

VSP Series Operation Manual

Dry Screw Vacuum Pump





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1. Use information

Dear users, Thanks for your trust and support for our VSP series dry screw vacuum pump (the pump or the product). We're dedicated to providing you high-quality services. Upon receiving the product, please carefully check whether the product is consistent with the ordered one, whether the accessories and User Manual are available, and whether there is any product damage during transportation. If any of the problems above occurs, Please contact our sales department or local distributor in time.

In order to ensure the long-term stable operation of the product, please read this Manual carefully before installing, operating, overhauling or maintaining the product so as to fully understand relevant points about the product, such as safety issues, technical parameters and operation methods.



Warning

Attention should be paid to prevent a possible threat to personal safety.



Notice

Special attention should be paid to prevent damage to the pump.



There may be danger of electric shock, cut off the power supply before wiring, repairing and maintaining. Cover the junction box when the pump is running.



The pump could be heated up while running ,even after it stopped. Do not touch it.



Notice

Before using this product, please read this operation instructions carefully. Follow the operation instructions strictly. This product (including the operation instructions) is subject to change without prior notice. Fill the pump oil as required before using a new one.



2. Precautions

To ensure personal safety, please read the following information carefully before installing, operating, overhauling or maintaining the product.



Warning

The power supply connection must be operated correctly by a person with an electrician's license in accordance with the technical standards for electrical equipment and wiring regulations.



Warning

Cut off the power supply before checking or repairing the pump, so as to avoid personal injury or death due to electric shock or sudden start of the pump.



Warning

Before starting the pump, make sure that the power supply of motor is the one marked on the product. The rated current of the selected cable and motor protection switch must match the rated current on the motor nameplate.



Warning

The product cannot be used for pumping active, corrosive, toxic, flammable or explosive gases. If necessary, please feel free to contact us.



Warning

Please do not place any object that affects ventilation effect around the motor, so as to avoid scalding or fire caused by abnormal temperature rise.



Warning

Make sure the exhaust port is kept unblocked prior to running the pump. It is forbidden to block or restrict air flow of the exhaust port in any way. The size of the exhaust pipe shall be such designed to ensure that the absolute pressure does not exceed 1.15 bar (relative pressure does not exceed 0.15 bar)









Attention

If the vacuum degree and current become abnormal, check whether the exhaust port is blocked. If the exhaust filter element is installed, check whether the element needs cleaning or replacing.



Attention

The ambient temperature of the pump needs to be assured in range of 5-40°C.



Attention

Check the oil level of the gear box before running the pump. Do not use the pump without oil or oil shortage in the gear box, otherwise the pump will fail.



Attention

Please fill oil to the pump in strict accordance with the requirements of scale line. Excessive oil may cause pump failure.

The normal oil level is at 1/3 of the oil immersion lens.

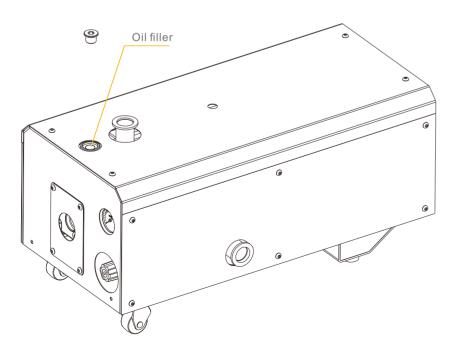


Figure 1







Attention

When the pump runs abnormally or the total running time exceeds 6,000 hours, remove the front plate to check the status of oil:

- 1. If the lubricating oil turns dark or the oil level is lower than Min. It means the oil needs to be replaced or filled.
- 2. Tighten the filler plug and drain plug after oil replace or filling; otherwise the vacuum degree will be affected and oil leakage may occur.
 - 3. Fill the specified vacuum pump oil.



Attention

Connect the pump to the vacuum system by placing pump feet directly on the ground horizontally or connecting pump feet via bolts.



