ULVAC

Compressor Unit

Instruction Manual

SA112-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.

D/N. MEOM082E, 2018AL02 **ULVAC CRYOGENICS INCORPORATED**

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 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 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

This Section describes information required for handling the equipment safely.
Read the following precautions carefully and follow the 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 equipments 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

- Do not disassemble, pressurize, heat, and/or throw into fire. The adsorber may explode.
- For safe disposal of an adsorber, follow the procedures below.
  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. Inspection

Upon receiving the compressor unit SA112-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

The pressure gauge indicates the helium charge pressure of 2.0 MPa at 20°C (helium charge pressure may vary depending on the system configurations).
If the pressure gauge indicates below the charge pressure, add helium gas following the procedures described in “4-1-2 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 carry out the following procedures.

・Apply protection caps to all self-sealing couplings for safe shipping.
・Reuse the packing materials from the time of purchase.
・Securely and correctly wrap the compressor unit.
・Affix “No Tilting” and “This Side Up” caution labels.

3. General Instructions

3.1. Specifications

Table 3-1 shows the specifications for Helium Compressor Unit SA112-C.

Table 3-1 Compressor Unit SA112-C Specifications

Compressor unit		SA112-C	
Power source		φ, V, Hz	Single phase, 100, 50/60
Power consumption *1		kW	1.1/1.3
Starting current *1		A	56/52
Operating current *1		A	11.2/12.4
Compressor nominal output*2		W	700
Environment	Installable room temperature	°C	4-38
	Installable room humidity	%Rah	88 % or lower
Refrigerant		Helium gas	99.999 % or purer
Refrigerant filling pressure		MPa	2.0±0.05 (20)
Size	Height	mm	396 (including casters)
	Width	mm	373
	Length	mm	449
Weight		kg	44
Connection	Refrigerant［SUPPLY］	1/2”self-sealing coupling	
	Refrigerant［RETURN］	1/2” self-sealing coupling	
Timing for scheduled maintenance		Change adsorbers every 30,000 hours [refer to hour meter]	

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

*2 Motor output when measuring with R-22.

3.2. Overview / General Descriptions

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 ultra-low-temperature refrigerator.

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

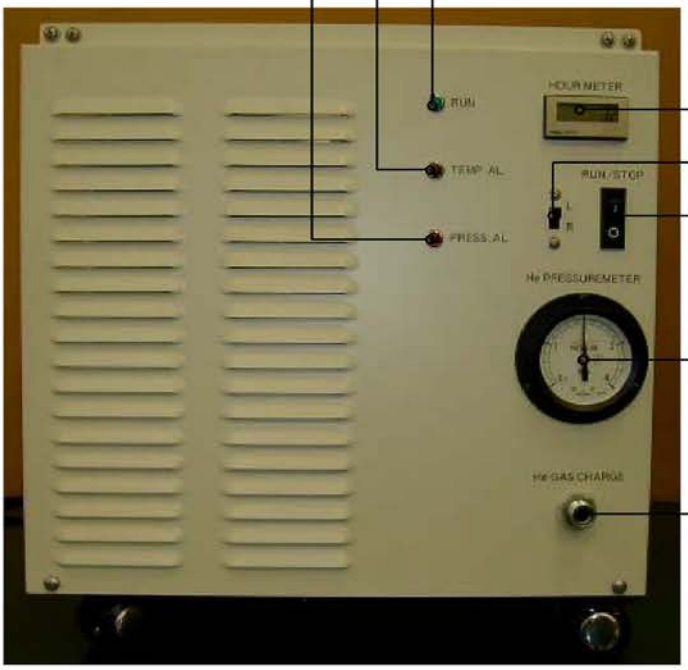
3.2.1. Control and Connection

Table 3-2 and Figure 3-1 show the control and connection of SA112-C.

Table 3-2 Control and connection of the compressor unit

No.	Item	Function
1	RUN Indicator Lamp (GL)	Lit when the compressor unit is in operation.
2	TEMP. AL. Indicator Lamp (RL1)	Lit when the thermal safeguard of the compressor unit is in operation.
3	PRESS. AL. Indicator Lamp (RL2)	Lit when the pressure safeguard of the compressor unit is in operation.
4	RUN/STOP Switch (SW1)	・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. Run/stop operations are carried out using (the EXTERNAL OPERATION switch handled on site). ・In the event a blackout occurs during operations, when the electricity is restored, operations will automatically continue .
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	Supply port for helium gas supply.
8	SUPPLY	Helium gas supply port to the ultra-low-temperature refrigerator. Flexible tube (supply side) is connected.
9	RETURN	Return port for helium gas from the ultra-low-temperature 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 to isolation transformer sourced 100 V.
14	FUSE	Fuse for control circuit protection（250 V 3.15A）.
15	SIGNAL(CN5)	Connection port for the cable connector when the operation/warning signal are extracted.
16	EARTH	Earth terminal for Refrigerator cable.

