HRX-MM-N007
1st edition: Feb. 2010
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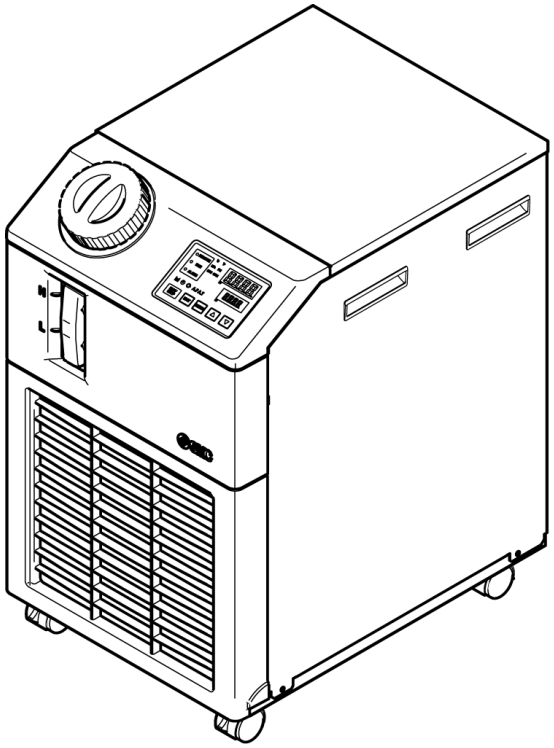
Service Manual

Thermo-chiller

Air-cooled refrigerated type	Water-cooled refrigerated type
HRS012-A*-10-*	***HRS012-W*-10-****
HRS018-A*-10-*	***HRS018-W*-10-****
HRS012-A*-20-*	***HRS012-W*-20-****
HRS018-A*-20-*	***HRS018-W*-20-****
HRS024-A*-20-*	***HRS024-W*-20-****
HRS030-A*-20-*	***HRS030-W*-20-****



Keep this manual available whenever necessary.

To users

Thank you for purchasing our Thermo-chiller HRS Series (hereinafter called “This system”).

For safe use of this system and personal safety, be sure to read and understand this manual thoroughly before performing repair of this system.

- Warnings and precautions defined in this manual shall be observed.

- This manual provides the explanations of the in-depth remedies for this system. This manual is intended for service personnel who have completed the service training SMC provides. Only those who fall under the above condition are allowed to perform maintenance and repair of this system with the use of the Service Manual.

This product contains a refrigerant circuit inside. Professional skill and exclusive facility are required for maintenance service and/or repair of the refrigerant circuit.

Maintenance and repair of the refrigerant circuit must be performed by a specialized operator.

- The contents of this manual and related documents supplied with this system shall be neither regarded as a provision of the contract nor utilized to correct or modify the existing agreements, commitments and relations.

- Copying, duplicating or transferring any part of or whole contents of this manual without the prior written consent of SMC Corporation is strictly prohibited.

- The Operation Manual is supplied in addition to this manual and provides the explanations of the installation and operation of this system. This manual does not contain the fundamental information and operating procedures that are provided in the Operation Manual.

Note: The contents of this manual are subject to change without notice.

Contents

Chapter 1 Safety Instructions

Read most critical instruction to be considered carefully and ensure well understanding of the content before operating the unit

1.1 Before Using Unit

- This chapter is intended to specifically describe the safety related issues for handling the unit.
- The unit is a cooling device using recirculating fluid. SMC does not take any responsibility for any problems that may arise from using the unit for other purposes.
- This product is for the indoor use and not available outdoor.
- This product is not designed for a clean room. It generates dust from the internal components such as pump and fan motor (for air-cooled type).
- The unit is operating at high voltage and contains components which become hot and rotate. If a component needs to be replaced or repaired, contact a specific vendor for parts and service.
- The operate's, maintence personnel and other people working nearby the unit should read and understand the safety related descriptions in this manual carefully before starting work.
- Safety manager is responsible to strictly observe safety standards, but responsibility in respect to safety standard during daily work resides with each individual operator and personnel for maintainance.
- This manual must be kept available to operator's whenever necessary.

1.2 Reading the Manual

This manual contains symbols to help identify important actions when installing, operating or maintain the unit.

This sign stands for actions that must be followed.

This sign stands for prohibited actions.

1.3 Hazards

1.3.1 Level of hazards

The instructions given in this manual aim to assure safe and correct operation of the unit and to prevent injury of operators or damage to the unit. These instructions are grouped into three categories, Danger, Warning and Caution, which indicate the level of hazard, damage and also the degree of emergency. All texts that contain safety critical matter and should be carefully observed.

DANGER, WARNING and CAUTION signs are in order according to seriousness (DANGER > WARNING > CAUTION).

⚠ DANGER

"DANGER": Hazard that will cause serious personal injury or death during operation.

⚠ WARNING

"WARNING": Hazard that may cause serious personal injury or death during operation.

⚠ CAUTION

"CAUTION": Hazard that may cause minor personal injury.

CAUTION

"CAUTION without exclamation symbol": Hazard that may cause damage or failure of the unit, facility, ect.

1.3.2 Definition of "Serious injury" and "Light injury"

- **"Serious injury"**

  The injury that gives aftereffects including loss of eyesight, burnt, electrical shock, fracture, poisoning, etc. and requires long-term treatment or hospitalization.

- **"Light injury"**

  The injury that does not need long term treatment or hospitalization. (Others excluded from serious injury.)

1.3.3 Types of hazard labels

The unit has various potential hazards and they are marked with warning labels. Be sure the read this section before starting any work on the unit.

■ Warning related to electricity

⚠ WARNING

This symbol stands for a possible risk of electric shock.

The product is operated at high voltage and contains uncovered live terminals inside.

- **DO NOT operate the product without cover panels fitted.**
- **DO NOT work inside this product unless you have been trained to do so.**

■ Warning related to high temperatures

⚠ WARNING

This symbol stands for a possible risk of hot surface and burns.

The product has surfaces that can reach high temperatures during operation. Even after the power is turned off, there can still be residual heat in the product.

- **DO NOT operate the product without cover panels fitted.**
- **DO NOT start working inside the product until the temperature has decreased sufficiently.**

■ Warning related to rotating objects

⚠ WARNING

This symbol stands for a possible risk of cutting fingers or hand, or entanglement by rotating fan (For air-cooled type).
The product contains a cooling fan that rotates during operation of the product.
The fan can start and stop intermittently and without warning.

- **DO NOT operate the product without cover panels fitted.**

■ Warning related to other general dangers

⚠ WARNING

This symbol stands for general danger.

Hazards Inside
Hot Surfaces Inside – See Hot Surface symbol
Rotating Fan Inside – See Rotating Fan symbol (For air-cooled type)
Pressurized Sytem Inside – The product contains pressurised fluid systems.

- **DO NOT operate the product without cover panels fitted.**

1.3.4 Locations of hazard labels

There are various warning labels on the product to show the potential hazards.

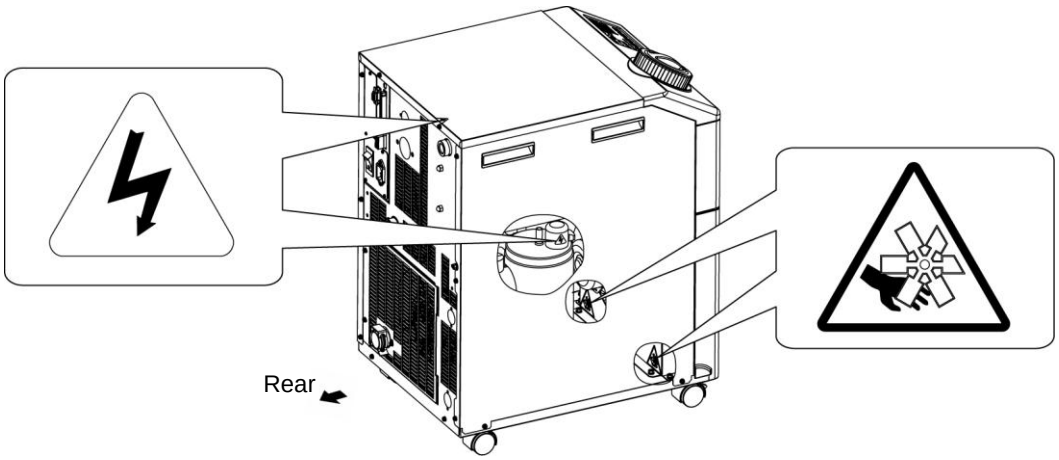
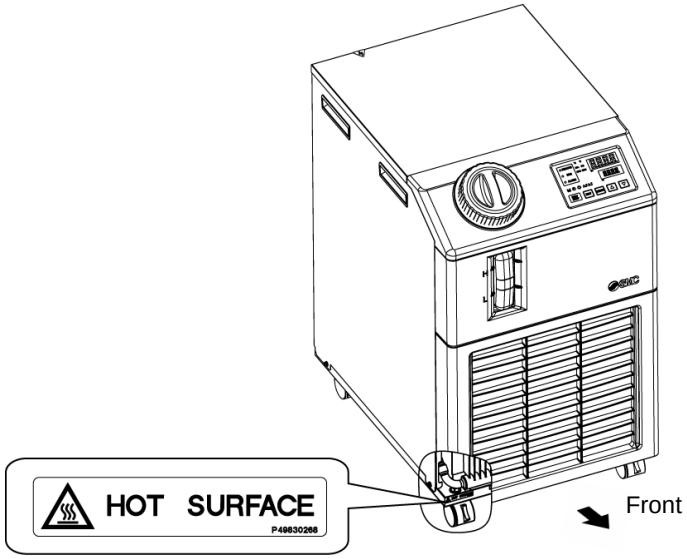


Fig.1.3-1 Warning label position



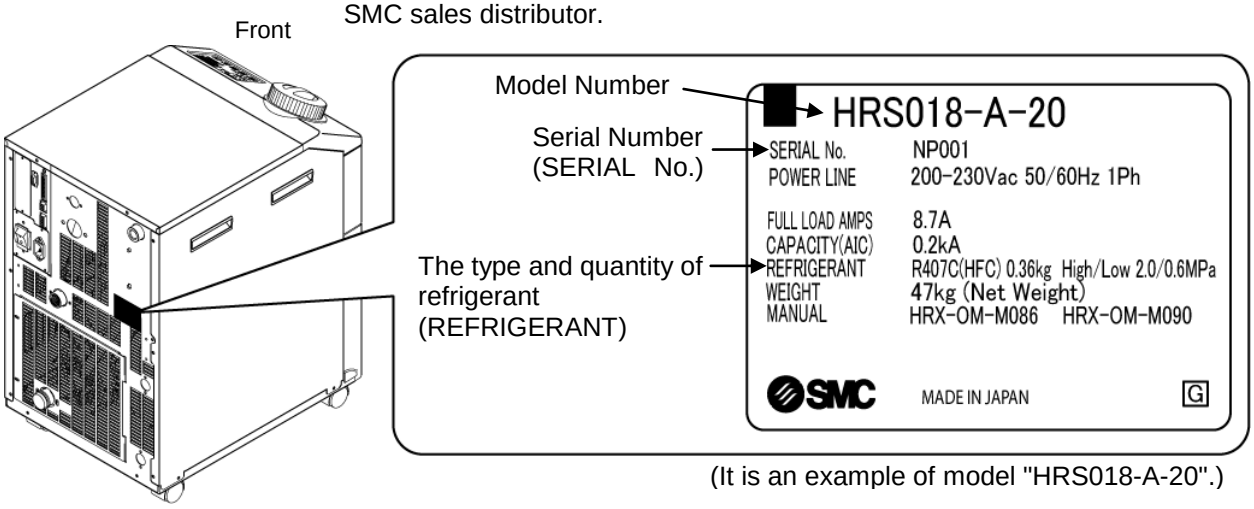
∗ For air-cooled type

Fig.1.3-2 Warning label position

1.4 Other Labels

1.4.1 Product label

Information about the product, such as Serial No. and Model No. can be found on the model label. This information is needed when contacting an SMC sales distributor.



(It is an example of model "HRS018-A-20".)

Fig.1.4-1 Position of product label

How to see the manufacturing code **R O 001** (**January 2013**)

R			O			001
Year	Symbol	Remarks	Month	Symbol	Remarks	Serial no.
2013 2014 2015 ↓	R S T ↓	Repeated from A to Z in alphabetical order	1 2 3 ↓	O P Q ↓	Repeated from O to Z in alphabetical order, with O for January and Z for December	—

1.5 Safety Measures

1.5.1 Safety instructions for use

⚠ WARNING

Follow the instructions below when using the product. Failure to follow the instructions may cause an accident and injury.

- Read and understand this manual carefully before using the product.
- Before starting maintenance of the product, be sure to lock out and tag out the breaker of the user's power supply.
- If operating the product during maintenance, be sure to inform all workers nearby.
- Use only the correct tools and procedure when installing or maintaning the product.
- Use personal protective equipment where specified (“4.4 Icons for Necessary Tools and Specifications”)

- Check all parts and screws are fitted correctly and securely after maintenance.
- Avoid working in a drunken or sick condition, which might cause an accident.
- Do not remove the panels except for the cases permitted in this manual.
- Do not remove the panels during operation.

1.6 Waste Disposal

1.6.1 Disposal of refrigerant and compressor oil

The product uses hydrofluorocarbon type refrigerant (HFC) and compressor oil. Comply with the laws and regulations in each country for the disposal of refrigerant and compressor oil. The type and quantity of refrigerant is described on the 1.4.1 Product label.

If these fluids need to be recovered, read and understand the instructions below carefully. If there is any unclear point, contact an SMC's sales distributor.

⚠ WARNING

- **Only maintenance personnel or qualified people are allowed to open the cover panels of the product.**
- **Do not mix the compressor oil with domestic waste for disposal. Also, the disposal of the waste must only be conducted by specific facilities that are permitted for that purpose.**

⚠ WARNING

- **Comply with the laws and regulations in each country for the disposal of refrigerant and compressor oil.**
- **The release of refrigerant in to the atmosphere is banned by law. Recover it with specific equipment and dispose of it correctly.**
- **Only people who have sufficient knowledge and experience about the product and its accessories are allowed to recover the refrigerant and compressor oil.**

1.6.2 Disposal of product

The disposal of the product must be handled by a specialized industrial waste disposal agency in accordance with local laws and regulations.

1.7 Material Safety Data Sheet (MSDS)

If the material safety data sheets of chemicals used in this product are needed, contact an SMC's sales distributor.

Any chemicals used by the user must be accompanied by an MSDS.

Chapter 2 Name of Parts

2.1 Appearance

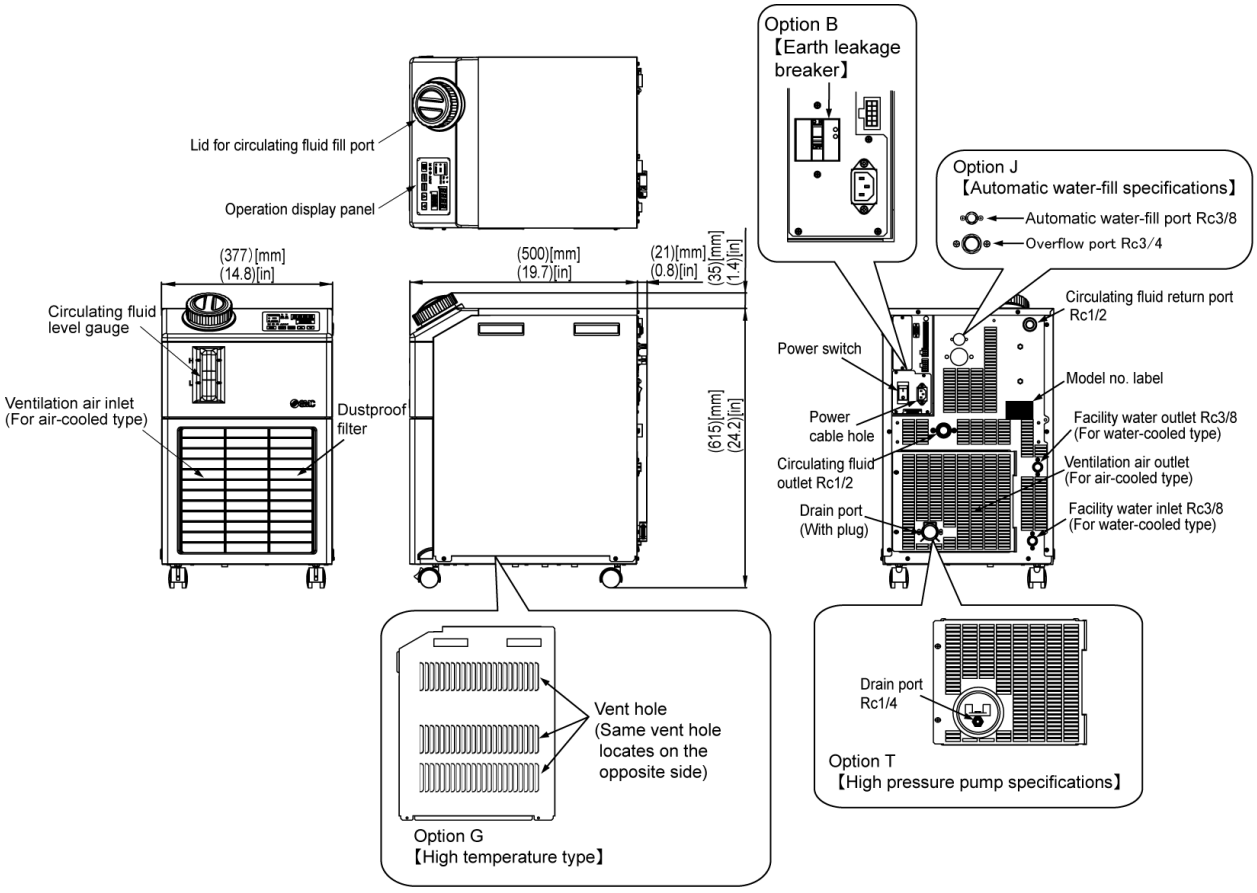


Fig.2.1-1 Name of Parts (HRS012/018/024-**-*-*)

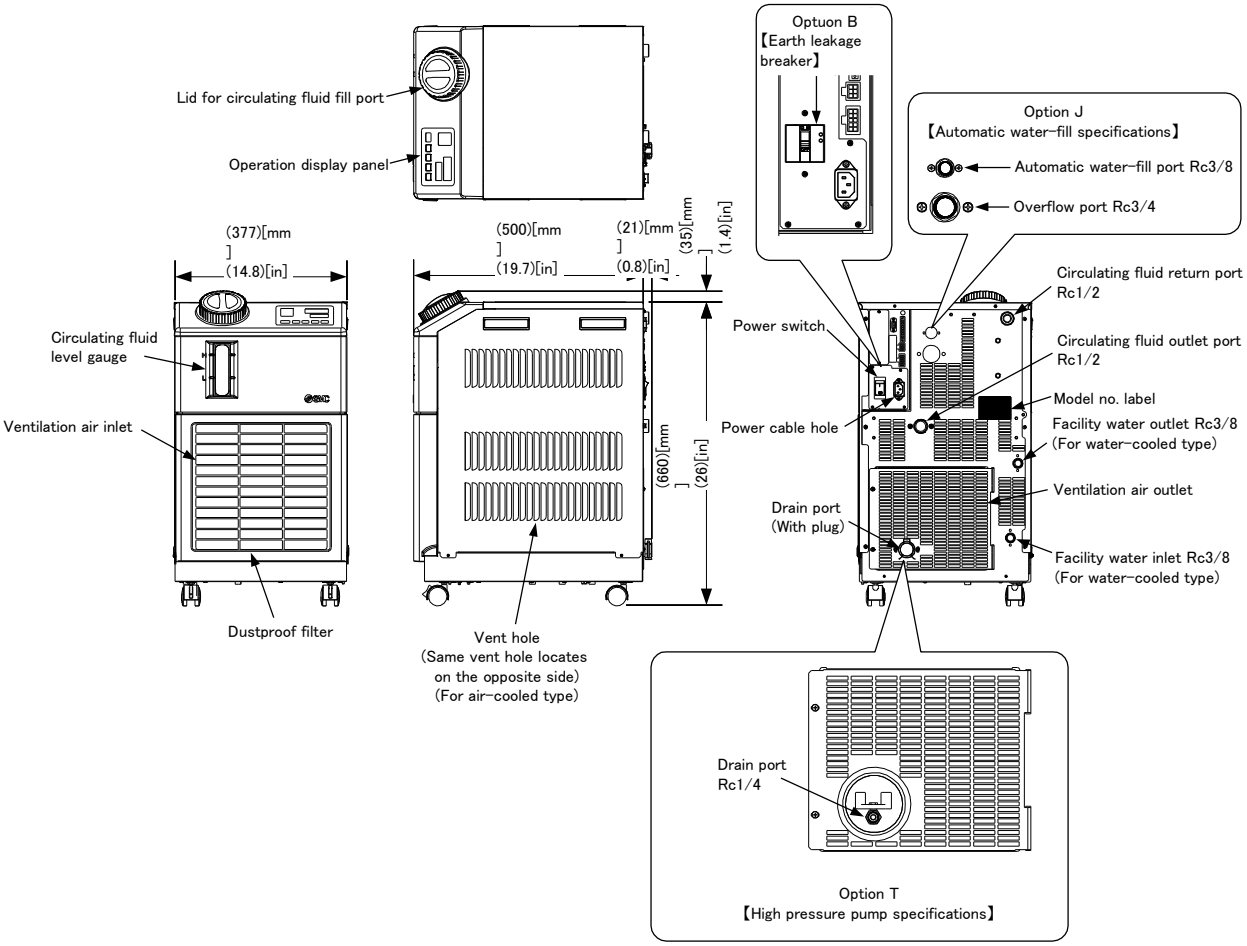


Fig.2.1-2 Name of Parts (HRS030-**-20-*)

2.2 Component Parts

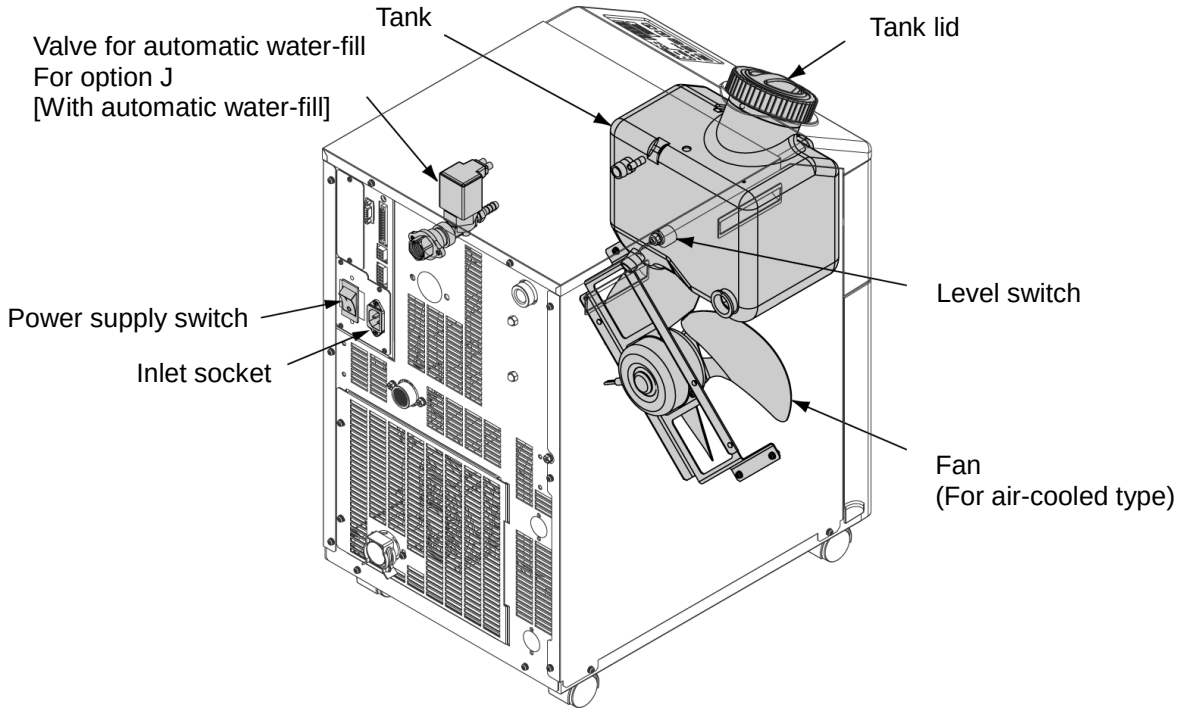


Fig.2.2-1 Component Parts

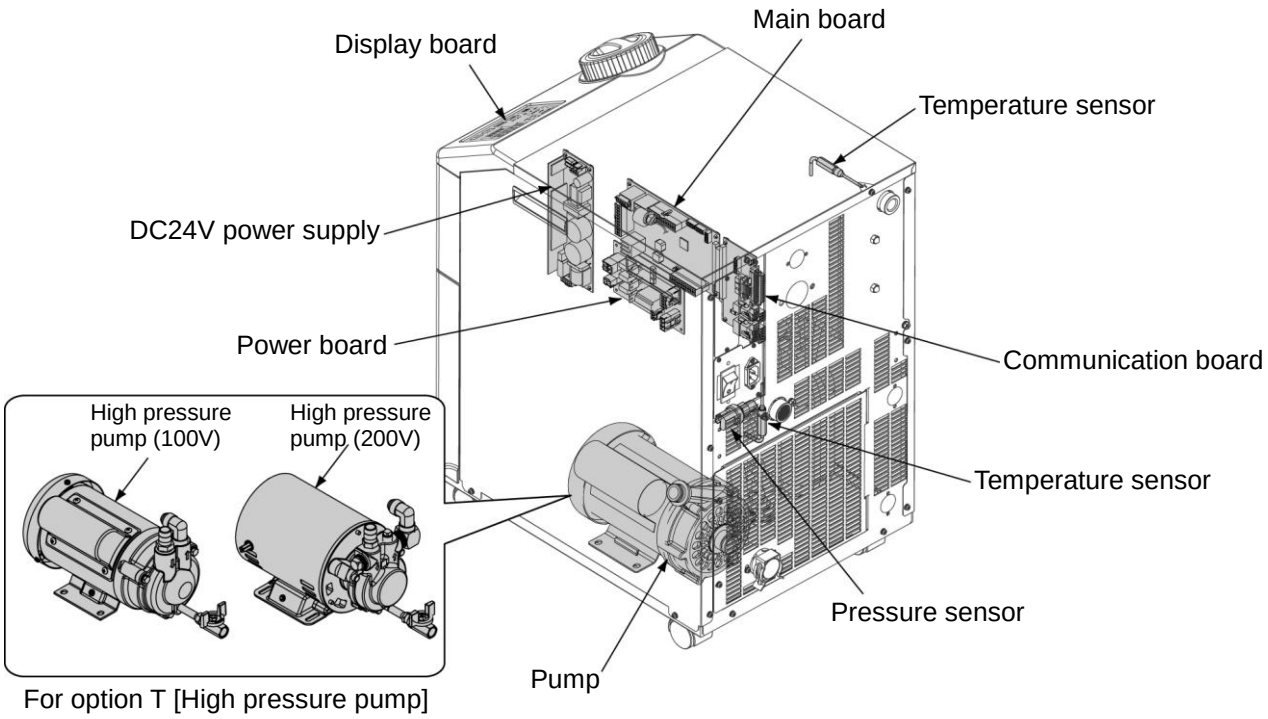


Fig.2.2-2 Component Parts

Chapter 3 Alarm Indication and Troubleshooting

3.1 Alarm Display

When any alarm occurs, the product responds with the following conditions.

- The [ALARM] lamp will flash.
- The alarm buzzer sounds.
- The alarm no. is displayed on PV.
- Contact signal of contact input/output communication is output.

  Refer to the Operation Manual for communication for details.
- Read alarm status with serial communication.

  Refer to the Operation Manual for communication for details.
- The thermo-chiller has two types of operation depending on the alarm status.

  One alarm type will stop operation when an alarm is generated during operation. The other type will not stop operation even when an alarm is generated.
- Only one alarm is displayed on the Thermo-Chiller. When more than one alarm is being generated, it is possible to check other alarms that are being generated and not being displayed by pressing the "SEL" key. When an alarm is being generated, press the "SEL" key to check if any other alarms are being generated.

CAUTION

When the alarm is reset, there is a possibility that the alarm display disappears. Before resetting the alarm, record details of the alarm.

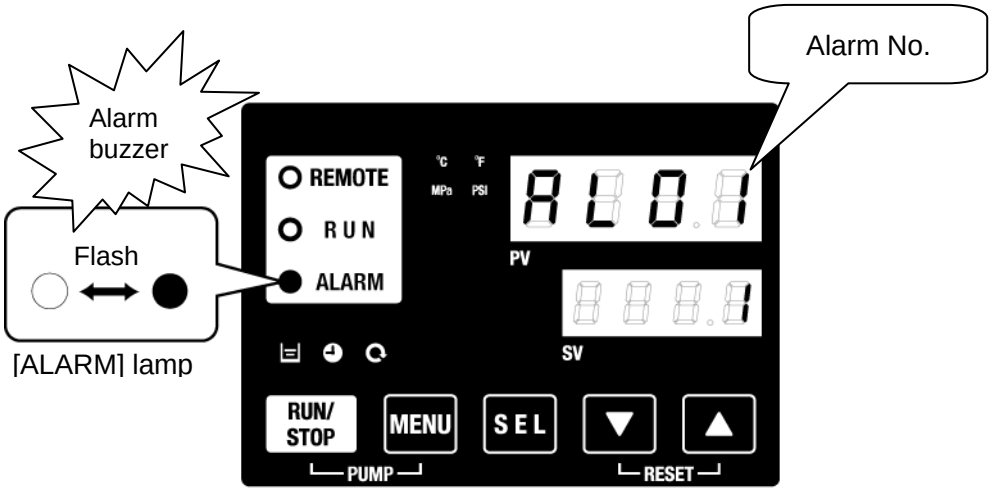


Fig.3.1-1 Operation panel

3.2 Error Type and Alarm Set Value

Table 3-1 Error Type and Alarm Set Value (1/2)

Code	Descriptioin	Operation	Cause / Remedy (Press the reset key after eliminating the cause.)
AL01	Low level in tank	Stop *1	The fluid level has fallen below the level indicator. Fill the circulating fluid.
AL02	High circulating fluid discharge temp.	Stop	・Ensure that the circulating fluid flow is 5l/min.or more. ・Reduce the ambient temperature or heat load. ・Wait until the temperature decreases.
AL03	Circulating fluid discharge temp. rise	Continued *1	
AL04	Circulating fluid discharge temp. drop	Continued *1	Check the ambient temperature condition and the temperature of supplied circulating fluid.
AL05	High circulating fluid return temp.	Stop	・Ensure that the circulating fluid flow is 5l/min.or more. ・Check the heat load are within the specified range.
AL06	High circulating fluid discharge pressure	Stop	Check the user's piping for bends, squash and foreign matters.
AL07	Abnormal pump operation	Stop	Restart and check the pump is operating.
AL08	Circulating fluid discharge pressure rise	Continued *1	Check the user's piping for bends, pinching or blockage by foreign matters.
AL09	Circulating fluid discharge pressure drop	Continued *1	・Restart and check the pump is operating. ・Ensure that the tank level is within the appropriate range.
AL10	High compressor intake temp.	Stop	Check the temperature of the circulating fluid returning to the product.
AL11	Low compressor intake temp.	Stop	・Check the circulating fluid flows. ・Check the circulating fluid in the evaporator is not frozen. ・Use a 15% ethylene glycol aqueous solution if operating with a set temperature lower than 10°C.
AL12	Low super heat temperature	Stop	
AL13	High compressor discharge pressure	Stop	Reduce the ambient temperature or heat load.
AL15	Refrigerant circuit pressure (high pressure side) drop	Stop	・Check the ambient temperature is within the specified range. ・It is possible that refrigerant is leaking. Ask for the service.
AL16	Refrigerant circuit pressure (low pressure side) rise	Stop	Reduce the ambient temperature or heat load.
AL17	Refrigerant circuit pressure (low pressure side) drop	Stop	Check the circulating fluid flows.
AL18	Compressor overload	Stop	Leave for 10 minutes and restart, and check the compressor is operating.
AL19	Communication error	Continued *1	The request message from the host computer has not arrived. Send it again.
AL20	Memory error	Stop	Written data is different from read data. Ask for the service of RAM.
AL21	DC line fuse cut	Stop *1	DC circuit fuse of the communication connector for the contact input/output is short circuited. Ask for the service of the fuse of the DC circuit. Confirm there is no incorrect wiring or load of 500mA or larger.
AL22	Circulating fluid discharge temp. sensor failure	Stop	The temperature sensor is short-circuited or opened. Ask for the service of the temperature sensor.
AL23	Circulating fluid return temp. sensor failure	Stop	
AL24	Compressor intake temp. sensor failure	Stop	
AL25	Circulating fluid discharge pressure sensor failure	Stop	The pressure sensor is short-circuited or opened. Ask for the service of the pressure sensor.
AL26	Compressor discharge pressure sensor failure	Stop	
AL27	Compressor intake pressure sensor failure	Stop	

Table 3-2 Error Type and Alarm Set Value (2/2)

Code	Descriptioin	Operation	Cause / Remedy (Press the reset key after eliminating the cause.)
AL28	Maintenance of pump	Continued	The timing of a periodical check is informed. Recommended to ask for the check and service of the pump, fan motor and compressor.
AL29 *2	Maintenance of fan motor *2	Continued	
AL30	Maintenance of comprssor	Continued	
AL31	Contact input1 signal detection	Stop *1	Contact input is detected.
AL32	Contact input 2 signal detection		
AL33	Water leakage	Stop *1	・Check if the leakage sensor is connected. ・Leakage occurred. Check the leakage point.
AL34	Electric resistivity/conductivity rise	Continued	Electrical resistivity/conductivity is larger than the set value. If an electric conductivity sensor is used, replace the DI filter.
AL35	Electric resistivity/conductivity drop	Continued	Electrical resistivity/conductivity is smaller than the set value. If an electric resistivity sensor is used, replace the DI filter.
AL36	Electric resistivity/conductivity sensor error	Continued	・Check if the electric resistivity/conductivity sensor is connected. ・There may be short circuit or open wire of the resistivity/conductivity sensor. Replace the sensor.

∗1: ’’Stop” or “Continued” are default settings. The user can change them to “Continued” and “Stop”.
∗2: For air-cooled type.

3.2.1 How to reset alarm

The troubleshooting method depends which alarm has been generated. Refer to'' Table 3-1 ''.

This page explains how to reset the alarm signal condition after eliminating the cause of the alarm.

1. Ensure that the alarm display screen is displayed.

Alarm can only be reset on this screen.

2. Press [▼] and [▲] keys down simultaneously.

3. The alarm is reset.

The [ALARM] lamp goes off.

The operation panel displays the circulating fluid temperature and the circulating fluid set temperature.

The contact signal of the contact input/output communication stops.

(Refer to the Operation Manual for communication for details.)

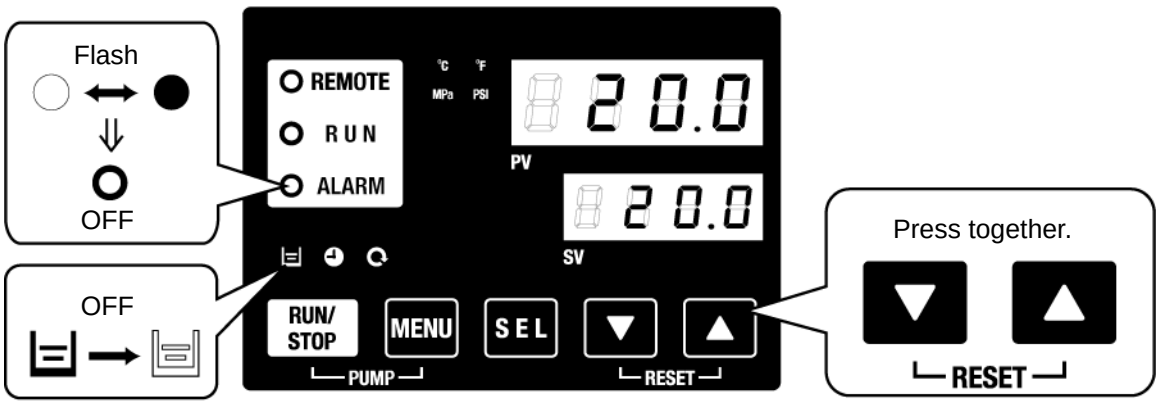


Fig.3.2-1 Alarm reset

3.3 Troubleshooting

3.3.1 How to use the flow chart of troubleshooting

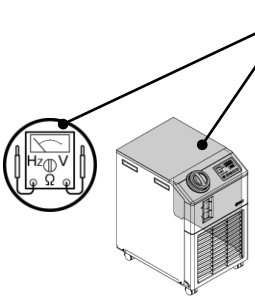
1. Find a flow chart of troubleshooting corresponding to the error, referring to table 3-1 “Error Type and Alarm Set Value”.

2. Troubleshoot a problem through an item-by-item check in the flow chart.

[Tips]

Go through the items of guidelines from top down for troubleshooting.
No items are to be skipped unless otherwise specified.

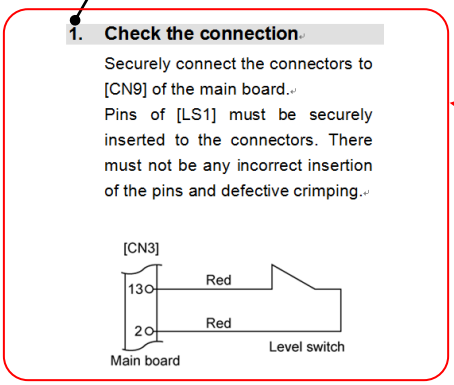
Example:

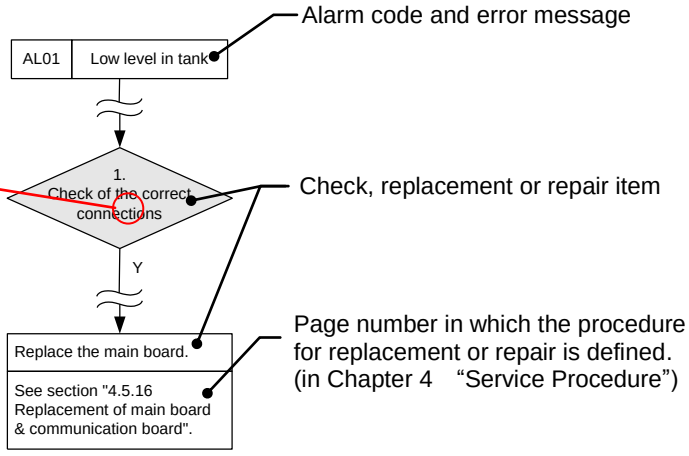


The removable panel as well as tools required for check and inspection are indicated by icons.

See section 3.3.2 “Required Tools and Icons” for details.

Important notes for check and inspection in the flow chart are provided at the end.





Alarm code and error message

Check, replacement or repair item

Page number in which the procedure for replacement or repair is defined. (in Chapter 4 “Service Procedure”)

⚠ CAUTION

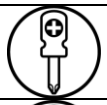
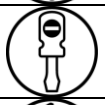
Replacement or repair of the refrigerant circuit parts must be performed by a specialized operator.
Any operators other than specialized operators must not replace or repair the refrigerant circuit including the parts.

3. See “Chapter 4 Service Procedure” for actual replacement of units.

3.3.2 Icons for necessary tools and specifications

■ Tools necessary for troubleshooting

Table 3-3 Tools necessary for troubleshooting

Description	Icon	Content
Cross recessed screwdriver *1		–
Flat blade screwdriver*1		–
Spanner/Wrench		Flat size: 14mm
Tester		For current/ frequency measurement [Required measurement range]: 0 to 500V, 0 to 100kΩ

∗1: Screwdriver with magnetic tip.

■ Recommended protective tools

Table 3-4 Recommended protective tools

Description	Icon
Gloves	
Goggles	
Safety shoes	

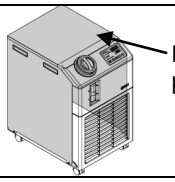
■ Tightening torque

Table 3-5 Tightening torque

Icon	Content
	The number shows torque.

■ Removable panels

Table 3-6 Panel Icon

Icon	Content
	• Removable panels The panels that can be removed for part check are shaded in the illustration.

See section 3.3.3 “Attachment and removal of panel” for details.

3.3.3 Removal and the mounting of the panel

⚠ CAUTION

Be sure to wear protective footwear and gloves when attaching or removing panels.
Sharp edges of the panels may lead to personal injury if not handled properly.

■ **Removal**

1. Remove the upper panel. (Screw ×2)

2. Remove the side panel. (Screw ×each right and left 6)

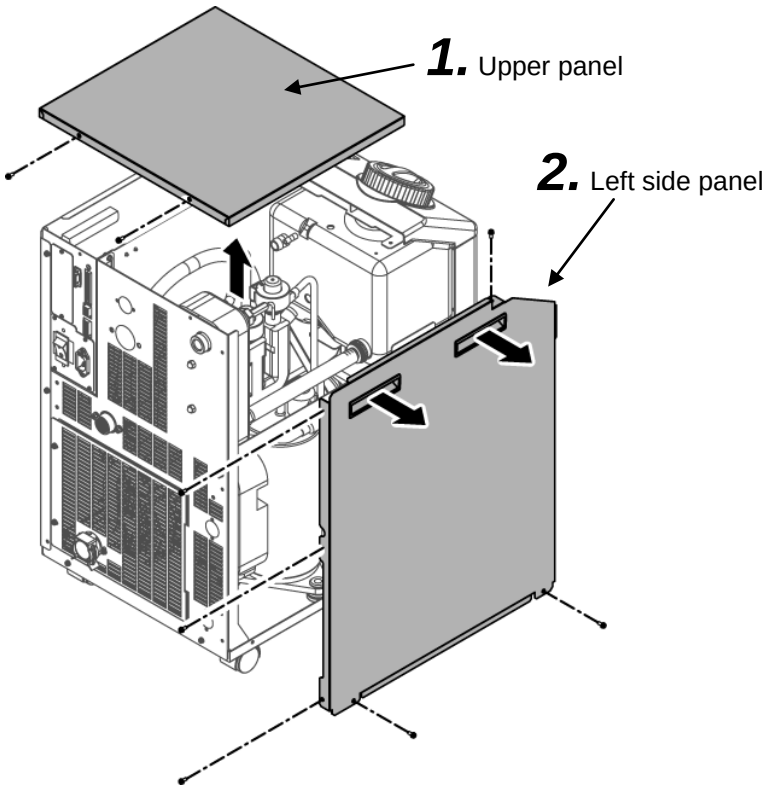


Fig. 3.3-1 Removal of panels

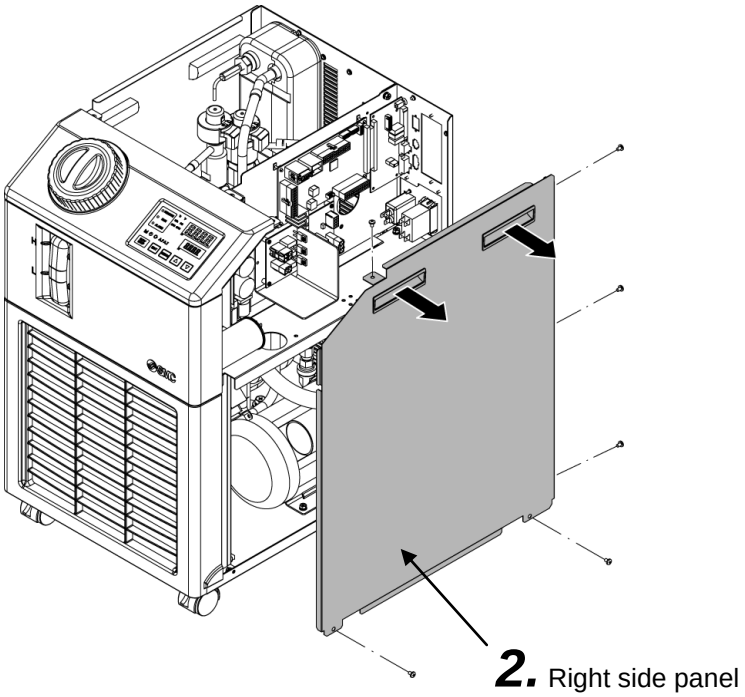


Fig. 3.3-2 Removal of panels

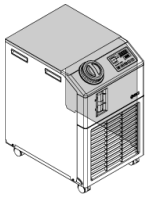
■ Mounting

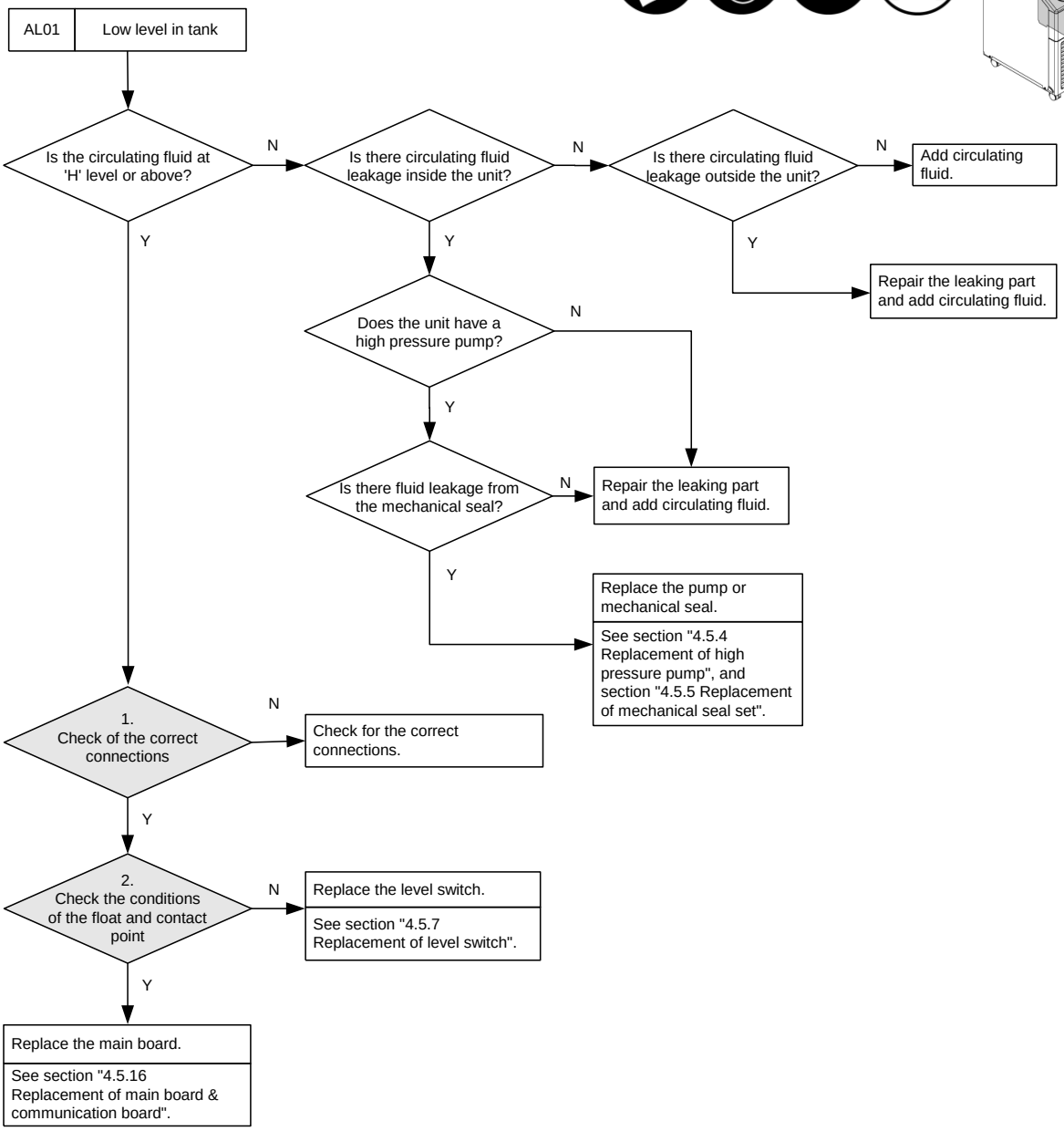
Panel attachment is performed in inverse order of its removal.

3.3.4 Troubleshooting of alarms

AL01: Low level in tank

<Detection method> The level switch in the tank operates to detect the alarm.

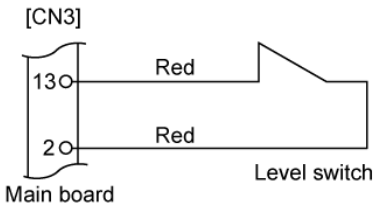




1. Check the connection

Securely connect the connectors to [CN9] of the main board.

Pins of [LS1] must be securely inserted to the connectors. There must not be any incorrect insertion of the pins and defective crimping.



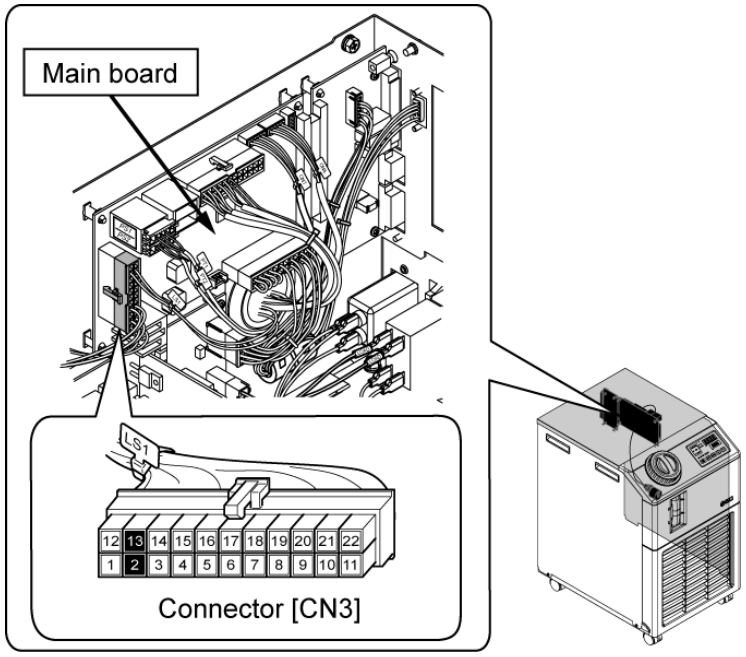


Fig. 3.3-3 Level switch connection check

2. Check conditions of the float and contact point

Remove the connectors [CN9]. Move the float of the level switch inside the tank.

Check that it is electrically conducted between the pin numbers 2 and 13 in the state shown below:

- When the float is in the lower position: Not electrically conducted between the contact points 2 and 13.
- When the float is in the upper position: Electrically conducted between the contact points 2 and 13.

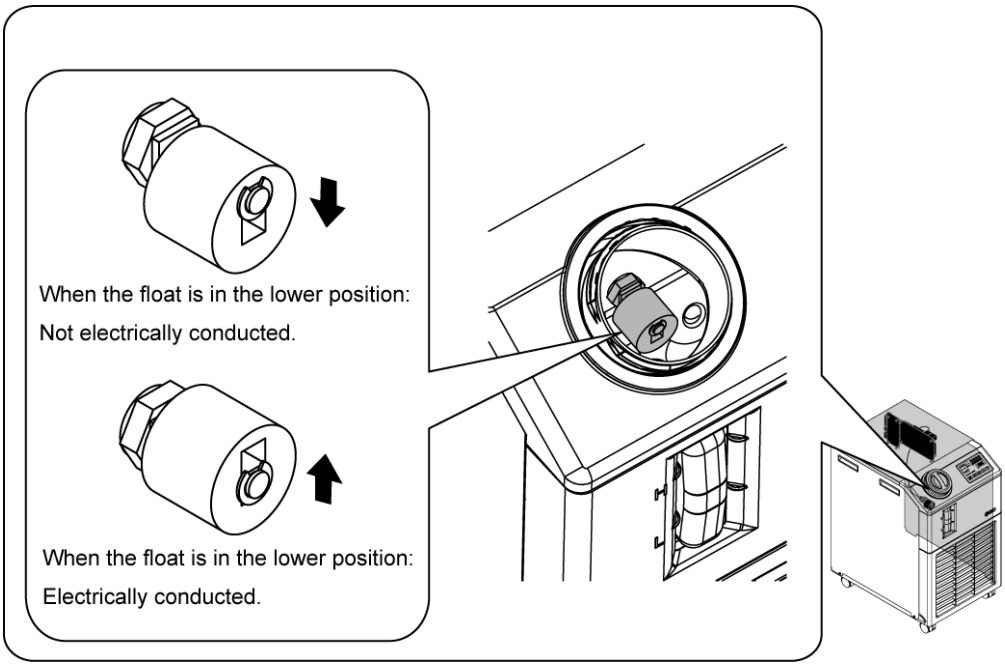
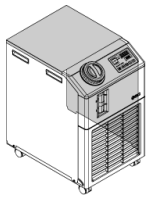


Fig. 3.3-4 Operation of the level switch

AL02: High circulating fluid discharge temp. [For air-cooled type]

<Detection method> This alarm goes off when the temperature sensor for the circulating fluid (for discharge) detects 60 °C or more.



AL02 | High circulating fluid discharge temp. [For air-cooled type]

AL22 is being generated. — Y → AL22: Circulating fluid discharge temp. sensor failure

N

1. Is ambient temperature out of the specification range? — Y → This system cannot be used.

N

2. Is external load out of the specification range? — Y → This system cannot be used.

N

3. Is there enough ventilation space? — Y → Have enough space for maintenance as specified in the Operation Manual. / Improve the environment for installation space.

N

4. Is the dustproof filter too dusty? — Y → Clean the dustproof filter.

N

5. Check the circulating fluid temperature sensor (PT1). — Error → 6. Check the circulating fluid temperature sensor (PT1) after it is replaced. — Error → Replace the main board. / See section "4.5.16 Replacement of main board & communication board".

Normal

7. Is flow rate of the circulating fluid less than 5 L/min? — Y → 8. Check the pump performance. — Normal → Connect a by-pass piping.

8. Check the pump performance. — Error → Replace the pump. / See section "4.5.3 Replacement of pump (For standard pump)", and section "4.5.4 Replacement of high pressure pump".

N

9. Is the circulating fluid contaminated? — Y → Clean the circulating fluid circuit. / Cleaning method: See a document No. HRX-MM-S060 / If contamination of the heat exchanger cannot be removed by cleaning, the heat exchanger, which is an evaporator and a part of the refrigerant circuit, needs to be replaced. Only a specialized operator is allowed to handle the refrigerant circuit. / See document No. HRX-MM-Q014 for replacement.

N

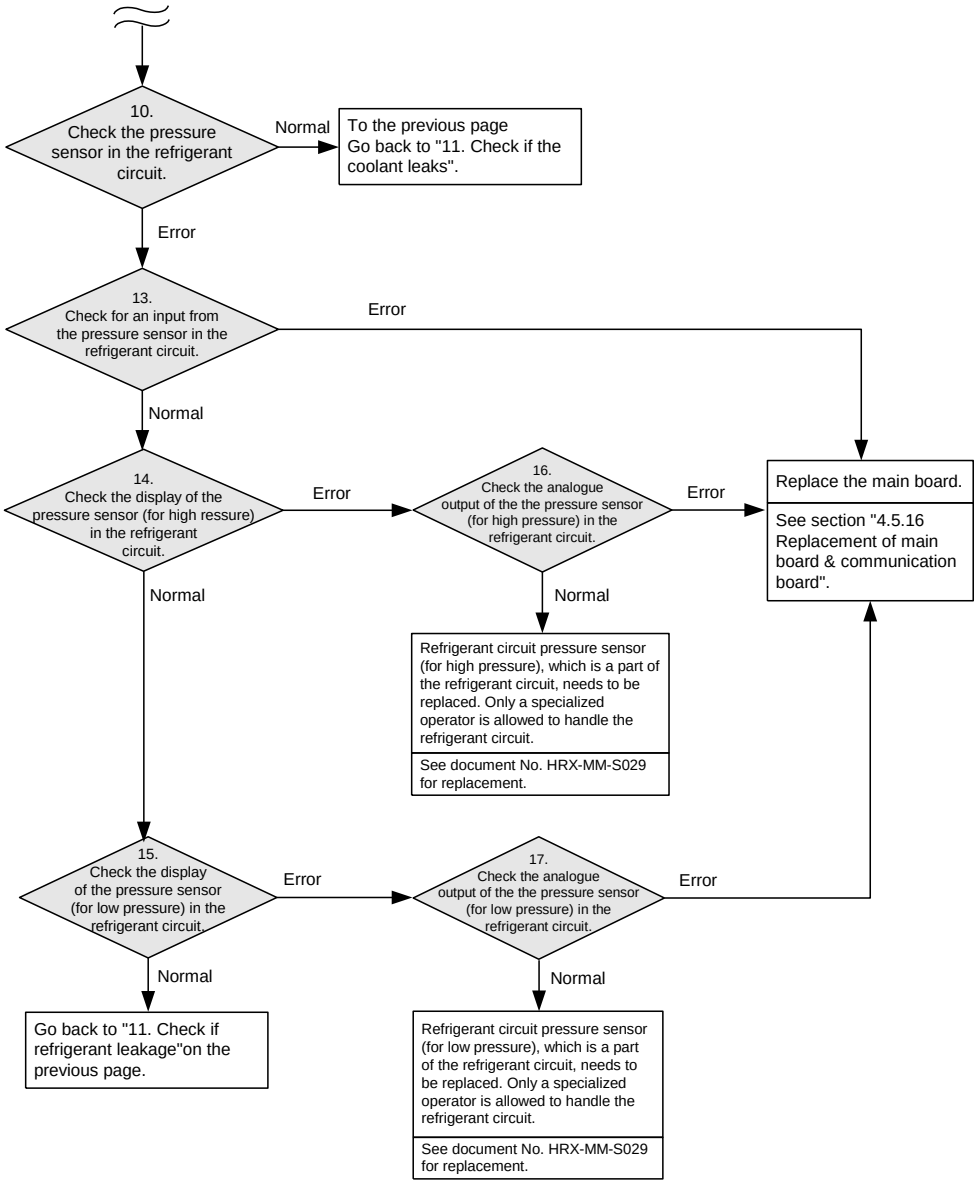
10. Check the pressure sensor in the refrigerant circuit. — Normal → 11. Check if refrigerant leaks. — With leakage → Repair the refrigerant circuit. Only a specialized operator is allowed to handle the refrigerant circuit.

No leakage

12. After stopping the power supply, does the same alarm goes off again when the chiller is restarted? — N → Electronic expansion valve, which is a part of the refrigerant circuit, needs to be replaced. Only a specialized operator is allowed to handle the refrigerant circuit. / See document No. HRX-MM-Q016 for replacement.

Y → Please contact SMC or a distributor.

10. Check the pressure sensor in the refrigerant circuit. — Error → To the next page


10.
Check the pressure sensor in the refrigerant circuit.
Normal
To the previous page
Go back to "11. Check if the coolant leaks".
Error
13.
Check for an input from the pressure sensor in the refrigerant circuit.
Error
Normal
14.
Check the display of the pressure sensor (for high ressure) in the refrigerant circuit.
Error
16.
Check the analogue output of the the pressure sensor (for high pressure) in the refrigerant circuit.
Error
Replace the main board.
See section "4.5.16 Replacement of main board & communication board".
Normal
Normal
Refrigerant circuit pressure sensor (for high pressure), which is a part of the refrigerant circuit, needs to be replaced. Only a specialized operator is allowed to handle the refrigerant circuit.
See document No. HRX-MM-S029 for replacement.
15.
Check the display of the pressure sensor (for low pressure) in the refrigerant circuit.
Error
17.
Check the analogue output of the the pressure sensor (for low pressure) in the refrigerant circuit.
Error
Normal
Normal
Go back to "11. Check if refrigerant leakage"on the previous page.
Refrigerant circuit pressure sensor (for low pressure), which is a part of the refrigerant circuit, needs to be replaced. Only a specialized operator is allowed to handle the refrigerant circuit.
See document No. HRX-MM-S029 for replacement.

1. Ambient temperature is out of the specification range.

Ambient temperature is higher than 40 °C (45 °C for Option G "High ambient temperature specification").

2. External load is out of the specification range.

Cooling capacity varies depending on the ambient temperature, set circulating fluid temperature, and power supply frequency.

Please refer to the "Cooling capacity" graph shown on the Operation Manual.

3. Enough ventilation space has not been secured.

- The Thermo-Chiller is installed too close to a wall.
- There are other equipment close to the Thermo-Chiller.
- Hot ventilated air from other equipment enters the Thermo-Chiller.
- The Thermo-Chiller is operating in an enclosed space.

(e.g. In a room without ventilation or air conditioner)

4. The dustproof filter is too dusty.

Dustproof filter on the front side of the Thermo-Chiller or the fin of the air-cooled condenser inside is contaminated.

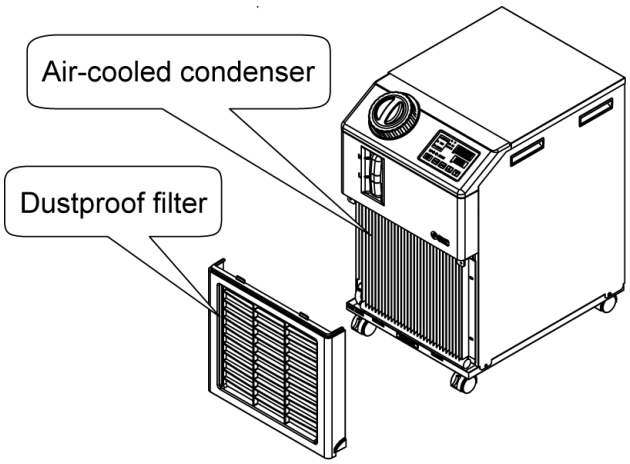


Fig. 3.3-5 An air-cooled condenser and a dustproof filter

5. Check the circulating fluid temperature sensor (PT1).

Two circulating fluid temperature sensors are used; one is for the outlet port (PT1) and one for the return port (PT2). Compare the temperatures sensed by the temperature sensors under the conditions shown below to judge if the values provided by the temperature sensors are correct or not:

(1) Connect a shorter pipe directly from the circulating fluid outlet port to the return port of the Thermo-Chiller with a valve mounted to the outlet port. (Mount a valve to the outlet port to make it possible to adjust the flow rate roughly.)

(2) Operate the Thermo-Chiller and stabilize the temperature.

(3) Check the temperature shown for "t1: Circulating fluid outlet temperature" and "t2: Circulating fluid return temperature" in the "Check Monitor Menu".

If the temperature is within the range of t1 = t2 +/- 2 oC, operation of the circulating fluid temperature sensor (PT1) is normal.

6. Check the circulating fluid temperature sensor (PT1) after it is replaced.

Replace the circulating fluid temperature sensor (PT1). (See section "4.5.1 Replacement of temperature sensor (PT1)".) After replacing, check that all the check items shown in "5. Check the circulating fluid temperature sensor (PT1)" are correctly followed.

7. Flow rate of the circulating fluid is less than 5 L/min.

Install a flow meter, and check the flow rate of the circulating fluid.

8. Check the pump performance.

Install a flow meter. Refer to the "Pump capacity" graph" shown in the catalogue and check that the pump capacity is suitable for the circulating fluid outlet pressure and the circulating fluid flow rate.

9. Circulating fluid is contaminated.

Contamination contained in the circulating fluid adheres to the heat exchanger (evaporator), and it decreases the heat exchanger performance.

Open the cap of the tank, and check visually the contamination (e.g. deformation, foreign matter, abnormal smell) of the circulating fluid inside the tank.

When the visual check finds contamination in the circulating fluid, check the influence of the contamination to the heat exchanger by following the instructions shown below.

(1) Connect the circulating fluid outlet directly to the fluid return port with a valve mounted to the outlet port with a shorter piping to make it possible to operate the system at flow rate of circulating fluid at 7 L/min.
(For Option T, adjust the flow rate so that the circulating fluid discharge pressure will be approximately 0.4 MPa.)

(2) Set the circulating fluid temperature to 20 oC, and operate the Thermo-Chiller.

(3) Check the temperature shown for "t2: Circulating fluid return temperature" and "t3: Compressor inlet temperature" in the "Check Monitor Menu".

(4) Displayed temperature will be as shown below in accordance with level of contamination of the heat exchanger.

<With no contamination with the heat exchanger>
"t3: Suction temperature of the compressor" ≥ "t2: Circulating fluid return temperature" -5 ^{o}C

<With contamination with the heat exchanger>
"t3: Suction temperature of the compressor" < "t2: Circulating fluid return temperature" -5 ^{o}C
e.g. (Normal) t2: 21.5, t3: 23.8, (Abnormal) t2: 21.5, t3: 15.5

10. Check the pressure sensor in the refrigerant circuit.

Two pressure sensors, one for high pressure and one for low pressure, are used for the refrigerant circuit. Take the following instructions to check for any abnormality with the pressure sensors:

(1) Stop the Thermo-Chiller operation.

(2) Check the temperature shown for "Ph: Refrigerant circuit pressure on the high pressure side" and "PL: Refrigerant circuit pressure on the low pressure side" in the "Check Monitor Menu".

(3) If the pressure value shown by each sensor is +/- 0.1 MPa (Ph = PL +/- 0.1), it means that the pressure sensors are operating correctly.

11. Check for refrigerant leakage.

Refrigerant leakage reduces the cooling capacity. To check for refrigerant leakage, it is necessary to make the refrigerant circuit temperature same as the ambient temperature. Stop the Thermo-Chiller operation, and leave it not operating for 24 hours.

Take the following instructions to check for refrigerant leakage after leaving not operating.

(1) Measure the ambient temperature (room temperature).

(2) Check the pressure shown for "Ph: Refrigerant circuit pressure on the high pressure side" in the "Check Monitor Menu" of the Thermo-Chiller.

(3) If the measured point is lower than the values shown in the graph in "Fig. 3.3-6: Ambient temperature and refrigerant circuit pressure", it means there is refrigerant leakage caused.

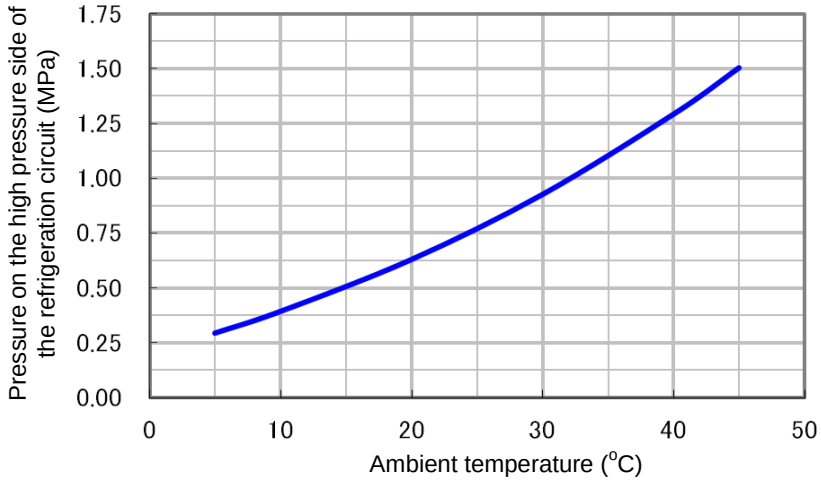


Fig. 3.3-6 Ambient temperature and refrigerant circuit pressure

12. After stopping power supply, check for the same alarm goes off again when the chiller is re-started.

After stopping power supply (by tuning off the power supply switch on the Thermo-Chiller), check if the same alarm goes off again when the Thermo-Chiller is restarted.

