A chiller is used to control the temperature of circulating fluid and supply it to the heat source.

**Chiller Lineup**

**Thermo-cooler**

* **Series HRG**
  - General-purpose, economy type for machine tools, etc.
  - Cooling capacity: 10 kW to 15 kW
  - Temperature stability: ±1.8°F (±1.0°C)

**Thermo-chiller**

* **Series HRS, HRZ, HRW**
  - High-performance type for semiconductor manufacturing equipment, etc.
  - The cooling capacity 4700 W/5100 W (50/60 Hz) have been added to the compact type, **Series HRS**!
  - Cooling capacity: 1 kW to 30 kW
  - Temperature stability: ±0.18/0.54°F (±0.1/0.3°C)

**Thermo-con**

* **Series HEC**
  - High-precision temperature control type for semiconductor manufacturing equipment, medical equipment, etc.
  - Cooling capacity: 140 W to 1200 W
  - Temperature stability: ±0.018°F to 0.054°F (±0.01° to 0.03°C)

**Thermoelectric Bath**

* **Series HEB**
  - Accurately controls the temperature of liquid in the bath.
  - Can indirectly control the temperature of chemical bottles, test tubes, flasks, cooling coils (heat exchangers) in the constant temperature bath.
  - Cooling capacity: 140 W
  - Temperature stability: ±0.018°F (±0.01°C)

**Chemical Thermo-con**

* **Series HED**
  - All wetted parts are made of fluororesin.
  - Controls the temperature of chemicals by directly cooling and heating them.
  - Can directly control the temperature of chemicals such as hydrofluoric acid, sulfuric acid, ammonia water, deionized water, etc.
  - Cooling capacity: 300 W to 750 W
  - Temperature stability: ±0.18°F (±0.1°C)

**SMC**

CAT.NAS43D
A Chiller is equipment to control temperature of customers’ heating sources. Chillers control fluid, such as water, and circulate the fluid to customers’ machine using a pump by controlling the output from a cooling source such as a compressor, or a heating source such as a heater. That’s why this equipment can be also called a circulator.

**Application Examples**

- **Laser machining**
  - Cooling of laser irradiated part
- **Electronic microscope**
  - Temperature control of electron-beam irradiated part
- **Atomizing device** (food and cosmetics)
  - Temperature control of sample and device
- **Cooling of die**
  - Cooling water
- **Shrink fitting machine**
  - Cooling of work pieces
- **Reagent cooling equipment**
  - Temperature control of reagent
- **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
- **Ultra sonic wave inspection machine**
  - Temperature control of ultrasonic wave laser part
- **Packaging line** (sealing of film and paper package)
  - Cooling of work pieces for bonding
- **Concentrating equipment**
  - Temperature control of concentration fluid
- **Cleaning tank**
  - Temperature control of cleaning tank
- **Gas cylinder cabinet**
  - Temperature control inside cabinet
- **Linear motor**
  - Temperature control of moving coil
- **Laser marker**
  - Cooling of laser irradiated part
- **Ultra sonic wave inspection machine**
  - Temperature control of ultrasonic wave laser part
- **Temperature control of paint material**
  - Circulating fluid
- **Temperature control of moving coil**
  - Coil
- **Temperature control of sample and device**
  - Temperature control of electron-beam irradiated part
- **Temperature control of moving coil**
  - Cooling water

**Features 1**

**What’s a Chiller?**

A Chiller is equipment to control temperature of customers’ heating sources. Chillers control fluid, such as water, and circulate the fluid to customers’ machine using a pump by controlling the output from a cooling source such as a compressor, or a heating source such as a heater. That’s why this equipment can be also called a circulator.
Three types of cooling and heating methods (refrigerated, water-cooled, Peltier-type) can be selected for a wide range of applications. Refrigerated Cooling capacity from 1 kW to 15 kW. For a wide range of applications

Generates low temperatures using a refrigeration cycle. This equipment cools the circulating fluid by performing heat exchange with low-temperature refrigerant gas, using a built-in refrigeration circuit that circulates refrigerant. Large-scale heat exchange can be handled compared with the Peltier type. There are two types of heating sources: high-temperature refrigerant gas, which is generated from the refrigeration circuit, and an electric heater. Both air-cooled and water-cooled types are available, depending on the condenser’s cooling method.

Economy type HRG
• Makes cooling water easily available, anytime, anywhere.
• As a replacement for a cooling tower
  Pump capacity: Max. 16.4 gpm (62 L/min)

Installing extra cooling towers can be troublesome. The HRG series (air-cooled refrigeration) can be moved easily to wherever you need it, when you need it. Cooling water is supplied from the attached hose.

High-performance type HRZ/HRZD
• Temperature stability ±0.18°F (±0.1°C), temperature range from −4°F (−20°C) to +194°F (90°C). Full array of features and equipment.
• A double inverter type is also available, saving energy more effectively through use of a DC inverter compressor and an inverter pump.

• Dual Thermo-chiller, HRZD series can control temperature for two systems separately by one chiller. Energy-saving thanks to reduced wiring, piping and labor, and double inverter type.

Space-saving
Footprint reduced by 23%
### 2 Water-cooled

**For temperature control in room temperature area**

Temperature range setting: **68 to 194°F**

Thermo-chiller

(20° to 90°C)

Refrigerant-free and energy-saving type using no compressor.

**High-performance type HRW**

Energy-saving With no compressor, power consumption is drastically reduced. Reduction in power consumption is even greater with inverter type: 0.5 kWh/h.

- Suitable for temperature control in room temperature areas not requiring compressor.
- Reduction in facility water volume (0.32 gpm (1.2 L/min)) thanks to direct heat exchange with circulating fluid.
- Features equivalent to HRZ series.

This equipment cools the circulating fluid by directly exchanging it with the cooling water in the plant. This can be used at room temperature or higher, and also used when there is a cooling water circulation facility. Large-scale heat exchange can be performed using less energy, and the device has a compact body since a compressor is not required. An electric heater is used for heating.

### 3 Peltier-type

**For high-precision temperature control**

Temperature stability: **±0.018 to 0.054°F**

Thermo-con

(±0.01 to 0.03°C)

Generates little vibration, and is refrigerant-free and environmentally friendly. Can control the temperature just in front of the heat source using the external temperature sensor.

**High-precision type HEC**

**Air-cooled**

- No facility water equipment
- Frequent piping changes

Can install the unit easily without facility water equipment. Can reduce the piping installation labor since facility water piping is not required.

**Water-cooled**

- Need to avoid effects of ambient temperature.
- Want to reduce installation space.

Since the unit is water-cooled, the ambient temperature will have little effect. Can reduce the space since the unit is compact.

A Peltier device is a plate type element, inside which P-type semiconductors and N-type semiconductors are located alternately. Therefore, changing the direction of the current supplied to the Peltier device can achieve heating and cooling operation. Temperature can be controlled very precisely because this method has a fast response and can switch quickly.
Thermoelectric Bath

Accurately controls the temperature of liquid in the bath.
Temperature stability: \( \pm 0.018 \, ^\circ F \) (\( \pm 0.01 \, ^\circ C \))
Temperature distribution in the bath: \( \pm 0.036 \, ^\circ F \) (\( \pm 0.02 \, ^\circ C \))

This equipment precisely controls the temperature of the fluid in the constant temperature tank. Customers can control the temperature by placing a container in the tank.

Application Examples

- **Semiconductor**
  - Evaporation of chemicals for MOCVD, temperature control of diffusion gas

- **Various tests**
  - Thermal test with immersion

- **Physical and chemical analysis**
  - Temperature control of various samples, materials and parts

- **Various chemical processes**
  - Indirect temperature control of chemicals and liquids with high viscosity

Chemical Thermo-con

Fluororesin heat exchanger allow direct temperature control for chemicals!!
Industry-leading withstand pressure 51 psi (0.35 MPa)!!

Type of circulating fluid
- Deionized water
- Hydrofluoric acid
- Ammonia hydrogen peroxide solution, etc.

Features 4
<table>
<thead>
<tr>
<th>Series</th>
<th>Features</th>
<th>Temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy-type chiller</td>
<td>With this chiller, cooling water can be obtained anywhere it is necessary because of easy installation and easy operation.</td>
<td>-22°F to 95°F</td>
</tr>
<tr>
<td>High-performance chiller/Compact type</td>
<td>Fits into the space under a laboratory table with a compact design. Available for single-phase 100/115 V, 200 to 230 V.</td>
<td>-22°F to 104°F</td>
</tr>
<tr>
<td>High-performance chiller</td>
<td>Suitable for semiconductor processing equipment with a wide variety of features such as high temperature stability, wide temperature range, fault diagnosis, external communication, etc.</td>
<td>-22°F to 194°F</td>
</tr>
<tr>
<td>High-performance chiller</td>
<td>In addition to advanced HRZ series, energy-saving is achieved through use of a DC inverter compressor. A single unit covers a wide temperature range and has a large cooling capacity. Can respond to change of process conditions flexibly, which is suitable for semiconductor equipment with a short innovation cycle. Conforming to UL, SEMI standards, CE marking.</td>
<td>-22°F to 194°F</td>
</tr>
<tr>
<td>High-performance chiller</td>
<td>Temperature for two systems can be controlled separately by one chiller. More effective energy-saving is achieved through use of a DC inverter compressor and an inverter pump. Conforming to UL, SEMI standards, CE marking.</td>
<td>-22°F to 194°F</td>
</tr>
<tr>
<td>High-performance chiller</td>
<td>Direct heat exchanger for in-plant circulating fluid Refrigerant-free Can control the temperature over a wide range since a compressor is not required. Suitable for semiconductor processing equipment with a wide variety of features such as high temperature stability, wide temperature range, failure diagnosis, external communication, etc. Conforming to UL, SEMI standards, CE marking.</td>
<td>-22°F to 194°F</td>
</tr>
<tr>
<td>High-precision chiller</td>
<td>High-precision temperature controller with a Peltier device suitable for applications that require high-precision temperature control. Refrigerant-free Highly-reliable simple construction Easy installation in equipment with a compact, low-vibration body Compatible with a wide range of power supply voltage Conforming to UL standards, CE marking.</td>
<td>-22°F to 140°F</td>
</tr>
<tr>
<td>High-precision bath</td>
<td>High-precision temperature control bath with a Peltier device Refrigerant-free Compact and low noise Minimal up-down temperature distribution with a unique agitation method</td>
<td>-22°F to 140°F</td>
</tr>
<tr>
<td>Fluororesin temperature control system for chemicals</td>
<td>Heat exchanger for direct temperature control with a Peltier device Refrigerant-free Compatible with a wide range of chemicals by use of a fluororesin heat exchanger Conforming to SEMI standards, CE marking</td>
<td>-22°F to 140°F</td>
</tr>
<tr>
<td>Max. cooling capacity</td>
<td>Cooling method</td>
<td>Temperature stability</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>15 kW Air-cooled refrigeration, Water-cooled refrigeration</td>
<td>±1.8°F (±1.0°C)</td>
<td>1.3 to 16.3 gpm (5 to 62 L/min)</td>
</tr>
<tr>
<td>5 kW Air-cooled refrigeration, Water-cooled refrigeration</td>
<td>±0.18°F (±0.1°C)</td>
<td>1.3 to 10.5 gpm (5 to 40 L/min)</td>
</tr>
<tr>
<td>15 kW Water-cooled refrigeration</td>
<td>±0.18°F (±0.1°C)</td>
<td>1.6 to 10.5 gpm (6 to 40 L/min)</td>
</tr>
<tr>
<td>10 kW Water-cooled refrigeration</td>
<td>±0.18°F (±0.1°C)</td>
<td>2.6 to 10.5 gpm (10 to 40 L/min)</td>
</tr>
<tr>
<td>9.5 kW x 2 Water-cooled refrigeration</td>
<td>±0.18°F (±0.1°C)</td>
<td>2.6 to 10.5 gpm (10 to 40 L/min)</td>
</tr>
<tr>
<td>30 kW Water-cooled (Without compressor)</td>
<td>±0.54°F (±0.3°C)</td>
<td>2.6 to 7.9 gpm (10 to 30 L/min)</td>
</tr>
<tr>
<td>600 W Peltier-type air-cooled</td>
<td>±0.018°F (±0.01°C)</td>
<td>0.26 to 2.6 gpm (1 to 10 L/min)</td>
</tr>
<tr>
<td>1.2 kW Peltier-type water-cooled</td>
<td>±0.018°F (±0.01°C)</td>
<td>0.79 to 6.1 gpm (3 to 23 L/min)</td>
</tr>
<tr>
<td>140 W Peltier-type water-cooled</td>
<td>±0.018°F (±0.01°C)</td>
<td>—</td>
</tr>
<tr>
<td>750 W Peltier-type water-cooled</td>
<td>±0.18°F (±0.1°C)</td>
<td>—</td>
</tr>
</tbody>
</table>
CONTENTS

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  Refrigerated Thermo-chiller Series HRZ .................................... Page 61
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Circulating Fluid Temperature Controller

Refrigerated Thermo-cooler  Series HRG

Makes cooling water easily available, anytime, anywhere.

- Cooling capacity (60 Hz):
  - **9.5 kW/14.5 kW** (Air-cooled refrigeration)
  - **11.0 kW/16.5 kW** (Water-cooled refrigeration)

- Temperature stability: ± 1.8°F (±1.0°C) (Compressor ON/OFF control)

- Temperature range setting: 41°F to 95°F (5 to 35°C)

**Application Examples**

- **Temperature control of LCD panels**
  - Example: Cooling an LCD panel
  - Can be used for cooling during transfer to processing, before and after resist coating and firing of the glass substrate.

- **Temperature control of welding torches**
  - Example: Laser welding
  - Can be used to supply cooling water to welding torches or commercially available laser welding devices, and to prevent overheating of the torch or the oscillation tube.

- **As a replacement for a cooling tower**
  - Air-cooled refrigeration HRG
  - Can be used in many applications other than those shown below. Refer to other “Application Examples” page in this catalog.
  - Installing extra cooling towers can be troublesome. The HRG series (air-cooled refrigeration) can be moved easily to wherever you need it, when you need it. Cooling water is supplied from the attached hose.
Efficiency: 42% improvement

A new high-performance heat exchanger improves the HRG heat exchange capability, delivering greater efficiency (= cooling capacity/power consumption).

<table>
<thead>
<tr>
<th>Existing model</th>
<th>Refrigerant weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRG015-A</td>
<td>3.7 lbs (1.7 kg)</td>
</tr>
<tr>
<td>HRG015-A</td>
<td>1.66</td>
</tr>
</tbody>
</table>

More environmentally friendly
Reduced running cost
More environmentally friendly

Energy-Saving

Refrigerant: Max. 50% reduction

Conventionally, reducing the amount of refrigerant gas has meant a reduction in cooling performance. Now, however, the HRG’s use of an improved high-performance heat exchanger makes it possible to reduce the volume of refrigerant used (refrigerant charge volume) without sacrificing cooling performance.

<table>
<thead>
<tr>
<th>Existing model</th>
<th>Refrigerant weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRG015-A</td>
<td>7.5 lbs (3.4 kg)</td>
</tr>
<tr>
<td>HRG015-A</td>
<td>3.7 lbs (1.7 kg)</td>
</tr>
</tbody>
</table>

High Performance

Temperature stability: ± 1.8°F (±1.0°C) (when a load is stable)

Cooling capacity: Max. 16.5 kW

A maximum cooling capacity of 16.5 kW has been achieved with our air-cooled and water-cooled refrigeration ranges.

<table>
<thead>
<tr>
<th>Circulating fluid temperature (°F)</th>
<th>Cooling capacity (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>60</td>
<td>10</td>
</tr>
<tr>
<td>70</td>
<td>15</td>
</tr>
<tr>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>90</td>
<td>25</td>
</tr>
</tbody>
</table>

Note) HRG015-W operating at a power supply frequency of 60 Hz

Note) HRG015-W operating at a power supply frequency of 60 Hz

SHOP ONLINE at www.airlinehyd.com

800-999-7378
Space-Saving

- **External volume:** Max. **35%** reduction (SMC comparison)
- **Weight:** **23%** reduction (SMC comparison)
- **Footprint:** Max. **12%** reduction (SMC comparison)

Improvements in the HRG’s high-performance heat exchanger have enabled the size of the unit to be reduced, with corresponding reductions in weight and space needed for installation.

**Install directly against the wall for further reduction in installation space**

- **Existing model**
- **Thermo-cooler**

**Existing model**
- **HRG015-A**
- **External volume:** Max. **35%** reduction
- **Weight:** **23%** reduction
- **Footprint:** Max. **12%** reduction

**Thermo-cooler**
- **Existing model**
- **HRG015-A**
- **External volume:** Max. **35%** reduction
- **Weight:** **23%** reduction
- **Footprint:** Max. **12%** reduction

*Note: Supply water with electrical conductivity of 1 µS/cm or more. Please note that it is not possible to maintain a specific electrical conductivity.*

- **Wetted parts adopt the materials compatible for various circulating fluids.**
  - 15% ethylene glycol aqueous solution
  - Clear water, Deionized water

Wetted parts adopt the materials compatible for various circulating fluids.

- **15% ethylene glycol aqueous solution**
- **Clear water, Deionized water**

Note: Supply water with electrical conductivity of 1 µS/cm or more. Please note that it is not possible to maintain a specific electrical conductivity.
Easy Operation and Maintenance

Simple operation
(Standard specifications)

Operation 1
Press the ON button.

Operation 2
Adjust the temperature setting with the UP/DOWN keys.

Operation 3
Press the OFF button to shut down.
What could be easier?!

Contact input/output signal
(Standard specifications)

- Remote operation signal input
  Startup and shutdown can be remotely controlled by applying 24 VDC.

- Operation, shutdown, alarm signal output
  Operation, shutdown, alarm signal can be output via the relay contact.

Easy maintenance
(Standard specifications)

Components can be accessed from the front. The pump, compressor thermal relay and reset switch (for use in the case of problems with facility water supply) are located inside the electrical component enclosure.

With individual alarm indicators
Three separate levels of alarm indicators for easy failure diagnosis.

Individual red LED alarm indicators
- ALARM1: Abnormal installation status
- ALARM2: Water delivery circuit error
- ALARM3: Refrigeration circuit error

Options

Various options are available, including with casters, breakers and communications function. Specify options according to your particular manufacturing process and method.
(Refer to page 21 for options.)

Optional accessories

Dustproof filters for the by-pass piping set and air-cooled refrigeration are available. These improve durability and ease of use.
(Refer to pages 22 through to 25 for optional accessories.)

Air-Cooled Refrigeration

Air-cooled refrigeration
Unlike the water-cooled refrigeration, the air-cooled refrigeration does not require a facility water, and is easy to install alongside your equipment.

Rainproof design: Enclosure IPx3
In addition to the previously available indoor installation specifications, we now offer specifications for outdoor installation.

Communications

- Communications function (RS-485)
  (Refer to page 21 for options.)
- Contact input/output function
  (Refer to page 20.)
### Application Examples

#### Semiconductor

Example: Temperature control of chamber electrode

- Etching equipment
- Spatter equipment
- Cleaning equipment
- Coating equipment
- Dicing equipment
- Tester, etc.

#### Medical

Example: Blood preservation

- X-ray instrument
- MRI
- Blood preservation equipment

#### Food

Example: Tofu (Bean curd) production

- Bottle-cleaning machine
- Tofu (Bean curd) production equipment
- Noodle-making machine, etc.

#### Analysis

Example: Electronic microscope

- Electron microscope
- X-ray analytical instrument
- Gas chromatography
- Sugar level analytical instrument, etc.

#### Machine tool

Example: Laser machining

- Wire cutting
- Grinder
- Spot welding
- Plasma welding
- Laser machining, etc.

- Temperature-controlling the laser generating tube enables the laser wavelength to be optimised, improving the accuracy of the machined cross sectional area.

#### Printing

Example: Printing temperature control

- Offset printing machine
- Automatic developing machine
- UV equipment, etc.

- Temperature-controlling the ink roller enables to control the evaporation amount and viscosity of an ink and optimise the tint of colors.

#### Molding

Example: Injection molding

- Plastic molding
- Rubber molding
- Wire cable coating machine
- Injection molding, etc.

- Temperature-controlling the mold results in improved product quality.
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-cooler.

Refrigerant 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 capillary tube and expansion valve, 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.

When the circulating fluid is cooled sufficiently, the solenoid valve and volume adjustment valve open. These valves balance the refrigerant pressure and prevent freezing of the circulating fluid (especially clear water) in excessively cold conditions.

If the temperature of the circulating fluid is higher than the preset temperature, the compressor starts up, and refrigerant gas flows to the evaporator (cooler). This cools the circulating fluid. If the temperature of the circulating fluid is lower than the preset temperature, the compressor shuts down, and the flow of refrigerant gas stops. At such times, the circulating fluid is not cooled, and the temperature rises.

Temperature stability is achieved by the compressor starting up and shutting down.

Facility water circuit

**Cooling method: Water-cooled refrigeration (HRG-W)**

When the refrigerant gas is adequately liquefied and the circulating fluid is adequately cooled, the water control valve automatically closes the facility water circuit and adjusts the flow of facility water.

This method assures normal pressure in the compressor and reduces energy use by your facility water equipment.
1. Which is best for you: a water-cooled refrigeration or an air-cooled refrigeration?

You should base your choice on the configuration of your equipment.

Thermo-cooler series refrigeration methods

- Water-cooled refrigeration
  - Requires facility water equipment (cooling tower etc.) as well as electrical power supply. This type provides stable cooling performance year round, regardless of ambient temperature changes.

- Air-cooled refrigeration
  - Only electrical power supply is needed. Facility water equipment is not necessary, so the system is easy to install wherever you need it, when you need it. Please note that ventilation or air conditioning is required to dissipate heat; for details, refer to page 26. Operating Environment/Storage Environment 3 on Specific Product Precautions 1.

Example) Customer requirement: Air-cooled refrigeration

2. How much is the temperature in degrees centigrade for the circulating fluid?

Temperature range which can be set with the Thermo-cooler

- 41 to 95°F (5°C to 35°C)

Example) Customer requirement: 68°F (20°C)

3. What kind of the circulating fluids will be used?

Relationship between circulating fluid (which can be used with the Thermo-cooler) and ambient temperature

- 15% ethylene glycol aqueous solution
- Clear water

Example) Customer requirement: Clear water

4. What power supply frequency?

Thermo-cooler power supply frequency specifications

- 50 Hz, 60 Hz (common use)

Example) Customer requirement: 60 Hz

5. What is the kW for the required cooling capacity?

- To calculate the cooling capacity, refer to pages 10 to 12.

Example) Customer requirement: 8.4 kW (Refer to example 1 (1).)
Selection

Example: Customer requirements 1 to 5

- Cooling method: Air-cooled refrigeration
- Circulating fluid temperature: 68°F (20°C)
- Fluid: Clear water
- Power supply frequency: 60 Hz
- Required cooling capacity: 8.4 kW

Based on the results of 1 to 5, refer to the graph of cooling capacity of an air-cooled refrigeration Thermo-cooler at 60 Hz (page 15). On the same graph, plot the intersections between the customer's required temperature (20°C) and cooling capacity (8.4 kW). Refer to the same graph that can be used for ethylene glycol aqueous solution (15% or less.)

[Cooling Capacity Graph] Cooling Method: Air-Cooled Refrigeration, Power Supply Frequency: 60 Hz

The point plotted in the graph is the requirement from your customer. Select the Thermo-cooler models exceeding this point. In this case, select the HRG010-A.
Example 1: When the heat generation amount in the customer’s machine is known.

The heat generation amount can be determined based on the power consumption or output of the heat generating area — i.e. the area requiring cooling — within customer’s machine.∗

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

   Power consumption $P$: 7.0 [kW]

   $Q = P = 7.0$ [kW]

   Cooling capacity = Considering a safety factor of 20%,
   $7.0$ [kW] x 1.2 = $[8.4$ [kW]]

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

   Power supply output $VI$: 4.1 [kVA]

   $Q = P = V \times I \times$ Power factor

   In this example, using a power factor of 0.85:
   $= 8.2$ [kVA] x 0.85 = 7.0 [kW]

   Cooling capacity = Considering a safety factor of 20%,
   $7.0$ [kW] x 1.2 = $[8.4$ [kW]]

3. Derive the heat generation amount from the output.

   Output (shaft power, etc.) $W$: 4.4 [kW]

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

   In this example, use an efficiency of 0.7:
   $= \frac{4.4}{0.7} \times 6.29$ [kW]

   Cooling capacity = Considering a safety factor of 20%,
   $6.29$ [kW] x 1.2 = $[7.6$ [kW]]

∗ The above examples calculate the heat generation amount based on the power consumption. The actual heat generation amount may differ due to the structure of customer facilities. Please be sure to check it carefully.
Obtaining 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 [kW] \([kJ/s]\)]

- **Circulating fluid**: Clear water
- **Circulating fluid mass flow rate** \( q_m \): \((- \cdot q_v + 60)\) [kg/s]
- **Circulating fluid density** \( \rho \): 1 [kg/L]
- **Circulating fluid (volume) flow rate** \( q_v \): 36 [L/min]
- **Circulating fluid specific heat capacity** \( C \): 4.2 [kJ/(kg\(\cdot\)K)]
- **Circulating fluid outlet temperature** \( T_1 \): 293 [K] (20 [\(^\circ\)C])
- **Circulating fluid return temperature** \( T_2 \): 296 [K] (23 [\(^\circ\)C])
- **Circulating fluid temperature difference** \( \Delta T \): 3.0 [K] (= \( T_2 - T_1 \))
- **Conversion factor**: minutes to seconds \( 60 \) [s/min]

\[ Q = \frac{q_m \times C \times (T_2 - T_1)}{\rho \times q_v \times C \times \Delta T} = \frac{1 \times 35 \times 4.2 \times 3.0}{60} = 7.35 \text{ [kJ/s]} = 7.4 \text{ [kW]} \]

Cooling capacity = Considering a safety factor of 20%,

\[ 7.4 \text{ [kW]} \times 1.2 = 8.9 \text{ [kW]} \]
### Required Cooling Capacity Calculation

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

<table>
<thead>
<tr>
<th><strong>Heat quantity by cooled substance (per unit time)</strong> $Q$</th>
<th>Unknown [kW] ([kJ/s])</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooled substance</td>
<td>Water</td>
</tr>
<tr>
<td>Cooled substance mass $m$</td>
<td>($= \rho \times V$) [kg]</td>
</tr>
<tr>
<td>Cooled substance density $\rho$</td>
<td>1 [kg/L]</td>
</tr>
<tr>
<td>Cooled substance total volume $V$</td>
<td>100 [L]</td>
</tr>
<tr>
<td>Cooled substance specific heat capacity $C$</td>
<td>4.2 [kJ/(kg·K)]</td>
</tr>
<tr>
<td>Cooled substance temperature when cooling begins $T_0$</td>
<td>308 [K] (35 °C)</td>
</tr>
<tr>
<td>Cooled substance temperature after $t$ hour $T_t$</td>
<td>293 [K] (20 °C)</td>
</tr>
<tr>
<td>Cooling temperature difference $\Delta T$</td>
<td>15 [K] ($= T_0 − T_t$)</td>
</tr>
<tr>
<td>Cooling time $t$</td>
<td>900 [s] ($= 15$ [min])</td>
</tr>
</tbody>
</table>

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)** $Q$
- Cooled substance
- Cooled substance mass $m$
- Cooled substance density $\rho$
- Cooled substance total volume $V$
- Cooled substance specific heat capacity $C$
- Cooled substance temperature when cooling begins $T_0$
- Cooled substance temperature after $t$ hour $T_t$
- Cooling temperature difference $\Delta T$
- Cooling time $t$

Conversion factor: hours to minutes $60$ [min/h]
Conversion factor: kcal/h to kW $860$ [(kcal/h)/kW]

\[
Q = \frac{m \times C \times (T_t - T_0)}{\Delta t} \times 860
= \frac{\gamma \times V \times 60 \times C \times \Delta T}{\Delta t \times 860}
= \frac{1 \times 100 \times 60 \times 1.0 \times 15}{15 \times 860}
= \frac{6000 \text{ [kcal/h]}}{860} = 7.0 \text{ [kW]}
\]

Cooling capacity = Considering a safety factor of 20%,

\[
7.0 \text{ [kW]} \times 1.2 = 8.4 \text{ [kW]}
\]
Precautions on Model Selection

1. Heating capacity
   If the circulating fluid is to be set at a higher temperature than room temperature, the Thermo-cooler will heat the fluid. However, the Thermo-cooler has a lower heating capacity than a dedicated heater.

2. Pump capacity
   <Circulating fluid flow rate>
   Pump capacity varies depending on the model selected from the HRG series. Also, circulating fluid flow varies depending on the circulating fluid discharge pressure. Consider the installation height difference between our cooler and a customer’s machine and the piping resistance such as circulating fluid pipings, or piping size, or piping curves in the equipment. Check beforehand if the required flow rate is achieved using the pump capacity curves for each respective model.
   <Circulating fluid discharge pressure>
   Circulating fluid discharge pressure has the possibility to increase up to the maximum pressure in the pump capacity curves for the respective model. 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 $C$: 4.2 [kJ/(kg·K)] (or, using conventional unit system of units, 1 [kcal/(kgf·°C)])

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

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Water</th>
<th>Density $\rho$ [kg/L]</th>
<th>Specific heat $C$ [kJ/(kg·K)]</th>
<th>Conventional unit system</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Weight volume ratio $\gamma$ [kgf/L]</td>
<td>Specific heat $C$ [kcal/(kgf·°C)]</td>
</tr>
<tr>
<td>5°C</td>
<td>1.00</td>
<td>4.20</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>10°C</td>
<td>1.00</td>
<td>4.19</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>15°C</td>
<td>1.00</td>
<td>4.19</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>20°C</td>
<td>1.00</td>
<td>4.18</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>25°C</td>
<td>1.00</td>
<td>4.18</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>30°C</td>
<td>1.00</td>
<td>4.18</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>35°C</td>
<td>0.99</td>
<td>4.18</td>
<td>0.99</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature</th>
<th>15% Ethylene Glycol Aqueous Solution</th>
<th>Density $\rho$ [kg/L]</th>
<th>Specific heat $C$ [kJ/(kg·K)]</th>
<th>Conventional unit system</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Weight volume ratio $\gamma$ [kgf/L]</td>
<td>Specific heat $C$ [kcal/(kgf·°C)]</td>
</tr>
<tr>
<td>5°C</td>
<td>1.02</td>
<td>3.91</td>
<td>1.02</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>10°C</td>
<td>1.02</td>
<td>3.91</td>
<td>1.02</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>15°C</td>
<td>1.02</td>
<td>3.91</td>
<td>1.02</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>20°C</td>
<td>1.01</td>
<td>3.91</td>
<td>1.01</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>25°C</td>
<td>1.01</td>
<td>3.91</td>
<td>1.01</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>30°C</td>
<td>1.01</td>
<td>3.91</td>
<td>1.01</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td>35°C</td>
<td>1.01</td>
<td>3.92</td>
<td>1.01</td>
<td>0.94</td>
<td>0.94</td>
</tr>
</tbody>
</table>

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

Series HRG

How to Order

HRG 010 - A -

Cooling capacity
- A Cooling capacity 9.0/9.5 kW (50/60 Hz)
- W Cooling capacity 10.0/11.0 kW (50/60 Hz)

015 - A Cooling capacity 13.0/14.5 kW (50/60 Hz)
- W Cooling capacity 14.5/16.5 kW (50/60 Hz)

Option
- Nil
- A With casters
- B With earth leakage breaker
- C With communications function (RS485)

Specifications

HRG010, 015

<table>
<thead>
<tr>
<th>Option</th>
<th>010</th>
<th>015</th>
</tr>
</thead>
<tbody>
<tr>
<td>nil</td>
<td>AHRG Series HRG</td>
<td>AHRG Series HRG</td>
</tr>
<tr>
<td>model</td>
<td>HRG010</td>
<td>HRG015</td>
</tr>
<tr>
<td>cooling capacity</td>
<td>A</td>
<td>W</td>
</tr>
<tr>
<td>air-cooled refrigeration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>refrigerant</td>
<td>R407C (HFC)</td>
<td>R407C (HFC)</td>
</tr>
<tr>
<td>control method</td>
<td>Compressor ON/OFF control</td>
<td>Compressor ON/OFF control</td>
</tr>
<tr>
<td>ambient temperature/humidity</td>
<td>Temperature: 23 to 104°F (-5 to 40°C), Humidity: 30 to 70%RH</td>
<td>Temperature: 23 to 104°F (-5 to 40°C), Humidity: 30 to 70%RH</td>
</tr>
<tr>
<td>circulating fluid</td>
<td>Clear water, Deionized water, 15% ethylene glycol aqueous solution</td>
<td>Clear water, Deionized water, 15% ethylene glycol aqueous solution</td>
</tr>
<tr>
<td>temperature range setting</td>
<td>41 to 95°F (5 to 35°C)</td>
<td>41 to 95°F (5 to 35°C)</td>
</tr>
<tr>
<td>cooling capacity Note 3)</td>
<td>9.0/9.5 kW (at 68°F (20°C))</td>
<td>10.0/11.0 kW (at 68°F (20°C))</td>
</tr>
<tr>
<td>heating capacity Note 4)</td>
<td>(50/60 Hz)</td>
<td>(50/60 Hz)</td>
</tr>
<tr>
<td>temperature stability Note 6)</td>
<td>41 to 90°F (5 to 32°C)</td>
<td>41 to 90°F (5 to 32°C)</td>
</tr>
<tr>
<td>pump capacity Note 7)</td>
<td>0.28/0.33 (at 37/49 L/min, total lifting height 25/25 m)</td>
<td>0.28/0.31 (at 42/53 L/min, total lifting height 25/25 m)</td>
</tr>
<tr>
<td>rated flow</td>
<td>9.8/12.9 gpm (37/49 L/min)</td>
<td>11.0/14.0 gpm (42/53 L/min)</td>
</tr>
<tr>
<td>tank capacity</td>
<td>10.6gal (40 L)</td>
<td>15.8gal (60 L)</td>
</tr>
<tr>
<td>wetted parts material</td>
<td>Stainless steel, Brass, PVC, Nylon 12, Polyurethane, Copper brazing (Heat exchanger)</td>
<td>Stainless steel, Brass, PVC, Nylon 12, Polyurethane, Copper brazing (Heat exchanger)</td>
</tr>
<tr>
<td>temperature range</td>
<td>—</td>
<td>41 to 90°F (5 to 32°C)</td>
</tr>
<tr>
<td>pressure range</td>
<td>—</td>
<td>44 to 73 psi (0.3 to 0.5 MPa)</td>
</tr>
<tr>
<td>required flow rate Note 8)</td>
<td>8.7/9.0 gpm (33/34 L/min)</td>
<td>10.0/10.6 gpm (38/40 L/min)</td>
</tr>
<tr>
<td>port size</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>wetted parts material</td>
<td>Stainless steel, Brass, Synthetic rubber, Copper brazing (Heat exchanger)</td>
<td>Stainless steel, Brass, Synthetic rubber, Copper brazing (Heat exchanger)</td>
</tr>
<tr>
<td>power supply</td>
<td>3-phase 200 VAC 50 Hz, 3-phase 200 to 220 VAC 60 Hz Allowable voltage fluctuation ±10%</td>
<td>3-phase 200 VAC 50 Hz, 3-phase 200 to 220 VAC 60 Hz Allowable voltage fluctuation ±10%</td>
</tr>
<tr>
<td>applicable earth leakage breaker capacity Note 9)</td>
<td>10% (40)</td>
<td>10% (60)</td>
</tr>
<tr>
<td>rated operating current (50/60 Hz) (A)</td>
<td>14/16</td>
<td>12/12.5</td>
</tr>
<tr>
<td>rated power consumption (50/60 Hz) (kW)</td>
<td>4.0/5.0</td>
<td>3.2/3.8</td>
</tr>
<tr>
<td>power supply</td>
<td>Remote startup with 8 mA input at 24 VDC, shutdown at 0 VDC</td>
<td>Remote startup with 8 mA input at 24 VDC, shutdown at 0 VDC</td>
</tr>
<tr>
<td>operation signal output</td>
<td>Relay contact output (switch closed when operating, switch open when stopped, switch open when shut down)</td>
<td>Relay contact output (switch closed when operating, switch open when stopped, switch open when shut down)</td>
</tr>
<tr>
<td>alarm stop signal output</td>
<td>Relay contact output (switch closed when alarm is turned off, switch open when alarm is turned on, switch closed when shut down)</td>
<td>Relay contact output (switch closed when alarm is turned off, switch open when alarm is turned on, switch closed when shut down)</td>
</tr>
<tr>
<td>weight</td>
<td>Refer to page 19.</td>
<td>Refer to page 19.</td>
</tr>
</tbody>
</table>

Note 1) It should have no condensation.

During seasons or in locations where the ambient temperature is likely to fall below freezing point, please use ethylene glycol aqueous solution.

Note 2) If clear water is used, please 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). If deionized water is used, supply water with electrical conductivity of 1 μS/cm or more (or electrical resistivity of 1 MΩ·cm or less).

If ethylene glycol aqueous solution is used, maintain the concentration at 15%.


Note 4) Thermo-cooler specifications do not have heating capability.

Note 5) Value with a stable load without turbulence in the operating conditions. It may be out of this range depending on operating conditions.

Note 6) Value with a stable load without turbulence in the operating conditions. It may be out of this range depending on operating conditions.

Note 7) It should have no condensation.

During seasons or in locations where the ambient temperature is likely to fall below freezing point, please use ethylene glycol aqueous solution.

Note 8) Required flow rate when a load for the cooling capacity is applied at a facility water temperature of 90°F (32°C).

Note 9) Value with a stable load without turbulence in the operating conditions. It may be out of this range depending on operating conditions.

Note 10) Weight in the dry state without circulating fluids

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800-999-7378
Cooling Capacity

HRG010-A

HRG015-A

HRG010-W

HRG015-W

Pump Capacity

HRG010-A, HRG010-W

HRG015-A, HRG015-W

Facility Water Required Flow Rate

* For all common models, temperature stability will decline in the flow rate range where circulating fluid is deduced (dotted line). Also, in this range, the circulating fluid outlet pressure will exceed the maximum operating pressure (73 psi (0.5 MPa)) (HRG010 to HRG015).

* This is the required flow rate of facility water at the rated cooling capacity and circulating fluid flow, operating at 60 Hz, when the facility water inlet temperature is between 41 to 90°F (5°C to 32°C).
Dimensions: Water-Cooled Refrigeration

**Thermo-cooler Series HRG**

**HRG010-W (-A)**

- Dimensions: 17.3 (440) x 3.3 (85) x 20 (507)
- With casters (-A) (Option)
- Fluid level gauge: 4 x ø1.46 (4 x ø37)
- Handle: 2.5 (65)
- Operation display panel

**HRG015-W (-A)**

- Dimensions: 20 (507) x 4 x ø0.51 (4 x ø13)
- With casters (-A) (Option)
- Fluid level gauge: 4 x ø1.46 (4 x ø37)
- Handle: 2.5 (65)
- Operation display panel

---

**HRG010-W (-A)**

- Dimensions: 17.3 (440) x 3.3 (85) x 20 (507)
- With casters (-A) (Option)
- Fluid level gauge: 4 x ø1.46 (4 x ø37)
- Handle: 2.5 (65)
- Operation display panel
Series HRG

Piping Connection and Installation Dimensions

Unit: inch (mm)

HRG010, HRG015

<table>
<thead>
<tr>
<th>Model</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
<th>h</th>
<th>i</th>
<th>j</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRG010-A</td>
<td>9.53</td>
<td>13.5</td>
<td>15.8</td>
<td>17.8</td>
<td>4.53</td>
<td>9.06</td>
<td>15.8</td>
<td>22</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>HRG010-W</td>
<td>9.53</td>
<td>13.5</td>
<td>15.8</td>
<td>17.8</td>
<td>4.53</td>
<td>9.06</td>
<td>15.8</td>
<td>22</td>
<td>33.5</td>
<td>43.3</td>
</tr>
<tr>
<td>HRG015-A</td>
<td>9.53</td>
<td>13.5</td>
<td>15.8</td>
<td>17.8</td>
<td>4.53</td>
<td>9.06</td>
<td>15.8</td>
<td>22</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>HRG015-W</td>
<td>9.53</td>
<td>13.5</td>
<td>15.8</td>
<td>17.8</td>
<td>4.53</td>
<td>9.06</td>
<td>15.8</td>
<td>22</td>
<td>33.5</td>
<td>43.3</td>
</tr>
</tbody>
</table>

* Example figure: HRG010-W

Unit: inch (mm)
Operation Display Panel

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7-segment display screen</td>
<td>Displays the current temperature of the circulating fluid outlet.</td>
</tr>
<tr>
<td>2</td>
<td>[ON] switch</td>
<td>Starts the operation.</td>
</tr>
<tr>
<td>3</td>
<td>[OFF] switch</td>
<td>Stops the operation.</td>
</tr>
<tr>
<td>4</td>
<td>[MODE] key</td>
<td>Changes the display between the temperature and control value.</td>
</tr>
<tr>
<td>5</td>
<td>[DOWN] key</td>
<td>Reduces the set temperature of the circulating fluid outlet.</td>
</tr>
<tr>
<td>6</td>
<td>[UP] key</td>
<td>Increases the set temperature of the circulating fluid outlet.</td>
</tr>
<tr>
<td>7</td>
<td>[FUNC] key</td>
<td>Activates functions that have been set.</td>
</tr>
<tr>
<td>8</td>
<td>[POWER] indicator</td>
<td>Lights up when the power is being supplied to the unit.</td>
</tr>
<tr>
<td>9</td>
<td>[RUN] indicator</td>
<td>Lights up when the unit is running.</td>
</tr>
<tr>
<td>10</td>
<td>[PUMP] indicator</td>
<td>Lights up when the pump is running independently, or when the main unit is running.</td>
</tr>
<tr>
<td>11</td>
<td>[ALARM] indicator, [ALARM1] indicator</td>
<td>Lights up when ALARM 1 is active.</td>
</tr>
<tr>
<td>12</td>
<td>[ALARM2] indicator</td>
<td>Lights up when ALARM 2 is active.</td>
</tr>
<tr>
<td>13</td>
<td>[ALARM3] indicator</td>
<td>Lights up when ALARM 3 is active.</td>
</tr>
</tbody>
</table>

Note 1) All control values used in normal operation are displayed, but are locked and cannot be changed. It is not necessary to unlock these values except during maintenance.

Note 2) However, functions are not set. Pressing this key will have no effect.

Alarm/Alarm Indicators and Explanation

The 6 basic temperature controller alarms are displayed on the operation display panel with alarm indicators (red LED). Operation stops if an alarm is active, assuring safety. When the source of the problem has been eliminated, the equipment must be restarted.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Alarm</th>
<th>Operation status</th>
<th>Main reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ALARM1]</td>
<td>Prevention of reverse electrical current to the pump and compressor</td>
<td>Stop</td>
<td>Power supply to this unit is incorrect.</td>
</tr>
<tr>
<td></td>
<td>Low level of fluid in tank</td>
<td>Stop</td>
<td>Level switch activated because fluid level in tank fell below LOW.</td>
</tr>
<tr>
<td></td>
<td>Interrupted or abnormal facility water supply</td>
<td>Stop</td>
<td>Pressure switch activated because inadequate heat dissipation caused refrigerant pressure to rise.</td>
</tr>
<tr>
<td>[ALARM2]</td>
<td>Circulating fluid temperature abnormally high</td>
<td>Stop</td>
<td>Temperature sensor activated because circulating fluid temperature became too high.</td>
</tr>
<tr>
<td></td>
<td>Overload of pump</td>
<td>Stop</td>
<td>Circulation pump overload relay activated.</td>
</tr>
<tr>
<td></td>
<td>Overload of compressor</td>
<td>Stop</td>
<td>Compressor overload relay activated.</td>
</tr>
</tbody>
</table>

Note 1) Only for water-cooled refrigeration (HRG010, HRG015-W)
Note 2) Only for air-cooled refrigeration (HRG010, HRG015-A)
Note 3) ALARM 1 lights up when power supply is turned on but operation has not commenced due to abnormal installation status: incorrect installation or inadequate preparation.
Note 4) ALARM 2 lights up if a water delivery circuit error occurs after operation has begun.
Note 5) ALARM 3 lights up if a refrigeration circuit error occurs after operation has begun.
Series HRG

Contact Input/Output Function

The Thermo-cooler is equipped with terminals that allow remote start/stop, and enable output of an operation signal or abnormal status stop signal. These should be used for synchronizing startup and shutdown with your other equipment, or when adding new patrol lights or buzzers. However, the contact output volume is limited, so please add patrol lights and/or buzzers for special relays (for amplification) if they are necessary.

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector type</td>
<td>M3 terminal block</td>
</tr>
<tr>
<td>Remote operation signal input</td>
<td></td>
</tr>
<tr>
<td>Signal type</td>
<td>DC voltage input</td>
</tr>
<tr>
<td>Input voltage range</td>
<td>24 VDC ±5 V</td>
</tr>
<tr>
<td>Input current</td>
<td>0.5 to 8 mA</td>
</tr>
<tr>
<td>Terminal number (Note)</td>
<td>24 (24 VDC), 25 (24 VCOM)</td>
</tr>
<tr>
<td>Alarm stop signal output</td>
<td>Non-voltage contact output</td>
</tr>
<tr>
<td>Contact capacity</td>
<td>250 VAC, 1 A (Resistance load)</td>
</tr>
<tr>
<td>Terminal number (Note)</td>
<td>28, 29</td>
</tr>
<tr>
<td>Operation signal output</td>
<td>Non-voltage contact output</td>
</tr>
<tr>
<td>Contact capacity</td>
<td>250 VAC, 1 A (Resistance load)</td>
</tr>
<tr>
<td>Terminal number (Note)</td>
<td>30, 31</td>
</tr>
</tbody>
</table>

Circuit diagram

Remote operation signal input
- DC + 24 V
- 24 COM

Alarm stop signal output

Operation signal output

Note) For terminal numbers shown in the diagram, please refer to the terminal numbers for each type of signal listed in the table.

Input/output signal connection location
Remove the front panel and connect a signal cable to the terminal block inside the electrical component enclosure.

Other Features

- Automatic water supply function (Built-in ball tap)
  The tank contains a built-in ball tap for water supply valve. By installing a water supply connection, you can automatically keep the water level at its rated position (halfway between HI and LOW).

- Modified product with remote operation signal
  Remote operation is possible with a contact input. No need for DC power supply.
  \* HRG010, 015-50132-X106

- Anti-freezing function
  This function detects the circulating fluid temperature. 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.
Series HRG Options

**A** Option symbol

**With Casters**

HRG [ ]-A

*With casters*

The casters allow easy movement when delivering the equipment for installation or when altering the production area. A level foot may be used instead of a brake.

<table>
<thead>
<tr>
<th>Applicable model</th>
<th>HRG010-□-A</th>
<th>HRG015-□-A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level foot height adjustment range</td>
<td>0 to 0.59 inch (0 to 15 mm)</td>
<td></td>
</tr>
<tr>
<td>Product weight (lb [kg])</td>
<td>485 (220)</td>
<td>474 (215)</td>
</tr>
<tr>
<td>Product height</td>
<td>540 (245)</td>
<td>541 (235)</td>
</tr>
</tbody>
</table>

Caster mounting location

Rotating casters with level foot at the four corners are attached to the caster bases.

**B** Option symbol

**With Earth Leakage Breaker**

HRG [ ]-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. The power supply can be switched on or off easily from the main unit.

<table>
<thead>
<tr>
<th>Applicable model</th>
<th>HRG010-□-B</th>
<th>HRG015-□-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pole number</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Rated current sensitivity (mA)</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Rated shutdown current (A)</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Short circuit display method</td>
<td>Mechanical button</td>
<td></td>
</tr>
</tbody>
</table>

Breaker mounting location

Remove the front panel. The breaker is mounted inside the electrical component enclosure.

**C** Option symbol

**With Communications Function (RS-485)**

HRG [□]-C

*With communications function (RS-485)*

With a host PC programmed in accordance with your manufacturing processor method, the communications function allows you to set (write) or monitor (read) the circulating fluid temperature.

*Writing*

Circulating fluid temperature setting (SV)

*Readout*

Circulating fluid present temperature (PV)

Circulating fluid temperature setting (SV)

<table>
<thead>
<tr>
<th>Applicable model</th>
<th>HRG010-□-C</th>
<th>HRG015-□-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector no.</td>
<td>37 (TRD+), 38 (TRD−)</td>
<td></td>
</tr>
<tr>
<td>Connector type (on this product side)</td>
<td>M3 terminal block</td>
<td></td>
</tr>
<tr>
<td>Standards</td>
<td>EIA RS-485 compliant</td>
<td></td>
</tr>
<tr>
<td>Protocol</td>
<td>Special protocol For details, refer to the Communications Specifications document</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circuit diagram</th>
<th>Customer's machine side</th>
<th>To the Thermo-cooler</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TRD (A+)</td>
<td>TRD (B−)</td>
</tr>
</tbody>
</table>

Communication connection location

Remove the front panel, and connect your communication cable to the terminal block mounted inside the electrical component enclosure.

With Casters

The casters allow easy movement when delivering the equipment for installation or when altering the production area. A level foot may be used instead of a brake.

Caster mounting location

Rotating casters with level foot at the four corners are attached to the caster bases.

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. The power supply can be switched on or off easily from the main unit.

Breaker mounting location

Remove the front panel. The breaker is mounted inside the electrical component enclosure.

With Communications Function (RS-485)

With a host PC programmed in accordance with your manufacturing processor method, the communications function allows you to set (write) or monitor (read) the circulating fluid temperature.

*Writing*

Circulating fluid temperature setting (SV)

*Readout*

Circulating fluid present temperature (PV)

Circulating fluid temperature setting (SV)

<table>
<thead>
<tr>
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<th>HRG010-□-C</th>
<th>HRG015-□-C</th>
</tr>
</thead>
<tbody>
<tr>
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<td>37 (TRD+), 38 (TRD−)</td>
<td></td>
</tr>
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<td>M3 terminal block</td>
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<td>Standards</td>
<td>EIA RS-485 compliant</td>
<td></td>
</tr>
<tr>
<td>Protocol</td>
<td>Special protocol For details, refer to the Communications Specifications document</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circuit diagram</th>
<th>Customer's machine side</th>
<th>To the Thermo-cooler</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TRD (A+)</td>
<td>TRD (B−)</td>
</tr>
</tbody>
</table>

Communication connection location

Remove the front panel, and connect your communication cable to the terminal block mounted inside the electrical component enclosure.

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. The power supply can be switched on or off easily from the main unit.

Breaker mounting location

Remove the front panel. The breaker is mounted inside the electrical component enclosure.

With Communications Function (RS-485)

With a host PC programmed in accordance with your manufacturing processor method, the communications function allows you to set (write) or monitor (read) the circulating fluid temperature.

*Writing*

Circulating fluid temperature setting (SV)

*Readout*

Circulating fluid present temperature (PV)

Circulating fluid temperature setting (SV)

<table>
<thead>
<tr>
<th>Applicable model</th>
<th>HRG010-□-C</th>
<th>HRG015-□-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector no.</td>
<td>37 (TRD+), 38 (TRD−)</td>
<td></td>
</tr>
<tr>
<td>Connector type (on this product side)</td>
<td>M3 terminal block</td>
<td></td>
</tr>
<tr>
<td>Standards</td>
<td>EIA RS-485 compliant</td>
<td></td>
</tr>
<tr>
<td>Protocol</td>
<td>Special protocol For details, refer to the Communications Specifications document</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circuit diagram</th>
<th>Customer's machine side</th>
<th>To the Thermo-cooler</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TRD (A+)</td>
<td>TRD (B−)</td>
</tr>
</tbody>
</table>

Communication connection location

Remove the front panel, and connect your communication cable to the terminal block mounted inside the electrical component enclosure.

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. The power supply can be switched on or off easily from the main unit.

Breaker mounting location

Remove the front panel. The breaker is mounted inside the electrical component enclosure.

With Communications Function (RS-485)

With a host PC programmed in accordance with your manufacturing processor method, the communications function allows you to set (write) or monitor (read) the circulating fluid temperature.

*Writing*

Circulating fluid temperature setting (SV)

*Readout*

Circulating fluid present temperature (PV)

Circulating fluid temperature setting (SV)
## Series HRG
### Optional Accessories

#### Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Description</th>
<th>Specifications</th>
<th>Applicable Thermo-cooler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dustproof filter set</td>
<td>For preventing a decline in the performance of air-cooled refrigerated Thermo-coolers, even in a dusty atmosphere.</td>
<td>Maximum ambient temperature</td>
<td>HRG010-A□ to 015-A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>104°F (40°C)</td>
<td></td>
</tr>
<tr>
<td>By-pass piping set</td>
<td>For preventing the pump from overloading at low flow rates when the maximum Thermo-cooler operating pressure of 73 psi (0.5 MPa) is exceeded.</td>
<td>Circulating fluid temperature range</td>
<td>HRG010-A□ to 015-A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>41 to 95°F (5°C to 35°C)</td>
<td>HRG010-W□ to 015-W</td>
</tr>
<tr>
<td>Separately installed power transformer</td>
<td>Power supply and voltage for those other than the standard.</td>
<td>Maximum ambient temperature</td>
<td>HRG010-A□ to 015-A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>104°F (40°C)</td>
<td>HRG010-W□ to 015-W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Relative humidity 85% or less)</td>
<td></td>
</tr>
<tr>
<td>Foundation bolt set</td>
<td>For fixing the Thermo-cooler to the foundation. Easy to use – just drive in the core rod.</td>
<td>Stainless steel</td>
<td>HRG010-A□ to 015-A</td>
</tr>
<tr>
<td>Piping adapter</td>
<td>For converting the thread type used in the connection port of the Thermo-cooler.</td>
<td>Copper alloy</td>
<td>HRG010-W□ to 015-W</td>
</tr>
</tbody>
</table>

#### How to Order

**[Dustproof filter set]**

**HRG – FL**

<table>
<thead>
<tr>
<th>Applicable Thermo-cooler</th>
<th>Symbol</th>
<th>Quantity per set</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRG010-A</td>
<td>010</td>
<td>1</td>
</tr>
<tr>
<td>HRG015-A</td>
<td>015</td>
<td>(Large) 1, (Small) 2</td>
</tr>
</tbody>
</table>

Note) Refer to page 23 for dimensions and page 25 for mounting.

**[By-pass piping set]**

**HRG – BP**

<table>
<thead>
<tr>
<th>Applicable Thermo-cooler</th>
<th>Symbol</th>
<th>Set pressure (Blow pressure)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRG010-□</td>
<td>010</td>
<td>45 psi (0.31 MPa)</td>
</tr>
<tr>
<td>HRG015-□</td>
<td>015</td>
<td>46 psi (0.32 MPa)</td>
</tr>
</tbody>
</table>

Note) Refer to page 23 for dimensions and pages 25 for mounting and flow-rate characteristics.

