For maintenance vendor, distributor, and SMC use only

# Thermo-chiller *HRS Series*
# Maintenance Handbook



SMC

M-E17-1A

# To users of this handbook

**This handbook is for use only by qualified refrigeration service technicians who hold valid local authorization. The procedures in this handbook require special skills and the use of special equipment and tools. The work required will be either extremely difficult or impossible for an un-authorized technician to perform.**

Read the accompanying service manual in addition to this handbook, and be sure to fully understand the contents before performing any repair work. Also, prepare the product operation manual in advance.

Only a fully-qualified technician who understands the content of the operation manual and the procedures for this model, and who has sufficient knowledge of general machinery and equipment can perform the maintenance and repair of this product.
All work must be performed according to the procedures. However, SMC will not be held responsible for any problems incurred during the work.



**Other caution**
Follow any special safety instructions if there is any given for the working site.

# Thermo-chiller *HRS Series* Maintenance Handbook

## CONTENTS

# 1 Safety Instructions

**Before starting maintenance on the product, be sure to carefully read and fully understand all the warnings and precautions described in this handbook.**

## Before Starting Maintenance on the Product

- This chapter describes safety related issues regarding the maintenance of the product.
- This product is a circulating fluid temperature controller. SMC shall not take any responsibility for any problems that may arise from using the product 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).
- This product operates at a high voltage and contains components which become very hot and rotate. If a component needs to be replaced or repaired, use extreme caution regarding electric shocks, burns, cuts, and entanglement.
- All personnel who work with or around the product and those involved in the maintenance, operation, or other work related to the product should carefully read and fully understand the safety related information in this handbook before starting any maintenance work.

## Reading the Handbook

This handbook contains symbols to help identify important actions when performing maintenance.

**This sign stands for actions that must be followed.**

**This sign stands for prohibited actions.**

# Hazards

## Level of hazards

The instructions given in this handbook 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, etc.**

## 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.)

## 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 System Inside — The product contains pressurized fluid systems.**
- **DO NOT operate the product without cover panels fitted.**

## Locations of hazard labels

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

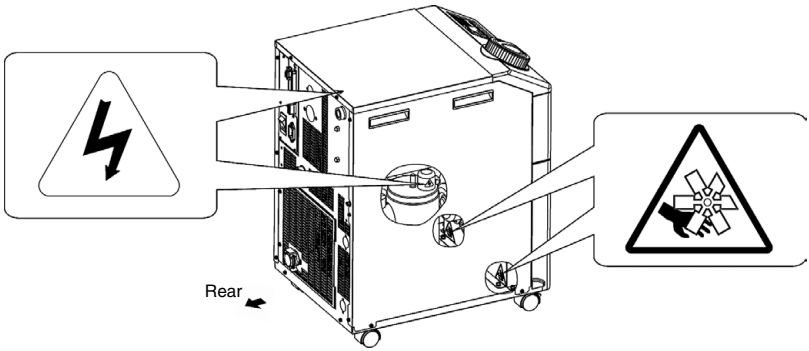
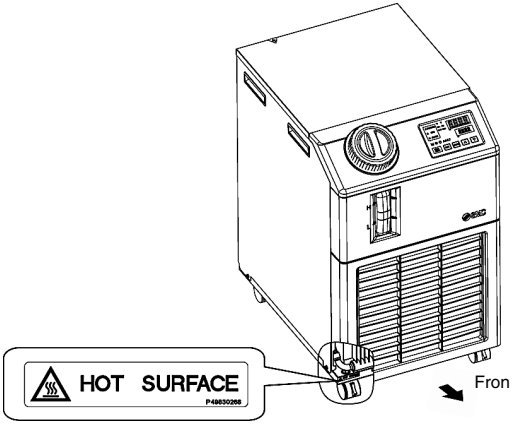



**Fig. 1-1 Warning label position**



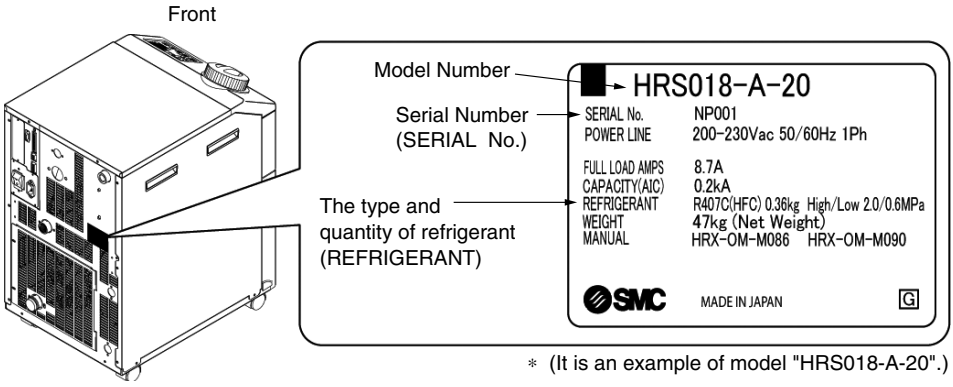

∗ For air-cooled type

**Fig. 1-2 Warning label position**

# Other Labels

## 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. 1-3 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 | R | Repeated from A to Z in alphabetical order | 1 | O | Repeated from O to Z in alphabetical order, with O for January and Z for December | — |
| 2014 | S | | 2 | P | | |
| 2015 | T | | 3 | Q | | |
| ↓ | ↓ | | ↓ | ↓ | | |

# Safety Measures

## Safety instructions for use

**⚠ WARNING**

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

- 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 maintaining the product.
- Use the recommended personal protective equipment where specified to protect yourself from any hazards.

- Check all parts and screws are fitted correctly and securely after maintenance.
- Do not remove the panels except for the cases permitted in this handbook.
- Do not remove the panels during operation.

## Waste Disposal

### 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 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.**

### 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.

## Material Safety Data Sheet (SDS)

Maintenance personnel should check with the customer whether any chemical substances, such as antiseptic, have been added to the circulating fluid or facility water remaining in the product.

If any such substance has been added, ask the customer to submit the SDS of that substance, and start maintenance in accordance with the hazard and toxicity information described therein.

However, depending on the case, you may wish to ask the customer to wash the product beforehand. Please note that safety should always take priority.

(UL Standards)

# Lightweight/Compact
# Temperature stability ±0.1°C

HRS050/HRS060

HRS012/018/024 HRS030

Same width for all models: 377 mm

| Model | Size [mm] | Weight | Cooling capacity (60 Hz) | Set temperature range |
|---|---|---|---|---|
| HRS012 | W 377 x H 615 x D 500 | 40 kg | 1300 W | 5 to 40°C |
| HRS018 | | | 1900 W | |
| HRS024 | | | 2400 W | |
| HRS030 | W 377 x H 660 x D 500 | 47 kg | 3200 W | |
| HRS050 | W 377 x H 976 x D 592 | 69 kg | 5100 W | |
| HRS060 | | 73 kg | 5900 W | |

**Compatible with power supplies in Europe, Asia, Oceania, North, Central, and South America**

- Single-phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)
- Single-phase 200 to 230 VAC (50/60 Hz)

**With heating function** Heating method using discharged heat makes a heater unnecessary.

**Convenient functions** Page 10
Timer operation function/Unit conversion function/Power failure auto-restart function/ Anti-freezing operation function

**Self diagnosis function and check display** Page 11
35 types of alarm codes

**Easy maintenance** Page 10
Tool-less maintenance of filter

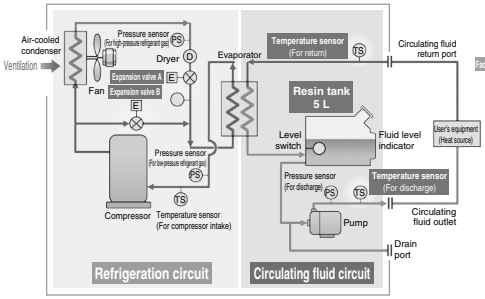
**Communication function** Page 11
Equipped with serial communication (RS232C/RS485) and contact I/Os (2 inputs and 3 outputs) as standard.

**Environmental friendly R407C R410A as refrigerant**

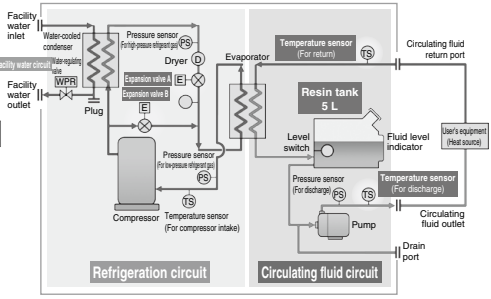
# Temperature stability ±0.1°C / Compact

The precision temperature control method by expansion valve and temperature sensor, realized high temperature stability of ±0.1°C and a small-size tank.

## ■Air-cooled HRS□-A-□




## ■Water-cooled HRS□-W-□




### Refrigeration circuit

- The compressor compresses the refrigerant gas, and discharges the high temperature and high pressure refrigerant gas.
- In the case of air-cooled refrigeration, the high temperature and high pressure refrigerant gas is cooled down by an air-cooled condenser with the ventilation of the fan, and becomes a liquid. In the case of water-cooled refrigeration, the refrigerant gas is cooled by a water-cooled condenser with the facility water in the facility water circuit, and becomes a liquid.
- The liquefied high pressure refrigerant gas expands and its temperature lowers when it passes through expansion valve A and vaporizes by taking heat from the circulating fluid in the evaporator.
- The vaporized refrigerant gas is sucked into the compressor and compressed again.
- When heating the circulating fluid, the high pressure and high temperature refrigerant gas is bypassed into the evaporator by expansion valve B, to heat the circulating fluid.

**Point** The combination of precise control of **expansion valve A** for cooling, and **expansion valve B** for heating realized high temperature stability.

### Circulating fluid circuit

- The circulating fluid discharged from the pump, is heated or cooled by the user's equipment and returns to the thermo-chiller.
- The circulating fluid is controlled to a set temperature by the refrigeration circuit, to be discharged to the user's equipment side again by the thermo-chiller.

**Point** Since the refrigeration circuit is controlled by the signal from **2 temperature sensors (for return and discharge)**, precise temperature control of the circulating fluid can be performed. Therefore, there is no necessity of absorbing the temperature difference in the circulating fluid with a large tank capacity, and realizes high temperature stability even with a **small-size tank**. Also, contributes to space-saving.

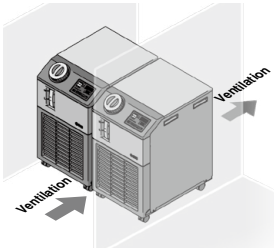
### Facility water circuit

**For water-cooled refrigeration HRS□-W-□**

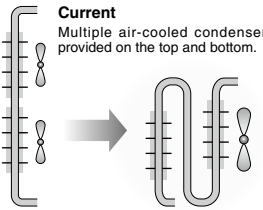
- The water-regulating valve opens and closes to keep the refrigerant gas pressure consistent. The facility water flow rate is controlled by the water-regulating valve.

## Installation close to a wall is possible on both sides.

(HRS012/018/024 ※ Except option G)

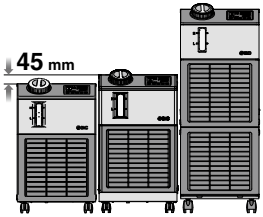



## Reduced-height double condenser structure (HRS030/060)



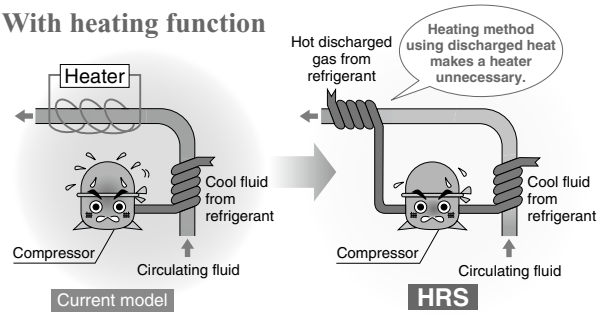
**Current**
Multiple air-cooled condensers are provided on the top and bottom.

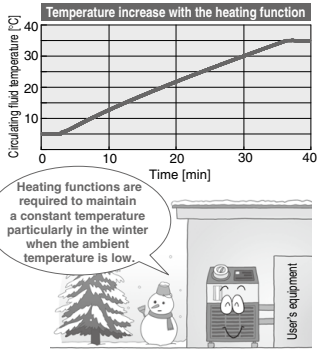
**HRS030**
Achieved a maximum reduction in the height of the product while expanding the cooling capacity, by providing overlapped air-cooled condensers.




**HRS012 018 024** **HRS030** **HRS050 HRS060**

## With heating function




∗ This is just an example diagram.

## Simple operation

Step ❶ Press the RUN/STOP keys.

Step ❷ Adjust the temperature setting with the ▼ / ▲ keys.

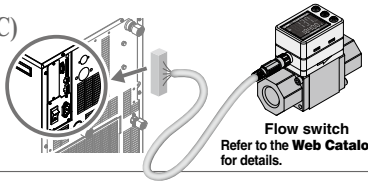
Step ❸ Press the RUN/STOP key to stop.
Easy operation by these steps


**Large digital display**

The "large digital display" (7-segment and 4 digits) and "2 row display" provide a clearer view of the current value (PV) and set value (SV).

## Power supply (24 VDC) available

Power can be supplied from the connector at the rear side of the HRS to external switches, etc.




## Variations

| Model | | Cooling method | Cooling capacity [W] (50/60 Hz) | Single-phase 100 VAC (50/60 Hz) 115 VAC (50/60 Hz) | Single-phase 200 to 230 VAC (50/60 Hz) | Option | Optional accessories | International standards |
|---|---|---|---|---|---|---|---|---|
|  | **HRS012** | Air-cooled refrigeration | 1100/1300 | ● | ● | · With earth leakage breaker<br>· With automatic fluid fill function<br>· Applicable to deionized water piping<br>· High pressure pump mounted (∗ The HRS050/060 cannot be selected.)<br>· High temperature environment specification (∗ The HRS030/050/060 cannot be selected.) | · Anti-quake bracket<br>· Piping conversion fitting (For air-cooled, water-cooled and option)<br>· Concentration meter<br>· Bypass piping set<br>· Power supply cable<br>· DI filter set<br>· Electric resistance sensor set/ Electric resistance control set<br>· Electric conductivity sensor set/ Electric conductivity control set<br>· Particle filter set<br>· Drain pan set (With water leakage sensor)<br>· Connector cover<br>· Analog gateway unit<br>· Replacement type dustproof filter set<br>· Separately installed power transformer<br>· Filter for circulating fluid fill port | CE<br>cMETus∗<br>(UL Standards)<br>**Refer to pages 15 to 18 for details on applicable models.** |
| | **HRS018** | | 1500/1700 | ● | — | | | |
| | | | 1700/1900 | — | ● | | | |
|  | **HRS024** | | 2100/2400 | — | ● | | | |
| | **HRS030** | Water-cooled refrigeration | 2600/3200 | — | ● | | | |
|  | **HRS050** | | 4700/5100 | — | ● | | | |
| | **HRS060** | | 4900/5900 | — | ● | | | |

∗ UL Standards: Applicable to only 60 Hz

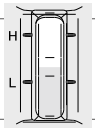
## Reduces the maintenance hours for the pump.

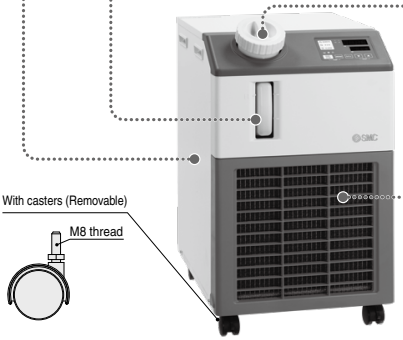
### Adoption of the magnet pump*1

No external leakage of the circulating fluid because the sealless pump is used, and a periodic check of the pump leakage and replacement of the mechanical seal are not necessary.

*1 When the option, high pressure pump, is selected and for the HRS050/060, the mechanical seal pump is chosen.

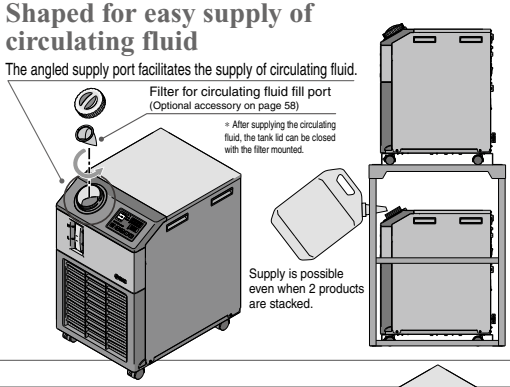
## Easy check of the circulating fluid level




## Shaped for easy supply of circulating fluid

The angled supply port facilitates the supply of circulating fluid.

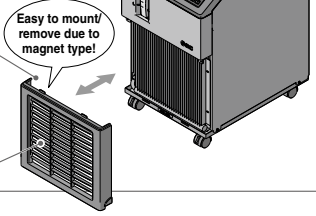



## Tool-less inspection and cleaning of air-cooled condenser

### Dustproof filter

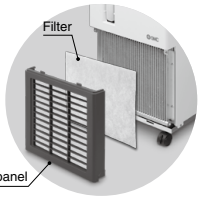
Integrated with the grill of the front panel. Mounting and removal can be done easily.

Easy to clean dust and cutting chips, etc. stuck to the dustproof net by brush or air blow.

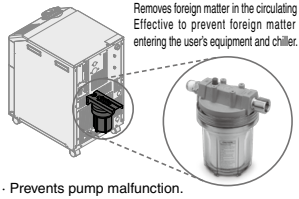



## Replacement type dustproof filter set

Suitable for use in excessively dusty atmospheres. The disposable type filter saves time and effort of cleaning.




## Particle filter set




- Prevents pump malfunction.
- Prevents lowering of the water-cooled condenser performance.

Protects the pump and condenser from foreign matter!!

## Convenient functions (Refer to the Operation Manual for details.)

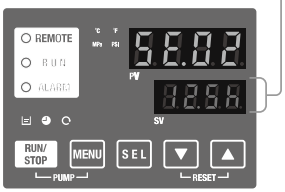
### Timer operation function

Timer for ON and OFF can be set in units of 0.5 h up to 99.5 h.

Ex.) Can set to stop on Saturday and Sunday and restart on Monday morning.

**Ex.** **SE.02 "ON timer"**

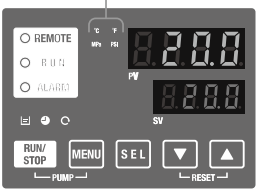
**Timer** The time remaining can be checked.




### Unit conversion function

Temperature and pressure units can be changed.

**Orange indicator lights up.**




### Power failure auto-restart function

Automatic restart from stoppage due to power failure, etc. is possible without pressing the RUN/STOP key and remote operation.

### Anti-freezing operation function

If the temperature approaches freezing point, e.g. in winter at night, the pump operates automatically and the heat generated by the pump warms the circulating fluid, preventing freezing.

### Key-lock function

Can be set in advance to protect the set values from being changed by pressing keys by mistake.

### Function to output a signal for completion of preparation

Notifies by communication when the temperature reaches the pre-set temperature range.

### Independent operation of the pump

The pump can be operated independently while chiller is powered off. You can check piping leak and remove the air.

## Self diagnosis function and check display

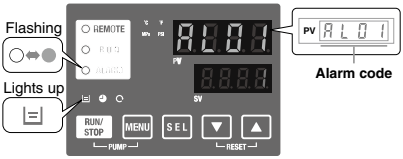
**Display of 35 types of alarm codes** For details, refer to page 120.
Operation is monitored all the time by the integrated sensor.
Should any error occur, the self diagnosis result is displayed by the applicable alarm code from 35 types.
This makes it easier to identify the cause of the alarm.
Can be used before requesting service.

**Changeable alarm set values**

| Setting item | Set value |
|---|---|
| Circulating fluid discharge temperature rise | 5 to 48°C |
| Circulating fluid discharge temperature drop | 1 to 39°C |
| Circulating fluid discharge pressure rise | 0.05 to 0.75 MPa*1 |
| Circulating fluid discharge pressure drop | 0.05 to 0.18 MPa*1 |

*1 Set values vary depending on the model.

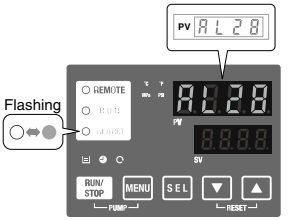
**Ex. AL01 "Low level in tank"**




**Alarm codes notify of checking times.**
Notifies when to check the pump and fan motor.
Helpful for facility maintenance.

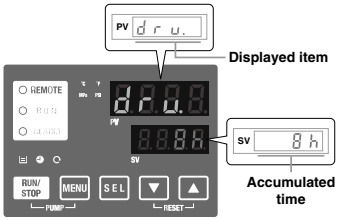
* The fan motor is not used in water-cooled refrigeration.

**Ex. AL28 "Pump maintenance"**




**Check display**
The internal temperature, pressure and operating time of the product are displayed.

**Ex. drv. "Accumulated operating time"**




| Displayed item |
|---|
| Circulating fluid outlet temperature |
| Circulating fluid return temperature |
| Compressor gas temperature |
| Circulating fluid outlet pressure |
| Compressor gas discharge pressure |
| Compressor gas return pressure |
| Accumulated operating time |
| Accumulated operating time of pump |
| Accumulated operating time of fan motor*1 |
| Accumulated operating time of compressor |

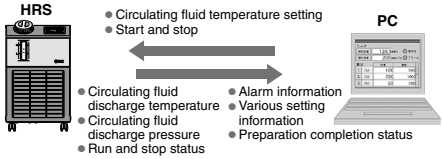
*1 These are displayed only for air-cooled refrigeration.

## Communication function

The serial communication (RS232C/RS485) and contact I/Os (2 inputs and 3 outputs) are equipped as standard.
Communication with the user's equipment and system construction are possible, depending on the application.
A 24 VDC output can be also provided, and is available for a flow switch (SMC's PF2W, etc.).

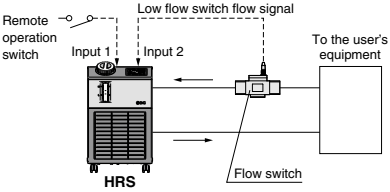
**Ex. 1 Remote signal I/O through serial communication**

The remote operation is enabled (to start and stop) through serial communication.




**Ex. 2 Remote operation signal input**

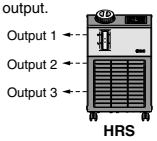
One of the contact inputs is used for remote operation and the other is used for a flow switch to monitor the flow, and their warning outputs are taken in.




Power for flow switch (24 VDC) can be supplied from thermo-chiller.

**Ex. 3 Alarm and operation status (start, stop, etc.) signal output**

The alarm and status generated in the product are assigned to 3 output signals based on their contents, and can be output.




**• Output setting example**
Output 1: Temperature rise
Output 2: Pressure rise
Output 3: Operation status (start, stop, etc.)

## Application Examples

| | Heat source | Automotive | Light electrical appliance | Food | Machinery | Medical | Semiconductor |
|---|---|---|---|---|---|---|---|
| Arc welding machine | Torch | ● | | | ● | | |
| Resistance welding machine | Tip | ● | ● | | ● | | |
| Laser welding machine | Oscillator | ● | ● | | ● | | ● |
| UV curing device | Lamp | ● | ● | ● | | ● | |
| X-ray instrument | | | ● | | | ● | ● |
| Electronic microscope | Lens | | ● | | | ● | ● |
| Laser marker | Oscillator | ● | ● | ● | | ● | ● |
| Ultra sonic wave inspection machine | | ● | ● | | ● | | |
| Atomizing device/ Crushing equipment | Blade | | | ● | | | |
| Linear motor | Motor | ● | | | ● | | |
| Packaging machines (food products) | Dies/ Welded portions | | | ● | | | |
| Mold cooling | Mold | ● | ● | ● | | ● | |
| Temperature control of adhesive and paint material | Paint material/ Welding materials | ● | ● | ● | | | |
| Cooling of vacuum pump | Pump | ● | | | | | ● |
| Shrink fit machine | Workpiece | ● | | | ● | | |
| Gas cylinder cabinet | | | | | | | ● |
| Concentrating equipment | Test liquid | | | ● | | ● | |
| Reagent cooling equipment | Reagent | | | ● | | ● | ● |
| Cleaning machine (hydrocarbon-based) | Cleaning tank | ● | ● | | ● | | |
| Printing machine | Roller | | ● | ● | ● | | |
| Chamber electrode | Electrode | | | | | | ● |
| High frequency induction heating equipment | Power supply/ Heating coil | ● | | | ● | | |

# Global Supply Network

## SMC has a comprehensive network in the global market.

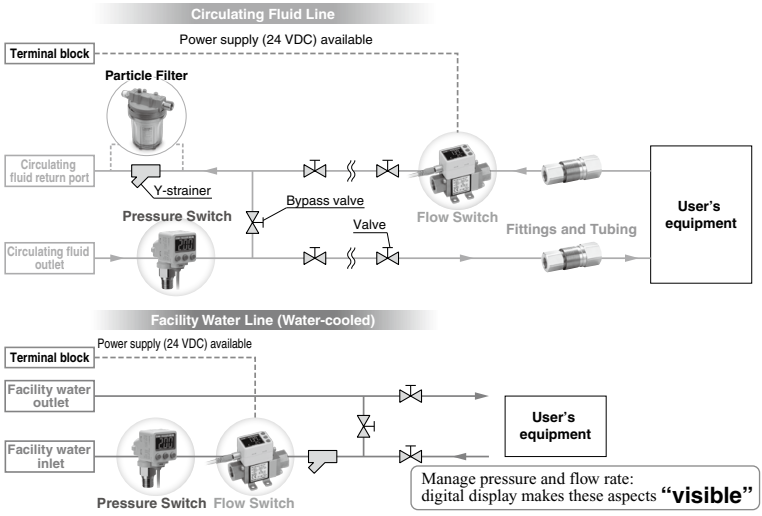
We now have a presence of more than 500 branch offices and distributors in 83 countries world wide such as Asia, Oceania, North/Central/South America, and Europe. With this global network, we are able to provide a global supply of our substantial range of products with the best service. We also provide full support to local factories, foreign manufacturing companies and Japanese companies in each country.

# SMC Thermo-chiller Variations

Lots of variations are available in response to the users' requirements.

| Series | | Temperature stability [°C] | Set temperature range [°C] | Cooling capacity [kW] | | | | | | | | | | | | Environment | International standards |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1.2 | 1.8 | 2.4 | 3 | 5 | 6 | 9 | 10 | 15 | 20 | 25 | 28 | | |
|  | **HRSE Basic type** | ±2.0 | 10 to 30 | ● | ● | ● | | | | | | | | | | Indoor use | CE (Only 230 VAC type) |
|  | **HRS Standard type** | ±0.1 | 5 to 40 | ● | ● | ● | ● | ● | ● | | | | | | | Indoor use | CE (Only 60 Hz) |
|  | **HRS090 Standard type** | ±0.5 | 5 to 35 | | | | | | | ● | | | | | | Indoor use | CE (400 V as standard) |
|  | **HRS100/150 Standard type** | ±1.0 | 5 to 35 | | | | | | | | ● | ● | | | | Outdoor installation IPX4 | CE (400 V as standard) |
|  | **HRSH090 Inverter type** | ±0.1 | 5 to 40 | | | | | | | ● | | | | | | Indoor use | CE (400 V as standard, 200 V as an option) (Only 200 V as an option) |
|  | **HRSH Inverter type** | ±0.1 | 5 to 35 | | | | | | | | ● | ● | ● | ● | ● | Outdoor installation IPX4 | CE (400 V as standard, 200 V as an option) (Only 200 V as an option) |

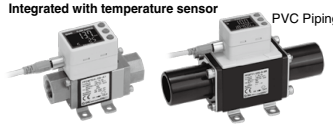
## Circulating Fluid/Facility Water Line Equipment




### Flow Switch: Monitors the flow rate and temperature of the circulating fluid and facility water.

Refer to the **Web Catalog** for details.

**3-Color Display Digital Flow Switch for Water** ***PF3W***
**Integrated with temperature sensor**




**3-Color Display**
**Electromagnetic Type Digital Flow Switch** ***LFE***

**Digital Flow Switch for**
**Deionized Water and Chemical Liquids** ***PF2D***
**4-Channel Flow Monitor** ***PF2□200***

### Pressure Switch: Monitors pressure of the circulating fluid and facility water.

Refer to the **Web Catalog** for details.

**2-Color Display**
**High-Precision Digital**
**Pressure Switch** ***ISE80***

**Pressure Sensor for General Fluids**
***PSE56□***
**Pressure Sensor Controller**
***PSE200,300***

### Particle Filter

### Fittings and Tubing

Refer to the **Web Catalog** for details.

**S Coupler** ***KK***

**S Coupler/Stainless Steel**
**(Stainless Steel 304)** ***KKA***

**Metal One-touch Fittings** ***KQB2***

**Stainless Steel 316**
**One-touch Fittings** ***KQG2***

**Stainless Steel 316 Insert Fittings** ***KFG2***

**Fluoropolymer Fittings** ***LQ***

**Tubing** ***T□***

| Series | Material |
|---|---|
| **T** | Nylon |
| **TU** | Polyurethane |
| **TH** | FEP (Fluoropolymer) |
| **TD** | Modified PTFE (Soft fluoropolymer) |
| **TL** | Super PFA |
| **TLM** | PFA |

# Thermo-chiller Standard Type
# Single-phase 100/115 VAC
## *HRS* Series

(UL Standards)

RoHS

## How to Order

**Air-cooled refrigeration** **HRS 018 – A □ – 10 – □**

**Cooling capacity**

| | |
|---|---|
| **012** | Cooling capacity 1100/1300 W (50/60 Hz) |
| **018** | Cooling capacity 1500/1700 W (50/60 Hz) |

∗ UL Standards: Applicable to only 60 Hz

**Cooling method**

| | |
|---|---|
| **A** | Air-cooled refrigeration |

**Pipe thread type**

| | |
|---|---|
| **Nil** | Rc |
| **F** | G (with PT-G conversion fitting set) |
| **N** | NPT (with PT-NPT conversion fitting set) |

**Power supply**∗1

| Symbol | Power supply |
|---|---|
| **10** | Single-phase 100 VAC (50/60 Hz)<br>115 VAC (60 Hz) |

∗1 UL Standards: Applicable to only 60 Hz

**Option**

| Symbol | Option |
|---|---|
| **Nil** | None |
| **B** | With earth leakage breaker |
| **J** | With automatic fluid fill function |
| **M** | Applicable to deionized water piping |
| **T** | High pressure pump mounted∗1 |
| **W** | SI unit only∗2 |

- When multiple options are combined, indicate symbols in alphabetical order.

∗1
- The cooling capacity will decrease by about 300 W from the value in the catalog.
- The pump has a mechanical seal in it and leakage could occur depending on circulating fluid quality. We recommend you to use Particle Filter Kit, HRS-PF003, as a preventive measure.

∗2 Unit selection function is not available in Japan due to new measurement law. If using this product within Japan, please select this option.
Fixed unit: MPa/°C

## Specifications

∗ There are different values from standard specifications. Refer to the **Web Catalog** for details.

| Model | | | | HRS012-A□-10 | HRS018-A□-10 |
|---|---|---|---|---|---|
| **Cooling method** | | | | Air-cooled refrigeration | |
| **Refrigerant** | | | | R407C (HFC) | |
| **Refrigerant charge** | | | kg | 0.32 | 0.33 |
| **Control method** | | | | PID control | |
| **Ambient temperature/Humidity/Altitude**∗1, 11 | | | | Temperature: 5 to 40°C, Humidity: 30 to 70%, Altitude: less than 3000 m | |
| **Circulating fluid system** | **Circulating fluid**∗2 | | | Tap water, 15% ethylene glycol aqueous solution∗4 | |
| | **Set temperature range**∗1 | | °C | 5 to 40 | |
| | **Cooling capacity (50/60 Hz)**∗3 | | W | 1100/1300 | 1500/1700 |
| | **Heating capacity (50/60 Hz)**∗3 | | W | 360/450 | |
| | **Temperature stability**∗5 | | °C | ±0.1 | |
| | **Pump** | **Rated flow (50/60 Hz)**∗6, 7 | L/min | 7 (0.13 MPa)/7 (0.18 MPa) | |
| | | **Maximum flow rate (50/60 Hz)** | L/min | 27/29 | |
| | | **Maximum pump head (50/60 Hz)** | m | 14/19 | |
| | | **Output** | W | 200 | |
| | **Tank capacity** | | L | Approx. 5 | |
| | **Port size** | | | Rc1/2 | |
| | **Fluid contact material** | | | Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC | |
| **Electrical system** | **Power supply** | | | Single-phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)<br>Allowable voltage range ±10% | |
| | **Circuit protector** | | A | 15 | |
| | **Applicable earth leakage breaker capacity**∗8 | | A | 15 | |
| | **Rated operating current** | | A | 7.5/8.3 | 7.7/8.4 |
| | **Rated power consumption (50/60 Hz)**∗3 | | kVA | 0.7/0.8 | 0.8/0.8 |
| **Noise level (50/60 Hz)**∗9 | | | dB | 58/55 | |
| **Accessories** | | | | Fitting (for drain outlet) 1 pc., Input/output signal connector 1 pc., Power supply connector 1 pc., Operation Manual (for installation/operation) 1, Quick Manual (with a clear case) 1, Alarm code list sticker 1, Ferrite core (for communication) 1 pc., Power supply cable: Option (sold separately) to be ordered or prepared by user. | |
| **Weight**∗10 | | | kg | 40 | |

∗1 It should have no condensation.
∗2 If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
∗3 ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Circulating fluid rated flow, ④ Circulating fluid: Tap water
Refer to the cooling capacity graph on page 19 for details.
∗4 Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temperature is 10°C or less.
∗5 Outlet temperature when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.
∗6 The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
∗7 Required minimum flow rate for cooling capacity or maintaining the temperature stability. The specification of the cooling capacity and the temperature stability may not be satisfied if the flow rate is lower than the rated flow. (In such a case, use a bypass piping set (sold separately).)
∗8 Purchase an earth leakage breaker with current sensitivity of 15 mA or 30 mA separately. (A product with an optional earth leakage breaker (option B) is also available. Refer to page 42.)
∗9 Front: 1 m, height: 1 m, stable with no load, Other conditions → See ∗3.
∗10 Weight in the dry state without circulating fluids
∗11 If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (**Web Catalog**) Item 14 "∗ For altitude of 1000 m or higher."

## How to Order

**Water-cooled refrigeration** **HRS 018 – W □ – 10 – □**

**Cooling capacity**

| | |
|---|---|
| **012** | Cooling capacity 1100/1300 W (50/60 Hz) |
| **018** | Cooling capacity 1500/1700 W (50/60 Hz) |

∗ UL Standards: Applicable to only 60 Hz

**Cooling method**

| | |
|---|---|
| **W** | Water-cooled refrigeration |

**Pipe thread type**

| | |
|---|---|
| **Nil** | Rc |
| **F** | G (with PT-G conversion fitting set) |
| **N** | NPT (with PT-NPT conversion fitting set) |

**Power supply**∗1

| Symbol | Power supply |
|---|---|
| **10** | Single-phase 100 VAC (50/60 Hz)<br>115 VAC (60 Hz) |

∗1 UL Standards: Applicable to only 60 Hz

**Option**

| Symbol | Option |
|---|---|
| **Nil** | None |
| **B** | With earth leakage breaker |
| **J** | With automatic fluid fill function |
| **M** | Applicable to deionized water piping |
| **T** | High pressure pump mounted∗1 |
| **W** | SI unit only∗2 |

- When multiple options are combined, indicate symbols in alphabetical order.

∗1
- The cooling capacity will decrease by about 300 W from the value in the catalog.
- The pump has a mechanical seal in it and leakage could occur depending on circulating fluid quality. We recommend you to use Particle Filter Kit, HRS-PF003, as a preventive measure.

∗2 Unit selection function is not available in Japan due to new measurement law. If using this product within Japan, please select this option. Fixed unit: MPa/°C

## Specifications

∗ There are different values from standard specifications. Refer to the **Web Catalog** for details.

| Model | | | | HRS012-W□-10 | HRS018-W□-10 |
|---|---|---|---|---|---|
| **Cooling method** | | | | Water-cooled refrigeration | |
| **Refrigerant** | | | | R407C (HFC) | |
| **Refrigerant charge** | | | kg | 0.25 | 0.26 |
| **Control method** | | | | PID control | |
| **Ambient temperature/Humidity/Altitude**∗1 | | | | Temperature: 5 to 40°C, Humidity: 30 to 70%, Altitude: less than 3000 m | |
| **Circulating fluid system** | **Circulating fluid**∗2 | | | Tap water, 15% ethylene glycol aqueous solution∗4 | |
| | **Set temperature range**∗1 | | °C | 5 to 40 | |
| | **Cooling capacity (50/60 Hz)**∗3 | | W | 1100/1300 | 1500/1700 |
| | **Heating capacity (50/60 Hz)**∗3 | | W | 360/450 | |
| | **Temperature stability**∗5 | | °C | ±0.1 | |
| | **Pump** | **Rated flow (50/60 Hz)**∗6, 7 | L/min | 7 (0.13 MPa)/7 (0.18 MPa) | |
| | | **Maximum flow rate (50/60 Hz)** | L/min | 27/29 | |
| | | **Maximum pump head (50/60 Hz)** | m | 14/19 | |
| | | **Output** | W | 200 | |
| | **Tank capacity** | | L | Approx. 5 | |
| | **Port size** | | | Rc1/2 | |
| | **Fluid contact material** | | | Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC | |
| **Facility water system** | **Temperature range** | | °C | 5 to 40 | |
| | **Pressure range** | | MPa | 0.3 to 0.5 | |
| | **Required flow rate (50/60 Hz)**∗11 | | L/min | 8 | 12 |
| | **Inlet-outlet pressure differential of facility water** | | MPa | 0.3 or more | |
| | **Port size** | | | Rc3/8 | |
| | **Fluid contact material** | | | Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber | |
| **Electrical system** | **Power supply** | | | Single-phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)<br>Allowable voltage range ±10% | |
| | **Circuit protector** | | A | 15 | |
| | **Applicable earth leakage breaker capacity**∗8 | | A | 15 | |
| | **Rated operating current** | | A | 7.5/8.3 | 7.7/8.4 |
| | **Rated power consumption (50/60 Hz)**∗3 | | kVA | 0.7/0.8 | 0.8/0.8 |
| **Noise level (50/60 Hz)**∗9 | | | dB | 58/55 | |
| **Accessories** | | | | Fitting (for drain outlet) 1 pc., Input/output signal connector 1 pc., Power supply connector 1 pc., Operation Manual (for installation/operation) 1, Quick Manual (with a clear case) 1, Alarm code list sticker 1, Ferrite core (for communication) 1 pc., Power supply cable: Option (sold separately) to be ordered or prepared by user. | |
| **Weight**∗10 | | | kg | 40 | |

∗1 It should have no condensation.
∗2 If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
∗3 ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Circulating fluid rated flow, ④ Circulating fluid: Tap water, ⑤ Facility water temperature: 25°C
Refer to the cooling capacity graph on page 19 for details.
∗4 Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temperature is 10°C or less.
∗5 Outlet temperature when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.
∗6 The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
∗7 Required minimum flow rate for cooling capacity or maintaining the temperature stability. The specification of the cooling capacity and the temperature stability may not be satisfied if the flow rate is lower than the rated flow. (In such a case, use a bypass piping set (sold separately).)
∗8 Purchase an earth leakage breaker with current sensitivity of 15 mA or 30 mA separately. (A product with an optional earth leakage breaker (option B) is also available. Refer to the **Web Catalog** for details.)
∗9 Front: 1 m, height: 1 m, stable with no load, Other conditions → See ∗3.
∗10 Weight in the dry state without circulating fluids
∗11 Required flow rate when a load for the cooling capacity is applied at a circulating fluid temperature of 20°C, and circulating fluid rated flow and facility water temperature of 25°C.

# Thermo-chiller Standard Type
# Single-phase 200 to 230 VAC RoHS
# *HRS* Series

(UL Standards)

## How to Order

**Air-cooled refrigeration** **HRS 018 – A □ – 20 – □**

**Cooling method**

| | |
|---|---|
| **A** | Air-cooled refrigeration |

**Pipe thread type**

| | |
|---|---|
| **Nil** | Rc |
| **F** | G (with PT-G conversion fitting set) |
| **N** | NPT (with PT-NPT conversion fitting set) |

**Cooling capacity**

| | |
|---|---|
| **012** | Cooling capacity 1100/1300 W (50/60 Hz) |
| **018** | Cooling capacity 1700/1900 W (50/60 Hz) |
| **024** | Cooling capacity 2100/2400 W (50/60 Hz) |
| **030** | Cooling capacity 2600/3200 W (50/60 Hz) |
| **050** | Cooling capacity 4700/5100 W (50/60 Hz) |
| **060** | Cooling capacity 4900/5900 W (50/60 Hz) |

∗ UL Standards: Applicable to only 60 Hz
The pump of 050 and 060 have a mechanical seal and leakage could occur depending on circulating fluid quality. We recommend you to use Particle Filter Kit, HRS-PF004, as a preventive measure.

**Power supply**∗1

| Symbol | Power supply |
|---|---|
| **20** | Single-phase 200 to 230 VAC (50/60 Hz) |

∗1 UL Standards: Applicable to only 60 Hz

**Option**

| Symbol | Option | Applicable model |
|---|---|---|
| **Nil** | None | HRS012/018/024 030/050/060 |
| **B** | With earth leakage breaker | |
| **J** | With automatic fluid fill function | |
| **M** | Applicable to deionized water piping | |
| **T** | High pressure pump mounted∗1 | HRS012/018/024/030 |
| **G** | High temperature environment specification | HRS012/018/024 |
| **W** | SI unit only∗2 | HRS012/018/024 030/050/060 |

- When multiple options are combined, indicate symbols in alphabetical order.

∗1 The cooling capacity will decrease by about 300 W from the value in the catalog.
The pump has a mechanical seal in it and leakage could occur depending on circulating fluid quality. We recommend you to use Particle Filter Kit, HRS-PF003, as a preventive measure.

∗2 Unit selection function is not available in Japan due to new measurement law. If using this product within Japan, please select this option.
Fixed unit: MPa/°C

## Specifications

∗ There are different values from standard specifications. Refer to the **Web Catalog** for details.

| Model | | | HRS012-A□-20 | HRS018-A□-20 | HRS024-A□-20 | HRS030-A□-20 | HRS050-A□-20 | HRS060-A□-20 |
|---|---|---|---|---|---|---|---|---|
| **Cooling method** | | | Air-cooled refrigeration | | | | | |
| **Refrigerant** | | | R407C (HFC) | | | | R410A (HFC) | |
| **Refrigerant charge** | | kg | 0.35 | 0.36 | 0.36 | 0.57 | 0.65 | 0.85 |
| **Control method** | | | PID control | | | | | |
| **Ambient temperature/Humidity/Altitude**∗1, 12 | | | Temperature: 5 to 40°C, High temperature environment specification (option): 5 to 45°C, Humidity: 30 to 70%, Altitude: less than 3000 m | | | | | |
| Circulating fluid system | **Circulating fluid**∗2 | | Tap water, 15% ethylene glycol aqueous solution∗4 | | | | | |
| | **Set temperature range**∗1 | °C | 5 to 40 | | | | | |
| | **Cooling capacity (50/60 Hz)**∗3 | W | 1100/1300 | 1700/1900 | 2100/2400 | 2600/3200 | 4700/5100 | 4900/5900 |
| | **Heating capacity (50/60 Hz)**∗3 | W | 530/650 | | | 600/640 | 1100/1400 | 1000/1300 |
| | **Temperature stability**∗5 | °C | ±0.1 | | | | | |
| | Pump **Rated flow (50/60 Hz)**∗6, 7 | L/min | 7 (0.13 MPa)/7 (0.18 MPa) | | | | 23 (0.24 MPa)/26 (0.32 MPa) | 23 (0.21 MPa)/28 (0.29 MPa) |
| | Pump **Maximum flow rate (50/60 Hz)** | L/min | 27/29 | | | 34/40 | 31/42 | 29/38 |
| | Pump **Maximum pump head (50/60 Hz)** | m | 14/19 | | | | 50 | |
| | Pump **Output** | W | 200 | | | | 550 | |
| | **Tank capacity** | L | Approx. 5 | | | | | |
| | **Port size** | | Rc1/2 | | | | | |
| | **Fluid contact material** | | Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC | | | | | |
| Electrical system | **Power supply** | | Single-phase 200 to 230 VAC (50/60 Hz) Allowable voltage range ±10% | | | | | |
| | **Circuit protector** | A | 10 | | | | 20 | 30 |
| | **Applicable earth leakage breaker capacity**∗8 | A | 10 | | | | 20 | 30 |
| | **Rated operating current** | A | 4.6/5.1 | 4.7/5.2 | 5.1/5.9 | 5.2/6.0 | 8/11 | 8.9/11.5 |
| | **Rated power consumption (50/60 Hz)**∗3 | kVA | 0.9/1.0 | 0.9/1.0 | 1.0/1.2 | 1.0/1.2 | 1.7/2.2 | 1.8/2.3 |
| **Noise level (50/60 Hz)**∗9 | | dB | 60/61 | | | 62/65 | 65/68 | 66/68 |
| **Accessories** | | | Fitting (for drain outlet) 1 pc.∗11, Input/output signal connector 1 pc., Power supply connector 1 pc.∗11, Operation Manual (for installation/operation) 1, Quick Manual (with a clear case) 1∗11, Alarm code list sticker 1, Ferrite core (for communication) 1 pc., Power supply cable: Option (sold separately) to be ordered or prepared by user. | | | | | |
| **Weight**∗10 | | kg | 43 | | | 47 | 69 | 73 |

∗1 It should have no condensation.
∗2 If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
∗3 ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Circulating fluid rated flow, ④ Circulating fluid: Tap water
Refer to the cooling capacity graph on pages 19 and 20 for details.
∗4 Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temperature is 10°C or less.
∗5 Outlet temperature when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.
∗6 The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
∗7 Required minimum flow rate for cooling capacity or maintaining the temperature stability. The specification of the cooling capacity and the temperature stability may not be satisfied if the flow rate is lower than the rated flow. (In such a case, use a bypass piping set (sold separately).)
∗8 Purchase an earth leakage breaker with current sensitivity of 30 mA separately. (A product with an optional earth leakage breaker (option B) is also available.)
∗9 Front: 1 m, height: 1 m, stable with no load, Other conditions → See ∗3.
∗10 Weight in the dry state without circulating fluids
∗11 It is not provided for the HRS050/060.
∗12 If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/ Storage Environment" (**Web Catalog**) Item 14 "∗ For altitude of 1000 m or higher."

## How to Order

**Water-cooled refrigeration** **HRS 018 – W □ – 20 – □**

### Cooling capacity

| | |
|---|---|
| **012** | Cooling capacity 1100/1300 W (50/60 Hz) |
| **018** | Cooling capacity 1700/1900 W (50/60 Hz) |
| **024** | Cooling capacity 2100/2400 W (50/60 Hz) |
| **030** | Cooling capacity 2600/3200 W (50/60 Hz) |
| **050** | Cooling capacity 4700/5100 W (50/60 Hz) |
| **060** | Cooling capacity 4900/5900 W (50/60 Hz) |

∗ UL Standards: Applicable to only 60 Hz
The pump of 050 and 060 have a mechanical seal and leakage could occur depending on circulating fluid quality. We recommend you to use Particle Filter Kit, HRS-PF004, as a preventive measure.

### Cooling method

| | |
|---|---|
| **W** | Water-cooled refrigeration |

### Pipe thread type

| | |
|---|---|
| **Nil** | Rc |
| **F** | G (with PT-G conversion fitting set) |
| **N** | NPT (with PT-NPT conversion fitting set) |

### Power supply∗1

| Symbol | Power supply |
|---|---|
| **20** | Single-phase 200 to 230 VAC (50/60 Hz) |

∗1 UL Standards: Applicable to only 60 Hz

### Option

| Symbol | Option | Applicable model |
|---|---|---|
| **Nil** | None | HRS012/018/024 030/050/060 |
| **B** | With earth leakage breaker | |
| **J** | With automatic fluid fill function | |
| **M** | Applicable to deionized water piping | |
| **T** | High pressure pump mounted∗1 | HRS012/018/024/030 |
| **W** | SI unit only∗2 | HRS012/018/024 030/050/060 |

- When multiple options are combined, indicate symbols in alphabetical order.

∗1 The cooling capacity will decrease by about 300 W from the value in the catalog.
The pump has a mechanical seal in it and leakage could occur depending on circulating fluid quality. We recommend you to use Particle Filter Kit, HRS-PF003, as a preventive measure.

∗2 Unit selection function is not available in Japan due to new measurement law. If using this product within Japan, please select this option.
Fixed unit: MPa/°C

## Specifications

∗ There are different values from standard specifications. Refer to the **Web Catalog** for details.

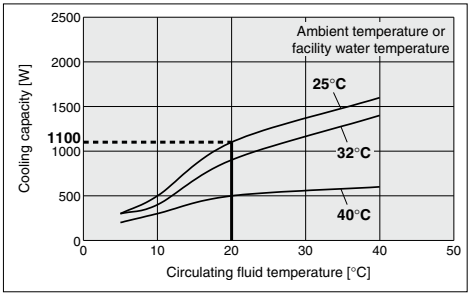
| Model | | | HRS012-W□-20 | HRS018-W□-20 | HRS024-W□-20 | HRS030-W□-20 | HRS050-W□-20 | HRS060-W□-20 |
|---|---|---|---|---|---|---|---|---|
| **Cooling method** | | | Water-cooled refrigeration | | | | | |
| **Refrigerant** | | | R407C (HFC) | | | | R410A (HFC) | |
| **Refrigerant charge** | | kg | 0.3 | 0.31 | 0.31 | 0.5 | 0.65 | 0.75 |
| **Control method** | | | PID control | | | | | |
| **Ambient temperature/Humidity/Altitude**∗1 | | | Temperature: 5 to 40°C, Humidity: 30 to 70%, Altitude: less than 3000 m | | | | | |
| Circulating fluid system | **Circulating fluid**∗2 | | Tap water, 15% ethylene glycol aqueous solution∗4 | | | | | |
| | **Set temperature range**∗1 | | 5 to 40 | | | | | |
| | **Cooling capacity (50/60 Hz)**∗3 | W | 1100/1300 | 1700/1900 | 2100/2400 | 2600/3200 | 4700/5100 | 4900/5900 |
| | **Heating capacity (50/60 Hz)**∗3 | W | 530/650 | | | 400/600 | 1000/1300 | |
| | **Temperature stability**∗5 | °C | ±0.1 | | | | | |
| | Pump **Rated flow (50/60 Hz)**∗6, 7 | L/min | 7 (0.13 MPa)/7 (0.18 MPa) | | | | 23 (0.24 MPa)/28 (0.32 MPa) | 23 (0.21 MPa)/28 (0.29 MPa) |
| | Pump **Maximum flow rate (50/60 Hz)** | L/min | 27/29 | | | 34/40 | 31/42 | 29/38 |
| | Pump **Maximum pump head (50/60 Hz)** | m | 14/19 | | | | 50 | |
| | Pump **Output** | W | 200 | | | | 550 | |
| | **Tank capacity** | L | Approx. 5 | | | | | |
| | **Port size** | | Rc1/2 | | | | | |
| | **Fluid contact material** | | Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC | | | | | |
| Facility water system | **Temperature range** | °C | 5 to 40 | | | | | |
| | **Pressure range** | MPa | 0.3 to 0.5 | | | | | |
| | **Required flow rate (50/60 Hz)**∗11 | L/min | 8 | 12 | 14 | 15 | 16 | 17 |
| | **Inlet-outlet pressure differential of facility water** | MPa | 0.3 or more | | | | | |
| | **Port size** | | Rc3/8 | | | | Rc1/2 | |
| | **Fluid contact material** | | Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber | | | | | |
| Electrical system | **Power supply** | | Single-phase 200 to 230 VAC (50/60 Hz) Allowable voltage range ±10% | | | | | |
| | **Circuit protector** | A | 10 | | | | 20 | |
| | **Applicable earth leakage breaker capacity**∗8 | A | 10 | | | | 20 | |
| | **Rated operating current** | A | 4.6/5.1 | 4.7/5.2 | 5.1/5.9 | 5.2/6.0 | 7.6/10 | 7.6/10.4 |
| | **Rated power consumption (50/60 Hz)**∗3 | kVA | 0.9/1.0 | 0.9/1.0 | 1.0/1.2 | 1.0/1.2 | 1.5/2.0 | 1.5/2.1 |
| **Noise level (50/60 Hz)**∗9 | | dB | 60/61 | | | 62/65 | 65/68 | 66/68 |
| **Accessories** | | | Fitting (for drain outlet) 1 pc.∗12, Input/output signal connector 1 pc., Power supply connector 1 pc.∗12, Operation Manual (for installation/operation) 1, Quick Manual (with a clear case) 1∗12, Alarm code list sticker 1, Ferrite core (for communication) 1 pc., Power supply cable: Option (sold separately) to be ordered or prepared by user. | | | | | |
| **Weight**∗10 | | kg | 43 | | | 46 | 67 | |

∗1 It should have no condensation.
∗2 If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
∗3 ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Circulating fluid rated flow, ④ Circulating fluid: Tap water, ⑤ Facility water temperature: 25°C
Refer to the cooling capacity graph on pages 19 and 20 for details.
∗4 Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temperature is 10°C or less.
∗5 Outlet temperature when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.
∗6 The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
∗7 Required minimum flow rate for cooling capacity or maintaining the temperature stability. The specification of the cooling capacity and the temperature stability may not be satisfied if the flow rate is lower than the rated flow. (In such a case, use a bypass piping set (sold separately).)
∗8 Purchase an earth leakage breaker with current sensitivity of 30 mA separately. (A product with an optional earth leakage breaker (option B) is also available.)
∗9 Front: 1 m, height: 1 m, stable with no load, Other conditions → See ∗3.
∗10 Weight in the dry state without circulating fluids
∗11 Required flow rate when a load for the cooling capacity is applied at a circulating fluid temperature of 20°C, and circulating fluid rated flow and facility water temperature of 25°C.
∗12 It is not provided for the HRS050/060.

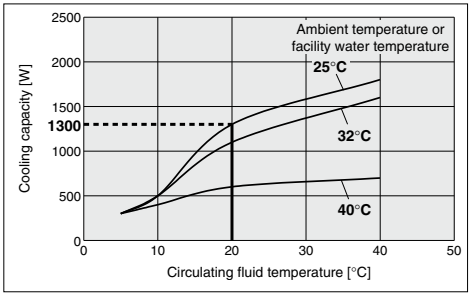
## Cooling Capacity

* If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (**Web Catalog**) Item 14 "* For altitude of 1000 m or higher."
* For models with high pressure pump mounted (-T), the cooling capacity will decrease by about 300 W from each graph.

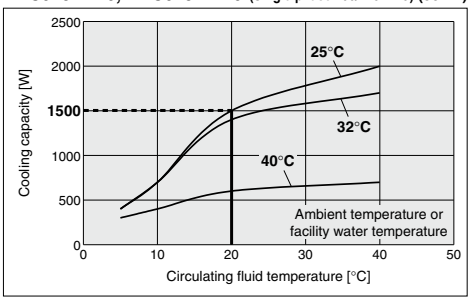
### HRS012-A-10, HRS012-W-10 (Single-phase 100/115 VAC) (50 Hz)



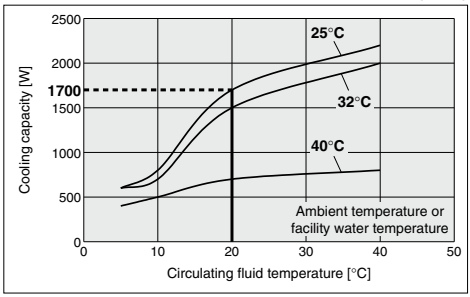

### (60 Hz)



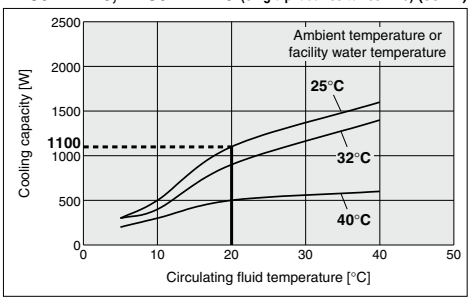

### HRS018-A-10, HRS018-W-10 (Single-phase 100/115 VAC) (50 Hz)



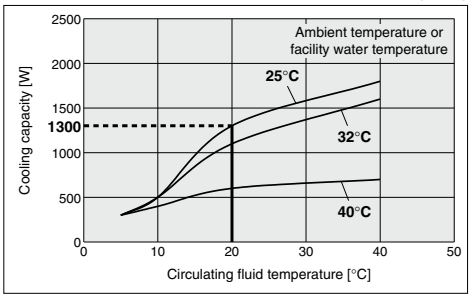

### (60 Hz)



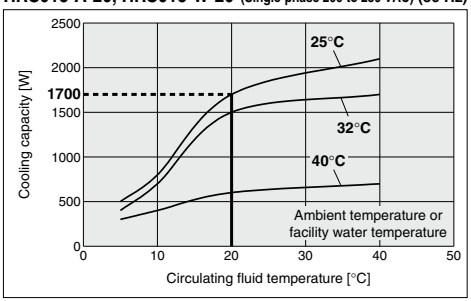

### HRS012-A-20, HRS012-W-20 (Single-phase 200 to 230 VAC) (50 Hz)



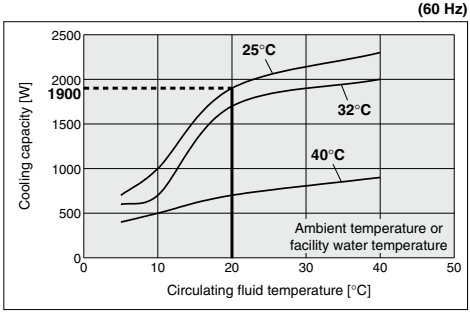

### (60 Hz)




### HRS018-A-20, HRS018-W-20 (Single-phase 200 to 230 VAC) (50 Hz)



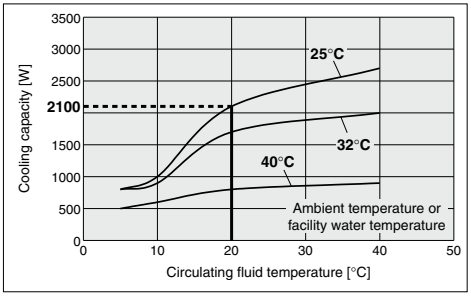

### (60 Hz)



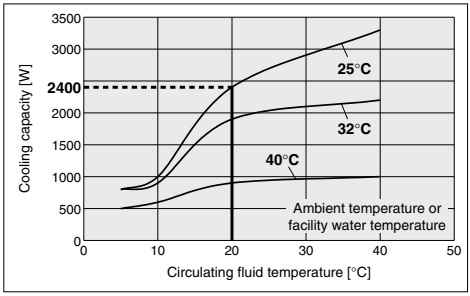
## Cooling Capacity

∗ If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (**Web Catalog**) Item 14 "∗ For altitude of 1000 m or higher."
∗ For models with high pressure pump mounted (-T), the cooling capacity will decrease by about 300 W from each graph.

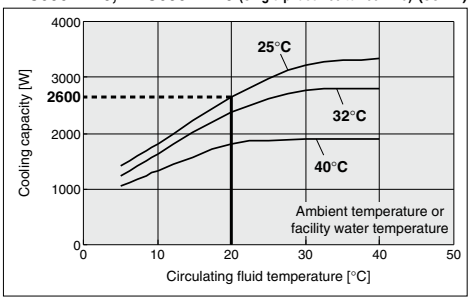
### HRS024-A-20, HRS024-W-20 (Single-phase 200 to 230 VAC) (50 Hz)



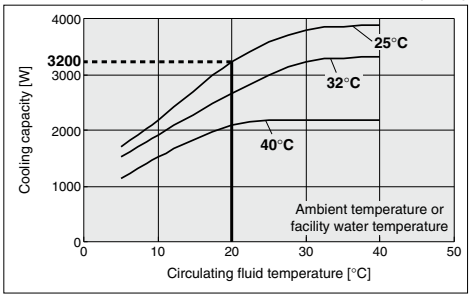

### (60 Hz)



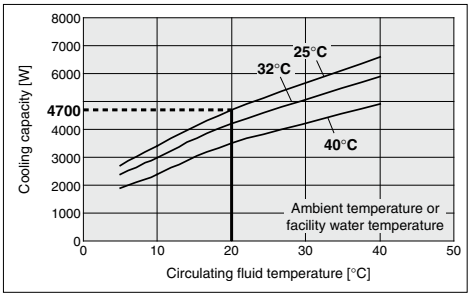

### HRS030-A-20, HRS030-W-20 (Single-phase 200 to 230 VAC) (50 Hz)



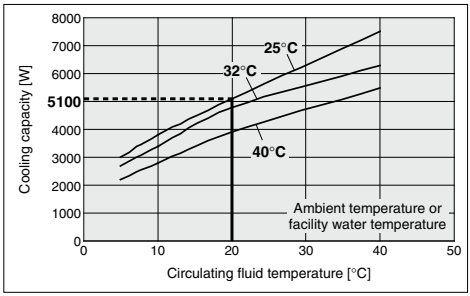

### (60 Hz)



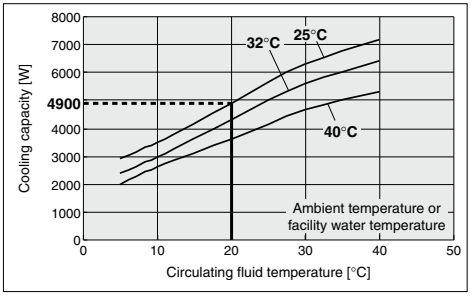

### HRS050-A-20, HRS050-W-20 (Single-phase 200 to 230 VAC) (50 Hz)



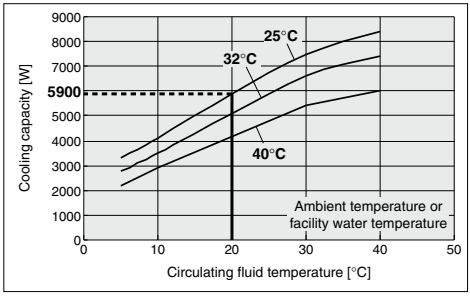

### (60 Hz)




### HRS060-A-20, HRS060-W-20 (Single-phase 200 to 230 VAC) (50 Hz)



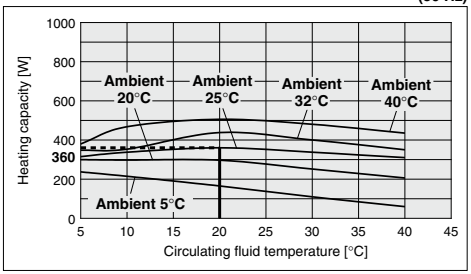

### (60 Hz)



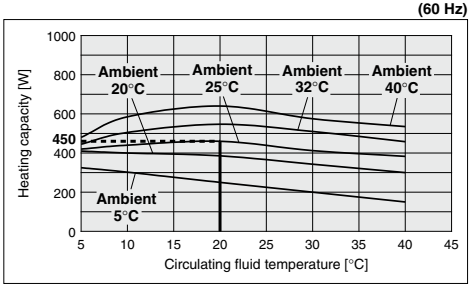
## Heating Capacity

### HRS$^{012}_{018}$-$^{A}_{W}$-10 (Single-phase 100/115 VAC)

(50 Hz)

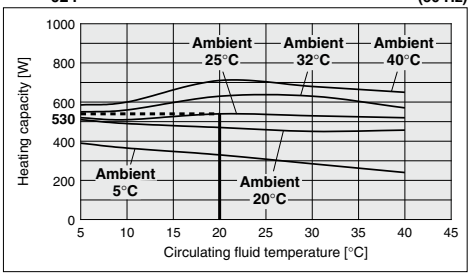



(60 Hz)

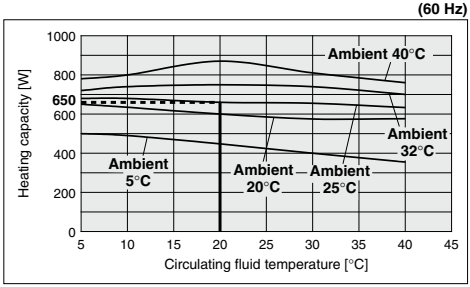



### HRS$^{012}_{018}_{024}$-$^{A}_{W}$-20 (Single-phase 200 to 230 VAC)

(50 Hz)

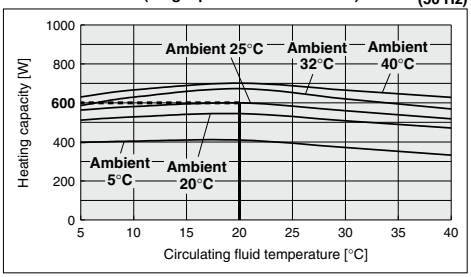



(60 Hz)

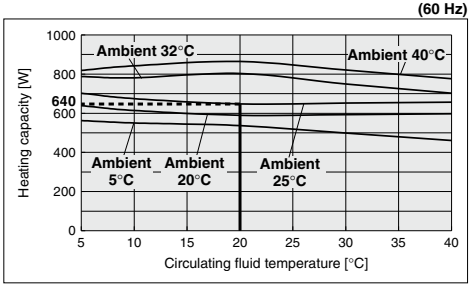



### HRS030-A-20 (Single-phase 200 to 230 VAC)

(50 Hz)

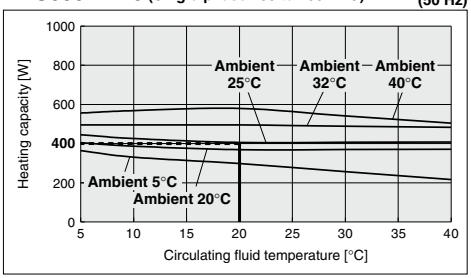



(60 Hz)

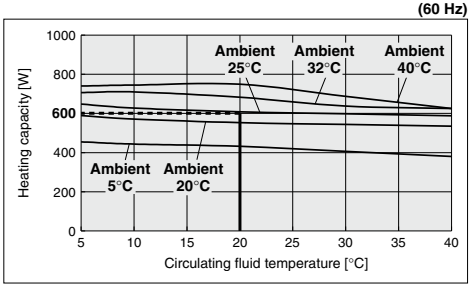



### HRS030-W-20 (Single-phase 200 to 230 VAC)

(50 Hz)



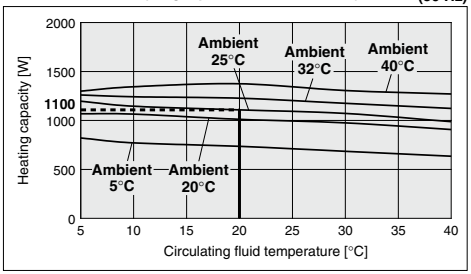

(60 Hz)



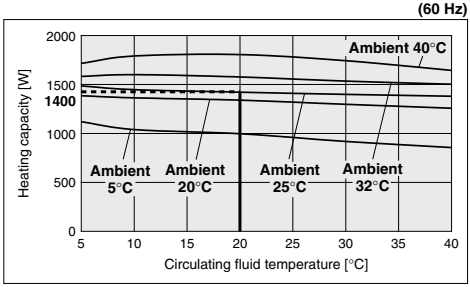
## Heating Capacity

### HRS050-A-20 (Single-phase 200 to 230 VAC)

(50 Hz)

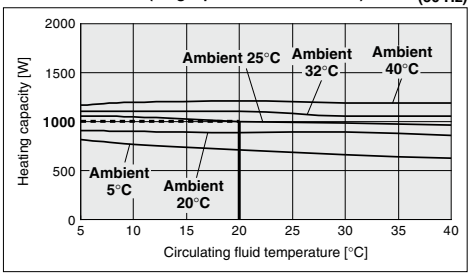



(60 Hz)

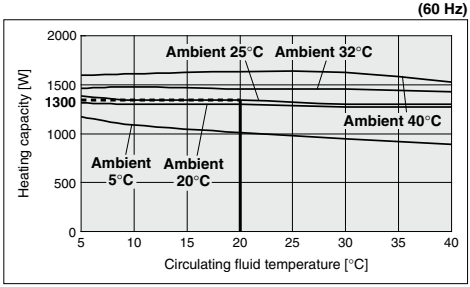



### HRS050-W-20 (Single-phase 200 to 230 VAC)

(50 Hz)

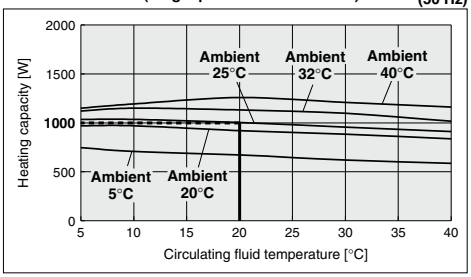



(60 Hz)

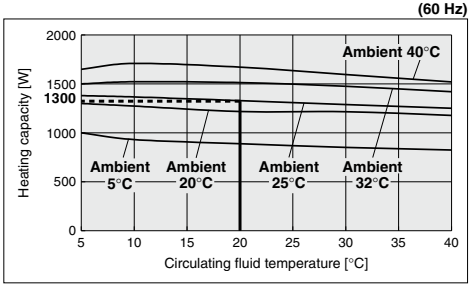



### HRS060-A-20 (Single-phase 200 to 230 VAC)

(50 Hz)

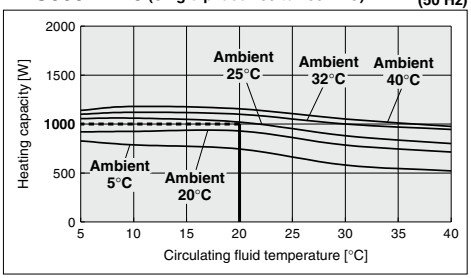



(60 Hz)

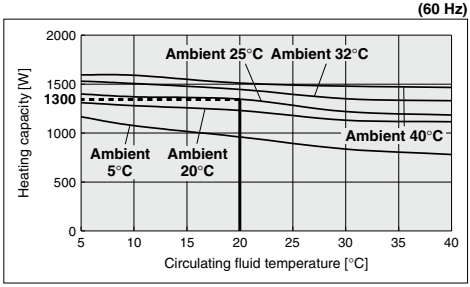



### HRS060-W-20 (Single-phase 200 to 230 VAC)

(50 Hz)

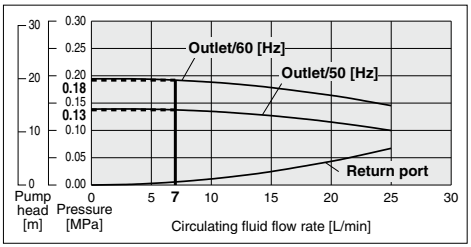



(60 Hz)

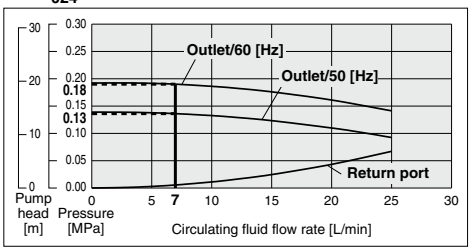


## Pump Capacity

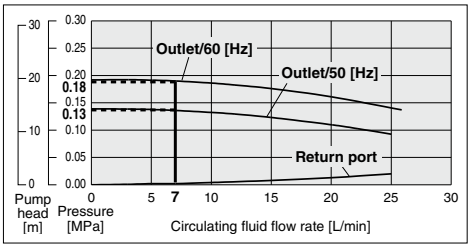
### HRS$^{012}_{018}$-$^{A}_{W}$-10 (Single-phase 100/115 VAC)



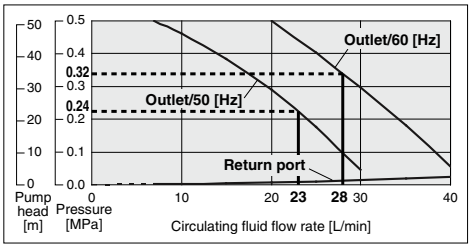

### HRS$^{012}_{018}$-$^{A}_{W}$-20 (Single-phase 200 to 230 VAC)



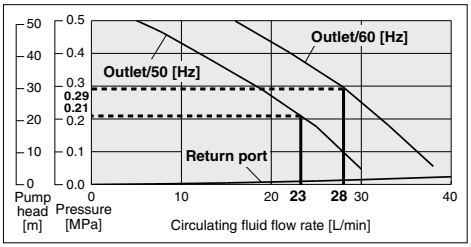

### HRS030-$^{A}_{W}$-20 (Single-phase 200 to 230 VAC)




### HRS050-$^{A}_{W}$-20 (Single-phase 200 to 230 VAC)




### HRS060-$^{A}_{W}$-20 (Single-phase 200 to 230 VAC)

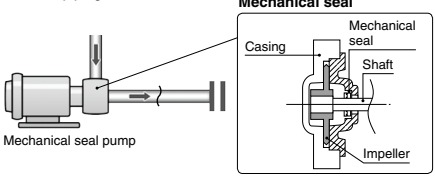



## ⚠Caution

**Mechanical Seal Pump**

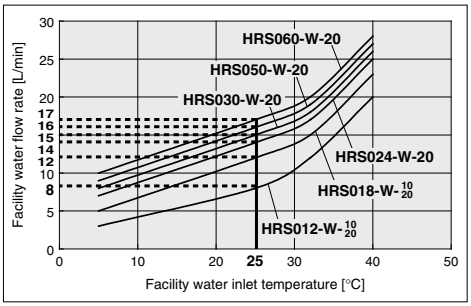
The pump used for the thermo-chiller HRS050/060 series uses a mechanical seal with the fixed ring and rotary ring used for the shaft seal part. If foreign matter enter the gap between the seals, this may cause a trouble such as leakage from the seal part or pump lock. Therefore, it is strongly recommended to install the particle filter in the return piping of the chiller.

**Mechanical seal**




## Required Facility Water Flow Rate

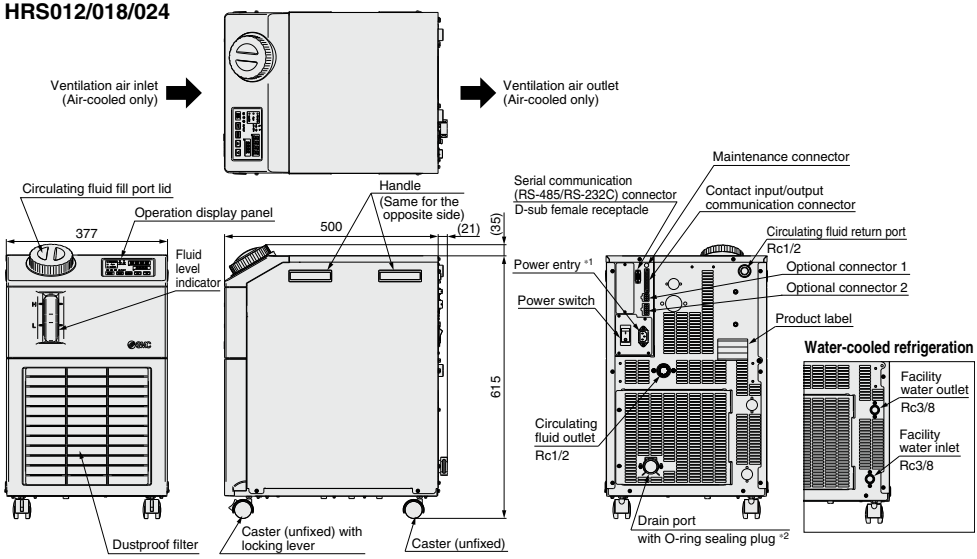
### HRS012-W-$^{10}_{20}$, HRS018-W-$^{10}_{20}$, HRS024-W-20
### HRS030-W-20, HRS050-W-20, HRS060-W-20




∗ This is the facility water flow rate at the circulating fluid rated flow and the cooling capacity listed in the "Cooling Capacity" specifications.

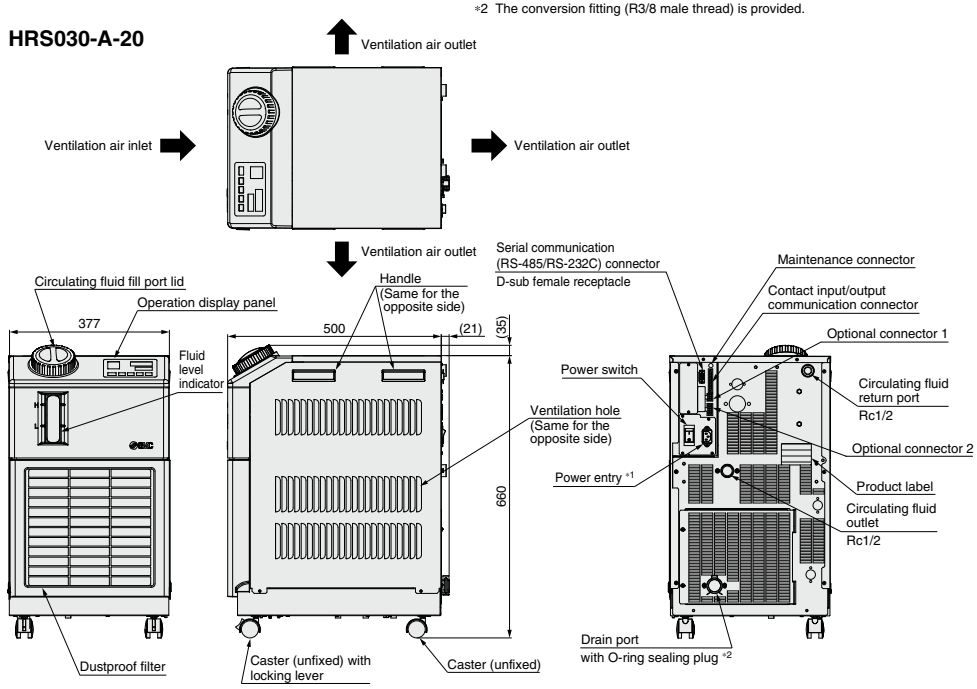
## Dimensions

### HRS012/018/024




*1 The power supply cable is not provided. (The power supply connector is provided.)
*2 The conversion fitting (R3/8 male thread) is provided.

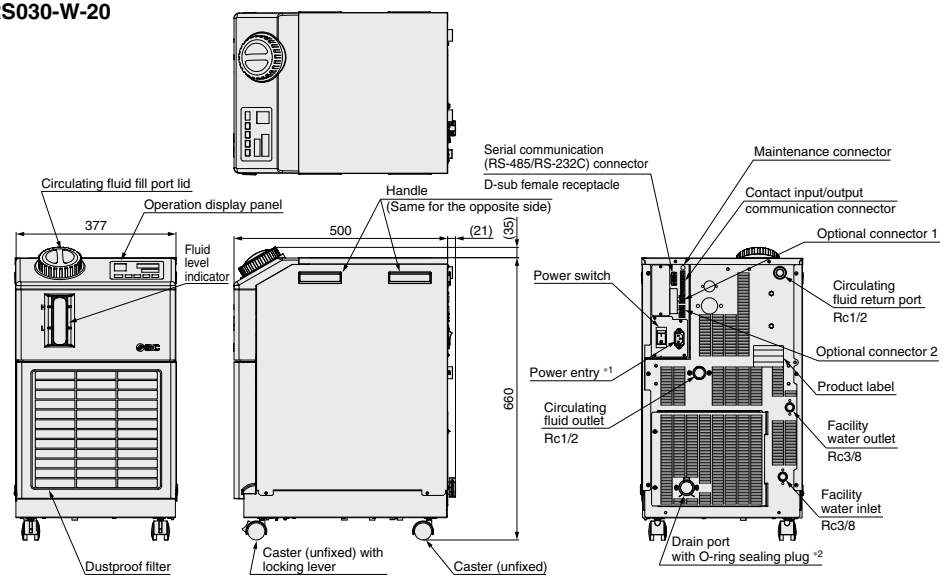
### HRS030-A-20




*1 The power supply cable is not provided. (The power supply connector is provided.)
*2 The conversion fitting (R3/8 male thread) is provided.

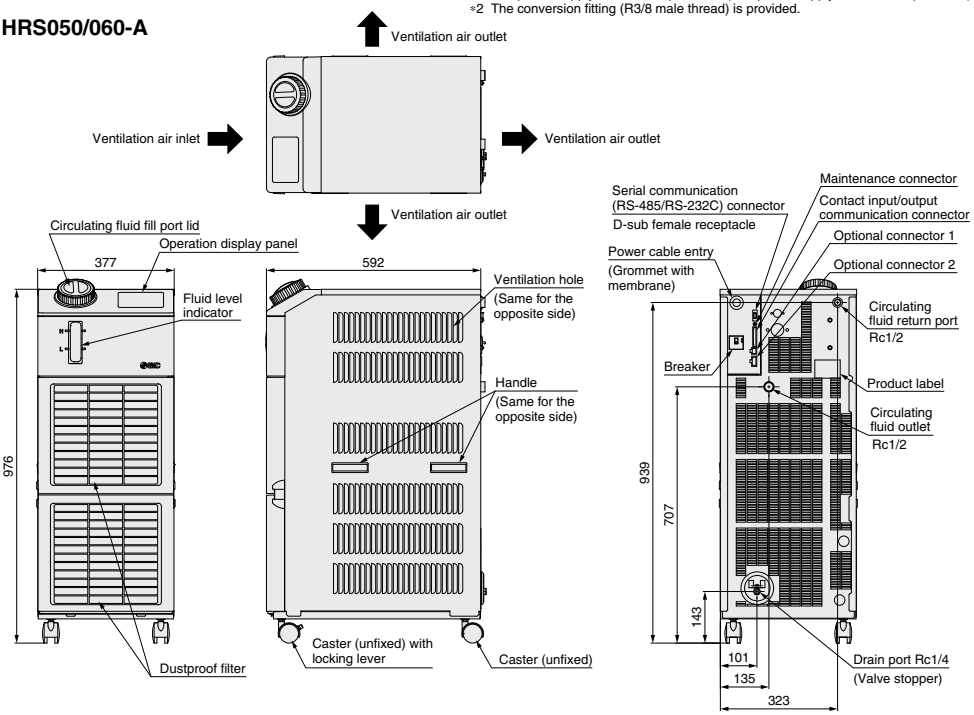
## Dimensions

### HRS030-W-20



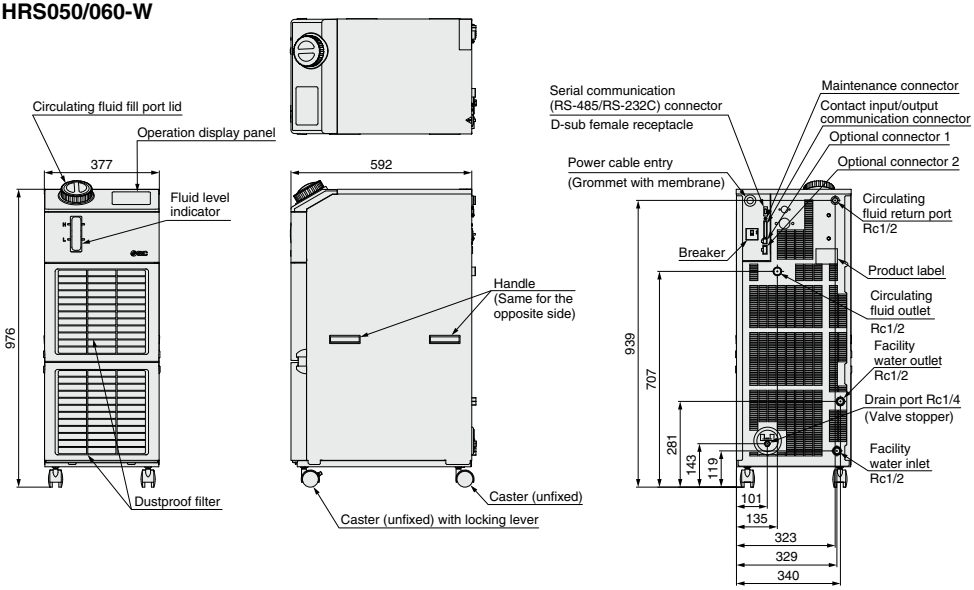

*1 The power supply cable is not provided. (The power supply connector is provided.)
*2 The conversion fitting (R3/8 male thread) is provided.

### HRS050/060-A



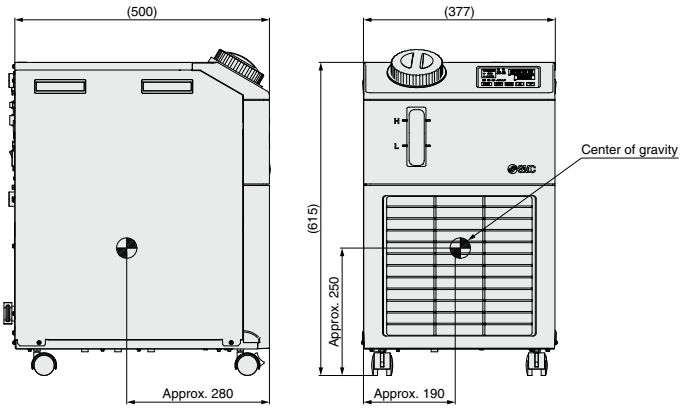
## Dimensions

### HRS050/060-W

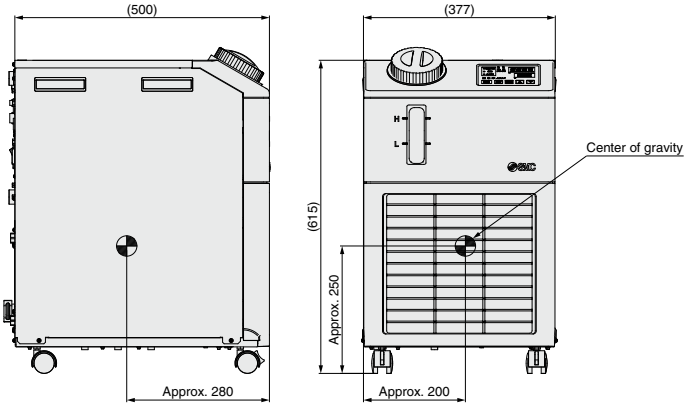


## Center of Gravity

### HRS012/018-A-10

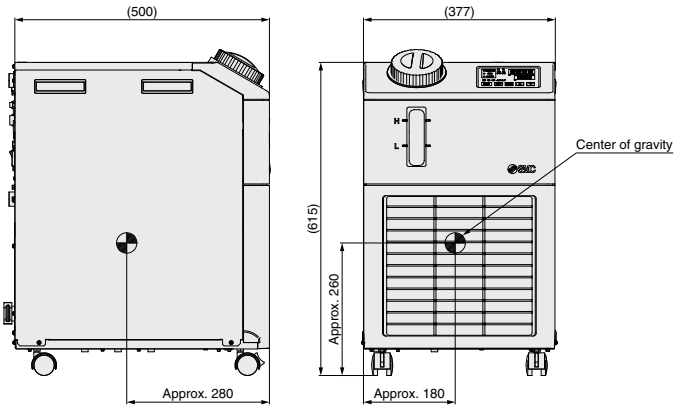



### HRS012/018-W-10

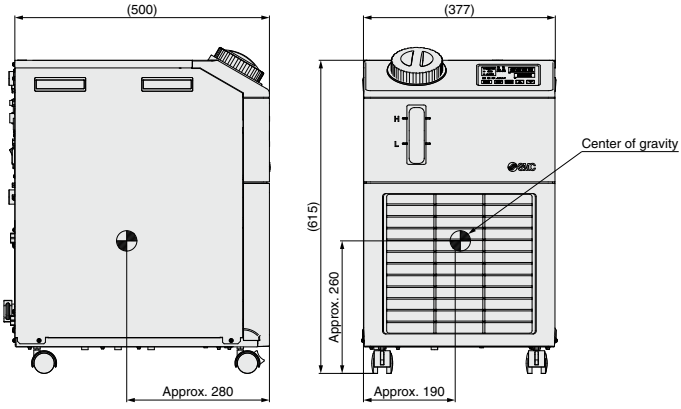


## Center of Gravity

### HRS012/018/024-A-20

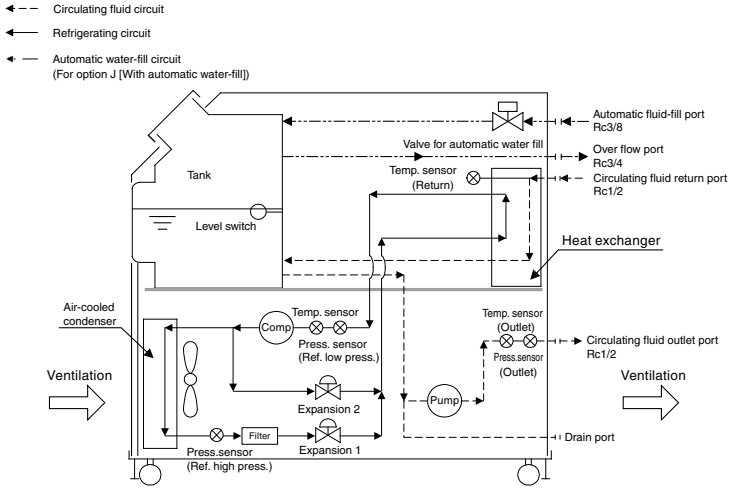



### HRS012/018/024-W-20

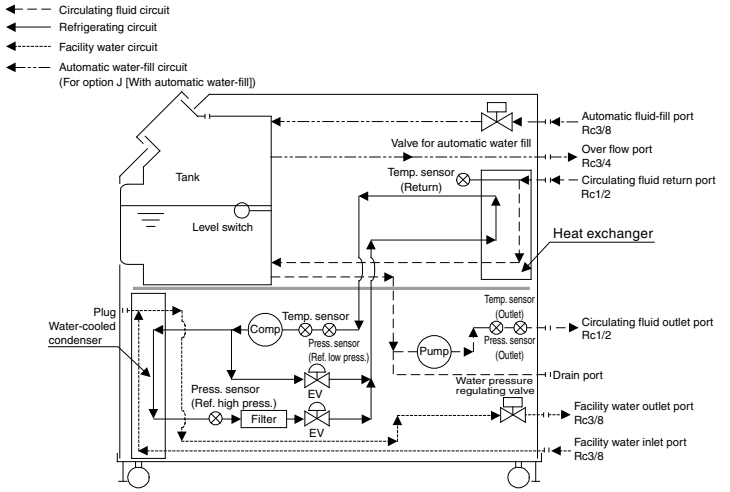


## Flow Chart

### HRS012/018/024/030-A-10/20

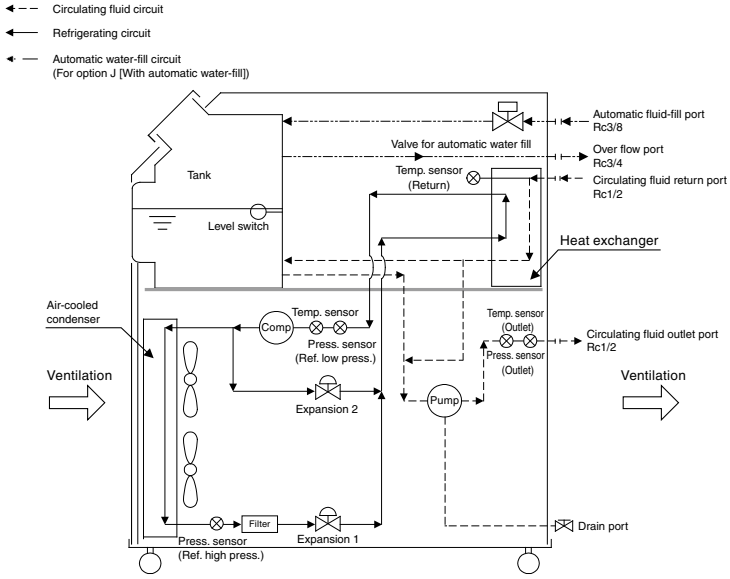



### HRS012/018/024/030-W-10/20

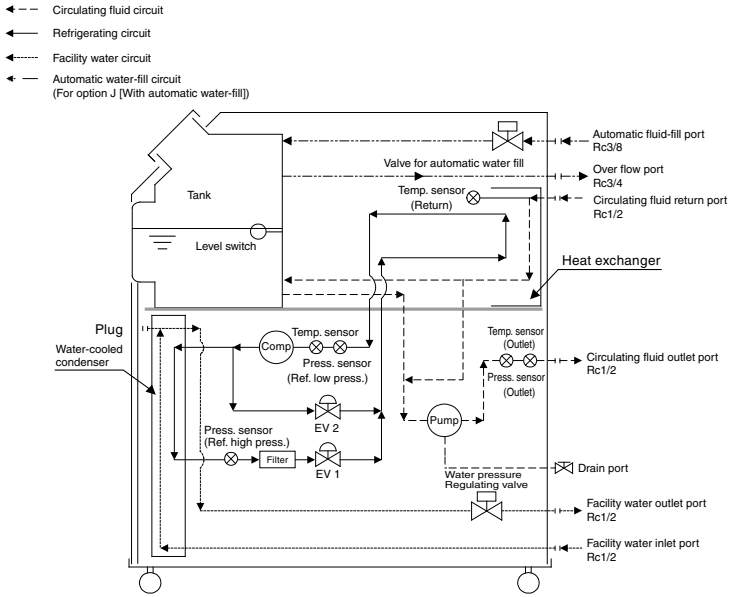


## Flow Chart

### HRS050/060-A-20

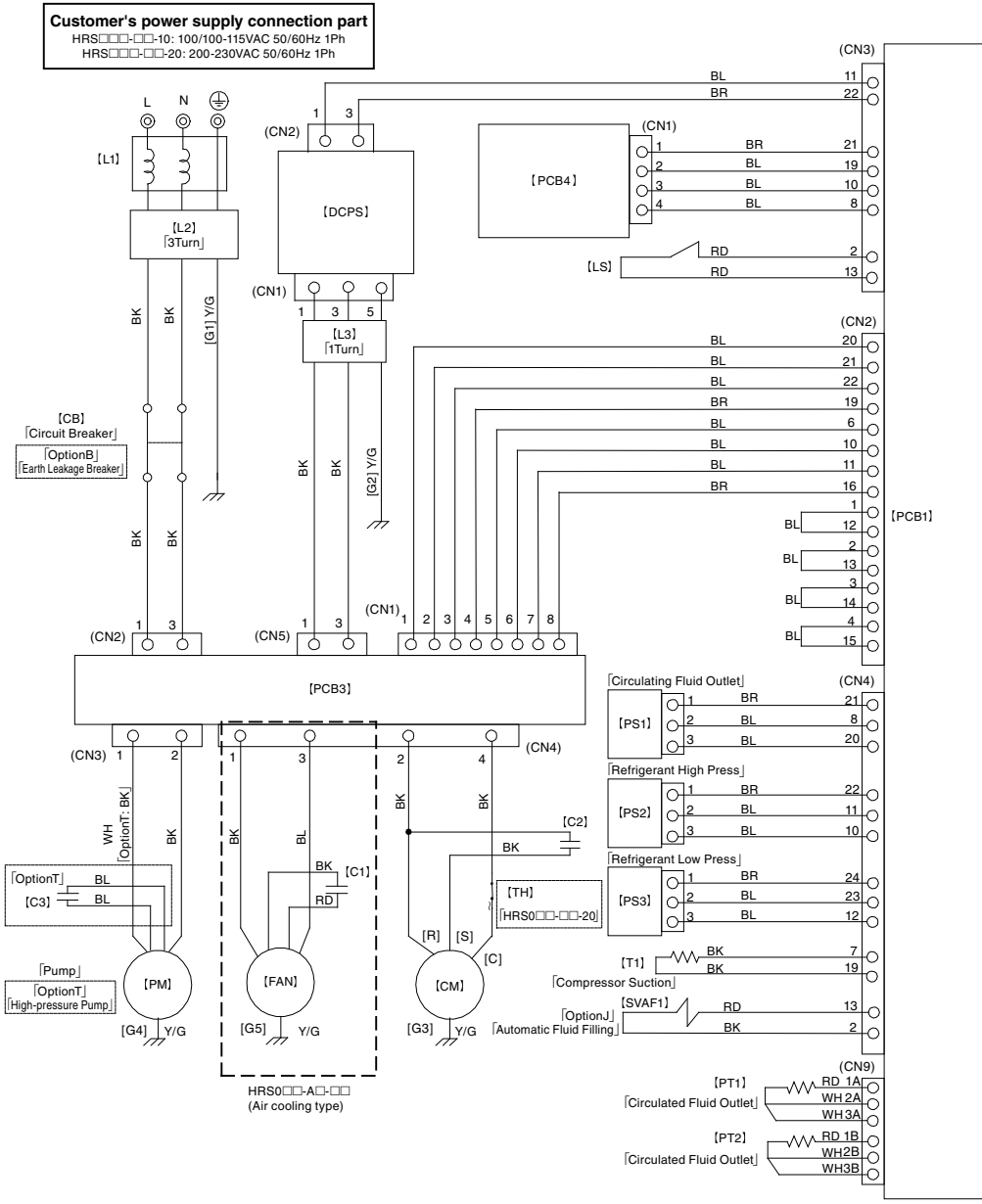


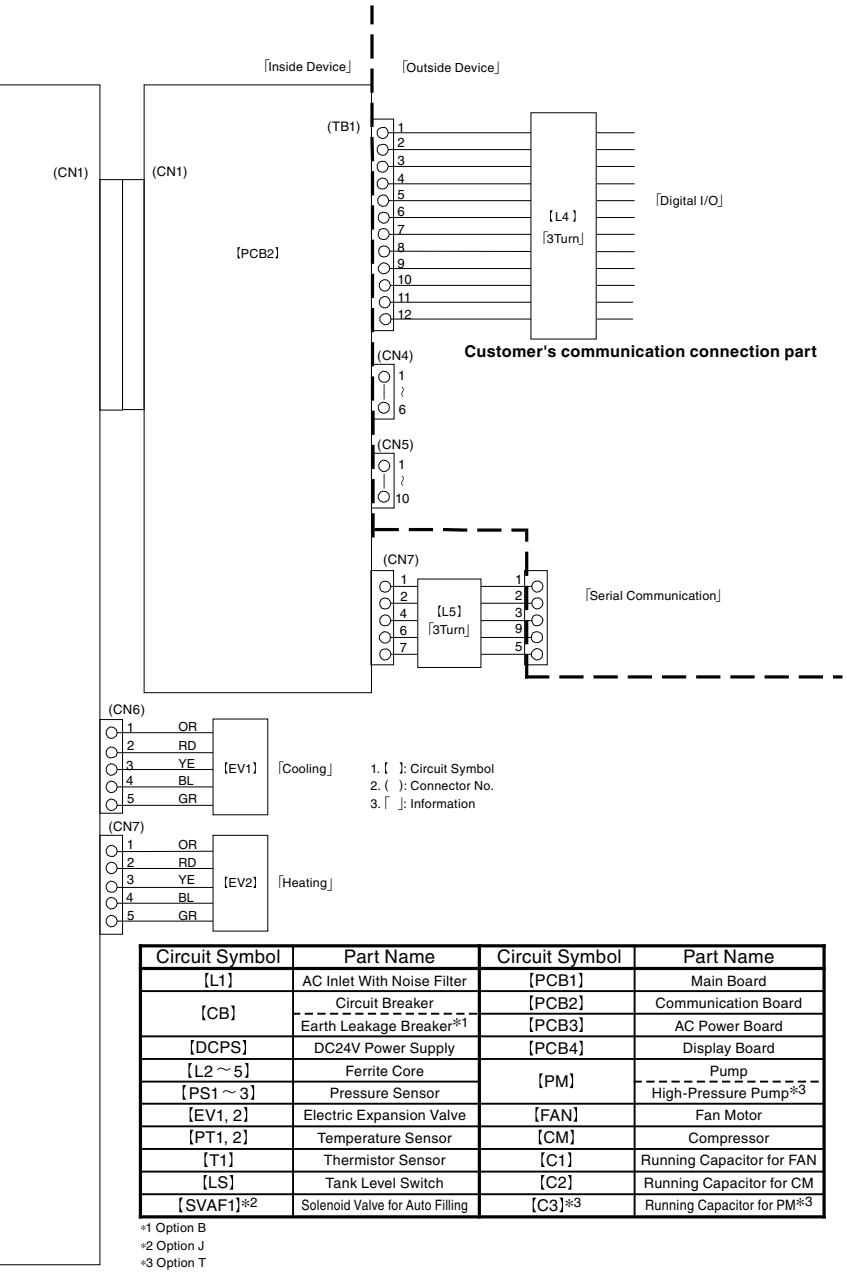

### HRS050/060-W-20



## Electric Circuit Diagram

**HRS0□□-□□-□□**





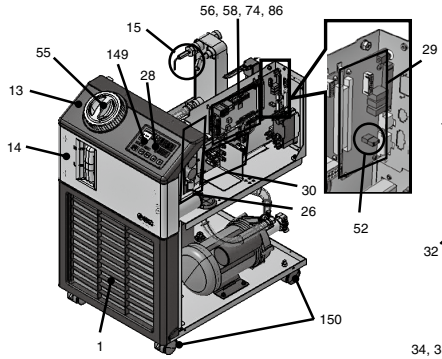

1. 【 】: Circuit Symbol
2. ( ): Connector No.
3. 「 」: Information

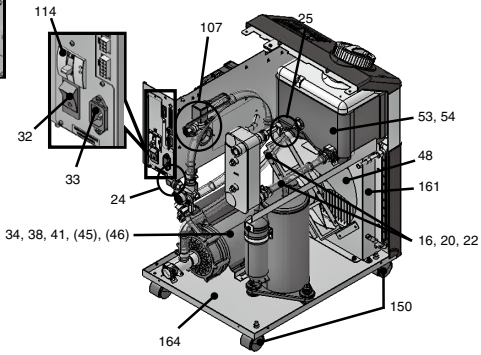
| Circuit Symbol | Part Name | Circuit Symbol | Part Name |
|---|---|---|---|
| 【L1】 | AC Inlet With Noise Filter | 【PCB1】 | Main Board |
| 【CB】 | Circuit Breaker | 【PCB2】 | Communication Board |
| | Earth Leakage Breaker*1 | 【PCB3】 | AC Power Board |
| 【DCPS】 | DC24V Power Supply | 【PCB4】 | Display Board |
| 【L2～5】 | Ferrite Core | 【PM】 | Pump |
| 【PS1～3】 | Pressure Sensor | | High-Pressure Pump*3 |
| 【EV1, 2】 | Electric Expansion Valve | 【FAN】 | Fan Motor |
| 【PT1, 2】 | Temperature Sensor | 【CM】 | Compressor |
| 【T1】 | Thermistor Sensor | 【C1】 | Running Capacitor for FAN |
| 【LS】 | Tank Level Switch | 【C2】 | Running Capacitor for CM |
| 【SVAF1】*2 | Solenoid Valve for Auto Filling | 【C3】*3 | Running Capacitor for PM*3 |

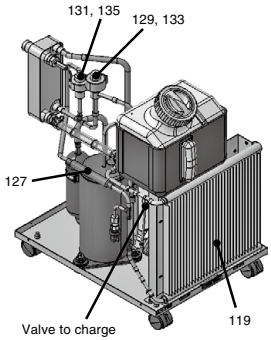
*1 Option B
*2 Option J
*3 Option T

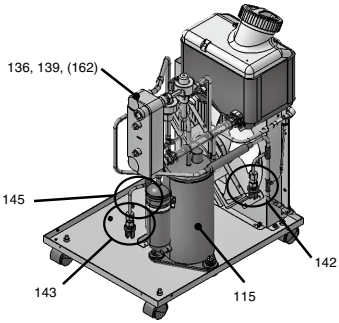
## Construction

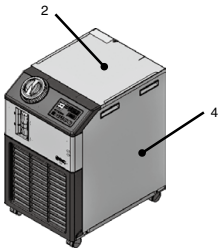
**Applicable models, Ser. No.: HRS012-A-10-□, TP (FEB. 2015) or earlier**

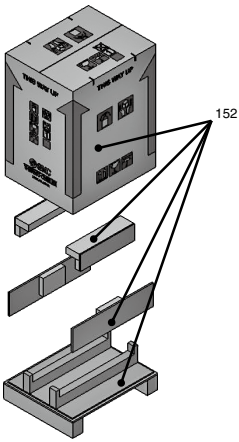


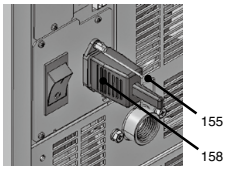



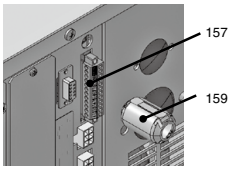



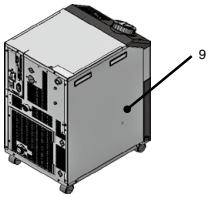



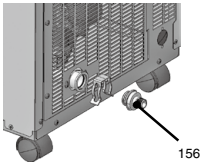



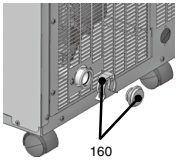



## Construction

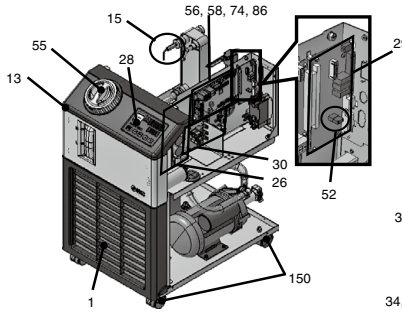
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ● |
| 33 | Inlet socket | HRS-S0021 | ● |
| 34 | Pump (for 100V) | HRS-S0022 | ● |
| 38 | High head pump (For 100V type option T) | HRS-S0265 | ○ (For option T) |
| 41 | High head pump (For 100V type option MT) | HRS-S0266 | ○ (For option MT) |
| 45 | Mechanical seal Kit (For 100V type option T) | HRS-S0390 | ○ (For option T) |
| 46 | Mechanical seal Kit (For 100V type option MT) | HRS-S0412 | ○ (For option MT) |
| 48 | Fan (for 100V)With bracket | HRS-S0023 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 58 | Main Board (for HRS012-A-10) | HRS-S0033 | ● |
| 74 | Main Board (for HRS012-A-10-T) | HRS-S0282 | ○ (For option T) |
| 86 | Main Board (for HRS012-A-10-MT) | HRS-S0283 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 115 | Compressor (for 100V type) | HRS-S0409 | ● |
| 119 | Condenser (For air-cooled type) | HRS-S0381 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 161 | Condenser bracket | HRS-S0015 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 164 | Base | HRS-S0061 | ● |

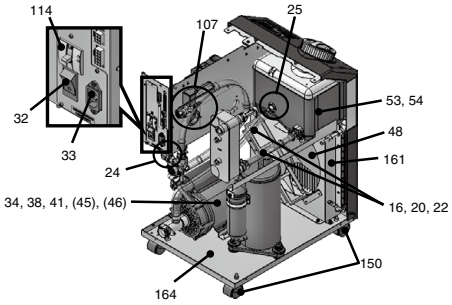
Note 1. Excerpt number from the total list of P.91 to 98

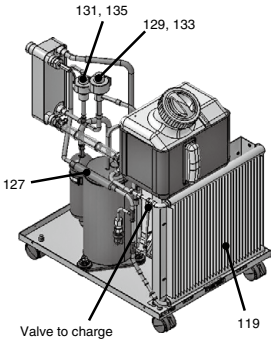
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

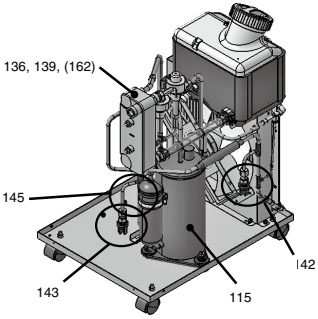
## Construction

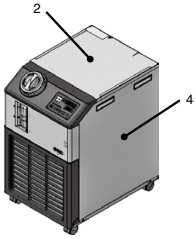
**Applicable models, Ser. No.: HRS012-A-10-□, After TQ (MAR. 2015)**

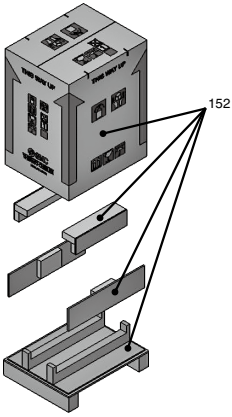


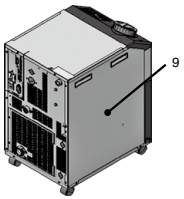



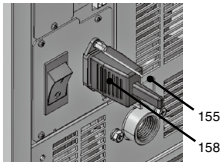



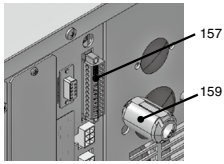



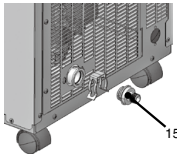



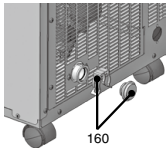



## Construction

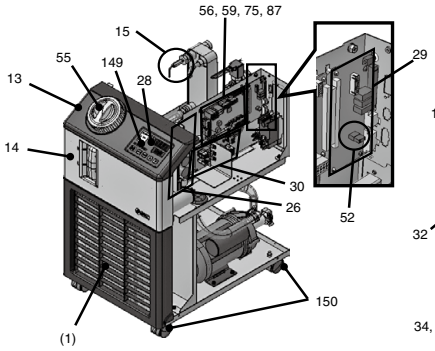
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel | HRS-S0519 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0520 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ● |
| 33 | Inlet socket | HRS-S0021 | ● |
| 34 | Pump (for 100V) | HRS-S0022 | ● |
| 38 | High head pump (For 100V type option T) | HRS-S0265 | ○ (For option T) |
| 41 | High head pump (For 100V type option MT) | HRS-S0266 | ○ (For option MT) |
| 45 | Mechanical seal Kit (For 100V type option T) | HRS-S0390 | ○ (For option T) |
| 46 | Mechanical seal Kit (For 100V type option MT) | HRS-S0412 | ○ (For option MT) |
| 48 | Fan (for 100V)With bracket | HRS-S0023 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 58 | Main Board (for HRS012-A-10) | HRS-S0033 | ● |
| 74 | Main Board (for HRS012-A-10-T) | HRS-S0282 | ○ (For option T) |
| 86 | Main Board (for HRS012-A-10-MT) | HRS-S0283 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 115 | Compressor (for 100V type) | HRS-S0409 | ● |
| 119 | Condenser (For air-cooled type) | HRS-S0381 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 161 | Condenser bracket | HRS-S0015 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 164 | Base | HRS-S0061 | ● |

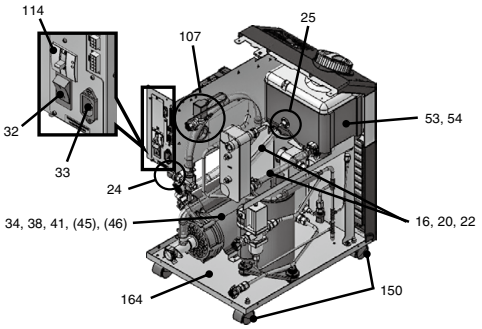
Note 1. Excerpt number from the total list of P.91 to 98

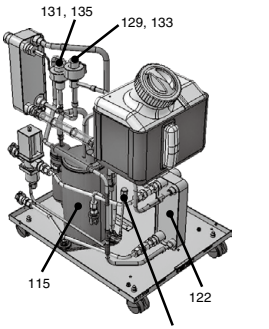
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

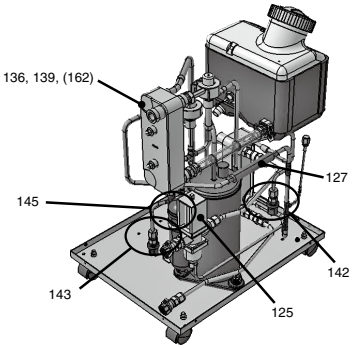
## Construction

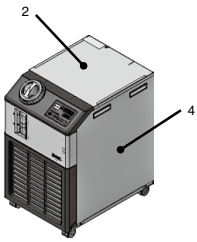
**Applicable models, Ser. No.: HRS012-W-10-□, TP (FEB. 2015) or earlier**

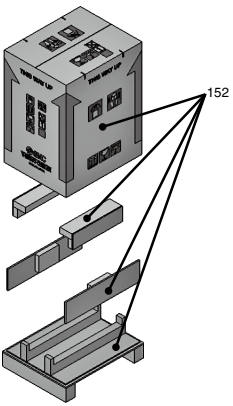


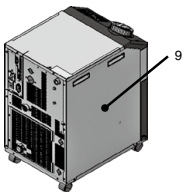



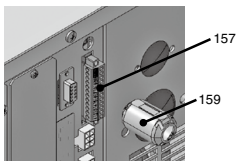



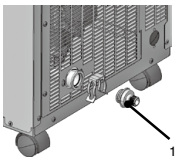



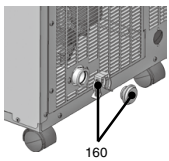







## Construction

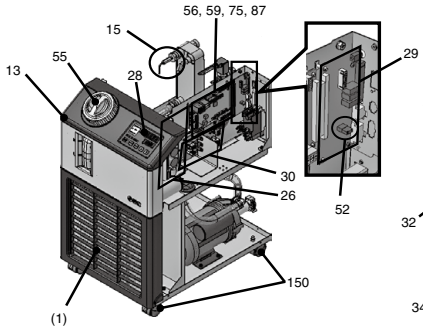
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ● |
| 33 | Inlet socket | HRS-S0021 | ● |
| 34 | Pump (for 100V) | HRS-S0022 | ● |
| 38 | High head pump (For 100V type option T) | HRS-S0265 | ○ (For option T) |
| 41 | High head pump (For 100V type option MT) | HRS-S0266 | ○ (For option MT) |
| 45 | Mechanical seal Kit (For 100V type option T) | HRS-S0390 | ○ (For option T) |
| 46 | Mechanical seal Kit (For 100V type option MT) | HRS-S0412 | ○ (For option MT) |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 59 | Main Board (for HRS012-W-10) | HRS-S0034 | ● |
| 75 | Main Board (for HRS012-W-10-T) | HRS-S0284 | ○ (For option T) |
| 87 | Main Board (for HRS012-W-10-MT) | HRS-S0285 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 115 | Compressor (for 100V type) | HRS-S0409 | ● |
| 122 | Heat exchanger (Condenser) | HRS-S0133 | ● |
| 125 | Water regulating valve | HRS-S0385 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |

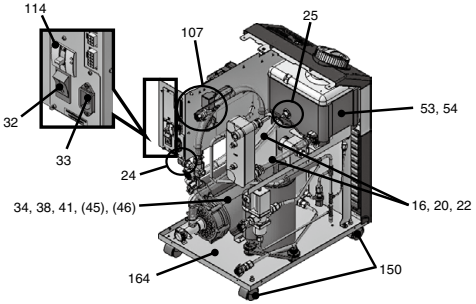
Note 1. Excerpt number from the total list of P.91 to 98

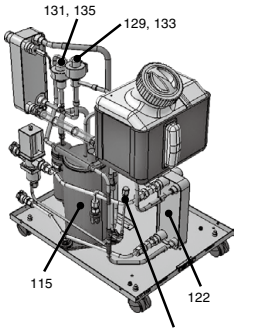
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

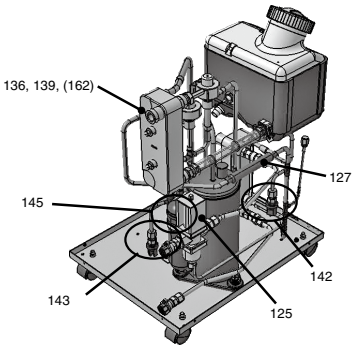
## Construction

**Applicable models, Ser. No.: HRS012-W-10-□, After TQ (MAR. 2015)**

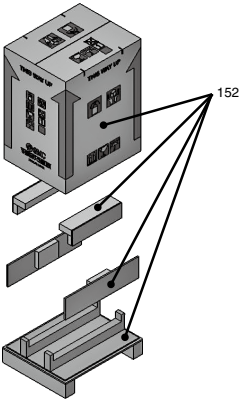


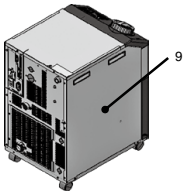



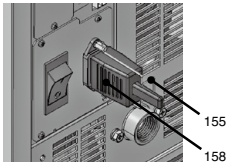



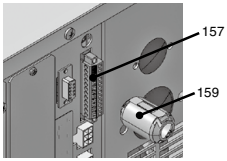



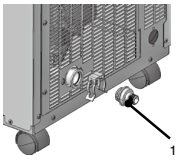


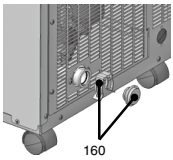


## Construction

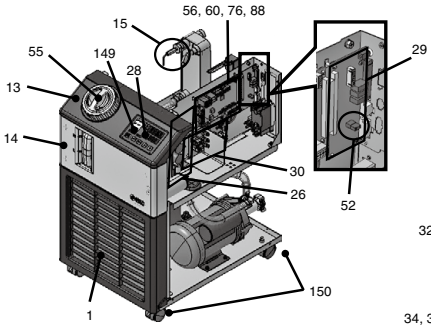
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel | HRS-S0519 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0520 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ● |
| 33 | Inlet socket | HRS-S0021 | ● |
| 34 | Pump (for 100V) | HRS-S0022 | ● |
| 38 | High head pump (For 100V type option T) | HRS-S0265 | ○ (For option T) |
| 41 | High head pump (For 100V type option MT) | HRS-S0266 | ○ (For option MT) |
| 45 | Mechanical seal Kit (For 100V type option T) | HRS-S0390 | ○ (For option T) |
| 46 | Mechanical seal Kit (For 100V type option MT) | HRS-S0412 | ○ (For option MT) |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 59 | Main Board (for HRS012-W-10) | HRS-S0034 | ● |
| 75 | Main Board (for HRS012-W-10-T) | HRS-S0284 | ○ (For option T) |
| 87 | Main Board (for HRS012-W-10-MT) | HRS-S0285 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 115 | Compressor (for 100V type) | HRS-S0409 | ● |
| 122 | Heat exchanger (Condenser) | HRS-S0133 | ● |
| 125 | Water regulating valve | HRS-S0385 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 164 | Base | HRS-S0061 | ● |

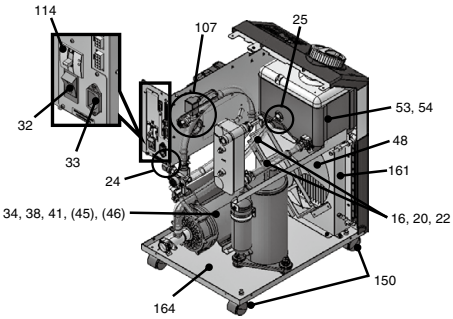
Note 1. Excerpt number from the total list of P.91 to 98

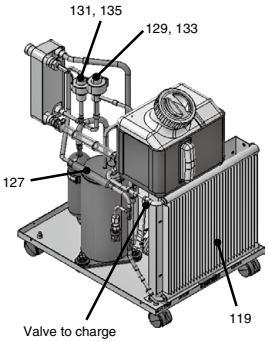
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

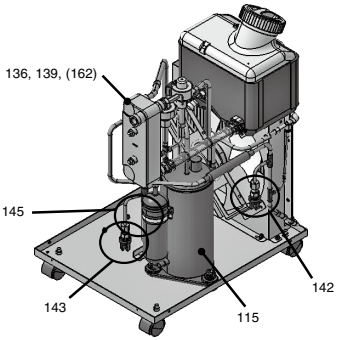
## Construction

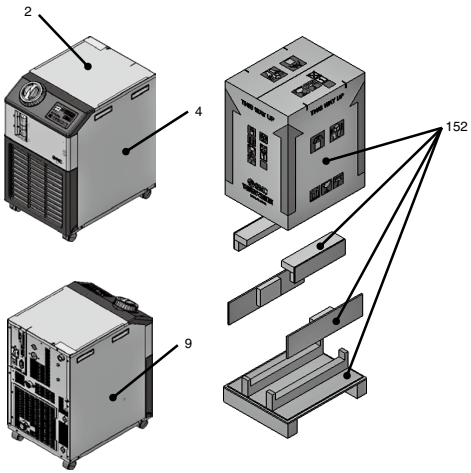
**Applicable models, Ser. No.: HRS018-A-10-□, TP (FEB. 2015) or earlier**

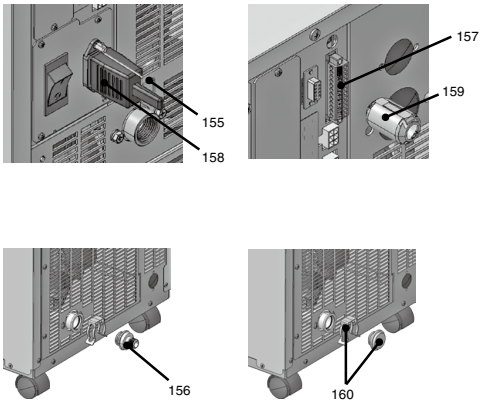


## Construction

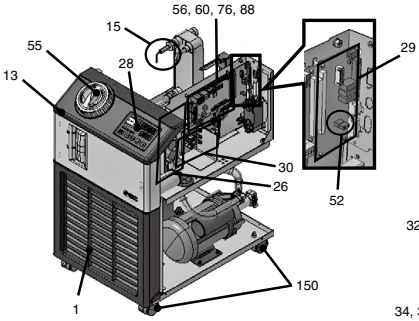
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ● |
| 33 | Inlet socket | HRS-S0021 | ● |
| 34 | Pump (for 100V) | HRS-S0022 | ● |
| 38 | High head pump (For 100V type option T) | HRS-S0265 | ○ (For option T) |
| 41 | High head pump (For 100V type option MT) | HRS-S0266 | ○ (For option MT) |
| 45 | Mechanical seal Kit (For 100V type option T) | HRS-S0390 | ○ (For option T) |
| 46 | Mechanical seal Kit (For 100V type option MT) | HRS-S0412 | ○ (For option MT) |
| 48 | Fan (for 100V)With bracket | HRS-S0023 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 60 | Main Board (for HRS018-A-10) | HRS-S0035 | ● |
| 76 | Main Board (for HRS018-A-10-T) | HRS-S0286 | ○ (For option T) |
| 88 | Main Board (for HRS018-A-10-MT) | HRS-S0287 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 115 | Compressor (for 100V type) | HRS-S0409 | ● |
| 119 | Condenser (For air-cooled type) | HRS-S0381 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 161 | Condenser bracket | HRS-S0015 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 164 | Base | HRS-S0061 | ● |

