

Circulating fluid temperature controller

# Refrigerated Thermo-cooler

Makes cooling water easily available, any time, anywhere.

- Universal in voltage: single phase 200 to 230 VAC, 50/60 Hz
- Compliant with overseas standards: C, E, RU<sup>®</sup> (pending)
- Environmentally friendly: RoHS directive compliant, Refrigerant R407C
- Energy saving: Stop-idling function (for  $\pm 1^{\circ}\text{C}$  type)  
Automatic facility-water-saving function (for water-cooled type)
- Easy installation: No need for facility water (for air-cooled type), Caster, by-pass valve and strainer (for water-cooled type), Stainless steel drain pan available as standard equipment, No need for power supply for remote operation
- Easy maintenance: "Alarm no." display, Accessible from the front electric control panel



- Cooling capacity (60 Hz):  
**1.1 kW/2.3 kW/4.8 kW** (Air-cooled refrigerator type/Water-cooled refrigerator type)
- Temperature stability:  $\pm 1^{\circ}\text{C}$  (Refrigerator ON/OFF control) /  
 $\pm 0.5^{\circ}\text{C}$  (Proportional valve PID control)
- Temperature range setting: **5 to 35 $^{\circ}\text{C}$**

Series **HRGC**

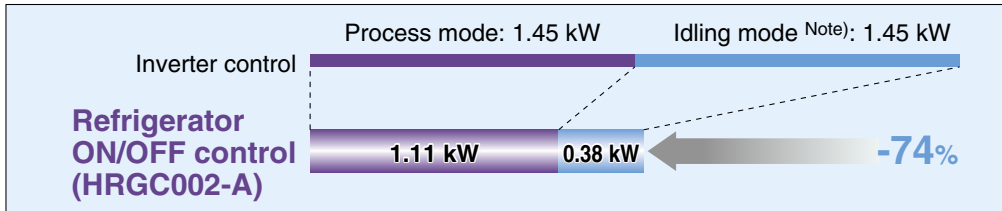


CAT.ES40-51A

## Energy Saving

### ● Power consumption: Max. 74% reduction

When the circulating fluid reaches a certain preset temperature, the refrigerator stops temporarily (idling stop) and the temperature is adjusted even in processes where there is heat loading, performance is at least as good as that of inverter control.



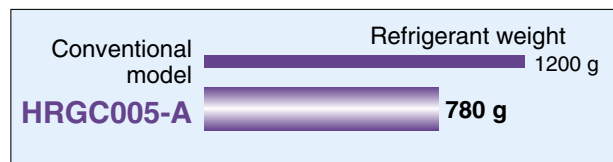
Note) Operating conditions: Process mode: Circulating fluid temperature 20°C, Heat load 2 kW  
 Idling mode: Circulating fluid temperature 20°C, Heat load 0 kW

- Reduced running cost
- Contribution to the environmental preservation

### ● Refrigerant: Max. 35% reduction (SMC comparison)

Conventionally, reducing the amount of refrigerant gas has meant a reduction in cooling performance. Now, however, the HRGC's use of an improved high-performance **heat exchanger** <sup>Note)</sup> makes it possible to reduce the volume of refrigerant used (refrigerant charge volume) without sacrificing cooling performance.

- More environmentally friendly



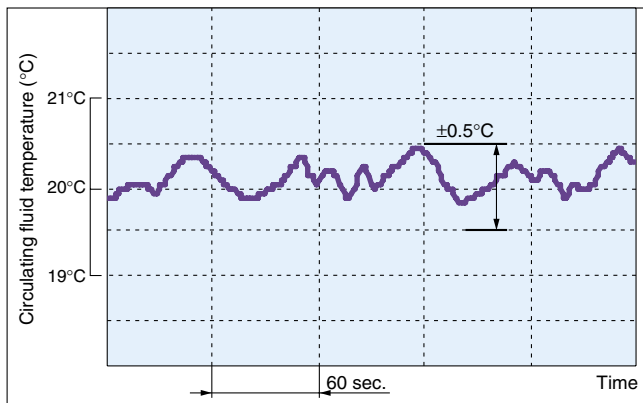
Note) HRGC005-A only

## High Performance

### ● Temperature stability: $\pm 0.5^{\circ}\text{C}$ <sup>Note 1) 3)</sup> $\pm 1.0^{\circ}\text{C}$ <sup>Note 2) 3)</sup> (when a load is stable)

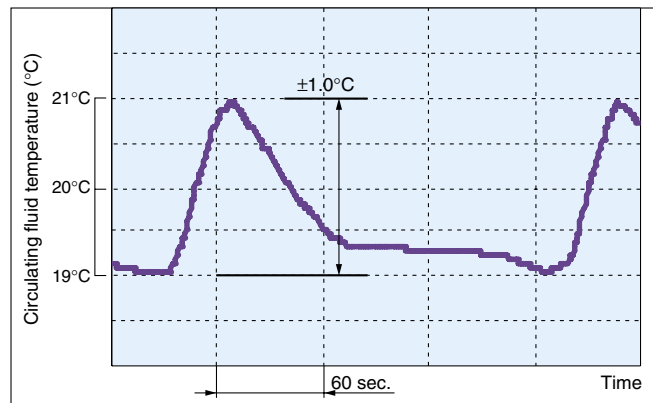
Two types of temperature control are provided: to  $\pm 0.5^{\circ}\text{C}$  specifications using split flow from a three-way proportional valve, and simple temperature control to  $\pm 1.0^{\circ}\text{C}$  specifications using the refrigerator ON/OFF mechanism. Choose the temperature stability that is right for your manufacturing process and method.

#### ■ $\pm 0.5^{\circ}\text{C}$ type (HRGC002-A5)



Note 1) HRGC001-□5 to HRGC005-□5 only  
 Note 2) HRGC001-□ to HRGC005-□

#### ■ $\pm 1.0^{\circ}\text{C}$ type (HRGC002-A)



Note 3) The value shown applies to a stable load state with no outside interference.  
 Actual values may vary depending on operating conditions.

# Easy Operation and Maintenance

## Simple operation

(Standard specifications)

### Operation 1

Press the START button.

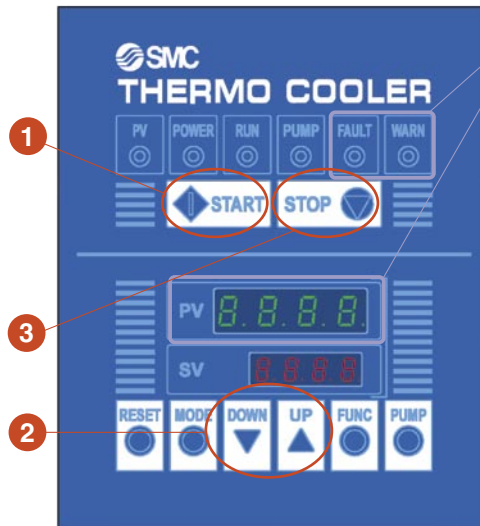
### Operation 2

Adjust the temperature setting with the UP/DOWN keys.

### Operation 3

Press the STOP button to shut down.

What could be easier?!



## “Alarm no.” display

The display of “Fault error light,” “Warning error light” and “Alarm no.” can provide easy failure diagnosis.

- Fault error (FAULT) light (Red LED)
- Warning error (WARN) light (Yellow LED)

Note) Refer to page 9 for an explanation of the display panel and alarms.

## Contact input/output signal

### Remote operation signal input

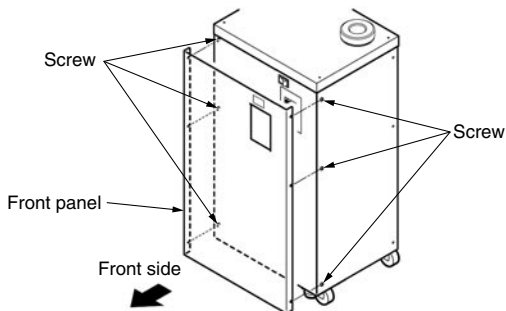
No need for power supply. Startup and shutdown can be remotely controlled.

### Operation, shutdown, alarm signal output

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

## Easy maintenance

Components can be accessed from the front. The pump, refrigerator thermal relay and reset switch are located inside the electrical component enclosure.



## Options

Various options are available, including with circuit breakers and communications function (RS-485). Specify options according to your particular manufacturing process and method.

(Refer to page 8 for options.)

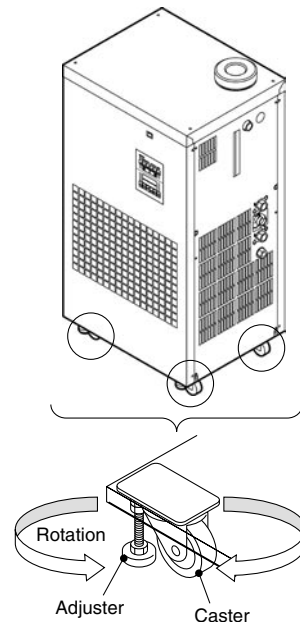
## Optional accessories

Dustproof filters for the air-cooled refrigerator are available. These improve durability and ease of use.

(Refer to page 9 for optional accessories.)

## Caster available as standard equipment

Can be used when the thermo-cooler is carried onto the floor or moved to change the layout. Also, there is an adjuster which can be used as a stopper.



## Air-cooled Refrigerator Type

### Air-cooled refrigerator type

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

## Communications

### Communications function (RS-485)

(Refer to page 8 for options.)

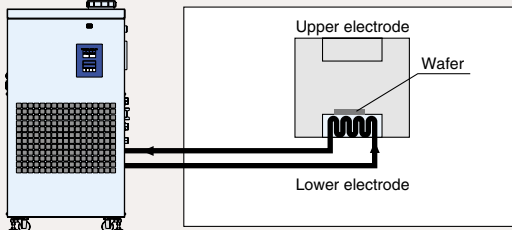
### Contact input/output function

(Refer to page 7.)

# Application Examples

## Semiconductor

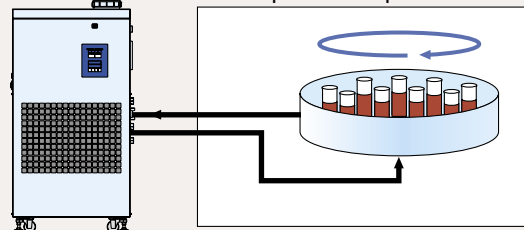
Example: Temperature control of a chamber electrode



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

## Medical

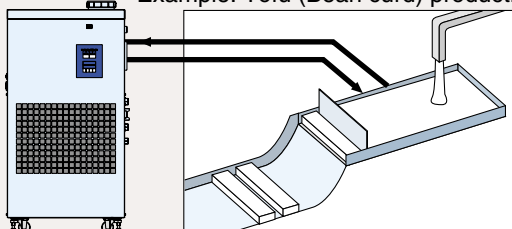
Example: Blood preservation



- X-ray instrument
- MRI
- Blood preservation equipment

## Food

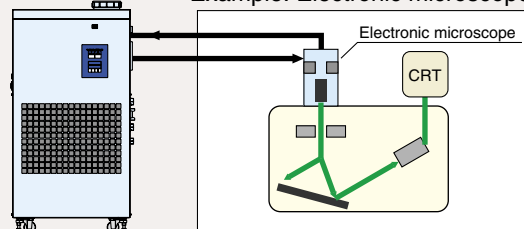
Example: Tofu (Bean curd) production



- Bottle-cleaning machine
  - Tofu (Bean curd) production equipment
  - Noodle-making machine, etc.
- Water temperature control for forming tofu by mixing the boiled soy-bean milk and bitter

## Diagnosis

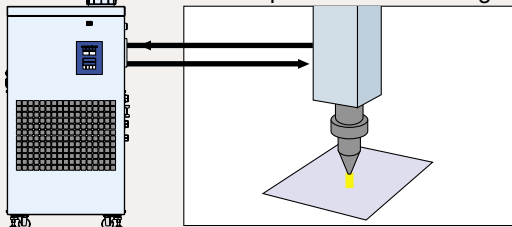
Example: Electronic microscope



- Electron microscope
  - X-ray diagnosis instrument
  - Gas chromatography
  - Sugar level diagnosis, etc.
- Prevents the distortion caused by the heat generated by the electronic gun in an electronic microscope.

