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HelixDrive Vacuum Pump
Operating Manual

Failure to follow warnings could result in death or serious injury.

SAVE THIS MANUAL FOR FUTURE REFERENCE

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Contents

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1. Use Information

Thanks for choosing NAVAC vacuum pump of high reliability (Hereinafter referred to as "the Pump / the Product").
Please check carefully whether the product received is the same as you ordered and the accessories, spare parts & operating manual are attached as well. Please also check if there's any damage occurred during transportation. If anything needed, contact the local distributor or our sales team.
In order to maintain a stable performance level of the pump, read this operating manual carefully to fully understand the safety instructions, technical data as well as operating procedures before installation, operation, repair and maintenance of the pump.

Warning

Failure to observe the terms could result in serious personal injury.

Notice

Failure to observe the terms could result in damage to the pump.

This warning label indicates that there may be a risk of electric shock. Cut off the power supply first in the process of electrical connection, repair and maintenance. Make sure the cover of the junction box is installed before running.

This warning label indicates high temperature hazard. Do not touch the pump when the pump is in operation.

Notice

Read the operating manual carefully and follow the operating procedures. We reserve the right to modify the design and technical data of the pump without notice which may have discrepancies in the manual. Add vacuum oil as requested before starting the new pump. Be sure to connect the nitrogen gas to blow out the pipeline and turn on the nitrogen gas.

2. Attention

For personal safety, please read the following hints carefully before installation, operation, repair and maintenance.

Warning

1) Make sure the power supply used is the one marked on the product. Connect power supply by personnel holding an electrician license according to the technical standards of power equipment and wiring requirements.

2) 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.

3) 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.

4) When checking or repairing the pump, the power supply must be cut off before operation. This will avoid personal injury or death caused by electric shock or sudden startup of the pump.

Warning

5) Objects around the motor that obstruct the air flow must be removed, so as to avoid the fire caused by abnormal heat.

6) 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)

Notice

1) 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.

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

3) 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.

4) 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.

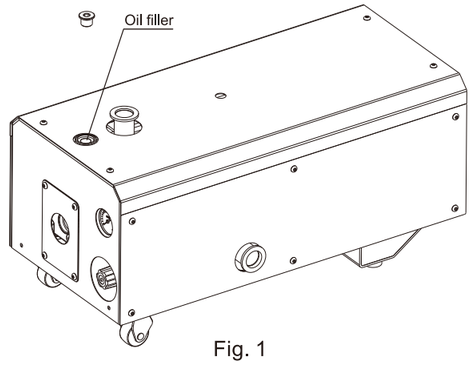

Fig. 1

5) When the pump runs abnormally or the total running time exceeds 6,000 hours, remove the front plate to check the status of oil:
a. If the lubricating oil turns dark or the oil level is lower than Min. It means the oil needs to be replaced or filled
b. Tighten the filler plug and drain plug after oil replace or filling; otherwise the vacuum degree will be affected and oil leakage may occur.
c. Fill the specified vacuum pump oil.

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

7) 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.

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

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

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

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3. Product Overview

This product is a dry screw vacuum pump, which belongs to a kind of basic vacuum obtaining equipment. In particular, it is applicable to plasma cleaning, freeze drying, analytical instruments, laboratories, etc., and can also be used as a backing pump for Roots pumps.

The pump exhausts the gas in the pumped container by constant suction – compression – exhausting via two rotors which rotate to the opposite directions, in order to form vacuum. There is a certain gap between screws and between screw and the pump body, which do not contact with each other. No lubricating oil exists in the pump cavity; The spiral groove formed by the pump body and the mutually meshed screw separates the whole pump cavity into spaces of different sizes. Gas is compressed and transmitted in the spaces from large to small ones. The pump has the advantages of stable operation, low noise, high ultimate vacuum and low power consumption.

