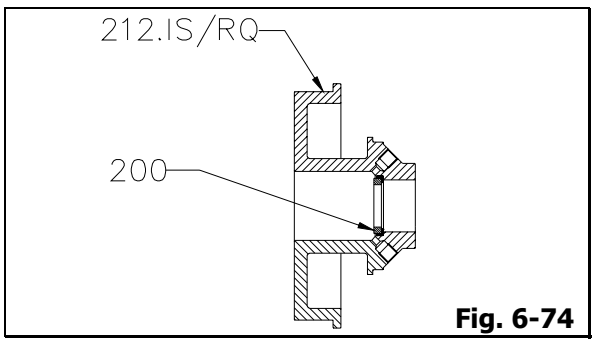


Fig. 6-74

2. Clean the sliding face with lint free cloths to make sure seal face is in a completely dry, dust free and clean state.

⚠ CAUTION

The mechanical seal face must be handle with care, ensuring clean and free from scratches, otherwise they are unfit for use.

3. Install stuffing box cover "O" ring (420) and stuffing box cover gasket (431) onto stuffing box cover (212.IS/RQ).

4. For single internal with rear quenching, install v-seal (202) into stuffing box cover (212.RQ) (Fig. 6-75).

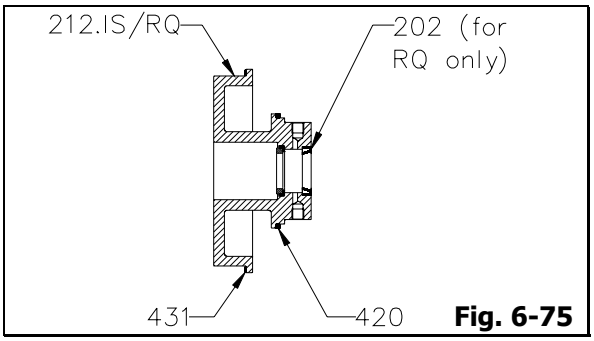


Fig. 6-75

5. Coat stuffing box cover "O" ring (420) seat surface in frame adaptor (220) with oil. Install stuffing box cover (212.IS/RQ) assembly onto frame adaptor (220) or adaptor extension ring (221). Align bolt holes and install stuffing box cover bolts (where applicable). Tighten bolts evenly.

⚠ CAUTION

Be careful not to damage the stationary portion of mechanical seal seated on stuffing box cover while installing stuffing box cover assembly.

6. Install all connection plugs (409) or/and piping adaptors into stuffing box cover (212.IS/RQ) (Fig. 6-76).

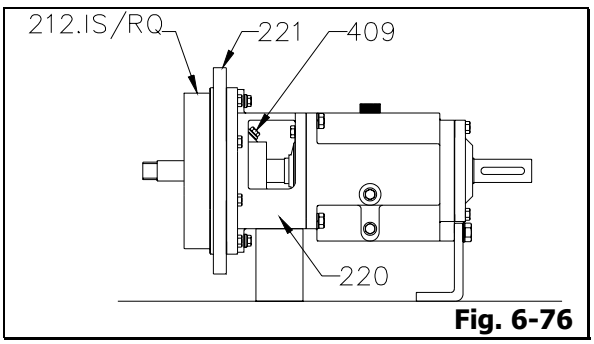


Fig. 6-76

7. Check stuffing box cover (212.IS/RQ) run out. Clamp stuffing box cover (212.IS/RQ) tight to frame adaptor (220) or adaptor extension ring (221). Rotate shaft (130) through 360°. If total indicator reading is greater than 0.13mm, determine cause and correct before proceeding (Fig. 6-77).

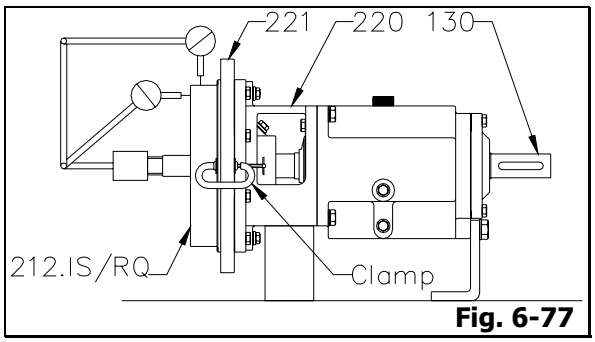


Fig. 6-77

8. Install abutment ring (463) onto shaft sleeve (133) until abutment ring (463) reach the abutment ring location marking which has been made on shaft sleeve (133) during disassembly, and install two (2) abutment ring jam nuts into abutment ring (463).

9. Coat shaft sleeve (133) surface with oil, slide the rotary portion of mechanical seal (200) carefully onto shaft sleeve (133) by hand until the end of the mechanical seal (200) is fully seated on abutment ring (463) (Fig. 6-78).

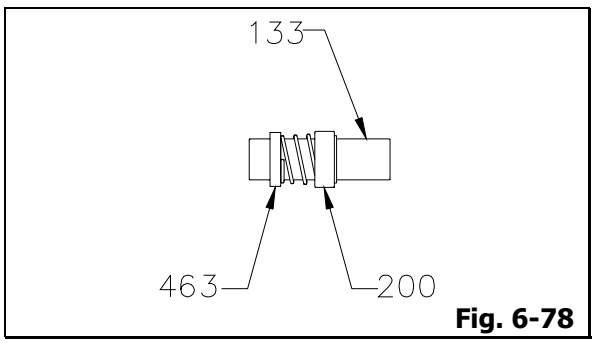


Fig. 6-78

10. For mechanical seal (200) furnish with jam nuts, where abutment ring (463) is not available, coat shaft sleeve (133) surface with oil, slide the rotary portion of mechanical seal (200) carefully onto shaft sleeve (133) by hand until the end of the mechanical seal (200) reach the mechanical seal location marking which has been made on shaft sleeve (133) during disassembly, and screw in mechanical seal jam nuts (Fig. 6-79).

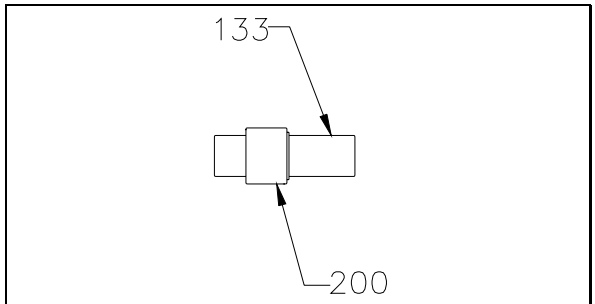


Fig. 6-79

11. Clean the sliding face with lint free cloths to make sure seal face is in a completely dry, dust free and clean state.

⚠ CAUTION

The mechanical seal face must be handle with care, ensuring clean and free from scratches, otherwise they are unfit for use.

12. Install shaft sleeve (133) assembly carefully onto shaft (130) until the lapped surfaces of the mechanical seal (200) are seated on each others (Fig. 6-80).

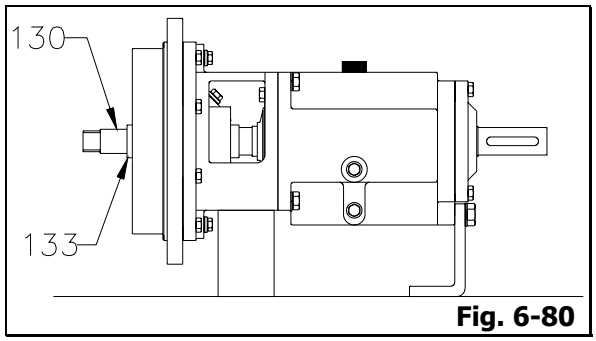


Fig. 6-80

⚠ CAUTION

Be careful not to damage the mechanical seal surfaces while installing, otherwise they are unfit for use.

6.3.4.2 Single External

1. Install stuffing box cover "O" ring (420) and stuffing box cover gasket (431) onto stuffing box cover (212.ES) (Fig. 6-81).

2. Coat stuffing box cover "O" ring (420) seat surface in frame adaptor (220) with oil. Install stuffing box cover (212.ES) assembly onto frame adaptor (220) or adaptor extension ring (221). Align bolt holes and install stuffing box cover bolts (where applicable). Tighten bolts evenly (Fig. 6-82).

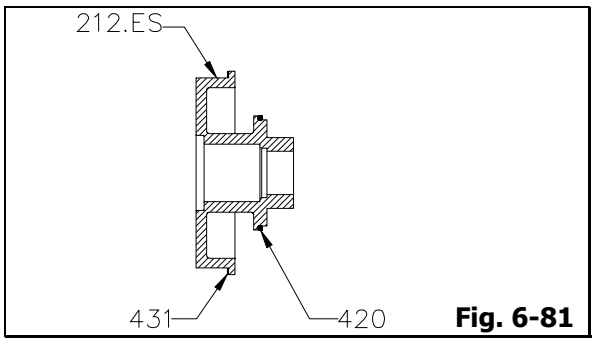


Fig. 6-81

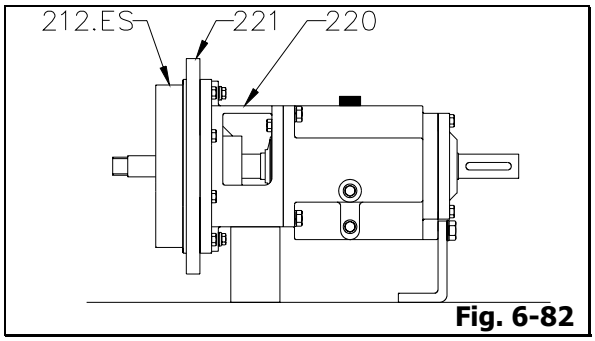


Fig. 6-82

3. Check stuffing box cover (212.ES) run out. Clamp stuffing box cover (212.ES) tight to frame adaptor (220) or adaptor extension ring (221). Rotate shaft (130) through 360°. If total indicator reading is greater than 0.13mm, determine cause and correct before proceeding (Fig. 6-83).

