Circulating fluid temperature controller

Water-cooled Thermo-chiller

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

- **Circulating fluids type:** Fluorinated fluids / Ethylene glycol aqueous solution / Clean water, DI water
- **Temperature range setting:** 20 to 90°C
- **Cooling capacity:** 2 kW / 8 kW / 15 kW / 30 kW
- **Temperature stability:** ±0.3°C

- **Overseas standards:** SEMATECH S2-93, S8-95 | SEMI Standard S2-0703, S8-1103, F47-0200

Series HRW

SMC

CAT.ES40-53A

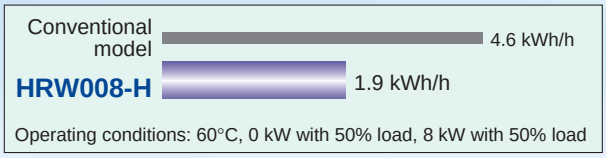
Energy Saving and Refrigerant-free

Energy saving and refrigerant-free (ordinary temperature to 90°C)

The water-cooled thermo-chiller which does not use a compressor (refrigerant-free) is suitable for processes operating from ordinary temperature to 90°C. The energy savings shown below can be achieved in comparison with existing models (depending on the conditions).

Power consumption: max. 59% reduction (SMC comparison)

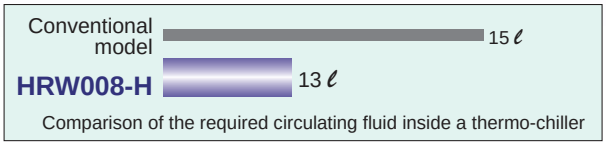
The power consumption can be reduced by direct heat exchange between the circulating fluid and facility water with no refrigerating circuit.



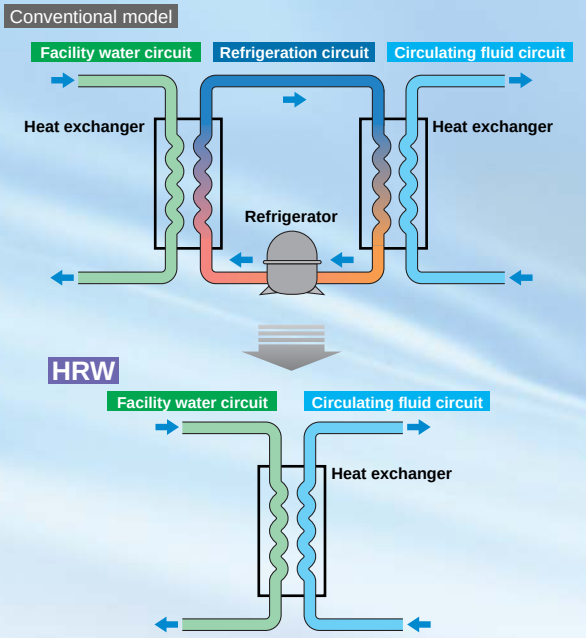
- Reduced running cost
- Contribution to the environmental preservation

Circulating fluid: max. 13% reduction (SMC comparison)

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



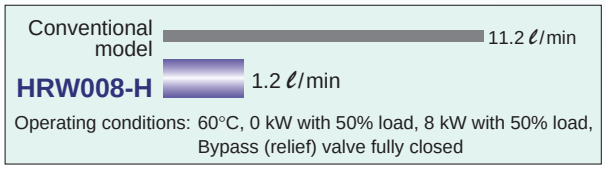
- Reduced initial cost
- Contribution to the environmental preservation



Facility water: max. 89% reduction

(SMC comparison)

The HRW can achieve reduction in power consumption as it does not have a compressor, and reduction in the amount of facility water used because heat is exchanged directly with the circulating fluid.



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

Space Saving

Installation area: max. 45% reduction

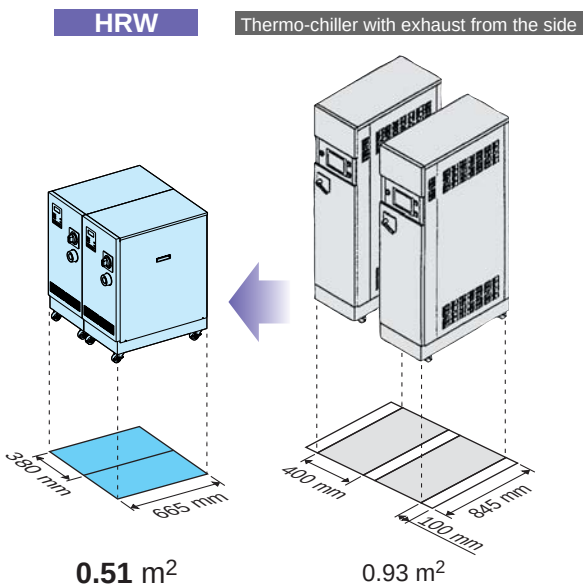
(SMC comparison)

Forced exhaust from rear side

By emitting the heat from the back, ventilation slits on the side are unnecessary offering reduced installation space.

Thermo-chiller with exhaust from the side:
Body space: W400 mm x D845 mm
Ventilation space: 100 mm

HRW008-H: Body space: W380 mm x D665 mm
Ventilation space: 0

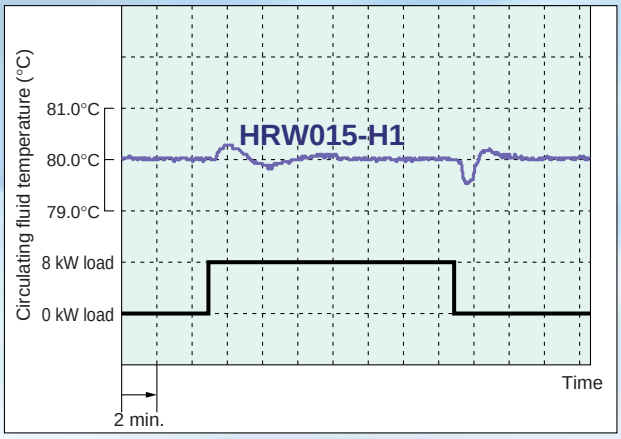


High Performance

Temperature stability:

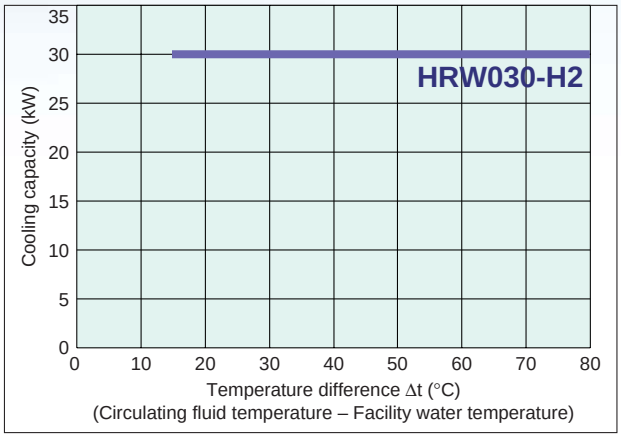
±0.3°C (when a load is stable)

Enhanced temperature control technology achieved ±0.3°C temperature stabilities when a load is stable.



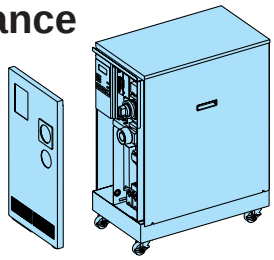
Cooling capacity: max. 30 kW

Up to 30 kW cooling capacity achieved.

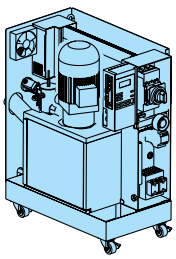


Ease of maintenance

- Checking the electrical component parts accessible from the front side only



- Possible to replace the maintenance parts (such as a pump) without removing the pipings and discharging the circulating fluid.



- Various alarm displays (Refer to page 10.)

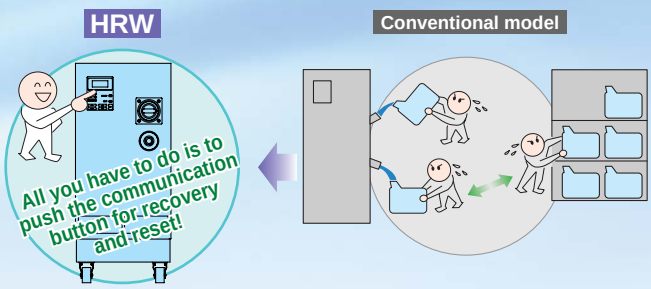
Ease of Maintenance

Circulating fluid automatic recovery function

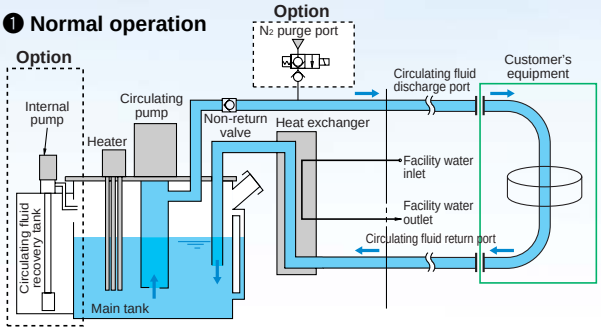
(Refer to “Options” on page 13.)

Circulating fluid inside a thermo-chiller tank can be recovered automatically. (Recovery volume: 12 ℓ)

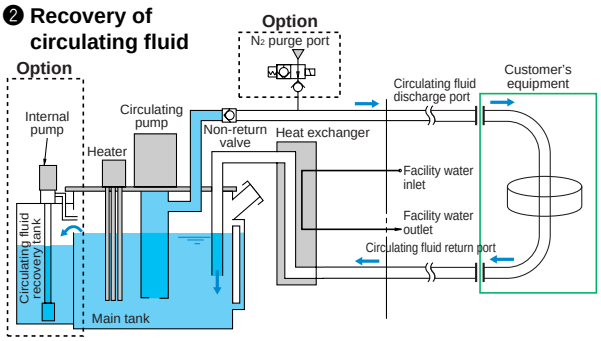
- Reduced maintenance time
- Faster operation
- Reduced circulating liquid loss by evaporation or spill.



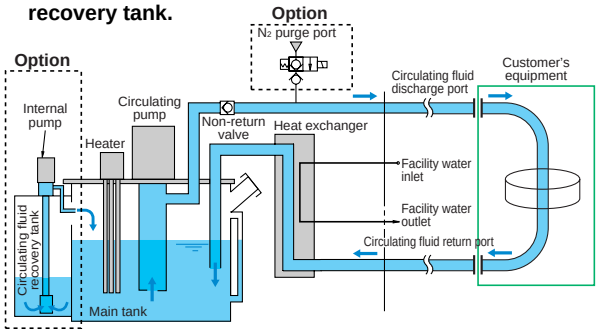
❶ **Normal operation**



❷ **Recovery of circulating fluid**



❸ **Fluid returns to the main tank from the circulating fluid recovery tank.**



Circulating fluid electric resistivity control function

(Refer to “Options” on page 12.)

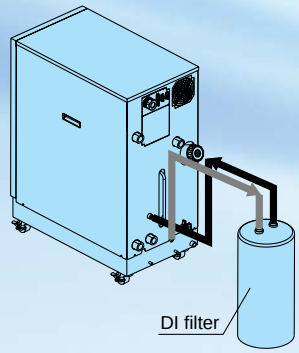
(DI control kit)

Electric Resistivity Controllable

(DI control kit)

(Refer to “Options” on page 12.)

Electric resistivity of circulating fluid (ethylene glycol aqueous solution and DI water) can be controlled.



Communication

- Contact input/output signal
- Serial RS-485 communication
- Analog communication (Refer to “Options” on page 11.)
- DeviceNet™ communication (Refer to “Options” on page 11.)

