Circulating Fluid Temperature Controller

Thermo-chiller
Compact Type

Installation close to a wall is possible on both sides. (Not available for HRS050 and option G.)

- Power supply is available in Europe, Asia, Oceania, and the Americas.
  - Single-phase 200 to 230 VAC (50/60 Hz)
  - Single-phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)

- Space-saving
- Cooling capacity (60 Hz)
  - 1300 W/ 1900 W/ 2400 W
  - Temperature stability
    - ±0.1°C
  - Temperature range setting
    - 5 to 40°C

- Compact
- Light-weight
  - 40 kg
  - 69 kg

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

- Easy maintenance
  - Tool-less maintenance of filter

- Convenient functions
  - Timer operation function
  - Low tank level detecting function
  - Power failure auto-restart function
  - Anti-freezing operation function

- Self diagnosis function and check display
  - 35 types of alarm codes

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

- Environmental friendly
  - R407C, R410A as refrigerant

- RoHS

- New
  - (UL Standards)

- Series HRS
  - CAT.ES40-55C
Supply is possible even when 2 products are stacked.

Adoption of the magnet pump
No fluid leakage because the sealless pump is used.

When the option, high-lift pump, is selected and for HRS050, the mechanical seal pump is chosen.

The angled supply port facilitates the supply of circulating fluid.

Variations

<table>
<thead>
<tr>
<th>Model</th>
<th>Cooling capacity (W)</th>
<th>Cooling method</th>
<th>Power supply</th>
<th>Option</th>
<th>Optional accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS012</td>
<td>1100/1300 (50/60 Hz)</td>
<td>Air-cooled refrigeration</td>
<td>Single-phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)</td>
<td>• With earth leakage breaker</td>
<td>Anti-quake bracket</td>
</tr>
<tr>
<td>HRS018</td>
<td>1700/1900 (50/60 Hz)</td>
<td>Water-cooled refrigeration</td>
<td>Single-phase 200 to 230 VAC (50/60 Hz)</td>
<td>• With automatic water supply function</td>
<td>Piping conversion fitting</td>
</tr>
<tr>
<td>HRS024</td>
<td>2100/2400 (50/60 Hz)</td>
<td></td>
<td></td>
<td>• Applicable to DI water (Deionized water) piping</td>
<td>Concentration meter</td>
</tr>
<tr>
<td><strong>New</strong> HRS050</td>
<td>4700/5100 (50/60 Hz)</td>
<td></td>
<td>Single-phase 200 to 230 VAC (50/60 Hz)</td>
<td>• High-lift pump (For HRS050 as standard)</td>
<td>Power supply cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• High-temperature environment specifications (HRS050 cannot be selected)</td>
<td>DI filter set</td>
</tr>
</tbody>
</table>

Features

- Shaped for easy supply of circulating fluid
  - The angled supply port facilitates the supply of circulating fluid.
  - Supply is possible even when 2 products are stacked.

- Easy check of the circulating fluid level.

- With unfixed caster
  - Locking lever (front wheels only)

- Power supply (24 VDC) available
  - Power can be supplied from the connector at the rear side of HRS to external switches, etc.

- Operation display panel
  - Alarm codes notify when to check the pump and fan motor.
  - **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).
  - **Simple operation**
    - Step 1: Press the keys.
    - Step 2: Adjust the temperature setting with the keys.
    - Step 3: Press the key to stop.

- Tool-less maintenance of filter
  - Dustproof filter
    - Integrated with the grill of the front panel. Mounting and removal can be done easily.

- Adoption of the magnet pump
  - No fluid leakage because the sealless pump is used.
  - When the option, high-lift pump, is selected and for HRS050, the mechanical seal pump is chosen.

- Optional accessories
  - Anti-quake bracket
    - Used to fix to a floor or base.

- Features 1

- **Features (UL Standards)**
  - Option P
  - Power supply (24 VDC)
    - Available
      - Power can be supplied from the connector at the rear side of HRS to external switches, etc.

- **Option**
  - Page 10

- **Optional accessories**
  - Page 12

- **Variations**
  - Model
  - Cooling capacity (W)
  - Cooling method
  - Power supply
  - Option
  - Optional accessories

- **New** HRS050
  - 4700/5100 (50/60 Hz)

- **Operation display panel**
  - Alarm codes notify when to check the pump and fan motor.

- **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).

- **Simple operation**
  - Step 1: Press the keys.
  - Step 2: Adjust the temperature setting with the keys.
  - Step 3: Press the key to stop.

- **Tool-less maintenance of filter**
  - Dustproof filter
    - Integrated with the grill of the front panel. Mounting and removal can be done easily.

- **Adoption of the magnet pump**
  - No fluid leakage because the sealless pump is used.
  - When the option, high-lift pump, is selected and for HRS050, the mechanical seal pump is chosen.

- **Optional accessories**
  - Anti-quake bracket
    - Used to fix to a floor or base.

- **Features 1**

- **Features (UL Standards)**
  - Option P
  - Power supply (24 VDC)
    - Available
      - Power can be supplied from the connector at the rear side of HRS to external switches, etc.
Self Diagnosis and Check Display for Easy Maintenance

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

Changeable alarm set values

<table>
<thead>
<tr>
<th>Setting item</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulating fluid discharge temperature rise</td>
<td>5 to 48°C</td>
</tr>
<tr>
<td>Circulating fluid discharge temperature drop</td>
<td>1 to 39°C</td>
</tr>
<tr>
<td>Circulating fluid discharge pressure rise</td>
<td>0.05 to 0.75 MPa</td>
</tr>
<tr>
<td>Circulating fluid discharge pressure drop</td>
<td>0.05 to 0.18 MPa</td>
</tr>
</tbody>
</table>

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”

Temperature Control Equipment

Features 2
Chillers are products that control the temperature of heat sources in customers’ devices and equipment using temperature-controlled circulating fluid. Maintaining a fixed temperature can improve the quality, reliability and service life of devices or equipment.

### Application Examples

#### Laser machining
- Cooling of laser irradiated part

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

#### Laser marker
- Cooling of laser irradiated part

#### UV curing device (printing, painting, bonding and sealing)
- Cooling of UV lamp

#### Electronic microscope
- Temperature control of electron-beam irradiated part

#### Ultra sonic wave inspection machine
- Temperature control of ultra sonic wave laser part

---

**When...**

There is no cooling tower. Tap water is being used.

Even without a cooling tower, an air-cooled refrigerated chiller can be used to easily supply cooling water.

---

There is a cooling tower, but high temperatures in summer or low (freezing) temperatures in winter make cooling water temperatures unstable.

Cooling water at a consistent temperature can be supplied regardless of the season.

