Production of HRGC001/ 002 will be discontinued in January 2011. Thereafter, please select Series HRS.

# **Refrigerated Thermo-cooler** Series HRGC

Worldwide in voltage: Single phase 200 to 23	30 VAC, 50/60 Hz	IRG
International standards: ( E 🔊		-
Energy saving: Stop-idling function (±1°C type)		IGC
Automatic facility-water-saving fu	Inction (water-cooled)	HF
Environmentally friendly: (RoHS), Refrigerant <b>H</b>		S
$\pm 0.5^{\circ}$ C (Proportional v	alve PID control)	HR
Easy installation: No need for facility water (air-c Strainer (water-cooled), Stainle standard equipment, No need f	ooled), Caster, By-pass valve and ss steel drain pan available as or power supply for remote operation	HRZ
Easy maintenance: "Alarm code" display, Access	ible from the front electric control panel	
A variety of "Options" and "Optional Accessories"	(Pages 59 to 64)	RZD
With earth leakage breaker     With automatic water sup     With communications function (RS-485)     With external switch inlet	ply function	I
<ul> <li>With communications function (RS-232C)</li> <li>With water leakage sensor</li> <li>With heater</li> <li>With DI control kit</li> </ul>	ts for circulating fluid • DJ-pass piping set • DI (deionized water) filter • Insulating material for DI (deionized water) filter	HRW
		НЕС
	•	
		HEB
		НЕD
	4 4	cal
Cooling capacity (60 Hz):		Techni Data
1.1 kW/2.3 kW/4.8 kW (Air-cooled ref	rigeration/Water-cooled refrigeration)	ed Sts
● Temperature stability: ±1°C (Refrigeration of the stability)	tor ON/OFF control)	selate rodu
$\pm$ <b>U_J</b> °C (Proportional valve PID control)		r C

Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.



# Material compatible with a wide variety of circulating fluids is used for wetted parts.

• 15% ethylene glycol aqueous solution

• Clear water, Deionized water Note)

Note) Supply water with electrical conductivity of 1  $\mu$  S/cm or more.

However, the same level of electrical conductivity cannot be maintained.

An optional DI control kit (option Y) is available to maintain electrical resistance. Refer to page 62 for details.

# Easy Installation and Maintenance

# Simple operation

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?!



## With alarm code indicators

Fault, Warn and alarm code indicators for easy failure diagnosis

- Fault (FAULT) indicator (red LED)
- · Warning (WARN) indicator (yellow LED)

Note) Refer to page 57 for operation display panel and alarms.

HRG

HRGC

HRS

HRZ

HRZD

HRW

HEC

HEB

HED

Technical Data

**Related Products** 

# 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

Checking the electrical component parts accessible from the front side. Reset switches such as pump, compressor thermal relay are located inside the electrical component enclosure.



# Options

- With earth leakage breaker
- With communications function (RS-485)
- With communications function (RS-232C)
- With water leakage sensor
- With heater
- With automatic water supply function
- With external switch inlet
- Stainless steel wetted parts
- for circulating fluid
- High-lift pump
- With DI control kit
- (Refer to pages 59 to 62 for options.)

# **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.

# Optional accessories

Dustproof filters for the air-cooled refrigeration and by-pass piping set for preventing pressure increase are available. These improve durability and ease of use.

(Refer to pages 63 and 64 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 a level foot which can be used as a brake.





# Communications

Communications function (RS-485. **RS-232C)** 

(Refer to pages 59 to 62 for options.)

Contact input/output function (Refer to page 58.)

# **Application Examples**



# **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 cool the customer's machine side, it will heat up and return to the Thermo-cooler.

#### ■ Temperature stability: ±0.5°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 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 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 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 in excessively cold conditions.

#### ■ Temperature stability: ±1.0°C type (HRGC□□□-□)

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 (HRGC□□□-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.

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**SMC** 

Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.

#### **Model Selection**

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Series HRGC

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HRZ

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Series HRGC

## **Guide to Model Selection**

# 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.

(Note that ventilation or air conditioning is required to dissipate heat: For details, refer to page 65, Specific Product Precautions 1, Operating Environment/Storage Environment 3.)

# 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 Thermocooler

5°C to 35°C

Example) Customer requirement: 20°C

## 3. What power supply frequency?

Thermo-cooler power supply frequency specifications

50 Hz, 60 Hz (common use)

Example) Customer requirement: 60 Hz

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

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

Example) Customer requirement: 4.2 kW (Refer to Example 1 (1).)

## Selection

### Example: Customer requirements 1 to 4

Cooling method	: Air-cooled refrigeration
Circulating fluid temperatur	e: 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 refrigeration Thermo-cooler at 60 Hz (page 53). 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 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 **HRGC005-A**.

# **Model Selection**

Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.

## **Required Cooling Capacity Calculation**

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

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

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

Power consumption P: 3.5 [kW]

Q = P = 3.5 [kW]

Cooling capacity = Considering a safety factor of 20%, 3.5 [kW] x 1.2 = 4.2 [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:

Cooling capacity = Considering a safety factor of 20%, 3.5 [kW] x 1.2 = 4.2 [kW]

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

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

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

In this example, use an efficiency of 0.7:

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

Cooling capacity = Considering a safety factor of 20%, 3.14 [kW] x 1.2 ≈ 3.8 [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.



## 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 [kW] ([kJ/s]) Circulating fluid Clear water

: (= ρ x <b>q</b> v ÷ 60) [kg/s]
: 1 [kg/dm <sup>3</sup> ]
: 25 [dm <sup>3</sup> /min]
: 4.2 [kJ/(kg•K)]
: 293 [K] (20 [°C])
: 295 [K] (22 [°C])
: 2.0 [K] (= <b>T</b> 2 – <b>T</b> 1)
: 60 [s/min]

\* Refer to page 50 for the typical physical property values of clear water or other circulating fluids.

$$= qm x C x (T_2 - T_1) = \frac{\rho x q_v x C x \Delta T}{60} = \frac{1 x 25 x 4.2 x 2.0}{60}$$

Q

= 3.50 [kJ/s] ~ 3.5 [kW]

Cooling capacity = Considering a safety factor of 20%, 3.5 [kW] x 1.2 = 4.2 [kW]



≈ 3.5 [kW] Cooling capacity = Considering a safety factor of 20%, 3.5 [kW] x 1.2 = 4.2 [kW]

HEB

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**Related Products** 

Data

HRG

# Model Selection

# **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 [kW] ([kJ/s]) Cooled substance : Water Cooled substance mass m : (=  $\rho \times V$ ) [kg] Cooled substance density p : 1 [kg/dm<sup>3</sup>]

Cooled substance total volume V	: 60 [dm <sup>3</sup> ]
Cooled substance specific heat capacity C	: 4.2 [kJ/(kg•K)]
Cooled substance temperature when cooling begins	To: 305 [K] (32 [°C])
Cooled substance temperature after t hour Tt	: 293 [K] (20 [°C])
Cooling temperature difference $\Delta T$	: 12 [K] (= <b>T</b> 0 – <b>T</b> t)
Cooling time $\Delta t$	: 900 [s] (= 15 [min])

\* Refer to the lower right for the typical physical property value by circulating fluid.

$$Q = \frac{m \times C \times (Tt - To)}{\Delta t}$$
$$= \frac{\rho \times V \times C \times \Delta T}{\Delta t}$$
$$= \frac{1 \times 60 \times 4.2 \times 12}{900}$$

= 3.36 [kJ/s] ~ 3.4 [kW]

