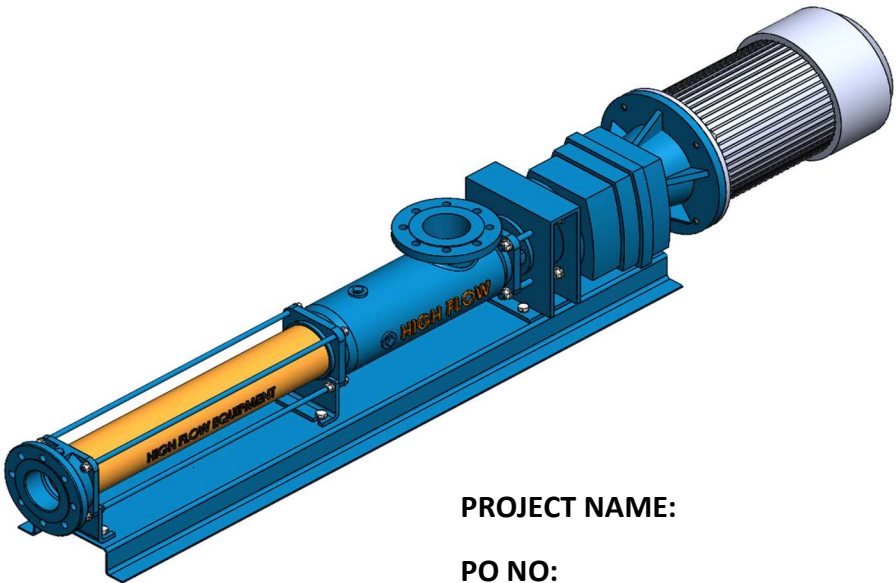


HIGH FLOW

EQUIPMENT

PROGRESSIVE CAVITY PUMP

INSTALLATION, OPERATIONS & MAINTENANCE MANUAL



PROJECT NAME:

PO NO:

DATE:

YEAR OF SUPPLY:

Before Operating the Pump, Please Read this Manual Carefully.

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FOREWORD

Thank you for being our valued customer.

We wish to extend our sincere gratitude for patronage and appreciate your confidence in us. Our products are designed, manufactured, and thoroughly tested to give you reliable, smooth, and trouble-free operation. We are backed by years of expertise in Positive Displacement Pumps (PDPs) and application.

We are grateful for the pleasure of serving you and meeting your needs.

This is the set of instruction for the installation, Operation, and maintenance of Progressive Cavity Pump manufactured by High Flow Equipment. This manual comprises of technical details, Procedures and work instruction regarding the use and maintenance of this unit. For optimal safety, Read and understand the instructions in this manual thoroughly before attempting to operate this unit.

Please keep this manual with this pump/pump unit, for future reference.

We wish to convey our appreciation for your purchase and hope to receive your valuable feedback and suggestions for improvement of our products and services.

For any further technical assistance, you can contact our local High Flow Dealer or may also visit us on the web at www.highflowequipment.com for any comment or suggestions, for questions please contact- sales@highflowequipment.com

WARRANTY

High Flow liability for any shortcomings in the supply is clearly mentioned in the conditions of delivery. High Flow is not liable for any damages occurred/caused by non-compliance with the operating and maintenance conditions.

In case of any change in operating condition (i.e., different liquid, speed, viscosity, temperature, or pressure conditions) later. We must investigate and decide on a case-to-case basis whether the pump is suitable for the new conditions. It is recommended to carry out pre-agreement with High Flow for the change in operating parameters. In the absence of special agreement with High Flow, supplied pump/equipment must be de-commissioned/serviced only by High Flow authorized personnel, otherwise our liability for any defect will cease.

DISCLAIMER

Information in this manual is believed to be reliable. Despite all the efforts of High Flow Equipment to provide sound and all necessary information, the content of this manual may appear insufficient and is not guarantee by High Flow Equipment Pvt Ltd. as to its completeness or accuracy. However High Flow Equipment will not accept responsibility for physical injury, damage, loss of user production by failure to observe the instruction for installation, operation and maintenance contained in this complete manual.

GENERAL

This instruction manual contains the basic instructions which are to be observed during installation, operation, and maintenance of the pump/pump unit.

Always keep this instruction manual close to the product's operation location or directly with the product.

If problems cannot be solved with reference to the installation, operations, and maintenance instruction manual, please contact High Flow authorized dealer or service centre.

Observe the following points in addition to these operating and maintenance instructions:

- Prohibition, warning and mandatory signs, warning notes on the pump/pump units.
- Relevant laws and ordinance.
- Statutory provisions on accident prevention.
- Corresponding harmonised standards and regulations.

SAFETY INSTRUCTIONS

Comply with safety and warning notes for the safe and efficient use of pump unit. A case of non-observance may cause danger to personnel. The instructions given on the name plates affixed on or to the equipment. The user is requested to follow the pump equipment. For e.g.: the direction of rotation or sign for fluid connection etc.

DANGERS IN CASE OF NON-COMPLIANCE WITH SAFETY INSTRUCTIONS

- Non-observance of these instructions may lead to the loss of any claims for damage and following can be the consequences.
- Failure of essential functions of the machine/equipment.
- Danger to the personnel from electrical, mechanical, and chemical influences.
- Danger to the environment and personnel from leakage of hazardous substances.
- Failure of specified methods for maintenance and servicing.

SYSTEM OVERVIEW

This pump range is positive displacement, progressive cavity pump manufactured by High Flow Equipment Pvt Ltd. This range is very versatile and provides an ideal solution for pumping all types of liquid with maximum efficiency and reliability. These pumps have application in fluid metering and pumping of viscous or shear-sensitive materials.

1.1 DESCRIPTION

The High Flow Equipment Progressive Cavity Pumps (PCPs) are self-priming rotary Positive Displacement Pump (PDPs) capable of handling viscosities up to **30,00,000 cSt** and discharge Pressures of up to **48 Bar**. The pumps are suitable for handling and dosing highly viscous, neutral, or aggressive, pure, or abrasive, gaseous fluids or fluids which tend to froth, even with fibre and solid contents.