3.1 Working Principle Diagram of HD Series Vacuum Pump

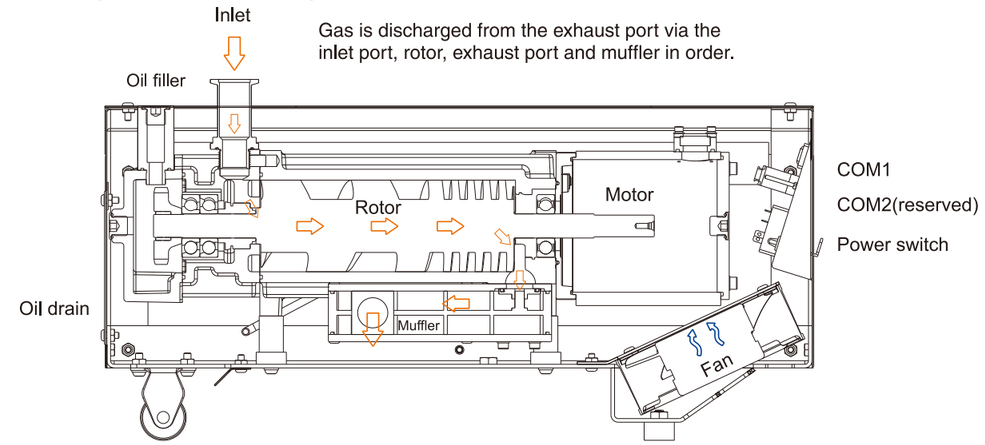


Fig.2

3.2 Schematic Diagram of Purge Piping of HD Series Vacuum Pump

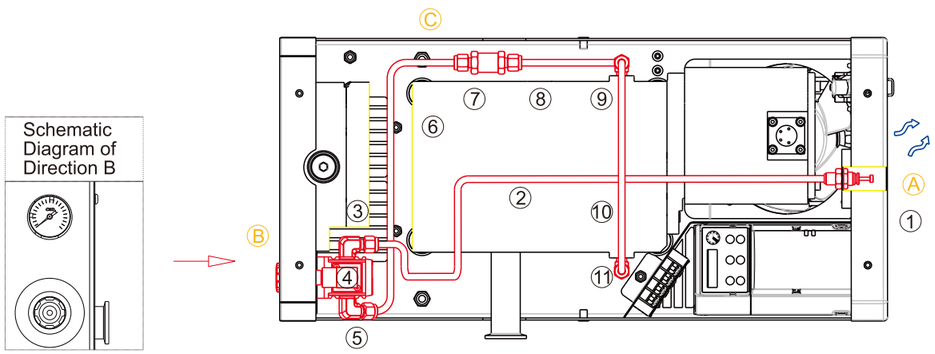


Fig.3

Sequence numbers 1 to 11 are the gas purge paths.

Notice

During the pump operation, continuously purge with dry gas to avoid the accumulation of drawn-in media, which may affect the pump's lifespan.

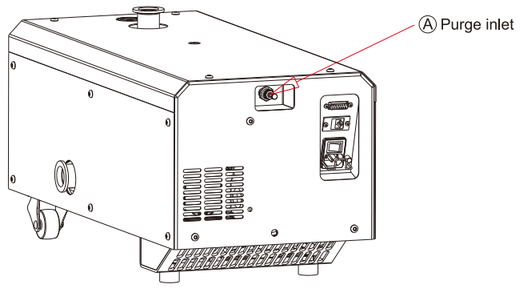
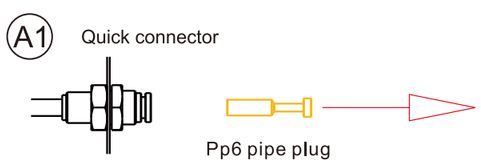
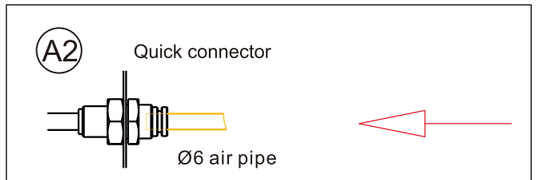


Fig.4

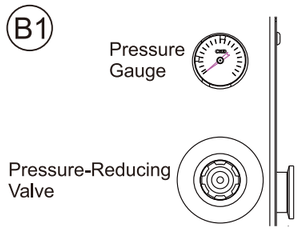
3.2.1 Preparations before purging



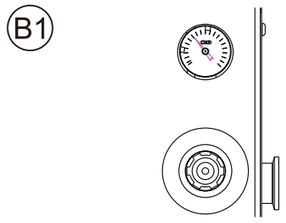
Remove the dust plug amounted on the quick connector