DeviceNet™

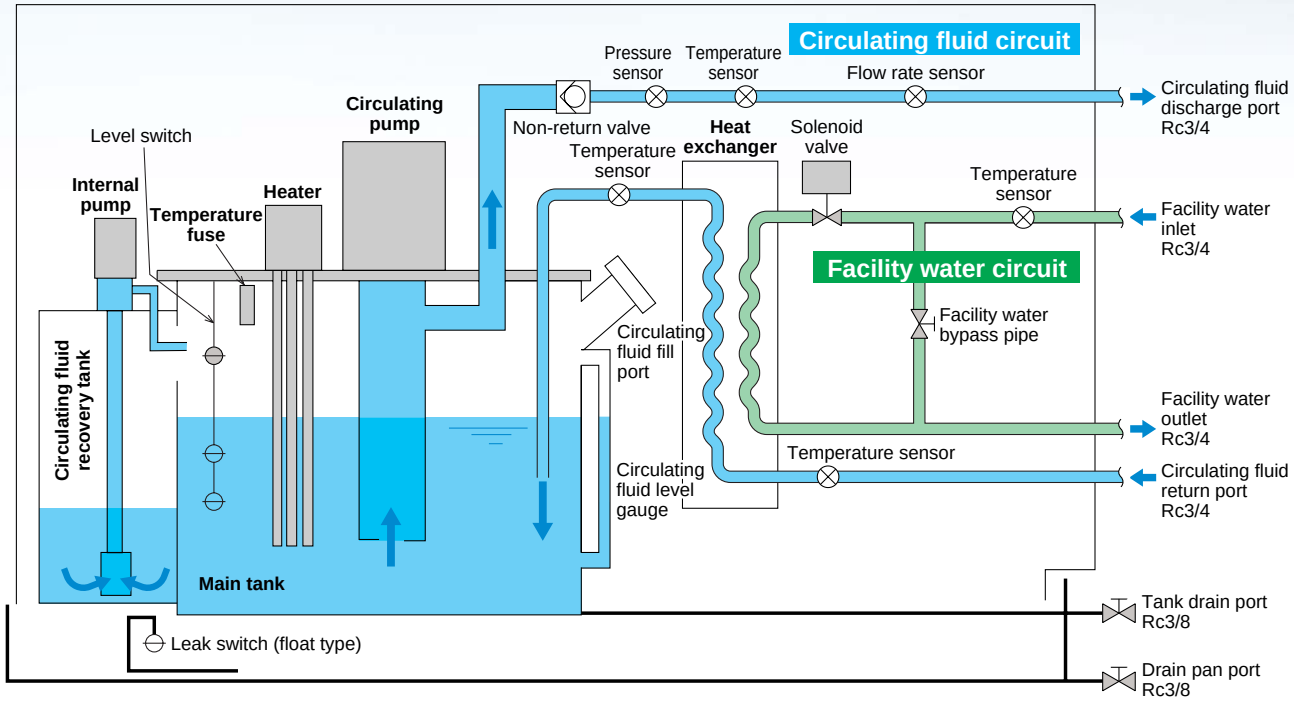
Wetted parts adopt the materials compatible for various circulating fluids.

(Stainless steel, EPDM, etc.)

- Fluorinated fluids: GALDEN® HT200
  Flourinert™ FC-40
- Ethylene glycol aqueous solution 60%
- DI water / Clean water

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

Construction and Principles



Circulating fluid circuit

With the **circulating pump**, circulating fluid will be discharged to the customer’s equipment side. After the circulating fluid will heat or cool the customer’s equipment side, it will be returned to the **main tank** via the **heat exchanger**.
When the automatic circulating fluid recovery function, which recovers the circulating fluid from the customer's equipment, is selected (refer to Features 2), a **sub tank** for recovery is installed. The internal pump is used to transfer the circulating fluid from the sub tank to the main tank. The **internal pump** is used to transfer a circulating fluid from the **sub tank** to the **main tank**.

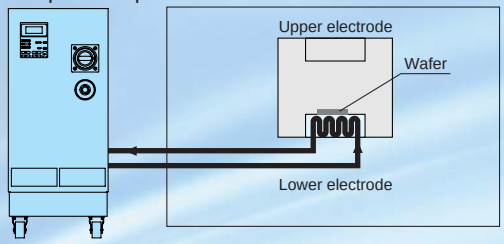
Facility water circuit

When the circulating fluid temperature rises higher than the set temperature, open the **solenoid valve** to introduce facility water to the **heat exchanger**.
When the circulating fluid temperature falls back below the set temperature, close the **solenoid valve** to shut off facility water to the **heat exchanger**.

Application Examples

Semiconductor

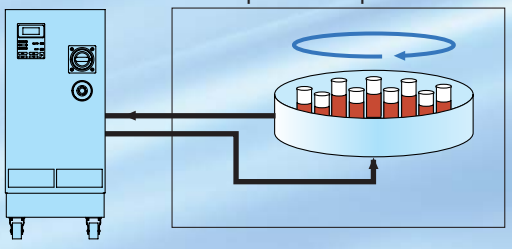
Example: Temperature control of a chamber electrode



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

Medical

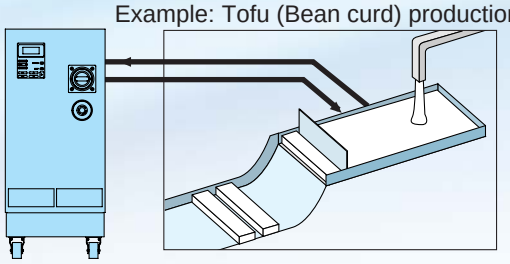
Example: Blood preservation



- X-ray instrument
- MRI
- Blood preservation equipment

Food

Example: Tofu (Bean curd) production

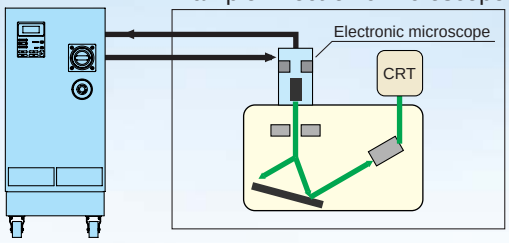


- Bottle-cleaning machine
- Tofu (Bean curd) production equipment
- Noodle-making machine, etc.

Water temperature control for forming tofu by mixing the boiled soybean milk and bittern

Diagnosis

Example: Electronic microscope

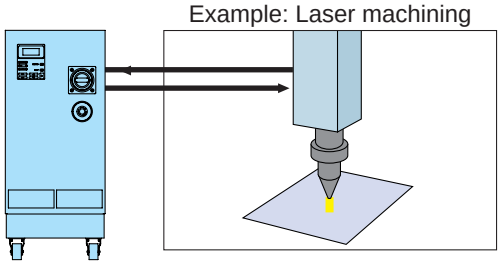


- Electron microscope
- X-ray diagnosis instrument
- Gas chromatography
- Sugar level diagnosis, etc.

Prevents the distortion caused by the heat generated by the electronic gun in an electronic microscope.

Machine tool

Example: Laser machining

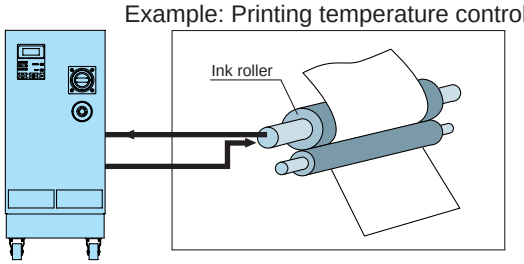


- Wire cutting
- Grinder
- Spot welding, etc.
- Plasma welding
- Laser machining

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

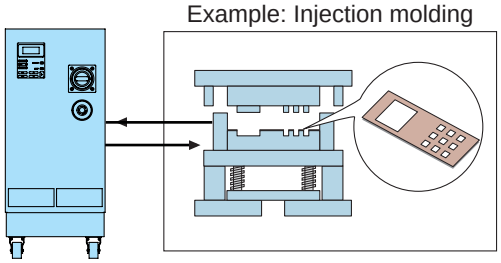


- Offset printing machine
- Automatic developing machine
- UV equipment, etc.

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.

CONTENTS

Series HRW
Model Selection

Guide to Model Selection

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

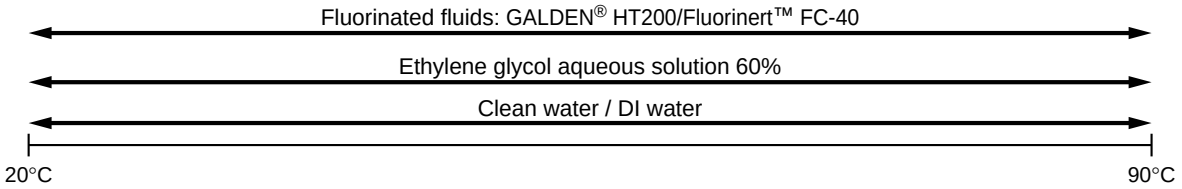
Temperature range which can be set with the thermo-chiller

H: 20°C to 90°C

Example) Requirement from customer: 50°C

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

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



Example) Requirement from customer: Clean water

3. How much is the temperature in degrees centigrade for the facility water?

Temperature range which can be set with the thermo-chiller

10°C to 35°C

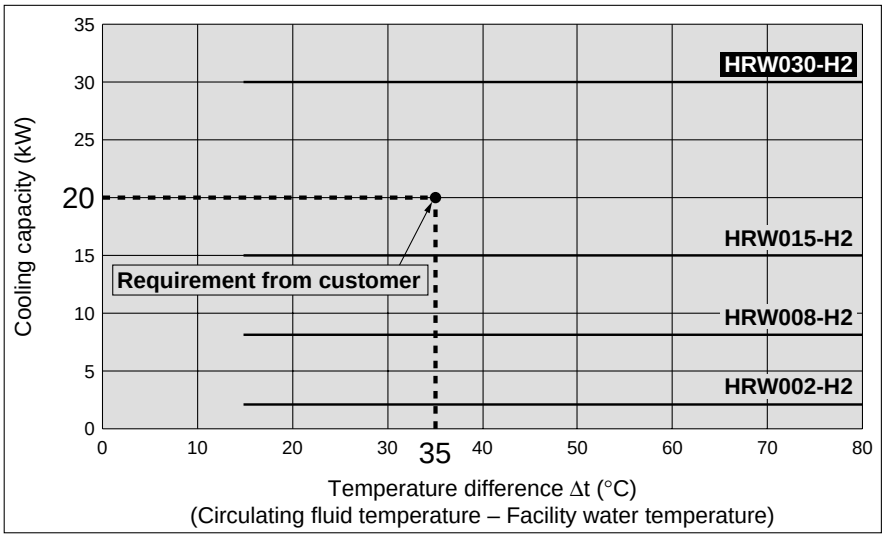
Example) Facility water temperature of customer's equipment: 15°C
Temperature difference between the circulating fluid and facility water is: 50 – 15 = 35°C.

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

Example) Requirement from customer: 20 kW →

Plot the point where the temperature difference between the circulating fluid and facility water (35°C) intersects the cooling capacity (20 kW) on the cooling capacity graph.

[Cooling capacity graph] Circulating fluid: Clean water / DI water



The point plotted in the graph is the requirement from your customer. Select the thermo-chiller models exceeding this point. In this case, select the **HRW030-H2**.

Calculation of Required Cooling Capacity

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

Heat generation amount Q: 3.5 kW

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

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.

Heat generation amount Q	: Unknown
Circulating fluid temperature difference ΔT (= T2 – T1)	: 6.0°C (6.0 K)
Circulating fluid outlet temperature T1	: 20°C (293.15 K)
Circulating fluid return temperature T2	: 26°C (299.15 K)
Circulating fluid flow rate L	: 20 ℓ/min
Circulating fluid	: Fluorinated fluid
	Density γ: 1.80 x 10^3 kg/m^3
	Specific heat C: 0.96 x 10^3 J/(kg•K) (at 20°C)

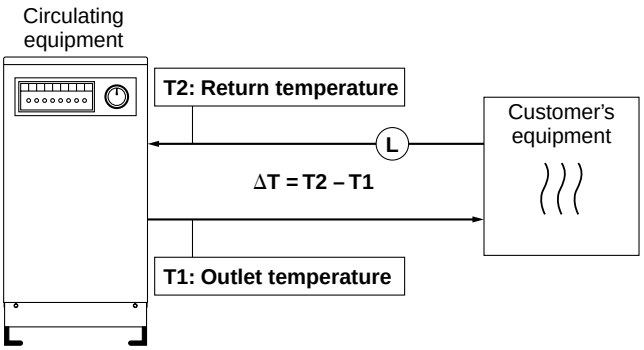
∗ Refer to the information shown on front matter 5 highlighting the representative physical property value by circulating fluid.

$$Q = \frac{\Delta T \times L \times \gamma \times C}{60 \times 1000}$$

$$= \frac{6.0 \times 20 \times 1.80 \times 10^3 \times 0.96 \times 10^3}{60 \times 1000}$$

$$= 3456\ W = 3.5\ kW$$

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



Example of the conventional measurement units (Reference)

Unknown
6.0°C
20°C
26°C
1.2 m^3/h
Fluorinated fluid
Density γ: 1.80 x 10^3 kg/m^3
Specific heat C: 0.23 kcal/kg•°C (at 20°C)

∗ Refer to the information shown on front matter 5 highlighting the representative physical property value by circulating fluid.

$$Q = \frac{\Delta T \times L \times \gamma \times C}{860}$$

$$= \frac{6.0 \times 1.2 \times 1.80 \times 10^3 \times 0.23}{860}$$

$$= 3.5\ kW$$

Cooling capacity = Considering a safety factor of 20%,
3.5 x 1.2 = 4.2 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.

