

MANUAL: - HYBRID PUMPS

HYBRID PUMPS

INSTALLATION, OPERATION AND MAINTENANCE MANUAL



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1.0 Introduction

The Hybrid pumps are a centrifugal pump and as the name suggests, this does not have any gland and or mechanical seal arrangement.

In all process Industries, the major problems faced are

- **Gland or Seal failure**
- **Maintenance problems**

The hybrid pump is for all practical purpose called the zero leakage pump. Hence all toxic and corrosive liquids can be handled without any leakage.

This has to be installed in the vertical position only. It has a vertical suction and side delivery arrangement. The principle of operation of the hybrid pumps does not differ from any conventional centrifugal pump.

The design of the pump is such that the liquid which ought to have leaked enters the annular gap where the impeller drive shaft enters the upper rotor casing aided by an auxiliary impeller (Expeller) and flows out into the suction tank through the over flow. This path of the liquid becomes a closed loop, thereby eliminates the necessity of any gland or seal.

The operation of the hybrid pumps is elaborated as under:

The liquid entering the suction is accelerated around the impeller casing and leaves through the delivery under pressure. Between the annular gap of upper rotor casing and impeller, some leakage liquid escapes to the overflow chamber. The auxiliary impeller (expeller) prevents the leakage liquid from going further up and canalizes it through the outlet in the overflow chamber.

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The vapor seal is dry running seal, which prevents the acid vapour from reaching the motor.

The main advantage of the pump is the elimination of any form of seal or packing arrangement in the absence of a seal and bearing on the pump side, the pump can run completely dry for an indefinite period and without any ill effect.

This feature enables us to use the pump for intermittent duties for transfer of industrial effluent from a collection vessel to the treatment plant.

Another advantage of the vertical pump is that it saves valuable floor area and to some extent the pump is self-draining one.

The hybrid pumps is simple in design and is manufactured in a wide range of corrosion and erosion resistant materials.

The limitations of the hybrid pumps are as under:

- The pump mounted by the side of a tank from which the liquid is pumped out must be arranged such that the maximum liquid level does not rise above the centerline of the pump.
- The pump should always have a negative suction only.

The hybrid pumps finds its application in a variety of industries. In the product finishing industries they are used in electroplating, electrocuting, pickling, anodizing, etching, galvanizing and in almost any process involving the chemical treatment of the metal. This is ideally suited for continues circulation application.

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In the pickling of steel this is used extensively for circulating the pickling of acid through a heat exchanger to maintain bath temperature. This is also used extensively in scrubber application.

2.0 Unpacking:

Extreme care has to be taken while handling the hybrid pumps. The mounting frame will be bolted to the bottom of the case. After the top and side planks are removed, the bolt from the bottom of the case has to be removed.

- Crowbars should not be used for removing the planks.

After receipt of the material, the pump has to be checked for any damage. If so, our works has to be contacted immediately. The case should not be dropped as this may damage the motor and the pump.

- Storage has to be in a place free from dust, heat, moisture and rain.

For all installation arrangements:

- a) The slope of the overflow piping should be 1 in 20 or more only.
- b) The overflow piping to the tank has to be in a straight line, i.e., No. bends in the piping.
- c) The overflow should not have any restrictions, i.e., valves etc.
- d) The foot valve should be of free flow type.

For all installation it is imperative that the delivery pipe has a 90 bend upward within 500mm from the delivery flange of the pump.

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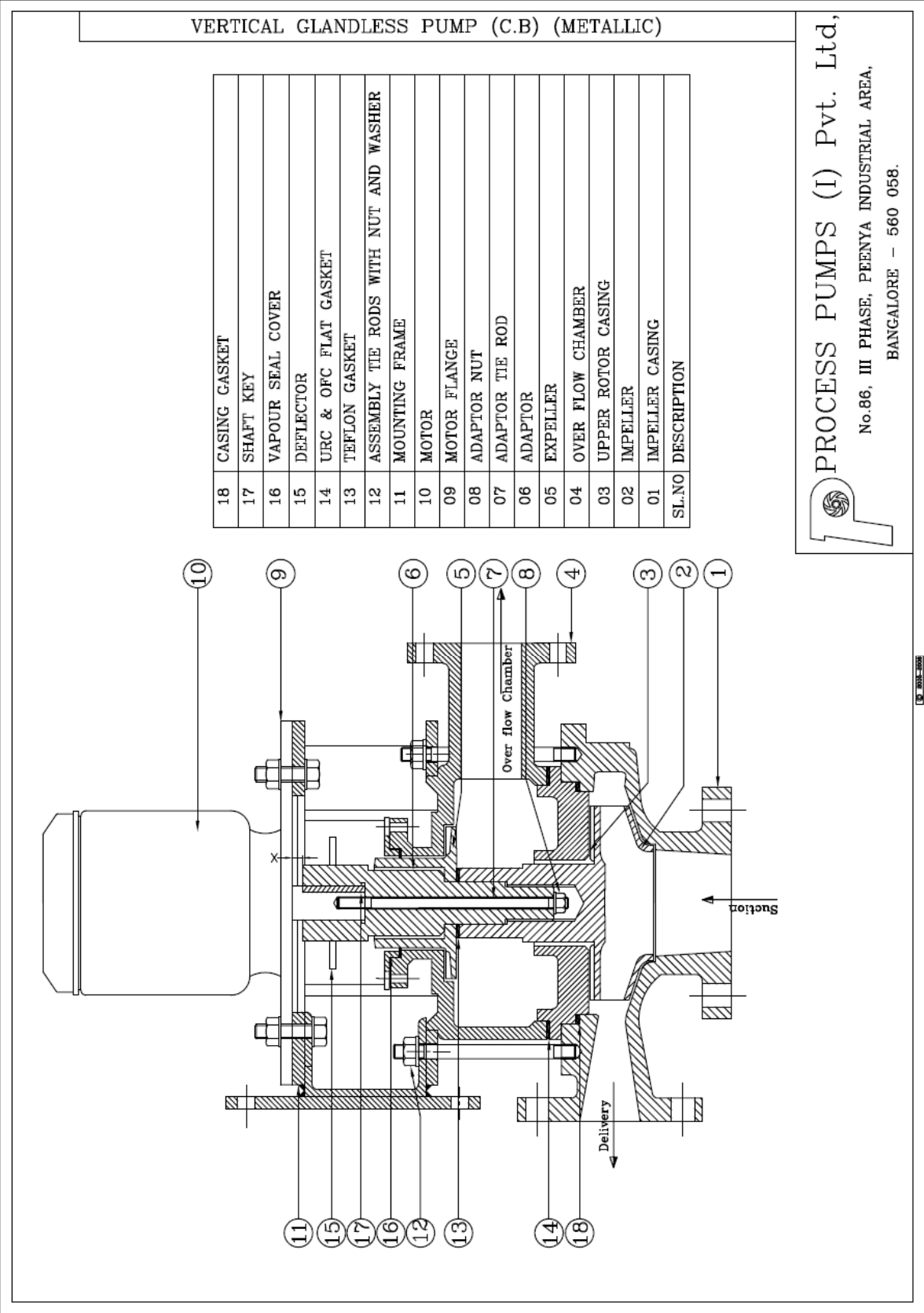


FIGURE: 2.1

3.0 Installation Procedure for HYBRID (Pump Dispatched With Out Motor)

Follow the following step-by-step procedure for installation and commissioning of the pump.

3.1 Dismantling Of Pump:

Step1: Remove the nut provided at place “A” before disassembling the pump.

Note: This nut is provided just to hold the adapter during transit only.

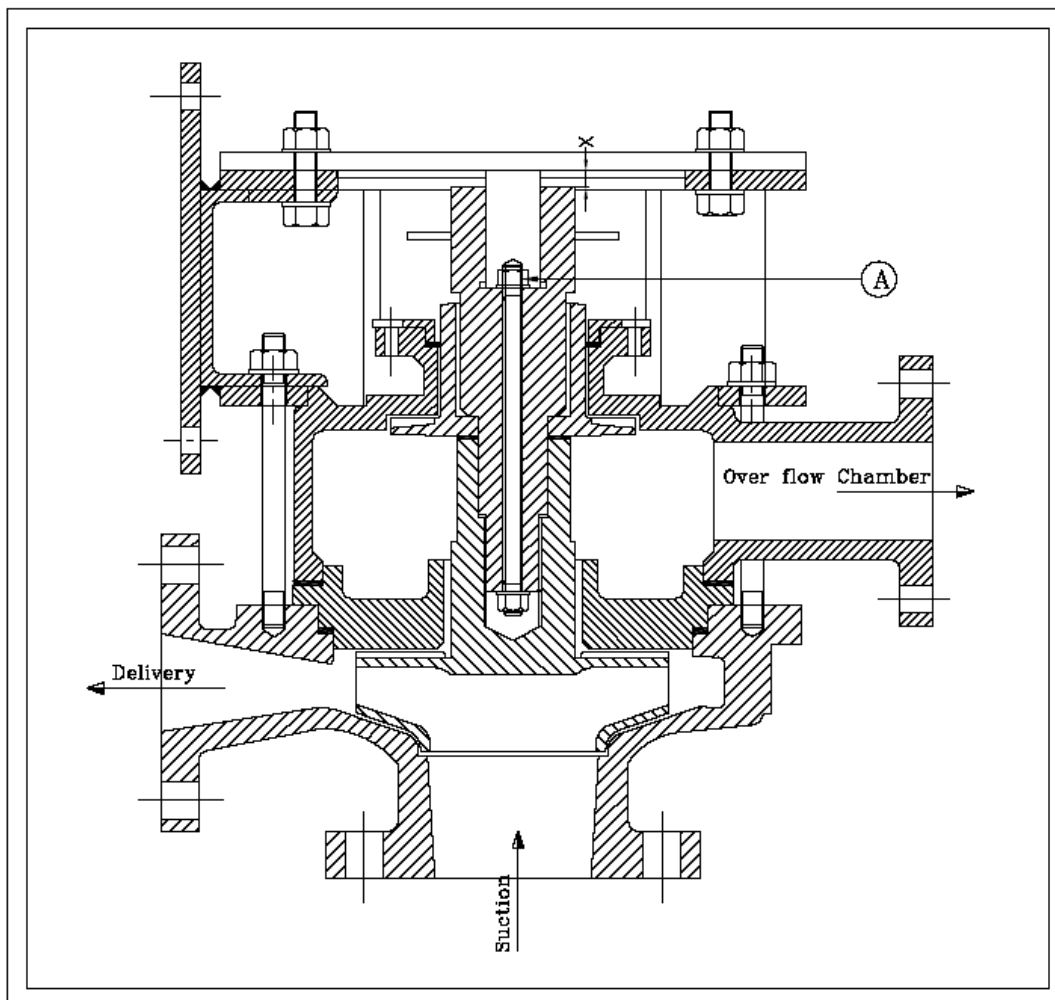


Figure 3.1

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Step2: Remove the Impeller Casing (Part No: 01) by unscrewing the assembly Tie Rods with nuts & washers (Part No: 12).

