

Original Instruction User Manual

Cryogenic Submerged Immersed Pump

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◆ SAFETY PRECAUTION

1. FOREWORDS



In the process of installation, use and maintenance, there may be one or more dangers, so only professionals can be engaged in the work. Before operating this equipment, relevant staff must read the manual, and understand all the content of the manual. All the charts in this manual should be read again, to comprehend all the contents relevant to safety control.

2. EXACTITUDE USAGE

Consult professional in the cryogenic industry, while install any cryogenic liquid equipment or pipeline. The material relevant used must have special physical properties to under the extreme low temperature. Low temperature can also lead to special thermal insulation problem and need to consider the factor of inflation and contraction. Dealing with above problems, installing special safety device and using other equipment are required to be guided by professional. We technical service DEP. is ready to answer any question about usage or installation this equipment.

3. HANDLE WITH CRYOGENIC LIQUID



The key to handle with cryogenic liquid safely is to learn about its feature, and use conventional test program on the basis of these knowledge. Because of the extreme low temperature environment and all the liquefied gas into a gas at a high conversion rate, we must abide by certain routine preventive measures and safety norms.

Any user of cryogenic liquid should be familiar with the characteristics of liquid medium and special safety precautions, also should master the user manual of the device. Consult relevant professional if have any puzzle about security handle method for liquefied gas.

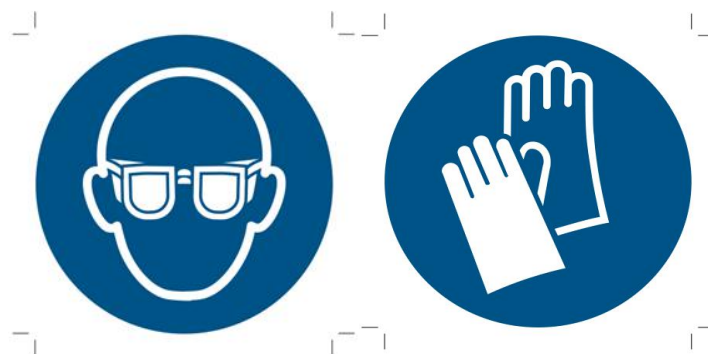
NOTE! These conventional security measures may not include all special protective measures recommended by this company.

Under the condition of different pressure and temperature, the characteristic of LNG is different from other characteristic of any liquid. But the potential danger of handle with all these liquefied gas result from their two properties: 1. Low temperature; 2. Fast gasification and big quantity.

The following routine preventive measures are aimed to avoid any potential harm or damage because of the above two properties of low temperature liquefied gas.

- 1) Handle with the liquid must be careful all the time.
- 2) If the liquid in extreme low temperature come into contact with the skin, the consequence is similar to burn.
- 3) When cryogenic liquid splash into the surface of skin, it will freeze a big area quickly. The gas which cryogenic liquid produced is cryogenic and can cause burn.
- 4) Forbid any part of body without protection contacting the pipeline, which have no heat insulation, otherwise when you try to walk away, the cryogenic metal will fast stick and tear up your skin. The primary emergency measure for this accident is to dip the burnt surface in the cold water, then ask the professional institution or professional to treat blisters of the skin or more serious burn.

4. PROTECTION





Protect your eyes with a pair of face shield or safety goggles. Must wear dry leather gloves, during deal with any low temperature object or when may nearest come into contact with cryogenic liquid. The gloves should be loose, so that hands can pull out from the gloves immediately, when liquid leaking or splashing into the gloves, When the pump is running on site, the maximum noise is about 75 dB at 1 m away from the pump center. People need to wear hearing protection devices such as earmuffs or earplugs in noisy environment for a long time. Paying attention to electricity safety and avoid electric shock when field circuit connection and equipment operation.

5. VENTILATION DEVICE

Cryogenic Pump only be installed and operated in a well-ventilated environment. In order to prevent gas excessive accumulation, handle with cryogenic liquid where must be always in a well-ventilated area. When there is no lifeline or no companion traction on the other side, never allow enter container or building which may have cryogenic gas. Because exist a serious security hidden danger when companion entry into a closed environment to save the fainted workmate.

NOTE! The mist steam generated when cryogenic liquid contact with air is just steam rather than gas itself. The gas that liquid vapor is invisible.

6. NITROGEN SYSTEM

Nitrogen which was vented or discharged to a closed area can replace 21% oxygen in the air. If people try to come into the atmospheric environment of low oxygen content, that will result in suffocation without any obvious sign. When oxygen concentration is less than 15% or lower, it will cause drowsiness and confusion, and that symptoms may be concealed by mental pleasant illusion. When oxygen concentration is less than 12% or lower, people will lose consciousness immediately without any obvious sign. If someone stay in low oxygen environment for a long time, that will lead to brain damage even death. Transfer the people to well ventilate area immediately, who seem to have any symptom of dizziness or lose consciousness during doing relevant work of nitrogen. Artificial breath should be taken immediately, if breath has stopped. Also should request medical assistance at once, whenever individual is unconscious.

7. HIGH PRESSURE GAS

To guard against over pressure, the high pressure discharge pipe of the pipeline system must be equipped with a suitable high pressure safety relief device, if the pipeline system is equipped with a booster pump. When the inlet and outlet valves of cryogenic liquid storage tank are both closed, nevertheless the rest of the fluid is still in this system, the import and export of return pipeline in system also must be equipped with low pressure safety relief device, which is called safety valve. If allow to heat cryogenic liquid in system, that will come into being enough high pressure, which will result in nearly all vessel breaks and explosion, along with which to release stored energy.

8. EXPLOSION PROOF STATEMENT

8.1 Ex Marking



8.2 Special conditions for safe use

- 1) Should follow relevant order, resolution, law, directives and standards, which are appropriate for this equipment installation.
- 2) The install stools used should apply to explosive gas atmospheres.
- 3) All of the safety accessories should be correctly installed, connected and set with signal value.
- 4) After installation, stress between pipe, pump pool and pump should be eliminated.
- 5) Degreasing cleaning and removing any impurity of inside pipe before connecting pipe to the pump. Transported fluid shall not contain any impurity which lager than $10\ \mu\text{m}$.
- 6) After installation, before precooling and running, using Dry Nitrogen gas (pressure $> 1\ \text{MPa}$) to purge the tank ambient to replace inside air at least 40-60 mins.
- 7) The precooling process shall not less than 15 mins before running. Before reaching the service temperature, it not allow pump to operate.
- 8) The bearing is lubricated and cooled by passing cryogenic fluid, no additional lubrication. The cryogenic liquid shall submerge the whole pump before running.
- 9) Without fluid pass through, the running is prohibited; During the running, the valve shall turn on.
- 10) The pump shall be installed according to the requirement of EN 60079-14 latest version (or its National equivalent standard) and shall only be installed by qualified electricians experienced for electrical work in explosive atmospheres.
- 11) The equipment is subject to all special installation and maintenance instructions referred to the user instruction. Initial and periodical inspection at least once a year according to the EN/EC 60079-17 is applicable to ensure the equipment remains in a safe condition.

- 12) The temperature transmitter shall be installed on the gas return pipe to monitor the gas return temperature.
- 13) The measure that make sure the inside tank is safety area shall comply with SIL 1 at least.
- 14) When the outlet pressure of the pump is 0.1MPa lower than the inlet pressure of the pump, the liquid volume in the tank is insufficient and the liquid entering the pump is not smooth, the pump stops immediately.

If the above regulations are not implement,the company will not be responsible for the losses caused.

9. USER RESPONSIBILITY

Installation, operation and maintenance of this equipment, which customer had ordered, must follow the rules according to the manual and relevant document. Equipment with any defect shall not be used anymore. Replaced the part immediately, once it has damage or wear or deformation or contaminated. When need to repair or replace this equipment, contact the franchiser.

If equipment failure or bad consequences result from user damage either because of improper operation or maintenance, or use other company's part, that shall be assumed by customer.

10. SPARE/SERVICE

User can confirm the required spare parts from the Parts list (refer to the appendix) or the corresponding assembly drawing. When user plan to order part, please provide the following information:

- 1) Serial number of the product's nameplate.
- 2) The name on the Parts list.
- 3) The required amount.

◆PRODUCT INTRODUCTION

1. PRODUCT PROFILE

Cryogenic pump is a special pump, which is designed to transport cryogenic liquid, such as liquid nitrogen, liquid argon, liquid hydrocarbons and liquefied natural gas, etc. in the field of petroleum, air separation equipment and chemical plant. Its application is conveying low temperature liquid from low pressure place to high pressure place. With the development of air separation technology, low temperature liquid is widely used and developed. The main

function in the air separation equipment is liquid circulation, or to extract liquid from the storage tank and press the liquid into the carburetor, then convey to the user after vaporization.

The medium cryogenic pump conveyed is only cryogenic liquid, so must maintain low temperature in the process of pump liquid. If once the pump absorbs the more heat from the around, the gas generated because of a lot of vaporization of cryogenic liquid will affect the pump work. Thus cryogenic pump has its own special requirements in structure, material, installation and operation of such areas to achieve requirements for cryogenic liquid pumped.

Cryogenic pump is a vertical, grade 3, direct coupling pump, which is directly mounted on a drive motor. All of these components are housed in a pump tank, which bear pump suction pressure. The motor of the pump units does not require the use of seal, because the motor is designed be submerged in the liquid pumped. The submerged motor is a part of standard supply units, all components are fully assembled together. The maximum pump capacity depends on the speed and frequency of the drive motor. No sealing model centrifugal pump is particularly suitable for the device which cannot tolerate product loss caused by the shaft seal leakage.

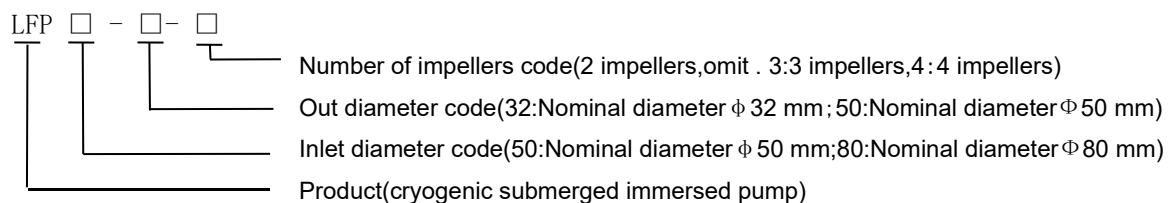
Cryogenic pump should be driven by an frequency inverter. If the inverter manufacturer's instruction is provided, from which you can obtain the operation manual for motor.

NOTE! Variable frequency motor must be equipped with frequency inverter. Please refer to the inverter manufacturer's instruction for more specific information about the frequency inverter.

NOTE! The frequency inverter is set to a constant voltage / frequency ratio: 380V@85Hz.

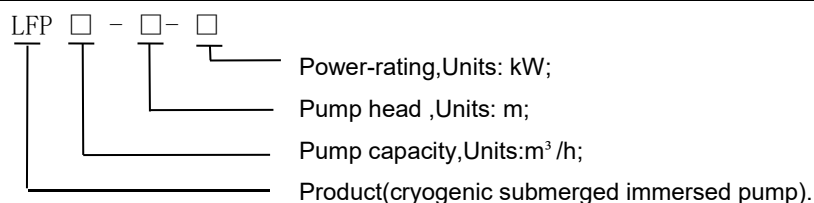
WARNING! Because the motor designed to be submerged lubrication by the liquid pumped, the specialist of submerged pump itself do not apply for liquid oxygen condition.

2. Model description



For example:

LFP50-32-3 means Inlet diameter: 50mm,Out diameter: 32mm,Cryogenic Submerged Immersed Pump with 3 impellers.



For example:

LFP20-280-15 means pump capacity: 20m³ /h, pump head: 280m, Power-rating: 15kW, Cryogenic Submerged Immersed Pump.