Attention

The temperature of pump surface may be very high when the pump is running and within 1 hour after it stops running. Therefore, it is forbidden to touch the surface of gear box and the pump in order to avoid scalding.



Attention

Please install the pump stably and firmly within an angle of 10°. Otherwise, the gear lubricating oil will flow into the pump cavity, which may cause vibration, noise and even damage of the pump.



Attention

Please dispose waste oils and other parts according to relevant environmental protection regulations



Attention

Use corresponding accessories when pumping a small amount of dust; otherwise, pump failure or sharp performance drop will occur.



Attention

Non-professionals are forbidden to disassemble the pump. Otherwise, pump may be damaged or fail to run normally. Where necessary, please feel free to contact us.





3. Product Overview

 $\label{thm:position:plasma:physics} Application: Plasma physics. Freeze drying. Vacuum oven. Thin film deposition. Electron microscopy. \\ Mass spectrometry.$

This pump is Screw type Dry vacuum pump, which rotates a pair of non-contact multi-stage rotors, synchronized by timing gears. The timing gears and bearings are enclosed in a compartment that is independent of the casing. For lubrication Perfluoro-Polyether (PFPE) oil and grease are used. The pump is factory filled with lubrication oil.

The VSP screw pumps function according to the double screw-pump principle. Two screw rotors rotate in the compression chamber. The medium to be pumped is trapped between the individual screw coils, compacted and transported to the gas outlet. During the compaction process, the two screw rotors do not come into contact with each other, nor with the suction chamber.

3.1 Working Principle Diagram of VSP Series Vacuum Pump

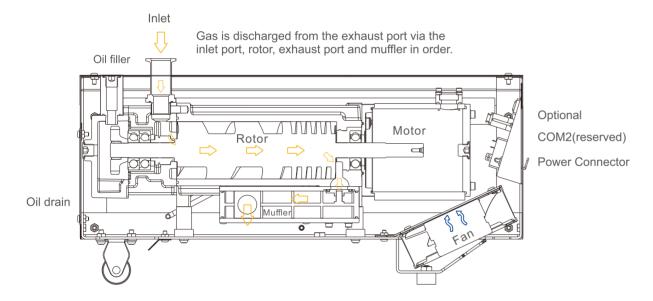


Figure 2



3.2 Schematic for purge gas and switches

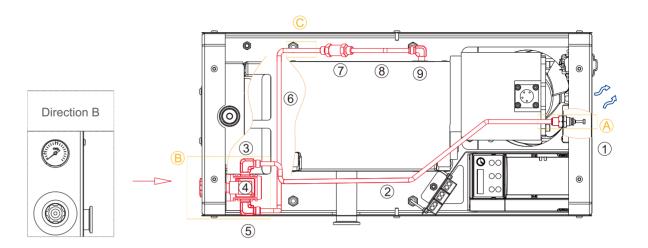


Figure 3

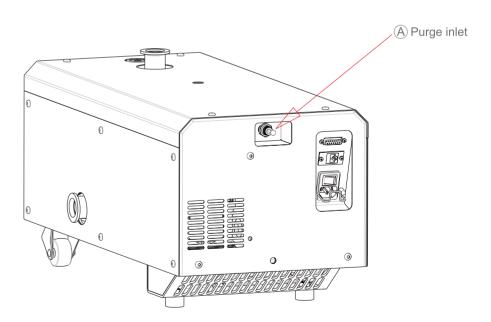


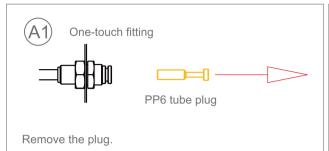
Figure 4

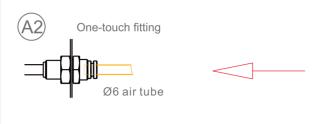




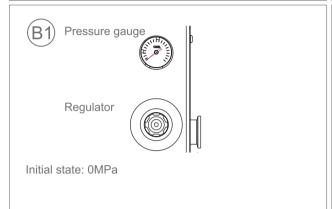


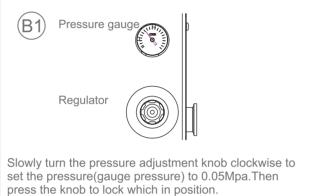
3.2.1 Preparations before purging

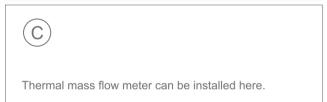




Plug φ6 tube. Notes: CDA or N2 is recommend.







