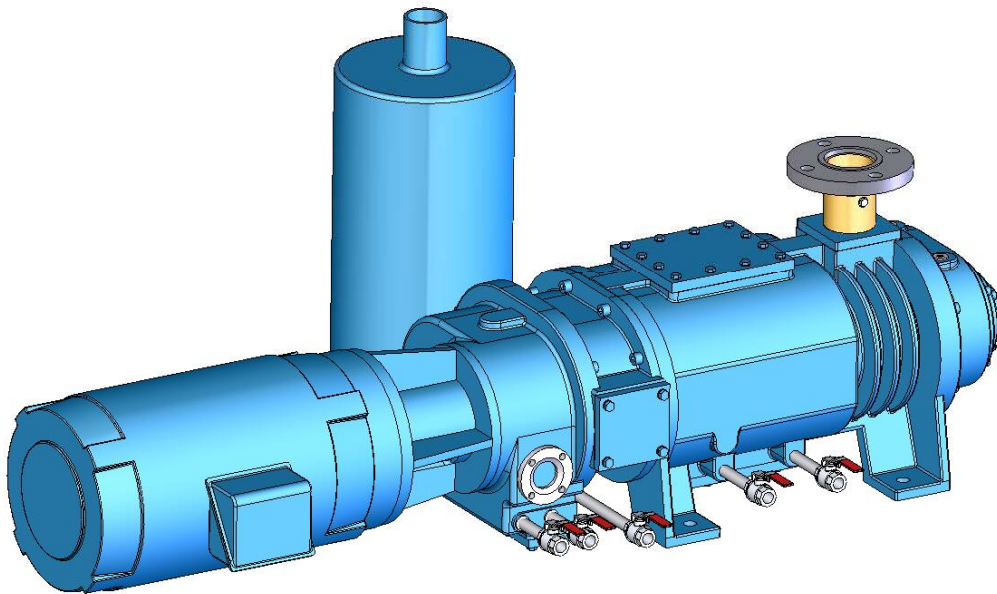


INSTALLATION AND OPERATION MANUAL

DRY – VAC SERIES



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INSTALLATION AND OPERATION MANUAL

DRY – VAC SERIES

IMPORTANT INFORMATION:

Please read this manual before operating your dry screw vacuum pump.

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1.0- GENERAL CONSTRUCTION

1.1 General

This Dry Vacuum pump compresses the incoming gas by means of two screw rotors, having a profile comprising plurality of curves, i.e. Archimedean curve, Quimby curve and arc, which rotate smoothly with a certain clearance maintained between each other and the inside wall of the casings.

The pump is so constructed as to allow no oil to be mixed with the handled gas.

The power of motor is transmitted to the main rotor shaft through a V-Pulley or a coupling device, and further to the driven rotor shaft through a timing gear.

1.2 Construction

•Screw Shaft

The Screw shaft is made of high grade ductile cast iron. The screw shaft had been through precision machining done by a numerically controlled special machine. The screw shaft will have a perfect dynamic balance after machining.

•Timing Gear

The timing gear is the most important part of the screw vacuum pump, and it is necessary for turning the rotors with a certain clearance kept from each other. The gears tooth surface is heat treated, and then polished with a special high precision tooth polishing machine for noises control.

•Bearing

The bearing on fixed side is an angular contact ball bearing and that on free side is a roller bearing of heavy load capacity. These bearings have been selected as to stand high speed and heavy service load and to assure clearances between gears and Screws are maintained.

•Shaft Seal

The shaft seals consist of Shaft Lip Seals on Suction side, mechanical Seal and Viton Oil Seal on Discharge side.

•Oil level Gauge

Oil Level Gauge is located at Front End Cover. Oil should be supplied to the top level of Center Line. If the oil level is too low, Gear, Bearing and Mechanical Seal will be damaged as a result of improper lubrication. While pump is not running, check the oil level and/or contamination then. Refill or change the oil if needed. The oil is splashed over by rotation of timing gear to lubricate bearings and Mechanical seals.