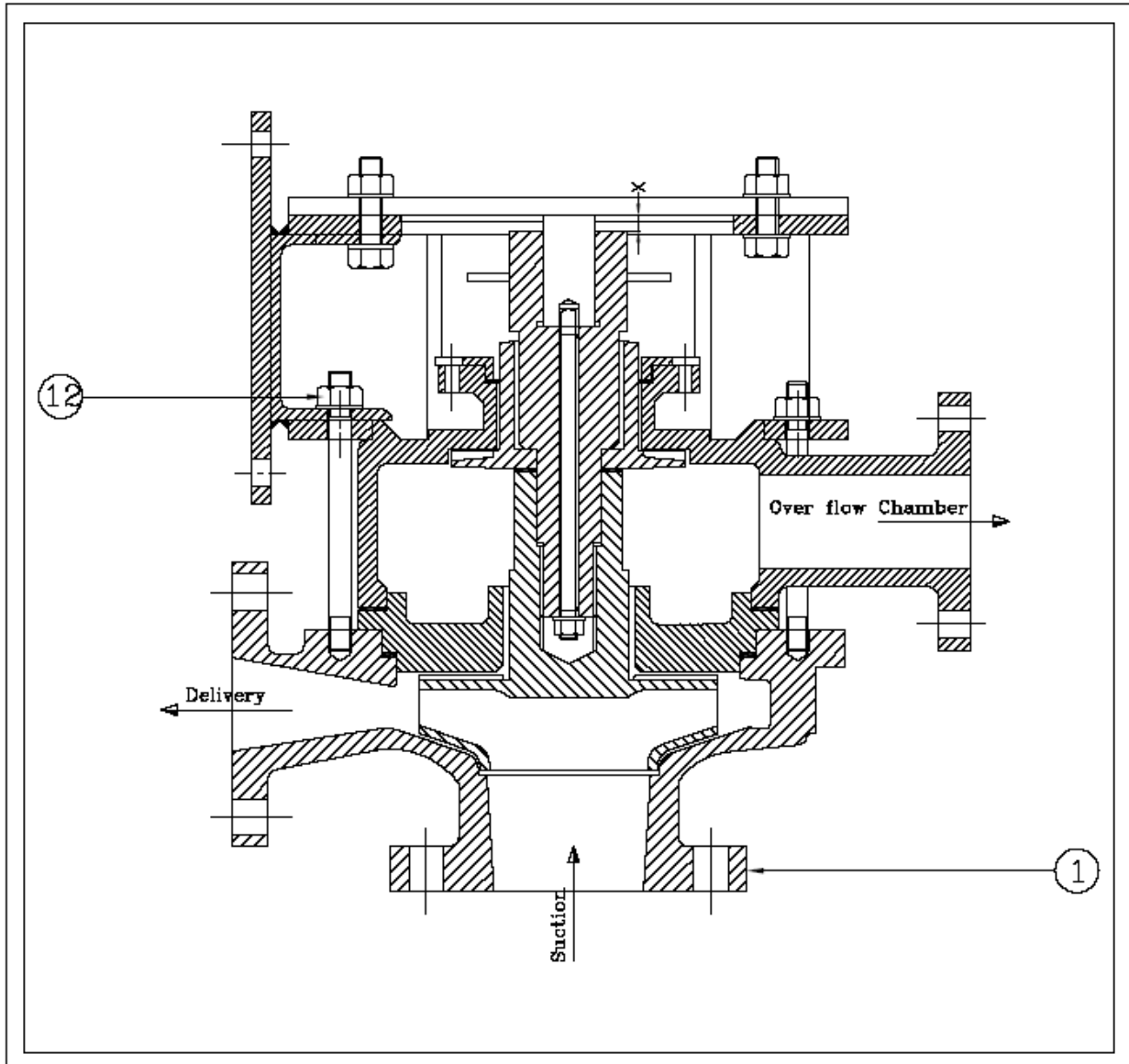


Figure 3.2

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Step3: Unscrew the Impeller (Part No: 2) and dismantle the URC, OFC and Expeller (Part No: 3, 4, 5).

- Ensure the Gaskets (Part No. 14, 18) and Teflon Gasket (Part No. 13) provided between Impeller and Expeller is safely kept.

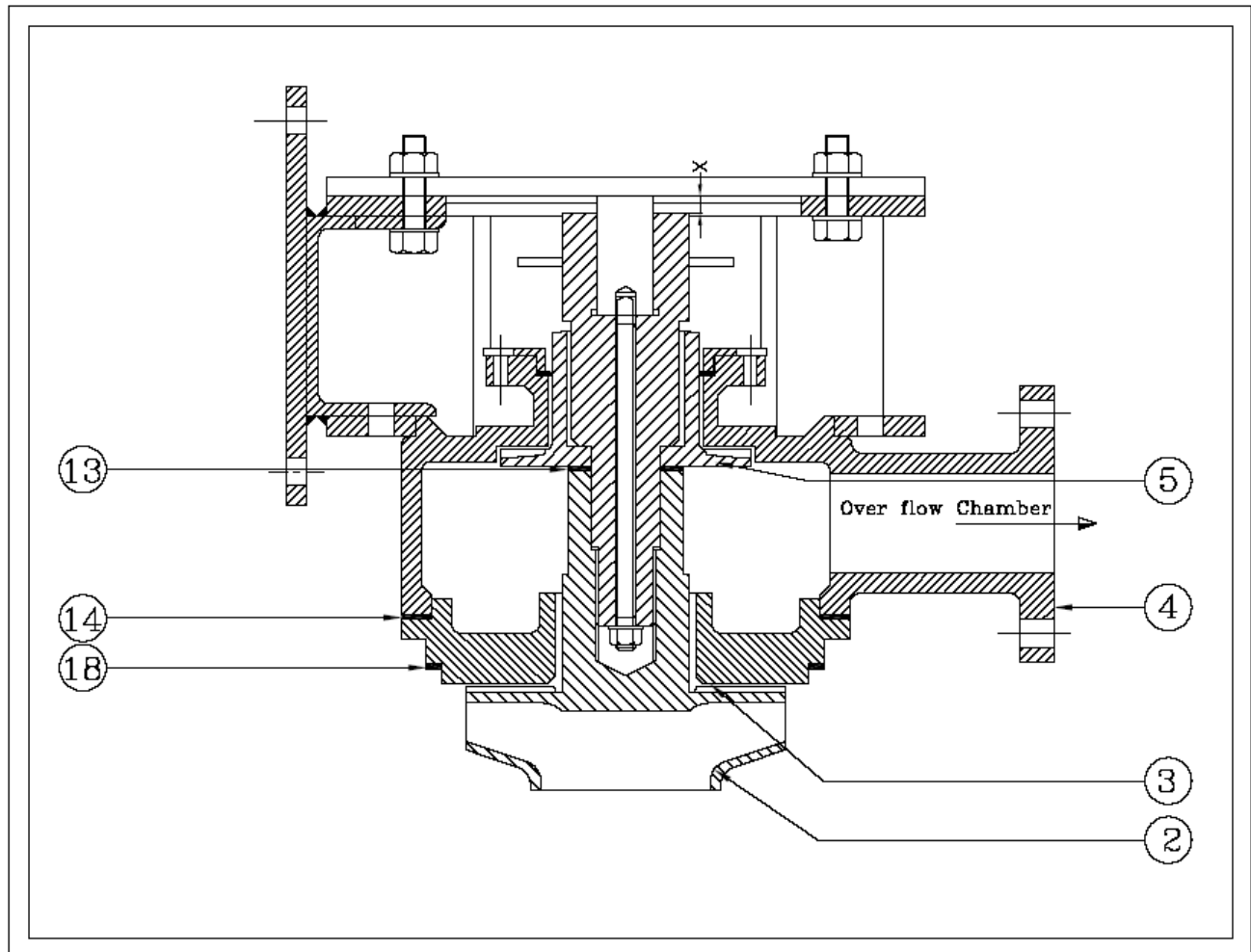


Figure 3.3

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Step4: Remove the Adapter Tie Rod (Part No: 7) along with nuts and washers (Part No. 8)