Total volume of the object being cooled down V : 60 ℓ
Cooling time h : 15 min
Cooling temperature difference ΔT: 20°C (20 K) (70°C – 50°C → 20°C)
Facility water temperature : 20°C (293.15 K)
Circulating fluid : Fluorinated fluid
Density γ: 1.74 x 10^3 kg/m^3
Specific heat C: 1.05 x 10^3 J/(kg•K) (at 50°C)

∗ Refer to the information shown on front matter 5 highlighting the representative physical property value by circulating fluid.

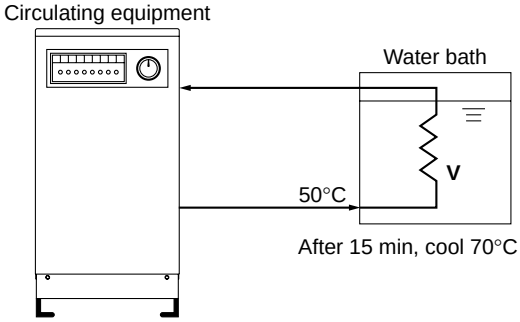
$$Q = \frac{\Delta T \times V \times \gamma \times C}{h \times 60 \times 1000}$$

$$\frac{20 \times 60 \times 1.74 \times 10^3 \times 1.05 \times 10^3}{15 \times 60 \times 1000} = 2436\ W = 2.4\ kW$$

Cooling capacity = Considering a safety factor of 20%,

2.4 x 1.2 = 2.9 kW (When the circulating fluid temperature is 50°C.)

(In this case, selected thermo-chiller model will be the HRW008-H.)



After 15 min, cool 70°C down to 50°C.

Example of the conventional measurement units (Reference)

0.06 m^3
0.25 h
20°C
20°C
Fluorinated fluid
Density γ: 1.74 x 10^3 kg/m^3
Specific heat C: 0.25 kcal/kg•°C (at 50°C)

∗ Refer to the information shown on front matter 5 highlighting the representative physical property value by circulating fluid.

$$Q = \frac{\Delta T \times V \times \gamma \times C}{h \times 860}$$

$$= \frac{20 \times 0.06 \times 1.74 \times 10^3 \times 0.25}{0.25 \times 860}$$

$$= 2.4\ kW$$

Cooling capacity = Considering a safety factor of 20%,

2.4 x 1.2 = 2.9 kW (When the circulating fluid temperature is 50°C.)

(In this case, selected thermo-chiller model will be the HRW008-H.)

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

Precautions on Model Selection

1. Temperature difference between the circulating fluid and facility water

The HRW series exchanges heat between the circulating fluid and facility water directly, so it may not be possible to lower the circulating fluid temperature to the set temperature if the facility water temperature is too high. Check that the facility water temperature can be maintained for the circulating fluid temperature referring to the cooling capacity graph of each model before using.

2. Heating capacity

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

3. Pumping capacity

<Circulating fluid flow>

Pumping capacity varies depending on the model selected from the HRW series. Also, circulating fluid flow varies depending on the circulating fluid discharge pressure. Consider the installation height difference between our thermo-chiller and a customer's 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 pumping 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 pumping 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

∗ Shown below are the representative values. For details, please contact the manufacturers of the circulating fluid.

Fluorinated Fluids

Physical property value / Temperature	Density γ	Specific heat C	
	[kg/m^3] [g/ℓ]	[J/(kg•K)]	([kcal/kg•°C])
–10°C	1.87 x 10^3	0.87 x 10^3	0.21
20°C	1.80 x 10^3	0.96 x 10^3	0.23
50°C	1.74 x 10^3	1.05 x 10^3	0.25
80°C	1.67 x 10^3	1.14 x 10^3	0.27

Ethylene Glycol Aqueous Solution 60%

Physical property value / Temperature	Density γ	Specific heat C	
	[kg/m^3] [g/ℓ]	[J/(kg•K)]	([kcal/kg•°C])
–10°C	1.10 x 10^3	3.02 x 10^3	0.72
20°C	1.08 x 10^3	3.15 x 10^3	0.75
50°C	1.06 x 10^3	3.27 x 10^3	0.78
80°C	1.04 x 10^3	3.40 x 10^3	0.81

Water

Density γ: 1 x 10^3 [kg/m^3] [g/ℓ] **Specific heat C: 4.2 x 10^3 [J/(kg•K)] (1.0 [kcal/kg•°C])**

Thermo-chiller Fluorinated Fluid Type

Series HRW

How to Order

Fluorinated Fluid Type **HRW 002 – H – □**

Cooling capacity

Symbol	Cooling capacity
002	2 kW
008	8 kW
015	15 kW
030	30 kW

Option

Symbol	Option
Nil	None
C	Analog communication
D	DeviceNet™ communication
N	NPT fitting
Z	Circulating fluid automatic recovery

Temperature range setting

Symbol	Temperature range setting
H	20 to 90°C

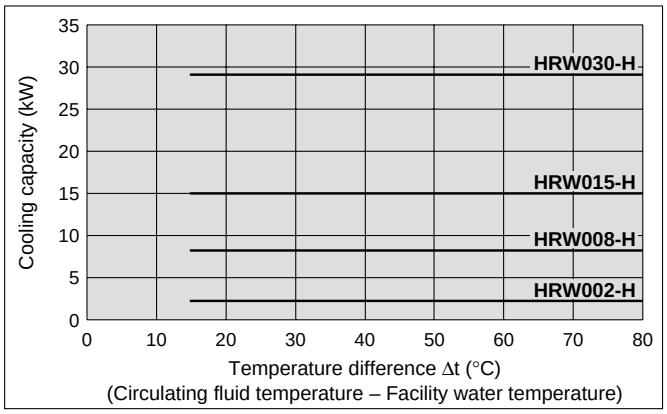
Specifications (For details, please consult our "Product Specifications" information.)

Model			HRW002-H	HRW008-H	HRW015-H	HRW030-H
Cooling method			Water-cooled type			
Ambient temp./humidity Note 1)			Temperature: 10 to 35, Humidity: 30 to 70%RH			
Circulating fluid system	**Circulating fluid** Note 2)		Fluorinert™ FC-40/GALDEN® HT200			
	Temp. range setting Note 1)	**(°C)**	20 to 90			
	Cooling capacity (50/60 Hz common)	**(kW)**	2	8	15	29
	Conditions **Circulating fluid temperature**	**(°C)**	Facility water temperature + 15			
	Conditions **Facility water temperature**	**(°C)**	10 to 35			
	Conditions **Circulating fluid rated flow**	**(ℓ/min)**	4	30	40	40
	Conditions **Facility water required flow**	**(ℓ/min)**	10	20	25	40
	Temp. stability Note 3)	**(°C)**	±0.3			
	Pumping capacity Note 4) **(50/60 Hz)**	**(MPa)**	0.40/0.60 (at 4 ℓ/min)	0.45/0.65 (at 30 ℓ/min)	0.40/0.60 (at 40 ℓ/min)	0.40/0.60 (at 40 ℓ/min)
	Tank capacity Note 5)	**(ℓ)**	Approx. 13		Approx. 14	
	Circulating fluid recovery tank volume Note 6)	**(ℓ)**	12			
	Port size		Rc3/4			
	Wetted parts material		Copper brazing (Heat exchanger), Stainless steel, EPDM, Silicon, PPS, Fluororesin			
Facility water system	**Temperature range**	**(°C)**	10 to 35			
	Required flow Note 7)	**(ℓ/min)**	10	20	25	40
	Inlet pressure range	**(MPa)**	0.3 to 0.7			
	Port size		Rc3/4			
	Wetted parts material		Copper brazing (Heat exchanger), Stainless steel, EPDM, Silicon, Bronze, Brass			
Electrical system	**Power supply**		3-phase 200/200 to 208 VAC ± 10%			
	Max. operating current	**(A)**	26			
	Breaker capacity	**(A)**	30			
	Communications		Serial RS-485 (Dsub-9 Pin) and Contact input/output (Dsub-25 Pin)			
Dimensions Note 8)		**(mm)**	W380 x D665 x H860			
Weight Note 9)		**(kg)**	Approx. 90		Approx. 100	
Safety standard			UL, CE marking, SEMI (S2-0703, S8-1103, F47-0200), SEMATECH (S2-93, S8-95)			

Note 1) It should have no condensation.
Note 2) Fluorinert™ is a trademark of 3M and GALDEN® is a registered trademark of Solvay Solexis, Inc. Regarding the fluid other than the above, please contact us.
Note 3) Temperature at the outlet of the thermo-chiller obtained 10 minutes after the external load is stabilized. There shall be rated flow of the circulating fluid and facility water with the circulating fluid supply and return directly connected. Also, the installation environment, power supply and facility water shall be stable within the specified range. It may be out of ±0.3°C in some other operating conditions.
Note 4) Circulating fluid temperature: The capacity of the circulating fluid discharge port at 20°C.
Note 5) Minimum volume required for operating only the thermo-chiller. (Circulating fluid temperature: 20°C, including the thermo-chiller's internal pipings or heat exchanger)
Note 6) To recover the circulating fluid inside the external pipings, the automatic circulating fluid recovering function will be provided by selecting "Z" for options.
Note 7) Required flow for cooling capacity or maintaining the temperature stability.
Note 8) Panel dimensions. All dimensions shown in the leaflet do not include possible protrusions e.g. a breaker handle.
Note 9) Weight in the dry state, without circulating fluids.

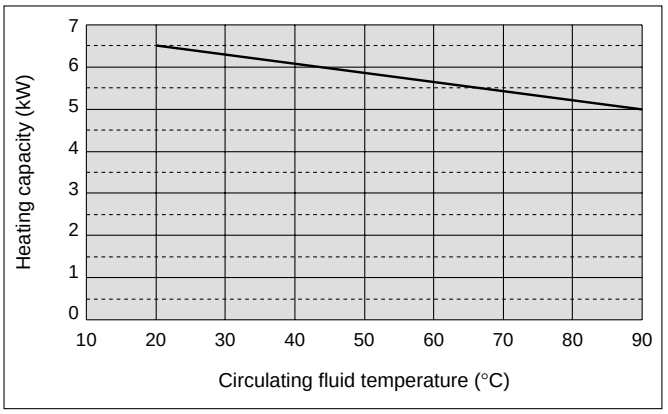
Cooling Capacity

HRW002-H/008-H/015-H/030-H



Heating Capacity

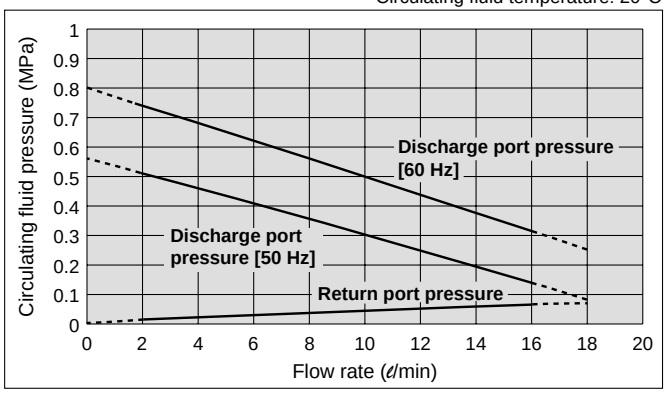
HRW002-H/008-H/015-H/030-H



Pumping Capacity

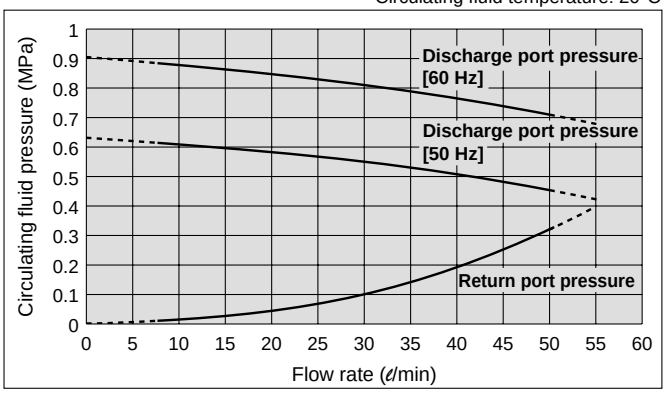
HRW002-H

Circulating fluid: Fluorinated fluids
Circulating fluid temperature: 20°C



HRW008-H/015-H/030-H

Circulating fluid: Fluorinated fluids
Circulating fluid temperature: 20°C



∗ When the circulating fluid flow is below
- 2 ℓ/min (HRW002-H)
- 8 ℓ/min (HRW008-H, 015-H, 030-H),

the built-in operation stop alarm will be activated. It is not possible to run the equipment.