13. Check for an input to the pressure sensor in the refrigerant circuit.

Check that the power is supplied to the refrigerant circuit pressure sensor.
Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

<Refrigerant circuit pressure sensor (for high pressure)>
Contact the positive probe to the pin number 22 and contact the negative probe to the pin number 10 of the "CN4" connector.
<Normal> Pin number 22 - Pin number 10: Voltage should be 5 VDC +/- 1V

<Refrigerant circuit pressure sensor (for low pressure)>
Contact the positive probe to the pin number 24 and contact the negative probe to the pin number 12 of the "CN4" connector.
<Normal> Pin number 24 - Pin number 12: Voltage should be 5 VDC +/- 1V

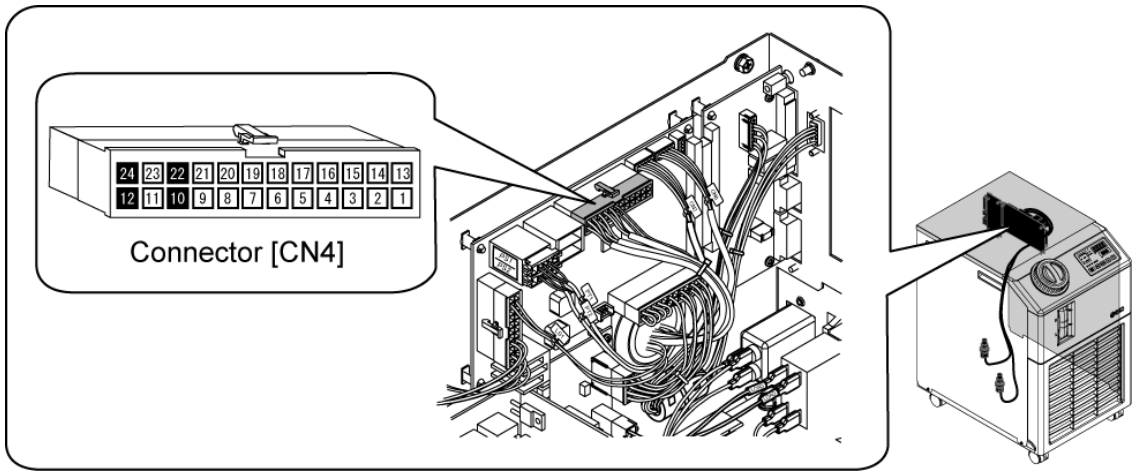


Fig. 3.3-7 Check of input to the refrigerant circuit pressure sensor

14. Check the display of the refrigerant circuit pressure sensor (for high pressure).

Compare the refrigerant circuit pressure and the ambient temperature with those shown in the graph to check the displayed value of the refrigerant circuit pressure sensor.

Follow the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours to make the ambient temperature and the temperature inside the Thermo-Chiller the same.

(2) Check the ambient temperature.

(3) Check the "Ph: Refrigerant circuit pressure on the high pressure side" value in the "Check Monitor Menu".

(4) Check if the value at the cross point of the ambient temperature and the "Ph: Refrigerant circuit pressure on the high pressure side" value is within the range (the shaded part) in Fig. 3.3-8. If the cross point is within the range, it means that the pressure sensor is operating correctly.

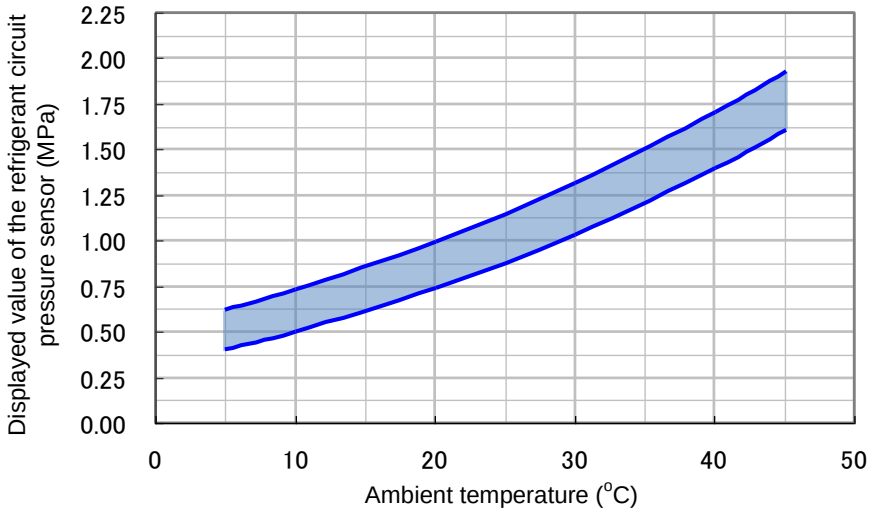


Fig. 3.3-8 Ambient temperature and refrigerant circuit pressure

15. Check the display of the refrigerant circuit pressure sensor (for low pressure).

Compare the refrigerant circuit pressure and the ambient temperature with those shown in the graph to check the displayed value of the refrigerant circuit pressure sensor.

Follow the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours to make the ambient temperature and the temperature inside the Thermo-Chiller the same.

(2) Check the ambient temperature.

(3) Check "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(4) Check if the value at the cross point of the ambient temperature and the "PL: Refrigerant circuit pressure on the low pressure side" value is within the range (the shaded part) in Fig. 3.3-8. If the cross point is within the range, it means that the pressure sensor is operating correctly.

16. Check the analogue output of the refrigerant circuit pressure sensor (for high pressure).

Find out if the main board is operating connectly.

Follow the instructions shown below:

(1) Check the "Ph: Refrigerant circuit pressure on the high pressure side" value in the "Check Monitor Menu".

(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 11 and contact the negative probe to the pin number 10 of the "CN4" connector.

(4) Check that the voltage between the pin number 11 and the pin number 10 is in the same relationship shown in Fig. 3.3-10. (Accuracy: +/- 5%)

(5) If the voltage is in the same relationship as the graph shows, it means that the main board is operating correctly.

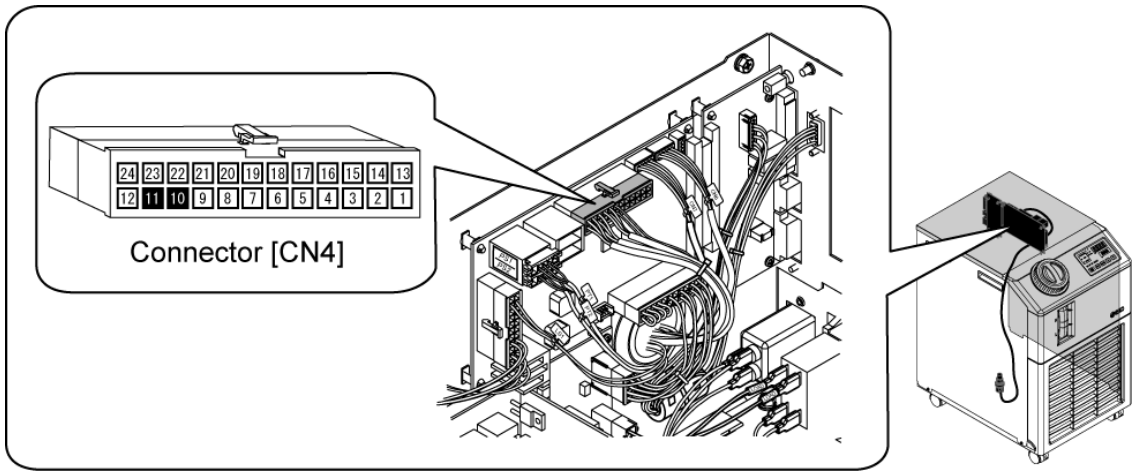


Fig. 3.3-9 Check of the refrigerant circuit pressure sensor (for high pressure) output

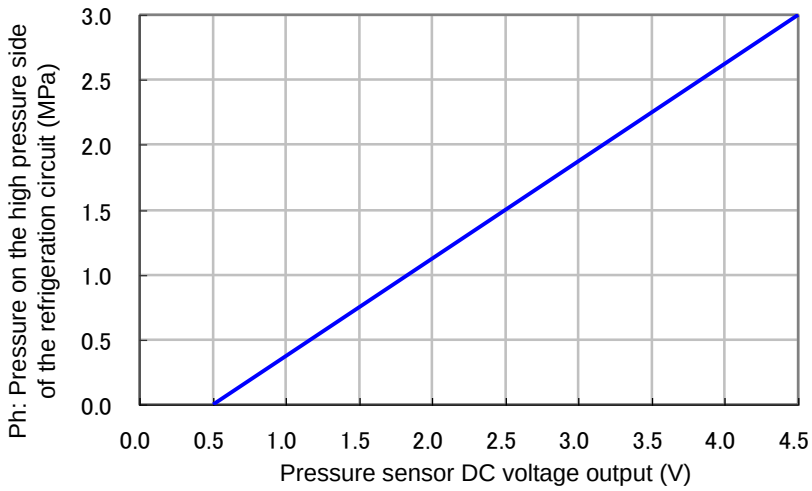


Fig. 3.3-10 Refrigerant circuit pressure sensor (for high pressure) analogue output

17. Check the analogue output of the refrigerant circuit pressure sensor (for low pressure).

Find out if the main board is operating connectly.

Follow the instructions shown below:

(1) Check the "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 23 and contact the negative probe to the pin number 12 of the "CN4" connector.

(4) Check that the voltage between the pin number 23 and the pin number 12 is in the same relationship shown in Fig. 3.3-12. (Accuracy: +/- 5%)

(5) If the voltage is in the same relationship as the graph shows, it means that the main board is operating correctly.

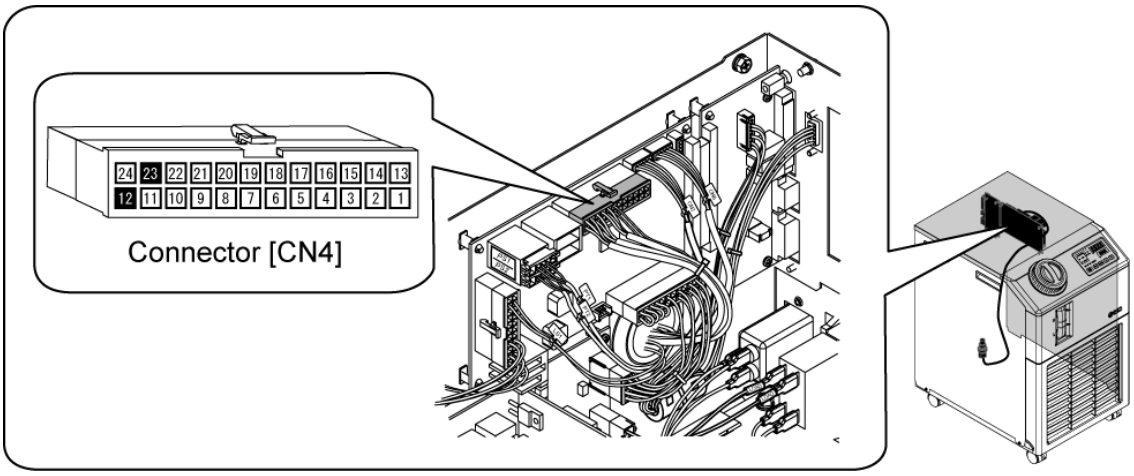


Fig. 3.3-11 Check of the refrigerant circuit pressure sensor (for low pressure) output

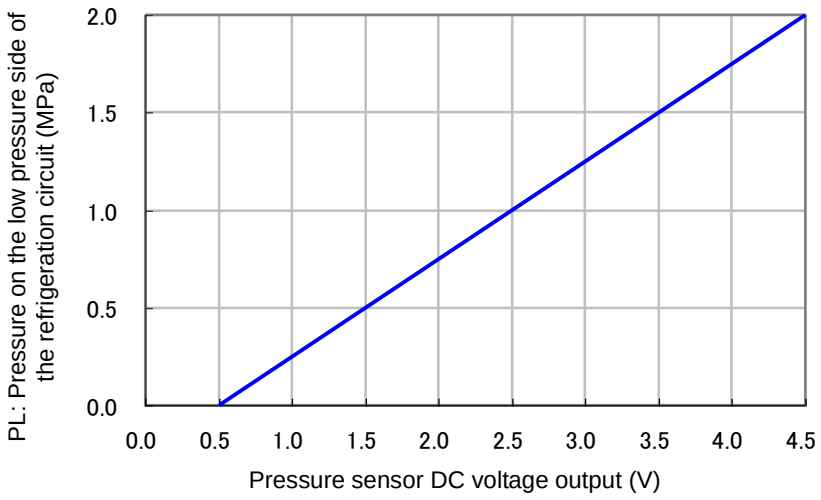
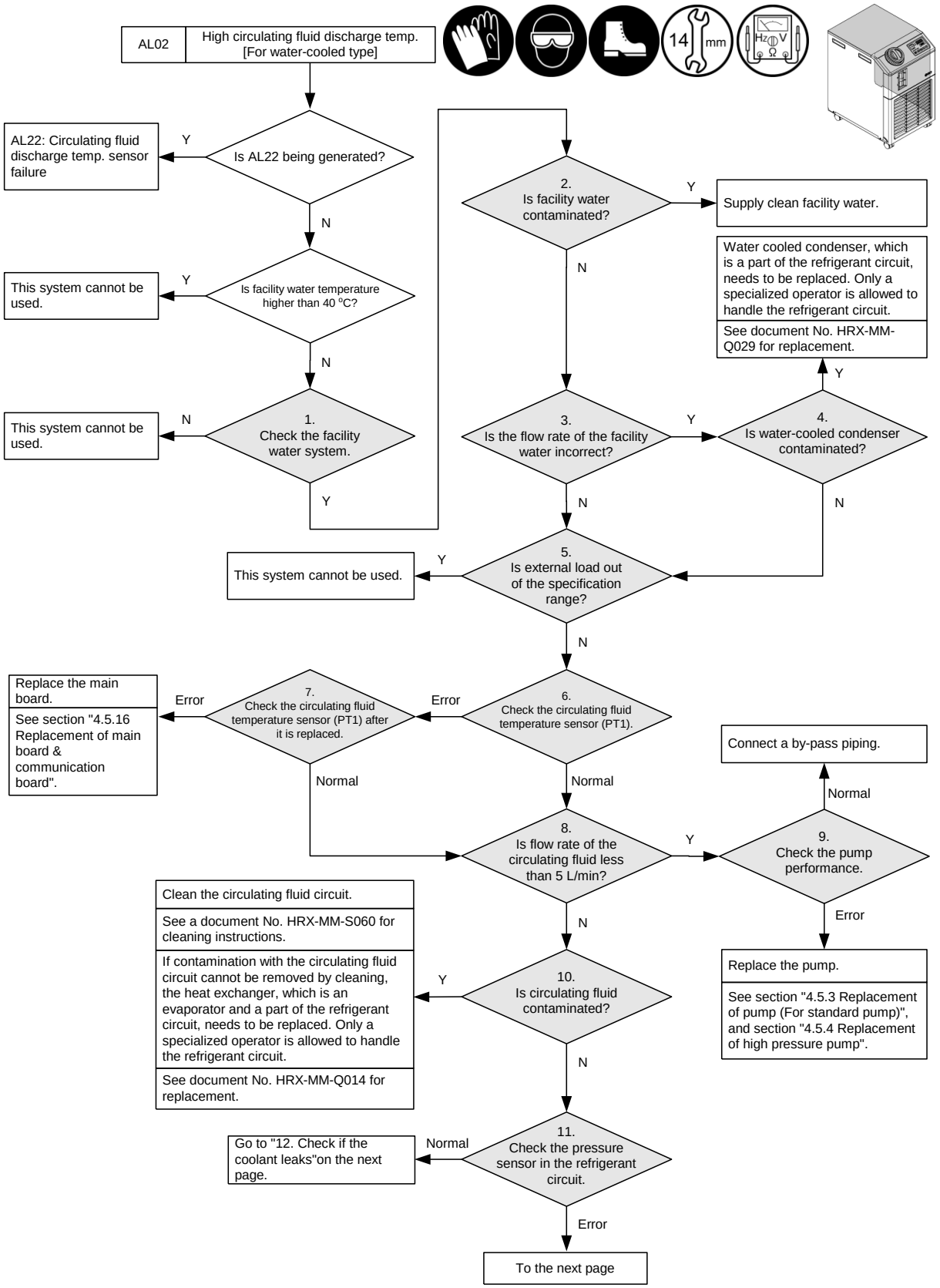
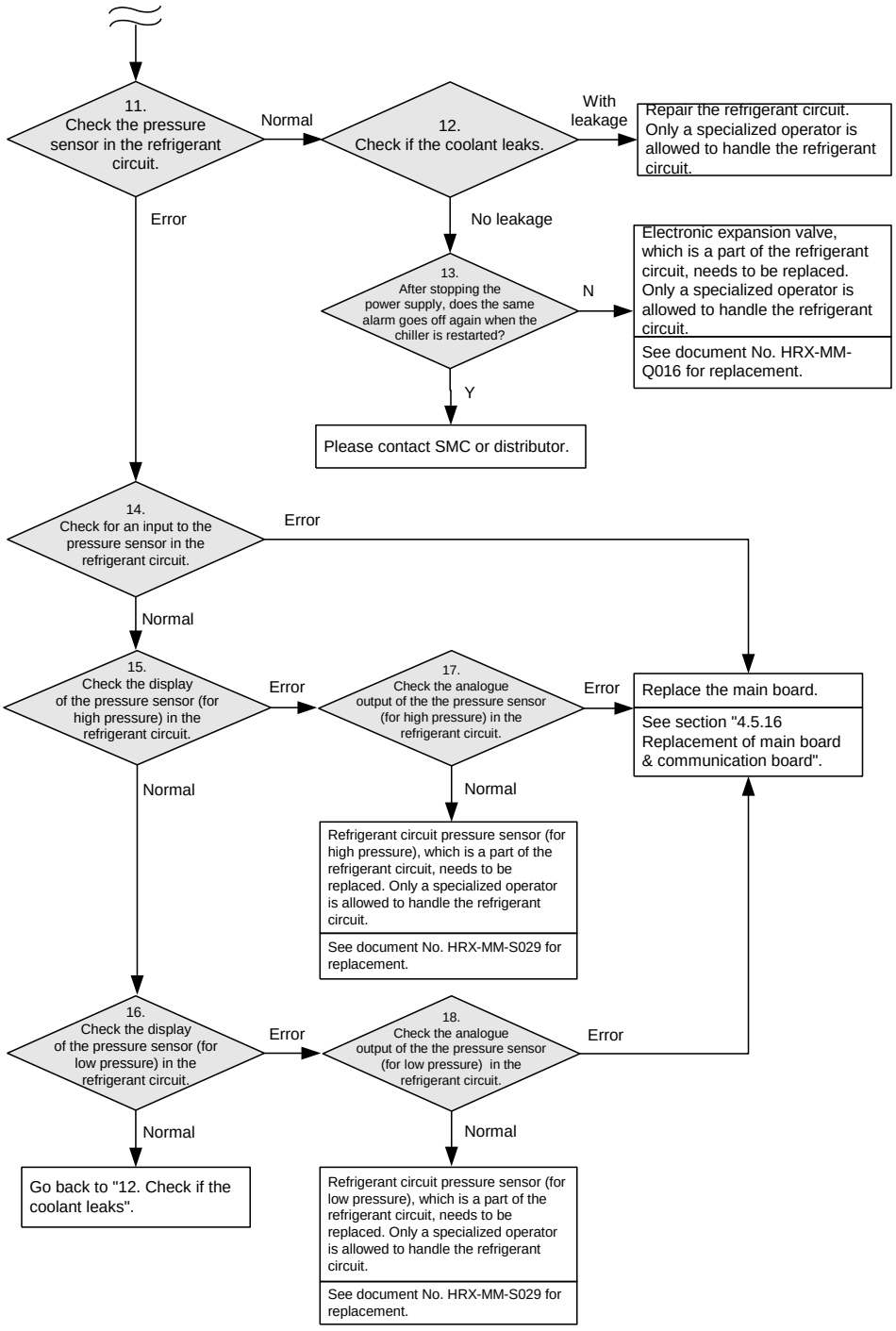


Fig. 3.3-12 Refrigerant circuit pressure sensor (for low pressure) analogue output

AL02: High circulating fluid discharge temp. [For water-cooled type]

<Detection method> This alarm goes off when the temperature sensor for the circulating fluid (for discharge) detects 60 °C or more.




11.
Check the pressure sensor in the refrigerant circuit.
Normal
12.
Check if the coolant leaks.
With leakage
Repair the refrigerant circuit.
Only a specialized operator is allowed to handle the refrigerant circuit.
Error
No leakage
13.
After stopping the power supply, does the same alarm goes off again when the chiller is restarted?
N
Electronic expansion valve, which is a part of the refrigerant circuit, needs to be replaced.
Only a specialized operator is allowed to handle the refrigerant circuit.
See document No. HRX-MM-Q016 for replacement.
Y
Please contact SMC or distributor.
14.
Check for an input to the pressure sensor in the refrigerant circuit.
Error
Normal
15.
Check the display of the pressure sensor (for high pressure) in the refrigerant circuit.
Error
17.
Check the analogue output of the the pressure sensor (for high pressure) in the refrigerant circuit.
Error
Replace the main board.
See section "4.5.16 Replacement of main board & communication board".
Normal
Normal
Refrigerant circuit pressure sensor (for high pressure), which is a part of the refrigerant circuit, needs to be replaced. Only a specialized operator is allowed to handle the refrigerant circuit.
See document No. HRX-MM-S029 for replacement.
16.
Check the display of the pressure sensor (for low pressure) in the refrigerant circuit.
Error
18.
Check the analogue output of the the pressure sensor (for low pressure) in the refrigerant circuit.
Error
Normal
Normal
Go back to "12. Check if the coolant leaks".
Refrigerant circuit pressure sensor (for low pressure), which is a part of the refrigerant circuit, needs to be replaced. Only a specialized operator is allowed to handle the refrigerant circuit.
See document No. HRX-MM-S029 for replacement.

1. Check the facility water system.

Check that the facility water system capability satisfies the required facility water flow rate that is specified in the Operation Manual.

2. Facility water is contaminated.

Check that the facility water is clean (without any foreign matter or discolouration).

3. Incorrect flow rate of the facility water.

Install a flow meter and check that the facility water system satisfies the required facility water flow rate that is specified in the Operation Manual.

* Facility water does not flow when the Thermo-Chiller is not operating. Check the facility water flow rate while the external load is being applied to the Thermo-Chiller or the circulating fluid temperature is being decreased.

4. Water-cooled condenser is contaminated.

Contamination given to the water-cooled condenser reduces cooling capacity. Check the water-cooled condenser for contamination by following the instructions shown below:

(1) Remove the pipings connected to the inlet and outlet of the facility water.
(2) Remove the upper panel and the right panel.
(3) Remove the plug of the water-cooled condenser, and check inside the water-cooled condenser for contamination.

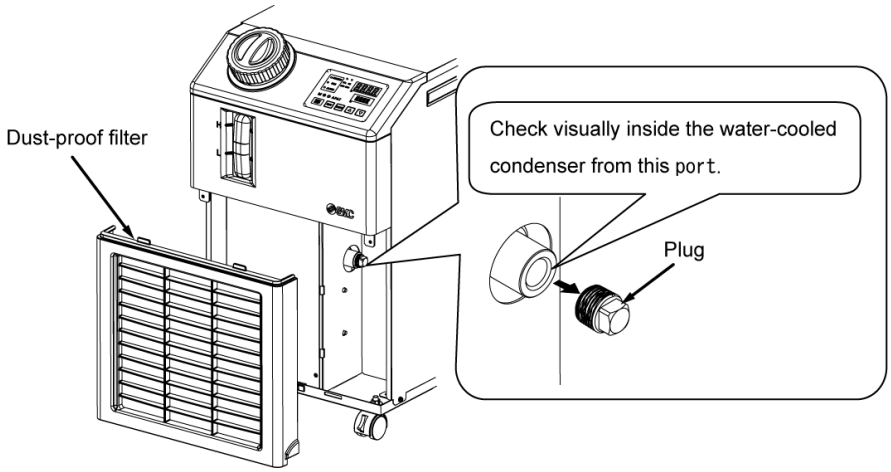


Fig. 3.3-13 The port for visual check for contamination inside the water-cooled condenser

5. External load is out of the specification range.

Cooling capacity varies depending on the facility water temperature, set circulating fluid temperature, and power supply frequency.

Please refer to the "Cooling capacity" graph shown in the Operation Manual.

6. Check the circulating fluid temperature sensor (PT1).

Two circulating fluid temperature sensors are used; one is for the outlet port (PT1) and one for the return port (PT2). Compare the temperatures sensed by the temperature sensors under the conditions shown below to judge if the values provided by the temperature sensors are correct or not:

(1) Connect a shorter pipe directly from the circulating fluid outlet port to the return port of the Thermo-Chiller with a valve mounted to the outlet port. (Mount a valve to the outlet port to make it possible to adjust the flow rate roughly.)
(2) Operate the Thermo-Chiller and stabilize the temperature.
(3) Check the temperature shown for "t1: Circulating fluid outlet temperature" and "t2: Circulating fluid return temperature" in the "Check Monitor Menu".
If the temperature is within the range of t1 = t2 +/- 2 ^{o}C, operation of the circulating fluid temperature sensor (PT1) is normal.

7. Check the circulating fluid temperature sensor (PT1) after it is replaced.

Replace the circulating fluid temperature sensor (PT1). (See section "4.5.1 Replacement of the temperature sensor (PT1)".) After replacing, check that all the check items shown in "6. Check the circulating fluid temperature sensor (PT1)" are correctly followed.

8. Flow rate of the circulating fluid is less than 5 L/min.

Install a flow meter, and check the flow rate of the circulating fluid.

9. Check the pump performance.

Install a flow meter. Refer to the "Pump capacity" graph" shown in the catalogue and check that the pump capacity is suitable for the circulating fluid outlet pressure and the circulating fluid flow rate.

10. Circulating fluid is contaminated.

Contamination contained in the circulating fluid adheres to the heat exchanger (evaporator), and it decreases the heat exchanger performance.

Open the cap of the tank, and check visually the contamination (e.g. deformation, foreign matter, abnormal smell) of the circulating fluid inside the tank.

When the visual checks find contamination in the circulating fluid, check the influence of the contamination to the heat exchanger following the instructions shown below.

(1) Connect the circulating fluid outlet directly to the fluid return port with a valve mounted to the outlet port with a shorter piping to make it possible to operate the system at flow rate of circulating fluid at 7 L/min.
(For Option T, adjust the flow rate so that the circulating fluid discharge pressure will be approximately 0.4 MPa.)
(2) Set the circulating fluid temperature to 20 ^{o}C, and operate the Thermo-Chiller.
(3) Check the temperature shown for "t2: Circulating fluid return temperature" and "t3: Compressor inlet temperature" in the "Check Monitor Menu".
(4) Displayed temperature will be as shown below in accordance with level of contamination of the heat exchanger.
<With no contamination with the heat exchanger>
"t3: Suction temperature of the compressor" ≥ "t2: Circulating fluid return temperature" -5 ^{o}C

<With contamination with the heat exchanger>

"t3: Suction temperature of the compressor" < "t2: Circulating fluid return temperature" -5 ^{o}C

e.g. (Normal) t2: 21.5, t3: 23.8, (Abnormal) t2: 21.5, t3: 15.5

11. Check the pressure sensor in the refrigerant circuit.

Two pressure sensors, one for high pressure and the other for low pressure, are used for the refrigerant circuit. Take the following instructions to check for any abnormality with the pressure sensors:

(1) Stop the Thermo-Chiller operation.

(2) Check the temperature shown for "Ph: Refrigerant circuit pressure on the high pressure side" and "PL: Refrigerant circuit pressure on the low pressure side" in the "Check Monitor Menu".

(3) If the pressure value shown by each sensor is +/- 0.1 MPa (Ph = PL +/- 0.1), it means that the pressure sensors are operating correctly.

12. Check for refrigerant leakage.

Refrigerant leakage reduces the cooling capacity. To check for refrigerant leakage, it is necessary to make the refrigerant circuit temperature same as the ambient temperature. Remove the facility water piping, stop the Thermo-Chiller operation, and leave it not operating for 24 hours.

Take the following instructions to check for refrigerant leakage after leaving not operating.

(1) Measure the ambient temperature (room temperature).

(2) Check the pressure shown for "Ph: Refrigerant circuit pressure on the high pressure side" in the "Check Monitor Menu" of the Thermo-Chiller.

(3) If the measured point is lower than the values shown in the graph in "Fig. 3.3-14: Ambient temperature and refrigerant circuit pressure", it means there is refrigerant leakage caused.

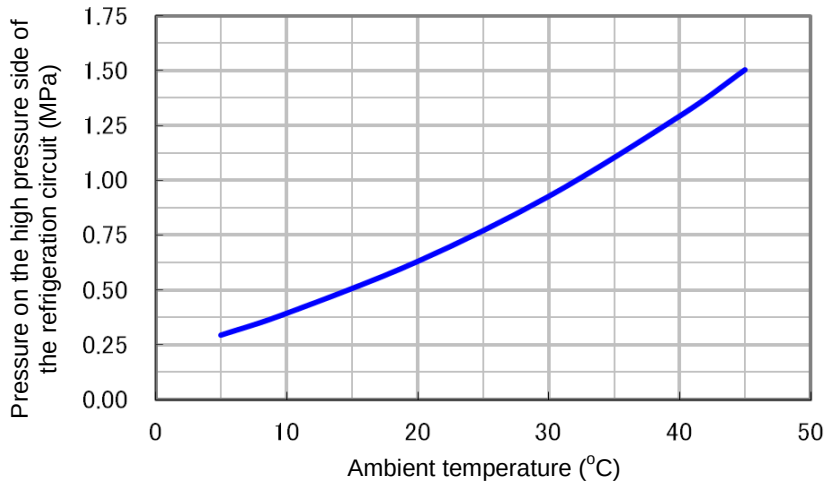


Fig. 3.3-14 Ambient temperature and refrigerant circuit pressure

13. After stopping power supply, check for the same alarm goes off again when the chiller is re-started.

After stopping power supply (by tuning off the power supply switch of the Thermo-Chiller), check if the same alarm goes off again when the Thermo-Chiller is restarted.

14. Check for an input to the pressure sensor in the refrigerant circuit.

Check that the power is supplied to the refrigerant circuit pressure sensor.
Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

<Refrigerant circuit pressure sensor (for high pressure)>
Contact the positive probe to the pin number 22 and contact the negative probe to the pin number 10 of the "CN4" connector.
<Normal> Pin number 22 - Pin number 10: Voltage should be 5 VDC +/- 1V

<Refrigerant circuit pressure sensor (for low pressure)>
Contact the positive probe to the pin number 24 and contact the negative probe to the pin number 12 of the "CN4" connector.
<Normal> Pin number 24 - Pin number 12: Voltage should be 5 VDC +/- 1V

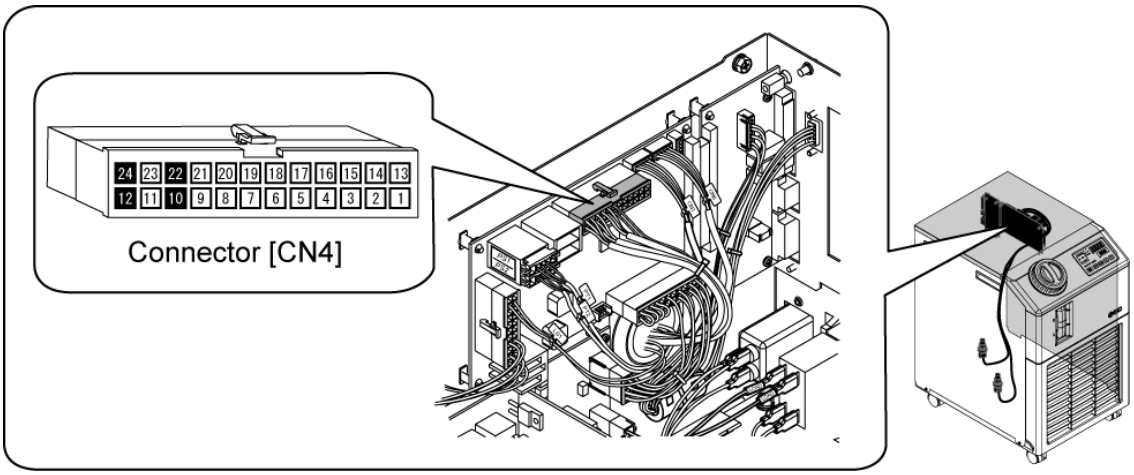


Fig. 3.3-15 Check of input to the refrigerant circuit pressure sensor

15. Check the display of the refrigerant circuit pressure sensor (for high pressure).

Compare the refrigerant circuit pressure and the ambient temperature with those shown in the graph to check the displayed value of the refrigerant circuit pressure sensor.

Follow the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours to make the ambient temperature and the temperature inside the Thermo-Chiller the same.

(2) Check the ambient temperature.

(3) Check the "Ph: Refrigerant circuit pressure on the high pressure side" value in the "Check Monitor Menu".

(4) Check if the value at the cross point of the ambient temperature and the "Ph: Refrigerant circuit pressure on the high pressure side" value is within the range (the shaded part) in Fig. 3.3-16. If the cross point is within the range, it means that the pressure sensor is operating correctly.

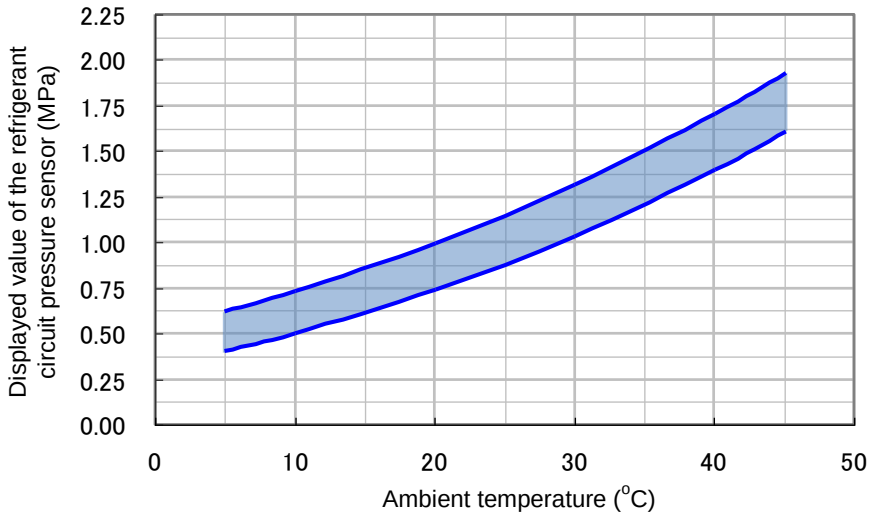


Fig. 3.3-16 Ambient temperature and refrigerant circuit pressure

16. Check the display of the refrigerant circuit pressure sensor (for low pressure).

Compare the refrigerant circuit pressure and the ambient temperature with those shown in the graph to check the displayed value of the refrigerant circuit pressure sensor.

Follow the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours to make the ambient temperature and the temperature inside the Thermo-Chiller the same.

(2) Check the ambient temperature.

(3) Check "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(4) Check if the value at the cross point of the ambient temperature and the "PL: Refrigerant circuit pressure on the low pressure side" value is within the range (the shaded part) in Fig. 3.3-16. If the cross point is within the range, it means that the pressure sensor is operating correctly.

17. Check the analogue output of the refrigerant circuit pressure sensor (for high pressure).

Find out if the main board is operating connectly.

Follow the instructions shown below:

(1) Check the "Ph: Refrigerant circuit pressure on the high pressure side" value in the "Check Monitor Menu".

(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 11 and contact the negative probe to the pin number 10 of the "CN4" connector.

(4) Check that the voltage between the pin number 11 and the pin number 10 is in the same relationship shown in Fig. 3.3-18. (Accuracy: +/- 5%)

(5) If the voltage is in the same relationship as the graph shows, it means that the main board is operating correctly.

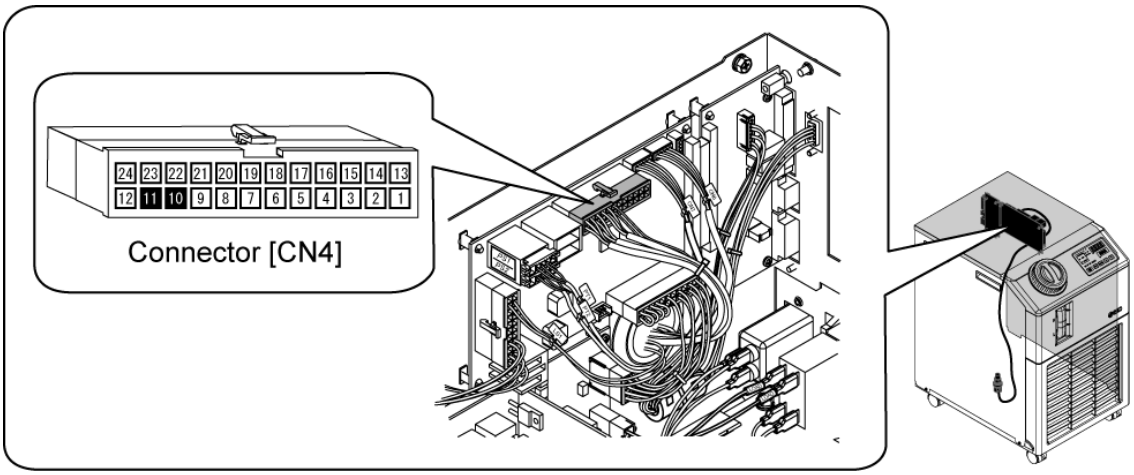


Fig. 3.3-17 Check of the refrigerant circuit pressure sensor (for high pressure) output

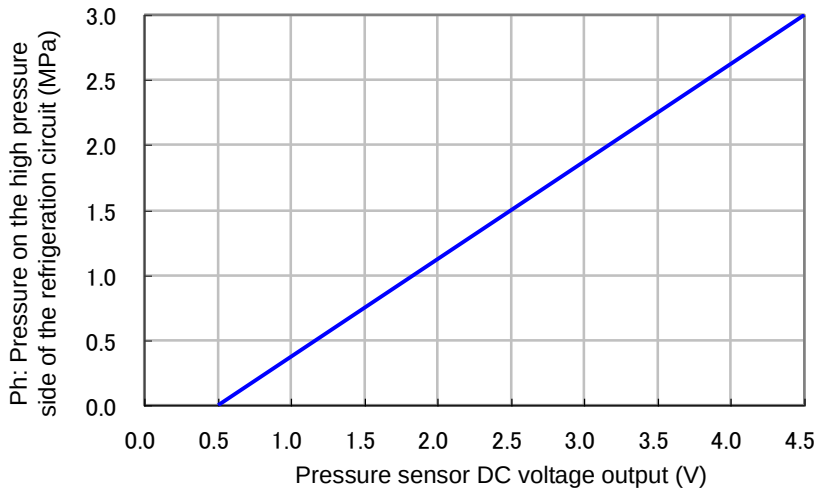


Fig. 3.3-18 Refrigerant circuit pressure sensor (for high pressure) analogue output

18. Check the analogue output of the refrigerant circuit pressure sensor (for low pressure).

Find out if the main board is operating connectly.

Follow the instructions shown below:

(1) Check the "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 23 and contact the negative probe to the pin number 12 of the "CN4" connector.

(4) Check that the voltage between the pin number 23 and the pin number 12 is in the same relationship shown in Fig. 3.3-20. (Accuracy: +/- 5%)

(5) If the voltage is in the same relationship as the graph shows, it means that the main board is operating correctly.

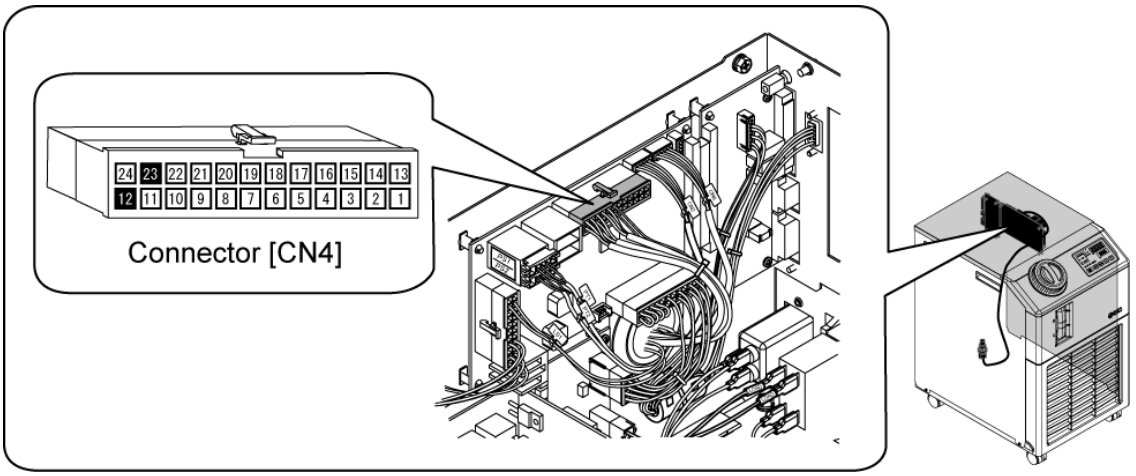


Fig. 3.3-19 Check of the refrigerant circuit pressure sensor (for low pressure) output

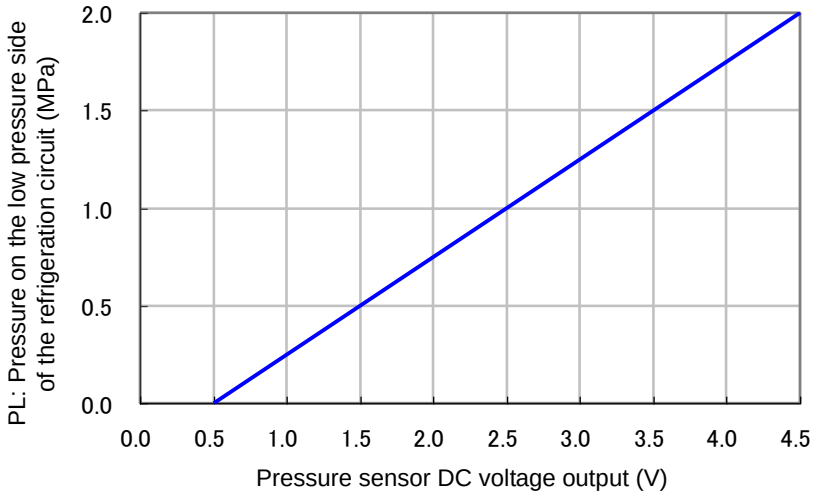
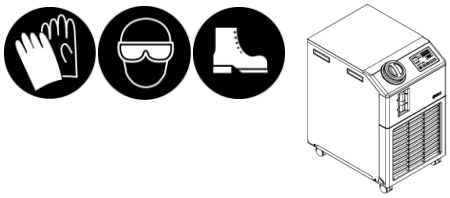
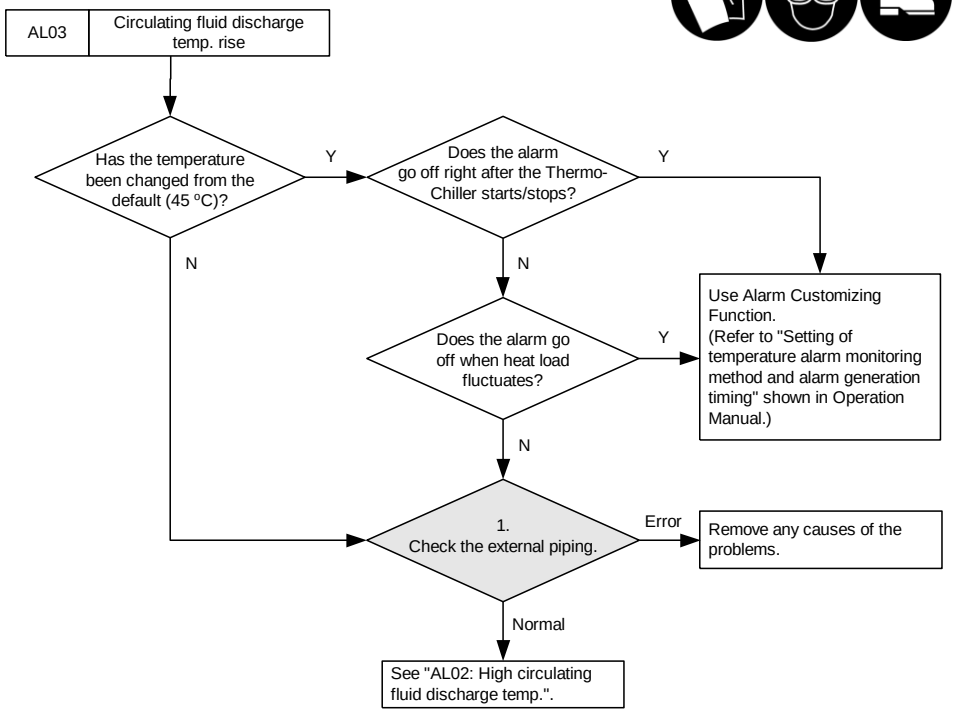


Fig. 3.3-20: Refrigerant circuit pressure sensor (for low pressure) analogue output

AL03: Circulating fluid discharge temp. rise

<Detection method> This alarm goes off when the temperature sensor for the circulating fluid (for discharge) detects 45 °C or more (can be changed).





1. Check the external piping.

Check if the external piping is in the conditions shown below:

(1) The system has a circuit that high temperature circulating fluid returns to the Thermo-Chiller at once due to an operation of the valve or the switching valve in the external piping.

(2) The system has a circuit that the circulating fluid that has been heated by a waste heat of the workpiece that is cooled returns to the Thermo-Chiller at once when the Thermo-Chiller starts operation.

AL04: Circulating fluid discharge temp. drop

<Detection method> This alarm goes off when the temperature sensor for the circulating fluid (for discharge) detects 1 °C or less (can be changed).

1. Cooling load that is larger than the heating capacity is being applied to the Thermo-Chiller.

Please refer to the "Heating capacity" graph shown in the Operation Manual.

2. Check the circulating fluid temperature sensor (PT1).

Two circulating fluid temperature sensors are used; one is for the outlet port (PT1) and the other is for the return port (PT2). Compare the temperatures sensed by the temperature sensors under the conditions shown below to judge if the values provided by the temperature sensors are correct or not:

(1) Connect a shorter pipe directly from the circulating fluid outlet port to the return port of the Thermo-Chiller with a valve mounted to the outlet port. (Mount a valve to the outlet port to make it possible to adjust the flow rate roughly.)

(2) Operate the Thermo-Chiller and stabilize the temperature.

(3) Check the temperature shown for "t1: Circulating fluid outlet temperature" and "t2: Circulating fluid return temperature" in the "Check Monitor Menu".
If the temperature is within the range of t1 = t2 +/- 2 ^{o}C, operation of the circulating fluid temperature sensor (PT1) is normal.

3. Check the circulating fluid temperature sensor (PT1) after it is replaced.

Replace the circulating fluid temperature sensor (PT1). (See section "4.5.1 Replacement of the temperature sensor (PT1)".) After replacing, check that all the check items shown in "2. Check the circulating fluid temperature sensor (PT1)" are correctly followed.

4. Check flow rate of the circulating fluid is not less than 5 L/min.

Install a flow meter, and check the flow rate of the circulating fluid.

5. Check the pump performance.

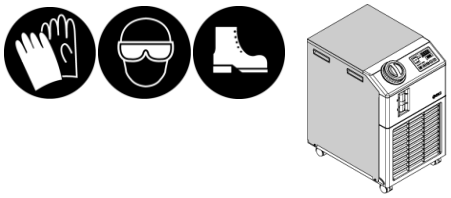
Install a flow meter. Refer to the "Pump capacity" graph" shown in the catalogue and check that the pump capacity is suitable for the circulating fluid outlet pressure and the circulating fluid flow rate.

6. Check after stopping power supply for the same alarm goes off again when the chiller is re-started.

After stopping power supply (by tuning off the power supply switch on the Thermo-Chiller), check if the same alarm goes off again when the Thermo-Chiller is restarted.

AL05: High circulating fluid return temp.

<Detection method> This alarm goes off when the temperature sensor for the circulating fluid (for fluid return) detects 60 °C or more.



1. External load is out of the specification range.

Cooling capacity varies depending on the ambient temperature, facility water temperature, set circulating fluid temperature, and power supply frequency.
Please refer to the "Cooling capacity" graph shown in the Operation Manual.

2. The alarm goes off right after the Thermo-Chiller starts.

Check if the the Thermo-Chiller has a circuit that the circulating fluid that has been heated to 60 ^{o}C or more by a waste heat of the workpiece that is cooled returns to the Thermo-Chiller at once when the Thermo-Chiller starts operation.

3. Check the external piping.

Check if the Thermo-Chiller has a circuit that high temperature circulating fluid returns to the Thermo-Chiller at once due to an operation of the valve or the switching valve in the external piping.

4. Check the circulating fluid temperature sensor (PT2).

Two circulating fluid temperature sensors are used; one is for the outlet port (PT1) and the other is for the return port (PT2). Compare the temperatures sensed by the temperature sensors under the conditions shown below to judge if the values provided by the temperature sensors are correct or not:

(1) Connect a shorter pipe directly from the circulating fluid outlet port to the return port of the Thermo-Chiller with a valve mounted to the outlet port. (Mount a valve to the outlet port to make it possible to adjust the flow rate roughly.)
(2) Operate the Thermo-Chiller and stabilize the temperature.
(3) Check the temperature shown for "t1: Circulating fluid outlet temperature" and "t2: Circulating fluid return temperature" in the "Check Monitor Menu".
If the temperature is within the range of t2 = t1 +/- 2 ^{o}C, operation of the circulating fluid temperature sensor (PT2) is normal.

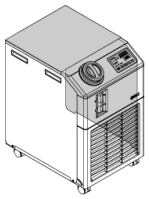
5. Check the circulating fluid temperature sensor (PT2) after it is replaced.

Replace the circulating fluid temperature sensor (PT2). (See section "4.5.2 Replacement of the temperature sensor (PT2)" for the replacement procedure.) After replacing, check that all the check items shown in "4. Check the circulating fluid temperature sensor (PT2)" are correctly followed.

AL06: High circulating fluid discharge pressure

<Detection method> This alarm goes off when the pressures detected by the circulating fluid pressure sensor (for discharge) reach the following values.

- Standard pump: The alarm will not be generated.
- Option T (High pressure pump): 0.70 MPa
- Option MT (High pressure pump for pure water): 0.60 MPa



1. Check the external piping.

Check if the external piping is in the conditions shown below:

(1) The external piping has close bending, curves at a sharp angle or clogging.

(2) A valve or a switching valve is mounted in the middle of the external piping, and it closes the piping temporarily.

(3) A filter (strainer) for circulating fluid is used, and the filter is clogged.

2. Check the operating time of the Thermo-Chiller.

Operate the Thermo-Chiller as a single unit.

Connect an external piping of an I.D. of approximately 15 mm and a length of 2 meters or less) and a valve that is capable of roughly regulating pressure to the Thermo-Chiller.

Start operating the Thermo-Chiller with the valve fully open.

(1) Check that "AL06: High circulating fluid discharge pressure" will not be generated with the valve fully open.

(2) Display the circulating fluid discharge pressure "P1" on the operation panel, and gradually close the valve while the Thermo-Chiller is operating.

Check that "AL06: High circulating fluid discharge pressure" is generated when the circulating fluid discharge pressure "P1" reaches the pressures shown below:

- Option T: 0.7 MPa
- Option MT: 0.6 MPa

3. Check for any clogging in the heat exchanger.

Check for clogging in the heat exchanger (evaporator) due to contamination contained in the circulating fluid adheres to the heat exchanger.

Operate the Thermo-Chiller as a single unit.

(1) Connect an external piping of an I.D. of approximately 15 mm and a length of 2 meters or less) and a valve that is capable of roughly regulating pressure to the Thermo-Chiller.

(2) Do not connect the piping to the circulating fluid return port that is usually connected to it. Open the cap of the water fill port and inset the piping to the water fill port (to stop the circulating fluid entering the heat exchanger).

Operate the Thermo-Chiller to confirm that the "AL06: High circulating fluid discharge pressure" goes off. If it does not, it will cause clogging in the heat exchanger.

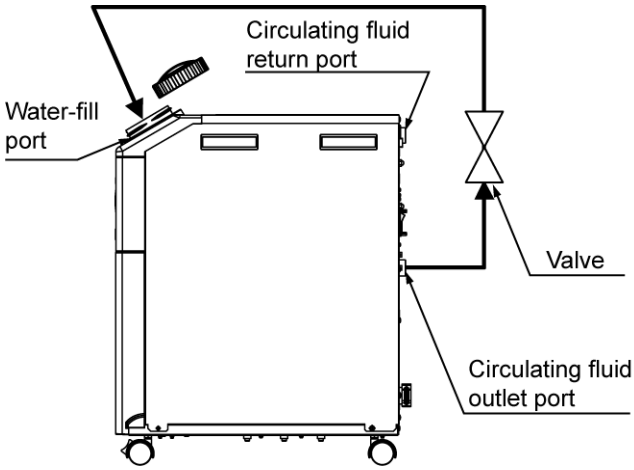


Fig. 3.3-21 Piping example

4. AL25 goes off when the circulating fluid pressure sensor connector is disconnected.

Confirm that "AL25: Circulating fluid discharge pressure sensor failure" goes off when the connector "PS1" of the circulating fluid pressure sensor (for discharge) is pulled out.

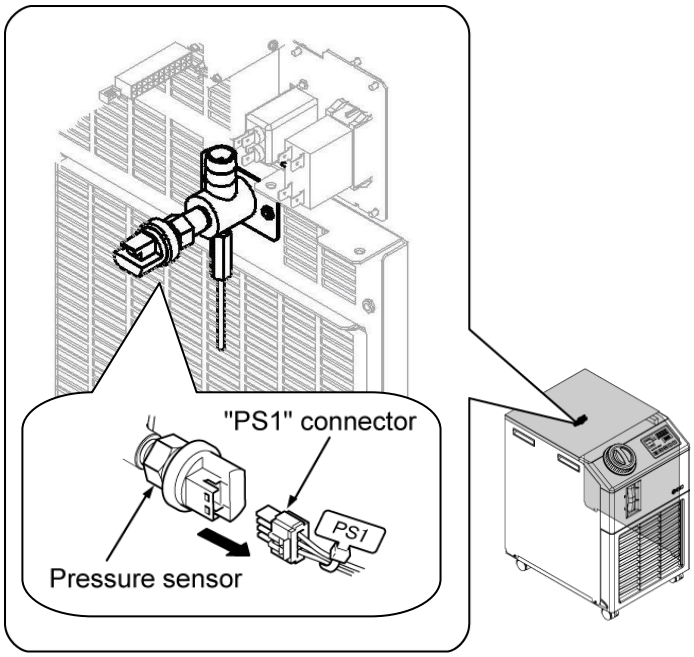


Fig. 3.3-22 Circulating fluid pressure sensor

5. Check the circulating fluid pressure sensor after it is replaced.

Replace the circulating fluid pressure sensor (for discharge). (See section "4.5.8 Replacement of pressure sensor")

After replacing the sensor, operate the Thermo-Chiller and confirm that the alarm does not go off again.

AL07: Abnormal pump operation

<Detection method> This alarm goes off when the pressures detected by the circulating fluid pressure sensor (for discharge) is 0.05 MPa or less.

1. Check the power supply voltage.

Check that the power supply voltage is within the specified range. Check the power supply voltage that is supplied to the connector of the power supply cable to be connected to Thermo-Chiller with a tester.

Thermo-Chiller model: HRS□-□-10/20-□

Power supply specification

- -10 (100V spec.): Single phase 100 VAC (50/60Hz), 115 VAC (60Hz)
- -20 (200V spec.): Single phase 200 VAC to 230 VAC (50/60 Hz)

2. Check the pump rotation manually.

Check if the impeller of the high pressure pump has been locked by making a manual rotation. Remove the seal on the back of the motor. Insert a flat blade driver to rotate the motor shaft and check if the impeller rotates smoothly. If it does not rotate smoothly, there are some problems such as lodging of foreign matter at the pump part.

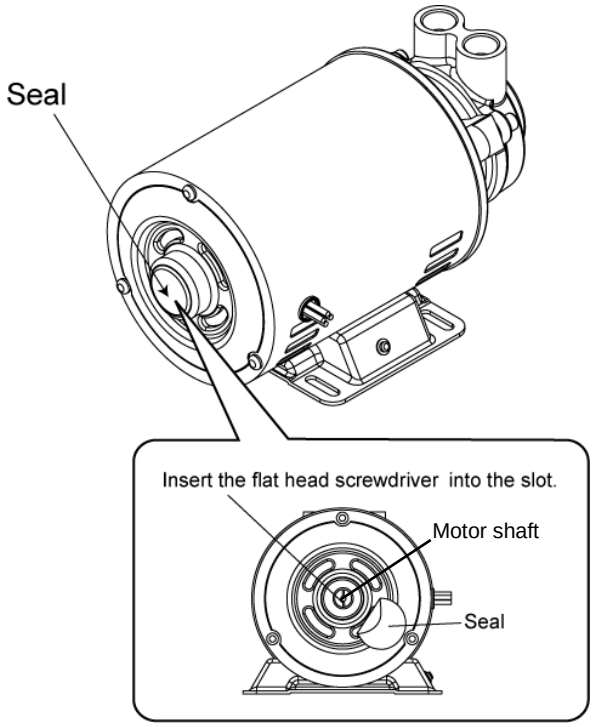


Fig. 3.3-23: Rotate the pump manually

3. Check the pump performance.

Operate the Thermo-Chiller as a single unit.

Install a pressure gauge (measurable range: approx. 0 to 1 MPa), a valve (with approximate flow adjustability), and a flow meter (measurable range: approx. 0 to 30 L/min) to the Thermo-Chiller.

Make an isolated operation of the pump (by pressing the "RUN/STOP" key and "MENU" key simultaneously) to check the pump performance.

Based on the measurement results of the flow meter and the pressure gauge installed, check if the pump performance satisfies the values shown in the "Pump performance" graph provided in the Operation Manual.

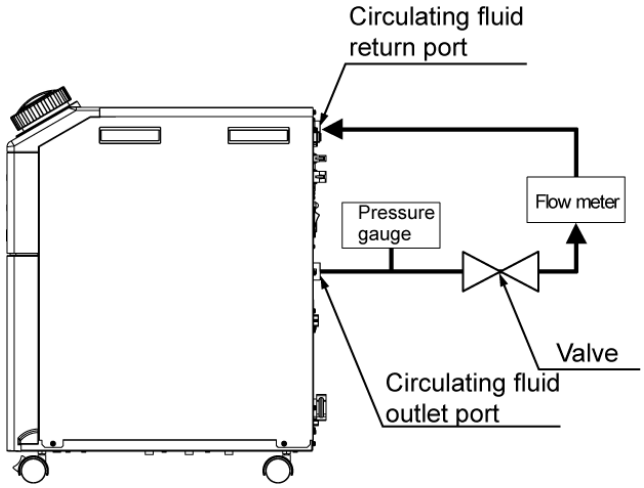


Fig. 3.3-24 Piping example

4. A small amount of circulating fluid flows.

Check that circulating fluid, even for a small amount, flows through the pump (that the pump can be rotated) when the pump makes an isolated operation (by pressing "RUN/STOP" key and "MENU" key simultaneously) with the piping conditions provided in section "3. Check the pump performance".

5. Check the main board.

Check that the main board outputs signals.

Disconnect the connector "CN1" on the power board.

Perform settings of the tester to make it possible to measure 24 VDC.

Contact the negative side probe to the connector pin number 6 on the cable side of the "CN1" that has been removed, and contact the positive side probe to the pin number 8.

Check the voltage between the cable side connectors number 6 and number 8 while making an isolated operation of the pump (by pressing the "RUN/STOP" key and "MENU" key simultaneously).

<Normal> Between pin numbers 6 and 8: 24 VDC

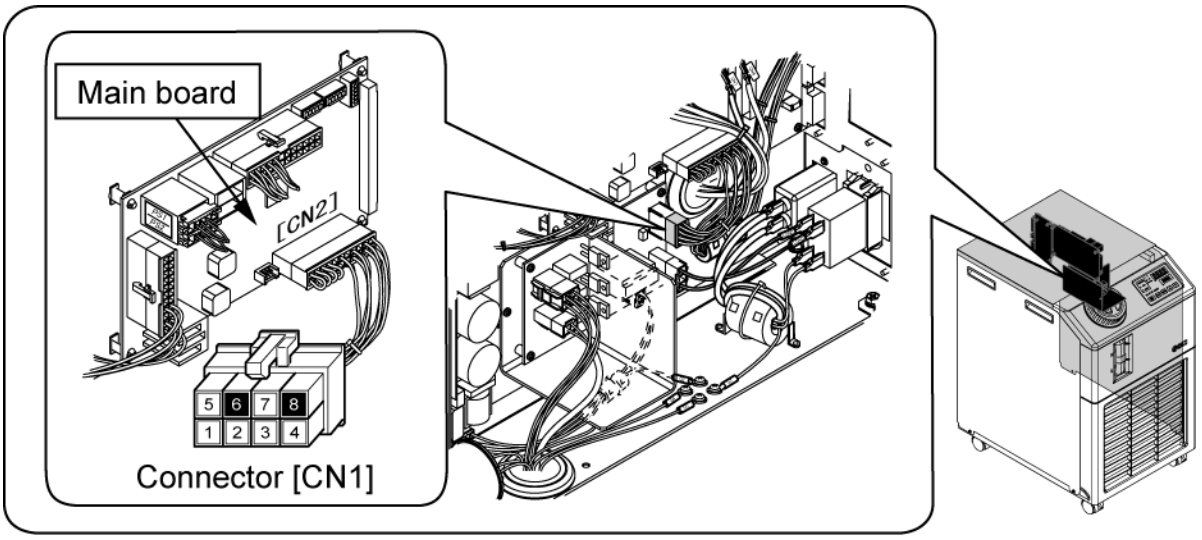


Fig. 3.3-25 Check the pump signal output

6. Check the power board.

Check that the power is being supplied to the pump.

Disconnect the connector "CN3" of the power board to which the pump cable is connected.

Check if power supply voltage is being supplied to the "CN3" connector (Pin No. 1 and No.2) of the power board with a tester while the pump makes an isolated operation (by pressing "RUN/STOP" key and "MENU" key simultaneously).

[Power supply voltage to be supplied]

- -10 (100V spec.): Single phase 100 VAC (50/60Hz), or 115 VAC (60Hz)
- -20 (200V spec.): Single phase 200 VAC to 230 VAC (50/60 Hz)

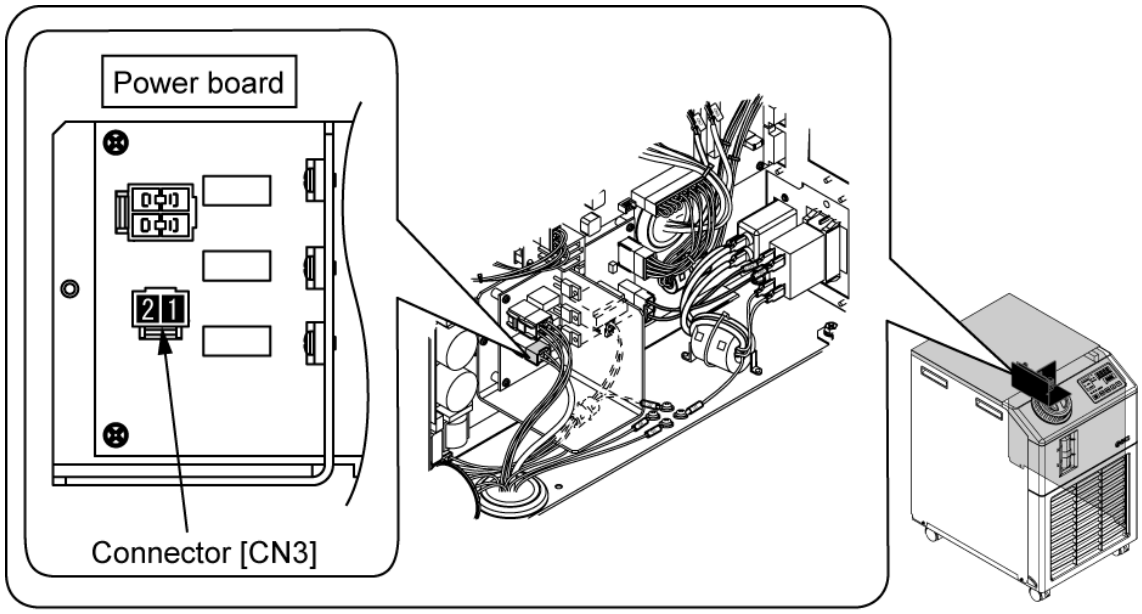


Fig. 3.3-26 Check the pump input

7. Check the circulating fluid pressure sensor.

Install a pressure gauge, valve, and flow meter to the Thermo-Chiller in the same way as in step "3. Check the pump performance". Compare the circulating fluid discharge pressure of the Thermo-Chiller with the value measured by the pressure gauge in the following procedure.

(1) Display the circulating fluid discharge pressure "P1" on the Operation Panel of the Thermo-Chiller.

(2) Perform an isolated operation of the pump (by pressing "RUN/STOP" key and "MENU" key simultaneously) to check if the value measured by the pressure gauge and the value displayed by the Thermo-Chiller are within the range provided below. If they are, the circulating fluid pressure sensor is operating correctly.

Pressure "P1" displayed by the Thermo-Chiller = Pressure measured by the pressure gauge +/- 0.07 MPa

8. Check the circulating fluid pressure sensor after it is replaced.

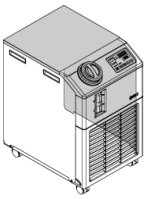
Replace the circulating fluid pressure sensor (for discharge). (See section "4.5.8 Replacement of pressure sensor")

After replacing the sensor, operate the Thermo-Chiller and confirm that the alarm does not go off again.

AL08: Circulating fluid discharge pressure rise

<Detection method> This alarm goes off when the pressures detected by the circulating fluid pressure sensor (for discharge) reach the following values (change in the values acceptable).

- Standard pump: 0.30 MPa
- Option T (High pressure pump): 0.70 MPa
- Option MT (High pressure pump for pure water): 0.60 MPa



1. Check the external piping.

Check if the external piping is in the conditions shown below:

(1) The external piping has close bending, curves at a sharp angle or clogging.

(2) A valve or a switching valve is mounted in the middle of the external piping, and it closes the piping temporarily.

(3) A filter (strainer) for circulating fluid is used, and the filter is clogged. Filtration rating has been changed.

2. Check for any clogging in the heat exchanger.

Check for clogging in the heat exchanger (evaporator) due to contamination contained in the circulating fluid adheres to the heat exchanger.

Operate the Thermo-Chiller as a single unit.

Install a pressure gauge (measurable range: approx. 0 to 1 MPa), a valve (with approximate flow adjustability), and a flow meter (measurable range: approx. 0 to 30 L/min) to the Thermo-Chiller.

Make an isolated operation of the pump (by pressing the "RUN/STOP" key and "MENU" key simultaneously) to measure the circulating fluid flow rate and the circulating fluid return pressure.

From the measurement results, if the circulating fluid return pressure is higher than the pressure at the return port in the "Pump capacity" graph shown in the Operation Manual, it means that there is a clogging i the heat exchanger.

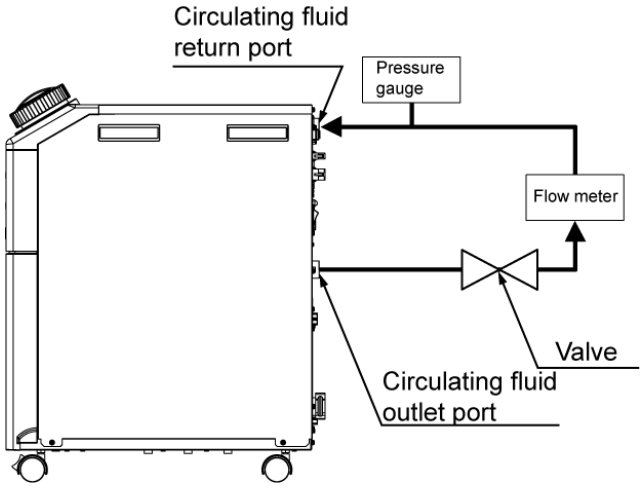


Fig. 3.3-27 Piping example

3. AL25 goes off when the circulating fluid pressure sensor connector is disconnected.

Confirm that "AL25: Circulating fluid discharge pressure sensor failure" goes off when the connector "PS1" of the circulating fluid pressure sensor (for discharge) is pulled out.