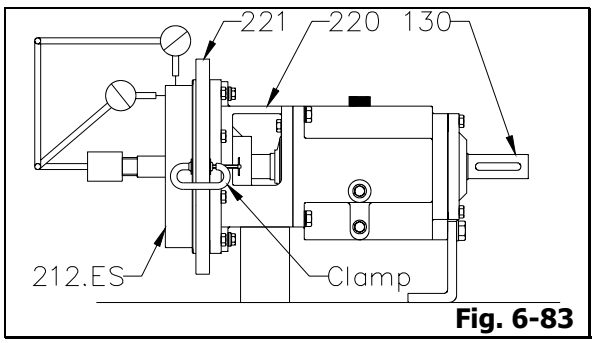


Fig. 6-83

4. Install abutment ring (463) onto shaft sleeve (133) until abutment ring (463) reach the abutment ring location marking which has been made on shaft sleeve (133) during disassembly, and install two (2) abutment ring jam nuts into abutment ring (463).

5. Coat shaft sleeve (133) surface with oil, slide the rotary portion of mechanical seal (200) carefully onto shaft sleeve (133) by hand until the end of the mechanical seal (200) is fully seated on abutment ring (463) (Fig. 6-84).

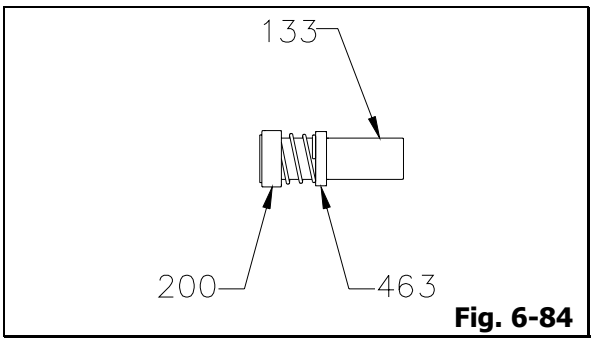


Fig. 6-84

6. For mechanical seal (200) furnish with jam nuts, where abutment ring (463) is not available, coat shaft sleeve (133) surface with oil, slide the rotary portion of mechanical seal (200) carefully onto shaft sleeve (133) by hand until the end of the mechanical seal (200) reach the mechanical seal location marking which has been made on shaft sleeve (133) during disassembly, and screw in mechanical seal jam nuts (Fig. 6-85).

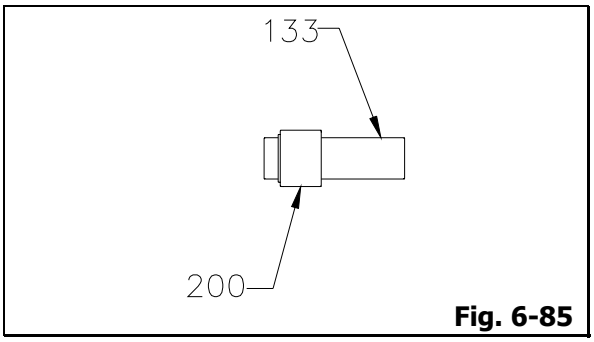


Fig. 6-85

7. Clean the sliding face with lint free cloths to make sure seal face is in a completely dry, dust free and clean state.

⚠ CAUTION

The mechanical seal face must be handle with care, ensuring clean and free from scratches, otherwise they are unfit for use.

8. Install shaft sleeve (133) assembly carefully onto shaft (130) (Fig. 6-86).

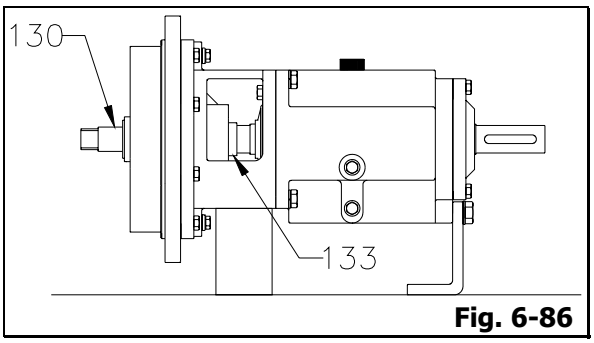


Fig. 6-86

⚠ C A U T I O N

Be careful not to damage the mechanical seal surfaces while installing, otherwise they are unfit for use.

9. Coat mechanical seal (200) seat surface in end ring for mechanical sealing (214.M) with oil. Carefully place the stationary portion of mechanical seal (200) into position and press gently by hand until the shoulder of the seal is fully seated against the end ring for mechanical sealing (214.M). Make sure that the lapped face of seal is facing outside.

10. Install end ring gasket (448) onto end ring for mechanical sealing (214.M) (Fig. 6-87).

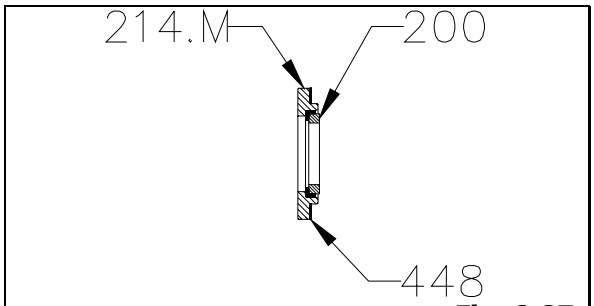


Fig. 6-87

11. Clean the sliding face with lint free cloths to make sure seal face is in a completely dry, dust free and clean state.

⚠ C A U T I O N

The mechanical seal face must be handle with care, ensuring clean and free from scratches, otherwise they are unfit for use.

12. Install end ring for mechanical sealing (214.M) assembly carefully into stuffing box cover (212.ES) until the lapped surfaces of the mechanical seal (200) are seated on each others. Align bolt holes and install end ring bolts. Tighten bolts evenly (Fig. 6-88).

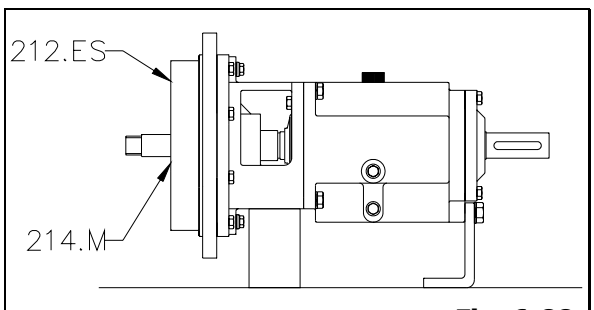


Fig. 6-88

⚠ C A U T I O N

Be careful not to damage the stationary portion of mechanical seal seated on end ring for mechanical sealing while installing end ring for mechanical sealing assembly.

6.3.4.3 Double Back-to-Back

1. Coat atmospheric end mechanical seal (205) seat surface in stuffing box cover (212.DB) with oil. Carefully place the stationary portion of atmospheric end mechanical seal (205) into position and press gently by hand until the shoulder of the seal is fully seated against the stuffing box cover (212.DB). Make sure that the lapped face of seal is facing outside (Fig. 6-89).

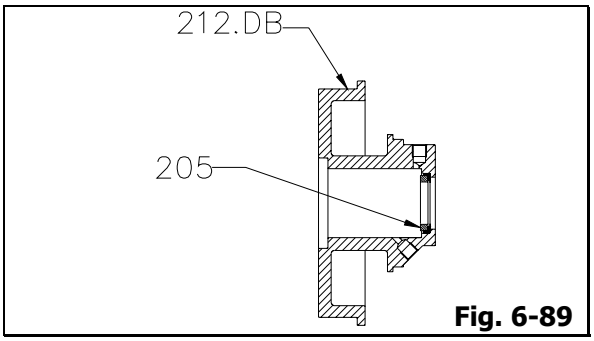


Fig. 6-89

2. Clean the sliding face with lint free cloths to make sure seal face is in a completely dry, dust free and clean state.

⚠ C A U T I O N

The mechanical seal face must be handle with care, ensuring clean and free from scratches, otherwise they are unfit for use.

3. Install stuffing box cover "O" ring (420) and stuffing box cover gasket (431) onto stuffing box cover (212.DB) (Fig. 6-90).

