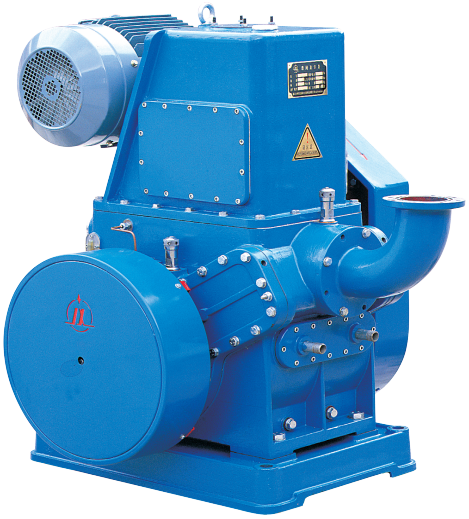
ROTARY PISTON VACUUM PUMP

HG150, HGL150, HGL70

Operating Instructions



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Thanks for your purchase of the HG & HGL series Rotary Piston vacuum pump products of our company. We reserve the right to continuously modify the design and improve the technique without prior notice. In case of any questions, please contact our sales engineer!

Safety

Warning: failure to observe the following precautions may cause serious person injury or damage to vacuum pump.

◇ Power supply must be disconnected prior to any maintenance and care operation for the pump.

◇ Never start the pump without the belt guard properly attached. Disconnect the pump motor from the electrical supply before removing the belt guard.

◇ The standard pump is not suitable for any explosive occasion. If it would be used in such occasion, contact us please.

◇ Do not operate the pump with oxygen-enriched gas (greater than 20% by volume) in the suction line, unless the pump has been prepared with an inert fluid suitable for the application.

Pumping oxygen-enriched gases with mineral oil or other non-inert fluids can cause fire or explosion in the pump, resulting in damage or serious bodily injury.

◇ Make sure the discharge pipe is not blocked and without any obstacle. The vacuum pump is a compressor and will generate high pressures without stalling the motor when operated at low suction pressures. Excessive pressure could cause damage or serious bodily injury.

◇ Do not allow the pump to discharge into a closed, or inadequately ventilated room. Check local laws and regulations before operating the pump with discharge to outside atmosphere.

◇ Check if the protective switch equipped in motor circuit is suitable before the first starting of the pump.

◇ When designing the control circuit of the device, it is required to make sure the pump should be started in manual mode if it has been stopped in failure.

◇ Never expose any part of the human body to vacuum.

◇ Besides the pump, either the temperature of pipeline or accessories may excess 82℃, not to touch them to prevent from burning your skin.

◇ Avoid long-time staying in an environment with high noise device, and it is necessary to wear ear protector.

◇ Small objects such as screws, nuts, washers, welding slag, iron beads are not allowed to be suctioned into the pump.

◇ The pump is unsuitable for applications that produce grinding material and grinding powder Adhesive or heavy viscosity deposit may be remained after procedures, use a proper separator at first.

◇ Both sides of inlet and outlet can be equipped with corrugated pipe to prevent the transfer of vibration from pump to other parts of the system.

This Operating Instructions applies to XI NGGUANG vacuum models HG-150, HG L-150 an d HGL-70. Please read th e oper ation instruction care fully, an d the instructions must be strictly observed during the installation, operation and maintenance. Only trained personnel can operate and repair this product.

For the further informat ion about safety operation and ma intenance, please cont act the after-sales service department of the company.

1 Description

1.1 General

The series HG, HGL pu mp is a kind of single-stage and single-cylinde r rot ary piston vacuum pump. It is suit able for p umping ordinary gases and cond ensable gases with a gas b allast. It is used in appl ication of vacuum me lting, vacuum d rying, vacuu m coating, vacuum impregnation and othe r va cuum industries. It can be oper ated i ndividually, o r as a backing pump co mbining with other va cuum pumps. However, it is unsuit able to use the pump as a deliver y pump to suck from one container to another. The pump must be fitted with an appropriate accessory if pumped gases are rich in oxyge n, explosive, corrosive to ferrous metals, chemical reaction to vacuum oil, vapor-containing and dust-containing etc.

Meanings of pump model:
e.g. HGL-150
H — rotary piston vacuum pump
G — high vacuum
L — vertical type, motor is installed above the side of pump body
150 — Pumping speed is 150L/s

1.2 Principle of Operation

This model of pump is mainly composed of pump body, piston & slide and eccentric etc.

Key to Fig. 1
1. Pump body
2. Eccentric
3. Shaft
4. Piston & Slide
5. Discharge valve
6. Slide guide

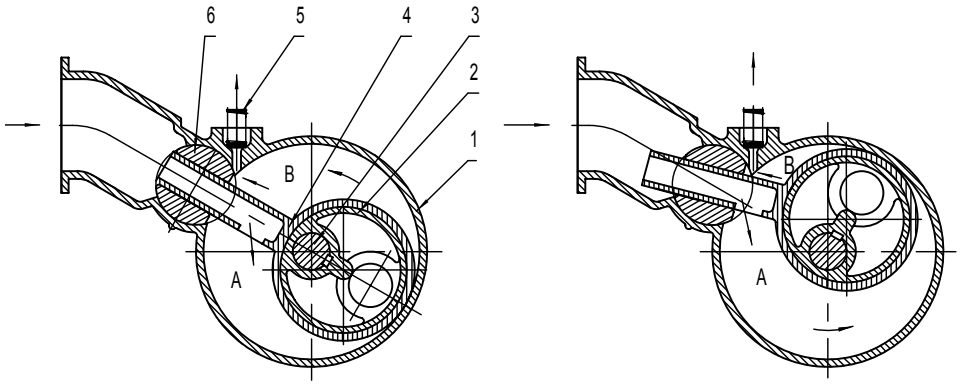


Fig.1 Principle of operation

Piston & Slide (1/4) is installed inside the pump body (1/1), while eccentric (1/2) is installed inside the piston & Slide. The eccentric is driven by the shaft (1/3) which leads to the out side of the pump cylinder and whose central line is coincident with that of the pump cylinder. External surface of the piston & Slide slides in the inner surface of the pump cylinder and its upper part freely slides up and down and swings left and right in the semicircular slide guide (1/6). As a result, the pump cylinder can be divided into chamber A and chamber B by the piston & slide (1/4), showed as the above picture. If the shaft rotates in counter-clockwise, chamber A extends gradually while chamber B reduces till chamber A reaches the maximum and chamber B reaches the minimum.

Furthermore, upper part of the piston & Slide is hollow. At the side of chamber A, there is a rectangular hole. During extension process of chamber A, gases pass through the hollow piston & Slide and enter chamber A of the pump cylinder through the rectangular hole. When the piston & Slide turns to the dead center of the cylinder, the original chamber B disappears and is replaced by chamber A. And a new chamber A is produced in the original chamber A position. At the final stage of chamber B compression, the compressed gases will be forced out the exhaust valve (1/5) and finally out the pump cylinder. And the pump works in this circulation.

This model of pump has six sets of exhaust valves (12/7) (see the constructional drawing Fig12). The exhaust valve is mainly composed of spring and valve disc etc. When gases and oil in the pump cylinder are forced from the exhaust valves, they are separated through the air/oil separator (12/4) in the oil reservoir (12/17) and the gases is discharged into the atmosphere, while the oil is filtered through oil filter (12/15). Oil is then absorbed by the oil pump and transported to the oil box (12/16) under high pressure to feed the movable parts such as bearing, piston & Slide and pump cylinder etc. when the pump is in operation, lubrication of the internal parts is completely automatic. Besides lubrication and sealing, the pump oil has another important effect, which is, when the gases pumped are relatively few, the few compressed gases together with oil is forced out the exhaust valves, so the exhaust valves can go on working and the gases is then discharged.

The pump body, A and B pump side cover, eccentric, piston & Slide and slide guide are all made of high strength cast iron. The shaft is made of high-grade carbon steel, which is installed with eccentric. One end of the shaft is equipped with balance wheel and the other end is equipped with pump V-belt pulley that is connected with the motor through V-belt. The bonding face between the rotary part and air inlet part of the pump is sealed with rubber O-ring, and the gap between pump body and pump cover is sealed with paper washer and 107 resin or soft plane sealing glue.

1.3 Vent Valve & Gage Port

The pump is provided with a vent valve (13/13) and it can also be used as a gage port.

1.4 Oil Flow Adjusting Valve

The pump is provided with two oil flow adjusting valves, which are used for increasing the oil flow and dredging oil passages in the event of an obstruct (see section 5.5).

1.5 Specifications

Model			**HG-150**	**HGL-150**	**HGL-70**
Pumping speed		L/S	150	150	70
		M^3/H	540	540	252
Ultimate pressure		Pa	0.3	0.3	0.3
		torr	2.3×10^{-3}	2.3×10^{-3}	2.3×10^{-3}
Pump speed		RPM	450	500	500
Mains voltage at the motor, 50HZ		V	380	380	380
Motor power, 50HZ		Kw	15	11	5.5
Motor speed, 50HZ		RPM	970	1460	960
Maximum vapor productivity		Kg/H	8.4	8.4	4
Oil capacity		L	25	20	15
Flange internal diameter	Inlet	mm	100	100	80
	Outlet	mm	80	80	63
Consumption of cooling water		L/H	700	450	230
Pipe connections	Water inlet	mm	3/4″	3/4″	1/2 ″
	Water outlet	mm	3/4″	3/4″	1/2 ″
Weight with motor		Kg	850	750	450
Shipping weight		Kg	980	850	520
Floor space		mm	1275×530	768×530	540×324
Overall dimension L×W×H		mm	1580×826 ×1285	1150×826 ×1200	700×670 ×970
Noise level (under ultimate pressure)		dB(A)	80	80	78

Note: Ultimate pressure of the pump refers to the partial pressure of the non-condensable gases measured by compression vacuum meter.

1.6 Gas Ballast

If the vacuum pump only pumps the incondensable gases, the gases won't be liquefied for the sake of pressure increment, and the pump oil won't be deteriorated. However, if it is used for vacuum drying or pumping damp air, the gases contain both incondensable gases and water vapor. Contamination occurs when water vapor or other gaseous components enter the pump and condense within the pump mixing with the oil as emulsified droplets. The contamination will deteriorate the oil quality and hence reduce the pumping speed and increase the ultimate pressure.

In order to satisfy the demand of pumping the damp air, the pump is provided with manually operated gas ballast valve to overcome the adverse effect on vacuum resulting from oil contamination. Gas ballast is a controlled bleed of air from the atmosphere, this air carries the water vapor through the compression cycle without it condensing to liquid and mixing with the oil. Other contaminates are also removed by ballasting except those that dissolve in the oil.