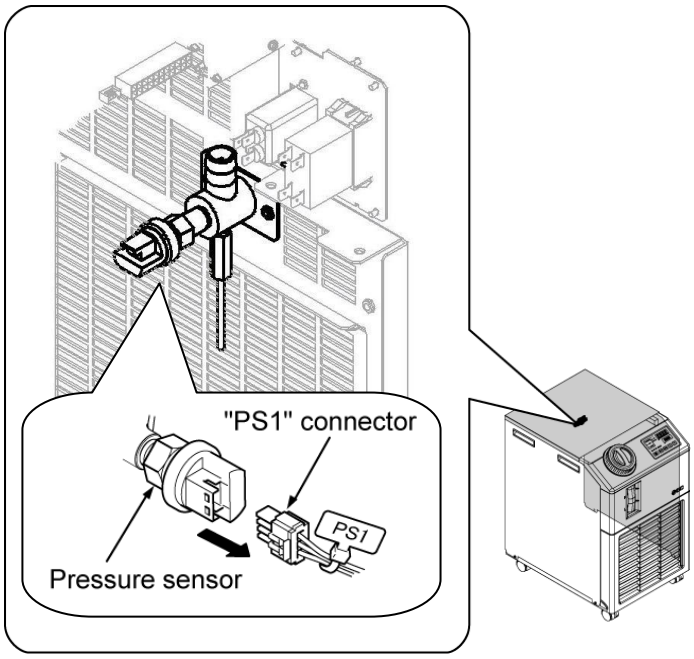


Fig. 3.3-28 Circulating fluid pressure sensor

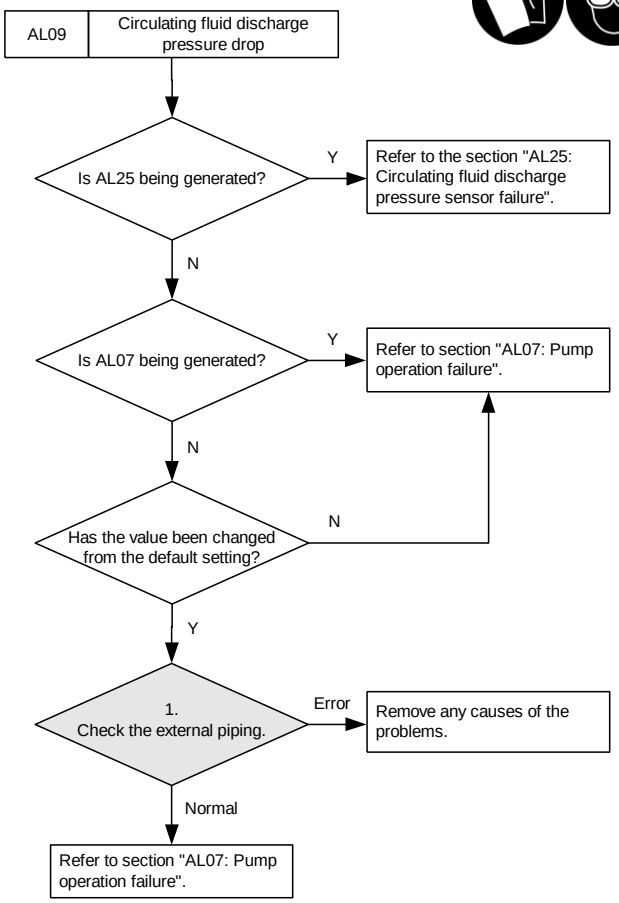
4. Check the circulating fluid pressure sensor after it is replaced.

Replace the circulating fluid pressure sensor (for discharge). (See section "4.5.8 Replacement of pressure sensor")

After replacing the sensor, operate the Thermo-Chiller and confirm that the alarm does not go off again.

AL09: Circulating fluid discharge pressure drop

<Detection method> This alarm goes off when the pressures detected by the circulating fluid pressure sensor (for discharge) is 0.05 MPa or less (change in the values acceptable).



1. Check the external piping.

Check if the external piping is in the conditions shown below:

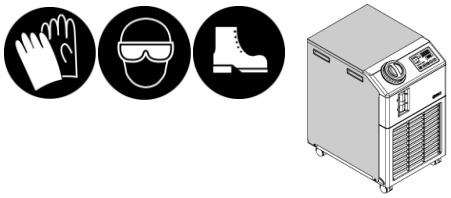
(1) Valve opening has been changed.

(2) A valve or a switching valve is mounted to the external piping, and they reduce the piping resistance temporarily.

(3) A filter (strainer) for circulating fluid is used, and the filter element has been replaced with new one. A filter element has been forgotten to be mounted. Filtration rating has been changed.

AL10: High compressor intake temp.

<Detection method> This alarm goes off when the compressor intake temperature sensor detects 60 °C or more.



1. External load is out of the specification range.

Cooling capacity varies depending on the ambient temperature, facility water temperature, set circulating fluid temperature, and power supply frequency.
Please refer to the "Cooling capacity" graph shown in the Operation Manual.

2. Check the external piping.

Check if the external piping is in the conditions shown below:

(1) The system has a circuit that high temperature circulating fluid returns to the Thermo-Chiller at once due to an operation of the valve or the switching valve in the external piping.
(2) The system has a circuit that the circulating fluid (60 ^{o}C or more) that has been heated by a waste heat of the workpiece that is cooled returns to the Thermo-Chiller at once when the Thermo-Chiller starts operation.

3. Flow rate of the circulating fluid is less than 5 L/min.

Install a flow meter, and check the flow rate of the circulating fluid.

4. Check the pump performance.

Install a flow meter. Refer to the "Pump capacity" graph" shown in the catalogue and check that the pump capacity is suitable for the circulating fluid outlet pressure and the circulating fluid flow rate.

5. Check the compressor intake temp. sensor.

Check for any difference between the actual compressor intake temperature and the temperature detected by the compressor intake temperature sensor by following the instructions shown below:

(1) Stop the Thermo-Chiller and leave it not operating for 24 hours to make the temperature of the temperature sensor itself be the same as the ambient temperature.
(2) Check the temperature shown for "t1: Circulating fluid discharge temperature" and "t3: Compressor inlet temperature" in the "Check Monitor Menu" of the Thermo-Chiller.
(3) If t3 = t1 +/- 3 ^{o}C, it means that the compressor intake temperature sensor is operating correctly.

6. Check the compressor intake temp. sensor after replacement.

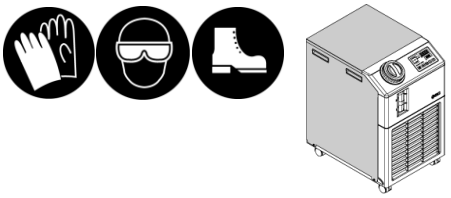
Replace the compressor intake temperature sensor with a new one. (See document No. HRX-MM-Q016 for replacement instructions) After replacing, check that all the check items shown in "5. Check the compressor intake temperature sensor." are correctly followed.

7. After stopping power supply, check for the same alarm goes off again when the chiller is re-started.

After stopping power supply (by tuning off the power supply switch of the Thermo-Chiller), check if the same alarm goes off again when the Thermo-Chiller is restarted.

AL11: Low compressor intake temp.

<Detection method> This alarm goes off when the compressor intake temperature sensor detects -15 °C or less.



1. Cooling load that is larger than the heating capacity is being applied to the Thermo-Chiller.

Please refer to the "Heating capacity" graph shown in the Operation Manual.

2. Flow rate of the circulating fluid is less than 5 L/min.

Install a flow meter, and check the flow rate of the circulating fluid.

3. Check the pump performance.

Install a flow meter. Refer to the "Pump capacity" graph" shown in the catalogue and check that the pump capacity is suitable for the circulating fluid outlet pressure and the circulating fluid flow rate.

4. Check the compressor intake temp. sensor.

Check for any difference between the actual compressor intake temperature and the temperature detected by the compressor intake temperature sensor by following the instructions shown below:

(1) Stop the Thermo-Chiller and leave it not operating for 24 hours to make the temperature of the temperature sensor itself be the same as the ambient temperature.
(2) Check the temperature shown for "t1: Circulating fluid discharge temperature" and "t3: Compressor inlet temperature" in the "Check Monitor Menu" of the Thermo-Chiller.
(3) If t3 = t1 +/- 3 ^{o}C, it means that the compressor intake temperature sensor is operating correctly.

5. Check the compressor intake temp. sensor after replacement.

Replace the compressor intake temperature sensor with a new one. (See document No. HRX-MM-Q016 for replacement instructions) After replacing, check that all the check items shown in "4. Check the compressor intake temperature sensor." are correctly followed.

6. Circulating fluid is contaminated.

Contamination contained in the circulating fluid adheres to the heat exchanger (evaporator), and it decreases the heat exchanger performance.

Open the cap of the tank, and check visually the contamination (e.g. deformation, foreign matter, abnormal smell) of the circulating fluid inside the tank.

When the visual check finds contamination in the circulating fluid, check the influence of the contamination to the heat exchanger by following the instructions shown below.

(1) Connect the circulating fluid outlet directly to the fluid return port with a valve mounted to the outlet port with a shorter piping to make it possible to operate the system at flow rate of circulating fluid at 7 L/min.
    (For Option T, adjust the flow rate so that the circulating fluid discharge pressure will be approximately 0.4 MPa.)
(2) Set the circulating fluid temperature to 20 ^{o}C, and operate the Thermo-Chiller.
(3) Check the temperature shown for "t2: Circulating fluid return temperature" and "t3: Compressor inlet temperature" in the "Check Monitor Menu".
(4) Displayed temperature will be as shown below in accordance with level of contamination of the heat exchanger.
    <With no contamination with the heat exchanger>
    "t3: Suction temperature of the compressor" ≥ "t2: Circulating fluid return temperature" -5 ^{o}C
    <With contamination with the heat exchanger>

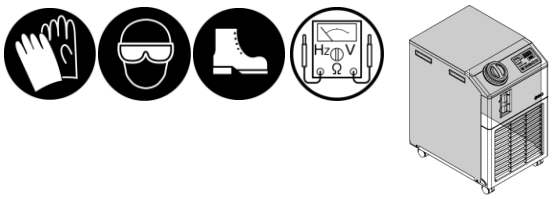
"t3: Suction temperature of the compressor" < "t2: Circulating fluid return temperature" -5 ^{o}C
e.g. (Normal) t2: 21.5, t3: 23.8, (Abnormal) t2: 21.5, t3: 15.5

7. After stopping power supply, check for the same alarm goes off again when the chiller is re-started.

After stopping power supply (by tuning off the power supply switch of the Thermo-Chiller), check if the same alarm goes off again when the Thermo-Chiller is restarted.

AL12: Low super heat temperature

<Detection method> This alarm goes off when the compressor intake temperature sensor detects the value that is lower than the converted temperature by the refrigerant circuit pressure sensor (for low pressure).



1. Flow rate of the circulating fluid is less than 5 L/min.

Install a flow meter, and check the flow rate of the circulating fluid.

2. Check the pump performance.

Install a flow meter. Refer to the "Pump capacity" graph" shown in the catalogue and check that the pump capacity is suitable for the circulating fluid outlet pressure and the circulating fluid flow rate.

3. Circulating fluid is contaminated.

Contamination contained in the circulating fluid adheres to the heat exchanger (evaporator), and it decreases the heat exchanger performance.

Open the cap of the tank, and check visually the contamination (e.g. deformation, foreign matter, abnormal smell) of the circulating fluid inside the tank.

When the visual check finds contamination in the circulating fluid, check the influence of the contamination to the heat exchanger by following the instructions shown below.

(1) Connect the circulating fluid outlet directly to the fluid return port with a valve mounted to the outlet port with a shorter piping to make it possible to operate the system at flow rate of circulating fluid at 7 L/min.
(For Option T, adjust the flow rate so that the circulating fluid discharge pressure will be approximately 0.4 MPa.)

(2) Set the circulating fluid temperature to 20 ^{o}C, and operate the Thermo-Chiller.

(3) Check the temperature shown for "t2: Circulating fluid return temperature" and "t3: Compressor inlet temperature" in the "Check Monitor Menu".

(4) Displayed temperature will be as shown below in accordance with level of contamination of the heat exchanger.
<With no contamination with the heat exchanger>
"t3: Suction temperature of the compressor" ≥ "t2: Circulating fluid return temperature" -5 ^{o}C
<With contamination with the heat exchanger>
"t3: Suction temperature of the compressor" < "t2: Circulating fluid return temperature" -5 ^{o}C
e.g. (Normal) t2: 21.5, t3: 23.8, (Abnormal) t2: 21.5, t3: 15.5

4. Check the compressor intake temp. sensor.

Check for any difference between the actual compressor intake temperature and the temperature detected by the compressor intake temperature sensor by following the instructions shown below:

(1) Stop the Thermo-Chiller and leave it not operating for 24 hours to make the temperature of the temperature sensor itself be the same as the ambient temperature.

(2) Check the temperature shown for "t1: Circulating fluid discharge temperature" and "t3: Compressor inlet temperature" in the "Check Monitor Menu" of the Thermo-Chiller.

(3) If t3 = t1 +/- 3 ^{o}C, it means that the compressor intake temperature sensor is operating correctly.

5. Check the compressor intake temp. sensor after replacement.

Replace the compressor intake temperature sensor with a new one. (See document No. HRX-MM-Q016 for replacement instructions) After replacing, check that all the check items shown in "4. Check the compressor intake temperature sensor." are correctly followed.

6. Check the pressure sensor in the refrigerant circuit.

Two pressure sensors, one for high pressure and the other for low pressure, are used for the refrigerant circuit. Take the following instructions to check for any abnormality with the pressure sensors:

(1) Stop the Thermo-Chiller operation.
(2) Check the temperature shown for "Ph: Refrigerant circuit pressure on the high pressure side" and "PL: Refrigerant circuit pressure on the low pressure side" in the "Check Monitor Menu".
(3) If the pressure value shown by each sensor is +/- 0.1 MPa (Ph = PL +/- 0.1), it means that the pressure sensors are operating correctly.

7. Check for an input to the pressure sensor in the refrigerant circuit.

Check that the power is supplied to the refrigerant circuit pressure sensor.
Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

<Refrigerant circuit pressure sensor (for low pressure)>

Contact the positive probe to the pin number 24 and contact the negative probe to the pin number 12 of the "CN4" connector.

<Normal> Pin number 24 - Pin number 12: Voltage should be 5 VDC +/- 1V

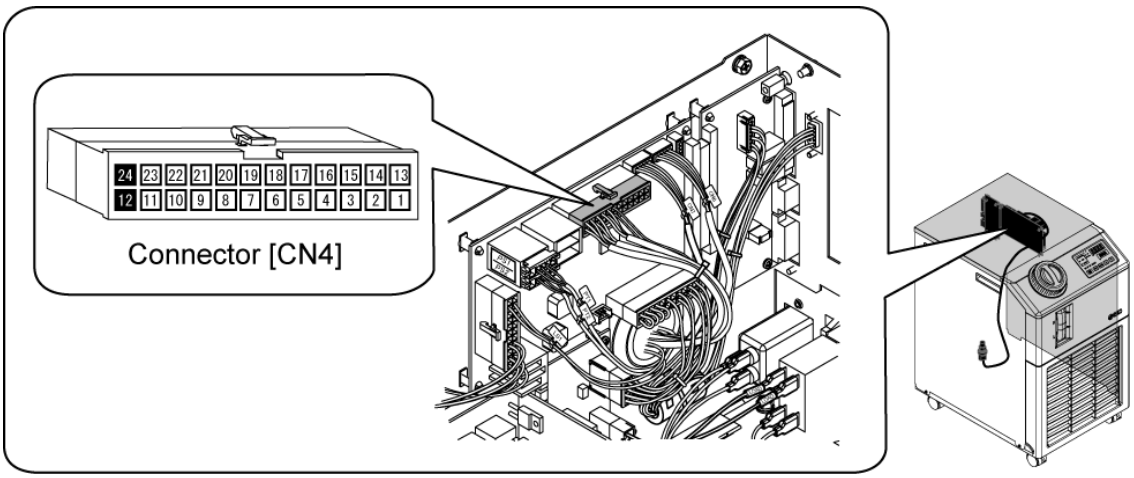


Fig. 3.3-29 Check of the refrigerant circuit pressure sensor (for low pressure) input

8. Check the display of the refrigerant circuit pressure sensor (for low pressure).

Compare the refrigerant circuit pressure and the ambient temperature with those shown in the graph to check the displayed value of the refrigerant circuit pressure sensor.

Follow the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours to make the ambient temperature and the temperature inside the Thermo-Chiller the same.

(2) Check the ambient temperature.

(3) Check "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(4) Check if the value at the cross point of the ambient temperature and the "PL: Refrigerant circuit pressure on the low pressure side" value is within the range (the shaded part) in Fig. 3.3-30. If the cross point is within the range, it means that the pressure sensor is operating correctly.

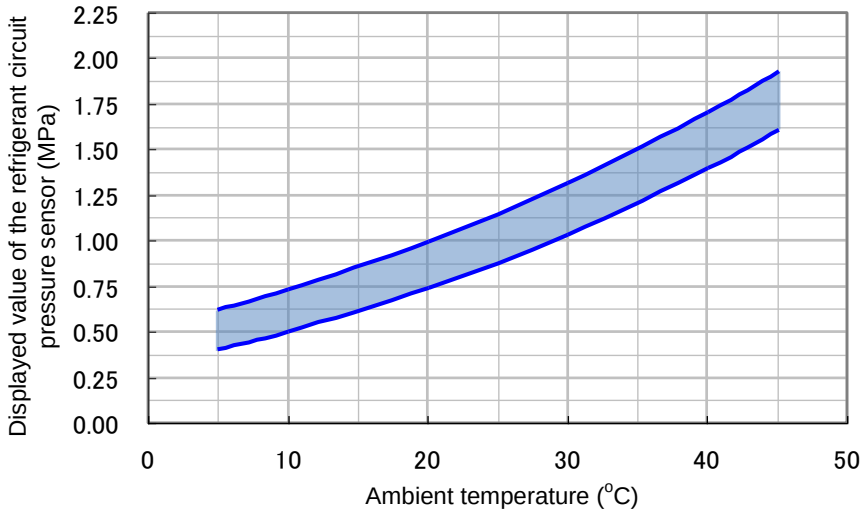


Fig. 3.3-30 Ambient temperature and refrigerant circuit pressure

9. After stopping power supply, check for the same alarm goes off again when the chiller is re-started.

After stopping power supply (by tuning off the power supply switch on the Thermo-Chiller), check if the same alarm goes off again when the Thermo-Chiller is restarted.

10. Check the analogue output of the refrigerant circuit pressure sensor (for low pressure).

Find out if the main board is operating connectly.

Follow the instructions shown below:

(1) Check the "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 23 and contact the negative probe to the pin number 12 of the "CN4" connector.

(4) Check that the voltage between the pin number 23 and the pin number 12 is in the same relationship shown in Fig. 3.3-32. (Accuracy: +/- 5%)

(5) If the voltage is in the same relationship as the graph shows, it means that the main board is operating correctly.

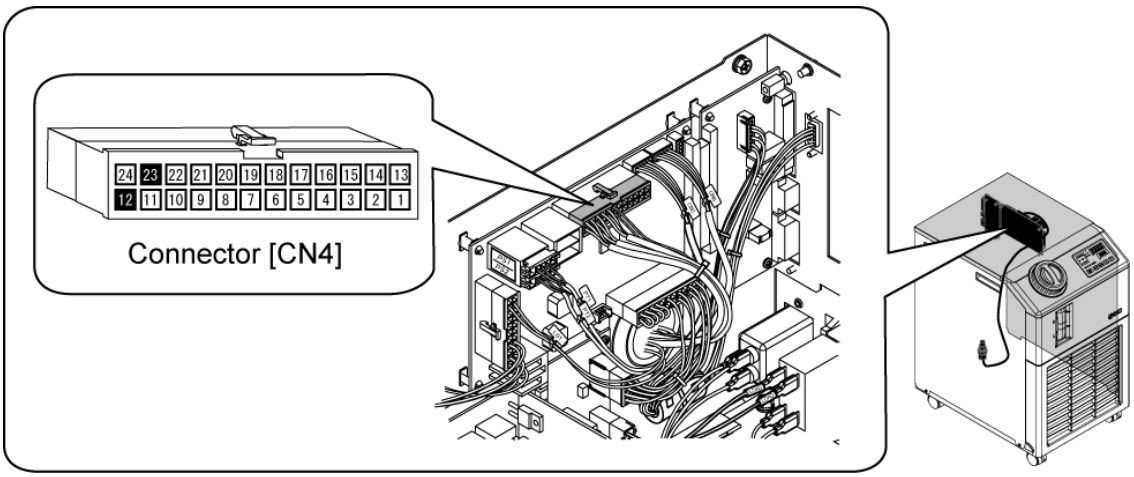


Fig. 3.3-31 Check of the refrigerant circuit pressure sensor (for low pressure) output

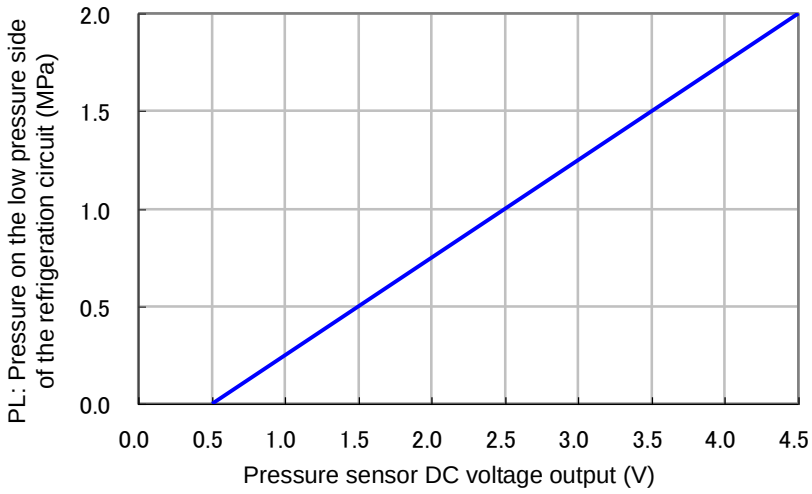
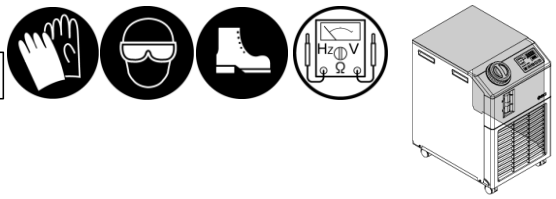
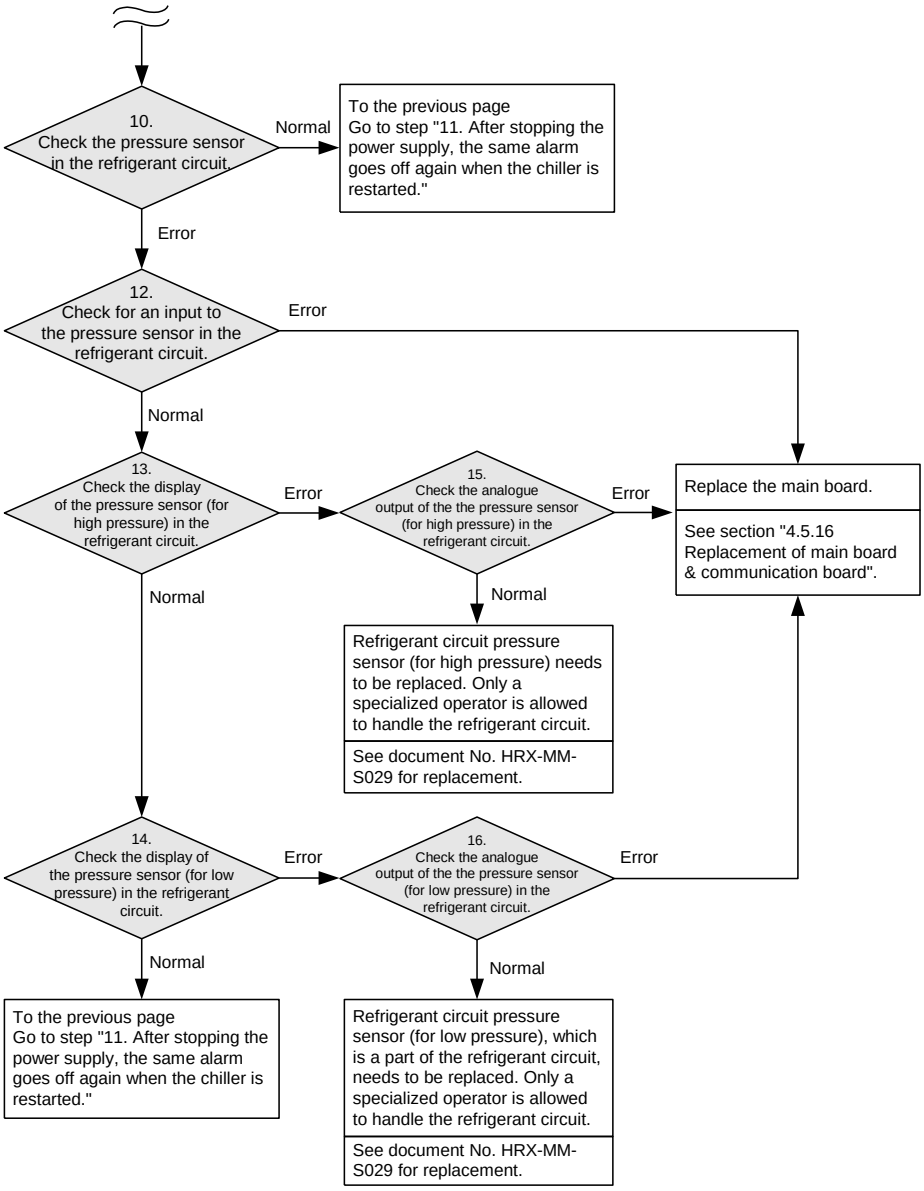


Fig. 3.3-32 Refrigerant circuit pressure sensor (for low pressure) analogue output

AL13: High compressor discharge pressure [For air-cooled type]

<Detection method> This alarm goes off when the pressure detected by the refrigerant circuit pressure sensor (for high pressure) is 2.6 MPa (Option G: 2.8 MPa) or more.




10.
Check the pressure sensor in the refrigerant circuit.
Normal
To the previous page
Go to step "11. After stopping the power supply, the same alarm goes off again when the chiller is restarted."
Error
12.
Check for an input to the pressure sensor in the refrigerant circuit.
Error
Normal
13.
Check the display of the pressure sensor (for high pressure) in the refrigerant circuit.
Error
15.
Check the analogue output of the the pressure sensor (for high pressure) in the refrigerant circuit.
Error
Replace the main board.
See section "4.5.16 Replacement of main board & communication board".
Normal
Normal
Refrigerant circuit pressure sensor (for high pressure) needs to be replaced. Only a specialized operator is allowed to handle the refrigerant circuit.
See document No. HRX-MM-S029 for replacement.
14.
Check the display of the pressure sensor (for low pressure) in the refrigerant circuit.
Error
16.
Check the analogue output of the the pressure sensor (for low pressure) in the refrigerant circuit.
Error
Normal
Normal
To the previous page
Go to step "11. After stopping the power supply, the same alarm goes off again when the chiller is restarted."
Refrigerant circuit pressure sensor (for low pressure), which is a part of the refrigerant circuit, needs to be replaced. Only a specialized operator is allowed to handle the refrigerant circuit.
See document No. HRX-MM-S029 for replacement.

1. Ambient temperature is out of the specification range.

Ambient temperature is higher than 40 °C (45 °C for Option G "High ambient temperature specification").

2. External load is out of the specification range.

Cooling capacity varies depending on the ambient temperature, set circulating fluid temperature, and power supply frequency.

Please refer to the "Cooling capacity" graph shown on the Operation Manual.

3. Enough ventilation space has not been secured.

- The Thermo-Chiller is installed too close to a wall.
- There is other equipment close to the Thermo-Chiller.
- Hot ventilated air from other equipment enters the Thermo-Chiller.
- The Thermo-Chiller is operating in an enclosed space.

(e.g. In a room without ventilation or air conditioner)

4. The dustproof filter is too dusty.

Dustproof filter on the front side of the Thermo-Chiller or the fin of the air-cooled condenser inside is contaminated.

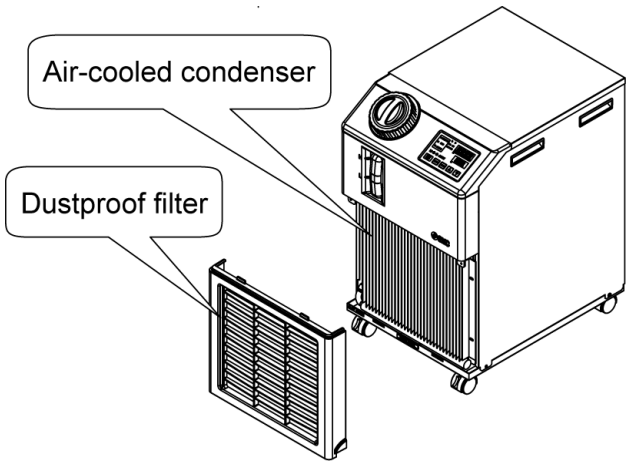


Fig. 3.3-33 An air-cooled condenser and a dustproof filter

5. Check the rotation of the fan.

Check visually that the fan rotates right afte
the Thermo-Chiller operation from the stopp
(Depending on the installation environment
may stop rotating for few seconds after sta
product operation, which is normal. If the f
not rotate after starting the operation, th
normal.)

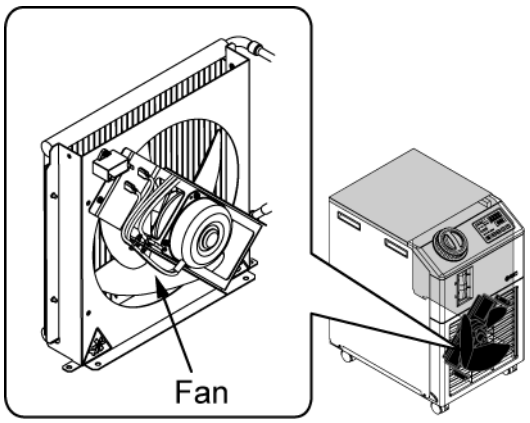


Fig. 3.3-34 Fan position

6. Check the power board.

Check that the power is being supplied to the fan motor.

Disconnect the connector "CN4" of the power board to which the fan/compressor cable is connected.

Operate the Thermo-Chiller (by pressing "RUN/STOP" key), and check if power supply voltage is supplied to the pins number 1 to number 3 of the "CN4" connector on the power board with a tester.

In this test, if voltage supply is confirmed only for a couple of seconds after the Thermo-Chiller is started, it is normal.

Depending on the installation environment, power supply voltage may stop (or the voltage may drop to approximately 10 VAC) in some seconds after starting the product operation, which is normal. If the power supply voltage is not confirmed at the start operation, it is judged not to be normal.

[Power supply voltage to be supplied]

- -10 (100V spec.): Single phase 100 VAC (50/60Hz), or 115 VAC (60Hz)
- -20 (200V spec.): Single phase 200 VAC to 230 VAC (50/60 Hz)

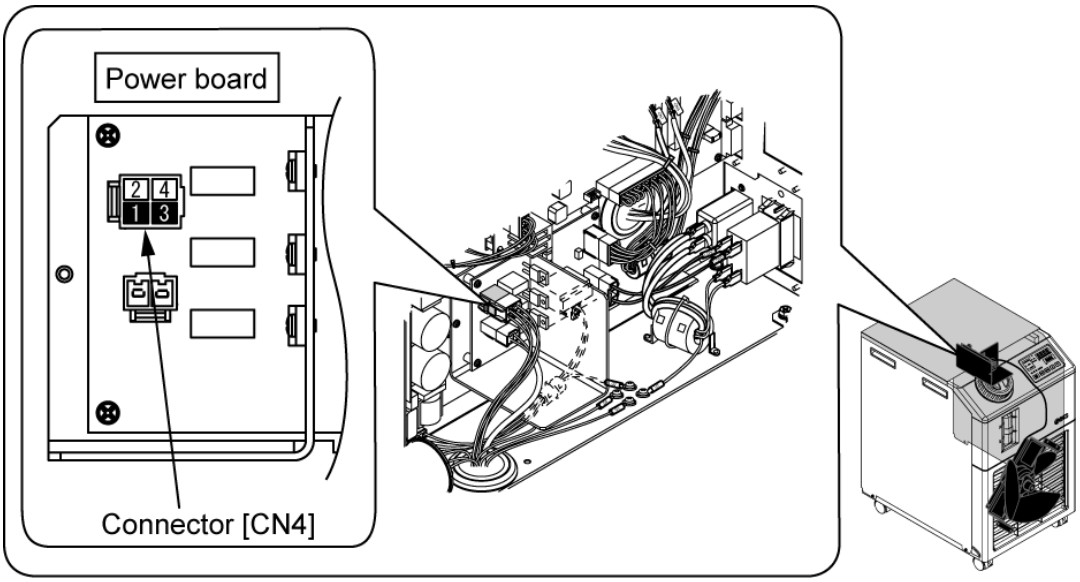


Fig. 3.3-35 Confirm the fan input

7. Check the power board after replacement.

Replace the power board .(See section "4.5.17 Replacement of power board)

After replacing the power board, confirm that all the items specified in step 6 have been checked.

8. Flow rate of the circulating fluid is less than 5 L/min.

Install a flow meter, and check the flow rate of the circulating fluid.

9. Check the pump performance.

Install a flow meter. Refer to the "Pump capacity" graph" shown in the catalogue and check that the pump capacity is suitable for the circulating fluid outlet pressure and the circulating fluid flow rate.

10. Check the pressure sensor in the refrigerant circuit.

Two pressure sensors, one for the high pressure and one for the low pressure, are used for the refrigerant circuit.

The following instructions are to check for any abnormality with the pressure sensors:

(1) Stop the Thermo-Chiller operation.

(2) Check the temperature shown for "Ph: Refrigerant circuit pressure on the high pressure side" and "PL: Refrigerant circuit pressure on the low pressure side" in the "Check Monitor Menu".

(3) If the pressure value shown by each sensor is +/- 0.1 MPa (Ph = PL +/- 0.1), it means that the pressure sensors are operating correctly.

11. After stopping power supply, check for the same alarm goes off when the chiller is re-started.

After stopping power supply (by tuning off the power supply switch on the Thermo-Chiller), check if the same alarm goes off when the Thermo-Chiller is restarted.

12. Check for an input to the pressure sensor in the refrigerant circuit.

Check that the power is supplied to the refrigerant circuit pressure sensor.

Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

<Refrigerant circuit pressure sensor (for high pressure)>

Contact the positive probe to the pin number 22 and contact the negative probe to the pin number 10 of the "CN4" connector.

<Normal> Pin number 22 - Pin number 10: Voltage should be 5 VDC +/- 1V

<Refrigerant circuit pressure sensor (for low pressure)>

Contact the positive probe to the pin number 24 and contact the negative probe to the pin number 12 of the "CN4" connector.

<Normal> Pin number 24 - Pin number 12: Voltage should be 5 VDC +/- 1V

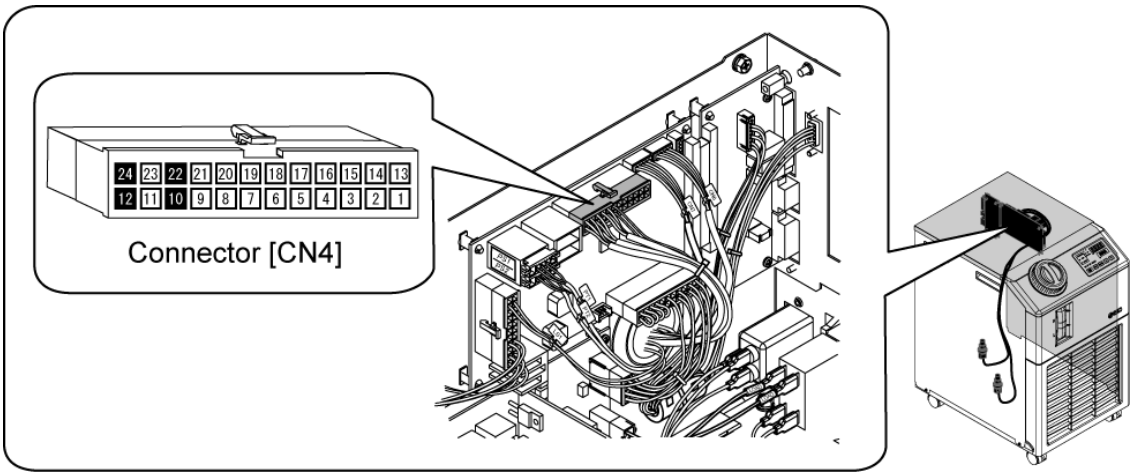


Fig. 3.3-36 Check of the refrigerant circuit pressure sensor input

13. Check the display of the refrigerant circuit pressure sensor (for high pressure).

Compare the refrigerant circuit pressure and the ambient temperature with those shown in the graph to check the displayed value of the refrigerant circuit pressure sensor.

Follow the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours to make the ambient temperature and the temperature inside the Thermo-Chiller the same.

(2) Check the ambient temperature.

(3) Check the "Ph: Refrigerant circuit pressure on the high pressure side" value in the "Check Monitor Menu".

(4) Check if the value at the cross point of the ambient temperature and the "Ph: Refrigerant circuit pressure on the high pressure side" value is within the range (the shaded part) in Fig. 3.3-37. If the cross point is within the range, it means that the pressure sensor is operating correctly.

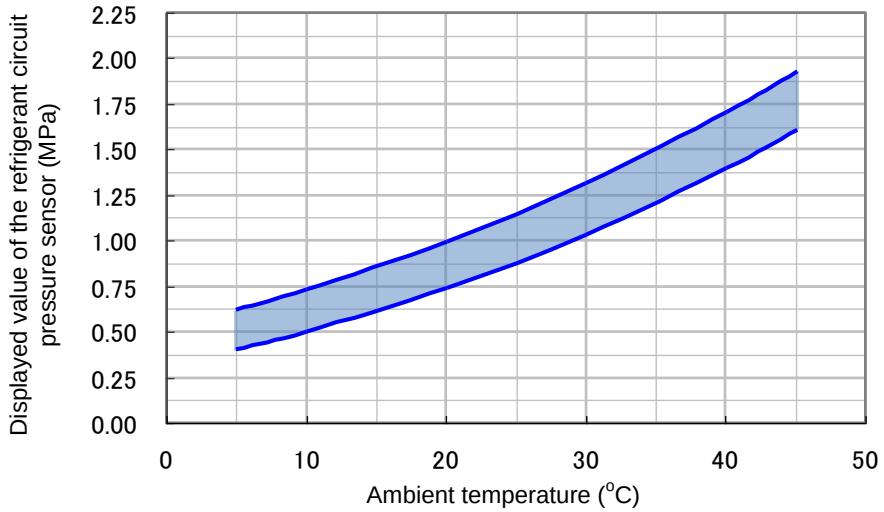


Fig. 3.3-37: Ambient temperature and refrigerant circuit pressure

14. Check the display of the refrigerant circuit pressure sensor (for low pressure).

Compare the refrigerant circuit pressure and the ambient temperature with those shown in the graph to check the displayed value of the refrigerant circuit pressure sensor.

Follow the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours to make the ambient temperature and the temperature inside the Thermo-Chiller the same.

(2) Check the ambient temperature.

(3) Check "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(4) Check if the value at the cross point of the ambient temperature and the "PL: Refrigerant circuit pressure on the low pressure side" value is within the range (the shaded part) in Fig. 3.3-37. If the cross point is within the range, it means that the pressure sensor is operating correctly.

15. Check the analogue output of the refrigerant circuit pressure sensor (for high pressure).

Find out if the main board is operating connectly.

Follow the instructions shown below:

(1) Check the "Ph: Refrigerant circuit pressure on the high pressure side" value in the "Check Monitor Menu".

(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 11 and contact the negative probe to the pin number 10 of the "CN4" connector.

(4) Check that the voltage between the pin number 11 and the pin number 10 is in the same relationship shown in Fig. 3.3-39. (Accuracy: +/- 5%)

(5) If the voltage is in the same relationship as the graph shows, it means that the main board is operating correctly.

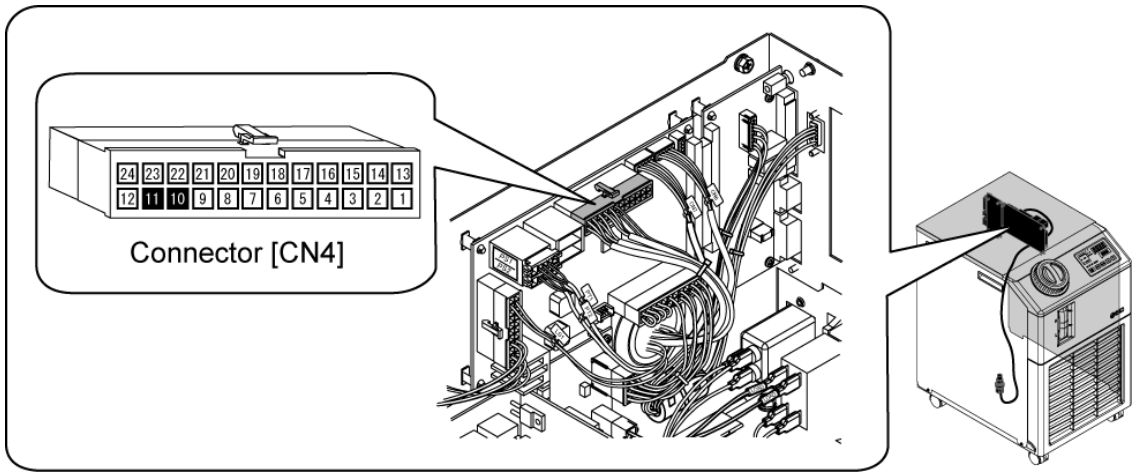


Fig. 3.3-38 Check of the refrigerant circuit pressure sensor (for high pressure) output

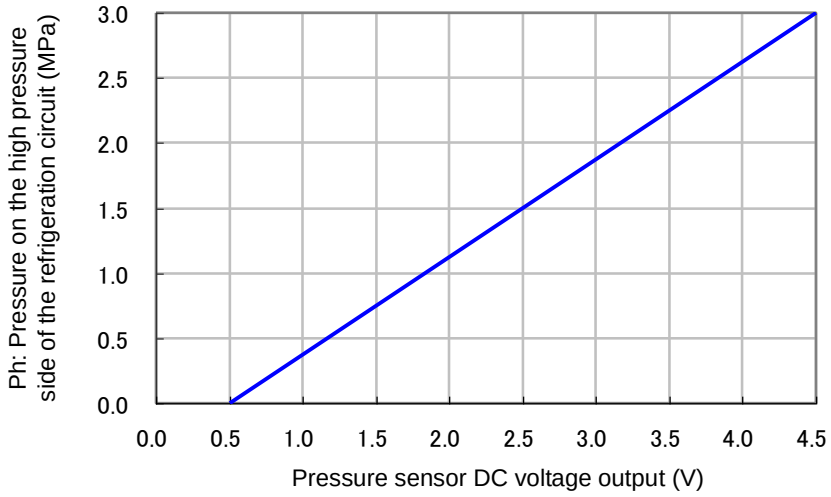


Fig. 3.3-39 Refrigerant circuit pressure sensor (for high pressure) analogue output

16. Check the analogue output of the refrigerant circuit pressure sensor (for low pressure).

Find out if the main board is operating connectly.

Follow the instructions shown below:

(1) Check the "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 23 and contact the negative probe to the pin number 12 of the "CN4" connector.

(4) Check that the voltage between the pin number 23 and the pin number 12 is in the same relationship shown in Fig. 3.3-41. (Accuracy: +/- 5%)

(5) If the voltage is in the same relationship as the graph shows, it means that the main board is operating correctly.

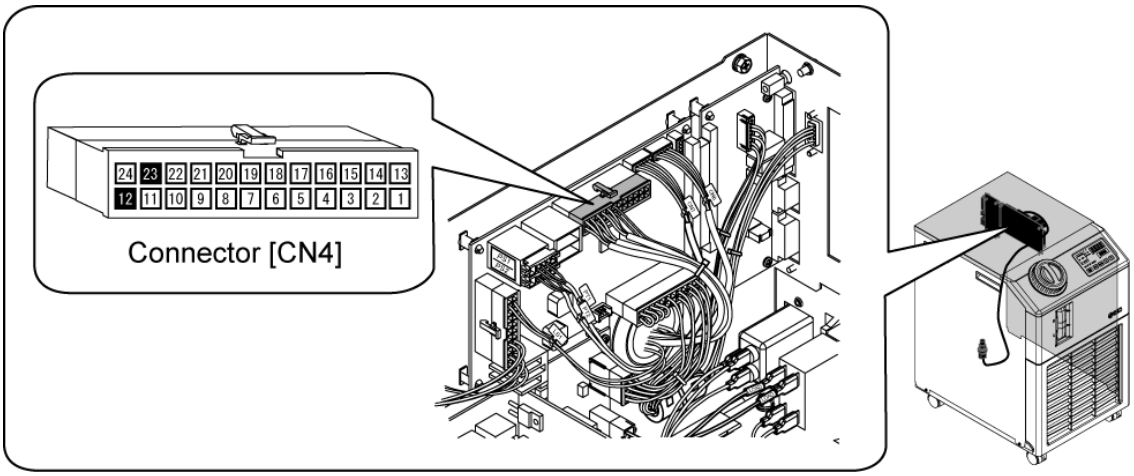


Fig. 3.3-40 Check of the refrigerant circuit pressure sensor (for low pressure) output

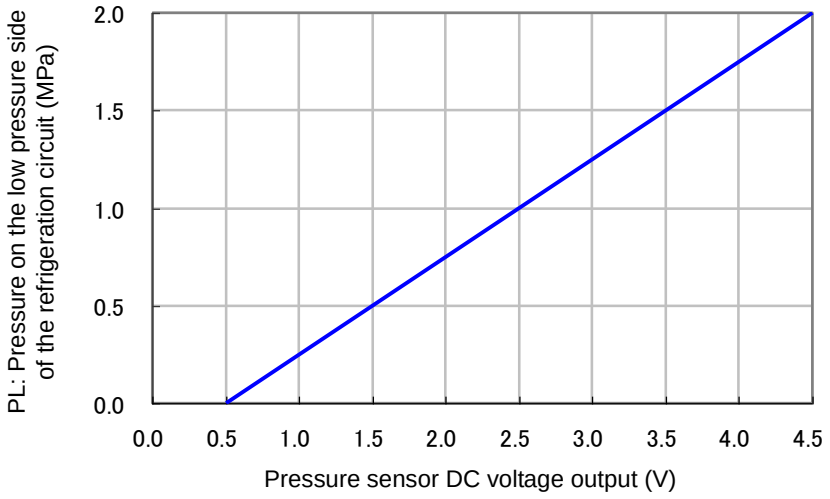
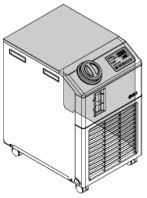


Fig. 3.3-41 Refrigerant circuit pressure sensor (for low pressure) analogue output

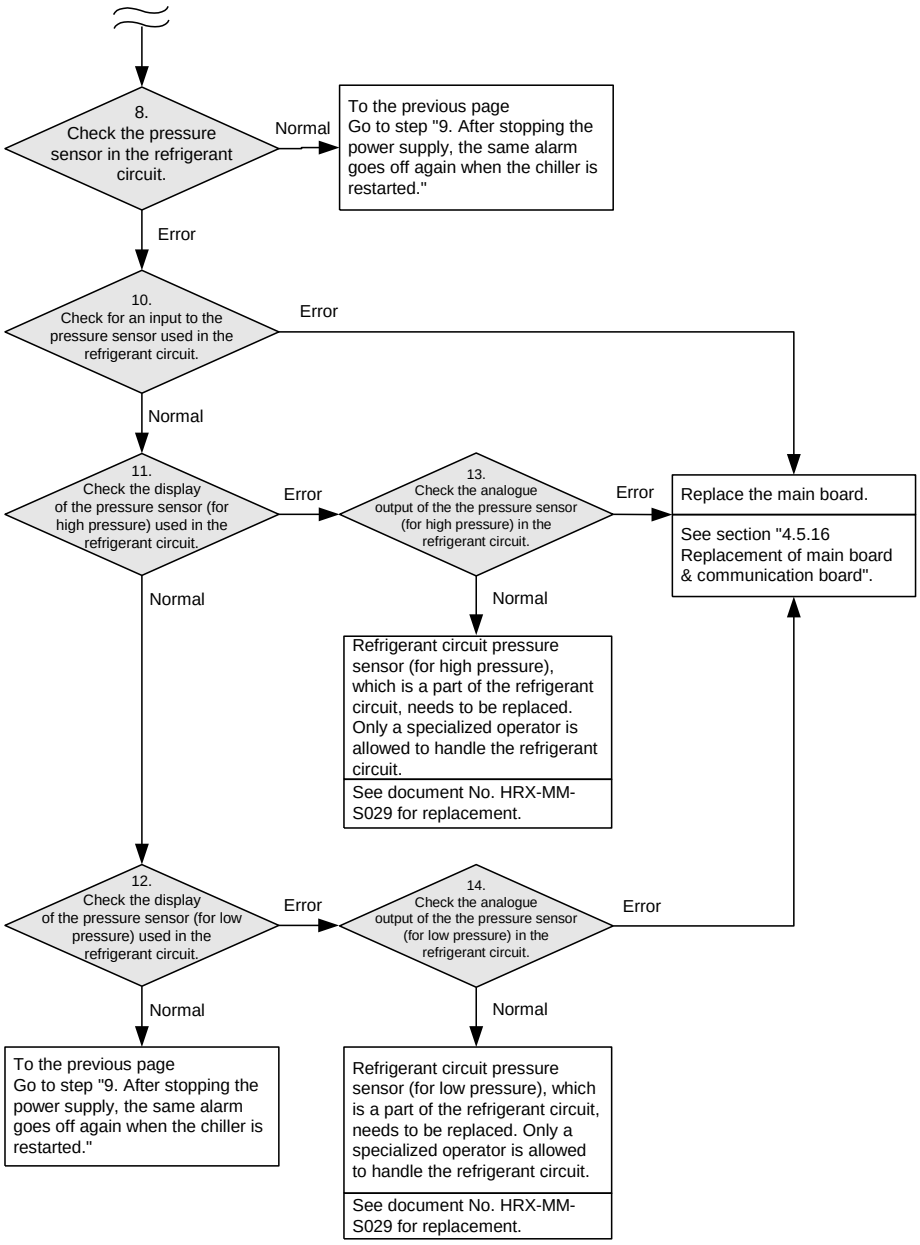
AL13: High compressor discharge pressure [For water-cooled type]

<Detection method> This alarm goes off when the pressure detected by the refrigerant circuit pressure sensor (for high pressure) is 2.6 MPa or more.



AL13 | High compressor discharge pressure [For water-cooled type]

Is the facility water temperature higher than 40 °C?
- Y → This system cannot be used.
- N → Is the piping connection for the facility water inlet/outlet correct?
  - Y → Check for the correct piping connections.
  - N → 1. Does the facility water system meet the required flow rate specifications?
    - N → This system cannot be used.
    - Y → 2. Is the facility water contaminated?
      - Y → Supply clean facility water.
      - N → 3. Is the flow rate for the facility water correct?
        - Y → 4. Is the Water-cooled condenser contaminated?
          - Y → Water cooled condenser, which is a part of the refrigerant circuit, needs to be replaced. Only a specialized operator is allowed to handle the refrigerant circuit. See document No. HRX-MM-Q029 for replacement.
          - N → 5. Is the External load out of specification range?
            - Y → This system cannot be used.
            - N → Are other alarms are being generated simultaneously?
              - Y → Check the troubleshooting that is corresponding to the alarm number that is being generated.
              - N → 6. Is flow rate of the circulating fluid less than 5 L/min?
                - Y → 7. Check the pump performance.
                  - Error → Replace the pump. See section "4.5.3 Replacement of pump (For standard pump)", and section "4.5.4 Replacement of high pressure pump".
                  - Normal → Connect a by-pass piping.
                - N → 8. Check the pressure sensor in the refrigerant circuit.
                  - Normal → 9. After stopping the power supply, does the same alarm go off again when the chiller is restarted?
                    - Y → Please contact SMC or a distributor.
                    - N → Electronic expansion valve, which is a part of the refrigerant circuit, needs to be replaced. Only a specialized operator is allowed to handle the refrigerant circuit. See document No. HRX-MM-Q016 for replacement.
                  - Error → To the next page



1. Check the facility water system.

Check that the facility water system satisfies the required facility water flow rate that is specified in the Operation Manual.

2. Facility water is contaminated.

Check that the facility water is clean (without any foreign matter or discolouration).

3. Incorrect flow rate of the facility water.

Install a flow meter and check that the facility water system satisfies the required facility water flow rate that is specified in the Operation Manual.

* Facility water does not flow when the Thermo-Chiller is not operating. Check the facility water flow rate while the external load is being applied to the Thermo-Chiller or the circulating fluid temperature is being decreased.

4. Water-cooled condenser is contaminated.

Contamination given to the water-cooled condenser reduces cooling capacity. Check the water-cooled condenser for contamination by following the instructions shown below:

(1) Remove the pipings connected to the inlet and outlet of the facility water.
(2) Remove the upper panel and the right panel.
(3) Remove the plug of the water-cooled condenser, and check inside the water-cooled condenser for contamination.

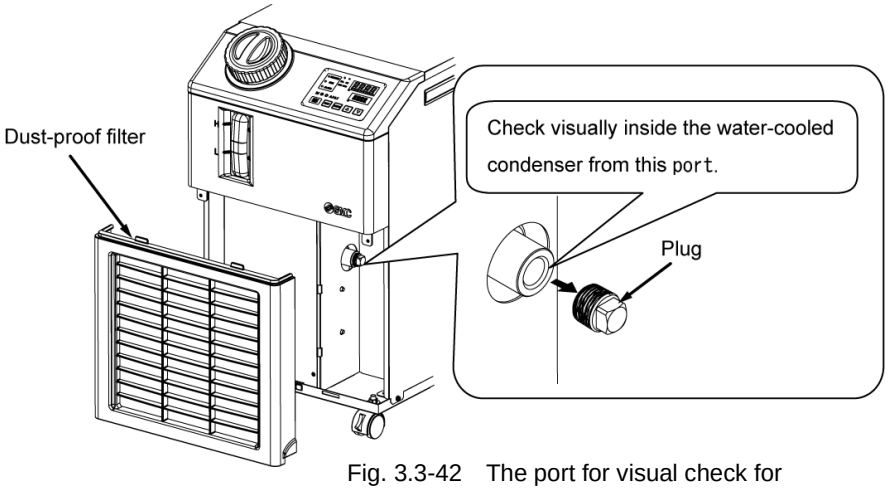


Fig. 3.3-42 The port for visual check for contamination inside the water-cooled condenser

5. External load is out of the specification range.

Cooling capacity varies depending on the facility water temperature, set circulating fluid temperature, and power supply frequency.

Please refer to the "Cooling capacity" graph shown in the Operation Manual.

6. Flow rate of the circulating fluid is less than 5 L/min.

Install a flow meter, and check the flow rate of the circulating fluid.

7. Check the pump performance.

Install a flow meter. Refer to the "Pump capacity" graph" shown in the catalogue and check that the pump capacity is suitable for the circulating fluid outlet pressure and the circulating fluid flow rate.

8. Check the pressure sensor in the refrigerant circuit.

Two pressure sensors, one for high pressure and the other for low pressure, are used for the refrigerant circuit. Take the following instructions to check for any abnormality with the pressure sensors:

(1) Stop the Thermo-Chiller operation.
(2) Check the temperature shown for "Ph: Refrigerant circuit pressure on the high pressure side" and "PL: Refrigerant circuit pressure on the low pressure side" in the "Check Monitor Menu".
(3) If the pressure value shown by each sensor is +/- 0.1 MPa (Ph = PL +/- 0.1), it means that the pressure sensors are operating correctly.

9. After stopping power supply, check for the same alarm goes off again when the chiller is re-started.

After stopping power supply (by tuning off the power supply switch on the Thermo-Chiller), check if the same alarm goes off again when the Thermo-Chiller is restarted.

10. Check for an input to the pressure sensor in the refrigerant circuit.

Check that the power is supplied to the refrigerant circuit pressure sensor.

Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

<Refrigerant circuit pressure sensor (for high pressure)>

Contact the positive probe to the pin number 22 and contact the negative probe to the pin number 10 of the "CN4" connector.

<Normal> Pin number 22 - Pin number 10: Voltage should be 5 VDC +/- 1V

<Refrigerant circuit pressure sensor (for low pressure)>

Contact the positive probe to the pin number 24 and contact the negative probe to the pin number 12 of the "CN4" connector.

<Normal> Pin number 24 - Pin number 12: Voltage should be 5 VDC +/- 1V

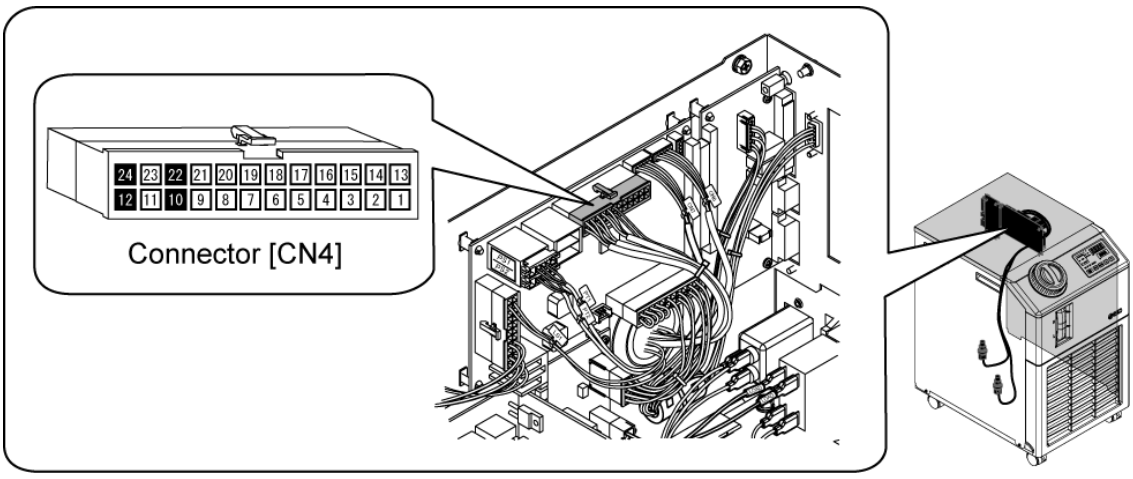


Fig. 3.3-43 Check of the refrigerant circuit pressure sensor input

11. Check the display of the refrigerant circuit pressure sensor (for high pressure).

Compare the refrigerant circuit pressure and the ambient temperature with those shown in the graph to check the displayed value of the refrigerant circuit pressure sensor.

Follow the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours to make the ambient temperature and the temperature inside the Thermo-Chiller the same.

(2) Check the ambient temperature.

(3) Check the "Ph: Refrigerant circuit pressure on the high pressure side" value in the "Check Monitor Menu".

(4) Check if the value at the cross point of the ambient temperature and the "Ph: Refrigerant circuit pressure on the high pressure side" value is within the range (the shaded part) in Fig. 3.3-44. If the cross point is within the range, it means that the pressure sensor is operating correctly.

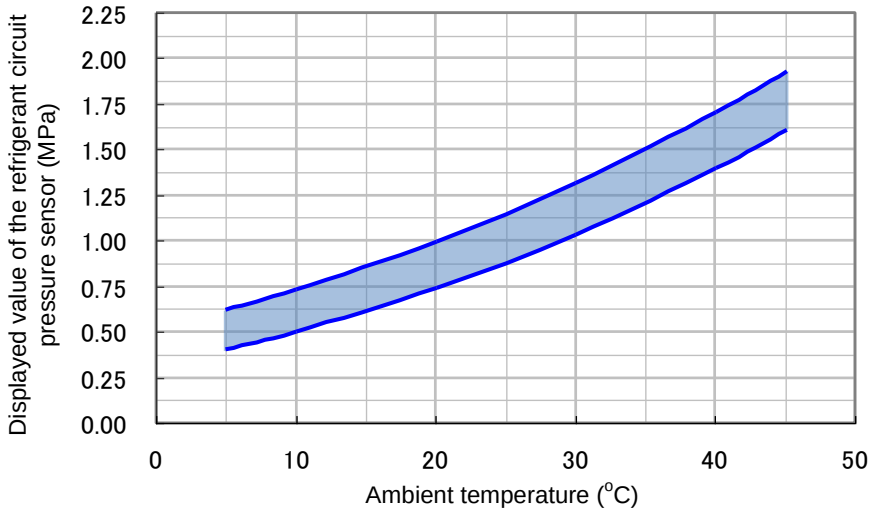


Fig. 3.3-44 Ambient temperature and refrigerant circuit pressure

12. Check the display of the refrigerant circuit pressure sensor (for low pressure).

Compare the refrigerant circuit pressure and the ambient temperature with those shown in the graph to check the displayed value of the refrigerant circuit pressure sensor.

Follow the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours to make the ambient temperature and the temperature inside the Thermo-Chiller the same.

(2) Check the ambient temperature.

(3) Check "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(4) Check if the value at the cross point of the ambient temperature and the "PL: Refrigerant circuit pressure on the low pressure side" value is within the range (the shaded part) in Fig. 3.3-44. If the cross point is within the range, it means that the pressure sensor is operating correctly.

13. Check the analogue output of the refrigerant circuit pressure sensor (for high pressure).

Find out if the main board is operating connectly.

Follow the instructions shown below:

(1) Check the "Ph: Refrigerant circuit pressure on the high pressure side" value in the "Check Monitor Menu".

(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 11 and contact the negative probe to the pin number 10 of the "CN4" connector.

(4) Check that the voltage between the pin number 11 and the pin number 10 is in the same relationship shown in Fig. 3.3-46. (Accuracy: +/- 5%)

(5) If the voltage is in the same relationship as the graph shows, it means that the main board is operating correctly.

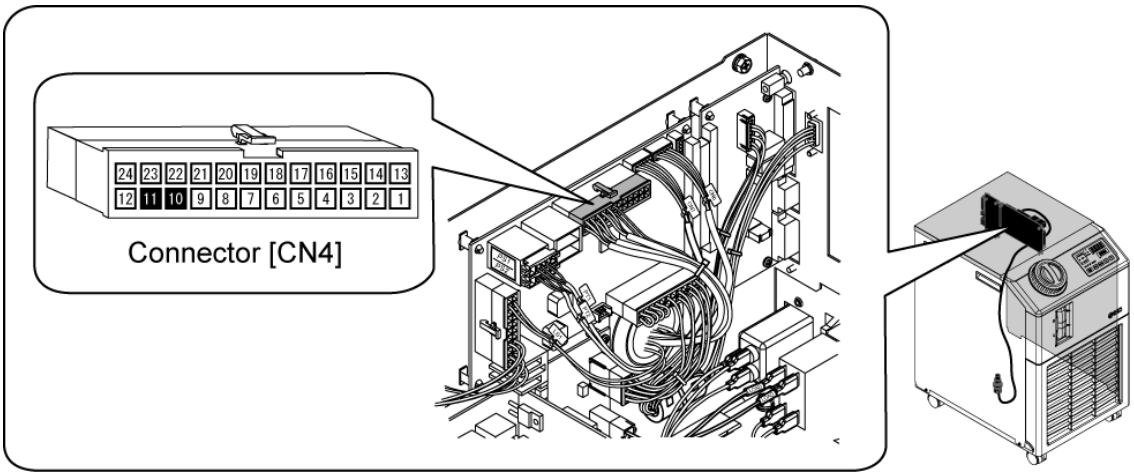


Fig. 3.3-45 Check of the refrigerant circuit pressure sensor (for high pressure) output

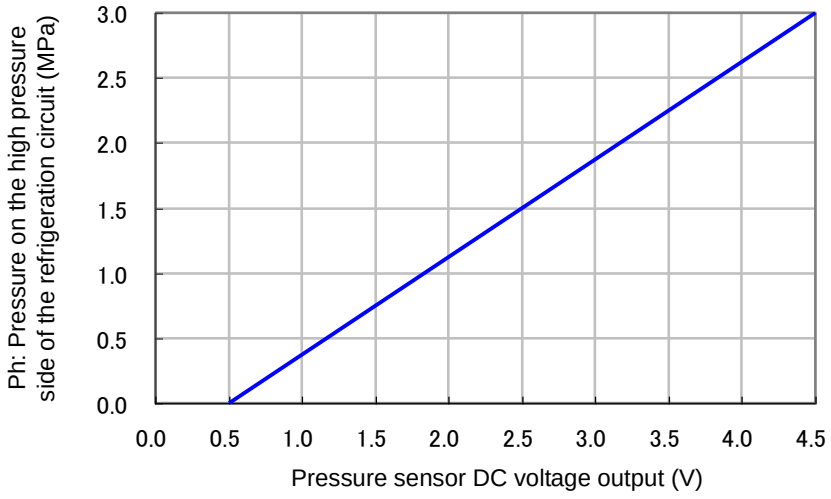


Fig. 3.3-46 Refrigerant circuit pressure sensor (for high pressure) analogue output

14. Check the analogue output of the refrigerant circuit pressure sensor (for low pressure).

Find out if the main board is operating connectly.

Follow the instructions shown below:

(1) Check the "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 23 and contact the negative probe to the pin number 12 of the "CN4" connector.

(4) Check that the voltage between the pin number 23 and the pin number 12 is in the same relationship shown in Fig. 3.3-48. (Accuracy: +/- 5%)

(5) If the voltage is in the same relationship as the graph shows, it means that the main board is operating correctly.