3.2.2 Gas flow

Purge gas passes through 1 quick connector, 2 high-pressure gas pipe B, 3 ferrule taper thread adapter L6.35-R1/4, 4 relief valve, 5 ferrule taper thread adapter L6.35-R1/4, 6 high-pressure gas pipe C, 7 relief valve, 8 high-pressure gas pipe A and 9 ferrule taper thread adapter L6.35-R1/8.



4. Check before Installation

4.1 Specifications & Model

Check the specification, if which not fits your needs, please contact us.

4.2 Accessories

Check the following items on receipt of the pump package. Accessories for all VSP series 8/20/40 dry screw vacuum pumps:

Qty	Unit
1	Piece
1	Pcs
1	Set
	1 1 1 1 1 1 1 1 1 1 1 1 1

Table 1







Accessories for all VSP series 60 dry screw vacuum pumps:

Items	Qty	Unit
User Manual	1	Pcs
Hex wrench (3mm-type 7)	1	Set
Hex wrench (4mm-type 7)	1	Set
Hex wrench (5mm-type 7)	1	Set
Hex wrench (5mm-type 7)	1	Set
Power cord 1	1	Set

Table 2

4.3 Moving Method

- 1. The VSP8/20/40 is equipped with a pair of directional wheels and 2 legs. Lift one end of the legs when trying to move the machine.
- 2. The VSP60 base is equipped with anti-skid and shock-absorbing feet, a pair of directional wheels and a pair of universal wheels. When trying to move the machine, please make sure that the feet have been raised to the highest position and that the universal wheel brake has been released in order to avoid damaging the feet and wheels during transportation.

4.4 Precautions for Lifting

Silencer is designed at the bottom of the vacuum pump. It is forbidden to lift the vacuum pump without protection. Instead, sling is recommended for handling.



5. Specifications

Specification of Power Cord									
	Confirm the voltage of power supply voltage								
Voltage	90-1	20V	200-2	220V	380-415V				
Models	Wire diameter		Wire di	iameter	Wire diameter				
VSP8	1.5mm ²	14AWG	1.5mm ²	14AWG					
VSP20	1.5mm ²	14AWG	1.5mm ²	14AWG					
VSP40	1.5mm ²	14AWG	1.5mm²	14AWG					
VSP60					2.5mm ²	14AWG			

Table 3

Table 4: for the technical parameters

Model		Unit	VSP8	VSP20	VSP40	VSP60		
		m³/h	8	20	32	50		
pum	ping speed	L/min	130	330	530	830		
		CFM	4.7	11.7	18.8	29.4		
		Pa		1	1	3		
Ultim	ate pressure	Torr		7.5×10 ⁻³		2.25×10 ⁻²		
		mbar		1×10 ⁻²		3×10 ⁻²		
	Dry nitrogen/ CDA	slm		0~100				
Gas	Pressure	Мра	No	0.04~0.07				
purge	Connector		110	One-touch fitting φ6 tube				
	Gas quality			ISO 8573 Class 2				
	Rated motor	kW	1.8			2.2		
	Ultimate power comsuption	kW		·				
	Voltage	V	200~240V, 1P			380~415V, 3I		
Motor	Voltage tolerance range							
	Frequency	Hz		50	/60			
	Control mode			Inve	erter			
	Rotating speed			3000-4800				







