HYDRODYNAMIC SEAL NON METALLIC PUMP

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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DATE: 12.12.2014
TABLE – A

Details of bearings, oil seals, ‘O’ rings and shaft sleeves used in pumps-group wise

<table>
<thead>
<tr>
<th>Group No</th>
<th>Model</th>
<th>Location</th>
<th>Bearings</th>
<th>Oil Seals</th>
<th>‘O-ring’</th>
<th>Sleeve OD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PPLL-P3, PPLL-P3M, PPLL-P4</td>
<td>D.E</td>
<td>6308</td>
<td>35 X 47X 10</td>
<td>90 X 3</td>
<td>31.75</td>
</tr>
</tbody>
</table>

1.0 Introduction
HYDRODYNAMIC SEAL NON METALLIC PUMP

The PPLL series pump is a Hydrodynamic, single stage; end suction centrifugal pump fitted with either a closed or semi open impeller. For handling clear liquids a closed impeller is used whereas for handling liquids containing solids a semi open impeller is preferred.

We have 5 different types of groups available Starting with Group-0 to Group-IV. According to the head and flow rate we have divided in to 5 different groups. All the pumps in one group will have the same bearing housing, Shaft and sleeve etc. We have given the cross sectional drawing for all the groups from Figure No: 1 to Figure No: 5.

The pumps are designed to ISO 2858 standard and the back pullout design allows for the easy removal of the rotating assembly without disturbing the existing pipeline. The drive from the electric Motor is transmitted to the pump through a spacer type flexible coupling.

**Advantages of Hydrodynamic Seal Pump:**

- Unique secondary impeller design to achieve very low gland leakage (less than 3 drops / min.)
- Well suited for clear liquids and slurries.
- Low gland maintenance (once in nine months).
- High performance to price ratio.
- Very low maintenance cost and down time.

2.0 Scope of Supply

The pump is supplied with the following accessories as a standard practice.
HYDRODYNAMIC SEAL NON METALLIC PUMP

a) Gland packing or Mechanical seal depending on the customer’s choice
b) Flexible coupling
c) M.S. coupling guard
d) M.S. fabricated base plate

3.0 Storage & Handling

3.1 Receiving the Material

a) As soon as the material is received the packages should be checked from the delivery challan to ensure that all the items are received and are intact. Discrepancies, if any, must be immediately reported.
b) Packages should not be dropped and are to be handled carefully to avoid damage to the pump and motor
c) The place of storage should be well ventilated but free from dust, heat moisture.

4.0 Erection

All external parts of pump and motor must be thoroughly cleaned before erection begins.

4.1 Foundation

The pump assembly must be firmly mounted on the foundation bed secured by means of foundation bolts. The foundation must be strong enough to support the unit and dampen any vibration when the pump is in operation (it is preferable to use a spirit level placed on cleaned machined surface of the pump while erecting the pump).

The level can be adjusted by inserting steel packers between the bedplate and the foundation bolt accompanied by a gentle tightening of the bolt and should be cemented prior to erection.
4.2 Alignment

To check the alignment of the pump and motor a straight edge is placed across the respective half coupling as shown in the FIG.1

FIG.6: CHECKING THE ALIGNMENT OF THE PUMP AND MOTOR

When pump is in correct alignment the straight edge will touch all the points, which can be checked against light. For correct alignment the gap between the two halves of the coupling must be uniform throughout the circumference and can be checked with feeler gauges. Proper alignment can be achieved by inserting metal shims under the appropriate feet of the motor.

After the cement hardens the foundation bolts are drawn up tight and the alignment of the pump and motor rechecked as explained above. The alignment can be checked using a dial gauge to ensure vibration free operation.

4.3 Final Check

The final check for correct alignment is to turn the coupling by hand. The shaft should rotate freely, with no resistance in any of the position.
5.0 Pipe work Installation

All piping should be supported by hangers or independent supports. Care must be taken to ensure that no piping strains are transmitted to the pump as this may cause misalignment.