1-3.Specification

Dry-Vac Type		200	300	400	800
Specification					
Normal Displacement 60Hz (M ³ /Hr)		200	300	400	800
Ultimate Pressure (Torr)		0.1	0.05	0.05	0.01
Power KW (60Hz)		7.5	11	15	22
Rotation (RPM) (60Hz)		3500			
Port size (mm)	Suction(A)	40	50	65	100
	Discharge(A)	40	40	50	65
Cooling Water (L/Min)		3.0	7.6	7.6	10
Weight (Kg, Pump Only)		260	320	385	820

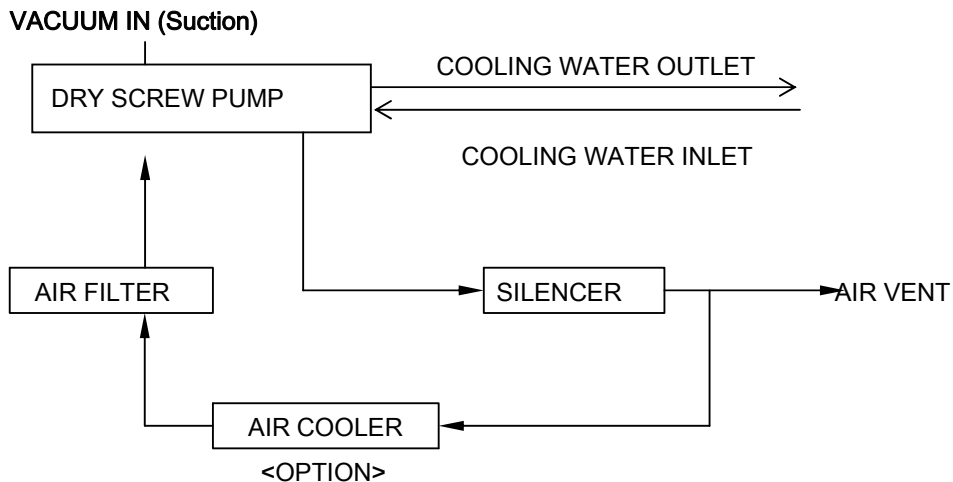
•Note

(1) Synthetic and mineral type of oil can be used.

For shipping, we supply pure mineral gear oil.

(2) Above listed amount of Cooling Water is based on water temperature 20°C. So, the amount of water may vary when using warmer water.

1.4 Piping Diagram



1.5 Purges

•Cooling Purge

This purge is intended to cool the Screws and inside of casing.

During the operation of the pump, this purge is required to cool down compression heat of discharged process gases. The process gases introduced into the casing from the suction side are compressed by the rotation of the screw and transferred to discharge side. This compression process generates heat and will be transformed to gases. Since this compression heat reaches above 130°C~200°C in discharge side, we need cooling purge to cool down this heat.

(1) Purge amount

Dry-Vac Model	Amount(m ³ /min N)	Remark
200	0.55	This purge amount can Vary as per the pump's vacuum level
300	0.55	
400	0.8 ~ 0.86	
800	Above 1	

(2) Type of Cooling Purge:

- ① Standard : Atmosphere purge through air filter
- ② Using Heat Exchanger : Recycle process gases from discharge after cooled through the heat exchanger.
- ③ Using Inert gases like N₂ etc. Instead of atmosphere or cooled process gas.

•Sealing Purge

This purge is required during the operation and intended to pressurize the front end cover with Inert gas like N₂ so that the process gas or fluid can not enter into the timing gear set and bearings. You can use either one of two plugs provided on the top of Front End Cover for this sealing purge connection.

The purge pressure is below 0.5kg/cm²G and the leak rate for our Mech. seal is below 3cc/Hr. Also our Mech. seal can seal pressure up to 3kg/cm²G.

•Cleaning Purge

This purge is required to clean inside the pump before stopping the pump. Before stopping the pump, purge N₂ gas, steam or cleaning agent for 20 to 30 minutes after closing the main valve on suction side to clean sticky process materials or process gases. This purge is important

when pumping corrosive/toxic gases or sticky materials like resin.

•Pump Steam Flushing

After each process, run the pump for 10~20 minutes without load after close main suction valve (Dry run, Cleaning purge).

This is to remove & clean process gases / condensed vapors the pump during the process.

These process materials build up inside the pump can be the reason for pump overload when restart the pump for next process.