	Model		VSP8	VSP20	VSP40	VSP60			
Motor	Curret at ulimate pressure	А	6	7	8	1.5			
	Peak current	А		13					
	PID function		Yes						
Control	Analog speed control		Yes						
functions	Parallel control and monitoring		Digital and modbus-rtu control						
	Serial communication		MODBUS-RTU						
Connection	Inlet port	KF		25		40			
Connection	Exhaust port	KF	16 25						
Max wate pumping	er vapor rate	g/h	135	20	00	250			
Gas balla	ast			Optional					
Oil type			PFPE or Fomblin oil						
Oil quant	tity	ml	80						
Dimension	ons	mm	520×300×320 600×300×320 66		663×350×400				
Lifting rin	ıg		M10 lifting ring (optional)						
Mass		kg	38±5kg 48±5kg		75±5kg				
Noise		dB(A)	≤58	≤6	0	≤63			
Ambient	temperature	°C	5~40						
Operatin	g humidity			Below	90%				
Storage	temperature	°C		0~	50				
Maintena	ance cycle		Once/year						
Cooling r	mode			Air co	ooling				
	Clean duty		/						
Working	Vapours condi	tion"	Switch on the inert / CDA gas purge (gas purge version), enable gas ballast (gas ballast version)						
conditions	Light corrosion	duty	Switch on the inert / CDA gas purge (gas purge version), Slowly turn the pressure adjustment knob clockwise to set the pressure (gauge pressure) to 0.1MPa.						

Notes
I: Refer to Appendix VSP20/40 gas flow- pressure relationship.
II:When the pump works in the working condition with high water vapor content, Need to run at a ultimate pressure period of time after the working condition end, in order to completely discharge the water vapor in the pump.

Table 4





Some signals of VSP8/20/40 inverters have been connected to the connector. See the appearance below

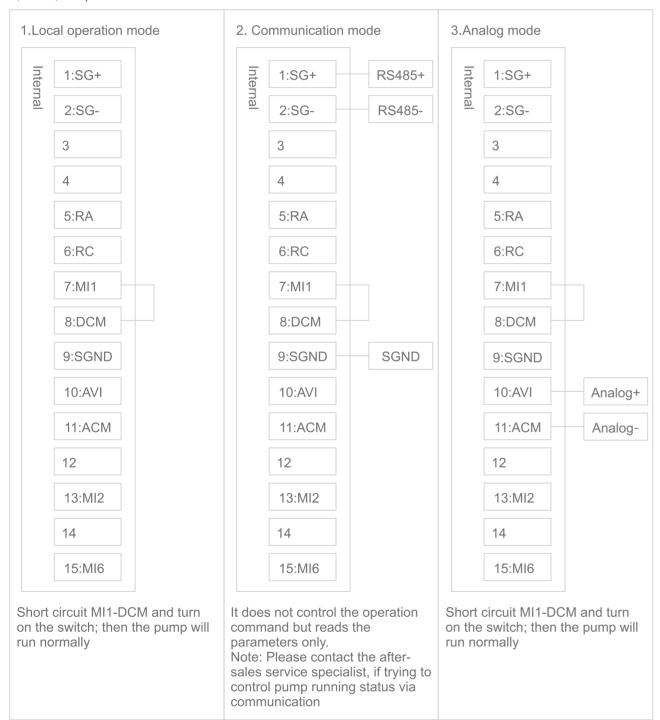
		DB15 contr	ol terminal c	orresponding	wiring	
DB15No.	I/O	Items	Use		Definition of corresponding wire No of inverters	Remark
1	Rs485+	MODBUS	Communi cation+		SG+	Default communication
2	Rs485-	MODBUS	Communi cation-		SG-	format 9600-8-N-2
3						
4	Output	24V			24V	
5	Output	Operation check	Closed: Alarm	Disconnect: Normal	RA	Dolov output torminal
6	Output	Output common terminal			RC	Relay output terminal
7	Input	Running command	Closed: Running	Disconnect: Shutdown	MI1	
8	Input	Output common terminal 1			DCM	
9	RS485-GND	Communication signal ground			SGND	
10	Input	Speed control	Analog quantity+		AVI	Input analog quantity (0-10V)
11	Input	Speed control	Analog quantity-		ACM	
12						
13	Input	Analog control Enabling command			MI2	Analog control terminal
14						
15	Input	Alarm reset	Closed: Reset		MI6	
Others	Tomporatura	Motor temperature			MI7	
Outers	Temperature	Common terminal			DCM	Common terminal of temperature sensor

