

Helium Compressor Unit Instruction Manual

SW112-C

Export Control Policy

When applying a refrigerator to a cryocooler for optical sensors, the cryocooler falls under row 6.A.2.d.2 of the control list established by The Wassenaar Arrangement, which is equal to row 10(2) of appended table 1 of Japan's Export Trade Control Order.

Customers must follow all related rules and regulations such as Foreign Exchange and Foreign Trade Act and take appropriate procedures when exporting or re-exporting our refrigerators.

INTRODUCTION

Thank you for choosing our products. This instruction manual provides information and precautions on handling, installation, operation, and maintenance of the product.

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. To ensure proper use of this product, read this instruction manual carefully and keep this manual close at hand so that you can use for reference during operation.

If you purchased our other products and/or optional devices with this product, read relevant instruction manuals carefully.

- (1) It is strictly prohibited to duplicate or distribute this instruction manual or any of its parts to a third party without written permission from ULVAC CRYOGENICS.
- (2) Information in this document is subject to change without notice due to specification change or the improvement of the product.
- (3) If you have any questions or comments on this document, please do not hesitate to contact us. The phone numbers of local customer support centers are listed at the end of this manual.

Safety Conventions

Our products have been designed to provide extremely safe and reliable operation when properly used. Following safety precautions must be observed during normal operation and when servicing them.

**WARNING**

A warning describes safety hazards or unsafe practices which could result in severe injury or loss of life.

**CAUTION**

A caution describes safety hazards or unsafe practices which could result in personal injury or equipment

**Toxic gas or chemicals used.**

There is a risk of severe injury upon contact.

**Corrosive chemicals used.**

There is a risk of severe injury upon contact.

**Flammable gas used.**

There is a danger of fire or burn injury.

**Explosive gas used.**

There is a risk of fire or explosion.

**Hazardous voltage .**

Electric shock may cause severe injury or loss of life.

**Hot heating part present.**

There is a risk of burn injury.

**Low-temperature area present.**

There is a risk of frostbite. Do not touch.

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Safety Instructions

1. Danger of electric shock exists. Do not touch electric parts.



Ensure to disconnect power before performing installation, maintenance or repair works. Touching non-isolated parts inside the compressor unit may cause severe injury including electric shock or equipment damage. Connect the earth wire to Class C grounding.

2. Danger of explosion exists. Do not expose to corrosive gases.



This system contains high-pressure helium gas. The gas must be removed before disassembling for maintenance or disposal. Optional helium charge adopter kit is required to release helium gas.

Do not use this system in the atmosphere of corrosive gas (such as chlorine). It may result in damaging human body or equipment failure.

3. Danger of burn injury exists. Never touch high temperature surface





Inside this equipment, there are high temperature areas, such as compressor motor or discharge line, during operation and immediately after shutdown.

When performing repair or maintenance works, wait until the inside returns to the normal temperature before start working. If the work starts when it is still hot, there is a risk of burn injury.

Disposal Considerations

The equipment and component parts must be disposed in accordance with applicable local and domestic standards for industrial wastes.

	 WARNING
<ul style="list-style-type: none">● Do not disassemble, pressurize, heat, and/or throw into fire. The adsorber may explode.● For safe disposal of an adsorber, follow the procedures below.<ol style="list-style-type: none">1) Depressurize high pressure helium gas in the adsorber to an ambient atmospheric pressure. To do so safely, connect the proper tools such as our charging adaptor (for refrigerator maintenance).2) Before proceeding with disposal work, remove the couplings of the adsorber to visually confirm that it has been depressurized.	

We offer Safety Data Sheet (called SDS) of our products upon your request. For detailed information please contact our Service Engineering Division or the nearest customer support center.

Unpacking and Inspection

Upon receiving the compressor unit SW112-C, immediately check for any damage that may have occurred during shipping according to the following procedures.

1. Check for any visible dents, etc., on the outside the packaging for shipping. Keep the packaging for shipping in case you need to make a claim regarding dents, etc.
2. Remove the packaging and check for dents, etc., on the compressor unit.

Never tilt the compressor unit more than 30 degrees.

Tilting the compressor may result in compressor failure or oil leaking into the helium gas pipes.

Make sure there are no defects in the following (a) - (c).

- (a) Overall exterior
- (b) Oil leaks
- (c) Helium gas charged pressure

Make sure the pressure gauge indicates 2.0 MPa at 20 °C.

If the pressure gauge indicates less than 2.0 MPa, add helium gas according to the procedures described in 4-1-2 Charging Helium Gas.

If the pressure gauge indicates 0MPa, some impurities may be mixed in the helium gas and the unit must be replaced.

Please contact us if any problem is observed.

Shipping

When shipping the compressor unit, follow the steps below.

- Attach protection caps to all self-sealing couplings for safe shipping.
- Use the packing materials as same as used at the time of shipment.
- Securely and correctly pack the compressor unit.
- Attach “No Tilting” and “This Side Up” caution labels.

1. General Description

1.1 Specifications

Table 1.1 shows the specifications for Compressor Unit SW112-C.

Table 1-1 Compressor Unit SW112-C Specifications

Compressor unit		SW112-C	
Power source	φ, V, Hz	Single phase, 100, 50/60	
Power consumption *1	kW	1.0/1.2	
Starting current *1	A	56/52	
Operating current *1	A	11.0/12.2	
Compressor nominal output *2	W	700	
Condition Ambient	Installable room temperature	°C	4-38
	Installable room humidity	%Rah	88 % or lower
Condition Cooling Water	Flow rate *3	L/min	2 – 5
	Inlet temperature *3	°C	5 – 35
Refrigerant	Helium gas	99.999 % or purer	
Refrigerant filling pressure	MPa	2.0±0.05 (20°C)	
Size	Height	mm	396 (including casters)
	Width	mm	373
	Length	mm	449
Weight	kg	53	
Connection	Cooling water [WATER IN]	PS 3/8" female	
	Cooling water [WATER OUT]	PS 3/8" female	
	Refrigerant [SUPPLY]	1/2" self-sealing coupling	
	Refrigerant [RETURN]	1/2" self-sealing coupling	
Scheduled maintenance intervals	Change adsorber every 30,000 hours		

- Notes
1. Value when connected with a cryopump unit.
 2. Motor output when measured with R-22.
 3. Refer to "2.2.4 Cooling Water" for detail of cooling water temperature or flow rates.

1.2 Overview / General description

The function of the compressor unit is to supply high-pressure helium gas to the cryogenic refrigerator and recompress the helium gas returning from the cryogenic refrigerator.

The compressor unit is comprised of the following components- a compressor, cooling system device, oil separator, absorber, and so on.

1.2.1 Control and connection

Table 1.2 and Figure 1.1 show the control and connection of SW112-C.

Table 1-2 Control and connection of the compressor unit

Item	Function
1 RUN Indicator Lamp (GL)	Lights when the compressor unit is in operation.
2 TEMP. AL. Indicator Lamp (RL1)	Lights when the thermal safeguard of the compressor unit is in operation.
3 PRESS. AL. Indicator Lamp (RL2)	Lights when the pressure safeguard of the compressor unit is in operation.
4 RUN/STOP Switch (SW1)	<ul style="list-style-type: none"> • Press to start or stop the compressor unit. Press the upper half of the switch to start operations. The RUN indicator lamp will be lit. Press the lower half of the switch to stop operations. The RUN indicator lamp will also turn off. For remote operation, leave this switch ON and use the remote operation switch. Use EXTERNAL OPERATION switch supplied on-site to turn ON or OFF. <ul style="list-style-type: none"> • In the event a blackout occurs during operations, when the electricity is restored, operations will automatically resume.
5 HOUR METER (HM)	The time counter indicates the total hours of operation of the compressor unit. There is life to a battery built in HOUR METER and it is used by about 10 years.
6 He PRESSURE METER	Pressure meter. When not in operation, indicates the helium gas charge pressure. During operation, indicates the compressed helium gas pressure (supply pressure).
7 He GAS CHARGE	Helium gas supply port.
8 SUPPLY	Helium gas supply port to the cryogenic refrigerator. Flexible tube (supply side) is connected.
9 RETURN	Return port for helium gas from the cryogenic refrigerator. Flexible tube (return side) is connected.

10	REF. : (CN1)	Connection port for the cable connector to supply power to the refrigerator (motor).
11	REMOTE : (CN2)	Connection port for the cable connector during remote run/stop of the compressor unit
12	L Switch R	To switch between LOCAL operation and REMOTE operation. L: start and stop operations with the RUN/STOP switch. R: When the RUN/STOP switch is ON, run/stop of operations is possible using the EXTERNAL OPERATION switch.
13	POWER SUPPLY CORD	Power source cable for 100 V.
14	FUSE	Fuse for control circuit protection (250V, 3A).
15	SIGNAL(CN5)	Connection port for the cable connector when the operation/warning signals are extracted.
16	EARTH	Earth terminal for Refrigerator cable.
17	WATER IN	Connection port for the cooling water supply line.
18	WATER OUT	Connection port for the cooling water return line.