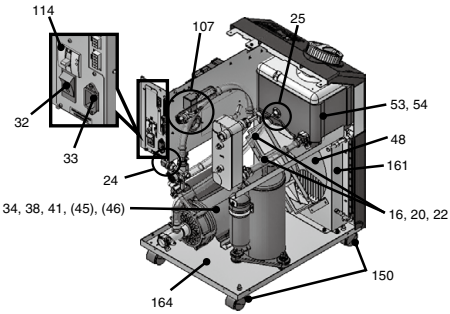
Note 1. Excerpt number from the total list of P.91 to 98

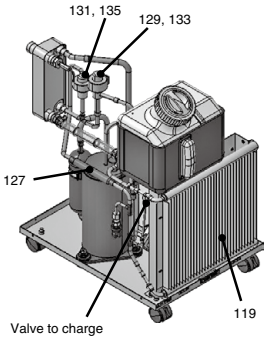
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

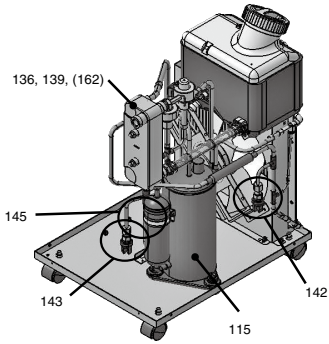
## Construction

**Applicable models, Ser. No.: HRS018-A-10-□, After TQ (MAR. 2015)**

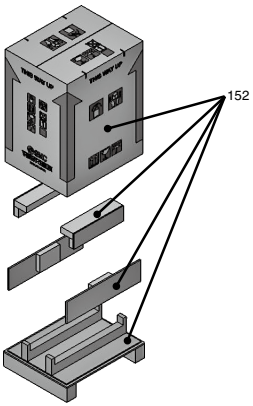


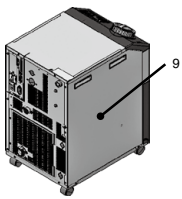



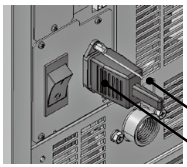



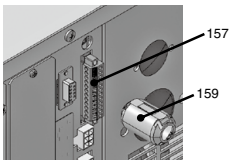



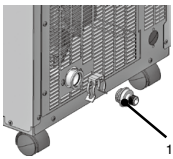


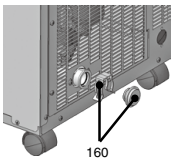


## Construction

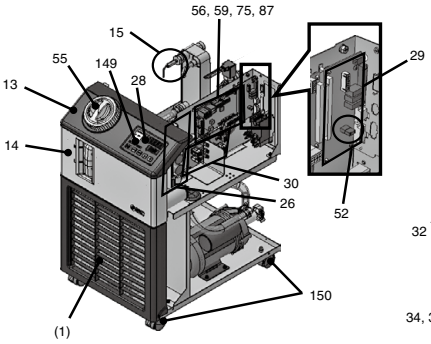
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel | HRS-S0519 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0520 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ● |
| 33 | Inlet socket | HRS-S0021 | ● |
| 34 | Pump (for 100V) | HRS-S0022 | ● |
| 38 | High head pump (For 100V type option T) | HRS-S0265 | ○ (For option T) |
| 41 | High head pump (For 100V type option MT) | HRS-S0266 | ○ (For option MT) |
| 45 | Mechanical seal Kit (For 100V type option T) | HRS-S0390 | ○ (For option T) |
| 46 | Mechanical seal Kit (For 100V type option MT) | HRS-S0412 | ○ (For option MT) |
| 48 | Fan (for 100V)With bracket | HRS-S0023 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 60 | Main Board (for HRS018-A-10) | HRS-S0035 | ● |
| 76 | Main Board (for HRS018-A-10-T) | HRS-S0286 | ○ (For option T) |
| 88 | Main Board (for HRS018-A-10-MT) | HRS-S0287 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 115 | Compressor (for 100V type) | HRS-S0409 | ● |
| 119 | Condenser (For air-cooled type) | HRS-S0381 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 161 | Condenser bracket | HRS-S0015 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 164 | Base | HRS-S0061 | ● |

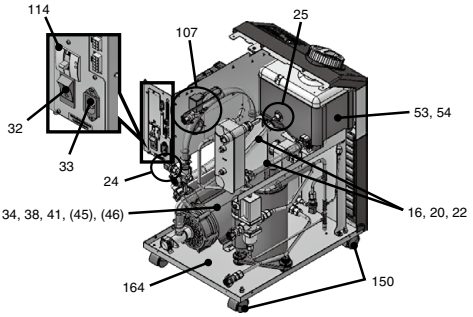
Note 1. Excerpt number from the total list of P.91 to 98

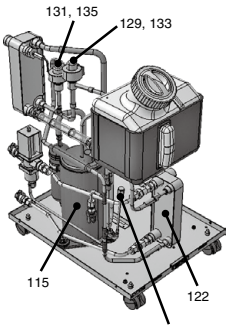
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

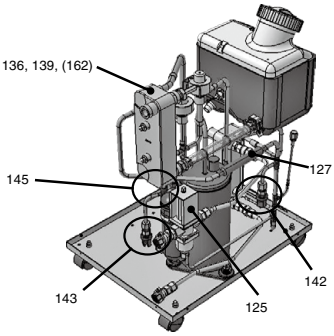
## Construction

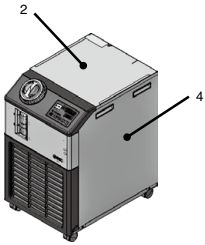
**Applicable models, Ser. No.: HRS018-W-10-□, TP (FEB. 2015) or earlier**

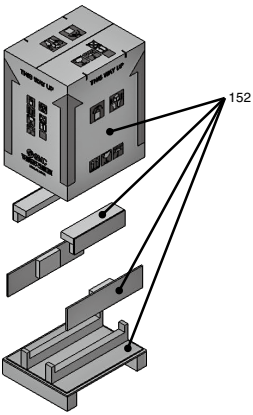


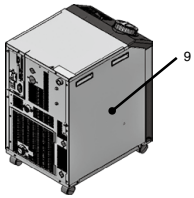



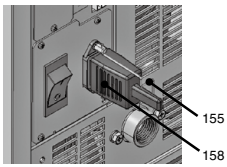



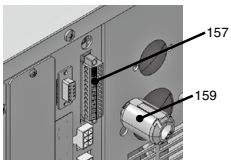



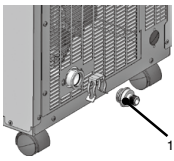



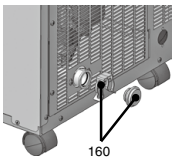



## Construction

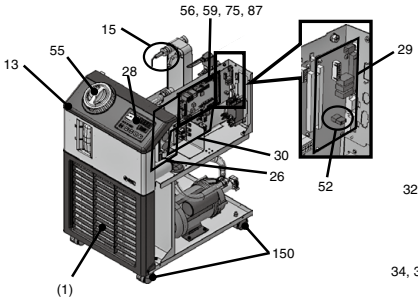
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ● |
| 33 | Inlet socket | HRS-S0021 | ● |
| 34 | Pump (for 100V) | HRS-S0022 | ● |
| 38 | High head pump (For 100V type option T) | HRS-S0265 | ○ (For option T) |
| 41 | High head pump (For 100V type option MT) | HRS-S0266 | ○ (For option MT) |
| 45 | Mechanical seal Kit (For 100V type option T) | HRS-S0390 | ○ (For option T) |
| 46 | Mechanical seal Kit (For 100V type option MT) | HRS-S0412 | ○ (For option MT) |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 61 | Main Board (for HRS018-W-10) | HRS-S0036 | ● |
| 77 | Main Board (for HRS018-W-10-T) | HRS-S0288 | ○ (For option T) |
| 89 | Main Board (for HRS018-W-10-MT) | HRS-S0289 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 115 | Compressor (for 100V type) | HRS-S0409 | ● |
| 122 | Heat exchanger (Condenser) | HRS-S0133 | ● |
| 125 | Water regulating valve | HRS-S0385 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 164 | Base | HRS-S0061 | ● |

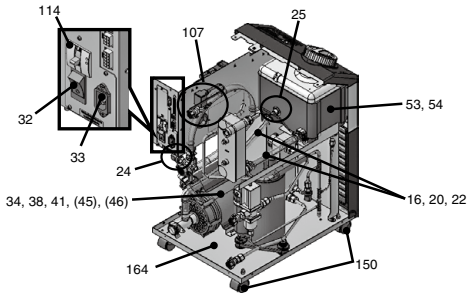
Note 1. Excerpt number from the total list of P.91 to 98

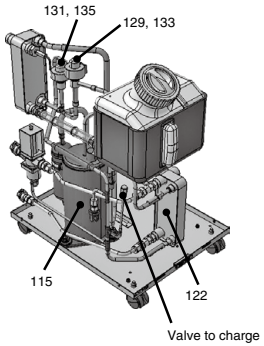
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

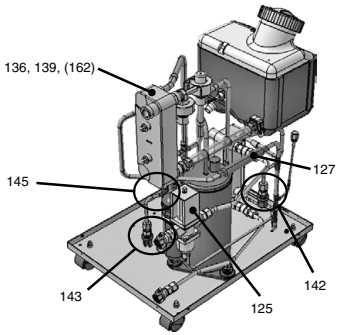
## Construction

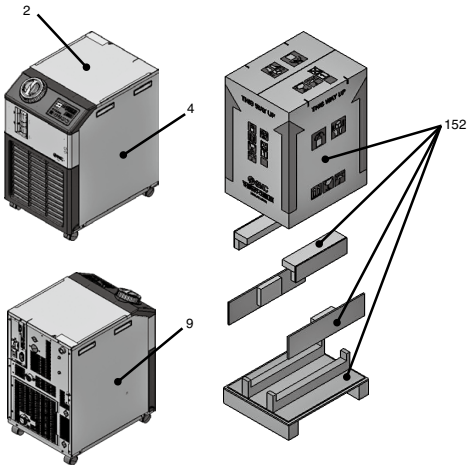
**Applicable models, Ser. No.: HRS018-W-10-□, After TQ (MAR. 2015)**

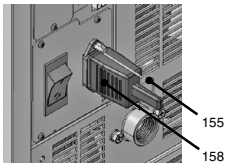


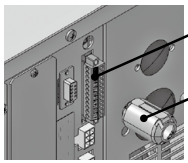



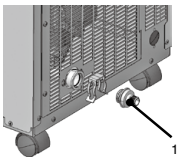



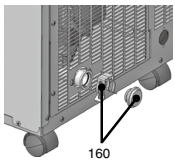



## Construction

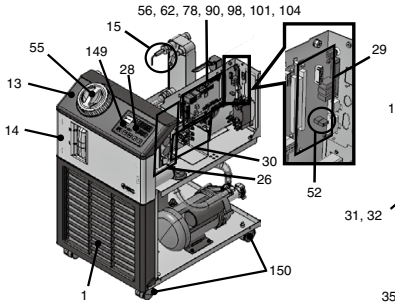
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel | HRS-S0519 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0520 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ● |
| 33 | Inlet socket | HRS-S0021 | ● |
| 34 | Pump (for 100V) | HRS-S0022 | ● |
| 38 | High head pump (For 100V type option T) | HRS-S0265 | ○ (For option T) |
| 41 | High head pump (For 100V type option MT) | HRS-S0266 | ○ (For option MT) |
| 45 | Mechanical seal Kit (For 100V type option T) | HRS-S0390 | ○ (For option T) |
| 46 | Mechanical seal Kit (For 100V type option MT) | HRS-S0412 | ○ (For option MT) |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 61 | Main Board (for HRS018-W-10) | HRS-S0036 | ● |
| 77 | Main Board (for HRS018-W-10-T) | HRS-S0288 | ○ (For option T) |
| 89 | Main Board (for HRS018-W-10-MT) | HRS-S0289 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 115 | Compressor (for 100V type) | HRS-S0409 | ● |
| 122 | Heat exchanger (Condenser) | HRS-S0133 | ● |
| 125 | Water regulating valve | HRS-S0385 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 164 | Base | HRS-S0061 | ● |

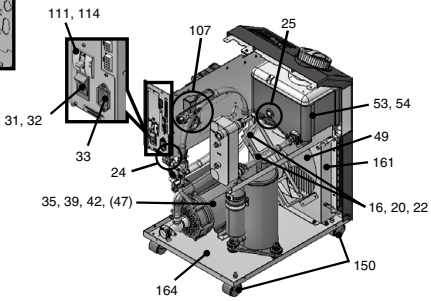
Note 1. Excerpt number from the total list of P.91 to 98

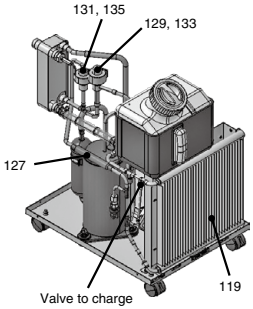
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

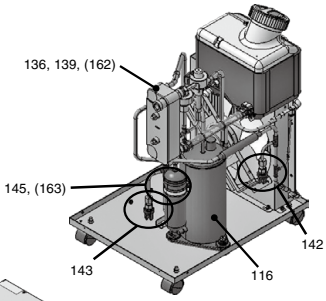
## Construction

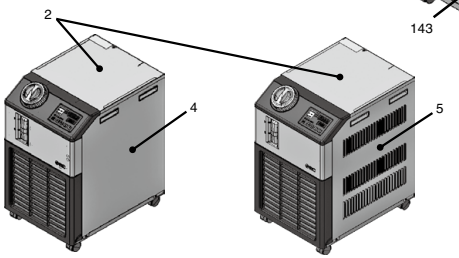
**Applicable models, Ser. No.: HRS012-A□-20-□, TP (FEB. 2015) or earlier**



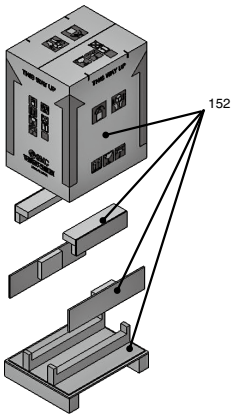



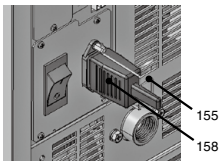



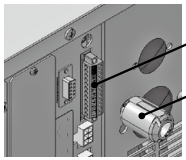



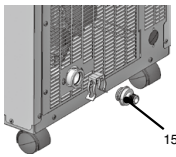

For options other than G

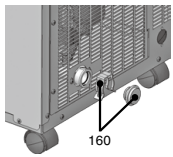
For options G



## Construction

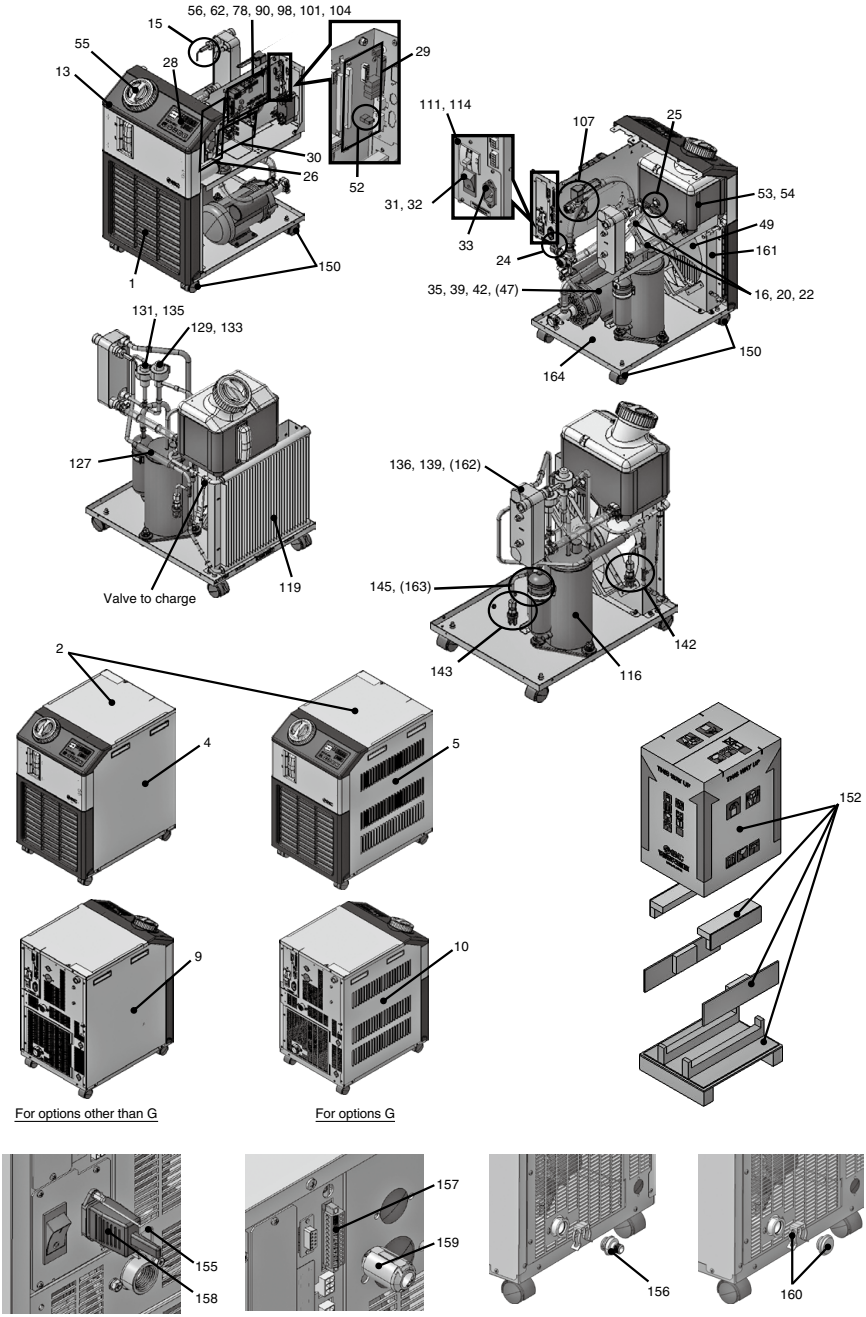
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 5 | Right Side Panel (For option G) | HRS-S0075 | ○ (For option G) |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 10 | Left Side Panel (For option G) | HRS-S0076 | ○ (For option G) |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 35 | Pump (for 200V type) | HRS-S0066 | ● |
| 39 | High head pump (For option T) | HRS-S0062 | ○ (For option T) |
| 42 | High head pump (For option MT) | HRS-S0063 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 49 | Fan (for 200V type) | HRS-S0067 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 62 | Main Board (for HRS012-A-20) | HRS-S0037 | ● |
| 78 | Main Board (for HRS012-A-20-T) | HRS-S0038 | ○ (For option T) |
| 90 | Main Board (for HRS012-A-20-MT) | HRS-S0039 | ○ (For option MT) |
| 98 | Main Board (for HRS012-A-20-G) | HRS-S0078 | ○ (For option G) |
| 101 | Main Board (for HRS012-A-20-GT) | HRS-S0079 | ○ (For option GT) |
| 104 | Main Board (for HRS012-A-20-GMT) | HRS-S0080 | ○ (For option GMT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 119 | Condenser (For air-cooled type) | HRS-S0381 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 161 | Condenser bracket | HRS-S0015 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |
| 164 | Base | HRS-S0061 | ● |

Note 1. Excerpt number from the total list of P.91 to 98

Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

## Construction

**Applicable models, Ser. No.: HRS012-A□-20-□, After TQ (MAR. 2015)**



## Construction

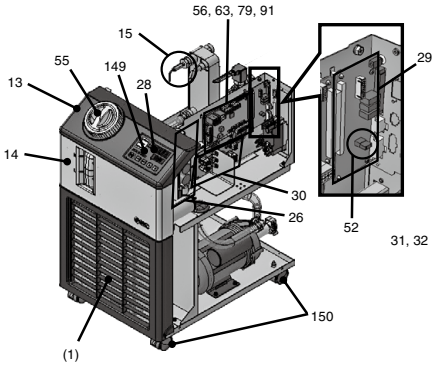
| No. Note1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 5 | Right Side Panel (For option G) | HRS-S0075 | ○ (For option G) |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 10 | Left Side Panel (For option G) | HRS-S0076 | ○ (For option G) |
| 13 | Front panel | HRS-S0519 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0520 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 35 | Pump (for 200V type) | HRS-S0066 | ● |
| 39 | High head pump (For option T) | HRS-S0062 | ○ (For option T) |
| 42 | High head pump (For option MT) | HRS-S0063 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 49 | Fan (for 200V type) | HRS-S0067 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 62 | Main Board (for HRS012-A-20) | HRS-S0037 | ● |
| 78 | Main Board (for HRS012-A-20-T) | HRS-S0038 | ○ (For option T) |
| 90 | Main Board (for HRS012-A-20-MT) | HRS-S0039 | ○ (For option MT) |
| 98 | Main Board (for HRS012-A-20-G) | HRS-S0078 | ○ (For option G) |
| 101 | Main Board (for HRS012-A-20-GT) | HRS-S0079 | ○ (For option GT) |
| 104 | Main Board (for HRS012-A-20-GMT) | HRS-S0080 | ○ (For option GMT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 119 | Condenser (For air-cooled type) | HRS-S0381 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 161 | Condenser bracket | HRS-S0015 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |
| 164 | Base | HRS-S0061 | ● |

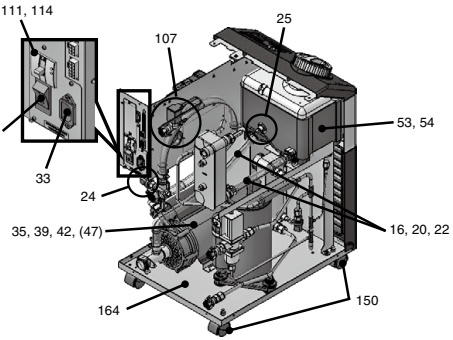
Note 1. Excerpt number from the total list of P.91 to 98

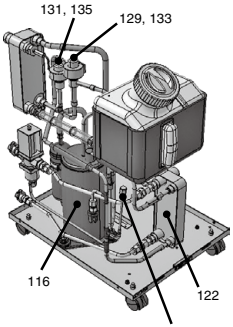
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

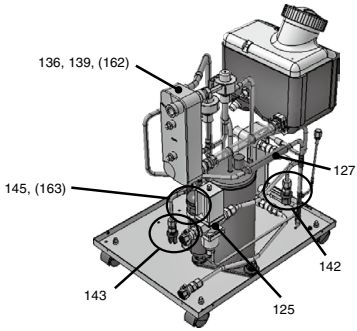
## Construction

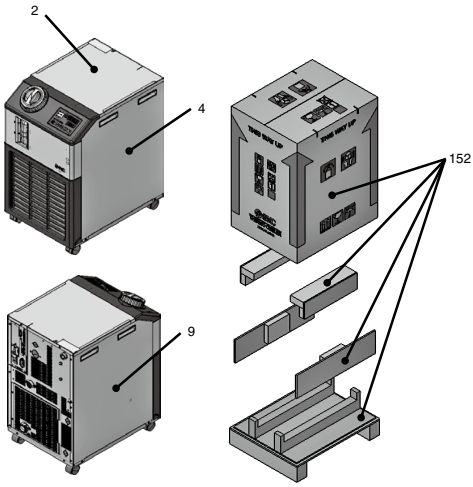
**Applicable models, Ser. No.: HRS012-W□-20-□, TP (FEB. 2015) or earlier**

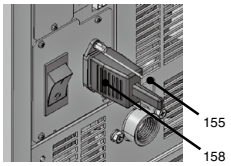


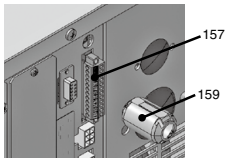



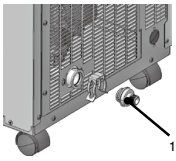



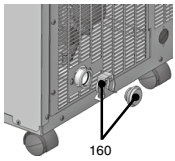



## Construction

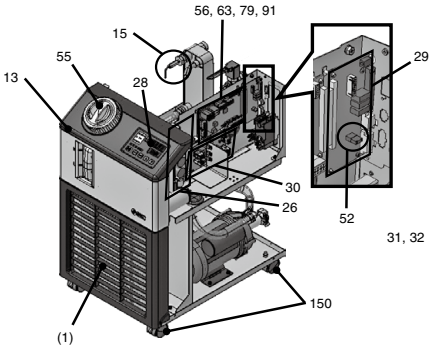
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 35 | Pump (for 200V type) | HRS-S0066 | ● |
| 39 | High head pump (For option T) | HRS-S0062 | ○ (For option T) |
| 42 | High head pump (For option MT) | HRS-S0063 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 63 | Main Board (for HRS012-W-20) | HRS-S0040 | ● |
| 79 | Main Board (for HRS012-W-20-T) | HRS-S0041 | ○ (For option T) |
| 91 | Main Board (for HRS012-W-20-MT) | HRS-S0042 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 122 | Heat exchanger (Condenser) | HRS-S0133 | ● |
| 125 | Water regulating valve | HRS-S0385 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |
| 164 | Base | HRS-S0061 | ● |

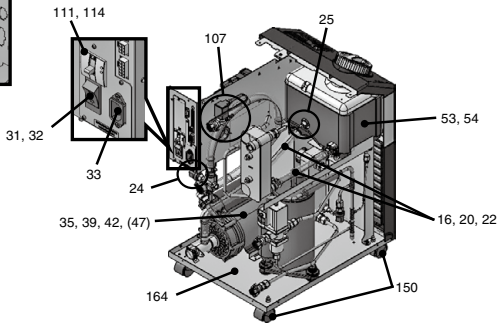
Note 1. Excerpt number from the total list of P.91 to 98

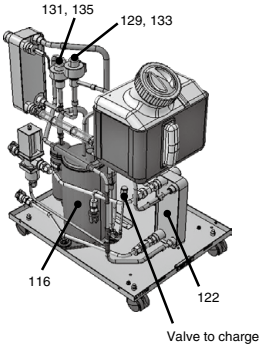
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

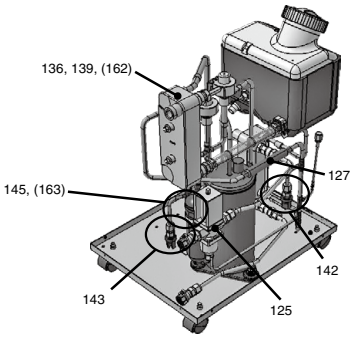
## Construction

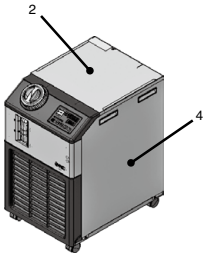
**Applicable models, Ser. No.: HRS012-W□-20-□, After TQ (MAR. 2015)**

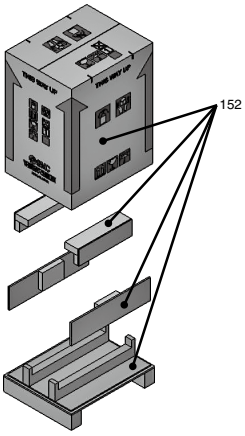


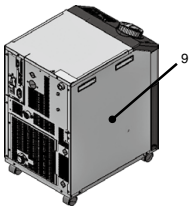



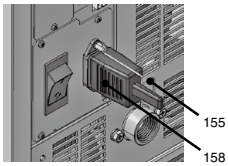



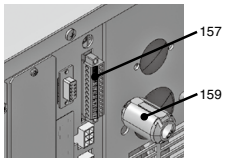



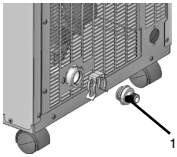



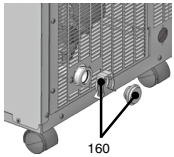



## Construction

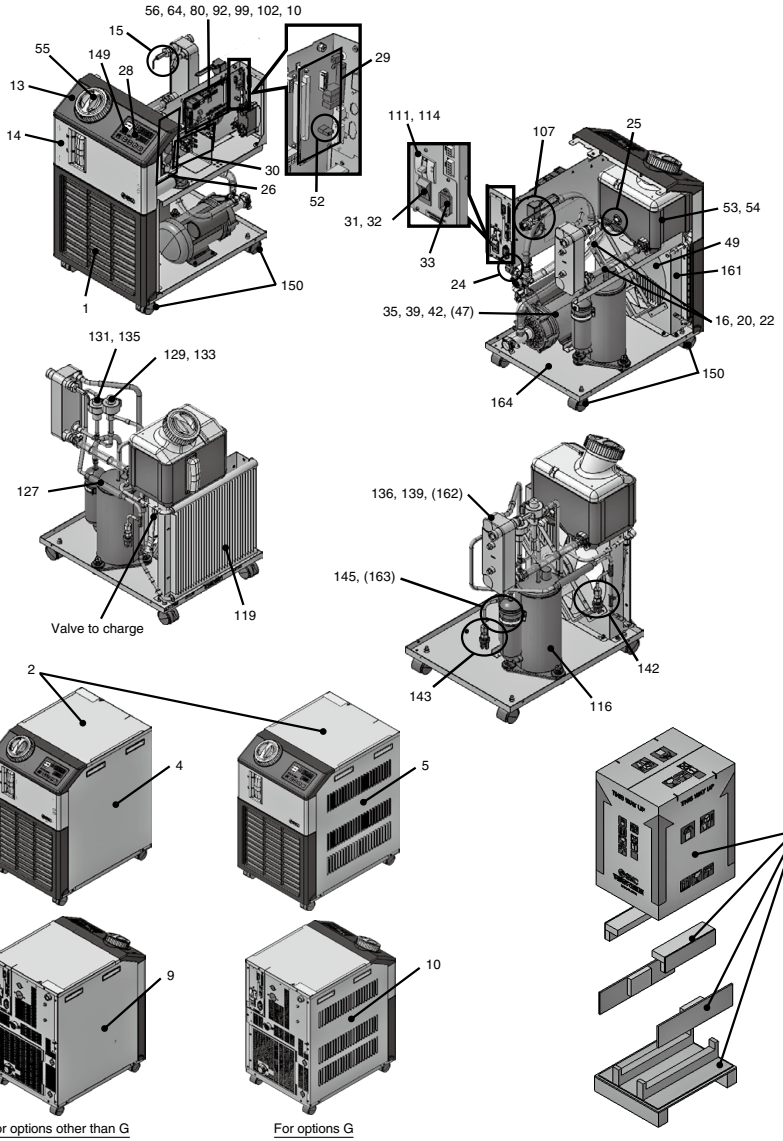
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel | HRS-S0519 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0520 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 35 | Pump (for 200V type) | HRS-S0066 | ● |
| 39 | High head pump (For option T) | HRS-S0062 | ○ (For option T) |
| 42 | High head pump (For option MT) | HRS-S0063 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 63 | Main Board (for HRS012-W-20) | HRS-S0040 | ● |
| 79 | Main Board (for HRS012-W-20-T) | HRS-S0041 | ○ (For option T) |
| 91 | Main Board (for HRS012-W-20-MT) | HRS-S0042 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 122 | Heat exchanger (Condenser) | HRS-S0133 | ● |
| 125 | Water regulating valve | HRS-S0385 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |
| 164 | Base | HRS-S0061 | ● |

Note 1. Excerpt number from the total list of P.91 to 98

Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

## Construction

**Applicable models, Ser. No.: HRS018-A□-20-□, TP (FEB. 2015) or earlier**



## Construction

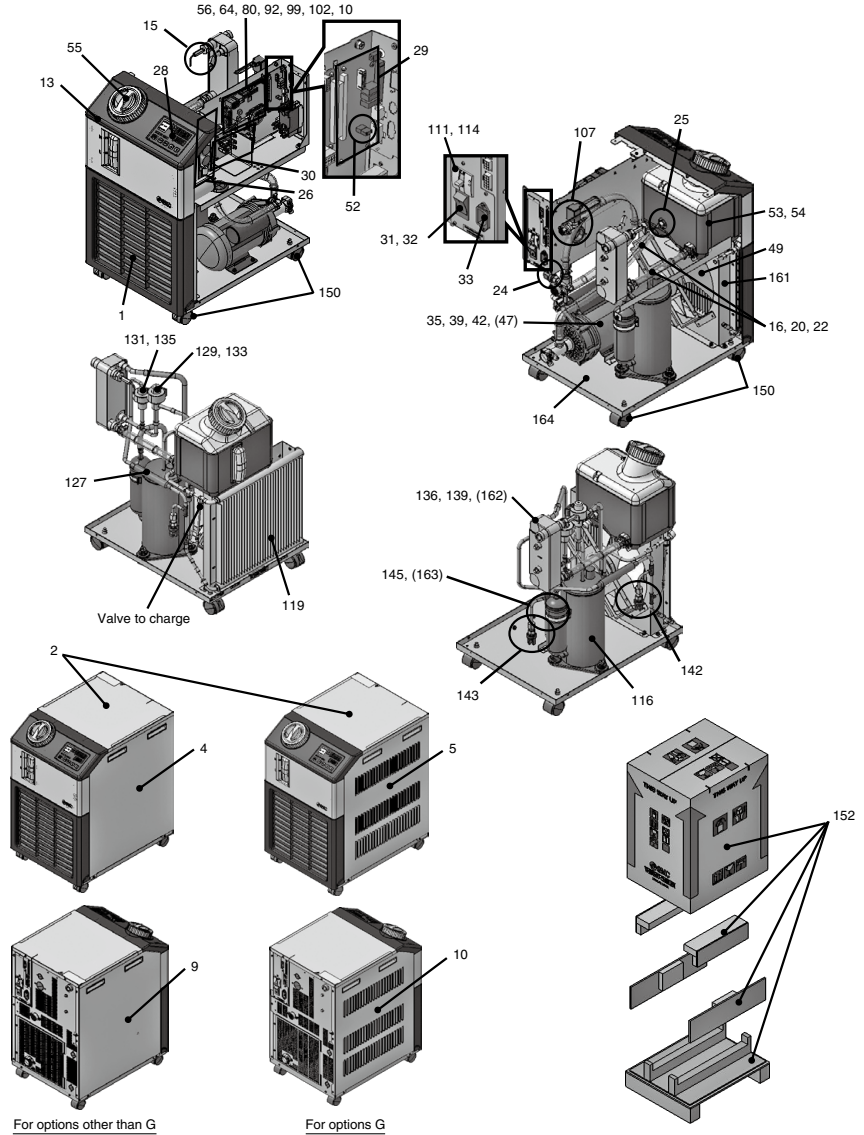
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 5 | Right Side Panel (For option G) | HRS-S0075 | ○ (For option G) |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 10 | Left Side Panel (For option G) | HRS-S0076 | ○ (For option G) |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 35 | Pump (for 200V type) | HRS-S0066 | ● |
| 39 | High head pump (For option T) | HRS-S0062 | ○ (For option T) |
| 42 | High head pump (For option MT) | HRS-S0063 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 49 | Fan (for 200V type) | HRS-S0067 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 64 | Main Board (for HRS018-A-20) | HRS-S0043 | ● |
| 80 | Main Board (for HRS018-A-20-T) | HRS-S0044 | ○ (For option T) |
| 92 | Main Board (for HRS018-A-20-MT) | HRS-S0045 | ○ (For option MT) |
| 99 | Main Board (for HRS018-A-20-G) | HRS-S0081 | ○ (For option G) |
| 102 | Main Board (for HRS018-A-20-GT) | HRS-S0082 | ○ (For option GT) |
| 105 | Main Board (for HRS018-A-20-GMT) | HRS-S0083 | ○ (For option GMT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 119 | Condenser (For air-cooled type) | HRS-S0381 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 161 | Condenser bracket | HRS-S0015 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |
| 164 | Base | HRS-S0061 | ● |

Note 1. Excerpt number from the total list of P.91 to 98

Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

## Construction

**Applicable models, Ser. No.: HRS018-A□-20-□, After TQ (MAR. 2015)**



## Construction

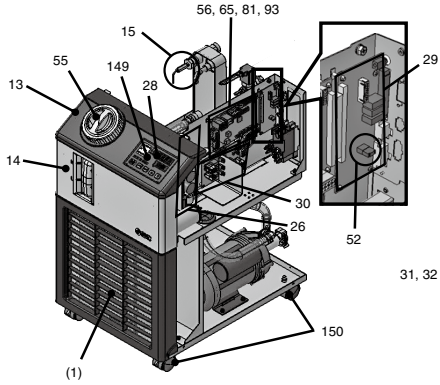
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 5 | Right Side Panel (For option G) | HRS-S0075 | ○ (For option G) |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 10 | Left Side Panel (For option G) | HRS-S0076 | ○ (For option G) |
| 13 | Front panel | HRS-S0519 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0520 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 35 | Pump (for 200V type) | HRS-S0066 | ● |
| 39 | High head pump (For option T) | HRS-S0062 | ○ (For option T) |
| 42 | High head pump (For option MT) | HRS-S0063 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 49 | Fan (for 200V type) | HRS-S0067 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 64 | Main Board (for HRS018-A-20) | HRS-S0043 | ● |
| 80 | Main Board (for HRS018-A-20-T) | HRS-S0044 | ○ (For option T) |
| 92 | Main Board (for HRS018-A-20-MT) | HRS-S0045 | ○ (For option MT) |
| 99 | Main Board (for HRS018-A-20-G) | HRS-S0081 | ○ (For option G) |
| 102 | Main Board (for HRS018-A-20-GT) | HRS-S0082 | ○ (For option GT) |
| 105 | Main Board (for HRS018-A-20-GMT) | HRS-S0083 | ○ (For option GMT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 119 | Condenser (For air-cooled type) | HRS-S0381 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 161 | Condenser bracket | HRS-S0015 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |
| 164 | Base | HRS-S0061 | ● |

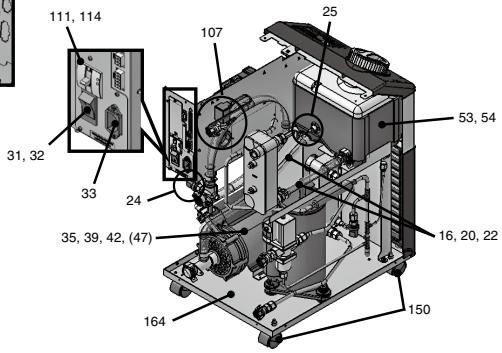
Note 1. Excerpt number from the total list of P.91 to 98

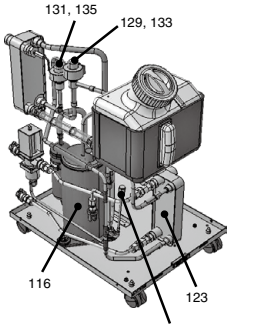
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

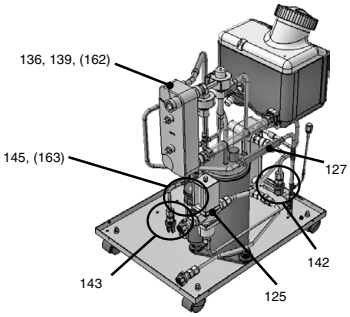
## Construction

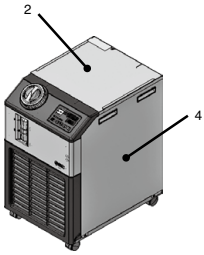
**Applicable models, Ser. No.: HRS018-W□-20-□, TP (FEB. 2015) or earlier**

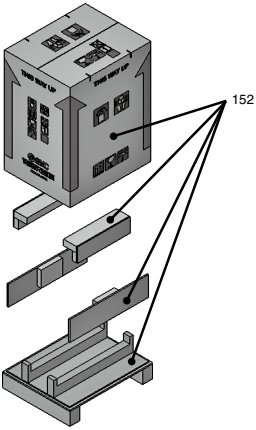


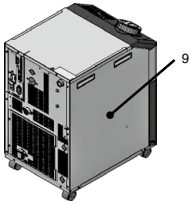



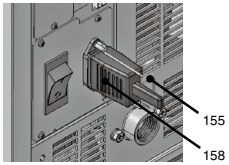



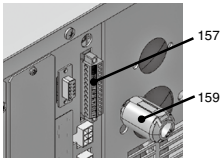



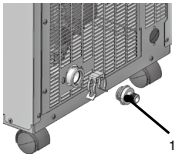



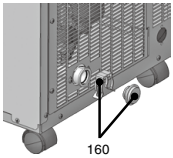



## Construction

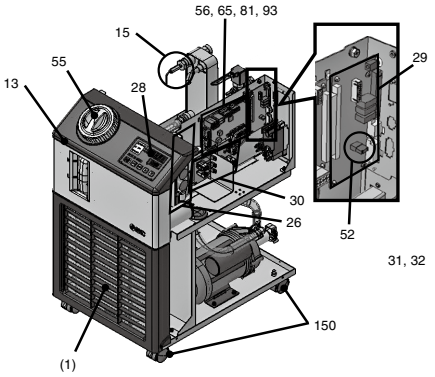
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 35 | Pump (for 200V type) | HRS-S0066 | ● |
| 39 | High head pump (For option T) | HRS-S0062 | ○ (For option T) |
| 42 | High head pump (For option MT) | HRS-S0063 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 65 | Main Board (for HRS018-W-20) | HRS-S0046 | ● |
| 81 | Main Board (for HRS018-W-20-T) | HRS-S0047 | ○ (For option T) |
| 93 | Main Board (for HRS018-W-20-MT) | HRS-S0048 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 123 | Heat exchanger (Condenser) | HRS-S0384 | ● |
| 125 | Water regulating valve | HRS-S0385 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |
| 164 | Base | HRS-S0061 | ● |

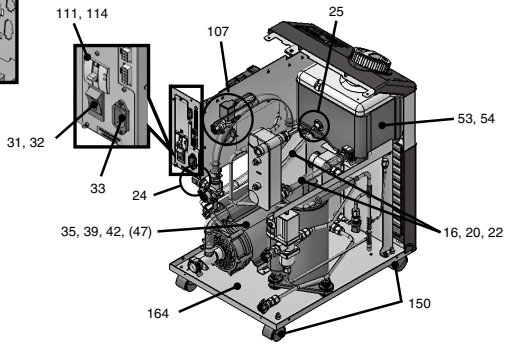
Note 1. Excerpt number from the total list of P.91 to 98

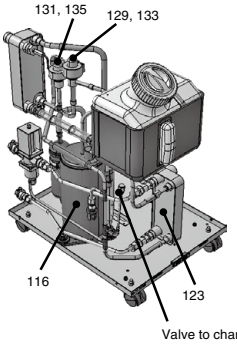
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

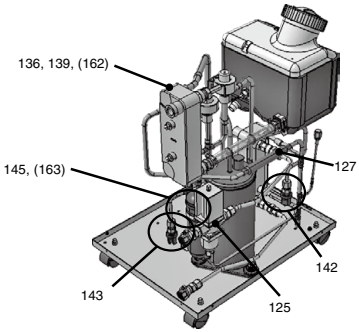
## Construction

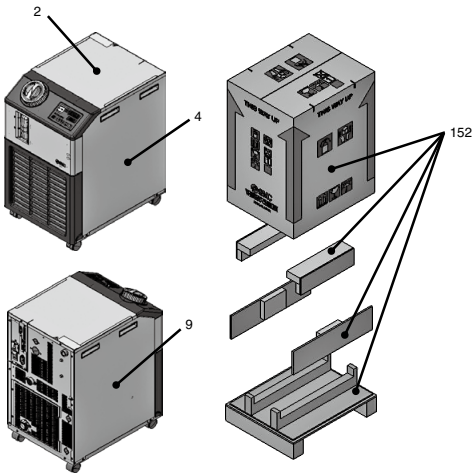
**Applicable models, Ser. No.: HRS018-W□-20-□, After TQ (MAR. 2015)**

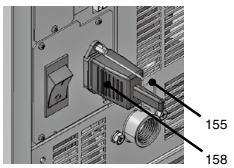


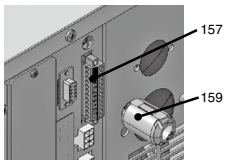



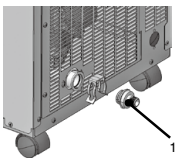



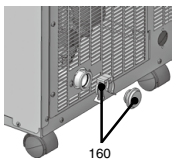



## Construction

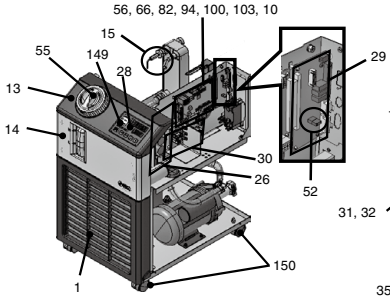
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel | HRS-S0519 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0520 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 35 | Pump (for 200V type) | HRS-S0066 | ● |
| 39 | High head pump (For option T) | HRS-S0062 | ○ (For option T) |
| 42 | High head pump (For option MT) | HRS-S0063 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 65 | Main Board (for HRS018-W-20) | HRS-S0046 | ● |
| 81 | Main Board (for HRS018-W-20-T) | HRS-S0047 | ○ (For option T) |
| 93 | Main Board (for HRS018-W-20-MT) | HRS-S0048 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 123 | Heat exchanger (Condenser) | HRS-S0384 | ● |
| 125 | Water regulating valve | HRS-S0385 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |
| 164 | Base | HRS-S0061 | ● |

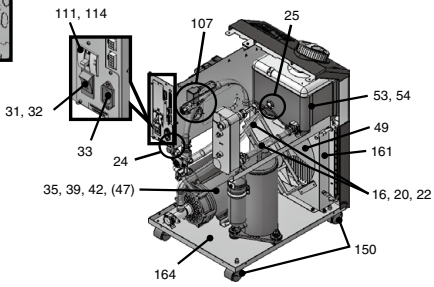
Note 1. Excerpt number from the total list of P.91 to 98

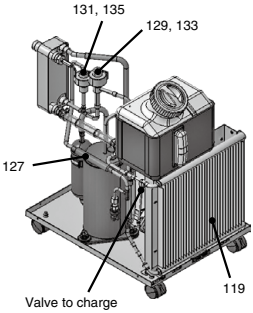
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

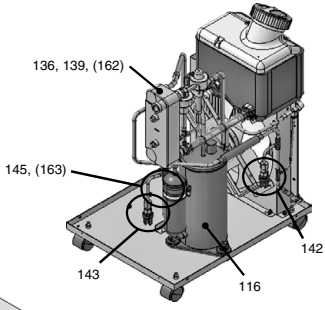
## Construction

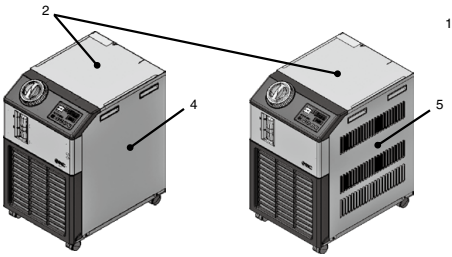
**Applicable models, Ser. No.: HRS024-A□-20-□, TP (FEB. 2015) or earlier**

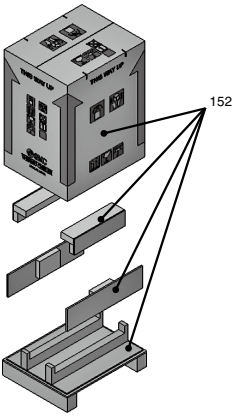


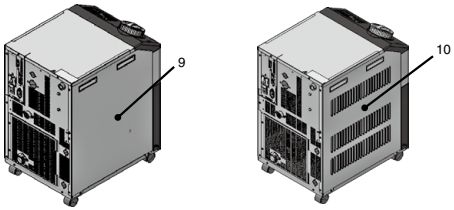



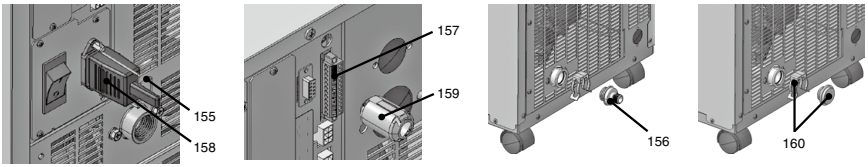



## Construction

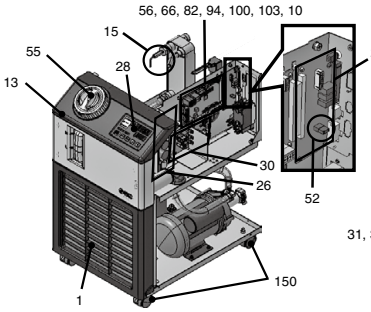
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 5 | Right Side Panel (For option G) | HRS-S0075 | ○ (For option G) |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 10 | Left Side Panel (For option G) | HRS-S0076 | ○ (For option G) |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 35 | Pump (for 200V type) | HRS-S0066 | ● |
| 39 | High head pump (For option T) | HRS-S0062 | ○ (For option T) |
| 42 | High head pump (For option MT) | HRS-S0063 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 49 | Fan (for 200V type) | HRS-S0067 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 66 | Main Board (for HRS024-A-20) | HRS-S0049 | ● |
| 82 | Main Board (for HRS024-A-20-T) | HRS-S0050 | ○ (For option T) |
| 94 | Main Board (for HRS024-A-20-MT) | HRS-S0051 | ○ (For option MT) |
| 100 | Main Board (for HRS024-A-20-G) | HRS-S0084 | ○ (For option G) |
| 103 | Main Board (for HRS024-A-20-GT) | HRS-S0085 | ○ (For option GT) |
| 106 | Main Board (for HRS024-A-20-GMT) | HRS-S0086 | ○ (For option GMT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 119 | Condenser (For air-cooled type) | HRS-S0381 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 161 | Condenser bracket | HRS-S0015 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |
| 164 | Base | HRS-S0061 | ● |

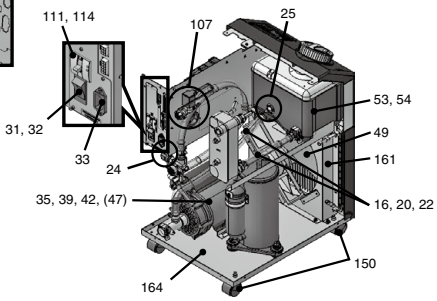
Note 1. Excerpt number from the total list of P.91 to 98

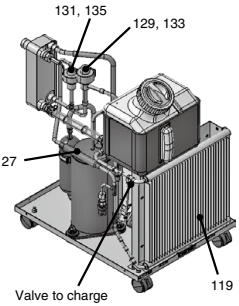
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

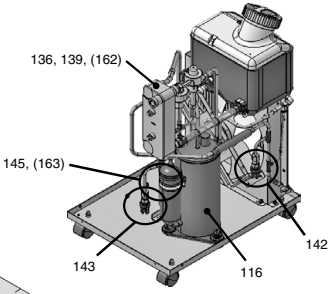
## Construction

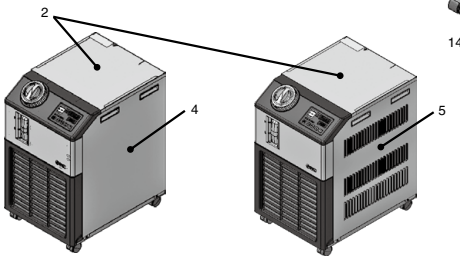
**Applicable models, Ser. No.: HRS024-A□-20-□, After TQ (MAR. 2015)**

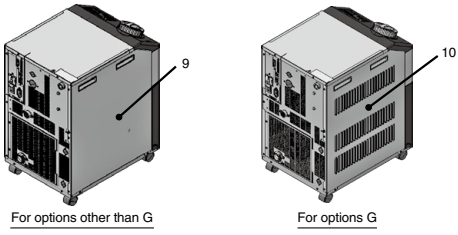


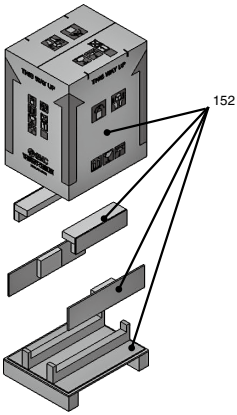



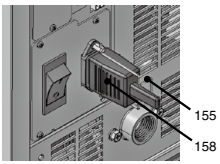



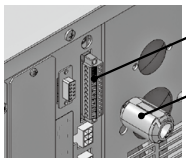



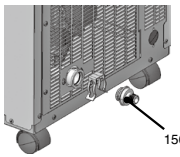



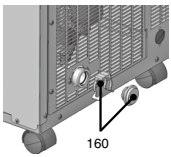



## Construction

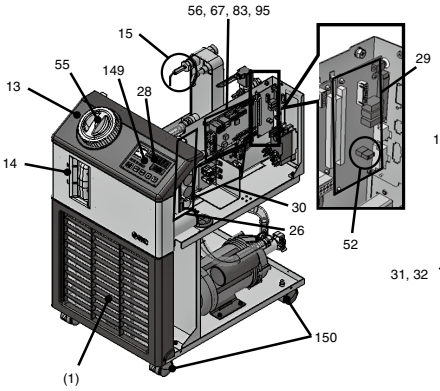
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 5 | Right Side Panel (For option G) | HRS-S0075 | ○ (For option G) |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 10 | Left Side Panel (For option G) | HRS-S0076 | ○ (For option G) |
| 13 | Front panel | HRS-S0519 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0520 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 35 | Pump (for 200V type) | HRS-S0066 | ● |
| 39 | High head pump (For option T) | HRS-S0062 | ○ (For option T) |
| 42 | High head pump (For option MT) | HRS-S0063 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 49 | Fan (for 200V type) | HRS-S0067 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 66 | Main Board (for HRS024-A-20) | HRS-S0049 | ● |
| 82 | Main Board (for HRS024-A-20-T) | HRS-S0050 | ○ (For option T) |
| 94 | Main Board (for HRS024-A-20-MT) | HRS-S0051 | ○ (For option MT) |
| 100 | Main Board (for HRS024-A-20-G) | HRS-S0084 | ○ (For option G) |
| 103 | Main Board (for HRS024-A-20-GT) | HRS-S0085 | ○ (For option GT) |
| 106 | Main Board (for HRS024-A-20-GMT) | HRS-S0086 | ○ (For option GMT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 119 | Condenser (For air-cooled type) | HRS-S0381 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 161 | Condenser bracket | HRS-S0015 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |
| 164 | Base | HRS-S0061 | ● |

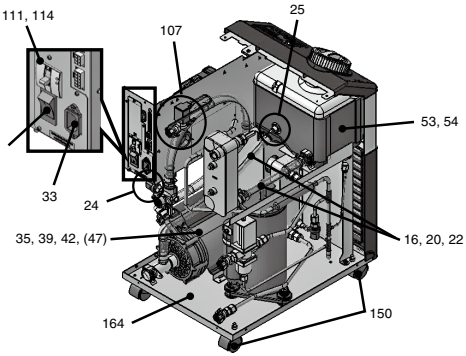
Note 1. Excerpt number from the total list of P.91 to 98

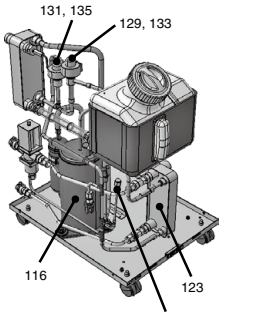
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

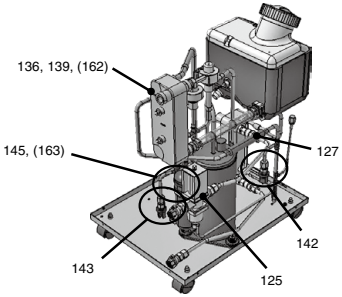
## Construction

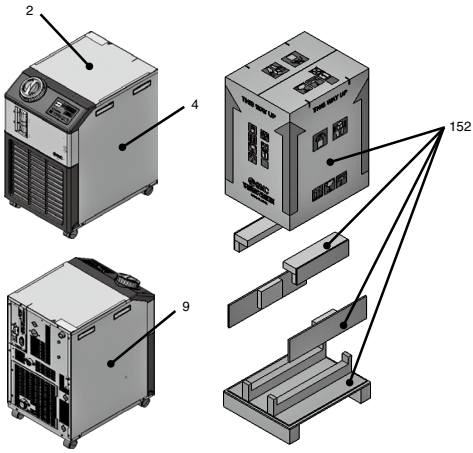
**Applicable models, Ser. No.: HRS024-W□-20-□, TP (FEB. 2015) or earlier**

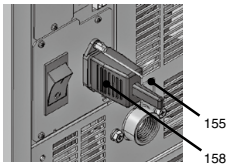


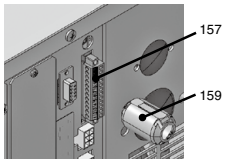



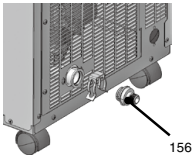



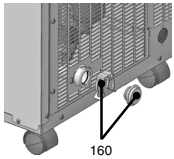



## Construction

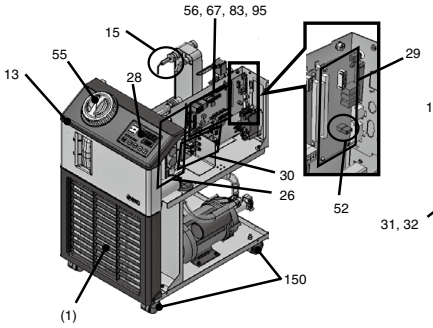
| No. Note1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 35 | Pump (for 200V type) | HRS-S0066 | ● |
| 39 | High head pump (For option T) | HRS-S0062 | ○ (For option T) |
| 42 | High head pump (For option MT) | HRS-S0063 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 67 | Main Board (for HRS024-W-20) | HRS-S0052 | ● |
| 83 | Main Board (for HRS024-W-20-T) | HRS-S0053 | ○ (For option T) |
| 95 | Main Board (for HRS024-W-20-MT) | HRS-S0054 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 123 | Heat exchanger (Condenser) | HRS-S0384 | ● |
| 125 | Water regulating valve | HRS-S0385 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |
| 164 | Base | HRS-S0061 | ● |

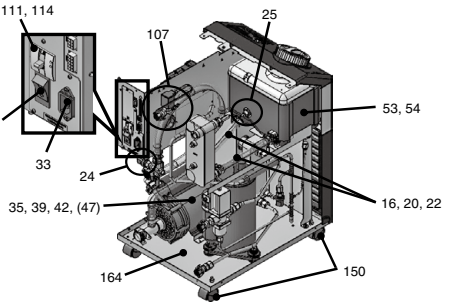
Note 1. Excerpt number from the total list of P.91 to 98

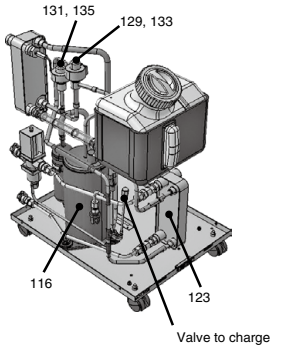
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○".
It is used by setting the program.

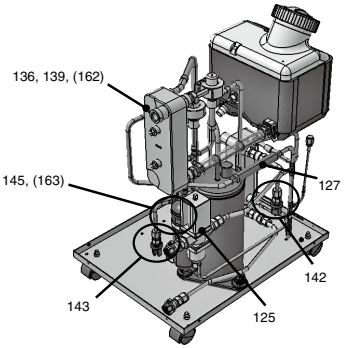
## Construction

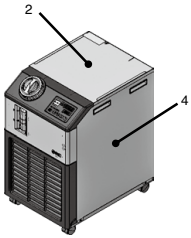
**Applicable models, Ser. No.: HRS024-W□-20-□, After TQ (MAR. 2015)**

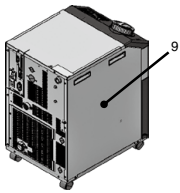


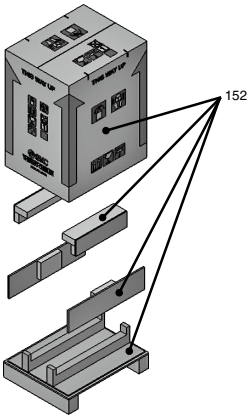



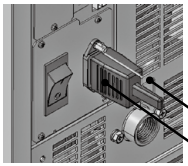



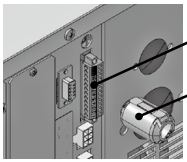



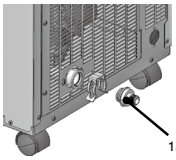



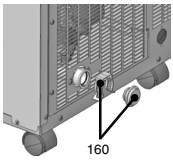



## Construction

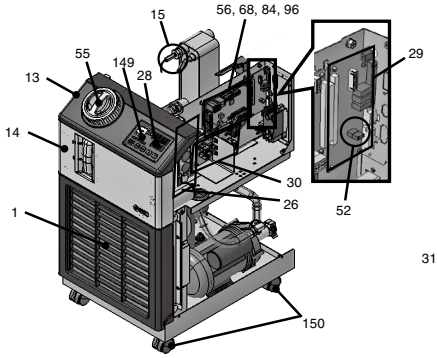
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 4 | Right Side Panel | HRS-S0003 | ● |
| 9 | Left Side Panel | HRS-S0004 | ● |
| 13 | Front panel | HRS-S0519 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 16 | Hose (For standard pump) | HRS-S0008 | ● |
| 20 | Hose (For option T) | HRS-S0077 | ○ (For option T) |
| 22 | Hose (For option MT) | HRS-S0069 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0520 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 35 | Pump (for 200V type) | HRS-S0066 | ● |
| 39 | High head pump (For option T) | HRS-S0062 | ○ (For option T) |
| 42 | High head pump (For option MT) | HRS-S0063 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 67 | Main Board (for HRS024-W-20) | HRS-S0052 | ● |
| 83 | Main Board (for HRS024-W-20-T) | HRS-S0053 | ○ (For option T) |
| 95 | Main Board (for HRS024-W-20-MT) | HRS-S0054 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 123 | Heat exchanger (Condenser) | HRS-S0384 | ● |
| 125 | Water regulating valve | HRS-S0385 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 136 | Heat exchanger | HRS-S0030 | ● |
| 139 | Heat exchanger (For option M) | HRS-S0413 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 145 | Thermistor sensor | HRS-S0057 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 152 | Packaging Materials set | HRS-S0060 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 162 | Thermal insulator for heat exchanger | HRS-S0031 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |
| 164 | Base | HRS-S0061 | ● |

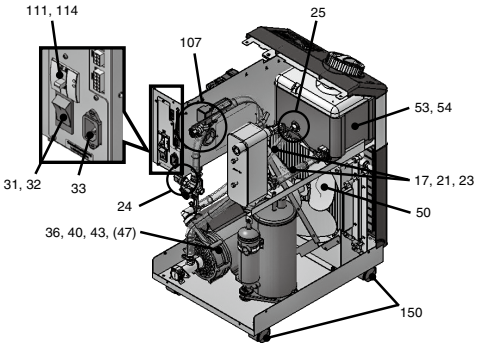
Note 1. Excerpt number from the total list of P.91 to 98

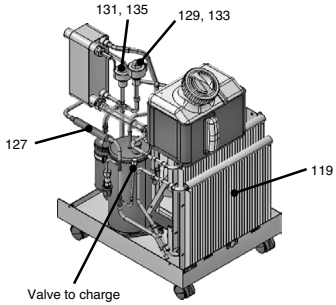
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

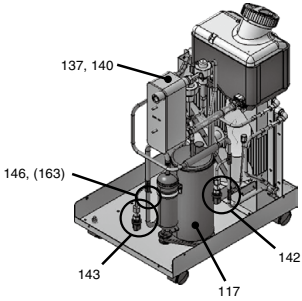
## Construction

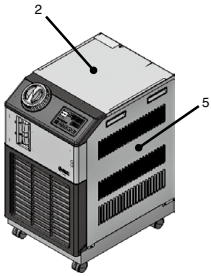
**Applicable models, Ser. No.: HRS030-A□-20-□, TP (FEB. 2015) or earlier**

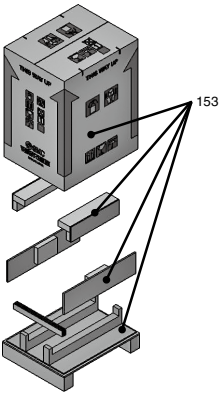


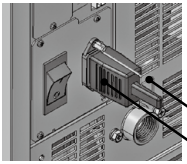



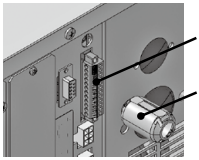



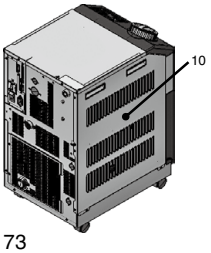



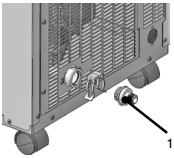



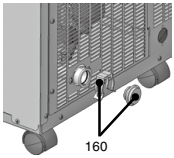



## Construction

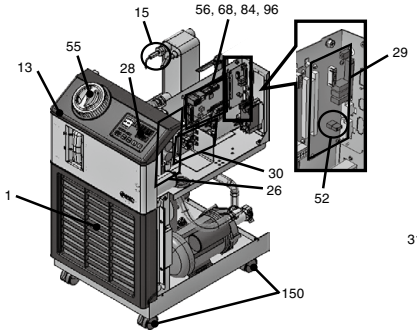
| No. Note1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 5 | Right Side Panel (For option G) | HRS-S0075 | ● |
| 10 | Left Side Panel (For option G) | HRS-S0076 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 17 | Hose (For standard pump) | HRS-S0302 | ● |
| 21 | Hose (For option T) | HRS-S0303 | ○ (For option T) |
| 23 | Hose (For option MT) | HRS-S0304 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 36 | Pump (for 200V) | HRS-S0361 | ● |
| 40 | High head pump (For option T) | HRS-S0299 | ○ (For option T) |
| 43 | High head pump (For option MT) | HRS-S0300 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 50 | Fan | HRS-S0301 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 68 | Main Board | HRS-S0290 | ● |
| 84 | Main Board (for HRS030-A-20-T) | HRS-S0291 | ○ (For option T) |
| 96 | Main Board (for HRS030-A-20-MT) | HRS-S0292 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 117 | Compressor (for 200V type) | HRS-S0423 | ● |
| 119 | Condenser (For air-cooled type) | HRS-S0381 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 137 | Heat exchanger Assy | HRS-S0380 | ● |
| 140 | Heat exchanger Assy (For option M) | HRS-S0414 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 146 | Thermistor sensor | HRS-S0338 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 153 | Packaging Materials set | HRS-S0391 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |

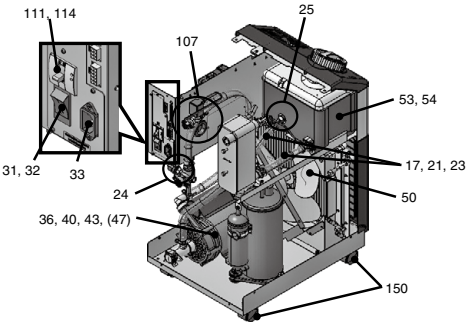
Note 1. Excerpt number from the total list of P.91 to 98

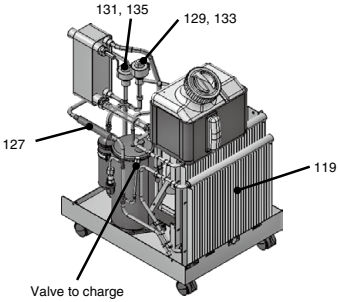
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

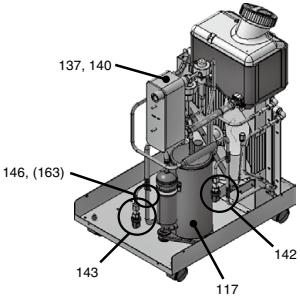
## Construction

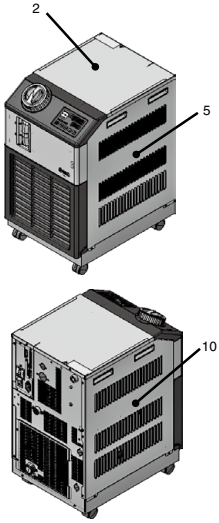
**Applicable models, Ser. No.: HRS030-A□-20-□, After TQ (MAR. 2015)**

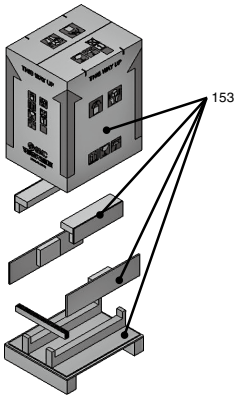


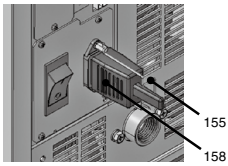



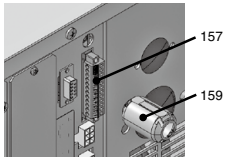



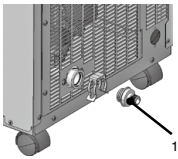



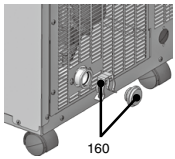



## Construction

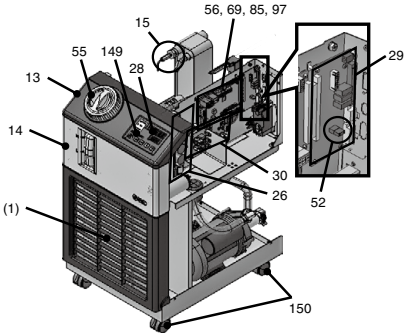
| No. Note1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 5 | Right Side Panel (For option G) | HRS-S0075 | ● |
| 10 | Left Side Panel (For option G) | HRS-S0076 | ● |
| 13 | Front panel | HRS-S0519 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 17 | Hose (For standard pump) | HRS-S0302 | ● |
| 21 | Hose (For option T) | HRS-S0303 | ○ (For option T) |
| 23 | Hose (For option MT) | HRS-S0304 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0520 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 36 | Pump (for 200V) | HRS-S0361 | ● |
| 40 | High head pump (For option T) | HRS-S0299 | ○ (For option T) |
| 43 | High head pump (For option MT) | HRS-S0300 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 50 | Fan | HRS-S0301 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 68 | Main Board | HRS-S0290 | ● |
| 84 | Main Board (for HRS030-A-20-T) | HRS-S0291 | ○ For option T) |
| 96 | Main Board (for HRS030-A-20-MT) | HRS-S0292 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 117 | Compressor (for 200V type) | HRS-S0423 | ● |
| 119 | Condenser (For air-cooled type) | HRS-S0381 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 137 | Heat exchanger Assy | HRS-S0380 | ● |
| 140 | Heat exchanger Assy (For option M) | HRS-S0414 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 146 | Thermistor sensor | HRS-S0338 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 153 | Packaging Materials set | HRS-S0391 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |

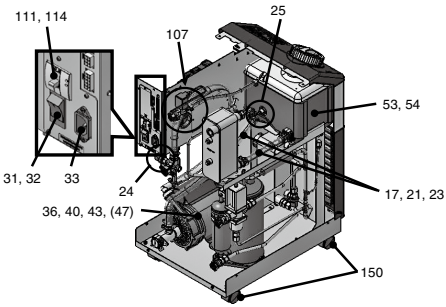
Note 1. Excerpt number from the total list of P.91 to 98

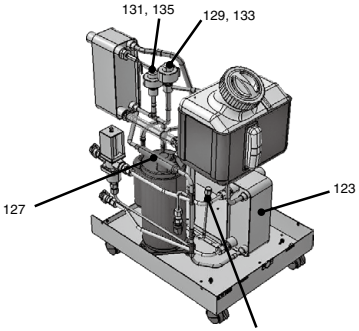
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○".
It is used by setting the program.

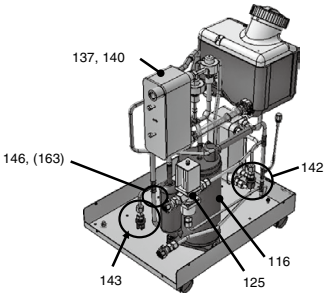
## Construction

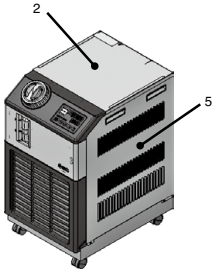
**Applicable models, Ser. No.: HRS030-W□-20-□, TP (FEB. 2015) or earlier**

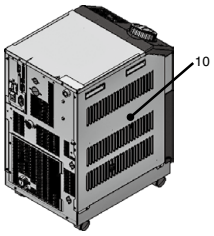


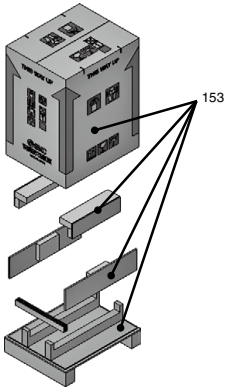



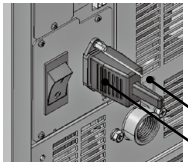



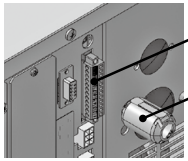



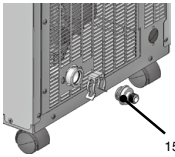



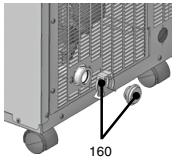



## Construction

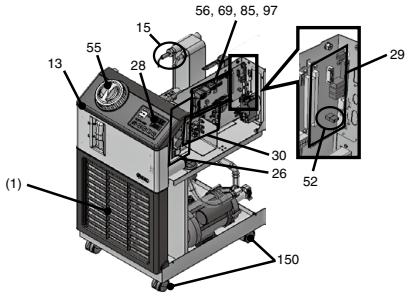
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 5 | Right Side Panel (For option G) | HRS-S0075 | ● |
| 10 | Left Side Panel (For option G) | HRS-S0076 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 17 | Hose (For standard pump) | HRS-S0302 | ● |
| 21 | Hose (For option T) | HRS-S0303 | ○ (For option T) |
| 23 | Hose (For option MT) | HRS-S0304 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 36 | Pump (for 200V) | HRS-S0361 | ● |
| 40 | High head pump (For option T) | HRS-S0299 | ○ (For option T) |
| 43 | High head pump (For option MT) | HRS-S0300 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 69 | Main Board | HRS-S0293 | ● |
| 85 | Main Board (for HRS030-W-20-T) | HRS-S0294 | ○ (For option T) |
| 97 | Main Board (for HRS030-W-20-MT) | HRS-S0295 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 123 | Heat exchanger (Condenser) | HRS-S0384 | ● |
| 125 | Water regulating valve | HRS-S0385 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 137 | Heat exchanger Assy | HRS-S0380 | ● |
| 140 | Heat exchanger Assy (For option M) | HRS-S0414 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 146 | Thermistor sensor | HRS-S0338 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 153 | Packaging Materials set | HRS-S0391 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |

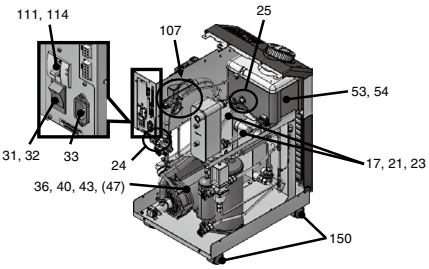
Note 1. Excerpt number from the total list of P.91 to 98

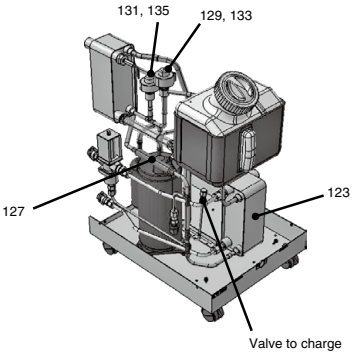
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

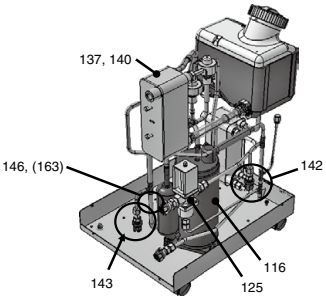
## Construction

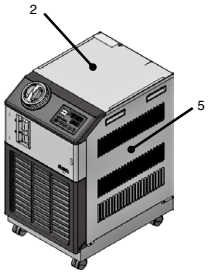
**Applicable models, Ser. No.: HRS030-W□-20-□, After TQ (MAR. 2015)**

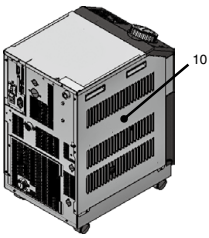


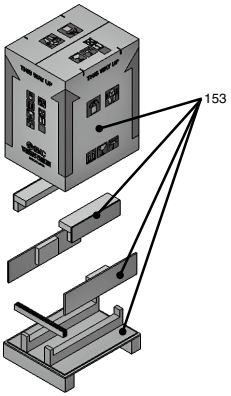



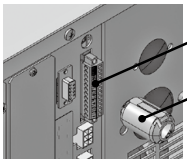



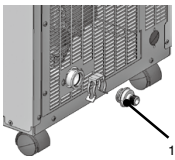



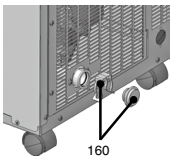







## Construction

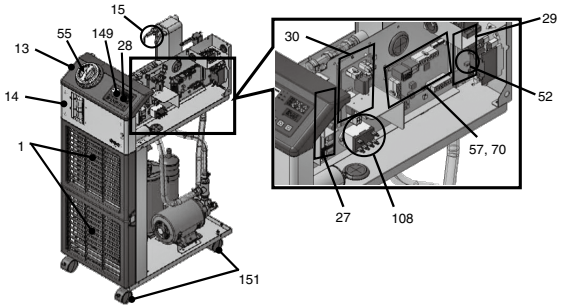
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 2 | Upper Panel | HRS-S0002 | ● |
| 5 | Right Side Panel (For option G) | HRS-S0075 | ● |
| 10 | Left Side Panel (For option G) | HRS-S0076 | ● |
| 13 | Front panel | HRS-S0519 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 17 | Hose (For standard pump) | HRS-S0302 | ● |
| 21 | Hose (For option T) | HRS-S0303 | ○ (For option T) |
| 23 | Hose (For option MT) | HRS-S0304 | ○ (For option MT) |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 26 | DC power supply | HRS-S0016 | ● |
| 28 | Display board | HRS-S0520 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 31 | Pawer switch | HRS-S0020 | ● |
| 32 | Pawer switch (For 15A) | HRS-S0070 | ○ (For option T) |
| 33 | Inlet socket | HRS-S0021 | ● |
| 36 | Pump (for 200V) | HRS-S0361 | ● |
| 40 | High head pump (For option T) | HRS-S0299 | ○ (For option T) |
| 43 | High head pump (For option MT) | HRS-S0300 | ○ (For option MT) |
| 47 | Mechanical seal Kit | HRG-S0211 | ○ (For option T) |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 56 | Main Board (for HRS012/018/024) | HRS-S0134 | ●/○ Note 2. |
| 69 | Main Board | HRS-S0293 | ● |
| 85 | Main Board (for HRS030-W-20-T) | HRS-S0294 | ○ (For option T) |
| 97 | Main Board (for HRS030-W-20-MT) | HRS-S0295 | ○ (For option MT) |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 111 | Earth leakage breaker (For option B) | HRS-S0393 | ○ (For option B) |
| 114 | Earth leakage breaker (For option B or BT) | HRS-S0394 | ○ (For option B or BT) |
| 116 | Compressor (for 200V type) | HRS-S0068 | ● |
| 123 | Heat exchanger (Condenser) | HRS-S0384 | ● |
| 125 | Water regulating valve | HRS-S0385 | ● |
| 127 | Filter drier | HRS-S0387 | ● |
| 129 | Electronic Expansion Valve (For heating) | HRS-S0028 | ● |
| 131 | Electronic Expansion Valve (For cooling) | HRS-S0029 | ● |
| 133 | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 137 | Heat exchanger Assy | HRS-S0380 | ● |
| 140 | Heat exchanger Assy (For option M) | HRS-S0414 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 143 | Pressure sensor (For high or low pressure) | HRS-S0013 | ● |
| 146 | Thermistor sensor | HRS-S0338 | ● |
| 150 | Caster (4Pcs.) | HRS-S0059 | ● |
| 153 | Packaging Materials set | HRS-S0391 | ● |
| 155 | Power supply connector omission prevention fittings | HRS-S0074 | ● |
| 156 | Drain Fitting | HRS-S0102 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 158 | Power supply connector | HRS-S0104 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |
| 160 | Drain Plug set | HRS-S0132 | ● |
| 163 | Thermal insulator for copper pipe | HRS-S0032 | ● |

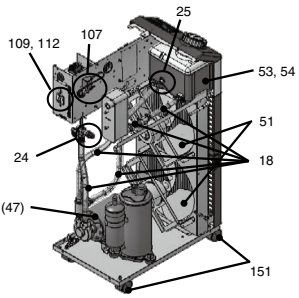
Note 1 Excerpt number from the total list of P.91 to 98

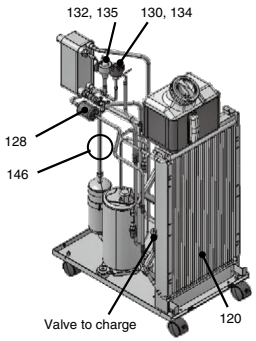
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

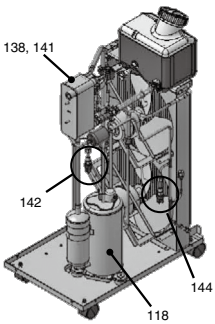
## Construction

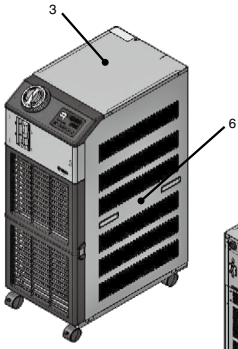
**Applicable models: HRS050-A□-20-□**

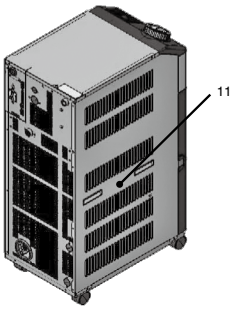


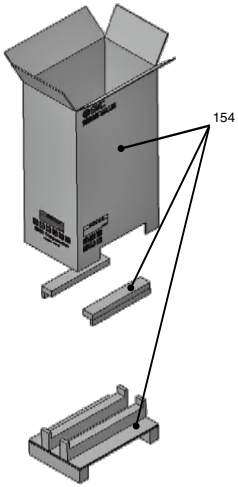



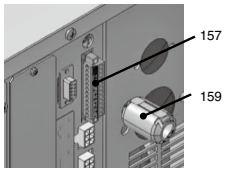



## Construction

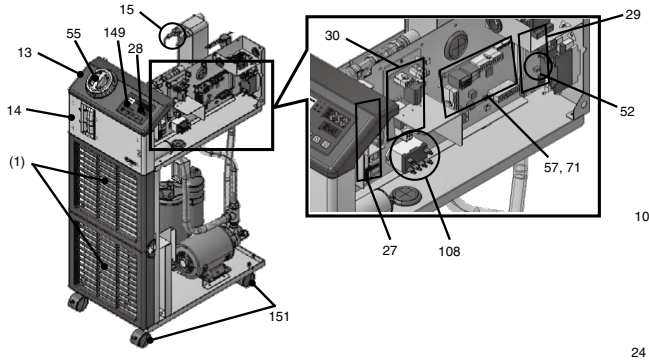
| No.<br>Note 1. | Names of parts | Parts number | ●: For standard type<br>○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 3 | Upper Panel | HRS-S0092 | ● |
| 6 | Right Side Panel (For air cooling) | HRS-S0093 | ● |
| 11 | Left Side Panel (For air cooling) | HRS-S0095 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 18 | Hose (For standard pump) | HRS-S0097 | ● |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 27 | DC power supply | HRS-S0087 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 37 | Pump | HRS-S0088 | ● |
| 44 | Pump (For option M) | HRS-S0089 | ○ (For option M) |
| 47 | Mechanical seal Kit | HRG-S0211 | ● |
| 51 | Fan | HRS-S0099 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 57 | Main Board (HRS050) | HRS-S0135 | ●/○ Note 2. |
| 70 | Main Board | HRS-S0090 | ● |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 108 | Relay (For Compressor) | HRS-S0392 | ● |
| 109 | Circuit breaker | HRS-S0395 | ● |
| 112 | Earth leakage breaker (For option B) | HRS-S0348 | ○ (For option B) |
| 118 | Compressor | HRS-S0337 | ● |
| 120 | Condenser (For air-cooled type) | HRS-S0382 | ● |
| 128 | Filter drier | HRZ-S0227 | ● |
| 130 | Electronic Expansion Valve (For heating) | HRS-S0340 | ● |
| 132 | Electronic Expansion Valve (For cooling) | HRS-S0341 | ● |
| 134 | Electronic Expansion Valve Coil (For heating) | HRS-S0386 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 138 | Heat exchanger | HRS-S0184 | ● |
| 141 | Heat exchanger (For option M) | HRS-S0415 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 144 | Pressure sensor (For high pressure) | HRS-S0183 | ● |
| 146 | Thermistor sensor | HRS-S0338 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 151 | Caster (4Pcs.)(for HRS050) | HRS-S0098 | ● |
| 154 | Packaging Materials set | HRS-S0151 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |

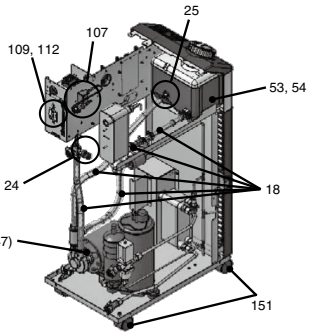
Note 1. Excerpt number from the total list of P.91 to 98

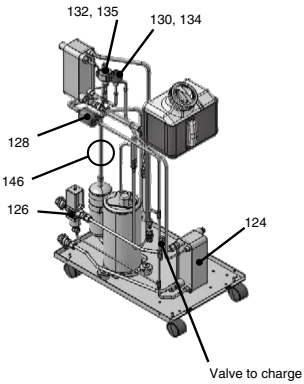
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○".
It is used by setting the program.

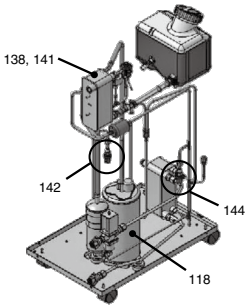
## Construction

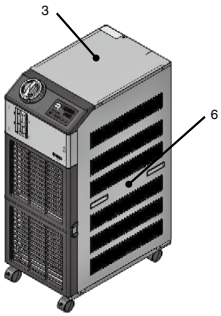
**Applicable models: HRS050-W□-20-□**

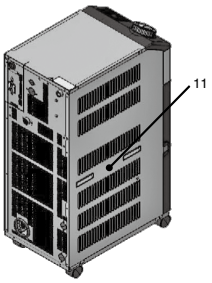


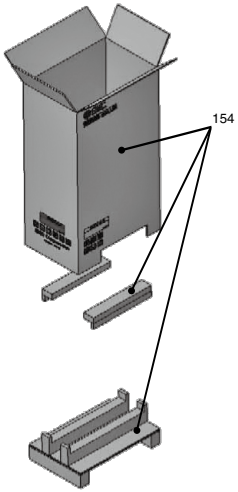



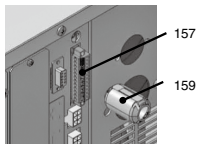



## Construction

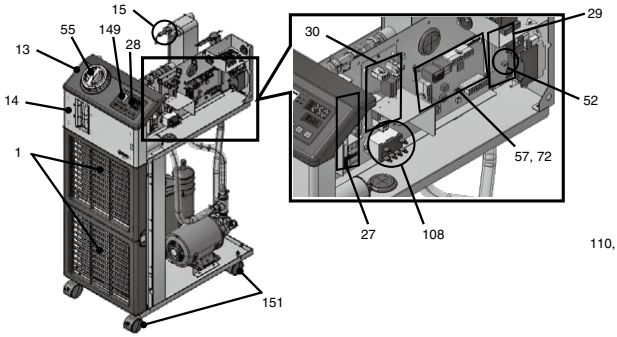
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 3 | Upper Panel | HRS-S0092 | ● |
| 8 | Right Side Panel (For water-cooled) | HRS-S0094 | ● |
| 12 | Left Side Panel (For water-cooled) | HRS-S0096 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 18 | Hose (For standard pump) | HRS-S0097 | ● |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 27 | DC power supply | HRS-S0087 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 37 | Pump | HRS-S0088 | ● |
| 44 | Pump (For option M) | HRS-S0089 | ○ (For option M) |
| 47 | Mechanical seal Kit | HRG-S0211 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 57 | Main Board (HRS050) | HRS-S0135 | ●/○ Note 2. |
| 71 | Main Board | HRS-S0091 | ● |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option T) |
| 108 | Relay (For Compressor) | HRS-S0392 | ● |
| 109 | Circuit breaker | HRS-S0395 | ● |
| 112 | Earth leakage breaker (For option B) | HRS-S0348 | ○ (For option B) |
| 118 | Compressor | HRS-S0337 | ● |
| 124 | Heat exchanger (Condenser) | HRS-S0152 | ● |
| 126 | Water regulating valve | HRS-S0388 | ● |
| 128 | Filter drier | HRZ-S0227 | ● |
| 130 | Electronic Expansion Valve (For heating) | HRS-S0340 | ● |
| 132 | Electronic Expansion Valve (For cooling) | HRS-S0341 | ● |
| 134 | Electronic Expansion Valve Coil (For heating) | HRS-S0386 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 138 | Heat exchanger | HRS-S0184 | ● |
| 141 | Heat exchanger (For option M) | HRS-S0415 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 144 | Pressure sensor (For high pressure) | HRS-S0183 | ● |
| 146 | Thermistor sensor | HRS-S0338 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 151 | Caster (4Pcs.)(for HRS050) | HRS-S0098 | ● |
| 154 | Packaging Materials set | HRS-S0151 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |

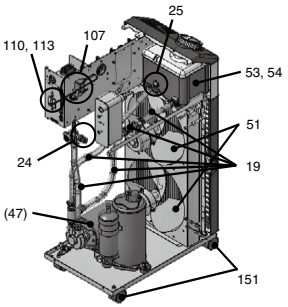
Note 1. Excerpt number from the total list of P.91 to 98

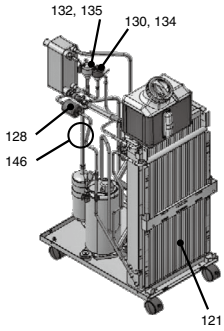
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

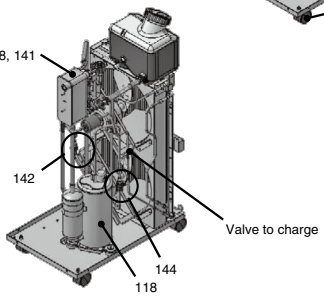
## Construction

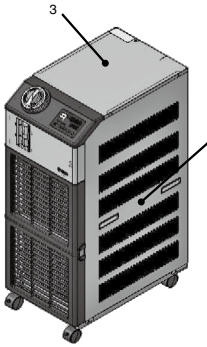
**Applicable models: HRS060-A□-20-□**

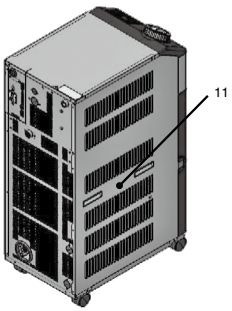


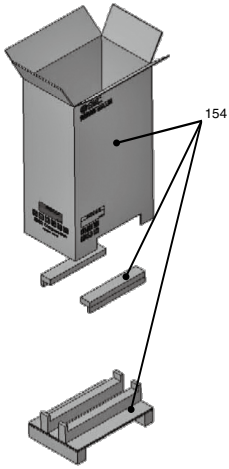



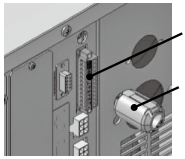



## Construction

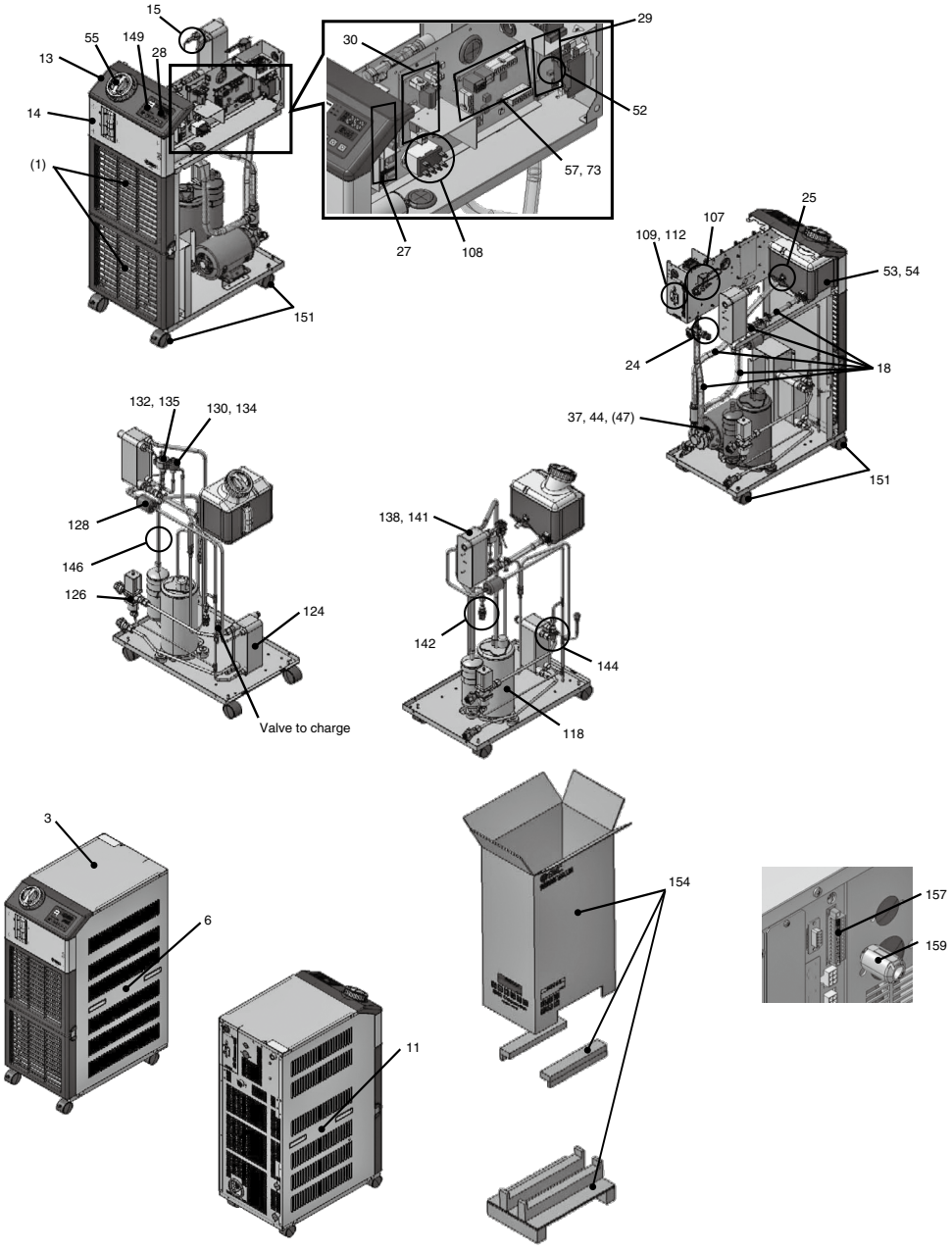
| No.<br>Note 1. | Names of parts | Parts number | ●: For standard type<br>○: For option type |
|---|---|---|---|
| 1 | Dustproof filter | HRS-S0001 | ● |
| 3 | Upper Panel | HRS-S0092 | ● |
| 7 | Right Side Panel (For air cooling) | HRS-S0298 | ● |
| 11 | Left Side Panel (For air cooling) | HRS-S0095 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 19 | Hose (For standard pump) | HRS-S0362 | ● |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 27 | DC power supply | HRS-S0087 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 37 | Pump | HRS-S0088 | ● |
| 44 | Pump (For option M) | HRS-S0089 | ○ (For option M) |
| 47 | Mechanical seal Kit | HRG-S0211 | ● |
| 51 | Fan | HRS-S0099 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 57 | Main Board (HRS050) | HRS-S0135 | ●/○ Note 2. |
| 72 | Main Board | HRS-S0296 | ● |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 108 | Relay (For Compressor) | HRS-S0392 | ● |
| 110 | Circuit breaker | HRS-S0396 | ● |
| 113 | Earth leakage breaker (For option B) | HRS-S0397 | ○ (For option B) |
| 118 | Compressor | HRS-S0337 | ● |
| 121 | Condenser (For air-cooled type) | HRS-S0383 | ● |
| 128 | Filter drier | HRZ-S0227 | ● |
| 130 | Electronic Expansion Valve (For heating) | HRS-S0340 | ● |
| 132 | Electronic Expansion Valve (For cooling) | HRS-S0341 | ● |
| 134 | Electronic Expansion Valve Coil (For heating) | HRS-S0386 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 138 | Heat exchanger | HRS-S0184 | ● |
| 141 | Heat exchanger (For option M) | HRS-S0415 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 144 | Pressure sensor (For high pressure) | HRS-S0183 | ● |
| 146 | Thermistor sensor | HRS-S0338 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 151 | Caster (4Pcs.)(for HRS050) | HRS-S0098 | ● |
| 154 | Packaging Materials set | HRS-S0151 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |

Note 1. Excerpt number from the total list of P.91 to 98

Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○".
It is used by setting the program.

## Construction

**Applicable models: HRS060-W□-20-□**



## Construction

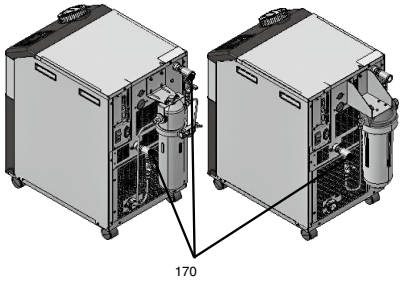
| No. Note 1. | Names of parts | Parts number | ●: For standard type ○: For option type |
|---|---|---|---|
| (1) | Dustproof filter | HRS-S0001 | ● |
| 3 | Upper Panel | HRS-S0092 | ● |
| 8 | Right Side Panel (For water-cooled) | HRS-S0094 | ● |
| 12 | Left Side Panel (For water-cooled) | HRS-S0096 | ● |
| 13 | Front panel B | HRS-S0005 | ● |
| 14 | Front panel A | HRS-S0006 | ● |
| 15 | Temperature sensor | HRS-S0007 | ● |
| 18 | Hose (For standard pump) | HRS-S0097 | ● |
| 24 | Pressure sensor (For circulating fluid) | HRS-S0011 | ● |
| 25 | Level switch | HRS-S0014 | ● |
| 27 | DC power supply | HRS-S0087 | ● |
| 28 | Display board | HRS-S0017 | ● |
| 29 | Communication board | HRS-S0018 | ● |
| 30 | Pawer board | HRS-S0019 | ● |
| 37 | Pump | HRS-S0088 | ● |
| 44 | Pump (For option M) | HRS-S0089 | ○ (For option M) |
| 47 | Mechanical seal Kit | HRG-S0211 | ● |
| 52 | Fuse (5Pcs.) | HRS-S0024 | ● |
| 53 | Tank | HRS-S0025 | ● |
| 54 | Tank (For automatic water-fill) | HRS-S0072 | ○ (For option J) |
| 55 | Tank lid | HRS-S0026 | ● |
| 57 | Main Board (HRS050) | HRS-S0135 | ●/○ Note 1. |
| 73 | Main Board | HRS-S0297 | ● |
| 107 | Solenoid Valve (For automatic water-fill) | HRS-S0071 | ○ (For option J) |
| 108 | Relay (For Compressor) | HRS-S0392 | ● |
| 109 | Circuit breaker | HRS-S0395 | ● |
| 112 | Earth leakage breaker (For option B) | HRS-S0348 | ○ (For option B) |
| 118 | Compressor | HRS-S0337 | ● |
| 124 | Heat exchanger (Condenser) | HRS-S0152 | ● |
| 126 | Water regulating valve | HRS-S0388 | ● |
| 128 | Filter drier | HRZ-S0227 | ● |
| 130 | Electronic Expansion Valve (For heating) | HRS-S0340 | ● |
| 132 | Electronic Expansion Valve (For cooling) | HRS-S0341 | ● |
| 134 | Electronic Expansion Valve Coil (For heating) | HRS-S0386 | ● |
| 135 | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | ● |
| 138 | Heat exchanger | HRS-S0184 | ● |
| 141 | Heat exchanger (For option M) | HRS-S0415 | ○ (For option M) |
| 142 | Pressure sensor (For high pressure) | HRS-S0012 | ● |
| 144 | Pressure sensor (For high pressure) | HRS-S0183 | ● |
| 146 | Thermistor sensor | HRS-S0338 | ● |
| 149 | Label (For Operation display) | HRS-S0058 | ● |
| 151 | Caster (4Pcs.)(for HRS050) | HRS-S0098 | ● |
| 154 | Packaging Materials set | HRS-S0151 | ● |
| 157 | Sequence I/O command signal connector | HRS-S0103 | ● |
| 159 | Ferrite core | HRS-S0105 | ● |

Note 1. Excerpt number from the total list of P.91 to 98

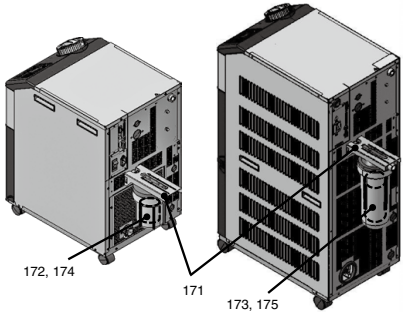
Note 2. These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.

## Replacement Parts for Optional Accessories

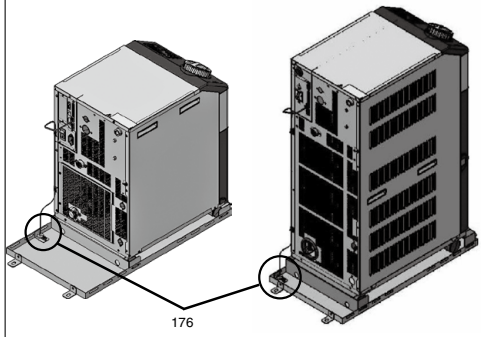
| Divergence piping | |
|---|---|
| HRS-DP001 | HRS-DP002 |



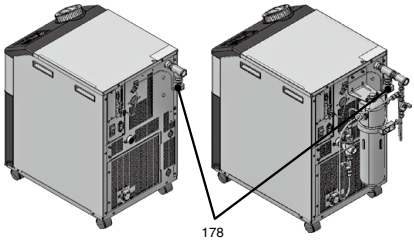

| Particle filter bracket, P.P.Depth Element | |
|---|---|
| HRS-PF001 | HRS-PF002 |



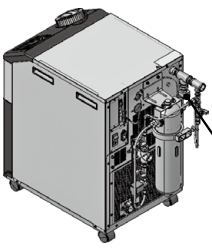
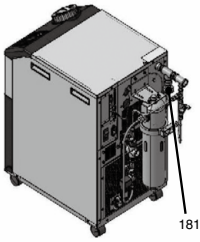

| Water leakage detector (For drain pan set) | |
|---|---|
| HRS-WL001 | HRS-WL002 |




| DI Sensor | |
|---|---|
| HRS-DI001 | HRS-DI004 |



## Replacement Parts for Optional Accessories

| DI Sensor for control | | Electrical conductivity Sensor | Electrical conductivity Sensor for control |
|---|---|---|---|
| HRS-DI003 | HRS-DI005 | HRS-DI008 | HRS-DI009 |
|   | |   |   |

## Construction (Accessories included in the package)


Operation manual (Japanese/English)*1

166 
Quick manual (Japanese/English)

167 
Alarm code list sticker

158 
Power supply connector (Female)

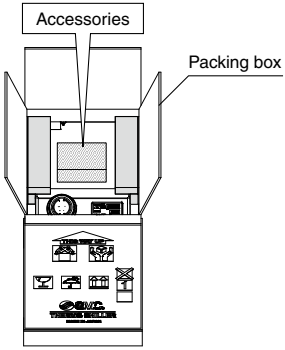
157 
Contact input/output communication connector

156 
Fitting (For drain outlet)

159 
Ferrite core (For contact input/output communication)



For N and F types*2
· For circulating fluid connection port: 1/2 x 2
· For facility water connection port: 3/8 x 2 (For water-cooled refrigeration)
· For automatic water fill connection: 3/8 x 1, 3/4 x 1 (For option J)




*1 Please download via our website.
*2 Refer to the **Web Catalog** for details on the optional accessories HRS-EP□□□

## Replacement Parts List

### ● Replacement parts for circulating fluid circuit and electrical circuit

| No. | Recommended stock parts | Names of parts | Parts number HRS-S□□□ HRZ-S□□□ HRG-S□□□ | Weight [kg] | Packaged qty | Unit |
|---|---|---|---|---|---|---|
| 1 | ■*1 | Dustproof filter | HRS-S0001 | 0.5 | 1 | pcs. |
| 2 | | Upper Panel | HRS-S0002 | 1.0 | 1 | pcs. |
| 3 | | Upper Panel | HRS-S0092 | 1.0 | 1 | pcs. |
| 4 | | Right Side Panel | HRS-S0003 | 1.6 | 1 | pcs. |
| 5 | | Right Side Panel (For option G) | HRS-S0075 | 1.6 | 1 | pcs. |
| 6 | | Right Side Panel (For air cooling) | HRS-S0093 | 3.0 | 1 | pcs. |
| 7 | | Right Side Panel (For air cooling) | HRS-S0298 | 3.0 | 1 | pcs. |
| 8 | | Right Side Panel (For water-cooled) | HRS-S0094 | 3.0 | 1 | pcs. |
| 9 | | Left Side Panel | HRS-S0004 | 1.6 | 1 | pcs. |
| 10 | | Left Side Panel (For option G) | HRS-S0076 | 1.6 | 1 | pcs. |
| 11 | | Left Side Panel (For air cooling) | HRS-S0095 | 3.0 | 1 | pcs. |
| 12 | | Left Side Panel (For water-cooled) | HRS-S0096 | 3.0 | 1 | pcs. |
| 13 | | Front panel B (~S/N TP) | HRS-S0005 | 0.2 | 1 | pcs. |
| | | Front panel (S/N TQ~) | HRS-S0519 | | 1 | pcs. |
| 14 | | Front panel A (~S/N TP) | HRS-S0006 | 0.2 | 1 | pcs. |
| | | (Integration to No.13)(S/N TQ~) | | | | |
| 15 | ■ | Temperature sensor | HRS-S0007 | 0.1 | 1 | ass'y |
| 16 | | Hose (For standard pump) | HRS-S0008 | 0.6 | 1 | kit |
| 17 | | Hose (For standard pump) | HRS-S0302 | 0.8 | 1 | kit |
| 18 | | Hose (For standard pump) | HRS-S0097 | 1.0 | 1 | kit |
| 19 | | Hose (For standard pump) | HRS-S0362 | 1.0 | 1 | kit |
| 20 | | Hose (For option T) | HRS-S0077 | 0.6 | 1 | kit |
| 21 | | Hose (For option T) | HRS-S0303 | 0.6 | 1 | kit |
| 22 | | Hose (For option MT) | HRS-S0069 | 0.6 | 1 | kit |
| 23 | | Hose (For option MT) | HRS-S0304 | 0.6 | 1 | kit |
| 24 | ■ | Pressure sensor (For circulating fluid) | HRS-S0011 | 0.1 | 1 | pcs. |
| 25 | ■ | Level switch | HRS-S0014 | 0.1 | 1 | pcs. |
| 26 | ■ | DC power supply | HRS-S0016 | 0.2 | 1 | pcs. |
| 27 | ■ | DC power supply | HRS-S0087 | 0.23 | 1 | pcs. |
| 28 | ■ | Display board (~S/N TP) | HRS-S0017 | 0.2 | 1 | ass'y |
| | | Display board (S/N TQ~) | HRS-S0520 | | 1 | ass'y |
| 29 | ■ | Communication board | HRS-S0018 | 0.1 | 1 | pcs. |
| 30 | ■ | Pawer board | HRS-S0019 | 0.2 | 1 | pcs. |
| 31 | | Pawer switch | HRS-S0020 | 0.037 | 1 | pcs. |
| 32 | | Pawer switch (For 15A) | HRS-S0070 | 0.037 | 1 | pcs. |
| 33 | | Inlet socket | HRS-S0021 | 0.044 | 1 | kit |
| 34 | | Pump (for 100V) | HRS-S0022 | 7.0 | 1 | ass'y |
| 35 | ■ | Pump (for 200V type) | HRS-S0066 | 7.0 | 1 | ass'y |
| 36 | ■ | Pump (for 200V) | HRS-S0361 | | 1 | ass'y |
| 37 | ■ | Pump | HRS-S0088 | 12.0 | 1 | ass'y |
| 38 | □*4 | High head pump (For 100V type option T) | HRS-S0265 | 12.0 | 1 | ass'y |
| 39 | ■ | High head pump (For option T) | HRS-S0062 | 12.0 | 1 | ass'y |
| 40 | ■ | High head pump (For option T) | HRS-S0299 | 12.0 | 1 | ass'y |
| 41 | | High head pump (For 100V type option MT) | HRS-S0266 | 12.0 | 1 | ass'y |
| 42 | | High head pump (For option MT) | HRS-S0063 | 12.0 | 1 | ass'y |
| 43 | | High head pump (For option MT) | HRS-S0300 | 12.0 | 1 | ass'y |
| 44 | | Pump (For option M) | HRS-S0089 | 12.0 | 1 | ass'y |
| 45 | □ | Mechanical seal Kit (For 100V type option T) | HRS-S0390 | | 1 | kit |
| 46 | □ | Mechanical seal Kit (For 100V type option MT) | HRS-S0412 | | 1 | kit |
| 47 | ■ | Mechanical seal Kit | HRG-S0211 | 0.018 | 1 | kit |
| 48 | □ | Fan (for 100V) With bracket | HRS-S0023 | 1.7 | 1 | ass'y |
| 49 | ■ | Fan (for 200V type) | HRS-S0067 | 1.7 | 1 | ass'y |
| 50 | ■ | Fan | HRS-S0301 | 3.1 | 1 | ass'y |
| 51 | ■ | Fan | HRS-S0099 | 3.1 | 1 | ass'y |
| 52 | ■ | Fuse (5Pcs.) | HRS-S0024 | 0.0005 | 5 | pcs. |
| 53 | ■ | Tank | HRS-S0025 | 0.8 | 1 | ass'y |
| 54 | ■ | Tank (For automatic water-fill) | HRS-S0072 | 0.8 | 1 | ass'y |
| 55 | ■ | Tank lid | HRS-S0026 | 0.1 | 1 | pcs. |

∗1 These are recommended stock for replacement parts that are marked "■".
∗2 These are replacement parts of the standard specification used in HRS that are marked "●".
∗3 These are replacement parts of the option specification used in HRS that are marked "○".
∗4 These are recommended stock for replacement parts of 100 VAC specifications that are marked "□".

| Applicable models of HRS | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HRS□□□-□-10 | | | | HRS□□□-□-20 | | | | | | | | | | | | |
| 012-A | 012-W | 018-A | 018-W | 012-A | 012-W | 018-A | 018-W | 024-A | 024-W | 030-A | 030-W | 050-A | 050-W | 060-A | 060-W |
| ●*2 | | ● | | ● | | ● | | ● | | ● | | ● | | ● | |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | | | | | | | | | | | | ● | ● | ● | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | |
| | | | | ○*3 | | ○ | | ○ | | ● | ● | | | | |
| | | | | | | | | | | | | ● | | | |
| | | | | | | | | | | | | | | ● | |
| | | | | | | | | | | | | | ● | | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | |
| | | | | ○ | | ○ | | ○ | | ● | ● | | | | |
| | | | | | | | | | | | | ● | | ● | |
| | | | | | | | | | | | | | ● | | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | | | | | | | | | | | | | | | |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | |
| | | | | | | | | | | ● | ● | | | | |
| | | | | | | | | | | | | ● | ● | | ● |
| | | | | | | | | | | | | | | ● | |
| ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | |
| | | | | | | | | | | ○ | ○ | | | | |
| ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | |
| | | | | | | | | | | ○ | ○ | | | | |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | | | | | | | | | | | | ● | ● | ● | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | | | | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| ● | ● | ● | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| ● | ● | ● | ● | | | | | | | | | | | | |
| | | | | ● | ● | ● | ● | ● | ● | | | | | | |
| | | | | | | | | | | ● | ● | | | | |
| | | | | | | | | | | | | ● | ● | ● | ● |
| ○ | ○ | ○ | ○ | | | | | | | | | | | | |
| | | | | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | |
| | | | | | | | | | | ○ | ○ | | | | |
| ○ | ○ | ○ | ○ | | | | | | | | | | | | |
| | | | | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | |
| | | | | | | | | | | ○ | ○ | | | | |
| | | | | | | | | | | | | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | | | | | | | | | | | | |
| ○ | ○ | ○ | ○ | | | | | | | | | | | | |
| | | | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ● | ● | ● | ● |
| ● | | ● | | | | | | | | | | | | | |
| | | | | ● | | ● | | ● | | | | | | | |
| | | | | | | | | | | ● | | | | | |
| | | | | | | | | | | | | ● | ● | ● | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |

∗5 These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.
∗6 These are the parts that are not included with HRS that are marked "(●)". But there is no problem to use.
∗7 These are replacement parts used to optional accessories that are marked "▲".

## Replacement Parts List

**● Replacement parts for circulating fluid circuit and electrical circuit (Continues)**

| No. | Recommended stock parts | Names of parts | Parts number HRS-S□□□ HRZ-S□□□ HRG-S□□□ | Weight [kg] | Packaged qty | Unit |
|---|---|---|---|---|---|---|
| 56 | ■ | Main Board (for HRS012/018/024) | HRS-S0134 | 0.13 | 1 | pcs. |
| 57 | ■ | Main Board (HRS050) | HRS-S0135 | 0.13 | 1 | pcs. |
| 58 | | Main Board (for HRS012-A-10) | HRS-S0033 | 0.13 | 1 | pcs. |
| 59 | | Main Board (for HRS012-W-10) | HRS-S0034 | 0.13 | 1 | pcs. |
| 60 | | Main Board (for HRS018-A-10) | HRS-S0035 | 0.13 | 1 | pcs. |
| 61 | | Main Board (for HRS018-W-10) | HRS-S0036 | 0.13 | 1 | pcs. |
| 62 | | Main Board (for HRS012-A-20) | HRS-S0037 | 0.13 | 1 | pcs. |
| 63 | | Main Board (for HRS012-W-20) | HRS-S0040 | 0.13 | 1 | pcs. |
| 64 | | Main Board (for HRS018-A-20) | HRS-S0043 | 0.13 | 1 | pcs. |
| 65 | | Main Board (for HRS018-W-20) | HRS-S0046 | 0.13 | 1 | pcs. |
| 66 | | Main Board (for HRS024-A-20) | HRS-S0049 | 0.13 | 1 | pcs. |
| 67 | | Main Board (for HRS024-W-20) | HRS-S0052 | 0.13 | 1 | pcs. |
| 68 | | Main Board | HRS-S0290 | 0.13 | 1 | pcs. |
| 69 | | Main Board | HRS-S0293 | 0.13 | 1 | pcs. |
| 70 | | Main Board | HRS-S0090 | 0.13 | 1 | pcs. |
| 71 | | Main Board | HRS-S0091 | 0.13 | 1 | pcs. |
| 72 | | Main Board | HRS-S0296 | 0.13 | 1 | pcs. |
| 73 | | Main Board | HRS-S0297 | 0.13 | 1 | pcs. |
| 74 | | Main Board (for HRS012-A-10-T) | HRS-S0282 | 0.13 | 1 | pcs. |
| 75 | | Main Board (for HRS012-W-10-T) | HRS-S0284 | 0.13 | 1 | pcs. |
| 76 | | Main Board (for HRS018-A-10-T) | HRS-S0286 | 0.13 | 1 | pcs. |
| 77 | | Main Board (for HRS018-W-10-T) | HRS-S0288 | 0.13 | 1 | pcs. |
| 78 | | Main Board (for HRS012-A-20-T) | HRS-S0038 | 0.13 | 1 | pcs. |
| 79 | | Main Board (for HRS012-W-20-T) | HRS-S0041 | 0.13 | 1 | pcs. |
| 80 | | Main Board (for HRS018-A-20-T) | HRS-S0044 | 0.13 | 1 | pcs. |
| 81 | | Main Board (for HRS018-W-20-T) | HRS-S0047 | 0.13 | 1 | pcs. |
| 82 | | Main Board (for HRS024-A-20-T) | HRS-S0050 | 0.13 | 1 | pcs. |
| 83 | | Main Board (for HRS024-W-20-T) | HRS-S0053 | 0.13 | 1 | pcs. |
| 84 | | Main Board (for HRS030-A-20-T) | HRS-S0291 | 0.13 | 1 | pcs. |
| 85 | | Main Board (for HRS030-W-20-T) | HRS-S0294 | 0.13 | 1 | pcs. |
| 86 | | Main Board (for HRS012-A-10-MT) | HRS-S0283 | 0.13 | 1 | pcs. |
| 87 | | Main Board (for HRS012-W-10-MT) | HRS-S0285 | 0.13 | 1 | pcs. |
| 88 | | Main Board (for HRS018-A-10-MT) | HRS-S0287 | 0.13 | 1 | pcs. |
| 89 | | Main Board (for HRS018-W-10-MT) | HRS-S0289 | 0.13 | 1 | pcs. |
| 90 | | Main Board (for HRS012-A-20-MT) | HRS-S0039 | 0.13 | 1 | pcs. |
| 91 | | Main Board (for HRS012-W-20-MT) | HRS-S0042 | 0.13 | 1 | pcs. |
| 92 | | Main Board (for HRS018-A-20-MT) | HRS-S0045 | 0.13 | 1 | pcs. |
| 93 | | Main Board (for HRS018-W-20-MT) | HRS-S0048 | 0.13 | 1 | pcs. |
| 94 | | Main Board (for HRS024-A-20-MT) | HRS-S0051 | 0.13 | 1 | pcs. |
| 95 | | Main Board (for HRS024-W-20-MT) | HRS-S0054 | 0.13 | 1 | pcs. |
| 96 | | Main Board (for HRS030-A-20-MT) | HRS-S0292 | 0.13 | 1 | pcs. |
| 97 | | Main Board (for HRS030-W-20-MT) | HRS-S0295 | 0.13 | 1 | pcs. |
| 98 | | Main Board (for HRS012-A-20-G) | HRS-S0078 | 0.13 | 1 | pcs. |
| 99 | | Main Board (for HRS018-A-20-G) | HRS-S0081 | 0.13 | 1 | pcs. |
| 100 | | Main Board (for HRS024-A-20-G) | HRS-S0084 | 0.13 | 1 | pcs. |
| 101 | | Main Board (for HRS012-A-20-GT) | HRS-S0079 | 0.13 | 1 | pcs. |
| 102 | | Main Board (for HRS018-A-20-GT) | HRS-S0082 | 0.13 | 1 | pcs. |
| 103 | | Main Board (for HRS024-A-20-GT) | HRS-S0085 | 0.13 | 1 | pcs. |
| 104 | | Main Board (for HRS012-A-20-GMT) | HRS-S0080 | 0.13 | 1 | pcs. |
| 105 | | Main Board (for HRS018-A-20-GMT) | HRS-S0083 | 0.13 | 1 | pcs. |
| 106 | | Main Board (for HRS024-A-20-GMT) | HRS-S0086 | 0.13 | 1 | pcs. |
| 107 | ■ | Solenoid Valve (For automatic water-fill) | HRS-S0071 | 0.3 | 1 | ass'y |
| 108 | | Relay (For Compressor) | HRS-S0392 | 0.09 | 1 | pcs. |
| 109 | | Circuit breaker | HRS-S0395 | 0.2 | 1 | pcs. |
| 110 | | Circuit breaker | HRS-S0396 | 0.2 | 1 | pcs. |

∗1 These are recommended stock for replacement parts that are marked "■".
∗2 These are replacement parts of the standard specification used in HRS that are marked "●".
∗3 These are replacement parts of the option specification used in HRS that are marked "○".
∗4 These are recommended stock for replacement parts of 100 VAC specifications that are marked "□".

| Applicable models of HRS | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HRS□□□-□-10 | | | | HRS□□□-□-20 | | | | | | | | | | | | |
| 012-A | 012-W | 018-A | 018-W | 012-A | 012-W | 018-A | 018-W | 024-A | 024-W | 030-A | 030-W | 050-A | 050-W | 060-A | 060-W |
| ●/○*5 | ●/○ | ●/○ | ●/○ | ●/○ | ●/○ | ●/○ | ●/○ | ●/○ | ●/○ | ●/○ | ●/○ | | | | |
| | | | | | | | | | | | | ●/○ | ●/○ | ●/○ | ●/○ |
| ● | | | | | | | | | | | | | | | |
| | ● | | | | | | | | | | | | | | |
| | | ● | | | | | | | | | | | | | |
| | | | ● | | | | | | | | | | | | |
| | | | | ● | | | | | | | | | | | |
| | | | | | ● | | | | | | | | | | |
| | | | | | | ● | | | | | | | | | |
| | | | | | | | ● | | | | | | | | |
| | | | | | | | | ● | | | | | | | |
| | | | | | | | | | ● | | | | | | |
| | | | | | | | | | | ● | | | | | |
| | | | | | | | | | | | ● | | | | |
| | | | | | | | | | | | | ● | | | |
| | | | | | | | | | | | | | ● | | |
| | | | | | | | | | | | | | | ● | |
| | | | | | | | | | | | | | | | ● |
| ○ | | | | | | | | | | | | | | | |
| | ○ | | | | | | | | | | | | | | |
| | | ○ | | | | | | | | | | | | | |
| | | | ○ | | | | | | | | | | | | |
| | | | | ○ | | | | | | | | | | | |
| | | | | | ○ | | | | | | | | | | |
| | | | | | | ○ | | | | | | | | | |
| | | | | | | | ○ | | | | | | | | |
| | | | | | | | | ○ | | | | | | | |
| | | | | | | | | | ○ | | | | | | |
| | | | | | | | | | | ○ | | | | | |
| | | | | | | | | | | | ○ | | | | |
| | | | | | | | | | | | | ○ | | | |
| ○ | | | | | | | | | | | | | | | |
| | ○ | | | | | | | | | | | | | | |
| | | ○ | | | | | | | | | | | | | |
| | | | ○ | | | | | | | | | | | | |
| | | | | ○ | | | | | | | | | | | |
| | | | | | ○ | | | | | | | | | | |
| | | | | | | ○ | | | | | | | | | |
| | | | | | | | ○ | | | | | | | | |
| | | | | | | | | ○ | | | | | | | |
| | | | | | | | | | ○ | | | | | | |
| | | | | | | | | | | ○ | | | | | |
| | | | | | | | | | | | ○ | | | | |
| | | | | | | | | | | | | ○ | | | |
| | | | | ○ | | | | | | | | | | | |
| | | | | | | ○ | | | | | | | | | |
| | | | | | | | | ○ | | | | | | | |
| | | | | ○ | | | | | | | | | | | |
| | | | | | | ○ | | | | | | | | | |
| | | | | | | | | ○ | | | | | | | |
| | | | | ○ | | | | | | | | | | | |
| | | | | | | ○ | | | | | | | | | |
| | | | | | | | | ○ | | | | | | | |
| ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | | | | | | | | | | | ● | ● | ● | ● |
| | | | | | | | | | | | | ● | ● | | ● |
| | | | | | | | | | | | | | | ● | |

*5 These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.
*6 These are the parts that are not included with HRS that are marked "(●)". But there is no problem to use.
*7 These are replacement parts used to optional accessories that are marked "▲".

