Circulating Fluid Temperature Controller

Thermo-chiller/Rack Mount Type

Air-cooled Refrigeration  Water-cooled Refrigeration

Operable without the need to remove the unit from the rack

**Front Access**
Simple to control, service and maintain with all filters and drainage via the front panel

**Space Saving**
Multiple chillers can be mounted to a 19-inch rack.

1 Details for 19-inch rack, refer to page 1.

**Temperature stability**
±0.1°C

**Cooling capacity**
1.2/1.8/2.4/3.0 kW (60 Hz)

**Global power supply**
Single-phase 200 to 230 VAC (50/60 Hz)

**HRR Series**
Front Access

Maintenance

DI filter replacement
Optional Accessories p.21

Drain pan (Built-in water leakage sensor)
Leakage sensor detects fluid leakage.
Drain pan prevents leaked fluid from being leaked to the bottom of the product.

Drain port (Rc1/4)
Cap

Discharge of the circulating fluid

Cleaning of the dustproof filter

Optional Accessories

Handle (Accessory)

Replacement particle filter element
Optional Accessories p.21

Space Saving

Footprint is reduced by 53% by installing in the 19-inch rack (EIA Standards*1).

HRR012 x 4 units
630 mm
570 mm
(Typical rack dimensions)

HRS012 x 4 units
1526 mm

*1 Standards for 19-Inch Rack

<table>
<thead>
<tr>
<th>Standards</th>
<th>EIA (Electronic Industries Alliance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards no.</td>
<td>EIA310-D</td>
</tr>
<tr>
<td>Height</td>
<td>44.5 mm (=1U)</td>
</tr>
<tr>
<td>Length</td>
<td>450 mm (min)</td>
</tr>
<tr>
<td>Width</td>
<td>483.4 mm</td>
</tr>
</tbody>
</table>
Setting and Adjustment

Bypass valve and flow sensor are built in (standard).

Flow rate and pressure adjustment can be seen on the displayed panel.

Color LCD screen

Current value (displayed in white): Discharge temperature, pressure, flow rate, etc.

Set value (displayed in green): Set temperature, etc. is displayed.

Angled inlet. Easy to supply circulating fluid

Easy check from the circulation fluid level

With feet/Without rack mounting brackets specification newly added (Option)

Applicable for installation in locations other than 19-inch racks

Height

281 mm reduction

334 mm

HRR012-Y

HRS012

Volume

22% reduction

HRR012

HRS012
Temperature stability: ±0.1°C

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

**Air-cooled Refrigeration**

- **HRR-A**

**Refrigeration circuit**

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

**Circulating fluid circuit**

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

**Facility water circuit**

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

**Point**

The combination of precise control of expansion valve A for cooling, and expansion valve B for heating realized high temperature stability.
Self-diagnosis function and alarm code display

Display of 23 types of alarm codes (For details ➔ p.16)
Operation is monitored all the time by the integrated sensor. The self-diagnosis result is displayed by the applicable alarm code from 23 types.

### Changeable alarm set values

<table>
<thead>
<tr>
<th>Setting item</th>
<th>Set range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulating fluid discharge temperature rise</td>
<td>10 to 45°C</td>
</tr>
<tr>
<td>Circulating fluid discharge temperature drop</td>
<td>5 to 35°C</td>
</tr>
<tr>
<td>Circulating fluid discharge pressure rise</td>
<td>0.05 to 0.5 MPa</td>
</tr>
<tr>
<td>Circulating fluid flow rate reduction</td>
<td>3.0 to 15.0 LPM</td>
</tr>
</tbody>
</table>

Ex.) AL02 “Low level in tank”

Menu for maintenance schedule

Time for periodical checks for the pumps, fan motor, dustproof filter, etc. will generate a maintenance code.
Helpful for facility maintenance

Ex.) MT01 “Pump maintenance notice”

Displaying screen for operating conditions

Temperatures of the thermo-chiller, pressure, etc. can be displayed.

With heating function

Heating method using discharged heat makes a heater unnecessary. Heating functions are effective to maintain a constant temperature particularly in the winter when the ambient temperature is low.
Communication functions

The serial communication (RS-232C/RS-485) and contact input/output signals (2 inputs and 3 outputs) are equipped as standard. Communication with the user's equipment and system construction are possible, depending on the application.

**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**
Chiller can be operated remotely by contact input signals.

**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.

Power supply (24 VDC) available

Power can be supplied from the contact input/output communication connector to external switches, etc.

### Variations

<table>
<thead>
<tr>
<th>Model</th>
<th>Cooling capacity [W] (50/60 Hz)</th>
<th>Heating capacity [W] (50/60 Hz)</th>
<th>Cooling method</th>
<th>Temperature stability</th>
<th>Power supply</th>
<th>Circulating fluid</th>
<th>Option</th>
<th>Optional accessories</th>
<th>International standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRR012-A/W</td>
<td>1000/1200</td>
<td>450/500</td>
<td>Air-cooled refrigeration</td>
<td>±0.1°C</td>
<td>Single-phase 200 to 230 VAC (50/60 Hz)</td>
<td>With electric conductivity control function, Applicable to DI water piping</td>
<td>Concentration meter, Particle filter element for replacement, DI filter replacement cartridge, Anti-quake bracket *1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRR018-A/W</td>
<td>1600/1800</td>
<td>450/500</td>
<td>Water-cooled refrigeration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRR024-A/W</td>
<td>2000/2400</td>
<td>550/700</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRR030-A/W</td>
<td>2500/3000</td>
<td>550/700</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 Option: Only applicable to the With feet/Without rack mounting brackets type
Application Examples

**Laser machining**
Cooling of the laser irradiated part

**UV curing device** (Printing, painting, bonding, and sealing)
Cooling of the UV lamp

**X-ray (digital) instrument**
Temperature control of the X-ray tube and X-ray light sensing part

**Electronic microscope**
Temperature control of the electron-beam irradiated part

**Laser marker**
Cooling of the laser irradiated part

**Ultrasonic wave inspection machine**
Temperature control of the ultrasonic wave laser part

**Laser oscillator**

**Transmission cable connector for fiber laser**
Global Supply Network

SMC has a comprehensive network in the global market.

We now have a presence of more than 500 branch offices and distributors in 83 countries and regions worldwide. 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.

Circulating Fluid/Facility Water Line Equipment

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

- ISE20C
- ISE7□G
- PSE56□
- PSE57□
- PSE200
- PSE300
- PSE300AC

For details, refer to the SMC website.