## Machine tool

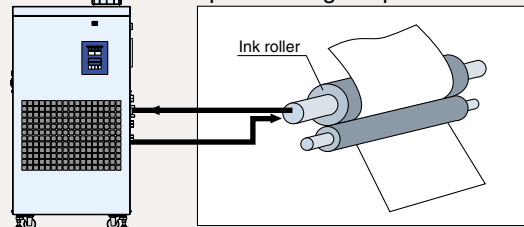
Example: Laser machining



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

## Printing

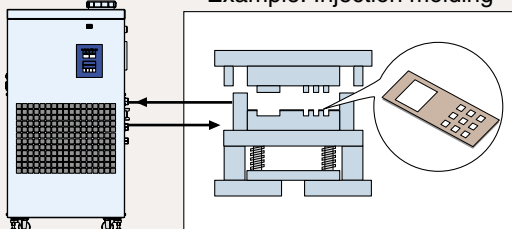
Example: Printing temperature control



- 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.

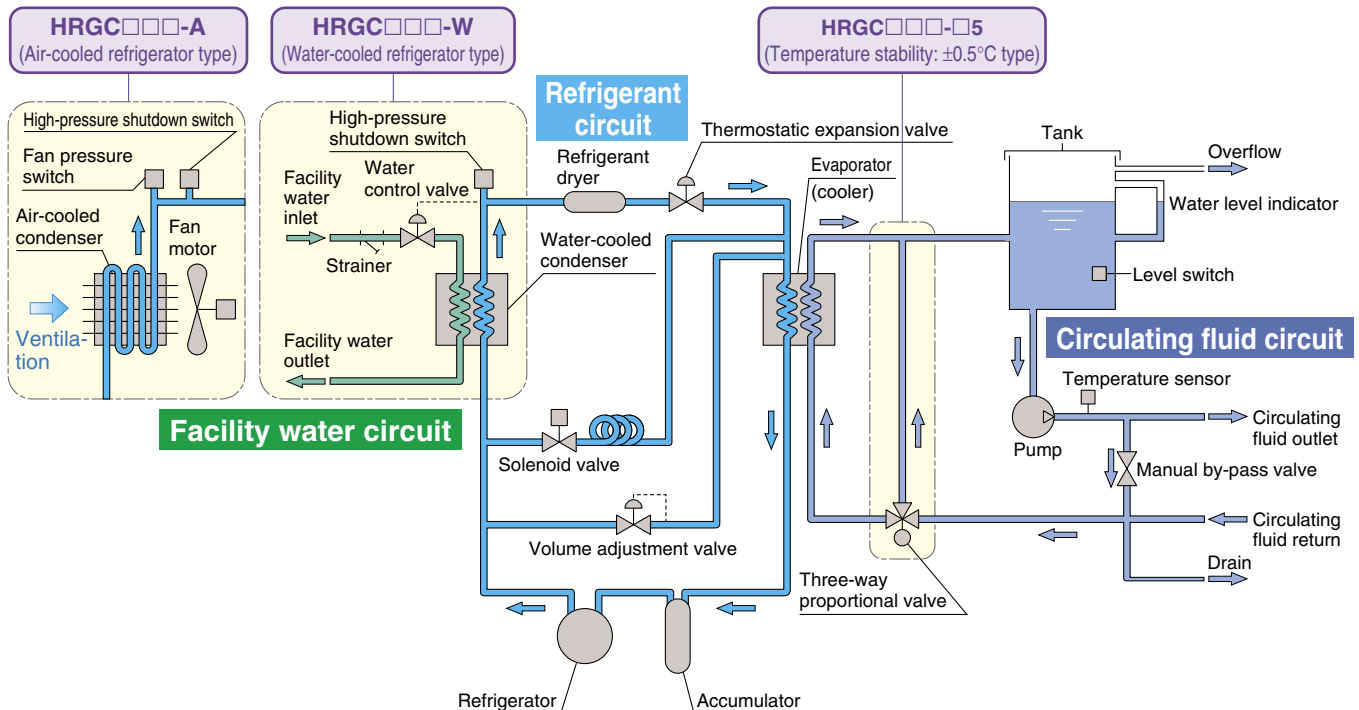
## Molding

Example: Injection molding



- Plastic molding
  - Rubber molding
  - Wire cable coating machine
  - Injection molding, etc.
- Temperature-controlling the mold results in improved product quality.

# Construction and Principles



## Circulating fluid circuit

With the circulating pump, circulating fluid will be discharged to the customer's equipment side. After the circulating fluid will cool the customer's equipment side, it will heat up and return to the thermo-cooler.

### ■ Temperature stability: $\pm 0.5^{\circ}\text{C}$ type (HRGC□□□-□5)

If the temperature of the circulating fluid is higher than the preset temperature, the three-way proportional valve will return the circulating fluid to the cooler. If the temperature of the circulating fluid is lower than the preset temperature, the fluid will be returned directly to the tank.

When the temperature of the circulating fluid is nearly the same as the preset temperature, the temperature will be stabilized by split flow between the cooler and the tank.

## Refrigerant circuit

High-temperature, high-pressure freon gas compressed by the refrigerator is made to release heat by the condenser, and turns to liquid. As the liquefied high-pressure freon passes through the thermostatic 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 freon is once again sucked in and compressed by the refrigerator, 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 in excessively cold conditions.

### ■ Temperature stability: $\pm 1.0^{\circ}\text{C}$ type (HRGC□□□-□□)

If the temperature of the circulating fluid is higher than the preset temperature, the refrigerator starts up, and freon 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 refrigerator shuts down, and the flow of freon gas stops. At such times, the circulating fluid is not cooled, and the temperature rises.

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

## Facility water circuit

### ■ Cooling method: Water-cooled refrigerator type (HRGC□□□-W)

When the freon 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 refrigerator and reduces energy use by your facility water equipment.



# CONTENTS

## ◆ Model Selection

- Guide to Model Selection ..... Front matter 2 to 3
- Calculation of Required Cooling Capacity ..... Front matter 4 to 6
- Precautions on Model Selection ..... Front matter 7
- Circulating Fluid Representative Physical Property Values ..... Front matter 7

## Basic Model

- How to Order/Specifications ..... P.1
- Cooling Capacity/Pump Capacity/Facility Water Flow Rate ..... P.2
- Dimensions ..... P.3 to 4
- Piping Connection and Installation Dimensions ..... P.5
- Operation Panel Display ..... P.6
- Alarm ..... P.6
- Contact Input/Output Function ..... P.7
- Other Features ..... P.7

## Options

- With Circuit Breaker ..... P.8
- With Communications Function (RS-485) ..... P.8

## Optional Accessories

- Specifications/How to Order ..... P.9
- Dimensions ..... P.9
- Mounting Example ..... P.9

- Warranty ..... P.10
- Safety Instructions ..... Back page 1
- Temperature Control Equipment Precautions ..... Back page 2 to 5
- Specific Product Precautions ..... Back page 6 to 10

# Series HRGC

# Model Selection

## Guide to Model Selection

### 1. Which is best for you: a water-cooled refrigerator or an air-cooled refrigerator?

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

Thermo-cooler series refrigeration methods

Water-cooled refrigerator type ····· 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 refrigerator type ····· 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. Note that ventilation or air conditioning is required to dissipate heat: for details, refer to back page 6. Operating Environment / Storage Environment 3 on Specific Product Precautions 1.

**Example) Requirement from customer: Air-cooled refrigerator type**

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

Temperature range which can be set with the thermo-cooler

5°C to 35°C

**Example) Requirement from customer: 20°C**

### 3. What power supply frequency?

Thermo-cooler power supply frequency specifications

50 Hz, 60 Hz (common use)

**Example) Requirement from customer: 60 Hz**

### 4. What is the kW for the required cooling capacity?

\* To calculate the cooling capacity, refer to example 1 through to 3.

**Example) Requirement from customer: 4.2 kW (Refer to example 1 (1).)**

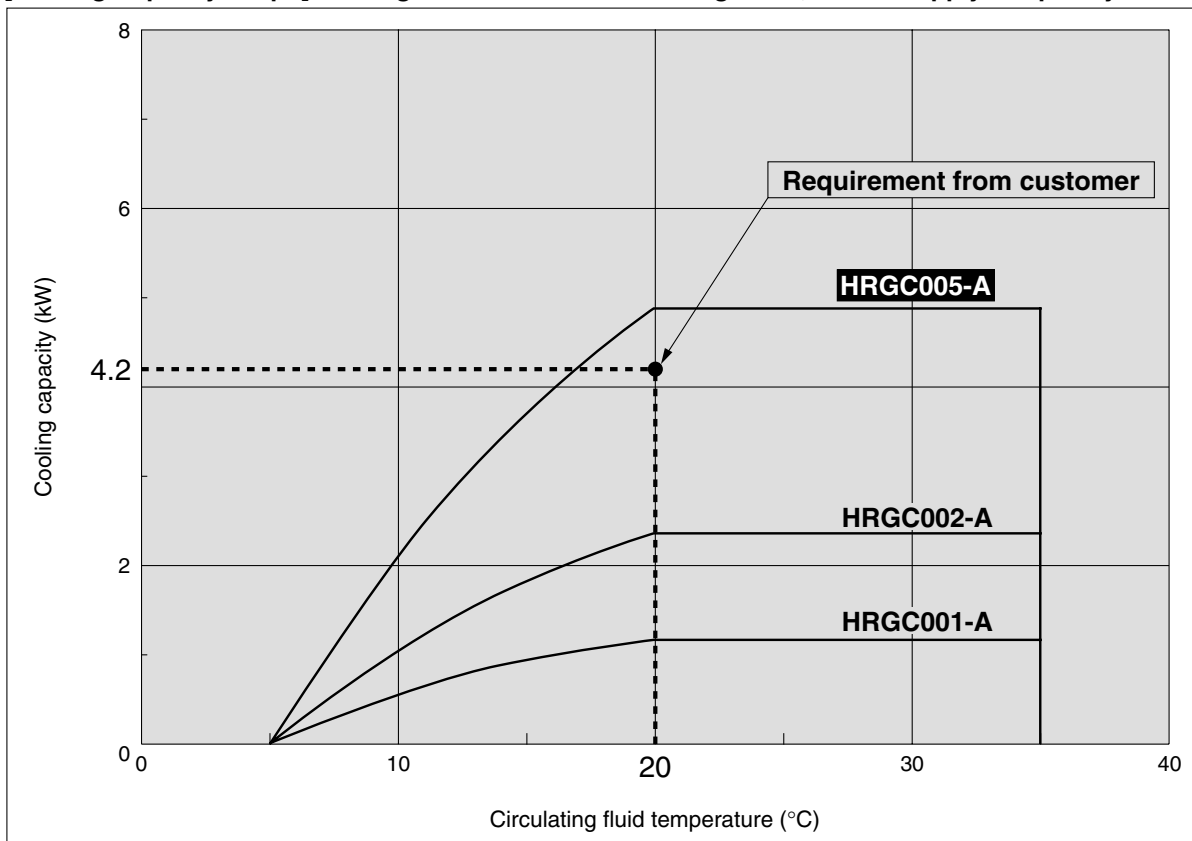
## Selection

**Example: Customer requirements 1 to 4**

Cooling method	: Air-cooled refrigerator type
Circulating fluid temperature:	20°C
Power supply frequency	: 60 Hz
Required cooling capacity	: 4.2 kW

Based on the results of 1 to 4, refer to the graph of cooling capacity of an air-cooled refrigerator type thermo-cooler at 60 Hz (page 2). On the same graph, plot the intersections between the customer's required temperature (20°C) and cooling capacity (4.2 kW).

**[Cooling Capacity Graph] Cooling Method: Air-cooled Refrigerator, 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 **HRGC005-A**.

# Model Selection

## Calculation of Required Cooling Capacity

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

The amount of heat generated can be determined based on the power consumption or output of the heat generating area — i.e. the area requiring cooling — within your facility.

#### (1) Derive the amount of heat generated from the power consumption.

Power consumption P: 3.5 [kW]

$$Q = P = 3.5 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

$$3.5 \text{ [kW]} \times 1.2 = \boxed{4.2 \text{ [kW]}}$$

#### (2) Derive the amount of heat generated from the power supply output.

Power supply output VI: 4.1 [kVA]

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

In this example, using a power factor of 0.85:

$$= 4.1 \text{ [kVA]} \times 0.85 = 3.5 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

$$3.5 \text{ [kW]} \times 1.2 = \boxed{4.2 \text{ [kW]}}$$

#### (3) Derive the amount of heat generated from the output.

Output (shaft power, etc.) W: 2.2 [kW]

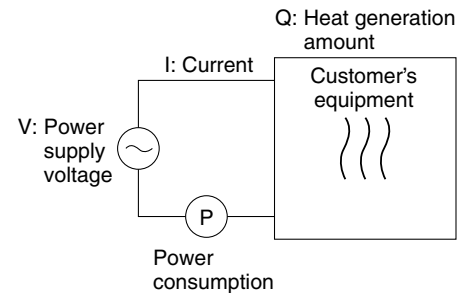
$$Q = P = \frac{W}{\text{Efficiency}}$$

In this example, use an efficiency of 0.7:

$$= \frac{2.2}{0.7} = 3.14 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

$$3.14 \text{ [kW]} \times 1.2 \approx \boxed{3.8 \text{ [kW]}}$$



\* The above examples calculate the amount of heat generation based on power consumption. The actual amount of heat generated may differ due to the structure of customer facilities. Please be sure to check it carefully.

