

# GRAVEL SAND PUMPS

ASSEMBLY, OPERATING AND

MAINTENANCE INSTRUCTIONS



## **SAFETY INFORMATION**

The following safety information relating to pump operation and maintenance should be carefully observed, and correct procedures followed, to avoid injuries to personnel, and damage to equipment. All statutory requirements relating to this equipment must be complied with at all times.

**DO NOT APPLY HEAT TO THE IMPELLER HUB OR INLET EYE TO ASSIST IMPELLER REMOVAL.** APPLICATION OF HEAT MAY RESULT IN SHATTERING OF THE IMPELLER, RESULTING IN INJURY OR EQUIPMENT DAMAGE.

**DO NOT OPERATE THE PUMP FOR AN EXTENDED TIME WITH ZERO OR VERY LOW FLOWRATE.** FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OVERHEATING OF THE PUMP, AND VAPORISATION OF THE PUMPED FLUID, WITH GENERATION OF VERY HIGH PRESSURES. SERIOUS INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT MAY RESULT FROM SUCH ACTION.

**CHECK DRIVE MOTOR ROTATION PRIOR TO FITTING OF DRIVE BELTS OR COUPLINGS.** INCORRECT MOTOR ROTATION MAY CAUSE PERSONNEL INJURY OR EQUIPMENT DAMAGE.

**DO NOT FEED VERY HOT OR VERY COLD FLUID INTO A PUMP AT AMBIENT TEMPERATURE.** THERMAL SHOCK MAY RESULT IN FRACTURE OF PUMP WET-END PARTS.

**A PUMP MUST BE REGARDED AS BOTH AN ITEM OF ROTATING MACHINERY, AND A PRESSURE VESSEL.** ALL RELEVANT SAFETY PRECAUTIONS AND PROCEDURES FOR SUCH EQUIPMENT SHOULD BE OBSERVED DURING PUMP INSTALLATION, OPERATION AND MAINTENANCE.

**WHERE AUXILIARY EQUIPMENT IS ASSOCIATED WITH A PUMP** e.g. MOTORS, DRIVE BELTS, DRIVE COUPLINGS, SPEED REDUCERS, VARIABLE SPEED DRIVES, ETC) ALL RELEVANT INSTRUCTION MANUALS SHOULD BE CONSULTED, AND RECOMMENDED PROCEDURES IMPLEMENTED, DURING INSTALLATION, OPERATION AND MAINTENANCE OF THE PUMP SYSTEM.

**DO NOT OPERATE THE PUMP UNTIL THE MECHANICAL SEAL WAS FLUSHED WITH COLD WATER FOR 5 MINS**

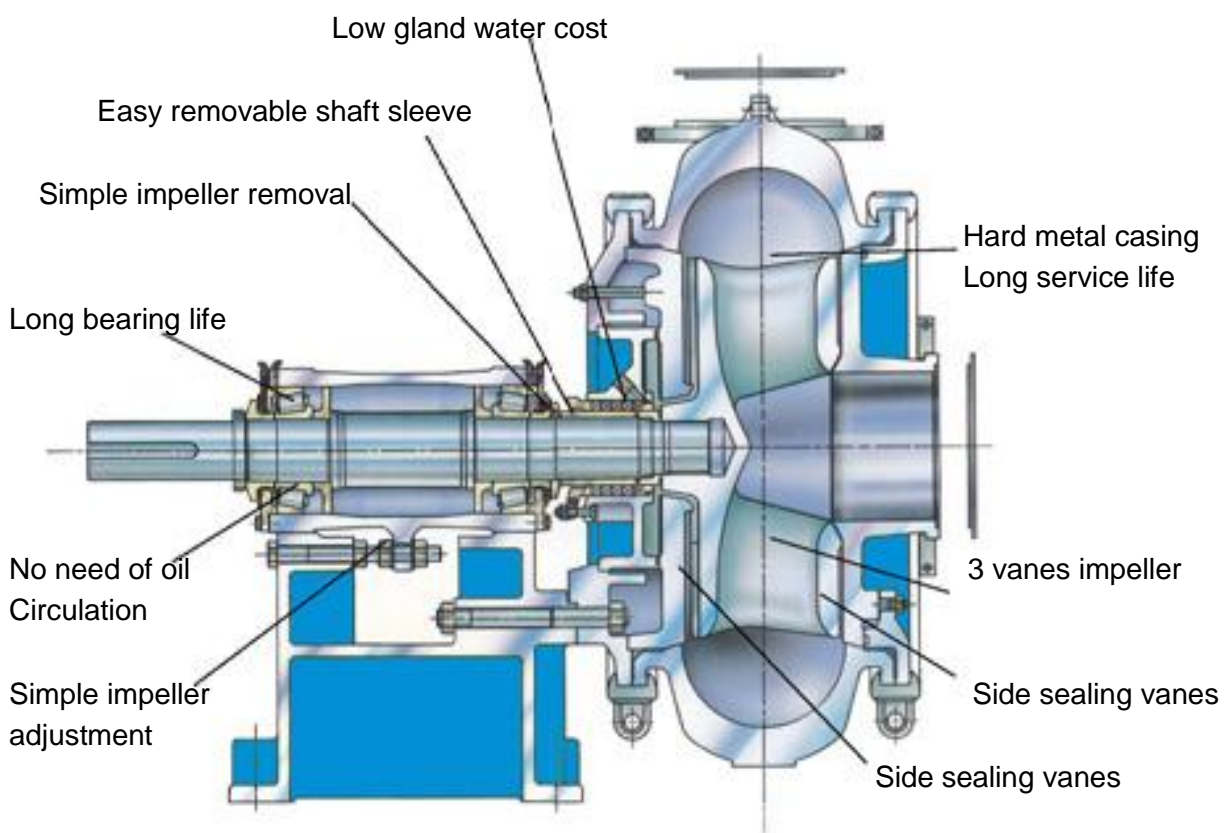
**DO NOT SHUT OFF FLUSH WATER FOR MECHANICAL SEAL UNTIL THE PUMP STOPS FOR 5 MINS**

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## 1. INTRODUCTION

This publication forms part of a set which together comprise the Assembly, Operating, and Maintenance Instruction Manual Dredge and Gravel Pumps, Type 'G' and 'GH'. Dredge and Gravel pumps are designed for dredging and similar low head duties. The design features a hard metal casing and wear resistant components are capable of passing extremely large particles. Size range from 4 to 18 inches discharge diameter. The pump's construction as follows:



## 2. APPLICATION AND FEATURES OF TYPE 'G' and 'GH' DREDGE AND GRAVEL PUMPS

These Gravel pumps are of heavy-duty construction, designed for continuous pumping of highly abrasive slurries containing large particles with high efficiencies, and low maintenance and ownership cost. They feature an unlined casing design, design simplicity, and minimum number of parts.

Type 'G' Gravel Pumps are designed for dredging and similar low head duties, and typically

have larger impellers and heavier casings for pumping to higher heads.

Type 'GH' High Head Gravel Pumps are similar to Types 'G' Pumps, but typically have larger impeller diameters than the G range, and stronger casings to permit pumping to higher heads, up to 80 meters. A common application is in dredging duties incorporating long discharge lines.

The pumps may be fitted with a range of seal types depending on the particular requirements, including the centrifugal seal, and water flushed packed gland seal and mechanical seal.

Important design features of this range of Gravel Pumps include:

- ◆ Cartridge type Bearing Assembly
- ◆ Casing attachment by quick-release clamps
- ◆ Heavy duty screw thread Impeller attachment
- ◆ Through-bolt design throughout
- ◆ Easily replaceable Shaft Sleeve
- ◆ Easily removal of impeller
- ◆ Replaceable casing components
- ◆ Minimum number of casing components

### **3. IDENTIFICATION OF PARTS**

Each pump part has a unique name and a three-digit Basic Part Number. Parts with the same name have the same Basic Part Number, regardless of pump size. For example, the Expeller of every pump has the Basic Part Number 028.

Additional letters and numbers are added before and after the Basic Part Number to further define a component part of a particular pump. This expanded marking is identified as the Part Number, and represents a unique identification for each component part.

Basic Part Numbers for all component parts of Type 'G' and 'GH' pumps are listed in the Appendix of this publication.

### **4. BEARING ASSEMBLY – ASSEMBLY AND MAINTENANCE**

The Bearing Assembly is assembled and maintained as described in the separate Publication,

### **5. LUBRICATION – BEARINGS AND CENTRIFUGAL SEAL**

It is recommended that grease used for lubricating both the rolling bearings (where applicable), and the packed gland of the centrifugal seal, should have the following characteristics:

Lithium soap base grease with EP additives and oxidation inhibitors.

N.L.G.I. Consistency No: 2  
Drop Point > 170° C  
Work penetration 25°C A.S.T.M. 265 – 295

**RECOMMENDED GREASE: SHELL ALVANIA EP GREASE 2, CASTROL EPL2, or equivalent.**

The static seal chamber of centrifugally sealed pumps should be lubricated sparingly but regularly by means of the grease nipple fitted to the Expeller Ring. Several shots from a grease gun per 12 hours running time, based on mid-range pump size, are recommended to form an adequate seal at the packing rings.

## **6. PUMP ASSEMBLY INSTRUCTIONS**

Reference to a Component Diagram for the particular pump being assembled will be of assistance in following the instructions outlined in the following sections.

All parts dismantled during pump overhaul should be inspected to assess suitability for reuse, and identification of new parts should be checked. Parts suitable for re-use should be cleaned and painted. Matching faces should be free of rust, dirt, and burrs, and have a coating of anti-seize compound applied prior to assembly.

Small fasteners should preferably be replaced, and all threads coated with graphite grease before assembly. Replacement of all rubber seals is recommended at major overhauls, as these materials tend to deteriorate with use. Exposure to direct and continuous sunlight will accelerate rubber degradation.

