



Empowering you to work smarter

ShieldDrive Vacuum Pump Operating Manual



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

**SAVE THIS MANUAL
FOR FUTURE REFERENCE**

NAVAC Inc.
www.navacvacuum.com
Tel/Fax: +1 877 MY-NAVAC
877 696 2822
MADE IN PRC

Contents

1. Introduction	1
1.1) About the Symbols	1
1.2) Safety Symbols	1
1.3) Attention	1
1.4) Unpack and Inspect	2
2. Product	3
2.1) Appearance	3
2.2) Structure and Features	3
2.3) Technical Data	4
2.3.4) Dimension	5
3. Installation	6
3.1) Transport	6
3.2) Pump Installation	6
3.3) Oil Filling and Draining	6
4. Power Supply	7
5. Pump Connection to a System	7
6. Pump Operation	7
6.1) Inspection Before Operation	7
6.2) Gas Ballast	7
6.3) ECO Mode	8
6.4) Shut Down	8
7. Maintenance	8
7.1) Pump Oil Checking	8
7.2) Pump Oil Changing	8
7.3) How to Change Oil	9
7.4) Inlet Filter Cleaning	9
7.5) Daily Maintenance Items	10
7.6) Troubleshooting	11
8. Disposal	11
9. Warranty	11
10. Spare Parts	12
10.1) Exploded View	12
10.2) Spare Parts List	13

Introduction

1.1 About the Symbols

- 1). Read the operating manual carefully before installation and operation of the pump.
- 2). The symbols of Warning and Caution are used to indicate important safety information.

The meanings are:

Warning

Failure to observe the terms could result in personal injury or even death.

Caution

Failure to observe the terms could result in damage to the pump, which may cause malfunction or less performance.

1.2 Safety Symbols

It is important that you read these descriptions thoroughly and fully understand the warning symbols in this manual. The following warning labels are on the pump:



This warning label indicates risk of electrical shock.



This warning label indicates high temperature hazard.

1.3 Attention

Warning

- 1). Before starting the pump, the motor must be effectively grounded and properly connected with a rated motor protection switch.
- 2). The exhaust passage must be unimpeded before operating. Make sure that the gas flow from the exhaust port is not blocked or restricted in any way.
- 3). Disconnect the pump from the power supply before repair and maintenance.
- 4). The pump is strictly prohibited to displace active toxic, flammable or explosive gases.
- 5). The pump is strictly prohibited to operate in areas with risk of fire and explosion.
- 6). Do not touch the pump or motor! The surface of the pump could be very hot during operation and after shutdown within one hour.

Caution

- 1). The pump must be operated at ambient temperature between 41°F - 104°F.
- 2). Do not place obstacles around motor which may affect ventilation and cause burn hazard and fire by abnormal temperature rise.
- 3). The power supply for the pump must be identical with the information shown on the pump nameplate.

4).Check the oil level before operation. Do not operate the pump without oil or short of oil. Otherwise it will result in pump failure.

5).It's required to install a filter while pumping a small amount of dust or condensable gases. Otherwise it will cause pump failure or sharp drop of performance.

1.4 Unpack and Inspect

Please check the following when you receive the product and open the packing box:

- 1). If the product you receive is what you ordered.
- 2). If the accessories (including pump oil for first time use and optional parts) are delivered according to the order.
- 3). If any damage is occurred during transportation.
- 4). If any bolts (screws) are loose or missing during transportation.
Feel free to contact us if you experience any problems.



Caution

Do not place the pump upside down or get it impacted to prevent possible damage.

