

# Circulating Fluid Temperature Controller

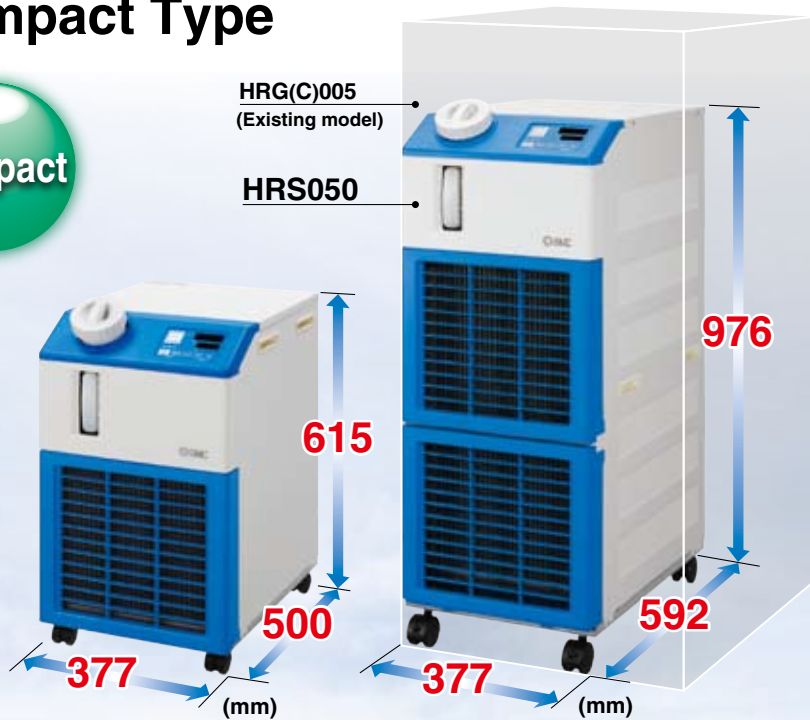
# Thermo-chiller

## Compact Type

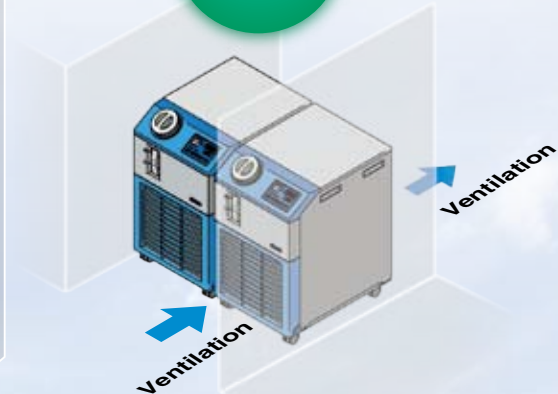
New



Compact



Space-saving



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

Light-weight

Cooling capacity (60 Hz)

40 kg

69 kg

1300 W/  
1900 W/  
2400 W

5100 W

Temperature stability  $\pm 0.1^{\circ}\text{C}$     Temperature range setting 5 to  $40^{\circ}\text{C}$

Fits neatly under a laboratory work bench.



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

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)

**Convenient functions**

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

**Easy maintenance**

- Tool-less maintenance of filter

**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.

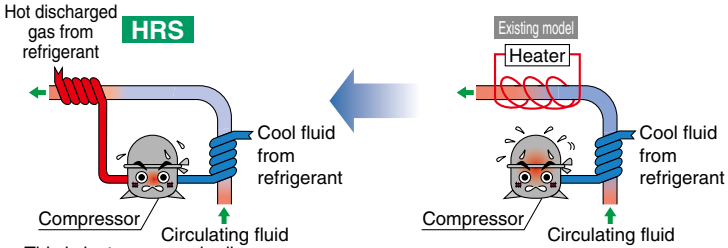
**Series HRS** Environmental friendly R407C R410A as refrigerant



# Features

## With heating function

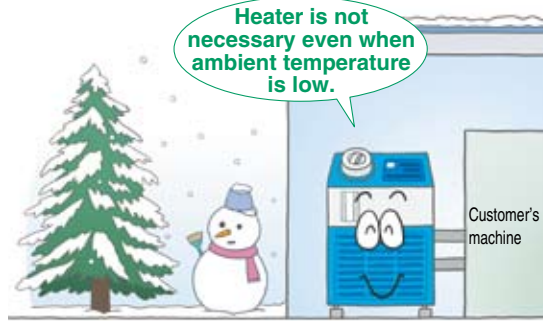
Heating method using discharged heat makes a heater unnecessary.



\* This is just an example diagram.

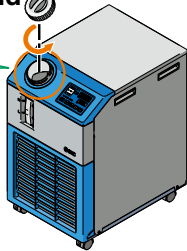
Refer to "Construction and Principles" on features 5 for piping.

Heater is not necessary even when ambient temperature is low.

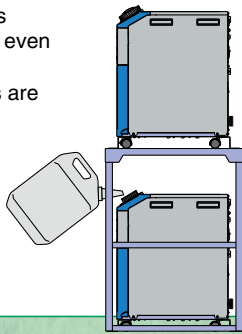


## Shaped for easy supply of circulating fluid

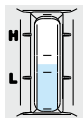
The angled supply port facilitates the supply of circulating fluid.



Supply is possible even when 2 products are stacked.

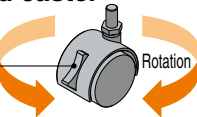


Easy check of the circulating fluid level.



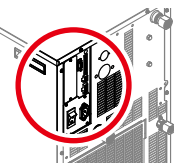
## With unfixed caster

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 **RUN/STOP** keys.
  - Step 2 Adjust the temperature setting with the **▼** **▲** keys.
  - Step 3 Press the **RUN/STOP** key to stop.
- Easy operation by these steps

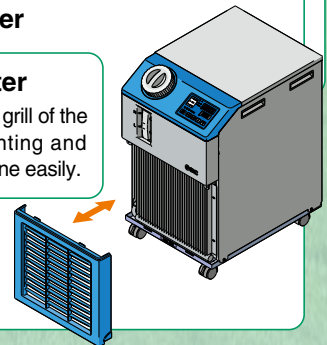


1 3 2

## 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.

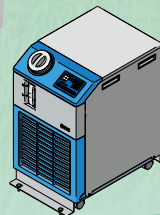
\* When the option, high-lift pump, is selected and for HRS050, the mechanical seal pump is chosen.

## Optional accessories



### Anti-quake bracket

Used to fix to a floor or base.

Option



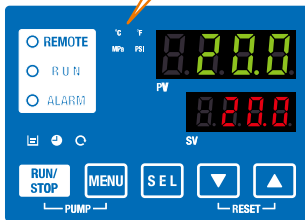
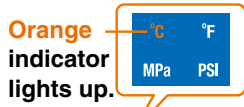
## Variations

| Model             | Cooling capacity (W)        | Cooling method   | Power supply                                     | Option <span style="background-color: red; color: white; border-radius: 50%; padding: 2px;">page10</span>   | Optional accessories <span style="background-color: red; color: white; border-radius: 50%; padding: 2px;">page12</span>  | International standards   |
|-------------------|-----------------------------|--|--|---|--|---|
| <b>HRS012</b>     | 1100/1300 (50/60 Hz)        | Air-cooled refrigeration<br>Water-cooled refrigeration | Single-phase 100 VAC (50/60 Hz), 115 VAC (60 Hz) | <ul style="list-style-type: none"> <li>• With earth leakage breaker</li> <li>• With automatic water supply function</li> <li>• Applicable to DI water (Deionized water) piping</li> <li>• High-lift pump (* For HRS050 as standard)</li> <li>• High-temperature environment specifications (* HRS050 cannot be selected)</li> </ul> | <ul style="list-style-type: none"> <li>• Anti-quake bracket</li> <li>• Piping conversion fitting (For air-cooled, water-cooled and option)</li> <li>• Concentration meter</li> <li>• By-pass piping set</li> <li>• Power supply cable</li> <li>• DI filter set</li> <li>• Electrical resistance sensor set</li> <li>• Drain pan set (With water leakage sensor)</li> </ul> | <br><br><small>(UL Standards)</small> |
| <b>HRS018</b>     | 1700/1900 (50/60 Hz)        |  | Single-phase 200 to 230 VAC (50/60 Hz)           |   |  |   |
| <b>HRS024</b>     | 2100/2400 (50/60 Hz)        |  | Single-phase 200 to 230 VAC (50/60 Hz)           |   |  |   |
| <b>New HRS050</b> | <b>4700/5100 (50/60 Hz)</b> |  |  |   |  |   |

\* UL standards: Applicable to 60 Hz only

## Convenient Functions

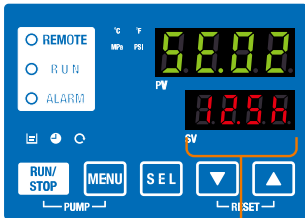
**Unit conversion function**  
The unit can be changed between °C and °F and MPa and PSI.



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

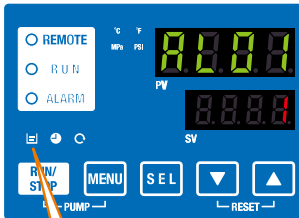
**Timer operation function**  
Timer for ON and OFF can be set in units of 0.5 h up to 99.5 h.  
Ex.) Can set to stop on Saturday and Sunday and restart on Monday morning.

Ex. SE.02 "ON timer"



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

**Low tank level detecting function**  
The reduction of the fluid level in the tank is notified by alarm code.



**Red indicator lights up.**

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

**Key-lock function**  
Can be set in advance to protect the set values from being changed by pressing keys by mistake.

**Function to output a signal for completion of preparation**  
Notifies by communication when the temperature reaches the pre-set temperature range.

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

## Self Diagnosis and Check Display for Easy Maintenance

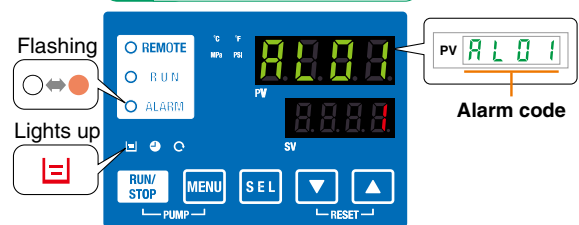
### Display of 35 types of alarm codes

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

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

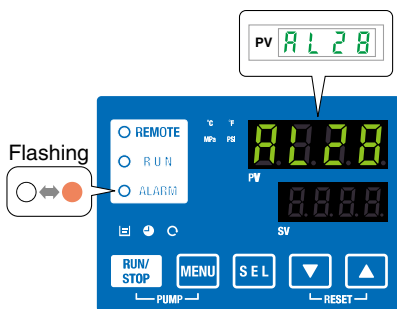
Ex. AL01 "Low level in tank"



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

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

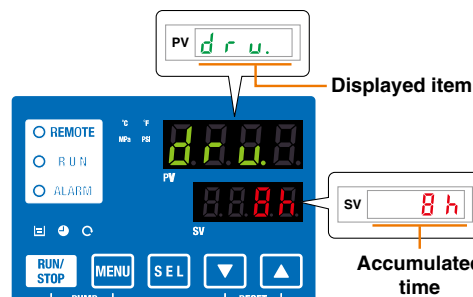
Ex. AL28 "Pump maintenance"



### Check display

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

Ex. drv. "Accumulated operating time"



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

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

## Temperature Control Equipment

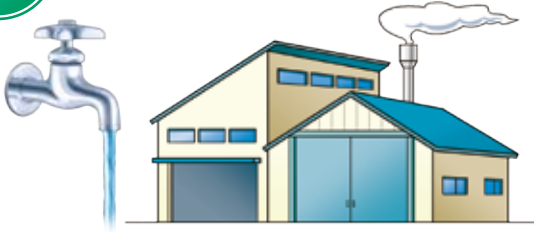


Chillers are products that control the temperature of heat sources in customers' devices and equipment using temperature-controlled circulating fluid. Maintaining a fixed temperature can improve the quality, reliability and service life of devices or equipment.

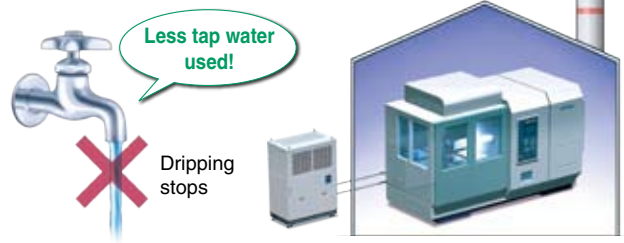
- Semi-conductors
- Machine tools
- Food products
- Measuring devices
- Physical and chemical/analytical equipment
- Medical/Pharmaceutical
- etc.

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.



When...

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.



## Application Examples

### Laser machining

- Cooling of laser irradiated part



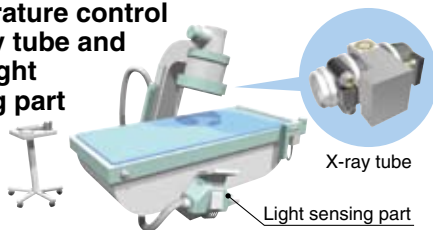
### UV curing device (printing, painting, bonding and sealing)

- Cooling of UV lamp



### X-ray (digital) instrument

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



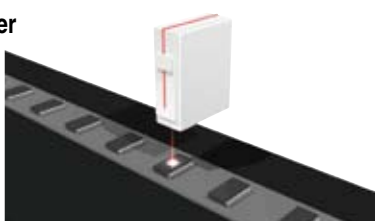
### Electronic microscope

- Temperature control of electron-beam irradiated part



### Laser marker

- Cooling of laser irradiated part



### Ultra sonic wave inspection machine

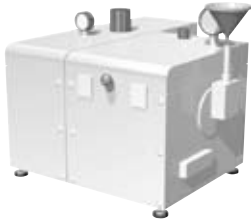
- Temperature control of ultra sonic wave laser part



Application Examples

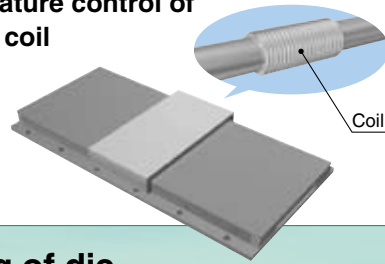
**Atomizing device** (food and cosmetics)