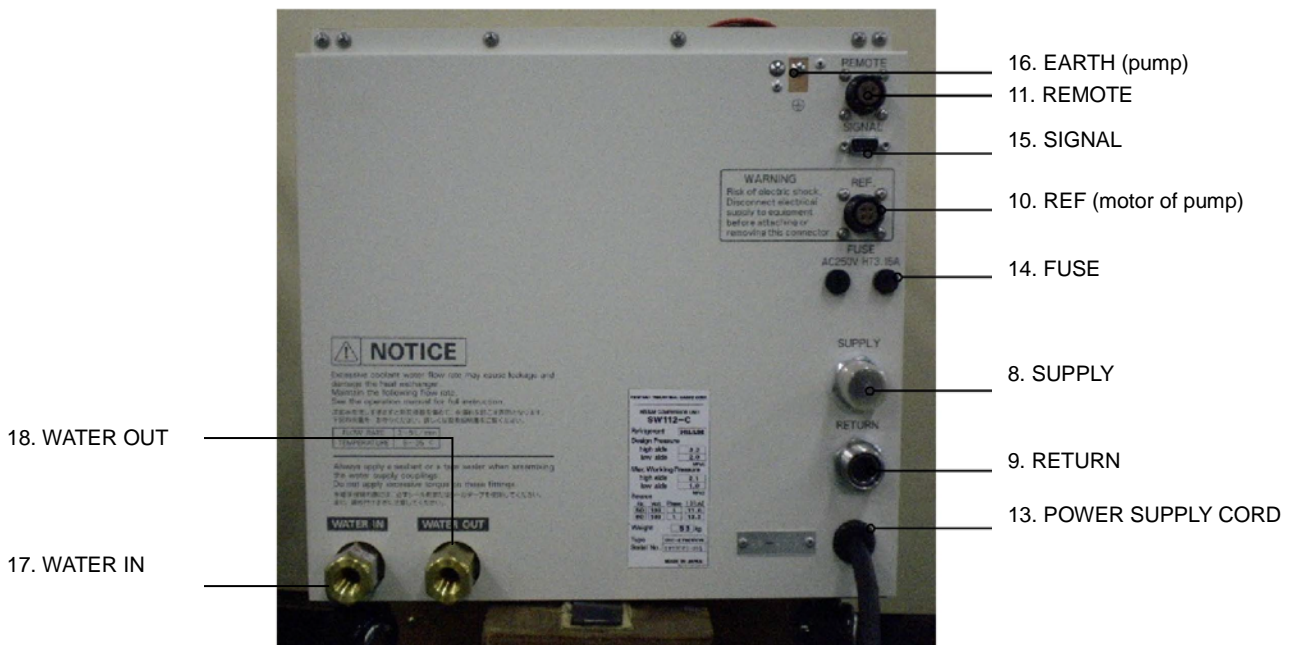
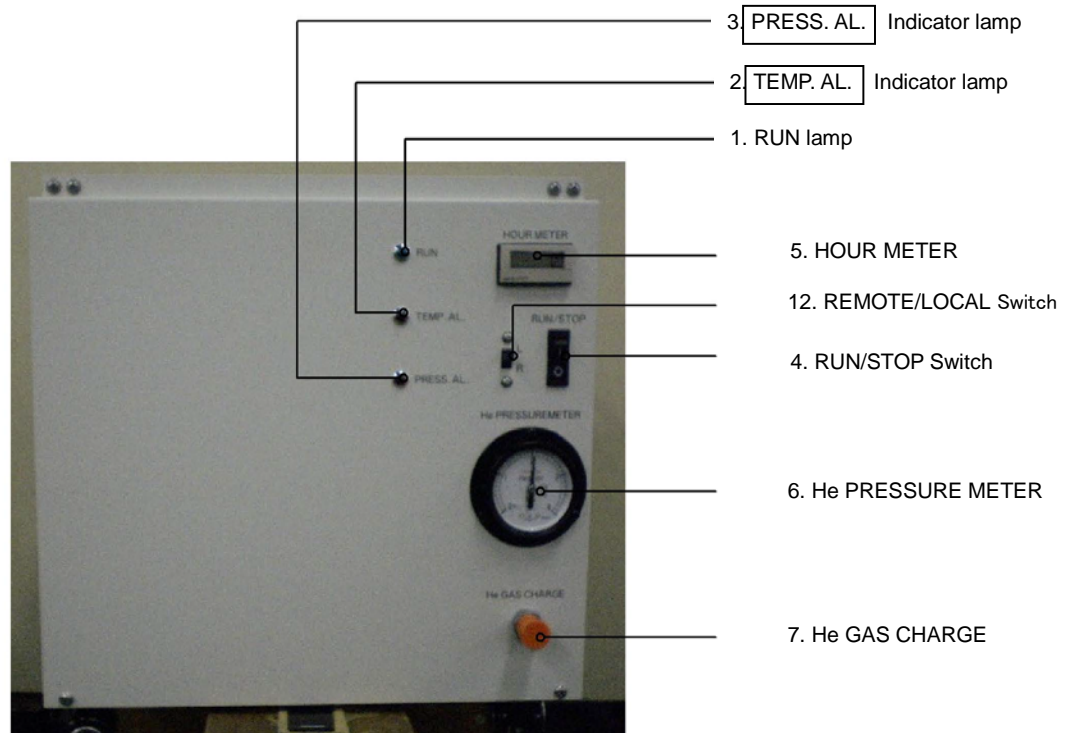


Figure 1-1 Compressor Front Panel

1.2.2 Flow of gas and oil in the compressor unit

Figure 1-2 shows the refrigerant circuit of compressor unit SW112-C.

Table 1-3 and Figure 1-3 show the components inside and the functions of SW112-C.



		WARNING
Before opening the panel, disconnect all power sources supplied to the compressor unit.		

Table 1-3 Components and function

No	Component	Function
1	Compressor	Compresses helium gas.
2	First heat exchanger	Air-cooled heat exchanger for helium compressed gas.
3	Second heat exchanger	Air-cooled heat exchanger for helium compressed gas.
4	Oil heat exchanger	Air-cooled heat exchanger of lubricating oil.
5	Oil separator	Separates oil from compressed helium gas.
6	Absorber	Separates residual oil mist in the processed compressed helium gas processed by oil separator.
7	Helium gas supply port (SUPPLY)	For connecting flexible tube (helium gas supply port) .
8	Helium gas return port (RETURN)	For connecting flexible tube (helium gas return port) .
9	Helium gas compensating port	Compensating port to compensate helium gas.
10	Pressure adjusting valve for low pressure	By-pass valve to maintain the pressure of the low-pressure helium gas above a certain level.
11	Safety valve	Safety pressure valve to maintain the pressure of the high-pressure at a specified value or below.
12	Solenoid valve (SVC)	Solenoid valve for helium gas pipes.
13	Pressure meter	Indicates the helium gas inclusion pressure when not in operation, and shows the compressed helium gas pressure during operation.
14	Low-pressure pressure switch (63PL)	Pressure detector to detect a drop in suction gas pressure.
15	Filter	Removes dirt and dust from circulating lubricating oil.
16	Capillary tube	Adjusts the flow rate of circulating lubricating oil.
17	Thermostat (26G)	Detection and control device for the temperature of the compressed helium gas at the outlet of the compressor.
18	Control panel	Control monitor and warning system for the helium gas compressor unit. (See item on "1-3 Instructions on the Electrical System.")
19	WATER IN	Connection port for the cooling water supply line.
20	WATER OUT	Connection port for the cooling water return line.