**[Separately installed power transformer]**

**IDF – TR**

<table>
<thead>
<tr>
<th>Volume</th>
<th>Symbol</th>
<th>Applicable Thermo-cooler</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>14000</td>
<td>HRG010-□</td>
<td>14 kVA</td>
<td></td>
</tr>
<tr>
<td>18000</td>
<td>HRG015-□</td>
<td>18 kVA</td>
<td></td>
</tr>
</tbody>
</table>

**[Foundation bolt set]**

**IDF – AB**

<table>
<thead>
<tr>
<th>Size</th>
<th>Symbol</th>
<th>Applicable Thermo-cooler</th>
<th>Material</th>
<th>Quantity per set</th>
</tr>
</thead>
<tbody>
<tr>
<td>501</td>
<td>HRG010-□</td>
<td>HRG015-□</td>
<td>Stainless steel</td>
<td>4</td>
</tr>
</tbody>
</table>

Note) Refer to page 24 for dimensions.

**[Piping adapter]**

**IDF – AP**

<table>
<thead>
<tr>
<th>Size</th>
<th>Symbol</th>
<th>Applicable Thermo-cooler</th>
<th>Thread type and port size</th>
<th>Material</th>
<th>Quantity per set</th>
</tr>
</thead>
<tbody>
<tr>
<td>603</td>
<td>HRG010-□</td>
<td>HRG015-□</td>
<td>Male side A, Female side B</td>
<td>Copper alloy</td>
<td>2</td>
</tr>
</tbody>
</table>

Note) Refer to page 24 for dimensions. Specify the quantity of units necessary for use with your piping system.
Dimensions

[Optional Accessories Series HRG]

[Dustproof filter set]

HRG-FL010

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>34.6 (880)</td>
<td>17.3 (440)</td>
<td>0.39 (10)</td>
</tr>
</tbody>
</table>

HRG-FL015

<table>
<thead>
<tr>
<th>Part no.</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Quantity per 1 set</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRG-FL010</td>
<td>34.6 (880)</td>
<td>17.3 (440)</td>
<td>0.39 (10)</td>
<td>1</td>
</tr>
<tr>
<td>HRG-FL015</td>
<td>(Large) 34.6 (880)</td>
<td>(Large) 17.3 (440)</td>
<td>(Large) 0.39 (10)</td>
<td>(Large) 1</td>
</tr>
<tr>
<td></td>
<td>(Small) 13.0 (330)</td>
<td>(Small) 17.3 (440)</td>
<td>(Small) 0.39 (10)</td>
<td>(Small) 2</td>
</tr>
</tbody>
</table>

[By-pass piping set]

HRG-BP010

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Connection thread R, Rc</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>H (Width across flats)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRG-BP010</td>
<td>3/4</td>
<td>8.1 (206)</td>
<td>6.7 (170)</td>
<td>5.9 (150)</td>
<td>4.5 (114)</td>
<td>5.4 (138)</td>
<td>1.9 (49)</td>
<td>5.7 lbs (2.6 kg)</td>
</tr>
<tr>
<td>HRG-BP015</td>
<td>3/4</td>
<td>9.3 (236)</td>
<td>6.7 (170)</td>
<td>5.9 (150)</td>
<td>4.8 (122)</td>
<td>5.4 (138)</td>
<td>1.9 (49)</td>
<td>7.1 lbs (3.2 kg)</td>
</tr>
</tbody>
</table>

Note) The connection thread of the nipple comes with PTFE seal tape.
Series HRG

Dimensions

[Separately installed power transformer]

Specifications

<table>
<thead>
<tr>
<th>Transformer part no.</th>
<th>Applicable Thermo-cooler</th>
<th>Volume</th>
<th>Type</th>
<th>Inlet voltage</th>
<th>Outlet voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDF-TR14000-8</td>
<td>HRG010</td>
<td>14 kVA</td>
<td>3-phase</td>
<td>220, 240, 380, 400, 415, 440 VAC (50/60 Hz)</td>
<td>200 VAC (50/60 Hz)</td>
</tr>
<tr>
<td>IDF-TR18000-8</td>
<td>HRG015</td>
<td>18 kVA</td>
<td>double</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IDF-TR-  

[Foundation bolt set]

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable Thermo-cooler</th>
<th>Nominal thread size</th>
<th>A</th>
<th>Quantity per set</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDF-AB501</td>
<td>HRG010</td>
<td>M10</td>
<td>2.75 (70)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>HRG015</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Piping adapter]

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable Thermo-cooler</th>
<th>Thread type and port size</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>Quantity per set</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDF-AP603</td>
<td>HRG010</td>
<td>R3/4</td>
<td>1.69 (43)</td>
<td>0.91 (23)</td>
<td>12.6 (32)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>HRG015</td>
<td>NPT3/4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Optional Accessories Series HRG

Mounting Example

Note) Please order separately. Necessary to be fitted by the customer.

[Dustproof filter set]

1. This dustproof filter is secured with hook-and-loop tape. This is sewed onto the male side of the surface fastener, and has adhesive tape backing for fixing to the female side.
2. Remove the paper covering of the adhesive tape and affix the loop tape to the external panel of the ventilation hole on the Thermo-cooler.
3. Simply press the hook tape on to the loop tape to mount the dustproof filter.

[By-pass piping set]

1. This set consists of a body with assembly of relief valve and union (female), along with a nipple, union (male) and union seal.
2. To mount, screw the union (male) and nipple onto the circulating fluid outlet and circulating fluid return port of the Thermo-cooler.
3. Next, place the union seal between the union (male) and union (female) of the body, and gently tighten screw on tentatively (manually), in the appropriate mounting direction for the model used (refer to Operation Manual), paying attention to the direction of flow of the body (relief valve).
4. Finally, tightly fasten the union (female) of the body to the union (male) tightly. Note)

[Pump capacity for each Thermo-cooler after mounting the by-pass piping set]

HRG010 (After mounting HRG-BP010)

HRG015 (After mounting HRG-BP015)
### Warning

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

2. When attempting to cool areas that are open to the atmosphere (tanks, pipes), plan your piping system accordingly.
   When cooling open-air external tanks, arrange the piping so that there are coil pipes for cooling inside the tanks, and to carry back the entire flow volume of circulating fluid that is released.

### Selection

1. Model selection
   For selecting a model of Thermo-cooler, it is required to know the heat generation amount of a customer's machine. Obtain the heat generation amount, referring to the model selection example on pages 8 and 9 before selecting a model.

2. Indication of model number
   Select the cooling method and temperature stability depending on the customer's application.

### 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.

2. Install in an environment where the unit will not come into direct contact with rain or snow.
   (HRG010/015)
   These models are built to rainproof enclosure IPx3, but are not completely waterproof to rain, etc. (as with IPx4 or higher).
   To prolong the lifespan of this equipment, we recommend installation under an awning or other shelter.

### Caution

1. Avoid oil or other foreign objects entering the circulating fluid.
2. Use an ethylene glycol aqueous solution that does not contain additives such as preservatives.
3. When using ethylene glycol aqueous solution, maintain a maximum concentration of 15%.
   Overly high concentrations can overload the pump, and cause safety protection devices to commence operation, stopping the operation of the unit.
   Low concentrations, however, can lead to freezing at cold temperatures and cause the Thermo-cooler to break down.
4. 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 in the table 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-22-1994 “Cooling water system – Circulation type – Make-up water”

<table>
<thead>
<tr>
<th>Standard item</th>
<th>Unit</th>
<th>Standard value</th>
<th>Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (at 77°F (25°C))</td>
<td>—</td>
<td>6.0 to 8.0</td>
<td>☑️ ☑️</td>
</tr>
<tr>
<td>Electrical conductivity (77°F)</td>
<td>[µS/cm]</td>
<td>100 to 300¹</td>
<td>☑️</td>
</tr>
<tr>
<td>Chloride ion (Cl⁻)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>☑️</td>
</tr>
<tr>
<td>Sulfuric acid ion (SO₄²⁻)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>☑️</td>
</tr>
<tr>
<td>Acid consumption amount (at pH4.5)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>☑️</td>
</tr>
<tr>
<td>Total hardness</td>
<td>[mg/L]</td>
<td>70 or less</td>
<td>☑️</td>
</tr>
<tr>
<td>Calcium hardness (CaCO₃)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>☑️</td>
</tr>
<tr>
<td>Ionic state silica (SiO₂)</td>
<td>[mg/L]</td>
<td>30 or less</td>
<td>☑️</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>☑️ ☑️</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td>☑️</td>
</tr>
<tr>
<td>Sulfide ion (S⁻)</td>
<td>[mg/L]</td>
<td>Should not be detected</td>
<td>☑️</td>
</tr>
<tr>
<td>Ammonium ion (NH₄⁺)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td>☑️</td>
</tr>
<tr>
<td>Residual chlorine (Cl⁻)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>☑️</td>
</tr>
<tr>
<td>Free carbon (CO₂)</td>
<td>[mg/L]</td>
<td>4.0 or less</td>
<td>☑️</td>
</tr>
</tbody>
</table>

¹: 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.

5. It is possible to use or supply the unit with deionized water, but it is not possible to maintain specific resistance.

When using deionized water, make sure to supply water with an electrical conductivity of 1 µS/cm or more. (In case of electrical resistivity, it should be 1 MΩ·cm or less.) However, it is not possible to maintain electrolyte concentration, as elements of the parts coming into contact with fluid may dissolve.
**Warning**

1. **Transportation by forklift**
   1. A licensed driver should drive the forklift.
   2. The proper place to insert the tines of the forklift differs depending on the model of cooler. Check the Operation Manual to confirm, and be sure to drive the fork in far enough for it to come out the other side.
   3. Be careful not to bump the fork to the cover panel or piping ports.

2. **Hanging transportation**
   1. Crane manipulation and slinging work should be done by an eligible person.
   2. Do not grip the piping on the right side or the handles of the panel.
   3. When hanging by the eye bolts, be sure to use a 4-point hanging method. For the hanging angle, use caution regarding the position of the center of gravity and hold it within 60°.

(When using optional casters HRG/L50132/L50132/L50132-A)

1. **Transportation by casters**
   1. This product is heavy and should be moved by at least two people.
   2. Do not grip the piping port on the right side or the handles of the panel.
   3. When transporting using a forklift, be sure not to let it hit the casters or adjusters, and drive the fork all the way through until it comes out the other side.

**Caution**

1. **Installation**
   1. Install on a rigid floor which can withstand this product’s weight.
   2. Secure with bolts, anchor bolts, etc.

Fasteners such as bolts or anchor bolts should be tighten with the recommended torque shown below.

**Fixing Thread Tightening Torque**

<table>
<thead>
<tr>
<th>Connection thread</th>
<th>Applicable tightening torque lbf•ft (N•m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M5</td>
<td>0.21(3)</td>
</tr>
<tr>
<td>M6</td>
<td>3.84 (5.2)</td>
</tr>
<tr>
<td>M8</td>
<td>9.22 (12.5)</td>
</tr>
<tr>
<td>M10</td>
<td>18.1 (24.5)</td>
</tr>
<tr>
<td>M12</td>
<td>31.0 (42)</td>
</tr>
</tbody>
</table>

(When using optional accessories/dustproof filter set)

1. **Use the attached surface fastener (with adhesive tape) to affix the dustproof filter to the panel of the Thermo-cooler.**

2. **Mounting the filter will create a certain amount of resistance to ventilation that will reduce the volume of airflow.**

For this reason, be sure to keep the ambient temperature at 104°F (40°C) or less.

3. **Depending on the installation height of the Thermo-cooler and/or the cooled substrates, circulating fluid may overflow from the tank lid or overflow outlet.**

In particular, avoid overflow from the lid of the built-in tank by installing with a height difference of 32.8 ft (10 m) or less. Be sure to pipe the overflow outlet to a wastewater collection pit, etc.
Series HRG
Specific Product Precautions 3
Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back pages 2 to 5 for Temperature Control Equipment Precautions.

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. For the circulating fluid pipings, use clean pipings which have no dust, piping debris or other foreign objects inside the pipings, and blow with air prior to undertaking any piping works.

   If piping debris or other foreign objects remain inside the circulating fluid circuit, it can result in blockage, insufficient cooling or damage to the pump impeller.

3. Select the piping port size which can exceed the rated flow.

   For the rated flow, refer to the pump capacity table.

4. When tightening at the circulating fluid inlets and outlets, tank drain port or overflow outlet of this product, use a pipe wrench to clamp the connection ports.

5. For the circulating fluid piping connection, install a drain pan and wastewater collection pit just in case the circulating fluid may leak.

6. While cleaning the inside of the tank, attach a valve to the tank drain outlet to drain the circulating fluid (clear water).

7. 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.

(Water-cooled refrigeration HRG□□□□-W□)

1. When tightening at the facility water inlets and outlets of this product, use a pipe wrench to clamp the connection ports.

2. Install by-pass piping.

   This product has a built-in water control valve, so when the refrigeration circuit is stopped, facility water does not flow out in order to save energy.

   For this reason, by-pass piping is necessary for conducting maintenance of your facility water equipment, so be sure to install it.

3. When tightening at the water supply ports of this product, use a pipe wrench to clamp these ports.

   This product has a built-in ball (float) tap. If you attach it to the faucet of a sink, etc. it will automatically supply water to the rated fluid level of the tank (halfway between HIGH and LOW.)

4. Supply water at a pressure of 73 psi (0.5 MPa) or less.

   If the water supply pressure is too high, the pipes may burst during use. Proceed with caution.

(When using optional accessories/by-pass piping set)

1. In order to prevent foreign objects from entering during shipment, a polyethylene cap is attached to the inlets and outlets.

   Remove these caps before piping.

2. Pay attention to the flow direction of the relief valve.

   Refer to the mounting example shown in the separate operating manual for the by-pass piping set when mounting.

3. Tighten to the applicable torque shown below when tightening the cap nut (female) of the union.

<table>
<thead>
<tr>
<th>Nominal size</th>
<th>Applicable tightening torque lb•ft (N•m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rc1/2</td>
<td>47.2 to 92.2 (64 to 125)</td>
</tr>
<tr>
<td>Rc3/4</td>
<td>78.2 to 153 (106 to 208)</td>
</tr>
</tbody>
</table>

⚠️ Warning

1. Never change the set value of the safety instrument.

   If the set value is changed, it will likely cause a breakdown or cause the product to catch on fire.

2. Before wiring, be sure to cut the power supply.

   Never perform any job while the product is energized.

3. When connecting the power, confirm the phase sequence (R, S, T) of the three-phase AC power supply.

   An incorrect phase sequence will cause the anti-reversal safety protection device to be activated, and the unit will fail to operate. If this occurs, switch the two wires to the correct phase sequence.

4. Secure the cable so that its force, etc. is not applied to the terminal connector parts.

   When the connection or attachment is incomplete, it will likely lead to an electrical shock, a fire, etc.

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

6. Multiple wiring is dangerous because it will lead to heat generation or cause a fire.

⚠️ Caution

1. Power supply, signal cable and connecting terminal should be prepared by the customer.

2. In the event of wiring the signal for operation/stop commands (remote control), use caution regarding the correct polarity (+, –) of 24 VDC.

   (When using the HRG□□□□-□□□□ with optional communications function)

1. Communication cables and adapters should be prepared by the customer.

   Prepare parts that conform to the connector specifications of your host computer.

2. Pay attention to the polarity (TRD+, TRD–) when connecting communication cables.
Facility Water Supply

⚠️ Warning

(Water-cooled refrigeration HRG□□□□-W□□)
1. Before startup, be sure to open the valve of your facility water equipment.
   Prepare before startup, so that facility water can flow when the fitted water control valve (facility water control valve) opens during operation.
2. Supply pressure of 73 psi (0.5 MPa) or less.
   If the supply pressure is high, it will cause water leakage.
3. Be sure to prepare your utilities so that the pressure of the Thermo-cooler facility water outlet is at 0 psi (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.

⚠️ Caution

1. The temperature set value can be written to EEPROM, but only up to approx. 1 million times.
   Especially when using communication function, save data with STOR before stoppage, and do not carry out frequent saving (STOR) of temporary setting values.

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 ±10%.
   • The order of the 3-phase power supply, R, S, T is different.
   • In case the water level inside the tank is reduced abnormally.
   • The order of the 3-phase power supply, R, S, T is different.
   • Refrigerant pressure is too high.
   • Refrigerant pressure is too high.
   • Ventilation hole is clogged with dust or dirt. (Especially HRG□□□□-A)

Maintenance

⚠️ Warning

1. Do not operate the switch with wet hands or touch electrical parts. This will lead to an electrical shock.
2. Do not splash water directly on this product for cleaning. This will lead to an electrical shock or a fire.
3. When the panel was removed for the purpose of inspection or cleaning, mount the panel after works were done.
   If the panel is still open, or running the equipment with the panel removed, it may cause an injury or electric shocks.
4. When cleaning the air-cooled condenser, do not touch the fin directly.
   This may lead to injuries.

Water-cooled refrigeration HRG□□□□-W□□

Series HRG Specific Product Precautions 4

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back pages 2 to 5 for Temperature Control Equipment Precautions.
Maintenance

⚠️ Caution

<Periodical inspection every one month>
(Air-cooled refrigeration HRG-L50132/L50132/L50132-A-□)
1. Clean the ventilation hole.
   - If the fin portion of the air-cooled condenser becomes clogged with dust or debris, a decline in heat-releasing performance can result.
   - In order to avoid deforming or damaging the fin, clean it with a long-haired brush or air gun.

(When using optional accessories/dustproof filter set)
1. Clean the dustproof filter.
   - To prevent dirt or clogging of the dustproof filter from leading to a decline in heat-releasing performance of the air-cooled condenser, clean or wash it regularly.
2. Remove the filter from the Thermo-cooler before cleaning it.
   - Do not directly splash water on the filter to clean it while it is still attached to the Thermo-cooler. This can lead to electric shock or fires in the main unit of the Thermo-cooler.

<Periodical inspection every three months>
1. Inspect the circulating fluid.
   - When using clear water or deionized water
     • Replacement of clear water or deionized water
       Failure to replace the clear water or deionized 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.
   - When using ethylene glycol aqueous solution
     Use a concentration measurement device to confirm that the concentration does not exceed 15%. Dilute or add as needed to adjust the concentration.
2. Check the water quality of facility water.
   - Regarding the water quality standards for facility water, refer to “Temperature Control Equipment Precautions”.

<Periodical inspection every six months>
1. Inspect the circulating fluid.
   - Remove the panel and inspect if there is abnormal leakage from the pump’s mechanical seal.
2. Leakage amount of a mechanical seal
   Leakage of the mechanical seal cannot be completely avoided due to its construction (rotating machine). Although this amount of leakage is stipulated as 0.1 oz/h (3 (cc/h)) or less (reference value) according to the JIS standard, replace the mechanical seal when the amount of leakage is 0.1oz/h (0.3 (cc/h)) or greater.
   - Also, as a guide for periodically replacement, the operation hours is 6000 to 8000 hours. (normally 1 year) Note

   Note) In placing an order of mechanical seal set (service parts), inform us of the complete model number and the production lot number of the product in use.

<Periodical inspection during the winter season>
1. Keep the pump operating.
   - Keep the power supply running (POWER light on, RUN light off), and fully open the valves in the circulating fluid piping.
   - If the circulating fluid temperature falls below 37°F (3°C), the pump will start operating automatically. The heat generated by the pump operation will warm up the circulating fluid. When the temperature rises above 41°F (5°C), the pump will stop automatically. Consequently, the circulating fluid temperature is kept between 37°F (3°C) and 41°F (5°C) to avoid being frozen.
   - In extremely cold weather conditions, the heat generated by the pump as described above may not be enough to prevent freezing. If you expect these kind of conditions, remove the circulating fluid (especially clear water or deionized water) beforehand.
3. Consult a professional.
   - For additional methods to prevent freezing (such as commercially available tape heaters, etc.), consult a professional for advice.
Circulating Fluid Temperature Controller

Thermo-chiller Compact Type Series HRS

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

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

Power supply is available in Europe, Asia, Oceania, and the Americas.

88 lbs (40 kg)

1300 W/ 1900 W/ 2400 W

Temperature stability ±0.18°F (±0.1°C)

41 to 104°F (5 to 40°C)

Compact

Light-weight

Cooling capacity (60 Hz)

152 lbs (69 kg)

5100 W

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

Fits neatly under a laboratory work bench.

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.

Environmental friendly R407C R410A as refrigerant

Technical Data

Related Products

SHOP ONLINE at www.airlinehyd.com

800-999-7378
Supply is possible even when 2 products are stacked.

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

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

The angled supply port facilitates the supply of circulating fluid.

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

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

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

Easy operation by these steps

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.

Variations

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

Option
- Anti-quake bracket
- Piping conversion fitting (for air-cooled, water-cooled and option)
- Concentration meter
- By-pass piping set
- Power supply cable
- DI filter set
- Electrical resistance sensor set
- Drain pan set (with water leakage sensor)

* UL standards: Applicable to 60 Hz only

Option

Optional accessories

- Anti-quake bracket
- Piping conversion fitting
- Concentration meter
- By-pass piping set
- Power supply cable
- DI filter set
- Electrical resistance sensor set
- Drain pan set (with water leakage sensor)

* UL standards: Applicable to 60 Hz only

Option

Optional accessories

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

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
- Piping conversion fitting
- Concentration meter
- By-pass piping set
- Power supply cable
- DI filter set
- Electrical resistance sensor set
- Drain pan set (with water leakage sensor)

* UL standards: Applicable to 60 Hz only

Optional accessories

- Anti-quake bracket
- Piping conversion fitting
- Concentration meter
- By-pass piping set
- Power supply cable
- DI filter set
- Electrical resistance sensor set
- Drain pan set (with water leakage sensor)

* UL standards: Applicable to 60 Hz only

Optional accessories
Convenient Functions

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

- **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.

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

- **Power failure auto-restart function**
  Automatic restart from stoppage due to power failure, etc. is possible without pressing the RUN 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.

- **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.

- **Orange indicator lights up.**

- **Red indicator lights up.**

Self Diagnosis and Check Display for Easy Maintenance

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

### Changeable alarm set values

<table>
<thead>
<tr>
<th>Setting item</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulating fluid discharge temperature rise</td>
<td>41.0 to 118.4°F</td>
</tr>
<tr>
<td>Circulating fluid discharge temperature drop</td>
<td>33.8 to 102.2°F</td>
</tr>
<tr>
<td>Circulating fluid discharge pressure rise</td>
<td>7 to 109 psi</td>
</tr>
<tr>
<td>Circulating fluid discharge pressure drop</td>
<td>7 to 26 psi</td>
</tr>
</tbody>
</table>

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” | Ex. drv. “Accumulated operating time” |

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.

**Application Examples**

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

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

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

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

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

**Ultra sonic wave inspection machine**
- Temperature control of ultrasonic wave laser part

---

**When...**

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

**When...**

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

---

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.

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

---

Cooling tower

Dripping stops

Less tap water used!

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

**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**
- Cooling water

**Temperature control of paint material**
- Circulating fluid

**Cooling of vacuum pump**
- 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**
- Dual thermo-chiller

---

**Technical Data**

**Related Products**

SHOP ONLINE at www.airlinehyd.com 800-999-7378
**Construction and Principles**

**Air-cooled HRS-A**

- Resin tank
- Level switch
- Temperature sensor (For return)
- Evaporator
- Temperature sensor (For compressor intake)
- Pressure sensor (For high-pressure refrigerant gas)
- Expansion valve A
- Expansion valve B
- Temperature sensor (For discharge)
- Temperature sensor (For return)
- Pressure sensor (For discharge)
- Circulating fluid return port Rc1/2
- Circulating fluid outlet Rc1/2
- Water-cooled HRS
- Air-cooled HRS

**Water-cooled HRS-W**

- Resin tank
- Level switch
- Temperature sensor (For return)
- Evaporator
- Temperature sensor (For compressor intake)
- Pressure sensor (For low-pressure refrigerant gas)
- Expansion valve A
- Expansion valve B
- Temperature sensor (For discharge)
- Temperature sensor (For discharge)
- Circulating fluid return port Rc1/2
- Circulating fluid outlet Rc1/2
- Water-cooled HRS
- Air-cooled HRS

**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.
- HRS
  - Circulating fluid temperature setting
  - Start and stop
  - Circulating fluid discharge temperature
  - Circulating fluid discharge pressure
  - Run and stop status
- PC
  - Alarm information
  - Various setting information
  - Preparation completion status

**Ex. 2 Remote operation signal input**

- One of the contact inputs is used for remote operation and the other is used for a flow switch to monitor the flow, and their warning outputs are taken in.
- Low flow switch flow signal
- To the customer’s machine

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

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

Power for flow switch (24 VDC) can be supplied from thermo-chiller.
Basic Model
How to Order/Specifications
- Single-phase 100/115 VAC ........................................... Page 38
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### Specifications

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

#### Model

<table>
<thead>
<tr>
<th>Model</th>
<th>HRS012-Al ◼-10</th>
<th>HRS012-W ◼-10</th>
<th>HRS018-Al ◼-10</th>
<th>HRS018-W ◼-10</th>
</tr>
</thead>
</table>

#### Cooling Method

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

#### Control Method

- **PID control**

#### Ambient Temperature/Humidity

- **Temperature**: 41 to 104°F (5 to 40°C), Humidity: 30 to 70%

#### Circulating Fluid System

- **Temperature range setting**: 41 to 104°F (5 to 40°C)
- **Cooling capacity**: HRS012-W ◼-10: 1100/1300 W, HRS018-W ◼-10: 1500/1700 W
- **Heating capacity**: 360/450 W
- **Temperature stability**: ±0.1°F (±0.1°C)
- **Pump**
  - **Rated flow rate** (50/60 Hz): 1.85 GPM (7 L/min)
  - **Maximum flow rate** (50/60 Hz): 1.85 GPM (7 L/min)
  - **Maximum high lift (50/60 Hz)**: 0.97 GPM (3.6 L/min)
  - **Output** (W): 200 W
- **Tank capacity**: Approx. 1.32 gal (5 L)
- **Port size**: Hc1/2
- **Wetted parts material**: Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC

#### Facility Water System (Note 1)

- **Temperature range**: 41 to 104°F (5 to 40°C), Humidity: 30 to 70%
- **Pressure range**: 43.5 to 72.5 psi (0.3 to 0.5 MPa)
- **Inlet-outlet pressure differential of facility water**: 43.5 psi (0.3 MPa) or more
- **Port size**: HcA8
- **Wetted parts material**: Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber

#### Electrical System

- **Circuit protector**: (A)
- **Applicable earth leakage breaker capacity** (Note 9): (A)
- **Rated operating current**: 7.5/8.3 A
- **Rated power consumption** (Note 6): (50/60 Hz) 7.7/8.4 (kVA)
- **Noise level** (50/60 Hz) (db): 58/55

#### Accessories

- **Fitting (for drain outlet)**: 1 pc., **Input/output signal connector**: 1 pc., **Power supply connector**: 1 pc., **Operation manual (for installation/operation)**: 1 pc., **Quick manual (with a clear case)**: 1 pc., **Alarm code list sticker**: 1 pc., **Ferritic core (for communication)**: 1 pc.

#### Weight

- **Model HRS012-W ◼-10**: 88 lbs (40 kg)
- **Model HRS018-W ◼-10**: 115 lbs (52 kg)

### Notes

- **Note 1**: Applicable to DI water (deionized water) piping with automatic water supply function.
- **Note 2**: Applicable to water-cooled refrigeration.
- **Note 3**: 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**: Ambient temperature: 77°F (25°C), Circulating fluid temperature: 68°F (20°C), Rated cooling fluid flow rate: 1.85 GPM (7 L/min), Circulating fluid: Clear water, Facility water temperature: 77°F (25°C).
- **Note 5**: Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temperature is 50°F (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.

### Contact Information

- **SHOP ONLINE**: [www.airlinehyd.com](http://www.airlinehyd.com)
- **Phone**: 800-999-7378
### Specifications

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

<table>
<thead>
<tr>
<th>Model</th>
<th>HRS012-A/-20</th>
<th>HRS012-W/-20</th>
<th>HRS018-A/-20</th>
<th>HRS018-W/-20</th>
<th>HRS024-A/-20</th>
<th>HRS024-W/-20</th>
<th>HRS050-A/-20</th>
<th>HRS050-W/-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control method</td>
<td>PID control</td>
<td>PID control</td>
<td>PID control</td>
<td>PID control</td>
<td>PID control</td>
<td>PID control</td>
<td>PID control</td>
<td>PID control</td>
</tr>
<tr>
<td>Ambient temperature/humidity</td>
<td>Temperature: 41 to 104°F (5 to 40°C), High-temperature environment specifications (option): 41 to 104°F (5 to 40°C), Humidity: 30 to 70%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid temperature</td>
<td>Note 3) Clear water, 15% ethylene glycol aqueous solution (Note 3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>Note 2) 41 to 104°F (5 to 40°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling capacity</td>
<td>Note 4) (50/60 Hz)</td>
<td>1100/1300</td>
<td>1700/1900</td>
<td>2100/2400</td>
<td>4700/5100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heating capacity</td>
<td>Note 4) (50/60 Hz)</td>
<td>530/650</td>
<td>1100/1400</td>
<td>1000/1300</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid temperature</td>
<td>Note 3) ±0.18 °F (±0.1°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure</td>
<td>43.5 to 72.5 psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required flow rate</td>
<td>Note 5) 1.85GPM (7 L/min)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum flow rate (50/60 Hz)</td>
<td>7.12/6.5GPM (27/29 L/min)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum high-lift (50/60 Hz)</td>
<td>45.9 to 62.3 ft (14/19 m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tank capacity</td>
<td>Approx. 1.32 gal (5 L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port size</td>
<td>Rc1/2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetted parts material</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>— 41 to 104°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure</td>
<td>43.5 to 72.5 psi</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>Note 6) 41 to 104°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure</td>
<td>43.5 to 72.5 psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>— 1.81GPM (8L/min)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>Note 7) 43.5psi more</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum pressure differential of facility water</td>
<td>— 43.5psi more</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port size</td>
<td>Rc3/8</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Wetted parts material</td>
<td>Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>Single-phase 200 to 230 VAC (50/60 Hz)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>Allowable voltage range ±10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit protector</td>
<td>(A) 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>95 lbs (43 kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise level</td>
<td>Note 11) (50/60 Hz) (dB) 65/68</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td>Fitting (for drain outlet) 1 pc, Input/output signal connector 1 pc, Power supply connector 1 pc, Operation manual (for installation/operation) 1, Quick manual (with a clear case) 1 Note 13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (Note 11)</td>
<td>95 lbs (43 kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1) For water-cooled refrigeration
Note 2) If 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 SL-00-1994 cooling water system - circulating type - make-up water).
Note 4) Ambient temperature: 77°F (25°C), Circulating fluid temperature: 68°F (20°C), Rated circulating fluid flow rate, Circulating fluid Clear water, Facility water temperature: 77°F (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 50°F (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 68°F (20°C).
Note 8) Required min. flow rate for cooling capacity or maintaining the temperature stability.
Note 9) Purchasing 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 68°F (20°C), and rated circulating fluid flow rate and facility water temperature of 77°F (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]

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

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

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

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

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

HRS024-A-20, HRS024-W-20 (Single-phase 200 to 230 VAC) [60 Hz]

HRS050-A-20, HRS050-W-20 (Single-phase 200 to 230 VAC) [60 Hz]

HRS024-A-20, HRS024-W-20 (Single-phase 200 to 230 VAC) [60 Hz]

HRS050-A-20, HRS050-W-20 (Single-phase 200 to 230 VAC) [60 Hz]

HRS012-A-10, HRS012-W-10 (Single-phase 100/115 VAC) [60 Hz]

HRS018-A-10, HRS018-W-10 (Single-phase 100/115 VAC) [60 Hz]

HRS012-A-20, HRS012-W-20 (Single-phase 200 to 230 VAC) [60 Hz]

HRS018-A-20, HRS018-W-20 (Single-phase 200 to 230 VAC) [60 Hz]
Thermo-chiller Series HRS

Heating Capacity

**HRS**

**HRS 012 - A - 10 (Single-phase 100/115 VAC)**

[50 Hz] [60 Hz]

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Heating Capacity [kW]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient 68°F</td>
<td>0.12</td>
</tr>
<tr>
<td>Ambient 77°F</td>
<td>0.18</td>
</tr>
<tr>
<td>Ambient 90°F</td>
<td>0.30</td>
</tr>
<tr>
<td>Ambient 104°F</td>
<td>0.45</td>
</tr>
</tbody>
</table>

**HRS 012 - A - 20 (Single-phase 200 to 230 VAC)**

[50 Hz] [60 Hz]

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Heating Capacity [kW]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient 68°F</td>
<td>0.65</td>
</tr>
<tr>
<td>Ambient 77°F</td>
<td>0.80</td>
</tr>
<tr>
<td>Ambient 90°F</td>
<td>1.00</td>
</tr>
<tr>
<td>Ambient 104°F</td>
<td>1.20</td>
</tr>
</tbody>
</table>

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

[50 Hz] [60 Hz]

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Heating Capacity [kW]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient 68°F</td>
<td>2.0</td>
</tr>
<tr>
<td>Ambient 77°F</td>
<td>2.5</td>
</tr>
<tr>
<td>Ambient 90°F</td>
<td>3.0</td>
</tr>
<tr>
<td>Ambient 104°F</td>
<td>3.5</td>
</tr>
</tbody>
</table>

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

[50 Hz] [60 Hz]

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Heating Capacity [kW]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient 68°F</td>
<td>2.0</td>
</tr>
<tr>
<td>Ambient 77°F</td>
<td>2.5</td>
</tr>
<tr>
<td>Ambient 90°F</td>
<td>3.0</td>
</tr>
<tr>
<td>Ambient 104°F</td>
<td>3.5</td>
</tr>
</tbody>
</table>
**Series HRS**

**Pump Capacity**

**HRS012-018-W-10** (Single-phase 100/115 VAC)

**HRS018-012-W-20** (Single-phase 200 to 230 VAC)

**HRS050-024-W-20** (Single-phase 200 to 230 VAC)

**Required Facility Water Flow Rate**

**HRS012-W-10, HRS018-W-10**

**HRS024-W-20, HRS050-W-20**

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

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

**Caution**
1. Install on a rigid floor which can withstand this product’s weight.
2. Secure with bolts, anchor bolts, etc. Fasteners such as bolts or anchor bolts should be tighten with the recommended torque shown below.

### Fixing Thread Tightening Torque

<table>
<thead>
<tr>
<th>Connection thread</th>
<th>Applicable tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>M3</td>
<td>0.46 lbf·ft (0.63 N·m)</td>
</tr>
<tr>
<td>M4</td>
<td>1.10 lbf·ft (1.5 N·m)</td>
</tr>
<tr>
<td>M5</td>
<td>2.21 lbf·ft (3.2 N·m)</td>
</tr>
<tr>
<td>M6</td>
<td>3.84 lbf·ft (5.3 N·m)</td>
</tr>
</tbody>
</table>

**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.

**Electrical Wiring**

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

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

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

\[
\frac{dV}{dt} = \text{Voltage ramp rate}
\]

\(
\frac{dV}{dt} = \text{Voltage ramp rate}
\)

\(\text{Time}\)
Operation Display Panel

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Digital display</td>
<td>PV Displays the circulating fluid current discharge temperature and pressure and alarm codes and other menu items (codes).</td>
</tr>
<tr>
<td>2</td>
<td>[°C] [°F] indicator</td>
<td>Equipped with a unit conversion function. Displays the unit of display temperature (default setting: °C).</td>
</tr>
<tr>
<td>3</td>
<td>[MPa] [PSI] indicator</td>
<td>Equipped with a unit conversion function. Displays the unit of display pressure (default setting: MPa).</td>
</tr>
<tr>
<td>4</td>
<td>[REMOTE] indicator</td>
<td>Enables remote operation (start and stop) by communication. Lights up during remote operation.</td>
</tr>
<tr>
<td>5</td>
<td>[RUN] indicator</td>
<td>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.</td>
</tr>
<tr>
<td>6</td>
<td>[ALARM] indicator</td>
<td>Flashes with buzzer when alarm occurs.</td>
</tr>
<tr>
<td>7</td>
<td>[ ] indicator</td>
<td>Lights up when the surface of the fluid level indicator falls below the L level.</td>
</tr>
<tr>
<td>8</td>
<td>[ ] indicator</td>
<td>Equipped with a timer for start and stop. Lights up when this function is operated.</td>
</tr>
<tr>
<td>9</td>
<td>[ ] indicator</td>
<td>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.</td>
</tr>
<tr>
<td>10</td>
<td>[RUN/STOP] key</td>
<td>Makes the product start or stop.</td>
</tr>
<tr>
<td>11</td>
<td>[MENU] key</td>
<td>Shifts the main menu (display screen of circulating fluid discharge temperature and pressure) and other menus (for monitoring and entry of set values).</td>
</tr>
<tr>
<td>12</td>
<td>[SEL] key</td>
<td>Changes the item in menu and enters the set value.</td>
</tr>
<tr>
<td>13</td>
<td>[ ] key</td>
<td>Decreases the set value.</td>
</tr>
<tr>
<td>14</td>
<td>[ ] key</td>
<td>Increases the set value.</td>
</tr>
<tr>
<td>15</td>
<td>[PUMP] key</td>
<td>Press the [MENU] and [RUN/STOP] keys simultaneously. The pump starts running independently to make the product ready for start-up (release the air).</td>
</tr>
<tr>
<td>16</td>
<td>[RESET] key</td>
<td>Press the [MENU] and [RUN/STOP] keys simultaneously. The alarm buzzer is stopped and the [ALARM] indicator is reset.</td>
</tr>
</tbody>
</table>

Alarm

This unit has 35 types of alarms as standard, and displays each of them by its alarm code on the PV screen with the [ALARM] lamp ([LOW LEVEL] lamp) lit up on the operation display panel. The alarm can be read out through communication.

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

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

1 “Stop” or “Continue” are default settings. Customers can change them to “Continue” and “Stop”. For details, read the Operation Manual.
2 “AL19, AL31, AL32” are disabled in the default setting. If this function is necessary, it should be set by the customer referring to the Operation Manual.
3 For water-cooled models, the alarm is not activated.
4 This alarm function can be used when the option (sold separately) is used.

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

SHOP ONLINE at www.airlinehyd.com
800-999-7378
Series HRS

Communication Function

Contact Input/Output

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector type (to the product)</td>
<td>MC 1,5/12-GF-3.5</td>
</tr>
<tr>
<td>Insulation method</td>
<td>Photocoupler</td>
</tr>
<tr>
<td>Rated input voltage</td>
<td>24 VDC</td>
</tr>
<tr>
<td>Operating voltage range</td>
<td>21.6 VDC to 26.4 VDC</td>
</tr>
<tr>
<td>Rated input current</td>
<td>5 mA TYP</td>
</tr>
<tr>
<td>Input impedance</td>
<td>4.7 kΩ</td>
</tr>
<tr>
<td>Contact output signal</td>
<td>Not set when shipping from factory</td>
</tr>
<tr>
<td>Rated load voltage</td>
<td>48 VAC or less/30 VDC or less</td>
</tr>
<tr>
<td>Maximum load current</td>
<td>500 mA AC/DC (resistance load)</td>
</tr>
<tr>
<td>Output voltage</td>
<td>24 VDC ± 10% 0.5 A Max</td>
</tr>
</tbody>
</table>

Circuit diagram

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

Serial Communication

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

For details, refer to the Operation Manual for communication.

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

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

*1 When optional electrical resistance sensor set is used

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector type</td>
<td>D-sub 9-pin, Female connector</td>
</tr>
<tr>
<td>Protocol</td>
<td>Modicon Modbus compliant/Simple communication protocol</td>
</tr>
<tr>
<td>Standards</td>
<td>EIA standard RS-485</td>
</tr>
</tbody>
</table>

Circuit diagram

- 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
Technical Data

**Related Products**

**Automatic water supply inlet**

Rc3/8

**Earth leakage breaker**

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

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.

**With Automatic Water Supply Function**

- **Option symbol**: J
- **Applicable to DI Water (Deionized Water) Piping**
- **Wetted parts material of the circulating fluid circuit is made from non-copper materials.**

**With Earth Leakage Breaker**

- **Option symbol**: B
- **Rated current sensitivity (mA)**: 15 (Single-phase 100/115 VAC)

**With Automatic Water Supply Function**

- **Option symbol**: J
- **Applicable to DI water (Deionized water) piping**
- **Recommended earth leakage breaker capacity**: 15 A (10 A for standard)

**High-lift Pump**

- **Option symbol**: T
- **Pump Capacity**

**Pump Capacity**

### HRS0120/180/240-20-T

<table>
<thead>
<tr>
<th>Lifting Height [ft]</th>
<th>Circulating Fluid Pressure [psi]</th>
<th>Circulating Fluid Flow Rate [L/min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>116</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>116</td>
<td>3.7</td>
</tr>
<tr>
<td>2</td>
<td>116</td>
<td>5.0</td>
</tr>
<tr>
<td>3</td>
<td>116</td>
<td>7.5</td>
</tr>
<tr>
<td>4</td>
<td>116</td>
<td>10.0</td>
</tr>
<tr>
<td>5</td>
<td>116</td>
<td>12.5</td>
</tr>
<tr>
<td>6</td>
<td>116</td>
<td>15.0</td>
</tr>
<tr>
<td>7</td>
<td>116</td>
<td>17.5</td>
</tr>
<tr>
<td>8</td>
<td>116</td>
<td>20.0</td>
</tr>
<tr>
<td>9</td>
<td>116</td>
<td>22.5</td>
</tr>
<tr>
<td>10</td>
<td>116</td>
<td>25.0</td>
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<tr>
<td>11</td>
<td>116</td>
<td>27.5</td>
</tr>
<tr>
<td>12</td>
<td>116</td>
<td>30.0</td>
</tr>
<tr>
<td>13</td>
<td>116</td>
<td>32.5</td>
</tr>
<tr>
<td>14</td>
<td>116</td>
<td>35.0</td>
</tr>
<tr>
<td>15</td>
<td>116</td>
<td>37.5</td>
</tr>
<tr>
<td>16</td>
<td>116</td>
<td>40.0</td>
</tr>
<tr>
<td>17</td>
<td>116</td>
<td>42.5</td>
</tr>
<tr>
<td>18</td>
<td>116</td>
<td>45.0</td>
</tr>
<tr>
<td>19</td>
<td>116</td>
<td>47.5</td>
</tr>
<tr>
<td>20</td>
<td>116</td>
<td>50.0</td>
</tr>
<tr>
<td>21</td>
<td>116</td>
<td>52.5</td>
</tr>
<tr>
<td>22</td>
<td>116</td>
<td>55.0</td>
</tr>
<tr>
<td>23</td>
<td>116</td>
<td>57.5</td>
</tr>
<tr>
<td>24</td>
<td>116</td>
<td>60.0</td>
</tr>
<tr>
<td>25</td>
<td>116</td>
<td>62.5</td>
</tr>
</tbody>
</table>

### HRS0120/180/240-20-MT

<table>
<thead>
<tr>
<th>Lifting Height [ft]</th>
<th>Circulating Fluid Pressure [psi]</th>
<th>Circulating Fluid Flow Rate [L/min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>116</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>116</td>
<td>3.7</td>
</tr>
<tr>
<td>2</td>
<td>116</td>
<td>5.0</td>
</tr>
<tr>
<td>3</td>
<td>116</td>
<td>7.5</td>
</tr>
<tr>
<td>4</td>
<td>116</td>
<td>10.0</td>
</tr>
<tr>
<td>5</td>
<td>116</td>
<td>12.5</td>
</tr>
<tr>
<td>6</td>
<td>116</td>
<td>15.0</td>
</tr>
<tr>
<td>7</td>
<td>116</td>
<td>17.5</td>
</tr>
<tr>
<td>8</td>
<td>116</td>
<td>20.0</td>
</tr>
<tr>
<td>9</td>
<td>116</td>
<td>22.5</td>
</tr>
<tr>
<td>10</td>
<td>116</td>
<td>25.0</td>
</tr>
<tr>
<td>11</td>
<td>116</td>
<td>27.5</td>
</tr>
<tr>
<td>12</td>
<td>116</td>
<td>30.0</td>
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<tr>
<td>13</td>
<td>116</td>
<td>32.5</td>
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<tr>
<td>14</td>
<td>116</td>
<td>35.0</td>
</tr>
<tr>
<td>15</td>
<td>116</td>
<td>37.5</td>
</tr>
<tr>
<td>16</td>
<td>116</td>
<td>40.0</td>
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<tr>
<td>17</td>
<td>116</td>
<td>42.5</td>
</tr>
<tr>
<td>18</td>
<td>116</td>
<td>45.0</td>
</tr>
<tr>
<td>19</td>
<td>116</td>
<td>47.5</td>
</tr>
<tr>
<td>20</td>
<td>116</td>
<td>50.0</td>
</tr>
<tr>
<td>21</td>
<td>116</td>
<td>52.5</td>
</tr>
<tr>
<td>22</td>
<td>116</td>
<td>55.0</td>
</tr>
<tr>
<td>23</td>
<td>116</td>
<td>57.5</td>
</tr>
<tr>
<td>24</td>
<td>116</td>
<td>60.0</td>
</tr>
<tr>
<td>25</td>
<td>116</td>
<td>62.5</td>
</tr>
</tbody>
</table>
Series **HRS**

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

**High-temperature Environment Specifications**

- **Option symbol**
- **G**
- **HRS 20**
- **GA**

**High-temperature environment specifications**

Makes use at ambient temperatures up to 113°F (45°C) possible. Also increases cooling capacity at ambient temperature of 89.6°F (32°C). (Cooling capacity is equal to standard products at ambient temperatures of less than 89.6°F (32°C)).

| Applicable model | HRS012/018/024-A-20-G | HRS050 cannot be selected.
| Cooling method | Air-cooled refrigeration |
| Power supply | Single-phase 200 to 230 VAC (50/60 Hz) |

* Ventilation slots are added to Thermo-chiller side panels. For this reason, please provide 11.8 inch (300 mm) of ventilation space next to the side panels (do not install with sides touching walls).

**Cooling Capacity**

**HRS012-A-20-G**

<table>
<thead>
<tr>
<th>Circulating fluid temperature [°C]</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling capacity [kW] 77°F</td>
<td>0.5</td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Cooling capacity [kW] 90°F</td>
<td>0.7</td>
<td>1.3</td>
<td>1.9</td>
<td>2.5</td>
<td>3.1</td>
<td>3.6</td>
</tr>
<tr>
<td>Cooling capacity [kW] 104°F</td>
<td>0.9</td>
<td>1.5</td>
<td>2.1</td>
<td>2.7</td>
<td>3.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Cooling capacity [kW] 113°F</td>
<td>1.0</td>
<td>1.6</td>
<td>2.2</td>
<td>2.9</td>
<td>3.4</td>
<td>3.9</td>
</tr>
</tbody>
</table>

**HRS018-A-20-G**

<table>
<thead>
<tr>
<th>Circulating fluid temperature [°C]</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling capacity [kW] 77°F</td>
<td>0.5</td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Cooling capacity [kW] 90°F</td>
<td>0.7</td>
<td>1.3</td>
<td>1.9</td>
<td>2.5</td>
<td>3.1</td>
<td>3.6</td>
</tr>
<tr>
<td>Cooling capacity [kW] 104°F</td>
<td>0.9</td>
<td>1.5</td>
<td>2.1</td>
<td>2.7</td>
<td>3.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Cooling capacity [kW] 113°F</td>
<td>1.0</td>
<td>1.6</td>
<td>2.2</td>
<td>2.9</td>
<td>3.4</td>
<td>3.9</td>
</tr>
</tbody>
</table>

**HRS024-A-20-G**

<table>
<thead>
<tr>
<th>Circulating fluid temperature [°C]</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling capacity [kW] 77°F</td>
<td>0.5</td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Cooling capacity [kW] 90°F</td>
<td>0.7</td>
<td>1.3</td>
<td>1.9</td>
<td>2.5</td>
<td>3.1</td>
<td>3.6</td>
</tr>
<tr>
<td>Cooling capacity [kW] 104°F</td>
<td>0.9</td>
<td>1.5</td>
<td>2.1</td>
<td>2.7</td>
<td>3.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Cooling capacity [kW] 113°F</td>
<td>1.0</td>
<td>1.6</td>
<td>2.2</td>
<td>2.9</td>
<td>3.4</td>
<td>3.9</td>
</tr>
</tbody>
</table>
### Series HRS

#### Optional Accessories

#### Applicable Model List

<table>
<thead>
<tr>
<th>Description</th>
<th>Part No.</th>
<th>HRS012-A</th>
<th>HRS018-A</th>
<th>HRS024-A</th>
<th>HRS025-A</th>
<th>HRS012-W</th>
<th>HRS018-W</th>
<th>HRS024-W</th>
<th>HRS050-W</th>
<th>Option [for-J] [for-T]</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anti-quake bracket</td>
<td>HRS-TK001</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>HRS-TK002</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Piping conversion fitting</td>
<td>HRS-EP001</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>(for air-cooled refrigeration)</td>
<td>HRS-EP002</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HRS-EP009</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HRS-EP010</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Piping conversion fitting</td>
<td>HRS-EP003</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>●</td>
<td>51</td>
</tr>
<tr>
<td>(for water-cooled refrigeration)</td>
<td>HRS-EP004</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<td>—</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HRS-EP011</td>
<td>—</td>
<td>—</td>
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<td>—</td>
<td>—</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HRS-EP012</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>4. Piping conversion fitting</td>
<td>HRS-EP005</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>●</td>
<td>51</td>
</tr>
<tr>
<td>(for automatic water supply inlet)</td>
<td>HRS-EP006</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>(Note 1)</td>
<td>HRS-EP007</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>(Note 2)</td>
<td>HRS-EP008</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>5. Concentration meter</td>
<td>HRS-BP002</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>52</td>
</tr>
<tr>
<td>6. By-pass piping set</td>
<td>HRS-EP001</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>52</td>
</tr>
<tr>
<td>7. Power supply cable</td>
<td>HRS-CA001</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>52</td>
</tr>
<tr>
<td>For single-phase 100/115 VAC</td>
<td>HRS-CA002</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>52</td>
</tr>
<tr>
<td>For single-phase 200 VAC</td>
<td></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>8. DI filter set</td>
<td>HRS-DP001</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>53</td>
</tr>
<tr>
<td>9. Electrical resistance sensor set</td>
<td>HRS-DI001</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>53</td>
</tr>
<tr>
<td>10. Drain pan set</td>
<td>HRS-WL001</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>54</td>
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<tr>
<td></td>
<td>HRS-WL002</td>
<td>—</td>
<td>—</td>
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<td>—</td>
<td>—</td>
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<td></td>
</tr>
<tr>
<td>11. Separately installed power transformer</td>
<td>IDF-TR1000-1</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>IDF-TR1000-2</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IDF-TR1000-3</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IDF-TR1000-4</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IDF-TR2000-9</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IDF-TR2000-10</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IDF-TR2000-11</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
</tbody>
</table>

Note 1) When option J is selected.
Note 2) When option T or HRS050 is selected.
Note 3) For HRS050 should be prepared by the customer.
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: 0.06” (1.6 mm))

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

2 Piping Conversion Fitting (For Air-Cooled Refrigeration)

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

This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, and for drain from Rc 3/8 to G3/8 or NPT3/8. It is not necessary to purchase this when pipe thread type F or N is selected in “How to Order” since it is included in the product.

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

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

HRS050-A□□□□□□□□□□□□□□□□□

This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, and for drain from Rc 1/4 to G1/4 or NPT1/4. It is not necessary to purchase this when pipe thread type F or N is selected in “How to Order” since it is included in the product.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-EP009</td>
<td>G thread conversion fitting set HRS050-A□□□□□□□□□□□□□□□□□</td>
</tr>
<tr>
<td>HRS-EP010</td>
<td>NPT thread conversion fitting set</td>
</tr>
</tbody>
</table>

When the option, with automatic water supply function “-J”, is selected, purchase piping conversion fitting (for option), too.
Conversion fitting for circulating fluid + Conversion fitting for facility water + Conversion fitting for drain outlet
HRS012-W□□, HRS018-W□□, HRS024-W□□

This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, for facility water from Rc3/8 to G3/8 or NPT3/8, and for drain from Rc1/4 to G1/4 or NPT1/4.

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

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

HRS050-W□□

This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, for facility water from Rc3/8 to G3/8 or NPT3/8, and for drain from Rc1/4 to G1/4 or NPT1/4.

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

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

Conversion fitting for automatic water supply inlet
HRS012-W□□-J, HRS018-W□□-J, HRS024-W□□-J, HRS050-W□□-J

This fitting changes the port size for 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.

Conversion fitting for drain outlet
HRS012-W□□-20-T, HRS018-W□□-20-T, HRS024-W□□-20-T, HRS050-W□□-20 Note 1)

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.

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.

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

6. **By-pass Piping Set**

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

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

Note: To be mounted by the customer.

7. **Power Supply Cable**

**For single-phase 100/115 VAC Type**

* Not applicable for the 200 V type.

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

**For single-phase 200 VAC Type**

* Not applicable for the 100 V type.
* Not available for HRS050. It should be prepared by the customer.

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

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

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

9 Electrical Resistance Sensor Set

Electrical resistance value of the circulating fluid (display range: 0 to 4.5 MΩ·cm) can be displayed on the Thermo-chiller operation display panel. It is possible to set alarms for the upper- and lower-limit electrical resistance values. Readout using serial communications (RS-485/RS-232C) can be performed as well. Use in combination with the DI Filter Set (HRS-DP001) or By-pass Piping Set (HRS-BP001) is also possible.