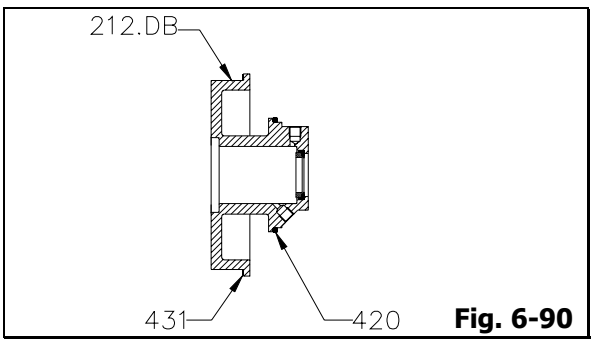


Fig. 6-90

4. Coat stuffing box cover "O" ring (420) seat surface in frame adaptor (220) with oil. Install stuffing box cover (212.DB) assembly onto frame adaptor (220) or adaptor extension ring (221). Align bolt holes and install stuffing box cover bolts (where applicable). Tighten bolts evenly.

> ⚠ **C A U T I O N**
> ***Be careful not to damage the stationary portion of mechanical seal seated on stuffing box cover while installing stuffing box cover assembly.***

5. Install all connection plugs (409) or/and piping adaptors into stuffing box cover (212.DB) (Fig. 6-91).

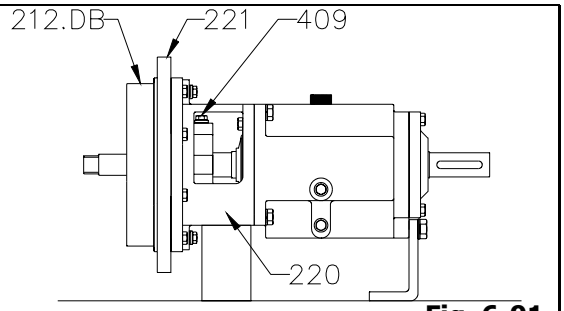


Fig. 6-91

6. Check stuffing box cover (212.DB) run out. Clamp stuffing box cover (212.DB) tight to frame adaptor (220) or adaptor extension ring (221). Rotate shaft (130) through 360°. If total indicator reading is greater than 0.13mm, determine cause and correct before proceeding (Fig. 6-92).

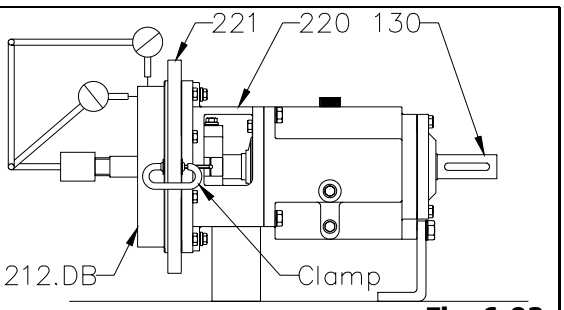


Fig. 6-92

7. Install abutment ring (463) onto shaft sleeve (133) until abutment ring (463) reach the abutment ring location marking which has been made on shaft sleeve (133) during disassembly, and install two (2) abutment ring jam nuts into abutment ring (463).

8. Coat shaft sleeve (133) surface with oil, slide the rotary portion of pump end and atmospheric end mechanical seal (204 and 205) carefully onto shaft sleeve (133) by hand until the end of mechanical seals (204 and 205) are fully seated on abutment ring (463) (Fig. 6-93).

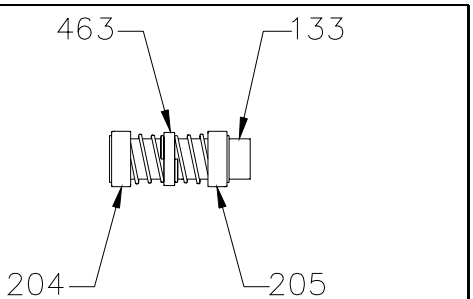


Fig. 6-93

9. For mechanical seals (204 and 205) furnish with jam nuts, where abutment ring (463) is not available, coat shaft sleeve (133) surface with oil, slide the rotary portion of pump end and atmospheric end mechanical seal (204 and 205) carefully onto shaft sleeve (133) by hand until the end of mechanical seals (204 and 205) reach the mechanical seals location marking which have been made on shaft sleeve (133) during disassembly, and screw in mechanical seals jam nuts (Fig. 6-94).

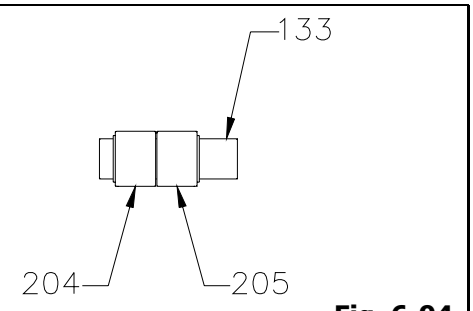


Fig. 6-94

10. Clean sliding faces with lint free cloths to make sure seal faces are in a completely dry, dust free and clean state.

> ⚠ **C A U T I O N**
> ***The mechanical seal face must be handle with care, ensuring clean and free from scratches, otherwise they are unfit for use.***

11. Install shaft sleeve (133) assembly carefully onto shaft (130) until the lapped

surfaces of the atmospheric end mechanical seal (205) are seated on each others (Fig. 6-95).

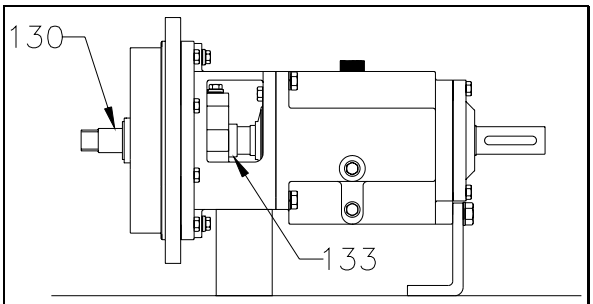


Fig. 6-95

⚠ C A U T I O N

Be careful not to damage the mechanical seal surfaces while installing, otherwise they are unfit for use.

12. Coat pump end mechanical seal (204) seat surface in end ring for mechanical sealing (214.M) with oil. Carefully place the stationary portion of pump end mechanical seal (204) into position and press gently by hand until the shoulder of the seal is fully seated against the end ring for mechanical sealing (214.M). Make sure that the lapped face of seal is facing outside.

13. Install end ring gasket (448) onto end ring for mechanical sealing (214.M) (Fig. 6-96).

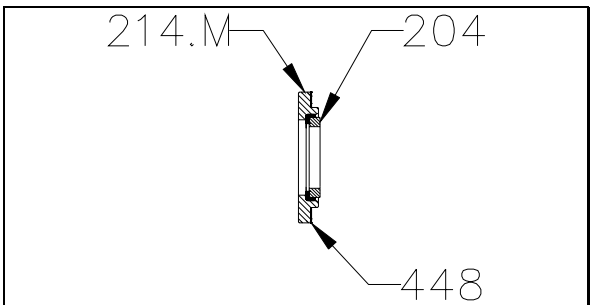


Fig. 6-96

14. Clean the sliding face with lint free cloths to make sure seal face is in a completely dry, dust free and clean state.

⚠ C A U T I O N

The mechanical seal face must be handle with care, ensuring clean and free from scratches, otherwise they are unfit for use.

15. Install end ring for mechanical sealing (214.M) assembly carefully into stuffing box cover (212.DB) until the lapped surfaces of the pump end mechanical seal (204) are seated on each others. Align bolt holes and install end ring bolts. Tighten bolts evenly (Fig. 6-97).

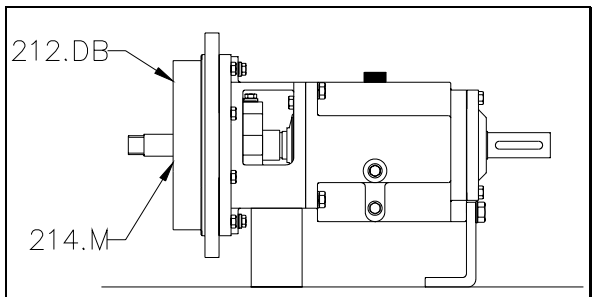


Fig. 6-97

⚠ C A U T I O N

Be careful not to damage the stationary portion of mechanical seal seated on end ring for mechanical sealing while installing end ring for mechanical sealing assembly.

6.3.4.4 Double Tandem

1. Coat atmospheric end mechanical seal (205) seat surface in seal cover (215) with oil. Carefully place the stationary portion of atmospheric end mechanical seal (205) into position and press gently by hand until the shoulder of the seal is fully seated against the seal cover (215). Make sure that the lapped face of seal is facing outside.

2. Install seal cover gasket (438) onto seal cover (215) (Fig. 6-98).

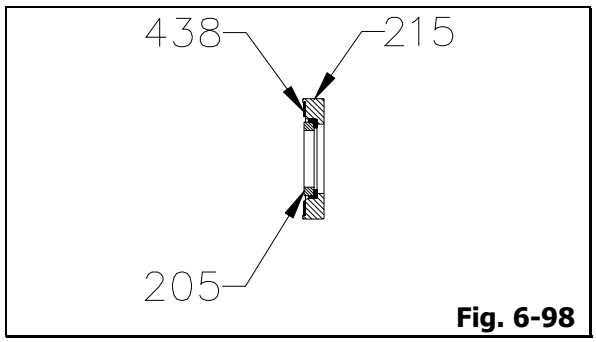


Fig. 6-98

3. Clean the sliding face with lint free cloths to make sure seal face is in a completely dry, dust free and clean state.