Product

2.1 Appearance

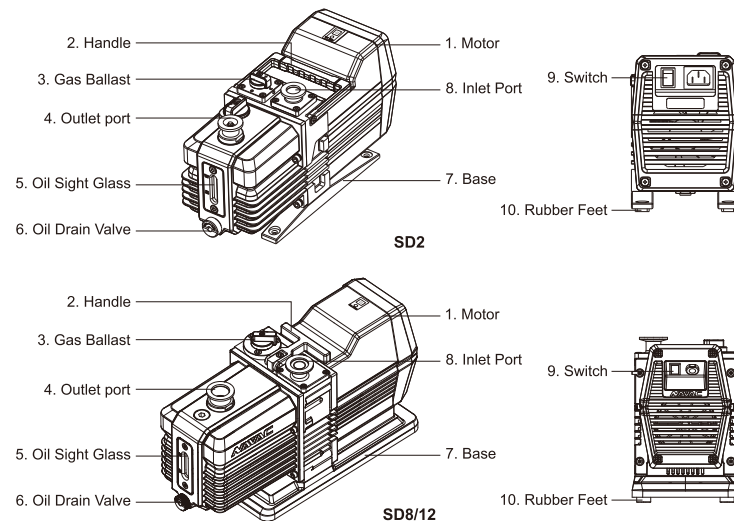


Fig. 1

2.2 Structure and features

- 1). SD Series pump is a dual stage rotary vane pump that is driven by a brushless DC motor which features energy-saving.
- 2). Corrosion resistant treatment is made to pump stator, rotor and all bolts inside are made of SUS304. Thus, the pump meets requirements of corrosive applications.
- 3). Thanks to magnetic coupling which results in static sealing instead of traditional dynamic sealing, the oil leakage risk is reduced to the minimum. The service life of the pump is therefore prolonged.

2.3 Technical Data

- 1). Operating and Storage Conditions

Ambient Temperature (Operation)	41°F ~ 104°F
Ambient Temperature (Storage)	-22°F ~ 158°F
Transport and Storage	Room Temperature
Max. Humidity (Operation)	85% RH
Max. Altitude (Operation)	1000 m

Table 1

2). Specifications

Model			SD2	SD8	SD12
Displacement	60Hz	m ³ /h	2.5	8	10
Ultimate Total Pressure without gas ballast		Pa	5x10 ⁻¹	5x10 ⁻¹	5x10 ⁻¹
Ultimate Total Pressure with gas ballast		Pa	3	3	3
Power Supply			Single Phase	Single Phase	Single Phase
Power Rating		kW	0.25	0.37	0.37
Inlet and Exhaust Port			KF16	KF25	KF25
Oil Capacity		L	0.33	1	1
Motor Speed	50/60Hz	rpm	1800	1500	1850
Ambient Temperature		°C	10 - 40	10 - 40	10 - 40
Noise		dB	≤50	≤52	≤53
Weight		lbs	22	33	33

Table 2

3). Pumping Speed Characteristics

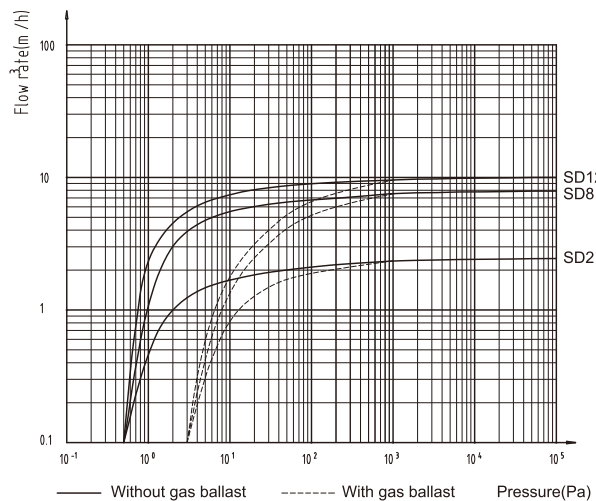
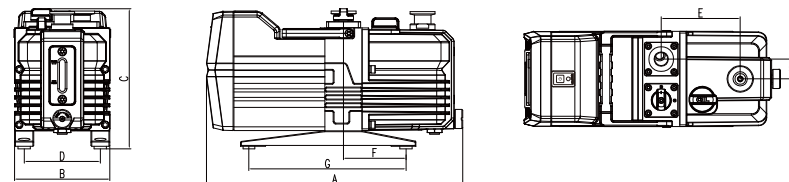


