

## Compressor Unit Instruction Manual

SW115-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 Icons and Texts

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.

<b>1. Danger of electric shock exists. Do not touch the live part.</b>	
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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.

<b>2. Danger of explosion exists. Do not expose to corrosive gases.</b>	
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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.

<b>3. Danger of burns exists. Never touch high temperature parts.</b>	
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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.

	 <b>WARNING</b>
<ul style="list-style-type: none"><li>● Do not disassemble, pressurize, heat, and/or throw into fire. The adsorber may explode.</li><li>● For safe disposal of an adsorber, follow the procedures below.<ol style="list-style-type: none"><li>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).</li><li>2) Before proceeding with disposal work, remove the couplings of the adsorber to visually confirm that it has been depressurized.</li></ol></li></ul>	

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 SW115-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 10 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 6.1.2 Charging Helium Gas.

If the pressure gauge indicates 0MPa, it may be the sign that impurities invaded into helium gas. The unit must be replaced.

Please contact us if you encounter any problem.

## 2. Transportation

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

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



### 3. General Instructions

#### 3.1. Specifications

Table 3.1 shows the specifications for SW115-C.

**Table 3-1 SW115 Compressor unit specifications**

Compressor unit		SW115-C	
Power source		φ, V, Hz	Three-phase, 200±10%, 50/60
Power consumption *1		kW	1.5/1.8
Operating current *1		A	5.5/6.0
Over current protection *3 (Provided by customer)		A	15
Ambient	Allowable room temperature	°C	4-38
	Allowable humidity	%Rh	88 % or lower
Refrigerant		Helium gas	Purity of 99.999 % or above
Refrigerant charging pressure		MPa	2.0±0.05 (20°C)
Size	Height	mm	461 (including casters)
	Width	mm	449
	Length	mm	462 (excluding cooling water connection part)
Weight		kg	54
Conne ction	Refrigerant [SUPPLY]	1/2"self-sealing coupling	
	Refrigerant [RETURN]	1/2" self-sealing coupling	
Timing for scheduled maintenance		Change adsorbents every 30,000 hours	

Note) \*1 Value 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. Configuration

The function of a compressor unit is to supply high-pressure helium gas to a cold head and recompress helium gas returning from the cold head.

Components of a compressor unit include a compressor, cooling device, oil separator, or absorber.

### 3.2.1. Control and connection

Table 3-2 and Figure 3-1 show the control and connections of SW115-C.

**Table 3-2 Control and connection of a compressor unit**

No.	Item	Function
1	POWER Lamp (WL)	Illuminates while power is supplied to the compressor unit.
2	OPERATION Lamp (GL)	Illuminates while the compressor unit is in operation.
3	ALARM Lamp (RL)	Illuminates when the safety device on the electric circuit is activated.
4	OPERATION Switch (SW1)	<ul style="list-style-type: none"> <li>• Press to startup or shutdown the compressor unit. Press the upper half of the switch to start operations. The OPERATION indicator lamp comes on and the compressor starts up.</li> <li>• Press the lower half of the switch to stop operations. The OPERATION indicator lamp will also be turned off.</li> <li>• For remote operation, leave this switch ON and use the LOCAL/REMOTE switch (EXTERNAL OPERATION switch supplied on site).</li> <li>• In the event power outage occurs during operations, operation will automatically resumed when the electricity is restored.</li> </ul>
5	RUNNING TIME (HM))	The time counter indicates the total hours of operation of the compressor unit.
6	SUPPLY PRESSURE	Pressure meter. When suspended, this 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.
8	SUPPLY	Helium gas supply port to the cold head. Connect the supply side of a flexible hose connected.
9	RETURN	Return port for helium gas from the cold head.. Flexible hose (return side) is connected.

10	REF POWER (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	SIGNAL (CN5)	Connection port for the cable connector when the operation/warning signal are extracted.
13	LOCAL/REMOTE 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.
14	FUSE 250V 3A F1, F2, F3	Use a flathead screwdriver to exchange fuses.
15	WATER IN	Port to connect the supply side of cooling water.
16	WATER OUT	Port to connect the return side of cooling water.
17	EARTH	Connecting terminal for earth wire of compressor

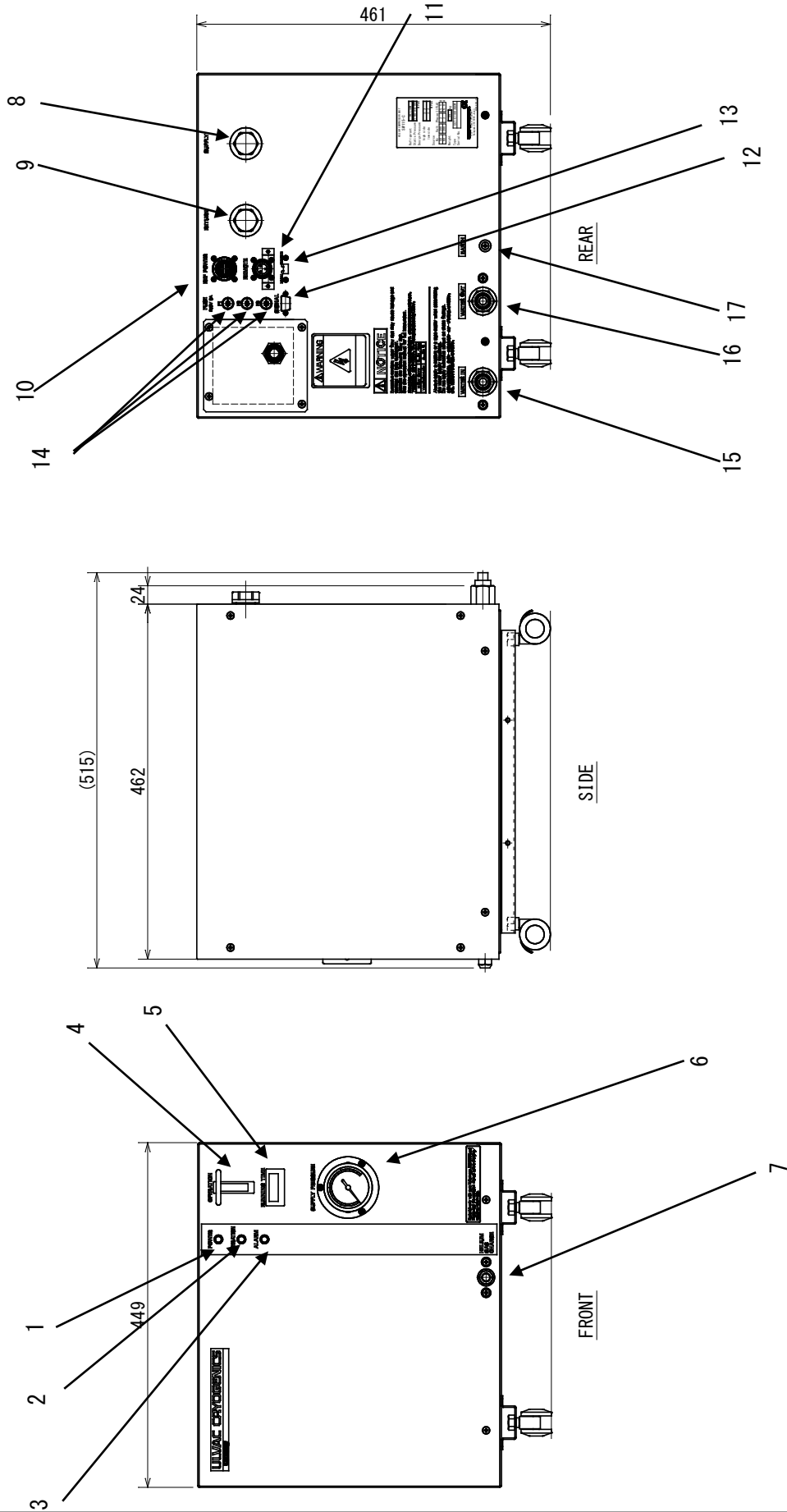


Figure 3-1 Control and Connection Components of SW115-C

## 3.2.2. Flow of gas and oil in the compressor unit

Figure 3-2 shows the refrigeration circuit of the compressor SW115-C.