- Temperature control of sample and device



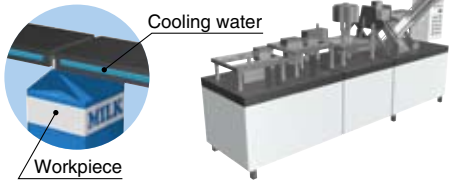
**Linear motor**

- Temperature control of moving coil

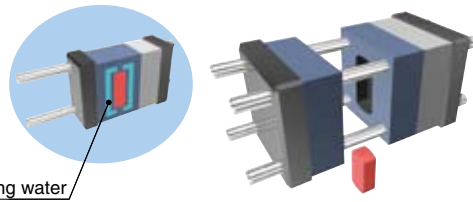


**Packaging line** (sealing of film and paper package)

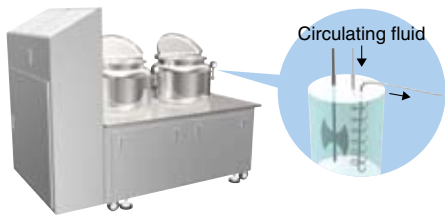
- Cooling of work pieces for bonding



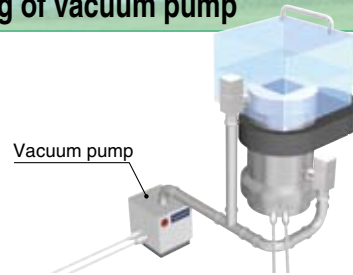
**Cooling of die**



**Temperature control of paint material**



**Cooling of vacuum pump**



**Shrink fitting machine**

- Cooling of workpiece



**Gas cylinder cabinet**

- Temperature control inside cabinet



**Concentrating equipment**

- Temperature control of concentration fluid



**Reagent cooling equipment**

- Temperature control of reagent

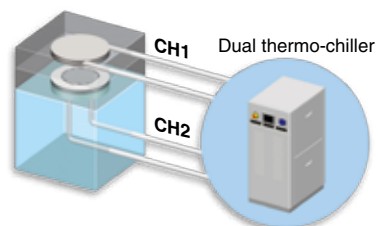


**Cleaning tank**

- Temperature control of cleaning tank

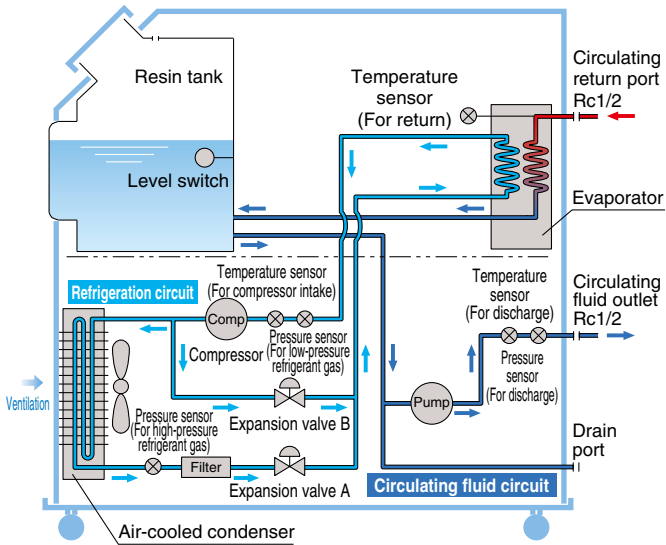


**Temperature control of chamber electrode**

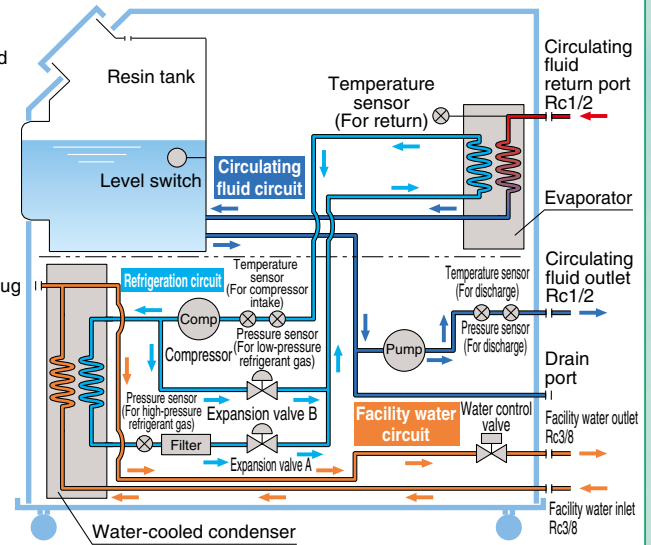


# Construction and Principles

## Air-cooled HRS□-A-□



## Water-cooled HRS□-W-□



### Circulating fluid circuit

With the circulating pump, circulating fluid will be discharged to the customer's machine side. After the circulating fluid will cool the customer's machine side, it will heat up and return to the Thermo-chiller.

### Refrigeration circuit

High-temperature, high-pressure refrigerant gas compressed by the compressor is made to release heat by the condenser, and turns to liquid. As the liquefied high-pressure refrigerant passes through the expansion valve A, it expands and cools down; as it passes through the evaporator, heat is extracted from the circulating fluid and it evaporates. The evaporated refrigerant is once again sucked in and compressed by the compressor, and the above cycle is repeated. The expansion valve B is open to heat the circulating fluid.

### Facility water circuit

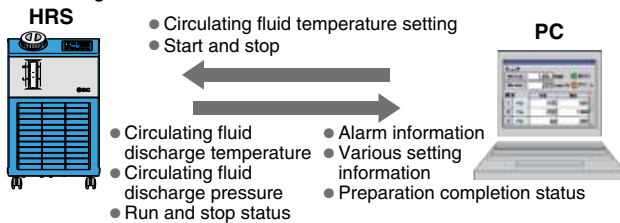
(For water-cooled refrigeration) HRS□-W-□  
The water control valve opens and closes to keep the refrigerant gas pressure consistent. The facility water flow rate is controlled by the water control valve.

# 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.).

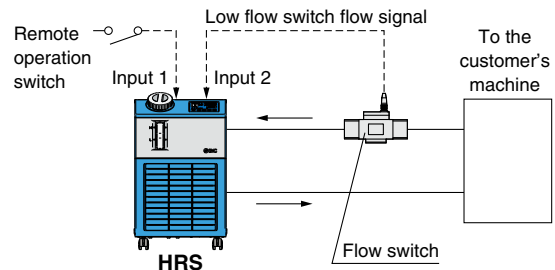
### Ex. 1 Remote signal I/O through serial communication

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



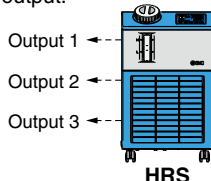
### Ex. 2 Remote operation signal input

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



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

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



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

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

# CONTENTS

## Series *HRS*

|   |             |
|---|-------------|
| ● <b>Basic Model</b>  |             |
| How to Order/Specifications                                     |             |
| Single-phase 100/115 VAC  | Page 1      |
| Single-phase 200 to 230 VAC                                     | Page 2      |
| Cooling Capacity  | Page 3      |
| Heating Capacity  | Page 4      |
| Pump Capacity/  |             |
| Required Facility Water Flow Rate                               | Page 5      |
| Dimensions  | Page 6, 7   |
| Operation Display Panel   | Page 8      |
| Alarm   | Page 8      |
| Communication Function  | Page 9      |
| ● <b>Options</b>  |             |
| With Earth Leakage Breaker                                      | Page 10     |
| With Automatic Water Supply Function                            | Page 10     |
| Applicable to DI Water (Deionized Water)                        |             |
| Piping  | Page 10     |
| High-lift Pump  | Page 10     |
| High-temperature Environment Specifications                     | Page 11     |
| ● <b>Optional Accessories</b>                                   | Page 12     |
| ① Anti-quake Bracket  | Page 13     |
| ② Piping Conversion Fitting<br>(For Air-Cooled Refrigeration)   | Page 13     |
| ③ Piping Conversion Fitting<br>(For Water-Cooled Refrigeration) | Page 14     |
| ④ Piping Conversion Fitting (For Option)                        | Page 14     |
| ⑤ Concentration Meter   | Page 15     |
| ⑥ By-pass Piping Set  | Page 15     |
| ⑦ Power Supply Cable  | Page 15     |
| ⑧ DI Filter Set   | Page 16     |
| ⑨ Electrical Resistance Sensor Set                              | Page 16     |
| ⑩ Drain Pan Set (With Water Leakage Sensor)                     | Page 17     |
| ⑪ Separately Installed Power Transformer                        | Page 18     |
| ● <b>Cooling Capacity Calculation</b>                           |             |
| Required Cooling Capacity Calculation                           | Page 19, 20 |
| Precautions on Cooling Capacity Calculation                     | Page 20     |
| Circulating Fluid Typical Physical<br>Property Values           | Page 20     |
| Specific Product Precautions                                    | Page 21, 22 |

# Thermo-chiller Compact Type

## Series HRS



### How to Order

Single-phase 100/115 VAC HRS 018 - A - 10 -

#### Cooling capacity

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

Note) UL standards: Applicable to 60 Hz only

#### Cooling method

|   |                            |
|---|----------------------------|
| A | Air-cooled refrigeration   |
| W | Water-cooled refrigeration |

#### Pipe thread type

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

#### Option

| Symbol | Option  |
|--------|---|
| Nil    | None  |
| B      | With earth leakage breaker                      |
| J      | With automatic water supply function            |
| M      | Applicable to DI water (deionized water) piping |

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

#### Power supply

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

Note) UL standards: Applicable to 60 Hz only

### Specifications \* There are different values from standard specifications. Refer to page 10 for details.

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

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 - circulating type - make-up water).

Note 4) ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Rated circulating fluid flow rate, ④ Circulating fluid: Clear water, ⑤ Facility water temperature: 25°C  
Refer to the cooling capacity graph on page 3 for details.

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) Front: 1 m, height: 1 m, stable with no load, Other conditions → Note 4)

Note 11) Weight in the dry state without circulating fluids

Note 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.



How to Order



Single-phase 200 to 230 VAC

**HRS 018 - A - 20 -**

● **Cooling capacity**

|            |   |
|------------|---|
| <b>012</b> | Cooling capacity 1100/1300 W (50/60 Hz) |
| <b>018</b> | Cooling capacity 1700/1900 W (50/60 Hz) |
| <b>024</b> | Cooling capacity 2100/2400 W (50/60 Hz) |
| <b>050</b> | Cooling capacity 4700/5100 W (50/60 Hz) |

Note) UL standards: Applicable to 60 Hz only

● **Cooling method**

|          |                            |
|----------|----------------------------|
| <b>A</b> | Air-cooled refrigeration   |
| <b>W</b> | Water-cooled refrigeration |

● **Pipe thread type**

|            |  |
|------------|--|
| <b>Nil</b> | Rc                                       |
| <b>F</b>   | G (with PT-G conversion fitting set)     |
| <b>N</b>   | NPT (with PT-NPT conversion fitting set) |

● **Power supply** Note)

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

Note) UL standards: Applicable to 60 Hz only

● **Option**

| Symbol     | Option   |
|------------|--|
| <b>Nil</b> | None   |
| <b>B</b>   | With earth leakage breaker   |
| <b>J</b>   | With automatic water supply function                               |
| <b>M</b>   | Applicable to DI water (deionized water) piping                    |
| <b>T</b>   | High-lift pump <small>Note 1)</small>                              |
| <b>G</b>   | High-temperature environment specifications <small>Note 2)</small> |

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

Note 1) The cooling capacity reduces about 300 W from the value in the catalog.

For HRS050, high-lift pump is available as standard.

Note 2) Air-cooled 200 V types, HRS012/018/024 only.

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

| Model  | HRS012-A□-20  | HRS012-W□-20   | HRS018-A□-20              | HRS018-W□-20               | HRS024-A□-20             | HRS024-W□-20               | HRS050-A□-20             | HRS050-W□-20               |                             |  |
|--|---|--|---------------------------|----------------------------|--------------------------|----------------------------|--------------------------|----------------------------|-----------------------------|--|
| <b>Cooling method</b>  | Air-cooled refrigeration  | Water-cooled refrigeration   | Air-cooled refrigeration  | Water-cooled refrigeration | Air-cooled refrigeration | Water-cooled refrigeration | Air-cooled refrigeration | Water-cooled refrigeration |                             |  |
| <b>Refrigerant</b>   | R407C (HFC)   |  |                           |                            |                          |                            | R410A (HFC)              |                            |                             |  |
| <b>Control method</b>  | PID control   |  |                           |                            |                          |                            |                          |                            |                             |  |
| <b>Ambient temperature/humidity</b> <small>Note 2)</small>           | Temperature: 5 to 40°C, High-temperature environment specifications (option): 5 to 45°C, Humidity: 30 to 70%  |  |                           |                            |                          |                            |                          |                            |                             |  |
| <b>Circulating fluid system</b>                                      | <b>Circulating fluid</b> <small>Note 3)</small>   | Clear water, 15% ethylene glycol aqueous solution <small>Note 5)</small>           |                           |                            |                          |                            |                          |                            |                             |  |
|  | <b>Temperature range setting</b> <small>Note 2)</small> (°C)  | 5 to 40  |                           |                            |                          |                            |                          |                            |                             |  |
|  | <b>Cooling capacity</b> <small>Note 4)</small> (50/60 Hz) (W)   | 1100/1300  |                           | 1700/1900                  |                          | 2100/2400                  |                          | 4700/5100                  |                             |  |
|  | <b>Heating capacity</b> <small>Note 4)</small> (50/60 Hz) (W)   | 530/650  |                           |                            |                          |                            |                          | 1100/1400   1000/1300      |                             |  |
|  | <b>Temperature stability</b> <small>Note 6)</small> (°C)  | ±0.1   |                           |                            |                          |                            |                          |                            |                             |  |
|  | <b>Pump</b>   | <b>Rated flow</b> <small>Note 7)</small> <small>Note 8)</small> (50/60 Hz) (L/min) | 7 (0.13 MPa)/7 (0.18 MPa) |                            |                          |                            |                          |                            | 23 (0.24 MPa)/28 (0.32 MPa) |  |
|  |   | <b>Maximum flow rate</b> (50/60 Hz) (L/min)  | 27/29                     |                            |                          |                            |                          |                            | 31/42                       |  |
|  |   | <b>Maximum high-lift</b> (50/60 Hz) (m)  | 14/19                     |                            |                          |                            |                          |                            | 50                          |  |
|  |   | <b>Output</b> (W)  | 200                       |                            |                          |                            |                          |                            | 550                         |  |
|  | <b>Tank capacity</b> (L)  | Approx. 5  |                           |                            |                          |                            |                          |                            |                             |  |
| <b>Port size</b>   | Rc1/2   |  |                           |                            |                          |                            |                          |                            |                             |  |
| <b>Wetted parts material</b>   | Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC  |  |                           |                            |                          |                            |                          |                            |                             |  |
| <b>Temperature range</b> (°C)  | —   | 5 to 40  | —                         | 5 to 40                    | —                        | 5 to 40                    | —                        | 5 to 40                    |                             |  |
| <b>Pressure range</b> (MPa)  | —   | 0.3 to 0.5   | —                         | 0.3 to 0.5                 | —                        | 0.3 to 0.5                 | —                        | 0.3 to 0.5                 |                             |  |
| <b>Required flow rate</b> <small>Note 12)</small> (50/60 Hz) (L/min) | —   | 8  | —                         | 12                         | —                        | 14                         | —                        | 16                         |                             |  |
| <b>Inlet-outlet pressure differential of facility water</b> (MPa)    | —   | 0.3 or more  | —                         | 0.3 or more                | —                        | 0.3 or more                | —                        | 0.3 or more                |                             |  |
| <b>Port size</b>   | Rc3/8   |  |                           |                            |                          |                            |                          |                            |                             |  |
| <b>Wetted parts material</b>   | Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber  |  |                           |                            |                          |                            |                          |                            |                             |  |
| <b>Power supply</b>  | Single-phase 200 to 230 VAC (50/60 Hz)<br>Allowable voltage range ±10%  |  |                           |                            |                          |                            |                          |                            |                             |  |
| <b>Electrical system</b>   | <b>Circuit protector</b> (A)  | 10   |                           |                            |                          |                            |                          | 20                         |                             |  |
|  | <b>Applicable earth leakage breaker capacity</b> <small>Note 9)</small> (A)   | 10   |                           |                            |                          |                            |                          | 20                         |                             |  |
|  | <b>Rated operating current</b> (A)  | 4.6/5.1  |                           | 4.7/5.2                    |                          | 5.1/5.9                    |                          | 8/11   7.6/10              |                             |  |
|  | <b>Rated power consumption</b> <small>Note 4)</small> (50/60 Hz) (kVA)  | 0.9/1.0  |                           | 0.9/1.0                    |                          | 1.0/1.2                    |                          | 1.7/2.2   1.55/2.0         |                             |  |
| <b>Noise level</b> <small>Note 10)</small> (50/60 Hz) (dB)           | 60/61   |  |                           |                            |                          |                            | 65/68                    |                            |                             |  |
| <b>Accessories</b>   | Fitting (for drain outlet) 1 pc. <small>Note 13)</small> , Input/output signal connector 1 pc., Power supply connector 1 pc. <small>Note 13)</small> , Operation manual (for installation/operation) 1, Quick manual (with a clear case) 1 <small>Note 13)</small> , Alarm code list sticker 1, Ferritic core (for communication) 1 pc.<br>Power supply cable should be ordered the option (sold separately) or prepared by the customer. |  |                           |                            |                          |                            |                          |                            |                             |  |
| <b>Weight</b> <small>Note 11)</small> (kg)                           | 43  |  |                           |                            |                          |                            | 69   67                  |                            |                             |  |

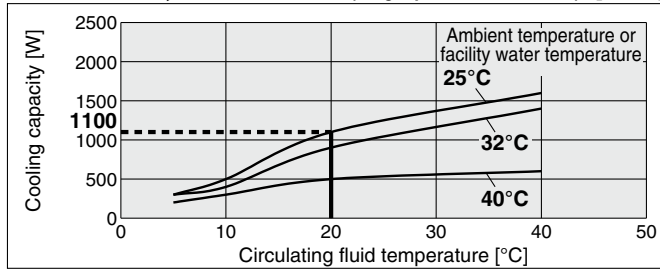
Note 1) For water-cooled refrigeration  
 Note 2) It should have no condensation.  
 Note 3) If clear water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industrial Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).  
 Note 4) ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Rated circulating fluid flow rate, ④ Circulating fluid: Clear water, ⑤ Facility water temperature: 25°C Refer to the cooling capacity graph on page 3 for details.  
 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 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  
 Note 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.

