LHP – V Type

VERTICAL HIGH SPEED PUMP

1. Overview

LHP-V type vertical high speed pump can replace imported counterparts, and is characterized by good performance, compact structure, and high reliability as well as parts interchangeable with those imported. Such type of pump may also replace multi-stage pump and reciprocating pump. The temperature of media transported by it ranges from -130 to 340℃, hence it is the ideal product used to transport petrochemical liquid. It satisfies such standards as API610 and GB3215-82 and has the following structural features (Fig. 1 and Fig. 2):

1.1 Step-up Box

Step-up box is the key component to the steady high-speed operation of the pump. Its casing is made of special aerospace alloy of good heat transfer, rigidity and stability; its gear wheels and shafts are made of high-intensity alloy steel and its high-speed sliding

bearings are made of lead-bronze alloy with its linear velocity allowed to reach 50m/s. Its bearings and gear wheels are forcedly lubricated by the pressure oil supplied by the small cycloidal pump installed at the lower end of input shaft which flows through oil filter and nozzle before such lubrication. In order to protect the high-speed shaft from burning and reach much higher reliability, the lubrication system of the step-up box is equipped with additional external hand pump or electric oil pump which will pre-lubricate the bearings and gear wheels before the primary pump is started up. Manufactured with precise machining and under strict quality management, such step-up box can operate so steadily that a coin may keep standing on it. The bearings of the input shaft and intermediate shaft of the step-up box are ball bearings, while those of output shaft are sliding bearings.