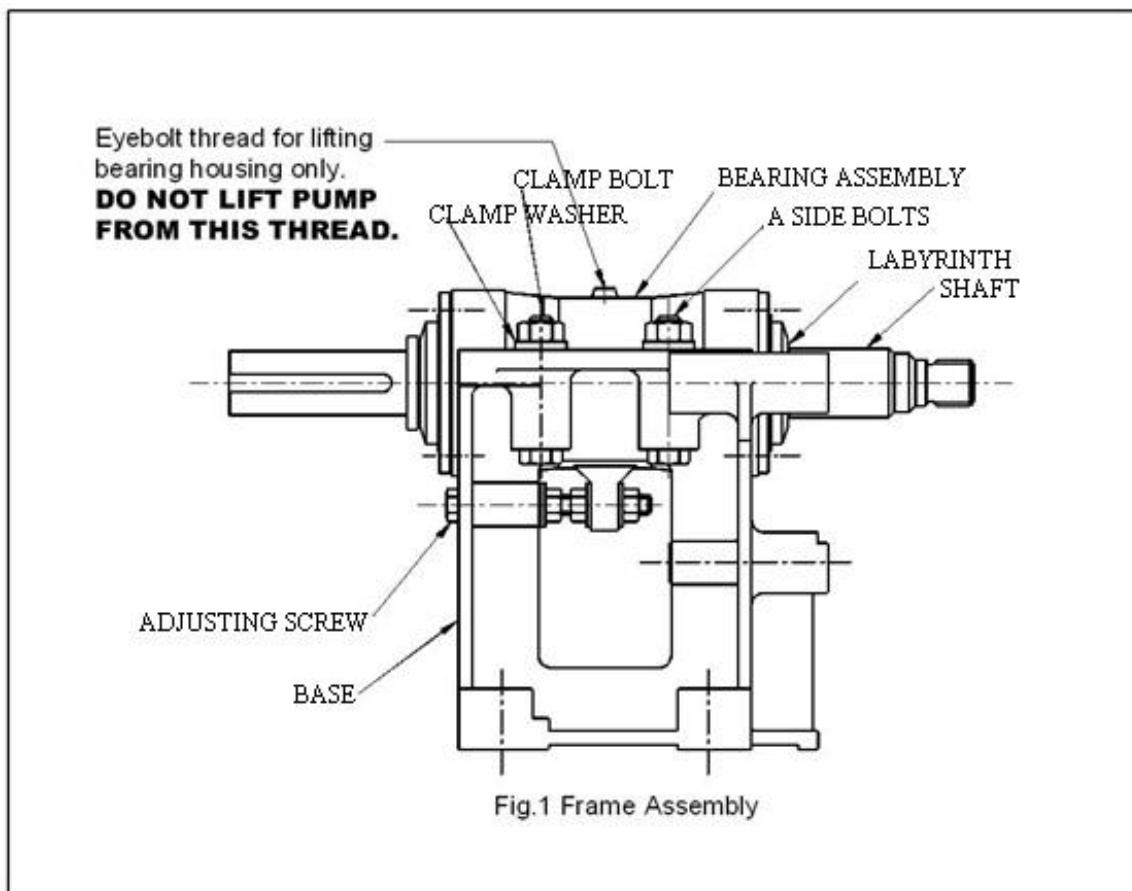
### **6.1 FRAME ASSEMBLY**

#### **6.1.1 Fitting Bearing Assembly to Base**

**- Refer Figs 1 and 8**

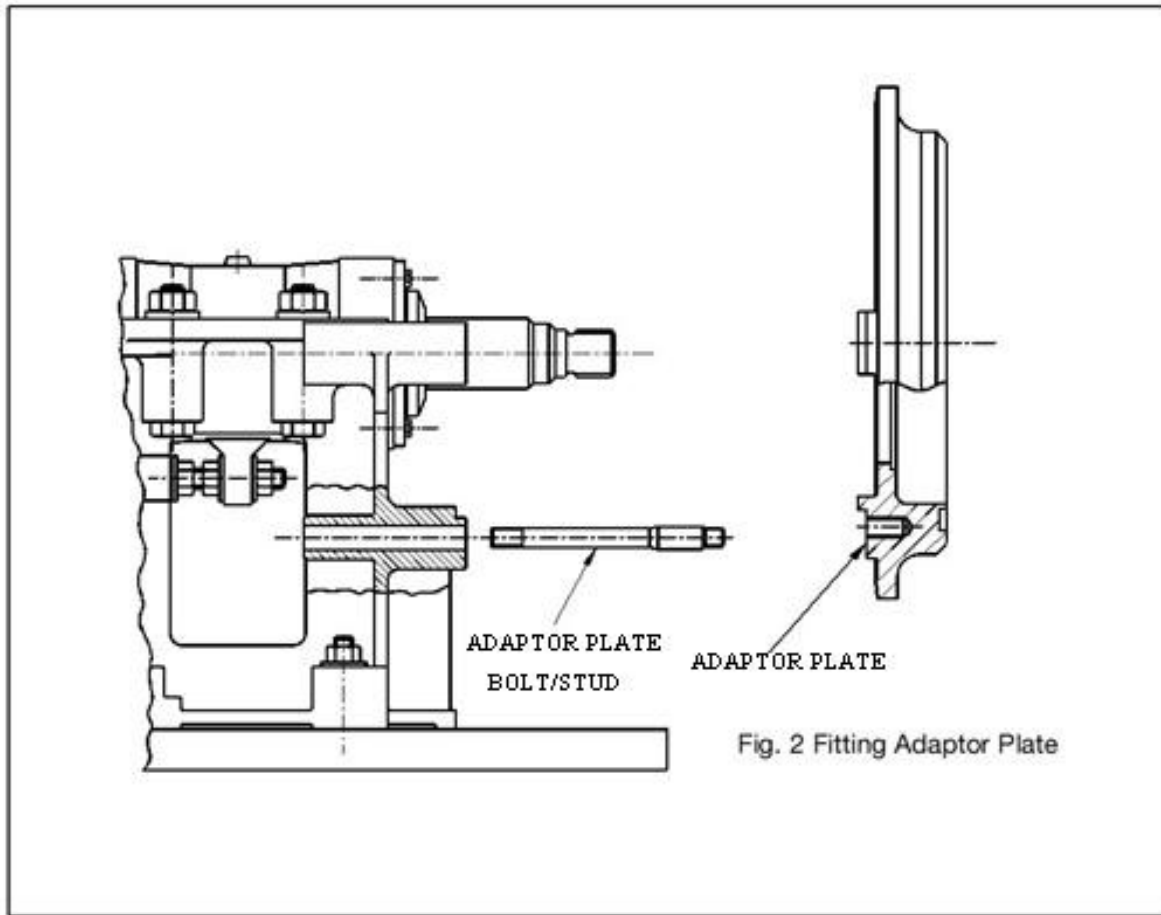
- (i) Insert ADJUSTING SCREW (001) in BASE (003) from end face. Fix to Base by fitting one nut and fully tighten. Fit two additional nuts separated by two flat washers. These nuts should be loose on Adjusting Screw and spaced well apart.
- (ii) Apply anti-seize compound to semi-circular machined surfaces (Bearing Housing support cradle) in Base.
- (iii) Lower BEARING ASSEMBLY (005) into Base. Approximately match machined surfaces of the Bearing Housing with those in Base. Ensure that the Bearing Housing lug has fitted over the Adjusting Screw mounted in the Base, and that it fits between the nuts and washers.

- (iv) Fit CLAMP BOLTS (012) through Base from below. Mount CLAMP WASHER (011) on each bolt (domed side up) and screw on nuts. Fully tighten Clamp Bolts on side 'A', i.e. on right hand side of Base as viewed from the drive-end (refer Figs 1 and 8). Clamp Bolts on the other side (i.e. side 'B') should not be tightened at this stage. Leave finger tight only, to maintain alignment but allow axial movement of the Bearing Assembly.
- (v) Apply anti-seize compound to SHAFT (073) protruding from LABYRINTH (062) at Impeller-end. This will assist fitting and removal of shaft components, and prevent damage to Shaft surfaces by moisture.



- (vi) Fit two pieces of timber, or an appropriate assembly cradle, to underside of Base to prevent the pump from tipping forward during assembly of casing, as shown in Fig 2. Ensure that the Base is at a sufficient height above the floor to enable casing components to be assembled.

### 6.1.2 Fitting Adaptor Plate – Refer Fig 2



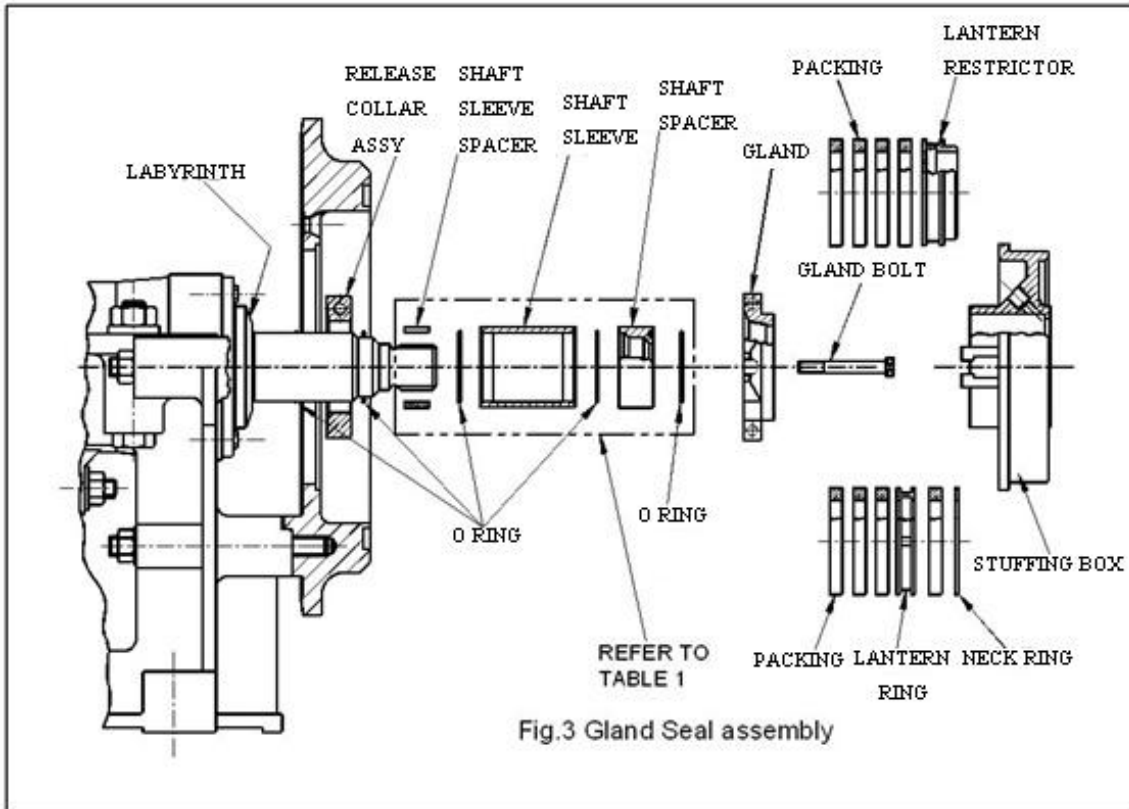
- (i) Screw ADAPTOR PLATE STUDS (034 or 039) to tapped holes in ADAPTOR PLATE (032), where applicable, and fully tighten.
- (ii) Lift Adaptor Plate, and fit to Base, engaging Studs in corresponding holes in Base, where applicable, and ensuring that the Adaptor Plate locating spigot engages with the corresponding Base recess. Before fitting Adaptor Plate, apply anti-seize compound to the recess to assist future dismantling. Fit nuts to Studs and fully tighten. For pumps in which Adaptor Plates have clearance holes for bolts, fit ADAPTOR PLATE BOLTS (034) to holes in Adaptor Plate, and engage corresponding holes in Base. Fit nuts to Bolts and fully tighten.