This set is not for controlling the electrical resistance value.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-D1001</td>
<td>HRS012-□□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS018-□□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS024-□□□□□</td>
</tr>
<tr>
<td></td>
<td>HRS050-□□□□□</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-WL001</td>
<td>HRS012/L52408</td>
</tr>
<tr>
<td></td>
<td>HRS018/L52408</td>
</tr>
<tr>
<td></td>
<td>HRS024/L52408</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-WL002</td>
<td>HRS050/L52408</td>
</tr>
</tbody>
</table>

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

Series HRS

54
## Separately Installed Power Transformer

### Specifications

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Applicable model</th>
<th>Volume</th>
<th>Type</th>
<th>Inlet voltage</th>
<th>Outlet voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDF-TR1000-1</td>
<td>HRS012-L-10</td>
<td>1 kVA</td>
<td>Single-phase</td>
<td>110 VAC 120 VAC</td>
<td>100 VAC 100, 110 VAC</td>
</tr>
<tr>
<td>IDF-TR1000-2</td>
<td>HRS012-L-10</td>
<td>1 kVA</td>
<td>Single-phase</td>
<td>110 VAC 120 VAC</td>
<td>100 VAC 100, 110 VAC</td>
</tr>
<tr>
<td>IDF-TR1000-3</td>
<td>HRS012-L-10 HRS018-L-10</td>
<td>1 kVA</td>
<td>Single-phase</td>
<td>240 VAC 240 to 260 VAC</td>
<td>240 VAC</td>
</tr>
<tr>
<td>IDF-TR1000-4</td>
<td>HRS012-L-10 HRS018-L-10</td>
<td>1 kVA</td>
<td>Single-phase</td>
<td>380, 400, 415 VAC 380 to 420 VAC</td>
<td>380 to 420 VAC</td>
</tr>
<tr>
<td>IDF-TR2000-9</td>
<td>HRS012-L-20 HRS018-L-20 HRS024-L-20</td>
<td>2 kVA</td>
<td>Single-phase</td>
<td>420, 440, 480 VAC 420 to 520 VAC</td>
<td>420 to 520 VAC</td>
</tr>
<tr>
<td>IDF-TR2000-10</td>
<td>HRS012-L-20 HRS018-L-20</td>
<td>2 kVA</td>
<td>Single-phase</td>
<td>380, 400, 415 VAC 380 to 420 VAC</td>
<td>380 to 420 VAC</td>
</tr>
<tr>
<td>IDF-TR2000-11</td>
<td>HRS012-L-20 HRS018-L-20</td>
<td>2 kVA</td>
<td>Single-phase</td>
<td>440, 460 VAC 440 to 460, 460 to 500 VAC</td>
<td>440 to 460, 460 to 500 VAC</td>
</tr>
</tbody>
</table>

* For HRS050 should be prepared by the customer.

**IDF-TR1000-1** in (mm)

![Drawing of IDF-TR1000-1](image1)

**IDF-TR1000-2** in (mm)

![Drawing of IDF-TR1000-2](image2)

**IDF-TR1000-3, 4** in (mm)

![Drawing of IDF-TR1000-3, 4](image3)

**IDF-TR2000-9** in (mm)

![Drawing of IDF-TR2000-9](image4)

**IDF-TR2000-10, 11** in (mm)

![Drawing of IDF-TR2000-10, 11](image5)

**Optional Accessories Series HRS**
Series HRS
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 the customer’s machine.*

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

\[
\text{Power consumption } P = 1000 \text{ [W]}
\]

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

Cooling capacity = Considering a safety factor of 20%,

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

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

\[
\text{Power supply output } VI = 1.0 \text{ [kVA]}
\]

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

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%,

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

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

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

\[
\text{Output (shaft power, etc.) } W = 800 \text{ [W]}
\]

\[
Q = P = \frac{W}{\text{Efficiency}}
\]

In this example, use an efficiency of 0.7:

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

Cooling capacity = Considering a safety factor of 20%,

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

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 \( q_m \): \((= \rho \times q_v \div 60) \text{ [kg/s]}\)

Circulating fluid density \( \rho \): 1 [kg/dm³]

Circulating fluid (volume) flow rate \( q_v \): 10 [dm³/min]

Circulating fluid specific heat capacity \( C \): 4.2 \times 10³ [J/(kg·K)]

Circulating fluid outlet temperature \( T_1 \): 293 [K] (20 [°C])

Circulating fluid return temperature \( T_2 \): 295 [K] (22 [°C])

Circulating fluid temperature difference \( \Delta T \): 2.0 [K] (= \( T_2 – T_1 \))

Conversion factor: minutes to seconds (SI units): 60 [s/min]

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

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

\[
= \frac{\rho \times q_v \times C \times \Delta T}{60} = 1 \times 10 \times 4.2 \times 10³ \times 2.0 \]

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

Cooling capacity = Considering a safety factor of 20%,

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

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 \( q_m \): \((= \rho \times q_v \times 60) \text{ [kgf/h]}\)

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 10³ [cal/(kgf·°C)]

Circulating fluid outlet temperature \( T_1 \): 20 [°C]

Circulating fluid return temperature \( T_2 \): 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]

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

\[
= \frac{\gamma \times q_v \times 60 \times C \times \Delta T}{860} = \frac{1 \times 10 \times 60 \times 1.0 \times 10³ \times 2.0}{860}
\]

\[
= \frac{1200000 \text{ [cal/h]}}{860} = \frac{1400 \text{ [W]}}{860}
\]

Cooling capacity = Considering a safety factor of 20%,

\[
1400 \text{ [W]} \times 1.2 = 1680 \text{ [W]}
\]
Cooling Capacity Calculation  

**Series HRS**

**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 \( m \) : \((= \rho x V)\) [kg]

Cooled substance density \( \rho \) : 1 [kg/L]

Cooled substance total volume \( V \) : 20 [dm³]

Cooled substance specific heat capacity \( C \) : 4.2 x 10³ [J/(kg·K)]

Cooled substance temperature when cooling begins \( T_0 \) : 305 [K] (32 °C)

Cooled substance temperature after t hour \( T_t \) : 293 [K] (20 °C)

Cooled substance temperature difference \( \Delta T \) : 12 [K] (\( T_0 - T_t \))

Cooled substance total volume \( V \) : 900 [L] (= 15 [min])

### 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 required flow is achieved, using the pump capacity curves.

### Circulating Fluid Typical Physical Property Values

1. **Density** : \( \rho \) [kg/L] (or, using conventional unit system, weight volume ratio \( \rho \) [kgf/L])

   Specific heat capacity : \( C \) [J/(kg·K)] (or, using conventional unit system, \( C \) [cal/(kgf·°C)])

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

#### Water

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

#### 15% Ethylene Glycol Aqueous Solution

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Density ( \rho ) [kg/L]</th>
<th>Specific heat ( C ) [J/(kg·K)]</th>
<th>Conventional unit system</th>
</tr>
</thead>
<tbody>
<tr>
<td>5°C</td>
<td>1.02</td>
<td>3.91 x 10³</td>
<td>1.02 x 10³</td>
</tr>
<tr>
<td>10°C</td>
<td>1.02</td>
<td>3.91 x 10³</td>
<td>1.02 x 10³</td>
</tr>
<tr>
<td>15°C</td>
<td>1.02</td>
<td>3.91 x 10³</td>
<td>1.02 x 10³</td>
</tr>
<tr>
<td>20°C</td>
<td>1.01</td>
<td>3.91 x 10³</td>
<td>1.01 x 10³</td>
</tr>
<tr>
<td>25°C</td>
<td>1.01</td>
<td>3.91 x 10³</td>
<td>1.01 x 10³</td>
</tr>
<tr>
<td>30°C</td>
<td>1.01</td>
<td>3.91 x 10³</td>
<td>1.01 x 10³</td>
</tr>
<tr>
<td>35°C</td>
<td>1.01</td>
<td>3.91 x 10³</td>
<td>1.01 x 10³</td>
</tr>
<tr>
<td>40°C</td>
<td>1.01</td>
<td>3.82 x 10³</td>
<td>1.01 x 10³</td>
</tr>
</tbody>
</table>

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

---

### Warning

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

2. **When attempting to cool areas that are open to the atmosphere (tanks, pipes), plan your piping system accordingly.**
   - When cooling open-air external tanks, arrange the piping so that there are coil pipes for cooling inside the tanks, and to carry back the entire flow volume of circulating fluid that is released.

---

### Selection

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

---

### Handling

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

---

### Operating Environment/Storage Environment

1. **Do not use in the following environment because it will lead to a breakdown.**
   - 1) Environment like written in “Temperature Control Equipment Precautions”
   - 2) Locations where spatter will adhere to when welding
   - 3) Locations where it is likely that the leakage of inflammable 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

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.

---

### Circulating Fluid

**Clear Water (as Circulating Fluid) Quality Standards**

The Japan Refrigeration and Air Conditioning Industry Association

JRA GL-02-1994 “Cooling water system – Circulation type – Make-up water”

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Standard value</th>
<th>Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (at 77°F (25°C))</td>
<td>—</td>
<td>6.0 to 8.0</td>
<td>○</td>
</tr>
<tr>
<td>Electrical conductivity (77°F [25°C]) [μS/cm]</td>
<td>—</td>
<td>100° to 300°</td>
<td>○</td>
</tr>
<tr>
<td>Chloride ion (Cl⁻)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
</tr>
<tr>
<td>Sulfuric acid ion (SO₄²⁻)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
</tr>
<tr>
<td>Add consumption amount (at pH 8)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
</tr>
<tr>
<td>Total hardness</td>
<td>[mg/L]</td>
<td>70 or less</td>
<td>○</td>
</tr>
<tr>
<td>Calcium hardness (CaCO₃)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
</tr>
<tr>
<td>Ionic state silica (SiO₂)</td>
<td>[mg/L]</td>
<td>30 or less</td>
<td>○</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>○</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td>○</td>
</tr>
<tr>
<td>Sulfide ion (S₂⁻)</td>
<td>[mg/L]</td>
<td>Should not be detected</td>
<td>○</td>
</tr>
<tr>
<td>Ammonium ion (NH₄⁺)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td>○</td>
</tr>
<tr>
<td>Residual chlorine (Cl)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>○</td>
</tr>
<tr>
<td>Free carbon (CO₂)</td>
<td>[mg/L]</td>
<td>4.0 or less</td>
<td>○</td>
</tr>
</tbody>
</table>

---

* In the case of [μS/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%.**
   - Overtly high concentrations can cause a pump overload.
   - Low concentrations, however, can lead to freezing when circulating fluid temperature is 50°F (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.

---

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800-999-7378
## Warning

### Facility Water Supply

**Water-cooled refrigeration**

1. Supply pressure of 72.5 psi (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 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.

### Operation

**Warning**

1. **Confirmation before operation**
   - 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. **Confirmation during operation**
   - Check the circulating fluid temperature.
     - The operating temperature range of the circulating fluid is between 41 and 104°F (5 and 40°C).

   - If the temperature is too high, the protection circuit will activate and an operation may not be performed or will stop.
     - Power supply voltage is not within the rated voltage range of ±10%.
     - In case the water level inside the tank is reduced abnormally.
     - Circulating fluid temperature is too high.
     - Compared to the cooling capacity, the heat generation amount of a customer's machine is too high.
     - Ambient temperature is too high. (104°F (40°C) or higher)
     - Refrigerant pressure is too high.
     - Ventilation hole is clogged with dust or dirt.

3. **Emergency stop method**
   - When an abnormality is confirmed, stop the machine immediately. After pushing the [OFF] switch, be sure to turn off the power switch.

### Maintenance

**Caution**

1. If operating in the below conditions, the protection circuit will activate and an operation may not be performed or will stop.
   - Power supply voltage is not within the rated voltage range of ±10%.
   - In case the water level inside the tank is reduced abnormally.
   - Circulating fluid temperature is too high.
   - Compared to the cooling capacity, the heat generation amount of a customer's machine is too high.
   - Ambient temperature is too high. (104°F (40°C) or higher)
   - Refrigerant pressure is too high.
   - Ventilation hole is clogged with dust or dirt.

**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.
   - 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.

   - 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**

   - 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.

**Caution**

1. If operating in the below conditions, the protection circuit will activate and an operation may not be performed or will stop.
   - Power supply voltage is not within the rated voltage range of ±10%.
   - In case the water level inside the tank is reduced abnormally.
   - Circulating fluid temperature is too high.
   - Compared to the cooling capacity, the heat generation amount of a customer's machine is too high.
   - Ambient temperature is too high. (104°F (40°C) or higher)
   - Refrigerant pressure is too high.
   - Ventilation hole is clogged with dust or dirt.
Refrigerated Thermo-chiller Series HRZ

- Type of circulating fluid: Fluorinated fluids/Ethylene glycol aqueous solution/Clear water, Deionized water
- Temperature range setting: –4°F to 104°F / 68°F to 194°F / –4°C to 194°C
- Cooling capacity: 1 kW / 2 kW / 4 kW / 8 kW / 10 kW to Max. 15 kW
- Temperature stability: ±0.18°F (±0.1°C)
- Refrigerant: R404A (HFC) / R134a (HFC)

More effective energy-saving is achieved through use of a DC inverter compressor and an inverter pump.

International standards: CE, SEMATECH S2-93, S8-95, SEMI Standard S2-0703, S8-0701, F47-0200
Energy-Saving

- **Power consumption:**
  - **Max. 40% reduction** (SMC comparison)
  
  In addition to the optimum control of the expansion valve by the original controller, by recycling the heat emitted from the facility water, power consumption is dramatically reduced.

<table>
<thead>
<tr>
<th>Existing model</th>
<th>HRZ002-L</th>
<th>3.9 kWh/h</th>
</tr>
</thead>
</table>

  Operating conditions: 14°F (-10°C), 0 kW with 50% load, 2 kW with 50% load

  - **Reduced running cost**
  - **Contribution to the environmental preservation**

- **Circulating fluid:**
  - **Max. 40% reduction** (SMC comparison)

  Enhanced temperature control technology and the dual tank construction achieved the reduced circulating fluid required for operation.

<table>
<thead>
<tr>
<th>Existing model</th>
<th>HRZ002-H</th>
<th>3.2 gal (12 L)</th>
</tr>
</thead>
</table>

  Comparison of the required circulating fluid inside a Thermo-chiller

  - **Reduced initial cost**
  - **Contribution to the environmental preservation**

**Double Inverter Type**

More effective energy-saving is achieved through use of a DC inverter compressor and an inverter pump.

- **Power consumption:**
  - **Max. 82% reduction** (SMC comparison)

<table>
<thead>
<tr>
<th>Existing model</th>
<th>HRZ10-WS</th>
<th>1.1 kWh/h</th>
</tr>
</thead>
</table>

  Operating conditions: 14°F (-10°C), 0 kW with 50% load, 2 kW with 50% load

- **Facility water:**
  - **Max. 75% reduction** (SMC comparison)

  Enhanced performance of a heat exchanger, recycle use of the emitted heat and the reduced power consumption achieved the reduced facility water amount.

<table>
<thead>
<tr>
<th>Existing model</th>
<th>HRZ002-L</th>
<th>1.3 gpm (5 L/min)</th>
</tr>
</thead>
</table>

  Operating conditions: 14°F (-10°C), 0 kW with 50% load, 2 kW with 50% load

  - **Reduced facilities investment**
  - **Space saved facility water equipment**
  - **Reduced running cost**

**High Performance**

- **Temperature stability:** ±0.18°F (±0.1°C)
  
  Enhanced temperature control technology achieved ±0.18°F (±0.1°C) temperature stabilities when a load is stable.

<table>
<thead>
<tr>
<th>Circulating fluid temperature (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ004-L</td>
</tr>
<tr>
<td>120 sec.</td>
</tr>
</tbody>
</table>

- **Cooling time:** **Max. 43% reduction** (SMC comparison)

  Special temperature control technology achieved the utmost performance, resulting in the reduced cooling time.

<table>
<thead>
<tr>
<th>Circulating fluid temperature (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ004-L</td>
</tr>
<tr>
<td>104</td>
</tr>
</tbody>
</table>

**SMC**

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Space-Saving

Installation area:
Max. 29% reduction (SMC comparison)
By emitting the heat from the rear side, ventilation slits on the side are unnecessary offering reduced installation space.

Existing model: Body space: W 15.7 in (400 mm) x D 33.3 in (845 mm)
Ventilation space: 3.9 in (100 mm)

HRZ008-H: Body space: W 15 in (380 mm) x D 34.3 in (870 mm)
Ventilation space: 0

Leakless

All in tank
Housing the pump or heat exchanger inside the tank has eliminated any external leakage of the circulating fluid.

Cooling capacity: Max. 15 kW
Up to 15 kW cooling capacity achieved.

Communications

- Contact input/output signal
- Serial RS-485 communication
- Analog communication (Refer to “Options” on page 90.)
- DeviceNet communication (Refer to “Options” on page 90.)

Wetted parts adopt the materials compatible for various circulating fluids.
(Stainless steel, EPDM, etc.)

- Fluorinated fluids: Flourinert™ FC-3283, FC-40
  GALDEN® HT135, HT200
- 60% ethylene glycol aqueous solution
- Deionized water/Clear water

Regarding the fluid other than the above, please contact SMC.
Flourinert™ is a trademark of 3M. GALDEN® is a registered trademark of Solvay Solexis, Inc.

Existing model: Body space: W 15.7 in (400 mm) x D 33.3 in (845 mm)
Ventilation space: 3.9 in (100 mm)

HRZ008-H: Body space: W 15 in (380 mm) x D 34.3 in (870 mm)
Ventilation space: 0

Cooling capacity: 15 kW

Circulating fluid temperature setting (°C)

Value: 10.0 ft² (0.93 m²)

Value: 7.1 ft² (0.66 m²)
Easy Maintenance

Circulating fluid automatic recovery function (Refer to “Options” on page 91.)
Circulating fluid inside a Thermo-chiller tank can be recovered automatically.
(Recovery volume: 4.0 to 4.5 gal (15 to 17 L))
- Reduced maintenance time
- Faster operation
- Reduced circulating liquid loss by evaporation or spill

Circulating fluid electrical resistance ratio control function (Refer to “Options” on page 90.)
(DI control kit)

Easy maintenance
- Checking the electrical component parts accessible from the front side only
- Possible to replace the maintenance parts (such as a pump) without removing the pipings and discharging the circulating fluid.
- Various alarm displays (Refer to page 86.)
### Application Examples

#### Semiconductor
- Example: Temperature control of chamber electrode
  - Upper electrode
  - Lower electrode
- Water

- Etching equipment
- Spatter equipment
- Cleaning equipment
- Coating equipment
- Dicing equipment
- Tester, etc.

### Medical
- Example: Blood preservation
  - X-ray instrument
  - MRI
  - Blood preservation equipment

- Electronic microscope
- Electron microscope
- X-ray instrument
- Gas chromatography
- Sugar level analytical instrument, etc.

### Food
- Example: Tofu (Bean curd) production
  - Water temperature control for forming tofu by mixing the boiled soybean milk and bittern
  - Bottle-cleaning machine
  - Tofu (Bean curd) production equipment
  - Noodle-making machine, etc.

- X-ray instrument
- MRI
- Blood preservation equipment

### Analysis
- Example: Electronic microscope
  - Electronic microscope
  - Electron microscope
  - X-ray analytical instrument
  - Gas chromatography
  - Sugar level analytical instrument, etc.

- X-ray instrument
- MRI
- Blood preservation equipment

### Machine tool
- Example: Laser machining
  - Temperature-controlling the laser generating tube enables the laser wavelength to be optimised, improving the accuracy of the machined cross sectional area.
  - Wire cutting
  - Grinder
  - Spot welding
  - Plasma welding
  - Laser machining, etc.

- Offset printing machine
- Automatic developing machine
- UV equipment, etc.

### Printing
- Example: Printing temperature control
  - Temperature-controlling the ink roller enables to control the evaporation amount and viscosity of an ink and optimise the tint of colors.
  - Ink roller

- Offset printing machine
- Automatic developing machine
- UV equipment, etc.

### Molding
- Example: Injection molding
  - Temperature-controlling the mold results in improved product quality.
  - Plastic molding
  - Rubber molding
  - Wire cable coating machine
  - Injection molding, etc.
**Circulating fluid circuit**

With the *circulating pump*, circulating fluid will be discharged to the customer's machine side. After the circulating fluid will heat or cool the customer's machine side, it will be returned to the *main tank* via the *heat exchanger*.

A *sub-tank* is not used under the normal operation. It will be used when a circulating fluid is recovered from the customer's machine side.

The *internal pump* is used to transfer a circulating fluid from the *sub-tank* to the *main tank*. (Refer to "Circulating fluid automatic recovery function" on page 64.)

**Refrigeration circuit**

When the circulating fluid temperature is rising higher than the set temperature, open the *expansion valve (a)* to introduce refrigerant gas at a lower temperature to the *heat exchanger*. With this, the circulating fluid will be cooled down.

Oppositely, when the circulating fluid is getting lower against the set temperature, open the *expansion valve (b)* and introduce refrigerant gas at a high temperature without going through the *water-cooled condenser* to the *heat exchanger*. With this heat, the circulating fluid will be heated.
Model Selection
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- Required Cooling Capacity Calculation ........ Page 69, 70
- Precautions on Model Selection ....................... Page 70
- Circulating Fluid Typical Physical Property Values ........ Page 71

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  How to Order/Specifications ....................... Page 72
  Cooling/Heating Capacity ....................... Page 73
  Pump Capacity ........................................ Page 74

- Ethylene Glycol Type
  How to Order/Specifications ....................... Page 75
  Cooling/Heating Capacity ....................... Page 76
  Pump Capacity ........................................ Page 77

- Clear Water/Deionized Water Type
  How to Order/Specifications ....................... Page 78
  Cooling/Heating Capacity, Pump Capacity .......... Page 79

- Double Inverter Type
  How to Order/Specifications ....................... Page 80
  Cooling/Heating Capacity, Pump Capacity .......... Page 81

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  Dimensions ........................................ Page 82, 83
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  - Contact Input/Output ................................ Page 84
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  - Connector Position ................................ Page 85
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  - By-pass Piping Set ................................ Page 87
  - Anti-quake Bracket ................................ Page 87
  - 4-Port Manifold .................................... Page 88
  - DI Filter .......................................... Page 88
  - Insulating Material for DI Filter .............. Page 88
  - 60% Ethylene Glycol Aqueous Solution ........ Page 89
  - Concentration Meter ................................ Page 89

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  - Analog Communication ....................... Page 90
  - DeviceNet Communication ....................... Page 90
  - NPT Fitting ........................................ Page 90
  - DI Control Kit .................................... Page 90
  - Circulating Fluid Automatic Recovery ....... Page 91
  Specific Product Precautions ....................... Page 92 to 94
1. How much is the temperature in degrees centigrade for the circulating fluid?

Temperature range which can be set with the Thermo-chiller

L: –4 to 104°F (–20 to 40°C) ("L2" (clear water, deionized water specification) can be set 50 to 104°F (10 to 40°C).
H: –68 to 194°F (20 to 90°C)
W: –4 to 194°F (–20 to 90°C) (Select “W” only when the temperature ranges of “L” or “H” are not applicable. HRZ010-W2S (clear water, deionized water specification) can be set 50 to 140°F (10 to 60°C)).

Example) Customer requirement: 122°F (50°C) (Temperature range 68 to 194°F (20 to 90°C), “H” type will be appropriate.)

2. What kind of the circulating fluids will be used?

Relationship between circulating fluid (which can be used with the Thermo-chiller) and temperature

<table>
<thead>
<tr>
<th>Temperature (°F)</th>
<th>Circulating Fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td>–4</td>
<td>Fluorinert™ FC-3283/GALDEN® HT135</td>
</tr>
<tr>
<td>50</td>
<td>Fluorinert™ FC-40/GALDEN® HT200</td>
</tr>
<tr>
<td>68</td>
<td>60% ethylene glycol aqueous solution</td>
</tr>
<tr>
<td>104</td>
<td>Clear water/Deionized water</td>
</tr>
<tr>
<td>140</td>
<td>Fluorinert™ Fluorinert™ FC-40/GALDEN® HT200</td>
</tr>
<tr>
<td>194</td>
<td></td>
</tr>
</tbody>
</table>

Example) Customer requirement: Fluorinated fluids

Based on the results 1. and 2., Cooling capacity relating “Fluorinated fluids” and “Temperature range 68 to 194°F (20 to 90°C)” is shown on page 73.

3. What is the kW for the required cooling capacity?

* To calculate the cooling capacity, referring to the following pages.

Example) Customer requirement: 5 kW

Plot the point of intersection between the operating temperature (122°F (50°C)) and the cooling capacity (5 kW) in the cooling capacity graph.

[Cooling Capacity Graph] Circulating Fluid: Fluorinert Fluids, Temperature Range: 68 to 194°F (20 to 90°C)

The point plotted in the graph is the requirement from your customer. Select the Thermo-chiller models exceeding this point. In this case, select the HRZ004-H.
Required Cooling Capacity Calculation

**Example 1: When the heat generation amount in the customer's machine is known.**

Heat generation amount \( Q \): 3.5 kW

Cooling capacity = Considering a safety factor of 20%, \( 3.5 \times 1.2 = 4.2 \text{ kW} \)

**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 \( Q \): Unknown
- Circulating fluid temperature difference \( \Delta T = (T_2 - T_1) \): 6.0°C (6.0 K)
- Circulating fluid outlet temperature \( T_1 \): 20°C (293.15 K)
- Circulating fluid return temperature \( T_2 \): 26°C (299.15 K)
- Circulating fluid flow rate \( L \): 20 L/min
- Circulating fluid: Fluorinated fluid
  - Density \( \gamma \): 1.80 \(\times\) 10\(^3\) kg/m\(^3\)
  - Specific heat \( C \): 0.96 \(\times\) 10\(^3\) J/(kg K)
  - (at 20°C)

\* Refer to page 71 for the typical physical property values by circulating fluid.

\[
Q = \frac{\Delta T \times L \times \gamma \times C}{60 \times 1000} = \frac{6.0 \times 20 \times 1.80 \times 10^3 \times 0.96 \times 10^3}{60 \times 1000} = 3456 \text{ W} = 3.5 \text{ kW}
\]

Cooling capacity = Considering a safety factor of 20%, \( 3.5 \times 1.2 = 4.2 \text{ kW} \)

---

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

- Unknown
- 6.0°C
- 20°C
- 26°C
- 1.2 m\(^3\)/h
- Fluorinated fluid
  - Density \( \gamma \): 1.80 \(\times\) 10\(^3\) kg/m\(^3\)
  - Specific heat \( C \): 0.23 kcal/kg°C
  - (at 20°C)

\* Refer to page 71 for the typical physical property values by circulating fluid.

\[
Q = \frac{\Delta T \times L \times \gamma \times C}{860} = \frac{6.0 \times 1.2 \times 1.80 \times 10^3 \times 0.23}{860} = 3.5 \text{ kW}
\]

Cooling capacity = Considering a safety factor of 20%, \( 3.5 \times 1.2 = 4.2 \text{ kW} \)
**Series HRZ**

**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.

  Cooled substance total volume \( V \) : 60 L
  Cooling time \( h \) : 15 min
  Cooling temperature difference \( \Delta T \) : (20°C (20 K))
    \[ (40°C – 20°C \rightarrow 20°C) \]
  Circulating fluid : Fluorinated fluid
    Density \( \gamma \) : 1.80 \( \times \) 10\(^3\) kg/m\(^3\)
    Specific heat \( C \) : 0.96 \( \times \) 10\(^3\) J/(kg·K)
    (at 20°C)

  *Refer to page 71 for the typical physical property values by circulating fluid.

\[
Q = \frac{\Delta T \times V \times \gamma \times C}{h \times 60 \times 1000} = \frac{20 \times 60 \times 1.80 \times 10^3 \times 0.96 \times 10^3}{15 \times 60 \times 1000} = 2304 \text{ W} = 2.3 \text{ kW}
\]

Cooling capacity = Considering a safety factor of 20%,

\( 2.3 \times 1.2 = 2.8 \text{ kW} \) (When the circulating fluid temperature is 20°C.)

(In this case, selected Thermo-chiller model will be either HRZ002-L or HRZ004-H.)

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

- Fluorinated fluid
  Density \( \gamma \) : 1.80 \( \times \) 10\(^3\) kg/m\(^3\)
  Specific heat \( C \) : 0.96 \( \times \) 10\(^3\) J/(kg·K)
  (at 20°C)

  *Refer to page 71 for the typical physical property values by circulating fluid.

\[
Q = \frac{\Delta T \times V \times \gamma \times C}{h \times 860} = \frac{20 \times 0.06 \times 1.80 \times 10^3 \times 0.23}{0.25 \times 860} = 2.3 \text{ kW}
\]

Cooling capacity = Considering a safety factor of 20%,

\( 2.3 \times 1.2 = 2.8 \text{ kW} \) (When the circulating fluid temperature is 20°C.)

(In this case, selected Thermo-chiller model will be either HRZ002-L or HRZ004-H.)

---

**Precautions on Model Selection**

1. **Heating capacity**
   - When setting the circulating fluid temperature at a higher temperature than the room temperature, the circulating fluid temperature will be heated with the Thermo-chiller. Heating capacity varies depending on the model of the HRZ series. Also, the heating capacity varies depending on the circulating fluid temperature. Consider the heat radiation amount or thermal capacity of the customer's machine. Check beforehand if the required heating capacity is provided, based on the heating capacity graph for the respective model.

2. **Pump capacity**
   - **<Circulating fluid flow rate>**
     - Pump capacity varies depending on the model selected from the HRZ series. Also, circulating fluid flow varies depending on the circulating fluid discharge pressure. Consider the installation height difference between our 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 for each respective model.
   - **<Circulating fluid discharge pressure>**
     - Circulating fluid discharge pressure has the possibility to increase up to the maximum pressure in the pump capacity curves for the respective model. Check beforehand if the circulating fluid pipings or circulating fluid circuit of the customer's machine are fully durable against this pressure.
Fluorinated Fluids

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Density $\gamma$ [kg/m$^3$] [g/L]</th>
<th>Specific heat C $\gamma$ [J/(kg*K)]</th>
<th>((kcal/kg·°C))</th>
</tr>
</thead>
<tbody>
<tr>
<td>$-10^\circ$C</td>
<td>$1.87 \times 10^3$</td>
<td>$0.87 \times 10^3$</td>
<td>(0.21)</td>
</tr>
<tr>
<td>$20^\circ$C</td>
<td>$1.80 \times 10^3$</td>
<td>$0.96 \times 10^3$</td>
<td>(0.23)</td>
</tr>
<tr>
<td>$50^\circ$C</td>
<td>$1.74 \times 10^3$</td>
<td>$1.05 \times 10^3$</td>
<td>(0.25)</td>
</tr>
<tr>
<td>$80^\circ$C</td>
<td>$1.67 \times 10^3$</td>
<td>$1.14 \times 10^3$</td>
<td>(0.27)</td>
</tr>
</tbody>
</table>

60% Ethylene Glycol Aqueous Solution

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Density $\gamma$ [kg/m$^3$] [g/L]</th>
<th>Specific heat C $\gamma$ [J/(kg*K)]</th>
<th>((kcal/kg·°C))</th>
</tr>
</thead>
<tbody>
<tr>
<td>$-10^\circ$C</td>
<td>$1.10 \times 10^3$</td>
<td>$3.02 \times 10^3$</td>
<td>(0.72)</td>
</tr>
<tr>
<td>$20^\circ$C</td>
<td>$1.08 \times 10^3$</td>
<td>$3.15 \times 10^3$</td>
<td>(0.75)</td>
</tr>
<tr>
<td>$50^\circ$C</td>
<td>$1.06 \times 10^3$</td>
<td>$3.27 \times 10^3$</td>
<td>(0.78)</td>
</tr>
<tr>
<td>$80^\circ$C</td>
<td>$1.04 \times 10^3$</td>
<td>$3.40 \times 10^3$</td>
<td>(0.81)</td>
</tr>
</tbody>
</table>

Water

Density $\gamma$: $1 \times 10^3$ [kg/m$^3$] [g/L]
Specific heat C: $4.2 \times 10^3$ [J/(kg*K)] (1.0 [kcal/kg·°C])
### Specifications

#### Fluorinated Fluid Type

**HRZ**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Cooling capacity</th>
<th>Temperature range setting</th>
<th>Temperature range setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>1 kW</td>
<td>L –4 to 104°F (~20 to 40°C)</td>
<td>L –4 to 104°F (~20 to 40°C)</td>
</tr>
<tr>
<td>002</td>
<td>2 kW</td>
<td>H 69 to 194°F (20 to 90°C)</td>
<td>H 69 to 194°F (20 to 90°C)</td>
</tr>
<tr>
<td>004</td>
<td>4 kW</td>
<td>W –4 to 194°F (~20 to 90°C)</td>
<td>W –4 to 194°F (~20 to 90°C)</td>
</tr>
<tr>
<td>008</td>
<td>8 kW</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

#### Option

- Nil
- None
- C Analog communication
- D Device/Net communication
- N NPT fitting
- Z Circulating fluid automatic recovery

#### Fluorinated Fluid Type

- **HRZ001-L**
- **HRZ002-L**
- **HRZ004-L**
- **HRZ008-L**
- **HRZ001-H**
- **HRZ002-H**
- **HRZ004-H**
- **HRZ008-H**
- **HRZ002-W**
- **HRZ008-W**

#### Model

- **HRZ001-L**
- **HRZ002-L**
- **HRZ004-L**
- **HRZ008-L**
- **HRZ001-H**
- **HRZ002-H**
- **HRZ004-H**
- **HRZ008-H**
- **HRZ002-W**
- **HRZ008-W**

#### Refrigerant

- R404A (HFC)

#### Control system

- PID control

#### Ambient temp./humidity

- Temperature: 50 to 95°F (10 to 35°C); Humidity: 30 to 70% RH

#### Circulating fluid system

- **Fluorinert™ FC-3283/GALDEN® HT135**
- **Fluorinert™ FC-40/GALDEN® HT200**

#### Pressure range

- 44 to 102 psi (0.3 to 0.7 MPa)

#### Power supply

- 3-phase 200 VAC 50 Hz, 3-phase 208 VAC 60 Hz

#### Weight

- 375 (170) lb (kg)
- 386 (175)
- 606 (275)
- 320 (145)
- 375 (170)

#### Electrical system

- UL, CE marking, SEMI (S2-0703, S8-0701, F47-0200), SEMATECH (S2-93, S8-95)

---

**Note 1** It should have no condensation.

**Note 2** Fluorinert™ is a trademark of 3M and GALDEN® is a registered trademark of Solvay Solexis, Inc. Regarding the fluid other than the above, please contact SMC.

**Note 3** Cooling capacity

**Note 4** Value with a stable load without turbulence in the operating conditions. It may be out of this range depending on operating conditions.

**Note 5** The capacity at the Thermo-chiller outlet when the circulating fluid temperature is 68°F (20°C).

**Note 6** Fluorinert™ FC-3283/GALDEN® HT135

**Note 7** Minimum volume required for operating only the Thermo-chiller. (Circulating fluid temperature: 68°F (20°C), including the Thermo-chiller’s internal pipings or heat exchanger)

**Note 8** Preliminary space volume without main tank capacity. Available for collecting the circulating fluid inside an external piping or for preliminary injection.

**Note 9** Required flow rate when a load for the cooling capacity is applied at a facility water temperature of 77°F (25°C).

**Note 10** Weight in the dry state without circulating fluids.

---

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SHOP ONLINE at www.airlinehyd.com

800-999-7378
Cooling Capacity

HRZ001-L/002-L/004-L/008-L

HRZ001-H/002-H/004-H/008-H

Heating Capacity

HRZ001-L/002-L/004-L/008-L

HRZ001-H/002-H/004-H/008-H

HRZ002-W/008-W

HRZ002-W/008-W
Series HRZ

Pump Capacity (Thermo-chiller Outlet)

HRZ001-L/002-L/004-L

HRZ008-L

HRZ001-H/002-H

HRZ004-H/008-H

HRZ002-W/008-W

When the circulating fluid flow is below 1.58 gpm (6 L/min), the in-built operation stop alarm will be activated. It is not possible to run the equipment. (common for all models)
## Specifications

### Control system
- PID control

### Refrigerant
- R404A (HFC)

### Ambient temp./humidity
- Temperature: 50 to 95°F (10 to 35°C), Humidity: 30 to 70% RH

### Circulating fluid system
- 60% ethylene glycol aqueous solution

#### Temp. range setting
- -4 to 104°F (-20 to 40°C)
- 68 to 194°F (20 to 90°C)
- -4 to 194°F (-20 to 90°C)

#### Cooling capacity
- HRZ001-L1 1 kW
- HRZ002-L1 2 kW
- HRZ004-L1 4 kW
- HRZ008-L1 8 kW

### Heating capacity
- Approx. 4.0 gal (15 L)
- Approx. 3.2 gal (12 L)
- Approx. 4.0 gal (15 L)

### Pump capacity
- 36/58 psi (0.25/0.40 MPa)
- 36/58 psi (0.25/0.40 MPa)
- 36/58 psi (0.25/0.40 MPa)

### Pressure range
- 44 to 102 psi (0.3 to 0.7 MPa)
- 44 to 102 psi (0.3 to 0.7 MPa)
- 44 to 102 psi (0.3 to 0.7 MPa)

### Electric input
- 200 VAC (50/60 Hz) ±10%

### Wetted parts material
- Stainless steel, EPDM, Copper brazing (Heat exchanger)
- Silicone, Fluoro resin

### Communications
- Contact input/output (D-sub 25 pin) and Serial RS-485 (D-sub 9pin)

### Weight
- 375 (170) lb (kg)

### Safety standards
- UL, CE marking, SEMI (S2-0703, S8-0701, F47-0200), SEMATECH (S2-93, S8-95)

### Notes
- Note 1: It should have no condensation.
- Note 2: Dillute pure ethylene glycol with clear water. Additives such as preservatives cannot be used.
- Note 4: Value with a stable load without turbulence in the operating conditions. May be out of this range when a DI control kit (option Y) is used or in some other operating conditions.
- Note 5: The capacity at the Thermo-chiller outlet when the circulating temperature is 68°F (20°C).
- Note 6: Required flow rate for cooling capacity or maintaining the temperature stability. When used below the rated flow, use the individually sold, “By-pass Piping Set” (Refer to page 87).
Series HRZ

Cooling Capacity

HRZ001-L1/002-L1/004-L1/008-L1

HRZ001-H1/002-H1/004-H1/008-H1

Heating Capacity

HRZ001-L1/002-L1/004-L1/008-L1

HRZ001-H1/002-H1/004-H1/008-H1

HRZ002-W1/008-W1

HRZ002-W1/008-W1
Pump Capacity (Thermo-chiller Outlet)

HRZ001-L1/002-L1/004-L1
HRZ004-H1/008-H1
HRZ002-W1/008-W1

HRZ008-L1

HRZ001-H1/002-H1

When the circulating fluid flow is below 1.58 gpm (6 L/min), the in-built operation stop alarm will be activated.
It is not possible to run the equipment. (common for all models)
## Specifications

(For details, please consult our “Product Specifications” information.)

### How to Order

**Clear/Deionized Water Type**

<table>
<thead>
<tr>
<th>Model</th>
<th>HRZ001-L2</th>
<th>HRZ002-L2</th>
<th>HRZ004-L2</th>
<th>HRZ008-L2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cooling method</strong></td>
<td>Water-cooled refrigeration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Refrigerant</strong></td>
<td>R134a (HFC)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control system</strong></td>
<td>PID control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ambient temperature/humidity</strong></td>
<td>Temperature: 50 to 95°F (10 to 35°C), Humidity: 30 to 70%RH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Circulating fluid</strong></td>
<td>Clear water, Deionized water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Temperature range setting</strong></td>
<td>50 to 104°F (10 to 40°C)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cooling capacity</strong></td>
<td>(kW)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0 (at 68°F (20°C))</td>
<td>2.0 (at 68°F (20°C))</td>
<td>4.0 (at 68°F (20°C))</td>
<td>8.0 (at 68°F (20°C))</td>
<td></td>
</tr>
<tr>
<td><strong>Heating capacity</strong></td>
<td>(kW)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.90 (at 68°F (20°C))</td>
<td>0.98 (at 68°F (20°C))</td>
<td>1.15 (at 68°F (20°C))</td>
<td>1.25 (at 68°F (20°C))</td>
<td></td>
</tr>
<tr>
<td><strong>Temperature stability</strong></td>
<td>±0.18°F (±0.1°C)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pump capacity</strong></td>
<td>5.3 gpm (20 L/min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Main tank capacity</strong></td>
<td>Approx. 4 gal (15 L)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sub-tank capacity</strong></td>
<td>Approx. 4.2 gal (16 L)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Port size</strong></td>
<td>Rc3/4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wetted parts material</strong></td>
<td>Stainless steel, EPDM, Copper brazing (Heat exchanger), PPS, Silicone, Fluororesin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td>43.5 to 102 psi (50 to 77°F (10 to 25°C))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pressure range</strong></td>
<td>0.3 to 0.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Required flow rate</strong></td>
<td>1.3/1.3 gpm (5/5 L/min)</td>
<td>1.6/1.6 gpm (6/6 L/min)</td>
<td>4.6/8.8 gpm (15/22 L/min)</td>
<td>4.8/6.1 gpm (18/23 L/min)</td>
</tr>
<tr>
<td><strong>Port size</strong></td>
<td>Rc1/2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wetted parts material</strong></td>
<td>Stainless steel, EPDM, Copper brazing (Heat exchanger), Silicone, Brass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>3-phase 200 VAC 50 Hz, 3-phase 200 to 208 VAC 60 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Breaker capacity</strong></td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated current</strong></td>
<td>19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Communications</strong></td>
<td>Contact input/output (D-sub 25 pin) and Serial RS-485 (D-sub 9 pin) (Refer to pages 84 and 85.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>375 lbs (170 kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Safety standards</strong></td>
<td>UL, CE marking, SEMI (S2-0703, S8-0701, F47-0200), SEMATECH (S2-93, S8-95)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes

1. It should have no condensation.
2. If clear water or deionized water is used, please use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JIRA GL-02-1994/circulating water system - circulation type - make-up water). The minimum electrical conductivity of the deionized water used as the fluid should be 0.5 µS/cm (or electrical resistivity 2 MΩ•cm at maximum).
4. Value with a stable load without turbulence in the operating conditions. It may be out of this range when a DI control kit (option Y) is used or in some other operating conditions.
5. The capacity at the Thermo-chiller outlet when the circulating fluid temperature is 68°F (20°C).
6. Required flow rate for cooling capacity or maintaining the temperature stability. When used below the rated flow, use the individually sold, “By-pass Piping Set” (Refer to page 87).
7. Minimum volume required for operating only the Thermo-chiller. (Circulating fluid temperature: 68°F (20°C), including the Thermo-chiller’s internal pipings or heat exchanger)
8. Preliminary space volume without main tank capacity. Available for collecting the circulating fluid inside an external piping or for preliminary injection.
9. Required flow rate when a load for the cooling capacity is applied at a facility water temperature of 77°F (25°C).
10. Weight in the dry state without circulating fluids.
Thermo-chiller Series HRZ

**Cooling Capacity**

| HRZ001-L2/002-L2/004-L2/008-L2 |

![Cooling Capacity Graph](image)

**Heating Capacity**

| HRZ001-L2/002-L2/004-L2/008-L2 |

![Heating Capacity Graph](image)

**Pump Capacity (Thermo-chiller Outlet)**

| HRZ001-L2/002-L2/004-L2/008-L2 |

![Pump Capacity Graph](image)

*When the circulating fluid flow is below 1.58 gpm (6 L/min), the in-built operation stop alarm will be activated. It is not possible to run the equipment. (common for all models)*
### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>HRZ010-WS</th>
<th>HRZ010-W1S</th>
<th>HRZ010-W2S</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cooling method</strong></td>
<td>Water-cooled refrigeration</td>
<td>R404A (HFC)</td>
<td></td>
</tr>
<tr>
<td><strong>Control system</strong></td>
<td>PID control</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ambient temperature/humidity</strong></td>
<td>Temperature: 50 to 95°F (10 to 35°C), Humidity: 30 to 70%RH</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Circulating fluid type</strong></td>
<td>Nil</td>
<td>Fluorinert™ FC-0283/GALDEN® HT135</td>
<td>Fluorinert™ FC-40/GALDEN® HT200</td>
</tr>
<tr>
<td><strong>Temperature range setting</strong></td>
<td>±0.18°F (±0.1°C) (In cases when the circulating fluid discharge port and the return port are directly connected)</td>
<td>±0.18°F (±0.1°C)</td>
<td>±0.18°F (±0.1°C)</td>
</tr>
<tr>
<td><strong>Cooling capacity (kW)</strong></td>
<td>10</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td><strong>Heating capacity (kW)</strong></td>
<td>5.0</td>
<td>4.5</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Temperature stability</strong></td>
<td>±0.18°F (±0.1°C)(at 68°F (20°C))</td>
<td>±0.18°F (±0.1°C)(at 68°F (20°C))</td>
<td>±0.18°F (±0.1°C)(at 68°F (20°C))</td>
</tr>
<tr>
<td><strong>Pump capacity</strong></td>
<td>Max. 104 psi (0.72MPa) (at 5.3gpm)</td>
<td>Max. 58 psi (0.40 MPa) (at 5.3gpm)</td>
<td>Max. 55 psi (0.38 gpm) (at 5.3gpm)</td>
</tr>
<tr>
<td><strong>Rated flow</strong></td>
<td>5.3 gpm (20 L/min)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flow range</strong></td>
<td>2.64 to 10.6 gpm (10 to 40 L/min) (With flow control function by inverter)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Main tank capacity</strong></td>
<td>Approx. 4 gal (15 L)</td>
<td>Approx. 4 gal (15 L)</td>
<td></td>
</tr>
<tr>
<td><strong>Sub-tank capacity</strong></td>
<td>Approx. 4.2 gal (16 L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Port size</strong></td>
<td>Rc3/4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wetted parts material</strong></td>
<td>Stainless steel, EPDM, Copper brazing (Heat exchanger), PPS, Silicone, Fluororesin</td>
<td>Stainless steel, EPDM, Copper brazing (Heat exchanger), PPS, Silicone, Brass</td>
<td>Stainless steel, EPDM, Copper brazing (Heat exchanger), PPS, Silicone, Brass</td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td>50 to 86°F (10 to 30°C)</td>
<td>50 to 77°F (10 to 25°C)</td>
<td></td>
</tr>
<tr>
<td><strong>Pressure range</strong></td>
<td>44 to 102 psi (0.3 to 0.7 MPa)</td>
<td>4/4 gpm (15/15 L/min)</td>
<td></td>
</tr>
<tr>
<td><strong>Required flow rate</strong></td>
<td>4/4 gpm (15/15 L/min)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wetted parts material</strong></td>
<td>Stainless steel, EPDM, Copper brazing (Heat exchanger), PPS, Silicone, Brass</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Breaker capacity (A)</strong></td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated current (A)</strong></td>
<td>26</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td><strong>Alarm</strong></td>
<td>Refer to page 86.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Communications</strong></td>
<td>Contact input/output (D-sub 25 pin) and Serial RS-485 (D-sub 25 pin) (Refer to pages 84 and 85.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>364 lbs (165 kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Safety standards</strong></td>
<td>UL, CE marking, SEMI (S2-0703, S8-0701, F47-0200), SEMATECH (S2-93, S8-95)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note 1)** It should have no condensation.

**Note 2)** Fluorinert™ is a trademark of 3M and GALDEN® is a registered trademark of Solvay Solexis, Inc. Dilute pure ethylene glycol with clear water. Additives such as preservatives cannot be used.

If clear water or deionized water is used, please use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994/cooling water system - circulation type - make-up water). The minimum electrical conductivity of the deionized water used as the fluid should be 0.5 µS/cm (or electrical resistivity 2 MΩ cm at maximum).

**Note 3)** 1) Facility water temperature: 77°F (25°C), 2) Circulating fluid flow rate: Values at rated circulating fluid flow rate. Values common for 50/60 Hz.

**Note 4)** Value with a stable load without turbulence in the operating conditions. It may be out of this range when a DI control kit (option Y) is used or in some other operating conditions.

**Note 5)** The capacity at the Thermo-chiller outlet when the circulating fluid temperature is 68°F (20°C).

**Note 6)** Required flow rate for cooling capacity or maintaining the temperature stability. When used below the rated flow, use the individually sold, “By-pass Piping Set” (Refer to page 87).

**Note 7)** May not be able to control with the set value depending on the piping specification in the customer side.

**Note 8)** Minimum volume required for operating only the Thermo-chiller. (Circulating fluid temperature: 68°F (20°C), including the Thermo-chiller’s internal pipings or heat exchanger). To use below the rated flow, use the individually sold, “By-pass Piping Set” (Refer to page 87).

**Note 9)** Preliminary space volume without main tank capacity. Available for collecting the circulating fluid inside an external piping or for preliminary injection.

**Note 10)** Required flow rate when a load for the cooling capacity is applied at a facility water temperature of 77°F (25°C).

**Note 11)** Weight in the dry state without circulating fluids.
Thermo-chiller *Series HRZ*

### Cooling Capacity

<table>
<thead>
<tr>
<th>Model</th>
<th>Circulating Fluid Temperature (°C)</th>
<th>HRZ010-WS/010-W1S</th>
<th>HRZ010-W2S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*When pump inverter is operating at frequency of 60 Hz (maximum).*

### Heating Capacity

<table>
<thead>
<tr>
<th>Model</th>
<th>Circulating Fluid Temperature (°C)</th>
<th>HRZ010-WS/010-W1S</th>
<th>HRZ010-W2S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

### Pump Capacity (Thermo-chiller Outlet)

<table>
<thead>
<tr>
<th>Model</th>
<th>Circulating Fluid Flow Rate (L/min)</th>
<th>HRZ010-WS</th>
<th>HRZ010-W1S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>145</td>
<td>145</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>130</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>116</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>81</td>
<td>81</td>
</tr>
</tbody>
</table>

*When the circulating fluid flow is below 1.58 gpm (6 L/min), the in-built operation stop alarm will be activated. It is not possible to run the equipment. (common for all models)*

*When the circulating fluid flow rate is below 1.58 gpm (6 L/min), the in-built operation stop alarm will be activated. It is not possible to run the equipment. (common for all models)*

*With flow control function by inverter.*
Series HRZ
Common Specifications

Dimensions

<table>
<thead>
<tr>
<th>Model</th>
<th>Fluorinated fluid type</th>
<th>Ethylene glycol type</th>
<th>Clear/Deionized water type</th>
<th>A (Unit: inch (mm))</th>
<th>B (Unit: inch (mm))</th>
<th>C (Unit: inch (mm))</th>
<th>D (Unit: inch (mm))</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ001-H</td>
<td>HRZ001-H1</td>
<td></td>
<td></td>
<td>15 (380)</td>
<td>34.3 (870)</td>
<td>33.9 (860)</td>
<td>±18.5 to 20.5</td>
</tr>
<tr>
<td>HRZ002-H</td>
<td>HRZ002-H1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRZ001-L</td>
<td>HRZ001-L1</td>
<td></td>
<td>HRZ001-L2</td>
<td>15 (380)</td>
<td>34.3 (870)</td>
<td>37.4 (950)</td>
<td>±18.5 to 20.5</td>
</tr>
<tr>
<td>HRZ002-L, W</td>
<td>HRZ002-L1, W1</td>
<td>HRZ002-L2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRZ004-L, H</td>
<td>HRZ004-L1, H1</td>
<td>HRZ004-L2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRZ008-H, W</td>
<td>HRZ008-H1, W1</td>
<td>HRZ008-L2</td>
<td>HRZ008-L2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRZ010-W5</td>
<td>HRZ010-W1S</td>
<td>HRZ010-W2S</td>
<td>HRZ010-W2S</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Dimensional tolerance of A, B, and C: ± 0.4 in (±10 mm))
Common Specifications **Series HRZ**

**Unit: in (mm)**

<table>
<thead>
<tr>
<th>Model</th>
<th>Fluorinated fluid type</th>
<th>Ethylene glycol type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ008-L</td>
<td>HRZ008-L1</td>
<td>16.3 (415)</td>
<td>42.5 (1080)</td>
<td>42.3 (1075)</td>
<td>±1.38 to 1.50 (±35.0 to 38.0)</td>
<td></td>
</tr>
</tbody>
</table>

(Dimensional tolerance of A, B, and C: ±0.4 in ±10 mm)

Anti-quake bracket mounting position (Dimensional tolerance: ±0.2 in ±5 mm)

* Anchor bolts (M8, 8 pcs.) which are suitable for the floor material should be prepared by the customer.
Communication Function

For details, please consult our “Communication Specifications” information.

Contact Input/Output

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector no.</td>
<td>P1 (Refer to the next page for connector location)</td>
</tr>
<tr>
<td>Connector type (on this product side)</td>
<td>D-sub 25 P type, Female connector</td>
</tr>
<tr>
<td>Fixing bolt size</td>
<td>M2.6 x 0.45</td>
</tr>
</tbody>
</table>

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 |

Open collector output signal

| Insulation method | Photocoupler |
| Rated load voltage | 24 VDC |
| Operating load voltage range | 21.6 VDC to 26.4 VDC |
| Maximum load current | 80 mA |
| Leakage current | 0.1 mA or less |
| Surge protection | Diode |

Contact output signal (Alarm signal)

| Rated load voltage | 48 VAC or less/24 VDC or less |
| Maximum load current | 500 mA AC/DC (resistance load) |

Contact output signal (EMO signal)

| Rated load voltage | 48 VAC or less/24 VDC or less |
| Maximum load current | 800 mA AC/DC (resistance load/inductive load) |

Circuit diagram

Note) The custom function is equipped for contact input/output. Using the custom function enables the customer to set the signal type for contact input/output or pin assignment numbers. For details, please consult “Communication Specifications” information.
Serial RS-485
The serial RS-485 enables the following items to be written and read out.

**Writing**
- Run/Stop
- Circulating fluid temperature setting
- Circulating fluid automatic recovery start/ stop

**Readout**
- Circulating fluid present temperature
- Circulating fluid flow
- Circulating fluid discharge pressure
- Circulating fluid electrical resistivity
- Alarm occurrence information
- Status (operating condition) information

*1 Only when the circulating fluid automatic recovery function (option Z) is selected.
*2 Only when the DI control kit (option Y) is selected.

### Connector Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector no.</td>
<td>P2</td>
</tr>
<tr>
<td>Connector type (on this product side)</td>
<td>D-sub 9 P type, Female connector</td>
</tr>
<tr>
<td>Fixing bolt size</td>
<td>M2.6 x 0.45</td>
</tr>
<tr>
<td>Standards</td>
<td>EIA RS485</td>
</tr>
<tr>
<td>Protocol</td>
<td>Modicon Modbus</td>
</tr>
</tbody>
</table>

### Diagram

#### Connector location

- **P3**: Not used for the maintenance purpose port
  - D-sub 9 (Male receptacle)

- **P2**: Serial RS-485
  - D-sub 9 (Female receptacle)

- **P1**: Contact input/output
  - D-sub 25 (Female receptacle)

- **Power cable entry**

#### Circuit Diagram

- Internal circuit

- **To the Thermo-chiller**

- **Customer's machine side**

- SD+
- SD−
- SG

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**Rear side**

---

**Technical Data**

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**Related Products**

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**Common Specifications Series HRZ**

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**Series HRZ**

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**SHOP ONLINE at www.airlinehyd.com**

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**800-999-7378**
Series HRZ

Operation Display Panel

Alarm

This unit can display 28 kinds of alarm messages as standard. Also, it can read out the serial RS-485 communication.