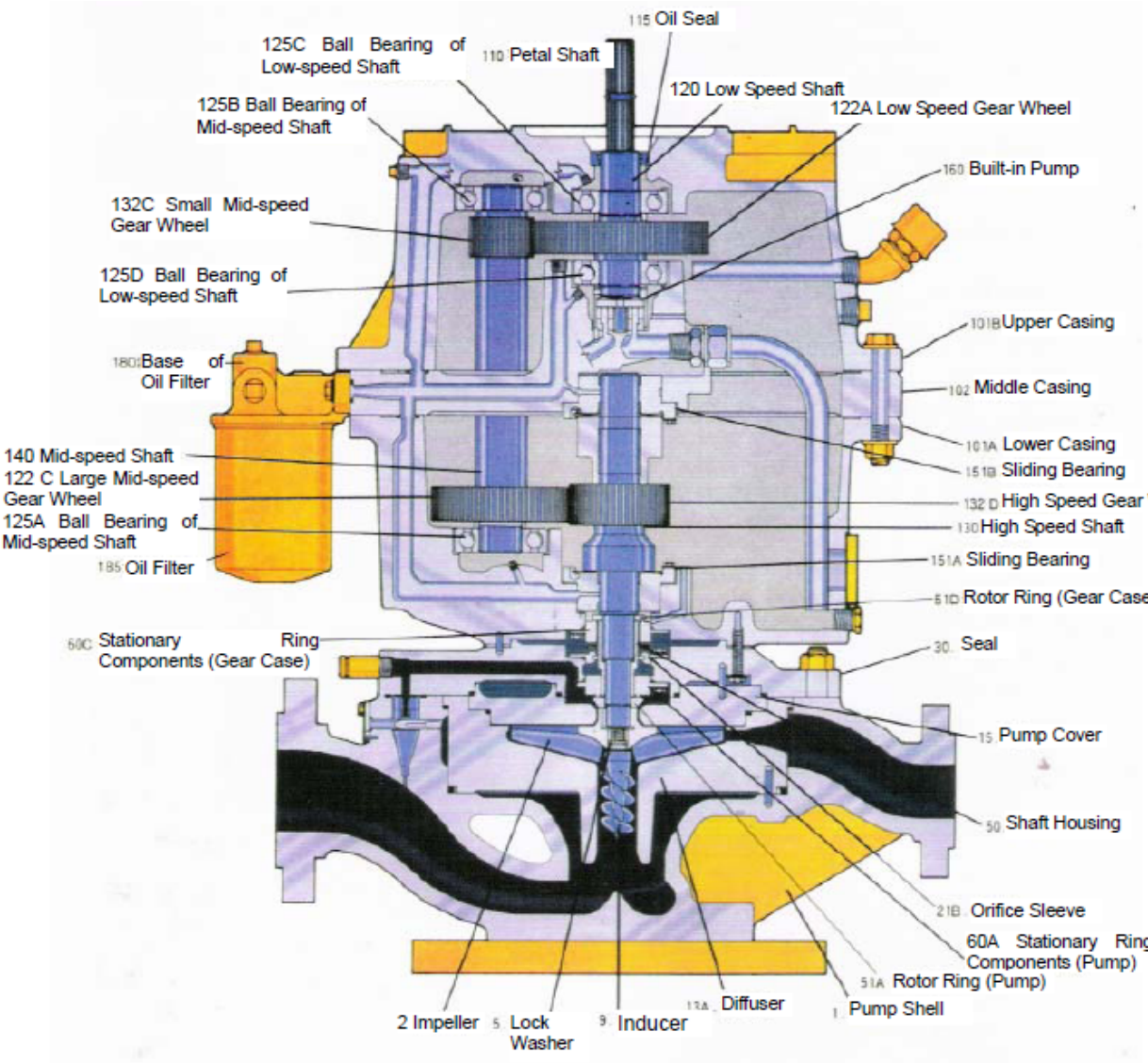


Fig. 1 Structure of LHP-V1 Type High-speed Pump

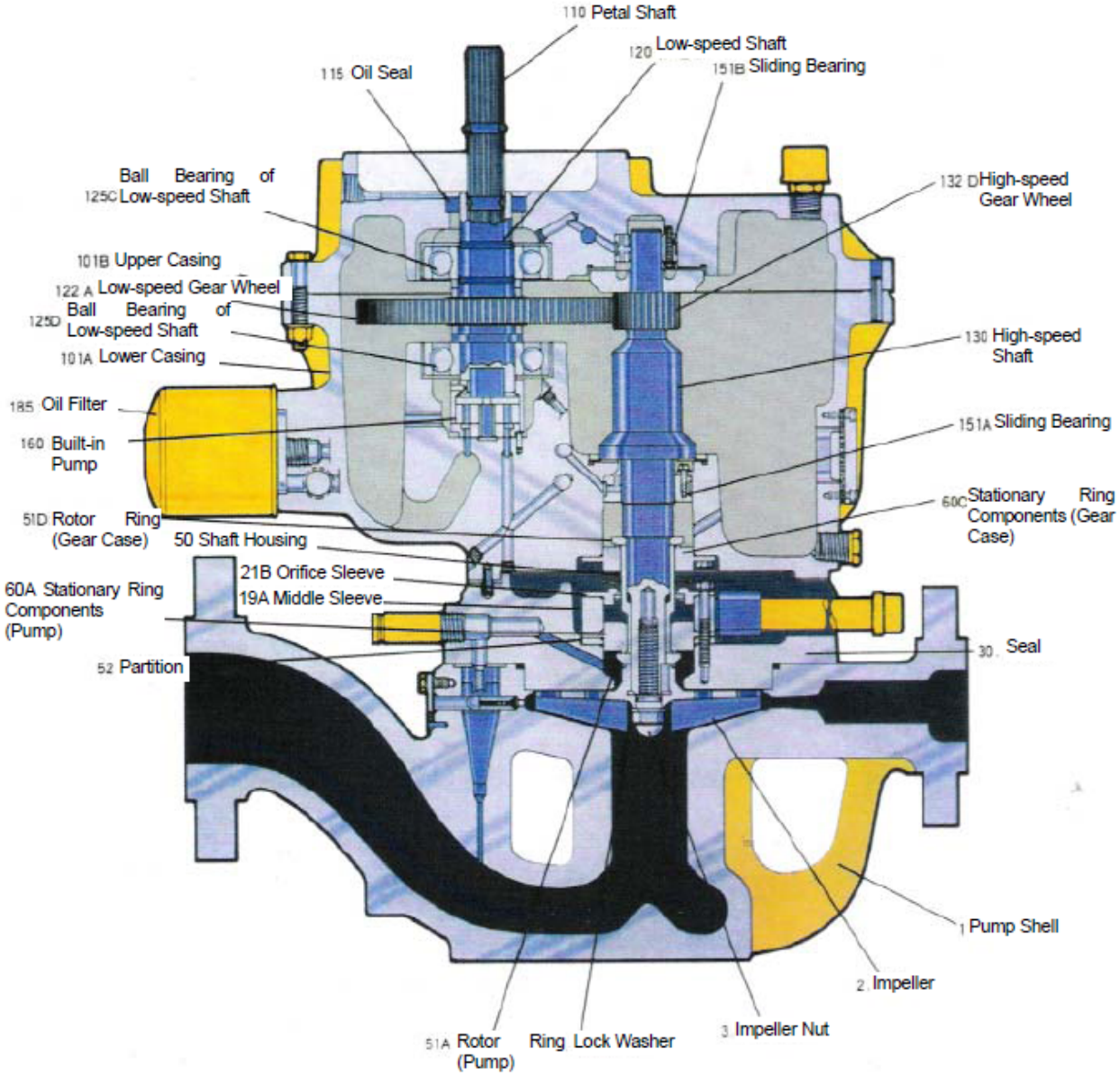


Fig. 2 Structure of LHP-V2 Type High-speed Pump

1.2. Structure of Pump Ends

The flanges at the inlet and outlet of the pump body are laid at the same linear horizontal line. With strong rigidity and good thermal shock resistance they can achieve higher load capacity for external piping. The structure of high-speed shaft has passed rotor dynamic analysis and the centrifugal impeller of open straight blades is installed on the output shaft of the step-up box (Fig. 3). The impeller does not have front cover and its back cover has balance holes, so high-speed operation almost produces no axial force. With the special design of pump shell diffuser the head of the pump can break off in case of overload on electric motor due to working condition changes or misoperations. The adoption of inducers