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

Obtaining the temperature difference between inlet and outlet by circulating the circulating fluid inside the customer's equipment.

Amount of heat generated by equipment Q : Unknown [kW] ([kJ/s])  
 Circulating fluid : Clean water\*  
 Circulating fluid flow rate (weight)  $q_m$  : (=  $\rho \times q_v \div 60$ ) [kg/s]  
 Circulating fluid density  $\rho$  : 1 [kg/dm<sup>3</sup>]  
 Circulating fluid flow rate (volume)  $q_v$  : 25 [dm<sup>3</sup>/min]  
 Circulating fluid specific heat capacity C : 4.2 [kJ/(kg·K)]  
 Circulating fluid outlet temperature T<sub>1</sub> : 293 [K (20 [°C])]  
 Circulating fluid return temperature T<sub>2</sub> : 295 [K (20 [°C])]  
 Circulating fluid temperature difference  $\Delta T$  : 2.0 [K] (= T<sub>2</sub> - T<sub>1</sub>)  
 Conversion factor: minutes to seconds : 60 [s/min]  
 (SI units)

\* Refer to front matter 7 for the representative physical property value by circulating fluid, e.g. clean water.

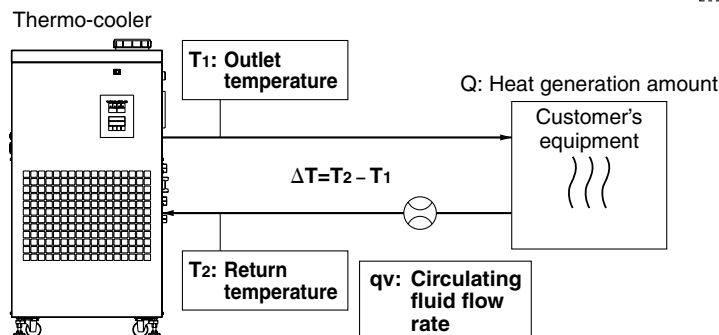
$$Q = q_m \times C \times (T_2 - T_1)$$

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

$$= \frac{1 \times 25 \times 4.2 \times 2.0}{60}$$

$$= 3.50 \text{ [kJ/s]} \approx 3.5 \text{ [kW]}$$

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



Example of the conventional measurement units (Reference)

Amount of heat generated by equipment Q : Unknown [kcal/h] → [kW]  
 Circulating fluid : Clean water\*  
 Circulating fluid flow rate (weight)  $q_m$  : (=  $\rho \times q_v \times 60$ ) [kgf/h]  
 Circulating fluid weight: volume ratio  $\gamma$  : 1 [kgf/l]  
 Circulating fluid flow rate (volume)  $q_v$  : 25 [l/min]  
 Circulating fluid specific heat capacity C : 1.0 [kcal/(kgf·°C)]  
 Circulating fluid outlet temperature T<sub>1</sub> : 20 [°C]  
 Circulating fluid return temperature T<sub>2</sub> : 22 [°C]  
 Circulating fluid temperature difference  $\Delta T$  : 2.0 [°C] (= T<sub>2</sub> - T<sub>1</sub>)  
 Conversion factor: hours to minutes : 60 [min/h]  
 Conversion factor: kcal/h to kW : 860 [(kcal/h)/kW]

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

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

$$= \frac{1 \times 25 \times 60 \times 1.0 \times 2.0}{860}$$

$$= \frac{3000 \text{ [kcal/h]}}{860}$$

$$\approx 3.5 \text{ [kW]}$$

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

# Model Selection

## Calculation of Required Cooling Capacity

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

Heat dissipated by cooled substance (per unit time) Q : Unknown [kW] ([kJ/s])  
 Cooled substance : Water  
 Weight of cooled substance m : (= ρ x V) [kg]  
 Density of cooled substance ρ : 1 [kg/dm<sup>3</sup>]  
 Total volume of the object being cooled down V : 60 [dm<sup>3</sup>]  
 Specific heat capacity of cooled substance C : 4.2 [kJ/(kg·K)]  
 Temperature of cooled substance when cooling begins T<sub>0</sub> : 305 [K] (32 [°C])  
 Cooled substance temperature after t hour T<sub>t</sub> : 293 [K] (20 [°C])  
 Cooling temperature difference ΔT : 12 [K] (=T<sub>0</sub> - T<sub>t</sub>)  
 Cooling time Δt : 900 [s] (= 15 [min])

\* Refer to front matter 7 for the representative physical property value by circulating fluid.

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

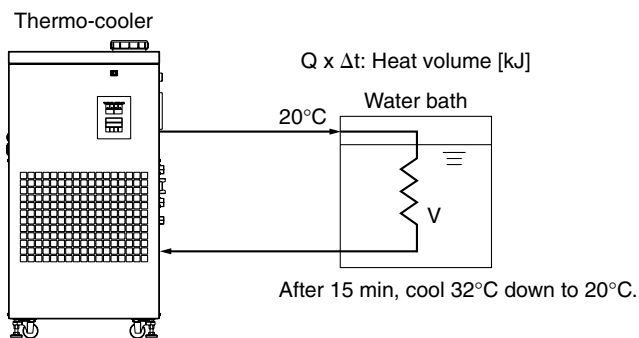
$$= \frac{\rho \times V \times C \times \Delta T}{\Delta t}$$

$$= \frac{1 \times 60 \times 4.2 \times 12}{900}$$

$$= 3.36 \text{ [kJ/s]} \approx 3.4 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

$$3.4 \text{ [kW]} \times 1.2 = 4.08 \text{ [kW]}$$



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

Example of the conventional measurement units (Reference)

Heat dissipated by cooled substance (per unit time) Q : Unknown [kcal/h] → [kW]  
 Cooled substance : Water  
 Cooled substance weight m : (= ρ x V) [kgf]  
 Cooled substance weight (volume ratio) γ : 1 [kgf/l]  
 Total volume of the substance being cooled down V : 60 [l]  
 Specific heat capacity of cooled substance C : 1.0 [kcal/(kgf·°C)]  
 Temperature of cooled substance when cooling begins T<sub>0</sub> : 32 [°C]  
 Cooled substance temperature after t hour T<sub>t</sub> : 20 [°C]  
 Cooling temperature difference ΔT : 12 [°C] (= T<sub>0</sub> - T<sub>t</sub>)  
 Cooling time Δt : 15 [min]  
 Conversion factor: hours to minutes : 60 [min/h]  
 Conversion factor: kcal/h to kW : 860 [(kcal/h)/kW]

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

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

$$= \frac{1 \times 60 \times 60 \times 1.0 \times 12}{15 \times 860}$$

$$= \frac{2880 \text{ [kcal/h]}}{860} \approx 3.4 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

$$3.4 \text{ [kW]} \times 1.2 = 4.08 \text{ [kW]}$$

## 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>

Pump capacity varies depending on the model selected from the HRGC 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 equipment, and the piping resistance such as circulating fluid pipings, or piping size, or piping curves in the equipment. Confirm 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. Confirm beforehand if the circulating fluid pipings or circulating fluid circuit of the customer's equipment are fully durable against this pressure.

## Circulating Fluid Representative 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/dm<sup>3</sup>] (or, using conventional unit system, weight: volume ratio  $\gamma = 1$  [kgf/l])  
 Specific heat capacity C: 4.19 [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 as shown in the below table. Use this as a reference. Note)

#### Water

Physical property value Temperature	Density $\rho$ [kg/dm <sup>3</sup> ]	Specific heat C [kJ/(kg·K)]	Conventional unit system	
			Weight: volume ratio $\gamma$ [kgf/l]	Specific heat C [kcal/(kgf·°C)]
5°C	1.00	4.20	1.00	1.00
10°C	1.00	4.19	1.00	1.00
15°C	1.00	4.19	1.00	1.00
20°C	1.00	4.18	1.00	1.00
25°C	1.00	4.18	1.00	1.00
30°C	1.00	4.18	1.00	1.00
35°C	0.99	4.18	0.99	1.00

# Thermo-cooler Series HRGC



## How to Order

HRGC 001 - A [ ] [ ] - [ ]

Cooling capacity

001	Cooling capacity: 0.9/1.1 kW (50/60 Hz)
002	Cooling capacity: 1.9/2.3 kW (50/60 Hz)
005	Cooling capacity: 4.5/4.8 kW (50/60 Hz)

Cooling method

A	Air-cooled refrigerator type
W	Water-cooled refrigerator type

Temperature stability

Nil	±1.0°C (Refrigerator ON/OFF control)
5	±0.5°C (Proportional valve PID control)

Option

Nil	None
B	With earth leakage breaker
C	With communications function (RS485)

\* Refer to page 8 for the specifications of each option.

Piping thread type

Nil	Rc
F	G (PT-G conversion fitting is included)
N	NPT (PT-NPT conversion fitting is included)

## Specifications

### HRGC001/002/005

Model		HRGC001		HRGC002		HRGC005	
Cooling method		Air-cooled refrigerator type	Water-cooled refrigerator type	Air-cooled refrigerator type	Water-cooled refrigerator type	Air-cooled refrigerator type	Water-cooled refrigerator type
Refrigerant		R407C (HFC)					
Control method		Refrigerator ON/OFF control or Proportional valve PID control					
Ambient temperature/humidity <sup>Note 1)</sup>		Temperature: 5 to 40°C, Humidity: 30 to 70%RH					
Circulating fluid system	Circulating fluid <sup>Note 2)</sup>	Clean water					
	Temperature range setting <sup>Note 1)</sup> °C	5 to 35					
	Cooling capacity <sup>Note 3)</sup> (50/60 Hz) kW	0.9/1.1 (at 20°C)	0.9/1.1 (at 20°C)	1.9/2.3 (at 20°C)	1.9/2.3 (at 20°C)	4.5/4.8 (at 20°C)	4.5/4.8 (at 20°C)
	Heating capacity <sup>Note 4)</sup> kW	—	—	—	—	—	—
	Temperature stability <sup>Note 5)</sup> °C	±1.0 (Refrigerator ON/OFF control), ±0.5 (Proportional valve PID control)					
	Pump capacity <sup>Note 6)</sup> (50/60 Hz) MPa	0.13/0.18 (at 10 ℓ/min)				0.20/0.24 (at 23 ℓ/min)	
	Rated flow <sup>Note 7)</sup> (50/60 Hz) ℓ/min	10/10				23/28	
	Tank capacity ℓ	Approx. 10				Approx. 20	
	Port size	Rc1/2					
	Wetted parts material	Stainless steel, PPE, PVC, Copper brazing (heat exchanger), Bronze					
Facility water system	Temperature range °C	—	5 to 32	—	5 to 32	—	5 to 32
	Pressure range MPa	—	0.3 to 0.5	—	0.3 to 0.5	—	0.3 to 0.5
	Required flow rate <sup>Note 8)</sup> (50/60 Hz) ℓ/min	—	10/12	—	10/12	—	27/28
	Port size	—	Rc1/2	—	Rc1/2	—	Rc1/2
Electrical system	Wetted parts material	Stainless steel, PVC, Copper brazing (heat exchanger), Bronze					
	Power supply	Single-phase 200 to 230 VAC 50/60 Hz Allowable voltage fluctuation ±10%					
	Applicable circuit breaker capacity <sup>Note 9)</sup> A	15		15		30	
	Maximum operating current A	8.1	7.8	8.6	8.0	17.2	14.1
	Rated power consumption <sup>Note 11)</sup> (50/60 Hz) kW	0.76/0.82	0.68/0.73	1.13/1.20	0.89/0.98	2.07/2.23	1.76/1.83
	Remote operation signal input	Relay contact input (operates when the switch is closed, stops when the switch is opened)					
	Operation signal output	Relay contact output (switch closed when operating, switch open when stopped, switch open when shut down)					
	Alarm stop signal output	Relay contact output (switch closed when alarm is turned off, switch open when alarm is turned on, switch closed when shut down)					
Alarm	Refer to page 6.						
Weight <sup>Note 10)</sup> kg	75	75	75	75	110	110	

Note 1) It should have no condensation.

During seasons or in locations where the ambient temperature is likely to fall below freezing point, consult SMC separately.