Fig. 2

4). Dimensions

SD2



SD8/12

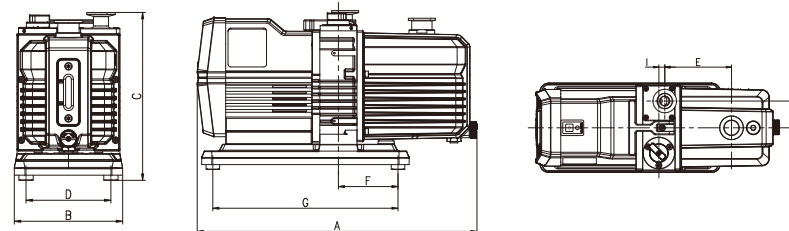


Fig. 3

Unit: inch

Model	A	B	C	D	E	F	G	H	I
SD2	12.2	4.5	6.6	3.6	3.7	2.9	7.5	0.95	/
SD8	16.3	6	9.3	4.7	4.5	3.4	10.7	1.8	0.4
SD12	16.3	6	9.3	4.7	4.5	3.4	10.7	1.8	0.4

Installation

3.1 Transport

The pump is fitted with a handle. Move the pump with care.

Warning

Do not move the pump unless it's switched off and the power supply is disconnected.

3.2 Pump Installation

Install the pump on a flat and firm surface. The oil sight glass shall be observable after installation. Make sure there's enough room for oil drainage and the power supply shall be easily accessible.

Warning

The pump is strictly forbidden to operate in areas with risk of fire and explosion.

Warning

Do not place obstacles around motor which may affect ventilation and cause burn hazard and fire by abnormal temperature rise.

Caution

Uneveled installation may result in pump's vibration, loud noise or even damage.

3.3 Oil Filling and Drainage

Remove Oil Mist Filter and fill oil into the pump. The first oil filling shall reach 80 - 90% below MAX position. Remove Oil Drain Valve to discharge the excess oil above MAX position.

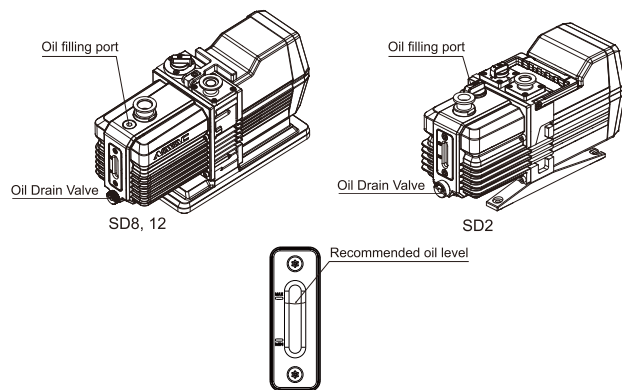


Fig. 4

Warning

The pump must be switched off before filling oil.



Fig. 5

4. Power Supply

Warning

The electrical connections must be performed by a skilled electrician according to the technical guidelines and wiring regulations for electrical equipment. Incorrect connections may result in injuries or even death.

SD Series Pump is a single-phase pump with cable and switch. It's not necessary to check the motor rotation direction. Connect the pump to the power supply of single phase to operate the pump. The pump motor is equipped with an overload and an overheat protector.

If the overheat protector is activated, disconnect the power supply before pump automatically restarts.

Caution

The power supply for the pump must be identical with the information shown on the pump nameplate.

5. Pump Connection to a System

The pump is connected with a vacuum system by quick release flange. At the outlet port there is an oil mist filter.

1) To achieve best pumping speed, the hose connected to the inlet port shall be as short as possible.

The inner diameter of the hose is not less than 16 mm.

2) Check filter of inlet port regularly and keep it clean.

3) An inlet filter is required for dirty applications. No dirt is allowed to enter the pump chamber.