## 6.2 SEAL ASSEMBLY

### GLAND SEAL ASSEMBLY

- Fitting Stuffing Box, Lantern Restrictor, (or Neck and Lantern Rings), Packing, Gland, Shaft Sleeve, Shaft Spacer, and Shaft Sleeve O-Rings

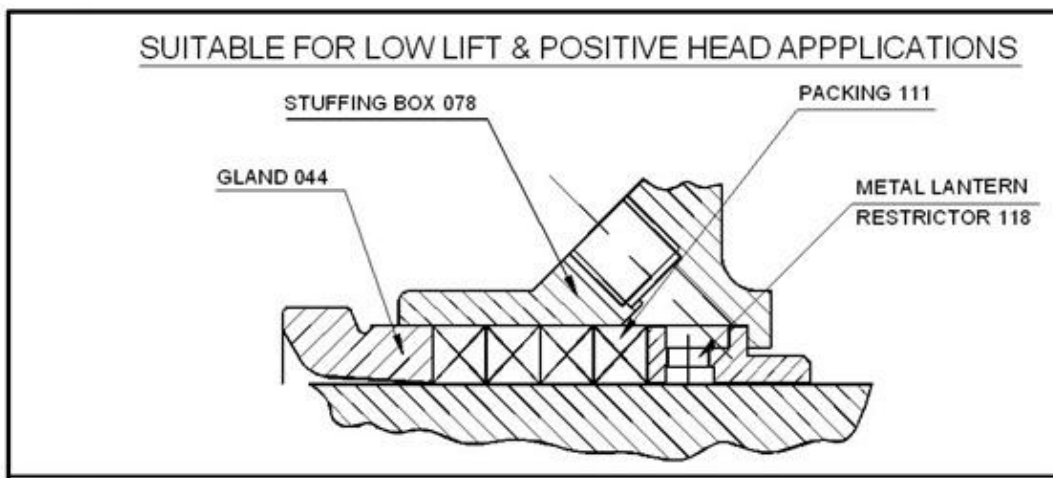
- Refer Fig 3, 4 and 6



**6.2.1**

Stuffing Box assemblies, which may be used depending on the particular pump application, are shown in Fig 4.

Figure 3 shows the relative position of Impeller Release Collar, Shaft Spacer, Shaft Sleeve, O-Rings, etc, on the Shaft. The specific arrangement of these components on the Shaft may vary according to pump size. Table 1 lists the components assembled onto the Shaft, in the order in which they are fitted, commencing at the LABYRINTH (062) at the Impeller-end of the Bearing Assembly. Pumps having similar arrangements of parts are grouped together in the Table. Generally, pumps having Modified Basic Frames (D, E, etc) will have the same shaft components as those having Basic Frames (D, E, etc).



**Fig.4 Gland arrangements for Stuffing Boxes**

**TABLE1****GLAND SEAL – ORDER OF ASSEMBLY OF COMPONENTS ON SHAFT**

<b>FRAME</b>	<b>PUMP</b>	<b>SHAFT COMPONENTS</b>
<b>D,F</b>	<b>6X4D-G 10X8F-G</b>	<b>109 Shaft O-Ring 075 Shaft Sleeve 109 Shaft O-Ring 117 Shaft Spacer 109 Shaft O-Ring</b>
<b>E</b>	<b>8X6E-G</b>	<b>109 Shaft O-Ring 075 Shaft Sleeve 109 Shaft O-Ring 117 Shaft Spacer 064 Impeller O-Ring</b>
<b>F</b>	<b>10X8F-G</b>	<b>109 Shaft O-Ring 179 Shaft Sleeve Spacer 109 Shaft O-Ring 075 Shaft Sleeve 117 Shaft Spacer 109 Shaft O-Ring</b>
<b>S</b>	<b>10X8S-GH</b>	<b>CSC210 Impeller O-Ring S239M Impeller Release Collar S179-3 Shaft Sleeve Spacer F109 Shaft O-Ring F075 Shaft Sleeve F109 Shaft O-Ring FG117 Shaft Spacer F109 Shaft O-Ring</b>
<b>G,S</b>	<b>10X8S-G 12X10G-G 12X10G-GH 14X12G-G 16X14G-G</b>	<b>109 Shaft O-Ring 239 Impeller Release Collar 109 Shaft O-Ring 075 Shaft Sleeve 109 Shaft O-Ring 117 Shaft Spacer 109 Shaft O-Ring</b>

**(A) Frame Sizes: D, E, F, S**

Assemble components for Gland Seal Assembly as described below.

- (i) Place STUFFING BOX (078) flat on bench, gland side up.
- (ii) Place LANTERN RESTRICTOR (118) (large diameter up) in gland recess, to rest on retaining lip.
- (iii) Stand SHAFT SLEEVE (075) on end, and slide through Lantern Restrictor.
- (iv) Fit the following items in turn:
  - a) Fit first PACKING RING (111) of required length to fill the Stuffing Box annulus.
  - b) Fit remaining Packing Rings (stagger joints) to almost completely fill the Stuffing Box chamber. Flatten each one separately.

**NOTE** – *When a NECK RING (067) is used, fit LANTERN RING (063) after first Packing Ring, and press down to compress packing. Fit remaining Packing Rings, taking care to stagger joints.*

- (v) Assemble GLAND (044) halves, fit GLAND CLAMP BOLTS (126), and fully tighten. Place Gland in Stuffing Box, around Shaft Sleeve, and press down to compress Packing Rings. Fit GLAND BOLTS (045) and tighten just sufficiently to hold Shaft Sleeve (final adjustment will be made when test running pump). A cable tie may be used to secure bolts in position.
- (vi) Determine which components fit between the LABYRINTH (062) and the SHAFT SLEEVE (075 or 076), from the pump Components Diagram, or from Table 1, for the particular pump being assembled. Fit these components to the Shaft. Fit the IMPELLER RELEASE COLLAR (239), if required.
- (vii) Apply anti-seize compound to Stuffing Box location recess in Adaptor Plate to assist future removal of Stuffing Box. Fit assembled Stuffing Box to Adaptor Plate, engaging Shaft Sleeve bore with Shaft, and tapping Stuffing Box into position with a mallet. Locate Stuffing Box with Gland Seal Water connection at the top. If Shaft Sleeve remains forward of its correct position, it should be pushed back until it is firmly in contact with other items assembled on the Shaft. Ensure that any Shaft O-Rings are correctly positioned in grooves.
- (viii) Fit remaining O-Rings and Shaft mounted items as indicated in Table 1.

**NOTE:**

- a) *Apply heavy grease to the O-Ring groove in the Shaft Spacer to assist in holding the O-Ring which seals against the back face of the Impeller.*
- b) *All O-Rings will be compressed and fully contained within their respective grooves when the Impeller is screwed on to the Shaft.*

(ix) Apply anti-seize compound liberally to Shaft thread.

**(B) Frame Sizes: G**

Assemble components for Gland Seal Assembly as described below.

- (i) Determine which components fit between LABYRINTH (062) and IMPELLER, from the pump Components Diagram, or from Table 1, for the particular pump being assembled, and fit these components to the Shaft. Fit the IMPELLER RELEASE COLLAR (239), if required.

**NOTE:**

- a) *Apply heavy grease to the O-Ring groove to assist in holding the O-Ring which seals against the back face of the Impeller.*
- b) *All O-Rings will be compressed and fully contained within their respective grooves when the Impeller is screwed on to the Shaft.*
- (ii) Place LANTERN RESTRICTOR (118) (small diameter towards Impeller end) over Shaft Sleeve, and move along Sleeve to contact Labyrinth (or Impeller Release Collar, if applicable).
- (iii) Attach LIFTING PLATE (310) to STUFFING BOX (078), using the 3 jacking screws provided, and ensure that the Gland Seal Water connection in Stuffing Box is in line with Lifting Beam (see Fig 6).
- (iv) Lift Stuffing Box, using a hoist, and insert Stuffing Box in Adaptor Plate, tapping into position with a mallet.
- (v) Assemble all Gland parts in Stuffing Box in the following manner, after all other parts of pump have been assembled.
  - a) Slide LANTERN RESTRICTOR (118) inside Stuffing Box against retaining lip.
  - b) Fit first PACKING RING (111) of required length to fill the Stuffing Box annulus, and push against the Lantern Restrictor.