Cooling capacity = Considering a safety factor of 20%,



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 un	its (Reference)
Heat quantity by cooled substance (per unit time) Cooled substance Cooled substance weight <b>m</b> Cooled substance weight volume ratio $\gamma$ Cooled substance total volume <b>V</b> Cooled substance specific heat capacity <b>C</b> Cooled substance temperature when cooling begins <b>T</b> Cooled substance temperature after t hour <b>T</b> t Cooling temperature difference $\Delta$ <b>T</b> Cooling time $\Delta$ <b>t</b> Conversion factor: hours to minutes Conversion factor: kcal/h to kW	$\begin{array}{l} \textbf{Q}: \mbox{ Unknown} [kcal/h] \rightarrow [kW] \\ : \mbox{ Water} \\ : (= \rho \times \textbf{V}) [kgf] \\ : 1 [kgf/L] \\ : 60 [L] \\ : 1.0 [kcal/(kgf \cdot ^{\circ}C)] \\ : 20 [^{\circ}C] \\ : 20 [^{\circ}C] \\ : 12 [^{\circ}C] (= \textbf{To} - \textbf{Tt}) \\ : 15 [min] \\ : 60 [min/h] \\ : 860 [(kcal/h)/kW] \end{array}$
$\mathbf{Q} = \frac{\mathbf{m} \mathbf{x} \mathbf{C} \mathbf{x} (Tt - To)}{\Delta t \mathbf{x} 860}$	
$=\frac{\gamma \times V \times 60 \times C \times \Delta T}{\Delta t \times 860}$	
$=\frac{1 \times 60 \times 60 \times 1.0 \times 12}{15 \times 860}$	
= <mark>860 [kcal/h]</mark> ≈ 3.4 [kW]	
Cooling capacity = Considering a safety fa	actor of 20%,
3.4 [kW] x 1.2 = 4.08 [kW]	

## **Precautions on Model Selection**

#### 1. Heating capacity

When the circulating fluid temperature is set above room temperature, it needs to be heated due to heat generation of a pump in the Thermo-cooler. 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 HRGC series. Also, circulating fluid flow varies depending on the circulating fluid discharge pressure. Consider the installation height difference between the thermo-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 p: 1 [kg/dm<sup>3</sup>]

(or, using conventional unit system, weight volume ratio  $\gamma = 1 [kgf/L]$ 

Specific heat capacity **C**: 4.19  $[kJ/(kg \cdot K)]$ 

- (or, using conventional unit system, 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)

#### Water

Physical	Demolity		Conventional unit system			
Temperature	[kg/dm <sup>3</sup> ]	[kJ/(kg•K)]	Weight volume ratio γ [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		

#### 15% Ethylene Glycol Aqueous Solution

Physical	Density	On a sifis hash O	Conventional unit system				
Temperature	[kg/L]	[kJ/(kg•K)]	Weight volume ratio γ [kgf/L]	Specific heat C [kcal/(kgf•°C)]			
5°C	1.02	3.91	1.02	0.93			
10°C	1.02	3.91	1.02	0.93			
15°C	1.02	3.91	1.02	0.93			
20°C	1.01	3.91	1.01	0.93			
25°C	1.01	3.91	1.01	0.93			
30°C	1.01	3.91	1.01	0.94			
35°C	1.01	3.92	1.01	0.94			

Note) The above shown are reference values.

Please contact circulating fluid supplier for details.



NPT (with PT-NPT conversion fitting)



## **Options and Combinations**

Symbol Note 1)	В	С	S	E	Н	J	К	М	Т	Y
Option Note 2) Size	With earth leakage breaker	Note 3) With communica- tions function (RS-485)	Note 3) Note 5) With communica- tions function (RS-232C)	With water leakage sensor	Note 4) With heater	With automatic water supply function	Note 5) With external switch inlet	Note 4) Stainless steel wetted parts for circulating fluid	High-lift pump	Note 4) With DI control kit
HRGC001-□ (Temperature stability ±1.0°C)	•	•	•	•	•	•	•	•	•	•
HRGC001-□5 (Temperature stability ±0.5°C)	•	•	•	•		•	•	—	•	
HRGC002- (Temperature stability ±1.0°C)	•	•	•	•	•	•	•	•	•	•
HRGC002-□5 (Temperature stability ±0.5°C)	•	•	•	•		•	•	_	•	
HRGC005- (Temperature stability ±1.0°C)	•	•	•	•	•	•	•	•		•
HRGC005-□5 (Temperature stability ±0.5°C)	•	•	•	•			•	_		_

Ν

Note 1) When multiple options are combined, indicate symbols in alphabetical order.

Note 2) Refer to pages 59 to 62 for details on options.

Note 3) Option C (with communications function (RS-485)) and option S (with communications function (RS-232C)) cannot be combined.

Note 4) Option M (stainless steel wetted parts for circulating fluid) and option Y (with DI control kit) cannot be combined.

When combined with option H (with heater), circulating fluid temperature will be between 5°C and 35°C.

Note 5) Option K (with external switch inlet) and option S (with communications function (RS-232C)) cannot be combined.

HRG

HRGC

HRS

HRZ

HRZD

HRW

HEC

HEB

HED

# Series HRGC

Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.

#### Specifications (Refer to the product specifications for details.)

#### HRGC001/002/005

	Model	HRG	C001	HRG	C002	HRG	C005					
С	ooling method	Air-cooled refrigeration	Water-cooled refrigeration	Air-cooled refrigeration	Water-cooled refrigeration	Air-cooled refrigeration	Water-cooled refrigeration					
R	efrigerant			R407C	(HFC)							
С	ontrol method		Compressor O	V/OFF control o	r Proportional va	alve PID control						
Α	mbient temperature/humidity Note 1)		Tempera	ature: 5 to 40°C,	Humidity: 30 to	70%RH						
	Circulating fluid Note 2)	Cl	ear water, Deior	nized water, 15%	6 ethylene glyco	l aqueous soluti	on					
	Circulating method			For externally	sealed circuit							
E	Temperature range setting Note 1) (°C)			5 to	o 35							
l syst	Cooling capacity Note 3) (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)					
luic	Heating capacity Note 4) (kW)	—										
lg f	Temperature stability Note 5)(°C)	±1.0	(Compressor O	N/OFF control),	±0.5 (Proportion	nal valve PID co	ntrol)					
atir	Pump capacity Note 6) (50/60 Hz) (MPa)		0.13/0.18 (a	at 10 L/min)		0.21/0.32 (at 2	23 L/28 L/min)					
cul	Rated flow Note 7) (50/60 Hz) (L/min)	10/10 23/28										
Cit	Tank capacity (L)	Approx. 10 Approx. 20										
	Port size			Rc	1/2							
	Wetted parts material	Stainless steel, PPE, PVC, Copper brazing (Heat exchanger), Bronze, Brass										
tem	Temperature range(°C)		5 to 32		5 to 32		5 to 32					
r sys	Pressure range (MPa)		0.3 to 0.5	_	0.3 to 0.5	<u> </u>	0.3 to 0.5					
wate	Required flow rate Note 8) (50/60 Hz) (L/min)		10/12		10/12	<u> </u>	27/28					
ility	Port size		Rc1/2		Rc1/2	Rc1/2 — Rc						
Fac	Wetted parts material	Stainless steel, PVC, Copper brazing (Heat exchanger), Bronze, Brass										
	Power supply	Single	-phase 200 to 2	30 VAC 50/60 H	Iz Allowable vo	Itage fluctuation	±10%					
tem	Applicable earth leakage breaker capacity Note 9) (A)	1	5	1	5	3	0					
sys	Maximum operating current (A)	8.1	7.8	8.6	8.0	17.2	14.1					
als	Rated power consumption Note 11) (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					
iric	Remote operation signal input	Relay contact	input (operates	when the switc	h is closed, stop	s when the swit	ch is opened)					
llec	Operation signal output	Relay contact ou	tput (switch closed	when operating, sw	vitch open when sto	pped, switch open	when shut down)					
	Alarm stop signal output	Relay contact output	(switch closed when a	larm is turned off, swit	tch open when alarm is	s turned on, switch clos	ed when shut down)					
	Alarm			Refer to	page 57.	1						
W	/eight Note 10) (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, please consult SMC separately.