Table 5



Control mode

- 1. Local mode: Short connect MI1-DCM for normal operation.
- 2. Communication mode: RS+ is connected with Rs485+, RS- is connected with RS485- and SGND is connected with signal ground.
- 3. Analog quantity mode: Connect MI1-MI2-DCM, connect AVI with analog quantity + and ACM with analog quantity-. Note: Do not run the motor below 3,000 rpm for a long time, for it will seriously damage electrode. For VSP8, 6.6-10V corresponds to 3,000-4,500rpm; for VSP20/40, 6.25-10V corresponds to 3,000-4,800rpm.





6. Product Overview

6.1 Installation

Confirm the voltage of power supply.									
Voltage	90-1	20V	200-2	220V	380-415V				
Models	Wire diameter		Wire di	ameter	Wire diameter				
VSP8	1.5mm ²	14AWG	1.5mm ²	14AWG					
VSP20	1.5mm ²	14AWG	1.5mm ²	14AWG					
VSP40	1.5mm ²	14AWG	1.5mm ²	14AWG					
VSP60					2.5mm ²	14AWG			

- 2. VSP8/20/40/60 is placed horizontally. A 30cm space is reserved in front and back respectively for heat dissipation.
- 3. Connect the vacuum system to the vacuum pump.
- 4. Connect the exhaust system.
- 5. For VSP20/40/60, it is necessary to connect purge gas(CDA or Ndry N2)
- 6. Parallel control and monitoring is available.

VSP8/20/40 starts

- 7. If purge gas is available, which has to set the pressure to 0.04MPa-0.07MPa.
- 8. Turn on the power switch.
- 9. In local mode, plug DB15 male connector in the accessory at com1, turn on the switch, and then the vacuum pump will start directly. In parallel control and monitoring mode, refering to communication instructions.
- 10. Check the parameter.

VSP60 starts

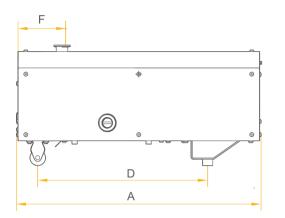
Direct power-on operation.

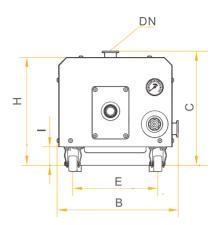






6.2 Installation specifications

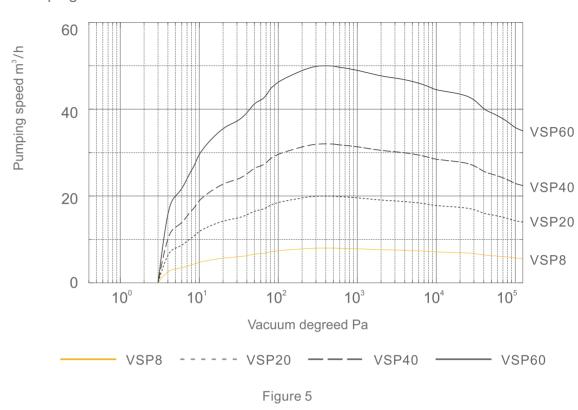




VSP series screw vacuum pump dimensions (unit: mm)									
Models	А	В	С	D	Е	F	Н	I	DN
VSP8	520	300	320	342	210	107	280	60	KF25
VSP20	600	300	320	415	210	107	280	60	KF25
VSP40	600	300	320	415	210	107	280	60	KF25
VSP60	655	312	325	485	242	133	307	70	KF40



6.3 Pumping Rate Curve



7. Handling and Storage

Warning

Do not move the pump until it stops running and power supply has been cut off.



