



ZHEZHEN ®

Model H - 150D

ROTARY PISTON VACUUM PUMP

Operation Installation & Maintenance Instruction Manual

Please read this manual
through before operation

Zhejiang Vacuum Equipment Group Co., Ltd.

The People's Republic of China

1. DESCRIPTION

The model H-150D rotary piston vacuum pump (hereafter called the pump) is a sort of vacuum equipment suitable for pumping ordinary gas and gases have a low percentage of condensable vapour (with a gas ballast used).

The volume flow rate of the pump is 150 l/s , ultimate pressure 1 Pa. It is widely used in vacuum smelting, vacuum drying , impregnating and high vacuum simulation test, etc. The pump can be a backing pump when combined with another high vacuum pump as well as operated singly. It can't be used as transfer pump to pumped from one container to another. It must be fitted with an appropriate accessory if pumped gas is rich in oxygen, explosive, corrosive to ferrous metal, chemical reactive with vacuum pump oil, etc.

Explanation of the pump model H-150D

H—single stage rotary piston vacuum pump

150—the nominal volume flow rate of the pump is 150 l/s

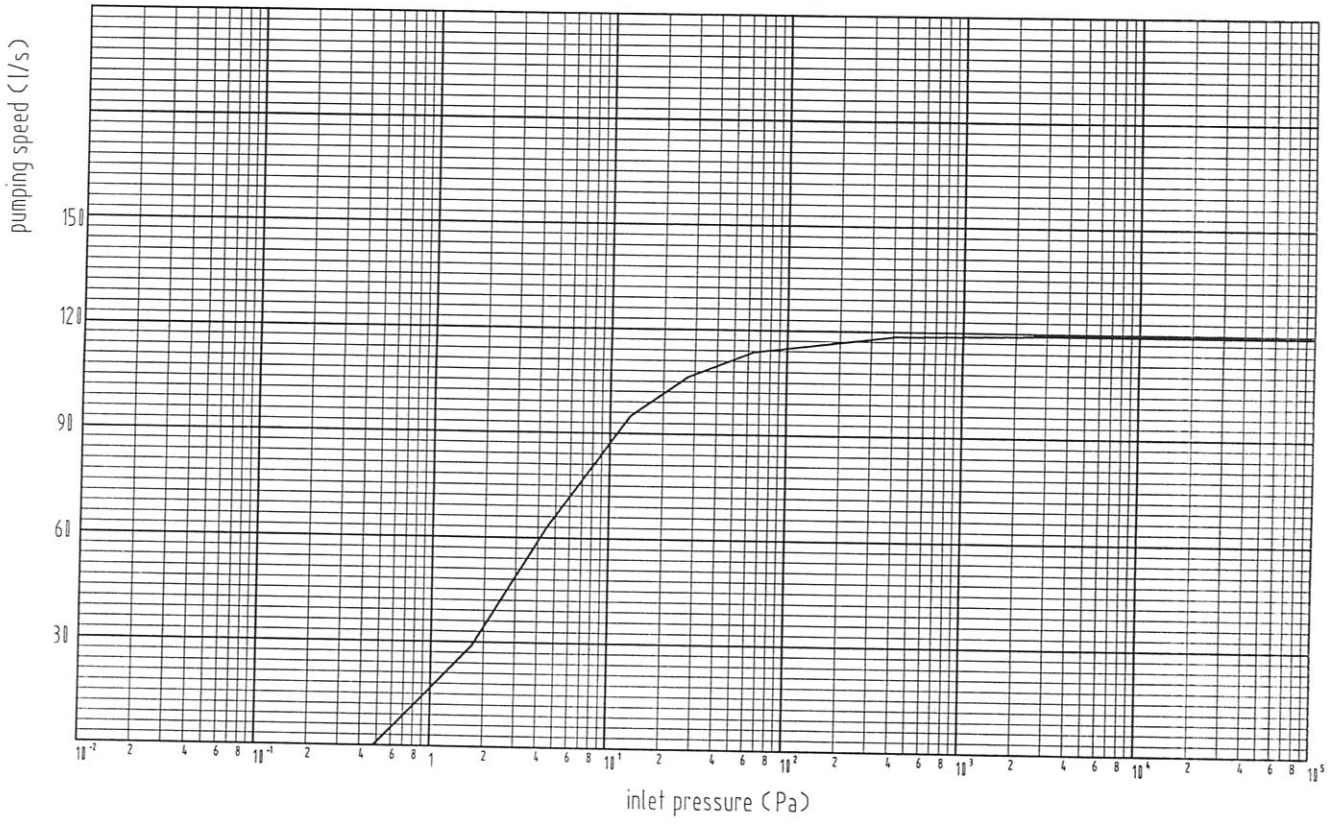
D—improved type

2. PERFORMANCE

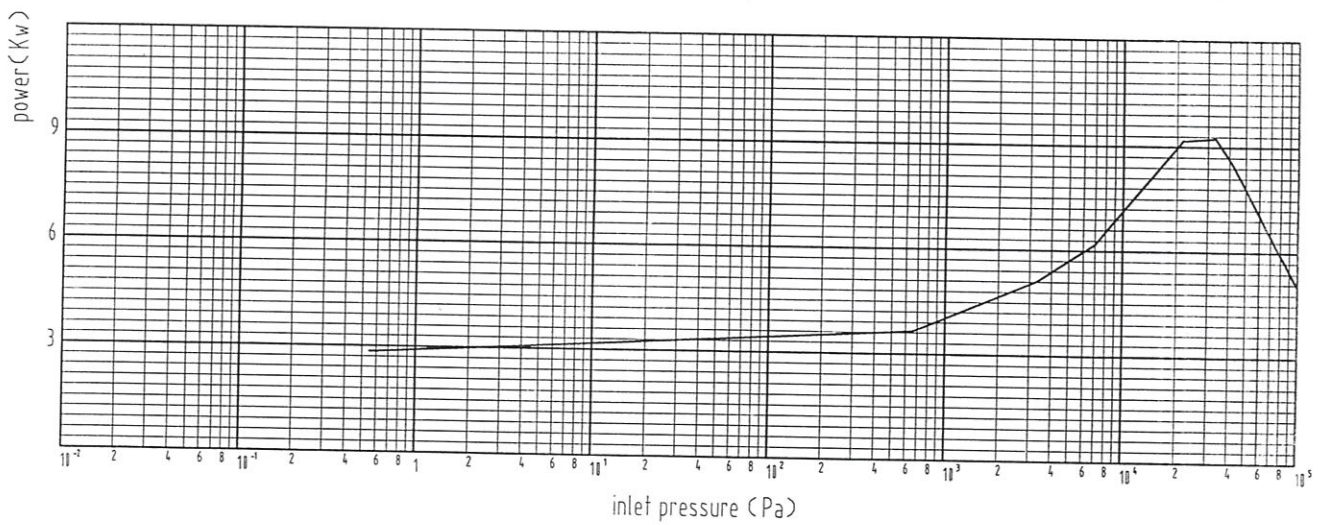
volume flow rate (L/s)	150
ultimate pressure (Pa)	1
pump rotational speed (rpm)	490
motor power (kw)	11
motor rotational speed (rpm)	1440
motor model	Y160M-4
max. inlet pressure permitted for long time running (Pa)	1.3×10^3
max. consumption of cooling water (L/hr.)	450
lubrication oil	mechanical vacuum pump oil
lubrication oil capacity (l)	36