1.2 CONSTRUCTIVE DESIGN

These pumps are available in two configurations i.e.:

- Closed Coupled Pump
- Bare Shaft Pump

1.3 PUMPING PRINCIPAL

The pumping element a precision-machined single external helix metallic rotor and a double internal helix elastomer stator. Due to the special profile of the rotor and stator set, a sealing line is formed along the axis of the rotor which is maintained at both static and dynamic conditions.

As the rotor turns within the stator, these cavities progress from the suction to the discharge end of the pump carrying the fluid.

1.4 PERFORMANCE DATA

The performance data, e.g., pressure, capacity, speed, temperature, and recommended power of the pump are to be taken from the order data sheet.



The range of utilization and other fluid parameters are to be taken from the order data sheet.

1.5 ABBREVIATION

The abbreviations i.e., range, size & model code of the Progressive Cavity Pumps (PCPs) is stated in the order data sheet.

1.6 MODIFICATION NOTIFICATION

In case any modification in the pump/pump unit is done either by High Flow or carried out in agreement with High Flow, an amended set of operating instructions will be provided, or the existing operating instructions will be supplemented by an additional set of sheets, along with a new cover sheet. The date of modification and modification index will be mentioned on the new cover sheet of revised manual.

1.7 TESTING

Prior to leaving the manufacturing facilities, all pumps are subjected to leakage and performance test. Pumps, operate properly and acquire the performance parameters, as assured by High Flow, only leave the factory. Thus, compliance with the following operating instructions ensures proper and safe operation.

1.8 PERSONNEL QUALIFICATION AND TRAINING

High Flow Equipment recommends that the operations, maintenance, inspection, and mounting work of the equipment should be carried out by qualified personnel only. Areas of responsibility, scope of authority and staff supervision must be exactly defined by the user. Proper training and instructions, if necessary, must be given to the personnel who do not acquire necessary knowledge. The user must also ensure that the contents of the instruction manual are fully understood by the concerned personnel involved.

The responsibility for carrying out the pump/equipment operations are broadly defined as, any person responsible for or in charge of:

- Working with lifting gear
- Mounting a drive
- Setting up installations in plant
- Doing work on start-up, operation, and maintenance
- Doing servicing

GENERAL INSTALLATION AND SAFETY RECOMMENDATIONS

- If there is a risk of danger from any hot or cold machine component, the user must fit protective guards to prevent such components from being touched. The warning instructions, symbols, and pictorial representations, specified in various sections of this manual and labels affixed to the equipment, have been provided to ensure the safety of the user/operator.
- Protective guards to prevent accidental contact with moving parts (e.g., couplings, shaft, and mechanical seal) must not be removed while the equipment is in operation.
- Adequate ventilation must be provided to disperse dangerous vapours when the pump is handling harmful or objectionable material.
- Adequate lighting should be provided to ensure effective maintenance.
- Usage of certain products may need a hosing facility to drain the pump to ease and simplify maintenance.
- The suitable arrangement should be provided to carry out gland draining.
- Adequate space must be provided for dismantling the pump as per the dimensional drawing of the pump.
- All possible dangers from electricity must be eliminated (for details, kindly refer, e.g., the regulation laid down by local energy supply associations).
- Use only direct online starters for meeting starting torque requirement of the pump.
- Always consult High Flow Equipment in case of any change in operating parameters like temperature, viscosity, percentage of solids, liquid composition, etc.
- Always use genuine High Flow Equipment spares for sustained pump performance and longer life of critical parts.
- It is instructed that the pump unit should be brought to a standstill i.e., electrical power supply turned off before repair/service work is carried out.
- It is to be ensured that before the dismantling of the pump takes place, the pipes are free from any kind of residual pressure and are empty or isolated by proper valve. All procedures mentioned in the operating instructions of this manual for decommissioning of the pump should be adhere to.
- The Pump which conveys harmful media must be decontaminated.

- Immediately after the maintenance work is finished, all safety devices and protection guards must be reinstalled, in position and, wherever applicable, reactivated.
- The pump must not be started until it is being properly secured to the foundation.
- It is instructed to integrate the pump unit in an emergency stop system, in such a way that the pump can be operated safely.
- The user must ensure that a fire extinguisher is placed at the pump installation site.

2.1 IMPORTANT SAFETY MEASURES

DO's

- Always fill the pump with fluid and give few turns to provide necessary lubrication before starting when subject to prolonged stoppage.
- Always use a pressure relief device on the delivery line for system safety.

DON'Ts

- Never run the pump in dry condition even for a few revolutions otherwise the rotor will damage the stator immediately.
- Never run the pump against a closed inlet or outlet valve.
- Never use foot valve for slurry application.
- Never vary flow rate by throttling the suction and delivery line.
- Never exceed recommended pump speed.
- Never reverse the recommended direction of rotation of pump without consulting High Flow Equipment.
- Never use local made or spurious spares that look alike but do not meet material standards or dimensional accuracy affecting the life of critical components and performance of pumps.
- High Flow Equipment does not undertake any liability for the consequences resulting from the use of unauthorized parts.
- Care is required when adjusting the gland while the pump is running.

2.2 NOISE & VIBRATION LEVEL

High Flow Equipment confirms that the maximum noise emission level of the pump equipment at a workplace is less than or equal to **85dBA**. However, the manufacturer advice the operator to use appropriate PPEs as a protection against any hearing disturbances or mental discomfort.

To ascertain the specified noise and vibration level, cavity free operation, proper screw Fastening, proper placement of bearings, secure bolting to a concrete base, use of safety relief valves and renewal of worn-out internal components is a major perquisite.

High Flow Equipment recommends a noise level meter to be kept at the pump installation site and the noise level in the pump to be checked on a periodic basis. The cause of failure is to be eliminated before the pump is again put into operation.