Attention

Any carelessness during handling may cause damage to the pump, so please handle it with care. Move the fully filled pump vertically and horizontally to avoid any oil spillage.



Attention

Please dispose packaging materials as per applicable environmental protection regulations.







8. Product Overview



Warning

Please check and maintain the product by personnel undergoing corresponding training in strict accordance with safety regulations.



Warning

In case of any hazardous substances, determine their nature first and obey the appropriate safety regulations. If the potential hazard still remains, decontaminate the pump before any maintenance work.

8.1 Check & Maintenance

Maintenance Content	Maintenance Cycle	Remark
Oil change interval	After running for 6,000h or oil turns black	8.2.1
Check the pump soun	When running	8.2.2
Change the oil for the first time	After running for 3,000h	8.2.3
Clean the silencer	After running for 6,000h or sound becomes abnormal	8.2.4
Clean the fan cover	Before running	8.2.5
Check wiring	Before running	

Table 6

8.2 Routine maintenance methods

8.2.1 Check oil level

- ① When the pump is working, the oil level should always be kept between the lowest and the highest oil level line. Add oil in time, if the liquid level is lower than the lowest line. If the liquid level is higher than the maximum oil level line, unscrew the oil drain plug to drain excess pump oil; otherwise, oil may enter the pump chamber.
- 2) Observe the color of pump oil. Normal pump oil is clean and transparent. Change the oil, if it turns dark or becomes turbid.



8.2.2 Check pump sound

(1) The sound when the pump is running should be continuous and stable and free of any abnormal sound. In case of any abnormal sound, analyze and treat the fault as per Table 7.

8.2.3 Change oil

- ① Change oil after the pump stops and becomes cool, in order to avoid scalding.
- ② To change oil, open the oil drain plug and drain the used oil into a suitable container. When oil stops flowing, screw on the oil drain plug. The oil drain plug and the oil filler plug must be screwed tightly to ensure gearbox airtightness and prevent the entry of any external air, thus causing a lower vacuum degree.
- ③ Drain the replaced oil into a designated container and dispose it in accordance with applicable environmental protection regulations.

8.2.4 Clean the silencer

- 1) In case of any abnormal sound when the pump is running or after it stops, check exhaust
- ② Please stop the pump before checking the exhaust filter. Wait for a period of time until the pump cools down.
- ③ Open the exhaust port housing at the bottom of the pump, remove the exhaust muffler cover plate, and clean impurities inside the cavity.

8.2.5 Clean fan housing

(1) Please check whether there is a large amount of dust on the fan housing of the lower fan inlet before running the pump. Ensure full ventilation of fan housing surface in order to avoid affecting heat dissipation and pump performance.









9. Troubleshooting

9.1 Check Methods for Rotor Rotation

Troubleshooting for rotor sticking

- 1. Remove 4 M5X12 stainless steel screws from the front cover plate of the gear, as shown in Figure 6.
- 2. Remove the front cover plate of gear.
- 3. Screw off the end face of the front cover of the gear with an 8mm 7-shaped wrench, and align the oil plug of shaft head of the driving and driven rotors, as shown in Figure 7.
- 4. Use a 5mm 7-shaped wrench to turn the driving rotor counterclockwise to experience the resistance during rotation, as shown in Figure 8.