suction diameter (mm)	105
outlet diameter (mm)	80
overall dimension (l × w × h) (mm ³)	660 × 1050 × 1310
weight without motor (kg)	896

Note: The ultimate pressure of the pump refers to the permissible gas pressure, indicated by a Mcleod gauge.

pumping speed versus inlet pressure curve



power versus inlet pressure curve



3. CONSTRUCTION AND PRINCIPLE

The pump mainly consists of a pump body, slide pistons, cams.

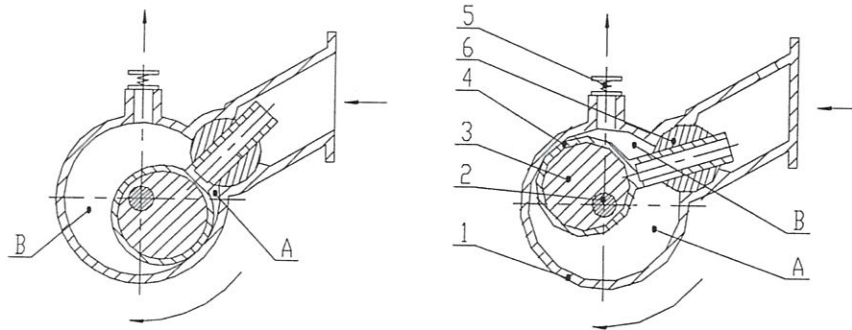


Fig.1

1. pump housing 2. shaft 3. cam 4. slide piston 5. exhaust valve 6. slide rail

This pump consists of two parallel housing. The operating principle of the pump is shown as follows:

The slide piston (4) is mounted within the pump housing (1) and the cam (3) eccentrically mounted within the slide piston. Driven by a shaft (2), the cam rotate, an axle of the shaft coincides with the centerline of the pump housing. The outer circular surface of the slide piston can slide on the inner surface of the pump housing and the upper part of it can flicker and slide freely within the half circle-shaped slide rail, two housings (housing A and housing B) are formed between the piston and the wall of the pump housing. Gas from the system enters the pump suction and goes into the housing A. This housing will gradually increase and more gas will be drawn in as the piston rotates counterclockwise. At the same time the housing B will gradually reduce and the gas in it will be discharged by means of gas and oil pressure. With the continuous rotation of the slide piston, pumping and discharged gas are performed.

