FISON

Rotary Vane Vacuum Pump

FM-VP-02

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1. Introduction

Rotary Vane Vacuum Pump FM-VP-02 acts as an optional accessory for a Vacuum Oven with 90 L, 210 L Capacity. Its Exhausting speed is 2 L/S and offers 1400 rpm rotary speed. It is suitable for Vacuum Oven FM-VO-A203 and FM-VO-A204. Designedwith dual-stage vacuum pumps for reliable long time continuous operation. It offersbalance between low cost and high performance. Equipped with gas ballast, which isdesigned to allows purposefully pull a less deep and slower vacuum by opening the gas ballast. It allow dry air to go directly into the pump and diluting the vacuum pull,and it also helps to keep moisture, solvent, and other contaminants from getting stuck in the pump, and instead passing through to the exhaust. Adopts built-in checkvalve prevents pump oil backflow.

2. Features

- ✓ Structures dual-stage and high speed directly connected structure
- ✓ Offers small size, lightweight, low noise, easy to start, stable operation
- ✓ Equipped with specially designed air ballast valve to prevent water mixing with oil pump and prolong working time Built-in check valve prevents pump oil back flow
- ✓ It helps to keep moisture, solvent, and other contaminants from getting stuckin the pump
- ✓ Designed with pump body, rotor, rotary vane, end cover, spring etc

3. Specifications

Model No.	FM-VP-02
Exhausting speed	2 L/S
Ultimate vacuum Gas Ballast Off	≤ 6×10-2
Ultimate vacuum Gas Ballast on	≤ 1.33
Rotary speed	1400 rpm
Inlet diameter	Φ 25
Oil capacity	0.8 L
Temperature rise of oil pump	≤45℃
Noise	≤60 dB
Vibration reference number	≤80 μ
Motor power	0.37 kW
Power supply	220/380 V
Dimension	488 × 145 × 280 mm
Weight	20 kg

4. Applications

Rotary Vane Vacuum Pump works in conjunction with Vacuum Oven as an optional accessory. Besides, it finds application in the electric vacuum device manufacturing industry, refrigeration industry, medical analysis device industry, solar energy industry, and scientific research unit.