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).

Deionized water can be used only for supply water. Supply water with electrical conductivity of 1 μS/cm or more (or electrical resistivity of 1 MΩ·cm or less). An optional DI control kit (option Y) is available to maintain electrical resistance. Refer to page 62 for details. If ethylene glycol aqueous solution is used, maintain the concentration at 15%.

Note 3) ① Ambient temperature: 32°C, Facility water temperature: 25°C (water-cooled refrigeration), ② Circulating fluid temperature: 20°C,

③ Circulating fluid flow rate: Values at rated circulating fluid flow rate.

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

(When heating capability is required, use a product with an optional heater (option H). Refer to page 59 for details.)

Note 5) Outlet temperature when the circulating fluid 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 6) The capacity at the Thermo-cooler outlet when the circulating fluid temperature is at 20°C.

Note 7) Required flow rate 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. Also, use the by-pass piping set sold separately.

Note 8) Required flow rate when a load for the cooling capacity is applied at a facility water temperature of 25°C.

Note 9) Purchase an earth leakage breaker with current sensitivity of 30 mA separately. (A product with an optional earth leakage breaker (option B) is also available. Refer to page 59.)

Note 10) Weight in the dry state without circulating fluids

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

#### Accessories (Enclosed)

Content	Applicable model
Eye bolt M12 (4 pcs.)	HRGC005
Y-type strainer (1 pc.)	Water-cooled type

• Eye bolts are included in HRGC005. (Not assembled)

• A Y-type strainer is included in the water-cooled type. (Not assembled)

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Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.

# **Cooling Capacity**



## HRGC002-A/002-W



## HRGC005-A/005-W



# **Pump Capacity**



## HRGC005-A/005-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.

HED

Technical Data

Related Products



# Series HRGC

Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.

## **Dimensions: Air-Cooled Refrigeration**



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**SMC** 

Eye bolts included. (Not assembled)

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# Thermo-cooler Series HRGC

Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.

## **Dimensions: Water-Cooled Refrigeration**



Y-type strainer and eye bolts included. (Not assembled)

# Series HRGC

Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.

# **Piping Connection and Installation Dimensions**

## HRGC001/002



HRG

HRGC

HRS

HRZ

HRZD

HRW

HEC

HEB

HED

Technical Data

**Related Products** 

Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.

## **Operation Display Panel**

## HRGC001/002/005

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

This operation display panel is common to all models.



No.	Description		Function							
1	Digital display PV/SV	PV	Displays the circulating fluid temperature. Displays the alarm code when an alarm is active.							
		SV	Displays the set temperature of the circulating fluid.							
2	[POWER] indicator	Lights	Lights up when the power is supplied.							
3	[RUN] indicator	Lights	Lights up when the [START] key is pressed.							
4	[PUMP] indicator	Lights	up when the pump is running.							
5	[PV] indicator	Lights	Lights up when the circulating fluid temperature is displayed.							
6	[FAULT] indicator	Lights	up when the emergency error occurs, and stops the operation.							
$\bigcirc$	[WARN] indicator	Lights up when the warning error occurs, and continues the operation.								
8	[START] key	Starts the operation.								
9	[STOP] key	Stops the operation.								
10	[RESET] key	Resets the alarm.								
1	[MODE] key	Chang	es settings such as the offset function, etc.							
12	[DOWN] key	Decre	creases the set temperature.							
13	[UP] key	Increases the set temperature.								
14)	[FUNC] key	Changes the display between the circulating fluid temperature and optional functions.								
(15)	[PUMP] kev	Opera	tes the pump independently while pressed.							

## Alarm/Alarm Indicators and Explanation

The 6 basic temperature controller alarms are displayed on the PV of the operation display panel with their alarm codes, as well as the fault (FAULT) indicator (red LED) and warning (WARN) indicator (yellow LED). When the source of the problem has been eliminated, the equipment must be restarted.

## ■ Explanation of Alarms (HRGC001/002/005)

Indicator	Alarm	Operation status	Main reason
	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.
[FAULT]	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 compressor	Stop	Compressor overload relay activated.
[FAULT/WARN]	Abnormal circulating fluid temperature	Stop/Continue	Circulating fluid temperature is out of the customer's preset range.

# 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 warning indicators or buzzers. However, the contact output volume is limited, so please add warning lamps and/or buzzers for special relays (for amplification) if they are necessary.