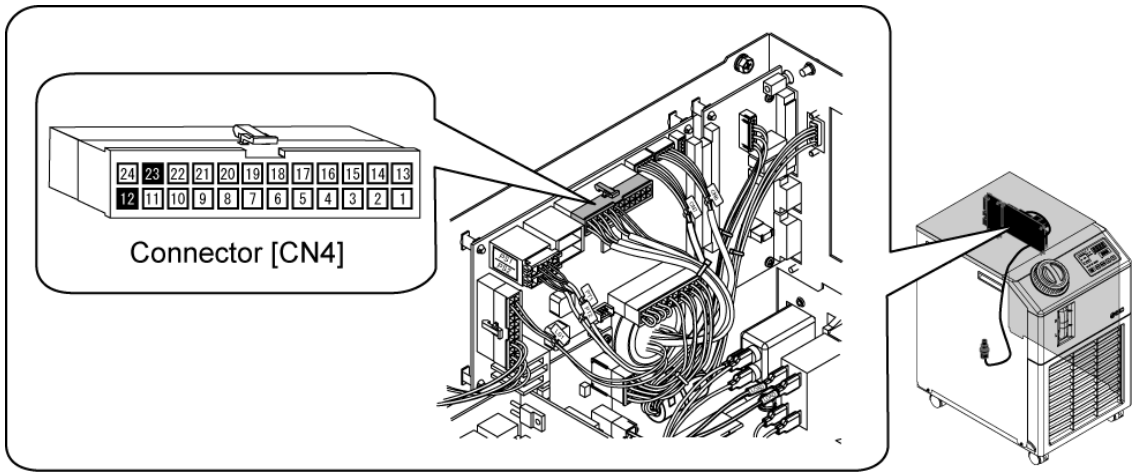


Fig. 3.3-47 Check of the refrigerant circuit pressure sensor (for low pressure) output

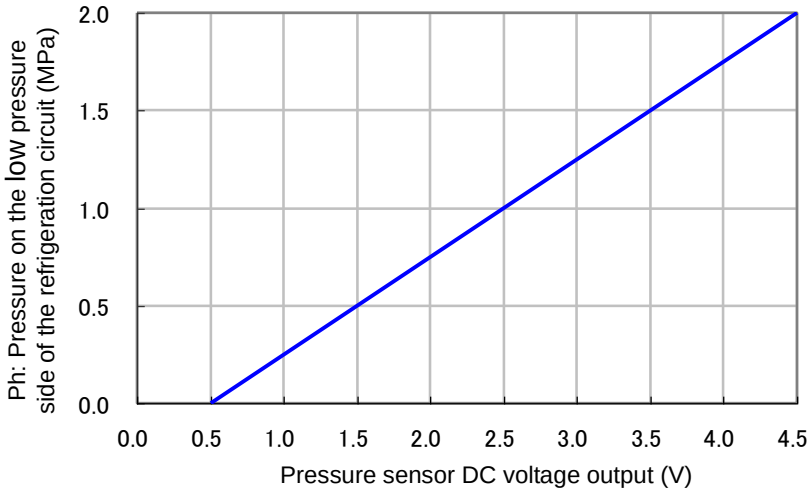
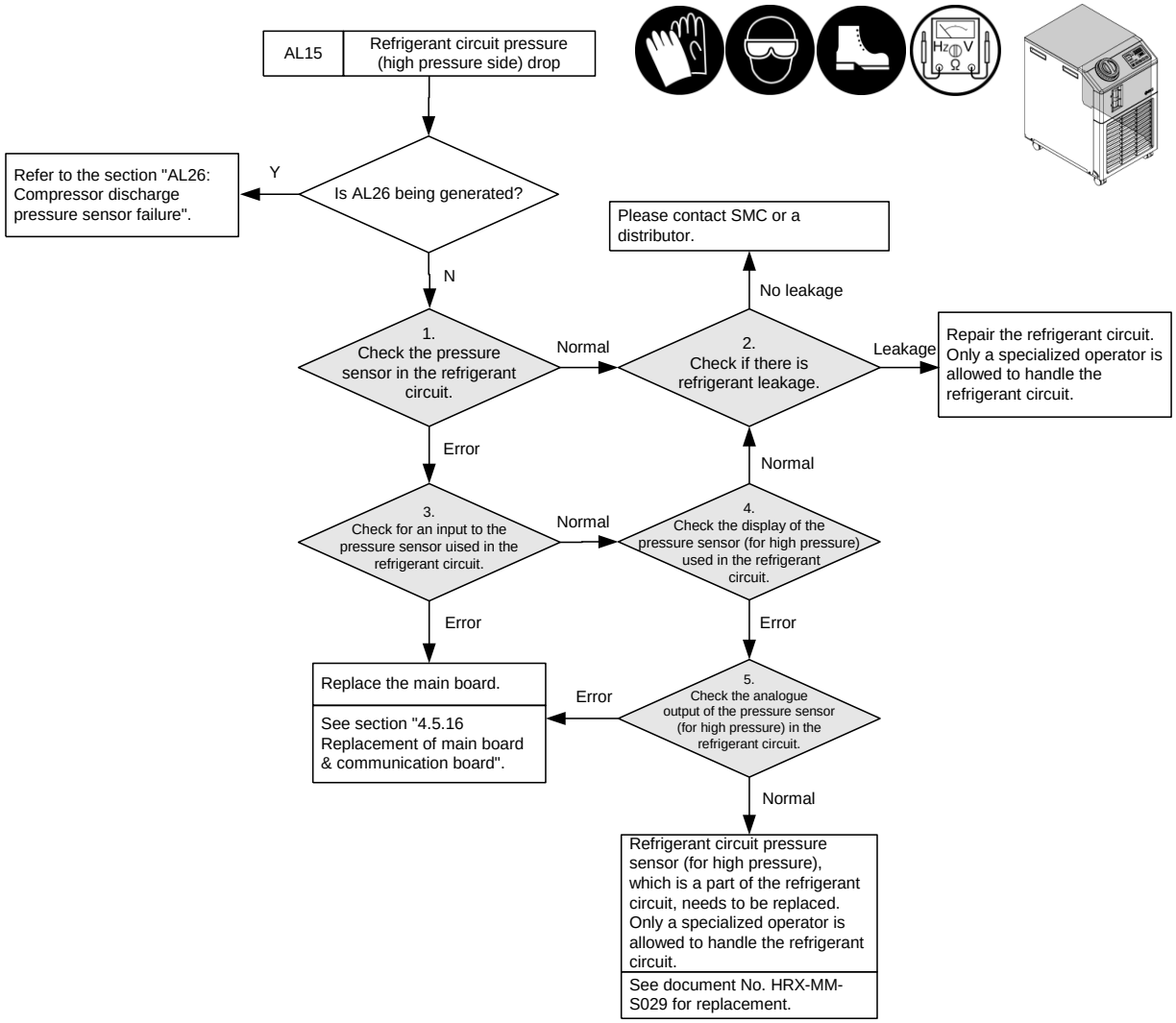


Fig. 3.3-48 Refrigerant circuit pressure sensor (for low pressure) analogue output

AL15: Refrigerant circuit pressure (high pressure side) drop

<Detection method> This alarm goes off when the pressure detected by the refrigerant circuit pressure sensor (for high pressure) is 0.1 MPa or less.



1. Check the pressure sensor in the refrigerant circuit.

Two pressure sensors, one for high pressure and the other for low pressure, are used for the refrigerant circuit. Take the following instructions to check for any abnormality with the pressure sensors:

(1) Stop the Thermo-Chiller operation.

(2) Check the temperature shown for "Ph: Refrigerant circuit pressure on the high pressure side" and "PL: Refrigerant circuit pressure on the low pressure side" in the "Check Monitor Menu".

(3) If the pressure value shown by each sensor is +/- 0.1 MPa (Ph = PL +/- 0.1), it means that the pressure sensors are operating correctly.

2. Check for refrigerant leakage.

Refrigerant leakage reduces the cooling capacity. To check for refrigerant leakage, it is necessary to make the refrigerant circuit temperature same as the ambient temperature. Stop the Thermo-Chiller operation, and leave it not operating for 24 hours.

Take the following instructions to check for refrigerant leakage after leaving not operating.

(1) Measure the ambient temperature (room temperature).

(2) Check the pressure shown for "Ph: Refrigerant circuit pressure on the high pressure side" in the "Check Monitor Menu" of the Thermo-Chiller.

(3) If the measured point is lower than the values shown in the graph in "Fig. 3.3-49: Ambient temperature and refrigerant circuit pressure", it means there is refrigerant leakage caused.

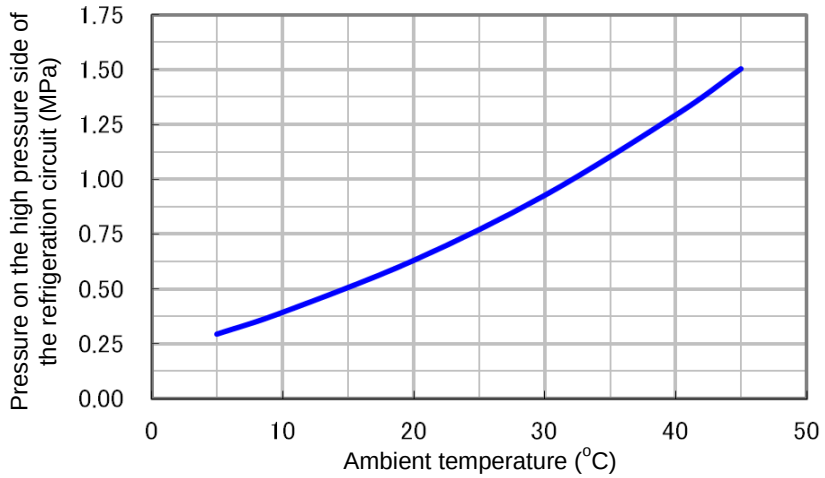


Fig. 3.3-49 Ambient temperature and refrigerant circuit pressure

3. Check for an input to the pressure sensor in the refrigerant circuit.

Check that the power is supplied to the refrigerant circuit pressure sensor.
Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

<Refrigerant circuit pressure sensor (for high pressure)>

Contact the positive probe to the pin number 22 and contact the negative probe to the pin number 10 of the "CN4" connector.

<Normal> Pin number 22 - Pin number 10: Voltage should be 5 VDC +/- 1V

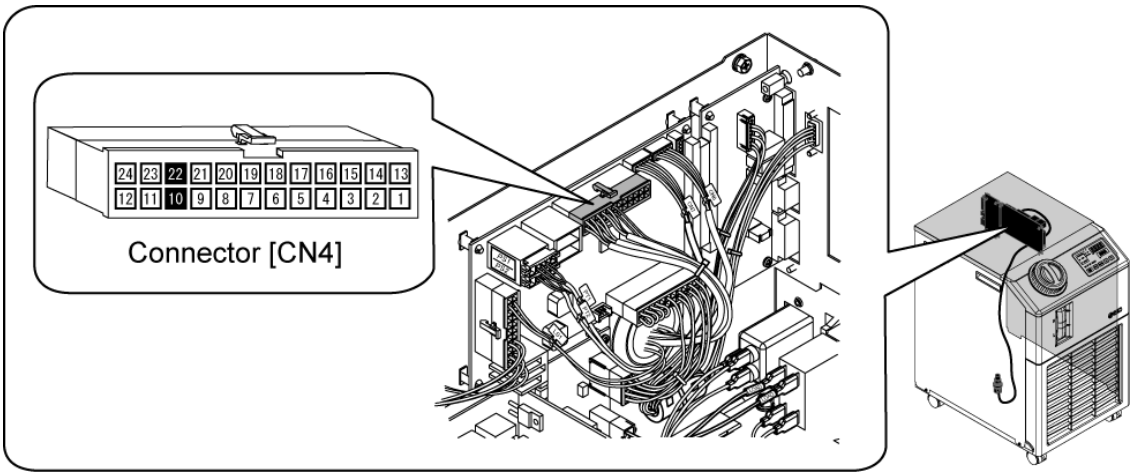


Fig. 3.3-50 Check of the refrigerant circuit pressure sensor (for high pressure) input

4. Check the display of the refrigerant circuit pressure sensor (for high pressure).

Compare the refrigerant circuit pressure and the ambient temperature with those shown in the graph to check the displayed value of the refrigerant circuit pressure sensor.

Follow the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours to make the ambient temperature and the temperature inside the Thermo-Chiller the same.

(2) Check the ambient temperature.

(3) Check the "Ph: Refrigerant circuit pressure on the high pressure side" value in the "Check Monitor Menu".

(4) Check if the value at the cross point of the ambient temperature and the "Ph: Refrigerant circuit pressure on the high pressure side" value is within the range (the shaded part) in Fig. 3.3-51. If the cross point is within the range, it means that the pressure sensor is operating correctly.

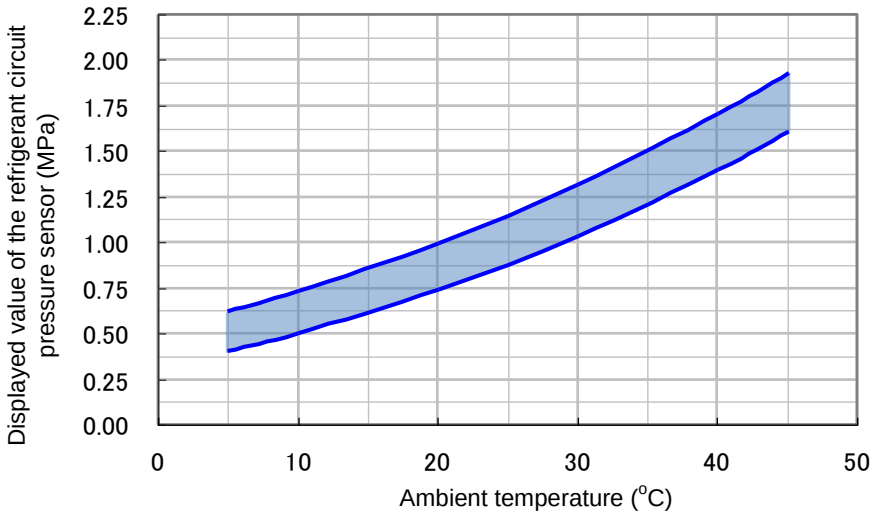


Fig. 3.3-51 Ambient temperature and refrigerant circuit pressure

5. Check the analogue output of the refrigerant circuit pressure sensor (for high pressure).

Find out if the main board is operating connectly.

Follow the instructions shown below:

(1) Check the "Ph: Refrigerant circuit pressure on the high pressure side" value in the "Check Monitor Menu".

(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 11 and contact the negative probe to the pin number 10 of the "CN4" connector.

(4) Check that the voltage between the pin number 11 and the pin number 10 is in the same relationship shown in Fig. 3.3-53. (Accuracy: +/- 5%)

(5) If the voltage is in the same relationship as the graph shows, it means that the main board is operating correctly.

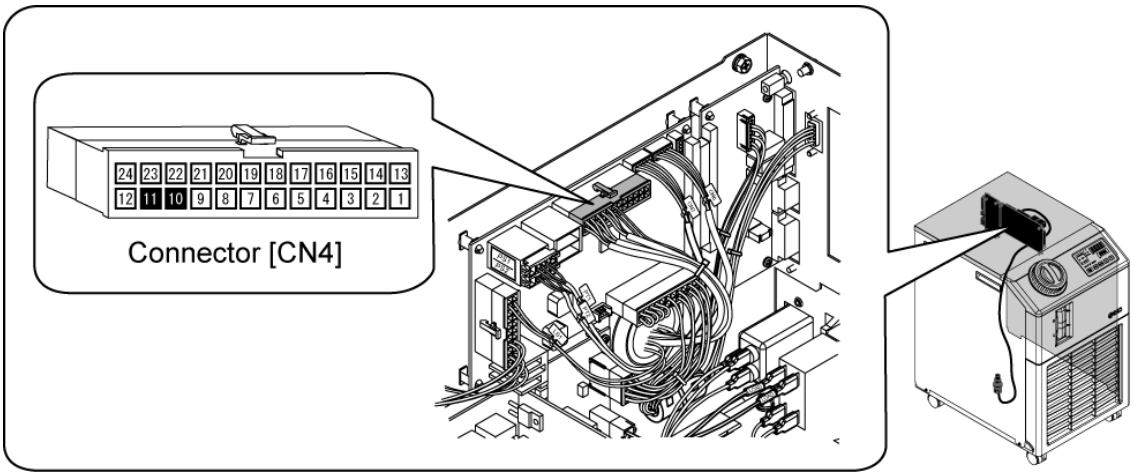


Fig. 3.3-52 Check of the refrigerant circuit pressure sensor (for high pressure) output

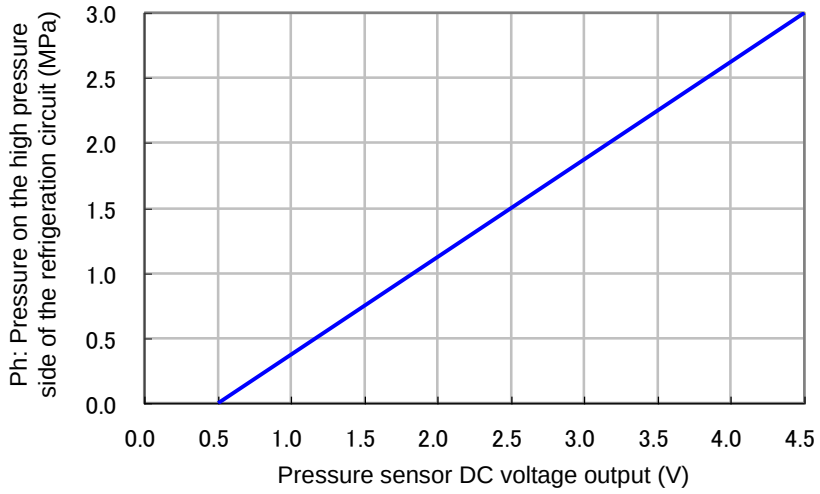
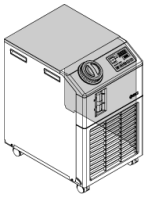


Fig. 3.3-53 Refrigerant circuit pressure sensor (for high pressure) analogue output

AL16: Refrigerant circuit pressure (low pressure side) rise

<Detection method> This alarm goes off when the pressure detected by the refrigerant circuit pressure sensor (for low pressure) is 0.8 MPa (Option G: 0.85 MPa) or more.



1. Check the surrounding environment.

Check if the surrounding environment is in the conditions shown below:

(1) Flow rate fluctuates due to a valve and a switching valve in the external piping. (Heat load is fluctuating.)

(2) Heat that is larger than the cooling capacity is transiently being applied to the Thermo-Chiller.

2. Check the pressure sensor in the refrigerant circuit.

Two pressure sensors, one for high pressure and the other for low pressure, are used for the refrigerant circuit. Take the following instructions to check for any abnormality with the pressure sensors:

(1) Stop the Thermo-Chiller operation.

(2) Check the temperature shown for "Ph: Refrigerant circuit pressure on the high pressure side" and "PL: Refrigerant circuit pressure on the low pressure side" in the "Check Monitor Menu".

(3) If the pressure value shown by each sensor is +/- 0.1 MPa (Ph = PL +/- 0.1), it means that the pressure sensors are operating correctly.

3. After stopping power supply, check for the same alarm goes off again when the chiller is re-started.

After stopping power supply (by tuning off the power supply switch on the Thermo-Chiller), check if the same alarm goes off again when the Thermo-Chiller is restarted.

4. Check for an input to the pressure sensor in the refrigerant circuit.

Check that the power is supplied to the refrigerant circuit pressure sensor.

Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

<Refrigerant circuit pressure sensor (for low pressure)>

Contact the positive probe to the pin number 24 and contact the negative probe to the pin number 12 of the "CN4" connector.

<Normal> Pin number 24 - Pin number 12: Voltage should be 5 VDC +/- 1V

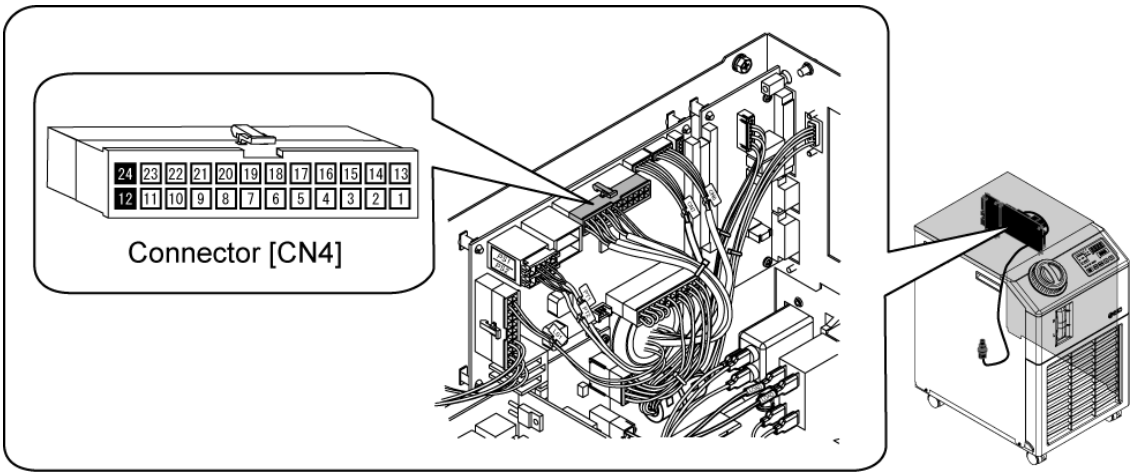


Fig. 3.3-54 Check of the refrigerant circuit pressure sensor (for low pressure) input

5. Check the display of the refrigerant circuit pressure sensor (for low pressure).

Compare the refrigerant circuit pressure and the ambient temperature with those shown in the graph to check the displayed value of the refrigerant circuit pressure sensor.

Follow the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours to make the ambient temperature and the temperature inside the Thermo-Chiller the same.

(2) Check the ambient temperature.

(3) Check "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(4) Check if the value at the cross point of the ambient temperature and the "PL: Refrigerant circuit pressure on the low pressure side" value is within the range (the shaded part) in Fig. 3.3-55. If the cross point is within the range, it means that the pressure sensor is operating correctly.

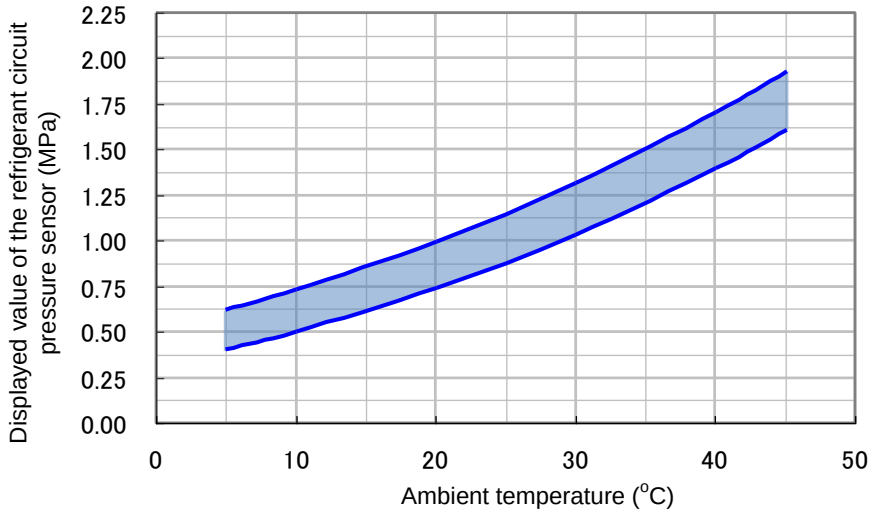


Fig. 3.3-55 Ambient temperature and refrigerant circuit pressure

6. Check the analogue output of the refrigerant circuit pressure sensor (for low pressure).

Find out if the main board is operating connectly.

Follow the instructions shown below:

(1) Check the "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 23 and contact the negative probe to the pin number 12 of the "CN4" connector.

(4) Check that the voltage between the pin number 23 and the pin number 12 is in the same relationship shown in Fig. 3.3-57. (Accuracy: +/- 5%)

(5) If the voltage is in the same relationship as the graph shows, it means that the main board is operating correctly.

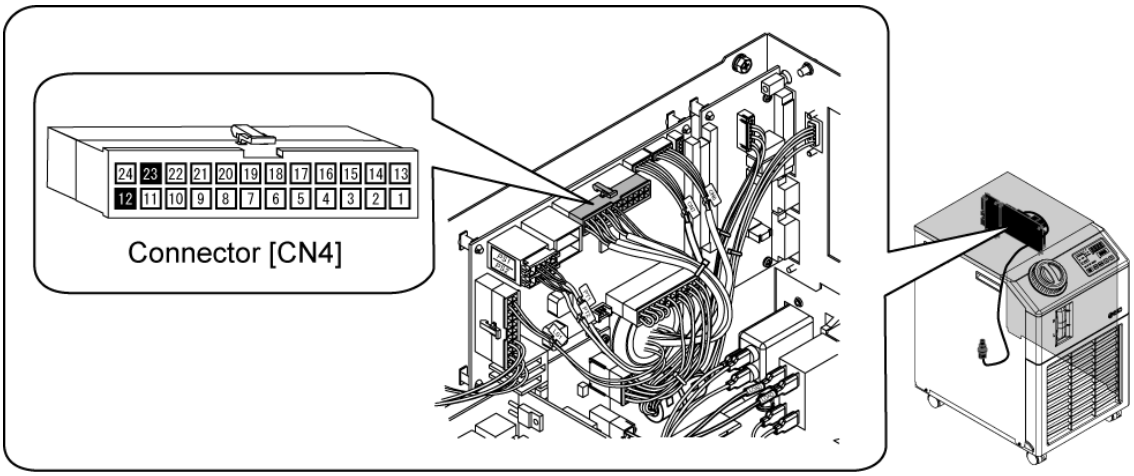


Fig. 3.3-56 Check of the refrigerant circuit pressure sensor (for low pressure) output

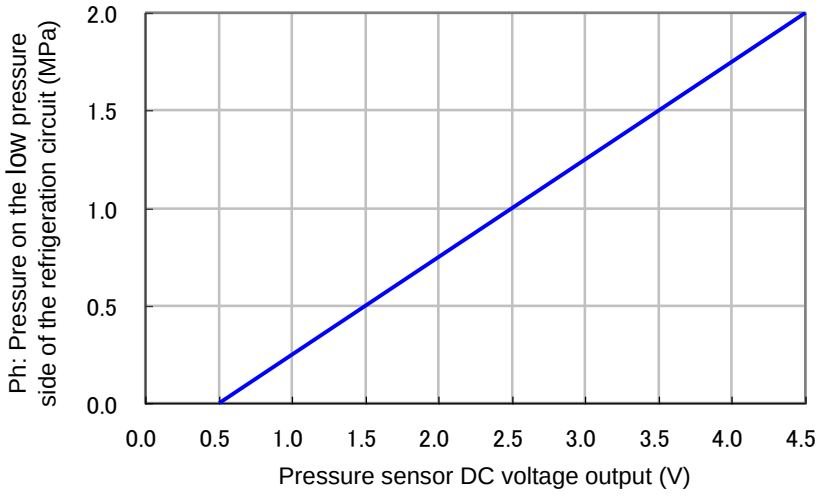
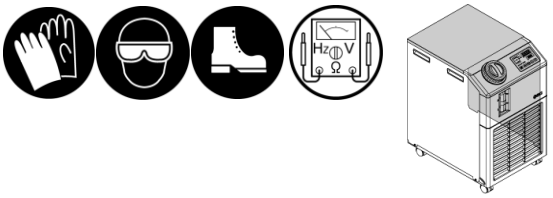


Fig. 3.3-57 Refrigerant circuit pressure sensor (for low pressure) analogue output

AL17: Refrigerant circuit pressure (low pressure side) drop

<Detection method> This alarm goes off when the pressure detected by the refrigerant circuit pressure sensor (for low pressure) is 0.2 MPa or less.



1. Check the surrounding environment.

Check if the surrounding environment is in the conditions shown below:

(1) Flow rate fluctuates due to a valve and a switching valve in the external piping. (Heat load is fluctuating.)

(2) The system has a circuit that low temperature circulating fluid returns to the Thermo-Chiller at once.

2. Flow rate of the circulating fluid is less than 5 L/min.

Install a flow meter, and check the flow rate of the circulating fluid.

3. Check the pump performance.

Install a flow meter. Refer to the "Pump capacity" graph" shown in the catalogue and check that the pump capacity is suitable for the circulating fluid outlet pressure and the circulating fluid flow rate.

4. Check the pressure sensor in the refrigerant circuit.

Two pressure sensors, one for high pressure and the other for low pressure, are used for the refrigerant circuit. Take the following instructions to check for any abnormality with the pressure sensors:

(1) Stop the Thermo-Chiller operation.

(2) Check the temperature shown for "Ph: Refrigerant circuit pressure on the high pressure side" and "PL: Refrigerant circuit pressure on the low pressure side" in the "Check Monitor Menu".

(3) If the pressure value shown by each sensor is +/- 0.1 MPa (Ph = PL +/- 0.1), it means that the pressure sensors are operating correctly.

5. After stopping power supply, check for the same alarm goes off again when the chiller is re-started.

After stopping power supply (by tuning off the power supply switch on the Thermo-Chiller), check if the same alarm goes off again when the Thermo-Chiller is restarted.

6. Check for an input to the pressure sensor in the refrigerant circuit.

Check that the power is supplied to the refrigerant circuit pressure sensor.
Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

<Refrigerant circuit pressure sensor (for low pressure)>
Contact the positive probe to the pin number 24 and contact the negative probe to the pin number 12 of the "CN4" connector.
<Normal> Pin number 24 - Pin number 12: Voltage should be 5 VDC +/- 1V

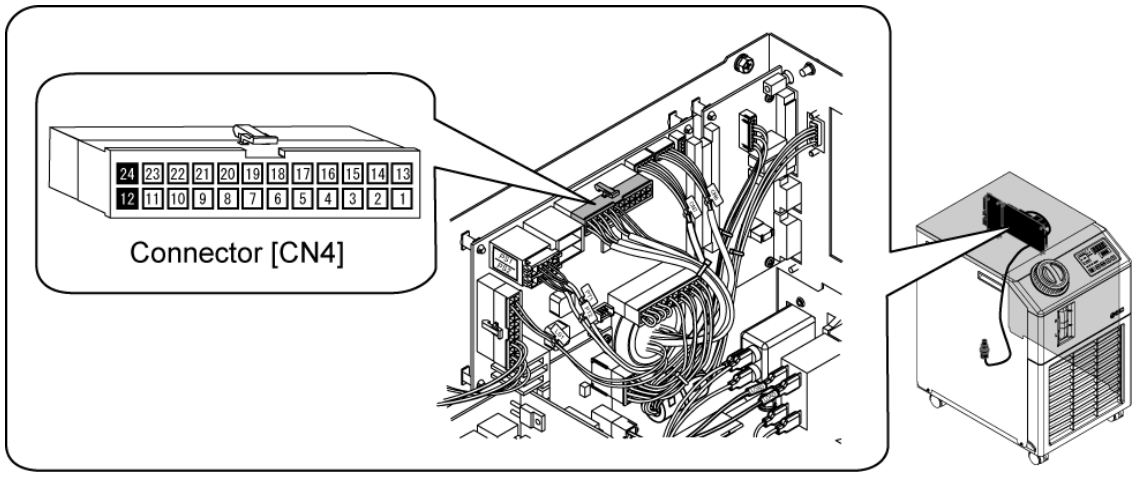


Fig. 3.3-58 Check of the refrigerant circuit pressure sensor (for low pressure) input

7. Check the display of the refrigerant circuit pressure sensor (for low pressure).

Compare the refrigerant circuit pressure and the ambient temperature with those shown in the graph to check the displayed value of the refrigerant circuit pressure sensor.

Follow the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours to make the ambient temperature and the temperature inside the Thermo-Chiller the same.

(2) Check the ambient temperature.

(3) Check "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(4) Check if the value at the cross point of the ambient temperature and the "PL: Refrigerant circuit pressure on the low pressure side" value is within the range (the shaded part) in Fig. 3.3-59. If the cross point is within the range, it means that the pressure sensor is operating correctly.

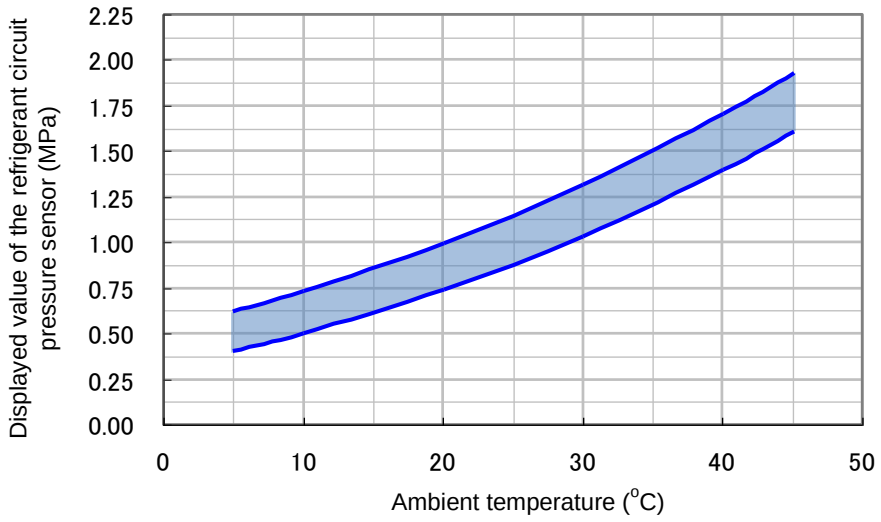


Fig. 3.3-59 Ambient temperature and refrigerant circuit pressure

8. Check the analogue output of the refrigerant circuit pressure sensor (for low pressure).

Find out if the main board is operating connectly.

Follow the instructions shown below:

(1) Check the "PL: Refrigerant circuit pressure on the low pressure side" value in the "Check Monitor Menu".

(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 23 and contact the negative probe to the pin number 12 of the "CN4" connector.

(4) Check that the voltage between the pin number 23 and the pin number 12 is in the same relationship shown in Fig. 3.3-61. (Accuracy: +/- 5%)

(5) If the voltage is in the same relationship as the graph shows, it means that the main board is operating correctly.

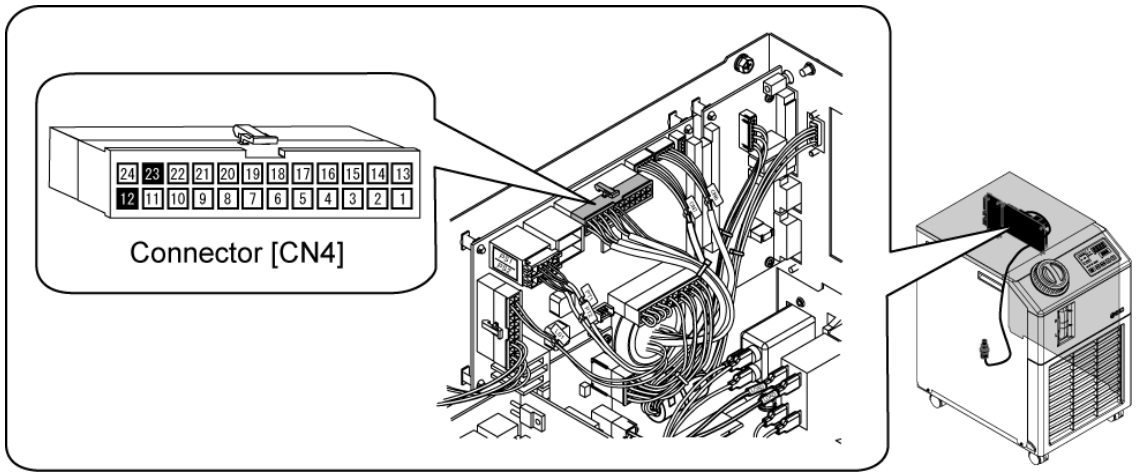


Fig. 3.3-60 Check of the refrigerant circuit pressure sensor (for low pressure) output

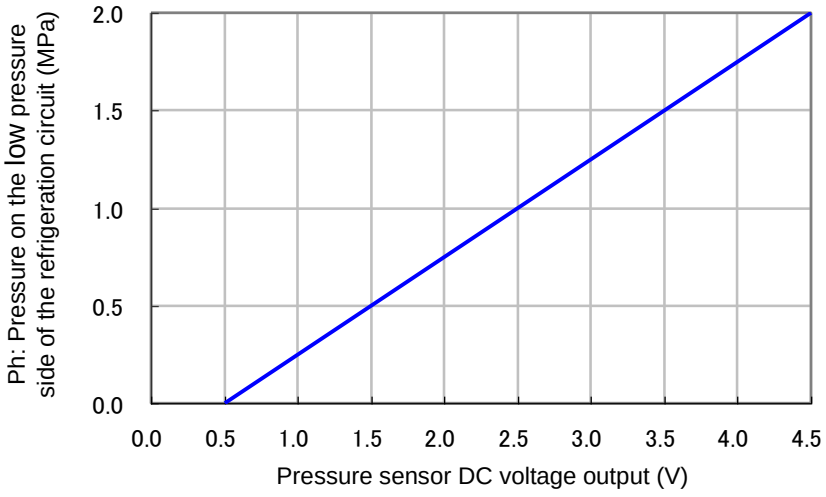
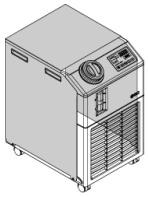


Fig. 3.3-61 Refrigerant circuit pressure sensor (for low pressure) analogue output

AL18: Compressor overload [For air-cooled type]

<Detection method> This alarm goes off when the difference between the pressure detected by the refrigerant circuit pressure sensor for high pressure and the pressure detected by the refrigerant circuit pressure sensor for low pressure is 0.1 MPa or less.



1. Check of power supply

Check if the power supply is correct.

(1) Check if the power supply is within the specified range. Measure the power supply voltage that is connected to the connector of the power supply cable to be connected to the Thermo-Chiller with a tester, and check if the power supply voltage is within the specification range.

Thermo-Chiller model: HRS□-□-10/20-□

Power supply specification

- -10 (100V spec.): Single phase 100 VAC (50/60Hz), 115 VAC (60Hz)
- -20 (200V spec.): Single phase 200 VAC to 230 VAC (50/60 Hz)

(2) Check that there is no temporary voltage drop or instantaneous power supply stop caused with the power supply.

2. Check the compressor operation.

Leave the Thermo-Chiller in an operation stop state for 2 hours or more (to decrease the temperature of the compressor body).

After starting Thermo-Chiller operation, judge if the compressor is operating with the compressor operating noise and the vibration of the compressor.

(When checking vibration, use a screwdriver to touch the compressor body. Do not touch the compressor body directly with hand as it becomes hot while it is operating.)

3. Ambient temperature is out of the specification range.

Ambient temperature is higher than 40 ^{o}C (45 ^{o}C for Option G "High ambient temperature specification").

4. External load is out of the specification range.

Cooling capacity varies depending on the ambient temperature, set circulating fluid temperature, and power supply frequency.

Please refer to the "Cooling capacity" graph shown on the Operation Manual.

5. Enough ventilation space has not been secured.

- The Thermo-Chiller is installed too close to a wall.
- There is other equipment close to the Thermo-Chiller.
- Hot ventilated air from other equipment enters the Thermo-Chiller.
- The Thermo-Chiller is operating in a enclosed space.

(e.g. In a room without ventilation or air conditioner)

6. The dustproof filter is too dusty.

Dustproof filter on the front side of the Thermo-Chiller or the fin of the air-cooled condenser inside is contaminated.

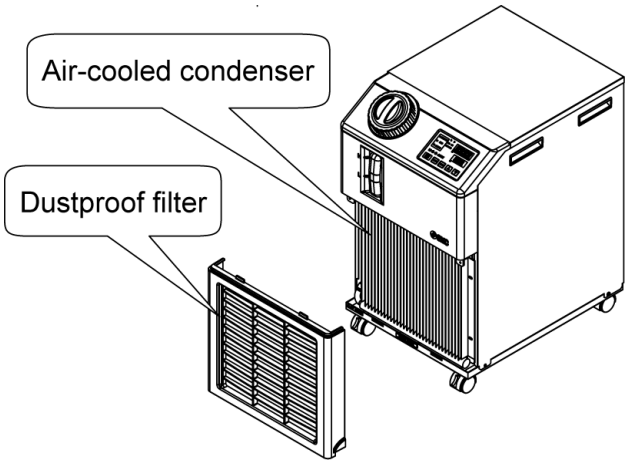


Fig. 3.3-62 An air-cooled condenser and a dustproof filter

7. Check the main board.

Check that the main board outputs signals.

Disconnect the connector "CN1" on the power board.

Perform settings of the tester to make it possible to measure 24 VDC.

Contact the negative side probe to the connector pin number 7 on the cable side of the "CN1" that has been removed, and contact the positive side probe to the pin number 8.

Operate the Thermo-Chiller (by pressing "RUN/STOP" key), and heck the voltage between the cable connectors number 7 and number 8.

<Normal> Between pin numbers 7 and 8: 24 VDC

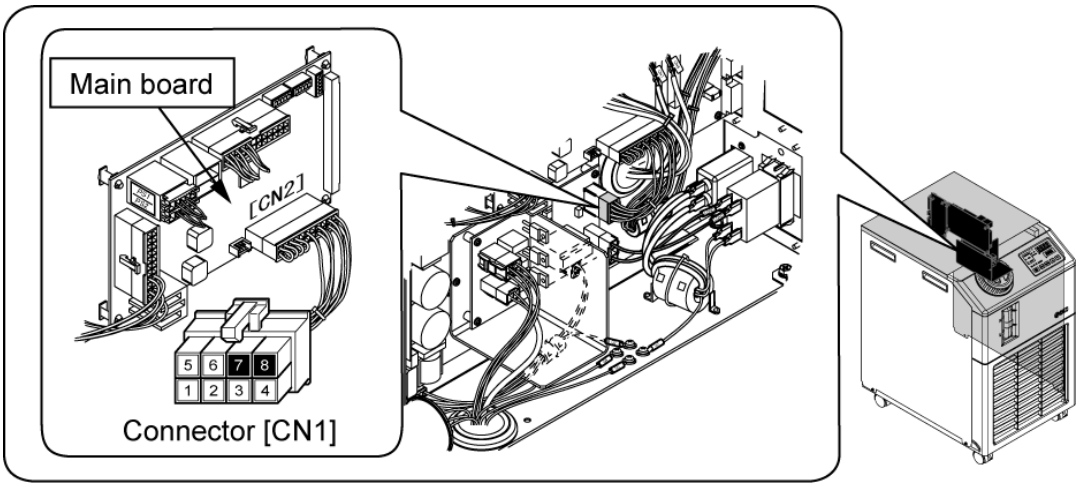


Fig. 3.3-63 Check the compressor signal output

8. Check the power board.

Check that the power is being supplied to the compressor.

Disconnect the connector "CN4" of the power board to which the fan/compressor cable is connected.

Operate the Thermo-Chiller (by pressing "RUN/STOP" key), and check if power supply voltage is supplied to the pins number 2 to number 4 of the "CN4" connector on the power board with a tester.

[Power supply voltage to be supplied]

- -10 (100V spec.): Single phase 100 VAC (50/60Hz), or 115 VAC (60Hz)
- -20 (200V spec.): Single phase 200 VAC to 230 VAC (50/60 Hz)

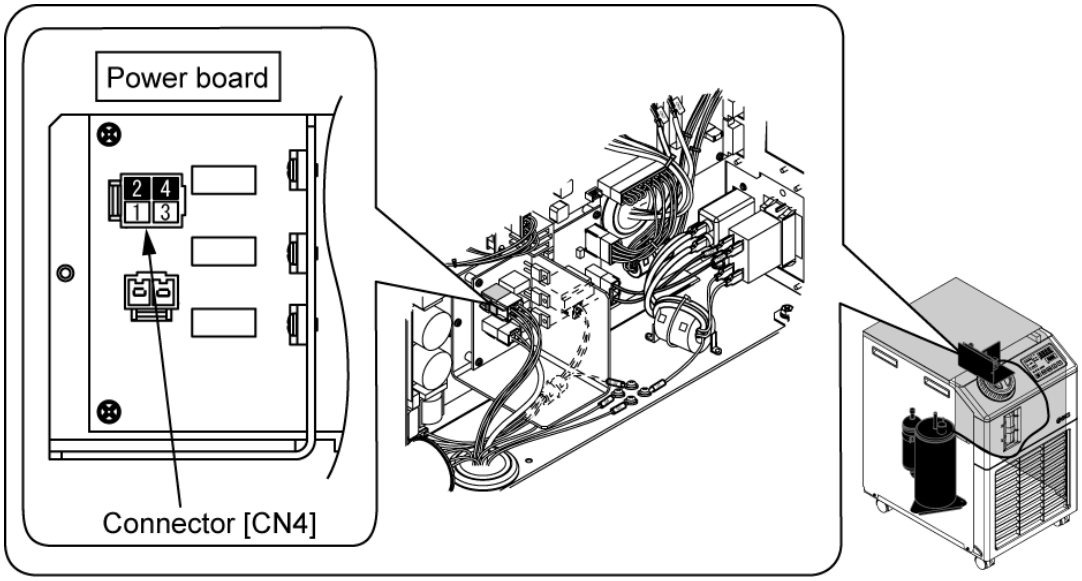


Fig. 3.3-64 Check the compressor input

9. Check the compressor.

Perform the checks after leaving the Thermo-Chiller not operating for 2 hours or more (after the compressor body temperature has decreased enough).

Disconnect the connector "CN4" of the power board to which the fan/compressor cable is connected.

Check the electricity continuity between the cable connector pin number 2 and the pin number 4 with a tester.

<Normal> Electric continuity between the cable connector pin number 2 and the pin number 4: Yes

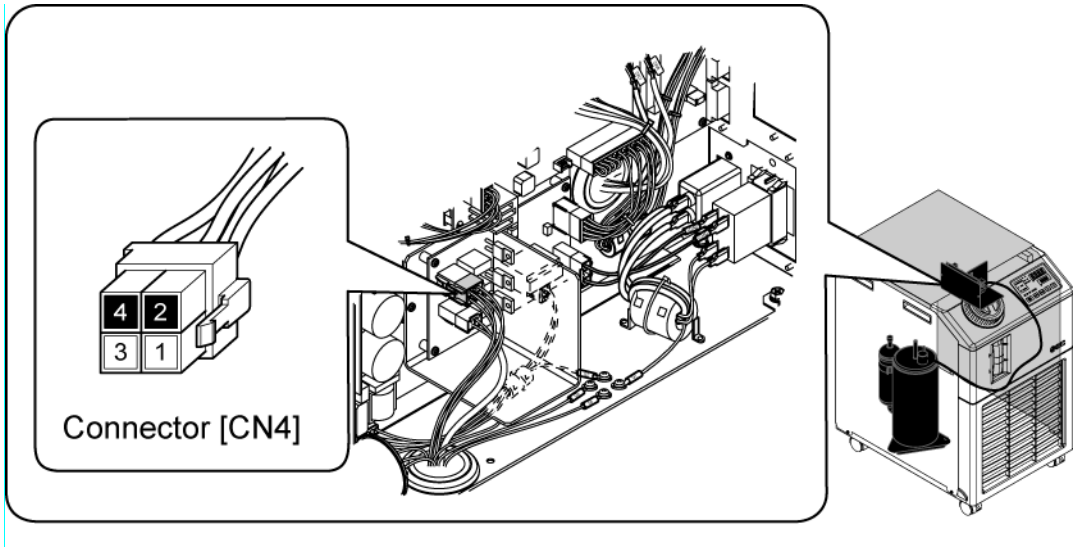
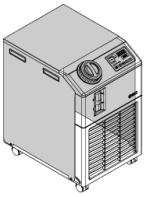


Fig. 3.3-65 Check the compressor

AL18: Compressor overload [For water-cooled type]

<Detection method> This alarm goes off when the difference between the pressure detected by the refrigerant circuit pressure sensor for high pressure and the pressure detected by the refrigerant circuit pressure sensor for low pressure is 0.1 MPa or less.



1. Check of power supply

Check if the power supply is correct.

(1) Check if the power supply is within the specified range. Measure the power supply voltage that is connected to the connector of the power supply cable to be connected to the Thermo-Chiller with a tester, and check if the power supply voltage is within the specification range.

Thermo-Chiller model: HRS□-□-10/20-□

Power supply specification

- -10 (100V spec.): Single phase 100 VAC (50/60Hz), 115 VAC (60Hz)
- -20 (200V spec.): Single phase 200 VAC to 230 VAC (50/60 Hz)

(2) Check that there is no temporary voltage drop or instantaneous power supply stop caused with the power supply.

2. Check the compressor operation.

Leave the Thermo-Chiller in an operation stop state for 2 hours or more (to decrease the temperature of the compressor body).

After starting Thermo-Chiller operation, judge if the compressor is operating with the compressor operating noise and the vibration of the compressor.

(When checking vibration, use a screwdriver to touch the compressor body. Do not touch the compressor body directly with hand as it becomes hot while it is operating.)

3. Check the facility water system.

Check that the facility water system capability satisfies the required facility water flow rate that is specified in the Operation Manual.

4. External load is out of the specification range.

Cooling capacity varies depending on the facility water temperature, set circulating fluid temperature, and power supply frequency.

Please refer to the "Cooling capacity" graph shown in the Operation Manual.

5. Facility water is contaminated.

Check that the facility water is clean (without any foreign matter or discolouration).

6. Incorrect flow rate of the facility water.

Install a flow meter and check that the facility water system satisfies the required facility water flow rate that is specified in the Operation Manual.

* Facility water does not flow when the Thermo-Chiller is not operating. Check the facility water flow rate while the external load is being applied to the Thermo-Chiller or the circulating fluid temperature is being decreased.

7. Water-cooled condenser is contaminated.

Contamination given to the water-cooled condenser reduces cooling capacity. Check the water-cooled condenser for contamination by following the instructions shown below:

(1) Remove the pipings connected to the inlet and outlet of the facility water.
(2) Remove the upper panel and the right panel.
(3) Remove the plug of the water-cooled condenser, and check inside the water-cooled condenser for contamination.

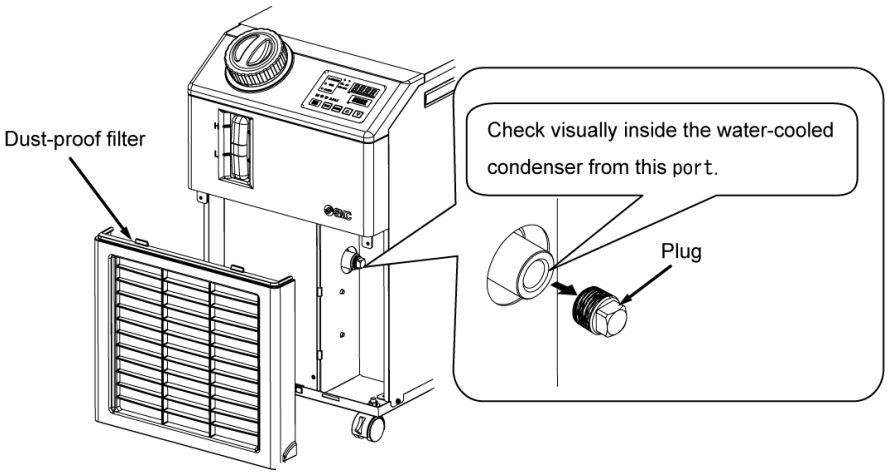


Fig. 3.3-66 The port for visual check for contamination inside the water-cooled condenser

8. Check the main board.

Check that the main board outputs signals.
Disconnect the connector "CN1" on the power board.
Perform settings of the tester to make it possible to measure 24 VDC.
Contact the negative side probe to the connector pin number 7 on the cable side of the "CN1" that has been removed, and contact the positive side probe to the pin number 8.
Operate the Thermo-Chiller (by pressing "RUN/STOP" key), and heck the voltage between the cable connectors number 7 and number 8.
<Normal> Between pin numbers 7 and 8: 24 VDC

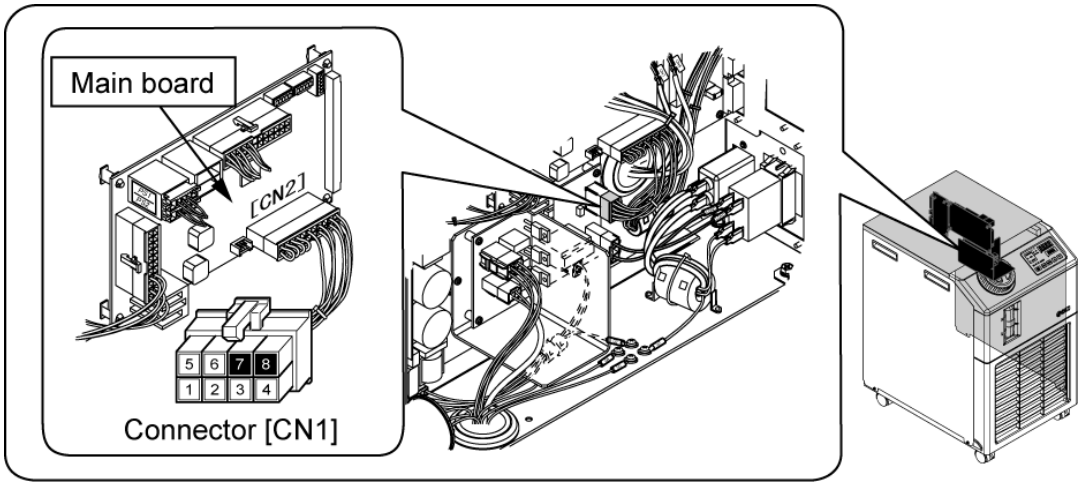


Fig. 3.3-67 Check the compressor signal output

9. Check the power board.

Check that the power is being supplied to the compressor.

Disconnect the connector "CN4" of the power board to which the fan/compressor cable is connected.

Operate the Thermo-Chiller (by pressing "RUN/STOP" key), and check if power supply voltage is supplied to the pins number 2 to number 4 of the "CN4" connector on the power board with a tester.

[Power supply voltage to be supplied]

- -10 (100V spec.): Single phase 100 VAC (50/60Hz), or 115 VAC (60Hz)
- -20 (200V spec.): Single phase 200 VAC to 230 VAC (50/60 Hz)

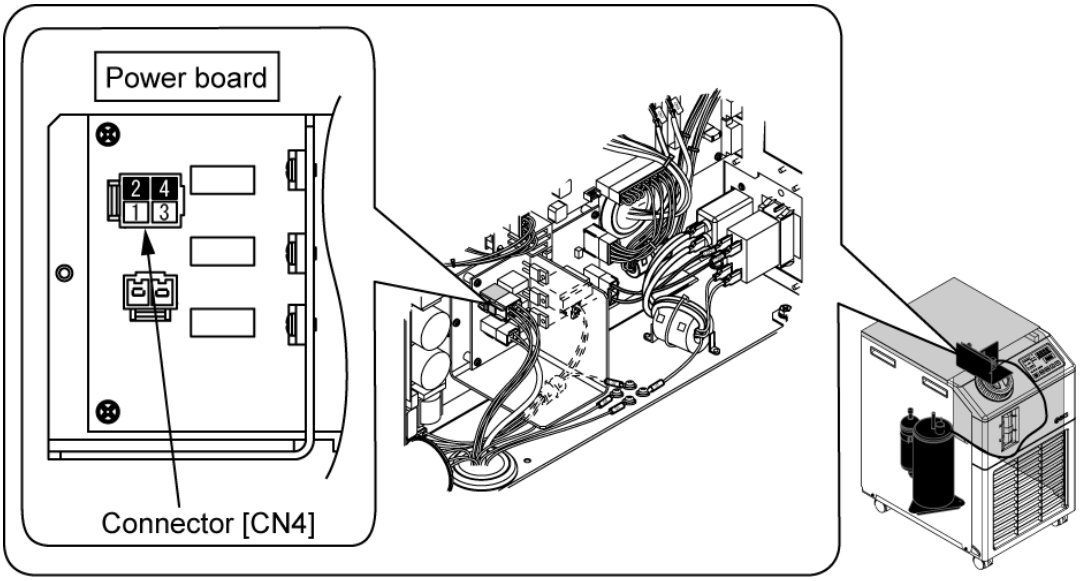


Fig. 3.3-68 Check the compressor input

10. Check the compressor.

Perform the checks after leaving the Thermo-Chiller not operating for 2 hours or more (after the compressor body temperature has decreased enough).

Disconnect the connector "CN4" of the power board to which the fan/compressor cable is connected.

Check the electricity continuity between the cable connector pin number 2 and the pin number 4 with a tester.

<Normal> Electric continuity between the cable connector pin number 2 and the pin number 4: Yes

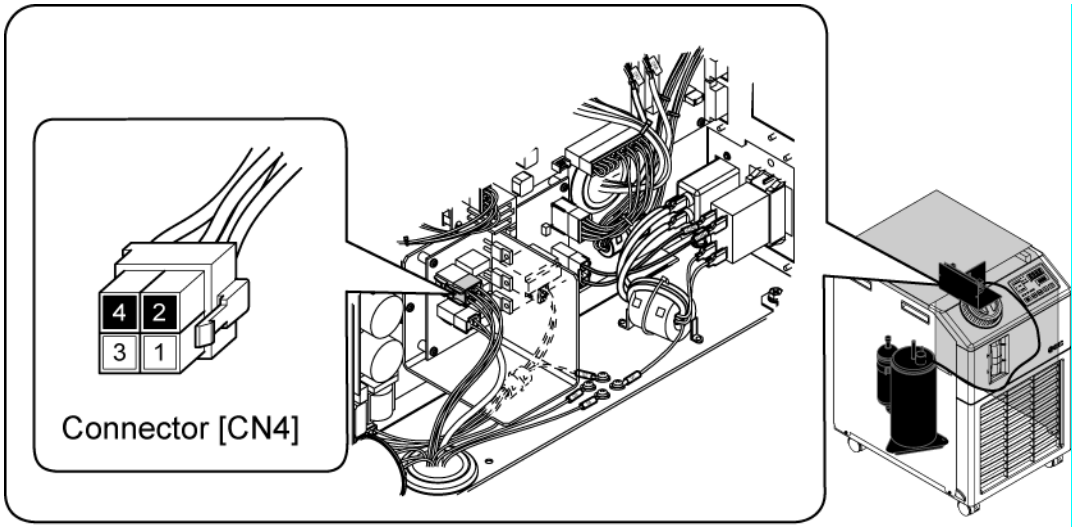
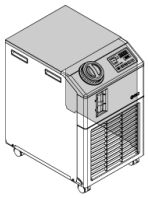
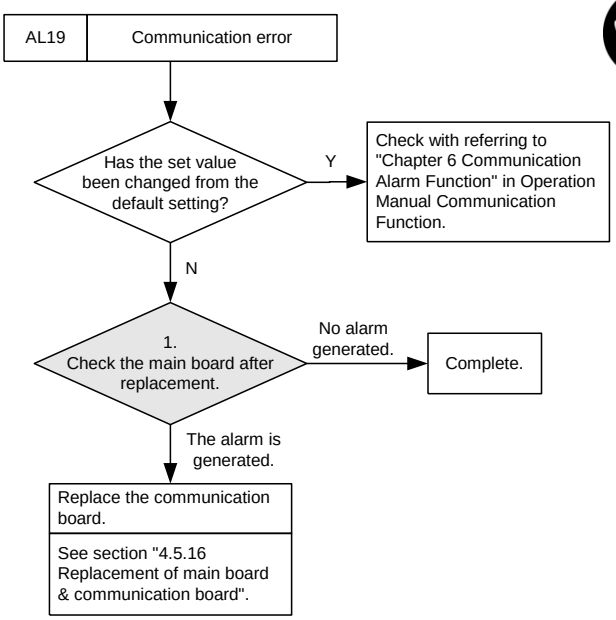


Fig. 3.3-69 Check the compressor

AL19: Communication error

<Detection method> This alarm goes off when no request messages have been received from the host computer for a specific period of time.





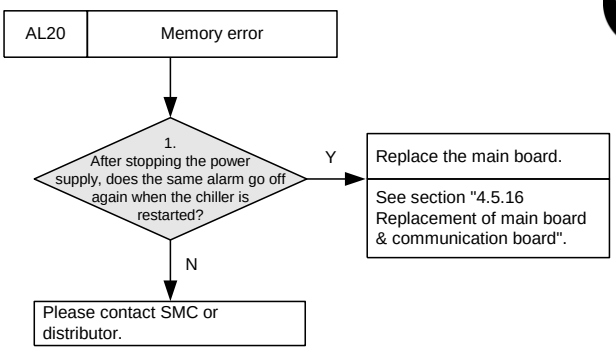
1. Check the main board after replacement.

Replace the main board with a new one. (See section "4.5.16 Replacement of main board & communication board")

After replacement, check if the alarm goes off again.

AL20: Memory error

<Detection method> This alarm goes off when the written data to the CPU and the read data do not match.

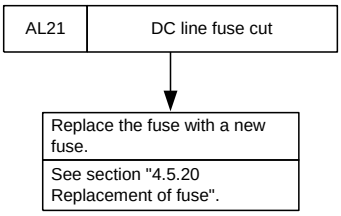


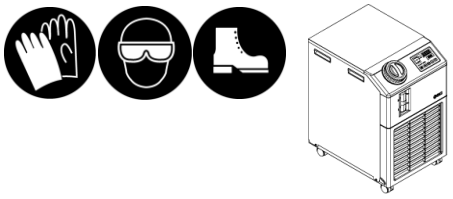
1. After stopping power supply, check for the same alarm goes off again when the chiller is re-started.

After stopping power supply (by tuning off the power supply switch on the Thermo-Chiller), check if the same alarm goes off again when the Thermo-Chiller is restarted.

AL21: DC line fuse cut

<Detection method> This alarm goes off when the fuse in the DC circuit of the contact I/O communication connector blows.



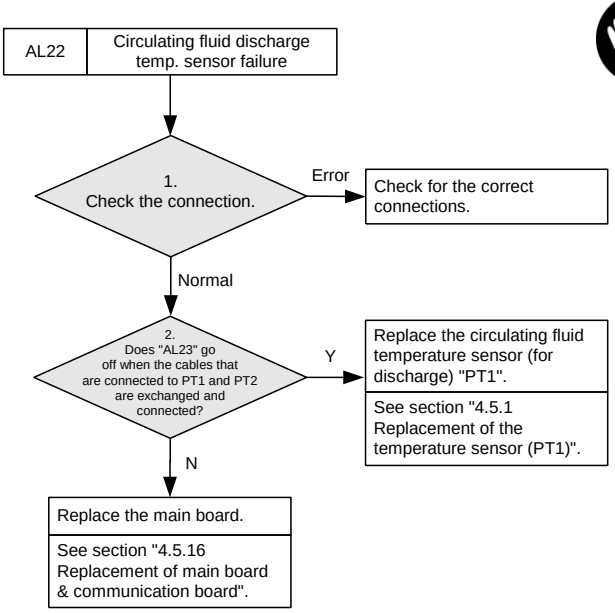


[Remarks]

- It is necessary to replace the fuse to reset the alarm.
- When AL21 is generated the Thermo-Chiller is stop as default setting. Although DC circuit cannot be used (the alarm cannot be reset), it is possible to continue the Thermo-Chiller operation even when the AL21 is being generated by changing setting of the "AS.15" in the Alarm Setting Menu. (Refer to the section “Alarm Customizing Function” in Operation Manual for details.)

AL22: Circulating fluid discharge temp. sensor failure

<Detection method> This alarm goes off when the circulating fluid temperature sensor (for discharge) detects temperature that is outside of -80 to 120 ^{o}C range.



1. Check the connection

Check the circulating fluid temperature sensor (for discharge) "PT1" that is connected to the main board for the items shown below:

(1) The connector is securely connected.

(2) The pins are securely inserted and there is no defective crimping. Check for the correct connection by lightly pulling the cable.

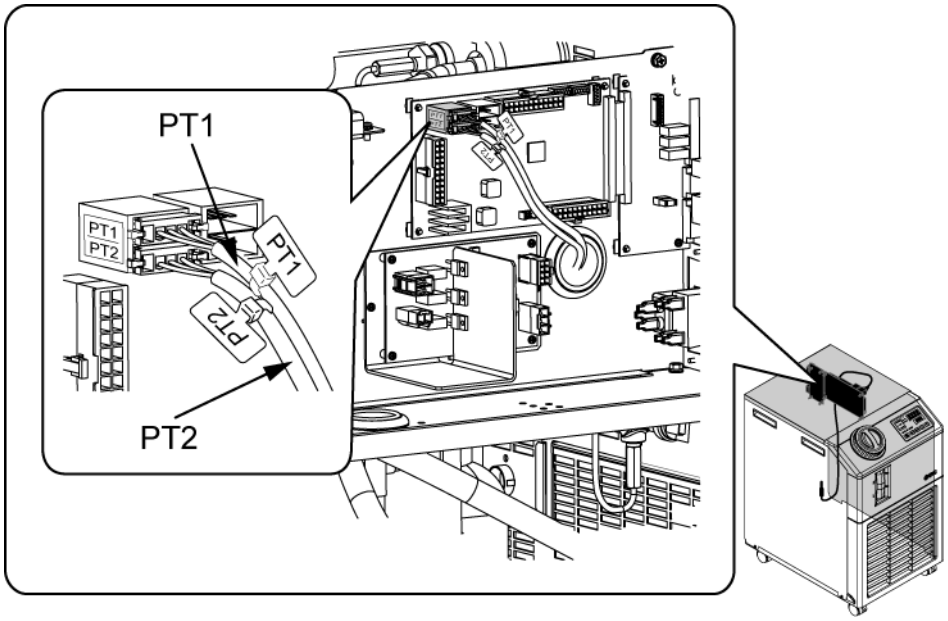


Fig. 3.3-70 Check for the correct connection of PT1

2. "AL23" goes off when the cables that are connected to PT1 and PT2 are exchanged and connected.

Perform checking with the Thermo-Chiller not operating. Check if "AL22" is reset and "AL23" is generated by taking the following instructions:

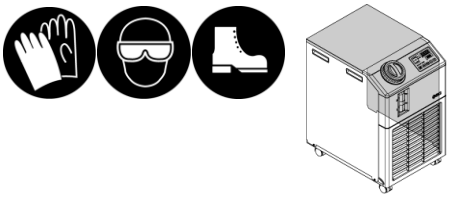
(1) Exchange the inserting position of the connector "PT1" for circulating fluid temperature sensor (for discharge) and the connector "PT2" for circulating fluid temperature sensor (for return).

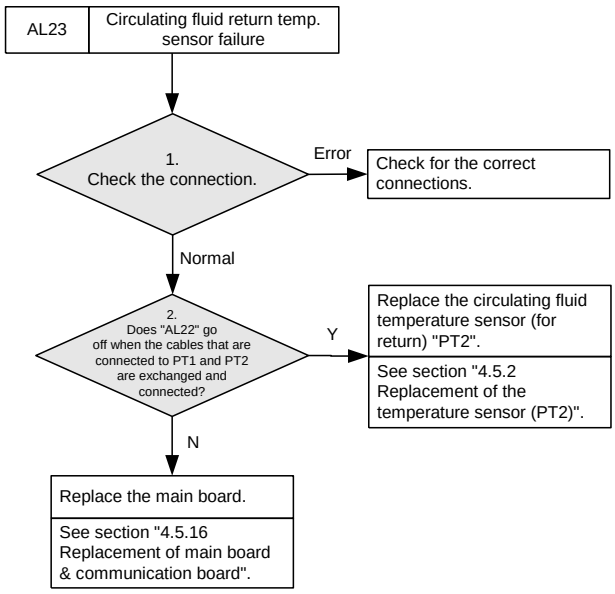
(2) Reset the alarm.

(3) Check if the cables inserting position exchange resets "AL22" and generates "AL23".

AL23: Circulating fluid return temp. sensor failure

<Detection method> This alarm goes off when the circulating fluid temperature sensor (for return) detects temperature that is outside of -80 to 120 °C range.





1. Check the connection

Check the circulating fluid temperature sensor (for return) "PT2" that is connected to the main board for the items shown below:

(1) The connector is securely connected.

(2) The pins are securely inserted and there is no defective crimping. Check for the correct connection by lightly pulling the cable.

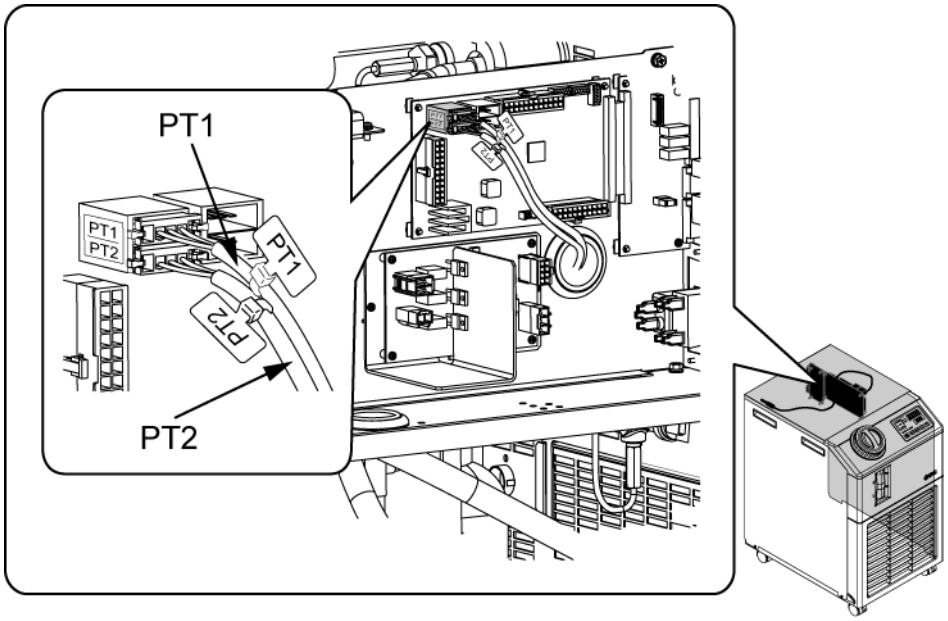


Fig. 3.3-71 Check for the correct connection of PT2

2. "AL22" goes off when the cables that are connected to PT1 and PT2 are exchanged and connected.