- **Running the pump with unusual noise may cause failure of the equipment or even accidents!**
- **Unusual noise and vibration occurring in the pump under operation may cause discomfort or even hearing losses to the operating personnel.**

2.3 HIGH FLOW EQUIPMENT USAGE INSTRUCTIONS

High Flow Equipment recommends that the pump/equipment must be used for the purpose only for which it has been sold. It is, therefore, advised that in case of any change in operating parameters like temperature, viscosity, percentage of solids, liquid compositions, etc. the user must consult with the supplier or original manufacturer for the compatibility of the equipment in the new process/medium. This is more important when dealing with highly aggressive, chemically reactive, or otherwise hazardous substances.

The criteria for safe usage of pumps include:

- Compatibility with the medium
- Suitability for seal design/material, especially the shaft seal
- Resistance to pressure and temperature of the medium

A blockage or closure of a valve in the discharge line can cause a pressure rise as high as cannot be tolerated by the installation. This can even result in bursting of the pipes, which must be avoided specially in hazardous media.

It is, therefore recommended to use safety equipment e.g., an emergency stop button, cut off device, a pressure relief valve with return pipe or a bursting disc. These devices are generally supplied by system supplier or the user.

During the servicing/maintenance or de-commissioning of the pump/equipment, note the following:

- Ensure that while the pump is being opened for servicing or while under operation, all necessary instruction for handling the fluid medium as well as the

equipment (such as protective clothing, safety gloves, safety shoes, no smoking, etc.) should be followed.

- Ensure that the pump drive cannot be turned on without the consent of the authorized personnel.
- Ensure that all safety devices and protection guards (such as relief valves, coupling guards, drive-belt protection, and gland guards) are properly reinstalled, in place, before the pump is being put into operation.

INSPECTION AND REPAIR

The legal regulation for safety at work such as regulations for the workplace governance of hazardous materials accidental prevention, environmental protection for e.g., regulation concerning disposal of worn-out components of the pump/equipment and water balance comply to all commercial business to protect their employees or other concerned personnel and the environment from adverse effects caused by contact from the hazardous materials.

3.1 CAUTIONS IN EXPLOSIVES AREAS

While performing commissioning, re-assembly and servicing activities, it is to be seen to that no dangers of ignition arise especially during heating-up of pump parts. This means e.g., heating up by explosion-proof heating devices or exclusively in non-explosive areas. The temperature of the heated part and the ignition temperature of the materials by which the danger of explosion may be caused are to be considered.

3.2 DRY-RUNNING PROTECTION



Never operate the pump dry even for a few revolutions.

Even for a few revolutions in dry-run condition, stator will damage immediately. If at start-up there are suspicions of abnormal operation, it is recommended to stop the unit and investigate the causes.

It is always recommended that the pumps from High Flow Equipment be fitted with dry running protector consisting of temperature sensor that monitors operating temperature in the stator elastomer. When the selected threshold temperature is reached, a control unit shuts down the pump.

3.3 OVERPRESSURE PROTECTION

The pump must not be loaded beyond the maximum allowable pressure as specified by the manufacturer. The pump is to be equipped with an appropriate overpressure protection device.



Never run the pump against a closed inlet or outlet valve.

3.4 DRIVES

The drives must be adjusted to the performance of each pump. In the case of the blocking of the pump, the drives must be turned off automatically by means of a motor protection unit.

3.5 DRIVE ALIGNMENT

It is necessary that the drive should be aligned within the maximum allowable tolerances. Incorrect alignment causes damage to the seals, shaft bearing and couplings.

3.6 ROTOR AND STATOR

These components are prone to wear and need to be replaced once they reached their wear limit. Many factors such as abrasively of fluid media, pressure, temperature, viscosity, etc. affect wear rate. In case of any change in the conveying fluid media, the user must consult the pump manufacturer concerning the durability of the rotor & stator, and if they are confirmed to be suitable for the intended application.



3.7 BEARING LUBRICATION

The bearing housing is pre-stuffed with grease/Oil from the factory. No external lubrication is required unless the bearing housing is opened for inspection, while during

re-assembly bearing should be cleaned and applied with grease thoroughly. The most appropriate time to inspect is during periods of regular scheduled downtime for routine maintenance or for any other reason.

End chambers (bearing cover + grease seal housing) should be packed with grease. Use one of the following recommended or equivalent grease:

- British Petroleum's BP LC2
- Mobil Grease XHP – 222

3.8 MECHANICAL SEAL

When the pump is supplied with mechanical seal, it may be necessary to ensure proper flushing & quenching arrangement as per the seal manufacturer's recommendation. Before initial start-up and after prolonged shutdown, the mechanical seal needs to be lubricated from outside before the pump is started. In this connection, the compatibility of the lubricant with the sealing material is to be considered.

3.9 GLAND PACKING

The wear rate under gland area of the drive shaft, depends on various factors like product abrasiveness, extent of tightening of the packing and speed of the pump. Periodic inspection and maintenance of the gland will maximize the life of the shaft. Replacement of gland packing or both the gland packing, and the drive shaft will be necessary when the shaft sealing becomes difficult to achieve.

The pump is fitted with gland packing which requires final adjustment during initial running period. Under normal running condition the gland rings are to be tightened in a manner to permit a slight drip from the gland. This enhances the life of the shaft and the gland packing. It is important to note that the gland packing is never over tightened to arrest the leakage completely. This can lead to excessive heat generation that can cause permanent damage to the shaft and the packing.

Adjustment by tightening should only be made when the pump is running. Indication of slight drip from the gland packing will only be evident if the pump is running delivery on gland, or with suction on gland, with flooded suction. If the pump runs with the vacuum on the gland, a flushing connection or greaser with lantern ring is recommended. Where lantern rings are fitted in stuffing box: the flushing liquid inlet or outlet should be connected for proper circulation of the liquid.