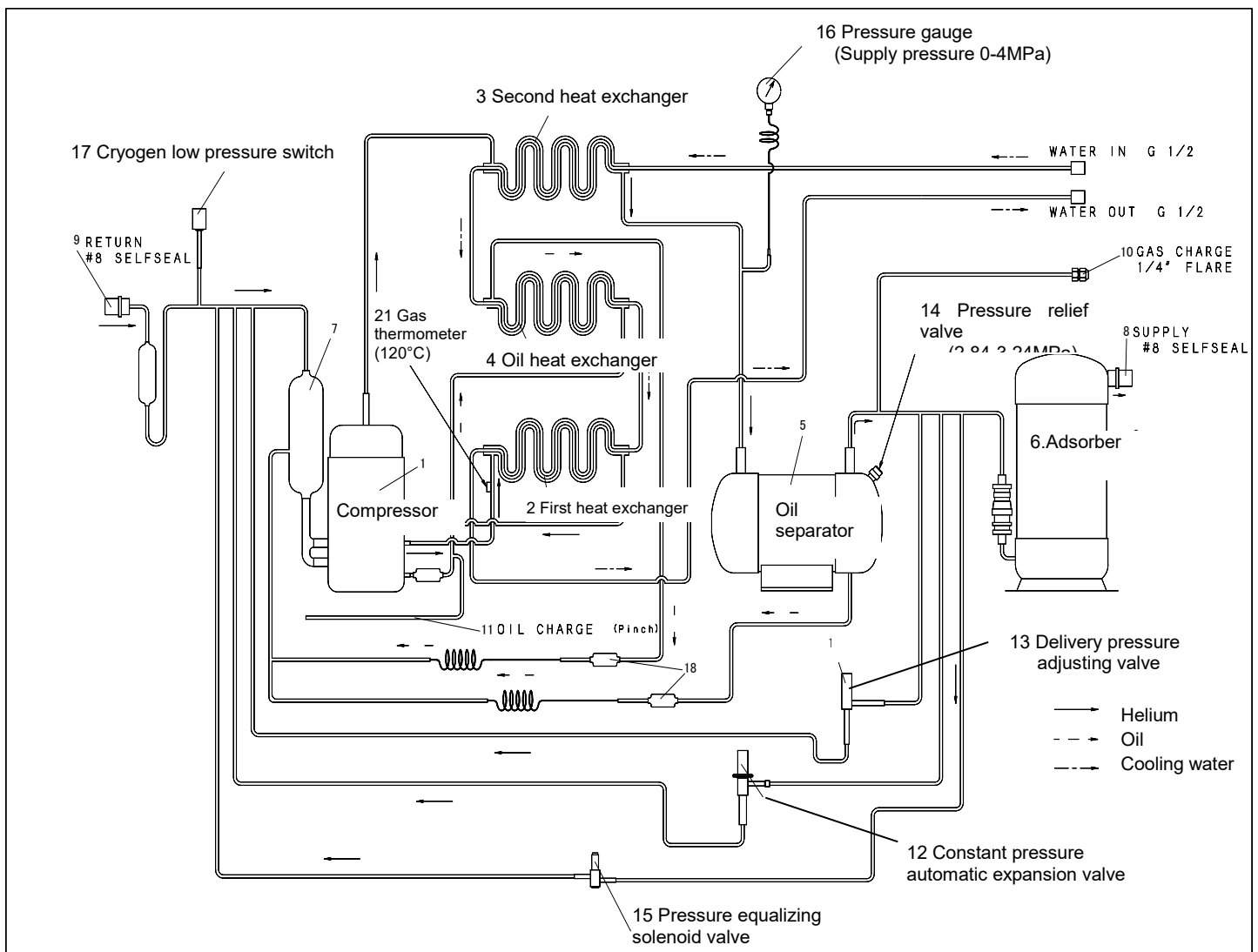
Table 3-3, Figure 3-3 and Figure 3-4 show the internal components and the function of the compressor unit SW115-C.





### WARNING

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



**Figure 3-2 Flow Diagram of Helium Gas in SW115-C**

### 3.2.3. Internal Components

The list of components and their functions are shown in the table below.

The pictures and descriptions of internal components are in Table 3-3, Figure 3-3 and Figure 3-4.

**Table 3-3 Internal Components**

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	Buffer tank filter	Helium gas reserve tank, removes dirt or trash on the entrance of helium gas of a compressor unit.
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 charging port	Port to charge helium gas.
11	Oil replenishing port	Port to replenish lubricating oil. This port is fixed with brazing.
12	Pressure adjusting valve for low pressure	By-pass valve to maintain the pressure of the low-pressure helium gas above a certain level.
13	Pressure adjusting valve for high pressure	By-pass valve to maintain the pressure of the high-pressure helium gas above a certain level.
14	Pressure relief 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. (Refer to 3.3)
16	Pressure meter	Indicates the helium gas inclusion pressure when not in operation, and shows the compressed helium gas pressure during operation.
17	Low-pressure pressure switch (63PL)	Pressure detector for controlling the pressure of compressed helium gas.
18	Filter	Removes dirt and dust from the circulating lubrication oil.
19	Capillary tube	Adjusts the flow volume of the circulating lubrication oil.
20	Capillary tube	Adjusts the oil flow of circulating lubrication oil.
21	Thermostat (26G)	Detection and control device for the temperature of the compressed helium gas at the outlet of the compressor.
22	Control panel	Control monitor and warning system for the helium gas compression unit. (See item on "3.3 Instructions on the Electrical System.")