The pump housing consists of a short housing and a long housing. Between housings, there is a middle plate (7); it could be disassembled. The pump is equipped with exhaust valves (5) (see pump construction view).

The exhaust valves mainly consist of springs and valve plates, etc. Gas and oil discharged out of the pump housing is filtered through the separator (14) within the oil box (15) to separate gas from oil. The gas separated is discharged into the open air and the oil returns to the oil reservoir, then oil pass through solenoid valve and oil pipe to the oil hole of the shaft (5), the oil lubricate the cam, slide piston and pump housing automatically, besides the functions of lubrication and seal, the pump oil

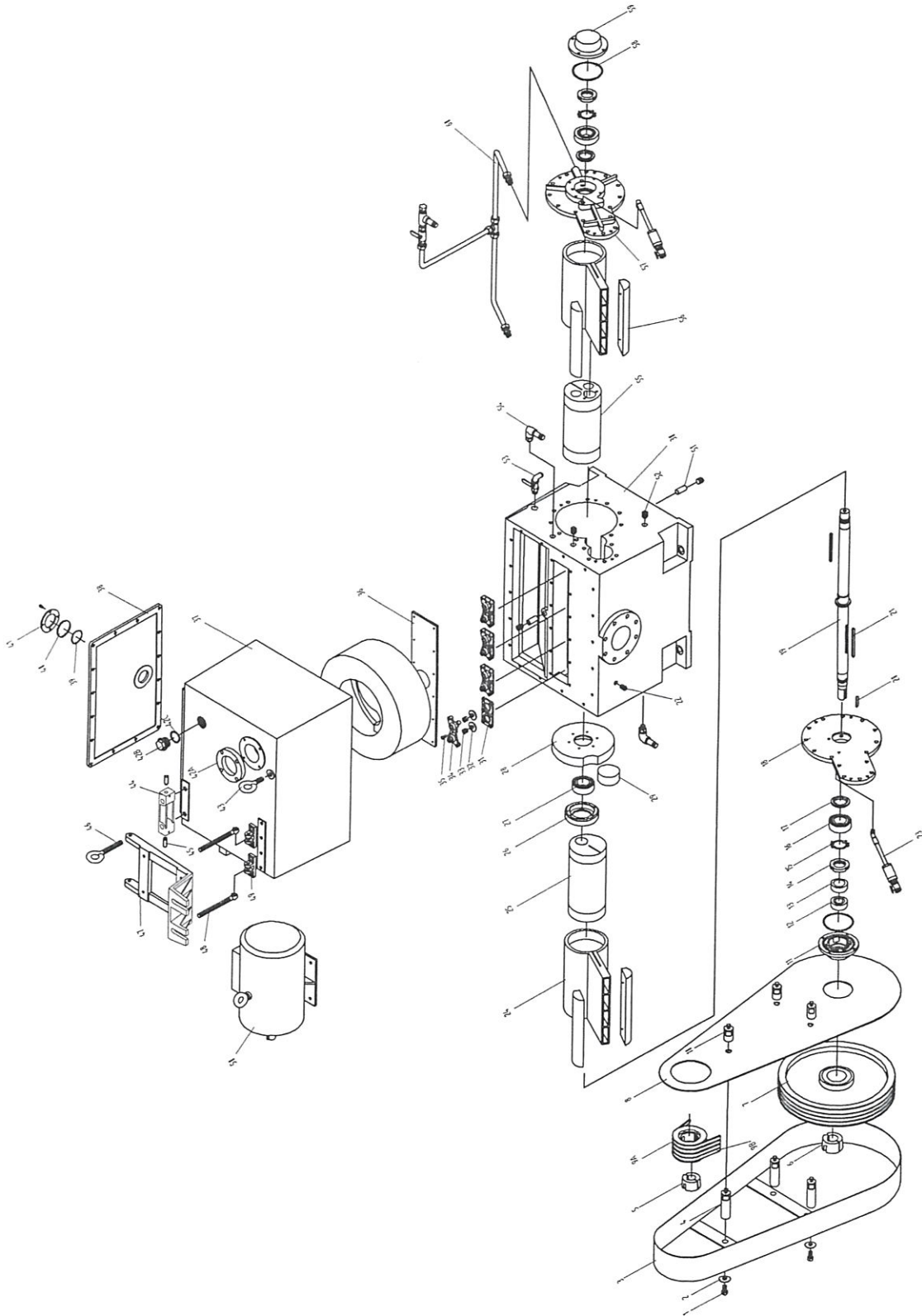
has another important function that when a little gas is sucked, the valve can also be opened to expel gas out of the pump by means of the pressure of compressed gas and oil.

The pump housing, pump side cover A and B, cam, slide piston and rail are all made from high strength cast iron HT250, which are precisely machined after rough machining and artificial ageing. They commonly form the working room of the pump.

