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# SH-DV (Oil free) Series



SH-DV150 / 300 / 600



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Keep this manual on-hand so it can be used by all operators of the unit. Use the unit only in the way described in this manual. Failure to follow the instruction in this manual may cause wrong operation.

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## 1. Safe operation precautions

For safe and efficient operation , thoroughly read this manual and any other additional information supplied by SH Scientific Co., Ltd. before operating the DV series dry scroll vacuum pump , make sure fully understand the precautions in use, performances of the pump, and operation procedures.

DV series dry scroll vacuum pump is suitable for clean processes only . Do not pump toxic, explosive , flammable or corrosive substances or substances which contain chemicals, solvents or particles.

Be sure the inlet gas temperature must be less than 122°F.

Be sure to carrying, installation, electric wiring, piping, operating, maintenance conducting and checking by qualified certificated specialists.

Be sure to conduct periodic inspection and maintenance.

Do not operate damaged pump. Do not use the pump for other than intend use.

Never alter the pump.

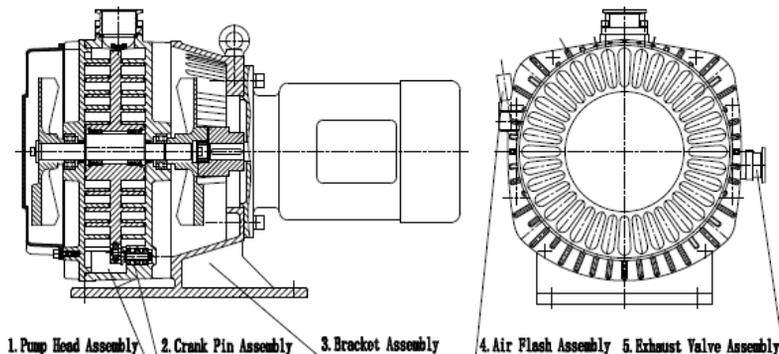
SH Scientific will not be held responsible for any events that occur due to non-compliance with these instructions , improper use by untrained persons , non-authorized interference with the equipment , or any action contrary to that provided for by specific national standards.

## 2. Description

### 2.1 Construction and operating principle

DV series dry scroll vacuum pump is constructed with pump head assembly, crank pin assembly, bracket assembly, air flush assembly, and exhaust valve assembly.

Two spiral cylinders, one offset and orbiting against the other fixed with an offset of 180° to form several crescent-shaped pockets of differing sizes. By means of an eccentric drive, the orbiting scroll is made to orbit about the fixed scroll, reducing the volume of the pockets and compressing gas from outside towards the inside thereby pumping the gas from vacuum chamber.



Drawing 1. Construction of DV series dry scroll vacuum pump

## 2.2 Applications

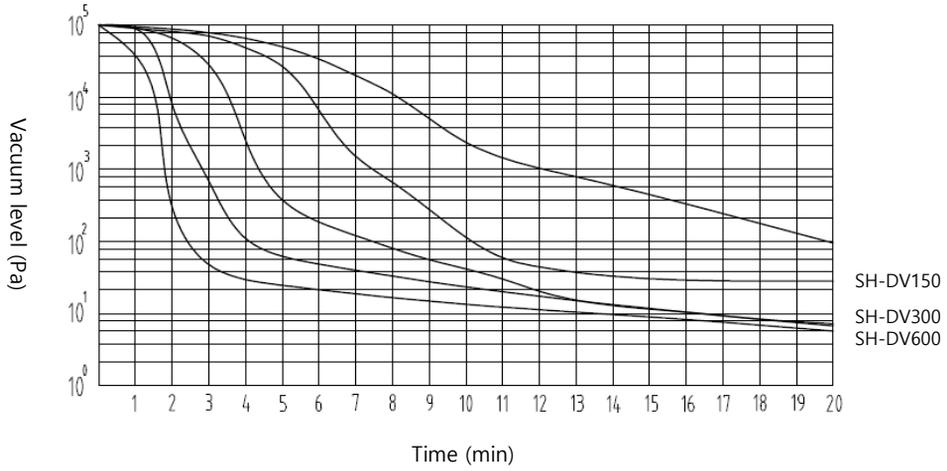
DV series dry scroll vacuum pump is mainly used in oil free vacuum pumping, leak detecting, vacuum exhauster, vacuum oven, glove box vacuum packaging storage, high energy beam lines accelerator, electron microscopy, mass spectrometer, rough pump for molecular pump, load lock pumping, etc.