contributes to excellent suction performance and greatly reduces the net positive suction head required by the pump (Fig. 4). Different combinations of centrifugal wheel diameter, diffuser throat diameter and pump rotational speed can satisfy the requirements of various performance parameters. Whenever that the permissible corrosion thickness of the pump shell is less than or equal to 2.5mm and the space between impeller and diffuser or pump cover ranges from 0.8mm to 3.5mm, the performance of the pump will remain uninfluenced and such problem does not exist that the changes of the space between impeller wear rings of common centrifugal pump affect the performance.

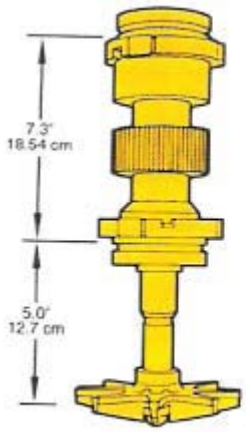
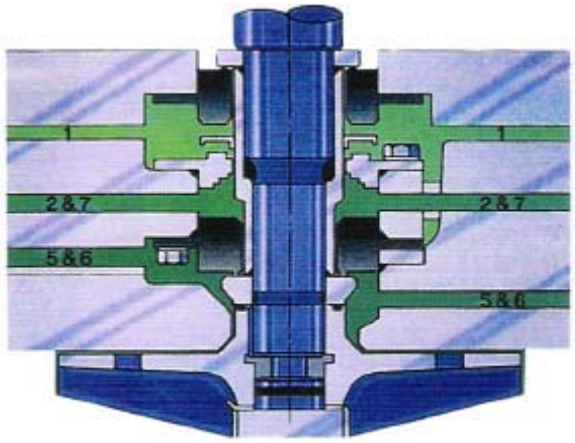


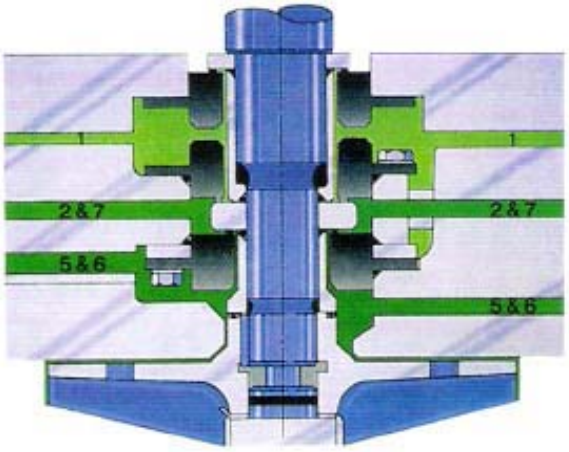
Fig. 3 The ratio of space between bearings of high-speed shaft to cantilever reduces to the minimum the radial load and vibration..