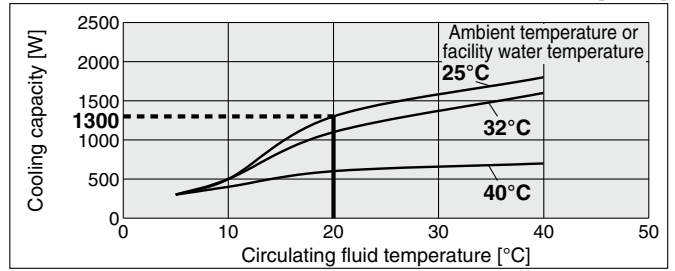
# Series HRS

## Cooling Capacity

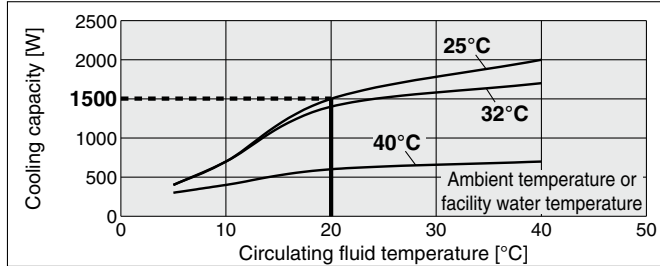
**HRS012-A-10, HRS012-W-10 (Single-phase 100/115 VAC) [50 Hz]**



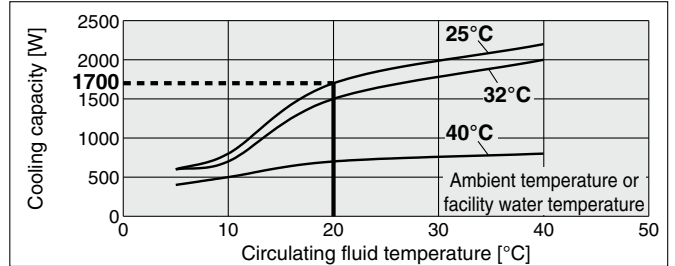
**[60 Hz]**



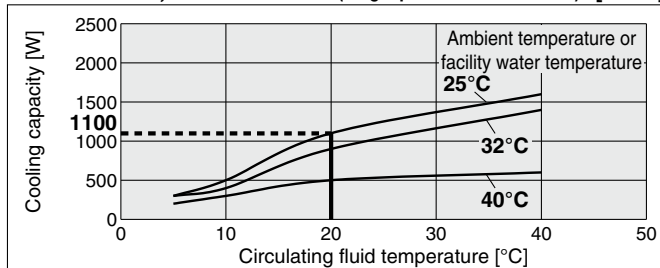
**HRS018-A-10, HRS018-W-10 (Single-phase 100/115 VAC) [50 Hz]**



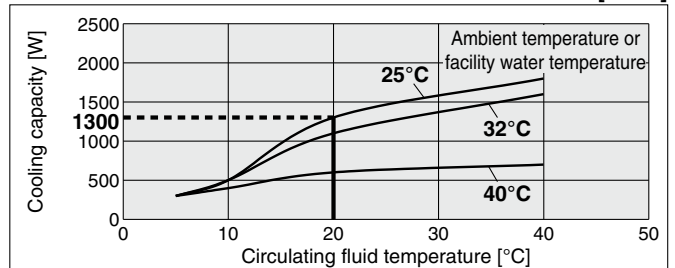
**[60 Hz]**



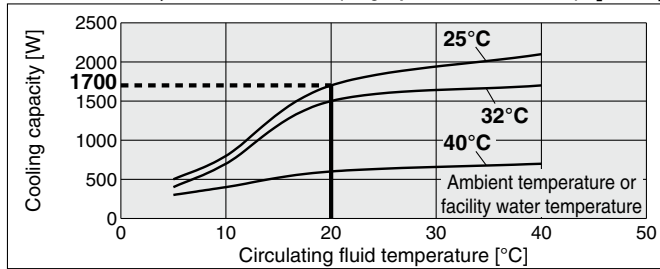
**HRS012-A-20, HRS012-W-20 (Single-phase 200 to 230 VAC) [50 Hz]**



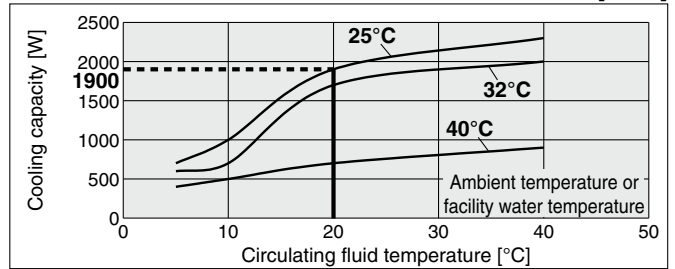
**[60 Hz]**



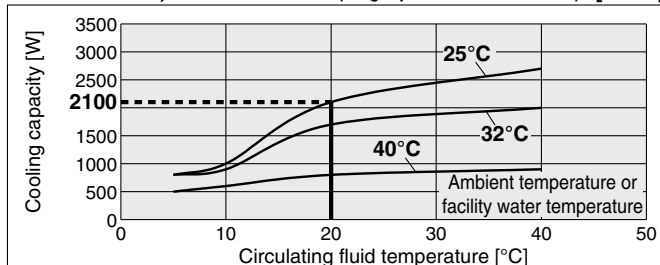
**HRS018-A-20, HRS018-W-20 (Single-phase 200 to 230 VAC) [50 Hz]**



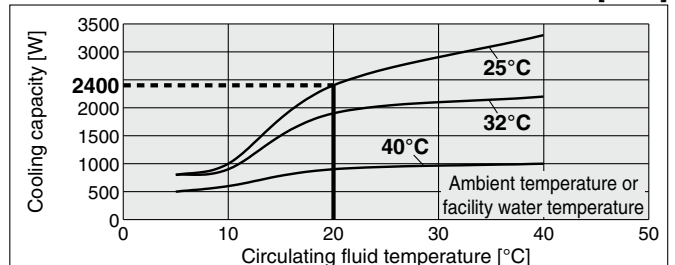
**[60 Hz]**



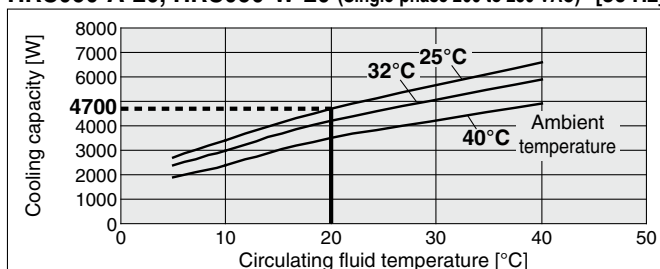
**HRS024-A-20, HRS024-W-20 (Single-phase 200 to 230 VAC) [50 Hz]**



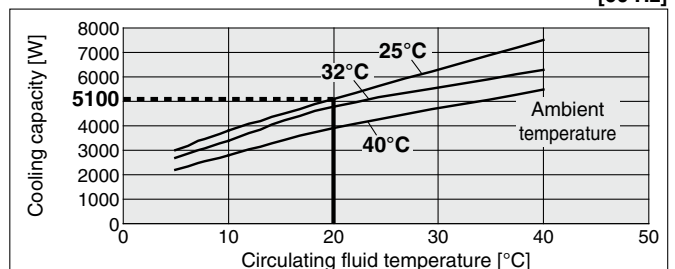
**[60 Hz]**



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

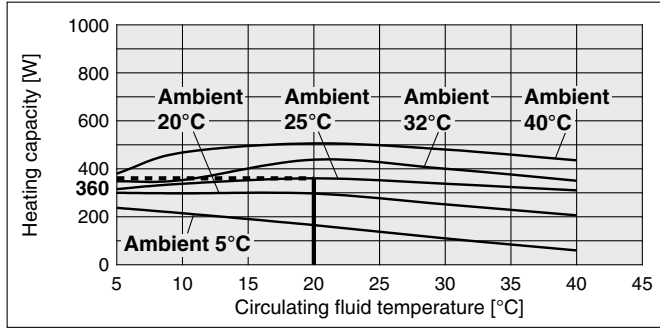


**[60 Hz]**

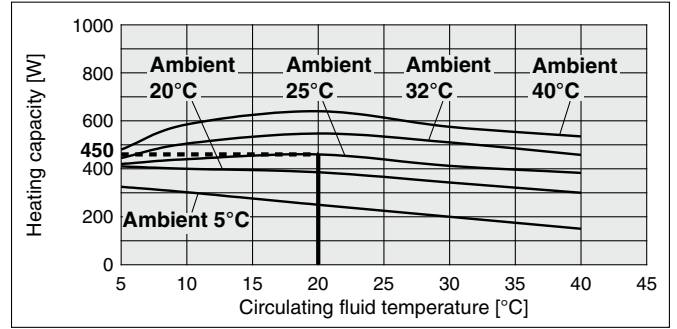


**Heating Capacity**

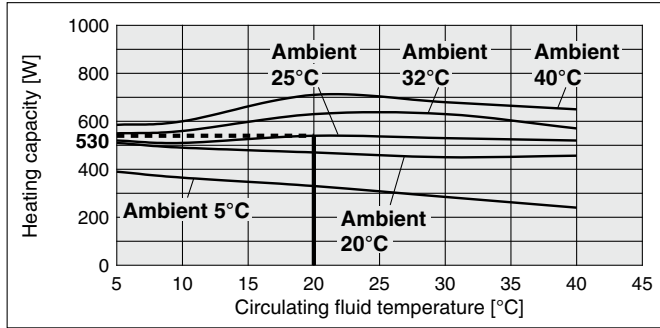
**HRS<sup>012</sup><sub>018</sub>-A-W-10** (Single-phase 100/115 VAC) [50 Hz]



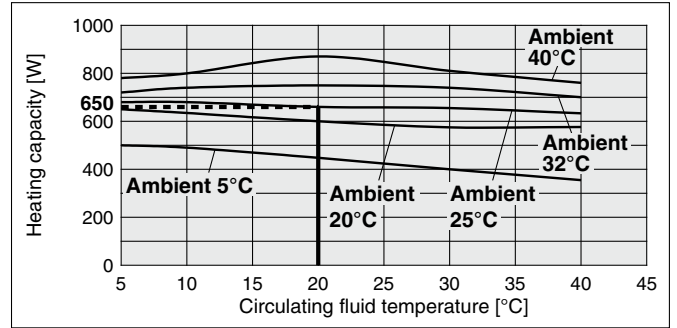
[60 Hz]



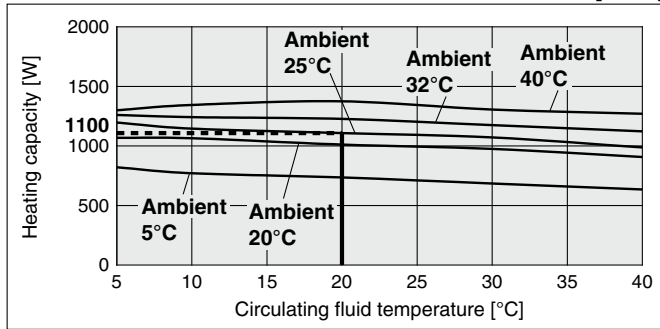
**HRS<sup>012</sup><sub>018</sub>-A-W-20** (Single-phase 200 to 230 VAC) [50 Hz]



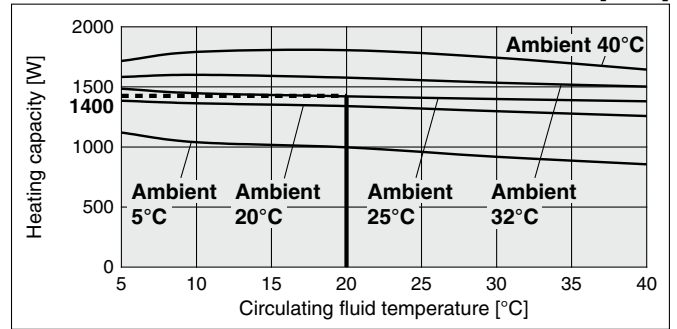
[60 Hz]



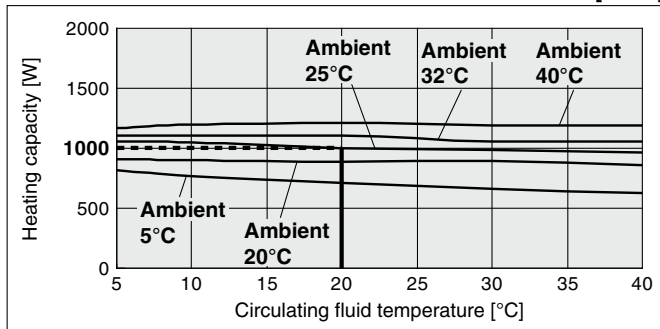
**HRS050-A-20** (Single-phase 200 to 230 VAC) [50 Hz]



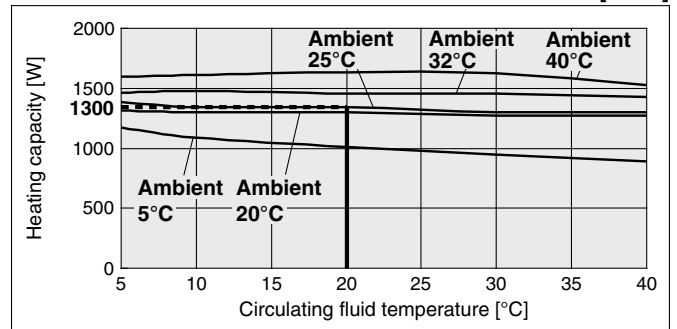
[60 Hz]



**HRS050-W-20** (Single-phase 200 to 230 VAC) [50 Hz]



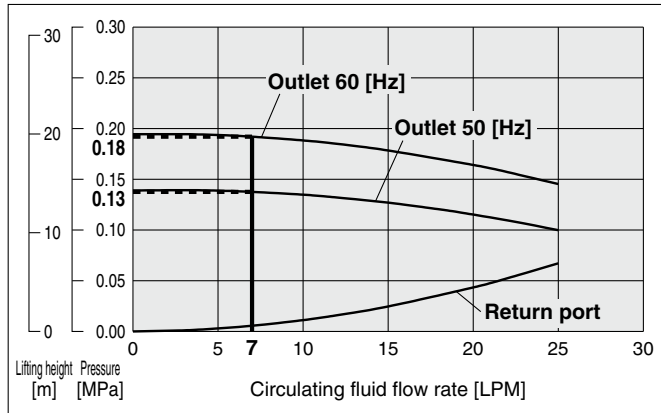
[60 Hz]