Connect one end of the hose with an outer diameter of Ø 6 with the air source and the other with the quick connector.
Remarks: The air source must be dry nitrogen or dry compressed air



The barometer is 0MPa when no air supply is not connected



1. The barometer should be 0.5~1MPa when the air supply is connected.
2. The pressure may also be manually adjusted by user by turning the relief valve knob at the lower part. To inquire the relationship between pressure and flow, please refer to Annex 12.3 Relationship between Purge Flow and Purge Pressure of HD20/40 Series

Thermal mass flow meter can be installed here

3.2.2 Process of purge gas entering pump body

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.

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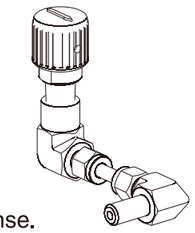
3.2.3 Gas ballast assembly



In the absence of nitrogen access conditions, the pumped medium contains condensable gases, it is necessary to open the gas ballast!
Open the gas ballast will be able to control the gas flow (usually dry air at room temperature) through the gas ballast holes into the screw pump in the pump cavity gas in the compression process with the pumping vapor mixing. When the gas mixture is compressed to exhaust pressure, the vapor partial pressure can be maintained in the pump temperature state below the saturation vapor pressure, so the vapor will not condense. At this point, push open the anti-reflux valve, the steam and other gases together are discharged to the pump. The more vapor content in the pumped gas, the more dry gas needs to be mixed in. Screw pumps are equipped with a gas town of 1 and 2 gears, the default is 1 gear, when necessary, can be adjusted by turning the black rubber cap (rubber cap hole corresponding to the small holes for the 1 gear, the large holes for the 2 gears, can be distinguished by observing the rubber cap holes).

4. Check before Installation

4.1 Specifications & Model .

Please check whether the specification of the vacuum pump meet your needs.

4.2 Accessories and Appearance

Upon receiving the vacuum pump, please check whether the attached parts are complete. For any doubt, please feel free to contact us. Accessories for all HD series 20/40 dry screw vacuum pumps:

Items	Qty	Unit
DB15 wiring leaflet	1	Pcs
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 (8mm-type 7)	1	Set
Power cord 1	1	Set
DB15male head (short pins 7 and 8)	1	Set
DB15male head with cables and with cable number	1	Set

Table 1

4.3 Precautions for Handling

The HD8/20/40 is equipped with a pair of directional wheels and 2 legs. Lift one end of the legs when trying to move the machine.

4.4 Precautions for Hoisting

A 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. Technical Parameters & Specifications

Specification of Power Cord					
Confirm the voltage of power supply voltage					
Voltage / Models	90-120V		200-220V		380-415V
	Wire diameter		Wire diameter		Wire diameter
HD8	1.5mm^2	14AWG	1.5mm^2	14AWG	
HD20	2.5mm^2	12AWG	1.5mm^2	14AWG	
HD40	2.5mm^2	12AWG	1.5mm^2	14AWG	
Hd60			2.5mm^2	12AWG	

Table 2

Technical Parameters

Model		Unit	HD8-2	HD20-2	HD40-2	HD60-2
Peak pumping speed		m^3/h	8	20	32	50
		L/min	130	330	530	830
		cfm	4.7	11.7	18.8	29.4
Ultimate vacuum		Pa	1			3
		Torr	7.5×10^{-3}			2.25×10^{-2}
		mbar	1×10^{-2}			3×10^{-2}
Gas purge	Dry nitrogen/ Dry compressed air	slm	/	0~50		0~100
	Pressure	Mpa		0.05~0.1		0.04~0.07
	Purge gas Inlet connection			One-touch fitting Φ6mm		
	Purge gas supply quality		ISO8673 CLASS 2			
Voltage Input		V	200-240V 1-phase			
Voltage frequency		Hz	50/60			
Motor rating		kW	1.8			2.2
Ultimate power consumption		kW	1.1			0.9
Maxmium power consumption		kW	3			3.5
Current at ultimate pressure		A	6	7	8	7
Heavy duty peak current		A	13	13	13	25