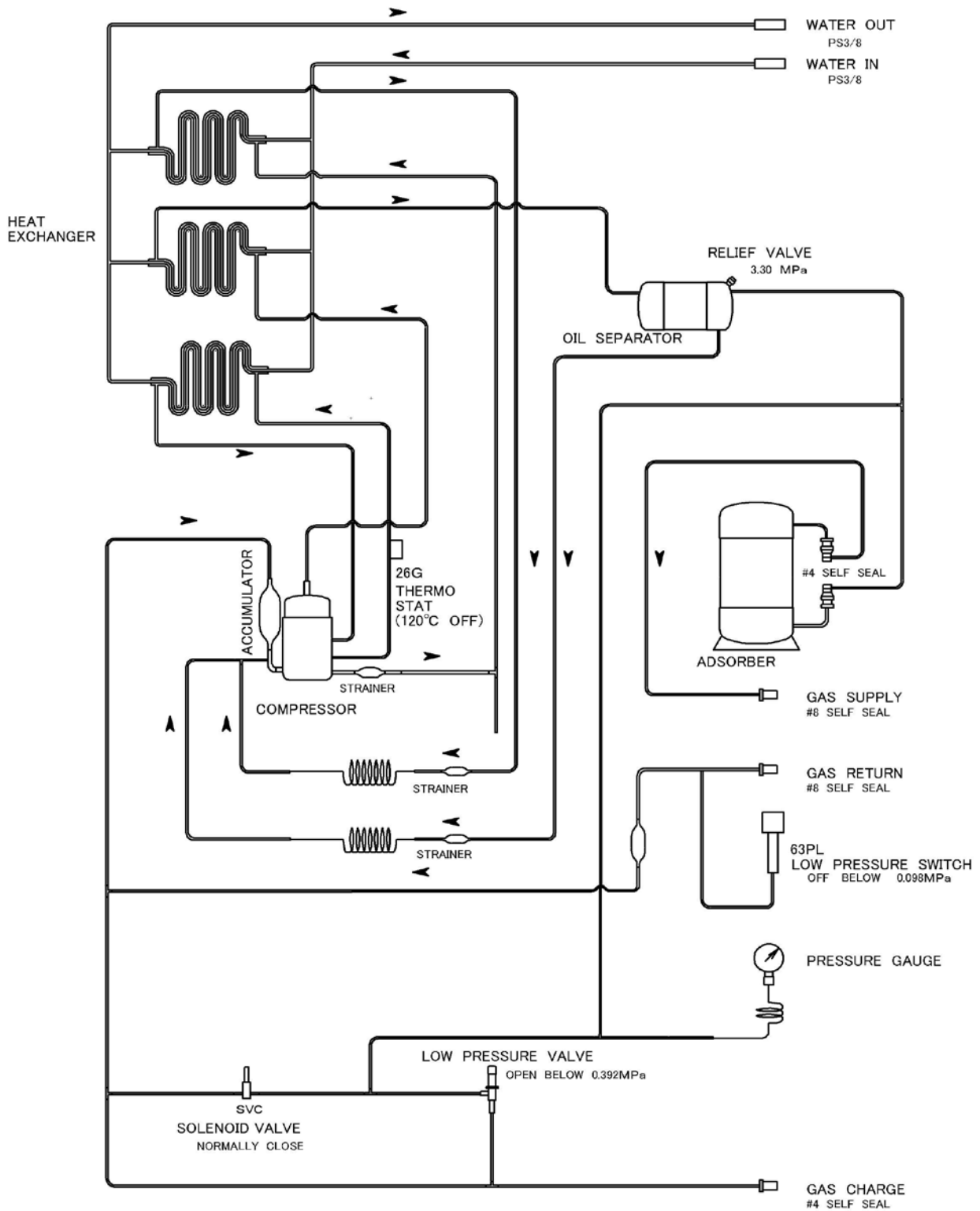


Figure 1-2 Helium Circuit Diagram

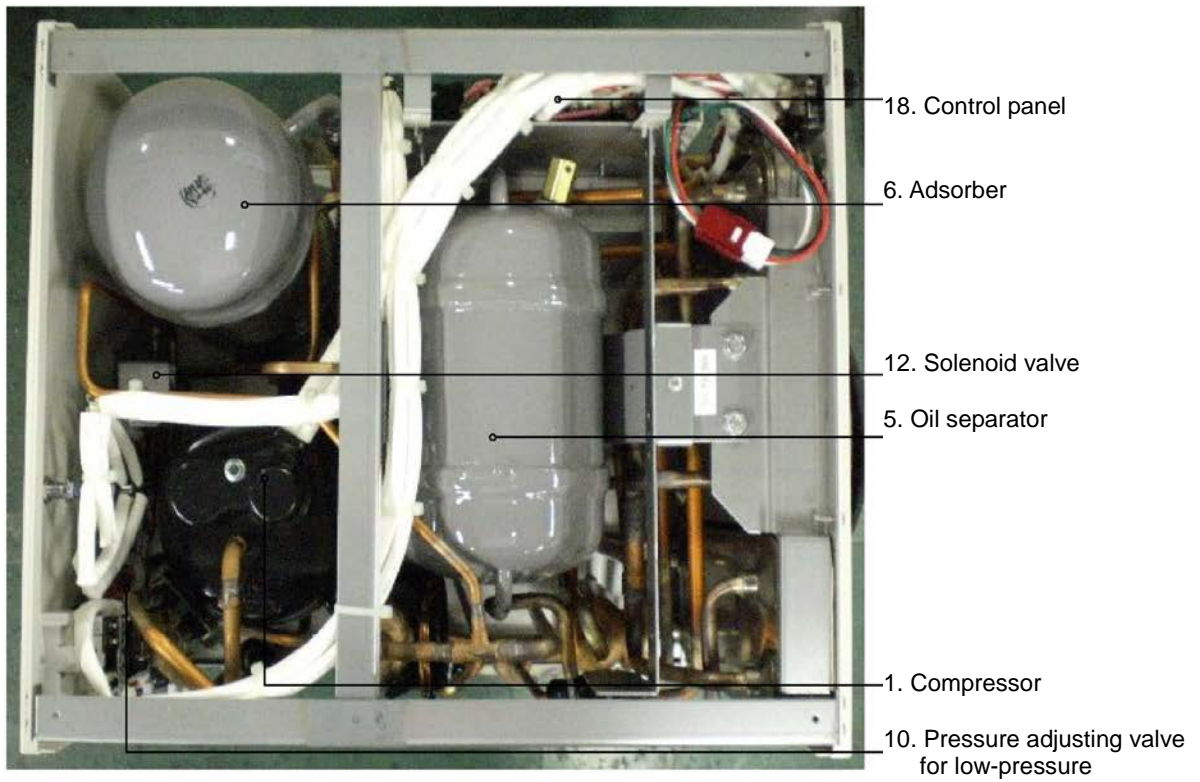
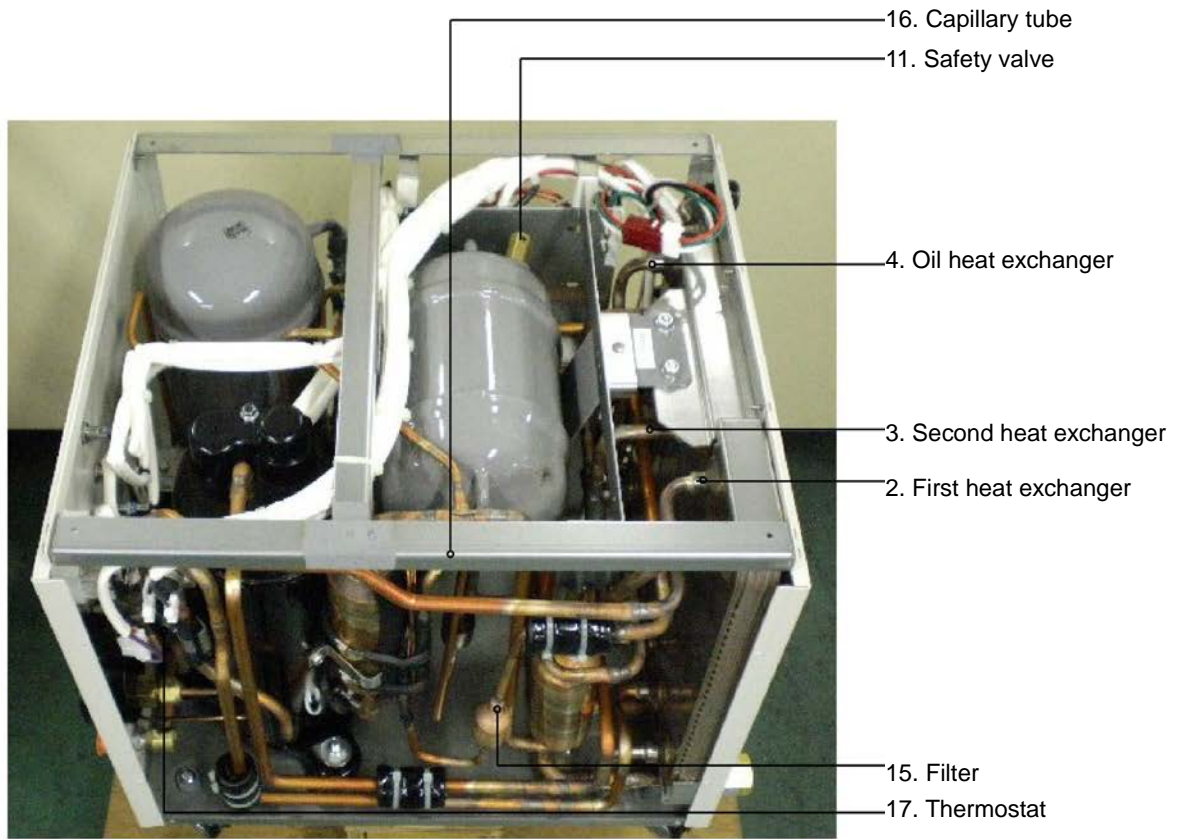


Figure 1-3 SW112-C Components inside

1.3 Instructions for the Electrical System

1.3.1 Control Components

The control components for SW112-C are shown in Table 1-4 and Figure 1-4.