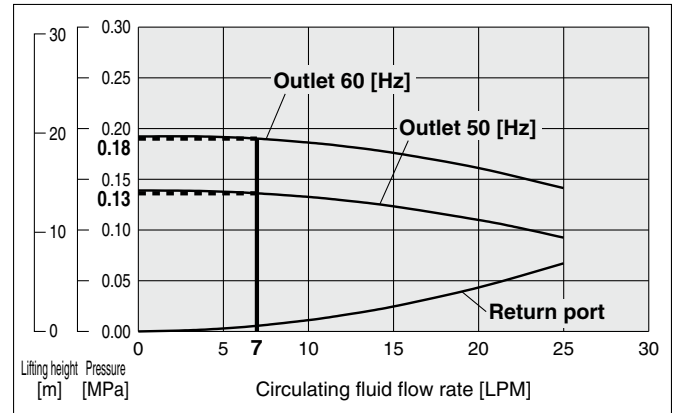
# Series HRS

## Pump Capacity

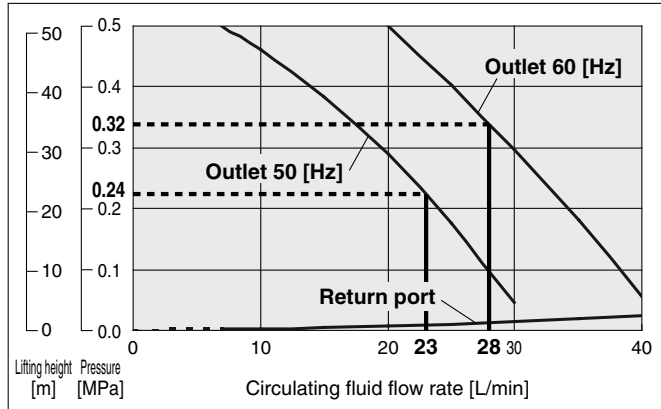
**HRS<sub>018</sub><sup>012</sup>- $\frac{A}{W}$ -10 (Single-phase 100/115 VAC)**



**HRS<sub>018</sub><sup>012</sup>- $\frac{A}{W}$ -20 (Single-phase 200 to 230 VAC)**

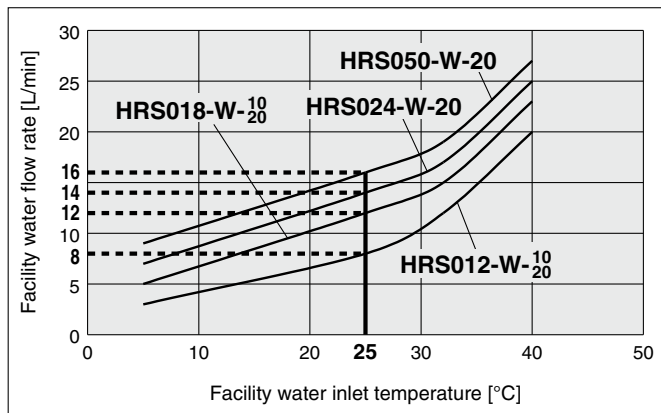


**HRS050- $\frac{A}{W}$ -20 (Single-phase 200 to 230 VAC)**



## Required Facility Water Flow Rate

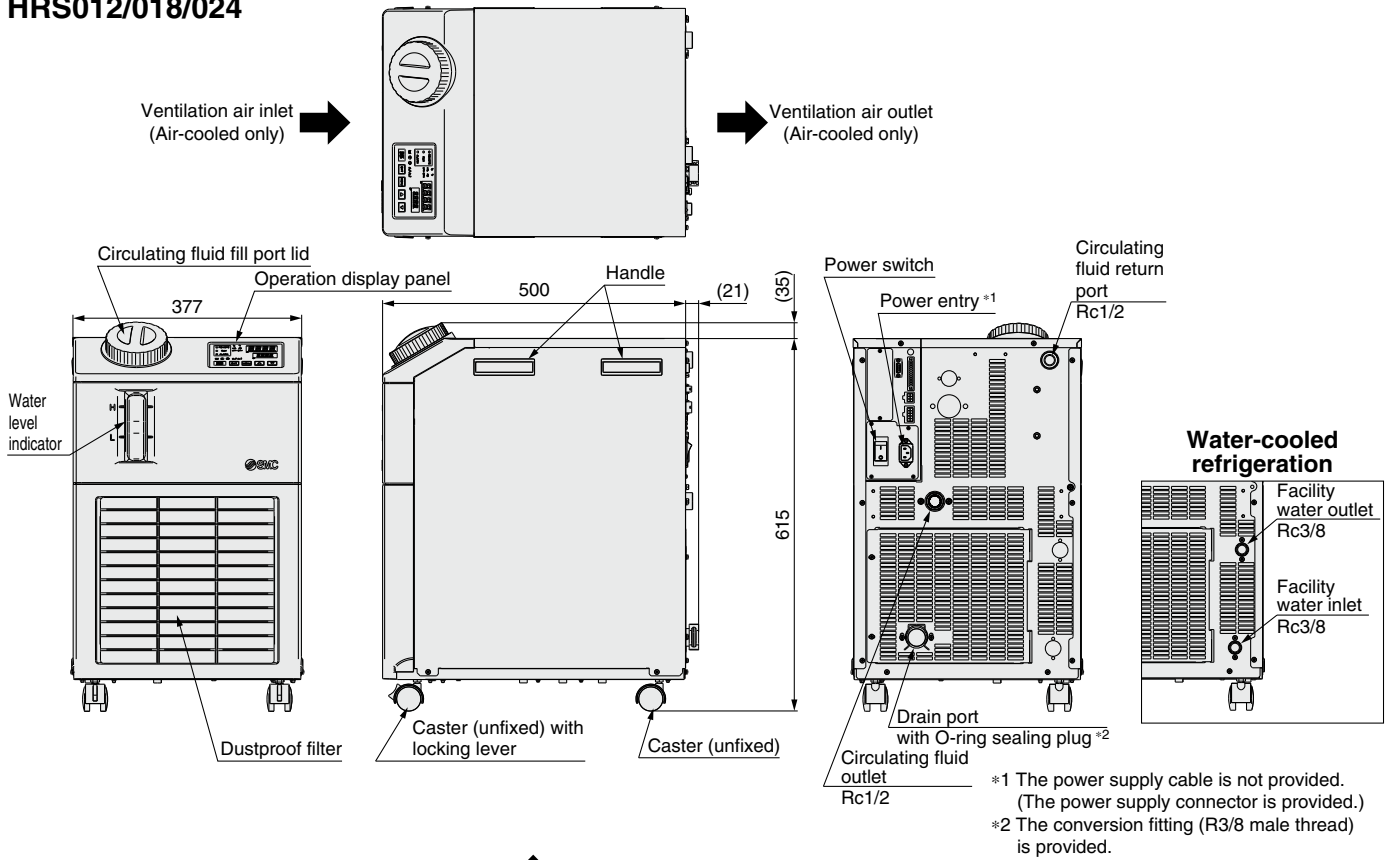
**HRS012-W- $\frac{10}{20}$ , HRS018-W- $\frac{10}{20}$   
HRS024-W-20, HRS050-W-20**



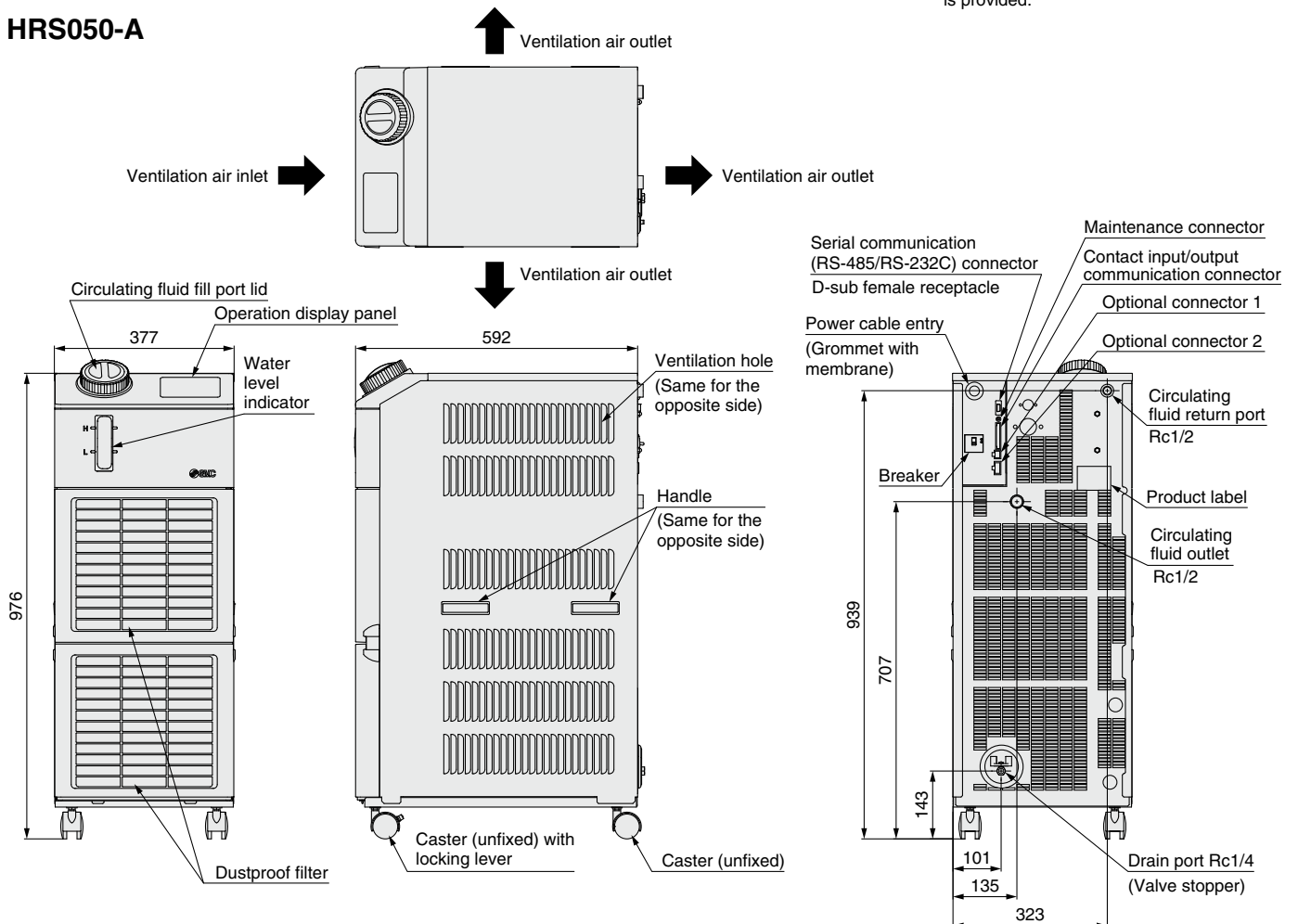
\* This is the facility water flow rate at the circulating fluid rated flow rate and the cooling capacity listed in the "Cooling Capacity" specifications.

## Dimensions

### HRS012/018/024



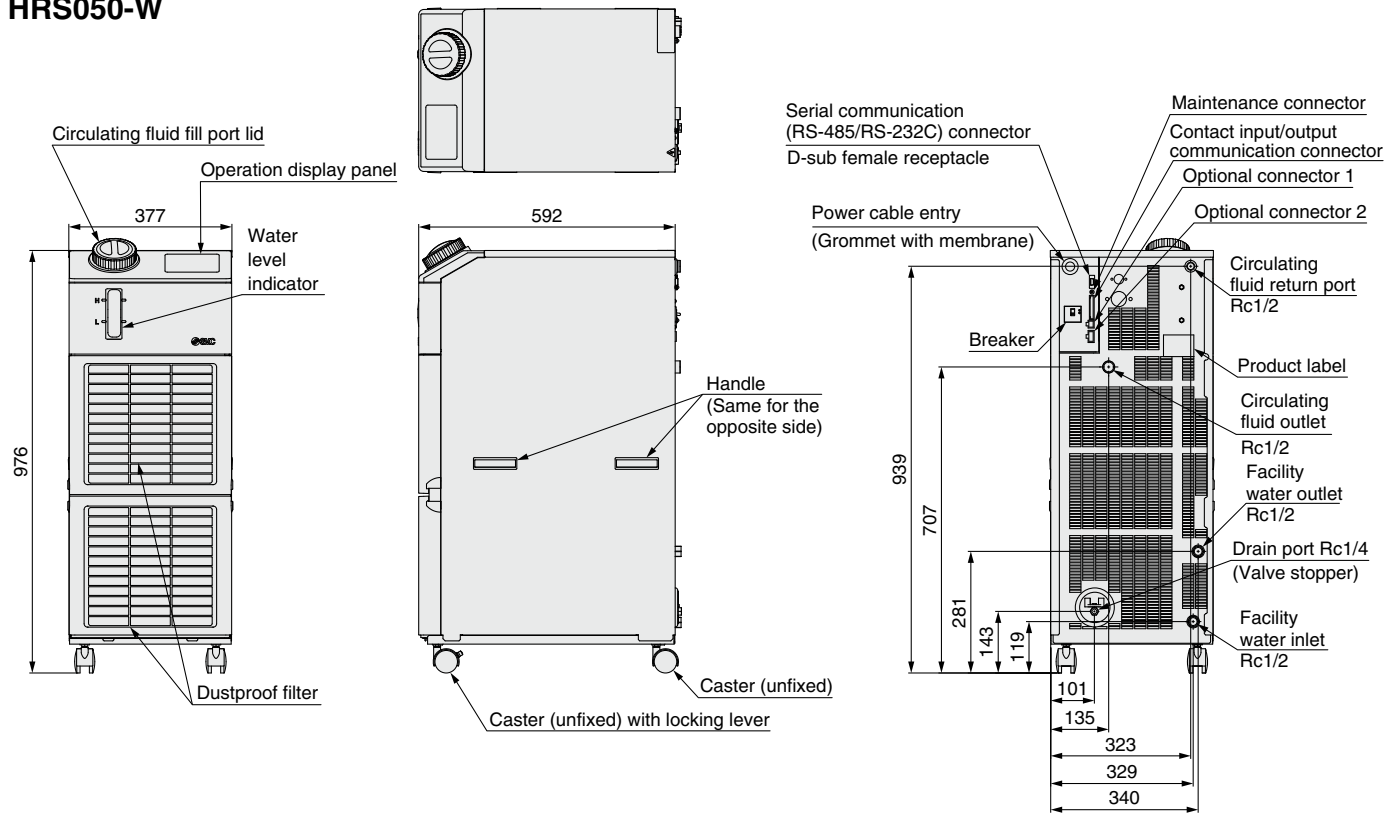
### HRS050-A



# Series HRS

## 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 tightened with the recommended torque shown below.

#### Fixing Thread Tightening Torque

| Connection thread | Applicable tightening torque (N·m) | Connection thread | Applicable tightening torque (N·m) |
|-------------------|------------------------------------|-------------------|------------------------------------|
| M3                | 0.63                               | M8                | 12.5                               |
| M4                | 1.5                                | M10               | 24.5                               |
| M5                | 3                                  | M12               | 42                                 |
| M6                | 5.2                                |                   |                                    |

### Piping

#### ⚠ Caution

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.