4) Detect leak on the connection between the hose and the flange. Good tightness ensures the pump to reach the ultimate pressure.

5) Do not pump liquid.

6) Do not pump flammable or explosive gases.

6. Pump Operation

6.1 Inspection Before Operation

1) Make sure the exhaust port is unblocked before operating the pump.

2) Check whether the filled oil amount meets requirement. Its' recommended to use genuine oil provided by NAVAC.

3) Check whether the power supply for the motor is identical with the information of voltage and frequency on the motor nameplate.

6.2 Gas Ballast

1). Pumping non-condensable gases in the vacuum system

Close the gas ballast to pump non-condensable gases (Gas ballast position refer to Fig. 6).

The ultimate pressure will rise (loss of vacuum) when the gas ballast is open.

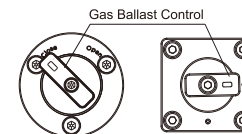


Fig. 6

2). Pumping condensable gases (vapor) in the vacuum system:

- 2.1). If the vacuum system contains a small amount of condensable gas, open gas ballast (Move gas ballast to open position refer to Fig. 6) to displace the vapor.
- 2.2). If the pump operates at low temperature, condensable gases may be dissolved in the pump oil. The oil may be deteriorated and then affect the pump performance, or even cause corrosion of the pump body. Therefore, DO NOT shut down the pump immediately when the pumping process is finished. Keep the pump running with gas ballast open and inlet port closed (It's recommended to run 30 minutes or more) to remove the condensable gases dissolved in the oil.

Warning

High temperature hazard! Do not touch the surface! The surface of the motor and pump could be very hot during operation and after shutdown within one hour.

Caution

It's recommended to open gas ballast to pump condensable gasses with small amount.

6.3 ECO Mode

To activate the energy-saving mode on the pump, simply press the ECO button. When in ECO mode, the indicator light will illuminate green. The pump will stay in ECO mode setting even when turned off until the ECO button is pressed again to revert to normal mode.

6.4 Shut Down

- 1). Normal stop
The pump can be shut down directly after a normal operation is finished. The integrated anti-siphon valve will close the inlet port automatically to prevent oil return and keep vacuum chamber clean.
- 2). Pump not in use for long time
 - 2.1). Cover the inlet and exhaust port to prevent the pump body from dust or dirt.
 - 2.2). Close the inlet port (No. 7 in Fig. 1) and open gas ballast (No. 3 in Fig. 1) before restarting the pump.
Keep the pump running for 30 minutes or more to eliminate the gases absorbed in the oil due to long time no use. If the ultimate vacuum still cannot be reached, replace vacuum oil.

7. Maintenance

Warning

Switch off the power supply to the pump before inspection and keep the power supply disconnected during inspection. Otherwise personal injury may occur.

Warning

High temperature hazard! Make sure the pump is cooled down before maintenance.

7.1 Pump Oil Checking

Make sure the oil is clean and oil capacity is proper to ensure the performance and service life of the pump. The oil level shall be between MAX and MIN position during pump operation (refer Fig. 4). If the oil level is below MIN position, pour more oil into the pump on time. The frequency of oil replacement depends on working conditions. Regular inspection is required. The oil color observed shall be clear. If it's cloudy, discolored or contaminated, change oil immediately.

7.2 Pump Oil Changing

- 1) If the pump displaces high volumes of vapor or corrosive gases, change the oil on time.
- 2) If the ultimate pressure drops after long time operation, change the oil on time.
- 3) It's recommended to replace the oil after 100 hours operation for a new pump.
- 4) If the pump works at pressure higher than 1000 Pa, check and add oil on time.
- 5) If the pump is used for clean gases at low pressure, it's recommended to replace the oil every 2000 hours.

Warning

In case of presence of hazardous substances caused by media sucked into the pump, it's necessary to define the hazard and take all necessary safety precautions.

Warning

In condition that hazardous substances exist, determine the hazard and follow all appropriate safety procedures. If the potential hazard is still there, the pump must be decontaminated before any maintenance.