Also, when restart the pump after a certain period later, these process materials can be cause for pump seizure or overload.

In this case, flush steam the pump internals & Screws with following procedure instead of rotating the pump with force.

•Steam Flushing Method(after operation)

(1) Process materials that require Steam flushing : Monomer, Polymer, Resin, etc.

(2) Steam pressure : approx. 1 kg/cm²G

(3) Flushing Procedure

① Close Suction valve, Open discharge valve or Silencer/ Separator's Drain valve

② Inject Steam for 1~10 minutes (the injecting time varies with process material) through pump suction line or through a plug in suction flange

③ Try to rotate shaft (Pulley or Coupling) by hand to see whether the pump rotate smoothly or not (This time, be careful not to start the motor)

④ If the pump move smoothly, stop injecting steam.

Then, start motor and check if the pump runs normal or not.

(4) If not satisfied with above procedures, repeat the procedures 2~3 times more.

2. HANDLING PROCEDURE

2.1 Assembly of Piping

•Location

(1) Mount the Pump on a clean, flat & level surface of sufficient rigidity. If it should be installed outdoor, check motor, V-Belt and other part are for outdoor service.

(2) There should be enough space for maintenance like dis-assembly, re-assembly and periodical inspection. etc.

•Foundation

- (1) The foundation concrete should have an adequate pressure bearing area, in consideration of pump weight and a withstanding pressure of the soil. The mix ratio of the concrete is 1-cement, 2-sand and 4-gravel.
- (2) In order to embed anchor bolts in the concrete, the foundation must have holes of good size, and its surface should be as even as possible.
- (3) Upon confirmation that the concrete has hardened, proceed with assembly of piping.

•Installation

- (1) Mount the pump horizontally and center it on base plate in accordance with the instruction manual.
- (2) Place the pump on the base plate, and support the base plate equally so that the bed will be horizontal and also a space for grouting the cement mortar is available between the foundation surface and the bed.
- (3) Put anchor bolts in place on the bed preliminarily, set nuts on the full head of bolts, and leave them pendulous in the bolt holes. At this time, if the bed is supported locally, it could be deformed, notwithstanding its strength.
- (4) Assure the level by using a level gauge:
Check the levelness on the machined surface. The levelness should be limited to 0.5mm in any one meter.
- (5) Grout the cement mortar made up from 1-cement and 2-sand in the space under the bed and in anchor bolt holes, and keep for few days. Upon hardening of the mortar, tighten the nuts for anchor bolts. Check pump & motor alignment.

2.2. Piping

• Main Piping

- (1) Clean inside of suction and discharge pipe to be free from rust, dust and foreign matters, and place a strainer of 40 mesh on or over suction side.
- (2) It is advisable to install expansion joint on the suction side as well as the discharge side of the pump. Also, provide supports for piping so that no excessive load will be imposed on the pump.
- (3) In case Silencer is provided on discharge side, install it as near to connection as possible.
- (4) Be sure to install a Non-return Valve adjacent to the suction port so that the pump will not turn reversely. If preferred, install a gate valve instead, and assure to shut off prior to stopping the pump.
- (5) In case, there is a risk of condensate gas being collected on the pump discharge pipe, install

a recovery tank under the pump, then the condensed gas and water will be collected during operation and can be discharged by opening of drain valve.

(6) Drain receiver should be installed under the drain valve to collect the discharged liquid.

•Cooling water piping

Cooling water piping is required to cool pump Front End plate & Casing. This piping should be assembled with reference to the piping diagram and the outline drawing .

2.3 Preparation for Operation

- (1) Remove dust and foreign particles such as welding slug from Vacuum pump and Piping.
- (2) Check all suction and discharge connections are properly tightened and all piping properly supported. Check cooling water piping as well.
- (3) Fill oil up to the red point of the oil gauge. If oil is low, gear and bearing can seize, and if oil is too high, the temperature will rise excessively, and can be cause for gear noise or other negative effect on other parts.
- (4) Let cooling water flow as specified in chart 1.3.