- c) Slide LANTERN RING (063) and press to flatten first Packing Ring. When a Lantern Restrictor is used, the Lantern Ring is omitted.
  - d) Fit remaining Packing Rings (stagger joints) to almost completely fill the Stuffing Box chamber. Flatten each one separately.
  - e) Assemble GLAND (044) halves over Shaft Sleeve with Gland spigot towards Stuffing Box, fit GLAND CLAMP BOLTS (126), and fully tighten. Fit Gland into Stuffing Box, and push down to compress Packing Rings. Fit Gland Bolts (045) and tighten sufficiently to remove slack (final adjustment will be made when test running pump).
- (vi) Apply anti-seize compound liberally to Shaft thread.

### 6.2.2 CENTRIFUGAL SEAL ASSEMBLY

- Fitting Expeller Ring, Neck Ring, Lantern Ring, Packing, Shaft Sleeve, Shaft Sleeve O-Rings, and Expeller
- Refer Figs 5 and 6

Different procedures are described below for assembling the seal components, depending on whether the pump frame size is larger than F. Either method may be used according to individual preference.

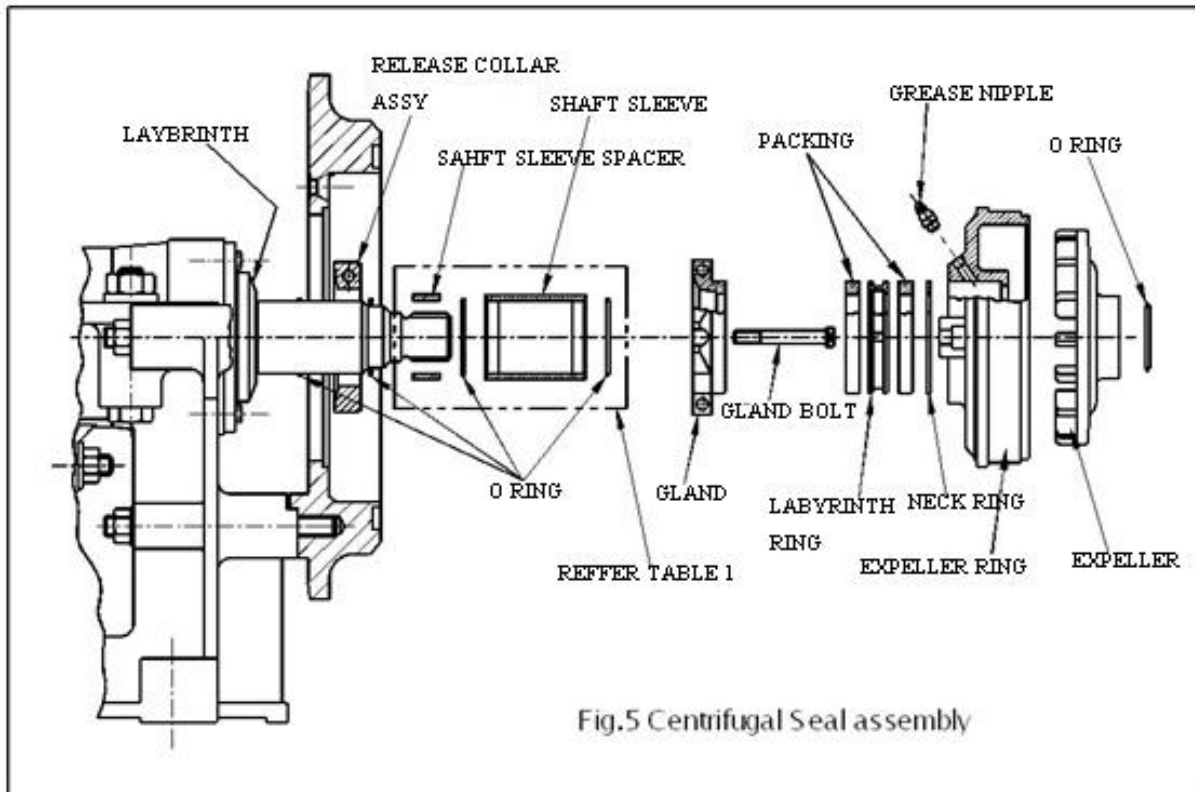
Fig 5 shows a typical assembly of shaft components, indicating the relative position of parts on the pump Shaft, which varies according to pump size. Table 1 lists shaft components for a **gland sealed pump** in the order in which are fitted to the Shaft, commencing at the end face of the LABYRINTH (062) on the pump end of the Bearing Assembly. Pumps with similar sets of Shaft components are grouped together in the Table. Generally, in **centrifugally sealed pumps**, the same sets of component parts apply as for **gland sealed pumps**, except for substituting the EXPELLER (028) for the SHAFT SPACER (117). Exceptions to the general case are listed in Table 2.

The following instructions describe the procedure to pack the gland of the Expeller Ring, which differs according to the pump frame size.

#### (A) Frame Sizes: D, E, F, S

- (i) Place EXPELLER RING (029) flat on bench, gland side up
- (ii) Place NECK RING (067) in gland recess, to rest on retaining lip.
- (iii) Stand SHAFT SLEEVE (075) on end, and slide through Neck Ring.
- (iv) Assemble the following items in turn:

- 1) Fit first PACKING RING (111) of required length to fill the packing annulus.
- 2) Fit LANTERN RING (063), and press down to flatten first packing ring.
- 3) Fit remaining Packing Rings, staggering joints, to almost completely fill the packing chamber. Flatten each ring separately.



**TABLE 2**

**CENTRIFUGAL SEAL-ORDER OF ASSEMBLY OF COMPONENTS ON SHAFT**

FRAME	PUMP	SHAFT COMPONENTS
D	6X4D-G	109 Shaft O-Ring 075 Shaft Sleeve 109 Shaft O-Ring 028 Expeller 064 Impeller O-Ring

- (v) Assemble GLAND (044) halves, fit GLAND CLAMP BOLTS (126), and fully tighten. Place Gland in Expeller Ring, around Shaft Sleeve, and push down to compress Packing Rings. Fit GLAND BOLTS (045) and tighten just sufficiently to hold Shaft Sleeve (final adjustment will be made when test running pump).

- (vi) Determine which components fit between LABYRINTH (062) and SHAFT SLEEVE (075), from the pump Components Diagram, or from Tables 1 and 2 for the particular pump being assembled. Fit these components to the Shaft. Fit the IMPELLER RELEASE COLLAR (239), if required.
- (vii) Apply anti-seize compound to Expeller Ring location recess in Adaptor Plate to assist future removal of Expeller Ring. Fit the assembled Expeller Ring to the Adaptor Plate, and tap into position with a mallet. Locate Expeller Ring with the grease inlet connection at the top. LIFTING PLATE (310) may be used in fitting the assembled Expeller Ring to the Adaptor Plate on the larger pump sizes, as shown in Fig 6. If the Shaft Sleeve remains forward of its correct position, it should be pushed back until it is firmly in contact with other items assembled on the Shaft. Ensure that any Shaft O-Rings are correctly positioned in grooves.
- (viii) Assemble remaining O-Rings and Shaft Spacers, which fit between SHAFT SLEEVE (075) and EXPELLER (028), as indicated in Tables 1 and 2.
- (ix) Fit EXPELLER (028) to Shaft, and compress assembled parts.
- (x) Fit O-Ring (109 or 064) to groove in Expeller.

**NOTE:**

- ◆ *Apply heavy grease to the O-Ring groove to hold the O-Ring which seals against the back face of the Impeller.*
  - ◆ *All O-Rings will be compressed and fully contained within their grooves when the Impeller is screwed to the Shaft.*
- (xi) Apply anti-seize compound liberally to Shaft thread.
  - (xii) Assemble gland lubricating parts, as follows, only when the pump assembly is otherwise complete:

Fit GREASE NIPPLE to Expeller Ring. Apply grease to Nipple with grease gun, to charge Lantern Ring cavity.

If requested, an optional GREASE CUP may be fitted in lieu of Grease Nipple, as follows: Fit GREASE CUP ADAPTOR (138) and GREASE CUP to Expeller Ring. Fill Grease Cup with recommended grease, and screw down to charge Lantern Ring cavity. Re-fill Grease Cup with grease.

**(C) Base G**

- (i) Determine which components fit between LABYRINTH (062) and EXPELLER (028), from the pump Components Diagram, or from Table 1, for the particular pump being assembled. Fit these components to the Shaft. Fit the IMPELLER RELEASE COLLAR (239), if required.
- (ii) Assemble LANTERN RING (063) followed by NECK RING (067) on Shaft Sleeve, and move along Sleeve to contact Labyrinth (or Impeller Release Collar, if applicable)
- (iii) Fit EXPELLER RING (029) to LIFTING PLATE (310), using the three jacking screws, as shown in Fig 6. Ensure that grease inlet on Expeller Ring is in line with the Lifting Beam.
- (iv) Apply anti-seize compound to Expeller Ring location recess in Adaptor Plate to assist future removal of Expeller Ring. Lift Expeller Ring, assembled to Lifting Beam, using a hoist, and fit to Adaptor Plate, tapping into position with a mallet.
- (v) Assemble gland parts in Expeller Ring as described below, when all other pump assembly is complete.
  - 1) Slide NECK RING (067) along Shaft Sleeve into Expeller Ring gland recess, to rest on retaining lip.
  - 2) Fit first PACKING RING (111) of required length to fill the packing annulus, and push against Neck Ring.
  - 3) Slide LANTERN RING (063) on Shaft Sleeve, and press down to flatten first packing ring.
  - 4) Fit remaining Packing Rings (stagger joints) to almost completely fill the packing chamber, flattening each ring separately.
  - 5) Assemble GLAND (044) halves over Shaft Sleeve, with gland spigot towards Expeller Ring, fit GLAND CLAMP BOLTS (126), and fully tighten. Engage Gland in Expeller Ring seal annulus, and push down to compress Packing Rings. Fit GLAND BOLTS (045) and tighten just sufficiently to hold Shaft Sleeve (final adjustment will be made when test running pump).
  - 6) Assemble gland lubricating parts, as follows, only when the pump assembly is otherwise complete:

Fit GREASE NIPPLE to Expeller Ring. Apply grease to Nipple with grease gun, to charge Lantern Ring cavity.