Thermo-chiller Ethylene Glycol Type

Series HRW

How to Order

Ethylene Glycol Type **HRW** **002** – **H** **1** – □

Cooling capacity

Symbol	Cooling capacity
002	2 kW
008	8 kW
015	15 kW
030	30 kW

Temperature range setting

Symbol	Temperature range setting
H	20 to 90°C

Ethylene glycol type

Option

Symbol	Option
Nil	None
C	Analog communication
D	DeviceNet™ communication
N	NPT fitting
Y	DI control kit
Z	Circulating fluid automatic recovery

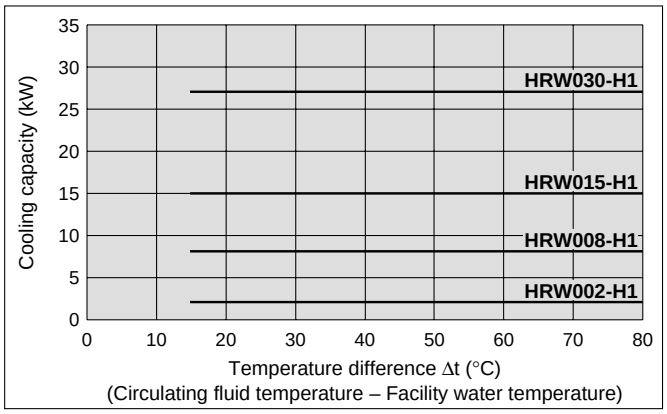
Specifications (For details, please consult our "Product Specifications" information.)

Model			HRW002-H1	HRW008-H1	HRW015-H1	HRW030-H1
Cooling method			Water-cooled type			
Ambient temp./humidity Note 1)			Temperature: 10 to 35, Humidity: 30 to 70%RH			
Circulating fluid system	**Circulating fluid** Note 2)		Ethylene glycol aqueous solution: 60%			
	Temp. range setting Note 1)	**(°C)**	20 to 90			
	Cooling capacity (50/60 Hz common)	**(kW)**	2	8	15	27
	Conditions **Circulating fluid temperature**	**(°C)**	Facility water temperature + 15			
	Conditions **Facility water temperature**	**(°C)**	10 to 35			
	Conditions **Circulating fluid rated flow**	**(ℓ/min)**	4	15	30	40
	Conditions **Facility water required flow**	**(ℓ/min)**	10	15	25	40
	Temp. stability Note 3)	**(°C)**	±0.3			
	Pumping capacity Note 4) **(50/60 Hz)**	**(MPa)**	0.35/0.55 (at 4 ℓ/min)	0.45/0.65 (at 15 ℓ/min)	0.40/0.60 (at 30 ℓ/min)	0.35/0.55 (at 40 ℓ/min)
	Tank capacity Note 5)	**(ℓ)**	Approx. 13			
	Circulating fluid recovery tank volume Note 6)	**(ℓ)**	12			
	Port size		Rc3/4			
	Wetted parts material		Nickel brazing (Heat exchanger), Stainless steel, EPDM, Silicon, PPS, Fluororesin			
Facility water system	**Temperature range**	**(°C)**	10 to 35			
	Required flow Note 7)	**(ℓ/min)**	10	15	25	40
	Inlet pressure range	**(MPa)**	0.3 to 0.7			
	Port size		Rc3/4			
	Wetted parts material		Nickel brazing (Heat exchanger), Stainless steel, EPDM, Silicon, Bronze, Brass			
Electrical system	**Power supply**		3-phase 200/200 to 208 VAC ± 10%			
	Max. operating current	**(A)**	26			
	Breaker capacity	**(A)**	30			
	Communications		Serial RS-485 (Dsub-9 Pin) and Contact input/output (Dsub-25 Pin)			
Dimensions Note 8)		**(mm)**	W380 x D665 x H860			
Weight Note 9)		**(kg)**	Approx. 90			
Safety standard			UL, CE marking, SEMI (S2-0703, S8-1103, F47-0200), SEMATECH (S2-93, S8-95)			

Note 1) It should have no condensation.
Note 2) Dilute pure ethylene glycol with clean water. Additives invading wetting parts material such as antiseptics cannot be used.
Note 3) Temperature at the outlet of the thermo-chiller obtained 10 minutes after the external load is stabilized (after stabilization with no load for HRW030-H1). There shall be rated flow of the circulating fluid and facility water with the circulating fluid supply and return directly connected. Also, the installation environment, power supply and facility water shall be stable within the specified range. It may be out of this range when a DI control kit (Option "Y") is used or in some other operating conditions.
Note 4) Circulating fluid temperature: The capacity of the circulating fluid discharge port at 20°C.
Note 5) Minimum volume required for operating only the thermo-chiller. (Circulating fluid temperature: 20°C, including the thermo-chiller's internal pipings or heat exchanger)
Note 6) To recover the circulating fluid inside the external pipings, the automatic circulating fluid recovering function will be provided by selecting "Z" for options.
Note 7) Required flow for cooling capacity or maintaining the temperature stability.
Note 8) Panel dimensions. All dimensions shown in the leaflet do not include possible protrusions e.g. a breaker handle.
Note 9) Weight in the dry state, without circulating fluids.

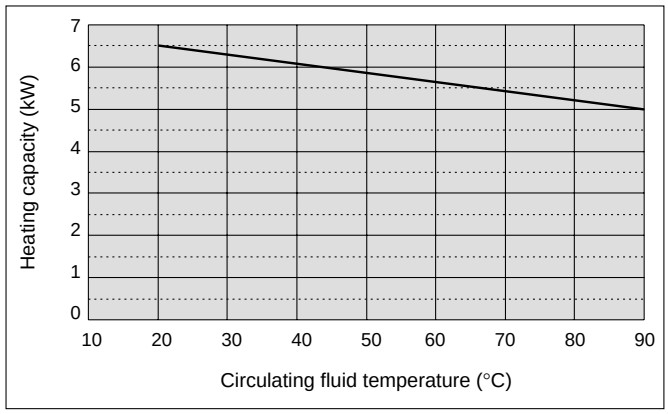
Cooling Capacity

HRW002-H1/008-H1/015-H1/030-H1



Heating Capacity

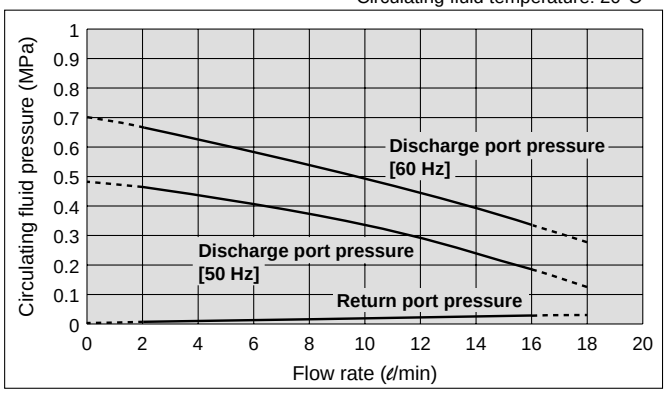
HRW002-H1/008-H1/015-H1/030-H1



Pumping Capacity

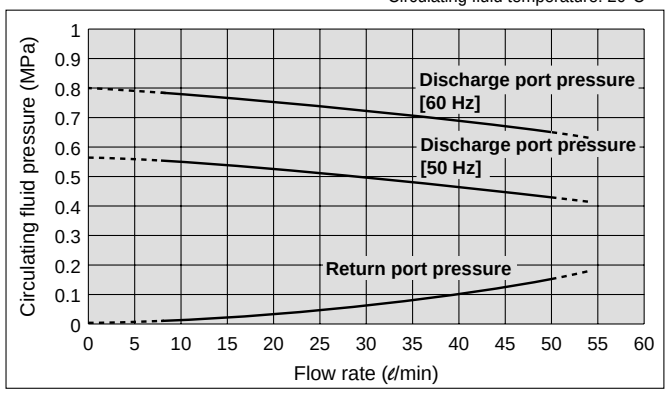
HRW002-H1

Circulating fluid: Ethylene glycol 60%
Circulating fluid temperature: 20°C



HRW008-H1/015-H1/030-H1

Circulating fluid: Ethylene glycol 60%
Circulating fluid temperature: 20°C



∗ When the circulating fluid flow is below
- 2 ℓ/min (HRW002-H1)
- 8 ℓ/min (HRW008-H1, 015-H1, 030-H1),

the built-in operation stop alarm will be activated. It is not possible to run the equipment.

Thermo-chiller Clean/DI Water Type

Series HRW

How to Order

Clean/DI Water Type **HRW** **002** – **H** **2** – □

Cooling capacity

Symbol	Cooling capacity
002	2 kW
008	8 kW
015	15 kW
030	30 kW

Temperature range setting

Symbol	Temperature range setting
H	20 to 90°C

Clean/DI water type

Option

Symbol	Option
Nil	None
C	Analog communication
D	DeviceNet™ communication
N	NPT fitting
Y	DI control kit
Z	Circulating fluid automatic recovery

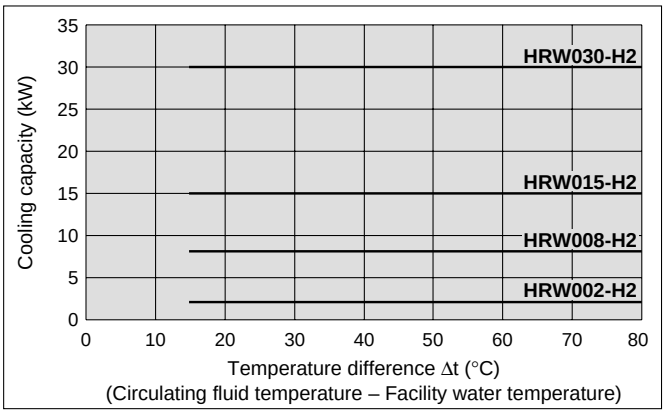
Specifications (For details, please consult our "Product Specifications" information.)

Model			HRW002-H2	HRW008-H2	HRW015-H2	HRW030-H2
Cooling method			Water-cooled type			
Ambient temp./humidity Note 1)			Temperature: 10 to 35, Humidity: 30 to 70%RH			
Circulating fluid system	**Circulating fluid** Note 2)		Clean water, DI water			
	Temp. range setting Note 1)	**(°C)**	20 to 90			
	Cooling capacity (50/60 Hz common)	**(kW)**	2	8	15	30
	Conditions **Circulating fluid temperature**	**(°C)**	Facility water temperature + 15			
	Conditions **Facility water temperature**	**(°C)**	10 to 35			
	Conditions **Circulating fluid rated flow**	**(ℓ/min)**	4	15	30	40
	Conditions **Facility water required flow**	**(ℓ/min)**	10	15	25	40
	Temp. stability Note 3)	**(°C)**	±0.3			
	Pumping capacity Note 4) **(50/60 Hz)**	**(MPa)**	0.35/0.55 (at 4 ℓ/min)	0.45/0.65 (at 15 ℓ/min)	0.40/0.60 (at 30 ℓ/min)	0.35/0.55 (at 40 ℓ/min)
	Tank capacity Note 5)	**(ℓ)**	Approx. 13			
	Circulating fluid recovery tank volume Note 6)	**(ℓ)**	12			
	Port size		Rc3/4			
	Wetted parts material		Nickel brazing (Heat exchanger), Stainless steel, EPDM, Silicon, PPS, Fluororesin			
Facility water system	**Temperature range**	**(°C)**	10 to 35			
	Required flow Note 7)	**(ℓ/min)**	10	15	25	40
	Inlet pressure range	**(MPa)**	0.3 to 0.7			
	Port size		Rc3/4			
	Wetted parts material		Nickel brazing (Heat exchanger), Stainless steel, EPDM, Silicon, Silicon, Brass			
Electrical system	**Power supply**		3-phase 200/200 AC to 208 V ± 10%			
	Max. operating current	**(A)**	26			
	Breaker capacity	**(A)**	30			
	Communications		Serial RS-485 (Dsub-9 Pin) and Contact input/output (Dsub-25 Pin)			
Dimensions Note 8)		**(mm)**	W380 x D665 x H860			
Weight Note 9)		**(kg)**	Approx. 90			
Safety standard			UL, CE marking, SEMI (S2-0703, S8-1103, F47-0200), SEMATECH (S2-93, S8-95)			

Note 1) It should have no condensation.
Note 2) If clean water or DI water is used, it should be in accordance with the Water Quality Standard of The Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994/cooling water system - circulation type - make-up water). The electrical conductivity of the DI water used as the fluid varies depending on operating conditions.
Note 3) Temperature at the outlet of the thermo-chiller obtained 10 minutes after the external load is stabilized (after stabilization with no load for HRW030-H2). There shall be rated flow of the circulating fluid and facility water with the circulating fluid supply and return directly connected. Also, the installation environment, power supply and facility water shall be stable within the specified range. It may be out of this range when a DI control kit (Option "Y") is used or in some other operating conditions.
Note 4) Circulating fluid temperature: The capacity of the circulating fluid discharge port at 20°C.
Note 5) Minimum volume required for operating only the thermo-chiller. (Circulating fluid temperature: 20°C, including the thermo-chiller's internal pipings or heat exchanger)
Note 6) To recover the circulating fluid inside the external pipings, the automatic circulating fluid recovering function will be provided by selecting "Z" for options.
Note 7) Required flow for cooling capacity or maintaining the temperature stability.
Note 8) Panel dimensions. All dimensions shown in the leaflet do not include possible protrusions e.g. a breaker handle.
Note 9) Weight in the dry state, without circulating fluids.