> ⚠ **C A U T I O N**
> ***The mechanical seal face must be handle with care, ensuring clean and free from scratches, otherwise they are unfit for use.***

4. Install seal cover (215) assembly carefully onto shaft (Fig. 6-99).

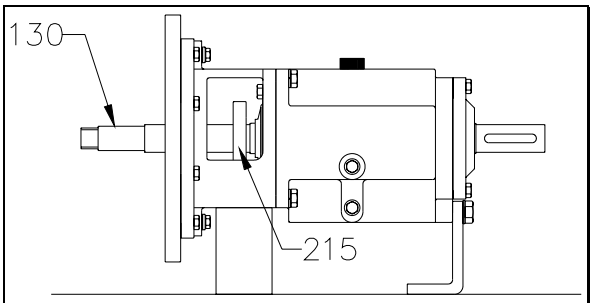


Fig. 6-99

> ⚠ **C A U T I O N**
> ***Be careful not to damage the stationary portion of mechanical seal seated on seal cover while installing seal cover assembly.***

5. Install abutment ring (463) onto shaft sleeve (133) until abutment ring (463) reach the abutment ring location marking which has been made on shaft sleeve (133) during disassembly, and install two (2) abutment ring jam nuts into abutment ring (463).

6. Coat shaft sleeve (133) surface with oil, slide the rotary portion of atmospheric end mechanical seal (205) carefully onto shaft sleeve (133) by hand until the end of the mechanical seal (205) is fully seated on abutment ring (463) (Fig. 6-100).

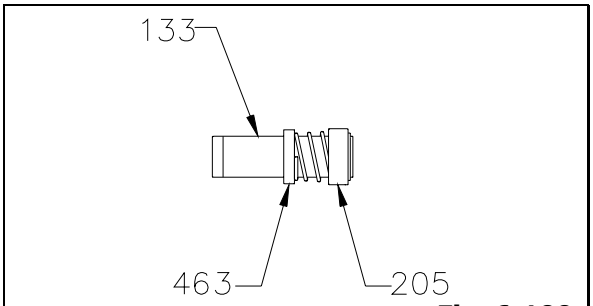


Fig. 6-100

7. For atmospheric end mechanical seal (205) furnish with jam nuts, where abutment ring (463) is not available, coat shaft sleeve (133) surface with oil, slide the rotary portion of atmospheric end mechanical seal (205) carefully onto shaft sleeve (133) by hand until the end of the mechanical seal (205) reach the mechanical seal location marking which has been made on shaft sleeve (133) during disassembly, and screw in mechanical seal jam nuts (Fig. 6-101).

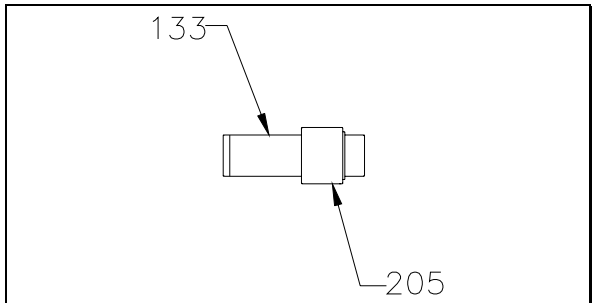


Fig. 6-101

8. Clean the sliding face with lint free cloths to make sure seal face is in a completely dry, dust free and clean state.

> ⚠ **C A U T I O N**
> ***The mechanical seal face must be handle with care, ensuring clean and free from scratches, otherwise they are unfit for use.***

9. Install shaft sleeve (133) assembly carefully onto shaft (130) until the lapped surfaces of the atmospheric end mechanical seal (205) are seated on each others (Fig. 6-102).

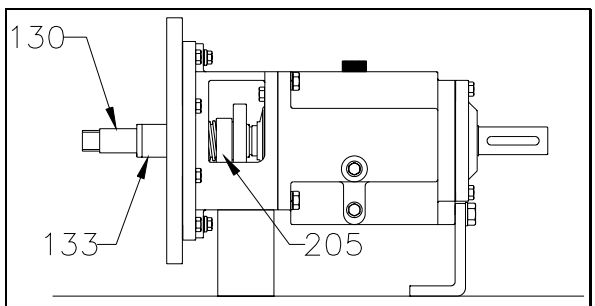


Fig. 6-102

> ⚠ **C A U T I O N**
> ***Be careful not to damage the mechanical seal surfaces while installing, otherwise they are unfit for use.***

10. Coat pump end mechanical seal (204) seat surface in seal cover extension (218) with

oil. Carefully place the stationary portion of pump end mechanical seal (204) into position and press gently by hand until the shoulder of the seal is fully seated against the seal cover extension (218). Make sure that the lapped face of seal is facing outside.

11. Install seal cover extension gasket (449) and seal cover extension "O" ring (429) onto seal cover extension (218) (Fig. 6-103).

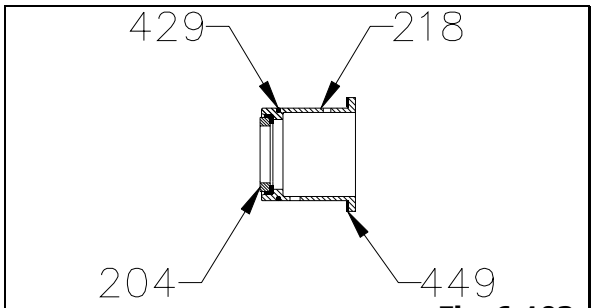


Fig. 6-103

12. Clean the sliding face with lint free cloths to make sure seal face is in a completely dry, dust free and clean state.

⚠ C A U T I O N

The mechanical seal face must be handle with care, ensuring clean and free from scratches, otherwise they are unfit for use.

13. Install seal cover extension (218) assembly carefully onto seal cover (215) (Fig. 6-104).

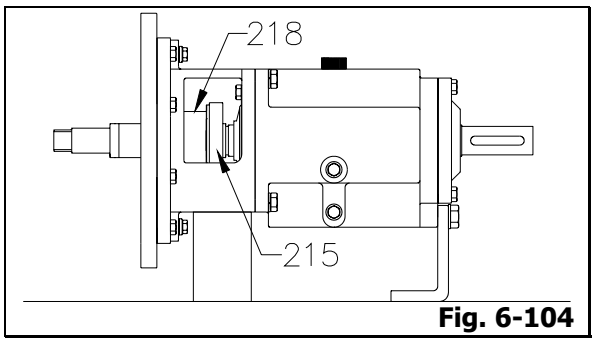


Fig. 6-104

⚠ C A U T I O N

Be careful not to damage the stationary portion of mechanical seal seated on seal cover extension while installing seal cover extension assembly.

14. Clean the rotary portion of pump end mechanical seal (204) sliding face with lint free cloths to make sure seal face is in a completely dry, dust free and clean state.

⚠ C A U T I O N

The mechanical seal face must be handle with care, ensuring clean and free from scratches, otherwise they are unfit for use.

15. Coat shaft sleeve (133) surface with oil, slide the rotary portion of pump end mechanical seal (204) carefully onto shaft sleeve (133) by hand until the lapped surfaces of the pump end mechanical seal (204) are seated on each others.

16. Install abutment ring (463) onto shaft sleeve (133) until abutment ring (463) reach the abutment ring location marking which has been made on shaft sleeve (133) during disassembly, and install two (2) abutment ring jam nuts into abutment ring (463) (Fig. 6-105).

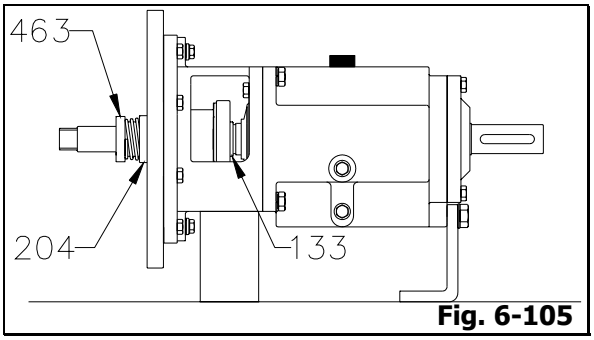


Fig. 6-105

⚠ C A U T I O N

Be careful not to damage the mechanical seal surfaces while installing, otherwise they are unfit for use.

17. For pump end mechanical seal (204) furnish with jam nuts, where abutment ring (463) is not available, coat shaft sleeve (133) surface with oil, slide the rotary portion of pump end mechanical seal (204) carefully onto shaft sleeve (133) by hand until the end of the mechanical seal (204) reach the mechanical seal location marking which has been made on shaft sleeve (133) during disassembly, and screw in mechanical seal jam nuts (Fig. 6-106).

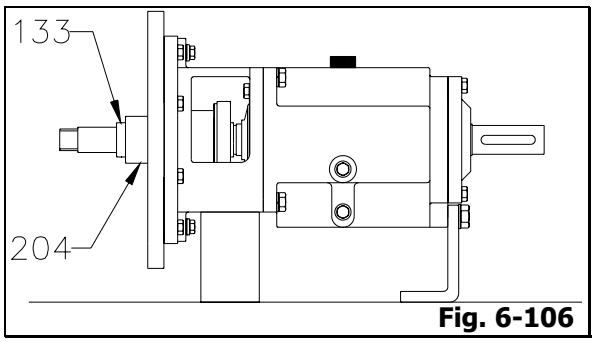


Fig. 6-106

> ⚠ **C A U T I O N**
> ***Be careful not to damage the mechanical seal surfaces while installing, otherwise they are unfit for use.***

18. Install stuffing box cover "O" ring (420), stuffing box cover gasket (431) and two (2) seal cover studs into stuffing box cover (212.DT) (Fig. 6-107).