		WARNING
Before opening the panel, disconnect all power sources supplied to the compressor unit.		

Table 1-4 List of control components

No.	Name of component	Code	Component number	Specifications	Volume
1	RUN indicator lamp	GL	BN3802-1G	AC100 V GREEN	1
2	TEMP.AL. indicator lamp	RL	BN3802-1R	AC100 V RED	1
3	PRESS.AL. indicator lamp	RL	BN3802-1R	AC100 V RED	1
4	RUN/STOP switch	SW1	AJ911102B3F	AC250 V 16A	1
5	REMOTE/LOCAL switch	SW2	S-1-Z	AC250 V 4A	1
6	Operation hour meter	HM	H7ET-N-300	DC3 V (internal battery)	1
7	Refrigerator connector	CN1	N/MS3102A14S-2S	4P	1
8	Remote connector	CN2	N/MS3102A14-7S	3P	1
9	Connector	CN3	VLR-04V-R	AC600 V 20A 4P red	1
10	Connector	CN4	VLP-04V	AC600 V 20A 4P white	1
11	Fuse Fuse holder	F1,F2,	HT3.15AN5 F-400-01-A2	AC250 V 3.15A AC250 V 10A	2 2
12	Overload protector (inside the compressor)	OLR	MRA98283-9200	20.0 A at 80 °C	1
13	Temperature limiter	26G	CS-74L120	120 °C	1
14	Pressure switch	63PL	ACB-1AU3	OFF: 0.098 MPa	1
15	Relay	52CM	G7L-2A-BUB	AC100 V	1
16	Delay relay Socket (with holding clamp)	2T1,2	ST7P-2 TP814X1	AC100 V Setup: 1 second	2 2
17	Auxiliary relay Socket (with holding clamp)	4X1	HH54P TP514X1	AC100 V	1 1
18	Auxiliary relay Socket (with holding clamp)	4XOP,2, 3	HH52P TP58X2	AC100 V	3 3
19	Starting relay	19C	AMVL-180A		1
20	Power source terminal	TB1	AYBN023-1	600 V 25A 3P	1
21	Terminal for control	TB2	KTUNS-10J	600 V 10A 10P	1
22	Power cord terminal	TB3	AYBN023-1	600 V 25A 3P	1
23	Solenoid valve coil	SVC	NEV-M0AC571UB0	AC100 V	1
24	Running capacitor	C1	RS22B606U4364A	220 V 60 μF	1
25	Starting capacitor	C2	DMS-1FJ150R	160 V 150 μF	1
26	Signal connector	CN5	DE-9P-NR	9P	1

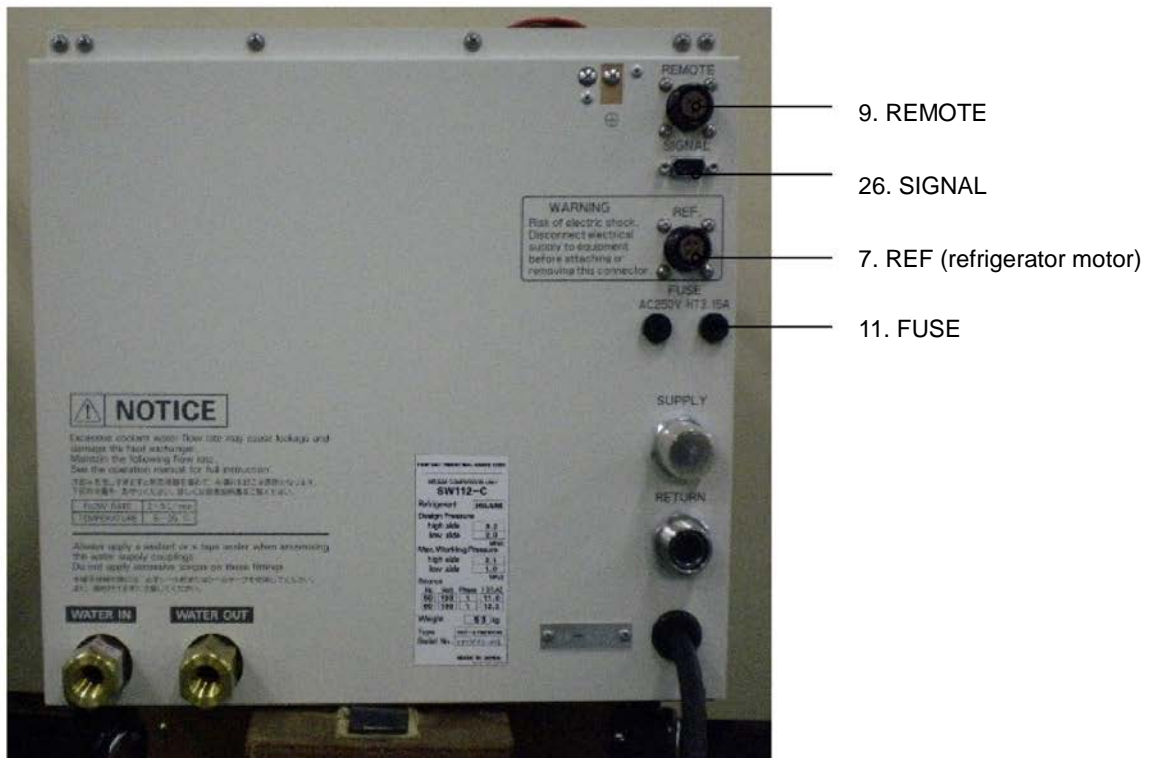
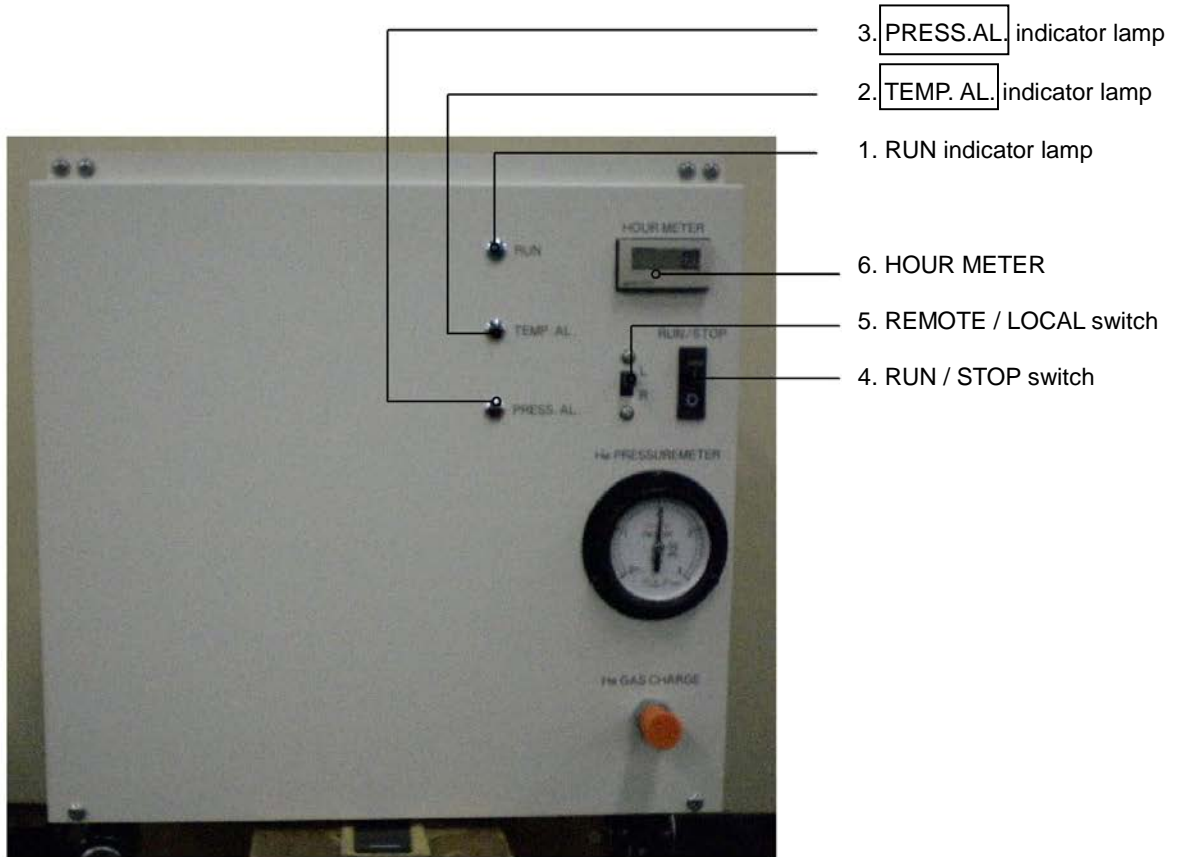