Item         HRGC001         HRGC002         HRGC005           Connector type         M3 terminal block         Signal type         Relay contact input (Remote star when the contact signal is closed, Remote stop when the contact signal is operation signal input         Signal type         Relay contact input (Remote star when the contact signal is closed, Remote stop when the contact signal is operation signal input           Abnormal status stop signal output         Signal type         Relay contact output (When fault error (FAULT) occurs: open)           Contact capacity         250 VAC, 1 A (Resistance load)         3,4           Operation signal output         Contact capacity         250 VAC, 1 A (Resistance load)         Closed capacity           Signal type         Relay contact output (When operating: closed)         Closed capacity         250 VAC, 1 A (Resistance load)           output         Terminal number         3,4         Contact capacity         250 VAC, 1 A (Resistance load)           signal output         Contact capacity         250 VAC, 1 A (Resistance load)         Closed capacity           Signal type         Relay contact output (When warning error (WARN) occurs: open)         Contact capacity         250 VAC, 1 A (Resistance load)           Communication standard         EIA standard RS-485 compliant         Information orientation         Terminal number           Communication standard         Contact capacity		ltom		Specifications								
Connector type         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 op input coursent           Abnormal status stop signal output         Signal type         Relay contact output (When fault error (FAULT) occurs: open)           Abnormal status stop signal output         Signal type         Relay contact output (When fault error (FAULT) occurs: open)           Contact capacity         250 VAC, 1 A (Resistance load)         Signal type           Operation signal output         Signal type         Relay contact output (When operating: closed)           Contact capacity         250 VAC, 1 A (Resistance load)           Contact capacity         250 VAC, 1 A (Resistance load)           Output         Terminal number         5, 6           Warning signal output         Signal type         Relay contact output (When warning error (WARN) occurs: open)           Contact capacity         250 VAC, 1 A (Resistance load)         Terminal number           Communication standard         ElA standard RS-485 compliant         Contact capacity           Communication standard         ElA standard RS-485 compliant         Information orientation           Information orientation         Half duplex         Synchronization method         Asynchronouse communication		nem	HRGC001		HRGC002	HRGC005						
Remote operation signal input       Signal type       Relay contact input (Remote start when the contact signal is closed, Remote stop when the contact signal is operation signal input         Abnormal status stop signal output       Input current       Max. 35 mA         Abnormal status stop signal output       Signal type       Relay contact output (When fault error (FAULT) occurs: open)         Operation signal output       Contact capacity       250 VAC, 1 A (Resistance load)         Operation signal output       Signal type       Relay contact output (When operating: closed)         Signal output       Signal type       Relay contact output (When warning error (WARN) occurs: open)         Warning signal output       Signal type       Relay contact output (When warning error (WARN) occurs: open)         Communication standard       EIA standard       Resistance load)         Terminal number       7, 8         Communication standard       EIA standard       Resistance load)         RS485) Note)       Synchronization method       Asynchronous communication         (RS-485) Note       Yet WC       1       1         (RS-485) Note       Communication standard       EIA standard       RS-485 compliant         Information orientation       Half duplex       Yet WC       1         (RS-485) Note       Yet WC       24 WCC       1	Con	nector type		Ν	3 terminal block							
Herrote operation signal input       Input voltage range       24 VDC±10% (Power supply is provided on the Thermo-cooler 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)         Signal output       Terminal number       3, 4         Operation signal output       Signal type       Relay contact output (When operating: closed)         Signal output       Terminal number       5, 6         Warning signal output       Signal type       Relay contact output (When warning error (WARN) occurs: open)         Contact capacity       250 VAC, 1 A (Resistance load)       course: open)         Contact capacity       250 VAC, 1 A (Resistance load)       course: open)         Contact capacity       250 VAC, 1 A (Resistance load)       course: open)         Contact capacity       250 VAC, 1 A (Resistance load)       course: open)         Contact capacity       250 VAC, 1 A (Resistance load)       course: open)         Contact capacity       250 VAC, 1 A (Resistance load)       course: open)         Communication standard       ElA standard RS-485 compliant       Information orientation         Information orientation       Herminal number       9, 10       24 VDC </td <td></td> <td>Signal type</td> <td>Relay contact input (Remote star</td> <td>t when the cont</td> <td>act signal is closed, Remote s</td> <td>stop when the contact signal is open.)</td>		Signal type	Relay contact input (Remote star	t when the cont	act signal is closed, Remote s	stop when the contact signal is open.)						
Operation signal input       Input current       Max. 35 mA         Abnormal status stop signal output       Signal type       Relay contact output (When fault error (FAULT) occurs: open)         Contact capacity       250 VAC, 1 A (Resistance load)         Operation signal output       Signal type       Relay contact output (When operating: closed)         Operation signal output       Signal type       Relay contact output (When operating: closed)         Operation signal output       Signal type       Relay contact output (When operating: closed)         Warning signal output       Signal type       Relay contact output (When warning error (WARN) occurs: open)         Contact capacity       250 VAC, 1 A (Resistance load)         Operation signal output       Contact capacity       250 VAC, 1 A (Resistance load)         Communica- tions function (RS-485) Note)       Signal type       Relay contact output (When warning error (WARN) occurs: open)         Communica- tions function (RS-485) Note)       Communication standard       EIA standard       RS-485 compliant         Information orientation       Half duplex       9, 10       9, 10       24 VDC         Voc       To the Thermo-cooler       9, 10       Abnormal status stop signal output (When fault error (FAULT) occurs: open)	Remote	Input voltage range	24 VDC±10%	Power supp	ly is provided on the Th	ermo-cooler side.)						
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)         Operation signal output       Signal type       Relay contact output (When operating: closed)         Contact capacity       250 VAC, 1 A (Resistance load)         Operation signal output       Signal type       Relay contact output (When operating: closed)         Varning signal output       Signal type       Relay contact output (When warning error (WARN) occurs: open)         Contact capacity       250 VAC, 1 A (Resistance load)         Communica- tions function (RS-485) Note)       Communication standard       EIA standard RS-485 compliant         Information orientation (RS-485) Note)       Information orientation Synchronization method       Asynchronous communication         Variation with disease       9, 10       Perminal number       9, 10         24 VDC To the Thermo-cooler (FAULT) occurs: open)       Abnormal status stop signal output (When fault error (FAULT) occurs: open)	signal input	Input current			Max. 35 mA							
Abnormal status stop signal output         Signal type         Relay contact output (When fault error (FAULT) occurs: open)           Operation signal output         Contact capacity         250 VAC, 1 A (Resistance load)           Operation signal output         Signal type         Relay contact output (When operating: closed)           Contact capacity         250 VAC, 1 A (Resistance load)           Contact capacity         250 VAC, 1 A (Resistance load)           Terminal number         5, 6           Warning signal output         Signal type           Contact capacity         250 VAC, 1 A (Resistance load)           Contact capacity         250 VAC, 1 A (Resistance load)           Terminal number         7, 8           Communications function (RS-485) Note)         Communication orientation           Information orientation         Half duplex           Synchronization method         Asynchronous communication           Terminal number         9, 10		Terminal number		1 (24	VDC), 2 (24 VCOM)							
