

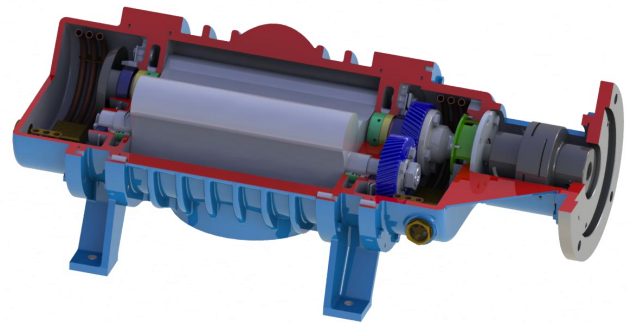


HV Series Roots Vacuum Pump

Version: 2023.A1

Warning: Operation is prohibited without reading this operation manual

HV Series Roots Vacuum Pump User Manual



Model

200	400	540	720	850	1200
1600	2000	2700	2900	3600	4500
5400	7300	7900	10000		



US Vacuum Pumps LLC reserves the right of final interpretation of the contents of this manual and is subject to change without notice

SAFETY WARNING

1. Do not perform any operations without reading this manual.
2. Before installing and operating this equipment, please take the necessary protective measures, safety warnings and safety facilities to prevent serious hazards.

WARNING



Please keep your body and clothes away from the machine gas vent

WARNING



Take necessary hearing protection measure

WARNING



Do not work without a protective shield

WARNING



Do not touch the heated surface of the machine

Safety Warning:

- Keep body and clothes away from rotating machinery, inlets and outlets
- Ensure pump body and drive base screws are securely fastened
- Ensure that drive belt and coupling guards are installed in the proper position
- Hearing protection as necessary to prevent machine noise damage
- Contact with the pump surface may cause skin burns due to the heat generated by the operation of the equipment

Note: The above safety indication marks are affixed to the product unit prior to shipment. Do not remove, cover or obscure the safety indication marks in any way. Any disregard of these safety warnings may result in serious personal injury to personnel operating and maintaining the machine and equipment.



CONTENT

1. Introduction.....	01
1.1. Scope of application.....	03
1.2. Illustration.....	04
1.3. Safety instruction.....	06
2. Product Description.....	09
2.1. Working principle.....	09
2.2. Structural characteristic.....	10
2.3. Lubricant.....	12
2.4. Product specification.....	14
3. Installation.....	17
3.1. Overview.....	17
3.2. Safety.....	20
3.3. Loading and unloading & storage.....	21
3.4. Lubrication.....	22
3.5. Suction and exhaust pipe.....	24
3.6. Cooling water.....	26
3.7. Motor drive.....	27
3.8. Electrical connection.....	27

4. Operation.....	29
4.1. Overview.....	29
4.2. Pump start-up.....	30
4.3. Pump operation.....	32
4.4. Pump shutdown.....	33
5. Maintenance.....	34
5.1. Overview.....	34
5.2. Maintenance plan.....	36
5.3. Inspection and repair guide.....	37
5.4. Purge guide.....	40
5.5. Cleaning guide.....	40
6. Disassembly And Assembly.....	41
6.1. Disassembly step.....	42
6.2. Assembly step.....	43
6.3. Spare parts list.....	46
7. Troubleshooting.....	50
8. Quality Assurance.....	52
9. Reference Drawing.....	54
9.1. Gap table.....	54
9.2. Assembly drawing.....	55
9.3. Outline drawing.....	55
9.4. Connector drawing.....	55

01 Introduction

First of all, thank you for purchasing a new HV Roots vacuum pump from US Vacuum. Please check the product in detail for any damage caused by shipping. If you find any damage, please report it to the shipper immediately. If you are not going to install it immediately, please make sure that all covers are still in place, store the machine in a clean, dry place and rotate the pump regularly by hand. If the machine is stored outdoors, take the necessary precautions to protect the pump from weather or corrosion.

HV Roots vacuum pumps are manufactured to exacting standards, and proper installation and maintenance will ensure that the pump will operate properly for many years. When installing and maintaining your vacuum pump, we strongly recommend that you take the time to read this manual and follow these instructions. We have tried to make these instructions clear and easy to understand.



WARNING

Without reading the user manual and taking adequate protective measures prior to operation or maintenance may result in serious personal injury.



ATTENTION

Before the official operation of the product, a short test run is necessary. If the operation is not performed according to the requirements, it may cause damage to the vacuum pump.

Safety Instruction

This manual describes safety, citing the following documents:

- 2006/42/CE-mechanical Instruction
- EN1012-2:1996-Compressors and vacuum pump. Safety requirements. Part 2: Vacuum pump

Please read the following safety information carefully before using the vacuum pump:

1. The belt cover or coupling cover must be secured in the proper position while the pump is running. Please disconnect the power line before removing the cover; install the cover before connecting

the power line. The transmission parts protected by the cover must not be exposed when the pump is running to avoid injury when the operator is near.

2. Do not start the Roots pump alone. The Roots vacuum pump is also a booster. It can only be started when the system pressure reaches the inlet pressure set by the Roots pump, otherwise when the pressure difference between the front and back of the pump is large, this high pressure will cause the destruction of equipment or harm to personnel if the motor does not have an overload protection device.
3. Always disconnect the power supply before disassembling or servicing the pump. Turn on the power after making sure the pump is fully installed, including the front pump connection, belt guard, condenser, etc. has been reinstalled.
4. Suddenly starting a pump while servicing it can cause damage to equipment or injury to personnel.
5. The single pump can be lifted at the lifting ring provided by the pump, and the complete set of equipment shall not be lifted at the lifting ring provided by the pump.
6. When the pump is running, there is an obvious high temperature phenomenon on the surface of the pump, do not directly touch the hot surface of the pump with your hand.



WARNING

The pump or pumping unit must be installed and operated by qualified technicians with adequate safety protection measures and appropriate safety facilities. At the same time, the operating instructions, as well as the relevant site and legal requirements, must be strictly observed. Violation of the operating instructions will result in the following consequences

--A hazard to you or your colleagues

--Pumps or pump sets may be damaged



ATTENTION

The manufacturer assumes no responsibility or liability for accidents caused by any work violations!

When working on pumps and motor/pump assemblies, please realize that you have an important responsibility for the safety of those around you!

1.1. Scope of application

This operating manual provides precautions and operating instructions that must be observed during the installation, operation and maintenance of MB Roots vacuum pumps. To ensure a long pump life, it is highly recommended to read this manual carefully before operation and maintenance, and to ensure that it is always available at the pump or motor-pump assembly installation site.

See table 1 for applicable pump models





Table 1

Model:	Max. Speed RPM
HV200	3600
HV400	3600
HV540	3600
HV720	3600
HV850	3600
HV1200	3600
HV1600	3600
HV2000	3600
HV2700	3600
HV2900	3000
HV3600	3000
HV4500	3000
HV5400	2400
HV7300	2400
HV7900	1800
HV10000	1800




1.2. Illustration




To ensure that equipment management and operators strictly comply with the safety instructions in this manual, we use the following risk alert levels and safety symbols to illustrate the information that should be paid special attention to in the use of the product.

(1) The following are the hazard levels mentioned in this manual:

	DANGER
	Danger, indicating an immediately dangerous situation that will result in personal injury or even death if not operated as required.
	WARNING
	Warning, indicating that a dangerous situation may occur and that failure to operate as required will result in bodily injury, detrimental health, or damage to property.
	CAUTION
	Caution, indicates a potential hazard that may occur and will result in minor or moderate injury if the operation is not followed.
	ATTENTION
	Attention, indicates a possible risk indication and that failure to follow the operation requirements may cause damage to the product.

(2) The meaning of the safety symbols used in this manual

WARNING	WARNING	WARNING
		
<p>Please keep your body and clothes away from the machine gas vent</p>	<p>Take necessary hearing protection measure</p>	<p>Do not work without a protective shield</p>

WARNING	WARNING	WARNING
		
<p>Risk of electric shock</p>	<p>Do not touch the heated surface of the machine</p>	<p>Danger of toxic gas</p>



WARNING

The above safety indication marks are affixed to the product unit prior to shipment. Do not remove, cover or obscure the safety indication marks in any way. Any disregard of these safety warnings may result in serious personal injury to personnel operating and maintaining the machine and equipment.

1.3. Safety instruction

(1) Worker qualifications and training

Qualified operators for use, maintenance and assembly must be qualified for the operation. The equipment purchaser must strictly control the scope of responsibility, skills and testing capabilities of the operating personnel. If employees do not have the necessary expertise, training must be provided. The manufacturer or supplier can conduct this training for the plant's operators. In addition, the purchaser must ensure that competent personnel have read and fully understand the entire contents of this manual.

(2) The hazards of non-compliance with safety instructions

Failure to observe the safety instructions will endanger personal safety, damage the environment and machinery and equipment, and result in the loss of the right to complain after exposure to danger. Failure to comply with these safety instructions will result, in particular, in the following situations:

- Failure of important functions of the unit
- Failure of a specific process for maintenance or repair
- Expose personnel to electrical hazards, mechanical hazards and chemical hazards Hazard of environmental pollution caused by leakage of hazardous substances.

(3) Work must fulfill the relevant safety regulations

The user guarantees compliance with the safety instructions clearly outlined in this manual, national accident prevention regulations and domestic regulations on working conditions, equipment operation and safety

(4) Safety instructions for operation

Parts with dangerously high or low temperatures are present, and to prevent accidents, the user must take protective measures. During operation, protective parts connected to running parts (e.g. couplings) must not be removed from the machine. Any harmful media (e.g. explosive, toxic, high temperature) must be discharged safely to avoid causing personal injury and endangering the environment. Relevant laws and regulations must be observed. The user must eliminate the risks associated with the use of electricity (e.g., German VDE code requirements and local regulations regarding electricity).

(5) Instructions for the safe use of maintenance, inspection, disassembly and assembly

- It is the customer's responsibility to ensure that all maintenance, inspection and assembly work is carried out by personnel who have carefully studied this manual and are qualified to do so.
- Any work on the machine must be performed while the machine is at a shutdown state. The shutdown procedures described in this manual must be followed.
- Pumps and motor-pump assemblies that transfer toxic media must be cleaned.
- All safety guards must be installed and made functional again immediately after the above operations are completed. Before restarting the equipment, the regulations listed under "First Test Drive" must still be observed.

(6) Safety instructions for use in explosive situations

This section gives information on operation when used in explosive situations.



I. Pump sets/systems

When the pump and other mechanical components, electronic components to form a pump group, the entire pump group and each component must comply with the requirements of Directive 94/9/EC.



WARNING

This guideline specifies specifically when the pump used conforms to the equipment categories in Directive 94/9/EC, but the motor used for the drive may not conform to this requirement. This means that even if the pump can be supplied with an EX certificate, the entire unit is still not allowed to be used in explosive hazardous areas. The operator must therefore take care that all components of the entire unit comply with the requirements of Directive 94/9/EC.

II. Types of coupling shield

The use of coupling shield in explosive hazard areas must conform to the following principles:

- Materials that are not spark-causing
- The shield should be made of steel plate and designed to take into account its possible deformation (e.g., the act of stepping on the guard, etc.) in order to reduce the potential danger posed by rotating parts touching it.

III. Pump monitoring

For pumps used in explosive hazardous areas, the operator must make the following checks:

- Leakage check of the shaft seal
- If necessary, check the temperature of the bearings

The operator must ensure that the pump is stopped in an abnormal environment and not restarted until the environmental conditions return to normal. The relevant operating and maintenance instructions mentioned in this operating manual must be observed. The relevant pump surface temperature information is given in chapter 9 of the operating manual.

IV. Avoid sparks due to external impact

When the pump is used in explosive atmospheres, the operator must ensure that any external impact that could cause a spark is avoided.

V. Grounding protection

The operator must ensure that the pump has grounding protection to discharge static electricity when used in explosive hazardous areas. All metal parts in the pump assembly must be properly

grounded by cables and devices, such as grounding conductors. The insulation effect of the coating should also be taken into account.

(7) Unauthorized modifications and spare parts production

Vacculex will not assume any obligation or responsibility for any modifications that are not authorized by Vacculex. In such cases, it is the responsibility of the operator of the equipment to ensure the safe operation of the unit. For safety reasons, spare parts and accessories approved by the manufacturer should be used. Otherwise, Vacculex will not assume any obligation or responsibility.

(8) Non-compliance with operating instructions

The correct operation of the machine can only be ensured safely if the operating instructions in this manual are observed. The operating limits of the pump must not be exceeded under any circumstances.

02 Product Description

2.1. Working principle

HV Roots vacuum pump is a volumetric vacuum pump. The pump is equipped with two rotors in opposite directions rotating synchronously, with small gaps between the rotors and between the rotors and the inner wall of the pump casing without contacting each other. Roots pump relies on the synchronous and reverse rotation of the rotors in the pump chamber to move the gas and achieve pumping.

The two rotors are supported in the bearings of the end cover, and a pair of synchronous helical gears keeps the two rotors in a certain mutual position when they rotate at high speed.

The MB series Roots pump has a horizontal structure, with the air inlet at the top and the exhaust port at the bottom. This structure enables the pump to have a low center of gravity and good stability during high speed operation.

The four sets of internal seals in the end cover prevent the lubricating oil from both sides from entering the pump casing, and the seal at the outlet shaft prevents the leakage of external or internal gas.

The power of the motor is transmitted to the main shaft through the coupling or triangle tape, and then the driven shaft is driven through the synchronous gear.

Roots pump features:

(1) It has a large pumping speed in a wide pressure range ($1\sim 10^3\text{Pa}$), which can quickly discharge the suddenly released gas, making up for the defects of diffusion pump and oil-sealed mechanical pump with small pumping speed in $1\sim 10^3\text{Pa}$, so it is most suitable for booster pump;

(2) Smooth operation and small vibration. There is a gap between the rotor and the rotor and the casing, without lubrication, small friction loss, can greatly reduce the driving power, so that a higher speed can be achieved;

(3) No need to use oil seal and lubrication in the pump cavity, which can reduce the pollution of the vacuum system by oil vapor;

(4) No compression in the pump chamber, no exhaust valve. Simple and compact structure, insensitive to dust and water vapor in the pumped gas;

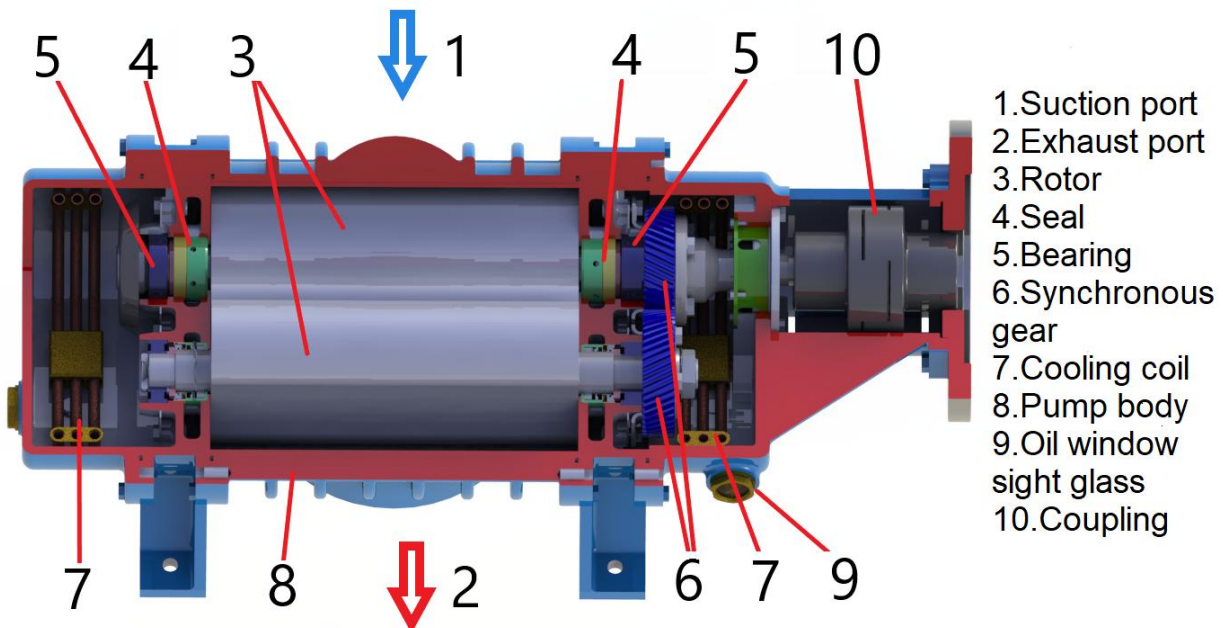
(5) Fast start-up, can reach the ultimate vacuum in a short time, low operation and maintenance cost;

(6) The surface of the rotor is a curved surface with a complex shape, which is difficult to process and check, and has poor effect on hydrogen pumping;

(7) The inlet and outlet ports are symmetrically distributed, located in the middle of the pump, and the specifications of the inlet and outlet ports are the same size;

(8) The power of the motor is small, and the motor is usually installed directly on the front cover

2.2. Structural characteristic



(1) Air Inlet

The inlet port is connected to the user's pipeline, and the vacuum pump works to extract the gas in the target vessel through the suction port.

(2) Exhaust port

The gas compressed by the vacuum pump is removed through the exhaust port.

(3) Rotor

The rotor has good geometric symmetry, so it has low vibration, smooth running and high speed. Impeller and shaft are cast in one piece, which reduces the risk of impeller damage.

(4) Seals

To ensure that the medium in the pump cavity will not leak outside the vacuum pump, the Roots pump adopts the double sealing form of labyrinth seal plus mechanical seal, the seal can achieve no leakage, reducing the link of maintenance and repair.

(5) Bearing

The pump has angular contact ball bearings on the fixed end and roller bearings with high load capacity on the free end. These bearings are used for high speeds, high load carrying capacity and to ensure precise clearance between gears and between rotors.

(6) Synchronous gear

Synchronous gears are in the form of helical teeth, which makes it easier to ensure synchronization and reduce noise and smooth operation. The gears are installed at the drive end to reduce the torsional deformation of the rotor, thus ensuring that the rotor clearance meets the design requirements. The gear surface is heat-treated and polished with a high-precision gear polishing machine, and the gear accuracy is strictly controlled.

(7) Cooling coil

HV Roots pump is designed with oil tanks for lubrication and cooling coils at the front and rear of the pump body. During the operation of the pump, the lubricating oil in the front and rear tanks absorbs the mechanical heat and takes away the heat through the coolant in the cooling coils.

The abnormal temperature and flow rate of the coolant in the cooling coil will cause the cooling function of the coil to fail, and the abnormally high temperature of the front and rear tanks will damage the Roots pump; if the cooling coil leaks, it will not only cause cooling failure, but also pollute the lubricating oil in the tank and damage the Roots pump.

(8) Pump body

The pump body is used to isolate the working medium from the outside environment, so the pump body needs good sealing, and the static sealing surface of MB series Roots pump body adopts O-ring seal to improve the reliability of sealing. And the strong pump body is suitable for operation under high temperature and pressure.

(9) Oil Window Sight Glass

The oil window sight glass is located on the front and back cover of the pump and the oil should be filled to the center of the oil mark.

(10) Coupling

The coupling is mounted on the shaft end and is used to transmit the power from the motor to the drive shaft, which transmits it to the driven shaft through the synchronous gear, driving the rotor to synchronous reverse rotation.



WARNING

If the oil level is too low, gears, bearings and mechanical seals will be damaged due to improper lubrication.

If the pump runs at a low oil level, the gears and bearings will lack sufficient lubrication, and if the oil level is too high, this can lead to high oil temperatures, causing gear noise and affecting other components on the drive side. When the pump stops running, check the oil level and oil contamination, and if necessary, replace the oil. Bearings and mechanical seals are lubricated with splash oil.

Structure material

NO.	Part name	Material characteristics
-----	-----------	--------------------------

1	Pump body	Gray cast iron (HT250), exterior painted, various anti-corrosion coatings available on request
2	Rotor	Ductile iron (QT500), exterior painted, various anti-corrosion coatings available on request
3	End cover	Grey iron (HT250), exterior painted, various anti-corrosion coatings available on request
4	Mechanical seal	Dynamic ring: tungsten carbide Static ring: Stainless steel housing, No. 5 graphite ring O-ring: Viton; optional Karlez
5	Coating	Standard: None; Optional: Ni-P : 15±5µm; PFA: 40±20µm

2.3. Lubricant

HV Roots vacuum pumps are subjected to strict factory tests before leaving the factory. In order to effectively protect the seals, bearings and gears of the vacuum pumps, the vacuum pumps are properly lubricated before leaving the factory. Whether there is any abnormality in the transportation process or in the installation and assembly process of the customer that causes the oil level to be abnormal and unable to achieve the correct lubrication effect belongs to the situation that our company cannot monitor. Before starting the vacuum pump, please check carefully whether the oil level of lubricating oil is at the center mark of the oil level gauge. If the oil level is not normal, add lubricant correctly according to the following requirements.