Figure 3-1 Control and Connection of SA112-C



3. PRESS. AL. indicator lamp
2. TEMP. AL. indicator lamp
1. RUN indicator lamp
5. HOUR METER
12. REMOTE/LOCAL switch
4. RUN/STOP switch
6. He PRESSURE METER
7. He GAS CHARGE

16. EARTH (pump)
11. REMOTE
15. SIGNAL
10. REF (motor of pump)
14. FUSE
8. SUPPLY
9. RETURN
13. POWER SUPPLY CORD

3.2.2. Flow of Gas and Oil in the Compressor Unit

Figure 3-2 shows the refrigerant circuit of compressor unit SA112.

Table 3-3 and Figure 3-3 show the components and their functions inside SA112.


WARNING

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

Table 3-3 Components inside and their functions

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	Adsorber	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 charging port	Port to charge helium gas.
10	Low pressure regulator	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 gauge	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 the circulating lubricating oil.
16	Capillary tube	Adjusts the flow amount of the 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 compression unit. (See item on "1-3 Instructions on the Electrical System.")

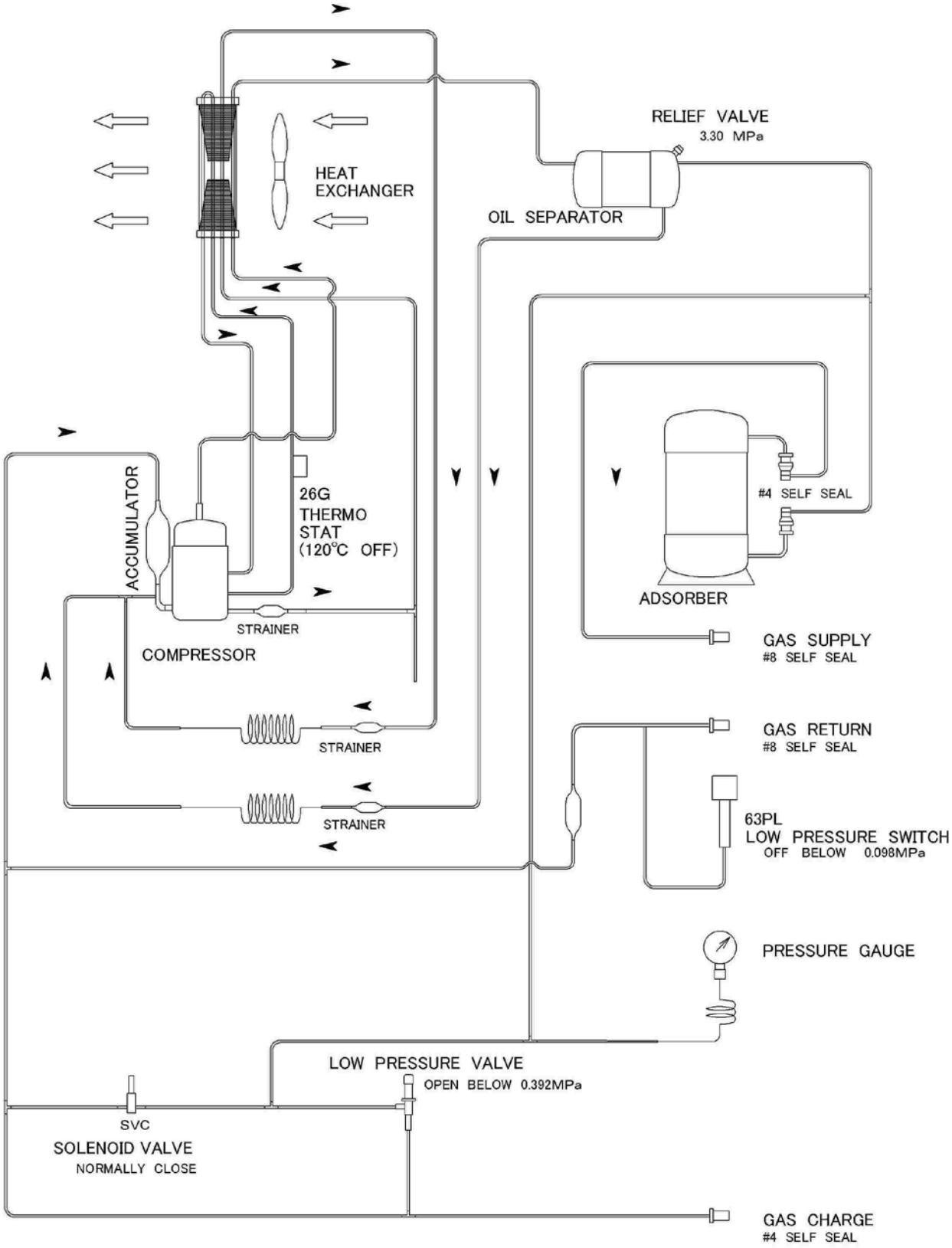


Figure 3-2 Refrigerant Circuit Diagram

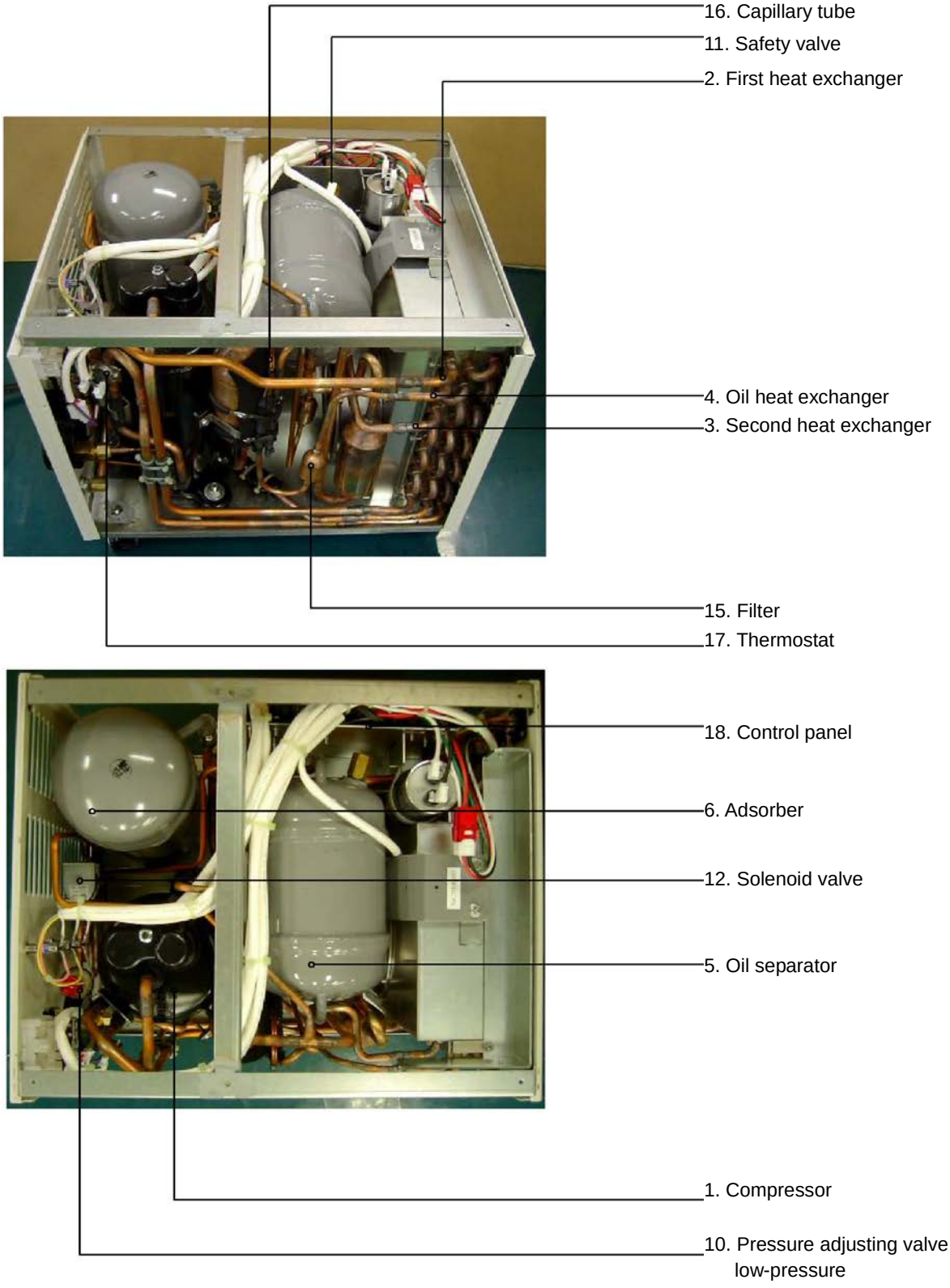


Figure 3-3 SA112-C Interior Components

3.3. Instructions for the Electrical System

3.3.1. Control Components

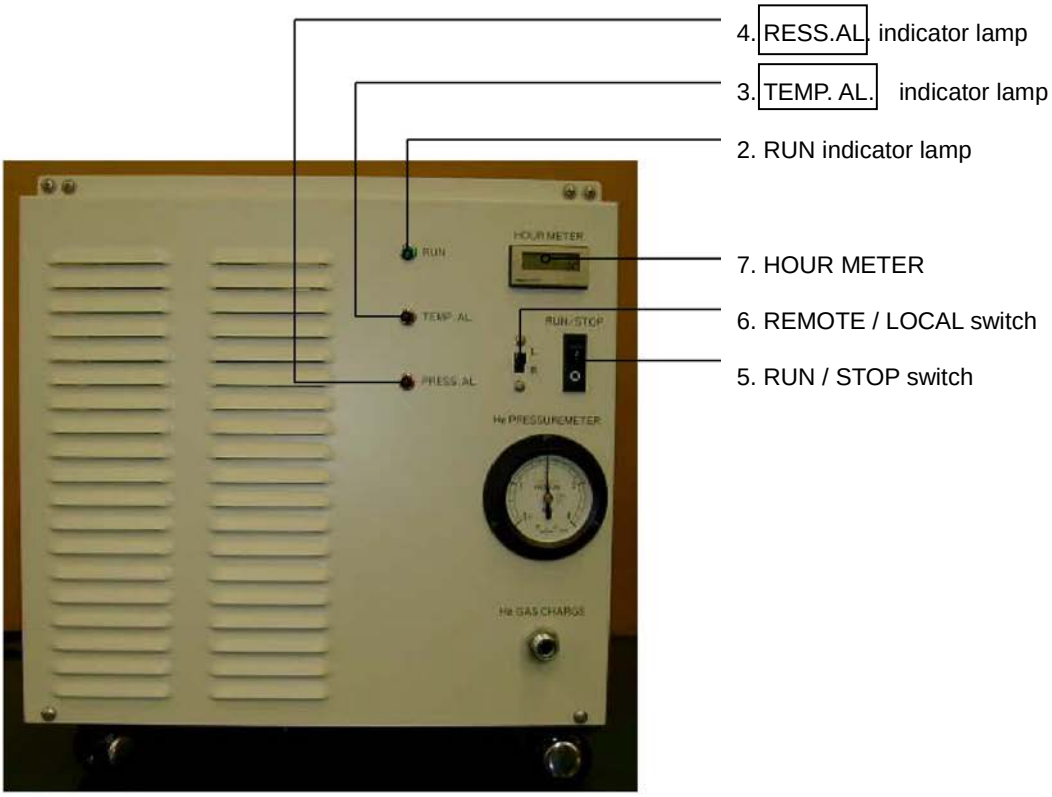
The control components for Compressor Unit SA112 are shown in Table 3-4 and Figure 3-4.