Warning

Do not change the oil when the pump temperature is high. Fit suitable guards and change oil when the pump is cooled down (less than 50°C).

Caution

Use proper vacuum oil for NDD pump to ensure stable operation and specific performance. It's recommended to use genuine vacuum oil.

7.3 Changing oil

- 1) Operate the pump for approximately 10 minutes to warm the oil (The oil can be drained easily then).
- 2) Open inlet port (about 10 seconds) before shutting down the pump to drain the oil inside pump chamber.
- 3) Switch off the pump from the power supply.
- 4) Open the oil drain valve to drain the oil.
- 5) If the oil is contaminated, pour clean oil into the filling hole and allow it to drain out of the pump.
Repeat this step till the contaminated oil reservoir in the pump is thoroughly cleaned.
- 6) Close the oil drain valve.

Warning

Do not change the oil if the pump is not switched off.

Warning

Do not change the oil when the temperature of the pump and the motor is high.

7.4 Inlet filter cleaning

The pumping speed will be reduced when the filter is blocked by dust or dirt. Meanwhile, the pump body could be damaged after the dirt enters into the pump chamber. In this case a replacement is required.

- 1) Disconnect the vacuum system from the inlet port.
- 2) Remove O-ring from the centering ring and inlet filter.
- 3) Clean the centering ring and filter by compressed air or proper detergent.
- 4) Refit O-ring to the centering ring and filter, and then to the inlet port. Refit the vacuum system to the pump inlet.

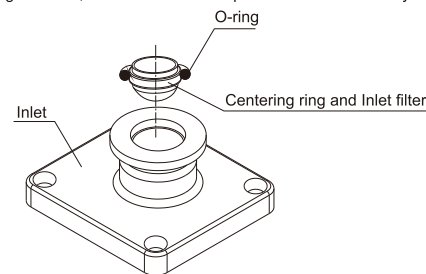


Fig. 7

7.5 Routine Inspection

NO.	Content	Operation	Frequency
1	Oil level	Visual inspection (proper level)	Every three days
2	Oil color	Visual inspection (normal)	Every three days
3	Pump noise	Acoustic inspection (normal)	Every three days
4	Pump vibration	Visual inspection (normal)	Every three days
5	Pump temperature	Temperature meter (normal)	Every one week
6	Seal & O-ring	Visual inspection (no oil leak)	Every one week
7	Filter of inlet port	Visual inspection (no dirt)	Every three months

Table 3

7.6 Troubleshooting

Fault	Possible Reason
The pump cannot start.	1. The power supply fuse is failed.
	2. The power supply voltage doesn't match that of motor.
	3. The ambient temperature is too low.
	4. The vacuum oil is too viscous.
	5. The vacuum oil is contaminated.
	6. The pump is left to stand after contaminants are pumped and seized.
	7. The motor is faulty.
The pump cannot reach ultimate pressure.	1. The pump is not proper (too small) for the vacuum system.
	2. The vacuum system leaks.
	3. The type of vacuum oil is wrong.
	4. The vacuum gauge is inaccurate or unsuitable.
	5. The oil level is too low.
	6. The vacuum oil is contaminated.
	7. The oil lubricating channel is blocked.
	8. The inlet port is dirty.
	9. The displacing valve is faulty.
The pump is noisy.	1. The motor bearings are worn.
	2. Some solid particles enter into the pump.
	3. The oil level is too low.
	4. Some component inside is damaged.

Fault	Possible Reason
The pumping speed is low.	1. The connecting pipeline is too narrow or too long.
	2. The vacuum system leaks.
	3. The inlet channel is blocked.
The pump surface temperature is too high.	1. The ambient temperature is too high.
	2. The pump operates continuously for long time under high pressure.
	3. The type of vacuum oil is wrong.
	4. The process gas is too hot.
	5. The outlet filter or pipeline is blocked.
	6. The vacuum oil is contaminated.
	7. The oil level is too low.
	8. The ventilation is insufficient.
	9. The oil circulation inside the pump is problematic.
The vacuum is not maintained after the pump is switched off	1. The vacuum system leaks.
	2. The anti-suckback valve is faulty.
There's much oil spray at outlet port.	1. The pump operates continuously for long time under high pressure.
	2. The oil level is too high.
There's oil leak on sealing surface.	1. The seal is worn or damaged.