DANGER

Never attempt to change the lubricant while the vacuum pump is running. Ignoring this warning may result in serious damage to the equipment and serious injury to personnel. The oil level should be checked only when the vacuum pump is not running.



ATTENTION

Do not start the vacuum pump until you have verified that the lubricant has been filled into the gear cavity and is at the proper oil level. Running a vacuum pump without adequate lubrication will cause the pump to stop and will void the warranty.

HV Roots vacuum pumps must be lubricated with high-grade petroleum products, including anti-oxidants, rust inhibitors, and special-pressure-resistant agents. Any lubricant containing water, sulfate resin or tar should not be used. We recommend the use of the following brands and specifications of lubricants for the specified parts.

List of lubricant

Recommended mineral-based lubricants

Ambient temperature	Shell	ExxonMobil
-18°C to 0°C	TELLUS S2 M 68(ISO68)	DTE HEAVY MEDIUM(ISO68)
0°C to 32°C	TELLUS S2 M 100(ISO100)	DTE HEAVY (ISO100)
32°C to 50°C	—	DTE EXTRA HEAVY MEDIUM(ISO150)

Recommended synthetic-based lubricants

Ambient temperature	Shell	ExxonMobil
-18°C to 0°C	MADRELA S4 B 68 (ISO68)	SHC626(ISO68)
0°C to 32°C	MADRELA S4 B 100 (ISO100)	SHC627(ISO100)
32°C to 50°C	MADRELA S4 B 150 (ISO150)	SHC629(ISO150)

What are the effects if the wrong lubricant is used?

Lubricants are selected based on the speed and operating temperature of the bearings and gears. A lubricant that is too light (low viscosity) will not separate sliding surfaces increasing wear on the parts and will not dissipate heat effectively. If the lubricant is too thick (high viscosity), the resistance in the bearing increases, resulting in more heat generated by operation. Since the splash of too thick oil will be reduced, it will not flow easily into the gears and the gears will not be effectively lubricated. Our recommended lubricants do not suffer from either of these misapplications.

What are the effects if the lubricant is not changed properly?

If the lubricant is not changed regularly as required, the shearing action of the bearings and gears will cause the lubricant to thicken (become more viscous), the thickening of the lubricant will lead to higher part temperatures and increased surface wear, and the material from the wear will further thicken the lubricant. From the oil window sight glass we will observe the lubricant deepening in color and becoming dirtier and dirtier. This process is a classic vicious cycle, and the longer it continues, the worse it gets. Eventually it will lead to damage of the entire component, making the vacuum pump no longer work properly. Our recommended lubricant replacement intervals are based on general working conditions. Operators need to conduct daily spot checks on the condition of the lubricant, replenishing and replacing it in a timely manner according to its color and oil level to ensure the best lubrication is achieved and to safeguard the long-term service life of the vacuum pump.

2.4. Product Specification

Model	Unit	HV200	HV400	HV540	HV720	HV850	HV1200
Max.Pumping speed	m ³ /h	340	680	920	1220	1450	2040
	L/s	94	189	256	339	403	567
Standard pumping speed	m ³ /h	270	540	740	980	1100	1640
	L/s	75	150	206	272	306	456
Ultimate full pressure	Torr	7.5×10 ⁻⁴					
	Pa	0.1					
Motor power	Kw	1.5	2.2	4	4	7.5	7.5
Recommended speed	rpm	2900	2900	2900	2900	2900	2900
Maximum speed	rpm	3600	3600	3600	3600	3600	3600
Inlet flange	ANSI	3"	4"	4"	4"	6"	6"
Outlet flange	ANSI	3"	4"	4"	4"	6"	6"
Cooling water consumption	l/min(15°C)	0.8	0.95	0.95	1.5	1.5	1.9
Cooling water connection	NPT	1/4	1/4	1/4	1/4	1/4	1/4
Lubricant volume	L	0.95	0.95	1.42	1.42	3.79	3.79
Seal type		/	/	Oil slinger	Oil slinger	Oil slinger	Oil slinger
		Oil Seal	Oil Seal	Oil Seal	Oil Seal	Oil Seal	Oil Seal
		Mechanical seal	Mechanical seal	Mechanical seal	Mechanical seal	Mechanical seal	Mechanical seal
Total length	mm	607	706	718	794	765	854
Total height	mm	377	377	380	380	508	508
Width	mm	285	285	337	337	432	432
Pump weight	Kg	73	88	118	136	204	236

Note: The pumping rate shown in the table above is the theoretical value, the actual value is related to the working condition configuration, etc., refer to the Roots pump pumping speed curve.

Model	Unit	HV1600	HV2000	HV2700	HV2900	HV3600	HV4500
Max.Pumpi ng speed	m ³ /h	2720	3400	4590	4930	6120	7820
	L/s	756	944	1275	1369	1700	2172
Standard pumping speed	m ³ /h	2190	2720	3700	4750	5910	7560
	L/s	608	756	1028	1319	1642	2100
Ultimate full pressure	Torr	7.5×10 ⁻⁴					
	Pa	0.1					
Motor power	Kw	7.5	7.5	7.5	15	15	18.5
Recommen ded speed	rpm	2900	2900	2900	2900	2900	2900
Maximum speed	rpm	3600	3600	3600	3000	3000	3000
Inlet flange	ANSI	6"	8"	10"	10"	12"	12"
Outlet flange	ANSI	6"	8"	10"	10"	12"	12"
Cooling water consumptio n	l/min(15 °C)	1.9	1.9	2.8	3.8	3.8	3.8
Cooling water connection	NPT	1/4	1/4	1/4	1/4	1/4	1/4
Lubricant volume	L	3.79	3.79	3.79	7.5	7.5	7.5
Seal type		Oil slinger	Oil slinger	Oil slinger	/	/	/
		Oil seal	Oil seal	Oil seal	/	/	/
		Mechanical seal	Mechanical seal	Mechanical seal	Mechanical seal	Mechani cal seal	Mechani cal seal
Total length	mm	930	1031	1183	1280	1380	1507
Total height	mm	508	508	508	651	651	651
Width	mm	432	432	432	585	585	585
Pump weight	Kg	263	310	358	578	658	726

Note: The pumping rate shown in the table above is the theoretical value, the actual value is related to the working condition configuration, etc., refer to the Roots pump pumping speed curve.

Model	Unit	MB5400	MB7300	MB7900	MB10000
Max.Pumping speed	m ³ /h	9350	12400	16000	21600
	L/s	2597	3444	4444	6000
Standard pumping speed	m ³ /h	5640	7500	12860	17380
	L/s	1567	2083	3572	4828
Ultimate full pressure	Torr	7.5×10^{-4}			
	Pa	0.1			
Motor power	Kw	22	22	30	30
Recommended speed	rpm	1450	1450	1450	1450
Maximum speed	rpm	2400	2400	1800	1800
Inlet flange	ANSI	14"	16"	14"	20"
Outlet flange	ANSI	14"	16"	14"	20"
Cooling water consumption	l/min (15°C)	5.7	5.7	7.6	9.5
Cooling water connection	NPT	3/8	3/8	3/4	3/4
Lubricant volume	L	30	30	38	38
Seal type		Mechanical seal			
Total length	mm	1560	1780	2047	2505
Total height	mm	781	781	747	747
Width	mm	720	720	954	954
Pump weight	Kg	1162	1474	2450	3110

Note: The pumping rate shown in the table above is the theoretical value, the actual value is related to the working condition configuration, etc., refer to the Roots pump pumping speed curve.

03 Installation

3.1. Overview



DANGER

If you need to use MB series Roots vacuum pumps in flammable, explosive or highly toxic gas environments, please consult the manufacturer before using them.



WARNING

The pump or pumping unit must be installed and operated by qualified technicians with adequate safety protection measures and appropriate safety facilities. At the same time, the operating instructions, as well as the relevant site and legal requirements, must be strictly observed. Violation of the operating instructions will result in the following consequences

- A hazard to you or your colleagues
- Pumps or pump sets may be damaged



WARNING

After the installation is completed, before powering on the pump or pump set, please manually pan the car.

If it can be easily rotated, then it can be turned on normally; if there is any abnormality, please check carefully whether the pump head connection is normal and whether there is any foreign substance into the pump cavity.



WARNING

Please use this product in strict accordance with the following operating parameters, exceeding these limits will result in damage to the pump

- Maximum speed according to product specification
- Maximum exhaust temperature 190°C

Please check the box carefully before unpacking to make sure there is no damage during shipping. If shipping damage occurs, please note the extent of the damage on the receipt or shipping slip and file a claim with the shipper or insurance company immediately.

Do not remove the protective cover and plug from the pump until the vacuum pump has been installed. The vacuum pump needs to be mounted on a flat, level surface. We recommend a rigid, sturdy support base. Adjust the height of the four pump feet by shims to ensure that they are at the same horizontal level and that the four feet can evenly share the weight of the pump itself, preventing large deformations in the pump body and vibrations during operation. Before tightening the bolts, please make sure that the lower surface of the pump feet and the upper surface of the base are at the same level, without tilting or twisting. If there is a tilted or twisted contact, we call it "soft foot". Soft feet can cause the vacuum pump to seize during operation, resulting in damage to the pump. (See soft foot section of this manual for details)

For vacuum pump units that come with a base, the factory has performed rigorous assembly and testing. However, the above "soft foot" phenomenon may occur due to twisting during transportation or lifting. Once the unit is in place, loosen the pump foot bolts to check for "soft feet" and adjust them with adjusting shims if present. The base of the complete unit should be installed on a solid foundation or heavy floor, and adjusted with shims to ensure that the whole unit is on the same level to avoid warping assembly.

The vacuum pump will operate with a slight vibration transmission to the base or frame. This can be effectively overcome by the use of vibration dampers or damping pads. In this case, the damping pad should not be mounted directly under the pump feet, but directly under the motor/vacuum pump base or frame.

Piping connections should be precisely aligned with the pump port and independently supported. Piping and mounting stresses that are not precisely aligned can lead to shortened bearing and seal life, or even to seizure due to rotor scraping in the pump chamber. The vacuum pump should be stress-free, placed horizontally on its support surface and the mounting bolts tightened evenly to avoid undue stress on the vacuum pump. The vacuum pump mounting clearance can be checked against the clearance table to see if it is within the normal range. (See clearance table section of this manual for details)

Most of the MB series Roots vacuum pumps are connected with C-flange, thus eliminating the need for separate motor base and coupling shield, except for the optical shaft connection. The motor speed must be controlled within the maximum speed range specified in the product specification. (See product specifications in this manual for details)

MB series Roots vacuum pumps are factory assembled and tested, and are shipped with the necessary protective controls to avoid rusting of the vacuum pump. Removal of the protective controls on the pump before installation is strictly prohibited. The maximum storage period is 6 months in a normal

indoor environment with the guards and plugs in place. For long term storage, refer to the Long Term Storage section of this manual.

(1) Location

Whether the HV series Roots vacuum pump is installed indoors or outdoors, it is important to ensure that adequate space and lighting are provided for routine maintenance and servicing. If installed indoors, be sure to keep the installation area well ventilated and as cool as possible, as high temperatures can cause overload or over-temperature shutdown of the pump. The size of the pump or pump set should be as spacious and ventilated as possible, at least 200mm away from the surrounding objects. Make sure that the access to switching and control equipment, and instrumentation measurement is not obstructed in any way. If installed outside in an unprotected environment, the correct lubricating grease must be used to meet the outdoor temperature operating requirements.

(2) Foundation

The installation of HV series Roots vacuum pumps does not require a special foundation, but it is important to ensure that they are installed on a horizontal surface, never on a vertical, sloping surface, on a hard, flat and sufficiently load-bearing ground or floorslab, and that they are securely bolted.

(3) Air inlet

To minimize maintenance, minimize dust and impurity contamination of the incoming gas and that the gas does not contain any flammable, explosive or toxic gases. Make sure the exhaust port is kept clear and free of obstruction, otherwise the vacuum pump or motor may shut down due to overload or overheating.

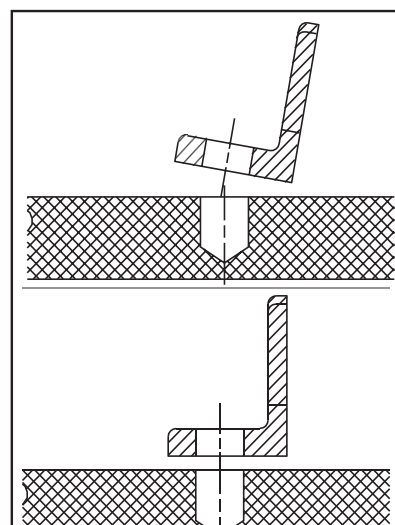
Each model of vacuum pump has the limit of running speed and exhaust temperature, please do not exceed the limit, otherwise it will cause damage to the vacuum pump.

The diameter of the inlet port must not be smaller than the diameter of the inlet port of the vacuum pump. If the distance of gas delivery is more than 6 meters, the diameter of inlet pipe must be increased to reduce the loss of inlet gas. Excessive losses will significantly reduce the efficiency of the vacuum pump and cause the exhaust temperature to rise. The piping must be corrosion resistant, free of scale and contamination. The air inlet should be well protected from rain, insects and small animals.

(4) Softfoot

"Soft foot" means that one of the pump feet of the vacuum pump fails to rest horizontally on the base/stand. Usually this is due to uneven surface of the base/stand. When the pump foot bolts are locked, the vacuum pump will be slightly deformed, which will affect the service life of the bearings and seals, and even cause the rotor and the pump cavity to scratch and collide.

- ① Place the vacuum pump on the base.
- ② Check the gap between each pump foot and the base to make sure it is less than 0.05mm, if there is any, use shims to adjust it. The figure on the right shows two typical "soft foot" phenomena, in any case, if the clearance exceeds 0.076mm, it will significantly affect the life of the vacuum pump.



- ③ Tighten all bolts.
- ④ Install a micrometer on the base with the 0 point position of the thimble touching one of the pump feet.
- ⑤ Loosen the bolts of this pump foot, observe the pointer change and add appropriate adjustment shims to ensure that the pump foot and base clearance is less than 0.05mm. repeat steps 4 and 5 to ensure that all pump foot clearance is less than 0.05mm.

3.2. Safety



DANGER

There are rotating parts inside or outside the vacuum pump/motor, improper operation or lack of protection can result in serious personal injury. Never run the vacuum pump when the inlet and exhaust pipes are removed. If it is necessary to check the rotating parts of the vacuum pump, make sure that the motor power is completely disconnected, the control cabinet is locked and a warning sign is hung.



DANGER

When the vacuum pump is in operation, the surface of the vacuum pump and its connecting piping is significantly hot, please do not touch the hot surface to avoid causing burns to personnel.



WARNING

The pump or pumping unit must be installed and operated by qualified technicians with adequate safety protection measures and appropriate safety facilities. At the same time, the operating instructions, as well as the relevant site and legal requirements, must be strictly observed. Violation of the operating instructions will result in the following consequences.

- Hazard to you or your colleagues
- Pump or pump set may be damaged



WARNING

Please use this product in strict accordance with the following operating parameters, exceeding these limits will result in damage to the pump.

- Maximum speed according to product specification
- Maximum exhaust temperature 190°C

- Keep adequate safety distance when loading and unloading cargo.
- Use only licensed lifting slings that are in good condition.
- Adjust the length of the slings to ensure that the pump or motor pump kit is suspended horizontally and secure.
- Do not remove the documentation that came with the pump.
- Do not remove the pump inlet/outlet protective cover, only before the pump set is about to be installed. Avoid contamination of the pump and the entry of foreign objects into the pump chamber.
- Before carrying out installation work, please vent and purge the engineering system.
- If the working medium involves toxic and hazardous substances, when disassembling and cleaning the pump or pump set, please decontaminate as required and wear safety clothing.

3.3. Loading and unloading & storage



WARNING

Please use appropriate lifting devices when handling the vacuum pump. Please refer to Table I for the weight of the pump.



WARNING

When handling or installing the pump, the inclination of the bracket to the horizontal surface should not exceed 10 degrees. If the tilt exceeds 10 degrees, it may cause the product to collapse.

(1) Loading and unloading

Please check the box carefully before unpacking to make sure there is no damage during shipping. If shipping damage occurs, please note the extent of the damage on the receipt or shipping slip and file a claim with the shipper or insurance company immediately.

Follow the steps below to unpack and inspect the pump:

- ① Use a forklift or palletizing truck to move the boxes to a place where they can be easily disassembled.
- ② Disassemble the pump package.
- ③ Take out the small accessories packed with the pump.
- ④ Check the equipment. If you find any damage or shortage of vacuum pump and other accessories, please inform the manufacturer or shipping company in writing within 3 days. If the pump product is found to be damaged, do not use it.
- ⑤ If the pump is not used immediately, wrap the box. Put it in a proper place for storage.

(2) Short-term storage (<6 months)

Vacuum pumps are factory assembled and tested, and are shipped with the necessary protective controls to avoid rusting of the vacuum pump. It is strictly forbidden to remove the protective controls from the pump before installation.

If the pump or pump set is not installed immediately after delivery, it must be stored without vibration and must be placed in a dry room, not outdoors in the rain or sun.

The maximum storage period is 6 months in a normal indoor environment with the protective cover and plug in place.

(3) Long-term storage (<6 months)

If the vacuum pump is to be stored for a long period of time, please follow the steps below to protect the pump from corrosion.

- ① Spray the inner cavity of the pump, including the rotor, pump body and end cover, with rust prevention oil, at least once a year depending on the storage condition.
- ② Ensure that both front and rear cover tanks are filled with vacuum pump oil.
- ③ Hang the indication label to indicate that both front and rear cover tanks are filled with oil, and the vacuum pump should be drained to the proper indication oil level before installation and use.
- ④ Apply anti-rust oil to the drive shaft
- ⑤ Apply anti-rust oil to all exposed parts, including intake and exhaust port flanges, motor connection flanges, etc.
- ⑥ Keep the inlet port, exhaust port and other externally connected pipe ports sealed. It is highly recommended to remove the pipeline and base connected to the vacuum pump before store it. If any internal parts of the vacuum pump are connected to the atmosphere, the anti-rust oil sprayed inside the vacuum pump will evaporate and cause the anti-rust failure.
- ⑦ During storage, avoid the vacuum pump from obvious vibration.
- ⑧ Hang the drying bag at both ends of the vacuum pump to prevent condensate from collecting. Make sure to remove the drying bag before reinstalling the vacuum pump.
- ⑨ If conditions allow, store the vacuum pump in a constant temperature and humidity environment, or at least keep the storage environment dry.
- ⑩ If conditions allow, manually rotate the rotor once a month to prevent the pump from getting stuck in a certain position.

3.4. Lubrication

MB series Roots vacuum pumps are factory tested strictly before delivery. In order to effectively protect the seals, bearings and gears of the vacuum pumps, the vacuum pumps are properly lubricated before delivery. Whether there is any abnormality in the transportation process or in the installation and assembly process of the customer that causes the oil level to be abnormal and unable to achieve the correct lubrication effect belongs to the situation that our company cannot monitor. Before starting the

vacuum pump, please check carefully whether the oil level is at the center mark of the oil level gauge. If the oil level is not normal, choose the appropriate lubricant according to this manual (see section 2.3 Lubricants) to add lubricant.



DANGER

Never attempt to change the lubricant while the vacuum pump is running. Ignoring this warning may result in serious damage to the equipment and serious injury to personnel. The oil level should only be checked when the vacuum pump is not running



ATTENTION

Do not start the vacuum pump until you have verified that the lubricant has been injected into the gear cavity and is at the proper oil level. Running a vacuum pump without adequate lubrication will cause the pump to stop and will void the warranty commitment.

To add lubricant, follow these steps:

- ① Loosen the plugs of the oiling port on the front and rear cover.
- ② Slowly add lubricant along the oil injection port, and observe the oil level in the oil window at the same time.
- ③ Check whether the oil level line of the oil window sight glass is within the required range.
- ④ Tighten the plug or breather valve loosened in the first step.

To drain the lubricant, follow these steps:

- ① Prepare a suitable container directly below the drain port to catch the released lubricant.
- ② Loosen the plugs of the oil drain port on the front and rear cover.
- ③ Slowly drain the lubricant, and observe the oil level of the oil window. When the oil level reaches the center of the oil window, tighten the plug that was loosened before and stop draining the oil.
- ④ Check whether the oil level line of the oil window sight glass is within the required range.
- ⑤ Tighten the plug loosened in the first step.