## Replacement Parts List

### ●Replacement parts for circulating fluid circuit and electrical circuit (Continues)

| No. | Recommended stock parts | Names of parts | Parts number HRS-S□□□ HRZ-S□□□ HRG-S□□□ | Weight [kg] | Packaged qty | Unit |
|---|---|---|---|---|---|---|
| 111 | | Earth leakage breaker (For option B) | HRS-S0393 | 0.2 | 1 | pcs. |
| 112 | | Earth leakage breaker (For option B) | HRS-S0348 | 0.2 | 1 | pcs. |
| 113 | | Earth leakage breaker (For option B) | HRS-S0397 | 0.2 | 1 | pcs. |
| 114 | | Earth leakage breaker (For option B or BT) | HRS-S0394 | 0.2 | 1 | pcs. |

### ●Replacement parts for refrigeration circuit and facility water circuit

| No. | Recommended stock parts | Names of parts | Parts number HRS-S□□□ HRZ-S□□□ HRG-S□□□ | Weight [kg] | Packaged qty | Unit |
|---|---|---|---|---|---|---|
| 115 | □ | Compressor (for 100V type) | HRS-S0409 | | 1 | kit |
| 116 | ■ | Compressor (for 200V type) | HRS-S0068 | 12.0 | 1 | kit |
| 117 | ■ | Compressor (for 200V type) | HRS-S0423 | 12.0 | 1 | kit |
| 118 | ■ | Compressor | HRS-S0337 | 17.0 | 1 | kit |
| 119 | ■ | Condenser (For air-cooled type) | HRS-S0381 | | 1 | ass'y |
| 120 | ■ | Condenser (For air-cooled type) | HRS-S0382 | | 1 | ass'y |
| 121 | ■ | Condenser (For air-cooled type) | HRS-S0383 | | 1 | kit |
| 122 | | Heat exchanger (Condenser) | HRS-S0133 | 1.0 | 1 | ass'y |
| 123 | | Heat exchanger (Condenser) | HRS-S0384 | 1.0 | 1 | ass'y |
| 124 | | Heat exchanger (Condenser) | HRS-S0152 | 1.0 | 1 | ass'y |
| 125 | | Water regulating valve | HRS-S0385 | 0.8 | 1 | ass'y |
| 126 | | Water regulating valve | HRS-S0388 | 0.9 | 1 | ass'y |
| 127 | | Filter drier | HRS-S0387 | | 1 | pcs. |
| 128 | | Filter drier | HRZ-S0227 | | 1 | pcs. |
| 129 | ■ | Electronic Expansion Valve (For heating) | HRS-S0028 | 0.30 | 1 | kit |
| 130 | ■ | Electronic Expansion Valve (For heating) | HRS-S0340 | 0.21 | 1 | kit |
| 131 | ■ | Electronic Expansion Valve (For cooling) | HRS-S0029 | 0.30 | 1 | kit |
| 132 | ■ | Electronic Expansion Valve (For cooling) | HRS-S0341 | 0.23 | 1 | kit |
| 133 | | Electronic Expansion Valve Coil (For heating) | HRS-S0009 | 0.20 | 1 | ass'y |
| 134 | | Electronic Expansion Valve Coil (For heating) | HRS-S0386 | 0.20 | 1 | ass'y |
| 135 | | Electronic Expansion Valve Coil (For cooling) | HRS-S0010 | 0.20 | 1 | ass'y |
| 136 | | Heat exchanger | HRS-S0030 | 1.0 | 1 | ass'y |
| 137 | | Heat exchanger Assy | HRS-S0380 | 1.0 | 1 | ass'y |
| 138 | | Heat exchanger | HRS-S0184 | 1.0 | 1 | ass'y |
| 139 | | Heat exchanger (For option M) | HRS-S0413 | 4.0 | 1 | ass'y |
| 140 | | Heat exchanger Assy (For option M) | HRS-S0414 | 5.0 | 1 | ass'y |
| 141 | | Heat exchanger (For option M) | HRS-S0415 | 5.0 | 1 | ass'y |
| 142 | ■ | Pressure sensor (For high pressure) | HRS-S0012 | 0.08 | 1 | pcs. |
| 143 | ■ | Pressure sensor (For high or low pressure) | HRS-S0013 | 0.08 | 1 | pcs. |
| 144 | ■ | Pressure sensor (For high pressure) | HRS-S0183 | 0.08 | 1 | pcs. |
| 145 | | Thermistor sensor | HRS-S0057 | 0.05 | 1 | kit |
| 146 | | Thermistor sensor | HRS-S0338 | 0.05 | 1 | kit |
| — | ■ | (Charging weight of refrigerant) | R407C | | | |
| — | ■ | (Charging weight of refrigerant) | R410A | | | |

∗1 These are recommended stock for replacement parts that are marked "■".
∗2 These are replacement parts of the standard specification used in HRS that are marked "●".
∗3 These are replacement parts of the option specification used in HRS that are marked "○".
∗4 These are recommended stock for replacement parts of 100 VAC specifications that are marked "□".

| | Applicable models of HRS | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HRS□□□-□-10 | | | | HRS□□□-□-20 | | | | | | | | | | | |
| | 012-A | 012-W | 018-A | 018-W | 012-A | 012-W | 018-A | 018-W | 024-A | 024-W | 030-A | 030-W | 050-A | 050-W | 060-A | 060-W |
| | | | | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | |
| | | | | | | | | | | | | | ○ | ○ | | ○ |
| | | | | | | | | | | | | | | | ○ | |
| | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | |

| | Applicable models of HRS | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HRS□□□-□-10 | | | | HRS□□□-□-20 | | | | | | | | | | | |
| | 012-A | 012-W | 018-A | 018-W | 012-A | 012-W | 018-A | 018-W | 024-A | 024-W | 030-A | 030-W | 050-A | 050-W | 060-A | 060-W |
| | ● | ● | ● | ● | | | | | | | | | | | | |
| | | | | | ● | ● | ● | ● | ● | ● | | ● | | | | |
| | | | | | | | | | | | ● | | | | | |
| | | | | | | | | | | | | | ● | ● | ● | ● |
| | ● | | ● | | ● | | ● | | ● | | ● | | | | | |
| | | | | | | | | | | | | | ● | | | |
| | | | | | | | | | | | | | | | ● | |
| | | ● | | ● | | ● | | ● | | ● | | | | | | |
| | | | | | | | | | | | | ● | | | | |
| | | | | | | | | | | | | | | ● | | ● |
| | | ● | | ● | | ● | | ● | | ● | | ● | | | | |
| | | | | | | | | | | | | | | ● | | ● |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | | | | | | | | | | | | | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | | | | | | | | | | | | | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | | | | | | | | | | | | | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | | | | | | | | | | | | | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | |
| | | | | | | | | | | | ● | ● | | | | |
| | | | | | | | | | | | | | ● | ● | ● | ● |
| | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | |
| | | | | | | | | | | | ○ | ○ | | | | |
| | | | | | | | | | | | | | ○ | ○ | ○ | ○ |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | | | | | | | | | | | | | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | |
| | | | | | | | | | | | ● | ● | ● | ● | ● | ● |
| | 0.315 to 0.325 kg | 0.250 to 0.260 kg | 0.315 to 0.325 kg | 0.250 to 0.260 kg | 0.345 to 0.360 kg | 0.295 to 0.305 kg | 0.345 to 0.360 kg | 0.295 to 0.305 kg | 0.345 to 0.360 kg | 0.295 to 0.305 kg | 0.550 to 0.580 kg | 0.480 to 0.510 kg | | | | |
| | | | | | | | | | | | | | 0.640 to 0.670 kg | 0.640 to 0.670 kg | 0.830 to 0.860 kg | 0.720 to 0.750 kg |

∗5 These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.
∗6 These are the parts that are not included with HRS that are marked "(●)". But there is no problem to use.
∗7 These are replacement parts used to optional accessories that are marked "▲".

## Replacement Parts List

### ● Other replacement parts

| No. | Recommended stock parts | Names of parts | Parts number HRS-S□□□ HRZ-S□□□ HRG-S□□□ | Weight [kg] | Packaged qty | Unit |
|---|---|---|---|---|---|---|
| 147 | ■ | Extraction tool (J.S.T.) | HRS-S0055 | 0.010 | 1 | pcs. |
| 148 | ■ | Extraction tool (molex) | HRS-S0056 | 0.005 | 1 | pcs. |
| 149 | ■ | Label (For Operation display) | HRS-S0058 | 0.010 | 1 | pcs. |
| | | (Integration to No.13)(S/N TQ～) | | | | |
| 150 | ■ | Caster (4Pcs.) | HRS-S0059 | 0.24 | 4 | pcs. |
| 151 | ■ | Caster (4Pcs.)(for HRS050) | HRS-S0098 | 0.24 | 4 | pcs. |
| 152 | ■ | Packaging Materials set | HRS-S0060 | 20.0 | 1-5 | kit |
| 153 | ■ | Packaging Materials set | HRS-S0391 | 20.0 | 1-5 | kit |
| 154 | ■ | Packaging Materials set | HRS-S0151 | 27.0 | 1 | kit |
| 155 | ■ | Power supply connector omission prevention fittings | HRS-S0074 | 0.005 | 1 | kit |
| 156 | ■ | Drain Fitting | HRS-S0102 | 0.1 | 1 | pcs. |
| 157 | ■ | Sequence I/O command signal connector | HRS-S0103 | 0.01 | 1 | pcs. |
| 158 | ■ | Power supply connector | HRS-S0104 | 0.04 | 1 | kit |
| 159 | ■ | Ferrite core | HRS-S0105 | 0.03 | 1 | pcs. |
| 160 | ■ | Drain Plug set | HRS-S0132 | 0.03 | 1 | kit |
| 161 | | Condenser bracket | HRS-S0015 | 1.0 | 1 | kit |
| 162 | | Thermal insulator for heat exchanger | HRS-S0031 | 0.0 | 1 | kit |
| 163 | | Thermal insulator for copper pipe | HRS-S0032 | 0.1 | 1 | kit |
| 164 | | Base | HRS-S0061 | 2.6 | 1 | pcs. |
| 165 | | PT Thread Adaptor Set | HRS-S0073 | 0.3 | 1 | pcs. |
| 166 | | Quick manual | HRS-S0106 | 0.03 | 1 | vol. |
| 167 | | Alarm cord list label | HRS-S0107 | 0.01 | 1 | pcs. |
| 168 | | Accessory set | HRS-S0108 | 0.90 | 1 | kit |
| 169 | | Accessory set | HRS-S0109 | 0.80 | 1 | kit |

### ● Replacement parts for optional accessories

| No. | Recommended stock parts | Names of parts | Parts number HRS-S□ HRZ-S□ HRG-S□ | Weight [kg] | Packaged qty | Unit |
|---|---|---|---|---|---|---|
| 170 | | Divergence piping | HRS-S0100 | 0.3 | 1 | ass'y |
| 171 | ■ | Particle filter bracket | HRS-S0244 | 0.35 | 1 | kit |
| 172 | ■ | P.P.Depth Element (5 µmm) | EJ202S-005X11 | 0.083 | 1 | pcs. |
| 173 | ■ | P.P.Depth Element (5 µmm) | EJ302S-005X11 | 0.083 | 1 | pcs. |
| 174 | | P.P.Depth Element (75 µmm) | EJ202S-075X11 | 0.165 | 1 | pcs. |
| 175 | | P.P.Depth Element (75 µmm) | EJ302S-075X11 | 0.165 | 1 | pcs. |
| 176 | ■ | Water leakage detector (For drain pan set) | HRS-S0215 | 0.06 | 1 | ass'y |
| 177 | | DI Sensor | HRS-S0419 | | 1 | ass'y |
| 178 | | DI Sensor for control | HRS-S0420 | | 1 | ass'y |
| 179 | | Electrical conductivity Sensor | HRS-S0424 | | 1 | ass'y |
| 180 | | Electrical conductivity Sensor for control | HRS-S0425 | | 1 | ass'y |

∗1 These are recommended stock for replacement parts that are marked "■".
∗2 These are replacement parts of the standard specification used in HRS that are marked "●".
∗3 These are replacement parts of the option specification used in HRS that are marked "○".
∗4 These are recommended stock for replacement parts of 100 VAC specifications that are marked "□".

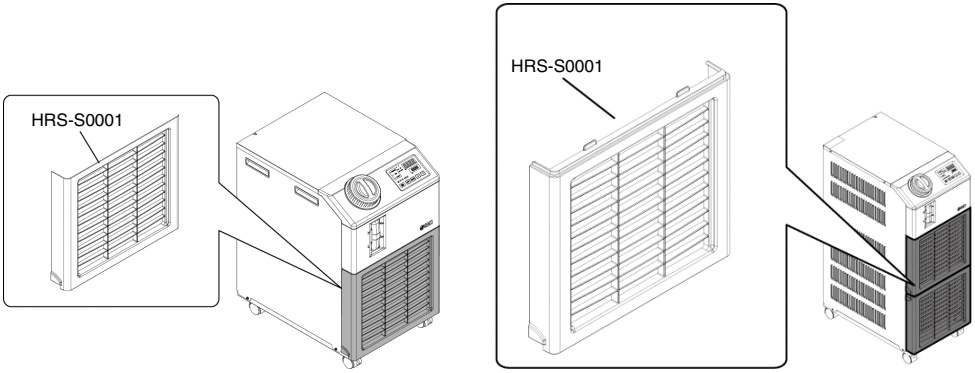
| | Applicable models of HRS | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HRS□□□-□-10 | | | | HRS□□□-□-20 | | | | | | | | | | | |
| | 012-A | 012-W | 018-A | 018-W | 012-A | 012-W | 018-A | 018-W | 024-A | 024-W | 030-A | 030-W | 050-A | 050-W | 060-A | 060-W |
| | ×*8 | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | | | | | | | | | | | | | | | | |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | | | | | | | | | | | | | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | |
| | | | | | | | | | | | ● | ● | | | | |
| | | | | | | | | | | | | | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | ● | | ● | | ● | | ● | | ● | | | | | | | |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | |
| | | | | | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | |
| | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | (●)*6 | (●) | (●) | (●) | (●) | (●) |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | |
| | | | | | | | | | | | | | ● | ● | ● | ● |

| | Applicable models of optional accessories | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HRS-□□□□□ | | | | | | | | | | | |
| | DP001 | PF002 | PF001 | PF002 | WL001 | WL002 | DI001 | DI003 | DI004 | DI005 | DI008 | DI009 |
| | ▲*7 | ▲ | | | | | | | | | | |
| | | | ▲ | ▲ | | | | | | | | |
| | | | ▲ | | | | | | | | | |
| | | | | ▲ | | | | | | | | |
| | | | ▲ | | | | | | | | | |
| | | | | ▲ | | | | | | | | |
| | | | | | ▲ | ▲ | | | | | | |
| | | | | | | | ▲ | | ▲ | | | |
| | | | | | | | | ▲ | | ▲ | | |
| | | | | | | | | | | | ▲ | |
| | | | | | | | | | | | | ▲ |

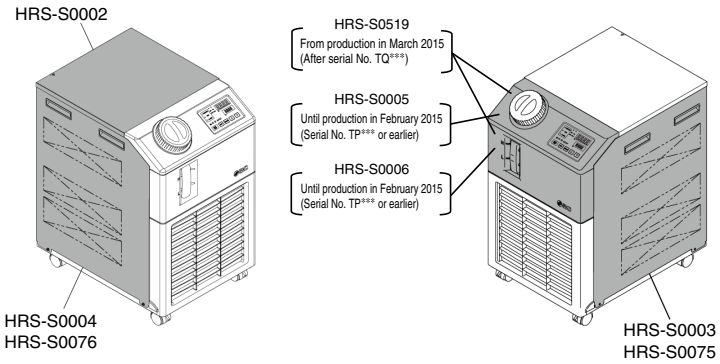
*5 These are replacement parts of the standard specification or option specification used in HRS that are marked "●/○". It is used by setting the program.
*6 These are the parts that are not included with HRS that are marked "(●)". But there is no problem to use.
*7 These are replacement parts used to optional accessories that are marked "▲".
*8 These parts that are marked "×" are not used in HRS. But can be used as tools or piping material at the time of replacement work.

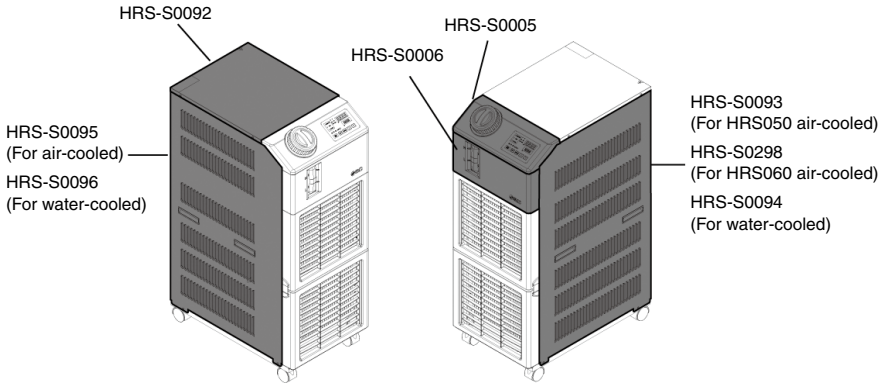
## Illustration of Replacement Parts

### Dustproof filter



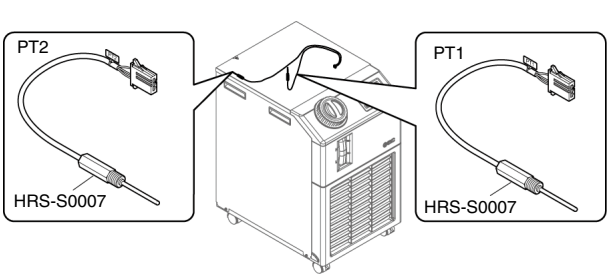

### Panel

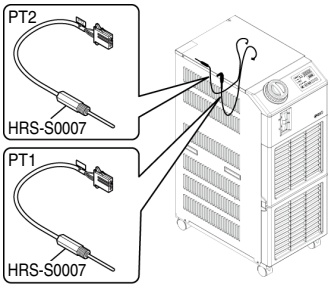


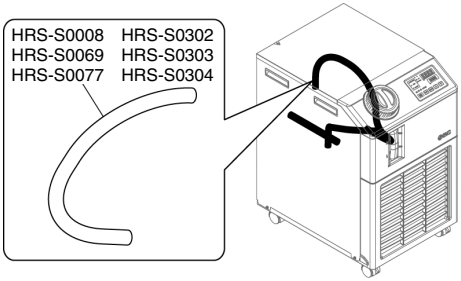
## Illustration of Replacement Parts

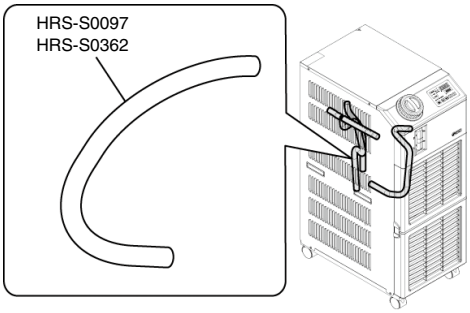
### Temperature sensor



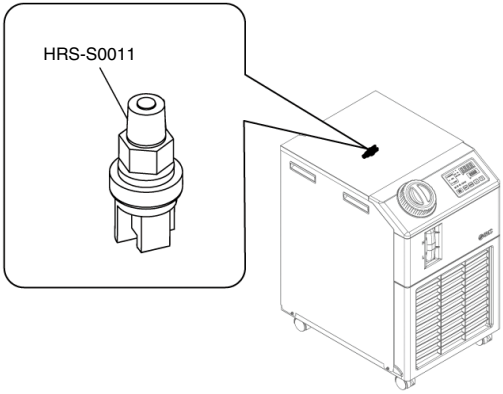

### Hose

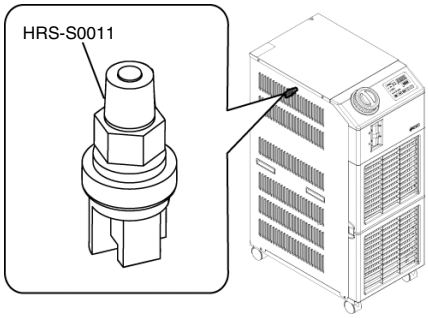


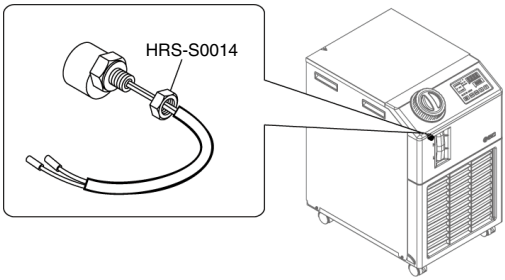
## Illustration of Replacement Parts

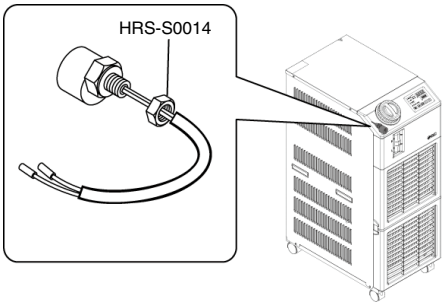
### ● Pressure sensor (For circulating fluid)



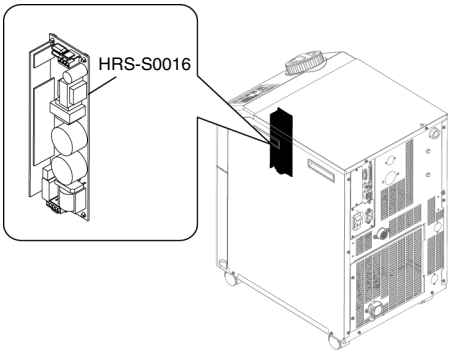

### ● Level switch

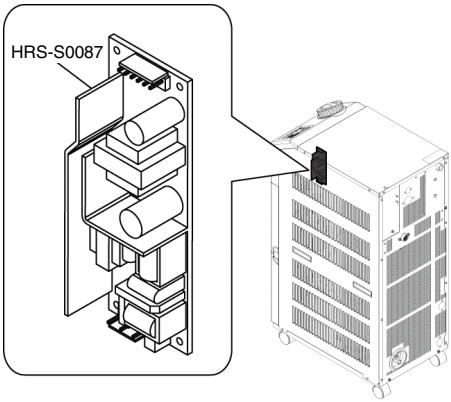


## Illustration of Replacement Parts

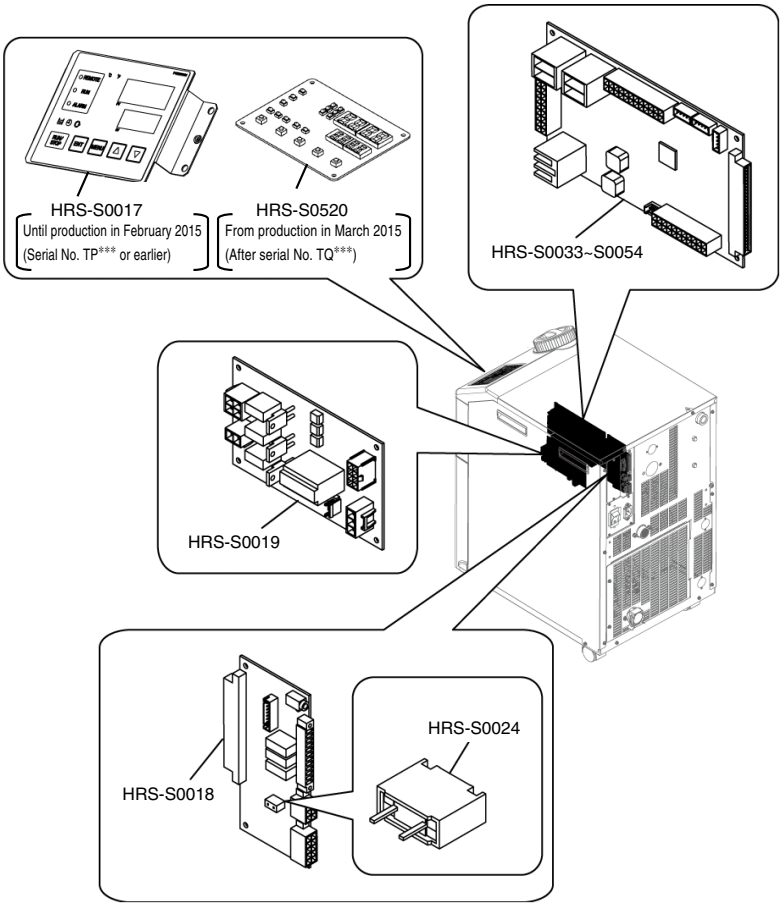
### DC power supply



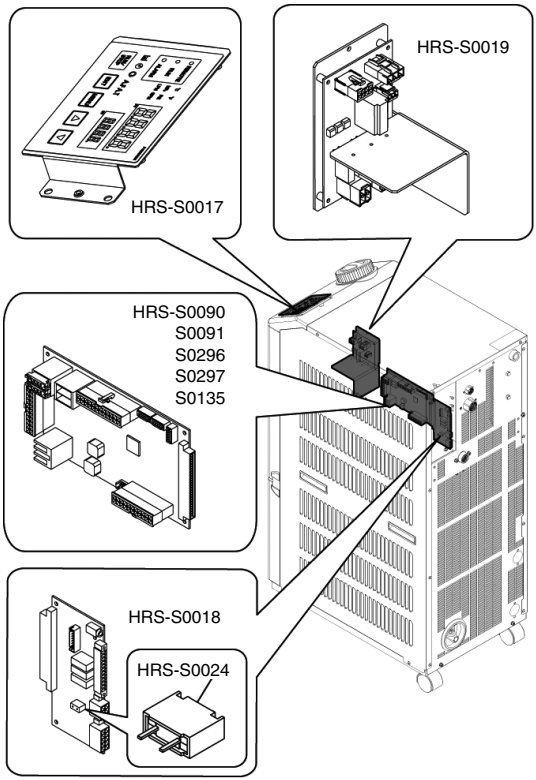
## Illustration of Replacement Parts

### Main board / Communication board / Power board / Display board / Fuse



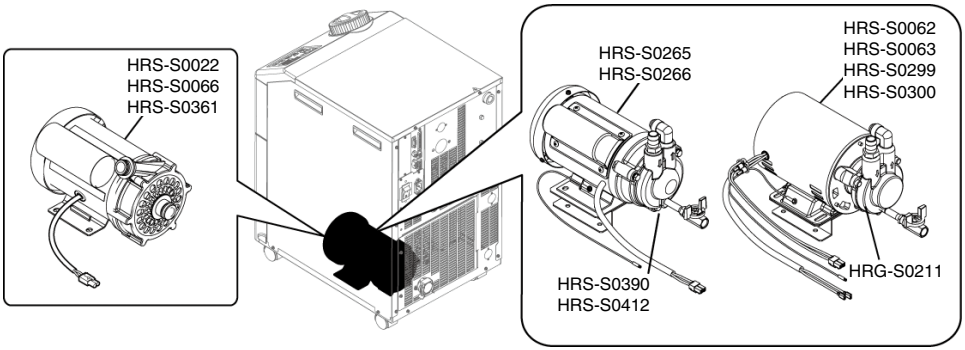
## Illustration of Replacement Parts

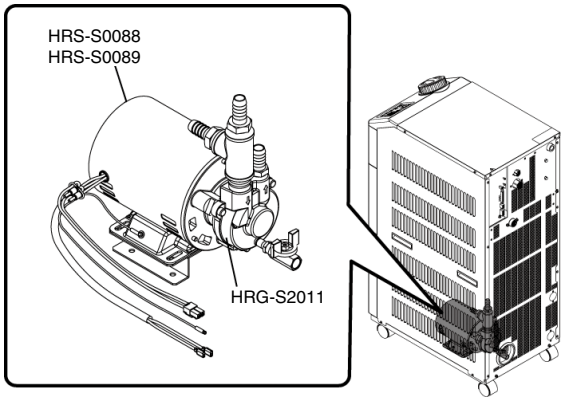
### ● Main board / Communication board / Power board / Display board / Fuse



## Illustration of Replacement Parts

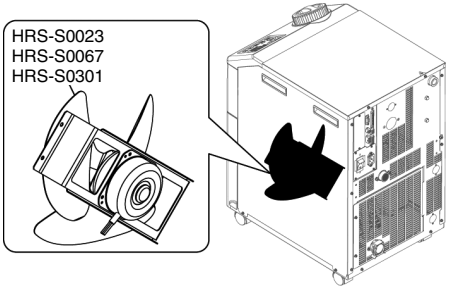
### Pump

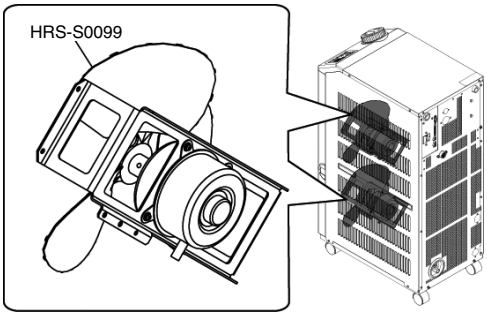


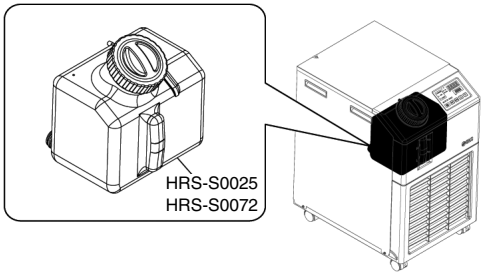
## Illustration of Replacement Parts

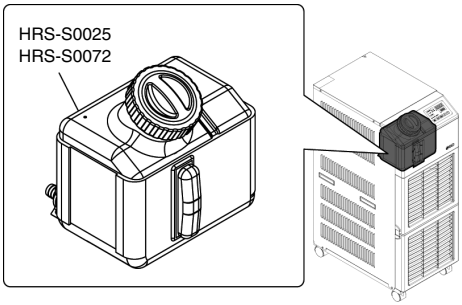
### Fan



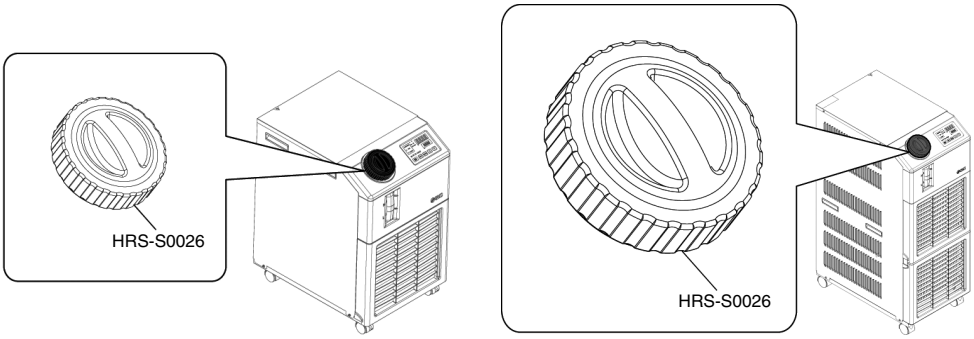

### Tank



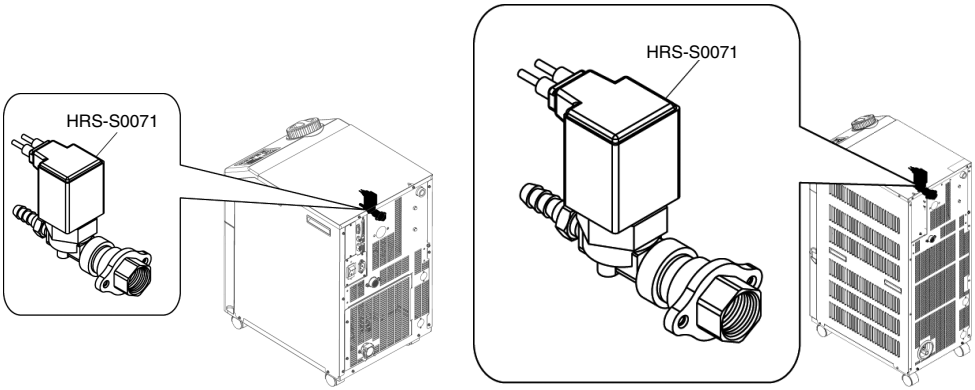



## Illustration of Replacement Parts

### Tank lid

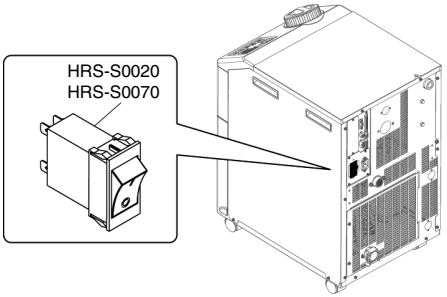



### Valve for automatic water fill

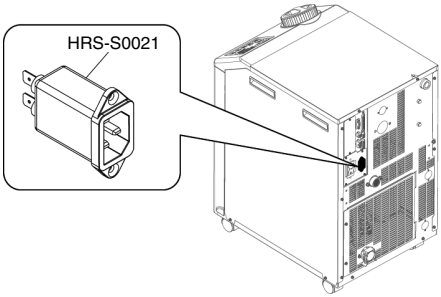


## Illustration of Replacement Parts

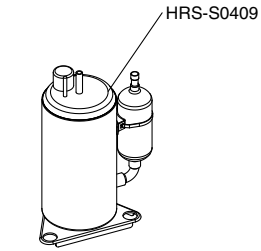
### Power switch

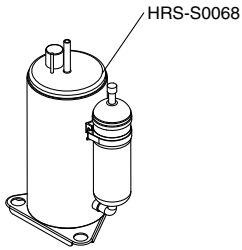


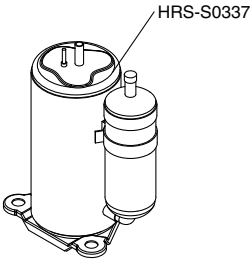

### Inlet socket

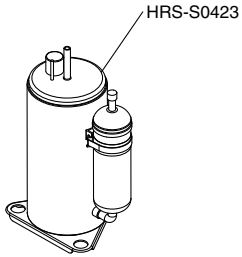



### Compressor



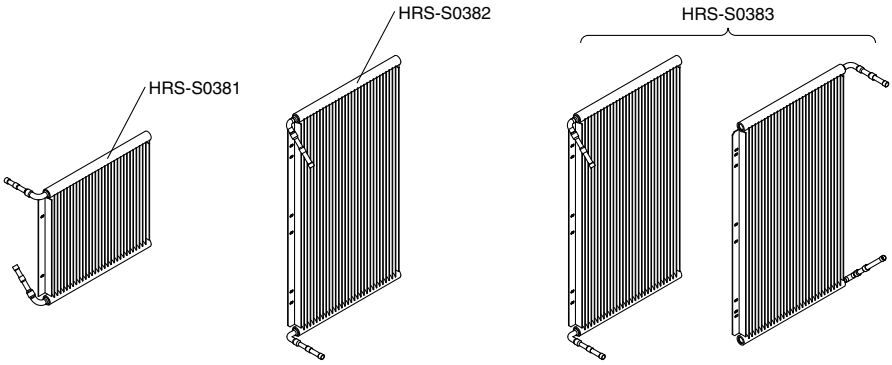



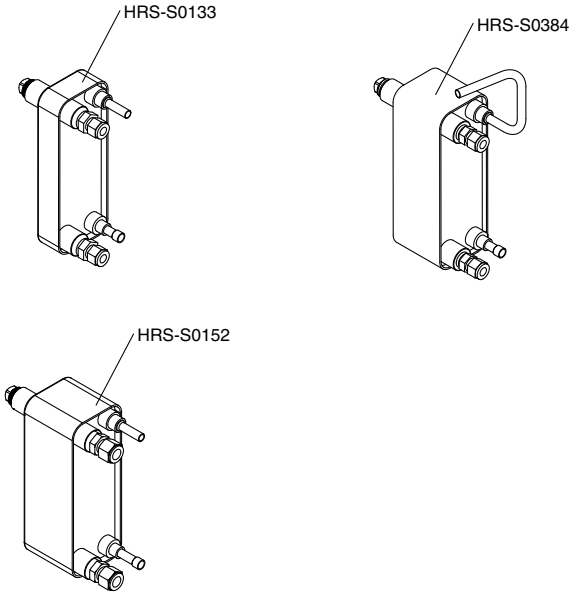



## Illustration of Replacement Parts

### Condenser (For air-cooled type)

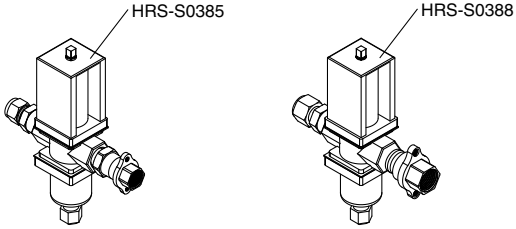



### Heat exchanger (For water-cooled type)

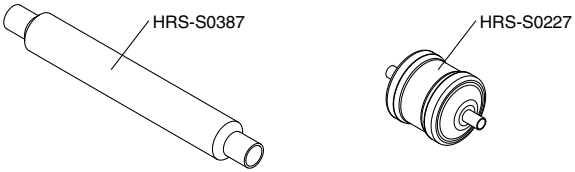


## Illustration of Replacement Parts

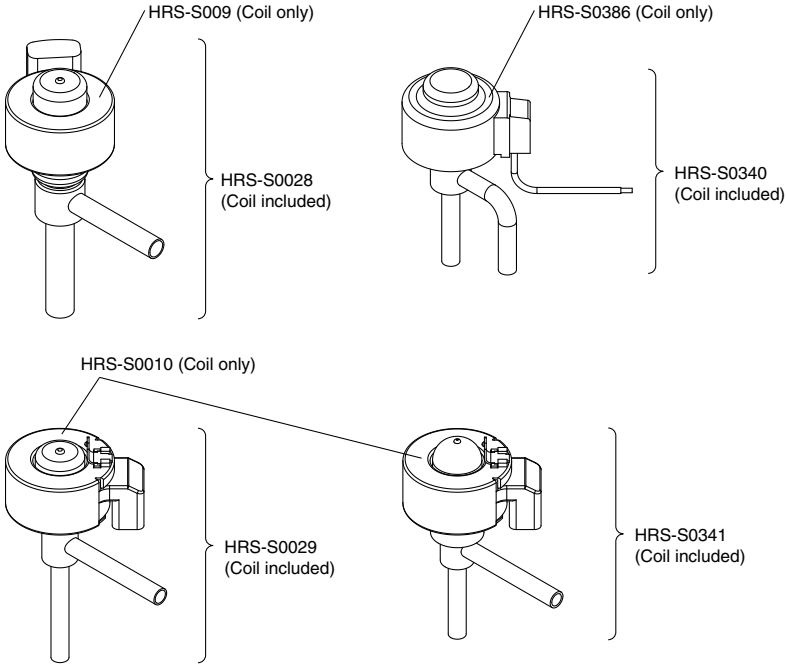
### Water regulating valve




### Filter drier

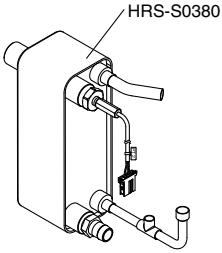


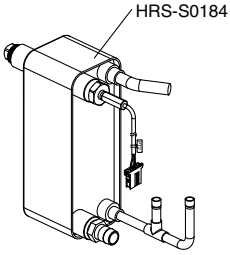

### Electronic expansion valve, Electronic expansion valve coil

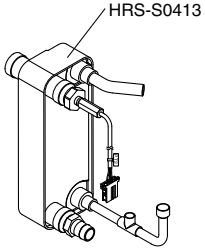


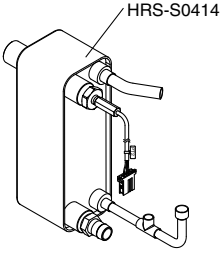
## Illustration of Replacement Parts

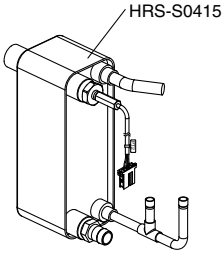
### Heat exchanger



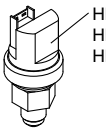



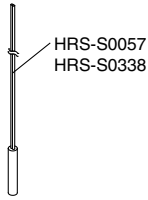




### Pressure sensor (For refrigerant)




### Thermistor sensor



## Parts Replacement Cycle

We recommend that you replace the parts according to the cycle specified in the table below so that you can extend the service life of your thermo-chiller.

| Description | | No. note) | Reason for recommendation | Replacement cycle |
|---|---|---|---|---|
| Pump mechanical seal (For option T: High pressure pump) | | 45 to 47 | Wear of the mechanical seal will lead to an increase in the leakage rate. (The mechanical seal may need to be replaced when the leakage rate exceeds 3 cc per hour.) | 6000 to 8000 hours (Normally 1 year) |
| Solenoid valve for automatic water fill (For option J: With automatic water fill function) | | 107 | Deterioration of the diaphragm will lead to a decrease in the opening and closing performance of the valve. | 24 months |
| Circulating pump | | 34 to 44 | Wear of the bearing will lead to a decrease in the circulating fluid flow rate. | 36 months |
| Cooling fan (For air-cooled type) | | 48 to 51 | Wear of the bearing will lead to a decrease in heat radiation efficiency. | |
| Electronic expansion valve | | 129 to 132 | Deterioration of the device will lead to a decrease in temperature control performance. | |
| Seal, O-ring | | — | Deterioration will lead to a decrease in seal performance. | |
| Dustproof filter | | 1 | Clogging will lead to a decrease in air vent performance. | |
| Compressor | | 115 to 118 | Wear of the bearing or compressed section (sliding section) will lead to a decrease in cooling capacity. | 72 months |
| Parts for refrigerant circuit | Heat exchanger assembly | 136 to 141 | Deterioration of the device will lead to a decrease in temperature control performance. | |
| | Condenser (Air-cooled) | 119 to 121 | | |
| | Condenser (Water-cooled) | 122 to 124 | | |
| | Filter drier | 127, 128 | | |
| | Water regulating valve | 125, 126 | | |
| Electrical boards | Display board | 28 | Failure to replace the parts will lead to a decrease in display function and/or operability. Deterioration of the board or mounted components will lead to a decrease in function. | |
| | Main board | 56 to 106 | | |
| | Communication board | 29 | | |
| | Power board | 30 | | |
| | DC power supply | 26, 27 | | |
| Electrical components | Earth leakage breaker (For option B or BT) | 109 to 114 | Wear or fixation of the sliding section will lead to a decrease in operating function. Deterioration of the condenser will lead to a decrease in control power supply function. | |
| Sensors | Temperature sensor | 15 | Deterioration will lead to a decrease in function. | |
| | Pressure sensor (For circulating fluid) | 24 | | |
| | Pressure sensor (For high pressure) | 142, 144 | | |
| | Pressure sensor (For low pressure) | 143 | | |
| | Level switch | 25 | | |
| | Thermistor sensor | 145, 146 | | |
| Parts for circulating fluid circuits | Hose | 16 to 23 | Deterioration will lead to a decrease in function. | |
| Other | Fuse | 52 | When replacement is required based on the inspection results | |
| | Upper panel | 2, 3 | | |
| | Right side panel | 4 to 8 | | |
| | Left side panel | 9 to 12 | | |
| | Front panel | 13, 14 | | |
| | Tank | 53, 54 | | |
| | Tank lid | 55 | | |
| | Electronic expansion valve coil | 133 to 135 | | |
| | Caster (4 pcs.) | 150, 151 | | |
| | Drain fitting | 156 | | |
| | Drain plug set | 160 | | |
| | Power supply connector | 158 | | |
| | Sequence I/O command signal connector | 157 | | |
| | Quick manual | 166 | | |
| | Alarm cord list label | 167 | | |
| | Accessory set | 168, 169 | | |

Note) Numbers correspond to those in the replacement parts list on pages 91 to 98

# I. Product Warranty

## 1. Period

The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.

The warranty period of service parts (replacement parts) is 0.5 years after replacement.

## 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.

Any damage incurred by the failure is not our responsibility.

## 3. Content

1. 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.
2. We guarantee that the product does not have any defects in components, materials or assembly.
3. We guarantee that the product complies with the outline dimensions provided.
4. 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 periodic inspection) 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) Sensory phenomena that are considered no effect on the functions (such as noise, vibration).
   (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. Disclaimer

The following are not covered by this warranty.

(1) Expenses for daily checks and periodic inspection
(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**”.

**Product Warranty**

### 5. 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.

### 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 periodic inspection) 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.

## II. Special Instructions

Instructions before the use of this unit

(1) This unit is designed to be installed and operated in an industrial environment and used with a production facility.
(2) This manual is intended to show the independent specifications of this unit.
In order to prevent unexpected failure, read and understand the contents of this manual and Operation Manual carefully and perform sufficient evaluation under the various possible operating conditions with your system connected before operating this unit.
(3) This product is for indoor use. It cannot be used outdoors.
(4) Clean room specifications are not applied to this unit. The pump and ventilating fan installed in this unit generate dust particles.
(5) If this unit is used in a system where there is a high risk of damage to human life and equipment, or in an application which needs particular consideration of safety, operate this unit with safety margins added to rated values, performance etc., and take appropriate safety measures such as fail-safe measures.
(6) The construction of this unit is not suitable for suspension. When loading off the packaged unit or lifting this unit, it is necessary to use a forklift. Additionally, it is not acceptable to mount heavy objects onto this unit or stack two or more units.
(7) This unit is used to supply circulating fluid to the customer's system using an installed pump. Do not install any pump or other devices on your system to forcibly return the circulating fluid to this unit.

## Product Warranty

### ⚠ Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of **"Caution," "Warning"** or **"Danger."** They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)*1), and other safety regulations.

**⚠ Caution:** **Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

**⚠ Warning:** **Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

**⚠ Danger :** **Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

*1) ISO 4414: Pneumatic fluid power – General rules relating to systems.
ISO 4413: Hydraulic fluid power – General rules relating to systems.
IEC 60204-1: Safety of machinery – Electrical equipment of machines.
(Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots – Safety.
etc.

### ⚠ Warning

**1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.**
Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

**2. Only personnel with appropriate training should operate machinery and equipment.**
The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

**3. Do not service or attempt to remove product and machinery/ equipment until safety is confirmed.**
1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

**4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.**
1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

### ⚠ Caution

**1. The product is provided for use in manufacturing industries.**
The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

## Limited warranty and Disclaimer/ Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".
Read and accept them before using the product.

### Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.*2)
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

*2) **Vacuum pads are excluded from this 1 year warranty.**
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

### Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

### ⚠ Caution

**SMC products are not intended for use as instruments for legal metrology.**
Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country. Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

# 3 Quick Manual and Check Sheets

# Quick Manual

## Read before using

Thank you for purchasing SMC's thermo-chiller (hereinafter referred to as the "product"). This "Quick Manual" (hereinafter referred to as this "manual") briefly explains the procedures to start and stop the product and reset its alarms. Read this manual as well as the Operation Manual attached before using.

## Safety Instructions

- Read and understand Safety Instructions carefully for proper use.
- In these instructions, warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury. Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury. Make sure to follow every instruction since they are important for safety.
- The symbols used in this manual have the following meanings.

| | |
|---|---|
| Don'ts | Dos |

**⚠ Warning**

- Do not service machinery/equipment or attempt to remove the product until safety is confirmed. In particular, before restarting the product, ensure that safety measures are taken.
- The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.
- Only personnel with appropriate training should operate machinery and equipment.
- The product can be dangerous when handled incorrectly.
- The piping, wiring, operation and maintenance of machines or equipment using this product must be performed by an operator who is appropriately trained and experienced.
- When the product is installed on equipment in conjunction with atomic energy, railways, air navigation, space, vehicles, medical treatment, or equipment in contact with food and beverages, or used for applications which could have negative effects on people, property, or animals requiring special safety analysis, give consideration to safety measures and contact SMC beforehand.

**⚠ Caution**

- Do not use the product outdoors. If the product is subjected to rain or water splash it may cause electrical shock, fire or failure.
- Do not use the product in an area of high temperature and humidity which cannot be exhausted, or where it is exposed to corrosive substances. Cooling failure can result.
- Do not handle the power supply connector and switch with wet hands. Electrical shock can result.
- Read the catalog and Operation Manual carefully. Keep to the specified procedures and within specified ranges.
- This product is heavy (over 40kg). When transferring the product with casters or handles, pay attention to slopes on the route and the risk of dropping the product.
- Select piping applicable to the operating pressure range. Otherwise, it can cause fluid leakage or rupture.
- Use fresh water or ethylene glycol aqueous solution (concentration of 15% or less) as the circulating fluid.
- For the precautions for handling the circulating fluid, get the Material Safety Data Sheet from the manufacturer and read it.

## 1. Name of Parts and Accessories

- Check the enclosed accessories with the delivered thermo-chiller.

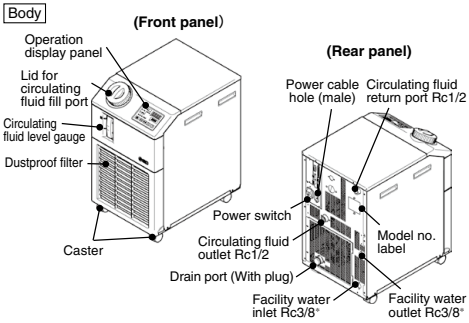
Accessories

| | | | |
|---|---|---|---|
| 1 | Quick manual (this manual) |  | 1 (with a clear cover) |
| 2 | Alarm code list label |  | 1 |
| 3 | Operation Manual |  | 1 |
| 4 | Power supply connector |  | 1 |
| 5 | Sequence I/O command signal connector* |  | 1 |
| 6 | Fitting (for drain port)* |  | 1 |
| 7 | Ferrite core* |  | 1 |

*These accessories are not explained in this manual.
For details, read the Operation Manual attached.

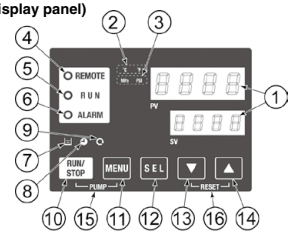
- **The names of parts used in this manual are as follows.**

Body



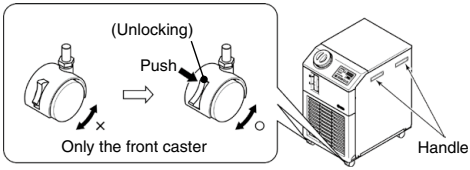

*Water-cooled refrigeration type HRS□□□-W

(Operation display panel)




## 2. Transportation, Transfer and Moving

1) Be sure to unlock the caster (only at the front wheel).
   There is no lock function with the rear casters.
2) Push the left and right panels with the handle and move.
3) Use corners when pushing the front or rear panel. Pushing at the center can deform the panel.



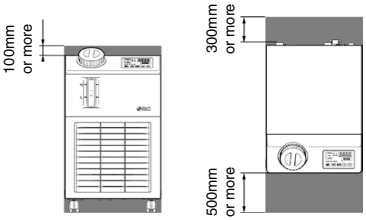
| No | Description | Function | |
|---|---|---|---|
| 1 | Digital display (7-segment,4 digits) | PV | Displays the temperature and pressure of the circulating fluid and alarm codes. |
| | | SV | Displays the discharge temperature of the circulating fluid and the set values of other menus. |
| 2 | [°C] [°F] lamp | Equipped with a unit conversion function. Displays the unit of display temperature (default setting °C). | |
| 3 | [MPa] [PSI] lamp | Equipped with a unit conversion function. Displays the unit of display pressure (default setting MPa). | |
| 4 | [REMOTE] lamp* | Enables the remote operation (start and stop) by communication. Lights up during remote operation. | |
| 5 | [RUN] lamp | Lights up when the product is started and in operation. Goes off when the product is stopped.Flashes during stand-by for stop or anti-freezing function, or independent operation of the pump. | |
| 6 | [ALARM] lamp | Flashes with buzzer when alarm occurs. | |
| 7 | [ ] lamp | Lights up when the surface of the level indicator falls below the LOW level. | |

| No | Description | Function |
|---|---|---|
| 8 | [ ] lamp* | Lights up while the run timer or stop timer function is working. |
| 9 | [ ] lamp* | Lights up when the product is in automatic operation. |
| 10 | [RUN/STOP] key | Makes the product start or stop. |
| 11 | [MENU] key* | Shifts the main menu (display screen of temperature) and secret menu (entry of set values and monitor screen). |
| 12 | [SEL] key* | Changes the item in menu and enters the set value. |
| 13 | [▼] key | Decreases the set value. |
| 14 | [▲] key | Increases the set value. |
| 15 | [PUMP] key | Keep the [MENU] and [RUN/STOP] keys pressed down simultaneously. The pump starts running independently to make the product ready for start-up (release the air). |
| 16 | [RESET] key | Keep the [▼] and [▲] keys pressed down simultaneously. This will stop the alarm buzzer and reset the [ALARM] lamp. |

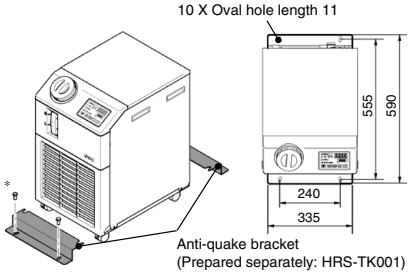
*These lamps and keys are not used in this manual.
For details, read the Operation Manual attached.

## 3. Mounting and Installation

1) Select a flat place applicable to the weight of the product for moving.
2) Install the product so that there are no obstacles in the work space for setting up and servicing, or blocking the radiation at the inlet and outlet of ventilation.



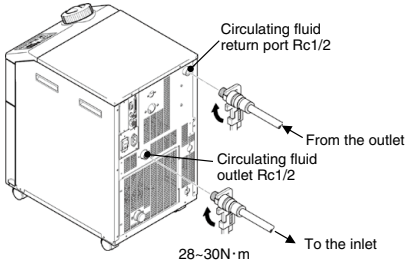

3) After moving, lock the caster at the front wheel again.
4) Fix the product to the floor or base using the anti-quake bracket (prepared separately).



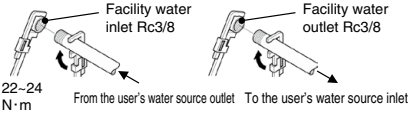

*The Anchor bolts are not attached. To be prepared by the user.

## 4. Piping

1) Connect the circulating fluid return port with the user's machine outlet.
2) Connect the circulating fluid discharge port with the user's machine inlet.

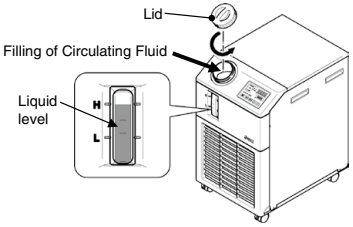



**<Water-cooled refrigeration type HRS□□□-W>**
1) Connect the facility water inlet with the user's water source outlet.
2) Connect the facility water outlet with the user's water source inlet.




## 5. Filling of Circulating Fluid

1) Check the drain port is plugged or closed by the valve to prevent the supplied circulating fluid from draining out.
2) Turn the lid for the circulating fluid fill port counterclockwise to open, and fill the circulating fluid up to "H" of the level indicator scale.
3) After filling to the specified level, turn the lid clockwise to close.



## 6. Wiring of Power Supply

**⚠ Warning**

- The electrical facilities should be installed and wired in accordance with local laws and regulations of each country and by the person who has knowledge and experience.
- Check the power supply. Operation with voltages, capacities, frequencies and cable sizes other than those specified can cause heat, fire and electrical shock.
- Wire with an applicable cable size and terminal.

**⚠ Caution**

- Use an individual socket or earth leakage breaker.
- Be sure to provide grounding. Incomplete grounding can cause failure and electrical shock.

### Preliminary preparation for wiring.

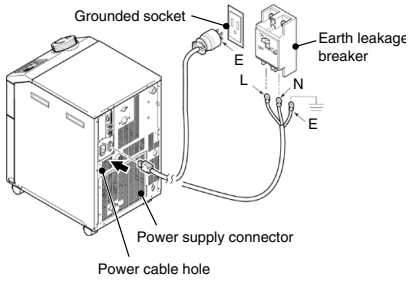
1) Prepare the cable and individual socket or earth leakage breaker shown in the table below.
2) Strip the sheath from both ends of the cable.
3) Disassemble the power supply connector (supplied as an accessory) and mount one end of the cable to the L, N and E terminals and reassemble the power supply connector.
4) Connect the other end of the cable to a plug or crimped terminal that is connectable to the secondary side of the earth leakage breaker.

| HRS model | Power supply voltage | Rated voltage [V] | Rated current [A] | Sensitivity of leak current [mA] | Cable qty. x size |
|---|---|---|---|---|---|
| **HRS012-□□-10**<br>**HRS018-□□-10** | 1-phase 100V AC (50/60 Hz)<br>1-phase 115 V AC (60 Hz) | Recommended earth leakage breaker | | | 3 cores x 14AWG (3 cores x 2.0 mm²) *including ground |
| | | 100<br>200<br>Sharing | 15 | 15<br>or<br>30 | |
| | | Recommended plug | | | |
| | | 125 | 15 | — | |
| **HRS012-□□-20**<br>**HRS018-□□-20**<br>**HRS024-□□-20**<br>**HRS030-□□-20** | 1-phase 200-230V AC (50/60 Hz) | Recommended earth leakage breaker | | | |
| | | 200,<br>230 | 10 | 30 | |
| **HRS0□□-□□-20-□□T**<br>(If option【high head pump】is used.) | | | 15 | 30 | |

### Wiring of power supply

1) Insert the power supply connector to the power cable hole.
2) Connect the plug or crimped terminal to the individual grounded socket or the secondary side of the earth leakage breaker and grounding.
3) Turn on the breaker, etc. of the facility power supply and energize the product.

1-phase AC100 V, 115 V or AC200-230 V



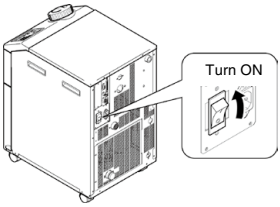

## 7. Start, Stop and Temperature Setting

### Preliminary preparation for start-up.

**Supply of power**

1) Turn on the power switch.

⇒The initial screen (HELLO) will be displayed for approx. 8 seconds on the operation panel, and changed to the display of the circulating fluid discharge temperature (main menu).

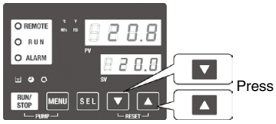



**Air release**

1) Press the [PUMP] key ([RUN/STOP] key and [MENU] key simultaneously). The [RUN] lamp flashes and only the pump continues to operation. This operation allows the discharge of the circulating fluid, and enables checking leakage from the piping and air release.
2) At this time, the fluid level can lower and cause the alarm “AL01; Low tank level”, which will lead to the stop of the product.
3) In that case, check that there is no leakage from the user's piping, fill the circulating fluid as specified in “5.Filling of Circulating Fluid” and take necessary actions in “8.How to Reset Alarms”.
4) Repeat steps 1) to 3) until the alarm (“AL01; Low tank level”) is no longer generated.

**Temperature setting**

1) Press the [▼] and [▲] keys to change the SV to the required value.

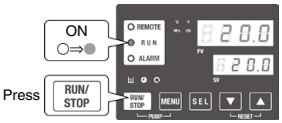



(e.g.) “Set value of circulating fluid discharge temperature” 20.0°C (Default value)

### Start of the product

1) Keep the [RUN/STOP] key pressed for approx. 2 seconds.

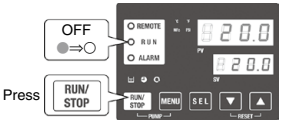
⇒The [RUN] lamp lights up (in green) and the product starts running.
The circulating discharge temperature (PV) is controlled to the set temperature (SV).




### Stop of the product

1) Keep the [RUN/STOP] key pressed for approx. 2 seconds.

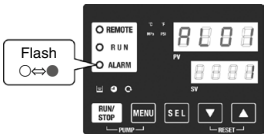
⇒The [RUN] lamp flashes (in green) and continues the operation until the product is ready to stop. After approx. 10 seconds, the [RUN] lamp goes off and the product stops.



### 8. How to Reset Alarms

**⚠ Caution**

- Should some error occur, the [ALARM] lamp flashes (in red) and the buzzer sounds to inform the user of the error. Also, the alarm code will be displayed on the operation panel so that the cause can be checked on "9. Alarm Code List".




- Before resetting the alarm, read the "Cause and Remedy" of "9. Alarm Code List" and eliminate the cause explained there. Otherwise, the same alarm may be repeated.
- As accessories, the clear cover (for this manual) and alarm code list label are enclosed. Stick the label to the panel to check the content of alarm codes.

**● Reset of alarm**

1) Press the [RESET] key ([▼] and [▲] keys simultaneously).
→The buzzer and then [ALARM] lamp (red) go off.


### Before requesting service

Should some error occur, the user will be informed by the alarm (for warning). Check the cause and restart the product after eliminating it. If the same alarm is repeated frequently, or multiple alarms occur at the same time, which is obviously abnormal compared to the past performance of the product, contact the retailer or SMC sales representative where you purchased the product.

**SMC Corporation**
Address: 4-14-1 Sotokanda, Chiyoda-ku, Tokyo 101-0021, Japan
TEL: +81 3 5207 8249 FAX : +81 3 5298 5362
URL: http://www.smcworld.com


### 9. Alarm Code List

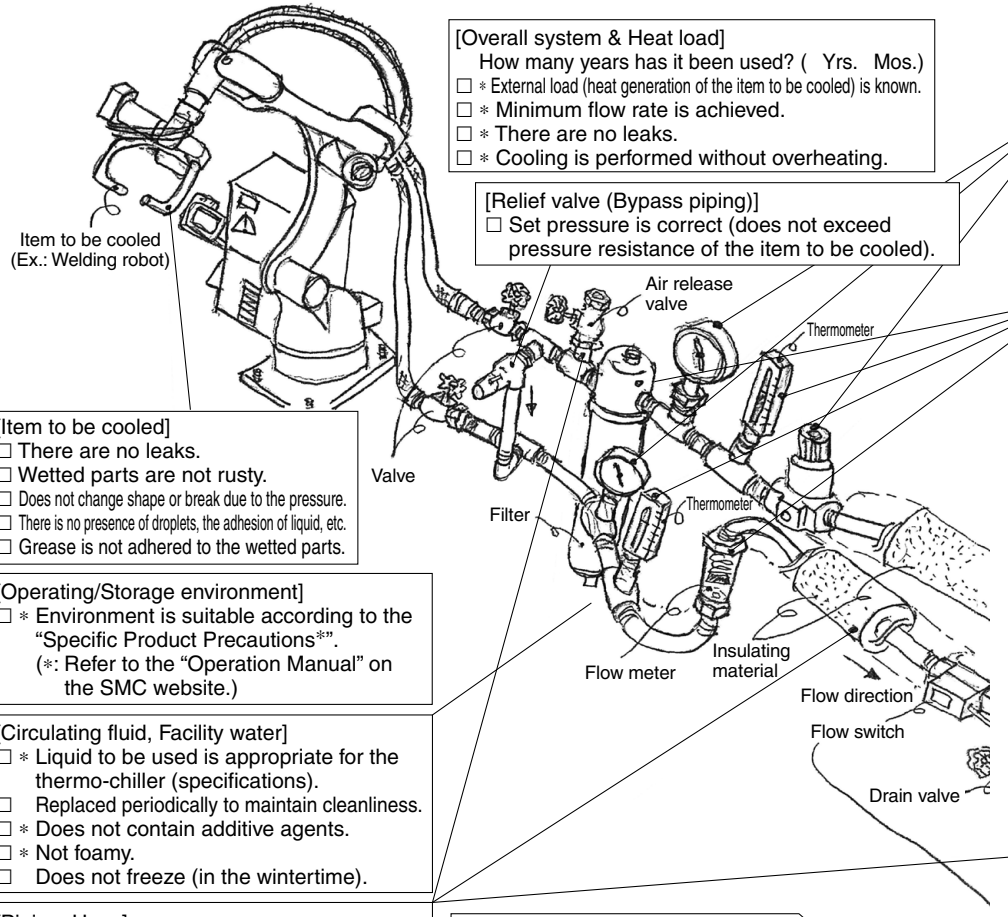
| Alarm code | Description | Operation | Cause/Remedy (Press the reset key after eliminating the cause.) |
|---|---|---|---|
| AL01 | Low level in tank | Stop*1 | The fluid level has fallen below the level indicator. Fill the circulating fluid. |
| AL02 | High circulating fluid discharge temp. | Stop | · Reduce the ambient temperature or heat load.<br>· 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 | · Check the circulating fluid flows.<br>· 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, squash and foreign matters. |
| AL09 | Circulating fluid discharge pressure drop | Continued*1 | Restart and check the pump is operating. |
| 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.<br>· Check the circulating fluid in the evaporator has not frozen. |
| 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. |
| 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*2 | Communication error*2 | 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 | Ask for the service of the fuse of the DC circuit. |
| AL22 | Circulating fluid discharge temp. sensor failure | Stop | The temperature sensor is short-circuited or opened.<br>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.<br>Ask for the service of the pressure sensor. |
| AL26 | Compressor discharge pressure sensor failure | Stop | |
| AL27 | Compressor intake pressure sensor failure | Stop | |
| AL28 | Maintenance of pump | Continued | The timing of a periodical check is informed.<br>Recommended to ask for the check and service of the pump, fan motor and compressor. |
| AL29*3 | Maintenance of fan motor*3 | Continued | |
| AL30 | Maintenance of compressor | Continued | |
| AL31*2 | Contact input1 Signal detection | Stop*1 | Contact input is detected. |
| AL32*2 | Contact input2 Signal detection | Stop*1 | |

*1 "Stop" or "Continued" are default setting. The user can changed to "Continued" and "Stop". For details, read the Operation Manual attached.
*2 "AL19, AL31, AL32" is disabled in the default setting. When this function needs to be enabled, refer to the Operation Manual attached.
*3 HRS□□□-A-□□ (Air-cooled refrigeration type).
*4 Refer to the "Operation Manual" (separate sheet) for other alarms.

## Piping Check Sheet

Please enter an "○" for Yes and "×" for No.

Be sure to check the items with a " ∗ " for trouble during a trial run.




[Overall system & Heat load]
How many years has it been used? ( Yrs. Mos.)
☐ ∗ External load (heat generation of the item to be cooled) is known.
☐ ∗ Minimum flow rate is achieved.
☐ ∗ There are no leaks.
☐ ∗ Cooling is performed without overheating.

[Relief valve (Bypass piping)]
☐ Set pressure is correct (does not exceed pressure resistance of the item to be cooled).

[Item to be cooled]
☐ There are no leaks.
☐ Wetted parts are not rusty.
☐ Does not change shape or break due to the pressure.
☐ There is no presence of droplets, the adhesion of liquid, etc.
☐ Grease is not adhered to the wetted parts.

[Operating/Storage environment]
☐ ∗ Environment is suitable according to the "Specific Product Precautions∗".
(∗: Refer to the "Operation Manual" on the SMC website.)

[Circulating fluid, Facility water]
☐ ∗ Liquid to be used is appropriate for the thermo-chiller (specifications).
☐ Replaced periodically to maintain cleanliness.
☐ ∗ Does not contain additive agents.
☐ ∗ Not foamy.
☐ Does not freeze (in the wintertime).

[Piping, Hose]
☐ Air is not trapped.
☐ An air vent (normally closed) is provided at the top.
☐ A drain valve (normally closed) is provided at the bottom.
☐ No condensation or freezing.
☐ Not bent or crushed.

[Valve, Bypass piping]
☐ Flow direction is correct.
☐ Aperture of the diaphragm (open/close) is appropriate.

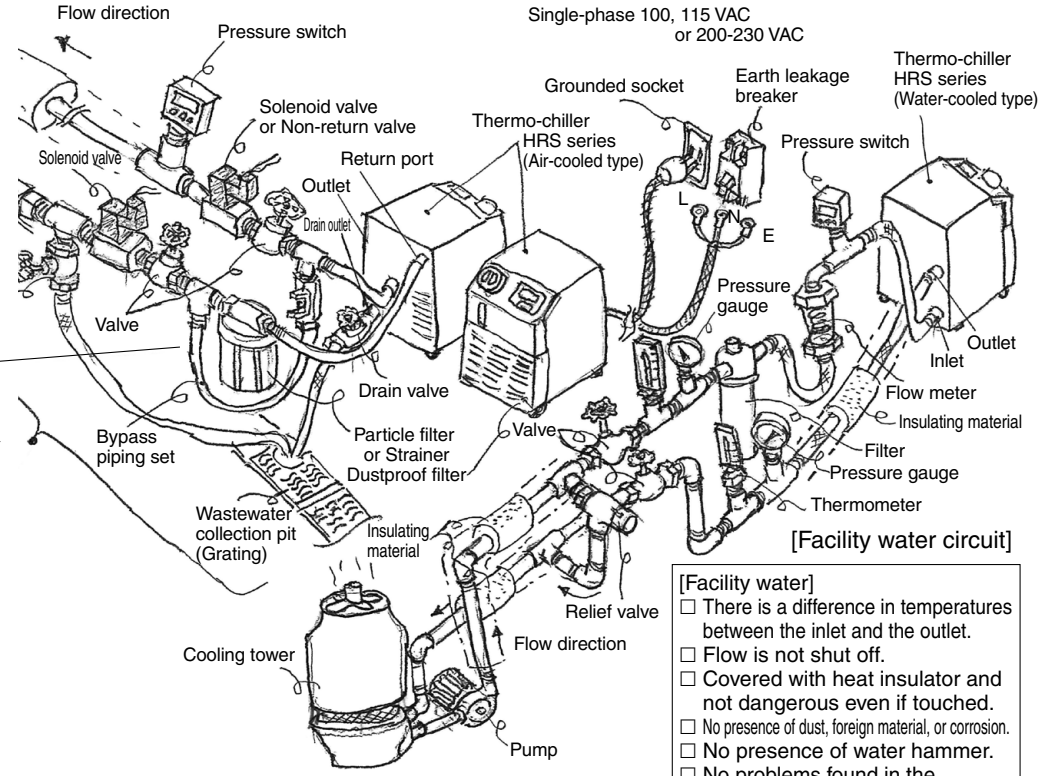
[Thermo-chiller, Peripheral equipment]
☐ Liquid level in the tank is appropriate.
☐ Power is supplied at a stable voltage.
☐ Dustproof filter is not dirty or clogged.
☐ Leaks from the pump (mechanical seal) are within the permissible level.
☐ Bypass piping is provided to achieve the minimum flow rate.
☐ A check valve or solenoid valve is provided at the outlet port to prevent back flow.
☐ A solenoid valve is provided at the return port to prevent the liquid from spilling.
☐ Installation space (maintenance space) is sufficient.
☐ Numerical values on the inspection monitor screen are correct. (Refer to page 123.)
☐ Alarm codes are checked (noted) if alarms are generated.
☐ (For -T, HRS050/060) A particle filter is provided.

[Regulator, Pressure gauge]
☐ ∗ Flow direction (IN-OUT) is correct.
☐ ∗ Pressure can be set.
☐ ∗ Set pressure (85% or less of the primary pressure) is correct.
☐ ∗ Bonnet seal is not loose.
☐ ∗ There are no external leaks.
☐ ∗ Pressure gauge does not show unusual deflection.

[Filter, Flow meter, Thermometer]
☐ No impurities in element
☐ Flow rate required for the item to be cooled is achieved.
☐ ∗ Flow rate and temperature have validity. (Heat generation of item to be cooled [kw] = 70 x Flow rate [L/min] x Difference in temperature [°C])

[Power supply]
☐ Electrical circuits are not overloaded.
☐ A power supply exclusively for the chiller is provided.
☐ Power supply capacity (circuit breaker size) is correct.
☐ Voltage is correct.
☐ No presence of short circuits.

[Circulating fluid circuit, Power supply]




[Facility water circuit]

[Facility water]
☐ There is a difference in temperatures between the inlet and the outlet.
☐ Flow is not shut off.
☐ Covered with heat insulator and not dangerous even if touched.
☐ No presence of dust, foreign material, or corrosion.
☐ No presence of water hammer.
☐ No problems found in the circulating fluid or facility water.

● The “Inspection Monitor Screen Check Sheet” and the “Piping Check Sheet” provide the items to be checked on the spot in the event of an alarm.
When you make a request for servicing, please submit the check sheets with all alarm codes that have been generated.

## Inspection Monitor Screen Check Sheet

Please enter an “○” for Yes and “×” for No.
Be sure to check the items with a “ ∗ ” for trouble during a trial run.

**List of inspection monitor menu check items**

| Display | Item | Contents | Value |
|---|---|---|---|
| t 1. | Circulating fluid outlet temperature | Displays the temperature of the circulating fluid outlet. This temperature does not take offset into consideration. | |
| t 2. | Circulating fluid return port temperature | Displays the temperature of the circulating fluid return. | |
| t 3. | Compressor inlet temperature | Displays the temperature of the inlet of the compressor. | |
| P 1. | Circulating fluid outlet pressure | Displays the circulating fluid outlet pressure at the outlet. | |
| P h. | Pressure of the higher pressure side of the refrigerant circuit | Displays the pressure of higher pressure side of the refrigerant circuit. | |
| P L. | Pressure of the lower pressure side of the refrigerant circuit | Displays the pressure of lower pressure side of the refrigerant circuit. | |
| d 1. | Electric resistivity/ conductivity | Displays the electric resistivity/conductivity. | |
| PUMP | Accumulated operation time of the pump | Displays the accumulated operation time of the pump. | |
| FAn.M | Accumulated operation time of the fun motor | Displays the accumulated operation time of the fan motor. (For air-cooled type) | |
| rEF. | Accumulated operation time of the compressor | Displays the accumulated operation time of the compressor. | |
| dru. | Accumulated operation time | Displays the accumulated operation time. | |

### Check of the circulating fluid outlet temperature

**1.** Press and hold the [MENU] key for approx. 2 sec.
The temperature of the circulating fluid outlet “ t 1. ” is displayed on the digital display.

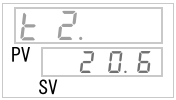

Displays the temperature of the circulating fluid at the outlet from which the fluid is fed to the customer’s device. This temperature does not take temperature offset into consideration

**CHECK!**

☐ ∗ Circulating fluid outlet temperature t1. is 1 [°C] or higher, AL02 [High circulating fluid discharge temperature] is not generated, and the temperature is controlled to the preset temperature (= SV + Offset).

## Check of the circulating fluid inlet temperature

**2.** Press the [SEL] key once.
The temperature of the circulating fluid return is displayed on the digital display.




Displays the temperature of the circulating fluid returning from the customer's device.

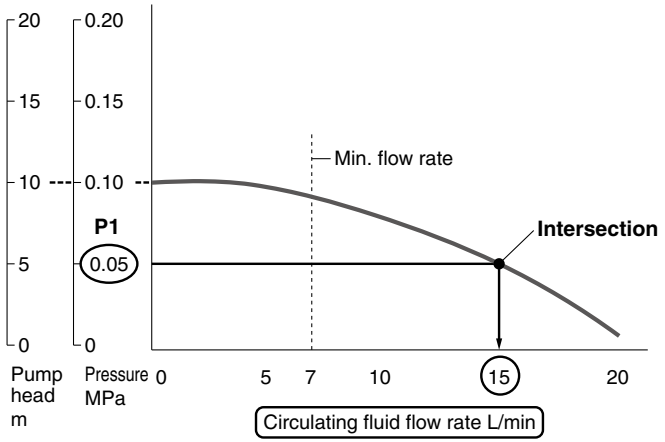
**CHECK!**

☐ ∗ Circulating fluid inlet temperature t2. is equal to or higher than t1. [°C], AL05 [High circulating fluid return temperature (60°C)] is not generated, and there is an allowance for cooling capacity relative to the heat generation of the item to be cooled.

[Refer to "Heat generation of the item to be cooled" below.]

**Heat generation of the item to be cooled**

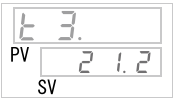
1. Plot the circulating fluid outlet pressure P1. on the pump capacity diagram, and read off the circulating fluid flow rate.




2. Calculate the heat generation of the item to be cooled.
Heat generation of item to be cooled [kW] = 70 x Circulating fluid flow rate [L/min] x (t2. [°C] – Circulating fluid outlet temperature t1. [°C]) / 1000 [W/kW]
At this point,
70: Multiplier [J·min/(L·K·s)] (= Density of water [kg/L] x Specific heat [J/(kg·K)] / 60 [s/min])
66 for the case of 15% ethylene glycol aqueous solution

## Check of the compressor inlet temperature

**3.** Press the [SEL] key once.
The compressor inlet temperature is displayed on the digital display.




Displays the compressor inlet temperature.

**CHECK!**

☐ The compressor inlet temperature t3. is −15 to 60 [°C], and AL12 [Low superheat temperature] is not generated.

## Check of the circulating fluid outlet pressure

**4.** Press the [SEL] key once.
The circulating fluid outlet pressure is displayed on the digital display.

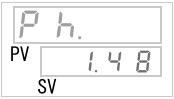

The pressure of the circulating fluid outlet from which the fluid is sent to the customer's device is displayed.

**CHECK!**

☐ Circulating fluid outlet pressure P1. is 0.05 [MPa] or higher, and AL06 [High circulating fluid discharge pressure] is not generated.

## Check of the pressure of the higher pressure side of the refrigerant circuit

**5.** Press the [SEL] key once.
The pressure of the higher pressure side of the refrigerant circuit is displayed on the digital display.




Displays the pressure of the higher pressure side of the refrigerant circuit.

**CHECK!**

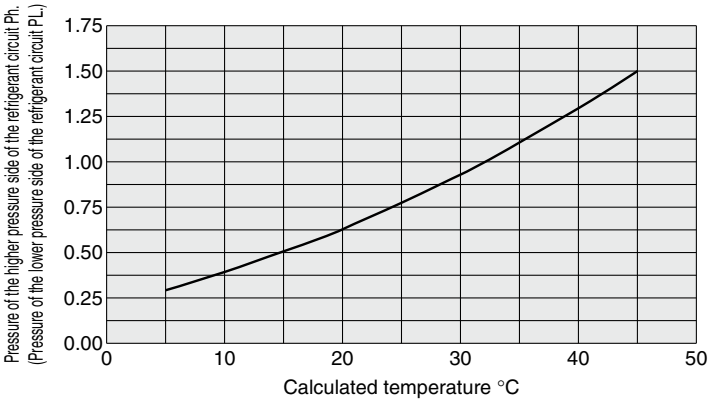
☐ Pressure of the higher pressure side of the refrigerant circuit Ph. during operation is 0.1 [MPa] or more, and AL13 [High compressor discharge pressure] is not generated.
In addition, the calculated temperature Note 2) of the pressure of the higher pressure side of the refrigerant circuit Ph. during stoppage Note 1) exceeds the ambient temperature.

Note 1) Leave the compressor off for 24 hours to sufficiently cool it down to the ambient temperature.
Note 2) Refer to "Calculated temperature of the pressure of the higher pressure side of the refrigerant circuit Ph. (the pressure of the lower pressure side of the refrigerant circuit PL.)" on page 126 for details.

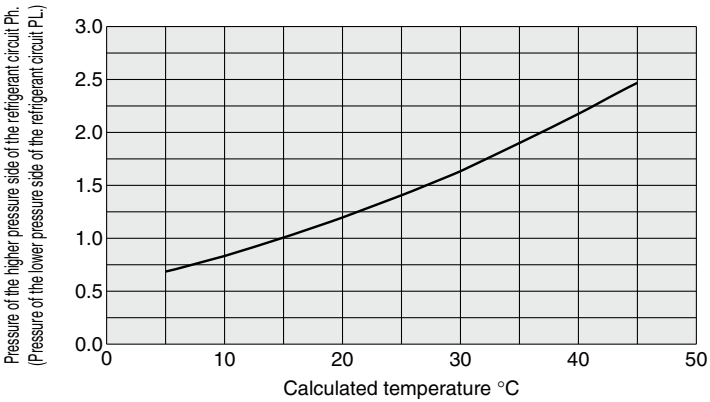
**Refrigerant leakage**

1. If the calculated temperature of the pressure of the higher pressure side of the refrigerant circuit Ph. during stoppage is equal to or lower than the ambient temperature, the refrigerant may be leaking. Have a specialist (an engineer possessing a Class 1 or Class 2 Refrigerant Freon Handling License) check the details.

**[HRS012/018/024/030]**



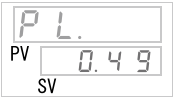

**[HRS050/060]**




**Calculated temperature of the pressure of the higher pressure side of the refrigerant circuit Ph. (the pressure of the lower pressure side of the refrigerant circuit PL.)**

## Check of the pressure of the lower pressure side of the refrigerant circuit

**6.** Press the [SEL] key once.
The pressure of the lower pressure side of the refrigerant circuit is displayed on the digital display.




Displays the pressure of the lower pressure side of the refrigerant circuit.

**CHECK!**

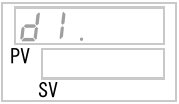
☐ Pressure of the lower pressure side of the refrigerant circuit PL. during operation is at least 0.2 Note 3) or 0.4 Note 4) [MPa], and AL16 [Refrigerant circuit pressure (lower pressure side) rise)] is not generated.

Note 3) Refer to “Calculated temperature of the pressure of the higher pressure side of the refrigerant circuit Ph. (the pressure of the lower pressure side of the refrigerant circuit PL.)” for the HRS012/018/024/030 on page 126 for details.

Note 4) Refer to “Calculated temperature of the pressure of the higher pressure side of the refrigerant circuit Ph. (the pressure of the lower pressure side of the refrigerant circuit PL.)” for the HRS050/060 on page 126 for details.

## Check of the electric resistivity/conductivity

**7.** Press the [SEL] key once.
The electric resistivity/conductivity is displayed on the digital display.




∗ This function is available for customers who have purchased the electric resistivity/conductivity sensor set which is a separately sold accessory. Refer to the Operation Manual attached to these optional accessories for details.

**CHECK!**

☐ Electric resistivity dI. is within the control range of 0.2 to 4.5 [MΩ] or 5 to 45 [μS], and neither AL34 [Electric resistivity/conductivity rise] nor AL35 [Electric resistivity/conductivity drop] are generated.

## Check of the accumulated operation time of the pump

**8.** Press the [SEL] key once.
The accumulated operation time of the pump is displayed on the digital display.

Displays the accumulated operation time of the pump. Refer to the table below for the display.

**List of time display**

| Cumulative time | Indicated value |
|---|---|
| 0h to 999h | 0h to 999h |
| 1,000h to 99,999h | 1hh to 99hh |
| 100,000h | Return to 0h |

**[For products other than the HRS012/018/024/030-T options (magnetic pump mounted)]**

AL28 Pump maintenance alarm is generated when the accumulated operation time of the pump reaches 20,000 hours (20hh) or more.

**[For the HRS012/018/024/030-T options (high-pressure pump) and the HRS050/060 standard products]**

AL28 Pump maintenance alarm is generated when the accumulated operation time of the pump reaches 8,000 hours (8hh) or more.

**CHECK!**

☐ Accumulated operating time of the pump PunP has not reached 20,000 [h] Note 5) or 8,000 [h] Note 6), and AL28 [Maintenance of pump] is not generated.

Note 5) For products other than the HRS012/018/024/030-T options (magnetic pump mounted)
Note 6) For the HRS012/018/024/030-T options (high-pressure pump) and the HRS050/060 standard products

## Check of the accumulated operation time of the fan motor

**9.** Press the [SEL] key once.
The accumulated operation time of the fun motor is displayed on the digital display.


Displays the accumulated operation time of the fan motor. “List of time display” above for the display.
AL29 Fan motor maintenance alarm is generated when the accumulated operation time of the fan motor reaches 20,000 hours (20hh) or more. For details, refer to Chapter 7 Alarm indication and trouble shooting.
Water-cooled refrigerated type does not have the fan motor. The accumulated time of the digital display shows “----”.
Also, AL29 fan motor maintenance alarm is not generated.

**CHECK!**

☐ Accumulated operation time of the fan motor FRn.n has not reached 20,000 [h] Note 7), and AL29 [Maintenance of fan motor] is not generated.

Note 7) For air-cooled type only

## Check of the accumulated operation time of the compressor

**10.** Press the [SEL] key once.
The accumulated operation time of the compressor is displayed on the digital display.


Displays the accumulated operation time of the compressor. For the display, refer to “List of time display” on page 128.
AL30 Compressor maintenance alarm is generated when the accumulated operation time of the compressor reaches 50,000 hours (50kh) or more. For details, refer to page 137.

**CHECK!**

☐ Accumulated operation time of the fan compressor rEF. has not reached 50,000 [h], and AL30 [Maintenance of compressor] is not generated.

## Check of the accumulated operation time

**11.** Press the [SEL] key once.
The accumulated operation time is displayed on the digital display.


Displays the accumulated operation time. For the display, refer to “List of time display” on page 128.

**CHECK!**

☐ The accumulated operation time has not reached 6,000 to 8,000 [h] Note 8) (Inspection time of mechanical seal), 20,000 [h] (Inspection time of pump and fan motor) Note 9), or 50,000 [h] (Inspection time of compressor).

Note 8) For the HRS012/018/024/030-T options and the HRS050/060 standard products (high-pressure pump)
Note 9) For air-cooled type only

## Completing the Inspection Monitor Screen Check Sheet (Question sheet)

**12.** Put a “○”or “×” in the check boxes of items 1 to 11 of the “Inspection Monitor Screen Check Sheet” on page 130.
When inquiring about a problem occurring at a customer’s premises, please complete this check sheet to report the problem accurately, and contact your local sales representative or a service company.

**⚠ Caution**

**If the “Inspection Monitor Screen Check Sheet” (question sheet) is not available, the service company will conduct their own checks instead.**
**In such cases, a certain period of time will be required before we can start repairing.**

## Inspection Monitor Screen Check Sheet (Question Sheet)

**Please enter an "○" for Yes and "×" for No.**
**Be sure to check the items with a " ∗ " for trouble during a trial run.**

☐∗ **Circulating fluid outlet temperature t1. is 1 [°C] or higher, AL02 [High circulating fluid discharge temperature] is not generated, and the temperature is controlled to the preset temperature (= SV + Offset).**

☐∗ **Circulating fluid inlet temperature t2. is equal to or higher than t1. [°C], AL05 [High circulating fluid return temperature (60°C)] is not generated, and there is an allowance for cooling capacity relative to the heat generation of the item to be cooled.**

☐ **The compressor inlet temperature t3. is –15 to 60 [°C], and AL12 [Low superheat temperature] is not generated.**

☐ **Circulating fluid outlet pressure P1. is 0.05 [MPa] or higher, and AL06 [High circulating fluid discharge pressure] is not generated.**

☐ **Pressure of the higher pressure side of the refrigerant circuit Ph. during operation is 0.1 [MPa] or more, and AL13 [High compressor discharge pressure] is not generated. In addition, the calculated temperature Note 2) of the pressure of the higher pressure side of the refrigerant circuit Ph. during stoppage Note 1) exceeds the ambient temperature.**

☐ **Pressure of the lower pressure side of the refrigerant circuit PL. during operation is at least 0.2 Note 3) or 0.4 Note 4) [MPa], and AL16 [Refrigerant circuit pressure (lower pressure side) rise)] is not generated.**

☐ **Electric resistivity dI. is within the control range of 0.2 to 4.5 [MΩ] or 5 to 45 [μS], and neither AL34 [Electric resistivity/conductivity rise] nor AL35 [Electric resistivity/conductivity drop] are generated.**

☐ **Accumulated operating time of the pump PunP has not reached 20,000 [h] Note 5) or 8,000 [h] Note 6), and AL28 [Maintenance of pump] is not generated.**

☐ **Accumulated operation time of the fan motor FRn.n has not reached 20,000 [h] Note 7), and AL29 [Maintenance of fan motor] is not generated.**

☐ **Accumulated operation time of the fan compressor rEF. has not reached 50,000 [h], and AL30 [Maintenance of compressor] is not generated.**

☐ **The accumulated operation time has not reached 6,000 to 8,000 [h] Note 8) (Inspection time of mechanical seal), 20,000 [h] (Inspection time of pump and fan motor) Note 9), or 50,000 [h] (Inspection time of compressor).**

**Other (Must be filled in)**
**Specifically describe the details of the problem and emergency measures taken.**

| |
|---|
| |
| |
| |
| |
| |
| |
| |

# 4 Maintenance

# Alarms: Causes and Remedies (HRS012/018/024/030/050/060)

When you've received requests from customers for product servicing due to the frequent generation of the same alarm or multiple alarms, refer to 1. Alarm Troubleshooting below and Troubleshooting on pages 138 to 248 in order to remedy the problem.

## 1. Alarm Troubleshooting

After taking note of all the alarm codes that are being generated, refer to Table 4-1 and follow the instructions to remedy each specific problem.

**Table 4-1**

| Conditions | Remedy for specific problem |
|---|---|
| ① No screen display or alarm, but chiller won't start up | p. 133 |
| ② Chiller starts up, but won't cool (Overload) | p. 133, 134 |
| ③ Won't warm up (Low load, Cooling load) | p. 135 |
| ④ Circulating fluid, facility water, automatic water fill, etc., won't flow | p. 136 |
| ⑤ Circulating fluid/Refrigerant leakage | p. 136 |
| ⑥ Recommended replacement period of main functioning parts | p. 137 |
| ⑦ Sensor disconnection and other part errors | p. 137 |
| ⑧ Purity levels when using deionized water as the circulating fluid | p. 137 |

### ① No screen display or alarm, but chiller won't start up

| Phenomenon | | Cause | Remedy |
|---|---|---|---|
| Alarm code | Description | | |
| — Note) | The operation panel displays nothing even the power supply switch is turned ON. | Power source not supplying power | Supply the correct power. |
| | | Poor display board connection | Securely insert the connector [CN1]. |
| | | Power board error | Replace the power board. |
| | | Display board error | Replace the display board. |
| — | Impossible to operate with the "RUN/STOP" key on the operation panel | Communication settings are set. ([REMOTE] light is ON.) | Set to local mode. |
| | | Display board error | Replace the display board. |
| — | Lights on the operation panel or display(s) on the digital display does not show anything. | Display board error | Replace the display board. |
| — | The alarm buzzer does not sound. | Is "AS.01" in the alarm setting menu "OFF"? | Turn "AS.01" ON. |
| | | Display board error | Replace the display board. |

Note) Problem with alarm symbol not being displayed

### ② Chiller starts up, but won't cool (Overload)

| Phenomenon | | Cause | Remedy |
|---|---|---|---|
| Alarm code | Description | | |
| AL02 | High circulating fluid discharge temp. | Temperature sensor error (with simultaneous AL22 generation) | Replace the temperature sensor. |
| | | Ambient temperature exceeds the specification range (High ambient temperature) | Reduce the ambient temperature by ventilation, air conditioning, etc. |
| | | External load exceeds the specification range (Object to be cooled is generating too much heat for the chiller to handle) | Reduce the amount of heat generated by the object to be cooled, or install a larger chiller. |
| | | Insufficient ventilation space | Secure sufficient ventilation space. |
| | | [For air-cooled type] Dirty dustproof filter | Clean or replace the dustproof filter. |
| | | [For water-cooled type] Dirty facility water | Replace facility water. |
| | | | Clean the facility water circuit. |
| | | | Replace the water-cooled condenser. |
| | | | Replace the water regulating valve. |
| | | Power not being supplied to the pressure sensor (for high pressure, for low pressure) | Replace the main board. |
| | | Main board error | |
| | | Flow rate of the circulating fluid is less than 5 L/min. | Install bypass piping and open the valve. |
| | | | Replace the pump. |
| | | Dirty circulating fluid | Replace circulating fluid. |
| | | | Clean the circulating fluid circuit. |
| | | | Replace the heat exchanger (evaporator). Please contact your nearest agency. |
| | | Refrigerant leakage | Repair or replace the part of the refrigerant circuit where leakage is present. Please contact your nearest agency. |
| | | Electronic expansion valve error | Replace the electronic expansion valve. Please contact your nearest agency. |
| | | Pressure sensor (for high pressure) error | Replace the pressure sensor (for high pressure). Please contact your nearest agency. |
| | | Pressure sensor (for low pressure) error | Replace the pressure sensor (for low pressure). Please contact your nearest agency. |
| | | Other | Please contact an SMC's sales distributor. |

## ②Chiller starts up, but won't cool (No refrigeration) (Continued)

| Phenomenon | | Cause | Remedy |
|---|---|---|---|
| Alarm code | Description | | |
| AL03 | Circulating fluid discharge temp. rise | Problems occur immediately after operation start or stop | Refer to "Setting of temperature alarm monitoring method and alarm generation timing" in the operation manual and review. |
| | | Heat load fluctuation | Same as above |
| | | Problem with the external piping (system) | Remedy the problem with the external piping (system). |
| | | Other (Same as AL02) | Remedy AL02. |
| AL05 | High circulating fluid return temp. | Temperature sensor error (with simultaneous AL23 generation) | Replace the temperature sensor. |
| | | External load exceeds the specification range (Object to be cooled is generating too much heat for the chiller to handle) | Reduce the amount of heat generated by the object to be cooled, or install a larger chiller. |
| | | Problems occur immediately after operation start or stop | Use bypass piping, etc., to reduce the circulating fluid return temperature to 60°C or below. |
| | | Heat load fluctuation | |
| | | Problem with the external piping (system) | Remedy the problem with the external piping (system). |
| | | Main board error | Replace the main board. |
| | | Other alarms are being generated. | Check the troubleshooting section for the remedy for the alarm being generated. |
| | | The circulating fluid discharge temperature is above 45°C. | Remedy AL02. |
| | | Other | Please contact an SMC's sales distributor. |
| AL10 | High compressor intake temp. | Compressor intake temp. sensor (T1) failure (with simultaneous AL24 generation) | Replace the thermistor (T1). |
| | | Temperature sensor error (with simultaneous AL05 generation) | Replace the temperature sensor. |
| | | The circulating fluid discharge temperature is above 45°C. | Remedy AL02. |
| | | External load exceeds the specification range (Object to be cooled is generating too much heat for the chiller to handle) | Reduce the amount of heat generated by the object to be cooled, or install a larger chiller. |
| | | Problem with the external piping (system) | Remedy the problem with the external piping (system). |
| | | Flow rate of the circulating fluid is less than 5 L/min. | Replace the pump. |
| | | | Install a bypass piping. |
| | | Main board error | Replace the main board. |
| | | Electronic expansion valve error | Replace the electronic expansion valve. Please contact your nearest agency. |
| AL13 | High compressor discharge pressure | Ambient temperature exceeds the specification range (High ambient temperature) | Reduce the ambient temperature by ventilation, air conditioning, etc. |
| | | External load exceeds the specification range (Object to be cooled is generating too much heat for the chiller to handle) | Reduce the amount of heat generated by the object to be cooled, or install a larger chiller. |
| | | Insufficient ventilation space | Secure sufficient ventilation space. |
| | | [For air-cooled type] Dirty dustproof filter | Clean or replace the dustproof filter. |
| | | [For water-cooled type] Dirty facility water | Replace facility water. |
| | | | Clean the facility water circuit. |
| | | | Replace the water-cooled condenser. |
| | | | Replace the water regulating valve. |
| | | Other alarms are being generated. | Check the troubleshooting section for the remedy for the alarm being generated. |
| | | Fan motor error | Replace the fan motor. |
| | | Power not being supplied to the pressure sensor (for high pressure, for low pressure) | Replace the main board. |
| | | Main board error | |
| | | Power board error | Replace the power board. |
| | | Flow rate of the circulating fluid is less than 5 L/min. | Replace the pump. |
| | | | Install a bypass piping. |
| | | Pressure sensor (for high pressure) error | Replace the pressure sensor (for high pressure). Please contact your nearest agency. |
| | | Pressure sensor (for low pressure) error | Replace the pressure sensor (for low pressure). Please contact your nearest agency. |
| | | Electronic expansion valve error | Replace the electronic expansion valve. Please contact your nearest agency. |
| AL16 | Refrigerant circuit pressure (low pressure side) rise | Other alarms are being generated. | Check the troubleshooting section for the remedy for the alarm being generated. |
| | | Problem in external environment | Improve the external environment (operating environment). |
| | | Power not being supplied to the pressure sensor (for high pressure, for low pressure) | Replace the main board. |
| | | Main board error | |
| | | Pressure sensor (for low pressure) error | Replace the pressure sensor (for low pressure). Please contact your nearest agency. |
| | | Electronic expansion valve error | Replace the electronic expansion valve. Please contact your nearest agency. |
| | | Other | Please contact an SMC's sales distributor. |
| AL18 | Compressor overload | Power supply failure | Use an appropriate power supply. |
| | | Other alarms are being generated. | Check the troubleshooting section for the remedy for the alarm being generated. |
| | | Ambient temperature exceeds the specification range (High ambient temperature) | Reduce the ambient temperature by ventilation, air conditioning, etc. |
| | | External load exceeds the specification range (Object to be cooled is generating too much heat for the chiller to handle) | Reduce the amount of heat generated by the object to be cooled, or install a larger chiller. |
| | | Insufficient ventilation space | Secure sufficient ventilation space. |
| | | [For air-cooled type] Dirty dustproof filter | Clean or replace the dustproof filter. |
| | | [For water-cooled type] Dirty facility water | Supply clean facility water. |
| | | [For water-cooled type] Facility water does not flow. | Please contact an SMC's sales distributor. |
| | | [For water-cooled type] Dirty water-cooled condenser | Replace the water-cooled condenser. |
| | | | Replace the water regulating valve. |
| | | Main board error | Replace the main board. |
| | | Power board error | Replace the power board. |
| | | Compressor error | Replace the compressor. |
| | | Other | Please contact an SMC's sales distributor. |

## ③Won't warm up (Low load, Cooling load)

| Phenomenon | | Cause | Remedy |
|---|---|---|---|
| Alarm code | Description | | |
| AL04 | Circulating fluid discharge temp. drop | Temperature sensor error (with simultaneous AL22 generation) | Replace the temperature sensor. |
| | | Problems occur immediately after operation start or stop | Refer to "Setting of temperature alarm monitoring method and alarm generation timing" in the operation manual and review. |
| | | Heat load fluctuation | Same as above |
| | | Cooling load exceeds the heating capacity (Heat generated by the object to be cooled is a negative cooling load) | Use within the heating capacity or refrain from using exclusively for heating. |
| | | Other alarms are being generated. | Check the troubleshooting section for the remedy for the alarm being generated. |
| | | Main board error | Replace the main board. |
| | | Flow rate of the circulating fluid is less than 5 L/min. | Replace the pump. |
| | | | Install a bypass piping. |
| | | Electronic expansion valve error | Replace the electronic expansion valve. Please contact your nearest agency. |
| | | Other | Please contact an SMC's sales distributor. |
| AL11 | Low compressor intake temp. | Compressor intake temp. sensor (T1) failure (with simultaneous AL24 generation) | Replace the thermistor (T1). |
| | | Temperature sensor error (with simultaneous AL04 generation) | Replace the temperature sensor. |
| | | Cooling load exceeds the heating capacity (Heat generated by the object to be cooled is a negative cooling load) | Use within the heating capacity or refrain from using exclusively for heating. |
| | | Flow rate of the circulating fluid is less than 5 L/min. | Replace the pump. |
| | | | Install a bypass piping. |
| | | Main board error | Replace the main board. |
| | | Dirty circulating fluid | Replace circulating fluid. |
| | | | Clean the circulating fluid circuit. |
| | | | Replace the heat exchanger (evaporator). Please contact your nearest agency. |
| | | Electronic expansion valve error | Replace the electronic expansion valve. Please contact your nearest agency. |
| | | Other | Please contact an SMC's sales distributor. |
| AL12 | Low super heat temperature | Other alarms are being generated. | Check the troubleshooting section for the remedy for the alarm being generated. |
| | | Flow rate of the circulating fluid is less than 5 L/min. | Replace the pump. |
| | | | Install a bypass piping. |
| | | Dirty circulating fluid | Replace circulating fluid. |
| | | | Clean the circulating fluid circuit. |
| | | | Replace the heat exchanger (evaporator). Please contact your nearest agency. |
| | | Compressor intake temp. sensor (T1) failure (with simultaneous AL24 generation) | Replace the thermistor (T1). |
| | | Pressure sensor (for high pressure) error | Replace the pressure sensor (for high pressure). Please contact your nearest agency. |
| | | Pressure sensor (for low pressure) error | Replace the pressure sensor (for low pressure). Please contact your nearest agency. |
| | | Power not being supplied to the pressure sensor (for high pressure, for low pressure) | Replace the main board. |
| | | Main board error | |
| | | Electronic expansion valve error | Replace the electronic expansion valve. Please contact your nearest agency. |
| AL17 | Refrigerant circuit pressure (low pressure side) drop | Other alarms are being generated. | Check the troubleshooting section for the remedy for the alarm being generated. |
| | | Problem in external environment | Improve the external environment (operating environment). |
| | | Flow rate of the circulating fluid is less than 5 L/min. | Replace the pump. |
| | | | Install a bypass piping. |
| | | Power not being supplied to the pressure sensor (for high pressure, for low pressure) | Replace the main board. |
| | | Main board error | |
| | | Pressure sensor (for low pressure) error | Replace the pressure sensor (for low pressure). Please contact your nearest agency. |
| | | Electronic expansion valve error | Replace the electronic expansion valve. Please contact your nearest agency. |
| | | Other | Please contact an SMC's sales distributor. |

## ④ Circulating fluid, facility water, automatic water fill, etc., won't flow

| Phenomenon | | Cause | Remedy |
|---|---|---|---|
| **Alarm code** | **Description** | | |
| **AL06** | **High circulating fluid discharge pressure** | Pressure sensor (for circulating fluid) error (with simultaneous AL25 generation) | Replace the pressure sensor (for circulating fluid). |
| | | Problem with the external piping (system) | Remedy the problem with the external piping (system). |
| | | | Install a bypass piping. |
| | | Clogging in the heat exchanger | Replace the heat exchanger (evaporator).<br>Please contact your nearest agency. |
| | | Other alarms are being generated. | Check the troubleshooting section for the remedy for the alarm being generated. |
| | | Main board error | Replace the main board. |
| **AL07** | **Abnormal pump operation** | Pressure sensor (for circulating fluid) error (with simultaneous AL25 generation) | Replace the pressure sensor (for circulating fluid). |
| | | Ethylene glycol is too highly concentrated. | Replace with a 15% ethylene glycol aqueous solution. |
| | | Power voltage error | Use an appropriate power supply. |
| | | Pump error | Replace the pump. |
| | | Main board error | Replace the main board. |
| | | Power board error | Replace the power board. |
| **AL08** | **Circulating fluid discharge pressure rise** | AL06 is simultaneously being generated. | Check the troubleshooting section for the remedy for the alarm being generated (AL06). |
| | | Pressure sensor (for circulating fluid) error (with simultaneous AL25 generation) | Replace the pressure sensor (for circulating fluid). |
| | | Problem with the external piping (system) | Remedy the problem with the external piping (system). |
| | | | Install a bypass piping. |
| | | This alarm set value is close to the external piping resistance. | Review the alarm set value. |
| | | Clogging in the heat exchanger | Replace the heat exchanger (evaporator).<br>Please contact your nearest agency. |
| | | Other alarms are being generated. | Check the troubleshooting section for the remedy for the alarm being generated. |
| | | Main board error | Replace the main board. |
| **AL09** | **Circulating fluid discharge pressure drop** | Pressure sensor (for circulating fluid) error (with simultaneous AL25 generation) | Replace the pressure sensor (for circulating fluid). |
| | | Pump error (with simultaneous AL07 generation) | Replace the pump. |
| | | Problem with the external piping (system) | Remedy the problem with the external piping (system). |
| **(AL17)** | **(Refrigerant circuit pressure (low pressure side) drop)** | Other alarms are being generated. | Check the troubleshooting section for the remedy for the alarm being generated. |
| | | Problem in external environment | Improve the external environment (operating environment). |
| | | Flow rate of the circulating fluid is less than 5 L/min. | Replace the pump. |
| | | | Install a bypass piping. |
| | | Power not being supplied to the pressure sensor (for high pressure, for low pressure) | Replace the main board. |
| | | Main board error | |
| | | Pressure sensor (for low pressure) error | Replace the pressure sensor (for low pressure).<br>Please contact your nearest agency. |
| | | Electronic expansion valve error | Replace the electronic expansion valve.<br>Please contact your nearest agency. |
| | | Other | Please contact an SMC's sales distributor. |
| **—** | **[For water-cooled type] Facility water does not flow.** | Doesn't flow when the thermo-chiller is stopped | Start the thermo-chiller or install bypass piping for the facility water circuit. |
| **—** | **[For option J] Automatic water fill does not operate.** | Power is not being supplied. | Supply power. |
| | | The tank fluid level is above "L." | Running normally, even if water is not being supplied.<br>Start supply of water at "L" or below. |
| | | Main board error | Replace the main board. |
| | | Clogged automatic water fill opening | Replace the solenoid valve for automatic water-fill. |
| | | Solenoid valve (used for automatic water fill) error | |

## ⑤ Circulating fluid/Refrigerant leakage

| Phenomenon | | Cause | Remedy |
|---|---|---|---|
| **Alarm code** | **Description** | | |
| **AL01** | **Low level in tank** | Declining liquid level of the level gauge | Supplement circulating fluid. |
| | | Chiller internal circulating fluid leakage | Repair leakage points. |
| | | External piping leakage | Repair external piping. |
| | | Mechanical seal leakage | Replace the mechanical seal or pump. |
| | | Poor level switch connection | Securely insert the main board connector [CN3]. |
| | | Level switch error | Replace the level switch. |
| | | Main board error | Replace the main board. |
| **AL15** | **Refrigerant circuit pressure (high pressure side) drop** | Pressure sensor (for high pressure) error (with simultaneous AL26 generation) | Replace the pressure sensor (for high pressure).<br>Please contact your nearest agency. |
| | | Refrigerant leakage | Repair or replace the part of the refrigerant circuit where leakage is present. Please contact your nearest agency. |
| | | Main board error | Replace the main board. |
| **AL33** | **Water leakage** | [When used with the HRS-WL001 accessory (Sold separately)] Poor water leakage sensor connection | Securely insert the water leakage sensor connector. |
| | | Liquid is adhered to the bottom of the water leakage sensor. | Repair water leakage points. |
| | | Water leakage sensor error | Replace the water leakage sensor. |

## ⑥ Recommended replacement period of main functioning parts

| Phenomenon | | Cause | Remedy |
|---|---|---|---|
| Alarm code | Description | | |
| AL28 | Maintenance of pump | Recommended circulating fluid pump replacement period | Replace the circulating fluid pump. |
| AL29 | Maintenance of fan motor | [For air-cooled type] Recommended fan motor replacement period | Replace the fan motor. |
| AL30 | Maintenance of compressor | Recommended compressor replacement period | Replace the compressor. |
| — Note) | [For -T (High pressure pump), HRS050/060] The accumulated operating time (dru.) has reached between 6,000 and 8,000 hours. | Recommended mechanical seal replacement period | Replace the mechanical seal. |

Note) Problem with alarm symbol not being displayed

## ⑦ Sensor disconnection and other part errors

| Phenomenon | | Cause | Remedy |
|---|---|---|---|
| Alarm code | Description | | |
| AL19 | Communication error | Change the value set at the time of shipment from the factory. | Check Chapter 6 Communication alarm function in the operation manual's communication function volume. |
| | | Main board error | Replace the main board. |
| | | Communication board error | Replace the communication board. |
| AL20 | Memory error | Main board error | Replace the main board. |
| | | Other | Please contact an SMC's sales distributor. |
| AL21 | DC line fuse cut | Fuse meltdown due to short-circuit protection function | Replace the fuse. |
| AL22 | Circulating fluid discharge temp. sensor failure | Poor circulating fluid discharge temp. sensor (P1) connection | Securely insert the main board connector [PT1]. |
| | | Main board error | Replace the main board. |
| | | Temperature sensor (PT1) error | Replace the temperature sensor (PT1). |
| AL23 | Circulating fluid return temp. sensor failure | Poor circulating fluid return temp. sensor (PT2) connection | Securely insert the main board connector [PT2]. |
| | | Main board error | Replace the main board. |
| | | Temperature sensor (PT2) error | Replace the temperature sensor (PT2). |
| AL24 | Compressor intake temp. sensor failure | Poor compressor intake temp. sensor (T1) connection | Securely insert pins 7 and 19 of the main board connector [CN4]. |
| | | Main board error | Replace the main board. |
| | | Thermistor (T1) error | Replace the thermistor (T1). |
| AL25 | Circulating fluid discharge pressure sensor failure | Poor circulating fluid discharge pressure sensor (P1) connection | Securely insert pins 8, 20, and 21 of the main board connector [CN4]. |
| | | Power is not being supplied to the pressure sensor (P1). | Replace the main board. |
| | | Main board error | |
| | | Pressure sensor P1 (for circulating fluid) error | Replace the pressure sensor P1 (for circulating fluid). |
| AL26 | Compressor discharge pressure sensor failure | Poor pressure sensor (for high pressure) connection | Securely insert pins 10, 11, and 22 of the main board connector [CN4]. |
| | | Power is not being supplied to the pressure sensor (for high pressure). | Replace the main board. |
| | | Main board error | |
| | | Pressure sensor (for high pressure) error | Replace the pressure sensor (for high pressure). |
| AL27 | Compressor intake pressure sensor failure | Poor pressure sensor (for low pressure) connection | Securely insert pins 12, 23, and 24 of the main board connector [CN4]. |
| | | Power is not being supplied to the pressure sensor (for low pressure). | Replace the main board. |
| | | Main board error | |
| | | Pressure sensor (for low pressure) error | Replace the pressure sensor (for low pressure). |
| AL31 | Contact input 1 signal detection | Contact input 1 signal was input. | Check the sensor connected to contact input 1 signal. |
| AL32 | Contact input 2 signal detection | Contact input 2 signal was input. | Check the sensor connected to contact input 2 signal. |

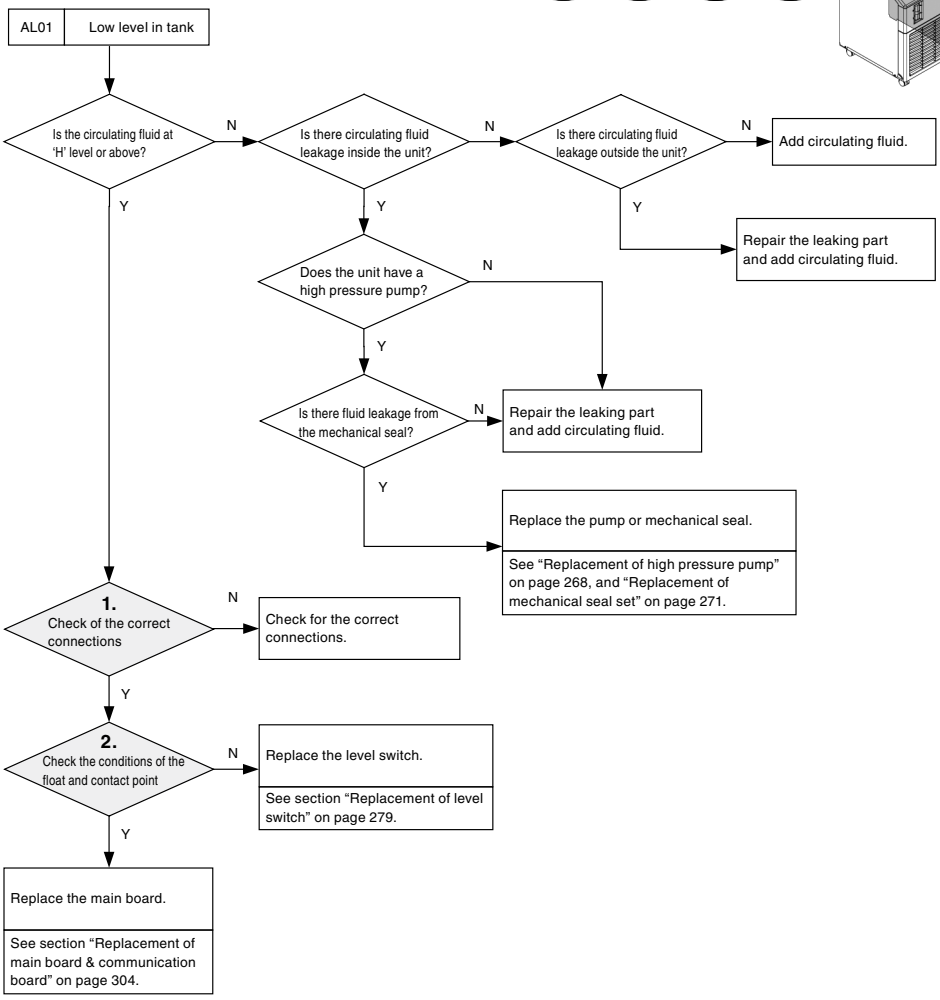
## ⑧ Purity levels when using deionized water as the circulating fluid

| Phenomenon | | Cause | Remedy |
|---|---|---|---|
| Alarm code | Description | | |
| AL34 | Electric resistivity/ conductivity rise | [When used with the HRS-DI accessory (Sold separately)] The purity level of the circulating fluid is above the set value. | Replace the DI filter set (HRS-DP). |
| | | Electric resistivity sensor or electric conductivity sensor error | Replace the electric resistivity sensor or electric conductivity sensor |
| AL35 | Electric resistivity/ conductivity drop | [When used with the HRS-DI accessory (Sold separately)] The purity level of the circulating fluid is below the set value. | Replace the DI filter set (HRS-DP). |
| | | Electric resistivity sensor or electric conductivity sensor error | Replace the electric resistivity sensor or electric conductivity sensor |
| AL36 | Electric resistivity/ conductivity sensor error | [When used with the HRS-DI accessory (Sold separately)] The purity level of the circulating fluid is below the set value. | Replace the DI filter set (HRS-DP). |
| | | Electric resistivity sensor or electric conductivity sensor error | Replace the electric resistivity sensor or electric conductivity sensor |

# Troubleshooting of alarms

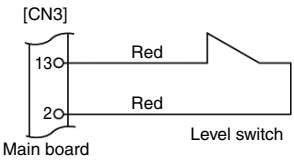
## AL01: Low level in tank

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



## 1. Check the connection

Securely connect the connectors to [CN3] 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.



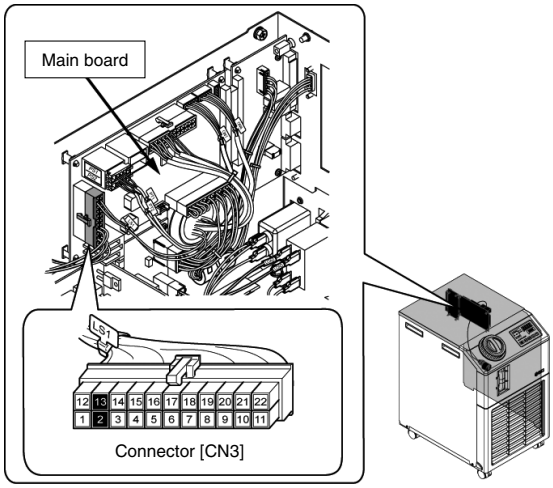




**Fig. 4-1 Level switch connection check**

## 2. Check conditions of the float and contact point

Remove the connectors [CN3]. 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.

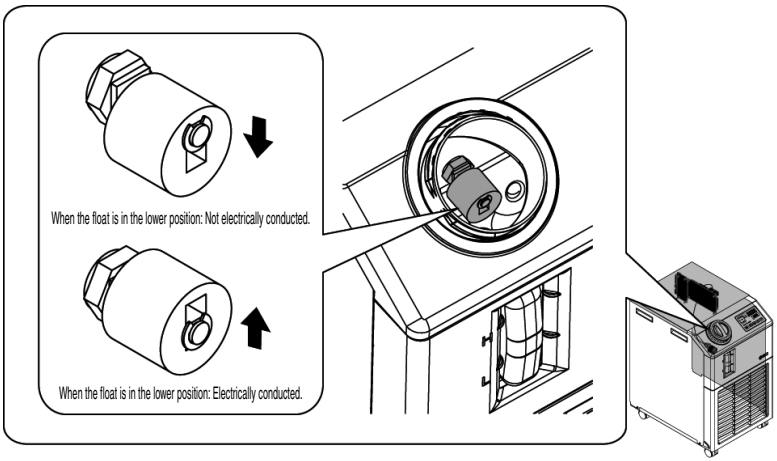
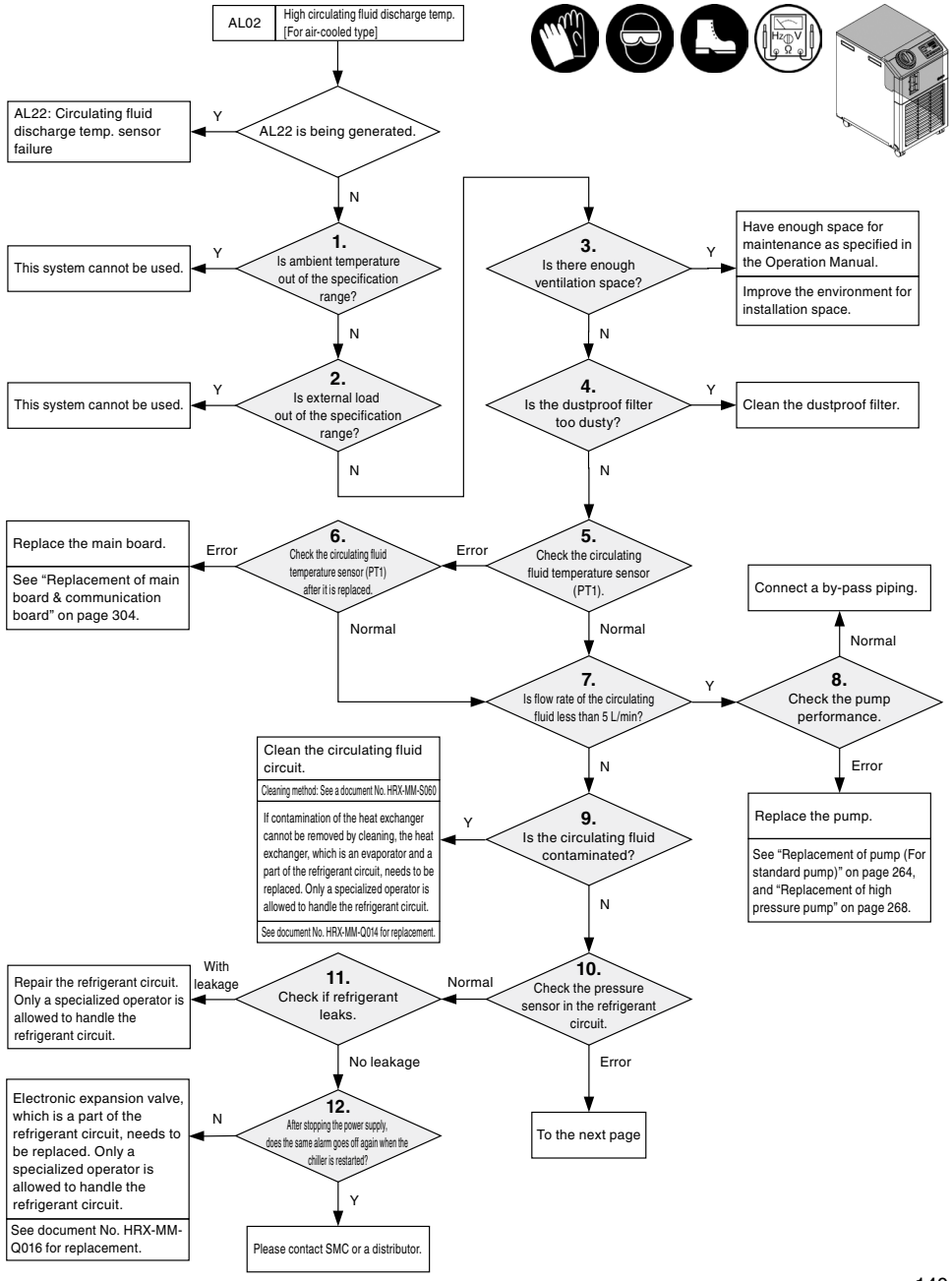


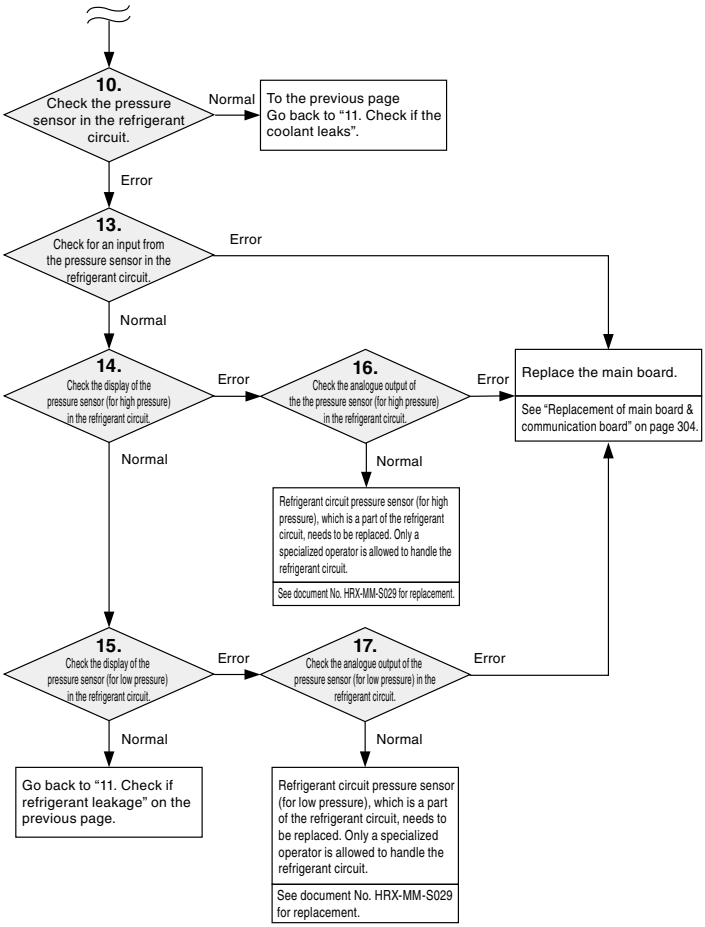

**Fig. 4-2 Operation of the level switch**

## 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.






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 pressure) 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 “Replacement of main board & communication board” on page 304.
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 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 pages 19 and 20.