---

Dripping stops

Cooling of UV lamp

Temperature control of X-ray tube and X-ray light sensing part

Temperature control of electron-beam irradiated part

Cooling of laser irradiated part

Temperature control of ultra sonic wave laser part

---

Features 3
<table>
<thead>
<tr>
<th>Application Examples</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Atomizing device</strong></td>
<td></td>
</tr>
<tr>
<td>(food and cosmetics)</td>
<td></td>
</tr>
<tr>
<td>- Temperature control of</td>
<td></td>
</tr>
<tr>
<td>sample and device</td>
<td></td>
</tr>
<tr>
<td><strong>Linear motor</strong></td>
<td></td>
</tr>
<tr>
<td>- Temperature control of</td>
<td></td>
</tr>
<tr>
<td>moving coil</td>
<td></td>
</tr>
<tr>
<td><strong>Packaging line</strong></td>
<td></td>
</tr>
<tr>
<td>(sealing of film and paper</td>
<td></td>
</tr>
<tr>
<td>package)</td>
<td></td>
</tr>
<tr>
<td>- Cooling of work pieces for</td>
<td></td>
</tr>
<tr>
<td>bonding</td>
<td></td>
</tr>
<tr>
<td><strong>Cooling of die</strong></td>
<td></td>
</tr>
<tr>
<td>- Cooling water</td>
<td></td>
</tr>
<tr>
<td>**Temperature control of</td>
<td></td>
</tr>
<tr>
<td>paint material</td>
<td></td>
</tr>
<tr>
<td>- Temperature control of</td>
<td></td>
</tr>
<tr>
<td>concentration fluid</td>
<td></td>
</tr>
<tr>
<td><strong>Shrink fitting machine</strong></td>
<td></td>
</tr>
<tr>
<td>- Cooling of workpiece</td>
<td></td>
</tr>
<tr>
<td><strong>Gas cylinder cabinet</strong></td>
<td></td>
</tr>
<tr>
<td>- Temperature control inside</td>
<td></td>
</tr>
<tr>
<td>cabinet</td>
<td></td>
</tr>
<tr>
<td><strong>Concentrating equipment</strong></td>
<td></td>
</tr>
<tr>
<td>- Temperature control of</td>
<td></td>
</tr>
<tr>
<td>concentration fluid</td>
<td></td>
</tr>
<tr>
<td><strong>Cleaning tank</strong></td>
<td></td>
</tr>
<tr>
<td>- Temperature control of</td>
<td></td>
</tr>
<tr>
<td>cleaning tank</td>
<td></td>
</tr>
<tr>
<td><strong>Reagent cooling equipment</strong></td>
<td></td>
</tr>
<tr>
<td>- Temperature control of</td>
<td></td>
</tr>
<tr>
<td>reagent</td>
<td></td>
</tr>
<tr>
<td>**Temperature control of</td>
<td></td>
</tr>
<tr>
<td>chamber electrode</td>
<td></td>
</tr>
</tbody>
</table>
Construction and Principles

- **Air-cooled HRS□-A-□**

  - Resin tank
  - Level switch
  - Temperature sensor (For return)
  - Pressure sensor
  - Refrigeration circuit
  - Compressor
  - Expansion valve A
  - Expansion valve B
  - Temperature sensor (For compressor intake)
  - Temperature sensor (For return)
  - Temperature sensor (For discharge)
  - Pressure sensor (For discharge)
  - Circulating fluid return port
  - Evaporator
  - Circulating fluid outlet
  - Drain port
  - Air-cooled condenser
  - Filter
  - Ventilation
  - PC
  - Remote operation switch
  - Input 1
  - Input 2
  - Output 1
  - Output 2
  - Output 3
  - Ex. 1
  - Ex. 2
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)

- **Water-cooled HRS□-W-□**

  - Resin tank
  - Level switch
  - Temperature sensor (For return)
  - Pressure sensor
  - Refrigeration circuit
  - Compressor
  - Expansion valve A
  - Expansion valve B
  - Temperature sensor (For compressor intake)
  - Temperature sensor (For return)
  - Temperature sensor (For discharge)
  - Pressure sensor (For discharge)
  - Circulating fluid return port
  - Evaporator
  - Circulating fluid outlet
  - Drain port
  - Water-cooled condenser
  - Filter
  - Facility water control valve
  - Facility water outlet
  - Facility water inlet
  - Water control valve
  - Facility water circuit
  - Ex. 1
  - Ex. 2
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)
  - Ex. 3
  - Alarm and operation status (start, stop, etc.) signal output
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)

Communication Function

The serial communication (RS232C/RS485) and contact I/Os (2 inputs and 3 outputs) are equipped as standard. Communication with the customer’s machine 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.
  - Circulating fluid temperature setting
  - Start and stop
  - Circulating fluid discharge temperature
  - Circulating fluid discharge pressure

**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.
  - Low flow switch flow signal
  - To the customer’s machine

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

- The alarm and status generated in the product are assigned to 3 output signals based on their contents, and can be output.
  - Output setting example:
    - Output 1: Temperature rise
    - Output 2: Pressure rise
    - Output 3: Operation status (start, stop, etc.)

Features 5
## Basic Model

### How to Order/Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-phase 100/115 VAC</td>
<td>1</td>
</tr>
<tr>
<td>Single-phase 200 to 230 VAC</td>
<td>2</td>
</tr>
<tr>
<td>Cooling Capacity</td>
<td>3</td>
</tr>
<tr>
<td>Heating Capacity</td>
<td>4</td>
</tr>
<tr>
<td>Pump Capacity/Required Facility Water Flow Rate</td>
<td>5</td>
</tr>
<tr>
<td>Dimensions</td>
<td>6, 7</td>
</tr>
<tr>
<td>Operation Display Panel</td>
<td>8</td>
</tr>
<tr>
<td>Alarm</td>
<td>8</td>
</tr>
<tr>
<td>Communication Function</td>
<td>9</td>
</tr>
</tbody>
</table>

### Options

- With Earth Leakage Breaker                        | 10   |
- With Automatic Water Supply Function              | 10   |
- Applicable to DI Water (Deionized Water)          | 10   |
- Piping                                           | 10   |
- High-lift Pump                                    | 10   |
- High-temperature Environment Specifications       | 11   |

### Optional Accessories

- Anti-quake Bracket                                | 12   |
- Piping Conversion Fitting (For Air-Cooled Refrigeration) | 13   |
- Piping Conversion Fitting (For Water-Cooled Refrigeration) | 14   |
- Piping Conversion Fitting (For Option)            | 14   |
- Concentration Meter                               | 15   |
- By-pass Piping Set                                | 15   |
- Power Supply Cable                                | 15   |
- DI Filter Set                                     | 16   |
- Electrical Resistance Sensor Set                  | 16   |
- Drain Pan Set (With Water Leakage Sensor)         | 17   |
- Separately Installed Power Transformer            | 18   |

### Cooling Capacity Calculation

- Required Cooling Capacity Calculation               | 19, 20 |
- Precautions on Cooling Capacity Calculation        | 20    |
- Circulating Fluid Typical Physical Property Values | 20    |

Specific Product Precautions                         | 21, 22 |
### Specifications

- There are different values from standard specifications. Refer to page 10 for details.

<table>
<thead>
<tr>
<th>Model</th>
<th>HRS012-A-10</th>
<th>HRS012-W-10</th>
<th>HRS018-A-10</th>
<th>HRS018-W-10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cooling method</strong></td>
<td>Air-cooled refrigeration</td>
<td>Water-cooled refrigeration</td>
<td>Air-cooled refrigeration</td>
<td>Water-cooled refrigeration</td>
</tr>
<tr>
<td><strong>Ambient temperature/humidity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Circulating fluid</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Temperature range setting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cooling capacity</strong></td>
<td>1100/1300 W (50/60 Hz)</td>
<td>1500/1700 W (50/60 Hz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Heating capacity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Temperature stability</strong></td>
<td>0.1 ±C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pump</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated flow</strong></td>
<td>7 (0.13 MPa)7/0.18 MPa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maximum flow rate</strong></td>
<td>27/29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maximum high-lift</strong></td>
<td>14/19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tank capacity</strong></td>
<td>Approx. 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Facility water system</strong></td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Electrical system</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>Single-phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)</td>
<td>Single-phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Circuit protector</strong></td>
<td>A</td>
<td></td>
<td>15</td>
<td></td>
</tr>
<tr>
<td><strong>Applicable earth leakage breaker capacity</strong></td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated operating current</strong></td>
<td>7.5/8.3</td>
<td>7.7/8.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated power consumption</strong></td>
<td>0.7/0.8</td>
<td>0.8/0.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Noise level</strong></td>
<td>58/55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Accessories</strong></td>
<td>Fitting (for drain outlet) 1 pc., Input/output signal connector 1 pc., Power supply connector 1 pc., Operation manual (for installation/operation) 1, Quick manual (with a clear case) 1, Alarm code list sticker 1, Ferritic core (for communication) 1 pc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>40</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note 1)** For water-cooled refrigeration.

