

Compressor Unit Instruction Manual

SA115-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.

General Precautions

- (1) It is strictly prohibited to duplicate or reproduce this manual either partially or entirely, or disclose or transfer to a third party without written permission from ULVAC CRYOGENICS.
- (2) Information in this document is subject to change without notice, along with the specification change or improvement of the product.
- (3) If you have any questions or comments on this document, please contact us. The contact details are listed at the end of this book.

Safety Considerations

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 damage.



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 the live part.**



Make sure to turn OFF the main power source before performing installation, maintenance or repair. Contacting the internal parts that are not insulated may damage human body or equipment such as electrical shock.

Connect the earth wire to D type grounding.

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



High pressure helium gas is sealed inside this equipment. Make sure to remove gas before disassembling for repair or disposing.

Do not use this device in the corrosive gas atmosphere (e.g. chloride). It may result in injury or damaging devices.

- 3. Danger of burns exists.
Never touch high temperature parts.**





Internal parts, such as compressor motor or exhaust piping are in extremely high temperature during and immediately after operation.

When performing repair or maintenance activities, wait until the inside returns to the normal temperature and start working. Otherwise, it may result in 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.

1. Unpacking and Inspection

Upon receiving the compressor unit SA115-C, immediately check for any damage that may have occurred during transportation with the following procedures.

1. Check for any visible dents, etc., on the shipping carton. Keep the packing for shipping in case you need to make a claim regarding dents, etc.

2. Remove the carton and check for dents, etc., on the compressor unit.

Never tilt the compressor unit more than 10 degrees.

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

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

(a) Overall exterior

(b) Oil leaks

(c) Helium gas charge pressure

The pressure gauge indicates the helium charge pressure of 1.9MPa at 20°C (helium charge pressure may vary depending on the system configurations).

If the pressure gauge reading is below 1.90MPa, add helium gas following the procedures described in "6.1.2. Charging Helium Gas".

When the pressure gauge indicates 0MPa, some impurities may be mixed in the helium gas and the unit is required to be replaced.

If you encounter any problem, please contact us.

2. Transportation

When transporting the compressor unit, be sure to follow the procedures below.

- Put protection caps to all self-sealing couplings for safe shipping.
- Pack the equipment with the packing materials used at the time of delivery.
- Securely and correctly pack the compressor unit.
- Attach "No Tilting" and "This Side Up" caution labels.

3. Compressor Description

3.1 Specifications

Table 3.1 shows the specifications for Helium Compressor Unit SA115-C.

Table 3-1 Compressor Unit SA115-C Specifications

Compressor unit		SA115-C	
Power source		φ, V, Hz	Three-phase, 200, 50/60
Power consumption *1		kW	1.6/1.9
Operating current *1		A	6.0/6.7
Over current protection *2 (Supplied by customer)		A	15
Ambient temperature		°C	4-38
Refrigerant		Helium gas	With purity of 99.999 % or above
Refrigerant filling pressure		MPa	1.90±0.05 (20°C)
Dimensions	Height	mm	484
	Width	mm	494
	Depth	mm	494
Weight		kg	59
Safety Valve Setting		MPa	2.84-3.24
Connection	Refrigerant [SUPPLY]	1/2"self-sealing coupling	
	Refrigerant [RETURN]	1/2" self-sealing coupling	
Scheduled maintenance		Change adsorber every 30,000 hours	

Note) *1. Figures when connected with a cryopump unit.

*2. The compressor unit is not equipped with overcurrent protection. Customers are requested to install overcurrent protection device (circuit breaker) on the customer's system. Refer to 4.2.3 Electrical Wiring for the detail.

3.2 Overview

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

The main components of a compressor unit include compressor motor, refrigeration system, oil separator, or adsorber.

3.2.1 Control and Connection

Table 3.2 and Diagram 3.1 show the control and connection of SA115-C.

Table 3-2 Control and Connection of the Compressor Unit

No.	Item	Function
1	OPERATION 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 operation. Press the lower half of the switch to stop operation. • For remote operation, leave this switch ON and use the remote operation function (EXTERNAL OPERATION Switch, to be procured on-site). • In the event blackout occurs during operations, when the electricity is restored, operations will automatically continue .
2	HOUR METER (HM)	The time counter indicates the total hours of operation of the compressor unit.
3	SUPPLY PRESSURE	Pressure meter. When not in operation, indicates the helium gas charge pressure. During operation, indicates the compressed helium gas pressure (supply pressure).
4	HELIUM GAS CHARGE	Port for helium gas supply.
5	SUPPLY	Helium gas supply port. Connect flexible hose (Supply side) to this port.
6	RETURN	Return gas port for helium gas. Connect flexible hose (Return side) to this port.
7	REF POWER: (CN1)	Connection port for the cable connector to supply power to the refrigerator.
8	REMOTE : (CN2)	Connection port for the cable connectors to start/stop operation remotely, and to pick up alarm signal.
9	L / R Switch	To switch between LOCAL operation and REMOTE operation. L: Start and stop operations with the OPERATION switch. R: When the OPERATION switch is ON, run/stop of operations is possible using the LOCAL/REMOTE (EXTERNAL OPERATION) switch.
10	FUSE 250V3A F1, F2, F3	Use flathead screwdriver to exchange fuses.
11	SIGNAL(CN5)	Connection port for the cable connector when the operation/warning signal are extracted.