Another function of gas ballast valve is to recover the ultimate pressure of the vacuum pump. Although we sometimes pump the general air, which contains relatively fewer condensable gases and hence the gas ballast valve is closed, the oil quality is contaminated by the fewer condensable gases in the air as time goes by. To the pump without gas ballast valve, it can recover its original ultimate pressure only by changing the pump oil or heat it to vaporize the liquefied vapor. To the pump with gas ballast valve, it can recover the ultimate pressure by running the pump for one to two hours while gas ballast is open.

1.7 Performance Curve

(1) Curve of pumping speed and power consumption versus inlet pressure for HG-150 (refer to figure 2);

(2) Curve of pumping speed and power consumption versus inlet pressure for HGL-150 (refer to figure3);

(3) Curve of pumping speed and power consumption versus inlet pressure for HGL-70 (refer to figure4);

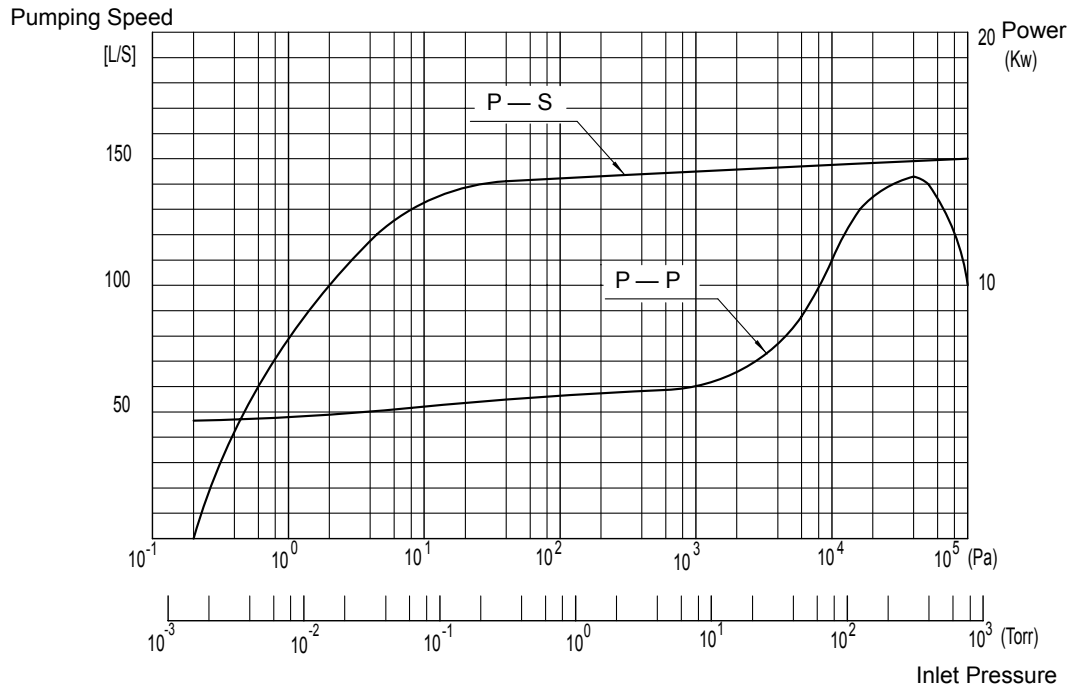


Fig 2. Curve of pumping speed and power consumption versus inlet pressure for HG-150

P — S : Inlet Pressure — Pumping Speed

P — P : Inlet pressure — Power

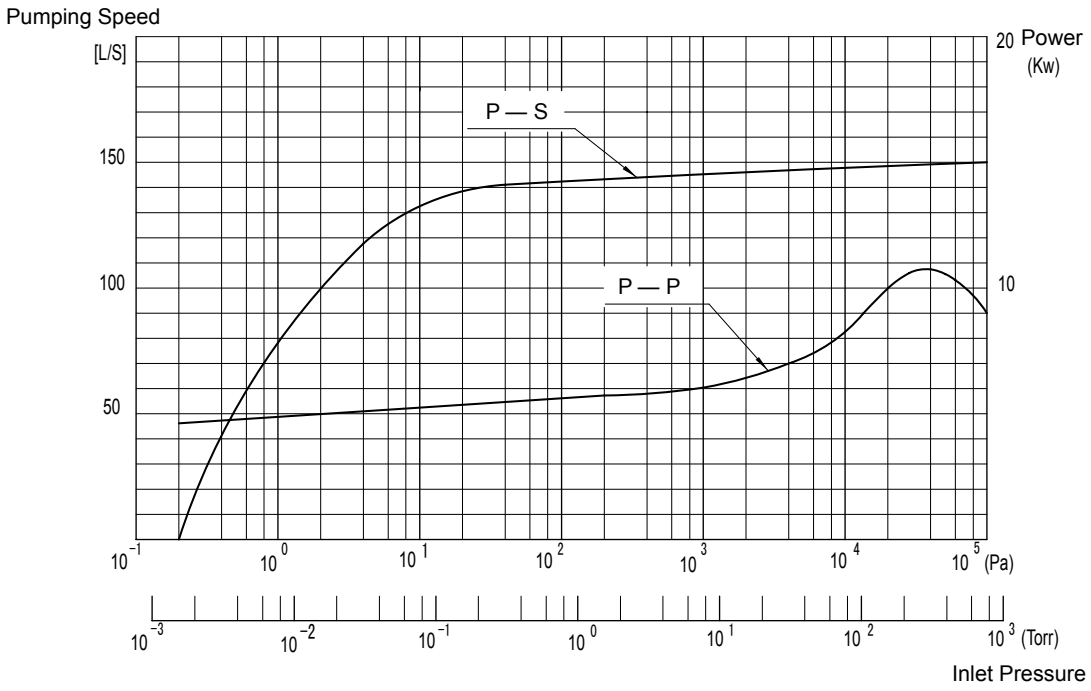


Fig. 3 Curve of pumping speed and power consumption versus inlet pressure for HGL-150

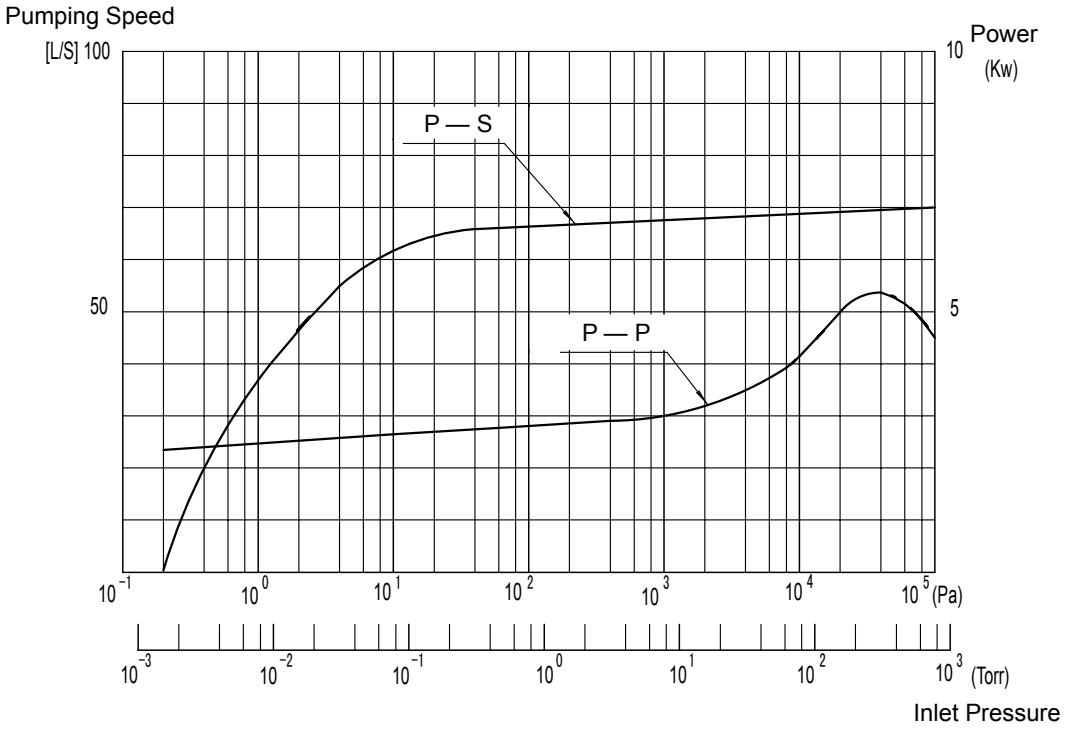


Fig. 4 Curve of pumping speed and power consumption versus inlet pressure for HGL-70

2 Installation

2.1 Locating and Mounting

Locate the pump as near as possible to the equipment being evacuated so that the vacuum, water and exhaust connections can be conveniently made. Provide for adequate space for convenient servicing where possible.

The pump should be mounted on a rigid foundation, such as a flat concrete ground. It should be made level and secured. The holes in the pump base frame are provided for fastening. Bolt pump to foundation without putting a strain or twist in the pump housing. See Figure 14, 15 or 16 for foundation bolting dimensions.

The pump house must be always kept clean and tidy. The ambient temperature should be within the range of 5 and 40℃.

2.2 Pipe Connection

Remove cap from exhaust and intake openings only when ready to make a pipe connection.

Intake connection of the pump should be equipped with dustproof device according to the use condition in order to absolutely prevent the hard solid particles such as glass fragment, sand, sheet metal or oxide etc. from being sucked. These particles should also be noticed in assembling the vacuum system. The gap between the piston & Slide and inwall of the pump cylinder is small; particles entering the pump can cause failure and possibly damage the internal parts. Therefore, measures should be taken beforehand, such as installing a filter screen. A filter screen can be used during the initial operation and as long thereafter as necessary, and removed when particles no longer accumulate.

Be sure all vacuum piping is tight enough since even tiny leakage will affect the degree of vacuum. All pipelines should be as short as possible and should be no smaller than the inlet and outlet to the pump. Tie-ins and elbows should be less used.

When connecting pump to the system, provide a vertical pipe at least 600mm long between the pump and the system, if the pump is below the system inlet. If the pump is above or level with the system inlet, provide an inverted 〝U〞 pipe to prevent migration of pump oil toward the system inlet. If an inline filter is being used it should be installed as noted below. (See Figure 5). It is advisable to install a flexible connection between pump intake and vacuum piping to eliminate vibration.