<table>
<thead>
<tr>
<th>Alarm code</th>
<th>Alarm message</th>
<th>Operation status</th>
<th>Main reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Water Leak Detect FLT</td>
<td>Stop</td>
<td>Liquid deposits in the base of this unit.</td>
</tr>
<tr>
<td>02</td>
<td>Incorrect Phase Error FLT</td>
<td>Stop</td>
<td>The power supply to this unit is incorrect.</td>
</tr>
<tr>
<td>03</td>
<td>RF GT High Press FLT</td>
<td>Stop</td>
<td>Pressure in the refrigeration circuit has exceeded the limitation.</td>
</tr>
<tr>
<td>04</td>
<td>CPRSR Overheat FLT</td>
<td>Stop</td>
<td>Temperature inside the compressor has increased.</td>
</tr>
<tr>
<td>05</td>
<td>Reservoir Low Level FLT</td>
<td>Stop</td>
<td>The amount of circulating fluid is running low.</td>
</tr>
<tr>
<td>06</td>
<td>Reservoir Low Level WRN</td>
<td>Continue</td>
<td>The amount of circulating fluid is running low.</td>
</tr>
<tr>
<td>07</td>
<td>Reservoir High Level WRN</td>
<td>Continue</td>
<td>Filling the circulating fluid too much.</td>
</tr>
<tr>
<td>08</td>
<td>Temp. Fuse Cutout FLT</td>
<td>Stop</td>
<td>Temperature of the circulating fluid tank is raised.</td>
</tr>
<tr>
<td>09</td>
<td>Reservoir High Temp. FLT</td>
<td>Stop</td>
<td>Temperature of the circulating fluid has exceeded the limitation.</td>
</tr>
<tr>
<td>11</td>
<td>Reservoir High Temp. WRN</td>
<td>Continue</td>
<td>Temperature of the circulating fluid has exceeded the limitation set by the customer.</td>
</tr>
<tr>
<td>12</td>
<td>Return Low Flow FLT</td>
<td>Stop</td>
<td>The circulating fluid flow has gone below 1.5 gpm (6 L/min).</td>
</tr>
<tr>
<td>13</td>
<td>Return Low Flow WRN</td>
<td>Continue</td>
<td>The circulating fluid flow has gone below the limitation set by the customer.</td>
</tr>
<tr>
<td>14</td>
<td>Heater Breaker Trip FLT</td>
<td>Stop</td>
<td>Protection device for the electric circuit of the heater is activated.</td>
</tr>
<tr>
<td>15</td>
<td>Pump Breaker Trip FLT</td>
<td>Stop</td>
<td>Protection device for the electric circuit of the circulating pump is activated.</td>
</tr>
<tr>
<td>16</td>
<td>CPRSR Breaker Trip FLT</td>
<td>Stop</td>
<td>Protection device for the electric circuit of the compressor is activated.</td>
</tr>
<tr>
<td>17</td>
<td>Interlock Fuse Cutout FLT</td>
<td>Stop</td>
<td>Overcurrent is flown to the control circuit.</td>
</tr>
<tr>
<td>18</td>
<td>DC Power Fuse Cutout WRN</td>
<td>Continue</td>
<td>Overcurrent has flowed to the (optional) solenoid valve.</td>
</tr>
<tr>
<td>19</td>
<td>FAN Motor Stop WRN</td>
<td>Continue</td>
<td>Cooling fan inside the compressor has stopped.</td>
</tr>
<tr>
<td>20</td>
<td>Internal Pump Time Out WRN</td>
<td>Continue</td>
<td>The internal pump continuously run for more than a certain period of time.</td>
</tr>
<tr>
<td>21</td>
<td>Controller Error FLT</td>
<td>Stop</td>
<td>The error occurred in the control systems.</td>
</tr>
<tr>
<td>22</td>
<td>Memory Data Error FLT</td>
<td>Stop</td>
<td>The data stored in the controller of this unit went wrong.</td>
</tr>
<tr>
<td>23</td>
<td>Communication Error WRN</td>
<td>Continue</td>
<td>The serial communications between this unit and customer's system has been suspended.</td>
</tr>
<tr>
<td>24</td>
<td>Di Low Level WRN</td>
<td>Continue</td>
<td>Di level of the circulating fluid has gone below the limitation set by the customer. (Option)</td>
</tr>
<tr>
<td>25</td>
<td>Pump Inverter Error FLT</td>
<td>Stop</td>
<td>An error has occurred in the inverter for the circulating pump.</td>
</tr>
<tr>
<td>26</td>
<td>DN ET Comm. Error WRN</td>
<td>Continue</td>
<td>The DeviceNet communications between this unit and customer's system has been suspended. (Only for DeviceNet communication specification - option D)</td>
</tr>
<tr>
<td>27</td>
<td>DN ET Comm. Error FLT</td>
<td>Stop</td>
<td>An error has occurred in the DeviceNet communication system of this unit. (Only for DeviceNet communication specification - option D)</td>
</tr>
<tr>
<td>28</td>
<td>CPRSR INV Error FLT</td>
<td>Stop</td>
<td>An error has occurred in the inverter for the compressor.</td>
</tr>
</tbody>
</table>

Alarm code Alarm message Operation status Main reason

Operating condition of this unit/Circulating fluid discharge temperature/Circulating fluid flow/ Circulating fluid discharge pressure/Setting value/Alarm message, etc. are displayed.

[START/STOP] key Starts/Stops the operation.

[RESET] key Stops the alarm buzzing. Resets the alarm.

[SEL] key Switches the display.

[ENT] key Decides the settings.

[ ]/L50774 moves the cursor and changes the setting values.

[ ]/L50776 moves the cursor.

(REMOTE) indicator Lights up when the unit is in the remote status.

[RUN] indicator Lights up when the unit is in the operating status.

[ALARM] indicator Lights up when the unit is alarming.
Series HRZ
Optional Accessories

By-pass Piping Set

When the circulating fluid goes below the rated flow, cooling capacity will be reduced and the temperature stability will be badly affected. In such a case, use the by-pass piping set.

Anti-quake Bracket

Bracket for earthquakes
Prepare the anchor bolts (M12) which are suited to the floor material by the customer.

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ-BP001</td>
<td>HRZ001-L/HRZ001-H1</td>
</tr>
<tr>
<td>HRZ002-L/HRZ002-H1</td>
<td></td>
</tr>
<tr>
<td>HRZ004-L/HRZ004-H1</td>
<td></td>
</tr>
<tr>
<td>HRZ008-L/HRZ008-H1</td>
<td></td>
</tr>
<tr>
<td>HRZ001-L/HRZ001-L1</td>
<td></td>
</tr>
<tr>
<td>HRZ002-L/HRZ002-L1</td>
<td></td>
</tr>
<tr>
<td>HRZ004-L/HRZ004-L1</td>
<td></td>
</tr>
<tr>
<td>HRZ008-L/HRZ008-L1</td>
<td></td>
</tr>
<tr>
<td>HRZ001-L2</td>
<td></td>
</tr>
<tr>
<td>HRZ002-L2</td>
<td></td>
</tr>
<tr>
<td>HRZ004-L2</td>
<td></td>
</tr>
<tr>
<td>HRZ008-L2</td>
<td></td>
</tr>
<tr>
<td>HRZ001-H/HRZ001-H1</td>
<td></td>
</tr>
<tr>
<td>HRZ002-H/HRZ002-H1</td>
<td></td>
</tr>
<tr>
<td>HRZ004-H/HRZ004-H1</td>
<td></td>
</tr>
<tr>
<td>HRZ008-H/HRZ008-H1</td>
<td></td>
</tr>
<tr>
<td>HRZ001-W/HRZ001-W1</td>
<td></td>
</tr>
<tr>
<td>HRZ002-W/HRZ002-W1</td>
<td></td>
</tr>
<tr>
<td>HRZ004-W/HRZ004-W1</td>
<td></td>
</tr>
<tr>
<td>HRZ008-W/HRZ008-W1</td>
<td></td>
</tr>
<tr>
<td>HRZ010-W+S</td>
<td></td>
</tr>
<tr>
<td>HRZ010-W1S</td>
<td></td>
</tr>
<tr>
<td>HRZ010-W2S</td>
<td></td>
</tr>
<tr>
<td>HRZ008-L/HRZ008-L1</td>
<td></td>
</tr>
<tr>
<td>HRZ008-L/HRZ008-L1</td>
<td></td>
</tr>
<tr>
<td>HRZ008-L/HRZ008-L1</td>
<td></td>
</tr>
<tr>
<td>HRZ008-L/HRZ008-L1</td>
<td></td>
</tr>
<tr>
<td>HRZ008-L/HRZ008-L1</td>
<td></td>
</tr>
</tbody>
</table>

Part no. | Applicable model |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ-TK002</td>
<td>HRZ001-L/HRZ001-L1</td>
</tr>
<tr>
<td>HRZ002-L/HRZ002-L1</td>
<td></td>
</tr>
<tr>
<td>HRZ004-L/HRZ004-L1</td>
<td></td>
</tr>
<tr>
<td>HRZ008-L/HRZ008-L1</td>
<td></td>
</tr>
<tr>
<td>HRZ001-H/HRZ001-H1</td>
<td></td>
</tr>
<tr>
<td>HRZ002-H/HRZ002-H1</td>
<td></td>
</tr>
<tr>
<td>HRZ004-H/HRZ004-H1</td>
<td></td>
</tr>
<tr>
<td>HRZ008-H/HRZ008-H1</td>
<td></td>
</tr>
<tr>
<td>HRZ001-W/HRZ001-W1</td>
<td></td>
</tr>
<tr>
<td>HRZ002-W/HRZ002-W1</td>
<td></td>
</tr>
<tr>
<td>HRZ004-W/HRZ004-W1</td>
<td></td>
</tr>
<tr>
<td>HRZ008-W/HRZ008-W1</td>
<td></td>
</tr>
<tr>
<td>HRZ010-W/S</td>
<td></td>
</tr>
<tr>
<td>HRZ010-W1S</td>
<td></td>
</tr>
<tr>
<td>HRZ010-W2S</td>
<td></td>
</tr>
</tbody>
</table>

Note 1) 2 pieces per set (for 1 unit) (HRZ-TK002)

Note 2) Anti-quake bracket is attached as standard. (HRZ008-L, HRZ008-L1)
Series HRZ

4-Port Manifold

4-branching the circulating fluid enables 4 temperature controls at the maximum with the 1 unit Thermo-chiller.

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ-MA001</td>
<td>Common for all models</td>
</tr>
</tbody>
</table>

DI Filter

This is the ion replacement resin to maintain the electrical resistivity of the circulating fluid. Customers who selected the DI control kit (option Y) need to purchase the DI filter separately.

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ-DF001</td>
<td>Common for all models which can select the DI control kit. (option Y)</td>
</tr>
</tbody>
</table>

Note) The DI filters are consumable. Depending on the status (electrical resistivity set value, circulating fluid temperature, piping volume, etc.), product life cycles will vary accordingly.

Insulating Material for DI Filter

When the DI filter is used at a high-temperature, we recommend that you use this insulating material to protect the radiated heat from the DI filter or possible burns. When the DI filter is used at a low-temperature, we also recommend that you use this to prevent heat absorption from the DI filter and to avoid forming condensation.

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ-DF002</td>
<td>Common for all models which can select the DI control kit. (option Y)</td>
</tr>
</tbody>
</table>

Weight: Approx. 44 lbs (20 kg)
Optional Accessories **Series HRZ**

### 60% Ethylene Glycol Aqueous Solution

This solution can be used as a circulating fluid for ethylene glycol-type Thermo-chillers. (Capacity: 2.64 gal (10 L))

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ-BR001</td>
<td>Common for all ethylene glycol-type models</td>
</tr>
</tbody>
</table>

Approx. 6.7 in (170 mm)

### Concentration Meter

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

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ-BR002</td>
<td>Common for all ethylene glycol-type models</td>
</tr>
</tbody>
</table>

Approx. 1.4 in (35 mm)

60% Ethylene Glycol Aqueous Solution

This solution can be used as a circulating fluid for ethylene glycol-type Thermo-chillers. (Capacity: 2.64 gal (10 L))

Approx. 11 inch (280 mm)

Approx. 9.1 in (230 mm)

Approx. 9.1 in (230 mm)

Approx. 1.4 in (35 mm)

Approx. 6.7 in (170 mm)
Series HRZ Options

**C** Option symbol

**Analog Communication**

HRZ[C] Analog communication

In addition to the standard contact input/output signal communication and the serial RS-485 communication, analog communication function can be added. The analog communication function enables to write and read out the following items.

- **<Writing>**
  - Circulating fluid temperature setting
  - Scaling voltage

- **<Readout>**
  - Circulating fluid present temperature
  - Electrical resistivity*

* Only when the DI control kit (option Y) is selected.

Scaling voltage – circulating fluid temperature can be set arbitrarily by the customer.

For details, please consult our “Communication Specifications” information.

**D** Option symbol

**DeviceNet Communication**

HRZ[D] DeviceNet communication

In addition to the standard contact input/output signal communication and the serial RS-485 communication, DeviceNet function can be added. DeviceNet function enables to write and read out the following items.

- **<Writing>**
  - Run/Stop
  - Circulating fluid temperature setting
  - Circulating fluid automatic recovery start/stop*1

- **<Readout>**
  - Circulating fluid present temperature
  - Circulating fluid flow
  - Circulating fluid discharge pressure
  - Electrical resistivity**1
  - Alarm occurrence information
  - Status (operating condition) information

*1 Only when the circulating fluid automatic recovery function (option Z) is selected.

*2 Only when the DI control kit (option Y) is selected.

For details, please consult our “Communication Specifications” information.

**N** Option symbol

**NPT Fitting**

HRZ[N] NPT fitting

An adapter is included to change the connection parts of circulating fluid piping and facility water piping to NPT thread type. The adapter must be installed by the customer.

**Y** Option symbol

**DI Control Kit**

HRZ[Y] DI control kit

Select this option if you want to maintain the electric resistance ratio (DI level) of the circulating fluid at a certain level. However, some components have to be fitted by the customer. For details, refer to specification table for this option.

Please note that this is not applicable to the fluorinated liquid type.

### Applicable model

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowable circulating fluid</td>
<td>—</td>
<td>60% ethylene glycol aqueous solution</td>
<td></td>
<td></td>
<td>Deionized water</td>
</tr>
<tr>
<td>DI level display range</td>
<td>MΩ/cm</td>
<td>0 to 20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DI level set range</td>
<td>MΩ/cm</td>
<td>0 to 2.0 (Note)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DI level reduction alarm set range</td>
<td>MΩ/cm</td>
<td>0 to 2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The DI filter is needed to control the DI level. (SMC Part No.: HRZ-DF001)

Please purchase additionally because the DI filter is not included in this option. Also, if necessary, additionally purchase the insulating material for the DI filter. (SMC Part No.: HRZ-DF002)

- Install the DI filter outside the thermo-chiller for piping. Secure the space for installing the DI filter on the rear side of the Thermo-chiller.
- It may go outside of the temperature stability range of ±0.18°F (±0.1°C) when this option is used in some operating conditions.

Note) Options have to be selected when ordering the Thermo-chiller. It is not possible to add them after purchasing the unit.
Select this option for customers who want to use the circulating fluid automatic recovery function. The automatic recovery function is a device which can recover the circulating fluid inside pipings into a sub-tank of the Thermo-chiller by the external communication or operating display panel. Some components need to be fitted by the customer. For details, please consult “Product Specifications” information for these options.

<table>
<thead>
<tr>
<th>Applicable model</th>
<th>Circulating fluid recoverable volume Note 1</th>
<th>Purge gas</th>
<th>Purge gas supply port</th>
<th>Purge gas supply pressure</th>
<th>Purge gas filtration</th>
<th>Regulator set pressure</th>
<th>Recoverable circulating fluid temperature</th>
<th>Recovery start/stop</th>
<th>Timeout error</th>
<th>Height difference with the customer system side</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ001-H-Z, HRZ001-H-Z, HRZ002-H-Z, HRZ002-H1-Z</td>
<td>4 gal (15 L)</td>
<td>Nitrogen gas</td>
<td>Self-align fitting for O.D. ø8 Note 2</td>
<td>58 to 102 psi (0.4 to 0.7 MPa)</td>
<td>0.01 µm or less</td>
<td>22 to 44 psi (0.15 to 0.3 MPa) Note 3</td>
<td>50 to 86°F (10 to 30°C)</td>
<td>Start: External communication Note 4</td>
<td>Timer from recovery start to completion</td>
<td>32.8 ft (10m) or less</td>
</tr>
<tr>
<td>HRZ0008-L-Z, HRZ0008-L1-Z</td>
<td>4.5 gal (17 L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1) This is the space volume of the sub-tank when the liquid level of the circulating fluid is within the specification. Guideline of the recovery volume is 80% of the circulating fluid recoverable volume.

Note 2) Before piping, clean inside the pipings with air blow, etc. Use the piping with no dust generation by purge gas. When using resin tube, where necessary, use insert fittings, etc. in order not to deform the tubings when connecting to self-align fittings.

Note 3) At the time of shipping from factory, it is set to 29 psi (0.2 MPa).

Note 4) For details, please consult our “Communication Specifications” information.
**Series HRZ**

**Specific Product Precautions 1**

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back pages 2 to 5 for Temperature Control Equipment Precautions.

---

### Design

**Warning**

1. This catalog shows the specifications of a single unit.
   1. For details, please consult our “Product Specifications” and thoroughly consider the adaptability between the customer’s system and this unit.
   2. Although the protection circuit as a single unit is installed, the customer is requested to carry out the safety design for the whole system.

### Selection

**Caution**

1. **Model selection**
   
   In order to select the correct Thermo-chiller model, the amount of thermal generation from the customer’s system, the operating circulating fluid, and its circulating flow are required. Select a model, by referring to the guideline to model selection on page 68.

2. **Option selection**
   
   Options have to be selected when ordering the Thermo-chiller. It is not possible to add them after purchasing the unit.

---

### 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

**Caution**

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 where the ambient temperature exceeds the limits as mentioned below.
      
      - During operation: 50 to 95°F (10°C to 35°C)
      - During storage: 32 to 122°F (0°C to 50°C) (but as long as water or circulating fluid are not left inside the pippings)
   5. Locations where the ambient relative humidity exceeds the limit as mentioned below.
      
      - During operation: 30% to 70%
      - During storage: 15% to 85%
   6. (Inside the operation facilities) locations where there is not sufficient space for maintenance.
   7. In locations where the ambient pressure exceeds the atmospheric pressure.

2. **The Thermo-chiller does not have clean room specification. It generates dust from the pump inside the unit and the cooling fan for the unit inside.**

### Circulating Fluid

**Caution**

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

---

### Circulating Fluid

2. **Use ethylene glycol that does not contain additives such as preservatives.**

3. **The condensation of ethylene glycol aqueous solution must be 60% or less. If the density is too high, the pump will be overloaded, resulting in occurrence of “Pump Breaker Trip FLT”. Also, if the density is too low, the unit will freeze at lower temperatures, resulting in product failure.**

4. **Avoid water moisture entering the fluorinated fluid. Otherwise, the unit will freeze, resulting in product failure.**

5. **Use clear water (including for diluting ethylene glycol aqueous solution) which must meet the water quality standards as mentioned below.**

**Clear Water (as Circulating Water) Quality Standards**

- The Japan Refrigeration and Air Conditioning Industry Association JRA GL-02-1994 “Cooling water system – Circulating type – Supply water”

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Standard value</th>
<th>Influence of Corrosion</th>
<th>Influence of Scale generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (at 77°F (25°C))</td>
<td>—</td>
<td>6.0 to 8.0</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Electrical conductivity (77°F)</td>
<td>[µS/cm]</td>
<td>100 to 300</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Chloride ion (Cl⁻)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Sulfate ion (SO₄²⁻)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Acid consumption amount (at pH6)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Total hardness</td>
<td>[mg/L]</td>
<td>70 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Calcium hardness (CaCO₃)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Sulfide ion (S⁻)</td>
<td>[mg/L]</td>
<td>Should not be detected</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Ammonium ion (NH₄⁺)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Residual chlorine (Cl⁻)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Free carbon (CO₂)</td>
<td>[mg/L]</td>
<td>4.0 or less</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

- 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.

### Transportation/Transfer/Movement

**Warning**

1. **Transportation by forklift**
   
   1. It is not possible to hang this product.
   2. The fork insertion position is either on the left side face or right side face of the unit. Be careful not to bump the fork against a caster or level foot and be sure to put through the fork to the opposite side.

2. **Transportation by casters**
   
   1. This product is heavy and should be moved by at least two people.
   2. Do not grip the pipings on the rear side or the handles of the panel.
Series HRZ

Specific Product Precautions 2

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back pages 2 to 5 for Temperature Control Equipment Precautions.

Mounting/Installation

⚠️ Caution

1. Avoid using this product outdoors.
2. Install on a rigid floor which can withstand this product's weight.
3. Install a suitable anchor bolt for the anti-quake bracket taking into consideration the customers floor material.
4. Avoid placing heavy objects on this product.

Piping

⚠️ Caution

1. Regarding the circulating fluid pipings, consider carefully the suitability for shutoff pressure, temperature and circulating fluid.
   If the operating performance specifications are regularly exceeded, the pipings may burst during operation.
2. The surface of the circulating fluid pipings should be covered with the insulating materials which can effectively confine the heat.
   Absorbing the heat from the surface of pipings may reduce the cooling capacity performance and the heating capacity may be shortened due to heat radiation.
3. When using fluorinated liquid as the circulating fluid, do not use pipe tape.
   Liquid leakage may occur around the pipe tape.
   For sealant, we recommend that you use the following sealant: SMC Part No., HRZ-S0003 (Silicone sealant)
4. For the circulating fluid pipings, use clean pipings which have no dust, oil or water moisture inside the pipings, and blow with air prior to undertaking any piping works.
   If any dust, oil or water moisture enters the circulating fluid circuit, inferior cooling performance or equipment failure due to frozen water may occur, resulting in bubbles in the circulating fluid inside the tank.
5. The reciprocating total volume of the circulating fluid pipings must be less than the volume of the sub-tank.
   Otherwise, when the equipment is stopped, the in-built alarm may activate or the circulating fluid may leak from the tank. Refer to the specifications table for the sub-tank volume.
6. Select the circulating fluid pipings which can exceed the required rated flow.
   For the rated flow, refer to the pump capacity table.
7. For the circulating fluid piping connection, install a drain pan just in case the circulating fluid may leak.
8. Do not return the circulating fluid to the unit by installing a pump in the customer system.

Electrical Wiring

⚠️ Caution

1. Power supply and signal cable should be prepared by the customer.
2. Provide a stable power supply which is not affected by surge or distortion.
   If the voltage increase ratio \( \frac{dV}{dt} \) at the zero cross should exceed 40 V/200 µsec., it may result in a malfunction.
3. This product is installed with a breaker with the following operating characteristics.
   For the customer's machine (inlet side), use a breaker whose operating time is equal to or longer than the breaker of this product. If a breaker with shorter operating time is connected, the customer’s machine could be cut off due to the inrush current of the motor of this product.

Breaker Operating Characteristics

Applicable model

- HRZ001-L
- HRZ002-L
- HRZ004-L
- HRZ001-L1
- HRZ002-L1
- HRZ004-L1
- HRZ008-L1
- HRZ001-L2
- HRZ002-L2
- HRZ004-L2
- HRZ008-L2
- HRZ001-H
- HRZ002-H
- HRZ004-H
- HRZ001-H1
- HRZ002-H1
- HRZ004-H1
- HRZ008-H1
- HRZ002-W
- HRZ008-W
- HRZ002-W1
- HRZ008-W1

Current (% for chiller main breaker volume)
**Series HRZ**

Specific Product Precautions 3

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back pages 2 to 5 for Temperature Control Equipment Precautions.

---

<table>
<thead>
<tr>
<th><strong>Operation Restart Time</strong></th>
</tr>
</thead>
</table>

**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.

---

<table>
<thead>
<tr>
<th><strong>Maintenance</strong></th>
</tr>
</thead>
</table>

**Warning**

1. Do not operate the switch with wet hands or touch electrical parts such as an electrical plug. This will lead to an electrical shock.

2. Do not splash water directly on this product for cleaning. This will lead to an electrical shock or a fire.

3. When the panel was removed for the purpose of inspection or cleaning, mount the panel after works were done.

   If the panel is still open, or running the equipment with the panel removed, it may cause an injury or electric shock.

**Caution**

1. In order to prevent a sudden product failure of the unit, replace the replacement parts every 36 months.

2. Perform an inspection of the circulating fluid every 3 months.

   1. In the case of fluorinated fluids:
      Discharge the circulating liquid and avoid any dirty objects, or water moisture, or foreign objects entering the system.
   2. In the case of ethylene glycol aqueous solution:
      Maintain the condensation at 60%.
   3. In the case of clear water, deionized water:
      Replacement is recommended.

3. Check the water quality of cooling water every 3 months.

   Regarding the water quality standards for cooling water, refer to “Temperature Control Equipment Precautions”.

---
Circulating Fluid Temperature Controller

Series HRZD

Refrigerated Dual Thermo-chiller
(Double inverter type)

Temperature for two systems can be controlled separately by one chiller.

Energy-saving

Double inverter type
More effective energy-saving is achieved through use of a DC inverter compressor and an inverter pump.

Power consumption:
Reduced by 84%
2.2 kWh/h
(Existing model: 13.8 kWh/h)

Facility water consumption:
Reduced by 90%
1.06 gpm (4 L/min) (Existing model: 10.6 gpm)

Conditions: Circulating fluid temperature 14°F (–10°C), Galden® HT135 x 5.3 gpm (20 L/min), Piping 3/4 inch x 13.1 ft (4 m), Idling 50%, Process 50% operation with 2 kW customer load, 60 Hz

Space-saving

Footprint reduced by 23%

Single power cable, single facility water piping system

International standards:
SEMI Standard S2-0706, S8-0308, F47-0706

Reduced wiring, piping and labor

Switchover from the conventional model is also possible.
Series HRZD

- Temperature range setting: −22 to 194°F (~−30 to 90°C) (Fluorinated fluid)
- Temperature stability: ±0.18°F (~±0.1°C)
- Circulating fluid flow range: 2.6 to 10.6 gpm (10 to 40 L/min)
- Cooling capacity: Max. 10 kW x 2 ch
- Type of circulating fluid: Galden® Fluorinert™ Ethylene glycol aqueous solution
- Communications: Contact input/output
  - Standard equipment: Serial RS-485/RS-232C
  - Analog communication (Selectable on the touch panel)

Specifications (Fluorinated Fluid Type)

<table>
<thead>
<tr>
<th>Channel</th>
<th>HRZD020-WS-WS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling method</td>
<td>Water-cooled refrigeration</td>
</tr>
<tr>
<td>Cooling capacity (kW)</td>
<td>3.5 (Circulating fluid temperature at 68 °F (20 °C))</td>
</tr>
<tr>
<td>Temperature range setting</td>
<td>−22 to 194°F (~−30 to 90°C)</td>
</tr>
<tr>
<td>Temperature stability</td>
<td>±0.18 °F (~±0.1°C)</td>
</tr>
<tr>
<td>Circulating fluid flow range</td>
<td>2.6 to 10.6 gpm (10 to 40 L/min)</td>
</tr>
<tr>
<td>Circulating fluid</td>
<td>−22 to 104 °F (~−30 to 40 °C), Galden® HT135 (Note 4), Fluorinert™ FC-3283 (Note 4), 60 to 194 °F (20 to 90 °C), Galden® HT200 (Note 4), Fluorinert™ FC-40 (Note 4)</td>
</tr>
<tr>
<td>Refrigerant</td>
<td>R404A (HFC)</td>
</tr>
<tr>
<td>Pump capacity</td>
<td>Max. 104 psi (0.72 MPa) (at 5.3 gpm) With flow control function by inverter</td>
</tr>
<tr>
<td>Main tank capacity</td>
<td>Approx. 4 gpm (15 L)</td>
</tr>
<tr>
<td>Sub-tank capacity</td>
<td>Approx. 4.2 gpm (16 L)</td>
</tr>
<tr>
<td>Circulating fluid connection port size (Outlet/Return port)</td>
<td>Rc3/4</td>
</tr>
<tr>
<td>Facility water</td>
<td>50 to 95 °F (10 to 35 °C) / 44 to 102 psi (0.3 to 0.7 MPa)</td>
</tr>
<tr>
<td>Power supply</td>
<td>3-phase, 50/60 Hz, 200/200 to 208 VAC ±10%</td>
</tr>
<tr>
<td>Main breaker capacity (A)</td>
<td>60</td>
</tr>
<tr>
<td>Dimensions (Note 9)</td>
<td>W23.6 in (600 mm) x D33.3 in (845mm) x H60.0 in (1525mm)</td>
</tr>
<tr>
<td>Weight (Note 10)</td>
<td>838 lbs (380 kg)</td>
</tr>
<tr>
<td>Communications</td>
<td>Serial RS-485/RS-232C (D-sub 9 pin), Contact input/output, Analog input/output (D-sub 25 pin)</td>
</tr>
</tbody>
</table>

Dimensions

- 33.3 (845) x 60.6 (1525) x 23.6 (600)
Circulating Fluid Temperature Controller

Water-cooled Thermo-chiller Series HRW

Refrigerant-free and energy saving type using no compressor. Ideal for ordinary temperature and high temperature processes.

- Type of circulating fluid: Fluorinated fluids/Ethylene glycol aqueous solution/Clear water, Deionized water
- Temperature range setting: 68 to 194°F (20 to 90°C)
- Cooling capacity: 2 kW/8 kW/15 kW/30 kW
- Temperature stability: ±0.54°F (±0.3°C)

More effective energy-saving through use of an inverter pump

Inverter type
Power consumption
0.5 kWh/h
Facility water
0.32 gpm (1.2 L/min)

International standards:
SEMA TECH S2-93, S8-95
SEMI Standard S2-0703, S8-1103, F47-0200

Related Products

SHOP ONLINE at www.airlinehyd.com
800-999-7378
Energy-Saving and Refrigerant-free

- Energy-saving and refrigerant-free
  (Ordinary temperature up to 194°F (90°C))

  The water-cooled Thermo-chiller which does not use a compressor (refrigerant-free) is suitable for processes operating from ordinary temperature to 194°F (90°C). The energy-savings shown below can be achieved in comparison with existing models (depending on the conditions).

- Power consumption: Max. 59% reduction (SMC comparison)

  The power consumption can be reduced by direct heat exchange between the circulating fluid and facility water with no refrigerating circuit.

<table>
<thead>
<tr>
<th>Existing model</th>
<th>HRW008-H</th>
<th>1.9 kWh/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating conditions: 140°F (60°C), 0 kW with 50% load, 8 kW with 50% load</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Circulating fluid: Max. 13% reduction (SMC comparison)

  Enhanced temperature control technology and the unique pump/tank construction achieved the reduced circulating fluid required for operation.

<table>
<thead>
<tr>
<th>Existing model</th>
<th>HRW008-H</th>
<th>3.4 gal (13 L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating conditions: 140°F (60°C), 0 kW with 50% load, 8 kW with 50% load</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Facility water: Max. 89% reduction (SMC comparison)

  The HRW series can achieve reduction in power consumption as it does not have a compressor, and reduction in the amount of facility water used because heat is exchanged directly with the circulating fluid.

<table>
<thead>
<tr>
<th>Existing model</th>
<th>HRW008-H</th>
<th>0.32 gpm (1.2 L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating conditions: 140°F (60°C), 0 kW with 50% load, 8 kW with 50% load, By-pass valve fully closed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pump Inverter Type

More effective energy-saving is achieved through use of an inverter pump.

- Power consumption: Max. 89% reduction (SMC comparison)

<table>
<thead>
<tr>
<th>Existing model</th>
<th>HRW008-HS</th>
<th>0.5 kWh/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating conditions: 140°F (60°C), 0 kW with 50% load, 8 kW with 50% load</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Facility water: Max. 89% reduction (SMC comparison)

<table>
<thead>
<tr>
<th>Existing model</th>
<th>HRW008-HS</th>
<th>0.32 gpm (1.2 L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating conditions: 140°F (60°C), 0 kW with 50% load, 8 kW with 50% load, By-pass valve fully closed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Space-Saving

- Installation area: Max. 45% reduction (SMC comparison)

  (Forced exhaust from rear side)

  By emitting the heat from the back, ventilation slits on the side are unnecessary offering reduced installation space.

  Thermo-chiller with exhaust from the side:

  **Body space:** W15.7in (400 mm) x D 33.3 in (845 mm)
  **Ventilation space:** 3.9 in (100 mm)

  **HRW008-H** : **Body space:** W15.0 in (380 mm) x D 26.2 in (665 mm)
  **Ventilation space:** 0

  5.5 ft² (0.51 m²) 10.0 ft² (0.93 m²)
High Performance

Temperature stability: ±0.54°F

Enhanced temperature control technology achieved ±0.54°F (±0.3°C) temperature stabilities when a load is stable.

Cooling capacity: Max. 30 kW

Up to 30 kW cooling capacity achieved.

Easy Maintenance

Circulating fluid automatic recovery function

Circulating fluid inside a Thermo-chiller tank can be recovered automatically. (Recovery volume: 3.2 gal (12 L))

- Reduced maintenance time
- Faster operation
- Reduced circulating liquid loss by evaporation or spill

Easy maintenance

- Checking the electrical component parts accessible from the front side only
- Possible to replace the maintenance parts (such as a pump) without removing the pipings and discharging the circulating fluid.
- Various alarm displays (Refer to page 117.)

Circulating fluid electrical resistivity control function

(Refer to “Options” on page 118.)
(DI control kit)
**Electrical Resistivity Control**

- **DI control kit**
  (Refer to “Options” on page 118.)
  Electrical resistivity of circulating fluid (ethylene glycol aqueous solution and deionized water) can be controlled.

**Communications**

- Contact input/output signal
- Serial RS-485 communication
- Analog communication (Refer to “Options” on page 118.)
- DeviceNet communication (Refer to “Options” on page 118.)

**Wetted parts adopt the materials compatible for various circulating fluids.**

(Stainless steel, EPDM, etc.)

- Fluorinated fluids: Flourinert™ FC-40
  GALDEN® HT200
- 60% ethylene glycol aqueous solution
- Deionized water/Clear water

Regarding the fluid other than the above, please contact SMC.
Flourinert™ is a trademark of 3M. GALDEN® is a registered trademark of Solvay Solexis, Inc.

**Construction and Principles**

**Circulating fluid circuit**

With the circulating pump, circulating fluid will be discharged to the customer's machine side. After the circulating fluid will heat or cool the customer's machine side, it will be returned to the main tank via the heat exchanger.

When the automatic circulating fluid recovery function, which recovers the circulating fluid from the customer's machine, is selected (refer to page 99), a sub-tank for recovery is installed. The internal pump is used to transfer a circulating fluid from the sub-tank to the main tank.

**Facility water circuit**

When the circulating fluid temperature rises higher than the set temperature, open the solenoid valve to introduce facility water to the heat exchanger.

When the circulating fluid temperature falls back below the set temperature, close the solenoid valve to shut off facility water to the heat exchanger.
Application Examples

**Semiconductor**
Example: Temperature control of chamber electrode

- Etching equipment
- Spatter equipment
- Cleaning equipment
- Coating equipment
- Dicing equipment
- Tester, etc.

**Medical**
Example: Blood preservation

- X-ray instrument
- MRI
- Blood preservation equipment

**Food**
Example: Tofu (Bean curd) production

- Bottle-cleaning machine
- Tofu (Bean curd) production equipment
- Noodle-making machine, etc.

**Analysis**
Example: Electronic microscope

- Electron microscope
- X-ray analytical instrument
- Gas chromatography
- Sugar level analytical instrument, etc.

**Machine tool**
Example: Laser machining

- Wire cutting
- Grinder
- Spot welding
- Plasma welding
- Laser machining, etc.

**Printing**
Example: Printing temperature control

- Offset printing machine
- Automatic developing machine
- UV equipment, etc.

**Molding**
Example: Injection molding

- Plastic molding
- Rubber molding
- Wire cable coating machine
- Injection molding, etc.
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- Precautions on Model Selection ..................... Page 106
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Ethylene Glycol Type
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Clear/Deionized Water Type
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Guide to Model Selection

1. How much is the temperature in degrees centigrade for the circulating fluid?

Temperature range which can be set with the Thermo-chiller
H: 68 to 195°F (20°C to 90°C)

Example) Customer requirement: 122°F (50°C)

2. What kind of the circulating fluids will be used?

Relation between circulating fluid (which can be used with the Thermo-chiller) and temperature

- Fluorinert™ FC-40/GALDEN® HT200
- 60% ethylene glycol aqueous solution
- Clear water/Deionized water

Example) Customer requirement: Clear water

3. How much is the temperature in degrees centigrade for the facility water?

Temperature range which can be set with the Thermo-chiller
10°C to 35°C

Example) Facility water temperature of customer’s machine: 15°C

Temperature difference between the circulating fluid and facility water is: 50 – 15 = 95°F (35°C).

4. What is the kW for the required cooling capacity?

Example) Customer requirement: 20 kW

Plot the point where the temperature difference between the circulating fluid and facility water (95°F (35°C)) intersects the cooling capacity (20 kW) in the cooling capacity graph.

The point plotted in the graph is the requirement from your customer. Select the Thermo-chiller models exceeding this point. In this case, select the HRW030-H2.
**Example 1: When the heat generation amount in the customer’s machine is known.**

Heat generation amount $Q$: 3.5 kW

Cooling capacity = Considering a safety factor of 20%, $3.5 \times 1.2 = \boxed{4.2 \text{ kW}}$

**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 $Q$: Unknown
- Circulating fluid temperature difference $\Delta T (= T_2 - T_1)$: $6.0^\circ\text{C}$ ($6.0 \text{ K}$)
- Circulating fluid outlet temperature $T_1$: $20^\circ\text{C}$ ($293.15 \text{ K}$)
- Circulating fluid return temperature $T_2$: $26^\circ\text{C}$ ($299.15 \text{ K}$)
- Circulating fluid flow rate $L$: 20 L/min
- Circulating fluid
  - Density $\gamma$: 1.80 x $10^3$ kg/m$^3$
  - Specific heat $C$: 0.96 x $10^3$ J/(kg·K)
  - (at 20°C)

$\Delta T = T_2 - T_1$

$Q = \Delta T \times L \times \gamma \times C$

$= \frac{6.0 \times 20 \times 1.80 \times 10^3 \times 0.96 \times 10^3}{60 \times 1000}$

$= \boxed{3456 \text{ W} = 3.5 \text{ kW}}$

Cooling capacity = Considering a safety factor of 20%, $3.5 \times 1.2 = \boxed{4.2 \text{ kW}}$

---

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

Unknown
6.0°C
20°C
26°C
1.2 m$^3$/h
Fluorinated fluid
Density $\gamma$: 1.80 x $10^3$ kg/m$^3$
Specific heat $C$: 0.23 kcal/kg·°C
(at 20°C)

$Q = \frac{\Delta T \times L \times \gamma \times C}{860}$

$= \frac{6.0 \times 1.2 \times 1.80 \times 10^3 \times 0.23}{860}$

$= 3.5 \text{ kW}$

Cooling capacity = Considering a safety factor of 20%, $3.5 \times 1.2 = \boxed{4.2 \text{ kW}}$
Example 3. When there is no heat generation, and when cooling the object below a certain temperature and period of time.

Cooled substance total volume \( V \) : 60 L
Cooling time \( h \) : 15 min
Cooling temperature difference \( \Delta T \) : 20°C (293.15 K) (70°C – 50°C → 20°C)
Facility water temperature : 20°C (293.15 K)
Circulating fluid : Fluorinated fluid
Density \( \gamma \) : 1.74 x 10³ kg/m³
Specific heat \( C \) : 1.05 x 10³ J/(kg·K) (at 50°C)

\( * \) Refer to page 107 for the typical physical property values by circulating fluid.

\[
Q = \frac{\Delta T \times V \times \gamma \times C}{h \times 60 \times 1000}
\]

\[
= \frac{20 \times 60 \times 1.74 \times 10^3 \times 1.05 \times 10^3}{15 \times 60 \times 1000}
\]

\( = 2.436 \text{ W} = 2.4 \text{ kW} \)

Cooling capacity = Considering a safety factor of 20%,
\[
2.4 \times 1.2 = 2.9 \text{ kW (When the circulating fluid temperature is 50°C.)}
\]

(In this case, selected Thermo-chiller model will be the HRW008-H.)

Precautions on Model Selection

1. Temperature difference between the circulating fluid and facility water
   The HRW series exchanges heat between the circulating fluid and facility water directly, so it may not be possible to lower the circulating fluid temperature to the set temperature if the facility water temperature is too high. Check that the facility water temperature can be maintained for the circulating fluid temperature referring to the cooling capacity graph of each model before using.

2. Heating capacity
   When setting the circulating fluid temperature at a higher temperature than the room temperature, the circulating fluid temperature will be heated with the Thermo-chiller. Heating capacity varies depending on the circulating fluid temperature. Also, the heating capacity varies depending on the circulating fluid temperature. Consider the heat radiation amount or thermal capacity of the customer's equipment. Check beforehand if the required heating capacity is provided, based on the heating capacity graph for the respective model.

3. Pump capacity
   <Circulating fluid flow rate>
   Pump capacity varies depending on the model selected from the HRW series. Also, circulating fluid flow varies depending on the circulating fluid discharge pressure. Consider the installation height difference between our 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 rate is achieved, using the pump capacity curves for each respective model.

   <Circulating fluid discharge pressure>
   Circulating fluid discharge pressure has the possibility to increase up to the maximum pressure in the pump capacity curves for the respective model. Check beforehand if the circulating fluid pipings or circulating fluid circuit of the customer's machine are fully durable against this pressure.
## Fluorinated Fluids

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Physical Property Value</th>
<th>Density $\gamma$ [kg/m$^3$] [g/L]</th>
<th>Specific heat $C$ [J/(kg·K)]</th>
<th>([kcal/kg·°C])</th>
</tr>
</thead>
<tbody>
<tr>
<td>–10°C</td>
<td>1.87 x 10$^3$</td>
<td>0.87 x 10$^3$</td>
<td>0.21</td>
<td></td>
</tr>
<tr>
<td>20°C</td>
<td>1.80 x 10$^3$</td>
<td>0.96 x 10$^3$</td>
<td>0.23</td>
<td></td>
</tr>
<tr>
<td>50°C</td>
<td>1.74 x 10$^3$</td>
<td>1.05 x 10$^3$</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>80°C</td>
<td>1.67 x 10$^3$</td>
<td>1.14 x 10$^3$</td>
<td>0.27</td>
<td></td>
</tr>
</tbody>
</table>

## 60% Ethylene Glycol Aqueous Solution

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Physical Property Value</th>
<th>Density $\gamma$ [kg/m$^3$] [g/L]</th>
<th>Specific heat $C$ [J/(kg·K)]</th>
<th>([kcal/kg·°C])</th>
</tr>
</thead>
<tbody>
<tr>
<td>–10°C</td>
<td>1.10 x 10$^3$</td>
<td>3.02 x 10$^3$</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>20°C</td>
<td>1.08 x 10$^3$</td>
<td>3.15 x 10$^3$</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>50°C</td>
<td>1.06 x 10$^3$</td>
<td>3.27 x 10$^3$</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>80°C</td>
<td>1.04 x 10$^3$</td>
<td>3.40 x 10$^3$</td>
<td>0.81</td>
<td></td>
</tr>
</tbody>
</table>

### Water

Density $\gamma$: 1 x 10$^3$ [kg/m$^3$] [g/L]  
Specific heat $C$: 4.2 x 10$^3$ [J/(kg·K)] (1.0 [kcal/kg·°C])
## Specifications

*(For details, please consult our “Product Specifications” information.)*

### Fluorinated Fluid Type

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Cooling capacity (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>002</td>
<td>2 kW</td>
</tr>
<tr>
<td>008</td>
<td>8 kW</td>
</tr>
<tr>
<td>015</td>
<td>15 kW</td>
</tr>
<tr>
<td>030</td>
<td>30 kW</td>
</tr>
</tbody>
</table>

### Temperature range setting

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Temperature range setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>68 to 194°F (20 to 90°C)</td>
</tr>
</tbody>
</table>

### Option

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>None</td>
</tr>
<tr>
<td>C</td>
<td>Analog communication</td>
</tr>
<tr>
<td>D</td>
<td>DeviceNet communication</td>
</tr>
<tr>
<td>N</td>
<td>NPT fitting</td>
</tr>
<tr>
<td>Z</td>
<td>Circulating fluid automatic recovery</td>
</tr>
</tbody>
</table>

### Pump inverter control

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Pump inverter control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>None</td>
</tr>
<tr>
<td>S</td>
<td>Applicable (Pump inverter type)</td>
</tr>
</tbody>
</table>

### Table of Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>HRW002-H</th>
<th>HRW002-HS</th>
<th>HRW008-H</th>
<th>HRW008-HS</th>
<th>HRW015-H</th>
<th>HRW015-HS</th>
<th>HRW030-H</th>
<th>HRW030-HS</th>
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</thead>
<tbody>
<tr>
<td>Cooling method</td>
<td>Water-cooled</td>
<td></td>
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<tr>
<td>Ambient temperature/humidity</td>
<td>Note 1) Temperature: 50 to 95°F (10 to 35°C), Humidity: 30 to 70%RH</td>
<td></td>
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<tr>
<td>Circulating fluid system</td>
<td></td>
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</tr>
<tr>
<td>Fluid type</td>
<td>Fluorinert™ FC-40/GALDEN® HT200</td>
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<tr>
<td>Temperature range setting</td>
<td>Note 1) 68 to 194°F (20 to 90°C)</td>
<td></td>
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<tr>
<td>Cooling capacity (50/60 Hz common) (kW)</td>
<td>2</td>
<td>8</td>
<td>15</td>
<td>29</td>
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<tr>
<td>Conditions</td>
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<tr>
<td>Circulating fluid temperature</td>
<td>Facility water temperature +27°F (15°C)</td>
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<td></td>
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<tr>
<td>Facility water temperature</td>
<td>50 to 95°F (10 to 35°C)</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid rated flow</td>
<td>1.1 gpm (4 L/min)</td>
<td>7.9 gpm (30 L/min)</td>
<td>10.6 gpm (40 L/min)</td>
<td>10.6 gpm (40 L/min)</td>
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<tr>
<td>Facility water required flow rate</td>
<td>2.6 gpm (10 L/min)</td>
<td>5.3 gpm (20 L/min)</td>
<td>6.6 gpm (25 L/min)</td>
<td>10.6 gpm (40 L/min)</td>
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<tr>
<td>Temperature stability</td>
<td>Note 3) ±0.54°F (±0.3°C)</td>
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</tr>
<tr>
<td>Pump capacity</td>
<td>Note 4) at 60 Hz indicates the maximum capacity of the HRW002-H/L50132/L50132/L50132-HS (pump inverter type).</td>
<td></td>
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<tr>
<td>Circulating fluid flow range</td>
<td>Note 5) 0.8 to 4.2 gpm (3 to 16 L/min)</td>
<td></td>
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</tr>
<tr>
<td>Tank capacity</td>
<td>Note 6) Approx. 3.4 gal (13 L)</td>
<td>Approx. 3.7 gal (14 L)</td>
<td></td>
<td></td>
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<tr>
<td>Circulating fluid recovery tank volume</td>
<td>Note 7) 3.2 gal (12 L)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Port size</td>
<td>Rc3/4</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Wetted parts material</td>
<td>Copper brazing (Heat exchanger), Stainless steel, EPDM, Silicone, PPS, Fluororesin</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Facility water system</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>Note 8) 50 to 95°F (10 to 35°C)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required flow rate</td>
<td>Note 8) 2.6 gpm (10 L/min)</td>
<td>5.3 gpm (20 L/min)</td>
<td>6.6 gpm (25 L/min)</td>
<td>10.6 gpm (40 L/min)</td>
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<tr>
<td>Inlet pressure range</td>
<td>Note 8) 44 to 102 psi (0.3 to 0.7 MPa)</td>
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<td></td>
</tr>
<tr>
<td>Port size</td>
<td>Rc3/4</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Wetted parts material</td>
<td>Copper brazing (Heat exchanger), Stainless steel, EPDM, Silicone, Bronze, Brass</td>
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<tr>
<td>Electrical system</td>
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</tr>
<tr>
<td>Power supply</td>
<td>3-phase 200/200 to 208 VAC ±10%</td>
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<tr>
<td>Max. operating current</td>
<td>Note 9) 26</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Breaker capacity</td>
<td>Note 10) 30</td>
<td></td>
<td></td>
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<tr>
<td>Communications</td>
<td>Serial RS-485 (D-sub 9 pin) and Contact input/output (D-sub 25 pin)</td>
<td></td>
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</tr>
<tr>
<td>Dimensions</td>
<td>W15 in (380mm) x D26.2 in (665mm) x H33.9 in (860 mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Weight</td>
<td>Note 10) Approx. 198 lbs (90 kg)</td>
<td>Approx. 220 lbs (100 kg)</td>
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<tr>
<td>Safety standards</td>
<td>UL, CE marking, SEMI (S2-0703, S8-1103, F47-0200), SEMATECH (S2-93, S8-95)</td>
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</tbody>
</table>

**Note 1)** It should have no condensation.

**Note 2)** Fluorinert™ is a trademark of 3M and GALDEN® is a registered trademark of Solvay Solexis, Inc. Regarding the fluid other than the above, please contact SMC.

**Note 3)** Outlet temperature when the circulating fluid and facility water are rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment, power supply, and facility water are within specification range and stable. Value obtained 10 minutes after the external load is stabilized. It maybe be out of ±0.54°F (±0.3°C) in some other operating conditions.

**Note 4)** The capacity at the circulating fluid outlet when the circulating fluid temperature is 68°F (20°C). Pump capacity at 60 Hz indicates the maximum capacity of the HRW002-HS (pump inverter type).

**Note 5)** Applicable to the HRW002-HS (pump inverter type) only.

**Note 6)** Minimum volume required for operating only the Thermo-chiller (Circulating fluid temperature: 68°F (20°C), including the Thermo-chiller's internal pipings of heat exchanger).

**Note 7)** The automatic circulating fluid recovering function will be provided by selecting option Z for collecting the circulating fluid inside an external piping.

**Note 8)** Required flow rate for cooling capacity or maintaining the temperature stability.

**Note 9)** Panel dimensions. These dimensions do not include possible protrusions such as a breaker handle.

**Note 10)** Weight in the dry state without circulating fluids.

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**800-999-7378**
Thermo-chiller Series HRW

Circulating fluid temperature (°C)

<table>
<thead>
<tr>
<th>Circulating fluid pressure (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 5 10 15 20 25 30 35 40 45 50 55 60 70 80 90</td>
</tr>
<tr>
<td>0 2 4 6 8 10 12 14 16 18 20</td>
</tr>
</tbody>
</table>

Circulating fluid pressure (psi)

<table>
<thead>
<tr>
<th>Flow rate (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 2 4 6 8 10 12 14 16 18 20</td>
</tr>
</tbody>
</table>

Temperature difference \( \Delta T (°C) \) (Circulating fluid temperature – Facility water temperature)

<table>
<thead>
<tr>
<th>Cooling capacity (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 5 10 15 20 25 30 35</td>
</tr>
<tr>
<td>0 10 20 30 40 50 60 70 80 90 100 110 120 130 145</td>
</tr>
</tbody>
</table>

Cooling Capacity

HRW002-H/008-H/015-H/030-H
HRW002-HS/008-HS/015-HS/030-H

Heating Capacity

HRW002-H/008-H/015-H/030-H
HRW002-HS/008-HS/015-HS/030-H

Heating capacity (kW)

<table>
<thead>
<tr>
<th>Circulating fluid temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 10 20 30 40 50 60 70 80 90 100 110 120 130 145</td>
</tr>
</tbody>
</table>

- When pump inverter is operating at frequency of 60 Hz (maximum).

Pump Capacity

HRW002-H
HRW002-HS

Circulating fluid: Fluorinated fluids
Circulating fluid temperature: 68°F (20°C)

<table>
<thead>
<tr>
<th>Outlet pressure [50 Hz]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 2 4 6 8 10 12 14 16 18 20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Return port pressure [50 Hz]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 2 4 6 8 10 12 14 16 18 20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outlet pressure [60 Hz]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 10 20 30 40 50 60 70 80 90 100 110 120 130 145</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Return port pressure [60 Hz]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 10 20 30 40 50 60 70 80 90 100 110 120 130 145</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flow rate (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 15 30 45 60 75 90 100 120 145 280</td>
</tr>
</tbody>
</table>

- If the circulating fluid flow drops below 0.53 gpm (2 L/min), the shutdown alarm activates and operation stops. Do not use the product when the flow exceeds 4.23 gpm (16 L/min), since the flow cannot be displayed accurately.

- Pump capacity at 60 Hz indicates the maximum capacity of the HRW002-HS (pump inverter type).

- If the circulating fluid flow drops below 2.1 gpm (8 L/min), the shutdown alarm activates and operation stops. Do not use the product when the flow exceeds 13.2 gpm (50 L/min), since the flow cannot be displayed accurately.