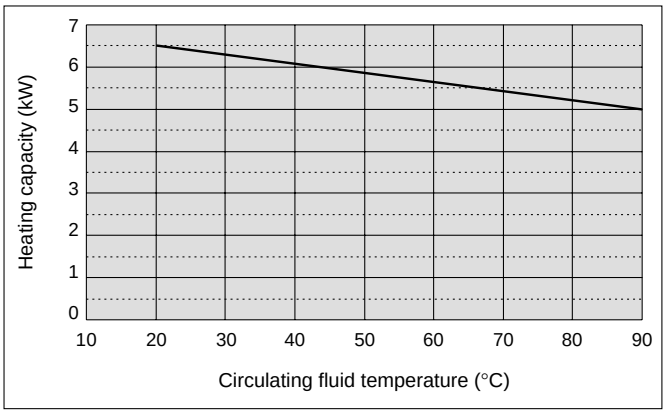
Cooling Capacity

HRW002-H2/008-H2/015-H2/030-H2



Heating Capacity

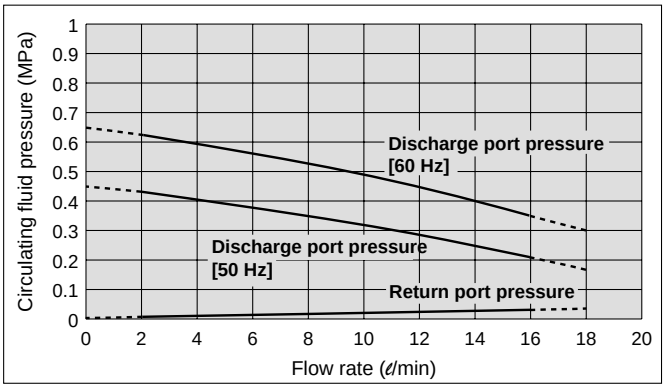
HRW002-H2/008-H2/015-H2/030-H2



Pumping Capacity

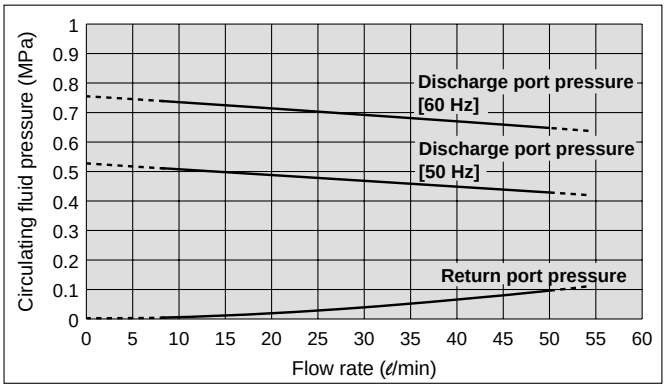
HRW002-H2

Circulating fluid: Clean water
Circulating fluid temperature: 20°C



HRW008-H2/015-H2/030-H2

Circulating fluid: Clean water
Circulating fluid temperature: 20°C

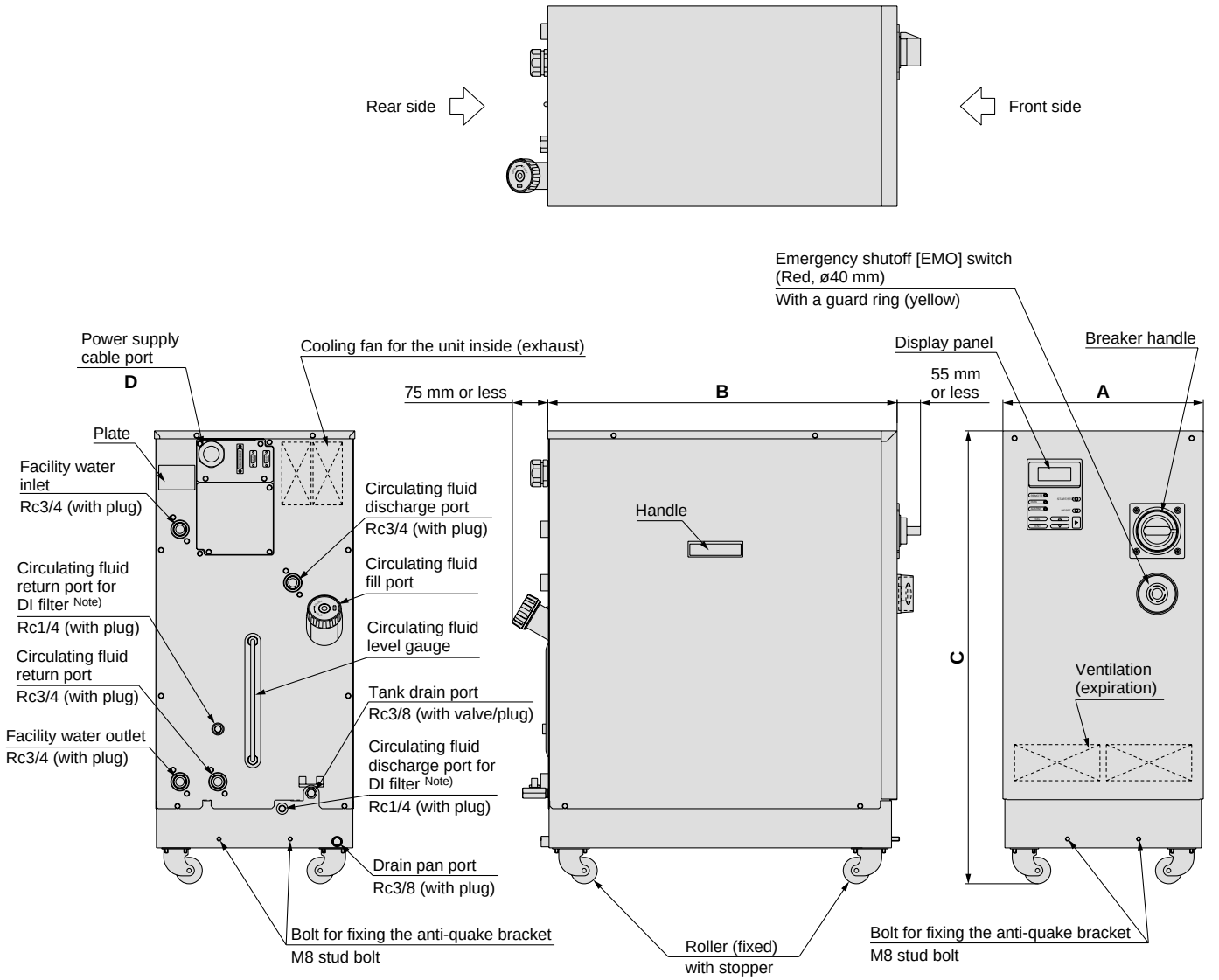


∗ When the circulating fluid flow is below
- 2 ℓ/min (HRW002-H2)
- 8 ℓ/min (HRW008-H2, 015-H2, 030-H2),

the built-in operation stop alarm will be activated. It is not possible to run the equipment.

Common Specifications

Dimensions



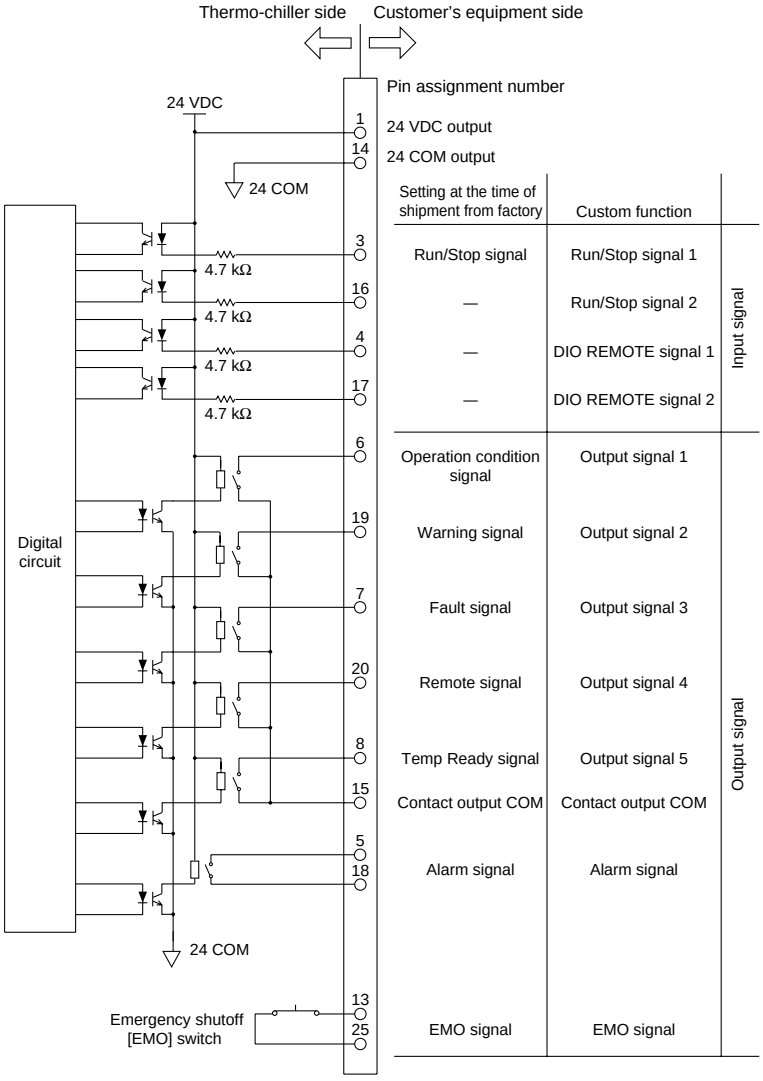
Note) Only when the DI control kit (Option "Y") is selected.

(mm)

Model			A	B	C	D
Fluorinated fluid type	Ethylene glycol type	Clean/DI water type				
HRW002-H **HRW008-H** **HRW015-H** **HRW030-H**	**HRW002-H1** **HRW008-H1** **HRW015-H1** **HRW030-H1**	**HRW002-H2** **HRW008-H2** **HRW015-H2** **HRW030-H2**	380	665	860	ø18.5 to 20.5

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

Contact Input/Output

Item		Specifications
Connector no.		P1
Connector type (on this product side)		D-sub 25 P type, Female connector
Fixing bolt size		M2.6 x 0.45
Input signal	Insulation method	Photocoupler
	Rated input voltage	24 VDC
	Operating voltage range	21.6 to 26.4 VDC
	Rated input current	5 mA TYP
	Input impedance	4.7 kΩ
Output signal	Rated load voltage	48 VAC or less / 30 VDC or less
	Maximum load current (total)	When using the power supply of the thermo-chiller: DC 200 mA (resistance load / inductive load) When using the power supply of the customer’s equipment: AC/DC 800 mA (resistance load / inductive load)
Alarm signal	Rated load voltage	48 VAC or less / 30 VDC or less
	Maximum load current	AC/DC 800 mA (resistance load / inductive load)
EMO signal	Rated load voltage	48 VAC or less / 30 VDC or less
	Maximum load current	AC/DC 800 mA (resistance load / inductive load)
Circuit diagram		

Note) The custom function is equipped for contact input/output. Using the custom function enables the customer to set the signal type for contact input/output or pin assignment numbers. For details, please consult “Communication Specifications” information.