3. TECHNICAL PARAMETERS

Model	LFP50-32-3	Power-rating	(7~15) kW
Type	Cryogenic Submerged Immersed Pump	Power Supply	(170~380) V
Pump Capacity	20m ³ /h	Phase	3
Pump head	220 m	RPM Range	(2400~5100) r/min (inverter)
NPSHr	0.9 m	Process Temp.	-196℃~-82℃
Impeller Stage	Grade 3	Pump Kilogram	≈85 kg
Transport Medium	LNG、LN2	Pump Dimension	Φ 235×844(mm)
Ambient Temperature Of Equipment Operation			<-80℃

Model	LFP80-50-3	Power-rating	(10~22) kW
Type	Cryogenic Submerged Immersed Pump	Power Supply	(170~380) V
Pump Capacity	30m ³ /h	Phase	3
Pump head	280 m	RPM Range	(2400~5100) r/min (inverter)
NPSHr	0.9 m	Process Temp.	-196℃~-82℃
Impeller Stage	Grade 3	Pump Kilogram	≈200 kg

Transport Medium	LNG、LN2	Pump Dimension	Φ 290×935(mm)
Ambient Temperature Of Equipment Operation			<-80℃

Model	LFP20-280-15	Power-rating	(7~15) kW
Type	Cryogenic Submerged Immersed Pump	Power Supply	(170~380) V
Pump Capacity	20m ³ /h	Phase	3
Pump head	280 m	RPM Range	(2400~5100) r/min (inverter)
NPSHr	0.9 m	Process Temp.	-196℃~-82℃
Impeller Stage	Grade 4	Pump Kilogram	≈105 kg
Transport Medium	LNG、LN2	Pump Dimension	Φ 275×800(mm)
Ambient Temperature Of Equipment Operation			<-80℃

4.STORAGE BEFORE INSTALLATION

- 1) Check before company deliver the product
Each pump is well-worked delivered from we company, which test with LN₂ before delivery. At the same time, the pump is fixed by adding clamps inside the wooden box to ensure the stability during transportation.
- 2) User Inspection after receipt
Once receipt, inspect the product immediately and report the damage resulted in the transport to the transport company or we company.
- 3) Storage of the pump
If the pump will not come into use at once, must store it in a dry environment and prevent from oil, dust, sand and water.

WARNING! Do not tear down the stretch film or other protecting object, which are used to protect the inner parts of the pump against the dirt and moisture, unless before installation.

NOTE! Periodically inspect the reserved equipment and spare parts at least every six months. User must dispose of dirt, moisture and other impurities before the pump work.

Inspection cycle above is only for your reference, user should act according to the actual situation of yourself and comply with safety regulations.

◆ PUMP INSTALLATION

DANGER! Do not used for oxygen service!

DANGER! Because of the electricity!

DANGER! Because of hypoxia caused by liquefied gas and air !

DANGER! Injury from cryogenic surfaces!

DANGER! Injury due to improper installation and initial startup!

1. SECURITY ALERTS AND PREVENTIVE MEASURES

During installation and initial start-up of a pump assembly, also take notice of the following special safety instructions and precautions in addition to those provided elsewhere in this manual. Improper installation and initial startup may lead to serious injury and significant property damage.

These special safety instructions and precautions include the followings:

- 1) Before work, ensure there is sufficient clearance to other objects.
- 2) Ensure order and cleanliness in the installation area. Components and tools lying loosely on or around each other can cause accidents.
- 3) When lifting pump assembly (motor and pump) at any time, adopt appropriate methods and lifting points.
- 4) Install components correctly.
- 5) Ensure components do not fall out or collapse after sub-assembly.
- 6) Ensure the following before initial startup:
 - a) Make sure that all installation processes has been carried out and completed in accordance with the information and instructions in this manual.
 - b) Insure no person is in the hazard area during startup.

2. INSTALLATION OF THE PUMP

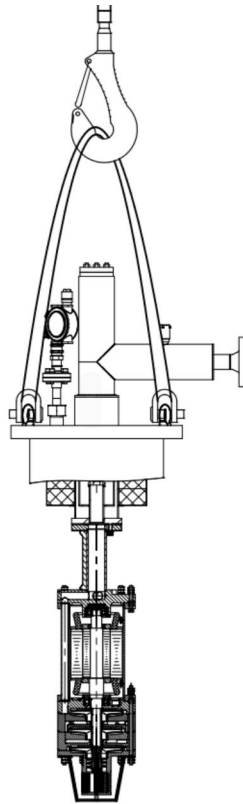
The installation of the pump includes the following processes:

- 1) Disassemble the cover of pump tank and Lift it from the vacuum pump tank(It can only be lifted through the two lifting lugs on the pump tank cover), then firmly connect the bottom flange on the pump tank and the flange of pump assembly with bolts, at the same time twist them trough the steel wire to prevent loose (Refer to Appendix I : Instructions for use accessories).
- 2) Lift the cover of pump tank and pump assembly, which are firmly connected with each other, into the vacuum pump tank. Tighten the bolts on the cover of the pump tank.
- 3) Connect the motor to the matched control system.

3. INSTALLATION AND LIFTING

- 1) Use the sling, which located under the pump body and motor and around them, to lift the pump assembly, if pump assembly is not installed on the pump tank cover
- 2) Only can use the two ringbolts or lifting lugs on the head cover of pump tank to lift the pump assembly, if the pump assembly had been installed in the vacuum pump tank, and forbid to lift with slings around the pump tank. The lifting belt is not allowed to cross, twist and knot, and the lifting belt is evenly stressed. As shown in the figure below.

Note: the lifting personnel must be professionals, and must work in accordance with the relevant specifications to ensure the safety of the lifting process.



Hoisting diagram

4. PIPING

The surfaces of pump connected with pipe flange must be parallel, install them effortlessly, flange bolt holes must be completely alignment. After completion, place spacers between the two flanges and butt them up.

5. CIRCUIT CONNECTION

- 1) Before pump body putted into vacuum pump tank, tree wires of connector sealing

tube at the cover of vacuum pump tank and the motor should be arranged with clamp connection. In order to achieve the effect of sealing and insulation, using heat shrinkable tube respectively to heat the connecting three conductors, which connected well(Refer to Appendix I : Instructions for use accessories).

- 2) After pump body installed in the vacuum pump tank, connect the tube of frequency converter and three conductors from the other side of sealing tube with the same method, and enclose them by a heat shrinkable tube.

NOTE! Confirm the motor is connected with the power supply conform to the voltage value on the nameplate. In order to make the motor can deliver sufficient electric current, the LFP50-32-3 cross-sectional area of power outgoing wire shall be not less than 6mm².the LFP80-50-3 cross-sectional area of power outgoing wire shall be not less than 10mm².The electrical circuit shall be equipped with over-current and overload protection.

6. SAFETY INERT DISPOSAL

- 1) For the pump assembly apply to pumped LNG or LN₂, its essential to remove all oxygenated substances including air through safe inert disposal for the entire equipment particularly the pump tank and the pump motor unit.
- 2) Oxygen and natural gas can form an explosive mixture that can be ignited, for example, by a spark of shorting electric motor wire. Without oxygen, whatever electric motor conveying LNG works safely under any circumstance.

7. OTHER INSTALLATION NOTES

- 1) During pipeline installation, the pump prone to deformation or displacement because of the pipeline stress, and that may affect the normal operation of the pump. Therefore, no stress on the pump!
- 2) Check all the pipelines before connect, inside there is no impurity, and then degrease clean the pipelines according to the pipeline cleaning procedure. Before the pump body finally installed into the vacuum tank in the process of installation, also need to carefully check cleaning of the pump body, where inside of the cylinder and the all the visible inner/outer surface. Purge and clean after properly clean, to ensure that the working fluid supplied to pump without mechanical impurities.
- 3) The inlet pipe should be as short as possible, must use vacuum tube to reduce heat loss if the inlet pipe is more than 3 meters.
- 4) Reduce the account of tee, valve and elbow as far as possible where at the inlet pipe, in order to reduce the pressure loss of the inlet pipe. Must install the necessary pressure gauge, vent valve, filter, vent pipe, etc. Vent pipe must be draw from the upper part of the pump tank, to ensure the discharge gas successfully from the main pipeline.
- 5) Add a draft tube to the liquid discharge port, vent valve and safety valve discharge, to lead liquid or gas to the security discharge position, draft tube's diameter should

not be less than 15mm.

8. INLET PRESSURE AND NPSH

Net positive pressure required (liquid height representation) during the pump runtime should be greater than liquid vapor pressure of the pump inlet, even if the inlet pressure is very high, the NPSH value will still not enough. NPSH is only the difference value between the actual liquid pressure and the liquid vapor pressure.

9. DIRECTION OF ROTATION

Check the rotation direction of pump after pre-cooling. If the pressure does not rise normally after the pump power-on within 5 seconds, cut off the power supply, restart the pump after exchange the direction of rotation.

10. BEARING LUBRICATION

The special rolling bearing and motor shaft, which are used for support pump, will be cooled down and lubricated by the liquid flow through inside the pump, so no longer need any other form of lubrication.

Technical operators on site must ensure that pump had been submerged in the liquid absolutely before run the pump, thus guarantee the upper shaft lubrication.

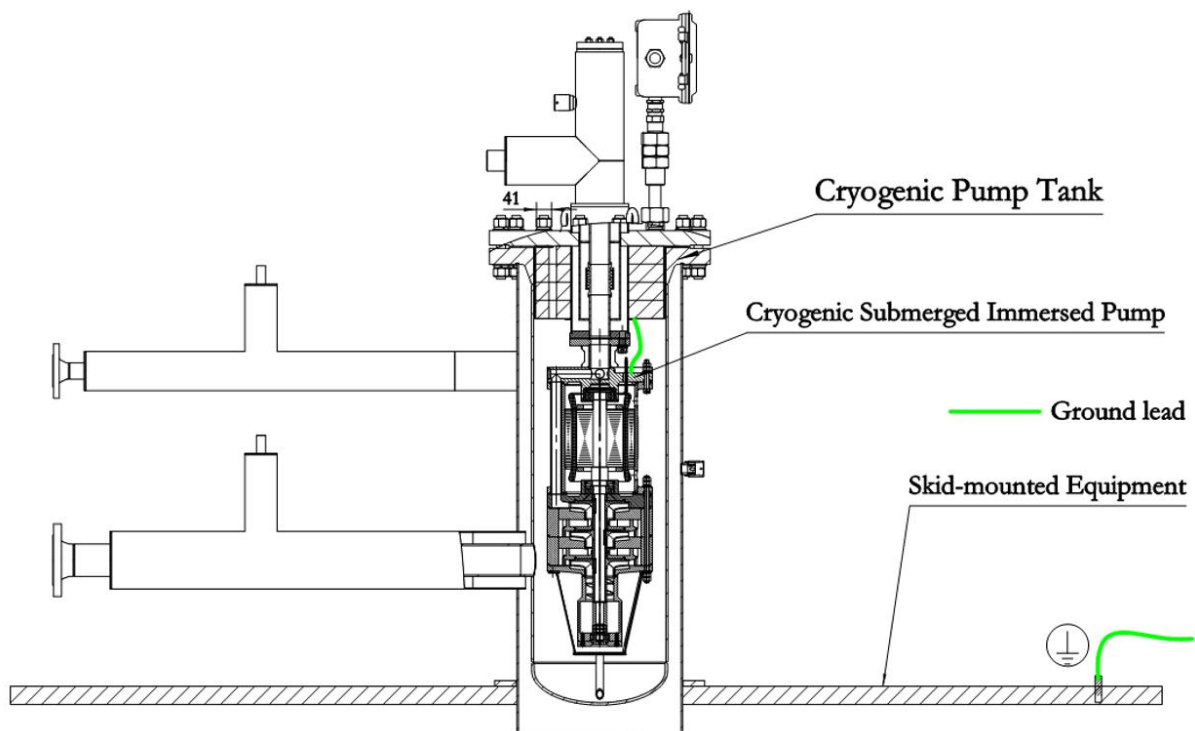
WARNING! In order to prevent damage to the shaft, the pumped liquid must be clean and have no mechanical impurity, which exceed 10 micrometer. The damage caused by mechanical impurity does not belong to warranty range.

11. UNLOAD THE VEHICLE

The pump work frequency can't exceed 70Hz, while unload the vehicle.

12. EARTH GROUNDING REQUIREMENT

The cryogenic submerged immersed pump is fixed with the cryogenic pump tank through the flange. The external grounding point of the pump body is connected with the pump pool in the pump pool. The low-temperature pump pool is fixedly installed on the skid. The skid platform must be equipped with an external grounding point to ensure that the grounding from the pump body, pump tank to the skid platform is in good condition.



◆ PUMP OPERATION

WARNING! Do not attempt to operate the pump before complete installation, cleaning all pipe system and purge pipe system and pump.

WARNING! Never operate the pump with no flow. Valves must be open to allow liquid flow through the pump at any time when work.