### 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.

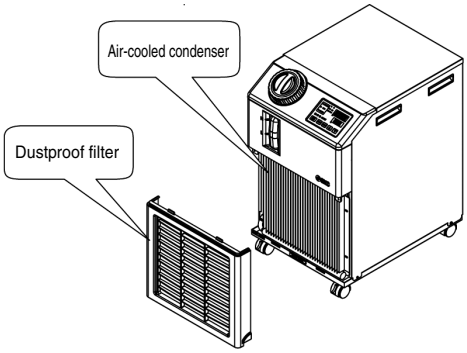



**Fig. 4-3 An air-cooled condenser and a dustproof filter**

### 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°C, 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 “Replacement of temperature sensor (PT1)” on page 260.) 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. Install a flow meter, and check the flow rate of the circulating fluid.

Install a flow meter. Refer to the “Pump capacity” graph” on page 23 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°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°C
<With contamination with the heat exchanger>
“t3: Suction temperature of the compressor” < “t2: Circulating fluid return temperature” –5°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. 4-4: Ambient temperature and refrigerant circuit pressure”, it means there is refrigerant leakage caused.

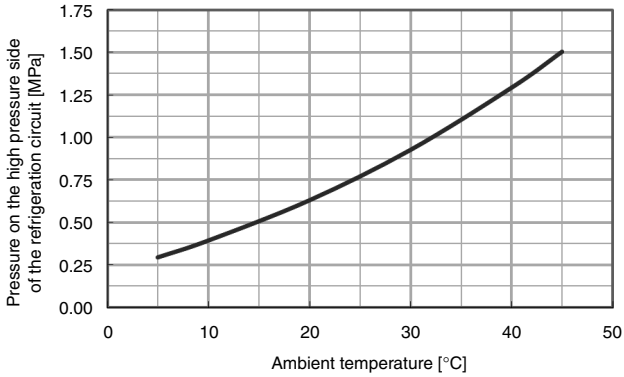



**Fig. 4-4 Ambient temperature and refrigerant circuit pressure**

## 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 +/- 1 V

<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 +/- 1 V

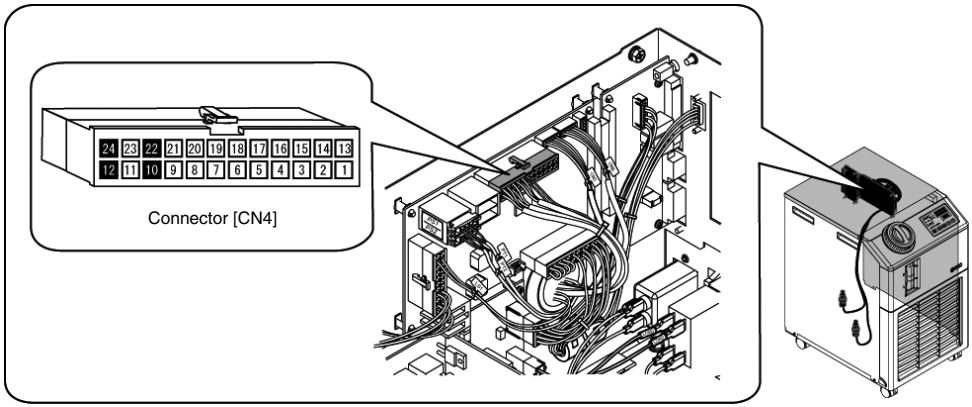



**Fig. 4-5 Check of input to the refrigerant circuit pressure sensor**

## 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. 4-6. If the cross point is within the range, it means that the pressure sensor is operating correctly.

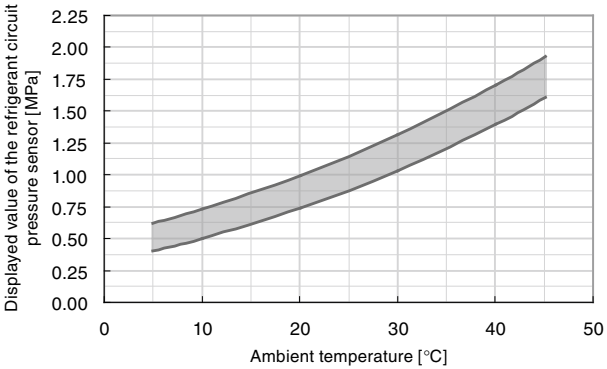



**Fig. 4-6 Ambient temperature and refrigerant circuit pressure**

## 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. 4-6. 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 correctly.

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. 4-8. (Accuracy: +/- 5%)

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

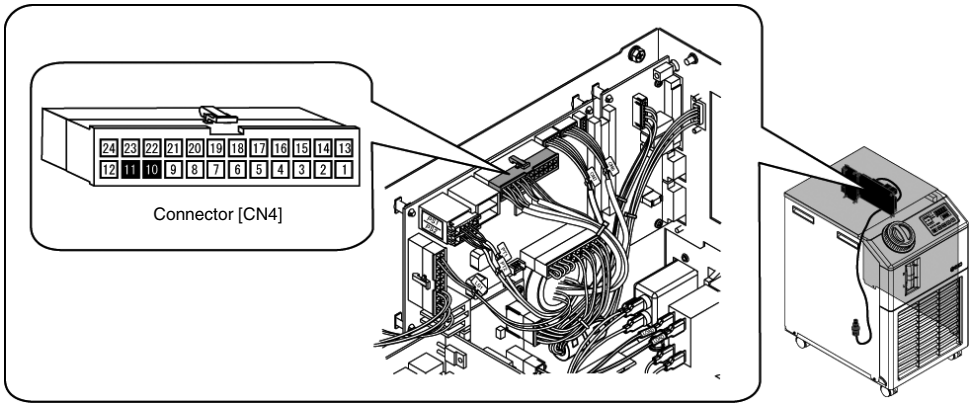



**Fig. 4-7 Check of the refrigerant circuit pressure sensor (for high pressure) output**

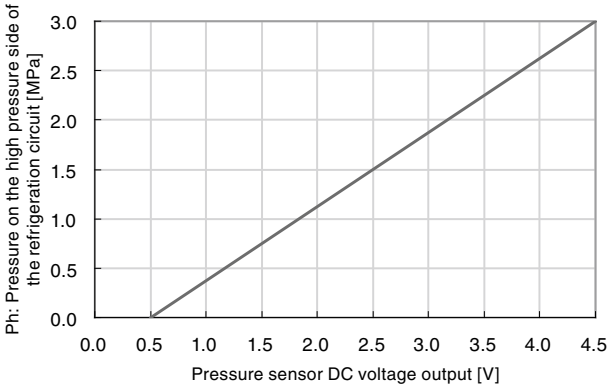



**Fig. 4-8 Refrigerant circuit pressure sensor (for high pressure) analogue output**

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

Find out if the main board is operating correctly.

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. 4-10. (Accuracy: +/- 5%)

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

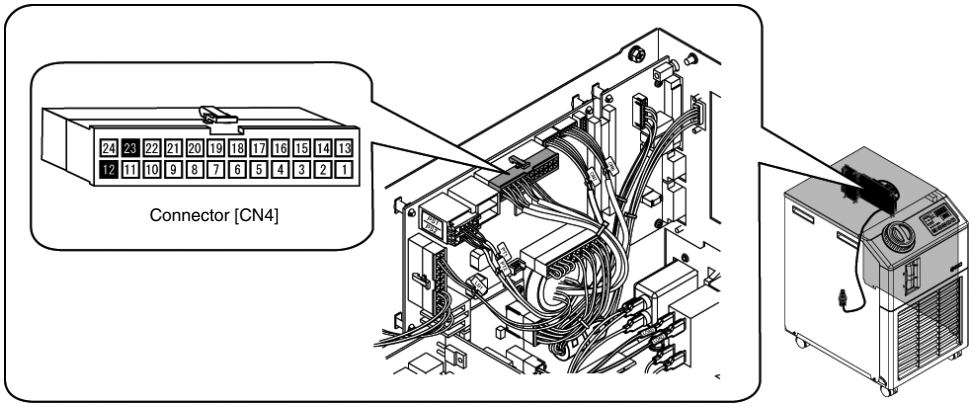



**Fig. 4-9 Check of the refrigerant circuit pressure sensor (for low pressure) output**

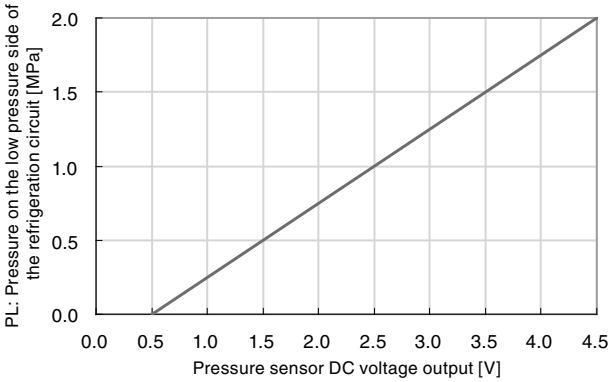
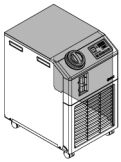



**Fig. 4-10 Refrigerant circuit pressure sensor (for low pressure) analogue output**

## 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.

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

Is AL22 being generated? (Y) → AL22: Circulating fluid discharge temp. sensor failure

Is facility water temperature higher than 40°C? (Y) → This system cannot be used.

1. Check the facility water system. (N) → This system cannot be used.

2. Is facility water contaminated? (Y) → Supply clean facility water.

3. Is the flow rate of the facility water incorrect? (Y) → 4. Is 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.

5. Is external load out of the specification range? (Y) → This system cannot be used.

6. Check the circulating fluid temperature sensor (PT1). (Error) → 7. Check the circulating fluid temperature sensor (PT1) after it is replaced. (Error) → Replace the main board. See “Replacement of main board & communication board” on page 304.

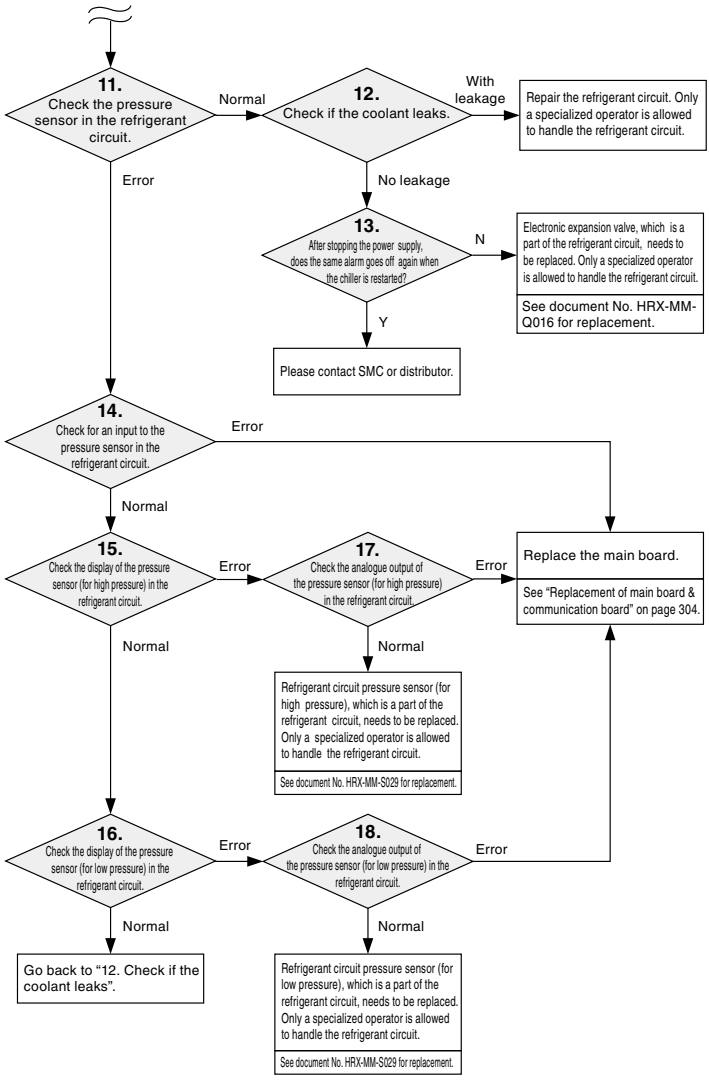
8. Is flow rate of the circulating fluid less than 5 L/min? (Y) → 9. Check the pump performance. (Normal) → Connect a by-pass piping.

9. Check the pump performance. (Error) → Replace the pump. See “Replacement of pump (For standard pump)” on page 264, and “Replacement of high pressure pump” on page 268.

10. Is circulating fluid contaminated? (Y) → Clean the circulating fluid circuit. See a document No. HRX-MM-S060 for cleaning instructions. If contamination with the circulating fluid circuit 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.

11. Check the pressure sensor in the refrigerant circuit. (Normal) → Go to "12. Check if the coolant leaks"on the next page.

11. Check the pressure sensor in the refrigerant circuit. (Error) → To the next page


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 pressure sensor (for high pressure) in the refrigerant circuit.
Error
Replace the main board.
See "Replacement of main board & communication board" on page 304.
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 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 on page 23.

## 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 on page 23.

* 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.

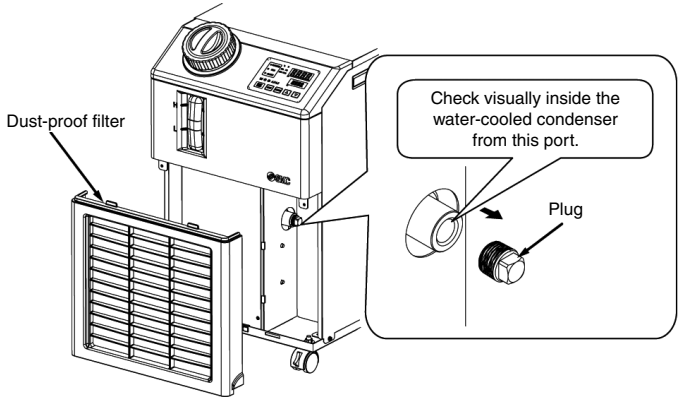



**Fig. 4-11 The port for visual check for contamination inside the water-cooled condenser**

## 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 on pages 19 and 20.

## 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°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 "Replacement of the temperature sensor (PT1)" on page 260.) 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" on page 23 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°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°C

<With contamination with the heat exchanger>

"t3: Suction temperature of the compressor" < "t2: Circulating fluid return temperature" –5°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. 4-12: Ambient temperature and refrigerant circuit pressure”, it means there is refrigerant leakage caused.

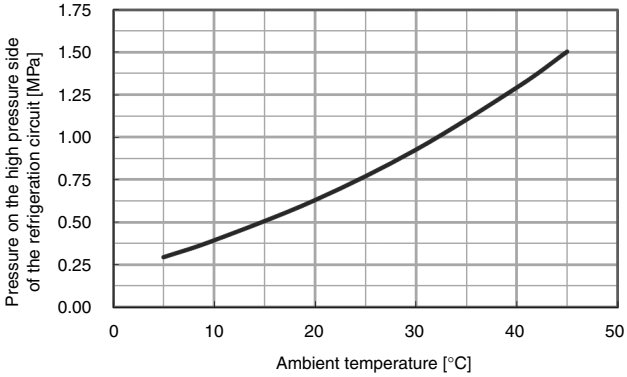



**Fig. 4-12 Ambient temperature and refrigerant circuit pressure**

## 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 +/- 1 V

<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 +/- 1 V

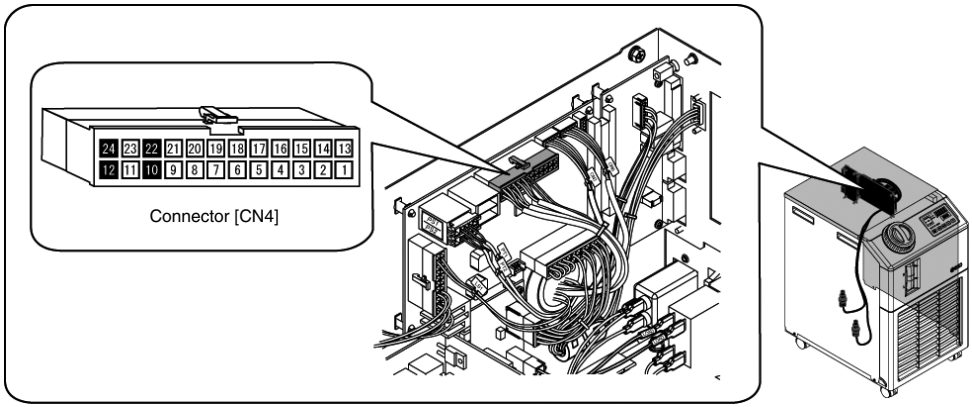



**Fig. 4-13 Check of input to the refrigerant circuit pressure sensor**

## 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. 4-14. If the cross point is within the range, it means that the pressure sensor is operating correctly.

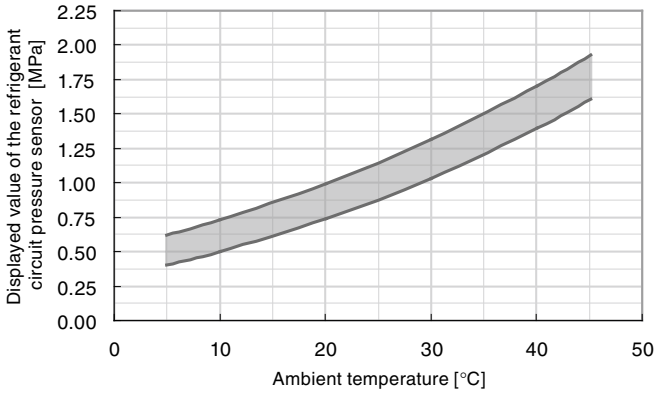



**Fig. 4-14 Ambient temperature and refrigerant circuit pressure**

## 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. 4-14. 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 correctly.

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. 4-16. (Accuracy: +/- 5%)

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

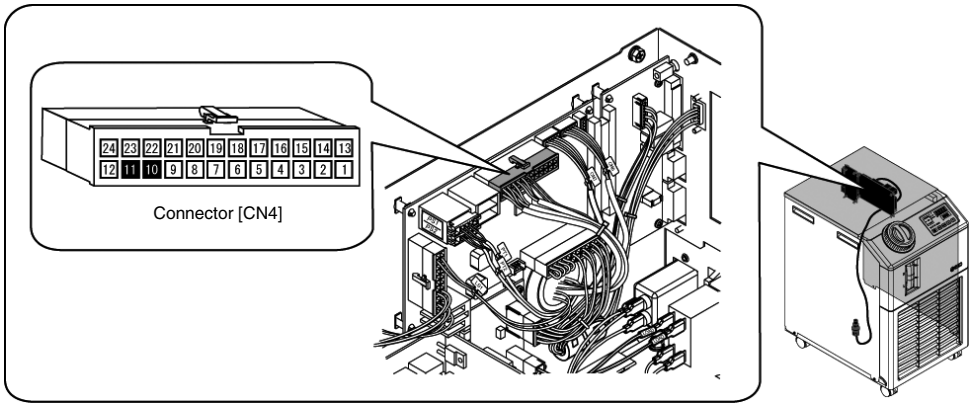



**Fig. 4-15 Check of the refrigerant circuit pressure sensor (for high pressure) output**

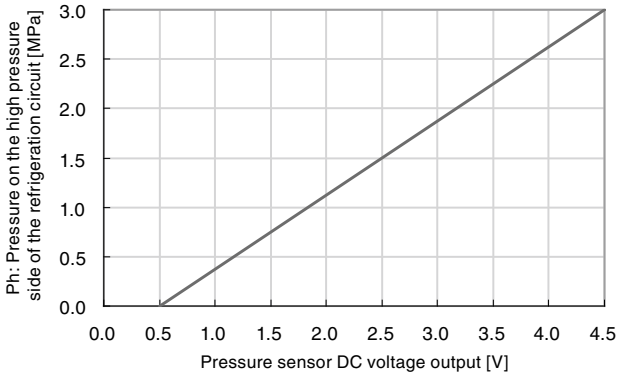



**Fig. 4-16 Refrigerant circuit pressure sensor (for high pressure) analogue output**

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

Find out if the main board is operating correctly.

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. 4-18. (Accuracy: +/- 5%)

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

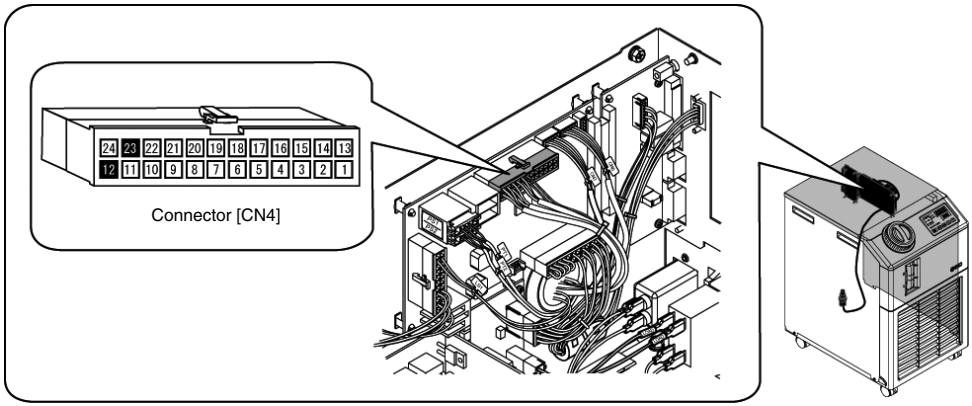



**Fig. 4-17 Check of the refrigerant circuit pressure sensor (for low pressure) output**

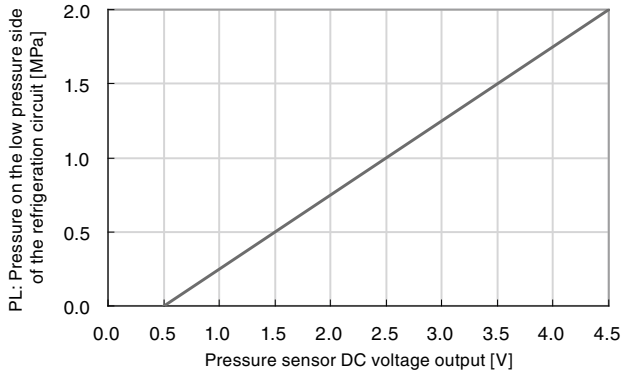
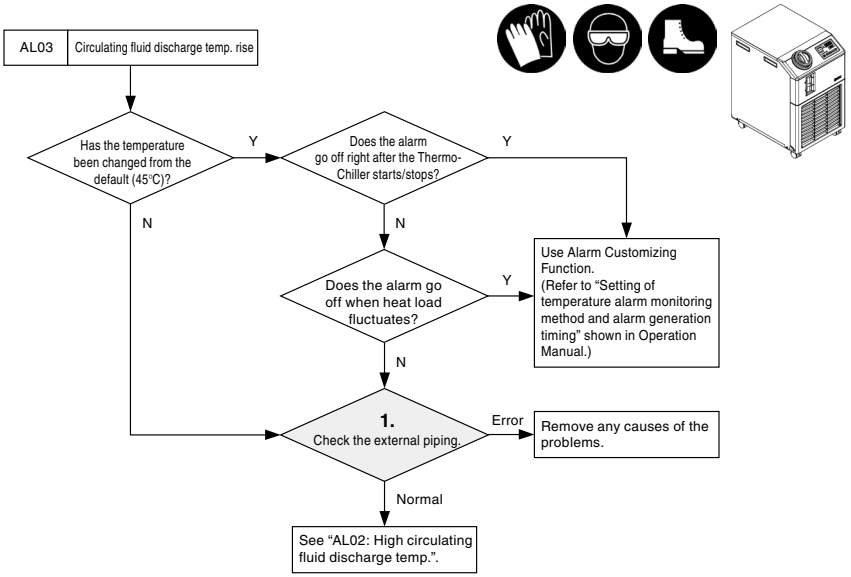



**Fig. 4-18: Refrigerant circuit pressure sensor (for low pressure) analogue output**

## 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.

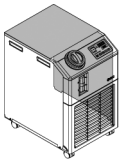
Check if the external piping is in the conditions shown below:

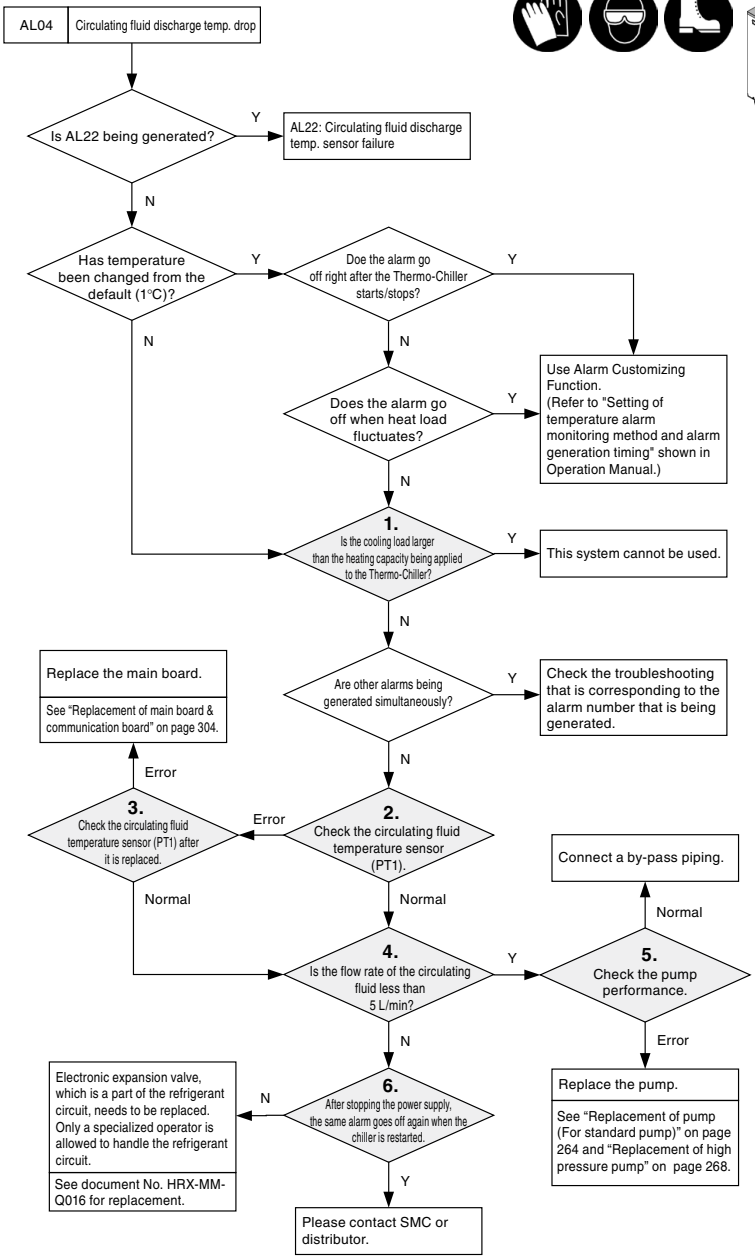
(1) The system has a circuit that high temperature circulating fluid returns to the Thermo-Chiller at once due to an operation of the valve or the switching valve in the external piping.

(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 on pages 21 and 22.

### 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°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 “Replacement of the temperature sensor (PT1)” on page 260.) 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.

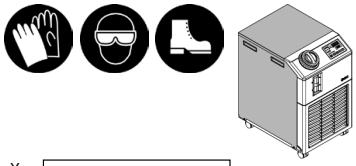
Install a flow meter. Refer to the “Pump capacity” graph” on page 23 and check that the pump capacity is suitable for the circulating fluid outlet pressure and the circulating fluid flow rate.

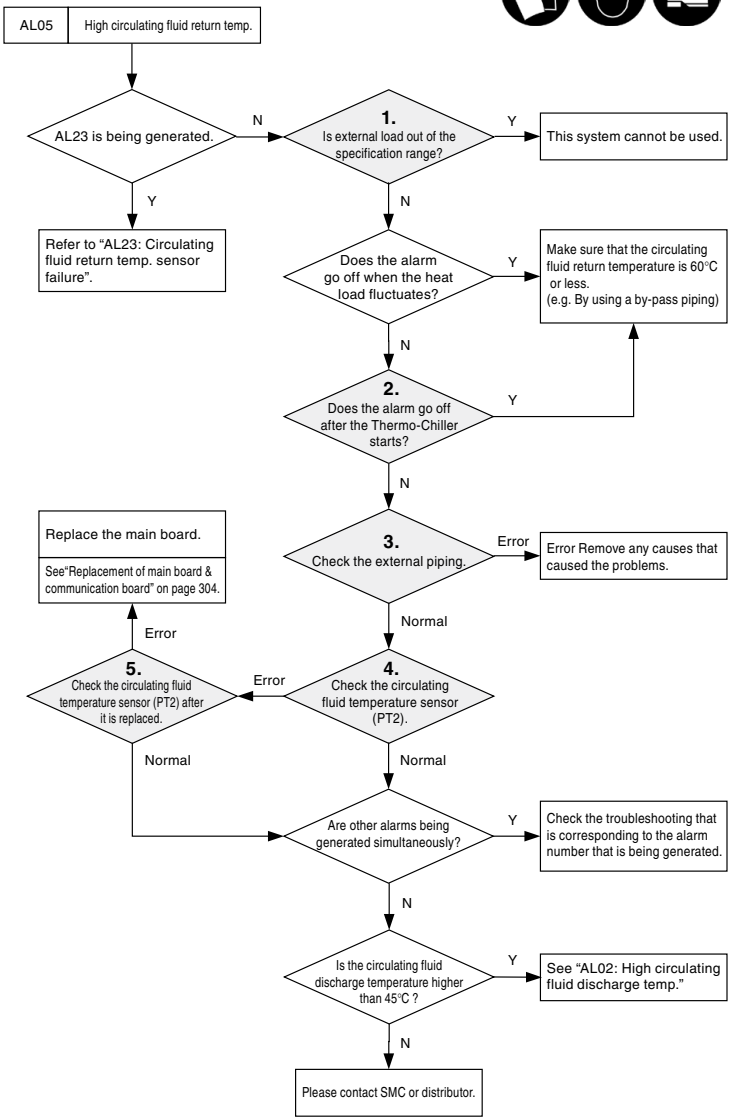
### 6. Check after stopping power supply for the same alarm goes off again when the chiller is re-started.

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 on pages 19 and 20.

### 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°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°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 “Replacement of the temperature sensor (PT2)” on page 262 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.

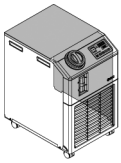
## AL06: High circulating fluid discharge pressure

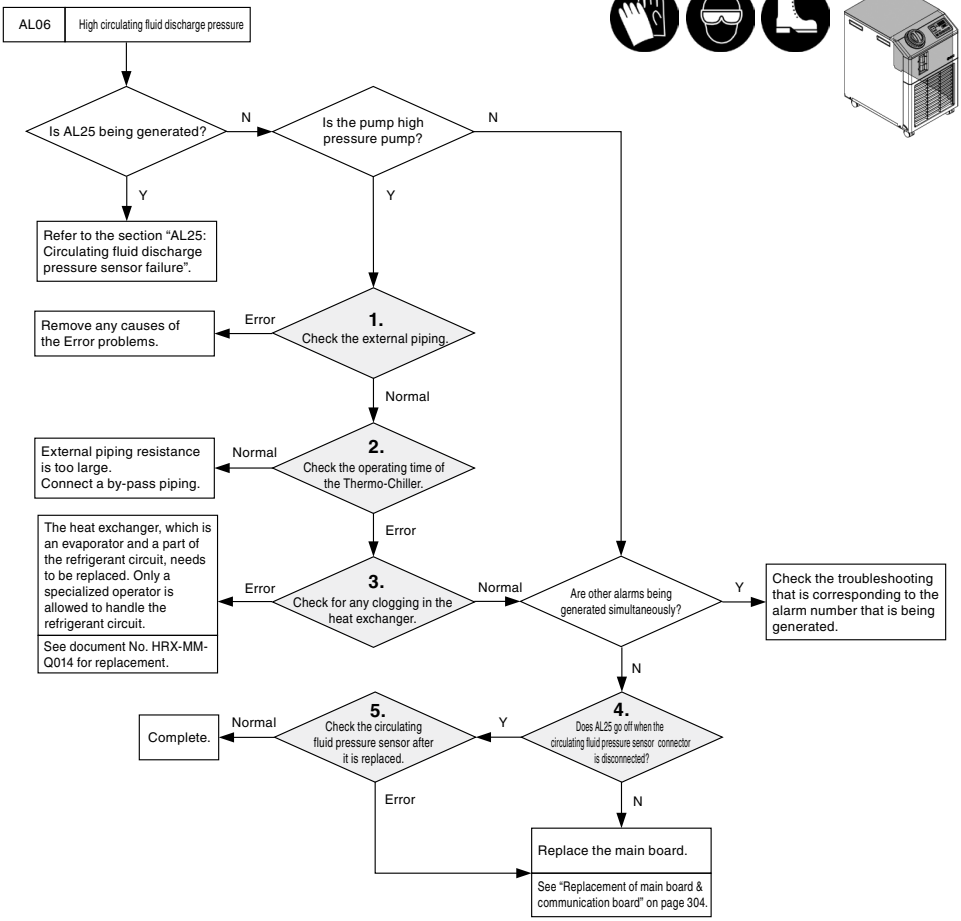
<Detection method> This alarm goes off when the pressures detected by the circulating fluid pressure sensor (for discharge) reach the following values.

· 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.

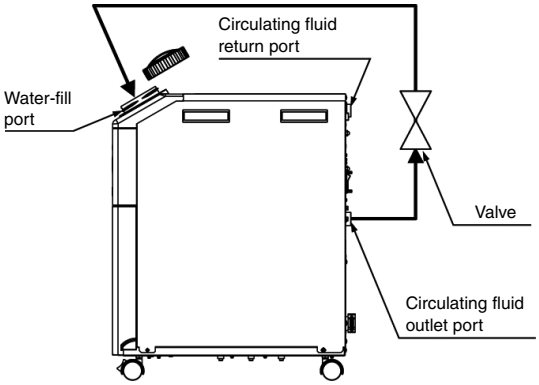



**Fig. 4-19 Piping example**

## 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.

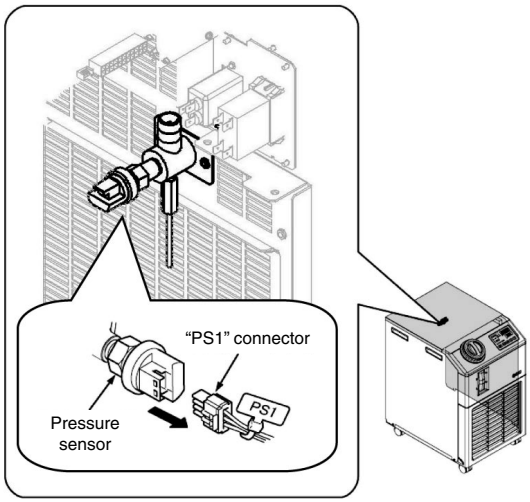



**Fig. 4-20 Circulating fluid pressure sensor**

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

Replace the circulating fluid pressure sensor (for discharge). (See “Replacement of pressure sensor” on page 282.)

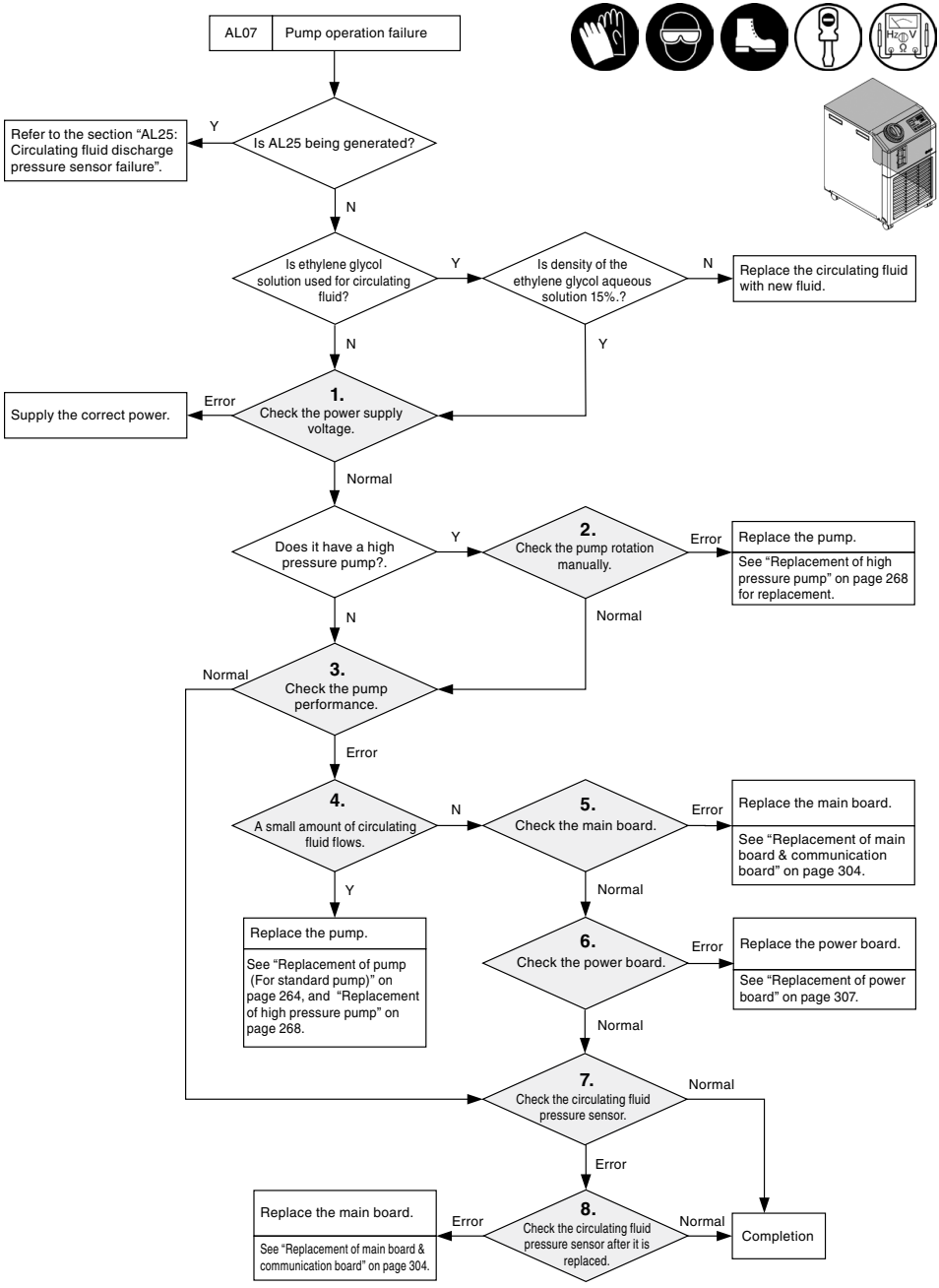
After replacing the sensor, operate the Thermo-Chiller and confirm that the alarm does not go off again.

## 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 (100 V spec.): Single phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)
· –20 (200 V 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.

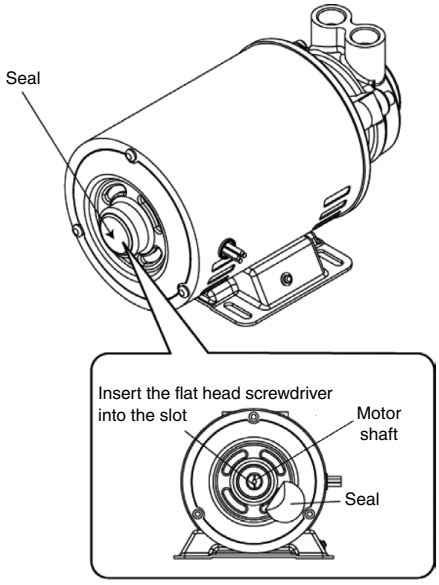



**Fig. 4-21 Rotate the pump manually**

### 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 on page 23.

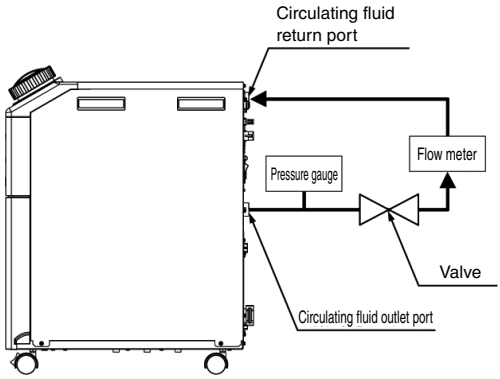



**Fig. 4-22 Piping example**

### 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

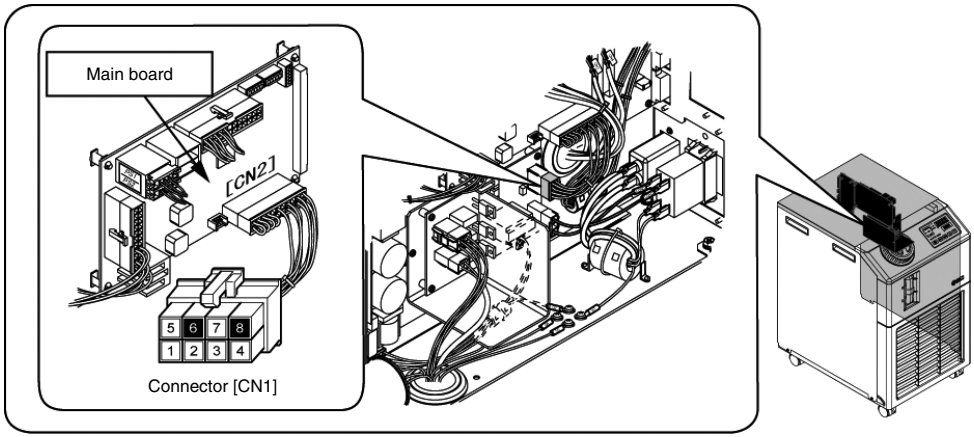



**Fig. 4-23 Check the pump signal output**

## 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 (100 V spec.): Single phase 100 VAC (50/60 Hz), or 115 VAC (60 Hz)

· –20 (200 V spec.): Single phase 200 VAC to 230 VAC (50/60 Hz)

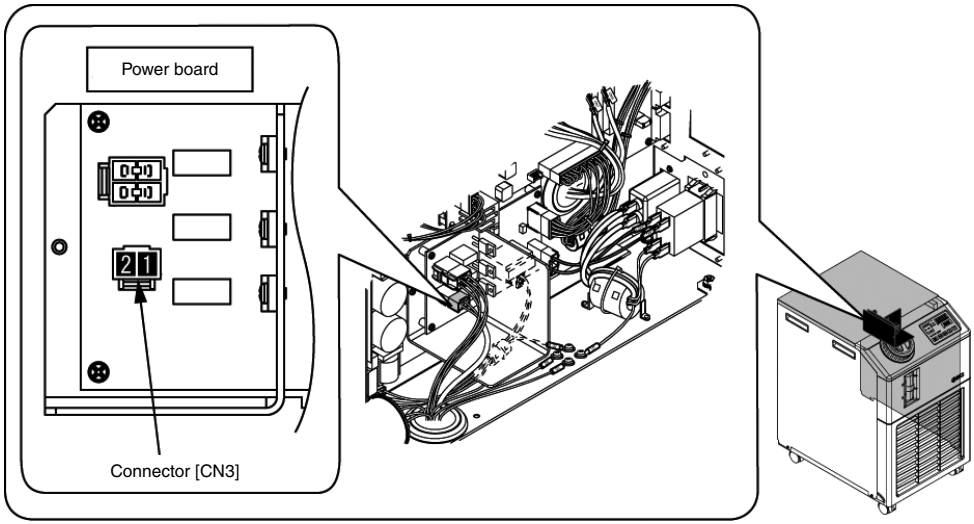



**Fig. 4-24 Check the pump input**

## 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 “Replacement of pressure sensor” on page 282.)

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

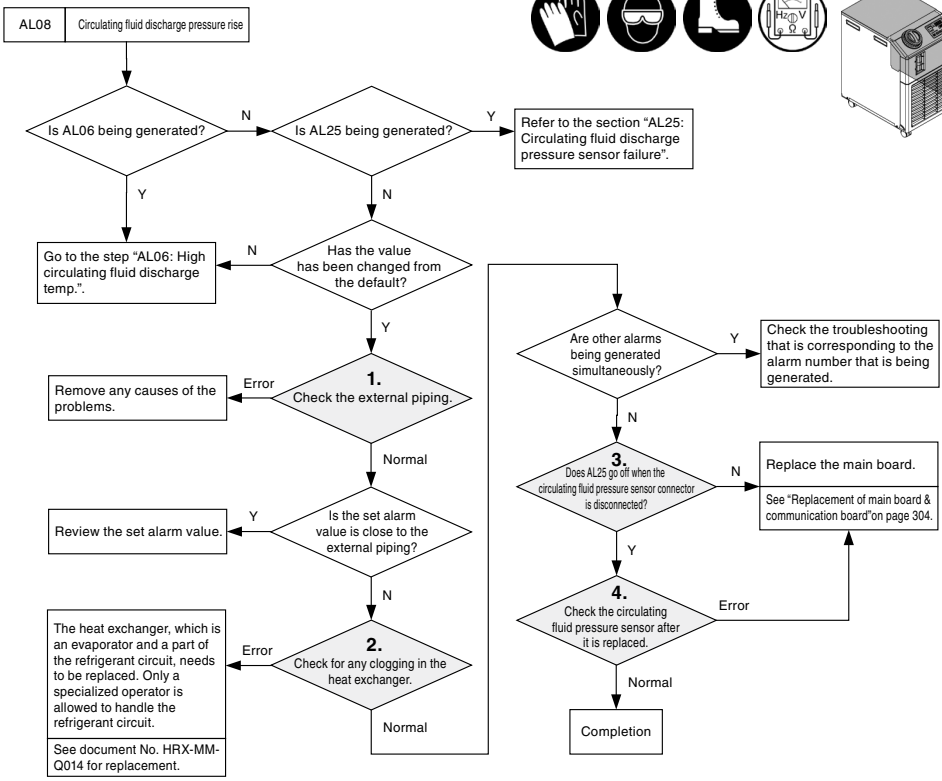
## AL08: Circulating fluid discharge pressure rise

<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.

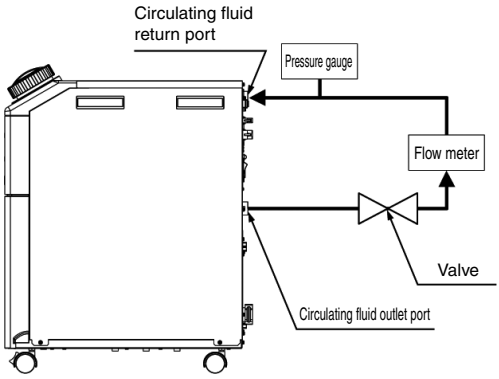



**Fig. 4-25 Piping example**

### 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.

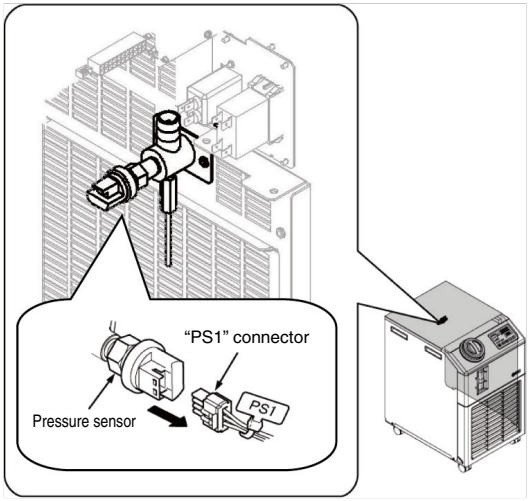



**Fig. 4-26 Circulating fluid pressure sensor**

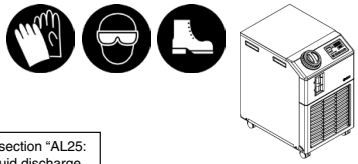
### 4. Check the circulating fluid pressure sensor after it is replaced.

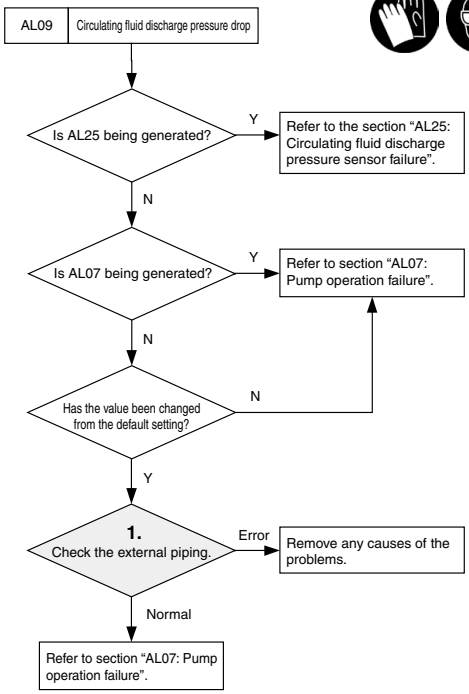
Replace the circulating fluid pressure sensor (for discharge). (See “Replacement of pressure sensor” on page 282.)

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:

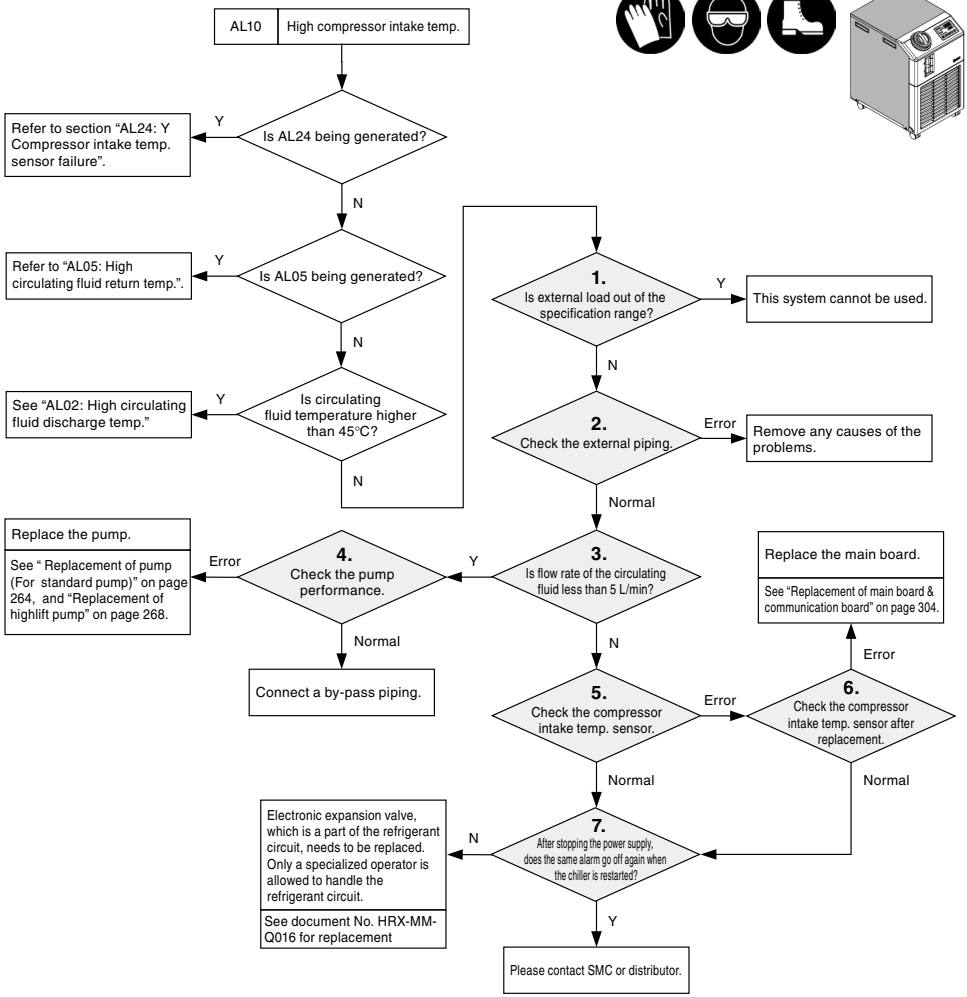
(1) Valve opening has been changed.

(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 on pages 19 and 20.

### 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°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” on page 23 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 oC, it means that the compressor intake temperature sensor is operating correctly.

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

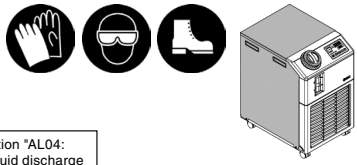
Replace the compressor intake temperature sensor with a new one. (See document No. HRX-MM-Q016 for replacement instructions) After replacing, check that all the check items shown in “5. Check the compressor intake temperature sensor.” are correctly followed.

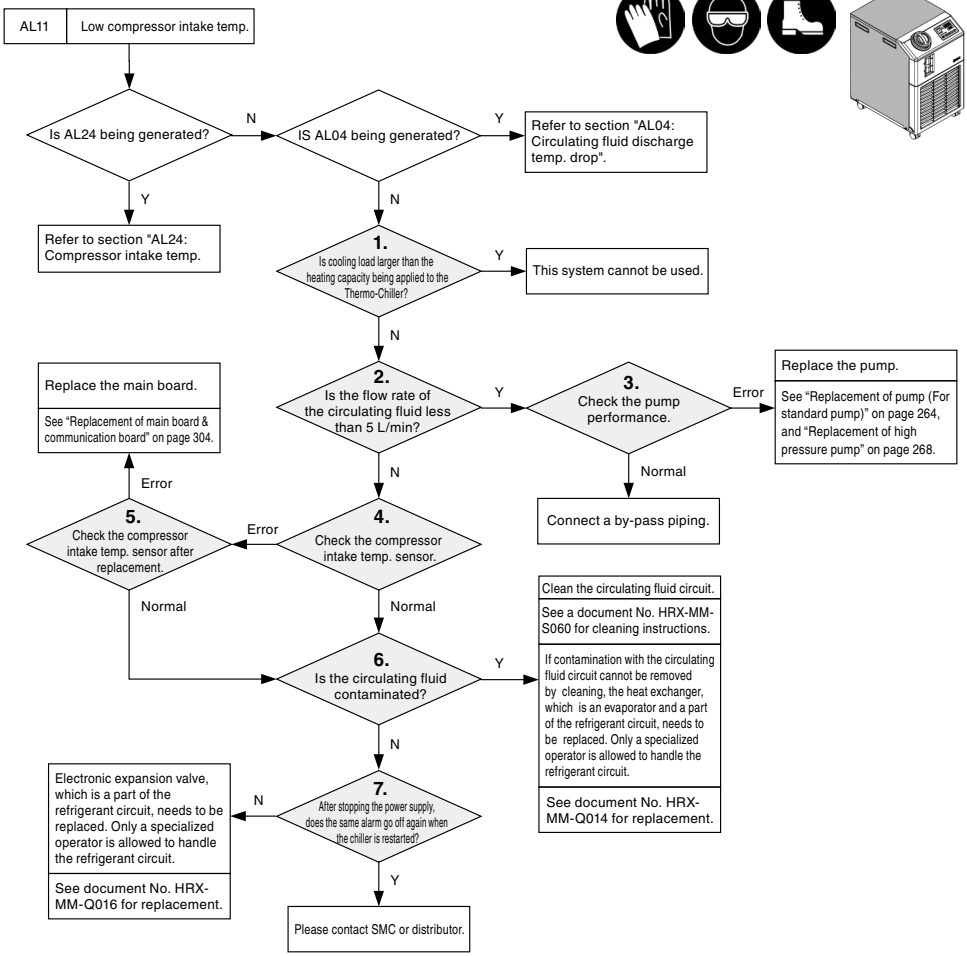
### 7. After stopping power supply, check for the same alarm goes off again when the chiller is re-started.

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 on pages 21 and 22.

**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” on page 23 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°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°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°C

<With contamination with the heat exchanger>

“t3: Suction temperature of the compressor” < “t2: Circulating fluid return temperature”–5°C

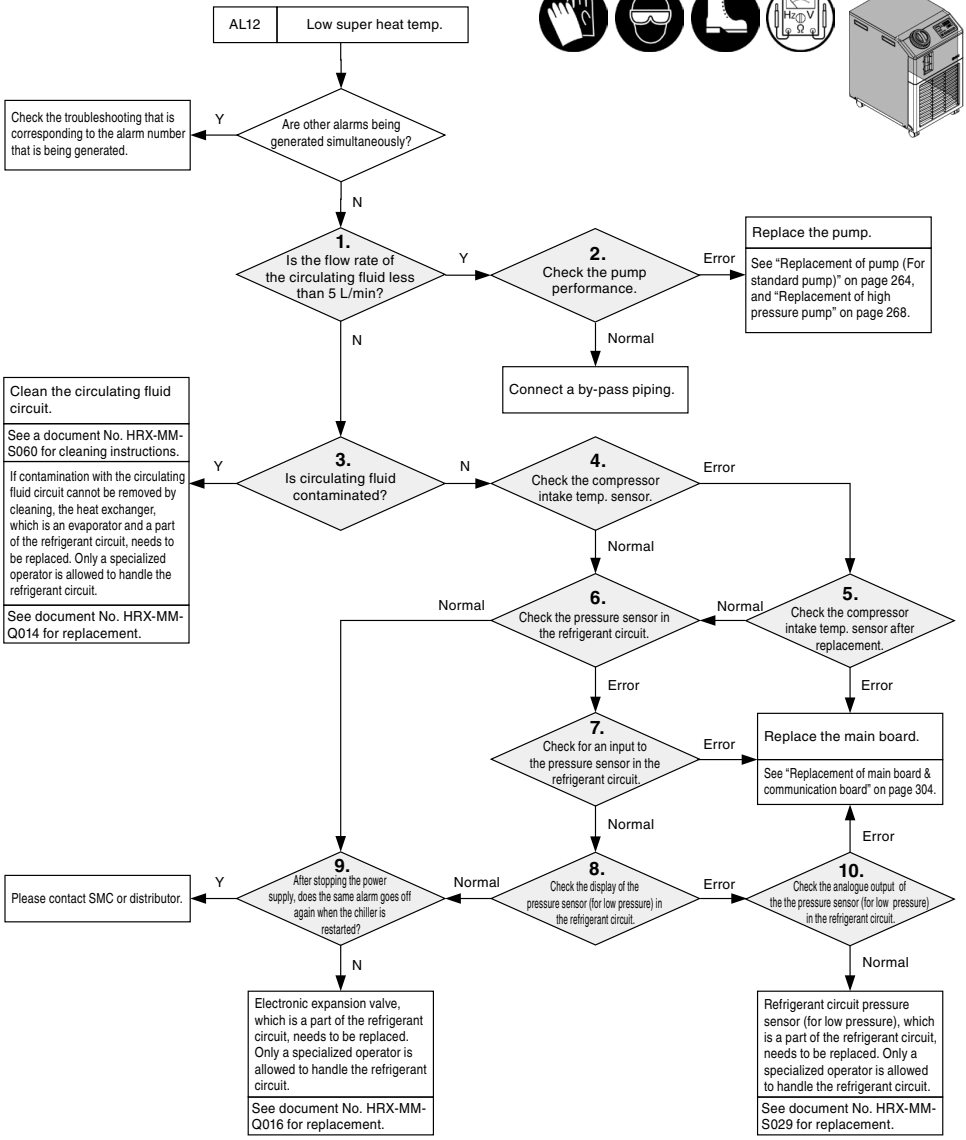
e.g. (Normal) t2: 21.5, t3: 23.8, (Abnormal) t2: 21.5, t3: 15.5

**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” on page 23 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°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°C
<With contamination with the heat exchanger>
“t3: Suction temperature of the compressor” < “t2: Circulating fluid return temperature” –5°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°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 +/- 1 V

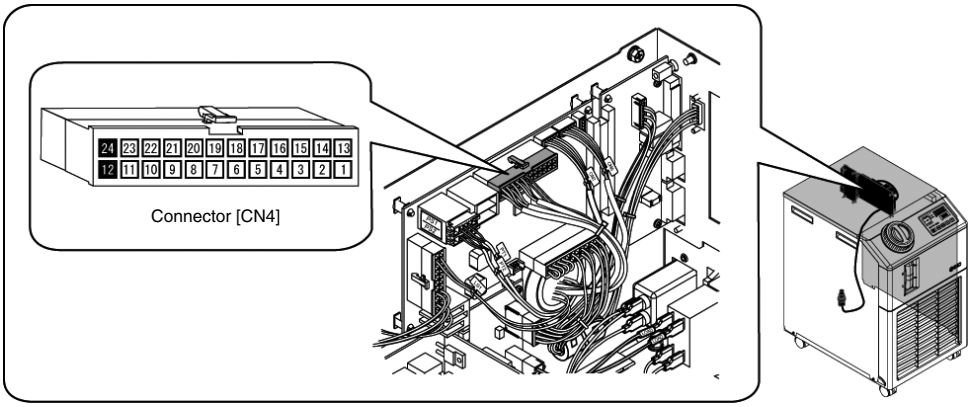



**Fig. 4-27 Check of the refrigerant circuit pressure sensor (for low pressure) input**

## 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. 4-28. If the cross point is within the range, it means that the pressure sensor is operating correctly.

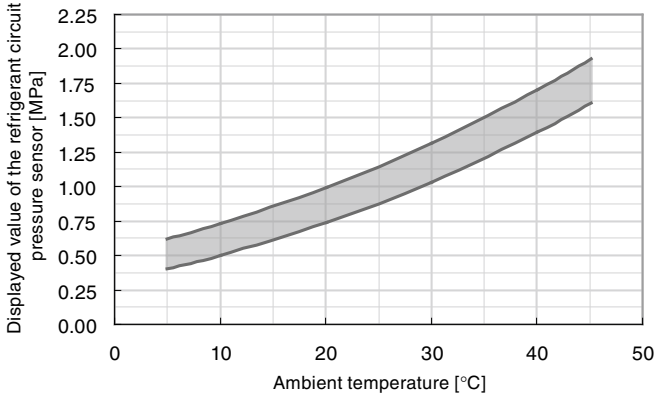



**Fig. 4-28 Ambient temperature and refrigerant circuit pressure**

## 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 correctly.

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. 4-30. (Accuracy: +/- 5%)

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

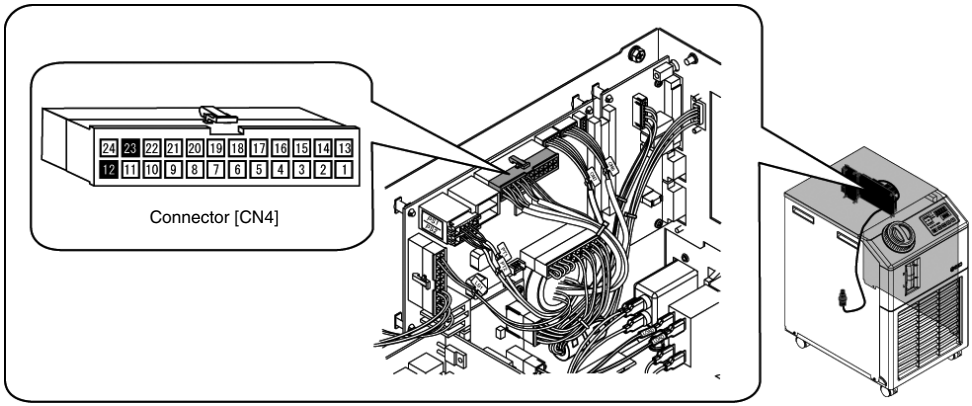



**Fig. 4-29 Check of the refrigerant circuit pressure sensor (for low pressure) output**

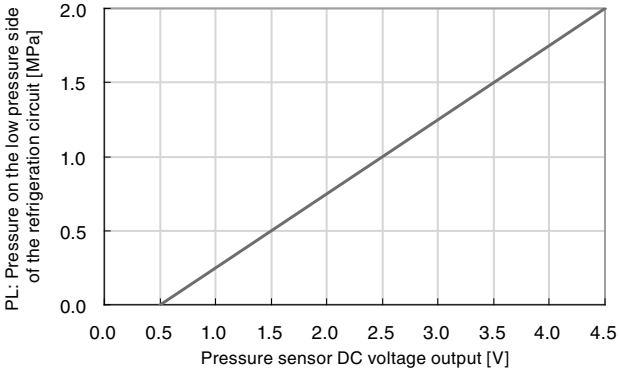
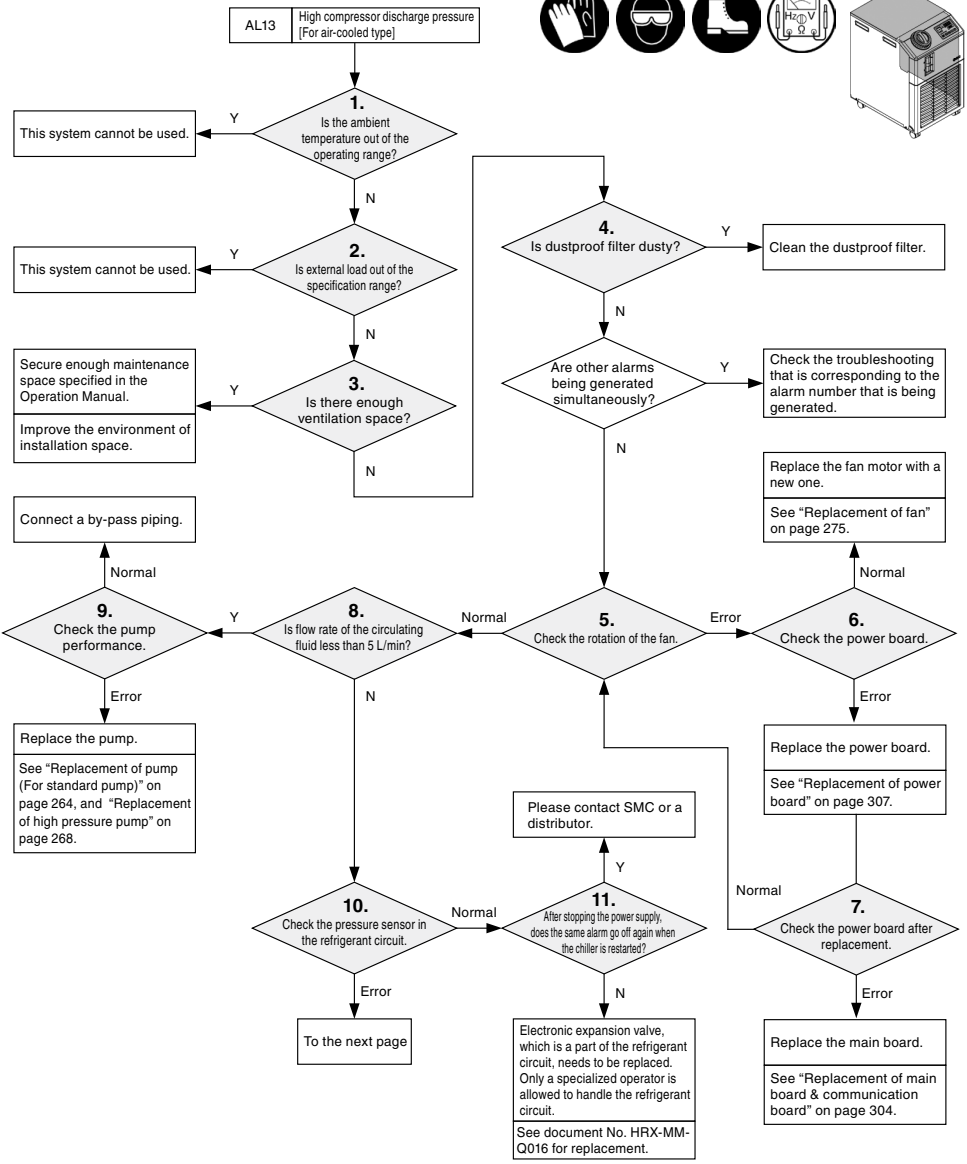
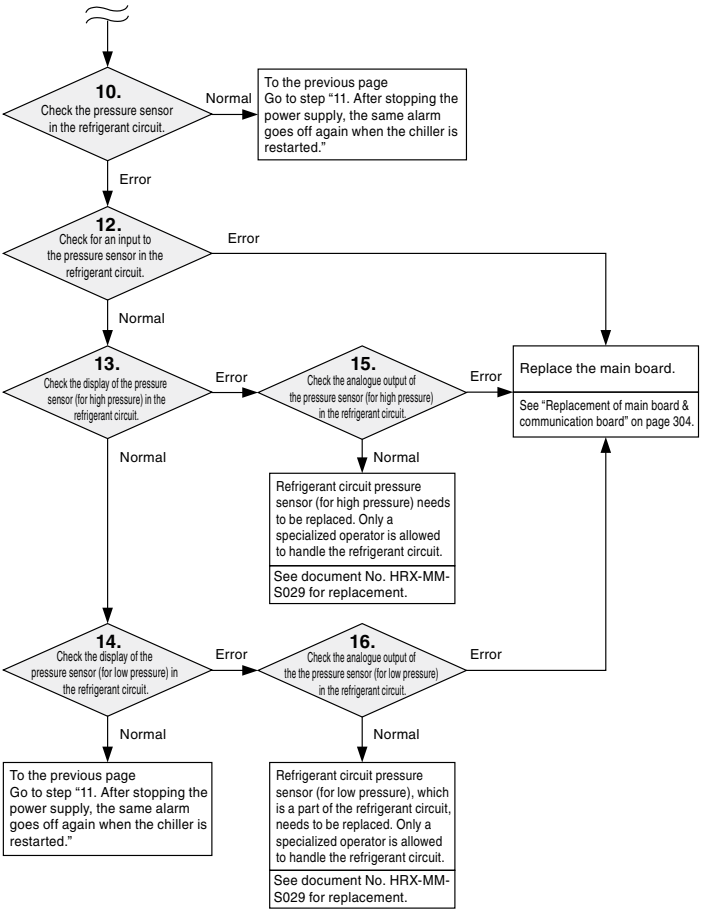



**Fig. 4-30 Refrigerant circuit pressure sensor (for low pressure) analogue output**

## 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 pressure sensor (for high pressure) in the refrigerant circuit.
Error
Replace the main board.
See “Replacement of main board & communication board” on page 304.
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 on pages 19 and 20.

### 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.

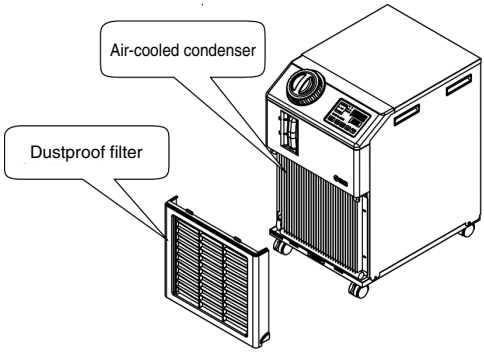



**Fig. 4-31 An air-cooled condenser and a dustproof filter**

### 5. Check the rotation of the fan.

Check visually that the fan rotates right after starting the Thermo-Chiller operation from the stopped state.
(Depending on the installation environment, the fan may stop rotating for few seconds after starting the product operation, which is normal. If the fan does not rotate after starting the operation, this is not normal.)

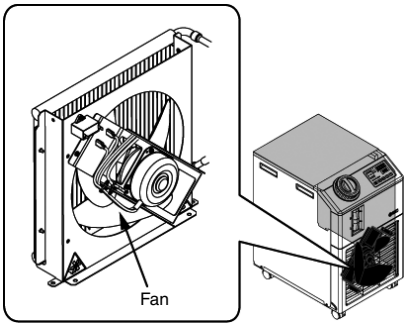



**Fig. 4-32 Fan position**

## 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 (100 V spec.): Single phase 100 VAC (50/60 Hz), or 115 VAC (60 Hz)

· –20 (200 V spec.): Single phase 200 VAC to 230 VAC (50/60 Hz)

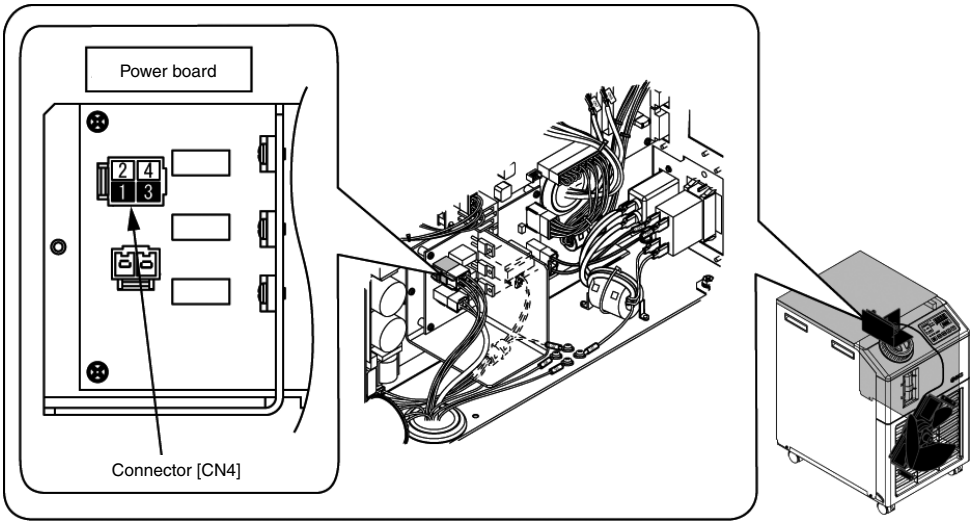



**Fig. 4-33 Confirm the fan input**

### 7. Check the power board after replacement.

Replace the power board. (See “Replacement of power board” on page 307.)
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” on page 23 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 +/- 1 V

<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 +/- 1 V

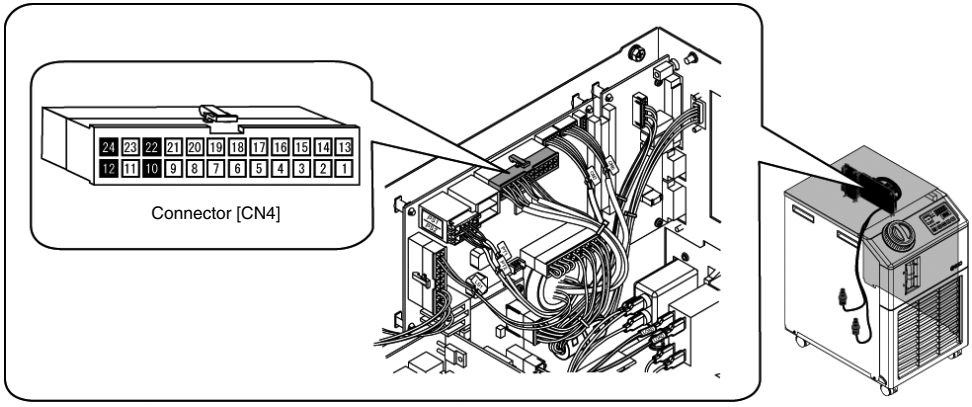



**Fig. 4-34 Check of the refrigerant circuit pressure sensor input**

## 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. 4-35. If the cross point is within the range, it means that the pressure sensor is operating correctly.

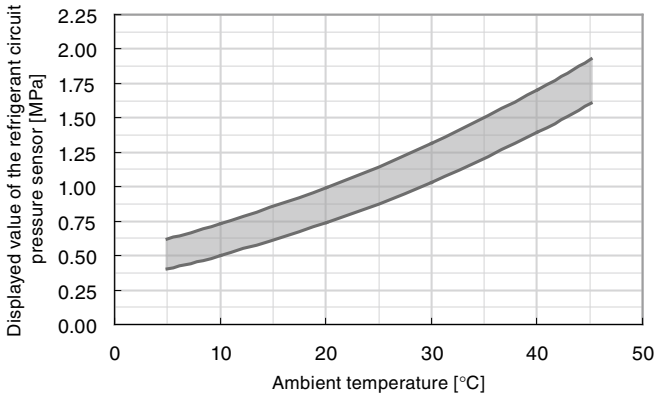



**Fig. 4-35 Ambient temperature and refrigerant circuit pressure**

## 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. 4-35 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 correctly.

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. 4-37. (Accuracy: +/- 5%)

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

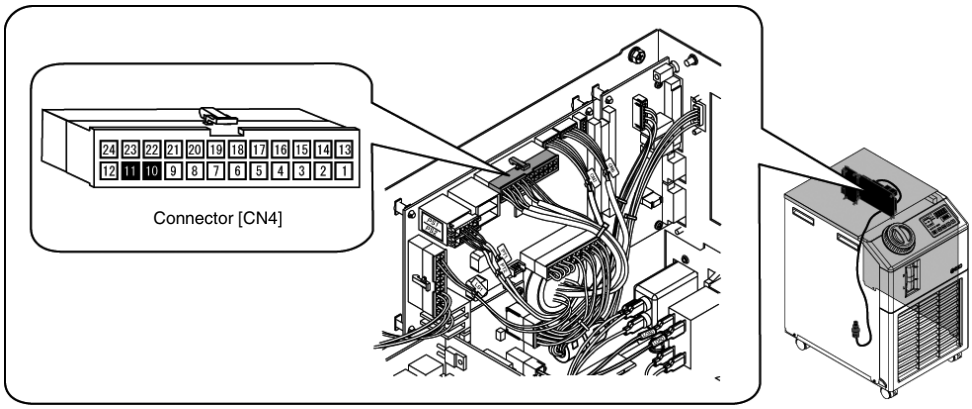



**Fig. 4-36 Check of the refrigerant circuit pressure sensor (for high pressure) output**

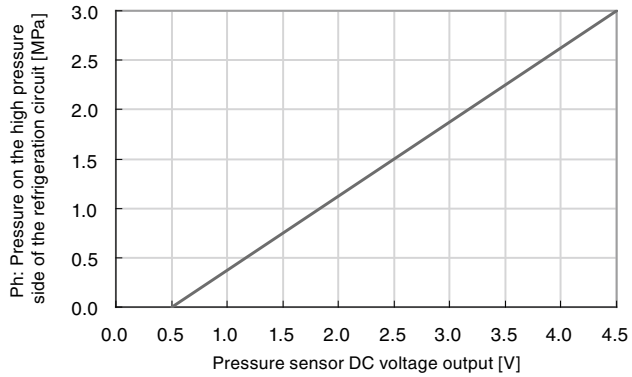



**Fig. 4-37 Refrigerant circuit pressure sensor (for high pressure) analogue output**

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

Find out if the main board is operating correctly.

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. 4-39. (Accuracy: +/- 5%)

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

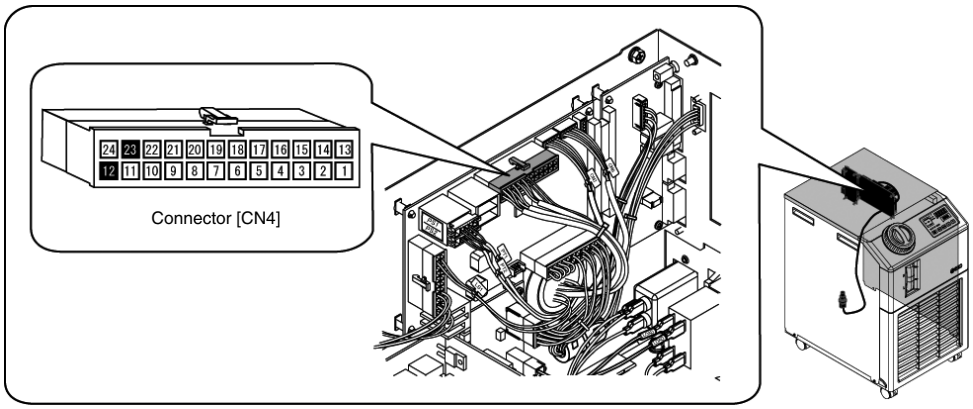



**Fig. 4-38 Check of the refrigerant circuit pressure sensor (for low pressure) output**

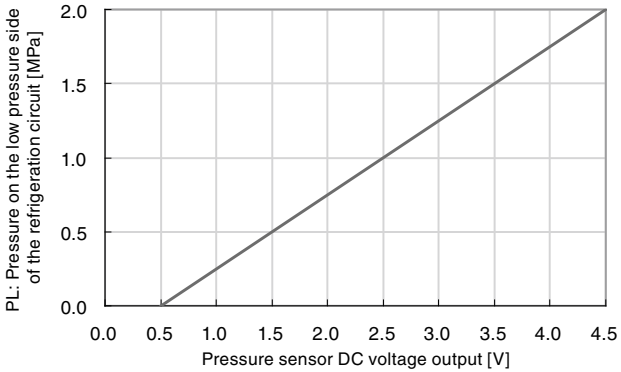
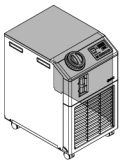



**Fig. 4-39 Refrigerant circuit pressure sensor (for low pressure) analogue output**

## 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 ↓

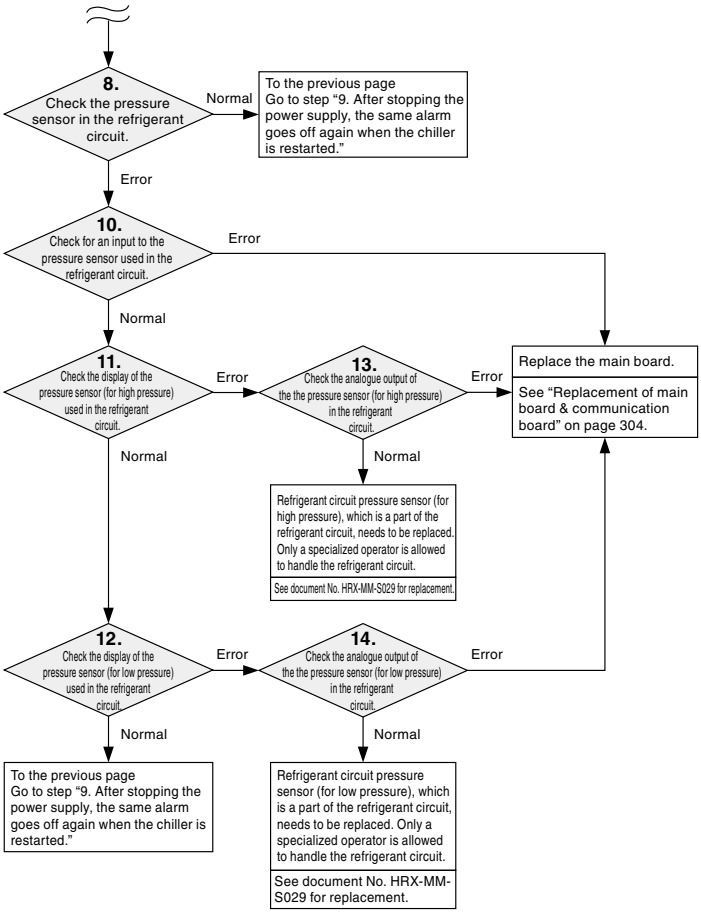
3. Is the flow rate for the facility water correct?
- Y → 4. Is the Water-cooled condenser contaminated?
  - Y → Water cooled condenser, which is a part of the refrigerant circuit, needs to be replaced. Only a specialized operator is allowed to handle the refrigerant circuit. See document No. HRX-MM-Q029 for replacement.
  - N ↓
- 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 “Replacement of pump (For standard pump)” on page 264, and “Replacement of high pressure pump” on page 268.
  - 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 on page 23.

## 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 on page 23.

* 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.

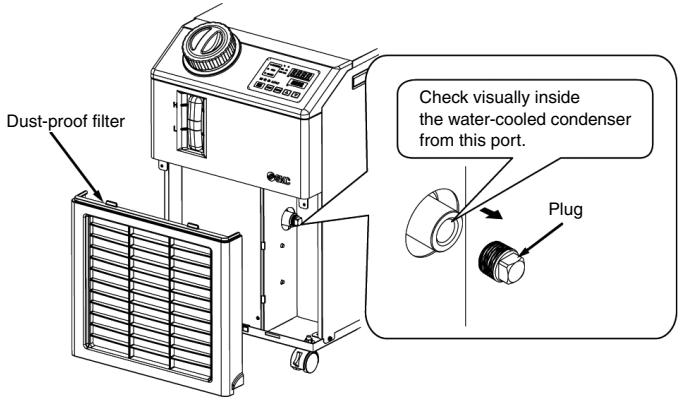



**Fig. 4-40 The port for visual check for contamination inside the water-cooled condenser**

## 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 on pages 19 and 20.

## 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” on page 23 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 +/- 1 V

<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 +/- 1 V



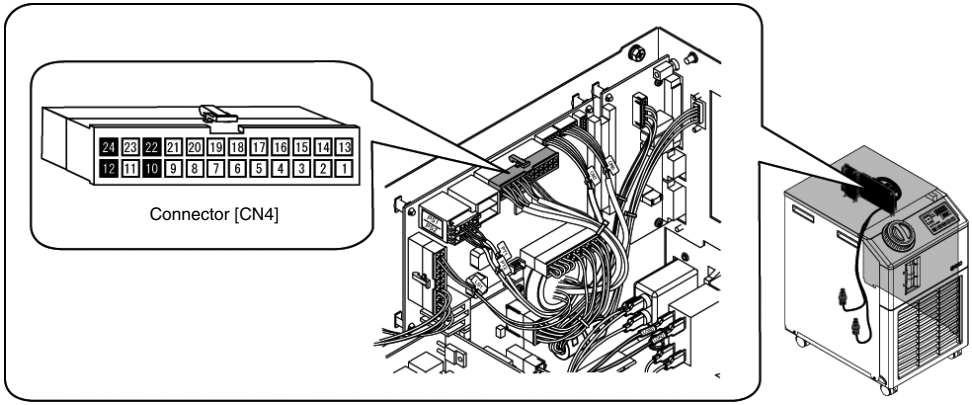



**Fig. 4-41 Check of the refrigerant circuit pressure sensor input**

## 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. 4-42. If the cross point is within the range, it means that the pressure sensor is operating correctly.

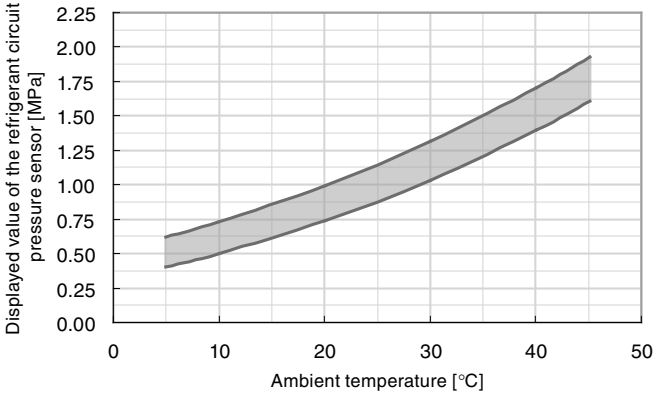



**Fig. 4-42 Ambient temperature and refrigerant circuit pressure**

## 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. 4-42. 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 correctly.

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. 4-44. (Accuracy: +/- 5%)

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

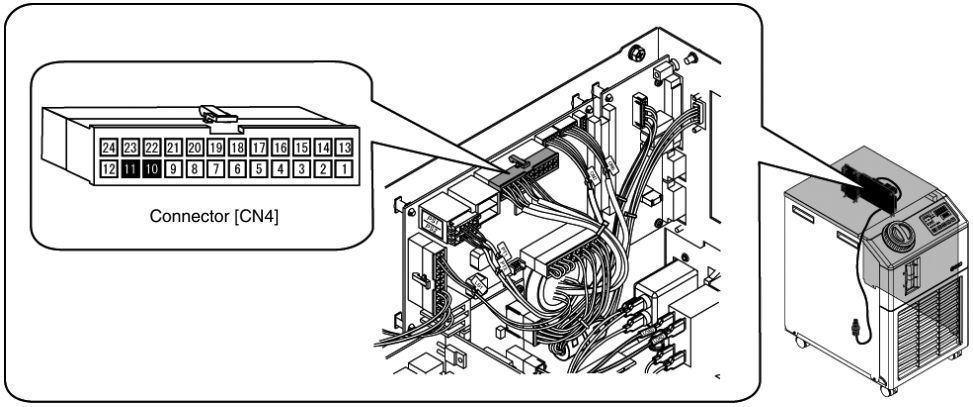



**Fig. 4-43 Check of the refrigerant circuit pressure sensor (for high pressure) output**

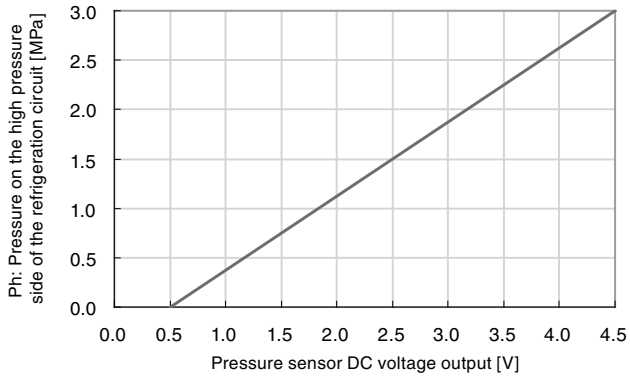



**Fig. 4-44 Refrigerant circuit pressure sensor (for high pressure) analogue output**

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

Find out if the main board is operating correctly.

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. 4-46. (Accuracy: +/- 5%)

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

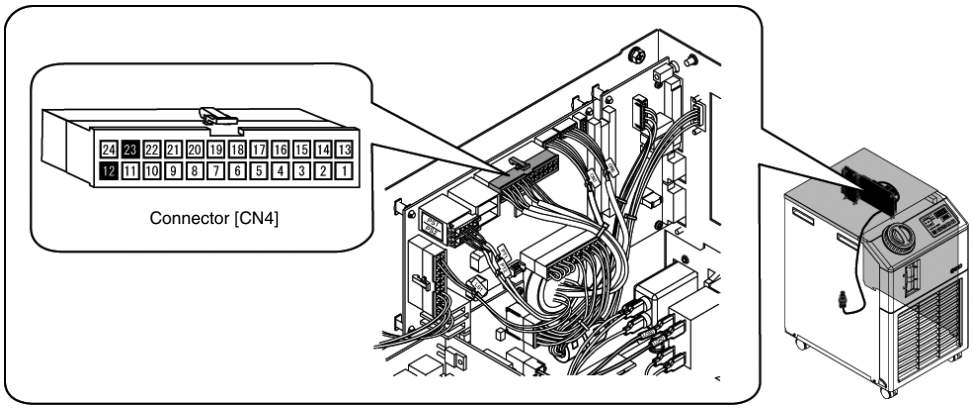



**Fig. 4-45 Check of the refrigerant circuit pressure sensor (for low pressure) output**

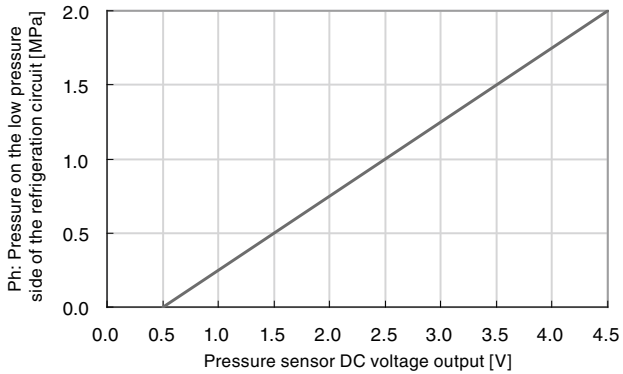
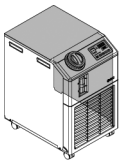
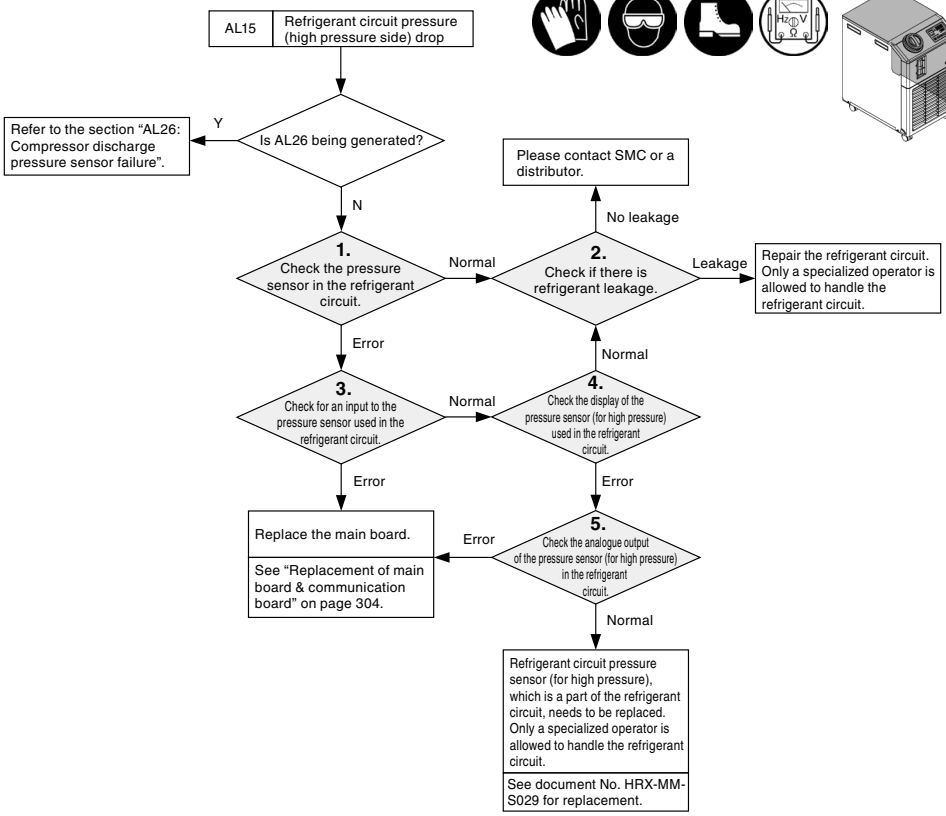



**Fig. 4-46 Refrigerant circuit pressure sensor (for low pressure) analogue output**

## 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. 4-47: Ambient temperature and refrigerant circuit pressure”, it means there is refrigerant leakage caused.

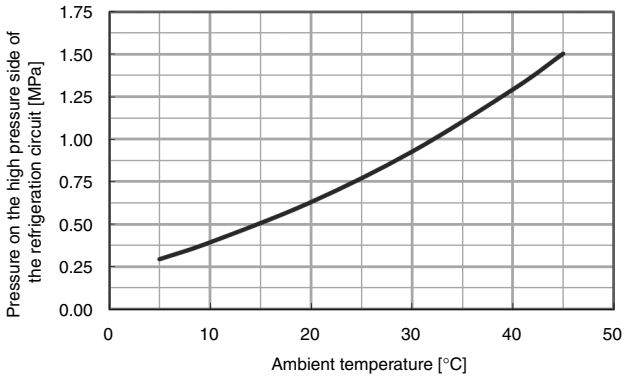



**Fig. 4-47 Ambient temperature and refrigerant circuit pressure**

### 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 +/- 1 V

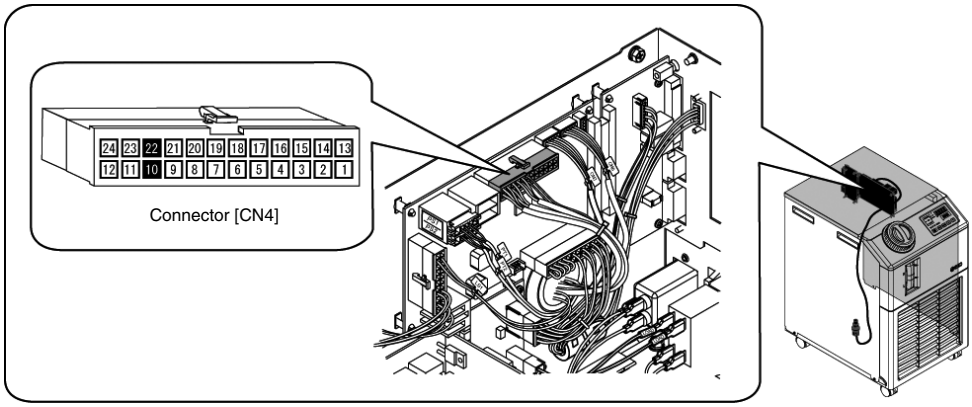



**Fig. 4-48 Check of the refrigerant circuit pressure sensor (for high pressure) input**

## 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. 4-49. If the cross point is within the range, it means that the pressure sensor is operating correctly.

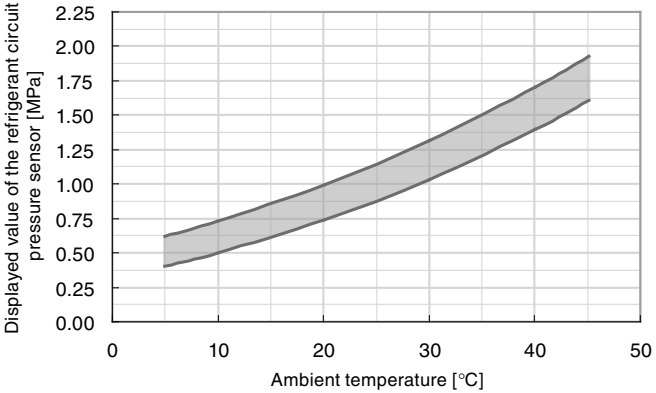



**Fig. 4-49 Ambient temperature and refrigerant circuit pressure**

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

Find out if the main board is operating correctly.

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. 4-51. (Accuracy: +/- 5%)

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

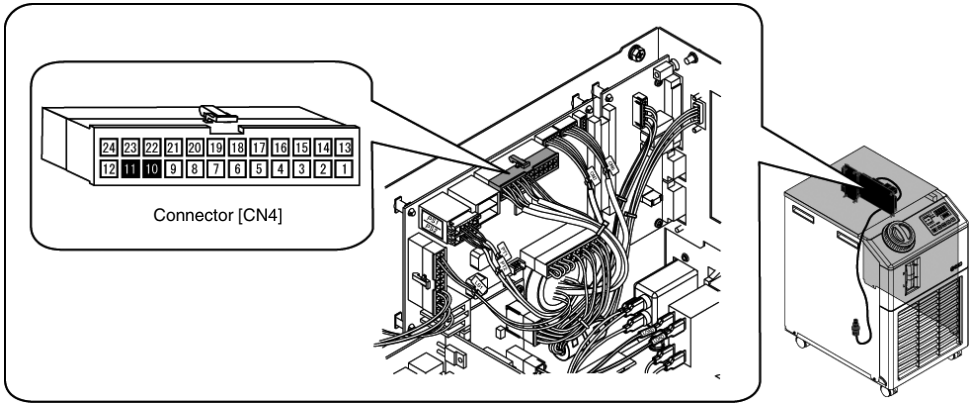



**Fig. 4-50 Check of the refrigerant circuit pressure sensor (for high pressure) output**

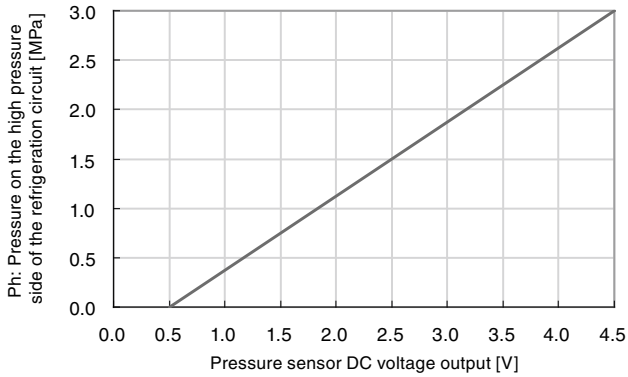
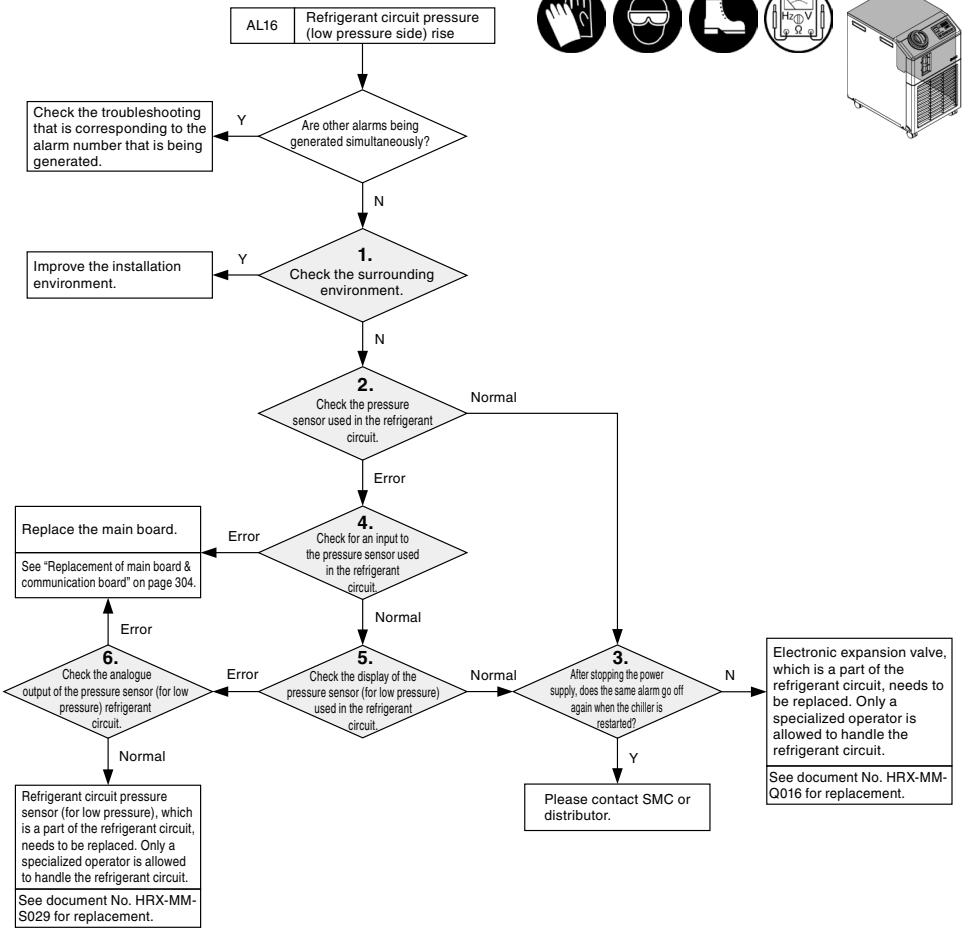



**Fig. 4-51 Refrigerant circuit pressure sensor (for high pressure) analogue output**

## 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 +/- 1 V

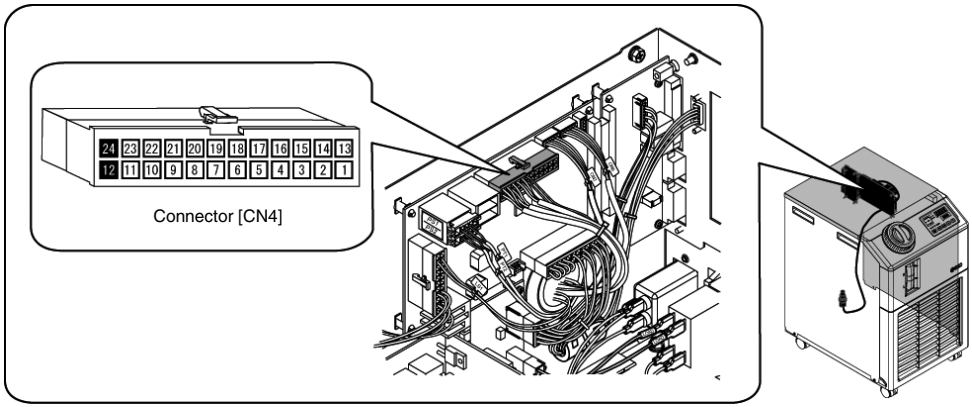



**Fig. 4-52 Check of the refrigerant circuit pressure sensor (for low pressure) input**

## 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. 4-53. If the cross point is within the range, it means that the pressure sensor is operating correctly.

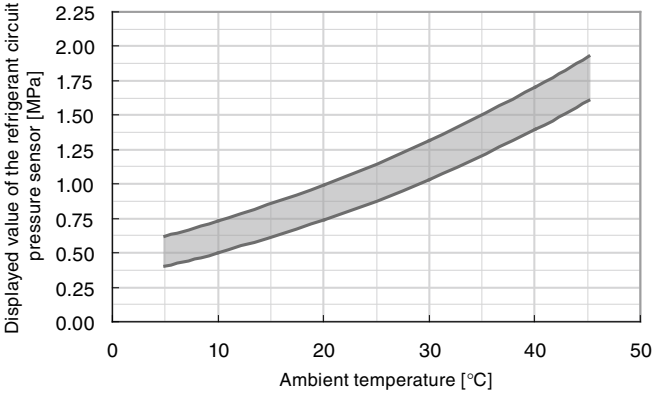



**Fig. 4-53 Ambient temperature and refrigerant circuit pressure**

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

Find out if the main board is operating correctly.

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. 4-55. (Accuracy: +/- 5%)

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

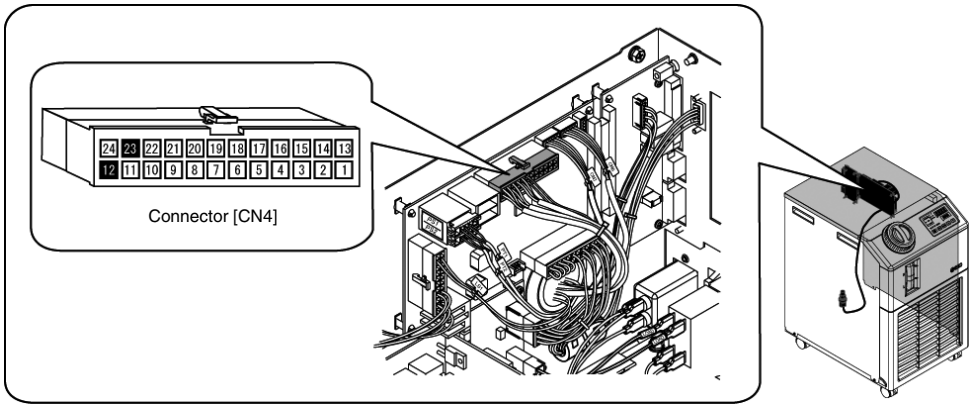



**Fig. 4-54 Check of the refrigerant circuit pressure sensor (for low pressure) output**

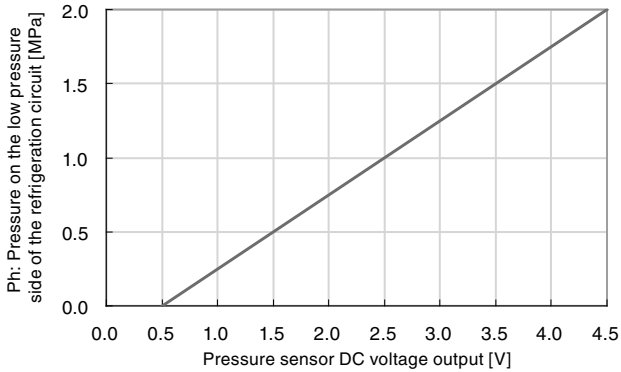
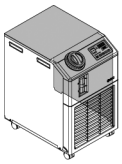



**Fig. 4-55 Refrigerant circuit pressure sensor (for low pressure) analogue output**

## 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.



AL17 Refrigerant circuit pressure (low pressure side) drop

Are other alarms being generated simultaneously?
- Y → Check the troubleshooting that is corresponding to the alarm number that is being generated.
- N

**1.** Check the surrounding environment.
- Y → Improve the installation environment.
- N

**2.** Is flow rate of the circulating fluid less than 5 L/min?
- Y → **3.** Check the pump performance.
  - Normal → Connect a by-pass piping.
  - Error → Replace the pump.
    See “Replacement of pump (For standard pump)” on page 264, and “Replacement of high pressure pump” on page 268.
- N

**4.** Check the pressure sensor used in the refrigerant circuit.
- Normal → **5.** After stopping the power supply, does the same alarm go 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.
- Error

**6.** Check for an input to the pressure sensor used in the refrigerant circuit.
- Error → Replace the main board.
  See “Replacement of main board & communication board” on page 304.
- Normal

**7.** Check the display of the pressure sensor (for low pressure) used in the refrigerant circuit.
- Error → **8.** Check the analogue output of the pressure sensor (for low pressure) in the refrigerant circuit.
  - Error
  - Normal → 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 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” on page 23 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 +/- 1 V

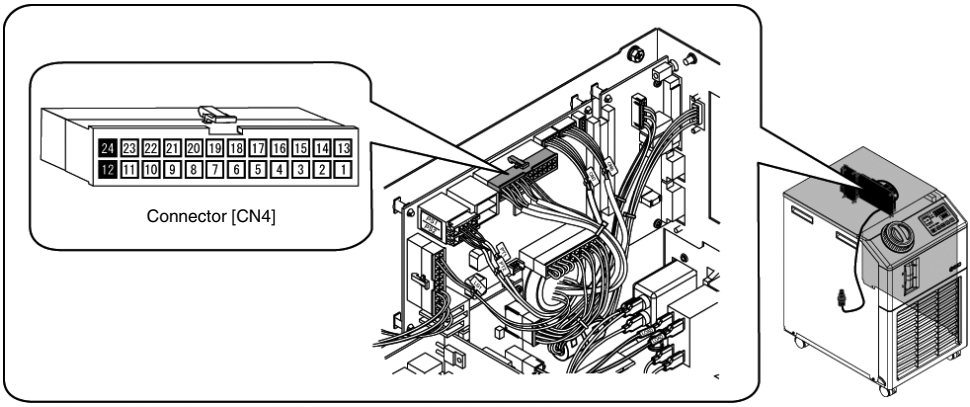



**Fig. 4-56 Check of the refrigerant circuit pressure sensor (for low pressure) input**

## 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. 4-57. If the cross point is within the range, it means that the pressure sensor is operating correctly.

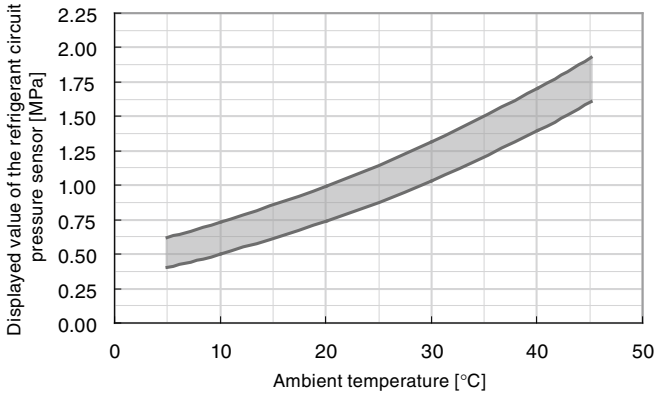



**Fig. 4-57 Ambient temperature and refrigerant circuit pressure**

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

Find out if the main board is operating correctly.

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. 4-59. (Accuracy: +/- 5%)

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

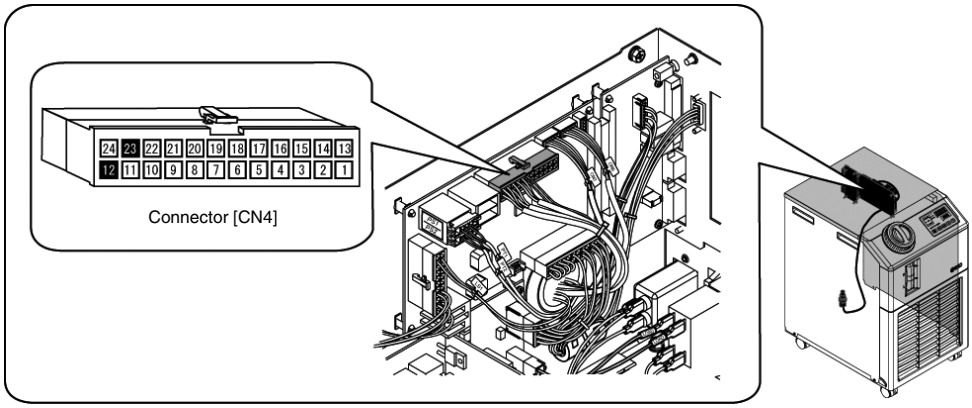



**Fig. 4-58 Check of the refrigerant circuit pressure sensor (for low pressure) output**

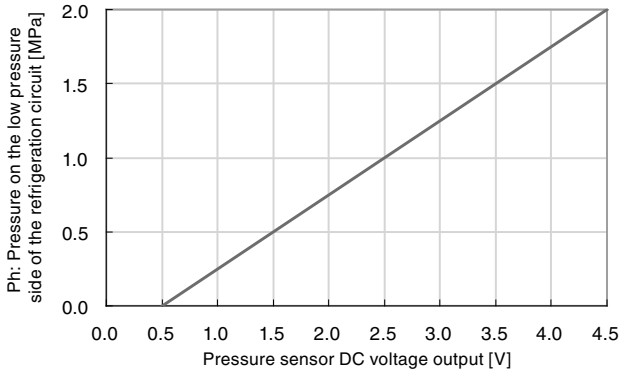
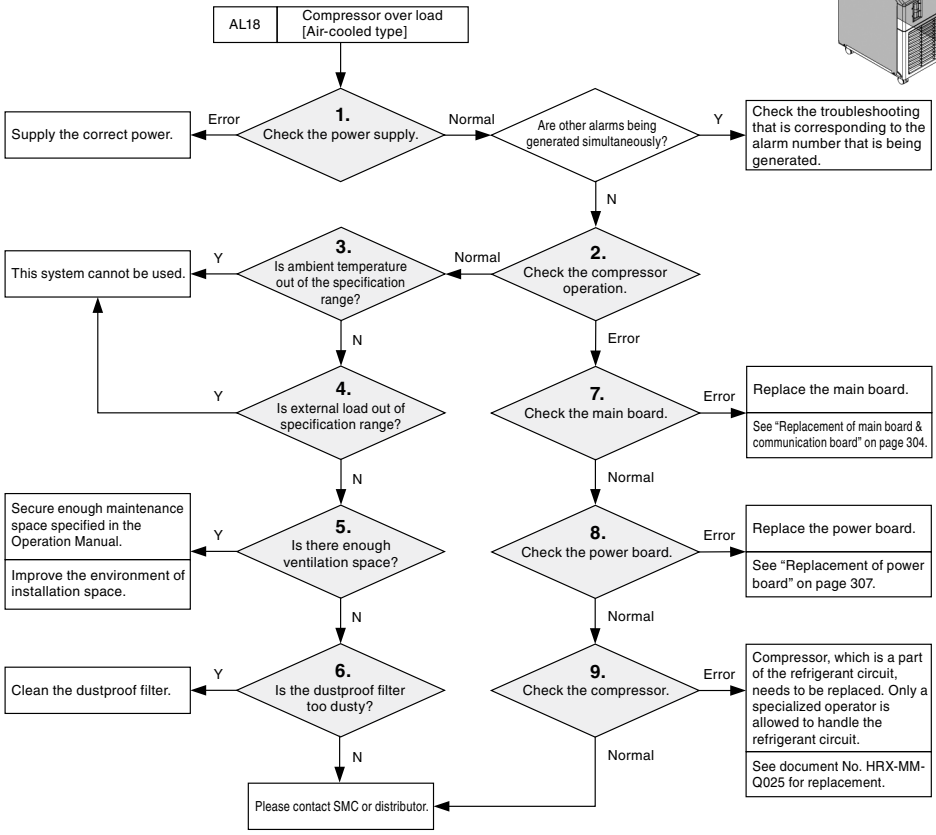



**Fig. 4-59 Refrigerant circuit pressure sensor (for low pressure) analogue output**

## 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 (100 V spec.): Single phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)

· –20 (200 V 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°C (45°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 on pages 19 and 20.

