

# Circulating Fluid Temperature Controller Thermo-chiller

## HRSH090 Series

### Inverter Type

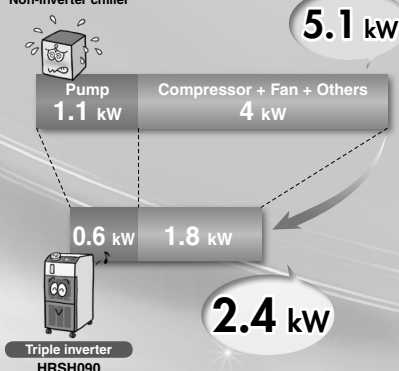
Power consumption reduced by **53%\***



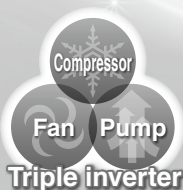
Outstanding energy saving effect with the triple inverter!



Non-inverter chiller



\*1 Under the conditions shown on page 128



1. DC inverter compressor
2. DC inverter fan (For air-cooled type)
3. Inverter pump

Water-cooled refrigeration

Air-cooled refrigeration



Cooling capacity **9.5 kW**

Temperature stability  $\pm 0.1^{\circ}\text{C}$   
(when a load is stable)

Set temperature range **5°C to 40°C**

Compact, Space-saving

W 377 x H 1080 x D 970 mm

Low-noise design Operating noise Max. **66 dB**

Max. ambient temperature **45°C**

Indoor use

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

- 3-phase 200 V
- 3-phase 400 V

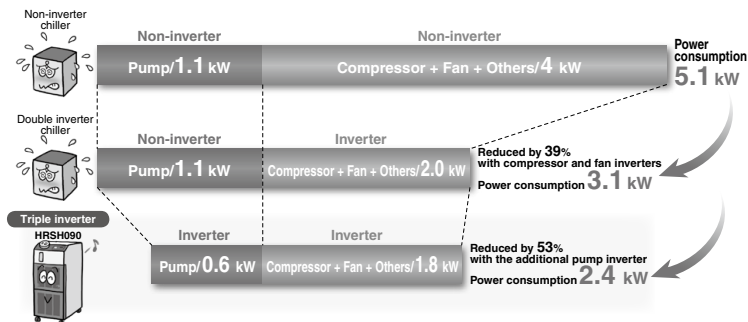
## Triple inverter

The inverter respectively controls the number of motor rotations of the compressor, fan and pump depending on the load from the user's equipment.

**Power consumption**

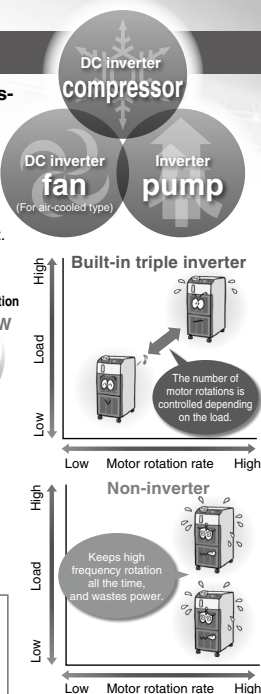
**reduced by 53%**  
**compared with a non-inverter**

With the inverter, it is possible to operate with the same performance even with the power supply of 50 Hz.



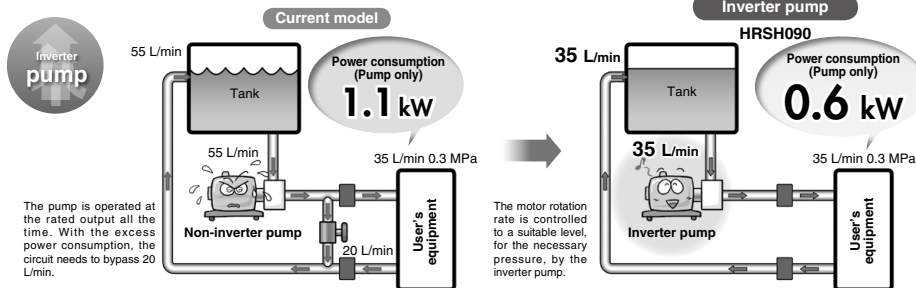
Operating ratio: Ratio of 9.5 kW (with heat load) to 0 kW (without heat load) Operating ratio: 50%, with heat load of 9.5 kW all the time

- Conditions**
- Common conditions for non-inverter and triple inverter:
    - Ambient temperature: 32°C
    - Circulating fluid flow rate: 35 L/min @ 0.3 MPa (60 Hz)
  - Conditions for non-inverter chiller: Continuous operation of the compressor which can cool down 9.5 kW at 60 Hz. The pump shall be same as that of the HRSH.
  - Circulating fluid temperature: 20°C
  - Heat load: 9.5 kW



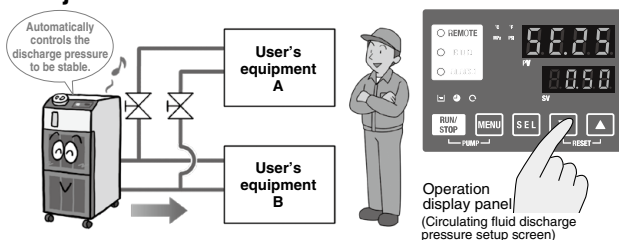
## Inverter pump

### Power reducing effect of the inverter pump




### Circulating fluid pressure adjustable

Discharge pressure of the circulating fluid can be set with the operation panel. The inverter pump automatically controls the discharge pressure to the set pressure without adjusting the bypass piping under various piping conditions. Power consumption can be reduced by this control. (Operation to the set pump operating frequency is also possible.)

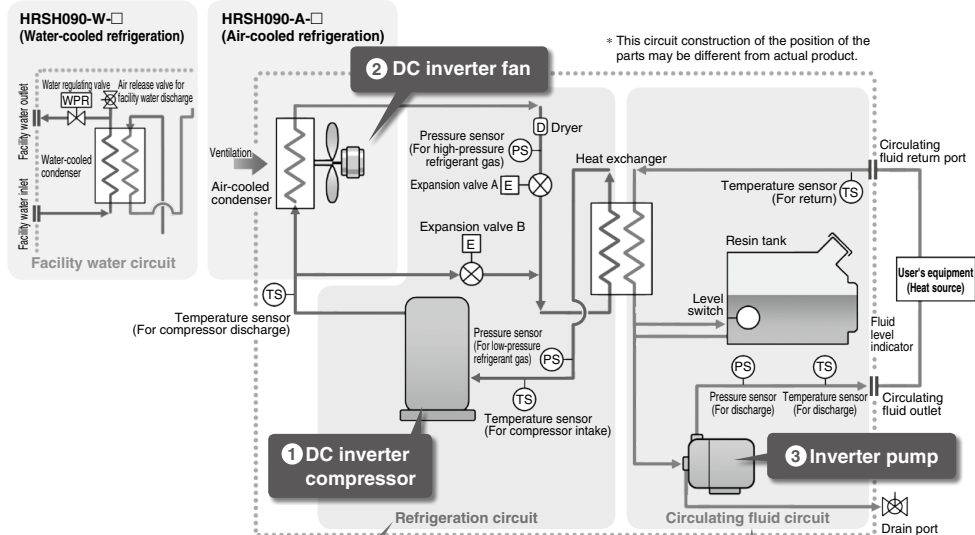


When the product is used with the flow path switched for maintenance, the pressure adjusting function controls the discharge pressure to be stable. (Secure the specified minimum flow for each branch circuit.)

## Variations

| Model                                                                            | Cooling method             | Cooling capacity | Power supply                                                                                        | Option <small>Page 145</small>                                                                      | Optional accessories <small>Pages 146 to 148-1</small>                                                                                                                                                                                     | International standards                                 |
|----------------------------------------------------------------------------------|----------------------------|------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
|  | Air-cooled refrigeration   | 9.5 kW           | · 3-phase 200 VAC (50 Hz),<br>3-phase 200 to 230 VAC (60 Hz)<br>· 3-phase 380 to 415 VAC (50/60 Hz) | · With earth leakage breaker (For 400 V type as standard)<br>· Applicable to deionized water piping | · Piping conversion fitting<br>· Bypass piping set<br>· Electric conductivity control set<br>· Particle filter set<br>· Filter for circulating fluid fill port<br>· Drain pan set (With water leakage sensor)<br>· Wired remote controller | C C<br>(400 V as standard)<br>(Only 200 V as an option) |
|                                                                                  | Water-cooled refrigeration | 11.0 kW          |                                                                                                     |                                                                                                     |                                                                                                                                                                                                                                            |                                                         |

## Circuit diagram



### Refrigeration circuit

- The DC inverter 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 DC inverter 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 DC inverter 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 inverter control of the compressor and fan (facility water flow control by a water regulating valve is used in water-cooled refrigeration), and the precise control of expansion valves A and B realizes energy saving operation without waste and high temperature stability.

### Circulating fluid circuit

- The circulating fluid discharged from the inverter pump, is heated or cooled by the user's equipment and returns to the tank.
- The circulating fluid is sent to the evaporator by the inverter pump, and 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

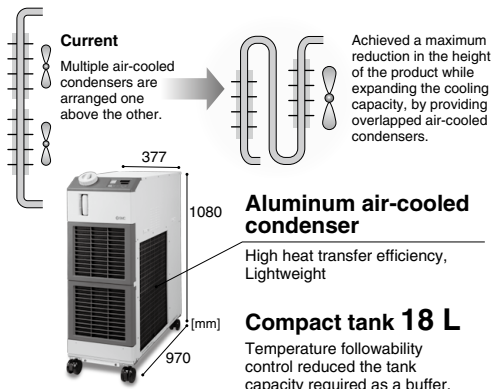
Adjusting the discharge pressure by pump inverter control eliminates wasteful discharge of the circulating fluid and realizes energy saving operation.

### 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.

## Compact and lightweight 130 kg

### Reduced-height double condenser structure



## Simple operation

- Step 1 Press the **RUN/STOP** key.
- Step 2 Adjust the temperature setting with the **▼/▲** keys.
- Step 3 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).

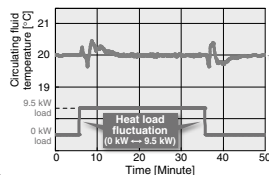
## Temperature stability $\pm 0.1^\circ\text{C}$ (when a load is stable)

By controlling the DC inverter compressor, DC inverter fan, and electronic expansion valve simultaneously, it maintains the good temperature stability when the heat load fluctuates.

\* For HRSH090-A-20

### Conditions

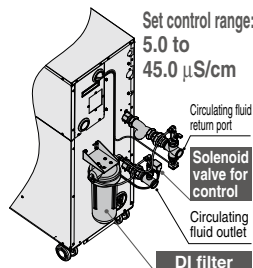
- Outdoor air temperature:  $32^\circ\text{C}$
- Circulating fluid temperature setting:  $20^\circ\text{C}$
- Heat load in the user's equipment: 9.5 kW
- Power supply: 200 V, 60 Hz
- Circulating fluid flow: 45 L/min @ 0.5 MPa
- External piping: Bypass piping + Heat load



## Electric conductivity control set

(With DI filter + Solenoid valve kit for control) P.147

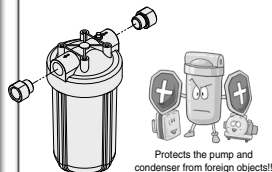
The electric conductivity of the circulating fluid can be set with the controller monitor arbitrarily.



## Particle filter set P.147

**Removes foreign objects in the circulating fluid.**

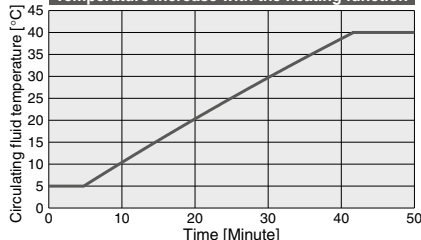
Effective to prevent foreign objects from entering the user's equipment and chiller.



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

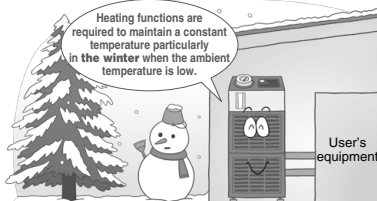
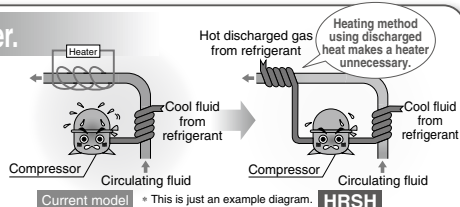
## Circulating fluid can be heated without a heater.

### Temperature increase with the heating function



\* For HRSH090-A-20

- Conditions**
- Ambient temperature:  $5^\circ\text{C}$
  - Circulating fluid flow: 45 L/min @ 0.5 MPa
  - External piping: Bypass piping
  - Power supply: 200 V, 60 Hz





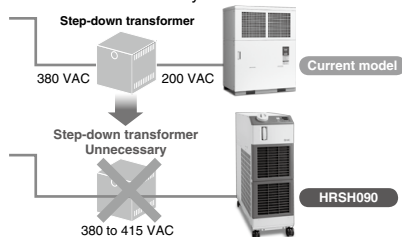
## Globally compatible power supplies (400 V type only)

(Europe, Asia, Oceania, Central and South America)

### Transformer unnecessary

**Power supply** Applicable to 200 to 230 VAC, or 380 to 415 VAC

Transformers are unnecessary even when used overseas.