When the pump operates under the inlet pressure over 133 Pa (1torr) in the coarse vacuum, the exhaust opening will discharge oil mist, which is caused by the following reasons: when working at coarse vacuum, pressure in the compression chamber will increase apparently and the exhausted gases will violently dash out from the small exhaust openings. And the oil near the small openings and the exhaust valves will be atomized in the same theory of atomizer and then is discharged out of the pump together with the gases. This kind of oil mist phenomenon always exists more or less. Besides, the oil mist has no bad effect on the pump. However, if it is

dispersed in the indoor ai r, it will not o nly contaminate the air , but also damage the indoor floor and app aratus. In order to avoid this cont amination and damage, arr ange the pipe out side the building, poi nt the out side end of the exhaust pipe do wnward to pr event the entr ance of rainwater.

There should be 300mm headroom clearance a bove the pu mp, which means, a 300mm long pipe should be connected to the exhaust port of the pump first and then connected the other end of the pipe with the exh aust pi pe p assage. In this way , only the 30 0mm pipe should b e t aken apart whe n disassembling the pu mp, and the oil reser voir can b e disassembled an d reassembled without moving the exhaust pipe passage.

A vacuum isolation valve should be inst alled adja cent to the suction port to be used for leak checking, shutting down the system, or blanking off the pump.

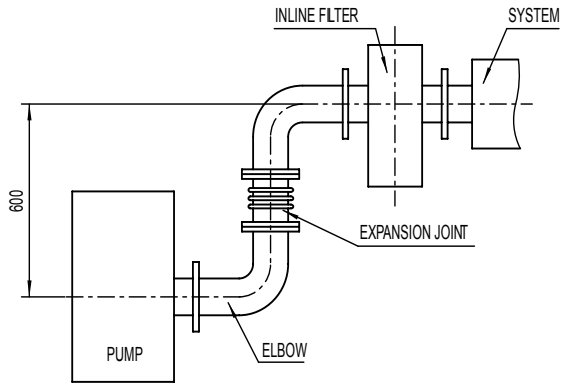
Types of Piping Joints

A. Standard wrought piping with welded joints makes the best vacuum piping system.

B. Copper piping with sweated fittings and joint s can also be made vacuu m tight and has the advantage of providing a neat, clean vacuum installation.

C. S tandard threaded piping, however , is satisfa ctory and more readily inst alled. The pipin g should be carefully ham mered to loosen any scales or chip s. Blow out the result ant with compressed air prior to inst allation. All ma le th readed joint s should be carefully d oped, screwed up tight and never "backed-off" to make parts align - this is apt to cause a leak. Paint the joints while the system is under vacuum until the paint is no longer drawn in.

Pump below system



Pump above system

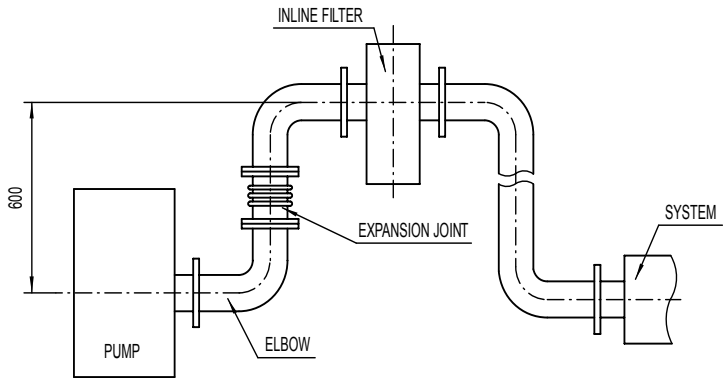


Fig. 5 Pipe connections

2.3 Cooling water

This pump is water-cooled and must be connected to a water supply. Water inlet and outlet connection is located in the pump housing on the intake side.

Cooling water temperature in the pump water jacket should be controlled between 20 and 40℃ during the operation, not exceeding 40℃ to prevent the furring from accumulating in the water jacket. Insert a valve in the water inlet line and regulate the water flow so that the temperature of the oil in the reservoir is between 60℃~85℃.

The water outlet should be connected to an open drain to permit the operator to check the flow and temperature of the outlet water periodically.

If the pumped gas temperature is higher than 40℃, it should be cooled to normal temperature. The maximum operating temperature of the pump can't exceed 85℃.

Do not allow the cooling water to freeze in the pump. Freezing of the cooling water jacket usually results in extensive damage to the pump cylinder that cannot be repaired. So if pump is outside & subjected to freezing temperatures, water tank & circulating pump should be installed with anti-freeze in the water.

If condensable are present in gas being pumped and Gas Ballast is used throttle the cooling water to raise operating temperature to the level needed for Gas Ballast.

2.4 Electrical Connections

The electrical connections must only be provided by a trained electrician.

Disconnect pump from source electrical power prior to making repairs or adjustments of any electrical component of the unit.

Connect the pump to the correct mains voltages through the terminals provide in the junction box. When electrical connection is complete turn the pump by hand to ensure that the pump is free to turn and then momentarily jog the motor to check that the pump rotation is anti-clockwise when viewed from the drive end. The proper rotate direction is marked on the belt guard cover. If the pump rotates in the wrong direction, interchange any two of the three-phase leads.

2.5 Lubrication of Pump

In common condition, the pump is filled with lubricating oil when it leaves factory. We recommend the use of our M100 mechanical vacuum oil (Heraeus N62 in Germany) for HGL and HG series rotary piston vacuum pumps for general operating conditions.

For initial oil filling and the first filling after the pump has been disassembled, the quantity of oil to be placed in the reservoir is one kilogram less than shown in the specifications. One kilogram should be added into the suction port before connecting the suction pipe, and then slowly rotate the pump through two revolutions, this will distribute the oil throughout the pump interior. The proper oil level should be at the center of the oil sight glass in the oil reservoir during general operation.

3 Operation

3.1 Pre-start Checks

Before starting the pump check the following items:

Remove cap from exhaust port before operating pump. Do not block or restrict the flow of gas from the pump discharge. Backpressure within the pump could cause severe damage.

Check the tension of the belt. It can be loos er before startup and then slowly tightened after startup in order to reduce startup moment by adjusting the adjusting bolt in the base.

Make sure oil level in the oil reservoir is about at center of the oil sight glass.

If the pump has been idle for a month or more, turn the pump by hand at least two revolutions.

If the ambient temperature in winter is too low (below 10 ℃), the pump should be heated before startup, since oil viscosity at low temperature is high and the motor will be overloaded and parts of the pump will be damaged in a sudden startup.

Jog the motor momentarily while observing pump rotation. Make sure the pump rotates in a correct direction (As marked on the belt guard cover).

If the oil level in the oil sight glass is dropped obviously compare to that of last time when the pump stopped, turn the pump at least 3 full rotations by hand using drive belt to discharge the oil in the pump cylinder into the oil reservoir before startup. Do not start the pump if a mass of oil exists in the pump cylinder under vacuum status.

3.2 Pump Start

(1) Check that the inlet isolation valve is closed.

(2) Check that the vent valve is closed.

(3) Open cooling water valve.

(4) Start the pump.

(5) Check and adjust the cooling water flow as shown in the specifications.

(6) Run the pump for about five minutes and then Slowly open the inlet isolation valve to open the suction of the pump to the process.

3.3 Pump Stop

(1) Close the inlet isolation valve.

(2) Open the Vent Valve while the pump is still operating.
The Vent Valve must be opened for at least 30 seconds before removing power from the pump. This will allow all the oil in the pump cylinder to be transferred into oil reservoir.

(3) Close the gas ballast valve.

(4) Stop the pump.

(5) Close cooling water valve.

(6) Close the Vent Valve.

It is import that the pump s hould be stopped according abo ve sequenc e. If the vacuum in the pump isn't broken (the vent valve isn't open) duri ng shut dow n, the oil in the reservoir would be sucked into the pump cylinde r, thus th e pump cylin der is full of oil. It is not a problem to stop the pump this time but hampers re-s tarting the pum p next time. The oil in the cylinder must be discharged out at the time of re-starting pump. Not only a to rque is very large nee ded by re-starting the motor, but also the shaft and eccentric will be subjected to enormous shock force. In order to avoid the damage to the m otor and pump, it is reco mmended that the vacuu m pump must be properly vented during shut down to insure normal startup conditions.

3.4 Operation of Gas Ballast Valve

Operation of the gas ballast valve is quite simple. Open the Gas Ba llast valves fully for maximum efficiency. For a lesser degree of ballasting, tu rn gas bal last valve toward close positio n (clockwise). Generally speaking, if th e gas ballast valve is fully opened, it s vacuum pressure is 13 Pa (10^{-1} torr). Full gas ballast will cause pump tem perature to rise but this is normal. For maximum effect of gas ballast, pump should be run approximate at 85℃. Throttling cooling water can raise operating temperature.

If pumping water vapor in excessive quantities and the oil has become c ontaminated, it can purified by running the pump with Gas Ballast valves full open while the pump is shut-off from the system. When excessive cont aminants are present, indicated by high o il level, or thinning, formation of varnish, etc., the oil should be replaced.

In dirty applications w here condensa ble cont aminants (asphalt, pitch , epoxie s, etc.) oth er than water vapor are present, the pump should be operated in the range of 85℃.

Gas Ballast should ne ver be used if vap ors bei ng pumpe d a re explosive, e.g. Methane Gas, Hydrogen, and certain solvent vapors.

Open the gas ballast valve slightly wi ll quite va lve noise when the pump is blanked-of f, but will prevent reaching the lowest final pressure.

3.5 Operating Notes

If large amounts of air pass through the pump, it may become warm and un der severe conditions may become hot. This d oes not indicate troubl e. The pump is designed fo r high vacuum work and should not be op erated at pr essures above 80Kp a for more tha n 15 minutes or at intermediate vacuums fo r periods wh ich cause oil temperature to exceed 90 ℃. For o ptimum pump operation the oil te mperature of the oil in the reservoir should b e between 60℃ and 85℃ with the pump operating on t he system or process. Oil te mperature c an be measured by

inserting a thermometer in the fill hol e or by cont act pyrometer on oil lines. If the pum p is to be operated with oil temperature in excess o f 85 ℃, the use of a heavi er viscosity oil is recommended.

When starting the pump or when handling large amounts of air, oil vapor in the form of smoke will issue from the exha ust. Again th is is no indication of trouble, as the v olume of smoke will decrease as the vacuum in the system improves.

If the pump has been shut down for an extended period, always turn over at least two revolutions by hand before starting to insure free movement of parts.

Low oil temperatur e can cause overl oading when st arting the pump and possibly pre vent the pump from sealing. HG and HGL series pumps should not be started when the oil temperature is below 10℃. Optimum operating oil temperature af ter starting is between 60 ℃ to 85℃. Opening the Gas Ballast valve will help warm-up the oil.