3.10 ADJUSTMENT OF GLAND PACKING

- The gland packing should be inspected every day after starting the pump.
- Remove the gland guards to check the leakage.
- If the sealing is not proper it must be adjusted by tightening or loosening of gland nuts to attain the preferred level of sealing.
- Excessive tightening should be avoided, as it would result in excessive heat generation leading to permanent damage of both the shaft as well as the packing.
- Experienced personnel should carry gland adjustment so that the safety of the personnel is not endangered.

3.11 PUMP SET

When a pump unit is dismantled and reassembled, it must be ensured that the following steps, as applicable, are covered:

1. Correct alignment of pump and driver.
2. Use of appropriate coupling and bushes.
3. Use of appropriate belts and pulleys.

3.12 DIRECTION OF FLOW

The pump can run in both S.O.G (Suction on Gland) and D.O.G (Discharge on Gland) conditions but at the same time, it is advised not to run a pump in the D.O.G condition if the discharge pressure is above **12 bar** (or 12kg/cm²).

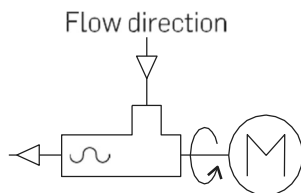


Operating the pump in the reverse direction may cause pump damage!

3.13 CHECKING DIRECTION OF ROTATION

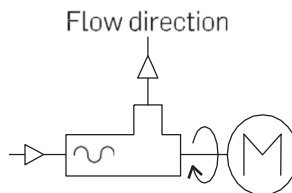
The rotational direction of the pump determines the flow direction of the conveying media. Always ensure direction of rotation of pump is same as the direction of driver as advised by High Flow Equipment.

In case any changes in the direction of rotation of the pump are to be made, the same must be done only in agreement with High Flow Equipment. The figure below shows the correct direction of rotation of the pump shaft, under both S.O.G (Suction on Gland) and D.O.G (Discharge on Gland) condition.



Counter-clockwise

S.O.G Condition



clockwise

D.O.G Condition

TRANSPORT, HANDLING & STORAGE

4.1 TRANSPORT

Depending on its weight, the High Flow Equipment must be transported with appropriate transport modes. Pumps are dispatched in duly assembled condition. During transportation & storage, the suction and outlet ports and auxiliary connections of the pump must be closed with plugs. However, during installation of the pump accessories, the plugs should be removed.

Place the pump/pump unit safely as improper storage can damage the equipment, which will void the warranty. Upon receipt of shipment, carefully inspect the pump, driver assembly and other devices to ensure that none of the components are missing or damaged.

Any damage must be reported promptly to the freight carrier and High Flow Equipment or its distributor, from where the equipment has been purchased. Claims against damage/loss must be made at the time of receipt.

4.2 HANDLING

When lifting the pump/pump unit, use lifting equipment having a safe working load rating, suitable for the weight specified. Use suitable slings/shackle for lifting any pump not provided with eye bolt.



Rough handling and incorrect selection of lifting points can cause permanent distortion of pump/pump unit base and/or casing which will affect the close operating clearance between the rotor and the stator.

For safe handling during installation and maintenance, follow below points to avoid any damage to the component or personnel injury:

- In case the pump or any of its component weigh more than 20 kgs (45 lbs), it is always recommended that suitable lifting tackle or slings should be used.
- The position of the slings will depend on specific pump model and mounted accessories. If eye bolts are provided, they should be used for lifting.
- Be cautious when lifting heavy pumps. The centre of gravity may act above eye bolt. If this is the case, secure additionally to prevent tipping over.
- Vertical pumps should be laid down horizontally unless they are secured vertically to prevent hazards of tipping!
- Avoid suspending complete pump unit by the eye bolts of the motor or gearbox. These bolts should be used to lift the motor and or gear box only.
- Experienced personnel should carry out handling.