**Fittings and Tubing**

- S Coupler **KK**
- S Coupler/Stainless Steel (Stainless Steel 304) **KKA**
- Metal One-touch Fittings **KQB2**
- Stainless Steel 316 One-touch Fittings **KQG2**
- Stainless Steel 316 Insert Fittings **KFG2**
- Fluoropolymer Fittings **LQ**

<table>
<thead>
<tr>
<th>Series</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Nylon</td>
</tr>
<tr>
<td>TU</td>
<td>Polyurethane</td>
</tr>
<tr>
<td>TH</td>
<td>FEP (Fluoropolymer)</td>
</tr>
<tr>
<td>TD</td>
<td>Modified PTFE (Soft fluoropolymer)</td>
</tr>
<tr>
<td>TL</td>
<td>Super PFA</td>
</tr>
<tr>
<td>TLM</td>
<td>PFA</td>
</tr>
</tbody>
</table>
**Contents**

**HRR Series**

**How to Order**

<table>
<thead>
<tr>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-cooled Refrigeration</td>
<td>p. 9</td>
</tr>
<tr>
<td>Water-cooled Refrigeration</td>
<td>p. 9</td>
</tr>
</tbody>
</table>

**Specifications**

<table>
<thead>
<tr>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-cooled Refrigeration</td>
<td>p. 10</td>
</tr>
<tr>
<td>Water-cooled Refrigeration</td>
<td>p. 11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling Capacity</td>
<td>p. 12</td>
</tr>
<tr>
<td>Heating Capacity</td>
<td>p. 13</td>
</tr>
<tr>
<td>Pump Capacity</td>
<td>p. 13</td>
</tr>
<tr>
<td>Required Facility Water Flow Rate</td>
<td>p. 13</td>
</tr>
</tbody>
</table>

**Dimensions**

<table>
<thead>
<tr>
<th>Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-cooled Refrigeration</td>
<td>p. 14</td>
</tr>
<tr>
<td>Water-cooled Refrigeration</td>
<td>p. 15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation Display Panel</td>
<td>p. 16</td>
</tr>
<tr>
<td>Alarm</td>
<td>p. 16</td>
</tr>
<tr>
<td>Communication Functions</td>
<td>p. 17</td>
</tr>
</tbody>
</table>

**Options**

- With Electric Conductivity Control Function, Applicable to DI Water Piping: p. 19
- High-Pressure Pump Mounted: p. 20

**Optional Accessories**

1. Concentration Meter: p. 21
2. Particle Filter Element for Replacement: p. 21
3. DI Filter Replacement Cartridge: p. 21

**Cooling Capacity Calculation**

- Required Cooling Capacity Calculation: p. 22
- Precautions on Cooling Capacity Calculation: p. 23
- Circulating Fluid Typical Physical Property Values: p. 23

Specific Product Precautions: p. 24

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Thermo-chiller/Rack Mount Type  **HRR Series**

---

8
**Thermo-chiller/Rack Mount Type**

**HRR Series**

### How to Order

**Air-cooled Refrigeration**

**HRR 012 - A - 20 -**

- **Cooling capacity**
  - 012: 1000/1200 W (50/60 Hz)
  - 018: 1600/1800 W (50/60 Hz)
  - 024: 2000/2400 W (50/60 Hz)
  - 030: 2500/3000 W (50/60 Hz)

- **Pipe thread type**
  - Nil
  - Rc
  - F: G (With Rc-G conversion fitting set)
  - N: NPT (With Rc-NPT conversion fitting set)

- **Cooling method**
  - A: Air-cooled refrigeration

### Option

- Option U
  - (UL Standards)

### Option 1

- Nil: None
- DM: With electric conductivity control function, Applicable to DI water piping
- M: Applicable to DI water piping
- T: High-pressure pump mounted
- U: Conforming to UL Standards
- Y: With feet/Without rack mounting brackets

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

### Option 2

- Nil: None
- Y: With feet/Without rack mounting brackets

**Water-cooled Refrigeration**

**HRR 012 - W - 20 - U**

- **Cooling capacity**
  - 012: 1000/1200 W (50/60 Hz)
  - 018: 1600/1800 W (50/60 Hz)
  - 024: 2000/2400 W (50/60 Hz)
  - 030: 2500/3000 W (50/60 Hz)

- **Pipe thread type**
  - Nil
  - Rc
  - F: G (With Rc-G conversion fitting set)
  - N: NPT (With Rc-NPT conversion fitting set)

- **Cooling method**
  - W: Water-cooled refrigeration

### Power supply

- Single-phase 200 to 230 VAC (50/60 Hz)
### Specifications: Air-cooled Refrigeration

<table>
<thead>
<tr>
<th>Model</th>
<th>HRR012-A</th>
<th>HRR018-A</th>
<th>HRR024-A</th>
<th>HRR030-A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cooling method</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control method</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigerant</td>
<td>R410A (HFC)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigerant charge [kg]</td>
<td>0.38</td>
<td></td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td><strong>Ambient temperature/Humidity/Altitude</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid¹²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set temperature range [°C]</td>
<td>10 to 35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling capacity (50/60 Hz) [W]</td>
<td>1000/1200</td>
<td>1600/1800</td>
<td>2000/2400</td>
<td>2500/3000</td>
</tr>
<tr>
<td>Heating capacity (50/60 Hz) [W]</td>
<td>450/500</td>
<td></td>
<td>550/700</td>
<td></td>
</tr>
<tr>
<td>Temperature stability [°C]</td>
<td>±0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump capacity (50/60 Hz) [MPa]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated flow (50/60 Hz) [L/min]</td>
<td>77/</td>
<td>For Options T, MT: 10/14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow display range [L/min]</td>
<td>3 to 16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric conductivity display range [μS/cm]</td>
<td>2 to 48 (Only for Option DM)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bypass valve</td>
<td>Installed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tank capacity [L]</td>
<td>Approx. 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outlet, Return port size</td>
<td>Rc1/2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drain port size</td>
<td>Rc1/4, With cap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leakage protection</td>
<td>Drain pan (With water leakage sensor)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluid contact material</td>
<td>Stainless steel, Copper (Heat exchanger brazing)¹¹, Brass¹⁶, SiC, Alumina ceramic, Carbon, PP, PE, POM, PA, FKM, EPDM, PVC, PPS, AS, Fluoropolymer¹², Ion exchange resin¹²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Electric system</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit protector [A]</td>
<td>10</td>
<td>For Options T, MT: 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applicable earth leakage breaker capacity [16]</td>
<td>Rated current: 10 A</td>
<td>For Options T, MT: 15 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable quantity x Size (including grounding cable) [15]</td>
<td>3.6/4.0</td>
<td>3.6/4.3</td>
<td>5.2/5.8</td>
<td>5.5/6.2</td>
</tr>
<tr>
<td>Rated operating current (50/60 Hz) [A]</td>
<td>4.7/5.2</td>
<td>4.7/5.5</td>
<td>6.3/6.0</td>
<td>6.5/6.3</td>
</tr>
<tr>
<td>Rated power consumption (50/60 Hz) [kW]</td>
<td>0.6/0.8 (0.7/0.9)</td>
<td>0.7/0.9 (0.7/0.9)</td>
<td>0.9/1.2 (1.1/1.2)</td>
<td>1.0/1.2 (1.1/1.3)</td>
</tr>
<tr>
<td><strong>Communication function</strong></td>
<td>Contact input/output, Serial RS-485/RS-232C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Noise level (50/60 Hz)</strong> [dB]</td>
<td>59/60</td>
<td>59/60</td>
<td>61/64</td>
<td>61/64</td>
</tr>
<tr>
<td><strong>Accessories</strong> [18]</td>
<td>Power supply connector, Particle filter element and maintenance handle, Operation manual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong> [kg]</td>
<td>40</td>
<td>46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

¹ It should have no condensation. During seasons or in locations where the ambient temperature is likely to fall below freezing point, please contact SMC for that case.

² If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).