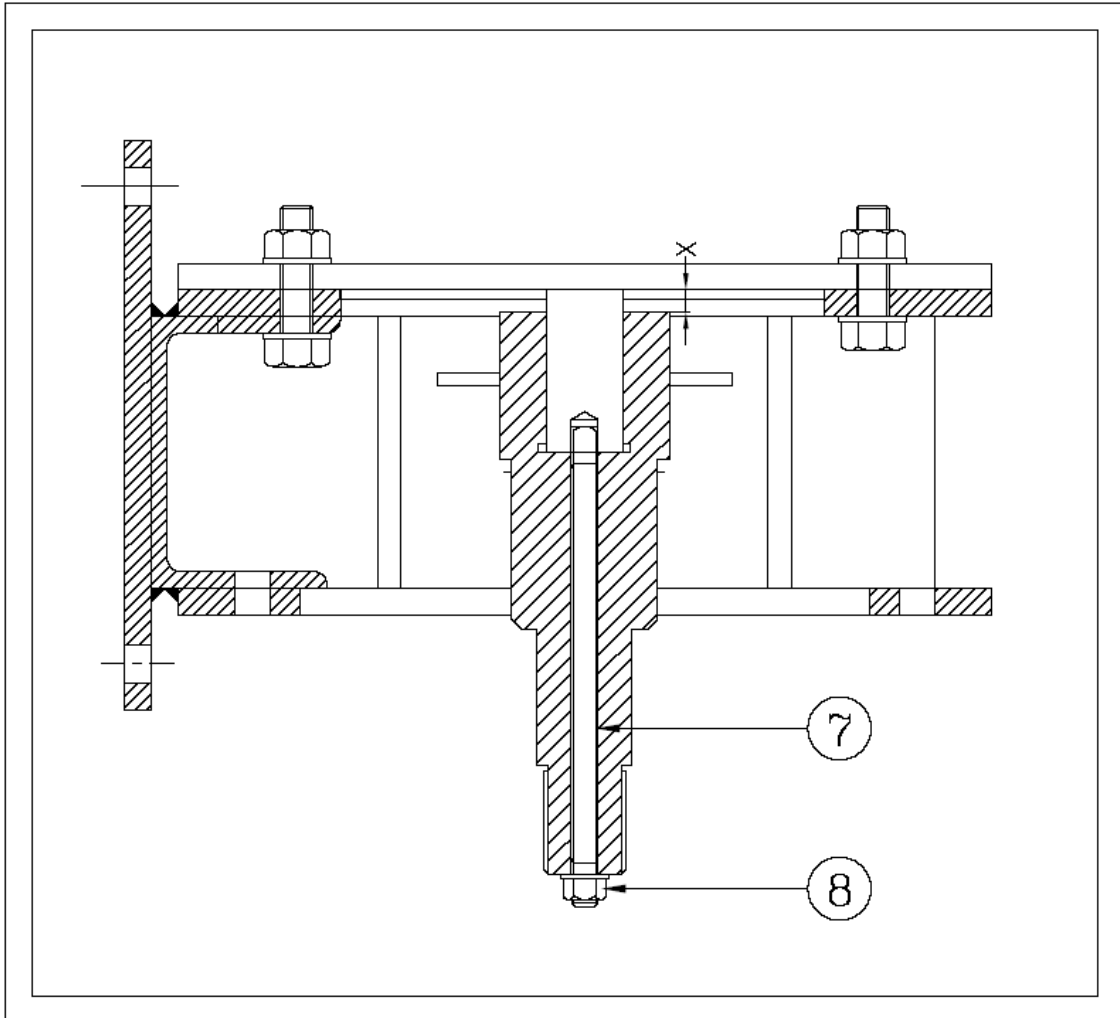


Figure 3.4

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3.2 Assembly of Pump:

Step1: Check the Motor Shaft for a tapped hole other wise drill and tap the Motor shaft as given in Motor Catalogue.

- Place the Motor (Part No: 10) on the Mounting Frame (Part No: 11) and tighten the Motor to the frame.

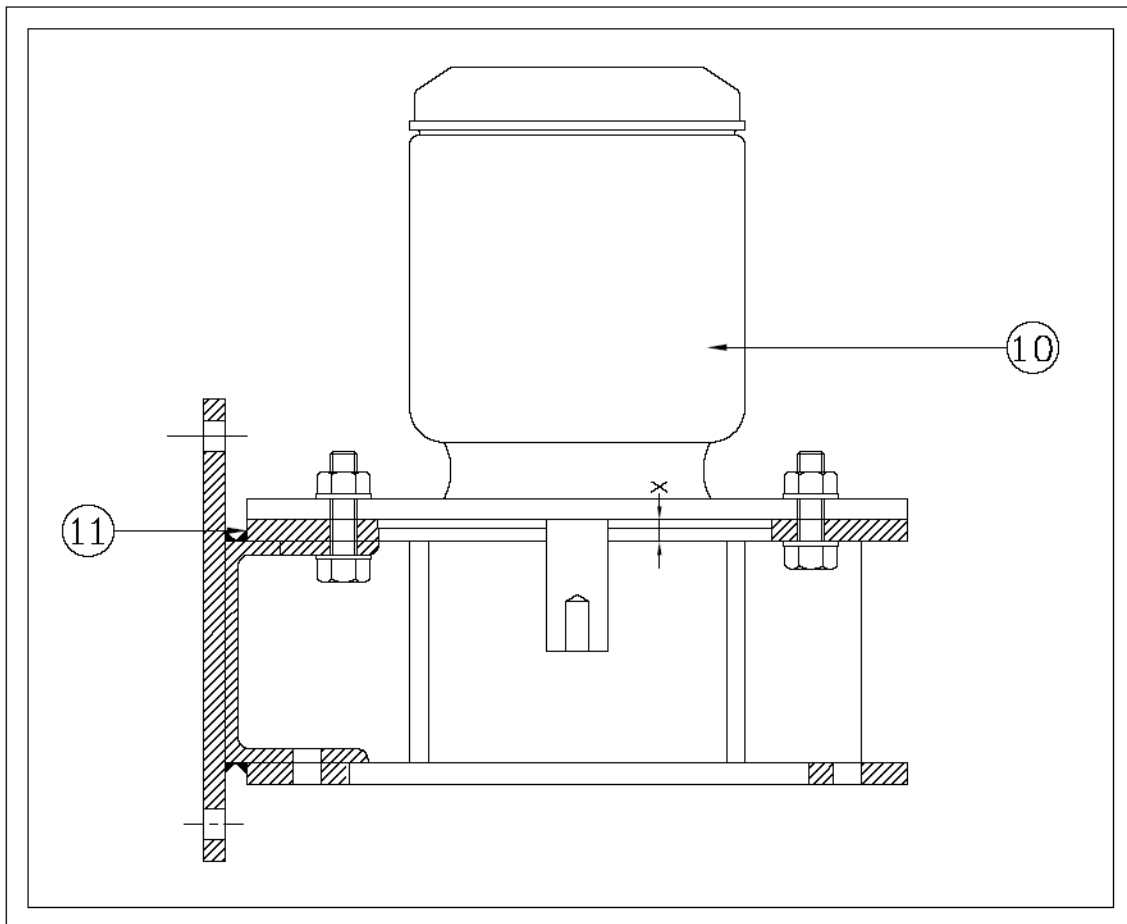


Figure 3.5

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Step2: Screw the Adapter Tie Rod (Part No: 7) to the Motor Shaft and then push the Adapter (Part No: 6) to the Motor shaft.

- Make sure the Motor shaft key is in position (Part No:17)

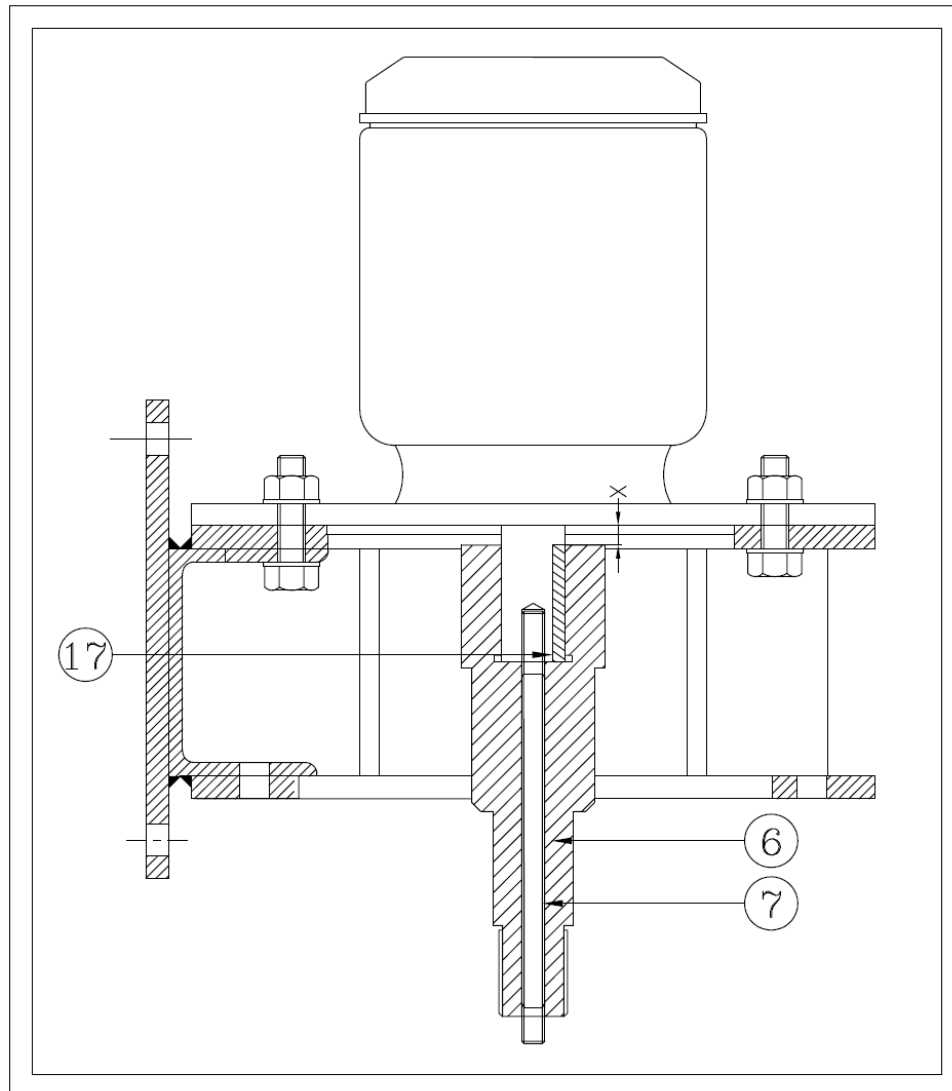


Figure 3.6

Step3: Tighten the Adapter Tie Rod Nut (Part No: 8) fully till the Motor Shaft touches the bottom face “Y” of the Adapter

- This can be ensured by checking the gap at point ‘X’ between motor flange and adapter.