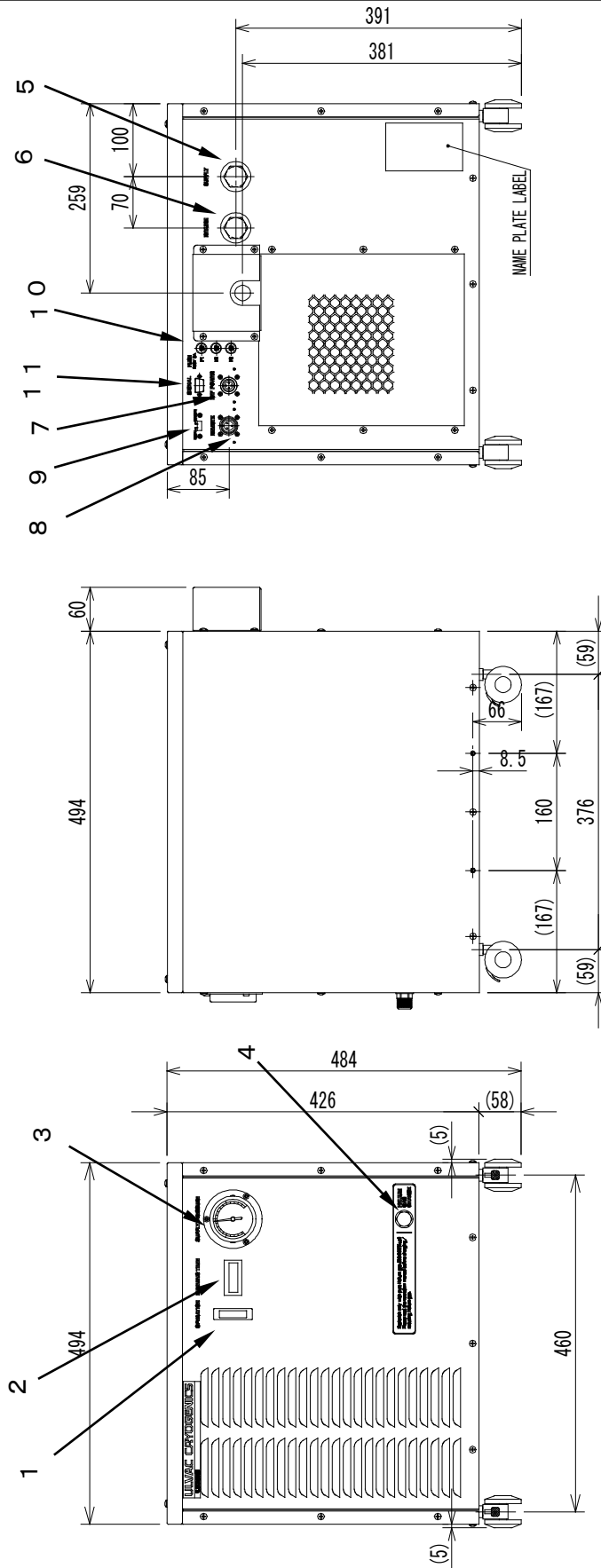


Figure 3-1 SA115-C Control and Connection Components

3.2.2 Flow of Gas and Oil in the Compressor Unit

Figure 1.2 shows the flow of helium gas and oil in compressor unit SA115-C.

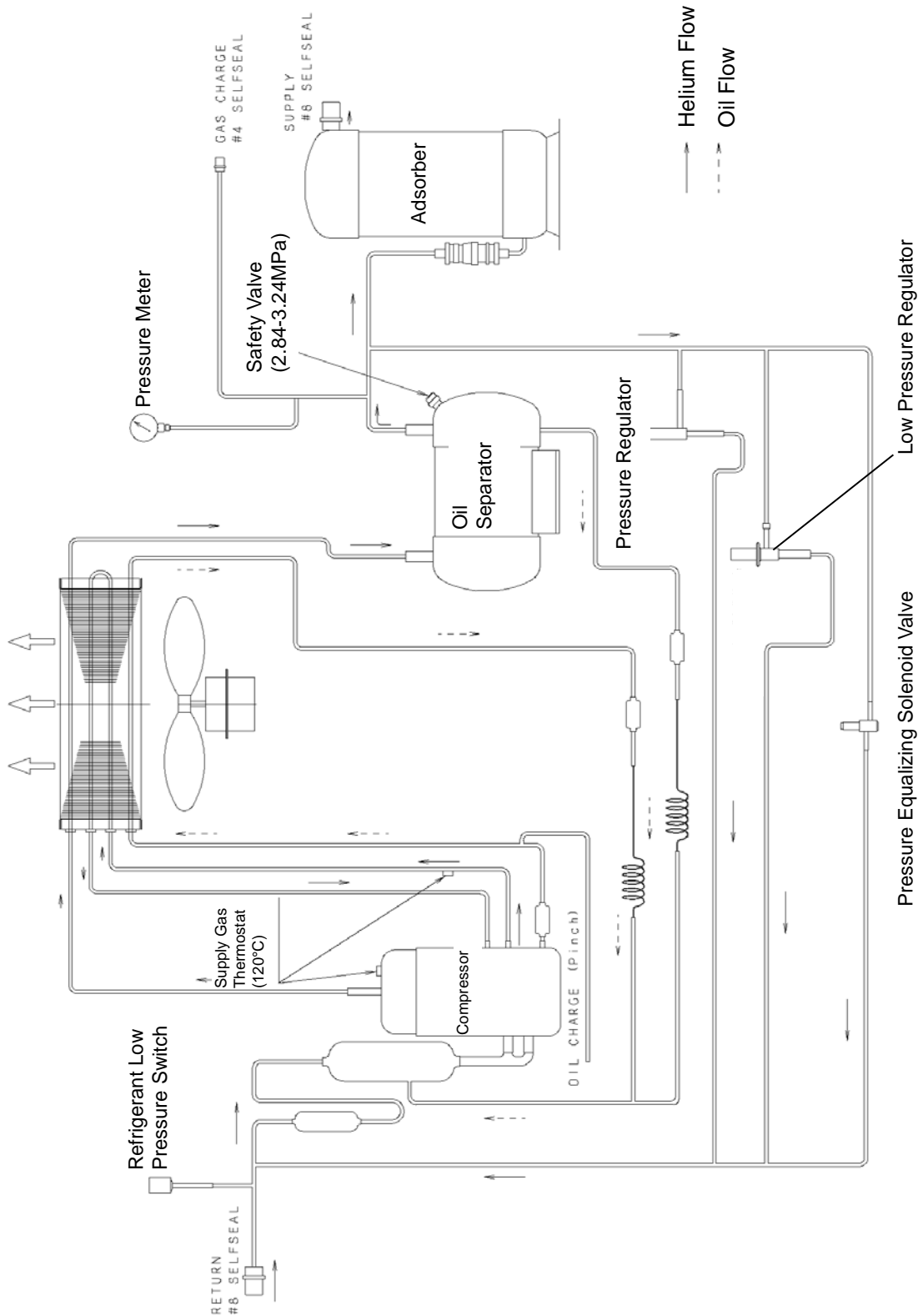


Figure 3-2 SA115-C Helium gas flow

3.2.3 Internal Components

Internal components are shown in Table 3-3, Figure 3-3 and 3-4.

Table 3-3 Components inside and their functions

No.	Component	Function
1	Compressor motor	Helium compressor motor.
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	Adsorber	Separates residual oil mist in the processed compressed helium gas processed by oil separator.
7	Buffer tank	Helium gas reserve tank.
8	Helium gas supply port (SUPPLY)	For connecting flexible hose (helium gas supply port).
9	Helium gas return port (RETURN)	For connecting flexible hose (helium gas return port).
10	Helium gas charge port	Port to charge helium gas.
11	Oil replenish port	Soldered port for charging lubricating oil.
12	Low pressure regulator	By-pass valve to maintain the pressure of the low-pressure helium gas above a certain level.
13	High pressure regulator	By-pass valve to maintain the pressure of the high-pressure helium gas above a certain level.
14	Safety valve	Safety pressure valve to maintain the pressure of the high-pressure at a specified value or below.
15	Solenoid valve (SVC)	Solenoid valve for helium gas pipes.
16	Pressure gauge	Indicates the helium gas charge pressure when not in operation, and shows the compressed helium gas pressure during operation.
17	Low-pressure pressure switch (63PL)	Pressure detector to detect a drop in suction gas pressure.
18	Filter	Removes dirt and dust from the circulating lubricating oil.
19, 20	Capillary tube	Adjusts the flow amount of the circulating lubricating oil.
21	Thermostat (26G)	Detection and control device for the temperature of the compressed helium gas at the outlet of the compressor.
22	Fan	Cools down the heat exchanger
23	Fan Motor	
24	Control panel	Control monitor and warning system for the helium gas compression unit. (Refer to "3-3 Instructions on the Electrical System.")