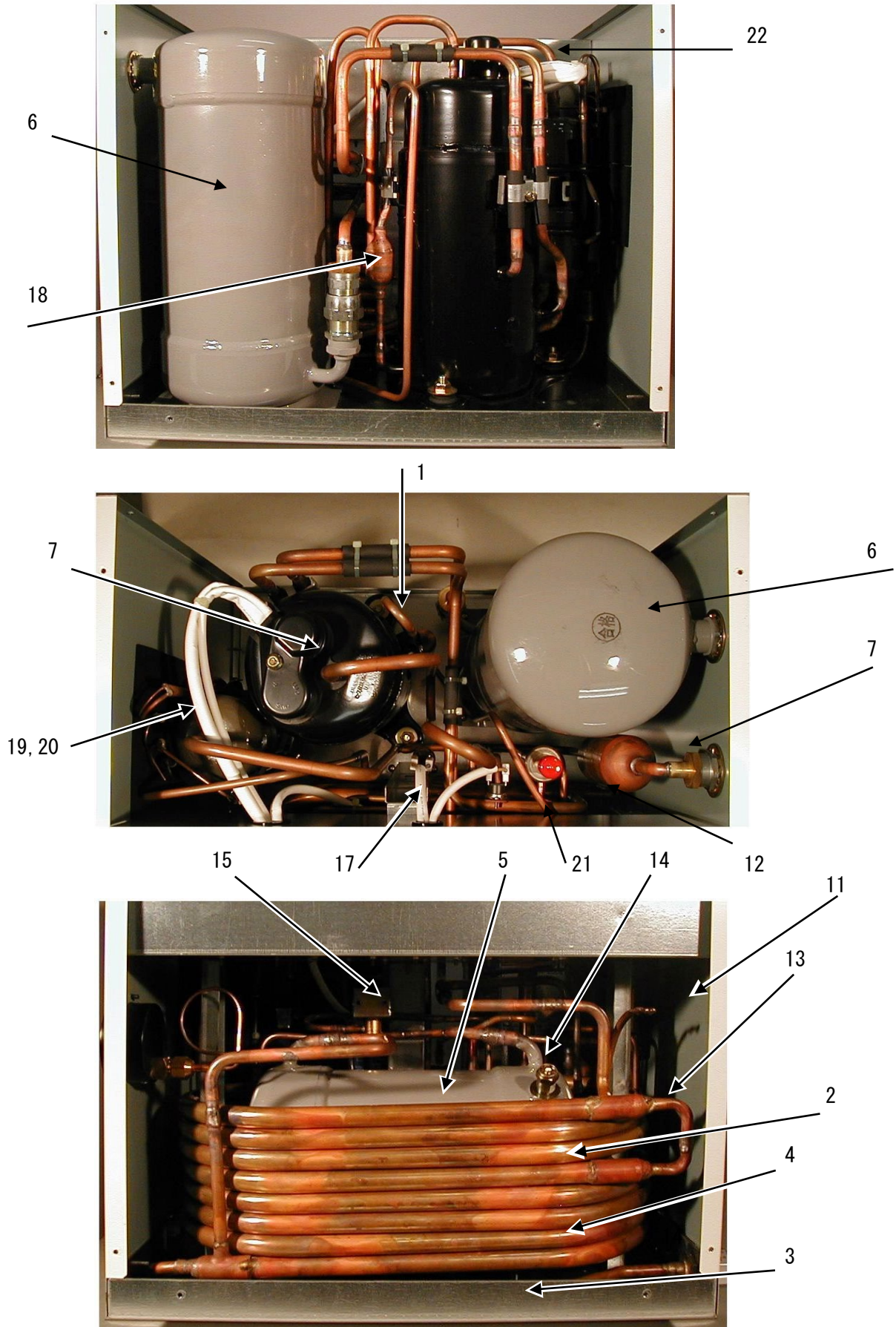


Figure 3-3 SW115-C Internal Components

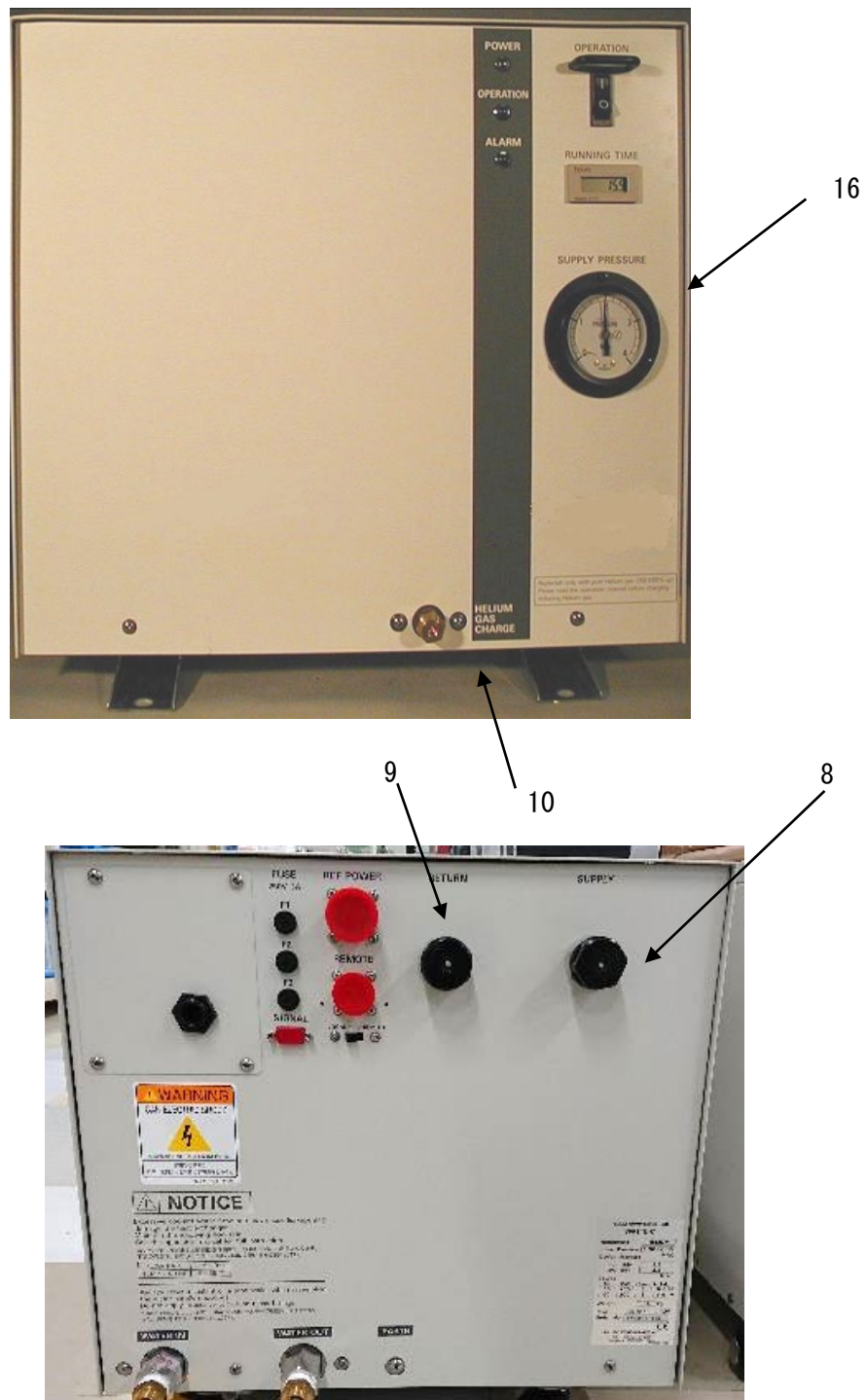


Figure 3-4 SW115-C Pressure Display and Connectors

## 3.3. Instructions for the Electrical System

### 3.3.1. Control Components

The control components for Compressor Unit SW115-C are shown in Table 3-4, Figure 3-5 and Figure 3-6.

		<b>WARNING</b>
Disconnect all the power sources to the compressor unit before opening the panel.		

**Table 3-4 List of control components**

No.	Component	Code	Number	Specifications	Volume
1	POWER Light	WL	BN-3802-2C	200VAC WHITE	1
2	OPERATION Light	GL	BN-3802-2G	200VAC GREEN	1
3	ALARM Light	RL	BN-3802-2R	200VAC RED	1
4	OPERATION Switch	SW1	AJ911102B3	250VAC 16A	1
5	Operation Hour Meter	HM	H7ET-NFV-300	3VDC	1
6	Cold Head Connector	CN1	MS3102A14S-2	4P	1
7	REMOTE Connector	CN2	MS3102A18-1S	3P	1
8	LOCAL / REMOTE Switch	SW2	S-1-Z	200VAC 4A	1
9	FUSE FUSE Holder	F1, F2, F3	02163.15	250VAC 3.15A	3
			F-220-01-A2	250VAC 16	3
10	Thermostat	49C,26G	CS-74L120	120°C	2
11	Pressure Switch	63PL	ACB-1UA03	OFF:0. 098MPa ON :0. 196MPa	1
12	Reverse Phase Prevention Relay	47C	QE-20N	ON :0. 196MPa	1
13	Magnet Switch	52CM	SW-0	200VAC Setting: 9A	1
	Thermal Overload Relay	51CM			
14	Delay Relay Socket (with holding clamp)	2T1	ST7P-2	200VAC Setting: 1 second	1
			TP88X1		1
15	Auxiliary Relay Socket (with holding clamp)	4XAL, 4X1	HH54P	200VAC	2
			TP514X1		2
16	Auxiliary Relay Socket (with holding clamp)	RY1	HH52P	Coil 200VAC	2
		RY2	TP58X2		2
17	Power Source Terminal	TB1	AYBN024-1	600V 25A 4P	1
18	Control Terminal	TB2	KTUNS-8J-SA1976	600V 10A 8P	1
19	Signal connector	CN5	DE-9P-NR	9P	1