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Sl.No	Pump Model	Frame Size	Dimension "X"
1.0	P -1	90	5.0mm
2.0	P -2	90	3.0mm
3.0	P -3 / P -2M	100	8.5mm
4.0	P -4 / P -3M	112	17.0mm
5.0	P -5	132	9.5mm
6.0	P -6	160	10.5mm
7.0	P -8	160	10.5mm

- Rotate the Adapter to ensure that the adapter rotates true with reference to the bore "Z" of the motor mounting frame.

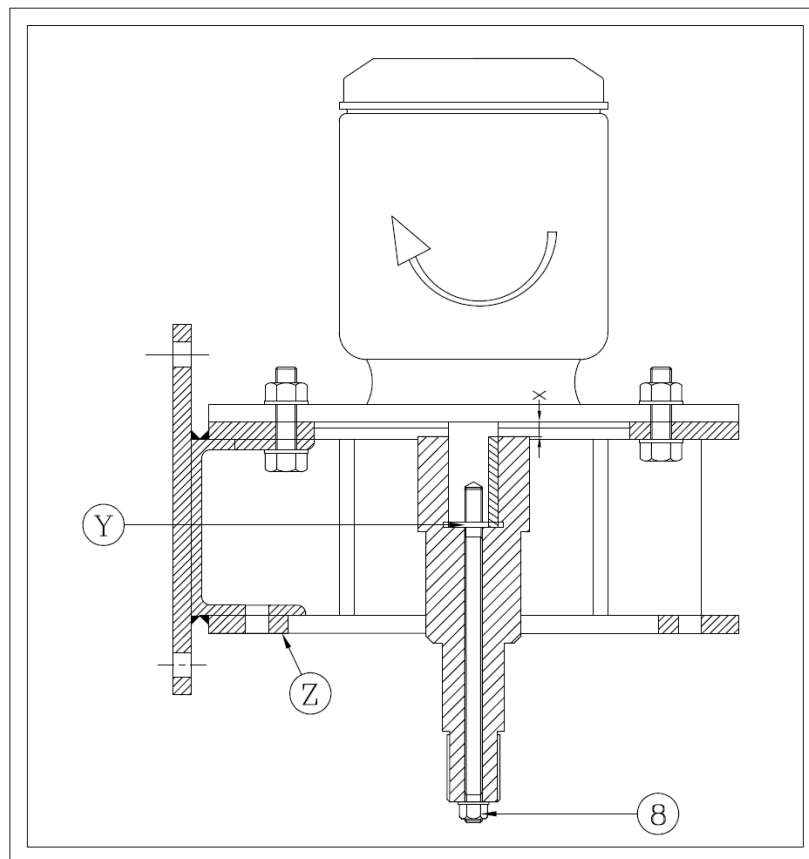


Figure 3.7

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Step4: Run the motor for a second to make sure the direction of rotation is clock wise while viewing from the top of the motor.

- This is very important since reverse rotation of motor will loosen the impeller and damage both impeller and Impeller casing.

Step5: Once the Adapter is fully tightened. Position the Over Flow Chamber (OFC) (Part No: 4) and Vapour seal cover (Part No: 16).

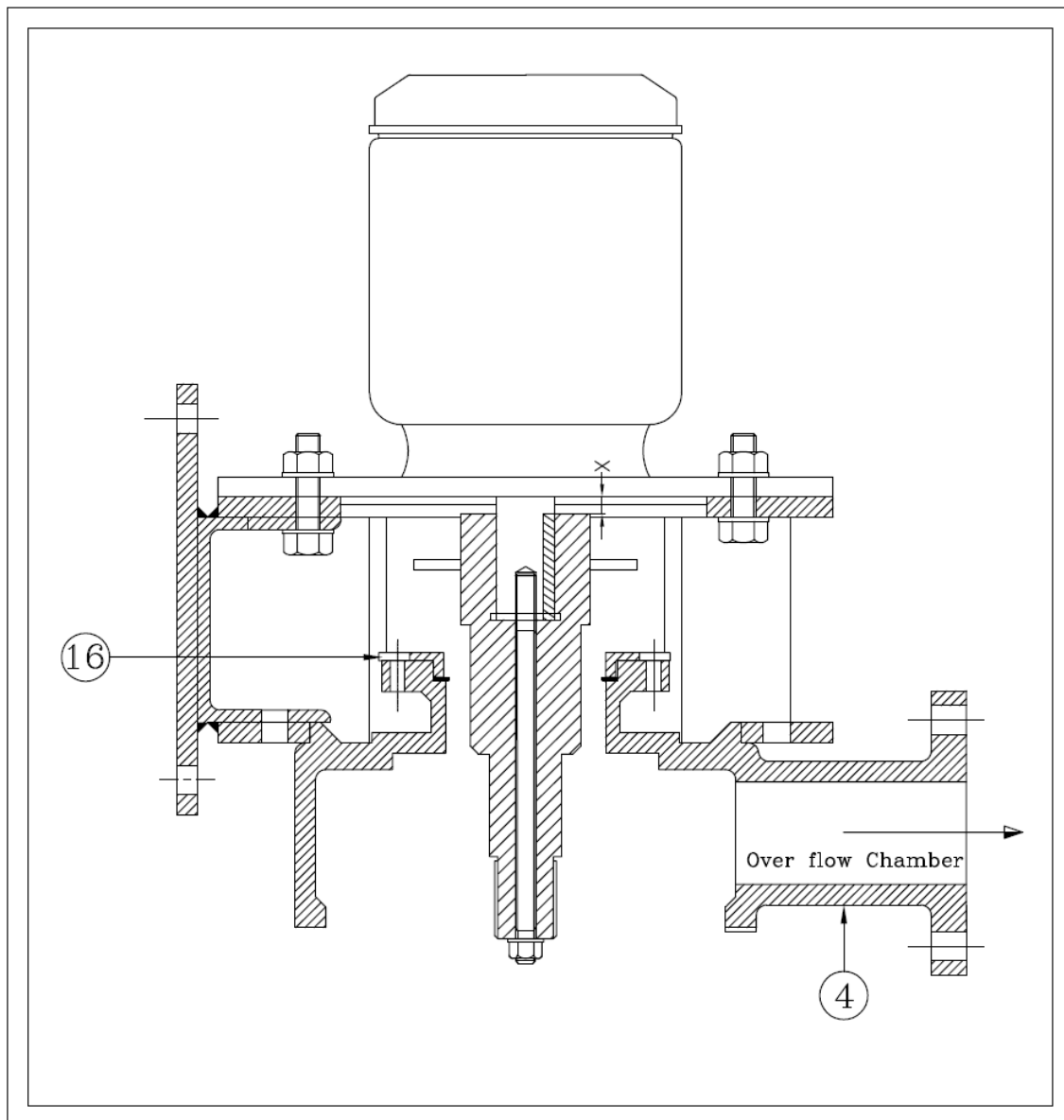


Figure 3.8

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Step6: Push the Expeller (Part No: 5) on the adapter. The gap between expeller and OFC to be between 1 to 2 mm

- Ensure that the Expeller rotates freely.

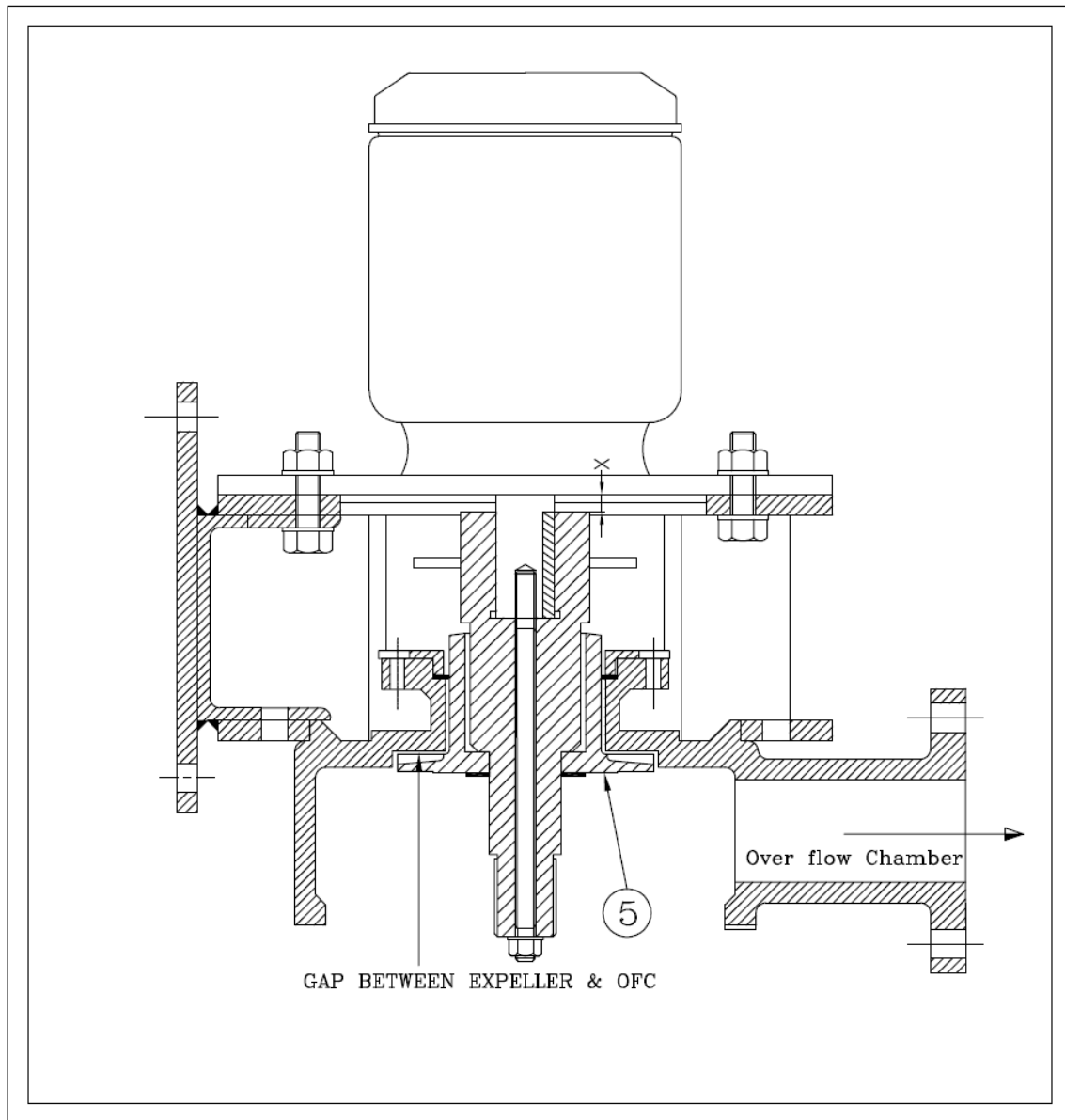


Figure 3.9

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Step7: Place URC & OFC Flat Gasket (Part No: 14) and assemble the Upper Rotor Casing (URC) (Part No: 3).