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Model		Unit	HD8-2	HD20-2	HD40-2	HD60-2
Control	PID function		PID functions			
	Analog input		Analogue speed control			
	Enabling mode		Parallel control and monitoring: Digital and modbus-rtu control			
	Communication function		Serial communication: MODBUS-RTU			
Inlet/exhaust DN			KF25/KF16	KF25	KF25	KF40
Water vapor treatment capacity		g/h	135	320	400	500
Gas ballast			Standard	None		
Lifting ring			M10 lifting ring (optional)			
Operating humidity			Below 90%			
Maintenance cycle			once a year			
Cooling mode			Forced-air			
Operating temperature range (storage)		°F	41~104 (23~122)			
Lubrication volume (Oil type)		ml	80 (PFPE)			
Noise		dB(A)	≤62	≤62		≤64
Dimensions(L*W*H)		in	20.5x11.8x12.6	23.6x11.8x12.6		26.1x13.7x15.7
Weight		lbs	83.7	105.8		364.6
Working conditions	Clean condition		/			
	High steam condition		Enable gas purging, pressure 0.07MPa; enable gas ballast			
	Mildly corrosive condition		Enable gas purging, pressure 0.1MPa			

Remark I: See Annex 12.3 for details.
Remark II:When the pump works in the working condition with high water vapor content, run it for a certain period of time after working conditions are met, in order to completely discharge the water vapor in the pump.

Table 3

Model		Unit	HD8	HD20	HD40
Peak pumping speed		m^3/h	8	20	32
		L/min	130	330	530
		cfm	4.7	11.7	18.8
Ultimate vacuum		Pa	1		
		Torr	7.5×10^{-3}		
		mbar	1×10^{-2}		
Gas purge	Dry nitrogen/ Dry compressed air	slm	None	0~50	
	Pressure	Mpa		0.05~0.1	
	Purge gas Inlet connection			One-touch fitting Φ6mm	
	Purge gas supply quality		ISO8673 CLASS 2		
Voltage Input		V	90-120V 1-phase		
Voltage frequency		Hz	50/60		
Motor rating		kW	1.8		
Power Consumption at Ultimate Pressure		kW	1.2		
Power Consumption at Atmosphere		kW	2.2		
Current at ultimate pressure		A	10	11	11
Heavy duty peak current		A	15	20	20
Control	PID function		None		
	Analog input		None		
	Enabling mode		None		
	Communication function		None		
Inlet/exhaust DN			KF25/KF16	KF25	KF25
Water vapor treatment capacity		g/h	135	320	400
Gas ballast			Standard	None	
Lifting ring			M10 lifting ring (optional)		
Operating humidity			Below 90%		
Maintenance cycle			once a year		
Cooling mode			Forced-air		
Operating temperature range (storage)		°F	41~104 (23~122)		
Lubrication volume (Oil type)		ml	80 (PFPE)		
Noise		dB(A)	≤62	≤62	
Dimensions(L*W*H)		in	20.5x11.8x12.6	23.6x11.8x12.6	
Weight		lbs	83.7	105.8	