WARNING

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

Table 3-4 List of control components

No.	Name of component	Code	Component number	Specifications	Num-ber
1	Fan motor	FM	Dinah ace109-311	AC100 V	1
2	RUN indicator lamp	GL	BN3802-1G	AC100 V GREEN	1
3	TEMP.AL. indicator lamp	RL	BN3802-1R	AC100 V RED	1
4	PRESS.AL. indicator lamp	RL	BN3802-1R	AC100 V RED	1
5	RUN/STOP switch	SW1	AJ911102B3F	AC250 V 16A	1
6	Switch between local and remote	SW2	S-1-Z	AC250 V 4A	1
7	Operation hour meter	HM	H7ET-N-300	DC3 V (internal battery)	1
8	Refrigerator connector	CN1	N/MS3102A14S-2S	4P	1
9	Remote connector	CN2	N/MS3102A14-7S	3P	1
10	Connector	CN3	VLR-04V-R	AC600 V 20A 4P red	1
11	Connector	CN4	VLP-04V	AC600 V 20A 4P white	1
12	Fuse Fuse holder	F1,F2,	HT3.15AN5 F-400-01-A2	AC250 V 3.15A AC250 V 10A	2 2
13	Overload protector （inside the compressor）	OLR	MRA98283-9200	20.0 A at 80 °C	1
14	Temperature limiter	26G	CS-74L120	120 °C	1
15	Pressure switch	63PL	ACB-1AU3	OFF: 0.098 MPa	1
16	Relay	52CM	G7L-2A-BUB	AC100 V	1
17	Delay relay Socket (with holding clamp)	2T1,2	ST7P-2 TP814X1	AC100 V Setup: 1 second	2 2
18	Auxiliary relay Socket (with holding clamp)	4X1	HH54P TP514X1	AC100 V	1 1
19	Auxiliary relay Socket (with holding clamp)	4XOP,2,3	HH52P TP58X2	AC100 V	3 3
20	Starting relay	19C	AMVL-180A		1
21	Power source terminal	TB1	AYBN023-1	600 V 25A 3P	1
22	Terminal for control	TB2	KTUNS-10J	600 V 10A 10P	1
23	Power cord terminal	TB3	AYBN023-1	600 V 25A 3P	1
24	Solenoid valve coil	SVC	NEV-M0AC571UB0	AC100 V	1
25	Running capacitor	C1	RS22B606U4364A	220 V 60 μF	1
26	Starting capacitor	C2	DMS-1FJ150R	160 V 150 μF	1
27	Signal connector	CN5	DE-9P-NR	9P	1



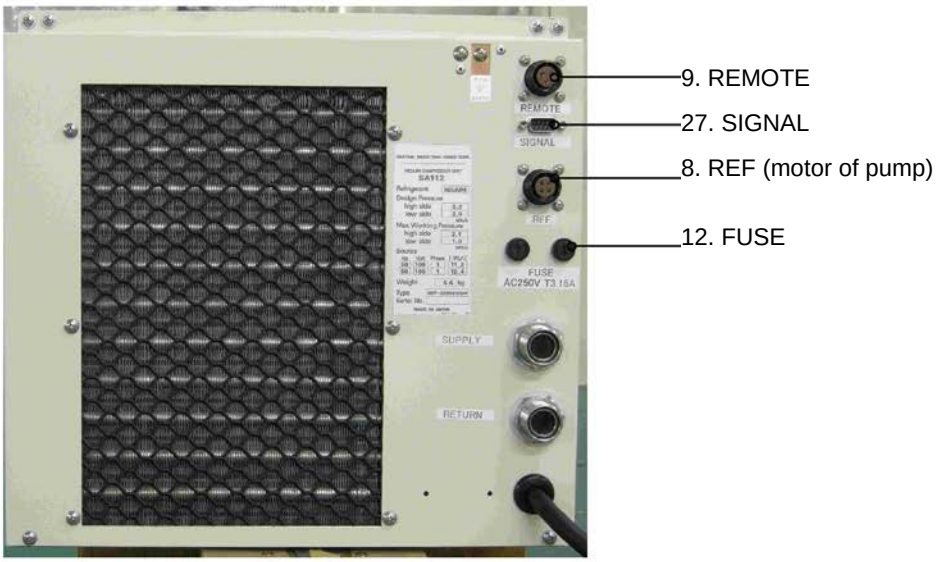


Figure 3-4 SA112 Control Components (exterior components)