Perform checking with the Thermo-Chiller not operating. Check if "AL23" is reset and "AL22" is generated by taking the following instructions:

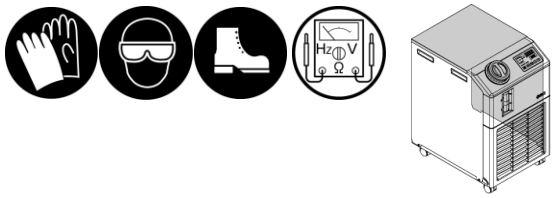
(1) Exchange the inserting position of the connector "PT1" for circulating fluid temperature sensor (for discharge) and the connector "PT2" for circulating fluid temperature sensor (for return).

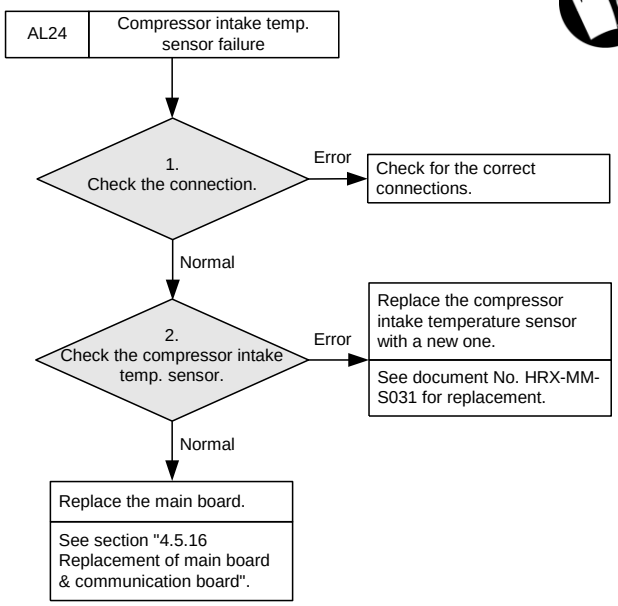
(2) Reset the alarm.

(3) Check if the cables inserting position exchange resets "AL23" and generates "AL22".

AL24: Compressor intake temp. sensor failure

<Detection method> This alarm goes off when the compressor intake temperature sensor detects temperature that is outside of -40 to 120 °C range.





1. Check the connection

Check the compressor intake temperature sensor "T1" (thermistor sensor) that is connected to the connector "CN4", pin numbers from 7 to 19, of the main board for the check points shown below:

(1) The connector "CN4" is securely connected.

(2) The pins of the compressor intake temperature sensor "T1" (with black lead wire) are securely inserted and there is no defective crimping. Check for the correct connection by lightly pulling the cable.

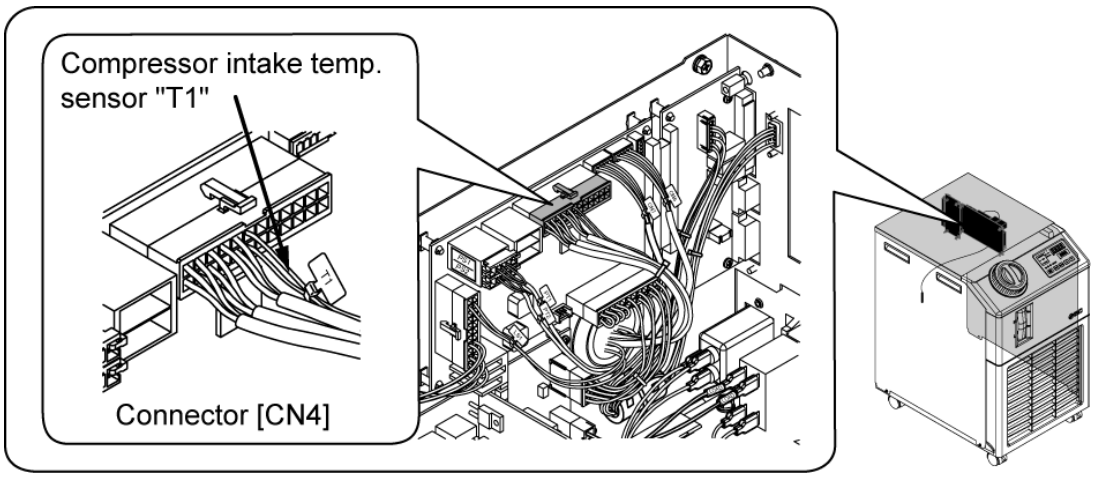


Fig. 3.3-72 Check the connection of the compressor intake temperature sensor

2. Check the compressor intake temperature sensor.

Disconnect the connector "CN4" of the main board. Check the resistance of the pins number 7 to 19 (compressor intake temperature sensor) of the remove cable side connector by following the instructions shown below:

(1) Leave the Thermo-Chiller not operating for 24 hours. (Make the temperature of the refrigerant circuit the same as the ambient temperature.)

(2) Measure the ambient temperature.

(3) Disconnect the connector "CN4" of the main board, and measure the resistance between the pin number 7 and the pin number 19 to which the compressor intake temperature sensor is connected with a tester.

(4) Check that the resistance and the ambient temperature detected by the tester almost match the resistances and ambient temperatures shown in Table 3-7 Resistances detected by thermistor sensor (Reference). If there is a difference of +/- 5 ^{o}C or more in the temperatures, it is judged to be abnormal.

(AL24 is generated when the temperature reaches -40 ^{o}C or less (resistance: 43.34 kΩ or more) or 70 ^{o}C or more (0.4895 kΩ or less). When the resistance is 43.34 kΩ or more or 0.4895 kΩ or less, the sensor is judged to have failure.)

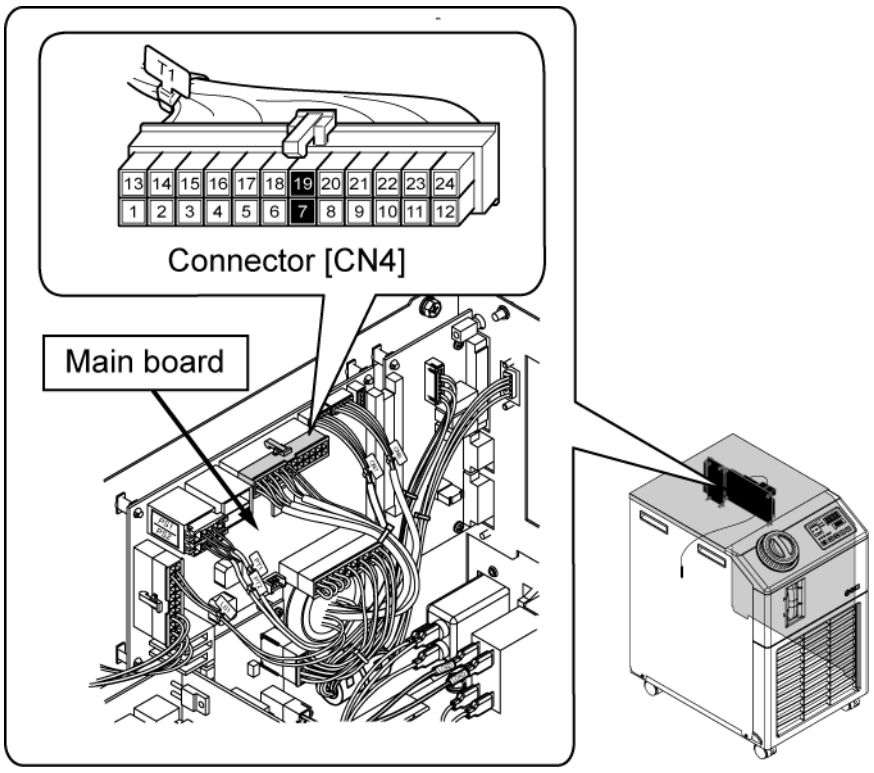


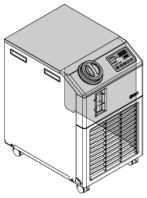
Fig. 3.3-73 Check the resistance of the compressor intake temperature sensor

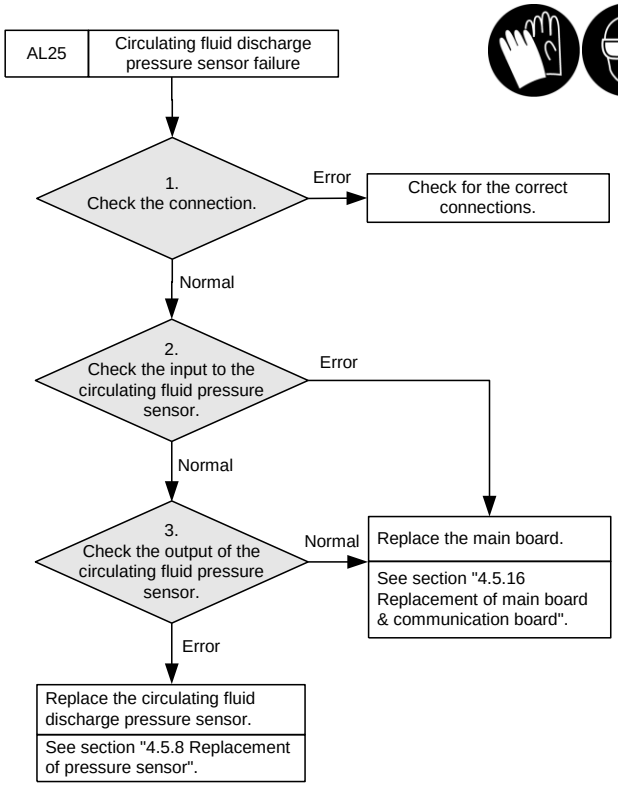
Table 3-7 Thermistor sensor resistance (Reference)

Temperature °C	Criterion kΩ	Temperature °C	Criterion kΩ	Temperature °C	Criterion kΩ
-40.0	43.34	0.0	6.000	40.0	1.274
-39.0	40.98	1.0	5.746	41.0	1.231
-38.0	38.76	2.0	5.503	42.0	1.190
-37.0	36.68	3.0	5.273	43.0	1.150
-36.0	34.72	4.0	5.053	44.0	1.111
-35.0	32.87	5.0	4.844	45.0	1.075
-34.0	31.14	6.0	4.645	46.0	1.039
-33.0	29.51	7.0	4.455	47.0	1.005
-32.0	27.97	8.0	4.273	48.0	0.9724
-31.0	26.53	9.0	4.100	49.0	0.9409
-30.0	25.17	10.0	3.935	50.0	0.9106
-29.0	23.88	11.0	3.778	51.0	0.8814
-28.0	22.67	12.0	3.628	52.0	0.8532
-27.0	21.53	13.0	3.485	53.0	0.8261
-26.0	20.45	14.0	3.348	54.0	0.8000
-25.0	19.43	15.0	3.217	55.0	0.7749
-24.0	18.47	16.0	3.092	56.0	0.7507
-23.0	17.57	17.0	2.972	57.0	0.7273
-22.0	16.71	18.0	2.858	58.0	0.7048
-21.0	15.90	19.0	2.749	59.0	0.6832
-20.0	15.13	20.0	2.644	60.0	0.6622
-19.0	14.41	21.0	2.545	61.0	0.6421
-18.0	13.72	22.0	2.449	62.0	0.6226
-17.0	13.07	23.0	2.358	63.0	0.6038
-16.0	12.46	24.0	2.270	64.0	0.5857
-15.0	11.88	25.0	2.186	65.0	0.5683
-14.0	11.33	26.0	2.106	66.0	0.5514
-13.0	10.80	27.0	2.029	67.0	0.5351
-12.0	10.31	28.0	1.955	68.0	0.5194
-11.0	9.838	29.0	1.885	69.0	0.5042
-10.0	9.392	30.0	1.817	70.0	0.4895
-9.0	8.969	31.0	1.752		
-8.0	8.568	32.0	1.690		
-7.0	8.187	33.0	1.630		
-6.0	7.825	34.0	1.573		
-5.0	7.481	35.0	1.518		
-4.0	7.154	36.0	1.465		
-3.0	6.844	37.0	1.414		
-2.0	6.548	38.0	1.366		
-1.0	6.267	39.0	1.319		
0.0	6.000	40.0	1.274		

AL25: Circulating fluid discharge pressure sensor failure

<Detection method> This alarm goes off when the pressure detected by the circulating fluid pressure sensor (for discharge) is out of -0.33 to 1.5 MPa range.





1. Check the connection

Check the circulating fluid pressure sensor (for discharge) that is connected to the connector "CN4", pin numbers 8, 20, and 21 of the main board for the check points shown below:

(1) The connector "CN4" is securely connected.

(2) Pin numbers 8, 20, and 21 of the circulating fluid pressure sensor (for discharge) "PS1 are securely inserted and there is no defective crimping. Check for the correct connection by lightly pulling the cable.

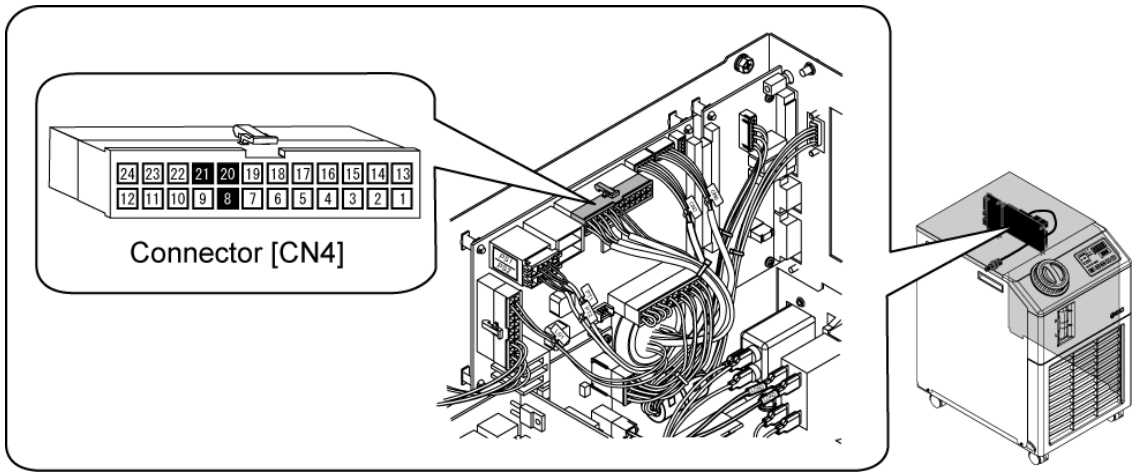


Fig. 3.3-74 Check the connection of the circulating fluid pressure sensor

2. Check the input to the circulating fluid pressure sensor.

Check that the power is supplied to the circulating fluid pressure sensor (for discharge).
Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

Contact the positive probe to the pin number 21 and contact the negative probe to the pin number 20 of the "CN4" connector.
<Normal> Pin number 21 - Pin number 20: Voltage should be 24 VDC.

3. Check the output of the circulating fluid pressure sensor.

Find which has a problem, the circulating fluid pressure sensor (for discharge) or the main board.
Follow the instructions shown below:

(1) Perform checking with the Thermo-Chiller not operating.

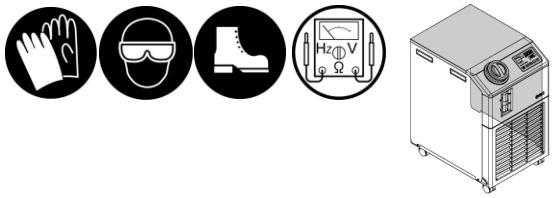
(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

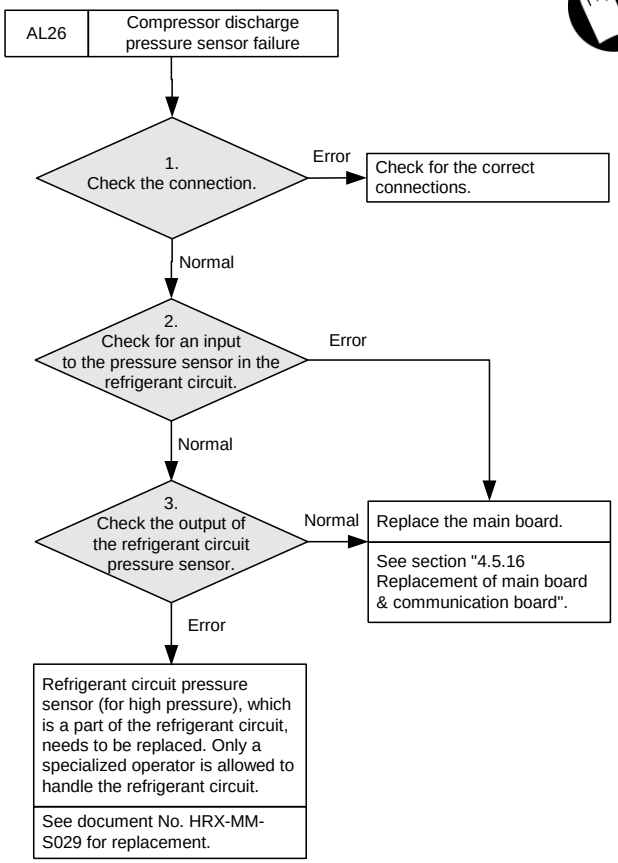
(3) Contact the positive probe to the pin number 8 and contact the negative probe to the pin number 20 of the "CN4" connector.

(4) Check that the voltage between the pin number 8 and the pin number 20 is in the range shown below:
<Normal> Between pin numbers 8 and 20: 1 VDC +/- 0.2 V

AL26: Compressor discharge pressure sensor failure

<Detection method> This alarm goes off when the pressure detected by the refrigerant circuit pressure sensor (for high pressure) is out of the -0.33 to 3.0 MPa range.





1. Check the connection

Check the refrigerant circuit pressure sensor (for high pressure) that is connected to the connector "CN4", pin numbers 10, 11, and 22 of the main board for the check points shown below:

(1) The connector "CN4" is securely connected.

(2) Pin numbers 10, 11, and 22 of the refrigerant circuit pressure sensor (for high pressure) "PS2" are securely inserted and there is no defective crimping. Check for the correct connection by lightly pulling the cable.

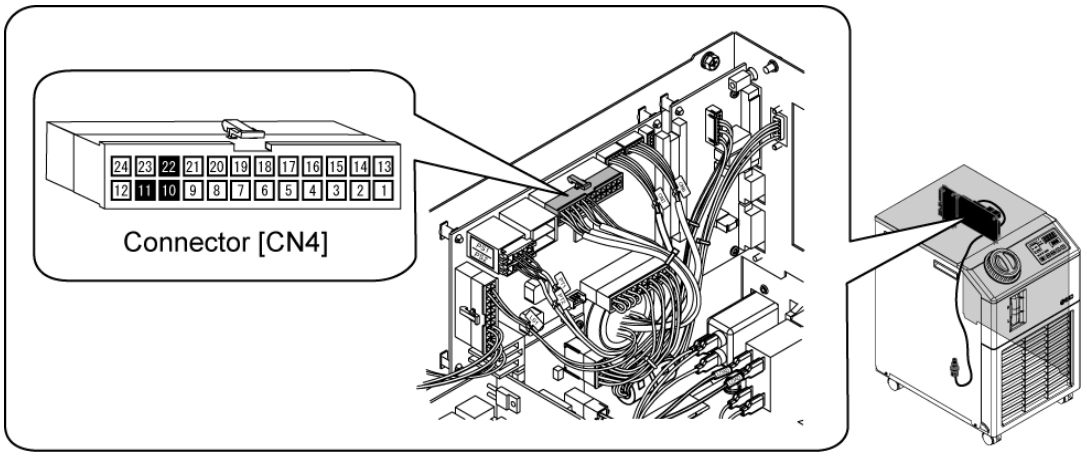


Fig. 3.3-75 Check connection of the refrigerant circuit pressure sensor (for high pressure)

2. Check for an input to the pressure sensor in the refrigerant circuit.

Check that the power is supplied to the refrigerant circuit pressure sensor (high pressure).
Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

Contact the positive probe to the pin number 22 and contact the negative probe to the pin number 10 of the "CN4" connector.
<Normal> Pin number 22 - Pin number 10: Voltage should be 5 VDC +/- 1V

3. Check the output of the refrigerant circuit pressure sensor.

Find which has a problem, the refrigerant circuit pressure sensor (for high pressure) or the main board.
Follow the instructions shown below:

(1) Perform checking with the Thermo-Chiller not operating.

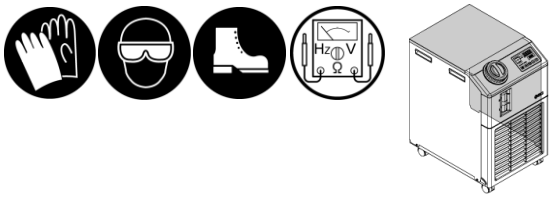
(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

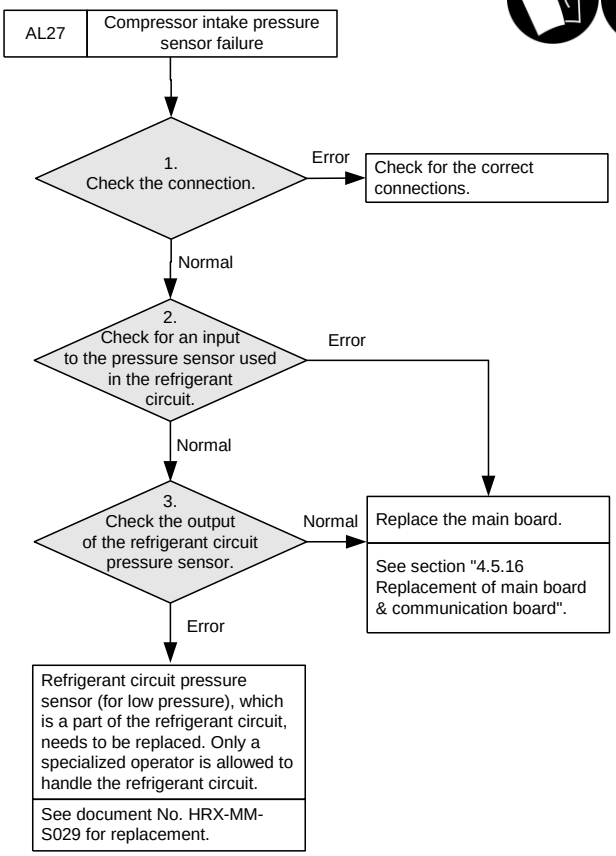
(3) Contact the positive probe to the pin number 11 and contact the negative probe to the pin number 10 of the "CN4" connector.

(4) Check that the voltage between the pin number 10 and the pin number 11 is in the range shown below:
<Normal> Between pin numbers 10 and 11: 0.5 to 4.5 VDC +/- 0.2 V

AL27: Compressor intake pressure sensor failure

<Detection method> This alarm goes off when the pressure detected by the refrigerant circuit pressure sensor (for low pressure) is out of the -0.20 to 3.0 MPa range.





1. Check the connection.

Check the refrigerant circuit pressure sensor (for low pressure) that is connected to the connector "CN4", pin numbers 12, 23, and 24 of the main board for the check points shown below:

(1) The connector "CN4" is securely connected.

(2) Pin numbers 12, 23, and 24 of the refrigerant circuit pressure sensor (for low pressure) "PS3" are securely inserted and there is no defective crimping. Check for the correct connection by lightly pulling the cable.

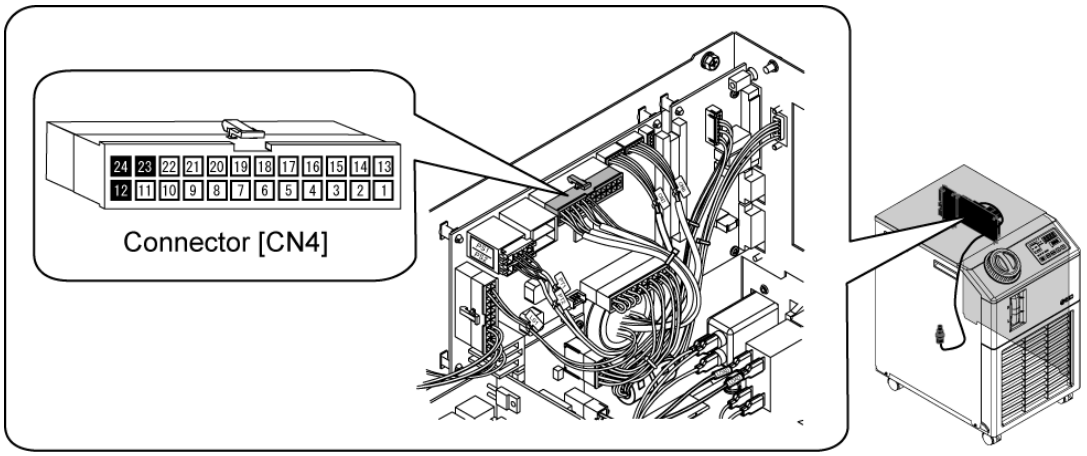


Fig. 3.3-76 Check connection of the refrigerant circuit pressure sensor (for low pressure)

2. Check for an input to the pressure sensor in the refrigerant circuit.

Check that the power is supplied to the refrigerant circuit pressure sensor (low pressure).
Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

Contact the positive probe to the pin number 24 and contact the negative probe to the pin number 12 of the "CN4" connector.
<Normal> Pin number 24 - Pin number 12: Voltage should be 5 VDC +/- 1V

3. Check the output of the refrigerant circuit pressure sensor.

Find which has a problem, the refrigerant circuit pressure sensor (for low pressure) or the main board.
Follow the instructions shown below:

(1) Perform checking with the Thermo-Chiller not operating.

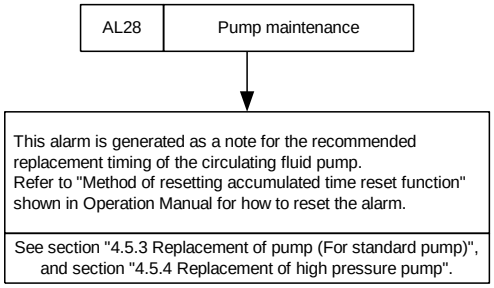
(2) Check voltage by contacting the probe of the tester directly to the connector external surface with the "CN4" connector of the main board being inserted.

(3) Contact the positive probe to the pin number 23 and contact the negative probe to the pin number 12 of the "CN4" connector.

(4) Check that the voltage between the pin number 23 and the pin number 12 is in the range shown below:
<Normal> Between pin numbers 23 and 12: 0.5 to 4.5 VDC +/- 0.2 V

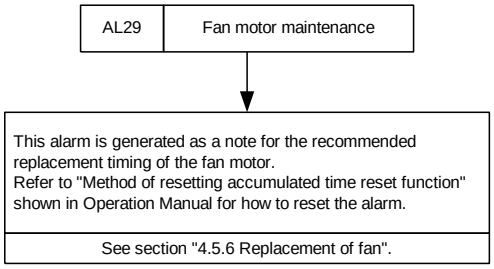
AL28: Maintenance of pump

<Detection method> This alarm goes off when the accumulated operating time of the pump reaches 20,000 hours.



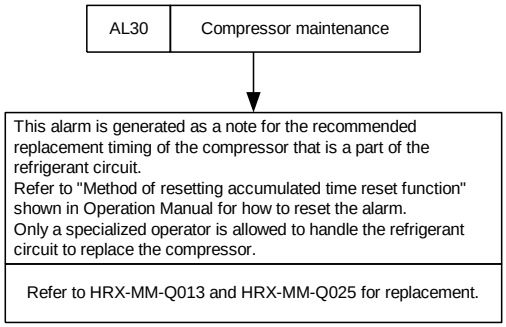
AL29: Maintenance of fan motor [For air-cooled type]

<Detection method> This alarm goes off when the accumulated operating time of the fan motor reaches 20,000 hours.



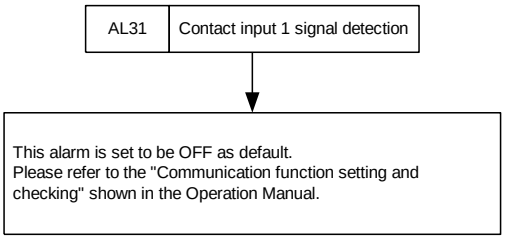
AL30: Maintenance of compressor

<Detection method> This alarm goes off when the accumulated operating time of the compressor reaches 50,000 hours.



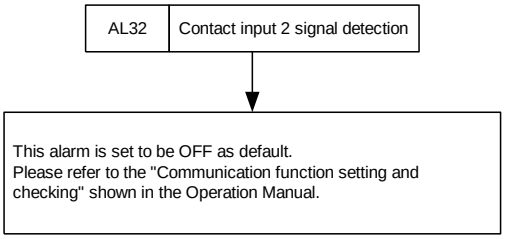
AL31: Contact input1 signal detection

<Detection method> This alarm goes off when a contact input is detected.



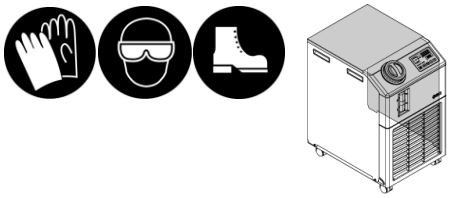
AL32: Contact input 2 signal detection

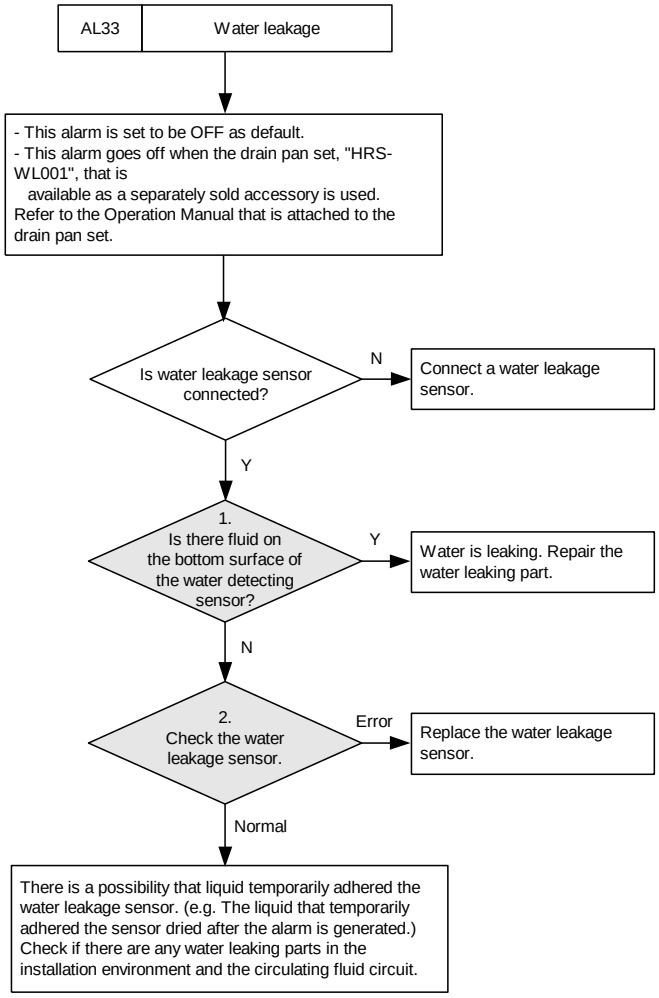
<Detection method> This alarm goes off when a contact input is detected.



AL33: Water leakage

<Detection method> This alarm goes off when the water leakage sensor detects water leakage.





1. Liquid remains on the bottom surface of the water detecting sensor.

There is a leakage sensing part on the bottom surface of the water leakage sensor, and if liquid contacts there, the water leakage sensor operates. Check if there is any liquid sticking to it.

2. Check the water leakage sensor.

Check the operation of the water leakage sensor following the instructions shown below:

(1) If any liquid adheres on the bottom surface (the sensing part) of the water leakage sensor, wipe it off with waste cloth, etc.

(2) Check that the indicator of the water leakage sensor turns green.

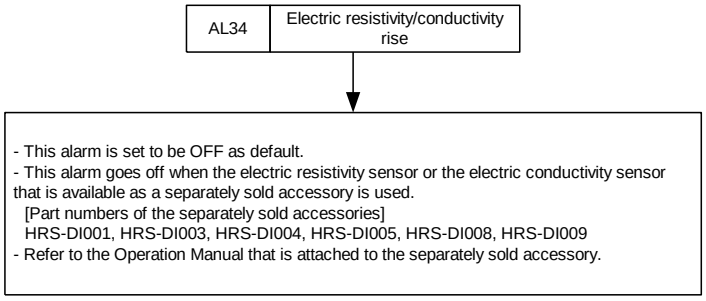
(3) Reset the alarm of the Thermo-Chiller and confirm that AL33 is reset.

(4) Put some water onto the bottom surface of the water leakage sensor to check if AL33 is generated.

(5) If AL33 is generated when the procedures 1 to 4 are taken, the water leakage sensor is judged to be operating normally.
If the indicator does not turn ON or the indicator light does not change from red, the water leakage sensor operation is judged to abnormal.

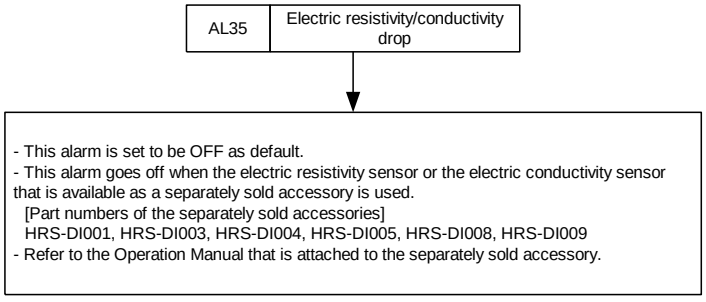
AL34: Electric resistivity/conductivity rise

<Detection method> This alarm goes off when the value detected by the electric resistivity sensor or the electric conductivity sensor exceeds the set value.



AL35: Electric resistivity/conductivity drop

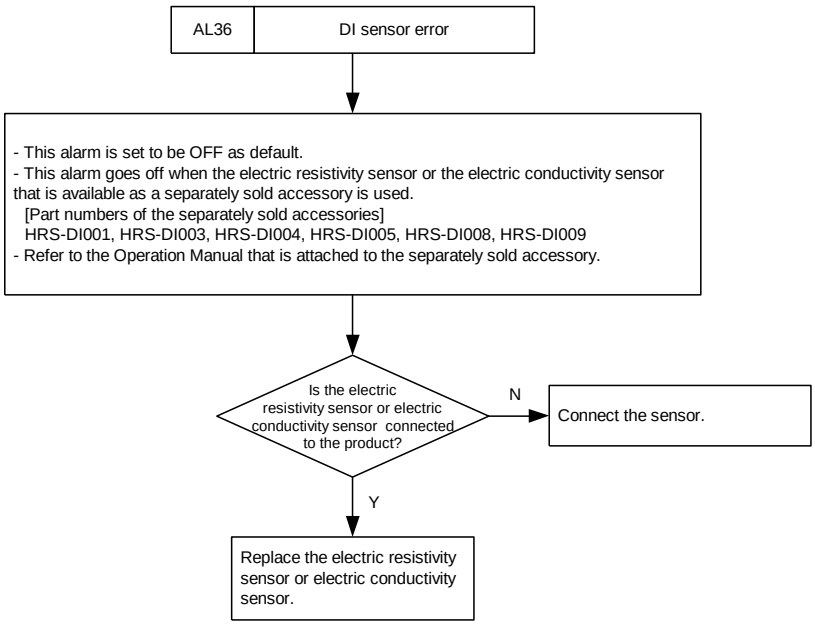
<Detection method> This alarm goes off when the value detected by the electric resistivity sensor or the electric conductivity sensor is lower than the set value.



AL36: DI sensor error

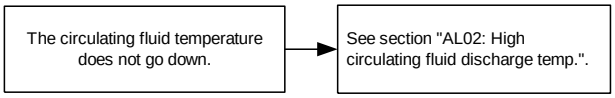
<Detection method> This alarm goes off when the value detected by the electric resistivity sensor is out of -0.6 to 5.6 MΩ range.

The value detected by the electric resistivity sensor is out of -6.2 to 56.2 MΩ range.

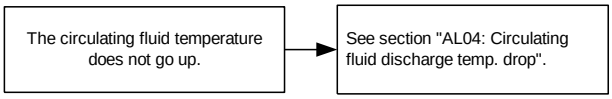


3.3.5 Troubleshooting of errors without alarm generation

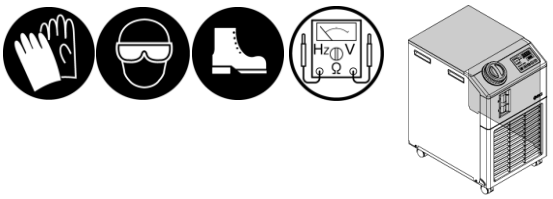
The circulating fluid temperature does not go down

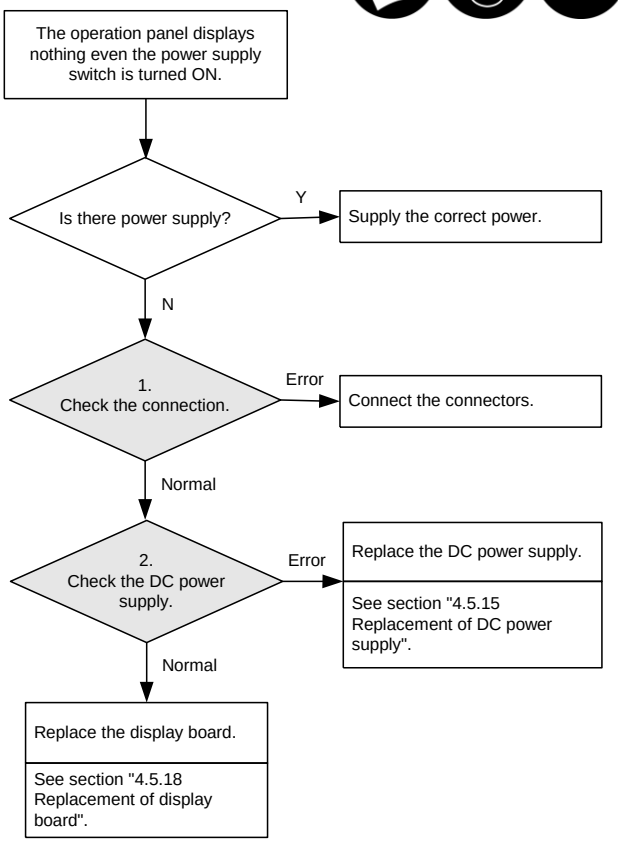


The circulating fluid temperature does not go up



The operation panel displays nothing





1. Check the connection.

Check that the connector "CN1" of the display board is connected.

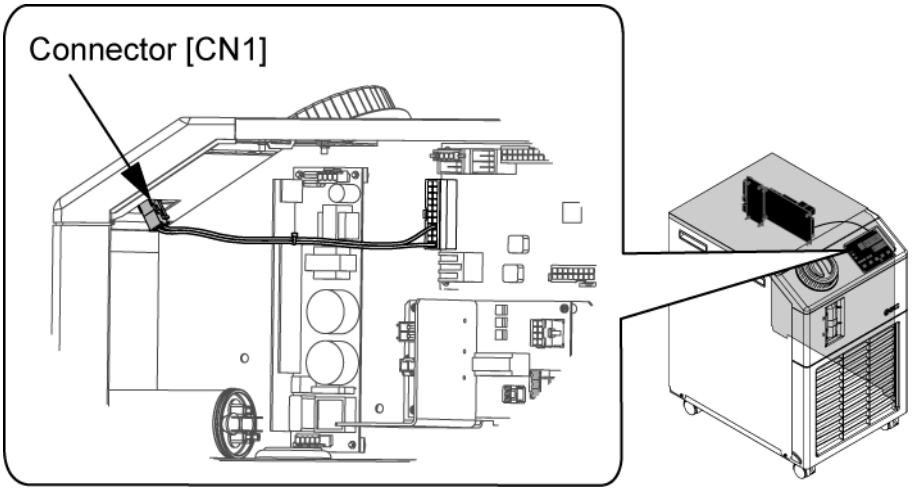


Fig. 3.3-77 Check connection of the display board

2. Check the DC power supply.

Follow the instructions shown below to check that 24 VDC is being output from the DC power supply.

(1) With the DC power supply connector "CN2" connected, directly contact the probe of the tester with the pins from outside of the connectors.

(2) Contact the negative probe to the pin number 1 and contact the positive probe to the pin number 3 of the "CN2" connector, and measure the DC voltage output.
<Normal> 24 VDC is being output.

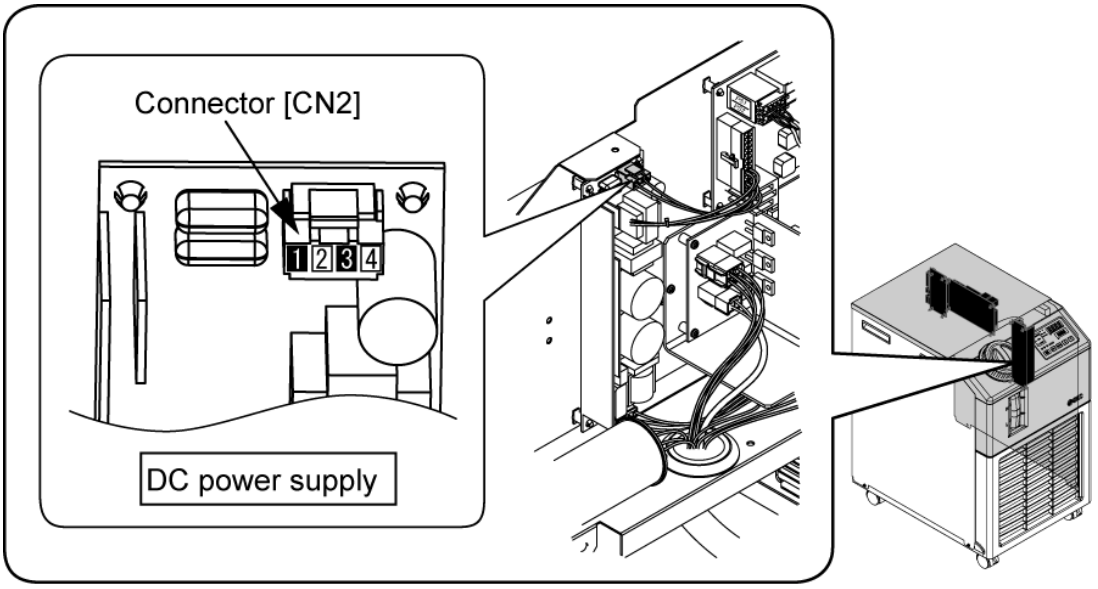
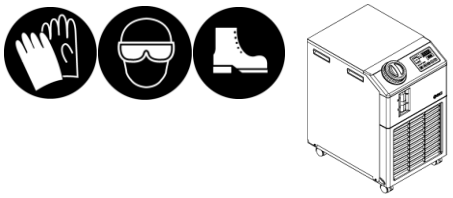
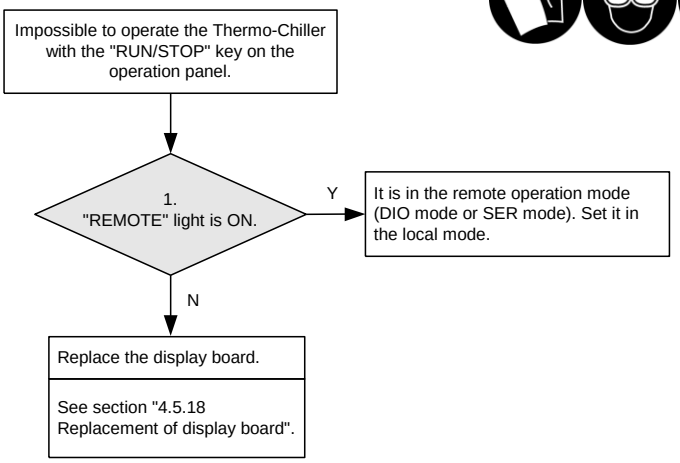


Fig. 3.3-78 Check the DC power supply output

Impossible to operate the Thermo-Chiller with the "RUN/STOP" key on the operation panel





1. "REMOTE" light is ON.

Check if the "REMOTE" light on the operation panel is ON. If it is ON, the Thermo-Chiller is in the remote operation mode.

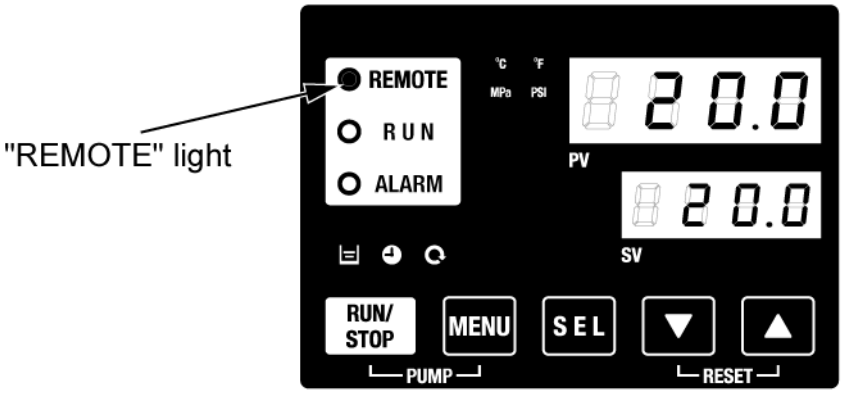
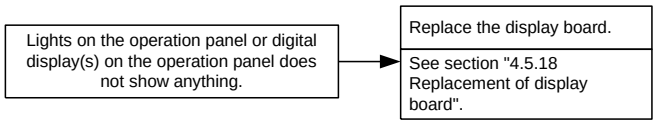
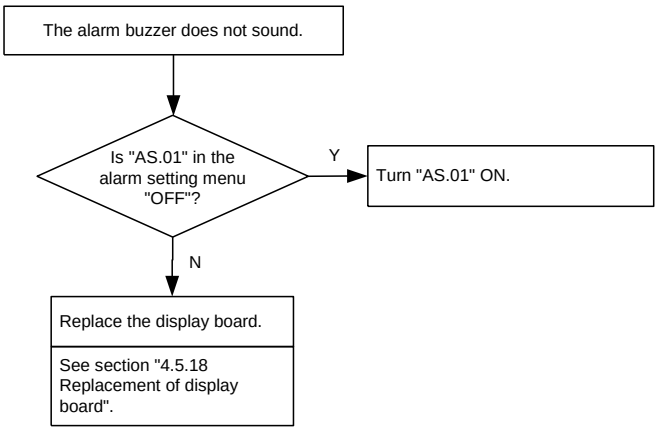


Fig. 3.3-79 Check the "REMOTE" light

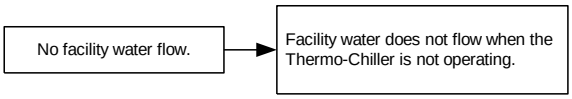
Lights on the operation panel or display(s) on the digital display does not operate



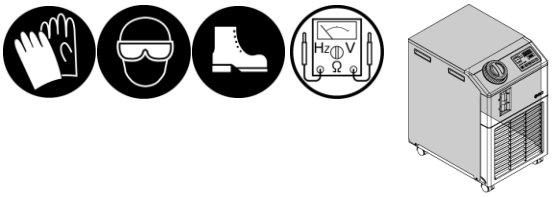
The alarm buzzer does not sound

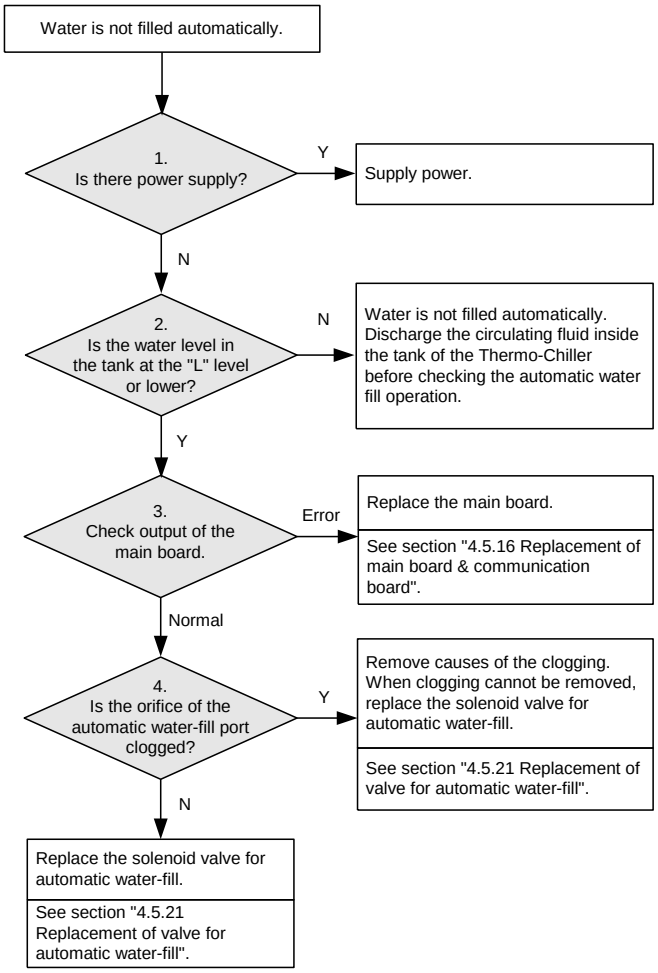


Facility water does not flow (for water-cooled type)



Automatic water fill does not operate (for Option J "Automatic water fill specification")





1. No power supply.

The solenoid valve for automatic water-fill opens when the power supply switch of the Thermo-Chiller is ON. Check that the power is being supplied to the Thermo-Chiller.

2. The water level in the tank is at the "L" level or lower.

Water is filled automatically when the water level in the tank is at "L" level or lower.

3. Check output of the main board.

Check if the power is supplied from the main board to the solenoid valve for automatic water-fill.

(1) Check it with the water level in the tank at "L" level or lower (the water level that generates "AL01: Low level in tank").

(2) With the connector "CN4" of the main board connected, directly contact the probe of the tester with the pins from outside of the connectors.

(3) Contact the negative probe to the pin number 1 and contact the positive probe to the pin number 13 of the "CN4" connector, and measure the DC voltage output.
<Normal> 24 VDC is being output.

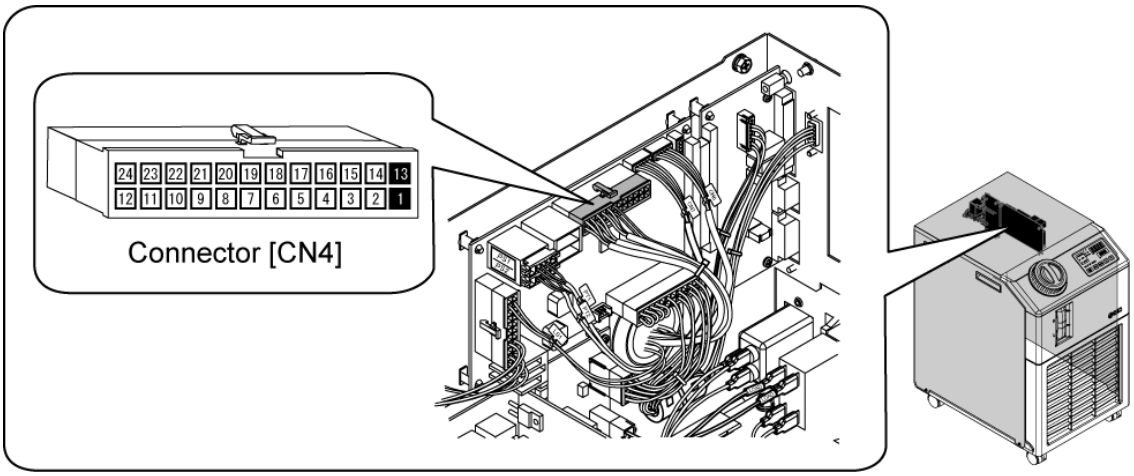


Fig. 3.3-80 Check the input of the solenoid valve for automatic water-fill

4. Orifice of the automatic water-fill port is clogged.

There is an orifice at the automatic water-fill port. Check that there is no clogging with foreign matter, etc.

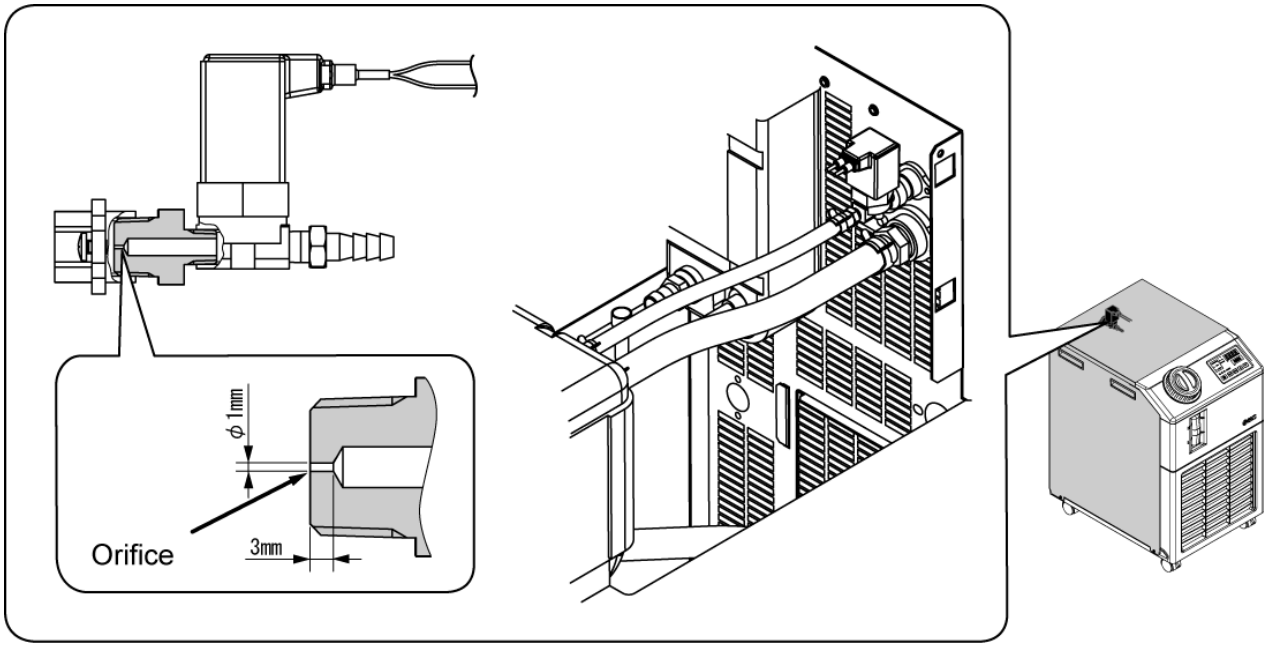


Fig. 3.3-81 Check the orifice for automatic water-fill port

Chapter 4 Service Procedure

4.1 Precautions for Whole Work

⚠ WARNING

The panel must not be removed or mounted during the operation of the product. While the product is in operation, some parts will get hot or cold and a high voltage power supply will be applied, so there is a risk of burns (or frostbite) and electric shock to the operator.

⚠ WARNING

After the product is stopped, there is still a danger of getting burnt (or frostbitten) due to residual heat. Do not start work until the product reaches normal temperature.

⚠ WARNING

Unless otherwise specified, be sure to shut off the breaker of the facility power supply (the user's machine power supply).

⚠ CAUTION

When the panel is removed or mouted, be sure to wear protective shoes and gloves to prevent injury with the edge of the panel.

4.1.1 Preparation for work

Remove the panel which covers the part to be replaced and drain the circulating fluid if necessary.

4.1.2 Check after work

After the work is completed, check the product can operate normally.

4.2 Work Procedure

4.2.1 Removal and the mounting of the panel

⚠ CAUTION

Be sure to wear protective footwear and gloves when attaching or removing panels.
Sharp edges of the panels may lead to personal injury if not handled properly.

■ Removal

1. Remove the upper panel. (Screw ×2)

2. Remove the side panel. (Screw ×each right and left 6)

3. Remove the tank lid.
Remove the front panel. (Screw ×3)

∗ Pull out the connector from the display board to remove the front panel.
After removing the tank lid, remove the O-ring at the side of the fluid inlet with a pair of tweezers.

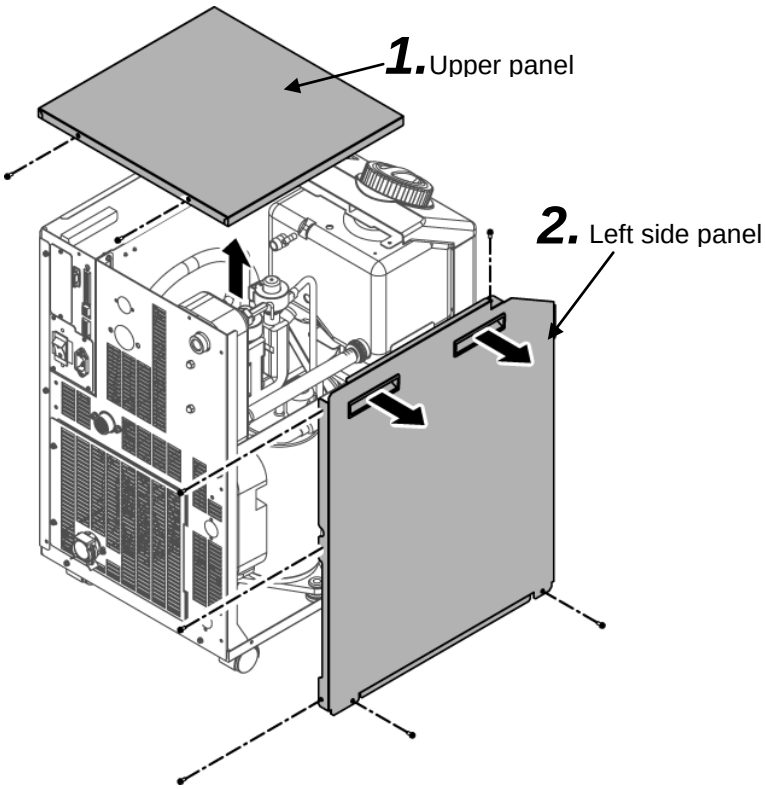


Fig. 4.2-1 Removal of panels

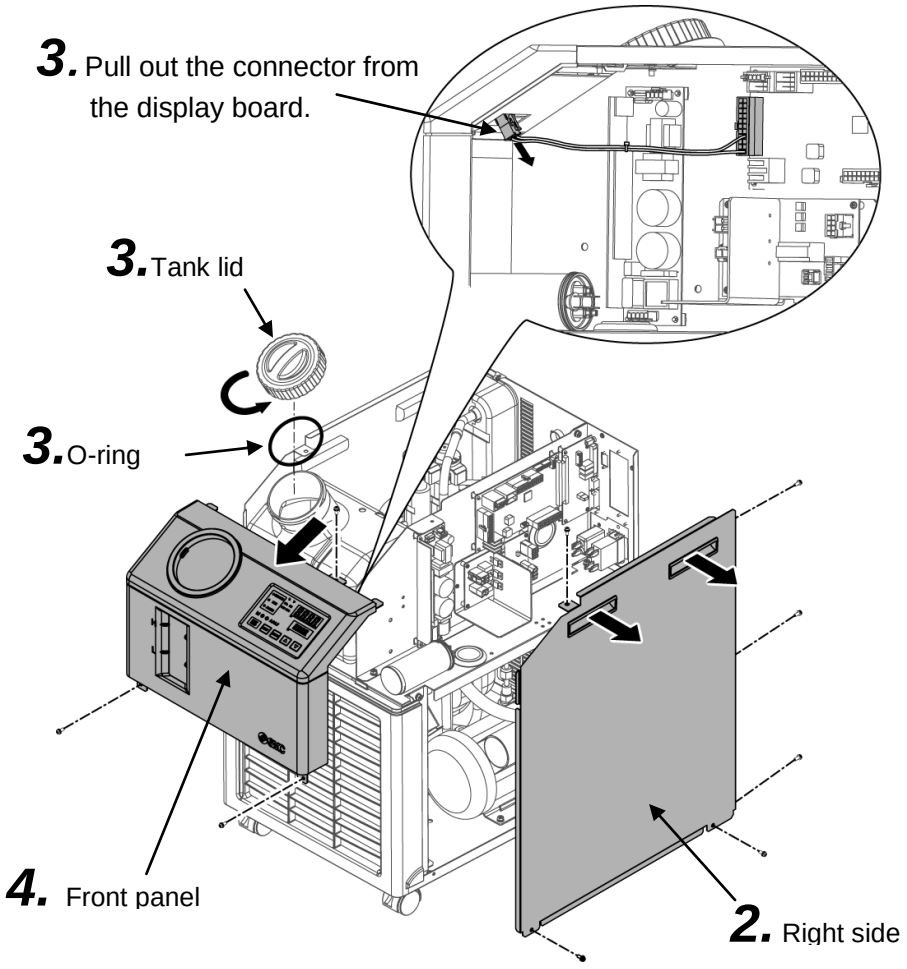


Fig. 4.2-2 Removal of panels

■ Mounting

Panel attachment is performed in inverse order of its removal.

4.2.2 Discharge of the circulating fluid and facility water

The following parts requires to discharge the circulating fluid. Follow the procedure below. Discharge the circulating fluid before the replacement.

Table 4-1 Service parts which requires the discharge of the circulating fluid.

Description	Part number
Temperature sensor	HRS-S0007
Hose (For standard pump)(For HRS012/018/024)	HRS-S0008
Hose (For standard pump)(For HRS030)	HRS-S0302
Hose (For high pressure pump MT) (For HRS012/018/024)	HRS-S0069
Hose (For high pressure pump MT) (For HRS030)	HRS-S0304
Hose (For high pressure pump T) (For HRS012/018/024)	HRS-S0077
Hose (For high pressure pump T) (For HRS030)	HRS-S0303
Level switch	HRS-S0014
Pump (For 100V type)	HRS-S0022
Pump (For 200V type)	HRS-S0066
Pump (For HRS030)	HRS-S0361
High pressure pump (For 100V type option T)	HRS-S0265
High pressure pump (For 100V type option MT)	HRS-S0266
High pressure pump (For 200V type option T) (For HRS012/018/024)	HRS-S0062
High pressure pump (For 200V type option T) (For HRS030)	HRS-S0299
High pressure pump (For 200V type option MT)	HRS-S0063
High pressure pump (For 200V type option MT) (For HRS030)	HRS-S0300
Mechanical seal set (For 100V type option T) (For HRS012/018/024)	HRS-S0390
Mechanical seal set (For 100V type option MT) (For HRS012/018/024)	HRS-S0412
Mechanical seal set (For 200V type option T, MT)	HRG-S0211
Tank	HRS-S0025
Tank (For automatic water fill)	HRS-S0072
Valve for automatic water fill	HRS-S0071

⚠ WARNING

- **Stop the customer device and release the residual pressure before discharging the circulating fluid.**
- **Before discharging the facility water, in case of water-cooled refrigerated type, stop the equipment for the facility water, or stop the facility water circuit to release the residual pressure.**

1. Place a container underneath the drain outlet.
(The capacity of the container should be approx. 10L)

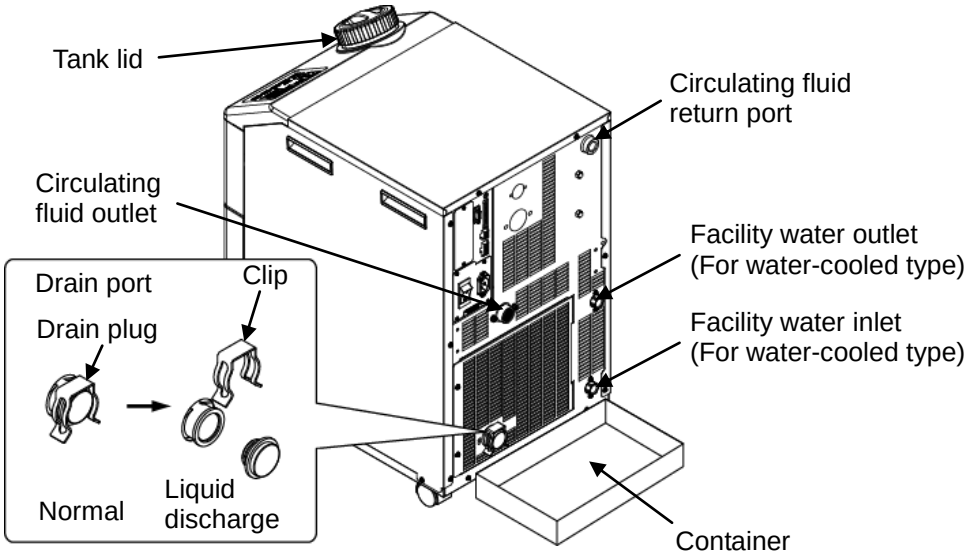


Fig. 4.2-3 Drain the circulating fluid and facility water

2. Remove the tank lid.

3. Remove the drain plug on the drain port on the piping to discharge the fluid.
An O ring is used for the drain plug. Take care not to damage the O ring.

4. Confirm that a sufficient amount of the circulating fluid has been drained from the user's machine and piping, and apply air purge from the circulating fluid return port.

5. After discharging the circulating fluid in the tank, refit the drain plug, clip and close the tank lid.

<For the water-cooled refrigeration chiller, drain the facility water according to the procedures from 6 to 8.>

6. Remove the piping of the outlet of the facility water.

7. Remove the dustproof filter to remove the plug.
Please refer P4-33 for the procedure of removal.

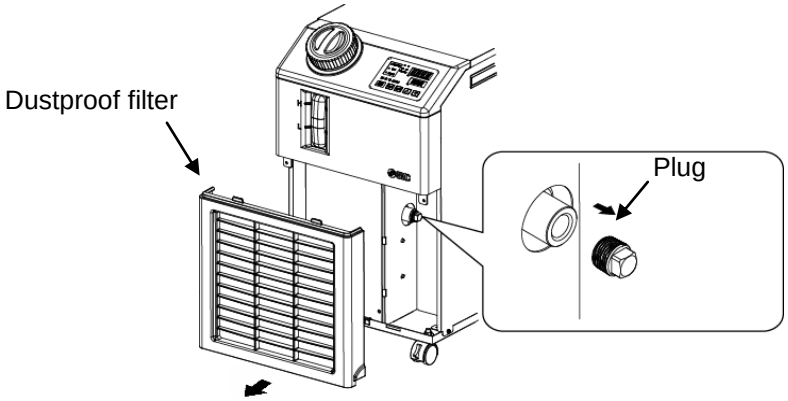


Fig. 4.2-4 Removal of plug

CAUTION

Just removing the facility water piping does not discharge the facility water completely. Remove the plug to discharge the facility water.

8. After ensuring that the facility water is completely discharged, apply the sealant tape to the plugs which are removed during step 7 for mounting.
Mount the dustproof filter after mounting them. Please refer P4-33 for how to mount.