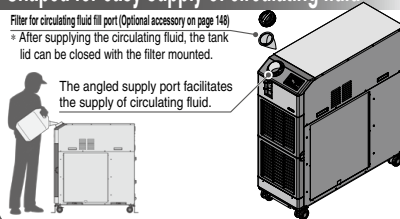


## Shaped for easy supply of circulating fluid

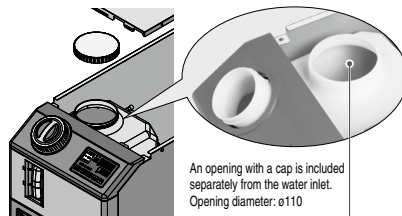
Filter for circulating fluid fill port (Optional accessory on page 148)

After supplying the circulating fluid, the tank lid can be closed with the filter mounted.

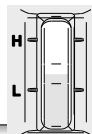
The angled supply port facilitates the supply of circulating fluid.



## Easy cleaning of the tank



## Easy check of the circulating fluid level



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

\* For air-cooled refrigeration

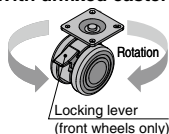
### Dustproof filter

\* It can be removed with no tools.

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



### With unfixed caster

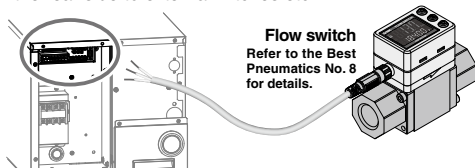


### Anchor bolt fixing bracket

\* Remove bracket when moving, using casters.

## Power supply (24 VDC) available

Power can be supplied from the terminal block on the rear side to external switches etc.



## Wired remote controller

(Optional accessory on page 148-1)

Operable from a distance.



HRS

HRS  
090

HRS  
100/150

HRS  
H090

HRS  
H

HRS  
E

HRS  
Z

HRS  
ZD

HRS  
W

HRS  
ECR

HRS  
EC

HRS  
EB

HRS  
ED

HRS  
EA

HRS  
IDH

## 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"

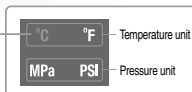
**Timer** The time remaining can be checked.



### ■ 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 and check display

### Display of individual alarm codes [For details, refer to page 143.]

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.

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 55°C       |
| Circulating fluid discharge temperature drop | 1 to 39°C       |
| Circulating fluid discharge pressure rise    | 0.05 to 0.6 MPa |
| Circulating fluid discharge pressure drop    | 0.05 to 0.6 MPa |

Ex. AL01 "Low level in tank"

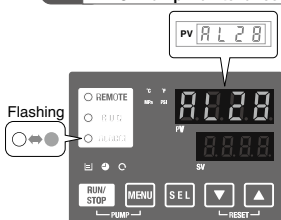


### Alarm codes notify of checking times.

Notifies when to check the pump and fan motor. Helpful for facility maintenance.

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

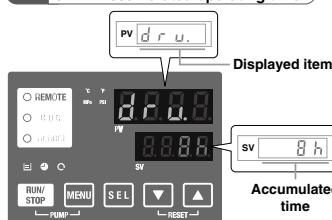
Ex. AL28 "Pump maintenance"



### 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              |
| Circulating fluid flow rate *1                    |
| 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 *2              |
| Accumulated operating time of compressor          |
| Accumulated operation time of dustproof filter *2 |

\*1 This is not measurement value.

Use it for reference.

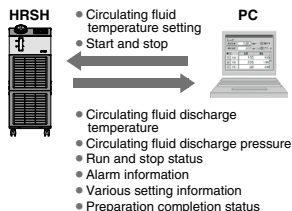
\*2 These are displayed only for air-cooled refrigeration.

## 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.).

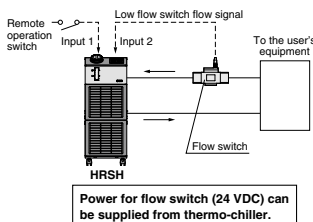
### Ex. 1 Remote signal I/O through serial communication

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



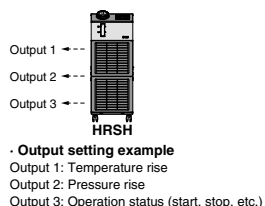
### Ex. 2 Remote operation signal input

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.

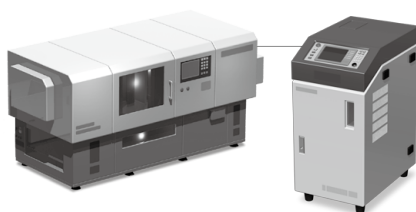


### Ex. 3 Alarm and operation status (start, stop, etc.) signal output

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

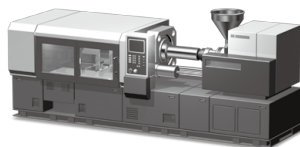


## Applications

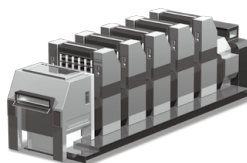


### Laser beam machine/Laser welding machine

Cooling of the laser oscillation part and power source



### Injection molding



### Printing machine

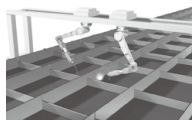
Temperature control of the roller



### Cleaning machine

Temperature control of cleaning solution

### Arc welding machine

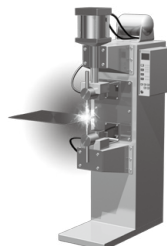


Cooling of the power source



### Resistance welding machine (Spot welding)

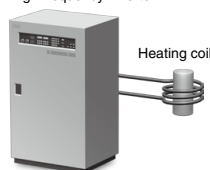
Cooling of the welding head electrodes, transformers and transistors (thyristors)



### High frequency induction heating equipment

Cooling of the heating coils, high frequency power source and around inverters

High frequency inverter



Heating coil



# Global Supply Network







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

We now have a presence of more than 400 branch offices and distributors in 78 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.

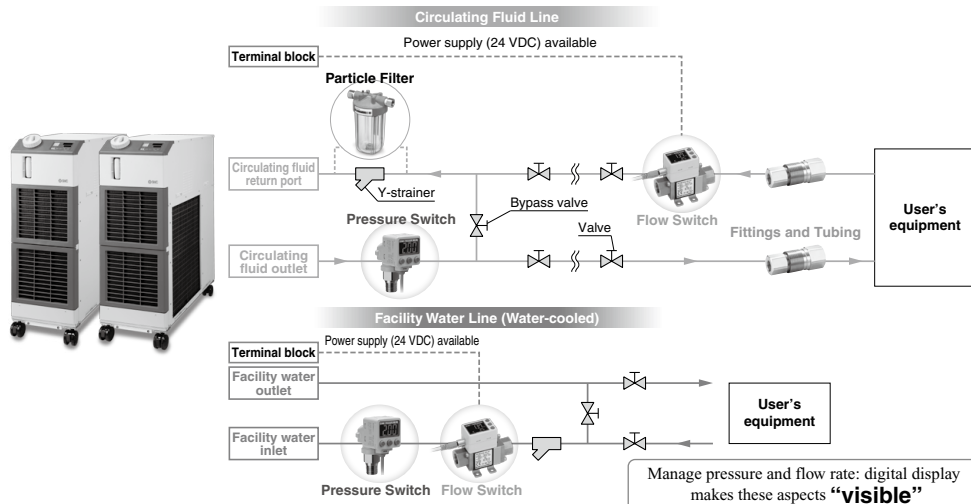


## SMC Thermo-chiller Variations

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

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

## Circulating Fluid/Facility Water Line Equipment



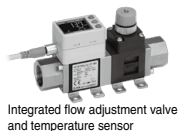
**Flow Switch:** Monitors flow rate and temperature of the circulating fluid.

Refer to the Best Pneumatics No. 8 for details.

3-Color Display Digital Flow Switch for Water **PF3W**

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. Refer to the Best Pneumatics No. 8 for details.

**Particle Filter**



### Fittings and Tubing

Refer to the Best Pneumatics No. 7 for details.

**S Coupler KK**

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

**Tubing T□**



**Metal One-touch Fittings KQB2**

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

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



**Stainless Steel 316 Insert Fittings KFG2**

**Fluoropolymer Fittings LQ**







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### Thermo-chiller HRSH090 Series

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HRSH

HRSH  
090

HRSH  
100/150

HRSH  
090

HRSH

HRSE

HRZ

HRZD

HRW

HECR

HEC

HEB

HED

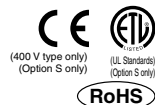
HEA

IDH

# Thermo-chiller Inverter Type

## Air-cooled 200 V/400 V Type

### HRSH090 Series



#### How to Order

HRSH 090 - A - 20 -

Cooling capacity

090 9.5 kW

Cooling method

A Air-cooled refrigeration

Pipe thread type

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

Power supply

|    |                                                           |
|----|-----------------------------------------------------------|
| 20 | 3-phase 200 VAC (50 Hz)<br>3-phase 200 to 230 VAC (60 Hz) |
| 40 | 3-phase 380 to 415 VAC (50/60 Hz)                         |

Option

|                      |                                      |
|----------------------|--------------------------------------|
| Nil                  | None                                 |
| B <sup>Note 1)</sup> | With earth leakage breaker           |
| J                    | With automatic fluid fill function   |
| M                    | Applicable to deionized water piping |
| S <sup>Note 2)</sup> | Conforming to CE/UL standards        |

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

Note 1) 200 V type only.  
400 V type is provided with an earth leakage breaker as standard.

Note 2) 200 V type only. 400 V type is CE-compliant as standard.  
Additionally, combination with option B is not necessary.  
An earth leakage breaker is equipped as standard.

#### Specifications

| Model                                                        | HRSH090-A□-20-□                                                                                                                                                                                                                                                                          | HRSH090-A□-40-□ |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Cooling method                                               | Air-cooled refrigeration                                                                                                                                                                                                                                                                 |                 |
| Refrigerant                                                  | R410A (HFC) (GWP1975)                                                                                                                                                                                                                                                                    |                 |
| Refrigerant charge                                           | kg 1.32                                                                                                                                                                                                                                                                                  |                 |
| Control method                                               | PID control                                                                                                                                                                                                                                                                              |                 |
| Ambient temperature/Humidity/Altitude <sup>Note 1), 9)</sup> | °C/% Temperature: 5 to 45°C, Humidity: 30 to 70%, Altitude: less than 3000 m                                                                                                                                                                                                             |                 |
| Circulating fluid <sup>Note 2)</sup>                         | Tap water, 15% Ethylene glycol aqueous solution, Deionized water                                                                                                                                                                                                                         |                 |
| Set temperature range <sup>Note 1)</sup>                     | °C 5 to 40                                                                                                                                                                                                                                                                               |                 |
| Cooling capacity <sup>Note 3), 9)</sup>                      | kW 9.5                                                                                                                                                                                                                                                                                   |                 |
| Heating capacity <sup>Note 4)</sup>                          | kW 2.5                                                                                                                                                                                                                                                                                   |                 |
| Temperature stability <sup>Note 5)</sup>                     | °C ±0.1                                                                                                                                                                                                                                                                                  |                 |
| Pump capacity                                                | L/min 45 (0.5 MPa)                                                                                                                                                                                                                                                                       |                 |
| Rated flow (Outlet)                                          | L/min 60                                                                                                                                                                                                                                                                                 |                 |
| Maximum flow rate                                            | L/min 50                                                                                                                                                                                                                                                                                 |                 |
| Maximum pump head                                            | m 0.1 to 0.5                                                                                                                                                                                                                                                                             |                 |
| Settable pressure range <sup>Note 6)</sup>                   | MPa 20                                                                                                                                                                                                                                                                                   |                 |
| Minimum operating flow rate <sup>Note 7)</sup>               | L/min 18                                                                                                                                                                                                                                                                                 |                 |
| Tank capacity                                                | L Rc1 (Symbol F: G1, Symbol N: NPT1)                                                                                                                                                                                                                                                     |                 |
| Circulating fluid outlet, circulating fluid return port      | Rc1/4 (Symbol F: G1/4, Symbol N: NPT1/4)                                                                                                                                                                                                                                                 |                 |
| Tank drain port                                              | Stainless steel, Copper (Heat exchanger brazing), Brass, Bronze, Carbon, Ceramic, PE, PVC, POM, PTFE, NBR, EPDM, FKM, PP                                                                                                                                                                 |                 |
| Fluid contact material                                       | 3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz)                                                                                                                                                                                                                                  |                 |
| Power supply                                                 | 3-phase 380 to 415 VAC (50/60 Hz)<br>Allowable voltage range ±10%<br>(No continuous voltage fluctuation)                                                                                                                                                                                 |                 |
| Applicable earth leakage breaker <sup>Note 8)</sup>          | Rated current A 30                                                                                                                                                                                                                                                                       |                 |
| Sensitivity of leak current <sup>Note 5)</sup>               | mA 30                                                                                                                                                                                                                                                                                    |                 |
| Rated operating current <sup>Note 5)</sup>                   | A 15                                                                                                                                                                                                                                                                                     |                 |
| Rated power consumption <sup>Note 5)</sup>                   | kW (kVA) 4.6 (5.2)                                                                                                                                                                                                                                                                       |                 |
| Noise level (Front 1 m/Height 1 m) <sup>Note 5)</sup>        | dB (A) 66                                                                                                                                                                                                                                                                                |                 |
| Accessories                                                  | Alarm code list stickers 2 pcs. (English 1 pc./Japanese 1 pc.),<br>Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.),<br>Y-strainer (40 meshes) 25A, Barrel nipple 25A, Anchor bolt fixing brackets 2 pcs. (including 4 M10 bolts) <sup>Note 10)</sup> |                 |
| Weight (dry state)                                           | kg Approx. 130                                                                                                                                                                                                                                                                           |                 |

Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less.

Note 2) Use fluid in condition below as the circulating fluid.

Tap water: Standard of The Japan Refrigeration And Air Conditioning Industry Association (JRA GL-02-1994)

15% ethylene glycol aqueous solution: diluted by tap water in condition above without any additives such as antiseptics.