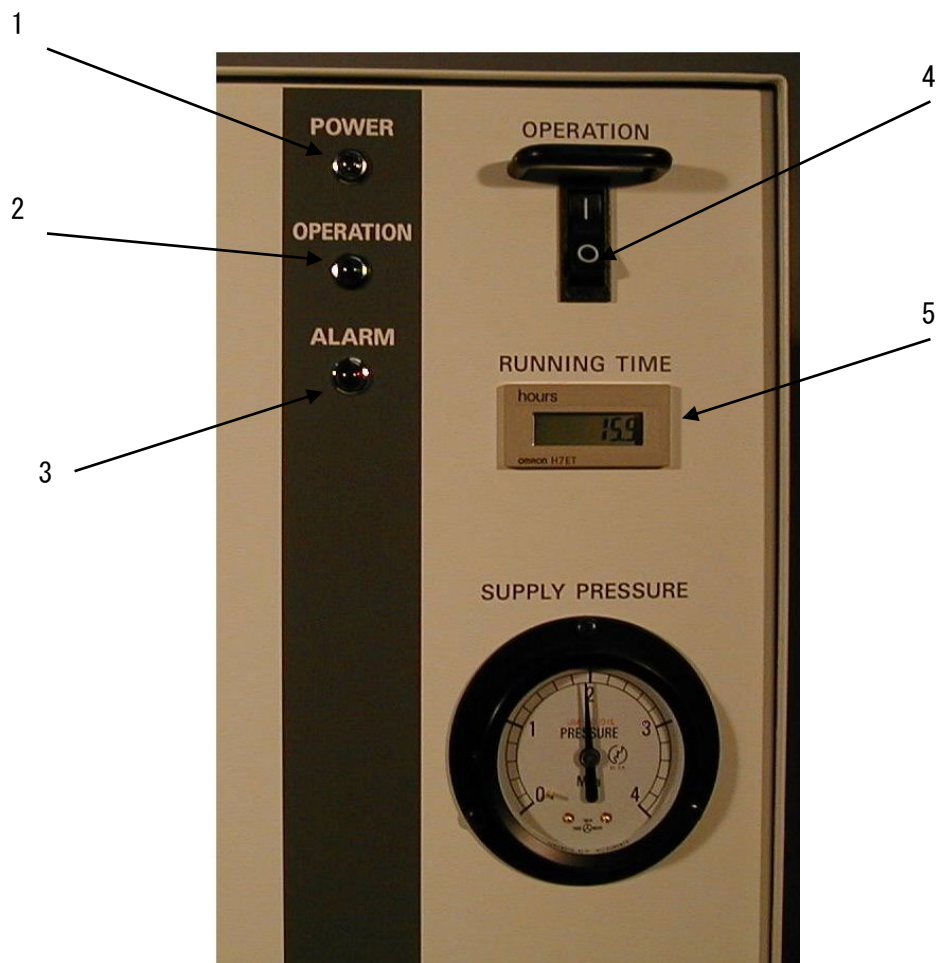
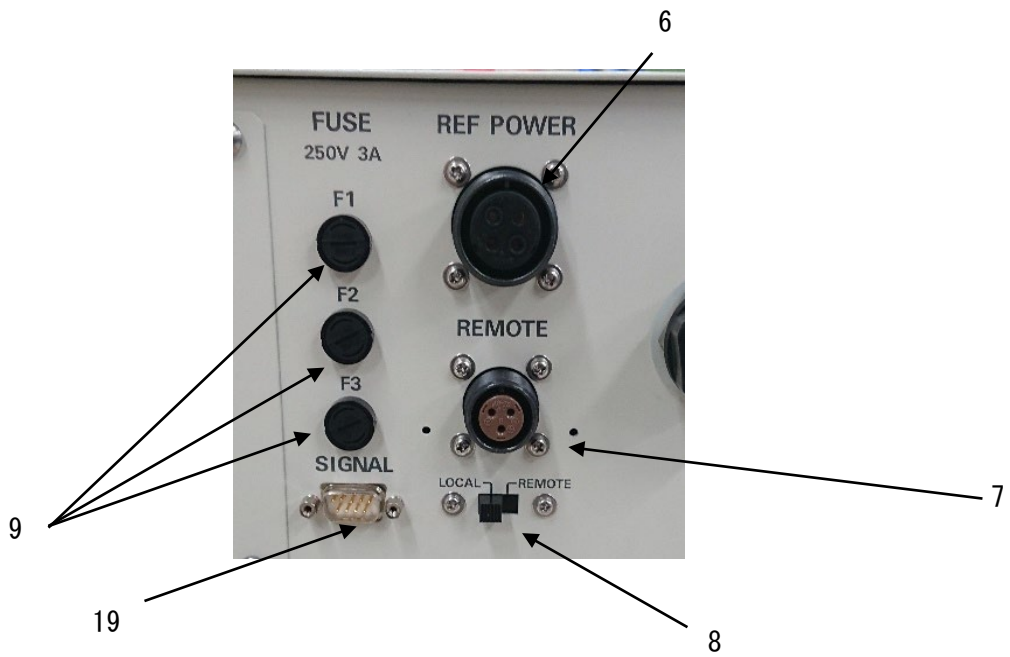


Figure 3-5 SW115-C Control Components (1)