4 Checking

4.1 Poor Vacuum

No pump wi ll give go od result s on a poo r vacuum system. If the vacu um in the system is unsatisfactory, the usual cause is leakage. To check for this condition, a methodical approach will usually resolve the problem in the least amount of time.

4.2 Localizing Leakage

A leak rate will help localize a vacuum leak. Such a test is easily made by successively isolating and evacuati ng each section of the system. The in-leakage ra te of the isolated section is then noted.

A vacuum leak detector will speed up the process of locating leaks.

4.3 Repairing Small Leaks

To repair small leaks or to close pores, use anaerobic adhesive to seal over the leaking area.

5 Maintenance

To insure efficient performance and minimum wear, the following procedures are recommended:

5.1 First Three Weeks of Operation

Check oil level daily and oil condition. (See section 5.3 and 5.6).

Check oil passages. (See section 5.4).

Check belt tension weekly.

Check the foundation bolts weekly.

5.2 After First Three Weeks of Operation

Check oil level and oil passages daily.

Check "V" belts, tension and wear every 3 months.

Tighten all flange side cover bolts and foundation bolts at regular intervals.

5.3 Checking Oil level

Check oil level each day.

The oil level should be about at center of oil sight glass in reservoir. Oil level will change depending on inlet pressure.

5.4 Checking Oil Passages

Check oil passages each day.

In a dirty pumping situation, oil passages may be obstructed, if so, the oil cannot circulate. This is indicated by poor vacuum and if the condition is allowed to continue for any length of time, the pump may suffer damage. So do as follows to make sure if the oil passages are really obstructed:

(1) Close the inlet isolation valve.

(2) Run the pump.

(3) After running the pump several minutes, air is invisible from the exhaust port. Then open the gas ballast valve, run pump for a short period of time, in most cases, oil is added after opening the gas ballast valve.

(4) Close the gas ballast valve. Observe the changes of oil level in reservoir. If the oil passages are unobstructed, the oil level will move down slowly in 2 or 3 minutes. If there are no changes in the oil level, this indicates obstruct in the oil passages.

If the oil passages are obstructed, stop the pump immediately. Otherwise insufficient lubrication results in the damage of the pump.

5.5 Dredging Oil Passages

In the event that oil passages are obstructed or suspected of obstruct. The following procedures are recommended:

(1) Stop the pump, drain oil, clean reservoir and oil filter (18/58)（see figure 18）.

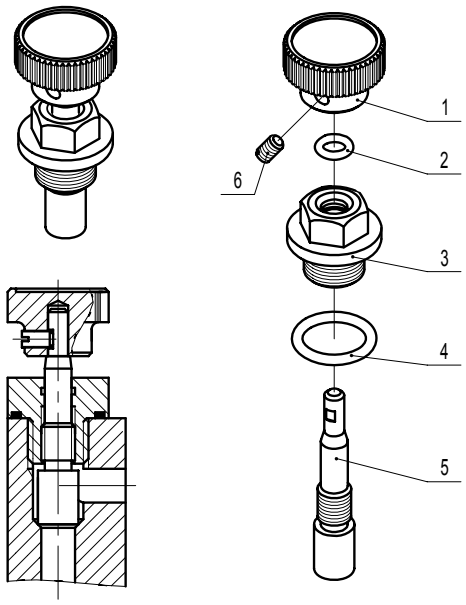
(2) Loose the Oil Flow Adjusting Valve（See Figure 6 ）by turning its hand wheel（6/1） anti-clockwise about 4 revolutions.

(3) Fill pump with oil, Run pump for approximate 15 minutes.

(4) Tighten the Oil Flow Adjusting Valve to original position by turning its hand wheel clockwise.

Refer to section 5.4; check oil passages. If the oil passages are still obstructed, then repeat the above steps until the oil passages are unobstructed.

The pump is provided with two Oil Flow Adjusting Valves separately on the two side covers, operate the two Oil Flow Adjusting Valves at the same time.



Key to Fig. 6

1. Hand wheel
2. O-ring
3. Hexagonal nut
4. O-ring
5. Regulating stem
6. Holding screw

Fig. 6 Oil Flow Adjusting Valve

5.6 Changing oil

The pump oil should be changed after initial 150 hours operation, then for general operation change oil every 300 hours of operation and clean reservoir every 600 to 900 hours of operation. For dirty applications decrease oil change intervals and this can be determined by experience and by deterioration of pump performance.

If the oil becomes contaminated (indicated by darkening in color and/or poor pump performance) it should be drained. Drain the reservoir. Wipe the filter and reservoir before filling with new oil. Milky appearance of oil indicates water contamination. Use Gas Ballast to clear oil, or change oil. Also most water can be removed by draining water from pump before starting pump.

To change oil, clean oil filter (See Section5.7) and reservoir proceed as follows:

(1) With pump running, close inlet isolation valve to system and open vent valve to pump and admit atmosphere to the system so that atmospheric pressure forces oil from the pump interior up into the reservoir. Run pump for approximately 30 seconds, then turn pump off.

(2) Drain oil by opening oil drain cock (17/5).

(3) After oil has been drained remove oil reservoir (17/18).

(4) Thoroughly wipe out oil Filter and reservoir, do not flush the reservoir with Kerosene, Gasoline or any other solvent that may, if not completely removed, contaminate the pump oil. Use only clean, dry, lint-free towels.

(5) Replace O-ring (17/25) and tighten securely.

To avoid blowing oil out the fill hole, do not add oil to the pump when in operation.

5.7 Checking and Cleaning oil filter

During the operating, the oil circulate through the pump and contaminates may be deposited in the oil filter, so check and clean the oil filter frequently.

Whenever the pump oil is changed, it is strongly suggested that the oil filter should be cleaned or replaced as follows:

(1) Remove the screw (7/1), Clamping Ring (7/2), Oil Sight Glass (7/3) and O-ring (7/4).

(2) Pull out the Oil Filter (7/5), check and clean it. Dry oil filter assembly.

(3) Reassemble Oil Filter Assembly by reversing the disassembly steps described above. Be careful to insert the Oil pipe (7/6) into the bottom of the Oil Filter.

Key to Fig. 7

1. Screw
2. Clamping Ring
3. Oil Sight Glass
4. O-ring ø70 × 5.7
5. Oil Filter
6. Oil pipe
7. Oil pipe joint 1/2”
8. Washer
9. Filter Screen

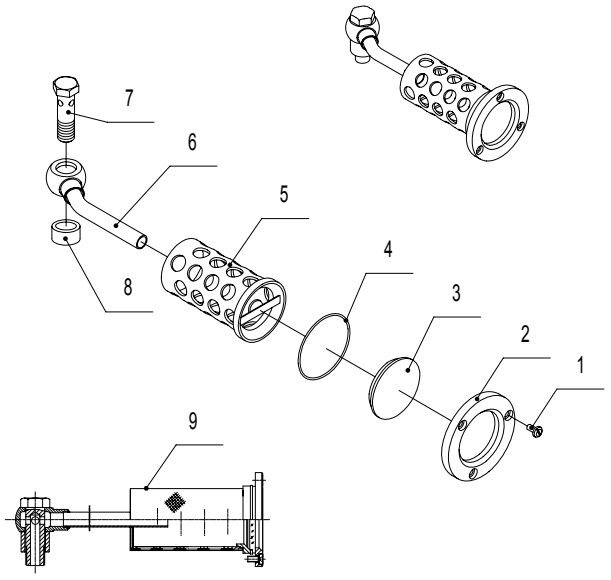


Fig. 7 Oil Filter Assembly

5.8 Cleaning Exhaust Valve Assembly

When the oil is badly contaminated the exhaust valves and chamber should be cleaned. Referring to Figure 8 proceed as follows:

(1) Repeat steps 5.6, 1) to 4).

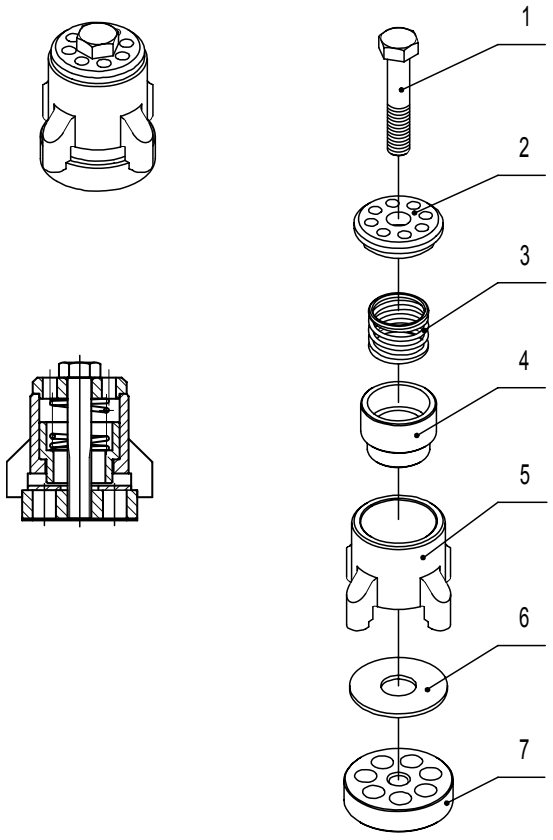
(2) Remove Air/oil Separator (17/21), exhaust hood (17/22) and exhaust seat (17/24).

(3) Remove valve assembly

To disassemble valve assembly (see figure 8), remove cap screw (8/1), lift off valve cap (8/2), remove spring (8/3) and valve disc (8/6).

(4) Clean and inspect valve parts, and wipe out valve chamber with clean, dry lint-free towels.

(5) Reassemble valve assemblies by reversing the disassembly steps described above.



Key to Fig. 8

1. Cap screw
2. Valve cap
3. Spring
4. Spring seat
5. Valve body
6. Valve disc
7. Valve seat

Fig. 8 Exhaust Valve Assembly

5.9 Checking and Changing Exhaust Valves

The valves are the puppets type and corrosion resistant construction. These valves operate many millions of cycles per year in normal operation and should be inspected at least once every six months even though the pump is operating satisfactorily, and more frequently where duty on pump is severe. The valve should be disassembled and cleaned in accordance with section 5.1.4. At the time of the inspection, it is advisable to replace the entire set of springs and valve discs. This procedure will increase the reliability of the pump, avoiding the possibility of additional spring failure.