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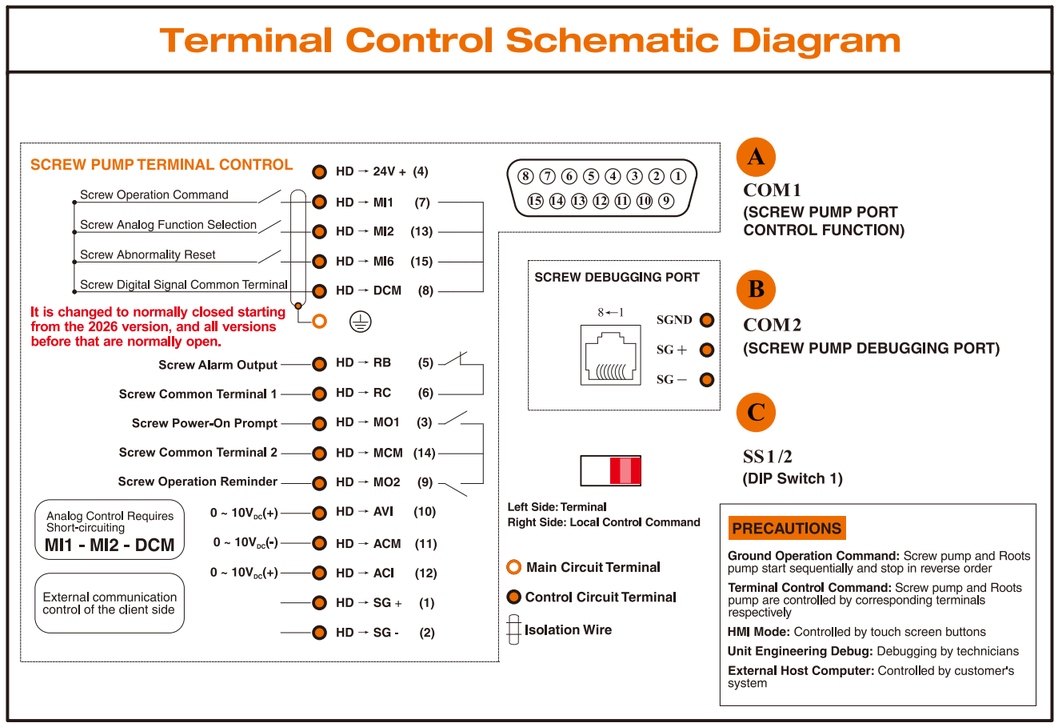
Model		Unit	HD8	HD20	HD40
Working conditions	Clean condition		None		
	High steam condition		Enable gas purging, pressure 0.07MPa; enable gas ballast		
	Mildly corrosive condition		Enable gas purging, pressure 0.1MPa		

Remark I: See Annex 12.3 for details.
Remark II:When the pump works in the working condition with high water vapor content, run it for a certain period of time after working conditions are met, in order to completely discharge the water vapor in the pump.

Table 4

Some signals of HD8/20/40/60 inverters have been connected to the connector. See the appearance below



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-.
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 HD20/40, 6.25-10V corresponds to 3,000-4,800rpm.

DB15 control terminal corresponding wiring						
Pin No.	I/O	Items	Use		Definition of corresponding wire No of inverters	Remark
1	Rs485+	MODBUS	Communi cation+		SG+	Default communication format 9600-8-N-2
2	Rs485-	MODBUS	Communi cation-		SG-	
3	Output	Power-on Reminder			MO1	
4	Output	24V			24V	
5	Output	Operation check	Closed: Alarm	Disconnect: Normal	RA	Relay output terminal
6	Output	Output common			RC	
7	Input	Run 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	Input	Other control			ACI	
13	Input	Analog control startup command			MI2	Analog control terminal
14	Output	Output common terminal 2			MCM	
15	Input	Alarm reset	Closed: Reset		MI6	

Table 5

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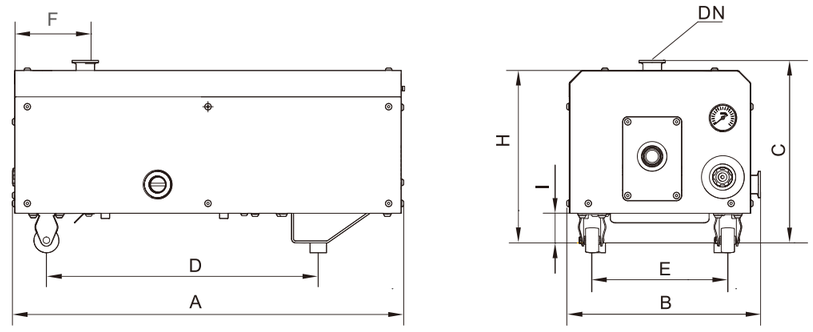
6. Installation Process