status stop signal output       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)         Output       Terminal number       5, 6         Warning signal output       Signal type       Relay contact output (When warning error (WARN) occurs: open)         Contact capacity       250 VAC, 1 A (Resistance load)       Course: open)         Contact capacity       250 VAC, 1 A (Resistance load)       Course: open)         Contact capacity       250 VAC, 1 A (Resistance load)       Course: open)         Contact capacity       250 VAC, 1 A (Resistance load)       Course: open)         Communica- tions function (RS-485) Note)       Communication standard       EIA standard       RS-485 compliant         Information orientation (RS-485) Note)       Information method       Asynchronous communication       Synchronization method         VEX       VDC       To the Thermo-cooler Capacity or the Contact signal closed: chiller operation)         Abnormal status stop signal output (When fault error (FAULT) occurs: open)       Abnormal status stop signal output (When fault error (FAULT) occurs: open) <td>Abnormal</td> <td>Signal type</td> <td>Relay conta</td> <td>ict output (N</td> <td>/hen fault error (FAULT</td> <td>) occurs: open)</td>	Abnormal	Signal type	Relay conta	ict output (N	/hen fault error (FAULT	) occurs: open)						
signal output       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         Warning signal output       Signal type         Relay contact output (When warning error (WARN) occurs: open)         Contact capacity       250 VAC, 1 A (Resistance load)         Contact capacity       250 VAC, 1 A (Resistance load)         Terminal number       7, 8         Communica- tions function (RS-485) Note)       Communication standard         Information orientation       Half duplex         Synchronization method       Asynchronous communication         (RS-485) Note)       Terminal number         9, 10       24 VDC         Contact signal output       1         Internal number       9, 10         24 VDC       1         To the Thermo-cooler (Contact signal output (Contact signal output (Contact signal output (Contact signal output (When fault error (FAULT) occurs: open)	status stop	Contact capacity	250 VAC, 1 A (Resistance load)									
Operation signal output         Signal type         Relay contact output (When operating: closed)           Contact capacity         250 VAC, 1 A (Resistance load)           Warning signal output         Signal type         Relay contact output (When warning error (WARN) occurs: open)           Warning signal output         Signal type         Relay contact output (When warning error (WARN) occurs: open)           Communica- tions function (RS-485) Note)         Communication standard         EIA standard         RS-485 compliant           Information orientation (RS-485) Note)         Communication method         Asynchronous communication         9, 10           Variation orientation (RS-485) Note)         Synchronization method         Asynchronous communication         9, 10           Variation orientation (RS-485) Note)         Information orientation         Synchronization         9, 10	signal output	Terminal number			3, 4							
signal output       Contact capacity       250 VAC, 1 A (Resistance load)         Warning signal output       Terminal number       5, 6         Warning 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         Communica- tions function (RS-485) Note)       Communication standard       EIA standard         Synchronization method       Asynchronous communication         Terminal number       9, 10         Variation       9, 10         Variation       24 VDC         To the Thermo-cooler       Such contact signal input (Contact signal closed: chiller operation)         Abnormal status stop signal output (When fault error (FAULT) occurs: open)	Operation	Signal type	Rel	Relay contact output (When operating: closed)								
output         Terminal number         5, 6           Warning 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           Communica- tions function (RS-485) Note)         Communication standard         EIA standard RS-485 compliant           Information orientation (RS-485) Note)         Synchronization method         Asynchronous communication           Terminal number         9, 10         9, 10	signal	Contact capacity		250 VAC	, 1 A (Resistance load)							
Warning 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         Communica- tions function (RS-485) Note)       Communication standard       EIA standard         Synchronization method       Asynchronous communication         Terminal number       9, 10         Z4 VDC       To the Thermo-cooler Cooler Cooler Signal input (Contact signal closed: chiller operation)         Abnormal status stop signal output (When fault error (FAULT) occurs: open)	output	Terminal number	5, 6									
Warning signal output       Contact capacity       250 VAC, 1 A (Resistance load)         Terminal number       7, 8         Communica- tions function (RS-485) Note)       Communication standard       EIA standard RS-485 compliant         Synchronization method       Asynchronous communication         Terminal number       9, 10         Terminal number       9, 10         Compute a standard standard       Customer's machine side         Information orientation       1         Information orientation       9, 10         Communication       9, 10         Communication signal input (Contact signal closed: chiller operation)         Abnormal status stop signal output (When fault error (FAULT) occurs: open)		Signal type	Relay contac	t output (Wh	en warning error (WAR	N) occurs: open)						
Signal output       Terminal number       7, 8         Communication standard       EIA standard       RS-485 compliant         Information orientation       Half duplex         Synchronization method       Asynchronous communication         Synchronization method       Asynchronous communication         Terminal number       9, 10         Zet VDC       To the Thermo-cooler         To the Thermo-cooler       9, 10         Remote operation signal input (Contact signal closed: chiller operation)         Abnormal status stop signal output (When fault error (FAULT) occurs: open)	vvarning signal output	Contact capacity		250 VAC, 1 A (Resistance load)								
Communication standard       EIA standard       RS-485 compliant         Information orientation (RS-485) Note)       Information orientation       Half duplex         Synchronization method       Asynchronous communication         Terminal number       9, 10         24 VDC To the Thermo-cooler       Customer's machine side         Amount of the thermo-cooler       Provide the thermo-cooler         Amount of the thermo-cooler       1         Remote operation signal input (Contact signal closed: chiller operation)         Abnormal status stop signal output (When fault error (FAULT) occurs: open)	Signal output	Terminal number	7, 8									
Communications function (RS-485) Note)       Information orientation       Half duplex         Synchronization method       Asynchronous communication         Terminal number       9, 10         24 VDC To the Thermo-cooler C       Customer's machine side         24 VDC To the Thermo-cooler C       Customer's machine side         1       Remote operation signal input (Contact signal closed: chiller operation)         Abnormal status stop signal output (When fault error (FAULT) occurs: open)		Communication standard		EIA stand	lard RS-485 compliant	t						
Synchronization method       Asynchronous communication         Terminal number       9, 10         24 VDC       Customer's machine side         Yes       Yes         Internal       Internal         Internal       Internal         Internal       Yes         Yes       Yes	Communica-	Information orientation		Half duplex								
Terminal number     9, 10       24 VDC To the Thermo-cooler     Customer's machine side       24 VCOM 24 VCOM 24 VCOM 3.9 kΩ internal circuit     Remote operation signal input (Contact signal closed: chiller operation)       Abnormal status stop signal output (When fault error (FAULT) occurs: open)	(RS-485) Note)	Synchronization method	Asynchronous communication									
Circuit diagram	( /	Terminal number	9, 10									
Circuit diagram Circuit diagram Circuit diagram Circuit diagram Circuit diagram Circuit diagram Circuit diagram Coperation signal output (When operating: closed) Alarm signal output (When warning error (WARN) occurs: open) SD <sup>+</sup> SD <sup>-</sup> Communications function (RS-485)	Circu	uit diagram	24 VDC To the The 24 VCOM 3.3 Internal circuit	rmo-cooler kΩ 0 1 % 0 2 0 3 0 3 0 4 0 5 0 6 0 7 8 0 9 0 10 0 10	<ul> <li>Customer's machine side</li> <li>Remote operation signal ir (Contact signal closed: chi</li> <li>Abnormal status stop sign: (When fault error (FAULT)</li> <li>Operation signal output (When operating: closed)</li> <li>Alarm signal output (When warning error (WAR</li> <li>SD+ SD-</li> </ul>	nput Iler operation) al output occurs: open) RN) occurs: open) ction (RS-485)						