9. Refer to Fig. 4.2-5 Plug to the piping of the product to mount the plug to the piping of the product.

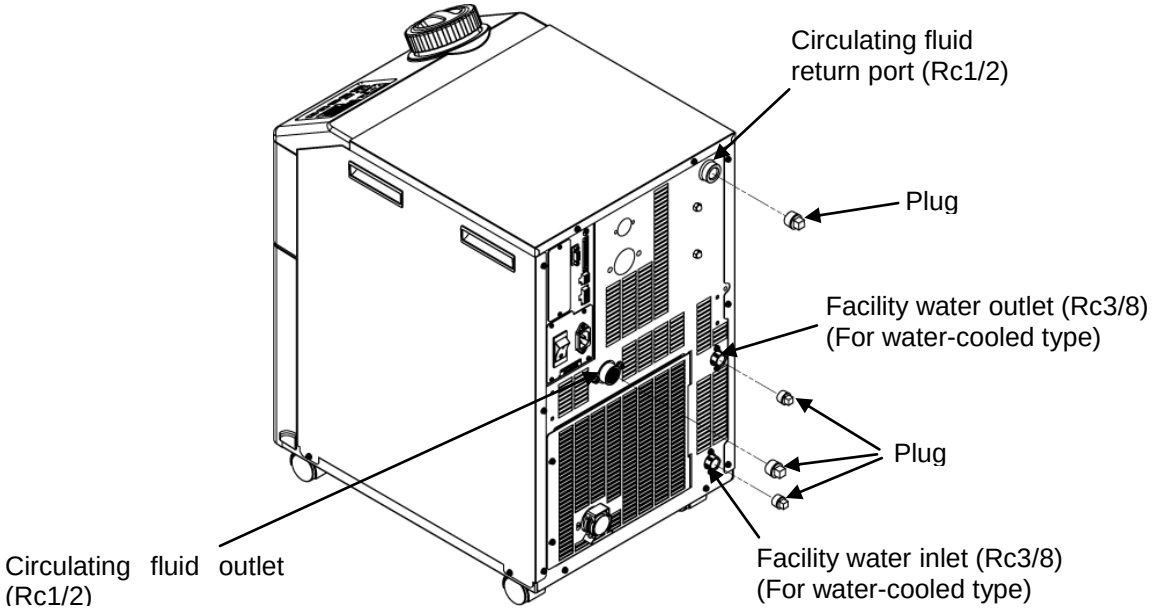


Fig. 4.2-5 Plug to the piping of the product

■ Option T [High pressure pump]

The ball valve is the drain port. Open the ball valve to discharge the circulating fluid in the same way as procedure 1 to 9. Close the ball valve after discharging the circulating fluid.

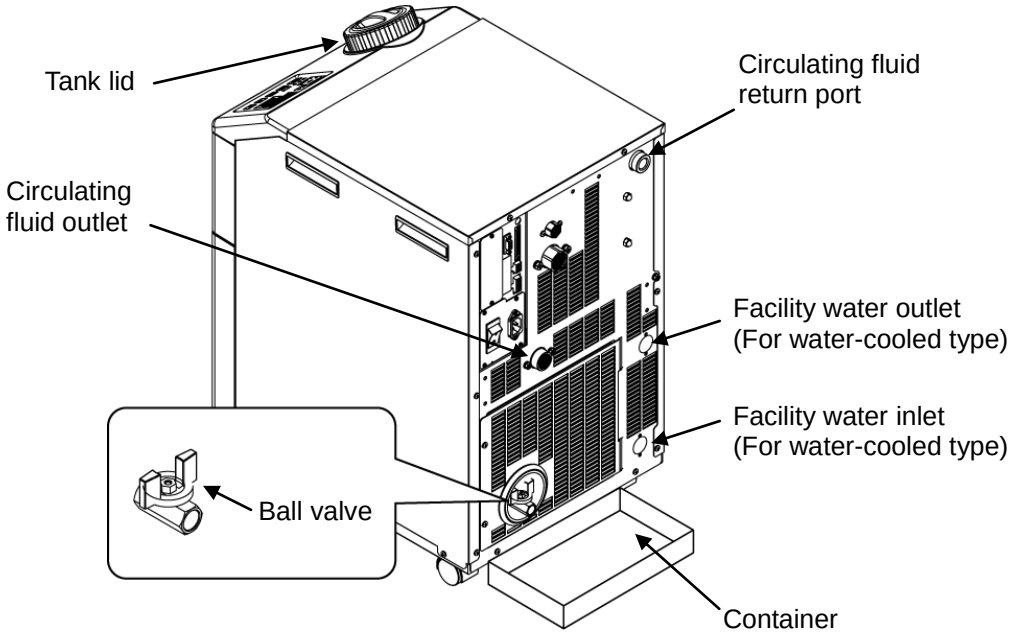


Fig. 4.2-6 Drain the circulating fluid and facility water from the product for option T [High pressure pump]

4.3 Check After Work

After the work is completed, check the product can operate normally.

4.3.1 Starting the product

Press the [RUN/STOP] key on the operation panel.

- The [RUN] lamp lights up (in green) and the product starts running.
- The circulating discharge temperature (PV) is controlled to the set temperature (SV).

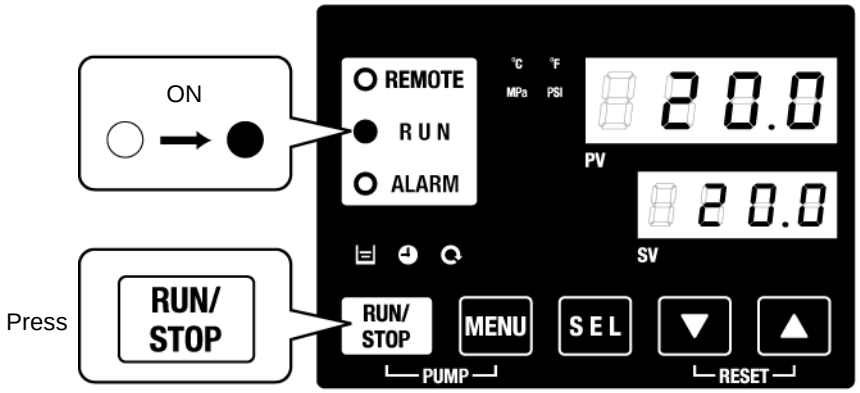


Fig. 4.3-1 Starting the product

4.3.2 Stopping the product

1. Press the [RUN/STOP] key on the operation panel.

- The [RUN] lamp on the operation panel flashes green at 1 second intervals, and continues operation to prepare to stop.
- After approx. 15 seconds, the [RUN] lamp goes off and the product stops.

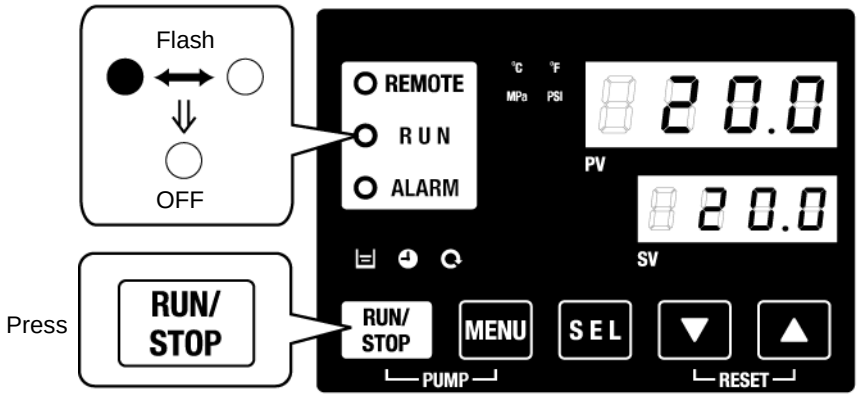


Fig. 4.3-2 Stopping the product

2. Turn off the power supply switch.

All LEDs go off.

4.3.3 Check items after starting

Check the following items after starting the product.

⚠ WARNING

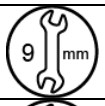
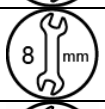
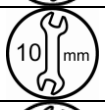
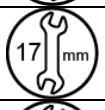
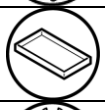
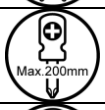
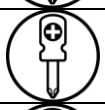
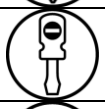
When an Alarm is seen, press the [STOP] key and then turn off the power supply switch to stop the product, and turn off the breaker of the user's power supply to isolate the product.

- There is no leakage from piping.
- There is no drain of circulating fluid from the drain port.
- The circulating fluid pressure is within the specified range.
- The tank level is within the specified range.

4.4 Icons for Necessary Tools and Specifications

■ Tools necessary for service

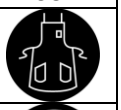
Table 4-2 Tools necessary for service

Description	Icon	Content
Spanner/Wrench		Flat size: 9mm
		Flat size: 8mm
		Flat size:10mm
		Flat size: 17mm
		Flat size: 21mm
		Flat size: 24mm
Drain pan		Height:Max.100mm
Nippers		-
Pliers		-
Cross recessed screwdriver (∗1)		Total length: Max. 200mm
		-
flat blade screwdriver(∗1)		-
Long-nose plier		-
Hexagon wrench		Flat size: 2mm
		Flat size: 5mm
Silicone sealant		Recommended：HRG-S0214 Drying time: 2 hours

(∗1) Screwdriver with magnetic tip.

■ Recommended protective tools

Table 4-3 Recommended protective tools

Description	Icon	Description	Icon
Apron		Safety shoes	
Mask		Gloves	
Goggles			

■ Tightening torque

Table 4-4 Tightening torque

Icon	Content
	The number shows torque.

4.5 Replacement Procedure

4.5.1 Replacement of temperature sensor (PT1)

＜HRS∗∗∗-A/W-∗＞

Table 4-5 Part number of service parts (Temperature sensor)

Description	Part number
Temperature sensor	HRS-S0007

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

CAUTION

- **When the temperature sensor is removed or mounted, it is turned using a spanner/wrench. At that time, be careful not to twist its cable. Otherwise, it can break.**
- **The product must not be operated until the liquid gasket is completely hardened. Otherwise, it can cause fluid leakage.**

■ Removal

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the connector (PT1) from the main board.

4. Remove the temperature sensor (PT1).

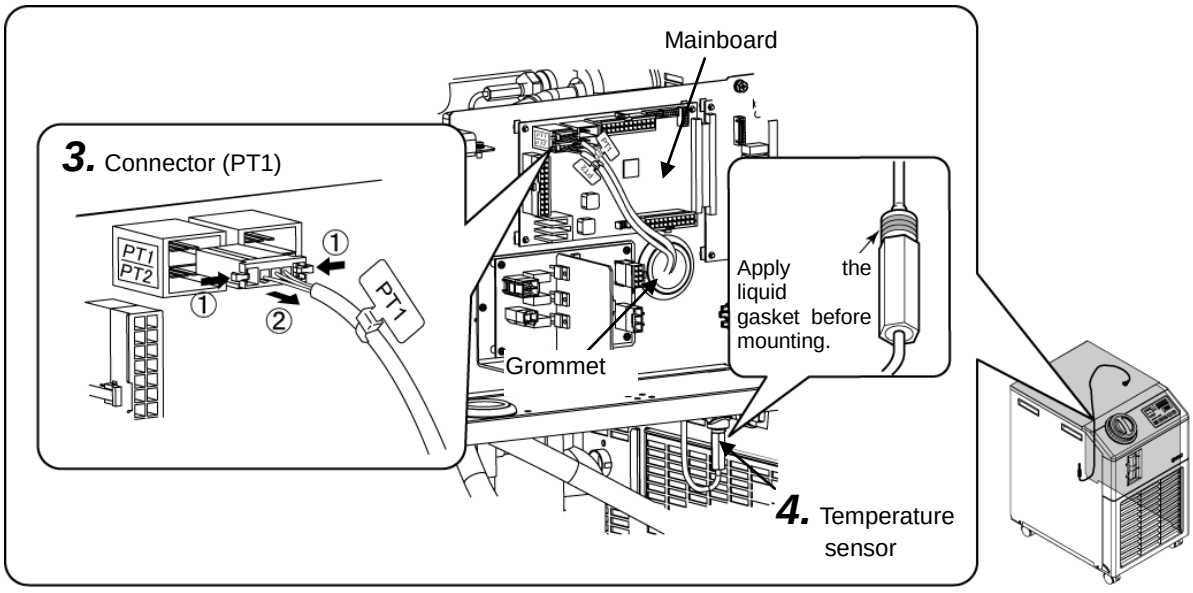


Fig. 4.5-1 Removal of temperature sensor

■ Mounting

1. Apply the liquid gasket to the threads of the temperature sensor and mount the temperature sensor using a spanner/wrench.

[Tips]

Do not apply the liquid gasket to the first thread. Otherwise, the liquid gasket will spread to the circulating circuit and cause the product to fail. To prevent dust from getting caught in the threads, check there is no dust stuck to the threads before the screw is mounted.

2. Put through the electric wire from the grommet to the inside of the electric equipment.

3. Mount the connector (PT1) of the temperature sensor.

4. Mount the upper panel and the rigrt panel in reversed order of removal. (Fixing screws ×8)

4.5.2 Replacement of temperature sensor (PT2)

＜HRS∗∗∗-A/W-∗＞

Table 4-6 Part number of service parts (Temperature sensor)

Description	Part number
Temperature sensor	HRS-S0007

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

CAUTION

- **When the temperature sensor is removed or mounted, it is turned using a spanner/wrench. At that time, be careful not to twist its cable. Otherwise, it can break.**
- **The product must not be operated until the liquid gasket is completely hardened. Otherwise, it can cause fluid leakage.**

■ Removal

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel and the side panel on the left referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the connector (PT2) from the main board.

4. Remove the temperature sensor (PT2).

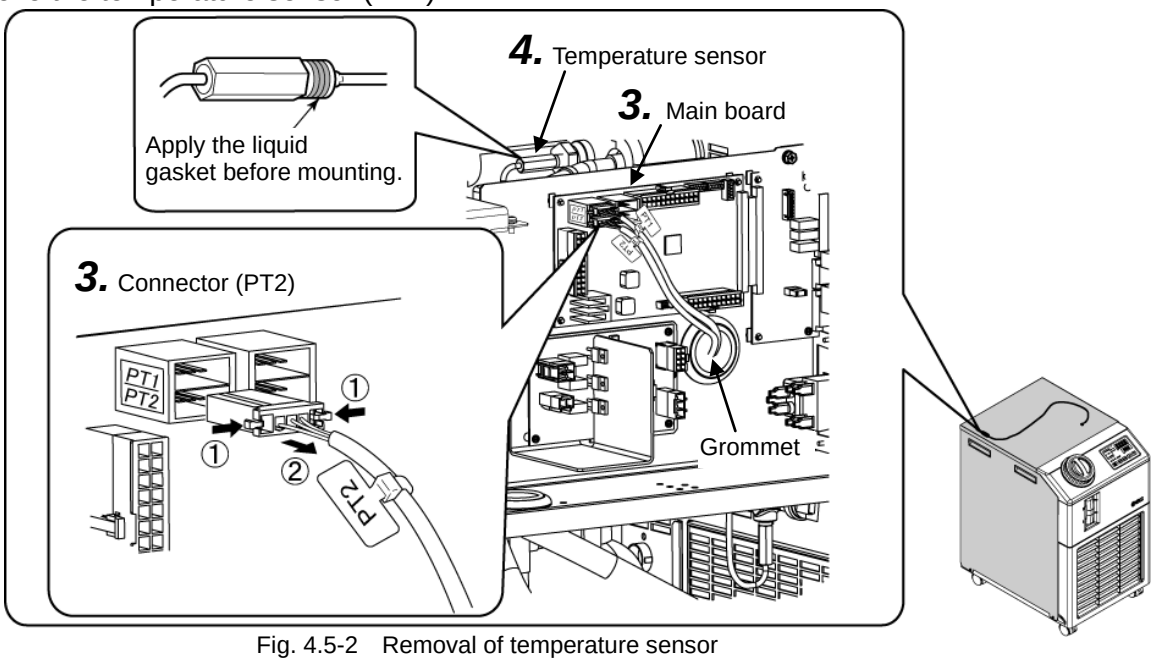


Fig. 4.5-2 Removal of temperature sensor

■ Mounting

1. Apply the liquid gasket to the threads of the temperature sensor and mount the temperature sensor using a spanner/wrench.

[Tips]

Do not apply the liquid gasket to the first thread. Otherwise, the liquid gasket will spread to the circulating circuit and cause the product to fail. To prevent dust from getting caught in the threads, check there is no dust stuck to the threads before the screw is mounted.

2. Put through the electric wire from the grommet to the inside of the electric equipment.

3. Mount the connector (PT2) of the temperature sensor.

4. Mount the upper panel and the left panel in reversed order of removal. (Fixing screws ×8)

4.5.3 Replacement of pump (For standard pump)

＜HRS∗∗∗-A/W-∗＞

Table 4-7 Part number of service parts (Pump (For standard type))

Description	Part number
Pump (For 100V type)	HRS-S0022
Pump (For 200V type)	HRS-S0066
Pump (For HRS030)	HRS-S0361

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the support panel. (Screw ×4)

4. Remove the connector of the pump cable from the power board.

∗ For the HRS030, cut the cable tie of the pump cable fixed to the fan motor bracket.

5. Remove the ground cable (G4) attached to the pump. (Screw ×1)

6. Place the drain pan beneath fitting A. Remove fitting A to discharge water in the pump.

7. Remove the clip mounted to fitting B to remove fitting B.

8. Remove bolts to remove the pump. (Bolt ×4)

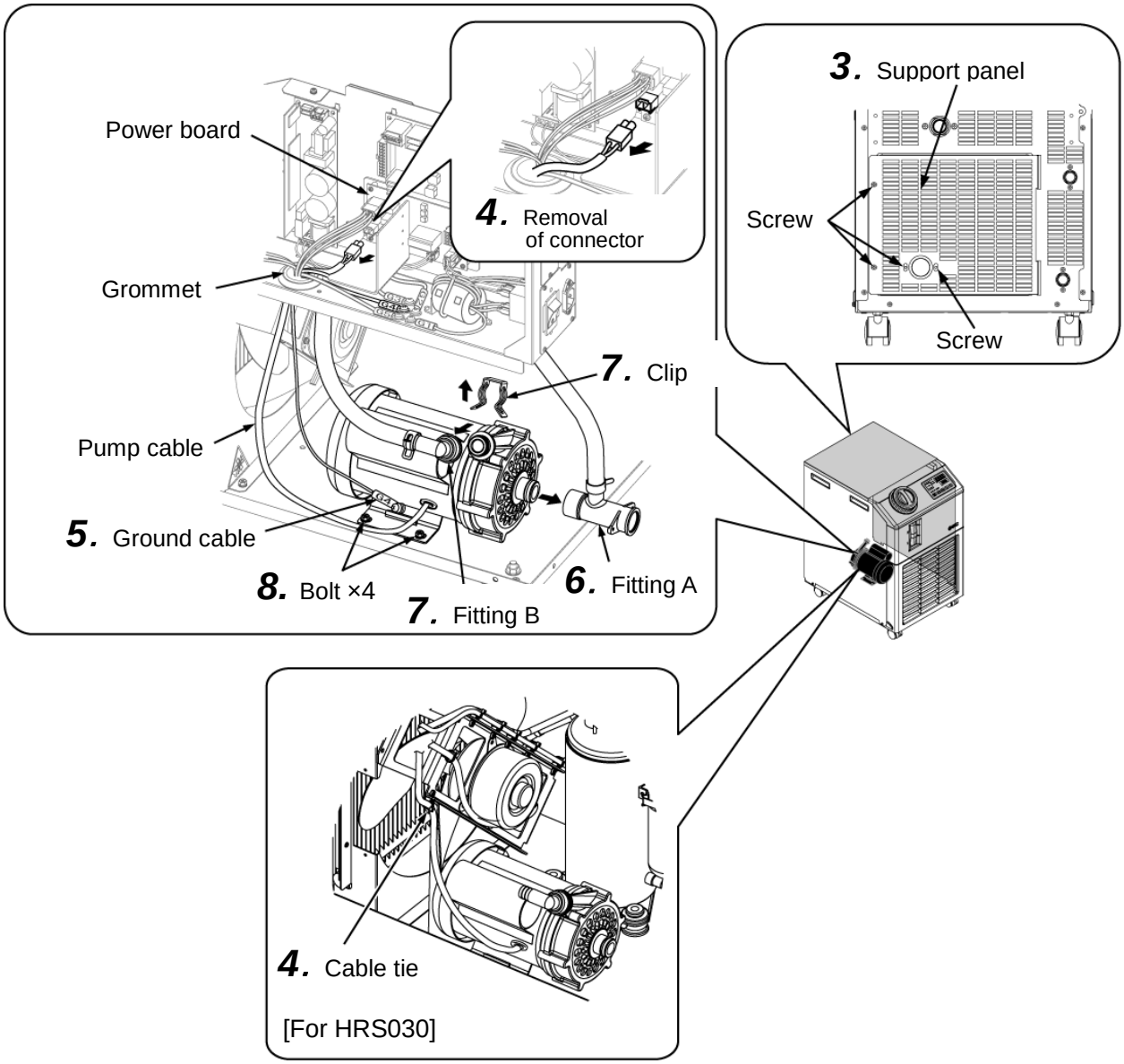


Fig. 4.5-3 Removal of pump

■ Mounting

1. Mount O-ring to the pump. (2 O-rings)
∗ Size is different. (Refer to Fig. 4.5-4.)

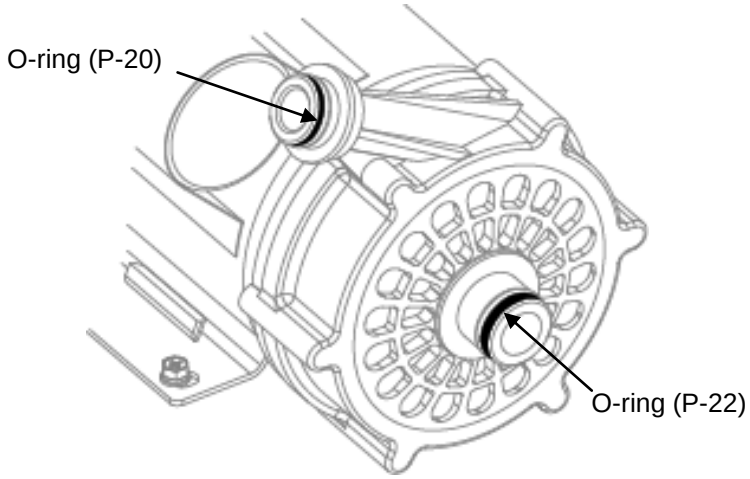


Fig. 4.5-4 Mount the o-ring

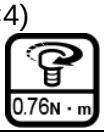
2. Insert the pump to the notch of the base. Hand tighten the screw to the end.
When the position is fixed, tighten with a screwdriver. (Bolt ×2)

3. Mount fitting to two locations.
∗ Apply grease.

4. Connect the ground cable (G4).
∗There are two washers inside. Hold the ground bable between them to fix it to the pump.

5. Put the pump connector through the grommet from the bottom in order to connect to the power board.
∗For the HRS030, fix the pump cable on the fan motor bracket with a cable tie to prevent the pump cable from touching the fan.

6. Mount the support panel. (Screw ×4)

(2pcs. of the left side)


(2pcs. of the drain port.)

7. Mount the upper panel and the right panel in reversed order of removal.

4.5.4 Replacement of high pressure pump
＜HRS∗∗∗-A/W-10-T＞

Table 4-8 Part number of service parts (High pressure pump)

Description	Part number
High pressure pump (For 100V type option T)	HRS-S0265
High pressure pump (For 100V type option MT)	HRS-S0266

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ **Removal**

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the support panel. (Screw ×4)

4. Remove the connector of the pump cable from the power board.

5. Remove the ground cable(G4) attached to the pump. (Screw ×1)

6. Remove the hose attached to the pump. (2 pcs.)

7. Remove the pump. (Screw ×4)

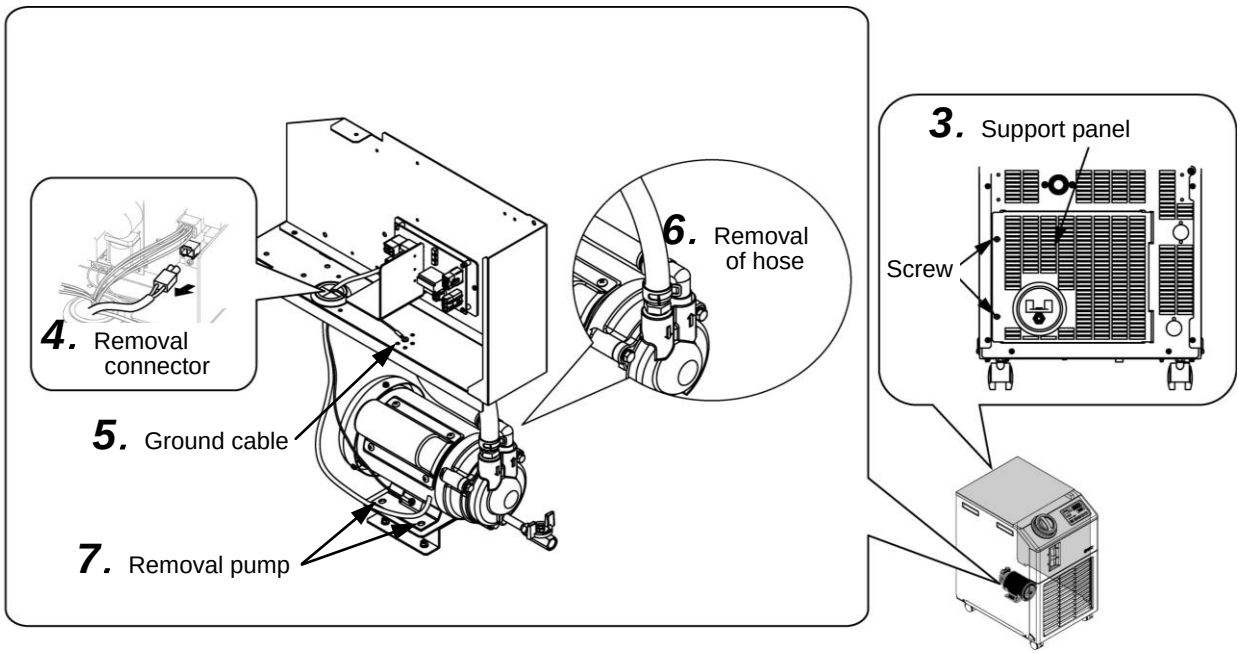


Fig. 4.5-5 Removal of high pressure pump

■ Mounting

1. Mount the pump. (Screw ×4)

2. Mount the hose. (2 pcs.)

Tightening torque of hose between high pressure pump and circulating fluid outlet :

3. Connect the ground cable (G4). (Screw ×1)

4. Mount pump cable to the power board.

5. Mount the support panel. (Screw ×2)

6. Mount the upper panel and the right panel in reversed order of removal.

＜HRS∗∗∗-A/W-20-T＞

Table 4-9 Part number of service parts (High pressure pump)

Description	Part number
High pressure pump (For 200V type option T)	HRS-S0062
High pressure pump (For HRS030 option T)	HRS-S0299
High pressure pump (For 200V type option MT)	HRS-S0063
High pressure pump (For HRS030 option MT)	HRS-S0300

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the support panel. (Screw ×4)

4. Remove the connector of the pump cable from the power board.

5. Remove the cable from the condenser.

6. Remove the ground cable(G4) attached to the pump. (Screw ×1)
∗For the HRS030, cut the cable tie of the pump cable fixed to the fan motor bracket.

7. Remove the hose attached to the pump. (2 pcs.)

8. Remove the condenser. (Screw ×1)

9. Remove the pump. (Screw ×4)

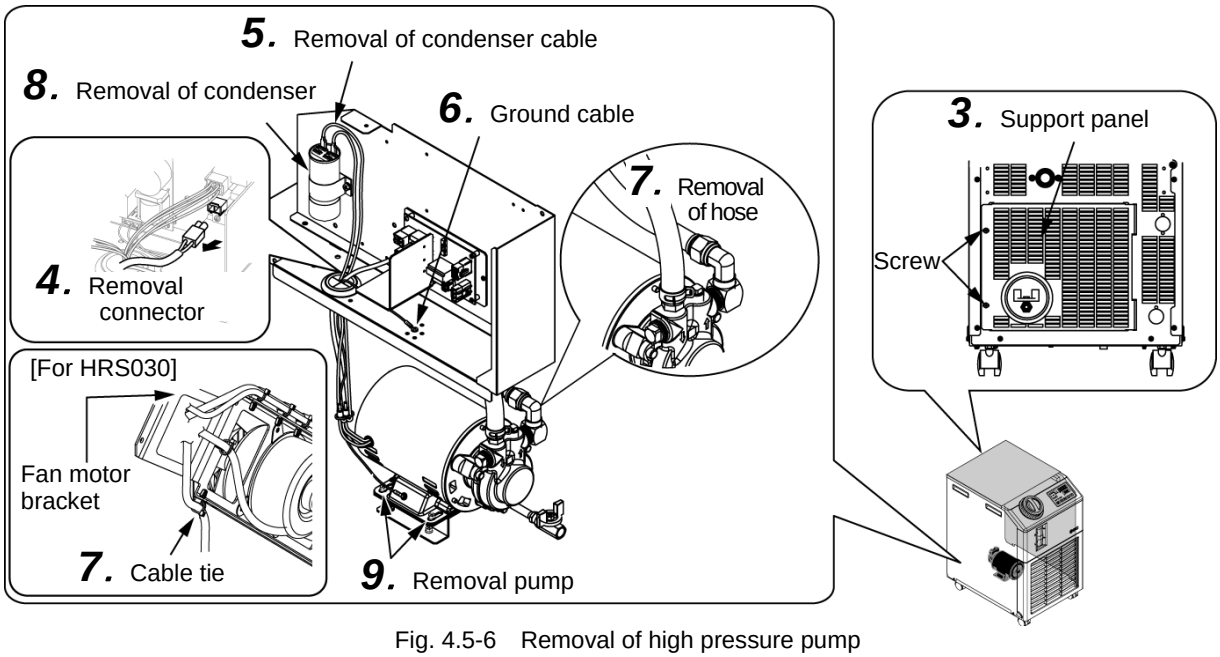


Fig. 4.5-6 Removal of high pressure pump

■ Mounting

1. Mount the cap and bracket to the condenser,and it mount the electrical equipment panel. (Screw ×1)

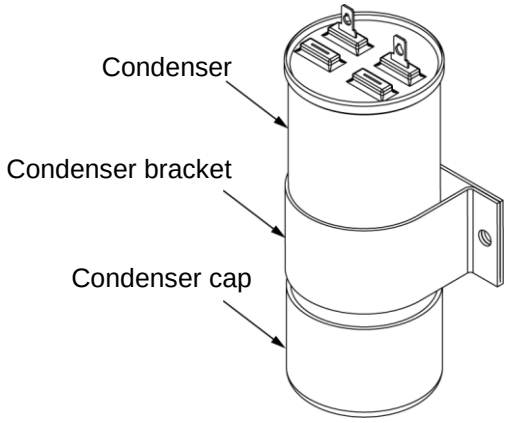


Fig. 4.5-7 Mount the condenser

2. Mount the pump. (Screw ×4)

3. Mount the hose. (2 pcs.)

Tightening torque of hose between high pressure pump and circulating fluid outle

4. Connect the ground cable (G4). (Screw ×1)

5. Mount cable to the condenser.

6. Mount pump cable to the power board.

∗ For the HRS030, fix the pump cable on the fan motor bracket with a cable tie to prevent the pump cable from touching the fan.

7. Mount the support panel. (Screw ×2)

8. Mount the upper panel and the right panel in reversed order of removal.

4.5.5 Replacement of mechanical seal set

＜HRS∗∗∗-A/W-10-(M)T＞ (For high pressure pump 100V type)

Table 4-10 Part number of service parts (Mechanical seal set)

Description	Part number
Mechanical seal set [For 100V type option T]	HRS-S0390
Mechanical seal set [For 100V type option MT]	HRS-S0412

＜HRS∗∗∗-A/W-20-(M)T＞ (For high pressure pump 200V type)

Table 4-11 Part number of service parts (Mechanical seal set)

Description	Part number
Mechanical seal set [For 200V type option T, MT]	HRG-S0211

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

O-ring size

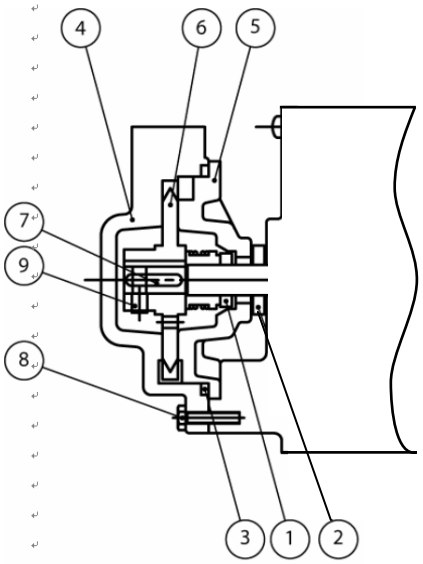
These service parts include three of O-rengs.
Please use A for HRS012/018/024/030 series (Only the high pressure pump).

Table 4-12 O-ring size

Chiller Model	O-ring type	Remarks
HRS012/018/024/030series	A	Only the high pressure pump (Option:T)
HRS050/060 series	B	-
HRGC series	B	Only the high pressure pump (Option:T)
HRG005 series	B	-
HRG010 series	C	-

Internal construction of pump

The internal construction of the pump is as follows.



No.	Description
1	Mechanical seal
2	Deflector rubber
3	O-ring
4	(Body)
5	(Cover)
6	(Impeller)
7	(Key)
8	(Set screw)
9	(Hexagon socket head bolts)

Fig. 4.5-8 Internal construction of pump

■ Removal

1. Remove the high pressure pump referring the 4.5.4 Replacement of high pressure pump.

2. Before disassembling the pump, place a “check mark” on the body, cover, and the motor.

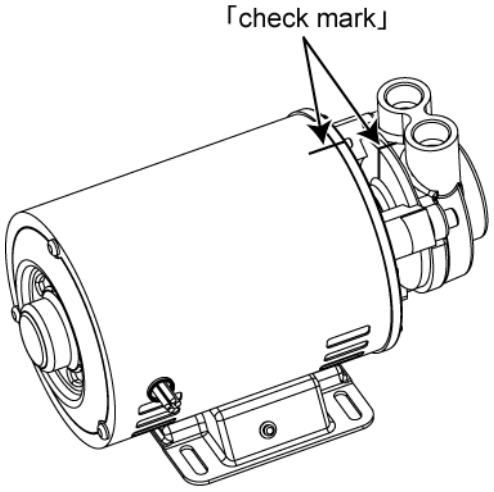


Fig. 4.5-9 Check mark

3. Remove the body. (Hexagon socket head bolt ×3)

Place the drain pan under the body and drain water from the pump.

4. Remove the impeller and spring. (Set screw ×2)

[Tips]

There is a danger of parts popping out.If the impeller gets stuck and cannot be removed, screw two screws of M6 x 50mm or larger into the two thread holes of the impeller to pull out the impeller.

5. Remove the mechanical seal, O-ring and cover all in one.

[Tips]

If the cover cannot be removed, insert the blade of the spanner/wrench between the cover and motor and bring it up.

6. Remove the deflector rubber.

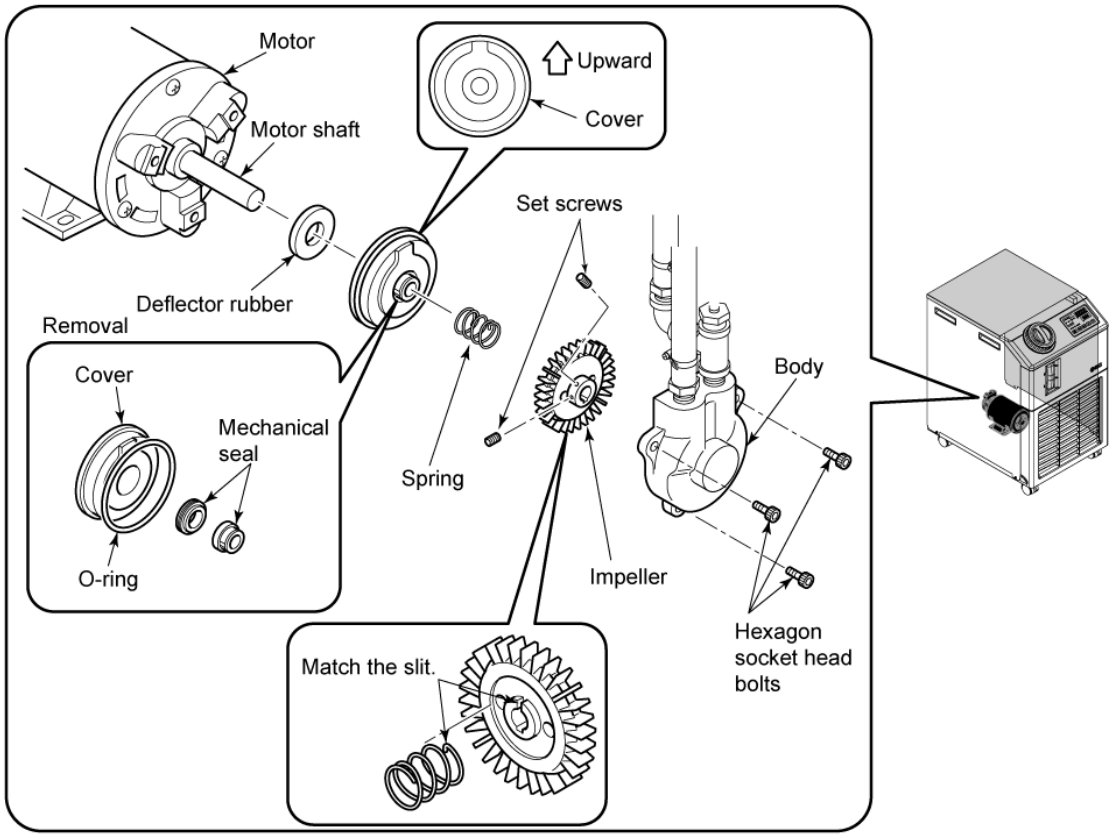


Fig. 4.5-10 Removal of mechanical seal set

■ Mounting

1. Mount the deflector rubber to the motor shaft.

2. Mount the O-ring and mechanical seals (2pcs) onto the cover and onto the motor shaft.

[Tips]

・Push the mechanical seal to the end.
・The mounting direction of the cover is specified. Pay attention to the direction.
・Align"check marks"(See How to Removal 2)

3. Mount the spring and impeller onto the motor shaft.

[Tips]

The direction of the spring is determined by the key of the impeller.

4. Mount the collar onto the motor shaft. (Set screw x 2)

[Tips]

Fix the set screws with the collar held down.

5. Remove the tape on the back of the motor. Insert the flat blade driver to rotate the motor shaft and check if the impeller rotates smoothly. Re-tape after checking. (Refer to Fig. 4.5-11 Rotation verification of impeller)

[Tips]

The moter shaft does not rotate smoothly when the impeller comes into contact with the body or cover. Remove the body, and adjust the impeller.

6. Mount the high pressure pump referring the 4.5.4 Replacement of high pressure pump.

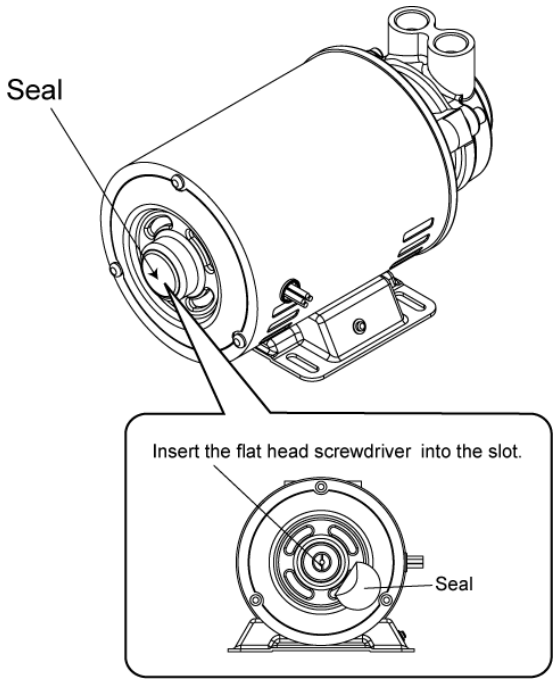


Fig. 4.5-11 Rotation verification of impeller

4.5.6 Replacement of fan

＜HRS∗∗∗-A-∗＞

Table 4-13 Part number of service parts (Fan)

Description	Part number
Fan (For 100V type)	HRS-S0023
Fan (For 200V type)	HRS-S0067
Fan(For HRS030)	HRS-S0301

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Remove the upper panel and the panels on both sides referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the fan motor pin from the connector of the compressor cable. (2 pcs.)

[Tips]

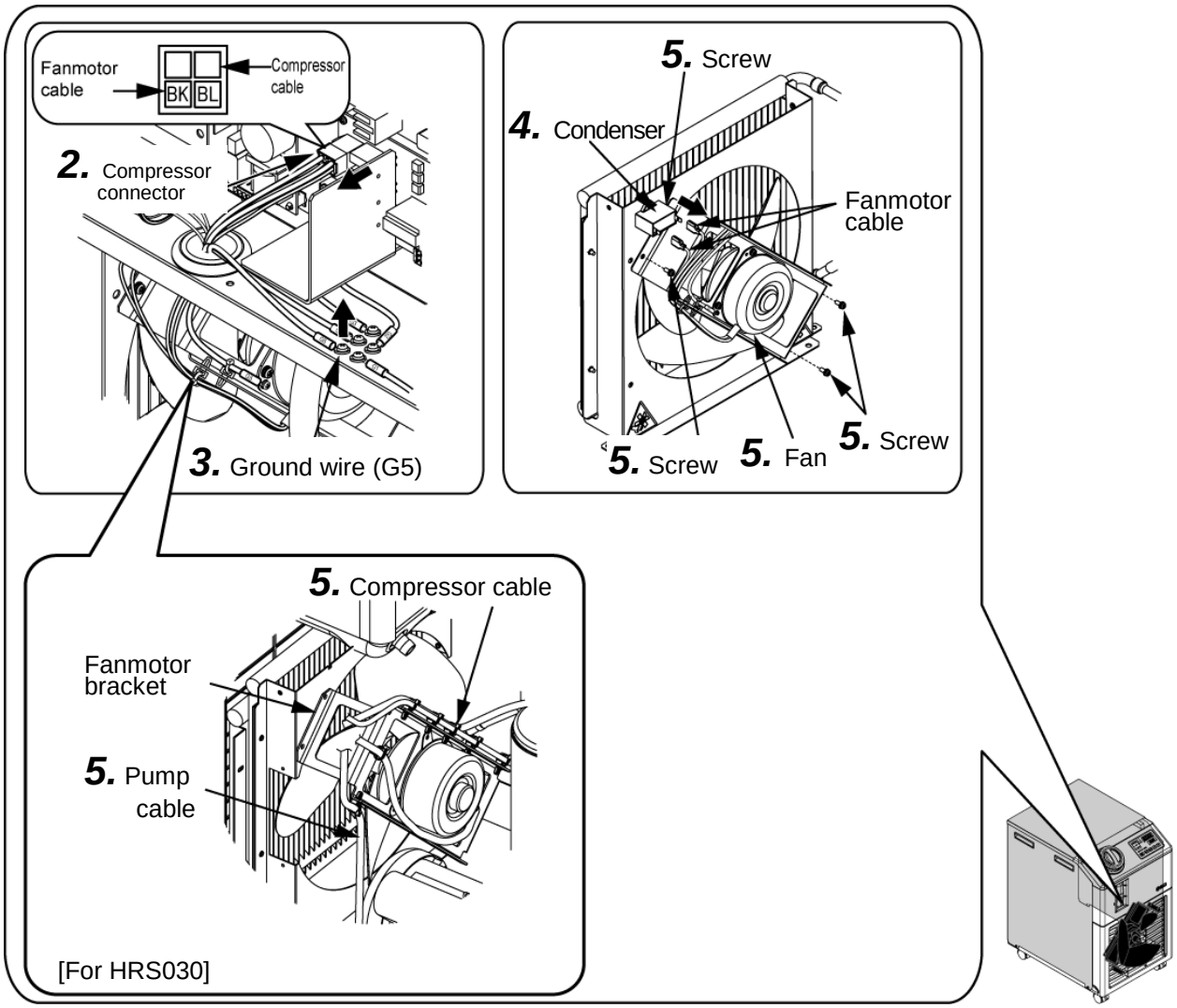
Use VLJ-20 of J.S.T. Mfg. Co.,Ltd for removing pins.
Our part no.:HRS-S0055

3. Remove the ground wire(G5). (Screw ×1)

4. Remove the condenser. (Screw ×1)

5. Remove the fan . (Screw×4)

∗ For the HRS030, cut the cable ties of the pump cable (1 place) and the compressor cable (5 places) fixed to the fan motor bracket.



∗BK is black, BL is blue.

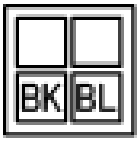
Fig. 4.5-12 Removal of fan

■ Mounting

1. Mount the fan. (Screw ×4)

2. Mount the condenser. Then, mount the fan motor cable. (Screw ×1)
Connect the pink cable to the left, black cable to the right.

3. Insert the fan motor cable to the compressor cable connector.



Black : No.1 Blue : No.3
∗BK is black, BL is blue.

4. Mount the ground wire(G5). (Screw ×1)

∗ For the HRS030, fix the pump cable (1 place) and the compressor cable (5 places) to the fan motor bracket with cable ties.

5. Mount the upper panel and the panels on both sides in reversed order of removal.

4.5.7 Replacement of level switch

＜HRS∗∗∗-A/W-∗＞

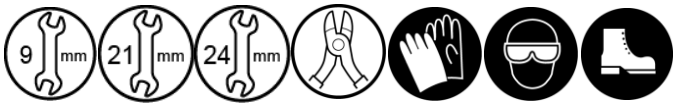


Table 4-14 Part number of service parts (Level switch)

Description	Part number
Level switch	HRS-S0014

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel and the side panel on the left referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the level switch pin [LS1] (two red lines) from the main board.

[Tips]

Use "57031-6000" of MOLEX for removing.
Our part no.: HRS-S0056

4. Remove the nut with a spanner/wrench.

5. Remove the lid of the tank and take out the level switch from the tank.

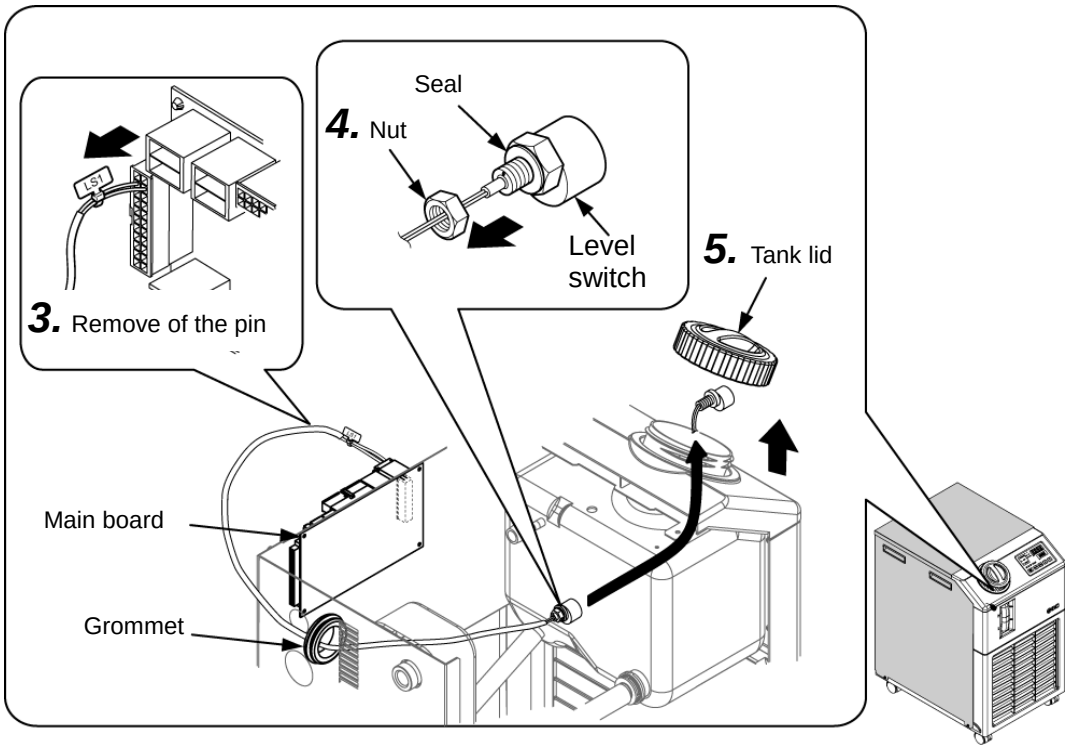


Fig. 4.5-13 Removal of level switch

■ Mounting

1. Mount the marking tie at approx. 40+/-5mm away from the cable end.

2. Remove the nut of the level switch.

3. Mount the nut after mounting the level switch to the tank. (Nut ×1)

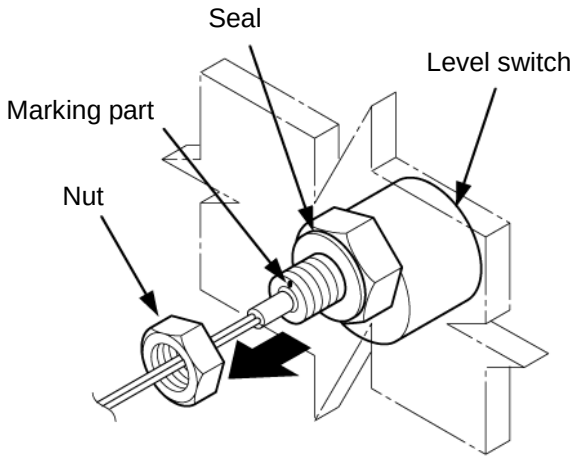


Fig. 4.5-14 Mount of level switch

[Tips]

The marking part of the level switch faces upward.

4. Put the level switch cable [LS1] (2pcs.) through the grommet. Insert the pin to the connector. (No.2 & No.13)

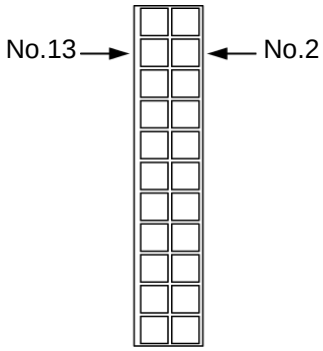


Fig. 4.5-15 Location to mount the connector

[Tips]

It does not matter which connector [LS1] is mounted to which socket.

5. Mount the upper panel and the side panel on the left in reversed order of removal.

6. Mount the lid of the tank.

4.5.8 Replacement of pressure sensor

＜HRS∗∗∗-A/W-∗＞

Table 4-15 Part number of service parts (Pressure sensor)

Description	Part number
Pressure sensor (For circulating fluid)	HRS-S0011

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the connector of the pressure sensor cable (PS1) from the pressure sensor.

3. Remove the pressure sensor.

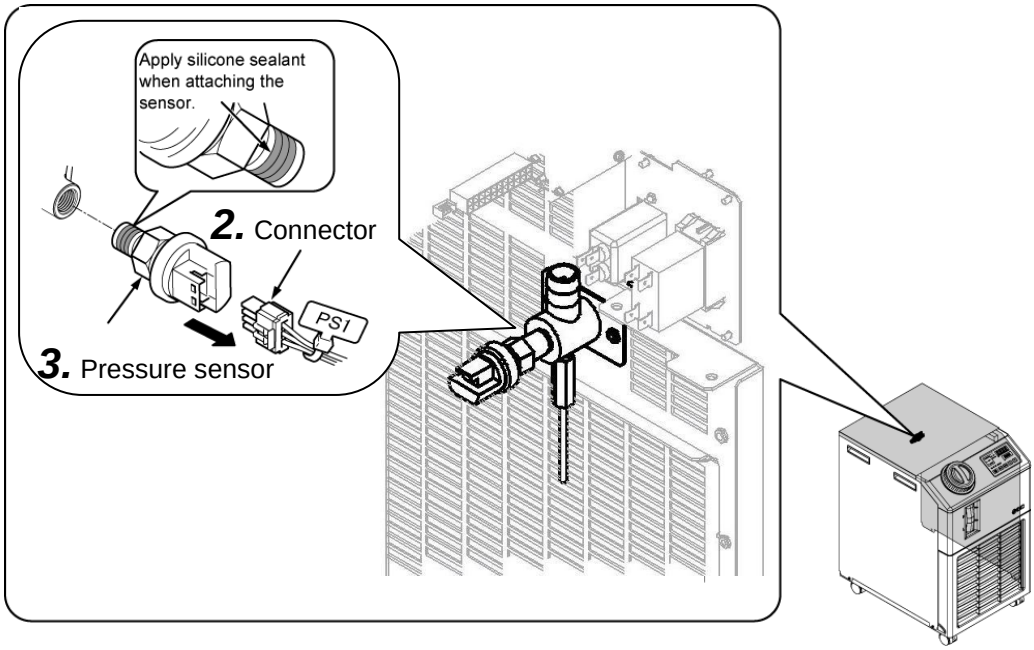


Fig. 4.5-16 Removal of pressure sensor

■ Mounting

1. Apply a liquid gasket to the threads of the pressure sensor and mount it.

2. Mount the connector or the pressure sensor cable (PS1) to the pressure sensor.

3. Mount the upper panel and the side panel on the right in reversed order of removal.

4.5.9 Replacement of dustproof filter

＜HRS∗∗∗-A-∗-∗＞

Table 4-16 Part number of service parts (Dustproof filter)

Description	Part number
Dustproof filter	HRS-S0001

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Pull out the lower part of the side surface of the dustproof filter.

2. When the magnet comes off, pull the dustproof filter downwards to remove.
Care should be taken not to deform or scratch the air-cooled condenser.

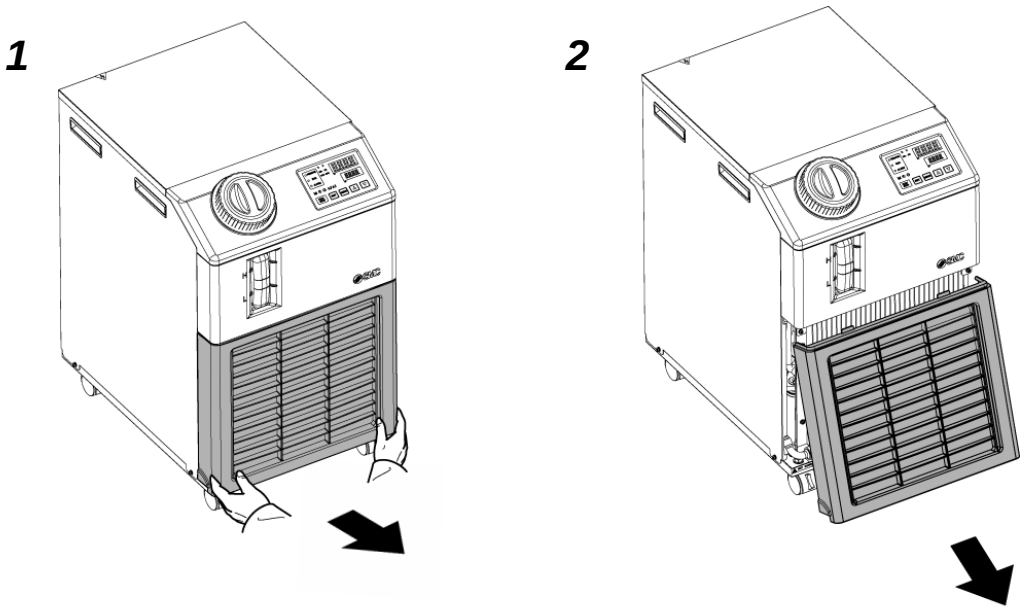


Fig. 4.5-17 Removal of dustproof filter

■ Mounting

1. Mount the dustproof filter in reversed order of removal.

4.5.10 Replacement of front panel

＜HRS∗∗∗-A/W-∗＞

Table 4-17 Part number of service parts (Front panel)

From production in March 2015
(After serial No. TQ***)

Description	Part number
Front panel	HRS-S0519

Until production in February 2015
(Serial No. TP*** or earlier)

Description	Part number
Front panel A	HRS-S0006
Front panel B	HRS-S0005

*Refer to 1.4-1 Product label for serial No.

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

From production in March 2015 (After serial No. TQ***)

■ Removal

1. Remove the upper panel, the panels on both sides and the front panel referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the display board.

[Tips]

Push the claws A at the back of the front panel with both thumbs to open the front panel. Pull the display board with fingers to remove the display board.

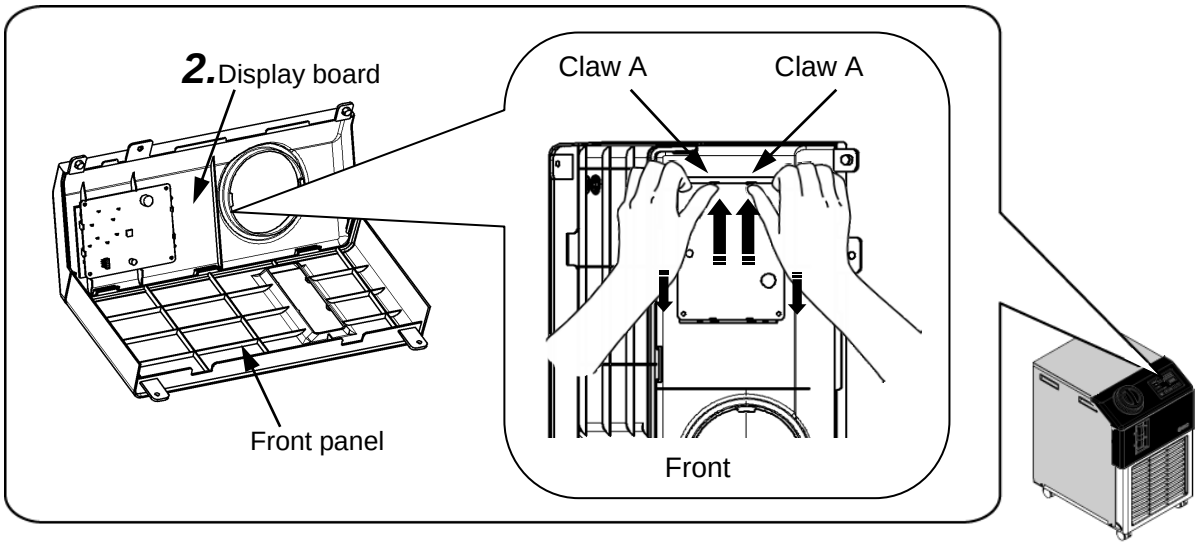


Fig. 4.5-18 Removal of front panel

■ Mounting

1. Mount the display board.

[Tips]

Align with the 4 guides at the back of the front panel, set the end of the display board to the 2 claws B. Pull the display board forward while pushing the 2 claws A out with both thumbs until the claws click.

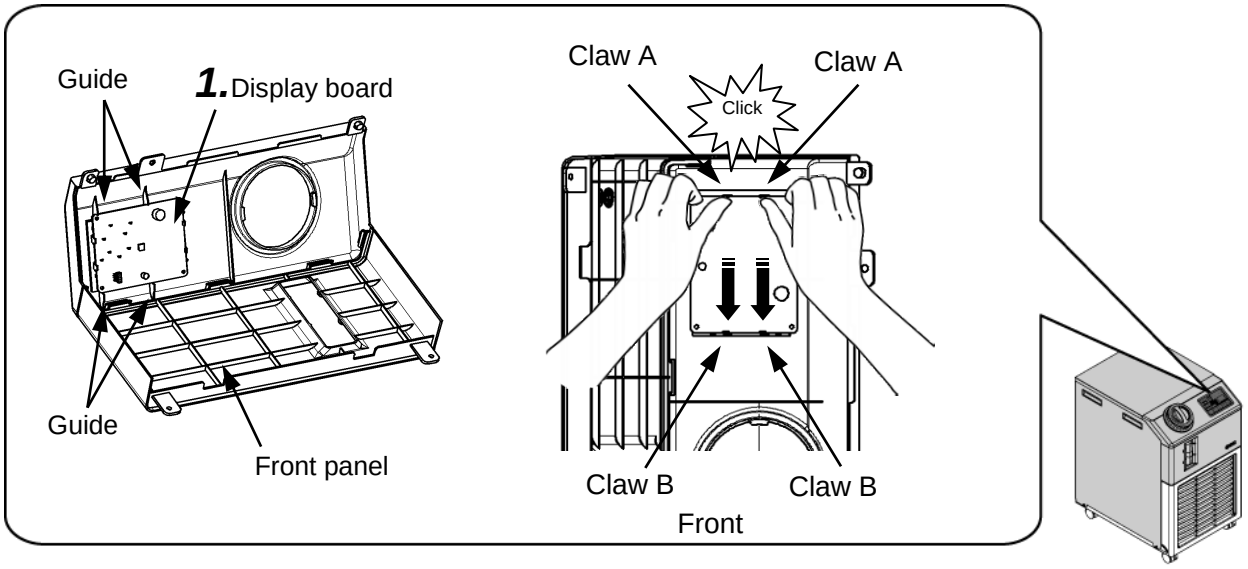


Fig. 4.5-19 Replacement of Front panel

2. Mount the upper panel, the panels on both sides and the front panel in reversed order of removal.

Until production in February 2015 (Serial No. TP*** or earlier)

Replacement of front panel A

■ Removal

1. Remove the upper panel, the panels on both sides and the front panel referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the front panel A. (Screw ×4)

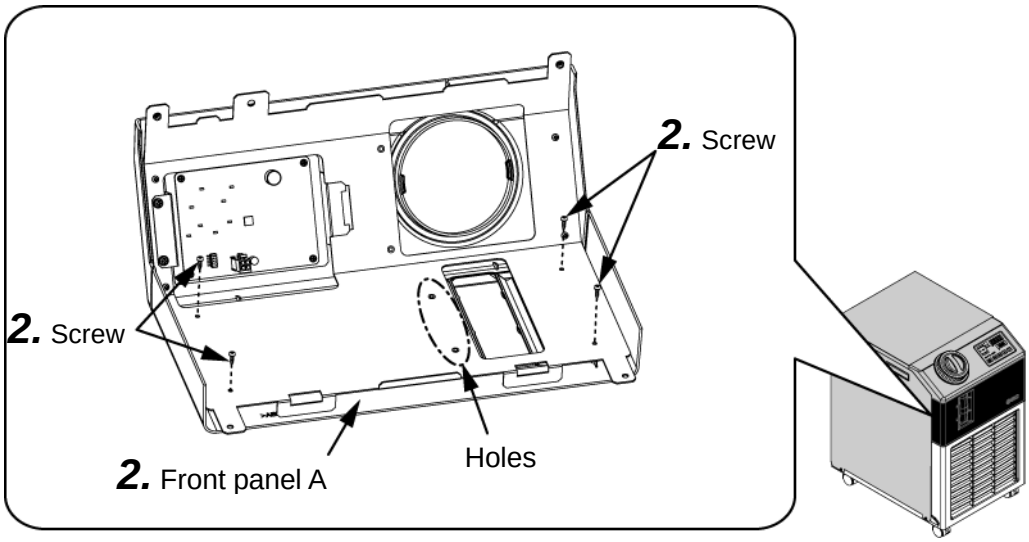


Fig. 4.5-20 Removal of front panel A

■ Mounting

1. Mount the front panel A. (Screw ×4)

[Tips]

Mount front panel A aligning with holes at the center.

2. Mount the upper panel, the panels on both sides and the front panel in reversed order of removal.

Until production in February 2015 (Serial No. TP*** or earlier)

Replacement of front panel B

■ Removal

1. Remove the upper panel, the panels on both sides and the front panel referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the front panel B. (Screw ×4)

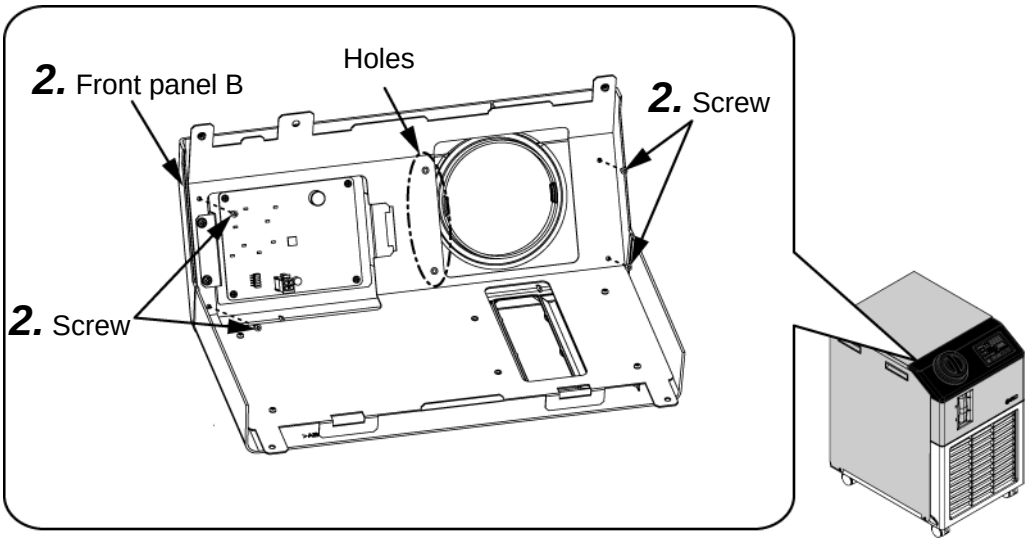


Fig. 4.5-21 Removal of front panel B

■ Mounting

1. Mount the front panel B. (Screw ×4)

[Tips]

Mount front panel A aligning with holes at the center.

2. Mount the upper panel, the panels on both sides and the front panel in reversed order of removal.

4.5.11 Replacement of tank

＜HRS∗∗∗-A/W-∗＞

Table 4-18 Part number of service parts (Tank)

Description	Part number
Tank	HRS-S0025

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel, the panels on both sides and the front panel referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the hose clamp and remove hose A and hose B.

4. Remove the level switch pin [LS1] (two red lines) from the main board.

[Tips]

Use "57031-6000" of MOLEX for removing.
Our part no.: HRS-S0056

5. Remove the tank.

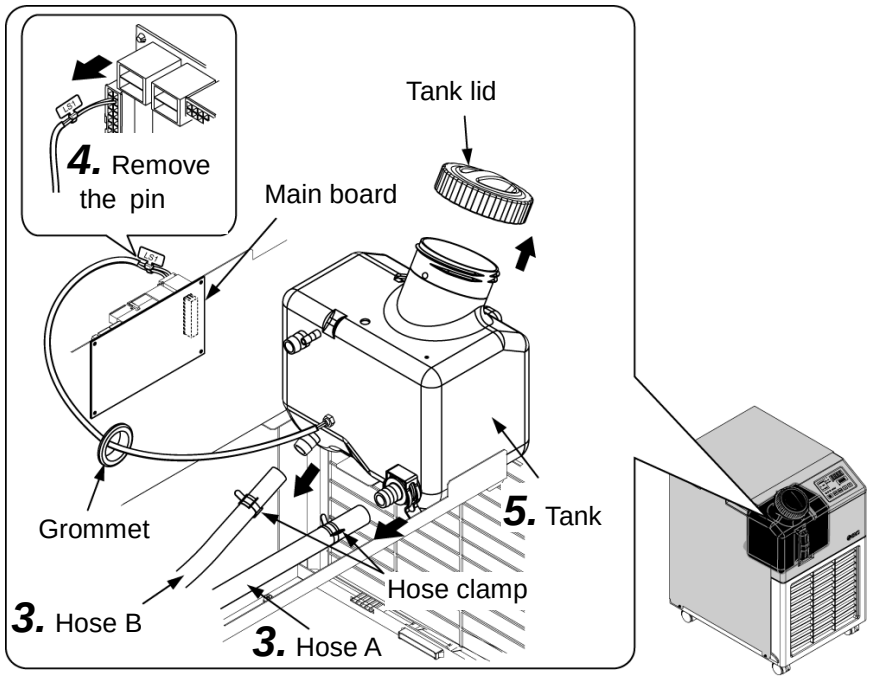


Fig. 4.5-22 Removal of tank

■ Mounting

1. Install the tank.

2. Assemble the fitting mounted to the tank and hose A.

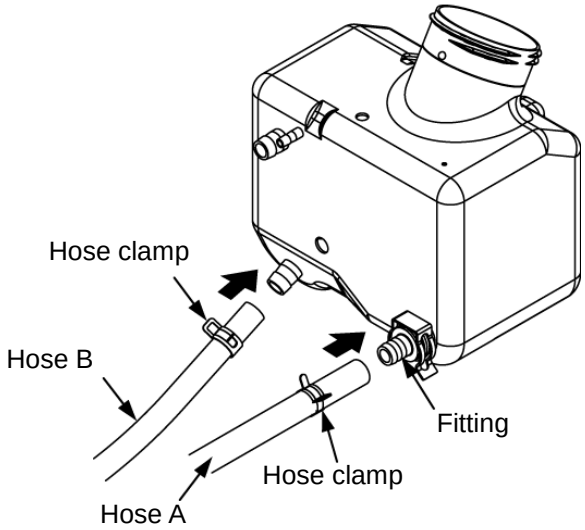


Fig. 4.5-23 Hose A attaching

3. Mount the hose B.

4. Put the level switch cable [LS1] (2pcs.) through the grommet. Insert the pin to the connector. (No.2 & No.13)

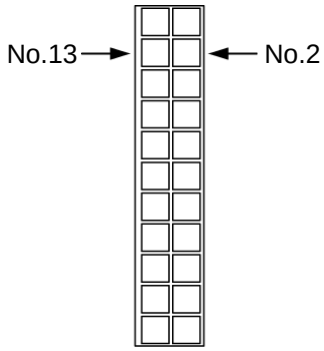


Fig. 4.5-24 Location to mount the connector

[Tips]

It does not matter which connector [LS1] is mounted to which socket.