If requested, an optional GREASE CUP may be fitted in lieu of Grease Nipple, as follows: Fit GREASE CUP ADAPTOR (138) and GREASE CUP to Expeller Ring. Fill Grease Cup with recommended grease, and screw down to charge Lantern Ring cavity. Re-fill Grease Cup

with grease.

(vi) Assemble SHAFT O-RING (109) between SHAFT SLEEVE (075) and EXPELLER (028), as indicated in Table 1.

(vii) Fit EXPELLER (028) to Shaft, and compress assembled parts.

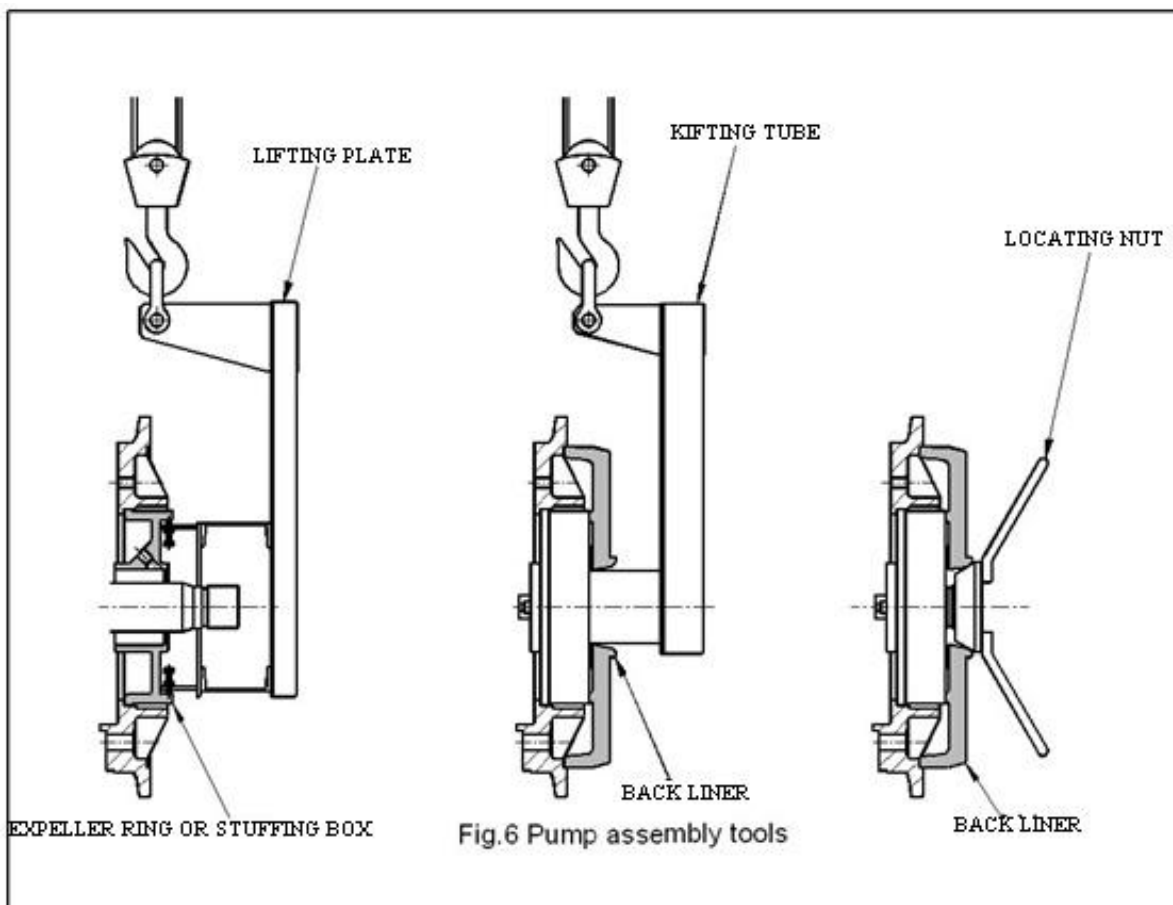
(viii) Fit O-RING (109 or 064) to groove in Expeller.

**NOTE:**

◆ Apply heavy grease to the Expeller O-Ring groove to hold the O-Ring which seals against the back face of the Impeller.

◆ All O-Rings will be compressed and fully contained within their grooves when the Impeller is screwed to the Shaft.

(ix) Apply anti-seize compound liberally to Shaft thread.



**6.2.3 MECHANICAL SEAL ASSEMBLY**

**- Fitting Mechanical Seal, Shaft Sleeve, Shaft Sleeve O-Rings, and Mechanical**

## Seal Box

- Refer Fig Mechanical Seal

### NOTE:

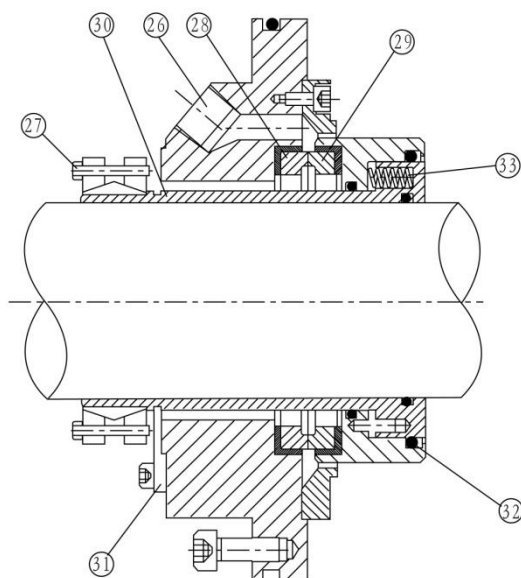
Make sure all outside and inside surfaces of the mechanical seal, shaft sleeve, and mechanical seal box are clean, and without dust, before assemble.

- (i) Fit pump shaft sleeve into mechanical seal shaft sleeve
- (ii) Fit pump shaft sleeve and mechanical seal to the pump shaft, and fit the mechanical seal with the mechanical seal box and tighten by bolts
- (iii) Fit SLEEVE LOCKING BOLTS and tighten just sufficiently to hold Pump Shaft Sleeve (final adjustment will be made when test running pump), after assembling the impeller to the shaft.

### NOTE:

Make sure the limited boards keep in the slots of the mechanical shaft sleeve when installing impeller to the shaft.

- (iv) Move the limited boards from the slots of the mechanical seal and tighten just sufficiently to hold the shaft sleeve



- 26—FLUSH INLET
- 27—SLEEVE LOCKING BOLT
- 28—STATIONARY SAL RING ASSEMBLY
- 29—ROTATING RING ASSEMBLY
- 30—MECHANICAL SEAL SHAFT SLEEVE
- 31—LIMITED BOARD
- 32—O-RING SEAL
- 33—TENSING SPRING

Fig Mechanical Seal

### NOTE:

1. Mechanical Shaft seal must be flushed by clean water, the pressure of the flush water is 0.1-0.2 MPa higher than the slurry pressure inside the pump, the recommended flow-rate is 0.5L/S. The flush clean water will be pumped along

- with the slurry
2. The pump must be operated after the mechanical seal been flushed by clean water for 5 minutes, and must still flush for 5mins after the pump is shut down
  3. No collision or hit when transport the mechanical

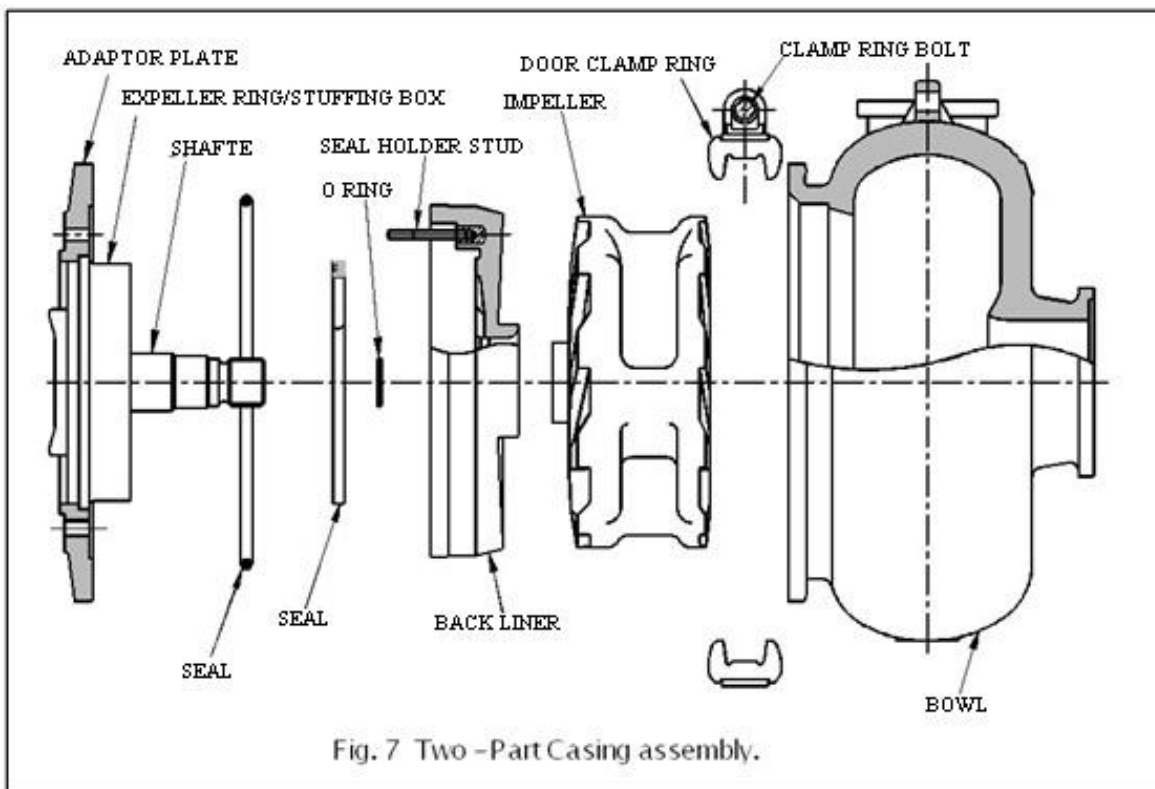
### 6.3 PUMP CASING ASSEMBLY

The pump casing typically comprises a Bowl, and casing end plates, the Door and Back Liner. In the smaller pump sizes the Door is integral with the Bowl, whereas in all other pump sizes these are provided as separate parts.