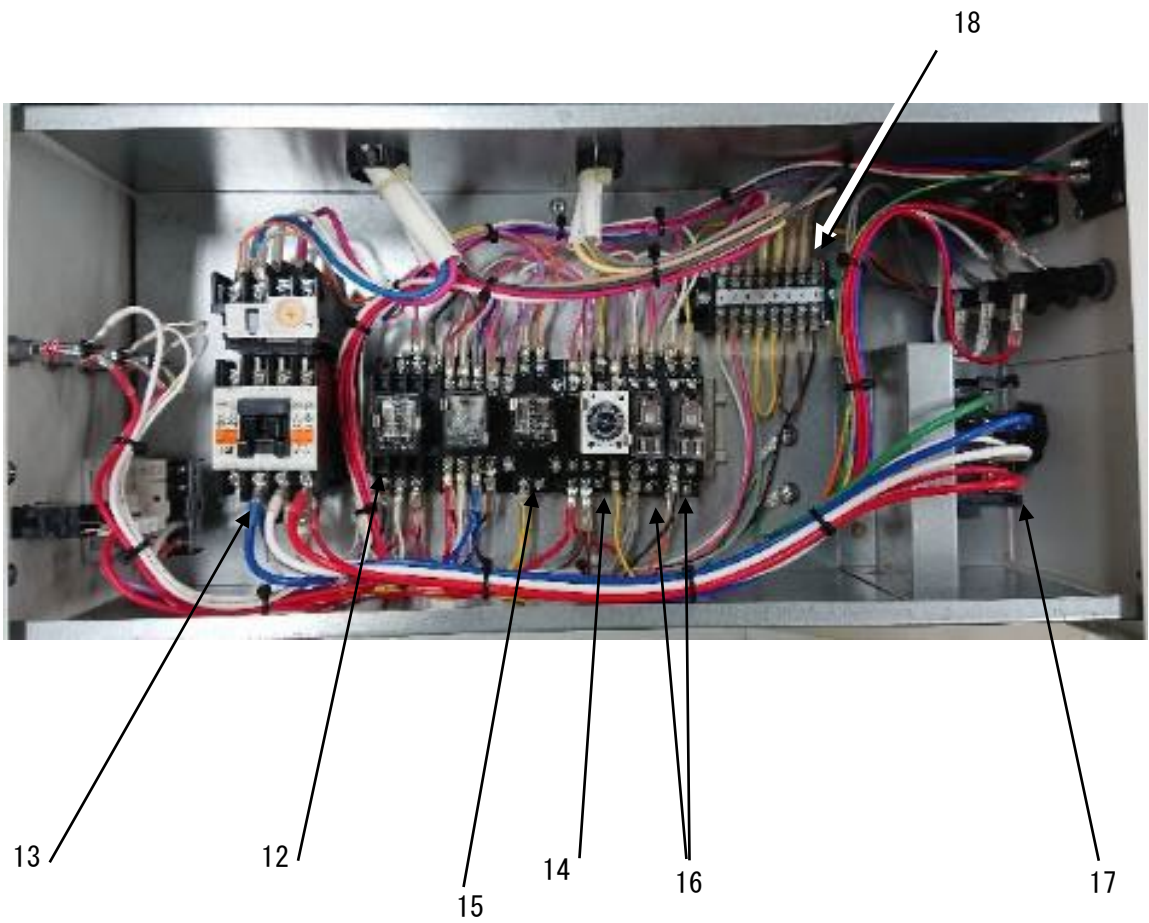
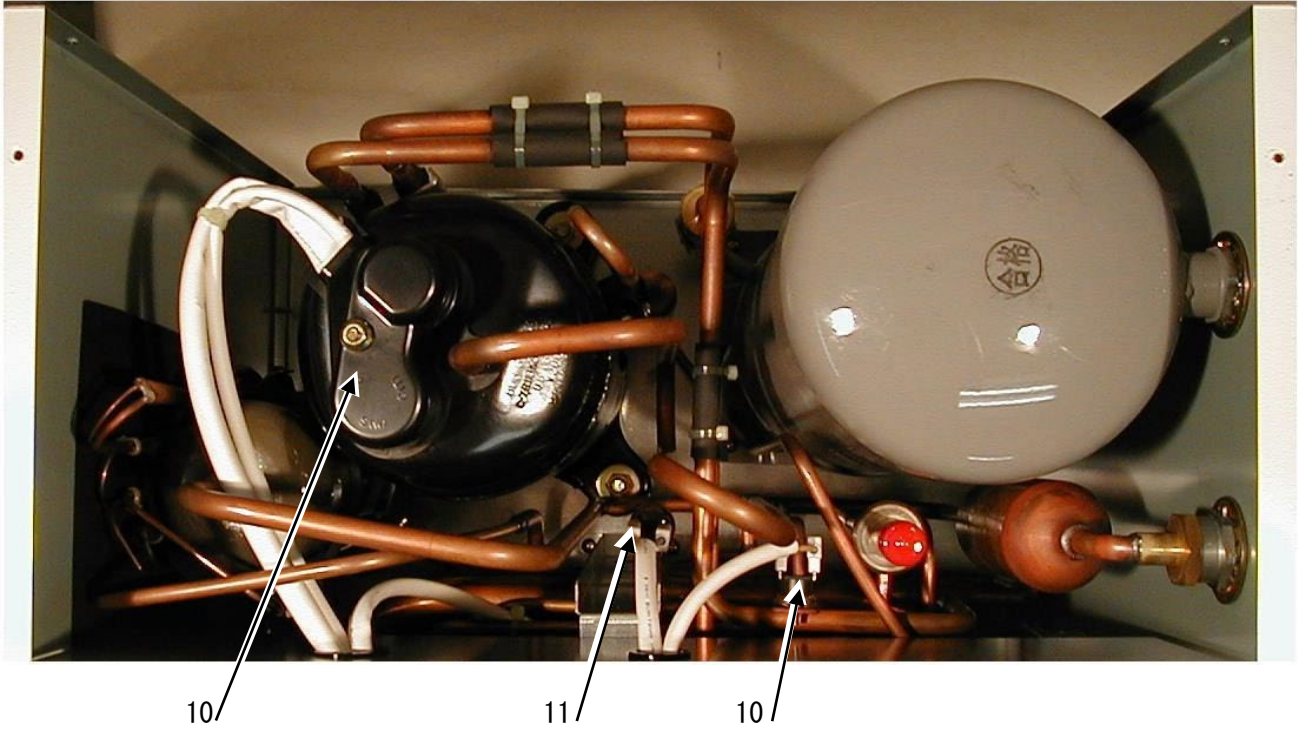


Figure 3-6 SW115-C Control Components (2)

### 3.3.2. Remote Connector

The remote connector can be used for remote operation or as the status monitor of the compressor unit.

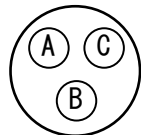
Table 3-5 shows the remote operation and monitor sequence.

**Table 3-5 Remote/Monitor Sequence**

No.	Item	Status		Pin No.	Contact Capacity
1	Remote Operation	Suspended	Release	A, B	Rated Volume: 200VAC above 0.1A Minimum load: 200VAC 0.01A
		In operation	Connect		

**Table 3-6 Applicable connector for remote operation**

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



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

**Figure 3-7 Remote Connector Pins**

### 3.3.3. Signal Connector

The signal connector can be used to monitor the status of compressor unit.

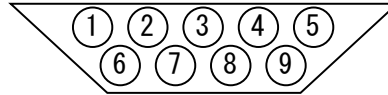
Table 3-7 shows the monitor sequence of the compressor unit.

**Table 3-7 Monitor sequence**

No.	Item	Status		Pin code	Contact capacity
1	Operation monitor	No-voltage contact point	Operated Close Stopped Open	<b>1, 2</b>	24VDC 0.1A
2	Warning monitor	No-voltage contact point	Normal Open Warning Close	<b>4, 5</b>	24VDC 0.1A

**Table 3-8 Applicable connector for remote operation**

Name	Specifications
Plug connector	Japan Aviation Electronics Industry, Ltd. DE9S-NR
Straight clamp	Japan Aviation Electronics Industry, Ltd. DE-C8-J9-B1-1R



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

**Figure 3-8 Remote Connector Pins**

### 3.3.4. Coldhead Connector

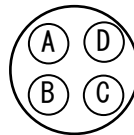
The coldhead connector can be used to supply power for coldhead motors.

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



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 safety devices of Compressor Unit SW115-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.
Solenoid Valve (SVC)	Stabilize the helium pressure between the supply and return flexible hoses when the compressor is suspended.
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 appropriate amount.
Solenoid Valve	Stabilize the helium pressure between the supply and return flexible hoses when the compressor stops.
Pressure relief valve	Set pressure Approx. 2.84 – 3.24MPa Control the helium gas supply pressure with the pressure relief 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**

#### Room Temperature

The room temperature must be between 4°C to 38°C. Humidity should be below 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 cylinder grade 6 (99.999 % purity or more), pressure adjustment valve, exit valve, and two charge hoses or similar supply lines, are needed.

#### Power Source

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

For more information, see 'Table 3.1 for the detail.

#### Ambient Temperature

Room temperature must be within the range specified on table 3-1.

Use air conditioners that are tolerant to the heat load of this system.

Keep the room temperature in the range specified on table 3-1.

#### Measures for Earthquake

Fix the compressor with fittings like anchor bolts as needed.

#### Maintenance Area

Clear the space of 400 mm or more in front and back, 200 mm or more on the right and left for maintenance.

## 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 it is forcibly moved over a rough floor, the casters may be damaged resulting in body injury.

### 4.2.2. Installation of 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.  
Make sure to lock all four wheels of the compressor when installation is finished.

### 4.2.3. Electrical Wiring

Perform electrical wiring as follows.



#### WARNING

Never attempt to connect the coldhead power cable to the coldhead while power is supplied to the compressor unit.

Make sure that OPERATIONO switch is turned OFF before connecting the power cable. Check that the primary power source is disconnected.

#### (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

In most standards, it is required to install a branch breaker to protect power cables connected to the equipment. A circuit breaker must be installed. Failure to follow this procedure could seriously damage the equipment.