NOTE! Never operate the pump, if pre-cooling still not cool down the pump to the normal working temperature. When the temperature of the gas return pipeline is lower than $-110\text{ }^{\circ}\text{C}$, the pump can be started because the pre-cooling of the pump is sufficient. When the temperature is higher than $-110\text{ }^{\circ}\text{C}$, the pump is not allowed to start because the precooling of the pump is insufficient.

NOTE! When the pump inlet pressure is 0.1MPa lower than the pump outlet pressure, the liquid in the tank is insufficient and the pump inlet is not smooth, the pump shall be shut down immediately.

1. CHECK BEFORE TEST RUN

- 1) Insure whether there have enough liquid in the tank to do the prospective pump works.
- 2) Insure the drive system have been connected to the power supply.
- 3) Insure the accept system ready to receive the liquid pumped.
- 4) Check all of the pipelines, connectors and fixing bolts are ready.

- 5) Insure that pump and pump tank already handled with inert through dry nitrogen, if the pump apply to LNG.

2. PRE-COOLING FOR PUMP

Slowly open the inlet liquid valve and return liquid valve, let the liquid fill the pump tank and pre-cool pump at least 15 minutes. Observe the temperature reading on the return gas pipe point, determines if the pump pre-cooling meet the relevant requirement. NOTE! Return gas pipe pressure = pump inlet pressure = The tank pressure.

3. START PUMP

The motor must be supplied power through the frequency inverter, and start the pump by means of it.

- 1) Start the pump via power the motor on. When inverter driver works, should start the pump in low speed and reach the normal work speed. If the pressure reading of pipeline still be low within 10 seconds after reached the full speed, then power off the motor, restart pump after changed the rotation direction of the motor. If the pressure failure to rise again within 10 seconds, stop the motor, rerun the motor after increase the pressure of the storage tank. Repeat the above steps until pump pressure boost.
- 2) Stop running if there is abnormal sound after start, adjust the opening degree of frontal and back valves, adjust frequency of frequency inverter. Bring pump to normal working state, also should pay attention to the export orientation of safety valve at the same time to prevent damage caused by safety valve take off.

4. STOP PUMP

- 1) When the receiving container is full, or pump conveying process have been completed, press the stop button, close inlet and outlet valves and open the return gas valve at the same time, this will enable the outlet pipe pressure to reduce the same pressure of the tank. And then partially open the vent valves, close the valve on the storage tank.
- 2) Shut down the valve of the receiving container and open outlet discharge liquid valve.
- 3) For insure system security, check the pressure of storage tank. Can reduce the pressure by open the vent valve located at top of storage tank.

WARNING! Don't try to control the pressure through the main inlet valve, the main inlet valve should be kept fully open in the whole operation process of pump; before liquid completely vaporized ,which is in the liquid inlet pipe and the vacuum tank, do not close the return gas valve, otherwise the rise of pressure will lead to the safety valve take off.

◆ DISMANTLE AND INSTALLATION

DANGER! Danger due to the liquefied gas!

WARNING! Danger due to the pressure!

DANGER! Danger due to the low temperature on the surface!

WARNING! Danger due to the risk of unauthorized restart of the pump.

1. CONFIRMATION BEFORE DISMANTLING

Take the following steps to ensure that proper dismantling.

- 1) Pump assembly and the associated piping system must be in the ambient temperature.
- 2) The power must be cut off.
- 3) Pump assembly and the related piping must be purged with nitrogen.
- 4) Pump assembly and the related piping must be decompressed to the atmospheric pressure.

2. DISMANTLING

Dismantle the pump assembly according to the following procedure.

- 1) Confirm all the above steps have been completed.
- 2) Disconnect the motor and its control system.
- 3) Remove the related fasteners from the pump pool cover.
- 4) Move the pump unit from the pump pool flange carefully.
- 5) Immediately cover the pump pool flange and the interfaces with the suitable blind flange or plastic sealing.
- 6) If using the blind flange in the above steps, there must be a small opening equipped with safety valve, in order to avoid overpressure while opening the valve and the liquid flowing into the pipeline.

3. INSTALLATION

Installation is basically the reversing sequence of the remove, and to abide by the following points.

- 1) Don't remove the lid of the pipeline and interface, until they are directly connected.
- 2) Use a new gasket.
- 3) Don't tighten the fasteners on the foundation until the pipeline connection is secured and the pump is cooling down.
- 4) Check if the three-phase motor wiring is properly connected.

5) The bolt tightening torque requirements are shown in the table below:

Bolt specification	Tightening torque (N·m)	Bolt specification	Tightening torque (N·m)
M10	50 ~ 55	M16	200 ~ 210
M12	75 ~ 80	M22	500 ~ 510

◆ FAULT AND METHODS

1. FAULT AND TROUBLESHOOTING

- 1) Possible reasons for the failure and troubleshooting steps, please see Table 1 "Fault and troubleshooting methods".
- 2) If probability of failure increased, should be based on the actual operation experience to adjust repair time interval.
- 3) If can't according to table 1 " troubles and troubleshooting methods " to trouble shoot, please contact the franchiser.

Table 1 Fault and troubleshooting methods		
Troubles	Possible reasons	Troubleshooting methods
No pressure/ No liquid delivery	Steering error	Check the direction of rotation
	Lack of liquid	Add liquid
Not according to the rated flow and pressure transmission	Insufficient net suction pressure	Rising storage tank pressure
	Steering error	Check the direction of rotation
	Low inlet pressure	Rising inlet pressure
	Vanes or volute passage obstruction	Disassembly, inspection and cleaning
	Vanes damage	Replace

Pump body vibration	Insufficient Pump body vibration gas corrosion allowance	To improve the cavitation allowance
	The liquid vaporization serious	Improve the cavitation allowance
Pump body vibration (continued)	Bearing wear	Replace
	Rotating components damage	Replace
Bearing overheating or excessive wear	Bearing too tight or pre-load is too heavy	Remove and repair
	Improper cooling	Check the filter and internal lubrication channels
	Vibration	Replace bearing
	External impurities in the system. The bearing is too dirty or There is water	Cleaning vacuum tank, filter and pump

2. INSPECTION AND MAINTENANCE

Most of the materials used in the pump assembly are steel, without harmful materials, which can be directly recycled after the pump is abandoned.

TO keep the best state of trouble-free operation of the pump unit, suggest to check and maintain the pump by the methods below:

WARNING! Only professionals are allowed to operate the works below.

Time	Preventive maintenance
Any time	Have no abnormal noise
A week	Check all the bolts and screws are not loose
Each 4000 hours	Check the operation noise of the bearing is normal or not, replace it if necessary; Check the cable, including the insulation aging wear or damage inside junction box; Check if the liquid flow freely, ensure the

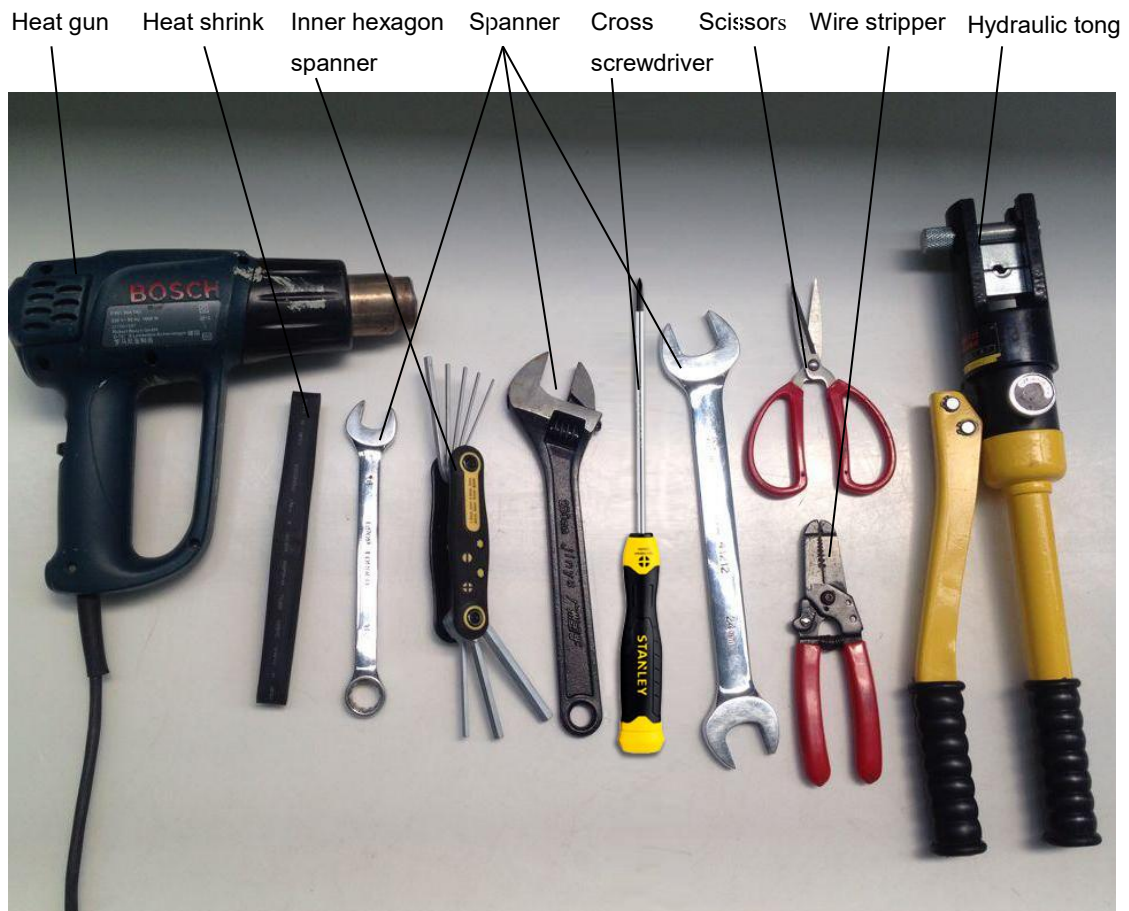
	cooling liquid flow smoothly. Check whether the filter screen is damaged. If it is damaged, stop using immediately and contact the manufacturer to provide replacement parts.
Each 8000 hours	Disassembling the pump body, and check the wear of all parts; check every 4000 hours at the same time and replace bearing.

◆ FAST OPERATION GUIDE

This guide is designed to the installation and key points for attention when using in using a visual overview description, in order to further protect the users to install and use the pump.

1. INSTALLATION STEPS

- 1) Preparation before installation: Ready with the tank vacuum jacket of pump, the pump and necessary installing tool; The necessary degreasing cleaning of equipment and tools. The main using tool for installation are as shown in picture below.



- 2) Through the joint assembly, In thread wrapped with raw material, Using a wrench through the six party at the threaded hole connection box assembly screw pump tank cover on the inner(reference to figure 1). While installing the Junction box, as far as possible to avoid the mutual rotation between parts, because there is direct current , If the relative rotation is too heavy, the 3 wires in the motor of tank pump may be even snare because twine each other.
- 3) Hang the cover of pump tank up, and put the pump upright with outlet flange upwards. Move pump below the cover of pump tank, Adjust position between the pump tank cover and the pump outlet flange, make the pump outlet flange and the 4 threaded holes on pump tank cover are aligned with each other. Put the spring energy storage ring, fastening pump to the cover of pump tank through bolts and nuts using a wrench.
- 4) Plug 3 wire of motor into the cable lug, use hydraulic forceps to press tight.
- 5) Use thermal heating gun to bake heat shrink tube external the nose line, heat shrink tube will become soft shrinkage at 105 °C. Note the uniform heating, heating layer thick heat shrink tube.
- 6) The pump with pump tank cover lifting to the pump tank, and properly install the pump tank cover, at once finish the installation of the pump body.
- 7) The pump must be supplied power through the inverter, are not allowed to avoid the frequency converter pump at any time. Operation frequency is arranged according to the pump nameplate on the speed.

NOTE! During the process of transportation and installation, there should not have a collision. Otherwise, immediately stop installation, check for housing damage and communicate with manufacturer to ensure whether the pump could work on.