### 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

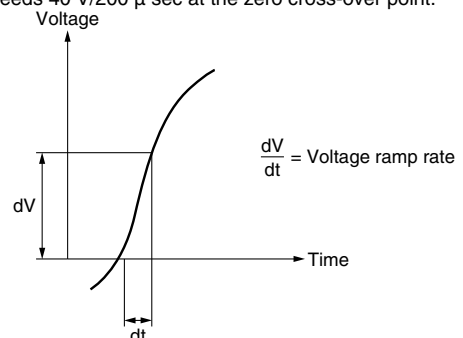
#### ⚠ Warning

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

#### ⚠ Caution

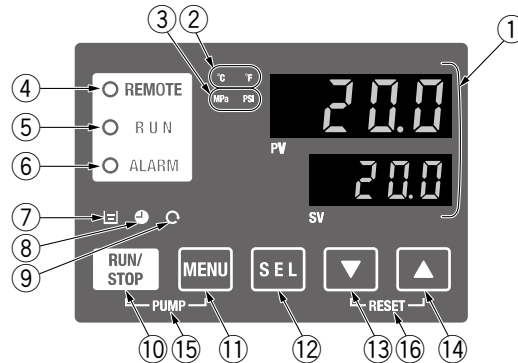
1. Communication cables should be prepared by the customer.
2. Ensure a stable power supply with no voltage surges and distortion.

In particular, operating failure can result when the voltage ramp rate ( $dV/dt$ ) exceeds  $40 \text{ V}/200 \mu \text{ sec}$  at the zero cross-over point.



## Operation Display Panel

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



| No. | Description  | Function   |
|-----|--|--|
| ①   | <b>Digital display</b><br>(7-segment and 4 digits) | <b>PV</b> Displays the circulating fluid current discharge temperature and pressure and alarm codes and other menu items (codes).<br><b>SV</b> Displays the circulating fluid discharge temperature and the set values of other menus. |
| ②   | <b>[°C] [°F] indicator</b>                         | Equipped with a unit conversion function. Displays the unit of display temperature (default setting: °C).  |
| ③   | <b>[MPa] [PSI] indicator</b>                       | Equipped with a unit conversion function. Displays the unit of display pressure (default setting: MPa).  |
| ④   | <b>[REMOTE] indicator</b>                          | Enables remote operation (start and stop) by communication. Lights up during remote operation.   |
| ⑤   | <b>[RUN] indicator</b>                             | Lights up when the product is started, and goes off when it is stopped. Flashes during stand-by for stop or anti-freezing function, or independent operation of the pump.  |
| ⑥   | <b>[ALARM] indicator</b>                           | Flashes with buzzer when alarm occurs.   |
| ⑦   | <b>[ L ] indicator</b>                             | Lights up when the surface of the fluid level indicator falls below the L level.   |
| ⑧   | <b>[ ● ] indicator</b>                             | Equipped with a timer for start and stop. Lights up when this function is operated.  |
| ⑨   | <b>[ ○ ] indicator</b>                             | Equipped with a power failure auto-restart function, which restarts the product automatically after stopped due to a power failure, is provided. Lights up when this function is operated.   |
| ⑩   | <b>[RUN/STOP] key</b>                              | Makes the product start or stop.   |
| ⑪   | <b>[MENU] key</b>                                  | Shifts the main menu (display screen of circulating fluid discharge temperature and pressure) and other menus (for monitoring and entry of set values).  |
| ⑫   | <b>[SEL] key</b>                                   | Changes the item in menu and enters the set value.   |
| ⑬   | <b>[▼] key</b>                                     | Decreases the set value.   |
| ⑭   | <b>[▲] key</b>                                     | Increases the set value.   |
| ⑮   | <b>[PUMP] key</b>                                  | Press the [MENU] and [RUN/STOP] keys simultaneously. The pump starts running independently to make the product ready for start-up (release the air).   |
| ⑯   | <b>[RESET] key</b>                                 | Press the [▼] and [▲] keys simultaneously. The alarm buzzer is stopped and the [ALARM] indicator is reset.   |

## 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.

| Alarm code | Alarm message  | Operation status | Alarm code | Alarm message  | Operation status |
|------------|--|------------------|------------|--|------------------|
| AL01       | Low level in tank  | Stop *1          | AL20       | Memory error   | Stop             |
| AL02       | High circulating fluid discharge temperature             | Stop             | AL21       | DC line fuse cut                                       | Stop             |
| AL03       | Circulating fluid discharge temperature rise             | Continue *1      | AL22       | Circulating fluid discharge temperature sensor failure | Stop             |
| AL04       | Circulating fluid discharge temperature drop             | Continue *1      | AL23       | Circulating fluid return temperature sensor failure    | Stop             |
| AL05       | High circulating fluid return temperature (60°C)         | Stop             | AL24       | Compressor intake temperature sensor failure           | Stop             |
| AL06       | High circulating fluid discharge pressure                | Stop             | AL25       | Circulating fluid discharge pressure sensor failure    | Stop             |
| AL07       | Abnormal pump operation                                  | Stop             | AL26       | Compressor discharge pressure sensor failure           | Stop             |
| AL08       | Circulating fluid discharge pressure rise                | Continue *1      | AL27       | Compressor intake pressure sensor failure              | Stop             |
| AL09       | Circulating fluid discharge pressure drop                | Continue *1      | AL28       | Pump maintenance                                       | Continue         |
| AL10       | High compressor intake temperature                       | Stop             | AL29       | Fan motor maintenance *3                               | Continue         |
| AL11       | Low compressor intake temperature                        | Stop             | AL30       | Compressor maintenance                                 | Continue         |
| AL12       | Low super heat temperature                               | Stop             | AL31 *2    | Contact 1 input signal detection                       | Stop *1          |
| AL13       | High compressor discharge pressure                       | Stop             | AL32 *2    | Contact 2 inputs signal detection                      | Stop *1          |
| AL15       | Refrigerating circuit pressure (high pressure side) drop | Stop             | AL33 *4    | Water leakage  | Stop *1          |
| AL16       | Refrigerating circuit pressure (low pressure side) rise  | Stop             | AL34 *4    | Electrical resistance rise                             | Continue         |
| AL17       | Refrigerating circuit pressure (low pressure side) drop  | Stop             | AL35 *4    | Electrical resistance drop                             | Continue         |
| AL18       | Compressor overload                                      | Stop             | AL36 *4    | Electrical resistance sensor failure                   | Continue         |
| AL19 *2    | Communication error *2                                   | Continue *1      |            |  |                  |

\*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>

## Communication Function

### Contact Input/Output

| Item                            | Specifications          |                                |
|---------------------------------|-------------------------|--------------------------------|
| Connector type (to the product) | MC 1,5/12-GF-3,5        |                                |
| Input signal                    | Insulation method       | Photocoupler                   |
|                                 | Rated input voltage     | 24 VDC                         |
|                                 | Operating voltage range | 21.6 VDC to 26.4 VDC           |
|                                 | Rated input current     | 5 mA TYP                       |
|                                 | Input impedance         | 4.7 kΩ                         |
| Contact output signal           | Rated load voltage      | 48 VAC or less/30 VDC or less  |
|                                 | Maximum load current    | 500 mA AC/DC (resistance load) |
| Output voltage                  | 24 VDC ± 10% 0.5 A Max  |                                |
| Circuit diagram                 |                         |                                |

\* 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  | Readout   |
|--|---|
| Run/Stop<br>Circulating fluid temperature setting (SV) | Circulating fluid present temperature (PV)<br>Circulating fluid discharge pressure (SV)<br>Electrical resistance *1<br>Status information<br>Alarm occurrence information |

\*1 When optional electrical resistance sensor set is used

| Item            | Specifications   |
|-----------------|--|
| Connector type  | D-sub 9-pin, Female connector                          |
| Protocol        | Modicon Modbus compliant/Simple communication protocol |
| Standards       | EIA standard RS-485                                    |
|                 | EIA standard RS-232C                                   |
| Circuit diagram |  |

\* 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>**



# Series HRS Options

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

## B Option symbol

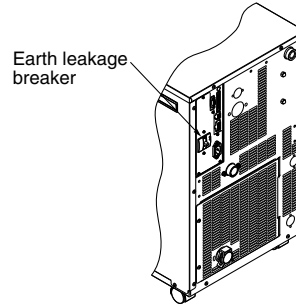
### With Earth Leakage Breaker

HRS  -   -  - **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.

| Symbol                         | HRS012/018/024- <input type="text"/> - <input type="text"/> - <input type="text"/> - <b>B</b> | HRS050- <input type="text"/> - <input type="text"/> - <input type="text"/> - <b>B</b> |
|--------------------------------|---|---|
| Rated current sensitivity (mA) | 30  | 30  |
| Rated shutdown current (A)     | 15 (Single-phase 100/115 VAC)<br>10 (Single-phase 200 to 230 VAC)                             | 20  |
| Short circuit display method   | Mechanical button   |   |



## J Option symbol

### With Automatic Water Supply Function

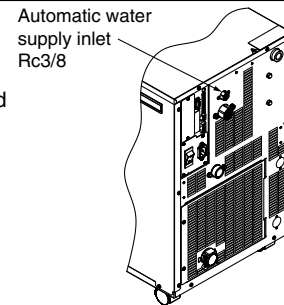
HRS  -   -  - **J**

#### 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.

| Symbol                      | HRS012/018/024/050- <input type="text"/> - <input type="text"/> - <input type="text"/> - <b>J</b> |
|-----------------------------|---|
| Water supply method         | Built-in solenoid valve for automatic water supply  |
| Water supply pressure (MPa) | 0.2 to 0.5  |

\* When the option, with automatic water supply function, is selected, the weight increases by 1 kg.



## M Option symbol

### Applicable to DI Water (Deionized Water) Piping

HRS  -   -  - **M**

Wetted parts material of the circulating fluid circuit is made from non-copper materials. **Applicable to DI water (Deionized water) piping**

| Symbol                                      | HRS012/018/024/050- <input type="text"/> - <input type="text"/> - <input type="text"/> - <b>M</b>                  |
|---|--|
| Wetted parts material for circulating fluid | Stainless steel (including heat exchanger brazing), Alumina ceramic, SiC, Carbon, PP, PE, POM, FKM, NBR, EPDM, PVC |

\* No change in external dimensions.

## 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.

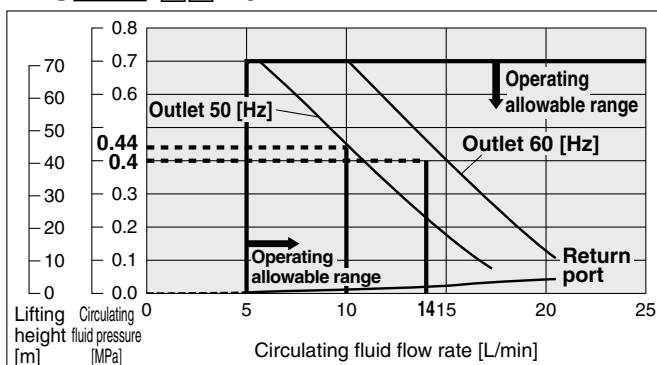
\* For HRS050, this option is available as standard.

| Symbol                                     |  | HRS012/018/024- <input type="text"/> - <input type="text"/> - <b>20-T</b> | HRS012/018/024- <input type="text"/> - <input type="text"/> - <b>20-MT</b> <small>Note 1)</small>                               |
|--|--|---|---|
| Pump                                       | Rated flow (50/60 Hz) <small>Note 2) Note 3)</small> | L/min 10 (0.44 MPa)/14 (0.40 MPa)   | 10 (0.32 MPa)/14 (0.32 MPa)   |
|  | Maximum flow rate (50/60 Hz)                         | L/min   | 18 / 22   |
|  | Maximum high-lift (50/60 Hz)                         | m   | 50  |
|  | Output   | W   | 550   |
| Circuit protection device                  |  | A 15 A (10 A for standard)  |   |
| Recommended earth leakage breaker capacity |  | A 15 A  |   |
| Cooling capacity <small>Note 4)</small>    |  | W   | The cooling capacity reduces about 300 W from the value in the catalog. (due to an increase in the heat generation of the pump) |

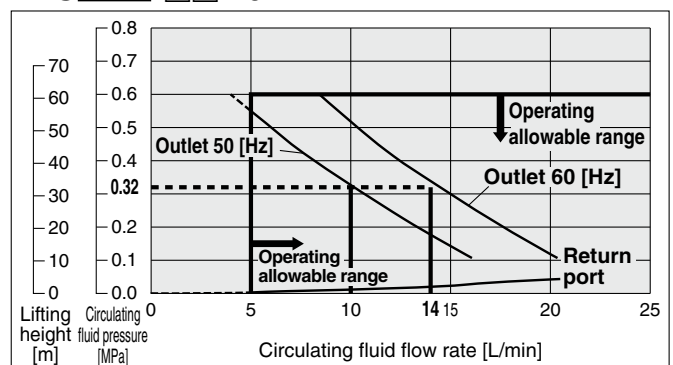
Note 1) -MT: Applicable to DI water (deionized water) piping + High-lift pump  
 Note 2) The capacity at the Thermo-chiller outlet when the circulating fluid temperature is 20°C.  
 Note 3) Required min. flow rate for cooling capacity or maintaining the temperature stability.  
 Note 4) Cooling capacity 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.

## Pump Capacity

HRS  -   - **20-T**



HRS  -   - **20-MT**



# Series HRS

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

## G Option symbol High-temperature Environment Specifications

### HRS [ ] - A [ ] - 20 - G

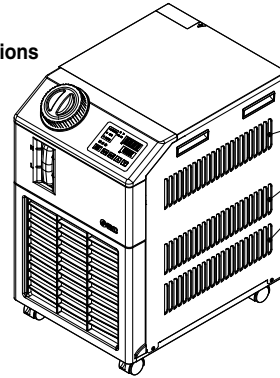
#### High-temperature environment specifications

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 | <b>HRS012/018/024-A[ ]-20-G</b>        |
| Cooling method   | Air-cooled refrigeration               |
| Power supply     | Single-phase 200 to 230 VAC (50/60 Hz) |

\* No change in external dimensions.

\* **HRS050 cannot be selected.**



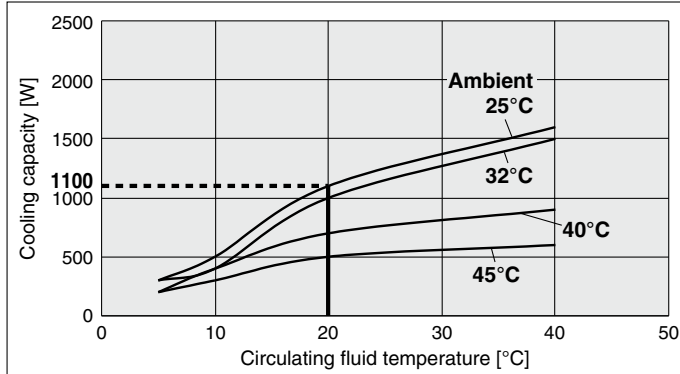
Ventilation slots are added to side panels (on both sides).

\*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).