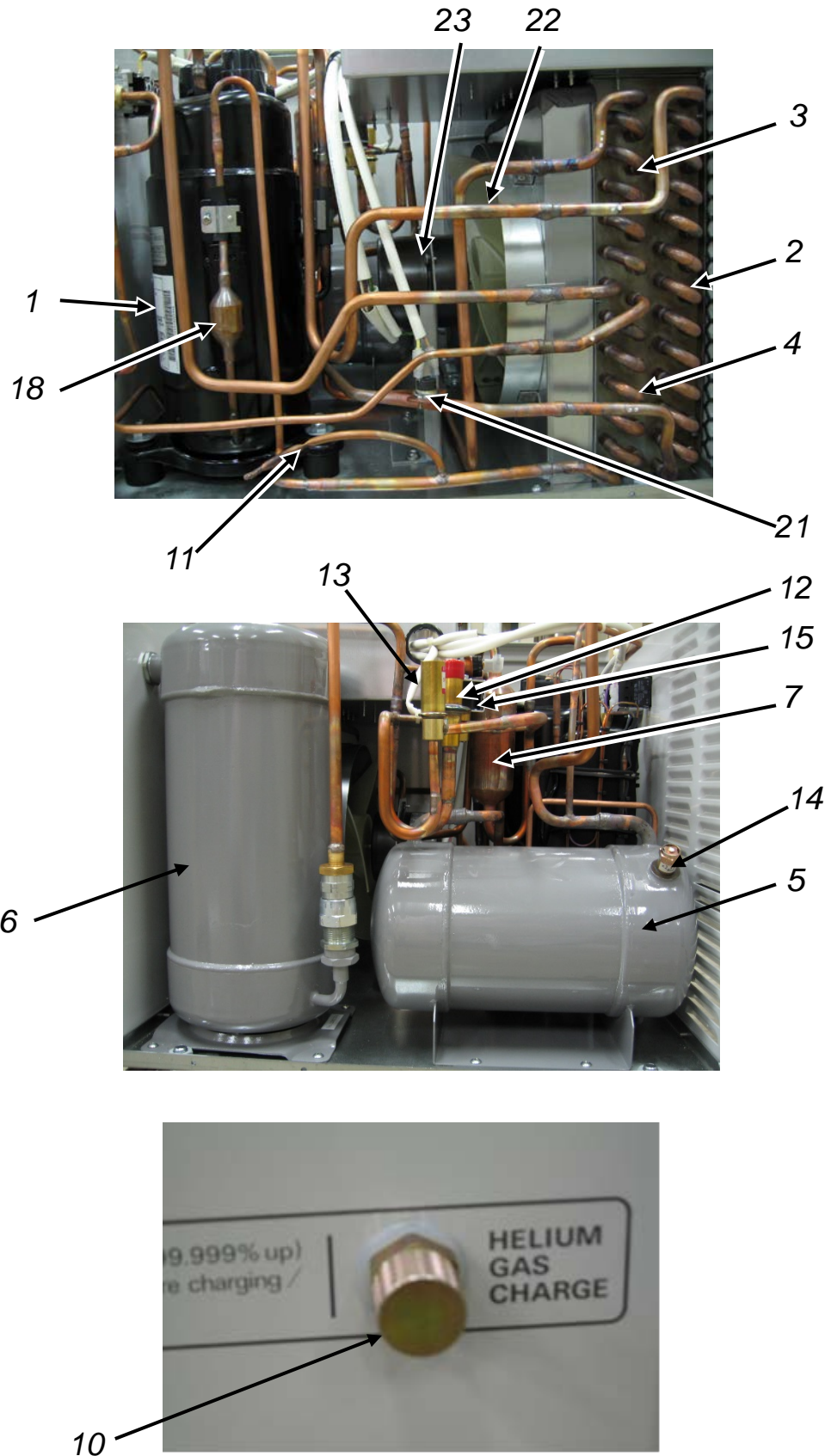


Figure 3-3 SA115-C Internal Components



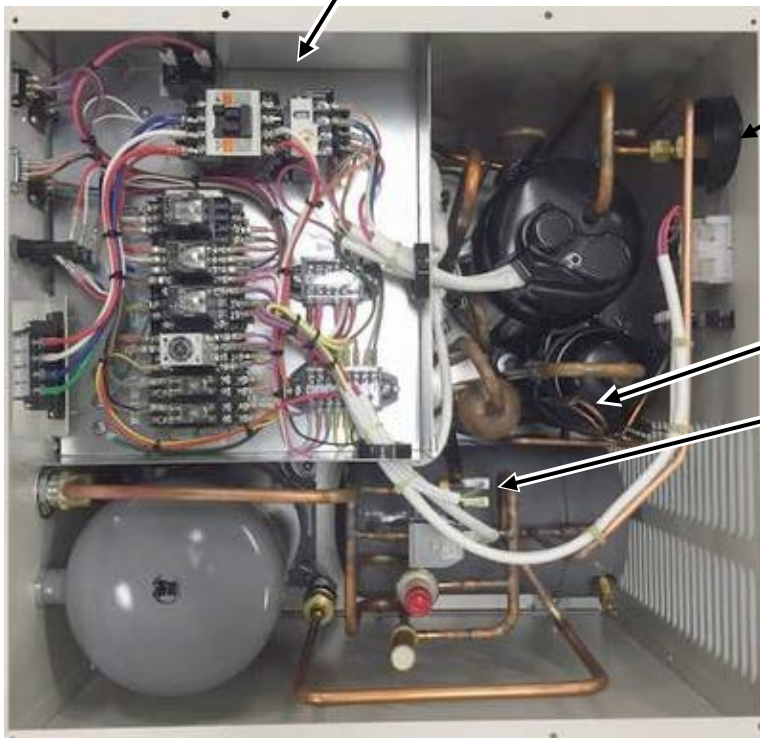
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24

16



19, 20

17

Figure 3-4 SA115-C Internal Components

3.3 Instructions for the Electrical System

3.3.1 Control Components

The control components for Compressor Unit SA115-C are shown in Table 3-4, Figure 3-5 and Figure 3-6.

		WARNING
Disconnect all the power sources supplied to the compressor unit before opening the panels.		

Table 3-4 List of Control Components

No.	Component	Code	Component number	Specifications	Volume
1	Operation Switch	SW1	AJ911102B3F	AC250V 16A	1
2	Elapsed Time Meter	HM	H7ET-NFV-300	DC3V	1
3	Refrigerator Connector	CN1	JL04V-2A18-10SE-B-R	4P	1
4	Remote Connector	CN2	N/MS3102A14-7S	3P	1
5	REOMTE / LOCAL Switch	SW2	S-1-Z	AC250V 4A	1
6	Fuse	F1, F2, F3	02163.15	AC250V 3.15A	3
	Fuse Holder		F-400-01-A2	AC250V 10A	3
7	Power Terminal Board	TB1	KTU15 (J)	600V 15A 4P	1
8	Thermostat	26G	CS-74L120	120°C	2
9	Low Pressure Switch	63PL	ACB-1AU3	OFF:0.098MPa	1
10	Reverse Phase Prevention Relay	47C	QE-20N	AC200V	1
11	Magnet Switch Thermal Overload Relay	52CM	SW-0/3QA	AC200C Setting: 9A	1
		51CM			1
12	Delay Relay Socket (With holding clamp)	2T1	ST7P-4 TP814X1	AC200V Setting: 1 second	1
13	Auxiliary Relay Socket (With holding clamp)	4X1	HH54P TP58X2	AC200V	1
14	Auxiliary Relay Socket (With holding clamp)	4XAL	HH52P	AC200V	2
			TP58X2		2
15	Terminal Board for Control	TB2	KTUNS-8J-SA 1976	600V 10A 8P	1
16	Fan Motor Power Terminal	TB3	KTUNS-6J	600V 10A 6P	1
17	Delay Relay Socket	RY1,RY2	G2R-2-SN P2RF-08	Coil AC200V	1
18	Signal connector	CN5	DE-9P-NR	9P	1