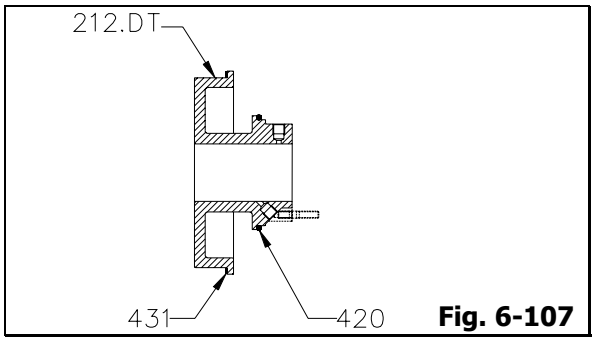


Fig. 6-107

19. Coat stuffing box cover "O" ring (420) seat surface in frame adaptor (220) and seal cover extension "O" ring (429) with oil. Install stuffing box cover (212.DT) assembly onto frame adaptor (220) or adaptor extension ring (221) by allowing seal cover extension (218) assembly go into stuffing box cover (212.DT) and seal cover studs go through two (2) bolt holes on seal cover (215). Align bolt holes and install stuffing box cover bolts (where applicable). Tighten bolts evenly (Fig. 6-108).

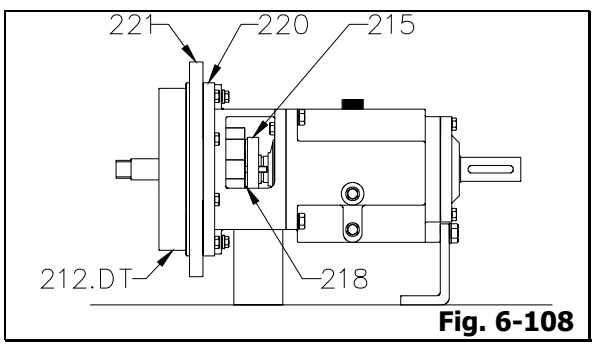


Fig. 6-108

20. Align flushing holes on stuffing box cover (212.DT) and seal cover extension (218). Install two (2) seal cover nuts after seal cover (215) and tighten nuts evenly.

21. Install all connection plugs (409) or/and piping adaptors into stuffing box cover (212.DT) (Fig. 6-109).

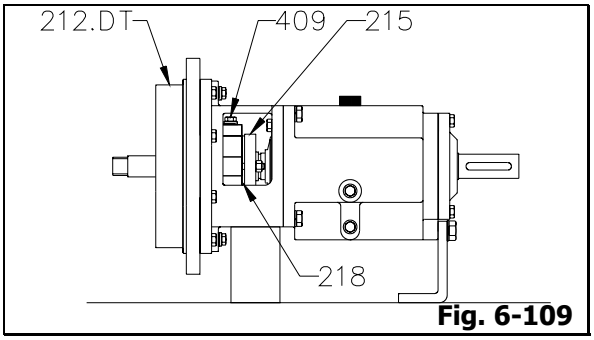


Fig. 6-109

22. Check stuffing box cover (212.DT) run out. Clamp stuffing box cover (212.DT) tight to frame adaptor (220) or adaptor extension ring (221). Rotate shaft (130) through 360°. If total indicator reading is greater than 0.13mm, determine cause and correct before proceeding (Fig. 6-110).

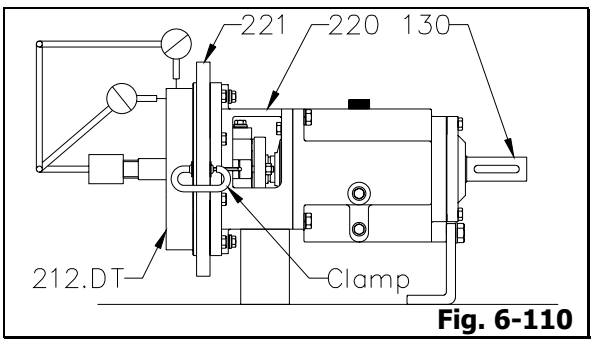


Fig. 6-110

6.3.4.5 Gland Packing

1. Install end ring for gland packing (214.G) into stuffing box cover (212.G). Align bolt holes and install end ring bolts. Tighten bolts evenly (Fig 6-111).

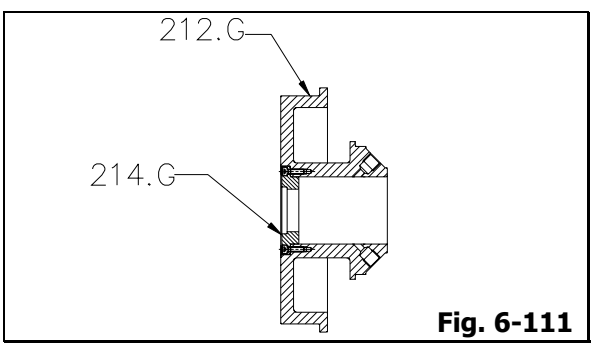


Fig. 6-111

2. Place a new uncut packing (201) round a shaft or round a mandrel of the shaft sleeve (133) diameter.

3. To assist in cutting rings, two guide lines parallel to the shaft axis and separated by a distance equal to the packing section may be drawn on the spiral (Fig. 6-112).

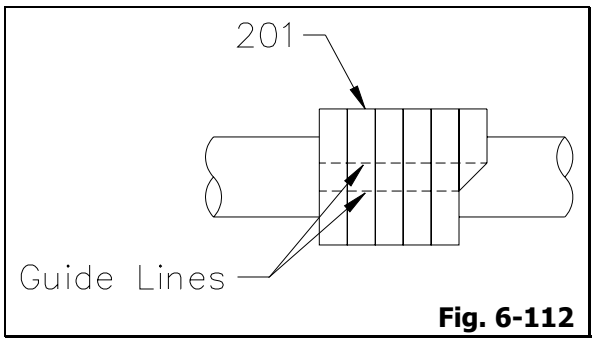


Fig. 6-112

4. Cut packing ring (201) from the spiral at an angle of 45° diagonal across the guidelines with no gap is left between the ends (Fig. 6-113).

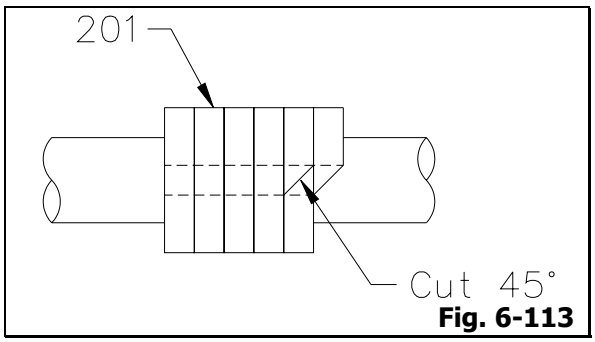


Fig. 6-113

5. Saturate packings (201) well with oil.

6. Insert a packing (201) into stuffing box cover (212.G) by hand until the packing (201) is fully seated against the end ring for gland packing (214.G), then follow by proper numbers of packing (201) and lantern ring (206) until stuffing box cover (212.G) is nearly full. Stagger all packing ring joints at 90° intervals (Fig. 6-114).

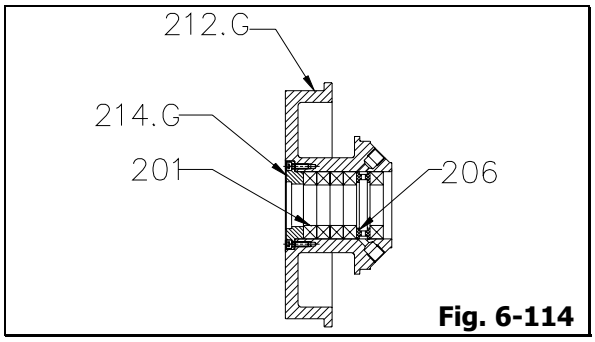


Fig. 6-114

ⓘ NOTE

Proper numbers of packing ring installed before and after lantern ring is depend on pump model. Correct location for the lantern ring is where the lantern ring aligned with flushing holes on stuffing box cover.

7. Install stuffing box cover "O" ring (420), stuffing box cover gasket (431) and two (2) gland studs into stuffing box cover (212.G) (Fig. 6-115).

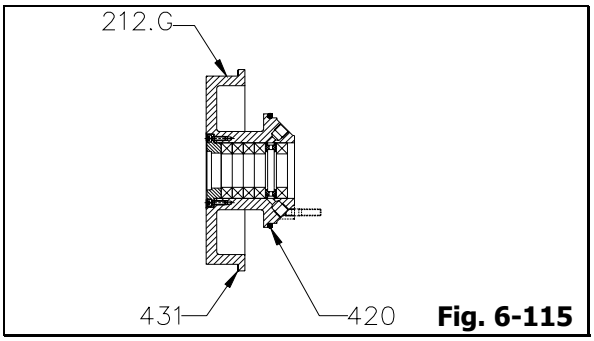


Fig. 6-115

8. Install gland (213) and shaft sleeve (133) onto shaft (130). Make certain that shaft sleeve (133) is fully seated on shaft (130) (Fig. 6-116).