6.1 Installation

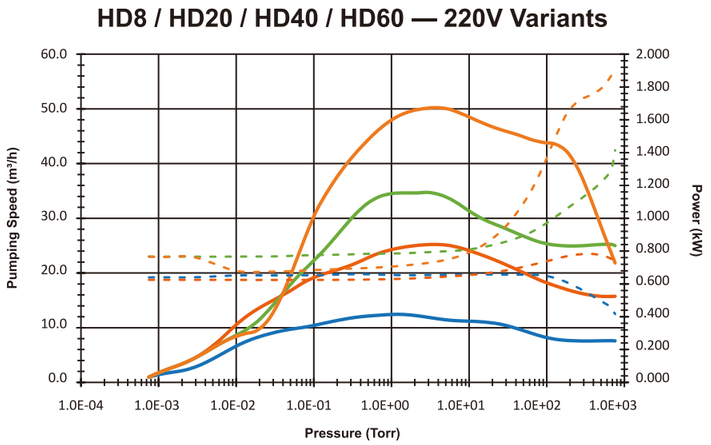
1. Confirm the voltage of power supply					
Voltage / Models	90-120V		200-220V		380-415V
	Wire diameter		Wire diameter		Wire diameter
HD8	1.5mm²	14AWG	1.5mm²	14AWG	
HD20	2.5mm²	12AWG	1.5mm²	14AWG	
HD40	2.5mm²	12AWG	1.5mm²	14AWG	
HD60			2.5mm²	12AWG	
2. HD8/20/40/60 is placed horizontally. A 30cm space 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 HD20/40/60, it is must be connected a dry nitrogen source or a dry compressed air source at the corresponding connection and check that the pressure conforms to the requirements.					
6. For start based on communication, connect the control signal. See Table 6 for details.					
7. Turn on the dry nitrogen source or dry compressed air source, and adjust it to an appropriate flow rate within the green range indicated on the pressure gauge.					
8. When the DIP switch is on the right side, turn on the rocker switch to operate the pump locally. When the DIP switch is moved to the left side, a run command needs to be input from the DB15 port.					
9. Check whether the operating current is normal.					

6.2 Installation specifications



Overall dimensions of HD series dry screw vacuum pump (unit: inch)									
Model	A	B	C	D	E	F	H	I	DN
HD8	20.5	11.8	12.6	13.5	8.2	4.2	11	2.3	KF25
HD20	23.6	11.8	12.6	16.3	8.2	4.2	11	2.3	KF25
HD40	23.6	11.8	12.6	16.3	8.2	4.2	11	2.3	KF25
HD60	25.7	12.2	12.7	19	9.5	5.2	12	2.7	KF40