## 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.

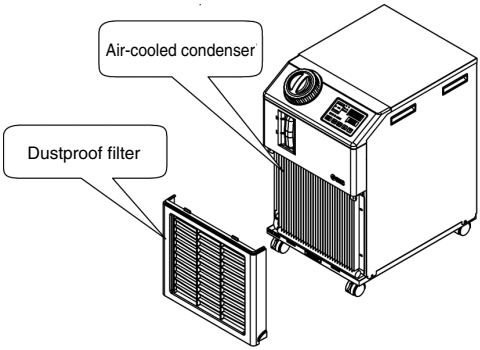



**Fig. 4-60 An air-cooled condenser and a dustproof filter**

## 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

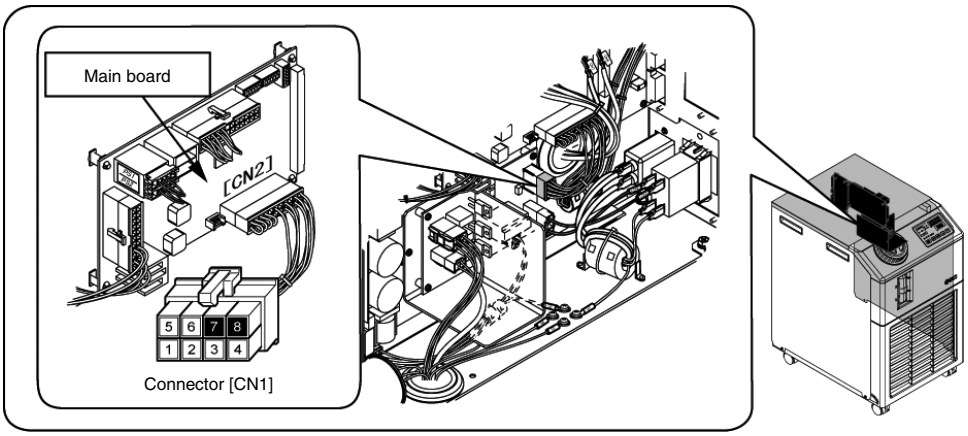



**Fig. 4-61 Check the compressor signal output**

## 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 (100 V spec.): Single phase 100 VAC (50/60 Hz), or 115 VAC (60 Hz)

· –20 (200 V spec.): Single phase 200 VAC to 230 VAC (50/60 Hz)

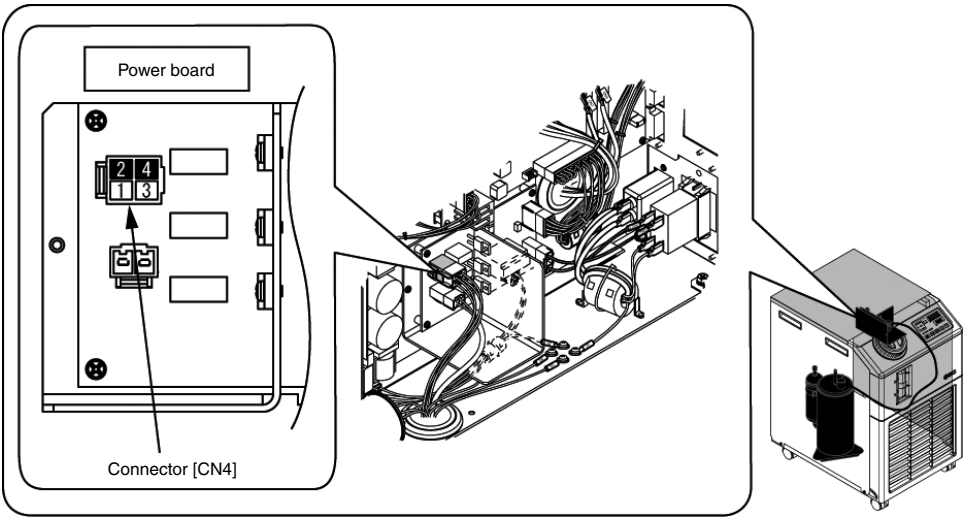



**Fig. 4-62 Check the compressor input**

## 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

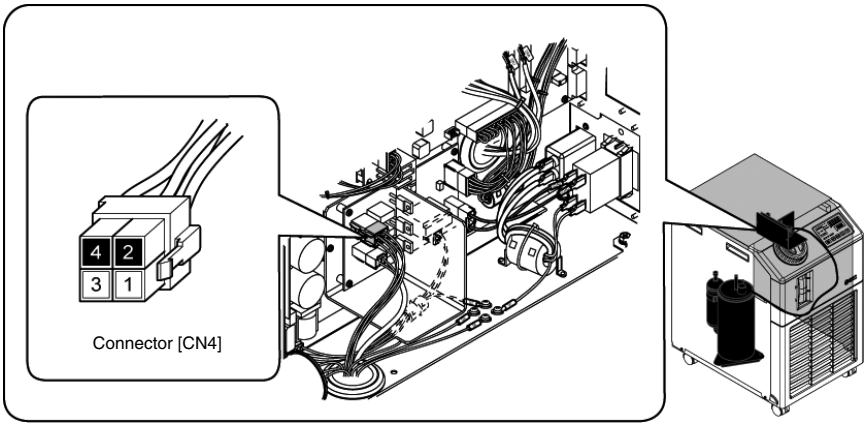
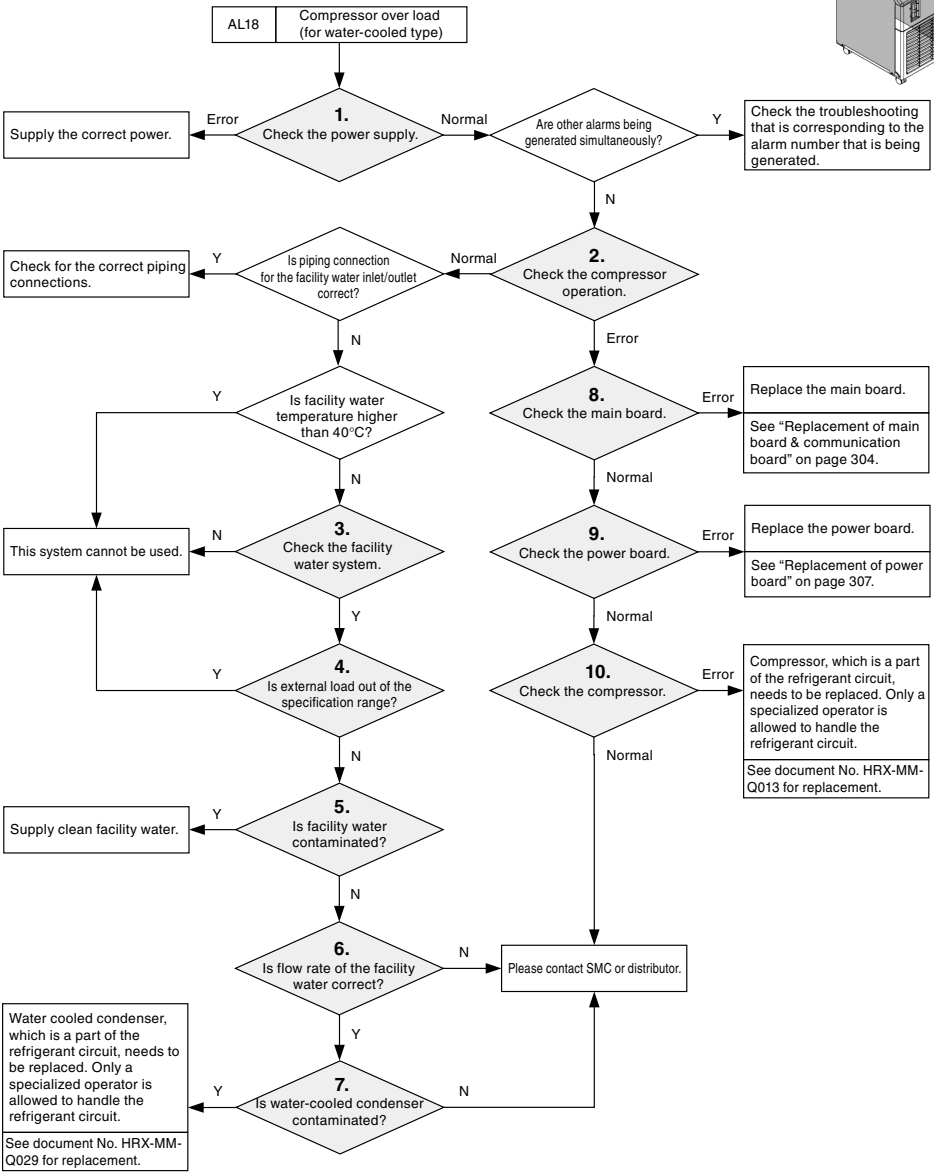



**Fig. 4-63 Check the compressor**

## 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 (100 V spec.): Single phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)

· –20 (200 V 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 on page 23.

## 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 on pages 19 and 20.

## 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 on page 23.

* 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.

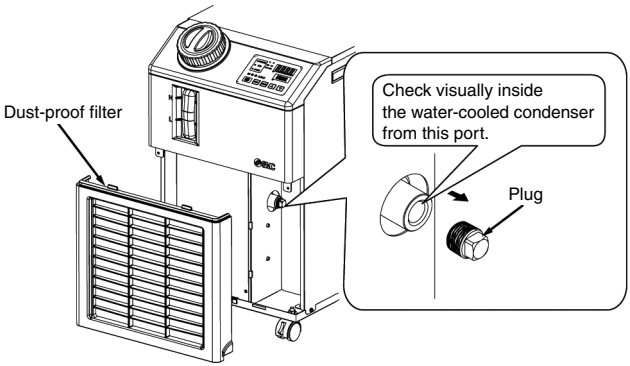



**Fig. 4-64 The port for visual check for contamination inside the water-cooled condenser**

## 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

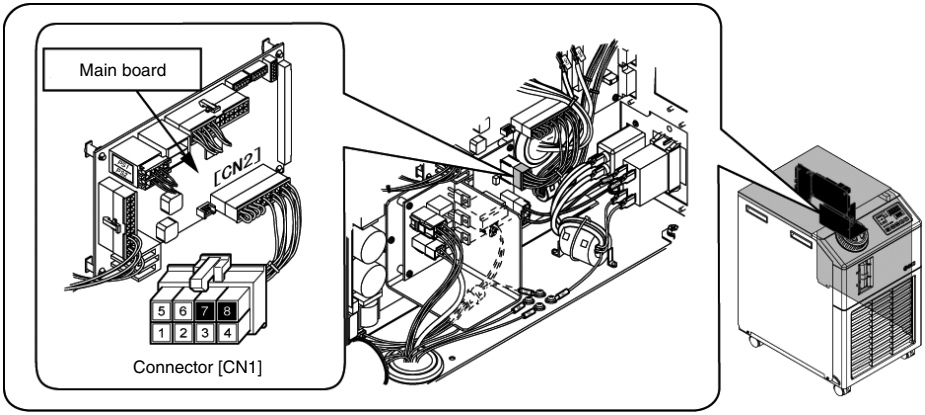



**Fig. 4-65 Check the compressor signal output**

## 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 (100 V spec.): Single phase 100 VAC (50/60 Hz), or 115 VAC (60 Hz)

· –20 (200 V spec.): Single phase 200 VAC to 230 VAC (50/60 Hz)

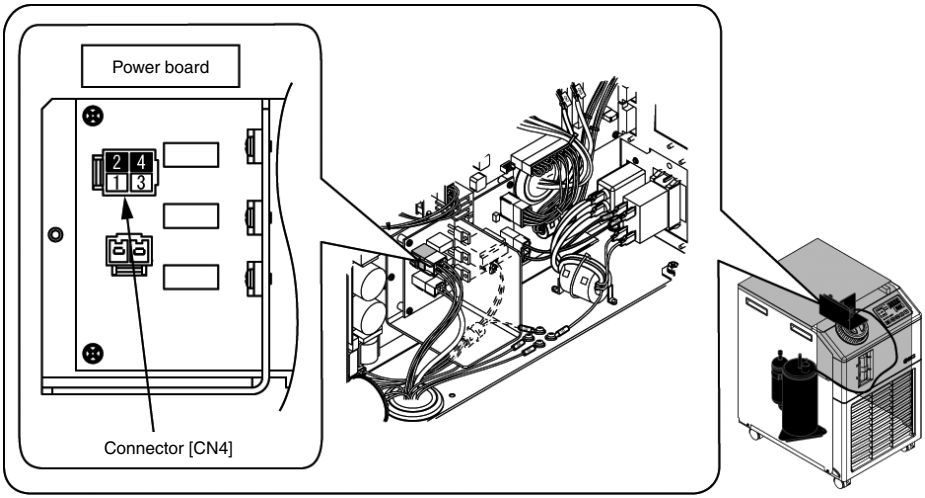



**Fig. 4-66 Check the compressor input**

## 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

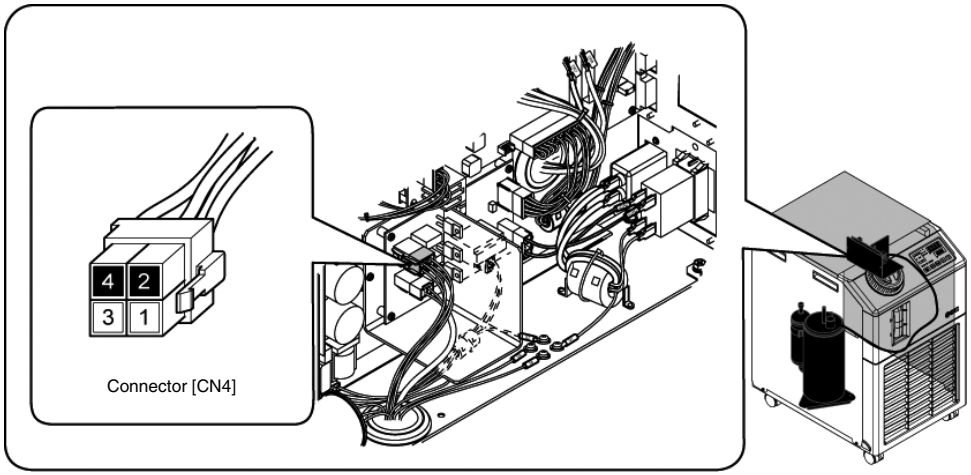
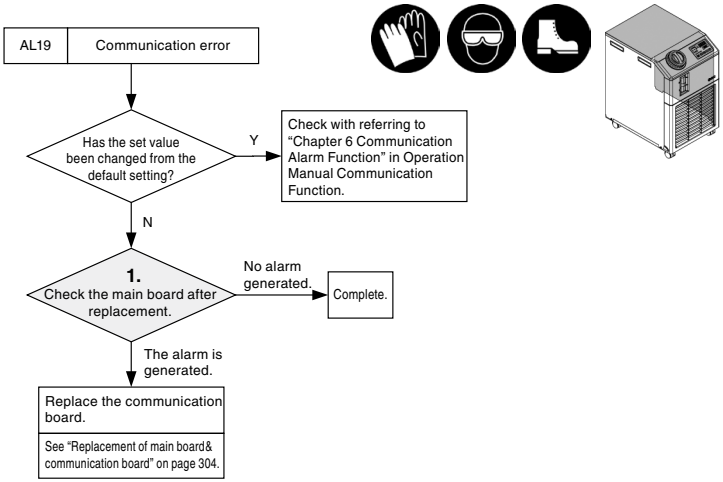



**Fig. 4-67 Check the compressor**

## 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.



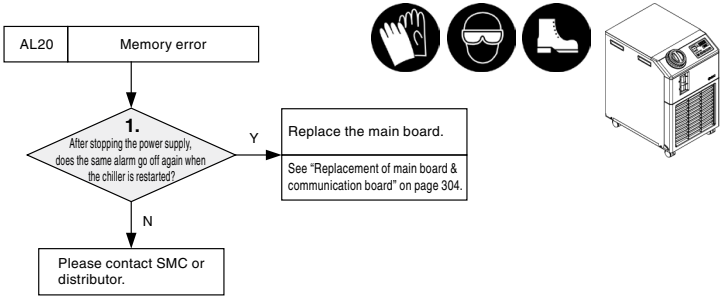

### 1. Check the main board after replacement.

Replace the main board with a new one. (See "Replacement of main board & communication board" on page 304.)

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.

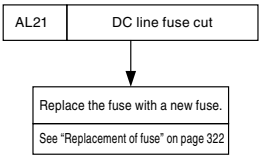



### 1. After stopping power supply, check for the same alarm goes off again when the chiller is re-started.

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.



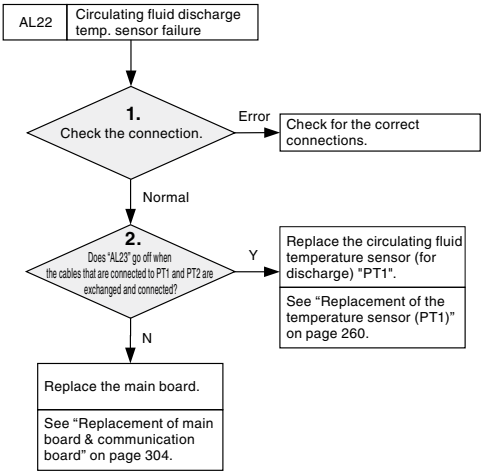

[Remarks]

· 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°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.

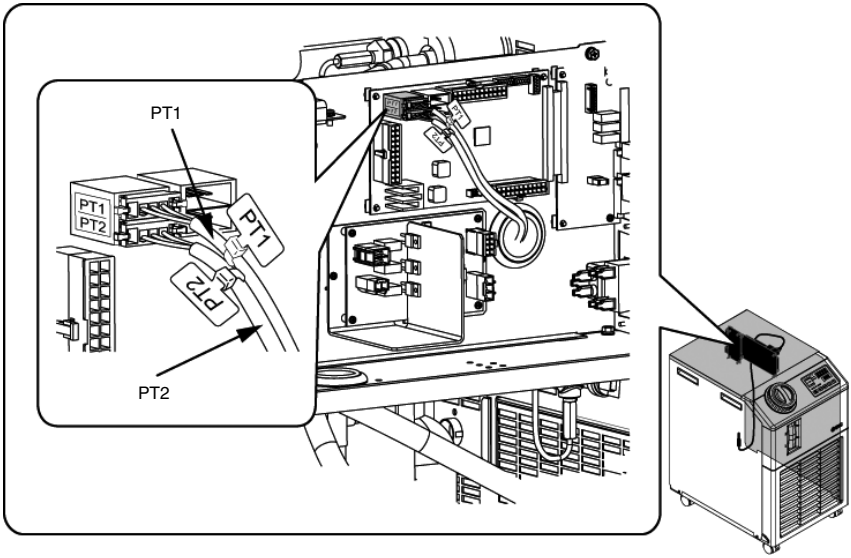



**Fig. 4-68 Check for the correct connection of PT1**

## 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:

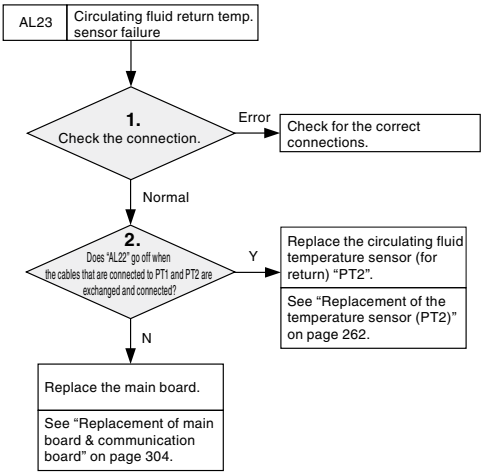
(1) Exchange the inserting position of the connector “PT1” for circulating fluid temperature sensor (for discharge) and the connector “PT2” for circulating fluid temperature sensor (for return).

(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.

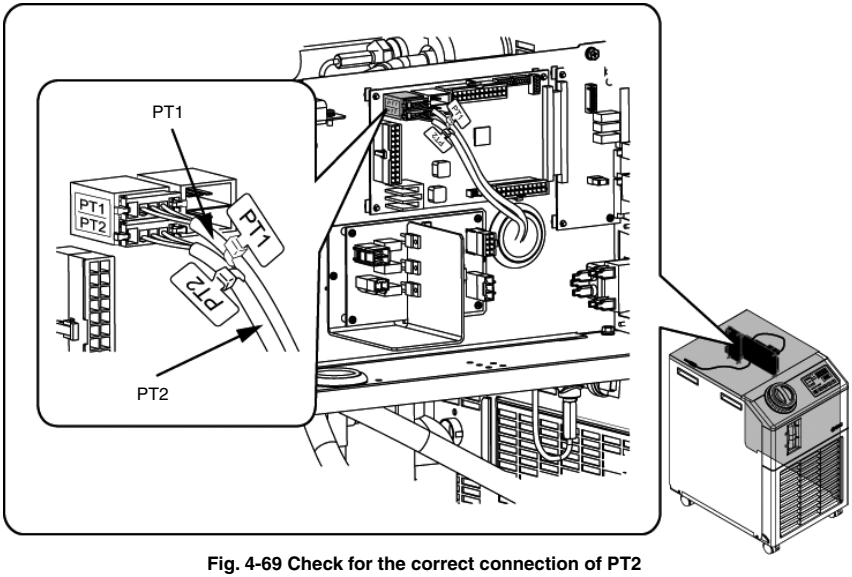



**Fig. 4-69 Check for the correct connection of PT2**

## 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:

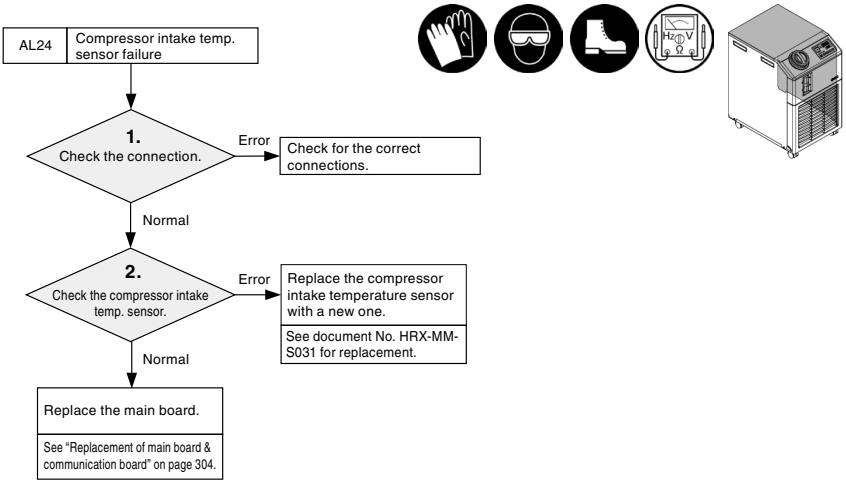
(1) Exchange the inserting position of the connector “PT1” for circulating fluid temperature sensor (for discharge) and the connector “PT2” for circulating fluid temperature sensor (for return).

(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 70°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.

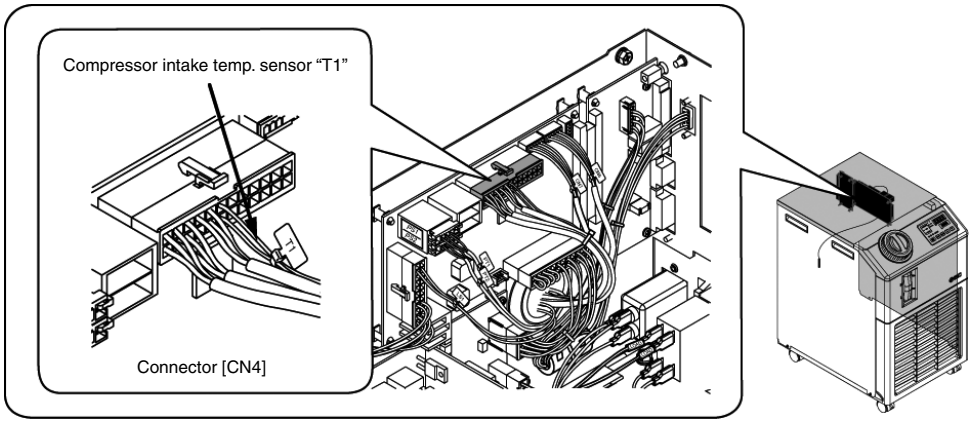



**Fig. 4-70 Check the connection of the compressor intake temperature sensor**

## 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 4-2 Resistances detected by thermistor sensor (Reference) on page 231. If there is a difference of +/- 5°C or more in the temperatures, it is judged to be abnormal.

(AL24 is generated when the temperature reaches –40°C or less (resistance: 43.34 kΩ or more) or 70°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.)

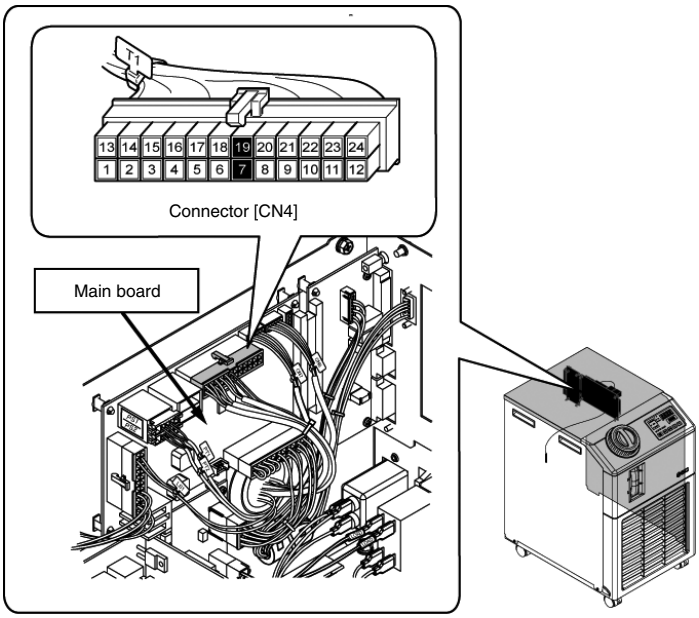


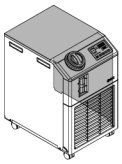

**Fig. 4-71 Check the resistance of the compressor intake temperature sensor**

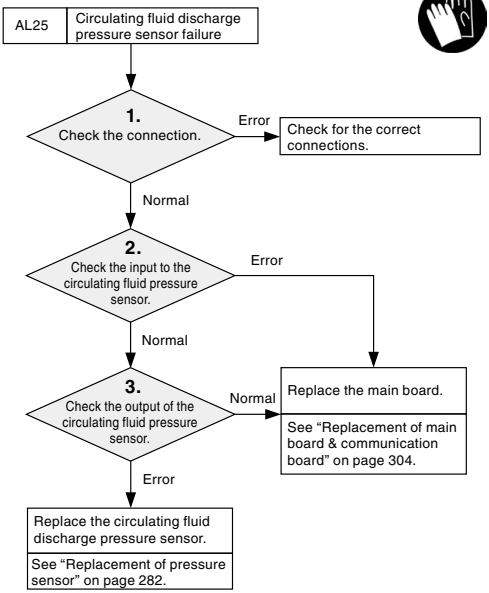
**Table 4-2 Thermistor sensor resistance (Reference)**

| 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.

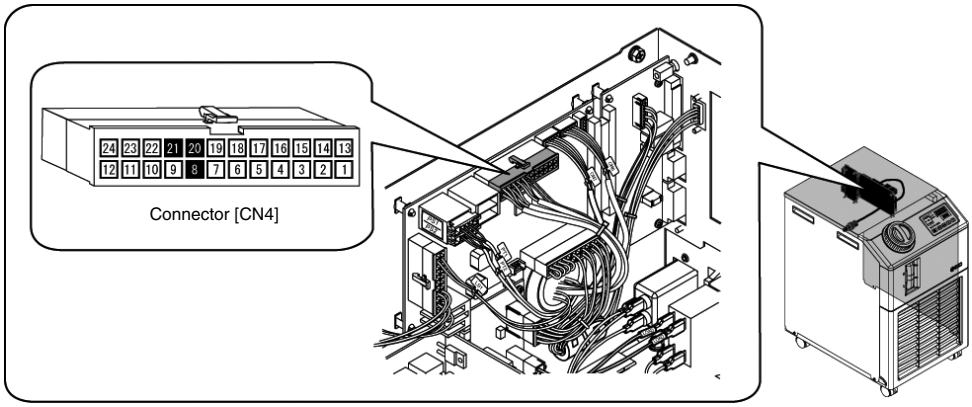



**Fig. 4-72 Check the connection of the circulating fluid pressure sensor**

## 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.

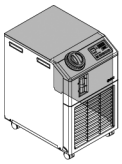
(3) Contact the positive probe to the pin number 8 and contact the negative probe to the pin number 20 of the "CN4" connector.

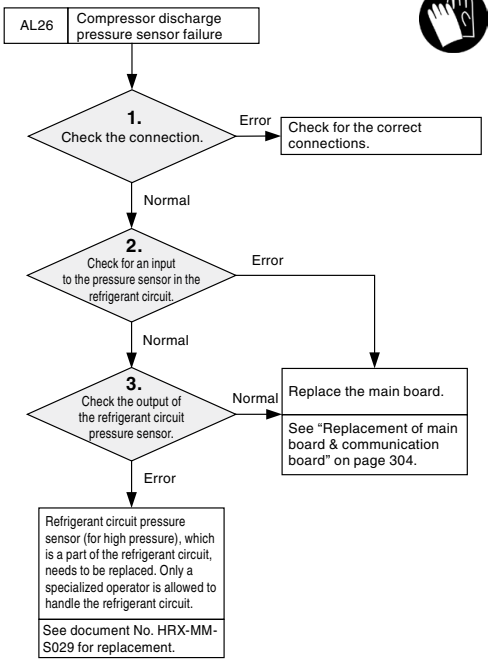
(4) Check that the voltage between the pin number 8 and the pin number 20 is in the range shown below:

<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.

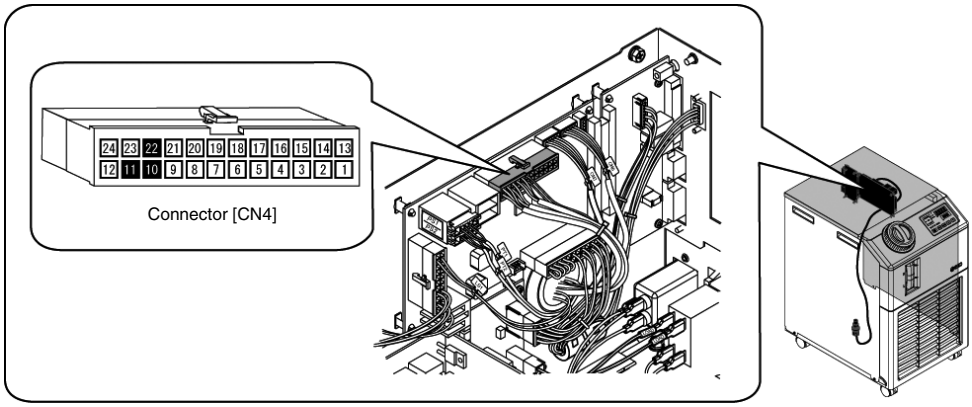



**Fig. 4-73 Check connection of the refrigerant circuit pressure sensor (for high pressure)**

## 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 +/- 1 V

## 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.

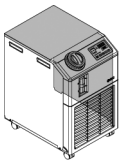
(3) Contact the positive probe to the pin number 11 and contact the negative probe to the pin number 10 of the “CN4” connector.

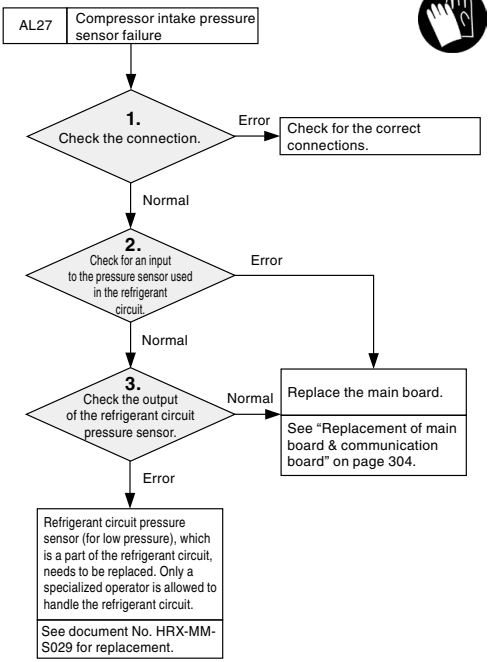
(4) Check that the voltage between the pin number 10 and the pin number 11 is in the range shown below:

<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.

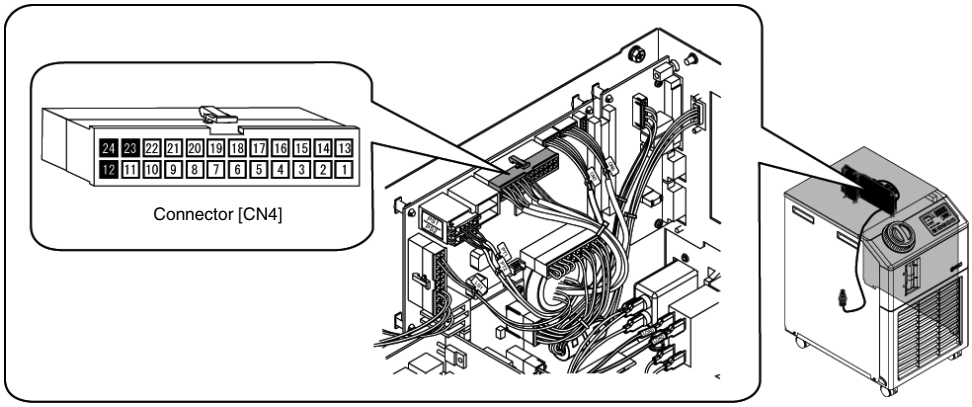



**Fig. 4-74 Check connection of the refrigerant circuit pressure sensor (for low pressure)**

## 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 +/- 1 V

## 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.

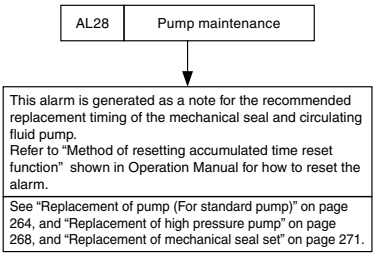
(3) Contact the positive probe to the pin number 23 and contact the negative probe to the pin number 12 of the “CN4” connector.

(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 8,000 hours or 20,000 hours.




### 1. For HRS012/018/024/030-A/W-□□-T, HRS050/060-A/W-□□

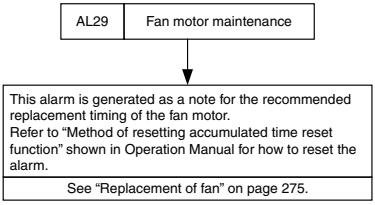
This alarm is generated every 8,000 hours of accumulated operating time. Be sure to check for leakage around the pump (mechanical seal). However, even in the absence of leakage, the mechanical seal should be replaced as a preventive measure.
The mechanical seal can be replaced up to 2 times. After the accumulated operating time has reached 20,000 hours, the pump itself will need to be replaced.

### 2. For HRS012/018/024/030-A/W-□□-□ (Other than high pressure pump specification)

This alarm is generated every 20,000 hours of accumulated operating time. Be sure to check for pump errors. However, even in the absence of errors, the pump should be replaced as a preventive measure.

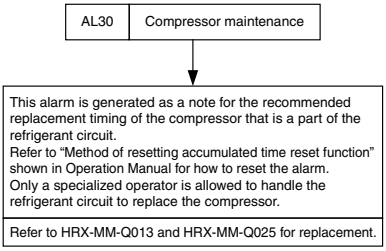
## AL29: Maintenance of fan motor [For air-cooled type]

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



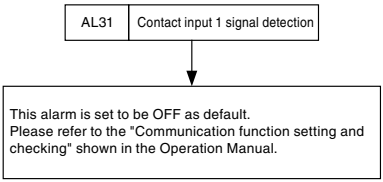

## AL30: Maintenance of compressor

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



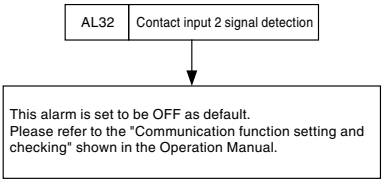
## AL31: Contact input1 signal detection

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



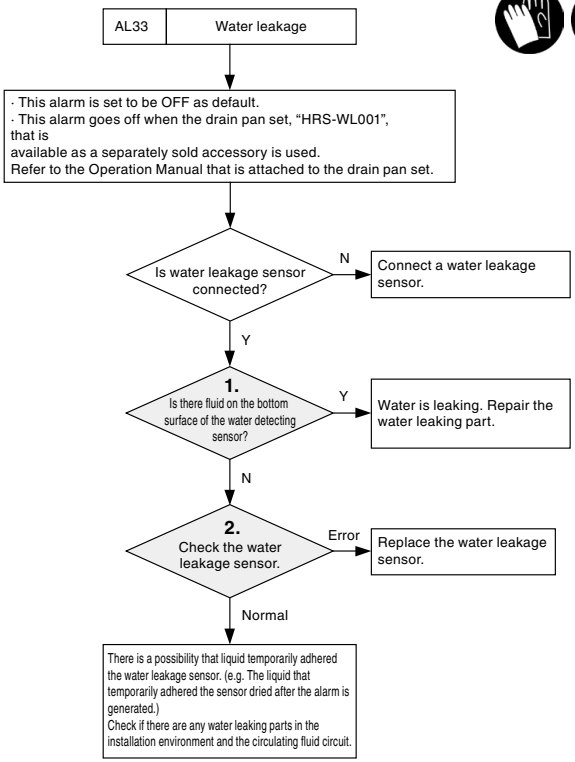

## AL32: Contact input 2 signal detection

<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.

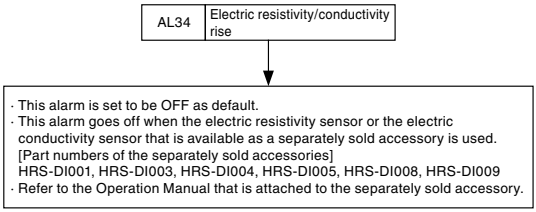
(4) Put some water onto the bottom surface of the water leakage sensor to check if AL33 is generated.

(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.

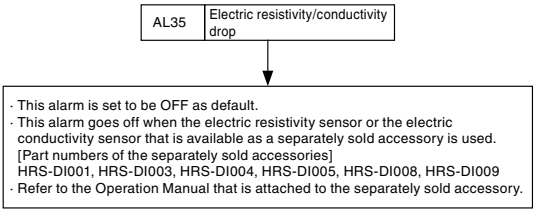
## AL34: Electric resistivity/conductivity rise

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



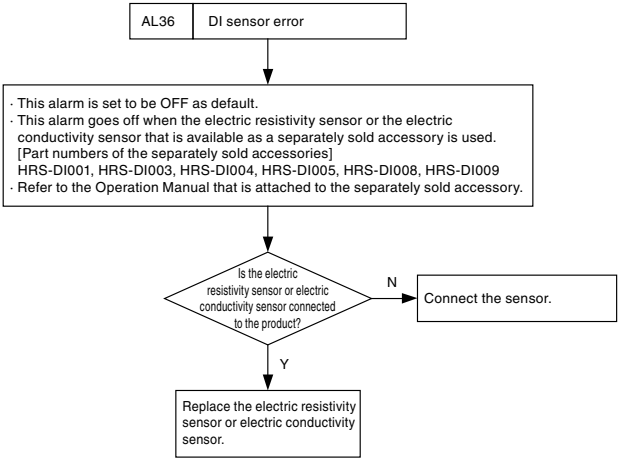

## AL35: Electric resistivity/conductivity drop

<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: Electric resistivity/conductivity 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.



# ■ Troubleshooting of errors without alarm generation

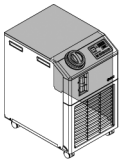
## ● The circulating fluid temperature does not go down

The circulating fluid temperature does not go down. → See section “AL02: High circulating fluid discharge temp.”.

## ● The circulating fluid temperature does not go up

The circulating fluid temperature does not go up. → See section “AL04: Circulating fluid discharge temp. drop”.

## ● The operation panel displays nothing



The operation panel displays nothing even the power supply switch is turned ON.

↓

Is there power supply?

- Y → Supply the correct power.
- N ↓

**1.** Check the connection.

- Error → Connect the connectors.
- Normal ↓

**2.** Check the DC power supply.

- Error → Replace the DC power supply. (See “Replacement of DC power supply” on page 301.)
- Normal ↓

Replace the display board. (See “Replacement of display board” on page 309.)

## 1. Check the connection.

Check that the connector “CN1” of the display board is connected.

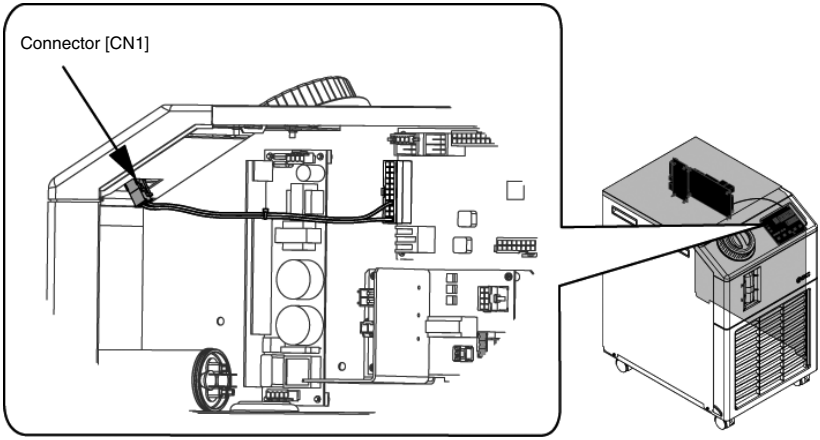



**Fig. 4-75 Check connection of the display board**

## 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.

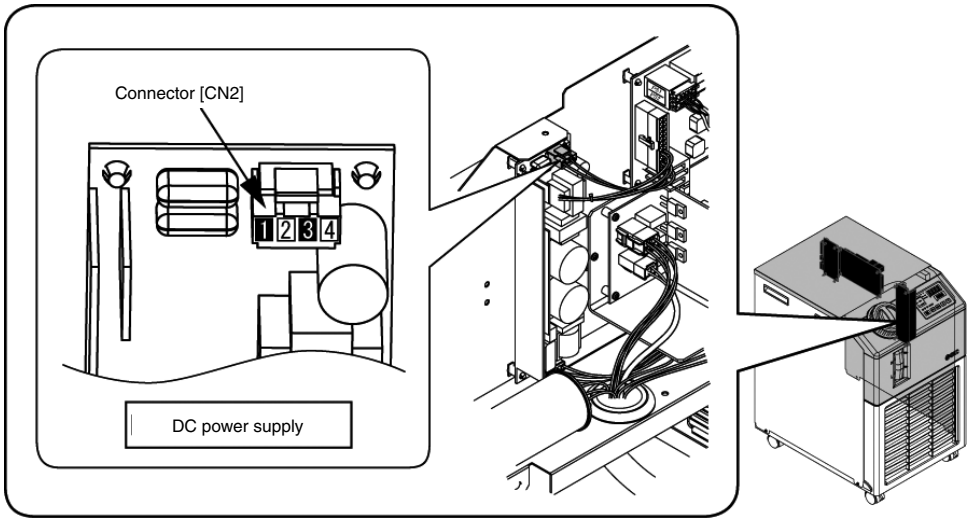
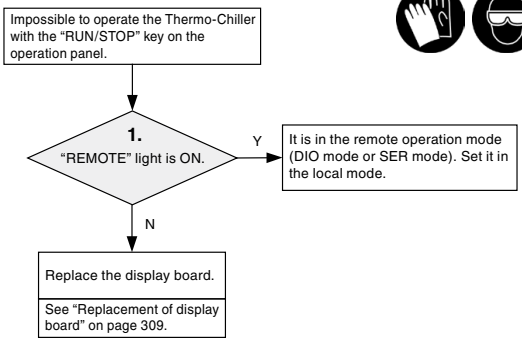



**Fig. 4-76 Check the DC power supply output**

## ● 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.

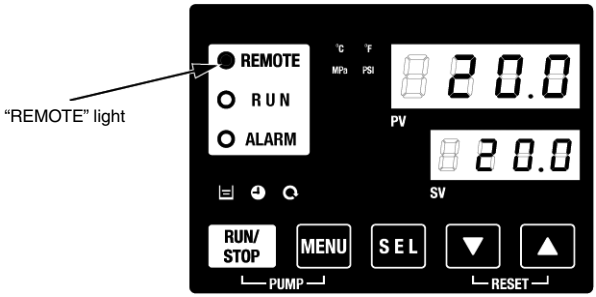
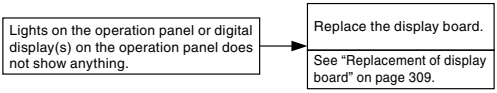
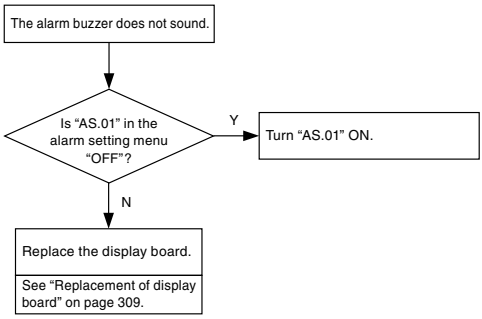



**Fig. 4-77 Check the “REMOTE” light**

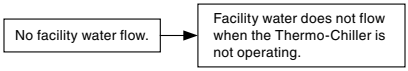
## ● Lights on the operation panel or display(s) on the digital display does not operate



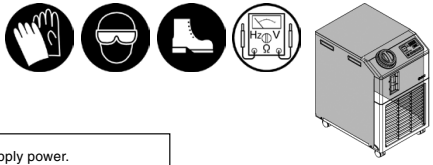
## The alarm buzzer does not sound

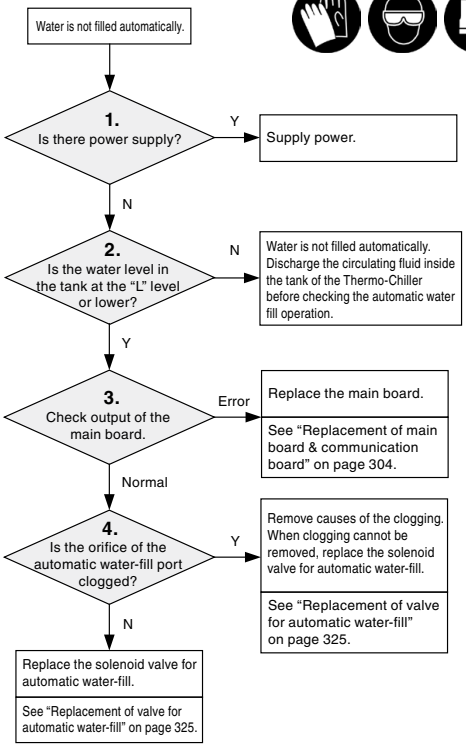



## Facility water does not flow (for water-cooled type)



## ● 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.

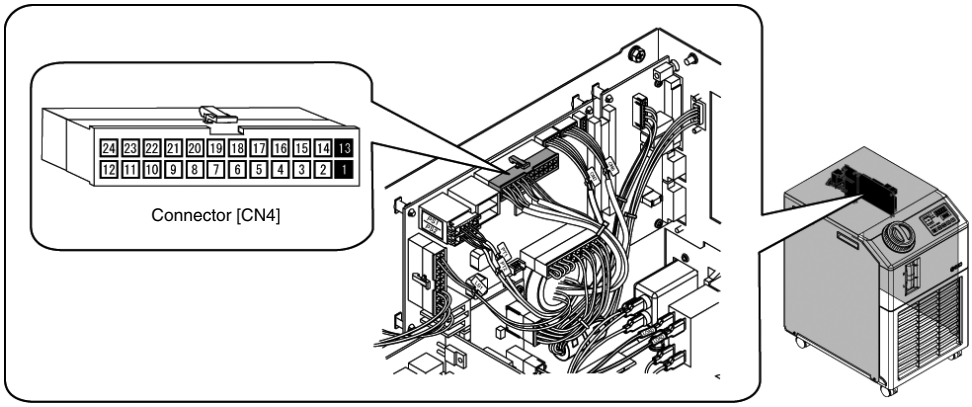



**Fig. 4-78 Check the input of the solenoid valve for automatic water-fill**

## 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.

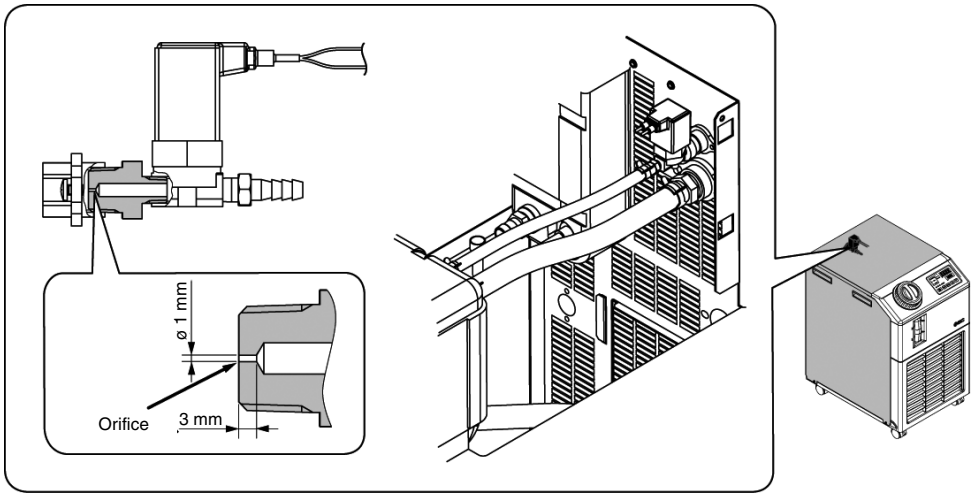



**Fig. 4-79 Check the orifice for automatic water-fill port**

## Replacement Parts Chart

An error occurring in one of the corresponding parts is the cause of the generation of the alarm. After checking the piping check sheet on pages 121 and 122, if there doesn't appear to be any problems with the operating environment, conditions, applications, etc., proceed to inspecting the corresponding parts and consider replacement if needed.

| | | Circulating fluid circuit/Electrical circuit parts | | | | | | | | | | | | | | | Refrigerant circuit parts | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Note1) No. | | 1 | 25 | 34 to 44 | 45 to 47 | 48 to 51 | Note2) — | 15 | 15 | 24 | 176 | 177 to 180 | 56 to 106 | 30 | 29 | 52 | 115 to 118 | 119 to 121 | 122 to 124 | 125 126 | 136 to 141 | 143 | 142 144 | 129 to 132 | 145 146 |
| Alarm code | Cooling method | Dustproof filter | Level switch | Pump/High pressure pump | Mechanical seal | Fan motor | Bypass piping | Circulating fluid temperature sensor (PT1) | Circulating fluid temperature sensor (PT2) | Circulating fluid discharge pressure sensor | Water leakage sensor | Electric resistivity/conductivity sensor | Main board | Power board | Communication board | Fuse | Compressor | Air-cooled condenser | Water-cooled condenser | Water regulating valve | Heat exchanger | Refrigerant circuit pressure sensor (for low pressure) | Refrigerant circuit pressure sensor (for high pressure) | Electronic expansion valve | Compressor intake temperature sensor (T1) |
| AL01 | Common | | ● | ● | ● | | | | | | | | ● | | | | | | | | | | | | |
| AL02 | Air-cooled | Note3) ● | | ● | | | ● | ● | | | | | ● | | | | | ● | | | ● | ● | ● | ● | |
| | Water-cooled | | | ● | | | ● | ● | | | | | ● | | | | | | ● | ● | ● | ● | ● | ● | |
| AL03 | Common | ● | | ● | | | ● | | | | | | ● | | | | | ● | ● | ● | ● | ● | ● | ● | |
| AL04 | Common | | | ● | | | ● | ● | | | | | ● | | | | | | | | | | | ● | |
| AL05 | Common | | | ● | | | ● | | ● | | | | ● | | | | | | | | | | | | |
| AL06 | Common | | | | | | ● | | | ● | | | ● | | | | | | | | ● | | | | |
| AL07 | Common | | | ● | | | | | | ● | | | ● | ● | | | | | | | | | | | |
| AL08 | Common | | | | | | ● | | | ● | | | ● | | | | | | | | ● | | | | |
| AL09 | Common | | | ● | | | | | | ● | | | | | | | | | | | | | | | |
| AL10 | Common | ● | | ● | | | ● | | ● | | | | ● | | | | | ● | ● | ● | ● | ● | ● | ● | ● |
| AL11 | Common | | | ● | | | ● | ● | | | | | ● | | | | | | | | ● | | | ● | ● |
| AL12 | Common | | | ● | | | ● | | | | | | ● | | | | | | | | ● | ● | ● | ● | ● |
| AL13 | Air-cooled | ● | | ● | | ● | ● | | | | | | ● | ● | | | | ● | | ● | | ● | ● | ● | |
| | Water-cooled | | | ● | | | ● | | | | | | ● | ● | | | | | ● | | | ● | ● | ● | |
| AL15 | Common | | | | | | | | | | | | ● | | | | | | | | | | ● | | |
| AL16 | Common | | | | | | | | | | | | ● | | | | | | | | | ● | | ● | |
| AL17 | Common | | | ● | | | ● | | | | | | ● | | | | | | | | | ● | | ● | |
| AL18 | Air-cooled | ● | | | | | | | | | | | ● | ● | | | ● | ● | | | | | | | |
| | Water-cooled | | | | | | | | | | | | ● | ● | | | ● | | ● | ● | | | | | |
| AL19 | Common | | | | | | | | | | | | ● | | ● | | | | | | | | | | |
| AL20 | Common | | | | | | | | | | | | ● | | | | | | | | | | | | |
| AL21 | Common | | | | | | | | | | | | | | | ● | | | | | | | | | |
| AL22 | Common | | | | | | | ● | | | | | ● | | | | | | | | | | | | |
| AL23 | Common | | | | | | | | ● | | | | ● | | | | | | | | | | | | |
| AL24 | Common | | | | | | | | | | | | ● | | | | | | | | | | | | ● |
| AL25 | Common | | | | | | | | | ● | | | ● | | | | | | | | | | | | |
| AL26 | Common | | | | | | | | | | | | ● | | | | | | | | | | ● | | |
| AL27 | Common | | | | | | | | | | | | ● | | | | | | | | | ● | | | |
| AL28 | Common | | | ● | Note4) ● | | | | | | | | | | | | | | | | | | | | |
| AL29 | Air-cooled | | | | | ● | | | | | | | | | | | | | | | | | | | |
| AL30 | Common | | | | | | | | | | | | | | | | ● | | | | | | | | |
| AL31 | Common | | | | | | | | | | | | | | ● | | | | | | | | | | |
| AL32 | Common | | | | | | | | | | | | | | ● | | | | | | | | | | |
| AL33 | Common | | | | | | | | | | ● | | | | | | | | | | | | | | |
| AL34 | Common | | | | | | | | | | | ● | | | | | | | | | | | | | |
| AL35 | Common | | | | | | | | | | | ● | | | | | | | | | | | | | |
| AL36 | Common | | | | | | | | | | | ● | | | | | | | | | | | | | |

Note 1) Each number corresponds to a number on the replacement parts list on pages 91 to 98.

Note 2) The bypass piping part number is HRS-BP001.

Note 3) The ● mark indicates the part error which is the cause of the generation of the alarm.

Note 4) For HRS012/018/024/030-T (High pressure pump) and HRS050/060

# Parts Replacement Procedure

## 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 mounted, be sure to wear protective shoes and gloves to prevent injury with the edge of the panel.**

### Preparation for work

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

### Check after work

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

## Tools to be used

Prepare all tools before starting work.

**Tools for repairing circulating fluid circuit/electrical circuit**

| Description | Icon | Content |
|---|---|---|
| Spanner/Wrench |   | Flat size: 9 mm |
| |   | Flat size: 8 mm |
| |   | Flat size: 10 mm |
| |   | Flat size: 17 mm |
| |   | Flat size: 21 mm |
| |   | Flat size: 24 mm |
| Drain pan |  | Height: Max. 100 mm |
| Nippers |  | — |
| Pliers |  | — |
| Cross recessed screwdriver (∗1) |   | Total length: Max. 200 mm |
| |  | — |
| flat blade screwdriver (∗1) |  | — |
| Long-nose plier |  | — |
| Hexagon wrench |   | Flat size: 2 mm |
| |   | Flat size: 5 mm |
| Silicone sealant |  | Recommended: HRG-S0214<br>Drying time: 2 hours |

(∗1) Screwdriver with magnetic tip.

- The following tools are required to perform repair work on the refrigerant circuit.

**Tools for repairing refrigerant circuit**

| No. | Description | Photo | Remarks |
|---|---|---|---|
| 1 | Charge valve |  | |
| 2 | Refrigerant gauge manifold<br>Charge hose |   | |
| 3 | Vacuum pump |  | |
| 4 | Leak detector<br>Refrigerant gas (R407C) |   | |
| 5 | Scale |  | |
| 6 | Set of brazing tools<br>Refrigerant recovery cylinder |   | |
| 7 | Refrigerant gas collector<br>Charge hose |   | |

## Removal and the mounting of the panel

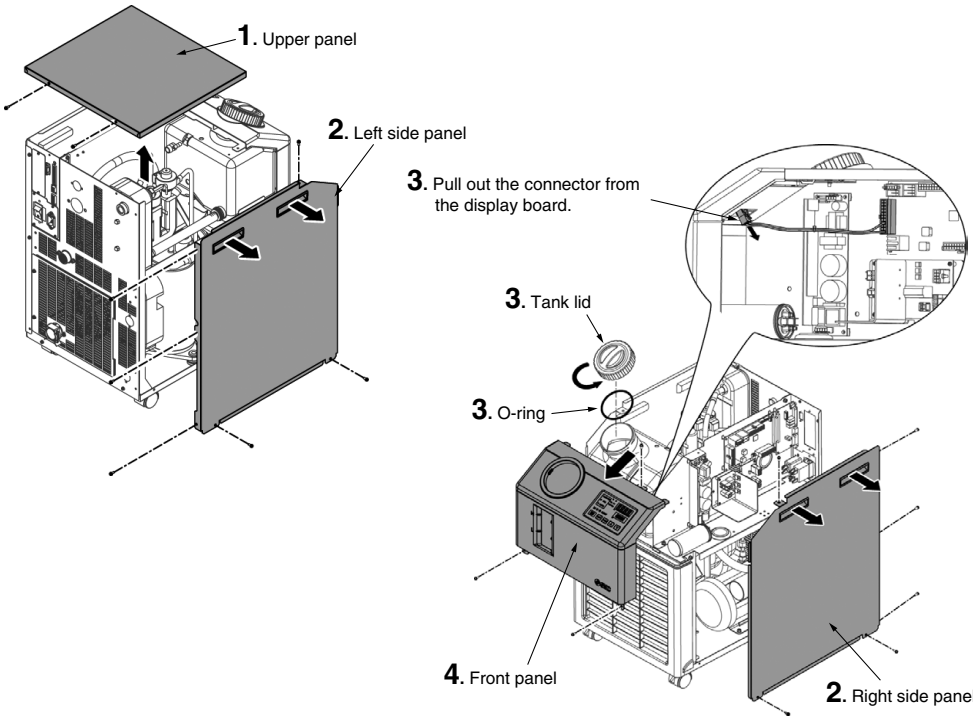
### Removal

**⚠ 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.**

**HRS□□□-A/W-□**

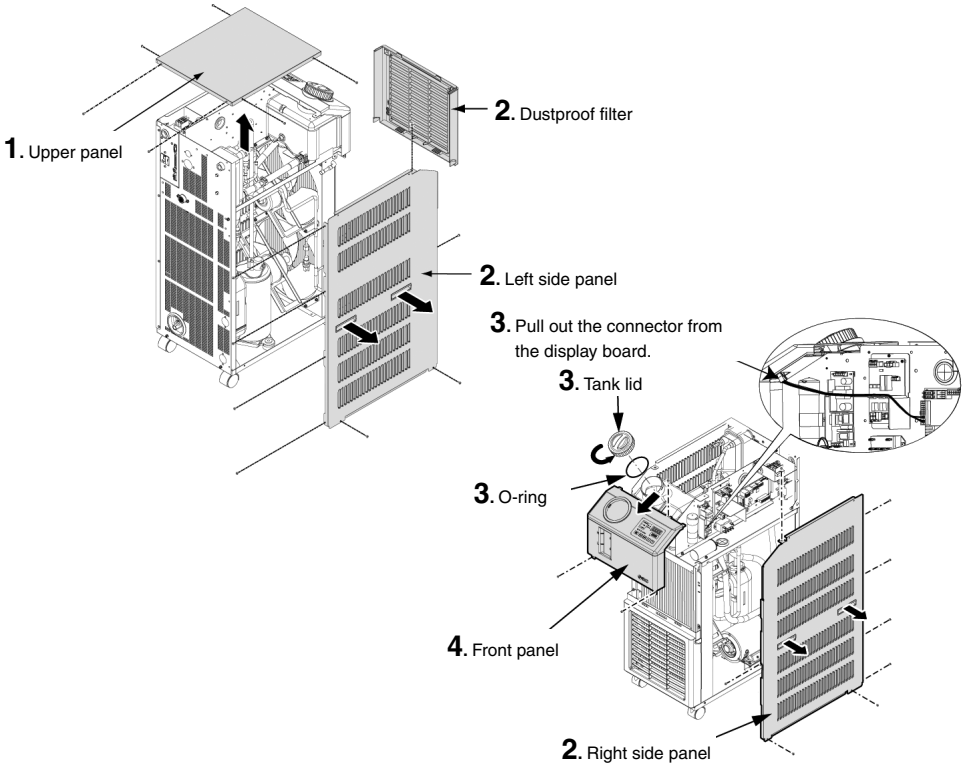
1. Remove the upper panel. (Screw x 2)
2. Remove the side panel. (Screw x each right and left 6)
3. Remove the tank lid.
4. Remove the front panel. (Screw x 3)
   * Pull out the connector from the display board to remove the front panel.
   After removing the tank lid, remove the O-ring at the side of the fluid inlet with a pair of tweezers.




**Removal of panels**

**HRS050/060-A/W-□**

1. Remove the upper panel. (Screw x 6)
2. Remove the side panels after removing the dustproof filter on the top. (Screw x 8 on each side)
   ∗ Refer to page 285 for the procedure of removal of the dustproof filter.
3. Remove the tank lid.
4. Remove the front panel. (Screw x 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.




**Removal of panels**

## ■ Mounting

Panel attachment is performed in inverse order of its removal.

## Discharge of the circulating fluid and facility water

### HRS□□□-A/W-□

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

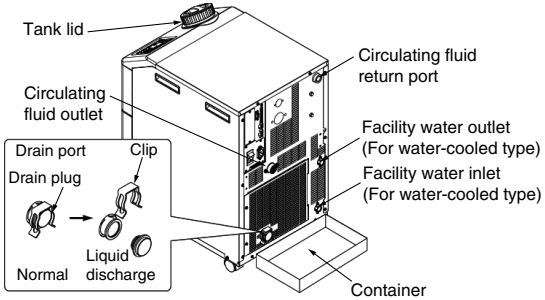
**Service parts which requires the discharge of the circulating fluid**

| 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 100 V type) | HRS-S0022 |
| Pump (For 200 V type) | HRS-S0066 |
| Pump (For HRS030) | HRS-S0361 |
| High pressure pump (For 100 V type option T) | HRS-S0265 |
| High pressure pump (For 100 V type option MT) | HRS-S0266 |
| High pressure pump (For 200 V type option T) (For HRS012/018/024) | HRS-S0062 |
| High pressure pump (For 200 V type option T) (For HRS030) | HRS-S0299 |
| High pressure pump (For 200 V type option MT) (For HRS012/018/024) | HRS-S0063 |
| High pressure pump (For 200 V type option MT) (For HRS030) | HRS-S0300 |
| Mechanical seal set (For 100 V type option T) (For HRS012/018) | HRS-S0390 |
| Mechanical seal set (For 100 V type option MT) (For HRS012/018) | HRS-S0412 |
| Mechanical seal set (For 200 V 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. 10 L)




**Drain the circulating fluid and facility water**

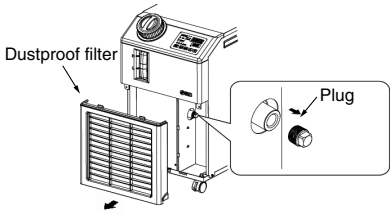
**2.** Remove the tank lid.

**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. Refer to page 284 for the procedure of removal.

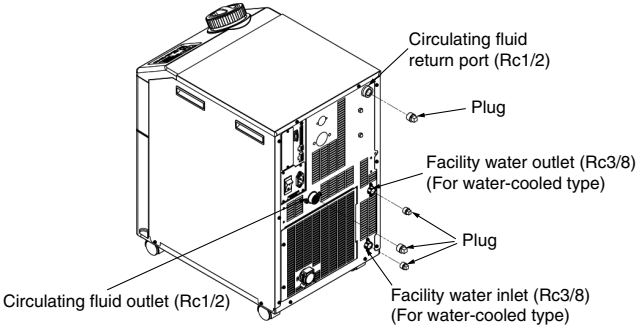



**Removal of plug**

**⚠ CAUTION**

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

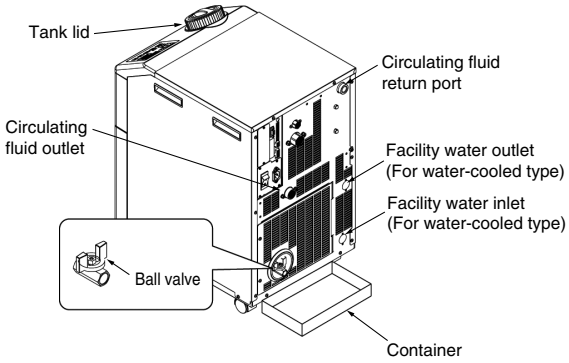
8. After ensuring that the facility water is completely discharged, apply the sealant tape to the plugs which are removed during step 7 for mounting. Mount the dustproof filter after mounting them. Refer to page 284 for how to mount.
9. Refer to the figure below. Plug to the piping of the product to mount the plug to the piping of the product.




**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.




**Drain the circulating fluid and facility water from the product for option T [High pressure pump]**

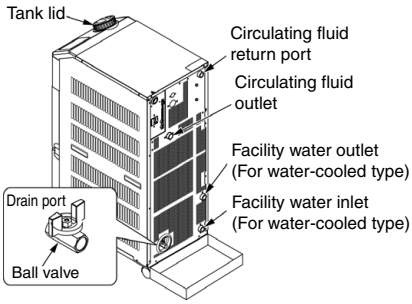
## HRS050/060-A/W-□

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

**Service parts which requires the discharge of the circulating fluid**

| Description | Part number |
|---|---|
| Temperature sensor | HRS-S0007 |
| Hose | HRS-S0097 |
| Hose (For HRS060 air-cooled type) | HRS-S0362 |
| Level switch | HRS-S0014 |
| Pump | HRS-S0088 |
| Pump (For option M) | HRS-S0089 |
| Tank | HRS-S0025 |
| Tank (For automatic water fill) | HRS-S0072 |
| Valve for automatic water fill | HRS-S0071 |
| Mechanical seal set | HRG-S0211 |

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




**Drain the circulating fluid and facility water**

**2.** Remove the tank lid.

**3.** Open the ball valves at the drain port and drain the fluid.

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.

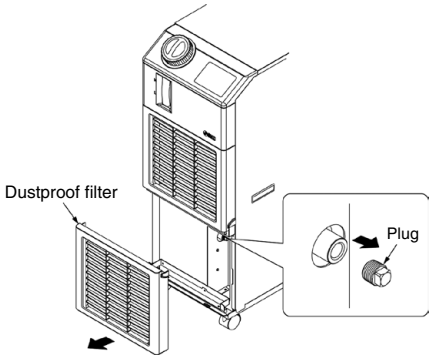
5. After the circulating fluid finishes has drained from the tank, close the ball valve at the drain port and put the tank lid back.

**<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. Refer to page 285 for the procedure of removal.





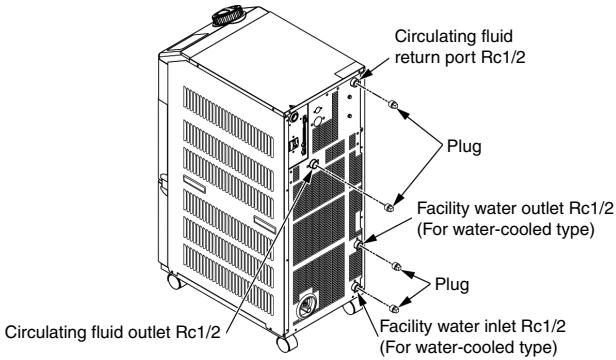

**Removal of the plug**

**⚠ 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. Refer to page 285 for how to mount.

9. Refer to the figure below. Plug to the piping of the product to mount the plug to the piping of the product.




**Plug to the piping of the product**

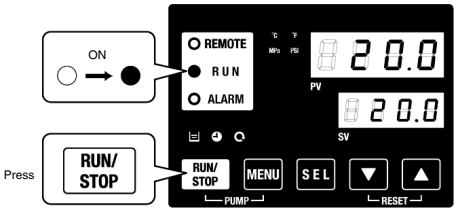
# Check After Work

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

## Starting the product

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

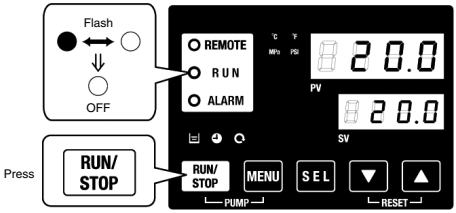
- The [RUN] lamp lights up (in green) and the product starts running.
- The circulating discharge temperature (PV) is controlled to the set temperature (SV).




**Starting the product**

## 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.




**Stopping the product**

## 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.

# ■ Replacement Procedure

## ● Replacement of temperature sensor (PT1)

**HRS□□□-A/W-□**


**Part number of service parts (Temperature sensor)**

| Description | Part number |
|---|---|
| Temperature sensor | HRS-S0007 |



**⚠ WARNING**

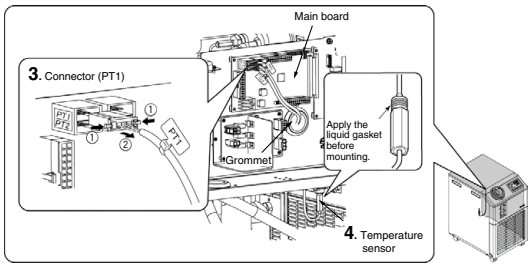
**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

**⚠ CAUTION**

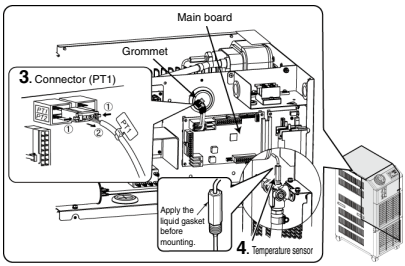
- **When the temperature sensor is removed or mounted, it is turned using a spanner/wrench. At that time, be careful not to twist its cable. Otherwise, it can break.**
- **The product must not be operated until the liquid gasket is completely hardened. Otherwise, it can cause fluid leakage.**

### ■ Removal

1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the right referring the removal and the mounting of the panel.
3. Remove the connector (PT1) from the main board.
4. Remove the temperature sensor (PT1).




**Removal of temperature sensor (PT1)**




**Removal of temperature sensor (PT1)**

## ■ 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 right panel in reversed order of removal. (Fixing screw x 8)

## Replacement of temperature sensor (PT2)

**HRS□□□-A/W-□**


**Part number of service parts (Temperature sensor)**

| Description | Part number |
|---|---|
| Temperature sensor | HRS-S0007 |



### ⚠ WARNING

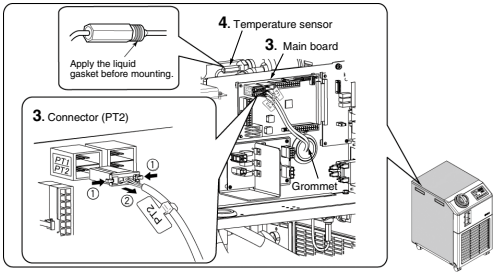
**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

### ⚠ CAUTION

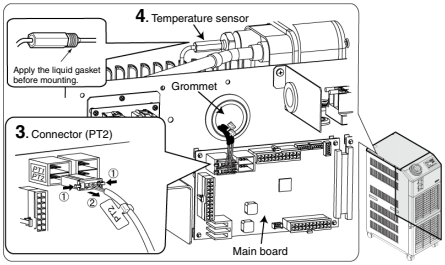
- **When the temperature sensor is removed or mounted, it is turned using a spanner/wrench. At that time, be careful not to twist its cable. Otherwise, it can break.**
- **The product must not be operated until the liquid gasket is completely hardened. Otherwise, it can cause fluid leakage.**

### Removal

1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the left referring the removal and the mounting of the panel.
3. Remove the connector (PT2) from the main board.
4. Remove the temperature sensor (PT2).




**Removal of temperature sensor (PT2)**




**Removal of temperature sensor (PT2)**

## ■ 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 screw x 8)

## Replacement of pump (For standard pump)

### Removal

**⚠ WARNING**

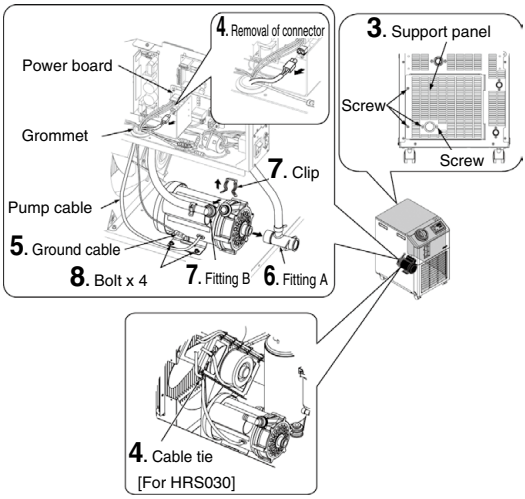
**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

**HRS□□□-A/W-□**


**Part number of service parts (Pump (For standard type))**

| Description | Part number |
|---|---|
| Pump (For 100 V type) | HRS-S0022 |
| Pump (For 200 V type) | HRS-S0066 |
| Pump (For HRS030) | HRS-S0361 |

1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the right referring the removal and the mounting of the panel.
3. Remove the support panel. (Screw x 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. Place the drain pan beneath fitting A. Remove fitting A to discharge water in the pump.
6. Remove the clip mounted to fitting B to remove fitting B.
7. Remove bolts to remove the pump. (Bolt x 4)
8. Remove the ground cable (G4) attached to the pump. (Screw x 1)




Removal of pump

## HRS050/060-A/W-20-□


**Part number of service parts (Pump)**

| Description | Part number |
|---|---|
| Pump | HRS-S0088 |
| Pump (For option M) | HRS-S0089 |

**1.** Discharge the circulating fluid referring to the discharge of the circulating fluid and facility water.

**2.** Remove the upper panel and the side panel on the right referring to the removal and the mounting of the panel.

**3.** Remove the band. (3 locations)

**4.** Remove the connector of the pump cable from the power board.

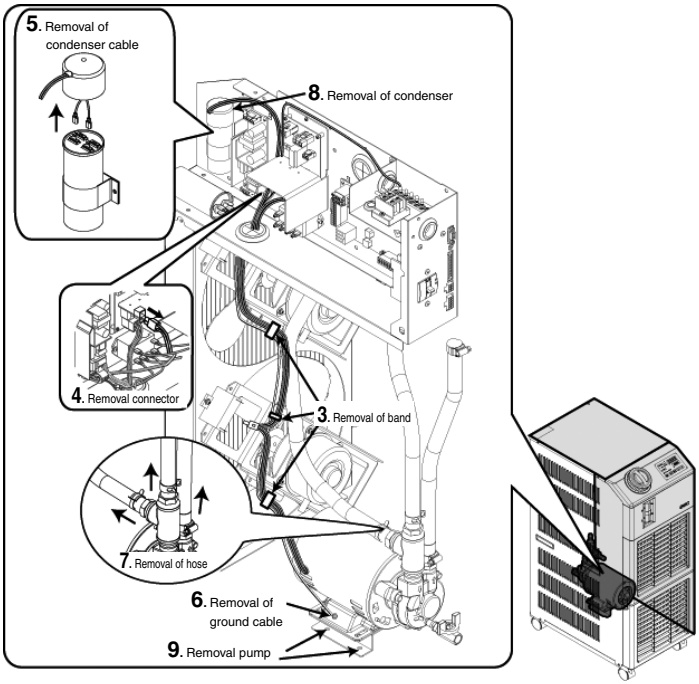
**5.** Remove the cable from the condenser.

**6.** Remove the ground cable (G3) attached to the pump. (Screw x 1)

**7.** Remove the hose attached to the pump. (3 pcs.)

**8.** Remove the condenser. (Screw x 1)

**9.** Remove the pump. (Screw x 4)

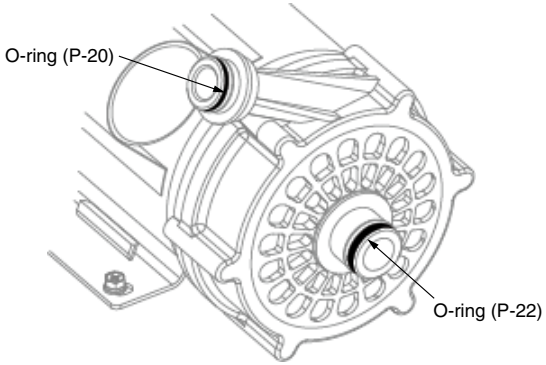



**Removal of pump**

## ■ Mounting

### HRS□□□-A/W-□

**1.** Mount O-ring to the pump. (2 O-rings)
∗ Size is different. (Refer to the figure below.)




**Mount the O-ring**

**2.** Connect the ground cable (G4).
∗ There are two washers inside. Hold the ground cable between them to fix it to the pump.

1.5N · m

**3.** 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 x 2)

3.0N · m

**4.** Mount fitting to two locations.
∗ Apply grease.

**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 x 4)

1.5N · m (2 pcs. of the left side) 0.76N · m (2 pcs. of the drain port)

**7.** Mount the upper panel and the right panel in reversed order of removal.

## HRS050/060-A/W-20-□

**1.** Mount the pump. (Screw x 4)

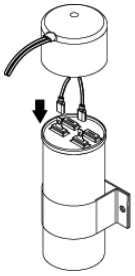
3.0N · m

**2.** Mount the hose. (2 pcs.)

Tightening torque of hose between pump and circulating fluid outlet: 29N · m

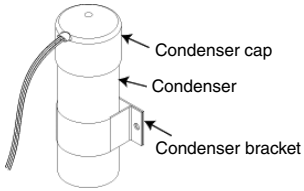
**3.** Connect the ground cable (G3). (Screw x 1)

**4.** Mount cable to the condenser.



**Mount the condenser**

**5.** Mount the cap and bracket to the condenser, and it mount the electrical equipment panel. (Screw x 1)




**Mount the condenser**

**6.** Mount pump cable to the power board.

**7.** Mount the band. (3 locations)

**8.** Mount the upper panel and the right panel in reversed order of removal.

## Replacement of high pressure pump

### Removal

**⚠ WARNING**

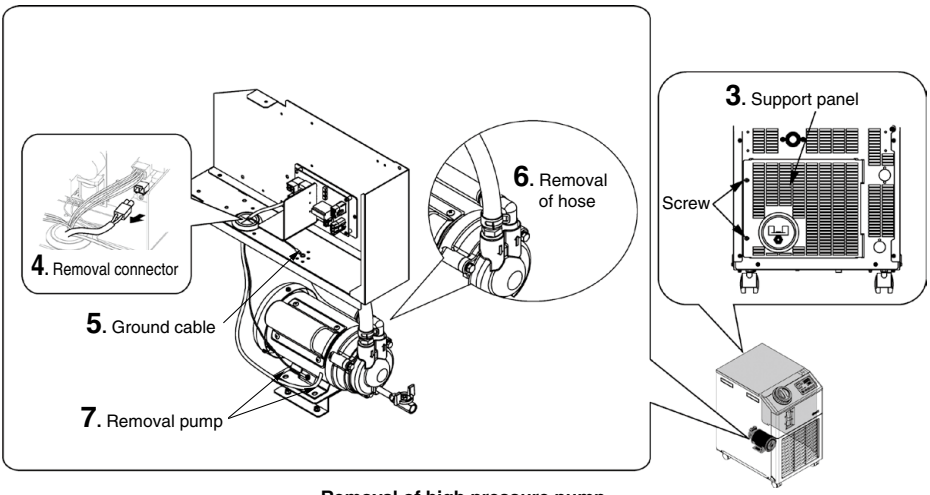
**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

**HRS□□□-A/W-10-T**


**Part number of service parts (High pressure pump)**

| Description | Part number |
|---|---|
| High pressure pump (For 100 V type option T) | HRS-S0265 |
| High pressure pump (For 100 V type option MT) | HRS-S0266 |

1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the right referring the removal and the mounting of the panel.
3. Remove the support panel. (Screw x 2)
4. Remove the connector of the pump cable from the power board.
5. Remove the ground cable (G4) attached to the pump. (Screw x 1)
6. Remove the hose attached to the pump. (2 pcs.)
7. Remove the pump. (Screw x 4)



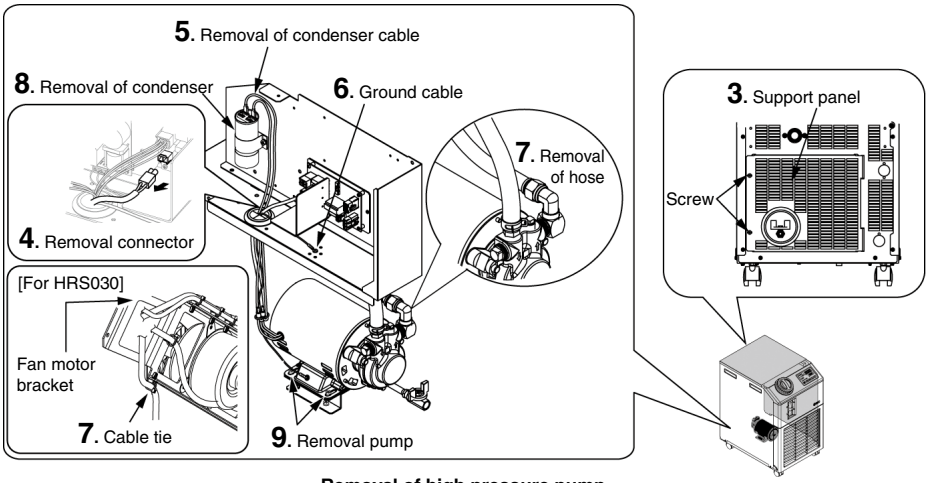

**Removal of high pressure pump**

## HRS□□□-A/W-20-T


**Part number of service parts (High pressure pump)**

| Description | Part number |
|---|---|
| High pressure pump (For 200 V type option T) (HRS012/018/024) | HRS-S0062 |
| High pressure pump (For 200 V type option T) (HRS030) | HRS-S0299 |
| High pressure pump (For 200 V type option MT) (HRS012/018/024) | HRS-S0063 |
| High pressure pump (For 200 V type option MT) (HRS030) | HRS-S0300 |

1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the right referring the removal and the mounting of the panel.
3. Remove the support panel. (Screw x 2)
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 x 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 x 1)
9. Remove the pump. (Screw x 4)




**Removal of high pressure pump**

## ■ Mounting

### HRS□□□-A/W-10-T

**1.** Mount the pump. (Screw x 4) 3.0N · m

**2.** Mount the hose. (2 pcs.)

Tightening torque of hose between high pressure pump and circulating fluid outlet: 29N · m

**3.** Connect the ground cable (G4). (Screw x 1)

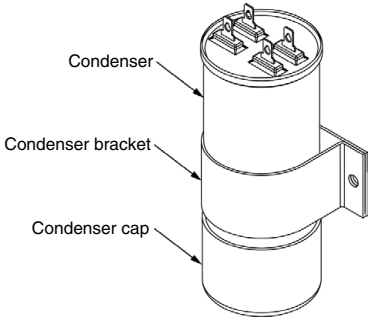
**4.** Mount pump cable to the power board.

**5.** Mount the support panel. (Screw x 2) 1.5N · m

**6.** Mount the upper panel and the right panel in reversed order of removal.

### HRS□□□-A/W-20-T

**1.** Mount the cap and bracket to the condenser, and it mount the electrical equipment panel. (Screw x 1)




**Mount the condenser**

**2.** Mount the pump. (Screw x 4) 3.0N · m

**3.** Mount the hose. (2 pcs.)

Tightening torque of hose between high pressure pump and circulating fluid outlet: 29N · m

**4.** Connect the ground cable (G4). (Screw x 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 x 2) 1.5N · m

**8.** Mount the upper panel and the right panel in reversed order of removal.

## Replacement of mechanical seal set

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**


### HRS0□□-A/W-10- (M) T (For high pressure pump 100 V type)

**Part number of service parts (Mechanical seal set)**

| Description | Part number |
|---|---|
| Mechanical seal set [For 100 V type option T] | HRS-S0390 |
| Mechanical seal set [For 100 V type option MT] | HRS-S0412 |

### HRS□□□-A/W-20- (M) T (For high pressure pump 200 V type)
### HRS050/060-A/W-20- (M)

**Part number of service parts (Mechanical seal set)**

| Description | Part number |
|---|---|
| Mechanical seal set [For 200 V type option T, MT] | HRG-S0211 |

#### O-ring size

These service parts include three of O-rings.

Please use A for HRS012/018/024/030 series (Only the high pressure pump).

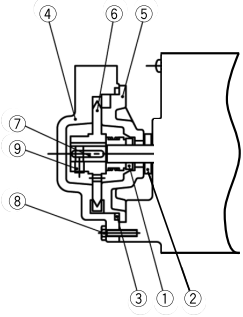
**O-ring size**

| Chiller model | O-ring type | Remarks |
|---|---|---|
| HRS012/018/024/030 series | A | Only the high pressure pump (Option T) |
| HRS050/060 series | B | – |
| HRG010 series | C | – |

∗ For details, refer to page 409.

### 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) |

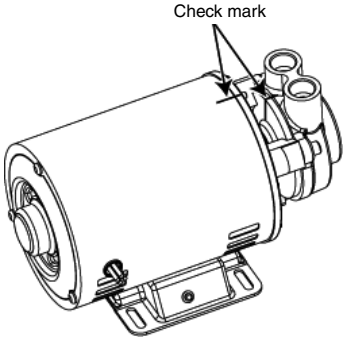
**Internal construction of pump**



## ■ Removal

**1.** Remove the high pressure pump referring the replacement of high pressure pump

**2.** Before disassembling the pump, place a “check mark” on the body, cover, and the motor.




**3.** Remove the body. (Hexagon socket head bolt x 3)
Place the drain pan under the body and drain water from the pump.

**4.** Remove the impeller and spring.

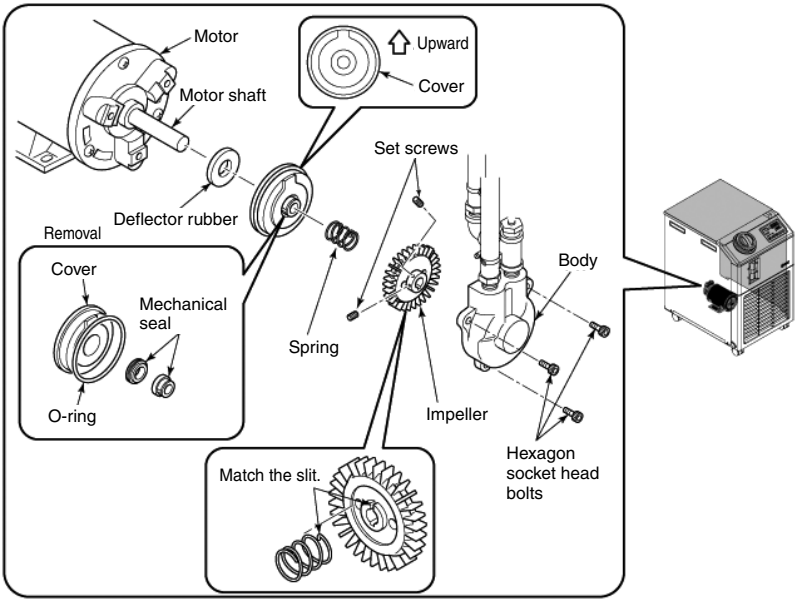
> **Tips**
> There is a danger of parts popping out. If the impeller gets stuck and cannot be removed, screw two screws of M6 x 50 mm or larger into the two thread holes of the impeller to pull out the impeller.

**5.** Remove the mechanical seal, O-ring and cover all in one.

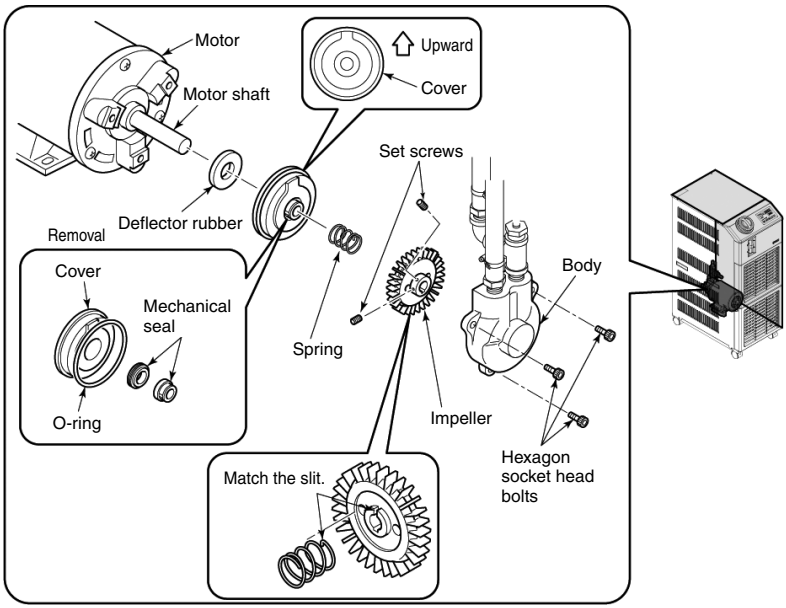
> **Tips**
> If the cover cannot be removed, insert the blade of the spanner/wrench between the cover and motor and bring it up.

**6.** Remove the deflector rubber.

## HRS012/018/024




## HRS050/060




**Removal of mechanical seal set**

## ■ Mounting

**1.** Mount the deflector rubber to the motor shaft.

**2.** Mount the O-ring and mechanical seals (2 pcs.) 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. (Set screw x 2)

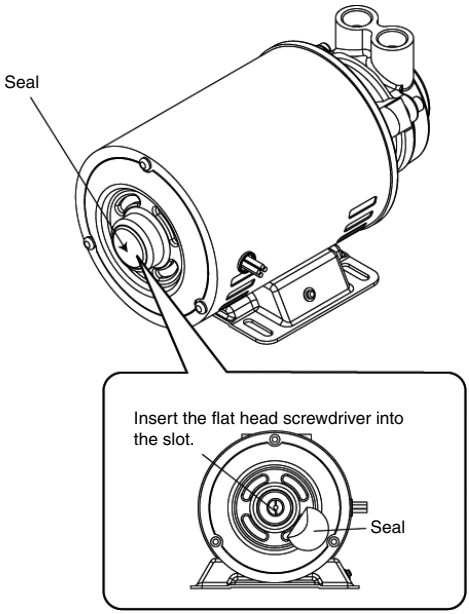
> **Tips**
> The direction of the spring is determined by the key of the impeller.

**4.** Mount the body onto the motor. (Hexagon socket head bolt x 3)

**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 the rotation verification of impeller below.)

> **Tips**
> The motor 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 replacement of high pressure pump.




**Rotation verification of impeller**

## Replacement of fan

### Removal

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

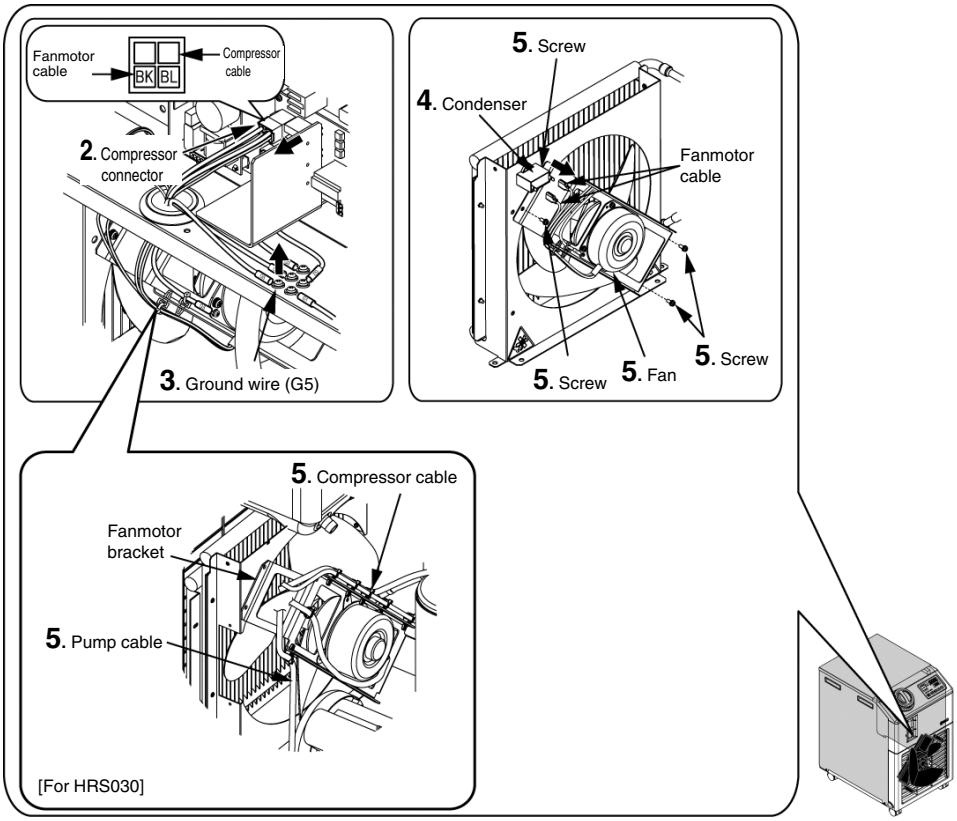
**HRS012/018/024-A□-□**


**Part number of service parts (Fan)**

| Description | Part number |
|---|---|
| Fan (For 100 V type) | HRS-S0023 |
| Fan (For 200 V type) (HRS012/018/024) | HRS-S0067 |
| Fan (For 200 V type) (HRS030) | HRS-S0301 |

1. Remove the upper panel and the panels on both sides referring the 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 x 1)
4. Remove the condenser. (Screw x 1)
5. Remove the fan. (Screw x 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.




Removal of fan

## HRS050/060-A-20-□


**Part number of service parts (Fan)**

| Description | Part number |
|---|---|
| Fan | HRS-S0099 |

**1.** Remove the upper panel and the panels on both sides referring to the removal and the mounting of the panel.

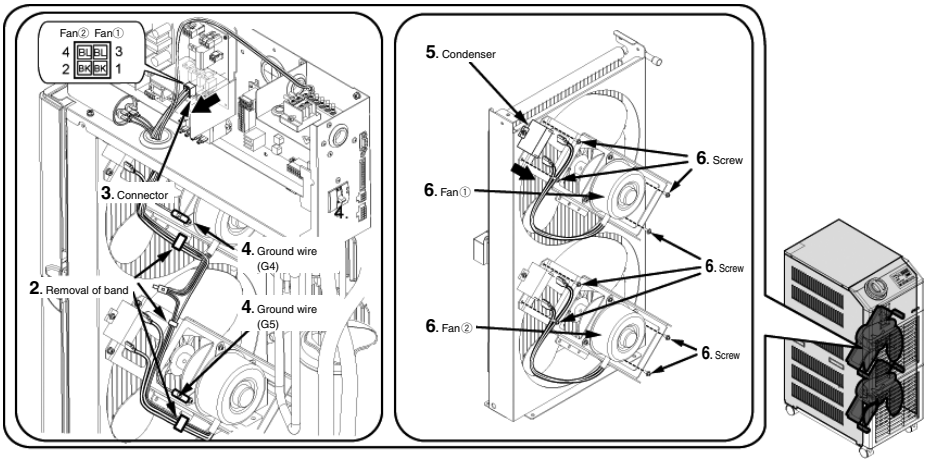
**2.** Remove the band. (3 locations)

**3.** Remove the fan motor pin from the connector of the compressor cable. (2 pcs.)
Insert the fan motor cable into the compressor cable connector.
(Fan①: No. 1 and No. 3; Fan②: No. 2 and No. 4)

**Tips**

Use VLJ-20 of J.S.T. Mfg. Co., Ltd for removing pins.
Our part no.: HRS-S0055

4. Remove the ground wire (Fan①: G4, Fan②: G5) mounted on the fan to be replaced. (Screw x 1)
5. Remove the condenser. (Screw x 1)
6. Remove the fan. (Screw x 4)




**Removal of fan**

## ■ Mounting

### HRS012/018/024-A□-□

1. Mount the fan. (Screw x 1)


2. Mount the condenser. Then, mount the fan motor cable. (Screw x 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 x 1)


∗ For the HRS030, fix the pump cable (1 place) and the compressor cable (5 places) to the fan motor bracket with cable ties.

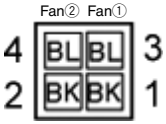
5. Mount the upper panel and the panels on both sides in reversed order of removal.

### HRS050/060-A-20-□

**1.** Mount the fan. (Screw x 4)


**2.** Mount the condenser. Then, mount the fan motor cable. (Screw x 1)
Connect the pink cable to the left, black cable to the right.


**3.** Insert the fan motor cable to the compressor cable connector.




For fan① → BK: No. 1 BL: No. 3
For fan② → BK: No. 2 BL: No. 4
∗ BK is black, BL is blue.

**4.** Mount the ground wire (Fan①: G4, Fan②: G5). (Screw x 1)


**5.** Mount the upper panel and the panels on both sides in reversed order of removal.

## Replacement of level switch

### Removal

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

**HRS012/018/024-A/W-□**


**Part number of service parts (Level switch)**

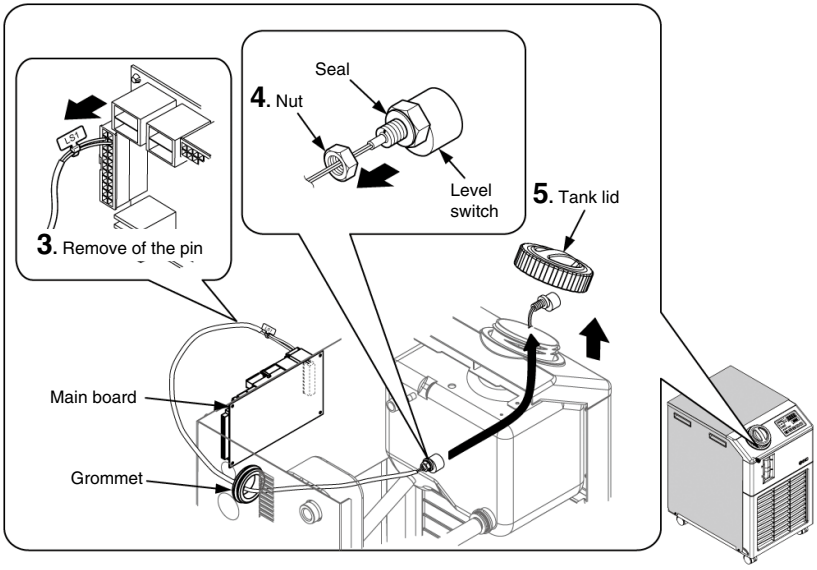
| Description | Part number |
|---|---|
| Level switch | HRS-S0014 |

1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the left referring the 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.




**Removal of level switch**

## HRS050/060-A/W-20-□


**Part number of service parts (Level switch)**

| Description | Part number |
|---|---|
| Level switch | HRS-S0014 |

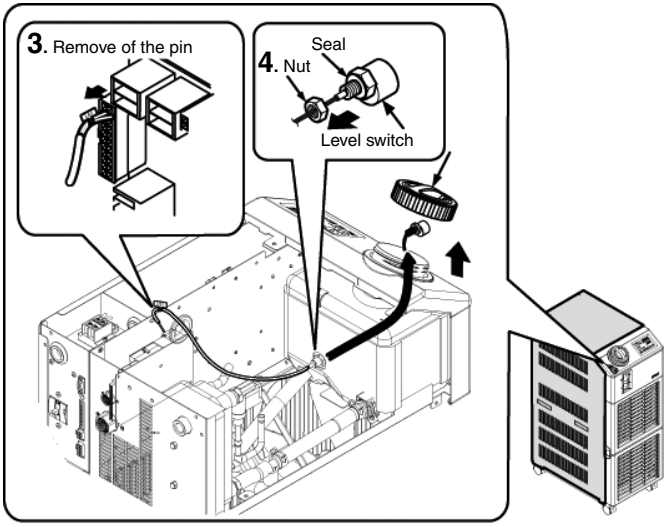


1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the left referring the removal and the mounting of the panel.
3. Remove the level switch pin [LS1] (two red lines) from the main board.

**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.




**Removal of level switch**

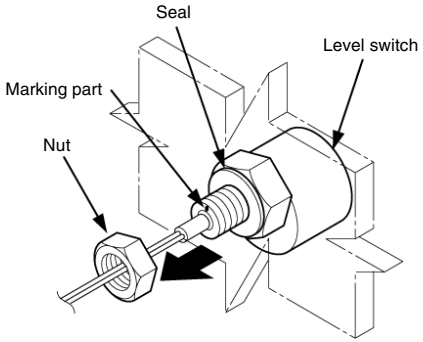
## ■ Mounting

### HRS012/018/024-□□-□□
### HRS050/060-□□-□□

**1.** Mount the marking tie at approx. 40 ±5 mm 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 x 1)

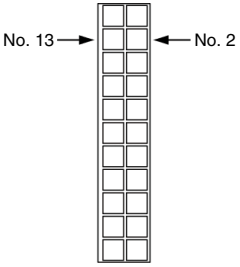



**Mount of level switch**

**Tips**

The marking part of the level switch faces upward.

**4.** Put the level switch cable [LS1] (2 pcs.) through the grommet. Insert the pin to the connector. (No. 2 & No. 13)




**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.

## Replacement of pressure sensor

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**



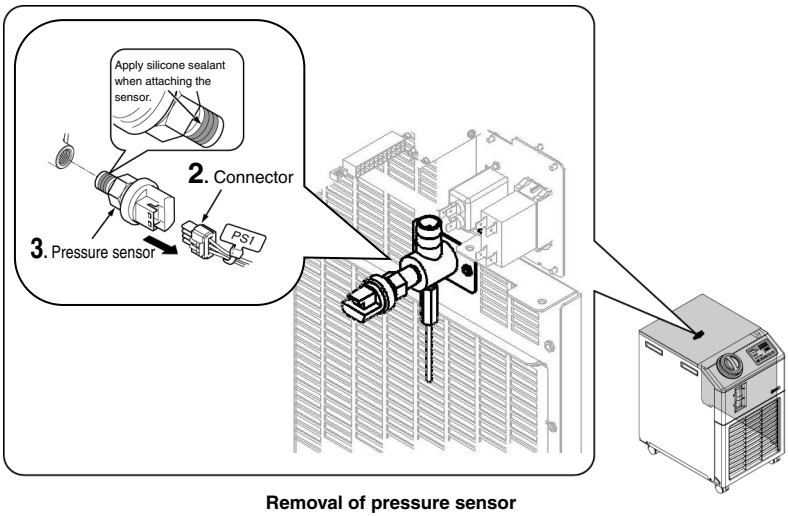
### Removal

**HRS012/018/024-□□-□□**
**HRS050/060-□□-□□**

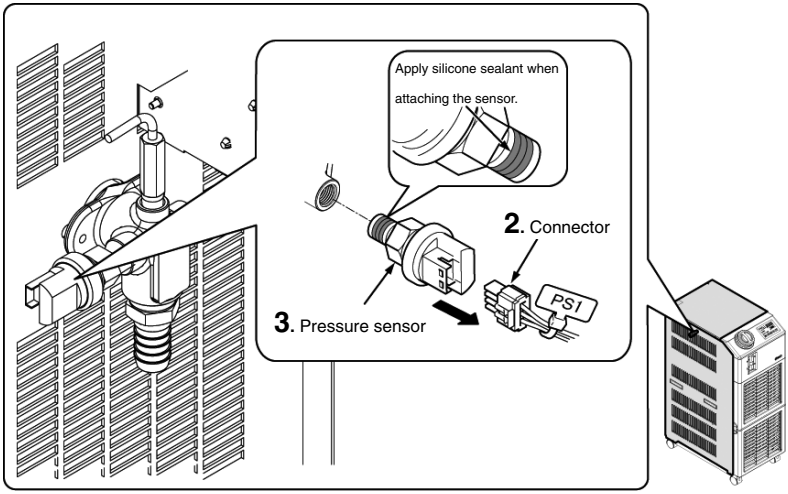

**Part number of service parts (Pressure sensor)**

| Description | Part number |
|---|---|
| Pressure sensor (For circulating fluid) | HRS-S0011 |

1. Remove the upper panel and the side panel on the right referring the 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.




**Removal of pressure sensor**




**Removal of pressure sensor**

## ■ Mounting

### HRS012/018/024/030-□□-□□
### HRS050/060-□□-□□

1. Apply a liquid gasket to the threads of the pressure sensor and mount it.
2. Mount the connector of 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.

## Replacement of dustproof filter

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**



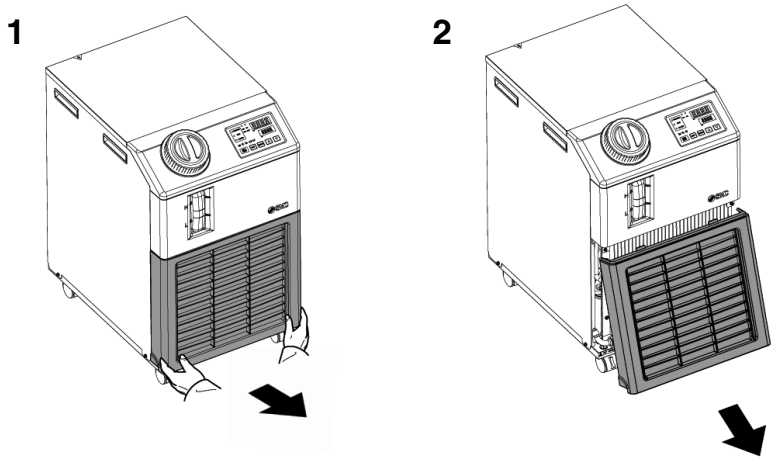
### Removal

**HRS012/018/024/030-□□-□□**
**HRS050/060-□□-□□**

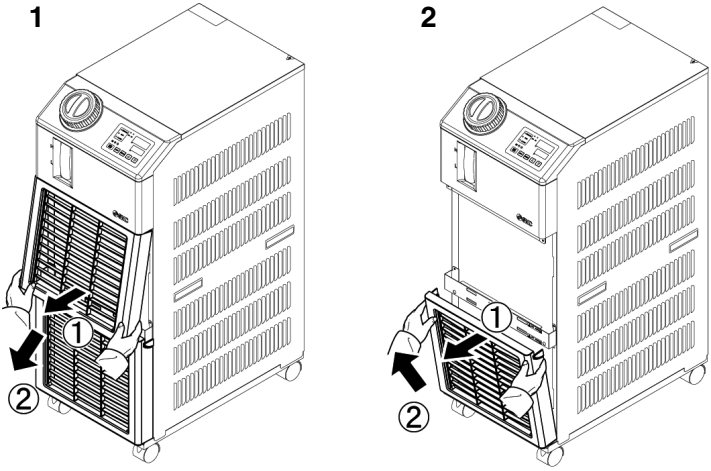
**Part number of service parts (Dustproof filter)**

| Description | Part number |
|---|---|
| Dustproof filter | HRS-S0001 |

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.




**Removal of dustproof filter**




**Removal of dustproof filter**

## ■ Mounting

### HRS012/018/024/030-□□-□□
### HRS050/060-□□-□□

**1.** Mount the dustproof filter in reversed order of removal.

## Replacement of front panel

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**



### Removal

**HRS012/018/024/030-A/W-□**

**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 |

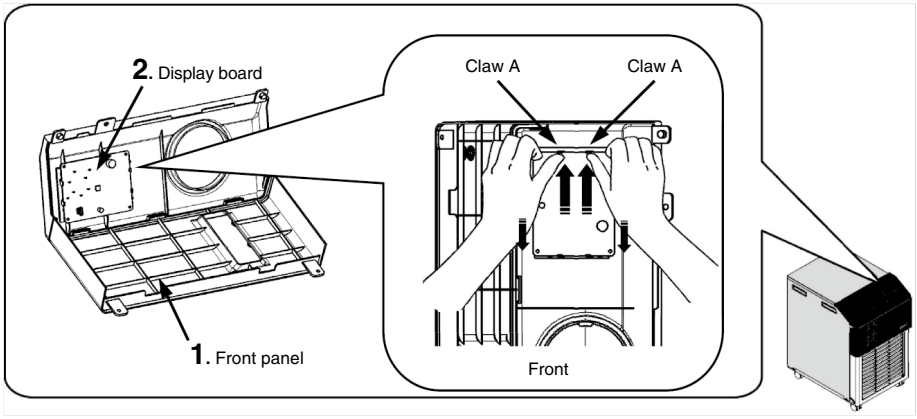
∗ For serial No., refer to Product label in the Operation Manual.

## From production in March 2015 (After serial No. TQ***)

1. Remove the upper panel, the panels on both sides and the front panel referring the 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.

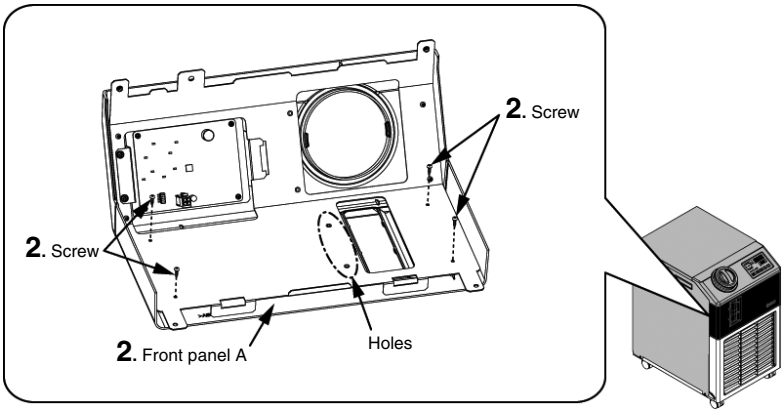



**Removal of front panel**

## Until production in February 2015 (Serial No. TP*** or earlier)

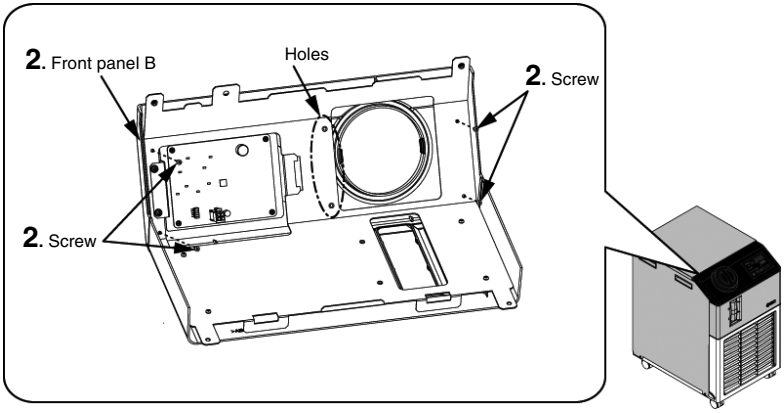
1. Remove the upper panel, the panels on both sides and the front panel referring the removal and the mounting of the panel.

2. Remove the front panel A. (Screw x 4)




**Removal of front panel A**

3. Remove the front panel B. (Screw x 4)




**Removal of front panel B**

## HRS050/060-A/W-20-□□-□□

**Part number of service parts (Front panel A)**

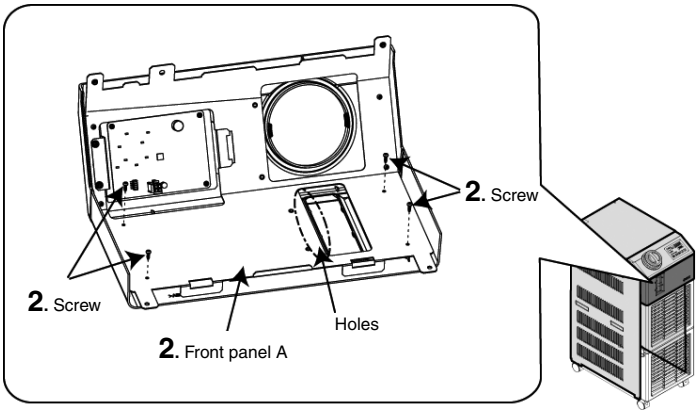
| Description | Part number |
|---|---|
| Front panel A | HRS-S0006 |

**Part number of service parts (Front panel B)**

| Description | Part number |
|---|---|
| Front panel B | HRS-S0005 |

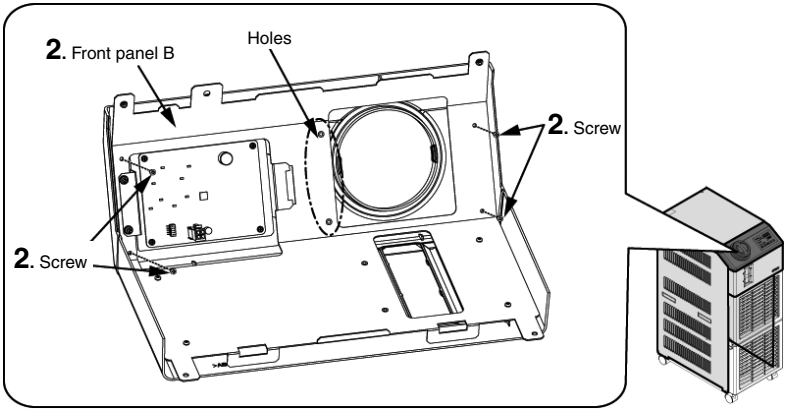


1. Remove the upper panel, the panels on both sides and the front panel referring the removal and the mounting of the panel.
2. Remove the front panel A. (Screw x 4)




**Removal of front panel A**

3. Remove the front panel B. (Screw x 4)




**Removal of front panel B**

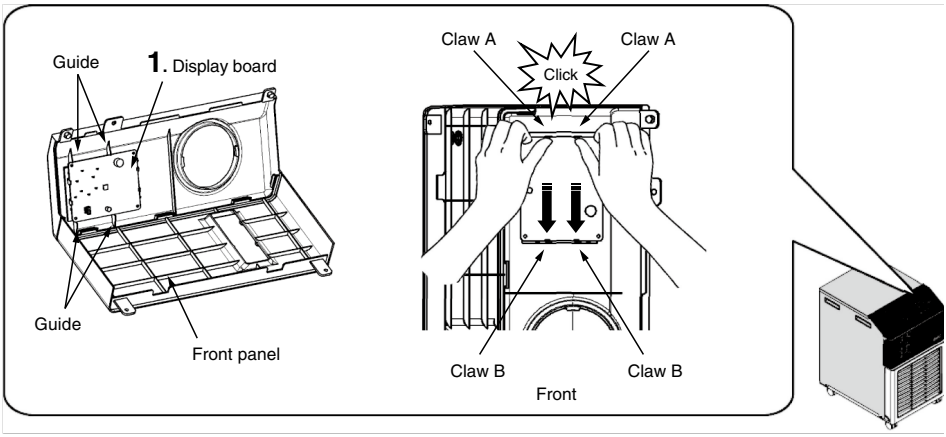
## ■ Mounting

### HRS012/018/024/030-A/W-□

## From production in March 2015 (After serial No. TQ***)

**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.




**Mounting 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)

**1.** Mount the front panel B. (Screw x 4)

> **Tips**
> Mount front panel B aligning with holes at the center.

**2.** Mount the front panel A. (Screw x 4)

> **Tips**
> Mount front panel A aligning with holes at the center.

**3.** Mount the upper panel, the panels on both sides and the front panel in reversed order of removal.

### HRS050/060-A/W-20-□

**1.** Mount the front panel B. (Screw x 4)

> **Tips**
> Mount front panel B aligning with holes at the center.

**2.** Mount the front panel A. (Screw x 4)

> **Tips**
> Mount front panel A aligning with holes at the center.

**3.** Mount the upper panel, the panels on both sides and the front panel in reversed order of removal.

## Replacement of tank

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

### ■ Removal

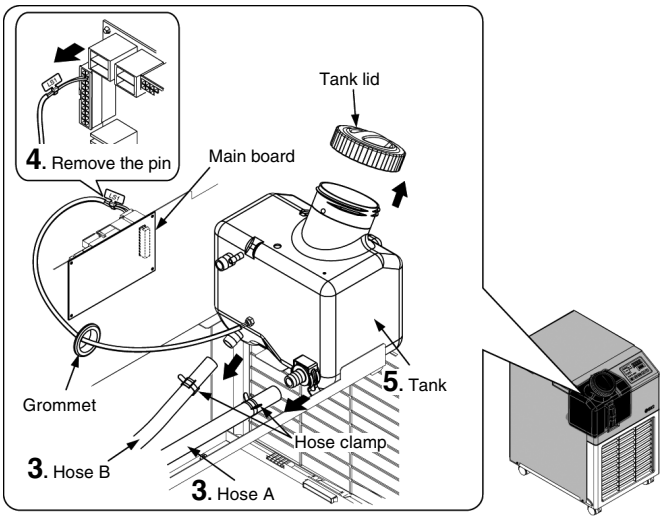
**HRS012/018/024/030-A/W-□**
**HRS050/060-A/W-20-□**

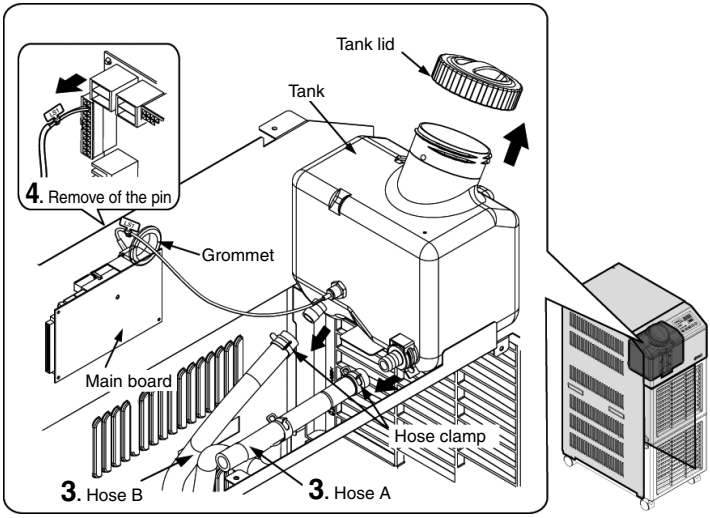
**Part number of service parts (Tank)**

| Description | Part number |
|---|---|
| Tank | HRS-S0025 |

1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel, the panels on both sides and the front panel referring the 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.




**Removal of tank**

## HRS012/018/024/030-A/W-J (With automatic water fill function)
## HRS050/060-A/W-20-J

**Part number of service parts (Tank (For automatic water fill))**

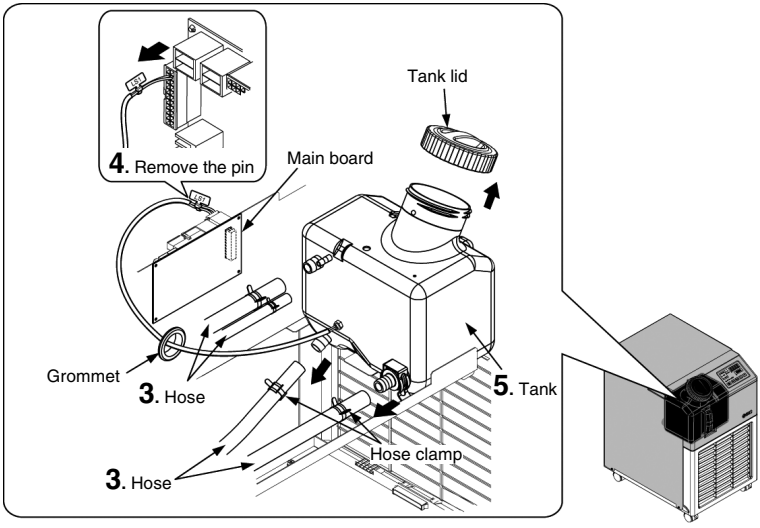
| Description | Part number |
|---|---|
| Tank (For automatic water fill) | HRS-S0072 |

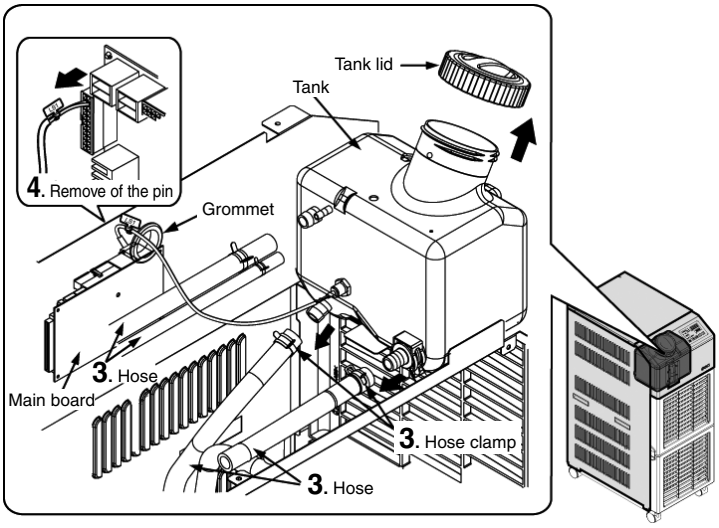
1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel, the panels on both sides and the front panel referring the removal and the mounting of the panel.
3. Remove the hose clamp and remove hoses. (4 pcs.)
4. Remove the level 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.



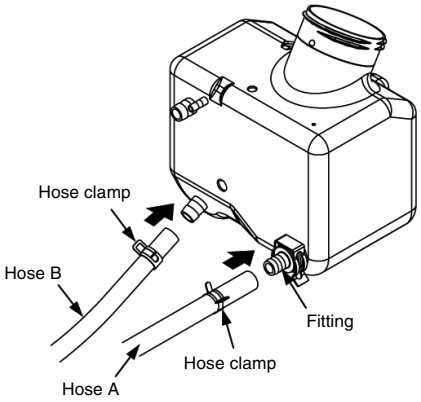

**Removal of tank (With automatic water fill function)**

## ■ Mounting

### HRS012/018/024/030-A/W-□
### HRS050/060-A/W-20-□

**1.** Install the tank.

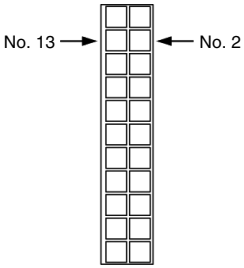
**2.** Assemble the fitting mounted to the tank and hose A.




**Hose A attaching**

**3.** Mount the hose B.

**4.** Put the level switch cable [LS1] (2 pcs.) through the grommet. Insert the pin to the connector. (No. 2 & No. 13)




**Location to mount the connector**

**Tips**

It does not matter which connector [LS1] is mounted to which socket.

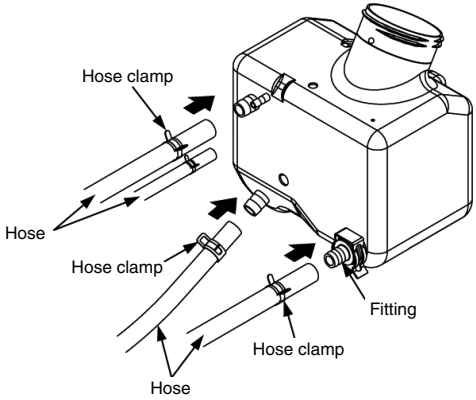
**5.** Mount the upper panel, the panels on both sides and the front panel in reversed order of removal.

**6.** Mount the tank lid.

### HRS012/018/024/030-A/W-□□-J (With automatic water fill function)
### HRS050/060-A/W-20-J

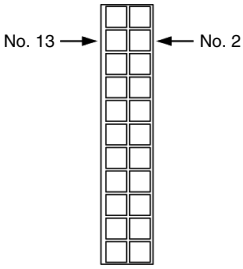
**1.** Install the tank.