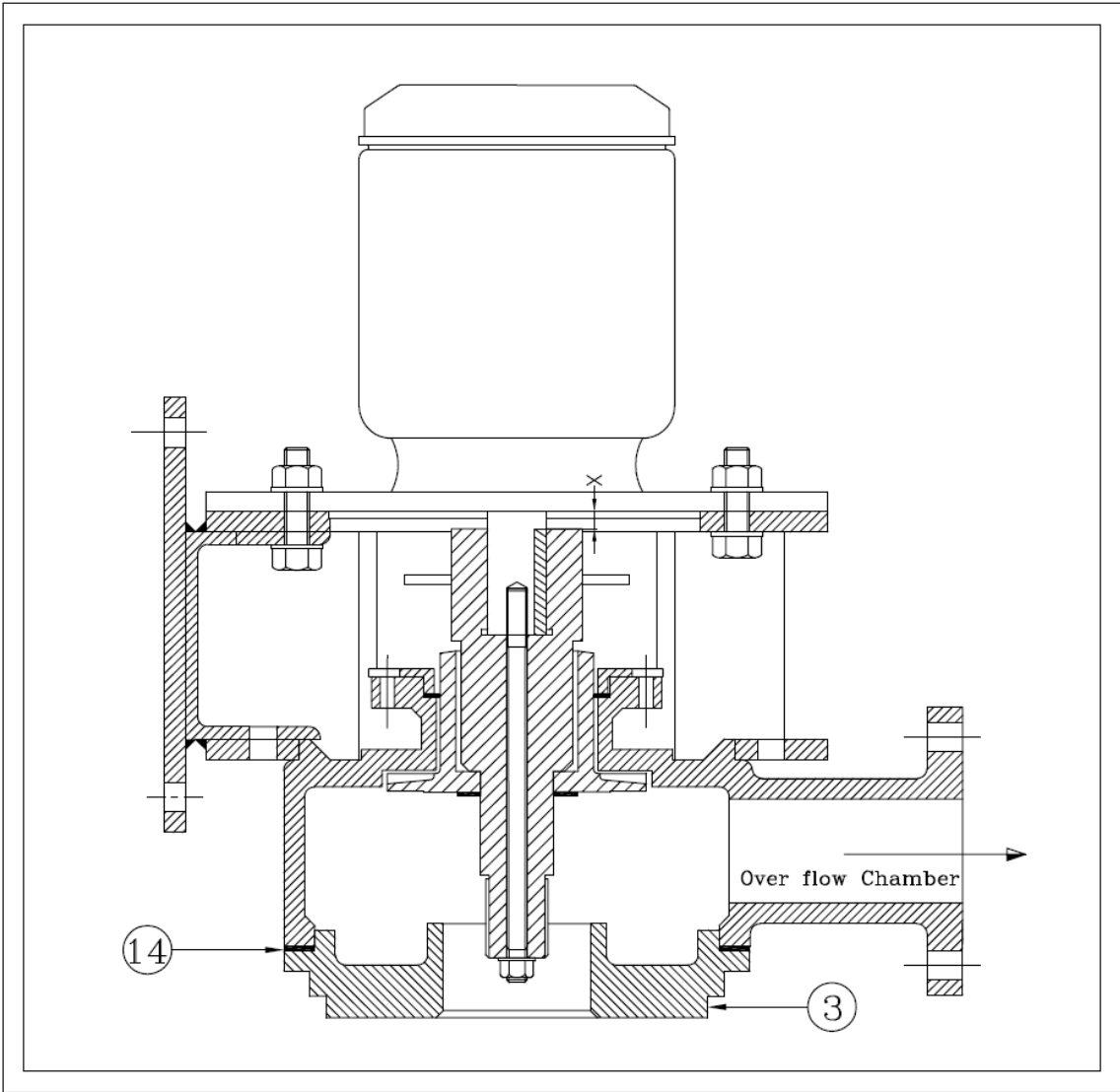


Figure 3.10

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Step8: Screw the Impeller (Part No: 2) to the Adapter sandwiching the Teflon gasket (Part No: 13) between Impeller and Expeller.

- Ensure that the impeller and Expeller rotate freely.

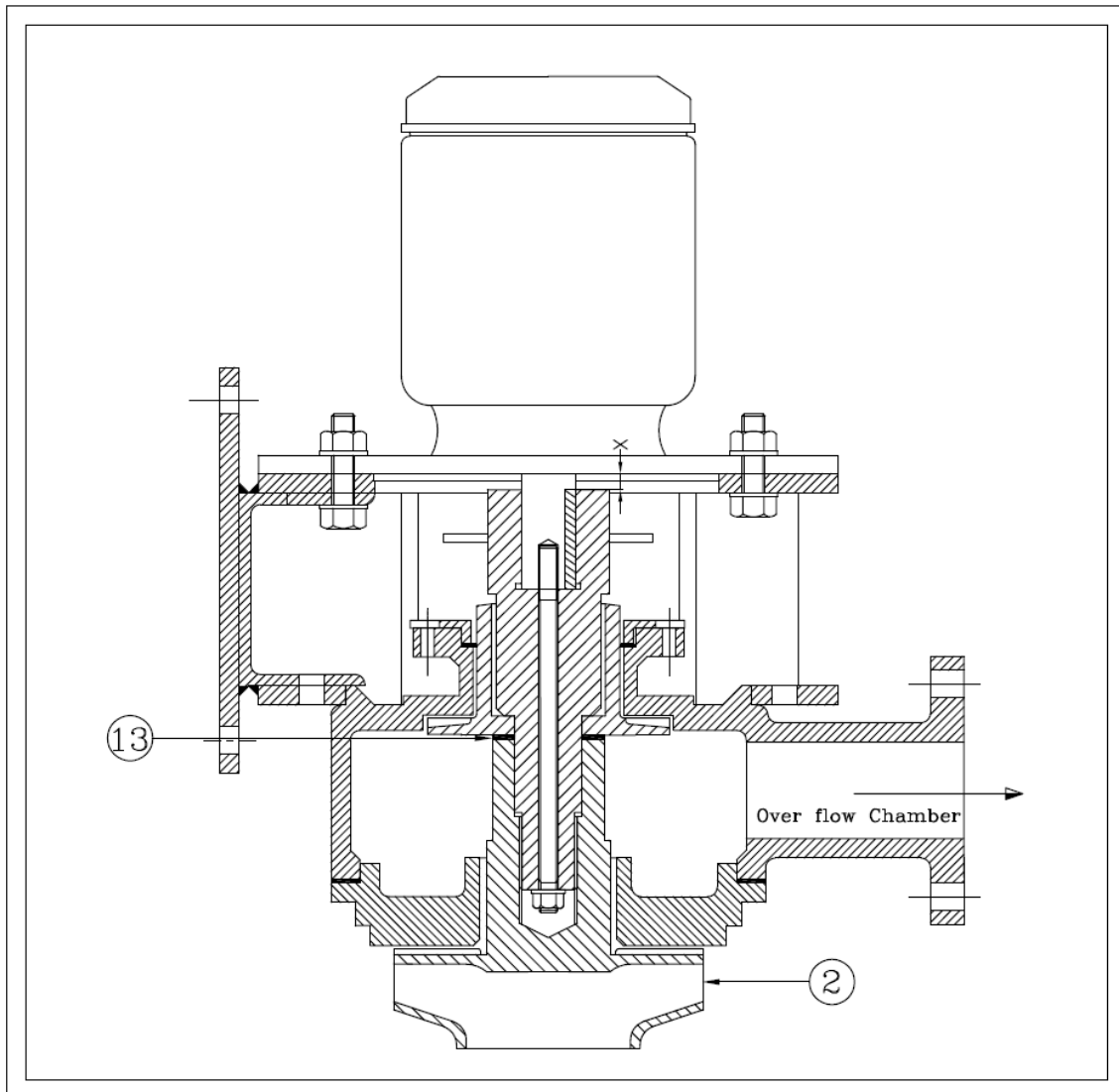


Figure 3.11

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Step9: Assemble the Impeller Casing (Part No: 1) and Casing Gasket (Part No: 18)

- Rotate the Impeller again to make sure that Impeller rotates freely.