![Piping Support Diagram](image-url)

**FIG.7: PIPING SUPPORT**

5.1 Suction Condition

Elbows should not be employed immediately before the pump inlet since they cause non-uniform condition of entry in to the impeller. If an elbow cannot be avoided a straight pipe section of length equal to at least twice the pipe diameter should be fitted before the pump inlet.
HYDRODYNAMIC SEAL NON METALLIC PUMP

Adequate care must be taken to ensure that the joints of the suction pipe are airtight, otherwise air leaks in to the suction line reducing the capacity of the pump or if the amount of the air drawn-in is considerable the pump will fail to the lift the liquid at all.

The suction line should be as short as possible and must have least number of elbows in it.

The minimum depth of submergence of the strainer, if used, should be approximately three times the suction pipe Dia, measured from upper row holes in the strainer. The distance of the bottom from the strainer and the floor of the pump or reservoir should not be less than twice the pipe diameter.

FIG.8: POSITION OF STARINER IN SUCTION SUMP
It is preferable to use the suction and discharge piping of one size larger diameter than the pump suction and delivery sizes respectively. In such cases an offset taper pipe transition should be used as shown in the fig.

When there is no foot valve on the suction side a non return valve should be fitted in the delivery pipe to protect the pump from ‘water hammer’ and to safe guard the pump and the motor against rotation in the reverse direction when the pump suddenly stops e.g. due to power failure.

5.2 Auxiliary Pipe Connections
The following pipe connections should be made if required
   a) Jacketed stuffing box.
   b) Mechanical seal flushing/quenching connections.
   c) Cooling connection to bearing housing.

6.0 Starting the Pump
6.1 Pre Start Check up

a) Wiring the motor terminals and starter should be checked. Direction of rotation if incorrect must be corrected by reversing two of the starter leads.

b) MECHANICAL SEALS: If pump is fitted with mechanical seal, the manufacturer’s instructions are to be carried out.

c) BEARING: The pumps are dispatched without oil and the bearing housing must be filled with oil of SAE 80 grades to the required height indicator.

6.2 Priming

The pump is filled with water or liquid through the priming funnel or the delivery pipe. Priming can also be accomplished by employing a vacuum pump to evacuate the air. Priming is not required for installations with positive suction.

The delivery valve should be closed before starting the pump. On acid service or organic liquid service the pump should not be run with the delivery closed for more than a few seconds because the increase in the temperature of acid or volatile liquid may be harmful.

The pressure indicated in the delivery gauge should go up steadily. Otherwise it can be assumed that there is air in the pump. Should the ammeter on the starter comeback almost to zero, it means that the pump has lost its priming and in such cases repriming is a must.

7.0 Operation of the Pump
HYDRODYNAMIC SEAL NON METALLIC PUMP

The gland nuts should be tightened excessively in case of pumps with gland packing. Liquid should not be allowed to leak from the stuffing box at the rate of 30 to 60 drops per minute. This cools the shaft and reduces friction. Packing should be replaced periodically when it gets worn away.

The desired capacity is to be set by throttling the discharge valve. Observing the pressure gauge, ammeter, voltage and speed for satisfactory suction conditions.

The level of the oil in the bearings must be checked. The temperature of the oil should not exceed 60 Deg C, above ambient temp. If the oil gets darker the same should be replaced with fresh oil after flushing out the bearing housing.

The drive end bearing cover is provided with six bolts altogether in pumps above 250 mm impeller diameter. It can be seen that three of the bolts are fully tightened to secure the bearing cover to the bearing housing and the other three are left untightened. These three bolts are meant only for adjusting the axial movement of the impeller and should never be mistaken for untightened bolts.