**2.** Mount the hoses and fitting to the tank. (4 pcs.)




**Hoses attaching**

**3.** Put the level switch cable [LS1] (2 pcs.) through the grommet. Insert the pin to the connector. (No. 2 & No. 13)




**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.

## Replacement of inlet socket

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

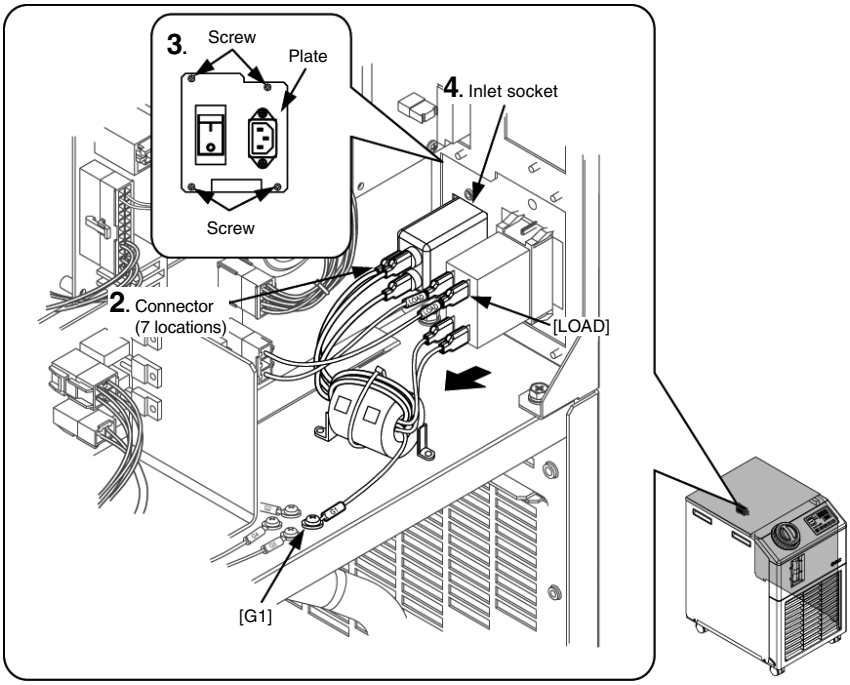
### Removal

**HRS012/018/024/030-A/W-□**

**Part number of service parts (Inlet socket)**

| Description | Part number |
|---|---|
| Inlet socket | HRS-S0021 |

1. Remove the upper panel and the side panel on the right referring the removal and the mounting of the panel.
2. Remove the connector. (7 locations)
3. Remove the plate. (Screw x 4)
4. Remove the inlet socket. (Screw x 2)

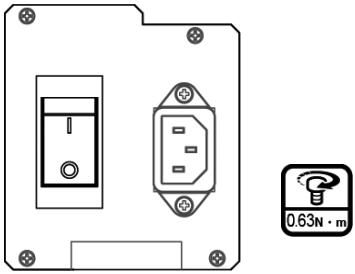



**Removal of inlet socket**

## ■ Mounting

### HRS012/018/024/030-A/W-□

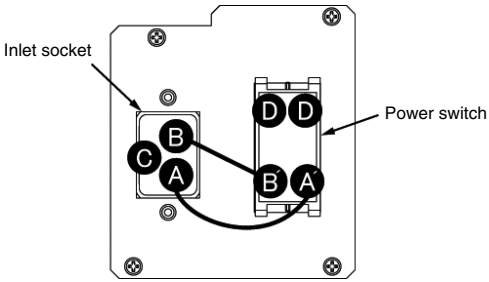
**1.** Mount the inlet socket. (Screw x 2)
∗ Be careful of the mounting direction.




**Mounting direction in inlet socket**

**2.** Mount the plate. (Screw x 4)


**3.** Insert wiring to terminal A-A', B-B', [G1] to terminal C, [LOAD] to terminal D.




**Entry of connector**

**4.** Mount the upper panel and the side panel on the right in reversed order of removal.

## Replacement of power switch

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

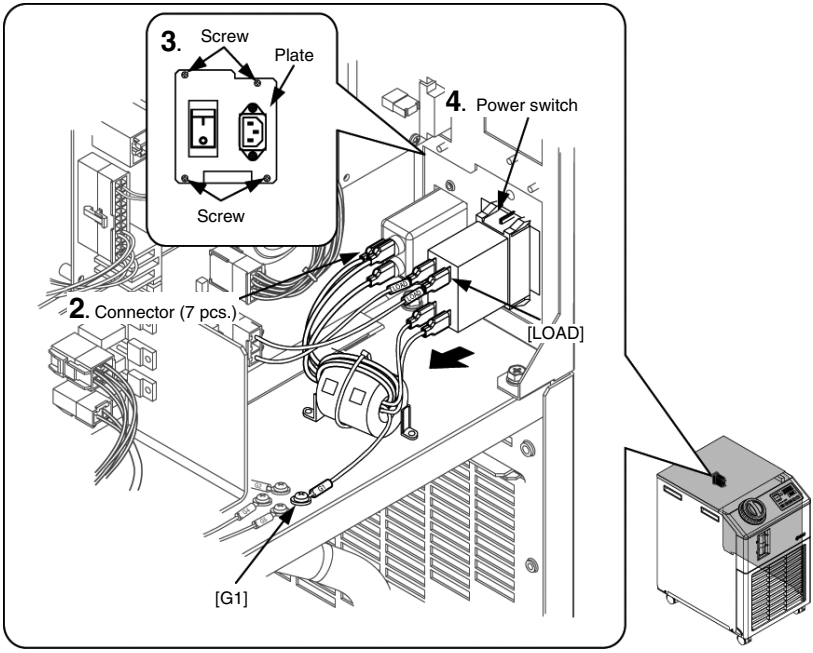
### Removal

**HRS012/018/024/030-A/W-□**

**Part number of service parts (Power switch)**

| Description | Part number | Applicable models |
|---|---|---|
| Power switch (For 10 A type) | HRS-S0020 | · For 200 V type<br>(Except high pressure pump) |
| Power switch (For 15 A type) | HRS-S0070 | · For 100 V type<br>· For high pressure pump 200 V type |

1. Remove the upper panel and the side panel on the right referring the removal and the mounting of the panel.
2. Remove the connector. (7 locations)
3. Remove the plate. (Screw x 4)
4. Remove the power switch.

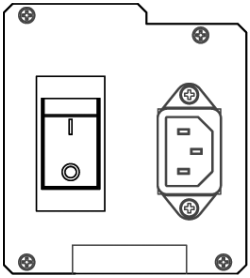



**Removal of power switch**

## ■ Mounting

### HRS012/018/024/030-A/W-□

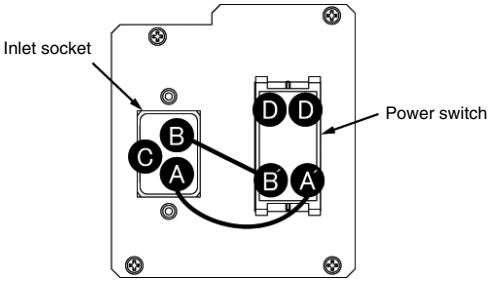
**1.** Mount the power switch.
∗ Be careful of the mounting direction.



**Mounting direction in power switch**

**2.** Mount the plate. (Screw x 4)


**3.** Insert wiring to terminal A-A', B-B', [G1] to terminal C, [LOAD] to terminal D.




**Entry of connector**

**4.** Mount the upper panel and the side panel on the right in reversed order of removal.

## Replacement of DC power supply

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

### Removal

**HRS□□□-A/W-□**

**Part number of service parts (DC power supply)**

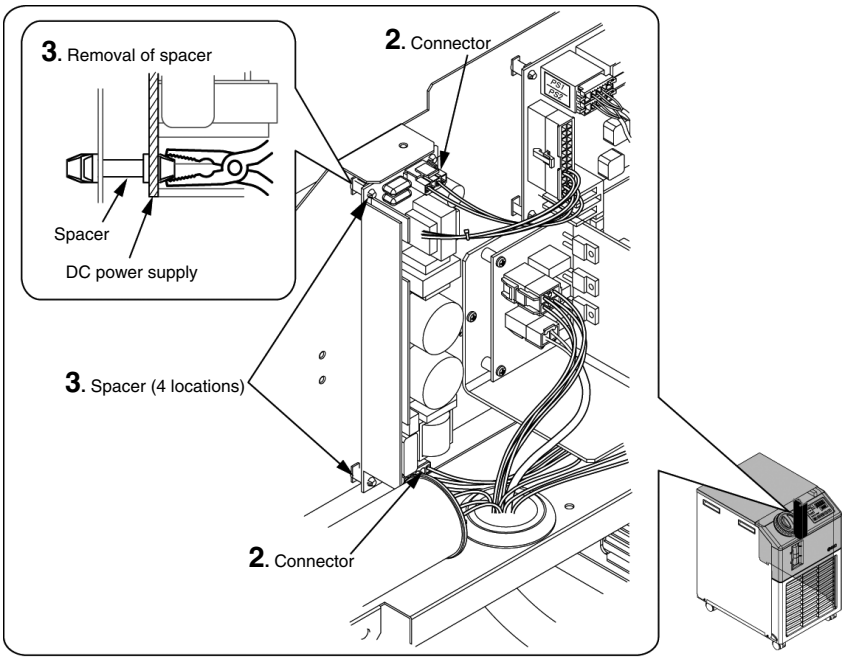
| Description | Part number |
|---|---|
| DC power supply | HRS-S0016 |

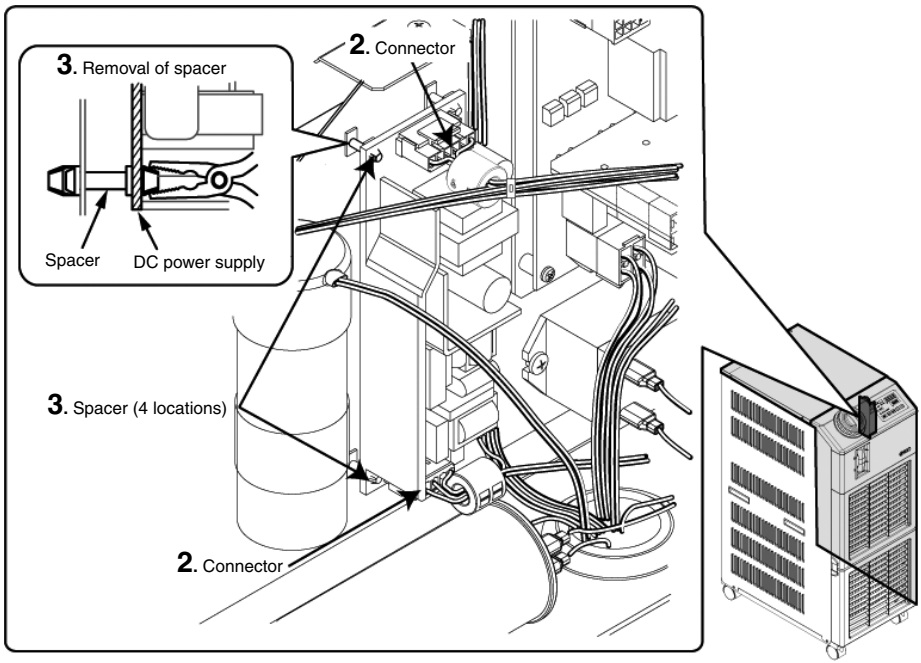
**HRS050/060-A/W-20-□**

**Part number of service parts (DC power supply)**

| Description | Part number |
|---|---|
| DC power supply | HRS-S0087 |

1. Remove the upper panel, the side panel on the right and the front panel referring the 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.




**Removal of DC power supply**

## ■ Mounting

### HRS012/018/024/030-A/W-□
### HRS050/060-A/W-□

1. Mount the DC power supply. (Spacer x 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.

## Replacement of main board & communication board

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

### Removal

**HRS012/018/024/030-A/W-□**

**Part number of service parts (Main board and communication board)**

| Description | Part number | Applicable models | Remarks |
|---|---|---|---|
| Main board* | 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 | — | — |

* 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 replace the board.

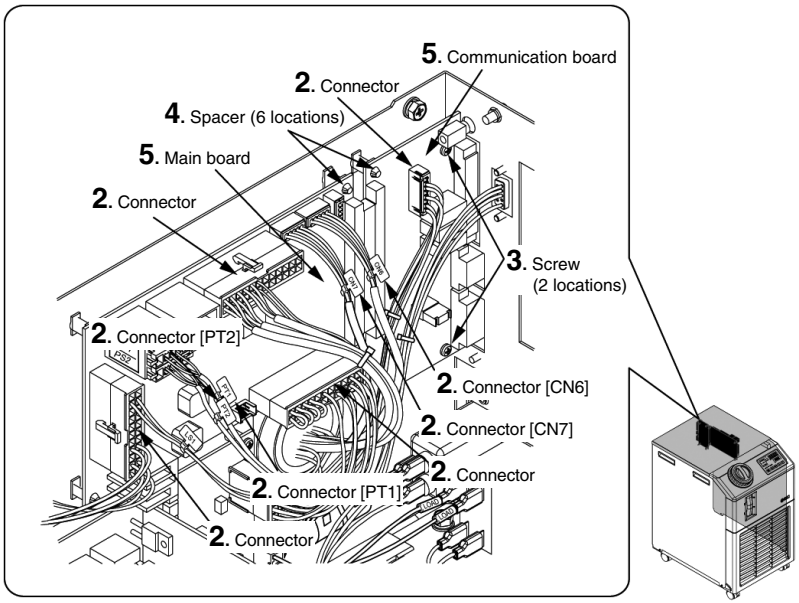
## HRS050/060-A/W-20-□

**Part number of service parts (Main board and communication board)**

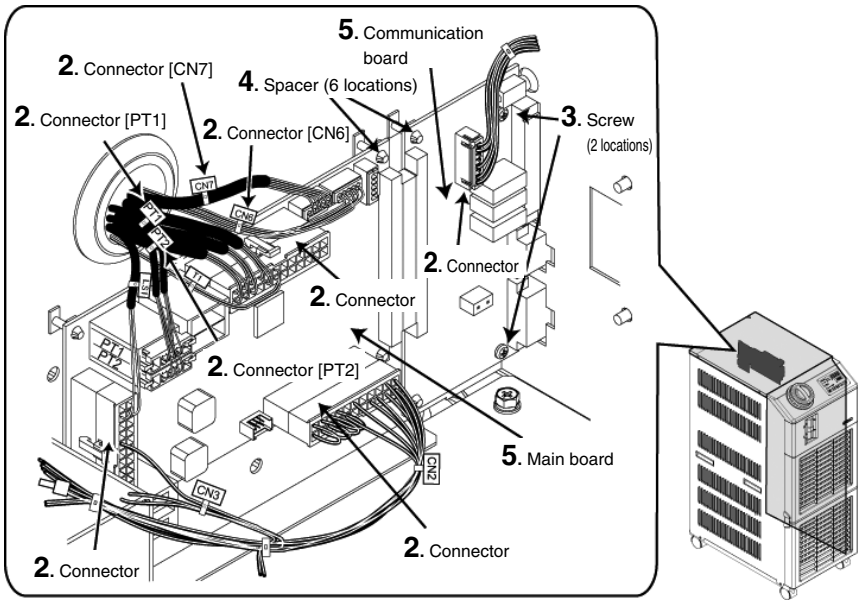
| Description | Part number | Applicable models | Remarks |
|---|---|---|---|
| Main board* | HRS-S0090 | HRS050-A-20 | — |
| | HRS-S0091 | HRS050-W-20 | — |
| | HRS-S0296 | HRS060-A-20 | |
| | HRS-S0297 | HRS060-W-20 | |
| | HRS-S0135 | HRS050/060 series | Be sure to perform an initial setting of the main board. |
| Communication board | HRS-S0018 | — | — |

* The main board has to be selected either one of options listed. HRS-S0090 and HRS-S0091, S0296, S0297 are preset their initial setting. HRS-S0135 is universal part so it needs initial setting after replace the board.

1. Remove the upper panel and the side panel on the right referring the 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 the figure on page 302.)
5. Remove the communication board from main board.




**Removal of main board & communication board**




**Removal of main board & communication board**

## ■ Mounting

### HRS012/018/024/030-A/W-□
### HRS050/060-A/W-20-□

1. Insert the main board to the communication board.
2. Mount the main board and communication board. (Spacer x 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.

## Replacement of power board

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

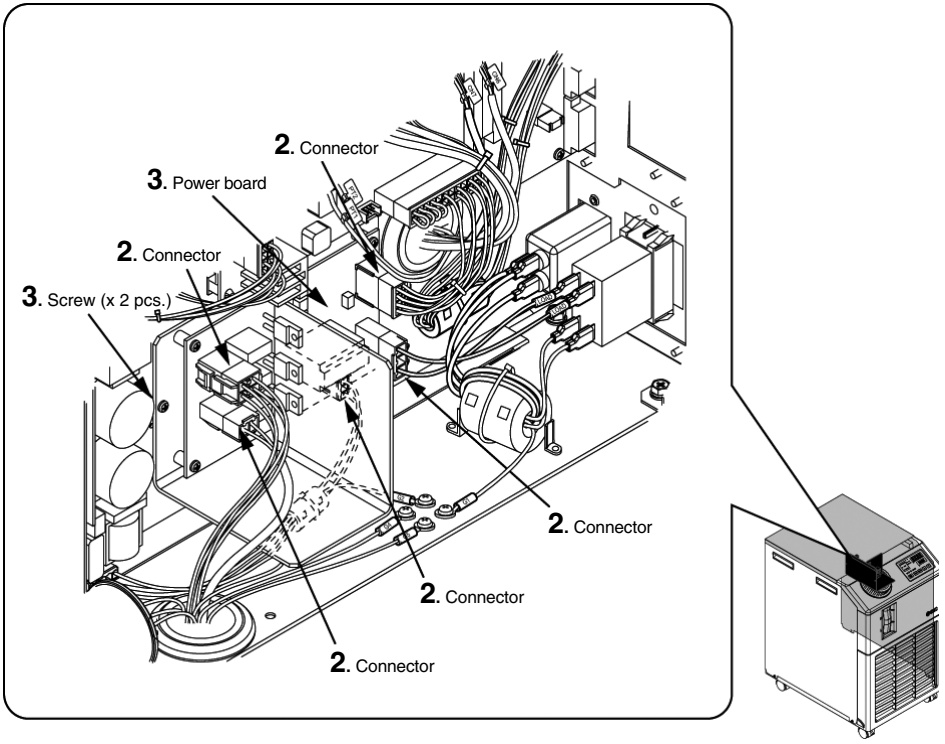
### Removal

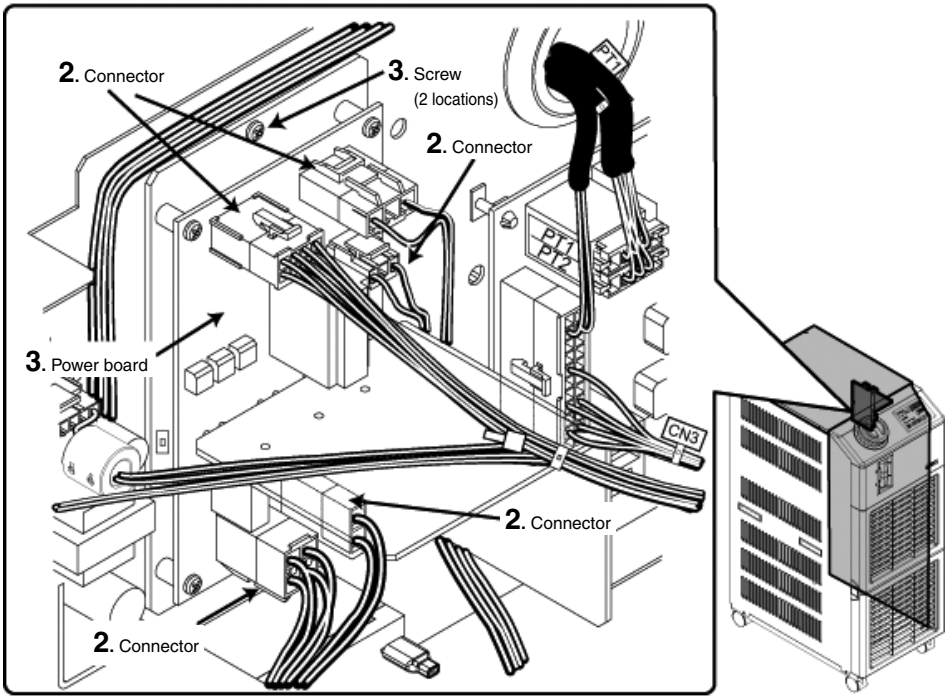
**HRS012/018/024/030-A/W-□**
**HRS050/060-A/W-20-□**

**Part number of service parts (Power board)**

| Description | Part number |
|---|---|
| Power board | HRS-S0019 |

1. Remove the upper panel and the side panel on the right referring the removal and the mounting of the panel.
2. Remove the connector of power board. (5 locations)
3. Remove the power board. (Screw x 2)






## ■ Mounting

### HRS012/018/024/030-A/W-□
### HRS050/060-A/W-20-□

**1.** Mount the power board. (Screw x 2)

0.63N · m

**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.

## Replacement of display board

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

### ■ Removal

**HRS□□□-A/W-□**

**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 |

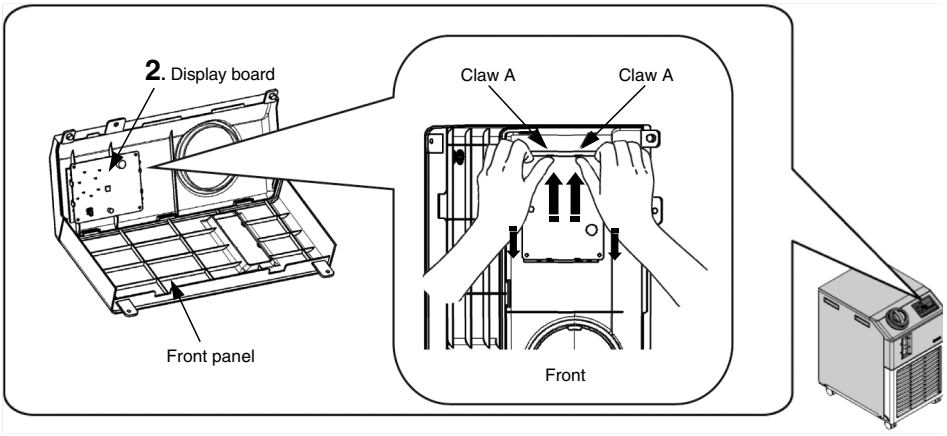
∗ For serial No., refer to Product label in the Operation Manual.

## From production in March 2015 (After serial No. TQ***)

1. Remove the upper panel, the panels on both sides and the front panel referring the removal and the mounting of the panel.
2. Remove the display board.

**Tips**

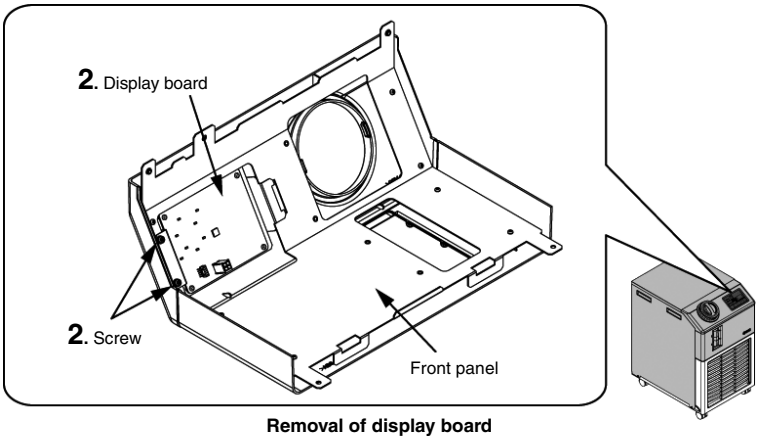
Push the claws A at the back of the front panel with both thumbs to open the front panel. Pull the display board with fingers to remove the display board.




**Removal of display board**

## Until production in February 2015 (Serial No. TP*** or earlier)

1. Remove the upper panel, the panels on both sides and the front panel referring the removal and the mounting of the panel.
2. Remove the display board. (Screw x 2)



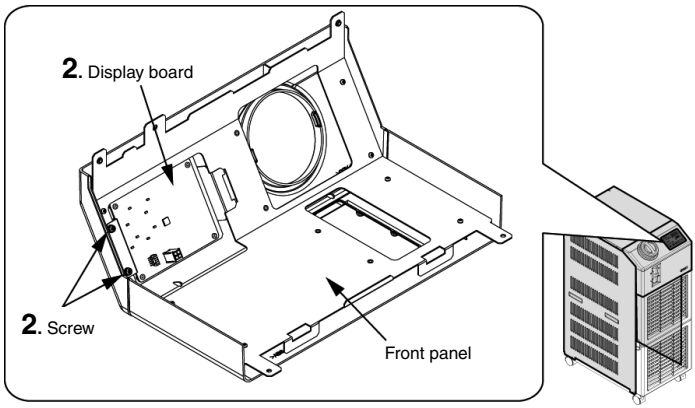

**Removal of display board**

**HRS050/060-A/W-20-□**

**Part number of service parts (Display board)**

| Description | Part number |
|---|---|
| Display board | HRS-S0017 |

1. Remove the upper panel, the panels on both sides and the front panel referring the removal and the mounting of the panel.
2. Remove the display board. (Screw x 2)




**Removal of display board**

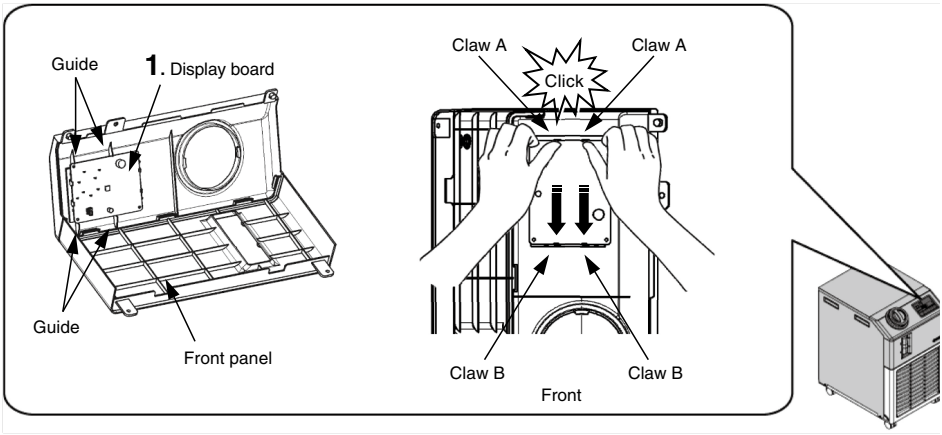
## ■ Mounting

**HRS012/018/024/030-A/W-□**

## From production in March 2015 (After serial No. TQ***)

**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.




**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)

**1.** Mount the display board. (Screw x 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.

### HRS050/060-A/W-20-□

**1.** Mount the display board. (Screw x 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.

## Replacement of hose

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

### ■ Removal

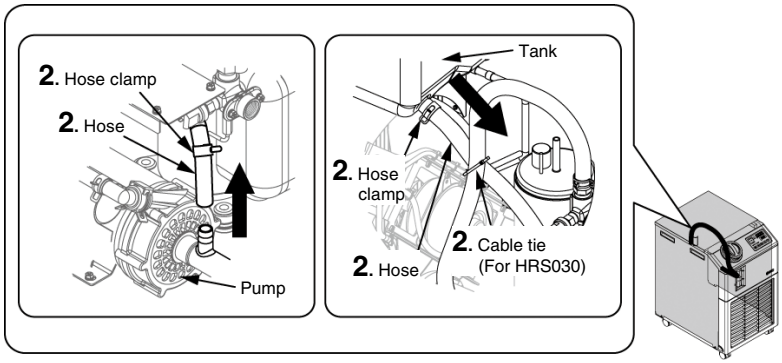
**HRS012/018/024/030-A/W-□**

**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 |

### ● Between tank-pump

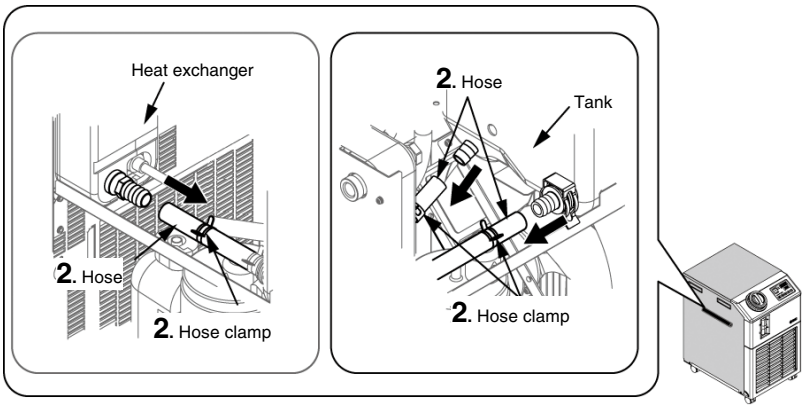
1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel and the panels on both sides referring the removal and the mounting of the panel.
3. Remove the hose clamp and remove the hose.
   ∗ For the HRS030, cut the cable tie which fixes the hose between the pump and circulating fluid outlet port.




**Removal of hose (Between tank-pump)**

### ● Between tank-heat exchanger

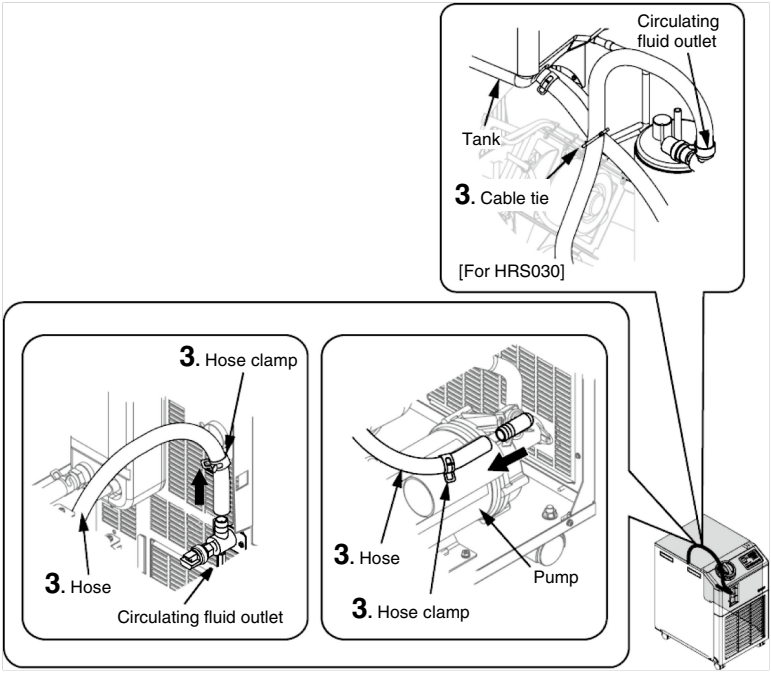
1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the left referring the removal and the mounting of the panel.
3. Remove the hose clamp on the tank side. (2 locations)
4. Remove the tank.
5. Remove the hose clamp on the heat exchanger side and remove the hose.




**Removal of plastic hose (Between tank-heat exchanger)**

## ●Between pump-circulating fluid outlet

1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the right referring the 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.




**Removal of plastic hose (Between pump-circulating fluid outlet)**

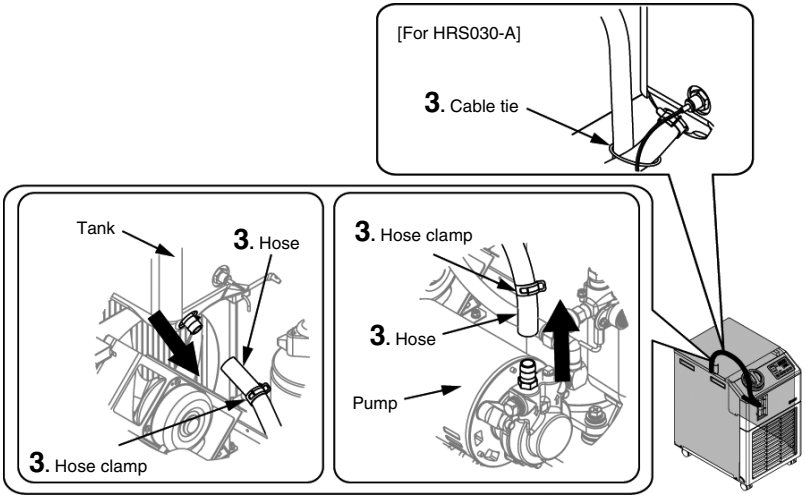
## High pressure pump

### ● Between tank-pump

**1.** Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.

**2.** Remove the upper panel and the panels on both sides referring the 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.




**Removal of plastic hose (Between tank-pump)**

### ● Between tank-heat exchanger

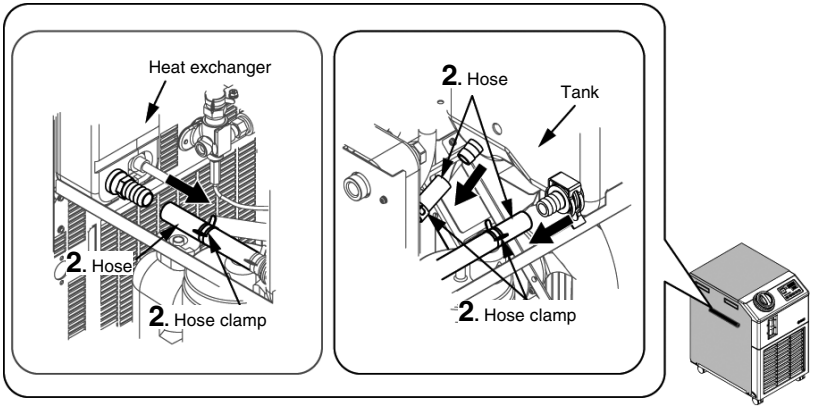
**4.** Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.

**5.** Remove the upper panel and the side panel on the left referring the removal and the mounting of the panel.

**6.** Remove the hose clamp on the tank side. (2 locations)

**7.** Remove the tank.

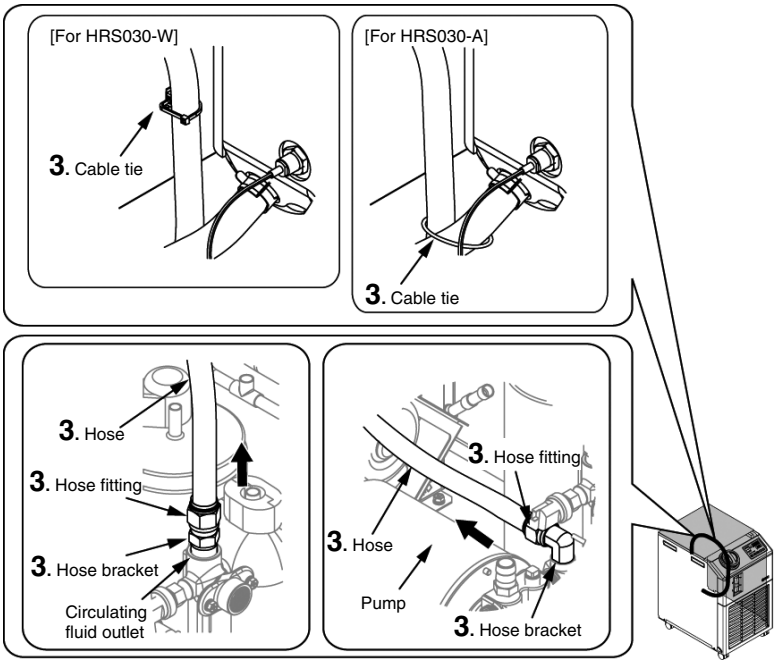
**8.** Remove the hose clamp on the heat exchanger side and remove the hose.




**Removal of plastic hose (Between tank-heat exchanger)**

## ●Between pump-circulating fluid outlet

1. Discharge the circulating fluid referring the discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the right referring the 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.




**Removal of plastic hose (Between pump-circulating fluid outlet)**

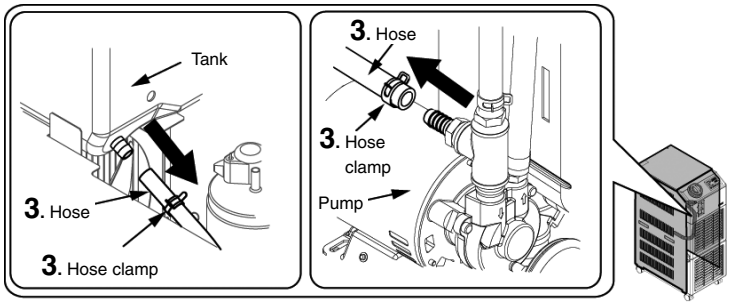
## HRS050/060-A/W-20-□

**Part number of service parts (Hose)**

| Description | Part number |
|---|---|
| Hose | HRS-S0097 |
| Hose (For HRS060) | HRS-S0362 |

### ● Between tank-pump

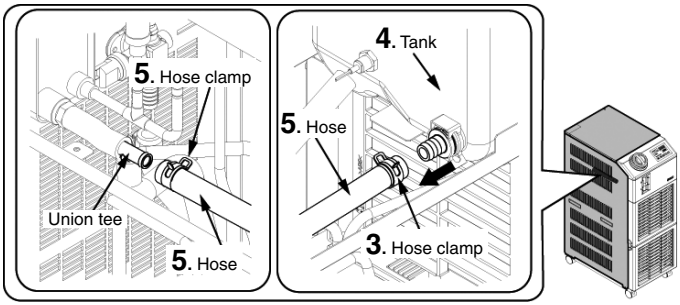
1. Discharge the circulating fluid referring to discharge of the circulating fluid and facility water.
2. Remove the upper panel and the panels on both sides referring to removal and the mounting of the panel.
3. Remove the hose clamp and remove the hose.




**Removal of hose (Between tank-pump)**

### ● Between tank-union tee

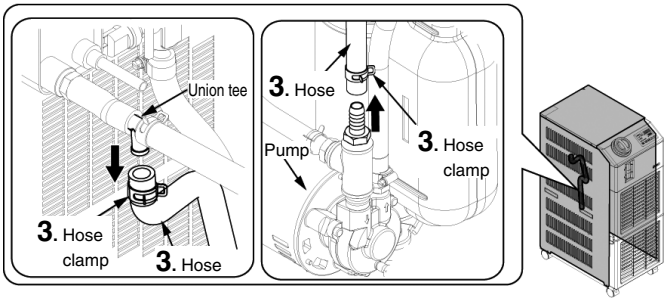
1. Discharge the circulating fluid referring to discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the left referring to removal and the mounting of the panel.
3. Remove the hose clamp on the tank side. (2 locations)
4. Remove the tank.
5. Remove the hose clamp on the union tee side and remove the hose.




**Removal of hose (Between tank-union tee)**

## ●Between heat exchanger-union tee

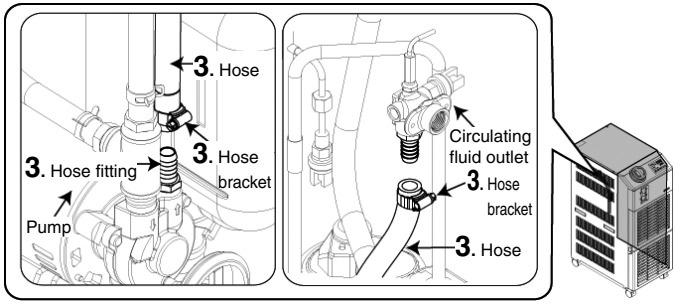
1. Discharge the circulating fluid referring to discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the left referring to removal and the mounting of the panel.
3. Remove the hose clamp and remove hose.




**Removal of plastic hose (Between heat exchanger-union tee)**

## ●Between pump-circulating fluid outlet

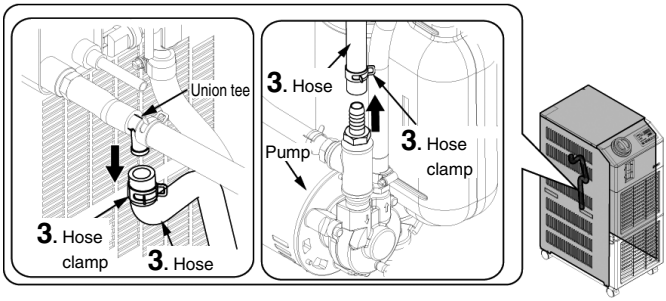
1. Discharge the circulating fluid referring to discharge of the circulating fluid and facility water.
2. Remove the upper panel and the side panel on the right referring to removal and the mounting of the panel.
3. The hose fitting is loosened and remove the hose.




**Removal of hose (Between pump-circulating fluid outlet)**

### ● Between pump-union tee

1. Discharge the circulating fluid referring to discharge of the circulating fluid and facility water.
2. Remove the upper panel and the panels on both sides referring to removal and the mounting of the panel.
3. Remove the hose clamp and remove hose.




**Removal of plastic hose (Between pump-union tee)**

## ■ Mounting

### HRS012/018/024/030-A/W-□

| ⚠ CAUTION |
|---|
| **Check the hose is not twisted after connecting.** |

### ■ 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 panels on both sides in reversed order of removal.

### ■ 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.

### ■ Mounting (Between pump-circulating fluid outlet)

1. Mount the hose using the hose clamp.
2. Hold the hose with the hose clamp.
   * For the HRS030, 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.
3. Mount the upper panel and the side panel on the right in reversed order of removal.



## High pressure pump

| ⚠ CAUTION |
| --- |
| **Check the hose is not twisted after connecting.** |

### ■ 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.

### ■ 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.

### ■ 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.

## HRS050/060-A/W-20-□

**⚠ CAUTION**

**Check the hose is not twisted after connecting.**

### ■ Mounting (Between tank-pump)

1. Mount the hose using the hose clamp.
2. Hold the hose with the hose clamp.
   * For the HRS060, bind heat insulation tube around the hose and fix it with a cable tie to prevent it from touching the upper fan motor.
3. Mount the upper panel and the side panel on the left in reversed order of removal.

### ■ Mounting (Between tank-union tee)

1. Mount the hose on the tank using the hose clamp.
2. Install the tank.
3. Mount the hose on the union tee.
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.

### ■ 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.

### ■ Mounting (Between heat exchanger-union tee)

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 left in reversed order of removal.

### ■ Mounting (Between pump-union tee)

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.

## Replacement of fuse

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**



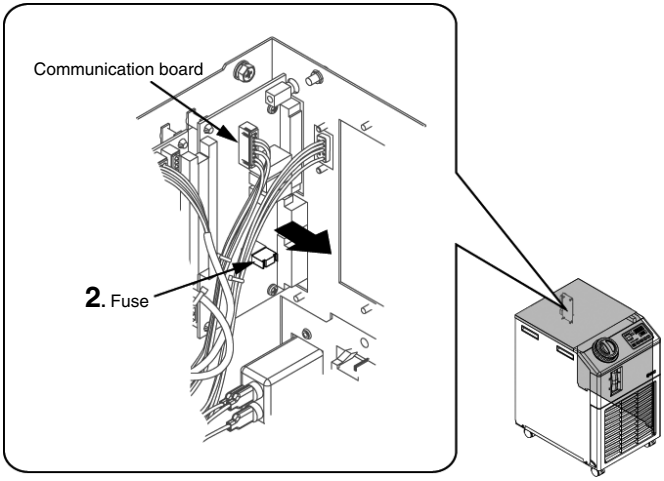
### Removal

**HRS012/018/024/030-A/W-□**

**Part number of service parts (Fuse)**

| Description | Part number |
|---|---|
| Fuse | HRS-S0024 |

1. Remove the upper panel and the side panel on the right referring the removal and the mounting of the panel.
2. Remove the fuse.



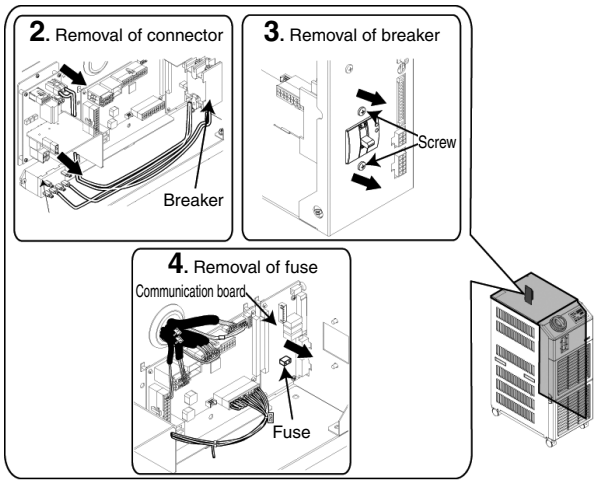

**Removal of fuse**

## HRS050/060-A/W-20-□

**Part number of service parts (Fuse)**

| Description | Part number |
|---|---|
| Fuse | HRS-S0024 |

1. Remove the upper panel and the side panel on the right referring to removal and the mounting of the panel.
2. Remove the connector of breaker.
3. Remove the breaker. (Screw x 2)
4. Remove the fuse.




**Removal of fuse**

## ■ Mounting

### HRS012/018/024/030-A/W-□

1. Mount the fuse.
2. Mount the upper panel and the side panel on the right in reversed order of removal.

### HRS050/060-A/W-20-□

1. Mount the fuse.
2. Mount the breaker. (Screw x 2)
3. Mount the upper panel and the side panel on the right in reversed order of removal.

## ● Replacement of valve for automatic water fill

**⚠ WARNING**

**Be sure to shut off the breaker of the facility power supply (the user's machine power supply) before replacement work.**

### ■ Removal

**HRS012/018/024/030-A/W-J**
**HRS050/060-A/W-20-J**

**Part number of service parts (Valve for automatic water fill)**

| Description | Part number |
|---|---|
| Valve for automatic water fill | HRS-S0071 |

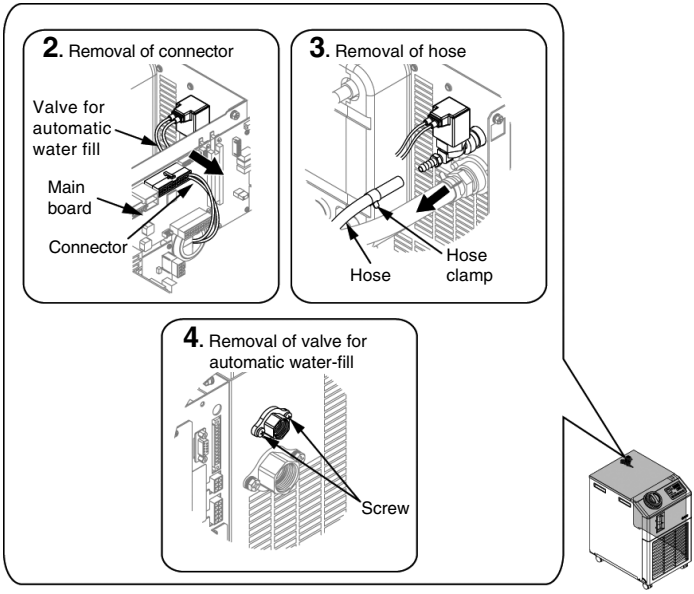
**1.** Remove the upper panel and the side panel on the right referring the removal and the mounting of the panel.

**2.** Remove the cable connector of valve from the main board.

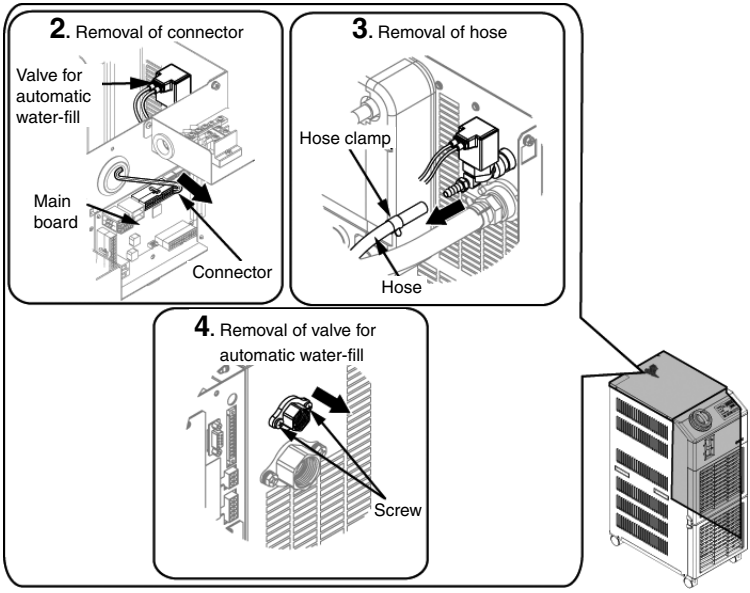
**Tips**
Use "57031-6000" of MOLEX for removing.
Our part no.: HRS-S0056

**3.** The hose mounted on valve for automatic water fill is removed.

**4.** Remove the valve for automatic water fill.




**Removal of valve for automatic water fill**



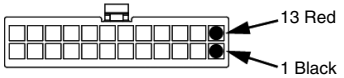

**Removal of valve for automatic water fill**

## ■ Mounting

### HRS012/018/024/030-A/W-J
### HRS050/060-A/W-20-J

**1.** Mount the valve for automatic water fill.


**2.** Mount the cable connector of valve to the main board.




**Mount the connector of valve for automatic water fill**

**3.** Mount the hose.

## Spare parts for replacement of the compressor
## HRS012/018/024/030-A/W-10/20

**Table 4-3. Tools list for repairing refrigerant circuit**

| Model | Part No | Part name | Qty. | Photo |
|---|---|---|---|---|
| HRS012-A/W-10<br>HRS018-A/W-10<br>HRS024-A/W-10<br>HRS030-A/W-10 | HRS-S0409 | Compressor<br>(Include accessories) | 1 |  |
| HRS012-A/W-20<br>HRS018-A/W-20<br>HRS024-A/W-20<br>HRS030-A/W-20 | HRS-S0068 | Compressor<br>(Include accessories) | 1 |  |

**⚠ WARNING**

**There is danger of an electric shock. Make sure to turn OFF the power supply before performing replacement work.**
**There is danger of an electric shock and burn. Be careful enough not to be hurt during the work.**

**⚠ 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.**

## ■ Disassembly

1. Remove the upper panels.
2. Remove the left side panel and right side panel.

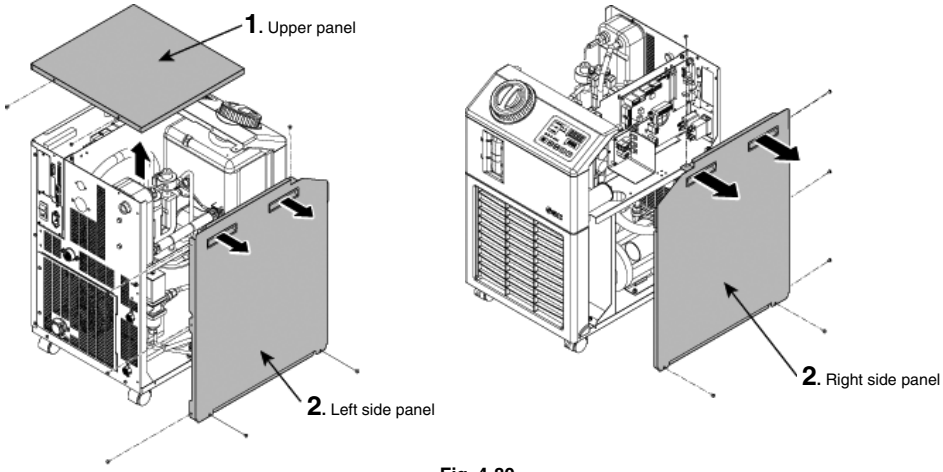



**Fig. 4-80**

3. Remove the cap of the high pressure service port on the refrigerant circuit, and then mount a charge valve.

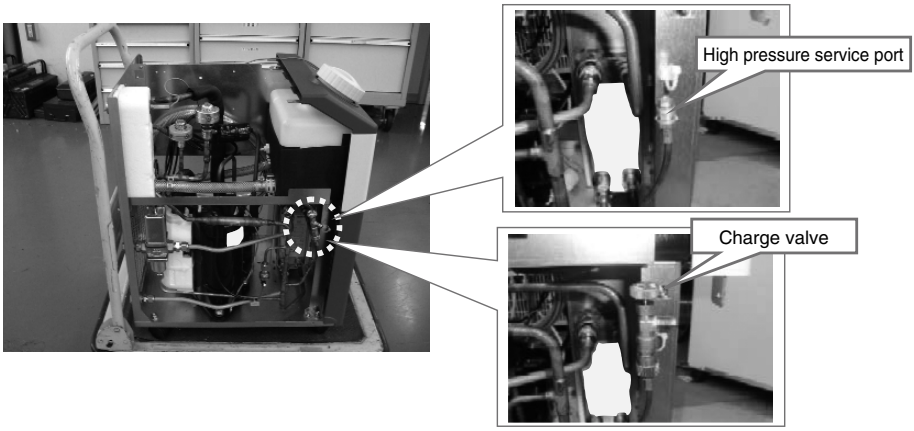



**Fig. 4-81**

**4.** Connect the hose of the gauge manifold to the charge valve, and then collect the refrigerant gas, with the refrigerant collector.

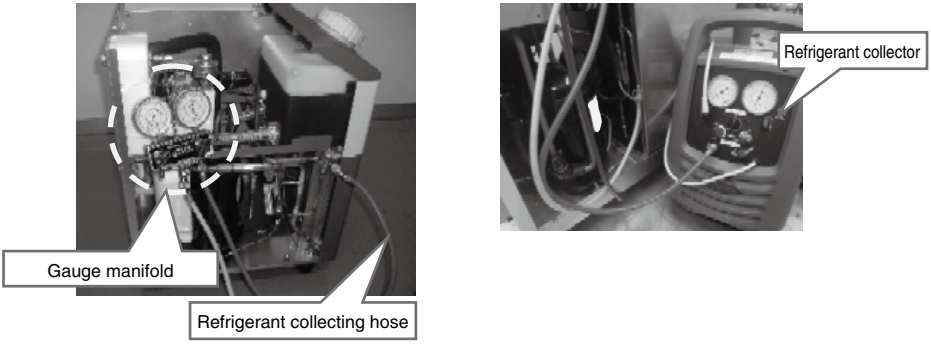



**Fig. 4-82**

**5.** Open the terminal cover of the compressor, and disconnect the wirings (R,S,T).


**Fig. 4-83**

**6.** Cut the cable ties with a pair of nippers, and remove the heat insulator of the accumulator.

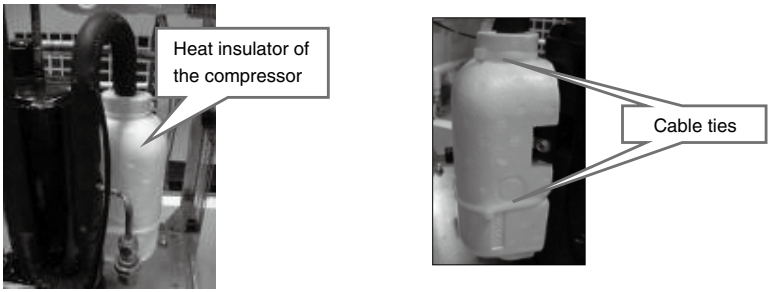



**Fig. 4-84**

**7.** Remove the heat insulator and remove the fixture from the thermistor sensor.

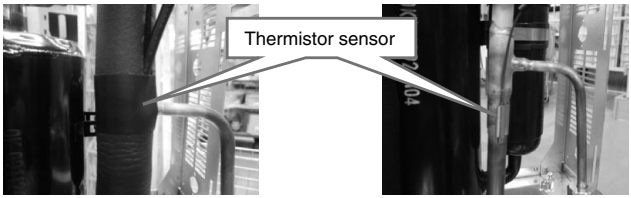



**Fig. 4-85**

**8.** Remove the earth wiring.

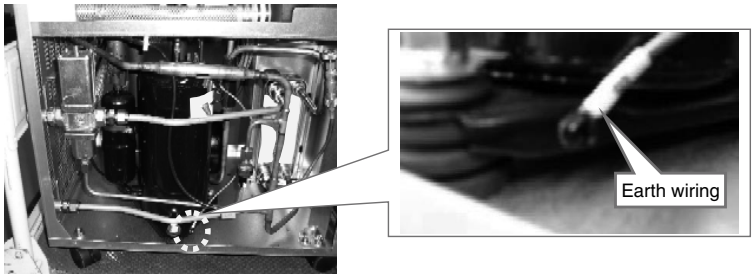



**Fig. 4-86**

**9.** Warm the brazing filler material of the suction piping A and outlet piping B, using the welding equipment. After melting the brazing filler material, hold and pull out the suction piping A and outlet piping B with pliers.

∗ The suction piping A and outlet piping B of the compressor are to be reused. Use caution not to deform or melt the copper tubings when disconnecting them.

**⚠ DANGER**

- **Only trained and qualified personnel who are knowledgeable and skilled in brazing can perform the work of this document.**
- **Brazing has to be performed in a well ventilated area and where no flammable objects are present.**

**⚠ CAUTION**

**The collection and the disposal of refrigerant (HFC) and compressor oil must be in compliance with the bylaws of the local municipality.**

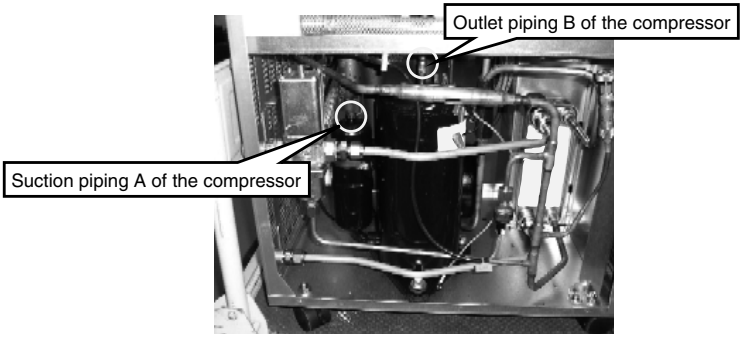



**Fig. 4-87**

**10.** Loosen the fitting with a spanner, and remove the facility water pipings A and B, and refrigerant piping flare.


**Fig. 4-88**

**11.** Loosen and remove the hexagon head nut of the feet of the compressor.

* Since it is difficult to remove the hexagon head bolt 3, remove the support panel first

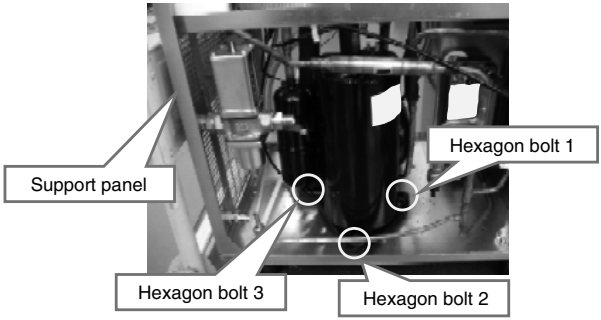



**Fig. 4-89**

## ■ Remount

**1.** Mount the compressor on the base while aligning it to the holes, and hold it with flat washers and hexagon head bolts by using a spanner.

* Do not remove the two rubber caps of the compressor until immediately before brazing in order to prevent oxidization inside the compressor.


**Fig. 4-90**

**2.** Remove the rubber caps. Insert copper piping into the suction piping A and outlet piping, and braze them.Mount the refrigerant piping flare to the water control valve.

**⚠ DANGER**

- **Only trained and qualified personnel who are knowledgeable and skilled in brazing can perform the work of this document.**
- **Brazing has to be performed in a well ventilated area and where no flammable objects are present.**

* When brazing, make sure to wear protective glasses for brazing, and do not directly look at the flame.
* Before starting to braze, nitrogen gas must be applied inside the copper pipe to avoid oxidization of the internal surface of the copper pipe.
* After brazing is complete, confirm that the brazing filler material is applied to the entire brazed part by visual observation.

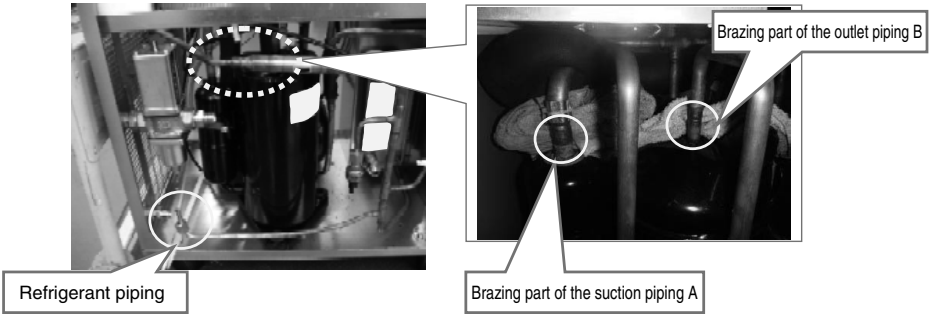



**Fig. 4-91**

**3.** Check for any leakage from the brazed parts by filling the refrigerant circuit with refrigerant gas and nitrogen gas.
· Fill the refrigerant gas (R407C) into the refrigerant circuit until the gas pressure reaches 0.29 MPa, and fill the nitrogen gas into the refrigerant circuit until the gas pressure reaches 1.37 MPa.

**4.** Check for leakage at the brazed parts using a leak detector.
Set value of the leakage detector: 1.5 x $10^{-5}$ std. cc/sec


**Fig. 4-92**

**5.** Collect the refrigerant gas and nitrogen gas used for the leakage check.
❗Entrust a special industrial waste disposal trader with the mixture of refrigerant gas and nitrogen gas which you have collected.

**6.** After confirming that the refrigerant pressure gage measures zero, start drawing vacuum for more than 30 minutes.
❗The charging hose (Red) shall be 0.92 m length.

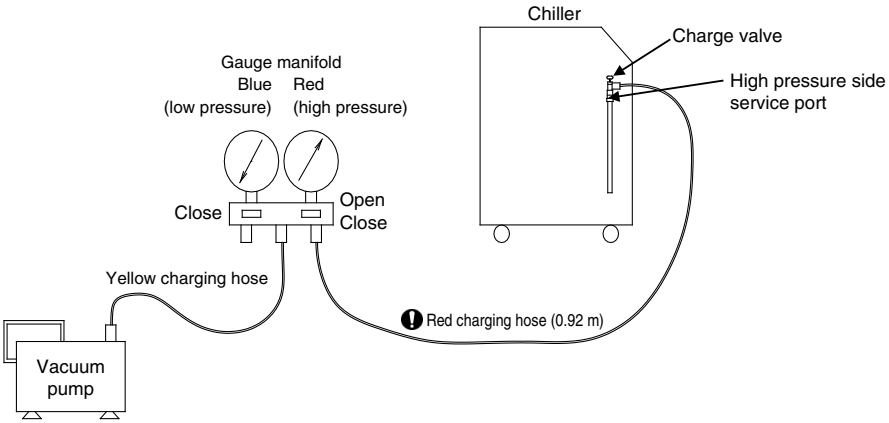



**Fig. 4-93**

**7.** Charge the specified amount of the refrigerant gas (Refer to Table 4-4.).

**⚠ CAUTION**

**Apply the correct amount of the refrigerant. The performance of the product may not be realized if the amount is too large or too small.**

* Use a regularly calibrated scale to measure the gas to be filled in.
* If air is left inside the hose between the refrigerant cylinder and the service port, the air enters the refrigerant piping. If air enters the compressor, it may cause the product failure. Make sure to fill the hose with refrigerant before enclosing the refrigerant.

❗The service port is located at high pressure side.
So you cannot add refrigerant during the system in operation.

**Table 4-4. The amount of refrigerant** **Unit g**

| Refrigerant | Chiller Model | | |
|---|---|---|---|
| | HRS012-W-10<br>HRS018-W-10 | HRS012-W-20<br>HRS018-W-20<br>HRS024-W-20 | HRS030-W-20 |
| R407C | 255 ±5 g | 300 ±5 g | 495 ±15 g |

❗Refer the refrigerant charge procedure HRX-MM-Q018
They contain useful tips to keep the charge amount controlled.

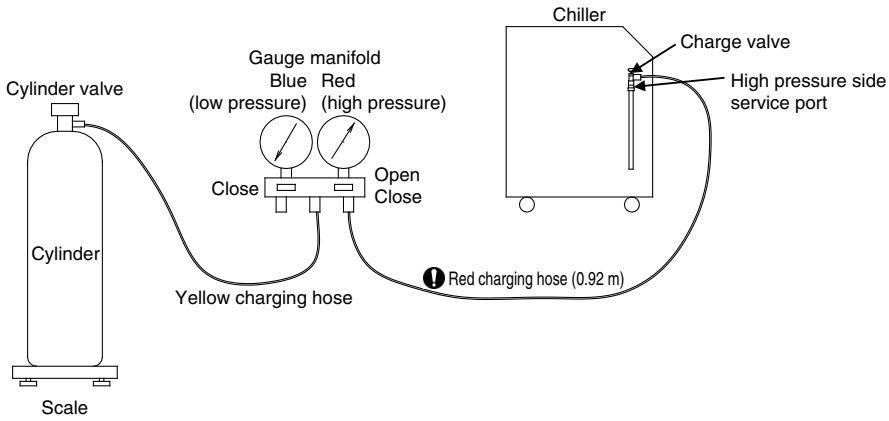



**Fig. 4-94**

**8.** Confirm that no refrigerant gas leaks from the service port
Loosen the charge valve if there is no leakage of the refrigerant gas. (This closes the spring loaded check valve.)
Disconnect the hose of the charge valve, and remove the charge valve.
Mount the cap nut to the service port, and tighten it with a spanner.

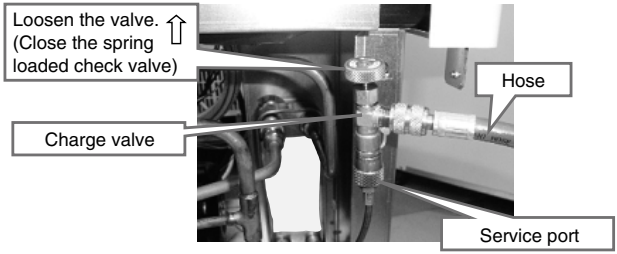



**Fig. 4-95**

**9.** Connect the facility water piping A and B.
Mount the heat insulator of the accumulator with cable ties (At 2 parts)


**Fig. 4-96**

**10.** Install the thermistor sensor with a fixture, and affix a heat insulator.

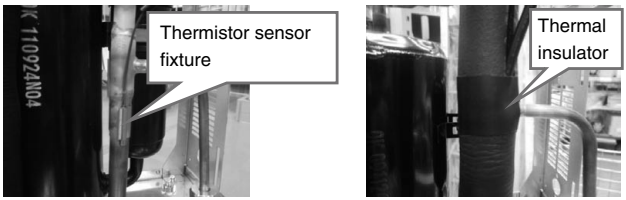



**Fig. 4-97**

**11.** Connect the grounding wire of the compressor.

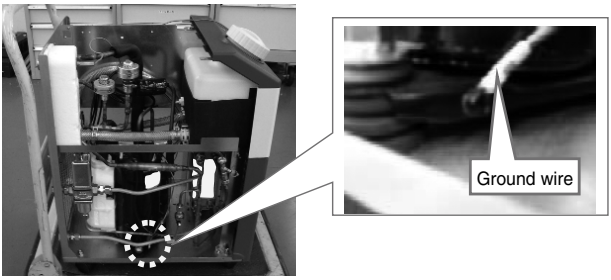



**Fig. 4-98**

**12.** Insert wiring (R, S, T) into the terminals of the compressor, and close the cover by tightening the nut.

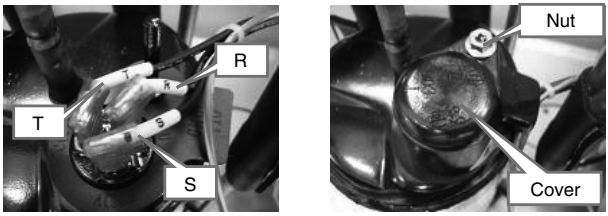



**Fig. 4-99**

**13.** Mount the panels in order, from left panel, right panel and upper panel.
Test the operation to confirm that the temperature control is correctly performed.
The replacement work is now completed, if temperature is controlled within the range of +/- 0.3°C of the set temperature.

**Fig. 4-100**

## Replacement procedure of compressor

### HRS050/060-A/W-20

**Table 4-5 Replacement parts**

| Model | Part No. | Description | Qty. | Image |
|---|---|---|---|---|
| HRS050-A/W-20<br>HRS060-A/W-20 | HRS-S0337 | Compressor,<br>(Include accessories) | 1 |  |

**⚠ WARNING**

**There is danger of an electric shock. Make sure to turn OFF the power supply before performing replacement work.**
**There is danger of an electric shock and burn. Be careful enough not to be hurt during the work.**

**⚠ 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.**

## ■ Disassembly

**1.** Remove the upper panel, dust-proof filter, side panel.

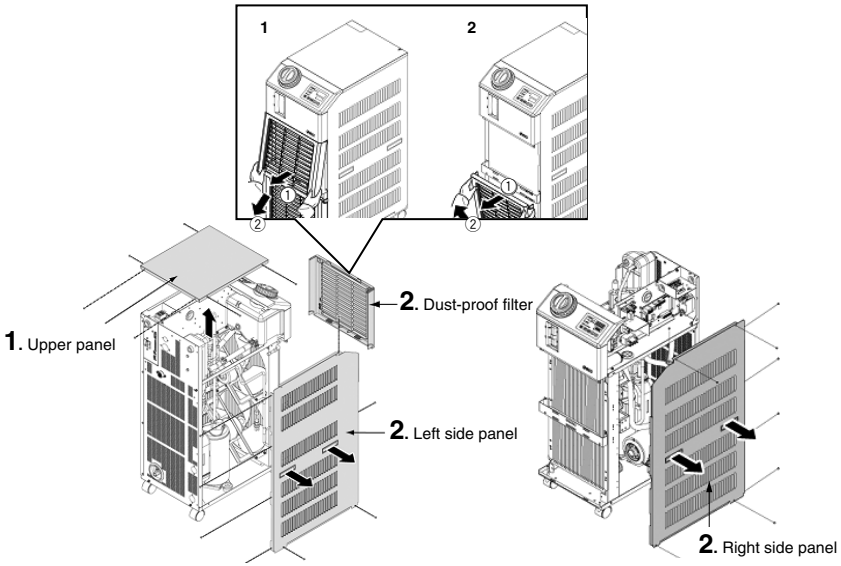



**Fig. 4-101**

**2.** Remove the cap of the service port on the refrigerant circuit, and then mount a charge valve.

**[Air-Cooled type]**

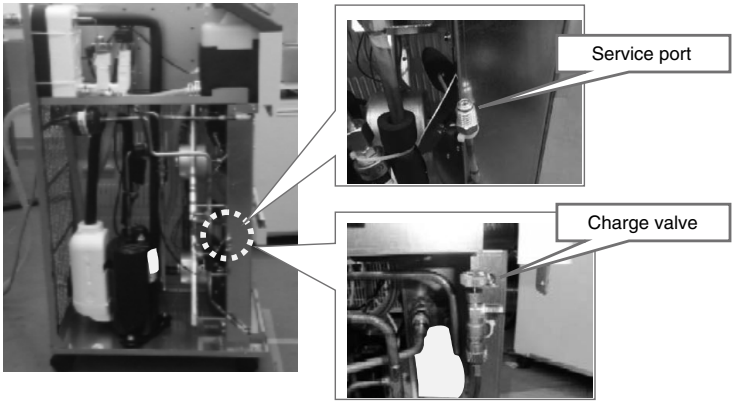



**Fig. 4-102**

**[Water-Cooled type]**

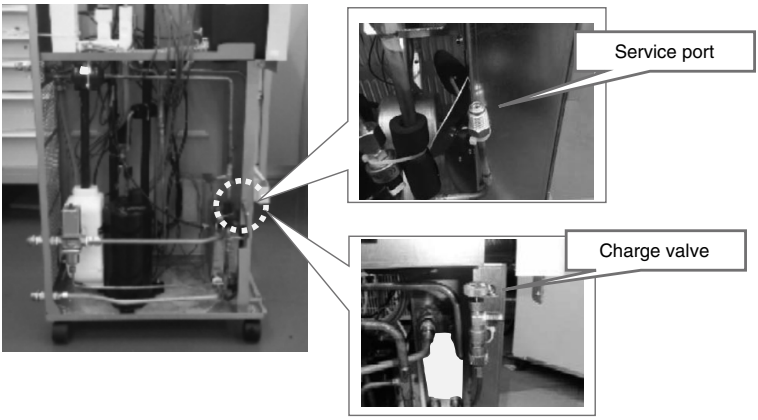



**Fig. 4-103**

**3.** Connect the hose of the gauge manifold to the high pressure service port, and then collect the refrigerant gas, with the refrigerant collector.

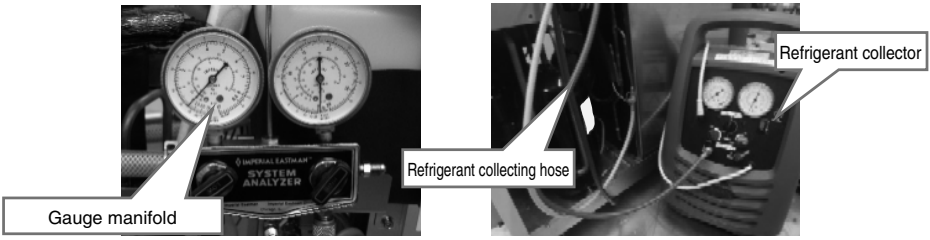



**Fig. 4-104**

**4.** Open the terminal cover of the compressor, and disconnect the wirings (R,S,C).


**Fig. 4-105**

**5.** Remove the earth wiring.

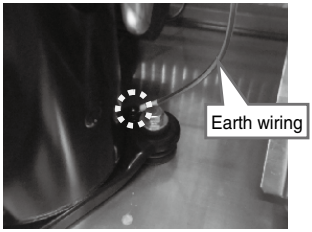



**Fig. 4-106**

**6.** Cut the cable ties with a pair of nippers, and remove the heat insulator of the accumulator.

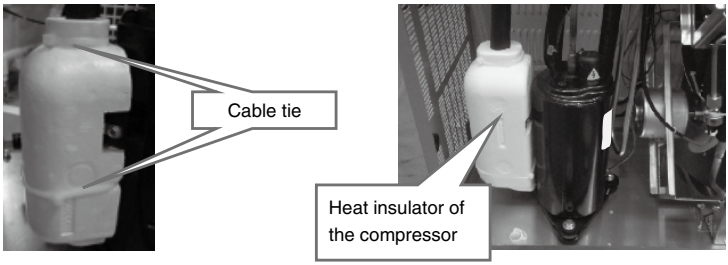



**Fig. 4-107**

**7.** Warm the brazing filler material of the suction piping A and outlet piping B, using the welding equipment. After melting the brazing filler material, hold and pull out the suction piping A and outlet piping B with pliers.

* The suction piping A and outlet piping B of the compressor are to be reused. Use caution not to deform or melt the copper tubings when disconnecting them.

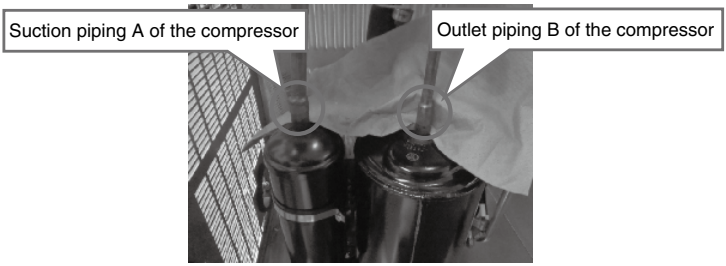



**Fig. 4-108**

**8.** Loosen and remove the hexagon head nuts (M8) of the feet of the compressor.

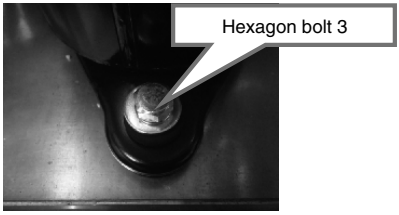



**Fig. 4-109**

## ■ Remount

**1.** Mount the vibration proof rubber and sleeve (Table 1, No.6) on the feet of the compressor while aligning the position of the holes, and mount the compressor on the base.

**2.** Install the flat washer and the hexagon head bolt, and tighten them with a spanner.
- ∗ Do not remove the two rubber caps of the compressor until immediately before brazing in order to prevent oxidization inside the compressor.

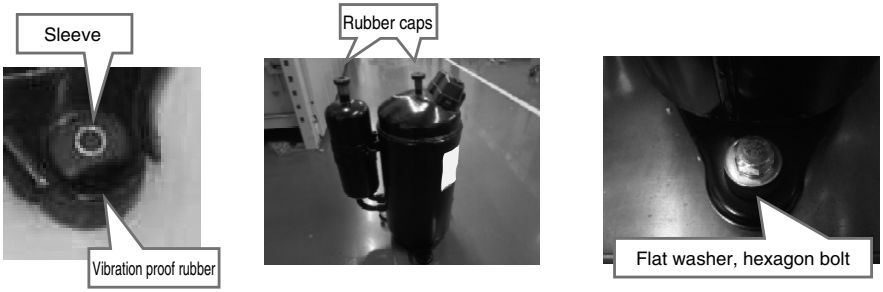



**Fig. 4-110**

**3.** Remove the rubber cap. Insert a copper piping to the suction piping A and outlet piping B, and braze them.

**⚠ DANGER**

- **Only trained and qualified personnel who are knowledgeable and skilled in brazing can perform the work of this document.**
- **Brazing has to be performed in a well ventilated area and where no flammable objects are present.**

- ∗ When brazing, make sure to wear protective glasses for brazing, and do not directly look at the flame.
- ∗ Before starting brazing, nitrogen gas must be applied inside the copper tubing to avoid oxidization of the internal surface of the copper tubing.
- ∗ After finishing brazing, confirm that the brazing filler material is applied to the entire brazed part by visual observation.

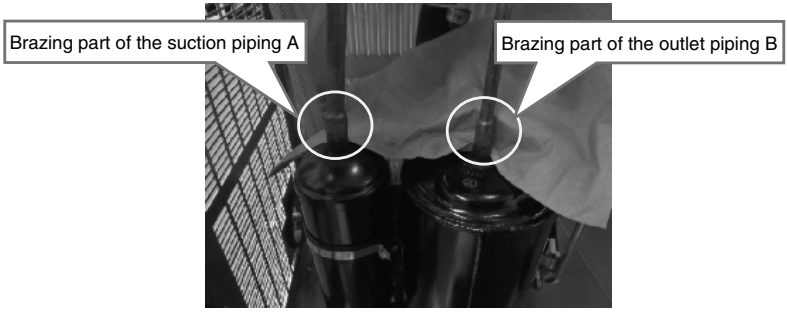



**Fig. 4-111**



**4.** Check for any refrigerant leakage from the brazed parts by filling coolant gas and nitrogen gas inside of the refrigerant circuit.
· Fill the refrigerant gas (R407C) into the refrigerant circuit until the gas pressure reaches 0.29 MPa, and fill the nitrogen gas into the refrigerant circuit until the gas pressure reaches 1.37 MPa.

**5.** Check for leakage at the brazed parts using a leak detector.
· Set value of the leakage detector: 1.5 x $10^{-5}$ std.cc/sec


**Fig. 4-112**

**6.** Collect the refrigerant gas and nitrogen gas used for the refrigerant leakage check.
❗ Entrust a special industrial waste disposal trader with the mixture of refrigerant gas and nitrogen gas which you have collected.

**7.** After confirming that the refrigerant pressure gage measures zero, start drawing vacuum for more than 30 minutes.
❗ Use the red hose with specified length (0.92 m).

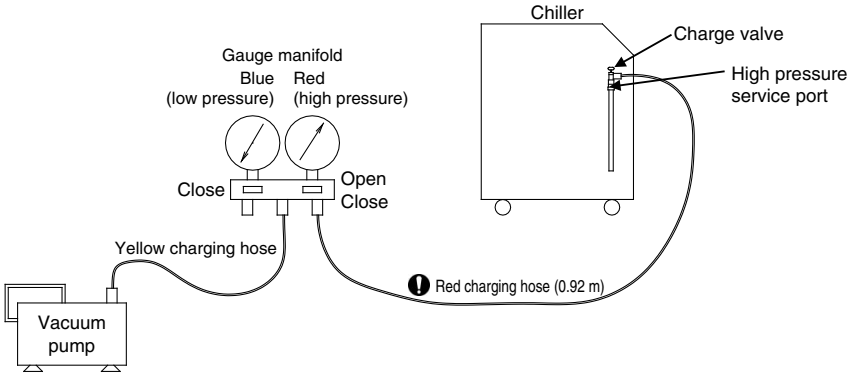



**Fig. 4-113**

**8.** Fill the specified amount of refrigerant gas. (See Table 4-6.)

**⚠ CAUTION**

**Apply the correct amount of the refrigerant. The performance of the product may not be realized if the amount is too large or too small.**

* Use a regularly calibrated scale to measure the gas to be filled in.
* If air is left inside the hose between the refrigerant cylinder and the service port, the air enters the refrigerant piping. If air enters the compressor, it may cause the product failure. Make sure to fill the hose with refrigerant before enclosing the refrigerant.

❗The service port is located at high pressure side.
The refrigerant cannot be enclosed during operation.

**Table 4-6. The amount of refrigerant for each model**

| Refrigerant | Model No. | | |
|---|---|---|---|
| | HRS050-A□-20<br>HRS050-W□-20 | HRS060-A□-20 | HRS060-W□-20 |
| R410A | 655 ±15 g | 845 ±15 g | 735 ±15 g |

❗Refer the refrigerant charge procedure HRX-MM-Q018
They contain useful tips to keep the charge amount controlled.

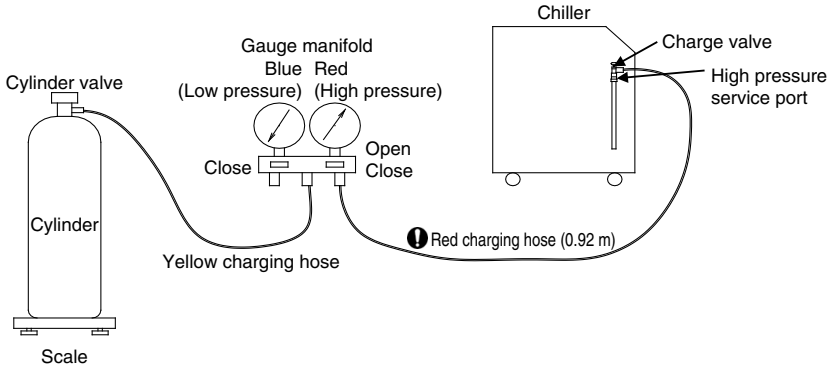



**Fig. 4-114**

**9.** Confirm that no refrigerant gas leaks from the service port.

**10.** Loosen the charge valve if there is no leakage of the refrigerant gas. (Close the spring loaded check valve.)

**11.** Disconnect the hose of the charge valve, and remove the charge valve.

**12.** Mount the cap nut to the service port, and tighten it with a spanner.

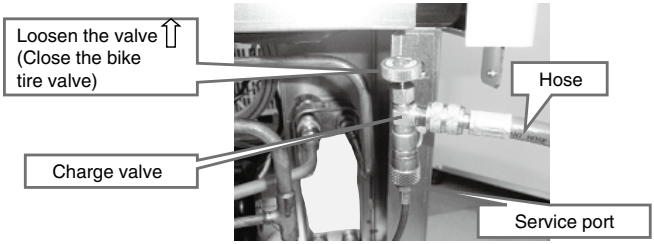



**Fig. 4-115**

**13.** Mount the heat insulator of the accumulator with cable ties (at two parts).

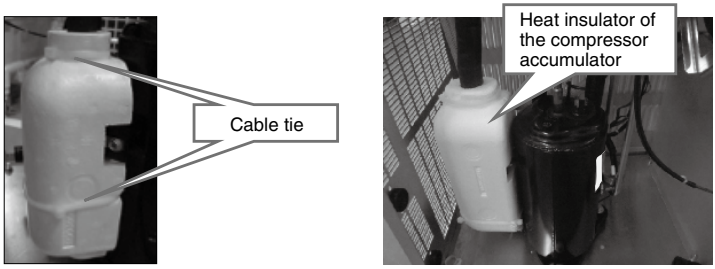



**Fig. 4-116**

**14.** Connect the earth wire to the compressor.

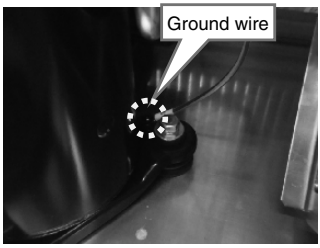



**Fig. 4-117**

**15.** Insert the wirings (R, S and C) into the terminals of the compressor.
Put the cover onto the terminals, and fix the cover by tightening the nuts.


**Fig. 4-118**

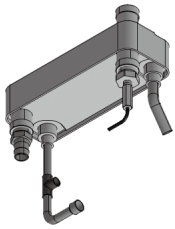
**16.** Mount the panels in order, from left panel, right panel, dust-proof filter, and upper panel.
Test the operation to confirm that the temperature control is correctly performed.
The replacement work is now completed, if temperature is controlled within the range of +/- 3.0°C of the set temperature.

**Fig. 4-119**

## Replacement of heat exchanger

## HRS012/018/024/030/050/060-A/W-10/20

**Table 4-7. Replacement parts**

| Model | Part No. | Description | Qty. | Image |
|---|---|---|---|---|
| HRS012-A/W-10/20<br>HRS018-A/W-10/20<br>HRS024-A/W-20 | HRS-S0030 | Heat exchanger | 1 |  |
| HRS012-A/W-10/20-M<br>HRS018-A-W-10/20-M<br>HRS024-A/W-20-M | HRS-S0413 | | | |
| HRS030-A/W-20 | HRS-S0380 | | | |
| HRS030-A/W-20-M | HRS-S0414 | | | |
| HRS050-A/W-20<br>HRS060-A/W-20 | HRS-S0184 | Heat exchanger | 1 | |
| HRS050-A/W-20-M<br>HRS060-A/W-20-M | HRS-S0415 | | | |

### ⚠ WARNING

**There is danger of an electric shock. Make sure to turn OFF the power supply before performing replacement work.**
**There is danger of an electric shock and burn. Be careful enough not to be hurt during the work.**

### ⚠ 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.**

## ■ Disassembly

**1.** Remove the upper panel.

**2.** Remove the left side panel and right side panel.

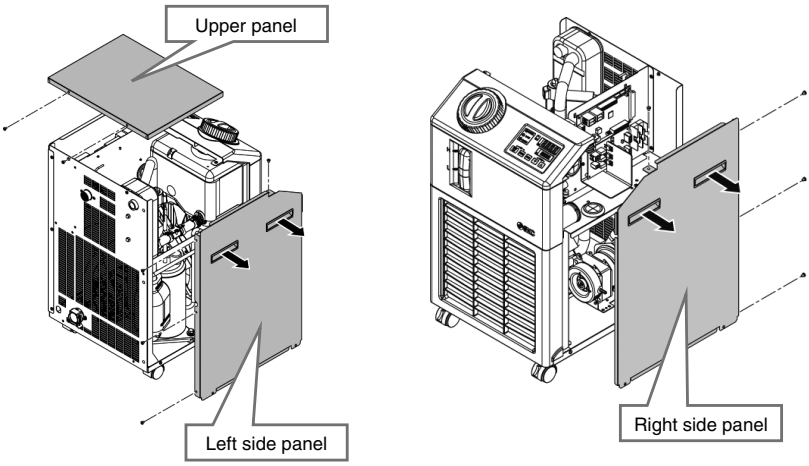



**Fig. 4-120**

**3.** Remove the cap of the high pressure service port on the refrigerant circuit, and then mount a charge valve.

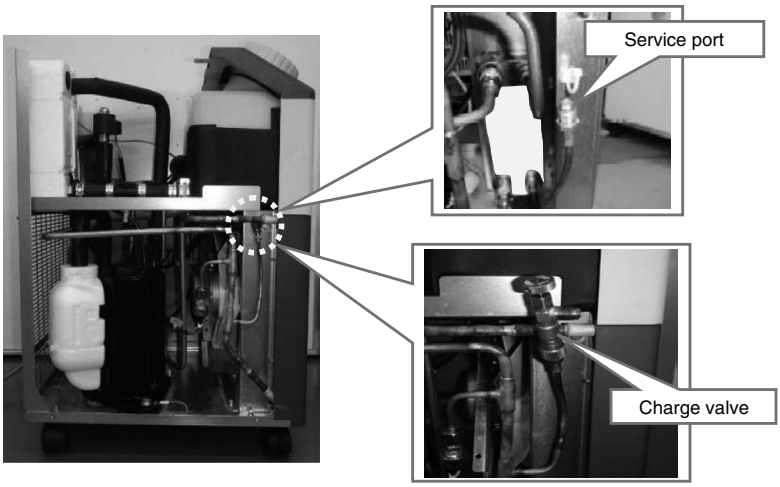



**Fig. 4-121**

4. Connect the hose of the gauge manifold to the charge valve, and then collect the refrigerant gas, with the refrigerant collector.

**⚠ CAUTION**

**The collection and the disposal of refrigerant (HFC) and compressor oil must be in compliance with the bylaws of the local municipality.**



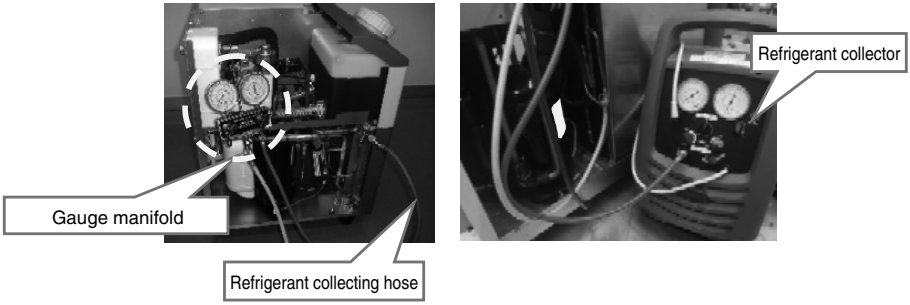



**Fig. 4-122**

5. Remove the hose which is connected to the heat exchanger from the tank and the clip mounted on the tank side.Move the hose band at heat exchanger side (barb fitting side), then pull the hose from the fitting.

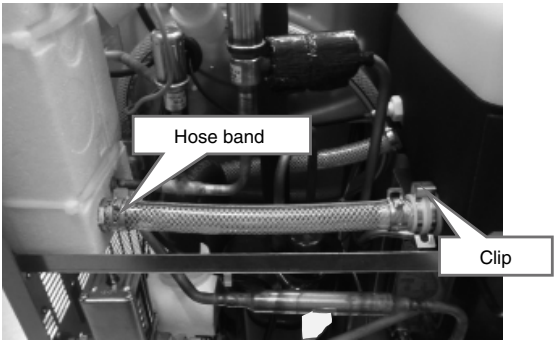



**Fig. 4-123**

6. Cut the cable ties to remove the thermal insulator of the heat exchanger.
Remove the temperature sensor connector.

**7.** Cut the copper tubes of the heat exchanger.

**⚠ DANGER**

- **Only trained and qualified personnel who are knowledgeable and skilled in brazing can perform the work of this document.**
- **Brazing has to be performed in a well ventilated area and where no flammable objects are present.**


**Fig. 4-124**

**8.** Heat the brazed parts where the copper pipes were connected, and pull out the copper pipes (2 pieces) after cutting them. Loosen the domed cap nuts (M6 x 2) and remove the sleeves, thermal insulator and heat exchanger from the panel.

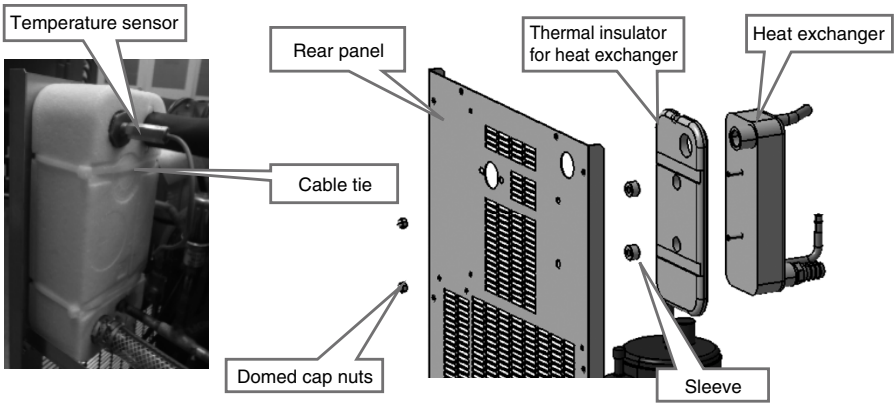



**Fig. 4-125**

## ■ Remount

**1.** Loosen the domed cap nuts (M6 x 2) and remove the sleeve, thermal insulator and heat exchanger from the panel.

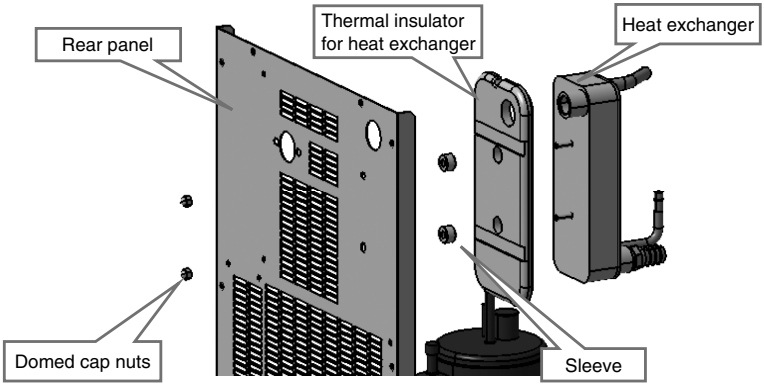



**Fig. 4-126**

**2.** Protect the electrical wires and heat insulator with wet waste cloth to prevent them from burning out.
Insert a copper pipe while warming the connection part with a burner, then braze it.

- ∗ When brazing, make sure to wear protective glasses for brazing, and do not directly look at the flame.
- ∗ Before starting brazing, nitrogen gas must be applied inside the copper tubing to avoid oxidization of the internal surface of the copper tubing.
- ∗ After finishing brazing, confirm that the brazing filler material is applied to the entire brazed part by visual observation.

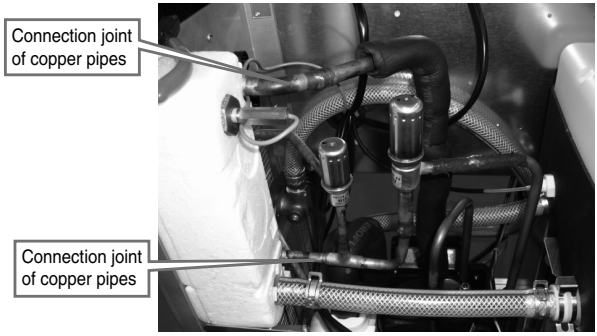



**Fig. 4-127**

**3.** Check for any refrigerant leakage from the brazed parts by filling coolant gas and nitrogen gas inside of the refrigerant circuit.
- · Fill the refrigerant gas (R407C) into the refrigerant circuit until the gas pressure reaches 0.29 MPa, and fill the nitrogen gas into the refrigerant circuit until the gas pressure reaches 1.37 MPa.
- · Set value of the leakage detector: (2 x $10^{-5}$ std.cc/sec)


**Fig. 4-128**

**4.** Collect the refrigerant gas (R407C) and nitrogen gas used for the refrigerant leakage check.

**5.** After confirming that the refrigerant pressure gage measures zero, start drawing vacuum for more than 30 minutes.

❗The charging hose (Red) shall be 0.92 m length.

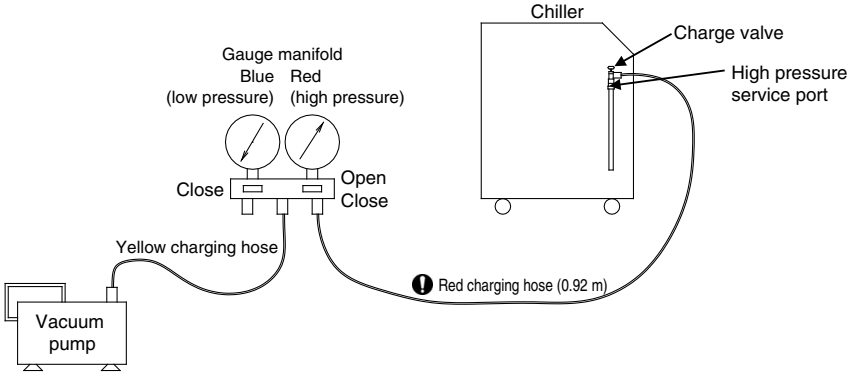



**Fig. 4-129**

**6.** Fill the specified amount of refrigerant gas. (See Table 4-8, 9.)

**⚠ DANGER**

- **Apply the correct amount of the refrigerant. The performance of the product may not be realized if the amount is too large or too small.**

* Use a regularly calibrated scale to measure the gas to be filled.
* If air is left inside the hose between the refrigerant cylinder and the charge valve, the air enters the refrigerant piping. If air enters the compressor, it may cause the product failure. Make sure to fill the hose with refrigerant before enclosing the refrigerant.

❗The refrigerant cannot be enclosed during operation.

**Table 4-8. The amount of refrigerant (HRS012/018/024/030)**

| Refrigerant | HRS012-A-10<br>HRS018-A-10 | HRS012-A-20<br>HRS018-A-20<br>HRS024-A-20 | HRS012-W-10<br>HRS018-W-10 | HRS012-W-20<br>HRS018-W-20<br>HRS024-W-20 | HRS030-A-20 | HRS030-W-20 |
|---|---|---|---|---|---|---|
| R407C | 320 ±5 g | 350 ±5 g | 255 ±5 g | 300 ±5 g | 565 ±15 g | 495 ±15 g |

**Table 4-9. The amount of refrigerant (HRS050/060)**

| Refrigerant | HRS050-A20 | HRS050-W-20 | HRS060-A-20 | HRS060-W-20 |
|---|---|---|---|---|
| R410A | 655 ±15 g | 655 ±15 g | 845 ±15 g | 735 ±15 g |

❗Make sure to refer to Procedure for filling refrigerant gas (HRX-MM-Q018) to fill the refrigerant correctly.

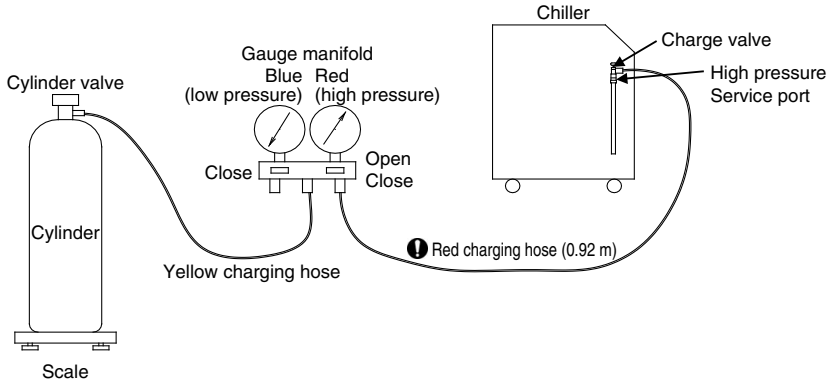



**Fig. 4-130**

**7.** Confirm that no refrigerant gas leaks from the service port. Loosen the charge valve if there is no leakage of the refrigerant gas. (Close the spring loaded check valve.)

**8.** Disconnect the hose of the charge valve, and remove the charge valve.
Mount the cap nut to the service port, and tighten it with a spanner.

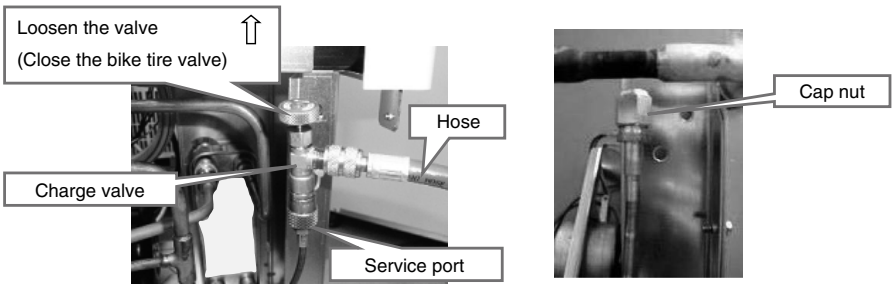



**Fig. 4-131**

**9.** Mount the thermal insulators for tube, heat exchanger and electric expansion valve, and hold them in position.

**10.** Connect the circulating water hose for heat exchanger, and hold it with a hose band.

**11.** Remount the panels in order, from left panel, right panel and upper panel.
Test the operation to confirm that the temperature control is correctly performed.
If the temperature is stabilized to within +/- 3.0°C of the set temperature, the replacement work is completed.

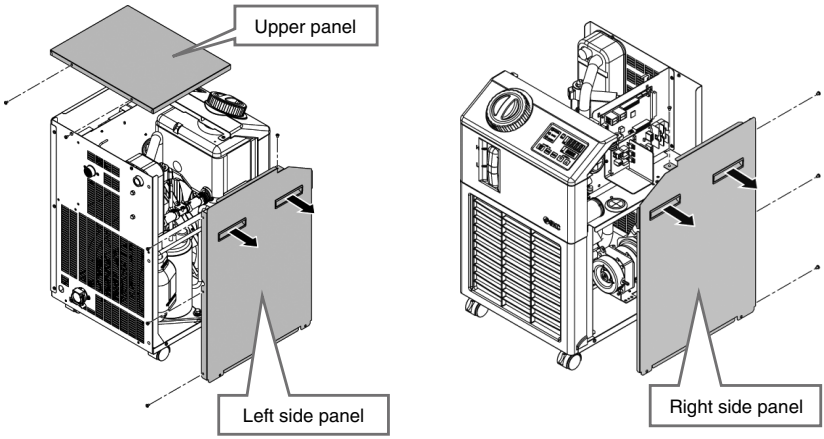



**Fig. 4-132**

## Replacement of air-cooled condenser

### HRS012 to 060-A-10/20

**Table 4-10. Replacement parts**

| Model | Part No. | Description | Qty. | Image |
|---|---|---|---|---|
| HRS012-A-10/20<br>HRS018-A-10/20<br>HRS024-A-20 | HRS-S0381 | Condenser<br>(For Air-cooled) | 1 |  |
| HRS030-A-20 | | | 2 | |
| HRS050-A-20 | HRS-S0382 | Condenser<br>(For Air-cooled) | 1 |  |
| HRS060-A-20 | HRS-S0383 | Condenser<br>(For Air-cooled) | 1 set |  <br>  |

## HRS012/018/024-A-10/20

### ■ Disassembly

**1.** Remove the upper panel, left panel, right panel, dust-proof filter and front panel.

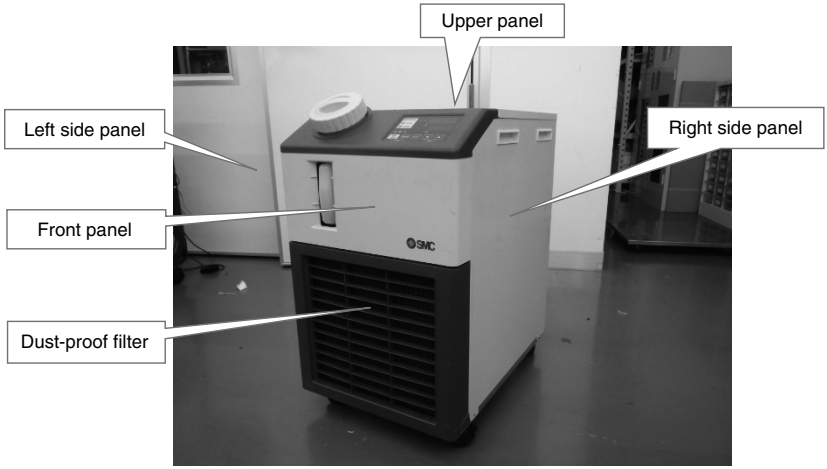



**Fig. 4-133**

**⚠ CAUTION**

**The collection and the disposal of refrigerant (HFC) and compressor oil must be in compliance with the bylaws of the local municipality.**

**2.** Hold the lower part of the service port with a spanner, and remove the cap nut.
(Spanner size: 14 mm, 17 mm)

**3.** After mounting a charge valve onto the service port, collect the refrigerant gas with a refrigerant gas collector.

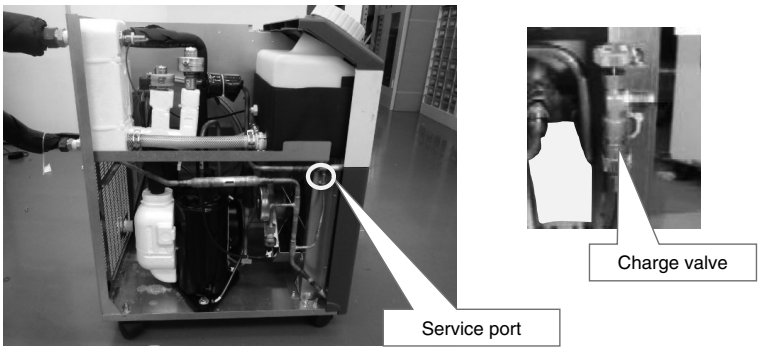



**Fig. 4-134**

**⚠ DANGER**

- **Only trained and qualified personnel who are knowledgeable and skilled in brazing can perform the work of this document.**
- **Brazing has to be performed in a well ventilated area and where no flammable objects are present.**



**4.** Protect the electrical wires and heat insulator with wet waste cloth to prevent them from burning out.

**5.** Pull the copper pipes out while warming the connection joints of the copper pipes of the air-cooled condenser with a burner.

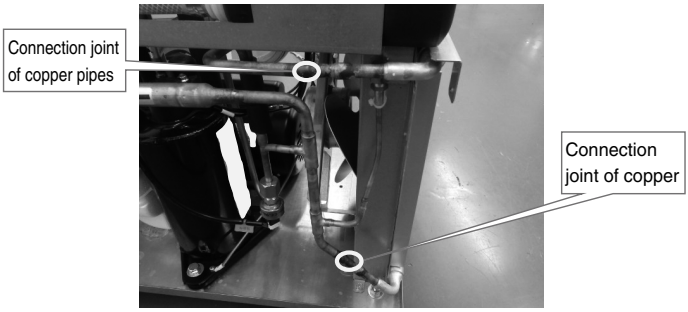



**Fig. 4-135**

**6.** Remove the screw of air-cooled condenser. (4 pcs.)

**7.** After removing the display connector inside of the front panel, remove the front panel. (3 parts.)

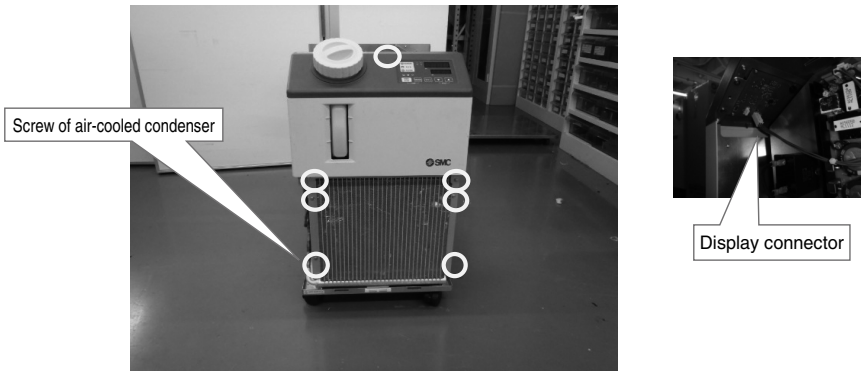



**Fig. 4-136**

**8.** Remove the screws of the tank bracket. (2 pcs.)

**9.** Lift the tank bracket up and remove the Air-Cooled condenser.

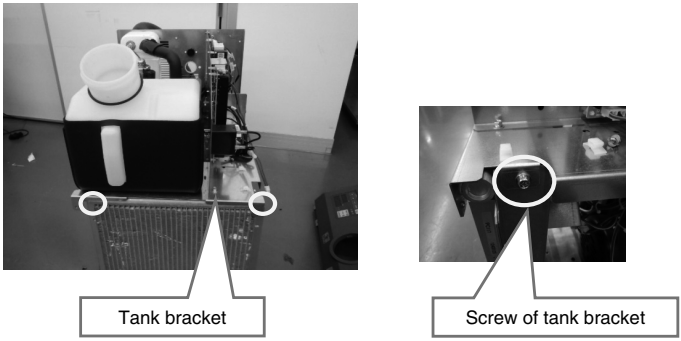



**Fig. 4-137**

## HRS030-A-20

### ■ Disassembly

**1.** Remove the upper panel, left panel, right panel, dust-proof filter and front panel.

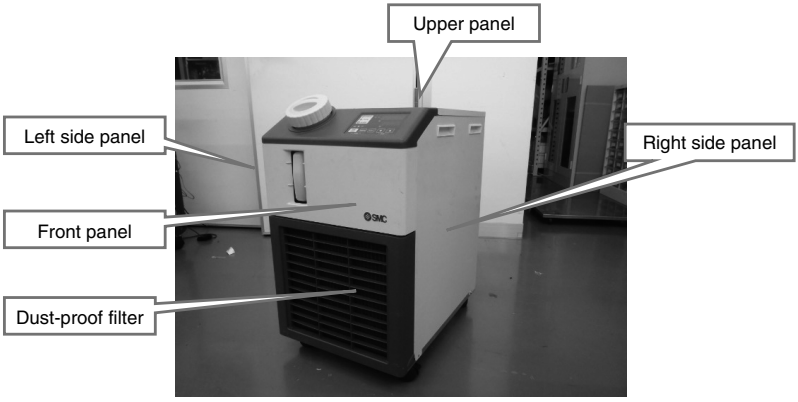



**Fig. 4-138**

**2.** Hold the lower part of the service port with a spanner, and remove the cap nut.
(Spanner size:14 mm,17 mm)

**3.** After mounting a charge valve onto the service port, collect the refrigerant gas with a refrigerant gas collector.

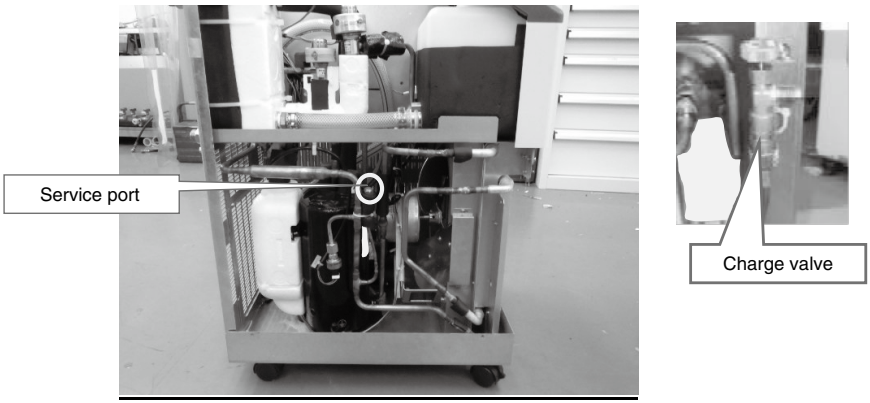



**Fig. 4-139**

**⚠ DANGER**

- **Only trained and qualified personnel who are knowledgeable and skilled in brazing can perform the work of this document.**
- **Brazing has to be performed in a well ventilated area and where no flammable objects are present.**

**4.** Protect the electrical wires and heat insulator with wet waste cloth to prevent them from burning out.

**5.** Pull the copper pipes out while warming the connection joints of the copper pipes of the air-cooled condensers No.1 and No.2 with a burner.

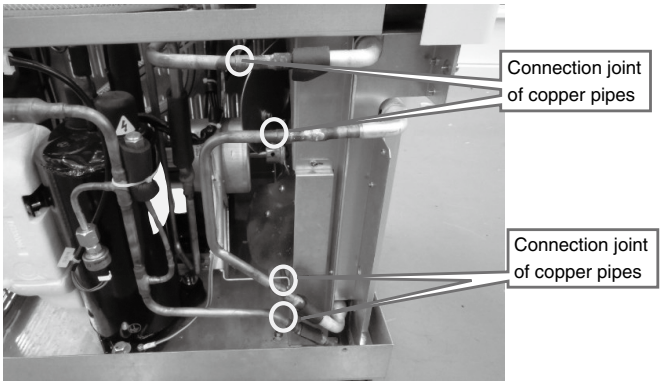



**Fig. 4-140**

**6.** After removing the display connector backside of the front panel, remove the front panel.

**7.** Remove the screw of Air-Cooled condenser 1.

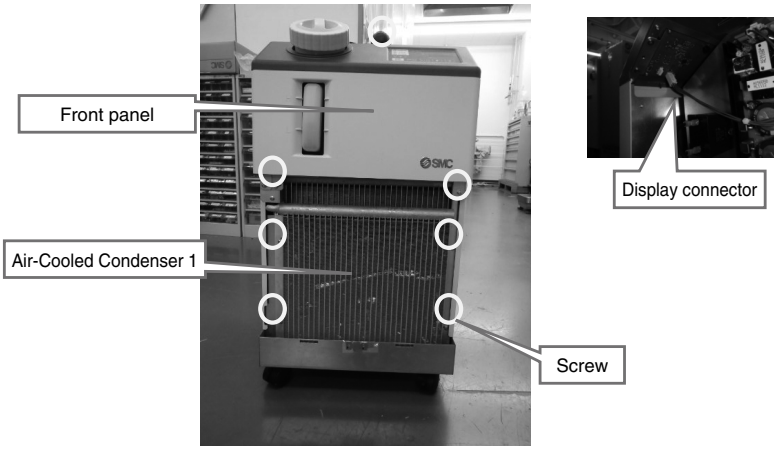



**Fig. 4-141**

**8.** Remove the screw of Air-Cooled condenser bracket. (Left / 2pcs., right / 3pcs.)

**9.** Lift the tank bracket up and remove the air-cooled condenser 2.

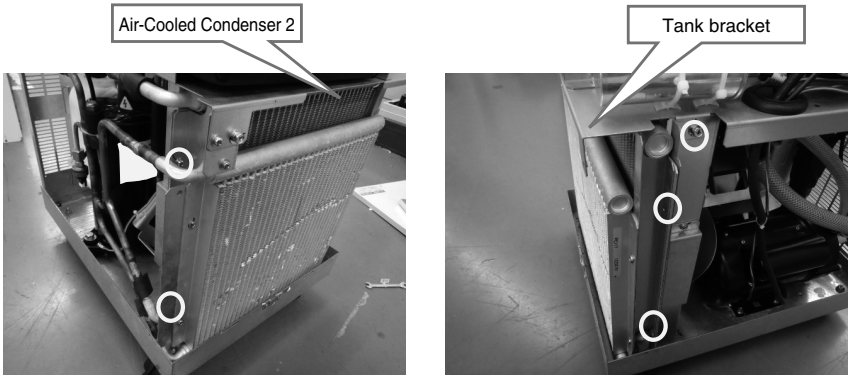



**Fig. 4-142**

## HRS050-A-20

### ■ Disassembly

**1.** Remove the upper panel, left panel, right panel, dust-proof filter.

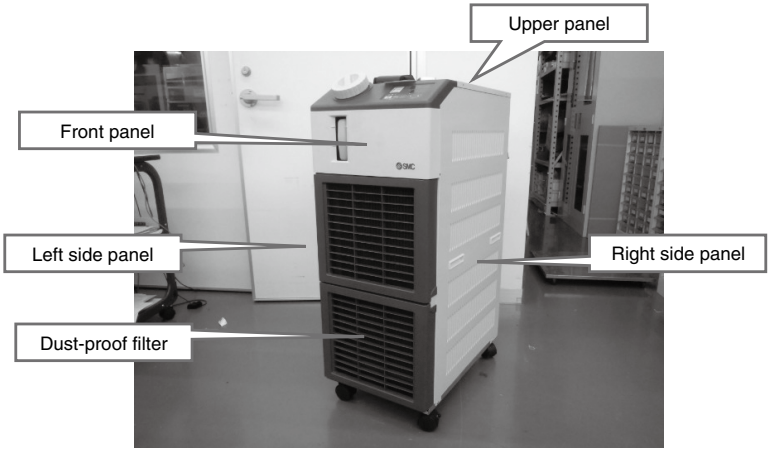



**Fig. 4-143**

**2.** Hold the lower part of the service port with a spanner, and remove the cap nut.
(Spanner size:14 mm,17 mm)

**3.** After mounting a charge valve onto the service port, collect the refrigerant gas with a refrigerant gas collector.

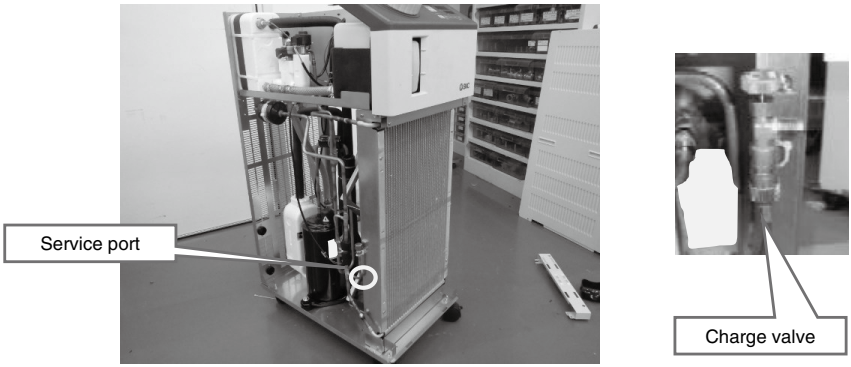



**Fig. 4-144**

**⚠ DANGER**

- **Only trained and qualified personnel who are knowledgeable and skilled in brazing can perform the work of this document.**
- **Brazing has to be performed in a well ventilated area and where no flammable objects are present.**

**4.** Protect the electrical wires and heat insulator with wet waste cloth to prevent them from burning out.

**5.** Pull the copper pipes out while warming the connection joints of the copper pipes of the air-cooled condenser with a burner.

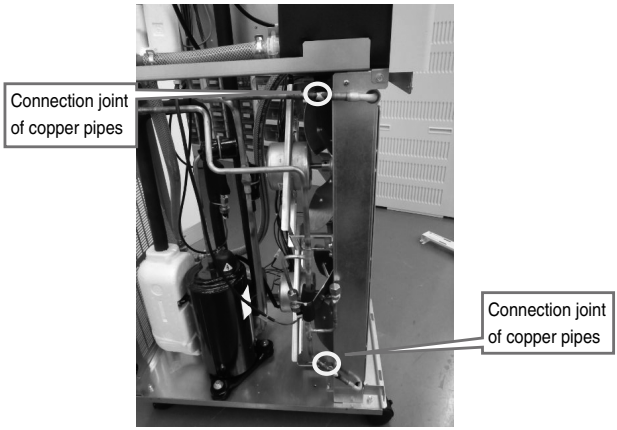



**Fig. 4-145**

**6.** Remove the bracket of the dust-proof filter.

**7.** Remove the condenser bracket.

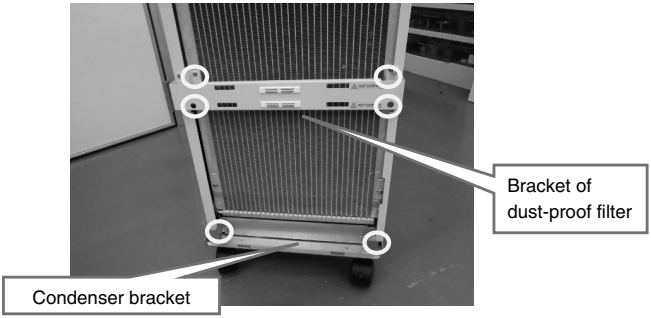



**Fig. 4-146**

**8.** Remove the screw of Air-Cooled condenser.

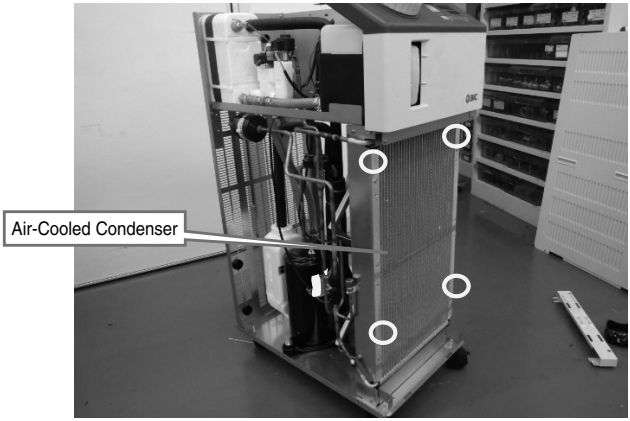



**Fig. 4-147**

## HRS060-A-20

### ■ Disassembly

**1.** Remove the upper panel, left panel, right panel, dust-proof filter.

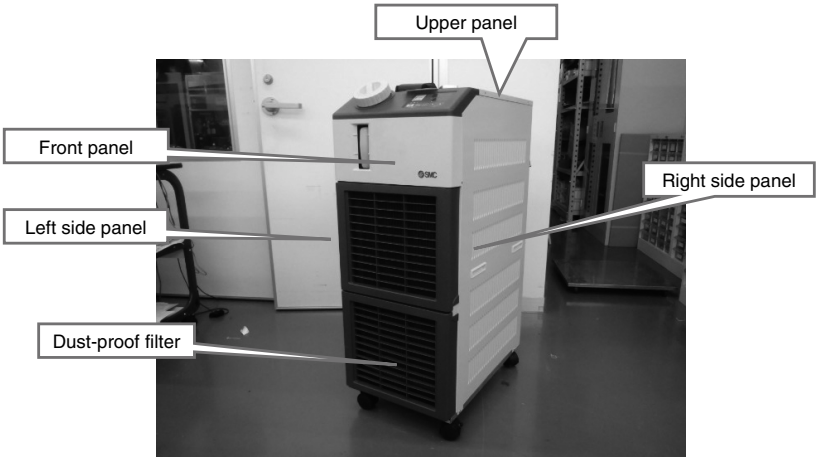



**Fig. 4-148**

2. Hold the lower part of the service port with a spanner, and remove the cap nut.
(Spanner size: 14 mm, 17 mm)

3. After mounting a charge valve onto the service port, collect the refrigerant gas with a refrigerant gas collector.

4. Protect the electrical wires and heat insulator with wet waste cloth to prevent them from burning out.

5. Pull the copper pipes out while warming the connection joints of the copper pipes of the air-cooled condenser with a burner.