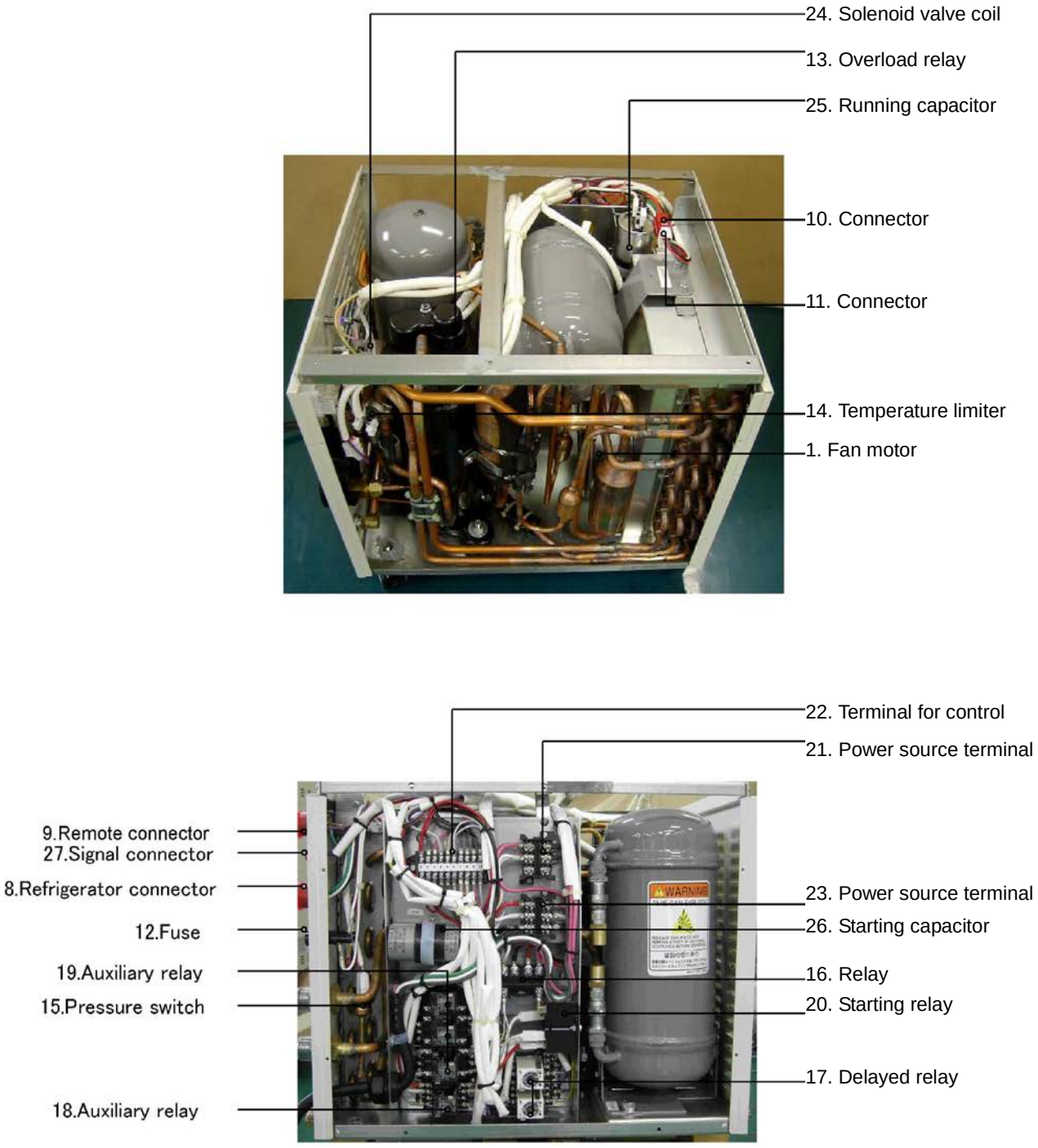


Figure 3-5 SA112-C Control Components (interior components)

3.3.2. Remote Connector

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

Table 3-5 shows the remote operation sequence.

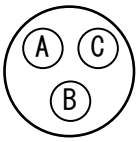
Table 3-5 Remote sequence

No.	Items	Condition		Pin code	Contact rating
		Stop	Release		
1	Remote operation EXTERNAL OPERATION	Operated	Connected	A, B	Rated Volume: AC125V above 0.1A Minimum load: AC 100V 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

Figure 3-6 Remote connector pin configuration



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

3.3.3. Signal Connector

The signal connector can be used to monitor conditions.

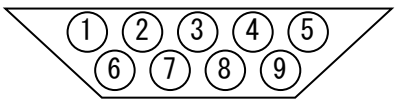
Table 3-7 shows the monitor sequence of the compressor unit.

