NAVAC

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

Empowering you to work smarter NAVAC

1. 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.


Read the Instruction Manual.


Hearing protection must be worn


If cable is damaged, pull the plug from the mains before examining.


Do not use in rain or wet conditions.

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 50°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.

2. Product

2.1 Appearance

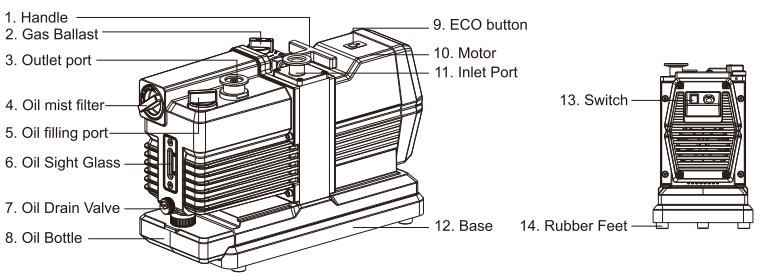

Fig. 1

2.2 Structure and features

1) SDi 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 and 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)	50°F ~ 104°F
Ambient Temperature (Storage)	-22°F ~ 158°F
Storage	Room
Max. Humidity (Operation)	85% RH
Max. Altitude (Operation)	1000 m

Table 1

2) Specifications

Model			SD4i	SD8i	SD12i	SD16i
Pumping Speed	50/60Hz	m^3/h	4	8	12	16
Ultimate Total Pressure without gas ballast		mbar/Torr	$2x10^{-3}$ mbar $1.5x10^{-3}$ Torr			
Ultimate Total Pressure with gas ballast		mbar/Torr	$3x10^{-2}$ mbar $2.2x10^{-2}$ Torr			
Power Supply		/	SD4i, SD8i, SD12i, SD16i: 115V/60Hz SD4i-2, SD8i-2, SD12i-2, SD16i-2: 200-240V~50/60Hz			
Power Rating		HP(kW)	1/3 (0.25kW)		1/2 (0.37kW)	
Inlet and Exhaust Port		/	KF25			
Oil Capacity		L	0.8			
Ambient Temperature		°F	50 ~ 104			
Noise		dB	≤50	≤52		≤54
Weight		lbs	16.5		17	

Table 2

3) Pumping Speed Characteristics

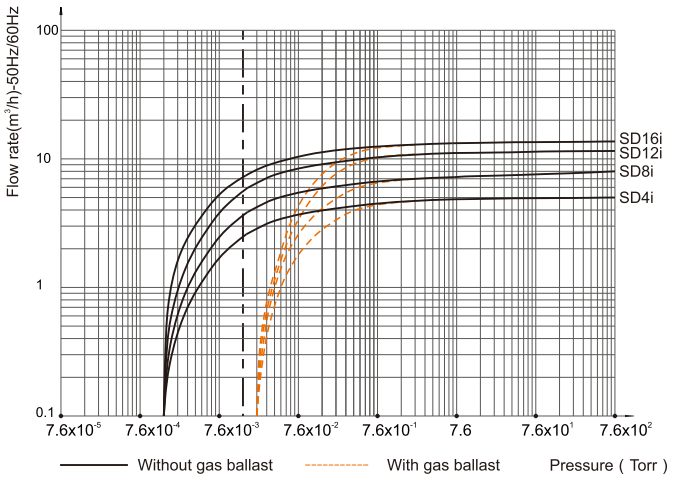

Fig. 2

4) Dimensions

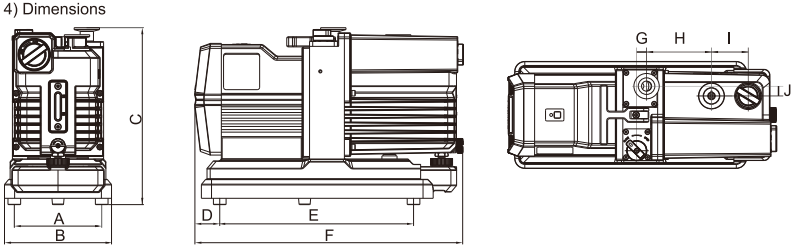

Fig. 3

Unit: inch

Model	A	B	C	D	E	F	G	H	I	J
SD4i/8i/12i/16i	5.4	6.6	11	1.5	12	16.7	0.6	4	2.3	0.6

Empowering you to work smarter NAVAC

3. 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

Oblique installation may result in pump's vibration, high noise or even damage.