2. IMPORTANT OPERATION STEPS

- 1) Check before the test run
 - a) Assurance the level of liquid. The liquid level in the storage tank must be maintained at more than 3 meters, the inlet pressure conforms to the provisions of the pump nameplate.
 - b) Before putting pump body into tank pump vacuum jacket, should first connect motor and inverter wiring, 3 wires were insulated joints.
 - c) Set parameters of converter, reference parameters of motor pump nameplate.
 - d) Piping accessories such as inlet and outlet pressure gauge, import / export valve are correct installed and degreasing treated, according to the pump flow chart.
 - e) Use sufficient nitrogen to replace the inside air of whole device including the pump tank, pump , motor, tank and pipeline system, to ensure the system without water and all the compounds containing oxygen.
- 2) Cryogenic pump fully Pre-cooling
The cryogenic pump system by oxygen replacement after the completion of the work, slowly open the inlet valve and return valve, pre-cooling for at least 15 minutes, to observe the return air temperature. After ensuring the pump cooling had finished,

half open return valve, slowly open the outlet valve to the opening degree of 1/3.

3) Start the pump

After check the startup conditions have completely, start the pump at the rated speed 65%. If there is abnormal sound, should stop immediately and check. If the pressure raise up after starting pump, adjusting the outlet valve opening and adjust the frequency, so that the pump to normal working condition.

If the pump can't increase pressure within 10 seconds (pressure gauge without swinging back and forth), need to immediately stop the pump and cooling pump for 3 minutes, and then restart the pump. If pump can't increase pressure twice again, need to change steering pump via the frequency converter then restart.

4) Stop the pump

After stopping the pump, close the inlet, outlet valve, and open the valve, release the pressure of pump tank.

After the pump is stopped firstly should ensure that the safety valve of the pump can work normally. After the pump is stopped, must maintain a certain slight pressure in pump tank. If the vent valve located on pump tank open for a long time, after pump pressure drop to atmospheric pressure, because the pump tank and the pump body is still cold, moisture in the air will enter the pump tank, lead to them in the pump body condenses into drops of water. These attached to the bearing, impeller, water, are relatively closed, it is difficult to purge out. The next time, water will be frozen into the ice of a cryogenic liquid, the bearing can't operate normally, it's serious that this still can burn out the motor.

If found the pump water during operation, the user must stop immediately, and lifting the pump tank. When the pump and pump tank completely heat, firstly clean pump tank water, and then flat pump, the pump purge for about 10 hours by hot air, blow out the evaporation of water in the pump body. In the blowing process, the pump needs to be heated to 40 °C, and change the direction of pump and hot air entrance, every 2 or 3 hours.

◆ APPENDIX I : INSTRUCTIONS FOR USE

ACCESSORIES

1. Accessories list

No.	Name	Material	Specification	Amount
1	Cross recessed pan head screw	A2-70	M6×10	6
2	Hex Nut	A2-70	M6	6

3	Shrinkable tube	Polyolefin	H ϕ 16/8	1000mm
4	Steel wire	06Cr19Ni10	ϕ 0.7	1000mm
5	Cable lug	T2	OT-50A	9
6	Spring washer	06Cr19Ni10	6	6
7	Flat washer	A2	6	6

2. The Location of Cable lug used

Copper wire joint.

Method of use: Strip a certain length insulation layer out of the copper wire, then plug it into the cable lug hole. Use fast hydraulic pliers to press those tight. Strip a certain length insulation layer out of another copper wire, then plug it into another cable lug hole. Use fast hydraulic pliers to press those tight. Connect the two cable luges with screw, refer to the picture 1 below.

3. The Location Shrinkable tube used

Set out in the pressed copper wire exposed.

Method of use: Set a certain length of shrinkable tube out in the pressed copper wire where is exposed. Use heat blower to heat the shrinkable tube until it shrink uniformity. Once again set shrinkable tube out in the tube which has been shrinking, and use heat blower to heat the shrinkable tube until it shrink.

NOTICE! No damage in the shrinkable tube.

4. The method of use for Steel wire

Twist the steel wire around the screws which connect the motor cover of submerged pump and the flange of pool pump to prevent losing. Refer to the picture 2 below.



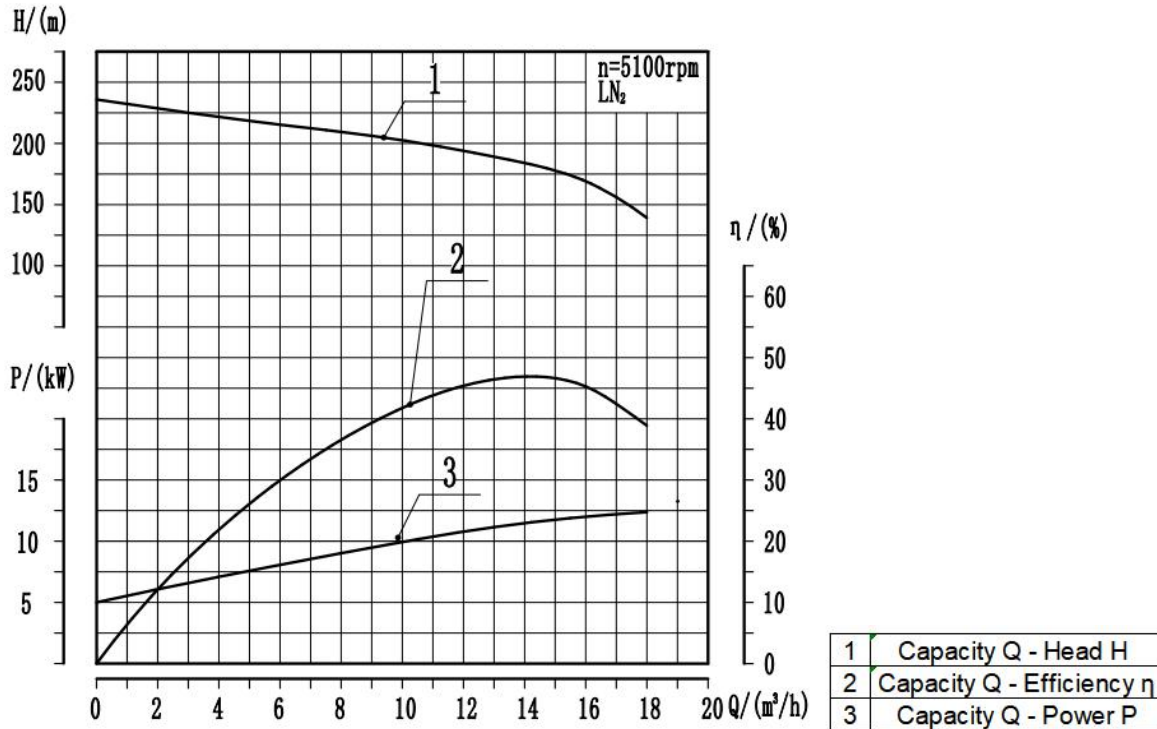
Picture 1



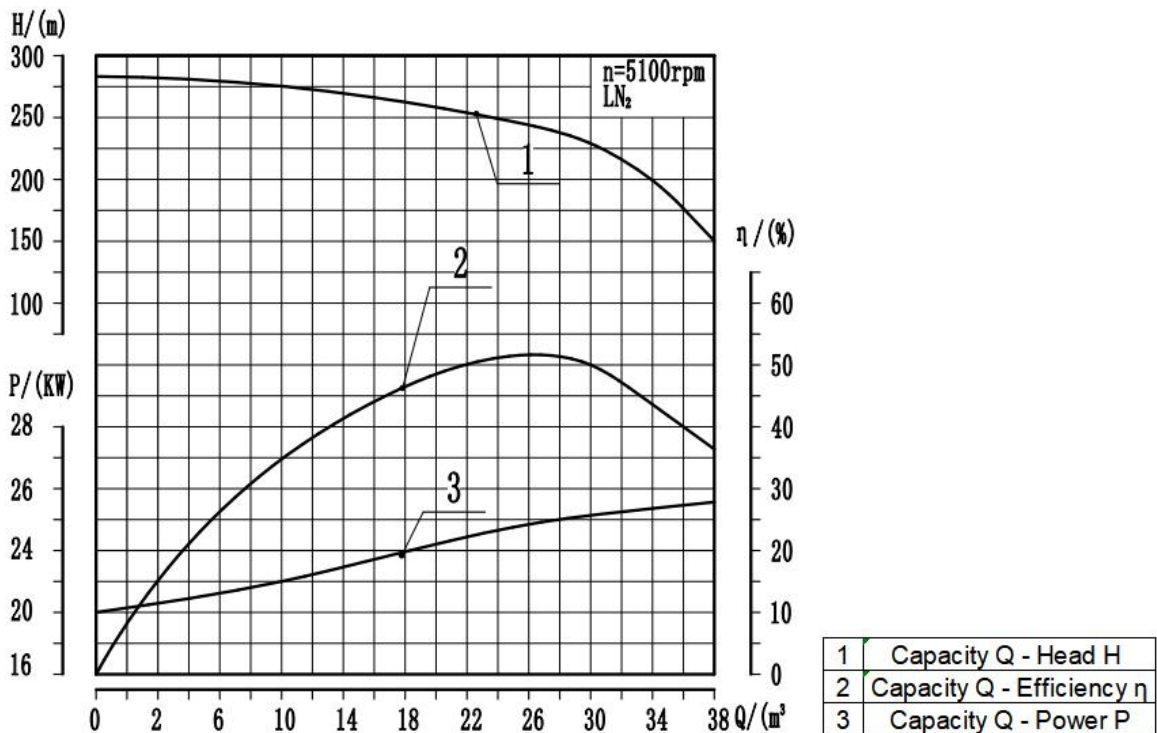
Picture 2

◆ APPENDIX II : PERFORMANCE PARAMETERS

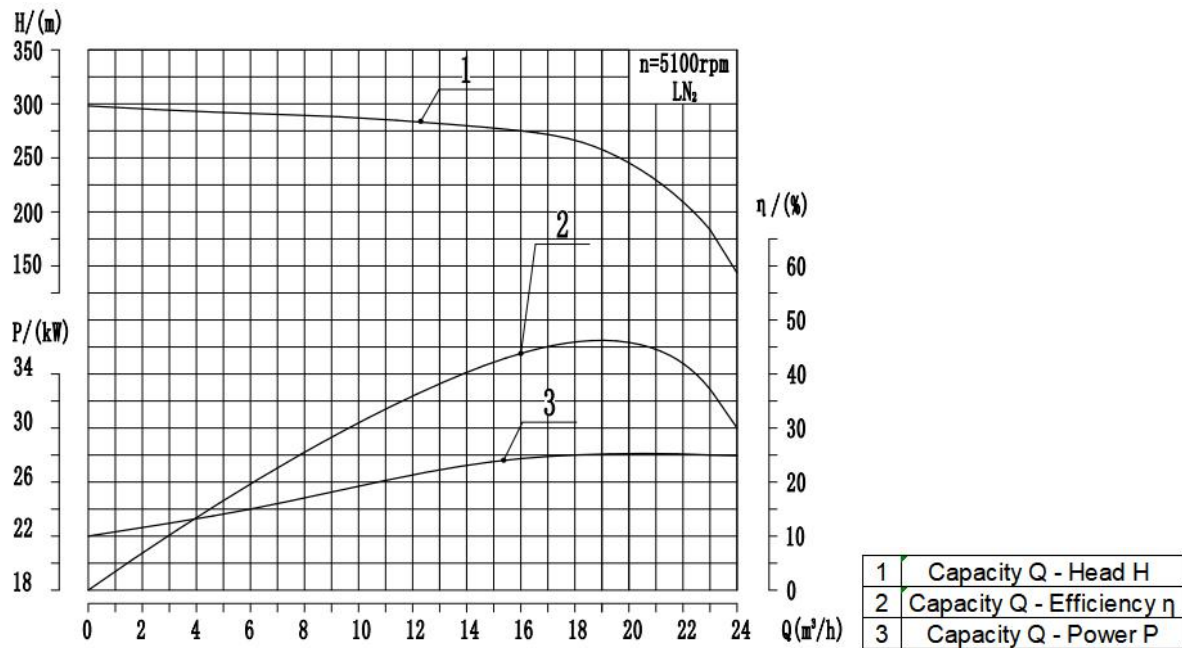
1) LFP50-32-3 cryogenic submerged immersed pump