8.0 Corrosion
HYDRODYNAMIC SEAL NON METALLIC PUMP

The material of construction of the pump has been selected after careful study of the liquid to be handled, its composition, its corrosiveness, specific gravity, pH, temperature, solid content, particle size, viscosity, etc. A slight variation in any of the above factor can cause severe corrosion of the wetted parts. Therefore it is necessary that ample care be taken to ensure with every fresh batch of liquid that its properties are the same for which the pump originally is meant.

When numbers of pumps with different materials of construction have been supplied for different duty conditions great care must be taken to ensure that the right pump is put in to service.

Operating the pump at the point other than the specified duty point might also have an adverse effect as far as the corrosion is concerned. Spare parts of the same original material are to be used while parts are replaced to avoid the formation of galvanic cell, which initiates corrosion.

9.0 Stopping the Pump

Before stopping the pump the discharge valve must be closed. The motor is switched off and the sealing fluid to the gland / seal should be left open in case of crystallizing liquid being pumped.

The liquid remaining in the impeller casing should drained off by means of the drain plug provided.

10.0 Direction of Rotation
FIG. 10: VIEW FROM MOTOR SIDE

The pump should always be run in the direction indicated by the arrow provided on the bearing housing. The pump has to rotate in the clockwise direction when viewed from the motor side. While checking the direction of the rotation the pump should be filled with liquid in order to prevent it from running the packing or seal dry. Dry running of the pump can cause immediate failure of the mechanical seal.

11.0 Maintenance

Depending on the operating conditions, the pump should be dismantled and inspected at suitable intervals. Only experience can tell how frequently these overhauls are necessary.

11.1 Renewing the Gland Packing

Packing of the correct size of square section suitable for the liquid to be handled is to be used. Packing should be cut accurately to size.

The following steps must be followed for renewing the packing:

a) Motor should be isolated from the supply.

b) Suction and the discharge valve must remain closed.
c) The packing to be slid away from the stuffing box after opening the gland cover.

d) The gland packing is removed.

e) The shaft sleeve to be examined for scoring or cording and, if necessary a new sleeve is to be fitted.

f) The same sequence of packing as is originally employed by the manufacturer is to be followed.

g) The gland is inserted and secured in position. The gland cover is tightened.

Note: A provision for flushing is provided in stuffing box if flushing fluid is available and if you would like to use flushing remove the plug and use a nipple of quarter inch plug for flushing.

11.2 Mechanical Seals

In case of pumps with mechanical seal, care should be taken to fit the seals exactly as per manufacturer’s instructions. Mechanical seal parts of Teflon should be used for only one installation. Reusing of such parts is not recommended.

11.3 Bearing Lubrication

Pumps are supplied with oil-lubricated bearings. The housing is provided with an oil level indicator and only a quick glance is required to
know whether proper lubrication is provided. Oil is to be flushed out through the drain plug and fresh oil to be filled through the oil breather provided at the top of the bearing housing. Oil of SAE 80 must be used for lubrication.

12.0 Reverse rotation

When there is power cut to the pump driver clubbed with malfunctioning of check valve at the discharge line. Subsequent to the power cut, the pump speed reduces very rapidly causing rapid reduction in flow arriving to a point where no flow could be pushed against the existing head. The flow of fluid tends to reverse its direction and pass through the pump chamber from discharge to suction and it makes impeller to rotate in reverse direction, Due to this reverse rotation of the impeller driven by the fluid flow

The following are the effects

- Bearing failure in the pump
- Mechanical seal failure in the pump
- Damage to the pump shaft, impeller and wearing
- Subsequent damage to the bearing housing and stuffing box

13.0 Routine Maintenance Schedule
1) The Pump has to be checked daily for sign of leakage, bearing temperature, suction and discharge pressure, undue noise or vibration and cooling liquid.

2) Weekly checking of the glands, mechanical seal, and oil level has to be carried out.

3) Once in three months the bearing oil has to be changed and the gland packing renewed.

4) Every six months the coupling alignment is to be checked.