3.3 Oil Filling and Drainage

Remove Oil Filling Port (No. 5 in Fig. 1) and fill oil into the pump. The first oil filling shall reach 80 - 90% below MAX position. Open Oil Drain Valve (No. 7 in Fig. 1) to discharge the excess oil above MAX position.

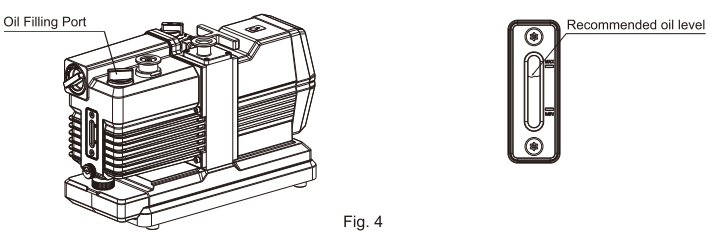

Fig. 4

Warning

The pump must be switched off before filling oil.

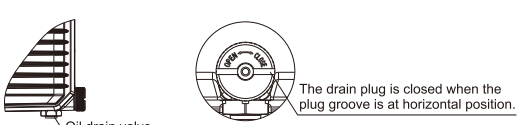

Fig. 5

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.

SDi 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.

The motor will be shut down when the protector is activated. After the motor is cooled down, the pump starts to work again automatically. The plug must be taken from the power supply before any operation to the pump.

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.

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 dusty applications. No dust 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 the pump manufacturer.
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 (No. 2 in Fig. 1) 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.

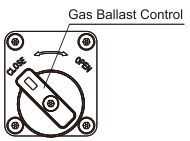

Fig. 6

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.

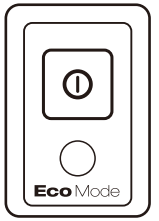

Fig. 7

6.4 Shut Down

1). Normal stop

The pump can be shut down directly after a normal operation is finished. The integrated anti-suckback 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. 11 in Fig. 1) and open gas ballast (No. 2 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 122°F).

Caution

Use proper vacuum oil for SDi 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 (refer to Fig. 5) 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 Plug. Fill clean oil into the pump till the oil reaches the specific level by observing oil sight glass.

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.

Empowering you to work smarter NAVAC

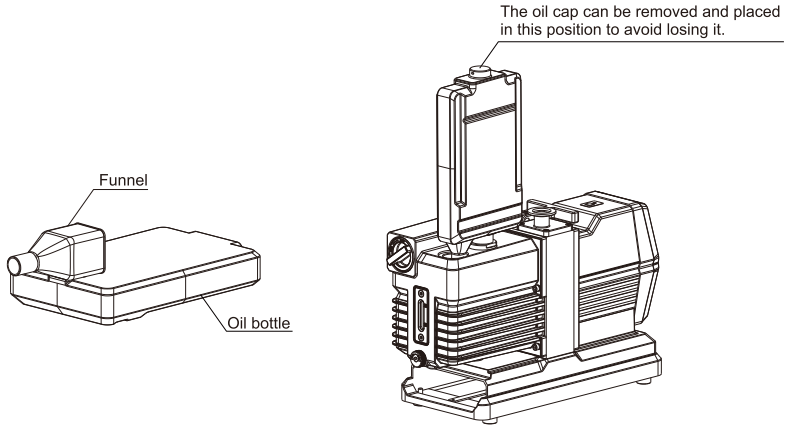

Fig. 9

How to drain the oil

First open the cap of the oil bottle, open the oil plug, open the drain knob to start draining, close the drain knob after draining, return the oil bottle to its place.