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

**Note 3)** If clear water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industrial Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).


**Note 5)** Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temperature is 10°C or less.

**Note 6)** Outlet temperature when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.

**Note 7)** The capacity at the Thermo-chiller outlet when the circulating fluid temperature is 20°C.

**Note 8)** Required min. flow rate for cooling capacity or maintaining the temperature stability. The specification of the cooling capacity and the temperature stability may not be satisfied if the flow rate is lower than the rated flow. (In such a case, use a by-pass piping set (sold separately).)

**Note 9)** Purchase an earth leakage breaker with current sensitivity of 15 mA or 30 mA separately. (A product with an optional earth leakage breaker (option B) is also available. Refer to page 10.)

**Note 10)** The capacity at the Thermo-chiller outlet when the circulating fluid temperature is 20°C.

**Note 11)** Weight of the dry state without circulating fluids.

**Note 12)** Required max. flow rate when the load for the cooling capacity is applied at a circulating fluid temperature of 20°C, and rated circulating fluid flow rate and facility water temperature of 25°C.
### Specifications

There are different values from standard specifications. Refer to page 10 for details.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature/humidity</td>
<td>Note 2)</td>
<td>Temperature: 5 to 40°C, High-temperature environment specifications (option): 5 to 45°C, Humidity: 30 to 70%</td>
<td>Clear water, 15% ethylene glycol aqueous solution</td>
<td>Clear water, 15% ethylene glycol aqueous solution</td>
<td>Clear water, 15% ethylene glycol aqueous solution</td>
<td>Clear water, 15% ethylene glycol aqueous solution</td>
<td>Clear water, 15% ethylene glycol aqueous solution</td>
<td>Clear water, 15% ethylene glycol aqueous solution</td>
<td>Clear water, 15% ethylene glycol aqueous solution</td>
<td>Clear water, 15% ethylene glycol aqueous solution</td>
</tr>
<tr>
<td>Circulating fluid temperature (°C)</td>
<td>Note 3)</td>
<td>5 to 40</td>
<td>5 to 40</td>
<td>5 to 40</td>
<td>5 to 40</td>
<td>5 to 40</td>
<td>5 to 40</td>
<td>5 to 40</td>
<td>5 to 40</td>
<td>5 to 40</td>
</tr>
<tr>
<td>Pressure range (MPa)</td>
<td>Note 4)</td>
<td>0.3 or more</td>
<td>0.3 or more</td>
<td>0.3 or more</td>
<td>0.3 or more</td>
<td>0.3 or more</td>
<td>0.3 or more</td>
<td>0.3 or more</td>
<td>0.3 or more</td>
<td>0.3 or more</td>
</tr>
<tr>
<td>Required flow rate (m³/min)</td>
<td>Note 5)</td>
<td>14/19</td>
<td>14/19</td>
<td>14/19</td>
<td>14/19</td>
<td>14/19</td>
<td>14/19</td>
<td>14/19</td>
<td>14/19</td>
<td>14/19</td>
</tr>
<tr>
<td>Tank capacity (L)</td>
<td>Approx. 5</td>
<td>Approx. 5</td>
<td>Approx. 5</td>
<td>Approx. 5</td>
<td>Approx. 5</td>
<td>Approx. 5</td>
<td>Approx. 5</td>
<td>Approx. 5</td>
<td>Approx. 5</td>
<td>Approx. 5</td>
</tr>
<tr>
<td>Wetted parts material</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber</td>
</tr>
<tr>
<td>Electrical system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit protector (A)</td>
<td>10</td>
<td>20</td>
<td>10</td>
<td>20</td>
<td>10</td>
<td>20</td>
<td>10</td>
<td>20</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Applicable earth leakage breaker capacity (A)</td>
<td>4.6/5.1</td>
<td>4.7/5.2</td>
<td>5.1/5.9</td>
<td>8/11</td>
<td>7/8.1</td>
<td>7/8.1</td>
<td>7/8.1</td>
<td>7/8.1</td>
<td>7/8.1</td>
<td>7/8.1</td>
</tr>
<tr>
<td>Rated operating current (A)</td>
<td>0.9/1.0</td>
<td>0.9/1.0</td>
<td>0.9/1.0</td>
<td>0.9/1.0</td>
<td>0.9/1.0</td>
<td>0.9/1.0</td>
<td>0.9/1.0</td>
<td>0.9/1.0</td>
<td>0.9/1.0</td>
<td>0.9/1.0</td>
</tr>
<tr>
<td>Noise level (50/60 Hz) (dB)</td>
<td>60/61</td>
<td>65/65</td>
<td>65/65</td>
<td>65/65</td>
<td>65/65</td>
<td>65/65</td>
<td>65/65</td>
<td>65/65</td>
<td>65/65</td>
<td>65/65</td>
</tr>
</tbody>
</table>

Note 1) For water-cooled refrigeration
Note 2) It should have no condensation.
Note 3) If clear water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industrial Association (JRA GL-02-1994 cooling water system - cooling type - make-up water).
Note 5) Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temperature is 10°C or less.
Note 6) Outlet temperature when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.
Note 7) The capacity at the Thermo-chiller outlet when the circulating fluid temperature is 20°C.
Note 8) Required min. flow rate for cooling capacity or maintaining the temperature stability.
Note 9) Purchase an earth leakage breaker with current sensitivity of 30 mA separately. (A product with an optional earth leakage breaker (option B) is also available.)
Note 10) Front: 1 m, height: 1 m, stable with no load. Other conditions: Note 4) Note 11) Weight in the dry state without circulating fluids, 12) Required flow rate when a load for the cooling capacity is applied at a circulating fluid temperature of 20°C, and rated circulating fluid flow rate and facility water temperature of 25°C.
Note 13) It is not provided for HRS050.
Heating Capacity

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

- **50 Hz**
  - Heating capacity vs. circulating fluid temperature
- **60 Hz**
  - Heating capacity vs. circulating fluid temperature

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

- **50 Hz**
  - Heating capacity vs. circulating fluid temperature
- **60 Hz**
  - Heating capacity vs. circulating fluid temperature
**Pump Capacity**

**HRS012-10** (Single-phase 100/115 VAC)

**HRS018-20** (Single-phase 200 to 230 VAC)

**HRS050-20** (Single-phase 200 to 230 VAC)

**Required Facility Water Flow Rate**

HRS012-W-10, HRS018-W-10
HRS024-W-20, HRS050-W-20

* This is the facility water flow rate at the circulating fluid rated flow rate and the cooling capacity listed in the “Cooling Capacity” specifications.
Circulating fluid return port Rc1/2
Drain port with O-ring sealing plug
Circulating fluid outlet Rc1/2
Circulating fluid return port Rc1/2
Circulating fluid outlet Rc1/2
Ventilation air inlet (Air-cooled only)
Ventilation air outlet (Air-cooled only)
Water level indicator
Dustproof filter
Operation display panel
Handle
Caster (unfixed) with locking lever
Caster (unfixed)