2) LFP80-50-3 cryogenic submerged immersed pump

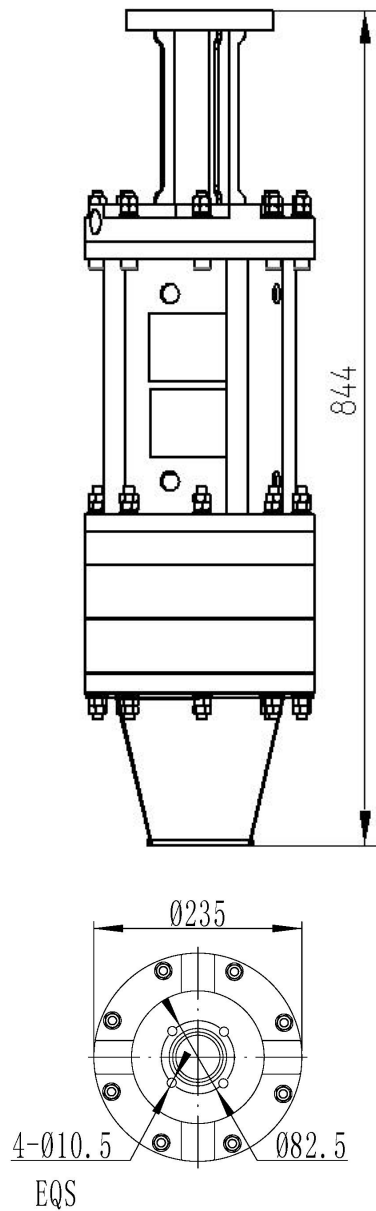


3) LFP20-280-15 cryogenic submerged immersed pump

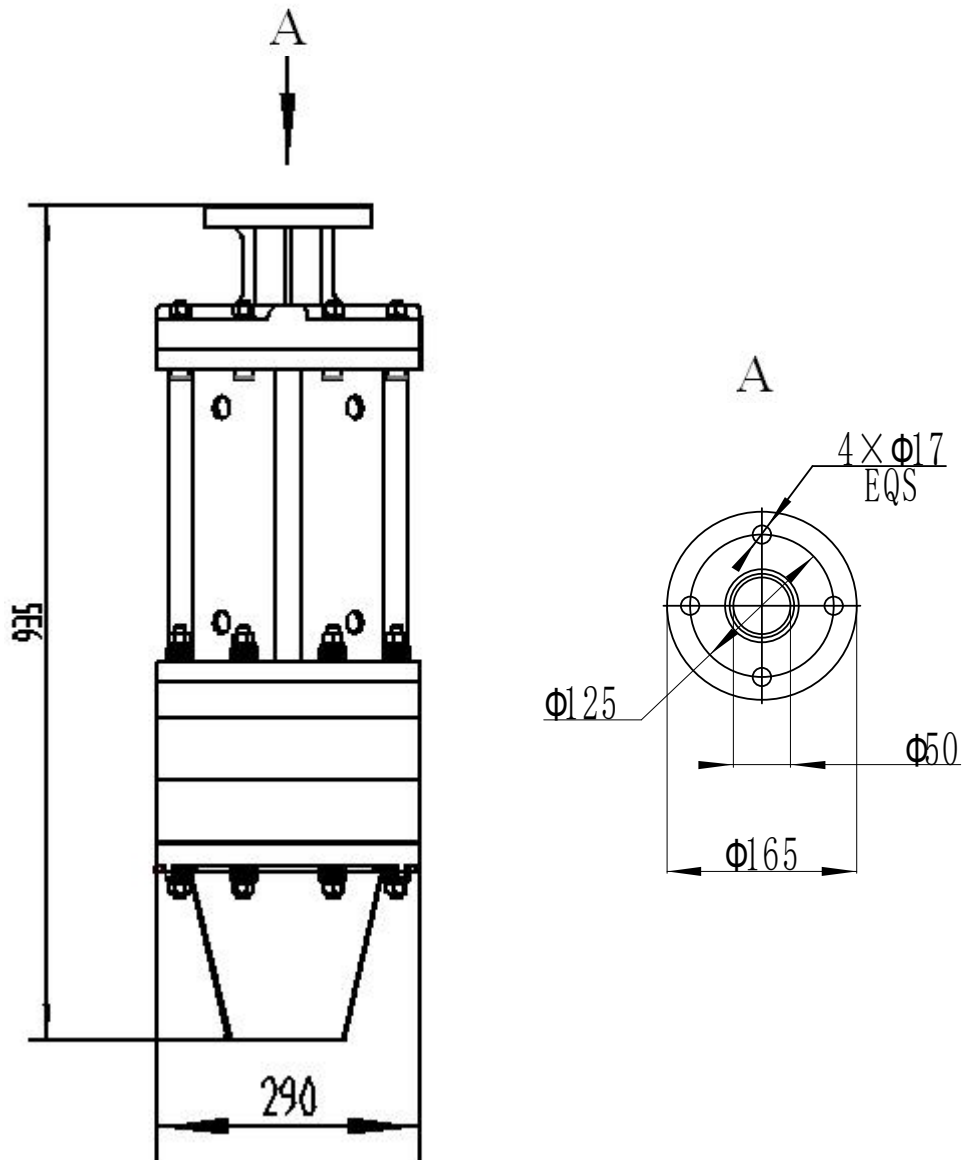


◆ APPENDIX III: PUMP OVERALL AND INSTALL DIMENSIONS

1) LFP50-32-3 cryogenic submerged immersed pump

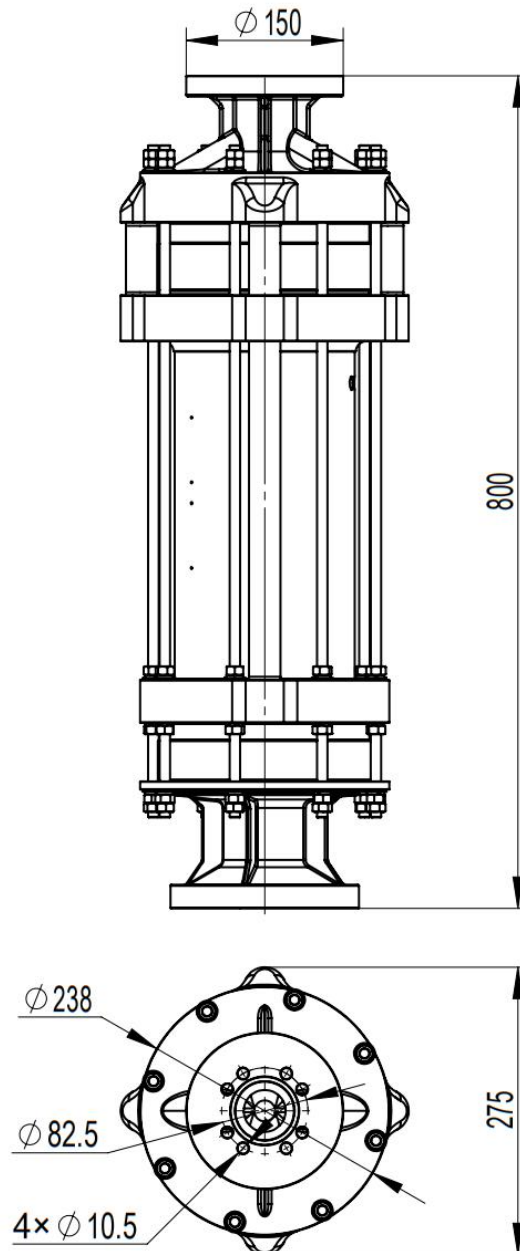


Units: mm

2) LFP80-50-3 cryogenic submerged immersed pump

Units: mm

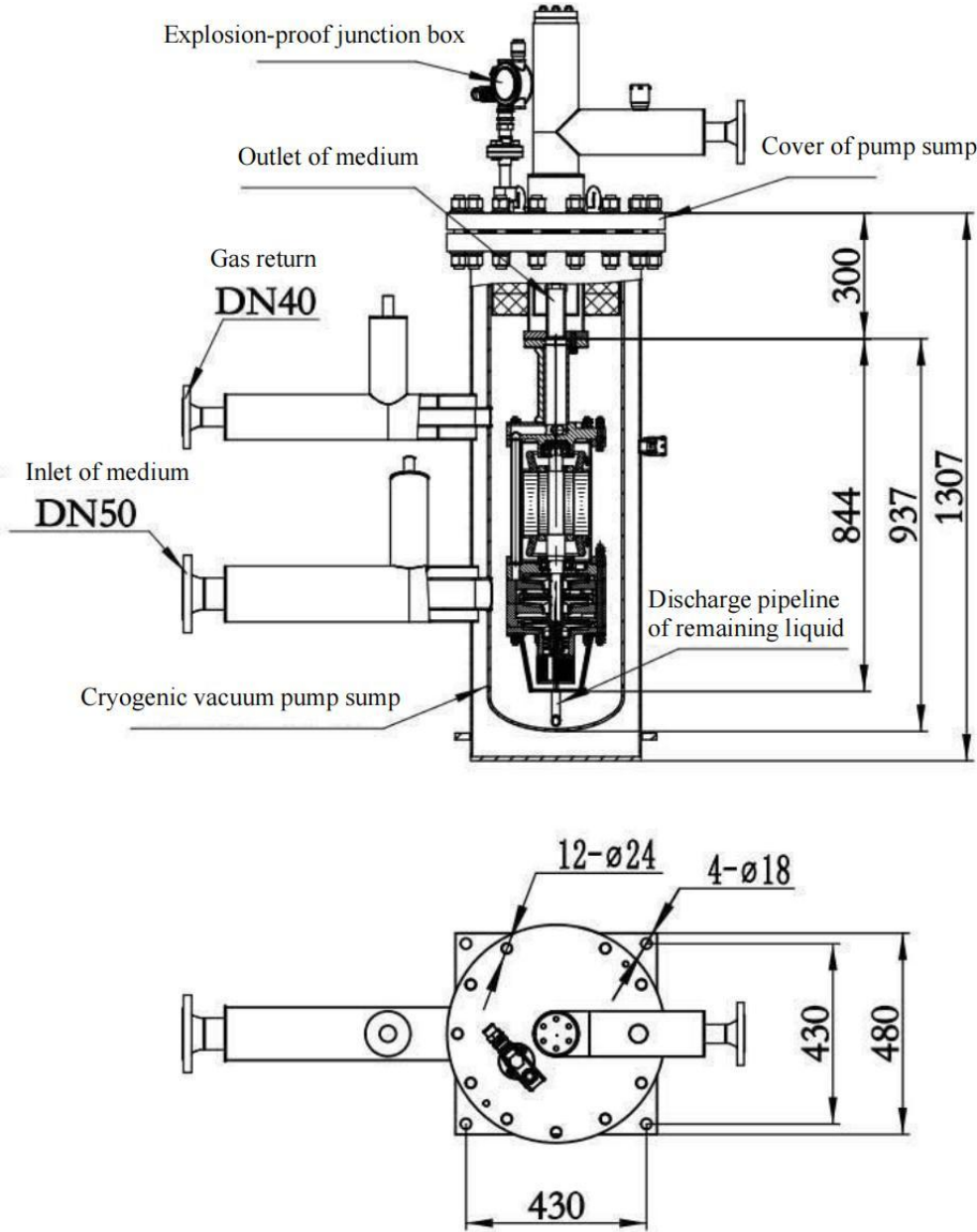
3) LFP20-280-15 cryogenic submerged immersed pump