3.5. Suction and exhaust pipe



DANGER

The delivery of toxic, flammable and explosive gases requires all necessary safety measures and may result in personal injury or even death if not operated in accordance with safety instructions.



DANGER

Systems conveying toxic gases need to perform proper gas purging operations to dilute the toxic gases to maintain safe values. Failure to follow instructions may result in a toxic gas leak hazard, resulting in injury or death.



DANGER

When conveying flammable and explosive gases, it is necessary to install flame arrestors and check that the system is capable of performing proper gas purification operations to dilute toxic gases to maintain safe values. Failure to follow instructions may result in the risk of flames ejecting from the suction and exhaust ports, causing a fire or explosion hazard that could result in injury or death.

General notes

- ① When transporting hazardous substances, isolate the pump from the atmosphere and the engineering system.
- ② Make sure that the inside of the piping of the engineering system connected to the vacuum pump inlet is clean, free of rust, dust, foreign substances and foreign objects such as welding slag. During the installation process, please take care to avoid foreign substances from entering the pump body.
- ③ When installing the pipeline, please avoid stress on the connection port. Expansion joints are required at both the inlet and exhaust ends. These joints are designed to prevent excessive loading by the unit's pumping line in direct applications. The piping must be supported and guided so that the pump is not affected by the loads generated by the piping. Hoses can also be used to connect the engineered system to the vacuum pump if necessary to reduce vibration and stress.

(1) Engineering system to connect the air inlet



WARNING

The vacuum pump is equipped with an opening strainer at the inlet to prevent impurities or foreign objects such as welding slag in the engineering system from entering the pump chamber. Do not remove it during initial start-up. Failure to do so may result in serious damage to the vacuum pump.

① The vacuum pump is equipped with an opening strainer at the inlet to prevent impurities or foreign objects such as welding slag in the engineering system from entering the pump chamber. Do not remove it during initial start-up. After a few hours of normal operation, remove the pump inlet tube and check if the strainer is clean. If there are solid particles such as welding slag, clean and reinstall the strainer into the inlet. It is highly recommended to regularly check the integrity and cleanliness of the strainer.

② In order to get the highest conveying efficiency the pipeline connecting the engineering system and the pump should be as short as possible, and the inner diameter of the pipeline should not be smaller than the pump suction diameter. If the gas conveying distance is greater than 6 meters, the inlet pipe diameter must be increased to reduce the inlet loss. Excessive losses will significantly reduce the efficiency of the vacuum pump and cause an increase in exhaust gas temperature.

③ When connecting the pump suction port to the engineered system using the appropriate bolts, use an effective sealing connection to ensure the sealing of the pipe connection. It is recommended to use O-ring (V type) of specified specifications.

④ The vacuum pump inlet should be equipped with an inlet check valve, which should be installed as close to the inlet as possible. Its function is to isolate the pump from the process gas after stopping the pump, and without the inlet check valve, the vacuum pump will reverse due to differential pressure. If for some reason a check valve cannot be installed, an isolation valve such as a gate valve should be installed and the inlet isolation valve should be closed before stopping the pump. It is strongly recommended that the inlet isolation valve should be installed whether the check valve is installed or not.

(2) Engineering system connection exhaust port



DANGER

When discharging dangerous gas, please ensure that the exhaust gas is handled by appropriate devices to avoid the leakage of dangerous gas or steam to affect the surrounding environment. Failure to follow the safety instructions may result in personal injury or even death.



DANGER

During the operation of the vacuum pump, the exhaust pipe must be kept unobstructed, and there should be no partial or complete blockage, if there is blockage, the vacuum pump will be shut down or even damaged. If not operated in accordance with the requirements with the exhaust pressure increases leading to the risk of explosion. If not operated in accordance with the safety instructions may lead to personal injury, or even death.



WARNING

If the pumped gas contains condensable gas, it is necessary to ensure the smooth removal of condensate during the operation of the vacuum pump. If the condensate is not removed smoothly and backflow occurs, the vacuum pump will be shut down or even completely damaged.

- ① The exhaust pipeline should be designed to ensure that the pipe has sufficient pressure resistance and is kept unobstructed.
- ② If the pumped gas contains condensable gases, a condensate recovery vessel should be installed to collect the condensate and then dispose of or drain the condensate as needed.

3.6. Cooling water



WARNING

Before the vacuum pump starts, during the operation, it is necessary to keep the cooling water unblocked and maintain a stable water temperature (15°C), if the cooling water supply is abnormal, it will cause the temperature of the vacuum pump lubricant to rise, resulting in seal failure and shutdown, and even damage the vacuum pump.



WARNING

In a long-running vacuum pump, foreign matter accumulated in the cooling water pipe may block the cooling water circuit, causing the lubricating oil temperature to rise and causing a breakdown. To eliminate these foreign materials, be sure to open the cooling water drain valve periodically to completely discharge foreign materials. Failure to do so may result in shortening the life of the vacuum pump or even damage.

HV series Roots vacuum pumps have a complete lubricating oil cooling system, and the cooling medium is usually water. It is better to use soft water or deionized water for cooling water. Long-term use of hard cooling water will cause calcium to precipitate and collect in the cooling water jacket, which will lead to blockage of the cooling water circuit and make the cooling system fail, resulting in shortening the service life of the vacuum pump and even damaging the pump.

When more than two Roots vacuum pumps need to be connected to the cooling water circulation device, they should be connected in parallel.

3.7. Motor drive

Most of the HV series Roots vacuum pumps are connected with a C-flange, thus eliminating the need for a separate motor base and coupling shield. The motor speed must be controlled within the maximum speed range specified in the product specification.

3.8. Electrical connection



DANGER

Explosion-proof motors need to use the appropriate cable glands when connecting to the power supply. Otherwise there is a risk of explosion.



DANGER

Before starting the motor, please check that the direction of rotation is the same as the indicated direction. If the motor rotates in the wrong direction, it will increase the pressure in the suction pipe and cause damage to the machine or personal injury.



DANGER

Before starting the motor, check that the coupling guard cover of the front cover is properly installed. If it is not installed, it may result in personal injury or death.

Make sure to connect the motor and other electrical equipment (such as solenoid valves and temperature switches) with the power supply or control cabinet disconnected.

After the wiring is connected, turn the vacuum pump by hand and observe whether the vacuum pump can rotate freely without obstacles; then start the vacuum pump instantly and check whether the rotation direction of the motor is correct.

- (1) The rotation direction of Roots vacuum pump is specified as from the suction port to the exhaust port.
- (2) Remove the plugging cover (or sticker strip) of the suction and exhaust ports of the vacuum pump.
- (3) Loosen the coupling protection cover bolts and remove the cover plate.
- (4) Turn on the power for 1~2 seconds, then turn off the power.
- (5) Observe the direction of the coupling or motor cooling fan, if it is not rotating in the direction of the indication mark, the power supply is connected incorrectly. At this point, the following steps need to be performed:
 - ① Disconnect the power to the pump.
 - ② Reverse the two power cables of the pump motor/input power.
 - ③ Repeat steps 3 ~ 4 to check if the rotation direction is back to normal.
- (6) Install the coupling protection cover and fix 4 bolts.

04 Operation

4.1. Overview



WARNING

The pump or pumping unit must be installed and operated by qualified technicians with adequate safety protection measures and appropriate safety facilities. At the same time, the operating instructions, as well as the relevant site and legal requirements, must be strictly observed. Violation of the operating instructions will result in the following consequences

- Hazards to you or your colleagues
- Pump or pump set may be damaged

Before starting the MB Roots vacuum pump for the first time, please check again that the pump has been installed correctly according to the installation requirements in this manual to avoid shortening the life of the pump or even damaging it due to incorrect installation. It is recommended to refer to the following checklist for the check, taking into account of course the specific working conditions and other requirements of the scenario in which the MB Roots vacuum pump is used.

- (1) Roots vacuum pump should be installed in a dry, well-ventilated and clean place.
- (2) The ambient temperature of Roots vacuum pump is 5-40°C.
- (3) The Roots vacuum pump should be installed horizontally, and there should be sufficient space around it for daily inspection and maintenance. Easy to assemble and disassemble.
- (4) The pipeline connecting the pumped container should be clean and free of foreign matter such as impurities, the hole diameter should not be smaller than the diameter of the pump connection, and the length should be short to ensure that it has sufficient conduction capacity, and the pipeline connection should be sealed and leak-proof.
- (5) The connection between Roots vacuum pump and the pre-stage pump should be equipped with elastic pipe to reduce the vibration caused by the backing pump.
- (6) Check to ensure that no bolts, rags and impurities are left in the pump chamber.
- (7) The pumped gas should be free of granular solids into the pump chamber.
- (8) Check to ensure that the oil level shown in the oil window sight glass is normal.
- (9) Check to ensure that the drive motor is properly lubricated and that proper overload protection is installed.
- (10) The electrical equipment must have interlocking protection devices, and the Roots pump must stop at the same time when the backing pump stops working.

- (11) Turn off the power and make a warning sign to prevent false start. Manually rotate the rotor of the vacuum pump to make sure it can rotate smoothly without jamming or blocking. If there is jamming, check carefully to remove the fault.
- (12) Observe the direction of motor fan/coupling rotation by flicking (instant start/stop), the motor steering should be in accordance with the steering arrow on the pump.

The initial start-up of the MB Roots vacuum pump should be done under "no load" conditions. If it is possible, it is better to open all vent valves. Then "flick" the motor and check if there is any abnormal noise during the operation of the pump. If there is no abnormality, repeat this check and let the motor run longer. If there is any abnormality, check carefully until the problem is eliminated before proceeding to the next step.

If all checks and tests are correct, the MB Roots vacuum pump is ready for continuous full load operation. During the first few days of operation, be sure to regularly check the operating parameters of the pump for any abnormalities.

These checks are equally important when the MB Roots vacuum pump is a part of a complete vacuum system. Before starting up the pump, make sure to carry out the required installation checks to avoid shortening the life of the pump or even damaging it due to incorrect operation.

4.2. Pump start-up



WARNING

Do not start the Roots pump alone, you must first start the backing pump for pre-pumping. The Roots vacuum pump is a booster. It can only be started when the system pressure reaches the inlet pressure set by the Roots pump. Otherwise, when the pressure difference between the front and rear of the pump is large, if the motor has no overload protection device, this high pressure may cause the vacuum pump to fail. damage and even casualties.



WARNING

When manually touching any rotating parts such as vacuum pumps, motors, couplings, etc., always make sure that the power has been disconnected to avoid any possibility of false starts. Failure to follow the operation requirements may result in damage to the vacuum pump or even injury to personnel.

The start-up of HV Roots vacuum pumps must be carried out by qualified operators or technicians who have undergone rigorous training and in strict accordance with the requirements of this manual. For initial installation, shutdown restart, restart after maintenance, and restart after equipment relocation,

we strongly recommend that operators follow the procedures in the "Start-up Checklist" below after completing the re-inspection procedures required by this manual.

Start-up Checklist		
We recommend that the following procedures be followed to avoid damage to the vacuum pump due to misuse		
➤ Initial Installation		➤ Maintenance
➤ Shutdown and restart		➤ Equipment Relocation
Check date:		Operator:
1	<input type="checkbox"/>	Check that the vacuum pump oil level is normal. (See instructions in the lubrication section of section 2.3/3.4 of this manual for details)
2	<input type="checkbox"/>	Manual rotation of the rotor to ensure smooth rotation without jamming
3	<input type="checkbox"/>	Check to confirm that the air inlet is closed and the exhaust port is open
4	<input type="checkbox"/>	Check to make sure the cooling water inlet is on, the cooling water outlet is on, and the cooling water is circulating normally
5	<input type="checkbox"/>	Make sure the vacuum pump rotates in the same direction as indicated by observing the direction of motor fan/coupling rotation by flicking (instant start/stop). If the direction is wrong, adjust the power cord connection.
6	<input type="checkbox"/>	Turn on the Roots pump after the no-load operation of the backing vacuum pump reaches the allowable starting pressure of the Roots pump. Check the operating parameters of the pump for any abnormalities, such as excessive vibration, high oil temperature, high noise, high current, etc. These abnormalities are usually caused by improper lubrication and improper installation. If there is any abnormality, stop the pump immediately and refer to the troubleshooting section to restart it after eliminating the fault.
7	<input type="checkbox"/>	Open the air inlet load and run for 1-2 hours, then recheck the operating parameters (see 2.4 Product Specification for details of each operating parameter). If there is any abnormality, stop immediately and refer to the troubleshooting section to restart after eliminating the fault.

Roots vacuum pump start-up procedure

- (1) Start the backing pump.
- (2) Open the valve of the pre-pumping pipeline of the backing pump and the valve on the air inlet of the Roots pump.
- (3) After the pressure in the system reaches the allowable pressure of Roots vacuum pump, close the pre-pumping valve and start the Roots vacuum pump. If there is no pre-pumping pipeline and valve, start the Roots vacuum pump after the starting pressure is reached. This process can also be automatically controlled by pressure sensor to realize the automation of the whole process.
- (4) According to the actual situation of the vacuum system, if it is not a large vacuum system, the Roots vacuum pump can be started after starting the backing pump. If it is a large vacuum system, even if the motor is with overload protection, the Roots pump itself can still overheat and seize due to long time working under high pressure, so the Roots pump should be started after the backing pump has pumped to the allowed starting pressure of the Roots pump.

4.3. Pump operation

**WARNING**

If the operation exceeds the allowable speed, differential pressure and temperature, it may lead to shorten the service life of the vacuum pump or even damage it.

**WARNING**

Please do not touch the surface of the vacuum pump when it is running. The surface temperature of the vacuum pump may reach its limit operating temperature of 190°C. Touching it will cause serious burns. Even if you need to touch the surface of the vacuum pump when it is stopped, please make sure that the surface of the vacuum pump has cooled down to room temperature. Failure to follow the operating requirements may result in serious personal injury.

**WARNING**

Temperature is detected by temperature sensor (thermocouple), please make sure the sensor is in normal working condition, otherwise wrong temperature detection will not protect and even lead to damage of the vacuum pump.

**ATTENTION**

The upper operating limit of a vacuum pump is only the limit it can withstand for a short period of time and is not a long-term operating parameter. Therefore, a vacuum pump cannot be operated continuously within the upper operating limit. If not operated as required, it may lead to a shortened service life of the vacuum pump or even damage

Points for attention in the operation of Roots vacuum pump

- (1) In operation, the Roots vacuum pump must be used in accordance with its technical specifications. Under normal circumstances, the inlet pressure of the Roots vacuum pump is below 1330 Pa, and the maximum differential pressure of the pump must not be higher than its maximum allowable differential pressure value
- (2) Pay attention to the motor load and the temperature rise of each part of the pump. Under normal operation, the maximum temperature rise of the pump should not exceed 40°C and the maximum temperature should not exceed 80°C. If the water ring pump is chosen as the

backing pump, sometimes the temperature rise of the Roots pump may increase due to the large ratio of pumping speed between the two pumps, but the maximum temperature of the pump shall not exceed 100°C.

- (3) There should be no irregular abnormal vibration and abnormal noise in operation.
- (4) If found in the operation of the motor overload, temperature rise is too high, abnormal sound, vibration, etc., should be immediately shut down to check the causes and troubleshooting.

4.4. Pump shutdown



WARNING

Before stopping the pump operation, isolate the Roots pump from the vacuum system and then purge/flush the vacuum pump to purge the pump chamber and piping. If the instructions are not followed, condensation of the vapors in the pump body will cause corrosion or damage to the pump body.



WARNING

Stop the Roots pump first, then stop the backing pump. If you stop the pump out of order, the Roots pump motor will be damaged.

For shutdown of the Roots vacuum pump, please follow the procedure below:

- (1) Isolate the Roots pump inlet valve from the vacuum system.
- (2) Run the pump dry for 10-20 minutes to remove the residual pumped gas and collected impurities; if the pump is equipped with a cleaning and purging device, please clean and purge according to the requirements of this manual(see the cleaning and purging section of this manual for details).
- (3) Stop the Roots vacuum pump step by step from top to bottom, and stop the backing pump last. It is strictly forbidden to make mistakes in the shutdown procedure.
- (4) After stopping the backing pump, immediately bleed the air into the inlet of the backing pump.

05 Maintenance

5.1. Overview



DANGER

For maintenance of vacuum pumps pumping hazardous gases, especially if contaminated lubricants/grease and spare parts need to be replaced, please ensure that the necessary decontamination and safety protection measures have been taken. Fluoride pyrolysis products are produced when the pump body is heated above 260°C. These pyrolysis products are very dangerous and should be avoided by touching or inhaling them. Failure to follow safety instructions may result in personal injury or even death.



DANGER

If the vacuum pump is used to pump hazardous gases, the sealing condition of the connection between the vacuum pump and the process piping should be checked regularly to avoid leakage of toxic gases into the atmosphere. Failure to follow the safety instructions may lead to personal injury or even death.



DANGER

Before vacuum pump maintenance, must ensure that all electrical connections have been properly disconnected, and hang a prominent sign to avoid accidental power start during maintenance. Failure to follow safety instructions may result in personal injury or even death.



DANGER

Before vacuum pump maintenance, must ensure that the valve between the inlet engineering piping and the vacuum pump is properly closed/disconnected and prominently marked to avoid accidental activation of the inlet valve during maintenance. Failure to follow safety instructions may result in personal injury or even death.



WARNING

The maintenance of vacuum pumps must be installed and operated by qualified technicians, and adequate safety protection measures and corresponding safety facilities must be taken. At the same time, the operating instructions, as well as the relevant site and legal requirements must be strictly observed. Violation of the operating instructions will result in the following consequences.

- Hazards to you or your colleagues
- Pump or pump set may be damaged



WARNING

Before repair and maintenance of the vacuum pump, must ensure that the vacuum pump has been cooled to room temperature, otherwise there is a risk of personnel burns.



ATTENTION

During the maintenance of vacuum pumps, please set up appropriate caution areas and hang warning signs in accordance with the safety requirements and maintenance areas.

HV Roots vacuum pumps are designed and manufactured with the long-term performance of vacuum pumps under different working conditions in mind. However, as a continuously operating equipment, if you can regularly check, maintain and repair the operating condition of the vacuum pump and the installation conditions of the equipment according to the operation requirements, it will effectively extend the service life of the vacuum pump and prevent the damage of the vacuum pump caused by improper use.

Most of the abnormalities of the vacuum pump will be reflected in its temperature, noise, vibration, current, oil level during operation, it is highly recommended to have the necessary measuring instruments (these instruments are simple and cheap) and to check these data daily. Abnormal changes in the data will remind us of the need for necessary maintenance of the vacuum pump. Special attention should be paid to the state of the gearbox oil, which will significantly affect the use of the vacuum pump and can be directly observed by the naked eye through the oil window sight glass, without the need for special instruments.

If the vacuum pump needs to be stopped for a long time, it needs to be cleaned and protected as necessary. The specific measures need to be determined specifically according to the site conditions and downtime. The general requirements can be found in the instructions in the Long-term storage (3.3) and pump shutdown (4.5) sections of this manual.

5.2. Maintenance plan

The maintenance cycle of HV Roots vacuum pumps is directly related to the operating condition of the pump body, and appropriate measures must be taken when necessary. The maintenance cycle can be extended in clean environment projects, and shortened in harsh environment projects. The maintenance schedule can be adjusted according to the site environment and experience. When maintaining and servicing the vacuum pump, please use the manufacturer's recommended parts. Seals, lubricants and other accessories required for maintenance and servicing should also be used from the appropriate manufacturer.

The following table lists the standard maintenance plans for MB Roots vacuum pumps during normal operation, and each operation schedule is detailed in the corresponding section of this manual.