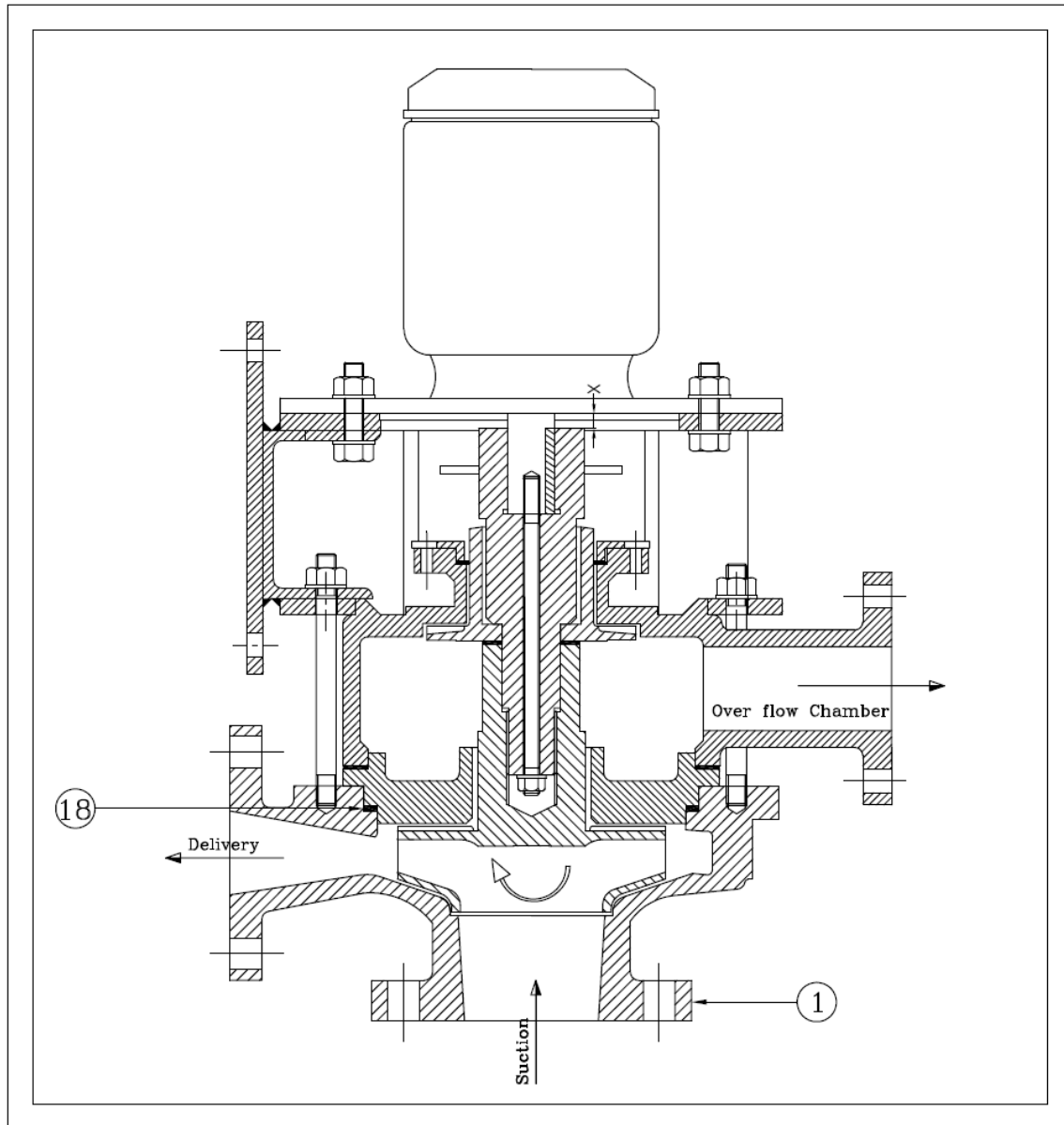


Figure 3.12

4.0 Installation:

The installation procedure for the hybrid pumps varies depending upon the site conditions and applications.

Some of the standard installation arrangements have been described below

4.1 Installation Scheme: I

1. Tank over flow 'D' is to prevent liquid level rising in pump body and damaging the motor. The lower slip of over flow 'D' should not be more than 1/2" above centre of pump over flow.
2. Isolation valve for sealing the tank during pump maintenance not essential for efficient working of the pump.

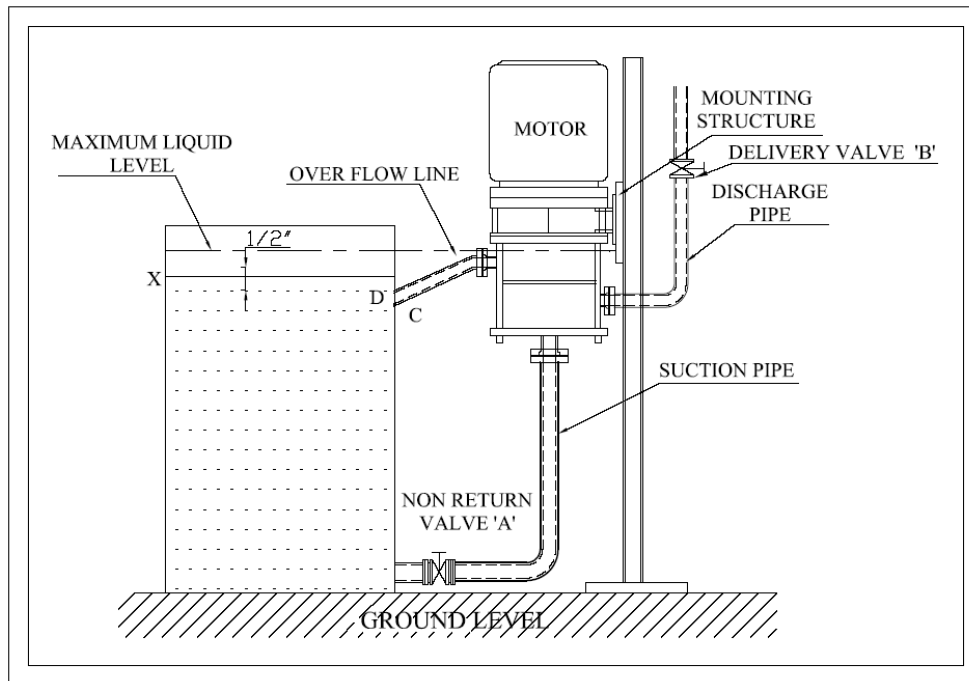


Figure 4.1

Installation: I

- a) Fully open valve 'A'
- b) Allow liquid level to rise in supply tank up to over flow 'D' level.
- c) Close valve 'B'
- d) Start pump

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- e) Open valve 'B' gradually for required flow

4.2 Installation Scheme: II

1. A vertical suction pipe with non return valve entering bottom of tank may be used when liquid is free from suspended solids.

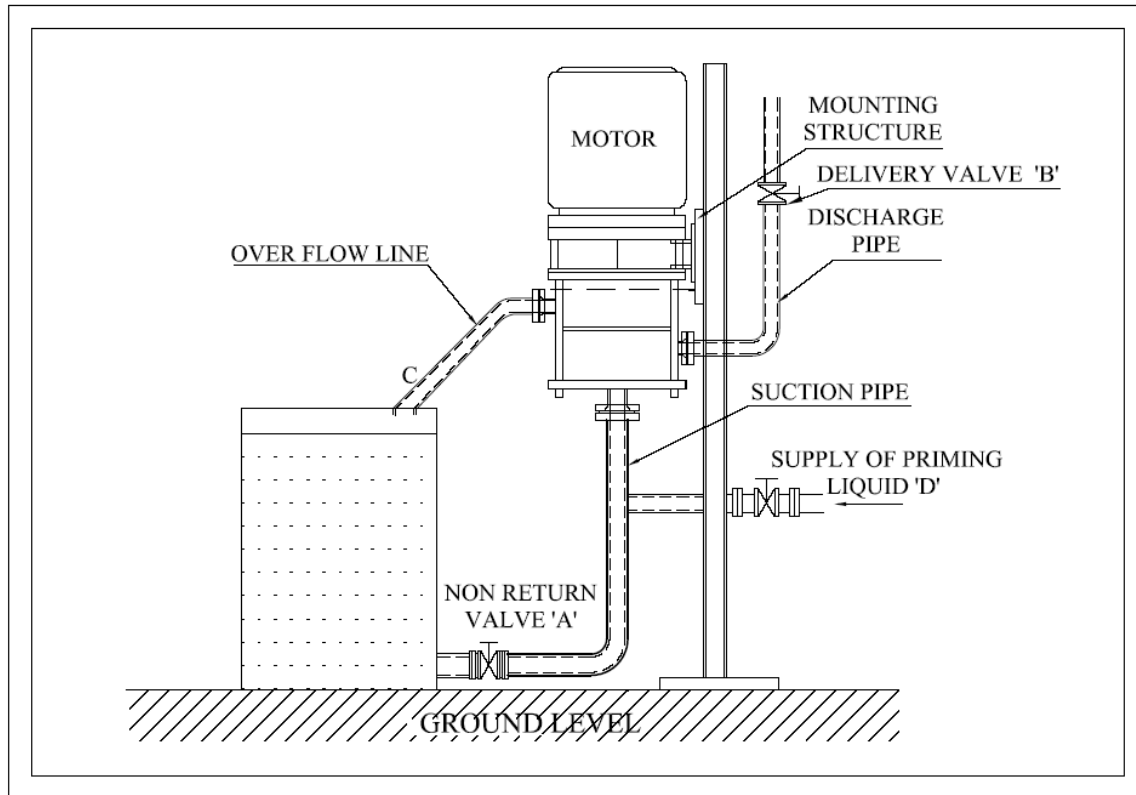


Figure 4.2

Installation: II

- a) Close valve 'A' and 'B'
- b) Open valve 'd' and prime the pump till the liquid over flows through 'C'
- c) Start pump and immediately open valve 'A'
- d) Close valve 'D'
- e) Open valve 'B' gradually for required flow