Deionized water: Electric conductivity 1 μS/cm or higher (Electric resistivity 1 MΩ·cm or lower)

Note 3) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 200/400 VAC

Note 4) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 200/400 VAC

Note 5) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity,

⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 200/400 VAC, ⑦ Piping length: Shortest

Note 6) With the pressure control mode by inverter. When the pressure control mode is not used, the pump power frequency set mode can be used.

Note 7) Fluid flow rate to maintain the cooling capacity. If the actual flow rate is lower than this, install a bypass piping.

Note 8) To be prepared by user. A specified earth leakage breaker is installed for option B [With earth leakage breaker], option S [Conforming to CE/UL standards] and 400 V type.

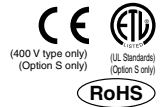
Note 9) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 151) Item 14 "For altitude of 1000 m or higher".

Note 10) The anchor bolt fixing brackets (including 4 M10 bolts) are used for fixing to wooden skids when packaging the thermo-chiller. No anchor bolt is included.

# Thermo-chiller Inverter Type

## Water-cooled 200 V/400 V Type

### HRSH090 Series



#### How to Order

HRSH 090 - W - 20 -

Cooling capacity ●  
090 | 11.0 kW

Cooling method ●  
W | Water-cooled refrigeration

Pipe thread type ●

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

Power supply ●

|    |                                   |
|----|-----------------------------------|
| 20 | 3-phase 200 VAC (50 Hz)           |
|    | 3-phase 200 to 230 VAC (60 Hz)    |
| 40 | 3-phase 380 to 415 VAC (50/60 Hz) |

Option

|            |                                      |
|------------|--------------------------------------|
| Nil        | None                                 |
| B (Note 1) | With earth leakage breaker           |
| J          | With automatic fluid fill function   |
| M          | Applicable to deionized water piping |
| S (Note 2) | Conforming to CE/UL standards        |

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

Note 1) 200 V type only.

400 V type is provided with an earth leakage breaker as standard.

Note 2) 200 V type only. 400 V type is CE-compliant as standard. Additionally, combination with option B is not necessary. An earth leakage breaker is equipped as standard.

#### Specifications

| Model                                                   | HRSH090-W□-20-□                                                                                                                                                                                                                                                               | HRSH090-W□-40-□                                                                                          |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Cooling method                                          | Water-cooled refrigeration                                                                                                                                                                                                                                                    |                                                                                                          |
| Refrigerant                                             | R410A (HFC) (GWP1975)                                                                                                                                                                                                                                                         |                                                                                                          |
| Refrigerant charge                                      | kg 1.4                                                                                                                                                                                                                                                                        |                                                                                                          |
| Control method                                          | PID control                                                                                                                                                                                                                                                                   |                                                                                                          |
| Ambient temperature/Humidity/Altitude (Note 1)          | °C/% Temperature: 5 to 45°C, Humidity: 30 to 70%, Altitude: less than 3000 m                                                                                                                                                                                                  |                                                                                                          |
| Circulating fluid (Note 2)                              | Tap water, 15% Ethylene glycol aqueous solution, Deionized water                                                                                                                                                                                                              |                                                                                                          |
| Set temperature range (Note 1)                          | °C 5 to 40                                                                                                                                                                                                                                                                    |                                                                                                          |
| Cooling capacity (Note 3)                               | kW 11.0                                                                                                                                                                                                                                                                       |                                                                                                          |
| Heating capacity (Note 4)                               | kW 2.5                                                                                                                                                                                                                                                                        |                                                                                                          |
| Temperature stability (Note 5)                          | °C ±0.1                                                                                                                                                                                                                                                                       |                                                                                                          |
| Pump capacity                                           | Rated flow (Outlet) L/min 45 (0.5 MPa)                                                                                                                                                                                                                                        |                                                                                                          |
|                                                         | Maximum flow rate L/min 60                                                                                                                                                                                                                                                    |                                                                                                          |
|                                                         | Maximum pump head m 50                                                                                                                                                                                                                                                        |                                                                                                          |
| Settable pressure range (Note 6)                        | MPa 0.1 to 0.5                                                                                                                                                                                                                                                                |                                                                                                          |
| Minimum operating flow rate (Note 7)                    | L/min 20                                                                                                                                                                                                                                                                      |                                                                                                          |
| Tank capacity                                           | L 18                                                                                                                                                                                                                                                                          |                                                                                                          |
| Circulating fluid outlet, circulating fluid return port | Rc1 (Symbol F: G1, Symbol N: NPT1)                                                                                                                                                                                                                                            |                                                                                                          |
| Tank drain port                                         | Rc1/4 (Symbol F: G1/4, Symbol N: NPT1/4)                                                                                                                                                                                                                                      |                                                                                                          |
| Fluid contact material                                  | Stainless steel, Copper (Heat exchanger brazing), Brass, Bronze, Carbon, Ceramic, PE, PVC, POM, PTFE, NBR, EPDM, FKM, PP                                                                                                                                                      |                                                                                                          |
| Temperature range                                       | °C 5 to 40                                                                                                                                                                                                                                                                    |                                                                                                          |
| Pressure range                                          | MPa 0.3 to 0.5                                                                                                                                                                                                                                                                |                                                                                                          |
| Required flow                                           | L/min 25                                                                                                                                                                                                                                                                      |                                                                                                          |
| Facility water pressure differential                    | MPa 0.3 or more                                                                                                                                                                                                                                                               |                                                                                                          |
| Facility water inlet/outlet                             | Rc1/2                                                                                                                                                                                                                                                                         |                                                                                                          |
| Fluid contact material                                  | Stainless steel, Copper (Heat exchanger brazing), Bronze, Brass, PTFE, NBR, EPDM                                                                                                                                                                                              |                                                                                                          |
| Power supply                                            | 3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz)<br>Allowable voltage range ±10%<br>(No continuous voltage fluctuation)                                                                                                                                                | 3-phase 380 to 415 VAC (50/60 Hz)<br>Allowable voltage range ±10%<br>(No continuous voltage fluctuation) |
| Applicable earth leakage breaker (Note 8)               | Rated current A 30                                                                                                                                                                                                                                                            | 20                                                                                                       |
| Sensitivity of leak current (Note 5)                    | A 12                                                                                                                                                                                                                                                                          | 6.8                                                                                                      |
| Rated operating current                                 | A 3.8 (4.0)                                                                                                                                                                                                                                                                   | 4.0 (4.7)                                                                                                |
| Rated power consumption (Note 5)                        | kW (kVA) 65                                                                                                                                                                                                                                                                   |                                                                                                          |
| Noise level (Front 1 m/Height 1 m) (Note 5)             | dB (A)                                                                                                                                                                                                                                                                        |                                                                                                          |
| Accessories                                             | Alarm code list stickers 2 pcs. (English 1 pc./Japanese 1 pc.),<br>Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.),<br>Y-strainer (40 meshes) 25A, Barrel nipple 25A, Anchor bolt fixing brackets 2 pcs. (including 4 M10 bolts) (Note 9) |                                                                                                          |
| Weight (dry state)                                      | kg Approx. 121                                                                                                                                                                                                                                                                |                                                                                                          |

Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less.

Note 2) Use fluid in condition below as the circulating fluid.

Tap water: Standard of The Japan Refrigeration And Air Conditioning Industry Association (JRA GL-Q2-1994)

15% ethylene glycol aqueous solution: diluted by tap water in condition above without any additives such as antiseptics.

Deionized water: Electric conductivity 1 μS/cm or higher (Electric resistivity 1 MΩ·cm or lower)

Note 3) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 200/400 VAC

Note 4) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 200/400 VAC

Note 5) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity,

⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 200/400 VAC, ⑦ Piping length: Shortest

Note 6) With the pressure control mode by inverter. When the pressure control mode is not used, the pump power frequency set mode can be used.

Note 7) Fluid flow rate to maintain the cooling capacity. If the actual flow rate is lower than this, install a bypass piping.

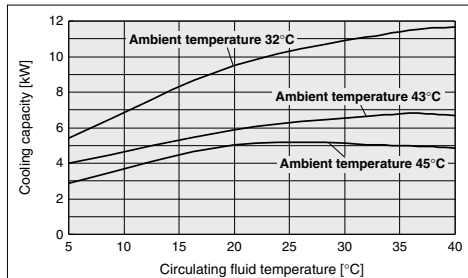
Note 8) To be prepared by user. A specified earth leakage breaker is installed for option B [With earth leakage breaker], option S [Conforming to CE/UL standards] and 400 V type.

Note 9) The anchor bolt fixing brackets (including 4 M10 bolts) are used for fixing to wooden skids when packaging the thermo-chiller. No anchor bolt is included.

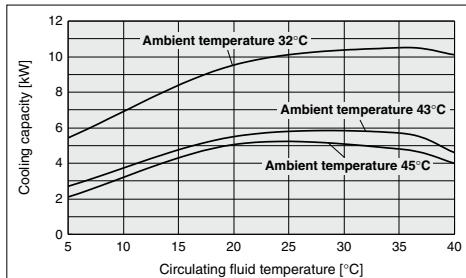
## Cooling Capacity

\* If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 151) Item 14 "For altitude of 1000 m or higher."

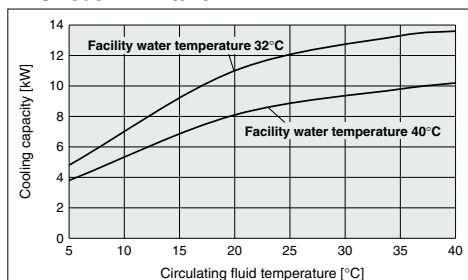
HRSH090-A□-20-□



HRSH090-A□-40-□

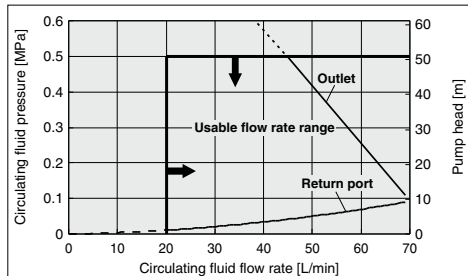


HRSH090-W□-20/40-□



## Pump Capacity

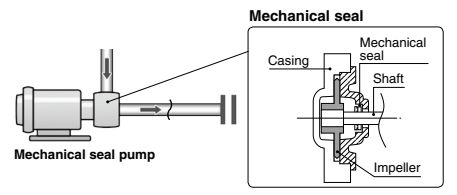
HRSH090-□□-20/40-□



## ⚠ Caution

### Mechanical Seal Pump

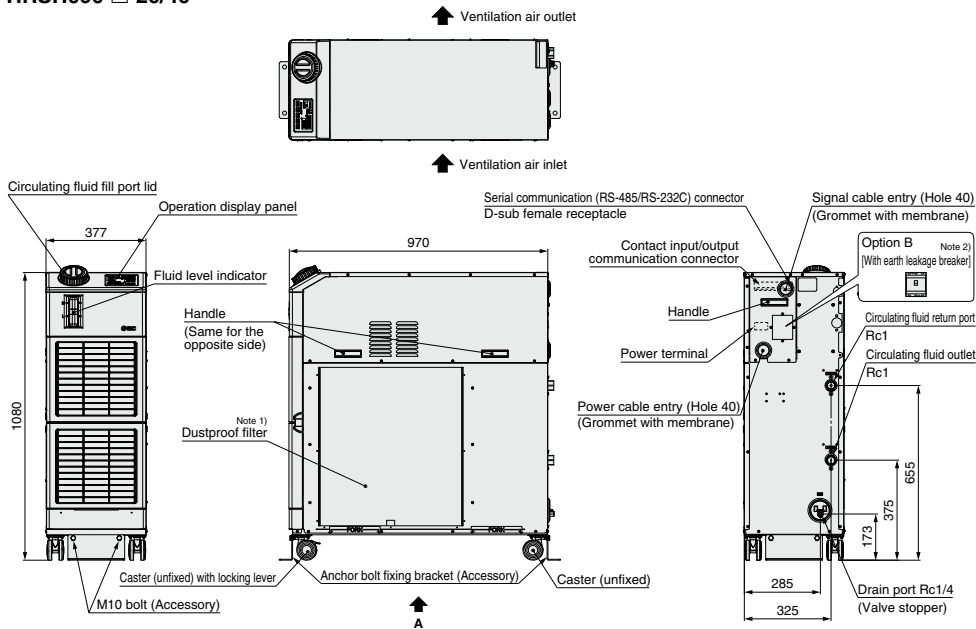
The pump used for the thermo-chiller HRSH090 series uses a mechanical seal with the fixed ring and rotary ring used for the shaft seal part. If foreign objects enter the gap between the seals, this may cause a trouble such as leakage from the seal part or pump lock. Therefore, it is strongly recommended to install the particle filter in the return piping of the chiller.





## Dimensions

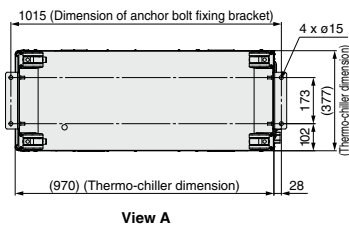
**HRSH090--20/40**



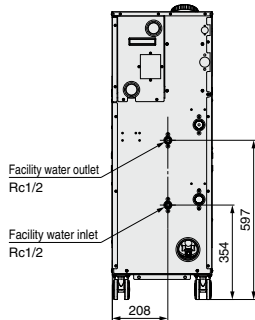
Note 1) The water-cooled type is not equipped with a dustproof filter.

Note 2) 400 V type is provided with an earth leakage breaker "-B" as standard.