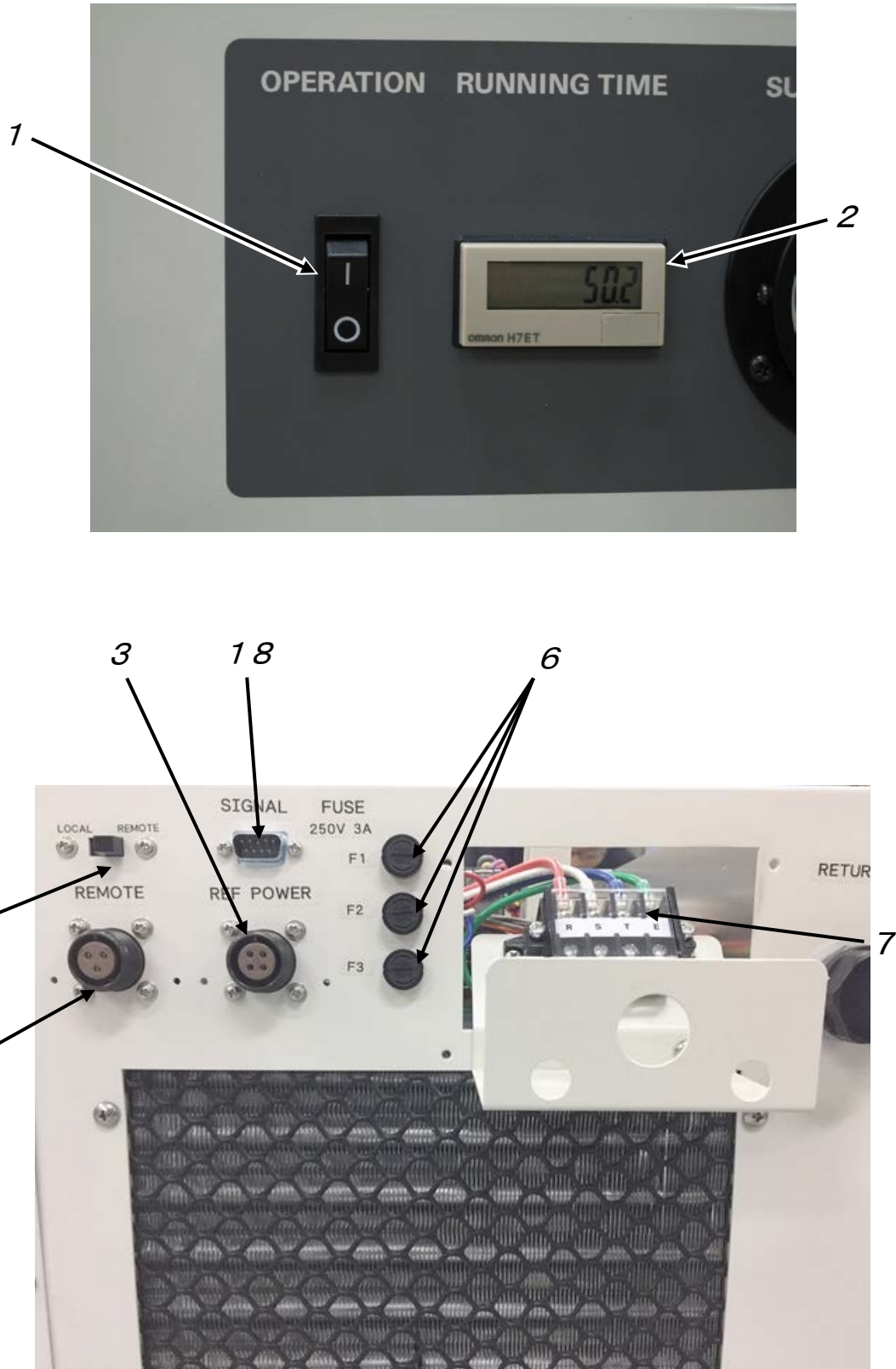


Figure 3-5 SA115-C Internal Components

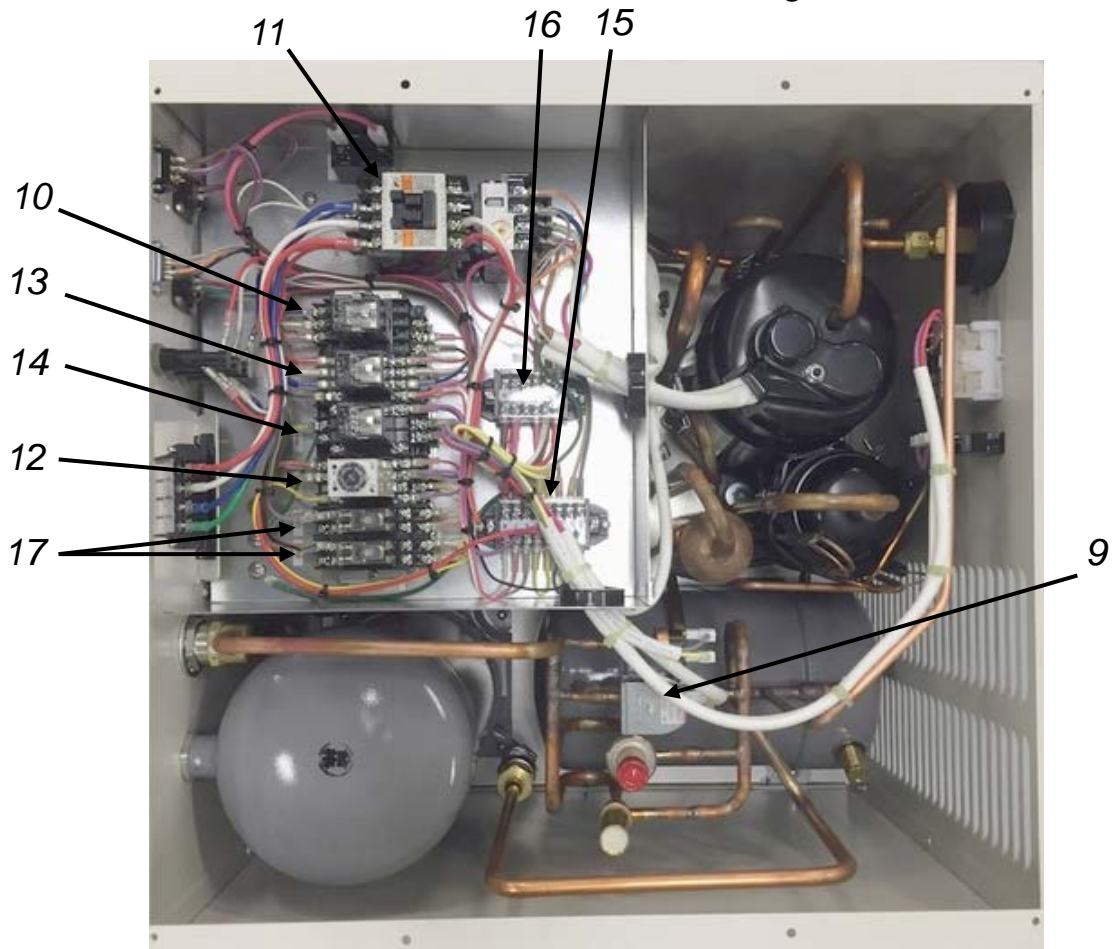
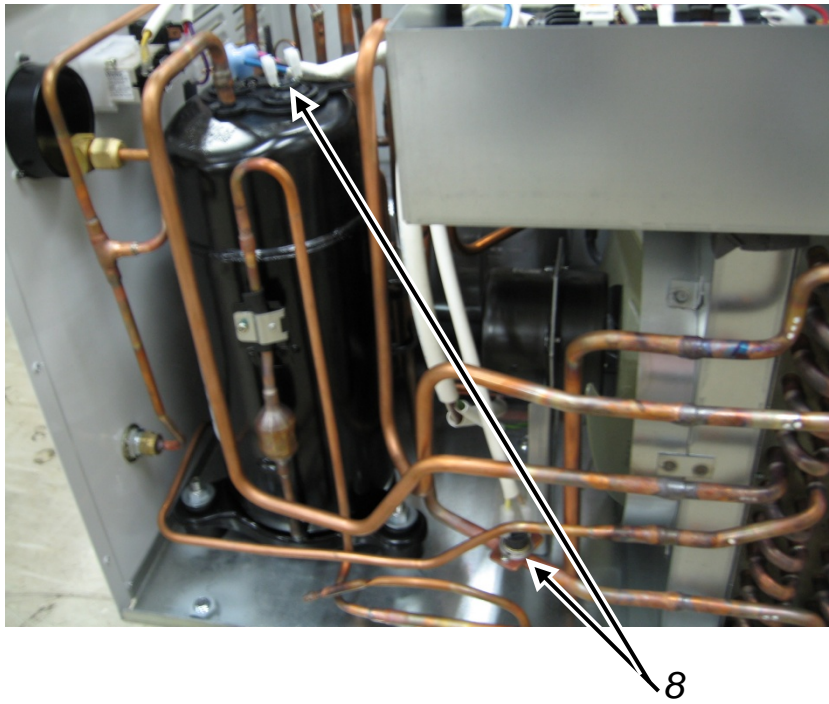