The shaft of the pump is made from the alloy constructional steel.

The mating faces between rotational parts and at the suction of the pump are sealed by 'o' rubber seal ring. And the mating faces between the pump housing and pump side covers are sealed with sealant. Balance weight is attached to the pump pulley in order to resist inertial force produced by the cam and slide piston when the pump is running.

4. STRUCTION EXPLOSIVE VIEW



ITEM NO.	DESCRIPTION	PARTS LIST			
		QTY	ITEM NO.	DESCRIPTION	QTY
1	BOLT M14×25	3	32	VALVE DISC	8
2	WASHER 14	3	33	SPRING	8
3	BELT GUARD	1	34	VALVE CAP	4
4	SLEEVE II	3	35	BOLTM8×20	4
5	PULLEY BUSH	1	36	OIL SEPARATOR	1
6	TAPERLOCK BUSH	1	37	OIL RESERVOIR	1
7	PUMP PULLEY	1	38	COVER PLATE	1
8	BACK GUARD	1	39	O RING 65×3.1	1
9A	PULLEY MOTOR	1	40	SIGHTGLASS	1
9B	VEE BELTS	4	41	SIGHT COVER	1
10	SLEEVE I	3	42A	EXHAUST FLANGE	1
11	SEAL BODY A	1	42B	1"SCREW PLUG	1
12	MECHANICAL SEAL	1	42C	O RING 35×3.5	1
13	SEATRING	1	43	HOOD SCREW I	1
14	LOCKING NUT	2	44	SUPPORT II	1
15	LOCKWASHER	2	45	SPRING PIN	2
16	BEARING 3210	2	46	HOOD SCREW II	1
17	BACKING RING	2	47	MOTOR BRACKET	1
18	SIDE COVER A	1	48	ADJUSTING BOLT	2
19	SHAFT	1	49	SUPPORT I	2
20	PULLEY KEY	1	50	MOTOR (10hp)	1
21	ECCENTRIC KEY	2	51	PIN 12×45	2
22	SCREWED PLUG	1	52	SCREWED PLUG	5
23	GAS BALLAST VALVE	2	53	OIL DRAIN VALVE	1
24	PISTON	2	54	WATER CONNECTION	2
25	SOLID ECCENTRIC	1	55	LIGHT ECCENTRIC	1
26	BEARING SEAT	1	56	HINGE BAR	4
27	BEARING22211C	1	57	SIDE COVER B	1
28	SPACER	1	58	O RING 125×3.1	2
29	HING BAR SPACER	1	59	SEAL BODY B	1
30	PUMP HOUSING	1	60	OIL PIPE UNIT	1
31	VALVE SEAT	4			

5. GAS BALLAST AND ITS OPERATING

the pump is equipped with a gas ballast valve whose function is to speed up discharging vapour so as to make vapour not contaminate oil. When permanent gas is to be pumped, pump oil does not go bad because the gas is not liquefied with the increase of pressure. But when the pump is used for vacuum drying or is used to pump damp air, the pump oil will go bad and the pumping speed and ultimate vacuum will be lowered without a gas ballast valve because the contained vapour in air liquefies and dissolves in oil. The compression process of the vapour can be further explained as follows:

Vapour being pumped will be compressed within the compression housing until the exhaust valve is open. The vapour will start condensing into water when the pressure of the compression reaches the saturated vapour pressure. If the temperature within the pump is 60°C , the saturated vapour pressure at this temperature is $2 \times 10^4 \text{ Pa}$. Without a gas ballast water vapour will be condensed into liquid and mixed with the pump oil because the exhaust valve, leading to the open air and pressed by springs, can be forced to be open only if the pressure within the pump reaches $1.2 \times 10^5 \text{ Pa}$.

In order to pump damp air and make vapour not contaminate the pump oil, the pump is equipped with a gas ballast valve. The principle of the valve is to fill certain amount of air to raise the partial pressure of the permanent gas in the total discharge pressure (i.e. Pressure of the mixed air). Before the partial pressure of the vapour reaches the saturated vapour pressure at the pump temperature, the valve is open to expelled the vapour out of the pump housing.

The gas ballast valve can be operated easily. If you want to fill a certain amount of gas into the pump housing, you can turn the ball valve. Of course, the larger the ball valve open, the more the gas filled. In general, the ultimate vacuum of the pump is 67 Pa if the ball valve opens completely. Close the ball valve if you do not fill gas into the pump housing, so as to reduce power consumption and decrease ultimate pressure.

The other function of the gas ballast valve is to resume the pump's ultimate vacuum. Sometimes, with air containing a small amount of vapour pumped, the valve is commonly closed. But if the pump has been operated for a long time, the pump oil will go bad because a small amount of vapour contained in air is liquefied.