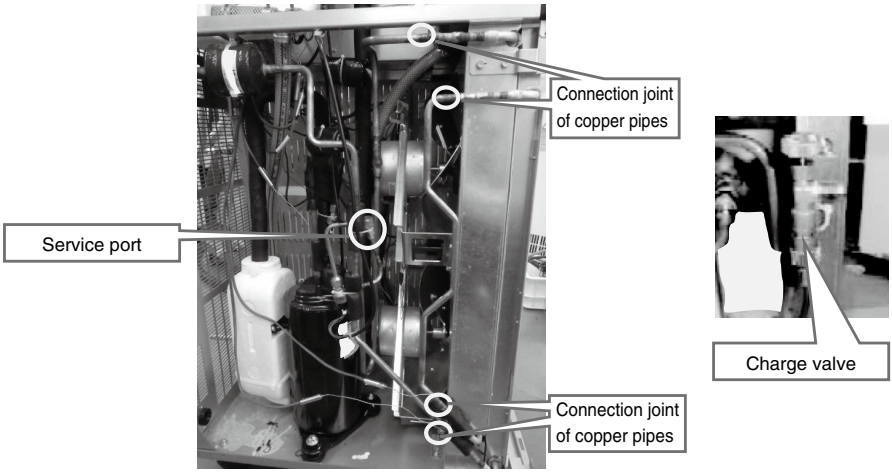



**Fig. 4-149**

6. After removing the display connector inside of the front panel, remove the front panel.

7. Remove the screws of the condenser bracket and the air-cooled condenser No.1.

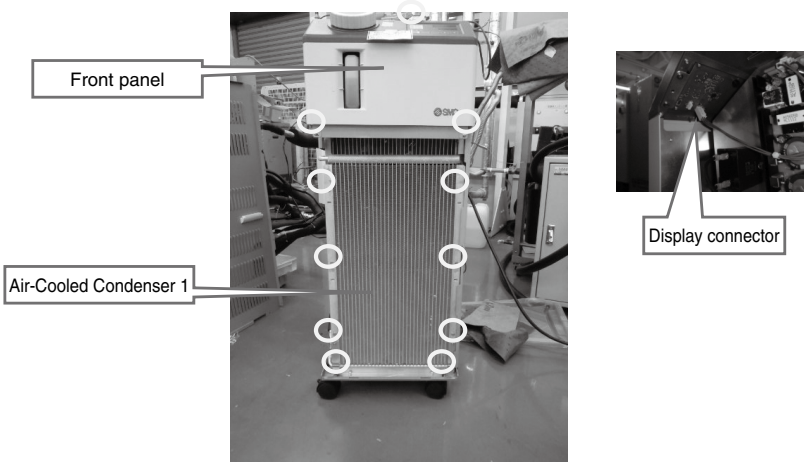



**Fig. 4-150**

**8.** Remove the condenser bracket, tank bracket.

**9.** Lift the tank bracket up and remove the air-cooled condenser 2.

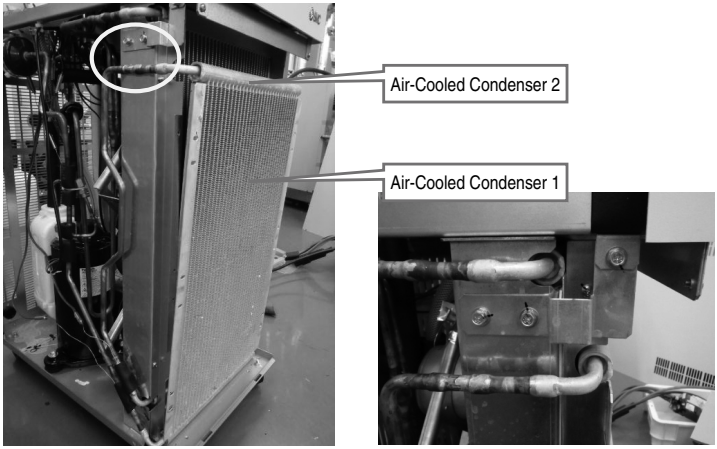



**Fig. 4-151**

## ■ Remount

**1.** Remount the new air-cooled condenser.

**2.** Insert copper pipes while warming the connection joints of the air-cooled condensers and copper pipes with a burner, then braze them.

**⚠ DANGER**

- **Only trained and qualified personnel who are knowledgeable and skilled in brazing can perform the work of this document.**
- **Brazing has to be performed in a well ventilated area and where no flammable objects are present.**

* When brazing, make sure to wear protective glasses for brazing, and do not directly look at the flame.
* Before starting brazing, nitrogen gas must be applied inside the copper tubing to avoid oxidization of the internal surface of the copper tubing.
* After finishing brazing, confirm that the brazing filler material is applied to the entire brazed part by visual observation.

**3.** Check for any refrigerant leakage from the brazed parts by filling coolant gas and nitrogen gas inside of the refrigerant circuit.
- Fill the refrigerant gas (R407C) into the refrigerant circuit until the gas pressure reaches 0.29 MPa, and fill the nitrogen gas into the refrigerant circuit until the gas pressure reaches 1.37 MPa.
- Check for leakage at the brazed parts using a leak detector.
- Set value of the leakage detector: (2 x $10^{-5}$ std.cc/sec)

**4.** Collect the refrigerant gas (R410A,R407C) and nitrogen gas used for the refrigerant leakage check.

**5.** Connect the vacuum pump and draw vacuum for more than 30 minutes.
· After confirming that the refrigerant pressure gage measures zero, start drawing vacuum for more than 30 minutes.

**6.** Fill the specified amount of refrigerant gas.

**⚠ CAUTION**

**Apply the correct amount of the refrigerant. The performance of the product may not be realized if the amount is too large or too small.**

❗The service port is located at high pressure side.
The refrigerant cannot be enclosed during operation.

**Table 4-11. The amount of refrigerant (HRS012/018/024/030)**

| Refrigerant | HRS012-A-10<br>HRS018-A-10 | HRS012-A-20<br>HRS018-A-20<br>HRS024-A-20 | HRS030-A-20 |
|---|---|---|---|
| R407C | 320 ±5 g | 350 ±5 g | 565 ±15 g |

**Table 4-12. The amount of refrigerant (HRS050/060)**

| Refrigerant | HRS050-A-20 | HRS060-A-20 |
|---|---|---|
| R410A | 655 ±15 g | 845 ±15 g |

Make sure to refer to Procedure for filling refrigerant gas (HRX-MM-Q018) to fill the refrigerant correctly.

* Use a regularly calibrated scale to measure the gas to be filled.
* If air is left inside the hose between the refrigerant cylinder and the charge valve, the air enters the refrigerant piping. If air enters the compressor, it may cause the product failure. Make sure to fill the hose with refrigerant before enclosing the refrigerant.

**7.** Remove the charge valve to confirm that no refrigerant leakage occurs from the service port, then, hold the lower part of the service port with a spanner and tighten the cap nut. (Spanner size: 14 mm, 17 mm)

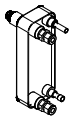
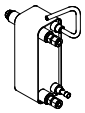
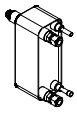
**8.** Test the operation to confirm that the temperature control is correctly performed.

**Fig. 4-152**

## ● Replacement of water-cooled condenser

### HRS012 to 060-W-10/20

**Table 4-13. Replacement parts**

| Model | Part No. | Part name | Appearance |
|---|---|---|---|
| HRS012-W-10<br>HRS018-W-10<br>HRS012-W-20<br>HRS018-W-20<br>HRS024-W-20 | HRS-S0133 | Heat exchanger |  |
| HRS030-W-20 | HRS-S0384 | Heat exchanger |  |
| HRS050-W-20<br>HRS060-W-20 | HRS-S0152 | Heat exchanger |  |

**⚠ WARNING**

**There is danger of an electric shock. Make sure to turn OFF the power supply before performing replacement work.**
**There is danger of an electric shock and burn. Be careful enough not to be hurt during the work.**

**⚠ 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.**

## ■ Disassembly

**1.** Remove the upper panel and side panel.

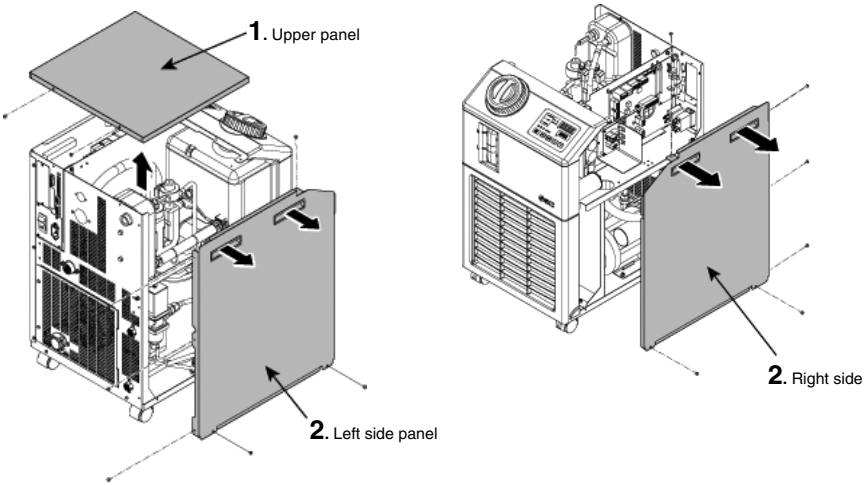



**Fig. 4-153**

**2.** Mount the charge valve to the service port.

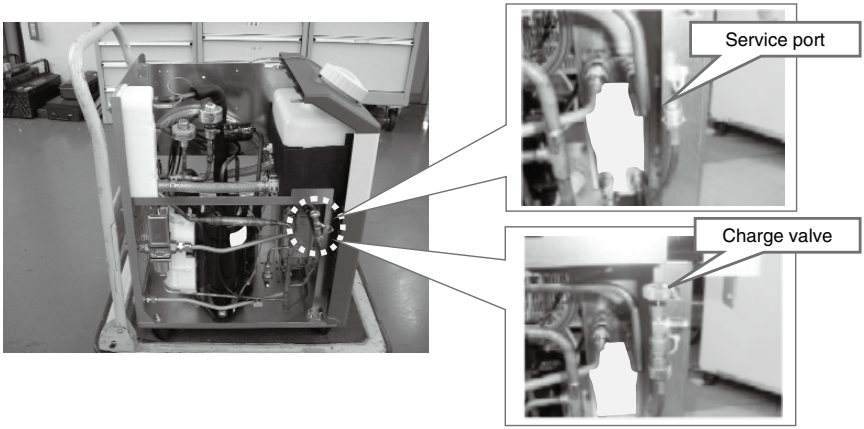



**Fig. 4-154**

**3.** Connect the hose of the gauge manifold to the high-pressure service port, and collect the refrigerant gas with the refrigerant collector.

**⚠ CAUTION**

**The collection and the disposal of refrigerant (HFC) and compressor oil must be in compliance with the bylaws of the local municipality.**

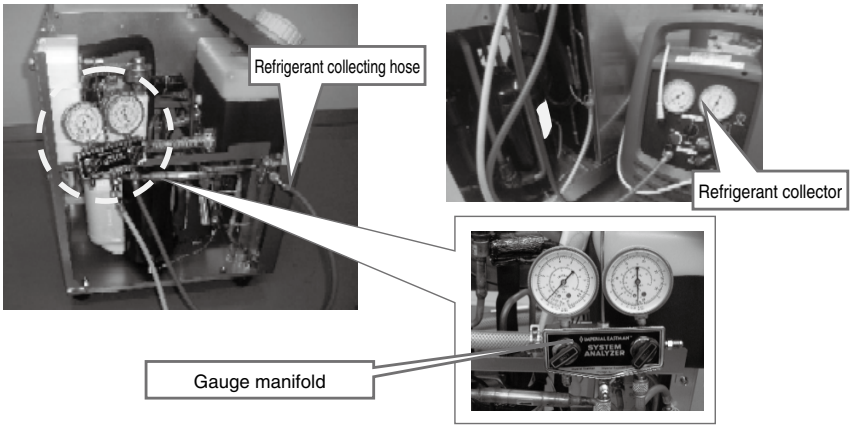



**Fig. 4-155**

**4.** Loosen the fittings with a spanner, and remove the facility water piping A and B.

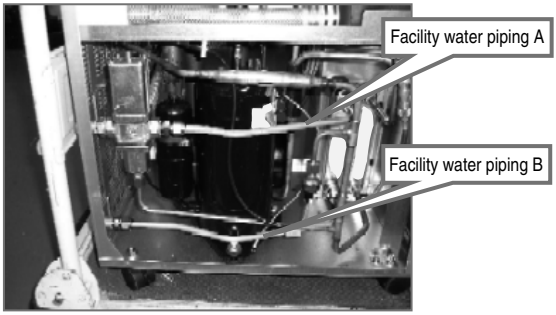



**Fig. 4-156**

**5.** Melt the brazing filler material at the joint of the copper pipes using the brazing equipment. After melting the brazing filler material, hold and pull out the copper pipes with pliers.

* The copper pipe is to be reused. Use caution not to deform or melt the copper pipe when disconnecting it.

**⚠ DANGER**

- **Only trained and qualified personnel who are knowledgeable and skilled in brazing can perform the work of this document.**
- **Brazing has to be performed in a well ventilated area and where no flammable objects are present.**

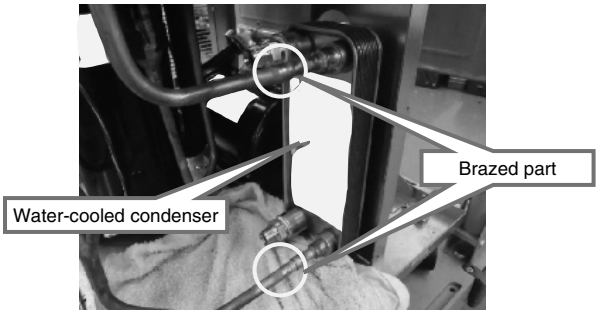



**Fig. 4-157**

**6.** Loosen the cap nuts (2pcs.) that are held to the condenser port, and remove the water-cooled condenser.


**Fig. 4-158**

**7.** Install a spacer to the holding bolt at the back of the water-cooled condenser. (The spacer is to be reused.)

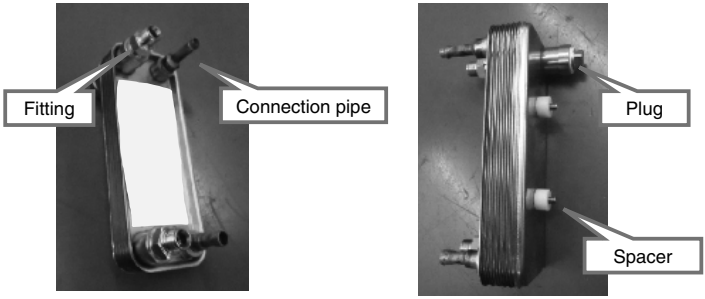



**Fig. 4-159**

**8.** Mount the water-cooled condenser assembly to the condenser port (Hexagon cap nut /2pcs.), and braze the joint of the condenser connection pipe.

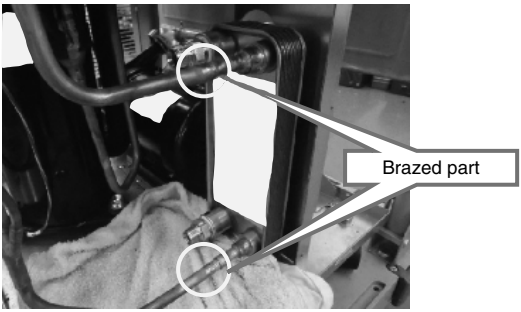



**Fig. 4-160**

**9.** Check for any refrigerant leakage from the brazed parts by filling coolant gas and nitrogen gas inside of the refrigerant circuit.
· Fill the refrigerant gas (R407C) into the refrigerant circuit until the gas pressure reaches 0.29 MPa , and fill the nitrogen gas into the refrigerant circuit until the gas pressure reaches 1.37 MPa.

**10.** Check for leakage at the brazed parts using a leak detector.


**Fig. 4-161**

**11.** Collect the refrigerant gas and nitrogen used for the refrigerant leakage check.
❗Entrust a special industrial waste disposal trader with the mixture of refrigerant gas and nitrogen gas which you have collected.

**12.** After confirming that the refrigerant pressure gage measures zero, start drawing vacuum for more than 30 minutes.
❗Use the red hose with specified length (0.92 m).

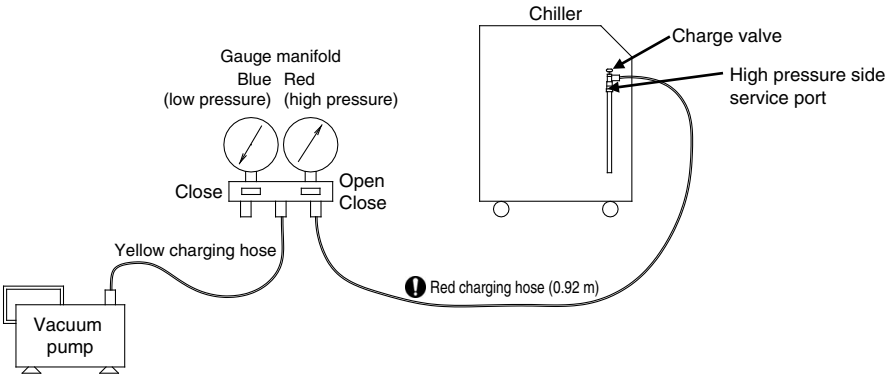



**Fig. 4-162**

**13.** Fill the specified amount of refrigerant gas. (See Table 4-14.)

**⚠ CAUTION**

**Apply the correct amount of the refrigerant. The performance of the product may not be realized if the amount is too large or too small.**

* Use a regularly calibrated scale to measure the gas to be filled.
* If air is left inside the hose between the refrigerant cylinder and the service port, the air enters the refrigerant piping. If air enters the compressor, it may cause the product failure. Make sure to fill the hose with refrigerant before enclosing the refrigerant.

❗ The service port is located at high pressure side.
The refrigerant cannot be enclosed during operation.

**Table 4-14. The amount of refrigerant for each model**

| Refrigerant | Model No. | | | | |
|---|---|---|---|---|---|
| | HRS012-W-10<br>HRS018-W-10 | HRS012-W-20<br>HRS018-W-20<br>HRS024-W-20 | HRS030-W-20 | HRS050-W-20 | HRS060-W-20 |
| R407C | 255 ±5 g | 300 ±5 g | 495 ±15 g | — | — |
| R410A | — | — | — | 655 ±15 g | 735 ±15 g |

❗ Make sure to refer to Procedure for filling refrigerant gas (HRX-MM-Q018) to fill the refrigerant correctly.

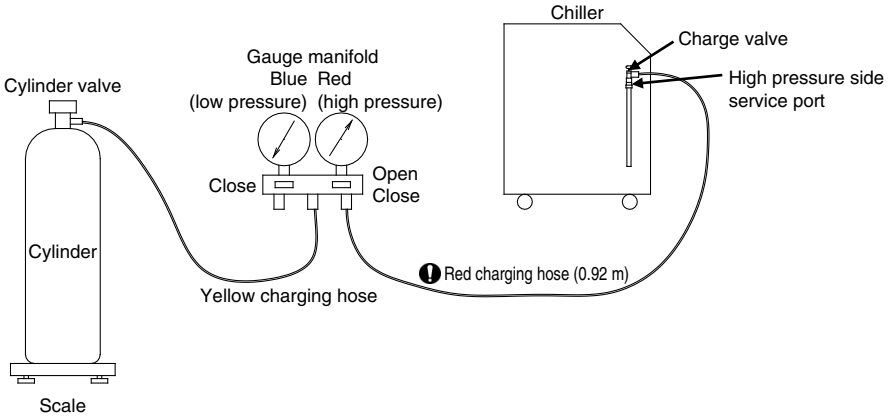



**Fig. 4-163**

**14.** Confirm that no refrigerant gas leaks from the service port.

**15.** Loosen the charge valve if there is no leakage of the refrigerant gas. (Close the spring loaded check valve.)

**16.** Disconnect the hose of the charge valve, and remove the charge valve.

**17.** Mount the cap nut to the service port, and tighten it with a spanner.

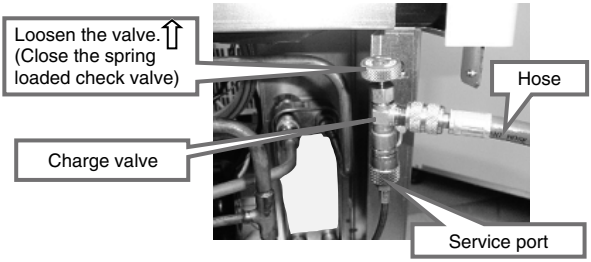



**Fig. 4-164**

**18.** Remount the panels in order, from left panel, right panel and upper panel.

**19.** Test the operation to confirm that the temperature control is correctly performed.
The replacement work is now completed, if temperature is controlled within the range of +/- 0.3°C of the set temperature.

**Fig. 4-165**

## ● Replacement of water pressure regulating valve

### HRS012 to 060-W-10/20

**Table 4-15. Replacement parts**

| Model | Part No. | Description | Qty. | Image |
|---|---|---|---|---|
| HRS012-W-10/20<br>HRS018-W-10/20<br>HRS024-W-20<br>HRS030-W-20 | HRS-S0385 | Water pressure regulating valve | 1 |  |
| HRS050-W-20<br>HRS060-W-20 | HRS-S0388 | Water pressure regulating valve | 1 | |



**⚠ WARNING**

**There is danger of an electric shock. Make sure to turn OFF the power supply before performing replacement work.**
**There is danger of an electric shock and burn. Be careful enough not to be hurt during the work.**

**⚠ 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.**

### ■ Disassembly

**1.** Remove the upper panel and side panel.

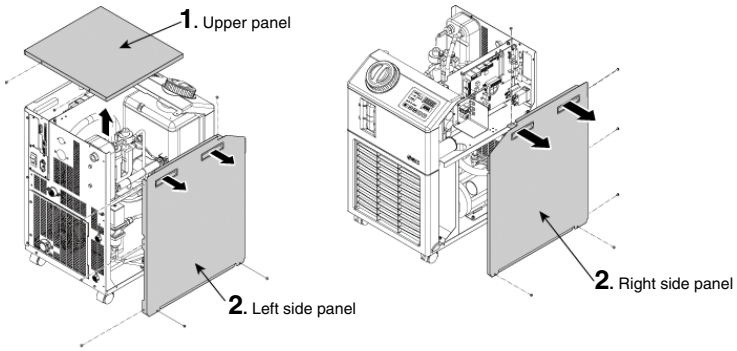



**Fig. 4-166**

**2.** Mount the charge valve to the service port.

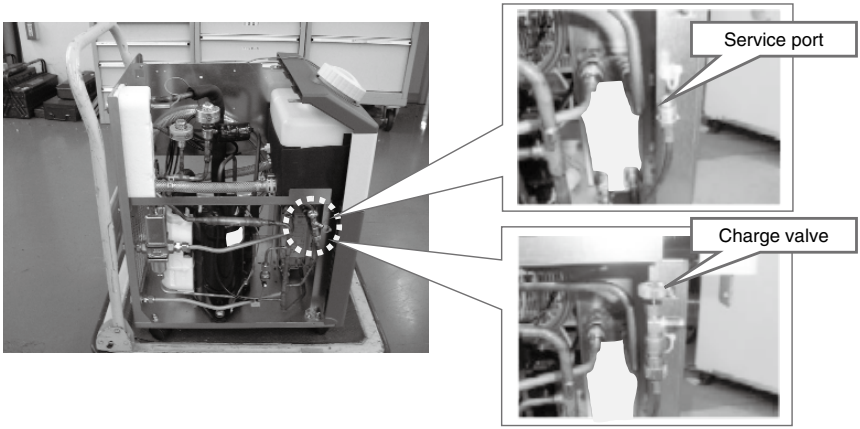



**Fig. 4-167**

**3.** Connect the hose of the gauge manifold to the high-pressure service port, and collect the refrigerant gas with the refrigerant collector.

**⚠ CAUTION**

**The collection and the disposal of refrigerant (HFC) and compressor oil must be in compliance with the bylaws of the local municipality.**

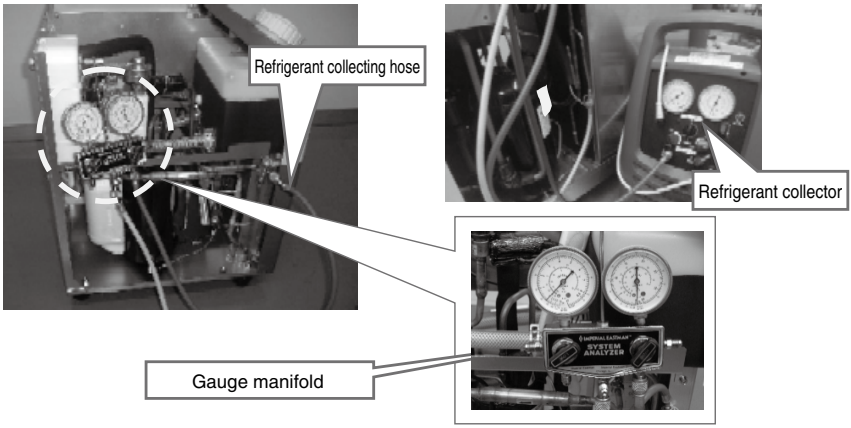



**Fig. 4-168**

4. Remove the cooling water piping.

5. Remove the flare nut on the copper pipe

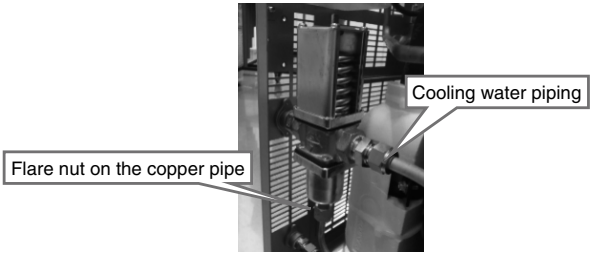



**Fig. 4-169**

6. Remove the facility water piping on the user side.

7. Remove the fitting of the water pressure regulating valve on the side of the facility water outlet on the rear panel.

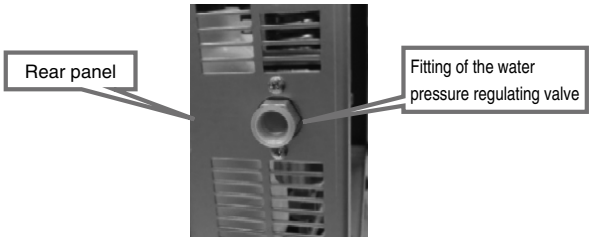



**Fig. 4-170**

## ■ Remount

1. Remount the water pressure regulating valve on the rear panel.

2. Tighten the flare nut on the copper pipe of the water pressure regulating valve with a spanner. (Spanner size: 17 mm)

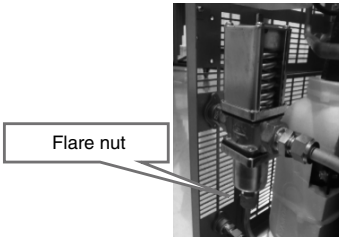



**Fig. 4-171**

**3.** Fill in refrigerant gas and nitrogen gas inside of the refrigerant circuit.
· Fill the refrigerant gas (R407C) into the refrigerant circuit until the gas pressure reaches 0.29 MPa, and fill the nitrogen gas into the refrigerant circuit until the gas pressure reaches 1.37 MPa.

**4.** Check for any leakage from the copper pipe flare with a leak detector.


**Fig. 4-172**

**5.** Collect the refrigerant gas and nitrogen used for the refrigerant leakage check.
❗Entrust a special industrial waste disposal trader with the mixture of refrigerant gas and nitrogen gas which you have collected.

**6.** After confirming that the refrigerant pressure gage measures zero, start drawing vacuum for more than 30 minutes.
❗Use the red hose with specified length (0.92 m).

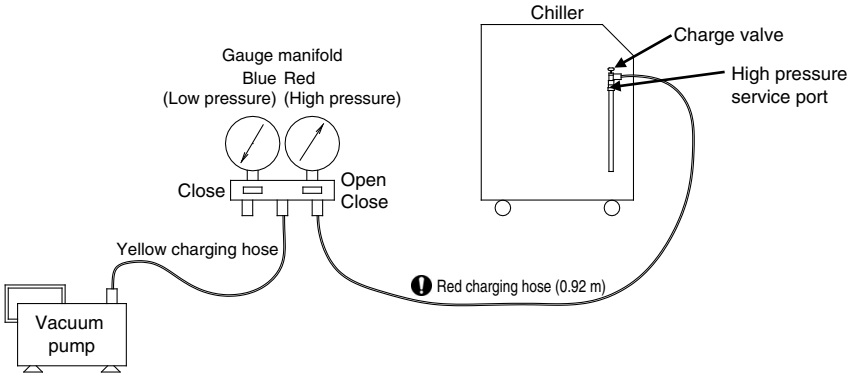



**Fig. 4-173**

**7.** Fill the specified amount of refrigerant gas. (See Table 4-16.)

**⚠ CAUTION**

**Apply the correct amount of the refrigerant. The performance of the product may not be realized if the amount is too large or too small.**

* Use a regularly calibrated scale to measure the gas to be filled.
* If air is left inside the hose between the refrigerant cylinder and the charge valve, the air enters the refrigerant piping. If air enters the compressor, it may cause the product failure. Make sure to fill the hose with refrigerant before enclosing the refrigerant.

❗The service port is located at high pressure side.
The refrigerant cannot be enclosed during operation.

**Table 4-16. The amount of refrigerant for each model**

| Refrigerant | Model No. | | | | |
|---|---|---|---|---|---|
| | HRS012-W-10<br>HRS018-W-10 | HRS012-W-20<br>HRS018-W-20<br>HRS024-W-20 | HRS030-W-20 | HRS050-W-20 | HRS060-W-20 |
| R407C | 255 ±5 g | 300 ±5 g | 495 ±15 g | — | — |
| R410A | — | — | — | 655 ±15 g | 735 ±15 g |

❗Make sure to refer to Procedure for filling refrigerant gas (HRX-MM-Q018) to fill the refrigerant correctly.

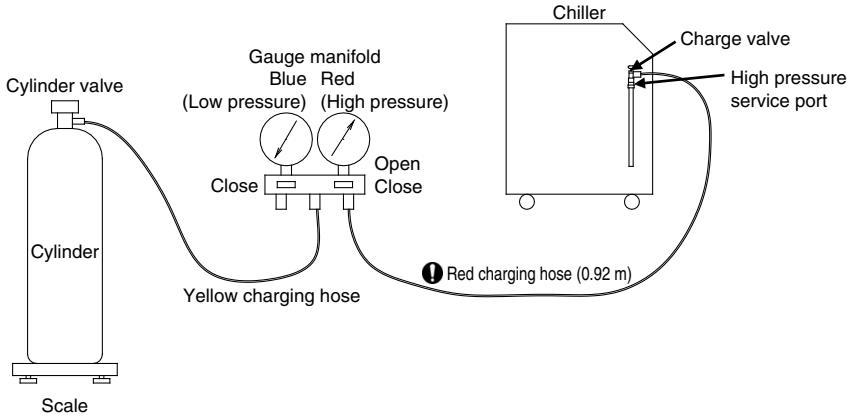



**Fig. 4-174**

**8.** Confirm that no refrigerant gas leaks from the service port.

**9.** Loosen the charge valve if there is no leakage of the refrigerant gas. (Close the spring loaded check valve.)

**10.** Disconnect the hose of the charge valve, and remove the charge valve.

**11.** Mount the cap nut to the service port, and tighten it with a spanner.

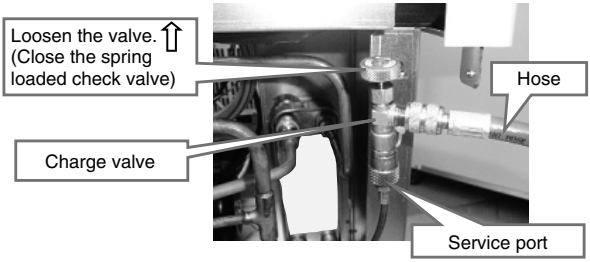



**Fig. 4-175**

**12.** Remount the panels in order, from left panel, right panel and upper panel.

**13.** Test the operation to confirm that the temperature control is correctly performed.
The replacement work is now completed, if temperature is controlled within the range of +/- 0.3°C of the set temperature.

**Fig. 4-176**

## Replacement of filter dryer
## HRS012/018/024/030-A/W10/20

**Table 4-17 Replacement parts**

| Model | Part No. | Description | Qty. | Image |
|---|---|---|---|---|
| HRS012-A/W-10/20<br>HRS018-A/W-10/20<br>HRS024-A/W-20<br>HRS030-A/W-20 | HRZ-S0387 | Filter dryer | 1 |  |



**⚠ WARNING**

**There is danger of an electric shock. Make sure to turn OFF the power supply before performing replacement work.**
**There is danger of an electric shock and burn. Be careful enough not to be hurt during the work.**

**⚠ 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.**

### ■ Disassembly

**1.** Remove the upper panel and side panel.

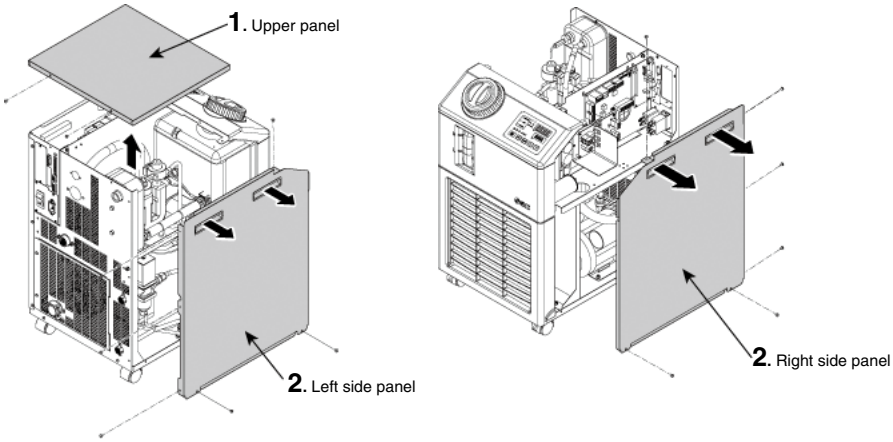



**Fig. 4-177**

**2.** Mount the charge valve to the service port of the refrigerant circuit.

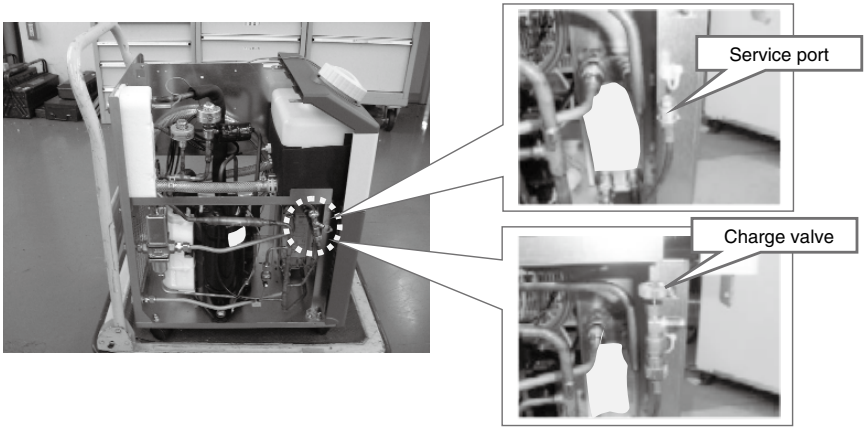



**Fig. 4-178**

**3.** Connect the hose of the gauge manifold to the service port, and collect the refrigerant gas with the refrigerant collector.

**⚠ CAUTION**

**The collection and the disposal of refrigerant (HFC) and compressor oil must be in compliance with the bylaws of the local municipality.**

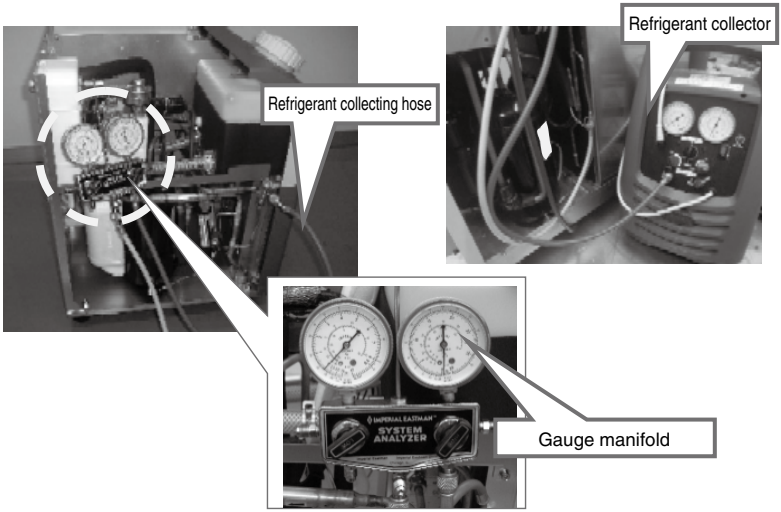



**Fig. 4-179**

4. Melt the brazing filler material at the joint of the copper pipes using the brazing equipment. After melting the brazing filler material, hold and pull out the copper pipes with pliers.
   * The copper pipe is to be reused. Use caution not to deform or melt the copper pipe when disconnecting it.

**⚠ DANGER**

- **Only trained and qualified personnel who are knowledgeable and skilled in brazing can perform the work of this document.**
- **Brazing has to be performed in a well ventilated area and where no flammable objects are present.**



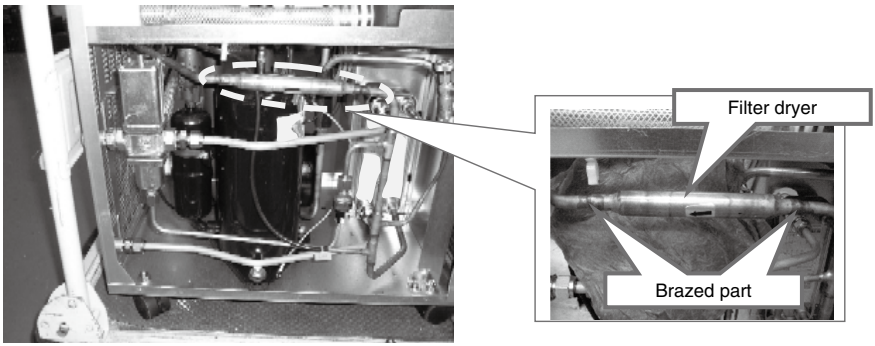



**Fig. 4-180**

## ■ Remount

1. Cover the flow direction label on the filter dryer with a wet cloth.Confirm the flow direction of the refrigerant. Insert the copper pipe to the filter dryer, and braze the joint.
   * Use a regularly calibrated scale to measure the gas to be filled.
   * If air is left inside the hose between the refrigerant cylinder and the charge valve, the air enters the refrigerant piping. If air enters the compressor, it may cause the product failure. Make sure to fill the hose with refrigerant before enclosing the refrigerant.

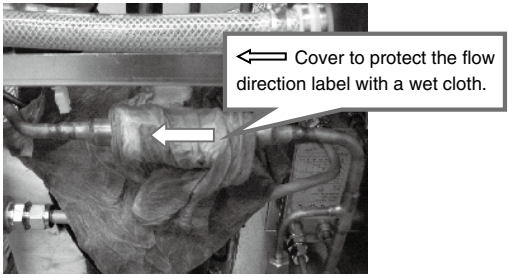



**Fig. 4-181**

**2.** Check for any leakage from the brazed parts by filling refrigerant gas and nitrogen gas inside of the refrigerant circuit.

**3.** Check for leakage at the brazed parts using a leak detector.
Set value of the leakage detector: 1.5 x $10^{-5}$ std.cc/sec


**Fig. 4-182**

**4.** Collect the refrigerant gas and nitrogen used for the refrigerant leakage check.
❗Entrust a special industrial waste disposal trader with the mixture of refrigerant gas and nitrogen gas which you have collected.

**5.** After confirming that the refrigerant pressure gage measures zero, start drawing vacuum for more than 30 minutes.
❗The charging hose (Red) shall be 0.92 m length.

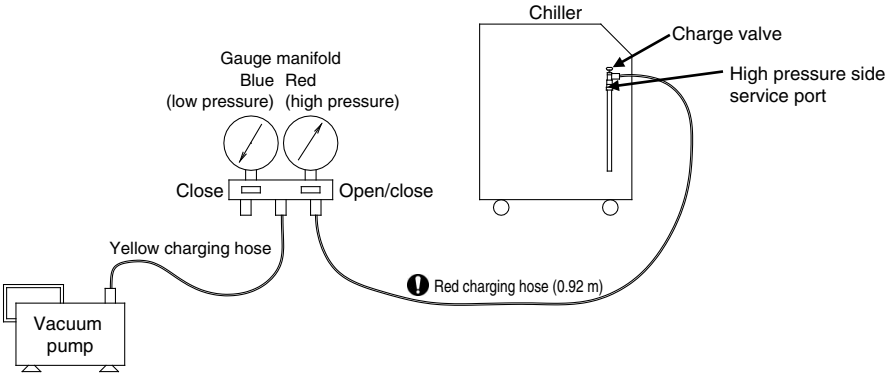



**Fig. 4-183**

**6.** Fill the specified amount of refrigerant gas. (See Table 4-18.)

**⚠ CAUTION**

**Apply the correct amount of the refrigerant. The performance of the product may not be realized if the amount is too large or too small.**

* Use a regularly calibrated scale to measure the gas to be filled in.
* If air is left inside the hose between the refrigerant cylinder and the service port, the air enters the refrigerant piping. If air enters the compressor, it may cause the product failure. Make sure to fill the hose with refrigerant before enclosing the refrigerant.

❗The service port is located at high pressure side.
So you cannot add refrigerant during the system in operation.

**Table 4-18 The amount of refrigerant for each model**

| Refrigerant | HRS012-A-10<br>HRS018-A-10 | HRS012-W-10<br>HRS018-W-10 | HRS012-A-20<br>HRS018-A-20<br>HRS024-A-20 | HRS012-W-20<br>HRS018-W-20<br>HRS024-W-20 | HRS030-A-20 | HRS030-W-20 |
|---|---|---|---|---|---|---|
| R407C | 320 ±5 g | 255 ±5 g | 350 ±5 g | 300 ±5 g | 565 ±15 g | 495 ±15 g |

❗Refer the refrigerant charge procedure HRX-MM-Q018
They contain useful tips to keep the charge amount controlled.

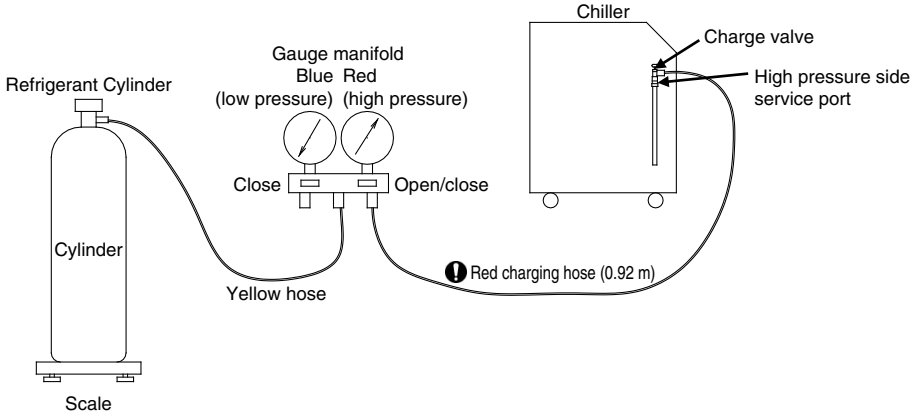



**Fig. 4-184**

**7.** Confirm that no refrigerant gas leaks from the service port.

**8.** Loosen the charge valve if there is no leakage of the refrigerant gas. (This closes the spring loaded check valve.)

**9.** Disconnect the hose of the charge valve, and remove the charge valve.

**10.** Mount the cap nut to the service port, and tighten it with a spanner.

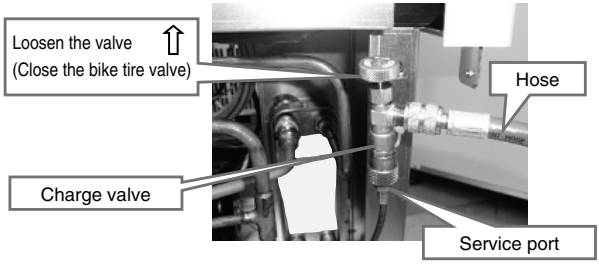



**Fig. 4-185**

**11.** Mount the panels in order, from left panel, right panel and upper panel.

**12..** Test the operation to confirm that the temperature control is correctly performed.
The replacement work is now completed, if temperature is controlled within the range of +/- 3.0°C of the set temperature.

**Fig. 4-186**

## Replacement of filter dryer

### HRS050/060-A/W-20

**Table 4-19. Replacement parts**

| Model | Part No. | Description | Qty. | Image |
|---|---|---|---|---|
| HRS050-A/W-20<br>HRS060-A/W-20 | HRZ-S0227 | Filter dryer | 1 |  |



**⚠ WARNING**

**There is danger of an electric shock. Make sure to turn OFF the power supply before performing replacement work.**
**There is danger of an electric shock and burn. Be careful enough not to be hurt during the work.**

**⚠ 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.**

### ■ Disassembly

**1.** Remove the left panel, right panel and upper panel.

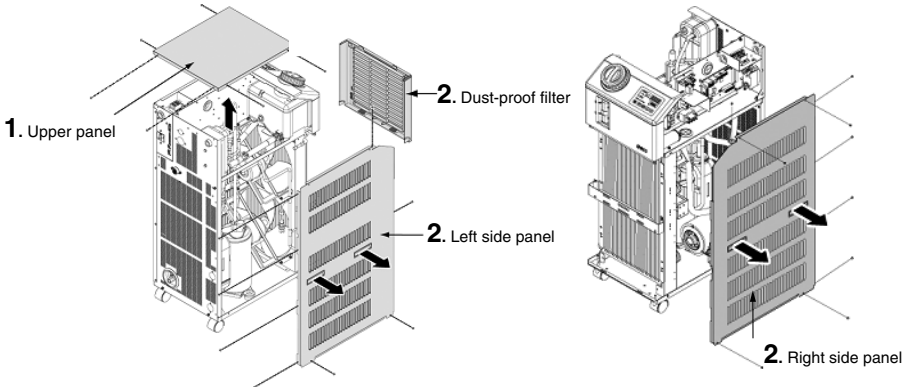



**Fig. 4-187**

**2.** Remove the cap nut of the high pressure service port on the refrigerant circuit, and then mount a charge valve.

**[Air-cooled type]**

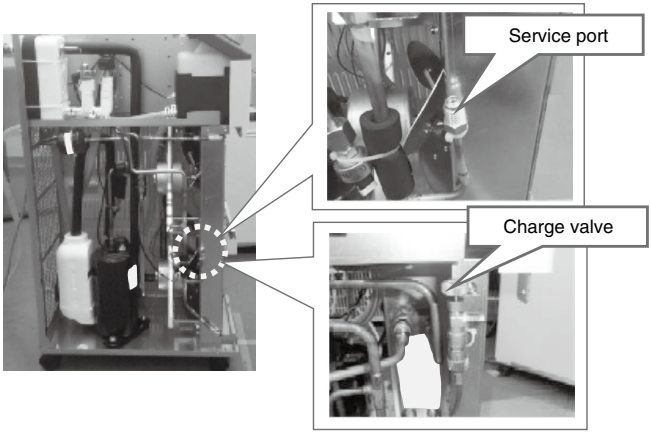



**Fig. 4-188**

**[Water-cooled type]**

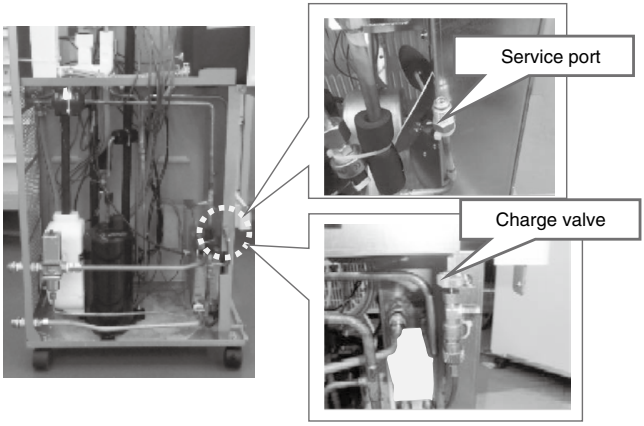



**Fig. 4-189**

**3.** Connect the hose of the gauge manifold to the high-pressure service port, and collect the refrigerant gas with the refrigerant collector.

**⚠ CAUTION**

**The collection and the disposal of refrigerant (HFC) and compressor oil must be in compliance with the bylaws of the local municipality.**



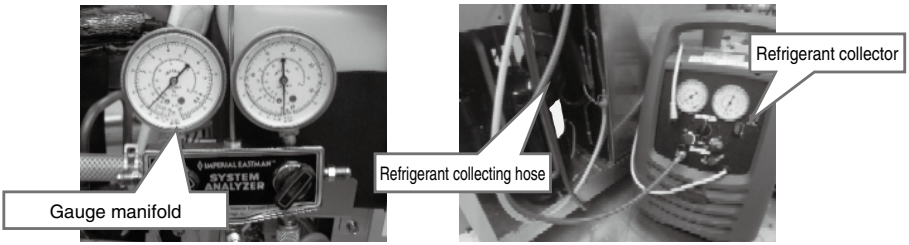



**Fig. 4-190**

**4.** Melt the brazing filler material at the joint of the copper pipes of the filter dryer using the brazing equipment. After melting the brazing filler material, hold and pull out the copper pipes with pliers.

* The copper pipe is to be reused. Use caution not to deform or melt the copper pipe when disconnecting it.

**⚠ DANGER**

- **Only trained and qualified personnel who are knowledgeable and skilled in brazing can perform the work of this document.**
- **Brazing has to be performed in a well ventilated area and where no flammable objects are present.**

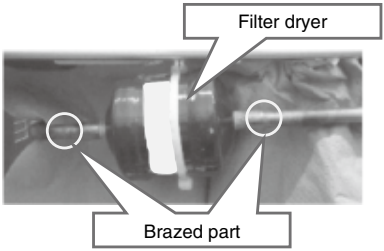



**Fig. 4-191**

**5.** Cover the flow direction label on the filter dryer with a wet cloth.

**6.** Confirm the flow direction of the refrigerant. Insert the filter dryer to the copper pipes, and braze the joint.

* When brazing, make sure to wear protective glasses for brazing, and do not directly look at the flame.
* Before starting brazing, nitrogen gas must be applied inside the copper tubing to avoid oxidization of the internal surface of the copper tubing.
* After finishing brazing, confirm that the brazing filler material is applied to the entire brazed part by visual observation.

**7.** Check for any leakage from the brazed parts by filling the refrigerant circuit with refrigerant gas and nitrogen gas.
· Fill the refrigerant gas (R407C) into the refrigerant circuit until the gas pressure reaches 0.29 MPa, and fill the nitrogen gas into the refrigerant circuit until the gas pressure reaches 1.37 MPa.

**8.** Check for leakage at the brazed parts using a leak detector.
Set value of the leakage detector: 1.5 x $10^{-5}$ std. cc/sec


**Fig. 4-192**

**9.** Collect the refrigerant gas and nitrogen used for the leakage check.
❗ Entrust a special industrial waste disposal trader with the mixture of refrigerant gas and nitrogen gas which you have collected.

**10.** After confirming that the refrigerant pressure gage measures zero, start drawing vacuum for more than 30 minutes.
❗ Use the red hose with specified length (0.92 m).

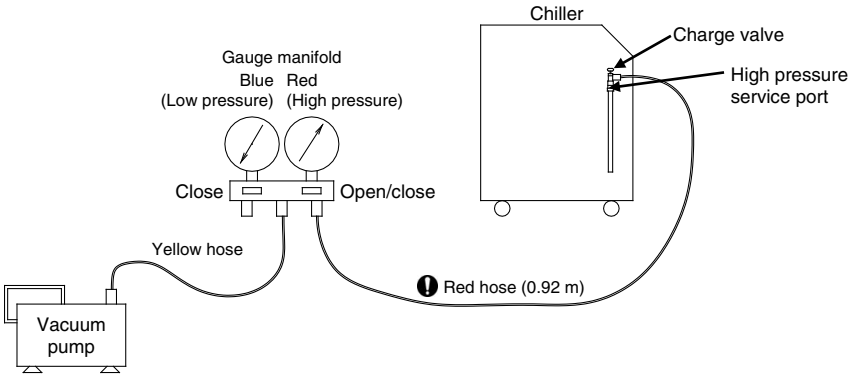



**Fig. 4-193**

**11.** Fill the specified amount of refrigerant gas. (See Table 4-20.)

**⚠ CAUTION**

**Apply the correct amount of the refrigerant. The performance of the product may not be realized if the amount is too large or too small.**

* Use a regularly calibrated scale to measure the gas to be filled in.
* If air is left inside the hose between the refrigerant cylinder and the service port, the air enters the refrigerant piping. If air enters the compressor, it may cause the product failure. Make sure to fill the hose with refrigerant before enclosing the refrigerant.

❗The service port is located at high pressure side.
So you cannot add refrigerant during the system in operation.

**Table 4-20. The amount of refrigerant for each model**

| Refrigerant | Model No. | | |
|---|---|---|---|
| | HRS050-A-20<br>HRS050-W-20 | HRS060-A-20 | HRS060-W-20 |
| R410A | 655 ±15 g | 845 ±15 g | 735 ±15 g |

❗Refer the refrigerant charge procedure HRX-MM-Q018
They contain useful tips to keep the charge amount controlled.

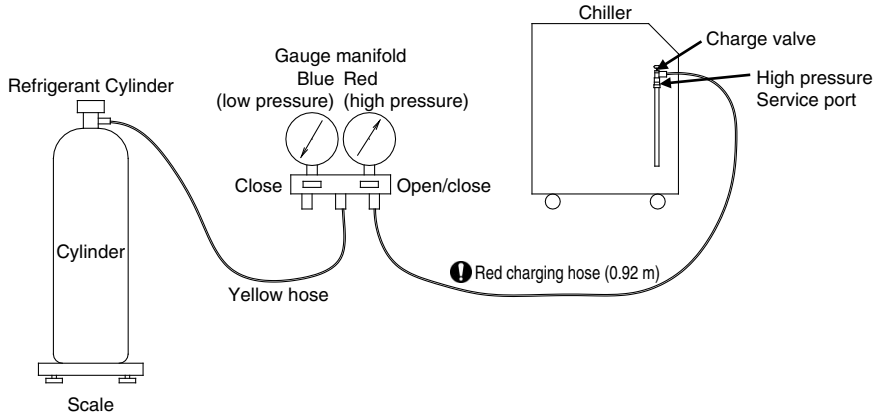



**Fig. 4-194**

**12.** Confirm that no refrigerant gas leaks from the service port.

**13.** Loosen the charge valve if there is no leakage of the refrigerant gas. (This closes the spring loaded check valve.)

**14.** Disconnect the hose of the charge valve, and remove the charge valve.

**15.** Mount the cap nut to the service port, and tighten it with a spanner.


**Fig. 4-195**

**16.** Mount the panels in order, from left panel, right panel and upper panel.

**17.** Test the operation to confirm that the temperature control is correctly performed.
The replacement work is now completed, if temperature is controlled within the range of +/- 3.0°C of the set temperature.

**Fig. 4-196**

## Replacement of Electric expansion valve

### HRS012 to 060-A/W-10/20

**Table 4-21. Replacement parts**

| Model | Part No. | Description | Qty. | Image |
|---|---|---|---|---|
| HRS012-A/W-10/20<br>HRS018-A/W-10/20<br>HRS024-A/W-20<br>HRS030-A/W-20 | HRS-S0029 | Electric expansion valve (EV1) | 1 |  |
| | HRS-S0028 | Electric expansion valve (EV2) | | |
| HRS050-A/W-20<br>HRS060-A/W-20 | HRS-S0341 | Electric expansion valve (EV1) | 1 |  |
| | HRS-S0340 | Electric expansion valve (EV2) | | |

**⚠ WARNING**

**There is danger of an electric shock. Make sure to turn OFF the power supply before performing replacement work.**
**There is danger of an electric shock and burn. Be careful enough not to be hurt during the work.**

**⚠ 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.**

## ■ Disassembly

**1.** Remove the upper panel and side panel.

### HRS012 to 030-A/W-10/20

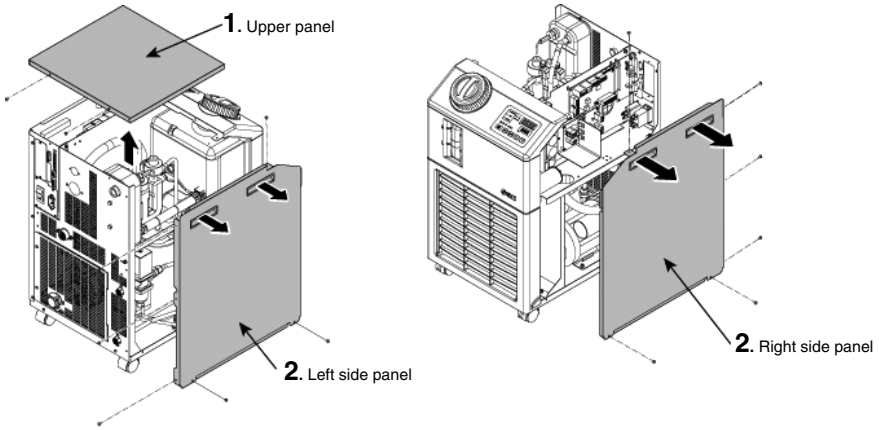



**Fig. 4-197**

### HRS050/060-A/W-20

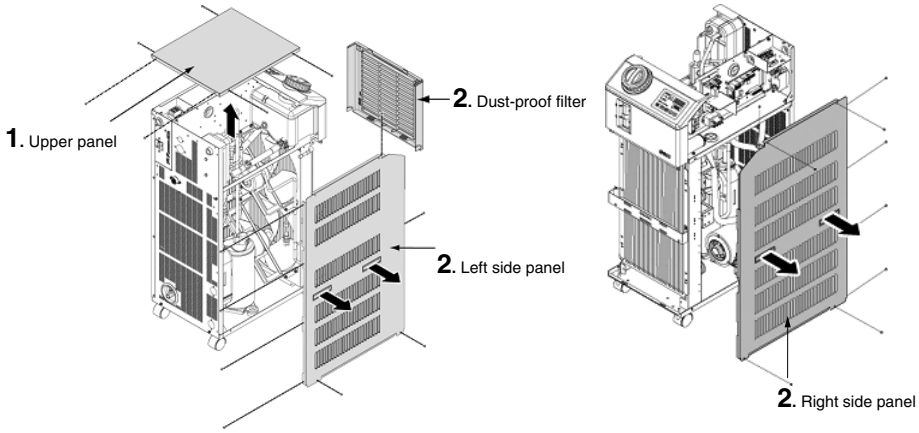



**Fig. 4-198**

**2.** Mount the charge valve to the service port.

### HRS012 to 030-A/W-10/20

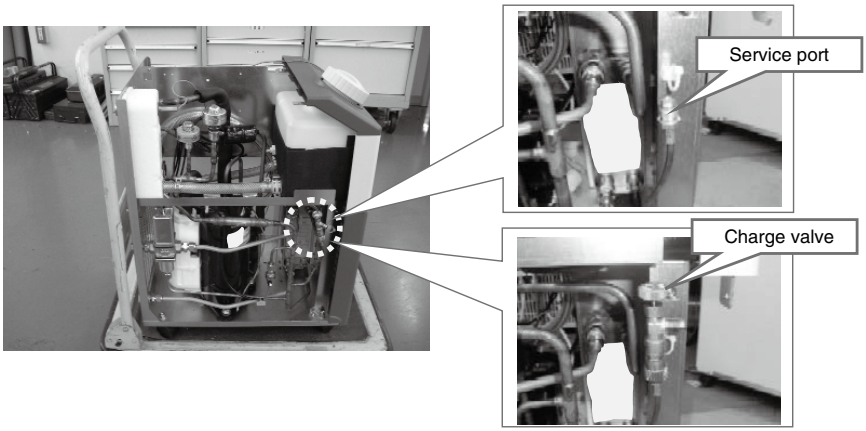



**Fig. 4-199**

**3.** Mount the charge valve to the service port.

### HRS050/060-A/W-20

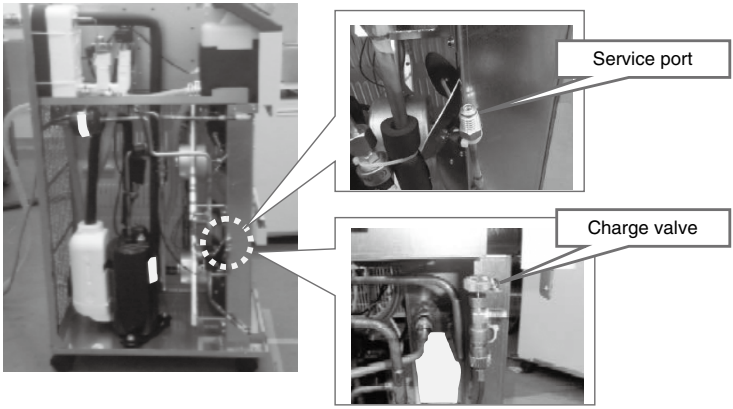



**Fig. 4-200**

**4.** Connect the hose of the gauge manifold to the high-pressure service port, and collect the refrigerant gas with the refrigerant collector.

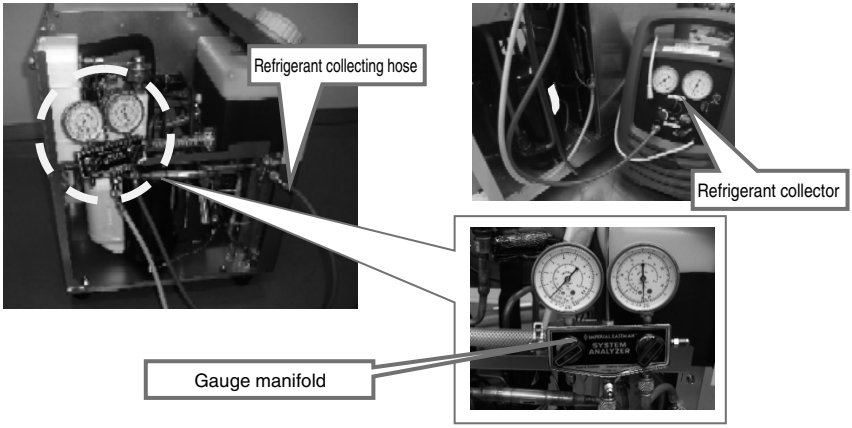



**Fig. 4-201**

**5.** Remove the coil which is mounted to the electronic expansion valve.

**6.** Remove all the thermal insulators around the electronic expansion valve.
Handle the insulators with care. They will be reused.

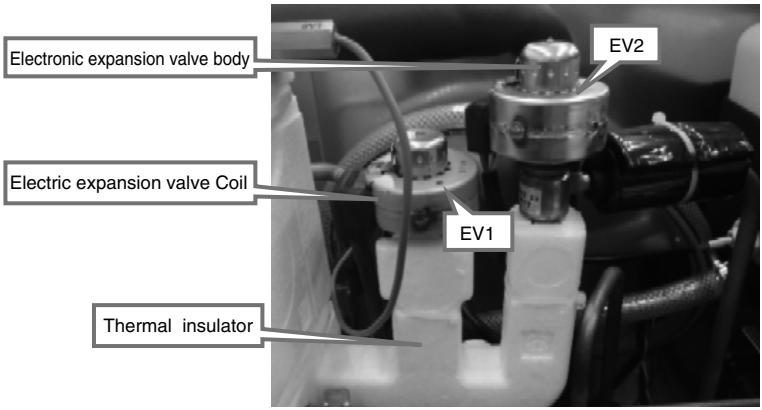



**Fig. 4-202**

**7.** Cut the copper pipes (2 places on the side of the electronic expansion valve from the brazed part) for removal.
After the removal, make sure that no compressor oil is left in the copper pipe. If some oil remains, remove it with a waste cloth.

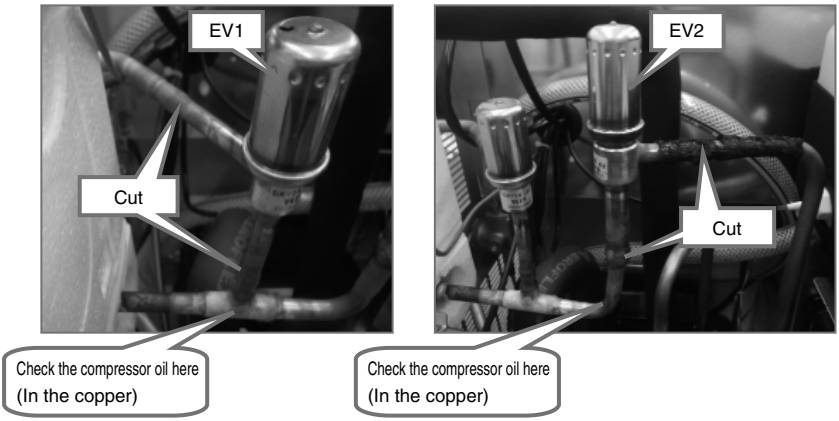



**Fig. 4-203**

**8.** Protect the electronic expansion valve, thermal insulator and cables with a wet cloth so that they are not burnt during mounting of the electronic expansion valve.

**9.** Heat the brazed parts where the electronic expansion valve and the copper pipe were connected, and pull out the copper pipes of the expansion valve (2 places).

**⚠ DANGER**

- **Only trained and qualified personnel who are knowledgeable and skilled in brazing can perform the work of this document.**
- **Brazing has to be performed in a well ventilated area and where no flammable objects are present.**

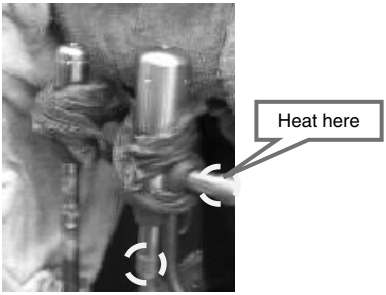



**Fig. 4-204**

## ■ Remount

**1.** Protect the new electronic expansion valve from heat by a wet cloth.

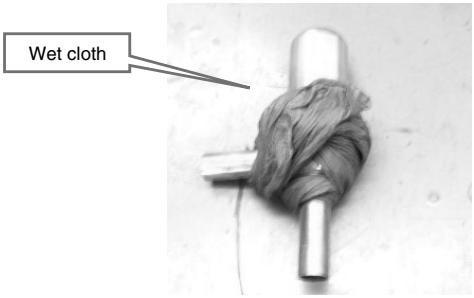



**Fig. 4-205**

**2.** The electronic expansion valve may not be inserted into the copper pipe smoothly.
Insert the copper pipe of the electronic expansion valve while heating the copper pipe, and braze it.

- ∗ When brazing, make sure to wear protective glasses for brazing, and do not directly look at the flame.
- ∗ Before starting brazing, nitrogen gas must be applied inside the copper tubing to avoid oxidization of the internal surface of the copper tubing.
- ∗ After finishing brazing, confirm that the brazing filler material is applied to the entire brazed part by visual observation.

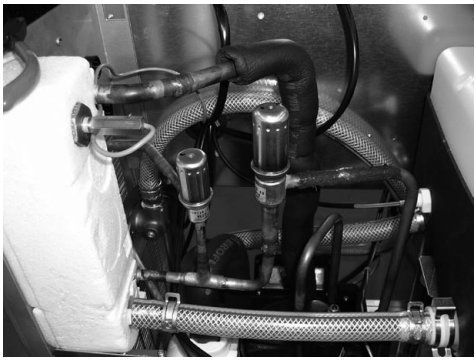


**Fig. 4-206**

**3.** Check for any leakage from the brazed parts by filling the refrigerant circuit with refrigerant gas and nitrogen gas.

- · Fill the refrigerant gas (R407C) into the refrigerant circuit until the gas pressure reaches 0.29 MPa, and fill the nitrogen gas into the refrigerant circuit until the gas pressure reaches 1.37 MPa.

**4.** Check for leakage at the brazed parts using a leak detector.
Set value of the leakage detector: 1.5 x $10^{-5}$ std. cc/sec


**Fig. 4-207**

**5.** Collect the refrigerant gas and nitrogen gas used for the leakage check.
❗Entrust a special industrial waste disposal trader with the mixture of refrigerant gas and nitrogen gas which you have collected.

**6.** After confirming that the refrigerant pressure gage measures zero, start drawing vacuum for more than 30 minutes.
❗The charging hose (Red) shall be 0.92 m length.

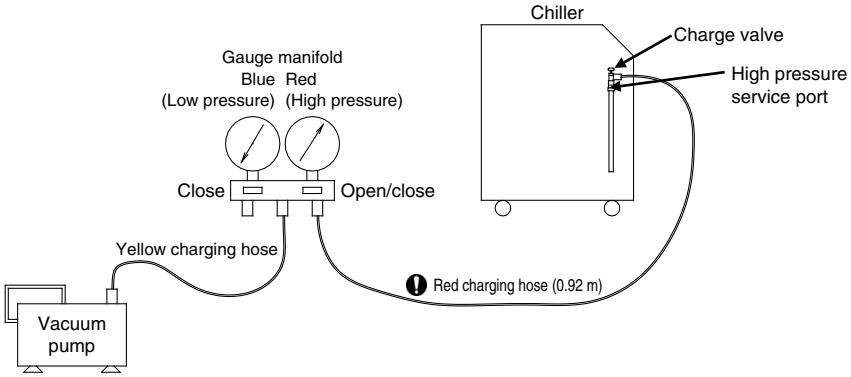



**Fig. 4-208**

**7.** Fill the specified amount of refrigerant gas. (See Table 4-22, 23.)

**⚠ CAUTION**

**Apply the correct amount of the refrigerant. The performance of the product may not be realized if the amount is too large or too small.**

* Use a regularly calibrated scale to measure the gas to be filled in.
* If air is left inside the hose between the refrigerant cylinder and the service port, the air enters the refrigerant piping. If air enters the compressor, it may cause the product failure. Make sure to fill the hose with refrigerant before enclosing the refrigerant.

❗ The service port is located at high pressure side.

The refrigerant cannot be enclosed during operation.

**Table 4-22. The amount of refrigerant (HRS012/018/024/030)**

| Refrigerant | HRS012-A-10<br>HRS018-A-10 | HRS012-A-20<br>HRS018-A-20<br>HRS024-A-20 | HRS012-W-10<br>HRS018-W-10 | HRS012-W-20<br>HRS018-W-20<br>HRS024-W-20 | HRS030-A-20 | HRS030-W-20 |
|---|---|---|---|---|---|---|
| R407C | 320 ±5 g | 350 ±5 g | 255 ±5 g | 300 ±5 g | 565 ±15 g | 495 ±15 g |

**Table 4-23. The amount of refrigerant (HRS050/060)**

| Refrigerant | HRS050-A-20 | HRS050-W-20 | HRS060-A-20 | HRS060-W-20 |
|---|---|---|---|---|
| R410A | 655 ±15 g | 655 ±15 g | 845 ±15 g | 735 ±15 g |

❗ Refer the refrigerant charge procedure HRX-MM-Q018

They contain useful tips to keep the charge amount controlled.

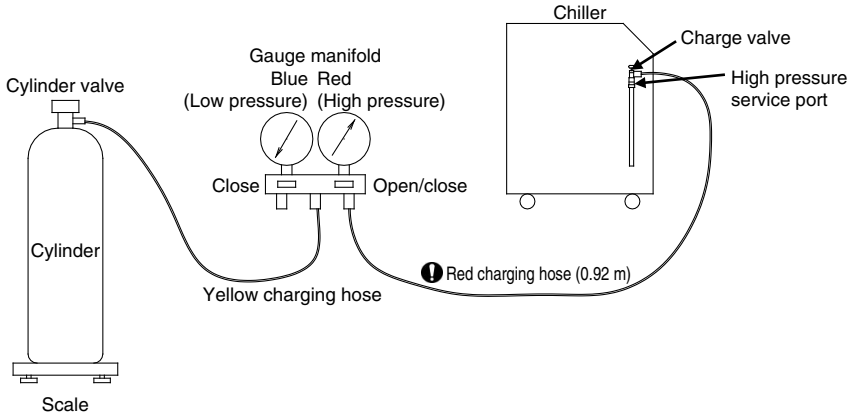



**Fig. 4-209**

**8.** Confirm that no refrigerant gas leaks from the service port.

**9.** Loosen the charge valve if there is no leakage of the refrigerant gas. (This closes the spring loaded check valve.)

**10.** Disconnect the hose of the charge valve, and remove the charge valve.

**11.** Mount the cap nut to the service port, and tighten it with a spanner.

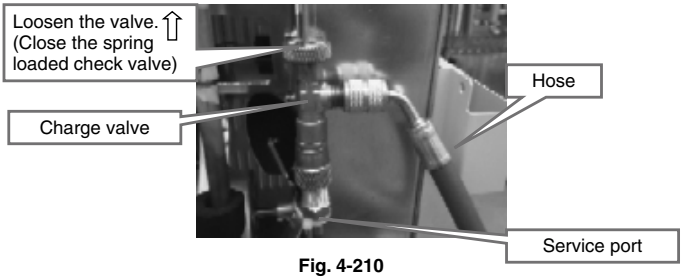



**Fig. 4-210**

**12.** Mount the panels in order, from left panel, right panel and upper panel.
❗ Initial setting is required after replacing EV1 (electronic expansion valve for cooling). Be sure to refer to How to set the minimum opening of the electronic expansion valve for cooling (HRX-MM-S002) in the attachment.

**13.** Test the operation to confirm that the temperature control is correctly performed.
The replacement work is now completed, if temperature is controlled within the range of +/- 3.0°C of the set temperature.

**Fig. 4-211**

## Replacement of Refrigerant Pressure Sensor

### HRS012 to 060-A/W-10/20

**Table 4-24. Replacement parts**

| Model | Part No. | Description | Qty. | Image |
|---|---|---|---|---|
| HRS012-A/W-10/20<br>HRS018-A/W-10/20<br>HRS024-A/W-20<br>HRS030-A/W-20 | HRS-S0012 | Refrigerant Pressure Sensor (For high pressure) | 1 |  |
| | HRS-S0013 | Refrigerant Pressure Sensor (For low pressure) | 1 | |
| HRS050-A-20<br>HRS060-A-20 | HRS-S0183 | Refrigerant Pressure Sensor (For high pressure) | 1 | |
| | HRS-S0012 | Refrigerant Pressure Sensor (For low pressure) | 1 | |

**⚠ WARNING**

**There is danger of an electric shock. Make sure to turn OFF the power supply before performing replacement work.**
**There is danger of an electric shock and burn. Be careful enough not to be hurt during the work.**

**⚠ 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.**

## HRS012 to 030-A/W-10/20

### ■ Disassembly [High pressure side]

**1.** Remove the upper panel and left side panel.

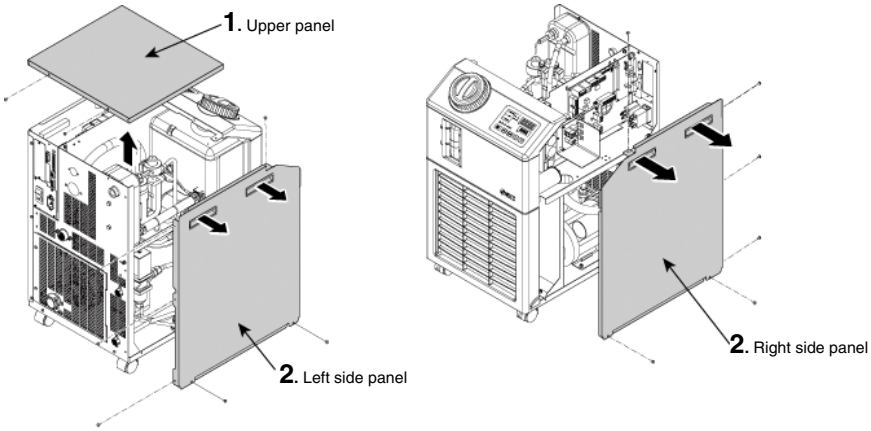



**Fig. 4-212**

**2.** Hold the lower part of the service port with a spanner, and remove the cap nut (Spanner size: 14 mm, 17 mm)

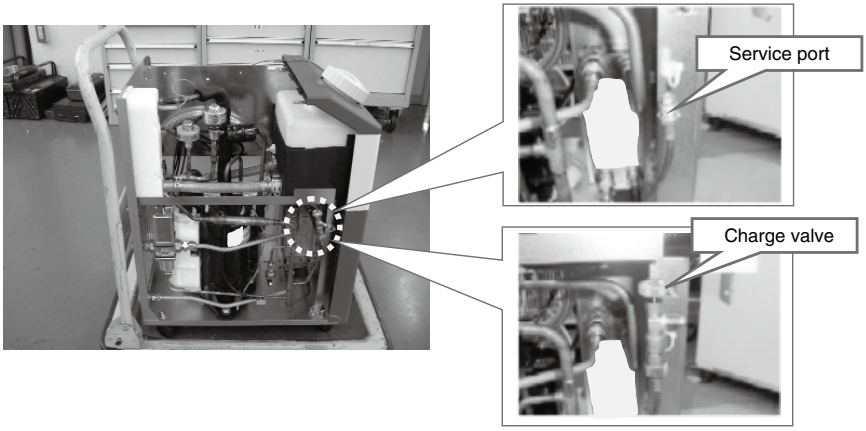



**Fig. 4-213**

**3.** After mounting a charge valve to the service port,collect the refrigerant gas. (Refrigerant gas collector)

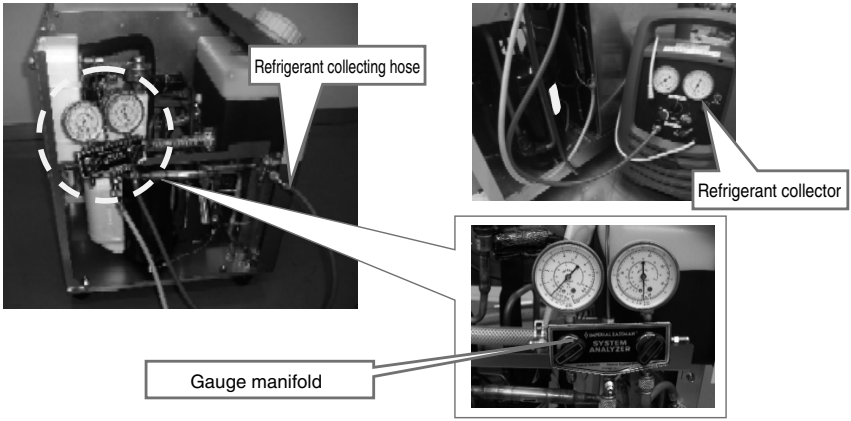



**Fig. 4-214**

**4.** Remove the wiring connector of the refrigerant pressure sensor.

**5.** Hold the refrigerant pressure sensor body with a spanner and remove the pressure sensor. (Spanner size: 12 mm, 17 mm)

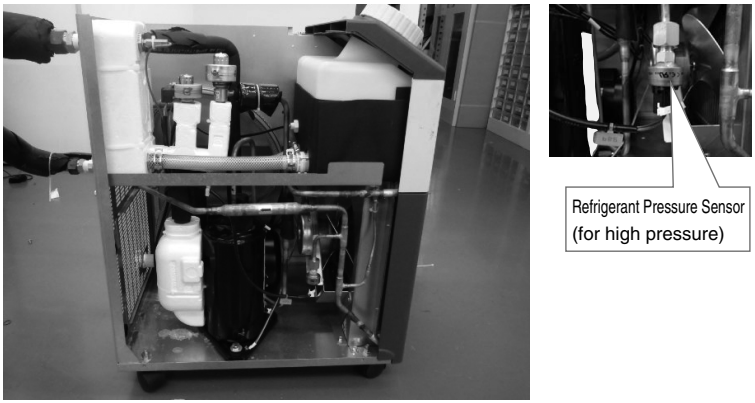
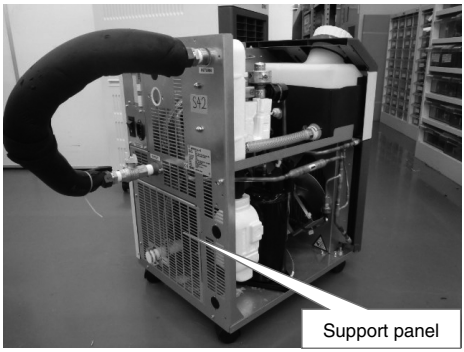



**Fig. 4-215**

## ■ Disassembly [Low pressure side]

1. Put a container under the drain port, and remove the drain clip and drain plug to discharge the circulating fluid.
2. Remove the support panel.



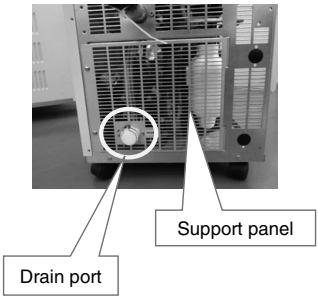




**Fig. 4-216**

3. Remove the wiring connector of the refrigerant pressure sensor.
4. Hold the refrigerant pressure sensor body with a spanner and remove the pressure sensor. (Spanner size: 12 mm, 17 mm)

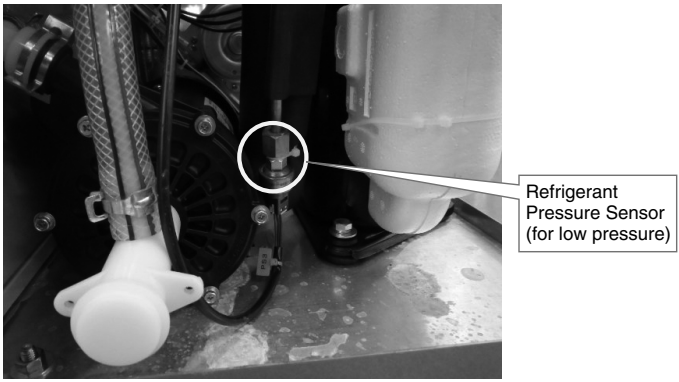



**Fig. 4-217**

## Replacement of Refrigerant Pressure Sensor

### HRS050/060-A/W-20

#### ■ Disassembly [High pressure side]

**1.** Remove the upper panel and left side panel.

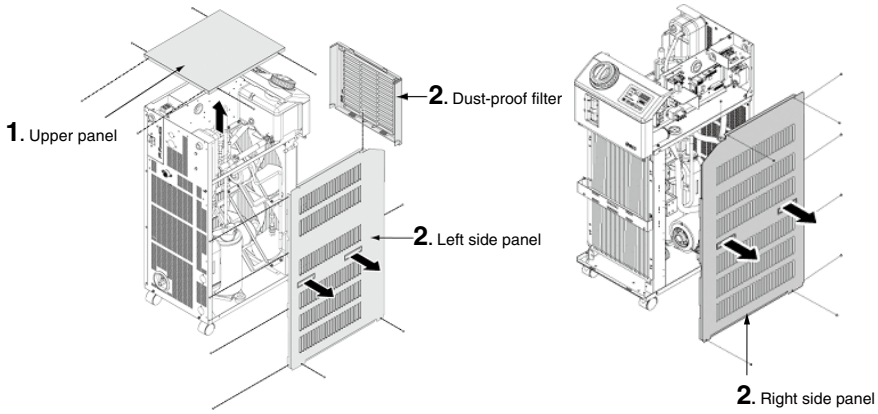



**Fig. 4-218**

**2.** Hold the lower part of the service port with a spanner, and remove the cap nut.
(Spanner size: 14 mm, 17 mm)

**3.** Mount the charge valve to the service port.

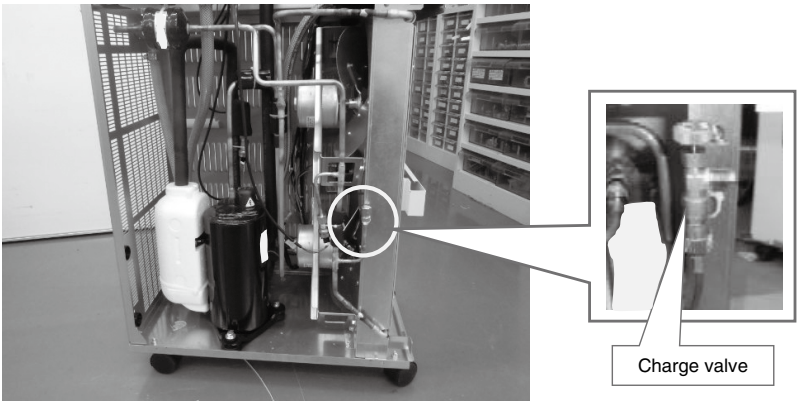



**Fig. 4-219**

**4.** After mounting a charge valve to the service port, collect the refrigerant gas. (Refrigerant collector)

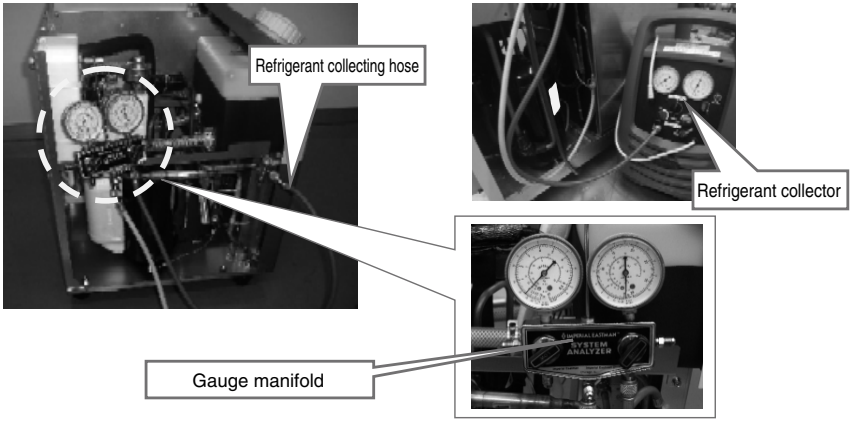



**Fig. 4-220**

**5.** Remove the wiring connector of the refrigerant pressure sensor.

**6.** Hold the refrigerant pressure sensor body with a spanner and remove the pressure sensor. (Spanner size: 12 mm, 17 mm)

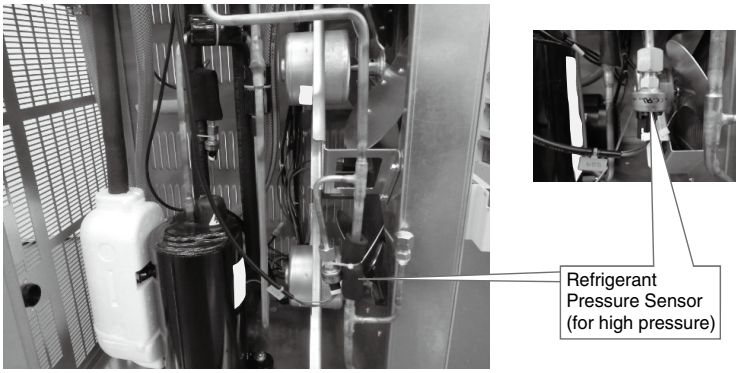



**Fig. 4-221**

## ■ Disassembly [Lower pressure side]

1. Hold the lower part of the service port with a spanner, and remove the cap nut. (Spanner size: 14 mm, 17 mm)
2. After mounting a charge valve to the service port, collect the refrigerant gas. (Refrigerant gas collector)
3. Remove the wiring connector of the refrigerant pressure sensor.
4. Hold the refrigerant pressure sensor body with a spanner and remove the pressure sensor. (Spanner size: 12 mm, 17 mm)

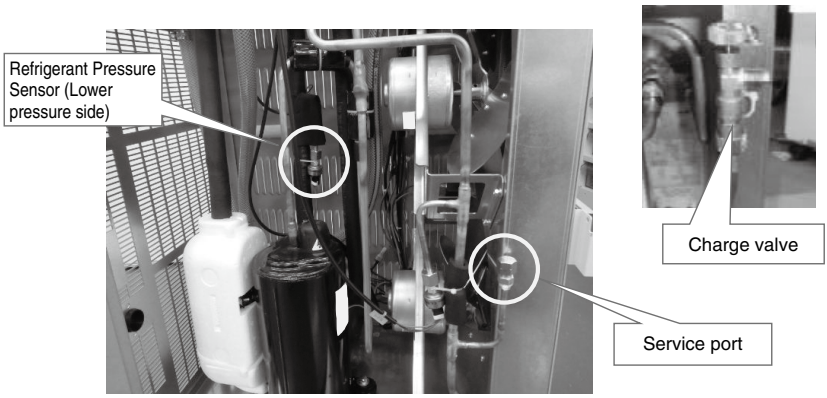



**Fig. 4-222**

## ■ Remount [High pressure side,Low pressure side]

1. Hold the new refrigerant pressure sensor body side with a spanner and mount the pressure sensor. (Spanner size: 12 mm, 17 mm)
2. Mount the wiring connector.
3. Connect the vacuum pump and draw vacuum. (For more than 30 minutes.)
   After confirming that the refrigerant pressure gage measures zero, start drawing vacuum for more than 30 minutes.
4. Fill the specified amount of refrigerant gas.(Refer to Table 4-25, 26.)
   * Use a regularly calibrated scale to measure the gas to be filled.
   * If air is left inside the hose between the refrigerant cylinder and the charge valve, the air enters the refrigerant piping. If air enters the compressor, it may cause the product failure. Make sure to fill the hose with refrigerant before enclosing the refrigerant.

**⚠ CAUTION**

**Apply the correct amount of the refrigerant. The performance of the product may not be realized if the amount is too large or too small.**

The service port is located at high pressure side.
The refrigerant cannot be enclosed during operation.

**Table 4-25. The amount of refrigerant (HRS012/018/024/030)**

| Refrigerant | HRS012-A-10<br>HRS018-A-10 | HRS012-A-20<br>HRS018-A-20<br>HRS024-A-20 | HRS012-W-10<br>HRS018-W-10 | HRS012-W-20<br>HRS018-W-20<br>HRS024-W-20 | HRS030-A-20 | HRS030-W-20 |
|---|---|---|---|---|---|---|
| R407C | 320 ±5 g | 350 ±5 g | 255 ±5 g | 300 ±5 g | 565 ±15 g | 495 ±15 g |

**Table 4-26. The amount of refrigerant (HRS050/060)**

| Refrigerant | HRS050-A-20 | HRS050-W-20 | HRS060-A-20 | HRS060-W-20 |
|---|---|---|---|---|
| R410A | 655 ±15 g | 655 ±15 g | 845 ±15 g | 735 ±15 g |

Refer the refrigerant charge procedure HRX-MM-Q018
They contain useful tips to keep the charge amount controlled.

**5.** Remove the charge valve to confirm that no refrigerant gas leakage occurs from the service port.

**6.** Mount the cap nut to the service port, and tighten it with a spanner.
(Spanner size: 14 mm, 17 mm)

**7.** Test the operation to confirm that the temperature control is correctly performed. (Temperature stability: +/- 0.1°C)

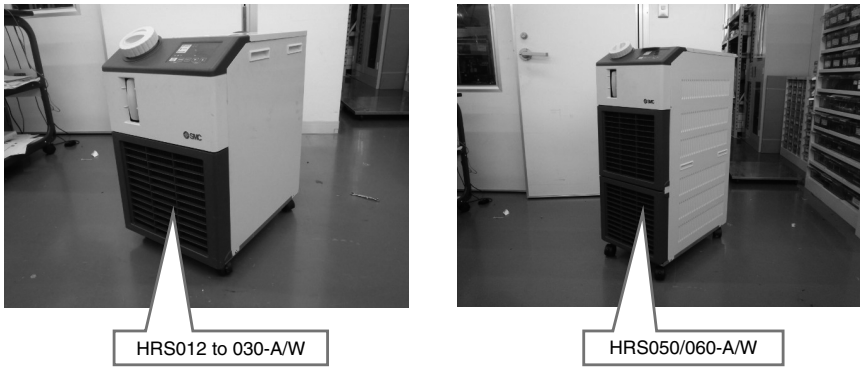


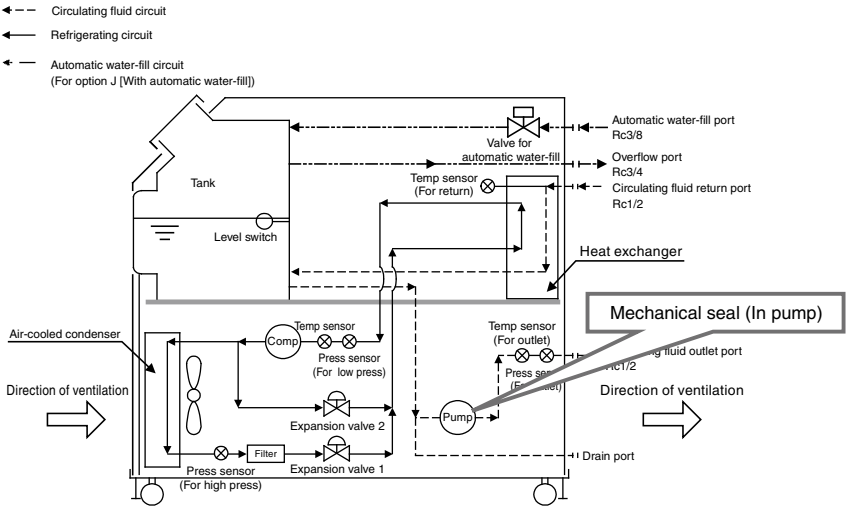

**Fig. 4-223**

# 5 Replacement Procedure for Mechanical Seal

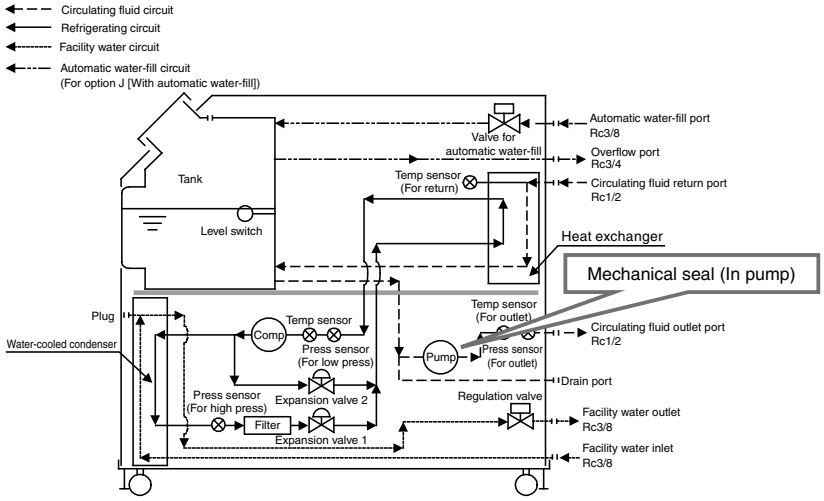
＊ For the 200 V only

## ■ Models with Mechanical Seal

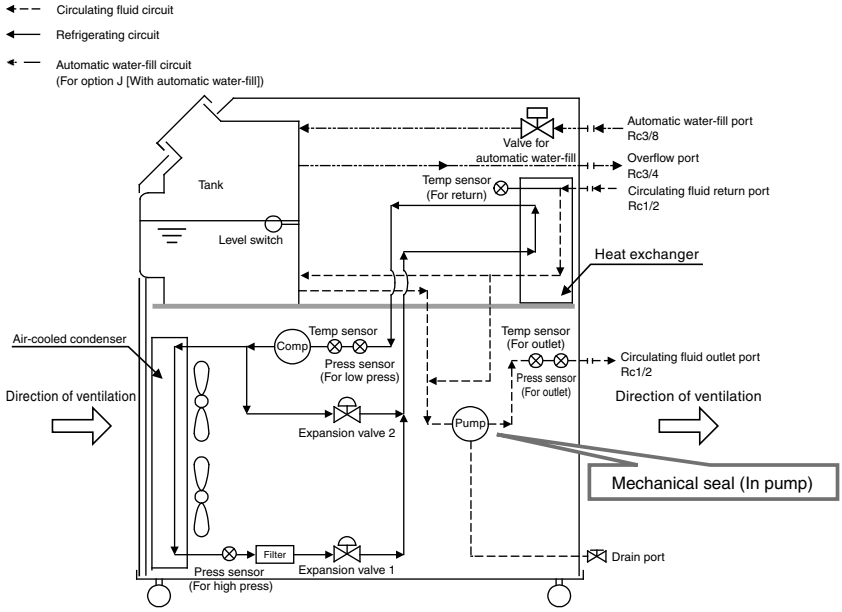
### HRS012/018/024/030-A□-20-(M)T



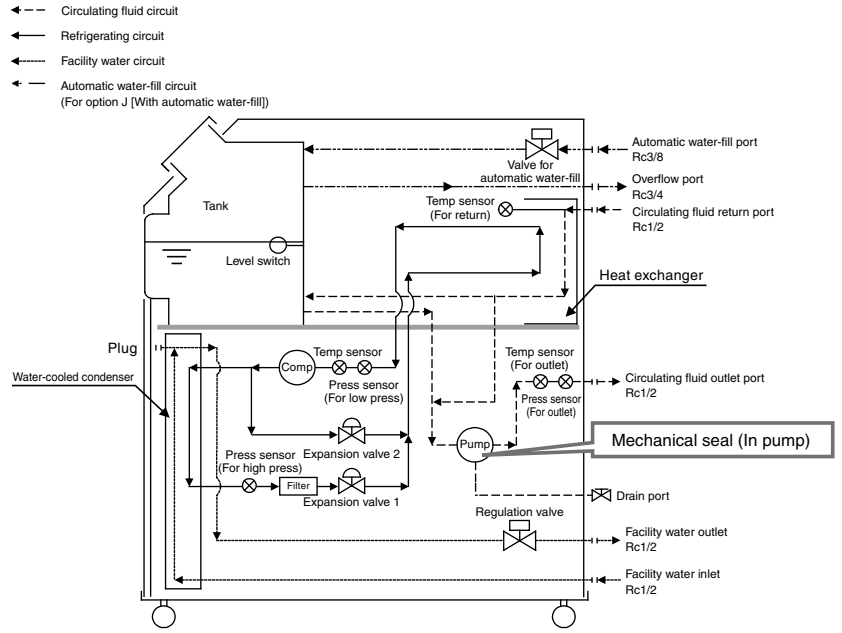

### HRS012/018/024/030-W□-20-(M)T



## HRS050/060-A□-20-□(M)



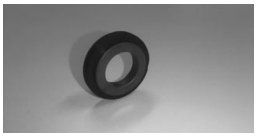
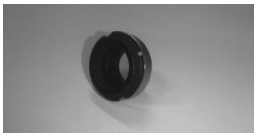
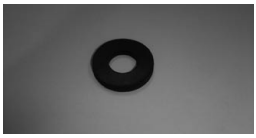
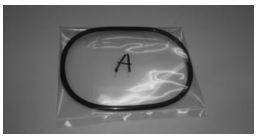
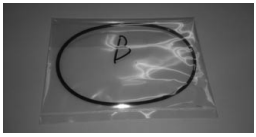
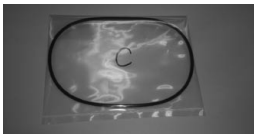
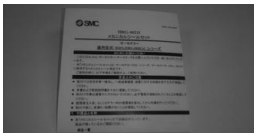

## HRS050/060-W□-20-□(M)



## Service parts to be used

· The mechanical seal set contains the following service parts.
Please confirm that all of them are present before replacement.

**Table 5-1 Mechanical seal set**

| Model | Part No. | Part name | Qty. | Photo |
|---|---|---|---|---|
| HRG-S0211 | — | Mechanical seal (Stationary) | 1 |  |
| | — | Mechanical seal (Dynamic) | 1 |  |
| | — | Mechanical seal (Spring) | 1 |  |
| | — | Rubber washer | 1 |  |
| | — | O-ring A | 1 |   |
| | — | O-ring B | 1 |   |
| | — | O-ring C | 1 |   |
| | HRX-OM-Q007 | Operation manual | 1 |  |

These service parts include three types of O-rings.
Select the appropriate O-ring referring to the comparison table below.

**Table 5-2 Appropriate models for each O-ring**

| O-ring | Applicable models | Remarks |
|---|---|---|
| A | HRS012/018/024/030 series | For high pressure pump option (-T) |
| B | HRS050/060 series | For standard and all options |
| C | HRG010 series | For standard and all options |



## Tools to be used and recommended protective equipment

· Tools to be used in the replacement work and useful equipment are shown in the table below.
Please prepare the tools shown in the table.

**Table 5-3 Tools list (1)**

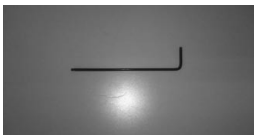
| No. | Description | Photo | Remarks |
|---|---|---|---|
| 1 | Permanent marker |  | |
| 2 | Allen wrench (Flat size: 5 mm) |  | |
| 3 | Allen wrench (Flat size: 2 mm) |  | |
| 4 | Pliers (which can hold 4-mm key width) |  | |
| 5 | Flat blade screwdriver<br>(which can be inserted into 4-mm key way) |  | |

**Table 5-3 Tools list (2)**

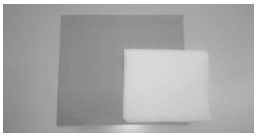
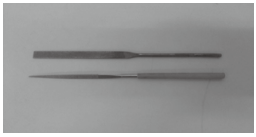
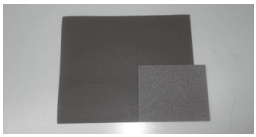
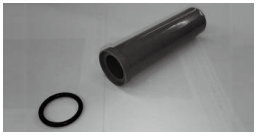
| No. | Description | Photo | Remarks |
|---|---|---|---|
| 6 | Flat head screwdriver<br>(which can be inserted into a flat blade groove of the shaft on the rear face of the motor) |  | |
| 7 | Pulley remover (Nominal size 3") |  | |
| 8 | Alcohol |  | |
| 9 | Cloth (such as paper towels) |  | |
| 10 | File (flat or triangle) |  | |
| 11 | Sandpaper or sponge abrasive material<br>(#180 to #200) |  | |
| 12 | Pushing tool (for rotating ring and for fixing ring) |  | |
| 13 | Pliers (medium size) |  | |

**Table 5-3 Tools list (3)**

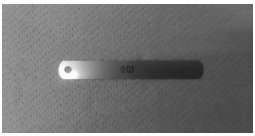
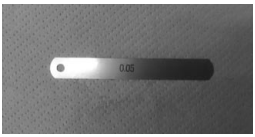
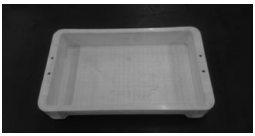
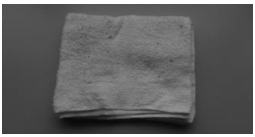
| No. | Description | Photo | Remarks |
|---|---|---|---|
| 14 | Thickness gauge (0.03 mm) |  | |
| 15 | Thickness gauge (0.05 mm) |  | |
| 16 | Plastic hammer (medium size) |  | |
| 17 | Drain pan (Less than 100 mm in height) |  | |
| 18 | Dustcloth |  | |

**Table 5-4 Recommended protective tools**

| No. | Description | Photo | Remarks |
|---|---|---|---|
| 1 | Gloves |  | |
| 2 | Goggles |  | |
| 3 | Safety shoes |  | |

## Internal construction of the pump

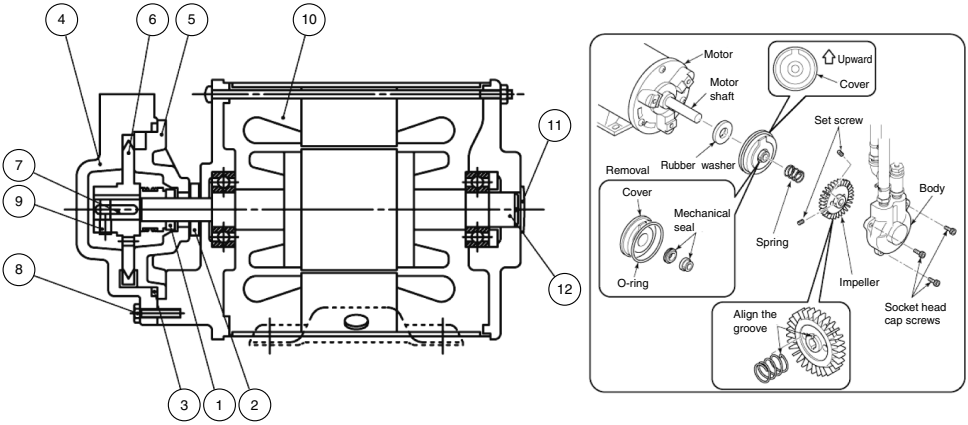



**Table 5-5 Internal construction of the pump**

| No. | Name | No. | Name |
|---|---|---|---|
| 1 | Mechanical seal | 7 | (Key) |
| 2 | Rubber washer | 8 | (Hexagon socket head cap screw) |
| 3 | O-ring | 9 | (Set screw x 2) |
| 4 | (Body) | 10 | (Motor) |
| 5 | (Cover) | 11 | (Seal) |
| 6 | (Impeller) | 12 | (Motor shaft) |

## Replacement procedure

**⚠ WARNING**

**The pump may operate suddenly due to automatic operation, which is dangerous. Make sure to turn OFF the power supply before performing replacement work.There is danger of an electric shock and burn. Be careful enough not to be hurt during the work.**

**⚠ 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 procedure

**1.** Remove the upper and side panels of the thermo-chiller to remove the pump.

**Note**
Please read and understand the separate service manual (HRX-MM-M056, P013).

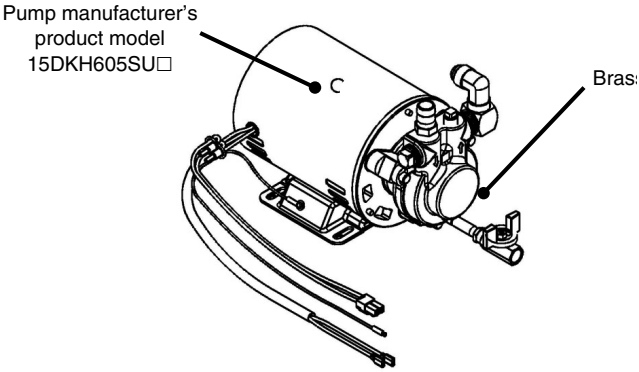



**Fig. 5-1 Pump for HRS012/018/024-□-20-T, HRS030-□-20-T**

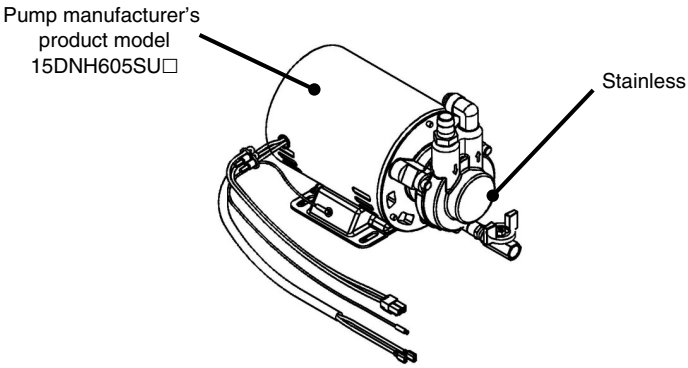



**Fig. 5-2 Pump for HRS012/018/024-□-20-MT, HRS030-□-20-MT**

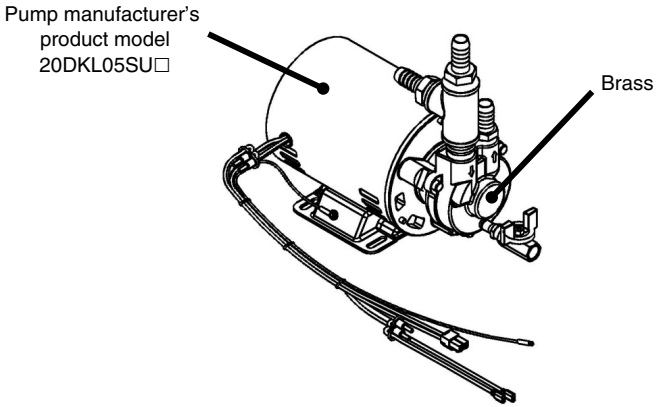



**Fig. 5-3 Pump for HRS050/060-□-20**

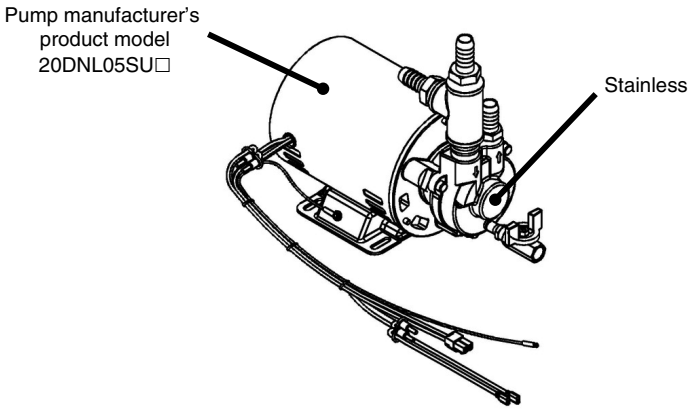


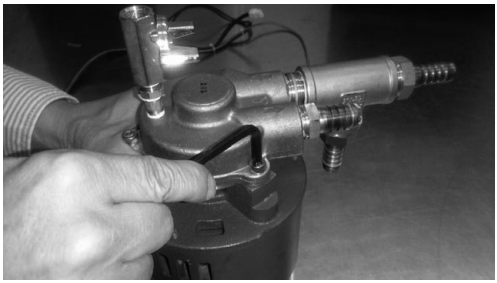

**Fig. 5-4 Pump for HRS050/060-□-20-M**

(The following procedure is common for all pump models. The procedure is shown using a HRS050/060-□-20 pump as an example.)

**2.** Draw alignment reference on the body (front casing), cover (back casing) and motor.

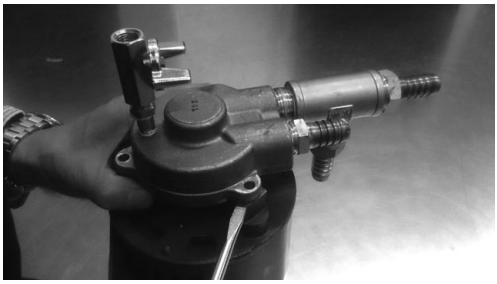
**Note**
Draw two or three reference.

**3.** Loosen the hexagon socket head cap screws that have fixed the body.



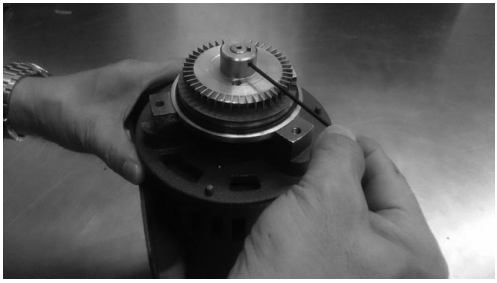
**4.** Remove the body.

**Note**
Remove the body slowly with a flat head screwdriver as a lever.



**5.** Loosen the two set screws that fix the impeller to the shaft.

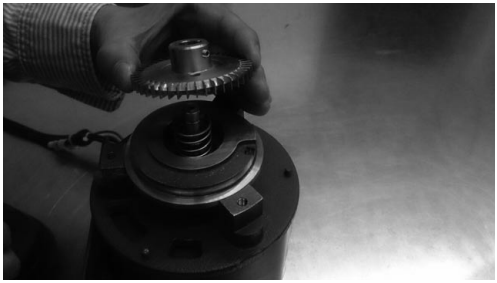
> **Note**
> Do not completely remove the two set screws from the impeller, so that they will not be lost.



**6.** Move the impeller forward together with the cover (back casing).

> **Note**
> Move the impeller slightly with a pulley remover or an alternative tool.
> If it is moved completely, the spring and rotating ring will run into the key.

**7.** Remove the impeller by hand.

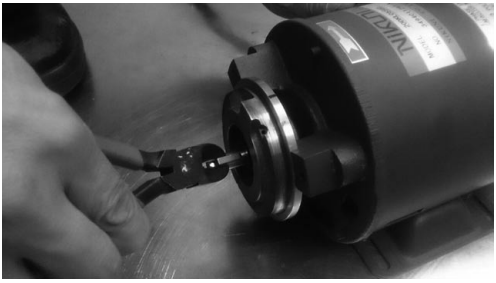


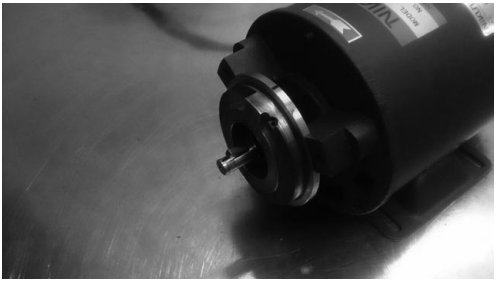
**8.** Then remove the spring.

**9.** Remove the key.

**Note**

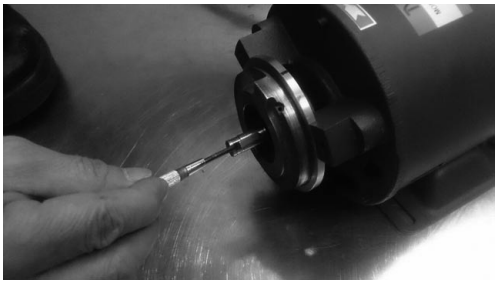
Pull the key up out of the way with pliers or an alternative tool.





**Note**

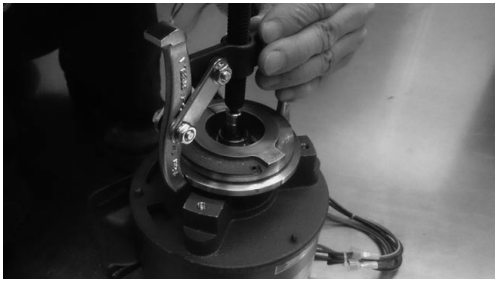
Insert a flat head (watchmaker's) screwdriver into a gap between the key and key way, and remove the key using the screwdriver as a lever.



**10.** Move the dynamic seal from pump, together with the cover (back casing).

**Note**

Move them with a pulley remover or an alternative tool.



**11.** Remove the dynamic seal from the motor shaft.

**12.** Then, remove the cover.

**13.** Remove the O-ring from the cover.

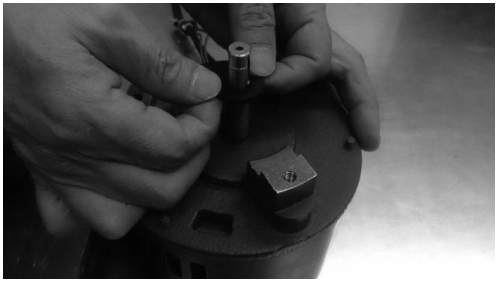
**14.** Then, remove the stationary seal which has been fitted into the cover.

**Note**

Turn the cover over and push the visible stationary seal lightly with a screwdriver end to remove it. Be careful not to damage it.

**15.** Pull the rubber washer off of the motor shaft.

> **Note**
> The rubber washer  covers the gap of motor shaft bearing.
> It can be removed by pulling up with fingers.



**16.** Removal is complete.

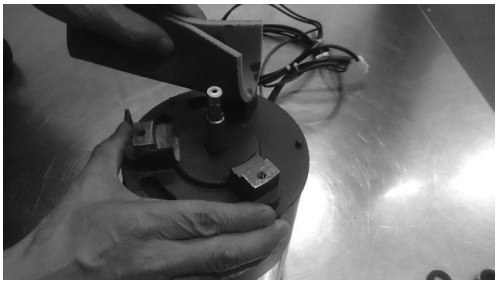
## ■ Cleaning procedure

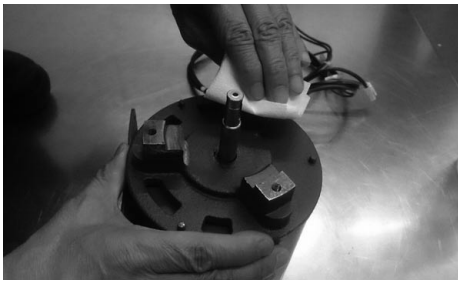
**Note**
Remove the adhered contamination with file, sandpaper and sponge abrasive material.

**Note**
When wiping off the contamination with alcohol, there should not be a large amount of inflammables or fire, and the area should be sufficiently ventilated.
Never use alcohol in a sealed place.



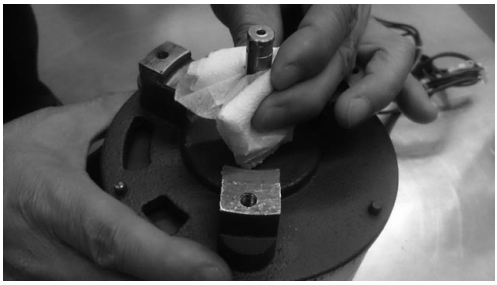
**1.** Clean the motor flange (cover mounting face).



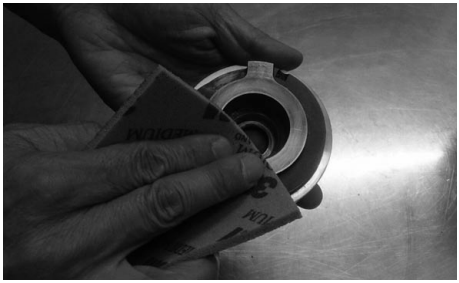


**2.** Clean the key way of the motor shaft.

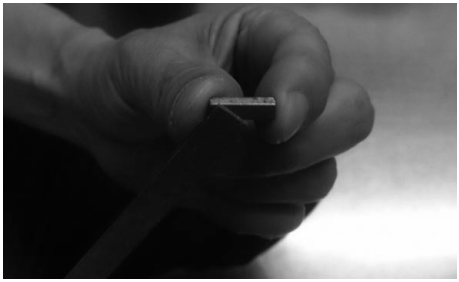
**3.** Clean the outer surface and step part of the motor shaft.

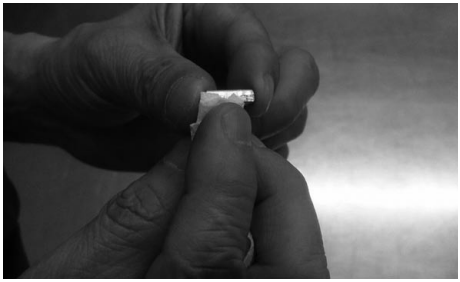


**4.** Clean the end surface of the cover.

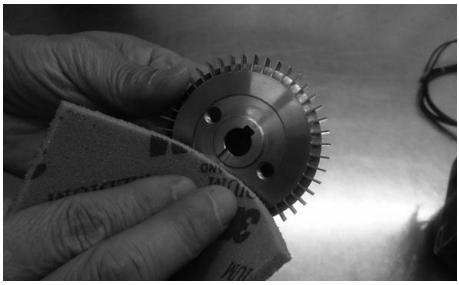


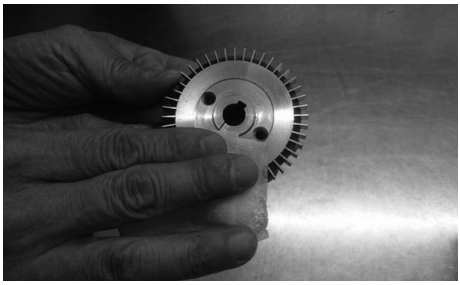
**5.** Clean the key.



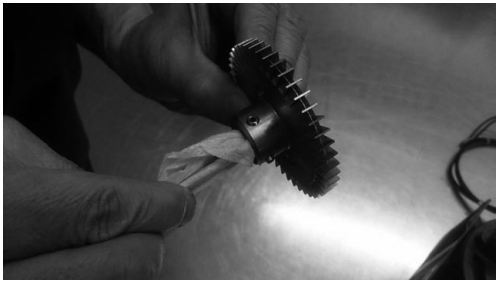


**6.** Clean the end surface of the impeller.





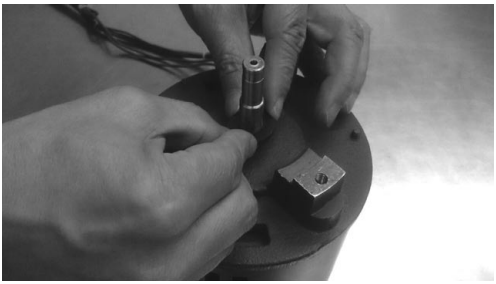
**7.** Clean the key way and inner surface of the impeller.



## ■ Remounting procedure

**1.** Install a new rubber washer onto the motor shaft, and press it against the outer surface of the motor.

> **Note**
> Cover the gap of the motor shaft bearing by pushing it lightly.



**2.** Install a new stationary seal into the cover.

> **Note**
> Push it firmly with a pushing tool or an alternative tool.