Note) Serial communication is optional. Refer to "Options" on page 59.

#### Input/output signal connection location

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



## Other Feature

#### 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. 58

# Series HRGC **Options 1**

Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.

Option combination (O: Available, X: Not available, C Possible, but specification needs to be modified partially.)

Н

With

heater

.

J

With automati

water supply function

0

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

М

Stainless stee

wetted parts for

circulating fluid

0

Κ

With

external

switch inlet

 $\bigcirc$ 

HRGC002-DD-B

s

With

nction (RS-232C

т

High-lift

pump

HRGC005-DD-B

γ

With DI

control

kit

0

HRG

#### Option symbol B

## With Earth Leakage Breaker



With earth leakage breaker

Symbol

Option

Combination possibility with options

Applicable model

5

Temperature

stability

±0.5°Ć

0

в

With earth

leakage

breaker

С

With

inction (RS-485)

0

HRGC001-DD-B

Ε

With wate

leakage sensor

0

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

#### **Breaker mounting location**

Breaker mounting location	Pole numbe	ər						2					
Remove the front panel. The breaker is mounted in-	Rated current ser	nsitivity (mA	)				;	30					()
side the electrical component enclosure.	Rated shutdown	current (A	)		1	5/20 Not	e)				30		5
	Short circuit disp	olay method					Mechan	ical butt	on				ä
Ontion symbol	Note) When c	pption H	or T is i	ncluded.									Ξ
C													
With Communications Function	on (RS-4	85)											(0)
HRGC – – – – – C	Option combine	ation (O:	Availab	le, X: No	t availabl	e, •: Po	ssible, bu	it specific	ation nee	eds to be	modified	partially.)	R S
• With communications	Symbol	3 Temperature	D With earth	U With	E With water		J With automatic	With	IVI Stainless steel	- S With	<b>I</b>	With DI	I
function (RS-485)	Option	stability ±0.5°C	leakage breaker	communications function (RS-485	leakage sensor	With heater	water supply function	external switch inlet	wetted parts for circulating fluid	communications function (RS-232C	High-lift pump	control kit	
The communications function allows you to set (write) or monitor (read) the circulating fluid temperature.	Combination possibility with options	0	0		0	0	0	0	0	×	0	0	N
<b>Writing&gt;</b> Circulating fluid temperature setting (SV)	Applicab	le mode		HRGCO	01-□□	]-C	HRGC	002-□	<b>□-C</b>	HRG	C005-	<b>□□-C</b>	
Circulating fluid temperature setting (SV)	Connector r	10.					9 (SD	+), 10 (S	<u> </u>				I
	Connector type (or	n this produc	t side)				M3 ter	minal b	lock				
Communication connection location	Standards					EIA st	andard	RS-48	5 compl	iant			
cable to the terminal block mounted inside the electrical	Protocol		Sp	pecial prot	tocol: For	details,	refer to th	e Comm	unication	s Specific	ations do	ocument.	Q
component enclosure.				То	the The	rmo-coc	ler C	ustomer	's machi	ne side			N
				10					Smaon				<u> </u>
						•		,					I
	Circuit diag	ram					<b>9</b>	SD+					
		am			Int	ernal	10						
Power cable Communication cable					C	rcuit		SD-					2
Communication cable outlet	4						Ļ						2
(also used as signal cable outlet)													I
Power cable entry													
Option symbol													
E With Water Leekage Sensor													0
with water Leakage Sensor													Ш
	Option combin	ation ( $\bigcirc$ :	Availabl	le, $ imes$ : No	t availabl	e, ●: Po	ssible, bu	it specific	ation nee	eds to be	modified	partially.)	Ī
	Symbol	5	В	С	Е	Н	J	K	M	S	Т	Y	
• With water	Ontion	Temperature	With earth	1 With	With water	With	With automatic	With	Stainless steel	With	High-lift	With DI	
leakage sensor	Option	±0.5°C	breaker	function (RS-485	sensor	heater	function	switch inlet	circulating fluid	function (RS-232C	pump	kit	
<b>-</b>	Combination	0	0	0		0	0	0	0		0	$\cap$	n n
This built-in water leakage sensor can detect	options	<u> </u>		<u> </u>		$\cup$	<u> </u>					Ŭ	ų ų
nuid leakage in the product and stop its	Applicable	model	HR	RGC001	I-00-E	E	IRGC0	02-□□	-E	HRGC	C005-⊡	] <b>□-E</b>	-
operation.	Water leakage dete	ection method					Infrared	reflection	on				
	Water leakage detect	able amount (	_)				1 L o	r more					
	Protection fu	Inction	A	Activates	if water	<sup>,</sup> leaks i	n the pr	oduct or	an abn	ormal st	top оссі	urs.	Q
Option symbol													Ш
With Heater													I
	4												
HRGC H- H	Option combine	ation (⊖:	Availab	le, X: No	t availabl	e, •: Po	ssible, bu	it specific	ation nee	eds to be	modified	partially.)	
Т	Symbol	5	В	С	E	н	J	K	M	S	Т	Y	Cal
With heater	Option	Temperature stability	With earth leakage	1 With communications	With water leakage	With	With automatic water supply	With external	Stainless steel wetted parts for	With communications	High-lift	With DI control	nic
This built in boater can beat up sizeulating fluid	Combination	±0.5°Ć	breaker	function (RS-485	sensor	neater	function	switch inlet	circulating fluid	function (RS-232C	pump	kit	5 Da
and adjust it at high temperatures.	possibility with options	×	0	0	0		0	0		0	0		Te
It can raise the circulating fluid temperature	Amplicatel			DOOO						LIDO	0005		
quickly, even when the initial temperature is low	Applicable	nodel	H	nGC00					n	пКG	C005-L		d ts
in winter. It can be also used to heat the fluid.		trol mother-	Dronovi-		control hard	na and cost!			rol or rotin-	rator and har-		ontrol Note 1)	te
	Tomperature con	uuu method	Proportional valve PID control, neating and cooling control of neater P control, or retrigerator and heater UN/OFF control Note 1)								ala Vdi		
	Temperature			5 to 60°C or 5 to 35°C (Note 1) 5 to 35°C								щ К С	
	Protection fr	inction	-				Thorn	nal fueo					
	Note 1) M/bas			n M or V			I IICIII	iai iuse					
	NOLE I) WITEI	i selectil	ig optiol										

Note 2) Temperature stability ±0.5°C specification cannot be selected.

# Series HRGC **Options 2**

Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.

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

#### Option symbol

With Automatic Water Supply Function

#### HRGC

#### With automatic water supply function

Water supply capacity (L/min)

By installing this at the automatic water supply inlet, circulating fluid can be easily supplied to the product using a built-in ball tap for water supply.



Option combination (): Available, X: Not available, V: Possible, but specification needs to be modified partia												
Symbol	5	В	С	Е	Н	J	К	М	S	Т	Y	
Option	Temperature stability ±0.5°C	With earth leakage breaker	With communications function (RS-485)	With water leakage sensor	With heater	With automatic water supply function	With external switch inlet	Stainless steel wetted parts for circulating fluid	With communications function (RS-232C)	High-lift pump	With DI control kit	
Combination possibility with options	0	0	0	0	0		0	0	0	0	0	
Applicable	model	HR	HRGC001-DD-J HRGC002-DD-J HRGC005-DD								□-J	
Water supply	method		Built-in ball tap for automatic water supply									
Water supply pres	sure (MPa)		0.2 to 0.5									

2 or more (at 0.2 MPa)

Option symbol
With External Switch Inlet

## HRGC

With external switch inlet

This can supply power to external switches (flow switch, etc.) for alarms, and send signals indicating abnormalities from the switch to the product.

If an abnormality signal is input from the external switch, the product will respond as follows:

- The product will continue operating (if already in operation).
- Alarm light turns on.
- Alarm signal is output.
- · Alarm is displayed.

Option combination (O: Available, X: Not available, Possible, but specification needs to be modified partially											partially.)
Symbol	5	В	С	Е	Н	J	K	M	S	Т	Y
Option	Temperature stability ±0.5°C	With earth leakage breaker	With communications function (RS-485)	With water leakage sensor	With heater	With automatic water supply function	With external switch inlet	Stainless steel wetted parts for circulating fluid	With communications function (RS-232C)	High-lift pump	With DI control kit
Combination possibility with options	0	0	0	0	0	0		0	×	0	0
Applicable	model		GCUUI	-UU-N		RGCU	02-111	-N	RRGC	<i>,</i> 002-🗆	⊔- <b>n</b>
External s	witch			Cont	act inpu	t or PNI	P open o	collector	r input		
signal inp	ut		(volt	age at C	) DFF: 24	VDC; c	urrent a	t ON: 3	5 mA or	less)	
External s	witch			Po	wer sur	nlv volt	age 24	VDC +1	0%		
power output 5 W to 20 W											
					To the	Thermo-	cooler	Custo	omer's m	achine s	side
						<					
					24 VI	C	` _	¬ ′			

24 COM

Internal

circuit

0

**12** 

13

14

External switch

External switch

signal input

power output

24 COM

24 VDC

24 COM

## Wiring Connection Location

Remove the front panel, and connect your communication cable to the terminal block mounted



Application Examples

When monitoring flow with a flow-rate switch

Circuit diagram

Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.