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

Note 3) ① Ambient temperature: 32°C, Facility water temperature: 25°C (for water-cooled refrigerator type), ② Circulating fluid temperature: 20°C, ③ Circulating fluid flow rate: Values at circulating fluid rated flow rate.

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

Note 5) Temperature at the outlet of the thermo-chiller when the circulating fluid has a rated flow, and the facility water with the circulating fluid supply and return are directly connected. The installation environment, power supply and facility water should be stable within the specified range.

Note 6) Circulating fluid temperature: The capacity of the thermo-cooler outlet port at 20°C.

Note 7) Required flow for cooling capacity or maintaining the temperature stability.

When used below the rated flow, open the standard manual by-pass valve and maintain a circulating fluid flow rate equivalent to the rated flow.

Note 8) Facility water temperature: 25°C, Required flow when a load is applied as shown in the cooling capacity.

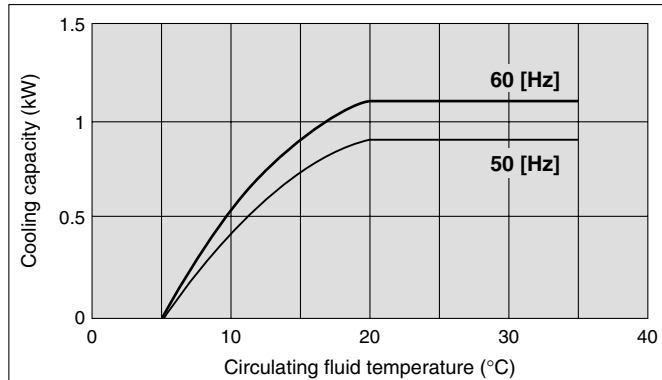
Note 9) Purchase a circuit breaker with current sensitivity of 30 mA separately. (Option [symbol B] is also available. Refer to "How to Order".)

Note 10) Weight in the dry state, without circulating fluids.

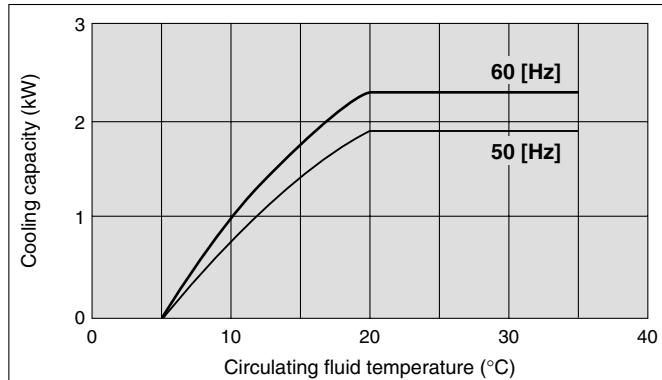
Note 11) In case of refrigerator ON/OFF control. For other conditions, refer to Note 3).

## Cooling Capacity

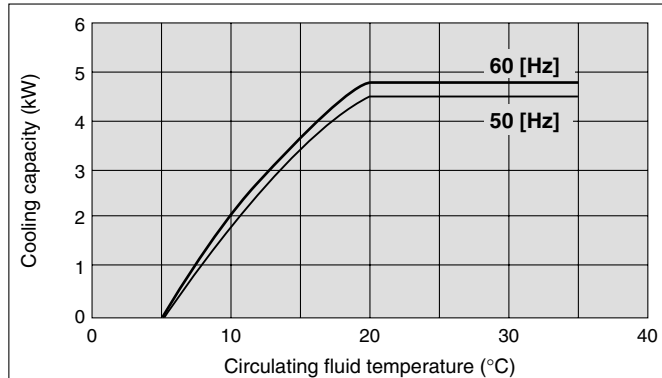
**HRGC001-A, HRGC001-W**



**HRGC002-A, HRGC002-W**

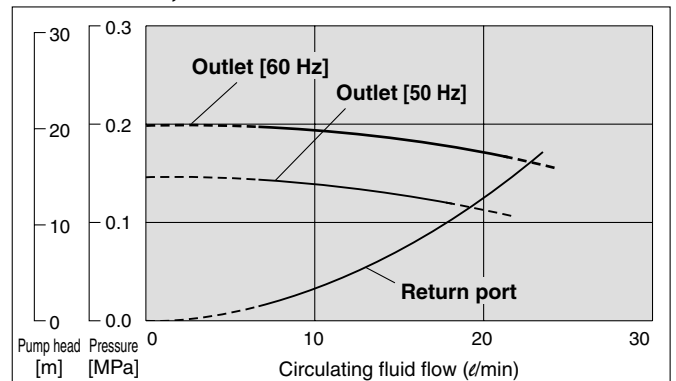


**HRGC005-A, HRGC005-W**

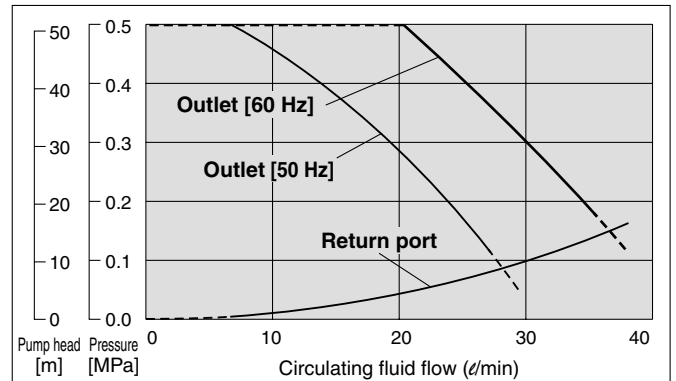


## Pump Capacity

**HRGC001-A, HRGC001-W  
HRGC002-A, HRGC002-W**

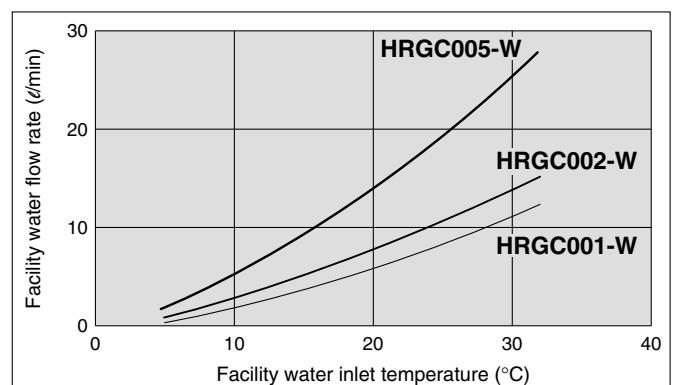


**HRGC005-A, HRGC005-W**



\* For all common models, temperature stability will decline in the flow rate range where circulating fluid is deduced (dotted line).

## Facility Water Flow Rate



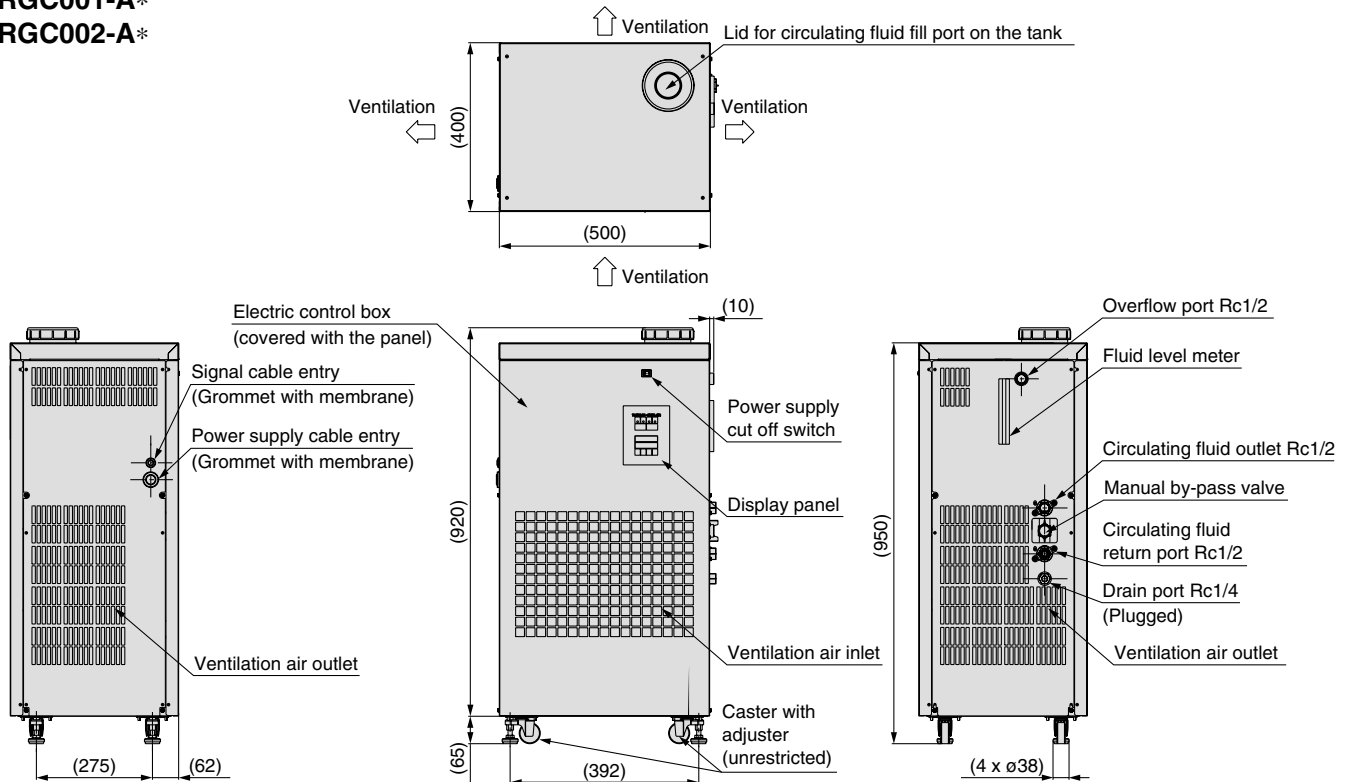
\* This is the flow rate of facility water at the rated cooling capacity and circulating fluid flow, operating at 60 Hz.

# Series HRGC

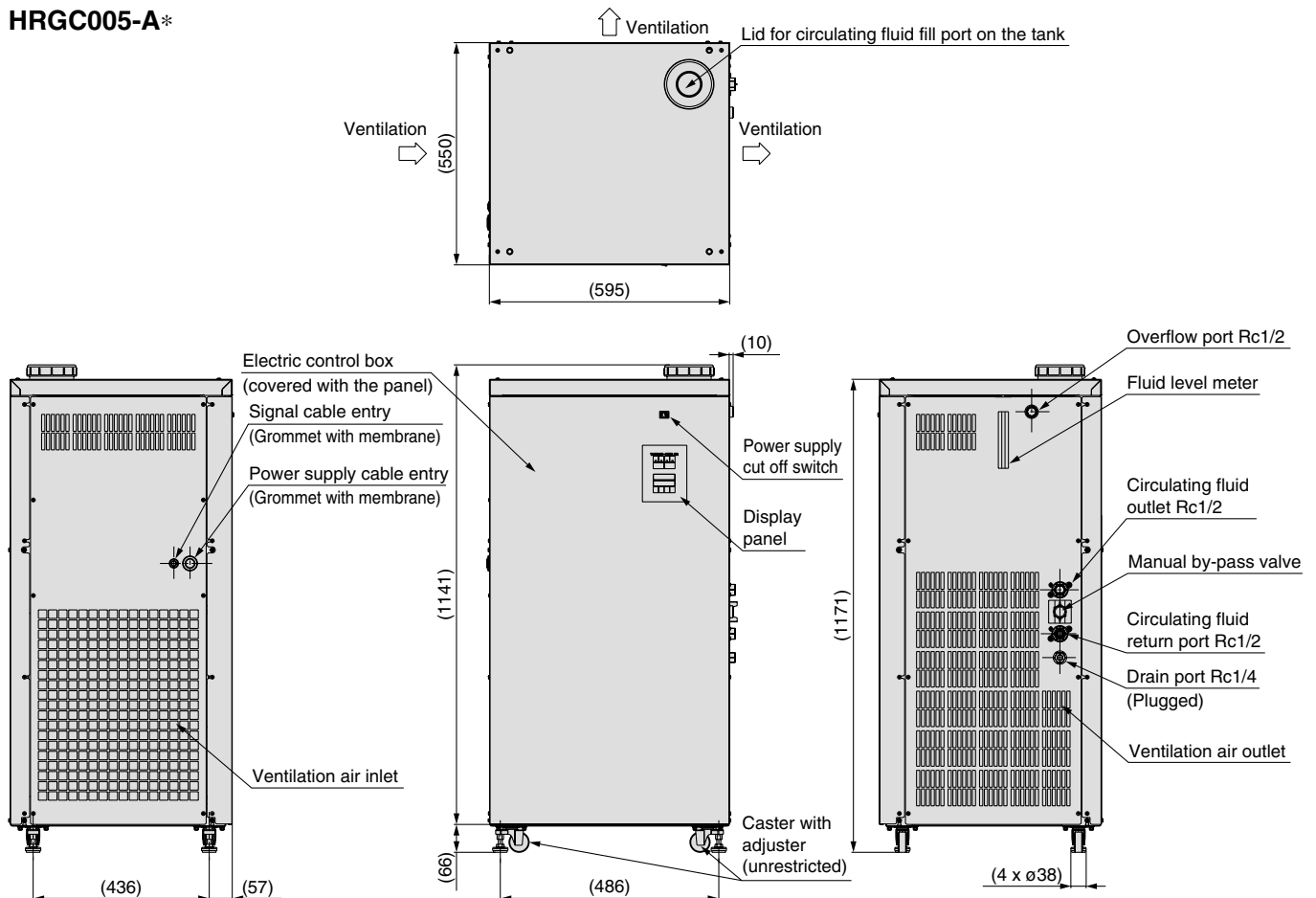
## Dimensions: Air-cooled Refrigerator Type