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

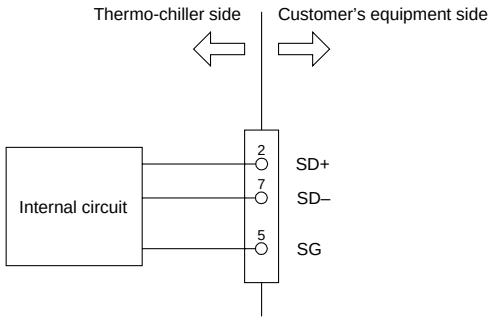
Serial RS-485

The serial RS-485 enables the following items to be written and read out.

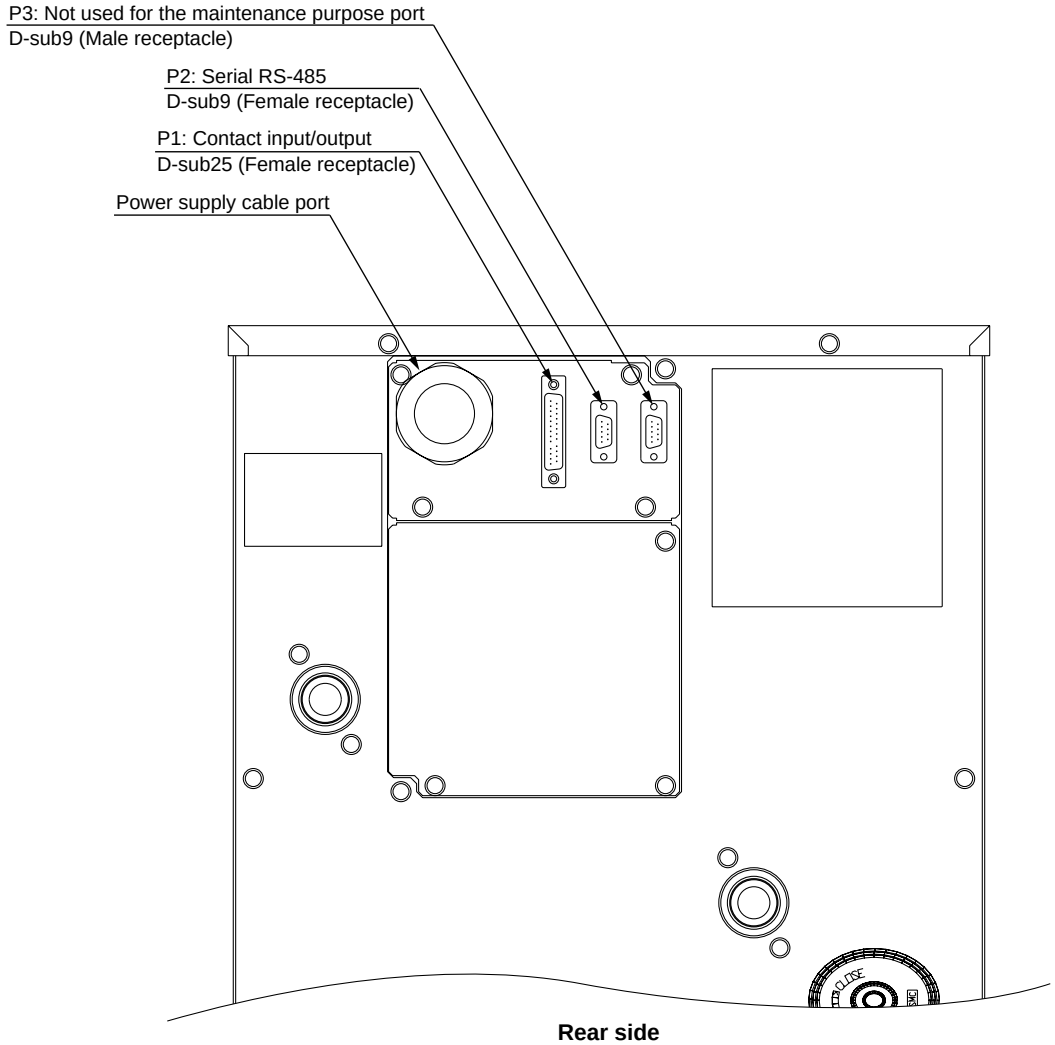
<Writing>
Run/Stop
Circulating fluid temperature setting
Circulating fluid automatic recovery start/stop*1

<Readout>
Circulating fluid present temperature
Circulating fluid flow
Circulating fluid discharge pressure
Circulating fluid electric resistivity*2
Alarm occurrence information
Status (operating condition) information

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

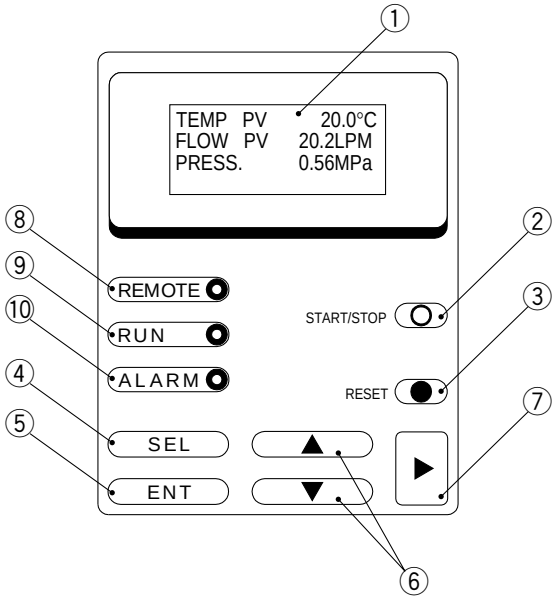
Item	Specifications
Connector no.	P2
Connector type (on this product side)	D-sub 9 P type, Female connector
Fixing bolt size	M2.6 x 0.45
Standard	EIA RS485
Protocol	Modicon Modbus
Circuit diagram	

Connector location



Rear side

Operation Panel Display



No.	Description	Function
①	**LCD screen**	Operating condition of this unit / Circulating fluid discharge temperature / Circulating fluid flow / Circulating fluid discharge pressure / Setting value / Alarm message, etc. are displayed.
②	**(START/STOP) key**	Starts/Stops the operation.
③	**(RESET) key**	Stops the alarm buzzing. Resets the alarm.
④	**(SEL) key**	Switches the display.
⑤	**(ENT) key**	Decides the settings.
⑥	**(▲) (▼) key**	Moves the cursor and changes the setting values.
⑦	**(▶) key**	Moves the cursor.
⑧	**(REMOTE) indicator light**	Blinks when the unit is in the remote status.
⑨	**(RUN) indicator light**	Blinks when the unit is in the operating status.
⑩	**(ALARM) indicator light**	Blinks when the unit is alarming.

Alarm

This unit can display 23 kinds of alarm messages as standard. Also, it can read out the serial RS-485 communication.

Alarm no.	Alarm message	Operation condition	Main reason
01	Water Leak Detect FLT	Stop	Liquid deposits in the drain pan of this unit.
02	Incorrect Phase Error FLT	Stop	The power supply to this unit is incorrect.
05	Reservoir Low Level FLT	Stop	The amount of circulating fluid tank is running low.
06	Reservoir Low Level WRN	Continue	The amount of circulating fluid tank is running low.
07	Reservoir High Level WRN	Continue	The amount of circulating fluid in the tank has increased.
08	Temp. Fuse Cutout FLT	Stop	Temperature of the circulating fluid tank is raised.
09	Reservoir High Temp. FLT	Stop	Temperature of the circulating fluid has exceeded the limitation.
10	Return High Temp. WRN	Continue	Temperature of returning circulating fluid has exceeded the limit.
11	Reservoir High Temp. WRN	Continue	Temperature of the circulating fluid has exceeded the limitation set by customer.
12	Return Low Flow FLT	Stop	The circulating fluid flow has gone below the limit.
13	Return Low Flow WRN	Continue	Flow rate of the thermo-chiller has dropped below the set value.
15	Pump Breaker Trip FLT	Stop	The protective equipment in the circulating fluid driving line has started.
17	Interlock Fuse Cutout FLT	Stop	Overcurrent is flown to the control circuit.
18	DC Power Fuse Cutout WRN	Continue	Overcurrent has flowed to the (optional) solenoid valve. (Only for the automatic circulating fluid recovery function - Option “Z”)
19	FAN Motor Stop WRN	Continue	Cooling fan inside the refrigerator has stopped.
21	Controller Error FLT	Stop	The error occurred in the control systems.
22	Memory Data Error FLT	Stop	The data stored in the controller of this unit went wrong.
23	Communication Error WRN	Continue	The serial communications between this unit and customer's system has been suspended.
24	DI Low Level WRN	Continue	DI level of the circulating fluid has gone below the limitation set by customer. (Only for DI control kit - Option “Y”)
26	DNET Comm. Error FLT	Stop	The DeviceNet communications between this unit and customer's system has been suspended. (Only for DeviceNet communication specification - Option “D”)
27	DNET Comm. Error WRN	Continue	An error has occurred in the DeviceNet communication system of this unit. (Only for DeviceNet communication specification - Option “D”)
29	F.Water Low Temp. WRN	Continue	Temperature of facility water has dropped below the set temperature.
30	F.Water High Temp. WRN	Continue	Temperature of facility water has exceeded the set temperature.

Series HRW
Options

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

C Option symbol: Analog Communication

HRW□□□ – □□ – C

Analog communication

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

<Writing>	<Readout>
Circulating fluid temperature setting	Circulating fluid present temperature
	Electric resistivity*

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

Scaling voltage - circulating fluid temperature can be set arbitrarily by customer.
For details, please consult our "Communication Specifications" information.

D Option symbol: DeviceNet™ Communication

HRW□□□ – □□ – D

DeviceNet™ communication

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

<Writing>	<Readout>
Run/Stop	Circulating fluid present temperature
Circulating fluid temperature setting	Circulating fluid flow
	Circulating fluid discharge pressure
Circulating fluid automatic recovery start/stop*1	Electric resistivity*2
	Alarm occurrence information
	Status (operating condition) information

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

For details, please consult our "Communication Specifications" information.

N Option symbol: NPT Fitting

HRW□□□ – □□ – N

NPT fitting

Includes an adapter which converts the connection of the circulating fluid pipe or facility water pipe to NPT thread type. The adapter should be installed on the thermo-chiller by the customer.

Y Option symbol: DI Control Kit

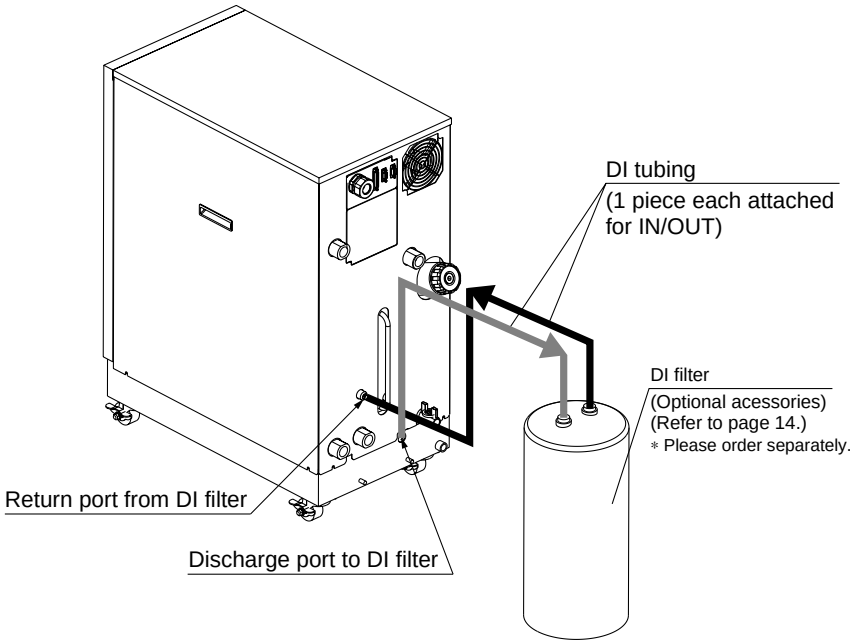
HRW□□□ – □□ – Y

DI control kit

Select this option if you want to maintain the electric resistivity (DI level) of the circulating fluid at a certain level. However, some components have to be fitted by customer. For details, refer to specification table for this option.
Please note that this is not applicable to the fluorinated liquid type.