4.3 Installation Scheme: III

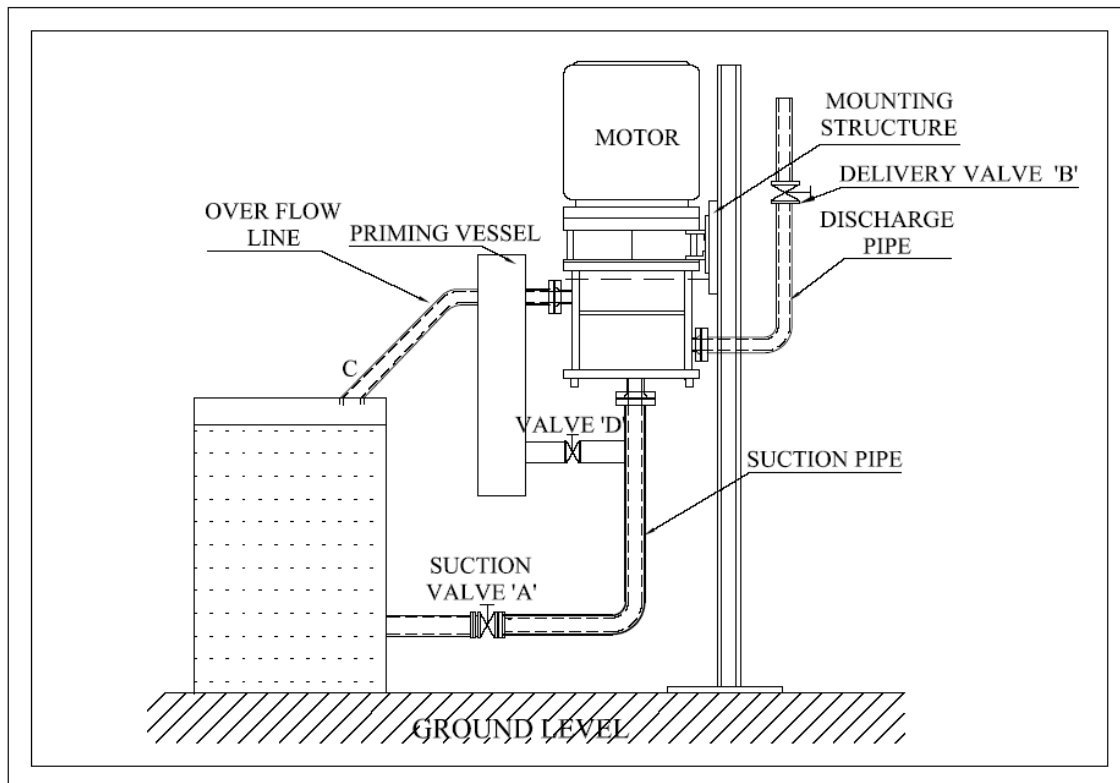


Figure 4.3

Installation: III

- a) Close valve 'A' and 'B' open valve 'D'
- b) Fill priming vessel to over flow through 'C'
- c) Start pump
- d) Open valve 'A'
- e) Close valve 'D' and open valve 'B' gradually for required flow

4.4 Installation Scheme: IV

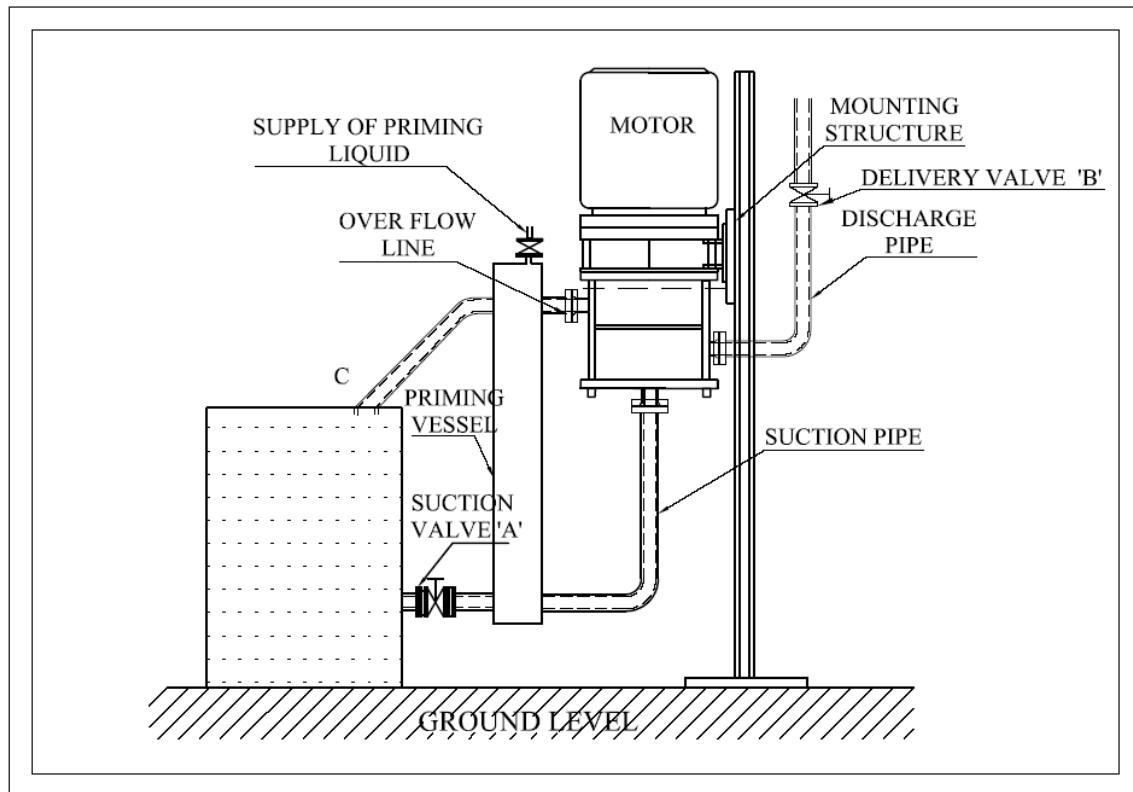


Figure 4.4

Installation: IV

- a) Close valve 'A' and 'B'
- b) Fill priming vessel
- c) Start pump
- d) Open valve 'A' gradually until fully open

4.5 Installation Scheme: V

1. This installation is basically *installation –I* but level in supply tank is regulated by a mechanical or electrical flow control valve.