---

9 Front: 1 m, height: 1 m, stable with no load, Other conditions → See *3.

10 Weight in the dry state without circulating fluids

11 Copper and brass are not included when Option M (Applicable to DI water piping) or MT (Applicable to DI water piping + High-pressure pump mounted) is selected.

12 For Option DM (With electric conductivity control function + Applicable to DI water piping) or MT (Applicable to DI water piping + High-pressure pump mounted) is selected.

13 If the product is used at altitude of 1000 m or higher, refer to "*6 For altitude of 1000 m or higher" on page 25.

14 No continuous voltage fluctuation

15 To be prepared by the customer

16 For Option T (High-pressure pump mounted), this material is included.


18 For Option DM (With electric conductivity control function + Applicable to DI water piping), a DI filter is attached.

---

*1 To DI water piping, a DI filter is attached.

*2 For models with high-pressure pump mounted (Options T, MT), the cooling capacity will decrease by 300 W.

*3 To DI water piping, a DI filter is attached.

*4 For Option T (High-pressure pump mounted), this material is included.

*5 To be prepared by the customer.

*6 For Option T (High-pressure pump mounted), this material is included.

*7 For Option DM (With electric conductivity control function + Applicable to DI water piping), a DI filter is attached.

*8 For pipe thread type F, A, G thread conversion fitting set is attached.
Specifications: Water-cooled Refrigeration

<table>
<thead>
<tr>
<th>Specifications</th>
<th>HRR012-W</th>
<th>HRR018-W</th>
<th>HRR024-W</th>
<th>HRR030-W</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cooling Method</strong></td>
<td>R410A (HFC)</td>
<td>R410A (HFC)</td>
<td>R410A (HFC)</td>
<td>R410A (HFC)</td>
</tr>
<tr>
<td><strong>Refrigerant</strong></td>
<td>Water-cooled refrigeration</td>
<td>Water-cooled refrigeration</td>
<td>Water-cooled refrigeration</td>
<td>Water-cooled refrigeration</td>
</tr>
<tr>
<td><strong>Refrigerant charge</strong> [kg]</td>
<td>0.25</td>
<td>0.25</td>
<td>0.40</td>
<td>0.40</td>
</tr>
<tr>
<td><strong>Control Method</strong></td>
<td>PID control</td>
<td>PID control</td>
<td>PID control</td>
<td>PID control</td>
</tr>
<tr>
<td><strong>Ambient temperature/Humidity/Altitude</strong></td>
<td>Temperature: 5 to 40°C, Humidity: 30 to 70%, Altitude: less than 3000 m</td>
<td>Temperature: 5 to 40°C, Humidity: 30 to 70%, Altitude: less than 3000 m</td>
<td>Temperature: 5 to 40°C, Humidity: 30 to 70%, Altitude: less than 3000 m</td>
<td>Temperature: 5 to 40°C, Humidity: 30 to 70%, Altitude: less than 3000 m</td>
</tr>
<tr>
<td><strong>Circulating fluid</strong></td>
<td>Tap water, 15% ethylene glycol aqueous solution</td>
<td>Tap water, 15% ethylene glycol aqueous solution</td>
<td>Tap water, 15% ethylene glycol aqueous solution</td>
<td>Tap water, 15% ethylene glycol aqueous solution</td>
</tr>
<tr>
<td><strong>Set temperature range</strong> [°C]</td>
<td>10 to 35</td>
<td>10 to 35</td>
<td>10 to 35</td>
<td>10 to 35</td>
</tr>
<tr>
<td><strong>Cooling capacity (50/60 Hz)</strong> [W]</td>
<td>1000/1200</td>
<td>1600/1800</td>
<td>2000/2400</td>
<td>2500/3000</td>
</tr>
<tr>
<td><strong>Heating capacity (50/60 Hz)</strong> [W]</td>
<td>450/500</td>
<td>550/700</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Temperature stability</strong> [°C]</td>
<td>±0.1</td>
<td>±0.1</td>
<td>±0.1</td>
<td>±0.1</td>
</tr>
<tr>
<td><strong>Pump capacity (50/60 Hz)</strong> [MPa]</td>
<td>0.13 (at 7 L/min)/0.18 (at 7 L/min)</td>
<td>For Option T: 0.42 (at 10 L/min)/0.4 (at 14 L/min)</td>
<td>For Option MT: 0.32 (at 10 L/min)/0.32 (at 14 L/min)</td>
<td>For Option MT: 0.32 (at 10 L/min)/0.32 (at 14 L/min)</td>
</tr>
<tr>
<td><strong>Rated flow (50/60 Hz)</strong> [L/min]</td>
<td>7/7</td>
<td>For Options T, MT: 10/14</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flow display range</strong> [L/min]</td>
<td>3 to 16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Electric conductivity display range</strong> [µS/cm]</td>
<td>2 to 48 (Only for Option DM)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Electric conductivity setting range</strong> [µS/cm]</td>
<td>5 to 45 (Only for Option DM)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Particle filter nominal filtration rating</strong> [µm]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bypass valve</strong></td>
<td>Installed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tank capacity</strong> [L]</td>
<td>Approx. 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Outlet, Return port size</strong></td>
<td>Rc1/2</td>
<td>With Cap</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Drain port size</strong></td>
<td>Rc1/4</td>
<td>With Cap</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Leakage protection</strong></td>
<td>Drain pan (With water leakage sensor)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fluid contact material</strong></td>
<td>Stainless steel, Copper (Heat exchanger brazing), Alumina ceramic, Carbon, PP, PE, FOM, PA, FKM, EPDM, PVC, PPS, AS, Fluoropolymer, Ion exchange resin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Temperature range</strong> [°C]</td>
<td>5 to 40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pressure range</strong> [MPa]</td>
<td>0.3 to 0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Required flow rate (50/60 Hz)</strong> [L/min]</td>
<td>8</td>
<td>12</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td><strong>Inlet-outlet pressure differential of facility water</strong> [MPa]</td>
<td>0.3 or more</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>Single-phase 200 to 230 VAC, 50/60 Hz, Allowable voltage range ±10%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Circuit protector</strong> [A]</td>
<td>10 For Options T, MT: 15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Applicable earth leakage breaker capacity</strong> [A]</td>
<td>10 For Options T, MT: 15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sensitivity current</strong> [mA]</td>
<td>30 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cable quantity x Size (Including grounding cable)</strong> [m]</td>
<td>3 cores x 14 AWG (3 cores x 2.0 mm²)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated operating current</strong> (50/60 Hz) [A]</td>
<td>3.2/3.6 For Options T, MT</td>
<td>4.3/5.8 For Options T, MT</td>
<td>4.4/5.8 For Options T, MT</td>
<td>4.9/5.1 For Options T, MT</td>
</tr>
<tr>
<td><strong>Rated power consumption</strong> (50/60 Hz) [kW]</td>
<td>0.6/0.7 (0.7/0.7) For Options T, MT</td>
<td>0.6/0.7 (0.7/0.7) For Options T, MT</td>
<td>0.8/1.0 (1.0/1.0) For Options T, MT</td>
<td>0.8/1.0 (1.0/1.0) For Options T, MT</td>
</tr>
<tr>
<td><strong>Communication function</strong></td>
<td>Contact input/output, Serial RS-485/RS-232C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Noise level</strong> (50/60 Hz) [dB]</td>
<td>59/60</td>
<td>59/60</td>
<td>61/64</td>
<td>61/64</td>
</tr>
<tr>
<td><strong>Accessories</strong> [kg]</td>
<td>Power supply connector, Particle filter element and maintenance handle, Operation manual</td>
<td>Power supply connector, Particle filter element and maintenance handle, Operation manual</td>
<td>Power supply connector, Particle filter element and maintenance handle, Operation manual</td>
<td>Power supply connector, Particle filter element and maintenance handle, Operation manual</td>
</tr>
</tbody>
</table>