In a clean and light pumping situation, the exhaust valve springs and discs should be replaced every 6 months. At this time the reservoir should be checked for sludge accumulation and foreign particles. A magnet is placed at the bottom of the reservoir to adsorb foreign metal particles. The presence of sludge and/or foreign particles in the reservoir indicates the same condition exists in the oil passages. This condition will cause an obstruct in the oil passages, do as described in the section 5.5.

If the pump is used in a dirty and heavy pumping situation, the preventive maintenance checks should be performed sooner.

Technical Specifications

Spring:

1. Developed length: L=472mm
2. Turning direction: Dextrorotation
3. Number of effective coils: 5
4. Total Number of coils: 6
5. Material: Phosphor brass wires

Valve Disc:

Material: 65Mn

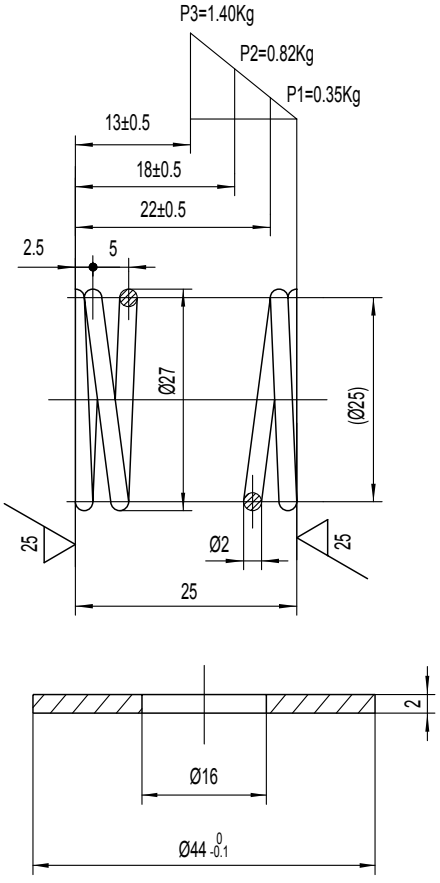


Fig. 9 Spring and Valve Disc in Exhaust Valve

5.10 Replacing Shaft Seal

After a long period of operation, the shaft seal may become worn or scratched on the sealing face. If oil drops from the shaft, it is an indication that the shaft seal should be inspected and replaced as necessary. The following procedure is suggested:

At the pump sheave's end
(The procedure for replacing shaft seal at the balance wheel's end is similar).

(1) Remove the belt guard cover (18/43) and V-belt (18/46).

(2) Remove the locking disc (18/44).

(3) Pull out the pump sheave (18/47). (Use a pull tool).

(4) Remove the oil pipe of gland (18/39).

(5) Remove the Sealing gland (18/38) with shaft seal (18/37).

(6) Take out the shaft seal (18/37) from the sealing gland (18/38), check and replace it if neccessary.

(7) Inspect the Sleeve B (18/35). If there are some scratches or grooves on the surface of sleeve, the sleeve must be replaced.

Clean the above parts and reassemble the parts in the reverse order as for disassembly.

5.11 Pump Disassembly

The following procedures are recommended for disassembling the pump (see figures 7):

After oil and water has been drained remove:

(1) Belt guard cover (18/43) and balance wheel cover (18/62).

(2) Pump sheave (18/47) and balance wheel (18/61). (Use a pull tool).

(3) Shaft seal assembly and Oil pump assembly.

(4) Side cover A (18/27) and side cover B (18/67).

(5) Eccentric (18/77), shaft (18/71), piston & slide (18/76) and slide guide (18/75).

The pump is reassembled by reversing the disassembly procedure. During the disassembling and reassembling, it is extremely important to handle mechanical surfaces with care. Do not directly beat the mechanical surfaces of the parts with a hammer. Clean all parts thoroughly being careful not to scratch or dent any of the surfaces.

6 Troubleshooting Guide

Before attempting to locate the cause of poor vacuum ultimate pressure, check the accuracy of the vacuum gages on the system.

1. Vacuum at pump is Unsatisfactory	
Probable Cause	***Possible Remedy***
A. Contaminated or insufficient oil.	1. Check oil level; Open the gas ballast and run the pump for 1~2 hours. See section 3.4. 2. Drain and wipe out oil filter, reservoir and valve chamber. Refill with proper oil. See Section 5.6 & 5.7.
B. Oil passages are obstructed.	1. Check oil passages, see section 5.5 2. Clean oil filter, Dredge Oil passages. See section 5.6.
C.Loose intake flange or side cover.	1. Tighten flange and side cover bolts at regular intervals.
D. Oil line connections leaking.	1. Tighten and paint connections with sealer.
E. Exhaust valve not sealing.	1. Disassemble, clean and check all parts thoroughly. 2. Check and replace any damaged or worn parts. See Section 5.8. If springs and valve discs are faulty it is advisable to replace them.
F. Excessive High temperature of pumping gas.	1. Cool pumping gas.
G. Pump seizes or knocks excessively, internal parts badly worn or broken.	1. Disassemble pump, Fix worn, broken or badly scored parts. See Section 5.11. Make sure oil passages are unobstructed. See section 5.4.
H. Leakage in vacuum system.	1. Check system as described in Section 4.
2. Motor Stops or Will Not Start	
Probable Cause	***Possible Remedy***
A. The motor may be overloaded or the fuse has been blown.	1. Find out the cause, replace the fuse.
B. Possible internal seizure.	1. Disassemble and correct.

3. Excessively Noisy	
Probable Cause	***Possible Remedy***
A. Pump knocking.	1. Check oil level and oil passages. 2. Broken parts or foreign material in the pump. 3. Disassemble and remove foreign material in the pump. 4. Replace broken parts as required.
B. Pump vibrates	1. Check oil level and oil passages. 2. Pump may not be placed on a flat foundation. Make sure the pump is horizontal. 3. Inlet or outlet connections are not flexible. Use more flexible connections.
C. Pump seizes due to lack of lubrication, or presence of foreign material.	1. Check oil passages; make sure the oil passages are unobstructed. 2. Disassemble and remove foreign material. 3. Smooth minor scoring with emery cloth and wash thoroughly then oil before installing. (A certain amount of scoring to the piston & Slide and cylinder and other parts usually will not seriously affect the vacuum obtainable so long as scoring is not in a continuous gage around entire piston & Slide surface).
4. Pump Does Not Turn When Motor Pulls	
Probable Cause	***Possible Remedy***
A. V-belts too loose.	1. Tighten V-belts.
B. Pump may be Stopped before opening vacuum break valve; cylinder may be flooded with excessive oil. Or foreign material may be in valve seat.	1. Turn pump over by hand to remove excessive oil. 2. Disassemble valve, clean and replace any worn parts.
C. Oil temperature may be too low.	1. Warm oil before pouring into pump (especially with low ambient temperatures). Pump should not be started when oil temperature is less than 10℃.

7 Parts list

Refer to Fig. 17 & 18 Explosion diagram for HGL150

Item No.	Part Description	Qty.	Item No.	Part Description	Qty.
1	Long cover	1	41	Fixing plate	2
2	Holding screw M10×16	1	42	Oil cup	2
3	Bracing frame	1	43	Belt guard cover	1
4	Hinge pin	1	44	Locking disc	2
5	Oil drain cock	1	45	Stand bar	1
6	Oil filter	1	46	V-Belt	4
7	Exhaust valve	6	47	Pump sheave	1
8	Short cover	1	48	Vent valve	1
9	Oil pipe	1	49	O-ring ø158×□5×3.3	1
10	Bolt M8×40	2	50	Elbow	1
11	Rotatable frame	1	51	Water inlet & outlet	2
12	Motor sheave	1	52	Water drain plug G3/4”	2
13	Motor	1	53	O-ring ø25×3.1	4
14	Holding screw M10×16	1	54	Water jacket cover	1
15	Oil reservoir cover	1	55	Base frame	1
16	Eyebolt	1	56	O-ring ø145×3.1	2
17	Oil fill cap	1	57	O-ring ø150×3.1	2
18	Oil reservoir	1	58	Oil flow adjusting valve	2
19	Oblong oil sight glass	2	59	O-ring ø19×2.4	4
20	Spit ring	1	60	Holding frame	1
21	Air/oil separator	1	61	Balance wheel	1
22	Exhaust hood	1	62	Balance wheel cover	1
23	Holding screw	6	63	Screw collar, left	1
24	Exhaust seat	1	64	Bearing seat B	1
25	O-ring ø520×3.1	1	65	Sleeve A	2
26	O-ring ø496×3.1	2	66	Vane wheel of oil pump	1
27	Side cover A	1	67	Side cover B	1
28	Sleeve C	1	68	Gas ballast valve	1
29	O-ring ø65×3.1	5	69	Screw plug M18×1.5	2
30	Bearing seat A	1	70	Pipe of oil pump	1
31	Washer	3	71	Shaft	1
32	Spacer ring	1	72	Flat key	2
33	Shaft seal ø75× ø95×10	4	73	Round key 10	1
34	Bearing NJ312EM	2	74	Flat key 16×80	2
35	Sleeve B	2	75	Slide guide	1
36	Screw collar, right	1	76	Piston & Slide	1
37	Shaft seal ø75× ø100×10	2	77	Eccentric	1
38	Sealing gland	2	78	Circlip for shaft	1
39	Oil pipe of gland	1	79	Pump body	1
40	Oil cup seat	2	80		