Table 4

8. Disposal

- 1) Disposal of the pump and any components removed from it must be in accordance with all local and national (regional) safety and environment requirements.
- 2) Take particular care with components and waste oil which have been contaminated with dangerous process substances.
- 3) Do not incinerate any fluoroelastomer seals and O-rings .

9. Warranty

- 1) SD Series pump has one year guarantee from the date of purchase.
- 2) Free maintenance service will be provided within the period of guarantee in condition that the pump is operated according to the operating manual.
- 3) The following failures will be charged for repair:
 - a. Malfunction caused by nature disasters or artificial factors
 - b. Malfunction caused by special operating environment
 - c. Damage of wear parts (see Table 4)
 - d. Malfunction caused by abnormal operation or incorrect use identified by our technicians
- 4) Consumables such as vacuum oil and filter elements are not under warranty.

Spare Parts

10.1 SD2 Exploded View

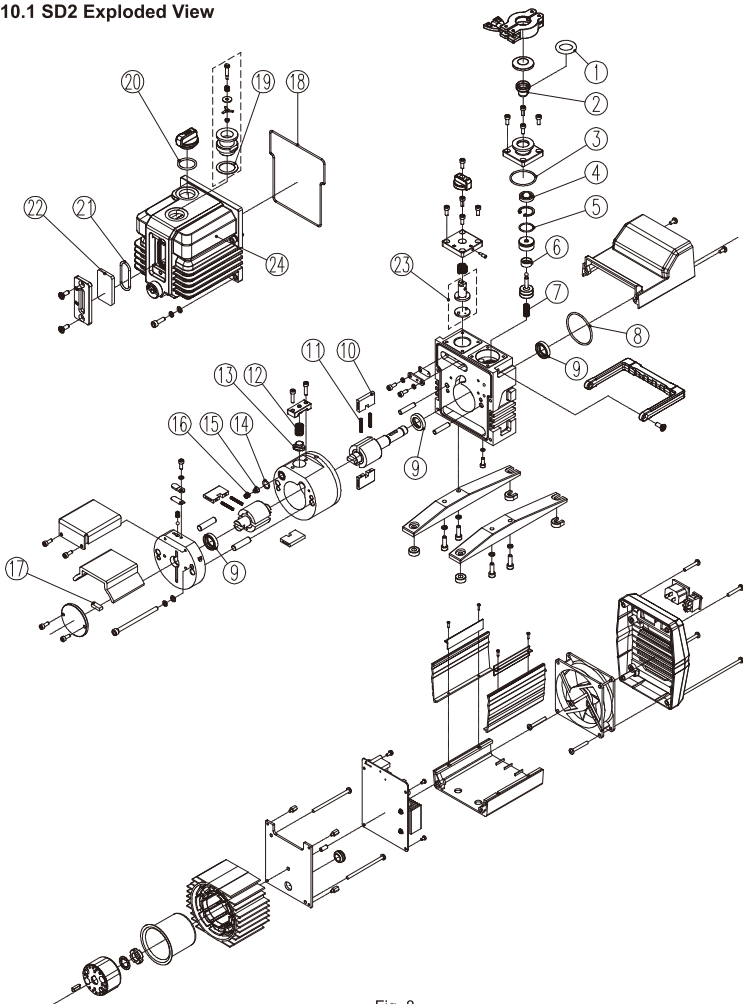


Fig. 8

10.2 SD2 Spare Parts List

Item No.	Description	Quantity (PCS)
1	O-ring	1
2	Filter (KF16)	1
3	O-ring	1
4	Anti-suckback plate	1
5	O-ring	1
6	Seal	1
7	Spring	1
8	O-ring	1
9	Seal	3
10	Vane	4
11	Spring	4
12	Spring	1
13	Displacing head	1
14	O-ring	1
15	Gas ballast head	1
16	Spring	1
17	rotary vane	1
18	O-ring	1
19	Gasket	1
20	O-ring	1
21	O-ring	1
22	Oil sight glass	1
Optional parts		
23	Gas ballast stem	1
24	Oil tank	1