- Pump capacity at 60 Hz indicates the maximum capacity of the HRW008-HS015-HS030-HS (pump inverter type).
## Specifications

### Ethylene Glycol Type

<table>
<thead>
<tr>
<th>Model</th>
<th>HRW002-H1</th>
<th>HRW008-H1</th>
<th>HRW008-H1S</th>
<th>HRW015-H1</th>
<th>HRW015-H1S</th>
<th>HRW030-H1</th>
<th>HRW030-H1S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling method</td>
<td>Water-cooled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Ambient temperature/humidity  
(Note 2) | 50 to 95°F (10 to 35°C), Humidity: 30 to 70%RH |           |            |           |            |           |            |
| Circulating fluid (Note 2) | 60% ethylene glycol aqueous solution |           |            |           |            |           |            |
| Temperature range setting (Note 1) | 68 to 194°F (20 to 90°C) |           |            |           |            |           |            |
| Cooling capacity (50/60 Hz common) (kW) | 2 | 8 | 15 | 27 |
| Facility water temperature | 50 to 95°F (10 to 35°C) |           |            |           |            |           |            |
| Facility water rated flow rate | 1.1 gpm (4 L/min) | 4.0 gpm (15 L/min) | 7.9 gpm (30 L/min) | 10.6 gpm (40 L/min) |
| Facility water required flow rate | 2.6 gpm (10 L/min) | 4.0 gpm (15 L/min) | 6.6 gpm (25 L/min) | 10.6 gpm (40 L/min) |
| Temperature stability (Note 3) | ±0.54°F (±0.3°C) |           |            |           |            |           |            |
| Pump capacity (50/60 Hz) | 0.35/0.55 (at 4 L/min) | 0.45/0.65 (at 15 L/min) | 0.40/0.60 (at 30 L/min) | 0.35/0.55 (at 40 L/min) |
| Circulating fluid flow rate (Note 6) | 0.8 to 4.2 gpm (3 to 16 L/min) | 2.4 to 13.2 gpm (9 to 50 L/min) |
| Tank capacity (Note 6) | Approx. 3.4 gal (13 L) |           |            |           |            |           |            |
| Circulating fluid recovery tank volume (Note 7) | 3.2 gal (12 L) |           |            |           |            |           |            |
| Port size | Rc3/4 |           |            |           |            |           |            |
| Wetted parts material | Nickel brazing (Heat exchanger), Stainless steel, EPDM, Silicone, PPS, Fluororesin |           |            |           |            |           |            |
| Circulating fluid system |           |            |            |           |            |           |            |
| Temperature range | 50 to 95°F (10 to 35°C) |           |            |           |            |           |            |
| Inlet pressure rate (Note 8) | 0.35/0.55 (at 40 L/min) |           |            |           |            |           |            |
| Port size | Rc3/4 |           |            |           |            |           |            |
| Wetted parts material | Nickel brazing (Heat exchanger), Stainless steel, EPDM, Silicone, Bronze, Brass |           |            |           |            |           |            |
| Electrical system |           |            |            |           |            |           |            |
| Power supply | 3-phase 200/200 to 208 VAC ±10% |           |            |           |            |           |            |
| Max. operating current (A) | 26 |           |            |           |            |           |            |
| Breaker capacity (A) | 30 |           |            |           |            |           |            |
| Communications | Serial RS-485 (D-sub 9 pin) and Contact input/output (D-sub 25 pin) |           |            |           |            |           |            |
| Dimensions (Note 9) | W15 in (380mm) x D 26.2 in (665mm) x H33.9 in (860mm) |           |            |           |            |           |            |
| Weight (Note 10) | Approx. 198 lbs (90 kg) |           |            |           |            |           |            |

### Notes

1. It should have no condensation.
2. Dilute pure ethylene glycol with clear water. Additives invading wetting parts material such as preservatives cannot be used.
3. Outlet temperature when the circulating fluid and facility water are rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment, power supply, and facility water are within specification range and stable. Value obtained 10 minutes after the external load is stabilized (after stabilization with no load for HRW030-H1). It may be out of this range when a DI control kit (option Y) is used or in some other operating conditions.
4. The capacity at the circulating fluid outlet when the circulating fluid temperature is 68°F (20°C). Pump capacity at 60 Hz indicates the maximum capacity of the HRW008-H1S (pump inverter type).
5. Applicable to the HRW008-H1S (pump inverter type) only.
6. Minimum volume required for operating only the Thermo-chiller. (Circulating fluid temperature: 68°F (20°C), including the Thermo-chiller’s internal pipings or heat exchanger)
7. The automatic circulating fluid recovery function will be provided by selecting option Z for collecting the circulating fluid inside an external piping.
8. Required flow rate for cooling capacity or maintaining the temperature stability.
9. Panel dimensions. These dimensions do not include possible protrusions such as a breaker handle.
10. Weight in the dry state without circulating fluids.
## Technical Data

### Related Products

- **HRG**
- **HRS**
- **HRZ**
- **HRD**
- **HEC**
- **HEB**

### Thermo-chiller Series HRW

#### Cooling Capacity

<table>
<thead>
<tr>
<th>HRW002-H1/008-H1/015-H1/030-H1</th>
<th>HRW002-H1S/008-H1S/015-H1S/030-H1S</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Cooling Capacity Chart" /></td>
<td><img src="image2" alt="Cooling Capacity Chart" /></td>
</tr>
</tbody>
</table>

**Circulating fluid:** 60% ethylene glycol  
**Circulating fluid temperature:** 68°F (20°C)

#### Heating Capacity

<table>
<thead>
<tr>
<th>HRW002-H1/008-H1/015-H1/030-H1</th>
<th>HRW002-H1S/008-H1S/015-H1S/030-H1S</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Heating Capacity Chart" /></td>
<td><img src="image4" alt="Heating Capacity Chart" /></td>
</tr>
</tbody>
</table>

**Circulating fluid:** 60% ethylene glycol  
**Circulating fluid temperature:** 68°F (20°C)

#### Pump Capacity

- **HRW002-H1**
- **HRW002-H1S**  
  - Circulating fluid: 60% ethylene glycol  
  - Circulating fluid temperature: 68°F (20°C)

| ![Pump Capacity Chart](image5) | ![Pump Capacity Chart](image6) |

- **HRW008-H1/015-H1/030-H1**
- **HRW008-H1S/015-H1S/030-H1S**  
  - Circulating fluid: 60% ethylene glycol  
  - Circulating fluid temperature: 68°F (20°C)

| ![Pump Capacity Chart](image7) | ![Pump Capacity Chart](image8) |

- **Outlet pressure**
- **Return port pressure**

- **Flow rate (L/min)**

- **Circulating fluid pressure (psi)**

- **Temperature difference (∆T °C)**

- **Circulating fluid temperature**

- **Heating capacity (kW)**

- **Cooling capacity (kW)**

- **Outlet pressure [50 Hz]**
- **Outlet pressure [60 Hz]**
- **Return port pressure [50 Hz]**
- **Return port pressure [60 Hz]**

### Notes

- If the circulating fluid flow drops below 0.53 gpm (2 L/min), the shutdown alarm activates and operation stops. Do not use the product when the flow exceeds 4.23 gpm (16 L/min), since the flow cannot be displayed accurately.
- Pump capacity at 60 Hz indicates the maximum capacity of the HRW002-H1S (pump inverter type).
- If the circulating fluid flow drops below 2.1 gpm (8 L/min), the shutdown alarm activates and operation stops. Do not use the product when the flow exceeds 13.2 gpm (50 L/min), since the flow cannot be displayed accurately.
- Pump capacity at 60 Hz indicates the maximum capacity of the HRW008-H1S/015-H1S/030-H1S (pump inverter type).
### Specifications

For details, please consult our “Product Specifications” information.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Cooling capacity</th>
<th>Temperature range setting</th>
<th>Clear/Deionized water type</th>
</tr>
</thead>
<tbody>
<tr>
<td>002</td>
<td>2 kW</td>
<td>68 to 194°F (20 to 90°C)</td>
<td></td>
</tr>
<tr>
<td>008</td>
<td>6 kW</td>
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</tr>
<tr>
<td>015</td>
<td>15 kW</td>
<td></td>
<td></td>
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<tr>
<td>030</td>
<td>30 kW</td>
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</table>

#### Clear/Deionized Water Type

**Thermo-chiller Series HRW**


<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Cooling method</td>
<td>Water-cooled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature/humidity</td>
<td>Note 1)</td>
<td>Temperature: 50 to 95°F (10 to 35°C), Humidity: 30 to 70%RH</td>
<td>Clear water, Deionized water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid temperature</td>
<td>Note 2)</td>
<td>Facility water temperature +27°F (15°C)</td>
<td>Clear water, Deionized water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid temperature</td>
<td>Note 3)</td>
<td>Facility water temperature +0.5°F (±0.3°C)</td>
<td>Clear water, Deionized water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid temperature</td>
<td>Note 4)</td>
<td>Facility water temperature +0.5°F (±0.3°C)</td>
<td>Clear water, Deionized water</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Circulating fluid temperature</td>
<td>Note 5)</td>
<td>Facility water temperature +0.5°F (±0.3°C)</td>
<td>Clear water, Deionized water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid temperature</td>
<td>Note 6)</td>
<td>Facility water temperature +0.5°F (±0.3°C)</td>
<td>Clear water, Deionized water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid temperature</td>
<td>Note 7)</td>
<td>Facility water temperature +0.5°F (±0.3°C)</td>
<td>Clear water, Deionized water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid temperature</td>
<td>Note 8)</td>
<td>Facility water temperature +0.5°F (±0.3°C)</td>
<td>Clear water, Deionized water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid temperature</td>
<td>Note 9)</td>
<td>Facility water temperature +0.5°F (±0.3°C)</td>
<td>Clear water, Deionized water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid temperature</td>
<td>Note 10)</td>
<td>Facility water temperature +0.5°F (±0.3°C)</td>
<td>Clear water, Deionized water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Electrical system**

- **Power supply**: 3-phase 200/200 to 208 VAC ±10%
- **Max. operating current**: 26 A
- **Breaker capacity**: 30 A
- **Communications**: Serial RS-485 (D-sub 9 pin) and Contact input/output (D-sub 25 pin)
- **Dimensions**: 15 in (380 mm) x D 26.2 in (665 mm) x H33.9 in (860 mm)
- **Weight**: Approx. 198 lbs (90 kg)

**Safety standards**

- UL, CE marking, SEMI (S2-0703, S8-1103, F47-0200), SEMATECH (S2-93, S8-95)

---

**Notes**

Note 1) It should have no condensation.
Note 2) If clear water or deionized water is used, please use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994/cooling water system - circulation type - make-up water). The electrical conductivity of the deionized water used as the fluid varies depending on the operating conditions.
Note 3) Outlet temperature when the circulating fluid and facility water are rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment, power supply, and facility water are within specification range and stable. Value obtained 10 minutes after the external load is stabilized (after stabilization with no load for HRW030-H2). It may be out of this range when a DI control kit (option Y) is used or in some other operating conditions.
Note 4) The capacity at the circulating fluid outlet when the circulating fluid temperature is 68°F (20°C). Pump capacity at 60 Hz indicates the maximum capacity of the HRW002-H2S (pump inverter type).
Note 5) Applicable to the HRW002-H2S (pump inverter type) only.
Note 6) Minimum volume required for operating only the Thermo-chiller. (Circulating fluid temperature: 68°F (20°C), including the Thermo-chiller’s internal pipings or heat exchanger)
Note 7) The automatic circulating fluid recovering function will be provided by selecting option Z for collecting the circulating fluid inside an external piping.
Note 8) Required flow rate for cooling capacity or maintaining the temperature stability.
Note 9) Panel dimensions. These dimensions do not include possible protrusions such as a breaker handle.
Note 10) Weight in the dry state without circulating fluids

---

**How to Order**

- **Clear/Deionized Water Type**
  - **Clear/Deionized Water Type**: Clear/Deionized Water Type
  - **Cooling capacity**: 2 kW, 6 kW, 15 kW, 30 kW
  - **Temperature range setting**: 68 to 194°F (20 to 90°C)

- **Option**
  - **Option**: Nil, C, D, N, Y, Z

- **Pump inverter control**
  - **Pump inverter control**: Nil, S

---

**Communications**

- **Serial RS-485 (D-sub 9 pin)**
- **Contact input/output (D-sub 25 pin)**

---

**Weight**

- **Approx. 198 lbs (90 kg)**
**Thermo-chiller Series HRW**

### Cooling Capacity

<table>
<thead>
<tr>
<th>Model</th>
<th>Heating Capacity (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRW002-H2/008-H2/015-H2/030-H2</td>
<td>10 20 30 40 50 60 70 80 90</td>
</tr>
<tr>
<td>HRW002-H2S/008-H2S/015-H2S/030-H2S</td>
<td>10 20 30 40 50 60 70 80 90</td>
</tr>
</tbody>
</table>

Circulating fluid temperature (°C):
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

### Heating Capacity

<table>
<thead>
<tr>
<th>Model</th>
<th>Heating Capacity (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRW002-H2/008-H2/015-H2/030-H2</td>
<td>10 20 30 40 50 60 70 80 90</td>
</tr>
<tr>
<td>HRW002-H2S/008-H2S/015-H2S/030-H2S</td>
<td>10 20 30 40 50 60 70 80 90</td>
</tr>
</tbody>
</table>

Circulating fluid temperature (°C):
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

### Pump Capacity

<table>
<thead>
<tr>
<th>Model</th>
<th>Circulating fluid capacity (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRW002-H2</td>
<td>0 50 70 90 110 130 150 170°F</td>
</tr>
<tr>
<td>HRW002-H2S</td>
<td>0 50 70 90 110 130 150 170°F</td>
</tr>
</tbody>
</table>

- If the circulating fluid flow drops below 0.53 gpm (2 L/min), the shutdown alarm activates and operation stops. Do not use the product when the flow exceeds 2.1 gpm (8 L/min), since the flow cannot be displayed accurately.
- Pump capacity at 60 Hz indicates the maximum capacity of the HRW002-H2S (pump inverter type).

<table>
<thead>
<tr>
<th>Model</th>
<th>Flow rate (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRW008-H2/015-H2/030-H2</td>
<td>0 10 20 30 40 50 60</td>
</tr>
<tr>
<td>HRW008-H2S/015-H2S/030-H2S</td>
<td>0 10 20 30 40 50 60</td>
</tr>
</tbody>
</table>

- If the circulating fluid flow drops below 0.53 gpm (2 L/min), the shutdown alarm activates and operation stops. Do not use the product when the flow exceeds 4.23 gpm (16 L/min), since the flow cannot be displayed accurately.
- Pump capacity at 60 Hz indicates the maximum capacity of the HRW008-H2S/015-H2S/030-H2S (pump inverter type).
Note) Only when the Di control kit (option Y) is selected.

**Dimensions**

- **Rear side**
  - Power cable entry
  - Plate
  - Facility water inlet Rc3/4 (with plug)
  - Circulating fluid return port Rc1/4 (with plug)
  - Circulating fluid return port Rc3/4 (with plug)
  - Facility water outlet Rc3/4 (with plug)
  - Cooling fan for the unit inside (exhaust)

- **Front side**
  - Emergency off (EMO) switch (Red, ø1.6 in (ø40 mm)
  - With a guard ring (yellow)
  - Operation display panel
  - Breaker handle
  - Handle
  - Caster (unfixed)
  - Bolt for fixing the anti-quake bracket M8 stud bolt
  - Bolt for fixing the anti-quake bracket M8 stud bolt
  - Ventilation (expiration)

**Model Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>Fluorinated fluid type</th>
<th>Ethylene glycol type</th>
<th>Clear/Deionized water type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRW002-H</td>
<td>HRW002-H1</td>
<td>HRW002-H2</td>
<td></td>
<td>15</td>
<td>26.2</td>
<td>33.9</td>
<td>ø0.7 x 0.81</td>
</tr>
<tr>
<td>HRW008-H</td>
<td>HRW008-H1</td>
<td>HRW008-H2</td>
<td></td>
<td>15</td>
<td>26.2</td>
<td>33.9</td>
<td>ø0.7 x 0.81</td>
</tr>
<tr>
<td>HRW015-H</td>
<td>HRW015-H1</td>
<td>HRW015-H2</td>
<td></td>
<td>15</td>
<td>26.2</td>
<td>33.9</td>
<td>ø18.5 to 20.5</td>
</tr>
<tr>
<td>HRW030-H</td>
<td>HRW030-H1</td>
<td>HRW030-H2</td>
<td></td>
<td>15</td>
<td>26.2</td>
<td>33.9</td>
<td>ø18.5 to 20.5</td>
</tr>
</tbody>
</table>

Unit: Inch (mm)

**Note:** Dimensions provided in parentheses are rounded down to the nearest inch for clarity.
## Communication Function
(For details, please consult our “Communication Specifications” information.)

### Contact Input/Output

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector no.</td>
<td>P1</td>
</tr>
<tr>
<td>Connector type (on this product side)</td>
<td>D-sub 25 P type, Female connector</td>
</tr>
<tr>
<td>Fixing bolt size</td>
<td>M2.6 x 0.45</td>
</tr>
</tbody>
</table>

#### Input signal
- **Insulation method:** Photocoupler
- **Rated input voltage:** 24 VDC
- **Operating voltage range:** 21.8 to 26.4 VDC
- **Rated input current:** 5 mA TYP
- **Input impedance:** 4.7 kΩ

#### Output signal
- **Rated load voltage:** 48 VAC or less/30 VDC or less
- **Maximum load current (total):** When using the power supply of the Thermo-chiller: 200 mA DC (resistance load/inductive load)
  When using the power supply of the customer’s machine: 800 mA AC/DC (resistance load/inductive load)

#### Alarm signal
- **Rated load voltage:** 48 VAC or less/30 VDC or less
- **Maximum load current:** 800 mA AC/DC (resistance load/inductive load)

#### EMO signal
- **Rated load voltage:** 48 VAC or less/30 VDC or less
- **Maximum load current:** 800 mA AC/DC (resistance load/inductive load)

---

**Note:** The custom function is equipped for contact input/output. Using the custom function enables the customer to set the signal type for contact input/output or pin assignment numbers. For details, please consult “Communication Specifications” information.

---

**Circuit diagram**

- 24 VDC output
- 24 COM output
- Setting at the time of shipment from factory
- Custom function
  - Run/Stop signal
  - Run/Stop signal 1
  - Run/Stop signal 2
  - DIO REMOTE signal
  - DIO REMOTE signal 1
  - DIO REMOTE signal 2
- Operation condition signal
- Output signal 1
- Output signal 2
- Output signal 3
- Output signal 4
- Output signal 5
- Contact output COM
- Contact output COM
- Alarm signal
- EMO signal

---

**Related Products**

- **Technical Data**
  - HRG
  - HRS
  - HRZ
  - HRZD
  - HEC
  - HEB
  - HED

---

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**800-999-7378**
**Series HRW**

**Communication Function** (For details, please consult our “Communication Specifications” information.)

### Serial RS-485
The serial RS-485 enables the following items to be written and read out.

**<Writing>**
- Run/Stop
- Circulating fluid temperature setting
- Circulating fluid automatic recovery start/stop

**<Readout>**
- Circulating fluid present temperature
- Circulating fluid flow
- Circulating fluid discharge pressure
- Circulating fluid electrical resistivity
- Alarm occurrence information
- Status (operating condition) information

---

**Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector no.</td>
<td>P2</td>
</tr>
<tr>
<td>Connector type (on this product side)</td>
<td>D-sub 9 P type, Female connector</td>
</tr>
<tr>
<td>Fixing bolt size</td>
<td>M2.6 x 0.45</td>
</tr>
<tr>
<td>Standards</td>
<td>EIA RS485</td>
</tr>
<tr>
<td>Protocol</td>
<td>Modicon Modbus</td>
</tr>
</tbody>
</table>

---

**Connector location**
- P3: Not used for the maintenance purpose port
  D-sub 9 (Male receptacle)
- P2: Serial RS-485
  D-sub 9 (Female receptacle)
- P1: Contact input/output
  D-sub 25 (Female receptacle)
- Power cable entry

---

**Diagram**

[Diagram showing connection and components]

---

*1 Only when the circulating fluid automatic recovery function (option Z) is selected.
*2 Only when the DI control kit (option Y) is selected.
Operation Display Panel

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>LCD</td>
<td>Operating condition of this unit/Circulating fluid discharge temperature/Circulating fluid discharge pressure/Setting value/Alarm message, etc. are displayed.</td>
</tr>
<tr>
<td>②</td>
<td>[START/STOP] key</td>
<td>Starts/Stop the operation.</td>
</tr>
<tr>
<td>③</td>
<td>[RESET] key</td>
<td>Stops the alarm buzzing. Resets the alarm.</td>
</tr>
<tr>
<td>④</td>
<td>[SEL] key</td>
<td>Switches the display.</td>
</tr>
<tr>
<td>⑤</td>
<td>[ENT] key</td>
<td>Decides the settings.</td>
</tr>
<tr>
<td>⑥</td>
<td>[▲]/[▼] key</td>
<td>Moves the cursor and changes the setting values.</td>
</tr>
<tr>
<td>⑦</td>
<td>[▶] key</td>
<td>Moves the cursor.</td>
</tr>
<tr>
<td>⑧</td>
<td>[REMOTE] indicator</td>
<td>Lights up when the unit is in the remote status.</td>
</tr>
<tr>
<td>⑨</td>
<td>[RUN] indicator</td>
<td>Lights up when the unit is in the operating status.</td>
</tr>
<tr>
<td>10</td>
<td>[ALARM] indicator</td>
<td>Lights up when the unit is alarming.</td>
</tr>
</tbody>
</table>

Alarm

This unit can display 23 kinds of alarm messages as standard. Also, it can read out the serial RS-485 communication.

<table>
<thead>
<tr>
<th>Alarm code</th>
<th>Alarm message</th>
<th>Operation status</th>
<th>Main reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Water Leak Detect FLT</td>
<td>Stop</td>
<td>Liquid deposits in the drain pan of this unit.</td>
</tr>
<tr>
<td>02</td>
<td>Incorrect Phase Error FLT</td>
<td>Stop</td>
<td>The power supply to this unit is incorrect.</td>
</tr>
<tr>
<td>05</td>
<td>Reservoir Low Level FLT</td>
<td>Stop</td>
<td>The amount of circulating fluid tank is running low.</td>
</tr>
<tr>
<td>06</td>
<td>Reservoir Low Level WRN</td>
<td>Continue</td>
<td>The amount of circulating fluid tank is running low.</td>
</tr>
<tr>
<td>07</td>
<td>Reservoir High Level WRN</td>
<td>Continue</td>
<td>The amount of circulating fluid in the tank has increased.</td>
</tr>
<tr>
<td>08</td>
<td>Temp. Fuse Cutout FLT</td>
<td>Stop</td>
<td>Temperature of the circulating fluid tank is raised.</td>
</tr>
<tr>
<td>09</td>
<td>Reservoir High Temp. FLT</td>
<td>Stop</td>
<td>Temperature of the circulating fluid has exceeded the limitation.</td>
</tr>
<tr>
<td>10</td>
<td>Return High Temp. WRN</td>
<td>Continue</td>
<td>Temperature of returning circulating fluid has exceeded the limit.</td>
</tr>
<tr>
<td>11</td>
<td>Reservoir High Temp. WRN</td>
<td>Continue</td>
<td>Temperature of the circulating fluid has exceeded the limitation set by the customer.</td>
</tr>
<tr>
<td>12</td>
<td>Return Low Flow FLT</td>
<td>Stop</td>
<td>The circulating fluid flow has gone below the limit.</td>
</tr>
<tr>
<td>13</td>
<td>Return Low Flow WRN</td>
<td>Continue</td>
<td>Flow rate of the Thermo-chiller has dropped below the set value.</td>
</tr>
<tr>
<td>15</td>
<td>Pump Breaker Trip FLT</td>
<td>Stop</td>
<td>The protective equipment in the circulating fluid driving line has started.</td>
</tr>
<tr>
<td>17</td>
<td>Interlock Fuse Cutout FLT</td>
<td>Stop</td>
<td>Overcurrent is flown to the control circuit.</td>
</tr>
<tr>
<td>18</td>
<td>DC Power Fuse Cutout WRN</td>
<td>Continue</td>
<td>Overcurrent has flowed to the (optional) solenoid valve. (Only for the automatic circulating fluid recovery function - option 2)</td>
</tr>
<tr>
<td>19</td>
<td>FAN Motor Stop WRN</td>
<td>Continue</td>
<td>Cooling fan inside the compressor has stopped.</td>
</tr>
<tr>
<td>21</td>
<td>Controller Error FLT</td>
<td>Stop</td>
<td>The error occurred in the control systems.</td>
</tr>
<tr>
<td>22</td>
<td>Memory Data Error FLT</td>
<td>Stop</td>
<td>The data stored in the controller of this unit went wrong.</td>
</tr>
<tr>
<td>23</td>
<td>Communication Error WRN</td>
<td>Continue</td>
<td>The serial communications between this unit and customer's system has been suspended.</td>
</tr>
<tr>
<td>24</td>
<td>DI Low Level WRN</td>
<td>Continue</td>
<td>DI level of the circulating fluid has gone below the limitation set by the customer. (Only for DI control kit - option Y)</td>
</tr>
<tr>
<td>25</td>
<td>Pump Inverter Error FLT</td>
<td>Stop</td>
<td>The error occurred in the circulating pump inverter. This alarm is applicable to the HRW/L50132/H-5 only.</td>
</tr>
<tr>
<td>26</td>
<td>DNET Comm. Error FLT</td>
<td>Stop</td>
<td>The DeviceNet communications between this unit and customer's system has been suspended. (Only for DeviceNet communication specification - option D)</td>
</tr>
<tr>
<td>27</td>
<td>DNET Comm. Error WRN</td>
<td>Continue</td>
<td>An error has occurred in the DeviceNet communication system of this unit. (Only for DeviceNet communication specification - option D)</td>
</tr>
<tr>
<td>29</td>
<td>F.Water Low Temp. WRN</td>
<td>Continue</td>
<td>Temperature of facility water has dropped below the set temperature.</td>
</tr>
<tr>
<td>30</td>
<td>F.Water High Temp. WRN</td>
<td>Continue</td>
<td>Temperature of facility water has exceeded the set temperature.</td>
</tr>
</tbody>
</table>

Common Specifications Series HRW
Options have to be selected when ordering the Thermo-chiller. It is not possible to add them after purchasing the unit.

**Series HRW**

**Options**

### Analog Communication

**HRW---C**

**Analog communication**

In addition to the standard contact input/output signal communication and the serial RS-485 communication, analog communication function can be added. The analog communication function enables to write and read out the following items.

- **Writing**
  - Circulating fluid temperature
  - Circulating fluid present temperature setting
  - Electrical resistivity
  - Only when the DI control kit (option Y) is selected.

- **Readout**
  - Circulating fluid discharge temperature
  - Circulating fluid flow
  - Circulating fluid discharge pressure
  - Electrical resistivity

Scaling voltage - circulating fluid temperature can be set arbitrarily by the customer.

For details, please consult our “Communication Specifications” information.

### DeviceNet Communication

**HRW---D**

**DeviceNet communication**

In addition to the standard contact input/output signal communication and the serial RS-485 communication, DeviceNet function can be added. DeviceNet function enables to write and read out the following items.

- **Writing**
  - Run/Stop
  - Circulating fluid temperature setting
  - Circulating fluid automatic recovery start/stop

- **Readout**
  - Circulating fluid present temperature
  - Circulating fluid flow
  - Circulating fluid discharge pressure
  - Electrical resistivity

- **Alarm occurrence information**
  - Status (operating condition) information

- **Note**
  - Only when the circulating fluid automatic recovery function (option Z) is selected.
  - Only when the DI control kit (option Y) is selected.

For details, please consult our “Communication Specifications” information.

### NPT Fitting

**HRW---N**

**NPT fitting**

An adapter is included to change the connection parts of circulating fluid piping and facility water piping to NPT thread type. The adapter must be installed by the customer.

### DI Control Kit

**HRW---Y**

**DI control kit**

Select this option if you want to maintain the electrical resistivity (DI level) of the circulating fluid at a certain level. However, some components have to be fitted by customer. For details, refer to specification table for this option.

Please note that this is not applicable to the fluorinated liquid type.

<table>
<thead>
<tr>
<th>Applicable model</th>
<th>HRW0- -H1-Y</th>
<th>HRW0- -H2-Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowable circulating fluid</td>
<td>60% ethylene glycol aqueous solution</td>
<td>Deionized water</td>
</tr>
<tr>
<td>DI level display range</td>
<td>MΩ/cm</td>
<td>0 to 20</td>
</tr>
<tr>
<td>DI level set range</td>
<td>MΩ/cm</td>
<td>0 to 20 (Note)</td>
</tr>
<tr>
<td>Solenoid valve hysteresis for control</td>
<td>MΩ/cm</td>
<td>0 to 0.9</td>
</tr>
<tr>
<td>DI level reduction alarm set range</td>
<td>MΩ/cm</td>
<td>0 to 20</td>
</tr>
</tbody>
</table>

**Note**

- Please order separately.
- Please purchase additionally because the DI filter is not included in this option. Also, if necessary, additionally purchase the insulating material for the DI filter. (SMC Part No.: HRZ-DF002)

DI tube (1 piece each attached for IN/OUT)

DI filter (Optional accessories) (Refer to page 121.)

- Install the DI filter outside the Thermo-chiller for piping. Secure the space for installing the DI filter in the rear side of the Thermo-chiller.
- It may go outside of the temperature stability range of ±0.3°C when this option is used in some operating conditions.

Outlet port to DI filter

Return port from DI filter
Select this option for customers who want to use the circulating fluid automatic recovery function. The automatic recovery function is a device which can recover the circulating fluid inside pipings into a sub-tank of the Thermo-chiller by the external communication or operation display panel. Some components need to be fitted by the customer. For details, consult “Product Specifications” information for these options.

### Applicable model
- Common for all models

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulating fluid recoverable volume</td>
<td>3.2 gal (12 L)</td>
</tr>
<tr>
<td>Purge gas</td>
<td>Nitrogen gas</td>
</tr>
<tr>
<td>Purge gas supply port</td>
<td>Self-align fitting for O.D. ø0.3in (ø8mm)</td>
</tr>
<tr>
<td>Purge gas supply pressure</td>
<td>58 to 102 psi (0.4 to 0.7 MPa)</td>
</tr>
<tr>
<td>Purge gas filtration</td>
<td>0.01 or less</td>
</tr>
<tr>
<td>Regulator set pressure</td>
<td>22 to 44 psi (0.15 to 0.3 MPa)</td>
</tr>
<tr>
<td>Recoverable circulating fluid temperature</td>
<td>50 to 104°F (10 to 40°C)</td>
</tr>
<tr>
<td>Recovery start/stop</td>
<td>Start: External communication or operation display panel/Stop: Automatic</td>
</tr>
<tr>
<td>Timeout error</td>
<td>Timer from recovery start to completion</td>
</tr>
<tr>
<td></td>
<td>Stops recovering when the timer turns to set time. Possible set range: 60 to 300 sec, at the time of shipping from the factory: 300 sec</td>
</tr>
<tr>
<td>Height difference with the customer system side</td>
<td>32.8 ft (10 m) or less</td>
</tr>
</tbody>
</table>

**Note 1:** This is the space volume of the sub-tank when the liquid level of the circulating fluid is within the specification. Guideline of the recovery volume is 80% of the circulating fluid recoverable volume.

**Note 2:** Before piping, clean inside the pipings with air blow, etc. Use the piping with no dust generation by purge gas. When using resin tube, where necessary, use insert fittings, etc. in order not to deform the tubings when connecting to self-align fittings.

**Note 3:** At the time of shipping from factory, it is set to 29 psi (0.2 MPa).

**Note 4:** For details, please consult our “Communication Specifications” information.
### Series HRW

#### Optional Accessories

**By-pass Piping Set**

When the circulating fluid goes below the rated flow, cooling capacity will be reduced and the temperature stability will be badly affected. In such a case, use the by-pass piping set.

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRW-BP001</td>
<td>Common for all models</td>
</tr>
</tbody>
</table>

**Anti-quake Bracket**

Bracket for earthquakes

Prepare the anchor bolts (M12) which are suited to the floor material by the customer.

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ-TK002</td>
<td>Common for all models</td>
</tr>
</tbody>
</table>

#### Mounting view (Rear side)

Approx. 5.9 in (150 mm)

- To circulating fluid outlet
- To circulating fluid return port
- By-pass volume adjustment valve
- 2 x Rc3/4
- Insulating material

**Antiquake Bracket Anchor bolt location**

- Front side
- Top side
- 4 x ø14 (4 x ø0.55)
- 6.3 (160)
- Anchor bolt location

**Unit:** In (mm)

2 pieces per set (4 nuts are included.)

**Nut (M8) x 2**

(Accessory to anti-quake bracket)

**Anchor bolt (M12)**

- 2 pieces per set (4 nuts are included.)

**Top side**

- Anchor bolt location

**Front side**

- Fit it on the opposite side similarly.
4-Port Manifold

4-branching the circulating fluid enables 4 temperature controls at the maximum with the 1 unit Thermo-chiller. Order the heat insulator for 4 port manifold (HRW-MA002) separately if necessary.

### DI Filter

This is the ion replacement resin to maintain the electric resistivity of the circulating fluid. Customers who selected the DI control kit (option Y) need to purchase the DI filter separately.

### Insulating Material for DI Filter

When the DI filter is used at a high temperature, we recommend that you use this insulating material to protect the radiated heat from the DI filter or possible burns. We also recommend that you use this to prevent heat absorption from the DI filter and to avoid forming condensation.

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRW-MA001</td>
<td>Common for all models</td>
</tr>
<tr>
<td>HRW-MA002</td>
<td>Common for all models which can select the DI control kit (option Y)</td>
</tr>
</tbody>
</table>

**Weight:** Approx. 44 lbs (20 kg)
Series HRW

Contaminant Filter

A filter mounted in the circulating fluid circuit to eliminate the dust which is contained in the circulating fluid. (Filtration: 20 µm) It is provided with its own heat insulator.

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRW-CF001</td>
<td>Common for all models</td>
</tr>
<tr>
<td>HRW-CF002</td>
<td></td>
</tr>
</tbody>
</table>

Note) The internal element of the contaminant filter (Part no.: HRW-CF002) is a replacement part. The period in service depends on the operating conditions.

60% Ethylene Glycol Aqueous Solution

This solution can be used as a circulating fluid for ethylene glycol-type Thermo-chillers. (Capacity: 2.6 gal (10 L))

Concentration Meter

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

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRZ-BR001</td>
<td>Common for all ethylene glycol-type models</td>
</tr>
<tr>
<td>HRZ-BR002</td>
<td>Common for all ethylene glycol-type models</td>
</tr>
</tbody>
</table>
**Series HRW**

Specific Product Precautions 1

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back pages 2 to 5 for Temperature Control Equipment Precautions.

### Warning

1. This catalog shows the specifications of a single unit.
   1. For details, please consult our “Product Specifications” and thoroughly consider the adaptability between the customer’s system and this unit.
   2. Although the protection circuit as a single unit is installed, the customer is requested to carry out the safety design for the whole system.

### Selection

#### Caution

1. Model selection
   In order to select the correct Thermo-chiller model, the amount of thermal generation from the customer’s system, the operating circulating fluid, and its circulating flow are required. Select a model, by referring to the guideline to model selection on page 104.

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

### Operating Environment/Storage Environment

#### Caution

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 where the ambient temperature exceeds the limits as mentioned below.

   - During operation 50 to 95°F (10 to 35°C)
   - During storage 32 to 122°F (0 to 50°C) (but as long as water or circulating fluid are not left inside the pipings)

2. Locations where the ambient pressure exceeds the atmospheric pressure.
   1. During operation 30% to 70%
   2. During storage 15% to 85%
3. (Inside the operation facilities) locations where there is not sufficient space for maintenance.
4. In locations where the ambient pressure exceeds the atmospheric pressure.

2. The Thermo-chiller does not have clean room specification. It generates dust from the pump inside the unit and the cooling fan for the unit inside.

### Caution

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

2. Use ethylene glycol that does not contain additives such as preservatives.

3. The condensation of ethylene glycol aqueous solution must be 60% or less. If the condensation is too high, the pump will be overloaded, resulting in occurrence of “Pump Breaker Trip FLT”.

4. Avoid water moisture entering the fluorinated fluid.

5. Use clear water (including for diluting ethylene glycol aqueous solution) which must meet the water quality standards as mentioned below.

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

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Standard Value</th>
<th>Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (at 77°F (25°C)</td>
<td>—</td>
<td>6.0 to 8.0</td>
<td>○ ○</td>
</tr>
<tr>
<td>Electrical conductivity (77°F)</td>
<td>[µS/cm]</td>
<td>100° to 300°</td>
<td>○ ○</td>
</tr>
<tr>
<td>Chloride ion (Cl⁻)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○ ○</td>
</tr>
<tr>
<td>Sulfuric acid ion (SO₄²⁻)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○ ○</td>
</tr>
<tr>
<td>Acid consumption amount (at pH 8.8)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○ ○</td>
</tr>
<tr>
<td>Total hardness</td>
<td>[mg/L]</td>
<td>70 or less</td>
<td>○ ○</td>
</tr>
<tr>
<td>Calcium hardness (CaCO₃)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○ ○</td>
</tr>
<tr>
<td>Ionic state silica (SiO₂)</td>
<td>[mg/L]</td>
<td>30 or less</td>
<td>○ ○</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>○ ○</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td>○ ○</td>
</tr>
<tr>
<td>Sulfide ion (S₂⁻)</td>
<td>[mg/L]</td>
<td>Should not be detected</td>
<td></td>
</tr>
<tr>
<td>Ammonium ion (NH₄⁺)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td>○ ○</td>
</tr>
<tr>
<td>Residual chlorine (Cl⁻)</td>
<td>[mg/L]</td>
<td>0.5 or less</td>
<td>○ ○</td>
</tr>
<tr>
<td>Free carbon (CO₂)</td>
<td>[mg/L]</td>
<td>4.0 or less</td>
<td>○ ○</td>
</tr>
</tbody>
</table>

* In the case of [ML/cm], it will be 0.003 to 0.01.
* If the water quality standards are met, complete prevention of corrosion is not guaranteed.

### Transportation/Transfer/Movement

#### Warning

1. Transportation by forklift
   1. It is not possible to hang this product.
   2. The fork insertion position is either on the left side face or right side face of the unit. Be careful not to bump the fork against a caster or level foot and be sure to put through the fork to the opposite side.
   3. Be careful not to bump the fork to the cover panel or piping ports.

2. Transportation by casters
   1. This product is heavy and should be moved by at least two people.
   2. Do not grip the pipings on the rear side of the handle of the panel.

---

**Design**

**Circulating Fluid**

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SHOP ONLINE at www.airlinehyd.com

800-999-7378
1. Regarding the circulating fluid pipings, consider carefully the suitability for shutoff pressure, temperature and circulating fluid. If the operating performance specifications are regularly exceeded, the pipings may burst during operation.

2. The surface of the circulating fluid pipings should be covered with the insulating materials which can effectively confine the heat. Absorbing the heat from the surface of pipings may reduce the cooling capacity performance and the heating capacity may be shortened due to heat radiation.

3. When using fluorinated liquid as the circulating fluid, do not use pipe tape. Liquid leakage may occur around the pipe tape. For sealant, we recommend that you use the following sealant: SMC Part No., HRZ-S0003 (Silicone sealant).

4. For the circulating fluid pipings, use clean pipings which have no dust, oil or water moisture inside the pipings, and blow with air prior to undertaking any piping works. If any dust, oil or water moisture enters the circulating fluid circuit, inferior cooling performance or equipment failure due to frozen water may occur, resulting in bubbles in the circulating fluid inside the tank.

5. Select the circulating fluid pipings which can exceed the required rated flow. For the rated flow, refer to the pump capacity table.

6. For the circulating fluid piping connection, install a drain pan just in case the circulating fluid may leak.

7. Do not return the circulating fluid to the unit by installing a pump in the customer system.

---

**Caution**

1. Avoid using this product outdoors.

2. Install on a rigid floor which can withstand this product’s weight.

3. Please install a suitable anchor bolt for the anti-quake bracket taking into consideration the customers floor material.

4. Avoid placing heavy objects on this product.

---

**Piping**

**Caution**

1. Regarding the circulating fluid pipings, consider carefully the suitability for shutoff pressure, temperature and circulating fluid. If the operating performance specifications are regularly exceeded, the pipings may burst during operation.

2. The surface of the circulating fluid pipings should be covered with the insulating materials which can effectively confine the heat. Absorbing the heat from the surface of pipings may reduce the cooling capacity performance and the heating capacity may be shortened due to heat radiation.

3. When using fluorinated liquid as the circulating fluid, do not use pipe tape. Liquid leakage may occur around the pipe tape. For sealant, we recommend that you use the following sealant: SMC Part No., HRZ-S0003 (Silicone sealant).

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5. Select the circulating fluid pipings which can exceed the required rated flow. For the rated flow, refer to the pump capacity table.

6. For the circulating fluid piping connection, install a drain pan just in case the circulating fluid may leak.

7. Do not return the circulating fluid to the unit by installing a pump in the customer system.
Series HRW
Specific Product Precautions 3

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back pages 2 to 5 for Temperature Control Equipment Precautions.

<table>
<thead>
<tr>
<th>Caution</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Caution</strong></td>
<td><strong>Warning</strong></td>
</tr>
<tr>
<td>1. Confirmation before operation</td>
<td>1. Do not operate the switch with wet hands or touch electrical parts such as an electrical plug. This will lead to an electrical shock.</td>
</tr>
<tr>
<td>1. The circulating fluid should be within the specified range of “HIGH” and “LOW”.</td>
<td>2. Do not splash water directly on this product for cleaning. This will lead to an electrical shock or a fire.</td>
</tr>
<tr>
<td>2. Be sure to tighten the cap for the circulating fluid port until the click sound is heard.</td>
<td>3. When the panel was removed for the purpose of inspection or cleaning, mount the panel after works were done.</td>
</tr>
<tr>
<td>2. Emergency stop method</td>
<td>If the panel is still open, or running the equipment with the panel removed, it may cause an injury or electric shock.</td>
</tr>
<tr>
<td>In the case of an emergency, press down the EMO switch which is fitted on the front face of this product.</td>
<td><strong>Caution</strong></td>
</tr>
<tr>
<td></td>
<td>1. In order to prevent a sudden product failure of the unit, replace the replacement parts every 36 months.</td>
</tr>
<tr>
<td></td>
<td>2. Perform an inspection of the circulating fluid every 3 months.</td>
</tr>
<tr>
<td></td>
<td>1. In the case of fluorinated fluids:</td>
</tr>
<tr>
<td></td>
<td>Discharge the circulating liquid and avoid any dirty objects, or water moisture, or foreign objects entering the system.</td>
</tr>
<tr>
<td></td>
<td>2. In the case of ethylene glycol aqueous solution:</td>
</tr>
<tr>
<td></td>
<td>Maintain the condensation at 60%.</td>
</tr>
<tr>
<td></td>
<td>3. In case of clear water, deionized water:</td>
</tr>
<tr>
<td></td>
<td>Replacement is recommended.</td>
</tr>
<tr>
<td></td>
<td>3. Check the water quality of facility water every 3 months.</td>
</tr>
</tbody>
</table>
| | Regarding the water quality standards for facility water, refer to “Temperature Control Equipment Precautions”.

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800-999-7378
Peltier-Type Chiller

Thermo-con **Air-cooled** **Water-cooled** Series **HEC**

Can precisely control the temperature of a heat source or process fluid.

Precisely control the temperature of the circulating fluid by using the Peltier device. Generates little vibration, and is refrigerant-free and environmentally friendly.

Can control the temperature of the heat source by using the external temperature sensor (sold separately).

(Automatically adjusts to the effects of ambient temperature.)

- **Temperature range setting:**
  50 to 140°F (10° to 60°C)

- **Temperature stability:**
  ±0.018 to 0.054°F (±0.01 to 0.03°C)

**Air-cooled** Series **HEC-A**

- Air-cooled: Can be used in the environments with no cooling equipment.
- Cooling capacity:
  230 W, 600 W

**Water-cooled** Series **HEC-W**

- Water-cooled: Can be used in the environments with facility water equipment.
- Cooling capacity:
  140 W, 320 W, 600 W, 1200 W
Compliant with safety standard for medical equipment IEC 60601-1 (Air-cooled/HEC002-A series)

Power supply: Applicable to 100 V to 240 V (Air-cooled/HEC-A series, Water-cooled/HEC001-W, HEC003-W)

Suitable to fluorinated fluids (Fluorinert™ FC-3283, Galden® HT135) (Water-cooled/HEC006-W, HEC012-W)

Compatible with ethylene glycol 20% (Water-cooled/HEC001-W, HEC003-W)

Learning Control Function (Temp. control by external temperature sensor)

This function adjusts the fluid temperature to the set value with an automatic offset setting. Set the external temperature sensor at the circulating fluid inlet located just in front of the heat source, which allows the Thermo-con to sample the fluid temperature. This function is effective when automatically adjusting for heat exhaust from piping, etc. If the external temperature sensor is installed directly on the heat source, the learning control function may not work properly due to large heat volume or large temperature difference. Be sure to install the sensor at the circulating fluid inlet.

Principle of Peltier Device (Thermo-module)

A Peltier device (thermo-module) is a plate type element, inside which P-type semiconductors and N-type semiconductors are located alternately. If direct current is supplied to the Peltier device (thermo-module), heat is transferred inside the device, and one face generates heat and increases temperature while the other face absorbs heat and decreases temperature. Therefore, changing the direction of the current supplied to the Peltier device (thermo-module) can achieve heating and cooling operation. This method has a fast response and can shift quickly between heating and cooling, so temperature can be controlled very precisely.
The Thermo-con is constructed as shown in Figure 1. It interposes a Peltier device (thermo-module) between the heat exchangers for the circulating fluid and facility water and controls the pulse width of supply direct current to achieve the target outlet temperature of circulating fluid precisely. The circulating fluid returns to the tank, and is transferred by the pump which is built in the Thermo-con, and goes through the heat exchangers and internal sensors and out from the circulating fluid outlet. Figure 2 shows an example of circulating fluid piping. The circulating fluid is transferred at a constant temperature by the pump.
When to Use Air-Cooled and Water-Cooled Thermo-con

Both air-cooled and water-cooled Thermo-cons are available. Select a proper Thermo-con by referring to the following.

**Air-cooled**
- No facility water equipment
- Frequent piping changes

**Water-cooled**
- Need to avoid effects of ambient temperature.
- Want to reduce the installation space.

Can install the unit easily without facility water equipment.

Can reduce the piping installation labor since facility water piping is not required.

Since the unit is water-cooled, the ambient temperature will have little effect.

Can reduce the space since the unit is compact.

### Application Examples

#### Semiconductor
Example: Temperature control of a chamber electrode
- Etching equipment
- Spatter equipment
- Cleaning equipment

#### Medical
Example: Blood preservation
- X-ray diagnostic instrument
- MRI
- Blood preservation equipment

#### Machine tool
Example: Laser machining
- Wire cutting
- Grinder
- Spot welding
- Plasma welding
- Laser machining, etc.

Temperature-controlling the laser generating tube enables the laser wavelength to be optimised, improving the accuracy of the machined cross sectional area.

#### Analysis
Example: Electronic microscope
- Electron microscope
- X-ray analytical instrument
- Gas chromatography
- Sugar level analytical instrument, etc.

Prevents the distortion caused by the heat generated by the electronic gun in an electronic microscope.

### Bonding of DVD including next generation
Air-cooled Water-cooled

### Cooling of semiconductor laser
Air-cooled Water-cooled

### Temperature control of die-cast mold
Air-cooled Water-cooled
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- Model Selection ................................. Page 132, 133

Air-cooled
Series HEC-A

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- Cooling Capacity/Heating Capacity/
  Pump Capacity (Thermo-con Outlet)  .... Page 135
- Parts Description ............................... Page 136
- Dimensions .................................... Page 137, 138
- Connectors ..................................... Page 139
- Alarm/Maintenance ......................... Page 140
- Options ........................................ Page 141
- Specific Product Precautions ............ Page 142 to 144

Water-cooled Series HEC-W

- How to Order/Specifications ............... Page 146, 147
- Cooling Capacity/Heating Capacity/
  Pump Capacity (Thermo-con Outlet)/
  Pressure Loss in Facility Water Circuit .... Page 148 to 150
- Parts Description .............................. Page 151
- Dimensions ................................... Page 152 to 154
- Connectors ................................... Page 155
- Alarm/Maintenance ......................... Page 156
- Options ........................................ Page 157
- Specific Product Precautions ............ Page 158, 159
1. What radiation method will be used?

Without a cooling tower ··············· Air-cooled HEC-A series
With a cooling tower ··············· Water-cooled HEC-W series

When to Use Air-cooled and Water-cooled Thermo-con

<Air-cooled>
- No facility water equipment → Can install the unit easily without facility water equipment.
- Frequent piping changes → Can reduce the piping installation labor since facility water piping is not required.

<Water-cooled>
- Need to avoid effects of ambient temperature. → Since the unit is water-cooled, the ambient temperature will have little effect.
- Want to reduce installation space. → Can reduce the space since the unit is compact.

2. How much is the temperature in degrees centigrade for the circulating fluid?

Temperature range which can be set with the Thermo-con: 50 to 140°F (10 to 60°C)
If a lower temperature (down to –4°F (~–20°C)) or higher temperature (up to 194°F (90°C)) than this range is necessary, select the Thermo-chiller HRZ series.

3. What kind of the circulating fluids will be used?

Circulating fluids that can be used in the Thermo-con

<table>
<thead>
<tr>
<th>Model</th>
<th>Clear water</th>
<th>Fluorinert™ FC-3238</th>
<th>20% ethylene glycol</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEC001-W, HEC003-W</td>
<td>○</td>
<td>×</td>
<td>○</td>
</tr>
<tr>
<td>HEC006-W, HEC012-W</td>
<td>○</td>
<td>○</td>
<td>×</td>
</tr>
<tr>
<td>HEC002-A, HEC006-A</td>
<td>○</td>
<td>×</td>
<td>×</td>
</tr>
</tbody>
</table>

○ : Usable  × : Unusable

4. How much cooling capacity required?

Allows a safety factor of 20% over the capacity that is actually required, taking into account the changes in the operating conditions. If a larger capacity than this Thermo-con is necessary, select the Thermo-cooler HRG series or Thermo-chiller HRZ series.

Example 1 When the heat generation amount in the customer’s machine is known.

Heat generation amount: 400 W

Cooling capacity = Considering a safety factor of 20%, \( 400 \times 1.2 = 480 \text{ W} \)
**Guide to Model Selection**

**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 fluid inside the customer's machine.

- Heat generation amount $Q$ : Unknown
- Circulating fluid temperature difference $\Delta T (= T_2 - T_1)$ : 0.8°C (0.8 K)
- Circulating fluid outlet temperature $T_1$ : 25°C (298.15 K)
- Circulating fluid return temperature $T_2$ : 25.8°C (298.95 K)
- Circulating fluid flow rate $L$ : 3 L/min
- Circulating fluid : Water

\[
Q = \frac{\Delta T \times L \times \gamma \times C}{60 \times 1000} = \frac{0.8 \times 3 \times 1 \times 10^3 \times 4.2 \times 10^3}{60 \times 1000} = 167 \text{ W}
\]

Cooling capacity = Considering a safety factor of 20%,

\[
167 \text{ W} \times 1.2 = 200 \text{ W}
\]

**Example 3** | When cooling the object below a certain temperature in certain period of time.

- Cooled substance total volume $V$ : 20 L
- Cooling time $h$ : 15 min
- Cooling temperature difference $\Delta T$ : Temperature difference: 10°C (10 K), Cool from 30°C (303 K) to 20°C (293 K).
- Circulating fluid : Clear water

\[
Q = \frac{\Delta T \times V \times \gamma \times C}{h \times 60 \times 1000} = \frac{10 \times 20 \times 1 \times 10^3 \times 4.2 \times 10^3}{15 \times 60 \times 1000} = 933 \text{ W}
\]

Cooling capacity = Considering a safety factor of 20%,

\[
933 \text{ W} \times 1.2 = 1120 \text{ W}
\]

**Precautions on Model Selection**

The flow rate of the circulating fluid depends on the pressure loss of the customer's machine and the length, diameter and resistance created by bends in the circulating fluid piping, etc. Check if the required flow rate of circulating fluid can be obtained before selecting.

**Circulating Fluid Typical Physical Property Values**

**Fluorinated Fluids**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Physical property value</th>
<th>Density $\gamma$ [kg/m$^3$]</th>
<th>Specific heat $C$ [J/(kg·K)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>$-10^\circ C$</td>
<td>1.87 x 10$^3$</td>
<td>0.87 x 10$^3$</td>
<td></td>
</tr>
<tr>
<td>$20^\circ C$</td>
<td>1.80 x 10$^3$</td>
<td>0.96 x 10$^3$</td>
<td></td>
</tr>
<tr>
<td>$50^\circ C$</td>
<td>1.74 x 10$^3$</td>
<td>1.05 x 10$^3$</td>
<td></td>
</tr>
<tr>
<td>$80^\circ C$</td>
<td>1.67 x 10$^3$</td>
<td>1.14 x 10$^3$</td>
<td></td>
</tr>
</tbody>
</table>

**Water**

Density $\gamma$: 1 x 10$^3$ [kg/m$^3$]  | Specific heat $C$: 4.2 x 10$^3$ [J/(kg·K)]
Peltier-Type Chiller
Thermo-con (Air-cooled)
Series HEC-A

How to Order

HEC 002 - A 5 B

Cooling capacity
002 230 W
006 600 W

Radiating method
A Air-cooled

Power supply
5 100 to 240 VAC

Option
None
F With flow switch
N NPT thread

Communication
A RS-485
B RS-232C

Note 1) The option should be specified when ordering.

Note 2) Select B when communication is not used.

Specifications
(For details, please consult our “Product Specifications” information.)

<table>
<thead>
<tr>
<th>Model</th>
<th>HEC002-A5A</th>
<th>HEC002-A5B</th>
<th>HEC006-A5A</th>
<th>HEC006-A5B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling method</td>
<td>Thermoelectric device (Thermo-module)</td>
<td>Forced air cooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiating method</td>
<td>Forced air cooling</td>
<td>Forced air cooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control method</td>
<td>Cooling/Heating automatic shift PID control</td>
<td>Cooling/Heating automatic shift PID control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature/humidity</td>
<td>50 to 95°F (10 to 35°C), 35 to 80% RH (no condensation)</td>
<td>50 to 95°F (10 to 35°C), 35 to 80% RH (no condensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>50 to 140°F (10 to 60°C) (no condensation)</td>
<td>50 to 140°F (10 to 60°C) (no condensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling capacity</td>
<td>230 W</td>
<td>600 W</td>
<td>230 W (Note 1)</td>
<td>600 W (Note 1)</td>
</tr>
<tr>
<td>Heating capacity</td>
<td>230 W</td>
<td>600 W</td>
<td>600 W (Note 1)</td>
<td>900 W (Note 2)</td>
</tr>
<tr>
<td>Temperature stability (Note 2)</td>
<td>±0.018 to ±0.05°F (±0.01 to ±0.03°C)</td>
<td>±0.018 to ±0.05°F (±0.01 to ±0.03°C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump capacity</td>
<td>Refer to performance chart</td>
<td>Refer to performance chart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tank capacity</td>
<td>Approx. 0.32 gal (1.2 L)</td>
<td>Approx. 0.32 gal (1.2 L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port size</td>
<td>IN/OUT</td>
<td>Rc1/4</td>
<td>Rc3/8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drain</td>
<td>Rc1/4 (with plug)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetted parts material</td>
<td>Stainless steel 304, Stainless steel 304, EPDM, Ceramics, PPS glass 30%, Carbon, PE, Polyurethane</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>Single-phase 100 to 240 VAC ±10%, 50/60 Hz</td>
<td>Single-phase 100 to 240 VAC ±10%, 50/60 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overcurrent protector</td>
<td>15 A</td>
<td>15 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>8 A (100 VAC) to 3 A (240 VAC)</td>
<td>10 A (100 VAC) to 4 A (240 VAC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm</td>
<td>Refer to alarm function</td>
<td>Refer to alarm function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td>RS-485</td>
<td>RS-232C</td>
<td>RS-485</td>
<td>RS-232C</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 38.6 lbs (17.5 kg) (including foot for fixing)</td>
<td>Approx. 60.6 lbs (27.5 kg) (including foot for fixing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td>Power cable, Foot for fixing</td>
<td>Power cable, Foot for fixing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety standards</td>
<td>CE marking, UL (NRTL) standards, Safety standard for medical equipment (IEC 60601-1)</td>
<td>CE marking, UL (NRTL) standards</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1) Conditions: Set temperature 77°F (25°C), Ambient temperature 77°F (25°C), Circulating flow rate 0.79 gpm (3 L/min)
Note 2) Conditions: Set temperature 77°F (25°C), Ambient temperature 68°F (20°C), Circulating flow rate 2.11 gpm (8 L/min)
Note 3) The indicated values are with a stable load without turbulence in the operating conditions. It may be out of this range in some other operating conditions.
Peltier-Type Chiller
Thermo-con (Air-cooled)  
**Series HEC-A**

### Cooling Capacity

**HEC002**  
Circulating fluid: Clear water

**HEC006**  
Circulating fluid: Clear water

The values shown on the performance chart are not guaranteed, but typical. Allow margins for safety when selecting the model.