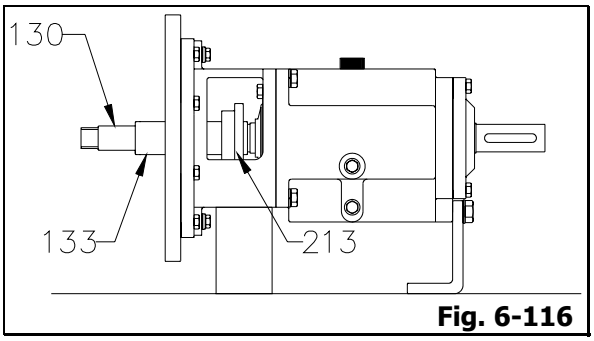


Fig. 6-116

9. Coat stuffing box cover "O" ring (420) seat surface in frame adaptor (220) with oil. Install stuffing box cover (212.G) assembly onto frame adaptor (220) or adaptor extension ring (221) by allowing shaft sleeve (133) go through packings (201) inside stuffing box cover (212.G) and gland studs go through two (2) bolt holes on gland (213). Align bolt holes and install stuffing box cover bolts (where applicable). Tighten bolts evenly.

10. Install gland (213) into stuffing box cover (212.G). Install two (2) gland nuts after gland (213) and tighten nuts evenly until

snug, then back off the nuts and tighten them again with fingers only (Fig. 6-117).

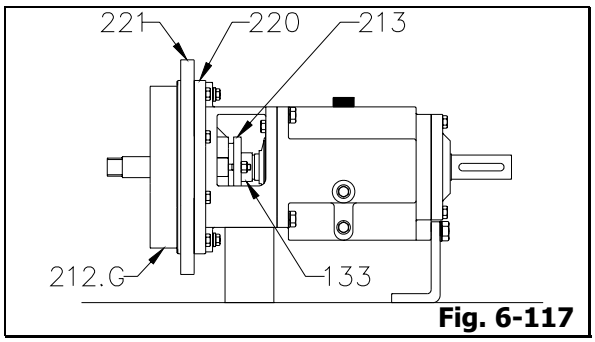


Fig. 6-117

11. Install all connection plugs (409) or/and piping adaptors into stuffing box cover (212.G) (Fig. 6-118).

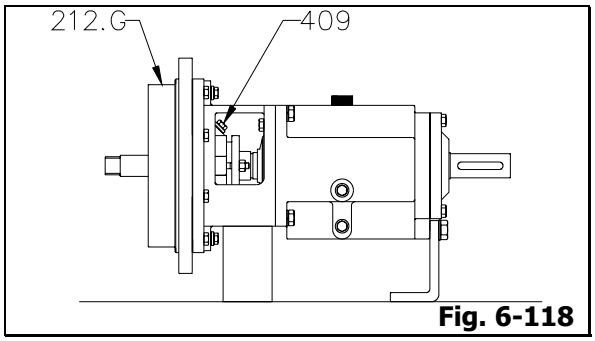


Fig. 6-118

12. Check stuffing box cover (212.G) run out. Clamp stuffing box cover (212.G) tight to frame adaptor (220) or adaptor extension ring (221). Rotate shaft (130) through 360°. If total indicator reading is greater than 0.13mm, determine cause and correct before proceeding (Fig. 6-119).

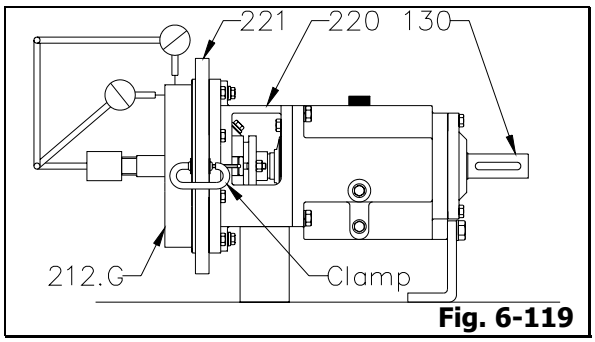


Fig. 6-119

6.3.5 Reinstallation of Impeller

⚠ WARNING

Wear heavy work gloves when handling impellers as sharp edges may cause physical injury.

ⓘ NOTE

It is recommended that the bearing frame support foot be clamped to the workbench when installing impeller.

1. Install shaft sleeve gasket (437) and key for impeller (135) onto shaft (130) (Fig. 6-120).

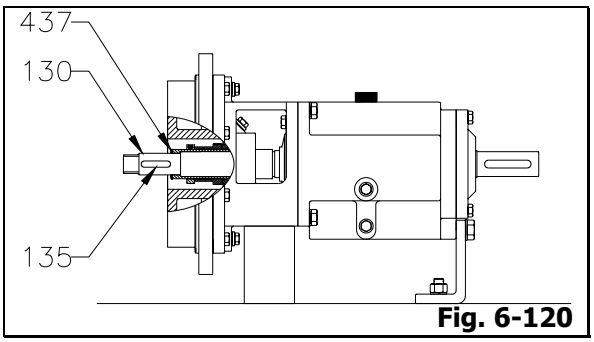


Fig. 6-120

⚠ CAUTION

Make sure mechanical seal is seated properly onto shaft sleeve while installing key for impeller, otherwise may damage the mechanical seal.

2. Install impeller (120) to shaft (130).

3. Install impeller nut gasket (445) and impeller nut (134) to shaft (130) by turning impeller nut (134) clockwise (viewed from the impeller end of the shaft) by hand until it is tightened (Fig. 6-121).

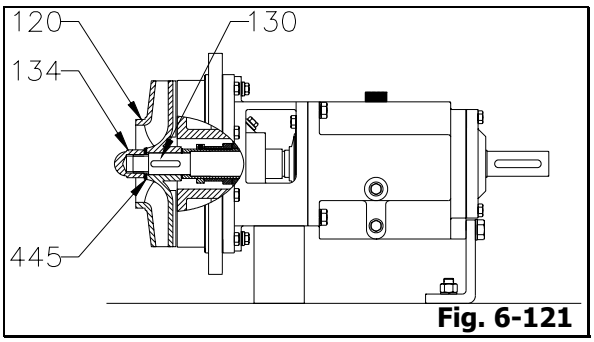


Fig. 6-121

4. Slide spanner over the shaft (130) and shaft end key (136). Hold spanner on the workbench or a solid block and make sure the power end is secure on the work surface.

5. Place another spanner over impeller nut (134). Turn spanner clockwise (viewed from the impeller end of the shaft) to

tighten impeller nut (134) properly (Fig. 6-122).

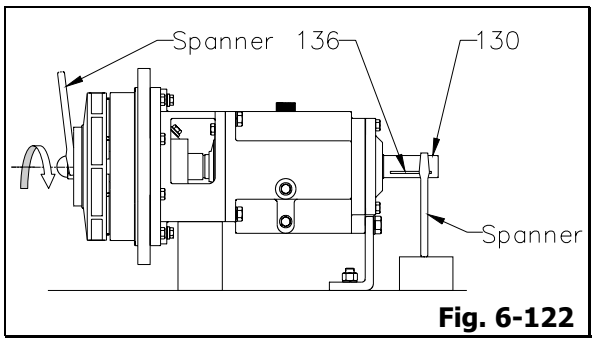


Fig. 6-122

6. Check impeller (120) run out. Rotate impeller (120) through 360°. If total indicator reading is greater than 0.13mm, determine cause and correct before proceeding (Fig. 6-123).

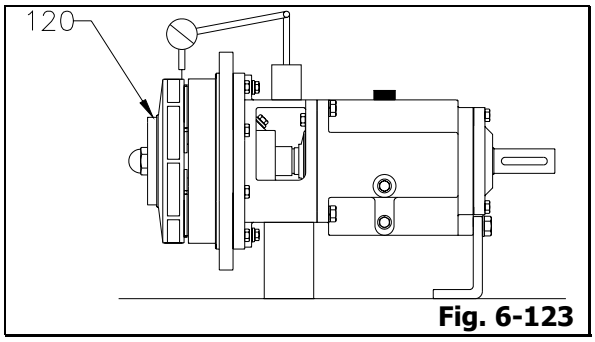


Fig. 6-123

6.3.6 Reinstallation of Pump to Base Plate

1. Install coupling to shaft (130) until coupling hub reach the hub location marking which has been made on shaft (130) during disassembly (Fig. 6-124).

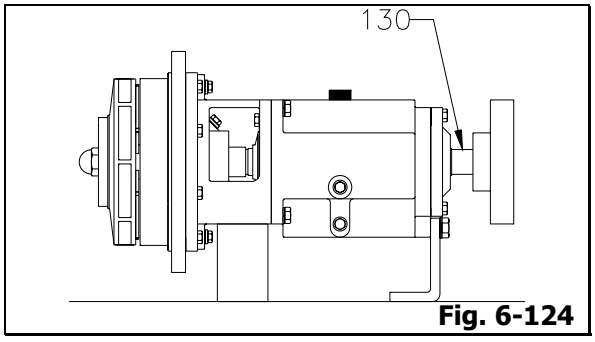


Fig. 6-124

2. Place sling from hoist through frame adaptor (220).

3. Install back pull out assembly to casing (100).

⚠ WARNING

Never handle the back pull-out assembly unassisted, physical injury can occur.