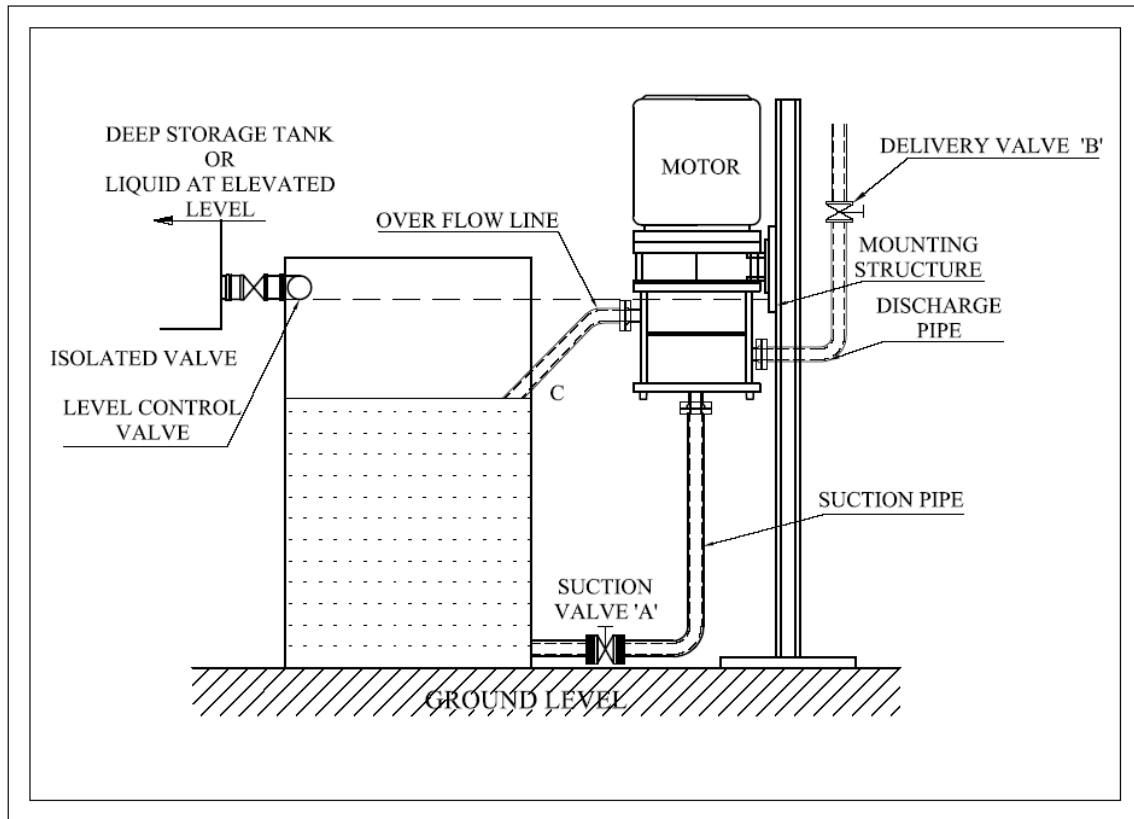


Figure 4.5

4.6 Installation Scheme: VI

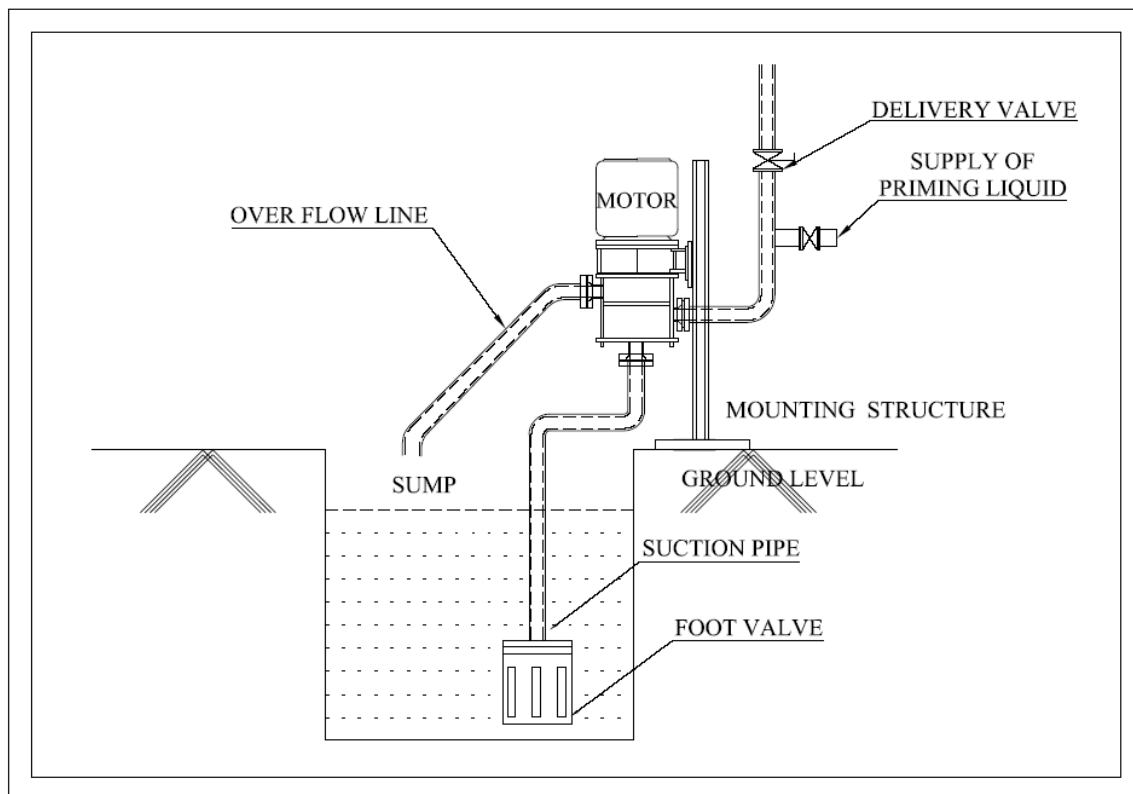


Figure 4.6

Installation: VI

- a) A column has to be raised on the side of the tank
- b) Pump is mounted on the column as shown in sketch
- c) In the suction line a foot valve has to be fitted
- d) Prime the pump through delivery pipe, so that the liquid level comes to the centerline of overflow chamber
- e) Start the pump and open delivery valve

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The hybrid pumps can be offered in a wide variety of materials of construction. The material of construction is chosen depending upon its application.

The metallic range of hybrid pumps consists of materials such as:

- a) Stainless Steel in all Grades
- b) Special Wear Resistant Alloy
- c) Regular Metals
- d) A R B
- e) Hastelloy-A, B & C
- f) Alloy – 20
- g) CD 4MCU, HV 9 etc

5.0 Piping:

The piping for the hybrid pumps will consist of three connections namely:

- **Suction line**
- **Delivery line**
- **Overflow line**

It has to be ensured that the suction pipeline diameter is about 1.5 times the suction port and the overflow pipeline has the same diameter as the overflow port.

All Installation should have a down slope piping from the overflow outlet as shown in Figs: 4.1 to 4.6

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The counter flanges have to suit the P.C.D. of the suction, delivery and overflow respectively.

Suitable flexible gaskets should be used to achieve pressure tightness at flange joints while fastening

Extra care has to be taken at the suction flange connection to achieve pressure/vacuum tightness. This will avoid the losing of priming due to suction leakage. However the flanges should not be over tightened as it may lead to breakage if a fragile material is used.

In case of high silicon Iron/Nihard/Special wear alloy pumps three sets of loose split flanges will be provided for suction delivery and overflow. Three numbers of rigid companion flanges has to be manufactured with corresponding P.C.D. of the split flanges and connected.

The flanges have to be tightened evenly to ensure no leakage. The flanges should be parallel; else undue mechanical force in tightening might break the casing. This can also occur because of the uneven stress and brittleness.

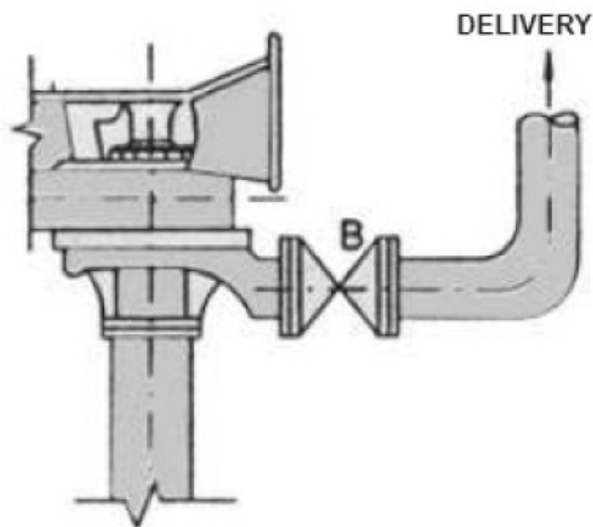
Heavy loading at all three connections must be avoided, as the dead weight of the piping and the valves should not fall on the suction, delivery and overflow. This has to be avoided by providing suitable supports at the suction, delivery and overflow piping.

6.0 Mounting:

The hybrid pumps has to be mounted on a rigid vertical structure. Four holes are provided on the foot of mounting frame of the pump for fastening to the vertical structure with bolts and nuts. The motor has to run **ONLY** in the direction indicated by the arrow on top of the motor, i.e., clockwise while viewing from the top of the motor. If the motor rotates in the reverse direction the impeller will get loosened from the adopter. This will damage the impeller and the impeller casing.

To ensure correct rotation of the motor:

- Phase sequence motor has to be used to get the desired direction of rotation.
- If the motor is operated through star – delta starter, then run for a moment in star position to check the direction.
- If the motor is operated through DOL starter, switch on and off momentarily to check the direction.



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SKETCH WITH 900 BEND AT THE DELIVERY

7.0 Pre start check up:

- The wiring to motor terminals has to be checked for correct direction of rotation.
- The maximum level of the liquid in the tank should not exceed the centerline of overflow chamber.
- The liquid has to be filled through the priming funnel or delivery pipe.
- The delivery valve has to be closed before starting the pump for acid / organic liquid the delivery pipe should not be closed for more than a few seconds, as the increase in temperature of liquid / volatile fluid might be hazardous.

8.0 Maintenance:

Once the pump has been properly installed without any suction leakage, the hybrid pumps is TROUBLE FREE. However occasional preventive maintenance of the pump and motor is desirable. The pump has to be opened once in six months, to check for any wear or corrosion in impeller or impeller casing.

The impeller has to be unscrewed (ie. Clockwise when viewed from the pump side.) Corrosion resistant grease (MOSIL 50) has to be applied to the threaded part of the adopter and impeller. Wear is usually indicated by gradual fall in the pump performance.

When this occurs, the pump should be dismantled for inspection. The suction, delivery and overflow pipe work has to be removed for a sufficient length to enable the pump components to be removed.

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In particular, sufficient length must be removed from the suction line to enable the Impeller casing to clear the impeller. This length will vary with the size of the pump. Generally 0.2 meters will be sufficient.

Unscrew the clamp bolts and the casing will need a temporary support and remove the clamp. The casing can now be removed in a vertically downward direction until the casing and the upper rotor casing is spigotted and a joint face. During this operation 2 clamping studs hold the upper body and upper rotor casing clamped to the mounting bracket.

The impeller is removed as follows:

The shafts extension is prevented from turning by the use of openended spanner. It is important that a strap wrench is used to unscrew the impeller. Any hammer or undue load on the impeller blades will result in damage. The strap should be wrapped around the periphery of the impeller. The screw thread is right handed on all versions of hybrid pumps.

The upper body can now be released from the mounted bracket by unscrewing the two nuts. Removal of these nuts will release the upper rotor casing. With the upper rotor casing removed the vaned thrower can be drawn downwards and removed followed by the upper body.

These joint faces and spigots must be treated with great care as any and scarring on the face may result in leakage on reassembly.

9.0 Reassembly:

Reassembly is in general a reverse of the above procedure but special care must be taken to ensure that the various axial and diametral clearances are maintained according to the specification. The diametral clearances are fixed by the spigot location of the pump components and no adjustment is necessary or provided.

The axial clearances of the various pump components are adjusted by means of shim, between the end of the motor shaft and shaft extensions. The correct axial location of the shaft extension is preset before assembly of the pump components.

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10.0 Trouble Shooting:

In the event of failure of any component or assembly, the primary cause of failure should be established before renewing the detective parts.

Symptom	Possible Cause	Remedy
1. Pump fails to start	a) No Power supply to motor or Power failure. b) Seizure of pump or motor.	Check power supply. Dismantle and overhaul as necessary.
2. Pump fails to lift the liquid	a) Leakage in the suction line. b) Clogging of the suction or discharge line. c) Priming loss	Check for leakage in the suction line. Clear the suction and discharge line. Priming required.
3. Pump fails to maintain discharge pressure	a) Pump running at low speed. b) Suction valve not open fully. c) Priming loss.	Check speed of motor Check suction valve Priming required 90 degree bend in delivery pipe
4. Pump delivers insufficient capacity	a) Low speed b) Suction valve not open fully c) Pump not primed d) Air leak in pump or suction system e) Excessive impeller	Check speed of motor Check suction valve Prime the pump Check for leak in suction Adjust the impeller

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	clearance	clearance
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5. Excessive leakage through vapour seal	a) Vapour seal fitted incorrectly. b) Overflow piping incorrect.	Fit vapour seal correctly Overflow pipe to be straight Slope of overflowing piping to be 1 in 20 or more
6. Excessive motor noise	a) Cavitation. b) Rotating assembly out of balance-wearing of impeller. c) Foreign material trapped in pump. d) Incorrectly supported pipe work.	Check suction condition Dismantle and overhaul as necessary Remove foreign material Check the pipe work

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11.0 High silicon iron pump:

The hybrid pumps with high silicon iron, as material of construction should be handled with extreme care, as this materials very brittle.

Minor mishandling or dropping of the pump will lead to breakage of the hybrid pumps.

NOTE: MAXIMUM CARE HAS TO BE TAKEN FOR THE HYBRID PUMPSWITH HIGH SILICON IRON AS MATERIAL OF CONSTRUCTION.

12.0 Spares:

It is advisable to maintain the following spares in stock to ensure trouble free continues operation.

Sl.No.	Part Name	Qty
1	Impeller casing (Part No 1)	1 No
2	Impeller (Part No 2)	1 No

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3	Teflon gasket (In between impeller and expeller) (Part No 13)	4 No's
4	Gaskets (Part No 14,18)	6 No's
5	Expeller (Part No 5)	1 No