5) Every two years the pump has to be dismantled and the following checks should be carried out to avoid any extensive damage or replacements or total breakdown at a later stage:
   - To be checked for loose fitting of the bearing and the extent of looseness determined should not be more than 0.05 mm on diameter.
   - Same way using a dial indicator check should be carried out for shaft bend, sleeve concentricity and the indicator movement should not exceed 0.05 mm.
   - Excessive internal thrust and bearing looseness may allow the shaft to move axially under certain conditions. The dial indicator is mounted on the base frame and the shaft given a gentle tap with a soft hammer and the reading should not exceed 1.0 mm.
   - Also the bearings, shaft, shaft sleeve, impeller, impeller casing, coupling etc. should be examined against any sign of wear, damage, corrosion etc.
   - Use Loctite 630 thread lock adhesive while refitting impeller nut

6) After all the above checks have been carried out the pump reassembly are taken up. While reassembling care must be taken to ensure that there are
no nicks, burrs, dirt or other foreign material on any mating surfaces which would cause uneven mating.

14.0 Trouble Shooting

In the event of failure of any component or assembly, the primary cause of failure should be established before renewing the defective parts.
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pump fails to start</td>
<td>a) No supply to motor or Power failure</td>
<td>Check power supply</td>
</tr>
<tr>
<td></td>
<td>b) Seizure of pump or motor</td>
<td>Dismantle and overhaul as necessary</td>
</tr>
<tr>
<td>2. Pump fails to lift the liquid</td>
<td>a) Leakage in the suction line</td>
<td>Check for leakage in the suction line</td>
</tr>
<tr>
<td></td>
<td>b) Available NPSH low</td>
<td>Charge installation as necessary</td>
</tr>
<tr>
<td></td>
<td>c) Clogging of the suction or discharge line.</td>
<td>Clear the suction and discharge line</td>
</tr>
<tr>
<td>3. Pump fails to maintain discharge pressure</td>
<td>a) Pump running at low speed</td>
<td>Check speed of motor</td>
</tr>
<tr>
<td></td>
<td>b) Suction valve not fully open</td>
<td>Check suction valve</td>
</tr>
<tr>
<td>4. Pump delivers insufficient capacity</td>
<td>a) Low speed</td>
<td>Check speed of motor</td>
</tr>
<tr>
<td></td>
<td>b) Suction valve not fully opened</td>
<td>Check suction valve opening</td>
</tr>
<tr>
<td></td>
<td>c) Pump not primed</td>
<td>Prime the pump</td>
</tr>
<tr>
<td></td>
<td>d) Air leak in pump or suction system</td>
<td>Check for leak in suction</td>
</tr>
<tr>
<td></td>
<td>e) Excessive impeller clearance</td>
<td>Adjust the impeller clearance</td>
</tr>
<tr>
<td>5. Excessive leakage from stuffing box</td>
<td>a) Gland packing fitted incorrectly</td>
<td>Repack the gland correctly</td>
</tr>
<tr>
<td></td>
<td>b) Gland packing worn out</td>
<td>Renew the gland packing</td>
</tr>
</tbody>
</table>
c) Mechanical seal component defective

d) Mechanical seal component fitted incorrectly

6. Excessive Motor vibration

a) Cavitation

b) Rotating assembly out of balance

Eg: wearing impeller

c) Holding bolts loose

d) Misalignment between motor and coupling

e) Bearing defective

f) Foreign material trapped

g) Incorrectly supported pipe work

Check suction condition

Dismantle and overhaul as necessary

Tighten the bolts

Check alignment

Renew bearing

Remove foreign material

Check the pipe work

7. Bearing overheating

a) Insufficient lubricant in bearing housing

b) Bearing defective

c) Misalignment

Check bearing lubricant

Renew the bearing

Check the alignment

15.0 Maintenance Practice

|------------|--------------|----------------|------------|--------------|--------------|---------|-----|------------|