Units: mm

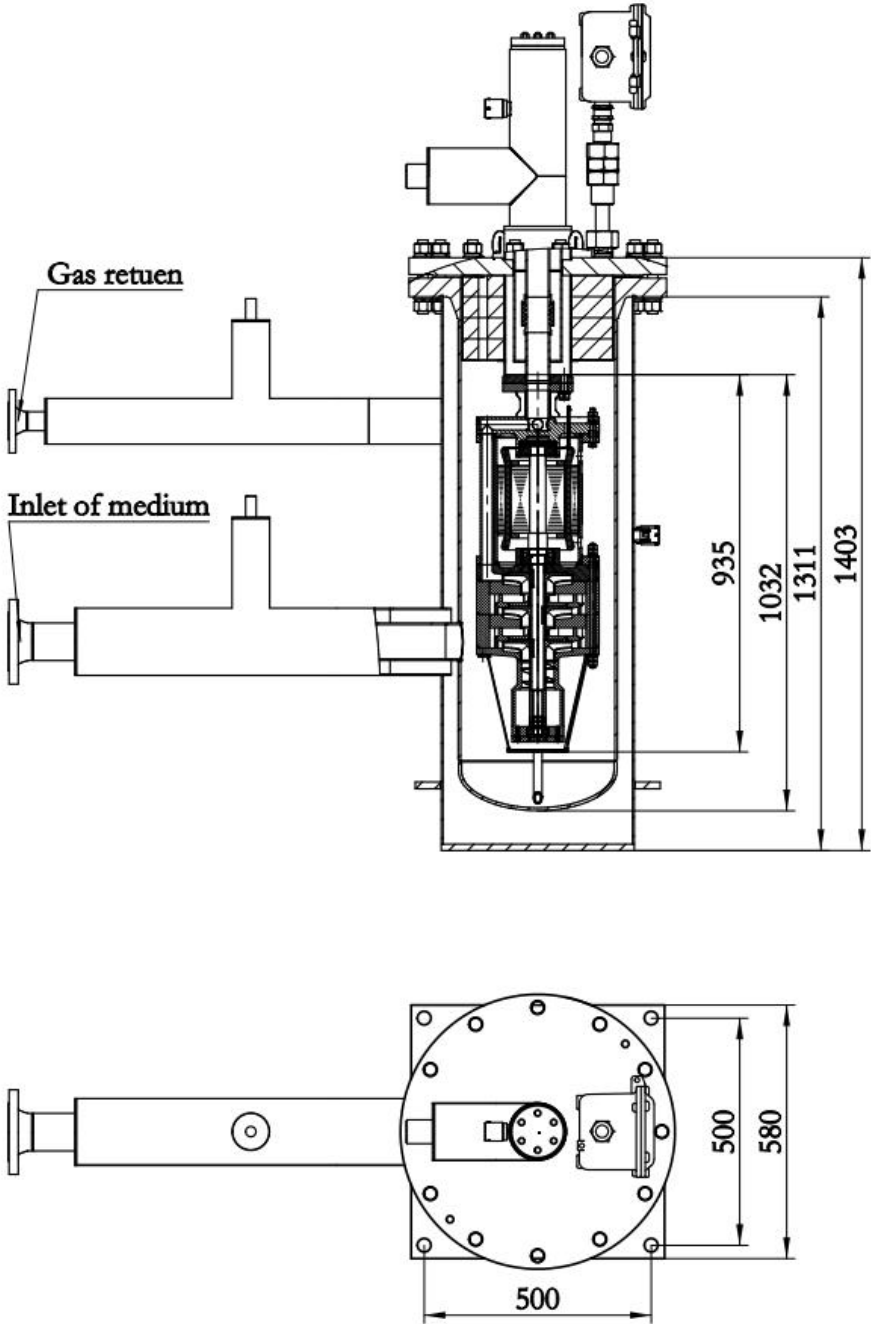
◆ APPENDIX IV: PROFILE DIAGRAM OF PUMP WITH PUMP TANK

1) LFP50-32-3 cryogenic submerged immersed pump



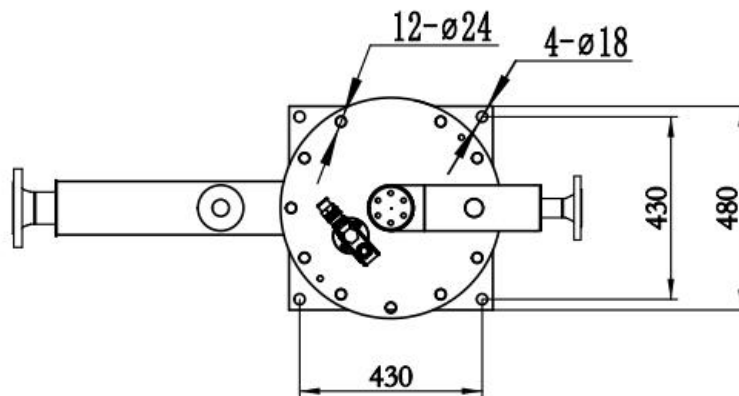
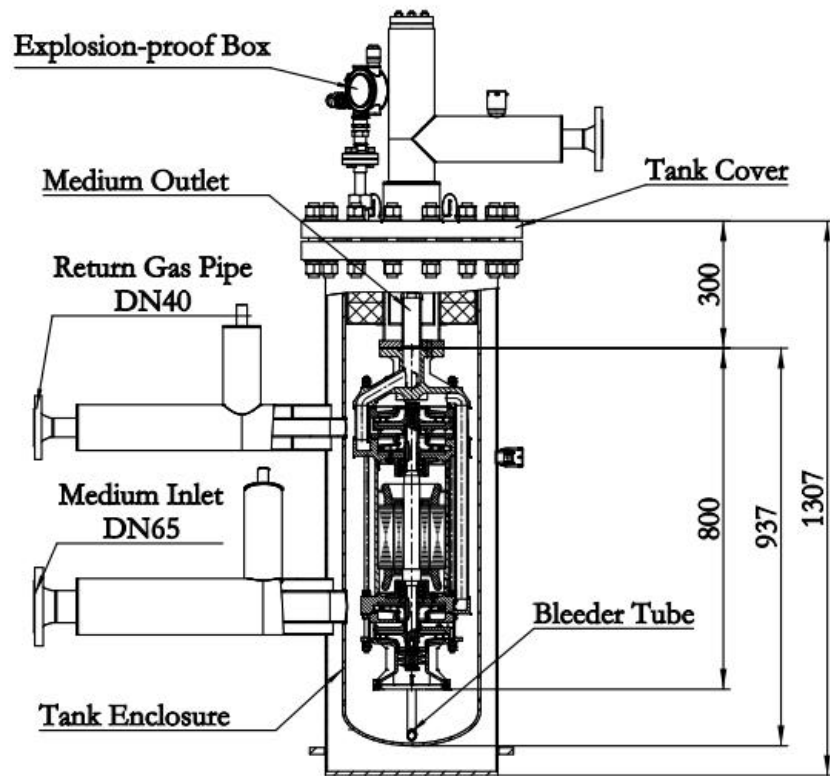
Units: mm

2)LFP80-50-3 cryogenic submerged immersed pump



Units: mm

3) LFP20-280-15 cryogenic submerged immersed pump



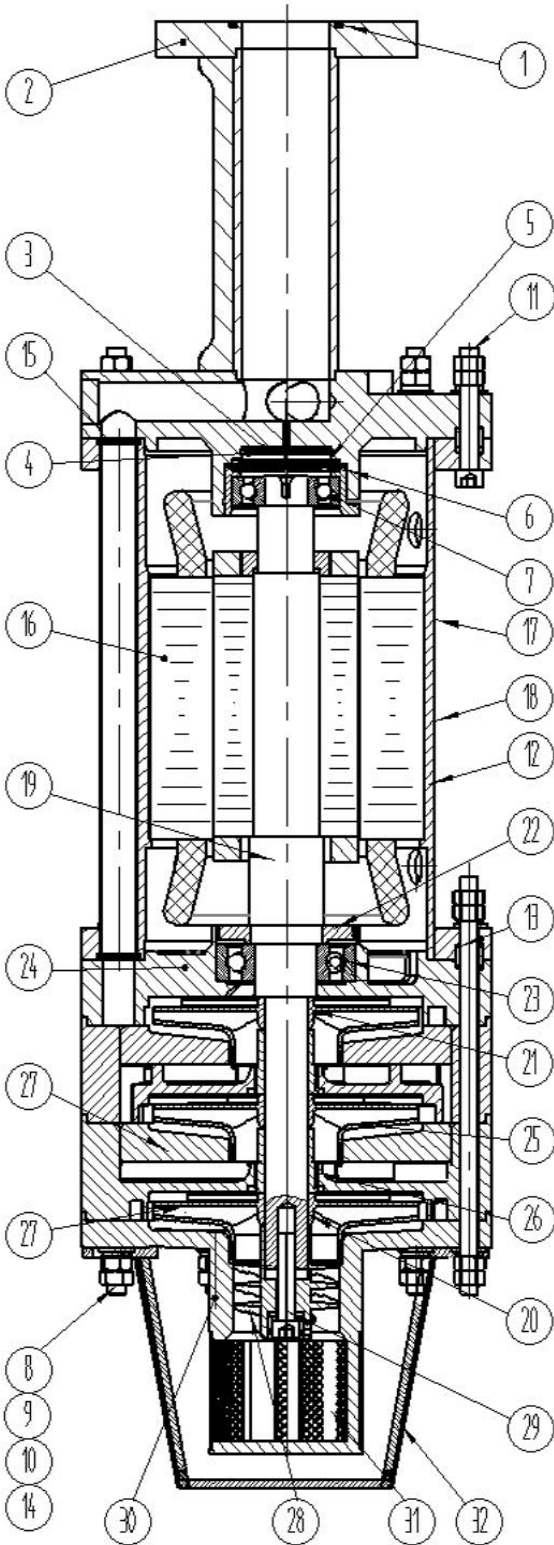
◆ APPENDIX V : PARTS/DRAWING

1.1 LFP50-32-3 parts List

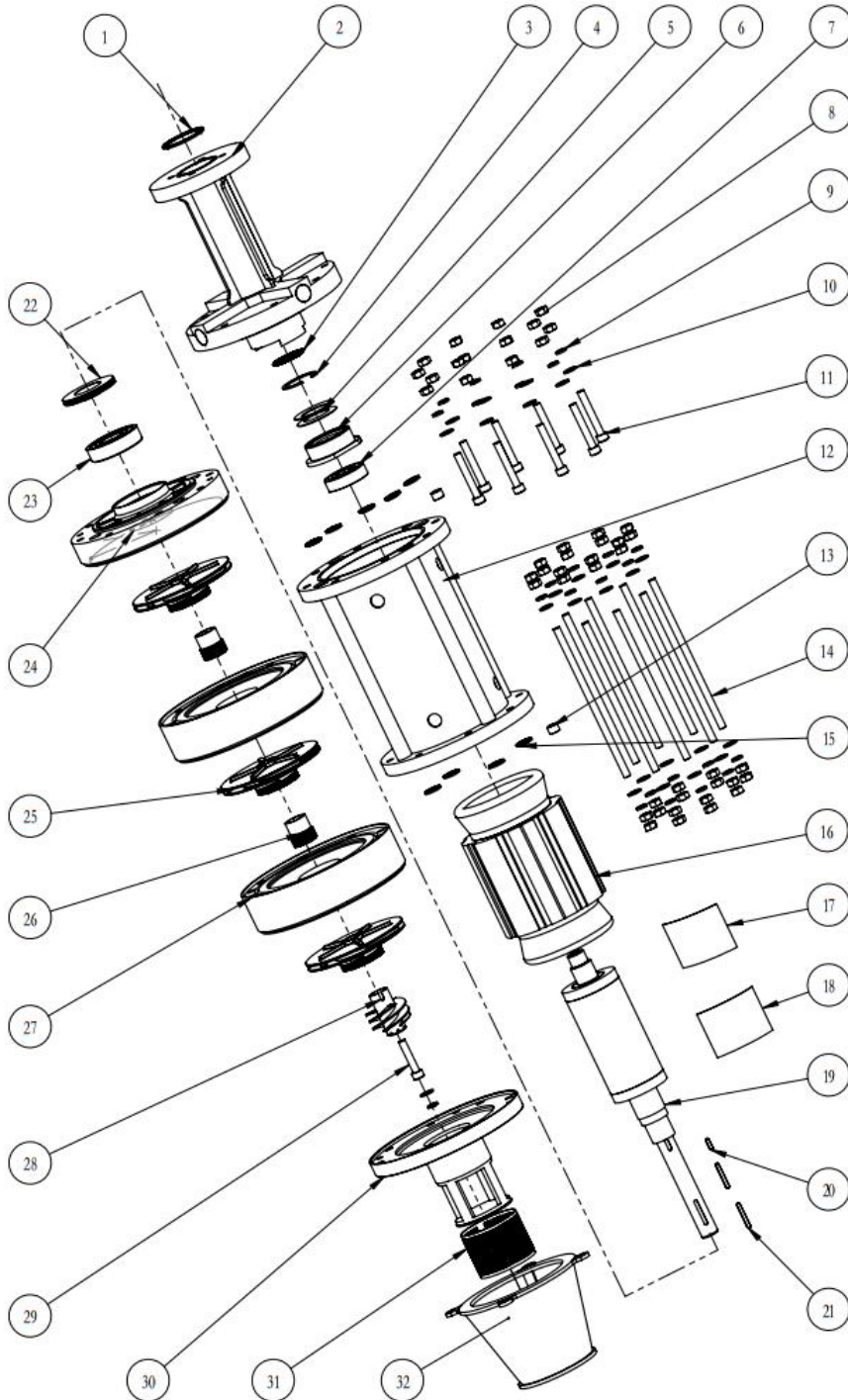
No.	Name	Amount
1	O-ring 1	1
2	The up cover of the motor	1
3	Folding screen	1
4	Snap ring of filter	1
5	Disc spring	2
6	Bearing housing	1
7	Angular Contact Ball Bearing 7305	1
8	Hex nut	48
9	Spring washer 10	25
10	Plain washers 10	25
11	Socket head cap screw M10×70	8
12	Shell	1
13	Locating sleeve	2
14	Screw bolt M10	8
15	O-ring 2	8
16	Stator Core	1
17	Nameplate in Chinese	1
18	Nameplate in English	1
19	Rotor	1
20	Flat key 1	1
21	Flat key 2	2
22	Retaining ring of dust	1
23	Angular Contact Ball Bearing 7307	1
24	The under cover of the motor	1
25	Impeller	3
26	Level 1 gland	2
27	Guide plate	2
28	Lead liquid worm	1
29	Socket head cap screw M10×50	1
30	Shell	1
31	Strainer	1
32	Filter mesh	1

NOTE! Corresponding to the list of numbers and the pump assembly drawing parts list.