6.3 Pumping speed and power curve



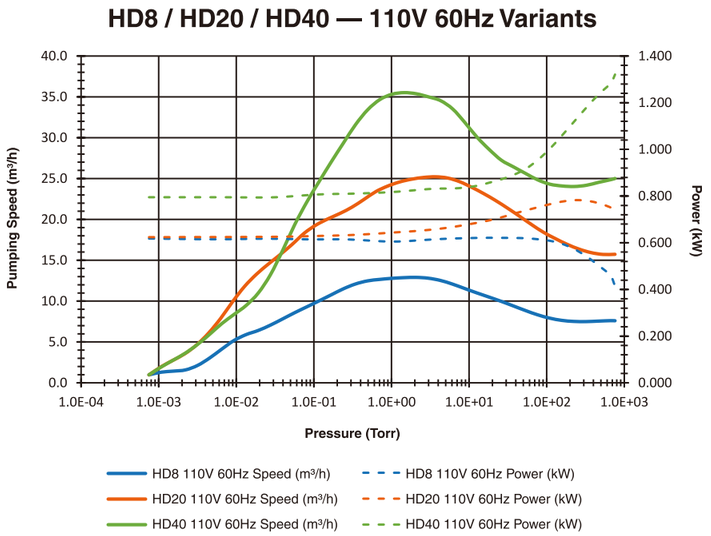


Fig.5

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Sub-Industries	Pump Model		Pump Accessories & Functions								
	HD8~60 Clean Operating Conditions	HD8~60M Moderately Severe Conditions	Gas	Nitrogen Purge	Built-In Dry Air Purge	Heating Module	Inlet Filter (304 SS, Horizontal Mount)	One-Click Moisture Removal	MODBUS-RTU / Host Computer	Industrial-Grade EMC	Dynamic Vacuum Stability (PID Control)
Electron Microscope Extension (Requires BackflowPrevention for Molecular Pumps)	√ √		√ √								
Food Freeze-Drying	√ √		√ √				√ √				
Pharmaceutical Freeze-Drying	√ √		√ √				√ √				
Laboratory Freeze-Drying	√ √		√ √				√ √				
Flight Mass Spectrometry		√ √	√+ √+	√ √	√+ √+			√ √			
Mass Spectrometers		√ √	√+ √+							√ √	
Plasma Cleaning (3C & Semiconductor Cleaning)	√ √			√ √			√ √		√ √	√ √	√ √
Space Simulation		√ √	√+ √+	√ √	√+ √+			√ √	√ √		
PVD Sputtering Coaters	√ √		√ √								
Vacuum Leak Detection	√ √		√ √								
Chip Packaging		√ √		√ √					√ √		
PVD Coating	√ √			√ √			√ √				
Lithium Batteries (Electrolyte Filling & Leak Testing)	√ √			√ √					√ √		
Yamato Drying Ovens		√ √		√ √			√ √		√ √		
Drying Ovens (Paraffin Wax)		√ √		√ √							
Plasma Etching (H_2/O_2 Mixture)		√ √		√ √	√+ √+			√+ √+			√ √
CF_4(Carbon Tetrafluoride) Plasma Cleaning		√ √		√ √			√ √		√ √		

Table 6

7. Handling and Storage

! Warning

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

! Notice

1) 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.

2) Please dispose packaging materials as per applicable environmental protection regulations.

3) If the dry pump is not installed immediately after receipt, store it in a clean environment at 5–40°C (41–104°F). Do not squeeze or lay the packaged dry pump on its side to avoid damage.

8. Check & Maintenance

Warning

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

2) 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.

3) If the system overheats to 260°C (500°F) or above, do not touch or inhale the thermal decomposition products of fluoride materials, as these failure by-products are highly hazardous. Fluorinated materials in the pump system may include oils, greases, and seals. Such overheating may occur if the pump system is misused, malfunctions, or catches fire.

8.1 Daily maintenance list

Maintenance Content	Maintenance Cycle	Remark
Oil change interval	After running for 6,000h or oil turns black	8.2.1
Check the pump sound	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 7

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 oil level is lower than the lowest line. If the oil 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.

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8.2.4 Clean the silencer

① In case of any abnormal sound when the pump is running or after it stops, check exhaust silencer;

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 Fi.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 Fig.7.
4. Use a 5mm 7-shaped wrench to turn the driving rotor counterclockwise to experience the resistance during rotation, as shown in Fig.8.

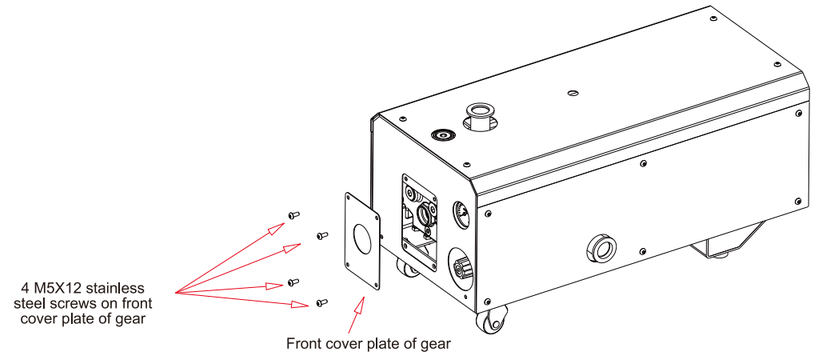

Fig.6

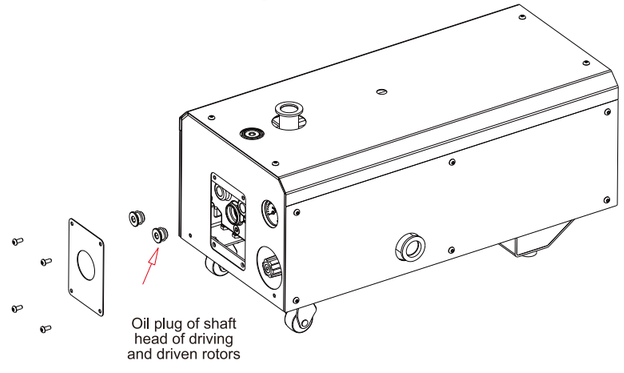

Fig.7

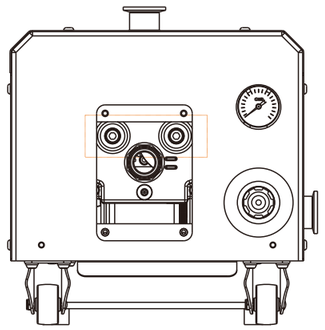

Fig.8

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 Fig.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 Fig.9.