Figure 1-4 SW112-C Control Components (Exterior components)

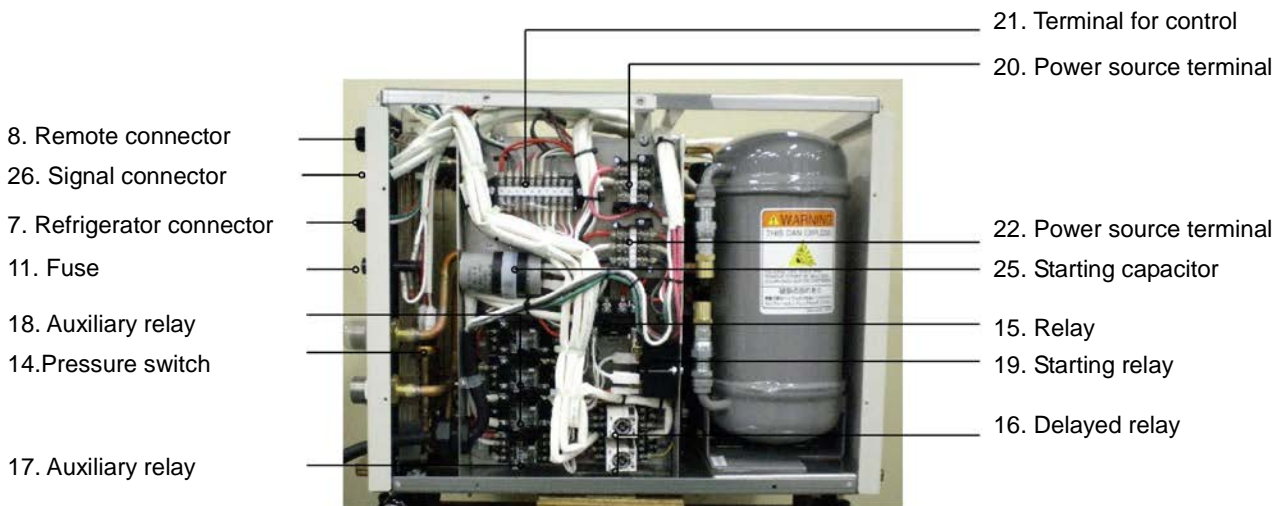
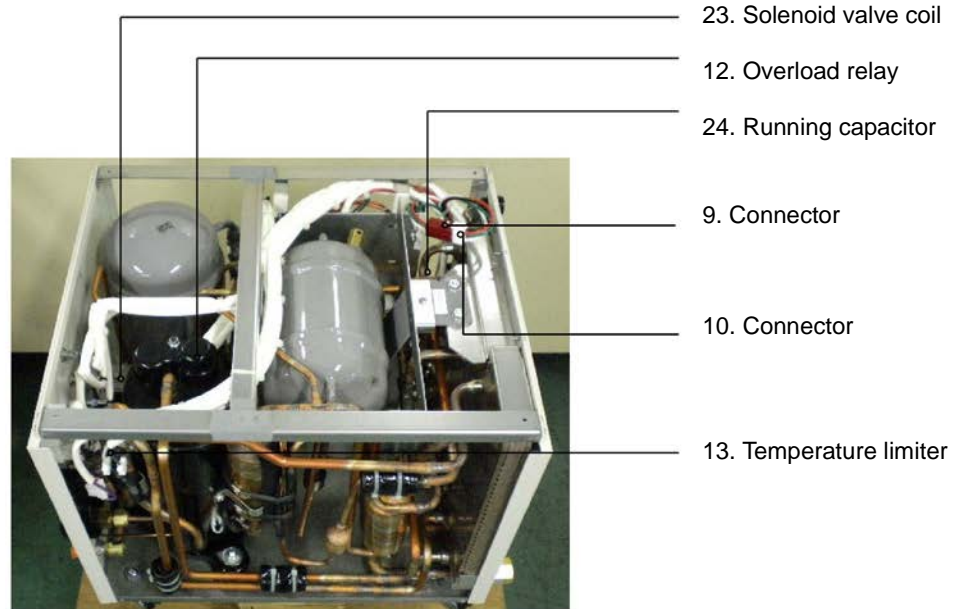


Figure 1-5 SW112-C Control Components (Inside)

1.3.2 Remote Connector

The remote connector can be used to remotely operate of the compressor unit.

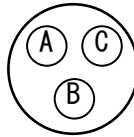
Table 1.5 shows the remote operation sequence.

Table 1-5 Remote sequence

No.	Item	Condition		Pin code	Contact point capacity
		Suspended	Released		
1	Remote operation	In Operation	Connected	A, B	Rated capacity: 100VAC 0.1A or more Minimum load: 100VAC 0.01A

Table 1-6 Remote connectors

Name	Specifications
Plug connectors (Straight type)	Made by Japan Aviation Electronics Industry, Ltd. N/MS3106B-14S-7P
Plug connectors (Angle type)	Made by Japan Aviation Electronics Industry, Ltd. N/MS3108B-14S-7P
Cable clamps	Made by Japan Aviation Electronics Industry, Ltd. N/MS3057-6A



This is the socket side insert, as seen from the pins at front of connector.

Figure 1-6 Remote connector pin locations

1.3.3 Signal Connector

The signal connector can be used to monitor conditions.

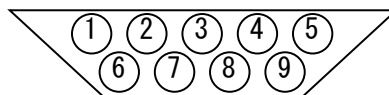
Table 1.7 shows the monitor sequence of the compressor unit.

Table 1-7 Monitor sequence

No.	Items	Condition		Pin code	Contact point capacity
1	Operation monitor	No-voltage contact	Running Close Suspended Open	1, 2	24VDC 0.1A
2	TEMP. Warning monitor	No-voltage contact	Normal Open Warning Close	4, 5	24VDC 0.1A
3	PRESS. Warning monitor	No-voltage contact	Normal Open Warning Close	3, 5	24VDC 0.1A

Table 1-8 Connectors for signals

Name	Specifications
Plug connectors	Japan Aviation Electronics Industry, Ltd. DE9S-NR



Socket side insert viewed from the pins at front of connector.

Figure 1-7 Signal connector pin configuration

1.3.4 Refrigerator [REF] Connector

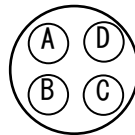
The refrigerator connector can be used to receive power for the motor of cryogenic refrigerator, etc.

Table 1-9 Refrigerator connector specifications

Items	Specifications
Power source	1φ 100VAC
Maximum volume	Rated 1.6A
Phase array	A:L, B:-, C:N, D:GND

Table 1-10 Connectors for the refrigerator

Names	Specifications
Plug connectors (Straight type)	Made by Japan Aviation Electronics Industry, Ltd. N/MS3106B-14S-2P
Plug connectors (Angle type)	Made by Japan Aviation Electronics Industry, Ltd. N/MS3108B-14S-2P
Cable clamps	Made by Japan Aviation Electronics Industry, Ltd. N/MS3057-6A



This is the socket side insert, as seen from the pins at front of connector.

Figure 1-8 Refrigerator connector pin locations

1.3.5 Table 1-11 lists the safeguards of Compressor Unit SW112-C.

Table 1-11 Safeguards

Items (Code)	Function
Discharged gas thermostat (26G)	Set temperature 120°C Activates when the temperature of first discharge helium gas is high. The Warning Indicator Lamp (RL1) is lit, and devices connected to the power source of the refrigerator connector, such as the compressor unit and cryopump unit stops. When temperature goes down to appropriate level, operation can be restarted. To restart, press the RUN/STOP switch (SW1) again.
Refrigerant low-pressure switch (63PL)	Set pressure: About 0.1MPa Activates when the suction pressure drops due to some reason, such as the amount of helium gas inclusion is less than the specified amount. The Warning Indicator Lamp (RL2) is lit and devices connected to the power source of the refrigerator connector, such as the compressor unit and cryopump unit, are stopped. The compressor can be resumed by turning on the RUN/STOP switch (SW1) again, but helium charge pressure is required to be adjusted in most cases.