HRGC001-A\*

HRGC002-A\*



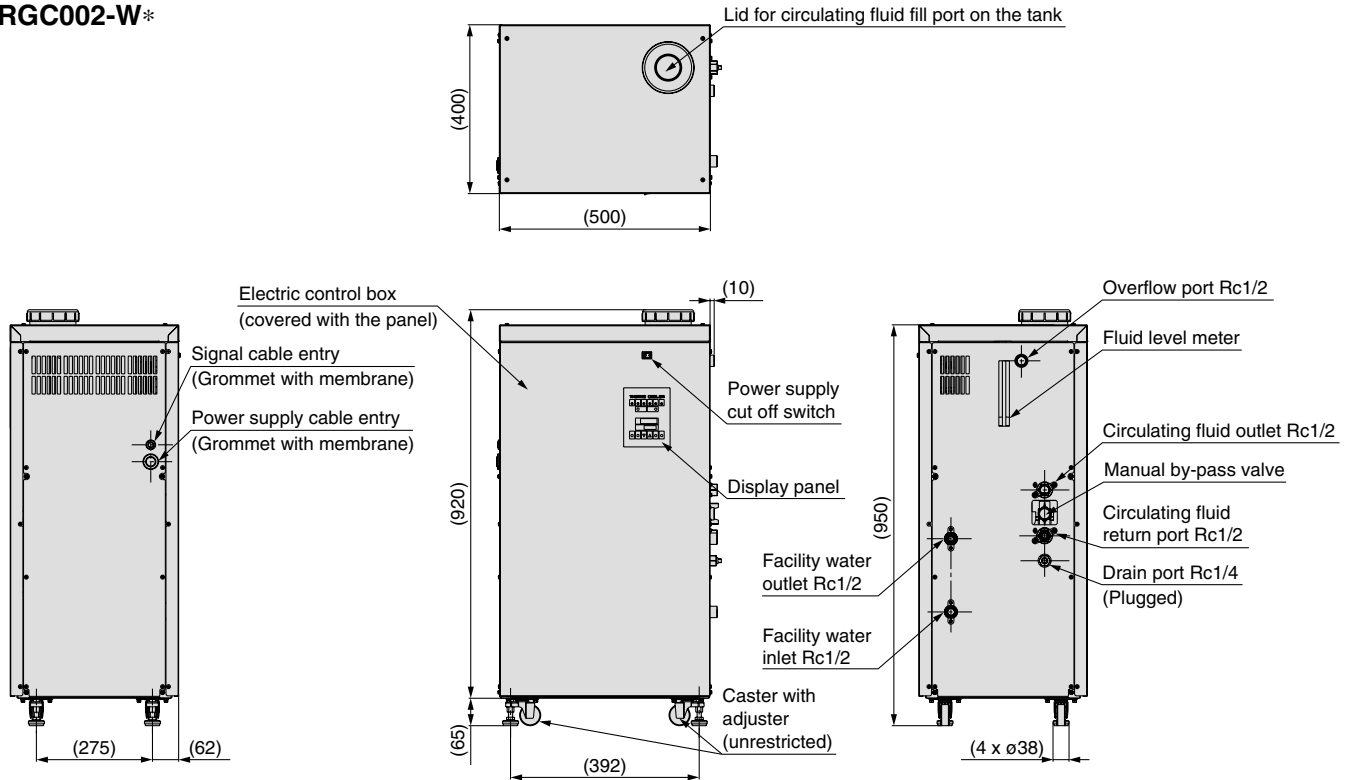
HRGC005-A\*



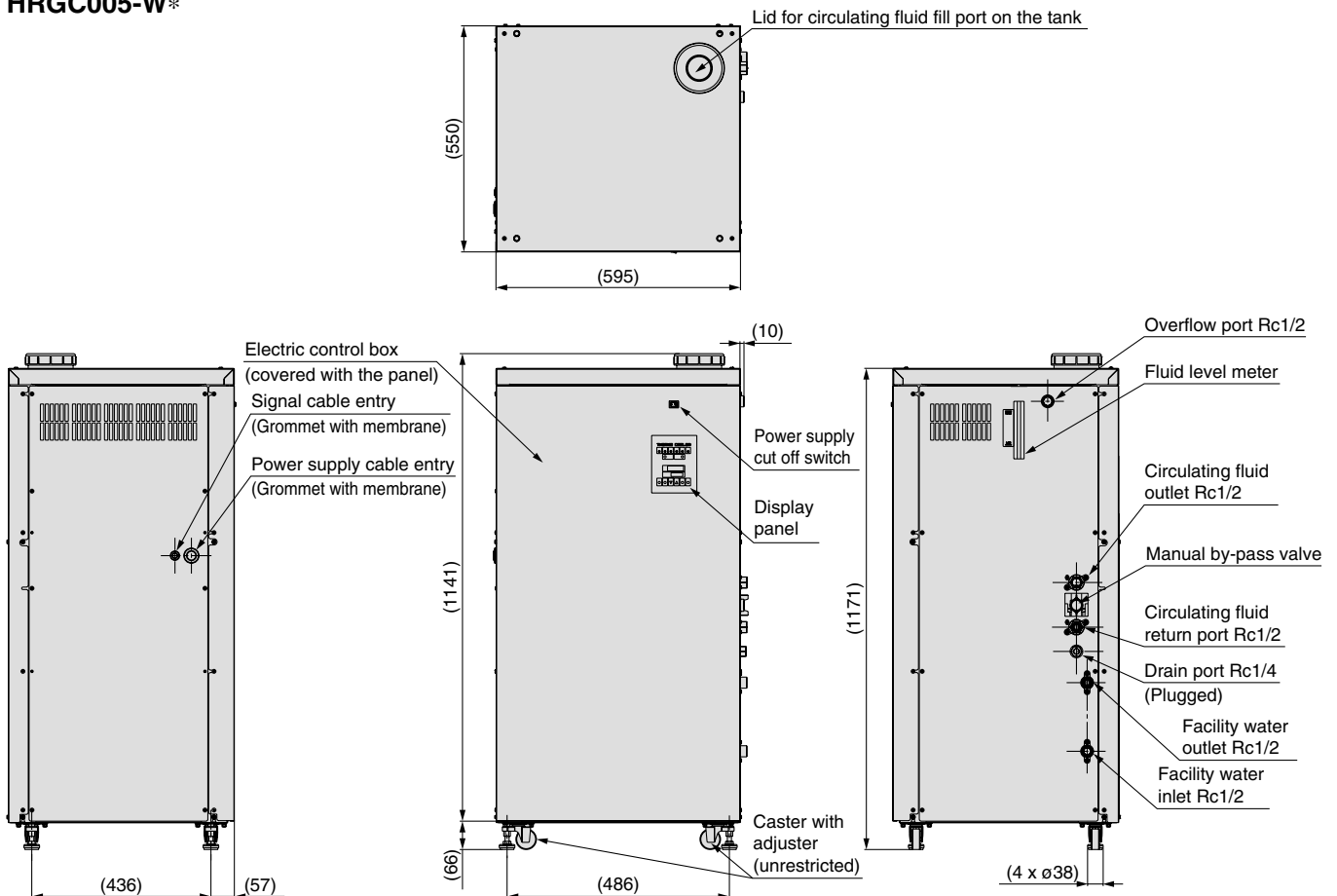
**Dimensions: Water-cooled Refrigerator Type**