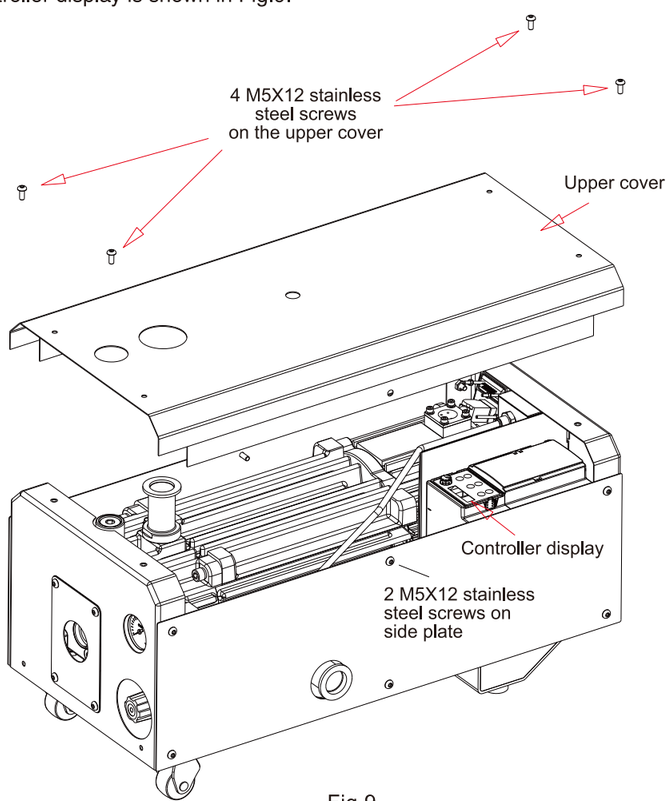

Fig.9

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 Fig.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 Fig.6, Fig.7 and Fig.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 Fig.9;
2. Listen carefully to confirm if the motor produces any abnormal.

Faults	Reasons	Troubleshooting
The pump cannot be started	1. The power supply is not started	1.1 Check power line connection
		1.2 Running command is not entered
	2. The input power supply voltage is abnormal	2. Make sure the voltage is within +10% of the rated voltage
	3. The motor becomes faulty	3. Change motor
	4. Enable protection of overload protector	4. Check ambient temperature or temperature of pumped gas
	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 exhaust pipe
	9. The internal parts of the pump are damaged	9. Repair the pump
The pump can't reach the extreme pressure or pumping speed is too slow	1. Vacuum system configuration is unreasonable	1. Choose another proper pump
	2. Leakage of vacuum system	2. Check the system
	3. Improper measurement or regulation	3. 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
	5. Air inlet pipe is too small or too long	5. Use short and thick air inlet pipe
	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	9. Clean the exhaust silencer or unblock exhaust pipe
	10. The internal parts of the pump body are damaged	10. Repair the pump
The vacuum degree of the system drops too quickly after the pump stops running	1. Leakage of vacuum system	1. Check the system
	2. No anti-reflux valve	2. Add vacuum valve or anti-reflux valve

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Faults	Reasons	Troubleshooting
Abnormal noise during operation	1. The input power supply voltage is abnormal	1.1 Check the connection of power supply, switch and line
		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
	4. The internal parts of the pump are damaged	4. Disassemble, repair and replace parts
Pump temperature rise too high	1. Poor installation ventilation	1. Improve ventilation environment
	2. The fan is damaged	2. Replace the fan
	3. 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	1. Check the vacuum system
	2. Oil level is too high in gearbox	2. Drain off excess pump oil

Table 8

10. Warranty

We provide 1-year warranty services for the HD 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.

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