(2) Connecting to the power source

Make sure that the OPERATION switch is on the OFF position. Connect the input power cable to the 200V three-phase (with grounding terminal) power source.

The power circuit should be dedicated with no other equipment is connected on the secondary side of circuit breaker.

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

- “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 mm<sup>2</sup> shows the cross-section area.

(4) Connection of coldhead power cable

Connect the refrigerator cable to the refrigerator connector (REF POWER) 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 coldhead cable and Remote cable

Fix the connectors with brackets supplied with the compressor unit as shown below.



#### **4.2.4. Cooling Water**

Keep the cooling water of the compressor below 35°C. The relations between cooling water temperature and flow rate, and minimum inlet pressure and flow rate are shown in Figure 4-1.

The shaded area in the figure shows the allowable range. Maximum inlet pressure is 1MPa (10.2kg/cm<sup>2</sup>G). The back pressure is not taken into consideration in Figure 4-1. If your cooling water supply has back pressure, make proper adjustment within the allowable range.

In regard to the cooling water quality, follow the guidelines of water quality for refrigerator and air conditioners fixed by the Japan Refrigeration and Air Conditioning Industry Association.

Check the water quality on a regular basis.

#### **Cautions for excess flow rate of cooling water**

Too much flow of cooling water might damage the heat exchanger. Please keep the flow rate within the allowable range in Figure 4-1.

It is recommended to attach a throttle valve and a flow rate meter to control flow rate on the entrance of cooling water to administrate the flow rate. If it is difficult to administrate the flow rate due to the fluctuation of primary pressure of cooling water, it is recommended to use constant flow valve. When a constant flow valve is used, there may be a case that scales accumulate due the impurities in cooling water and the flow valve does not function properly. To prevent this, attach a filter above the constant flow valve and clean the filter on a regular basis.

#### **Cautions for piping work of cooling water**

Follow the torque regulation of 10N·m to prevent the damage when attaching the equipments to water couplings.

Recommended specifications;

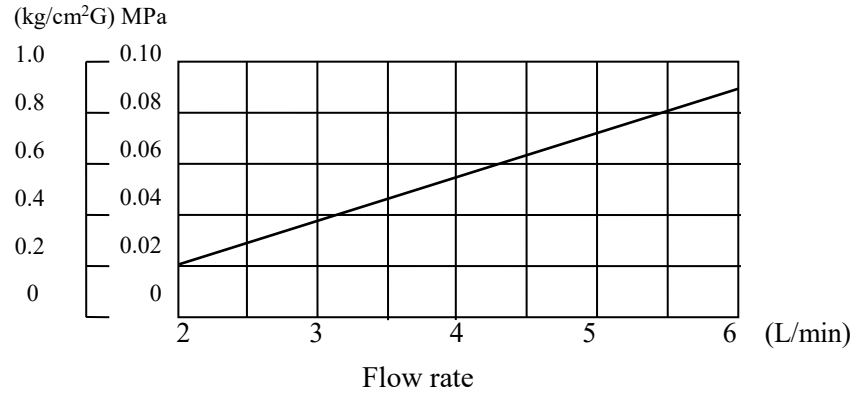
Constant flow valve: HCT-15A (15A, 10L/m) from Japan Flow Cell

Filter : KY-4 (Bronze) (A, Mesh #40) from VENN or  
Bronze 150 (10K) Screw Y type strainer from KITZ

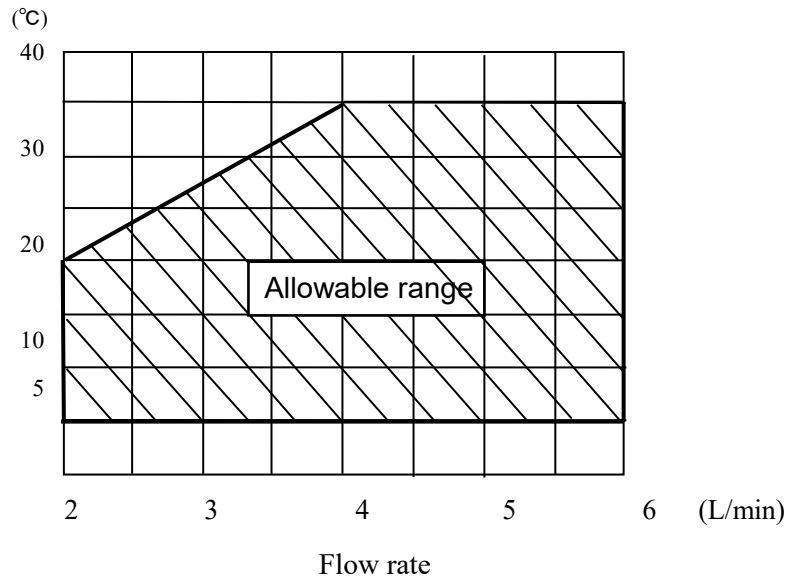
## SW115 Cooling water flow rate and pressure

- Back pressure is not taken into consideration

### Minimum inlet pressure



### Inlet temperature



**Figure 4-1 Water flow rate vs. supply pressure and temperature**

#### 4.2.5. Helium Line Connections

- Use the specified flexible hoses for helium gas piping connection. Self-sealing couplings are attached to the both ends and helium gas is charged in the specified flexible hoses. Self-sealing couplings of flexible hoses must be female.
- The compressor has the SUPPLY and RETURN connection ports. Connect the high-pressure line (supply to the coldhead) to the SUPPLY port, and low-pressure line (return from the coldhead) to the RETURN port. Do not connect to the wrong ports. Remove the protective cap on the SUPPLY port and confirm that there are gaskets on the SUPPLY port.
  - 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. Make sure to use two spanners to further tighten the union nuts. Since gas may leak while fastening union nuts, connections should be made in a quick manner to minimize leakage. Although couplings must be tightly fixed, avoid a torque of 44N·m or larger.
- In the same way, connect the RETURN to low-pressure line (return piping from the coldheads).
- Once connection to the coldhead is completed, check that the connections are correct.
- In particular, make sure the high-pressure piping and low-pressure piping are connected to the correct port and the union nuts are securely fastened.
- Perform a leak test using leak test liquid (SNOOP®) etc. after connecting the piping. Once no leakage is confirmed, the piping connection is completed. Wipe off any leak test liquid.

## 5. Operation

### 5.1. Startup Operation

Before starting up refrigerating system, make sure that the compressor unit, coldhead, helium lines and power source cables are correctly connected as described in this book.

To start the refrigerating system.

- (1) Confirm that the compressor pressure is at appropriate level.
- (2) Turn the compressor unit OPERATION switch on the front panel to the ON position.

The compressor unit (refrigerating system) starts operation.

→ If the unit does not startup, check that the switch between REMOTE and LOCAL is on "L." For other problems, see "5. Troubleshooting."

#### Operating noise

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





## 5.2. Shutdown Operation

The steps to shutdown operation of the refrigerator system is described below.

Turn the OPERATION switch on the front panel of the compressor unit to OFF by pressing the circle side. The compressor unit (refrigerator system) stops operation.



### **5.3. Inspections in Normal Operations**

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

(1) Monitor helium charge pressure of the compressor motor.

Read the helium pressure gauge on the front panel during normal operation with appropriate load. The value differs depending on the kind or number of units of coldhead.

(2) Monitor the temperature of the coldhead.

The ultimate temperature of a coldhead is dependent on the heat load, the degree of vacuum of the vacuum chamber, etc. When the temperature is high and stable, the total heat load to the coldhead is too large. Check the heat load.

(3) The temperature of the helium gas tube on the supply side should not exceed 40°C. If the temperature of helium gas tube is too high, check the flow rate and temperature of the compressor cooling water.

#### Operating Noise

The coldhead makes operating sound and noise caused by inlet and outlet of gas when in operation.