How to add oil

Install the oil funnel on the oil bottle, open the oil plug, then add oil (note that the oil drain knob is closed), close the oil plug after adding oil, the oil bottle and the oil funnel return to their place.

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 (refer to Fig. 8).
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.

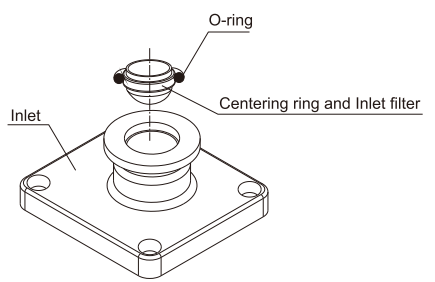

Fig. 8

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	Solution
The pump cannot start.	1. Out of electrical 2. Operation voltage is abnormal 3. Motor is malfunctioning 4. Overload protector start up 5. Oil temperature is below 10°C 6. Pump is jammed 7. Out of operation for long, liquid and organic solvents result rust of the pump body 8. Pump inner accessories are damaged	1. Check the connection of power supply, switch 2. Voltage wave within ±10% 3. Replace the motor 4. Press the overload protector 5. Heat the pump and pump oil 6. Repair the pump 7. Repair the pump 8. Repair the pump
Pump can not reach to the maximum pressure	1. Pump is too small 2. Vacuum system leak 3. Measuring technique or gauge is unsuitable 4. Vacuum gauge not correct 5. Oil level is too low 6. Oil is unsuitable or deteriorated 7. Lubricate seal oil channel inside pump blocked 8. Intake line is dirty 9. Exhaust valve is malfunctioning	1. Replace the pump 2. Check the leakage 3. Use correct measuring technique and gauge. Measure the pressure directly at pump's intake port 4. Chose suitable vacuum gauge. 5. Add oil 6. Change oil 7. Clean oil channel 8. Clean the vacuum lines. 9. Repair the valve.
The pumping speed is low.	1. Intake port channel is clogged 2. Connecting lines are too narrow or too long 3. Exhaust port channel is clogged unsuitable 4. Exhaust filter is clogged	1. Clean the intake port channel 2. Use adequately wide and short connecting lines. 3. Keep the exhaust port channel free 4. Clean or change the exhaust filter
Abnormal voice	1. Abnormal input power supply 2. Motor is malfunction 3. Foreign body into the pump 4. Oil level is too low 5. Coupling element is worn 6. Pump inner accessories are damaged.	1. Check the connection of power supply, switch 2. Voltage wave within ±10% 3. Clean the pump body 4. Add oil 5. Install new coupling element 6. Repair or change the accessories

Fault	Possible Reason	Solution
Higher temperature than normal	1. Continuous operation under high pressure in the intake port 2. Oil level is too low 3. Process gas is too hot 4. Cooling air supply is obstructed 5. Pump fan is malfunction 6. Oil cycle is obstructed 7. Ambient temperature is too high	1. Shorten exhaust time as far as possible 2. Add oil 3. Set pump up correctly 4. Set pump up correctly 5. Change the pump fan 6. Clean and repair the oil lines and channels 7. Reduce the ambient temperature
Oil in the intake line or in vacuum vessel	1. Oil comes from the vacuum system 2. Anti-suckback valve spring is obstructed 3. Anti-suckback valve board is obstructed 4. Oil level is too high	1. Check the vacuum system 2. Change the anti-suckback valve spring 3. Change the anti-suckback valve board 4. Drain the excess oil
After switching the pump, pressure in system rises too fast	1. System has a leak 2. Anti-suckback valve is malfunctioning	1. Check the vacuum system 2. Repair the anti-suckback valve
Too much oil in the exhaust port	1. Too much oil in the pump 2. Continuous operation under high pressure in the intake port	1. Drain some oil 2. Shorten exhaust time as far as possible
Oil seal leak	1. Oil seal broken 2. Seal ring was deformed	1. Replace new oil seal 2. Replace new seal ring

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) SDi 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 indentified by our technicians
4) Consumables such as vacuum oil and filer elements are not under warranty.