1.2 LFP50-32-3 Drawing



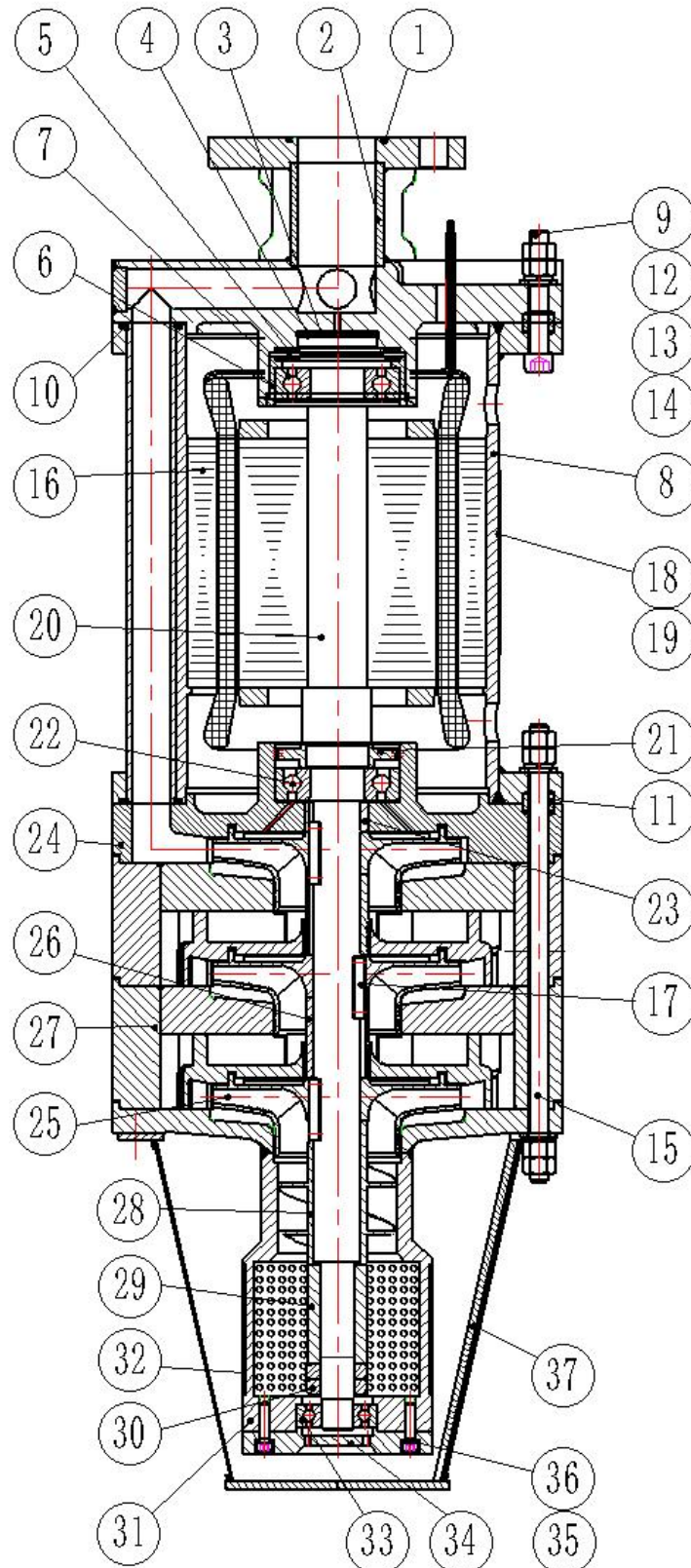
1.3 LFP50-32-3 Explosive view



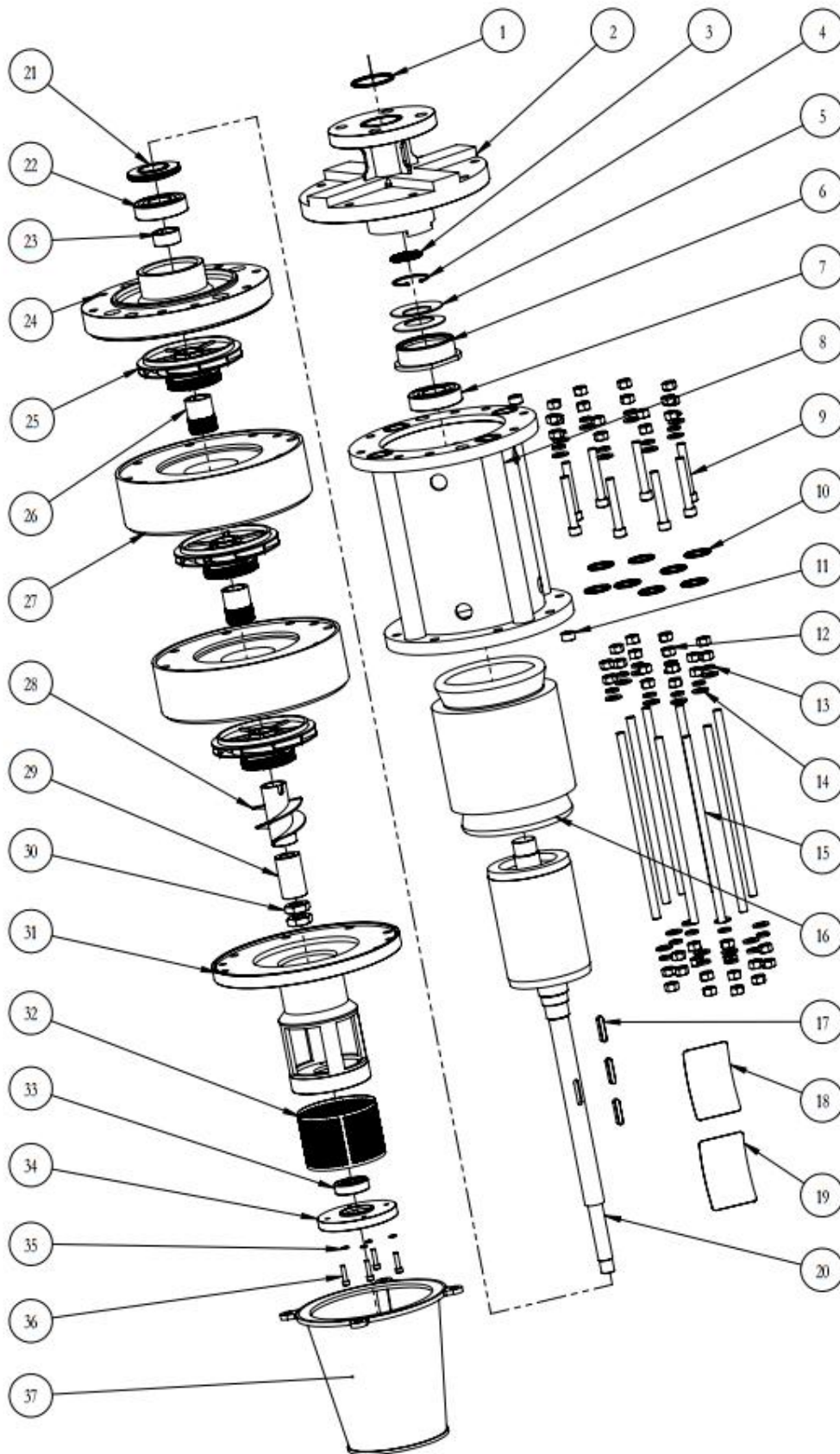
2.1 LFP80-50-3 parts List

No.	Name	Amount
1	Spring energy storage ring ($\varnothing 65 \times \varnothing 57 \times 3$) sealed by internal pressure end face 1	1
2	Motor Cover	1
3	Filter screen	1
4	Check ring	1
5	Disc spring	2
6	Bearing sleeve	1
7	Bearing 6304	1
8	Motor housing	1
9	Socket head cap screw M12×80	8
10	Spring energy storage ring ($\varnothing 40 \times \varnothing 30 \times 3$) sealed by internal pressure end face	8
11	Locating sleeve	2
12	Hex nut M12	48
13	Spring Washer 12	24
14	Plain Washer12	24
15	Screw	8
16	Stator	1
17	Flat key	3
18	Nameplate (Chinese)	1
19	Nameplate (English)	1
20	Rotor	1
21	Dust ring	1
22	Bearing 7307	1
23	Grade 2 seal gland	1
24	The under cover of motor	1
25	Impeller	1
26	Grade 1 seal gland	2
27	Guide plate	1
28	Guiding liquid worm	1
29	Shaft sleeve	1
30	Hex nut M22×1.5	2
31	Housing	1
32	Filter screen	1
33	Bearing6304	1
34	Bearing cover	1
35	Spring Washer 6	4
36	Socket head cap screw M6×25	4
37	Filter screen	1