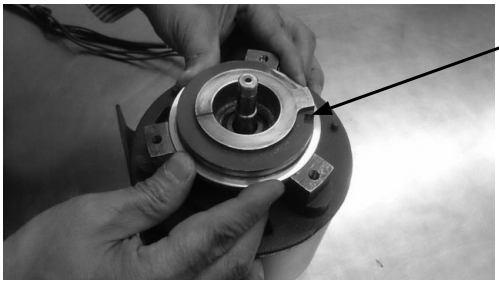
**3.** Install the cover with the stationary seal onto the motor shaft, and push it into the motor bracket.

**Note**

Confirm that the cover put onto the motor bracket can be rotated by hand.

**Note**

Align the parts using the “Alignment marks” drawn on before disassembling the product. If the marks have been been rubbed off, the water passage block should be mounted pointing at the top of the motor.



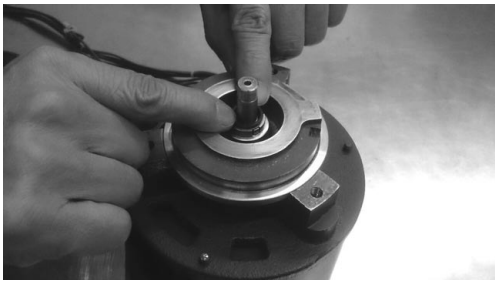

**4.** Install dynamic seal a new rotating ring onto the motor shaft.

**Note**

Wet the inner part (rubber lip) of the dynamic seal slightly with water and insert the rotating ring by sliding it.

**Note**

Never apply oil, It can damage the rubber.



**Note**

Push the dynamic seal until it comes into contact with the fixed ring. Confirm that the end of the rubber lip of the dynamic seal is almost the same surface level as the step part of the motor shaft.

**Note**

If the dynamic seal does not come into contact with the stationary seal, it may lead to liquid leakage.
Make contact it firmly with a pushing tool or an alternative tool.

**5.** Install the key into the key way of the motor shaft.

**Note**

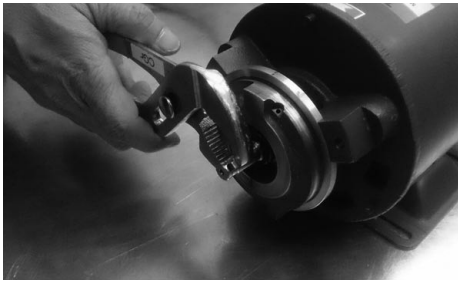
If it is difficult to fit the key, remove the burrs caused by the file.

**Note**

The direction (right or left; front or rear; front or back) of the key is not specified.

**Note**

Put the key with pliers and a plastic hammer. Be careful not to crush the R part of the key way with the edge of the key.



**6.** Install a new spring onto the motor shaft.

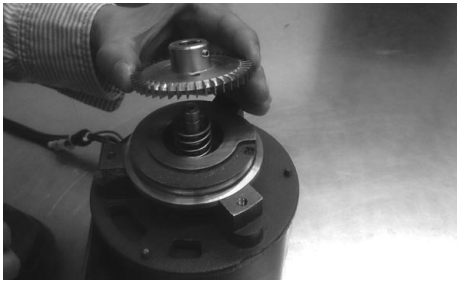
> **Note**
> Install it with the spring tang pointing to the top of the pump, as shown.

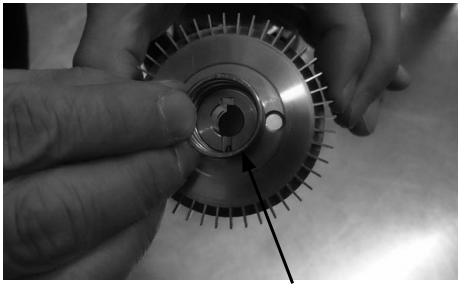
**7.** Install the impeller onto the motor shaft.

> **Note**
> Install it by aligning the key and the key way of the impeller.

> **Note**
> If it is difficult to insert the impeller, remove the burrs using a file.

> **Note**
> Hang the spring tang on the groove of the impeller.





**8.** Slide the impeller to the specified motor shaft position, and fix it with grub screws.

**Note**

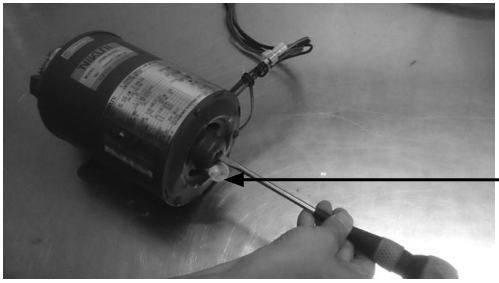
Insert the thickness gauge (Pump manufacturer's model DKH, DNH: 0.03 mm, DKL, DNL: 0.05 mm) into a gap between the impeller and the cover, and tighten it temporarily.

**Note**

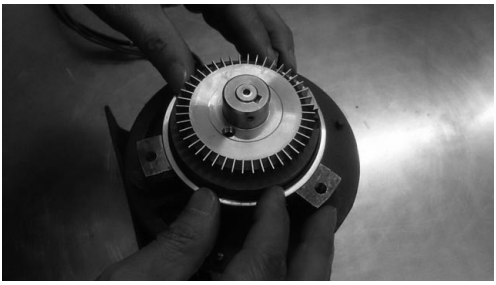
Pull out the thickness gauge after the temporary tightening, and tighten the hollow set screws to the specified tightening torque (1.5 N·m) to fix the impeller.

**Note**

After tightening the hollow set screws, remove the seal (silver) on the rear face of the motor. And then, insert the flat head screwdriver to the motor shaft to check if it rotates smoothly.



**9.** Install a new O-ring (Thickness: 2 mm) onto the cover.



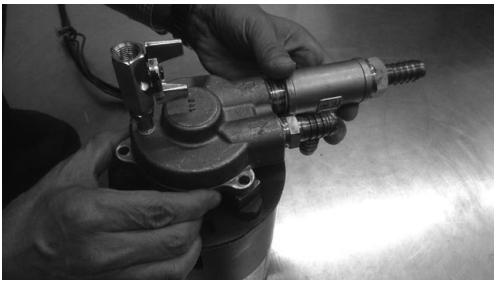
**10.** Put the body over the cover of Step 9.

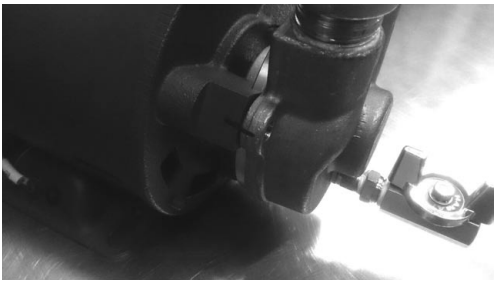
**Note**

The O-ring should not be caught on the body.

**Note**

Align the parts using the “Alignment marks” draw on before disassembling the product.
If the marks have been gone, align the water passage blocks.

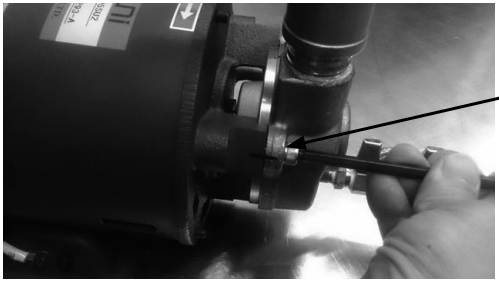




**11.** Fix the body of Step 10 to the motor bracket by tightening the hexagon socket head cap screws.

**Note**

The tightening torque of the hexagon socket head cap screw is 5.2 N·m.
Tighten them so that a gap remains between the body and motor bracket.
No liquid leakage will occur even if there is a gap as an O-ring seal is used.
Be careful not to tighten the screws excessively, otherwise the body may deform.




**12.** Remove the seal (silver) on the rear face of the motor of Step 11. And then, use the flat head screwdriver to check if the motor shaft rotates smoothly.

**Note**

If it does not rotate smoothly, the body or cover may come into contact with the impeller.
If so, disassemble and reassemble the product again until the motor shaft rotates smoothly.

## ■ Inspection and precautions before use

**1.** Install the pump to a thermo-chiller and confirm that no liquid leaks from the mechanical seal.

> **Note**
> Refer to the separate service manual (HRX-MM-M056, P013) for installation of the pump to thermo-chiller.

> **Note**
> If liquid leaks, perform the removal, cleaning and remounting procedure again until the liquid leakage is stopped.

**2.** Confirm that there is no abnormality (vibration or noise) when running the pump.

> **Note**
> If some errors were found, reinspect the parts and assembly condition.

**3.** Lastly, wipe off the “Alignment marks” with alcohol.The replacement procedure is complete.

# 6 Fluorocarbon Recovery Procedure

This section describes the basic structure of the recovery equipment and the recovery method. Please refer to the catalogs and instruction manuals provided by the recovery equipment manufacturer for details.

**⚠ CAUTION**

**The previous "Law Concerning the Recovery and Destruction of Fluorocarbons" was revised, and the new "Act on Rational Use and Proper Management of Fluorocarbons" (abbreviated as the "Fluorocarbons Emission Control Law", and commonly known as the "Revised Fluorocarbons Law") was put into force in April 2015.**
**The new law mandates that the recovery and filling of fluorocarbons during the maintenance of a Class I Specified Product** Note 1) **such as a thermo-chiller only be performed by qualified Class I Fluorocarbon Filling and Recovery Operators** Note 2) **registered in the prefecture in which the place of maintenance is located and having sufficient knowledge about the special inspections and periodic inspections of fluorocarbons (Class I Refrigerant Fluorocarbons Handling Engineer** Note 2) **or Class II Refrigerant Fluorocarbons Handling Engineer** Note 3)**.**
**We ask the owners (or managers) of our thermo-chillers to check the qualifications of the maintenance personnel when they arrive on the premises.**

Note 1) Commercial air conditioners, freezing equipment, and refrigeration equipment filled with fluorocarbon as a refrigerant (excluding Class II Specified Products and car air conditioners) including thermo-chillers.
Note 2) Previously known as Class I Fluorocarbon Recovery Operators
Note 3) Qualification certified by the Japan Association of Refrigeration and Air Conditioning Contractors in line with the enforcement of the Fluorocarbons Emission Control Law
Note 4) Qualification certified by the Japan Refrigerants and Environment Conservation Organization

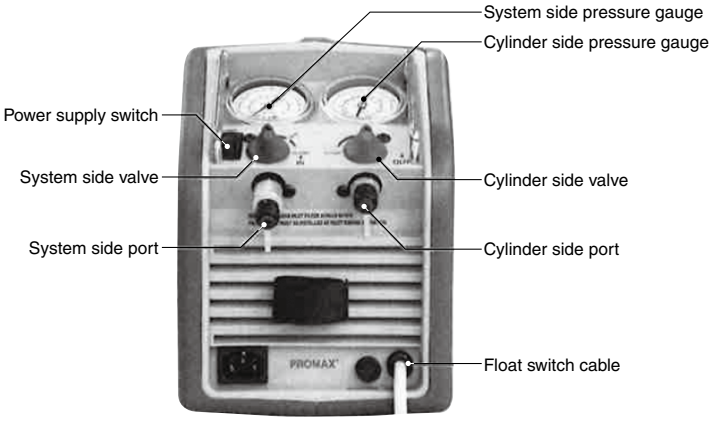
## Structure of Recovery Equipment

The fluorocarbon in the thermo-chiller is sucked into the system side port on the recovery equipment (built-in compressor). The fluorocarbon is then liquefied by the built-in air-cooled condenser and discharged from the cylinder side port. The fluorocarbon is then filled into the recovery cylinder.

**[Recovery equipment]**


**Specifications (Example)**

| | |
|---|---|
| **Name/Application** | Fluorocarbon recovery equipment |
| **Recovery method** | Compressor system (with high-pressure cutoff function) |
| **Types of fluorocarbons that can be recovered** | R134a, R404A, R407C, R410A, etc. |
| **Recovery cylinder** | With float switch exclusively for recovery equipment 21 L |
| **Safety device** | Overfilling prevention<br>(High-pressure cutoff, Float switch) |
| **(Power supply)** | (100 VAC (50 Hz, 60 Hz)) |
| **(Weight)** | (Approx. 10 kg) |




## [Accessories]

**① Adapter hose**

**② IN side filter**

**③ Red hose (With ball valve)**

**④ Power supply cable**

## Other Tools to be Prepared

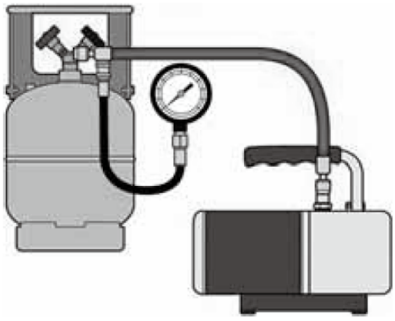
1. Prepare a recovery cylinder (designated by the recovery equipment manufacturer) for each type of fluorocarbon.

**⚠ CAUTION**

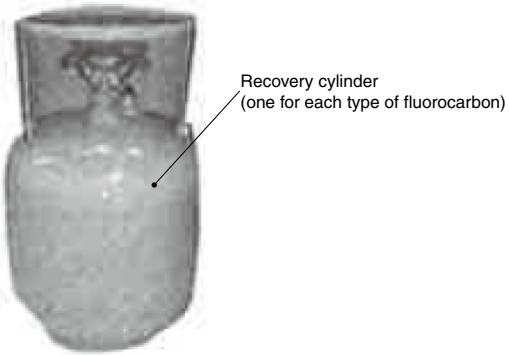
**Be sure to use the cylinder designated by the recovery equipment manufacturer.**

**⚠ CAUTION**

**When using an empty cylinder for the first time, be sure to vacuum it to –0.1 [MPa] before use.**
**If any uncondensed gas (e.g. nitrogen, air) remains in the cylinder, the inner pressure will rise during the recovery of the fluorocarbon, causing the safety device to be activated. Use extreme caution.**

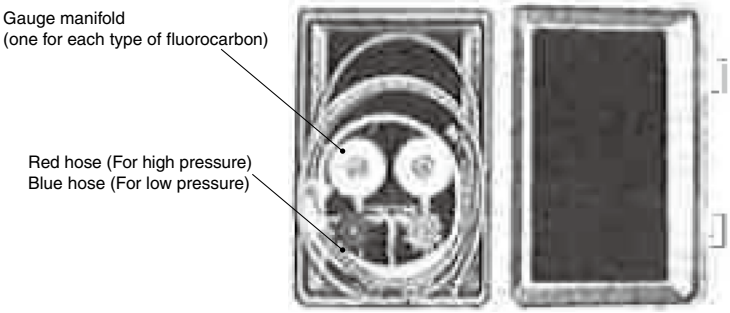


**Cylinder vacuuming**



**2.** Prepare a gauge manifold and hose for each type of fluorocarbon.

| ⚠ CAUTION |
| --- |
| **Use the gauge manifold and hoses exclusively for each type of fluorocarbon.** |

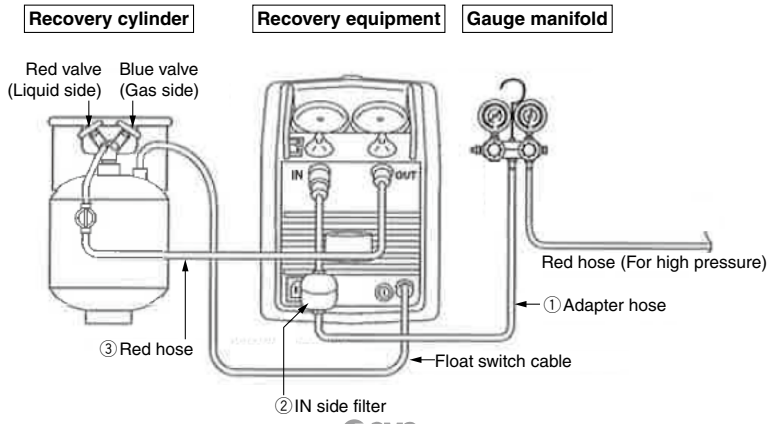



## Connection with Recovery Cylinder and Gauge Manifold

**1.** Connect one end of the provided red hose to the OUT port on the recovery equipment and the other end to the red valve on the cylinder (liquid side).

| ⚠ CAUTION |
| --- |
| **There are cases in which the valve colors are reversed (depending on the recovery equipment manufacturer). Use extreme caution.** |

**2.** Connect one end of the yellow hose to the IN port on the recovery equipment and the other end to the provided IN side filter. Then, connect one end of the provided adapter hose to the IN side filter and the other end to the center port of the gauge manifold.



## Connection of the Power Supply Cable and Float Switch (Safety Device) Cable

1. Connect one end of the provided power supply cable ④ to the recovery equipment and the other end to the 100 VAC power supply.
2. Connect the float switch cable on the recovery equipment to the float switch on the recovery cylinder.

**⚠ CAUTION**

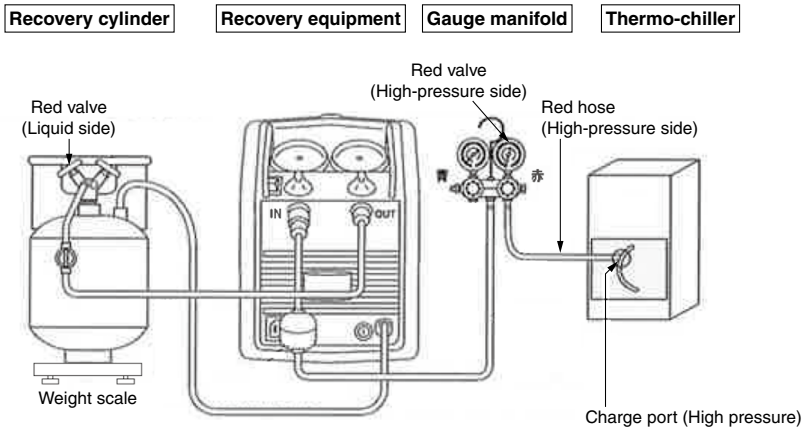
**Be extremely careful regarding the position of the cable terminal pin.**
**Connecting the cable forcibly may damage the pin.**

## Connection with Thermo-chiller

1. Connect one end of the red hose to the gauge manifold and the other end to the charge port (high-pressure side) of the thermo-chiller.

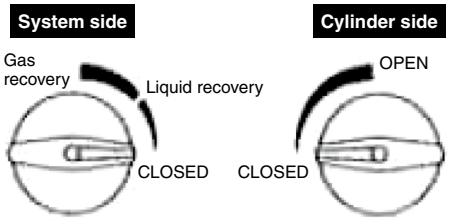
**⚠ CAUTION**

**All connections must be appropriate and sufficiently tightened.**

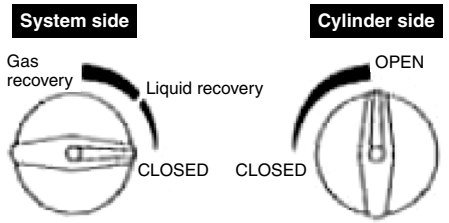


## Preparation for Recovery

1. Turn both the system side valve and the cylinder side valve on the recovery equipment to the CLOSED position.
2. Read off the weight of the recovery cylinder before starting the recovery process.
3. Open (turn counterclockwise) the red valve (liquid side) on the cylinder.
4. Open the red valve (high-pressure side) on the gauge manifold.
5. Check that the needle of the pressure gauge (high-pressure side) on the gauge manifold goes up.
6. Check again that both the system side (thermo-chiller side) valve and the cylinder side valve on the recovery equipment are set to the CLOSED position.



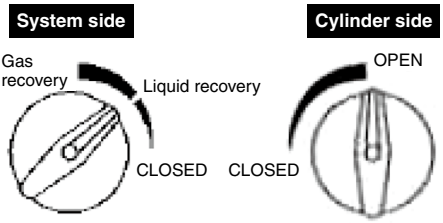

7. Turn the cylinder side (right side) valve on the recovery equipment to the OPEN position.



## Starting the Recovery Process

**1.** Turn the power supply switch to ON. (Activate the recovery equipment.)

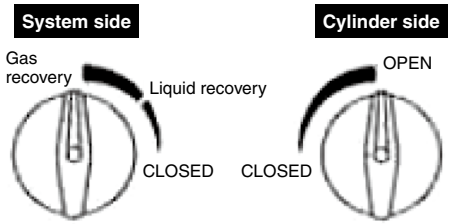
**2.** Turn the system side (thermo-chiller side) valve on the recovery equipment to the liquid recovery position.




**3.** Then, turn the system side (thermo-chiller side) valve slowly to the gas recovery position.

**Tips**

If the recovery equipment generates violent knocking, slowly turn the system side (thermo-chiller side) valve in the CLOSED direction until the knocking weakens.
After the knocking weakens, turn the valve to the gas recovery position, and resume the fluorocarbon recovery.



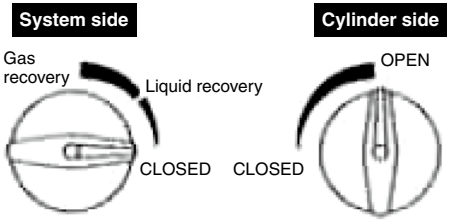

**4.** After the pressure on the system side (thermo-chiller side) has remained at –0.08 [MPa] for approximately 20 seconds or longer, turn the power supply switch to OFF to stop the recovery equipment.

**Tips**

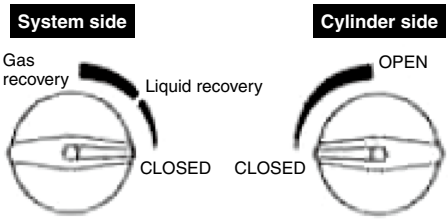
When the fluorocarbon remaining in the thermo-chiller has vaporized, the gauge pressure of the gauge manifold will increase again.
Continue to repeat the recovery process until the gauge pressure stops increasing.

## Finishing the Recovery Process

1. Close the red valve (high-pressure side) on the gauge manifold.
2. Close the system side (thermo-chiller side) valve on the recovery equipment. Leave the cylinder side valve open at this point.




3. When the pressure remains stable at –0.08 [MPa], turn the power supply switch to OFF to stop the recovery equipment.
4. Close the red valve on the recovery cylinder.
5. Close the cylinder side valve on the recovery cylinder.




6. Read off the weight of the recovery cylinder after the recovery process.
7. Lastly, disconnect all hoses.

**⚠ CAUTION**

**Check the IN side filter for dirt.**
**If the filter is dirty, replace it with a new one.**

## Submission of Certificate for Fluorocarbon Recovered

1. After the recovery process, calculate the difference in the weight of the cylinder before and after the recovery process to obtain the amount recovered.
2. Enter the amount recovered in the “Certificate for Fluorocarbon Recovered,” and submit it to the manager (customer).

Form (Sample)

### Certificate for Fluorocarbon Recovered

Certificate no.

| | | | | |
|---|---|---|---|---|
| Date of issue | Month | Date | Year | |
| Date of recovery | Month | Date | Year | |
| Type and amount of fluorocarbon recovered | Type (R no.) | R– | Amount (kg) | |

| | | | | |
|---|---|---|---|---|
| Manager who ordered the maintenance (E.g. owner of equipment) | Address | | | |
| | Name | | | |
| Person in charge of control | Address | | | |
| | Name | | Department | |
| | TEL | | email | |
| Location of equipment from which fluorocarbon was recovered | Address | | | |
| | Name of facility (E.g. name of building) | | | |
| Specific equipment information | Control no. | | | |
| | Model no. | | Product no. | |
| Fluorocarbon Filling and Recovery Operator | Address | | | |
| | Name | | | |
| | TEL | | Registration no. | |
| Recovered by or witnessed by (E.g. Refrigerant Fluorocarbons Handling Engineer) | Name | | Qualified person no. | |

To managers of equipment
Note: Store this “Certificate for Fluorocarbon Recovered” as it will be necessary to calculate the leakage amount.

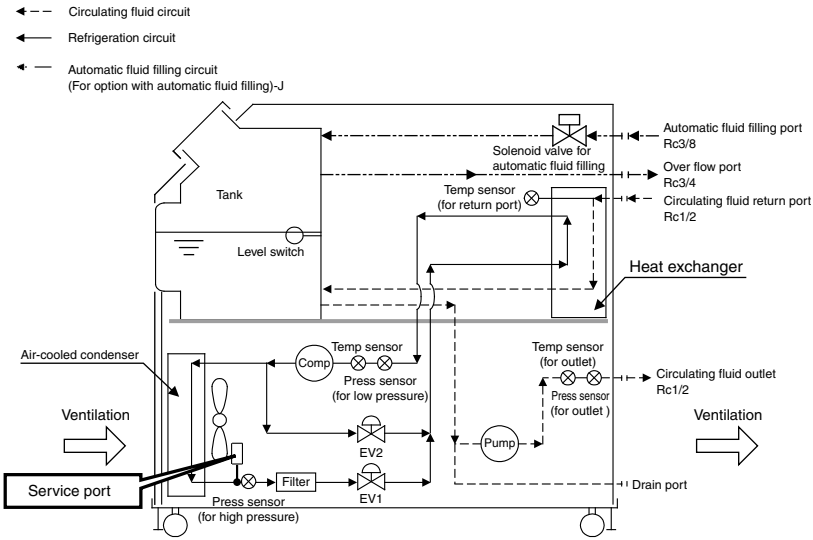
[Reference documents]


- Bosch Automotive Service Solutions Corp., Operation Manual for the RG3000J made by RoBINAIR
- Industrial Network for Fluorocarbon Recovery Promotion (INFREP), Fluorocarbon Recovery Guideline, March 25, 2009
- Ministry of the Environment, Ministry of Economy, Trade, and Industry, “Act on Rational Use and Proper Management of Fluorocarbons (Fluorocarbons Emission Control Law) – Guidelines for Operation Concerning Filling and Recovery Operators” (1st edition issued in March 2015)

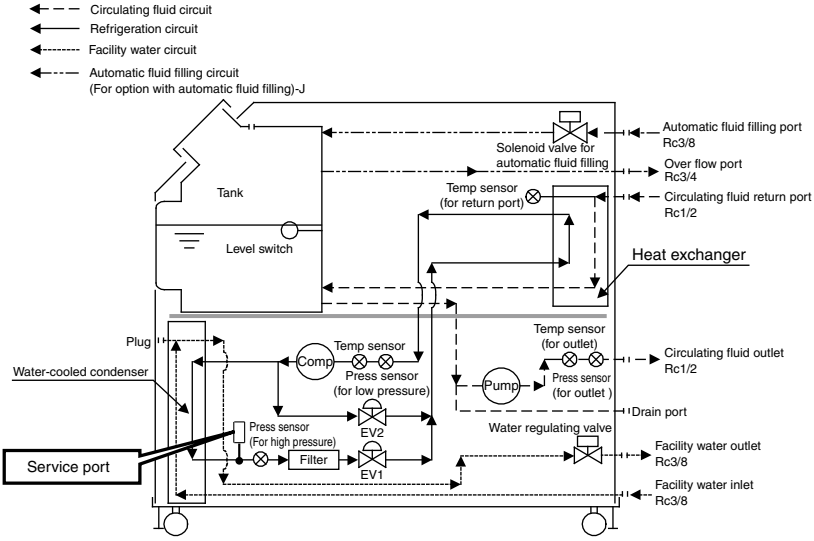
# 7 Replacement Procedure for Filling Coolant Gas

## Flow Chart

### HRS012-A□-□, HRS018-A□-□, HRS024-A□-20, HRS030-A□-20




### HRS012-W□-□, HRS018-W□-□, HRS024-W□-20, HRS030-W□-20



# Required tools

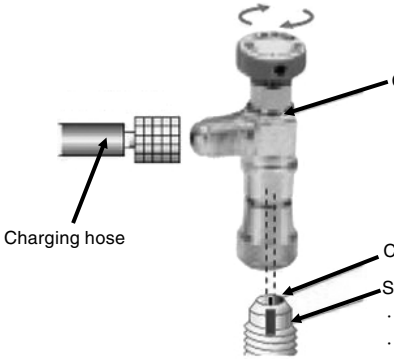
Some special tools are required in the procedure

## Charge valve (Example)

HRS chiller equips Schrader core valve at the service port.

When remove the charging hose from the Schrader core valve, you experienced to have not a little amount of refrigerant was evacuated from the system.

By using the charge valve, you can disconnect the charging hose with minimum refrigerant loss from the system. The size of the parts are varied depending on the model. Please use the charge valve with the service port to fit.




## Gauge Manifold for R407c/R410a and charging hose

High pressure gauge ··· –1 to 35 x 100 kPa (–1 to 35bar)
Low pressure gauge ···· –1 to 15 x 100 kPa (–1 to 15bar)
Charging hose (Red, Yellow) 0.92 m UNF7/16 (1/4 flare)

You cannot use a gauge manifold for R22

**Gauge manifold**

**Charging hose**

❗We cannot use another length charging hose.

## Weight scale

Min. Resolution ····· 2 g, 0.005 lbs. , 0.1 oz.
Accuracy ····· +/- 0.5%
Max. weight ····· 100 kg (220 Pounds)
[Example] Brand: AccuTools
Model#: DS-220R

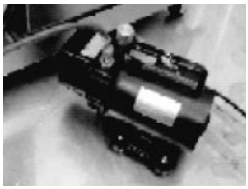
**Weight scale**

## Refrigerant gas cylinder

R407C/R410A

**Refrigerant gas cylinder**

## Vacuum pump



**Vacuum pump**

## Tools

| No.1 | Description | Q'ty | Note |
|---|---|---|---|
| 1 | Screwdriver | 1 | Phillips head screwdriver |
| 2 | Wrench | 2 | 100 mm |
| 3 | Protective glove | 1 | Rubber glove |

## Procedure

**⚠ WARNING**

**There is danger of an electric shock. Be sure to turn the power off before installation work.**
**There is danger of an electric shock and burn. Be careful enough not to be hurt during the work.**

**⚠ CAUTION**

**When mounting or removing the panel, be sure to wear protective gloves or shoes to prevent injuries from its sharp edges.**

### 1. Remove panel and install the charge valve

View after removal of the upper panel and the side paneler.

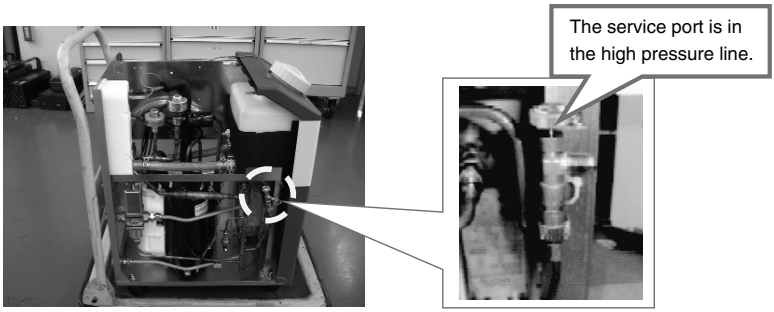
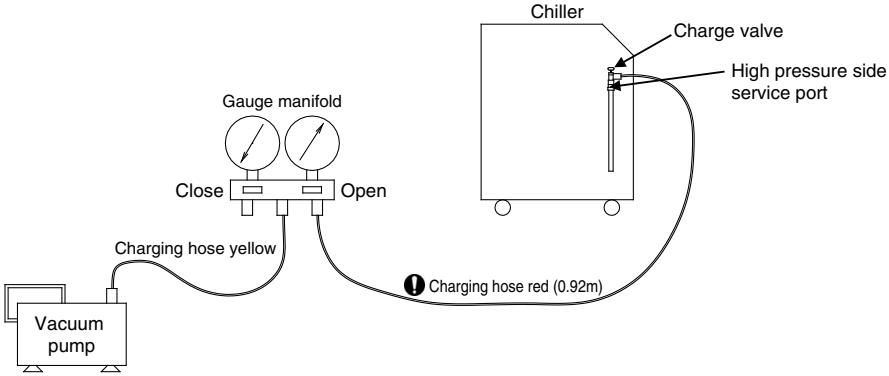



**Fig. 7-1**

### 2. Vacuum

The vacuum pumping has to be more than 30 minutes.

❗The charging hose (Red) shall be 0.92 M length



## 3. Charging

Setup the equipment as Fig. 7-2 for the refrigerant charging
Purge out the air from the charging hose

**⚠ CAUTION**

**Wear gloves to protect your hands from frostbite from the refrigerant gas.**

Charge the refrigerant carefully adjusting the valve opening on the gauge manifold so that you can control precise charge amount

**Hint: Close the valve on the gauge manifold when getting 1g before getting the desired charging amount.**

**After the charging operation, around 12g of the refrigerant will be existing in the 0.92m charging hose (Red hose in the Fig.7-2).**

**Table 7-1. The amount of refrigerant (HRS012/018/024/030)** Unit g

| Refrigerant gas | HRS012-A-10<br>HRS018-A-10 | HRS012-A-20<br>HRS018-A-20<br>HRS024-A-20 | HRS012-W-10<br>HRS018-W-10 | HRS012-W-20<br>HRS018-W-20<br>HRS024-W-20 | HRS030-A-20 | HRS030-W-20 |
|---|---|---|---|---|---|---|
| R407C | 320 ±5 | 350 ±5 | 255 ±5 | 300 ±5 | 565 ±15 | 495 ±15 |

**Table 7-2. The amount of refrigerant (HRS050/060)** Unit g

| Refrigerant gas | HRS050-A-20 | HRS050-W-20 | HRS060-A-20 | HRS060-W-20 |
|---|---|---|---|---|
| R410A | 655 ±15 | 655 ±15 | 845 ±15 | 735 ±15 |

You have to count 12 g of refrigerant that will remain in the 0.92 m charging hose
You have to add 12 g extra on above charging amount when you check the scale indication measuring the weight decrease of the refrigerant cylinder.

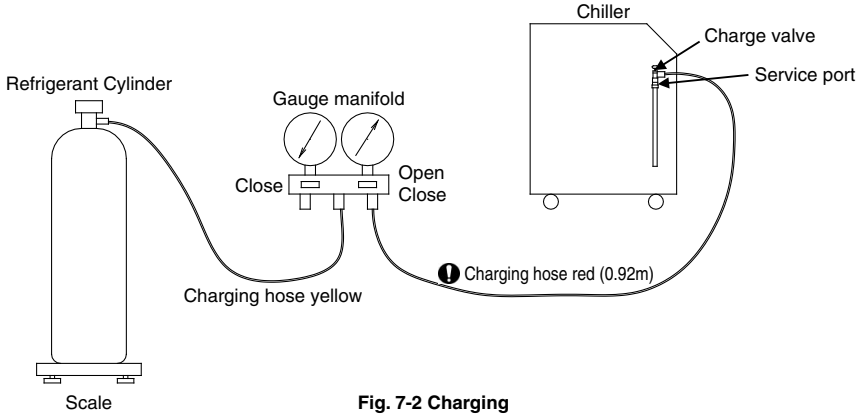



**Fig. 7-2 Charging**

**Hint: The service port is located in high pressure side of refrigeration system, so you cannot add refrigerant into the system during the chiller in operation,**

## Submission of Certificate for Fluorocarbon Filled

1. After the filling process, calculate the difference in the weight of the cylinder before and after the filling process to obtain the amount filled.
2. Enter the amount filled in the “Certificate for Fluorocarbon Filled,” and submit it to the manager (customer).

Form (Sample)

### Certificate for Fluorocarbon Filled

Certificate no.

| | | | | |
|---|---|---|---|---|
| Date of issue | Month Date Year | | | |
| Date of filling | Month Date Year | | | |
| Type of fluorocarbon filled | Type (R no.) | R– | GWP value | |
| Amount of fluorocarbon filled | Amount filled (kg) | | Amount filled with fluorocarbon recovered (kg) | |
| The timing at which the fluorocarbon was filled (Circle either item.) | Filled when maintenance of the equipment was performed | | Filled onsite when the new equipment was installed | |

| | | | | |
|---|---|---|---|---|
| Manager who ordered the maintenance (E.g. owner of equipment) | Address | | | |
| | Name | | | |
| Person in charge of control | Address | | | |
| | Name | | Department | |
| | TEL | | email | |
| Location of equipment into which fluorocarbon was filled | Address | | | |
| | Name of facility (E.g. name of building) | | | |
| Specific equipment information | Control no. | | | |
| | Model no. | | Product no. | |
| Fluorocarbon Filling and Recovery Operator | Address | | | |
| | Name | | | |
| | TEL | | Registration no. | |
| Filled by or witnessed by (E.g. Refrigerant Fluorocarbons Handling Engineer) | Name | | Qualified person no. | |

To managers of equipment
Note: Store this “Certificate for Fluorocarbon Filled” as it will be necessary to calculate the leakage amount.

[Reference document]

· Ministry of the Environment, Ministry of Economy, Trade, and Industry, “Act on Rational Use and Proper Management of Fluorocarbons (Fluorocarbons Emission Control Law) – Guidelines for Operation Concerning Filling and Recovery Operators” (1st edition issued in March 2015)

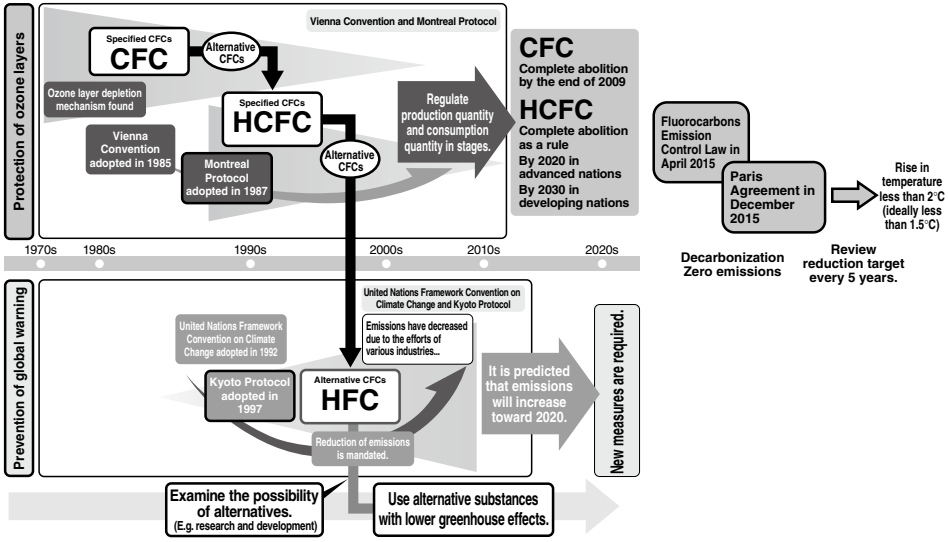
# 8 Fluorocarbons

## Types of Fluorocarbons and Regulations

| Name | Characteristics | Application |
|---|---|---|
| CFC / Chlorofluorocarbons | Ozone layer depleting substances including chlorine<br>Complete abolition [Note 1] was required by the Montreal Protocol.<br>Specified CFCs including R11, 12, 113, 114, and 115 | · Refrigerant: Refrigerators, car air conditioners<br>· Foaming agent<br>· Cleaning agent<br>· Aerosol (spray) |
| HCFC / Hydrochlorofluorocarbons | Alternative CFCs of specified CFCs<br>These are still ozone layer depleting substances including chlorine.<br>Complete abolition [Note 2] was required by the Montreal Protocol.<br>R22, 123, 141b, 142b, 225, etc. | · Refrigerant: Refrigerators, room air conditioners, packaged air conditioners, air dryers, chillers, etc.<br>· Foaming agent<br>· Cleaning agent |
| HFC / Hydrofluorocarbons | Alternative CFCs of specified CFCs<br>Although these do not include chlorine, and thus do not deplete ozone layers, these are called greenhouse gases because their global warming potential (GWP) is approximately hundreds to four thousand times that of carbon dioxide.<br>These are listed in the substances targeted for reduction specified by the Kyoto Protocol [Note 3].<br>R32, R134a, 404A, 407C, 410A, etc. | · Refrigerant: Refrigerators, room air conditioners, packaged air conditioners, air dryers, thermo-chillers, etc.<br>· Foaming agent<br>· Cleaning agent<br>· Aerosol (spray) |
| HFO / Hydrofluoroolefins | Substances having low GWP and less impact on global warming<br>However, there are few examples of these substances being used in refrigeration equipment because of their combustion characteristics.<br>R1234yf, 1234ze, etc. | · Refrigerant: Car air conditioners<br>· Foaming agent<br>· Cleaning agent |
| Natural refrigerant / Refrigerants other than fluorocarbons | Substances used as refrigerant during the initial stages of refrigeration equipment development<br>Ammonia ($NH_3$, GWP0), which is hazardous if it leaks during handling, carbon dioxide ($CO_2$, GWP1), water ($H_2O$), hydrocarbons (HC) such as propane, air, etc. | · Refrigerant: Refrigerators of some manufacturers and commercial refrigerators<br>· Foaming agent<br>· Cleaning agent<br>· Aerosol (spray)<br>· Dry-cleaning (solvent) |

Note 1) They have already been abolished completely in advanced nations. They were abolished at the end of 2009 in developing nations.
Note 2) They will be abolished completely by 2020 in advanced nations, and by 2030 in developing nations.
Note 3) Concerning Japan's $CO_2$ reduction target, Japan was able to successfully reduce emissions by 8.4%, achieving their target (reduction by 6% compared to 1990) of the first commitment period (2008 to 2012).
For the target (reduction by 25% compared to 1990) of the second commitment period (2013 to 2020), Japan declared non-participation due to the Great East Japan Earthquake.
For more information, refer to the website of the Ministry of Economy, Trade, and Industry and the Ministry of the Environment.

## Reduction Plan in Accordance with the Montreal Protocol, Kyoto Protocol, and Paris Agreement




Excerpt: Ministry of the Environment and Ministry of Economy, Trade, and Industry, "Overview of the Fluorocarbons Emission Control Law - Required Efforts based on the Revised Law" (January 2015)

# The "Act on Rational Use and Proper Management of Fluorocarbons" (the "Fluorocarbons Emission Control Law") was put into force in April 2015.

To protect the ozone layer and prevent global warming, owners (or managers) of chillers are obliged to control the emission of fluorocarbons (CFC, HCFC, HFC).
In response to this, measures that must be implemented by customers are described below.
We ask customers to implement these measures appropriately.

## Obligation concerning the installation of equipment

Check!

### ■Install equipment in an appropriate location.

**To prevent damage to the equipment, install the equipment in an appropriate location and maintain the installation environment.**

* Do not install a source of vibration near the equipment. Provide sufficient space for inspection and repair. Clean around the equipment.

## Obligations concerning the use of equipment

Inspect!

### ■Implement equipment inspection.

**Implement the simple inspection of all pieces of equipment. For equipment larger than the specified size, implement periodic inspection by an expert.**

* To fulfill the obligation, consider making a list of equipment owned or to be managed, establishing an inspection system and creating a schedule.

Repair!

### ■Implement leak prevention measures and prohibit the filling of unrepaired equipment with refrigerant*.

**Repair the equipment when a leak of fluorocarbon is found.**
**Filling unrepaired equipment with fluorocarbon is prohibited as a rule.**

* The filling of fluorocarbons must be entrusted to a Class I Fluorocarbon Filling and Recovery Operator registered in the relevant prefecture.

Record!

### ■Store inspection history.

**Concerning the equipment inspection and maintenance history, keep records for each piece of equipment, and store these records until the equipment is disposed of.**

Calculate! Report!

### ■Calculate and report the fluorocarbon leakage amount.

**Calculate the leakage amount upon receipt of the "Certificate for Fluorocarbon Filled/Recovered" issued by the Class I Fluorocarbon Filling and Recovery Operator. If the leakage amount is more than the specified level, this must be reported to the nation every fiscal year.**

* The leakage amount reported is officially announced with the name of the company.
* To fulfill the obligation, consider establishing a system of tallying the amount filled and amount recovered and creating a schedule.

## Obligation concerning the disposal of equipment

Recover!

### ■Thoroughly recover fluorocarbons* when disposing of equipment.

**Entrust the recovery of unnecessary fluorocarbons, issue the "Request for Recovery" or the "Confirmation of Entrustment," and bear the cost of the recovery, recycling, and destruction of the fluorocarbons.**

* The recovery of fluorocarbons must be entrusted to a Class I Fluorocarbon Filling and Recovery Operator registered in the relevant prefecture.

## ∗1 Implement equipment inspection.

**The two types of equipment inspection based on the "Fluorocarbons Emission Control Law" are as follows:**

- **Simple inspection intended for all commercial air conditioners, freezing equipment, and refrigeration equipment (Visual checks of product appearance, etc.)**
- **Periodic inspection intended for commercial air conditioners, freezing equipment, and refrigeration equipment larger than the specified size (Inspection conducted by an expert)**

The table below summarizes the products subject to periodic inspection and the inspection frequency based on the laws.

**For refrigerated air dryers and refrigerated thermo-chillers (including coolers) ∗ Excerpted from website**

| | Inspection frequency | Compressor output | Refrigerated air dryer | Refrigerated thermo-chiller (Production of the underlined series has been terminated.) | |
|---|---|---|---|---|---|
| **Simple inspection** | At least once every 3 months | Less than 7.5 [kW] | All<br>IDF□ series<br>IDU series<br>IDH series<br>INOD series | All<br>HRZ□ series<br>HRS□ series<br>INR-496 series<br>INR-497 series<br>INR-499 series | INR-242-12□<br>HRG□ series<br>INR-242 series<br>INR-338 series<br>INR-341 series<br>INR-57□ series |
| **Periodical inspection** | At least once every year | 7.5 [kW] or more | IDF370B<br>IDF370D<br>only | HRZ008-L<br>HRZ008-L1<br>only | |

## ∗2 Store inspection history.

Carefully read the instructions below, and be sure to store the "Refrigerant Leakage Inspection and Maintenance Record" (refer to page 453).

[Instructions for filling out the Refrigerant Leakage Inspection and Maintenance Record]

① Visit the website of the Japan Association of Refrigeration and Air Conditioning Contractors (http://www.jarac.or.jp/kirokubo/), and download the "Refrigerant Leakage Inspection and Maintenance Record" (normal version of Excel macro execution type) in compliance with the "Fluorocarbons Emission Control Law". Prepare a record for each thermo-chiller and store it in an appropriate location. Ensure that the name of the manager has been entered.
② Use one of the specialized companies (a Class I Fluorocarbon Filling and Recovery Operator) tied up with SMC, wherever possible.
Only an expert qualified as a Class I or Class II Fluorocarbons Handling Engineer may implement inspection.
③ For the refrigerant to be used, total initial amount filled, and initial amount filled at production, copy the refrigerant type and the amount filled provided on the nameplate on the rear of the thermo-chiller or in the catalog. Enter "Less than 7.5 kW" for the compressor output and "0.00 kg" for the additional amount filled at installation.
④ Conduct a simple inspection of all thermo-chillers at least once every three months, and record the results. Conduct a comprehensive inspection along with the "Daily Check Sheet" (indirect method) provided in the Operation Manual.
⑤ Inspection can be undertaken by one of the specialized companies tied up with SMC in place of the customer.
⑥ If any repairs are made, record the amount recovered, amount filled, and repair details.
⑦ Continue to conduct inspections and record the results according to the specified frequency.

① **Refrigerant Leakage Inspection and Maintenance Record** April 11, 2009 to June 30, 2017 — Control no. — Supplement

| | | | | | | |
|---|---|---|---|---|---|---|
| Manager of equipment | Name | Fluorocarbon Co., Ltd. | | | Equipment manufacturer | XYZ Refrigerator Co., Ltd. |
| | Address | 3-4-5 ○○, ○○City, ○○Prefecture, JAPAN 123-4567 | System | A-1 | Date of installation | April 11, 2009 |
| Location of equipment | Name of facility | XXX Supermarket, XX Shop | TEL | 01-234-5678 | Equipment used | Type: Thermo-chiller; Model: HRS018-A-20 |
| | Address | 9-87 ○○, ○○City, ○○Prefecture, JAPAN 321-9876 | TEL | 01-222-3333 | | Mfg. code: NP001; Application: For cooling |
| Person responsible for operation and control | | Taro Kankyo | TEL | 01-222-3333 | | Rated output of compressor motor: Less than 7.5 kW |

② Name and address of company inspected etc.

| | | | |
|---|---|---|---|
| SD Maintenance Co., Ltd. | 12-32 ○○, ○○City, ○○Prefecture, JAPAN xxx-xxxx | TEL | ○○○-○○○-○○○○ |
| XYZ Co., Ltd. | 2321 ○○, ○○City, ○○Prefecture, JAPAN xxx-xxxx | TEL | ○○○-○○○-○○○○ |
| | | TEL | |

Refrigerant amount

| Total amount filled | Total amount recovered | Total amount emitted | CO2-t |
|---|---|---|---|
| 0.72 | 0.36 | 0.00 | 0.0000 |

Refrigerant used: R407C — Total initial amount filled (kg): 0.36

| GWP value of main refrigerant | R11 | R12 | R32 | R134a | R22 | R123 | R245fa | R502 | R404A | R407A | R407C | R410A | R410B | R152a | R142b | R507A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 4750 | 10900 | 675 | 1430 | 1810 | 77 | 1030 | 4660 | 3920 | 2110 | 1770 | 2090 | 2230 | 124 | 2310 | 3990 |

③

| Date | Inspection/ Maintenance | Amount filled (kg) | Use of FC recovered (kg) | Amount recovered (kg) | Inspection method | Inspection result | Cause of leakage/ failure | Location of leakage/ failure | Repair contents (including planned repair) | Name of company (inspection, repair, recovery, filling) | Name of engineer | Engineer no. | Reason for difficulties of repair | Date of planned repair |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02/2009(NP001) | Initial amount filled at production | 0.36 | | | | | | | | | | | | |
| 04/11/2009 | Additional amount filled at installation | 0.00 | | | | | | | | — | — | — | | |
| MM/DD/2015 | Simple inspection | 0.00 | 0.00 | 0.00 | Indirect | None | — | — | — | — | — | — | — | — |
| ④ MM/DD/2015 | Simple inspection | 0.00 | 0.00 | 0.00 | Indirect | None | — | — | — | — | — | — | — | — |
| MM/DD/2015 | Simple inspection | 0.00 | 0.00 | 0.00 | Indirect | None | — | — | — | — | — | — | — | — |
| ⑤ MM/DD/2015 | Simple inspection | 0.00 | 0.00 | 0.00 | Indirect, Direct | None | — | — | — | XYZ Co., Ltd. | ○○○○ | No. 2-xx-xxx | — | — |
| MM/DD/2016 | Simple inspection | 0.00 | 0.00 | 0.00 | Indirect | | — | — | — | — | — | — | — | — |
| ⑥ MM/DD/2016 | Inspection after maintenance (repair) | 0.36 | 0.00 | 0.36 | Indirect, Direct | None | — | — | Replacement of heat exchanger | XYZ Co., Ltd. | ○○○○ | No. 2-xx-xxx | — | — |
| MM/DD/2016 | Simple inspection | 0.00 | 0.00 | 0.00 | Indirect | None | — | — | — | — | — | — | — | — |
| MM/DD/2016 | Simple inspection | 0.00 | 0.00 | 0.00 | Indirect | None | — | — | — | — | — | — | — | — |
| ⑦ MM/DD/2016 | Simple inspection | 0.00 | 0.00 | 0.00 | Indirect | None | — | — | — | — | — | — | — | — |
| MM/DD/2016 | Simple inspection | 0.00 | 0.00 | 0.00 | Indirect | None | — | — | — | — | — | — | — | — |
| MM/DD/2016 | Simple inspection | 0.00 | 0.00 | 0.00 | Indirect | None | — | — | — | — | — | — | — | — |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Total | | 0.72 | 0.00 | 0.36 | | | | | | | | | | |

## SMC Thermo-chiller Daily Check Sheet

**For information about how to perform daily checks of the thermo-chiller, refer to section "8.21 Daily Check" in the "Operation Manual".**
**Check and record the condition at startup right after setting up.**

**Model no.** _____
**Mfg. code** _____

| Date | Performed by | Setting up conditions: Temperature °C | Setting up conditions: Humidity % | Fluid leakage: Present/ Not present | Fluid amount: Inside/Outside of liquid level indicator range: Inside/Outside | Operation panel: Display | Operation panel: Operation | Circulating fluid temperature °C | Operation conditions: Presence of error Present/Not present | Facility water (Water-cooled only): Temperature °C | Flow rate L/min | Supply pressure MPa | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Initial value (Default setting) | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

## ∗3 Calculate and report the fluorocarbon leakage amount.

**It is necessary to calculate the leakage amount (each business operator, each business place) using the formula below based on the "Certificate for Fluorocarbon Filled/Recovered" issued by the Class I Fluorocarbon Filling and Recovery Operator.**

**Fluorocarbon leakage amount calculated ($CO_2$-t)**
**= (Amount filled (kg) – Amount recovered at maintenance of equipment (kg)) x Global warming potential/1,000**

If the leakage amount calculated every fiscal year exceeds 1,000 $CO_2$-t, it must be reported to the nation (government agency in charge of business) by the end of July of the next fiscal year.

**A penalty is imposed on companies that violate the obligation required by the "Fluorocarbons Emission Control Law" as below.**

- ○Discharge of fluorocarbons without good reason ····**Imprisonment for up to 1 year or fine of up to 500,000 yen**
- ○Violation of the municipal or prefectural governor's orders concerning the obligations related to the use or disposal of equipment ·····**Fine of up to 500,000 yen**
- ○Non-report or false report of leakage amount calculated··**Administrative penalty of up to 100,000 yen**

**If you need further information regarding the management of equipment, the recovery of fluorocarbons, etc., contact the manufacturer of the air conditioner, freezing equipment, or refrigeration equipment, or the maintenance agency, prefectural government, Ministry of the Environment, Ministry of Economy, Trade, and Industry, or visit the website shown below.**

**Ministry of the Environment,**
Global Environment Bureau, Climate Change Policy Division, Office of Fluorocarbons Control Policy
1-4-2, Kasumigaseki, Chiyoda-ku, Tokyo 100-0013
[TEL] 03-3581-3351 (Main number)
[URL] http://www.env.go.jp/seisaku/list/ozone.html

**Ministry of Economy, Trade, and Industry,**
Manufacturing Industries Bureau, Chemical Management Policy Division, Fluoride Gases Management Office
1-3-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8901
[TEL] 03-3501-1511 (Main number)
[URL] http://www.meti.go.jp/policy/chemical_management/ozone/index.html

∗ The list of contacts of prefectural bureaus in charge of the Fluorocarbons Emission Control Law is provided on the website of the Ministry of the Environment.

[Excerpt]
Ministry of the Environment, the "Act on Rational Use and Proper Management of Fluorocarbons" (the "Fluorocarbons Emission Control Law") was put into effect in April 2015.

# Importing restrictions on Hydrofluorocarbons (HFCs) into the European Union (EU).

Did you know that?

## EU F-Gas Regulation (517/2014)

**Refrigeration equipment using HFC refrigerant imported into the EU from January 2017, such as refrigerated Thermo-chillers and Air dryers, is subject to this regulation.**

## HFCs imported into the EU must be from the EU Quota system.

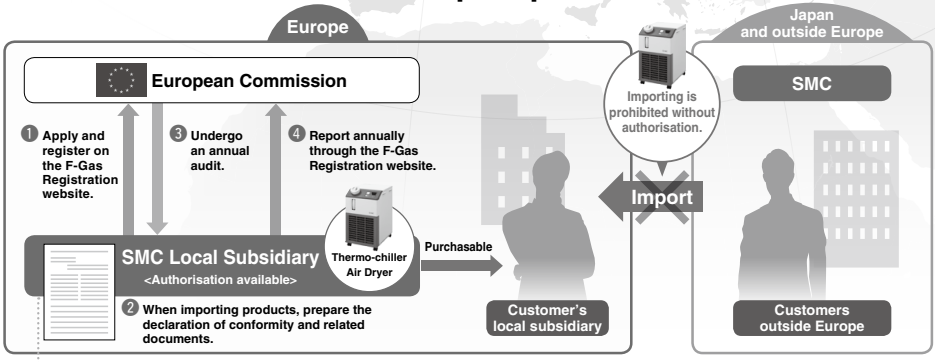
- It shall apply to producers or importers of 100 tonnes and more **$CO_2$ equivalent*** of hydrofluorocarbons per year.
- European Commission annually allocates 'Quotas' to manufacturers and importers of HFC refrigerants.
- Quota holders can give 'authorisation' to refrigeration equipment importers to use a specified amount of quota held by the quota holder.

* **$CO_2$ equivalent** is calculated by multiplying the global warming potential (GWP) with the amount of HFC refrigerants.
100 tonnes
Ex.: equivalent to 156 of Thermo-chiller (HRS024-A-20).

SMC Europe

## holds 'Authorisation' for import.

**Purchasing products from our local subsidiaries eliminates complex procedures.**



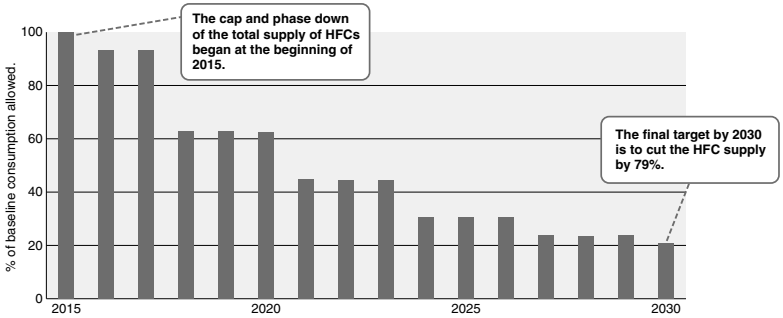

**List of local subsidiaries of SMC Europe (with import quota licenses available)**

| | | | |
|---|---|---|---|
| **Ireland** | SMC Pneumatics (Ireland) Ltd. | **Spain/Portugal** | SMC España SA |
| **U.K.** | SMC Pneumatics (U.K.) Ltd. | **Denmark** | SMC DANMARK A/S |
| **Italy/Greece** | SMC Italia S.p.A. | **Germany** | SMC Deutschland GmbH |
| **Austria** | SMC Pneumatik GmbH (Austria) | **Finland** | SMC Automation Oy |
| **Netherlands** | SMC Nederland BV | **France** | SMC France |
| **Sweden** | SMC Automation AB | **Belgium** | SMC Belgium NV/SA |

* For more information, refer to page 456.

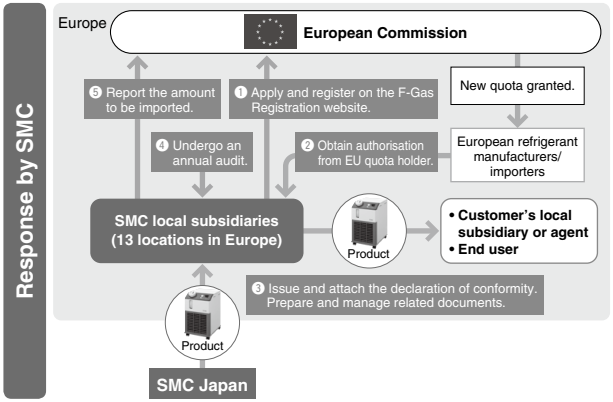
# EU F-Gas Regulation (517/2014)

**The European Union aims to reduce the environmental impact of HFCs via regulation. The EU commission released the new F-gas regulation. One of the key changes is implementing a phase down of the quantity of HFC that can be placed in the market by producers and importers between 2015 and 2030.**




**Effect of the EU F-Gas Regulation**

From January 2017, importers who intend to import refrigeration equipment into the EU must first register on the European Commission 'HFC register' and obtain authorisation from an EU quota holder. This is mandatory.




**SMC performs the following tasks when importing refrigeration equipment:**

1. **Applies and registers on the F-Gas Registration website**
2. **Obtain authorisations from quota holders to import refrigeration equipment in the EU.**
3. **When importing refrigeration equipment, prepares the declaration of conformity and related documents.**
4. **Annual audit.**
5. **Reports annually through the F-Gas Registration website**

∗ SMC does not provide authorisation.

**Customer management of the F-Gas regulation∗:**

Each importer (customers local subsidiary / agent or end user) who receives the refrigeration equipment directly, must perform the above five tasks in Europe.

∗ This information is based on SMC's own investigation. It is recommended that customers conduct their own investigation into the European F-Gas Regulation 517/2014 and take appropriate actions at their discretion.

**⚠ Safety Instructions** Be sure to read the "Handling Precautions for SMC Products" (M-E03-3) and "Operation Manual" before use.

## Handling of Thermo-chillers That Have Become Unnecessary

**As SMC is not registered as a specialized handling operator based on the "Fluorocarbons Emission Control Law" and the "Industrial Waste Disposal Law," we are not permitted to collect and dispose of thermo-chillers that users no longer require. If you are requested by users to collect such thermo-chillers, take action as described below.**

**<Response to users>**
Explain to users that SMC is not permitted to collect unnecessary thermo-chillers (industrial waste) as we are not a Class I Fluorocarbon Filling and Recovery Operator, and then take either action described below.

**Response 1**: Introduce a maintenance agency qualified to conduct disposal.
**Response 2**: Ask users to directly request an operator registered with the local government. (A list of registered operators can be found on the website of the relevant prefectural government or municipality.)

### Filling and recovery of fluorocarbons and collection and transfer of industrial waste

**1. Recovery of fluorocarbons**

Equipment containing fluorocarbons must be disposed of by a Class I Fluorocarbon Filling and Recovery Operator based on the "Fluorocarbons Emission Control Law."
<Reference>
Fluorocarbon Filling and Recovery Operators can implement the recovery process only in the prefecture where they are registered.
E.g.) An operator registered in Hiroshima Prefecture can only recover fluorocarbons in Hiroshima Prefecture and bring them to a Fluorocarbon Destruction Operator in Hiroshima Prefecture. In the case where the fluorocarbons are recovered in Hiroshima Prefecture and then brought to a Fluorocarbon Destruction Operator in Yamaguchi Prefecture, this Fluorocarbon Filling and Recovery Operator must be registered in both Hiroshima and Yamaguchi Prefectures.

**2. Disposal of industrial waste**

After fluorocarbons are recovered from thermo-chillers, these chillers are handled as industrial waste. Based on the "Industrial Waste Disposal Law," disposal of industrial waste must be entrusted to an Industrial Waste Collection and Transfer Operator registered with the local government.
<Reference>
Industrial Waste Collection and Transfer Operators must be registered in the location where they perform loading and unloading.
E.g.) If an operator loads the industrial waste in Kanagawa Prefecture and unloads it in Fukushima Prefecture, they must be registered in both of these prefectures.

### Precautions when SMC collects and inspects a product

When a product is collected from the user to inspect alarm causes and it is determined that repair is not possible, you may be asked by the user to dispose of the product instead of returning it to them. However, SMC is not permitted to perform disposal due to the abovementioned "Fluorocarbons Emission Control Law" and the "Industrial Waste Disposal Law."
When you are requested to collect and inspect a product, be sure to explain before collection that the product will be returned to the user even if it turns out to be irreparable.

# 9 Earthquake Resistance Strength Calculation: Selection of Anchor Bolts

This chapter describes how to select the anchor bolts that need to be prepared to prevent the product from falling in the case of an earthquake.

For customers, please provide the calculated values in this chapter when you make a request for the installation of a product to a company specializing in construction, foundation concrete placement, or installation work.

For companies specializing in construction, foundation concrete placement, or installation work, please check the calculated values in this chapter when you have received a request for product installation from a customer.

**⚠ CAUTION**

**This chapter provides earthquake-proof calculations to cope with earthquakes of an anticipated side. These calculations do not guarantee resistance for earthquakes beyond anticipation. We ask for your understanding.**

**⚠ CAUTION**

**Calculation results vary greatly depending on the installation location (penthouse, roof floor, higher floors, middle floors, ground floor, or basement), horizontal seismic intensity for design, equipment weight, center of gravity position, or the interval, quantity, size or embedded length of the anchor bolts. Refer to "Seismic Design and Construction Guideline for Building Equipment" (2014 Edition) issued by The Building Center of Japan.**

## Installation Location and Anticipated Seismic Force

**1) HRS012/018-A/W-10**

| Item | | | | Model | HRS012/018 -A-10 | HRS012/018 -W-10 |
|---|---|---|---|---|---|---|
| Thermo-chiller | Dry mass | | | [kg] | 45 | |
| | Tank capacity | | | [L] | 5 | |
| | Other capacity (Piping, etc.) | | | [L] | 2 | |
| | Fluid | | | | Tap water | |
| | Fluid density | | | [kg/L] | 1 | |
| | Operating mass | | m | [kg] | 52 | |
| | Center of gravity | Height | h | [cm] | 25 | |
| | | From the left | | [cm] | 19 | 20 |
| | | From the front | | [cm] | 28 | |
| | | From the closest anchor bolt | Lg | [cm] | 11.85 | 10.85 |
| Installation location | Seismic zoning factor | | Z | [–] | 1.0 | |
| | Standard seismic intensity for design | | Ks | [–] | 2.0 | |
| | Horizontal seismic intensity for design | | Z·Ks | [–] | 2.0 | |
| | Vertical seismic intensity for design | | Z·Ks/2 | [–] | 1.0 | |
| Anticipated seismic force | Horizontal direction | | $F_H = m \cdot Z \cdot Ks$ | [N] | 1020 | |
| | Vertical direction | | $F_V = m \cdot Z \cdot Ks/2$ | [N] | 510 | |

**2) HRS012/018/024-A/W-20**

| Item | | | | | Model | HRS012/018/024 -A-20 | HRS012/018/024 -W-20 |
|---|---|---|---|---|---|---|---|
| Thermo-chiller | Dry mass | | | | [kg] | 48 | |
| | Tank capacity | | | | [L] | 5 | |
| | Other capacity (Piping, etc.) | | | | [L] | 2 | |
| | Fluid | | | | | Tap water | |
| | Fluid density | | | | [kg/L] | 1 | |
| | Operating mass | | | m | [kg] | 55 | |
| | Center of gravity | Height | | h | [cm] | 26 | |
| | | From the left | | | [cm] | 18 | 19 |
| | | From the front | | | [cm] | 28 | |
| | | From the closest anchor bolt | | Lg | [cm] | 11.15 | 11.85 |
| Installation location | Seismic zoning factor | | | Z | [–] | 1.0 | |
| | Standard seismic intensity for design | | | Ks | [–] | 2.0 | |
| | Horizontal seismic intensity for design | | | Z·Ks | [–] | 2.0 | |
| | Vertical seismic intensity for design | | | Z·Ks/2 | [–] | 1.0 | |
| Anticipated seismic force | Horizontal direction | | | $F_H = m \cdot Z \cdot Ks$ | [N] | 1079 | |
| | Vertical direction | | | $F_V = m \cdot Z \cdot Ks/2$ | [N] | 539 | |

**3) HRS050/060-A/W-20**

| Item | | | | | Model | HRS050/060 -A-20 | HRS050/060 -W-20 |
|---|---|---|---|---|---|---|---|
| Thermo-chiller | Dry mass | | | | [kg] | 69 | 67 |
| | Tank capacity | | | | [L] | 5 | |
| | Other capacity (Piping, etc.) | | | | [L] | 3 | |
| | Fluid | | | | | Tap water | |
| | Fluid density | | | | [kg/L] | 1 | |
| | Operating mass | | | m | [kg] | 77 | 75 |
| | Center of gravity | Height | | h | [cm] | 48.8 | |
| | | From the left | | | [cm] | 18.85 | |
| | | From the front | | | [cm] | 296 | |
| | | From the closest anchor bolt | | Lg | [cm] | 12 | |
| Installation location | Seismic zoning factor | | | Z | [–] | 1.0 | |
| | Standard seismic intensity for design | | | Ks | [–] | 2.0 | |
| | Horizontal seismic intensity for design | | | Z·Ks | [–] | 2.0 | |
| | Vertical seismic intensity for design | | | Z·Ks/2 | [–] | 1.0 | |
| Anticipated seismic force | Horizontal direction | | | $F_H = m \cdot Z \cdot Ks$ | [N] | 1510 | 1471 |
| | Vertical direction | | | $F_V = m \cdot Z \cdot Ks/2$ | [N] | 755 | 735 |

## Anchor Bolt (M8), Anti-quake Bracket (HRS-TK001/002) Specifications

| Item | | | | Specifications |
|---|---|---|---|---|
| Anchor bolt | Nominal | | | M8 |
| | Total quantity | $n$ | [pcs.] | 4 |
| | Quantity per side | $n_t$ | [pcs.] | 2 |
| | Effective area (For coarse bolts) | $A_n$ | [mm²] | 36.6 |
| | Material | | – | SS400 |
| | Tensile strength | | [MPa] (N/mm²) | 400 to 510 |
| | Yield point or proof stress | | [MPa] (N/mm²) | 235 or more |
| Anti-quake bracket (Optional accessory) | Part no. | | | HRS-TK001/002 |
| | Anchor bolt through-hole pitch | Short side L | [cm] | 24 |
| | | Long side | [cm] | Refer to the Web Catalog. |
| Construction method | Embedded length | | [mm] | 40 |
| | Foundation strength (Concrete) | | [MPa] (N/mm²) | 18 or more |

## Force Acting on Anchor Bolts

**1) HRS012/018-A/W-10**

| Item | | Model | | HRS012/018 -A-10 | HRS012/018 -W-10 |
|---|---|---|---|---|---|
| Overturning moment (Seismic force in horizontal direction) | | $M_H = F_H \cdot h$ | [N·m] | 255 | |
| Vertical moment (Seismic force in vertical direction) | | $M_V = F_V \cdot Lg$ | [N·m] | 60.4 | 55.3 |
| Resisting moment (Dead weight of thermo-chiller) | | $M_m = 9.8 \cdot m \cdot Lg$ | [N·m] | 60.4 | 55.3 |
| Force acting on anchor bolts | Pull-out force | $Rb = (M_H + M_V - M_m)/(L \cdot n_t)$ | [N/pc.] | 531 | 531 |
| | | Short-term allowance (Refer to page 462.) | [N/pc.] | 3,000 | |
| | Tensile stress | $\sigma = Rb/A_n$ | [MPa/pc.] | 14.51 | 14.51 |
| | | Short-term allowance [= Yield point or proof stress] | [MPa/pc.] | 235 | |
| | Shearing stress | $\tau = F_H/(n \cdot A_n)$ | [MPa/pc.] | 6.97 | |
| | | Short-term allowance [= Yield point or proof stress/√3] | [MPa/pc.] | 136 | |

**2) HRS012/018/024-A/W-20**

| Item | | | | Model | HRS012/018/024 -A-20 | HRS012/018/024 -W-20 |
|---|---|---|---|---|---|---|
| Overturning moment (Seismic force in horizontal direction) | | $M_H = F_H \cdot h$ | [N·m] | | 280 | |
| Vertical moment (Seismic force in vertical direction) | | $M_V = F_V \cdot Lg$ | [N·m] | | 60.1 | 63.9 |
| Resisting moment (Dead weight of thermo-chiller) | | $M_m = 9.8 \cdot m \cdot Lg$ | [N·m] | | 60.1 | 63.9 |
| Force acting on anchor bolts | Pull-out force | $Rb = (M_H + M_V - M_m)/(L \cdot n_t)$ | [N/pc.] | | 584 | 584 |
| | | Short-term allowance (Refer to page 462.) | [N/pc.] | | 3,000 | |
| | Tensile stress | $\sigma = Rb/A_n$ | [MPa/pc.] | | 15.96 | 15.96 |
| | | Short-term allowance [= Yield point or proof stress] | [MPa/pc.] | | 235 | |
| | Shearing stress | $\tau = F_H/(n \cdot A_n)$ | [MPa/pc.] | | 7.37 | |
| | | Short-term allowance [= Yield point or proof stress/$\sqrt{3}$] | [MPa/pc.] | | 136 | |

**3) HRS050/060-A/W-20**

| Item | | | | Model | HRS050/060 -A-20 | HRS050/060 -W-20 |
|---|---|---|---|---|---|---|
| Overturning moment (Seismic force in horizontal direction) | | $M_H = F_H \cdot h$ | [N·m] | | 737 | 718 |
| Vertical moment (Seismic force in vertical direction) | | $M_V = F_V \cdot Lg$ | [N·m] | | 90.6 | 88.3 |
| Resisting moment (Dead weight of thermo-chiller) | | $M_m = 9.8 \cdot m \cdot Lg$ | [N·m] | | 90.6 | 88.3 |
| Force acting on anchor bolts | Pull-out force | $Rb = (M_H + M_V - M_m)/(L \cdot n_t)$ | [N/pc.] | | 1,535 | 1,496 |
| | | Short-term allowance (Refer to page 462.) | [N/pc.] | | 3,000 | |
| | Tensile stress | $\sigma = Rb/A_n$ | [MPa/pc.] | | 42.0 | 40.9 |
| | | Short-term allowance [= Yield point or proof stress] | [MPa/pc.] | | 235 | |
| | Shearing stress | $\tau = F_H/(n \cdot A_n)$ | [MPa/pc.] | | 10.3 | 10.0 |
| | | Short-term allowance [= Yield point or proof stress/$\sqrt{3}$] | [MPa/pc.] | | 136 | |

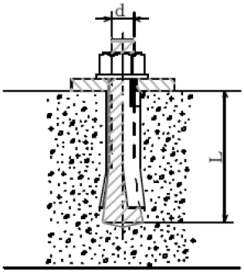
## Result of Anchor Bolt Selection (Result of Earthquake Resistance Strength Calculation)

If an anchor bolt with a sufficient pull-out load, compared to the pull-out force acting on the anchor bolt shown in the above calculation sheets, is selected, the size of the anchor bolt will be larger than the extension type shown below. Check with the bolt manufacturer for details.

Anchor bolts will differ depending on the installation location at the customers' premises and the strength of the floor or foundation concrete.

Regarding these points, consult with the company specializing in construction, foundation concrete placement, or installation work with which you request installation.

**Post-installed male thread type mechanical anchor bolt**




Extension type

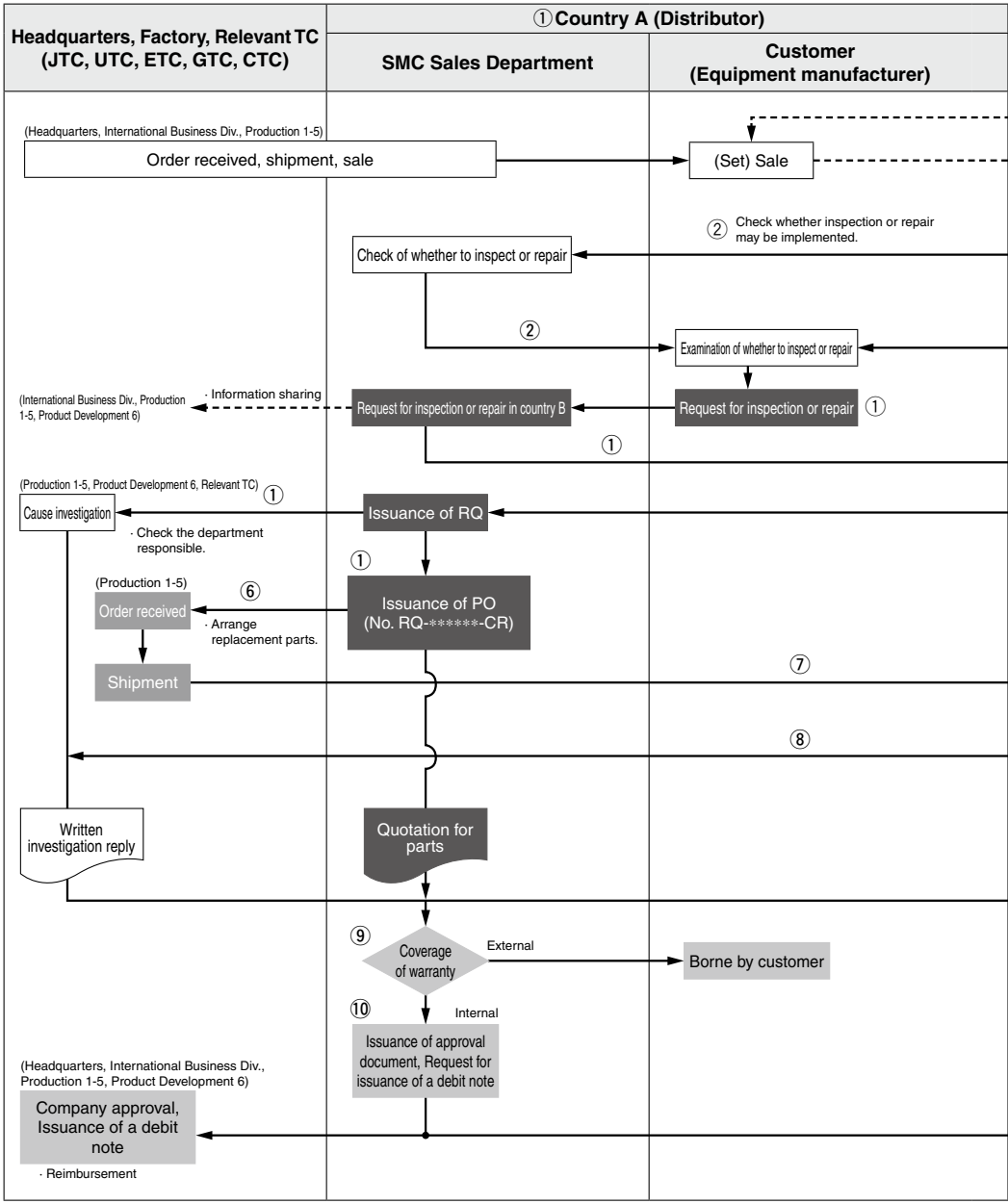
**Short-term allowable pull-out load (kgf)**

| Bolt size d (Nominal) | Concrete thickness (mm) | | | | Embedded length L (mm) |
|---|---|---|---|---|---|
| | 120 | 150 | 180 | 200 | |
| M8 | 300 | 300 | 300 | 300 | 40 |
| M10 | 380 | 380 | 380 | 380 | 45 |
| M12 | 670 | 670 | 670 | 670 | 60 |
| M16 | 920 | 920 | 920 | 920 | 70 |
| M20 | 1,200 | 1,200 | 1,200 | 1,200 | 90 |
| M24 | 1,200 | 1,200 | 1,200 | 1,200 | 100 |
| Limit of embedded length of bolt (L) | 100 or less | 120 or less | 160 or less | 180 or less | |

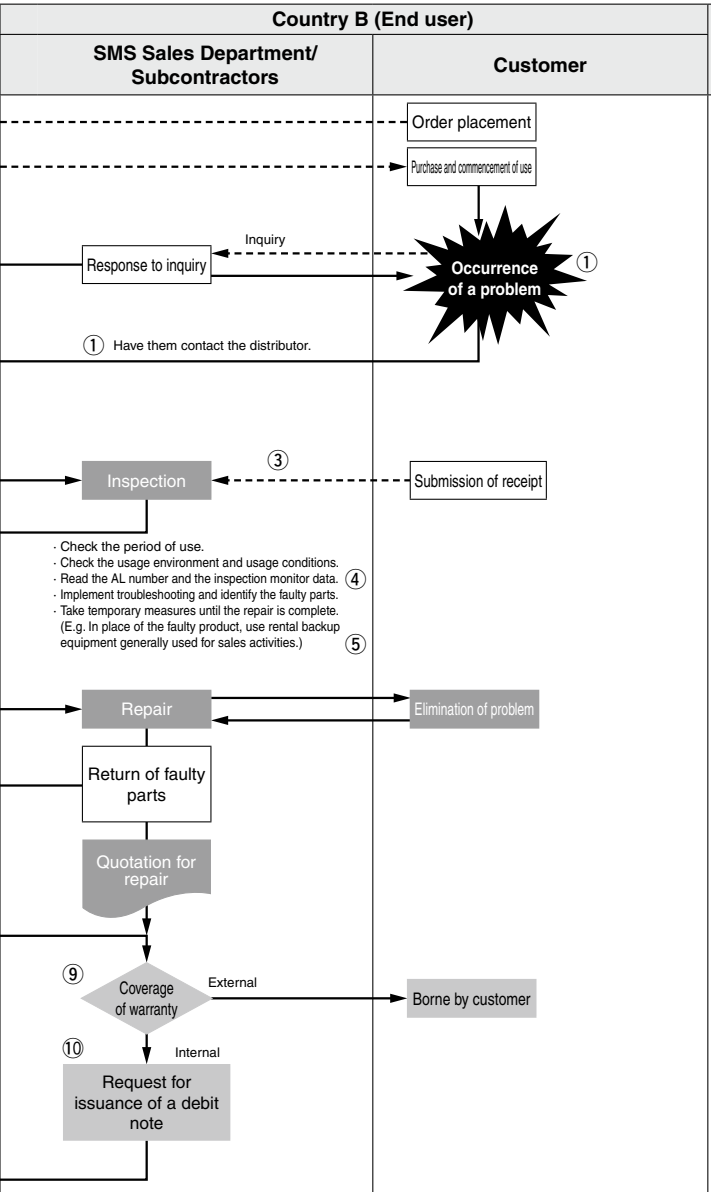
[Excerpt] "Earthquake-proof Calculation Software for Equipment" explanatory material prepared by the Japan Federation of Mechanical & Electrical Consulting Firms Association

# 10 Customer Support Flow Chart for Use in the Event of a Problem

**Customer support flow chart for when there is a problem with a product an end user in country B has purchased from a distributer in country A**



This flow chart has been created based on the information provided in the “S-ComPa 2 PAGE” and “Chiller Maintenance” materials. Refer to these materials for details.




**Remarks**

① Support for the end user (country B) should be requested by the distributor (country A). This method allows us to provide quick support for country B. We ask country B for cooperation.
② The end user may have signed a warranty agreement with the distributor. Therefore, check with the distributor (country A) whether inspection or repair may be implemented.
③ Check the period of use to determine the validity of the warranty by asking the customer to submit a receipt (invoice, etc.) that shows the date of purchase.
④ When immediate cause investigation is requested, read the AL number and the inspection monitor data and inform us of them. Also, inform us of the usage environment and usage conditions.
⑤ To minimize downtime of the end user’s equipment and system, consider using backup equipment.
⑥ In cases where the production of the product has been terminated, consult with the customer and prepare substitute parts. If substitute parts are not provided, we may not be able to accept the order. We ask for your understanding.
⑦ In urgent cases, use replacement parts in stock in country B. Parts procured via PO by the distributor (country A) will be sent at a later date to replenish the stock.
⑧ If the customer requires a detailed reply concerning the investigation, return to us the faulty parts collected from the customer.
⑨ Follow the coverage of warranty described in the catalog or the Operation Manual to determine the validity of the warranty.
⑩ If it is determined that the case is covered by the warranty, apply for a reimbursement of expenses from the sales departments in country A and country B by submitting an approval document and a debit note.

# 11 Frequently Asked Questions (FAQ)

| Question | | Answer | Refer to |
|---|---|---|---|
| Replacement parts | How can I find the part number of the replacement parts? | Refer to “Construction” and “Replacement Parts List” in this handbook as well as the Service Manual. | This handbook: Construction, Replacement Parts List (pages 33 to 111) |
| | What is the replacement cycle of the mechanical seal? | The approximate cycle is every 6,000 to 8,000 hours of operation.<br>When 8,000 hours have passed, you will be notified by AL28 (Pump maintenance).<br>When this alarm is generated, consider conducting a leak inspection and replacing the mechanical seal. | This handbook: Parts Replacement Cycle (page 112), Maintenance Standards, Operation Manual, etc. |
| | How do I replace the mechanical seal? | Refer to this handbook as well as the Service Manual.<br>This work can be carried out by any of the service companies tied up with SMC. Please consider outsourcing the replacement work.<br>When replacement is performed by the customer, be sure to conduct pre-training. | This handbook: 5 Replacement Procedure for Mechanical Seal (pages 409 to 434) |
| Alarm handling | What do I do when AL01 (Low level in tank) is generated? | The level in the tank is low. Check that there is no leakage from the piping, including that of the customer’s equipment.<br>If no leakage is found, fill the tank with circulating fluid in accordance with the Operation Manual. | This handbook: 4 Maintenance (pages 138 and 139) |
| | What do I do when AL06 (High circulating fluid discharge pressure) is generated? | Resistance (pressure loss) of the piping, including that of the customer’s equipment, has exceeded the pump capacity of the thermo-chiller.<br>Check whether there are throttles in the piping, including that of the customer’s equipment. If throttles are present, increase the piping size or relieve the circulating liquid flow rate by providing bypass piping (set). | This handbook: 4 Maintenance (pages 163 to 165) |
| | What do I do when AL28 (Pump maintenance) is generated? | This alarm notifies you that the pump or mechanical seal needs to be inspected or replaced.<br>This work can be carried out by any of the service companies tied up with SMC. Please consider outsourcing the replacement work.<br>When replacement is performed by the customer, be sure to conduct pre-training. | This handbook: 4 Maintenance (page 238) |

| Question | | Answer | Refer to |
|---|---|---|---|
| Circulating fluid | Can I use circulating fluids or additive agents not listed in the catalog? | SMC can check this for you. Inform us of the chemical compositions of the circulating fluids and additive agents you wish to use and the names of the manufacturers or distributors of them. All wetted parts materials are listed in the SMC Thermo-chiller catalog. Confirm these materials, and also contact the distributor or manufacturer if needed. | Catalog, Operation Manual (Specific Product Precautions, Water Quality Standards) |
| | Will you verify circulating fluids and additive agents not included in the catalog? | SMC can check this for you. When a circulating fluid and additive agent blended by the manufacturer (distributor) for long-term use is used, it is very difficult to find problems in a short-term life test. Therefore, all wetted parts materials are listed in the SMC Thermo-chiller catalog. Confirm these materials, and also contact the distributor or manufacturer if needed. | |
| Storage | What should I do when the product will not be in use for long periods? | Leaving a product that contains circulating fluid inactive may cause the pump to get stuck. When you do not plan to use the product for long periods (one month or longer), conduct a non-load operation periodically or remove the circulating fluid from the product before storing it. | Operation Manual (For long-term stoppage) |
| Support system | How is the maintenance system in Japan? | In Japan, our 54 branch offices and 94 distributors with 500 sales offices provide support for customers. A number of service companies tied up with SMC provide support for the thermo-chiller. As SMC's sales offices are also capable of providing support, we will be able to help you even in emergencies. | SMC Website, Support Guide |
| | How is the maintenance system overseas? | In countries overseas, our 500 sales offices in 83 countries/regions provide support for customers. Support for the thermo-chiller is accepted by 3 offices in North, Central, and South America, by 9 offices in Europe, and by 10 offices in Asia (22 offices in total). As SMC's sales offices in Japan also serve as mediators, we will be able to help you even in emergencies. | |

## Refrigeration Circuits, Peltier Devices, Cooling Sources

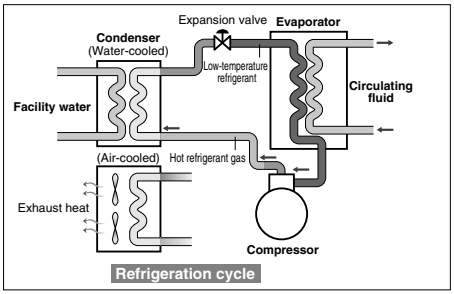
**Compressor**
A compressor draws in low-pressure chlorofluorocarbon (CFC) refrigerant gas, compresses the gas and then discharges it as a high-pressure, high-temperature gas. Compressors are classified into various types (reciprocating, rotary, screw, etc.) according to the mechanical compression method used.

**Refrigerator**
A compressor that compresses a refrigerant gas. These are called refrigerators to distinguish them from machines such as air compressors.

**CFC refrigerant**
CFC (chlorofluorocarbon) refrigerants are organic compounds made up of elements including carbon, hydrogen, chlorine and fluorine. They are referred to generically using the DuPont brand name of Freon®.
When CFCs are used as heat-transfer mediums and circulated inside refrigeration circuits, causing heating and cooling during their condensation and evaporation phase changes, the CFCs are referred to as CFC refrigerants.

**Specified CFC**
Due to their stability as a chemical substance and their safety with respect to humans, CFCs came to be widely used as industrial materials, particularly refrigerants. However, it was later recognized that when CFCs (and HCFCs (hydrochlorofluorocarbons)) containing chlorine are released into the atmosphere, they rise up into the ozone layer and deplete it.
This resulted in the establishment of the Montreal Protocol in 1987, which classified CFCs such as Freon R12 and HCFCs such as Freon R22 as "specified CFCs" and prohibited their manufacture. As a result, their use has now almost completely died out.
Instead of specified CFCs and HCFCs, SMC products now use HFC refrigerants such as R134a and R404A that have an ozone depletion potential (ODP) of zero.

**Fundamentals of refrigeration circuits**
In a refrigeration circuit, refrigerant gas injected into the circuit repeatedly travels through a cycle of compression, condensation, expansion and evaporation, creating high-temperature and low-temperature sections in the circuit. The compressor compresses low-pressure refrigerant gas and discharges the gas at a high temperature and pressure level. The hot, pressurized refrigerant gas enters the condenser where it is cooled by the external air or cooling water and condenses to form a high-pressure liquid refrigerant. As the high-pressure liquid refrigerant passes through a constricting mechanism, such as an expansion valve, it rapidly depressurizes and some of the refrigerant evaporates. The release of evaporation heat causes the refrigerant itself to cool so that it becomes a combination of gas and liquid at a low-temperature and pressure level. In its combined gas-liquid state, the refrigerant enters the evaporator where it continually evaporates while absorbing the heat within the evaporator, thereby cooling the interior of the evaporator. When the refrigerant emerges from the evaporator, it evaporates entirely and becomes a low-pressure refrigerant gas. The low-pressure refrigerant gas is then drawn into the compressor and again becomes a high-temperature, high-pressure gas as the cycle is repeated.



Refrigeration cycle

**Condenser**
A heat exchanger used to condense high-temperature, high-pressure refrigerant gas. A condenser has the function of releasing heat drawn up by the refrigeration circuit to the outside. Condensers can be air-cooled or water-cooled, depending on the cooling method used.

**Air-cooled condenser**
Air-cooled condensers are generally made up of copper tubes through which the refrigerant flows, with numerous thin aluminum fins attached around the outside of the tubes. Outside air is forced over the fins by a device, such as a fan motor, to cool the pipes to the ambient temperature and condense the refrigerant gas.
If an air-cooled condenser is installed inside a building, it can be used to heat the interior of the building since the heat generated by the refrigeration circuit is released as waste heat from the outside of the condenser. The room in which an air-cooled condenser is installed must have adequate ventilation or air-conditioning equipment.

**Water-cooled condenser**
A heat exchanger that uses cooling water to cool and condense the coolant. Water-cooled condensers can be used in environments, such as large factories where cooling tower water or the cooling water for an air-conditioning system can be circulated and used.
Depending on their construction, heat exchangers can be double-pipe type, shell-and-tube type or plate type units.

**Refrigerant dryer**
In a refrigeration circuit, a refrigerant dryer consists of filters that absorb and remove moisture inside the refrigeration circuit. Refrigerant dryers are normally installed in pipes carrying liquid refrigerant after it emerges from the condenser.

**Expansion valve**
A component that creates an expansion in the refrigeration circuit. As the refrigerant passes through this valve, a large pressure loss results, thereby making it possible to create high-pressure and low-pressure segments within the refrigeration circuit.
There are several types of expansion valve, including constant-pressure expansion valves and thermal expansion valves. Such types allow the size of the valve aperture to be adjusted using refrigerant pressure or temperature feedback from an outlet passage.

**Capillary tube**
The capillary tubes used in refrigeration circuits are simply small-caliber copper tubes, normally used in the expansion step, that act as a fixed restrictor in the refrigerant passage.

**Evaporator**
A heat exchanger used to cool the target substance (e.g., water or air) using the evaporative heat from a low-temperature, low-pressure combined gaseous and liquid refrigerant in the refrigeration circuit.

**Cooler**
→ Evaporator

● **Accumulator**
A tank installed in a refrigeration circuit on the inlet side of the compressor. A compressor is a component designed to compress gas, so a malfunction will occur if any liquid coolant enters the compressor. Installing an accumulator has the function of separating out the coolant gas that is sucked into the compressor and any remaining refrigerant, and of preventing the liquid refrigerant from being sucked into the compressor. The inclusion of an accumulator creates a system that is highly resistant to variability in factors such as the cooling load.

● **Hot gas bypass**
A refrigeration circuit sometimes includes a circuit that allows high-temperature, high-pressure refrigerant gas (hot gas) discharged from the compressor to bypass the condenser so that it reaches the evaporator (on the low-pressure side) without being condensed. This prevents the evaporator temperature (on the low-pressure side) from dropping too far and reduces the risk of liquid refrigerant being drawn into the compressor when the cooling load is low (if there is nothing to refrigerate), thereby ensuring more stable functions of the refrigeration circuit.
This also allows a flow of hot gas to be intentionally directed to the evaporator with the aim of heating the evaporator rather than cooling it.

● **Water-regulating valve**
A control valve, installed on the cooling water pipe for a water-cooled condenser, used to adjust the amount of cooling water flowing to the condenser. Water-regulating valves can be either pressure-regulated or temperature-regulated, with the amount of flow regulated using feedback from the condensing pressure or condensing temperature, respectively.
When the cooling water temperature is low, a large flow of cooling water to a water-cooled condenser reduces the condensing pressure and lowers the cooling capacity. In this sort of situation, a water-regulating valve restricts the cooling water flow and maintains the condensing pressure at the desired value. Water-regulating valves also have the function of reducing water consumption by preventing unnecessarily large flows of cooling water.

● **Inverter control**
In compressors that use an ordinary AC motor, the motor rotation rate is fixed according to the frequency of the AC power supply, with the result that the refrigerant discharge rate is also fixed. Inverter control in a refrigeration circuit is the use of an inverter to vary the compressor rotation rate and thereby control the rate of refrigerant circulation.
This provides means of saving energy by, for example, running the compressor at a slower rate when the cooling load is low.

● **Protective devices in refrigeration circuits**
In refrigeration circuits, protection must be provided for electrical components such as compressors, and against abnormal refrigerant pressures. Protective measures for compressors (motors) include protective devices such as overload relays (built into the compressor to detect overcurrent and overheating), thermal relays (fitted externally to detect motor overcurrent) and temperature switches.
The devices used to protect against pressure faults include pressure switches, safety valves and rupture disks. However, in refrigeration circuits built into compact devices, the protective devices are often confined to just overload relays, or just thermal relays and pressure switches depending on the anticipated level of risk.

● **Facility water**
The cooling water flowing through a water-cooled condenser used to expel waste heat generated in the refrigeration circuit to the outside.
In ordinary factories or buildings, fluids such as cooling tower water or chiller water are used as facility water.

● **Cooling tower**
A cooling tower is a facility that uses cooling water to expel the waste heat circulated and collected inside a factory or other building into the outside air. Cooling towers are installed in outdoor locations such as on the rooftops of buildings. The cooling water is sprayed down like a shower from the top of the cooling tower and forcibly brought into contact with the outside air by a fan motor. As well as being directly cooled by the temperature of the outside air, the partial evaporation of the cooling water itself draws off evaporation heat, cooling the water further.
Because cooling towers are directly cooled by the outside air, the resulting cooling water temperature varies seasonally depending on the climatic conditions. In addition, the cooling water cannot theoretically be cooled to a temperature any lower than 5°C above the wet-bulb temperature of the outside air.

● **Peltier device**
An element with a structure made up of alternating layers of flat P-type and N-type semiconductors arrayed in series. When a direct current flows through the element, heat moves from one plate surface to the next, so that one surface is cooled as the opposing surface is heated. This is referred to as the Peltier effect.
By changing the direction of current flow, the direction of heat movement can also be changed, providing a simple means of cooling and heating.

● **Thermo-module**
→ Peltier device

● **Thermoelectric device**
→ Peltier device

● **Thermoelectric system**
A temperature control system that uses a Peltier element to directly cool and heat a liquid, gas or solid.
Heat exchangers suitable for fluids are installed on both sides of the Peltier element, with the fluid to be temperature-controlled on one side of the element while the heat exchanger on the other side is used to dissipate heat.

## Fluid Control and Heat-related

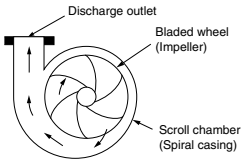
● **Pump capacity/Water-supply capacity**
A pump's water-supply capacity is indicated by the amount of water it can cause to flow at a given pressure (lifting height).
The characteristic curve (pump curve) that indicates the correlation between pressure and flow rate varies depending on the pump type, and thus, the user must check that the type of pump selected is suitable for the intended application.

● **Lifting height/Pressure**
Lifting height (in meters) is often used instead of pressure to indicate the pump capacity. Lifting height is a numerical value that indicates the capacity of a pump in terms of the height (in meters) to which it can lift a fluid.
The value for pressure is obtained by multiplying the lifting height by the density of the fluid; for example, if a pump capable of generating a lifting height of 10 meters is used to pump water, which has a density of 1 kg/L, the unit pressure generated by the pump is 1 kgf/cm$^2$ (0.1 MPa).
If a more dense fluid is used, the pressure is higher even though the lifting height remains the same.

● **Pipe resistance**
When water or another fluid is caused to flow through a passage composed of pipes, valves, etc., the pressure differential generated by friction between the various devices and the fluid is known as “pipe resistance.” A synonymous term is “pressure loss.”

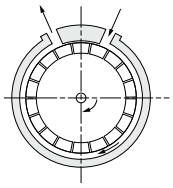
● **Centrifugal pump**
This is one type of pump in which a bladed wheel (impeller) spins inside the pump chamber (casing), applying centrifugal force to the fluid. This force is converted to pressure that discharges the fluid. A large volume of fluid can be pumped, but it is difficult to attain high pressure. When high-pressure is desired, a type fitted with multistage impellers can be used.
This is a low-lifting height, high-flow volume pump.

**Centrifugal pump**




● **Vortex pump**
In this type of pump, a bladed wheel (impeller) spins inside the pump chamber (casing), applying centrifugal force to the fluid. This force is converted to pressure that discharges the fluid. As in a centrifugal pump, the fluid is discharged using centrifugal force, but the impeller has more blades than in a centrifugal pump, and in the pump chamber (casing), the aperture (clearance) is set more narrowly, allowing for a higher discharge pressure.
The pressure and flow rate characteristics attained are somewhere between that of a centrifugal pump and a vane pump.
This is a mid-lifting height, mid-flow volume pump.

**Vortex pump**

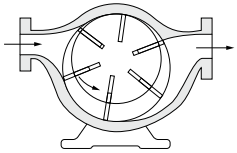


● **Turbine pump**
→ Vortex pump

● **Cascade pump**
→ Turbine pump

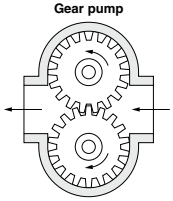
● **Vane pump**
In this type of pump, vanes set in a rotor inside the pump chamber brush against the inside walls of the chamber as they rotate, pushing out and discharging the fluid that is surrounded by the vanes, rotor and pump chamber walls. This is a type of PD (positive displacement) pump.
This is a high-lifting height, low-flow volume pump.
The vanes slide against the interior walls of the pump chamber, generating abrasion powder. In addition, this type of pump is susceptible to entry of foreign matter such as outside debris, etc.

**Vane pump**



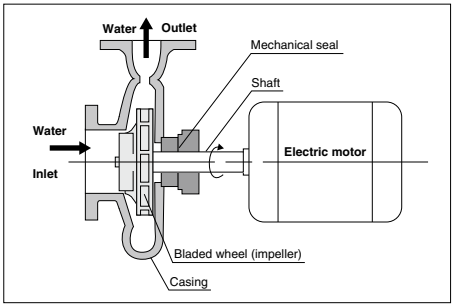
● **Gear pump**
Like the vane pump, this is a type of PD (positive displacement) pump, in which a pair of gears meshes with one another and rotates, pushing the fluid through the gap between them and discharging it.
This is a high-lifting height, low-flow volume pump.

**Gear pump**

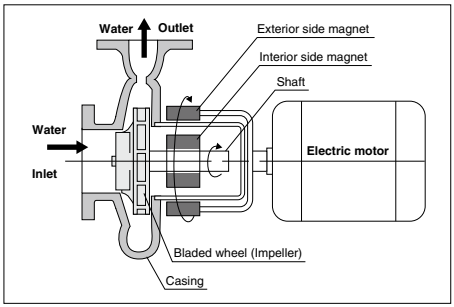


● **Sealing mechanism**
The bladed wheel (impeller) in the pump chamber through which the fluid passes is linked to the shaft of the external electric motor, and the rotation of the impeller discharges the fluid. As water or other fluids seeping through the motor shaft and reaching the electric motor can cause short circuits and other damage, it is necessary to have a mechanism sealing the pump chamber off from the shaft. This is known as a “sealing mechanism.”
There are mechanical seal types, magnet coupling types and others.

● **Mechanical seal pump**
This is a general terms for pumps that use mechanical seals for the sealing mechanism.
The rotating seal mounted on the motor shaft side and the fixed seal mounted on the pump chamber side rotate, and their surfaces touch one another, sealing off the fluid. As a result, there is a slight, external leakage of fluid. The volume of leakage increases over time, so it is necessary to replace the seal portions regularly.
This type can be used for applications where the motor shaft and impeller are directly linked and there is high-shaft power.



● **Magnet pump**
This is a general term for pumps that use magnetic coupling for the sealing mechanism.
Using magnetism to couple the rotor on the inside of the pump chamber to the permanent magnet mounted on the motor shaft side, with the pump chamber wall between them, the rotation is conveyed to the rotor inside the pump chamber. Since the pump chamber can be completely separated, pump chamber can be completely sealed off, so there is absolutely no external leakage.
Since a large magnet coupling is needed, this type of pump is more difficult to make in small sizes than the mechanical seal type, and the cost is also higher.




● **DC canned pump**
A pump with a sealless construction combining the motor and the pump in one. It can be made in compact sizes with absolutely no external leakage of fluid. A DC brushless motor is used.

● **Pump heat input**
The volume of heat applied to the circulation loop, generated by the operation of the pump. When calculating the overall volume of heat applied to the circulation loop, it is necessary to consider the volume of heat generated by the pump, along with that of the object being cooled.
The pump converts the electrical power entering the motor into the kinetic energy of the fluid, which causes the fluid to circulate. This kinetic energy is reduced as a result of undergoing pressure loss inside the piping, and eventually the entirety of the kinetic energy is released into the circulating fluid as heat.
While there are differences depending on the type of pump, for rough calculations, the nominal heat emitted from the pump can be treated as the pump heat input.

● **Solenoid valve**
A component that switches the flow of fluid from ON to OFF, or changes the direction by moving the plunger (iron core) using the force of electromagnetism.

● **Relief valve**
When the inlet pressure exceeds a set level, this valve opens to release the outlet pressure.

● **Flow sensor/Flow switch**
These components monitor the flow rate of the fluid. The flow sensor measures the flow rate linearly. The flow switch only has the function of commencing operation when the flow rate reaches a certain level, and does not perform measurement of the flow volume.

● **Particle filter**
A filter that removes debris and other particles.

● **Check valve**
A check valve is a device that prevents reverse flow of the fluid, keeping it flowing in one direction only.

● **Non-return valve**
→ Check valve

● **Level switch**
A switch that detects the fluid level inside the liquid tank. There are many different types, but the most common type employs a floating buoy, which causes a lead switch (magnetic switch) to turn ON and OFF.

● **DI filter**
A filter that is filled with ion exchange resin used to remove leftover ions from the water. DI stands for “deionized,” while “DI water” is deionized water, or water with its ions removed.

## Fluid Properties, Materials, Physical Values

● **Density, specific gravity**
The weight per unit of volume, measured in units of [kg/m$^3$]. Specific gravity is the ratio of the density of a given substance to the density of water (1.0 [g/cm$^3$]), and is a dimensionless quantity. When expressing this quantity within the CGS system of units, density and specific gravity have the same value.

● **Degree of viscosity**
Thickness of a fluid. The units used to express absolute degree of viscosity are [Pa·s] units, but it is often expressed within the CGS system of units with [P] (Poise).
1 [Pa·s] = 10 [P]
The value obtained by dividing absolute degree of viscosity by density is called the kinetic viscosity. This can be measured in [m$^2$/s] units, but in general, [St] (Stokes) are used.
1 [St] = 0.0001 [m$^2$/s]

● **Specific heat, specific heat capacity**
The heat energy required to increase the temperature of an object by a certain temperature interval, under specific pressure and volume conditions.
The specific heat of water: 1 [cal/g·K] = 4.184 x 10$^3$ [J/kg·K]

● **Cooling capacity**
The volume of heat (heat energy) that temperature control equipment can absorb (cool) per unit of time, at an arbitrary temperature.

● **Heat load**
→ Cooling capacity

● **Heat**
Terms such as heat, heat load, cooling capacity, etc., that are used in this catalog, indicate quantities of heat that can be absorbed or radiated per unit of time. As a result, the units employed are [W] = [J/s] (work rate) or [kcal/hr].
1 kW = 860 kcal/hr

● **Specific resistance**
A value indicating the electrical insulating properties of a liquid, and the unit used is [Ω·cm]. When expressing the specific resistance of deionized water, it is sometimes called "DI level." At 25°C, the specific resistance of theoretically 100% deionized water is 18.3 [MΩ·cm].

● **Electric conductivity**
A value indicating the ease with which electricity passes through a liquid, and is inversely proportional to the specific resistance. The unit used is [S/m], incorporating [S] (Siemens), the opposite of [Ω] (resistance).
At 25°C, the electric conductivity of theoretically 100% deionized water is 0.055 [μS/cm].

● **Tap water**
Water that has been filtered and distilled and any impurities eliminated. It is also known as purified water.

● **Deionized water**
Water that has had any impurities or ion elements removed. It is obtained by removing ion elements with ion exchange resin, after filtering out impurities with a particle filter. Its theoretical specific resistance has a limit of 18.3 [MΩ·cm], but it is impossible to actually attain this value. As a general rule, water with a specific resistance of 1 to 10 MΩ·cm is referred to as deionized water.

● **Ethylene glycol aqueous solution**
Ethylene glycol is a type of alcohol, and adding it to water causes the freezing point of the water to drop. It is a major ingredient in antifreeze for automobiles. At a concentration of 60%, the freezing point drops to –40°C or lower, but the viscosity increases as the temperature drops, so taking fluidity into account, it is practical to consider about –20°C as the minimum temperature.
By adding ethylene glycol to deionized water, it is possible to raise the fluid's specific resistance, so it can be used for applications where circulating fluid with high insulating properties is desired.

● **Propylene glycol aqueous solution**
Propylene glycol is a type of alcohol, and adding it to water causes the freezing point of water to drop. Like ethylene glycol, it is a major ingredient in antifreeze for automobiles.
It has lubricating properties, and is characteristically non-volatile.

● **Fluorinated fluids**
Inert fluids in the fluorine series. There are many types, including perfluoropolyether (PFPE), perfluorocarbon (PFC), hydrofluoropolyether (HFPE), and hydrofluoroether (HFE), but they share the characteristic of high electrical insulation properties, and grades can be selected with appropriate fluidity even at low temperatures, such as –100°C, and high temperatures, such as 200°C and above.
They are chemically inert and non-poisonous.
Products are sold on the market, such as Fluorinert, made by 3M, and GALDEN, made by Solvay Solexis.

● **GALDEN®**
The product name of a fluorinated fluid manufactured by Solvay Solexis. It is a perfluoropolyether with a high polymer compound, and various grades can be selected with differing temperature ranges and viscosity ranges depending on the degree of polymerization.

● **Fluorinert™**
The product name of a fluorinated fluid manufactured by 3M. Its basic structure is a perfluorocarbon, but it has a wide variety of chemical structures, and various grades can be selected with differing temperature and viscosity ranges.

● **Circulating fluid, constant temperature circulating fluid**
Fluid that circulates among the user's equipment, with temperature controlled by a chiller.
Taking freezing temperature, boiling point, electrical insulation properties and so on into consideration, tap water, deionized water, ethylene glycol aqueous solution, fluorinated fluids, etc., can be selected depending on the application.

## Temperature Measurement and Control

● **PT sensor, platinum resistance temperature detector**
A type of temperature sensor taking advantage of the properties of platinum (Pt), which has an electric resistance that increases in proportion to the temperature. A sensor with the specification Pt 100Ω has a resistance of 100Ω at 0°C. As the resistance value is relatively small, and the sensor is easily influenced by the resistance value of the conductive wires, an input circuit is generally used which cancels out the resistance value of the conductive wires, by using, for instance, 3-wire or 4-wire wiring configurations and long conductive wires.

● **RTD (Resistance Temperature Detector)**
→ PT sensor

● **Thermo couple**
This is created by forming a loop, connecting the ends of two wires made of two different metals, and by keeping the two wires at separate temperatures at the connecting point. Thermoelectric power is generated according to this temperature differential (the Seebeck effect).
As a sensor, by keeping the end of one wire at a standard temperature and measuring the thermoelectric power generated, it can determine the temperature of the other wire terminal. A thermo couple is a sensor employing this principle.

● **Thermistor**
A temperature sensor employing a semiconductor with electric resistance that changes in accordance with the temperature. There are two types,
PTC: positive temperature coefficient (a type for which the resistance increases as the temperature rises)
NTC: negative temperature coefficient (a type for which the resistance decreases as the temperature rises.)
The resistance value is generally large, amounting to several MΩ, and there is little influence from the resistance of the conductive wires, so a 2-wire configuration is generally used.

● **Thermostat**
A switch that turns ON or OFF when it reaches a certain set temperature. Most thermostats are bimetallic.
They are sometimes used for direct temperature control, such as switching a heater ON or OFF, but are also used often for safety circuits which switch OFF when the temperature becomes abnormally high.
The switch can be returned to its original position either automatically or manually.

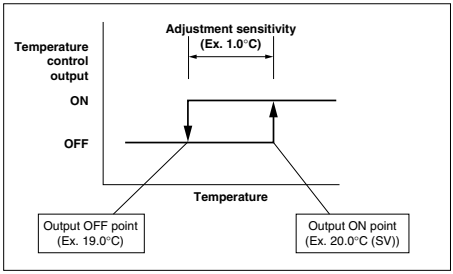
● **Temperature fuse**
A fuse in which an internal metal wire melts, breaking the circuit when exposed to a temperature exceeding the set temperature. When this kind of fuse blows, it cannot be reset and must be replaced.

● **PV**
PV: Process Value. In temperature control equipment, this indicates the current temperature measured by the temperature sensor.

● **SV**
SV: Set Value. In temperature control equipment, this indicates the target value (set value) for performing temperature control.

● **ON/OFF temperature control**
A control method for adjusting temperature by turning temperature control output ON or OFF relative to the set temperature.
When the temperature is above (below) the set temperature, output of the refrigerator (heater) is turned ON, and when the temperature is below (above) the set temperature, output is turned OFF.
Since there are only two operating rates relative to the set temperature, 0% or 100%, this is also called 2-position control.

● **Adjustment sensitivity (Hysteresis)**
When the PV is extremely close to the SV in ON/OFF control, there may be "chattering" where the temperature control output repeatedly turns ON/OFF with small temperature variations, and this may have an adverse impact on output relays and connected equipment. To prevent this, spacing is provided between ON and OFF operation to stabilize control. This operation spacing is called adjustment sensitivity (hysteresis).
For example, if the cooling output ON point (SV) is set to 20.0°C and hysteresis is set to 1.0°C, then cooling output will go OFF when temperature drops to 19.0°C, and go ON when temperature rises to 20.0°C.




● **PID control**
A control method for producing temperature control output by comparing the temperature difference between the input value from the temperature sensor (PV) and the set temperature (SV), and using a combination of P (Proportional) operation, I (Integral) operation and D (Derivative) operation.
Output is linearly variable from 0 to 100%, and this enables smooth temperature control with no temperature wavering.

P (Proportional) operation: Operation where the amount of output is varied from 0 to 100% in proportion to the deviation between PV and SV (temperature difference). The range of temperatures for performing proportional operation (proportional band) must be input as a parameter.

I (Integral) operation: Operation where the temperature discrepancy is corrected by adjusting the amount of output relative to the time that deviation between PV and SV has continued. Since the amount of output is determined in response to the time that deviation continues, the integral time must be input as a parameter.

D (Derivative) operation: Operation where output is produced in accordance with the derivative (speed of change) of the temperature deviation. This is used to quickly correct sudden temperature variations when there is a sudden change in the ambient environment or load. The derivative time is input as a parameter, and the longer the derivative time, the stronger the correction output that is produced.

● **ARW width (Anti-Reset Windup width)**
Range of integral operation used for PID control. This value is used to designate the range for calculating the integral term, to suppress buildup of the integral component.

● **Auto-tuning**
In PID control, P, I, D and each parameter must be optimally set for the balance of the heat capacity of all parts where the circulation loop is connected. Auto-tuning refers to a function for automatically determining the setting of those parameters.
SMC's temperature control equipment is shipped with PID parameters set at factory shipment to the greatest common factor for the various use conditions. However, if those parameter settings are likely to be unsuitable for the actual operating environment, some models provide a function which can automatically set parameters by using auto-tuning.

● **Time division proportional output**
When controlling output of a heater or other device via a relay or SSR, this method of operation makes the ratio of ON time to OFF time proportional to the control output over a fixed time (0.2 to 1.0 sec) in accordance with a previously set time cycle.
For example, if the control cycle is 1.0 sec, and the control output is 70%, then the ON time will be 0.7 sec and the OFF time 0.3 sec.

● **PWM control**
→ Time division control

● **Offset function**
Function for shifting the target temperature for actual temperature control from SV by adding or subtracting a separately set offset value (+ or – a certain number of °C) to or from the set temperature (SV).
For example, if the temperature upon arrival at the object of temperature control is shifted higher (or lower) relative to the temperature discharged from the chiller because a certain amount of heat input is received from piping due to the effects of ambient temperature, this offset value is set to correct that effect.

● **Learning control**
A function for automatically calculating and setting the offset value (correction value for the set temperature).
A temperature sensor (external sensor) is provided near the object to be temperature controlled, and those signals are input to the chiller. The offset value is automatically calculated from the deviation between the discharged temperature and the external sensor.

● **External sensor**
Temperature sensor mounted to the outside of temperature control equipment and used for learning control, etc.

● **Band width, Temperature upper/lower limit width**
Temperature range for outputting alarms, etc., when PV deviates by more than a fixed temperature from the set temperature (SV).

## Power Supply, Electrical Equipment

● **Power supply frequency**
There are two frequencies for commercial AC power: 50 Hz and 60 Hz. The AC motors installed in temperature control equipment turn at a rotation speed corresponding to the power supply frequency. When operating with a 60 Hz power supply, the rotation speed is generally 10% faster than with 50 Hz. In the case of a pump, the flow rate and pressure increase, and in the case of a compressor in a refrigeration circuit, the cooling capacity increases. Current consumption also increases in the same way.
In the case of a resistance load, such as a DC pump or heater, performance does not depend on the frequency.

● **Three-phase power supply**
With three-line AC current or AC voltage, the phases of the lines are shifted by 120°.
The current values of each line are $1/\sqrt{3}$ smaller than single phase with the same level of transmitted power, so thinner wires can be used. There is also the advantage that a rotating magnetic field can be easily produced. (It is possible to use a 3-phase motor with a simple structure.)
A 3-phase power supply is used for equipment with high output.

● **Breaker**
A device which protects load circuits and wires by breaking the circuit when an abnormal current flows in an outlet circuit due to problems such as overload or shorting. Depending on the application, a breaker may be called a motor breaker, circuit protector or other names. Earth leakage breakers monitor both current in the main circuit and leakage current, and break the circuit if leakage current is too high.

● **Relay**
A switch which turns a mechanical contact ON/OFF with the power of an electromagnet (solenoid). This makes it possible to turn ON/OFF the high power of the contact with the low power needed to drive the electromagnet only, and thus relays are used for amplification. They are also frequently used as logic elements in sequence circuits.

● **Electromagnetic contactor**
An electric device for turning power circuits ON/OFF to start and stop power equipment (e.g. motors, heaters). Just like a relay, these devices open or close a mechanical contact with the power of a solenoid. The principle of operation is the same as a relay, but a contactor is designed for high-voltage and large current.

● **Thermal relay**
A circuit protection device incorporated into the power input circuit of a motor to provide output when motor overcurrent is detected. It is comprised of a heater which heats up in response to current, and a bimetal which opens and closes a contact in response to that heat. Since the thermal relay itself cannot open and close a high capacity power circuit, the main circuit for a motor or other device is broken by incorporating a control circuit with an electromagnetic contactor or relay.

● **Electromagnetic switch**
A device integrating an electromagnetic contactor with a thermal relay.

● **Overload relay**
This has the same structure as a thermal relay, and is used for the same purpose. Overload relays built into the compressors of small refrigeration circuits are installed on the wall of the compressor, and are actuated not by heat due to overcurrent but by the temperature of the compressor itself. In many small compressors, the main circuit is directly broken by the overload relay.

● **Impedance protection**
A type of motor protection generally used for small AC fan motors and other small motors.
The motor is constructed so that it will not rise above a certain temperature, even when locked for some reason, due to the inherent impedance (AC resistance) of the motor coil itself. Therefore, the motor itself is protected against burnout, even though no thermal relay or other protective device is installed.

● **Solid state relay (SSR)**
A relay which enables switching of high power using low power by using a thyristor or other semiconductor element. In comparison with an electromagnetic relay, this type has no mechanical moving parts, and thus is capable of high-speed switching. SSRs are compact, and have a long service life.
However, this does not mean that contacts are physically isolated. The fact that there is some leakage current even when the device is OFF must be taken into account.

● **Phase reversal relay (Plugging relay)**
A switch which monitors the phase sequence of a 3-phase main power supply, and issues a warning if anything is abnormal.
When driving a 3-phase motor with a 3-phase power supply, the motor will turn backwards if the phase sequence of wiring is wrong. This relay is installed to prevent such reverse rotation. These relays are also called plugging relays.

● **DC power supply**
A device which produces DC power from commercial AC power. DC power is for CPUs inside equipment and other control circuits. Peltier elements for Peltier circulators, thermoelectric baths and other equipment are driven with DC power, so they have a high-capacity DC power supply built-in.

● **EMO circuit**
An EMO (EMergency Off) circuit is an electrical circuit provided to shut off all power and ensure safe conditions when an emergency stop button (EMO button) is pressed in an emergency.

● **Hardware interlock**
This is an equipment control circuit for shutting off power in case of trouble. The circuit is logically configured using only relays and other hardware, and does not use software running on the CPU.

● **RS232C**
A standard for serial communication. This is the communication standard when connecting a PC with an acoustic coupler or modem, and is used for one-to-one communication between PCs.
Since RS232C itself only roughly stipulates the use of wiring systems and other hardware, detailed hardware specifications and software protocols are determined independently by each equipment manufacturer.

**RS485**
A standard for serial communication. Only one-to-one communication between devices can be done with RS232C, but with RS485 it is possible to communicate simultaneously with multiple devices by wiring them in a chained, multidrop fashion, and providing addresses via software.
Since RS485 itself only roughly stipulates the use of wiring systems and other hardware, detailed hardware specifications and software protocols are determined independently by each equipment manufacturer. Actual detailed protocols are determined independently by each equipment manufacturer.

**DeviceNet**
A standard for serial communication.
An open network owned by ODVA (Open DeviceNet Vendor Association Inc.), a non-profit organization headquartered in the US. This is a field network standard covering a wide scope, from the sensor level to the device level.

**Analog communication**
A method of communicating with external devices using voltage output such as 0 to 10 V. This enables output of PV (measured temperature, etc.) and reception of values like SV (set temperature).

**Signal input/output, I/O**
Input/Output signals such as alarm signal, or operation signals. Since there are various communication methods depending on the equipment model, such as relay output and open collector output, communication specifications must be checked before wiring.

**Insulation withstand voltage**
Electric potential difference where an insulator material will not be destroyed. In withstand voltage testing at product shipment from the factory, a high AC voltage of 1.5 kV (varies depending on the model) is applied between the electric circuit conductor and the chassis (grounded). Then it is checked that there is no flow of leakage current above the reference value.

**Insulation resistance**
Electric resistance between the conductor inside the device and the chassis (grounded). In insulation resistance testing at product shipment from the factory, it is checked that the resistance value with a measured DC voltage of 500 V (or 250 V) is at or above the reference value (a value such as 1 MΩ; varies depending on the model).

## Safety Standards

**CE marking**
For machinery and other equipment distributed in the EU (European Union), it is mandatory to display the CE mark. To display the CE mark, a product must declare itself to be in compliance with EU Directives. The main EU Directives relating to the products in this catalog are the Machinery Directive, EMC Directive and Low Voltage Directive. Each directive requires product compliance with the corresponding EN Standard (European Standard).

**UL standards**
Standards of a non-profit testing organization founded by the US National Fire Protection Association.
In the US, some states and municipalities require UL certification for the sale of electrical products.

**CSA standards**
Safety standards by the Canadian Standard Association, a non-governmental Canadian standardization organization.
Electrical products distributed in Canada must be CSA certified.

**NRTL (National Recognized Test Laboratories)**
Testing organizations capable of certification (of UL or CSA standards, etc.) which have been recognized according to Occupational Safety and Health Law set forth by OSHA (the US Occupational Safety and Health Administration). At present, 18 organizations have been recognized as NRTLs. UL and CSA are examples of certified organizations.

**eti mark**
eti (Electro-Test Inc.) is the mark that demonstrates compliance with UL standards.

**ETL mark**
Intertek ETL SEMKO is an NRTL, and issues the ETL mark. This mark demonstrates compliance with UL standards.

**SEMI S2**
SEMI is an international industry association of companies producing equipment and materials for the manufacture of semiconductors and flat panel displays. It has established its own standards as safety guidelines for the design of semiconductor manufacturing equipment.
SEMI S2 requirements relate to the work environment, health and safety for products used in semiconductor manufacturing, and cover chemical, radiation, electrical, physical, mechanical, environmental, fire, earthquake, emissions and ergonomics, as well as quality, documentation, manuals, etc. Many semiconductor manufacturers require that equipment operating in their plants comply with SEMI S2.

**SEMI S8**
SEMI S8 is a guideline on ergonomics which is more detailed than the ergonomic requirements in Section 14 of SEMI S2.

**SEMI F47**
SEMI F47 is a SEMI standard which stipulates guidelines regarding voltage sag immunity.
Semiconductor manufacturers require this standard for temperature control equipment, just like SEMI S2.

**SMC Corporation**

Akihabara UDX 15F,
4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, JAPAN
http://www.smcworld.com