## 2.3 Specification

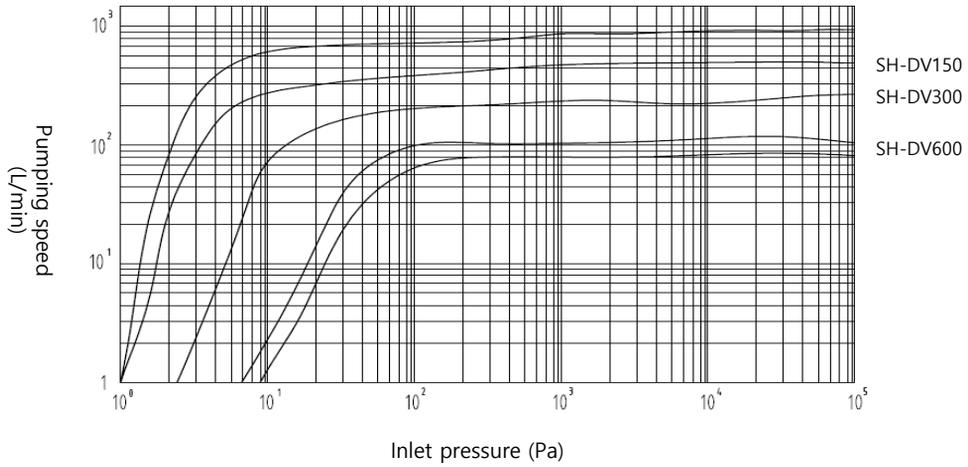
Chart 1. Technical specification of DV series dry scroll vacuum pump

Model			SH-DV150	SH-DV300	SH-DV600
Displacement	50Hz	m <sup>3</sup> /h	7.2	15.5	31.3
		cfm	4.3	9.3	18.7
	60Hz	m <sup>3</sup> /h	8.6	18.3	37.4
		cfm	5.1	10.9	22.3
Ultimate Pressure		mbar	$\leq 6.0 \times 10^{-2}$	$\leq 2.6 \times 10^{-2}$	$\leq 1.0 \times 10^{-2}$
		Torr	$\leq 4.0 \times 10^{-2}$	$\leq 1.9 \times 10^{-2}$	$\leq 7.5 \times 10^{-3}$
		psi	$\leq 9.0 \times 10^{-4}$	$\leq 3.8 \times 10^{-4}$	$\leq 1.4 \times 10^{-4}$
Noise Level		dB(A)	$\leq 57$	$\leq 60$	$\leq 61$
Leakage		mbar-l/s	$1 \times 10^{-7}$		
Max. Inlet/Exhaust Pressure		MPa	0.1 / 0.13		
Ambient Operation Temp.		°F	41 ~ 104		
Cooling Type			Air cooled		
Inlet/Exhaust Flange			KF25/KF16	KF25/KF16	KF40/KF16
Motor 1 phase	Power	kW	0.55	0.55	0.75
	Voltage	VAC	110 ~ 115V, 60Hz or 200 ~ 230V, 50Hz		
	Speed	rpm	1725(60Hz); 1425(50Hz)		
	Connector		North America, Europe, UK/Ireland, India		
Motor 3 phase	Power	kW	0.55	0.55	0.75
	Voltage	VAC	200 ~ 230V or 460V, 60Hz; 200 ~ 230V or 380 ~ 415V, 50Hz		
	Speed	rpm	1725(60Hz); 1425(50Hz)		
Dimensions	1 phase	mm	475x265x270	495x305x355	500x320x360
	3 phase	mm	475x265x270	495x305x355	500x320x360
Net Weight	1 phase	Kg	22	29	36
	3 phase	kg	21	28	31
Others			With air flush		