HRS012/018/024

Water-cooled refrigeration
Facility water outlet Rc3/8
Facility water inlet Rc3/8

HRS050-A

Ventilation hole (Same for the opposite side)
Ventilation air inlet (Same for the opposite side)
Ventilation air outlet (Same for the opposite side)

Water level indicator
Dustproof filter
Operation display panel
Handle
Caster (unfixed) with locking lever
Caster (unfixed)

Serial communication (RS-485/RS-232C) connector
D-sub female receptacle
Power cable entry (Grommet with membrane)

Maintenance connector
Contact input/output communication connector
Optional connector 1
Optional connector 2

Water-cooled refrigeration
Facility water outlet Rc3/8
Facility water inlet Rc3/8

Dimensions
HRS012/018/024
HRS050-A

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

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

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

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

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

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

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

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

**Dimensions**

**HRS050-W**

**Mounting/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. Secure with bolts, anchor bolts, etc.
   Fasteners such as bolts or anchor bolts should be tighten with the recommended torque shown below.

**Fixing Thread Tightening Torque**

<table>
<thead>
<tr>
<th>Connection thread</th>
<th>Applicable tightening torque (N·m)</th>
<th>Connection thread</th>
<th>Applicable tightening torque (N·m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M3</td>
<td>0.63</td>
<td>M8</td>
<td>12.5</td>
</tr>
<tr>
<td>M4</td>
<td>1.5</td>
<td>M10</td>
<td>24.5</td>
</tr>
<tr>
<td>M5</td>
<td>3</td>
<td>M12</td>
<td>42</td>
</tr>
<tr>
<td>M6</td>
<td>5.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Piping**

**Caution**
4. For the circulating fluid piping connection, install a drain pan and wastewater collection pit just in case the circulating fluid may leak.
5. This product series consists of circulating fluid temperature controllers 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.

**Electrical Wiring**

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

**Caution**
1. Communication cables should be prepared by the customer.
2. Ensure a stable power supply with no voltage surges and distortion.
   In particular, operating failure can result when the voltage ramp rate (\(\frac{dV}{dt}\)) exceeds 40 V/200 µsec at the zero cross-over point.

**Piping**

1. Regarding the circulating fluid pipings, consider carefully the suitability for shutoff pressure, temperature and circulating fluid.
   If the operating performance is not sufficient, the pipings may burst during operation.
2. Select the piping port size which can exceed the rated flow.
   For the rated flow, refer to the pump capacity table.
3. When tightening at the circulating fluid inlets and outlets, drain port or overflow outlet of this product, use a pipe wrench to clamp the connection ports.
Operation Display Panel

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

### Alarm

This unit has 35 types of 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.

<table>
<thead>
<tr>
<th>Alarm code</th>
<th>Alarm message</th>
<th>Operation status</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL01</td>
<td>Low level in tank</td>
<td>Stop ^1</td>
</tr>
<tr>
<td>AL02</td>
<td>High circulating fluid discharge temperature</td>
<td>Stop</td>
</tr>
<tr>
<td>AL03</td>
<td>Circulating fluid discharge temperature rise</td>
<td>Continue ^1</td>
</tr>
<tr>
<td>AL04</td>
<td>Circulating fluid discharge temperature drop</td>
<td>Continue ^1</td>
</tr>
<tr>
<td>AL05</td>
<td>High circulating fluid return temperature (60°C)</td>
<td>Stop</td>
</tr>
<tr>
<td>AL06</td>
<td>High circulating fluid discharge pressure</td>
<td>Stop</td>
</tr>
<tr>
<td>AL07</td>
<td>Abnormal pump operation</td>
<td>Stop</td>
</tr>
<tr>
<td>AL08</td>
<td>Circulating fluid discharge pressure rise</td>
<td>Continue ^1</td>
</tr>
<tr>
<td>AL09</td>
<td>Circulating fluid discharge pressure drop</td>
<td>Continue ^1</td>
</tr>
<tr>
<td>AL10</td>
<td>High compressor intake temperature</td>
<td>Stop</td>
</tr>
<tr>
<td>AL11</td>
<td>Low compressor intake temperature</td>
<td>Stop</td>
</tr>
<tr>
<td>AL12</td>
<td>Low super heat temperature</td>
<td>Stop</td>
</tr>
<tr>
<td>AL13</td>
<td>High compressor discharge pressure</td>
<td>Stop</td>
</tr>
<tr>
<td>AL15</td>
<td>Refrigerating circuit pressure (high pressure side)</td>
<td>Stop</td>
</tr>
<tr>
<td>AL16</td>
<td>Refrigerating circuit pressure (low pressure side) rise</td>
<td>Stop</td>
</tr>
<tr>
<td>AL17</td>
<td>Refrigerating circuit pressure (low pressure side) drop</td>
<td>Stop</td>
</tr>
<tr>
<td>AL18</td>
<td>Compressor overload</td>
<td>Stop</td>
</tr>
<tr>
<td>AL19 ^2</td>
<td>Communication error</td>
<td>Continue ^1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alarm code</th>
<th>Alarm message</th>
<th>Operation status</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL20</td>
<td>Memory error</td>
<td>Stop</td>
</tr>
<tr>
<td>AL21</td>
<td>DC line fuse cut</td>
<td>Stop</td>
</tr>
<tr>
<td>AL22</td>
<td>Circulating fluid discharge temperature sensor failure</td>
<td>Stop</td>
</tr>
<tr>
<td>AL23</td>
<td>Circulating fluid return temperature sensor failure</td>
<td>Stop</td>
</tr>
<tr>
<td>AL24</td>
<td>Compressor intake temperature sensor failure</td>
<td>Stop</td>
</tr>
<tr>
<td>AL25</td>
<td>Circulating fluid discharge pressure sensor failure</td>
<td>Stop</td>
</tr>
<tr>
<td>AL26</td>
<td>Compressor discharge pressure sensor failure</td>
<td>Stop</td>
</tr>
<tr>
<td>AL27</td>
<td>Compressor intake pressure sensor failure</td>
<td>Stop</td>
</tr>
<tr>
<td>AL28</td>
<td>Pump maintenance</td>
<td>Continue</td>
</tr>
<tr>
<td>AL29</td>
<td>Fan motor maintenance ^3</td>
<td>Continue</td>
</tr>
<tr>
<td>AL30</td>
<td>Compressor maintenance</td>
<td>Continue</td>
</tr>
<tr>
<td>AL31 ^2</td>
<td>Contact 1 input signal detection</td>
<td>Stop ^1</td>
</tr>
<tr>
<td>AL32 ^2</td>
<td>Contact 2 inputs signal detection</td>
<td>Stop ^1</td>
</tr>
<tr>
<td>AL33 ^4</td>
<td>Water leakage</td>
<td>Stop ^1</td>
</tr>
<tr>
<td>AL34 ^4</td>
<td>Electrical resistance rise</td>
<td>Continue</td>
</tr>
<tr>
<td>AL35 ^4</td>
<td>Electrical resistance drop</td>
<td>Continue</td>
</tr>
<tr>
<td>AL36 ^4</td>
<td>Electrical resistance sensor failure</td>
<td>Continue</td>
</tr>
</tbody>
</table>

^1 "Stop" or "Continue" are default settings. Customers can change them to "Continue" and "Stop". For details, read the Operation Manual.

^2 “AL19, AL31, AL32” are disabled in the default setting. If this function is necessary, it should be set by the customer referring to the Operation Manual.