### Anchor bolt fixing position

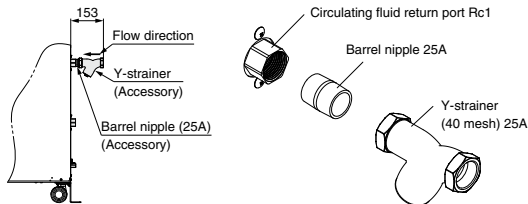


View A



### Accessory: Y-strainer mounting view

\* Mount it by yourself on the circulating fluid return port.

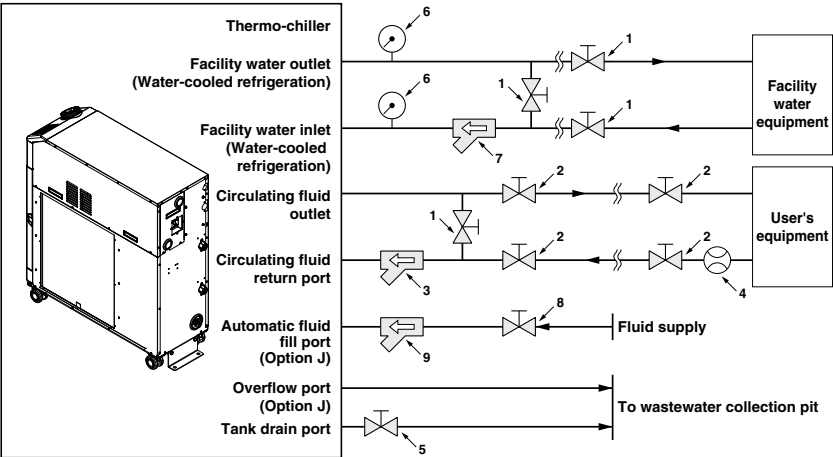


### For water-cooled type

HRS  
HRS  
090  
HRS  
100/150  
**HRSH  
090**  
HRSH  
HRSE  
HRZ  
HRZD  
HRW  
HECR  
HEC  
HEB  
HED  
HEA  
IDH

**Recommended External Piping Flow**

External piping circuit is recommended as shown below.



| No. | Description                    | Size         | Recommended part no.         | Note                                                                                                                                                                                                                       |
|-----|--------------------------------|--------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Valve                          | Rc1/2        | —                            | —                                                                                                                                                                                                                          |
| 2   | Valve                          | Rc1          | —                            | —                                                                                                                                                                                                                          |
| 3   | Y-strainer                     | Rc1 #40      | Accessory                    | Install either the strainer or filter. If foreign objects with a size of 20 μm or more are likely to enter, install the particle filter. For the recommended filter, refer to the optional accessory HRS-PF005 (page 147). |
|     | Filter                         | Rc1 20 μm    | HRS-PF005 (Note)             |                                                                                                                                                                                                                            |
| 4   | Flow meter                     | —            | —                            | Prepare a flow meter with an appropriate flow range.                                                                                                                                                                       |
| 5   | Valve (Part of thermo-chiller) | Rc1/4        | —                            | —                                                                                                                                                                                                                          |
| 6   | Pressure gauge                 | 0 to 1.0 MPa | —                            | —                                                                                                                                                                                                                          |
| 7   | Y-strainer                     | Rc1/2 #40    | —                            | Install either the strainer or filter. If foreign objects with a size of 20 μm or more are likely to enter, select and prepare a particle filter.                                                                          |
|     | Filter                         | Rc1/2 20 μm  | —                            |                                                                                                                                                                                                                            |
| 8   | Valve                          | Rc3/8        | —                            | —                                                                                                                                                                                                                          |
| 9   | Y-strainer                     | Rc3/8 #40    | —                            | Install either the strainer or filter. If foreign objects with a size of 20 μm or more are likely to enter, install the particle filter.                                                                                   |
|     | Filter                         | Rc3/8 20 μm  | FQ1011N-10-T020-B-X61 (Note) |                                                                                                                                                                                                                            |

Note) The filter shown above cannot be directly connected to the thermo-chiller. Install it in the user's piping system.

**Cable Specifications**

Power supply and signal cable should be prepared by user.

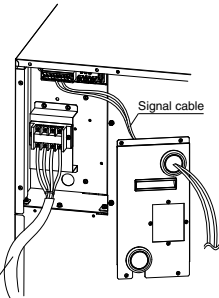
**Power Cable Specifications**

| Applicable model | Rated value for thermo-chiller                            |                                  |                               | Power cable examples                                                                                      |                                                  |
|------------------|-----------------------------------------------------------|----------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------|
|                  | Power supply                                              | Applicable breaker rated current | Terminal block screw diameter | Cable size                                                                                                | Crimped terminal on the thermo-chiller side      |
| HRSH090-□□-20    | 3-phase 200 VAC (50 Hz)<br>3-phase 200 to 230 VAC (60 Hz) | 30 A                             | M5                            | 4 cores x 5.5 mm <sup>2</sup> (4 cores x AWG10) (Including grounding cable)                               | R5.5-5                                           |
| HRSH090-□□-40    | 3-phase 380 to 415 VAC (50/60 Hz)                         | 20 A                             |                               | 3 x 5.5 mm <sup>2</sup> (3 x AWG10) (Power supply)<br>1 x 14 mm <sup>2</sup> (1 x AWG6) (Grounding cable) | R5.5-5 (Power supply)<br>R14-5 (Grounding cable) |

Note) An example of the cable specifications is when two kinds of vinyl insulated wires with a continuous allowable operating temperature of 70°C at 600 V, are used at an ambient temperature of 30°C. Select the proper size of cable according to an actual condition.

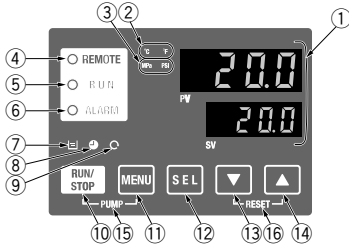
**Signal Cable Specifications**

| Terminal specifications       |                                  | Cable specifications                        |
|-------------------------------|----------------------------------|---------------------------------------------|
| Terminal block screw diameter | Recommended crimped terminal     | 0.75 mm <sup>2</sup> (AWG18) Shielded cable |
| M3                            | Y-shape crimped terminal 1.25Y-3 |                                             |



## Operation Display Panel

The basic operation of this unit is controlled through the operation display panel on the front of the product.



| No. | Description                           | Function                                                                                                                                                                                                                 |
|-----|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ①   | Digital display (7-segment, 4 digits) | PV Displays the circulating fluid current discharge temperature and pressure and alarm codes and other menu items (codes).<br>SV Displays the circulating fluid discharge temperature and the set values of other menus. |
| ②   | [°C] [°F] lamp                        | Equipped with a unit conversion function. Displays the unit of displayed temperature (default setting: °C).                                                                                                              |
| ③   | [MPa] [PSI] lamp                      | Equipped with a unit conversion function. Displays the unit of displayed pressure (default setting: MPa).                                                                                                                |
| ④   | [REMOTE] lamp                         | Enables remote operation (start and stop) by communication. Lights up during remote operation.                                                                                                                           |
| ⑤   | [RUN] lamp                            | Lights up when the product is started, and goes off when it 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   | [L] lamp                              | Lights up when the surface of the fluid level indicator falls below the L level.                                                                                                                                         |
| ⑧   | [●] lamp                              | Equipped with a timer for start and stop. Lights up when this function is operated.                                                                                                                                      |
| ⑨   | [○] lamp                              | Equipped with a power failure auto-restart function, which restarts the product automatically after stopped due to a power failure. Lights up when this function is operated.                                            |
| ⑩   | [RUN/STOP] key                        | Makes the product start or stop.                                                                                                                                                                                         |
| ⑪   | [MENU] key                            | Shifts the main menu (display screen of circulating fluid discharge temperature and pressure) and other menus (for monitoring and entry of set values).                                                                  |
| 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                            | Press the [MENU] and [RUN/STOP] keys simultaneously. The pump starts running independently to make the product ready for start-up (release the air).                                                                     |
| ⑯   | [RESET] key                           | Press the [▼] and [▲] keys simultaneously. The alarm buzzer is stopped and the [ALARM] lamp is reset.                                                                                                                    |

## Alarm

This unit has alarms as standard, and displays each of them by its alarm code on the PV screen with the [ALARM] lamp ([LOW LEVEL] lamp) lit up on the operation display panel. The alarm can be read out through communication.

| Code | Alarm message                                            |
|------|----------------------------------------------------------|
| AL01 | Low level in tank                                        |
| AL02 | High circulating fluid discharge temp.                   |
| AL03 | Circulating fluid discharge temp. rise                   |
| AL04 | Circulating fluid discharge temp. drop                   |
| AL05 | High circulating fluid return temp. (60°C)               |
| AL06 | High circulating fluid discharge pressure                |
| AL07 | Abnormal pump operation                                  |
| AL08 | Circulating fluid discharge pressure rise                |
| AL09 | Circulating fluid discharge pressure drop                |
| AL10 | High compressor intake temp.                             |
| AL11 | Low compressor intake temp.                              |
| AL12 | Low super heat temp.                                     |
| AL13 | High compressor discharge pressure                       |
| AL15 | Refrigeration circuit pressure (high pressure side) drop |
| AL16 | Refrigeration circuit pressure (low pressure side) rise  |
| AL17 | Refrigeration circuit pressure (low pressure side) drop  |

| Code | Alarm message                                       |
|------|-----------------------------------------------------|
| AL18 | Compressor running failure                          |
| AL19 | Communication error                                 |
| AL20 | Memory error                                        |
| AL21 | DC line fuse cut                                    |
| AL22 | Circulating fluid discharge temp. sensor failure    |
| AL23 | Circulating fluid return temp. sensor failure       |
| AL24 | Compressor intake temp. sensor failure              |
| AL25 | Circulating fluid discharge pressure sensor failure |
| AL26 | Compressor discharge pressure sensor failure        |
| AL27 | Compressor intake pressure sensor failure           |
| AL28 | Pump maintenance                                    |
| AL29 | Fan maintenance <sup>Note 1)</sup>                  |
| AL30 | Compressor maintenance                              |
| AL31 | Contact input 1 signal detection                    |
| AL32 | Contact input 2 signal detection                    |
| AL37 | Compressor discharge temp. sensor failure           |

| Code | Alarm message                                   |
|------|-------------------------------------------------|
| AL38 | Compressor discharge temp. rise                 |
| AL39 | Internal unit fan stoppage                      |
| AL40 | Dustproof filter maintenance <sup>Note 1)</sup> |
| AL41 | Power stoppage                                  |
| AL42 | Compressor waiting                              |
| AL43 | Fan breaker trip <sup>Note 1)</sup>             |
| AL44 | Fan inverter error <sup>Note 1)</sup>           |
| AL45 | Compressor breaker trip <sup>Note 2)</sup>      |
| AL46 | Compressor inverter error                       |
| AL47 | Pump breaker trip <sup>Note 2)</sup>            |
| AL48 | Pump inverter error                             |
| AL49 | Air exhaust fan stoppage <sup>Note 3)</sup>     |

<sup>Note 1)</sup> Does not occur on the product of water-cooled refrigeration type.

<sup>Note 2)</sup> Does not occur on the product of power supply specification '20'.

<sup>Note 3)</sup> Does not occur on the product of air-cooled refrigeration type.

\* For details, read the Operation Manual.

## List of Function

| No. | Function                                 | Outline                                                                                                                                                        |
|-----|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Main display                             | Displays the current and set temperature of the circulating fluid, discharge pressure of the circulating fluid. Changes the circulating fluid set temperature. |
| 2   | Alarm display menu                       | Indicates alarm number when an alarm occurs.                                                                                                                   |
| 3   | Inspection monitor menu                  | Product temperature, pressure and accumulated operating time can be checked as daily inspection. Use these for daily inspection.                               |
| 4   | Key-lock                                 | Keys can be locked so that set values cannot be changed by operator error.                                                                                     |
| 5   | Timer for operation start/stop           | Timer is used to set the operation start/stop.                                                                                                                 |
| 6   | Signal for the completion of preparation | A signal is output when the circulating fluid temperature reaches the set temperature, when using contact input/output and serial communication.               |
| 7   | Offset function                          | Use this function when there is a temperature offset between the discharge temperature of the thermo-chiller and user's equipment.                             |
| 8   | Reset after power failure                | Start operation automatically after the power supply is turned on.                                                                                             |
| 9   | Key click sound setting                  | Operation panel key sound can be set on/off.                                                                                                                   |
| 10  | Changing temp. unit                      | Temperature unit can be changed.<br>Centigrade [°C] ⇔ Fahrenheit [°F]                                                                                          |
| 11  | Changing pressure unit                   | Pressure unit can be changed.<br>MPa ⇔ PSI                                                                                                                     |
| 12  | Data reset                               | Functions can be reset to the default settings (settings when shipped from the factory).                                                                       |
| 13  | Accumulation time reset                  | Reset function when the pump, the fan or the compressor is replaced. Reset the accumulated time here.                                                          |
| 14  | Pump operation mode set                  | The fluid supply mode of the pump can be changed<br>Pressure control mode ⇔ Frequency set mode                                                                 |
| 15  | Anti-freezing function                   | Circulating fluid is protected from freezing during winter or at night. Set beforehand if there is a risk of freezing.                                         |
| 16  | Warming-up function                      | When circulating fluid temperature rising time at starting needs shortening during winter or at night, set beforehand.                                         |
| 17  | Alarm buzzer sound setting               | Alarm sound can be set to on/off.                                                                                                                              |
| 18  | Alarm customizing                        | Operation during alarm condition and threshold values can be changed depending on the alarm type.                                                              |
| 19  | Communication                            | This function is used for contact input/output or serial communication.                                                                                        |

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**Communication Function**

**Contact Input/Output**

| Item                         |                         | Specifications                                         |
|------------------------------|-------------------------|--------------------------------------------------------|
| <b>Connector type</b>        |                         | M3 terminal block                                      |
| <b>Input signal</b>          | Insulation method       | Photocoupler                                           |
|                              | Rated input voltage     | 24 VDC                                                 |
|                              | Operating voltage range | 21.6 to 26.4 VDC                                       |
|                              | Rated input current     | 5 mA TYP                                               |
|                              | Input impedance         | 4.7 kΩ                                                 |
| <b>Contact output signal</b> | Rated load voltage      | 48 VAC or less/30 VDC or less                          |
|                              | Maximum load current    | 500 mA AC/DC (resistance load)                         |
|                              | Minimum load current    | 5 VDC 10 mA                                            |
| <b>Output voltage</b>        |                         | 24 VDC ±10% 500 mA MAX (not usable for inductive load) |
| <b>Circuit diagram</b>       |                         |                                                        |

\* The pin numbers and output signals can be set by user. For details, refer to the Operation Manual, Communication function.