N O.	Maintenance items	Checkpoint	Each day	Each month	Each quarter	Six months	Each year
1	Gas inlet/outlet	Are the pressure and temperature within the specified range?	√				
2	Oil level sight glass	Is the gearbox oil level in the proper position, too high or too low oil level will damage the gears and bearings, is there oil leakage?	√				
3	Motor load	Does the motor current change by testing? Is the current intensity within the specified range? An increase in current reflects abnormal pump operation.	√				
4	Pump and motor rotation	Is the rotation smooth and in the correct direction (clockwise)?	√				
5	Noise and vibration	Are there abnormal sounds and vibrations? Use the stethoscope to determine the scraping noise between the rotor and between the rotor and the pump body.	√				
6	Temperature	Check whether the oil tank temperature and vacuum pump surface temperature are normal?	√				
7	Oil level sight glass	Check the oil level, if the oil level drops in a short period of time, please check whether the seal including mechanical seal and lip seal fails.	√				
8	Oil level sight glass	Check the color of lubricant, contaminated oil is white or black, serious discoloration needs to replace the oil, clean the oil level sight glass.		√			
9	Bearing	Check whether the bearing lubricant is darkened, contaminated or failed?		√			
10	Oil cooling system	Check whether the flow of cooling water is normal, if abnormalities are found check the cooling system.			√		
11	Pipe connection	Check whether the sealing performance of the engineering pipeline connected to the vacuum pump is normal, whether there is impurities and dirt deposits inside the pipeline, and clean it if there is.			√		
12	Gearbox	Change the lubricant in the gearbox.			√		
13	Bearing	Change bearing lubricant.			√		
14	Gearbox	Change lubricant in gear box, clean oil level sight glass.				√	
15	Bearing	Change bearing lubricant.				√	
16	Cooling Circulation	Check the flow of cooling water and the color of the discharged cooling water, check whether the temperature rise of in and out water of the cooling water is normal, if abnormalities are found				√	

		clean the cooling system.					
17	Pipe Connection	Check whether the sealing performance of the engineering pipeline connected to the vacuum pump is normal, whether there is impurities and dirt deposits inside the pipeline, and clean it if there is.				√	
18	Disassembly	Disassemble the vacuum pump, check the wear condition of each part, and replace them as needed.					√
19	Seals	Check whether all mechanical seals, lip seals and O-rings are damaged, and replace them as needed.					√
20	Synchronous gear	Check for damage and replace as needed.					√
21	Bearing	Check for damage and replace as needed.					√
22	Motor	Check the use status of the motor and replace as needed.					√

5.3. Inspection and repair guide

(1) Temperature check

According to the design principle of MB Roots vacuum pumps, the temperature of the pump will increase after the gas is compressed during normal operation, but it is abnormal if the local temperature of the pump increases and the external paint burns. High temperature is caused by high differential pressure or large clearance. If overheating is detected, the pump should be stopped and inspected immediately. The rotor and pump chamber may be corroded, which will increase the clearance between the pump chamber and the rotor and increase the return flow, thus affecting the pumping speed, the pump should be stopped immediately and the clearance size should be measured in order to decide whether to take appropriate corrective measures

(2) Gearbox oil replacement



WARNING

There is internal pressure in the gearbox, if you need to change the gearbox oil, you need to do the oil change operation after shutdown. If the operation is not performed as required, the gearbox may cause personal injury due to internal pressure or gears rotating at high speed and ejecting hot oil (above 90°C).



WARNING

If you need to fill the gearbox with oil frequently or consume a large amount of oil in a short period of time, it is possible that there is a leak in the seal section. Please stop the pump quickly and consult the manufacturer or agent. Failure to follow the requirements may result in damage to the vacuum pump.

The lubricant in the gearbox is an important guarantee for the continuous and stable operation of the Roots vacuum pump. Please strictly follow the operation requirements of this manual for maintenance to ensure the service life of the vacuum pump. The front and rear covers of the vacuum pump are equipped with oil window sight glass, which can be easily used for daily inspection of the lubricating oil status. The oil windows may be contaminated during long-term use, making observation difficult, so please clean these two oil windows when replacing the gearbox oil.

Please change the lubricant and clean the oil window in strict accordance with the following procedures:

- ① Remove the plug of the oil filling port.
- ② Put an appropriate amount of container at the bottom of the drain port to collect the discharged lubricant.
- ③ Remove the oil drain plug to drain oil.
- ④ Remove the oil window.
- ⑤ Wipe the oil window with alcohol and a dry cloth.
- ⑥ Reassemble the oil window.
- ⑦ If the oil discharged from the oil tank is badly discolored, clean it with clean oil or new oil until the gear box is discharged with clean oil.
- ⑧ Clean the oil drain plug and reassemble it.
- ⑨ Select the appropriate funnel and nozzle to insert into the oil fill port and observe the oil level sight glass to inject the appropriate oil.
- ⑩ Remove the funnel or nozzle and reinstall the oil filler plug.
- ⑪ Dispose of the used oil safely.

(3) Bearing Maintenance



WARNING

Before disassembling the bearings, wait for the pump body to cool down. If you do not wait for the cooling down to operate, it may cause the risk of high temperature burns.

A. Free end bearing

- ① Disassemble the rear cover and rear end cover.
- ② Please refer to the disassembly order and disassemble in the order of rear cover, rear end cover and bearing.
- ③ When inspecting the bearings, check for foreign objects or seizure in the optional state after cleaning first. If any abnormality is found, please consult the manufacturer or agent.
- ④ After bearing inspection, assemble in the reverse order of disassembly. (Refer to the assembly sequence)

B. Fixed end bearing

- ① When checking the fixed end bearing, it is necessary to disassemble the vacuum pump completely.
- ② When checking the bearing, clean it first and then check if there is any foreign body or seizure in the optional state. If any abnormality is found, please consult the manufacturer or agent.

(4) Pipeline Inspection

- ① Check all cooling water pipes and connections to make sure there is no corrosion or damage. If corroded or damaged pipes and connections are found, replace them with new parts. Check all cooling water connections to make sure they are securely connected. If any loose condition is found, please retighten them.
- ② Check all power connections to make sure there is no damage or overheating. If damage or overheating is found, please replace with new products. Check all power connections to make sure they are securely connected. If a loose condition is found, retighten the connections.
- ③ Check all engineering and exhaust piping to make sure there is no corrosion or damage. If corrosion or damage is found, please replace the parts. Check all engineering and exhaust connections to make sure they are securely connected. If loose connections are found, retighten them.

(5) Pump body cleaning



WARNING

Be sure to turn off the power to the motor after filling the vacuum pump with cleaning agent. Running the vacuum pump after filling it with cleaner can cause malfunction or even damage to the vacuum pump.

Choose the appropriate cleaning agent according to the gas or medium to be pumped by the vacuum pump. To clean the pump body, fill the pump chamber with cleaning agent, and prepare sufficient cleaning agent (about 10L ~ 20L). If the vacuum pump is installed with a flushing system, please follow the operation requirements of the flushing system to clean the vacuum pump.

If not equipped with a flushing system, clean the pump body according to the following procedure:

- ① Close the valve of the suction port of the engineering system and disconnect the connection between the suction port of the vacuum pump and the engineering pipeline.
- ② Disconnect the vacuum pump exhaust port from the exhaust piping, and seal the exhaust port with a blind flange.

- ③ Fill the cleaner from the suction port until the pump body is filled with cleaner, and seal the suction port with the blind flange.
- ④ Let the pump body stand for more than one hour in order to let the precipitate react completely with the cleaning agent.
- ⑤ Use a wrench to rotate the pump body 3-4 times in clockwise direction from the drive shaft.
 - If the pump body does not rotate, repeat step 4 (leave it for longer)
 - If the pump body can rotate, continue with step 5
- ⑥ Put a suitable container at the bottom of the pump's exhaust port and then disconnect the blind flange of the inlet and exhaust port to discharge the cleaning agent.
- ⑦ Use the tool to rotate the pump body completely 3~4 turns in clockwise direction to check whether the vacuum pump can rotate freely and smoothly. Repeat steps 3~6 to clean the pump body repeatedly if necessary.
- ⑧ Reconnect the suction port of the vacuum pump with the engineering pipeline
- ⑨ Reconnect the vacuum pump exhaust port with the exhaust pipe
- ⑩ Safely dispose of used cleaning agent and discharged sediment.

5.4. Purge guide

If the HV series Roots vacuum pump system is designed with auxiliary purging systems, such as seal purging, cooling purging and cleaning purging. These auxiliary systems can effectively help the vacuum pump to keep running continuously for a long time, extend the maintenance and servicing intervals of the vacuum pump, and prolong the service life of the pump. Please design and use these auxiliary systems in strict accordance with the design guidelines provided in this manual.

The auxiliary systems themselves are also subject to maintenance issues during long-term use, so please schedule regular inspections and maintenance as needed, mainly involving regular maintenance of piping, valves and instruments, and daily checks of gas source pressure, flow and cleanliness.

5.5. Cleaning guide

If the HV series Roots vacuum pump system is designed with auxiliary cleaning systems, such as solvent cleaning, steam cleaning. These auxiliary systems can effectively help the vacuum pump to keep running continuously for a long time, extend the maintenance and servicing cycle of the vacuum pump, and prolong the service life of the vacuum pump. Please design and use these auxiliary systems in strict accordance with the design guidelines provided in this manual.

The auxiliary system itself will also have maintenance problems during long-term use, please arrange regular inspection and maintenance as necessary, mainly concerning the regular maintenance of piping, valves and instruments, and whether the cleaning agent and steam meet the design requirements.

06 Disassembly And Assembly

Precautions:

When disassembling and reassembling a Roots vacuum pump, the following precautions should be taken:

1. Measure and record the rotor clearances before disassembling the Roots vacuum pump.
2. Try to avoid hitting with a heavy hammer, the removed parts must not be bruised, and properly stored.
3. Record in detail the reasons for replacement and the use of the parts that need to be replaced.
4. Before reassembling the Roots vacuum pump, clean the parts and trim the burrs.
5. Do not damage the gaskets at the joints when disassembling the pipes.
6. Measure and record the thickness of gaskets used in all different parts.
7. When disassembling and assembling, please clean all tools and use protective gloves properly.
8. When disassembling, pay attention to check whether there is abnormal wear or damage to the parts, damage to the connecting parts will greatly affect the performance of the pump, any damage to such parts should be repaired or replaced.
9. The removed parts should be placed in a clean, rust-free and dust-free place, taking care not to stick to the dust. Especially, mechanical seals, lip seals, O-rings, bearings, synchronous gears, etc.
10. All disassembled parts should be wiped with cleaning agent. For worn or damaged parts should be replaced with products that conform to our company's regulations. Use new bearings, seals, gaskets, and O-rings for each disassembly and assembly.
11. Adjust the clearance of each part of the rotor according to the clearance chart.
12. Leak detection shall be carried out after all the assembly.
13. After reassembling, trial operation and necessary performance tests must be carried out, and the installation and use can only be performed after normal operation.

6.1. Disassembly step

1. Remove all accessories from the pump system.
2. Remove the motor and coupling, and remove the drive key.
3. Remove the oil drain plug from the front and rear cover and drain the lubricant.
4. Use a wrench to loosen the bolts fixing the seal seat, and then remove the seal seat from the front cover, taking care to avoid damaging the mechanical seal and oil seal installed on the oil seal seat when disassembling.
5. Loosen the hexagonal bolts fixed on the front and back covers, and disassemble the front and back covers to remove the end O-rings.
6. Loosen the hexagonal bolt on the drive shaft with the hexagonal wrench, and then remove the drive shaft.
7. Loosen the hexagonal countersunk head screw at the end of the rotor shaft with the hexagonal wrench and remove the oil slinger, elastic pin, bearing gasket, shaft gasket, etc.
Note: The anti-loosening bolt is coated with thread fastening adhesive and may be difficult to remove. Use a flat-faced hammer to tap the bolt head evenly for removal.
8. Use a hexagonal wrench to remove the hexagonal nut connecting the rear end cap to the pump body, and use a puller to remove the back cover part. The mechanical seal dynamic ring, mechanical seal static ring, labyrinth, and bearing in the back cover are then removed.
9. Then fingers evenly force (or gently knock with tools, remember not to damage the mechanical seal) pull out the bearing in the back cover, remove the mechanical seal dynamic ring, pay attention to protect the sealing surface, and place the mechanical seal.
10. Remove the O-ring from the end face of the pump body and the auxiliary parts on the end cover, and the removal of the back cover is completed. Note: Unless the end cover is replaced, it is not necessary to remove the static ring and labyrinth of the machine seal.
11. Use a wrench to unscrew the round nut on the gear end and remove the round nut stop washer. Mark the position of the keyway of the two rotors to facilitate the next assembly.
12. Use the puller to unload the synchronous gears. During the process of unloading the gears, you need to turn the gears back and forth to avoid entering the dead point of the rotor and biting the gears. Note: Mark the position of the left and right gears for facilitating reassembly.
13. Use a screwdriver to remove the two gear keys.
14. Use the press (or puller) to press out the two rotors, taking care to remove the rotors from the vertical direction.
15. Use the hexagonal wrench to loosen the hexagonal nut connecting the end cover and the pump body, and remove the front cover. The mechanical seal and bearing in the end cover will be removed.
16. Use the hexagonal wrench to loosen the hexagonal nut fixing the bearing platen and remove the locking washer.

17. Then finger evenly force (or gently knock with tools, remember not to damage the mechanical seal) pull out the bearing in the back cover, remove the mechanical seal dynamic ring, pay attention to protect the sealing surface.
18. Remove the O-ring from the end face of the pump body and the auxiliary parts on the end cover, and the removal of the front cover is completed. Note: Unless the end cover is replaced, it is not necessary to remove the static ring and labyrinth of the machine seal.
19. Mark the front and back cover to facilitate the next assembly.

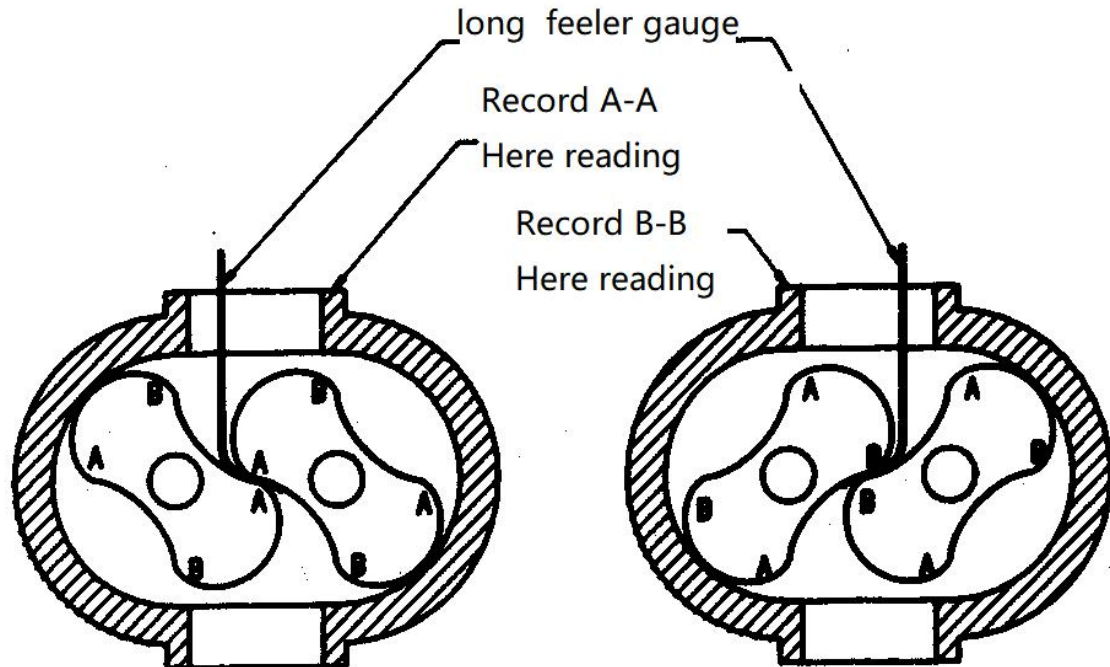
This completes all disassembly steps.

6.2. Assembly step

1. Remove all scratches on the sealing surface and thoroughly clean all parts.
2. Install the labyrinth and mechanical seal static ring onto the end cover. Note: Evenly apply RTV silicone rubber sealant, or a sealant equivalent to its specifications, to the mechanical seal mounting holes.
3. Place the rotor vertically so that the gear end is up, following the direction of the marked keyway placement. The two rotors are distributed at 90°.
4. Install the gear end cover onto the shaft carefully. Take care to protect the mechanical seal.
5. Wipe the mechanical seal sealing surface with a dust-free cloth, and then lubricate the sealing surface.
6. Install the mechanical seal dynamic ring onto the shaft.
7. Lubricate the shaft, and then install the double-row ball bearing in place.
8. Then tighten the oil retaining plate, bearing platen, locking washer and hexagonal bolt. Note: tilt the edge of the locking washer to prevent the threads from loosening.
9. Check the clearance between the rotor and the end cover and check the correct free end clearance from the clearance table. If the clearance is not within the specified range, find the cause of the incorrect clearance before proceeding with the assembly work.
10. Install the gear key to the correct position so that it is level with the top end of the shaft and tighten it. Then lubricate the shaft and key. Install the drive gear to the drive rotor first. Then install the driven gear, taking care to align the gear position with the marked position. Carefully install the driven gear to avoid damaging the gear teeth, and finally tighten the stop washers and hex nuts. Note: All synchronous gears have consecutive matching numbers, so they must be used in sets.
11. Add the spacer at the bottom of the pump body, place it vertically, install the O-ring and positioning pins.
12. Install the rotor parts installed in the steps vertically into the pump body, with the two pins positioned. Use hexagonal bolts to fasten the pump body and end cover.
13. The assembled component is turned over and the end of the rotor is placed vertically facing upward.

14. Refer to the free end clearance value on the clearance table and use the depth gauge to check the clearance between the rotor and the pump body. If the clearance is not within the specified range, find the cause of the incorrect clearance and then proceed with the assembly work.
15. Install the O-ring and positioning pin on the pump body.
16. Then carefully install the free end cover to the pump body, position it by the pin and fix it with hexagonal bolt. Pay attention to protect the mechanical seal.
17. Install the mechanical seal dynamic ring according to the method used earlier.
18. Install the bearing gasket.
19. Lubricate the shaft, and then install the free end bearing in place. Note: When the free end bearing is a single retaining edge roller bearing with separable inner ring, install the single retaining edge facing outward, otherwise bearing seizure or serious wear will occur.
20. Install the oil retainer plate, fix it with bolts, install the shaft washer, oil slinger and elastic pin, and fix it with hexagonal socket countersunk head screws. Note: Use thread fastening adhesive for hexagonal socket head screws at shaft end to prevent loosening of threads.
21. Install the O-ring in the end cover, then install the back cover parts and fix it with hexagonal bolts. The back cover parts includes: oil cooler, O-ring, water pass-through bolt, and oil window sight glass.
22. The assembled part is placed horizontally for easy adjustment of the inter-rotor clearance.
23. The driven gear is made up of two parts. The gear housing is fixed to the gear hub by four screws and positioned by two pins. The gear housing and the gear hub are separated one by one by a number of gear adjustment gaskets with a thickness of 0.08mm stacked together. When the number of these gaskets is increased or decreased, the gear housing moves axially with respect to the gear ring. Since helical gears are used, a certain distance of axial movement of the gear housing is equivalent to a certain angle of rotation of the gear, while the driven rotor is following the rotation of the driven gear, so changing the value of the clearance between the rotors. For every 0.16mm change in the total thickness of these gaskets, the clearance between the rotors changes by 0.08mm.

Example: Refer to the picture below, check the clearance at AA, BB, if the clearance at AA is 0.23mm, the clearance at BB is 0.07mm, then you need to take away two pcs of gaskets (0.16mm), at this time the clearance between the rotor changes 0.08mm so the clearance at AA becomes 0.15mm, the clearance at BB becomes 0.15mm. the difference between the clearance at AA, BB should be controlled within 0.05mm. If the reading on the left side is larger than the right side, take away a certain amount of gaskets, and if the reading on the left side is smaller than the right side, increase the gaskets. It is not necessary to remove the locking nut when removing the gear housing. Make sure that the bolt is locked in the right position because the pin will definitely be removed after the gear.



24. Bend the protruding part of the locking spacer and press it into the groove of the locking nut.
25. Install the drive shaft, making sure the surface is clean and burr-free, and the runout of the drive shaft should be less than 0.08mm (measure the shaft section after the keyway).
26. Install the positioning pin and rubber O-ring in the front cover.
27. Install the front cover assembly and fix it with hex bolts.
28. Install the new mechanical seal static ring on the seal seat and press in the oil seal.
29. Install the mechanical seal dynamic ring on the drive shaft.
30. Depth gauge measure the compression of the outer mechanical seal, and control the compression to 1.2mm by the number of mechanical seal adjustment gaskets.
31. Install the seal seat. And lock it with bolts.
32. Install the ferrule joint on the front and back cover, pay attention to wrap the raw tape on the male thread to prevent leakage. Install the external cooling pipe and tighten it with a wrench.
33. Install the drive key and install the flexible coupling.
34. Install the motor connecting flange and fix it with hexagonal bolt.
35. Lock the coupling screws. Install the coupling guard cover and fasten it with bolts.
36. Follow the assembly and operation instructions to run the pump. It is necessary to observe the oil level frequently during the first few hours of operation. Improper installation or damaged oil seals can cause oil leakage.