5. Mount the upper panel, the panels on both sides and the front panel in reversed order of removal.

6. Mount the tank lid.

4.5.12 Replacement of tank (For automatic water fill) ＜HRS∗∗∗-A/W-∗＞

Table 4-19 Part number of service parts (Tank)

Description	Part number
Tank (For automatic water fill)	HRS-S0072

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel, the panels on both sides and the front panel referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the hose clamp and remove hoses. (4 pcs.)

4. Remove the level switch pin [LS1] (two red lines) from the main board.

[Tips]

Use "57031-6000" of MOLEX for removing.
Our part no.: HRS-S0056

5. Remove the tank.

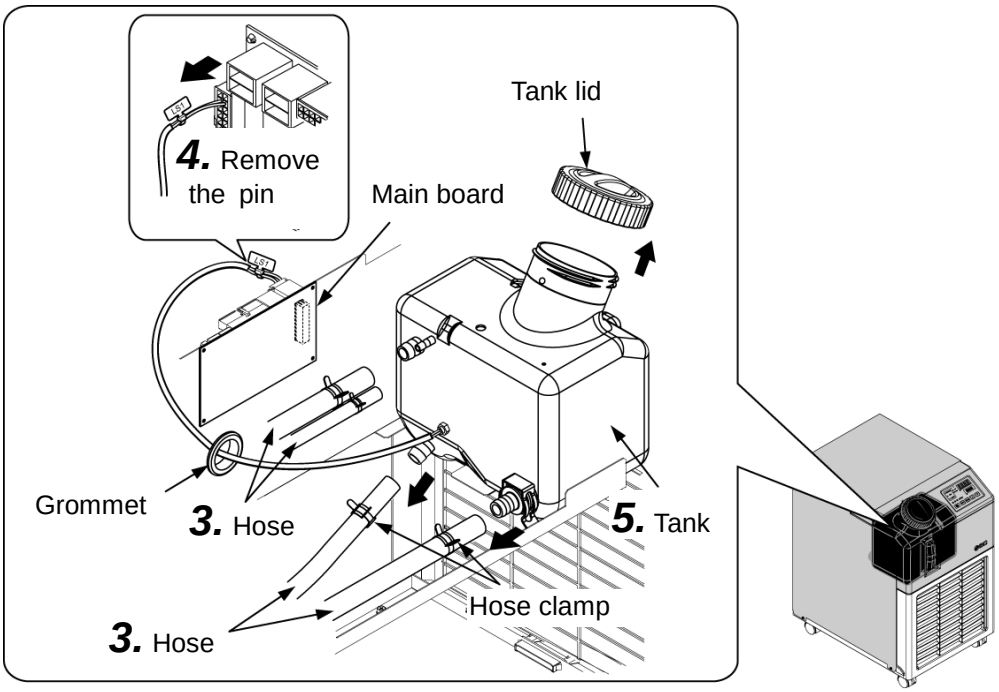


Fig. 4.5-25 Removal of tank

■ Mounting

1. Install the tank.

2. Mount the hoses and tank to the tank. (4 pcs.)

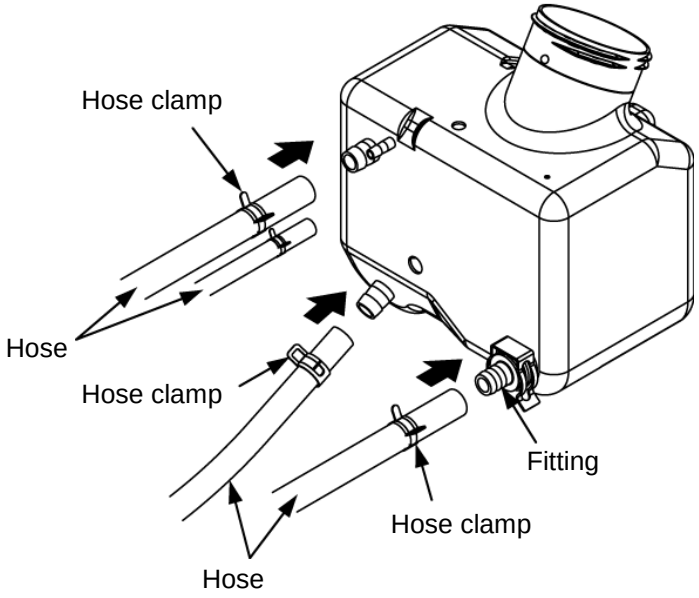


Fig. 4.5-26 Hoses attaching

3. Put the level switch cable [LS1] (2pcs.) through the grommet. Insert the pin to the connector.

(No.2 & No.13)

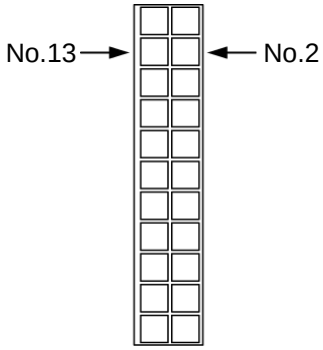


Fig. 4.5-27 Location to mount the connector

[Tips]

It does not matter which connector [LS1] is mounted to which socket.

4. Mount the upper panel, the panels on both sides and the front panel in reversed order of removal.

5. Mount the tank lid.

4.5.13 Replacement of inlet socket

＜HRS∗∗∗-A/W-∗＞

Table 4-20 Part number of service parts (Inlet socket)

Description	Part number
Inlet socket	HRS-S0021

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the connector. (7 locations)

3. Remove the plate. (Screw ×4)

4. Remove the inlet socket. (Screw ×2)

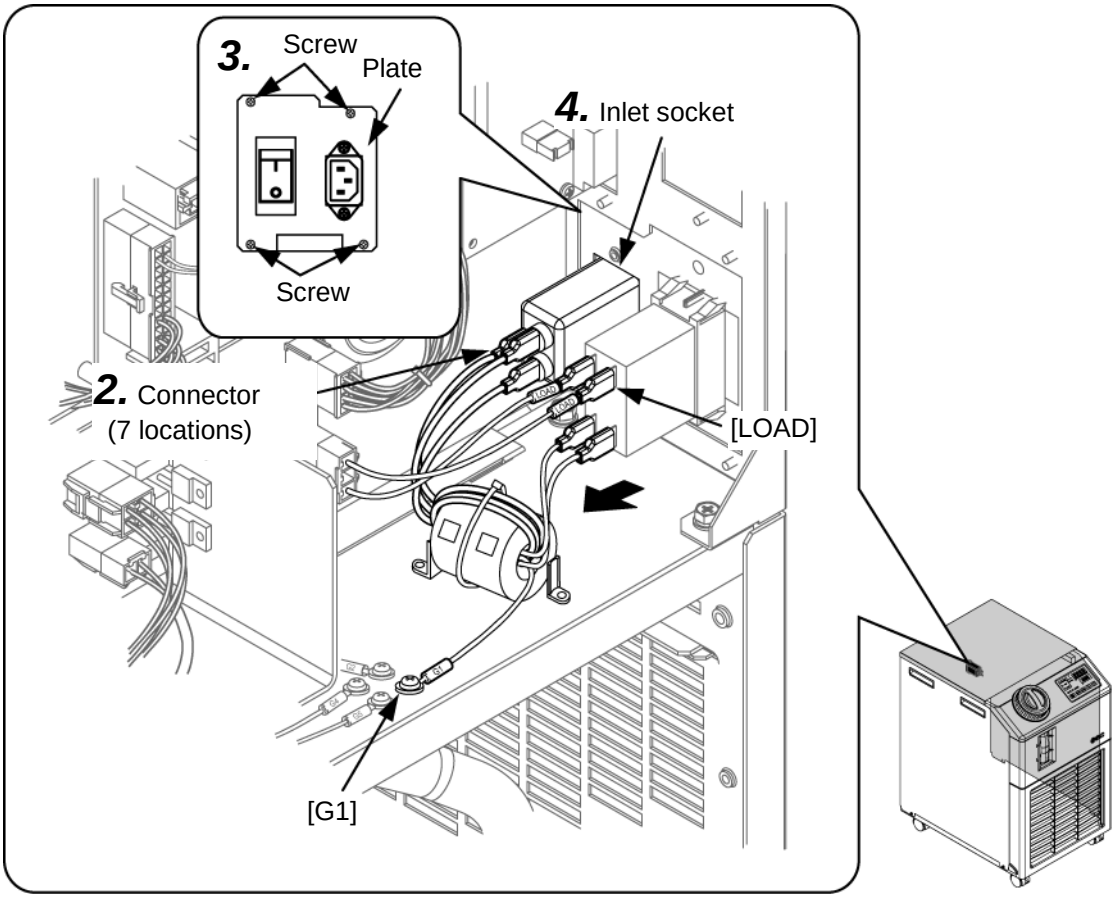


Fig. 4.5-28 Removal of inlet socket

■ Mounting

1. Mount the inlet socket. (Screw ×2)

∗ Be careful of the mounting direction.

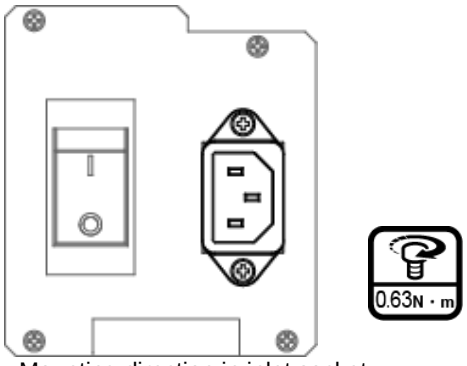


Fig. 4.5-29 Mounting direction in inlet socket

2. Mount the plate. (screw ×4)

3. Insert wiring to terminal A-A', B-B', [G1] to terminal C, [LOAD] to terminal D.

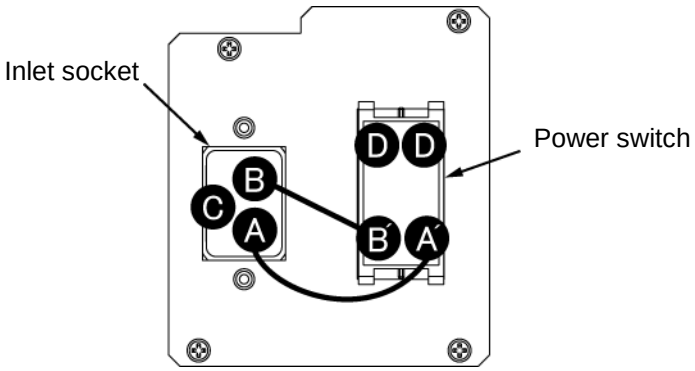


Fig. 4.5-30 Entry of connector

4. Mount the upper panel and the side panel on the right in reversed order of removal.

4.5.14 Replacement of power switch

＜HRS∗∗∗-A/W-∗＞

Table 4-21 Part number of service parts (Power switch)

Description	Part number	Applicable models
Power switch (For 10A type)	HRS-S0020	・For 200V type (Except high pressure pump)
Power switch (For 15A type)	HRS-S0070	・For 100V type ・For high pressure pump 200V type

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ **Removal**

1. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the connector. (7 locations)

3. Remove the plate. (Screw ×4)

4. Remove the power sitch.

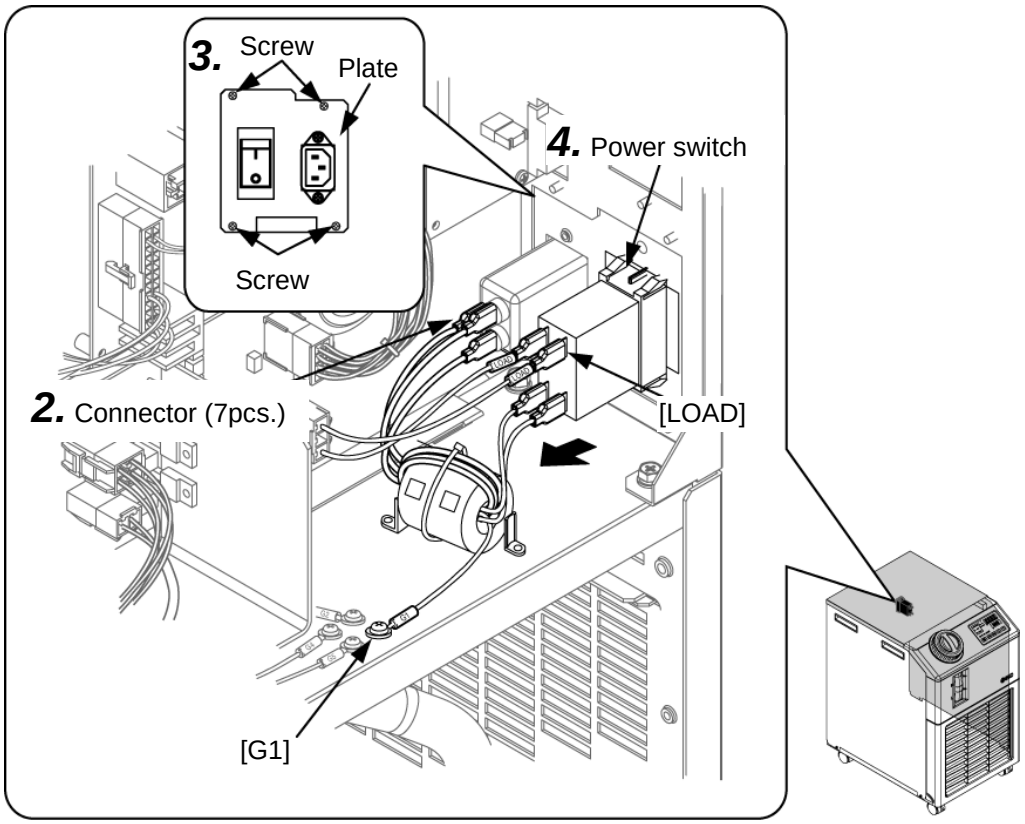


Fig. 4.5-31 Removal of power switch

■ Mounting

1. Mount the power switch.

∗ Be careful of the mounting direction.

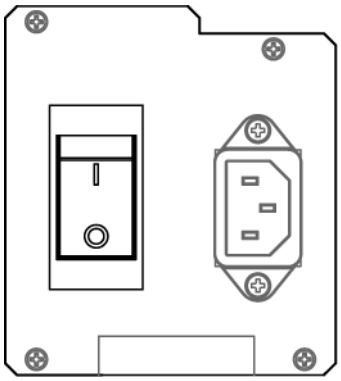


Fig. 4.5-32 Mounting direction in power switch

2. Mount the plate. (screw ×4)

3. Insert wiring to terminal A-A', B-B', [G1] to terminal C, [LOAD] to terminal D.

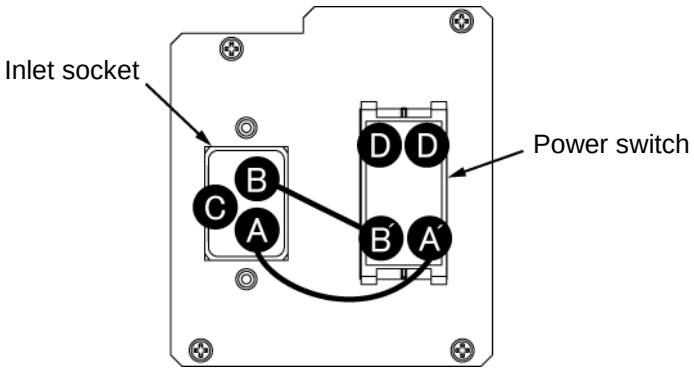


Fig. 4.5-33 Entry of connector

4. Mount the upper panel and the side panel on the right in reversed order of removal.

4.5.15 Replacement of DC power supply

＜HRS∗∗∗-A/W-∗＞

Table 4-22 Part number of service parts (DC power supply)

Description	Part number
DC power supply	HRS-S0016

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Remove the upper panel, the side panel on the right and the front panel referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the connector of DC power supply. (2 locations)

3. Hold the spacer (4 locations) to remove DC power supply.

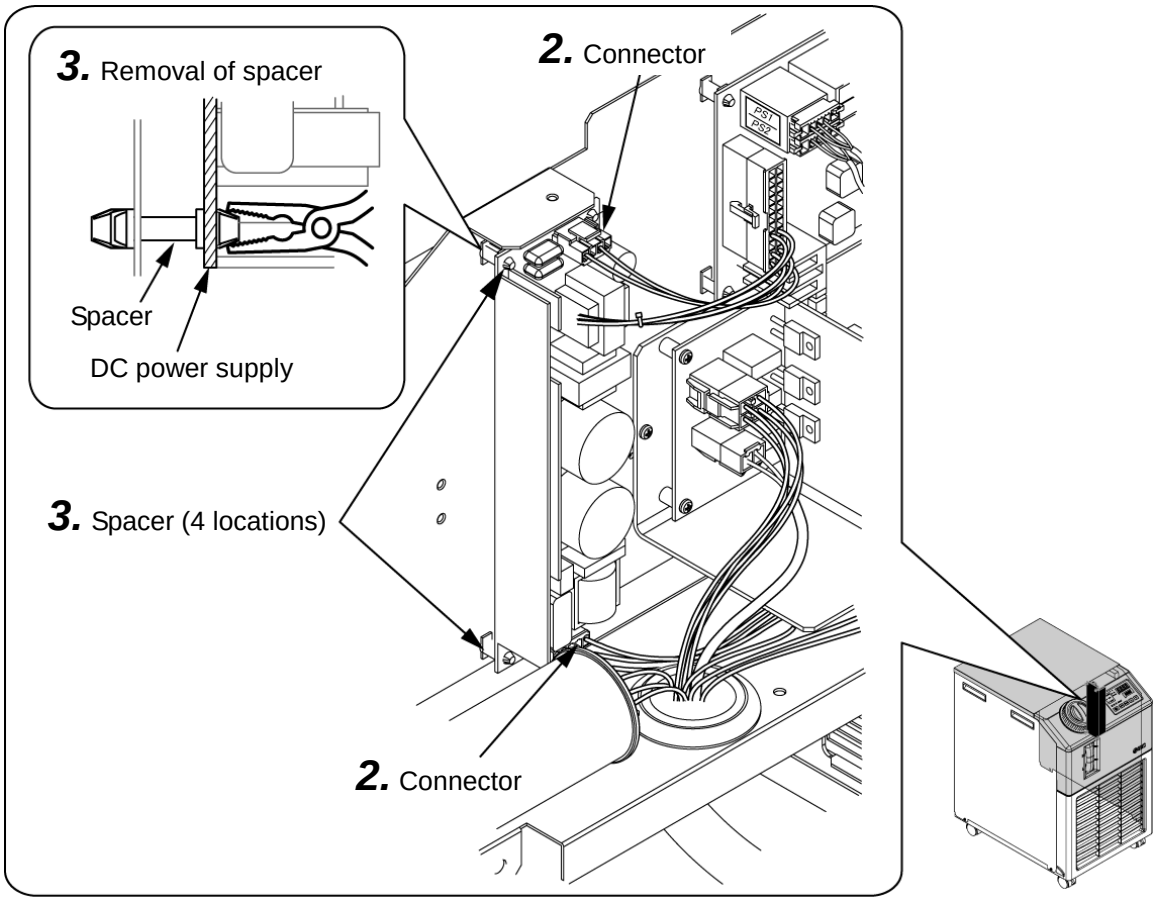


Fig. 4.5-34 Removal of DC power supply

■ Mounting

1. Mount the DC power supply. (Spacer ×4)

2. Mount the connector (2 locations).

3. Mount the upper panel, the side panel on the right and the front panel in reversed order of removal.

4.5.16 Replacement of main board & communication board <HRS***-A/W-*>

Table 4-23 Part number of service parts (Main board and Communication board)

Description	Part number	Applicable models	Remarks
Main board Note1)	HRS-S0033	HRS012-A-10	−
	HRS-S0282	HRS012-A-10-T	−
	HRS-S0283	HRS012-A-10-MT	−
	HRS-S0034	HRS012-W-10	−
	HRS-S0284	HRS012-W-10-T	−
	HRS-S0285	HRS012-W-10-MT	−
	HRS-S0035	HRS018-A-10	−
	HRS-S0286	HRS018-A-10-T	−
	HRS-S0287	HRS018-A-10-MT	−
	HRS-S0036	HRS018-W-10	−
	HRS-S0288	HRS018-W-10-T	−
	HRS-S0289	HRS018-W-10-MT	−
	HRS-S0037	HRS012-A-20	−
	HRS-S0078	HRS012-A-20-G	−
	HRS-S0038	HRS012-A-20-T	−
	HRS-S0079	HRS012-A-20-GT	−
	HRS-S0039	HRS012-A-20-MT	−
	HRS-S0080	HRS012-A-20-GMT	−
	HRS-S0040	HRS012-W-20	−
	HRS-S0041	HRS012-W-20-T	−
	HRS-S0042	HRS012-W-20-MT	−
	HRS-S0043	HRS018-A-20	−
	HRS-S0081	HRS018-A-20-G	−
	HRS-S0044	HRS018-A-20-T	−
	HRS-S0082	HRS018-A-20-GT	−
	HRS-S0045	HRS018-A-20-MT	−
	HRS-S0083	HRS018-A-20-GMT	−
	HRS-S0046	HRS018-W-20	−
	HRS-S0047	HRS018-W-20-T	−
	HRS-S0048	HRS018-W-20-MT	−
	HRS-S0049	HRS024-A-20	−
	HRS-S0084	HRS024-A-20-G	−
	HRS-S0050	HRS024-A-20-T	−
	HRS-S0085	HRS024-A-20-GT	−
	HRS-S0051	HRS024-A-20-MT	−
	HRS-S0086	HRS024-A-20-GMT	−
	HRS-S0052	HRS024-W-20	−
	HRS-S0053	HRS024-W-20-T	−
	HRS-S0054	HRS024-W-20-MT	-
	HRS-S0290	HRS030-A-20	-
	HRS-S0291	HRS030-A-20-T	-
	HRS-S0292	HRS030-A-20-MT	-
	HRS-S0293	HRS030-W-20	-
	HRS-S0294	HRS030-W-20-T	-
	HRS-S0295	HRS030-W-20-MT	-
	HRS-S0134	HRS012, 018, 024, 030 series	Be sure to perform an initial setting of the main board.
Communication board	HRS-S0018	−	−

Note1) The main board has to be selected either one of options listed. HRS-S0033 to HRS-S0054 and HRS-S0078 to HRS-S0086 and HRS-S0282 to HRS-S0295 are preset their initial setting. HRS-S0134 is universal part so it needs initial setting after replase the board.

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the connector of main board and communication board. (7 locations)

3. Remove the screw (2 locations) of communication board.

4. Hold the spacer (6 locations) to remove main board and communication board. (Refer to Fig. 4.5-35 Removal of main board & communication board.)

5. Remove the communication board from main board.

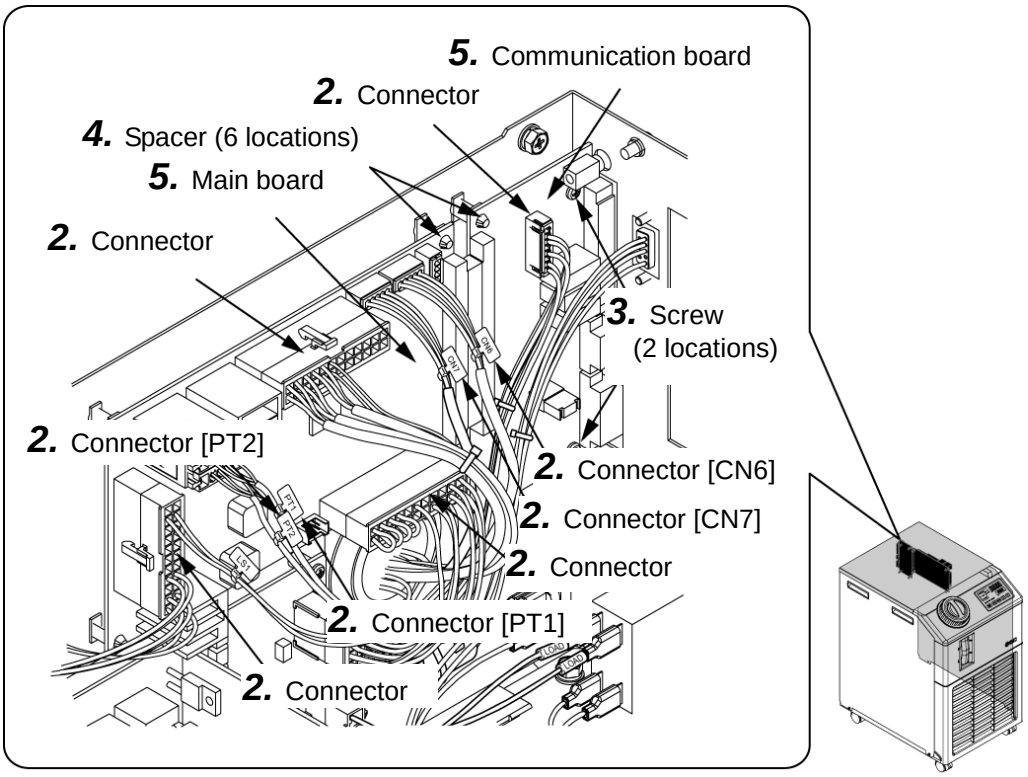


Fig. 4.5-35 Removal of main board & communication board

■ Mounting

1. Insert the main board to the communication board.

2. Mount the main board and communication board.(Spacer ×6)

3. Mount the screw of communication board. (2 locations)

4. Mount the connector of the main board and the communication board. (7 locations)

5. Mount the upper panel and the side panel on the right in reversed order of removal.

∗ When replacing the main control board, HRS-S0134, be sure to perform an initial setting of the main board. Please refer to the initial setting procedure attached to the service parts.

4.5.17 Replacement of power board

＜HRS∗∗∗-A/W-∗＞

Table 4-24 Part number of service parts (Power board)

Description	Part number
Power board	HRS-S0019

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the connector of power board. (5 locations)

3. Remove the power board. (Screw ×2)

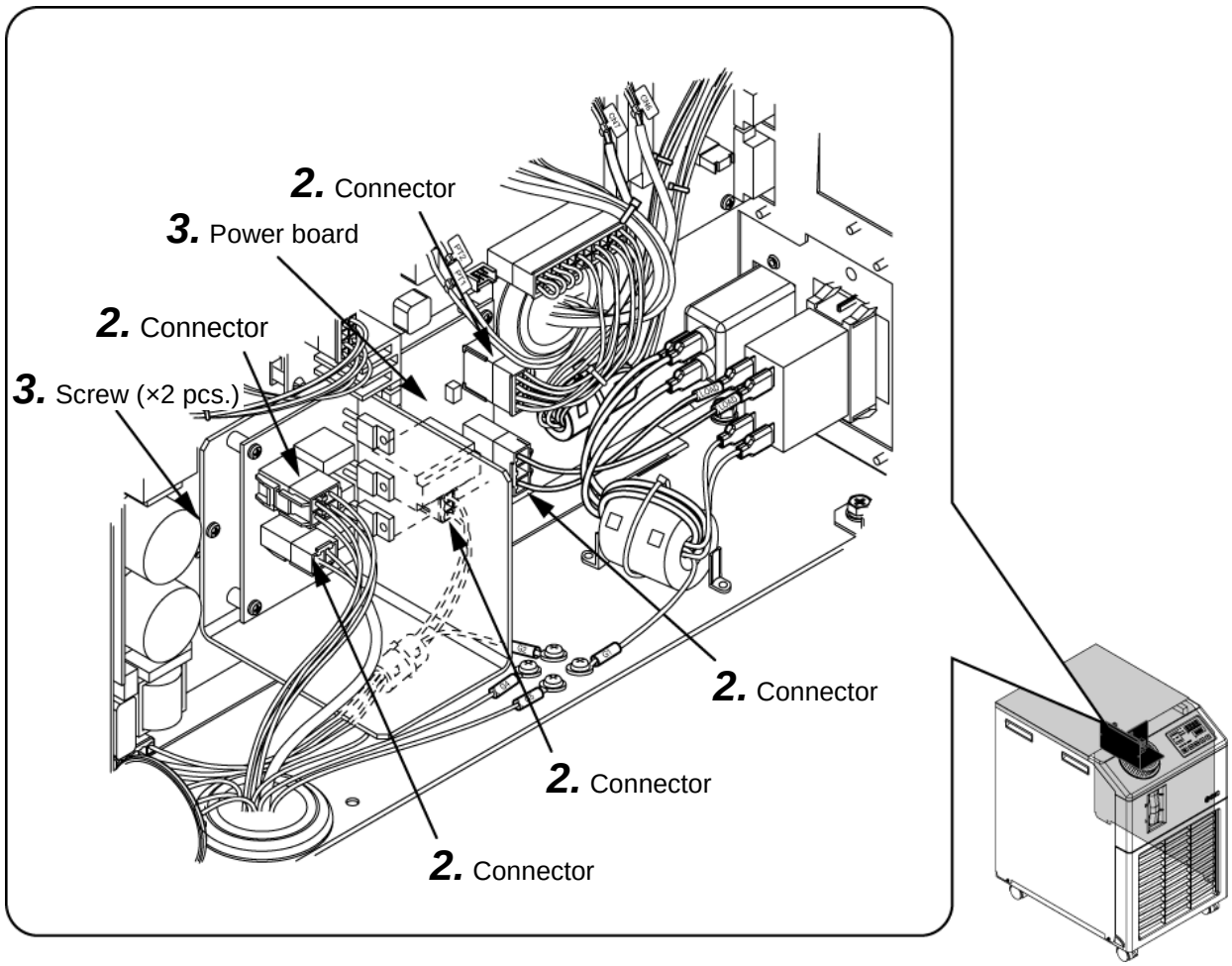


Fig. 4.5-36 Removal of power board

■ Mounting

1. Mount the power board. (screw ×2)

2. Mount the connector of power board. (5 locations)

3. Mount the upper panel and the side panel on the right in reversed order of removal.

4.5.18 Replacement of display board

＜HRS∗∗∗-A/W-∗＞

Table 4-25 Part number of service parts (Display board)

From production in March 2015
(After serial No. TQ***)

Description	Part number
Display board	HRS-S0520

Until production in February 2015
(Serial No. TP*** or earlier)

Description	Part number
Display board	HRS-S0017

*Refer to 1.4-1 Product label for serial No.

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

From production in March 2015 (After serial No. TQ***)

■ Removal

1. Remove the upper panel, the panels on both sides and the front panel referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the display board.

[Tips]

Push the claws A at the back of the front panel with both thumbs to open the front panel. Pull the display board with fingers to remove the display board.

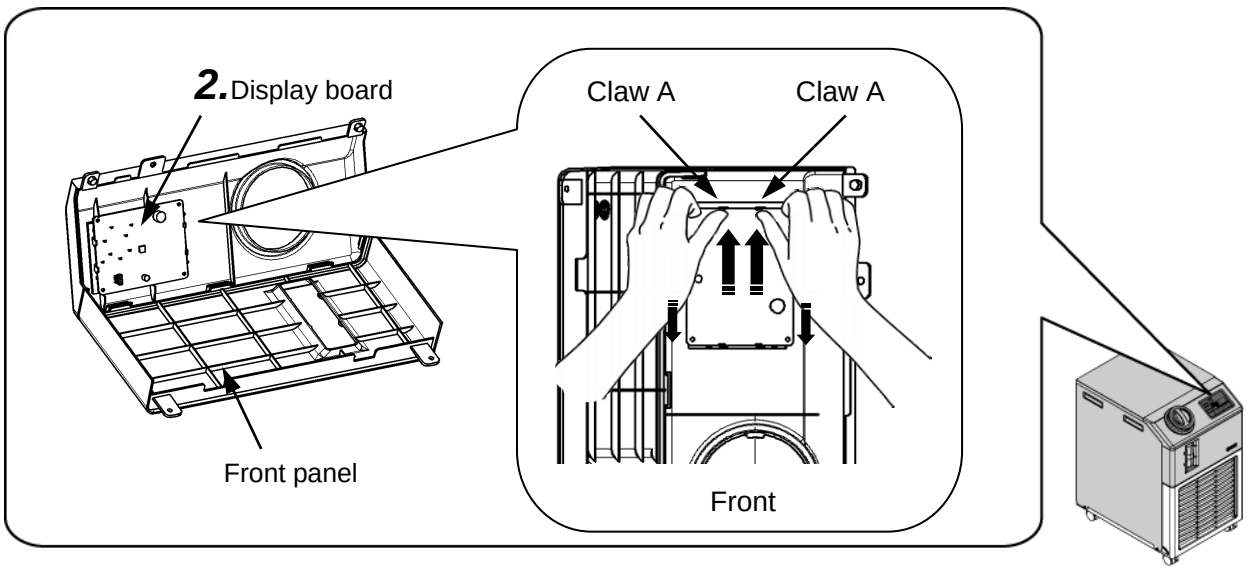


Fig. 4.5-37 Removal of display board

■ Mounting

1. Mount the display board.

[Tips]

Align with the 4 guides at the back of the front panel, set the end of the display board to the 2 claws B. Pull the display board forward while pushing the 2 claws A out with both thumbs until the claws click.

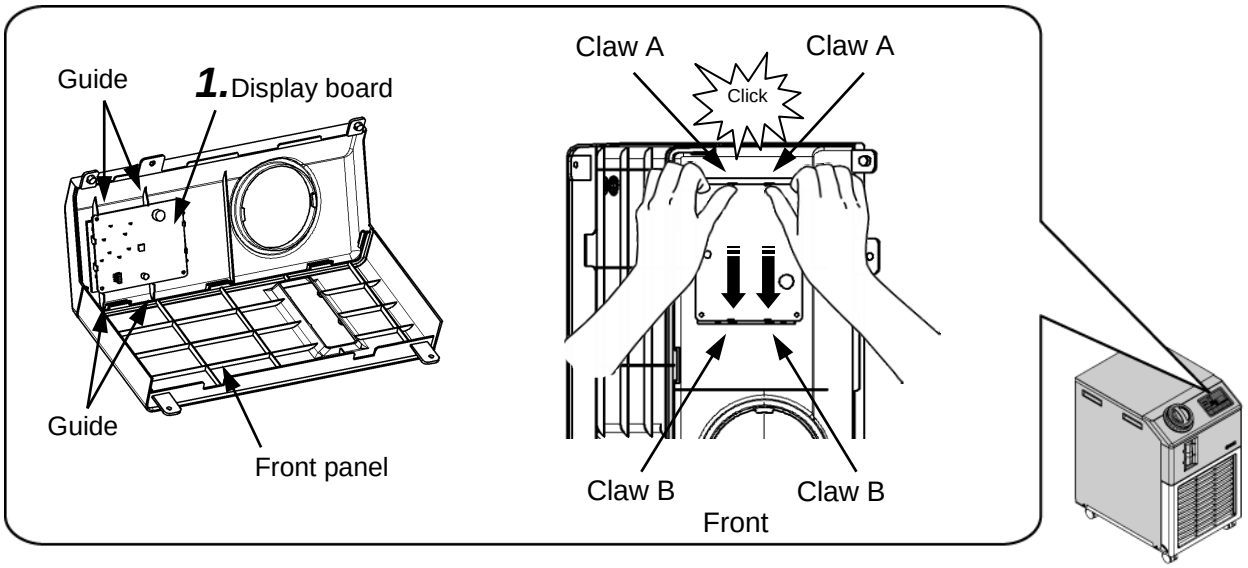


Fig. 4.5-38 Mount the display board

2. Mount the upper panel, the panels on both sides and the front panel in reversed order of removal.

Until production in February 2015 (Serial No. TP*** or earlier)

Replacement of display board

■ Removal

1. Remove the upper panel, the panels on both sides and the front panel referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the display board. (Screw ×2)

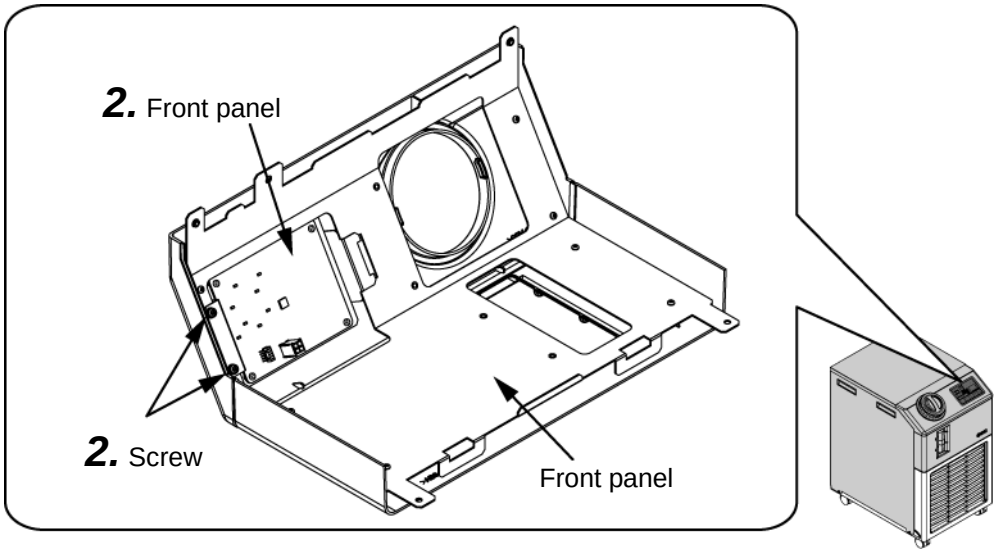


Fig. 4.5-39 Removal of display board

■ Mounting

1. Mount the display board. (Screw ×4)

[Tips]

Mount the display board using the notch.

2. Mount the upper panel, the panels on both sides and the front panel in reversed order of removal.

4.5.19 Replacement of hose

＜HRS∗∗∗-A/W-∗＞

Table 4-26 Part number of service parts (Hose)

Description	Part number
Hose	HRS-S0008
Hose (For HRS030)	HRS-S0302
Hose (For high pressure pump MT)	HRS-S0069
Hose (For high pressure pump MT) (For HRS030)	HRS-S0304
Hose (For high pressure pump T)	HRS-S0077
Hose (For high pressure pump T) (For HRS030)	HRS-S0303

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal (Between tank-pump)

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel and the side panel on the left referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the hose clamp and remove the hose.

∗ For the HRS030, cut the cable tie which fixes the hose between the pump and circulating fluid outlet port.

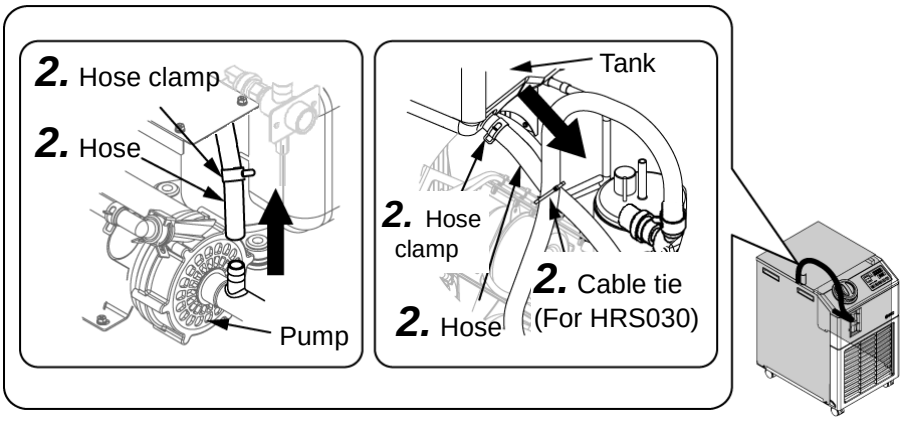


Fig. 4.5-40 Removal of hose (Between tank－pump)

■ Mounting (Between tank-pump)

1. Mount the hose using the hose clamp.

2. Hold the hose with the hose clamp.

∗ For the HRS030, fix the hose between the pump and circulating fluid outlet port with a cable tie to prevent the hose between the tank and pump from touching the fan motor bracket.

3. Mount the upper panel and the side panel on the left in reversed order of removal.

CAUTION

Check the hose is not twisted after connecting.

■ Removal (Between tank-heat exchanger)

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel and the side panel on the left referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the hose clamp on the tank side. (2 locations)

4. Remove the tank.

5. Remove the hose clamp on the heat exchanger side and remove the hose.

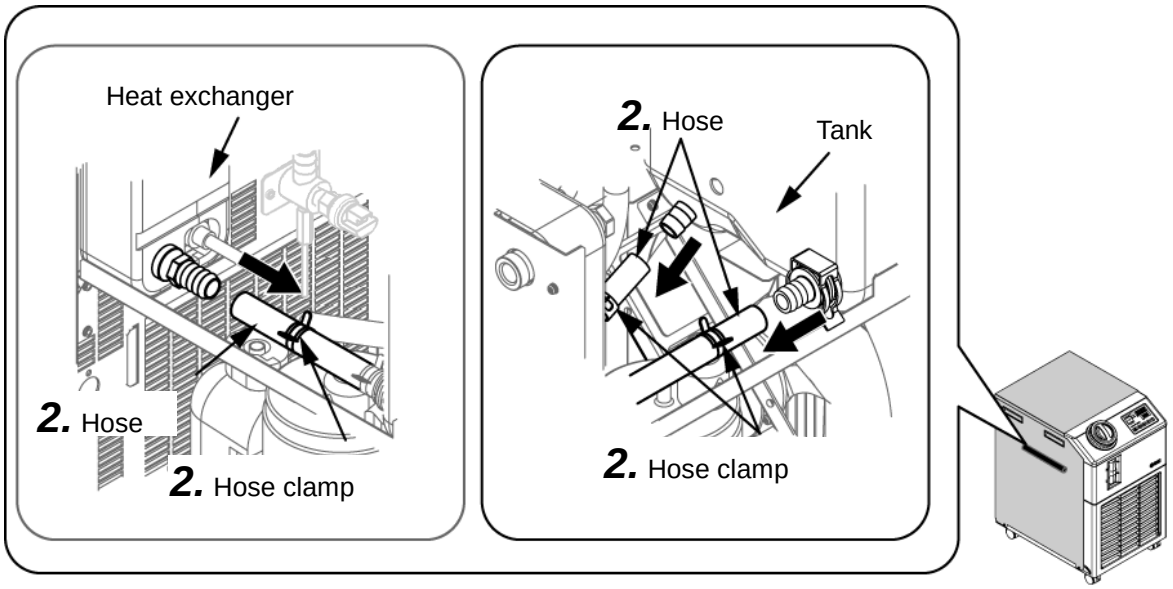


Fig. 4.5-41 Removal of plastic hose (Between tank-heat exchanger)

■ Mounting (Between tank-heat exchanger)

1. Mount the hose on the tank using the hose clamp.

2. Install the tank.

3. Mount the hose on the heat exchanger.

4. Hold the hose with the hose clamp. (3 locations)

5. Mount the upper panel and the side panel on the left in reversed order of removal.

CAUTION

Check the hose is not twisted after connecting.

■ Removal (Between pump- circulating fluid outlet)

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the hose clamp and remove hose.

∗ For the HRS030, cut the cable tie which fixes the hose between the pump and tank.

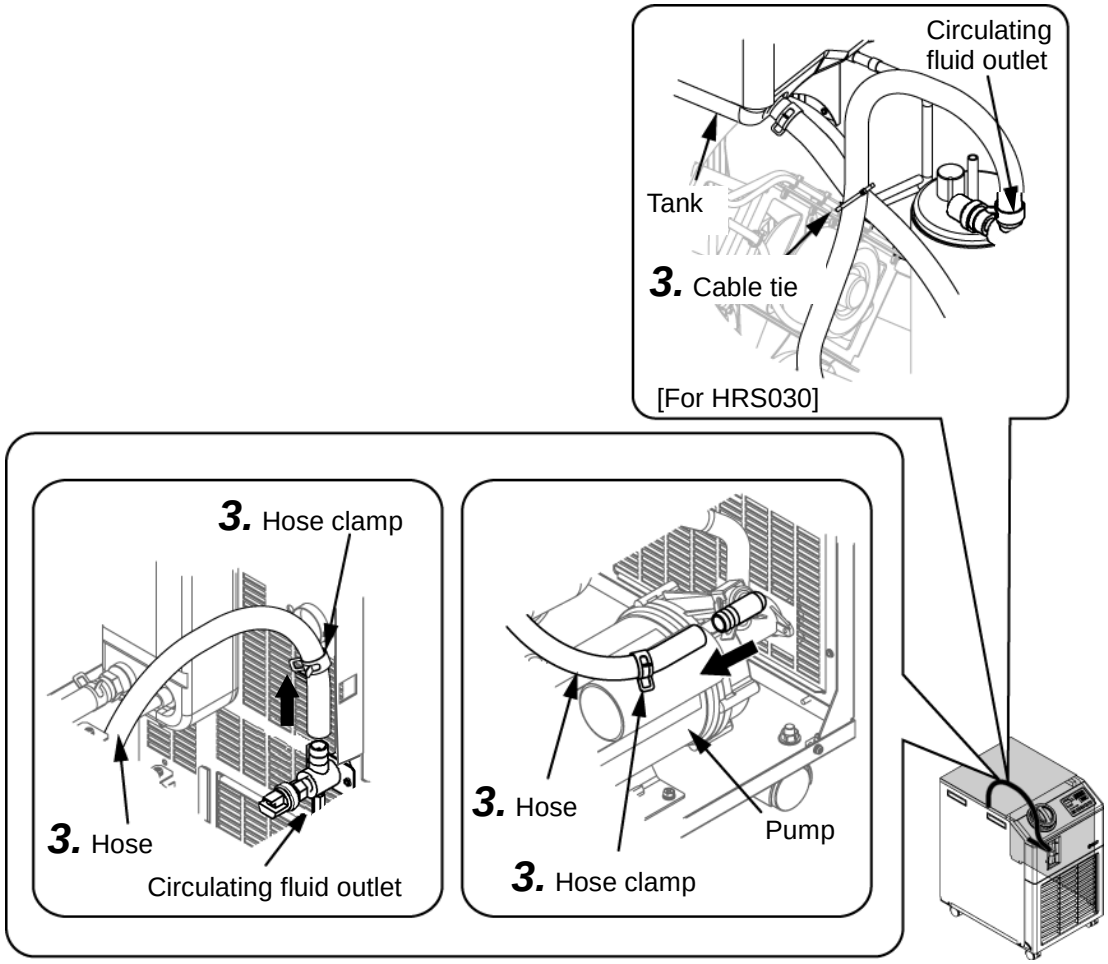


Fig. 4.5-42 Removal of plastic hose (Between pump- circulating fluid outlet)

■ Mounting (Between pump- circulating fluid outlet)

1. Mount the hose using the hose clamp.

2. Hold the hose with the hose clamp.

3. Mount the upper panel and the side panel on the right in reversed order of removal.

∗ For the HRS030-A, fix the hose between the tank and pump with a cable tie to prevent the hose between the pump and circulating fluid outlet port from touching the fan motor bracket.

CAUTION

Check the hose is not twisted after connecting.

<High pressure pump>

■ Removal (Between tank-pump)

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel and the panels on both sides referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the hose clamp and remove hose.
∗ For the HRS030-A, cut the cable tie which fixes the hose between the pump and circulating fluid outlet port.

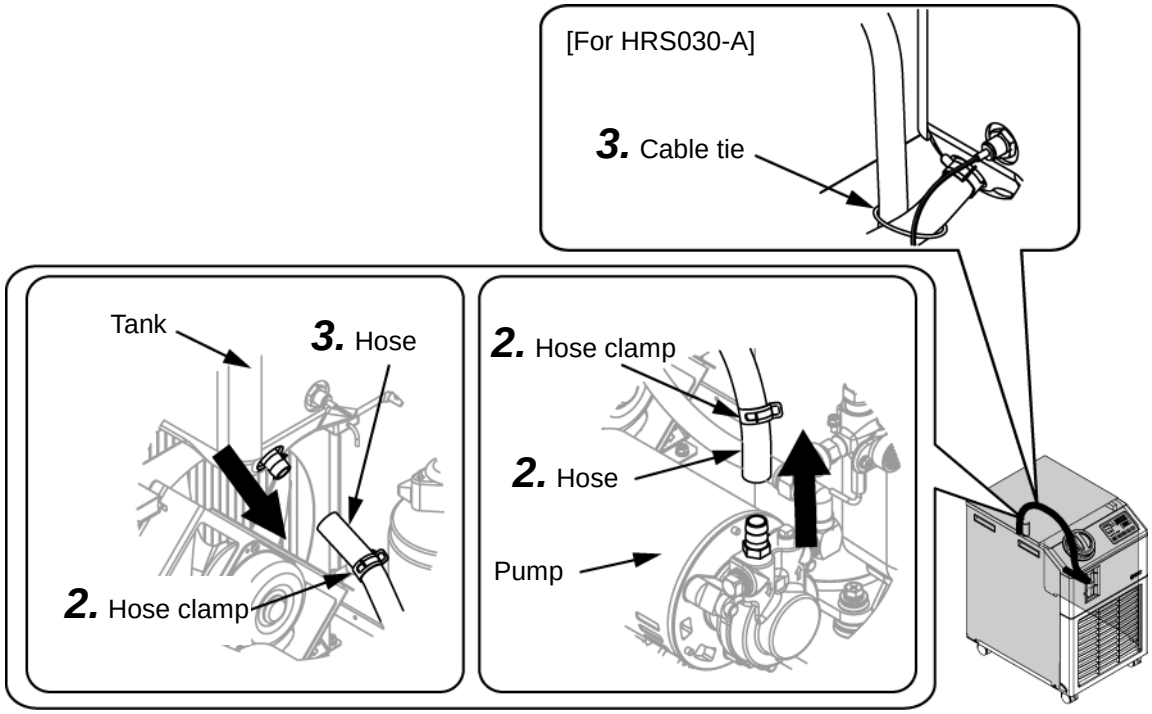


Fig. 4.5-43 Removal of plastic hose (Between tank-pump)

■ Mounting (Between tank-pump)

1. Mount the hose using the hose clamp.

2. Hold the hose with the hose clamp.

3. Mount the upper panel and the panels on both sides in reversed order of removal.
∗ For the HRS030-A, fix the hose between the pump and circulating fluid outlet port with a cable tie to prevent the hose between the tank and pump from touching the fan motor bracket.

CAUTION

Check the hose is not twisted after connecting.

■ Removal (Between tank-heat exchanger)

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel and the side panel on the left referring the 4.2.1 Removal and the mounting of the panel.

3. Remove the hose clamp on the tank side. (2 locations)

4. Remove the tank.

5. Remove the hose clamp on the heat exchanger side and remove the hose.

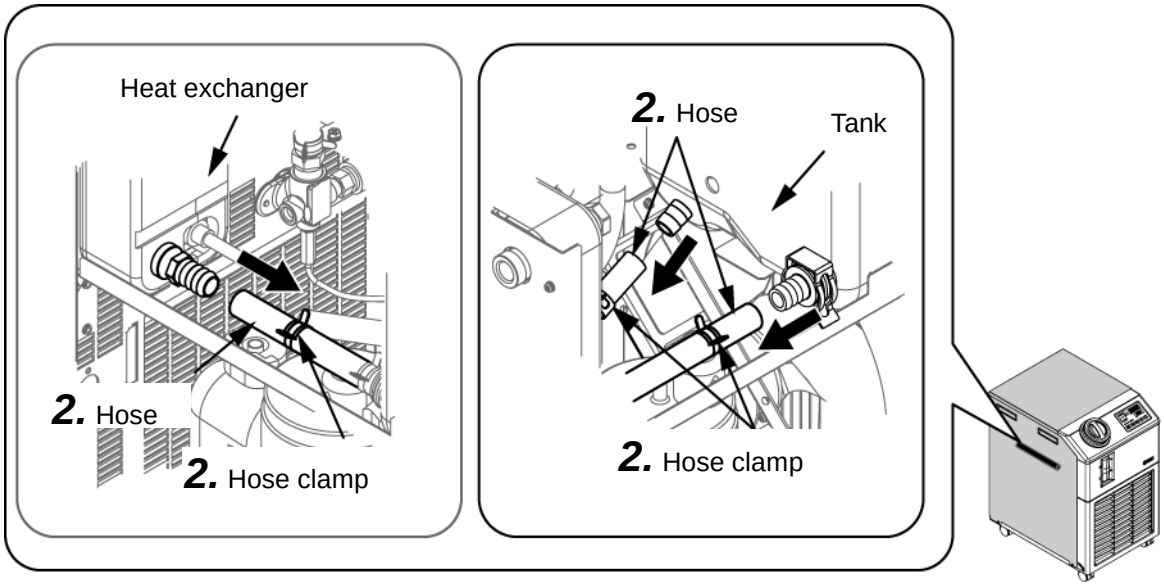


Fig. 4.5-44 Removal of plastic hose (Between tank-heat exchanger)

■ Mounting (Between tank-heat exchanger)

1. Mount the hose on the tank using the hose clamp.

2. Install the tank.

3. Mount the hose on the heat exchanger.

4. Hold the hose with the hose clamp. (3 locations)

5. Mount the upper panel and the side panel on the left in reversed order of removal.

CAUTION

Check the hose is not twisted after connecting.

■ Removal (Between pump- circulating fluid outlet)

1. Discharge the circulating fluid referring the 4.2.2 Discharge of the circulating fluid and facility water.

2. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

3. The hose fitting is loosened and remove the hose.

∗ For the HRS030-A, cut the cable tie which fixes the hose between the tank and pump.

∗ For the HRS030-W, cut the cable tie fixed on the electrical panel.

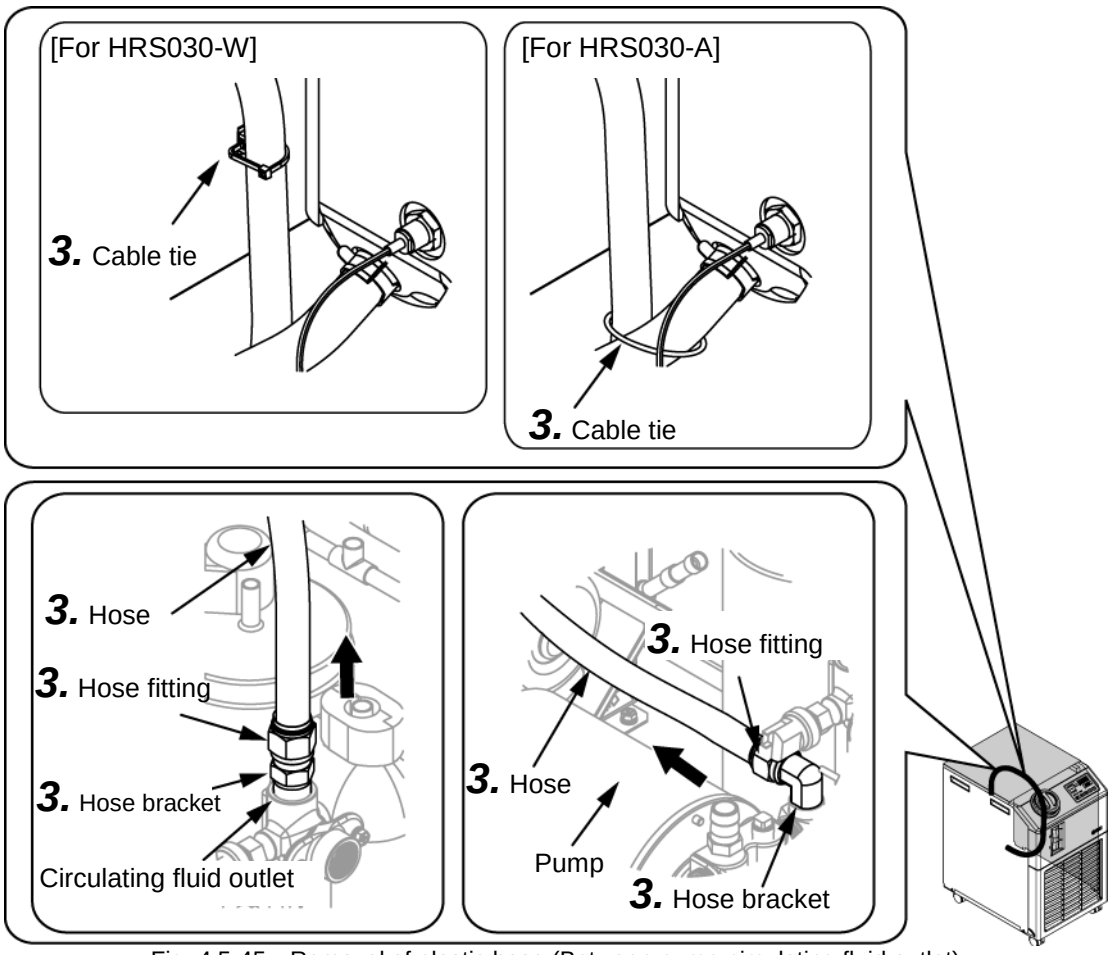


Fig. 4.5-45 Removal of plastic hose (Between pump-circulating fluid outlet)

■ Mounting (Between pump- circulating fluid outlet)

1. Mount the hose fitting to the hose bracket.

2. Mount the upper panel and the side panel on the right in reversed order of removal.

∗ For the HRS030-A, fix the hose between the tank and pump with a cable tie to prevent the hose between the pump and circulating fluid outlet port from touching the fan motor bracket.

∗ For the HRS030-W, fix the cable tie on the electrical panel.

CAUTION

Check the hose is not twisted after connecting.

4.5.20 Replacement of fuse

＜HRS*-A/W-*＞**

Table 4-27 Part number of service parts (Fuse)

Description	Part number
Fuse	HRS-S0024

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the fuse

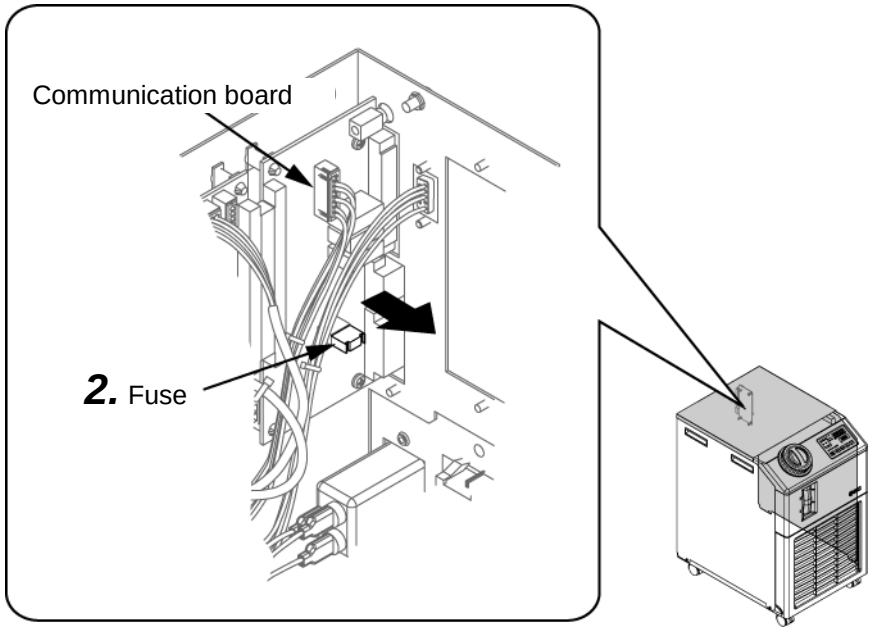


Fig. 4.5-46 Removal of fuse

■ Mounting

1. Mount the fuse.

2. Mount the upper panel and the side panel on the right in reversed order of removal.

4.5.21 Replacement of valve for automatic water fill ＜HRS∗∗∗-A/W-J＞

Table 4-28 Part number of service parts (Valve for automatic water fill)

Description	Part number
Valve for automatic water fill	HRS-S0071

⚠ WARNING

Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.

■ Removal

1. Remove the upper panel and the side panel on the right referring the 4.2.1 Removal and the mounting of the panel.

2. Remove the cable connector of valve from the main board.

[Tips]

Use "57031-6000" of MOLEX for removing.
Our part no.：HRS-S0056

3. The hose mounted on valve for automatic water fill is removed.

4. Remove the valve for automatic water fill.

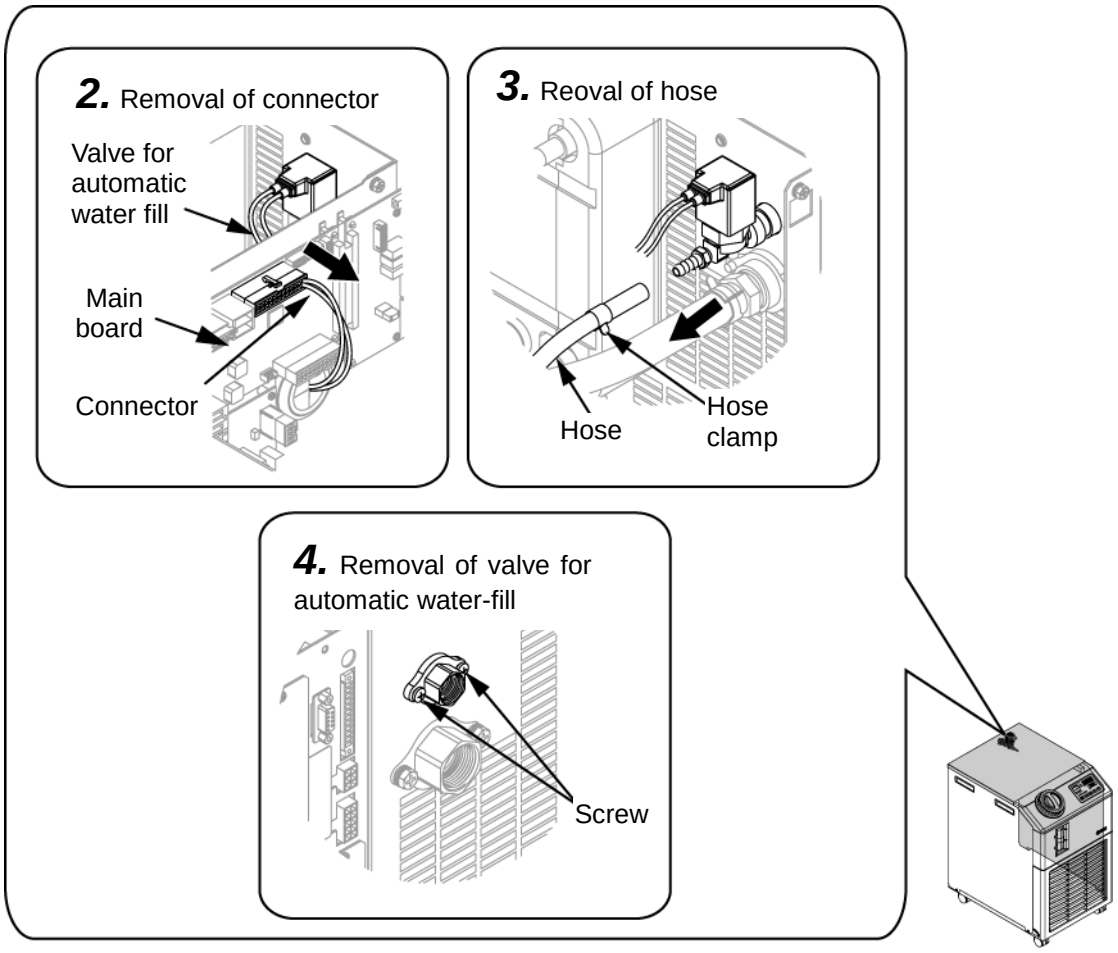


Fig. 4.5-47 Removal of valve for automatic water fill

■ Mounting

1. Mount the valve for automatic water fill.

2. Mount the cable connector of valve to the main board.

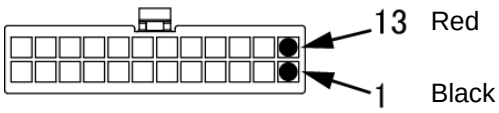


Fig. 4.5-48 Mount the connector of valve for automatic water fill

3. Mount the hose.

Chapter 5 Service Parts List

5.1 Before Using Service Parts List

- When the service part is ordered, specify its part number, description and quantity. If any of these information lacks, you may receive wrong part.
- A part which is not shown in the service parts list is not prepared as a service part.
- When the service part is ordered, contact the place from which you purchased the product.
- Service parts depend on the type of the product. 5.1.1 Referring the numbering system, confirm the applicable service parts following “5.2 Service parts list” after checking the part number of the product.

5.1.1 Numbering system chart

HRS 012 - A □ - 10 - □

①Cooling capacity

012	1100W/1300W (50/60Hz)
018	1500W/1700W(50/60Hz)(∗1) 1700W/1900W (50/60Hz)(∗2)
024	2100W/2400W (50/60Hz)(∗3)
030	2600W/3200W (50/60Hz)(∗3)

∗1 ④Power supply：-10(100V Type)
∗2 ④Power supply：-20(200V Type)
∗3 ④Power supply：Only -20(200V Type)can be chosen.
∗4 ②Cooling method：Only -A(Air-cooled refrigerator type),
④Power supply：Only -20(200V Type)can be chosen.
∗5 ①Cooling capacity:030 does not correspond.

②Cooling method

A	Air-cooled refrigerator type
W	Water-cooled refrigerator type

③Piping thread type

Null	Rc
F	G (PT-G conversion fitting is included)
N	NPT (PT-NPTconversion fitting is included)

④Power supply

10	1-phase AC100V(50Hz) 1-phase AC100~115V(60Hz)
20	1-phase AC200～230V(50/60Hz)

⑤Option

Null	None
B	Earth leakage breaker
G	High temperature type∗4∗5
J	Automatic water-supply
M	Pure water piping
T	High-pressure pump mounted

Fig. 5.1-1 Numbering system chart

5.2 Service Parts List

1.4.1 Check the part number referring the model number label and 5.1.1 Numbering system. Select the part number of the service part from confirmed part number and service part number.