Figure 3-6 SA115-C Internal Components

3.3.2 Remote Connector

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

Table 3-5 shows the detail of remote operation and monitor sequence.

Table 3-5 Remote/Monitor Sequence

No.	Item	Status		Pin No.	Contact Capacity
		Stop	Release		
1	Remote Operation	Run	Connect	A, B	Rated Volume: AC200V above 0.1A Minimum load: AC 200V 0.01A

Table 3-6 Applied connector for remote

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

Diagram 1.5 Remote connector pin configuration

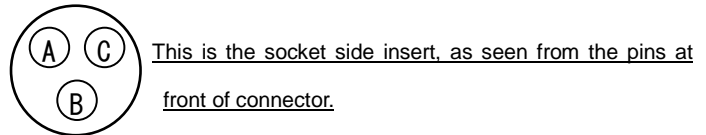


Figure 3-7 Remote Connector Pins

3.3.3 Signal Connector

The signal connector can be used to monitor conditions.

Table 1.7 shows the monitor sequence of the compressor unit.

Table 3-7 Monitor sequence

No.	Items	Condition		Pin code	Volume of contact points
1	Operation monitor	No-voltage contact point	Operated Close Stopped Open	1, 2	DC 24V 0.1A
2	Warning monitor	No-voltage contact point	Normal Open Warning Close	4, 5	DC 24V 0.1A

Table 3-8 Applicable connector for remote

Name	Specifications
Plug connector	DE9S-NR Made by Japan Aviation Electronics Industry, Ltd.
Connector Shell	DE-C8-J9-B1-1R Made by Japan Aviation Electronics Industry, Ltd.

Signal connector pin configuration

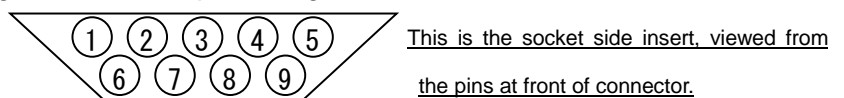


Figure 3-8 Remote Connector Pins

3.3.4 Coldhead Connector

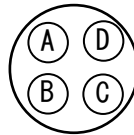
The coldhead connector can be used to supply power for coldhead motors and so on.

Table 3-9 Coldhead Connector Specifications

Item	Specifications
Power Source	3φ 200VAC
Maximum Capacity	Rated 1.6A
Phase Array	A : L1、 B : L2、 C : L3、 D : GND

Table 3-10 Coldhead Connectors

Item	Specifications
Plug Connector (Straight)	Made by Japan Aviation Electronics Industry, Ltd. JL04V-6A-18-10PE-EB-R
Plug Connector (Angle type)	Made by Japan Aviation Electronics Industry, Ltd. JL04V-8A-18-10PE-EB-R
Cable Clamp	Made by Japan Aviation Electronics Industry, Ltd. JL04-18CK(10)-CR-R



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

Figure 3-9 Coldhead Connector Pins

3.3.5 Safeguards

Table 3-9 lists the safeguards of Compressor Unit SA115-C.

Table 3-11 Safeguards

Items (Code)	Function
Thermostat (26G)	Set temperature: 120°C Stops the compressor and send warning signal to the external connector when the temperature of compressed helium gas at the compressor motor exit is higher than the set temperature.
Thermostat (49C)	Set temperature: 120°C Stops the compressor and send warning signal to the external connector when the temperature of top surface of the compressor is higher than the set temperature.
Refrigerant low-pressure switch (63PL)	Set pressure: About 0.1MPa Stops the compressor and send warning signal to the external connector when the suction pressure drops due to some reasons, such as the amount of helium gas inclusion is less than the specified amount.
Solenoid Valve	Stabilize the helium pressure between the supply and return flexible hoses when the compressor stops.
Safety Valve	Set pressure Approx. 2.84 – 3.24MPa Control the helium gas supply pressure with the safety valve function that release helium gas into the air when the helium gas supply pressure is higher than the set value.
Thermal Overload Relay (51CM)	Set current: 9A Stops the compressor in case of over current or short circuit.
Fuse (F1,F2, F3)	Activates to protect the circuit in the event of a surge in the operations circuit. The ones that are connected to the compressor refrigerator connectors will stop. The Warning Indicator Lamp might not lit. To restore operations, replace the fuse (AC250V, 3A). Make sure to disconnect power source and check for the causes, perform corrective actions, and then restart.

4. Installation

4.1 Conditions for Installation

Ambient Temperature

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

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 bottle (99.999% purity or above), pressure regulator, exit valve, and a charge hose or similar supply line, are needed.

Power Source

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

For more information, see 'Table 3-1 Compressor Unit SA115-C Specifications.'