Applicable models		HRW0□□-H1-Y	HRW0□□-H2-Y
Allowable circulating fluids	—	Ethylene glycol aqueous solution: 60%	DI water
DI level display range	MΩ•cm	0 to 20	
DI level set range	MΩ•cm	0 to 20 Note)	
Solenoid valve hysteresis for control	MΩ•cm	0 to 0.9	
DI level reduction alarm set range	MΩ•cm	0 to 20	

Note) The DI filter is needed to control the DI level. (SMC Part No.: HRZ-DF001)
Please purchase additionally because the DI filter is not included in this option. Also, if necessary, additionally purchase the insulating material for the DI filter. (SMC Part No.: HRZ-DF002)



* Install the DI filter outside the thermo-chiller for piping. Secure the space for installing the DI filter in the back side of the thermo-chiller.
* It may go outside of the temperature stability range of ±0.3°C when this option is used in some operating conditions.

Z Option symbol

Circulating Fluid Automatic Recovery

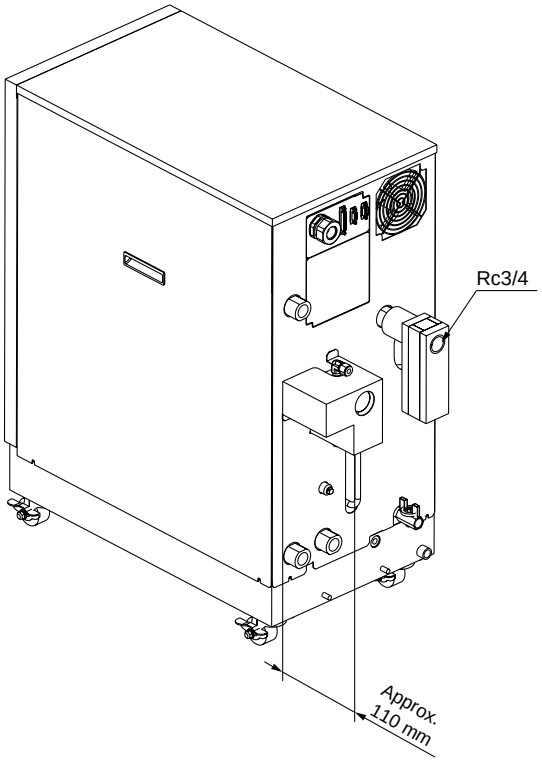
HRW□□□ – □□ – Z

Circulating fluid automatic recovery

Select this option for customers who want to use the circulating fluid automatic recovery function.
The automatic recovery function is a device which can recover the circulating fluid inside pipings into a sub tank of the thermo-chiller by the external communication or operating display panel.
Some components need to be fitted by the customer. For details, consult “Product Specifications” information for these options.

Applicable models		Common for all models
Circulating fluid recoverable volume Note 1)	ℓ	12
Purge gas	—	Nitrogen gas
Purge gas supply port	—	Self-align fitting for O.D. ø8 Note 2)
Purge gas supply pressure	MPa	0.4 to 0.7
Purge gas filtration	μm	0.01 or less
Regulator set pressure	MPa	0.15 to 0.3 Note 3)
Recoverable circulating fluid temperature	°C	10 to 40
Recovery start/stop	—	Start: External communication Note 4) or operation display panel / Stop: Automatic
Timeout error	sec	Timer from recovery start to completion Stops recovering when the timer turns to set time. Possible set range: 60 to 300, at the time of shipping from the factory: 300
Height difference with the customer system side	m	10 or less

Note 1) This is the space volume of the sub tank when the liquid level of the circulating fluid is within the specification. Guideline of the recovery volume is 80% of the circulating fluid recoverable volume.
Note 2) Before piping, clean inside the pipings with air blow, etc. Use the piping with no dust generation by purge gas. When using resin tubing, where necessary, use insert fittings, etc. in order not to deform the tubings when connecting to self-align fittings.
Note 3) At the time of shipping from factory, it is set to 0.2 MPa.
Note 4) For details, please consult our “Communication Specifications” information.



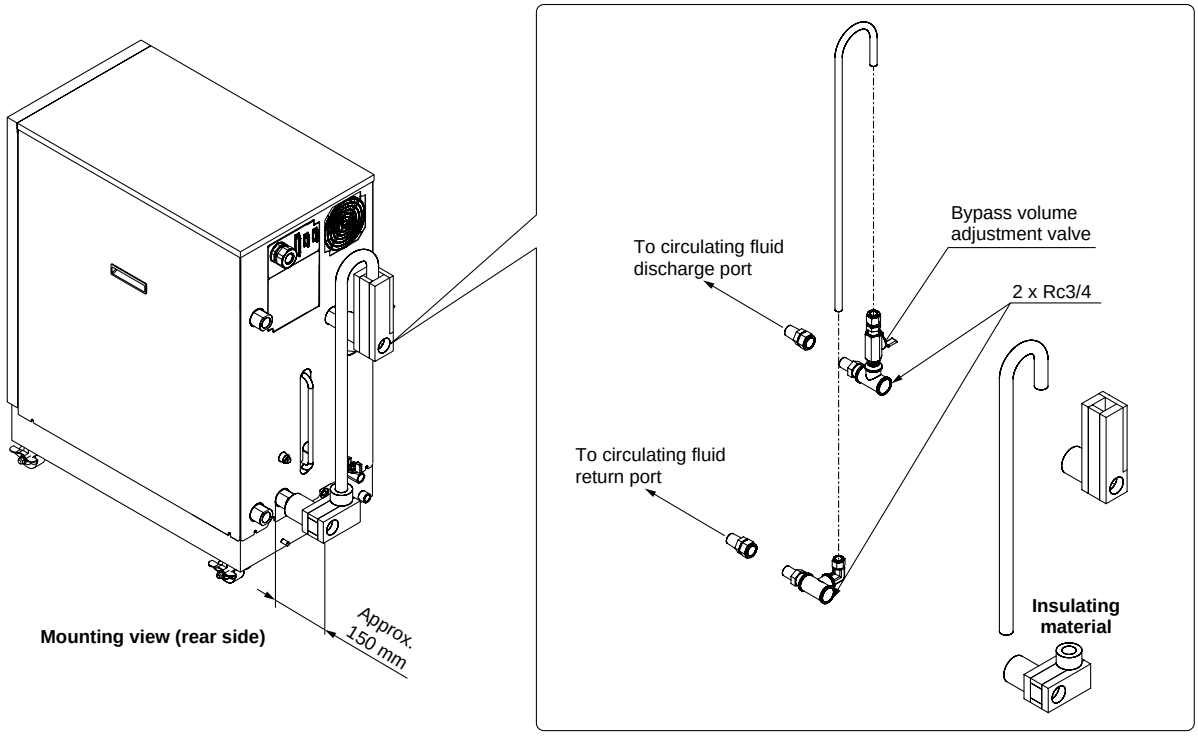
Optional Accessories

Note) Necessary to be fitted by the customer.

Bypass Piping Set

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

Part no.	Applicable models
HRW-BP001	Common for all models

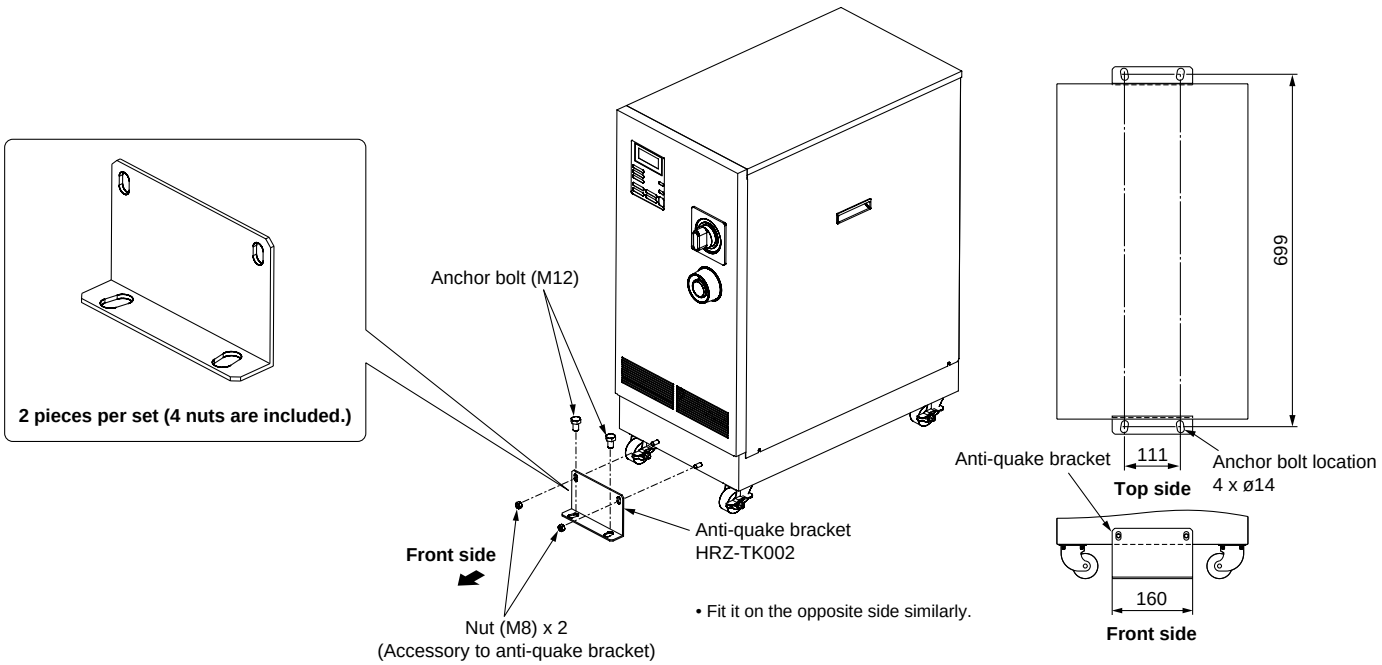


Anti-quake Bracket

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

Part no.	Applicable models
HRZ-TK002	Common for all models

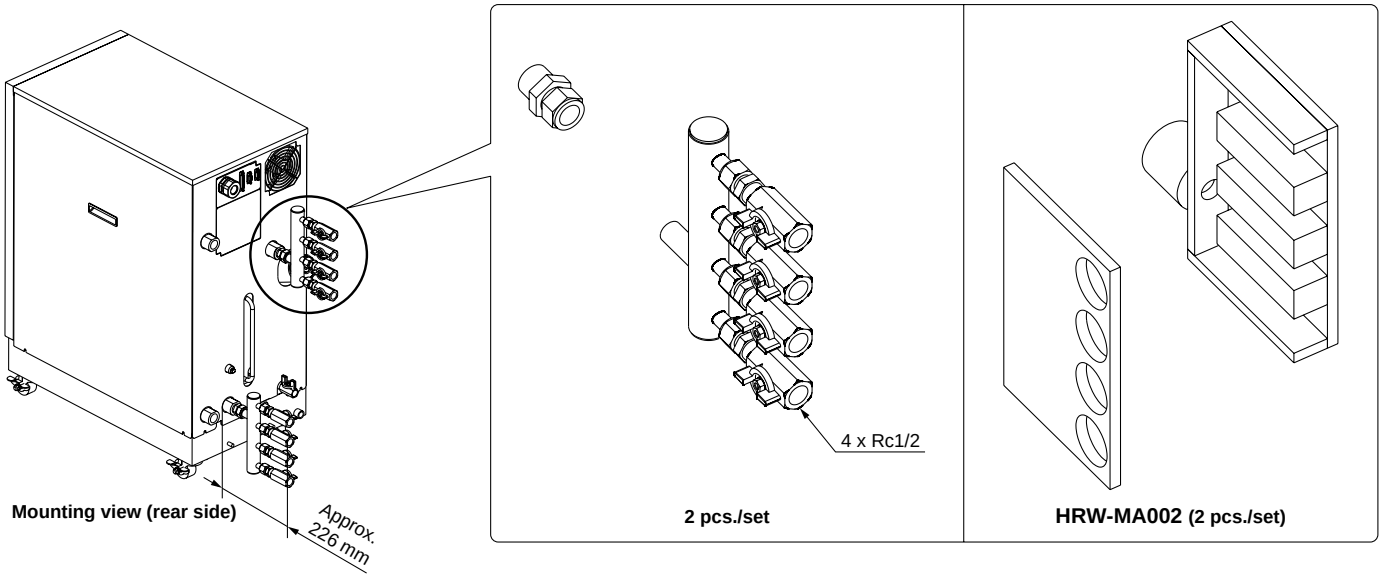
Note) 2 pieces per set (for 1 unit) (HRZ-TK002)



4 Port Manifold

4-branching the circulating fluid enables 4 temperature controls at the maximum with the 1 unit thermo-chiller. Order the heat insulator for 4 port manifold (HRW-MA002) separately if necessary.