When the pump without a gas ballast valve, the ultimate pressure of the pump may be resumed only by renewing pump oil or by heating the pump oil to evaporate the liquefied vapour mixed with the pump oil. And when the pump with a gas ballast valve, the ultimate vacuum can be resumed if the pump is operated for one to two hours on the condition that the gas ballast valve is open. It is exact to say that the ultimate vacuum of the pump oil is resumed. An assistant function of gas ballast valve is forcing oil into oil box from the pump housing without a vacuum break valve. Gas ballast valve should be opened before stopping the pump, so that the pump can be started easily next time.

6. INSTALLATION AND OPERATION

1. Pump chassis should be put on a concrete foundation, in order to prevent oil or cooling water from polluting ambience, it is necessary to construct 5~10 cm wide ditches around foundation.
2. Being fitted, the pump should be proofread and corrected until it is level, then tighten the foundation bolts.
3. A dustproof device should be fitted at the pump suction if pumped gases contain dust, a neutralizing device fitted if pumped gases are corrosive and chemical reactive with pump oil and a drying device fitted if pumped gases contain undue water vapour to prevent the pump oil from contaminating.
4. The pump should be put in the clean and dry room where ambient temperature is at 5°C~40°C. Wipe and clean the pump before installation. Dust or impurities may be dropped into the pump housing to result in parts inside rusting. It is requested that the pump should be fitted after the pump is unpacked, cleaned and reassembled.
5. Oil mist similar to smoke will be discharged out at the outlet of the pump if the pump is being pumped at the state of coarse vacuum (the suction pressure is more than 133 Pa). The cause that the oil mist brought about can be explained as follows:
With the pump operated at the state of the coarse vacuum, the compression room pressure will rise largely and oil to be discharged is expelled out of the small holes of the exhaust valves so that oil near the small holes and exhaust valves is atomized. Oil atomized together with gas will be expelled out of the pump. Whatever kinds of oil sealed pumps are operated, oil mist will be produced. Producing this sort of oil mist has no effort upon performance of the pump. However, this sort of oil will diffuse in air to

contaminate the surroundings and damage floor and apparatus if it is not discharged out of the room, so a discharge piping, with its diameter no smaller than that of the pump outlet port, should lead the oil mist to open air. Point the outside end of the exhaust pipe downward to prevent ingress of rain water.

6. The suction piping must be hermetically-sealed to avoid gas leaking. Also they must be as short as possible and have as few elbows as possible. Their diameters should not be smaller than that of the suction port.

7. Insert a valve in the inlet pipe to control the water flow and the temperature of cooling water of the pump jacket between 20°C~40°C. Water temperature within the pump jacket must not be higher than 40°C to avoid producing scale deposit.

8. If the temperature of the gas pumped is higher than 40°C, cool gas to the normal atmospheric temperature.

9. The highest operating temperature of the pump must not be more than 85°C.

10. When filling oil to a new pump or overhauling pump, 1 Kg oil should be filled in the pump suction port, the rest added in oil filling hole.

7. STARTING AND STOPPING

1. Precautions before starting:

1). Check whether the belts are loose or tight. At the moment of start the belts could be loose a little, and after start regulate the belts tight slowly so as to reduce start torque.

2). Check if parts at all places are loose or not and if the motor rotation direction is the same as that stipulation by the pump.

3). Before starting, check if the oil level is near the middle of the oil sight glass.

4). For the pump which has not been operated for a long time, turn on the motor intermittently to check whether the pump can be easily rotated before operating.

5). Open the valve in the water pipe.

6). The temperature in the room may be too low in winter, so the pump should be warmed up before large oil viscosity at low temperature may make the motor overload to damage the pump parts. when the ambient temperature is lower than 5°C, **please do not start the pump.**

7). If oil level is obviously different after pump stops, the pump pulley must be rotated by hand so as to force the oil in pump housing exhaust to oil reservoir, then the pump can be started. In vacuum state, a large amount of oil in pump housing, the pump must not be start.

2. Starting:

- 1). Turn on the power switch to start the motor.
- 2). Check if lubrication oil and cooling water are regular or not.
- 3). It is recommended that the suction valve be opened slowly after the pump rotates for about five minutes to avoid the pump overload.

3. Stopping:

Unless the pump is stopped in the following sequence, it is difficult for the pump to be started next time.

- 1). Close the valve mounted on the suction piping.
- 2). Open the vacuum break valve or gas ballast valve to lower the vacuum within the pump housing.
- 3). Turn off the power switch after the vacuum break valve is open for about half a minute.

It is important that pump should be stopped in above sequence, or else oil from the oil reservoir will be absorbed into the pump housing continuously to fill it because a vacuum within the pump housing is kept yet after the pump stopped. The situation will not hamper stopping the pump but will hamper re-starting the pump next time. The oil full of the housing being discharged out will bring on enormous resistance. Then re-starting the motor needs a very large torque, the shaft and cam will shock tremendously. In order to avoid damaging the motor and pump, it is recommended that the pump should be stopped in the above sequence.