2.2 LFP80-50-3 Drawing



2.3 LFP50-32-3 Explosive view

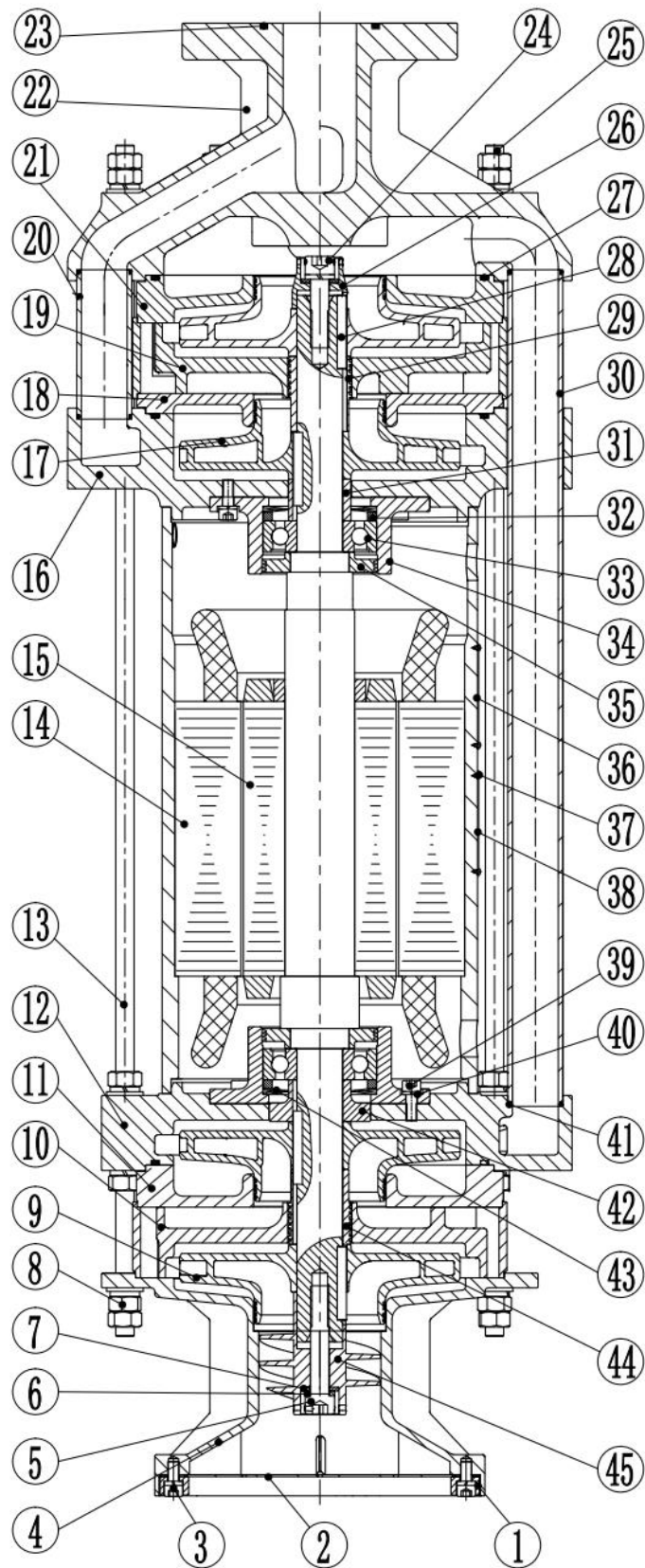


3.1 LFP20-280-15 parts List

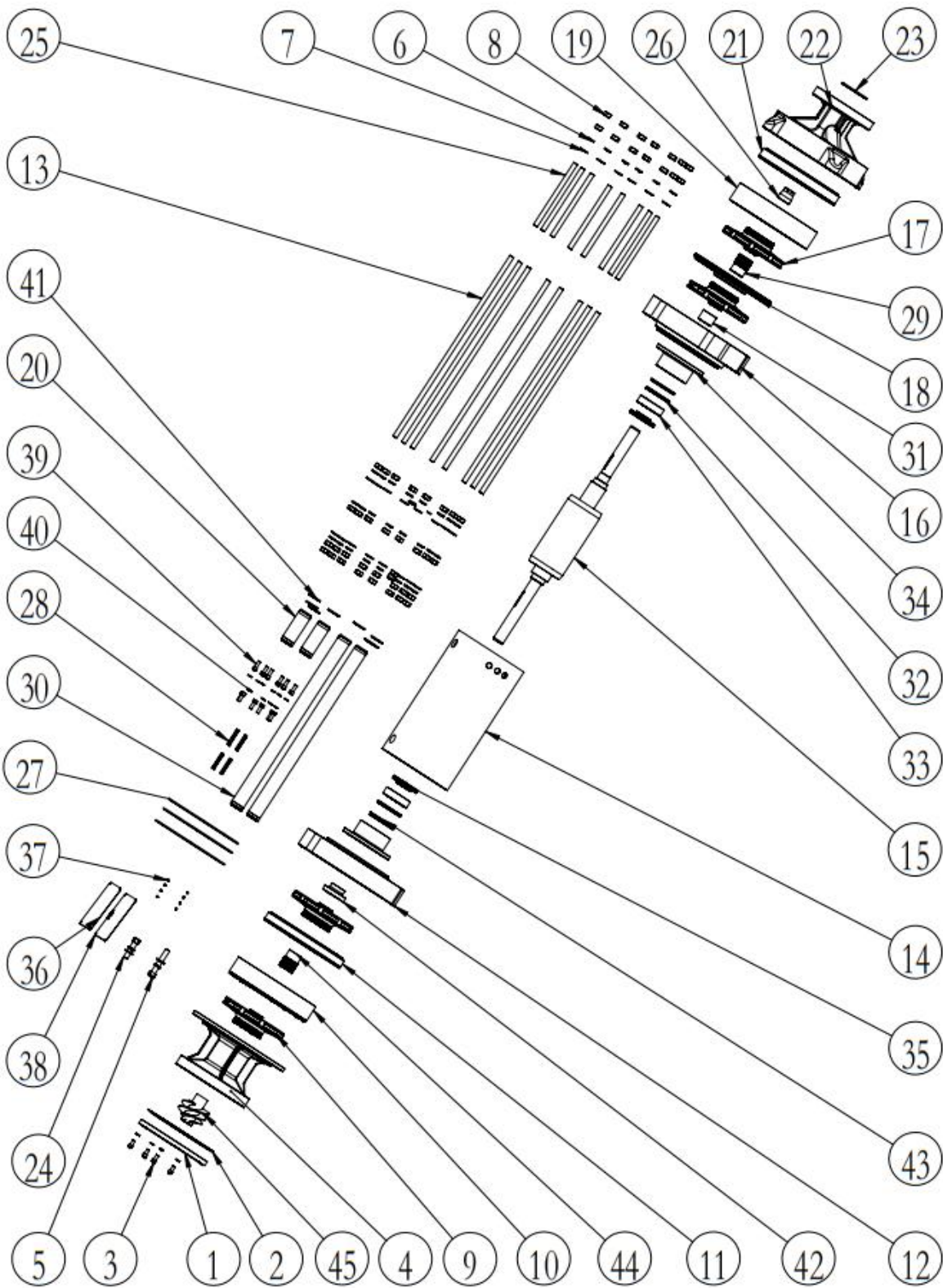
No.	Name	Amount
1	Screen cover	1
2	Filter mesh	1
3	Socket head cap screw M6×12	4
4	Inlet Shell	1
5	Locking socket head cap screw 1	1
6	Spring washer 10	34
7	Plain washers 10	26
8	Hex nut M10	48
9	Impeller 1	2
10	Guide plate 1	1
11	Cover plate 1	1
12	Motor upper cover	1
13	Screw 1	8
14	Stator	1
15	rotor	1
16	Motor lower cover	1
17	Impeller 2	2
18	Cover plate 2	1
19	Guide plate 2	1
20	Liquid pipe 2	2
21	Cover plate 3	1
22	Outlet shell	1
23	Spring energy storage ring	1
24	Locking socket head cap screw 2	1
25	Screw 2	8
26	Locking ring	1
27	O-ring	3
28	Flat key	4
29	Seal gland 2	1
30	Liquid pipe 1	2
31	Seal sleeve 2	1
32	Bearing washer	2
33	Bearing 7305	2
34	Bearing seat	2
35	Retaining ring of dust	2
36	Nameplate (Chinese)	1
37	Self tapping screw ST2.2×4.5	8
38	Nameplate (English)	1
39	Socket head cap screw M6×16	12

40	Spring washer 6	16
41	Spring energy storage ring	8
42	Seal sleeve 1	1
43	Disc spring	4
44	Seal gland 1	1
45	Lead liquid worm	1

3.2 LFP20-280-15 Drawing

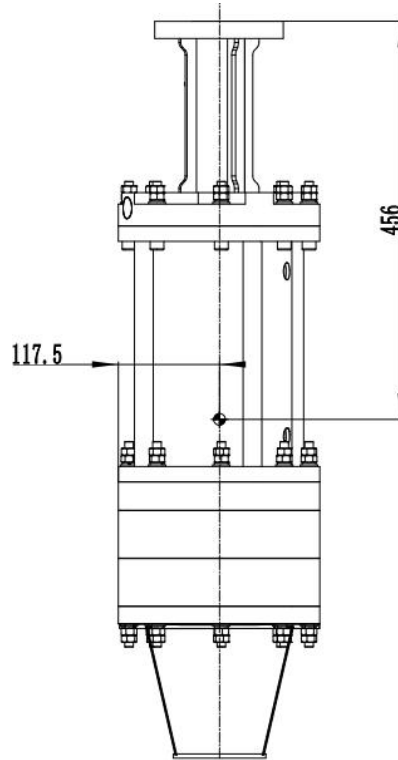


3.3 LFP20-280-15 Explosive view

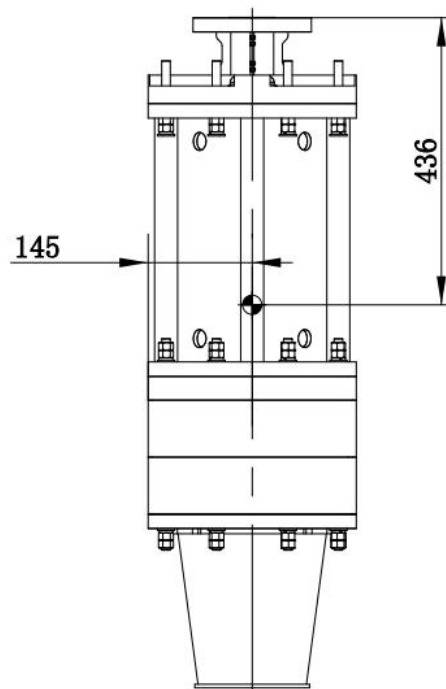


4. Position of center of gravity

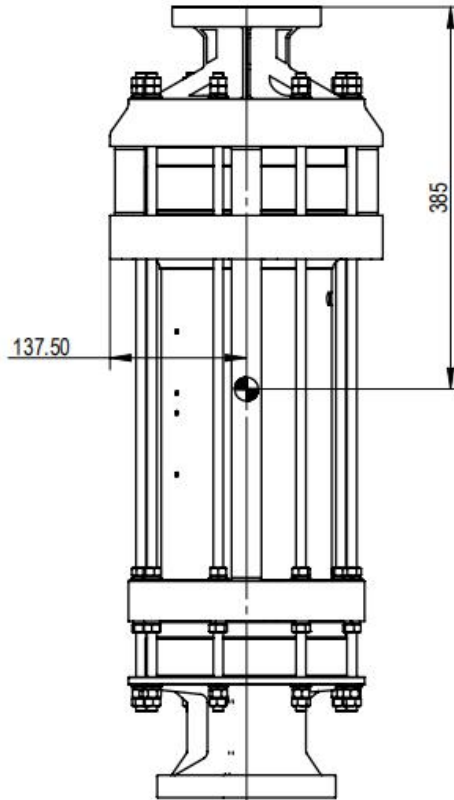
1) The LFP50-32-3 center of gravity is located on the central axis of the pump, and the specific location is as follows:



2) The LFP80-50-3 center of gravity is located on the central axis of the pump, and the specific location is as follows:



4) The LFP20-280-15 center of gravity is located on the central axis of the pump, and the specific location is as follows:



Declaration of Conformity

For the following equipment:

Product: Cryogenic Submerged Immersed Pump
Type Designation/Trademark: LFP50-32-3, LFP80-50-3,LFP20-280-15
Manufacturer's Name: Chengdu Andisoon Measure Co., Ltd.
Manufacturer's Address: No.555, Kanglong Road, Gaoxin District Chengdu P.R. China
610000

According to the following directives and laws

- Low Voltage Directive 2014/35/EU
- Machinery Directive 2006/42/EC
- Electromagnetic Directive 2014/30/EU

tested in accordance with below standards

EN ISO 12100: 2010, EN 60204-1: 2018, EN 809:1998+A1:2009

Responsible for making this declaration is the:

Manufacturer Authorized representative established within the EU

Authorized representative established within the EU (if applicable):

Company Name:

Company Address:

Person responsible for making this declaration

Name, Surname:

Position/Title:

Shanghai, P.R.China

2021-05-25

(Place)
(Company stamp and legal signature)

(Date)



Declaration Of Conformity

For the European ATEX 2014/34/EU directive

Manufacturer : Chengdu Andisoon Measure Co.,Ltd.

Address : No.555, Kanglong Road, Gaoxin District Chengdu R.P. China 610000

Product : Cryogenic Submerged Immersed Pump

Model(s): LFP50-32-3, LFP80-50-3

Chengdu Andisoon Measure Co.,Ltd. declares that the product above mentioned, complies with the European ATEX 2014/34/EU directive and with the essential health and safety requirements of Annex III of the directive.

Applied standards:

EN IEC 60079-0:2018, EN ISO 80079-36:2016, EN ISO 80079-37:2016

Ex Marking:



II -/2G Ex IIB T5 -/Gb -60°C≤Ta≤+55°C

Notified body responsible for Type Examination Certificate:

Certificate No.:TÜV IT 21 ATEX 094 X

Notified Body Name: TÜV Italia srl –TÜV SÜD Group

Via Carducci 125, Pal. 23 -20099 Sesto San Giovanni(MI)

Italy

Representative in the European Union:

Name and title:

Signature:

Place:

Date:

Approved by:

Manufacturer:

Representative: N/A

Name and title:

Name and title: N/A

Signature:

Signature: N/A

Place / Date: Chengdu China

Place / Date: /

2021/06/10

Chengdu Andisoon Measure Co., Ltd.

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Tel.: 028-63165820

Fax: 028-63165817

E-mail: info@andisoon.com

<http://www.andisoon.com>

This user manual is subject to change without prior notice.