Key to Fig. 15

1 Bolt
2 Flat washer
3 Elastic washer
4 Hand wheel
5 Valve cover
6 O-ring
7 Valve body
8 O-ring
9 Valve block

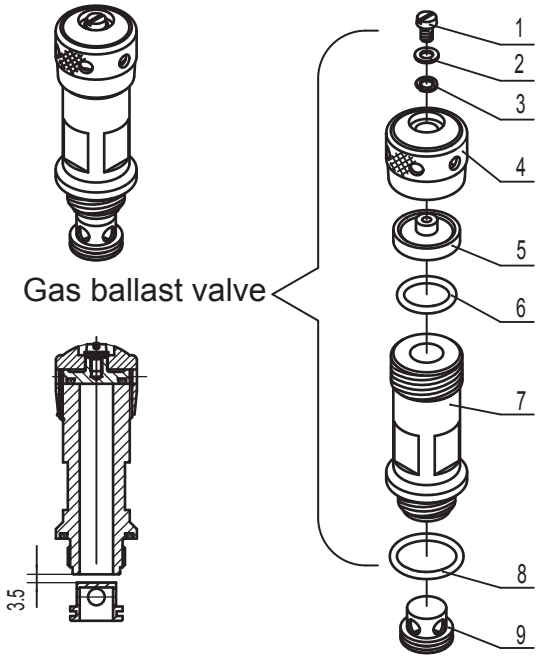
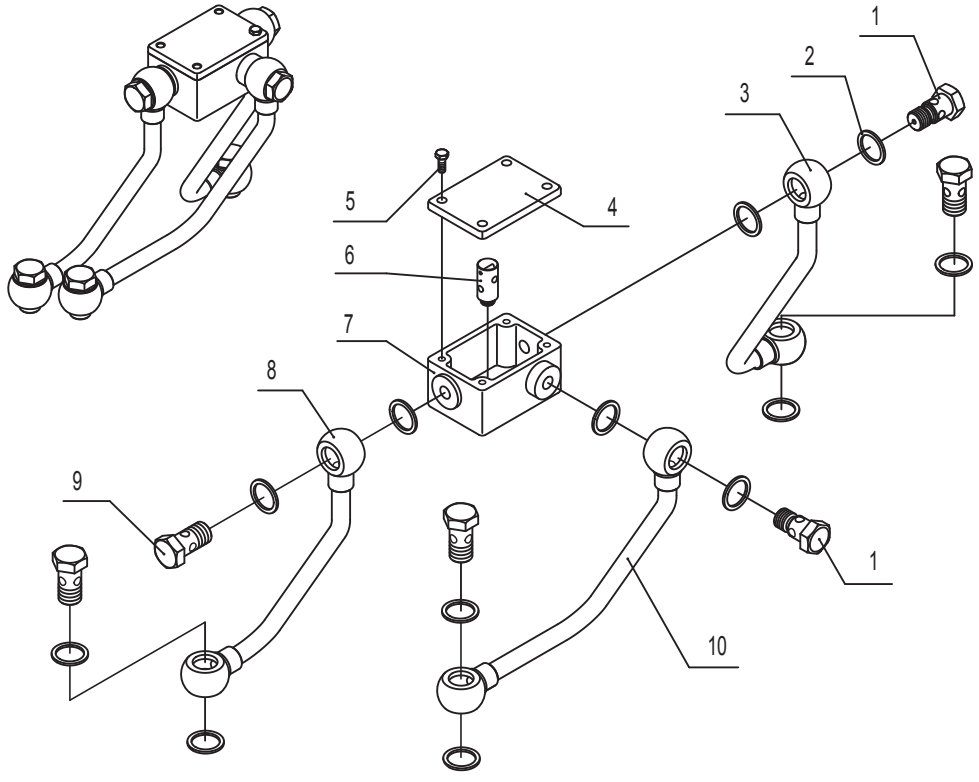


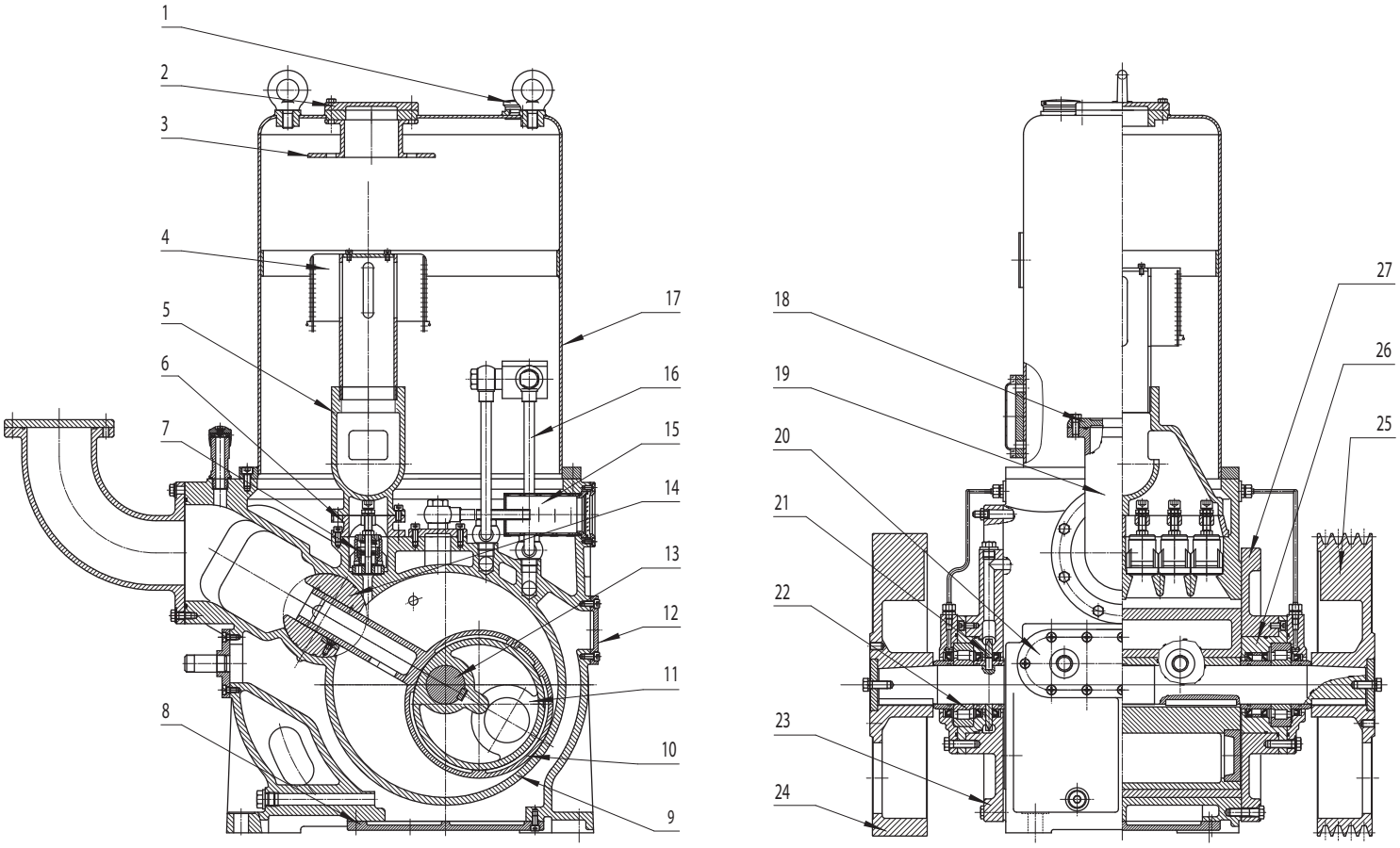
Fig. 10 Gas ballast valve & vent valve



Key to Fig. 16

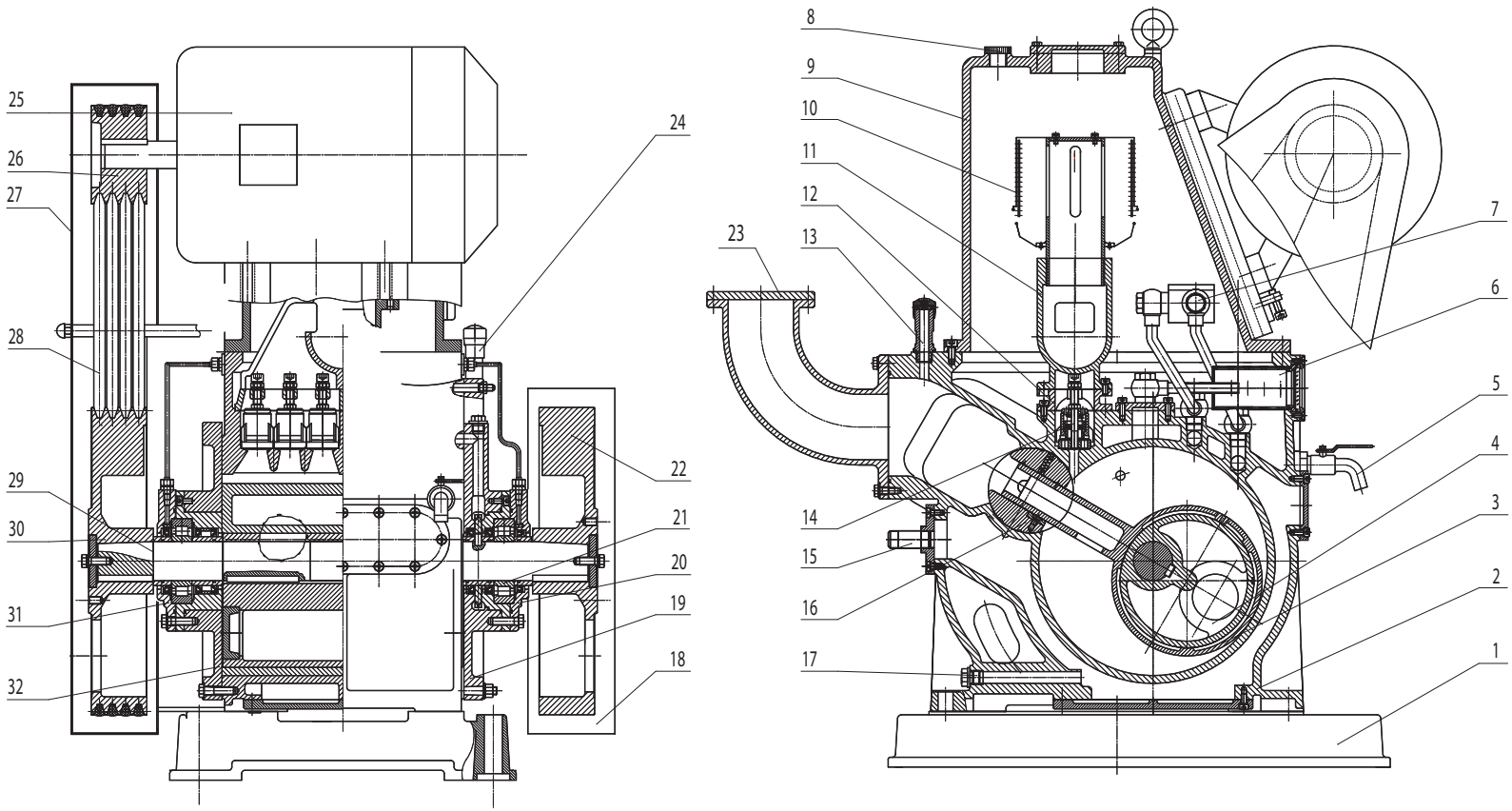
1 Oil pipe joint M18×1.5	2 paper gasket	3 Discharge pipe A	4 Box lid
5 Screw	6 Check valve	7 Box body	8 Suction pipe
9 Oil pipe joint	10 Discharge pipe B		