8.SERVICE AND REMARKS

1.Service:

- 1). Often keep oil clean and check oil level. It is recommended that change oil after the new pump has been operated for 150 hours, and later change oil every two or three months. If the pump is used under bad conditions, in order not to lower vacuum, please shorten the period for changing oil.

- 2). Often keep the pump and the pump room dry and clean.
- 3). Often measure the temperature of the pump and oil.

2. Remarks:

- 1). In cold locations, drain cooling water completely within the water jacket after the pump stops to avoid frozen water damaging the pump body.
- 2). Unless lubrication oil is mechanical vacuum pump oil, it is difficult for the pump to produce a vacuum stipulated.
- 3). If the pump is not to be operated for a long time, please turn on the power switch to make the pump operated for about one hour every seven to ten days to avoid rusting in the pump.
- 4). Keep oil clean and often wipe filter.

9. DISASSEMBLY AND REASSEMBLY

Disassembly procedure (first drain oil and water)

Remove 1. belt guard

2. pump pulley
3. oil piping units
4. bearing covers and seal units
5. pump side cover A and B with bearings
6. slide piston and slide rail
7. cam, key and shaft

Disassembly procedure of the exhaust valves (disassemble separator first)

Remove 1. bolt

2. valve cap
3. springs
4. valve plate

Reassemble the pump in the opposite sequence to disassembling.

Remarks during disassembling and reassembling:

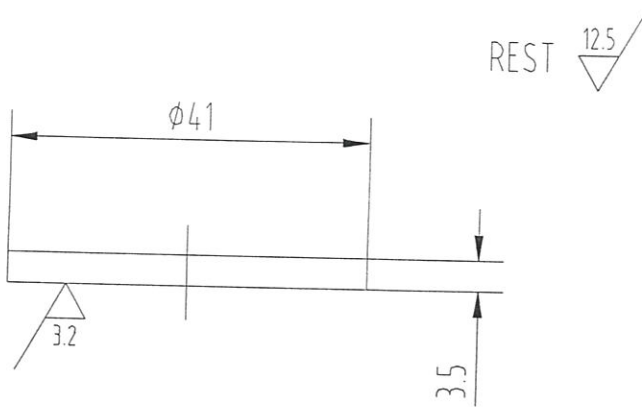
1. Do not beat the machined surfaces of the parts with a hammer.
2. Care for damage and burrs of the pump parts.
3. Wipe all parts before reassembling until there is no dirt.
4. Care for gas and oil leakage at every place of seals.

10.TROUBLES AND THEIR REMEDY

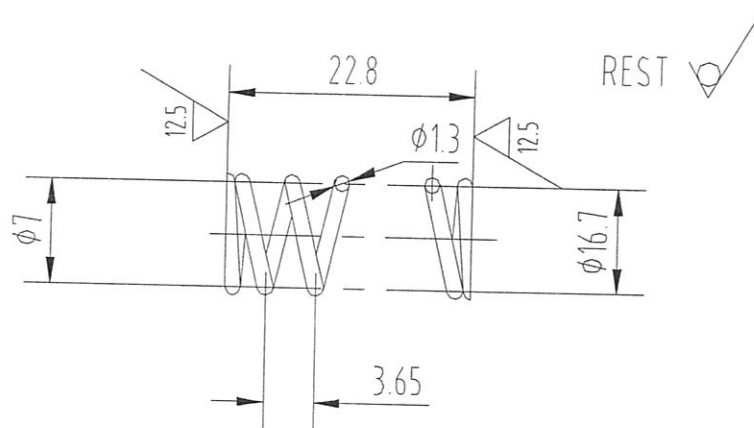
symptom	probable cause	remedy
1.Ultimate vacuum low	<ol style="list-style-type: none"> 1.Pump oil was contaminated 2.Air leak at shaft seal. 3.Air leak at joints of oil piping. 4.Exhaust valve plates were damaged. 5.Exhaust valve springs were broken. 6.Air leak at mating seal surfaces. 7.There are collision, block and abnormal sounds within the pump. 8.Oil piping is blocked. 9.The temperature of air pumped is too high. 10.Oil capacity within the oil box is not enough. 	<ol style="list-style-type: none"> 1.With the gas ballast open, run the pump for one to two hours or renew the pump oil. 2.Repair or change the shaft seal. 3.Tighten screws. 4.Change the exhaust valve plates. 5.Change the exhaust valve springs. 6.Tighten screws. 7.Repair slide piston and slide rail, wipe all parts. 8.Clean oil piping. 9.Cool air to the normal atmospheric temperature by means of cooling device. 10.Fill oil.
2.Pump will not start.	<ol style="list-style-type: none"> 1.The motor may be overloaded or the power fuse has been blown. 2.The pump is short of lubrication oil. 3.The pump is blocked by impurities. 4.The pump oscillates excessively. 	<ol style="list-style-type: none"> 1.Find out reasons to cause the motor overloaded and fuse blown. Change the fuse. 2. Clean pump parts to make oil piping unblocked. fill oil. 3.Eliminate external impurities. 4.Tighten the foundation bolts and check if binder screws are loose or not.
3.During rotation the pump overheats	<ol style="list-style-type: none"> 1.Bearings overheat. 2.Exhaust valves and oil reservoir overheat. 	<ol style="list-style-type: none"> 1.Loose the bolts a little and check if oil piping is blocked or not and if cooling water is enough. 2.Open the cooling water valves more.
4.During rotation, there is abnormal sounds within the pump.	<ol style="list-style-type: none"> 1.Impurities are dropped into the pump. 2.Pump parts are loose or damaged. 	<ol style="list-style-type: none"> 1.Unpack the pump and check it. 2.Tighten parts or change them.