Fig. 4 The combination of tailor-made inducers and impellers, The combination of impeller and inducer with optimization design can reduce NPSHr value.

1.3 Seal Structure

Three types of mechanical seals can be applied to seal cavity (Fig. 5) which in combination with auxiliary sealing system can satisfy various operation requirements.

Single Seal Single seal structure is standard and economic and can meet most operation requirements. When such seal is adopted, the medium transported by the pump must be clear or there must be available external clear rinse liquid. When a small number of solid particles enter the pump, with cyclone separator clear medium transported by the pump can used to rinse the pump itself. Even if the liquid transported is clear, by using cyclone separator unexpected foreign substances which will cause damage to the seal can be kept outside so as to make the seal more durable.	

Dual Seal When the medium transported by the pump is not clear liquid or there is no external rinse liquid, dual seal shall be applied. In addition such seal shall also be used in case that danger or long-time dry running would occur due to the delayed solution to fluid leakage as a result of adopting single seal. When dual seal is used, buffer solution with pressure higher than that of the first-stage seal cavity must be used and supplied to the second-stage seal cavity so as to ensure the proper working of such seal.	

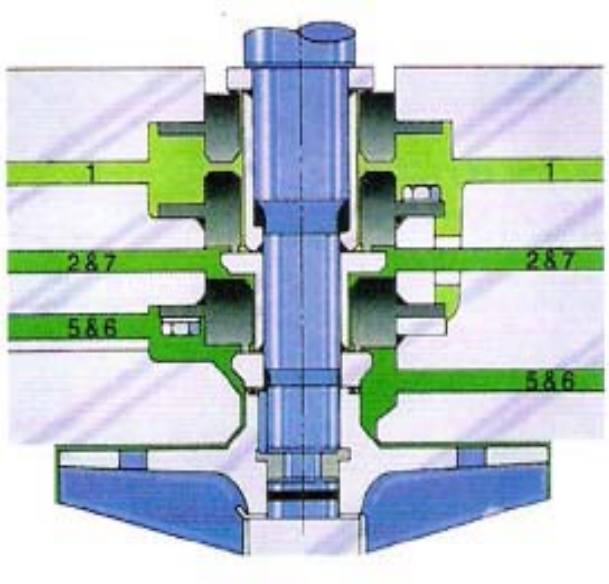
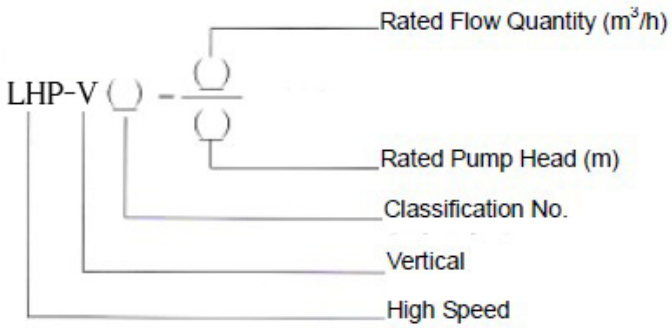
Tandem Seal When the pressure of pipeline exceeds that tolerable to single seal, tandem seal shall be applied to keep within the permissible range the pressure difference between the first-stage seal and second-stage seal. Therefore using tandem seal can make the pipeline pressure about twice as high as that in case of single seal. In addition, abnormal leakage of the first-stage seal can be detected by only checking the pressure of the first-stage and second-stage cavities and thus the pump can be preset to give warning or automatically halt in case of such leakage. The difference between tandem seal and dual seal: for dual seal the seal liquid will leak toward the pump side, while for tandem seal the pump side liquid will leak toward the seal liquid side. Their similarity: both of them need buffer solution.	