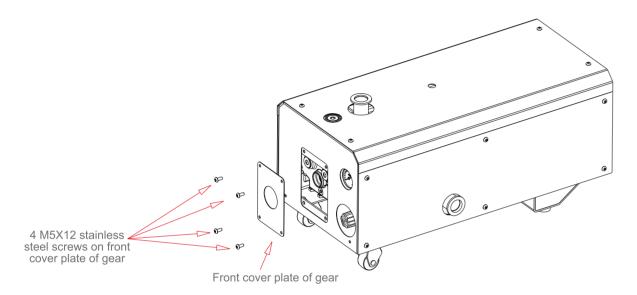


Figure 6

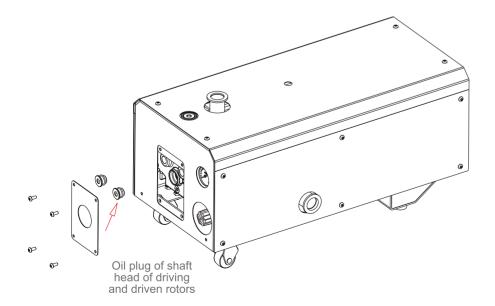


Figure 7





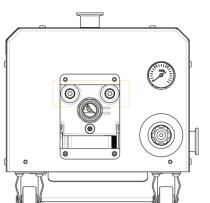


Figure 8



9.2 Error Code Query of Controller

Troubleshooting for rotor sticking

- 1. Remove 4 M5X12 stainless steel screws from the upper cover plate, as shown in Figure 9.
- 2. Remove 2 M5X12 stainless steel screws in the middle of the left and right-side plates.
- 3. Remove the upper cover plate.
- 4. The location of controller display is shown in Figure 9.

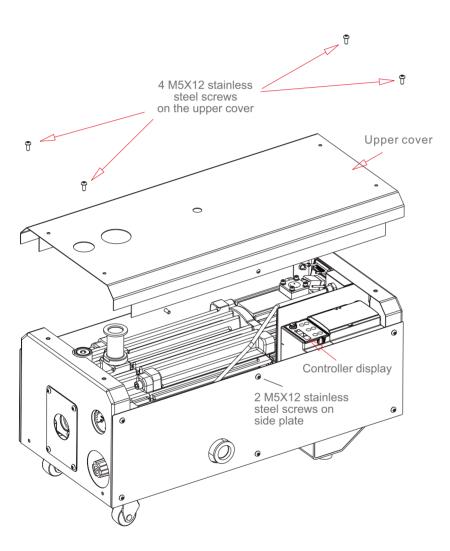


Figure 9





9.3 Examples for Faults

Example: User shall carry out inspection, if pump could not be started normally.

Possible cause 1:

Load changes suddenly in working environment and exceeds the bearing range of controller; the controller gives out protective warning (including but not limited to ocX, ovX, and olX).

Solutions for cause 1:

Power off the pump completely for 3 min (unplug and disconnect the switch), reinsert power plug, turn on the switch and access the run command. Then the pump will run normally.

Possible cause 2:

If unplanned shutdown occurs repeatedly in a working environment with high concentration of dust, corrosion and vapor, solid-liquid mixture may attach to the pump gap, which results in the increase of load. Record the controller error code as per the requirements in Figure 9.

Solutions for cause 2:

- 1. Full-cycle start purging (pump shutdown purging and operation purging);
- 2. Use gas ballast in environment with high water vapor.

Possible cause 3:

It's completely stuck.

Solutions for cause 3:

Check whether the rotor is stuck according to the steps shown in Figure 6, Figure 7 and Figure 8.

Example: User shall carry out inspection, if abnormal noise occurs while pump is running.

- 1. Check whether the current of controller is normal according to the requirements in Figure 9;
- 2. Listen carefully to confirm if the motor produces any bnormal.