*Remedy troubles, please call our market service department or send for a professional.

11.EASILY DAMAGED PART CHART



H-150D PUMP VALVE PLATE
 METIERIAL: NYLON 1010



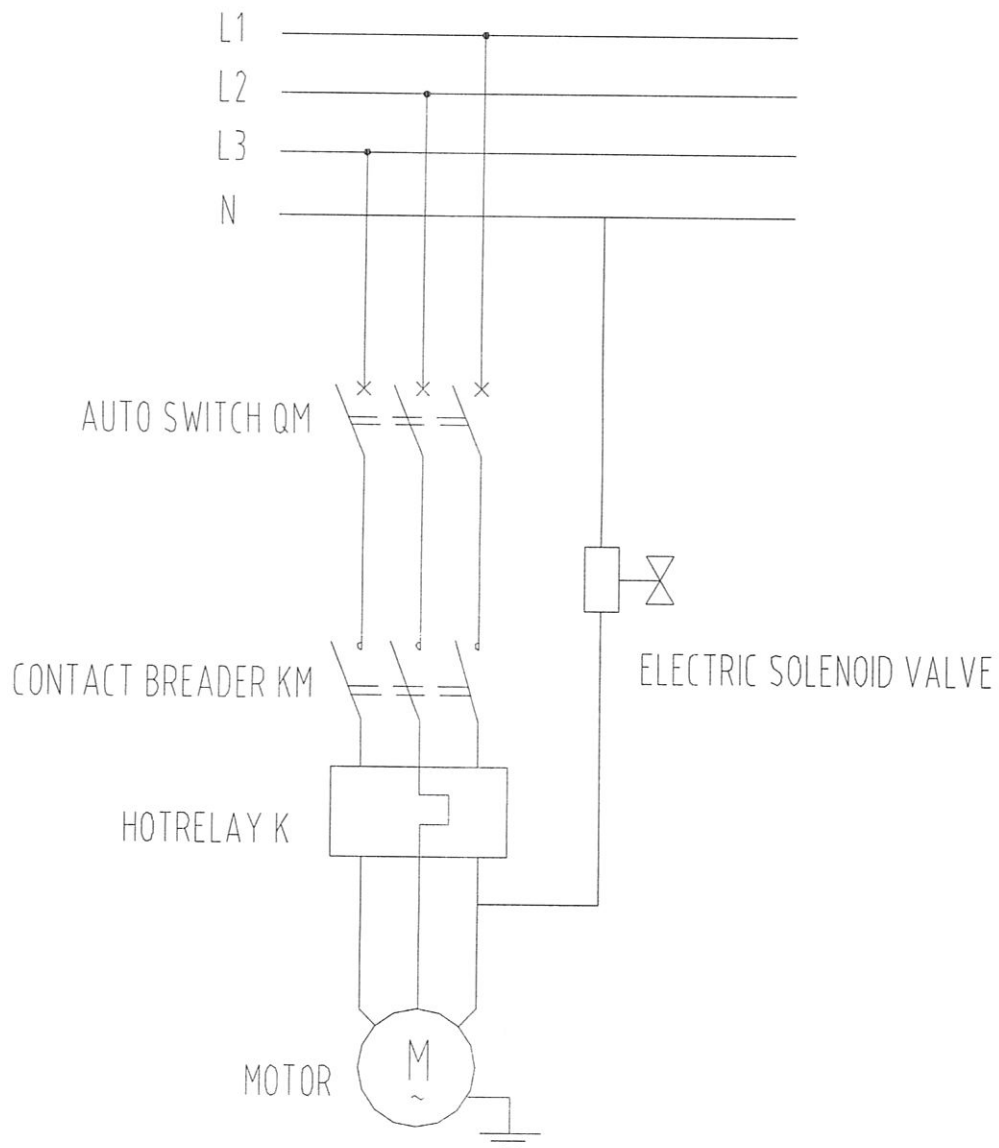
H-150D PUMP EXHAUST VALVE SPRING

1. SPIRAL DIRECTION: RIGHT
2. EFFECTIVE TURN: 5
3. TOTAL TURN: 6.5