**HRGC001-W\***

**HRGC002-W\***



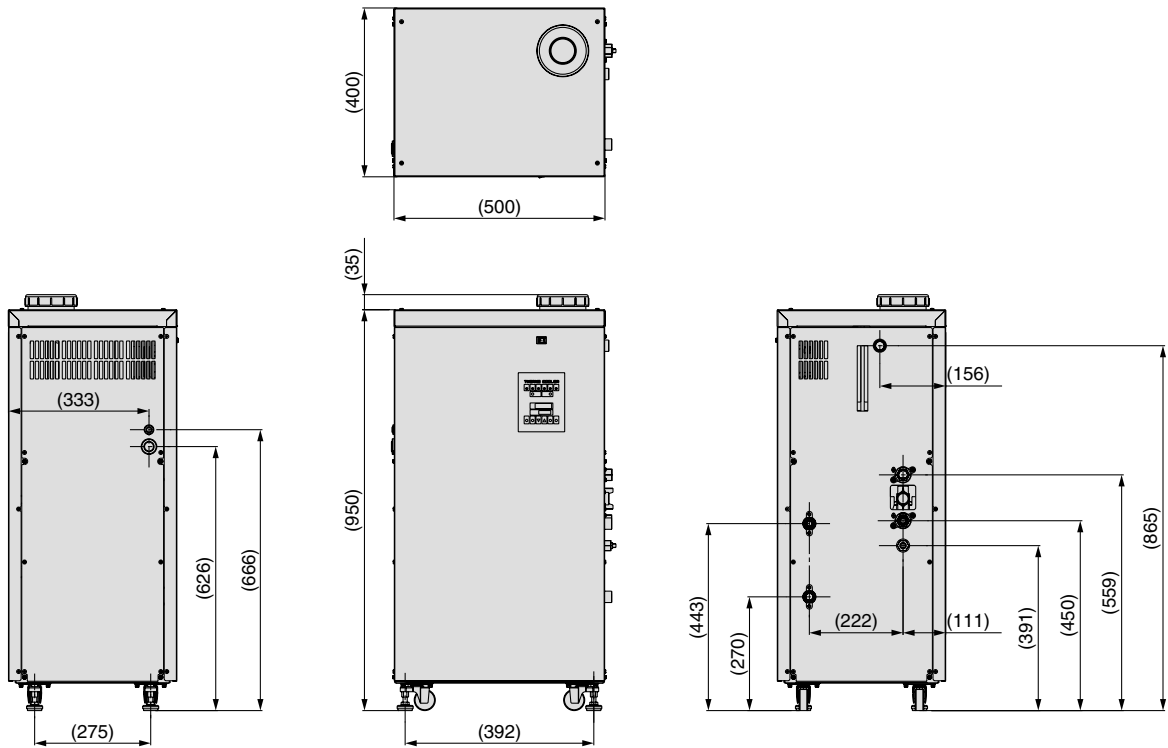
**HRGC005-W\***



# Series HRGC

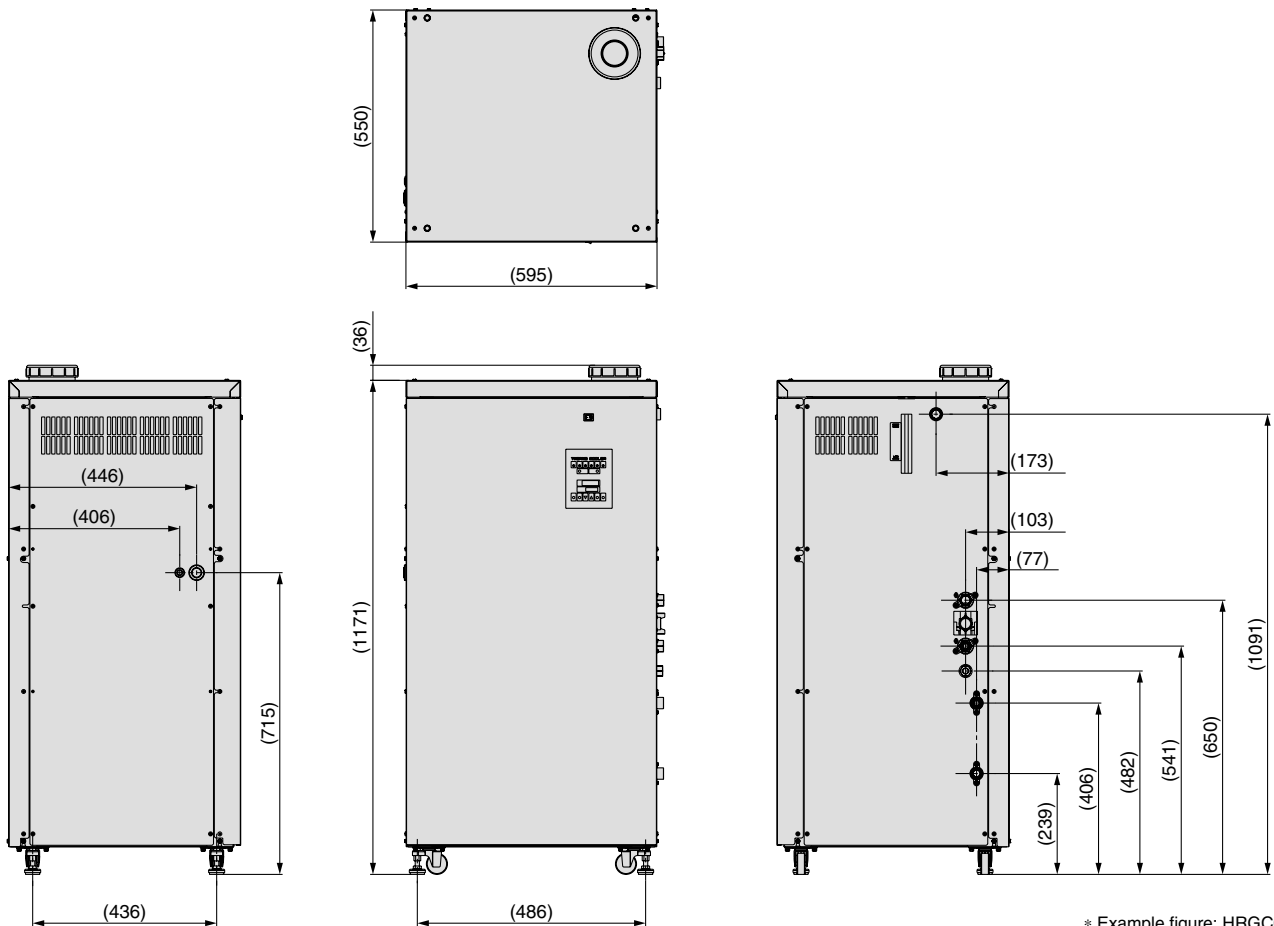
## Piping Connection and Installation Dimensions

### HRGC001/002



\* Example figure: HRGC001-W

### HRGC005

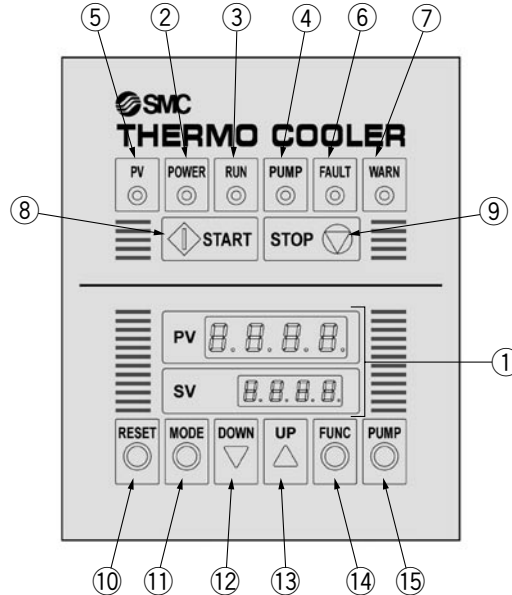


\* Example figure: HRGC005-W

## Operation Panel Display

### HRGC001/002/C005

The basic operation of the thermo-chiller is shown on the front operation display panel. This operation display panel is common to all models.



No.	Description	Function	
①	<b>Digital display PV/SV</b>	PV	Displays the temperature of circulating fluid. Displays the alarm no. when an alarm occurs.
		SV	Displays the set temperature of the circulating fluid.
②	<b>[POWER] indicator light</b>	Lights up when the power supply is turned on.	
③	<b>[RUN] indicator light</b>	Lights up when the [START] key is pressed.	
④	<b>[PUMP] indicator light</b>	Lights up when the pump is started.	
⑤	<b>[PV] indicator light</b>	Lights up when the temperature of the circulating fluid is displayed.	
⑥	<b>[FAULT] indicator light</b>	Lights up when the fault error to stop the thermo-chiller occurs.	
⑦	<b>[WARN] indicator light</b>	Lights up when the warning error that does not stop the thermo-chiller occurs.	
⑧	<b>[START] key</b>	Starts to operate the thermo-chiller.	
⑨	<b>[STOP] key</b>	Stops the thermo-chiller.	
⑩	<b>[RESET] key</b>	Resets the alarm.	
⑪	<b>[MODE] key</b>	Changes settings such as the offset function, etc.	
⑫	<b>[DOWN] key</b>	Decreases the set temperature.	
⑬	<b>[UP] key</b>	Increases the set temperature.	
⑭	<b>[FUNC] key</b>	Changes the display between the circulating fluid temperature and optional functions.	
⑮	<b>[PUMP] key</b>	Operates the pump independently while pressed.	

## Alarm/Alarm Indicators and Explanations of Alarms

The 7 basic temperature controller alarms are displayed on the PV of the operation display panel with their alarm numbers, the fault error (FAULT) light (red LED) and warning error (WARN) light (yellow LED).

When an alarm occurs, eliminate the cause by improving the operating conditions, etc. and restart the thermo-chiller.

### ■ Explanations of Alarms for HRGC001/002/005

Display light	Alarm	Operation condition	Main reason
[FAULT]	Low level of fluid in tank	Stop	Level switch activated because fluid level in tank fell below LOW.
	Rise in coolant pressure	Stop	Pressure switch activated because inadequate heat dissipation caused refrigerant pressure to rise.
	Circulating fluid temperature abnormally high	Stop	Temperature sensor activated because circulating fluid temperature became too high. (fixed at 40°C)
	Overload of pump	Stop	Circulation pump overload relay activated.
	Overload of refrigerator	Stop	Refrigerator overload relay activated.

# Series HRGC

## Contact Input/Output Function

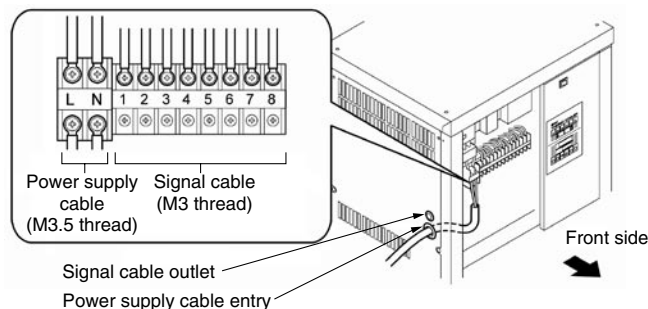
The thermo-cooler is standard-equipped with terminals that allow remote start/stop, and enable output of an operation signal, abnormal status stop signal or alarm signal. These should be used for synchronizing startup and shutdown with your other equipment, or when adding new patrol lights or buzzers.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

Item	Specifications		
	HRGC001	HRGC002	HRGC005
Connector format	M3 terminal block		
Remote operation signal input	Signal type	Relay contact input (Remote start when the contact signal is closed, Remote stop when the contact signal is open.)	
	Input voltage range	24 VDC±10% (Power supply is provided on the thermo-chiller side.)	
	Input current	Max. 35 mA	
	Terminal number	1 (24 VDC), 2 (24 VCOM)	
Abnormal status stop signal output	Signal type	Relay contact output (When fault error (FAULT) occurs: open)	
	Contact capacity	250 VAC, 1 A (Resistance load)	
	Terminal number	3, 4	
Operation signal output	Signal type	Relay contact output (When operating: closed)	
	Contact capacity	250 VAC, 1 A (Resistance load)	
	Terminal number	5, 6	
Alarm signal output	Signal type	Relay contact output (When warning error (WARN) occurs: open)	
	Contact capacity	250 VAC, 1 A (Resistance load)	
	Terminal number	7, 8	
Communications function (RS-485)	Communication standard	EIA standard RS-485 compliant	
	Information orientation	Half duplex	
	Synchronization method	Asynchronous communication	
	Terminal number	9, 10	
Circuit diagram			

Note) Serial communication is optional. Refer to "Options" on page 8.

### Input and output signal connection location

Remove the front panel connect a signal cable to the terminal block inside the electrical component enclosure.



## Other Features

### 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 HRGC Options

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

## B Option symbol

### With Circuit Breaker

HRGC    -B

● With circuit breaker

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

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

Applicable model	HRGC001- <input type="checkbox"/> <input type="checkbox"/> -B	HRGC002- <input type="checkbox"/> <input type="checkbox"/> -B	HRGC005- <input type="checkbox"/> <input type="checkbox"/> -B
Pole number	2		
Rated current sensitivity (mA)	30		
Rated shutdown current (A)	15	30	
Short circuit display method	Mechanical button		

#### Breaker mounting location

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

## C Option symbol

### With Communications Function (RS-485)

HRGC    -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>

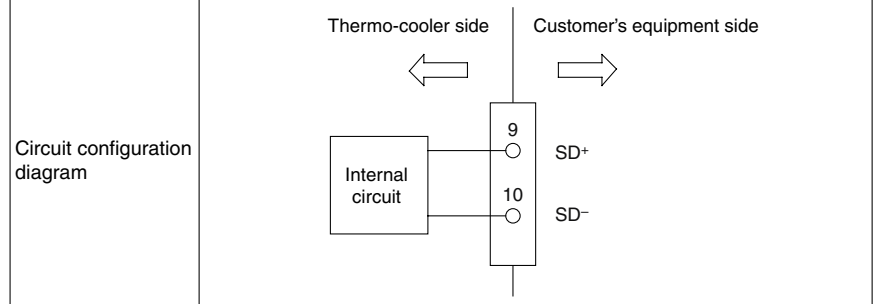
Circulating fluid temperature setting (SV)

<Readout>

Circulating fluid present temperature (PV)

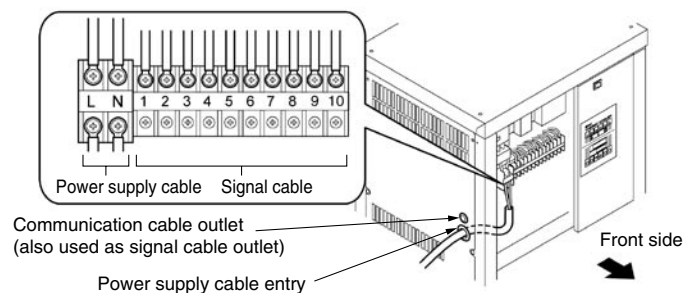
Circulating fluid temperature setting (SV)

Applicable model	HRGC001- <input type="checkbox"/> <input type="checkbox"/> -C	HRGC002- <input type="checkbox"/> <input type="checkbox"/> -C	HRGC005- <input type="checkbox"/> <input type="checkbox"/> -C
Connector number	9 (SD+), 10 (SD-)		
Connector format (thermo-cooler side)	M3 terminal block		
Standards	EIA standard RS-485 compliant		
Protocol	Special protocol: For details, Refer to the Communications Specifications document.		