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	TEMP. Warning monitor	No-voltage contact point	Normal Open Warning Close	**4 , 5**	DC 24V 0.1A
3	PRESS. Warning monitor	No-voltage contact point	Normal Open Warning Close	**3 , 5**	DC 24V 0.1A

Table 3-8 Applicable connector for remote

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



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

Figure 3-7 Signal connector pin configuration

3.3.4. Refrigerator [REF] Connector

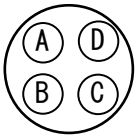
The refrigerator connector can be used to receive the motor power source for the ultra-low-temperature refrigerator, etc.

Table 3-9 Refrigerator connector specifications

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

Table 3-10 Applicable 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 3-8 Refrigerator connector configuration

3.3.5. Safeguards

Table 3-11 lists the safeguards of Compressor Unit SA112.

Table 3-11 Safeguards

Items (Code)	Function
Discharged gas thermostat (26G)	Setup temperature 120℃ 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, are stopped. When temperature decreases, operation can be restarted. To restart, press the RUN/STOP switch (SW1) again.
Refrigerant low-pressure switch (63PL)	Setup 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. It is possible to restart the unit by pressing the RUN/STOP switch（SW1）again, but in most cases, adjustment of the helium gas inclusion pressure of helium gas is needed.
Compressor motor Overload relay (OLR)	Activates depending on the compressor temperature and electric current. Activates when the compressor temperature is 80℃ and the electric current is 20.0A or more. The Warning Indicator Lamp (RL1) is lit and devices connected to power source of the refrigerator connector such as the compressor unit and cryopump unit, are stopped. When temperature decreases, operations can be restarted. To restart, press the RUN/STOP switch (SW1) again.
Fuse （F1,F2）	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 (AC250V, 3A). **Be sure to remove the compressor unit power cable plug from the supply outlet to safely isolate the equipment.** Check for causes and perform corrective actions, and then restart.

4. Installation

4.1. Conditions for Installation

Room Temperature

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

The installed 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 bottle grade 6 (99.999 % purity or more), pressure adjustment valve, 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, tolerable voltage variation is ±10 %.

For more information, see 'Table 1.1 Compressor Unit SA112-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.

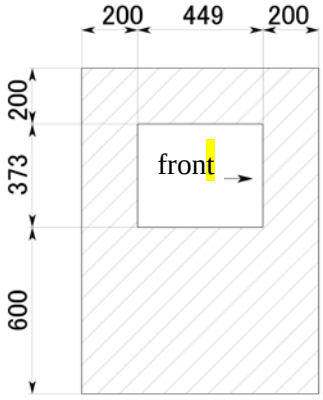


Figure 4-1 Maintenance space
(unit: mm)

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.
(a) Overall appearance
(b) Self-sealing coupling on the supply and return
(c) Helium gas compensating port
(d) Oil leaks around the bottom plate

(2) Be 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 specified value, compensate the helium gas from the helium compensating port.
If the indicator reads 0 MPa, the helium may be contaminated. Replace the compressor unit.

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

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 points for installation conditions.

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 that is dusty.
4. Install the compressor unit in a clean environment without dust and that is not affected by exhaust heat.
5. Ensure that the air conditioner can supply sufficient volume at the location of the compressor unit.
6. Do not place anything that is easily influenced by heat near the compressor unit.

4.2.3. Electrical Wiring

Perform electrical wiring as follows.


WARNING

Never connect cables while the compressor unit is connected to the electrical current.
Make sure that the operation switch is turned OFF before connecting the power cable.

(1) Wiring capacity

In order to secure 100±8V to the outlet (socket receiving the plug of the Compressor), install the electrical supply wiring in consideration of Table 4-1 Electric Wiring Capacity.

Table 4-1 Electric Wiring Capacity

Power source wiring Room temperature 30℃or less (Metal tube/vinyl tube etc.) Voltage lowering standard 2 %	Power source minimum thickness	2 mm^2 (5m)
	Distance up to 5 m	2 mm^2
	up to 10 m	3.5 mm^2
	up to 15 m	5.5 mm^2
Electric wiring Room temperature 40℃ or less （Metal tube/vinyl tube etc.） Voltage lowering standard 2 %	Minimum thickness of power source	3.5 mm^2 (10 m)
	Distance up to 10 m	3.5 mm^2
	up to 15 m	5.5 mm^2
Thickness of ground wire		2 mm^2
Thickness of power source to the refrigerator		2 mm^2

- Set the cable from the supply separating/isolation transformer to the outlet as an exclusive circuit and attach a 20Acircuit breaker.
- Distance is the distance from the distribution panel (separating/isolation transformer in case of IEC/EN conformity) to 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 for minimum thickness of power source wiring are maximum distances.

(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.

(3) When you use a transformer

When a transformer is needed to transform the power supply voltage, use non-automatic reset type.

4.2.4. Piping Connections

Please 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 included. 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 in 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 will 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.

In the same way, connect the RETURN 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 high-pressure piping and low-pressure piping are not mixed up 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.

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 refrigerating system.

（1）Confirm that the pressure the compressor unit is within the rated values.

（2）Turn the compressor unit “RUN/STOP switch” on the front panel to RUN.

The compressor unit (refrigerating system) will start operating.

→ If the unit does not start operating, check if 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.