^3 For water-cooled models, the alarm is not activated.

^4 This alarm function can be used when the option (sold separately) is used.

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

8
**Communication Function**

### Contact Input/Output

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector type (to the product)</td>
<td>MC 1.5/12-GF-3,5</td>
</tr>
<tr>
<td>Insulation method</td>
<td>Photocoupler</td>
</tr>
<tr>
<td>Operating voltage range</td>
<td>21.6 VDC to 26.4 VDC</td>
</tr>
<tr>
<td>Rated input voltage</td>
<td>24 VDC</td>
</tr>
<tr>
<td>Rated input current</td>
<td>5 mA TYP</td>
</tr>
<tr>
<td>Input impedance</td>
<td>4.7 kΩ</td>
</tr>
<tr>
<td>Rated load voltage</td>
<td>48 VAC or less/30 VDC or less</td>
</tr>
<tr>
<td>Maximum load current</td>
<td>500 mA AC/DC (resistance load)</td>
</tr>
<tr>
<td>Output voltage</td>
<td>24 VDC ± 10% 0.5 A Max</td>
</tr>
</tbody>
</table>

![Circuit diagram](image)

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

### 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 for communication.

#### Writing
- Run/Stop
- Circulating fluid temperature setting (SV)

#### Readout
- Circulating fluid present temperature (PV)
- Circulating fluid discharge pressure (SV)
- Electrical resistance +1
- Status information
- Alarm occurrence information

+1 When optional electrical resistance sensor set is used

<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>Protocol</td>
<td>Modicon Modbus compliant/Simple communication protocol</td>
</tr>
<tr>
<td>Standards</td>
<td>EIA standard RS-485</td>
</tr>
</tbody>
</table>

![Circuit diagram](image)

* The terminal resistance of RS-485 (120 Ω) can be switched by the operation display panel. For details, refer to the Operation Manual. 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](http://www.smcworld.com)
**Series HRS Options**

**B Option symbol**

**With Earth Leakage Breaker**

**HRS-J-B**

With earth leakage breaker

In the event of a short circuit, overcurrent or overheating, the earth leakage breaker will automatically shut off the power supply.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>HRS012/018/024-J-B</th>
<th>HRS050-J-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current sensitivity (mA)</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Rated shutdown current (A)</td>
<td>15 (Single-phase 100/115 VAC) 10 (Single-phase 200 to 230 VAC)</td>
<td>20</td>
</tr>
<tr>
<td>Short circuit display method</td>
<td>Mechanical button</td>
<td></td>
</tr>
</tbody>
</table>

**J Option symbol**

**With Automatic Water Supply Function**

**HRS-J**

With automatic water supply function

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

**Note 1)** Options have to be selected when ordering the Thermo-chiller. It is not possible to add them after purchasing the unit.

**Note 2)** The capacity at the Thermo-chiller outlet when the circulating fluid temperature is 20°C.

**Note 3)** Required min. flow rate for cooling capacity or maintaining the temperature stability.

**Note 4)** Cooling capacity may decrease as pump power increases.

**Note 5)** When the option, high-lift pump, is selected, the weight increases by 6 kg.

**M Option symbol**

Applicable to DI Water (Deionized Water) Piping

**HRS-M**

Wetted parts material for circulating fluid circuit is made from non-copper materials.

**T Option symbol**

**High-lift Pump**

**HRS-20-T**

High-lift pump

Possible to choose a high-lift pump in accordance with customer’s piping resistance.

Cooling capacity may decrease by heat generated in the pump.

Power supply 200 V type only.

* For HRS050, this option is available as standard.

**Pump Capacity**

**HRS-20-T**

Outlet 50 [Hz] — Operating allowable range

Outlet 60 [Hz] — Return port

**HRS-20-MT**

Outlet 50 [Hz] — Operating allowable range

Outlet 60 [Hz] — Return port

Note 1) -MT: Applicable to DI water (deionized water) piping + High-lift pump

Note 2) The capacity at the Thermo-chiller outlet when the circulating fluid temperature is 20°C.

Note 3) Required min. flow rate for cooling capacity or maintaining the temperature stability.

Note 4) Cooling capacity may decrease as pump power increases.

Note 5) When the option, high-lift pump, is selected, the weight increases by 6 kg.

* No change in external dimensions.
Series HRS

High-temperature Environment Specifications

HRS- A-20- G

Makes use at ambient temperatures up to 45°C possible.
Also increases cooling capacity at ambient temperature of 32°C.
(Cooling capacity is equal to standard products at ambient temperatures of less than 32°C.)

Applicable model: HRS012/018/024-A-20-G
Cooling method: Air-cooled refrigeration
Power supply: Single-phase 200 to 230 VAC (50/60 Hz)

* No change in external dimensions.

Note) Options have to be selected when ordering the Thermo-chiller. It is not possible to add them after purchasing the unit.

Option symbol

Ventilation slots are added to side panels (on both sides).

Ventilation slots are added to Thermo-chiller side panels. For this reason, please provide 300 mm of ventilation space next to the side panels (do not install with sides touching walls).

Cooling Capacity

HRS012-A-20-G

HRS018-A-20-G

HRS024-A-20-G

* HRS050 cannot be selected.
### Optional Accessories Applicable Model List

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Anti-quake bracket</td>
<td>HRS-TK001</td>
<td>● ● ● ● ●</td>
<td>— — — — —</td>
<td>— — — — — —</td>
<td>— — — — — —</td>
<td>— — — — —</td>
<td>— — — — —</td>
<td>— — — — — —</td>
<td>— — — — — —</td>
<td>— — — — — — — — — — — —</td>
<td>13</td>
</tr>
<tr>
<td>5 Concentration meter</td>
<td>HRZ-BR002</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>— — — — — — — — — — — —</td>
<td>15</td>
</tr>
<tr>
<td>6 By-pass piping set</td>
<td>HRS-BP001</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>— — — — — — — — — — — —</td>
<td>15</td>
</tr>
<tr>
<td>For single-phase 100/115 VAC</td>
<td>HRS-CB002</td>
<td>— — ● — —</td>
<td>— — — — —</td>
<td>— — — — — —</td>
<td>— — — — — —</td>
<td>— — — — —</td>
<td>— — — — —</td>
<td>— — — — — —</td>
<td>— — — — — —</td>
<td>— — — — — — — — — — — —</td>
<td></td>
</tr>
<tr>
<td>8 Oil filter set</td>
<td>HRS-DP001</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>— — — — — — — — — — — —</td>
<td>16</td>
</tr>
<tr>
<td>9 Electrical resistance sensor set</td>
<td>HRS-DI001</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>— — — — — — — — — — — —</td>
<td>16</td>
</tr>
<tr>
<td>10 Drain pan set</td>
<td>HRS-WL001</td>
<td>● ● ● ● ●</td>
<td>— — ● ● ●</td>
<td>— — ● ● ●</td>
<td>— — ● ● ●</td>
<td>— — ● ● ●</td>
<td>— — ● ● ●</td>
<td>— — ● ● ●</td>
<td>— — ● ● ●</td>
<td>— — — — — — — — — — — —</td>
<td>17</td>
</tr>
<tr>
<td>11 Separately installed power transformer</td>
<td>IDF-TR1000-1</td>
<td>● — — — —</td>
<td>— — — — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — — — — — — — — — — —</td>
<td>18</td>
</tr>
<tr>
<td>IDF-TR1000-2</td>
<td>● — — — —</td>
<td>— — — — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — — — — — — — — — — —</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IDF-TR1000-3</td>
<td>● — — — —</td>
<td>— — — — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — — — — — — — — — — —</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IDF-TR1000-4</td>
<td>● — — — —</td>
<td>— — — — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — ● — —</td>
<td>— — — — — — — — — — — —</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1) When option J is selected.
Note 2) When option T or HRS050 is selected.
Note 3) For HRS050 should be prepared by the customer.
1 Anti-quake Bracket