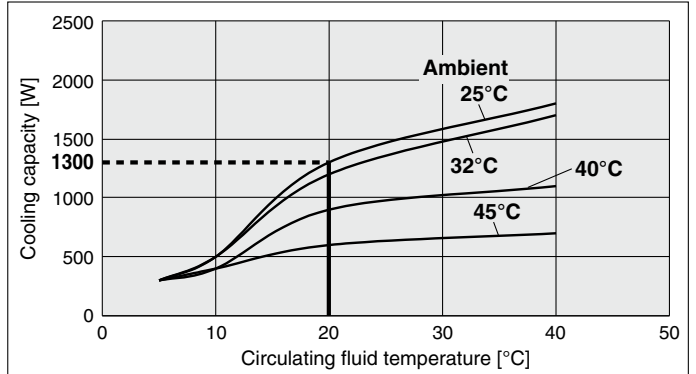
## Cooling Capacity

### HRS012-A[ ]-20-G

[50Hz]

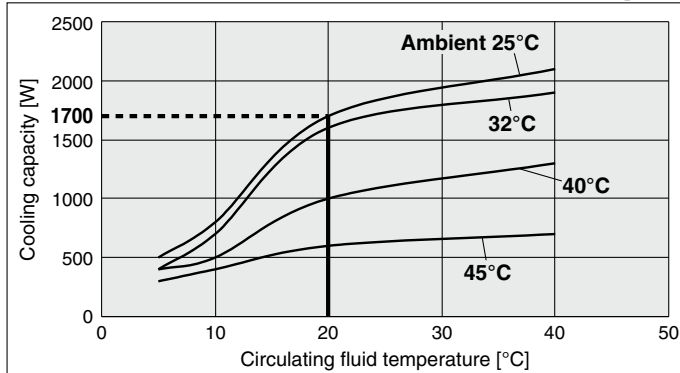


[60Hz]

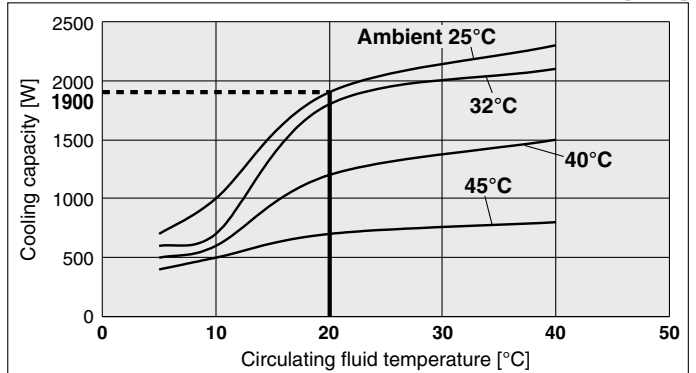


### HRS018-A[ ]-20-G

[50Hz]

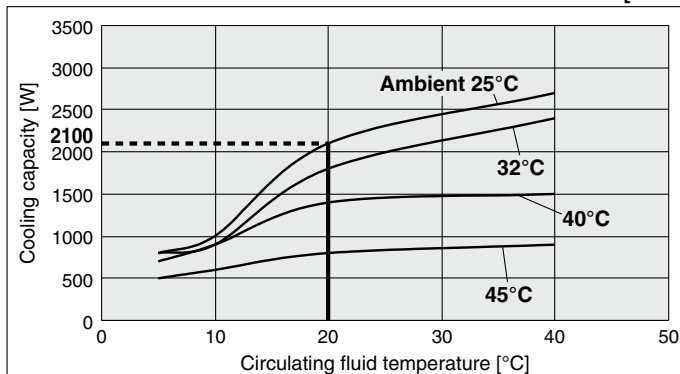


[60Hz]

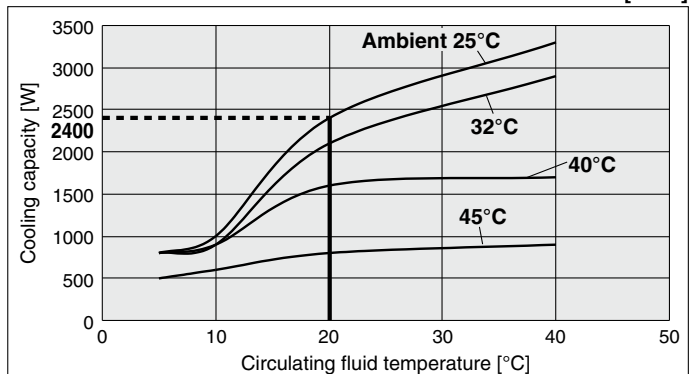


### HRS024-A[ ]-20-G

[50Hz]



[60Hz]



# Series HRS

## Optional Accessories

### Optional Accessories Applicable Model List

| Description |  | Part No.                          | HRS012-A  |    | HRS018-A |    | HRS024-A-20 | HRS050-A-20 | HRS012-W  |    | HRS018-W |    | HRS024-W-20 | HRS050-W-20 | Option    |         | Page    |   |
|-------------|--|-----------------------------------|-----------|----|----------|----|-------------|-------------|-----------|----|----------|----|-------------|-------------|-----------|---------|---------|---|
|             |  |                                   | 10        | 20 | 10       | 20 |             |             | 10        | 20 | 10       | 20 |             |             | (for-J)   | (for-T) |         |   |
| ①           | Anti-quake bracket   | HRS-TK001                         | ●         | ●  | ●        | ●  | ●           | —           | ●         | ●  | ●        | ●  | ●           | —           | —         | —       | Page 13 |   |
|             |  | HRS-TK002                         | —         | —  | —        | —  | —           | ●           | —         | —  | —        | —  | —           | ●           | —         | —       |         |   |
| ②           | Piping conversion fitting (for air-cooled refrigeration)             | G thread conversion fitting set   | HRS-EP001 | ●  | ●        | ●  | ●           | ●           | —         | —  | —        | —  | —           | —           | —         | —       | Page 13 |   |
|             |  | NPT thread conversion fitting set | HRS-EP002 | ●  | ●        | ●  | ●           | ●           | —         | —  | —        | —  | —           | —           | —         | —       |         |   |
|             |  | G thread conversion fitting set   | HRS-EP009 | —  | —        | —  | —           | —           | ●         | —  | —        | —  | —           | —           | —         | —       |         |   |
|             |  | NPT thread conversion fitting set | HRS-EP010 | —  | —        | —  | —           | —           | ●         | —  | —        | —  | —           | —           | —         | —       |         |   |
| ③           | Piping conversion fitting (for water-cooled refrigeration)           | G thread conversion fitting set   | HRS-EP003 | —  | —        | —  | —           | —           | —         | ●  | ●        | ●  | ●           | ●           | —         | —       | Page 14 |   |
|             |  | NPT thread conversion fitting set | HRS-EP004 | —  | —        | —  | —           | —           | —         | ●  | ●        | ●  | ●           | ●           | —         | —       |         |   |
|             |  | G thread conversion fitting set   | HRS-EP011 | —  | —        | —  | —           | —           | —         | —  | —        | —  | —           | —           | ●         | —       |         |   |
|             |  | NPT thread conversion fitting set | HRS-EP012 | —  | —        | —  | —           | —           | —         | —  | —        | —  | —           | —           | ●         | —       |         |   |
| ④           | Piping conversion fitting (for automatic water supply inlet) Note 1) | G thread conversion fitting set   | HRS-EP005 | —  | —        | —  | —           | —           | —         | —  | —        | —  | —           | —           | ●         | —       | Page 14 |   |
|             | Piping conversion fitting (for automatic water supply inlet) Note 1) | NPT thread conversion fitting set | HRS-EP006 | —  | —        | —  | —           | —           | —         | —  | —        | —  | —           | —           | ●         | —       |         |   |
|             | Piping conversion fitting (for high-lift pump) Note 2)               | G thread conversion fitting       | HRS-EP007 | —  | —        | —  | —           | —           | ●         | —  | —        | —  | —           | —           | ●         | —       |         |   |
|             | Piping conversion fitting (for high-lift pump) Note 2)               | NPT thread conversion fitting     | HRS-EP008 | —  | —        | —  | —           | —           | ●         | —  | —        | —  | —           | —           | ●         | —       |         |   |
| ⑤           | Concentration meter  |                                   | HRZ-BR002 | ●  | ●        | ●  | ●           | ●           | ●         | ●  | ●        | ●  | ●           | ●           | —         | —       | Page 15 |   |
| ⑥           | By-pass piping set   |                                   | HRS-BP001 | ●  | ●        | ●  | ●           | ●           | ●         | ●  | ●        | ●  | ●           | ●           | —         | —       | Page 15 |   |
| ⑦           | Power supply cable   | For single-phase 100/115 VAC      | HRS-CA001 | ●  | —        | ●  | —           | —           | —         | ●  | —        | ●  | —           | —           | —         | —       | Page 15 |   |
|             |  | For single-phase 200 VAC          | HRS-CA002 | —  | ●        | —  | ●           | ●           | — Note 3) | —  | ●        | —  | ●           | ●           | — Note 3) | —       |         | — |
| ⑧           | DI filter set  |                                   | HRS-DP001 | ●  | ●        | ●  | ●           | ●           | ●         | ●  | ●        | ●  | ●           | ●           | —         | —       | Page 16 |   |
| ⑨           | Electrical resistance sensor set                                     |                                   | HRS-DI001 | ●  | ●        | ●  | ●           | ●           | ●         | ●  | ●        | ●  | ●           | ●           | —         | —       | Page 16 |   |
| ⑩           | Drain pan set  |                                   | HRS-WL001 | ●  | ●        | ●  | ●           | ●           | —         | ●  | ●        | ●  | ●           | ●           | —         | —       | Page 17 |   |
|             |  |                                   | HRS-WL002 | —  | —        | —  | —           | —           | ●         | —  | —        | —  | —           | —           | ●         | —       |         |   |
| ⑪           | Separately installed power transformer                               | IDF-TR1000-1                      | ●         | —  | ●        | —  | —           | — Note 3)   | ●         | —  | ●        | —  | —           | — Note 3)   | —         | —       | Page 18 |   |
|             |  | IDF-TR1000-2                      | ●         | —  | ●        | —  | —           |             | ●         | —  | ●        | —  | —           |             | —         | —       |         |   |
|             |  | IDF-TR1000-3                      | ●         | —  | ●        | —  | —           |             | ●         | —  | ●        | —  | —           |             | —         | —       |         |   |
|             |  | IDF-TR1000-4                      | ●         | —  | ●        | —  | —           |             | ●         | —  | ●        | —  | —           |             | —         | —       |         |   |
|             |  | IDF-TR2000-9                      | —         | ●  | —        | ●  | ●           |             | —         | ●  | —        | ●  | ●           |             | —         | —       |         | — |
|             |  | IDF-TR2000-10                     | —         | ●  | —        | ●  | ●           |             | —         | ●  | —        | ●  | ●           |             | —         | —       |         | — |
|             |  | IDF-TR2000-11                     | —         | ●  | —        | ●  | ●           |             | —         | ●  | —        | ●  | ●           |             | —         | —       |         | — |

Note 1) When option J is selected.

Note 2) When option T or HRS050 is selected.

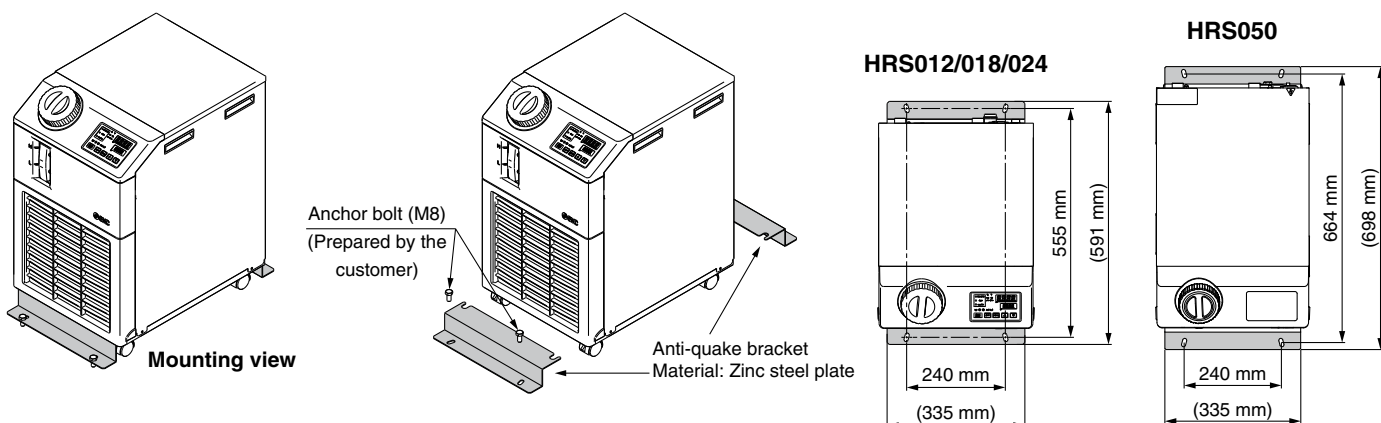
Note 3) For HRS050 should be prepared by the customer.

# Series HRS

## 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)

| Part No. (for single unit) | Symbol      |
|----------------------------|-------------|
| HRS-TK001                  | HRS012-□□-□ |
|                            | HRS018-□□-□ |
|                            | HRS024-□□-□ |
| HRS-TK002                  | HRS050-□□-□ |



## 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.

|           | Part No.                          | Applicable model |
|-----------|-----------------------------------|------------------|
| HRS-EP001 | G thread conversion fitting set   | HRS012-A-□       |
|           |                                   | HRS018-A-□       |
| HRS-EP002 | NPT thread conversion fitting set | HRS024-A-□       |

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

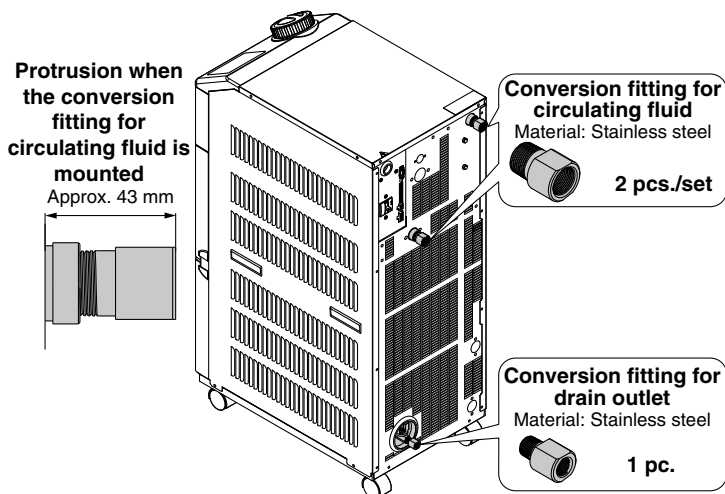
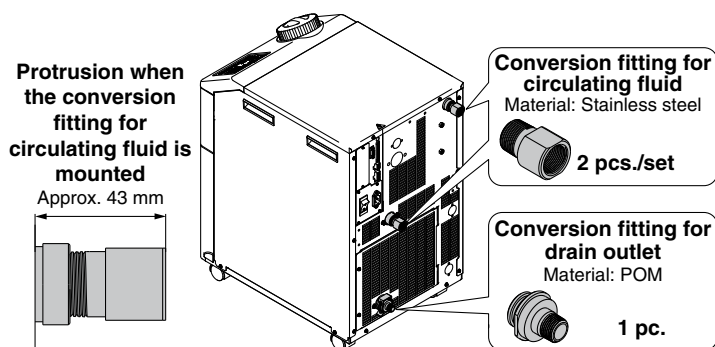
### HRS050-A□-□

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.

|           | Part No.                        | Applicable model |
|-----------|---------------------------------|------------------|
| HRS-EP009 | G thread conversion fitting set | HRS050-A-□       |
|           |                                 |                  |

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 Rc3/8 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.

| Part No.         |                                   | Applicable model         |
|------------------|-----------------------------------|--------------------------|
| <b>HRS-EP003</b> | G thread conversion fitting set   | HRS012-W-□<br>HRS018-W-□ |
| <b>HRS-EP004</b> | NPT thread conversion fitting set | HRS024-W-□               |