## 2.4 Performance curve



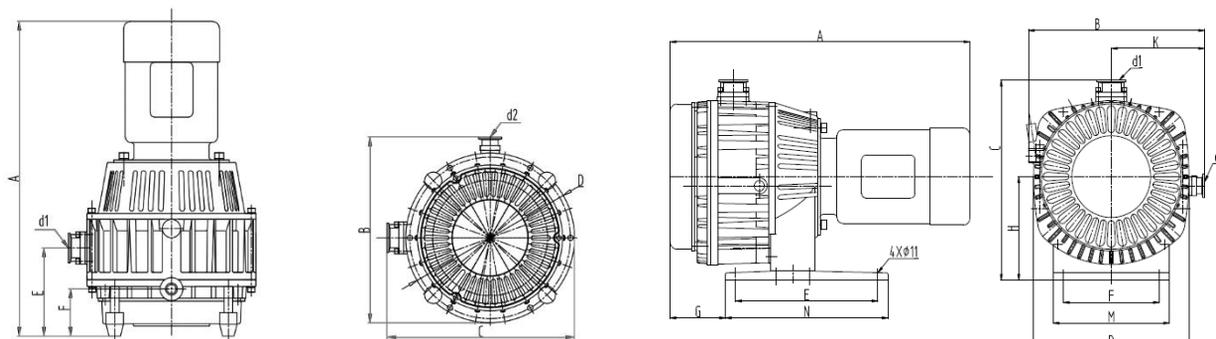
Drawing 2. Average evacuation time curve of DV series dry scroll vacuum pump



Drawing 3. Pressure-pumping speed relation curve of DV series dry scroll vacuum pump

## 2.5 Overall dimension

Drawing 4. Dimension drawing of DV series dry scroll vacuum pump



SH-DV150

SH-DV300, 600

Model	A	B	C	D	E	F	G	H	M	N	K	d1	d2
SH-DV150	475	265	270	220	122	76	-	-	-	-	-	KF25	KF16
SH-DV300	495	305	355	226	252	163	87	174	192	288	140	KF25	KF16
SH-DV600	500	320	360	275	252	170	115	178	206	288	165	KF40	KF16

Chart 2. Dimension of DV series dry scroll vacuum pump

## 3. Preparation of installation

Before assembly the ordered pump, do following preparation work:

### 3.1 Preparation of operation environment

The operating environment: Room inside, Temperature: 41 ~ 104°F, Humidity ≤ 85%, Altitude ≤ 1000 meters. Without direct sun shine.

Install the pump on a level, firm, clean, large enough foundation, and free of flammable, explosive gases, dirt or dust, iron debris, stone or wood parts, corrosive gases or expose to steam, moisture or rain.

Be sure no barrier around the install area, the environment suitable to conduct the pump transformation, adjustment, assembly, electric power wiring, and maintenance.

Make sure the pump nameplate can be seen easily. Do not displace or remove the nameplate.

Keep operation environment in good ventilation.

If placing the pump inside an enclosure, provide ample room to supply ambient air to the pump front and rear air intakes. Make sure the environment temperature ≤ 104°F, distance from pump to enclosure wall longer than 250mm.

### 3.2 Preparation of assembly tools

Wrench, screw driver for installation, electrical tools for connect the power cord.

### 3.3 Preparation of power configuration

Wiring the pump and power source by qualified electrician.

Be sure to switch off power supply before power configuration.

Be sure to make power cord meet the ordered pump requirements, including power phase, capacity, etc.

3 phase power source cord requirements: capacity $\geq$ 10A standard 4 core cable, cross section area over 2mm<sup>2</sup>.

Single phase power source cord requirements: capacity $\geq$ 10A standard 3 core cable, cross section area over 2mm<sup>2</sup>.

Power source cord for grounding cross section area must be over 2mm<sup>2</sup>. and properly grounded.

Be sure to apply power source cord overload protective breaker.

### 3.4 Piping configuration

Be sure to make the vacuum pipe line connected to the pump inlet/outlet with KF flanges (See Chart 1. for dimensions of KF flanges).

Install isolation valve between the pump and vacuum chamber to prevent debris attached to the pump inside surface drawback to the vacuum chamber when the pump switched on/off.

When pumping gases with slight powders, install fore line filter in the piping between chamber and the pump.

When pumping vapor ( Humidity $\geq$ 60% ), be sure to install steam water separator in the piping between chamber and the pump.

The inlet gas temperature must be kept lower than 122°F, when temperature became higher than 130°F, install chiller or cold trap in the piping between chamber and the pump, to reduce inlet temperature to lower than 122 °F.