2.4 Operation

- (1) Open suction valve, and turn on the power under no load condition to check rotating direction. At this time, start up instantly.
 - (2) Run the pump under no load condition for 20-30 minutes to check any abnormal vibration or heat. In case of any abnormality, stop operation and search for the cause. Often the cause is improper installation or failure of alignment.
 - (3) Run the pump for 2-3 hours under normal load condition and check the temperature and vibration.
 - (4) During operation, pay attention to level of Ampere drawn by the motor.
- If case of abnormality, stop the pump immediately and check for cause. Often, the cause is interference between rotors or between the periphery of rotor and the inner surface of casing. All pumps are tested prior to shipping. However, full care and inspection is still necessary after the pump is disassembled and reassembled at site.

•Caution during Operation

1. Check temperature of bearing & lubricant and indication of Ampere Meter & cooling water.

2. Keep operation within designated specifications.

2.5 Stopping

- (1) Shut off main valve on suction side.
- (2) If any corrosive gas has been inhaled, introduce the atmosphere air to suction side for 20-30 minutes before stopping to clean inside of pump.
- (3) Stop the pump by turning off the motor.
- (4) Shut off cooling water.

If freezing is anticipated, drain water from pump by opening Drain Valves.

2.6 Lubrication

Lubricants to be used must be good quality high grade petroleum products containing oxidation inhibitor, rust preventive, extreme-pressure additive, etc. (Do not use any lubricant which contains any element of water, sulfate resin or tar.)

Turbine oil (ISO VG68) readily obtainable in the market will generally satisfy these requirements.

The following brands are recommended for use as lubricants for gear and bearing.

●Lubricant :

BP, Energol THHT 68

BP, Energol THB 68

Petro canada, R & O 68

Shell, Turbo 68

Mobil, Gear 626

or, equivalent.

●Grease :

G 40M (SHIN ETSU)

JFE 552 (NOK-KLUBER)

3. MAINTENANCE AND INSPECTION

3.1 General

(1) During operation, the temperature will rise corresponding to the compression ratio due to compression heat. However, if the temperature rise is local and the outside coating scorched, it is abnormal. It may be because of the improper Cooling water supply or Cooling water cut-off, interference of Screw with casing or the pump has sucked in some foreign material.

Therefore, stop the operation immediately to check the condition.

In some case, the Screw and the casings might have corroded due to lengthy operation, this will result in larger clearance between these parts with gas slippage from discharge gas to suction side in large quantities, the pumping capacity of the pump will less than originally planned. In such cases, the pump capacity has shown a steady decreased..

It is recommended to stop the pump and take measurements of the clearances for any consideration of corrective action to be taken.

(2) Abnormalities can be noticed immediately by making routine checks on bearing temperature, vibration or noise.

(3) Interference between Screws or between Screw and casing can be noticed by listening to any sound through stethoscope applied against the casing. Make checks from time to time.

(4) In winter, in cold regions, whenever the pump is stopped, let cooling water drained. Freezing of water could damage the pump jacket.

3.2 Periodical

•Daily

(1) Oil-Level Gauge: Excess or low lubricant level can damage gears and bearings.

(2) Check that the amount of cooling water is adequate.

(3) Check the temperatures of Grease cover and Front End Cover.

Use of suitable thermometer or of surface thermometer will be convenient.

(4) Check the suction and discharge pressures. To check these pressures, make sure that the operation of the pump is within specifications.

(5) Check load on the motor.

Be aware that an increase in the motor load indicates some kind of abnormality.

•Monthly

- (1) Check tension of V-belt (if any).
- (2) Check lubricant color.(If Oil color is dark, replace lubricant).
- (3) Check Oil level. If Oil disappears constantly, check Mechanical Seal.

•Quarterly

Check Cooling water flow & color. If something wrong, clean water jackets and water piping.

•Every 6 Months

- (1) Check pipe supports for the pump.
- (2) Replace lubricant in the Front End Cover.
- 3) Replace grease in the Rear End Cover.

•Yearly

- (1) Check Mech. seals.
- (2) Check inner surface of Screws and casing.
Disassemble the piping on suction side to check the inner surface of screws and casing.
- (3) Check the gear- Remove the Front End Cover to check the gear.