Bracket for earthquakes Prepare the anchor bolts (M8) which are suited to the floor material by the customer. (Anti-quake bracket thickness: 1.6 mm)

<table>
<thead>
<tr>
<th>Part No. [for single unit]</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-TK001</td>
<td>HRS012-A</td>
</tr>
<tr>
<td></td>
<td>HRS018-A</td>
</tr>
<tr>
<td></td>
<td>HRS024-A</td>
</tr>
<tr>
<td>HRS-TK002</td>
<td>HRS050-A</td>
</tr>
</tbody>
</table>

2 Piping Conversion Fitting (For Air-Cooled Refrigeration)

Conversion fitting for circulating fluid + Conversion fitting for drain outlet
HRS012-A-□-□, HRS018-A-□-□, HRS024-A-□-□

This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, and for drain from Rc 3/8 to G3/8 or NPT3/8.

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 No.</th>
<th>Applicable model</th>
<th>HRS012-A-□-□</th>
<th>HRS018-A-□-□</th>
<th>HRS024-A-□-□</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-EP001</td>
<td>G thread conversion fitting set</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRS-EP002</td>
<td>NPT thread conversion fitting set</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When the options, with automatic water supply function “-J”, or high-lift pump “-T” are selected, purchase 4 piping conversion fitting (for option), too.

HRS050-A-□-□

This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, and for drain from Rc 1/4 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 No.</th>
<th>Applicable model</th>
<th>HRS050-A-□-□</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-EP009</td>
<td>G thread conversion fitting set</td>
<td></td>
</tr>
<tr>
<td>HRS-EP010</td>
<td>NPT thread conversion fitting set</td>
<td></td>
</tr>
</tbody>
</table>

When the option, with automatic water supply function “-J”, is selected, purchase 4 piping conversion fitting (for option), too.
3 Piping Conversion Fitting (For Water-Cooled Refrigeration)

Conversion fitting for circulating fluid + Conversion fitting for facility water + Conversion fitting for drain outlet
HRS012-W-□, HRS018-W-□, HRS024-W-□

This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, for facility water from Rc3/8 to G3/8 or NPT3/8, 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 No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-EP003</td>
<td>G thread conversion fitting set HRS012-W-□, HRS018-W-□, HRS024-W-□</td>
</tr>
<tr>
<td>HRS-EP004</td>
<td>NPT thread conversion fitting set HRS018-W-□, HRS024-W-□</td>
</tr>
</tbody>
</table>

When the options, with automatic water supply function “-J”, or high-lift pump “-T” are selected, purchase 4 piping conversion fitting (for option), too.

HRS050-W-□

This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, for facility water from Rc3/8 to G3/8 or NPT3/8, 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 No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-EP011</td>
<td>G thread conversion fitting set HRS050-W-□</td>
</tr>
<tr>
<td>HRS-EP012</td>
<td>NPT thread conversion fitting set HRS050-W-□</td>
</tr>
</tbody>
</table>

When the option, with automatic water supply function “-J”, is selected, purchase 4 piping conversion fitting (for option), too.

4 Piping Conversion Fitting (For Option)

Conversion fitting for automatic water supply inlet

This fitting changes the port size for option-J “With Automatic Water Supply Function” from Rc3/8, Rc3/4 to G3/8, G3/4 or NPT3/8, NPT3/4. 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 No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-EP005</td>
<td>G thread conversion fitting set HRS012-□-□-J, HRS018-□-□-J, HRS024-□-□-J</td>
</tr>
<tr>
<td>HRS-EP006</td>
<td>NPT thread conversion fitting set HRS018-□-□-J, HRS024-□-□-J, HRS050-□-□-J</td>
</tr>
</tbody>
</table>

Conversion fitting for drain outlet

This fitting changes the port size for drain outlet for option-T “High-lift Pump” 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 No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-EP007</td>
<td>G thread conversion fitting set HRS012-□-20-T, HRS018-□-20-T, HRS024-□-20-T, HRS050-□-20</td>
</tr>
<tr>
<td>HRS-EP008</td>
<td>NPT thread conversion fitting set HRS018-□-20-T, HRS024-□-20-T, HRS050-□-20</td>
</tr>
</tbody>
</table>

Note 1) It is not necessary to purchase this when you purchase HRS-EP009 to 012 since it is included in the product.
5 Concentration Meter
This meter can be used to control the concentration of ethylene glycol aqueous solution regularly.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ-BR002</td>
<td>HRS012-□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS018-□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS024-□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS050-□□□□</td>
</tr>
</tbody>
</table>

6 By-pass Piping Set
When the circulating fluid goes below the rated flow (7 L/min for HRS012, 018, 024 and 23/28 L/min for HRS050), cooling capacity will be reduced and the temperature stability will be badly affected. In such a case, use the by-pass piping set. A high-lift pump is also available.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-BP001</td>
<td>HRS012-□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS018-□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS024-□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS050-□□□□</td>
</tr>
</tbody>
</table>

Note) To be mounted by the customer.

7 Power Supply Cable
For single-phase 100/115 VAC Type
* Not applicable for the 200 V type.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-CA001</td>
<td>HRS012-□□-10</td>
</tr>
<tr>
<td></td>
<td>HRS018-□□-10</td>
</tr>
</tbody>
</table>

For single-phase 200 VAC Type
* Not applicable for the 100 V type.
* Not available for HRS050. It should be prepared by the customer.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-CA002</td>
<td>HRS012-□□-20</td>
</tr>
<tr>
<td></td>
<td>HRS018-□□-20</td>
</tr>
<tr>
<td></td>
<td>HRS024-□□-20</td>
</tr>
</tbody>
</table>
8. DI Filter Set

It is possible to keep electrical resistance by flowing the circulating fluid to the ion replacement resin (DI filter).
The set parts are in order to install DI filter to by-pass circuit and flow the fixed rate of the circulating fluid to DI filter.
It is not to control the value of electrical resistance. (Replacement cartridge: HRS-DF001)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-DP001</td>
<td>HRS012-□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS018-□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS024-□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS050-□□□□</td>
</tr>
</tbody>
</table>

9. Electrical Resistance Sensor Set

Electrical resistance value of the circulating fluid (display range: 0 to 4.5 MΩ·cm) can be displayed on the Thermo-chiller operation display panel. It is possible to set alarms for the upper- and lower-limit electrical resistance values. Readout using serial communications (RS-485/RS-232C) can be performed as well. Use in combination with the DI Filter Set (HRS-DP001) or By-pass Piping Set (HRS-BP001) is also possible.
This set is not for controlling the electrical resistance value.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-DI001</td>
<td>HRS012-□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS018-□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS024-□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS050-□□□□</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parts List</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

Optional Accessories Series HRS
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. Anchor bolt (M8) suitable for the flooring material should be prepared separately by the customer.