Table 5-1 Service parts list

Description	Part no.	Product part no.	Reference page
Dustproof filter	HRS-S0001	HRS series common part	5-4
Apper panel	HRS-S0002	HRS series common part	5-4
Right side panel	HRS-S0003	HRS series common part (Except option G/HRS030)	5-4
Right side panel (For option G)	HRS-S0075	For option G/HRS030 (Vent hole)	5-4
Left side panel	HRS-S0004	HRS series common part (Except option G/HRS030)	5-4
Left sade panel (For option G)	HRS-S0076	For option G/HRS030 (Vent hole)	5-4
Front panel	HRS-S0519	HRS series common part From production in March 2015 (After serial No. TQ***)	5-4
Front panel B	HRS-S0005	HRS series common part Until production in February 2015 (Serial No. TP*** or earlier)	5-4
Front panel A	HRS-S0006	HRS series common part Until production in February 2015 (Serial No. TP*** or earlier)	5-4
Temperature sensor	HRS-S0007	HRS series common part	5-5
Hose (For standard pump)	HRS-S0008	For standard pump (For HRS012/018/024)	5-5
Hose (For standard pump)	HRS-S0302	For standard pump(For HRS030)	5-5
Hose (For high pressure pump MT)	HRS-S0069	Option MT: High pressure pump (For HRS012/018/024)	5-5
Hose (For high pressure pump MT)	HRS-S0304	Option MT: High pressure pump (For HRS030)	5-5
Hose (For high pressure pump T)	HRS-S0077	Option T: High pressure pump (For HRS012/018/024)	5-5
Hose (For high pressure pump T)	HRS-S0303	Option T: High pressure pump (For HRS030)	5-5
Pressure sensor (For circurating fluid)	HRS-S0011	HRS series common part	5-6
Level switch	HRS-S0014	HRS series common part	5-6
DC power supply	HRS-S0016	HRS series common part	5-7
Display board	HRS-S0520	HRS series common part From production in March 2015 (After serial No. TQ***)	5-8
Display board	HRS-S0017	HRS series common part Until production in February 2015 (Serial No. TP*** or earlier)	5-8
Communication board	HRS-S0018	HRS series common part	5-8
Power board	HRS-S0019	HRS series common part	5-8
Power switch (For 10A type)	HRS-S0020	200V type (Except high pressure pump)	5-9
Power switch (For 15A type)	HRS-S0070	100V type 200V type high pressure pump	5-9
Inlet socket	HRS-S0021	HRS series common part	5-9
Pump (For 100V type)	HRS-S0022	Standard pump for 100V	5-10
Pump (For 200V type)	HRS-S0066	Standard pump for 200V	5-10
Pump (For HRS030)	HRS-S0361	Standard pump for HRS030	5-10
High pressure pump (For 100V type option T)	HRS-S0265	100V type Option T:High pressure pump	5-10
High pressure pump (For 100V type option MT)	HRS-S0266	100V type Option MT:High pressure pump	5-10
High pressure pump (For 200V type option T)	HRS-S0062	200V type Option T:High pressure pump (For HRS012/018/024)	5-10
High pressure pump (For 200V type option T)	HRS-S0299	200V type Option T:High pressure pump (For HRS030)	5-10
High pressure pump (For 200V type option MT)	HRS-S0063	200V type Option MT:High pressure pump (For HRS012/018/024)	5-10
High pressure pump (For 200V type option MT)	HRS-S0300	200V type Option MT:High pressure pump (For HRS030)	5-10
Mechanical seal set (For 100V type option T)	HRS-S0390	100V type Option T:High pressure pump	5-10
Mechanical seal set (For 100V type option MT)	HRS-S0412	100V type Option MT:High pressure pump	5-10
Mechanical seal set (For 200V type option T,MT)	HRG-S0211	200V type Option T,MT:High pressure pump	5-10
Fan (For 100V type)	HRS-S0023	For 100V fan	5-10
Fan (For 200V type)	HRS-S0067	For 200V fan	5-10
Fan (For HRS030)	HRS-S0301	For HRS030 fan	5-10

Fuse	HRS-S0024	HRS series common part	5-8
Tank	HRS-S0025	HRS series common part	5-11
Tank (For automatic water fill)	HRS-S0072	Option J:Automatic water fill	5-11
Tank lid	HRS-S0026	HRS series common part	5-11
Main board Note1)	HRS-S0033 to S0054, S0078 to S0086, S0282 to S0295	The model number is set according to the model. (Refer page 4-41 for detail)	5-8
	HRS-S0134	HRS series common part	
Valve for automatic water fill	HRS-S0071	Option J:Automatic water fill	5-12

Note1) The main board has to be selected either one of options listed. HRS-S0033 to HRS-S0054 and HRS-S0078 to HRS-S0086 and HRS-S0282 to HRS-S0295 are preset their initial setting. HRS-S0134 is universal part so it needs initial setting after replase the board.

5.3 Illustration of Service Parts

5.3.1 Dustproof filter

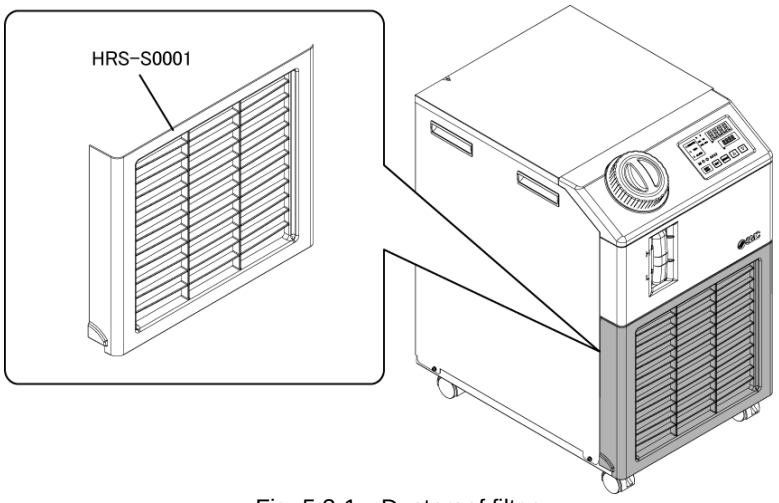


Fig. 5.3-1 Dustproof filter

Table 5-2 Part number of service parts (Dustproof filter)

Description	Part number
Dustproof filter	HRS-S0001

5.3.2 Panel

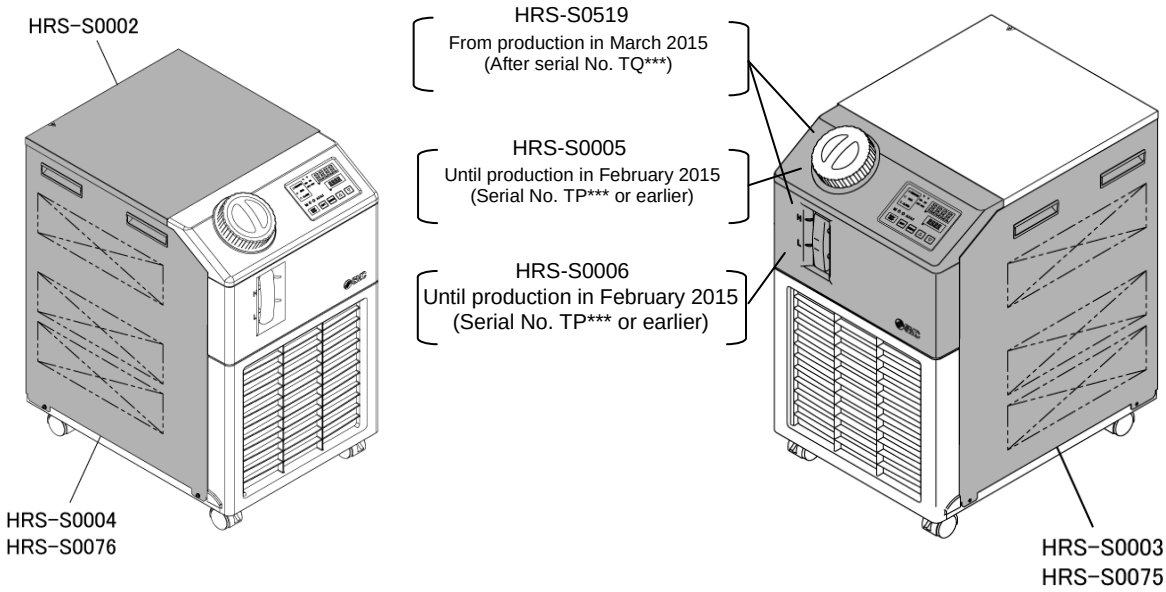


Fig. 5.3-2 Panel

Table 5-3 Part number of service parts (Panel)

Description	Part number
Apper panel	HRS-S0002
Right side panel	HRS-S0003
Right side panel (For option G/HRS030)	HRS-S0075
Left side panel	HRS-S0004
Left side panel (For option G/HRS030)	HRS-S0076
Front panel	HRS-S0519
Front panel B	HRS-S0005
Front panel A	HRS-S0006

5.3.3 Temperature sensor

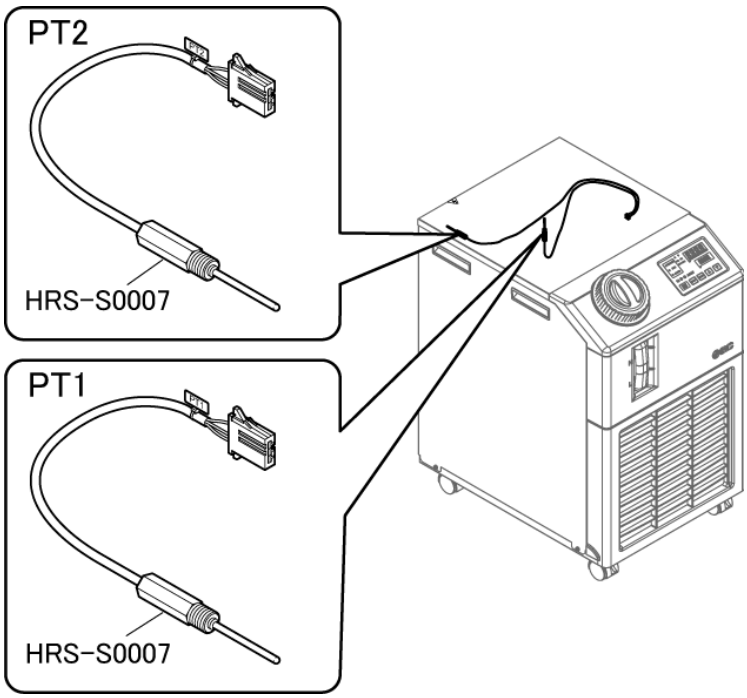


Fig. 5.3-3 Temperature sensor

Table 5-4 Part number of service parts (Temperature sensor)

Description	Part number
Temperature sensor	HRS-S0007

5.3.4 Hose

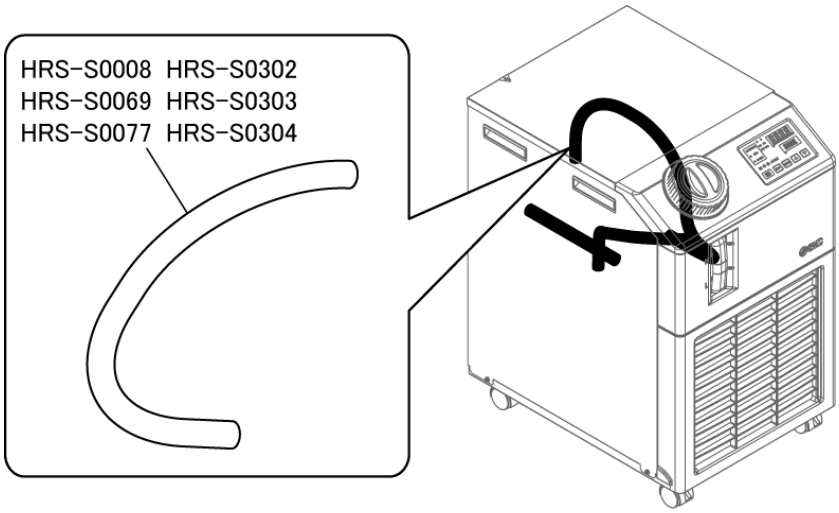


Fig. 5.3-4 Hose

Table 5-5 Part number of service parts (Hose)

Description	Part number
Hose (For standard pump)	HRS-S0008
Hose (For standard pump)(For HRS030)	HRS-S0302
Hose (For high pressure pump MT)	HRS-S0069
Hose (For high pressure pump MT)(For HRS030)	HRS-S00304
Hose (For high pressure pump T)	HRS-S0077
Hose (For high pressure pump T)(For HRS030)	HRS-S0303

5.3.5 Pressure sensor (For circulating fluid)

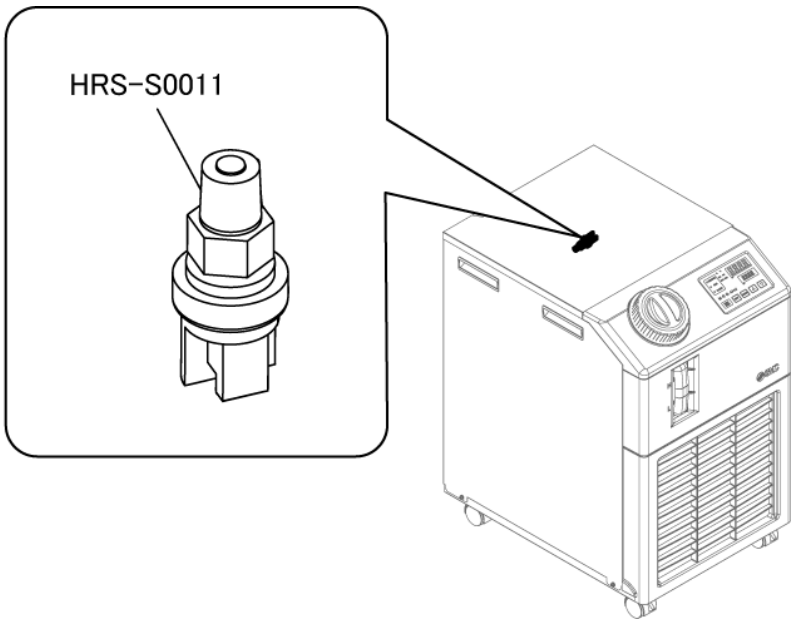


Fig. 5.3-5 Pressure sensor (For circulating fluid)

Table 5-6 Part number of service parts (Pressure sensor (For circulating fluid))

Description	Part number
Pressure sensor (For circulating fluid)	HRS-S0011

5.3.6 Level switch

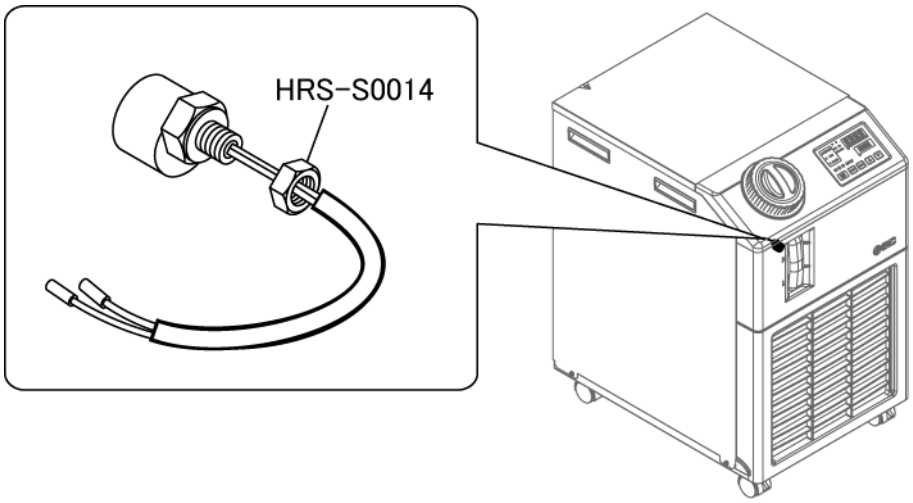


Fig. 5.3-6 Level switch

Table 5-7 Part number of service parts (Level switch)

Description	Part number
Level switch	HRS-S0014

5.3.7 DC power supply

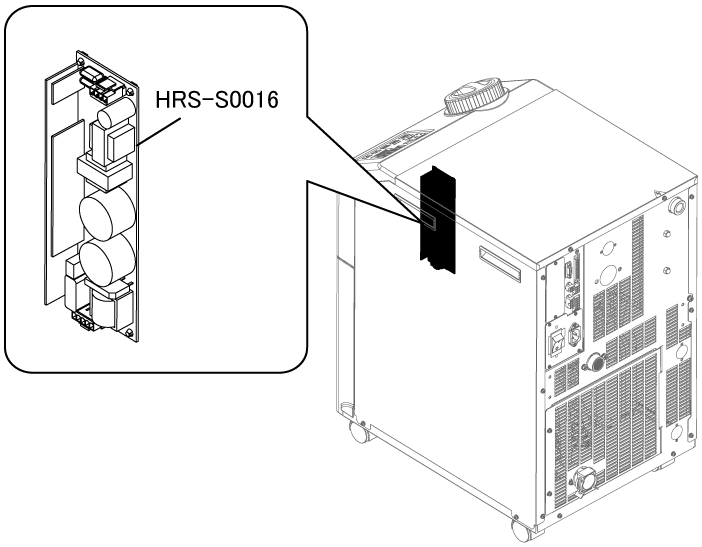


Fig. 5.3-7 DC power supply

Table 5-8 Part number of service parts (DC power supply)

Description	Part number
DC power supply	HRS-0016

5.3.8 Main board / Communication board / Power board / Display board / Fuse

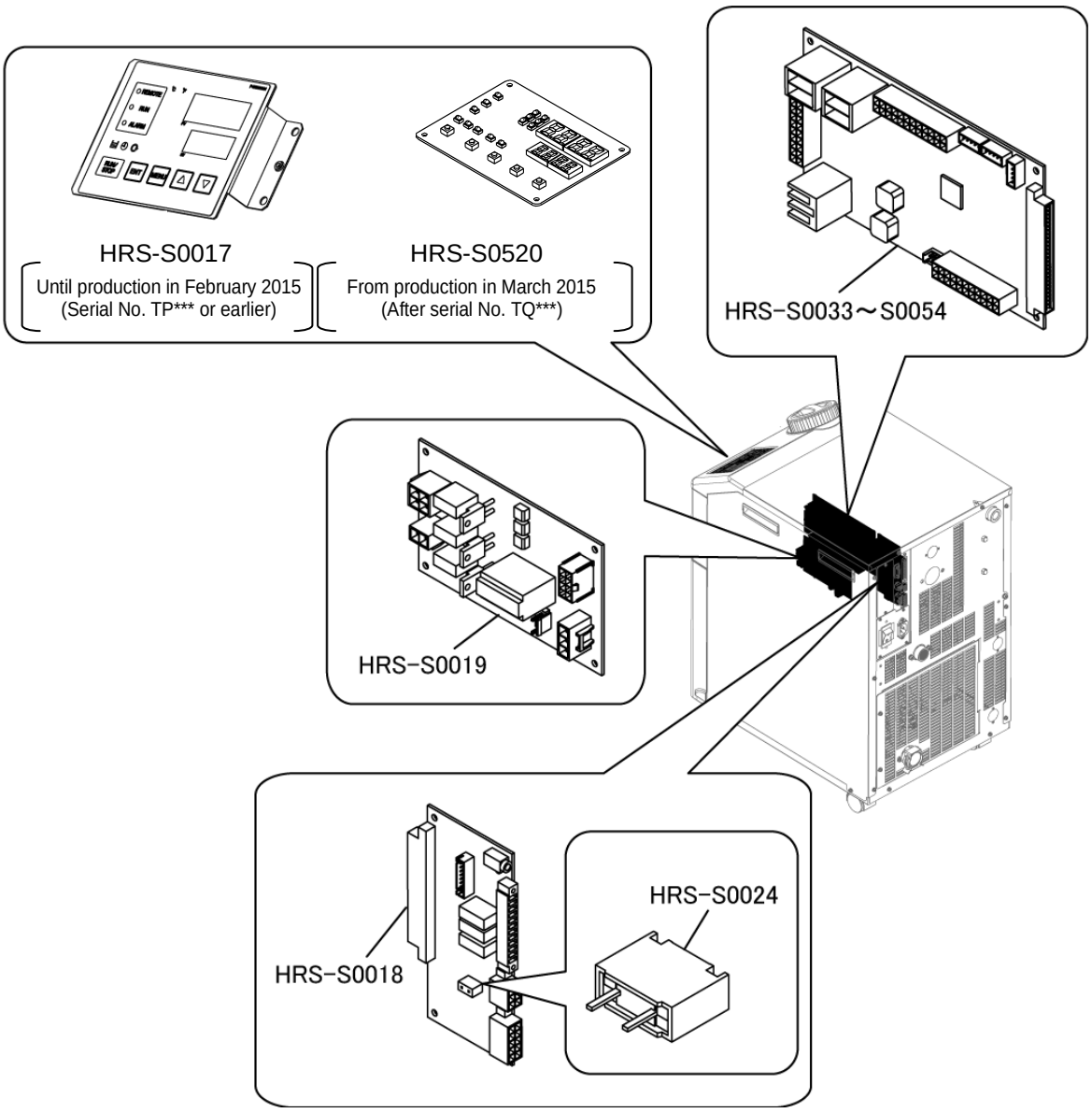


Fig. 5.3-8 Main board / Communication board / Power board / Display board / Fuse

Table 5-9 Part number of service parts (Main board / Communication board / Power board / Display board / Fuse)

Description	Part number
Display board	HRS-S0520
Display board	HRS-S0017
Communication board	HRS-S0018
Power board	HRS-S0019
Main board	HRS-S0033 to S0054 S0076 to S0086 S0282 to S0295 S0134
Fuse	HRS-S0024

5.3.9 Power switch

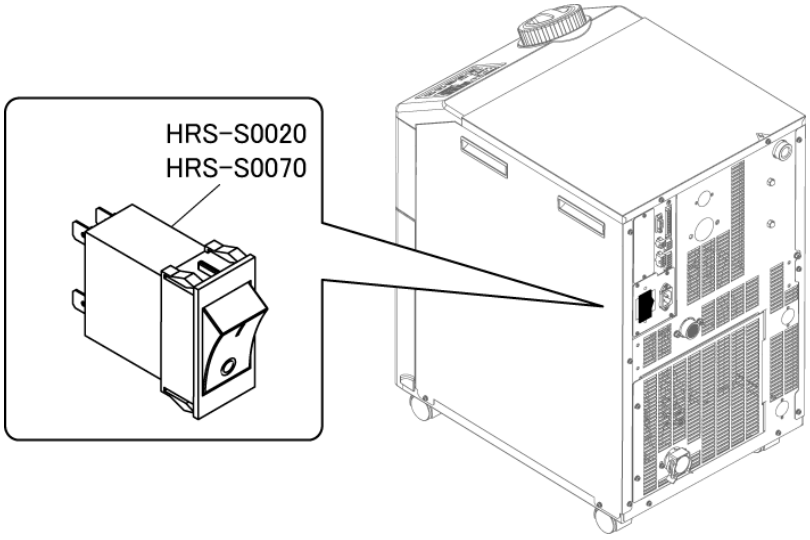


Fig. 5.3-9 Power switch

Table 5-10 Part number of service parts (Power switch)

Description	Part number
Power switch (For 10A type)	HRS-S0020
Power switch (For 20A type)	HRS-S0070

5.3.10 Inlet socket

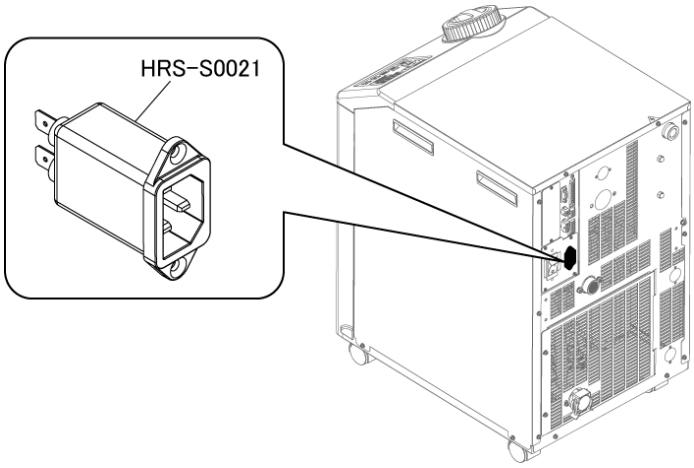


Fig. 5.3-10 Inlet socket

Table 5-11 Part number of service parts (Inlet socket)

Description	Part number
Inlet socket	HRS-S0021

5.3.11 Pump

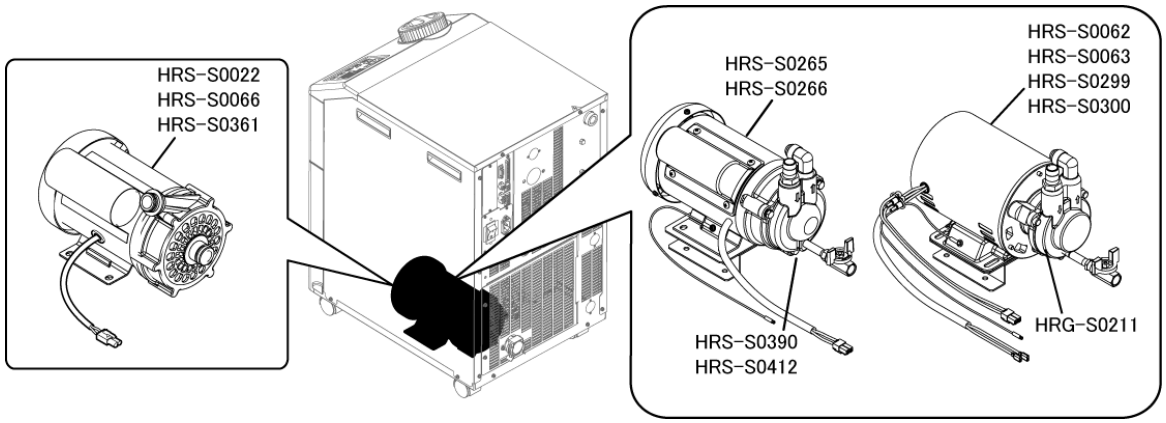


Fig. 5.3-11 Pump

Table 5-12 Part number of service parts (Pump)

Description	Part number
Pump (For 100V type)	HRS-S0022
Pump (For 200V type)	HRS-S0066
Pump (For HRS030 type)	HRS-S0361
High pressure pump (For 100V type option T)	HRS-S0265
High pressure pump (For 100V type option MT)	HRS-S0266
High pressure pump (For 200V type option T)	HRS-S0062
High pressure pump (For 200V type option T)(For HRS030)	HRS-S0299
High pressure pump (For 200V type option MT)	HRS-S0063
High pressure pump (For 200V type option MT)(For HRS030)	HRS-S0300
Mechanical seal set (For 100V type option T)	HRS-S0390
Mechanical seal set (For 100V type option MT)	HRS-S0412
Mechanical seal set (For 200V type option T, MT)	HRG-S0211

5.3.12 Fan

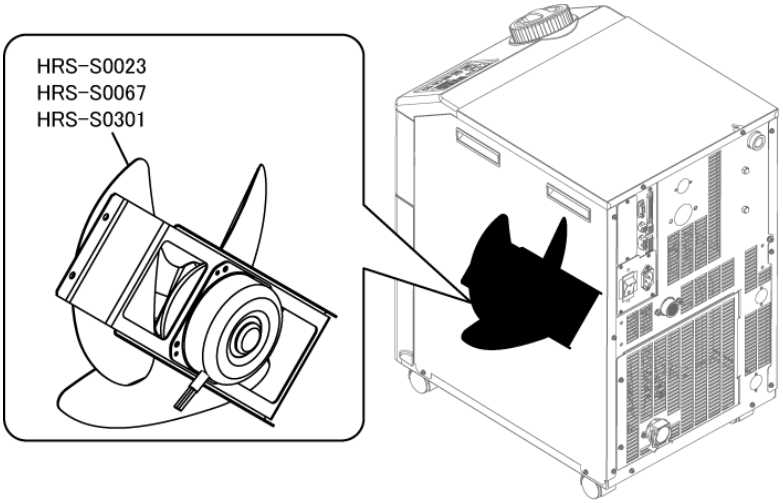


Fig. 5.3-12 Fan

Table 5-13 Part number of service parts (Fan)

Description	Part number
Fan (For 100V type)	HRS-S0023
Fan (For 200V type)	HRS-S0067
Fan (For HRS030)	HRS-S0301

5.3.13 Tank

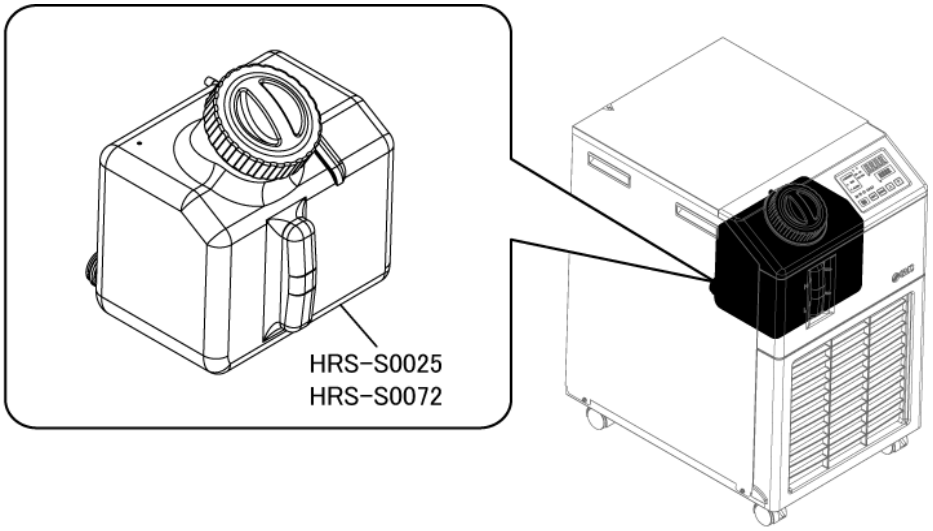


Fig. 5.3-13 Tank

Table 5-14 Part number of service parts (Tank)

Description	Part number
Tank	HRS-S0025
Tank (For automatic water fill)	HRS-S0072

5.3.14 Tank lid

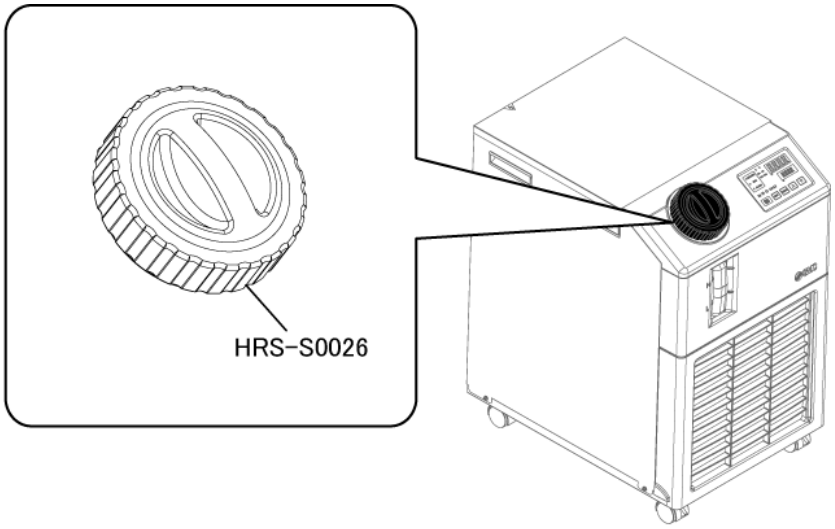


Fig. 5.3-14 Tank lid

Table 5-15 Part number of service parts (Tank lid)

Description	Part number
Tank lid	HRS-S0026

5.3.15 Valve for automatic water fill

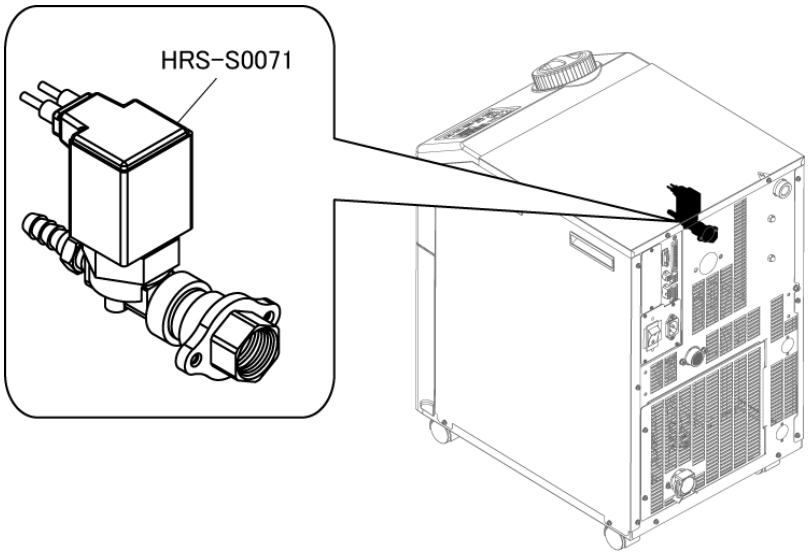


Fig. 5.3-15 Valve for automatic water fill

Table 5-16 Part number of service parts (Valve for automatic water fill)

Description	Part number
Valve for automatic water fill	HRS-S0071

Chapter 6 Documents

6.1 Specifications List

Table 6-1 Specifications List (HRS01∗-∗∗-10-(BJMT))

Model				HRS012-A∗ -10-(BJMT)	HRS012-W∗ -10-(BJMT)	HRS018-A∗ -10-(BJMT)	HRS018-W∗ -10-(BJMT)
Cooling method				Air-Cooled refrigerated type	Water-Cooled refrigerated type	Air-Cooled refrigerated type	Water-Cooled refrigerated type
Refrigerant				R407C(HFC)			
Control method				PID control			
Ambient temperature and humidity*2				Temperature :5 to 40 °C, Humidity:30 to 70%			
Circulating fluid system	Circulating fluid*3			Tap water, Ethylene glycol aqueous solution 15%*5			
	Operating temperature range*2		°C	5 to 40			
	Cooling capacity*4 (50/60Hz)		W	1100/1300		1500/1700	
	Temperature stability*6		°C	±0.1			
	Pump capacity*7 (50/60Hz)		MPa	0.13(at 7L/min) / 0.18(at 7L/min) For option -T, -MT: 0.36(at 7L/min) / 0.42(at 10L/min)			
	Rated fiow*8 (50/60Hz)		L/min	7/7 For option -T, -MT: 7/10			
	Tank capacity		L	Approx. 5			
	Port size			Rc1/2			
	Wetted material			Stainless steel, Copper brazing (Heat exchanger)*15, Bronze*15 Brass*15, SIC,Aluminum oxide ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC			
Facility water outlet system*1	Temperature range		°C	-	5 to 40	-	5 to 40
	Pressure range		MPa	-	0.3 to 0.5	-	0.3 to 0.5
	Required flow*13		L/min	-	8	-	12
	Facility water pressure differential		MPa	-	0.3 more	-	0.3 more
	Port size			Rc3/8			
	Wetted material			Stainless steel, Copper brazing, Bronze, Synthetic rubber			
Automatic fluid filling*14	Feed water pressure range		MPa	0.2 to 0.5			
	Feed water temperature range		°C	5 to 40			
	Feed water capacity		L/min	Approx.1			
	Automatic fluid filling Port size			Rc3/8			
	Over flow port Port size			Rc3/4			
Electric system	Power supply			1-phase AC100V 50Hz, 1-phase AC100 to 115V 60Hz. Allowable voltage range ±10%			
	Circuit protector*17		A	15			
	Applicable earth leakage breaker capacity*9		A	15			
	Rated operating current*4 (50/60Hz)		A	7.5/8.3 For option -T, -MT: 9.8/10.6		7.7/8.4 For option –T, -MT: 10.0/11.0	
	Rated power consumption*4 (50/60Hz)		kVA	0.7/0.8 For option -T, -MT: 1.0/1.1		0.8/0.8 For option -T, -MT: 1.0/1.1	
Noise level*10 (50/60Hz)			dB	58/55			
Dimensions*11			mm	W377xD500xH615 (W14.8XD19.7xH24.2[Inch])			
Accessory				Fitting (for drain port) 1pc.*16, Sequence I/O command signal connector 1pc., Power supply connector 1pc., Operation manual (Installatio･Operation) 1pc, Quick manual (with a clear cover) 1pc., Alarm code list label 1pc.			
Weight*12			kg	40			

∗1 For water -cooled type.
∗2 Use the product in conditions where freezing will not occur.
Consult with SMC if using in a season or region where the ambient temperature will fall below zero.
∗3 If tap water is used, use water which satisfies the standard of The Japan Refregeration And Air Conditioning Industry Association (JRA GL-02-1994/Cooling water system - circulation type - make-up water)
∗4 (1)Operating ambient temp.: 25°C, (2)Circulating fluid temp.: 20°C, (3)Circulating fluid rated flow, (4)Criculating fluid : Tap water,(5)Facility water temp.: 25°C.
The cooling capacity will be reduced by 300W when option T and MT [High pressure pump] are selected.
∗5 Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temp. is lower than 10°C.
∗6 Outlet temp. when the circulating fluid flow is rated flow, and the circulating fluid outlet and the return are directly connected. Installation environment and power supply are within specification range and stable.
∗7 The capacity at the thermo-chiller outlet when the circulating fluid temp. is 20°C.
∗8 Fluid flow to maintain the cooling capacity and the temperature stability.
The specification of the coolong capacity and the temperature stability may not be satisfied if the flow rate is lower than the rated flow.
∗9 To be prepared by the customer. Use an earth leakage breaker with sensitivity of 15mA or 30mA/100V in power supply specification.
∗10 Front 1m/Height 1m/Static with no load. See note 3 for other conditions.
∗11 Dimension between panels. Projection is not included.
∗12 Weight when the circulating fluid and facility water (for water-cooled type) is not included.
The weight will increase by 1kg when option J [Automatic fluid filling] is selected. The weight will increase by 4kg when option T and MT [High pressure pump] are selected.
∗13 There is required flow when adding load described on cooling capacity in case of note 4 conditions.
∗14 For option J [Automatic fluid filling port].
∗15 Copper, bronze and brass are not included when option M [DI water piping] is selected.
∗16 This fitting is not included when option T and MT [High pressure pump] are selected.
∗17 If option “Earth leakage breaker type” is selected, the earth leakage breaker is used instead of the circuit protector.

Table 6-2 Specifications List (HRS0∗∗-A∗-20-(BGJMT))

Model			HRS012-A∗ -20-(BGJMT)	HRS018-A∗ -20-(BGJMT)	HRS024-A∗ -20-(BGJMT)	HRS030-A∗ -20-(BJMT)
Cooling method			Air-Cooled refrigerated type			
Refrigerant			R407C(HFC)			
Control method			PID control			
Ambient temperature and humidity*1			Temperature :5 to 40°C*16, Humidity:30 to 70%			
Circulating fluid system	Circulating fluid*2		Tap water, Ethylene glycol aqueous solution 15%*4			
	Operating temperature range*1	°C	5 to 40			
	Cooling capacity*3 (50/60Hz)	W	1100/1300	1700/1900	2100/2400	2600/3200
	Temperature stability*5	°C	±0.1			
	Pump capacity*6 (50/60Hz)	MPa	0.13(at 7L/min)/0.18(at 7L/min) For option -T: 0.44(at 10L/min)/0.40(at 14L/min) For option -MT: 0.32(at 10L/min)/0.32(at 14L/min)			
	Rated fiow*7 (50/60Hz)	L/min	7/7 For option -T: 10/14, For option -MT: 10/14			
	Tank capacity	L	Approx. 5			
	Port size		Rc1/2			
	Wetted material		Stainless steel, Copper brazing (Heat exchanger)*15, Bronze*13, Brass*13, SIC, Aluminum oxide ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC			
Automatic fluid filling*12	Feed water pressure range	MPa	0.2 to 0.5			
	Feed water temperature range	°C	5 to 40			
	Feed water capacity	L/min	Approx.1			
	Automatic fluid filling Port size		Rc3/8			
	Over flow port Port size		Rc3/4			
Electric system	Power supply		1-phase AC200 to 230V 50/60Hz. Allowable voltage range ±10%			
	Circuit protector*15	A	10（For option -T, -MT: 15）			
	Applicable earth leakage breaker capacity*8	A	10（For option -T, -MT: 15）			
	Rated operating current*3 (50/60Hz)	A	4.6/5.1 For option -T, -MT : 5.6/6.7	4.7/5.2 For option -T, -MT : 5.7/6.8	5.1/5.9 For option -T, -MT : 6.1/7.5	5.2/6.0 For option -T, -MT : 6.2/7.6
	Rated power consumption*3 (50/60Hz)	kVA	0.9/1.0 For option -T, -MT : 1.1/1.3	0.9/1.0 For option -T, -MT : 1.1/1.4	1.0/1.2 For option -T, -MT : 1.2/1.5	1.0/1.2 For option -T, -MT : 1.2/1.5
Noise level*9 (50/60Hz)		dB	60/61			62/65
Dimensions*10		mm	W377xD500xH615 (W14.8XD19.7xH24.2[Inch])			W377xD500xH660 (W14.8XD19.7xH26.0[Inch])
Accessory			Fitting (for drain port) 1pc.*14, Sequence I/O command signal connector 1pc., Power supply connector 1pc., Operation manual (Installatio·Operation) 1pc, Quick manual (with a clear cover) 1pc., Alarm code list label 1pc.			
Weight*11		kg	43			47

∗1 Use the product in conditions where freezing will not occur.
Consult with SMC if using in a season or region where the ambient temperature will fall below zero.
∗2 If tap water is used, use water which satisfies the standard of The Japan Refregeration And Air Conditioning Industry Association (JRA GL-02-1994/Cooling water system - circulation type - make-up water)
∗3 (1)Operating ambient temp.: 25°C, (2)Circulating fluid temp.: 20°C, (3)Circulating fluid rated flow, (4)Criculating fluid : Tap water.
The cooling capacity will be reduced by 300W when option T and MT [High pressure pump] are selected.
∗4 Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temp. is lower than 10°C.
∗5 Outlet temp. when the circulating fluid flow is rated flow, and the circulating fluid outlet and the return are directly connected. Installation environment and power supply are within specification range and stable.
∗6 The capacity at the thermo-chiller outlet when the circulating fluid temp. is 20°C.
∗7 Fluid flow to maintain the cooling capacity and the temperature stability.
The specification of the coolong capacity and the temperature stability may not be satisfied if the flow rate is lower than the rated flow.
∗8 To be prepared by the customer. Use an earth leakage breaker with sensitivity of 30mA/200V in power supply specification..
∗9 Front 1m/Height 1m/Static with no load. See note 4 for other conditions.
∗10 Dimension between panels. Projection is not included.
∗11 Weight when the circulating fluid is not included.
The weight will increase by 1kg when option J [Automatic fluid filling] is selected.The weight will increase by 6kg when option T and MT [High pressure pump] are selected.
∗12 For option J [Automatic fluid filling port].
∗13 Copper, bronze and brass are not included when option M [DI water piping] is selected
∗14 This fitting is not included when option T and MT [High pressure pump] are selected.
∗15 If option “Earth leakage breaker type” is selected, the earth leakage breaker is used instead of the circuit protector.
∗16 The operating ambient temperature is 5 to 45°C for option G [High temperature type]. HRS030 does not correspond.

Table 6-3 Specifications List (HRS0∗∗-∗-20-(BGJMT))

Model			HRS012-W∗ -20-(BGJMT)	HRS018-W∗ -20-(BGJMT)	HRS024-W∗ -20-(BGJMT)	HRS030-W∗ -20-(BJMT)
Cooling method			Water-Cooled refrigerated type			
Refrigerant			R407C(HFC)			
Control method			PID control			
Ambient temperature and humidity[*1]			Temperature :5 to 40°C, Humidity:30 to 70%			
Circulating fluid system	Circulating fluid[*2]		Tap water, Ethylene glycol aqueous solution 15%[*4]			
	Operating temperature range[*1]	°C	5 to 40			
	Cooling capacity[*3] (50/60Hz)	W	1100/1300	1700/1900	2100/2400	2600/3200
	Temperature stability[*5]	°C	±0.1			
	Pump capacity[*6] (50/60Hz)	MPa	0.13(at 7L/min)/0.18(at 7L/min) For option -T: 0.44(at 10L/min)/0.40(at 14L/min) For option -MT: 0.32(at 10L/min)/0.32(at 14L/min)			
	Rated flow[*7] (50/60Hz)	L/min	7/7 For option -T: 10/14, For option -MT: 10/14			
	Tank capacity	L	Approx. 5			
	Port size		Rc1/2			
	Wetted material		Stainless steel, Copper brazing (Heat exchanger)[*14], Bronze[*14] Brass[*14], SIC, Aluminum oxide ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC			
Facility water outlet system[*1]	Temperature range	°C	5 to 40			
	Pressure range	MPa	0.3 to 0.5			
	Required flow[*12]	L/min	8	12	14	15
	Facility water pressure differential	MPa	0.3 more			
	Port size		Rc3/8			
	Wetted material		Stainless steel, Copper brazing, Bronze, Synthetic rubber			
Automatic fluid filling[*14]	Feed water pressure range	MPa	0.2 to 0.5			
	Feed water temperature range	°C	5 to 40			
	Feed water capacity	L/min	Approx.1			
	Automatic fluid filling Port size		Rc3/8			
	Over flow port Port size		Rc3/4			
Electric system	Power supply		1-phase AC200 to 230V 50/60Hz. Allowable voltage range ±10%			
	Circuit protector[*16]	A	10 (For option -T, -MT: 15)			
	Applicable earth leakage breaker capacity[*8]	A	10 (For option -T, -MT: 15)			
	Rated operating current[*3] (50/60Hz)	A	4.6/5.1 For option –T, -MT : 5.6/6.7	4.7/5.2 For option -T, -MT : 5.7/6.8	5.1/5.9 For option -T, -MT : 6.1/7.5	5.2/6.0 For option -T, -MT : 6.2/7.6
	Rated power consumption[*3] (50/60Hz)	kVA	0.9/1.0 For option -T, -MT : 1.1/1.3	0.9/1.0 For option -T, -MT : 1.1/1.4	1.0/1.2 For option -T, -MT : 1.2/1.5	1.0/1.2 For option -T, -MT : 1.2/1.5
Noise level[*9] (50/60Hz)		dB	60/61			62/65
Dimensions[*10]		mm	W377xD500xH615 (W14.8XD19.7xH24.2[Inch])			W377xD500xH660 (W14.8XD19.7xH26.0[Inch])
Accessory			Fitting (for drain port) 1pc.[*15], Sequence I/O command signal connector 1pc., Power supply connector 1pc., Operation manual (Installatio·Operation) 1pc, Quick manual (with a clear cover) 1pc., Alarm code list label 1pc.			
Weight[*11]		kg	43			

∗1 Use the product in conditions where freezing will not occur.
Consult with SMC if using in a season or region where the ambient temperature will fall below zero.

∗2 If tap water is used, use water which satisfies the standard of The Japan Refregeration And Air Conditioning Industry Association (JRA GL-02-1994/Cooling water system - circulation type - make-up water)

∗3 (1)Operating ambient temp.: 25°C, (2)Circulating fluid temp.: 20°C, (3)Circulating fluid rated flow, (4)Criculating fluid : Tap water,(5)Facility water temp.: 25°C.
The cooling capacity will be reduced by 300W when option T and MT [High pressure pump] are selected.

∗4 Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temp. is lower than 10°C.

∗5 Outlet temp. when the circulating fluid flow is rated flow, and the circulating fluid outlet and the return are directly connected. Installation environment and power supply are within specification range and stable.

∗6 The capacity at the thermo-chiller outlet when the circulating fluid temp. is 20°C.

∗7 Fluid flow to maintain the cooling capacity and the temperature stability.
The specification of the coolong capacity and the temperature stability may not be satisfied if the flow rate is lower than the rated flow.

∗8 To be prepared by the customer. Use an earth leakage breaker with sensitivity of 30mA/200V in power supply specification..

∗9 Front 1m/Height 1m/Static with no load. See note 4 for other conditions.

∗10 Dimension between panels. Projection is not included.

∗11 Weight when the circulating fluid and facility water (for water-cooled type) is not included.
The weight will increase by 1kg when option J [Automatic fluid filling] is selected.The weight will increase by 6kg when option T and MT [High pressure pump] are selected.

∗12 There is required flow when adding load described on cooling capacity in case of note3 conditions.

∗13 For option J [Automatic fluid filling port].

∗14 Copper, bronze and brass are not included when option M [DI water piping] is selected

∗15 This fitting is not included when option T and MT [High pressure pump] are selected.

∗16 If option “Earth leakage breaker type” is selected, the earth leakage breaker is used instead of the circuit protector.

6.2 Outline Dimensions

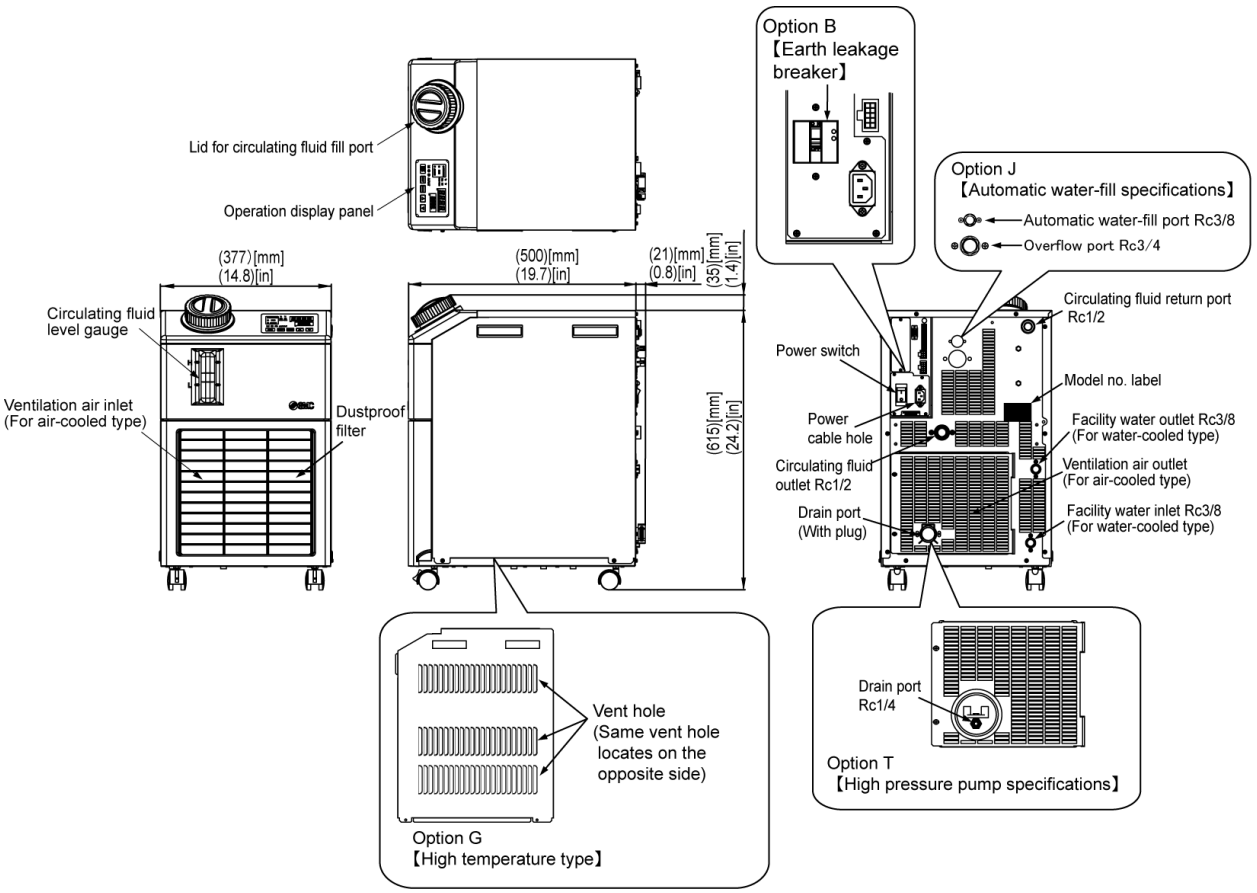


Fig. 6.2-1 Outline Dimensions (HRS012/018/024-**-*-*)

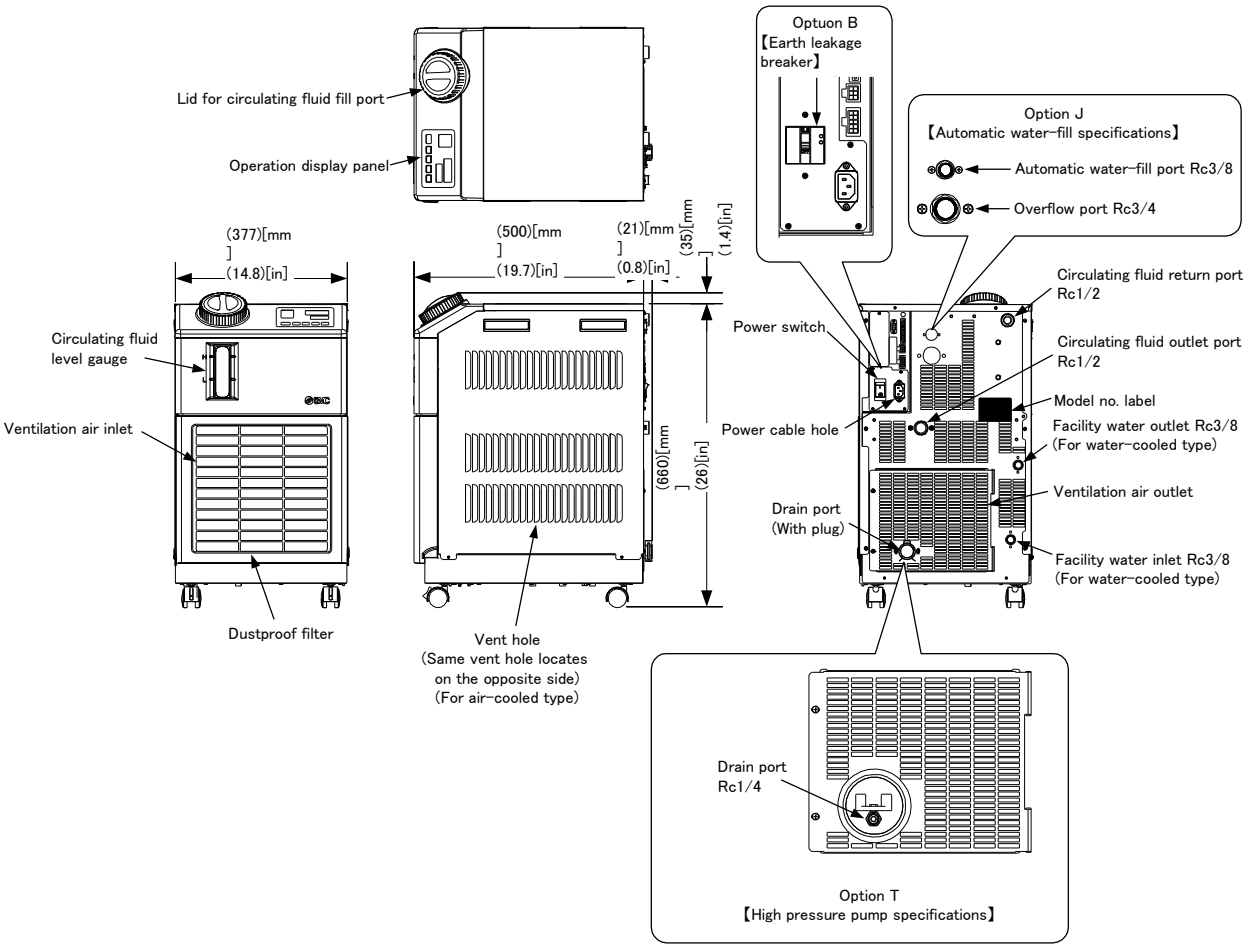
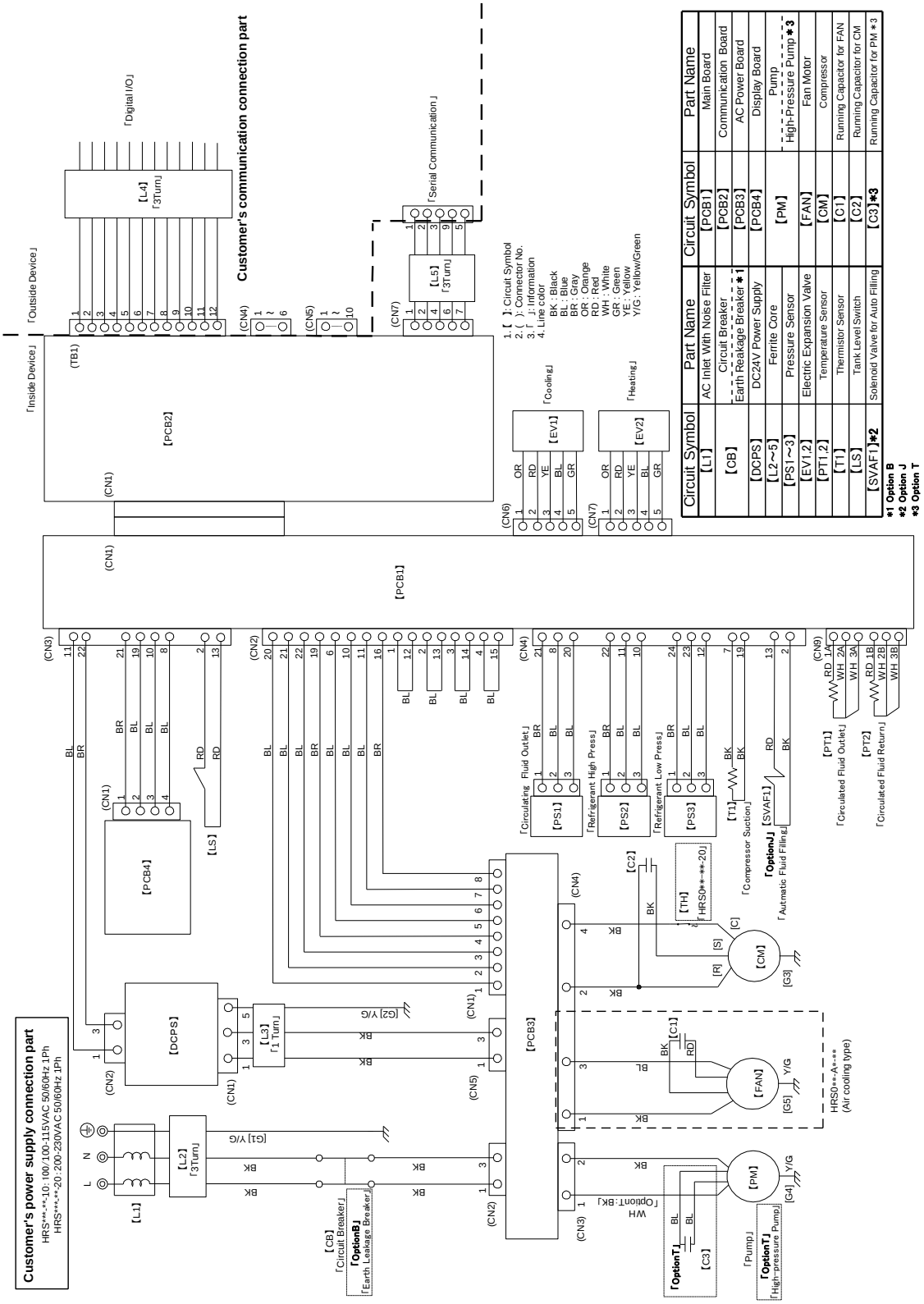


Fig. 6.2-2 Outline Dimensions (HRS030-∗∗-20-∗)

6.3 Electric Circuit Diagram

6.3.1 HRS0**-**-**



Circuit Symbol	Part Name
[L1]	AC Inlet With Noise Filter
[CB]	Circuit Breaker Earth Leakage Breaker *1
[DCPS]	DC24V Power Supply
[L2~5]	Ferrite Core
[PS1~3]	Pressure Sensor
[EV1,2]	Electric Expansion Valve
[PT1,2]	Temperature Sensor
[T1]	Thermistor Sensor
[LS]	Tank Level Switch
[SVAF1]*2	Solenoid Valve for Auto Filling

Circuit Symbol	Part Name
[PCB1]	Main Board
[PCB2]	Communication Board
[PCB3]	AC Power Board
[PCB4]	Display Board
[PM]	Pump High-Pressure Pump *3
[FAN]	Fan Motor
[CM]	Compressor
[C1]	Running Capacitor for FAN
[C2]	Running Capacitor for CM
[C3]*3	Running Capacitor for PM *3

Fig. 6.3-1 Electric Circuit Diagram (HRS0**-**-**)

6.4 Flow chart

6.4.1 HRS012-A∗-∗, HRS018-A∗-∗, HRS024-A∗-20, HRS030-A∗-20

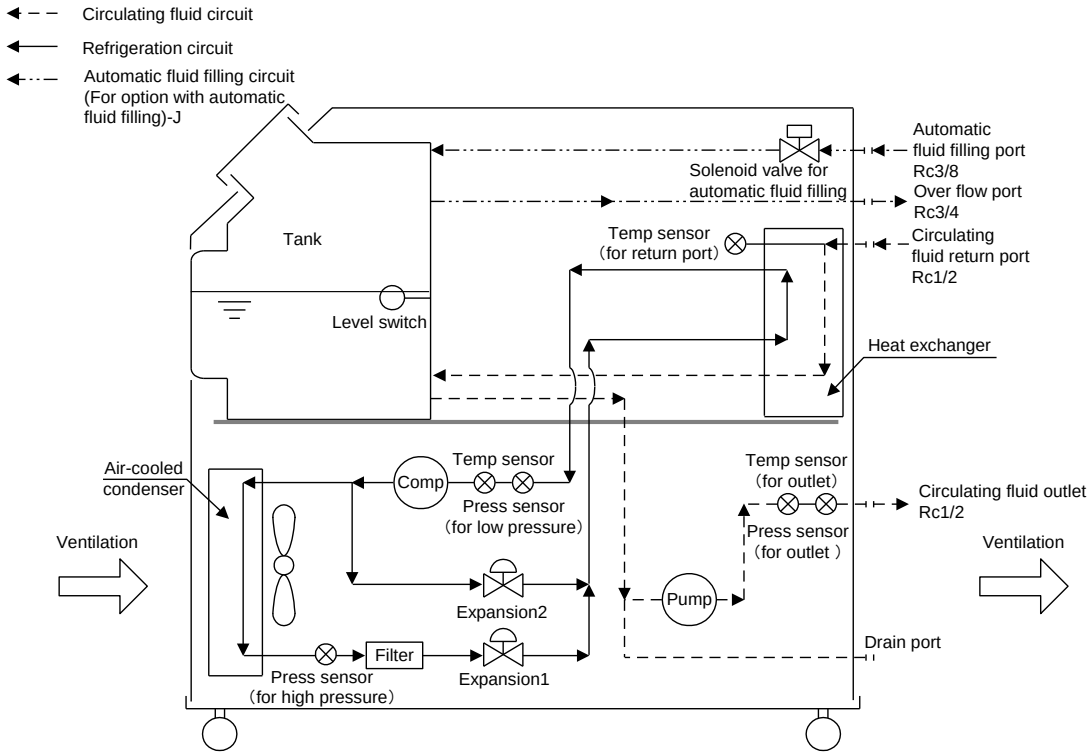


Fig. 6.4-1 Flow chart (HRS012-A∗-∗, HRS018- A∗-∗, HRS024-A∗-20, HRS030-A∗-20)

6.4.2 HRS012-W∗-∗, HRS018-W∗-∗, HRS024-W∗-20, RS030-W∗-20

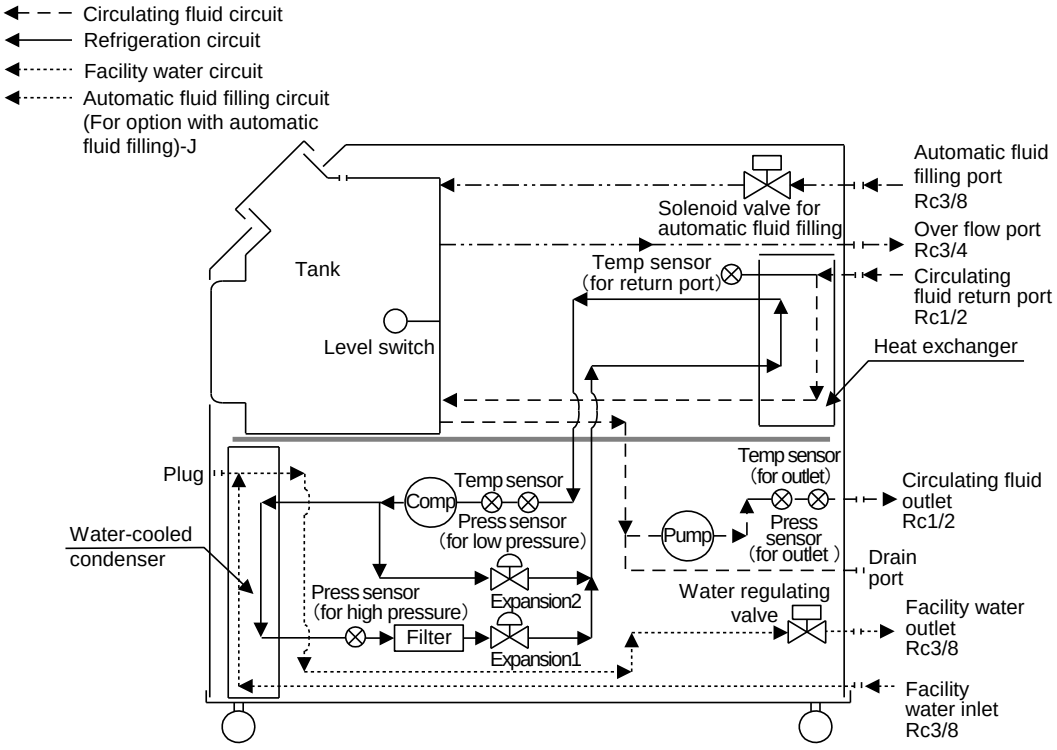


Fig. 6.4-2 Flow chart (HRS012-W∗-∗, HRS018-W∗-∗, HRS024-W∗-20, HRS030-W∗-20)

Chapter 7 Product Warranty

1. Period

The warranty period of the service parts is 0.5 years after the service parts is delivered.

2. Scope

For any failure reported within the warranty period which is clearly our responsibility, replacement parts will be provided. In that case, removed parts shall become the property of SMC.
This guarantee applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Content

We guarantee that the product will operate normally if it is installed under maintenance and control in accordance with the Operation Manual, and operated under the conditions specified in the catalog or contracted separately.
We guarantee that the product does not have any defects in components, materials or assembly.
We guarantee that the product complies with the outline dimensions provided.
The following situations are out of scope of this warranty.

(1) The product was incorrectly installed or connected with other equipment.
(2) The product was under insufficient maintenance and control or incorrectly handled.
(3) The product was operated outside of the specifications.
(4) The product was modified or altered in construction.
(5) The failure was a secondary failure of the product caused by the failure of equipment connected to the product.
(6) The failure was caused by a natural disaster such as an earthquake, typhoon, or flood, or by an accident or fire.
(7) The failure was caused by operation different from that shown in the Operation Manual or outside of the specifications.
(8) The checks and maintenance specified (daily checks and regular checks) were not performed.
(9) The failure was caused by the use of circulating fluid or facility water other than those specified.
(10) The failure occurred naturally over time (such as discoloration of a painted or plated face).
(11) The failure does not affect the functioning of the product (such as new sounds, noises and vibrations).
(12) The failure was due to the “Installation Environment” specified in the Operation Manual.
(13) The failure was caused by the customer disregarding “6. Request to customers”.

4. Agreement

If there is any doubt about anything specified in “2. Scope” and "3. Content”, it shall be resolved by agreement between the customer and SMC.

5. Disclaimer

(1) Expenses for daily and regular checks
(2) Expenses for repairs performed by other companies
(3) Expenses for transfer, installation and removal of the product
(4) Expenses for replacement of parts other than those in this product, or for the supply of liquids
(5) Inconvenience and loss due to product failure (such as telephone bills, compensation for workplace closure, and commercial losses)
(6) Expenses and compensation not covered in “2. Scope”.

6. Request to customers

Proper use and maintenance are essential to assure safe use of this product. Be sure to satisfy the following preconditions. Please note that we may refuse to carry out warranted repair if these preconditions have been disregarded.

(1) Use the product following the instructions for handling described in the Operation Manual.
(2) Perform checks and maintenance (daily checks and regular checks) specified in the Operation Manual and Maintenance Manual.
(3) Record the check and maintenance results on the daily check sheet attached to the Operation Manual and Maintenance Manual.

7. Request for Warranted Repair

For warranted repair, please contact the supplier you purchased this product from.
Warranted repair shall be on a request basis.

Repair shall be provided free of charge in accordance with the warranty period, preconditions and terms defined above. Therefore, a fee will be charged for any repairs if a failure is detected after the end of the warranty period.