1. It should have no condensation. During seasons or in locations where the ambient temperature is likely to fall below freezing point, please consult SMC for that case.
2. If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
3. The capacity at the thermo-chiller outlet when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.
4. If the product is used at altitude of 1000 m or higher, refer to "* F for altitude of 1000 m or higher" on page 25.
5. Copper and brass are not included when Option M (Applicable to DI water piping) or MT (Applicable to DI water piping + High-pressure pump mounted) is selected.
6. For Option DM (With electric conductivity control function + Applicable to DI water piping) is selected.
7. If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
8. If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
Cooling Capacity

**HRR012-A, HRR012-W**

**HRR018-A, HRR018-W**

**HRR024-A, HRR024-W**

**HRR030-A, HRR030-W**

*If the product is used at altitude of 1000 m or higher, refer to “Operating Environment/Storage Environment” (page 25) Item 14.*

*For altitude of 1000 m or higher.*

*For models with high-pressure pump mounted (-T, -MT), the cooling capacity will decrease by about 300 W from each graph.*
**HRR Series**

### Heating Capacity

**HRR012-A, HRR012-W, HRR018-A, HRR018-W**

<table>
<thead>
<tr>
<th>Heating capacity [W]</th>
<th>Circulating fluid temperature [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>40°C</td>
</tr>
<tr>
<td>600</td>
<td>32°C</td>
</tr>
<tr>
<td>400</td>
<td>25°C</td>
</tr>
<tr>
<td>200</td>
<td>5°C</td>
</tr>
</tbody>
</table>

**Ambient temperature or facility water temperature**

**Facility water inlet temperature** [°C]
- 40°C
- 32°C
- 25°C
- 5°C

### Pump Capacity

**HRR012-A, HRR012-W, HRR018-A, HRR018-W**

- **Allowable operating range**
- **Outlet: 60 Hz**
- **Outlet: 50 Hz**
- **Return port**

### Required Facility Water Flow Rate

**HRR012-W, HRR018-W, HRR024-W, HRR030-W**

<table>
<thead>
<tr>
<th>Facility water flow rate [L/min]</th>
<th>Facility water inlet temperature [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>HRR030-W</td>
</tr>
<tr>
<td>25</td>
<td>HRR024-W</td>
</tr>
<tr>
<td>20</td>
<td>HRR018-W</td>
</tr>
<tr>
<td>15</td>
<td>HRR012-W</td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

- This is the required facility water flow rate at the circulating fluid rated flow and the cooling capacity listed in the “Cooling Capacity” specifications.
Dimensions: Air-cooled Refrigeration

HRR012-A, HRR018-A

HRR024-A, HRR030-A
The basic operation of this unit is controlled through the operation panel on the front of the product.

Alarm

Displaying of the type of alarm and alarm code take place simultaneously. Type of alarm is displayed in (1) and alarm code is displayed in (9) of the operation display panel at the same. The alarm can be read out through communication.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Digital display (7-segment, 5 digits)</td>
<td>Displays the current circulating fluid discharge temperature, pressure, flow rate, alarm codes, and other set values</td>
</tr>
<tr>
<td>2</td>
<td>Digital display (11-segment, 5 digits)</td>
<td>Displays the circulating fluid discharge temperature and the set values of other menu items</td>
</tr>
<tr>
<td>3</td>
<td>[ °C ] lamp</td>
<td>Lights up when temperature is displayed on the digital display</td>
</tr>
<tr>
<td>4</td>
<td>[ MPa ] lamp</td>
<td>Lights up when pressure is displayed on the digital display</td>
</tr>
<tr>
<td>5</td>
<td>[ LPM ] lamp</td>
<td>Lights up when flow rate is displayed on the digital display</td>
</tr>
<tr>
<td>6</td>
<td>[ H ] lamp</td>
<td>Lights up when time is displayed on the digital display</td>
</tr>
<tr>
<td>7</td>
<td>[ SEC ] lamp</td>
<td>Lights up when seconds are displayed on the digital display</td>
</tr>
<tr>
<td>8</td>
<td>[ RUN ] lamp</td>
<td>Lights up during operation, and goes off when it is stopped</td>
</tr>
<tr>
<td>9</td>
<td>[ ALM ] lamp</td>
<td>Lights up when the FLT alarm occurs (This product will stop.)</td>
</tr>
<tr>
<td>10</td>
<td>[ WRN ] lamp</td>
<td>Lights up when the WRN alarm occurs (This product will continue operation.)</td>
</tr>
<tr>
<td>11</td>
<td>[ ] lamp</td>
<td>Lights up when &quot;AL.01 Low level in tank abnormal&quot; or &quot;AL.02 Low level in tank&quot; alarm is generated</td>
</tr>
<tr>
<td>12</td>
<td>Digital display (11-segment, 1 digit)</td>
<td>&quot;X&quot; is displayed when maintenance notification is generated.</td>
</tr>
<tr>
<td>13</td>
<td>[ RMT ] lamp</td>
<td>Lights up during remote operation by communication function</td>
</tr>
<tr>
<td>14</td>
<td>[ KEYLOCK ] lamp</td>
<td>Lights up when key lock setting is active</td>
</tr>
<tr>
<td>15</td>
<td>[ RUN/STOP ] key</td>
<td>Press and hold for 1 second to start or stop.</td>
</tr>
<tr>
<td>16</td>
<td>[ MENU ] key</td>
<td>Switching of each menu and cancellation of setting values</td>
</tr>
<tr>
<td>17</td>
<td>[ ENT ] key</td>
<td>Switch to setting mode and set values.</td>
</tr>
<tr>
<td>18</td>
<td>[ ▲ ] key</td>
<td>Move item upward or increase the set value.</td>
</tr>
<tr>
<td>19</td>
<td>[ ▼ ] key</td>
<td>Move item downward or decrease the set value.</td>
</tr>
<tr>
<td>20</td>
<td>[ RESET ] key</td>
<td>Reset the alarm.</td>
</tr>
</tbody>
</table>

**Alarm**

* Selectable from OFF/WRN/FLT
  - OFF: Disables the alarm function
  - WRN: Operation of this product will continue when the alarm occurs.
  - FLT: Operation of this product will stop when the alarm occurs.