**Serial Communication**

The serial communication (RS-485/RS-232C) enables the following items to be written and read out. For details, refer to the Operation Manual, Communication function.

| Writing                                                | Readout                                                                                                                             |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Run/Stop<br>Circulating fluid temperature setting (SV) | Circulating fluid present temperature<br>Circulating fluid discharge pressure<br>Status information<br>Alarm occurrence information |

| Item                   |  | Specifications                                                                                                                                       |
|------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Connector type</b>  |  | D-sub 9-pin, Female connector                                                                                                                        |
| <b>Protocol</b>        |  | Modicon Modbus compliant/Simple communication protocol                                                                                               |
| <b>Standards</b>       |  | EIA standard RS-485      EIA standard RS-232C                                                                                                        |
| <b>Circuit diagram</b> |  | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> </div> <div style="text-align: center;"> </div> </div> |

\* The terminal resistance of RS-485 (120 Ω) can be switched by the operation display panel. For details, refer to the Operation Manual, Communication function. Do not connect other than in the way shown above, as it can result in failure.

Please download the Operation Manual via our website, <http://www.smcworld.com>

# HRSH090 Series

## Options

Note) Select the option when ordering the thermo-chiller because the option cannot be added after purchasing the unit.

### B Option symbol

#### With Earth Leakage Breaker

##### HRSH090-□□-20-B

###### With earth leakage breaker

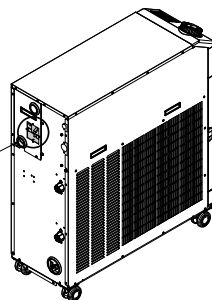
A leakage breaker is built in to automatically stop the supply power when it has short-circuit, over current or electrical leakage. (For models with power supply specification "-40", it is not necessary to select this option because an earth leakage breaker is equipped as standard.)

| Applicable model | Rated current [A] | Sensitivity of leak current [mA] | Short circuit display method |
|------------------|-------------------|----------------------------------|------------------------------|
| HRSH090-□□-20-B  | 30                | 30                               | Mechanical button            |

\* 400 V type is equipped as standard.

(Refer to the specifications on pages 138, 139 and the dimensions on page 141 for details.)

Earth leakage breaker



### J Option symbol

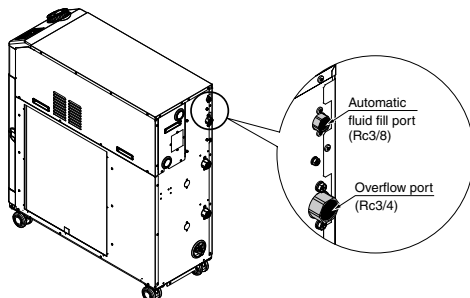
#### With Automatic Fluid Fill Function

##### HRSH090-□□-□-J

###### With automatic fluid fill function

By installing this at the automatic fluid fill port, the circulating fluid can be automatically supplied to the product using a built-in solenoid valve for a water fill while the circulating fluid is decreasing.

| Applicable model            | HRSH090-□□-□-J                                   |
|-----------------------------|--------------------------------------------------|
| Fluid fill method           | Built-in solenoid valve for automatic water fill |
| Fluid fill pressure (MPa)   | 0.2 to 0.5                                       |
| Feed water temperature (°C) | 5 to 40                                          |



### M Option symbol

#### Applicable to Deionized Water Piping

##### HRSH090-□□-□-M

###### Applicable to deionized water piping

Contact material of the circulating fluid circuit is made from non-copper materials.

| Applicable model                       | HRSH090-□□-□-M                                                                                          |
|----------------------------------------|---------------------------------------------------------------------------------------------------------|
| Contact material for circulating fluid | Stainless steel (including heat exchanger brazing), SiC, Carbon, PP, PE, POM, FKM, NBR, EPDM, PVC, PTFE |

\* No change in external dimensions.

### S Option symbol

#### Conforming to CE/UL Standards

##### HRSH090-□□-20-S

###### Conforming to CE/UL standards

Products conforming to CE/UL standards.  
The following standards are applicable.

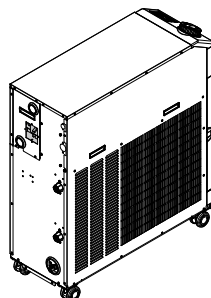
| Applicable standard |                     |             |
|---------------------|---------------------|-------------|
| CE marking          | EMC directive       | 2004/108/EC |
|                     | Machinery directive | 2006/42/EC  |
| UL standard         | 3054524 (UL61010-1) |             |

When selecting this option,

- An earth leakage breaker with a breaker handle is equipped.  
(The breaker are the same as those for option B.)
- A caution label is added.
- The CE/UL certification mark is added.

\* Cannot be selected for 400 V type.

\* Cannot be selected together with option B.



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# HRSH090 Series

## Optional Accessories

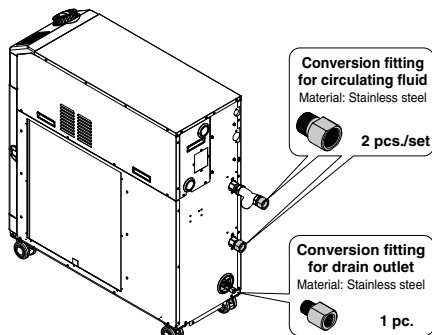
### ① Piping Conversion Fitting

This is a fitting to change the port from Rc to G or NPT.

- Circulating fluid outlet, Circulating fluid return port Rc1 → NPT1 or G1
- Drain port Rc1/4 → NPT1/4 or G1/4

(It is not necessary to purchase this when pipe thread type F or N is selected in "How to Order" since it is included in the product.)

| Part no.         | Contents                          | Applicable model   |
|------------------|-----------------------------------|--------------------|
| <b>HRS-EP018</b> | NPT thread conversion fitting set | <b>HRSH090-A-□</b> |
| <b>HRS-EP019</b> | G thread conversion fitting set   |                    |



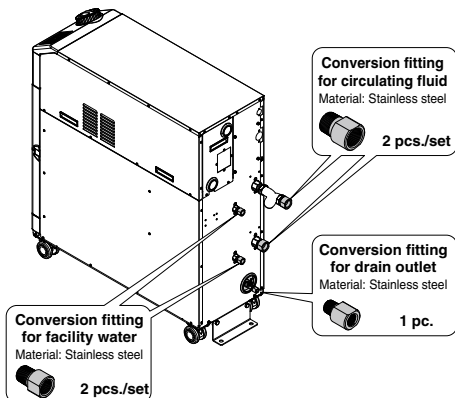
When option J (With automatic fluid fill function) is included, use the following part numbers.

- Automatic fluid fill port Rc3/8 → NPT3/8 or G3/8
- Overflow port Rc3/4 → NPT3/4 or G3/4

\* The conversion fittings for circulating fluid outlet/return port, drain port, facility water inlet/outlet (for water-cooled refrigeration) are also included.

| Part no.         | Contents                          | Applicable model   |
|------------------|-----------------------------------|--------------------|
| <b>HRS-EP020</b> | NPT thread conversion fitting set | <b>HRSH090-A-J</b> |
| <b>HRS-EP021</b> | G thread conversion fitting set   |                    |

| Part no.         | Contents                          | Applicable model   |
|------------------|-----------------------------------|--------------------|
| <b>HRS-EP022</b> | NPT thread conversion fitting set | <b>HRSH090-W-□</b> |
| <b>HRS-EP023</b> | G thread conversion fitting set   |                    |

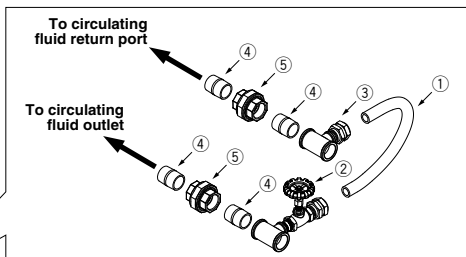
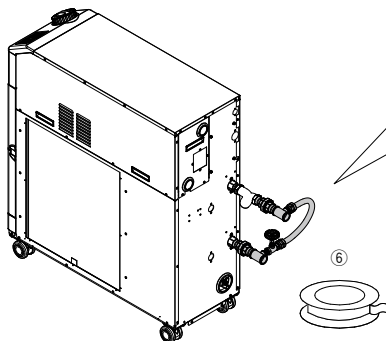


| Part no.         | Contents                          | Applicable model   |
|------------------|-----------------------------------|--------------------|
| <b>HRS-EP024</b> | NPT thread conversion fitting set | <b>HRSH090-W-J</b> |
| <b>HRS-EP025</b> | G thread conversion fitting set   |                    |

### ② Bypass Piping Set

When the circulating fluid goes below the minimum operating flow rate (as shown below), cooling capacity will be reduced and the temperature stability will be badly affected. Use the bypass piping set to ensure a circulating fluid flow rate of the minimum operating flow rate or more.

| Part no.         | Applicable model    | Minimum operating flow rate [L/min] |
|------------------|---------------------|-------------------------------------|
| <b>HRS-BP005</b> | <b>HRSH090-□□-□</b> | 20                                  |



#### Parts List

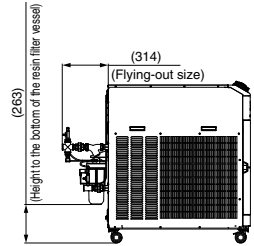
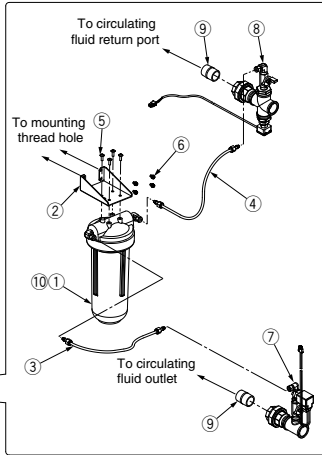
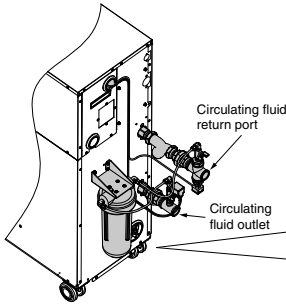
| No. | Description                               |
|-----|-------------------------------------------|
| ①   | Hose (I.D.: 15 mm, Length: 700 mm)        |
| ②   | Outlet piping assembly (With globe valve) |
| ③   | Return piping assembly                    |
| ④   | Barrel nipple (Size: 1 inch) (2 pcs.)     |
| ⑤   | Union (Size: 1 inch) (2 pcs.)             |
| ⑥   | Sealant tape                              |
| ⑦   | Operation Manual                          |

### ③ Electric Conductivity Control Set

The set indicates and controls the electric conductivity of the circulating fluid. Refer to the Operation Manual for details.

| Part no.  | Applicable model |
|-----------|------------------|
| HRS-DI007 | HRSH090-□□-□     |

|                                                             |                                     |
|-------------------------------------------------------------|-------------------------------------|
| Measurement range of electric conductivity                  | 2.0 to 48.0 $\mu\text{S}/\text{cm}$ |
| Set range of electric conductivity target                   | 5.0 to 45.0 $\mu\text{S}/\text{cm}$ |
| Set range of electric conductivity hysteresis               | 2.0 to 10.0 $\mu\text{S}/\text{cm}$ |
| Operating temperature range (Circulating fluid temperature) | 5 to 60°C                           |
| Power consumption                                           | 400 mA or less                      |



#### Parts List

| No. | Description                               |
|-----|-------------------------------------------|
| ①   | DI filter vessel (Resin)                  |
| ②   | Mounting bracket                          |
| ③   | DI filter inlet tube                      |
| ④   | DI filter outlet tube                     |
| ⑤   | Tapping screw (4 pcs.)                    |
| ⑥   | Mounting screw (4 pcs.)                   |
| ⑦   | DI control piping assembly                |
| ⑧   | DI sensor assembly                        |
| ⑨   | Nipple (2 pcs.)                           |
| ⑩   | DI filter cartridge (Part no.: HRS-DF001) |

### ④ Particle Filter Set

Removes foreign objects in the circulating fluid. If foreign objects such as scales in the piping enter the circulating fluid, this may cause the pump to malfunction. Therefore, it is strongly recommended to install the particle filter set. This set cannot be directly connected to the thermo-chiller. Install it in the user's piping system. For details, refer to the operation manual.