5.2. Stop Operation

（1）Switch the “RUN/STOP switch” of the front panel of the compressor unit to STOP.

The compressor unit (refrigerating system) will stop.

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 2.1MPa to 2.3MPa.

（2）Check the temperature of the refrigerator on a regular basis.

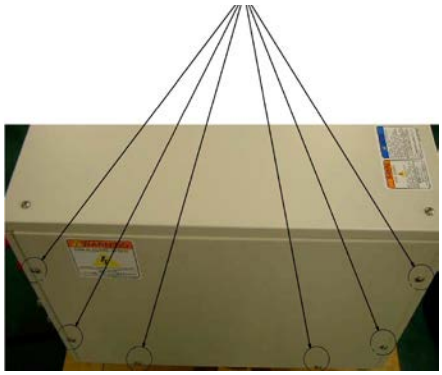
6. Maintenance

6.1. Scheduled Maintenance

6.1.1. Replacing Adsorbers

Adsorbers should be replaced every 30,000 hours of compressor unit operation.[See Time Counter]

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 panel and remove the panel.

（3）Remove the adsorbers. To remove the adsorbers-

(i) Loosen the self-sealing couplings (two places) 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 attachment bolts (used up to now) 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 gauge indicates the rated pressure.
In the event the proper rated pressure is not shown, adjust the rated pressure according to '4-1-2. Charging Helium Gas.'

（10） Record the time shown in the hour meter and display the next time for replacement. Write it in the operations record as well.

（11） Re-connect power cable plug to the supply outlet and switch on the local switch of the power source side.


WARNING

Before disposing the adsorber, discharge the gas inside and remove one of the self sealing couplings

6.1.2. Charging Helium Gas

When the gas pressure drops below the rated value, helium gas needs to be filled.

If there is no cause during normal works by which to attribute a change in gas pressure, such as attaching or removing flexible tubes, 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)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 bottle.
Be 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 regulator, connect the connecting port to the male end of the self-sealing coupling.

Set the helium gas regulator to 0.1 MPa, remove the male coupling of the connecting port while purging the air inside the charging hose,

(4)Connect the connecting port of the charge hose to connecting port on the unit.

(5)Set the regulator to above regulated pressure, and charge the helium gas.

(6)After filling the helium gas to the rated pressure, fully close the stop valve (or the backless valve) and remove the charge hose.

(7)Attach the cap to the charge port.

NOTES

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

6.1.3. Cleaning the Compressor Unit

Periodical cleaning of the heat exchanger is necessary to ensure proper the performance of the refrigerator.

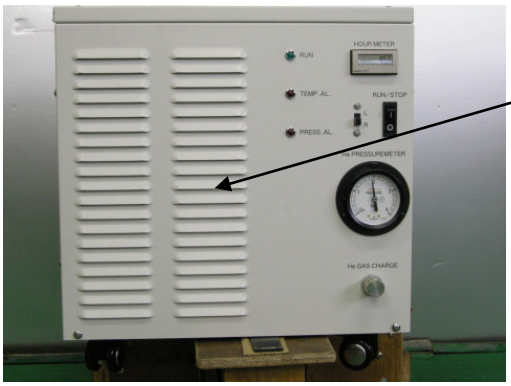
The frequency of the cleaning will be depended on the environment condition of the Compressor Unit.

Cleaning Procedure

(1) Clean up collected dust on the surface of the Compressor Cooling Fins using a portable Vacuum cleaner.

(2) Clean up collected dust on the surface of Air Suction Grid using a portable Vacuum cleaner.

Surface of the Compressor Cooling Fin



Air Intake Grid

6.2. On-site Repair

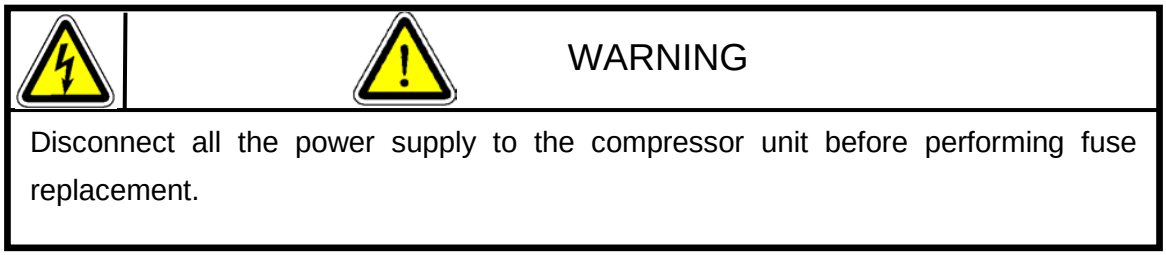
6.2.1. Replacing Fuses

The fuse holder is on the backside panel.

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

Fuse No.	Specifications	Component No.	Notice
F1 F2	HBC (ceramic) tube fuse AC250 V H3.15A	ET3.15A	For control circuits

Procedures to replace fuse



(1) Loosen the cap of the fuse holder with minus screwdriver and remove the old fuse.

(2) Insert a new fuse into the fuse holder and fasten the cap as before.