## 4. Unpacking and inspection

### 4.1 Arrival inspection

Before unpacking, make sure the packing box is right side up and in good condition, pump model is in agree with ordered.

### 4.2 Unpacking inspection

When unpacking, make sure the pump is the same as ordered and the goods in packing box are the same as shown in packing list.

Open the box, unlock fasten bolts between base plates of the pump and packing box, then take out the pump using suitable lifting and carrying equipment when carrying the pump, do not hold motor or fan cover when carry or move the pump.

### 4.3 Carrying

Carrying the packing box according to its center of box gravity and construction.

Do not drop or hit or vibrate the pump when unpacking and carrying.

Be careful to install the pump using eyebolt and crane with sufficient allowable load capacity while paying attention to stability of suspended load.

Use suitable lifting and carrying equipment when carrying the pump, do not hold motor or fan cover when carry or move the pump.

## 5. Installation

Install the pump on a firm, level foundation. Fix the pump with 4 M8 bolts if the foundation is not firm or level.

Save the carton and all packing materials.

Inspect the pump for damage. If there is shipping damage, contact the freight carrier and sales office immediately.

## 6. Wiring

Wiring the pump and power source by qualified electrician.  
Be sure to switch off power supply before power configuration.

### 6.1 Wring to three phase power cords

Remove 4 M5 bolt at motor terminal box and remove protection cover. Be careful not to lose removed M5 bolts and washer.

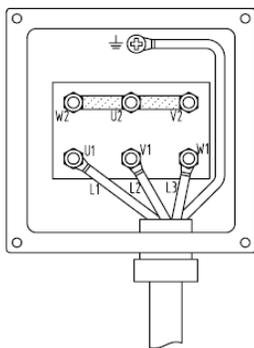
Disassemble the terminal box cover, check the cable gland inside, and connect power source cord to terminal according to motor operation instruction.

Connection of the pump and power source cords can be changed to a 220V or 380V or 460V by changing terminal connecting method (3 pcs.). It is wired to 380V when delivered.

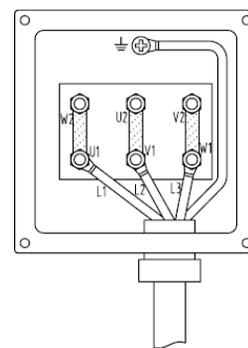
If change to a 220V connection, remove M5 nuts of power source terminal and change terminal connection as illustrated as Diagram 3.

Insert power source cord through cable-gland on the bottom side of terminal box.

Connect each phase L1-L2-L3 to each power source terminal respectively in accordance with the wiring diagram below.



Three phase 380V connection (When delivered)



Three phase 220V connection

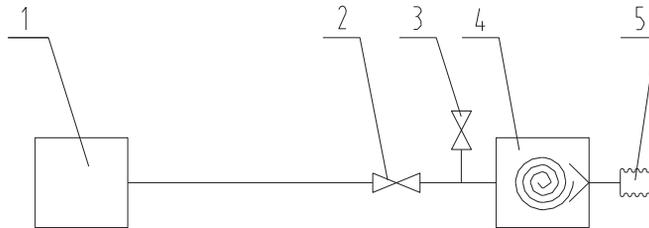
Drawing 5. Power cord three phase connection

### 6.2 Wring to single phase power cords

When this pump is configured for use on a nominal single phase 220V/50Hz or 110V/60Hz circuit, it must be used with a factory supplied cord and plug that permits connection to the proper electric circuit.

## 7. Piping

Use KF flanges to connection the pump and pumping pipe line as indicate in Chart 1.  
 Pay attention to the length and size of inlet piping. It is suggested that for SH-DV75, max .length  $\leq 5$  meter, inner dia. 25mm; for SH-DV150 and SH-DV300 max. length  $\leq 8$  meter, inner dia. 25mm; for SH-DV600, max. length  $\leq 15$  meter, inner dia. 40mm



1. Vacuum chamber
  2. Isolation valve
  3. Leak valve
  4. The pump
  5. Exhaust pipe
- Drawing  
6. Connecting between DV series vacuum pump and vacuum chamber

## 8. Test Operation

### 8.1 Safe precautions

Before switch on power source to operate the pump, be sure that the pump is assembled, ground and cooling fan assembled correctly.