This completes all assembly steps.

6.3. Spare parts list

When disassembling and assembling MB Roots vacuum pumps, the service parts listed in the table below cannot be used again after complete disassembly, including all seals, bearings and other parts. These parts can be purchased as "kits" or "single parts".

Note: Synchronous gears are not included in the repair parts, please purchase separately if needed.

1) Overhaul spare parts kit list

NO.	Applicable Models	Material Code	Structure Type
1	HV200、 400	Y.E.MB400B	Oil Seal
		Y.E.MB400MI	Mechanical Seal
2	HV540、 720	Y.E.MB540	Oil Slinger Seal
		Y.E.MB540B	Oil Seal
		Y.E.MB540MI	Mechanical Seal
3	HV850、 1200、 1600、 2000、 2700	Y.E.MB2000	Oil Slinger Seal
		Y.E.MB2000B	Oil Seal
		Y.E.MB2000MI	Mechanical Seal
4	HV2900、 3600、 4500	Y.E.MB4500B	Oil Seal
		Y.E.MB4500MI	Mechanical Seal
5	HV5400、 HV7300	Y.E.MB7300	Mechanical Seal
6	HV7900、 HV10000	Y.E.MB7900	Mechanical Seal

2) Overhaul spare parts kit parts list

NO	Parts Name	HV200、HV400		HV540、HV720		
		Quantity		Quantity		
		Oil Seal	Mechanical Seal	Oil Slinger	Oil Seal	Mechanical Seal
1	Double row angular contact ball bearing	2	2	2	2	2
2	Roller bearing	2	2	2	2	2
3	Mechanical seal (inside)	/	4	/	/	4
4	Mechanical seal (outside)	1	1	1	1	1
5	Labyrinth Seal	4	4	/	4	4
6	Oil slinger dynamic ring	/	/	4	/	/
7	Oil slinger static ring	/	/	4	/	/
8	Skeleton Oil Seal (inside)	4	/	/	4	/
9	Skeleton Oil Seal (outside)	1	1	1	1	1
10	O-Ring (end cover)	4	4	4	4	4
11	O-Ring (sealing seat)	/	/	1	1	1
12	Coupling elastomer	1	1	1	1	1
13	Gear key	2	2	2	2	2
14	Gear adjustment gasket	10	10	10	10	10
15	Mechanical seal adjustment gasket	/	/	10	10	10
16	Bearing washer	2	2	2	2	2
17	Hexagon socket countersunk head screw	4	4	2	2	2
18	Hexagon socket bolt	2	2	/	/	/
19	Stop washers for round nut	/	/	2	2	2
20	Lock washer	/	/	4	4	4
21	Drive shaft lock washer	/	/	2	2	2

NO.	Parts Name	HV850、HV1200、HV1600、 HV2000、HV2700			HV2900、 HV3600、 HV4500
		Quantity			Quantity
		Oil Slinger	Oil Seal	Mechanical Seal	Mechanical Seal
1	Double row angular contact ball bearing	2	2	2	4
2	Roller bearing	2	2	2	1
3	Mechanical seal (inside)	/	/	4	4
4	Mechanical seal (outside)	1	1	1	1
5	Labyrinth Seal	/	4	4	1
6	Oil slinger dynamic ring	4	/	/	/
7	Oil slinger static ring	4	/	/	/
8	Skeleton Oil Seal (inside)	/	4	/	/
9	Skeleton Oil Seal (outside)	1	1	1	1
10	O-Ring (end cover)	4	4	4	4
11	O-Ring (sealing seat)	1	1	1	1
12	Coupling elastomer	1	1	1	1
13	Gear key	2	2	2	2
14	Gear adjustment gasket	10	10	10	10
15	Mechanical seal adjustment gasket	10	10	10	/
16	Bearing washer	2	2	2	2
17	Hexagon socket countersunk head screw	2	2	2	4
18	Hexagon socket bolt	/	/	/	/
19	Stop washers for round nut	2	2	2	/
20	Lock washer	6	6	6	4
21	Drive shaft lock washer	2	2	2	/

NO.	Parts Name	HV5400、HV7300	HV7900、HV10000
1	Double row angular contact ball bearing	4	4
2	Self-aligning bearing	1	1
3	Mechanical seal (inside)	4	4
4	Mechanical seal (outside)	1	1
5	Labyrinth Seal	4	4
6	Oil slinger dynamic ring	/	/
7	Oil slinger static ring	/	/
8	Skeleton Oil Seal (inside)	/	/
9	Skeleton Oil Seal (outside)	1	/
10	O-Ring (end cover)	2	4
11	O-Ring (sealing seat)	1	1
12	Coupling elastomer	/	/
13	Gear key	2	2
14	Gear adjustment gasket	10	10
15	Mechanical seal adjustment gasket	/	/
16	Bearing washer	2	
17	Hexagon socket countersunk head screw	/	/
18	Hexagon socket bolt	/	/
19	Stop washers for round nut	/	4
20	Lock washer	/	/
21	Drive shaft lock washer	/	/

07 Troubleshooting

Despite the excellent design and rigorous assembly tests, MB series Roots vacuum pumps can still malfunction during use due to improper installation, wear and tear of parts, and poor maintenance. The following table lists the common failures and the corresponding solutions for the maintenance personnel to refer to.

With proper use and maintenance, MB series Roots vacuum pumps can operate stably for many years. If the following conventional measures still fail to solve the vacuum pump failure or if annual overhaul is required, please contact our after-sales staff for advice.

Common malfunction	Cause	Solution
Low vacuum degree	Air leak in piping system	System leak detection
	Backing pump ultimate pressure drop	Repair or replace backing pump
	Mechanical seal wear	Replace mechanical seal
Motor overload	Inlet pressure is too high	Extend the pumping time of the backing pump to reach the inlet pressure
	Contact between rotor end face and end cover end face	Adjust rotor end face clearance
	Return of fluid from backing pump to the Roots pump	Anti fluid return device
Pump body overheat	Insufficient pumping speed of backing pump, resulting in too large compression ratio	Re-selection of backing pump
	High inlet pressure	Extend the pumping time of the backing pump to reach the inlet pressure
	Rotor contact with pump body	Make adjustments and repairs
High oil tank temperature	Excessive gearbox lubricant	Drain part of the oil volume
	Poor cooling	Check the cooling device
	Poor lubrication of gears, bearings and mechanical seals	Ensure oil volume and check lubrication
Abnormal sound	Poor assembly	Reassembly
	Gear and rotor offset, so that the rotor	Readjust rotor relative position to ensure

	touches each other	clearance
	High inlet pressure	Extend the pumping time of the backing pump to reach the inlet pressure
	Gear damage due to overload or poor lubrication	Check overload, lubrication, replace gears if necessary
	Bearing wear	Replace bearing
	Gear damage	Replace synchronous gear

08 Quality Assurance

Vacculex Vacuum Equipment (Zhejiang) Co.,Ltd.("Vacculex" for short) hereby promises that the products produced by our company are subject to strict quality inspection and will not have material or manufacturing defects under normal use conditions.

Warranty responsibility

- This quality assurance is valid only if the product is used in full compliance with our product operating instructions.
- The products sold by Vacculex (except consumables such as vacuum pump oil, oil filter, exhaust filter, gas inlet filter, etc.) will be guaranteed by Vacculex for 18 months from the date of shipment or 12 months after installation and commissioning under normal use condition and permitted working condition. If there is any problem with the quality or performance of the products, Vacculex will assign authorized dealers to repair or replace the new products for free. There will be no return or replace for vacuum products, parts and components that are customized to the customer's requirements or that have been discontinued by Vacculex.
- After the products repaired by Vacculex are qualified by commissioning, Vacculex will provide a 3-month warranty from the date of qualified repair and commissioning under normal use conditions and permitted working conditions; this warranty is limited to the repair parts.
- Vacculex checks the faulty product or component, and confirms that it is caused by product material or manufacturing defect, and Vacculex is responsible for free replacement or repair. Apart from this, Vacculex is not responsible for any indirect or direct losses caused by the company's products, including losses to other products, construction, machinery or property, etc.
- Corrosion and wear of vacuum pump due to improper use environment, improper repair and maintenance, wrong installation and operation, or damage caused by disassembly of the product or replacement of original parts without the authorization of Vacculex are not covered by the company's warranty.
- This warranty does not cover services such as installation and maintenance of the product, if customers need this, please contact our company.
- The final right to interpret the content of this quality guarantee belongs to Vacculex Vacuum Equipment (Zhejiang) Co.,Ltd.

Warranty Period

- New product: Vacculex provides product quality assurance for 18 months from the date of delivery or 12 months after installation and commissioning (whichever comes first).
- Repaired products: Vacculex provides quality assurance for 3 months from the date of qualified repair and commissioning (this quality assurance is limited to repaired parts).
- Spare parts: Vacculex provides a 3-month warranty for spare parts from the date of delivery.

Warranty Area

- Worldwide (excluding domestic areas in China).

Attention

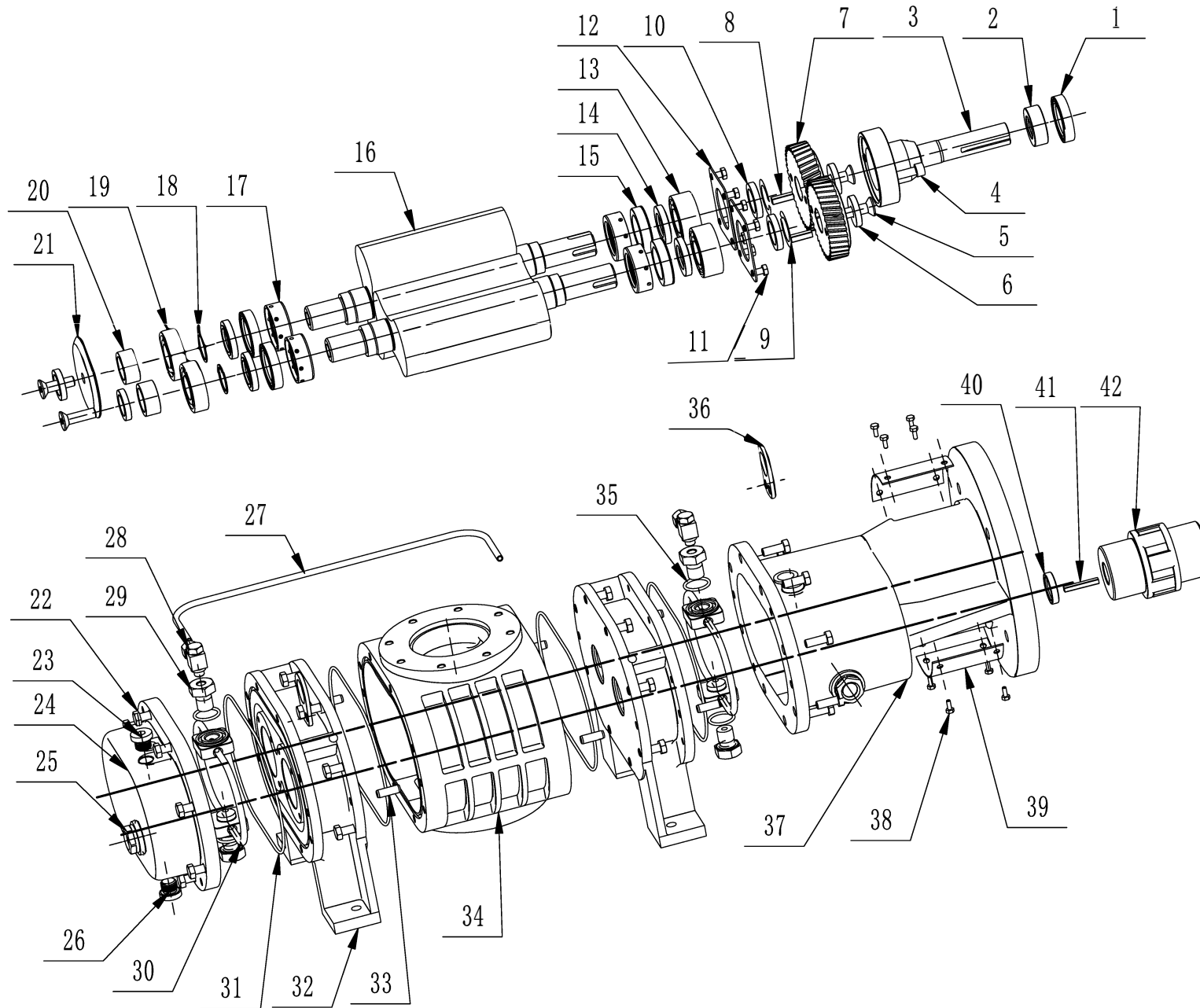
- During the quality assurance period, if there is any problem with the product, please contact the company (with the warranty letter or related documents), and the company will assign authorized dealer service personnel to deal with after-sales; if you need to send the product to our authorized dealer, please pay by yourself freight, after the company's authorized dealers confirm that the product is with material or manufacturing defects, they will repair or replace parts for customers free of charge (consumables update need to be charged), and the products will be returned to the customer after qualified inspection and commissioning.

09 Reference drawing

9.1. Clearance Table

Roots vacuum pump clearance table					Unit:mm	
Model	Fixed End	Free End	Between rotors	Rotor and pump body		
				At the positioning pin	At the port	
HV200	0.08-0.13	0.30-0.43	0.15-0.30	0.08-0.18	0.15-0.25	
HV400	0.08-0.13	0.30-0.43	0.15-0.30	0.08-0.18	0.15-0.25	
HV540	0.10-0.15	0.28-0.41	0.15-0.30	0.08-0.20	0.15-0.28	
HV720	0.10-0.15	0.28-0.41	0.15-0.30	0.08-0.20	0.15-0.28	
HV850	0.10-0.18	0.33-0.46	0.15-0.30	0.18-0.30	0.28-0.41	
HV1200	0.10-0.18	0.36-0.48	0.15-0.30	0.18-0.30	0.28-0.41	
HV1600	0.10-0.18	0.43-0.56	0.15-0.30	0.18-0.30	0.28-0.41	
HV2000	0.10-0.18	0.53-0.66	0.15-0.30	0.18-0.30	0.28-0.41	
HV2700	0.10-0.18	0.64-0.76	0.15-0.30	0.20-0.33	0.30-0.43	
HV2900	0.15-0.23	0.53-0.69	0.25-0.36	0.20-0.30	0.38-0.48	
HV3600	0.15-0.23	0.68-0.81	0.25-0.36	0.20-0.30	0.38-0.48	
HV4500	0.15-0.23	0.79-0.94	0.25-0.36	0.20-0.30	0.38-0.48	
HV5400	0.18-0.25	0.51-0.63	0.33-0.46	0.23-0.33	0.33-0.46	
HV7300	0.18-0.25	0.76-0.86	0.33-0.46	0.23-0.33	0.33-0.46	
HV7900	0.28-0.36	0.89-1.07	0.64-0.81	0.30-0.48	0.53-0.69	
HV10000	0.28-0.36	1.35-1.52	0.64-0.81	0.30-0.48	0.53-0.69	

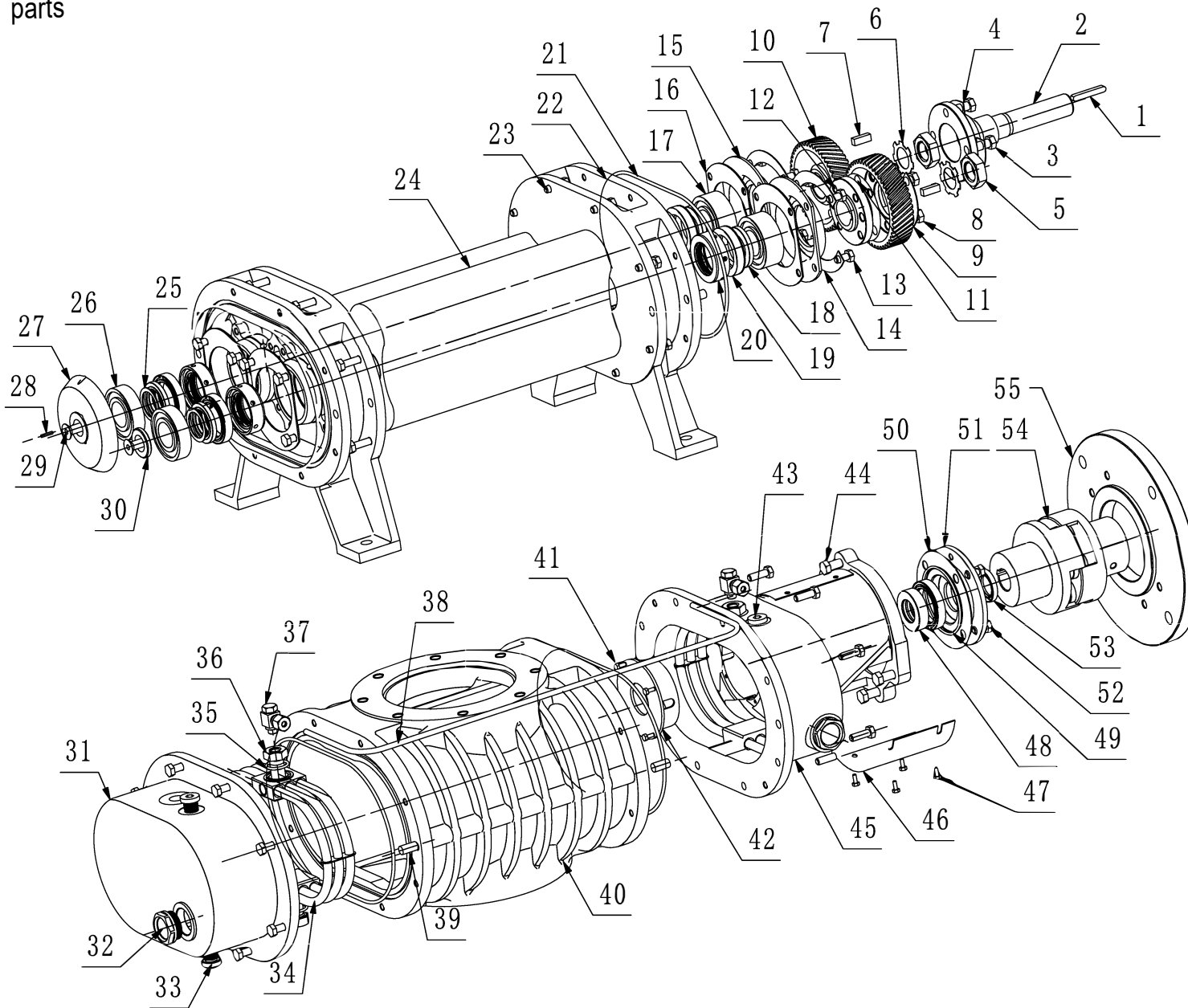
Structure Type: Mechanical seal
 HV100,HV200,HV400 series exploded drawing of parts



42	Coupling	1
41	Drive Key	1
40	Skeleton Oil Seal	1
39	Protective Cover	2
38	Hexagonal bolt	8
37	Front Cover	1
36	Lifting Ring	2
35	O Seal	4
34	Pump Body	1
33	Positioning Pin	6
32	End Cover	2
31	O Seal	4
30	Oil Cooler	2
29	Water Bolt	4
28	Ferrule Fitting	2
27	External Cooling Tube	1
N.O.	Name	Quantity