Faults	Reasons	Troubleshooting		
	The power supply is not started	1.1 Check power line connection		
	1. The power supply is not started	1.2 Running command is not entered		
	2. The input power supply voltage is abnormal	Make sure the voltage is within +10% of the rated voltage		
	3. The motor becomes faulty	3. Change motor		
The pump cannot	Enable protection of overload protector	Check ambient temperature or temperature of pumped gas		
be started	5. Ambient temperature is too low	5. Raise ambient temperature by 5°C or above		
	6. The pump is stuck by foreign matter inside it	6. Repair the pump		
	7. The pump has been idled for too long a time	7. Repair the pump		
	8. The air outlet is blocked	8. Clean the exhaust silencer or unblock exhaupipe		
	9. The internal parts of the pump are damaged	9. Repair the pump		
	Vacuum system configuration is unreasonable	Choose another proper pump		
	2. Leakage of vacuum system	2. Check the system		
	Improper measurement or regulation	Measure the vacuum degree directly at the pump inlet using correct measurement method and pipe		
	4. Air inlet is blocked	4. Clean the air inlet duct		
The pump can't reach the extreme pressure or pumping	5. Air inlet pipe is too small or too long	5. Use short and thick air inlet pipe		
speed is too slow	6. Air outlet is blocked	6. Unblock air outlet		
	7. Exhaust silencer is blocked	7. Clean the exhaust silencer		
	8. Motor speed is too low	8. Check supply voltage		
	9. Exhaust pipe is blocked	Clean the exhaust silencer or unblock exhaust pipe		
	10. The internal parts of the pump body are damaged	10. Repair the pump		



Faults	Reasons	Troubleshooting		
The vacuum degree of the system drops	Leakage of vacuum system	1. Check the system		
too quickly after the pump stops running	2. No anti-reflux valve	2. Add vacuum valve or anti-reflux valve		
Abnormal noise during operation	The input power supply voltage	1.1 Check the connection of power supply, switch and line		
	is abnormal	1.2 Ensure the voltage is within ±10% of the rated voltage		
	2. Foreign matters inside the pump	2. Repair the pump		
	3. Too low oil level	3. Add oil of specified amount		
	The internal parts of the pump are damaged	4. Disassemble, repair and replace parts		
Pump temperature rise too high	Poor installation ventilation	1. Improve ventilation environment		
	2. The fan is damaged	2. Replace the fan		
	Temperature of the pumped gas is too high	3. Add a cold trap at air inlet		
	4. Exhaust pipe is blocked	4. Clean the exhaust pipe		
	5. Poor lubrication			
	5.1 Improper or deteriorated pump oil	5.1 Add qualified oil		
	5.2 Insufficient oil in gearbox	5.2 Add oil to specified level		
	5.3 Ambient environment is too high	5.3 Reduce ambient temperature		
Oil exists in the inlet pipeline of the pump	1. Oil is from vacuum system	Check the vacuum system		
	2. Oil level is too high in gearbox	2. Drain off excess pump oil		

Table 7







10. Warranty Terms

We provide 1-year warranty services for the VSP series vacuum pump since the date of purchase. During the warranty term, we will provide free maintenance service for any failure occurring on the premise of using the product as per the Manual. We will provide paid services in any of the following conditions:

- (1) Faults caused by natural disasters or human factors.
- (2) Faults caused by special environment.
- (3) Faults caused by abnormal operation or improper use according to our technicians' judgment.
- (4) If the pump is sent back to us for repairing, user needs to state whether the pump is contaminated or contain any substances that do harm to human. If the pump is contaminated, user needs to specify the specific contaminants. We will return the pump to the shipper based on the address, if not receiving any contamination statement.

11. Accessories

Please use the accessories we supply in order to ensure reliability of the pump. When ordering any accessory, customer needs to provide the pump model and the code of wearing parts. Optional parts are shown in the diagram. For any other requirements for accessories, please feel free to contact us.

Accessories we supply:

- 1. Other types of inlet/exhaust interfaces
- 2. Dust filter

Way to dispose the product correctly

This mark indicates it is forbidden to dispose the product together with other household wastes. To prevent uncontrolled waste disposal from causing any possible hazards to the environment or human health, please do use a recycling and collection system or contact the retailer where the product was purchased for recycling the product safely and without contaminating the environment.