### Heating Capacity

**HEC002**  
Circulating fluid: Clear water

**HEC006**  
Circulating fluid: Clear water

### Pump Capacity (Thermo-con Outlet)

The pressure on the y-axis shows the discharge pressure of circulating fluid in the Thermo-con.

**HEC002**  
Circulating fluid: Clear water

**HEC006**  
Circulating fluid: Clear water

---

**Related Products**

**HRG**  
**HRS**  
**HRZ**  
**HRZD**  
**HRW**  
**HEC**  
**HEB**  
**HED**  
**Technical Data**

SHOP ONLINE at www.airlinehyd.com  
800-999-7378
Series HEC-A

Parts Description

HEC002

Power connector
Handle
Communication connector
RS-232C type 1 pc.
RS-485 type 2 pcs.
Alarm connector
External temperature sensor connector

HEC006

Power connector
Handle
Communication connector
RS-232C type 1 pc.
RS-485 type 2 pcs.
Alarm connector
External temperature sensor connector

Display/Operation panel
Power switch
Tank lid with gasket
Circulating fluid outlet
Filter
Circulating fluid inlet
Drain (circulating fluid drain port)
Circulating fluid level gauge
Peltier-Type Chiller
Thermo-con (Air-cooled)  Series HEC-A

Dimensions
Unit: inch (mm)

HEC002

Technical Data

Related Products
Series **HEC-A**

### Dimensions

**HEC006**

![Diagram](image)

#### Option (Fitting part)

NPT fitting specification (-N, -FN)

- Circulating fluid outlet: NPT3/8
- Circulating fluid inlet: NPT3/8
- Circulating fluid drain port (with plug): NPT1/4

#### Power Cable (Accessory)

**Connector:** IEC 60320 C13 or equivalent

**Cable:** 14AWG, O.D. ø8.4

**Wire color** | **Contents**
---|---
Black | 100 to 240 VAC
Black | 100 to 240 VAC
Green/Yellow | PE

**Contents:**
- **Power cable** (Accessory)
- **Connector:** IEC 60320 C13 or equivalent
- **Cable:** 14AWG, O.D. ø8.4
- **Wire color** (Black, Black, Green/Yellow)
- **Contents** (100 to 240 VAC, 100 to 240 VAC, PE)

### Warning/Caution label

- **CAUTION**
  - No user serviceable parts inside.
  - Do not remove the panel.
  - Contact may cause electric shock, or burn.

- **WARNING**
  - HAZARDOUS VOLTAGE INSIDE
  - Refer all repair to the manufacturer.
  - Please keep air filter clean as performance decreases with dust build up.

---

**Dimensions**

- **Model no. label**
- **Handle**
- **Filter cover**
- **Filter**
- **Circulating fluid outlet** NPT3/8
- **Circulating fluid inlet** NPT3/8
- **Circulating fluid drain port (with plug)** NPT1/4
- **Tank lid with gasket**
- **Alarming**
- **External temperature sensor**
- **Power connector**
- **Communication connector**
- **Alarm output connector**
- **External temperature sensor connector**
- **Display/Operation panel**
- **Circulating fluid level gauge**

---

**Contents**

- **Power cable** (Accessory)
- **Connector:** IEC 60320 C13 or equivalent
- **Cable:** 14AWG, O.D. ø8.4
- **Wire color** (Black, Black, Green/Yellow)
- **Contents** (100 to 240 VAC, 100 to 240 VAC, PE)

---

**Serial No.**

**Model No.**

**Input Voltage**

- 1Phase, 100-240V to 50/60Hz
Connectors

1. Power connector (AC)
   IEC 60320 C14 or equivalent
<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100 to 240 VAC</td>
</tr>
<tr>
<td>2</td>
<td>100 to 240 VAC</td>
</tr>
<tr>
<td>3</td>
<td>PE</td>
</tr>
</tbody>
</table>

2. Communication connector (RS-232C or RS-485)
   D-sub 9 pin (socket)
   Holding screw: M2.6
<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-232C</td>
<td>RS-485</td>
</tr>
<tr>
<td>1</td>
<td>Unused</td>
</tr>
<tr>
<td>2</td>
<td>RD</td>
</tr>
<tr>
<td>3</td>
<td>SD</td>
</tr>
<tr>
<td>4</td>
<td>Unused</td>
</tr>
<tr>
<td>5</td>
<td>SG</td>
</tr>
<tr>
<td>6-9</td>
<td>Unused</td>
</tr>
</tbody>
</table>

3. External sensor connector (EXT.SENSOR)
   D-sub 15 pin (socket)
   Holding screw: M2.6
<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Terminal A of resistance temperature detector</td>
</tr>
<tr>
<td>3</td>
<td>Terminal B of resistance temperature detector</td>
</tr>
<tr>
<td>4</td>
<td>Terminal B of resistance temperature detector</td>
</tr>
<tr>
<td>5</td>
<td>Terminal B of resistance temperature detector</td>
</tr>
<tr>
<td>6-14</td>
<td>Unused</td>
</tr>
<tr>
<td>15</td>
<td>FG</td>
</tr>
</tbody>
</table>

4. Alarm output connector (ALARM)
   D-sub 9 pin (pin)
   Holding screw: M2.6
<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Contact a for output cut-off alarm (open when alarm occurs)</td>
</tr>
<tr>
<td>2</td>
<td>Common for output cut-off alarm</td>
</tr>
<tr>
<td>3</td>
<td>Contact b for output cut-off alarm (closed when alarm occurs)</td>
</tr>
<tr>
<td>4-5</td>
<td>Unused</td>
</tr>
<tr>
<td>6</td>
<td>Contact a for upper/lower temp. limit alarm (open when alarm occurs)</td>
</tr>
<tr>
<td>7</td>
<td>Common for upper/lower temp. limit alarm</td>
</tr>
<tr>
<td>8</td>
<td>Contact b for upper/lower temp. limit alarm (closed when alarm occurs)</td>
</tr>
<tr>
<td>9</td>
<td>Unused</td>
</tr>
</tbody>
</table>
**Series HEC-A**

### Alarm

This unit is equipped as standard with a function allowing 15 kinds of alarms to display on the LCD and can be read out by serial communication. Also, it can generate relay output for upper/lower temperature limit alarm and output cut-off alarm.

#### Alarm

<table>
<thead>
<tr>
<th>Alarm code</th>
<th>Alarm description</th>
<th>Operation status</th>
<th>Main reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRN</td>
<td>Upper/Lower temp. limit alarm</td>
<td>Continue</td>
<td>The temperature has exceeded the upper or lower limit of the target temperature.</td>
</tr>
<tr>
<td>ERR00</td>
<td>CPU hung-up</td>
<td>Stop</td>
<td>The CPU has crashed due to noise, etc.</td>
</tr>
<tr>
<td>ERR01</td>
<td>CPU check error</td>
<td>Stop</td>
<td>The contents of the CPU cannot be read out correctly when the power supply is turned on.</td>
</tr>
<tr>
<td>ERR03</td>
<td>Back-up data error</td>
<td>Stop</td>
<td>The contents of the back-up data cannot be read out correctly when the power supply is turned on.</td>
</tr>
<tr>
<td>ERR04</td>
<td>EEPROM writing error</td>
<td>Stop</td>
<td>The data cannot be written to EEPROM.</td>
</tr>
<tr>
<td>ERR11</td>
<td>DC power supply failure</td>
<td>Stop</td>
<td>The DC power supply has failed (due to fan stop or abnormal high temperature) or the thermo-module has been short-circuited.</td>
</tr>
<tr>
<td>ERR12</td>
<td>Internal temp. sensor high temp.</td>
<td>Stop</td>
<td>The internal temperature sensor has exceeded the upper limit of cut-off temperature.</td>
</tr>
<tr>
<td>ERR13</td>
<td>Internal temp. sensor low temp.</td>
<td>Stop</td>
<td>The internal temperature sensor has exceeded the lower limit of cut-off temperature.</td>
</tr>
<tr>
<td>ERR14</td>
<td>Thermostat alarm</td>
<td>Stop</td>
<td>The thermostat has been activated due to filter clog or fan/pump failure, etc.</td>
</tr>
<tr>
<td>ERR15</td>
<td>Abnormal output alarm</td>
<td>Continue</td>
<td>The temperature cannot be changed even at 100% output due to overload or disconnection of the thermo-module.</td>
</tr>
<tr>
<td>ERR16</td>
<td>Low flow rate alarm (option)</td>
<td>Stop</td>
<td>The flow rate of the circulating fluid has dropped.</td>
</tr>
<tr>
<td>ERR17</td>
<td>Internal temp. sensor disconnection alarm</td>
<td>Stop</td>
<td>The internal temperature sensor has been disconnected or short-circuited.</td>
</tr>
<tr>
<td>ERR18</td>
<td>External temp. sensor disconnection alarm</td>
<td>Continue</td>
<td>The external temperature sensor has been disconnected or short-circuited. (Only detected when in learning control or external tune control)</td>
</tr>
<tr>
<td>ERR19</td>
<td>Abnormal auto tuning alarm</td>
<td>Stop</td>
<td>Auto tuning has not been completed within 20 minutes.</td>
</tr>
<tr>
<td>ERR20</td>
<td>Low fluid level alarm</td>
<td>Stop</td>
<td>The amount of circulating fluid in the tank has dropped.</td>
</tr>
</tbody>
</table>

### Maintenance

Maintenance of this unit is performed only in the form of return to and repair at SMC’s site. As a rule, SMC will not conduct on-site maintenance. Separately, the following parts have a limited life and need to be replaced before the life ends.

#### Parts Life Expectation

<table>
<thead>
<tr>
<th>Description</th>
<th>Expected life</th>
<th>Possible failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump</td>
<td>3 to 5 years</td>
<td>The bearing is worn so the pump fails to transfer the circulating fluid, which results in temperature control failure.</td>
</tr>
<tr>
<td>Fan</td>
<td>5 to 10 years</td>
<td>The bearing uses up lubrication and makes the fan unable to supply enough air, which deteriorates the cooling and heating capacity.</td>
</tr>
<tr>
<td>DC power supply</td>
<td>5 to 10 years</td>
<td>The capacity of the electrolytic condenser decreases, and causes abnormal voltage which results in DC power supply failure and stops the Thermo-con.</td>
</tr>
<tr>
<td>Display panel</td>
<td>50,000 hours (approx. 5 years)</td>
<td>The display turns off when the backlight of the LCD reaches the end of its life.</td>
</tr>
</tbody>
</table>
### Series HEC-A Options

#### With Flow Switch

**Option symbol:** F  
**With Flow Switch**

This is an ON/OFF switch detecting low levels of the circulating fluid. When the fluid volume is 1 L/min. or less, “ERR16” is displayed and the Thermo-con stops. This switch is installed between the circulating fluid inlet and the tank, and built into the Thermo-con. Refer to page 129.

<table>
<thead>
<tr>
<th>Type</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-cooled</td>
<td>HEC002-A5□-F</td>
</tr>
<tr>
<td></td>
<td>HEC006-A5□-F</td>
</tr>
</tbody>
</table>

#### NPT Thread

**Option symbol:** N  
**NPT Thread**

The connection parts of circulating fluid piping, facility water piping and circulating fluid drain port are NPT thread type.

<table>
<thead>
<tr>
<th>Type</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-cooled</td>
<td>HEC002-A5□-N</td>
</tr>
<tr>
<td></td>
<td>HEC006-A5□-N</td>
</tr>
</tbody>
</table>
### System Design

**Warning**

1. This catalog shows the specifications of the Thermo-con.
   1. Check detailed specifications in the separate “Product Specifications”, and evaluate the compatibility of the Thermo-con with customer’s system.
   2. Although the protection circuit as a single unit is installed, the customer is requested to carry out the safety design for the whole system.

### Handling

**Warning**

1. Thoroughly read the Operation Manual. 
   Read the Operation Manual completely before operation, and keep this manual available whenever necessary.
2. If the set temperature is repeatedly changed by 50°F (10°C) or more, the Thermo-con may fail in short periods of time.

### Operating Environment/Storage Environment

**Warning**

1. Keep within the specified ambient temperature and humidity range.
   Also, if the set temperature is too low, condensation may form on the inside of the Thermo-con or the surface of piping even within the specified ambient temperature range. Dew condensation can cause failure, and so must be avoided by considering operating conditions.
2. The Thermo-con is not designed for clean room usage.
   It generates dust from the pump inside the unit and the cooling fan.
3. Low molecular siloxane can damage the contact of the relay.
   Use the Thermo-con in a place free from low molecular siloxane.

---

### Radiation Air

**Caution**

1. The inlet for radiation air must not be exposed to particles and dust as far as possible.
2. Do not let the inlet and outlet for radiation air get closed.

<HEC002>
If radiation is prevented, the set temperature may not be achieved depending on the value of the set temperature and the load. Keep a space of 3.9 in (100 mm) for opened rear side or 7.9 in (200 mm) for closed rear side respectively.

Note) The space must be 19.7 in (500 mm) or more. Be sure that the ambient temperature is within the specification range.
3. If more than one Thermo-con is used, consider their arrangement so that the downstream sides of the Thermo-cons suck radiation air from the upstream sides. Otherwise, the performance at the downstream sides may deteriorate. Also, the set temperature may not be achieved depending on the value of the set temperature and the load. In such a case, take countermeasures such as changing the direction of the Thermo-cons to prevent the deterioration of performance.

4. If dust adheres to the filter, remove dust with a vacuum cleaner or a dry cloth. Otherwise, dust may accumulate on the heat sink and electrical components, causing abnormal heating.

5. Do not operate without the filter. The maximum operating pressure of circulating fluid is 14.5 psi (0.1 MPa). If this pressure is exceeded, leakage from the tank in the thermo-con can result.

6. Select a pipe with a length and diameter which allow a flow rate of 0.25 gpm (1 L/min) or more (HEC007) or 0.79 gpm (3 L/min) or more (HEC006) for the circulating fluid. If the flow rate is less than these values, the Thermo-con cannot provide precise control, but also can fail because of the repeated cooling and heating operation.

7. A magnet driven pump is used as a circulat-ing pump. A fluid which contains metal powders such as iron powder cannot be used.

8. The Thermo-con must not be operated with-out circulating fluid. The pump can break due to idling.

9. If the tank lid is opened after the supply of circulating fluid, the circulating fluid may spill out depending on the condition of external piping.

10. If an external tank is used, the circulating fluid may spill out from the internal tank lid depending on where the external tank is installed. Check that the internal tank has no leakage if using an external tank.

11. If there is a point where fluid is released to atmosphere externally (tank or piping), minimize the piping resistance at the circulating fluid return side. If the piping resistance is too large, the piping may be crushed, or the built-in circulator tank may be deformed or cracked because the pressure in the piping for return will become negative. The built-in circulator tank is made of resin (PE). Therefore, the tank may be crushed if the pressure is negative. Special attention must be paid if the flow rate of the circulating fluid is high. To avoid getting negative pressure less than –2.9 psi (~0.02 MPa), the piping for return should be as thick and short as possible to minimize the piping resistance. It is also effective to restrict the flow rate of circulating fluid or remove the gasket of internal tank for the release to atmosphere.

12. Fluorinated fluid is outside of the specifications. If it is used in the Thermo-con, static electricity will be generated by the flow of fluid. This static electricity may be discharged to the board of the Thermo-con, causing damage or operation failure and loss of data of such as set temperature. Also, as the specific gravity of the fluorinated fluid is 1.5 to 1.8 times of water, the pump will be overloaded, which also causes fluorinated fluid to be outside the specifications. Therefore, if fluorinated fluid is used, please contact SMC and we will introduce a suitable special product (water-cooled type).

13. Avoid operation with cavitation or bubbles due to low fluid level in the tank. This may shorten the pump life.

14. If clear water is used, it should satisfy the quality standards shown below.

Clear Water (as Circulating Water) Quality Standards

The Japan Refrigeration and Air Conditioning Industry Association

JRA GL-02-1994 “Cooling water system – Circulating type – Supply water”

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Standard value</th>
<th>Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (at 77°F (25°C))</td>
<td>—</td>
<td>6.0 to 8.0</td>
<td>○</td>
</tr>
<tr>
<td>Electrical conductivity</td>
<td>µS/cm</td>
<td>100* to 300*</td>
<td>○</td>
</tr>
<tr>
<td>Chloride ion (Cl–)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>■</td>
</tr>
<tr>
<td>Sulfuric acid ion (SO42–)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
</tr>
<tr>
<td>Acid consumption amount</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
</tr>
<tr>
<td>Total hardness</td>
<td>[mg/L]</td>
<td>70 or less</td>
<td>○</td>
</tr>
<tr>
<td>Calcium hardness (CaCO3)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
</tr>
<tr>
<td>Ionic state silica (SiO2)</td>
<td>[mg/L]</td>
<td>30 or less</td>
<td>○</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>○</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td>○</td>
</tr>
<tr>
<td>Sulfide ion (S2–)</td>
<td>[mg/L]</td>
<td>Should not be detected</td>
<td>○</td>
</tr>
<tr>
<td>Ammonium ion (NH4+)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td>○</td>
</tr>
<tr>
<td>Residual chlorine (Cl)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>○</td>
</tr>
<tr>
<td>Free carbon (CO2)</td>
<td>[mg/L]</td>
<td>4.0 or less</td>
<td>○</td>
</tr>
</tbody>
</table>

* In the case of [µS/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.
Communication

⚠️ Caution

1. **The set value can be written to EEPROM, but only up to approx. 1 million times.**
   In particular, pay attention to how many of times the writing is performed using the communication function.

Maintenance

⚠️ Warning

1. **Prevention of electric shock and fire**
   Do not operate the switch with wet hands. Also, do not operate the Thermo-con with water left on it.

2. **Action in the case of error**
   If any error such as abnormal sounds, smoke, or bad smell occurs, cut off the power at once, and stop supplying and conveying fluid. Please contact SMC or a sales distributor to repair the Thermo-con.

3. **Regular inspection**
   Check the following items at least once a month. The inspection must be done by an operator who has sufficient knowledge and experience.
   a) Check of displayed contents.
   b) Check of temperature, vibration and abnormal sounds in the body of the Thermo-con.
   c) Check of the voltage and current of the power supply system.
   d) Check for leakage and contamination of the circulating fluid and intrusion of foreign objects to it, and subsequent replacement of the fluid.
   e) Check for flow condition, temperature and filter of radiation air.
### Peltier-Type Chiller
**Thermo-con (Water-cooled)**

**Series HEC-W**

**How to Order**

- **140 W, 320 W**
- **HEC 003-W 5 B**

**Cooling capacity**
- 001: 140 W
- 003: 320 W

**Radiating method**
- W: Water-cooled

**Power supply**
- 5: 100 to 240 VAC

**Option**
- Nil
- F: With flow switch
- N: NPT thread
- L: With level switch

**Communication**
- A: RS-485
- B: RS-232C

*The option should be specified when ordering.*

---

### Specifications
(For details, please consult our “Product Specifications” information.)

<table>
<thead>
<tr>
<th>Model</th>
<th>HEC001-W5A</th>
<th>HEC001-W5B</th>
<th>HEC003-W5A</th>
<th>HEC003-W5B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling method</td>
<td>Thermoelectric device (Thermo-module)</td>
<td>Water-cooled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiating method</td>
<td>Water-cooled</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control method</td>
<td>Cooling/Heating automatic shift PID control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature/humidity</td>
<td>50 to 95°F (10 to 35°C), 35 to 80%RH (no condensation)</td>
<td>Clear water, 20% ethylene glycol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temp. range</td>
<td>50 to 140°F (10 to 60°C) (no condensation)</td>
<td>50 to 140°F (10 to 60°C) (no condensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling capacity</td>
<td>140 W [Note 1]</td>
<td>320 W [Note 1]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heating capacity</td>
<td>400 W [Note 1]</td>
<td></td>
<td>770 W [Note 1]</td>
<td></td>
</tr>
<tr>
<td>Temperature stability [Note 2]</td>
<td>±0.018 to 0.054°F (±0.01 to 0.03°C)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump capacity</td>
<td></td>
<td>Refer to performance chart.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tank capacity</td>
<td>Approx. 0.32 gal (1.2 L)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port size</td>
<td></td>
<td>Drain: Rc3/8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetted parts material</td>
<td>PPE, PP glass 10%, Alumina ceramics, Carbon, EPDM, Stainless steel 303, Stainless steel 304, PE, PP, NBR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>50 to 95°F (10 to 35°C) (no condensation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure range</td>
<td>Within 145 psi (1 MPa)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required flow rate [Note 3]</td>
<td>0.8 to 1.9 gpm (3 to 7 L/min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port size</td>
<td></td>
<td>IN/OUT: Rc3/8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetted parts material</td>
<td>Stainless steel 304</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>Single-phase 100 to 240 VAC ±10%, 50/60 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overcurrent protector</td>
<td>10 A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical system</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>3.5 A (100 VAC) to 1.5 A (240 VAC)</td>
<td>5.5 A (100 VAC) to 2.5 A (240 VAC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm</td>
<td></td>
<td>Refer to alarm function.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td>RS-485</td>
<td>RS-232C</td>
<td>RS-485</td>
<td>RS-232C</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 26.5 lbs (12 kg)</td>
<td>Approx. 28.7 lbs (13 kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td>Power cable, Foot for fixing, Splashproof cover</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Safety standards**
- CE marking, UL (NRTL) standards, SEMI

---

**Note 1)** Circulating fluid/Clear water conditions: Circulating fluid set temperature 68°F (20°C), Flow rate 1.3 gpm (5 L/min), Facility water temperature 68°F (20°C), Flow rate 1.3 gpm (5 L/min), Ambient temperature 77°F (25°C)

**Note 2)** The indicated values are with a stable load without turbulence in the operating conditions. It may be out of this range in some other operating conditions.

**Note 3)** The flow rate over or below the set range may deteriorate performance or generate noise.
**Technical Data**

**Series HEC-W**

**Peltier-Type Chiller**
Thermo-con (Water-cooled)

### How to Order

![Images of chiller models](Image)

**Model**

- **HEC006-W2A**
- **HEC006-W2B**
- **HEC012-W2A**
- **HEC012-W2B**

**Cooling capacity**

- **600 W, 1200 W**

**Radiating method**

- **W** Water-cooled

**Power supply**

- **2** 200 to 220 VAC

**Option**

- **Nil** None
- **N** NPT thread

**Communication**

- **A** RS-485
- **B** RS-232C

*Select B when communication is not used.*

### Specifications

(For details, please consult our “Product Specifications” information.)

<table>
<thead>
<tr>
<th>Model</th>
<th>HEC006-W2A</th>
<th>HEC006-W2B</th>
<th>HEC012-W2A</th>
<th>HEC012-W2B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling method</td>
<td>Thermoelectric device (Thermo-module)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiating method</td>
<td>Water-cooled</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control method</td>
<td>Cooling/Heating automatic shift PID control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature/humidity</td>
<td>50 to 95°F (10 to 35°C), 35 to 80% RH (no condensation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid</td>
<td>CLEAR water, Fluorinated fluid (Fluorinert™ FC-3283, GALDEN® HT135)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>50 to 140°F (10 to 60°C) (no condensation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling capacity</td>
<td>600 W (Clear water), 400 W (Fluorinert™ FC-3283)</td>
<td>1200 W (Clear water), 800 W (Fluorinert™ FC-3283)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heating capacity</td>
<td>900 W (Clear water), 600 W (Fluorinert™ FC-3283)</td>
<td>2200 W (Clear water), 1500 W (Fluorinert™ FC-3283)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature stability</td>
<td>±0.018 to 0.054°F (±0.10 to 0.3°C)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump capacity</td>
<td>Refer to performance chart.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tank capacity</td>
<td>Approx. 0.8 gal (3 L)</td>
<td>Approx. 1.3 gal (5 L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port size</td>
<td>IN/OUT: Rc3/8, Drain: Rc1/4 (with plug)</td>
<td>IN/OUT: Rc3/4, Drain: Rc1/4 (with plug)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetted parts material</td>
<td>Stainless steel 303, Stainless steel 304, EPDM, Ceramics, PPS glass 30%, Carbon, PE, Polyurethane</td>
<td>Stainless steel 303, Stainless steel 304, EPDM, Ceramics, PR, PE, Polyurethane, SiC, PPS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>50 to 95°F (10 to 35°C) (no condensation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure range</td>
<td>Within 145 psi (1 MPa)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required flow rate</td>
<td>2.1 to 2.6 gpm (8 to 10 L/min)</td>
<td>2.6 to 4.0 gpm (10 to 15 L/min)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port size</td>
<td>IN/OUT: Rc3/8</td>
<td>IN/OUT: Rc1/2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetted parts material</td>
<td>Stainless steel 303, Stainless steel 304</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>Single-phase 200 to 220 VAC ±10%, 50/60 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overcurrent protector</td>
<td>10 A</td>
<td></td>
<td>15 A</td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>5 A</td>
<td></td>
<td>10 A</td>
<td></td>
</tr>
<tr>
<td>Alarm</td>
<td>Refer to alarm function.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td>RS-485</td>
<td>RS-232C</td>
<td>RS-485</td>
<td>RS-232C</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 55 lbs (25 kg) (including foot for fixing)</td>
<td>Approx. 88 lbs (40 kg) (including foot for fixing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td>Power cable, Foot for fixing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety standards</td>
<td>CE marking</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note 1** Fluorinert™ is a trademark of 3M and GALDEN® is a registered trademark of Solvay Solexis, Inc. Regarding the fluid other than the above, please consult with SMC.

**Note 2** Conditions: Set temperature 77°F (25°C), Facility water temperature 68°F (20°C), Facility water flow rate 2.1 gpm (8 L/min), Ambient temperature 77°F (25°C).

**Note 3** Conditions: Set temperature 77°F (25°C), Facility water temperature 68°F (20°C), Facility water flow rate 2.6 gpm (10 L/min), Ambient temperature 77°F (25°C).

**Note 4** The indicated values are with a stable load without turbulence in the operating conditions. It may be out of this range in some other operating conditions.

**Note 5** The flow rate over or below the set range may deteriorate performance or generate noise.

---

**Related Products**

**HRG**
**HRS**
**HRZ**
**HRZD**
**HRW**
**HEB**

**800-999-7378**

**SHOP ONLINE at www.airlinehyd.com**
Facility water: 86°F

The values shown on the performance chart are not guaranteed, but typical. Allow margins for safety when selecting the model.

Cooling Capacity

**HEC001**

Circulating fluid: Clear water

<table>
<thead>
<tr>
<th>Circulating fluid temperature (°C)</th>
<th>Cooling capacity (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>70</td>
<td>200</td>
</tr>
<tr>
<td>90</td>
<td>300</td>
</tr>
<tr>
<td>110</td>
<td>400</td>
</tr>
<tr>
<td>130</td>
<td>500</td>
</tr>
<tr>
<td>150</td>
<td>600</td>
</tr>
</tbody>
</table>

Facility water: 50°F (10°C)

Facility water flow rate: 1.3 gpm (5 L/min)

**HEC003**

Circulating fluid: Clear water

<table>
<thead>
<tr>
<th>Circulating fluid temperature (°C)</th>
<th>Cooling capacity (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>1000</td>
</tr>
<tr>
<td>70</td>
<td>800</td>
</tr>
<tr>
<td>90</td>
<td>600</td>
</tr>
<tr>
<td>110</td>
<td>400</td>
</tr>
<tr>
<td>130</td>
<td>200</td>
</tr>
<tr>
<td>150</td>
<td>100</td>
</tr>
</tbody>
</table>

Facility water: 50°F (10°C)

Facility water flow rate: 1.3 gpm (5 L/min)

**HEC006**

Circulating fluid: Clear water

<table>
<thead>
<tr>
<th>Circulating fluid temperature (°C)</th>
<th>Cooling capacity (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>1500</td>
</tr>
<tr>
<td>70</td>
<td>1000</td>
</tr>
<tr>
<td>90</td>
<td>500</td>
</tr>
<tr>
<td>110</td>
<td>250</td>
</tr>
<tr>
<td>130</td>
<td>100</td>
</tr>
</tbody>
</table>

Facility water: 50°F (10°C)

Facility water: 95°F (35°C)

Facility water flow rate: 2.1 gpm (8 L/min)

**HEC012**

Circulating fluid: Clear water

<table>
<thead>
<tr>
<th>Circulating fluid temperature (°C)</th>
<th>Cooling capacity (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>3000</td>
</tr>
<tr>
<td>70</td>
<td>2500</td>
</tr>
<tr>
<td>90</td>
<td>2000</td>
</tr>
<tr>
<td>110</td>
<td>1500</td>
</tr>
<tr>
<td>130</td>
<td>1000</td>
</tr>
<tr>
<td>150</td>
<td>500</td>
</tr>
</tbody>
</table>

Facility water: 50°F (10°C)

Facility water: 95°F (35°C)

Facility water flow rate: 2.6 gpm (10 L/min)
Peltier-Type Chiller
Thermo-con (Water-cooled) Series HEC-W

Heating Capacity

The values shown on the performance chart are not guaranteed, but typical. Allow margins for safety when selecting the model.

<table>
<thead>
<tr>
<th>Model</th>
<th>Circulating fluid: Clear water</th>
<th>Circulating fluid: 20% ethylene glycol</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEC01</td>
<td>Facility water flow rate: 13 gpm (5 L/min)</td>
<td>Facility water flow rate: 1.3 gpm (5 L/min)</td>
</tr>
<tr>
<td>HEC03</td>
<td>Facility water flow rate: 1.3 gpm (5 L/min)</td>
<td>Facility water flow rate: 1.3 gpm (5 L/min)</td>
</tr>
<tr>
<td>HEC06</td>
<td>Facility water flow rate: 2.1 gpm (8 L/min)</td>
<td>Facility water flow rate: 2.1 gpm (8 L/min)</td>
</tr>
<tr>
<td>HEC12</td>
<td>Facility water flow rate: 2.6 gpm (10 L/min)</td>
<td>Facility water flow rate: 2.6 gpm (10 L/min)</td>
</tr>
</tbody>
</table>

- Facility water: 68°F (20°C)
- Facility water: 86°F (30°C)
- Facility water: 50°F (10°C)

Related Technical Data

SMC

SHOP ONLINE at www.airlinehyd.com

800-999-7378
Series HEC-W

Pump Capacity (Thermo-con Outlet)

HEC001/003 Since a DC pump is used, the unit is not affected by power requirements.

Circulating fluid flow rate (L/min)

Discharge pressure

0.00

0.05

0.10

0.15 MPa

20 psi

2% ethylene glycol

HEC006 Since a DC pump is used, the unit is not affected by power requirements.

Circulating fluid flow rate (L/min)

Discharge pressure

0.00

0.05

0.10

0.15 MPa

Fluorinert™ FC-3283

Pressure Loss in Facility Water Circuit

HEC001

Facility water flow rate (L/min)

Pressure loss

0.000

0.002

0.004

0.006

0.008

0.010

0.012

0.014 MPa

2 psi

HEC003

Facility water flow rate (L/min)

Pressure loss

0.000

0.005

0.010

0.015

0.020

0.025 MPa

3.5 psi

HEC006

Facility water flow rate (L/min)

Pressure loss

0.000

0.005

0.010

0.015

0.020

0.025 MPa

HEC012

Facility water flow rate (L/min)

Pressure loss

0.000

0.005

0.010

0.015

0.020

0.025 MPa

1.5 psi

60Hz

50Hz

9.0 psi

7.0

6.0

5.0

4.0

3.0

2.0

1.0
Peltier-Type Chiller
Thermo-con (Water-cooled) Series HEC-W

Parts Description

HEC001/003

Display/Operation panel
Tank lid (with O-ring)
Circulating fluid level gauge
Power switch
Handle
Circulating fluid inlet
Facility water outlet
Facility water inlet
Circulating fluid outlet
Drain (Circulating fluid drain port)
Splashproof cover

HEC006/012

Display/Operation panel
Tank lid (with gasket)
Circulating fluid level gauge
Power switch
Handle
Facility water outlet
Facility water inlet
Splashproof cover
Cooling fan
Communication connector
RS-232C type 1 pc.
RS-485 type 2 pcs.
Alarm output connector
External temperature sensor connector
Power connector
(Connect the attached power cable.)
Circulating fluid inlet
Circulating fluid outlet
Drain (Circulating fluid drain port)
**Series HEC-W**

**Dimensions**

<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions</th>
<th>Unit: Inch (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEC001-W5</td>
<td>![Dimensions Image]</td>
<td></td>
</tr>
<tr>
<td>HEC003-W5</td>
<td>![Dimensions Image]</td>
<td></td>
</tr>
</tbody>
</table>

**Warning/Caution label**

- Width: 0.16 (4) x height: 0.2 (5)

**Tank lid**

- Diameter: ø2.8 (72)
- Thickness: 1.0 (25)

**Foot**

- Width: 7.2 (184)
- Height: 7.2 (184)

**Display/Operation panel**

- Height: 2.2 (55)
- Width: 13.7 (348)

**Power switch**

- Diameter: ø2.8 (72)

**Circulating fluid level gauge**

- Diameter: ø2.8 (72)

**Handle**

- Height: 14.5 (368)
- Width: 1.2 (30)

**Splashproof cover**

- Diameter: ø2.8 (72)
- Width: 13.7 (348)

**Power Cable (Accessory)**

- Connector: IEC 60320 C13 or equivalent
- Cable: 14AWG, O.D. ø8.4

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Contents</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>100 to 240 VAC</td>
<td>Black</td>
</tr>
<tr>
<td>Green/Yellow</td>
<td>PE</td>
<td></td>
</tr>
</tbody>
</table>

**Facility water outlet**

- Connector: Rc3/8

**Facility water inlet**

- Connector: Rc3/8

**Circulating fluid outlet**

- Connector: Rc3/8

**External temperature sensor connector**

- Diameter: ø2.8 (72)

**Alarm output connector**

- Diameter: ø2.8 (72)

**Communication connector**

- Diameter: ø2.8 (72)

**Model no. label**

- Diameter: ø2.8 (72)

For NPT thread specification (-N), all fittings (including those at the circulating fluid drain port) are made of NPT.

**Power cable (Accessory)**

- Connector: IEC 60320 C13 or equivalent
- Cable: 14AWG, O.D. ø8.4

- Diameter: ø2.8 (72)

**For NPT thread specification (-N), all fittings (including those at the circulating fluid drain port) are made of NPT.**
For NPT thread specification (-N), all fittings (including those at the circulating fluid drain port) are made of NPT.

### Power Cable

Connector: IEC 60320 C13 or equivalent
Cable: 14AWG, O.D. ø8.4

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>200 to 220 VAC</td>
</tr>
<tr>
<td>Black</td>
<td>200 to 220 VAC</td>
</tr>
<tr>
<td>Green/Yellow</td>
<td>PE</td>
</tr>
</tbody>
</table>
Series HEC-W

Dimensions

HEC012-W2

Power Cable

Connector: DOK CE05-6A18-10SD-D-BSS or equivalent
Cable: 14AWG, O.D. ø8.4

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>200 to 220 VAC</td>
</tr>
<tr>
<td>Black</td>
<td>200 to 220 VAC</td>
</tr>
<tr>
<td>Green/Yellow</td>
<td>PE</td>
</tr>
</tbody>
</table>

For NPT fitting specification (-N), all fittings (including those at the circulating fluid drain port) are made of NPT.

Power cable (Accessory)
Connectors

HEC006-W2□/001-W5□/003-W5□

1. Power connector (AC)
   IEC 60320 C14 or equivalent
   HEC006-W2□
   HEC001-W5□
   HEC003-W5□

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200 to 220 VAC</td>
</tr>
<tr>
<td>2</td>
<td>200 to 220 VAC</td>
</tr>
<tr>
<td>3</td>
<td>PE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100 to 240 VAC</td>
</tr>
<tr>
<td>2</td>
<td>100 to 240 VAC</td>
</tr>
<tr>
<td>3</td>
<td>PE</td>
</tr>
</tbody>
</table>

2. Communication connector (RS-232C or RS-485)
   D-sub 9 pin (socket)
   Holding screw: M2.6

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:2</td>
<td>Unused</td>
</tr>
<tr>
<td>3</td>
<td>RD</td>
</tr>
<tr>
<td>4</td>
<td>SD</td>
</tr>
<tr>
<td>5</td>
<td>SG</td>
</tr>
<tr>
<td>6-9</td>
<td>Unused</td>
</tr>
<tr>
<td>10</td>
<td>FG</td>
</tr>
</tbody>
</table>

3. External sensor connector (EXT.SENSOR)
   D-sub 15 pin (socket)
   Holding screw: M2.6

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Unused</td>
</tr>
<tr>
<td>3</td>
<td>Terminal A of resistance temperature detector</td>
</tr>
<tr>
<td>4</td>
<td>Terminal B of resistance temperature detector</td>
</tr>
<tr>
<td>5</td>
<td>Terminal B of resistance temperature detector</td>
</tr>
<tr>
<td>6-14</td>
<td>Unused</td>
</tr>
<tr>
<td>15</td>
<td>FG</td>
</tr>
</tbody>
</table>

4. Alarm output connector (ALARM)
   D-sub 9 pin (pin)
   Holding screw: M2.6

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Contact a for output cut-off alarm (open when alarm occurs)</td>
</tr>
<tr>
<td>2</td>
<td>Common for output cut-off alarm</td>
</tr>
<tr>
<td>3</td>
<td>Contact b for output cut-off alarm (closed when alarm occurs)</td>
</tr>
<tr>
<td>4-5</td>
<td>Unused</td>
</tr>
<tr>
<td>6</td>
<td>Contact a for upper/lower temp. limit alarm (open when alarm occurs)</td>
</tr>
<tr>
<td>7</td>
<td>Common for upper/lower temp. limit alarm</td>
</tr>
<tr>
<td>8</td>
<td>Contact b for upper/lower temp. limit alarm (closed when alarm occurs)</td>
</tr>
<tr>
<td>9</td>
<td>Unused</td>
</tr>
</tbody>
</table>

HEC012-W2□

Power connector (AC)
   DDK CE05-2A18-10PD-D or equivalent

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>200 to 220 VAC</td>
</tr>
<tr>
<td>B</td>
<td>200 to 220 VAC</td>
</tr>
<tr>
<td>C</td>
<td>Unused</td>
</tr>
<tr>
<td>D</td>
<td>PE</td>
</tr>
</tbody>
</table>

Other connectors are the same as those for the HEC006-W2□.
**Series HEC-W**

**Alarm**

This unit is equipped as standard with a function allowing 15 kinds of alarms to display on the LCD and can be read out by serial communication. Also, it can generate relay output for upper/lower temperature limit alarm and output cut-off alarm.

<table>
<thead>
<tr>
<th>Alarm code</th>
<th>Alarm description</th>
<th>Operation status</th>
<th>Main reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRN</td>
<td>Upper/Lower temp. limit alarm</td>
<td>Continue</td>
<td>The temperature has exceeded the upper or lower limit of the target temperature.</td>
</tr>
<tr>
<td>ERR00</td>
<td>CPU hung-up</td>
<td>Stop</td>
<td>The CPU has crashed due to noise, etc.</td>
</tr>
<tr>
<td>ERR01</td>
<td>CPU check error</td>
<td>Stop</td>
<td>The contents of the CPU cannot be read out correctly when the power supply is turned on.</td>
</tr>
<tr>
<td>ERR03</td>
<td>Back-up data error</td>
<td>Stop</td>
<td>The contents of the back-up data cannot be read out correctly when the power supply is turned on.</td>
</tr>
<tr>
<td>ERR04</td>
<td>EEPROM writing error</td>
<td>Stop</td>
<td>The data cannot be written to EEPROM.</td>
</tr>
<tr>
<td>ERR11</td>
<td>DC power supply failure</td>
<td>Stop</td>
<td>The DC power supply has failed (due to abnormal high temperature) or an irregular voltage has occurred or the thermo-module has been short-circuited.</td>
</tr>
<tr>
<td>ERR12</td>
<td>Internal temp. sensor high temp. error</td>
<td>Stop</td>
<td>The internal temperature sensor has exceeded the upper limit of cut-off temperature.</td>
</tr>
<tr>
<td>ERR13</td>
<td>Internal temp. sensor low temp. error</td>
<td>Stop</td>
<td>The internal temperature sensor has exceeded the lower limit of cut-off temperature.</td>
</tr>
<tr>
<td>ERR14</td>
<td>Thermostat alarm</td>
<td>Stop</td>
<td>The thermostat has been activated due to insufficient of the facility water or high temperature.</td>
</tr>
<tr>
<td>ERR15</td>
<td>Abnormal output alarm</td>
<td>Continue</td>
<td>The temperature cannot be changed even at 100% output due to overload or disconnection of the thermo-module.</td>
</tr>
<tr>
<td>ERR16</td>
<td>Pump failure or low circulating fluid level alarm</td>
<td>Stop</td>
<td>The pump has been overloaded or the flow switch is activated.</td>
</tr>
<tr>
<td>ERR17</td>
<td>Internal temp. sensor disconnection alarm</td>
<td>Stop</td>
<td>The internal temperature sensor has been disconnected or short-circuited.</td>
</tr>
<tr>
<td>ERR18</td>
<td>External temp. sensor disconnection alarm</td>
<td>Continue</td>
<td>The external temperature sensor has been disconnected or short-circuited. (Only detected when in learning control or external tune control.)</td>
</tr>
<tr>
<td>ERR19</td>
<td>Abnormal auto tuning alarm</td>
<td>Stop</td>
<td>Auto tuning has not been completed within 20 minutes.</td>
</tr>
<tr>
<td>ERR20</td>
<td>Low fluid level alarm</td>
<td>Stop</td>
<td>The amount of circulating fluid in the tank has dropped and the level switch is activated.</td>
</tr>
</tbody>
</table>

1. The HEC012 only
2. Optional for the HEC001 and HEC003 only (Not available for the HEC006)
3. Optional for the HEC001 and HEC003

**Maintenance**

Maintenance of this unit is performed only in the form of return to and repair at SMC’s site. As a rule, SMC will not conduct on-site maintenance. Separately, the following parts have a limited life and need to be replaced before the life ends.

**Parts Life Expectation**

<table>
<thead>
<tr>
<th>Description</th>
<th>Expected life</th>
<th>Possible failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump</td>
<td>3 to 5 years</td>
<td>The bearing is worn so the pump fails to transfer the circulating fluid, which results in temperature control failure.</td>
</tr>
<tr>
<td>Fan</td>
<td>5 to 10 years</td>
<td>The bearing uses up lubrication and makes the fan unable to supply enough air, which increases the internal temperature of the Thermo-con, and activates the overheat protection of the power supply and generates the alarm.</td>
</tr>
<tr>
<td>DC power supply</td>
<td>5 to 10 years</td>
<td>The capacity of the electrolytic condenser decreases, and causes abnormal voltage which results in DC power supply failure and stops the Thermo-con.</td>
</tr>
<tr>
<td>Display panel</td>
<td>50,000 hours (approx. 5 years)</td>
<td>The display turns off when the backlight of the LCD reaches the end of its life.</td>
</tr>
</tbody>
</table>
This is an ON/OFF switch detecting low levels of the circulating fluid. When the fluid volume is 1 L/min. or less, "ERR16" is displayed and the Thermo-con stops. This switch is installed between the circulating fluid inlet and the tank, and built into the Thermo-con. Refer to page 129.

The connection parts of circulating fluid piping, facility water piping and circulating fluid drain port are NPT thread type.

This switch is used to detect a LOW level of tank fluid. When the fluid level becomes below the LOW level, "ERR20" is displayed and the Thermo-con stops. This switch is installed in the circulating fluid tank and built into the Thermo-con. Refer to page 129.

Note: Options have to be selected when ordering the Thermo-con. It is not possible to add them after purchasing the unit.
Series HEC-W
Specific Product Precautions 1

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back pages 2 to 5 for Temperature Control Equipment Precautions.

⚠️ Warning

1. This catalog shows the specifications of the Thermo-con.
   1. Check detailed specifications in the separate “Product Specifications”, and evaluate the compatibility of the Thermo-con with customer’s system.
   2. Although the protection circuit as a single unit is installed, the customer is requested to carry out the safety design for the whole system.

⚠️ Warning

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

2. If the set temperature is repeatedly changed by 50°F (10°C) or more, the Thermo-con may fail in short periods of time.

⚠️ Warning

1. Keep within the specified ambient temperature and humidity range.
   Also, if the set temperature is too low, condensation may form on the inside of the Thermo-con or the surface of piping even within the specified ambient temperature range. Dew condensation can cause failure, and so must be avoided by considering operating conditions.

2. The Thermo-con is not designed for clean room usage.
   The pump and fan generate dust.

3. Low molecular siloxane can damage the contact of the relay.
   Use the Thermo-con in a place free from low molecular siloxane.

⚠️ Warning

1. Check the space for air intake and discharge.
   If the space for the intake and discharge of air is insufficient, the amount of transferred air will decrease, which can impair the performance and life of the product. Therefore, keep the conditions illustrated below for installation. Also, if ambient temperature is expected to be over 95°F (35°C), vent or exhaust air to prevent the increase of ambient temperature over 95°F (35°C).

⚠️ Warning

1. If the temperature of the facility water is too low, it can cause formation of dew condensation inside the heat exchanger.
   Supply facility water with a temperature over the atmospheric dew point to avoid the formation of dew condensation.

2. If the facility water piping is connected to multiple machines, the facility water exchanges heat at the upstream side and its temperature will become higher as it goes downstream.
   Limit the number of connected Thermo-cons to two per facility water system, and if more than two Thermo-cons are to be connected, increase the number of systems.

⚠️ Caution

1. Use tap water or fluid which will not damage the wetted parts material as described in this catalog’s specifications.
   (PPE, PP glass 10%, Alumina ceramics, Carbon, EPDM, Stainless steel 303, Stainless steel 304, PE, PP, NBR)

2. Deionized water (with an electrical conductivity of approx. 1 µS/cm) can be used, but may lose its electrical conductivity.
Caution

3. If deionized water is used, bacteria and algae may grow in a short period.
If the Thermo-con is operated with bacteria and algae, its heat exchanging capacity or the capacity of the pump may deteriorate. Exchange all deionized water regularly depending on the conditions (once a month as a guide).

4. If using a fluid other than this catalog, please contact SMC beforehand.

5. The maximum operating pressure of circulating fluid circuit is 14.5 psi (0.1 MPa).
If this pressure is exceeded, leakage from the tank in the Thermo-con can result.

6. Select a pipe with a length and diameter which allow a flow rate of 0.8 gpm (3 L/min) or more for the circulating fluid.
If the flow rate is less than 0.8 gpm (3 L/min), the Thermo-con cannot provide precise control, but also can fail because of the repeated cooling and heating operation.

7. A magnet driven pump is used as a circulating pump.
A fluid which contains metal powders such as iron powder cannot be used.

8. The Thermo-con must not be operated without circulating fluid.
The pump can break due to idling.

9. If the tank lid is opened after the supply of circulating fluid, the circulating fluid may spill out depending on the condition of external piping.

10. If an external tank is used, the circulating fluid may spill out from the internal tank lid depending on where the external tank is installed.
Check that the internal tank has no leakage if using an external tank.

11. If there is a point where fluid is released to atmosphere externally (tank or piping), minimize the piping resistance at the circulating fluid return side.
If the piping resistance is too large, the piping may be crushed, or the built-in circulator tank may be deformed or cracked because the pressure in the piping for return will become negative. The built-in circulator tank is made of resin (PE). Therefore, the tank may be crushed if the pressure is negative. Special attention must be paid if the flow rate of the circulating fluid is high. To avoid getting negative pressure less than –2.9 psi (–0.02 MPa), the piping for return should be as thick and short as possible to minimize the piping resistance. It is also effective to restrict the flow rate of circulating fluid or remove the gasket of internal tank for the release to atmosphere.

12. If fluorinated fluid is used in the Thermo-con (HEC006/012), static electricity will be generated by the flow of fluid. This static electricity may be discharged to the board of the Thermo-con, causing damage or operation failure and loss of data such as set temperature.
Ground pipe in order to remove static electricity.

13. Avoid operation with cavitation or bubbles due to low fluid level in the tank. This may shorten the pump life.

Caution

14. If clear water is used, it should satisfy the quality standards shown below.

Clear Water (as Circulating Water) Quality Standards
The Japan Refrigeration and Air Conditioning Industry Association
JRA GL-02-1994 “Cooling water system – Circulating type – Supply water”

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Standard value</th>
<th>Influence Corrosion</th>
<th>Scale generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (at 77°F (25°C))</td>
<td></td>
<td>––</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Electrical conductivity (77°F)</td>
<td>μS/cm</td>
<td>100* to 300*</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Chloride ion (Cl⁻)</td>
<td>mg/L</td>
<td>0.1 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Sulfuric acid ion (SO₄²⁻)</td>
<td>mg/L</td>
<td>0.3 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Acid consumption amount (at pH 8.0)</td>
<td>mg/L</td>
<td>0.1 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Total hardness</td>
<td>mg/L</td>
<td>30 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Calcium hardness (CaCO₂⁻)</td>
<td>mg/L</td>
<td>50 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Ionic state silica (SiO₂⁻)</td>
<td>mg/L</td>
<td>50 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>mg/L</td>
<td>0.3 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>mg/L</td>
<td>0.1 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Sulfide ion (S₂⁻)</td>
<td>mg/L</td>
<td>Should not be detected</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Ammonium ion (NH₄⁺)</td>
<td>mg/L</td>
<td>0.1 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Residual chlorine (Cl⁻)</td>
<td>mg/L</td>
<td>0.3 or less</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Free carbon (CO₂⁻)</td>
<td>mg/L</td>
<td>4.0 or less</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

* In the case of [ML/cm³], 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.

Communication

1. The set value can be written to EEPROM, but only up to approx. 1 million times.
In particular, pay attention to how many times the writing is performed using the communication function.

Maintenance

1. Prevention of electric shock and fire
Do not operate the switch with wet hands. Also, do not operate the Thermo-con with water left on it.

2. Action in the case of error
If any error such as abnormal sounds, smoke, or bad smell occurs, cut off the power at once, and stop supplying and conveying fluid. Please contact SMC or a sales distributor to repair the Thermo-con.

3. Regular inspection
Check the following items at least once a month. The inspection must be done by an operator who has sufficient knowledge and experience.
a) Check of displayed contents.
b) Check of temperature, vibration and abnormal sounds in the body of the Thermo-con.
c) Check of the voltage and current of the power supply system.
d) Check for leakage and contamination of the circulating fluid and intrusion of foreign objects to it, and subsequent replacement of water.
e) Check for leakage, quality change, flow rate and temperature of facility water.

SHOP ONLINE at www.airlinehyd.com
800-999-7378
Peltier-Type

Thermoelectric Bath  Series HEB

Accurately controls the temperature of liquid in the bath.

Temperature stability: \(\pm 0.018^\circ F\)

Temperature distribution: \(\pm 0.036^\circ F\) in the bath

- Environmentally friendly and refrigerant-free
- Heaterless
- Function to detect abnormal heating and temperature sensor errors comes standard.
- Light and compact
- Greatly reduced vibration and operating noise when compared with the refrigerated type.

Applications

- Chemicals for MOCVD
- Diffusion gas
- Various samples, materials and parts
- Chemicals and liquids with high viscosity

Controller

Facility water outlet  Facility water inlet

Circulating pump

Circulating fluid

Water, Fluorinated liquid

Fluorinert™ GALDEN®

W9.8 in x H 7.1 in x D13.4 in
W250 mm x H180 mm x D340 mm

W7.9 in x H13.1 x D8.1 in
W200 x H332 x D207
**Application Examples**

**Semiconductor**
- Evaporation of chemicals for MOCVD
- Temperature control of diffusion gas

**Various tests**
- Thermal test with immersion

**Physical and chemical analysis**
- Temperature control of various samples, materials, and parts

**Various chemical processes**
- Indirect temperature control of chemicals and liquids with high viscosity

**Features**
- Exclusively developed dual tank construction to provide consistent temperature at any position in the bath
- Accurate display by measuring the circulating fluid with a temperature sensor directly

**Principle of Peltier Device (Thermo-module, Thermoelectric device)**

A Peltier device (thermo-module, thermoelectric device) is a plate type element, inside which P-type semiconductors and N-type semiconductors are located alternately. If direct current is supplied to the Peltier device, heat is transferred inside the device, and one face generates heat and increases temperature while the other face sucks heat and decreases temperature. Therefore, changing the direction of the current supplied to the Peltier device can achieve heating and cooling operation. This method has a fast response and can shift quickly between heating and cooling, so temperature can be controlled very precisely.
Peltier-Type Thermoelectric Bath
Series HEB

How to Order

Combination (Controller + Liquid tank)

**HEB C 002 - W A 10**

- **Shape of bath**: Round (C)
- **Cooling capacity**: 140 W (002)
- **Radiating method**: Water-cooled (W)
- **Option**: Nil (N), Rc1/4 (R), NPT1/4 (T)
- **Liquid tank size**: ø5.1 in (130 mm) x H7.1 in (180 mm)
- **Communication**: 
  - A: RS-485
  - B: RS-232C

Liquid tank

**HEB C 002 - H W 10**

- **Shape of bath**: Round (C)
- **Cooling capacity**: 140 W (002)
- **Liquid tank**: 
- **Radiating method**: Water-cooled (W)
- **Option**: Nil (N), Rc1/4 (R), NPT1/4 (T)
- **Liquid tank size**: ø5.1 in (130 mm) x H7.1 in (180 mm)

Controller

**HEBC002 - C A**

- **Controller**: 
- **Communication**: 
  - A: RS-485
  - B: RS-232C
### Specifications

For details, please consult our “Product Specifications” information.