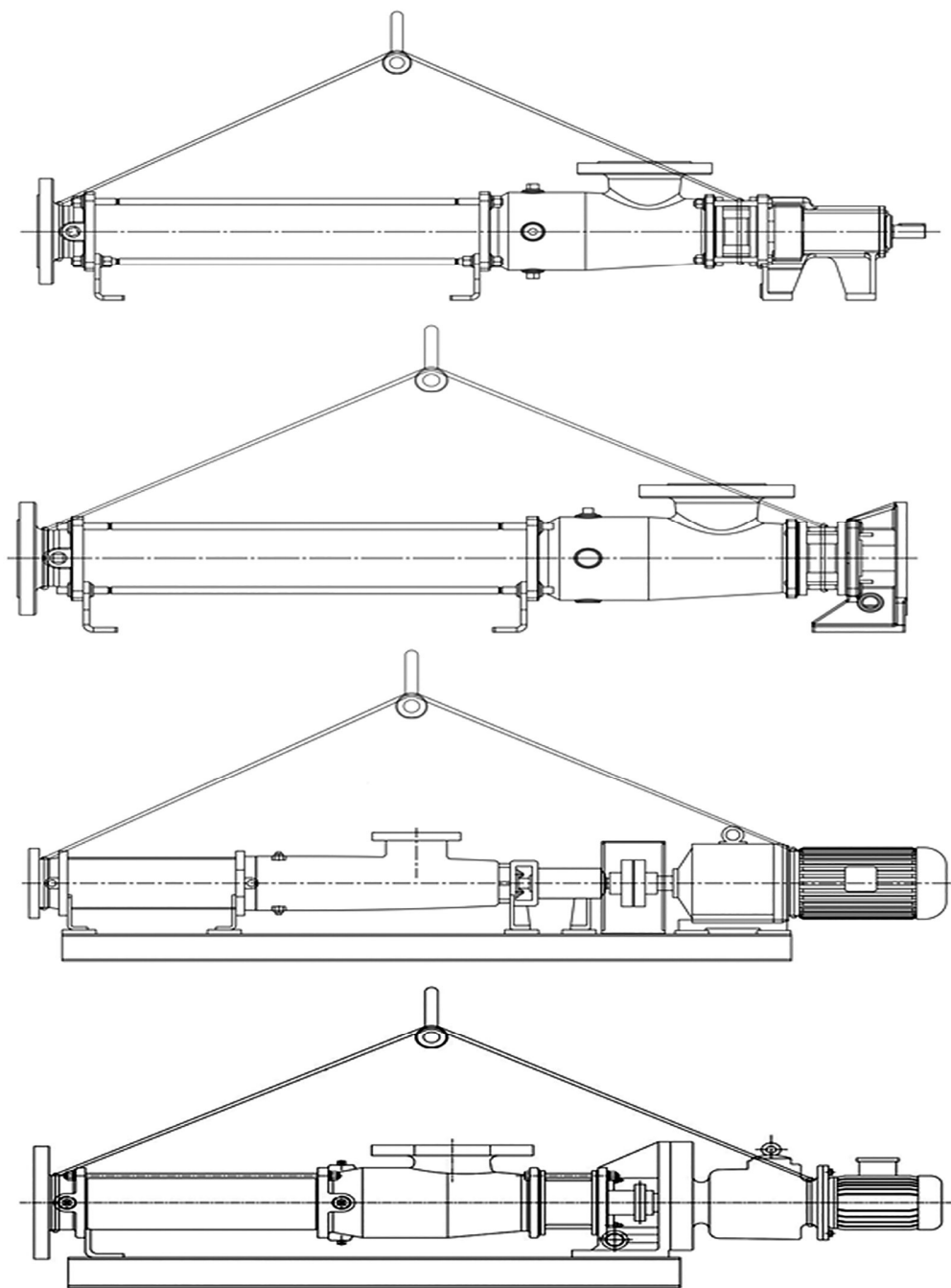


Follow measures to avoid slippage or tipping.

- Due to variety of pump designs and applications, only general instruction is laid down in this manual.

However, these instruction sets are ample for experienced personnel. Refer figures in recommended lifting arrangements for lifting pump. In case of any doubt in the same, contact High Flow Equipment for clarifications.

RECOMMENDED LIFTING ARRANGEMENTS:



4.3 STORAGE

Unless specified in the order data sheet, High Flow Equipment are packaged for transportation and short-term storage of less than **6 months** only. Before installation, the external and internal preservations should be removed.

4.3.1 SHORT TERM STORAGE

Following points are advised for storage of pump and spares. The pump should be kept in moisture free area, preferably, with protective covering.

- The pump should be kept after draining out the pumping liquid and preferably after flushing it with water.
- A small amount of light oil should be injected in the stuffing box after loosening the gland. For food application pump use compatible vegetable or edible grease.
- Anti-rust oil or agent must be applied on the metallic parts to be stored.
- Refer manufacturer's instructions for storage of other items like gearbox, motor, etc.
- Stator when stored for long periods must be removed and kept separately in a clean, cool, and dry environment to avoid occurrence of breakaway torque. This happens when elastomer line distorts permanently between rotor and stator.



Ensure that the anti-rusting oil or compatible lubrication agent applied on the metallic parts should also be compatible with elastomeric compounds meeting their metallic component.

NOTE:

- The elastomer stator is sensitive to weather influences (ozone, light, temperature, etc.) therefore must be stored in a cool, dry, dust-free, and well-ventilated area. If possible, it can be wrapped in dark foil and stored at a maximum temperature of **-10 to 40 °C**.
- Recommended relative **humidity <65%**.
- There must be no solvents, oil, grease, lubricants or chemical stored in an area.
- Prior to start-up after prolonged storage, all elastomer (stator, mechanical seal, O-Ring) must be checked for their elasticity of shape.
- Support the rotor with wooden blocks and cover up against harm from mechanical impact.
- Pump parts to be made of stainless steel- no grease coating necessary.
- Other pump parts (non-coated) – protection with grease is necessary.

4.3.2 LONG TERM STORAGE

In case of prolonged storage (for more **than 6 months**), store the pump in a clean and dry place. It is recommended that the above mentioned must be followed on regular basis (i.e., after **every 2-3 weeks**), in addition to the below point:



Always fill the pump with a compatible lubrication fluid and give one or two rotations to the pump to avoid the rotor setting in the stator.

MOUNTING & INSTALLATION

It is always recommended to leave space around the pump to carry out maintenance & adjustments hassle free. The following factors must be considered for space requirements:

- Avoid mounting the pump at places where the ambient temperature is not within the pump operating temperature limits (may refer order sheet). In case the pump/pump unit installed in an open area, it must be protected from frost or other climatic effects (e.g., rain, thunderstorm, dust, direct sun, etc.).
- Install pump close to a liquid supply source to use short and straight inlet pipelines, wherever possible, to ensure adequate flow of liquid to the suction port of the pump. Make sure the piping is perfectly airtight.



It is recommended that for installing the pump/unit, a dry, clean, well lit, and well-ventilated site should be selected.

The removable distance piece must be installed between the discharge flange and the piping to enable disassembly of rotor and stator easily, without dismantling the pump.

5.1 FOUNDATION

The foundation must be strong enough to reduce vibration & rigid enough to avoid any twisting or misalignment. A small sized progressive cavity pump must be mounted either on the baseplate or to the floor that meets the criteria for a safe and smooth foundation. For large sized pump, baseplate mounted on a concrete foundation must be used.

Care should be exercised to ensure all components are levelled and mounted in a direct line. For maximum rigidity and lower noise levels, the baseplate should be grouted to the foundation after the anchor bolts have been evenly tightened.

5.2 MOUNTING INSTRUCTION FOR FOOT MOUNTED PUMPS

Below mounting sequence should be followed:

- Place the pump on the baseplate.
- Install and tighten each coupling half on the pump shaft and drive shaft, respectively.
- Place the drive motor on the baseplate and set proper distance between the shaft and coupling hubs. Gap length in no case should exceed, 0.05mm.
- Locate the drive motor so that the pump and drive shaft are in axial alignment.