#### Communication connection location


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



# Series HRGC Optional Accessories

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

## Specifications

Description	Description	Specifications	Applicable thermo-coolers
<b>Dustproof filter set</b> 	Prevents performance degradation when using air-cooled refrigerator thermo-coolers in dusty or contaminated environments.	Maximum ambient temperature 40°C	HRGC001-A□ to 005-A

## How to Order

[Dustproof filter set]

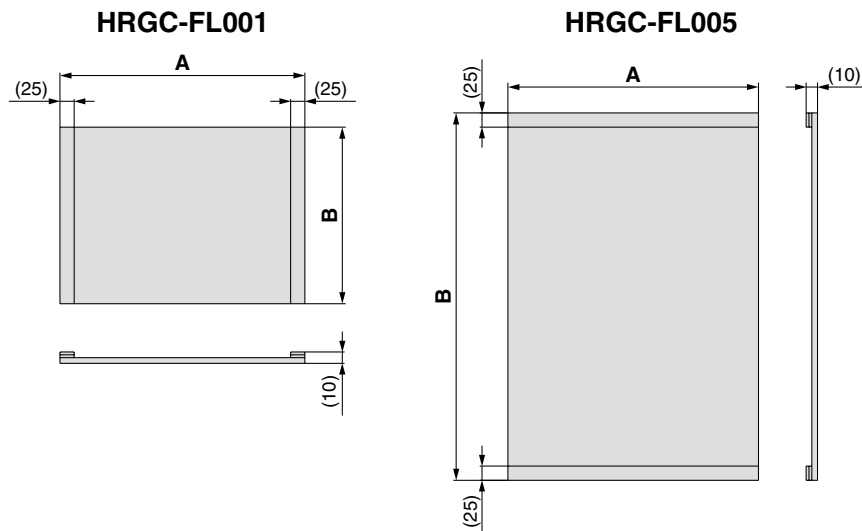
HRGC-FL 

### Applicable thermo-coolers

Symbol	Applicable thermo-coolers	Quantity per set
001	HRGC001-A□ HRGC002-A□	1
005	HRGC005-A□	1

## Dimensions

[Dustproof filter set]

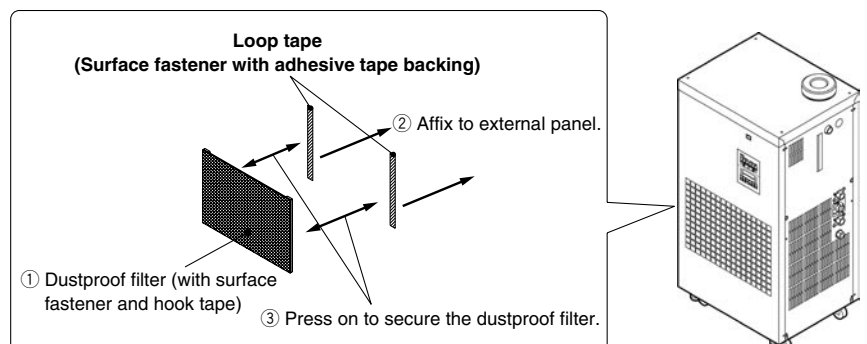


Part no.	(mm)			Quantity per set
	A	B	C	
HRGC-FL001	475	310	10	1
HRGC-FL005	430	530	10	1

## Mounting Example

[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.



# Series HRGC Warranty

## 1. Conditions of warranty

When a nonconformance should take place to our thermo-cooler, 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 operating manual.
- 2) Conduct inspection and maintenance (daily check-up, regular check-up) as mentioned in the operating manual.
- 3) Record the inspection and maintenance results as mentioned in the operating 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.





Series *HRGC*

# Safety Instructions

The following safety instructions are intended to prevent a hazardous situation and/or equipment damage. The instructions indicate the level of potential hazard by a label of "**Caution**", "**Warning**" or "**Danger**". To ensure safety, please observe safety practices.

 **Caution** : Operator error could result in injury or equipment damage.

 **Warning** : Operator error could result in serious injury or loss of life.

 **Danger** : In extreme conditions, there is a possible result of serious injury or loss of life.

## Warning

**1. The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.**

Since the products specified here are used in various operating conditions, their compatibility with the specific system must be based on specifications or after analysis and/or tests to meet your specific requirements. The expected performance and safety assurance will be the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalog information with a view to giving due consideration to any possibility of equipment failure when configuring a system.

**2. Only trained personnel should operate pneumatic machinery and equipment.**

The equipment can be dangerous if handled incorrectly. Assembly, handling or maintenance of systems should be performed by trained and experienced operators.

**3. Do not service the machinery/equipment or attempt to remove components until the safety is confirmed.**

1. Inspection and maintenance of the machinery/equipment should only be performed after confirming that all safety precautions have been taken.
2. If the equipment must be removed, confirm that all safety precautions have been taken before beginning.
3. Before the machinery/equipment is restarted, confirm that all safety precautions have been taken.

**4. If the equipment will be used in the following conditions or environment, please contact SMC first and be sure to take all necessary safety precautions.**

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, clutch and brake circuits in press applications, or safety equipment.
3. An application which has the possibility of having a negative effect on people, property, requiring special safety analysis.

## ■ Exemption from Liability

1. SMC, its officers and employees shall be exempted from liability for any loss or damage arising out of earthquakes or fire, action by a third person, accidents, customer error with or without intention, product misuse, and any other damages caused by abnormal operating conditions.
2. SMC, its officers and employees shall be exempted from liability for any direct or indirect loss or damage, including consequential loss or damage, loss of profits, or loss of chance, claims, demands, proceedings, costs, expenses, awards, judgments and any other liability whatsoever including legal costs and expenses, which may be suffered or incurred, whether in tort (including negligence), contract, breach of statutory duty, equity or otherwise.
3. SMC is exempted from liability for any damages caused by operations not contained in the catalogs and/or instruction manuals, and operations outside of the specification range.
4. SMC is exempted from liability for any loss or damage whatsoever caused by malfunctions of its products when combined with other devices or software.



# Temperature Control Equipment Precautions 1

Be sure to read this before handling. Refer to the back of page 1 for Safety Instructions and the back of page 6 through to 10 for Specific Product Precautions.

## Selection

### 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, 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 operating 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 a malfunction.

1. In locations where water, steam, brine, 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)
15. Clean room

## Fluid

### Warning

#### 1. Type of fluids

1. The operating fluids must be used within the specified range shown in this catalog.  
Consult SMC when using the product with other fluids.
2. When foreign matter may be mixed with a fluid, install a filter.

## 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 transporting 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.

## Mounting / Installation

### Warning

#### 1. Installation should be performed by a knowledgeable and experienced person.

Especially, installation of a heavy object is dangerous. This product is heavy. 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. Confirm the mounting orientation.

Mount and install horizontally.



# Temperature Control Equipment Precautions 2

Be sure to read this before handling. Refer to the back of page 1 for Safety Instructions and the back of page 6 through to 10 for Specific Product Precautions.

## Piping

### Warning

- 1. 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 operating manual.**

Read the operating manual completely before piping, and keep a copy on-site, for future reference.
- 4. Observe the tightening torque for screws.**

When installing fitting, etc., follow the given torque levels below.

**Tightening Torque for Piping**

Connecting thread	Applicable tightening torque N•m
M3	0.63
M4	1.5
M5	1.5 to 2
Rc1/8	7 to 9
Rc1/4	12 to 14
Rc3/8	22 to 24
Rc1/2	28 to 30
Rc3/4	28 to 30
Rc1	36 to 38
Rc1 1/4	40 to 42
Rc1 1/2	48 to 50
Rc2	48 to 50

- 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.

### Caution

- 1. Before piping**

Confirm that chips, cutting oil, dust etc., in contact with piping is cleaned up or air blown (flushing) before piping.
- 2. Use caution regarding the flowing direction of the fluid.**

When installing piping to a product, do not mistake the flow direction of supply port, etc. Check "IN" and "OUT" or labels and the operating manual before connection.
- 3. Sealant tape**

When installing piping or fitting into a port, ensure that sealant material does not enter the port internally. When using sealant tape, leave 1.5 to 2 threads exposed on the end of pipe/fitting.
- 4. Take countermeasures against condensation.**

Depending on the operating condition, condensation may occur in the piping. In such a case, take countermeasures such as installing insulation material, etc.



# Temperature Control Equipment Precautions 3

Be sure to read this before handling. Refer to the back of page 1 for Safety Instructions and the back of page 6 through to 10 for Specific Product Precautions.

## Electrical Wiring

### 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 circuit breaker.

As a countermeasure against current leakage, install a 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, volume, and frequency. Confirm that the voltage fluctuation is within  $\pm 10\%$  of the specified value.

#### 4. Grounding

Be sure to ground (frame ground) with class D grounding (grounding resistance of 100  $\Omega$  or less). Can be grounded with the ground wire of the power cord. Also, do not use together with equipment that generates a strong solenoid 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 refrigerator type)

### Warning

#### 1. Be sure to supply the facility water.

1. Prohibition of water-cut operation, micro small amount of water operation.

Do not operate under the condition that there is no facility water or where there is an extremely small amount 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, 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, consult SMC.
2. When it is likely that foreign matter may enter the fluid, install a filter (20 mesh or equivalent).

#### Facility Water Quality Standard

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

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

\* In case of [M $\Omega$ ·cm], it will be 0.00125 to 0.01.



# Temperature Control Equipment Precautions 4

Be sure to read this before handling. Refer to the back of page 1 for Safety Instructions and the back of page 6 through to 10 for Specific Product Precautions.

## 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 electric wiring conditions.**
  1. Confirm that the mounting and installation conditions are safe.
  2. Confirm that the circulating fluid is filled and that the fluid level is within the display range.
  3. 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.
  4. Confirm the flow direction of the fluid.

Make sure that the flow direction of the fluid (Inlet/Outlet direction) is connected correctly.
  5. Confirm that the electrical wiring condition is safe.

Incorrect wiring will lead to a malfunction or breakage of the product. Confirm that there is no error in wiring before operation.
  6. When using the product with a 3-phase power supply, confirm the connection.

If the phase order is incorrect, the pump, etc. will run in reverse, or the phase-reversal relay will activate and the product will not operate.

In this case, after installing the main power supply, reverse 2 wires out of the 3 wires and connect them in the correct phase order.
- 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 the power supply breaker.
- 6. When not used for a long period of time, confirm the safety once again prior to beginning its operation.**

## Maintenance

### Warning

- 1. Maintenance should be performed according to the procedure indicated in the operating manual.**

Improper handling can cause damage and malfunction of equipment and machinery.
  - 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, turn 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 operating fluid (circulating fluid, facility water) and cut the main power supply.
  - 7. Removal of product**

Take the stop/inspection measures and confirm that there is no danger before the product is removed.

In the event of removing the product, discharge the used fluid and clean the inside of the piping.

When a dangerous fluid or polluted fluid is left, it is likely that the polluted area will be enlarged or an accident will occur.
- 8. Disposal of product**

When the product is disposed, it must be in compliance the ordinance or rules of the local municipality.

Ask for help from a professional industrial waste disposal company.

In particularly, in case of a refrigerant type product, entrust a company to collect the refrigerant, etc.

In that case, the customer may be requested to submit a certificate that is showing the type of operating fluid and whether any quantity is left.

These procedures are the responsibility of the customer.
- 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.



# Series HRGC Specific Product Precautions 1

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

## Design

### ⚠ Warning

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

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

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

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

## Selection

### ⚠ Warning

#### 1. Model selection

For selecting a model of thermo-cooler, it is required to know the heat generation amount of a customer's equipment. Obtain the heat generation amount, referring to the model selection example for the HRGC series before selecting a model.

#### 2. Indication of model number

Select the cooling method and temperature stability depending on a customer's application.

## Handling

### ⚠ Warning

#### 1. Thoroughly read the operating manual.

Read the operating manual completely before operation, and keep a copy on-site, for future reference.

## 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.  
If it is necessary to use the unit in an environment where there is a risk of the fin portion of the air-condenser becoming clogged, use the dustproof filter set (sold separately).
5. A place in which water freezes. If such an environment is unavoidable, contact SMC.

#### 2. Install in an environment where the unit will not come into direct contact with rain or snow.

(HRGC001 to HRGC005)

These models are for indoor use only.

Do not install outdoors where rain or snow may fall on them.

## Operating Environment / Storage Environment

### ⚠ Warning

#### 3. Conduct ventilation and cooling to discharge heat.

(Air-cooled refrigerator)

The heat which is cooled down through air-cooled condenser is discharged.

When using in a room which is shut tightly, ambient temperature will exceed the specification range stipulated in this catalog, which will activate the safety detector and stop the operation.

In order to avoid this situation, discharge the heat outside of a room by ventilation or cooling facilities.

#### 4. The thermo-chiller is not designed for a clean room. It generates particles internally.

## Circulating Fluid

### ⚠ Caution

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

#### 2. When using clean 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.

#### Clean 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"

	Item	Unit	Standard value
Standard item	pH (at 25°C)	—	6.8 to 8.0
	Electric conductivity (25°C)	[μS/cm]	100* to 300*
	Chloride ion (Cl <sup>-</sup> )	[mg/L]	50 or less
	Sulfuric acid ion (SO <sub>4</sub> <sup>2-</sup> )	[mg/L]	50 or less
	Acid consumption amount (at pH4.8)	[mg/L]	50 or less
	Total hardness	[mg/L]	70 or less
	Calcium hardness (CaCO <sub>3</sub> )	[mg/L]	50 or less
Reference item	Ionic state silica (SiO <sub>2</sub> )	[mg/L]	30 or less
	Iron (Fe)	[mg/L]	0.3 or less
	Copper (Cu)	[mg/L]	0.1 or less
	Sulfide ion (S <sub>2</sub> <sup>-</sup> )	[mg/L]	Should not be detected.
	Ammonium ion (NH <sub>4</sub> <sup>+</sup> )	[mg/L]	0.1 or less
	Residual chlorine (Cl)	[mg/L]	0.3 or less
	Free carbon (CO <sub>2</sub> )	[mg/L]	4.0 or less

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

#### (HRGC001/002)

#### 1. A magnet pump is used as a circulating pump for the lubricating liquid.

It is particularly impossible to use liquid including metallic powder such as iron powder.