4. Install casing nuts to casing studs. Casing nuts may be coated with anti-galling compound to aid disassembly. Tighten casing nuts evenly.

⚠ CAUTION

Do not over tighten casing nuts. Refer to bolts and nuts manufacturer for recommended torque values.

5. Replace shims (if used) under support foot (410), install and tighten support foot (410) hold down bolts and nuts to baseplate (Fig. 6-125).

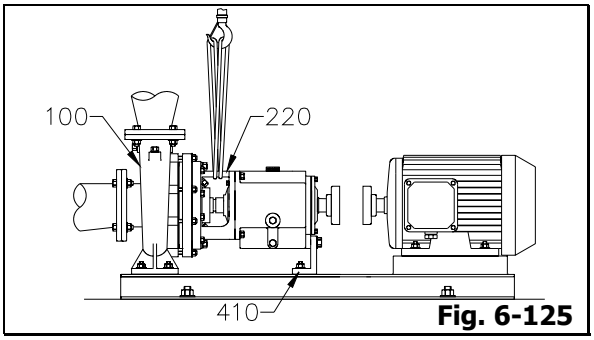


Fig. 6-125

6. Check coupling alignment per alignment procedures in section *3.6.3 Alignment Procedures for Direct Coupled Baseplate Design*.

7. Replace all auxiliary piping and tubing.

6.3.7 Post Assembly Checks

After completion of these operations, check if it is possible to rotate shaft easily by hand. If all is proper, continue with pump start-up per instructions in section *4 Operation*.

6.3.8 Assembly Troubleshooting

Excessive Shaft Play

1. *Bearing internal clearance too great* – Replace bearings (311 and 312) with correct type.

Excessive Shaft or Shaft Sleeve Run Out

1. *Shaft or Shaft Sleeve worn* – Replace.

2. *Shaft bend* – Replace.

Excessive Bearing Frame Face Run Out

1. *Shaft bend* – Replace.
2. *Bearing frame face distorted* – Replace.

Excessive Frame Adaptor Run Out

1. *Frame adaptor corrosion* – Replace.
2. *Frame adaptor gasket not seated properly* – Reseat.

Excessive Stuffing Box Cover Run Out

1. *Stuffing box cover not properly seated on frame adaptor or adaptor extension ring* – Reseat.
2. *Stuffing box cover corrosion or wear* – Replace.

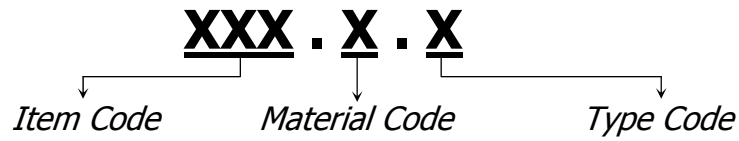
Excessive Impeller Run Out

1. *Impeller corrosion or wear* – Replace.
2. *Impeller not properly installed* – Reinstall.
3. *Shaft bent* – Replace.

7 SPARE PARTS

Part No. Notations

Part No.



- Part No. with standard material and type are shown in the individual parts list.

Example Part No. : 120.1.C (Item = Impeller Material = SS304 Type = Closed)

Item Code

- Refer to Item Codes Denomination.
- For parts which have no variation in material and type, Part No. contains of Item Code only.

Example Part No. : 440 (Item = Deflector)

Material Code

For Item Codes 100, 104, 120, 133, 134, 206, 212, 213, 214, 215, 218, 401, 402, 409 and 463 only :

1 = SS304	4 = Ni-Hard	7 = Alloy 20
2 = SS316	5 = Cast Iron	8 = Mild Steel
3 = CA40	6 = Ductile Iron	9 = CD 4MCu

For Item Codes 200, 204 and 205 only :
Material codes according to DIN 24960 Standard.
Example : BVVGG = Carbon vs. Ceramic with Viton elastomers

- Available materials for the above items are depended on the product specifications.
- For parts which have no variation in type, Part No. contains of Item Code and Material Code only.

Example Part No. : 213.5 (Item = Gland Material = Cast Iron)

Type Code

For Item Code 100 only : J = With Heating Chamber

For Item Code 300 only : OBC = With Oil Bath Cooling

For Item Codes 100, 120 and 300 only :

C = Closed	S = Semi-Open	R = Fully-Open

For Item Code 212 only :

IS = Single Internal	RQ = Single Internal with Rear Quenching
ES = Single External	DB = Double Back-to-Back
DT = Double Tandem	G = Gland Packing

For Item Code 214 only :

M = Mechanical Sealing	G = Gland Packing

- Available types for the above items are depended on the product specifications.

Example Part No. : 212.2.DB (Item = Stuffing Box Cover Material = SS316 Type = Double Back-to-Back)

Kewpump (M) Sdn. Bhd. reserves the right to change the materials and types to keep pace with technological progress.

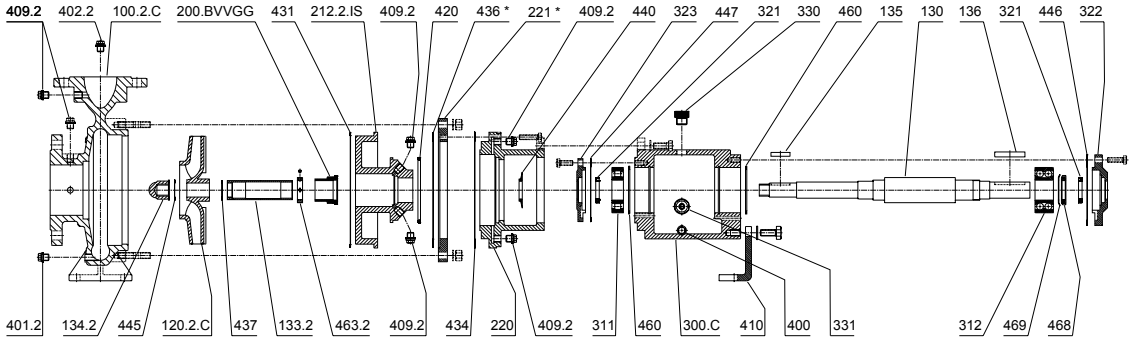
Item Codes Denomination

Item Code	Designation
100	Casing
104	Casing Wear Plate
120	Impeller
130	Shaft
133	Shaft Sleeve
134	Impeller Nut
135	Key for Impeller
136	Shaft End Key
200	Mechanical Seal
201	Packing
202	V-Seal
204	Pump End Mechanical Seal
205	Atmospheric End Mechanical Seal
206	Lantern Ring
212	Stuffing Box Cover
213	Gland
214	End Ring
215	Seal Cover
218	Seal Cover Extension
220	Frame Adaptor
221	Adaptor Extension Ring
300	Bearing Frame
303	Adjustable Bearing Box
311	Pump End Bearing
312	Drive End Bearing
321	Oil Seal
322	Drive End Bearing Cover
323	Pump End Bearing Cover
330	Oil Cover
331	Oil Gauge
340	Bearing Frame Cooling Coil

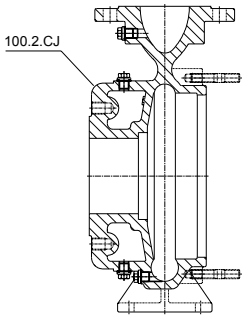
Item Code	Designation
400	Bearing Frame Drain Plug
401	Casing Drain Plug
402	Venting Plug
409	Connection Plug
410	Support Foot
420	Stuffing Box Cover "O" Ring
428	Bearing Box "O" Ring
429	Seal Cover Extension "O" Ring
431	Stuffing Box Cover Gasket
434	Frame Adaptor Gasket
436	Adaptor Extension Ring Gasket
437	Shaft Sleeve Gasket
438	Seal Cover Gasket
440	Deflector
445	Impeller Nut Gasket
446	Drive End Bearing Cover Gasket
447	Pump End Bearing Cover Gasket
448	End Ring Gasket
449	Seal Cover Extension Gasket
460	Cir Clip
463	Abutment Ring
468	Bearing Nut
469	Bearing Washer
481	Cooling Coil Adaptor
491	Cooling Coil "O" Ring