Table 5

10.3 SD8, 12 Exploded View

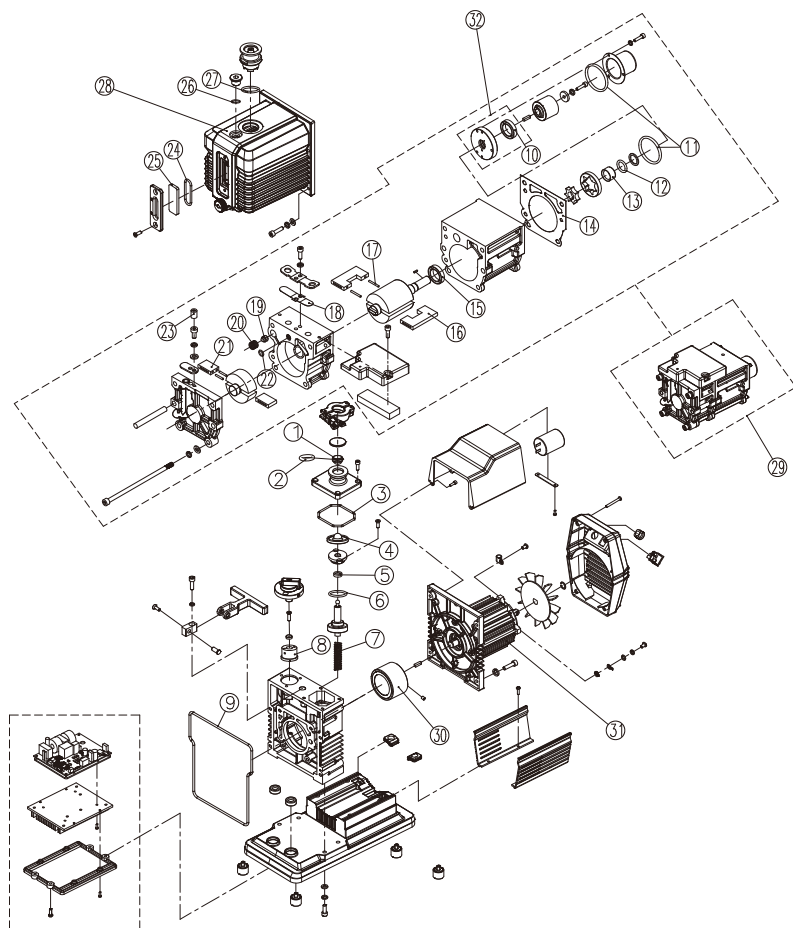


Fig. 9

10.4 SD8, 12 Spare Parts List

Item No.	Description	Quantity (PCS)
1	Filter (KF25)	1
2	O-ring	1
3	O-ring	1
4	Anti-suckback plate	1
5	Seal	1
6	O-ring	1
7	Spring	1
8	Gas ballast bushing	1
9	O-ring	1
10	Seal	1
11	O-ring	2
12	O-ring	1
13	Sleeve	1
14	Gasket	1
15	Seal	1
16	Fore vane	2
17	Spring	4
18	Displacing valve	1
19	Gas ballast head	1
20	Spring	1
21	Rear vane	2
22	O-ring	1
23	Sealing cover	1
24	Sealing ring	1
25	Oil sight glass	1
26	O-ring	1
27	O-ring	1
Optional parts		
28	Oil tank	1
29	Pump body	1
30	Magnetic coupling	1
31	Motor	1
32	Oil pump cover	1

Table 6