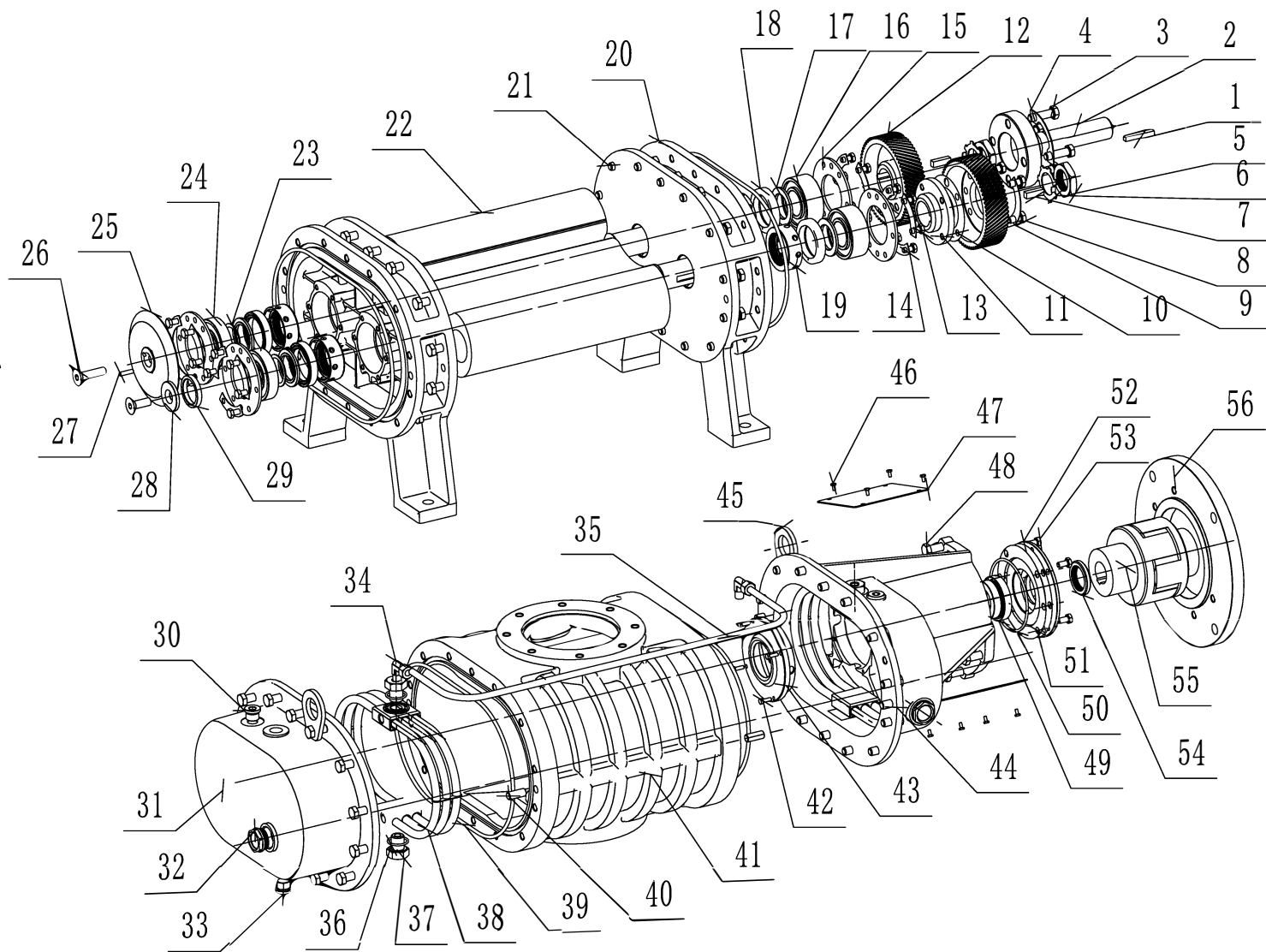
26	Magnetic Plug	2
25	Oil Window	2
24	Back Cover	1
23	Plug	2
22	Hexagonal bolt	32
21	Oil Slinger	1
20	Bushing	2
19	Cylindrical Roller Bearing	2
18	Bearing Washer	2
17	Labyrinth	4
16	Rotor	2
15	Mechanical Seal Static Ring	4
14	Mechanical Dynamic Ring	4
13	Double-row Angular Contact Ball Bearing	2
12	Bearing Platen	2
11	Hexagonal Bolt	8
10	Gear Washer	2
9	Gear Adjustment Gasket	
8	Gear Key	2
7	Synchronous Gear	1
6	Shaft Washer	4
	Hexagon Socket Countersunk Head Bolt	4
	Hexagon Socket Head Bolt	2
	Drive Shaft	1
	External Mechanical Seal Dynamic Ring	1
	External Mechanical Seal Static Ring	1
N.O.	Name	Quantity

Structure Type: Mechanical seal
 MHV40,MB720 series exploded drawing of parts



			28	Flexible pin	1
55	Motor connection flange	1	27	Oil Slinger	1
54	Flexible coupling	1	26	Single retaining edge roller bearing	2
53	Skeleton Oil Seal	1	25	Bearing Washer	2
52	Hexagonal bolt	4	24	Rotor	2
51	Seal seat	1	23	Hexagonal Nut	32
50	Mechanical seal adjustment gasket		22	End Cover	2
49	O-ring rubber seal	1	21	O-ring rubber seal	4
48	External Mechanical Seal Dynamic Ring	1	20	Labyrinth	4
47	Hexagonal bolt	8	19	Mechanical Seal Static Ring	5
46	Protective Cover	2	18	Mechanical Seal Dynamic Ring	4
45	Front Cover	1	17	Double-row ball bearing	2
44	Hexagonal bolt	4	16	Oil baffle	4
43	Plug	2	15	Bearing Platen	2
42	Oil collection box	1	14	Locking gasket	4
41	Phillips screw	4	13	Hexagonal Nut	16
40	Pump body	1	12	Gear Hub	1
39	Cylindrical pin	6	11	Gear Adjustment Gasket	
38	External cooling tube	1	10	Synchronous helical gear	1
37	Ferrule Fitting	2	9	Gear locking gasket	2
36	Connection bolt	4	8	Hexagonal Nut	4
35	O-ring rubber seal	4	7	Gear Key	2
34	Oil Cooler	2	6	Stop Gasket	2
33	Magnetic Plug	2	5	Hexagonal Nut	2
32	Oil Window	2	4	Drive shaft locking gasket	2
31	Back Cover	1	3	Hexagonal bolt	4
30	Shaft end gasket	1	2	Drive Shaft	1
29	Hexagon socket countersunk head screw	2	1	Driver Key	1
N.O.	Name	Quantity	N.O.	Name	Quantity

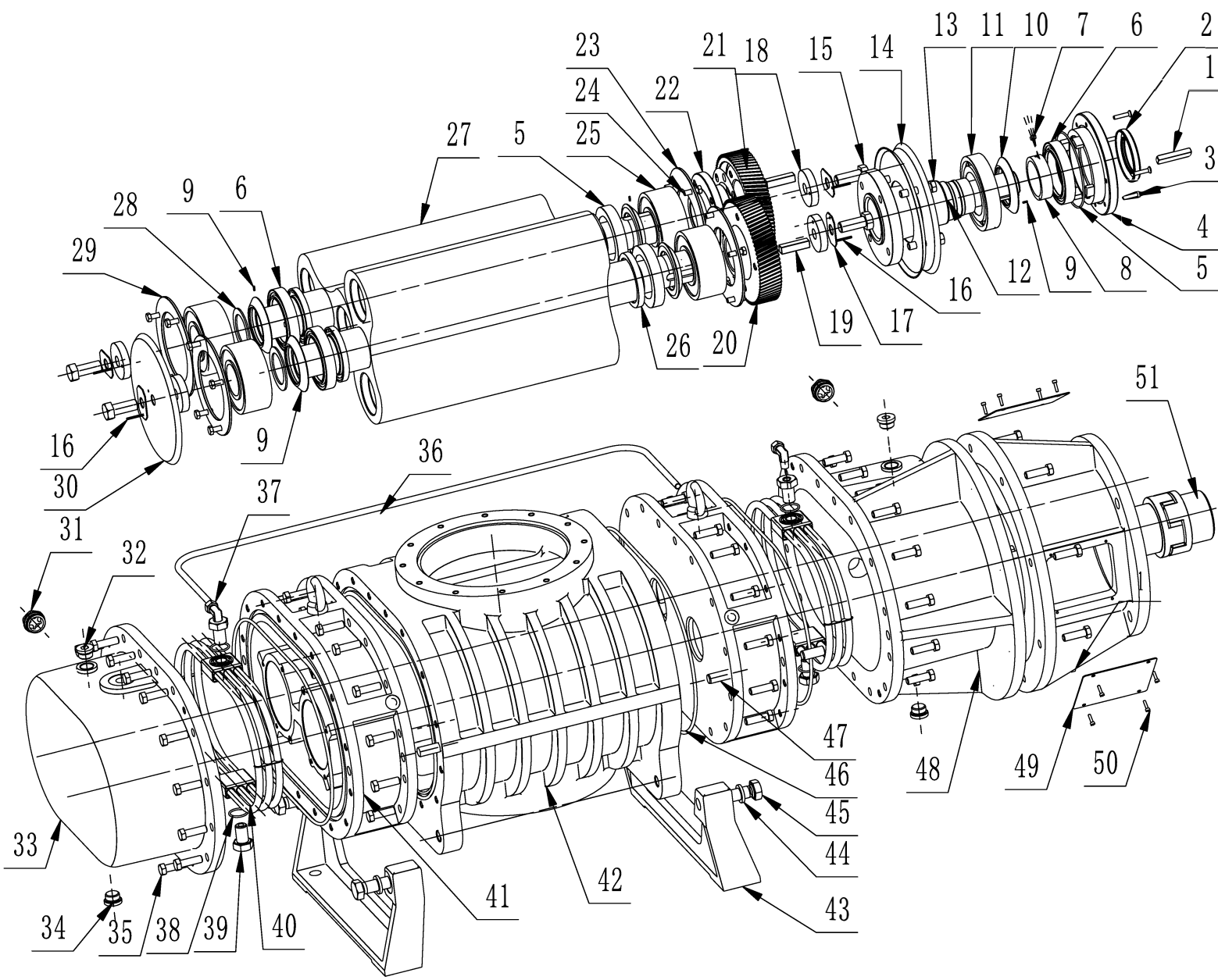
Structure Type: Mechanical seal
 HV850,HV1200,HV1600,HV2000,HV2700 series exploded
 drawing of parts



56	Motor connection flange	1
55	Coupling	1
54	Skeleton Oil Seal	1
53	Hexagonal bolt	4
52	Seal seat	1
51	Mechanical seal adjustment gasket	1
50	O-ring seal	1
49	External Mechanical Seal	1
48	Hexagonal bolt	4
47	Coupling shield	2
46	Hexagon socket bolt	8
45	Lifting ring	2
44	Front cover	1
43	Oil collection box	1
42	Hexagonal bolt	4
41	Pump body	1
40	Positioning pin	6
39	O-ring seal	4
38	Oil Cooler	2
37	Water Bolt	4
36	O-ring seal	4
35	Cooling tube	1
34	Ferrule Fitting	2
33	Magnetic Plug	2
32	Oil Window	2
31	Back cover	1
30	Plug	2
29	Gasket	1
N	Name	Quantity

28	Shaft Washer	1
27	Flexible pin	1
26	Hexagon Socket Countersunk Head Bolt	2
25	Oil Slinger	1
24	Cylindrical Roller Bearing	2
23	Bearing Washer	2
22	Rotor	2
21	Hexagonal bolt	56
20	End Cover	2
19	Labyrinth	4
18	Mechanical Seal Static Ring	4
17	Mechanical Seal Dynamic Ring	4
16	Double-row Angular Contact Ball Bearing	2
15	Bearing Platen	4
14	Locking gasket	6
13	Hexagonal bolt	18
12	Synchronous Gear	1
11	Gear Hub	1
10	Gear Adjustment Gasket	
9	Gear locking gasket	2
8	Hexagonal Nut	4
7	Gear Key	2
6	Stop Gasket	2
5	Hexagonal Nut	2
4	Locking gasket	2
3	Hexagonal bolt	4
2	Drive Shaft	1
1	Driver Key	1
N	Name	Quantity

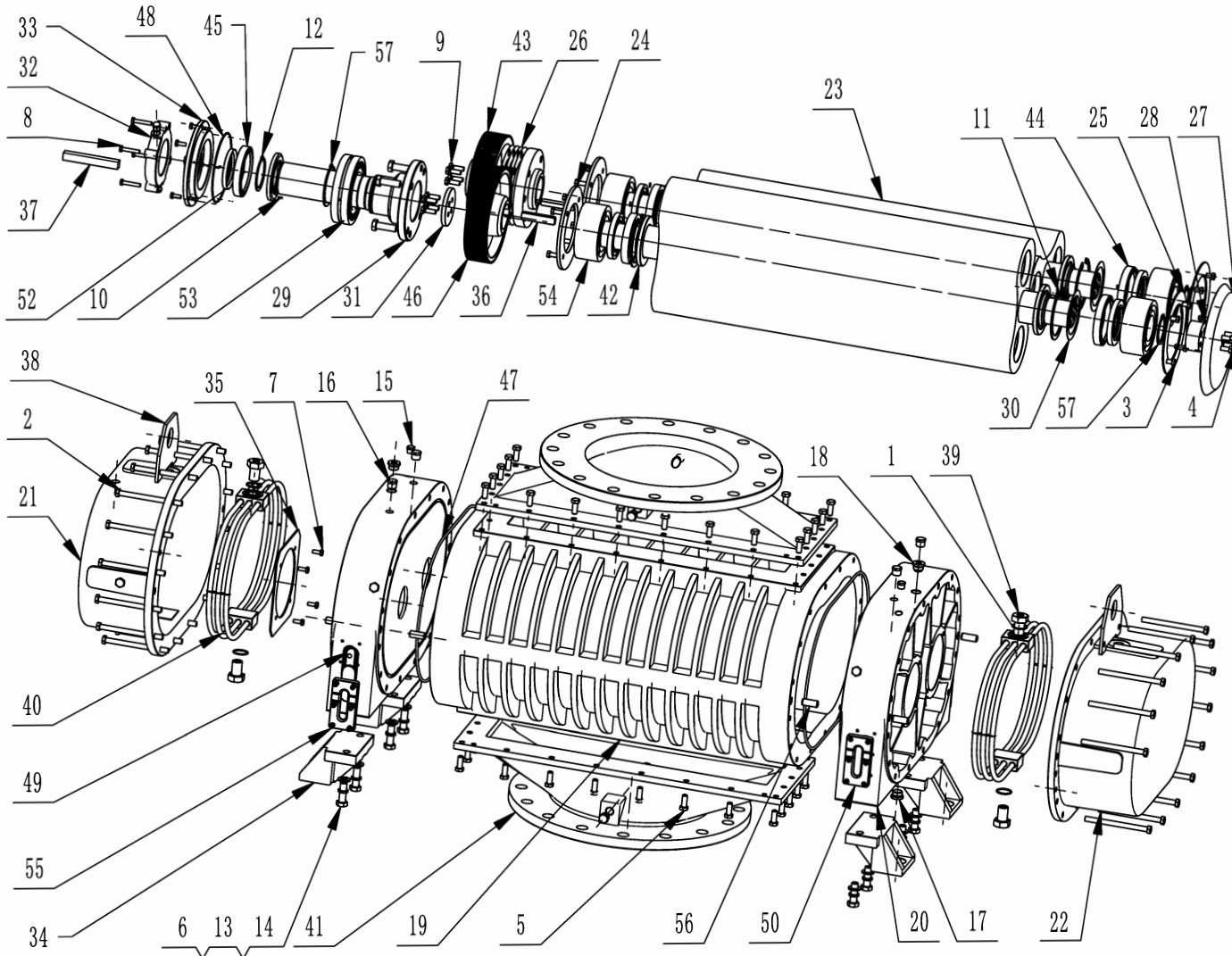
Structure Type: Mechanical seal
 HV2900,HV3600,HV4500 series exploded drawing of parts



51	Coupling	1
50	Hexagonal bolt	8
49	Protective Cover	2
48	Front Cover	1
47	Positioning pin	6
46	O-ring seal	4
45	Hexagonal bolt	4
44	Flexible gasket	4
43	Pump foot	2
42	Pump body	1
41	End Cover	2
40	Oil cooler	2
39	Water bolt	4
38	O-ring seal	4
37	Ferrule Fitting	2
36	External cooling tube	1
35	Hexagonal bolt	72
34	Magnetic Plug	2
33	Back cover	1
32	Plug	2
31	Oil window	2
30	Oil Slinger(back)	1
29	Bearing Platen(back)	2
28	Bearing gasket	2
27	Rotor	2
N	Name	Quantity

26	Labyrinth	4
25	Double-row Angular Contact Ball Bearing	4
24	Hexagonal bolt	16
23	Bearing Platen(front)	2
22	Gear Hub	1
21	Gear Adjustment Gasket	
20	Synchronous Gear	1
19	Gear key	2
18	Shaft end gasket	4
17	Locking gasket	2
16	Flexible pin	4
15	Hexagonal bolt	4
14	Oil Slinger(front)	2
13	Hexagonal bolt	4
12	Drive Shaft	1
11	Cylindrical Roller Bearing	1
10	Mechanical Seal Dynamic Ring	5
9	Flexible pin	5
8	Dynamic ring retainer	1
7	Hexagon socket set screws	3
6	Mechanical Seal Static Ring	5
5	O-ring seal	1
4	Seal seat	1
3	Hexagon Socket Countersunk Head Bolt	4
2	Skeleton Oil Seal	1
1	Driver Key	1
N	Name	Quantity

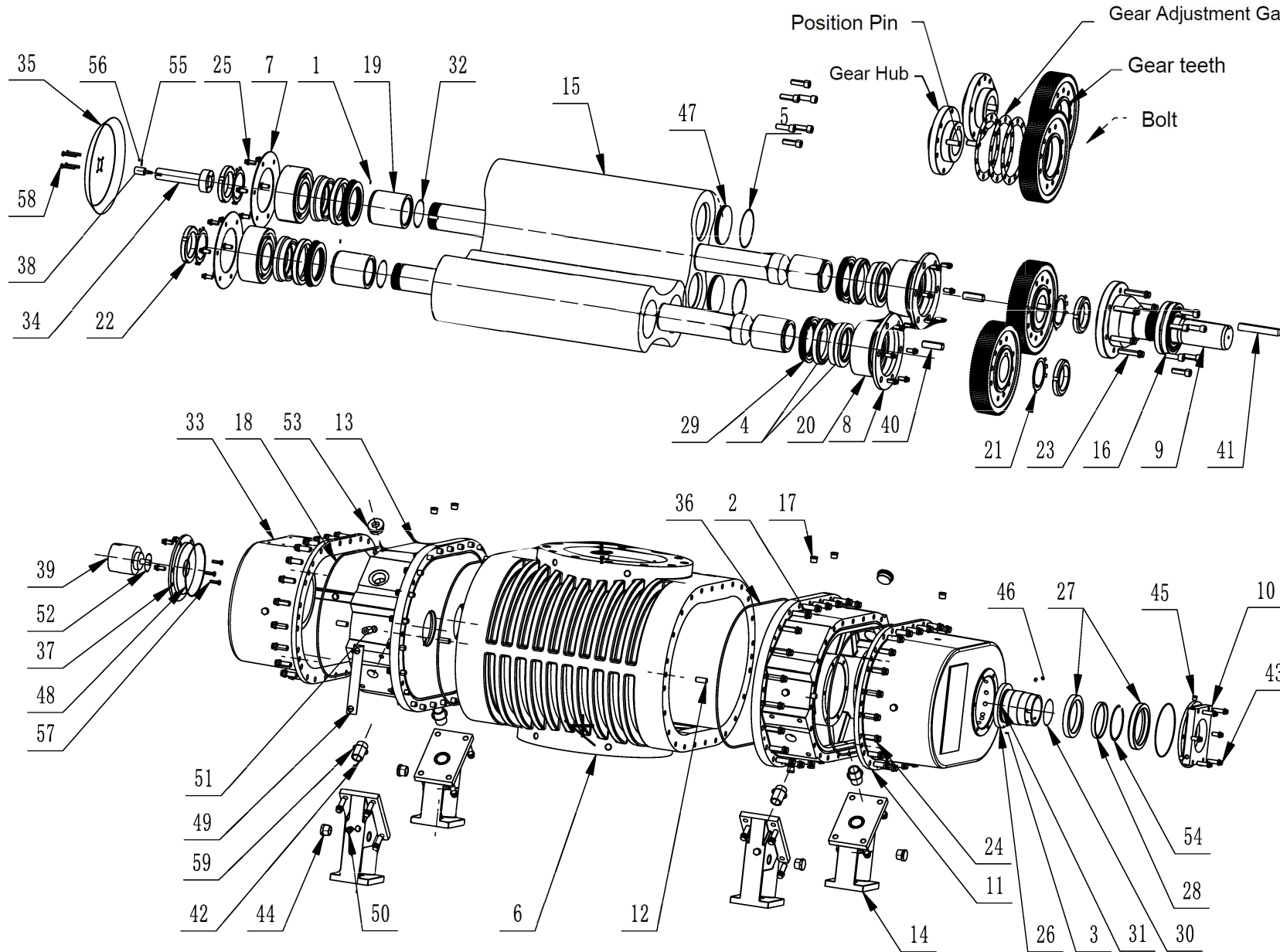
HV5400, HV7300 series exploded drawing of parts



57	Shaft retaining ring	2
56	Shaft retaining ring	2
55	Cylindrical pin	8
54	Hexagon socket screw	24
53	Double-row Angular Contact Ball Bearing	4
52	Spherical Roller Bearings	1
51	Skeleton Oil Seal	1
50	Sight glass platen	4
49	O-ring seal	4
48	O-ring seal	1
47	O-ring seal	2
46	Drive gear	1
45	Mechanical Seal Static Ring	5
44	Mechanical Seal Dynamic Ring	5
43	Driven gear	1
42	Labyrinth	4
41	Air inlet and outlet connector	2
40	Oil cooler	2
39	Water Bolt	4
38	Lifting ring	2
37	Drive key	1
36	Gear Key	2
35	Oil baffle	1
34	Pump foot	4
33	Seal seat	1
32	Seal seat cover	1
31	Shaft Gasket	2
30	Mechanical seal gasket	2
29	Drive shaft	1
N	Name	Quantity
O.		