3.3- SCREW VACUUM PUMP MAINTENANCE AND CHECK LIST

No.	Item	Check Point	Daily	Monthly	3 ~ 6 Month	Yearly
1	Ampere of Motor	Any Change? Ampere as specified?	0			
2	Rotation	Is rotation smooth and Correct?	0			
3	Suction and Discharge Pressure	Are pressure as Specified?	0			
4	Noise and Vibration	Any abnormal sound or Vibration	0			
5	Temperature	Any excessive oil temperature rise on Bearing and other parts?	0			
6	Oil amount of Front End Cover	Is Oil at proper level?	0			
7	Water contamination	Clean or not?	0			

	On Front End Cover					
8	Oil Leak	Oil not leaked?	0			
9	Lubricant Replacement	All Oil & Grease in Front end Cover & Grease cover to be Replaced.			0	
10	Amount and Pressure of Cooling Water for Pump Casing	The amount as specified? The pressure not too high?	0			
11	Suction and Discharge pipe	Is there any Scale?			0	
12	Cleaning and Dry Run at stop	Before stopping the pump after Each batch, Close the main V/V On suction side and run for 20~30min. While purging N ² or air				
13	Check Inside of Casing and Rotor	Any rust or flaw found?				0
14	Lip seal, Oil seal, Bearing, O-ring, Slip sleeve, Packing V-Belt/Coupling	Replace when need.				0

4. TROUBLE SHOOTING

PROBLEM	CAUSE	SOLUTION
Insufficient Air quantity	<ul style="list-style-type: none"> · Filter is clogged · Too much Clearance 	<ul style="list-style-type: none"> · Clean or Change FILTER · Check Clearance
Overload on Electric Motor	<ul style="list-style-type: none"> · Foreign matter are caught in · Pressure loss in Piping is increased (increase in Suction Pressure) · interference between screws. · interference between Screw and Casing · Discharge with Cooling water flow 	<ul style="list-style-type: none"> · Clean or Change Filter · Adjust or Replace the Screw and Casing · Check the pressure difference between Inlet and Outlet · Adjust improper Screw clearance. Adjust Timing Gear · Make the Side Clearance larger / Make the clearance between Screw and Casing larger. · Drain & clean Discharge line
Overheat	<ul style="list-style-type: none"> · Excessive lubricant in Front End Cover · Vacuum Pump inlet temperature high · Too much Compression ratio · Interference between Rotor and Casing · Problem with Cooling water flow 	<ul style="list-style-type: none"> · Check Oil level · Check suction & discharge pressure · Search for the cause of interference · Clean Cooling water kline
Knocking	<ul style="list-style-type: none"> · Interrelated position between Timing Gear and Rotor is incorrect · Improper assembly · Abnormal rise in pressure · Damage on gear due to overload or improper lubrication 	<ul style="list-style-type: none"> · Reposition · Reassemble · Search for the cause · Replace Timing Gear
Bearing or Gear damaged / Shaft broken	<ul style="list-style-type: none"> · Improper lubricant · Lubricant runs short · Overload 	<ul style="list-style-type: none"> · Change lubricant · Refill lubricant · Replace the Shaft

※ If the troubles are not resolved by the above mentioned actions, the cause may possibly be located in Pump operation condition. In such case, please contact us with the following information.

1. Model Name & Number Serial Number, Application, etc.
2. Information of Piping (Valve, Strainer, Number of Bends, etc.)

5. VACUUM SYSTEM CHECK LIST

	CHECK LIST	CHECKS
Before Operation	Open cooling water supply valve. Is it flow properly?	
	Close Vacuum suction line	
	Open discharge line	
	Check lubricant color and level. Is it acceptable?	
	Check Belt tension (for V-belt type only), coupling alignment	
	Run Vacuum pump for few minutes before open the suction line	
During Operation	Check vacuum level in full vacuum. Is it normal?	
	Check electrical connections (voltage & amperage) in full vacuum. Is it normal?	
	Any abnormal noise?	
	Check operation temperature. Is it normal?	
	Check lubricant color and level. Is it acceptable?	
Stopping	Run Vacuum pump for few minutes after closing suction line.	
	If foreign material is introduced inside of vacuum pump, clean it with cleaning agent.	
	Drain cooling water from vacuum pump if the pump is stopped for long time	
	Make sure that suction & discharge line is closed	
	Make sure power supply is closed	