#### 6.3.1 TWO-PART CASING

- Fitting Seal Rings, Back Liner, Impeller, Bowl, and Clamp Ring
- Refer Figs 6, 7 and 8

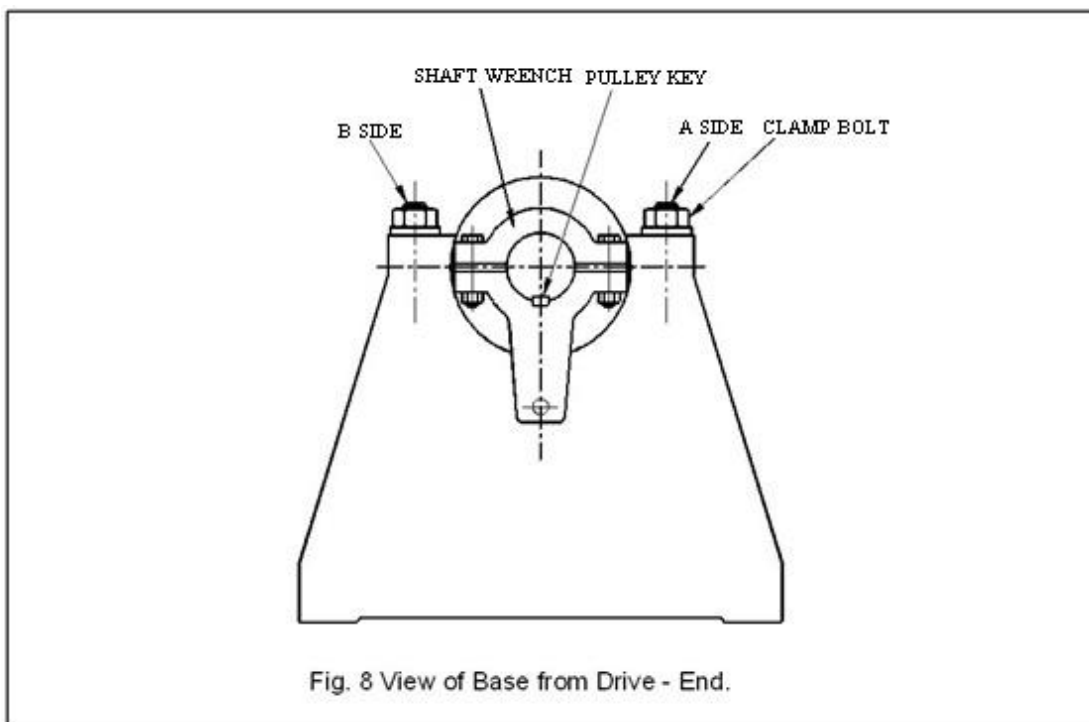
In Two-Part Casings, a separate Door is not provided, as it is integral with the Bowl. This applies to **pump sizes 6X4D-G**. The pump casing assembly, with Two-Part Casings, is described below.



- (i) Fit 'C'-Section SEAL RING (122) to periphery of STUFFING BOX (078) or EXPELLER RING (029), preferably using contact cement adhesive. Apply adhesive to compression face of Seal Ring in about 4 to 6 points only to avoid undue restraint of Seal during compression.

(ii) Fit BACK LINER (041), as follows:

- (a) Screw BACK LINER STUDS (144) to tapped holes in Back Liner and fully tighten.
- (b) Place Back Liner in position, concentric with SHAFT (073). Engage Back Liner Studs with holes in ADAPTOR PLATE (032). Fit washers and nuts to Studs, and leave loose at this stage.
- (c) Fit SHAFT KEY (070) in Shaft keyway, and bolt SHAFT WRENCH (306) to Shaft, over key. Ensure that CLAMP BOLTS (012) on Side 'B' of Base (refer Fig 8) are sufficiently tight to hold Bearing Assembly horizontal, but not lock it. Restrain Shaft with Wrench, and fit LOCATING NUT (303) on Shaft thread, as shown in Fig 6. The conical face will locate the Back Liner in its correct radial position, and engage the peripheral spigot on the Back Liner with the corresponding recess in the Adaptor Plate. Fully tighten all Back Liner Studs, and remove Locating Nut.
- (d) Place BOWL SEAL (124) over periphery of Back Liner, and move backwards until it is in contact with the Adaptor Plate.



(iii) Fit IMPELLER to Shaft thread as follows:

- (a) Ensure that the O-Ring (109) at the end of the Expeller or Shaft Spacer is positioned in its locating groove.
- (b) Select IMPELLER, and apply anti-seize compound to thread. Lift Impeller, and screw to Shaft.

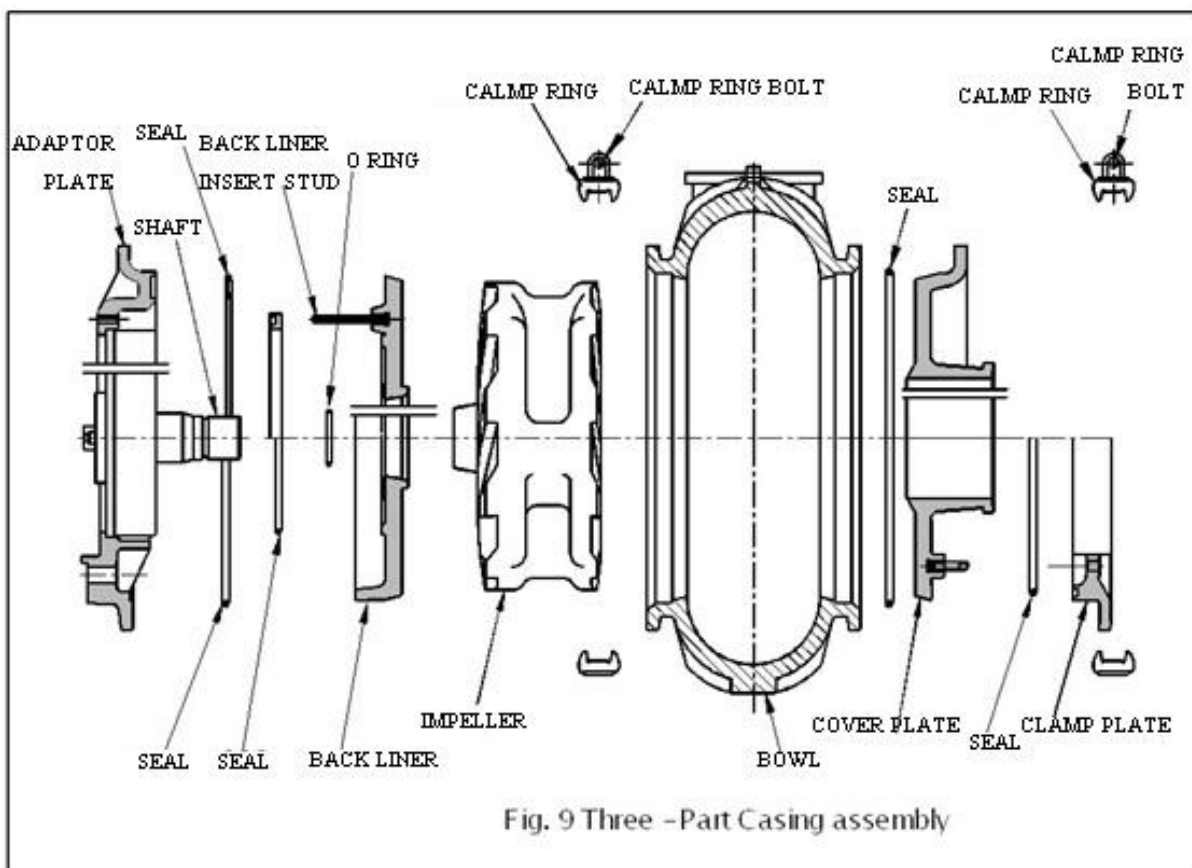
- (c) While restraining Impeller, turn Shaft with Wrench to engage Impeller and Shaft threads. Tighten Impeller on Shaft, with bar between Impeller vanes, and flogging Shaft Wrench.
- (d) Move Bearing Assembly rearwards by adjustment of ADJUSTING SCREW (001) until Impeller contacts Back Liner.
- (e) Ensure that the various O-Rings on the Shaft are not damaged, and are covered by adjacent parts.
- (iv) Fit BOWL (131), as described below. The Bowl is secured to the Adaptor Plate by the Clamp Ring.
  - a) Ensure that the BOWL SEAL (124) is correctly positioned around the Back Liner, and against the Adaptor Plate.
  - b) Lift Bowl, using hoist, and position around Back Liner. Push rearwards until it contacts the Bowl Seal.
  - c) Adjust angular orientation of Bowl discharge to the required position.
- (v) Fit CLAMP RING (135), as described below. These rings are made up of four segments, joined together by four CLAMP RING BOLTS (129).
  - a) With the Bowl supported in place around the Back Liner, and fully rearwards against the Adaptor Plate clamp flange, fit one Clamp Ring segment on the upper vertical centre-line to clamp the Adaptor Plate and Bowl clamping flanges.
  - b) Fit two Clamp Ring segments on the horizontal center-line, adjacent upper segment, and attach to upper segment with Clamp Ring Bolts.
  - c) Fit remaining Clamp Ring segment on lower vertical center-line, and attach Clamp Ring Bolts.
  - d) Tighten each Clamp Ring Bolt in turn to lock Bowl in position.

### **6.3.2 THREE-PART CASING**

- **Fitting Seal Rings, Back Liner, Impeller, Bowl, Clamp Rings, Door, and Door Clamp Plate**
- **Refer Figs 6, 8 and 9**

In Three Part-Casings, a separate Door is provided, independent of the Bowl. This applies to **pump sizes larger than 6X4D-G**. The pump casing assembly, with Three-Part Casings, is described below.