4. HEATED TREATMENT

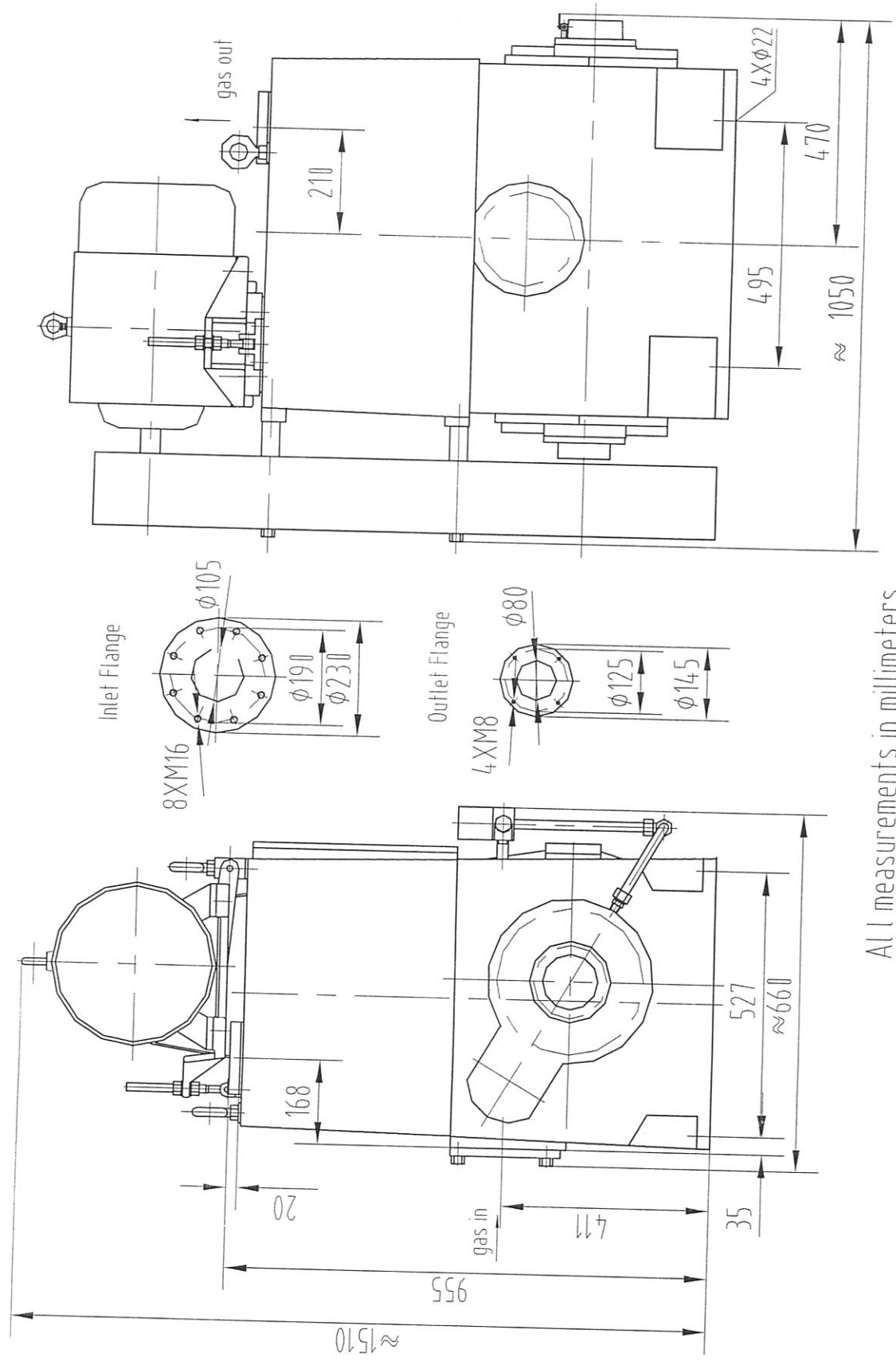
12. SPARE PARTS

DESCRIPTION	QUANTITY
EXHAUST VALVE SPRING	8
EXHAUST VALVE PLATE	8

13. WIRING DIAGRAM

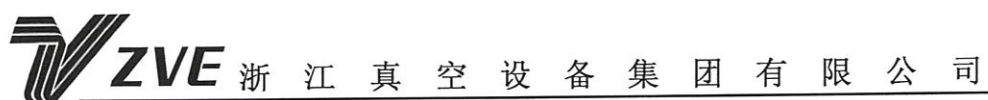


14. INSTALLATION DIMENSION DRAWING



All measurements in millimeters

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