**Parts List**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drain pan</td>
</tr>
<tr>
<td>2</td>
<td>Thermo-chiller fixing bracket (2 pcs.)</td>
</tr>
<tr>
<td>3</td>
<td>Drain pan fixing bracket (4 pcs.)</td>
</tr>
<tr>
<td>4</td>
<td>Water leakage sensor</td>
</tr>
<tr>
<td>5</td>
<td>Bracket fixing screw (M6 screw, 12 pcs.)</td>
</tr>
</tbody>
</table>

**Part No. | Applicable model**
--- | ---
HRS-WL001 | HRS012/018/024

**Part No. | Applicable model**
--- | ---
HRS-WL002 | HRS050
## Separately Installed Power Transformer

### Specifications

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Applicable model</th>
<th>Volume</th>
<th>Type</th>
<th>Inlet voltage</th>
<th>Outlet voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 Hz</td>
<td>60 Hz</td>
</tr>
<tr>
<td>IDF-TR1000-1</td>
<td>HRS012-□-10</td>
<td>1 kVA</td>
<td>Single-phase</td>
<td>110 VAC</td>
<td>120 VAC</td>
</tr>
<tr>
<td>IDF-TR1000-2</td>
<td>HRS018-□-10</td>
<td>1 kVA</td>
<td>Single-phase</td>
<td>240 VAC</td>
<td>240 to 260 VAC</td>
</tr>
<tr>
<td>IDF-TR1000-3</td>
<td>HRS012-□-20</td>
<td>2 kVA</td>
<td>Single-phase</td>
<td>380, 400, 415 VAC</td>
<td>380 to 420 VAC</td>
</tr>
<tr>
<td>IDF-TR1000-4</td>
<td>HRS024-□-20</td>
<td>2 kVA</td>
<td>Single-phase</td>
<td>420, 440, 480 VAC</td>
<td>420 to 520 VAC</td>
</tr>
<tr>
<td>IDF-TR2000-9</td>
<td>HRS012-□-20</td>
<td>2 kVA</td>
<td>Single-phase</td>
<td>380, 400, 415 VAC</td>
<td>380 to 420 VAC</td>
</tr>
<tr>
<td>IDF-TR2000-10</td>
<td>HRS018-□-20</td>
<td>2 kVA</td>
<td>Single-phase</td>
<td>440, 460 VAC</td>
<td>420 to 520 VAC</td>
</tr>
<tr>
<td>IDF-TR2000-11</td>
<td>HRS024-□-20</td>
<td>2 kVA</td>
<td>Single-phase</td>
<td>—</td>
<td>240 VAC</td>
</tr>
</tbody>
</table>

* For HRS050 should be prepared by the customer.

### Optional Accessories

- **Series HRS**
  - **IDF-TR1000-1**
  - **IDF-TR1000-2**
  - **IDF-TR1000-3, 4**
  - **IDF-TR2000-9**
  - **IDF-TR2000-10, 11**
**Example 1: When the heat generation amount in the customer’s machine 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 customer’s machine.

1. Derive the heat generation amount from the power consumption.
   - Power consumption $P$: 1000 [W]
   - $Q = P = 1000$ [W]
   - Cooling capacity = Considering a safety factor of 20%,
     $$1000 \ [W] \times 1.2 = 1200 \ [W]$$

2. Derive the heat generation amount from the power supply output.
   - Power supply output $VI$: 1.0 [kVA]
   - $Q = P = V \times I \times \text{Power factor}$
   - In this example, using a power factor of 0.85:
     $$= 1.0 \ [kVA] \times 0.85 = 0.85 \ [kW] = 850 \ [W]$$
   - Cooling capacity = Considering a safety factor of 20%,
     $$850 \ [W] \times 1.2 = 1020 \ [W]$$

3. Derive the heat generation amount from the output.
   - Output (shaft power, etc.) $W$: 800 [W]
   - $Q = P =$ Efficiency
   - In this example, use an efficiency of 0.7:
     $$= \frac{800}{0.7} = 1143 \ [W]$$
   - Cooling capacity = Considering a safety factor of 20%,
     $$1143 \ [W] \times 1.2 = 1372 \ [W]$$

*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 customer’s machine. Please be sure to check it carefully.*

**Example 2: When the heat generation amount in the customer’s machine is not known.**

Obtain the temperature difference between inlet and outlet by circulating the circulating fluid inside the customer’s machine.

Heat generation amount by customer’s machine $Q$: Unknown [W] ([J/s])
- Circulating fluid
- Circulating fluid mass flow rate $q_m = (\rho \times q_v) \times 60 \ [kg/s]$ (kg/dm$^3$/min)
- Circulating fluid density $\rho = 1 \ [kg/dm^3]$
- Circulating fluid (volume) flow rate $q_v = 10 \ [dm^3/min]$
- Circulating fluid specific heat capacity $C = 4.2 \times 10^3 \ [J/(kg\cdot K)]$
- Circulating fluid outlet temperature $T_1 = 293 \ [K] (20 \ [°C])$
- Circulating fluid return temperature $T_2 = 295 \ [K] (22 \ [°C])$
- Circulating fluid temperature difference $\Delta T = 2.0 \ [K] (= T_2 - T_1)$
- Conversion factor: minutes to seconds (SI units): 60 [s/min]

$$Q = q_m \times C \times (T_2 - T_1) = \frac{\rho \times q_v \times C \times \Delta T}{60} = \frac{1 \times 10 \times 4.2 \times 10^3 \times 2.0}{60}$$

$$= 1400 \ [J/s] \sim 1400 \ [W]$$

Cooling capacity = Considering a safety factor of 20%,

$$1400 \ [W] \times 1.2 = 1680 \ [W]$$

**Example of conventional measurement units (Reference)**

Heat generation amount by customer’s machine $Q$: Unknown [cal/h] → [W]
- Circulating fluid
- Circulating fluid weight flow rate $q_m = (\rho \times q_v \times 60) \ [kgf/L]$ (kgf/L)
- Circulating fluid density $\rho = 1 \ [kgf/L]$
- Circulating fluid (volume) flow rate $q_v = 10 \ [L/min]$
- Circulating fluid specific heat capacity $C = 1.0 \times 10^3 \ [cal/(kgf\cdot°C)]$
- Circulating fluid outlet temperature $T_1 = 20 \ [°C]$ (°C)
- Circulating fluid return temperature $T_2 = 22 \ [°C]$ (°C)
- Circulating fluid temperature difference $\Delta T = 2.0 \ [°C] (= T_2 - T_1)$
- Conversion factor: hours to minutes
- Conversion factor: kcal/h to kW

$$Q = q_m \times C \times (T_2 - T_1) = \gamma \times q_v \times 60 \times C \times \Delta T \times 860$$

$$= \frac{1 \times 10 \times 60 \times 1.0 \times 10^3 \times 2.0}{860}$$

$$= \frac{1200000 \ [cal/h]}{860}$$

$$= 1400 \ [W]$$

Cooling capacity = Considering a safety factor of 20%,

$$1400 \ [W] \times 1.2 = 1680 \ [W]$$
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 \( m \): (= \( \rho \) x V) [kg]
- Cooled substance density \( \rho \): 1 [kg/L]
- Cooled substance total volume \( V \): 20 [dm³]
- Cooled substance specific heat capacity \( C \): 4.2 x 10³ [J/(kg·°C)]
- Cooled substance temperature when cooling begins \( T_0 \): 305 [K] (32 [°C])
- Cooled substance temperature after t hour \( T_t \): 293 [K] (20 [°C])
- Cooling temperature difference \( \Delta T \): 12 [K] (= \( T_0 \) – \( T_t \))
- Cooling time \( \Delta t \): 900 [s] (= 15 [min])

\[ Q = \frac{m \times C \times (T_0 - T_t)}{\Delta t} = \frac{\rho \times V \times C \times \Delta T}{\Delta t} = \frac{1 \times 20 \times 4.2 \times 10^3 \times 12}{900} = 1120 \text{ [J/s]} = 1120 \text{ [W]} \]

Cooling capacity = Considering a safety factor of 20%,

1120 [W] x 1.2 = 1344 [W]

Thermo-chiller

Q x \( \Delta t \): Heat volume [kJ]

20°C

Water bath

After 15 minutes, cool 32°C down to 20°C.