- (i) Fit 'C'-Section, or O-Ring type, SEAL RING (122) to periphery of STUFFING BOX (078) or EXPELLER RING (029), preferably using contact cement adhesive. Apply adhesive to compression face of Seal Ring in about 4 to 6 points only to avoid undue restraint of Seal during compression.
- (ii) **Where applicable**, fit 'C'-Section, pressure activated, BOWL SEAL (124 or 125). Fit to groove in the Adaptor Plate, mounted flat face in, using contact cement adhesive if required. This seal configuration is shown above the centerline in Fig 9.



**NOTE:** This instruction applies only to pump sizes in which the Bowl Seal (124, 125) between the Back Liner and Adaptor Plate is a 'C'-Section pressure seal. Where this Seal is an O-Ring, e.g. in the 6X4D-G Pump, ignore this instruction.

- (iii) Fit BACK LINER (041), as follows:
  - (a) Screw BACK LINER STUDS (026) to tapped holes in Back Liner and fully tighten.
  - (b) Suspend LIFTING TUBE (302) from hoist (refer Fig 6). Stand Back Liner on edge, and engage Lifting Tube in bore of Liner. Lift Tube, with Liner attached, and slide Tube over Shaft thread. Align Studs with holes in Adaptor Plate, and move Back Liner fully

rearwards. Ensure that the Seal Rings have not been displaced. Fit washers and nuts to Back Liner Studs, and leave loose at this stage. Remove Lifting Tube.

- (c) Fit SHAFT KEY (070) in Shaft keyway, and bolt SHAFT WRENCH (306) to Shaft, over key. Ensure that CLAMP BOLTS (012) on Side 'B' of Base (refer Fig 8) are sufficiently tight to hold Bearing Assembly horizontal, but not lock it. Restrain Shaft with Wrench, and fit LOCATING NUT (303) on Shaft thread, as shown in Fig 6. The conical face will locate the Back Liner in its correct radial position, and engage the peripheral spigot on the Back Liner in the corresponding recess in the Adaptor Plate on some pump sizes (refer note below). Fully tighten all Back Liner Studs, and remove Locating Nut.

**NOTE:** *The spigot engagement applies only to pump sizes in which the Bowl Seal (124, 125) between the Back Liner and Adaptor Plate is an O-Ring, e.g. the 6X4D-G Pump.*

- (d) **Where applicable**, place O-Ring type BOWL SEAL (124 or 125) over periphery of Back Liner, and move rearwards until it is in contact with Adaptor Plate. This seal configuration is shown below the centre-line in Fig 9.

**NOTE:** *This instruction applies only to pump sizes in which the Bowl Seal (124, 125) between the Back Liner and Adaptor Plate is an O-Ring, e.g. in the 10X8FG. Pump. Where this Seal is a 'C'-Section pressure seal, ignore this instruction.*

- (iv) Fit IMPELLER to Shaft thread as follows:

- a) Ensure that the O-RING (064 or 109) at the end of the Expeller or Shaft Spacer is positioned in its locating groove.
- b) Select IMPELLER, and apply anti-seize compound to thread. Lift Impeller, using a hoist, and screw to Shaft. While restraining Impeller, turn Shaft with Wrench to engage Impeller and Shaft threads. Tighten Impeller on Shaft with bar between Impeller vanes, and flogging Shaft Wrench.
- c) Move Bearing Assembly rearwards by adjustment of ADJUSTING SCREW (001) until Impeller contacts Back Liner.
- d) Ensure that the various O-Rings on the Shaft are not damaged, and are covered by adjacent parts.

- (v) Fit BOWL (131), as described below. The Bowl is secured to the Adaptor Plate by means of the Clamp Ring.

- a) Ensure that the O-Ring type BOWL SEAL (124 or 125) (where applicable) is correctly positioned around the Back Liner, and against the Adaptor Plate.

- b) Lift Bowl from the lifting lug provided, using a hoist, and position around Back Liner. Push rearwards until it contacts the Bowl Seal.
  - c) Adjust angular orientation of Bowl discharge to the required position.
- (vi) Fit first CLAMP RING (134), as described below. These rings are made up of four segments, joined together by four CLAMP RING BOLTS (129).
- a) With the Bowl supported in place around the Back Liner, and fully rearwards against the Adaptor Plate clamp flange, fit one Clamp Ring segment on the upper vertical centre-line to clamp the Adaptor Plate and Bowl clamping flanges.
  - b) Fit two Clamp Ring segments on the horizontal centerline, adjacent upper segment, and attach to upper segment with Clamp Ring Bolts.
  - c) Fit remaining Clamp Ring segment on lower vertical centerline, and attach Clamp Ring Bolts.
  - d) Tighten each Clamp Ring Bolt in turn to lock Bowl in position.
- (vii) Fit DOOR (013) as described below. Depending on pump size, they may be fitted with one of two Door design configurations. In one Door design, provided on some pump sizes, the peripheral clamp flange is integral with the Door, and its assembly is described in 'Procedure A'. In an alternative design configuration, the peripheral clamp flange is provided on a separate part, the DOOR CLAMP PLATE (292), which is fastened to the Door by multiple DOOR STUDS. This type of Door design is assembled as described in 'Procedure B'.

**(A) Procedure A – Applicable only to Door with integral peripheral clamp flange.**

This Door configuration is shown above the centre-line in Fig 9.

- (a) Place BOWL SEAL (124 or 125) over outer cylindrical surface of Door, and move forwards until it is in contact with the peripheral clamp flange.
- (b) Lift Door, using a hoist, and fit inside Bowl. Ensure that Bowl Seal has not been displaced. Push Door rearwards until it contacts the Bowl clamp flange.
- (c) Tighten each Clamp Ring Bolt in turn to lock Bowl in position.

**(B) Procedure B – Applicable only to Door with peripheral clamp flange on separate Door Clamp Plate, which is bolted to Door.**

This Door and seal configuration is shown below the centre-line in Fig 9.

- (a) Fit DOOR SEAL (124 or 125) to groove in end face of DOOR CLAMP PLATE (292), using contact cement adhesive if required. This Seal may be alternatively a 'C'-Section pressure seal, or an O-Ring seal (as shown in Fig 9 below centre-line), depending on the particular pump size. If of the 'C'-Section pressure seal type, mount flat face in, against Door Clamp Plate.
- (b) Firmly fasten STUDS to tapped holes in Door.
- (c) Place Door on a bench top, or floor, with Studs upwards. Lift Door Clamp Plate and position over Door, with Door Seal downwards. Ensure that Seal is not displaced. Engage Studs with corresponding holes, and lower Door Clamp Plate until it rests on Door, with Door Seal in contact.
- (d) Fit Nuts to Studs, and tighten uniformly.
- (e) **Where applicable**, place O-Ring type BOWL SEAL (124 or 125) over periphery of Door, and move rearwards until it is in contact with clamp flange of Door Clamp Plate.

**NOTE:** *This instruction applies only to pump sizes in which the Bowl Seal (124, 125) between the Door and Door Clamp Plate is an O-Ring, e.g. in the 14X12G-G. Pump. **Where this Seal Ring is a 'C'-Section pressure seal, e.g. in the 8/6F-GH Pump, ignore this instruction.***

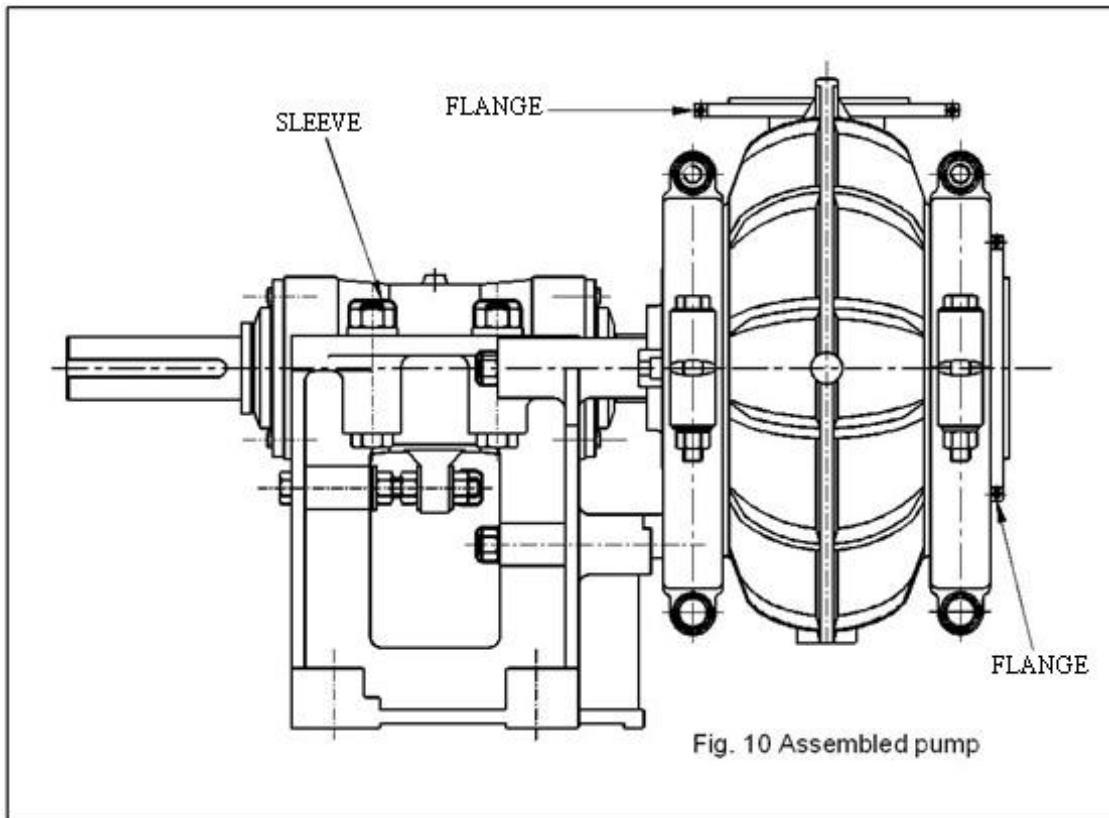
- f) Fit the second Clamp Ring, as described in (vi) above, to fix Door to Bowl.