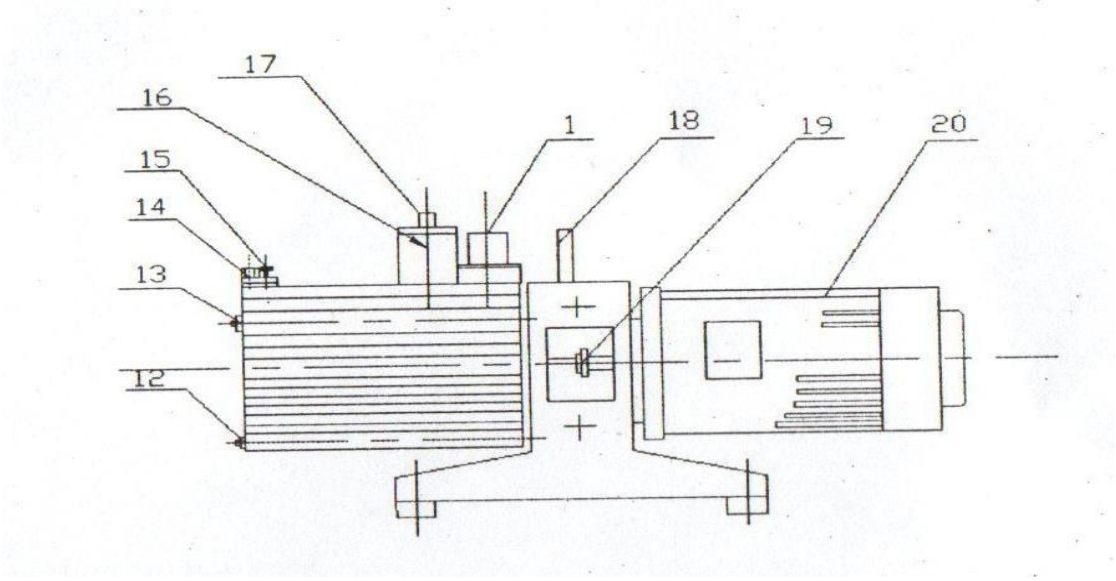
5. Instrument introduction

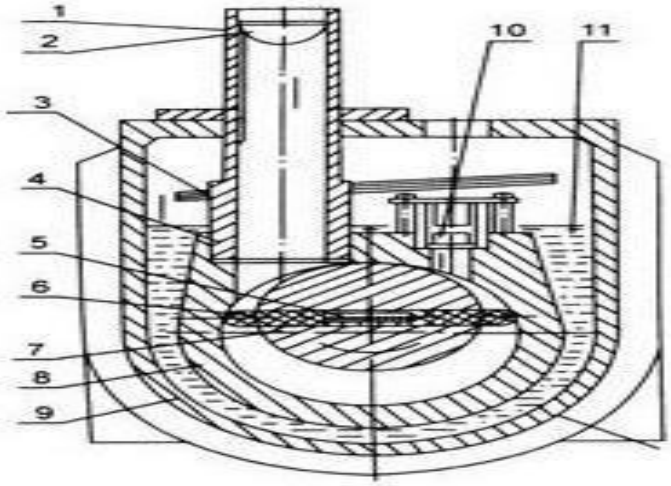
The rotary vane vacuum pump is a two-stage high-speed direct drive rotary vane vacuum pump (in the following called “the pump” for short). Its working principle isthe same as the type of pump. Rotors are eccentrically mounted within the cylindrical housing of the stators and vanes are fitted freely inside the respective slots of the rotor. When the rotor rotates at high speed, vanes are urged outwards by centrifugal force as well as by spring force to keep close contact at their tips with the stator wall throughout the rotation. Thus, the inlet port and outlet port on the station are separated by them. The volume of the space leading to the inlet port expands progressively and periodically with gas filling the space through the inlet pipe, meanwhile, the volume of the space leading to the outlet port diminishes progressively and periodically to compress the gas previously sucked. Using gas pressure and oil pressure exhaust valve on the outlet port is opened to expel gasout of the pump through the valve, and then a vacuum is obtained at the intake side of the pump. Fig 1 shows the working principle of a single-stage pump. A double-stage pump is the arrangement of two single-stage pumps in series. When the intake pressure is higher, both stages of the pump may exhaust simultaneously, while at lower suction pressure gas is first expelled out from the first stage to the second stage,then from the second stage exhaust to the open air.

The pump is equipped with a gas-ballast valve. Its function is to fill the exhaust spacewith a certain amount of air, when the valve is open, to reduce the proportion of the partial pressure of vapor in the total discharge pressure. As the partial pressure of vapor is lower than that of the saturated vapor pressure corresponding to the working temperature of the pump, vapor can be discharged from the pump with thefilled air to avoid condensation of vapor in the pump oil and to prevent oil from emulsifying by the condensed vapor to prolong the useful life of the oil. However, the ultimate vacuum of the pump shall drop, and the temperature of the pump shall risewhen the gas-ballast valve is open.

This pump has the outstanding advantages of its small size, less weight, low noise, and easy to start. Besides devices to prevent from sucking back of oil and leakage ofoil from axle sealing to contaminate the environment are also provided.

Structure





1. Inlet port	2. Filter net	3. Oil baffle
4. “O” ring	5. Spring	6. Vane
7. Rotor	8. Stator	9. Oil box
10. Vacuum oil	11. Exhaust valve plate	12. Screw plug for oil drain
13. Oil glass	14. Screw plug for oil filling	15. Gas-ballast valve
16. Mist arrester	17. Outlet port	18. Handle
19. Driving bushing	20. Protective covers	

6. Installation

1. The pump should be placed in a dry air and clean place.
2. The pump, with a handle at the top and four rubber pillarlets at the footings, is o a portable type. Therefore, in most cases, the pump is merely placed on a flat and stable surface.
3. To wire the motor, note the direction of rotation viewing from the fan end of the motor, the rotation should be clockwise.
4. The diameter of the pipe, which joins the vessel to be exhausted and the pump, should not be smaller than that of the inlet port of the pump. The pipe should be short and should have as few bends as possible to reduce the loss of pumping speed. Meantime leakage of the pipe should be noticed. If a rubber pipe is adopted, the pipe should preferably be desulfurized.
5. When the pump is started with the inlet port wide opened to the atmosphere, a small amount of oil mist will be brought out. It might affect the working environment, using a plastic pipe to lead it away to open air.
6. The pump is equipped with such a device which can prevent suck-duck of oil when it is stopped. Therefore, it is not necessary to mount a magnetic-operated valve on the inlet port.