**Alarm code**

1. AL01 Low level in tank abnormal
2. AL02 Low level in tank
3. AL04 Water leakage
4. AL09 Circulating fluid discharge pressure rise
5. AL10 Flow rate reduction
6. AL11 Outside ambient temperature range
7. AL12 Electric conductivity rise
8. AL13 NOT TEMP READY
9. AL14 Circulating fluid temperature range rise
10. AL15 Circulating fluid temperature range drop
11. AL17 Flow rate failure
12. AL18 High circulating fluid discharge temp.
13. AL25 Contact input 1 signal detection
14. AL26 Contact input 2 signal detection
15. AL28 Maintenance notice
16. AL29 Communication error
17. AL30 Refrigerant circuit abnormal
18. AL31 Sensor abnormal
19. AL32 Controller abnormal
20. AL33 Controller abnormal

**Alarm code**

1. AL19 High circulating fluid return temp.
2. AL21 High circulating fluid discharge pressure
3. AL24 Memory abnormal
4. AL25 Contact input 1 signal detection
5. AL26 Contact input 2 signal detection
6. AL27 Forced a stop
7. AL28 Maintenance notice
8. AL29 Communication error
9. AL30 Refrigerant circuit abnormal
10. AL31 Sensor abnormal
11. AL32 Controller abnormal

* Selectable from OFF/WRN/FLT
* Only air-cooled refrigeration type can be set.
* Option DM (With electric conductivity control function + Applicable to DI water piping) only. When entering the range, the alarm is released automatically.

For details, refer to the “Operation Manual” on the SMC website.
## Communication Functions

### Contact Input/Output Communication Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
</table>
| Contact input signal 1, 2 | - 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  
- Run/Stop signal  
- External switch signal |
| Contact output signal 1, 2, 3 | - 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  
- Run status signal  
- Alarm status signal  
- Signal for completion of preparation (TEMP READY), etc. |

### Contact Output Pin Nos.

<table>
<thead>
<tr>
<th>Pin no.</th>
<th>Application</th>
<th>Division</th>
<th>Initial value (Default setting)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24 VDC output</td>
<td>Output</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>24 VDC output</td>
<td>Output</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>24 VDC output</td>
<td>Output</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>Contact input signal 1</td>
<td>Input</td>
<td>OFF</td>
</tr>
<tr>
<td>5</td>
<td>Common of contact output signal 1</td>
<td>Output</td>
<td>—</td>
</tr>
<tr>
<td>6</td>
<td>Common of contact output signal 2</td>
<td>Output</td>
<td>—</td>
</tr>
<tr>
<td>7</td>
<td>Contact output signal 1</td>
<td>Output</td>
<td>—</td>
</tr>
<tr>
<td>8</td>
<td>Usable</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>9</td>
<td>24 COM output</td>
<td>Output</td>
<td>—</td>
</tr>
<tr>
<td>10</td>
<td>24 COM output</td>
<td>Output</td>
<td>—</td>
</tr>
<tr>
<td>11</td>
<td>Common of contact input signal</td>
<td>Output</td>
<td>—</td>
</tr>
<tr>
<td>12</td>
<td>Contact input signal 2</td>
<td>Input</td>
<td>OFF</td>
</tr>
<tr>
<td>13</td>
<td>Contact output signal 1</td>
<td>Output</td>
<td>Run status signal (N.O. type)</td>
</tr>
<tr>
<td>14</td>
<td>Contact output signal 2</td>
<td>Output</td>
<td>Remote status signal (N.O. type)</td>
</tr>
<tr>
<td>15</td>
<td>Contact output signal 3</td>
<td>Output</td>
<td>Alarm signal (N.C. type)</td>
</tr>
</tbody>
</table>

*1 When using the power supply of this product, make sure that the total load current is 500 mA or less.
Serial Communication

The serial communication (RS-485/RS-232C) enables the following items to be written and read out.

### Writing
- Run/Stop
- Circulating fluid temperature setting

### Readout
- Circulating fluid discharge temperature
- Status information
- Circulating fluid flow rate
- Circulating fluid discharge pressure
- Electric conductivity**¹

**¹ When using the Option DM

### Item Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector type</td>
<td>D-sub 9-pin female connector</td>
</tr>
<tr>
<td>Standards</td>
<td>EIA Standards, RS-485 (ASCII mode/RTU mode)</td>
</tr>
</tbody>
</table>

---

### Circuit Diagram

#### Master
- SD+ 1
- SD− 9
- SG 5

#### This product (1st slave)
- SD+ 1
- SD− 9
- SG 5

#### This product (31st slave)
- SD+ 1
- SD− 9
- SG 5

Terminal resistance 120 Ω

* Be sure to wire to the correct pin numbers according to the diagram.

---

### Standards
- EIA Standards, RS-232C

---

### Circuit Diagram

#### Master
- RD 2
- SD 3
- SG 5

#### This product
- RD 2
- SD 3
- SG 5

* Be sure to wire to the correct pin numbers according to the diagram.

---

** SMCC**

---

For details, refer to the “Operation Manual” on the SMC website.

---

**Thermo-chiller/Rack Mount Type HRR Series**

---

**web-kigou**

※このレイヤーは、通常は隠しておく（web校了時のみ表示）
* Options have to be selected when ordering the thermo-chiller. It is not possible to add them after purchasing the unit.

**DM**

**Option symbol**

**With Electric Conductivity Control Function, Applicable to DI Water Piping**

**HRR-Atlanta-20-DM**

With electric conductivity control function, Applicable to DI water piping

By entering the set value of electric conductivity and hysteresis, flow of circulating fluid to the DI filter is controlled by the solenoid valve to control electric conductivity. Contact material of the circulating fluid circuit is made from non-copper materials. (For details, refer to Option M.)

<table>
<thead>
<tr>
<th>Applicable model</th>
<th>HRR012/018/024/030-Atlanta-20-DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range of electric conductivity</td>
<td>2.0 to 48.0 µS/cm</td>
</tr>
<tr>
<td>Set range of target electric conductivity</td>
<td>5.0 to 45.0 µS/cm</td>
</tr>
<tr>
<td>Set range of electric conductivity hysteresis</td>
<td>2.0 to 10.0 µS/cm</td>
</tr>
</tbody>
</table>

* Default setting is set to “Electric conductivity set value: 25.0 µS/cm” and “Hysteresis: 5.0 µS/cm.”

**Example of operation of electric conductivity control**

- Electric conductivity target value: 25.0 [µS/cm]
- Electric conductivity control hysteresis: 5.0 [µS/cm]

<table>
<thead>
<tr>
<th>Elapsed time</th>
<th>Electric conductivity [µS/cm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
</tr>
</tbody>
</table>

Solenoid valve: Open

Solenoid valve: Close

---

**M**

**Option symbol**

**Applicable to DI Water Piping**

**HRR-Atlanta-20-M**

Applicable to DI water piping

Contact material of the circulating fluid circuit is made from non-copper materials.
- Available DI water is electric conductivity: 2 µS/cm or more. (Electric resistivity: 0.5 MΩ·cm or less)
- This Option M does not have electric resistance/electric conductivity control function. If this function is necessary, Option DM should be selected.

<table>
<thead>
<tr>
<th>Applicable model</th>
<th>HRR012/018/024/030-Atlanta-20-M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact material for circulating fluid</td>
<td>Stainless steel (including heat exchanger brazing), Alumina ceramic, SiC, Carbon, PP, PE, POM, PA, FKM, EPDM, PVC, PPS, AS</td>
</tr>
</tbody>
</table>

* No change in external dimensions
Options have to be selected when ordering the thermo-chiller. It is not possible to add them after purchasing the unit.

### High-Pressure Pump Mounted

**HRR012/018/024/030-□□-20-T /MT**

Possible to choose a high-pressure pump in accordance with user’s piping resistance. Cooling capacity will decrease by heat generated in the pump.