Room Temperature

Check that the room temperature of the site meet the specifications shown in table3-1.

Use air conditioners that have sufficient performance to the heat load of the equipment.

Keep the room temperature as shown in table 3-1.

Earthquake Proof measures

Fix the compressor unit with anchor bolts as required.

Maintenance Area

Keep clear the space for maintenance works around the compressor unit; 400mm in front, 600mm in rear, and 200mm on the right, left and top.

4.2 Installation

4.2.1 Inspection

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 components.

- (2) Be sure that the helium static pressure indicated by the compressor unit pressure meter is within the specified range.

If the indicator reads lower than the specified range, add helium gas from the helium charge port.

If the indicator reads 0 MPa, the helium may be contaminated. The compressor unit need to be replaced.

- (3) Check for damage on any attached components, etc.

- a). Overall exterior
- b). Self-sealing couplings of supply and return side
- c). Helium gas charge port
- d). Oil leakage around the bottom plate



CAUTION

When moving the compressor unit, do so on a smooth floor. If forcibly moved over a rough floor, the casters may be damaged, resulting in the injury in your feet.



4.2.2 Install the Compressor Unit

Check that the following installation conditions are met.

- (1) Install the compressor unit on a smooth floor that is visually level.
- (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) SA115-C is air-cooled type. The installation site is required to have sufficient space for air circulation and well ventilated so that exhaust heat from the compressor does not affect.
- (6) Ensure that the air conditioner can supply sufficient volume at the location of the compressor unit.
- (7) Do not place anything that is easily affected by heat near the compressor unit.

4.2.3 Electrical Wiring


Perform electrical wiring as follows.

	 WARNING
<p>Never connect cables while the compressor unit is supplied power. Make sure that the operation switch is turned OFF before connecting the power cable.</p>	

(1) Install the circuit breakers

Supply AC power for compressor from the equipment-side distribution panel. The distribution panel should have circuit breakers dedicated for respective compressors. Follow the descriptions below to choose and install a circuit breaker.

- Use components that are appropriate and meet the international and the national codes and standards of the country installed (Refer to IEC60947-1, IEC60947-2, and IEC60947-3).
- Install a circuit breaker in a place close to the compressor unit (within 3m) and can be easily accessed.
- Do not install in a way that hinders easy operation.
- Indicate that the circuit breaker is for the compressor unit.
- OFF position should be easily located.
- Refer to Table 3-1 for circuit breaker current rating.

 CAUTION
<p>In most standards, it is required to install a branch breaker and protect power cables connected to the equipment. Make sure to Install circuit breakers. Failure to follow this procedure could seriously damage the equipment.</p>

(2) Connecting the Power Cable

Check that the compressor OPERATION switch is turned OFF, and connect the input power cable to the power source of 200V, three-phase with grounding terminal. The power supply circuit should be dedicated which does not have other devices connected to the secondary side of the circuit breaker.

<Power terminal board> Thread size: M4, Width of the board: 9mm

(3) Wiring capacity

Table 4-1 shows the electric wiring capacity.

Table 4-1 Electric Wiring Capacity

Power source wiring Room temperature 30°C or less (Metal tube/PVC tube etc.) Voltage drop standard 2 %	Power cable minimum thickness	2 mm ² (21m)
	Distance up to 10 m	2 mm ²
	up to 20 m	2 mm ²
	up to 30 m	3.5 mm ²
Electric wiring Room temperature 38°C or less (Metal tube/PVC tube etc.) Voltage drop standard 2 %	Minimum thickness of power cable	2 mm ² (21 m)
	Distance up to 10 m	2 mm ²
	up to 20 m	2 mm ²
	up to 30 m	3.5 mm ²
Thickness of ground wire		Same as the power cable
Thickness of power source to the refrigerator		2 mm ²

- “Metal and PVC tube, etc.” refer to metal pipe wiring, plastic pipe wiring, floor duct or cellular duct wiring, and cable wiring.
- Values in parenthesis for minimum thickness of power source wiring are maximum distances.
- Values with mm² shows the cross-section area.

(4) Connection of coldhead cables

Connect the coldhead 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.

(5) Connection of Remote cable

Fix the connector with the brackets delivered with the SA115-C.



Piping Connections

Use the specified flexible hoses for helium gas piping connection.

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

There are both the SUPPLY and RETURN for the piping connection ports of the unit.

Attach high-pressure piping (outgoing piping to the refrigerator) to the SUPPLY, and low-pressure piping (incoming piping from the refrigerator) to the RETURN. Be careful not to incorrectly attach the piping.

Remove the protective cap on the SUPPLY and confirm that there are gaskets on the self-sealing coupling. Missing gaskets can cause helium gas leaks.

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 hand.

Always fasten the union nuts using two spanners.

Since gas might slightly leak while fastening union nuts, finish connecting quickly in order to minimize leakage.

Although couplings must be tightly fixed, do not use a torque of 22N·m or more.

In the same way, connect the RETURN port to low-pressure piping (incoming piping from the refrigerators).

After connecting the ultra-low-temperature refrigerator, make sure the connections are correct.

In particular, make sure the SUPPLY piping and RETURN 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 completed. Wipe off any leak test liquid.

5. Operation

5.1 Start Operation

Before starting refrigerating system, make sure that the compressor unit, ultra-low-temperature refrigerator, flexible tubes and power source cables are correctly connected.

To start the cryocooler system;

- (1) Confirm that the pressure of the compressor unit is within the rated values.
- (2) Turn the “OPERATION” switch to ON on the front panel of the compressor unit.

The compressor unit (refrigerating system) will start operating.

→ If the unit does not start operating, check if REMOTE/LOCAL switch is on “L” position.

For other problems, refer to “7. Troubleshooting.”



5.2 Stop Operation

Turn the OPERATION switch on the front panel of the compressor unit to OFF.

The compressor unit (refrigerating system) stops.

5.3 Checking Normal Operation

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

- (1) Check the helium gas supply pressure of the compressor on a regular basis.

The helium charge pressure in normal operation is from 2.0MPa to 2.3MPa.

- (2) Monitor the temperature of the refrigerator.

The ultimate temperature of the coldhead depends on the heat load or vacuum level of the vacuum chamber. If the temperature is high and stable, the total heat load for the coldhead may be too large. Check the heat load.

- (3) The temperature of the helium flexible hose on the supply side should not exceed 40°C.

When the helium flexible hose is hot, check the compressor ventilation or air filter.

Operating Noise

The cryocooler makes noise of operating sound and gas exchange while in operation.

Cooling Air Flow

The cooling fan is attached inside the compressor and it works continuously.

The cooling air comes in from the front panel and goes out from the heat exchanger on the rear panel.

6. Maintenance

6.1 Scheduled Maintenance

		WARNING
<p>When disposing used adsorbers, first release the gas inside, and then remove one of the self-sealing couplings.</p>		

6.1.1 Cleaning Heat Exchanger

Periodical cleaning of compressor oil and helium gas heat exchanger is required to maintain good performance and reliability of cryocoolers.

It is requested to clean the heat exchanger at least once in a circumstance such as computer rooms. The timing may vary depending on the ambient conditions of a compressor.

Cleaning Procedure

- (1) Clean dust on the surface of the compressor heat exchanger fins with a vacuum cleaner.