7. Operations

1. It is suitable to stop the pump and then fill the oil to the middle glass when checking the oil level. Too low, the exhaust valve cannot be sealed and the vacuum degree is affected. Too high, spraying of oil may happen while thepump is started with its inlet port wide open to the atmosphere. It is quitenormal to lift the oil level when the pump is rotating. Sho528-100, the number 1 vacuum oil is adopted. When the pump isn't water-cooling, we should use KS3 oil. After filling the oil, screw the plug. The oil should be filtered to prevent it from mixing with impurities in the dog oil hole. The new standard mineral oil type vacuum oil is recommended.
2. The pump can be started with an inlet port wide open to the atmosphere under any degree of vacuum. If the magnetic valve is provided on the inletport, it should be started simultaneously with the pump.
3. When the pump is operated under higher room temperature, the oil temperature will be raised and the viscosity of oil will be lowered, the saturated vapor pressure will be increased to cause a drop of the ultimatevacuum of the pump, especially the total ultimate pressure measured by thermocouple gauge. Good ventilation for radiating heat or substitution ofoil of better quality will improve the ultimate vacuum.
4. To check the ultimate vacuum of the pump, a column of mercury gauge should be used. Under the condition that a column of mercury gauge is directly connected to the inlet port of the pump and temperature of the pump is stable and the gauge itself is checked after sufficient for pumping,the pump will attain its ultimate vacuum when it runs within 30 minutes.
5. If the pumped gas contains more condensable vapor (its relative humidityis higher) let the pump run for 20-40 minutes with the gas-ballast valve widely open, then close the valve. Before stopping the pump open the gas-ballast valve and let the pump run for 30 minutes without a gas load.

8. Maintenance

8.1 General remarks

1. The pump should always be kept clean to prevent any impurities from entering the pump. Suggest doing as the figure.
2. The oil level should always be kept in the middle of the sight glass.
3. Due to the improper storage of the pump, water or any other impurities are introduced into the pump, and the ultimate vacuum of the pump will be impaired. Open gas-ballast valve to provide the purification of oil. Then observe the promotive effect on the ultimate vacuum. In case no improvement of the ultimate vacuum is observed after several hours, the oil should be renewed and even renewed the oil twice again if necessary.

Process of renewing oil:
Let the pump operate for about 1/2 hour to raise the temperature of oil to decrease the viscosity of oil, stop the pump, and drain out the oil. Restart the pump and let it operatefor about 1-2 minutes with the inlet port wide open. In this interval slowly fill a small amount of clean oil into the pump through the inlet port to replace the oil originally in the pump housing.

4. Diesel oil, gasoline, and other oil of higher saturated vapor pressure are forbidden to mix with the vacuum oil to avoid the impairment of its ultimate vacuum. Generally, cotton cloth is used to wipe the parts to be cleaned. To wash the parts with metal chips, sand, and other impurities, gasoline is employed. Reassembly should be carried out afterthey are dried.
5. If the pump should be disassembled to clean or to inspect the interior parts, attention should be paid to the process of disassembly and reassembly to avoid impairment of the parts.

8.2 Disassembly

1. Drain oil.
2. Screw out the bolts on the inlet flange, take out the inlet pipe. Screw out the bolts on the gas-ballast flange, take out the gas-ballast valve.
3. Take off the oil box.
4. Take off the split pin on the oil check valve and the impeller to the check valve.
5. Screw out the tightened bolts of the frame and pump body and take off the pump body.
6. Screw out the cover plate bolts, take off the cover, and then pull out the two, rotors and their respective vanes.

8.3 Assembly

1. Wipe all parts.
2. Put vanes into the respective slots of the rotor then put the rotor of the high stageinto the stator, put the cover plate on the stator and mount the pins, key and sleevein their original place. The rotor should be rotated by hand freely and evenly.
3. Repeat the same process once again for the lower-stage rotor.
4. Put back the impeller of the check valve and check valve to their original place.The flat surface of the valve head should be pointed to the oil hole. Stop the impeller byhand while rotating the rotor, the oil hole should be alternately closed and opened by the valve then