However, for pumps driven through separate gearbox or other applicable drive arrangement, the step areas as follows:

- Align driving device relative to the pump.
- Align driver relative to the driving device.

Final alignment of pump & drive assembly should be performed only after the complete pump unit with baseplate, has been properly set.

To avoid lateral shifting of the base plate due to irregularities in the foundation, grouting is usually recommended. Always install proper guards over coupling and shaft to avoid accidental contact of the attending personnel with the rotating shaft, keyway, coupling, chain etc.

5.3 ALIGNMENT OF PUMP & DRIVE UNIT

Once the pump is in continuous operating condition, it is mandatory to recheck the alignment of the pump shaft and drive shaft once in a week.



Do not check the alignment of pump shaft and drive shaft while the pump is in running condition! Always switch off the drive motor first and then check the alignment before the pump cools down.

In case of misalignment, change the motor and pump unit ground settings. Now place and fix the coupling guard back to its original position.

5.4 SUCTION AND DISCHARGE PIPING

When the pump is idle, suction pipe should be filled with fluid media to lubricate the pump during restart. This arrangement is vital to ensure lubrication of the rubber stator.

5.4.1 PIPING SYSTEM LAYOUT

- Install piping as straight as possible avoiding unnecessary bends. Bending radius should be calculated accurately to decrease losses.
- When pumping fluids at high temperatures, flexible expansion joints must be included to prevent strain caused by thermal expansion.
- All pipes should be fixed with the pump flanges in such a way that the piping loads are not transferred on the pump flanges. These pipes must be replaceable independently without subjecting the pump to any strain.
- For correct alignment of piping connections, the mounting bolts should be inserted through the locating holes of the pipe flange and the pump flange. If the bolting is done by hand (hand push) and the flanges are parallel to each other, the piping connections are stress free. However, it is recommended to maintain some clearance between two mating flanges (of the pipe and pump).
- Flanges at suction & discharge pipelines should be designed as per the nominal diameter of suction/discharge flanges of pump. In case of any deviation in the flange connections, refer to High Flow Equipment.
- Operating fault such as cavitation, noise vibration etc. may occur due to error in layout in pipelines.
- If there is suction lift at the pump end, the suction side pipeline should be properly designed and adequately sized to reduce friction losses.
- It is required that suction pipelines and valves must be carefully and thoroughly cleaned, rinsed, and flushed, before the piping connections are made.



Pipe strain will lead to failure, malfunctioning or even distortion of the pump!

5.4.2 AUXILIARY PIPING

- Auxiliary piping connections, used as supply lines (for shaft sealing arrangement) or as pump casing (for heating and cooling of a pump) should be stress free.
- In case of double mechanical seal, the sealing liquid lines must have a large possible cross-sectional area for flow. The outlet piping of the sealing liquid is at the highest connection of the mechanical seal housing.
- For automatic ventilation, ensure the pipelines laid are continuously ascending, short and promoting easy flow.
- To prevent the formation of foam, gas bubbles and air entrainments, all return pipelines in recirculating system should end well below the liquid surface in the tank/reservoir. Bypass liquid from safety relief valves and flow control valves

should return to the source, e.g., tank, reservoir and not to the pump suction line. If required, ventilation connection to these pipelines must also be provided.

- The outlet piping of the heating/cooling should be connected at the highest connection of the pump casing.

NOTE: Return pipelines connected back to the pump suction can cause excessive temperature to rise at the pump, may result in severe pump failure!

5.4.3 PIPING ACCESSORIES

➤ SUCTION STRAINER

High Flow Equipment recommends use of a strainer at the suction side, to ensure that no undesired foreign material or large contaminants enter the system.

The strainer provides primary protection to all the internal pump parts and thus, improves life of the pump. It should be installed immediately before the inlet port (suction port) to ensure easy cleaning or replacement of strainer element.

NOTE: Appropriate gauges or suitable monitoring devices must be provided for monitoring the pump pressure.

As a thumb rule, for High Flow Equipment Progressive Cavity Pump, the total free flow area of the strainer must **be 5 to 6 times** more than the cross-sectional free flow area of the suction pipeline. The pressure drop through the strainer should not be more **than 0.05 kg/cm²**.

In general, the suction strainers can be used for any liquid media except highly viscous fluid. For highly viscous fluid, careful and proper flushing of the suction line is advised to remove all foreign particles.

NOTE: Differential pressure gauges should be used in the suction piping, before and after the strainer to check during cleaning of the strainer.

Before connecting the pump to the system, ensure all debris and foreign particles are thoroughly flushed from the system piping. Particles may cause internal damage to the pump and may result into a complete pump overhaul.

➤ **PRESSURE RELIEF VALVES NON-RETURN VALVE**

It is recommended that a suitable safety device is installed on the discharge side of the pump to prevent over-pressurisation of the system.

It is also recommended that a non-return valve is installed on the discharge side of the pump to prevent reverse flow through the system.

When both are installed, it is advised that the relief valve is positioned closer to the pump than the non-return valve. Never set RV pressure (Relief Valve Pressure) higher than the maximum pressure rating of the pump (including the pressure accumulation at 100% bypass).

Always remember not to connect the suction lines to the pump with the relief valve return lines, as these might cause overheating of the pump due to the formation of a closed loop.

➤ **MONITORING DEVICES**

Pressure and temperature gauges, Leak Detection Devices and other applicable monitoring devices are recommended for monitoring the pump's operating conditions. These gauges should be duly calibrated and easily readable. The pressure and temperature gauges need to be placed as close as possible to the pump's suction and discharge flanges.