# Series HRGC Specific Product Precautions 2

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

## Transportation / Transfer / Movement

### Warning

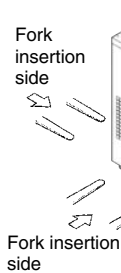
#### 1. Transportation by forklift (HRGC001 to 005)

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 instruction 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.

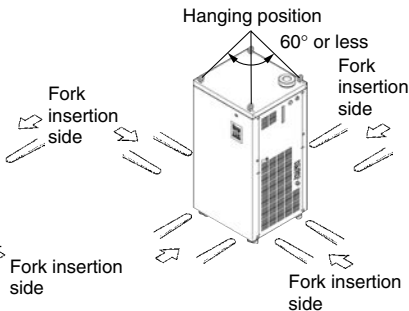
#### 2. Hanging transportation (HRGC005)

1. Crane manipulation and slinging work should be done by an eligible person.
2. Do not grip the piping or the handles of the panel on the right side.
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°.

#### HRGC001/002



#### HRGC005



#### 3. Transporting using casters

1. This product is heavy and should be moved by at least two people.
2. Do not grip the piping port 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.

## Mounting / Installation

### Warning

#### 1. Do not place heavy objects on top of this piping, or step on it.

The external panel can be deformed and danger can result.

#### 2. Lower the adjuster and do not move.

Be sure to lower all four adjusters to the level of the floor.

### Caution

#### 1. Install on a rigid floor which can withstand this product's weight.

#### 2. Secure with bolts, anchor bolts, etc.

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

#### Tightening Torque for Fixing Threads

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

#### (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 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 10 m or less.

Be sure to pipe the overflow outlet to a wastewater collection pit, etc.





# Series HRGC Specific Product Precautions 4

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

## Operation

### Warning

#### 1. Confirmation before operation

1. The fluid level of a tank should be within the specified range of "HIGH" and "LOW".  
When exceeding the specified level, the circulating fluid will overflow.
2. Remove the air.  
Conduct a trial operation, looking at the fluid level.  
Since the fluid level will go down when the air is removed from a customer's piping system, supply water once again when the fluid level is reduced. When there is no reduction in the fluid level, the job of removing the air is completed.
3. Handling of by-pass valve  
At the time this product is shipped from our factory, the by-pass valve is fully open.  
Operation with it fully closed will cause the circulating fluid outlet pressure to increase high and it may safely stop in order to prevent the pump's operation from overloading.  
When operating for the first time after installation, be sure to operate it with the by-pass valve fully open.

#### 2. Confirmation during operation

1. Adjust the by-pass valve.  
Monitor the external piping, pressure gauge, or flow meter mounted on the equipment from the customer's side, in order to adjust the open angle of the by-pass valve, so that the required pressure or flow can be obtained.
2. Confirm the circulating fluid temperature.  
The operating temperature range of the circulating fluid is between 5 and 35°C.  
When the amount of heat generated from a customer's equipment is greater than the product's capability, the circulating fluid temperature may exceed this range. Use caution regarding this matter.

#### 3. Emergency stop method

- When an abnormality is confirmed, stop the equipment immediately.  
After pushing the (OFF) switch, be sure to turn off the power supply breaker.

### Caution

#### 1. The temperature setting value is written in EEPROM, but the number of times it can be written to is limited to approximately one million.

Especially when using communication function, save data with STOR before stoppage, and do not carry out frequent saving (STOR) of temporary setting values.

## Protection Circuit

### Caution

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

- Power supply voltage is not within the rated voltage range of  $\pm 10\%$ .
- In case the water level inside the tank is reduced abnormally.
- Facility water is not supplied. (HRGC□□□-W)
- Transfer pressure of the circulating fluid is too high.
- Circulating fluid temperature is too high.
- Compared to the cooling capacity, the heat generation amount of a customer's equipment is too high.
- Ambient temperature is too high (40°C or higher)
- Refrigerant pressure is too high.
- Ventilation hole is clogged with dust or dirt. (Especially HRGC□□□-A)

## Maintenance

### Warning

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

#### 2. In the event of cleaning, 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. In the event of cleaning the air cooled condenser, do not touch the fin directly.

This may lead to injuries.

### Caution

#### <Periodical inspection every one month> (Air-cooled refrigerator type HRGC□□□-A□)

##### 1. Cleaning the ventilation hole

If the fin portion of the air-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.



# Series HRGC Specific Product Precautions 5

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

## Maintenance

### Caution

(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-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.

##### 1. When using clean water

- Replacement of clean water  
Failure to replace the clean water can lead to the development of bacteria or algae. Replace it regularly depending on your usage conditions.
- Tank cleaning  
Consider whether dirt, slime or foreign objects may be present in the circulating fluid inside the tank, and carry out regular cleanings of the tank.

##### 2. When using ethylene glycol aqueous solution

Use a concentration 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>

(HRGC005-□□) <sup>Note 1)</sup>

#### 1. Inspect the circulating fluid.

##### 1. 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 3 (cc/h) or less (reference value) according to the JIS standard, replace the mechanical seal when the amount of leakage is 0.3 (cc/h) or greater.

Also, as a guide for periodically replacement, the operation hours is 6000 to 8000 hours. (normally 1 year) <sup>Note 2)</sup>

Note 1) In case of the HRGC001/002, because the pump included in the unit is a magnet pump with no rotating shaft seal, it is not necessary to inspect the mechanical seal (rotating shaft seal).

Note 2) 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 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 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 5°C, the pump will stop automatically.

As a result, the circulating fluid maintains a temperature of between 3°C and 5°C, preventing freezing.

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

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 clean water or deionized water) beforehand.

#### 3. Consult a professional.

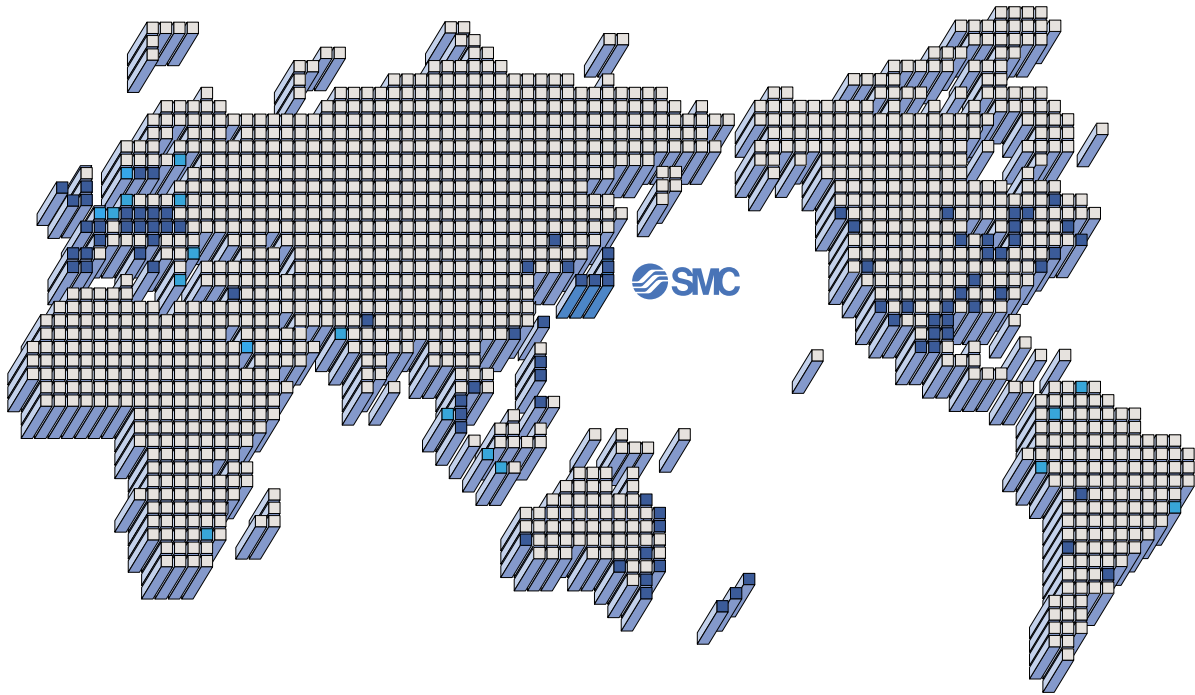
For additional methods to prevent freezing (such as commercially available tape heaters, etc.), consult a professional for advice.







# SMC'S GLOBAL MANUFACTURING, DISTRIBUTION AND SERVICE NETWORK



## EUROPE

### AUSTRIA

SMC Pneumatik GmbH (Austria)

### BELGIUM

SMC Pneumatics N.V./S.A.

### BULGARIA

SMC Industrial Automation Bulgaria Eood

### CROATIA

SMC Industrijska Automatika d.o.o.

### CZECH REPUBLIC

SMC Industrial Automation CZ s.r.o.

### DENMARK

SMC Pneumatik A/S

### ESTONIA

SMC Pneumatics Estonia OÜ

### FINLAND

SMC Pneumatics Finland Oy

### FRANCE

SMC Pneumatique SA

### GERMANY

SMC Pneumatik GmbH

### GREECE

SMC Hellas E.P.E.

### HUNGARY

SMC Hungary Ipari Automatizálási Kft.

### IRELAND

SMC Pneumatics (Ireland) Ltd.

### ITALY

SMC Italia S.p.A.

### LATVIA

SMC Pneumatics Latvia SIA

### LITHUANIA

UAB "SMC Pneumatics"

### NETHERLANDS

SMC Pneumatics B.V.

### NORWAY

SMC Pneumatics Norway AS

### POLAND

SMC Industrial Automation Polska Sp.z.o.o.

### ROMANIA

SMC Romania S.r.l.

### RUSSIA

SMC Pneumatik LLC

### SLOVAKIA

SMC Priemyselná Automatizácia Spol s.r.o.

### SLOVENIA

SMC Industrijska Avtomatika d.o.o.

### SPAIN/PORTUGAL

SMC España S.A.

### SWEDEN

SMC Pneumatics Sweden AB

### SWITZERLAND

SMC Pneumatik AG

### U.K.

SMC Pneumatics (U.K.) Ltd.

## ASIA

### CHINA

SMC (China) Co., Ltd.

### HONG KONG

SMC Pneumatics (Hong Kong) Ltd.

### INDIA

SMC Pneumatics (India) Pvt. Ltd.

### INDONESIA

PT SMC Pneumatics Indonesia

### MALAYSIA

SMC Pneumatics (S.E.A.) Sdn. Bhd.

### PHILIPPINES

Shoketsu SMC Corporation

### SINGAPORE

SMC Pneumatics (S.E.A.) Pte. Ltd.

### SOUTH KOREA

SMC Pneumatics Korea Co., Ltd.

### TAIWAN

SMC Pneumatics (Taiwan) Co., Ltd.

### THAILAND

SMC (Thailand) Ltd.

## NORTH AMERICA

### CANADA

SMC Pneumatics (Canada) Ltd.

### MEXICO

SMC Corporation (Mexico), S.A. de C.V.

### U.S.A.

SMC Corporation of America

## SOUTH AMERICA

### ARGENTINA

SMC Argentina S.A.

### BOLIVIA

SMC Pneumatics Bolivia S.r.l.

### BRAZIL

SMC Pneumáticos do Brasil Ltda

### CHILE

SMC Pneumatics (Chile) S.A.

### VENEZUELA

SMC Neumatica Venezuela S.A.

## OCEANIA

### AUSTRALIA

SMC Pneumatics (Australia) Pty. Ltd.

### NEW ZEALAND

SMC Pneumatics (N.Z.) Ltd.

## SMC Corporation

Akihabara UDX 15F,  
4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, JAPAN  
Phone: 03-5207-8249 Fax: 03-5298-5362  
URL <http://www.smcworld.com>  
© 2007 SMC Corporation All Rights Reserved

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

D-DN

1st printing LY printing LY 13500DN Printed in Japan.

This catalog is printed on recycled paper with concern for the global environment.