7. Troubleshooting


WARNING

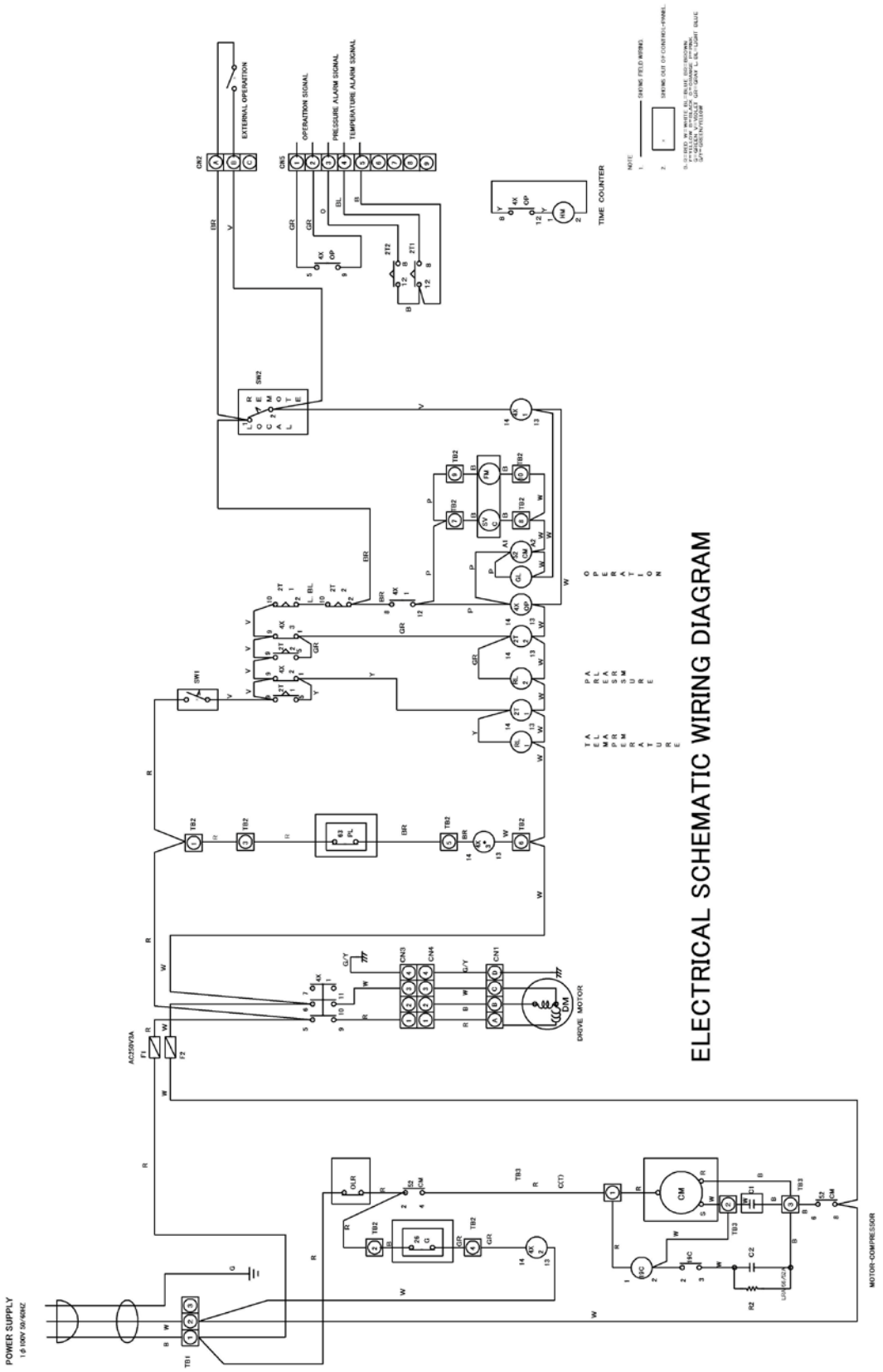
Disconnect all the power supply cables to the compressor before performing any troubleshooting procedures.

Problem	Possible 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 is not supplied.	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 normal. 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.
	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	Possible 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 that air intake is not blocked. If blocked, take appropriate actions to allow smooth air flow. ・ Secure the space for air intake and exhaust around the compressor unit. ・ If the temperature limiter is activated due to abnormal temperature, it may take time to return to the normal conditions. Wait for a while before attempting to resume operation. If the compressor still fails, please contact us.
	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, please contact us.
Compressor unit stops during operation. The PRESS.ALARM indicator lamp (red) is lit.	Abnormality in operation due to a drop in pressure	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.	Inappropriate 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	Possible Cause	Corrective Action
Operation pressure does not rise.	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 the gas flow adjusting 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 because large and loud. Consult our service department.

8. Electrical Schematic Wiring Diagram



9. 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

Refer to “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.

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Revision History

Date	Revision No.	Contents
2014/12/01	2014.12	First edition
2015/06/18	2015JE01	"Inspection", "3.3 Checking Normal Operation", "4.1.2 Charging Helium Gas" Some descriptions have been added in regard to charging helium gas. "Service Network" has been revised.
2018/04/27	2018AL02	"Introduction", "Safety Instructions", "Disposal Considerations" have been added. "7. Troubleshooting" has been modified. "SERVICE NETWORK" has been modified.

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