## 6.4 MISCELLANEOUS FITTINGS

### - Refer Fig 10

The pump assembly is now substantially complete, and requires only fitting of miscellaneous external components.

- (i) Fit rubber NUT COVERS (430) to all external nuts to prevent fouling of threads with slurry.
- (ii) Fit split FLANGES (130, 221) to intake and discharge openings. Screw clamp bolts to taped holes in flange halves, and fully tighten to secure flanges.
- (iii) The INTAKE JOINT RING (060) and DISCHARGE JOINT RING (132) are supplied loose with pumps. Fit Intake Joint Ring and Discharge Joint Ring as shown in Fig 10, using contact cement adhesive to provide support during fitting of intake and discharge pipe-work.



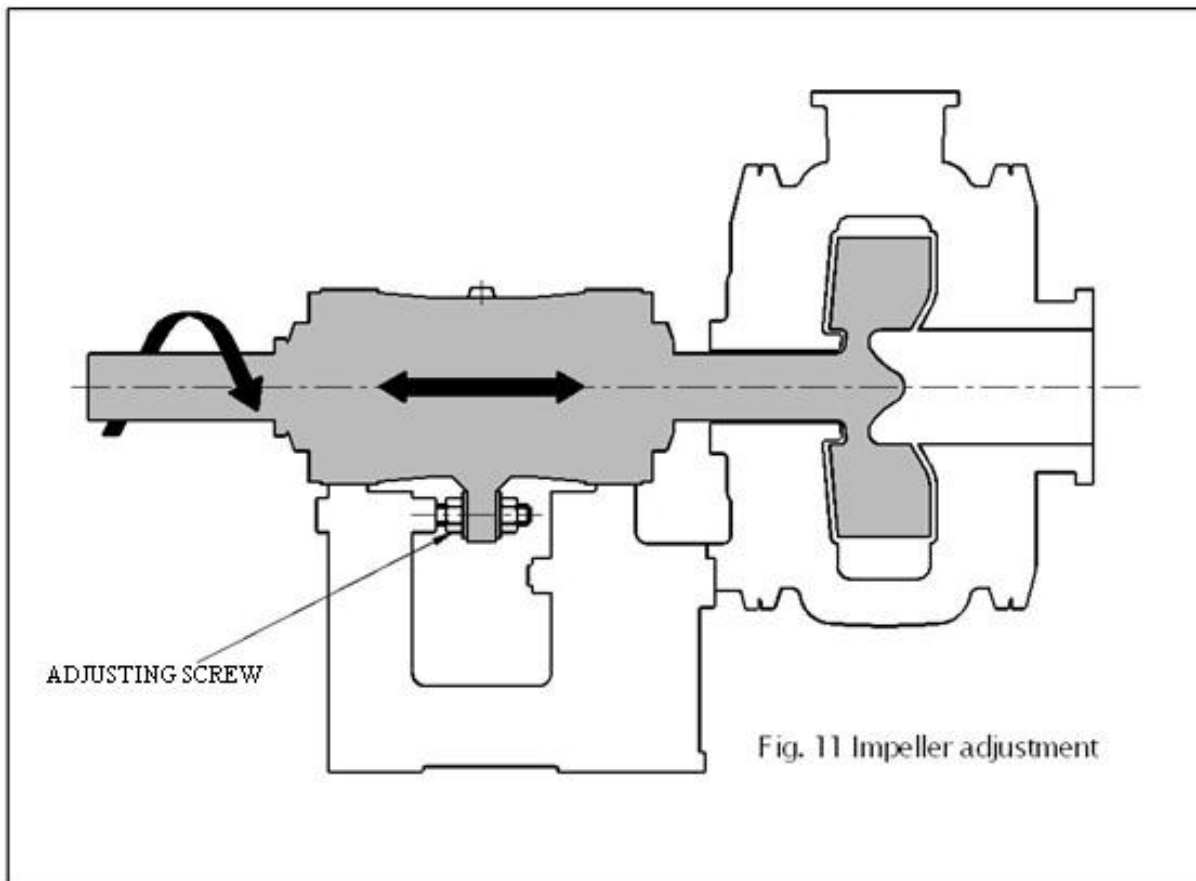
## 6.5 IMPELLER ADJUSTMENT

- Refer Figs 8 and 11.

### (a) Initial Adjustment

With a Gland Seal fitted, the pump should be adjusted to operate with the Impeller having minimum axial clearance with the intake-end casing surface. Adjustment of Impeller front-end clearance is carried out as follows:

- (i) Rotate the Shaft clockwise (as viewed from the drive-end) by hand, and move the Bearing Assembly forward (towards the pump intake) by adjusting the rear nut on the ADJUSTING SCREW (001) until the Impeller contacts the casing surface.
- (ii) Unscrew the rear nut by one sixth of a turn, and move the Bearing Assembly back by adjustment of the front nut on the Adjusting Screw until the lug on the Bearing Assembly contacts the rear nut. Fully tighten the front nut to secure the Bearing Assembly in position.
- (iii) Ensure that the Shaft can now rotate freely without contact of the Impeller with the casing surface. If contact occurs, repeat step (ii).



**NOTE:** After the initial Impeller adjustment is completed, the **BEARING HOUSING CLAMP BOLTS (012)** must be tightened to torque values indicated in Table 3, below. If a torque wrench, or equivalent device is not available, bolts should be tightened in accordance with the procedure as described in Appendix C of Part 1 of the Pump Manual.

With a Centrifugal Seal assembly fitted, the pump should be adjusted to operate with the Impeller having approximately equal axial clearance with the front and rear casing liners. If leakage occurs from the Centrifugal Seal during pump operation, the Impeller should be adjusted rearwards to minimize axial clearance between the Impeller and rear casing liner. If seal leakage persists after Impeller adjustment, this indicates that the intake pressure is excessive for the Impeller fitted. Leakage may be prevented by fitting of an alternative Impeller having improved intake pressure sealing characteristics. This may require fitting of a differential Impeller.

#### **(b) Periodic Adjustment**

Periodic adjustment of Impeller clearance over its operating life is an important factor in maximizing wear life of both Impeller and casing parts. Extensive field experience has shown that an increase in wear life of up to 50 percent can be achieved by regular Impeller

adjustment, compared with pumps not subject to initial or ongoing adjustment. Regular Impeller adjustment has shown an increase in wear life of typically 20 percent compared with pumps subjected only to initial adjustment. The recommended procedure for periodic Impeller adjustment is as follows:

- (i) At initial pump assembly, adjust Impeller to “just clear” the casing intake-end surface, as described in (a).
- (ii) After 50 to 100 hours of pump operation, re-adjust Impeller front-end clearance, as described in (a).
- (iii) Re-adjust Impeller front-end clearance a further two or three times at regular intervals over its wear life. This may coincide with regular pump maintenance intervals, typically 500 hours.

**NOTE: After each Impeller adjustment is completed, the BEARING HOUSING CLAMP BOLTS (012) must be tightened to torque values indicated in Table 3, below. If a torque wrench, or equivalent device is not available, bolts should be tightened in accordance with the procedure as described in Appendix C of Part 1 of the Pump Manual.**

**TABLE 3  
TIGHTENING TORQUE  
FOR BEARING HOUSING CLAMP BOLTS  
Base Size Minimum Torque  
(N m)**

Base Size	Minimum Torque(N m)
D	45
E, F, S	185
G	325

**7. DISMANTLING PUMP AND REMOVAL OF IMPELLER**

The procedure for dismantling the pump is generally the reverse of that described for pump assembly.

Access to the IMPELLER requires removal of the DOOR (013), CLAMP RINGS (134, 135), and BOWL (131). These parts may be withdrawn after removal of the Clamp Rings. Impellers are fitted to Shafts with a right hand screw thread attachment on all pumps. Impeller removal generally involves applying an impulsive torque loading to the Impeller, while separately restraining the Shaft from rotation.

**8. NOTATION WHEN PUMPS ARE USED**

- ◆ When pumps are fixed at the job site, please check the prime mover shaft and pump shaft are on the same axis first, if not, then please make adjustment.

- ◆ Pump water pipeline should carry out support, to avoid the line of gravity applied to the pump, Installation of pipelines extending outward from the pump outlet flanges, and immediately do a good support to it.
- ◆ Pump must be on the high-pressure clear water into the gland packing to protect the seal components when the pumps are working. Water pressure should be greater than the pump working pressure.

## APPENDIX

### BASIC PART NUMBERS

BASIC PART NO.	PART NAME	BASIC PART NO.	PART NAME
001	Adjusting Screw	117	Shaft Spacer
003	Base	118	Lantern Restrictor
005	Bearing Assembly	118-1	Lantern Restrictor (Non-metal)
011	Clamp Washer	122	Expeller Ring/Stuffing Box Seal
012	Clamp Bolt	124	Bowl Seal, Door Seal
013	Door	125	Bowl Seal, Door Seal
026	Frame Plate Liner/Insert Stud	126	Gland Clamp Bolt
028	Expeller	129	Clamp Ring Bolt
029	Expeller Ring	130	Flange
032	Adaptor Plate	131	Bowl
034	Adaptor Plate Bolt	132	Discharge Joint Ring
039	Adaptor Plate Stud	134	Clamp Ring
041	Back Liner	138	Grease Cup Adaptor
044	Gland	144	Back Liner Stud
045	Gland Bolt	179	Shaft Sleeve Spacer
060	Intake Joint	221	Discharge Flange
062	Labyrinth	239	Impeller Release Collar
063	Lantern Ring	292	Door Clamp Plate
064	Impeller O-Ring	302	Lifting Tube
067	Neck Ring	303	Locating Nut
070	Shaft Key	306	Shaft Wrench
073	Shaft	310	Stuffing Box/Expeller Ring
075	Shaft Sleeve		Lifting Beam
076	Shaft Sleeve (Long)	430	Nut Covers
078	Stuffing Box		Grease Cup
109	Shaft O-Ring		Grease Nipple
111	Packing		