Fig. 11 Oil box



1	Oil fill cap	2	Outlet cover	3	Spit ring	4	Air/oil separator	5	Exhaust hood	6	Exhaust seat
7	Exhaust valve assembly	8	Bottom cover	9	Pump body	10	Piston & Slide	11	Eccentric	12	Long cover
13	Shaft	14	Slide guide assembly	15	Oil filter assembly	16	Oil box assembly	17	Oil reservoir	18	Inlet cover
19	Inlet elbow	20	Water jacket cover	21	Oil pump assembly	22	Bearing 42312	23	Side cover B	24	Balance wheel
25	Pump Sheave	26	Shaft seal assembly	27	Side cover A						

Fig. 12 Constructional drawing for HG150



1	Base frame	2	Pump body	3	Piston & slide	4	Eccentric	5	Oil drain cock	6	Oil filter assembly
7	Oil box assembly	8	Oil fill cap	9	Oil reservoir	10	Air/oil separator	11	Exhaust hood	12	Exhaust seat
13	Vent valve	14	Exhaust valve assembly	15	Water inlet & outlet	16	Slide guide Assembly	17	Water drain plug	18	Balance wheel cover
19	Side cover B	20	Oil pump assembly	21	Bearing 42312	22	Balance wheel	23	Inlet elbow	24	Gas ballast value
25	Motor	26	Motor sheave	27	Belt guard cover	28	V-Belt	29	Shaft	30	Pump sheave
31	Shaft seal assembly	32	Side cover A								