KS-SG2 Parts List

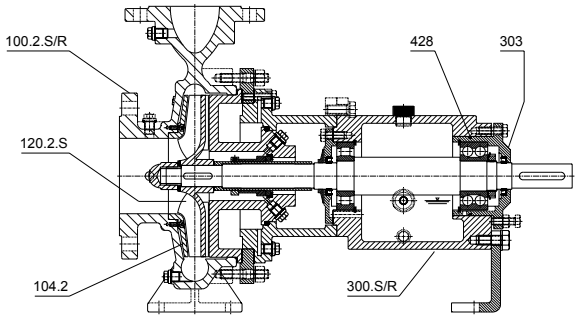
Standard Arrangement



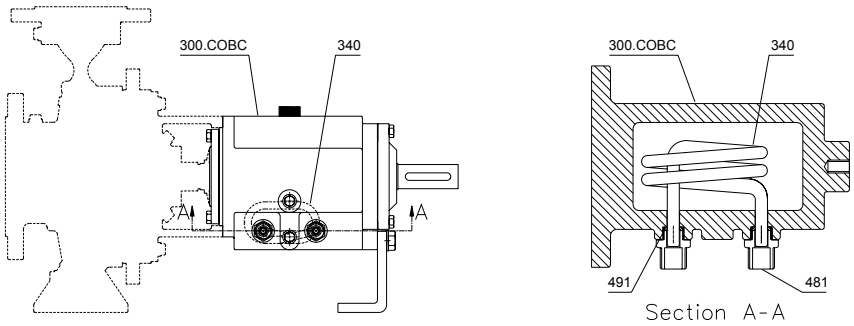
Design Variants



Casing with Heating Chamber

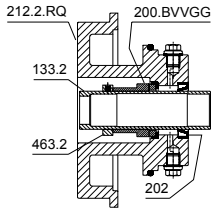


Open Type Impeller with Casing Wear Plate and Axial Adjustment

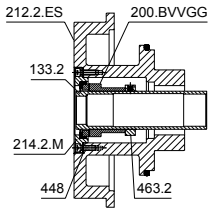


Bearing Frame with Oil Bath Cooling

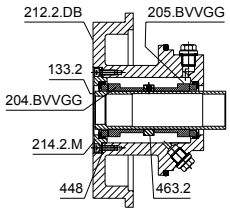
Shaft Seal Options



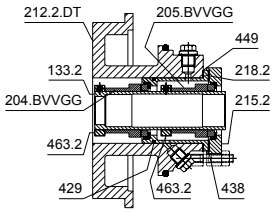
Single Internal with Rear Quenching



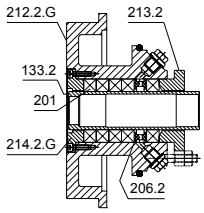
Single External



Double Back-to-Back



Double Tandem



Gland Packing

KS-SG2 Parts List

Part No.	Description	Standard Material
100.2.C	Casing for Closed Impeller	Stainless Steel 316
100.2.CJ	Casing for Closed Impeller with Heating Chamber	Stainless Steel 316
100.2.S/R	Casing for Open Type Impeller	Stainless Steel 316
100.2.S/RJ	Casing for Open Type Impeller with Heating Chamber	Stainless Steel 316
104.2	Casing Wear Plate	Stainless Steel 316
120.2.C	Closed Impeller	Stainless Steel 316
120.2.S	Semi-Open Impeller	Stainless Steel 316
120.2.R	Fully-Open Impeller	Stainless Steel 316
130	Shaft	Stainless Steel 304
133.2	Shaft Sleeve	Stainless Steel 316
134.2	Impeller Nut	Stainless Steel 316
135	Key for Impeller	Stainless Steel 304
136	Shaft End Key	Stainless Steel 304
200.BVVGG	Mechanical Seal	Carbon vs. Ceramic
201	Packing	P.T.F.E.
202	V-Seal	Synthetic Rubber
204.BVVGG	Pump End Mechanical Seal	Carbon vs. Ceramic
205.BVVGG	Atmospheric End Mechanical Seal	Carbon vs. Ceramic
206.2	Lantern Ring	Stainless Steel 316
212.2.IS	Stuffing Box Cover for Single Internal	Stainless Steel 316
212.2.RQ	Stuffing Box Cover for Single Internal with Rear Quenching	Stainless Steel 316
212.2.ES	Stuffing Box Cover for Single External	Stainless Steel 316
212.2.DB	Stuffing Box Cover for Double Back-to-Back	Stainless Steel 316
212.2.DT	Stuffing Box Cover for Double Tandem	Stainless Steel 316
212.2.G	Stuffing Box Cover for Gland Packing	Stainless Steel 316
213.2	Gland	Stainless Steel 316
214.2.M	End Ring for Mechanical Sealing	Stainless Steel 316
214.2.G	End Ring for Gland Packing	Stainless Steel 316
215.2	Seal Cover	Stainless Steel 316

Part No.	Description	Standard Material
218.2	Seal Cover Extension	Stainless Steel 316
220	Frame Adaptor	Cast Iron
221 *	Adaptor Extension Ring	Cast Iron
300.C	Bearing Frame for Closed Impeller	Cast Iron
300.COBC	Bearing Frame for Closed Impeller with Oil Bath Cooling	Cast Iron
300.S/R	Bearing Frame for Open Type Impeller	Cast Iron
300.S/ROBC	Bearing Frame for Open Type Impeller with Oil Bath Cooling	Cast Iron
303	Adjustable Bearing Box	Cast Iron
311	Pump End Bearing	Steel
312	Drive End Bearing	Steel
321	Oil Seal	Synthetic Rubber
322	Drive End Bearing Cover	Cast Iron
323	Pump End Bearing Cover	Cast Iron
330	Oil Cover	Aluminium Alloy
331	Oil Gauge	Plastic Threaded
340	Bearing Frame Cooling Coil	Copper
400	Bearing Frame Drain Plug	Galvanise Steel
401.2	Casing Drain Plug	Stainless Steel 316
402.2	Venting Plug	Stainless Steel 316
409.2	Connection Plug	Stainless Steel 316
410	Support Foot	Cast Iron
420	Stuffing Box Cover "O" Ring	Synthetic Rubber
428	Bearing Box "O" Ring	Synthetic Rubber
429	Seal Cover Extension "O" Ring	Synthetic Rubber
431	Stuffing Box Cover Gasket	P.T.F.E.
434	Frame Adaptor Gasket	Asbestos Sheet
436 *	Adaptor Extension Ring Gasket	Asbestos Sheet
437	Shaft Sleeve Gasket	P.T.F.E.
438	Seal Cover Gasket	Asbestos Sheet
440	Deflector	Synthetic Rubber
445	Impeller Nut Gasket	P.T.F.E.
446	Drive End Bearing Cover Gasket	Asbestos Sheet
447	Pump End Bearing Cover Gasket	Asbestos Sheet
448	End Ring gasket	P.T.F.E.
449	Seal Cover Extension Gasket	Asbestos Sheet
460	Cir Clip	Steel
463.2	Abutment Ring	Stainless Steel 316
468	Bearing Nut	Steel
469	Bearing Washer	Steel
481	Cooling Coil Adaptor	Stainless Steel 304
491	Cooling Coil "O" Ring	Synthetic Rubber

* For all models except 32-130, 40-130, 50-130, 65-130, 65-160, 80-160, 100-260, 125-260, 125-320, 125-400, 150-200, 150-260 and 150-320

How to Order Spare Parts

ⓘ N O T E

By giving complete information you will enable us to fill your order correctly and avoid unnecessary delays.

When ordering spare parts, please specify:

1. Pump Type
2. Pump Model
3. Serial Number
4. Part No. (with material code and type code if available)
5. Part Description
6. Quantity

Items 1, 2 and 3 can be found from the pump nameplate, while items 4 and 5 can be found from the pump parts lists in this section.

Example:

Pump Type	:	KS-SG2
Pump Model	:	SGN 80-200 RQ
Serial Number	:	BO02002PN1
Part No.	:	212.2.RQ
Part Description	:	Stuffing Box Cover
Quantity	:	2

Recommended Spare Parts

- Casing (100)
- Casing Wear Plate (104)
- Impeller (120)
- Shaft (130)
- Shaft Sleeve (133)
- Mechanical Seal (200, 204 and 205)
- Packing (201)
- Stuffing Box Cover (212)
- End Ring (214)
- Seal Cover (215)
- Seal Cover Extension (218)
- Bearing (311 and 312)
- Stuffing Box Cover "O" Ring (420)
- Bearing Box "O" Ring (428)
- Seal Cover Extension "O" Ring (429)
- Cooling Coil "O" Ring (491)
- All Gaskets

8 WARRANTY STATEMENT

Kewpump products are guaranteed to be free from defects in material and/or workmanship and to perform as advertised when properly installed, used and maintained per instructions in the manual. Should any part(s) prove defective within one (1) year from the date of purchase, it (they) will be replaced without charge provided the defective part(s) is returned to our factory or branch transportation charges prepaid. **Warranty is valid only when genuine Kewpump parts are used**.

Kewpump (M) Sdn. Bhd. will not be responsible for labour charges, loss, or consequential damage of any kind of character caused by defective parts or for charges incurred in the replacement or repair of defective parts by Purchaser. This warranty does not apply when damage is caused by sand or abrasive materials, chemical deposits, corrosion, or wear and tear unless written approval is obtained in advance from Kewpump (M) Sdn. Bhd.. Careless handling and improper installation or use may void all warranties.

Drivers that are furnished with part of our own manufacture to make complete pumping units are warranted as to workmanship and materials for a period of six (6) months from date of purchase. Should any failure occur within six (6) months period, determination of warranty responsibility can be made only by the driver companies or their service shops. An inoperative unit should be taken to an authorised service shop and, according to the service shop's determination of the cause of failure, the actual repair will be either charged to the customer or put on a no charge basis. If the repair is on a no charge basis, it will not cover removal or reinstallation charges, mileage, service calls, or other charges not part of the actual repair.

Kewpump (M) Sdn. Bhd. must be notified of a failure within the warranty period and will then supply instructions to Customer or Dealer.

The forgoing states the Company's entire liability for any claim to damages whatever, and is made by Company and accepted by Purchaser in lieu of all other warranties, obligations, or liabilities expressed or implied.

KEWPUMP®