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

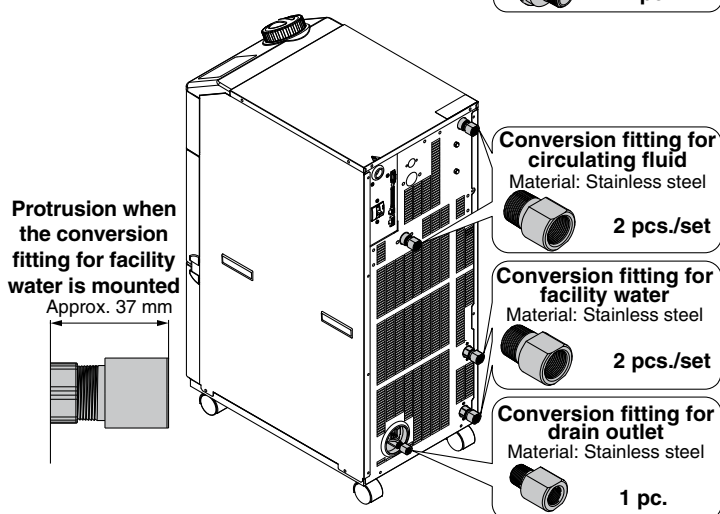
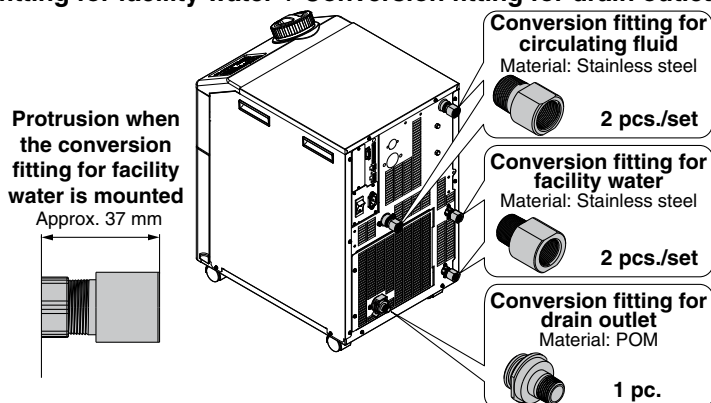
#### HRS050-W□-□

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 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.

| Part No.         |                                   | Applicable model |
|------------------|-----------------------------------|------------------|
| <b>HRS-EP011</b> | G thread conversion fitting set   | HRS050-W-□       |
| <b>HRS-EP012</b> | NPT thread conversion fitting set |                  |

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



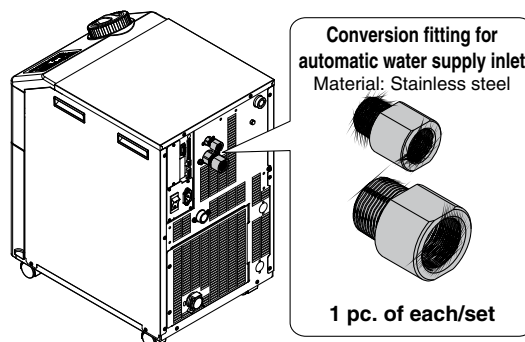
### ④ Piping Conversion Fitting (For Option)

#### ■ 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.

| Part No.         |                                   | Applicable model             |
|------------------|-----------------------------------|------------------------------|
| <b>HRS-EP005</b> | G thread conversion fitting set   | HRS012-□-□-J<br>HRS018-□-□-J |
| <b>HRS-EP006</b> | NPT thread conversion fitting set | HRS024-□-□-J<br>HRS050-□-□-J |



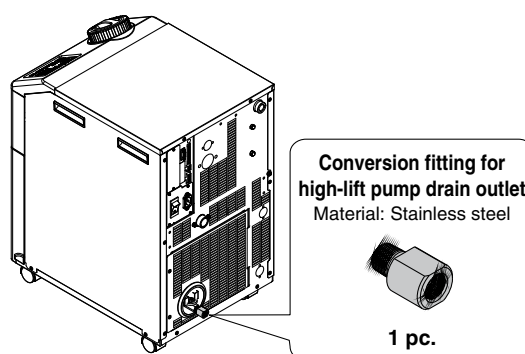
#### ■ Conversion fitting for drain outlet

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.

| Part No.         |                               | Applicable model                      |
|------------------|-------------------------------|---------------------------------------|
| <b>HRS-EP007</b> | G thread conversion fitting   | HRS012-□-20-T<br>HRS018-□-20-T        |
| <b>HRS-EP008</b> | NPT thread conversion fitting | HRS024-□-20-T<br>HRS050-□-20 (Note 1) |

Note 1) It is not necessary to purchase this when you purchase HRS-EP009 to 012 since it is included in the product.

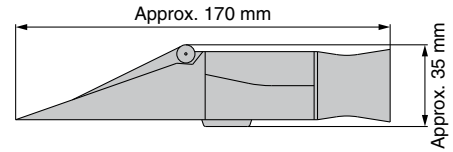


# Series HRS

## ⑤ Concentration Meter

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

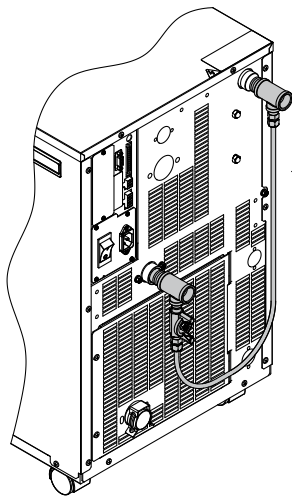
| Part No.  | Applicable model |
|-----------|------------------|
| HRZ-BR002 | HRS012-□□-□      |
|           | HRS018-□□-□      |
|           | HRS024-□□-□      |
|           | HRS050-□□-□      |



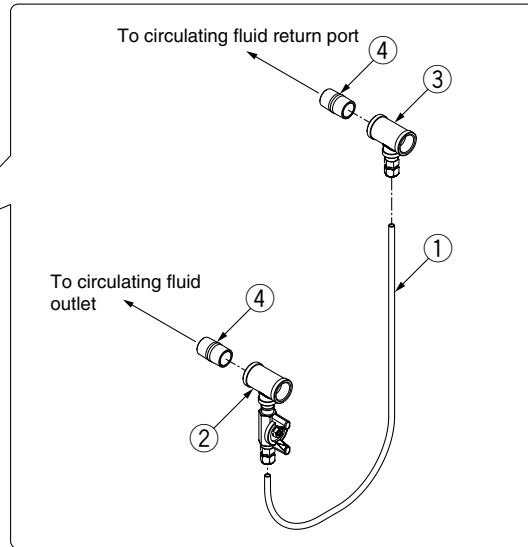
## ⑥ By-pass Piping Set

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.

| Part No.  | Applicable model |
|-----------|------------------|
| HRS-BP001 | HRS012-□□-□      |
|           | HRS018-□□-□      |
|           | HRS024-□□-□      |
|           | HRS050-□□-□      |



Note) To be mounted by the customer.



### Parts List

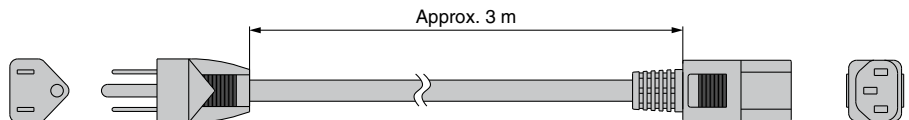
| No. | Description                                 |
|-----|---|
| ①   | By-pass tube (700 mm)<br>(Part no.: TL0806) |
| ②   | Outlet piping (with ball valve)             |
| ③   | Return port piping                          |
| ④   | Nipple (Size: 1/2)<br>(2 pcs.)              |

## ⑦ Power Supply Cable

### ■ For single-phase 100/115 VAC Type

\* Not applicable for the 200 V type.

| Part No.  | Applicable model |
|-----------|------------------|
| HRS-CA001 | HRS012-□□-10     |
|           | HRS018-□□-10     |

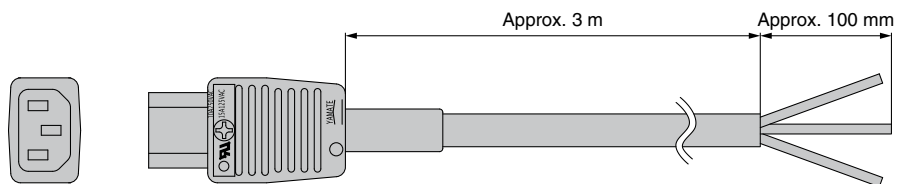


### ■ For single-phase 200 VAC Type

\* Not applicable for the 100 V type.

\* Not available for HRS050. It should be prepared by the customer.

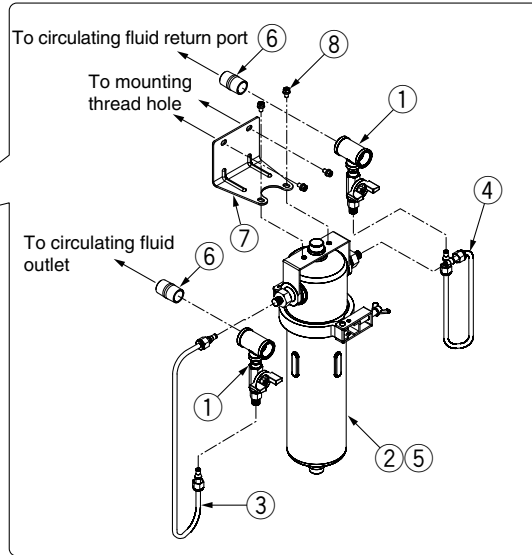
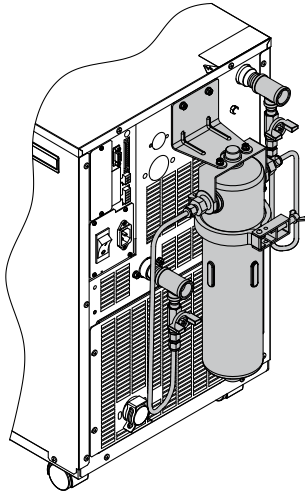
| Part No.  | Applicable model |
|-----------|------------------|
| HRS-CA002 | HRS012-□□-20     |
|           | HRS018-□□-20     |
|           | HRS024-□□-20     |



### 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)

| Part No.         | Applicable model |
|------------------|------------------|
| <b>HRS-DP001</b> | HRS012-□□-□      |
|                  | HRS018-□□-□      |
|                  | HRS024-□□-□      |
|                  | HRS050-□□-□      |



#### Parts List

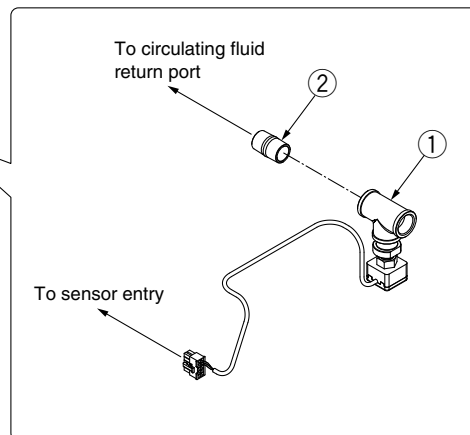
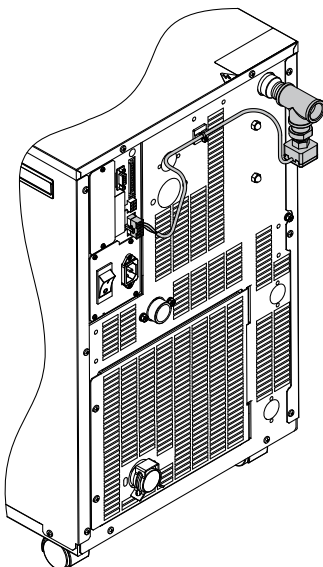
| No. | Description  |
|-----|--|
| ①   | Branch line (2 pcs.)                                 |
| ②   | DI filter case                                       |
| ③   | DI filter inlet tube                                 |
| ④   | DI filter outlet tube                                |
| ⑤   | DI filter cartridge (Part no.: HRS-DF001)            |
| ⑥   | Nipple (Size: 1/2) (2 pcs.)                          |
| ⑦   | Mounting bracket                                     |
| ⑧   | Mounting screw (M6 screw, 2 pcs.) (M5 screw, 2 pcs.) |

### 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.

| Part No.         | Applicable model |
|------------------|------------------|
| <b>HRS-DI001</b> | HRS012-□□-□      |
|                  | HRS018-□□-□      |
|                  | HRS024-□□-□      |
|                  | HRS050-□□-□      |



#### Parts List

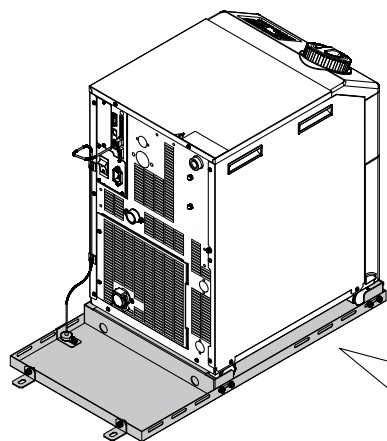
| No. | Description                  |
|-----|------------------------------|
| ①   | Electrical resistance sensor |
| ②   | Nipple (Size: 1/2) (1 pc.)   |

# Series HRS

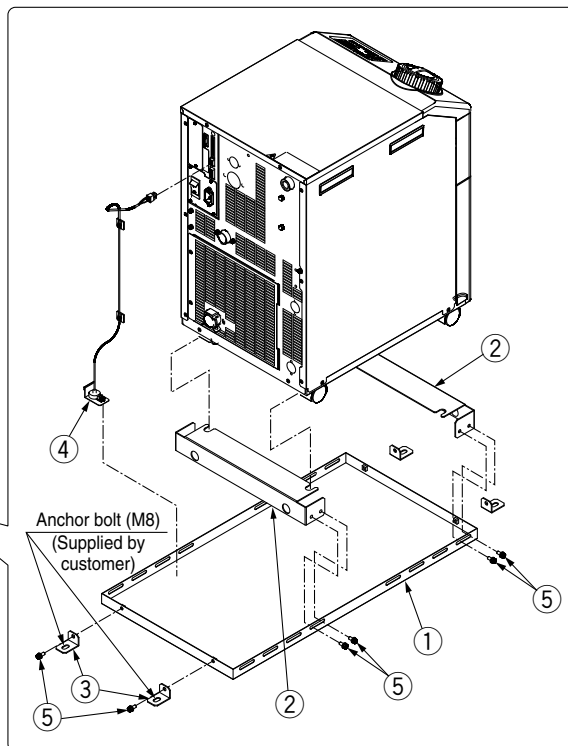
## ⑩ Drain Pan Set (With Water Leakage Sensor)

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.

| Part No.  | Applicable model |
|-----------|------------------|
| HRS-WL001 | HRS012-□□-□      |
|           | HRS018-□□-□      |
|           | HRS024-□□-□      |



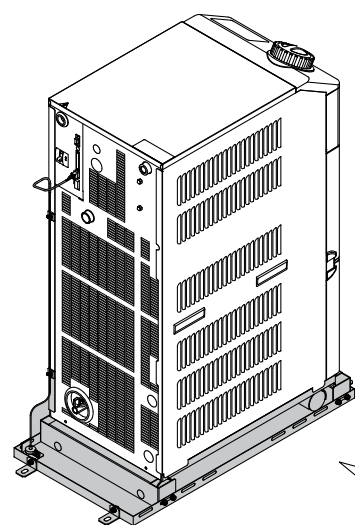
HRS012/018/024



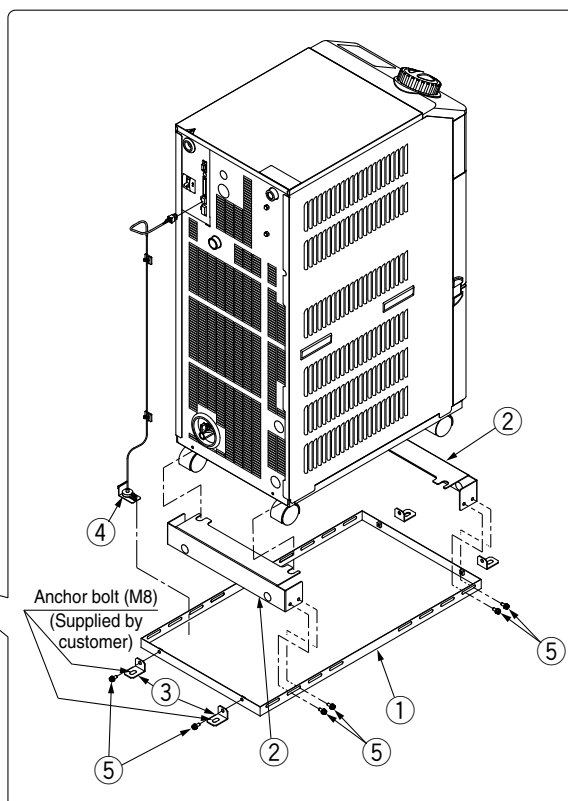
### Parts List

| No. | Description                              |
|-----|--|
| ①   | Drain pan                                |
| ②   | Thermo-chiller fixing bracket (2 pcs.)   |
| ③   | Drain pan fixing bracket (4 pcs.)        |
| ④   | Water leakage sensor                     |
| ⑤   | Bracket fixing screw (M6 screw, 12 pcs.) |

| Part No.  | Applicable model |
|-----------|------------------|
| HRS-WL002 | HRS050-□□-□      |