- The high-pressure pump uses a mechanical seal.
- The thermo-chiller indicates maintenance notification when driving time is passed a recommended preventive maintenance hours.

Please contact to service center to ask for maintenance of the pump and mechanical seal.

<table>
<thead>
<tr>
<th>Applicable model</th>
<th>HRR012/018/024/030-□□-20-T</th>
<th>HRR012/018/024/030-□□-20-MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated flow (50/60 Hz)</td>
<td>10 (0.42 MPa)/14 (0.40 MPa)</td>
<td>10 (0.32 MPa)/14 (0.32 MPa)</td>
</tr>
<tr>
<td>Maximum pump head (50/60 Hz)</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Output</td>
<td>W</td>
<td>550</td>
</tr>
<tr>
<td>Circuit protector</td>
<td>A</td>
<td>15 A</td>
</tr>
<tr>
<td>Recommended earth leakage breaker capacity</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Cooling capacity</td>
<td>The cooling capacity reduces about 300 W from the value in the catalog. (due to an increase in the heat generation of the pump)</td>
<td></td>
</tr>
</tbody>
</table>

**Option symbol**

- **T**: High-pressure pump mounted

**Pump Capacity**

**HRR012/018/024/030-□□-20-T**

**HRR012/018/024/030-□□-20-MT**

<table>
<thead>
<tr>
<th>Model Dimension</th>
<th>Model</th>
<th>Dimension [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRR012/018-□□-20-Y</td>
<td></td>
<td>334</td>
</tr>
<tr>
<td>HRR024/030-□□-20-Y</td>
<td></td>
<td>423</td>
</tr>
</tbody>
</table>

**Option symbol**

- **Y**: With feet/Without rack mounting brackets specification

**With Feet/Without Rack Mounting Brackets Specification**

- **HRR**: Air-cooled refrigeration
- **W**: Water-cooled refrigeration

Instead of the 19-inch rack mounting brackets, the product comes with rubber legs under its base.
**HRR Series**

**Optional Accessories**

1. **Concentration Meter**
   This meter can be used to control the concentration of ethylene glycol aqueous solution regularly.

<table>
<thead>
<tr>
<th>Part number</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ-BR002</td>
<td>HRR012/018/024/030-□-□-20</td>
</tr>
</tbody>
</table>

2. **Particle Filter Element for Replacement**
   Element for the maintenance of the particle filter for circulating fluid

<table>
<thead>
<tr>
<th>Part number</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>EJ202S-005X11</td>
<td>HRR012/018/024/030-□-□-20</td>
</tr>
</tbody>
</table>

3. **DI Filter Replacement Cartridge**
   DI filter cartridge for replacement for Option DM [Electric conductivity control type, DI water piping type]

<table>
<thead>
<tr>
<th>Part number</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRR-DF001</td>
<td>HRR012/018/024/030-□-□-20-DM</td>
</tr>
</tbody>
</table>

4. **Anti-quake Bracket**
   Bracket for earthquakes
   Prepare the anchor bolts (M12) which are suited to the floor material by the customer. (Anti-quake bracket material : Stainless steel, thickness: 1.5 mm)

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
<th>Q’ty</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRR-TK001</td>
<td>Anti-quake bracket A</td>
<td>2</td>
<td>HRR012/018-□-20-□Y</td>
</tr>
<tr>
<td></td>
<td>Anti-quake bracket B</td>
<td>2</td>
<td>HRR012/018-□-20-□Y</td>
</tr>
<tr>
<td></td>
<td>Nut (M8)</td>
<td>4</td>
<td>HRR024/030-□-□-20-DM</td>
</tr>
<tr>
<td></td>
<td>Bolt (M8)</td>
<td>4</td>
<td>HRR024/030-□-□-20-DM</td>
</tr>
</tbody>
</table>

Anchor bolt location
- Fit it on the opposite side similarly.
- Anchor bolt (M8) (Prepared by user)
### Piping Conversion Fitting (For Air-Cooled Refrigeration)

- Conversion fitting for circulating fluid + Conversion fitting for drain outlet
- This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, and for drain from Rc1/4 to G1/4 or NPT1/4.
- 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.

<table>
<thead>
<tr>
<th>Part number</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRR-EP001</td>
<td>G thread conversion fitting set</td>
</tr>
<tr>
<td>HRR-EP002</td>
<td>NPT thread conversion fitting set</td>
</tr>
</tbody>
</table>

**Part number**
- HRR-EP001: G thread conversion fitting set
- HRR-EP002: NPT thread conversion fitting set

**Material**
- Stainless steel

**Conversion fitting for circulating fluid**
- 2 pcs./set

**Conversion fitting for drain outlet**
- 1 pc.

### Piping Conversion Fitting (For Water-cooled Refrigeration)

- Conversion fitting for circulating fluid + Conversion fitting for drain outlet
- This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, and for drain from Rc1/4 to G1/4 or NPT1/4.
- 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.

<table>
<thead>
<tr>
<th>Part number</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRR-EP003</td>
<td>G thread conversion fitting set</td>
</tr>
<tr>
<td>HRR-EP004</td>
<td>NPT thread conversion fitting set</td>
</tr>
</tbody>
</table>

**Part number**
- HRR-EP003: G thread conversion fitting set
- HRR-EP004: NPT thread conversion fitting set

**Material**
- Stainless steel

**Conversion fitting for circulating fluid**
- 2 pcs./set

**Conversion fitting for drain outlet**
- 1 pc.

### Power Supply Cable

<table>
<thead>
<tr>
<th>Part number</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRR-CA001</td>
<td>HRR012/018/024/030-A-20</td>
</tr>
<tr>
<td>HRR-CA002</td>
<td>HRR012/018/024/030-B-20</td>
</tr>
</tbody>
</table>

**Approx. 3 m**

**Approx. 100 mm**
HRR Series
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: 1000 [W]**
   
   \[ Q = \frac{P}{1.2} = \frac{1000}{1.2} = 833.33 \text{ [W]} \]

   Cooling capacity = Considering a safety factor of 20%,
   
   \[1000 \text{ [W]} \times 1.2 = 1200 \text{ [W]}\]

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

   **Power supply output VI: 1.0 [kVA]**

   \[ Q = \frac{P}{1.0} \times 1.2 = \frac{1.0 \times 10^3}{1.0} \times 1.2 = 1200 \text{ [W]} \]

   Cooling capacity = Considering a safety factor of 20%,
   
   \[850 \text{ [W]} \times 1.2 = 1020 \text{ [W]}\]

3. Derive the heat generation amount from the output.  

   **Output (shaft power, etc.) W: 800 [W]**

   \[ Q = \frac{P}{W} = \frac{800}{0.85} = 941.18 \text{ [W]} \]

   Cooling capacity = Considering a safety factor of 20%,
   
   \[850 \text{ [W]} \times 1.2 = 1020 \text{ [W]}\]

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

   \[ Q = q_m \times C \times (T_2 - T_1) \]

   \[= \frac{\rho \times q_v \times C \times \Delta T}{60} = \frac{1 \times 10 \times 4.2 \times 10^3 \times 2.0}{60} = 1400 \text{ [J/s]} \approx 1400 \text{ [W]} \]