#### Model

<table>
<thead>
<tr>
<th>Model</th>
<th>HEBC002-WA10</th>
<th>HEBC002-WB10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application fluid</td>
<td>Clear water, Fluorinated liquid (Fluorinert™ FC-3283, GALDEN® HT135, HT200)</td>
<td></td>
</tr>
<tr>
<td>Set temperature range</td>
<td>5.0 to 140.0 °F (–15.0 to 60.0°C) (41 to 140°F for water)</td>
<td></td>
</tr>
<tr>
<td>Cooling capacity</td>
<td>140 W (Water)</td>
<td></td>
</tr>
<tr>
<td>Heating capacity</td>
<td>300 W (Water)</td>
<td></td>
</tr>
<tr>
<td>Temperature stability</td>
<td>±0.017°F (±0.01°C)</td>
<td>±0.036°F (±0.02°C)</td>
</tr>
<tr>
<td>Temperature distribution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>50 to 95°F (10 to 35°C) (no condensation)</td>
<td></td>
</tr>
<tr>
<td>Pressure range</td>
<td>Within 73 psi (0.5 MPa)</td>
<td></td>
</tr>
<tr>
<td>Flow rate</td>
<td>0.8 to 1.3 gpm (3 to 5 L/min)</td>
<td></td>
</tr>
<tr>
<td>Port size</td>
<td>IN/OUT: Rc1/4</td>
<td></td>
</tr>
<tr>
<td>Wetted parts material</td>
<td>Stainless steel 303, Stainless steel 304, FEP, A6063 (anodized)</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>Single-phase 100 to 240 VAC, 50/60 Hz</td>
<td></td>
</tr>
<tr>
<td>Overcurrent protector</td>
<td>10 A</td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>4 A (100 VAC) to 2 A (240 VAC)</td>
<td></td>
</tr>
<tr>
<td>Alarm (With alarm output connector)</td>
<td>1) Overheating of liquid tank (which activates the thermostat)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2) Controller output voltage reduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3) Controller fan rotation stopped</td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td>RS-485</td>
<td>RS-232C</td>
</tr>
<tr>
<td>Weight</td>
<td>Liquid tank: Approx. 18.7 lbs (8.5 kg)</td>
<td>Controller: Approx. 14.3 lbs (6.5 kg)</td>
</tr>
<tr>
<td>Accessories</td>
<td>Power cable (2 m), DC cable, Signal cable (3 m each)</td>
<td></td>
</tr>
<tr>
<td>Safety standards</td>
<td>CE marking, UL (NRTL) standard</td>
<td></td>
</tr>
</tbody>
</table>

#### Notes

1) GALDEN® is a trademark of Solvay Solexis and Fluorinert™ is a trademark of 3M. For other fluids, please contact SMC.

2) Determined under the following conditions: water as the recirculating fluid, set temperature 77°F (25°C), facility water temperature 77°F (25°C), flow rate 0.8 gpm (3 L/min), ambient temperature 77°F (25°C), and sealed from outside air with a lid.

3) Differs depending on the operating conditions.

4) An appropriate range is from 0.8 to 1.3 gpm (3 to 5 L/min). To prevent damage to the radiating system, do not supply a flow over the maximum flow rate of 2.11 gpm (8 L/min).

5) When the temperature is set high, the liquid temperature inside of the liquid tank and the temperature inside of the thermostat could differ greatly depending on the heating mode at start-up, and the thermostat could then begin operating and stop the output. Confirm that there is no problem by carrying out an operating test beforehand.
### Cooling Capacity

<table>
<thead>
<tr>
<th>Liquid temperature (°C)</th>
<th>Time (minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20</td>
<td>0</td>
</tr>
<tr>
<td>-15</td>
<td>10</td>
</tr>
<tr>
<td>-10</td>
<td>20</td>
</tr>
<tr>
<td>-5</td>
<td>30</td>
</tr>
<tr>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>15</td>
<td>70</td>
</tr>
<tr>
<td>20</td>
<td>80</td>
</tr>
</tbody>
</table>

Ambient temperature: 77°F (25°C)
Liquid level: 7.1 in (180 mm)
Facility water temperature: 77°F (25°C)
Facility water flow rate: 0.8 gpm (3 L/min)
Shut out from outside with a lid (polystyrene foam)

### Heating Capacity

<table>
<thead>
<tr>
<th>Liquid temperature (°C)</th>
<th>Time (minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>0</td>
</tr>
<tr>
<td>70</td>
<td>10</td>
</tr>
<tr>
<td>75</td>
<td>20</td>
</tr>
<tr>
<td>80</td>
<td>30</td>
</tr>
<tr>
<td>85</td>
<td>40</td>
</tr>
<tr>
<td>90</td>
<td>50</td>
</tr>
<tr>
<td>95</td>
<td>60</td>
</tr>
<tr>
<td>100</td>
<td>70</td>
</tr>
<tr>
<td>105</td>
<td>80</td>
</tr>
</tbody>
</table>

Fluorinert™ FC-3283
Water

Ambient temperature: 77°F (25°C)
Liquid level: 7.1 in (180 mm)
Facility water temperature: 77°F (25°C)
Facility water flow rate: 0.8 gpm (3 L/min)
Shut out from outside with a lid (polystyrene foam)

### Pressure Loss in Facility Water Circuit

<table>
<thead>
<tr>
<th>Flow rate (L/min)</th>
<th>Pressure loss (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>0</td>
</tr>
<tr>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>0.75</td>
<td>2</td>
</tr>
<tr>
<td>1.00</td>
<td>3</td>
</tr>
<tr>
<td>1.25</td>
<td>4</td>
</tr>
<tr>
<td>1.5</td>
<td>5</td>
</tr>
<tr>
<td>1.75</td>
<td>6</td>
</tr>
<tr>
<td>2.00</td>
<td>7</td>
</tr>
</tbody>
</table>

### Parts Description

- RUN LED
- TROUBLE LED
- Display/Operation panel
- Power switch
- Fan
- Alarm output connector
- DC output connector
- Communication connector
- Tank
- Facility water outlet
- Facility water inlet
- DC connector
- Signal connector

The values shown on the performance chart are not guaranteed, but typical. Allow margins for safety when selecting the model.
### Series HEB

#### Dimensions

**Liquid tank**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. liquid level</td>
<td>7.4 (188)</td>
</tr>
<tr>
<td>Min. liquid level</td>
<td>3.0 (76)</td>
</tr>
</tbody>
</table>

**Internal dimensions of liquid tank**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø5.8 (147)</td>
<td>7.8 (198)</td>
</tr>
<tr>
<td>ø1.4 (35)</td>
<td>5.4 (138)</td>
</tr>
</tbody>
</table>

**Controller**

- **RUN LED (Green)**
- **TROUBLE LED (Red)**
- **Ventilation hole (Air IN)**
- **Fan (Air OUT)**
- **Alarm output connector**
- **DC output connector**
- **DC cable**
- **Signal cable**
- **Model no. label**

**Warning**

- **Temperature sensor**
- **Rubber foot**
- **Circulating pump**

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SHOP ONLINE at www.airlinehyd.com

800-999-7378
Connectors

Water Bath and Controller Connection

- **Connector for water baths**
  - DC connector (male connector)
  - Signal connector (male connector)
  - Nanaboshi Electric Mfg. Co., Ltd.: NJC-245-RM UL CSA
  - Hirose Electric Co., Ltd.: CDA-15S
  - Holding screw M2.6

- **Connector for controllers**
  - Power connector
  - IEC 60320 C-14 or equivalent
  - Male connector

- **Connector for External Equipment**
  - Connectors that fit with a communication connector and an alarm output connector should be prepared by customer.
  - **Alarm output connector**
    - Hirose Electric Co., Ltd.: CDE-9P
    - Holding screw M2.6
    - Fitting connector: CDE-9S or equivalent

- **Communication connector**
  - Hirose Electric Co., Ltd.: CDE-9S
  - Holding screw M2.6
  - Fitting connector: CDE-9P or equivalent

Power Cable Connection

- **Connector for water baths**
  - DC connector (male connector)
  - Signal connector (male connector)
  - Nanaboshi Electric Mfg. Co., Ltd.: NJC-245-PF UL CSA
  - Hirose Electric Co., Ltd.: CDA-15S
  - Holding screw M2.6

- **Connector for controllers**
  - Power connector
  - IEC 60320 C-13 or equivalent
  - Female connector

- **Fitting connector**
  - CDE-9P or equivalent

Maintenance

Maintenance of this unit is performed only in the form of return to and repair at SMC’s site. As a rule, SMC will not conduct on-site maintenance. Separately, the following parts have a limited life and need to be replaced before the life ends.

### Parts Life Expectation

<table>
<thead>
<tr>
<th>Description</th>
<th>Expected life</th>
<th>Possible failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulating pump</td>
<td>3 to 5 years</td>
<td>The circulating fluid cannot be fed due to worn bearing and/or insufficient capacity of electrolytic capacitor, which results in temperature controlling failure.</td>
</tr>
<tr>
<td>Fan</td>
<td>5 to 10 years</td>
<td>The capacity of the fan lowers due to the end of lubricating performance of the bearing, which results in increase of internal temperature of the Controller. The overheat protective function at the inside of the power supply starts, the output stops and the display goes off.</td>
</tr>
<tr>
<td>DC power supply</td>
<td>5 to 10 years</td>
<td>Abnormal voltage is generated and the display goes off due to insufficient capacity of electrolytic capacitor.</td>
</tr>
</tbody>
</table>
Circulating Fluid

Caution

4. The pump can be broken by foreign objects entering the circulating pump.
Control to prevent any foreign object from entering the fluid. If the fluid is fluorinated liquid and it is set to a temperature below freezing point, steam from the atmosphere will form ice (frost) when entering the fluid. Be sure to remove this ice (frost) regularly.
5. If water is used for the circulating fluid, set its temperature to over or more 41°F (5°C) to prevent it from being frozen.
6. Clear Water (as Circulating Water) Quality Standards

Facility Water Quality Standard
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
|----------------------------|------|----------------|-----------
| pH (at 77°F (25°C))       | —    | 6.0 to 8.0     | ○         |
| Electrical conductivity (77°F (25°C)) | [µS/cm] | 100 to 300    | ○         |
| Chloride ion (Cl–)        | [mg/L] | 50 or less    | ○         |
| Sulfuric acid ion (SO42–) | [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 (CaCO3) | [mg/L] | 50 or less    | ○         |
| Ionic state silica (SiO2) | [mg/L] | 30 or less    | ○         |
| Iron (Fe)                 | [mg/L] | 0.3 or less   | ○         |
| Copper (Cu)               | [mg/L] | 0.1 or less   | ○         |
| Sulfide ion (Sr2+)        | [mg/L] | Should not be detected | ○ |
| Ammonium ion (NH4+)       | [mg/L] | 0.1 or less   | ○         |
| Residual chlorine (Cl)    | [mg/L] | 0.3 or less   | ○         |
| Free carbon (CO2)         | [mg/L] | 4.0 or less   | ○         |

* In the case of [µS/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.

Facility Water

Caution

1. The maximum operating pressure of facility water is 73 psi (0.5 MPa).
If this value is exceeded, the internal piping of the tank can break, causing leakage of facility water.
2. Do not supply a flow rate of 8 L/min or more which can break the facility water piping.
3. Appropriate range of the flow rate of the facility water is 0.8 to 1.3 gpm (3 to 5 L/min).
Flow rate higher than this range will not slightly affect the cooling and heating capacity. However, a flow rate below 0.8gpm (3 L/min) will reduce the cooling and heating capacity significantly.

Communication

Caution

1. The set value can be written to EEPROM, but only up to approx. 100,000 times.
In particular, pay attention to how many of times the writing is performed using the communication function.
Maintenance

**Warning**

1. **Prevention of electric shock and fire**
   Do not operate the switch with wet hands. Also, do not operate the Thermoelectric Bath with water or fluid left on it.

2. **Action in the case of error**
   If any error such as abnormal sounds, smoke, or bad smell occurs, cut off the power at once, and stop supplying facility water. Please contact SMC or a sales distributor to repair the Thermoelectric Bath.

3. **Regular inspection**
   Check the following items at least once a month. The inspection must be done by an operator who has sufficient knowledge and experience.
   a) Check of displayed contents.
   b) Check of temperature, vibration and abnormal sounds in the body of the Thermoelectric Bath.
   c) Check of the voltage and current of the power supply system.
   d) Check for leakage and contamination of the recirculating fluid and intrusion of foreign objects to it.
   e) Check radiation air flow condition and temperature.
   f) Check for leakage, quality change, flow rate and temperature of facility water.
Fluororesin heat exchanger allows direct temperature control for chemicals!!

Industry-leading withstand pressure 51 psi!! (0.35MPa)

- With leakage detection function
- Operating temperature range: 50° to 140°F (10° to 60°C)
- Temperature stability: ±0.18°F (±0.1°C)
- Cooling capacity (with water):
  - 300w, 500w, 750w
- International standards:
  - SEMI Standard S2-0706, F47-0706
- Environment friendly: RoHS
Allows direct control of chemical temperature.

- PFA wetted parts material prevents contamination from metal ion elution.
- No need for a tube-type heat exchanger.

### Compact and Light

- Self-developed heat exchanger matched to the configuration of the Peltier device (Thermo-module). Compact and light.

#### Heat Exchanger

<table>
<thead>
<tr>
<th>Model</th>
<th>W (inch)</th>
<th>D (inch)</th>
<th>H (inch)</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HED003</td>
<td>5.1 (130)</td>
<td>10.4 (263)</td>
<td>6.7 (170)</td>
<td>17.6 (8)</td>
</tr>
<tr>
<td>HED005</td>
<td>5.9 (150)</td>
<td>11.6 (294)</td>
<td>8.7 (222)</td>
<td>30.9 (14)</td>
</tr>
<tr>
<td>HED007</td>
<td>6.5 (165)</td>
<td>17.6 (447)</td>
<td>8.5 (215)</td>
<td>33.1 (15)</td>
</tr>
</tbody>
</table>

The outline dimensions do not include protruding parts such as the foot flange and tube.

#### Temperature Controller

<table>
<thead>
<tr>
<th>Model</th>
<th>W (inch)</th>
<th>D (inch)</th>
<th>H (inch)</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HED003</td>
<td>3.9 (100)</td>
<td>12.6 (320)</td>
<td>8.5 (215)</td>
<td>13.2 (6)</td>
</tr>
<tr>
<td>HED005</td>
<td>5.5 (140)</td>
<td>13.8 (350)</td>
<td>8.5 (215)</td>
<td>17.6 (8)</td>
</tr>
<tr>
<td>HED007</td>
<td>6.5 (165)</td>
<td>17.6 (447)</td>
<td>8.5 (215)</td>
<td>28.7 (13)</td>
</tr>
</tbody>
</table>

The outline dimensions do not include protruding parts such as the foot flange, screw and connector.

### Applications

- Cleaning equipment
- Plating equipment
- Wet etching equipment, etc.

### Applicable Fluid Examples

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Operating temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deionized water</td>
<td>50 to 140°F (10 to 60°C)</td>
</tr>
<tr>
<td>Hydrofluoric acid</td>
<td>50 to 104°F (10 to 40°C)</td>
</tr>
<tr>
<td>Sulfuric acid (except fuming sulfuric acid)</td>
<td>50 to 122°F (10 to 50°C)</td>
</tr>
<tr>
<td>Copper sulfate solution</td>
<td>50 to 122°F (10 to 50°C)</td>
</tr>
<tr>
<td>Ammonia hydrogen peroxide solution</td>
<td>50 to 140°F (10 to 60°C)</td>
</tr>
<tr>
<td>Sodium hydroxide</td>
<td>50 to 140°F (10 to 60°C)</td>
</tr>
<tr>
<td>Ozone water</td>
<td>50 to 140°F (10 to 60°C)</td>
</tr>
</tbody>
</table>

Note) Chemical Thermo-con is not designed to be explosion proof, so it is not suitable for flammable fluids.
**Principle of Peltier Device (Thermo-module, Thermoelectric device)**

The Peltier device (thermo-module, thermoelectric device) is plate-shape solid state element with P-type, N-type semiconductor arrayed alternately. When direct current is supplied to the element, heat moves from one surface to another along with electron flow in N-type semiconductor and electron hole in P-type semiconductor. As a result of the heat move, one surface of the element absorbs heat and decrease temperature. And other surface heats up. When the DC current is switched to reverse direction, the heat move will also be reverse direction. Therefore, Peltier element can achieve heating effect as well as cooling effect depending on the current direction. It can achieve high speed switching and precise temperature control.

**Construction and Principle**

The temperature controller controls the circulating fluid in the heat exchanger. A temperature sensor (platinum resistance temperature detector) installed in the heat exchanger sends a signal to the controller, which changes the temperature of the circulating fluid by adjusting the output direction and energizing time of the built-in DC power supply based on the difference between the set and measured temperatures.

This product can be used safely since the sensor to detect leakage of the circulating fluid is installed as a standard device.
**Guide to Model Selection**

**Example 1: When the heat generation amount in the customer’s machine is known.**

Heat generation amount Q: 400 W (at 77°F (25°C))

Cooling capacity = Considering a safety factor of 20%, select 400 W \times 1.2 = 480 W (at 77°F (25°C)) or more.

**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 Q : Unknown
Circulating fluid temperature difference \( \Delta T = T_2 - T_1 \) : 1.0°C (1.0 K)
Circulating fluid outlet temperature \( T_1 \) : 20°C (293.15 K)
Circulating fluid inlet temperature \( T_2 \) : 21°C (294.15 K)
Circulating fluid flow rate L : 7 L/min
Circulating fluid : Water
: Density \( \gamma \) : 1 \( \times \) 10³ kg/m³
: Specific heat \( C \) : 4.2 \( \times \) 10³ J/(kg·K)

\[
Q = \frac{\Delta T \times L \times \gamma \times C}{60 \times 1000} = \frac{1 \times 7 \times 1 \times 10^3 \times 4.2 \times 10^3}{60 \times 1000} = 490 \text{ W}
\]

Cooling capacity = Considering a safety factor of 20%,
490 \times 1.2 = 588 W

**Example 3. In cases where cooling the object below a certain temperature and period of time.**

Cooled substance total volume \( V \) : 20 L
Cooling time \( h \) : 15 min
Cooling temperature difference \( \Delta T \) : 5°C (5 K)
Circulating fluid : Clear water
: Density \( \gamma \) : 1 \( \times \) 10³ kg/m³
: Specific heat \( C \) : 4.2 \( \times \) 10³ J/(kg·K)

\[
Q = \frac{\Delta T \times V \times \gamma \times C}{h \times 60 \times 1000} = \frac{5 \times 20 \times 1 \times 10^3 \times 4.2 \times 10^3}{15 \times 60 \times 1000} = 467 \text{ W}
\]

Cooling capacity = Considering a safety factor of 20%,
467 \times 1.2 = 560 W

**Precautions on Model Selection**

The flow rate of the circulating fluid depends on the internal resistance of the customer’s machine and the length, diameter and resistance created by bends in the circulating fluid piping, etc. Check if the required flow rate of circulating fluid can be obtained before using.
Chemical Thermo-con
Series HED

How to Order

Part number of set (Temperature controller + Heat exchanger)

Note) The model numbers of the temperature controller and heat exchanger are printed respectively on the product name label.

Chemical
Thermo-con

Cooling capacity
003 300 W
005 500 W
007 750 W

Radiating method
W Water-cooled

Communication
A RS-485
RS-232C

Power supply
2 Single-phase 180 to 242 VAC 50/60 Hz

Combination in Set

<table>
<thead>
<tr>
<th>Part number of set</th>
<th>Heat exchanger model</th>
<th>Temperature controller model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HED003-W2A13</td>
<td>HED003-HW13</td>
<td>HED003-C2A</td>
</tr>
<tr>
<td>HED003-W2A19</td>
<td>HED003-HW19</td>
<td>HED003-C2A</td>
</tr>
<tr>
<td>HED003-W2B13</td>
<td>HED003-HW13</td>
<td>HED003-C2B</td>
</tr>
<tr>
<td>HED003-W2B19</td>
<td>HED003-HW19</td>
<td>HED003-C2B</td>
</tr>
<tr>
<td>HED005-W2A13</td>
<td>HED005-HW13</td>
<td>HED005-C2A</td>
</tr>
<tr>
<td>HED005-W2A19</td>
<td>HED005-HW19</td>
<td>HED005-C2A</td>
</tr>
<tr>
<td>HED005-W2B13</td>
<td>HED005-HW13</td>
<td>HED005-C2B</td>
</tr>
<tr>
<td>HED005-W2B19</td>
<td>HED005-HW19</td>
<td>HED005-C2B</td>
</tr>
<tr>
<td>HED007-W2A13</td>
<td>HED007-HW13</td>
<td>HED007-C2A</td>
</tr>
<tr>
<td>HED007-W2A19</td>
<td>HED007-HW19</td>
<td>HED007-C2A</td>
</tr>
<tr>
<td>HED007-W2B13</td>
<td>HED007-HW13</td>
<td>HED007-C2B</td>
</tr>
<tr>
<td>HED007-W2B19</td>
<td>HED007-HW19</td>
<td>HED007-C2B</td>
</tr>
</tbody>
</table>

Heat exchanger

HED 007 - H W 13

Cooling capacity
003 300 W
005 500 W
007 750 W

Heat exchanger

Radiating method
W Water-cooled

Tube size
13 1/2" x 3/8"
19 3/4" x 5/8"

* The tube size should be specified when ordering.

Temperature controller

HED 007 - C 2 B

Cooling capacity
003 300 W
005 500 W
007 750 W

Temperature controller

Communication
A RS-485
RS-232C

Power supply
2 Single-phase 180 to 242 VAC 50/60 Hz
Main Specifications (For details, please consult our “Product Specifications” information.)

Heat Exchanger Specifications

<table>
<thead>
<tr>
<th>Heat exchanger model</th>
<th>HED003-HW13</th>
<th>HED003-HW19</th>
<th>HED005-HW13</th>
<th>HED005-HW19</th>
<th>HED007-HW13</th>
<th>HED007-HW19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling capacity (Water)</td>
<td>300 W</td>
<td>500 W</td>
<td>750 W</td>
<td>1000 W</td>
<td>1800 W</td>
<td></td>
</tr>
<tr>
<td>Heating capacity (Water)</td>
<td>600 W</td>
<td>1000 W</td>
<td>1800 W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling/Heating method</td>
<td>Pettler device (Thermoelectric device, Thermo-module)</td>
<td>Water-cooled</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid</td>
<td>Deionized water, Hydrofluoric acid, Ammonia hydrogen peroxide solution, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applicable fluid</td>
<td>PFA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetted parts material</td>
<td>FEP, Stainless steel 304, Stainless steel 316</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tube size (PFA tube)</td>
<td>1/2” x 3/8”, 3/4” x 5/8”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>50 to 95 °F (10 to 35°C) (no condensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetted parts material</td>
<td>73 psi (0.5 MPa)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. operating pressure</td>
<td>IN/OUT: FEP tube 3/8” x 1/4”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow rate</td>
<td>1.3 to 2.6 gpm (5 to 10 L/min)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature/humidity</td>
<td>Temperature: 50 to 95°F (10 to 35°C), Humidity: 35 to 80%RH (no condensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions (inch/mm)</th>
<th>W5.1 (130) x D10.4 (263) x H6.7 (170)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>Approx. 17.6 lbs (8 kg)</td>
</tr>
</tbody>
</table>

Temperature Controller Specifications

<table>
<thead>
<tr>
<th>Temperature controller model</th>
<th>HED003-C2A</th>
<th>HED003-C2B</th>
<th>HED005-C2A</th>
<th>HED005-C2B</th>
<th>HED007-C2A</th>
<th>HED007-C2B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control method</td>
<td>Cooling/Heating automatic shift PID control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>50 to 140°F (10 to 60°C) (no condensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature stability</td>
<td>Within ±0.18°F (±0.1°C) (with stable load)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>Resistance thermometer Pt100, J, 3-wires, class A, 2 mA (for both internal control sensor and external sensor)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main functions</td>
<td>Auto-tuning, Sensor fine adjustment, Offset, Learning control, External sensor control, Set value memory, Upper/Lower temperature limit alarm, Output shutdown alarm, Remote ON/OFF, Leakage detection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature/humidity</td>
<td>Temperature: 50 to 95°F (10 to 35°C), Humidity: 35 to 80%RH (no condensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply spec.</td>
<td>Power supply Single-phase 180 to 242 VAC 50/60 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated current</td>
<td>3 A 5 A 14 A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions (inch/mm)</td>
<td>W3.9 (100) x D12.6 (320) x H8.5 (215)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 13.2 lbs (6 kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applied heat exchanger</td>
<td>HED003-HW13, HED003-HW19, HED005-HW13, HED005-HW19, HED007-HW13, HED007-HW19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Caution

- For the combination of the heat exchanger and temperature controller, refer to “Combination in Set”.

Note 1) The conditions are as follows:
- Circulating fluid: Water (Circulating flow rate 3.96 gpm (15 L/min), Set temperature 77°F (25°C), Facility water temperature 77°F (25°C), Facility water flow rate 1.32 gpm (5 L/min), Ambient temperature 77°F (25°C)
- Note 2) For the compatibility between the circulating fluid and materials, refer to “Applicable Fluids”.
- Note 3) Install the heat exchanger in the discharge side of a circulating pump. Do not use at location where a negative pressure is applied. The circulating fluid pump should be prepared by the customer.
- Note 4) The outline dimensions do not included protruding parts such as the foot flange and tube.

Note 1) This value is with a stable load with no disturbance and cannot be achieved in some operating conditions.
Note 2) The outline dimensions do not included protruding parts such as the foot flange, screw and connector.
Note 3) The temperature controller should be connected with a specific series of heat exchanger. If connected with a different series of heat exchanger, it may not operate normally. (The HED003 and HED005 series use the same connector, so be careful for incorrect wiring.)
**Series HED**

**Cooling Capacity**  
*Conditions* Circulating fluid: Clear water, Circulating fluid flow rate: 3.96 gpm (15 L/min), Facility water flow rate: 1.32 gpm (5 L/min)

**Heating Capacity**  
*Conditions* Circulating fluid: Clear water, Circulating fluid flow rate: 3.96 gpm (15 L/min), Facility water flow rate: 1.32 gpm (5 L/min)

The values shown on the performance chart are representative and not guaranteed. Allow a margin for safety to device when choosing the product.
Pressure Loss in Circulating Fluid Circuit  
<Condition> Clear water

HED003

![Graph for HED003](image1)

HED005

![Graph for HED005](image2)

HED007

![Graph for HED007](image3)

Pressure Loss in Facility Water Circuit  
<Condition> Clear water

HED003

![Graph for HED003](image4)

HED005

![Graph for HED005](image5)

HED007

![Graph for HED007](image6)
Dimension

HED007-W2

Temperature controller: HED007-C2
Heat exchanger: HED007-HW

Fluid leak sensor

Terminal block

Communication connector

The RS-232C uses only upper side connector.

Fan

Power switch

Display panel

DC connector

Signal connector

Alarm output connector

Power connector

Circulating fluid inlet

Facility water outlet

Purge outlet

Purge inlet

Wire color:
- Black 1
- Black 2
- Green/Yellow

Circulating fluid tube size

Heat exchanger model:
- HED007-HW13
- HED007-HW19

Circulating fluid tube size:
- 1/2" x 3/8"
- 3/4" x 5/8"

Power Cable (Accessory)

Connector: DDK CE05-6A18-10SD-D-BSS
Cable: 12AWG, O.D. ø11.8

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black 1</td>
<td>180 to 242 VAC</td>
</tr>
<tr>
<td>Black 2</td>
<td>180 to 242 VAC</td>
</tr>
<tr>
<td>Green/Yellow</td>
<td>PE</td>
</tr>
</tbody>
</table>
Series HED

Connectors

- Use the special power cable included with the temperature controller.
- Connect the DC cable and signal cable that come from the heat exchanger to the DC and signal connectors of the temperature controller.
- Prepare other required connectors and wiring by the customer.

1. Power connector
   <For HED003-C2, HED005-C2>  
   IEC 60320 C14 or equivalent
   Connect the included special power cable.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>180 to 242 VAC</td>
</tr>
<tr>
<td>2</td>
<td>180 to 242 VAC</td>
</tr>
<tr>
<td>3</td>
<td>PE</td>
</tr>
</tbody>
</table>

   <For HED007-C2>  
   DDK Ltd. CE05-2A18-10PD-D
   Connect the included special power cable.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>180 to 242 VAC</td>
</tr>
<tr>
<td>B</td>
<td>180 to 242 VAC</td>
</tr>
<tr>
<td>C</td>
<td>Unused</td>
</tr>
<tr>
<td>D</td>
<td>PE</td>
</tr>
</tbody>
</table>

2. DC connector
   <For HED003-C2, HED005-C2>  
   Nanaboshi Electric Mfg. Co., Ltd.: NJC-243-RF (UL, CSA)
   Connect the DC cable connector of the heat exchanger.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DC output</td>
</tr>
<tr>
<td>2</td>
<td>DC output</td>
</tr>
<tr>
<td>3</td>
<td>FG</td>
</tr>
</tbody>
</table>

   <For HED007-C2>  
   DDK Ltd. DMS3102A20-15S
   Connect the DC cable connector of the heat exchanger.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>DC output</td>
</tr>
<tr>
<td>B</td>
<td>DC output</td>
</tr>
<tr>
<td>C</td>
<td>DC output</td>
</tr>
<tr>
<td>D</td>
<td>DC output</td>
</tr>
<tr>
<td>E</td>
<td>DC output</td>
</tr>
<tr>
<td>F</td>
<td>DC output</td>
</tr>
<tr>
<td>G</td>
<td>FG</td>
</tr>
</tbody>
</table>

3. Signal connector
   <Common to HED003-C2, HED005-C2, HED007-C2>
   Tajimi Electronics Co., Ltd.: TRC01-A16R-10FA
   Connect the signal connector of the heat exchanger.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Thermostat +</td>
</tr>
<tr>
<td>2</td>
<td>Thermostat –</td>
</tr>
<tr>
<td>3</td>
<td>Terminal A of resistance temperature detector</td>
</tr>
<tr>
<td>4</td>
<td>Terminal B of resistance temperature detector</td>
</tr>
<tr>
<td>5</td>
<td>Terminal B of resistance temperature detector</td>
</tr>
<tr>
<td>6</td>
<td>Fluid leak sensor +24 V</td>
</tr>
<tr>
<td>7</td>
<td>Fluid leak alarm signal input</td>
</tr>
<tr>
<td>8</td>
<td>Fluid leak 24VE</td>
</tr>
<tr>
<td>9-10</td>
<td>Unused</td>
</tr>
<tr>
<td></td>
<td>Grounding</td>
</tr>
</tbody>
</table>

4. Terminal block
   <Common to HED003-C2, HED005-C2, HED007-C2>
   Morimatsu Co., Ltd.: M111A-7A, for holding screw M3
   Connection cable: 22AWG or more, max. 32.8 feet (10 m)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Remote ON/OFF +</td>
</tr>
<tr>
<td>2</td>
<td>Remote ON/OFF –</td>
</tr>
<tr>
<td>3</td>
<td>FG</td>
</tr>
<tr>
<td>4</td>
<td>External sensor: Terminal A of resistance temperature detector</td>
</tr>
<tr>
<td>5</td>
<td>External sensor: Terminal B of resistance temperature detector</td>
</tr>
<tr>
<td>6</td>
<td>External sensor: Terminal B of resistance temperature detector</td>
</tr>
<tr>
<td>7</td>
<td>FG</td>
</tr>
</tbody>
</table>

   A short pin is installed between No. 1 and No. 2 pins to short-circuit it (Remote ON) when shipped.
   Remote ON/OFF signal
   Circuit voltage: 24 VDC ±10%; passing current: 2.9 to 4.3 mA
   Exterior sensor signal
   Applicable sensor: Pt100 Ω; passing current: 2 mA

5. Alarm output connector: D-sub 9 pin
   <Common to HED003-C2, HED005-C2, HED007-C2>
   OMRON Corp. XM2A-0901 or equivalent, holding screw M2.6
   Fixed contact point (load resistance: 125 VAC, 0.3 A; 30 VDC, 2 A)
   Connection cable: With shielding 22AWG or more, max. 32.8 feet (10 m)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Contact a for output cut-off alarm (open when alarm occurs)</td>
</tr>
<tr>
<td>2</td>
<td>Common for output cut-off alarm</td>
</tr>
<tr>
<td>3</td>
<td>Contact b for output cut-off alarm (closed when alarm occurs)</td>
</tr>
<tr>
<td>4</td>
<td>Contact a for upper/lower temp. limit alarm (open when alarm occurs)</td>
</tr>
<tr>
<td>5</td>
<td>Common for upper/lower temp. limit alarm</td>
</tr>
<tr>
<td>6</td>
<td>Contact b for upper/lower temp. limit alarm (closed when alarm occurs)</td>
</tr>
<tr>
<td>7-9</td>
<td>Unused</td>
</tr>
</tbody>
</table>

6. Communication connector: D-sub 9 pin
   OMRON Corp. XM2D-0901 or equivalent, holding screw M2.6
   Connection cable: With shielding 22AWG or more

1) Common to HED003-C2A, HED005-C2A, HED007-C2A
   RS-485

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RS-485 BUS +</td>
</tr>
<tr>
<td>2</td>
<td>RS-485 BUS –</td>
</tr>
<tr>
<td>3</td>
<td>Unused</td>
</tr>
<tr>
<td>4</td>
<td>Unused</td>
</tr>
<tr>
<td>5</td>
<td>SG</td>
</tr>
<tr>
<td>6-9</td>
<td>Unused</td>
</tr>
</tbody>
</table>

2) Common to HED003-C2B, HED005-C2B, HED007-C2B
   RS-232C

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unused</td>
</tr>
<tr>
<td>2</td>
<td>RS-232C RD</td>
</tr>
<tr>
<td>3</td>
<td>RS-232C SD</td>
</tr>
<tr>
<td>4</td>
<td>Unused</td>
</tr>
<tr>
<td>5</td>
<td>SG</td>
</tr>
<tr>
<td>6-9</td>
<td>Unused</td>
</tr>
</tbody>
</table>

---

SHOPT ONLINE at www.airlinehyd.com 800-999-7378
Alarm

This unit has failure diagnosis function. When a failure happens, its failure mode is displayed on the LCD display in the controller and it can be read out through the serial communication, and has relay outputs for upper/lower temperature limit alarm and shutdown alarm.

<table>
<thead>
<tr>
<th>Alarm code</th>
<th>Alarm description</th>
<th>Operation status</th>
<th>Main reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRN</td>
<td>Upper/Lower temp. limit alarm</td>
<td>Continue</td>
<td>The temperature has exceeded the upper or lower limit of the set temperature.</td>
</tr>
<tr>
<td>WRN</td>
<td>Remote OFF alarm</td>
<td>Stop</td>
<td>The remote ON/OFF contact is set to be off. (This alarm is not generated by the relay output.)</td>
</tr>
<tr>
<td>ERR00</td>
<td>CPU hung-up</td>
<td>Stop</td>
<td>The CPU has crashed due to noise, etc.</td>
</tr>
<tr>
<td>ERR01</td>
<td>CPU check failure</td>
<td>Stop</td>
<td>The contents of the CPU cannot be read out correctly when the power supply is turned on.</td>
</tr>
<tr>
<td>ERR03</td>
<td>Back-up data error</td>
<td>Stop</td>
<td>The contents of the back-up data cannot be read out correctly when the power supply is turned on.</td>
</tr>
<tr>
<td>ERR04</td>
<td>EEPROM writing error</td>
<td>Stop</td>
<td>The data cannot be written to EEPROM.</td>
</tr>
<tr>
<td>ERR05</td>
<td>EEPROM input over time error</td>
<td>Stop</td>
<td>The number of times of writing to EEPROM has exceeded the maximum value.</td>
</tr>
<tr>
<td>ERR11</td>
<td>DC power voltage failure</td>
<td>Stop</td>
<td>Momentary loss of AC power supply, DC power supply has excessive temperature, or the thermo-module has been short-circuited.</td>
</tr>
<tr>
<td>ERR12</td>
<td>Internal sensor value is high.</td>
<td>Stop</td>
<td>The internal temperature sensor has exceeded the upper limit where the Chemical Thermo-con is set to stop.</td>
</tr>
<tr>
<td>ERR13</td>
<td>Internal sensor value is low.</td>
<td>Stop</td>
<td>The internal temperature sensor has exceeded the lower limit where the Chemical Thermo-con is set to stop.</td>
</tr>
<tr>
<td>ERR14</td>
<td>Thermostat alarm</td>
<td>Stop</td>
<td>The thermostat has been activated due to insufficient flow rate of the circulating fluid or facility water or high temperature.</td>
</tr>
<tr>
<td>ERR15</td>
<td>Output failure alarm</td>
<td>Continue</td>
<td>The temperature cannot be changed even at 100% output, due to overload or disconnection of the thermo-module.</td>
</tr>
<tr>
<td>ERR17</td>
<td>Cutoff/short of internal sensor</td>
<td>Stop</td>
<td>The internal temperature sensor has been disconnected or short-circuited.</td>
</tr>
<tr>
<td>ERR18</td>
<td>Cutoff/short of external sensor</td>
<td>Continued by normal control</td>
<td>The external temperature sensor has been disconnected or short-circuited. (Only detected when in learning control, auto-tuning operation 2, or external sensor control)</td>
</tr>
<tr>
<td>ERR19</td>
<td>Auto-tuning failure</td>
<td>Stop</td>
<td>Auto-tuning has not been completed within 60 minutes.</td>
</tr>
<tr>
<td>ERR21</td>
<td>Fan alarm</td>
<td>Stop</td>
<td>The air-cooled fan alarm of the power supply has been activated.</td>
</tr>
<tr>
<td>ERR22</td>
<td>Leak alarm</td>
<td>Stop</td>
<td>The fluid leak sensor has detected leakage of fluid.</td>
</tr>
</tbody>
</table>

Maintenance

Please prepare back-up equipment as necessary to minimize the downtime.

1) Heat exchanger

The heat exchanger will not be repaired in principle. Only the return to SMC for an investigation within warranty will be accepted. The return unit has to be completely decontaminated with appropriate method such as use of neutralizing agent before return to SMC.

2) Temperature controller

Maintenance of the temperature controller will be performed only at SMC. SMC will not support on-site maintenance. The following parts have published life time. To make a maintenance return schedule is recommended based on the following parts life expectation.

Parts Life Expectation

<table>
<thead>
<tr>
<th>Description</th>
<th>Expected life</th>
<th>Possible failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan</td>
<td>5 to 10 years</td>
<td>Lack of fan cooling because of the life time of the bearing. It will activate the overheat protection of DC power supply and generate alarm.</td>
</tr>
<tr>
<td>DC power supply</td>
<td>5 to 10 years</td>
<td>End life of electrolytic condenser. It will generate DC power supply alarm.</td>
</tr>
<tr>
<td>Display panel</td>
<td>50,000 hours (approx. 5 years)</td>
<td>End life of backlight of LCD.</td>
</tr>
</tbody>
</table>
## Chemical Compatibility Table against the Wetted Parts Material in Chemical Thermo-con

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Concentration</th>
<th>Operating temperature range</th>
<th>Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrofluoric acid</td>
<td>HF: 10% or less</td>
<td>50 to 104°F (10 to 40°C)</td>
<td>Note 2)</td>
</tr>
<tr>
<td>Buffered hydrogen fluoride</td>
<td>HF: 10% or less</td>
<td>50 to 104°F (10 to 40°C)</td>
<td>Note 2)</td>
</tr>
<tr>
<td>Hydrofluoric acid and Nitric acid mixture</td>
<td>HF: 5% or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HNO₃: 5% or less</td>
<td></td>
<td>Note 2)</td>
</tr>
<tr>
<td>Nitric acid (except fuming nitric acid)</td>
<td>HNO₃: 5% or less</td>
<td></td>
<td>Note 2)</td>
</tr>
<tr>
<td>Hydrochloric acid</td>
<td>HCl: 5% or less</td>
<td></td>
<td>Note 2)</td>
</tr>
<tr>
<td>Copper sulfate solution</td>
<td>H₂SO₄: 96% or less</td>
<td>50 to 122°F (10 to 50°C) (Note HED007)</td>
<td>Note 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 to 86°F (10 to 30°C)</td>
<td>Note 2)</td>
</tr>
<tr>
<td>Sulfuric acid (except fuming sulfuric acid)</td>
<td>H₂SO₄: 96% or less</td>
<td>50 to 122°F (10 to 50°C) (Note HED007)</td>
<td>Note 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 to 86°F (10 to 30°C)</td>
<td>Note 2)</td>
</tr>
<tr>
<td>Ozone</td>
<td>—</td>
<td>50 to 140°F (10 to 60°C)</td>
<td>Note 2)</td>
</tr>
<tr>
<td>Ammonium hydroxide</td>
<td>NH₃: 5% or less</td>
<td>50 to 140°F (10 to 60°C)</td>
<td>Note 2)</td>
</tr>
<tr>
<td>Ammonia hydrogen peroxide solution</td>
<td>NH₃: 5% or less</td>
<td>50 to 140°F (10 to 60°C)</td>
<td>Note 1)</td>
</tr>
<tr>
<td></td>
<td>H₂O₂: 20% or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium hydroxide</td>
<td>NaOH: 50% or less</td>
<td>50 to 140°F (10 to 60°C)</td>
<td>Note 2)</td>
</tr>
<tr>
<td>Deionized water</td>
<td>—</td>
<td>50 to 140°F (10 to 60°C)</td>
<td>Note 1)</td>
</tr>
<tr>
<td>Ultrapure water</td>
<td>—</td>
<td>50 to 140°F (10 to 60°C)</td>
<td>Note 1)</td>
</tr>
</tbody>
</table>

---

**How to read the table:**
- 🟩: Useable
- 🟠: Consult with SMC separately.

- **Note 1:** Static electricity may be generated. Anti-static electricity countermeasures should be implemented.
  - Flow friction may generate static electricity, which can cause electric discharge to the temperature sensor or other devices and cause a malfunction.
  - It is possible to discharge electricity by using a conductive PFA tube, metal piping (metal flexible hose), or other type of tubing, and by installing a ground line.
- **Note 2:** Permeation of the chemical may be possible. The permeated chemical may have a moderate corrosion to inside components and it may effect their life time. If the chemical has high concentration, permeation becomes greater, which effects the service life. In case the fluid has a possibility to generate corrosive gas, SMC recommends a nitrogen purge of the enclosure. Ni purge ports are located at the piping connection side of the heat exchanger.
**Series HED**

**Specific Product Precautions 1**

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back pages 2 to 5 for Temperature Control Equipment Precautions.

---

**System Design**

⚠️ **Warning**

This catalog shows the specifications of the Chemical Thermo-con.

1. Check detailed specifications in the separate “Product Specifications”, and evaluate the compatibility of the Chemical Thermo-con with the customer’s system.
2. The Chemical Thermo-con is equipped with a protective circuit independently, but the whole system should be designed by customer to ensure safety.

---

**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. Keep within the specified ambient temperature and humidity range. Also, if the set temperature is too low, condensation may form on the inside of the Chemical Thermo-con or the surface of piping even within the specified ambient temperature range. Dew condensation can cause failure, and so must be avoided by considering operating conditions.
2. The Chemical Thermo-con is not designed for clean room usage. The fan will generate dust.
3. Low molecular siloxane can damage the contact of the relay. Use the Chemical Thermo-con in a place free from low molecular siloxane.

---

**Piping**

⚠️ **Warning**

2. Work performed on the piping should be done by a knowledgeable and experienced person.

If work performed on the piping is done by a less knowledgeable and inexperienced person, it will likely lead to operating fluid leakage, etc.

3. **Confirm the leakage of fluid.**

Fluid leakage can cause dangerous accidents. Be sure to confirm that the hose or tubing is not pulled out and that there is no leakage in the fitted parts.

4. **Confirm that the resin tube is not kinked or collapsed.**

If a resin tube is used, it should be checked for the presence and possibility of kink or collapse.

5. **Countermeasures against fluid leakage**

Water drops may accumulate due to leakage of circulating fluid or facility water, or condensation on the piping. Install the Chemical Thermo-con with a drip pan, fluid leak sensor and exhaust system.

If leakage is detected, cut off the circulating pump with a hardware interlock, and cut off the power to the Chemical Thermo-con.

Depending on the type of chemical used (circulating fluid), it may have a harmful effect on the surrounding equipment and the human body.

---

**Caution**

1. **Before piping**

Confirm that dust, scales etc., in contact with piping is cleaned up or air blown (flushing) before piping.

2. **Take care over the direction of fluid.**

Do not mistake the direction of “IN” and “OUT” for the facility water system and circulating fluid system.

3. **Take countermeasures against condensation.**

Depending on the operating condition, condensation may occur on the piping. In such a case, take countermeasures such as installing insulation material, etc.

4. **Avoid electrostatic discharge.**

If a fluid with low conductivity such as deionized water is used as the circulating fluid, static electricity generated by flow friction may be discharged to the temperature sensor and malfunction the Chemical Thermo-con. Consider measures to minimize the discharge of static electricity from the circulating fluid to signal line including the temperature sensor.

For example, a PFA conductive tube or metal piping (metal flexible hose) can be used to provide grounding to the piping of the external sensor and discharge.

---

**Piping**

1. **Piping must be designed taking the whole system into consideration.**

For this product and future equipment, design of the piping system should be performed by a knowledgeable and experienced person.

The fitting is not attached, and should be prepared separately by customer.

Select a fitting suitable for the material and dimensions of the tube. When connecting the fitting, use a specific tool specified by fitting manufacturer.
### Warning

1. **Electrical wiring job should be performed by a knowledgeable and experienced person.**
   
   Power supply facilities and wiring works should be implemented in accordance with the electric facilities technical standards and provisions and conducted correctly.

2. **Mounting a dedicated earth leakage breaker.**
   
   As a countermeasure against current leakage, install an earth leakage breaker in the main power supply.

3. **Confirmation of power supply**
   
   If this product is used with voltages other than specified, it will likely lead to a fire or an electrical shock. Before wiring, confirm the voltage, capacity, and frequency. Confirm that the voltage fluctuation is within the specified value.

4. **Grounding**
   
   Be sure to ground (frame ground) with class D grounding. (grounding resistance of 100 Ω or less)
   
   Can be grounded with the PE line of the power supply cable. Also, do not use together with equipment that generates a strong electrical magnetic noise or high frequency noise.

5. **Wiring cable should be handled with care.**
   
   Do not bend, twist or pull the cord or cable.

6. **Wire with an applicable cable size and terminal.**
   
   In the event of attaching a power supply cable, use a cable and terminal size which is suitable for the electrical current of each product. Forcibly mounting with an unsuitable size cable will likely result in a fire.

7. **Avoid wiring the signal line and power line in parallel.**
   
   Since there may be a possibility of malfunction from noise, avoid parallel wiring between the temperature sensor line, communications line, signal line of alarm line, etc. and the power line and high voltage line. Also, do not place them in the same wiring tube.

8. **Check for incorrect wiring.**
   
   Incorrect wiring can damage the Chemical Thermo-con or cause malfunction. Be sure to check wiring is connected properly.

9. **Check the model of the Chemical Thermo-con.**
   
   The HED003 and HED005 series use the same connector. If the temperature controller and heat exchanger of different models are combined by mistake, an alarm may be generated and the specified performance may not be obtained. Be sure to check the combination of models.

### Facility Water Supply

1. **Be sure to supply the facility water.**
   
   1. Prohibition of water-cut operation, very little flow rate of water operation.
      
      Do not operate under the condition that there is no facility water or where there is very little flow rate of water is flowing. (Facility water flow rate range: 1.3 to 2.6 gpm (5 to 10 L/min))
      
      In this kind of operation, facility water temperature may become extremely higher. It is dangerous enough the material of hose may soften and burst when the piping supplying the facility water is connected with hose.

   2. Actions to be taken when an emergency stop occurs due to extremely high temperature.
      
      In case a stop occurs due to extremely high temperature resulting from a decrease in the facility water flow rate, do not immediately flow facility water. It is dangerous enough the material of hose may soften and burst when the piping supplying the facility water is connected with hose. First, naturally let it cool down, and removing the cause of the flow rate reduction. Secondly, make sure that there is no leakage again.

### Caution

1. **Facility water quality**
   
   1. Use the facility water within the specified range.
      
      When using with other fluid than facility water, please consult with SMC.

   2. When it is likely that foreign objects may enter the fluid, install a filter (20 mesh or equivalent).

### Facility Water Quality Standards

The Japan Refrigeration and Air Conditioning Industry Association

JRA GL-02-1994 “Cooling water system – Circulating type – Circulating water”

<table>
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<tr>
<th>Standard item</th>
<th>Reference item</th>
<th>Standard value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (at 77°F (25°C))</td>
<td>Copper</td>
<td>6.5 to 8.2</td>
</tr>
<tr>
<td>Electrical conductivity (77°F (25°C))</td>
<td>Sulfide ion</td>
<td>&lt;0.3 [mg/L]</td>
</tr>
<tr>
<td>Chloride ion</td>
<td>Acid consumption amount (at pH4.8)</td>
<td>&lt;0.3 [mg/L]</td>
</tr>
<tr>
<td>Sulfuric acid ion</td>
<td>Total hardness</td>
<td>&lt;200 [mg/L]</td>
</tr>
<tr>
<td>Acid consumption amount (at pH4.8)</td>
<td>Calcium hardness</td>
<td>&lt;200 [mg/L]</td>
</tr>
<tr>
<td>Total hardness</td>
<td>Ionic state silica</td>
<td>&lt;50 [mg/L]</td>
</tr>
<tr>
<td>Calcium hardness</td>
<td>Iron</td>
<td>&lt;1.0 [mg/L]</td>
</tr>
<tr>
<td>Ionic state silica</td>
<td>Residual chlorine</td>
<td>&lt;0.3 [mg/L]</td>
</tr>
<tr>
<td>Iron</td>
<td>Free carbon</td>
<td>&lt;4.0 [mg/L]</td>
</tr>
</tbody>
</table>

\* Electrical conductivity should be 100 [µS/cm] or more.

2. **If the temperature of the facility water is too low, it can cause formation of condensation inside the heat exchanger.**

   Supply facility water with a temperature over the atmospheric dew point to avoid the formation of dew condensation.

3. **If the facility water piping is connected to multiple machines, the facility water exchanges heat at the upstream side and its temperature will become higher as it goes downstream.**

   Limit the number of connected Chemical Thermo-cons to two per facility water system, and if more than two chemical thermo-cons are to be connected, increase the number of systems.
Series HED
Specific Product Precautions 3

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back pages 2 to 5 for Temperature Control Equipment Precautions.

Mounting

⚠️ Caution

1. Mount and install horizontally.
When mounting, fix the foot of the Chemical Thermo-con by tightening the screws to the specified torque below.

<table>
<thead>
<tr>
<th>Device to mount</th>
<th>Thread size</th>
<th>Applicable tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat exchanger</td>
<td>M6</td>
<td>1.1 to 1.8 lbf·ft (1.5 to 2.5 N·m)</td>
</tr>
<tr>
<td>Temperature controller</td>
<td>M5</td>
<td>1.1 to 1.8 lbf·ft (1.5 to 2.5 N·m)</td>
</tr>
</tbody>
</table>

Communication

⚠️ Caution

1. The set value can be written to EEPROM, but only up to approx. 1 million times.
In particular, pay attention to how many of times the writing is performed using the communication function.

Maintenance

⚠️ Warning

1. Prevention of electric shock and fire
Do not operate the switch with wet hands. Also, do not operate the Chemical Thermo-con with water or fluid left on it.

2. Action in the case of error
If any error such as abnormal noise, smoke, or bad smell occurs, cut off the power at once, and stop supplying facility water. Please contact SMC or a sales distributor to repair the Chemical Thermo-con.

3. Regular inspection
Check the following items at least once a month. The inspection must be done by an operator who has sufficient knowledge and experience.
   a) Check of displayed contents.
   b) Check of temperature, vibration and abnormal sounds in the body of the Chemical Thermo-con.
   c) Check of the voltage and current of the power supply system.
   d) Check for leakage and contamination of the circulating fluid and intrusion of foreign objects to it, and subsequent replacement water.
   e) Check for leakage, quality change, flow rate and temperature of facility water.

4. Wearing of protective clothing
Some fluids can be dangerous when handled incorrectly. Wear protective clothing for safety during maintenance. In particular, observe the MSDS of the circulating fluid, and wear protective goggles, gloves and mask for the operation of the Chemical Thermo-con accompanied with the use of fluids.

Circulating Fluid

⚠️ Caution

1. Applicable fluids
For the compatibility between the material of components and fluid, refer to “Applicable Fluids” (page 184). Please contact SMC for fluids other than those described on the check list.

2. Caution for the use of fluids with high permeation
When the Chemical Thermo-con is used for a fluid with high permeation into fluorine resin, the permeation can affect its life. If the fluid also generates corrosive gas, perform N₂ supply and exhaust (N₂ purge) inside the heat exchanger.

3. Caution for the use of deionized water
If deionized water is used, bacteria and algae may grow in a short period. If the Chemical Thermo-con is operated with bacteria and algae, the performance of the heat exchanger may deteriorate. Exchange all deionized water regularly depending on the conditions (once a month as a guide).

4. Prohibition of small flow rate
Be sure to avoid operation with the circulating pump stopped or with extremely small flow rate of recirculating fluid (7 L/min or less for water). Otherwise, the Chemical Thermo-con will repeat change cooling and heating operation, which may shorten the life of the Peltier element significantly, and it will become unable to control the temperature accurately. When the circulating pump is stopped, stop the temperature control of the Chemical Thermo-con as well by using the remote ON/OFF function.

5. Operating pressure range of circulating fluid
The operating pressure range is 0 to 51 psi (0 to 0.35 MPa). Do not use with negative pressure which can cause the Chemical Thermo-con to fail. (Specifically, install the heat exchanger at the secondary (discharge) side of the circulating pump.) Also, avoid excessive pressure being applied to the circulating fluid circuit by a clogged filter or fully closed valve.

6. Prohibition of fluid pulsation
If a pump generating pulsation is used, install a damper to absorb the pulsation directly before the Chemical Thermo-con. Fluid pulsation can break the Chemical Thermo-con.

Goggles  Mask  Gloves  Safety shoes
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Refrigeration Circuits, Peltier Devices, Cooling Sources

- Compressor
  A compressor draws in low-pressure chlorofluorocarbon (CFC) refrigerant gas, compresses the gas and then discharges it as a high-pressure, high-temperature gas. Compressors are classified into various types (reciprocating, rotary, screw, etc.) according to the mechanical compression method used.

- Refrigerator
  A compressor that compreses a refrigerant gas. These are called refrigerators to distinguish them from machines such as air compressors.