10. Spare Parts

10.1 SDi Series Exploded View

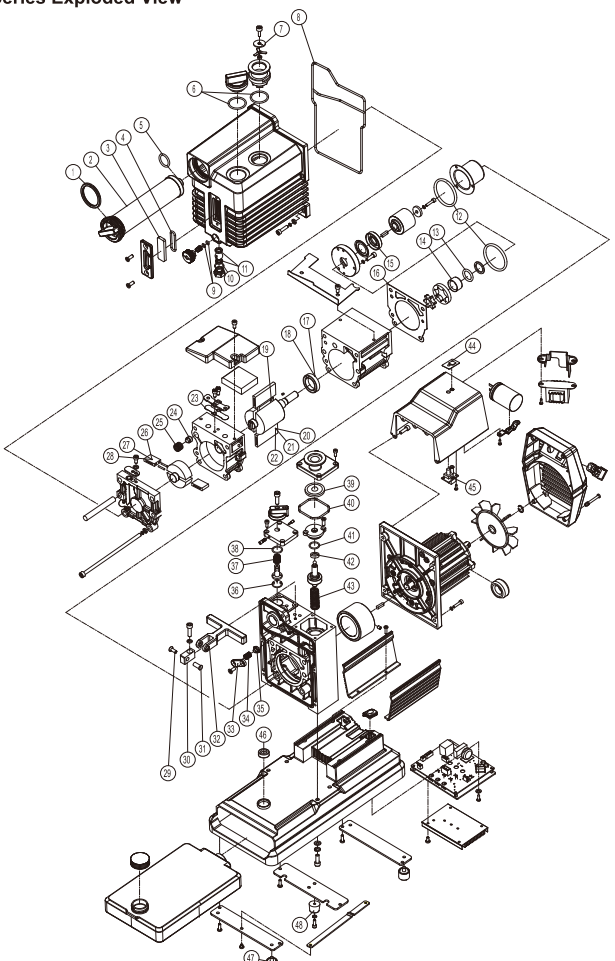

Fig. 10

Empowering you to work smarter NAVAC

10.2 SDi Series Spare Parts List

Item No.	Description	Qty
1	Y-ring Seal Ring	1
2	Oil Mist Filter Element Assembly	1
3	Oil Lens	1
4	Oil Mirror Seal Ring	1
5	O-ring	1
6	O-ring	1
7	Rubber Plate	1
8	O-ring	1
9	O-ring	2
10	O-ring	1
11	Seal	2
12	O-ring	2
13	O-ring	1
14	Bushing	1
15	Oil Seal	1
16	Front end gasket	1
17	Oil Seal for SD4i/8i	1
18	Oil Seal for SD12i/16i	1
19	Spring	4
20	Front Vane for SD12i	2
21	Front Vane for SD16i	2
22	Front Vane for SD4i/8i	2
23	Exhaust Valve Plate	1
24	Gas Ballast Valve Heads	1
25	Spring	1
26	Rear Vane for SD4i/8i	2
27	Rear Vane for SD12i	2
28	Rear Vane for SD16i	2
29	Screw	1
30	Handlebar Seat	1
31	Handlebar Swivel	1
32	Handle	1
33	Press Board	1
34	Spring	1
35	Rubber Head	1
36	Gas Ballast Rubber Mats	1
37	Spring	1
38	O-ring	1
39	Anti-suckback Plate	1
40	O-ring	1
41	O-ring	1
42	Oil Seal	1
43	Spring	1
44	Button Labeling	1
45	Plate	1
46	Rubber Pad	1
47	Rubber Feet	4
48	Rubber Feet	1

Table 5