M Stainless Steel Wetted Parts fe	or Circu	lating	g Flui	id								
	Option combin	ation (O:	Available	ə, $ imes$ : Not	t available	e, 🌒: Pos	ssible, bu	t specific	ation nee	ds to be i	nodified	partially.)
	Symbol	5	В	С	E	н	J	K	М	S	Т	Y
<ul> <li>Stainless steel wetted parts for circulating</li> </ul>	Option	Temperature stability ±0.5°C	With earth leakage breaker	With communications function (RS-485)	With water leakage sensor	With heater	With automatic water supply function	With external switch inlet	Stainless steel wetted parts for circulating fluid	With communications function (RS-232C)	High-lift pump	With DI control kit
	Combination possibility with options	×	0	0	0	•	0	0		0	0	×
By changing the material of the wetted parts in	Applicable	model	HF	RGC00	1-□-M		HRGC	)02-□-	M	HRG	C005-□	<b>]-M</b>
deionized water with electrical resistance of 2	Temperature ra	nge setting					5 to 35	°C Note 1	)			
MO or less (electrical conductivity of 0.5 µS/cm	Temperature	mperature stability ±1.0°C Note 2)										
or more) can be used (However, heat exchan-	Circulating fl	irculating fluid type Clear water, Deionized wa							iylene g	lycol aq	ueous s	olution
ger is made of copper brazing.)	Wetted parts material fo	or circulating flui	1	Star	nless st	eel, Cop	oper bra	zing (H	eat exch	anger),	PVC	
3	Note 1) This cannot be used in circulating fluid temperatures of 35°C or higher, even when option H is colorted											
S Option symbol With Communications Function	Note 2) Temp Note 3) Use o µS/cr	perature deionized m or mor <b>32C)</b>	stability I water v e).	±0.5°C s vith elec	specificat trical res	tions car istance	nnot be s 2 MΩ∙cm	elected	(electric	al condu	ctivity of	0.5
	Option combin	ation (O	Available	e ×∙Not	t available	e • Po	ssible bu	t specific	ation nee	ds to be	modified	partially )
	Symbol	5	В	C	E	H	J	K	M	S	T	Y
• With communications		Temperature	With earth	With	With water	With	With automatic	With	Stainless steel	With	- High-lift	With DI
function (RS-232C)	Option	stability +0.5°C	leakage breaker	communications function (RS-485)	leakage	heater	water supply function	external switch inlet	wetted parts for circulating fluid	communications function (RS-232C)	pump	control kit
With a host PC programmed in accordance with your manufacturing processor method, the communications	Combination possibility with options	0	0	×	0	0	0	×	0		0	0
function allows you to set (write) or monitor (read) the	Applicable	model	HR	GC001	I-00-S	6 H	IRGC0	02-□□	-S	HRGC	005-□	l <b>⊡-S</b>
circulating fluid temperature.	Connector r	no.	9 (RD), 10 (SD), 11 (SG)									
<pre><writing> Circulating fluid temperature setting (SV)</writing></pre>	Connector t	type	M3 terminal block									
Circulating fluid tomporature setting (SV)	(on this prod	auct side,	تا FIA standard BS-232C compliant									
Circulating haid temperature setting (CV)	Brotocol		EIA standard RS-232C compliant									
Communication connection location			Special protocol: For details, reter to the Communications Specifications docum									oundiil.
Remove the front panel, and connect your communication cable to the terminal block mounted inside the electrical			To the Thermo-cooler Customer's machine side									
component enclosure.												
			9 RD									
	Circuit diag	ram			Inte	mal	10	SD				
					circ	uit	ŏ	0D				
							11	SG				
Bawar aabla Signal cable						-0						
						T						
(also used as signal cable outlet)	side											
Power cable entry												

HRGC

HRG

HRS

Series HRGC **Options 3** 

pump

Production of HRGC001/002 will be discontinued in January 2011. Thereafter, please select Series HRS.

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

### Option symbol

**High-lift Pump** 

Possible to choose a high-lift pump in accordance with customer's piping resistance. Cooling capacity may decrease by heat generated in the pump (For HRGC005 as standard).

## **Pump Capacity**



### Option symbol With DI Control Kit

#### HRGC **−**-Y With DI control kit

This option adds a function to control the electrical resistance of circulating fluid to the stainless steel wetted parts for the fluid. By using this with a DI (deionized water) filter (sold separately), the electrical resistance of the circulating fluid can be maintained at a constant level.

Option combination (○: Available, ×: Not available, ●: Possible, but specification needs to be modified partially.)											
Symbol         5         B         C         E         H         J         K         M         S         T         Y											
Option	Temperature stability ±0.5°C	With earth leakage breaker	With communications function (RS-485)	With water leakage sensor	With heater	With automatic water supply function	With external switch inlet	Stainless steel wetted parts for circulating fluid	With communications function (RS-232C)	High-lift pump	With DI control kit
Combination possibility with options	×	•	0	0	0	0	0	0	0		0
Applicable	model	HF	RGC00	1-□-T		HRGC	)02-□-	Т	HRGC005-□-T		
Cooling capacity	(50/60 Hz)	0.6/0.6 kW Note)				1.6/1.8	kW Note	)		_	
Pump capacity (	50/60 Hz)		0.31/	0.41 M	Pa (at 1	8/22 L/n	nin)				

Note) Cooling capacity may decrease as pump power increases.

# **Cooling Capacity**



## HRGC002-D-T



Option combination (○: Available, ×: Not available, ●: Possible, but specification needs to be modified partially.)											
Symbol	5	В	С	Е	н	J	K	М	S	Т	Y
Option	Temperature stability ±0.5°C	With earth leakage breaker	With communications function (RS-485)	With water leakage sensor	With heater	With automatic water supply function	With external switch inlet	Stainless steel wetted parts for circulating fluid	With communications function (RS-232C)	High-lift pump	With DI control kit
Combination possibility with	×	0	0	0	•	0	0	×	0	0	

Applicable model	el HRGC001-D-Y HRGC002-D-Y HRGC005-D-Y		
Temperature range setting		5 to 35°C Note 1)	
Temperature stability		±1.0°C Note 2)	
Circulating fluid type	Clear water, Deionized w	vater Note 3), 15% ethylene	glycol aqueous solution
Wetted parts material for circulating fluid	Stainless steel, Copper brazing (Heat exchanger), PVC		
DI display range	0 to 20 MΩ·cm <sup>Note 3)</sup>		
DI setting range	0.00 to 2.00 MΩ·cm Note 4)		
DI circuit rated flow	1.5 L/min		
DI alarm	Max. DI level, Min. DI level, Selectable from Max. to Min.		
DI alarm operation	Can choose whether to stop or continue operation when alarm activates		

Note 1) This cannot be used in circulating fluid temperatures of 35°C or higher, even when option H is selected.

Note 2) Temperature stability  $\pm 0.5^{\circ}C$  specification cannot be selected.

Note 3) Use deionized water with electrical resistance of 2 MΩ cm or less. (electrical conductivity of 0.5 μS or more)

Note 4) The DI filter is needed to control the DI level. (SMC Part No.: HRZ-DF001) Please purchase additionally because the DI (deionized water) filter is not included in this option.

\*Install the DI (deionized water) filter outside the Thermo-chiller for piping. Secure the space for installing the DI (deionized water) filter on the rear side of the Thermo-cooler.

\*It may go outside of the temperature stability range of ±1.0°C when this option is used in some operating conditions



Production of HRGC001/002 will be discontinued in January 2011. Series HRGC Thereafter, please select Series HRS. **Optional Accessories 1** 

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

HRG

HRGC

HRS

HRZ

HRZD

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## **Dustproof Filter Set**

Prevents performance degradation when using air-cooled refrigeration Thermo-coolers in dusty or contaminated environments.

Maximum ambient temperature: 40°C

## How to Order



## **Dimensions**



## Mounting Example

- 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

This prevents the occurrence of pump overload that exceeds the maximum operating pressure of the Thermocooler at low flow rate.

Use circulating fluid in 5 to 60°C temperature range

## How to Order



	olicable Thermo-cooler		
Symbol	Applicable Thermo-cooler	Wetted parts material	Pressure setting range (50/60 Hz) Note)
001	HRGC001-□ HRGC002-□	Bronze, PTFE, Stainless steel	0.12 to 0.13/
001G	HRGC001-□ HRGC002-□	PTFE, Stainless steel	0.16 to 0.18 MPa
005	HRGC005-□ HRGC00□-□-T	Bronze, PTFE, Stainless steel	0.22 to 0.48/
005G	HRGC005-□ HRGC00□-□-T	PTFE, Stainless steel	0.29 to 0.48 MPa

Note) The pressure of the by-pass piping set can be adjusted by the customer.