Fig. 5 Mechanical Seal Structure

1.4 Advanced high-speed thrust bearing design can make the inlet pressure reach 6.8Mpa.

2. Pump Model



Note: LHP-V1 type is second level step-up high-speed pump which can replace imported LMV-311 type high-speed pump.

LHP-V2 type is first level step-up high-speed pump which can replace imported LMV-322 type high-speed pump.

LHP-V3 type is second level step-up high-speed pump which can replace imported LMV-331 type high-speed pump.

3. Performance Parameter Spectrum and Optimization Design

3.1 The following Fig. 6 shows the performance parameter spectrum of LHP-V type vertical high-speed pump:

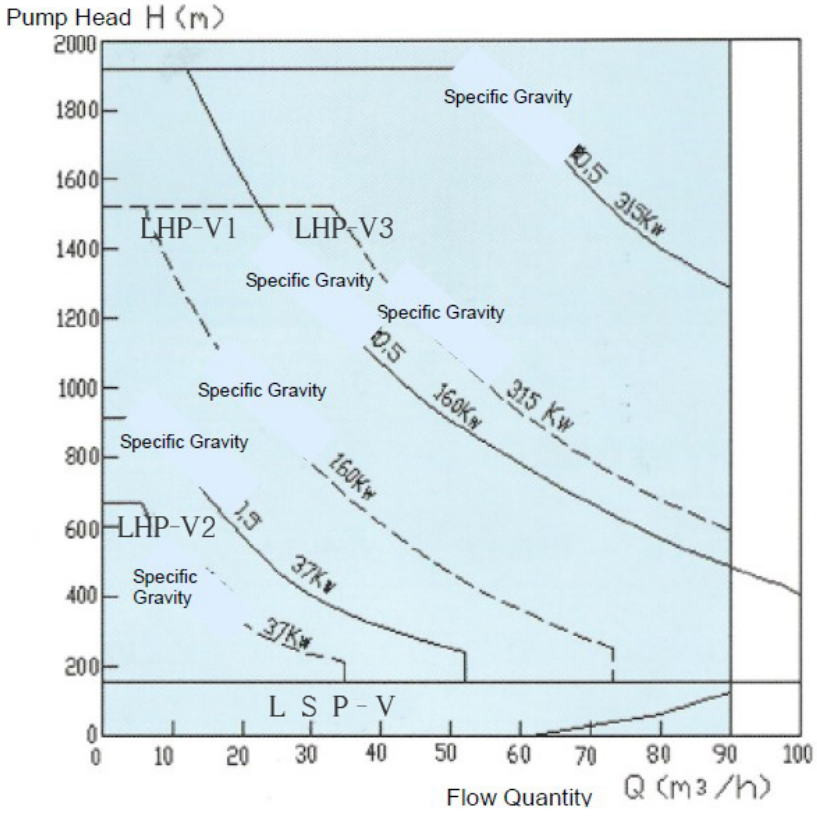


Fig.6 Spectrum of LHP-V Type Vertical High-Speed Pump

Note: LSP-V is motor directly mounted vertical pump with its rotational speed being 2950rpm, and it has two types: LSP-V1 and LVP-L2. See also “4. Performance Parameter Spectrum of LHP-V Type High-speed Pump” for its applicable parameter spectrum.

3.2 Optimization Design

When a user decides on the required performance parameter, we can optimize the design with computer, which involves efficiency, H-Q curve shape, NPSHr, power and radial load.

We will provide highly-efficient and reliable high-speed centrifugal pump by well combining diffusers (Fig. 7), impellers (Fig. 8) and inducers (Fig. 9) of different physical dimensions.

Fig. 7 Diffuser

Fig. 8 Impeller

Fig. 9 Inducer

4. Performance Parameter Spectrum of LHP-V Type High-speed Pump

Model	LHP-V1	LHP-V2	LHP-V3	LSP-V1	LSP-V2
Maximum Quantity of Flow (m3/h)	100	52	90	100	34
Maximum Pump Head (m)	1920	915	1920	219	64
Maximum Suction Pressure (Mpa)	6.8	4.0	6.8	6.8	4.0

Maximum Working Pressure (Mpa)	15.2	10.0	15.2	10.0	10.0
Maximum Motor Power (KW)	160	37	315	55	37
Working Temperature (℃)	-130～+340	-130～+340	-130～+340	-130～+340	-130～+340

Note:

1) The technological parameters being satisfied, the selection of pump type is mainly restricted by maximum permissible power. See also Fig. 6.