<p>Compressor motor Overload relay (OLR)</p>	<p>Activates depending on the compressor temperature and electric current. It is set to be activated when the compressor temperature is 80°C and the electric current is 20.0A or higher. The Warning Indicator Lamp (RL1) is lit and devices connected to power source of the refrigerator connector will stop such as the compressor unit and cryopump unit. When temperature decreases, operations can be resumed. To restart, press the RUN/STOP switch (SW1) again.</p>
<p>Fuse (F1,F2)</p>	<p>Activates to protect the circuit in the event of a surge in the operations circuit. The Warning Indicator Lamp (RL1) is lit and devices connected to the power source of the refrigerator connector, such as the compressor unit and cryopump unit, are stopped. The warning lamp may not be lit at this time. To restore operations, replace the fuse (250VAC, 3A). <u>Make sure to disconnect all the power supply before</u> checking for causes and take appropriate actions, and then restart.</p>

2. Installation

2.1 Conditions for installation

Room Temperature

The room temperature must be between 4 °C and 38°C, Maximum humidity is 88%.

The air conditioner in the room should be sufficient to prevent heat overload of the device.

Be sure to maintain room temperature within the range shown above.

Helium Supply System

A helium supply system is necessary to purify the helium gas or to compensate for helium that has leaked from the compressor unit.

For the helium supply system, a helium gas cylinder of grade 6 (purity with 99.999 % or higher), pressure regulator, exit valve, and a charge hose or similar supply line, are needed. For more information, see ‘4-1-2 Charging the Helium Gas.’

Power Source

Make sure that the correct AC power source is supplied to the compressor.

Specifications for the compressor unit are a power source of 100 V with allowable voltage variation of $\pm 10\%$.

For more information, see ‘Table 1.1 Compressor Unit SW112-C Specifications.’

Maintenance Area

Ensure an area of 20 cm or more in front and back, 20 cm or more on the right, and 60 cm or more on the left as maintenance space.

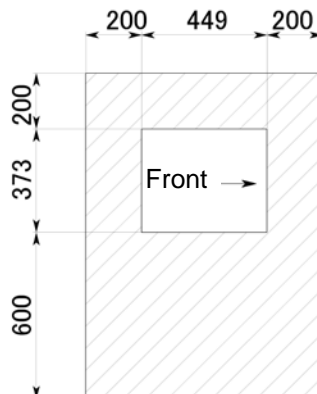


Figure 2-1 Maintenance space (unit: mm)

2.2 Installation

2.2.1 Inspections

Prior to installation, check the compressor unit as shown below.

- (1) Check for signs of damage in the overall appearance of compressor unit or any oil leaks.

In particular, check the following.

- (a) Overall appearance
 - (b) Self-sealing coupling on the supply and return
 - (c) Helium gas supply port
 - (d) Oil leaks around the bottom plate
- (2) Make sure that the pressure indicated by the compressor unit pressure meter when not in operation is within the specified values.
If the indicator reads less than the appropriate value, charge helium gas from the helium supply port.
If the indicator reads 0 MPa, helium may be contaminated. Replacement of the compressor unit is required.
 - (3) Check for damage on any attached components, etc.



CAUTION

When moving the compressor unit, do so over a smooth floor. If forcibly moved over a rough floor, the casters may break, resulting in injuries in feet.


2.2.2 Installation of the compressor unit


Check for following items for installation.

1. Install the compressor unit at visually level on a smooth floor.
2. Be sure that all four casters are securely in contact with the floor.
3. Do not install the compressor unit in a place where it may get wet or dusty.
4. Install the compressor unit in a clean environment without dust and that is not affected by exhaust heat.
5. Install air conditioner with sufficient performance on the installation site.
6. Do not place objects vulnerable to heat near the compressor unit.

2.2.3 Electrical wiring

Perform electrical wiring as follows.





WARNING

Never connect cables while the compressor unit is connected to the electrical current. Be sure the electrical supply system is isolated before connecting the power source cables. Make sure the power source on the primary side is turned off.

(1) Wiring Capacity

In order to secure 100±8V for the outlet (socket receiving the plug of the Compressor), install the electrical supply wiring in consideration of Table 2-1 Electric Wiring Capacity.

Table 2-1 Electric wiring capacity

Power source wiring Room temperature 30°C or less (Metal tube/PCV tube etc.) Voltage lowering standard 2 %	Power source minimum diameter	2 mm ² (5m)
	Distance: up to 5 m	2.5 mm ²
	up to 10 m	3.5 mm ²
	up to 15 m	5.5 mm ²
Electric wiring Room temperature 40°C or less (Metal tube/vinyl tube etc.) Voltage lowering standard 2 %	Power source minimum diameter	4 mm ² (10 m)
	Distance up to 10 m	4 mm ²
	up to 15 m	5.5 mm ²
Thickness of ground wire		2.5 mm ²
Thickness of power source to the refrigerator		2.5 mm ²

- Install dedicated wiring from the distribution board to the outlet with a 20A circuit breaker.
- “Distance” is the length between the distribution panel (separating/isolation transformer in case of IEC/EN conformity) and the outlet (socket receiving the plug of the Compressor).
- Metal and PVC pipes (conduits), etc., shall be metal pipe wiring, plastic pipe wiring, floor duct or cellular duct wiring, and cable wiring.
- Values in parenthesis indicate the maximum distance.
- mm² shows the diameter.

(2) Connection of refrigerator cables

Connect the refrigerator cable to the refrigerator connector (REF) on the back panel of the compressor unit and then connect the other end to the power source connector of the refrigerator.

2.2.4 Cooling water

The maximum inlet temperature of cooling water for SW112-C is 35°C. The relation between the inlet temperature and water flow rate is shown in figure 2.2. The allowable range is marked with diagonal lines. The maximum pressure is 1MPa (10.2kg/cm²G).

Please note that the chart in figure 2.2. does not reflect the effect of back-pressure. If your cooling water supply has back-pressure, adjustment measures should be taken within the range that does not exceed the maximum pressure.

The cooling water must also meet the standards of “Guideline of Water Quality for Refrigeration and Air Conditioning Equipment” by The Japan Refrigeration and Air Conditioning Industry Association and be administered on a regular basis.

<Notes for excessive flow of cooling water>

Excessive flow of cooling water may damage the heat exchanger. Please keep the flow rate within the allowable range shown in figure 2.2.

It is recommended that you install a throttle valve to control flow rate and a flowmeter on the cooling water supply port (WATER IN). If it is difficult to control flow rate due to fluctuations of the primary pressure of cooling water, it is recommended to use hydraulic flow control valve.

Please note that scale may build up in flow control valves due to impurities in cooling water and the valve may fail to function correctly. When using flow valves, attach filter on the inlet side and clean it on a regular basis.

<Notes for piping work of cooling water>

When connecting devices to water pipe fittings, use the right torque of 10Nm. Failure to observe this may result in damaging the devices.

Recommended specifications for constant flow valve:

HCT-15A from Nippon Flow Cell Corporation (15A, 10L/min)

Recommended specifications for filter:

KY-4 (bronze) (15A, mesh #40) from Venn Co., Ltd, or

Y Type Strainer, bronze, 150 (10K), screw type from KITZ Corporation

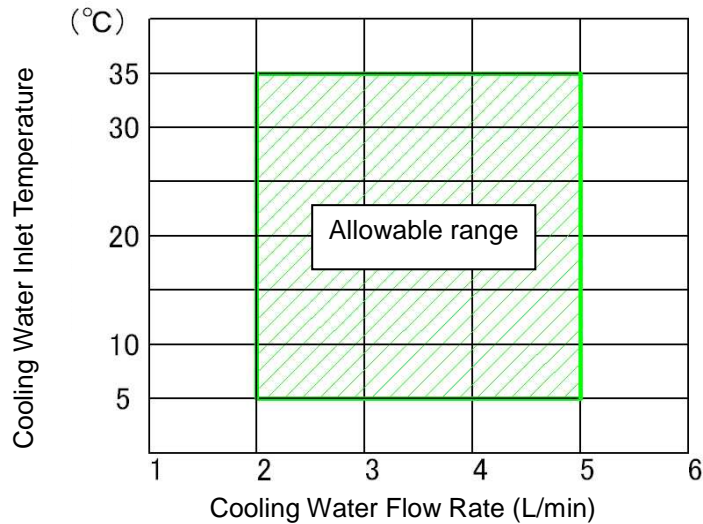


Figure 2-2 Cooling water flow and inlet temperature

2.2.5 Helium line connections

Use flexible hoses specified for helium line connections.

Self-sealing couplings are attached to both ends of the specified flexible hoses and helium gas is already charged. Self-sealing couplings of flexible tubes must be female.

The compressor unit has both SUPPLY and RETURN ports for piping connection. Connect the high-pressure line (supply to the refrigerator) to the SUPPLY, and low-pressure line (return from the refrigerator) to the RETURN. Make sure that the lines are connected to the correct port.