Fig. 13 Constructional drawing for HGL150, HGL70

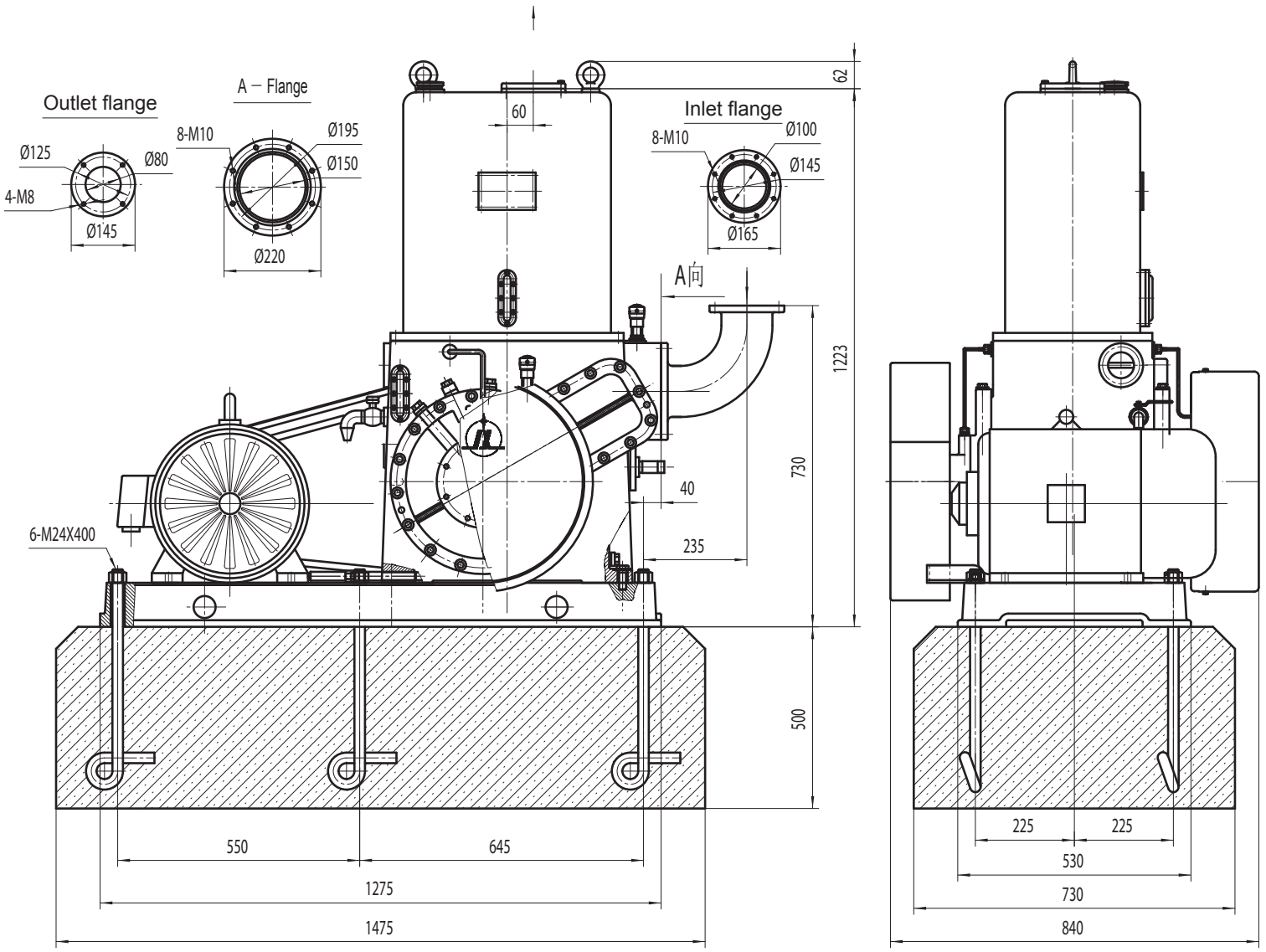


Fig. 14 Dimensional drawing for HG150

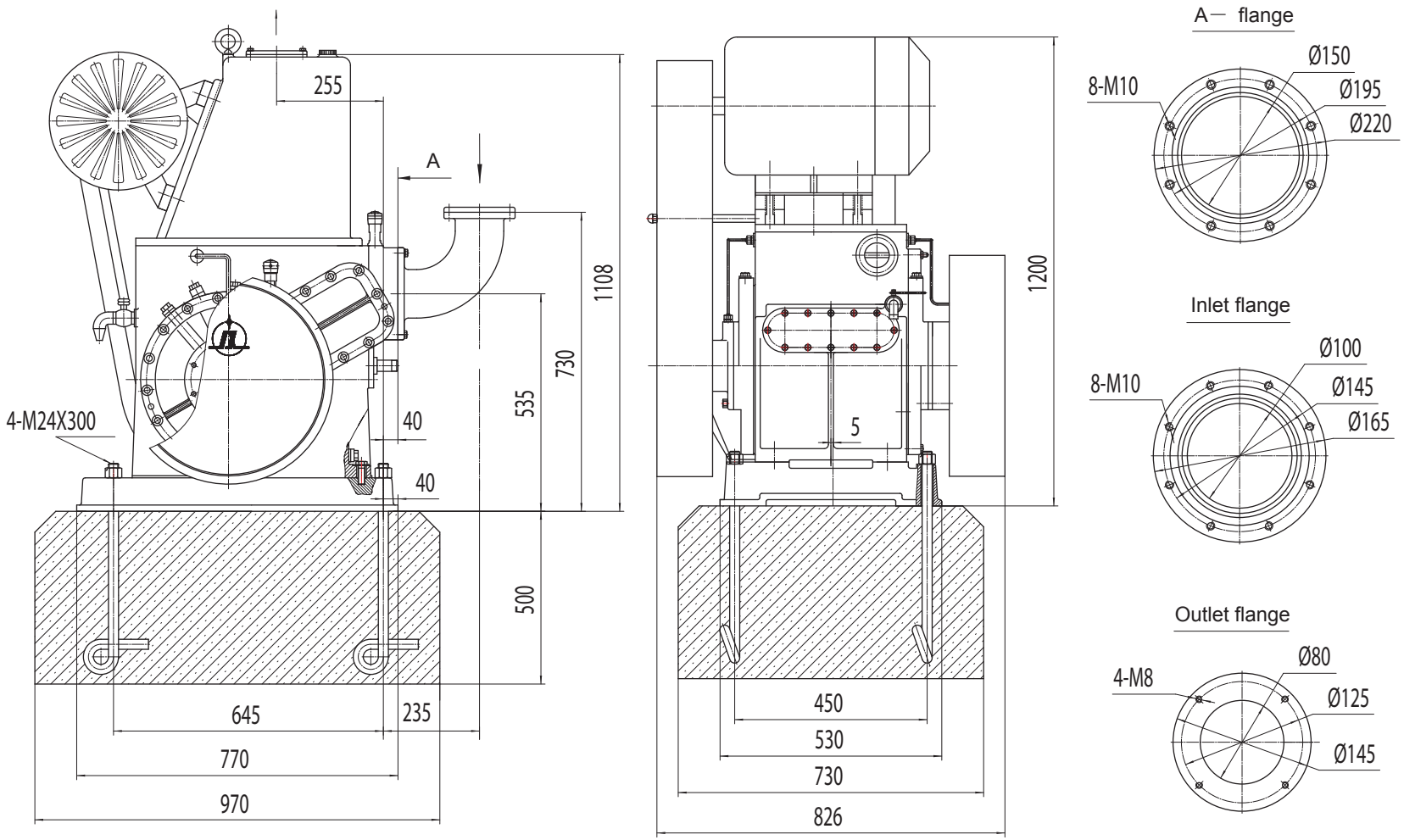


Fig. 15 Dimensional drawing for HGL150

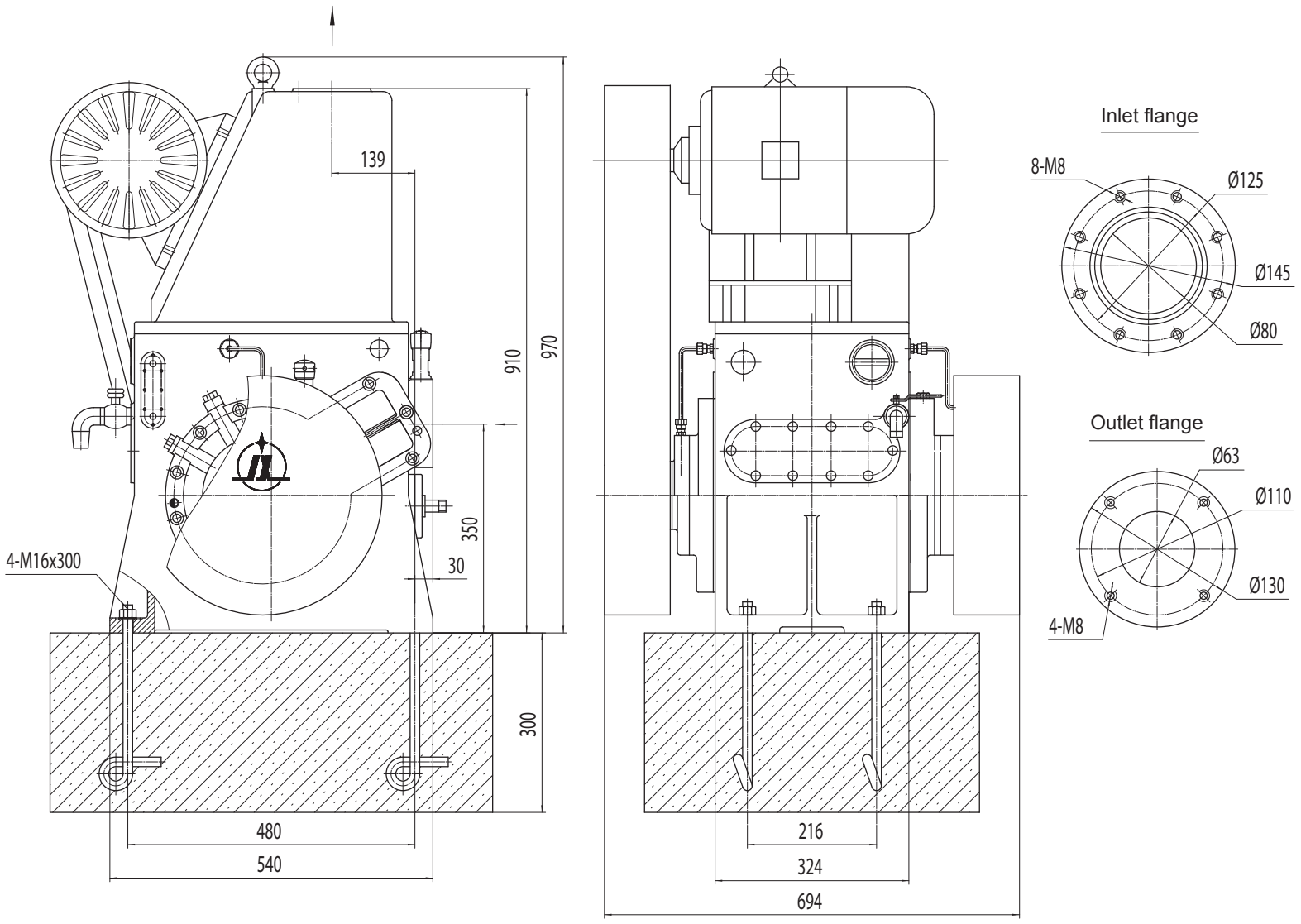


Fig. 16 Dimensional drawing for HGL70

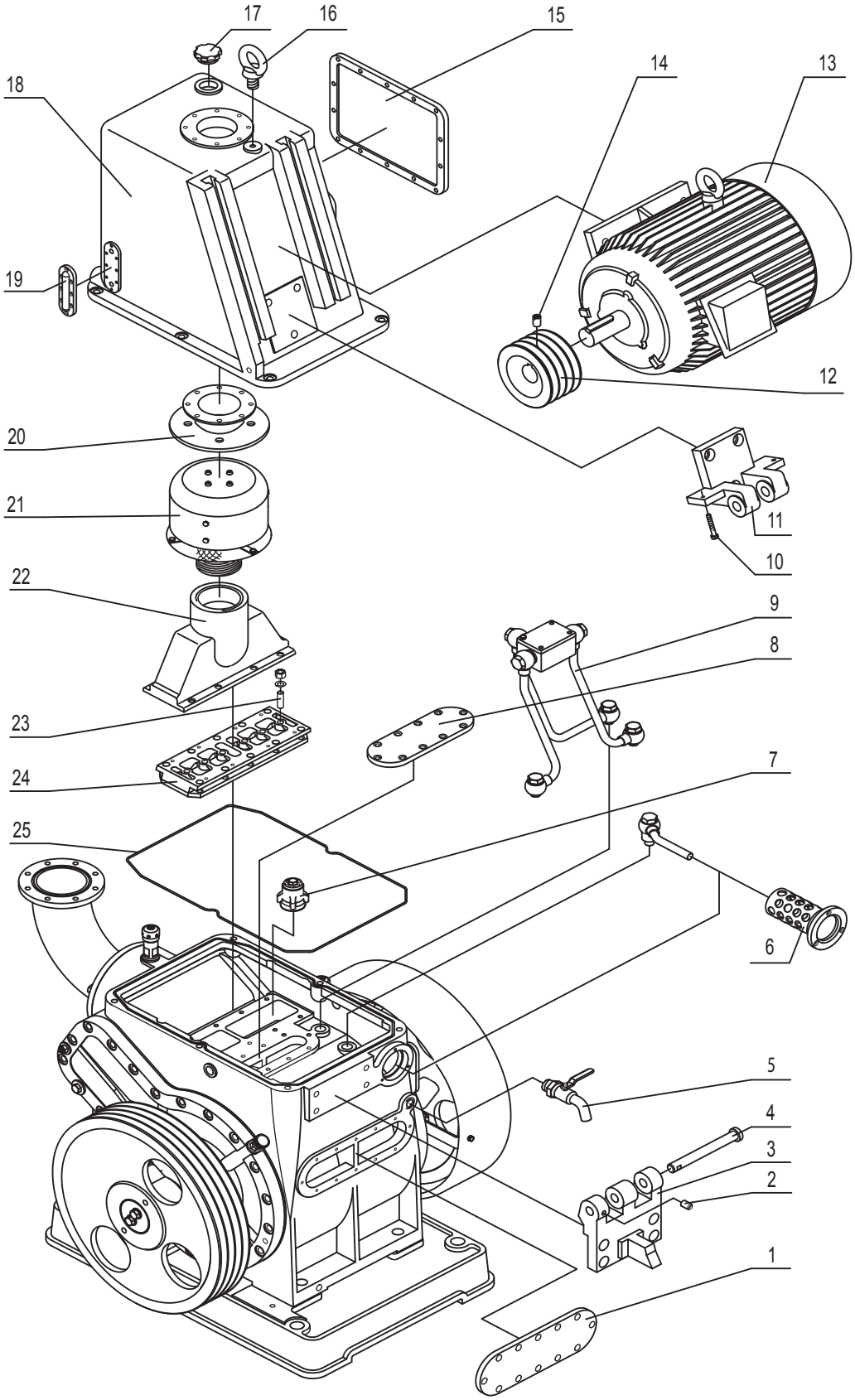


Fig. 17 Explosion diagram for HGL150

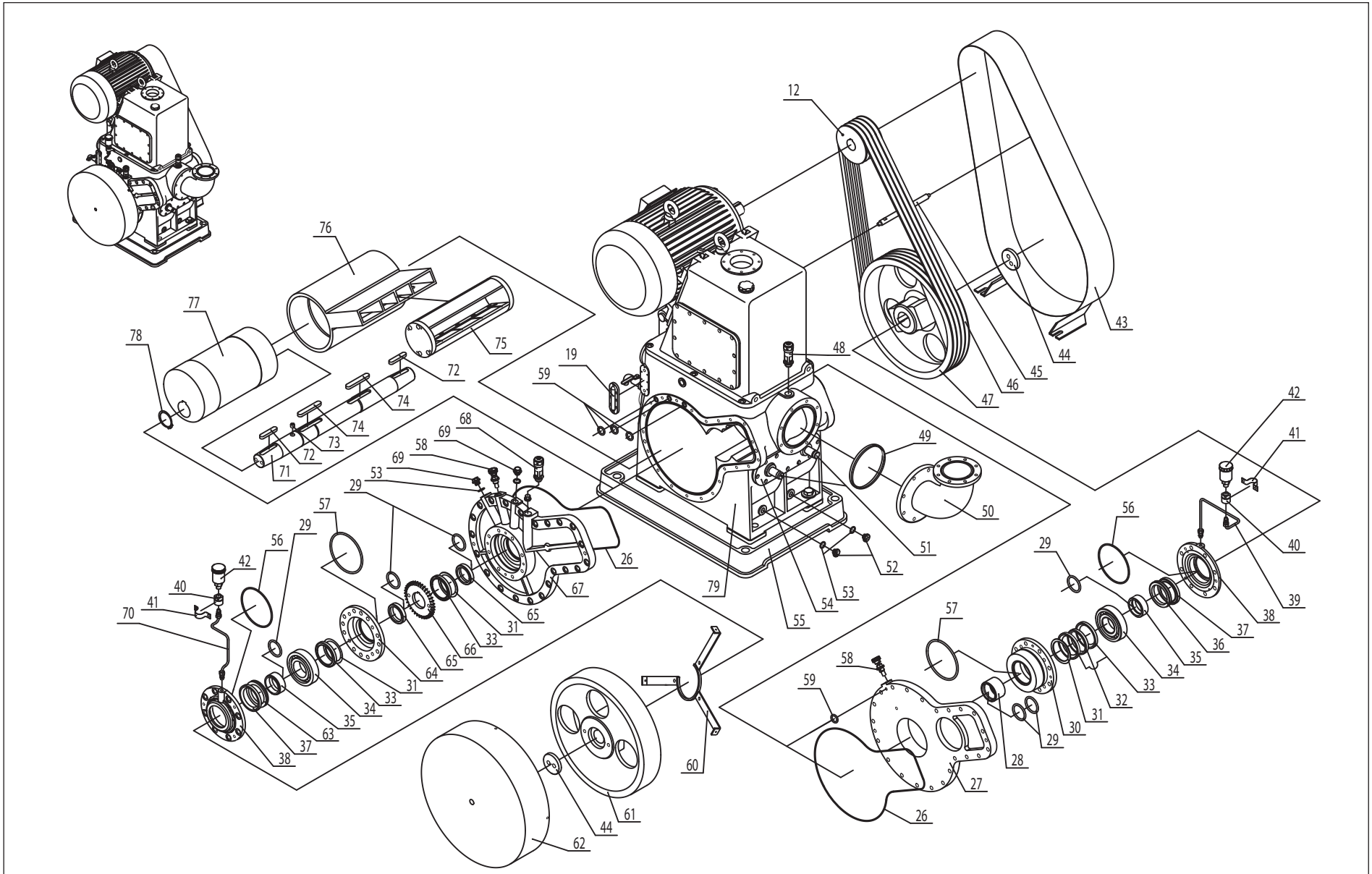


Fig. 18 Explosion diagram for HGL150

- HG series rotary piston vacuum pump
- HGL series rotary piston vacuum pump
- ZJP series Roots vacuum pump
- SK single stage water ring vacuum pump
- 2SK double stage water ring vacuum pump
- YK single stage liquid ring vacuum pump
- 2YK double stage liquid ring vacuum pump
- LG series dry compressing vacuum pump
- 2XZ series rotary vane vacuum pump
- Vacuum system

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