   Cooling capacity = Considering a safety factor of 20%,
   
   \[1400 \text{ [W]} \times 1.2 = 1680 \text{ [W]}\]

**Example of conventional units (Reference)**

Heat generation amount by user's equipment Q: Unknown [cal/h]  
Circulating fluid : Tap water
Circulating fluid weight flow rate q_m : (= ρ x q_v x 60) [kgf/h]
Circulating fluid weight volume ratio g : 1 [kgf/L]
Circulating fluid (volume) flow rate q_v : 10 [L/min]
Circulating fluid specific heat C : 1.0 x 10^3 [cal/(kgf·°C)]
Circulating fluid outlet temperature T_1 : 20 [°C]
Circulating fluid return temperature T_2 : 22 [°C]
Circulating fluid temperature difference ΔT : 2.0 [°C] (= T_2 – T_1)
Conversion factor: hours to minutes (SI units): 60 [s/min]
Conversion factor: kcal/h to kW

\[ Q = \frac{q_m \times C \times (T_2 - T_1)}{860} = \frac{1 \times 10 \times 60 \times 1.0 \times 10^3 \times 2.0}{860} = 1200000 \text{ [cal/h]} \]

\[= \frac{1200000}{860} \approx 1400 \text{ [W]} \]

Cooling capacity = Considering a safety factor of 20%,
   
   \[1400 \text{ [W]} \times 1.2 = 1680 \text{ [W]}\]

* Calculation example for the temperature and flow rate based on customer’s piping condition

For calculating the required cooling capacity based on the displayed value of temperature and flow rate in the chiller, fully close the bypass valve.
**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) \( Q \):

- **Water**

\[
Q = \frac{m \times C \times (T_0 - T_t)}{\Delta t}
\]

**Example of conventional units (Reference)**

Heat quantity by cooled substance (per unit time) \( Q \):

- **Water**

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

**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** \( \rho \) [kg/dm³]
   
   **Specific heat** \( C \) [J/(kg·K)]
   
   **Conventional units**

   - **Water**
     
     \( \rho = 1 \) [kg/dm³] (or, using conventional units, weight volume ratio \( \gamma = 1 \) [kgf/L])
     
     Specific heat \( C = 4.19 \times 10^3 \) [J/(kg·K)] (or, using conventional units, 1 x 10³ [cal/(kgf·°C)])

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

   **15% Ethylene Glycol Aqueous Solution**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Density ( \rho ) [kg/dm³]</th>
<th>Specific heat ( C ) [J/(kg·K)]</th>
<th>Conventional units</th>
</tr>
</thead>
<tbody>
<tr>
<td>5°C</td>
<td>1.00</td>
<td>3.91 x 10³</td>
<td>Weight volume ratio ( \gamma = 1 ) [kgf/L] Specific heat ( C = 1.01 ) [cal/(kgf·°C)]</td>
</tr>
<tr>
<td>10°C</td>
<td>1.02</td>
<td>3.91 x 10³</td>
<td>1.02</td>
</tr>
<tr>
<td>15°C</td>
<td>1.02</td>
<td>3.91 x 10³</td>
<td>0.93 x 10³</td>
</tr>
<tr>
<td>20°C</td>
<td>1.01</td>
<td>3.91 x 10³</td>
<td>1.01</td>
</tr>
<tr>
<td>25°C</td>
<td>1.01</td>
<td>3.91 x 10³</td>
<td>0.93 x 10³</td>
</tr>
<tr>
<td>30°C</td>
<td>1.01</td>
<td>3.91 x 10³</td>
<td>1.01</td>
</tr>
<tr>
<td>35°C</td>
<td>1.01</td>
<td>3.91 x 10³</td>
<td>0.94 x 10³</td>
</tr>
<tr>
<td>40°C</td>
<td>1.01</td>
<td>3.91 x 10³</td>
<td>1.01</td>
</tr>
</tbody>
</table>

* Shown above are reference values. Contact circulating fluid supplier for details.
HRR Series
Specific Product Precautions 1
Be sure to read this before handling the products. Refer to the back cover for safety instructions.
For temperature control equipment precautions, refer to the “Handling Precautions for SMC Products” and the “Operation Manual” on the SMC website: http://www.smcworld.com

⚠️ 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 material 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 matter enter the chiller.
   If foreign matter such as scales in the piping enter the circulating fluid, this may cause the pump to malfunction.

⚠️ Warning
1. 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 22 and 23 before selecting a model.

⚠️ Warning
1. Thoroughly read the Operation Manual.
   Read the Operation Manual completely before operation, and keep this manual available whenever necessary.

⚠️ 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 sideway as this may cause failure.
   The product will be delivered in the packaging shown below.

<table>
<thead>
<tr>
<th>Model</th>
<th>Weight [kg]*1</th>
<th>Dimensions [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRR012-A</td>
<td>54</td>
<td>Height 575 x Width 610 x Depth 820</td>
</tr>
<tr>
<td>HRR018-A</td>
<td>55</td>
<td>Height 575 x Width 610 x Depth 820</td>
</tr>
<tr>
<td>HRR012-W</td>
<td>61</td>
<td>Height 665 x Width 610 x Depth 820</td>
</tr>
<tr>
<td>HRR018-W</td>
<td>60</td>
<td>Height 665 x Width 610 x Depth 820</td>
</tr>
<tr>
<td>HRR030-A</td>
<td>61</td>
<td>Height 665 x Width 610 x Depth 820</td>
</tr>
<tr>
<td>HRR030-W</td>
<td>60</td>
<td>Height 665 x Width 610 x Depth 820</td>
</tr>
</tbody>
</table>

*1 For models with an option, the weights are increased as below.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Additional weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>With electric conductivity control function, Applicable to DI water piping</td>
<td>+1 kg</td>
</tr>
<tr>
<td>M</td>
<td>Applicable to DI water piping</td>
<td>Not changed</td>
</tr>
<tr>
<td>T</td>
<td>High-pressure pump mounted</td>
<td>+5 kg</td>
</tr>
<tr>
<td>U</td>
<td>Conforming to UL Standards</td>
<td>Not changed</td>
</tr>
</tbody>
</table>
**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 exceeds the limits as mentioned below.
      - During transportation/storage: 0 to 50°C (But as long as water or circulating fluid are not left inside the pipings)
      - During operation: 5 to 40°C
   6) In locations where the ambient humidity is out of the following range or where condensation occurs.
      - During transportation/storage: 15 to 85%
      - During operation: 30 to 70%
   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.
   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.

2. Install in an environment where the unit will not come into direct contact with rain or snow.
   These models are for indoor use only. Do not install outdoors where rain or snow may fall on them.

3. Conduct ventilation and cooling to discharge heat.
   (Air-cooled refrigeration)
   The heat which is cooled down through air-cooled condenser is discharged.
   When using in a room which is shut tightly, ambient temperature will exceed the specification range stipulated in this catalog, which will activate the safety detector and stop the operation.
   In order to avoid this situation, discharge the heat outside of a room by ventilation or cooling facilities.