Remove the protective cap on the SUPPLY and confirm that there are gaskets on the self-sealing coupling. Helium can leak if the coupling does not have gaskets.

Attach the female self-sealing coupling of the high-pressure piping (outgoing piping to the refrigerator) to the male self-sealing coupling of the SUPPLY and screw the union nuts of the female self-sealing couplings by hands.

Always fasten the union nuts using two spanners.

Helium gas may leak while fastening union nuts, quickly finish connecting in order to minimize leakage.

Although couplings must be tightly fixed, avoid a torque of 44N·m or more.

Connect the RETURN to low-pressure line (incoming piping from the refrigerators).

After connecting the cryogenic refrigerator, make sure the connections are correct. Use cautions to check that the connections of high-pressure piping and low-pressure piping are correct and the union nuts are securely fastened.

Perform a leak test using leak test liquid (SNOOP®) etc. after connecting the piping.

If there is no leak, the piping connection is complete. Wipe off any leak test liquid.

3. Operation

3.1 Start-up operation

Before starting refrigeration system, make sure that the compressor unit, cryogenic refrigerator, flexible hoses and power source cables are correctly connected.

To start-up the refrigerating system.

- (1) Confirm that the pressure the compressor unit is within the appropriate level.
- (2) Switch the compressor unit "RUN/STOP switch" on the front panel to RUN.

The compressor unit (refrigerating system) starts operation.

→ If the unit does not start-up, check that the switch between remote and local is on "L." For other problems, see "5. Troubleshooting."

Operating noise

The compressor unit will generate operating noise (54 dB/56 dB (50/60 Hz) at 0.7 MPa) while running. Also the refrigerator will generate operating noise and noise caused by the gas coming in and going out.

3.2 Shutdown

- (1) Switch the "RUN/STOP switch" of the front panel of the compressor unit to STOP to shutdown compressor unit (refrigerating system).

3.3 Inspections in normal operation

Check the following items during normal operations, and keep operation record.

- (1) Regularly check the helium gas supply pressure of the compressor.
- (2) Regularly check the temperature of the refrigerator.
- (3) Regularly check cooling water temperature and flow rate.

4. Maintenance

4.1 Scheduled maintenance

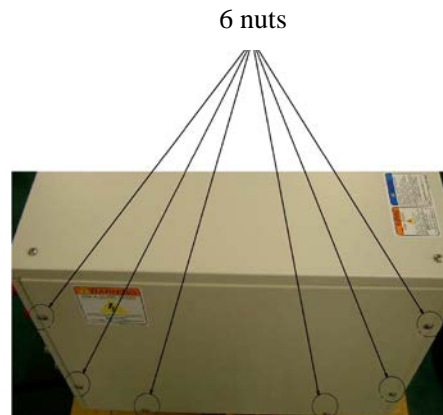
4.1.1 Replacing Adsorbers

Adsorbers should be replaced every 30,000 hours of compressor unit operation.

Replacement procedures are as follows.



- (1) Remove the compressor unit power cable plug from the supply outlet to safely isolate the equipment.
- (2) Remove the six screws attaching to the left side of the adsorbers. To remove the adsorbers-

- i. Loosen the self-sealing couplings (two) connected to the adsorber and inner piping, and remove the piping from the adsorber. The male gaskets may come off with the female part. Take a close look and if it is attached to the female part, remove it.
- ii. Remove the bolt attaching the bottom face (skirt part) of the adsorber.
- iii. Bring the adsorber forward.



- (4) Remove the two dust caps on the new adsorber self-sealing coupling.
- (5) Make sure that the male end of the self-sealing couplings includes a gasket. Attach the adsorber. To attach the adsorber-
 - i. Align the holes for attachment on the flange of the adsorber bottom face (skirt part) with the bolt positions.
 - ii. Attach the unit base with the adsorber attaching bolts through the holes of the skirt part.
- (6) Connect the adsorber and self-sealing couplings of the inner piping (two places).
- (7) Check for leaks using snoop (SNOOP®) focusing on the self-sealing coupling areas.
- (8) After confirming that there are no leaks, attach the left panel.

- (9) Confirm that the helium gas pressure displays the rated pressure.
In the event the proper rated pressure is not displayed, adjust the rated pressure according to '4-1-2. Charging the Helium Gas.'
- (10) Record the time of the hour meter and display the next time for replacement. Write it in the operations record
- (11) Re-connect power cable plug to the supply outlet and switch on the local switch of the power source side.

		WARNING
Before disposing of adsorber, release the gas pressure inside, and remove one of the self-sealing couplings.		

4.1.2 Charging helium gas

When the gas pressure drops below the appropriate value, helium gas must be refilled.

If there is no cause during normal operations by which to attribute a change in gas pressure, such as attaching or removing flexible hoses, determine the cause of pressure decline and take necessary actions. Check the connection of the self-sealing coupling and connectors of the safety valves, charge valves, etc.

Next, perform a leak test by sniffer method.

When refilling helium gas, use helium with purity of 99.999 % or higher.

Follow the steps below to charge helium gas

- (1) Remove the cap of charge port (self-sealing coupling) on the front side of the compressor unit.
- (2) Connect the charge hose to the pressure adjuster of the helium gas cylinder.
Make sure the female connection port of the self-sealing coupling of the charge hose is connected to the charge port. Also, the charge hose should have either a stop valve or be connected with backless valve.
- (3) Open the stop valve (or the backless valve) of the charge hose to full. Prior to opening the helium gas pressure adjuster, connect the connecting port to the male end of the self-sealing coupling. Set the helium gas pressure adjuster to 0.1 MPa and after barging the air inside the charge hose, remove the male coupling of the connecting port.
- (4) Connect the connecting port of the charge hose to connecting port on the unit.
- (5) Set the helium gas pressure adjuster to 2.0 MPa, and charge the helium gas.
- (6) After filling the helium gas to the set pressure, fully close the stop valve (or the backless valve) and remove the charge hose.
- (7) Attach the cap to the charge port

NOTE

1. When the helium gas pressure indicator reads 0 MPa, air may be included. Contact us before refilling helium gas.
2. When attaching the pressure regulator to a new cylinder, purge between cylinder-side valve and the pressure regulator.

4.2 On-site maintenance



4.2.1 Replacing fuse

The fuse holder is located on the backside panel.

Table 4-1 Fuse List (Spare fuses are attached to the product)

Fuse No.	Specifications	Component No.	Notice
F1 F2	HBC (ceramic) tube fuse 250 VAC 3.15A	ET3.15A	For control circuits

Follow the steps below to replace fuses.

		WARNING
Before opening the panel, disconnect all power sources supplied to the compressor unit.		

- (1) Loosen the cap of the fuse holder with flathead screwdriver and remove the old fuse.
- (2) Insert a new fuse into the fuse holder and fasten the cap as before.

5. Troubleshooting

		WARNING
Disconnect the power supply to the compressor unit before determining the cause of trouble and performing repair work.		

Problem	Cause	Corrective Action
When starting operations: The compressor unit does not operate when switching the RUN/STOP switch. The TEMP.ALARM indicator lamp (red) and the PRESS.ALARM indicator lamp (red) are not lit.	The power source is not properly attached.	Check any wiring related to the power source.
	Although the remote operation switch is put into "R," the remote signal has not been received.	Set the remote operation switch to "L" or perform the correct remote operations.
	Either the fuse is blown or disconnected.	Check if the fuse (F1&F2) is ok are intact. If defective, replace the fuse with a new one. If the problem continues, check if the components above the rated volume level are properly connected to the refrigerator connector or to the remote
	Incorrect operation of control components	Control components may not be working. Consult our service department.
When starting operations: The compressor unit does not operate when switched on. The TEMP.ALARM indicator lamp (red) is immediately lit.	The unit is still in safeguard mode.	In the event a safeguard function has just stopped the unit, the condition may still be in effect. In cases such as abnormal temperature, it may take some time for the temperature lower. Wait for a while before resuming operations.
	A sensor or a control component is not working.	A sensor or a control component may be damaged. Consult our service department.
When starting operations: The compressor unit does not operate when switched on. The PRESS.ALARM indicator lamp (red) is immediately lit.	Abnormality in operation due to pressure drop	When pressure of the low-pressure drops to about 0.1MPa or lower, operations are stopped. Charge the helium gas. If the helium gas needs to be charged often, check for leaks of helium.
	A sensor or a control component is not working.	A sensor or a control component may be damaged. Consult our service department.