28	Oil Slinger Gasket	1
27	Oil Slinger	1
26	Gear Adjustment Gasket	10
25	Retaining ring	2
24	Bearing platen	2
23	Rotor	2
22	Back cover	1
21	Front cover	1
20	End cover	2
19	Pump body	1
18	Plug	2
17	Magnetic Plug	2
16	Plug	18
15	Plug	4
14	Flat washer	8
13	Flexible gasket	8
12	Elastic retaining ring for shaft	1
11	Elastic retaining ring for hole	4
10	Flexible pin	5
9	Hexagonal bolt	8
8	Hexagonal bolt	4
7	Hexagonal bolt	8
6	Hexagonal bolt	12
5	Hexagonal bolt	44
4	Hexagonal bolt	4
3	Hexagonal bolt	16
2	Hexagonal bolt	32
1	O-ring seal	4
N	Name	Quantity
O.		

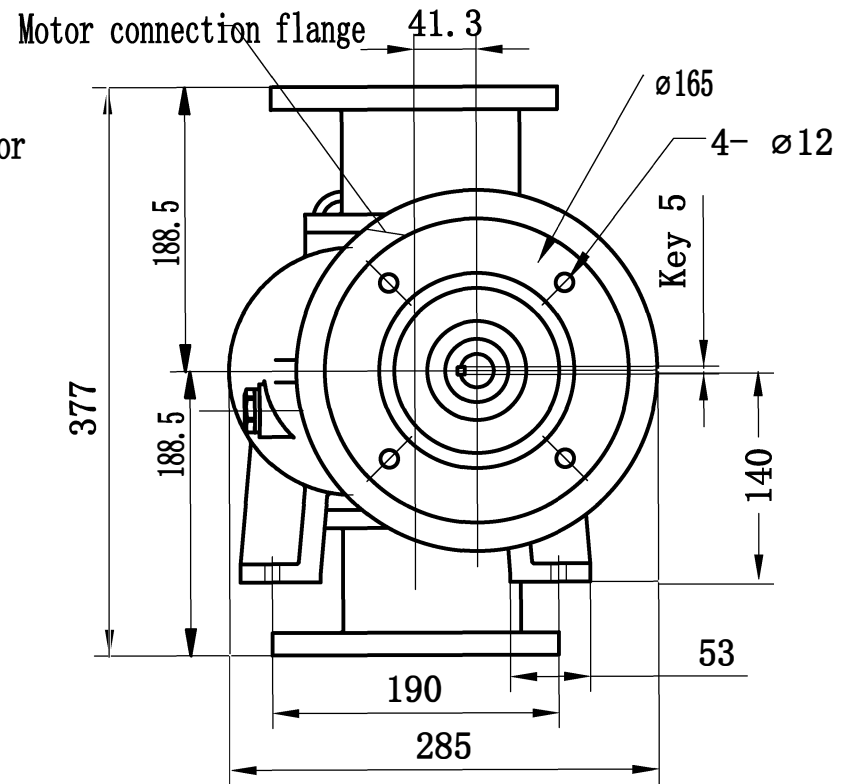
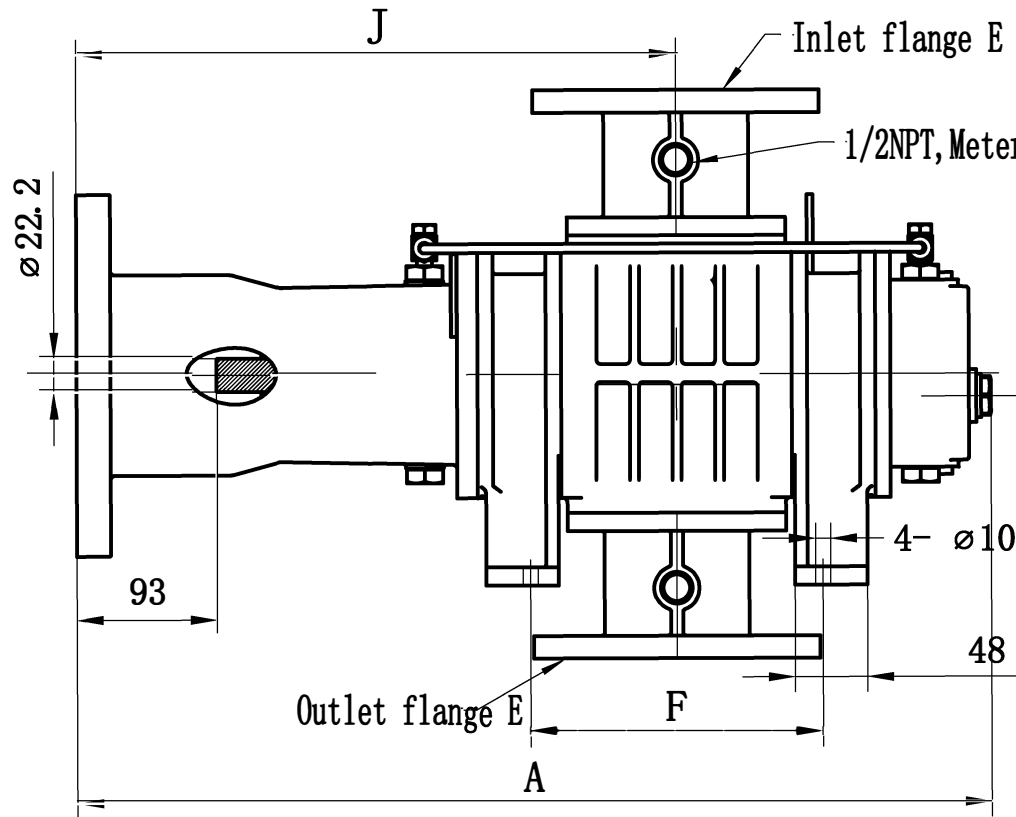
HV7900, HV10000 series exploded drawing of parts



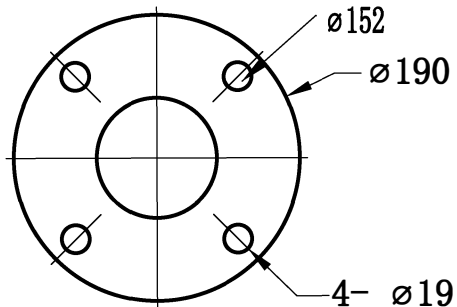
59	O-ring seal	4
58	Hexagonal head bolt	4
57	Hexagonal head bolt	4
56	Hexagon socket set screw	1
55	Elastic cylindrical pin	1
54	Spiral retaining ring	1
53	Hexagon socket oil plug	2
52	O-ring seal	2
51	Female and male thread fitting	1
50	Female and male thread fitting	1
49	Oil Level Indicator	1
48	O-ring seal	8
47	Rotor cover plate	8
46	Hexagon socket set screw	2
45	Plug	4
44	WHP Hexagonal plug head	4
43	Twelve-angle head flange face bolts	4
42	Positioning tube	4
41	Drive key	1
40	Gear key	2
39	Oil pump	2
38	Oil pump shaft	1
37	Oil pump seat	1
36	O-ring seal	2
35	Oil Slinger	1
34	Oil pump drive shaft	1
33	Back cover	1
32	O-ring seal	4
31	O-ring seal	1
N	Name	Quantity
O		

30	O-ring seal	1
29	Labyrinth	1
28	External mechanical seal dynamic ring platen	1
27	External mechanical seal	1
26	Dynamic ring locking nut	1
25	Flange Face Bolt	32
24	Flange Face Bolt	64
23	Flange Face Bolt	6
22	Round nut	4
21	Stop washers for round nut	4
20	Double-row Angular Contact Ball Bearing	4
19	Bushing	4
18	O-ring seal	2
17	Plug	20
16	Spherical Bearing	1
15	Rotor	2
14	Pump foot	4
13	End cover	2
12	Cylindrical pin	8
11	Front cover	1
10	Seal seat	1
9	Drive shaft	1
8	Bearing platen	2
7	Retaining ring	2
6	Pump body	1
5	O-ring seal	8
4	Mechanical seal	4
3	Elastic cylindrical pin	1
2	Flange Face Bolt	60
1	Elastic cylindrical pin	8
N	Name	Quantity
O		

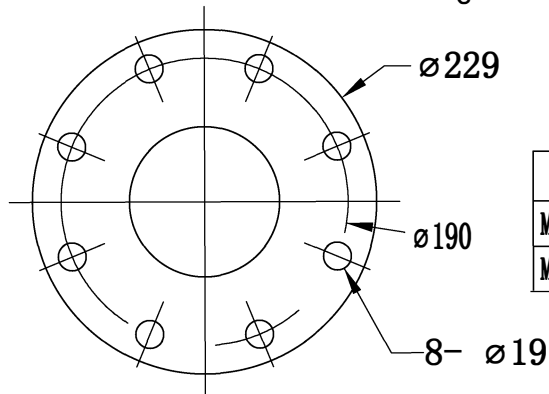
MB32 series Roots vacuum pump dimension drawing



MB200 inlet and outlet flange size



MB400 inlet and outlet flange size



Model	A	E	F	J
MB200	607	ANSI 80	194	398
MB400	706	ANSI 100	295	449

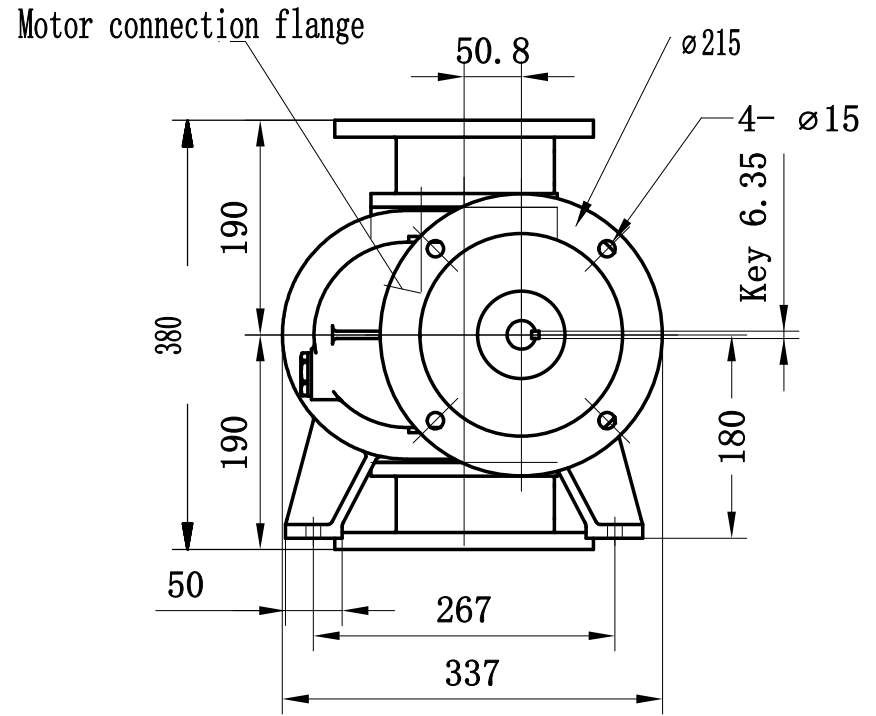
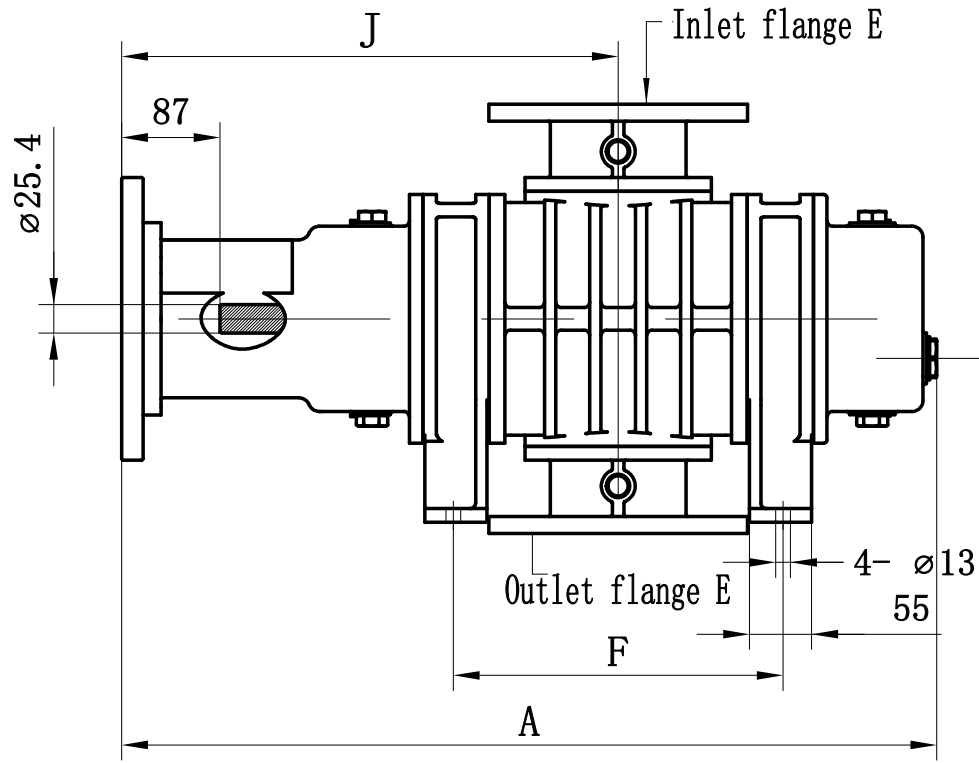


Vacculex Vacuum Equipment (Zhejiang) Co., Ltd.

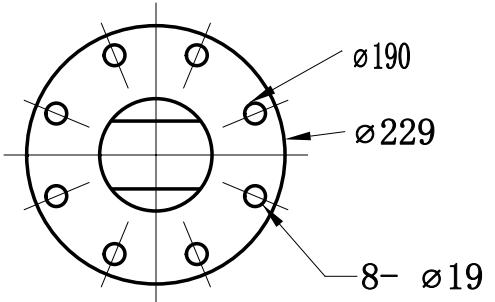
Vacuum pump dimension drawing

MB32 series


MB40 series Roots vacuum pump dimension drawing



Inlet and outlet flange size



Model	A	E	F	J
MB540	718	ANSI 100	292	440
MB720	794	ANSI 100	368	478

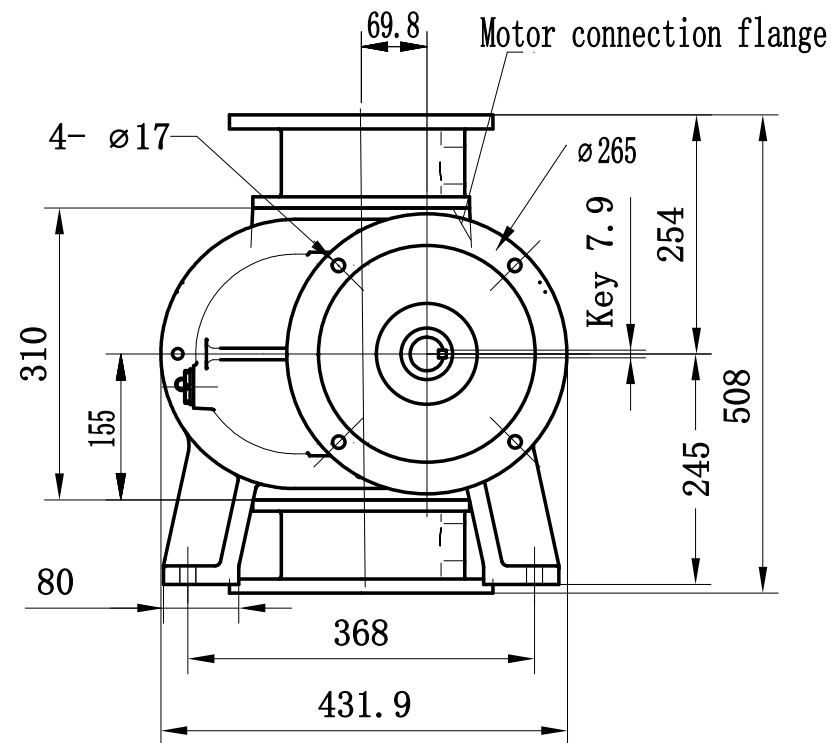
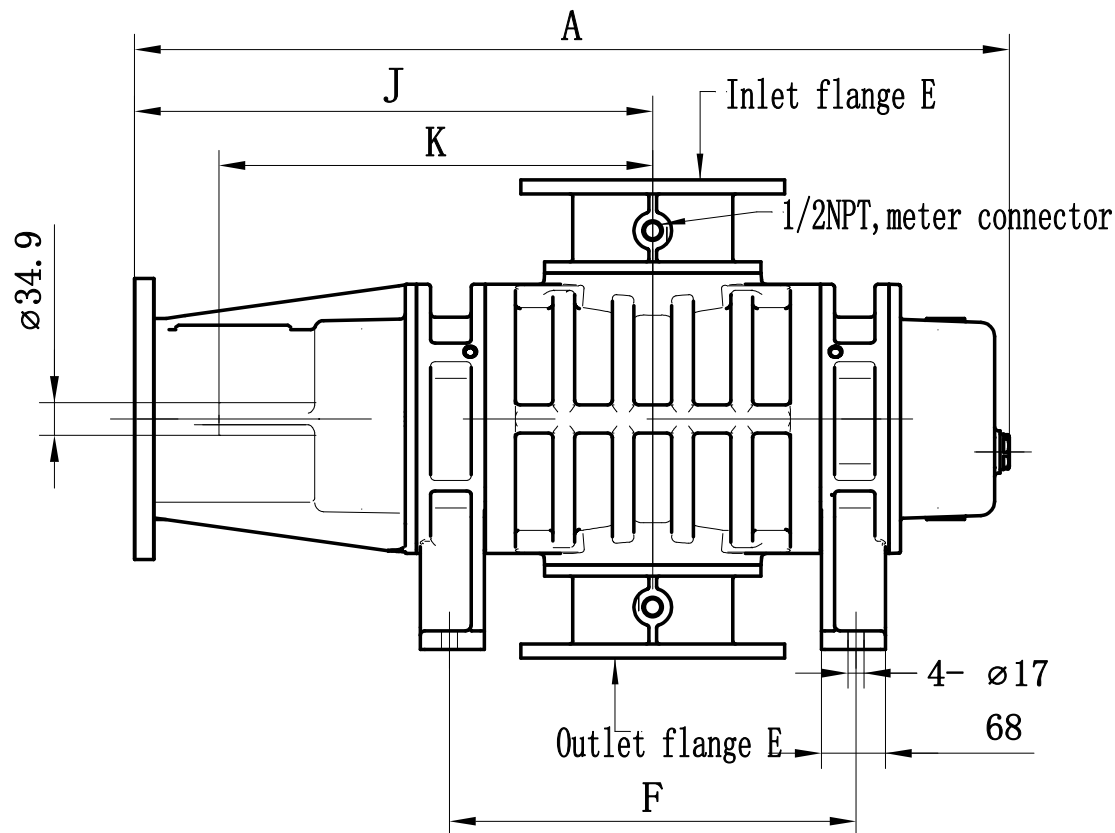


Vacculex Vacuum Equipment (Zhejiang) Co., Ltd.