#### Particle Filter Set

HRS-PF005-**H**

|                             |                 |
|-----------------------------|-----------------|
| Fluid                       | Tap water       |
| Max. operating pressure     | 0.65 MPa        |
| Operating temperature range | 5 to 35°C       |
| Nominal filtration accuracy | 5 $\mu\text{m}$ |
| Installation environment    | Indoors         |

#### Accessory

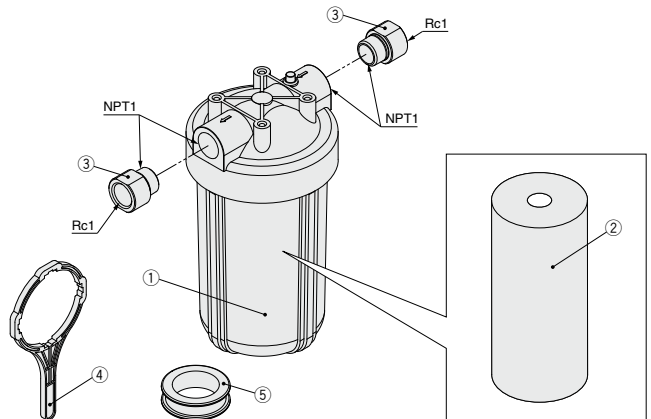
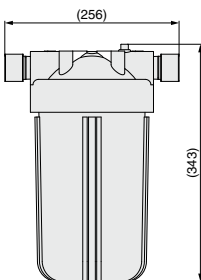
| Symbol | Accessory   |
|--------|-------------|
| NII    | None        |
| H      | With handle |

#### Parts List

| No. | Description     | Material        | Q'ty | Note                      |
|-----|-----------------|-----------------|------|---------------------------|
| ①   | Body            | PC, PP          | 1    | —                         |
| ②   | Element         | PP              | 1    | —                         |
| ③   | Extension piece | Stainless steel | 2    | Conversion from NPT to Rc |
| ④   | Handle          | —               | 1    | When -H is selected       |
| ⑤   | Sealant tape    | PTFE            | 1    | —                         |

#### Replacement Element

HRS-PF006

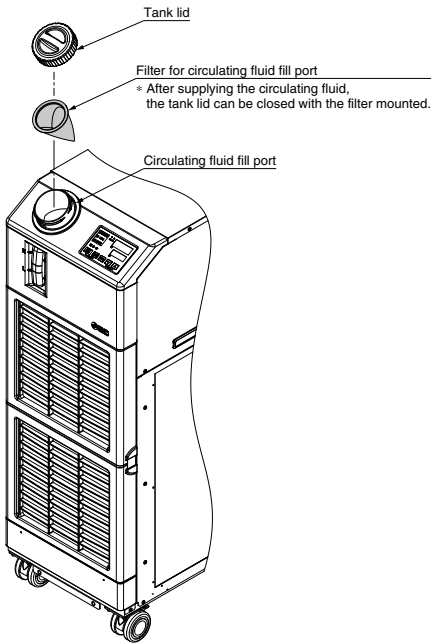


⑤ Filter for Circulating Fluid Fill Port

Prevents foreign objects from entering the tank when supplying the circulating fluid. Can be used just by fitting into the circulating fluid fill port.

■ Filter for circulating fluid fill port  
HRS-PF007

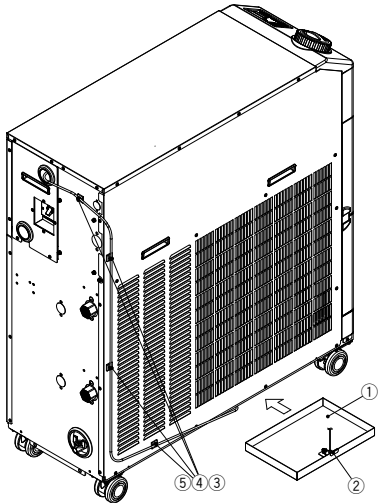
|           |                                             |
|-----------|---------------------------------------------|
| Material  | Stainless steel 304,<br>Stainless steel 316 |
| Mesh size | 200                                         |



⑥ Drain Pan Set (With Water Leakage Sensor)

Drain pan for the thermo-chiller. Liquid leakage from the thermo-chiller can be detected by mounting the attached water leakage sensor. Align the drain pan with the hole in the bottom of the thermo-chiller for installation.

|           |                  |
|-----------|------------------|
| Part no.  | Applicable model |
| HRS-WL003 | HRS090-□□-20/40  |



Parts List

| No. | Description            |
|-----|------------------------|
| ①   | Drain pan              |
| ②   | Water leakage sensor   |
| ③   | Extension cable        |
| ④   | Binding band (4 pcs.)  |
| ⑤   | Cable fixture (4 pcs.) |

## ⑦ Wired Remote Controller

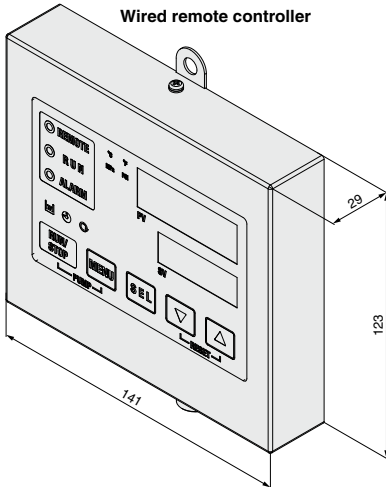
When the wired remote controller is connected to the thermo-chiller, the operation start/stop setting or the set temperature can be changed from a place apart from the thermo-chiller. For details, refer to the Operation Manual.

### Wired remote controller

HRS-CV004-1

#### Accessories

| Symbol | Accessories                |
|--------|----------------------------|
| Nil    | None                       |
| 1      | With cable (Approx. 20 m)  |
| 2      | With cable (Approx. 50 m)  |
| 3      | With cable (Approx. 100 m) |



Wired remote controller

#### Displayed items

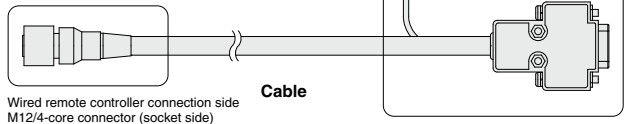
|                                             |
|---------------------------------------------|
| Circulating fluid discharge temperature     |
| Circulating fluid discharge set temperature |
| Circulating fluid discharge pressure        |
| Circulating fluid electric conductivity*1   |
| Circulating fluid flow rate                 |
| Alarm code*2                                |

\*1 Only when the electric conductivity control set is used.

\*2 Only when an alarm occurs. The alarm cannot be reset with the remote controller. Be sure to reset the alarm with the thermo-chiller main unit.

#### Operable items

|                                       |
|---------------------------------------|
| Operation start/stop                  |
| Circulating fluid temperature setting |
| Alarm sound stop                      |
| Key-lock                              |
| Key operation sound ON/OFF            |
| Digital display brightness adjustment |
| Alarm sound ON/OFF                    |



- \* To use the wired remote controller, the thermo-chiller main unit setting is needed.
- \* Use the wired remote controller indoors.
- \* Pass the cable through the duct, etc. so that it is not exposed to rain water or direct sunlight.

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# Cooling Capacity Calculation

## Required Cooling Capacity Calculation

### Example 1: When the heat generation amount in the user's equipment is known.

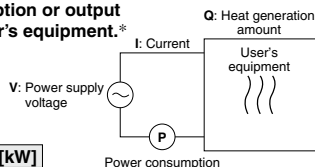
The heat generation amount can be determined based on the power consumption or output of the heat generating area — i.e. the area requiring cooling — within the user's equipment.\*

#### ① Derive the heat generation amount from the power consumption.

Power consumption **P**: 7 [kW]

$$Q = P = 7 \text{ [kW]}$$

$$\text{Cooling capacity} = \text{Considering a safety factor of 20\%, } 7 \text{ [kW]} \times 1.2 = \boxed{8.4 \text{ [kW]}}$$



#### ② Derive the heat generation amount from the power supply output.

Power supply output **VI**: 8.8 [kVA]

$$Q = P = V \times I \times \text{Power factor}$$

In this example, using a power factor of 0.85:

$$= 8.8 \text{ [kVA]} \times 0.85 = 7.5 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

$$7.5 \text{ [kW]} \times 1.2 = \boxed{9.0 \text{ [kW]}}$$

#### ③ Derive the heat generation amount from the output.

Output (shaft power etc.) **W**: 13 [kW]

$$Q = P = \frac{W}{\text{Efficiency}}$$

In this example, using an efficiency of 0.7:

$$= \frac{5.1}{0.7} = 7.3 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

$$7.3 \text{ [kW]} \times 1.2 = \boxed{8.8 \text{ [kW]}}$$

\* The above examples calculate the heat generation amount based on the power consumption. The actual heat generation amount may differ due to the structure of the user's equipment. Be sure to check it carefully.

### Example 2: When the heat generation amount in the user's equipment is not known.

Obtain the temperature difference between inlet and outlet by circulating the circulating fluid inside the user's equipment.

|                                                     |                                         |
|-----------------------------------------------------|-----------------------------------------|
| Heat generation amount by user's equipment <b>Q</b> | : Unknown [W] (J/s)                     |
| Circulating fluid                                   | : Tap water*                            |
| Circulating fluid mass flow rate <b>qm</b>          | : $(= \rho \times qv \times 60)$ [kg/s] |
| Circulating fluid density <b>p</b>                  | : 1 [kg/L]                              |
| Circulating fluid (volume) flow rate <b>qv</b>      | : 35 [L/min]                            |
| Circulating fluid specific heat <b>C</b>            | : $4.186 \times 10^3$ [J/(kg·K)]        |
| Circulating fluid outlet temperature <b>T1</b>      | : 293 [K] (20 [°C])                     |
| Circulating fluid return temperature <b>T2</b>      | : 296 [K] (23 [°C])                     |
| Circulating fluid temperature difference <b>ΔT</b>  | : 3 [K] (= T2 - T1)                     |
| Conversion factor: minutes to seconds (SI units)    | : 60 [s/min]                            |

\* Refer to page 150 for the typical physical property value of tap water or other circulating fluids.

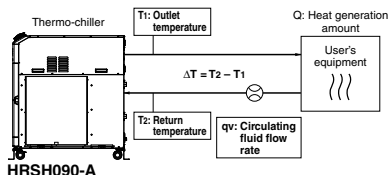
$$Q = qm \times C \times (T_2 - T_1)$$

$$= \frac{\rho \times qv \times C \times \Delta T}{60} = \frac{1 \times 35 \times 4.186 \times 10^3 \times 3.0}{60}$$

$$= 7325 \text{ [J/s]} \approx 7325 \text{ [W]} = 7.3 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

$$7.3 \text{ [kW]} \times 1.2 = \boxed{8.8 \text{ [kW]}}$$



#### Example of current measurement units (Reference)

|                                                     |                                         |
|-----------------------------------------------------|-----------------------------------------|
| Heat generation amount by user's equipment <b>Q</b> | : Unknown [cal/h] → [W]                 |
| Circulating fluid                                   | : Tap water*                            |
| Circulating fluid weight flow rate <b>qm</b>        | : $(= \rho \times qv \times 60)$ [kg/h] |
| Circulating fluid weight volume ratio <b>γ</b>      | : 1 [kg/L]                              |
| Circulating fluid (volume) flow rate <b>qv</b>      | : 35 [L/min]                            |
| Circulating fluid specific heat <b>C</b>            | : $1.0 \times 10^3$ [cal/(kg·°C)]       |
| Circulating fluid outlet temperature <b>T1</b>      | : 20 [°C]                               |
| Circulating fluid return temperature <b>T2</b>      | : 23 [°C]                               |
| Circulating fluid temperature difference <b>ΔT</b>  | : 3 [°C] (= T2 - T1)                    |
| Conversion factor: hours to minutes                 | : 60 [min/h]                            |
| Conversion factor: kcal/h to kW                     | : 860 [(kcal/h)/W]                      |

$$Q = \frac{qm \times C \times (T_2 - T_1)}{860}$$

$$= \frac{\gamma \times qv \times 60 \times C \times \Delta T}{860}$$

$$= \frac{1 \times 35 \times 60 \times 1.0 \times 10^3 \times 3.0}{860}$$

$$\approx 7325 \text{ [W]} = 7.3 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

$$7.3 \text{ [kW]} \times 1.2 = \boxed{8.8 \text{ [kW]}}$$

## Required Cooling Capacity Calculation

**Example 3: When there is no heat generation, and when cooling the object below a certain temperature and period of time.**

Heat quantity by cooled substance (per unit time) **Q** : Unknown [W] (J/s)  
 Cooled substance : Water  
 Cooled substance mass **m** : (=  $\rho \times V$ ) [kg]  
 Cooled substance density  $\rho$  : 1 [kg/L]  
 Cooled substance total volume **V** : 150 [L]  
 Cooled substance specific heat **C** :  $4.186 \times 10^3$  [J/(kg·K)]  
 Cooled substance temperature when cooling begins **T<sub>0</sub>** : 303 [K] (30 [°C])  
 Cooled substance temperature after t hour **T<sub>t</sub>** : 293 [K] (20 [°C])  
 Cooling temperature difference  $\Delta T$  : 10 [K] (= **T<sub>0</sub>** - **T<sub>t</sub>**)  
 Cooling time  $\Delta t$  : 900 [s] (= 15 [min])

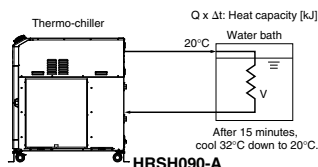
\* Refer to the following for the typical physical property values by circulating fluid.

$$Q = \frac{m \times C \times (T_0 - T_t)}{\Delta t} = \frac{\rho \times V \times C \times \Delta T}{\Delta t}$$

$$= \frac{1 \times 150 \times 4.186 \times 10^3 \times 10}{900} = 6977 \text{ [J/s]} = 7.0 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

$$7.0 \text{ [kW]} \times 1.2 = \boxed{8.4 \text{ [kW]}}$$



### Example of current measurement units (Reference)

Heat quantity by cooled substance (per unit time) **Q** : Unknown [cal/h] → [W]  
 Cooled substance : Water  
 Cooled substance weight **m** : (=  $\rho \times V$ ) [kgf]  
 Cooled substance weight volume ratio  $\gamma$  : 1 [kgf/L]  
 Cooled substance total volume **V** : 150 [L]  
 Cooled substance specific heat **C** :  $1.0 \times 10^3$  [cal/(kgf·°C)]  
 Cooled substance temperature when cooling begins **T<sub>0</sub>** : 30 [°C]  
 Cooled substance temperature after t hour **T<sub>t</sub>** : 20 [°C]  
 Cooling temperature difference  $\Delta T$  : 10 [°C] (= **T<sub>0</sub>** - **T<sub>t</sub>**)  
 Cooling time  $\Delta t$  : 15 [min]  
 Conversion factor: hours to minutes : 60 [min/h]  
 Conversion factor: kcal/h to kW : 860 [(cal/h)/W]

$$Q = \frac{m \times C \times (T_0 - T_t)}{\Delta t \times 860} = \frac{\gamma \times V \times 60 \times C \times \Delta T}{\Delta t \times 860}$$

$$= \frac{1 \times 150 \times 60 \times 1.0 \times 10^3 \times 10}{15 \times 860}$$

$$= 6977 \text{ [W]} = 7.0 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

$$7.0 \text{ [kW]} \times 1.2 = \boxed{8.4 \text{ [kW]}}$$

Note) This is the calculated value by changing the fluid temperature only.  
 Thus, it varies substantially depending on the water bath or piping shape.