Problem	Cause	Corrective Action
Compressor unit stops during operation. The TEMP.ALARM indicator lamp (red) is lit.	Temperature safeguard has been activated.	Check whether the voltage of the power source is within 100V±10%. If not, set it within the rated voltage range. Check whether the temperature and amount of coolant water are within the rated ranges. If not, reset them within the rated range. See 2-2-4. If the temperature limiter has been activated due to abnormal temperature, time is needed for recovery. Wait for a while before trying to resume operations. If the unit still stops, contact our service department.
	Overload safeguard (compressor) has been activated	Check whether the voltage of the power source is within 100V±10%. If not, set it within the rated voltage range. Check the coil resistance, insulating stage and operation current. If there are no problems with the compressor, consult our service department.
Compressor unit stops during operation. The PRESS.ALARM indicator lamp (red) is lit.	Operation failure due to a pressure drop	When pressure of the low-pressure drops to about 0.1MPa or lower, operations are stopped. Charge the helium gas. If the helium gas needs to be charged often, check for leaks of helium.
Compressor unit stops during operation. The TEMP.ALARM indicator lamp (red) and the PRESS.ALARM indicator lamp (red) are not lit.	Abnormal voltage of AC power source (voltage fluctuation)	Check if the wiring related to the power source. Make sure the voltage is within 100 V±10 %. If not, set it within the rated voltage range.
	Either the fuse is blown or disconnected.	Check if the fuse(F1&F2) is ok. If defective, replace the fuse with a new one. If the problem continues, check if the components above the rated volume level are properly connected to the refrigerator connector or to the remote connector.

Problem	Cause	Corrective Action
Operation pressure does not increase.	Refrigerator system failure	About the following items, please check the refrigerator system. Mainly check the condition of the gas seals and condition of activity. Remove the flexible tube from the helium compressor unit and check whether operation pressure increases.
	Failure in gas flow control valve, etc.	There may be an abnormality in the gas adjusting valve etc. included in the compressor unit. Consult our service department.
	Compressor failure	There may be an abnormality within the compressor. In such cases, usually operating vibration and noise become large and loud. Consult our service department.

6. Electrical Wiring

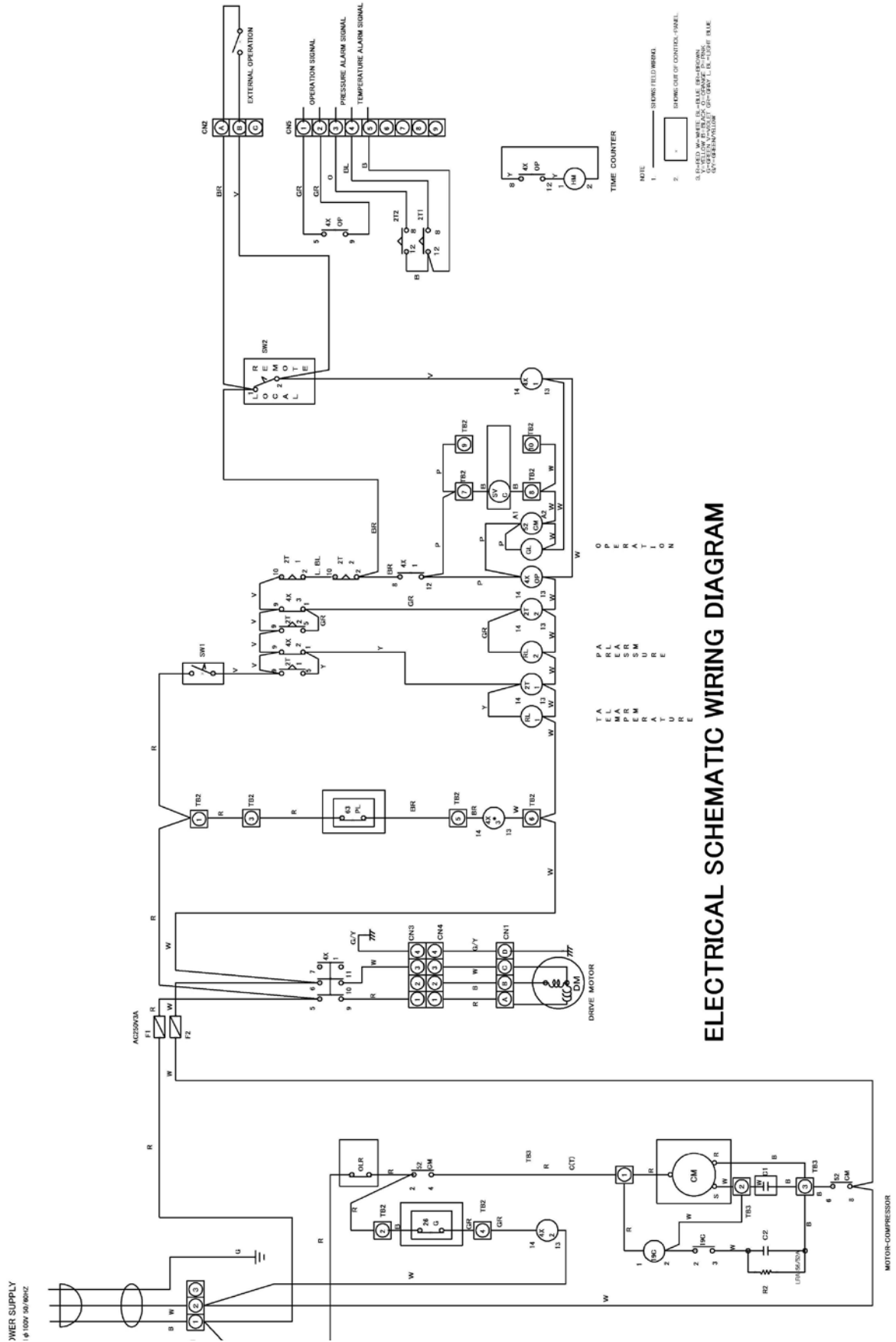


Figure 6-1 Electrical wiring

7. Warranty

1. Gratis warranty period and warranty coverage

【Gratis warranty period】

Gratis warranty period is one year starting from the date of delivery.

【Coverage】

(1) Failure diagnosis

As a general rule, diagnosis of failure should be done on site by customer.

However, ULVAC CRYOGENICS or our service network can perform this service for an agreed fee upon the customer's request. There will be no charge if the cause of the breakdown is found to be a fault of ULVAC CRYOGENICS.

(2) Damage during transportation

When damage by delivery/transportation is admitted, the product will be repaired free of charge within the range of the guarantee expressed in the sales contract.

(3) Breakdown repairs

There will be a charge for breakdown repairs, replacements and on-site visits for the following seven conditions. In those cases the cost shall be your own expense even though the product is within the warranty period.

- (i) Breakdowns due to improper storage or handling, careless accident, software or hardware design by the customer.
- (ii) Breakdowns due to modifications of the product without consent of the manufacturer.
- (iii) Breakdowns due to maintenance of the product without authentic parts or breakdowns resulting from using the product outside the specified specifications of the product.
- (iv) Breakdowns due to contamination or corrosion caused by user's use conditions.
- (v) Breakdowns due to natural disasters (such as fire, earthquake, flood, lightning, salt damage, and so on) , environmental pollution, irregular voltage, and /or usage of undesignated power source.
- (vi) Breakdowns that are outside the terms of warranty.
- (vii) Consumables and/or replacement service.

Since the above services are limited to within Japan, diagnosis of failures, etc are not performed abroad. If you desire the after service abroad, please contact ULVAC CRYOGENICS and consult us for details in advance.

2. Exclusion of opportunity loss from warranty liability

Regardless of the gratis warranty term, compensation to opportunity losses incurred to your company or your customers by failures of ULVAC CRYOGENICS products and compensation for damages to products other than ULVAC CRYOGENICS products and other services are not covered under warranty.

3. Repair period after production is discontinued

ULVAC CRYOGENICS shall accept product repairs for seven years after production of the product is discontinued.

Manufacturer: ULVAC CRYOGENICS INCORPORATED

Please refer to the SERVICE NETWORK at the end of this book for our contact information.

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SERVICE NETWORK

- For technical support, servicing or additional contact information, visit us at www.ulvac-cryo.com.

ULVAC CRYOGENICS INC.

www.ulvac-cryo.com

1222-1 Yabata, Chigasaki, Kanagawa 253-0085, Japan

<Sales>

Tel: +81-467-85-8884

<Service Engineering Division>

Tel: +81-467-85-9366

Fax: +81-467-83-4838

ULVAC CRYOGENICS KOREA INC.

www.ulvac-cryo.co.kr

107, Hyeongoksandan-ro, Cheongbuk-Myeon, Pyeongtaek-si,
Gyeonggi-Do, Korea, 17812

Tel: +82-31-683-2926

Fax: +82-31-683-2956

ULVAC CRYOGENICS (NINGBO) INC.

www.ulvac-cryo.com

No.888 Tonghui Road, Jiangbei District, Ningbo, China, 315020

Tel: +86-574-879-03322

Fax: +86-574-879-10707

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