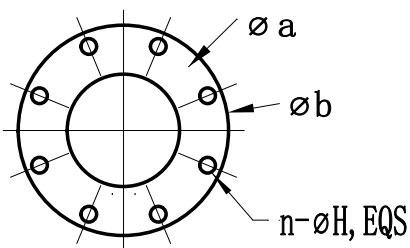
Vacuum pump dimension drawing

MB40 series

MB55 series Roots vacuum pump demension drawing



Inlet and outlet flange size



Model	A	E	F	J	K	n	H	ϕa	ϕb
MB850	765	ANSI 150	267	467	378	8	22	241.3	280
MB1200	854	ANSI 150	356	513	423	8	22	241.3	280
MB1600	930	ANSI 150	432	551	461	8	22	241.3	280
MB2000	1031	ANSI 200	533	602	511	8	22	298.5	345
MB2700	1183	ANSI 250	686	678	588	12	26	362	405

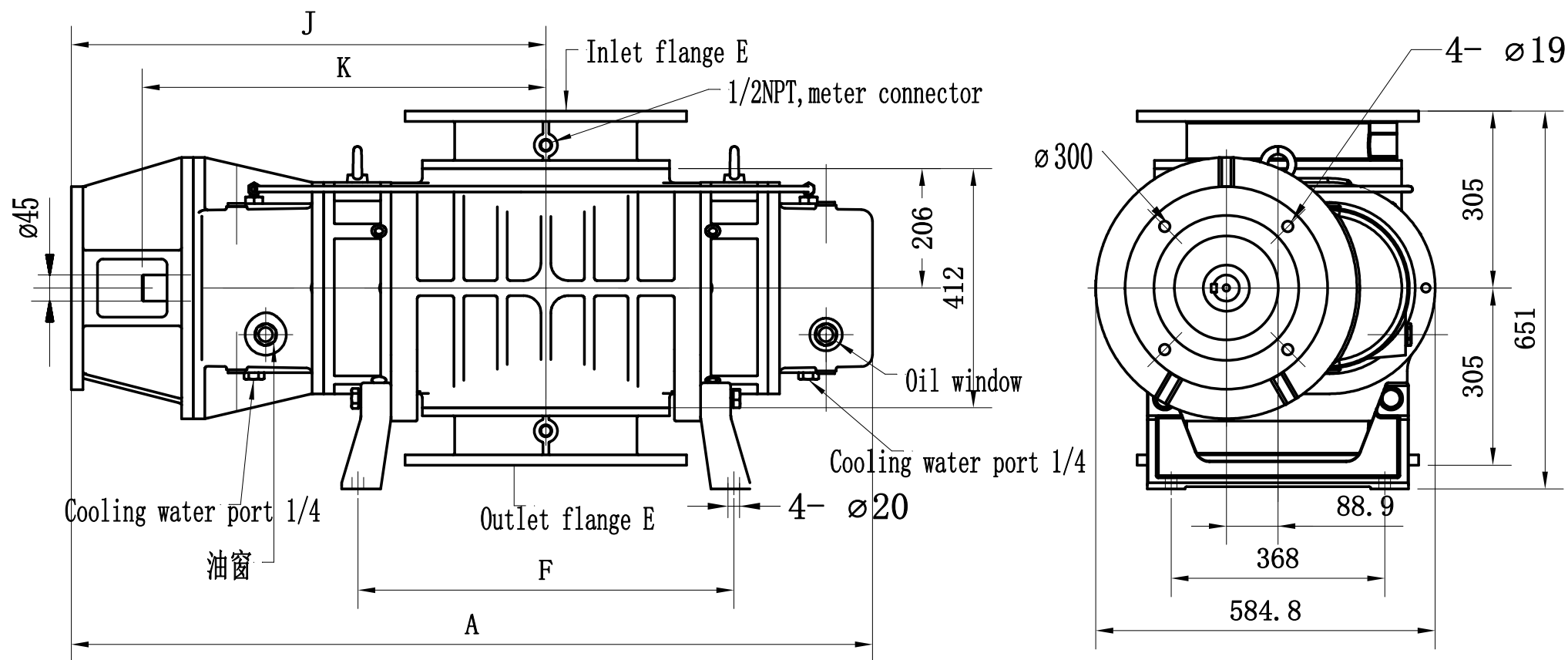


Vacculex Vacuum Equipment (Zhejiang) Co., Ltd.

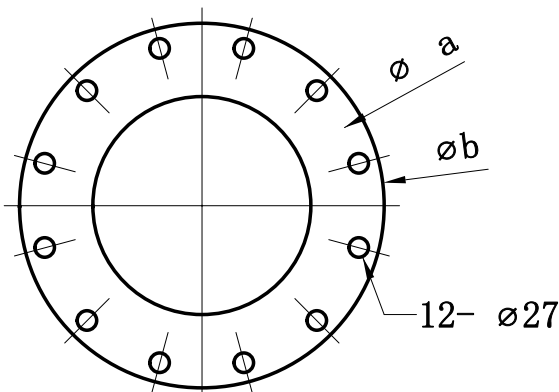
Vacuum pump dimension drawing

MB55 series

MB70 series Roots vacuum pump dimension drawing (C flange)



Inlet and outlet flange size



Model	A	E	F	J	K	ϕa	ϕb
MB2900	1280	ANSI 250	546	768	646	362	405
MB3600	1380	ANSI 300	648	818	696	432	485
MB4500	1507	ANSI 300	775	881	760	432	485

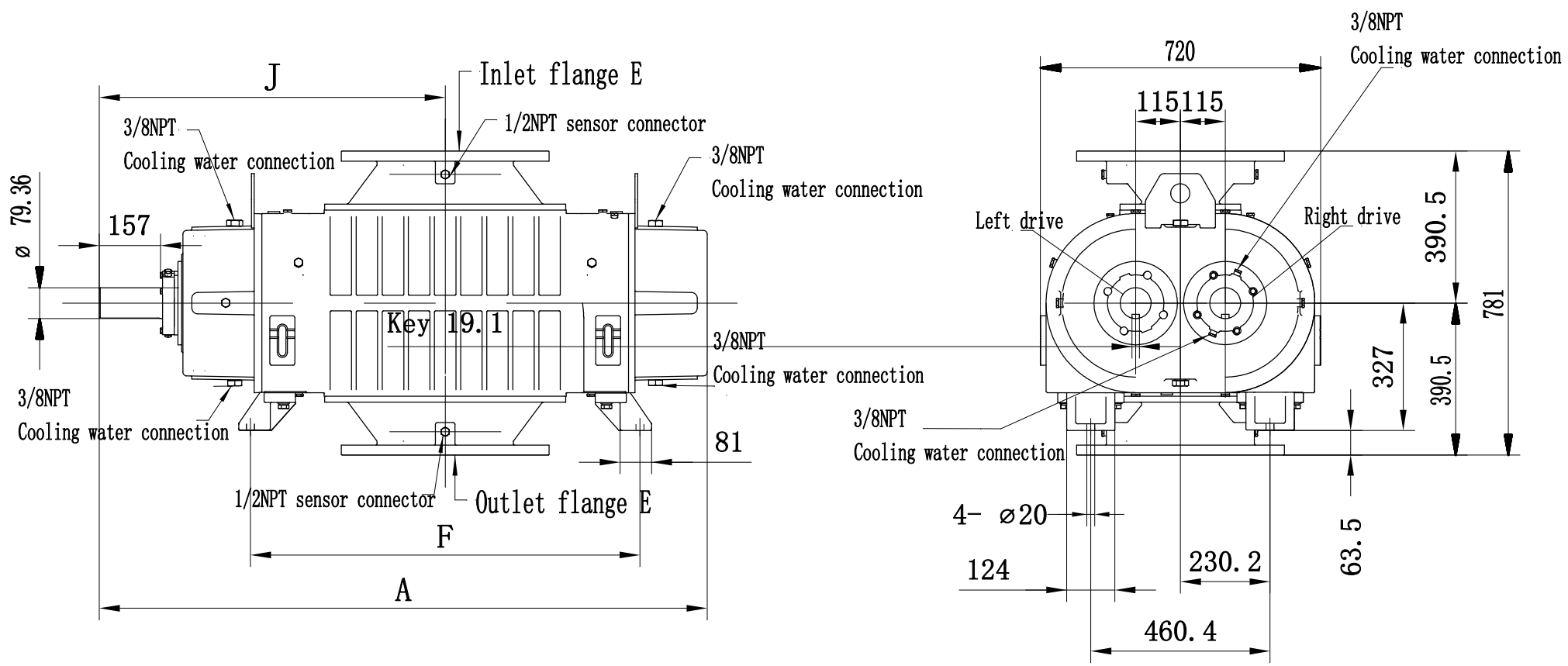


Vacculex Vacuum Equipment (Zhejiang) Co., Ltd.

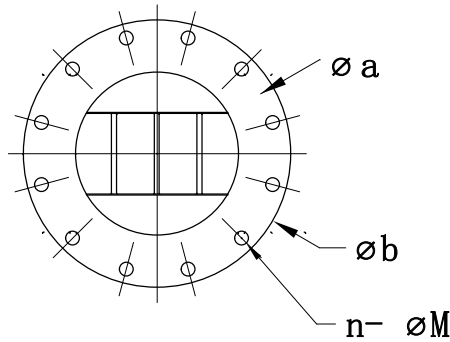
Vacuum pump dimension drawing

MB70 series


MB90 series Roots vacuum pump dimension drawing



Inlet and outlet flange size



Model	A	E	F	J	n	M	ϕa	ϕb
MB5400	1560	ANSI 14	1000	888	12	28.5	476.2	533.4
MB7300	1780	ANSI 16	1220	998	16	28.5	540	600

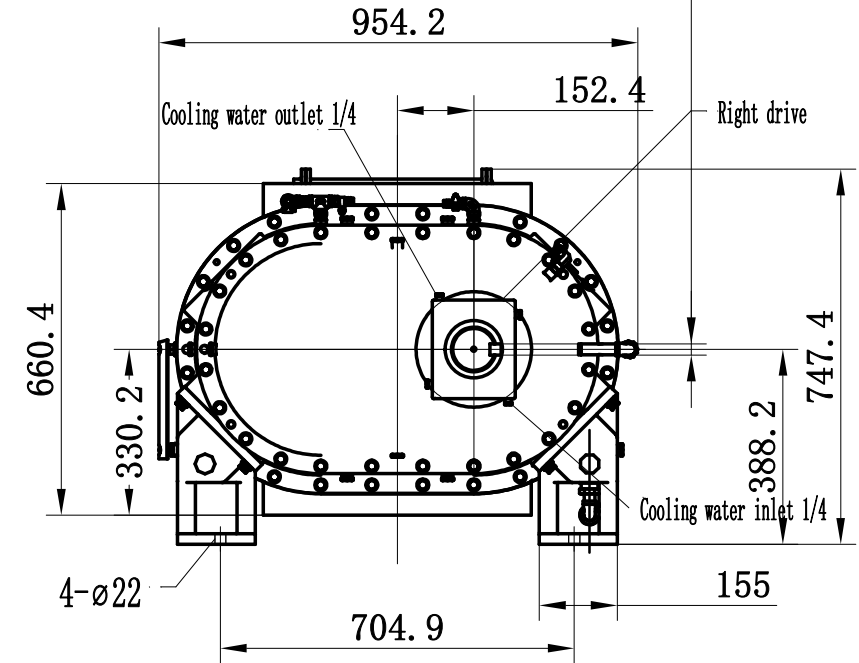
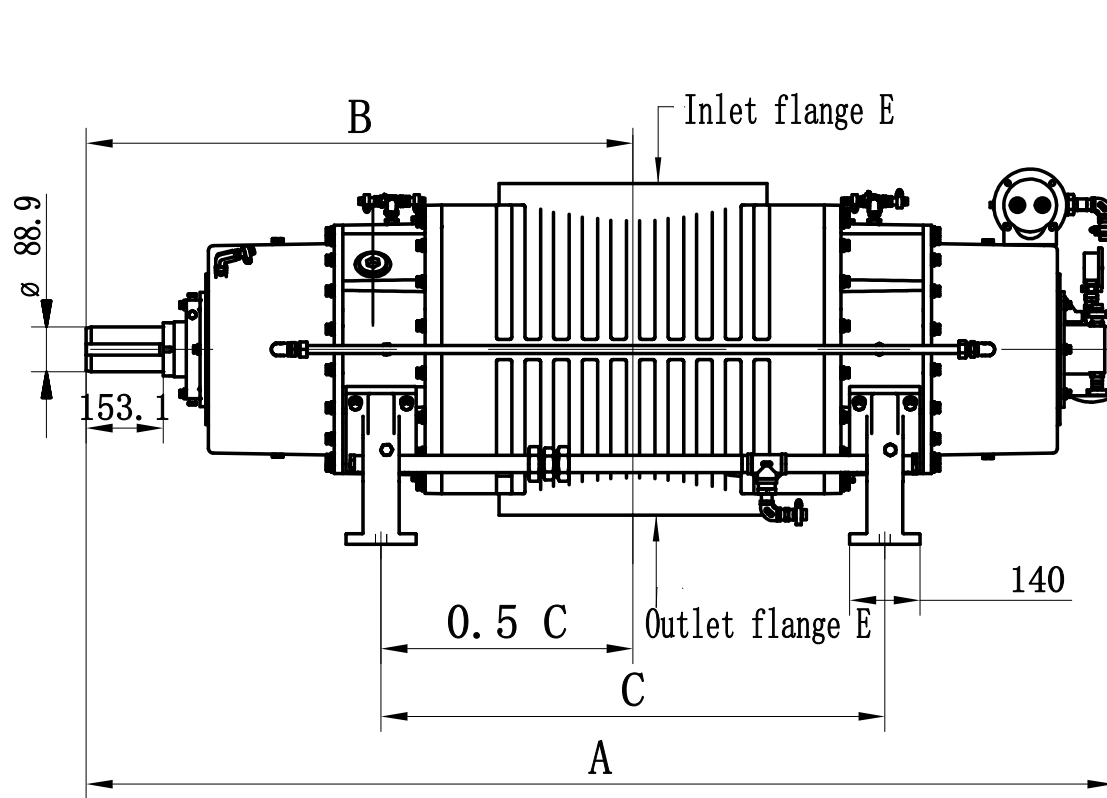


Vacculex Vacuum Equipment (Zhejiang) Co., Ltd.

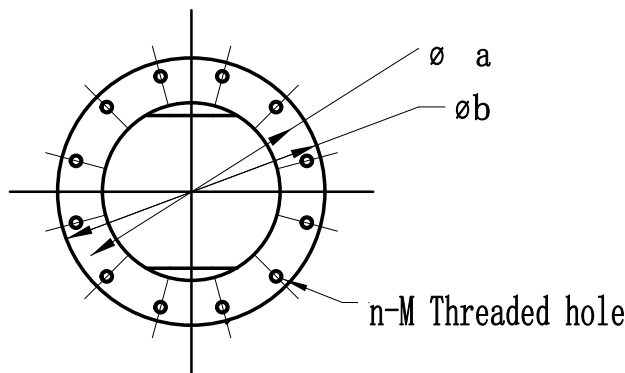
Vacuum pump dimension drawing

MB90 series

MB1200 series Roots vacuum pump dimension drawing



Inlet and outlet flange size



Model	A	B	C	E	n	M	$\varnothing a$	$\varnothing b$
MB7900	2047	1089	1003	ANSI 14	12	M27	476	535
MB10000	2505	1318	1461	ANSI 20	20	M30	635	700

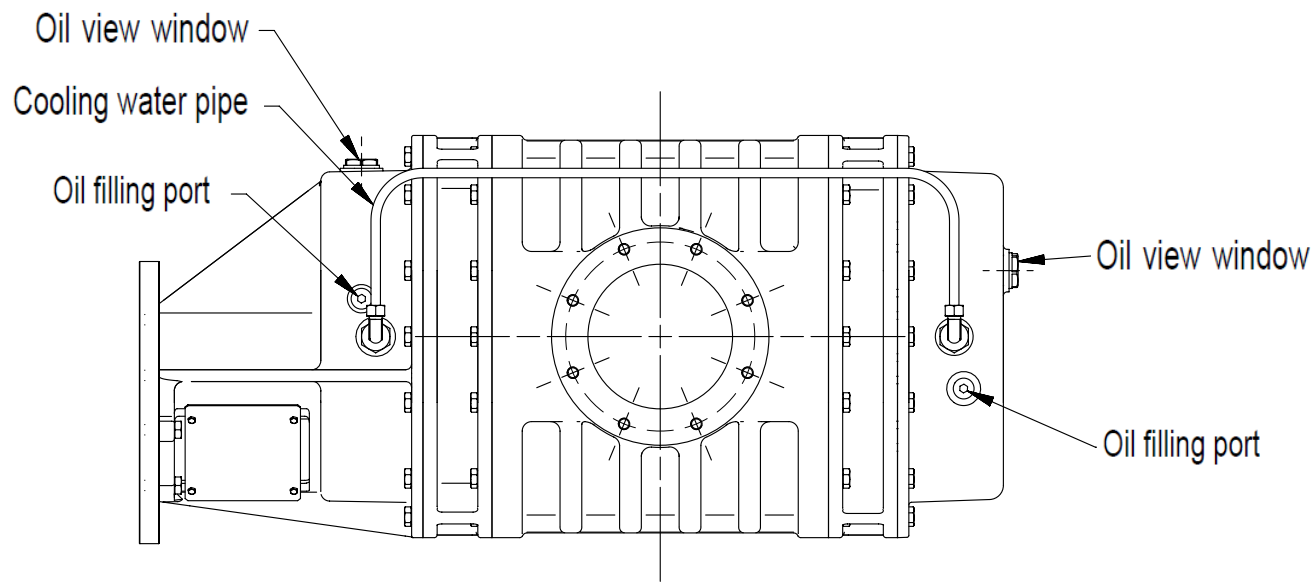
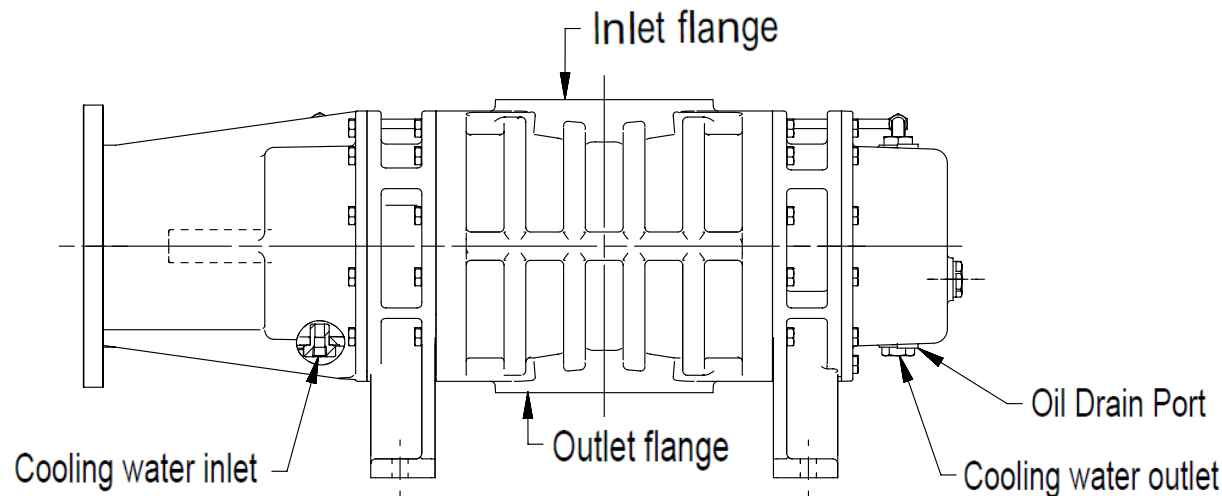


Vacculex Vacuum Equipment (Zhejiang) Co., Ltd.

Vacuum pump dimension drawing

MB1200 series

Roots pump connector illustration diagram



Connection Notes:

1. Inlet and outlet flange: the diameter of the inlet pipe shall not be smaller than the diameter of the inlet of the vacuum pump to ensure the pumping efficiency of the vacuum pump.
2. Cooling water: When the vacuum pump is running, ensure the cooling water flowing through the inlet and outlet of the cooling water, and the water flow should meet the requirements. Suitable cooling water can effectively take away the heat generated by the friction, which is one of the important guarantees for the long-term reliable operation of the pump.
3. Sight glass window: Lubricant is the necessary condition for vacuum pump gears, bearings and mechanical seals to work. Through the sight glass window to monitor the quality of lubricant and oil level. Once the oil level is found to become low rapidly and the oil quality is bad, it should be investigated in time, otherwise it will lead to pump damage. Oil level check is an important item of vacuum pump point inspection.
4. Filling and discharging oil port: The oil should be replaced during the routine maintenance of the pump. When replacing the oil, clean the magnetic plug at the bottom. When draining oil, first open the oil filling port (to prevent the high pressure in the oil tank from causing damage), and then release the oil discharging port to drain oil.



US Vacuum Pumps LLC

Mail: P.O. Box 909 Canton, Texas 75103 USA

Facility: 2095 West State Hwy 243 Canton, Texas 75103 USA

Tel: 903-848-9800 (Main)

Toll Free: 888-416-7366

Website: www.usvacuumpumps.com

E-mail: help@usvacuumpumps.com



US Vacuum Pumps LLC has the final interpretation right for the content of this manual. There will be no prior notice for any changes.