➤ **BASE PLATE AND COUPLING GUARDS**

The drive arrangements for High Flow Equipment Progressive Cavity Pump are as follows:

- Direct Drive
- Belt & Pulley Drive
- Overhead Type
- L-Type
- Chain & Sprocket Drive

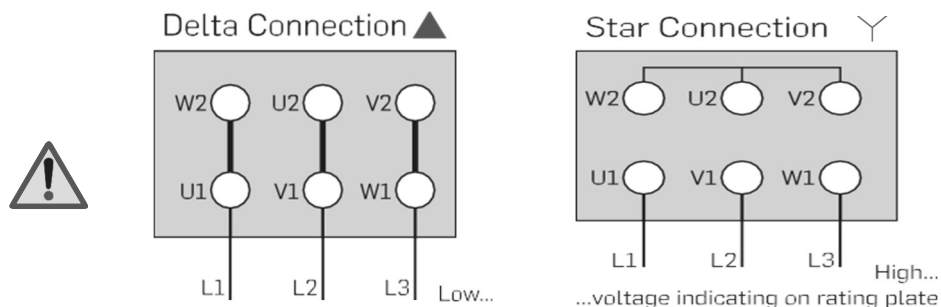
5.5 ELECTRICAL CONNECTION

The power sheath cables of the driving motor, coupled to the pump should be connected as per the switching. All the electrical connections must be installed according to the specification given by the motor manufacturer and are always to be verified by an electrical expert only. The main voltage and frequency should match with the specified ratings indicated on the name plate & rating plate of the motor.

Normally, High Flow Equipment Progressive Cavity Pump should be installed with starting equipment arranged to give direct online starting (D.O.L), to ensure maximum starting torque. When the motor is being wired and checked for the direction of rotation, ensure that the motor is not coupled with the pump.

If any wiring or control device is to be fitted on the electrical equipment, they must be set in accordance with their specific instructions. Protection of all electrical equipment should be ensured for minimum safety requirement as per the environment and fluid being pumped in accordance with applicable safety rules.

Check direction of rotation of the pump every time the drive motor is being connected or any alteration in the wiring connections is being done. Below are three phase squirrel cage motor terminal configurations:



NOTE: Earthing points of electrical equipment should be connected when the pump is fitted with electrical drives, and it is essential that these be correctly connected as per the electric equipment manufacturer's recommendation.

PRECAUTIONS BEFORE START UP OF THE PUMP UNIT

- Ensure all mounting connections and fittings are properly tightened.
- The fluid media must cover the pump suction flange completely, to avoid air access into the pump.
- Auxiliary flushing or lubrication lines needs to be checked for damages or distortion, if any.
- Pump fitted with mechanical seals may create some resistance on the pump shaft is being rotated. Therefore, pumps should always be filled either with the pumped liquid or with a neutral compatible liquid before the pump is put in to operation. This is required to protect the sealed faces from running dry.
- Direction of rotation of the shaft is in accordance with the desired circulation direction of the product. Check the direction of rotation by switching on the

pump motor and ensure that the motor is rotating in the same direction as indicated by the arrow marked on the directional arrow plate of the pump.

- In case the requirement of special coupling exists, details from the same should be read from the drive motor manufacturer's manual.
- The user must wear all protective clothing, while pumping hazardous liquids.
- Inspect all piping and check for any leakage or stress in the system.
- Clean all pipelines, valves, reservoirs, and strainer filters to ensure that all debris and foreign materials have been removed.

5.6 START-UP PROCEDURE

Pumps must be filled with liquid before starting (a threaded plug has been provided on the top of the pump housing for this purpose). The initial filling is not for priming purpose, but to provide proper lubrication of the stator until the pump primes itself. When the pump is stopped, sufficient liquid is normally trapped between the pumping elements to provide the necessary lubrication for restarting.

If, however, the pump has been left standing for a long time or has been dismantled, it must be refilled with liquid and given a few turns before starting, to get sufficient lubrication between the rotor and stator. If the pumping liquid is hazardous, then extreme care must be taken while initial filling of the pump using all safety and precautionary measures.

During the initial few minutes of operation, the following points are to be observed:

- Pump fluid discharges from the delivery pipe, no vibration in the pump.
- No abnormal noises.
- No leaks from the sealing system.
- If a pressure gauge is installed, check the pressure to stabilise.
- No abnormal heating at the stator and shaft sealing.
- The absorbed power as well as the suction and discharge pressure should be checked from order data sheet.
- Close the safety relief valve as soon as the pump reached its rated speed.
- Besides this following parameter should be checked:
 - Speed of the pump
 - Pressure
 - Viscosity of the conveying fluid
 - Percentage of solids in the media
 - Temperature of the conveying fluid
 - Flow Rate

These must correspond to the parameters (refer order data sheet) for which the pump was designed. The Progressive Cavity Pump manufactured by High Flow Equipment can generate excessive pressures that may even result in bursting of the piping or vessels.

 **Precaution must be taken when venting air in the system using hazardous liquids.**

5.6.1 GENERAL OPERATING REQUIREMENTS

Ensure following conditions are met during operation of pump/pump unit:

- Delivery pressure of the conveying fluid is stable and lower than the rated capacity of the pump model.
- Process operating requirements are met properly.
- Temperature of the conveying fluid is within the operating limits (as given in the pump order data sheet).
- Check the temperature of the bearing housing, as it is expected that temperature in this area may rise for a while when the pump is in operation for quite some time and may result in minor burns or scalds, if touched.
- In case the Progressive Cavity Pump is a part of a closed system, the discharge piping should be free from any trapped air (de-aerated) during operation.
- Once the pump has been running for some hours, check the tightening torque of the bolts and nuts. Repeat this check after one week of pump operation.

5.6.2 CLEANING OF THE PUMP

- Remove all dust and dirt which might corrode the pump body and / or its components.
- Put the pump in operating condition and use the suction port to supply the cleaning product. Ensure that the cleaning product is compatible with the fluid media to be pumped and the materials from which the pump is made.
- However, the cleaning time will depend on the process time of the pump. The pump needs to be stooped once the cleaning time is up.