Example of conventional measurement units (Reference)

Heat quantity by cooled substance (per unit time) \( Q \): Unknown [cal/h] → [W]

- Cooled substance: Water
- Cooled substance weight \( m \): (= \( \rho \) x V) [kgf]
- Cooled substance weight volume ratio \( \gamma \): 1 [kgf/L]
- Cooled substance total volume \( V \): 20 [L]
- Cooled substance specific heat capacity \( C \): 1.0 x 10³ [cal/(kgf·°C)]
- Cooled substance temperature when cooling begins \( T_0 \): 32 [°C]
- Cooled substance temperature after t hour \( T_t \): 20 [°C]
- Cooling temperature difference \( \Delta T \): 12 [°C] (= \( T_0 \) – \( T_t \))
- Cooling time \( \Delta t \): 15 [min]
- Conversion factor: hours to minutes: 60 [min/h]
- Conversion factor: kcal/h to kW: 860 [(cal/h)/W]

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

\[ = \frac{1 \times 20 \times 60 \times 1.0 \times 10^3 \times 12}{15 \times 860} = 1120 \text{ [W]} \]

Cooling capacity = Considering a safety factor of 20%,

1120 [W] x 1.2 = 1344 [W]

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 customer’s machine 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 a customer’s machine, 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 customer’s machine are fully durable against this pressure.

Circulating Fluid Typical Physical Property Values

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

- Density \( \rho \): 1 [kg/L] or, using conventional unit system, weight volume ratio \( \gamma \) = 1 [kgf/L]
- Specific heat capacity \( C \): 4.19 x 10³ [J/(kg·°C)] (or, using conventional unit system, 1 x 10³ [cal/(kgf·°C)])

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

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Density ( \rho ) [kg/L]</th>
<th>Specific heat C [J/(kg·°C)]</th>
<th>Conventional unit system</th>
</tr>
</thead>
<tbody>
<tr>
<td>5°C</td>
<td>1.00</td>
<td>4.2 x 10²</td>
<td>1.00</td>
</tr>
<tr>
<td>10°C</td>
<td>1.00</td>
<td>4.19 x 10³</td>
<td>1.00</td>
</tr>
<tr>
<td>15°C</td>
<td>1.00</td>
<td>4.19 x 10³</td>
<td>1.00</td>
</tr>
<tr>
<td>20°C</td>
<td>1.00</td>
<td>4.18 x 10³</td>
<td>1.00</td>
</tr>
<tr>
<td>25°C</td>
<td>1.00</td>
<td>4.18 x 10³</td>
<td>1.00</td>
</tr>
<tr>
<td>30°C</td>
<td>1.00</td>
<td>4.18 x 10³</td>
<td>1.00</td>
</tr>
<tr>
<td>35°C</td>
<td>0.99</td>
<td>4.18 x 10³</td>
<td>0.99</td>
</tr>
<tr>
<td>40°C</td>
<td>0.99</td>
<td>4.18 x 10³</td>
<td>0.99</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Density ( \rho ) [kg/L]</th>
<th>Specific heat C [J/(kg·°C)]</th>
<th>Conventional unit system</th>
</tr>
</thead>
<tbody>
<tr>
<td>5°C</td>
<td>1.02</td>
<td>3.91 x 10³</td>
<td>1.02</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>1.02</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>1.01</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>1.01</td>
</tr>
<tr>
<td>40°C</td>
<td>1.01</td>
<td>3.92 x 10³</td>
<td>1.01</td>
</tr>
</tbody>
</table>

Note) The above shown are reference values. Please contact circulating fluid supplier for details.
Warning

1. This catalog shows the specifications of a single unit.
   1) Confirm the specifications of the single unit (contents of this catalog) and thoroughly consider the adaptability between the customer’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 customer’s operating condition. Also, the customer 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.

Selection

1. Model selection

   For selecting a model of Thermo-chiller, it is required to know the heat generation amount of a customer’s machine. Obtain the heat generation amount, referring to “Cooling Capacity Calculation” on pages 19 and 20 before selecting a model.

Operating Environment/Storage Environment

1. Do not use in the following environment because it will lead to a breakdown.
   1) Environment like written in “Temperature Control Equipment Precautions”.
   2) Locations where spatter will adhere to when welding.
   3) Locations where it is likely that the leakage of flammable gas may occur.
   4) Locations having a large quantity of dust.
   5) A location in which water freezes.

   If such a location is unavoidable, please contact SMC.

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.

Circulating Fluid

1. Avoid oil or other foreign objects entering the circulating fluid.

2. When using clear water as a circulating fluid, use water that conforms to the appropriate water quality standards.

   Use water that conforms to the standards shown below (including water used for dilution of ethylene glycol aqueous solution).

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

* In the case of [mL/cm²], 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.

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 is used as a circulating pump for circulating fluid.

   It is particularly impossible to use liquid including metallic powder such as iron powder.
Series HRS
Specific Product Precautions 2
Be sure to read this before handling. Refer to back cover for Safety Instructions, “Handling Precautions for SMC Products” (M-E03-3) and “Operation Manual” for Temperature Control Equipment Precautions. The Operation Manual can be downloaded from the SMC website: http://www.smcworld.com

---

**Facility Water Supply**

**Warning**

(Water-cooled refrigeration)

1. Supply pressure of 0.5 MPa or less.
   If the supply pressure is high, it will cause water leakage.

2. 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.

---

**Operation**

**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 a 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 a customer’s machine 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 pushing the [OFF] switch, be sure to turn off the power switch.

---

**Maintenance**

**Caution**

1. 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 a customer’s machine is too high.
   • Ambient temperature is too high. (40°C or higher)
   • Refrigerant pressure is too high.
   • Ventilation hole is clogged with dust or dirt.

---

**Operation Restart Time**

**Caution**

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.

---

**Protection Circuit**

**Caution**

1. Clean the ventilation hole
   If the fin portion of the air-cooled condenser becomes clogged with dust or debris, a decline in cooling performance can result. In order to avoid deforming or damaging the fin, clean it with a long-haired brush or air gun.

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

Be sure to read “Handling Precautions for SMC Products” (M-E03-3) before using.

Caution:

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

Warning:

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

Danger:

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

ISO 4414: Pneumatic fluid power – General rules relating to systems.

Edition

Edition B

- Addition of water-cooled refrigeration
- Addition of cooling capacity 1100 W (50 Hz)/1300 W (60 Hz), 2100 W (50 Hz)/2400 W (60 Hz)
- Addition of single phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)
- All models: CE marking and UL compliant

Edition C

- Addition of cooling capacity 4700 W (50 Hz)/5100 W (60 Hz)
- Addition of separately installed power transformer to optional accessories
- Number of pages from 20 to 32

Revision history

SMC Corporation

Akihabara UDX 15F,
4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, JAPAN
Phone: 03-5207-8249 Fax: 03-5296-5362
http://www.smcworld.com
© 2011 SMC Corporation All Rights Reserved

Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.

D-DN 1st printing NS printing PZ 7850SZ Printed in Japan.