## 6. Maintenance

### 6.1. On-site Repair

#### 6.1.1. 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 F3	Glass tube fuse 250VAC 3A	02163.15	For control circuits

#### Procedures to replace fuse

	 <b>WARNING</b>
Disconnect all the power supply to the compressor before performing maintenance work.	

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

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

## 6.1.2. Charging Helium Gas

Optional products such as helium bottles are necessary when charging helium gas.



### CAUTION

Charge helium gas when the compressor is suspended. Operate the charge control valve or pressure regulator slowly. If you operate them too quickly, it might result in gas leakage or damaging the equipment.

When the gas pressure drops below the appropriate level, charge helium gas. If there is no possible cause of pressure change during normal operation 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 and connectors of the pressure relief valves and pressure relief valve, charge valve, etc.

Next, perform a leak test by sniffer method.

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

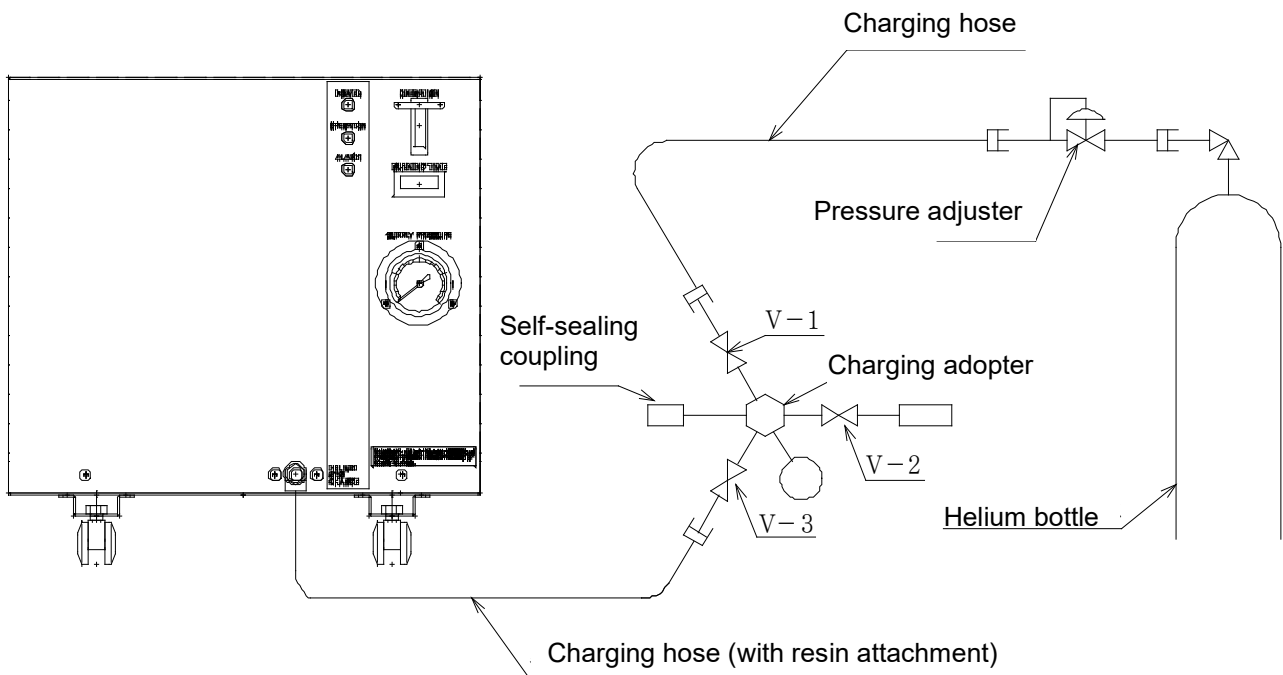
### How to charge helium gas

- (1) Check that the valve of the pressure regulator is closed and connect the pressure regulator to helium gas bottle.
- (2) Open the valve of helium gas bottle.
- (3) Connect the charging hose to the pressure regulator of the helium gas bottle.
- (4) While releasing small amount of helium gas from both helium bottle side and charging adopter side (V-1 side), connect the charging hose to the charging adopter side (V-1 side), and quickly close the V-1 charge control valve.
- (5) Set the pressure regulator of helium bottle slightly higher than the specified pressure of the compressor.
- (6) Open the V-1 charge control valve.
- (7) Connect the charging hose to the charging adopter (V-3 side) from the side without a small resin attachment.
- (8) Remove the cap of the charging port on the front panel of a compressor.
- (9) Slightly open the V-3 charge control valve to release helium gas, and connect the charging hose to the charging port from the side with a small resin attachment.
- (10) Open the V-3 valve further and charge helium gas to the specified pressure, and close the V-3 valve.
- (11) Slowly loosen the charging hose on the compressor side and remove.
- (12) Close the V-1 charge control valve.

- (13) Close the helium bottle valve first, and close the pressure regulator valve.
- (14) Remove the charging hose connected to the pressure regulator of helium bottle.
- (15) Again slightly open the pressure regulator and confirm that there is no pressure between helium bottle and pressure regulator.
- (16) Remove the pressure regulator from helium bottle.

## NOTE

1. When the helium gas pressure indicator reads 0 MPa, air may have already invaded. Contact us before charging helium gas.
2. When attaching the pressure regulator to a new bottle, air between bottle-side valve and the pressure regulator must be purged.



**Figure 6-1 Flow Diagram of Charging Helium Gas**

## 7. Troubleshooting

	 <b>WARNING</b>
Disconnect all the power supply to the compressor unit before performing any troubleshooting procedures.	

Problem	Possible Cause	Corrective Action
Abnormal sound has been heard continuously during the compressor operation.	Lubricating oil of the compressor has reduced.	Please contact us.
When starting operations: The compressor unit does not operate when turning on the OPERATION switch. The ALARM indicator lamp (red) does not light.	The power is not supplied. (The POWER light on the compressor is not on.)	Check any wiring related to the power source.
	Compressor failure (Snapping of winding)	Measure the coil resistance with the terminal of the compressor
	Either the fuse is blown or disconnected.	Check if the 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.
When starting operations: The compressor unit does not operate when switched on. The ALARM indicator lamp (red) is immediately lit.	Reverse phase or phase interruption of the power source	Check if the power source voltage between each phase is within 200V $\pm$ 10%. If not, adjust it within the above range. If there is nothing abnormal with power source voltage, turn off the power source and replace two power source wires.
	Operation failure due to pressure drop	Charge helium gas to the regulated pressure. If the helium gas needs to be charged often, check for leaks of helium.
	Compressor failure	Measure the insulation resistance with the compressor terminal. Contact us when a problem is observed.

Problem	Possible Cause	Corrective Action
	Either the fuse is blown or disconnected.	Check if the fuse inside is all right. Replace fuses if there is any trouble. 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.
When starting operations: The compressor unit does not operate when switched on. The ALARM indicator lamp (red) turns on.	Abnormal operation due to pressure drop	Charge helium gas to the regulated pressure. If the helium gas needs to be charged often, check for leaks of helium.
	Temperature safeguard has been activated.	Check if the power source voltage is within 200V ± 10%. If not, please manage to set it within the above range. Check if the cooling water temperature and flow rate is within the allowable range. If not, please arrange to meet them. Reference: 2-2-4 If the thermostat is activated due to detecting the abnormal temperature, it may take quite long to recover. Please wait for a while and restart the compressor. If the compressor stops again, please contact us.