- CFC refrigerant
  CFC (chlorofluorocarbon) refrigerants are organic compounds made up of elements including carbon, hydrogen, chlorine and fluorine. They are referred to generically using the DuPont brand name of Freon®.

  When CFCs are used as heat-transfer mediums and circulated inside refrigeration circuits, causing heating and cooling during their condensation and evaporation phase changes, the CFCs are referred to as CFC refrigerants.

- Specified CFC
  Due to their stability as a chemical substance and their safety with respect to humans, CFCs came to be widely used as industrial materials, particularly refrigerants. However, it was later recognized that when CFCs (and HCFCs (hydrochlorofluorocarbons)) containing chlorine are released into the atmosphere, they rise up into the ozone layer and deplete it.

  This resulted in the establishment of the Montreal Protocol in 1987, which classified CFCs such as Freon R12 and HCFCs such as Freon R22 as “specified CFCs” and prohibited their manufacture. As a result, their use has now almost completely died out.

  Instead of specified CFCs and HCFCs, SMC products now use alternative substances such as R134a and R404A that have an ozone depletion potential (ODP) of zero.

- Fundamentals of refrigeration circuits
  In a refrigeration circuit, refrigerant gas injected into the circuit repeatedly travels through a cycle of compression, condensation, expansion and evaporation, creating high-temperature and low-temperature sections in the circuit. The compressor compresses low-pressure refrigerant gas and discharges the gas at a high temperature and pressure level. The hot, pressurized refrigerant gas enters the condenser where it is cooled by the external air or cooling water and condenses to form a high-pressure liquid refrigerant. As the high-pressure liquid refrigerant passes through a constricting mechanism, such as an expansion valve, it rapidly depressurizes and some of the refrigerant evaporates. The release of evaporation heat causes the refrigerant itself to cool so that it becomes a combination of gas and liquid at a low-temperature and pressure level. In its combined gas-liquid state, the refrigerant enters the evaporator where it continually evaporates while absorbing the heat within the evaporator, thereby cooling the interior of the evaporator. When the refrigerant emerges from the evaporator, it evaporates entirely and becomes a low-pressure refrigerant gas. The low-pressure refrigerant gas is then drawn into the compressor and again becomes a high-temperature, high-pressure gas as the cycle is repeated.

- Condenser
  A heat exchanger used to condense high-temperature, high-pressure refrigerant gas. A condenser has the function of releasing heat drawn up by the refrigeration circuit to the outside. Condensers can be air-cooled or water-cooled, depending on the cooling method used.

- Air-cooled condenser
  Air-cooled condensers are generally made up of copper tubes through which the refrigerant flows, with numerous thin aluminum fins attached around the outside of the tubes. Outside air is forced over the fins by a device, such as a fan motor, to cool the pipes to the ambient temperature and condense the refrigerant gas.

  If an air-cooled condenser is installed inside a building, it can be used to heat the interior of the building since the heat generated by the refrigeration circuit is released as waste heat from the outside of the condenser. The room in which an air-cooled condenser is installed must have adequate ventilation or air conditioning equipment.

- Water-cooled condenser
  A heat exchanger that uses cooling water to cool and condense the coolant. Water-cooled condensers can be used in environments, such as large factories where cooling tower water or the cooling water for an air-conditioning system can be circulated and used.

  Depending on their construction, heat exchangers can be double-pipe type, shell-and-tube type or plate type units.

- Refrigerant dryer
  In a refrigeration circuit, a refrigerant dryer consists of filters that absorb and remove moisture inside the refrigeration circuit. Refrigerant dryers are normally installed in pipes carrying liquid refrigerant after it emerges from the condenser.

- Expansion valve
  A component that creates an expansion in the refrigeration circuit. As the refrigerant passes through this valve, a large pressure loss results, thereby making it possible to create high-pressure and low-pressure segments within the refrigeration circuit.

  There are several types of expansion valve, including constant-pressure expansion valves and thermal expansion valves. Such types allow the size of the valve aperture to be adjusted using refrigerant pressure or temperature feedback from an outlet passage.

- Capillary tube
  The capillary tubes used in refrigeration circuits are simply small-caliber copper tubes, normally used in the expansion step, that act as a fixed restrictor in the refrigerant passage.

- Evaporator
  A heat exchanger used to cool the target substance (e.g., water or air) using the evaporative heat from a low-temperature, low-pressure combined gaseous and liquid refrigerant in the refrigeration circuit.

- Cooler
  → Evaporator
Technical Data

- **Accumulator**
  A tank installed in a refrigeration circuit on the inlet side of the compressor. A compressor is a component designed to compress gas, so a malfunction will occur if any liquid coolant enters the compressor. Installing an accumulator has the function of separating out the coolant gas that is sucked into the compressor and any remaining refrigerant, and of preventing the liquid refrigerant from being sucked into the compressor. The inclusion of an accumulator creates a system that is highly resistant to variability in factors such as the cooling load.

- **Hot gas by-pass**
  A refrigeration circuit sometimes includes a circuit that allows high-temperature, high-pressure refrigerant gas (hot gas) discharged from the compressor to by-pass the condenser so that it reaches the evaporator (on the low-pressure side) without being condensed. This prevents the evaporator temperature (on the low-pressure side) from dropping too far and reduces the risk of liquid refrigerant being drawn into the compressor when the cooling load is low (if there is nothing to refrigerate), thereby ensuring more stable functions of the refrigeration circuit. This also allows a flow of hot gas to be intentionally directed to the evaporator with the aim of heating the evaporator rather than cooling it.

- **Water control valve**
  A water control valve, installed on the cooling water pipe for a water-cooled condenser, is used to adjust the amount of cooling water flowing to the condenser. Water control valves can be either pressure-regulated or temperature-regulated, with the amount of flow regulated using feedback from the condensing pressure or condensing temperature, respectively. When the cooling water temperature is low, a large flow of cooling water to a water-cooled condenser reduces the condensing pressure and lowers the cooling capacity. In this sort of situation, a water control valve restricts the cooling water flow and maintains the condensing pressure at the desired value. Water control valves also have the function of reducing water consumption by preventing unnecessarily large flows of cooling water.

- **Inverter control**
  In compressors that use an ordinary AC motor, the motor rotation rate is fixed according to the frequency of the AC power supply. With the result that the refrigerant discharge rate is also fixed. Inverter control in a refrigeration circuit is the use of an inverter to vary the compressor rotation rate and thereby control the rate of refrigerant circulation. This provides means of saving energy by, for example, running the compressor at a slower rate when the cooling load is low.

- **Protective devices in refrigeration circuits**
  In refrigeration circuits, protection must be provided for electrical components such as compressors, and against abnormal refrigerant pressures. Protective measures for compressors (motors) include protective devices such as overload relays (built into the compressor to detect overcurrent and overheating), thermal relays (fitted externally to detect motor overcurrent) and temperature switches. The devices used to protect against pressure faults include pressure switches, safety valves and rupture disks. However, in refrigeration circuits built into compact devices, the protective devices are often confined to just overload relays, or just thermal relays and pressure switches depending on the anticipated level of risk.

- **Facility water**
  The cooling water flowing through a water-cooled condenser used to expel waste heat generated in the refrigeration circuit to the outside. In ordinary factories or buildings, fluids such as cooling tower water or chiller water are used as facility water.

- **Cooling tower**
  A cooling tower is a facility that uses cooling water to expel the waste heat circulated and collected inside a factory or other building into the outside air. Cooling towers are installed in outdoor locations such as on the rooftops of buildings. The cooling water is sprayed down like a shower from the top of the cooling tower and forcibly brought into contact with the outside air by a fan motor. As well as being directly cooled by the temperature of the outside air, the partial evaporation of the cooling water itself draws off evaporation heat, cooling the water further. Because cooling towers are directly cooled by the outside air, the resulting cooling water temperature varies seasonally depending on the climatic conditions. In addition, the cooling water cannot theoretically be cooled to a temperature any lower than 5°C above the wet-bulb temperature of the outside air.

- **Peltier device**
  An element with a structure made up of alternating layers of flat P-type and N-type semiconductors arrayed in series. When a direct current flows through the element, heat moves from one plate surface to the next, so that one surface is cooled as the opposing surface is heated. This is referred to as the Peltier effect. By changing the direction of current flow, the direction of heat movement can also be changed, providing a simple means of cooling and heating.

  - **Thermo-module**
    → Peltier device

  - **Thermoelectric device**
    → Peltier device

  - **Thermoelectric system**
    A temperature control system that uses a Peltier element to directly cool and heat a liquid, gas or solid. Heat exchangers suitable for fluids are installed on both sides of the Peltier element, with the fluid to be temperature-controlled on one side of the element while the heat exchanger on the other side is used to dissipate heat.

### Fluid Control and Heat-related

- **Pump capacity/Water-supply capacity**
  A pump’s water-supply capacity is indicated by the amount of water it can cause to flow at a given pressure (lifting height). The characteristic curve (pump curve) that indicates the correlation between pressure and flow rate varies depending on the pump type, and thus, the user must check that the type of pump selected is suitable for the intended application.

- **Lifting height/Pressure**
  Lifting height (in meters) is often used instead of pressure to indicate the pump capacity. Lifting height is a numerical value that indicates the capacity of a pump in terms of the height (in meters) to which it can lift a fluid. The value for pressure is obtained by multiplying the lifting height by the density of the fluid; for example, if a pump capable of generating a lifting height of 10 meters is used to pump water, which has a density of 1 kg/L, the unit pressure generated by the pump is 1 kg/cm² (0.1 MPa).
Pipe resistance
When water or another fluid is caused to flow through a passage composed of pipes, valves, etc., the pressure differential generated by friction between the various devices and the fluid is known as “pipe resistance.” A synonymous term is “pressure loss.”

Centrifugal pump
This is one type of pump in which a bladed wheel (impeller) spins inside the pump chamber (casing), applying centrifugal force to the fluid. This force is converted to pressure that discharges the fluid. A large volume of fluid can be pumped, but it is difficult to attain high pressure. When high-pressure is desired, a type fitted with multistage impellers can be used. This is a low-lifting height, high-flow volume pump.

Vortex pump
In this type of pump, a bladed wheel (impeller) spins inside the pump chamber (casing), applying centrifugal force to the fluid. This force is converted to pressure that discharges the fluid. As in a centrifugal pump, the fluid is discharged using centrifugal force, but the impeller has more blades than in a centrifugal pump, and in the pump chamber (casing), the aperture (clearance) is set more narrowly, allowing for a higher discharge pressure. The pressure and flow characteristics attained are somewhere between that of a centrifugal pump and a vane pump. This is a mid-lifting height, mid-flow volume pump.

Turbine pump
→ Vortex pump

Cascade pump
→ Turbine pump

Vane pump
In this type of pump, vanes set in a rotor inside the pump chamber brush against the inside walls of the chamber as they rotate, pushing out and discharging the fluid that is surrounded by the vanes, rotor and pump chamber walls. This is a type of PD (positive displacement) pump. This is a high-lifting height, low-flow volume pump. The vanes slide against the interior walls of the pump chamber, generating abrasion powder. In addition, this type of pump is susceptible to entry of foreign objects such as outside debris, etc.

Gear pump
Like the vane pump, this is a type of PD (positive displacement) pump, in which a pair of gears meshes with one another and rotates, pushing the fluid through the gap between them and discharging it. This is a high-lifting height, low-flow volume pump.

Sealing mechanism
The bladed wheel (impeller) in the pump chamber through which the fluid passes is linked to the shaft of the external electric motor, and the rotation of the impeller discharges the fluid. As water or other fluids seeping through the motor shaft and reaching the electric motor can cause short circuits and other damage, it is necessary to have a mechanism sealing the pump chamber off from the shaft. This is known as a “sealing mechanism.” There are mechanical seal types, magnet coupling types and others.

Mechanical seal pump
This is a general term for pumps that use mechanical seals for the sealing mechanism. The rotating seal mounted on the motor shaft side and the fixed seal mounted on the pump chamber side rotate, and their surfaces touch one another, sealing off the fluid. As a result, there is a slight, external leakage of fluid. The volume of leakage increases over time, so it is necessary to replace the seal portions regularly.
Magnet pump
This is a general term for pumps that use magnetic coupling for the sealing mechanism. Using magnetism to couple the rotor on the inside of the pump chamber to the permanent magnet mounted on the motor shaft side, with the pump chamber wall between them, the rotation is conveyed to the rotor inside the pump chamber. Since the pump chamber can be completely separated, pump chamber can be completely sealed off, so there is absolutely no external leakage. Since a large magnet coupling is needed, this type of pump is more difficult to make in small sizes than the mechanical seal type, and the cost is also higher.

DC canned pump
A pump with a seal-less construction combining the motor and the pump in one. It can be made in compact sizes with absolutely no external leakage of fluid. A DC brushless motor is used.

Pump heat input
The volume of heat applied to the circulation loop, generated by the operation of the pump. When calculating the overall volume of heat applied to the circulation loop, it is necessary to consider the volume of heat generated by the pump, along with that of the object being cooled. The pump converts the electrical power entering the motor into the kinetic energy of the fluid, which causes the fluid to circulate. This kinetic energy is reduced as a result of undergoing pressure loss inside the piping, and eventually the entirety of the kinetic energy is released into the circulating fluid as heat. While there are differences depending on the type of pump, for rough calculations, the nominal heat emitted from the pump can be treated as the pump heat input.

Solenoid valve
A component that switches the flow of fluid from ON to OFF, or changes the direction by moving the plunger (iron core) using the force of electromagnetism.

Relief valve
When the inlet pressure exceeds a set level, this valve opens to release the outlet pressure.

Flow sensor/Flow switch
These components monitor the flow rate of the fluid. The flow sensor measures the flow rate linearly. The flow switch only has the function of commencing operation when the flow rate reaches a certain level, and does not perform measurement of the flow volume.

Particle filter
A filter that removes debris and other particles.

Check valve
A check valve is a device that prevents reverse flow of the fluid, keeping it flowing in one direction only.

Non-return valve → Check valve

Level switch
A switch that detects the fluid level inside the liquid tank. There are many different types, but the most common type employs a floating buoy, which causes a lead switch (magnetic switch) to turn ON and OFF.

DI filter
A filter that is filled with ion exchange resin used to remove leftover ions from the water. DI stands for “deionized,” while “DI water’ is deionized water, or water with its ions removed.

Density, specific gravity
The mass per unit of volume, measured in units of [kg/m³]. Specific gravity is the ratio of the density of a given substance to the density of water (1.0 [g/cm³]), and is a dimensionless quantity. When expressing this quantity within the CGS system of units, density and specific gravity have the same value.

Degree of viscosity
Thickness of a fluid. The units used to express absolute degree of viscosity are [Pa·s] units, but it is often expressed within the CGS system of units with [P] (Poise). The value obtained by dividing absolute degree of viscosity by density is called the kinetic viscosity. This can be measured in [m²/s] units, but in general, [St] (Stokes) are used.

Specific heat, specific heat capacity
The heat energy required to increase the temperature of an object by a certain temperature interval, under specific pressure and volume conditions. The specific heat of water: 1 [cal/g·K] = 4.184 x 10³ [J/kg·K]

Cooling capacity
The volume of heat (heat energy) that temperature control equipment can absorb (cool) per unit of time, at an arbitrary temperature.

Heat load → Cooling capacity

Heat
Terms such as heat, heat load, cooling capacity, etc., that are used in this catalog, indicate quantities of heat that can be absorbed or radiated per unit of time. As a result, the units employed are [W] = [J/s] (work rate) or [kcal/hr].

1 kW = 860 kcal/hr
Specific resistance
A value indicating the electrical insulating properties of a liquid, and the unit used is [Ω·cm]. When expressing the specific resistance of deionized water, it is sometimes called “DI level.” At 25°C, the specific resistance of theoretically 100% deionized water is 18.3 [MΩ·cm].

Electrical conductivity
A value indicating the ease with which electricity passes through a liquid, and is inversely proportional to the specific resistance. The unit used is [S/m], incorporating [S] (Siemens), the opposite of [Ω] (resistance). At 25°C, the electrical conductivity of theoretically 100% deionized water is 0.055 [μS/m].

Clear water
Water that has been filtered and distilled and any impurities eliminated. It is also known as purified water.

Deionized water
Water that has had any impurities or ion elements removed. It is obtained by removing ion elements with ion exchange resin, after filtering out impurities with a particle filter. Its theoretical specific resistance has a limit of 18.3 [MΩ·cm], but it is impossible to actually attain this value. As a general rule, water with a specific resistance of 1 to 10 MΩ·cm is referred to as deionized water.

Ethylene glycol aqueous solution
Ethylene glycol is a type of alcohol, and adding it to water causes the freezing point of the water to drop. It is a major ingredient in antifreeze for automobiles. At a concentration of 60%, the freezing point drops to −40°C or lower, but the viscosity increases as the temperature drops, so taking fluidity into account, it is practical to consider about −20°C as the minimum temperature. By adding ethylene glycol to deionized water, it is possible to raise the fluid’s specific resistance, so it can be used for applications where circulating fluid with high insulating properties is desired.

Propylene glycol aqueous solution
Propylene glycol is a type of alcohol, and adding it to water causes the freezing point of water to drop. Like ethylene glycol, it is a major ingredient in antifreeze for automobiles. It has lubricating properties, and is characteristically non-volatile.

Fluorinated fluids
Inert fluids in the fluorene series. There are many types, including perfluoropolyether (PFPE), perfluorocarbon (PFC), hydrofluoropolyether (HFPE), and hydrofluoroether (HFE), but they share the characteristic of high electrical insulation properties, and grades can be selected with appropriate fluidity even at low temperatures, such as −100°C, and high temperatures, such as 200°C and above. They are chemically inert and non-poisonous. Products are sold on the market, such as Fluorinert, made by 3M, and GALDEN, made by Solvay Solexis.

GALDEN®
The product name of a fluorinated fluid manufactured by Solvay Solexis. It is a perfluoropolyether with a high polymer compound, and various grades can be selected with differing temperature ranges and viscosity ranges depending on the degree of polymerization.

Fluorinert™
The product name of a fluorinated fluid manufactured by 3M. Its basic structure is a perfluorocarbon, but it has a wide variety of chemical structures, and various grades can be selected with differing temperature and viscosity ranges.

Circulating fluid, constant temperature circulating fluid
Fluid that circulates among the customer’s equipment, with temperature controlled by a chiller. Taking freezing temperature, boiling point, electrical insulation properties and so on into consideration, clear water, deionized water, ethylene glycol aqueous solution, fluorinated fluids, etc., can be selected depending on the application.

Temperature Measurement and Control

PT sensor, platinum resistance temperature detector
A type of temperature sensor taking advantage of the properties of platinum (Pt), which has an electrical resistance that increases in proportion to the temperature. A sensor with the specification Pt 100Ω has a resistance of 100Ω at 0°C. As the resistance value is relatively small, and the sensor is easily influenced by the resistance value of the conductive wires, an input circuit is generally used which cancels out the resistance value of the conductive wires, by using, for instance, 3-wire or 4-wire wiring configurations and long conductive wires.

RTD (Resistance Temperature Detector)
→ PT sensor

Thermo couple
This is created by forming a loop, connecting the ends of two wires made of two different metals, and by keeping the two wires at separate temperatures at the connecting point. Thermoelectric power is generated according to this temperature differential (the Seebeck effect). As a sensor, by keeping the end of one wire at a standard temperature and measuring the thermoelectric power generated, it can determine the temperature of the other wire terminal. A thermo couple is a sensor employing this principle.

Thermistor
A temperature sensor employing a semiconductor with electrical resistance that changes in accordance with the temperature. There are two types:
PTC: positive temperature coefficient (a type for which the resistance increases as the temperature rises)
NTC: negative temperature coefficient (a type for which the resistance decreases as the temperature rises.)
The resistance value is generally large, amounting to several MΩ, and there is little influence from the resistance of the conductive wires, so a 2-wire configuration is generally used.

Thermostat
A switch that turns ON or OFF when it reaches a certain set temperature. Most thermostats are bimetallic. They are sometimes used for direct temperature control, such as switching a heater ON or OFF, but are also used often for safety circuits which switch OFF when the temperature becomes abnormally high.
Temperature fuse
A fuse in which an internal metal wire melts, breaking the circuit when exposed to a temperature exceeding the set temperature. When this kind of fuse blows, it cannot be reset and must be replaced.

PV
PV: Process Value. In temperature control equipment, this indicates the current temperature measured by the temperature sensor.

SV
SV: Set Value. In temperature control equipment, this indicates the target value (set value) for performing temperature control.

ON/OFF temperature control
A control method for adjusting temperature by turning temperature control output ON or OFF relative to the set temperature. When the temperature is above (below) the set temperature, output of the refrigerator (heater) is turned ON, and when the temperature is below (above) the set temperature, output is turned OFF. Since there are only two operating rates relative to the set temperature, 0% or 100%, this is also called 2-position control.

Adjustment sensitivity (Hysteresis)
When the PV is extremely close to the SV in ON/OFF control, there may be “chattering” where the temperature control output repeatedly turns ON/OFF with small temperature variations, and this may have an adverse impact on output relays and connected equipment. To prevent this, spacing is provided between ON and OFF operation to stabilize control. This operation spacing is called adjustment sensitivity (hysteresis). For example, if the cooling output ON point (SV) is set to 20.0°C and hysteresis is set to 1.0°C, then cooling output will go OFF when temperature drops to 19.0°C, and go ON when temperature rises to 20.0°C.

PID control
A control method for producing temperature control output by comparing the temperature difference between the input value from the temperature sensor (PV) and the set temperature (SV), and using a combination of P (Proportional) operation, I (Integral) operation and D (Derivative) operation. Output is linearly variable from 0 to 100%, and this enables smooth temperature control with no temperature wavering.

P (Proportional) operation:
Operation where the amount of output is varied from 0 to 100% in proportion to the deviation between PV and SV (temperature difference). The range of temperatures for performing proportional operation (proportional band) must be input as a parameter.

I (Integral) operation:
Operation where the temperature discrepancy is corrected by adjusting the amount of output relative to the time that deviation between PV and SV has continued. Since the amount of output is determined in response to the time that deviation continues, the integral time must be input as a parameter.

D (Derivative) operation:
Operation where output is produced in accordance with the derivative (speed of change) of the temperature deviation. This is used to quickly correct sudden temperature variations when there is a sudden change in the ambient environment or load. The derivative time is input as a parameter, and the longer the derivative time, the stronger the correction output that is produced.

Temperature control with no temperature wavering.
Output is linearly variable from 0 to 100%, and this enables smooth

Temperature fuse
A fuse in which an internal metal wire melts, breaking the circuit when exposed to a temperature exceeding the set temperature. When this kind of fuse blows, it cannot be reset and must be replaced.

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Temperature sensor mounted to the outside of temperature control equipment and used for learning control etc.
Thermal relay.

A device integrating an electromagnetic contactor with a thermal relay.

A device integrating an electromagnetic contactor with a control circuit with an electromagnetic contactor or relay.

Overload relay

This has the same structure as a thermal relay, and is used for the same purpose. Overload relays built into small refrigeration circuits are installed on the wall of the compressor, and are actuated not by heat due to overcurrent but by the temperature of the compressor itself. In many small compressors, the main circuit is directly broken by the overload relay.

Impedance protection

A type of motor protection generally used for small AC fan motors and other small motors.

The motor is constructed so that it will not rise above a certain temperature, even when locked for some reason, due to the inherent impedance (AC resistance) of the motor coil itself. Therefore, the motor itself is protected against burnout, even though no thermal relay or other protective device is installed.

Solid state relay (SSR)

A relay which enables switching of high power using low power by using a thyristor or other semiconductor element. In comparison with an electromagnetic relay, this type has no mechanical moving parts, and thus is capable of high-speed switching. SSRs are compact, and have a long service life. However, this does not mean that contacts are physically isolated. The fact that there is some leakage current even when the device is OFF must be taken into account.

Phase reversal relay (Plugging relay)

A switch which monitors the phase sequence of a 3-phase main power supply, and issues a warning if anything is abnormal.

When driving a 3-phase motor with a 3-phase power supply, the motor will turn backwards if the phase sequence of wiring is wrong. This relay is installed to prevent such reverse rotation. These relays are also called plugging relays.

DC power supply

A device which produces DC power from commercial AC power. DC power is for CPUs inside equipment and other control circuits. Peltier elements for Peltier coolers, thermoelectric baths and other equipment are driven with DC power, so they have a high-capacity DC power supply built-in.

EMO circuit

An EMO (EMergency Off) circuit is an electrical circuit provided to shut off all power and ensure safe conditions when an emergency stop button (EMO button) is pressed in an emergency.

Hardware interlock

This is an equipment control circuit for shutting off power in case of trouble. The circuit is logically configured using only relays and other hardware, and does not use software running on the CPU.

RS232C

A standard for serial communication. This is the communication standard when connecting a PC with an acoustic coupler or modem, and is used for one-to-one communication between PCs. Since RS232C itself only roughly stipulates the use of wiring systems and other hardware, detailed hardware specifications and software protocols are determined independently by each equipment manufacturer.

Band width, Temperature upper/lower limit width

Temperature range for outputting alarms etc., when PV deviates by more than a fixed temperature from the set temperature (SV).
RS485
A standard for serial communication. Only one-to-one communication between devices can be done with RS232C, but with RS485 it is possible to communicate simultaneously with multiple devices by wiring them in a chained, multidrop fashion, and providing addresses via software. Since RS485 itself only roughly stipulates the use of wiring systems and other hardware, detailed hardware specifications and software protocols are determined independently by each equipment manufacturer. Actual detailed protocols are determined independently by each equipment manufacturer.

DeviceNet
A standard for serial communication. An open network owned by ODVA (Open DeviceNet Vendor Association Inc.), a non-profit organization headquartered in the US. This is a field network standard covering a wide scope, from the sensor level to the device level.

Analog communication
A method of communicating with external devices using voltage output such as 0 to 10 V. This enables output of PV (measured temperature etc.) and reception of values like SV (set temperature).

Signal input/output, I/O
Input/Output signals such as alarm signal, or operation signals. Since there are various communication methods depending on the equipment model, such as relay output and open collector output, communication specifications must be checked before wiring.

Insulation withstand voltage
Electric potential difference where an insulator material will not be destroyed. In withstand voltage testing at product shipment from the factory, a high AC voltage of 1.5 kV (varies depending on the model) is applied between the electric circuit conductor and the chassis (grounded). Then it is checked that there is no flow of leakage current above the reference value.

Insulation resistance
Electrical resistance between the conductor inside the device and the chassis (grounded). In insulation resistance testing at product shipment from the factory, it is checked that the resistance value with a measured DC voltage of 500 V (or 250 V) is at or above the reference value (a value such as 1 MΩ; varies depending on the model).

CSA standards
Safety standards by the Canadian Standard Association, a non-governmental Canadian standardization organization. Electrical products distributed in Canada must be CSA certified.

NRTL (National Recognized Test Laboratories)
Testing organizations capable of certification (of UL or CSA standards etc.) which have been recognized according to Occupational Safety and Health Law set forth by OSHA (the US Occupational Safety and Health Administration). At present, 18 organizations have been recognized as NRLTs. UL and CSA are examples of certified organizations.

eti mark
eti (Electro-Test Inc.) is the mark that demonstrates compliance with UL standards.

ETL mark
Intertek ETL SEMKO is an NRTL, and issues the ETL mark. This mark demonstrates compliance with UL standards.

SEMI S2
SEMI is an international industry association of companies producing equipment and materials for the manufacture of semiconductors and flat panel displays. It has established its own standards as safety guidelines for the design of semiconductor manufacturing equipment. SEMI S2 requirements relate to the work environment, health and safety for products used in semiconductor manufacturing, and cover chemical, radiation, electrical, physical, mechanical, environmental, fire, earthquake, emissions and ergonomics, as well as quality, documentation and manuals etc. Many semiconductor manufacturers require that equipment operating in their plants comply with SEMI S2.

SEMI S8
SEMI S8 is a guideline on ergonomics which is more detailed than the ergonomic requirements in Section 14 of SEMI S2.

SEMI F47
SEMI F47 is a SEMI standard which stipulates guidelines regarding voltage sag immunity. Semiconductor manufacturers require this standard for temperature control equipment, just like SEMI S2.
# Pressure Switch: Monitors pressure of the circulating fluid and facility water.

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

<table>
<thead>
<tr>
<th>Series</th>
<th>Type</th>
<th>Rated pressure range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISE80</td>
<td>Positive</td>
<td>– 14.5 to 145 psi (–0.100 to 1.000 MPa)</td>
</tr>
</tbody>
</table>

**Features**

- Suitable for a wide variety of fluids with stainless diaphragm
- IP65
- RoHS compliant
- Low leakage. VCR®, Swagelok® compatible fittings can be selected.
- With One-touch fitting (Straight, Elbow)
- Back piping, Underside piping

## Pressure Sensor for General Fluids  **PSE56**

### Separate type sensor

<table>
<thead>
<tr>
<th>Series</th>
<th>Type</th>
<th>Rated pressure range</th>
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</thead>
<tbody>
<tr>
<td>PSE564</td>
<td>Positive</td>
<td>0 to 72.5 psi (0 to 500 kPa)</td>
</tr>
<tr>
<td>PSE560</td>
<td>Positive</td>
<td>0 to 145 psi (0 to 1 MPa)</td>
</tr>
</tbody>
</table>

**Features**

- Wetted parts: Stainless steel 316L
- IP65
- Suitable for a wide variety of fluids
- Analog output (voltage/current)
- Low leakage. VCR®, Swagelok® compatible fittings can be selected.

## Multi-Channel Digital Pressure Sensor Controller  **PSE200**

### Separate type monitor

<table>
<thead>
<tr>
<th>Series</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSE200</td>
<td>Four sensors can be connected.</td>
</tr>
<tr>
<td></td>
<td>Applicable sensors: PSE53®, 54®, 56®.</td>
</tr>
<tr>
<td></td>
<td>Capable of controlling various different applications from one controller</td>
</tr>
<tr>
<td></td>
<td>4 inputs, 5 outputs</td>
</tr>
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</table>

## 2-Color Display Digital Pressure Sensor Controller  **PSE300**

### Separate type monitor

<table>
<thead>
<tr>
<th>Series</th>
<th>Features</th>
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</thead>
<tbody>
<tr>
<td>PSE300</td>
<td>Applicable sensors: PSE53®, 54®, 56®, 56®.</td>
</tr>
<tr>
<td></td>
<td>Compatible with voltage input and current input</td>
</tr>
<tr>
<td></td>
<td>Response time: 1 ms</td>
</tr>
<tr>
<td></td>
<td>Space-saving, capable of vertical and horizontal contact mounting</td>
</tr>
<tr>
<td></td>
<td>Panel mount, Bracket, DIN rail mount</td>
</tr>
</tbody>
</table>
Related Products

(2) Industrial Filter: Filters the circulating fluid and facility water.

Industrial Filter/Vessel Series \textit{FGD}

<table>
<thead>
<tr>
<th>Series</th>
<th>Port size</th>
<th>Max. operating pressure</th>
<th>Temperature (\degree\text{C})</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGD</td>
<td>Rc3/8, 1/2, 3/4</td>
<td>102, 145 psi (0.7, 1 MPa)</td>
<td>Max. 176°F (80°C)</td>
</tr>
</tbody>
</table>

Features
- Ideal for low-flow filtration (Max. 15.8 gpm (60 L/min))
- Possible to select the antistatic specification (FGDE, FGDF).

High-Precision Filter for Fluid \textit{FGH}

<table>
<thead>
<tr>
<th>Series</th>
<th>Port size</th>
<th>Max. operating pressure</th>
<th>Temperature (\degree\text{C})</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGH</td>
<td>Rc3/8 to 1</td>
<td>145 psi (1 MPa)</td>
<td>Max. 176°F (80°C)</td>
</tr>
</tbody>
</table>

Features
- Filtration efficiency: Removing over 99%

Quick Change Filter \textit{FQ1}

<table>
<thead>
<tr>
<th>Series</th>
<th>Port size</th>
<th>Max. operating pressure</th>
<th>Temperature (\degree\text{C})</th>
</tr>
</thead>
<tbody>
<tr>
<td>FQ1</td>
<td>Rc1/2, 3/4, 1</td>
<td>145 psi (1 MPa)</td>
<td>Max. 176°F (80°C)</td>
</tr>
</tbody>
</table>

Features
- Ideal for low flow filtration (Max. 7.9 gpm (30 L/min))
- No tools required
- Takes only 60 seconds for element replacement.

(3) Flow Switch: Monitors the flow rate of the circulating fluid and facility water.

3-Color Display Digital Flow Switch for Water \textit{PF3W}

Integrated type

<table>
<thead>
<tr>
<th>Series</th>
<th>Set flow rate range \ gpm (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF3W</td>
<td>0.13 to 1.1 (0.5 to 4)</td>
</tr>
<tr>
<td></td>
<td>0.53 to 4.2 (2 to 16)</td>
</tr>
<tr>
<td></td>
<td>1.32 to 10.6 (5 to 40)</td>
</tr>
<tr>
<td></td>
<td>2.64 to 26.4 (10 to 100)</td>
</tr>
</tbody>
</table>

Features
- Flow rate sensor with three-color display and two-screen display
- Integrated with temperature sensor
- 40% reduction (compared with SMC PF2W)
- IP65 compliant, Grease-free
- Operating fluid temperature 32 to 194°F (0 to 90°C)
- PVC piping type: Applicable to deionized water and chemical

3-Color Display Digital Flow Switch for PVC Piping \textit{PF3W}

Integrated type

<table>
<thead>
<tr>
<th>Series</th>
<th>Set flow rate range \ gpm (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF3W</td>
<td>2.64 to 26.4 (10 to 100)</td>
</tr>
</tbody>
</table>

Features
- Applicable fluid: Deionized water and chemical, etc
- Flow rate sensor with three-color display and two-screen display
- IP65 compliant, Grease-free
- Operating fluid temperature 32 to 158°F (0 to 70°C)
- PVC pipe O.D.: 25A

Digital Flow Switch for Water \textit{PF2W}

Integrated type

<table>
<thead>
<tr>
<th>Series</th>
<th>Set flow rate range \ gpm (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF2W</td>
<td>0.13 to 1.1 (0.5 to 4)</td>
</tr>
<tr>
<td></td>
<td>0.53 to 4.2 (2 to 16)</td>
</tr>
<tr>
<td></td>
<td>1.32 to 10.6 (5 to 40)</td>
</tr>
<tr>
<td></td>
<td>2.64 to 26.4 (10 to 100)</td>
</tr>
</tbody>
</table>

Features
- Integrated type and Separate monitor type are available.
- Switch output, Accumulated pulse output, Analog output
- Capable of switching back and forth between cumulative and instantaneous flow
- Capable of operating at temperatures as high as 194°F (90°C)
- IP65

Refer to Best Pneumatics No. 7 for details.

Refer to Best Pneumatics No. 6 for details.
Digital Flow Switch for Deionized Water and Chemicals PF2D

<table>
<thead>
<tr>
<th>Series</th>
<th>Applicable sensor</th>
<th>Set flow rate range gpm (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF2W200/201</td>
<td>For water</td>
<td>PF2WS</td>
</tr>
<tr>
<td>PF2D200/201</td>
<td>For deionized water/chemicals</td>
<td>PF2DS</td>
</tr>
</tbody>
</table>

Features:
- One controller can handle four units’ worth of flow volume maintenance.
- Four different flow ranges can be connected to one controller.

4-Channel Flow Monitor PF2D 200

Fittings and Tubing

S Coupler

Series KK
- Fluid: Air, Water
- Applicable tube O.D.: ø3.2 to ø16
- Applicable hose I.D./O.D.: 5/8 to 11/16
- Port size: M5 to 25A(3/4)

Series KKA
- Fluid: Air, Water
- Port size: 6A to 50A (1/8 to 11/2)

S Coupler/Stainless Steel (Stainless Steel 304)

Series KFG2
- Fluid: Air, Water, Steam
- Applicable tube O.D.: ø4 to ø16

Series KQG2
- Fluid: Air, Water, Steam
- Applicable tube O.D.: ø3.2 to ø16

Metal One-touch Fittings

Series KQB2
- Fluid: Air, Water
- Applicable tube O.D.: ø3.2 to ø16

Stainless Steel 316 One-touch Fittings

Series KQG2
- Fluid: Air, Water, Steam
- Applicable tube O.D.: ø3.2 to ø16

Stainless Steel 316 Insert Fittings

Series KFG2
- Fluid: Air, Water, Steam
- Applicable tube O.D.: ø4 to ø16

Fluoropolymer Fittings

Series LQ
- Fluid: Deionized water, Chemicals, etc.
- Applicable tube O.D.: ø3 to ø25

Tubing

<table>
<thead>
<tr>
<th>Series</th>
<th>Material</th>
<th>Fluid</th>
<th>O.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Nylon</td>
<td>Air, Water</td>
<td>ø4 to ø16</td>
</tr>
<tr>
<td>TU</td>
<td>Polyurethane</td>
<td>Air, Water</td>
<td>ø4 to ø16</td>
</tr>
<tr>
<td>TH</td>
<td>FEP (Fluoropolymer)</td>
<td>Air, Water, Inert gas</td>
<td>ø4 to ø12</td>
</tr>
<tr>
<td>TD</td>
<td>Modified PTFE (Soft fluoropolymer)</td>
<td>Air, Water, Inert gas</td>
<td>ø4 to ø12</td>
</tr>
<tr>
<td>TL</td>
<td>Super PFA</td>
<td>Deionized water, Chemicals, etc. (Note)</td>
<td>ø4 to ø19</td>
</tr>
</tbody>
</table>

Length: Rolls up to 500 m in length are available, but please contact SMC for details because the maximum roll length varies depending on the tubing material and outer diameter. (Available with made-to-order specifications)

Related Products

Refer to Best Pneumatics No. 6 for details.
Temperature Control Equipment Warranty

1. Conditions of warranty
   When a nonconformance should take place to our temperature control equipment, we will repair the unit without charge in accordance with our current terms and conditions. This free repair covers the replacement of all nonconforming parts, their adjustment and checks. Please note that the disassembled parts will be the property of SMC.

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

3. Items out of warranty
   The following cases are not subject to warranty.
   1. Nonconformance caused by implementing no check-up (daily check-up, regular check-up) specified by SMC.
   2. Nonconformance caused by the usage other than stipulated in the operating manual or outside the specification designated by SMC.
   3. Nonconformance caused by remodeling which is not permitted by SMC.
   4. Nonconformance caused by the usage other than the specified circulating fluid or facility water.
   5. Nonconformance caused by elapsing. (painted surface, plated surface discolored naturally)
   6. Sensuous phenomenon which is not affected functionally (sound, noise, vibration, etc.)
   7. Nonconformance caused by natural disasters such as earthquake, typhoon, water disaster, accidents, or fire hazard.
   8. Nonconformance caused by the installation environment stipulated in the operating manual.
   9. Nonconformance caused by no observation to the following 5, “Items to be observed by customer.”

4. Exemption from liability
   1. Cost for daily check-up, regular check-up.
   2. Cost for repair by a third party other than the designated distributors or agents.
   3. Cost for moving this unit and installation or dislocation.
   4. Cost for replacement or replenishment of the component parts or liquid other than specified.
   5. Cost for inconvenience or loss caused by not being able to use the unit. (Telephone charge, warranty for job suspension, commercial loss, etc.)
   6. Cost or compensation, etc. stipulated other than the above 1. “Conditions of warranty.”

5. Items to be observed by customer
   In order to use this product safely, the correct usage and check-up by customer are necessary. Please be sure to observe the following things. Please note that we may decline the repair request upon warranty in case that the following things are not observed.
   1) Use the unit in accordance to the proper handling as mentioned in the Operation Manual.
   2) Conduct inspection and maintenance (daily check-up, regular check-up) as mentioned in the Operation Manual.
   3) Record the inspection and maintenance results as mentioned in the Operation Manual.

6. How to ask a repair upon warranty
   When a warranty repair is requested, please contact the nearest sales distributor. With this, we will repair the unit upon warranty.

   We promise a repair for free on the basis of the above mentioned periods or terms. Therefore, nonconformance occurred after the warranty period will be charged in principle.
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.

\(^1\) 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.

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

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

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

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.

Limited warranty and Disclaimer/Compliance Requirements

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

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.\(^2\)
2. The product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
3. 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.
4. 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.

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

---

**Caution**

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

**Warning**

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

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

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

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

**Danger**

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. 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.
Temperature Control Equipment Precautions 1
Be sure to read this before handling. Refer to back page 1 for Safety Instructions and the main text for Specific Product Precautions on every series.

⚠️ Warning

1. **Confirm the specifications.**
   Fully understand the applications, environment, fluids and other operating conditions. Use this product within the specified range shown in this catalog. Using outside the specified range can cause injury, damage, or malfunction. When in doubt, please contact SMC beforehand.

2. **Secure the performance margin.**
   When you consider the product’s cooling/heating performance or flow characteristics, allowance must be made because there are heat loss from the piping, etc. or pressure drop.

Operating Environment/Storage Environment

⚠️ Warning

1. **Observe the ambient temperature range.**
   The operating ambient temperature range must be within the specification range shown in this catalog. Use caution because using beyond the range will lead to damage, breakage or malfunction.

2. **Avoid using and storing in the following environment because it will lead to malfunction.**
   1. In locations where water, water steam, salt water, and oil may splash on the product.
   2. In locations where a large amount of particles are airborne.
   3. In locations with an atmosphere of corrosive or explosive gases, solvents, or chemicals. (This product is not explosion proof.)
   4. In locations which receive direct sunlight or radiated heat. (Protect from direct sunshine to avoid the resin from deteriorating by ultraviolet rays or increasing the temperature.)
   5. In locations where temperature substantially changes.
   6. In locations where there is a heat source nearby and the ventilation is poor. (Insulate the heat source or ventilate well to avoid damages caused by the heat or temperature increase, such as softening.)
   7. In locations where condensation occurs.
   8. In locations where strong magnetic noise occurs. (In locations where strong electric fields, strong magnetic fields and surge voltage occur.)
   9. In locations where static electricity occurs, or conditions which make the product discharge static electricity.
   10. In locations where high frequency occurs.
   11. In locations where damage is likely to occur due to lightning.
   12. In locations where impacts or vibrations occur.
   13. In conditions where a massive force strong enough to deform the product is applied or a weight from a heavy object is applied.
   14. In locations more than 1000 m in altitude (except storage, transportation).

⚠️ Warning

1. **Type of fluids**
   1. The operating fluids must be used within the specified range shown in this catalog. Please consult with SMC when using the product with other fluids.
   2. Depending on the combination, foreign matter, chemical leakage and catalysts may change the piping material and operating fluid qualities.
   3. When solid foreign objects may be mixed with a fluid, install a filter to remove them.

2. **Use clear water (including for diluting ethylene glycol aqueous solution) which must meet the water quality standards as mentioned below.**

Clear Water (as Circulating Fluid) Quality Standard

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Standard value</th>
<th>Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (at 77°F (25°C))</td>
<td>—</td>
<td>6.0 to 8.0</td>
<td>○</td>
</tr>
<tr>
<td>Electrical conductivity (77°F (25°C))</td>
<td>[µS/cm]</td>
<td>100 to 300°</td>
<td>○</td>
</tr>
<tr>
<td>Chloride ion (Cl⁻)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
</tr>
<tr>
<td>Sulfuric acid ion (SO₄²⁻)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
</tr>
<tr>
<td>Acid consumption amount (at pH 6.8)</td>
<td>[mg/L]</td>
<td>70 or less</td>
<td>○</td>
</tr>
<tr>
<td>Total hardness</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
</tr>
<tr>
<td>Calcium hardness (CaCO₃)</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
</tr>
<tr>
<td>Ionic state silica (SiO₂)</td>
<td>[mg/L]</td>
<td>30 or less</td>
<td>○</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>○</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td>○</td>
</tr>
<tr>
<td>Sulfide ion (S₂⁻)</td>
<td>[mg/L]</td>
<td>Not to be detected</td>
<td>○</td>
</tr>
<tr>
<td>Ammonium ion (NH₄⁺)</td>
<td>[mg/L]</td>
<td>0.1 or less</td>
<td>○</td>
</tr>
<tr>
<td>Residual chlorine (Cl⁻)</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>○</td>
</tr>
<tr>
<td>Free carbon (CO₂)</td>
<td>[mg/L]</td>
<td>4.0 or less</td>
<td>○</td>
</tr>
</tbody>
</table>

* In the case of [µS/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.

Transportation/Transfer/Movement

⚠️ Warning

1. **Product transfer should be performed by a knowledgeable and experienced person.**
   Especially, transferring a heavy object is dangerous. Use adequate caution to prevent falling down or dropping accidents from occurring.

2. **Avoid transportation in the following environment because it will lead to breakage.**
   1. In conditions where strong shock and vibrations occur.
   2. In operating and storage environments other than those specified.

3. **Caution when transferring a heavy object**
   This product is heavy. Use adequate caution to avoid injury when picking up and setting down the product, and falling and dropping accidents should be avoided.

4. **Before moving this product, remove operating fluid, facility water from the inside of this product.**
Temperature Control Equipment Precautions 2

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and the main text for Specific Product Precautions on every series.

### Warning

1. **Installation should be performed by a knowledgeable and experienced person.**
   
   Especially, installation of a heavy object is dangerous. Use adequate caution to avoid falling and dropping accidents from occurring.

### Caution

1. **Provide space for ventilation and maintenance.**
   
   Provide enough space for the ventilation requirement of each equipment. Otherwise, a cooling malfunction or operation stoppage may occur. Also, provide space required for maintenance.

2. **Verify the mounting orientation.**
   
   Mount and install horizontally.

### Piping

#### Warning

1. **Design the piping for the whole system.**
   
   For this product and future equipment, design of the piping system should be performed by a knowledgeable and experienced person.

2. **Work performed on the piping should be done by a knowledgeable and experienced person.**
   
   If work performed on the piping is done by a less knowledgeable and inexperienced person, it will likely lead to operating fluid leakage, etc.

3. **Thoroughly read the Operation Manual.**
   
   Read the Operation Manual completely before piping. Also, keep the manual available whenever necessary.

4. **Tighten threads with the proper tightening torque.**
   
   When installing piping, etc., follow the given torque levels below.

#### Piping Tightening Torque

<table>
<thead>
<tr>
<th>Connection thread</th>
<th>Proper tightening torque (lbf·ft (N⋅m))</th>
</tr>
</thead>
<tbody>
<tr>
<td>M5</td>
<td>1.1 to 1.5 (1.5 to 2)</td>
</tr>
<tr>
<td>Rc 1/8</td>
<td>5.2 to 6.6 (7 to 9)</td>
</tr>
<tr>
<td>Rc 1/4</td>
<td>8.9 to 10.3 (12 to 14)</td>
</tr>
<tr>
<td>Rc 3/8</td>
<td>16.2 to 17.7 (22 to 24)</td>
</tr>
<tr>
<td>Rc 1/2</td>
<td>20.7 to 22.1 (28 to 30)</td>
</tr>
<tr>
<td>Rc 3/4</td>
<td>20.7 to 22.1 (28 to 30)</td>
</tr>
<tr>
<td>Rc 1</td>
<td>26.6 to 28.0 (36 to 38)</td>
</tr>
<tr>
<td>Rc 1 1/4</td>
<td>29.5 to 31.0 (40 to 42)</td>
</tr>
<tr>
<td>Rc 1 1/2</td>
<td>35.4 to 36.9 (48 to 50)</td>
</tr>
<tr>
<td>Rc 2</td>
<td>35.4 to 36.9 (48 to 50)</td>
</tr>
</tbody>
</table>

5. **Confirm the leakage of fluid.**
   
   Confirm that the hose or tubing is not pulled out and that there is no leakage in the fitted parts.

### Back page 3

SHOP ONLINE at www.airlinehyd.com
800-999-7378
Warning

1. Electrical wiring job should be performed by a knowledgeable and experienced person.
   Power supply facilities and wiring works should be implemented in accordance with the electric facilities technical standards and provisions and conducted correctly.

2. Mounting a dedicated earth leakage breaker.
   As a countermeasure against current leakage, install an earth leakage breaker in the main power supply.

3. Check the power supply.
   If this product is used with voltages other than specified, it will likely lead to a fire or an electrical shock. Before wiring, confirm the voltage, volume, and frequency. Confirm that the voltage fluctuation is within ±10% of the specified value.

4. Grounding
   Be certain to ground (frame ground) with class D grounding (grounding resistance of 100 Ω or less). Can be grounded with the PE line of the power supply cable. Also, do not use together with equipment that generates a strong electrical magnetic noise or high frequency noise.

5. Wiring cable should be handled with care.
   Do not bend, twist or stretch the cord or cable.

6. Wire with an applicable size cable and terminal.
   In the event of attaching a power supply cable, use a cable and terminal size which is suitable for the electrical current of each product. Forcibly mounting with an unsuitable size cable will likely result in a fire.

7. Avoid wiring the signal line and power line in parallel.
   Since there may be a possibility of malfunction from noise, avoid parallel wiring between the temperature sensor line, communication line, signal line of alarm line, etc. and the power line and high voltage line. Also, do not place them in the same wiring tube.

Facility Water Supply
(Water-cooled refrigeration)

Warning

1. Be certain to supply the facility water.
   1. Prohibition of water-cut operation, very little flow rate of water operation.
      Do not operate under the condition that there is no facility water or where there is very little flow rate of water is flowing. In this kind of operation, facility water temperature may become extremely higher. It is dangerous enough the material of hose may soften and burst when the piping supplying the facility water is connected with hose.

2. Actions to be taken when an emergency stop occurs due to high temperature.
   In case a stop occurs due to extremely high temperature resulting from a decrease in the facility water flow rate, do not immediately flow facility water. It is dangerous enough the material of hose may soften and burst when the piping supplying the facility water is connected with hose. First, naturally let it cool down by removing the cause of the flow rate reduction. Secondly, confirm that there is no leakage again.

Caution

1. Facility water quality
   1. Use the facility water within the specified range as shown below. When using with other fluid than facility water, please consult with SMC.

   2. When it is likely that foreign objects may enter the fluid, install a filter (20 mesh or equivalent).

Facility Water Quality Standards
The Japan Refrigeration and Air Conditioning Industry Association JRA GL-02-1994 “Cooling water system – Circulation type – Circulating water”

<table>
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<tr>
<th>Item</th>
<th>Unit</th>
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<td>○</td>
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<tr>
<td>Electrical conductivity (77°F (25°C))</td>
<td>[µS/cm]</td>
<td>100 to 800°</td>
<td>○</td>
</tr>
<tr>
<td>Chloride ion ([Cl–])</td>
<td>[mg/L]</td>
<td>200 or less</td>
<td>○</td>
</tr>
<tr>
<td>Sulfuric acid ion ([SO4²–])</td>
<td>[mg/L]</td>
<td>200 or less</td>
<td>○</td>
</tr>
<tr>
<td>Acid consumption amount (at pH4.8)</td>
<td>[mg/L]</td>
<td>100 or less</td>
<td>○</td>
</tr>
<tr>
<td>Total hardness</td>
<td>[mg/L]</td>
<td>200 or less</td>
<td>○</td>
</tr>
<tr>
<td>Calcium hardness ([CaCO3])</td>
<td>[mg/L]</td>
<td>150 or less</td>
<td>○</td>
</tr>
<tr>
<td>Ionic state silica ([SiO2])</td>
<td>[mg/L]</td>
<td>50 or less</td>
<td>○</td>
</tr>
<tr>
<td>Iron ([Fe])</td>
<td>[mg/L]</td>
<td>1.0 or less</td>
<td>○</td>
</tr>
<tr>
<td>Copper ([Cu])</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>○</td>
</tr>
<tr>
<td>Sulfide ion ([S2–])</td>
<td>[mg/L]</td>
<td>Should not be detected</td>
<td>○</td>
</tr>
<tr>
<td>Ammonium ion ([NH4+])</td>
<td>[mg/L]</td>
<td>1.0 or less</td>
<td>○</td>
</tr>
<tr>
<td>Residual chlorine ([Cl])</td>
<td>[mg/L]</td>
<td>0.3 or less</td>
<td>○</td>
</tr>
<tr>
<td>Free carbon ([CO2])</td>
<td>[mg/L]</td>
<td>4.0 or less</td>
<td>○</td>
</tr>
</tbody>
</table>

* In the case of [Ma/cm], it will be 0.00125 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.
### Operation

**Warning**

1. Handle and operate after the safety of this product and the whole system are confirmed.
   - For this product and incidental equipment, operate this product by a knowledgeable and experienced person.
2. Before operation, confirm the safety of mounting, installation, piping and electrical wiring conditions.
   - Confirm that the mounting and installation conditions are safe.
   - Confirm whether the valve is open or closed and that the hose and resin tube are not twisted.
   - It is dangerous when the valve in the piping is closed because the circulating fluid and the facility water will not flow and the fluid pressure will increase.
3. Do not remove the external panel during energization or operation.
   - If removed, there are the dangers of electrical shock, burn, frostbite, injury from a rotating object.
4. Avoid operating with a lower flow.
   - Avoid operating with a lower flow because the temperature control may become unstable or the service life of the pump may shorten.
5. Confirm the safety during the operation.
   - During the operation, if an emergency is detected, stop this product immediately and cut off the power supply breaker.
6. When not used for long periods of time, confirm the safety once again prior to beginning its operation.

### Maintenance

**Warning**

1. Perform maintenance inspection according to the procedures indicated in the operating manual.
   - If handled improperly, malfunction and damage of machinery or equipment may occur.
2. Maintenance operations
   - Improper handling of compressed air is dangerous. Therefore, in addition to observing the product specifications, replacement of elements and other maintenance activities should be performed by personnel having sufficient knowledge and experience pertaining to pneumatic equipment.
3. Pre-maintenance inspection
   - When removing this product, cut off the electric power, and be certain to shut off the supply pressure and exhaust the compressed air in the system. Proceed only after confirming that all pressure has been released to the atmosphere.
4. Post maintenance inspection
   - After installation or repair, reconnect compressed air and electricity and conduct appropriate inspections to confirm proper operation. If there is an audible air leakage, or if the equipment does not operate properly, stop operation and confirm that the equipment is installed correctly.
5. Modification prohibited
   - Do not modify or reconstruct the unit.
6. Stopping for long periods of time
   - When not using for long periods of time, remove the fluid (circulating fluid, facility water) and cut off the main power supply.
7. Removal of product
   - Take the stop/inspection measures and confirm that there is no fluid, facility water) and cut off the main power supply.
   - In this case, after cutting off the main power supply, reverse 2 wires out of the 3 wires and connect them in the correct phase order.
8. Disposal of product
   - When a dangerous fluid or polluted fluid is left, it is likely that the polluted area will be enlarged or an accident will occur.
9. Preparation of a backup product
   - In order to keep the downtime of a customer’s system to a minimum, prepare a backup product, when necessary.
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