Make sure the pump is in good operation state, no abnormal noise and vibration.

Be sure to remove inlet/exhaust flanges before starting the pump.

Be sure to close isolation valve between the pump and vacuum chamber during start up and shut down.

Starts the motor, make sure the inlet is suck gas in. If not, the electric power source cord connect direction may be incorrect.

Be sure to close the pump switch when electric power is cut off.

### 8.2 Test operation

Close isolate valve.

Disconnect the pump inlet to the vacuum chamber pipe line.

Starts the motor for less than 1 minute, make sure the inlet is suck gas in and the exhaust discharges, and without abnormal noise or vibration.

## 9. Operation

### 9.1 Safe precautions

Before switch on power source to operate the pump, be sure that the motor terminal box protection cover is closed, the pump is assembled, ground and cooling fan assembled correctly. Be sure to close isolation valve between the pump and vacuum chamber during start up and shut down.

Never put fingers or any foreign matter into inlet/exhaust hole of the pump or fin clearance of cooling fan when the pump works.

Never touch the pump head or motor with hands when the pump works and within 1 ~ 2 hours of the pump stop, for high temperature of 158°F may make human burn or injury.

Cut off power switch when abnormal happens as soon as possible.

Be sure to close the pump switch when electric power is cut off.

### 9.2 Operation precautions

When continuously operating the pump at around ultimate pressure, open air-flush pumping for 1 hour, close isolation valve and open inlet to atmosphere for 3 ~ 5 seconds, 3 ~ 5 times daily to prevent foreign matter or moisture deposited inside the pump.

Be careful not to damage air-flush port when doing air flush operation for pumping gases with slight powders or pumping vapors.

When first time operate the pump or operate the pump after long time stop, it will need longer time to arrive ultimate pressure, keep the pump in operation for 3 ~ 5 hours, open inlet to atmosphere for 3 ~ 5 seconds, 3 ~ 5 times per hour, to pumping out foreign matter or moisture deposited inside the pump.

### 9.3 Standard operation (with air flush close)

When pumping dry clean gas, conduct standard operation.

#### 9.3.1 Standard startup procedure

Close isolate valve to prevent the debris inside the pump surface to be drawback to the vacuum chamber.

Turn on pump switch.

Open the isolation valve to conduct vacuum pumping after makes sure that the pump is startup.

#### 9.3.2 Standard shutdown procedure

Be sure to close isolation valve before stop the pump to prevent the debris inside the pump to be drawback to the vacuum chamber.

Turn off pump switch, stop the pump.

### 9.4 Air flush operation (with air flush open)

When pumping vapor or gas with slightly powder, conduct air flush operation.

#### 9.4.1 Startup procedure

Close isolate valve to prevent the debris inside the pump surface to be drawback to the vacuum chamber.

Open air flush.

Turn on the pump switch.

Make sure that the pump is startup, and then open the isolation valve.

### 9.4.2 Shutdown procedure

Be sure to close isolation valve before stop the pump to prevent the debris inside the pump to be drawback to the vacuum chamber.

Continue air flush operation for over 1 hour, to remove condensed moisture in pump.

Close air flush.

Turn off the pump switch, stop the pump.

## 10. Inspection and maintenance

### 10.1 Safe precautions

Conduct periodical inspection and maintenance. Otherwise, it may cause the pump performance decrease or even failure.

Conduct inspection and maintenance after the pump fully cooled. Otherwise it may cause burn injury. It is suggested to cool for 1 ~ 2 hours after the pump stop operation.

Must cut off power source before inspection and maintenance to avoid electric shock or hurt by turning parts.

If it was in poor assembly or operation environment, shorten the maintenance interval.

Maintenance standard of the pump is made based on pumping clean gas, operation environment temperature around 41 ~ 104°F, average annual temperature about 77°F.

If environment temperature is lower, please decrease maintenance interval.