4. The product is not designed for clean room usage. It generates particles internally.

### Altitude [m] vs. Upper Limit of Ambient Temperature

<table>
<thead>
<tr>
<th>Altitude [m]</th>
<th>Upper limit of ambient temperature [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1000 m</td>
<td>40</td>
</tr>
<tr>
<td>Less than 1500 m</td>
<td>38</td>
</tr>
<tr>
<td>Less than 2000 m</td>
<td>36</td>
</tr>
<tr>
<td>Less than 2500 m</td>
<td>34</td>
</tr>
<tr>
<td>Less than 3000 m</td>
<td>32</td>
</tr>
</tbody>
</table>
**Caution**
1. Make sure that the rack and the rack rail can support the weight of the product.
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 40°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.

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

<table>
<thead>
<tr>
<th>Model</th>
<th>Heat radiation amount [kW]</th>
<th>Required ventilation rate (m³/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Differential temp. of 3°C between inside and outside of installation area</td>
<td>Differential temp. of 6°C between inside and outside of installation area</td>
</tr>
<tr>
<td>HRR012-A</td>
<td>Approx. 2</td>
<td>40</td>
</tr>
<tr>
<td>HRR018-A</td>
<td>Approx. 4</td>
<td>70</td>
</tr>
<tr>
<td>HRR024-A</td>
<td>Approx. 5</td>
<td>90</td>
</tr>
<tr>
<td>HRR030-A</td>
<td>Approx. 8</td>
<td>100</td>
</tr>
</tbody>
</table>

**Warning**
1. Communication cable should be prepared by the customer.

**Caution**
2. 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 malfunction.
Circulating Fluid

**Caution**

1. Avoid oil or other foreign matter entering the circulating fluid.
2. 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”

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Standard value</th>
<th>Influence</th>
<th>Scale generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (at 25°C)</td>
<td></td>
<td>6.0 to 8.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric conductivity (25°C)</td>
<td>[μS/cm]</td>
<td>100 to 300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloride ion (Cl⁻)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfuric acid ion (SO₄²⁻)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acid consumption amount (at pH 8)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total hardness</td>
<td>[mg/L]</td>
<td>70 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium hardness (CaCO₃)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ionic state silica (SiO₂)</td>
<td>[mg/L]</td>
<td>30 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfide ion (S₂⁻)</td>
<td>[mg/L]</td>
<td>Should not be detected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonium ion (NH₄⁺)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual chlorine (Cl⁻)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free carbon (CO₂)</td>
<td>[mg/L]</td>
<td>4.0 or less</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. In the case of [μS/cm], it will be 0.003 to 0.01.
2. 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. Use an ethylene glycol aqueous solution that does not contain additives such as preservatives.
4. 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.
5. A magnet pump or mechanical seal pump is used as the circulating pump for the circulating fluid.
   It is particularly impossible to use liquid including metallic powder such as iron powder.

**Facility Water Supply**

**Warning**

1. 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**

**<Water-cooled refrigeration>**

1. 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”

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Standard value</th>
<th>Influence</th>
<th>Scale generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (at 25°C)</td>
<td></td>
<td>6.5 to 8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric conductivity (25°C)</td>
<td>[μS/cm]</td>
<td>100 to 300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloride ion (Cl⁻)</td>
<td>[mg/L]</td>
<td>200 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfuric acid ion (SO₄²⁻)</td>
<td>[mg/L]</td>
<td>200 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acid consumption amount (at pH 8)</td>
<td>[mg/L]</td>
<td>100 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total hardness</td>
<td>[mg/L]</td>
<td>200 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium hardness (CaCO₃)</td>
<td>[mg/L]</td>
<td>150 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ionic state silica (SiO₂)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>[mg/L]</td>
<td>1.0 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfide ion (S₂⁻)</td>
<td>[mg/L]</td>
<td>Should not be detected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonium ion (NH₄⁺)</td>
<td>[mg/L]</td>
<td>1.0 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual chlorine (Cl⁻)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free carbon (CO₂)</td>
<td>[mg/L]</td>
<td>4.0 or less</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. In the case of [μS/cm], it will be 0.001 to 0.01.
2. 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. Supply pressure of 0.5 MPa or less.
   If the supply pressure is high, it will cause water leakage.
4. Be sure to prepare your utilities so that the pressure of the thermo-chiller facility water outlet is at 0 MPa (atmospheric pressure) or more.
   If the facility water outlet pressure becomes negative, the internal facility water piping may collapse, and proper flow control of facility water will be impossible.
   Using deionized water as facility water may cause problems such as clogging in the piping due to metal ion.
5. Do not use fluid that includes metallic powders and other foreign materials.
   It can cause issues: clogging of the circulating fluid circuit or leakage.

---

HRR Series
Specific Product Precautions 4

Be sure to read this before handling the products. Refer to the back cover for safety instructions.
For temperature control equipment precautions, refer to the “Handling Precautions for SMC Products” and the “Operation Manual” on the SMC website: http://www.smcworld.com
**HRR Series**

Specific Product Precautions 5

Be sure to read this before handling the products. Refer to the back cover for safety instructions. For temperature control equipment precautions, refer to the “Handling Precautions for SMC Products” and the “Operation Manual” on the SMC website: http://www.smcworld.com

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### Warning

#### 1. Confirmation before operation

1) The fluid level of a tank should be within the specified range of “HIGH” and “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.

---

### Caution

#### <Periodical inspection every one month>

1. **Clean the ventilation hole.**

   - If the dustproof filter 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.

---

### Operation

#### 1. Confirmation during operation

- **Check the circulating fluid temperature.**

  The operating temperature range of the circulating fluid is between 10 and 35°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.

---

### Maintenance

#### <Periodical inspection every three months>

1. **Inspect the circulating fluid.**

   1) When using tap water

      - Replacement of tap water

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

   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 freezing when the product is stopped, release the circulating fluid in advance.

   - Consult a professional.

      For additional methods to prevent freezing (such as commercially available tape heaters, etc.), consult a professional for advice.

---

### Operation Restart Time/Operation and Suspension Frequency

#### Caution

1. **1. 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.

2. **2. Operation and suspension frequency should not exceed 10 times per day.** Frequently switching between operation and suspension may result in the malfunction of the refrigeration circuit.

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### Protection Circuit

#### Caution

1. If operating in the conditions below, 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. (40°C or more)
   - Refrigerant pressure is too high.
   - Ventilation hole is clogged with dust or dirt.

---

### Refrigerant with GWP reference

<table>
<thead>
<tr>
<th>Refrigerant</th>
<th>Global warming potential (GWP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R134a</td>
<td>1,430</td>
</tr>
<tr>
<td>R404A</td>
<td>3,922</td>
</tr>
<tr>
<td>R407C</td>
<td>1,774</td>
</tr>
<tr>
<td>R410A</td>
<td>2,088</td>
</tr>
</tbody>
</table>

*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.*

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

### Safety Instructions

Be sure to read the “Handling Precautions for SMC Products” (M-E03-3) and “Operation Manual” before use.

### Warning

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

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

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

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

### Caution

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

### Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.

#### Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.\(^2\)
   - Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
   - This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.
   - Vacuum pads are excluded from this 1 year warranty.
   - Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

#### Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.
3. SMC products are not intended for use as instruments for legal metrology.
   - Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country. Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

\(^{1}\) ISO 4414: Pneumatic fluid power – General rules relating to systems.
- ISO 4413: Hydraulic fluid power – General rules relating to systems.
- IEC 60204-1: Safety of machinery – Electrical equipment of machines.
- (Part 1: General requirements)
- etc.