HRS050



### Parts List

| No. | Description                              |
|-----|--|
| ①   | Drain pan                                |
| ②   | Thermo-chiller fixing bracket (2 pcs.)   |
| ③   | Drain pan fixing bracket (4 pcs.)        |
| ④   | Water leakage sensor                     |
| ⑤   | Bracket fixing screw (M6 screw, 12 pcs.) |



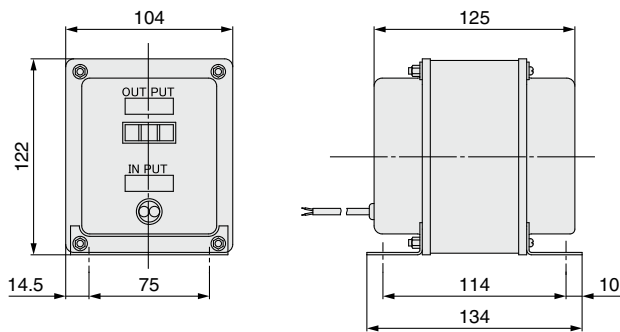
① **Separately Installed Power Transformer**

**Specifications**

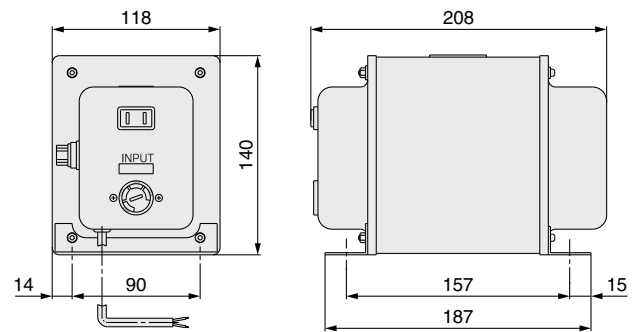
| Part No.             | Applicable model                          | Volume | Type         | Inlet voltage     |   | Outlet voltage |              |
|----------------------|---|--------|--------------|-------------------|---|----------------|--------------|
|                      |   |        |              | 50 Hz             | 60 Hz                                     | 50 Hz          | 60 Hz        |
| <b>IDF-TR1000-1</b>  | HRS012-□-10<br>HRS018-□-10                | 1 kVA  | Single-phase | 110 VAC           | 120 VAC                                   | 100 VAC        | 100, 110 VAC |
| <b>IDF-TR1000-2</b>  |   |        |              | 240 VAC           | 240 to 260 VAC                            |                |              |
| <b>IDF-TR1000-3</b>  |   |        |              | 380, 400, 415 VAC | 380 to 420 VAC                            |                |              |
| <b>IDF-TR1000-4</b>  |   |        |              | 420, 440, 480 VAC | 420 to 520 VAC                            |                |              |
| <b>IDF-TR2000-9</b>  | HRS012-□-20<br>HRS018-□-20<br>HRS024-□-20 | 2 kVA  | Single-phase | —                 | 240 VAC                                   | 200 VAC        | 200, 220 VAC |
| <b>IDF-TR2000-10</b> |   |        |              | 380, 400, 415 VAC | 380 to 400, 400 to 415,<br>415 to 440 VAC |                |              |
| <b>IDF-TR2000-11</b> |   |        |              | 440, 460 VAC      | 440 to 460,<br>460 to 500 VAC             |                |              |

\* For HRS050 should be prepared by the customer.

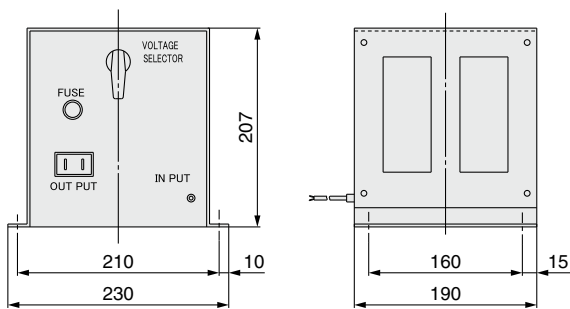
**IDF-TR1000-1**



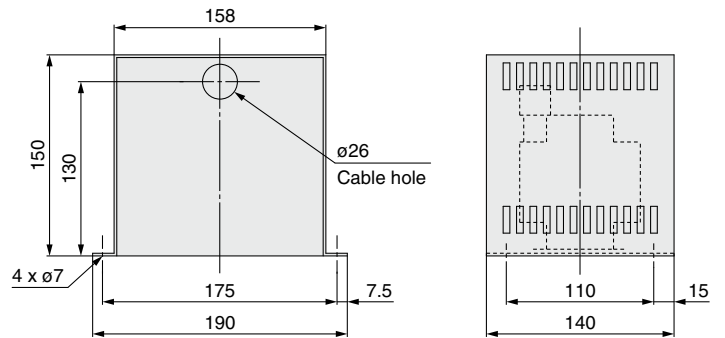
**IDF-TR1000-2**



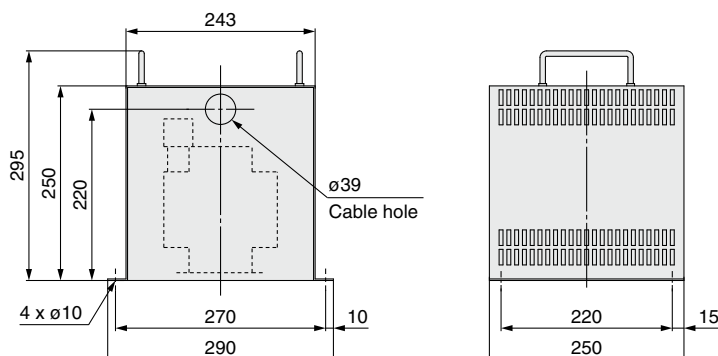
**IDF-TR1000-3, 4**



**IDF-TR2000-9**



**IDF-TR2000-10, 11**



# Cooling Capacity Calculation

## Required Cooling Capacity Calculation

### 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.\*

Q: Heat generation amount

**(1) Derive the heat generation amount from the power consumption.**

Power consumption P: 1000 [W]

$$Q = P = 1000 \text{ [W]}$$

Cooling capacity = Considering a safety factor of 20%,

$$1000 \text{ [W]} \times 1.2 = \boxed{1200 \text{ [W]}}$$

**(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:

$$= 1.0 \text{ [kVA]} \times 0.85 = 0.85 \text{ [kW]} = 850 \text{ [W]}$$

Cooling capacity = Considering a safety factor of 20%,

$$850 \text{ [W]} \times 1.2 = \boxed{1020 \text{ [W]}}$$

**(3) Derive the heat generation amount from the output.**

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

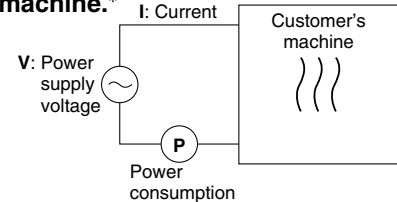
$$Q = P = \frac{W}{\text{Efficiency}}$$

In this example, use an efficiency of 0.7:

$$= \frac{800}{0.7} = 1143 \text{ [W]}$$

Cooling capacity = Considering a safety factor of 20%,

$$1143 \text{ [W]} \times 1.2 = \boxed{1372 \text{ [W]}}$$



\* 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 : Clear water\*
- Circulating fluid mass flow rate  $q_m$  :  $(= \rho \times q_v \div 60)$  [kg/s]
- Circulating fluid density  $\rho$  : 1 [kg/dm<sup>3</sup>]
- Circulating fluid (volume) flow rate  $q_v$  : 10 [dm<sup>3</sup>/min]
- Circulating fluid specific heat capacity C :  $4.2 \times 10^3$  [J/(kg·K)]
- Circulating fluid outlet temperature T<sub>1</sub> : 293 [K] (20 [°C])
- Circulating fluid return temperature T<sub>2</sub> : 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]

\* Refer to page 20 for the typical physical property value of clear water or other circulating fluids.

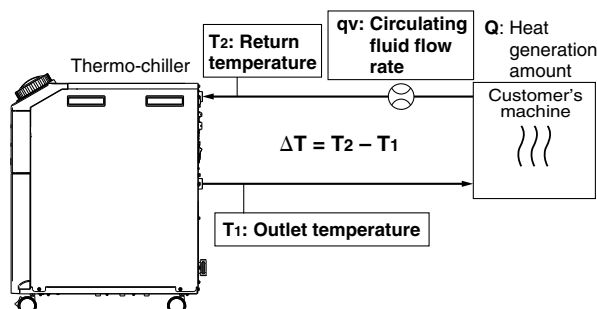
$$Q = q_m \times C \times (T_2 - T_1)$$

$$= \frac{\rho \times q_v \times C \times \Delta T}{60} = \frac{1 \times 10 \times 4.2 \times 10^3 \times 2.0}{60}$$

$$= 1400 \text{ [J/s]} \approx 1400 \text{ [W]}$$

Cooling capacity = Considering a safety factor of 20%,

$$1400 \text{ [W]} \times 1.2 = \boxed{1680 \text{ [W]}}$$



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

- Heat generation amount by customer's machine Q: Unknown [cal/h] → [W]
- Circulating fluid : Clear water\*
- Circulating fluid weight flow rate  $q_m$  :  $(= \rho \times q_v \times 60)$  [kgf/h]
- Circulating fluid weight volume ratio  $\gamma$  : 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·°C)]
- Circulating fluid outlet temperature T<sub>1</sub> : 20 [°C]
- Circulating fluid return temperature T<sub>2</sub> : 22 [°C]
- Circulating fluid temperature difference  $\Delta T$  : 2.0 [°C] ( $= T_2 - T_1$ )
- Conversion factor: hours to minutes : 60 [min/h]
- Conversion factor: kcal/h to kW : 860 [(cal/h)/W]

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

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

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

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

$$\approx 1400 \text{ [W]}$$

Cooling capacity = Considering a safety factor of 20%,

$$1400 \text{ [W]} \times 1.2 = \boxed{1680 \text{ [W]}}$$

## Required Cooling Capacity Calculation

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

Heat quantity by cooled substance (per unit time) **Q**: Unknown [W] [(J/s)]  
 Cooled substance : Water  
 Cooled substance mass **m** : (=  $\rho \times V$ ) [kg]  
 Cooled substance density  $\rho$  : 1 [kg/L]  
 Cooled substance total volume **V** : 20 [dm<sup>3</sup>]  
 Cooled substance specific heat capacity **C** :  $4.2 \times 10^3$  [J/(kg·K)]  
 Cooled substance temperature when cooling begins **T<sub>0</sub>** : 305 [K] (32 [°C])  
 Cooled substance temperature after t hour **T<sub>t</sub>** : 293 [K] (20 [°C])  
 Cooling temperature difference  $\Delta T$  : 12 [K] (=  $T_0 - T_t$ )  
 Cooling time  $\Delta t$  : 900 [s] (= 15 [min])

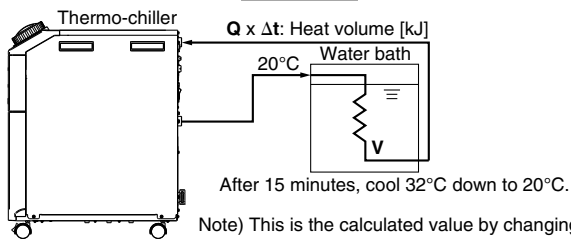
\* Refer to the following for the typical physical property values by circulating fluid.

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

$$= \frac{1 \times 20 \times 4.2 \times 10^3 \times 12}{900} = 1120 \text{ [J/s]} \approx 1120 \text{ [W]}$$

Cooling capacity = Considering a safety factor of 20%,

$$1120 \text{ [W]} \times 1.2 = \boxed{1344 \text{ [W]}}$$



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

#### 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** : (=  $\rho \times V$ ) [kgf]  
 Cooled substance weight volume ratio  $\gamma$  : 1 [kgf/L]  
 Cooled substance total volume **V** : 20 [L]  
 Cooled substance specific heat capacity **C** :  $1.0 \times 10^3$  [cal/(kgf·°C)]  
 Cooled substance temperature when cooling begins **T<sub>0</sub>** : 32 [°C]  
 Cooled substance temperature after t hour **T<sub>t</sub>** : 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]

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

$$= \frac{1 \times 20 \times 60 \times 1.0 \times 10^3 \times 12}{15 \times 860}$$

$$\approx 1120 \text{ [W]}$$

Cooling capacity = Considering a safety factor of 20%,

$$1120 \text{ [W]} \times 1.2 = \boxed{1344 \text{ [W]}}$$

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

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

#### Water

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

#### 15% Ethylene Glycol Aqueous Solution

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

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



# Series HRS

## Specific Product Precautions 1

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>

### Design

#### 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

#### Warning

##### 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.

### Handling

#### Warning

##### 1. Thoroughly read the Operation Manual.

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

### Operating Environment/Storage Environment

#### Warning

##### 1. Do not use in the following environment 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.

### Operating Environment/Storage Environment

#### Warning

##### 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.

### Circulating Fluid

#### Caution

##### 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"

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

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

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

##### 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.

### 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. 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  $\pm 10\%$ .
- 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.

### Maintenance

#### Caution

<Periodical inspection every one month>

##### 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.

<Periodical inspection every three months>

##### 1. Inspect the circulating fluid.

1) When using clear water

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

• Tank cleaning

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

2) When using ethylene glycol aqueous solution

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

Dilute or add as needed to adjust the concentration.

<Periodical inspection during the winter season>

##### 1. Make water-removal arrangements beforehand.




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

##### 2. Consult a professional.

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

## Safety Instructions

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

-  **Caution:** **Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
-  **Warning:** **Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
-  **Danger :** **Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

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

### Warning

#### 1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

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

#### 2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

#### 3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

#### 4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

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

### Caution

#### 1. The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

## Limited warranty and Disclaimer/ Compliance Requirements

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

Read and accept them before using the product.

### Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.\*2)

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

#### \*2) Vacuum pads are excluded from this 1 year warranty.

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

### Compliance Requirements

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

### Revision history

|                  |   |    |
|------------------|---|----|
| <b>Edition B</b> | * Addition of water-cooled refrigeration<br>* Addition of cooling capacity 1100 W (50 Hz)/1300 W (60 Hz),<br>2100 W (50 Hz)/2400 W (60 Hz)<br>* Addition of single phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)<br>* All models: CE marking and UL compliant | NY |
| <b>Edition C</b> | * Addition of cooling capacity 4700 W (50 Hz)/5100 W (60 Hz)<br>* Addition of separately installed power transformer to optional accessories<br>* Number of pages from 20 to 32   | PZ |

## Safety Instructions

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

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