## Precautions on Cooling Capacity Calculation

### 1. Heating capacity

When the circulating fluid temperature is set above room temperature, it needs to be heated by the thermo-chiller. The heating capacity depends on the circulating fluid temperature. Consider the radiation rate and heat capacity of the user's equipment and check beforehand if the required heating capacity is provided.

### 2. Pump capacity

#### <Circulating fluid flow rate>

Circulating fluid flow rate varies depending on the circulating fluid discharge pressure. Consider the installation height difference between the thermo-chiller and the user's equipment, and the piping resistance such as circulating fluid pipings, or piping size, or piping curves in the machine. Check beforehand if the required flow is achieved, using the pump capacity curves.

#### <Circulating fluid discharge pressure>

Circulating fluid discharge pressure has the possibility to increase up to the maximum pressure in the pump capacity curves.

Check beforehand if the circulating fluid pipings or circulating fluid circuit of the user's equipment are fully durable against this pressure.

## Circulating Fluid Typical Physical Property Values

### 1. This catalog uses the following values for density and specific heat in calculating the required cooling capacity.

Density  $\rho$ : 1 [kg/L] (or, using current unit system, weight volume ratio  $\gamma = 1$  [kgf/L])

Specific heat **C**:  $4.19 \times 10^3$  [J/(kg·K)] (or, using current unit system,  $1 \times 10^3$  [cal/(kgf·°C)])

### 2. Values for density and specific heat change slightly according to temperature shown below. Use this as a reference.

#### Water

| Physical property value<br>Temperature | Density $\rho$<br>[kg/L] | Specific heat C<br>[J/(kg·K)] | Current unit system                  |                                |
|----------------------------------------|--------------------------|-------------------------------|--------------------------------------|--------------------------------|
|                                        |                          |                               | Weight volume ratio $\gamma$ [kgf/L] | Specific heat C [cal/(kgf·°C)] |
| 5°C                                    | 1.00                     | $4.2 \times 10^3$             | 1.00                                 | $1 \times 10^3$                |
| 10°C                                   | 1.00                     | $4.19 \times 10^3$            | 1.00                                 | $1 \times 10^3$                |
| 15°C                                   | 1.00                     | $4.19 \times 10^3$            | 1.00                                 | $1 \times 10^3$                |
| 20°C                                   | 1.00                     | $4.18 \times 10^3$            | 1.00                                 | $1 \times 10^3$                |
| 25°C                                   | 1.00                     | $4.18 \times 10^3$            | 1.00                                 | $1 \times 10^3$                |
| 30°C                                   | 1.00                     | $4.18 \times 10^3$            | 1.00                                 | $1 \times 10^3$                |
| 35°C                                   | 0.99                     | $4.18 \times 10^3$            | 0.99                                 | $1 \times 10^3$                |
| 40°C                                   | 0.99                     | $4.18 \times 10^3$            | 0.99                                 | $1 \times 10^3$                |

#### 15% Ethylene Glycol Aqueous Solution

| Physical property value<br>Temperature | Density $\rho$<br>[kg/L] | Specific heat C<br>[J/(kg·K)] | Current unit system                  |                                |
|----------------------------------------|--------------------------|-------------------------------|--------------------------------------|--------------------------------|
|                                        |                          |                               | Weight volume ratio $\gamma$ [kgf/L] | Specific heat C [cal/(kgf·°C)] |
| 5°C                                    | 1.02                     | $3.91 \times 10^3$            | 1.02                                 | $0.93 \times 10^3$             |
| 10°C                                   | 1.02                     | $3.91 \times 10^3$            | 1.02                                 | $0.93 \times 10^3$             |
| 15°C                                   | 1.02                     | $3.91 \times 10^3$            | 1.02                                 | $0.93 \times 10^3$             |
| 20°C                                   | 1.01                     | $3.91 \times 10^3$            | 1.01                                 | $0.93 \times 10^3$             |
| 25°C                                   | 1.01                     | $3.91 \times 10^3$            | 1.01                                 | $0.93 \times 10^3$             |
| 30°C                                   | 1.01                     | $3.91 \times 10^3$            | 1.01                                 | $0.94 \times 10^3$             |
| 35°C                                   | 1.01                     | $3.91 \times 10^3$            | 1.01                                 | $0.94 \times 10^3$             |
| 40°C                                   | 1.01                     | $3.92 \times 10^3$            | 1.01                                 | $0.94 \times 10^3$             |

Note) The above shown are reference values. Contact circulating fluid supplier for details.



# HRSH090 Series

## Specific Product Precautions 1

Be sure to read this before handling the products. Refer to back page 50 for Safety Instructions and pages 13 to 16 for Temperature Control Equipment Precautions.

### Design

#### Warning

##### 1. This catalog shows the specifications of a single unit.

1. Check the specifications of the single unit (contents of this catalog) and thoroughly consider the adaptability between the user's system and this unit.
2. Although the protection circuit as a single unit is installed, prepare a drain pan, water leakage sensor, discharge air facility, and emergency stop equipment, depending on the user's operating condition. Also, the user is requested to carry out the safety design for the whole system.

##### 2. When attempting to cool areas that are open to the atmosphere (tanks, pipes), plan your piping system accordingly.

When cooling open-air external tanks, arrange the piping so that there are coil pipes for cooling inside the tanks, and to carry back the entire flow volume of circulating fluid that is released.

##### 3. Use non-corrosive materials for fluid contact parts of circulating fluid.

The recommended circulating fluid is the tap water or 15% ethylene glycol aqueous solution. Using corrosive materials such as aluminum or iron for fluid contact parts such as piping may cause clogging or leakage in the circulating fluid circuit. Therefore, take sufficient care when selecting fluid contact part materials such as piping.

##### 4. Design the piping so that no foreign objects enter the chiller.

If foreign objects such as scales in the piping enter the circulating fluid, this may cause the pump to malfunction. Therefore, it is strongly recommended to install the particle filter.

##### 5. The facility water outlet temperature (water-cooled type) may increase up to around 60°C.

When selecting the facility water pipings, consider the suitability for temperature.

### Selection

#### Warning

##### Model selection

For selecting a model of thermo-chiller, it is required to know the heat generation amount of the user's equipment. Obtain the heat generation amount, referring to "Cooling Capacity Calculation" on pages 149 and 150 before selecting a model.

### Handling

#### Warning

##### Thoroughly read the Operation Manual.

Read the Operation Manual completely before operation, and keep this manual available whenever necessary.

### Operating Environment/Storage Environment

#### Warning

##### 1. Do not use in the following environment as it will lead to a breakdown.

1. Outdoors
2. In locations where water, water vapor, salt water, and oil may splash on the product.
3. In locations where there are dust and particles.
4. In locations where corrosive gases, organic solvents, chemical fluids, or flammable gases are present. (This product is not explosion proof.)
5. In locations where the ambient temperature/humidity exceeds the limits as mentioned below or where condensation occurs.

During transportation/storage: -15°C to 50°C, 15% to 85%  
(But as long as water or circulating fluid are not left inside the pipings)

During operation: 5°C to 45°C, 30% to 70%  
(However, use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature or circulating fluid temperature is 10°C or less.)

6. In locations where condensation may occur.
7. In locations which receive direct sunlight or radiated heat.
8. In locations where there is a heat source nearby and the ventilation is poor.
9. In locations where temperature substantially changes.
10. In locations where strong magnetic noise occurs.  
(In locations where strong electric fields, strong magnetic fields and surge voltage occur.)
11. In locations where static electricity occurs, or conditions which make the product discharge static electricity.
12. In locations where high frequency occurs.
13. In locations where damage is likely to occur due to lightning.
14. In locations at altitude of 3000 m or higher (Except during storage and transportation)

\* For altitude of 1000 m or higher

Because of lower air density, the heat radiation efficiencies of the devices in the product will be lower in the location at altitude of 1000 m or higher. Therefore, the maximum ambient temperature to use and the cooling capacity will lower according to the descriptions in the table below. Select the thermo-chiller considering the descriptions.

- ① Upper limit of ambient temperature: Use the product in ambient temperature of the described value or lower at each altitude.
- ② Cooling capacity coefficient: The product's cooling capacity will lower to one that multiplied by the described value at each altitude.

| Altitude [m]     | ① Upper limit of ambient temperature [°C] | ② Cooling capacity coefficient |
|------------------|-------------------------------------------|--------------------------------|
| Less than 1000 m | 45                                        | 1.00                           |
| Less than 1500 m | 42                                        | 0.85                           |
| Less than 2000 m | 38                                        | 0.80                           |
| Less than 2500 m | 35                                        | 0.75                           |
| Less than 3000 m | 32                                        | 0.70                           |

15. In locations where strong impacts or vibrations occur.
  16. In locations where a massive force strong enough to deform the product is applied or a weight from a heavy object is applied.
  17. In locations where there is not sufficient space for maintenance.
  18. Bevelled place
  19. Insects or plants may enter the unit.
2. The product is not designed for clean room usage. It generates particles internally.

HRSH

HRSH  
090

HRSH  
100/150

HRSH  
090

HRSH

HRSE

HRZ

HRZD

HRW

HECR

HEC

HEB

HED

HEA

IDH



# HRSH090 Series

## Specific Product Precautions 2

Be sure to read this before handling the products. Refer to back page 50 for Safety Instructions and pages 13 to 16 for Temperature Control Equipment Precautions.

### Transportation/Carriage/Movement

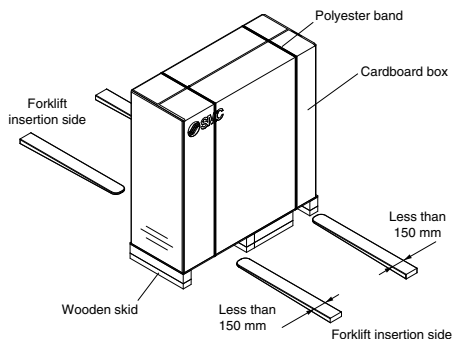
#### Warning

1. This product is heavy. Pay attention to safety and position of the product when it is transported, carried and moved.
2. Read the Operation Manual carefully to move the product after unpacking.

#### Caution

1. Never put the product down sideways as this may cause a failure.

The product will be delivered in the packaging shown below.

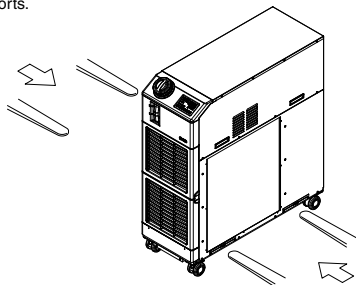


#### <When packaged>

| Model           | Weight [kg] | Dimensions [mm]                      |
|-----------------|-------------|--------------------------------------|
| HRSH090-A-20/40 | 158         | Height 1290 x Width 470 x Depth 1180 |
| HRSH090-W-20/40 | 148         |                                      |

#### 2. Moving with forklift

1. A licensed driver should drive the forklift.
2. Insert the fork to the place specified on the label. The fork should reach through to the other side of the product.
3. Be careful not to bump the fork to the cover panel or piping ports.



#### 3. Moving with casters

1. This is a heavy product. Make sure this product is lifted by at least two people to avoid falling.
2. Do not grip the piping port on the back side or the handles of the panel.
3. Do not pass over bumps etc. with the casters.

### Installation

#### Warning

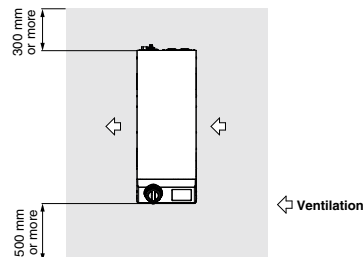
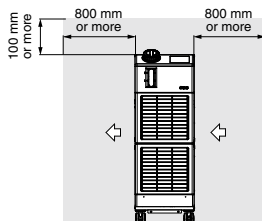
1. Do not use the product outdoors.
2. Do not place heavy objects on top of this product, or step on it.  
The external panel can be deformed and danger can result.

#### Caution

1. Install on a rigid floor which can withstand this product's weight.
2. Refer to the Operation Manual for this product, and secure an installation space that is necessary for the maintenance and ventilation.