### 10.2 Daily inspection

Chart 3. Daily inspection content and maintenance measures

Items	Contents	Measures
Vacuum pump itself	Abnormal sound	Ask specialist to repair.
	Abnormal vibration	Ask specialist to repair
	Abnormal temperature	Ask specialist to repair
	Cooling fins are dirty or clogged	Blow air, cleaning
Cooling fan	Unsmooth turning	Ask specialist to repair
	Fan cover dirty, clogged, damaged	Blowing air, clean, ask specialist to repair.
Inlet gas muffler	Dirty, clogged	Replace
Exhaust valve	Dirty, clogged	Blowing air, clean
Power cords	Deteriorated	Replace

### 10.3 Periodical inspection

Chart 4. Periodical inspection and maintenance content

Description of maintenance kit	Description of maintenance parts	Qty	Interval	
			1 year or every 8,000 hr	2 years or every 16,000 hr
Tip seal kit	Tip seal	1	○	○
	O ring (Fixed scroll plates connect sealing)	1	○	○
	O ring (Fixed scroll plate air flush line sealing)	1	○	○
Shaft seal kit	Shaft seal (for fixed scroll plate seal)	2	△	○
	Shaft seal (for orbiting scroll plate seal)	2	△	○
Bearing kit	Bearing (for inside fixed scroll plate)	1	△	○
	Bearing (for outside fixed scroll plate)	1	△	○
	Bearing (for orbiting scroll plate)	4	△	○
Crank pin kit	Crank pin	1	△	△
	Crank pin spring gasket	1	△	△
Inlet kit	Gas inlet filter	3	△	○
	O ring (for fixed scroll plate and inlet sealing)	3	△	○
Exhaust valve kit	Exhaust valve spring	1	△	△
	Exhaust valve spool	4	△	△
	Retaining clamp	1	△	△
Bracket kit	Elastic coupling	1	△	△

**Note:**

○----Replace.

△----Replace if any thing goes wrong.

Maintenance interval must shorter than instructed above.

Before conduct maintenance after operated for 6 years or 48,000 hours, contact Supplier.

## 11. Troubleshooting

Chart 5. Troubleshooting

Problems	Causes	Remedies
Pump dose not rotate	Breaker failure	Inspect and repair
	Wiring loose or cut	Inspect and repair
	Voltage drops	Check cable length or size
	Motor failure	Inspect and repair (contact supplier)
	Pump failure	Inspect and repair (contact supplier)
Can not reach ultimate pressure	Pipe leak	Check and make sure pipe is well sealed
	Draw in water or solvent	Open inlet to atmosphere and operate for a few minutes. Then close isolate valve, pumping for 24 hours.
	Shaft seal broken	Replace (contact supplier)
	O ring broken	Replace (contact supplier)
Abnormal noise or vibration	Wiring loose or cut	Inspect and repair
	Pump set is not level	Adjust and make sure it is level.
	Foreign things enter pump inside	Inspect and repair (contact supplier)
	Exhaust valve failure	Inspect and repair (contact supplier)
	Motor failure	Inspect and repair (contact supplier)
	Pump failure	Inspect and repair (contact supplier)

If any above problem happens, make remedies as above. If problem cannot be solved, contact supplier.

## 12. Warranty

Scientific supply one year warranty for normally manufactured and sold, and operated DV series dry scroll vacuum pumps.

Take fully filled "Warranty sheet" ( Chart. 8 ) with the pump, and give it to SH Scientific for successful warranty service.

## 13. After sale service

### 13.1 Maintenance

SH Scientific supply repair for normally manufactured and sold, and operated SH-DV series dry scroll vacuum pumps after one year warranty period . Repair work includes spare part exchange, repair for abnormal operation and others.

Take fully filled "Declaration on chemical contamination" ( Chart. 9 ) with the pump, and give it to Supplier for successful repair or after sale service.

### 13.2 Spare part purchase

Contact Supplier for spare part and accessories purchase and technical service .

Contact information see above part "11. Troubleshooting". Please make clear followings when order spare part and accessories:

Pump Model, Description, and S/N.

## 14. Storage

Clean vacuum chamber and the pump inside with dry nitrogen.

Disconnect the pump and vacuum chamber.

Disconnect electric power source between the pump and power source.

Close the pump inlet and exhaust port with protect cover.

Move and store after the pump stop 1 ~ 2 hours, fully cooled.

Try to keep the pump in original packing box. Inlet/exhaust port should sealed before connect to the vacuum chamber pipe.

Keep the pump in a place free of flammable, explosive gases, dirt or dust, iron debris, stone or wood parts, corrosive gases or expose to rain.

## 15. Discard

Treat the discarded pump according to local safe and environment requirement.