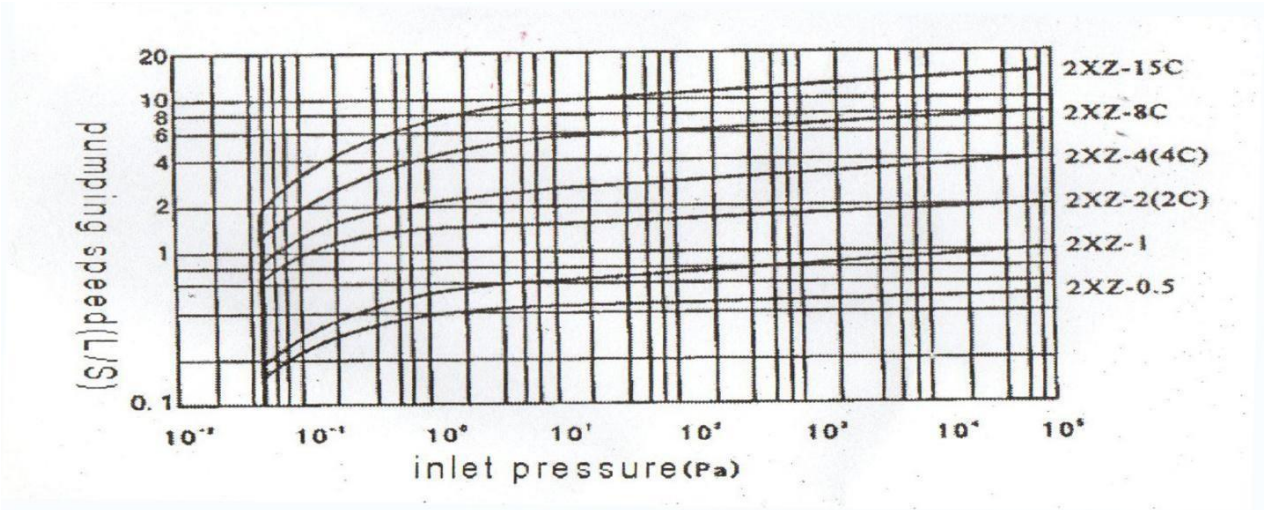
adjust the max height of the opening of the flat surface of the valve head to a value of 0.8-1.2 mm.

5. Put the exhaust valve and oil baffle plate on the top of the pump body
6. Mount the pump body, key, bushing and motor on the frame.
7. Enclose the pump body with an oil box.
8. Insert the inlet pipe and gas-ballast valve and screw on their flanges to fix them.

8.4 Cautions

- During assembly, spread clean vacuum oil on the rubbing surfaces of all mating parts. Allparts should be set back to their original positions to diminish the time of running. All the screwed parts should be tightened, no loosening is allowed.
- All worn-out parts should be inspected. Readjustment or replacement should be made for them if necessary.
- After assembly, there should be a “running in”. Inspection should be made on the running condition of the pump and the ultimate vacuum at the inlet port of the pump. Ifthe ultimate vacuum does not conform with the specified value, adjustments should be made for them if necessary.
- After worn out parts should be inspected. Readjustment or replacement should be madefor them if necessary.
- After assembly, there should be a “running in”. Inspection should be made on the running condition of the pump and the ultimate vacuum at the inlet port of the pump. If the ultimate vacuum does not conform with the specified value, adjustments should be made.
- At the same time with the overhauling of the pump the pipe system, valves and motor should also be cleaned and overhauled.

Pressure-pumping Speed Curves



9. Troubleshooting

Malfunction	Possible reason	Troubleshooting
No vacuum	1. Less oil, no sealing function, and loud noise. 2. Oil is contaminated by vapor. 3. Air leak at the joint. 4. A damaged or worn-off PTFE seal. 5. Clogging of the oil holes. 6. The vacuum system is seriously contaminated, including the vessel and pipe. 7. Vane spring split off. 8. Worn-off vanes or copper may cause a large gap. 9. Overheating of the pump.	1. Adding more oil. 2. Using the gas-ballast valve to purify the oil or renew the oil. 3. Repair the leaking parts. 4. Replace the seals. 5. Drain oil, dismount the oil box, and clear the oil holes. 6. Cleaning the vacuum system. 7. Replace the spring. 8. Check regularly and replace them. 9. Cool the overheating vapor before exhausting it.
Oil splash	1. Too much oil. 2. Oil or impurities clog the oil separator. 3. The oil baffle is not in the right place.	1. Discharge any excess oil. 2. Check and clean it regularly. 3. Adjust the oil baffle and mount it firmly.
Oil leakage	1. Check the oil plug, sight glass and oil box shim. 2. The oil standard isn't tightened. 3. A damaged or worn-off PTFE seal.	1. Replace them if necessary. 2. Tighten the oil standard. 3. Check and replace it.
Loud noise	1. Vane springs break. 2. Burrs, dirt or deformation. 3. Worn-off parts. Motor problem	1. Replace the vane spring. 2. Clean the device regularly. 3. Check and replace parts. Check and repair.
Oil back-flow	1. Check valve isn't closed tight. 2. Worn-off oil seals in two covers. 3. Pump cover or pump isn't flat. The outlet valve is broken.	1. Check and tighten the check valve. 2. Replace worn-off seals. 3. Adjust the position. Replace the broken outlet valve.