2) The parameters in the table are standard. The design and manufacturing can follow user's parameters which are beyond the spectrum listed in the table.

5. Installation Dimension of LHP-V Type High-speed Pump

See also Fig. 10 and 11.

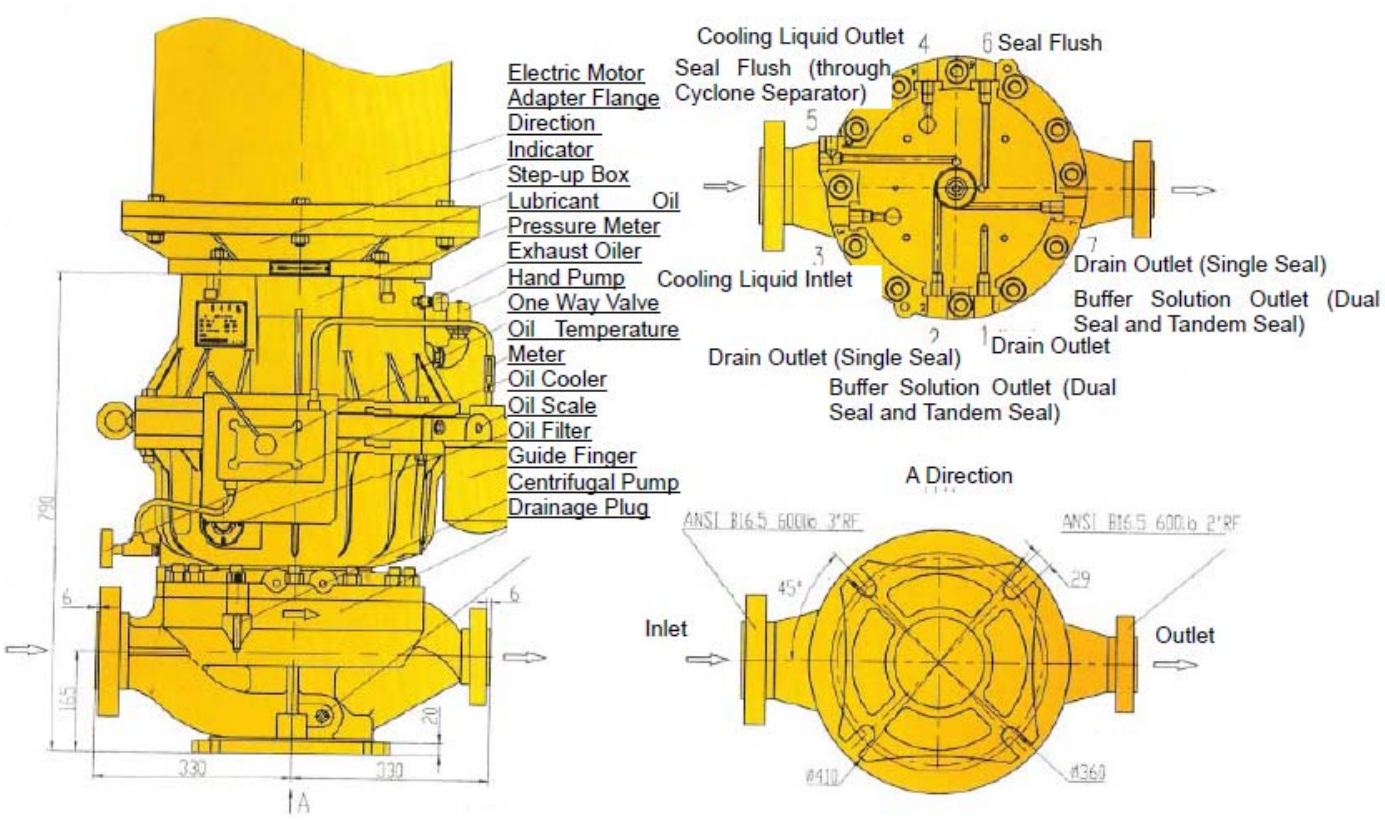


Fig. 10 LHP-V1 High-speed Pump Installation Dimension

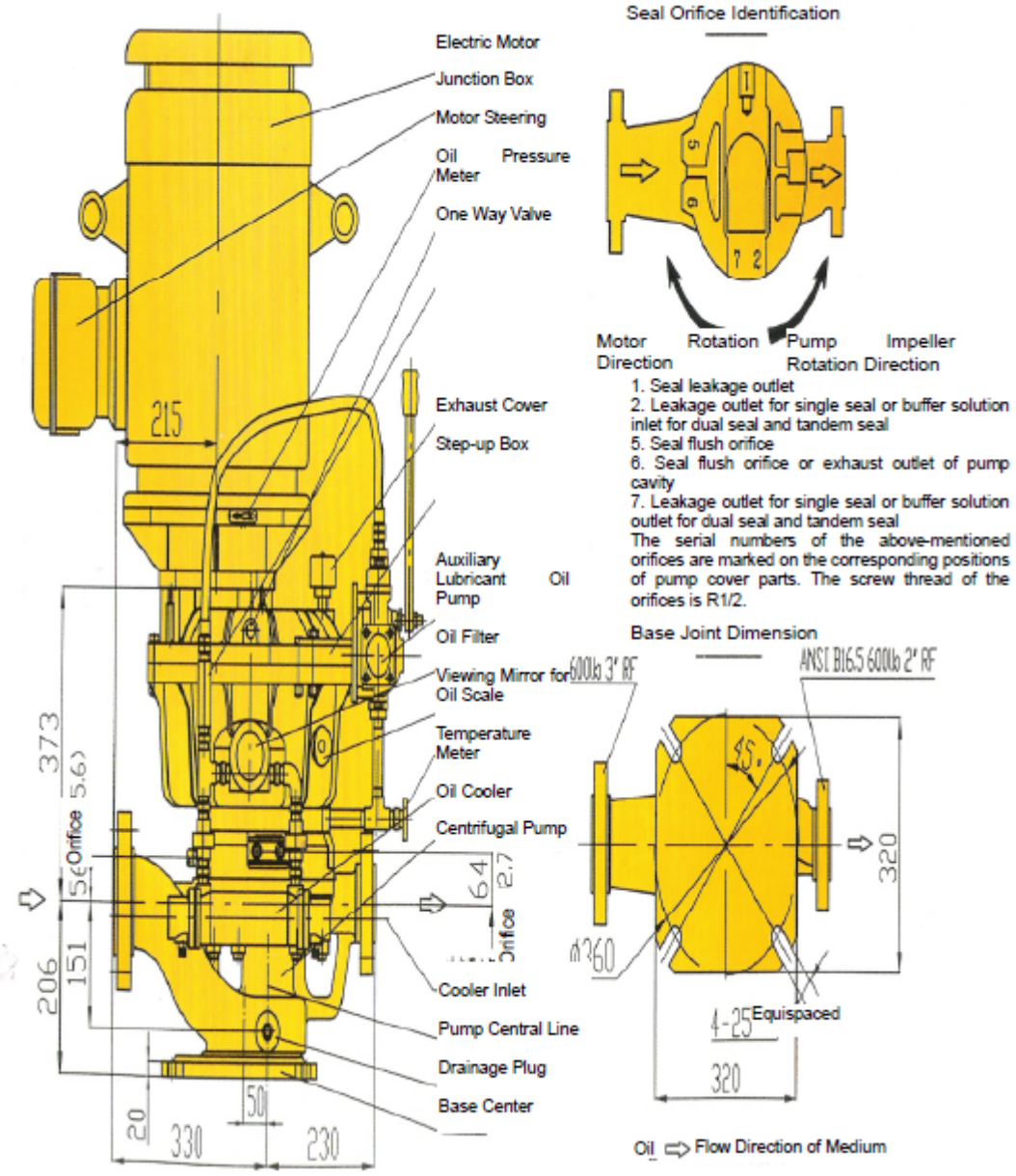


Fig. 11 LHP-V2 High-speed Installation