#### <Air-cooled refrigeration>

1. The air-cooled type product exhausts heat using the fan that is mounted to the product. If the product is operated with insufficient ventilation, ambient temperature may exceed 45°C, and this will affect the performance and life of the product. To prevent this ensure that suitable ventilation is available (see below).
2. For installation indoors, ventilation ports and a ventilation fan should be equipped as needed.



3. If it is impossible to exhaust heat from the installation area indoors, or when the installation area is conditioned, provide a duct for heat exhaustion to the air outlet port of this product for ventilation. Do not mount the inlet of the duct (flange) directly to the air vent of the product, and keep a space larger than the diameter of the duct. Additionally, consider the resistance of the duct when making the air vent port for the duct.

#### <Heat radiation amount/Required ventilation rate>

| Model           | Heat radiation amount [kW] | Required ventilation rate [m³/min]                                        |                                                                           |
|-----------------|----------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
|                 |                            | Differential temp. of 3°C between inside and outside of installation area | Differential temp. of 6°C between inside and outside of installation area |
| HRSH090-A-20/40 | Approx. 18                 | 305                                                                       | 155                                                                       |



# HRSH090 Series

## Specific Product Precautions 3

Be sure to read this before handling the products. Refer to back page 50 for Safety Instructions and pages 13 to 16 for Temperature Control Equipment Precautions.

### Piping

#### ⚠ Caution

- Regarding the circulating fluid and facility water pipings, consider carefully the suitability for temperature, circulating fluid.

If the operating performance is not sufficient, the pipings may burst during operation. Using corrosive materials such as aluminum or iron for fluid contact parts such as piping may cause clogging or leakage in the circulating fluid and facility water circuits. Provide protection against corrosion when you use the product.

- Select the piping port size which can exceed the rated flow. For the rated flow, refer to the pump capacity table.
- When tightening at the drain port of this product, use a pipe wrench to clamp the connection ports.
- For the circulating fluid piping connection, install a drain pan and wastewater collection pit just in case the circulating fluid may leak.

- This product series are constant-temperature fluid circulating machines with built-in tanks.

Do not install equipment on your system side such as pumps that forcibly return the circulating fluid to the unit. Also, if you attach an external tank that is open to the air, it may become impossible to circulate the circulating fluid. Proceed with caution.

### Circulating Fluid

#### ⚠ Caution

- Avoid oil or other foreign objects entering the circulating fluid.
- When water is used as a circulating fluid, use tap water that conforms to the appropriate water quality standards. Use tap water that conforms to the standards shown below (including water used for dilution of ethylene glycol aqueous solution).

#### Tap Water (as Circulating Fluid) Quality Standards

The Japan Refrigeration and Air Conditioning Industry Association

JRA GL-02-1994 "Cooling water system - Circulation type - Make-up water"

|                | Item                                               | Unit    | Standard value          | Influence |                  |
|----------------|----------------------------------------------------|---------|-------------------------|-----------|------------------|
|                |                                                    |         |                         | Corrosion | Scale generation |
| Standard item  | pH (at 25°C)                                       | —       | 6.0 to 8.0              | ○         | ○                |
|                | Electric conductivity (25°C)                       | [μS/cm] | 100* to 300*            | ○         | ○                |
|                | Chloride ion (Cl <sup>-</sup> )                    | [mg/L]  | 50 or less              | ○         | ○                |
|                | Sulfuric acid ion (SO <sub>4</sub> <sup>2-</sup> ) | [mg/L]  | 50 or less              | ○         | ○                |
|                | Acid consumption amount (at pH4.8)                 | [mg/L]  | 50 or less              | ○         | ○                |
|                | Total hardness                                     | [mg/L]  | 70 or less              | ○         | ○                |
|                | Calcium hardness (CaCO <sub>3</sub> )              | [mg/L]  | 50 or less              | ○         | ○                |
| Reference item | Ionic state silica (SiO <sub>2</sub> )             | [mg/L]  | 30 or less              | ○         | ○                |
|                | Iron (Fe)                                          | [mg/L]  | 0.3 or less             | ○         | ○                |
|                | Copper (Cu)                                        | [mg/L]  | 0.1 or less             | ○         | ○                |
|                | Sulfide ion (S <sub>2</sub> <sup>-</sup> )         | [mg/L]  | Should not be detected. | ○         | ○                |
|                | Ammonium ion (NH <sub>4</sub> <sup>+</sup> )       | [mg/L]  | 0.1 or less             | ○         | ○                |
|                | Residual chlorine (Cl)                             | [mg/L]  | 0.3 or less             | ○         | ○                |
|                | Free carbon (CO <sub>2</sub> )                     | [mg/L]  | 4.0 or less             | ○         | ○                |

\* In the case of [M2-cm], it will be 0.003 to 0.01.

○: Factors that have an effect on corrosion or scale generation.  
Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

- Use an ethylene glycol aqueous solution that does not contain additives such as preservatives.
- When using ethylene glycol aqueous solution, maintain a maximum concentration of 15%.

Overly high concentrations can cause a pump overload.

Low concentrations, however, can lead to freezing when circulating fluid temperature is 10°C or lower and cause the thermo-chiller to break down.

### Circulating Fluid

#### ⚠ Caution

- When deionized water is used, the electric conductivity should be 1 μS/cm or higher (Electric resistivity: 1 MΩ·cm or lower).

### Electrical Wiring

#### ⚠ Warning

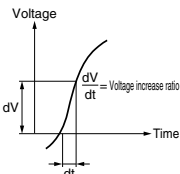
Grounding should never be connected to a water line, gas line or lightning rod.

#### ⚠ Caution

- Power supply and communication cables should be prepared by user.

- Provide a stable power supply which is not affected by surge or distortion.

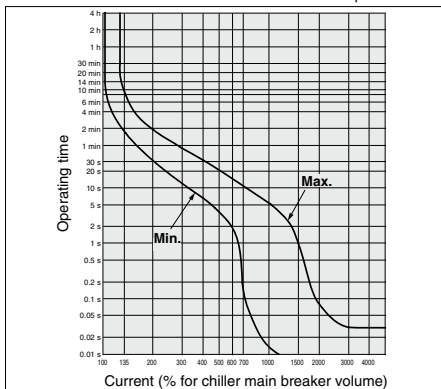
If the voltage increase ratio (dV/dt) at the zero cross should exceed 40 V/200 μsec., it may result in a malfunction.



<For option B [With earth leakage breaker]>

- This product is installed with a breaker with the following operating characteristics.

For the user's equipment (inlet side), use a breaker whose operating time is equal to or longer than the breaker of this product. If a breaker with shorter operating time is connected, the user's equipment could be cut off due to the inrush current of the motor of this product.



### Facility Water Supply

#### ⚠ Warning

<Water-cooled refrigeration>

- The water-cooled refrigeration type thermo-chiller radiates heat to the facility water. Prepare the facility water system that satisfies the heat radiation and the facility water specifications below.

#### ■ Required facility water system

<Heat radiation amount/Facility water specifications>

| Model         | Heat radiation [kW] | Facility water specifications                                       |
|---------------|---------------------|---------------------------------------------------------------------|
| HRSH090-W-□-□ | Approx. 20          | Refer to "Facility water system" in the specifications on page 139. |



# HRSH090 Series

## Specific Product Precautions 4

Be sure to read this before handling the products. Refer to back page 50 for Safety Instructions and pages 13 to 16 for Temperature Control Equipment Precautions.

### Facility Water Supply

#### Warning

2. When using tap water as facility water, use tap water that conforms to the appropriate water quality standards.

Use tap water that conforms to the standards shown below.

#### Tap Water (as Facility Water) Quality Standards

The Japan Refrigeration and Air Conditioning Industry Association  
JRA GL-02-1994 "Cooling water system – Circulation type – Make-up water"

|                | Item                                               | Unit    | Standard value          | Influence |                  |
|----------------|----------------------------------------------------|---------|-------------------------|-----------|------------------|
|                |                                                    |         |                         | Corrosion | Scale generation |
| Standard item  | pH (at 25°C)                                       | —       | 6.5 to 8.2              | ○         | ○                |
|                | Electric conductivity (25°C)                       | [μS/cm] | 100* to 800*            | ○         | ○                |
|                | Chloride ion (Cl <sup>-</sup> )                    | [mg/L]  | 200 or less             | ○         | ○                |
|                | Sulfuric acid ion (SO <sub>4</sub> <sup>2-</sup> ) | [mg/L]  | 200 or less             | ○         | ○                |
|                | Acid consumption amount (at pH4.8)                 | [mg/L]  | 100 or less             |           | ○                |
|                | Total hardness                                     | [mg/L]  | 200 or less             | ○         | ○                |
|                | Calcium hardness (CaCO <sub>3</sub> )              | [mg/L]  | 150 or less             | ○         | ○                |
|                | Ionic state silica (SiO <sub>2</sub> )             | [mg/L]  | 50 or less              | ○         | ○                |
| Reference item | Iron (Fe)                                          | [mg/L]  | 1.0 or less             | ○         | ○                |
|                | Copper (Cu)                                        | [mg/L]  | 0.3 or less             | ○         | ○                |
|                | Sulfide ion (S <sub>2</sub> <sup>-</sup> )         | [mg/L]  | Should not be detected. | ○         | ○                |
|                | Ammonium ion (NH <sub>4</sub> <sup>+</sup> )       | [mg/L]  | 1.0 or less             | ○         | ○                |
|                | Residual chlorine (Cl)                             | [mg/L]  | 0.3 or less             | ○         | ○                |
|                | Free carbon (CO <sub>2</sub> )                     | [mg/L]  | 4.0 or less             | ○         | ○                |
|                |                                                    |         |                         |           |                  |

\* In the case of [MΩ·cm], it will be 0.001 to 0.01.

○: Factors that have an effect on corrosion or scale generation.

Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

3. Set the supply pressure between 0.3 to 0.5 MPa. Ensure a pressure difference at the facility water inlet/outlet of 0.3 MPa or more.

If the supply pressure is high, it will cause water leakage. If the supply pressure and pressure difference at the facility water inlet/outlet is low, it will cause an insufficient flow rate of the facility water, and poor temperature control.

### Operation

#### Warning

1. Confirmation before operation

1) The fluid level of a tank should be within the specified range of H (High) and L (Low). When exceeding the specified level, the circulating fluid will overflow.

2) Remove the air.

Conduct a trial operation, looking at the fluid level.

Since the fluid level will go down when the air is removed from the user's piping system, supply water once again when the fluid level is reduced. When there is no reduction in the fluid level, the job of removing the air is completed.

Pump can be operated independently.

2. Confirmation during operation

• Check the circulating fluid temperature.

The operating temperature range of the circulating fluid is between 5 and 40°C.

When the amount of heat generated from the user's equipment is greater than the product's capability, the circulating fluid temperature may exceed this range. Use caution regarding this matter.

3. Emergency stop method

• When an abnormality is confirmed, stop the machine immediately. After stopping operation, disconnect the power supply from the user's equipment.

### Operation Restart Time

#### Caution

Wait five minutes or more before restarting operation after it has been stopped. If the operation is restarted within five minutes, the protection circuit may activate and the operation may not start properly.

### Protection Circuit

#### Caution

If operating in the below conditions, the protection circuit will activate and an operation may not be performed or will stop.

- Power supply voltage is not within the rated voltage range of ±10%.
- In case the water level inside the tank is reduced abnormally.
- Circulating fluid temperature is too high.
- Compared to the cooling capacity, the heat generation amount of the user's equipment is too high.
- Ambient temperature is too high. (Check the ambient temperature in the specifications.)
- Ventilation hole is clogged with dust or dirt.

### Maintenance

#### Caution

<Periodical inspection every one month>

Clean the ventilation hole.

If the dustproof filter of water-cooled type product becomes clogged with dust or debris, a decline in cooling performance can result.

In order to avoid deforming or damaging the dustproof filter, clean it with a long-haired brush or air gun.

<Periodical inspection every three months>

Inspect the circulating fluid.

1. When using tap water or deionized water

• Replacement of circulating fluid

Failure to replace the circulating fluid can lead to the development of bacteria or algae. Replace it regularly depending on your usage conditions.

• Tank cleaning (same as the HRS series)

Consider whether dirt, slime or foreign objects may be present in the circulating fluid inside the tank, and carry out regular cleanings of the tank.

2. When using ethylene glycol aqueous solution

Use a concentration meter to confirm that the concentration does not exceed 15%.

Dilute or add as needed to adjust the concentration.

<Periodical inspection during the winter season>

1. Make water-removal arrangements beforehand.

If there is a risk of the circulating fluid and facility water freezing when the product is stopped, release the circulating fluid and facility water in advance.

2. Consult a professional.

This product has an "anti-freezing function" and "warming-up function." Read the Operation Manual carefully, and if any additional anti-freezing function (e.g. tape heater) is needed, ask for it from the vendor.





# HRSH090 Series

## Specific Product Precautions 5

Be sure to read this before handling the products. Refer to back page 50 for Safety Instructions and pages 13 to 16 for Temperature Control Equipment Precautions.

### ■ Refrigerant with GWP reference

| Refrigerant | Global warming potential (GWP)                         |                                                                         |
|-------------|--------------------------------------------------------|-------------------------------------------------------------------------|
|             | Regulation (EU) No 517/2014<br>(Based on the IPCC AR4) | Revised Fluorocarbons<br>Recovery and Destruction<br>Law (Japanese law) |
| R134a       | 1,430                                                  | 1,430                                                                   |
| R404A       | 3,922                                                  | 3,920                                                                   |
| R407C       | 1,774                                                  | 1,770                                                                   |
| R410A       | 2,088                                                  | 2,090                                                                   |

Note 1) This product is hermetically sealed and contains fluorinated greenhouse gases (HFC). When this product is sold on the market in the EU after January 1, 2017, it needs to be compliant with the quota system of the F-Gas Regulation in the EU.

Note 2) See specification table for refrigerant used in the product.