5.7 SHUT-DOWN PROCEDURE

Following points must be observed when pump will be in stand by for a long time:

- The pump should not remain unused for long period of time. The pump should be operated at least once in a week, if possible. In case the pump remains idle it is advisable to rotate the pump shaft & motor shaft, by hand, once in every two weeks.

- Any contact between the internal components of the pump may be detected by rotating the pump shaft by hand.
- In case the pump is put into operation after a long period of time, it is advised to run the pump for a short period of time, without any pressure, to allow proper wetting of all rotating parts.

5.7.1 MEASURES FOR ABNORMAL PUMP OPERATION

In case of any deviation in operating pump, refer section trouble shooting chart given in the operating manual and take remedial action accordingly.

5.7.2 AUTOMATIC CONTROL

The use of safety devices that automatically start or stop the pump operation is always recommended e.g., safety relief valves etc.

5.8 MOUNTING TOOL & HOISTS

For mounting and installation of the pump/unit, no special tools are required. However, the user is advised to keep the following tools near the installation site of the pump/unit as may be necessary for installing, mounting, dismantling, re-assembly, or repair:

- Set of spanners
- Torque wrench.
- Mounting device
- Shims and distance rings, if necessary
- Bolt adhesives, e.g., Loctite® 243.

However, the user is advised to check the dimensions and weight of the High Flow Equipment Progressive Cavity Pump to ascertain whether the available hoisting apparatus is safe for the assembly and fitting of the pump.

TROUBLE SHOOTING CHART

List of Causes	Corrective Actions
Wrong direction of rotation	Check rotational direction of the pump as per data sheet and name plate. In case of wrong direction, change the drive motor wiring connections.
Air or vapour pocket in suction line	Ensure that the suction lines are full of liquid and the pump is vented. Check the level of the tank/reservoir and fill, if necessary. In case of negative suction, open the air vent till air remove then prime the pump. Check all lines, flanges, joints and connections for leakage and repair, if needed.
Inlet or suction pipe insufficiently submerged	Check liquid level in the reservoir and correct, as required. Clean up/replace Strainer or Filter element. Remove obstructions from the suction line, if any.
Suction pipe blocked	Clean suction pipeline.
Available NPSH too low	Increase suction line diameter. Increase suction head. Reduce Pump Speed. Simplify suction line configuration and reduce length.
Pump is not running at rated speed	Correct the pump speed as per data sheet.
Delivery pressure higher than rated	Check pressure head with a pressure gauge. Reduce the pressure head by increasing the diameter of the pipe. Use pressure relief valve on delivery line. Simplify discharge line to reduce pressure.
Air leak in suction line or stuffing box	Check flange & valve connections.
Viscosity lower than rated	Check and accommodate as per Pump data/performance sheet. Flow may reduce a lower viscosity.
Viscosity greater than rated	Check and accommodate as per data sheet. Motor power should be checked.

List of Causes	Corrective Actions
Gas or vapour in liquid	Arrange to flooded suction. Avoid inclusion of gas or vapour in liquid.
Pump speed too high	Reduce the pump speed when the conveying fluid media to be pumped is highly viscous - danger of cavitation.
Pump speed too low	Increase the speed of the pump when high suction performances are required and when the conveying fluid media is very thin (less viscous).
Specific gravity higher than rated	Check and accommodate as per data sheet.
Misalignment of couplings	Check whether coupling is worn. Re-align coupling. If worn out, then the coupling needs to be replaced.
Elastic element of the coupling worn-out	Relace the elastic element of coupling
Worn or loose / tight bearings	Replace bearings.
Foundation not rigid	Foundation bolt to be tightened properly.
Defective mechanical seal	Check seal faces and O-rings. If necessary, replace corresponding defective parts (in case of mechanical seal).
Worn mechanical seal	Replace mechanical seal
Oil level too low/high. lack of lubrication.	Ensure oil level as per maintenance schedule in installation and operation manual.
Wrong grade of oil	Ensure oil grade as per maintenance schedule in installation and operation manual.
Bearing too tight. bearing badly installed.	Ensure bearing fitment as per instruction given under installation and operation manual.
Excessive thrust	Ensure proper bearing (make and type) as per instruction given in installation and operation manual.
Too much oil in the bearing	Ensure oil level as per maintenance schedule in installation and operation manual.

List of Causes	Corrective Actions
Too much grease in the bearing	Ensure grease qty. as per maintenance schedule in installation and operation manual.
Pipes exert forces on pump	Ensure proper flange connection.
Relief valve spring badly adjusted	Re-adjust spring compression.
Relief valve jammed	Clean relief valve & re-adjust.
Relief valve chatter	Check the condition of the valve. If necessary, replace the valve with new one.
Improper location of safety valve	Use the safety valve after discharge line of the pump.
Stator swelling	Select a suitable stator material. Else use a rotor with diameter smaller than specified. Check the temperature of media.
Excessive interference between rotor and stator	Provide lubrication (e.g., through soft soap solution) between rotor and stator. Then give one or two rotations to the pump shaft.
Worn pump element	Dismantle the pump and replace defective parts.
Strainer obstructed or blocked	Clean/replace the strainer
Belt drive slipping	Check and adjust tension of the belt. Else replace.
Incorrect pump / drive mounting on base plate	Check & tighten the bolts.
Low voltage	Maintain the voltage as per data sheet.



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"Quality Assurance Certificate"

Customer

Purchase Order No

Purchase Order Date

Quotation No

Offer Date

Pump Sr. No

Pump Model

Capacity (m³/hr.)

Pressure (Bar)

Viscosity (CSt)

Speed (rpm)

Specific Gravity

Power Absorbed (kw)

Prime Mover Rating (kw)(Recomd)

Flange Connection(Suction)

Flange Connection(Discharge)

Special Features (If any)

This pump is designed & tested on above parameters for trouble free operations and found satisfactory.



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