6.1.2 Charging Helium Gas

Helium bottles or other optional parts are required to charge helium gas.

	 WARNING
<p>Charge helium gas when the compressor is suspended. Operate charging valves or pressure regulators slowly. If they are handled in a quick manner, it may result in helium gas leakage or damage to the equipment.</p>	

When the helium pressure drops below the appropriate value, helium gas needs to be filled. If no cause is found during normal works by which to attribute a change in gas pressure, such as attaching or removing flexible hoses, determine and repair the cause of the lowering pressure.

Check the connection condition of the self-sealing coupling, connection parts of the safety valves, charge valves, etc.

Next, perform a leak test by sniffer method.

Use helium gas with purity of 99.999 % or above.

How to charge helium gas

- (1) Check that the pressure regulator valve is closed, and connect the pressure regulator to the helium bottle.
- (2) Open the helium bottle valve.
- (3) Remove the cap of the helium charge port on the front panel of the compressor, and connect helium charging valve to the port.
- (4) Connect the charging hose to the pressure regulator of the helium bottle.
- (5) Connect the charging hose to the charging valve while releasing small amount of helium gas from the helium bottle and the helium charging valve.
- (6) Set the pressure regulator of the helium bottle a little higher than specified, open the charging valve slowly, and charge helium gas to the specified pressure.
- (7) Close the charging valve.
- (8) Close the valve of the helium bottle, close the pressure regulator, and then remove the charging hose and the helium charging valve.
- (9) Put the cap on the charging port on the front panel of the compressor.
- (10) Slightly open the pressure regulator again, and check that there is no pressure between the helium bottle and the pressure regulator.
- (11) Remove the pressure regulator from the helium bottle.

- NOTES
1. When the helium gas pressure meter reads 0 MPa, air may already present. Contact our service department before refilling helium gas.
 2. When attaching the pressure regulator to a new bottle, air between bottle valve and the pressure regulator must be purged.

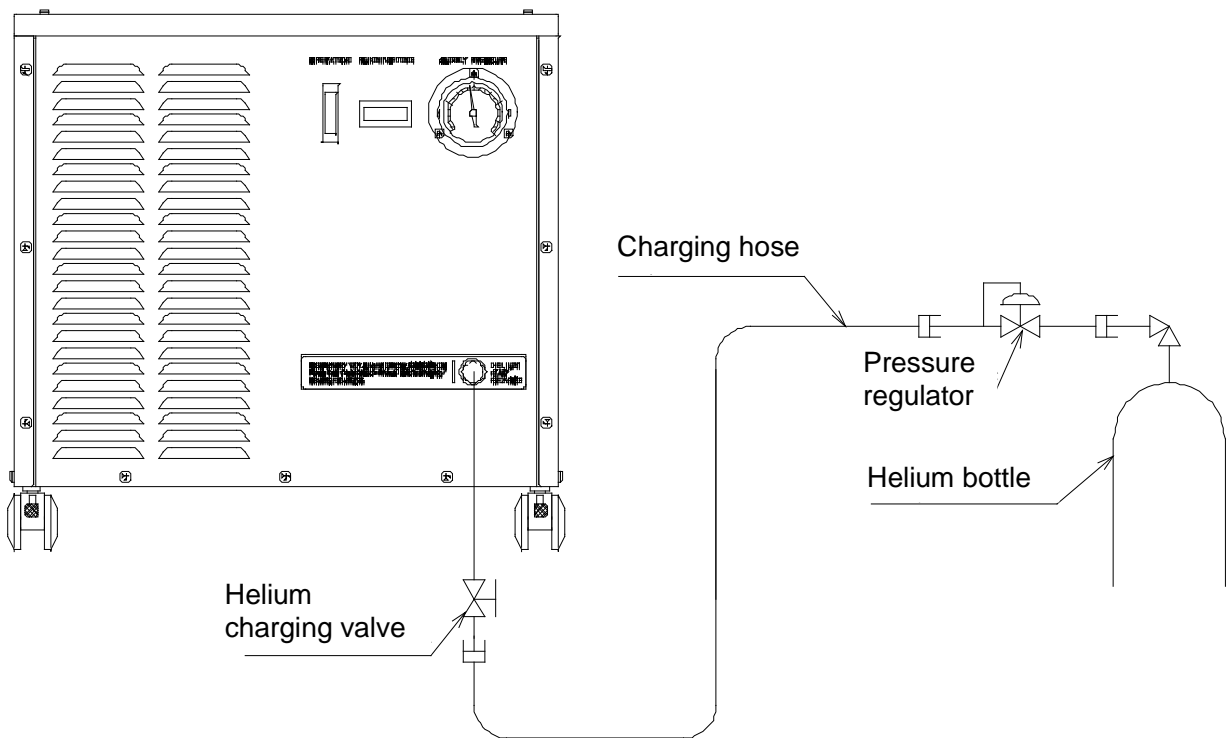


Figure 6-1 Helium Charge Flow Diagram

6.2 On-Site Repair

6.2.1 Replacing Fuses

The fuse holder is on the back panel.

Table 6-1 Fuse List (Spare fuses are attached to the product).

Fuse No.	Specifications	Component No.	Notes
F1	Glass tube fuse 250VAC 3A	MT4-3A	For control circuits
F2			
F3			

Procedures to replace fuse

	 WARNING
Disconnect all the power supply to the compressor unit before performing fuse replacement.	

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

7. Troubleshooting

	 WARNING
Disconnect all the power supply to the compressor unit before performing any troubleshooting procedures.	

Problem	Possible Cause	Corrective Action
When starting operations: The compressor unit does not start when turning on the OPERATION switch.	The power is not supplied.	Turn ON the power supply. Check any wiring related to the power source.
	Compressor motor failure (break of winding wire)	Measure the wire wound resistance at the compressor motor terminal. Or, measure the insulation resistance at the compressor motor terminal. Contact us if there is a problem.
	Although the REMOTE/LOCAL switch is put into "R," the remote signal has not been received.	Set the REMOTE/LOCAL switch to "L" or perform the correct remote operations.
	Either the fuse is blown or disconnected.	Check if the inner fuse is OK. If defective, replace the fuse with a new one. If the problem continues, check if the number of components that are connected to the refrigerator connector or to the remote connector is more than allowed.
	Open-phase	Check that the voltages among each phase are within the range of 200V±10%. If they are not, adjust them to be in the above range.
	Incorrect operation of control components	Please contact us.
	Abnormal operation due to the pressure drop.	Charge helium gas to the specified pressure. If helium gas charge is required frequently, check the helium gas leakage.