## Mounting Example

A pressure relief valve and pressure gauge can be mounted on the body with unions and nipples.



**SMC** Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com

Production of HRGC001/002 will be discontinued in January 2011. Series HRGC Thereafter, please select Series HRS. **Optional Accessories 2** 

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

## DI (Deionized Water) 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 (deionized water) filter separately.

Part no.	Applicable model
HRZ-DF001	Common for all models which can select the DI control kit. (option Y)

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



Weight: Approx. 20 kg

## Insulating Material for DI (Deionized Water) Filter

When the DI (deionized water) filter is used at a hightemperature, we recommend that you use this insulating material to protect the radiated heat from the DI (deionized water) 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 (deionized water) filter and to avoid forming condensation.

Part no.	Applicable model		
HRZ-DF002	Common for all models which can select the DI control kit. (option Y)		



# Series HRGC **Specific Product Precautions 1**

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

Production of HRGC001/ 002 will be discontinued in January 2011. Thereafter, please select Series HRS.

#### Design

# \land 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.
  - 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

# \land Warning

#### 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 page 48 before selecting a model.

#### 2. Indication of model number

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

Handling

# 🗥 Warning

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

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

## **Operating Environment/Storage Environment**

# Warning

#### 1. Do not use in the following environment because it will lead to a breakdown.

- 1. Environment like written in "Temperature Control Equipment Precautions
- 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-cooled condenser becoming clogged, use the dustproof filter set (sold separately).
- 5. A place in which water freezes. If such an environment is unavoidable, please 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.

3. Conduct ventilation and cooling to discharge heat. (Air-cooled refrigeration)

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

When using in a room which is shut tightly, ambient temperature will ex-ceed 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-cooler is not designed for a clean room. It generates particles internally.

**Circulating Fluid** 

# A Caution

- Avoid oil or other foreign objects entering the circulating 1. fluid.
- 2. Use an ethylene glycol aqueous solution that does not contain additives such as preservatives.

#### **Circulating Fluid**

# Caution

When using ethylene glycol aqueous solution, maintain a 3. maximum condensation of 15%.

Overly high concentration aqueous solution will overload to the pump and activates the safety interlock, which may stop the operation. On the other hand, if the concentration is too low, the aqueous solution freezes at low temperature, which may cause malfunction in the product.

4. When using clear water as a circulating fluid, use water that conforms to the appropriate water quality standards. Use clear water (including diluted ethylene glycol aqueous solution) that satisfies the quality standard shown below.

# Clear Water (as Circulating Fluid) Quality Standards

The Japan Refrigeration and Air Conditioning Industry Association IDA CI 02 1004 "Cooling water

ULL CE OF	Tool booling Mator by storn b	inoulation ty	oo mallo up maloi
	Item	Unit	Standard value
	pH (at 25°C)	—	6.8 to 8.0
	Electrical conductivity (25°C)	[µS/cm]	100* to 300*
	Chloride ion (Cl-)	[mg/L]	50 or less
Standard	Sulfuric acid ion (SO <sub>4</sub> <sup>2-</sup> )	[mg/L]	50 or less
item	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
	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
Reference item	Sulfide ion (S2 <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

<sup>\*</sup> In the case of [M $\Omega$ •cm], it will be 0.003 to 0.01.

#### 5. Deionized water can be used (as supply water), but resistivity cannot be maintained.

When supplying water, use deionized water with electrical conductivity of 1  $\mu$ S/cm or more (electrical resistivity of 1 M $\Omega$ ·cm or less). However, since components of the wetted part will be released in water, electrolyte concentration cannot be maintained.

#### (HRGC001/002)

1. A magnet pump is used as a circulating pump for the circulating liquid. It is particularly impossible to use liquid including metallic powder such as iron powder.

#### Transportation/Transfer/Movement

# \land Warning

- 1. Transportation by forklift (HRGC001 to HRGC005)
  - 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 operating manual 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)

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



- This product is heavy and should be moved by at least two people. Do not grip the piping port on the right side or the handles of the panel. 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 3. the other side.

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**Related Products** 

Data

HRG

HRGC

HRS

HRZ

HRZD

HRW

# Series HRGC Specific Product Precautions 2

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back page 2 to 5 for Temperature Control Equipment Precautions. Production of HRGC001/ 002 will be discontinued in January 2011. Thereafter, please select Series HRS.



#### Mounting/Installation

# **A** Warning

- 1. Do not place heavy objects on top of this product or step on it. The external panel can be deformed and danger can result.
- 2. Do not directly touch the edge of the external panel when removing and installing it.

It may cause injury. Be sure to wear protective gloves.

**3. Lower the level foot and do not move.** Be sure to lower all four level feet to the level of the floor.

# **A**Caution

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

	<u> </u>		
Connection thread	Applicable tightening torque N•m	Connection thread	Applicable tightening torque N•m
M3	0.63	M8	12.5
M4	1.5	M10	24.5
M5	3	M12	42
M6	52		

(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.
- 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.

#### Piping

# **A** 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.

## Piping

#### (Water-cooled refrigeration HRGC

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.

A Caution

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.

#### **Electrical Wiring**

# \land 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.
- Before wiring, be sure to cut the power supply. Never perform any job while the product is energized.
- 3. 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.

- 4. Grounding should never be connected to a water line, gas line or lightning rod.
- 5. Multiple wiring is dangerous because it will lead to heat generation or cause a fire.

# A Caution

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

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 when connecting communication cables.

## Facility Water Supply

# A Warning

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 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 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.



# \land 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.



# Series HRGC **Specific Product Precautions 3**

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

Production of HRGC001/ 002 will be discontinued in January 2011. Thereafter, please select Series HRS.

HRG

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### Operation

# \land Warning

- 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 customer's machine side, in order to adjust the open angle of the by-pass valve, so that the required pressure or flow can be obtained.

2. Check 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 machine is greater than the product's capability, the circulating fluid temperature may exceed this range. Use caution regarding this matter.

#### 3. Emergency stop method

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

# /!\ Caution

1. The temperature set value can be written to EEPROM, but only up to approximately one 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** 

# 

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** 

# A 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.
  - Facility water is not supplied. (HRGC
  - 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 machine is too high.
  - Ambient temperature is too high. (40°C or higher)
  - · Refriderant 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. 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.
- When cleaning the air-cooled condenser, do not touch the fin directly.

This may lead to injuries.

## Maintenance

## A Caution

<Periodical inspection every one month>

(Air-cooled refrigeration HRGC -- A-)

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 longhaired 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 Thermocooler

#### <Periodical inspection every three months>

- 1. Inspect the circulating fluid.
  - 1. When using clear water

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

- Tank cleaning Consider whether dirt, slime or foreign objects may be present in the circulating fluid inside the tank, and carry out regular cleanings of the tank.
- 2. When using ethylene glycol aqueous solution Use a concentration 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-DD) Note 1)

- 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).

This amount of leakage is stipulated as 3 (cc/h) or less (reference value) according to the JIS standard.

Also, as a guide for periodically replacement, the operation hours is 6000 to 8000 hours. (normally 1 year)  $^{\rm Note\ 2)}$ 

Note 1) In the 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 op-erating 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 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.

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