Problem	Possible Cause	Corrective Action
Compressor unit suspends operation during normal operation.	<p>Abnormal pressure</p> <p>A. Abnormal operation due to the pressure drop</p> <p>B. Relief valve is activated</p> <p>C. The operating pressure does not rise.</p>	<p>A. Charge helium gas to the specified level.</p> <p>B. Stop compressor operation, wait for the coldhead to reach to the room temperature, and check the helium pressure. When it is too high, reduce to the specified level. When it is appropriate, check the coldhead and coldhead cable. When the helium pressure is normal and the coldhead and coldhead cable have no problem, please contact us</p> <p>C. If the coldhead does not have any problem, possible cause may be the failure of compressor solenoid valve for equaling pressure or pressure regulator valve. Please contact us.</p>
	<p>Helium gas temperature is too high.</p> <p>A. The temperature of cooling water is too high, the flow rate is too low.</p> <p>B. Lubricating oil of the compressor has reduced.</p>	<p>A. Check that the temperature and flow rate of cooling water are within the allowable range. If not, adjust them to be in the allowable range. (Refer to 2-2-4)</p> <p>B. If it is possible to resume operation in a couple of minutes after the compressor is suspended, the possible cause may be that the thermostat (26G) was activated due to reduced lubricating oil. Please contact us.</p>
	<p>Either the fuse is blown or disconnected.</p>	<p>Check if the internal fuses have no problem. If defective, replace the fuse with a new one. If the problem continues, check if excessive number of components are connected to the coldhead connector or to the remote connector.</p>



## 8. Accessories

### 8.1. Standard Accessories

Standard accessories may vary depending on the customers' specifications.

**Table 8-1 Standard Accessories**

No.	Parts	Volume	Notes
1	Fues 3A	3	2163.15
2	Coldhead cable	1	With connector
3	Remote connector	1	For remote operation
4	Cooling water hose	2	$\phi 18 \times \phi 12$
5	Cooling water coupling	2	For connecting cooling water hose
6	Single head wrench	1 set	For connecting helium gas tube
7	Instruction manual	1	This book

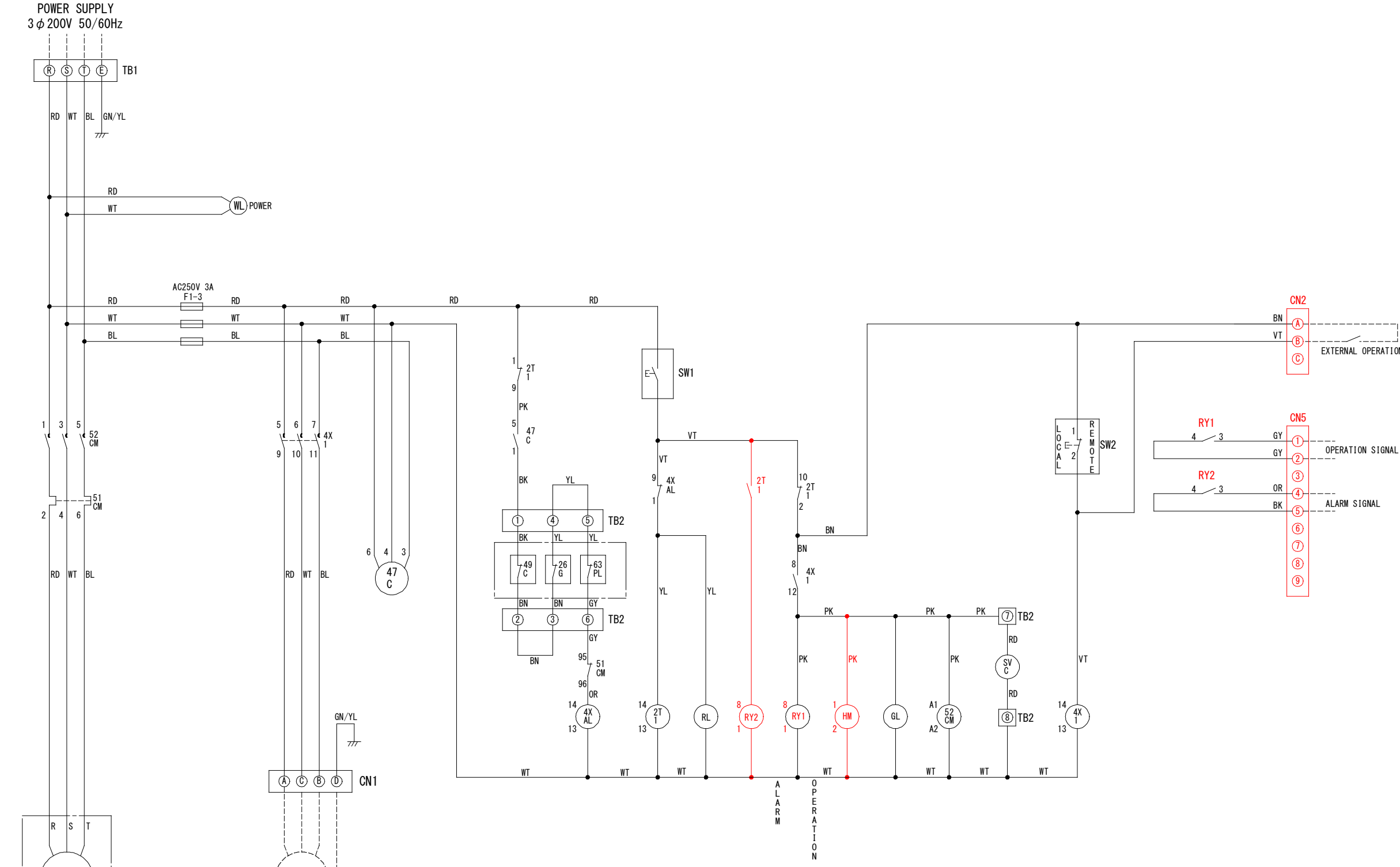
### 8.2. Optional Parts

**Table 8-2 Optional parts**

No.	Parts	Volume	Notes
1	Oil adsorber	1 set	For regular maintenance
2	Helium gas pressure adjuster	1 set	For charging helium gas
3	Helium charging adopter	1 set	For charging helium gas
4	Charging hose	2	For charging helium gas Length: 900mm

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9. Electrical Schematic Wiring Diagram



NOTE  
 1. - - - - - SHOWS FIELD WIRING.  
 2. [ ] SHOWS OUT OF CONTROL-PANEL.  
 3. RD=RED WT=WHITE BL=BLUE BN=BROWN  
 YL=YELLOW BK=BLACK OR=ORANGE PK=PINK  
 GN=GREEN VT=VIOLET GY=GRAY

MOTOR-COMPRESSOR

DRIVE MOTOR

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## 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, first diagnosis of failure should be done on site by customer.

However, UCI 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 attributed to ULVAC CRYOGENICS INCORPORATED (hereinafter "UCI").

##### (2) Damage during transportation

When damage by transportation is observed at the time of delivery, the product will be repaired without charge based on the scope of the guarantee expressed in the sales contract.

##### (3) Breakdown repairs

The cost of repairs, replacements and on-site visits for the failures caused by the reasons as follows shall be borne by the customer regardless the product is within the warranty period.

- (i) Inappropriate storage or handling, careless accident, software or hardware design by the customer.
- (ii) Modifications of the product without consent of UCI.
- (iii) Performing maintenance of the product using parts or components which are not approved by UCI, or using the product outside the conditions specified for the product.
- (iv) Contamination or corrosion occurred during the use by the customer or customer's customer.
- (v) Fire, earthquake, flood, lightning or other natural disasters, environmental pollution, salt damage, hazardous gases, irregular voltage, and/or usage of power source other than specified by UCI.
- (vi) Other reasons which are regarded to be outside the scope of warranty.
- (vii) Consumables and/or replacement service.

Since the above services are limited inside Japan, diagnosis of failures, etc may not be performed outside of Japan. If you desire the after sale 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 accepts product repairs for seven years after production of the product is discontinued.

[Manufacturer] ULVAC CRYOGENICS INCORPORATED

Please contact us when you encounter failure or need information.

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](http://www.ulvac-cryo.com).

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