Problem	Possible Cause	Corrective Action
<p>When starting operations: The compressor unit soon stops right after starting-up when turned on.</p>	<p>Power source is in reversed-phase.</p>	<p>Check that the voltages among each phase are within the range of 200V±10%. If the supply voltage is in normal condition, turn off the power source and replace the two power cables.</p>
	<p>Abnormal operation due to the pressure drop</p>	<p>Charge helium gas to the specified pressure. If helium gas charge is required frequently, check the helium gas leakage.</p>
	<p>Protective circuit for abnormal temperature works</p>	<ul style="list-style-type: none"> ● Check that the voltages among each phase are within the range of 200V±10%. If they are not, adjust them to be in the above range. ● Check that the air intake is not blocked. Clear if blocked. ● Secure the space to intake and exhaust air around the compressor unit. In case the thermostat is activated due to the abnormal temperature, it may take time to return to the normal conditions. Wait for a while and start the compressor. If the compressor still stops, please contact us.
<p>Abnormal sound continues during normal operation.</p>	<p>Lubricating oil of the compressor decreased.</p>	<p>Please contact us.</p>
<p>Compressor stops during normal operation.</p>	<p>Supply voltage may be in trouble (voltage fluctuation).</p>	<p>Check the wiring relating to power source. Refer to 4.2.3. Check that the voltages among each phase are within the range of 200V±10%. If they are not, adjust them to be in the above range.</p>
	<p>Either the fuse is blown or disconnected.</p>	<p>Check if the internal fuses are 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.</p>

Problem	Possible Cause	Corrective Action
	<p>Abnormal pressure</p> <p>A. Abnormal running due to pressure drop</p> <p>B. Relief valve is activated.</p> <p>C. The operating pressure does not go up</p>	<p>A. Charge helium gas to the specified pressure.</p> <p>B. Stop the compressor unit, leave it until the coldhead reaches to the room temperature, and check if the helium pressure is not too high. If the helium pressure is normal and the cryocooler and coldhead cable have no problem, please contact us.</p> <p>C. When the cryocooler has no problem, there may be failure with the pressure equalizing solenoid valve or pressure regulator valve. Please contact us.</p>
Compressor unit stops during operation.	<p>Helium gas temperature is not in normal range.</p> <p>A. Abnormal temperature The flow rate of the cooling air is low.</p> <p>B. Lubricating oil of the compressor is decreased.</p>	<p>A. Check the ambient temperature of the compressor. Check that the air intake is not blocked. Clear if blocked. Secure the space to intake and exhaust air around the compressor unit.</p> <p>B. If the compressor unit can be restarted in a couple of minutes after it stops, the thermostat (26G) might have been activated due to low lubricating oil. Please contact us.</p>
	Fuse is broken or disconnected.	Check if the inner fuse is in normal condition. If it has problem, replace with new one. If the problem continues, check if the number of components that are connected to the refrigerator connector or to the remote connector is more than allowed.

8. Accessories and Parts

8.1 Standard Accessories

The content may vary depending on the customers' specifications.

Table 8-1 Standard Accessories

No.	Parts	Volume	Note
1	Fuse 3A	3	MT4-3A
2	Coldhead Cable	1	Connectors attached
3	Remote Connector	1	For remote operation
4	Single Head Wrench	1 set	For connecting helium gas lines
5	Instruction Manual	1	This book

8.2 Optional Parts

Table 8-2 Optional Parts

No.	Parts	Volume	Note
1	Adsorber	1 set	For scheduled maintenance
2	Helium Charging Valve	1 set	For charging helium gas
3	Helium Charging Hose	1	For charging helium gas Length: 900mm
4	Pressure Regulator	1 set	For charging helium gas

9. Electrical Diagram

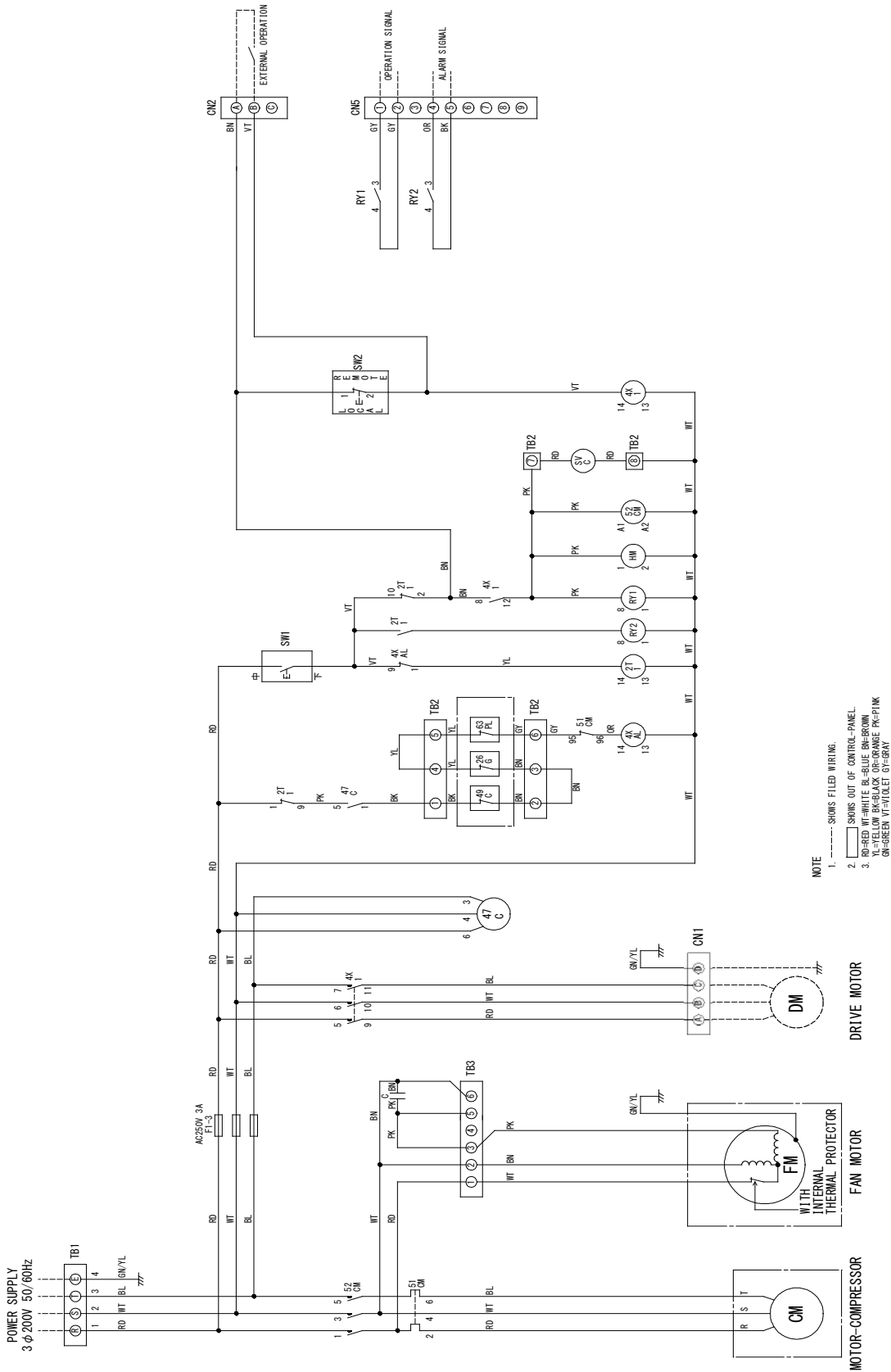


Figure 9-1 SA115-C Electrical Diagram

10. 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.

SERVICE NETWORK

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

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Revision History

Date	Revision No.	Contents
2017/07/27	2017.07	First edition
2021/07/08	2021JU01	Table 3-4, 3-8, 3-10 Parts model name has been changed. Table 3-1 has been modified. Figure9-1 has been modified.

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