Part no.	Applicable models
HRW-MA001	Common for all models
HRW-MA002	



Mounting view (rear side)

2 pcs./set

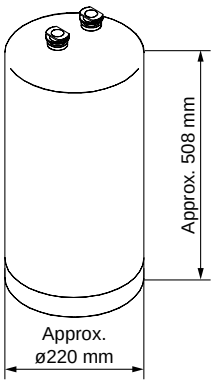
HRW-MA002 (2 pcs./set)

DI Filter

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

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

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

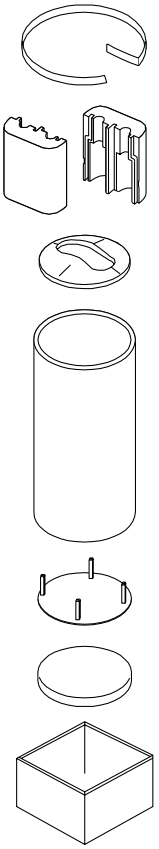


Weight: Approx. 20 kg

Insulating Material for DI Filter

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

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

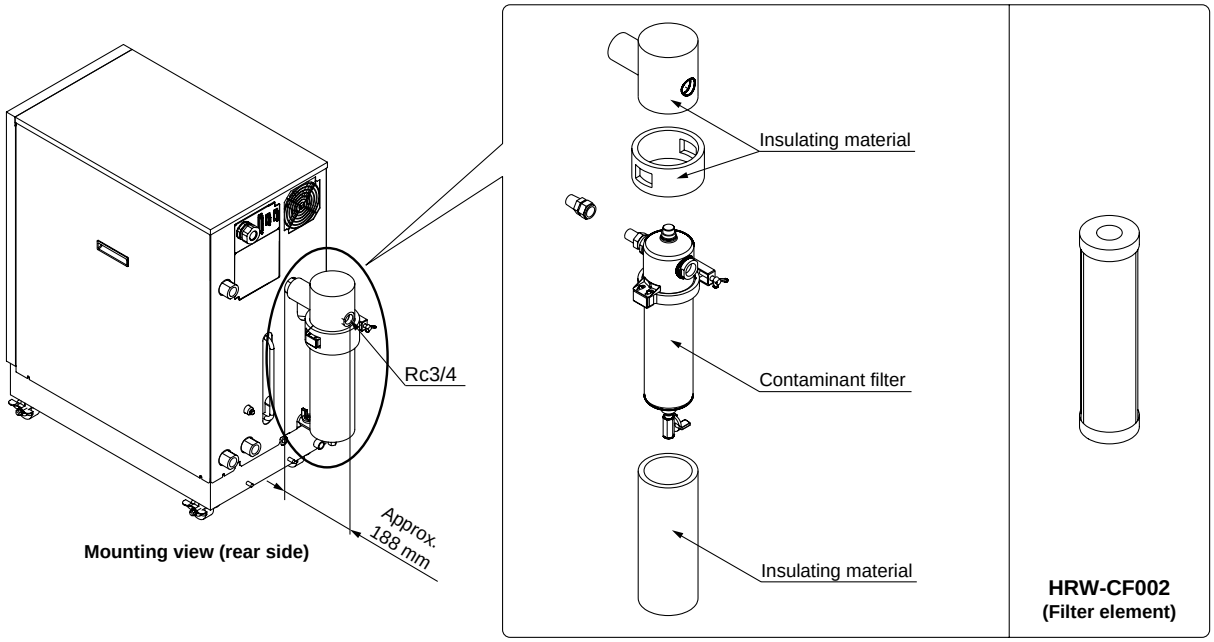


Contaminant Filter

A filter mounted in the circulating fluid circuit to eliminate the dust which is contained in the circulating fluid. (Filtration: 20 μm) It is provided with its own heat insulator.

Part no.	Applicable models
HRW-CF001	Common for all models
HRW-CF002	

Note) The internal element of the contaminant filter (part no.: HRW-CF002) is a replacement part. The period in service depends on the operating conditions.



Series HRW
Warranty

1. Conditions of warranty

When a nonconformance should take place to our thermo-chiller, 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

Effective for 1 year after purchase.

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 HRW
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 8 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, please contact SMC beforehand.

2. Secure the performance margin.

When you consider the product's cooling/heating performance or flow characteristics, allowance must be made because there are heat loss from the piping, etc. or pressure drop.

Operating Environment / Storage Environment

⚠Warning

1. Observe the 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. Locations more than 1000 m in altitude (except for storage, transportation)

Fluid

⚠Warning

1. Type of fluids

1. The operating fluids must be used within the specified range shown in this catalog.
   Consult with us 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 for 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 8 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. 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
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

4. 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 instruction 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 sealing 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 8 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 ±10% of the specified value.

4. Grounding

Be sure to ground (frame ground) with class D grounding (grounding resistance of 100 Ω or less).
Can be grounded with the 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, communications line, signal line of alarm line, etc. and the power line and high voltage line. Also, do not place them in the same wiring tube.

Facility Water Supply

⚠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, please consult with us.
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	Standard value
Standard item	pH (at 25°C)	6.5 to 8.2
	Electric conductivity (25°C)	100* to 800 [μS/cm]
	Chloride ion	200 [mg/L] or less
	Sulfuric acid ion	200 [mg/L] or less
	Acid consumption amount (at pH4.8)	100 [mg/L] or less
	Total hardness	200 [mg/L] or less
	Calcium hardness	150 [mg/L] or less
	Ionic state silica	50 [mg/L] or less
Reference item	Iron	1.0 [mg/L] or less
	Copper	0.3 [mg/L] or less
	Sulfide ion	Should not be detected.
	Ammonium ion	1.0 [mg/L] or less
	Residual chlorine	0.3 [mg/L] or less
	Free carbon	4.0 [mg/L] or less

* Electric conductivity should be 100 [μS/cm] or more.

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 8 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.
Please 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, please kindly prepare a backup product, when necessary.

Series HRW
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. For details, please consult our “Product Specifications” and thoroughly consider the adaptability between the customer's system and this unit.
2. Although the protection circuit as a single unit is installed, the customer is requested to carry out the safety design for the whole system.

Selection

⚠Caution

1. Model selection

In order to select the correct thermo-chiller model, the amount of thermal generation from the customer’s system, the operating circulating fluid, and its circulating flow are required. Select a model, by referring to the guideline to model selection of this catalog.

2. Option selection

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

Handling

⚠Warning

1. Thoroughly read the operating manual.

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

Operating Environment / Storage Environment

⚠Caution

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

1. Environment like written in the Temperature Control Equipment Precautions.
2. Locations where spatter will adhere to when welding.
3. Locations where it is likely that the leakage of flammable gas may occur.
4. Locations where the ambient temperature exceeds the limits as mentioned below.
   During operation 10°C to 35°C
   During storage 0°C to 50°C (but as long as water or circulating fluid are not left inside the pipings)
5. Locations where the ambient relative humidity exceeds the limit as mentioned below.
   During operation 30% to 70%
   During storage 15% to 85%
6. (inside the operation facilities) Locations where there is not sufficient space for maintenance.
7. In locations where the ambient pressure exceeds the atmospheric pressure.

2. The thermo-chiller does not have clean room specification. It generates dust from the pump inside the unit and the cooling fan in the refrigerator.

Circulating Fluid

⚠Caution

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

2. Use ethylene glycol which does not contain additives such as antiseptics.

3. Density of the ethylene glycol aqueous solution should be 60% or less. If the density is too high, the pump will be overloaded, resulting in occurrence of “Pump Breaker Trip FLT”.

4. Avoid water moisture entering the fluorinated fluid.

5. Use clean water (including for diluting ethylene glycol aqueous solution) which must meet the water quality standards as mentioned 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)	—	6.0 to 8.0
	Electric conductivity (25°C)	[μS/cm]	100 to 300*
	Chloride ion	[mg/L]	50 or less
	Sulfuric acid ion	[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	[mg/L]	50 or less
	Ionic state silica	[mg/L]	30 or less
Reference item	Iron	[mg/L]	0.3 or less
	Copper	[mg/L]	0.1 or less
	Sulfide ion	[mg/L]	Should not be detected.
	Ammonium ion	[mg/L]	0.1 or less
	Residual chlorine	[mg/L]	0.3 or less
	Free carbon	[mg/L]	4.0 or less

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

Transportation / Transfer / Movement

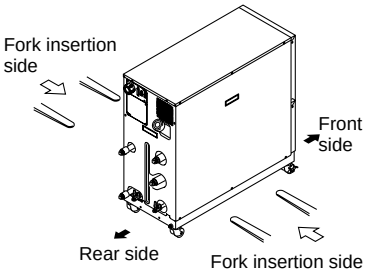
⚠Warning

1. Transportation by forklift

1. It is not possible to hang this product.
2. The fork insertion position is either on the left side face or right side face of the unit. Be careful not to bump the fork against a roller or adjuster foot and be sure to put through the fork to the opposite side.
3. Be careful not to bump the fork to the cover panel or piping ports.

2. Transportation by roller

1. This product is heavy. Be sure to move the unit using more than 2 persons.
2. Do not grab the pipings or panel at the back of the unit.



Series HRW
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.

Mounting / Installation

⚠Caution

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

Piping

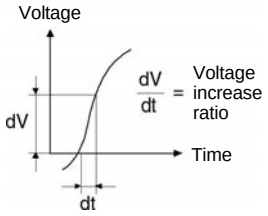
⚠Caution

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

Electrical Wiring

⚠Caution

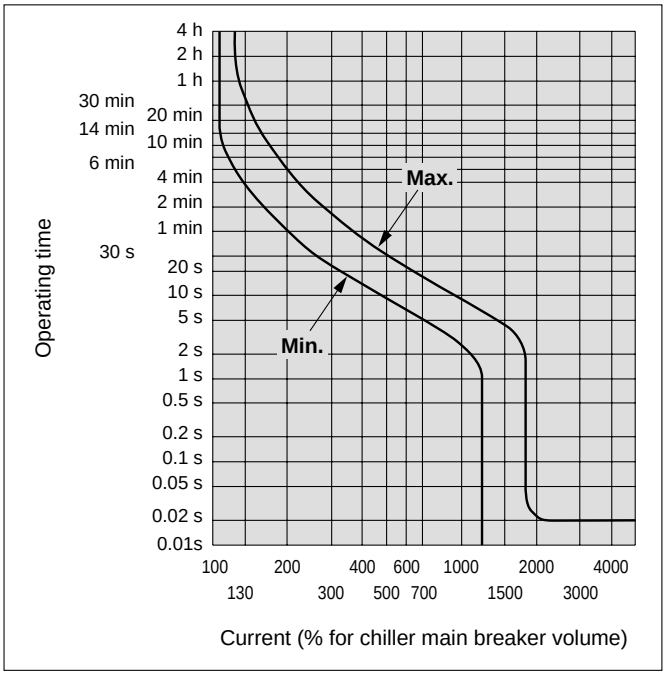
1. **Power supply and signal cable should be prepared by the customer.**
2. **Provide a stable power supply which is not affected by surge or distortion.**
   If the voltage increase ratio (dV/dt) at the zero cross should exceed 40 V/200 μsec., it may result in malfunction.



3. **This product is installed with a circuit breaker with the following operating characteristics.**
   For the customer's equipment (primary side), use a breaker whose operating time is equal to or longer than the breaker of this product. If a breaker with shorter operating time is connected, the customer's equipment could be cut off due to the inrush current of the motor of this product.

Breaker Operating Characteristics

Common for all models



SMC

Series HRW
Specific Product Precautions 3

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

⚠ Caution

1. Confirmation before operation

1. The circulating fluid should be within the specified range of "HIGH" and "LOW".
2. Be sure to tighten the cap for the circulating fluid port until the click sound is heard.

2. Emergency stop method

In the case of an emergency, press down the EMO switch which is fitted on the front face of this product.

Maintenance

⚠ Warning

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

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

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

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

⚠ Caution

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

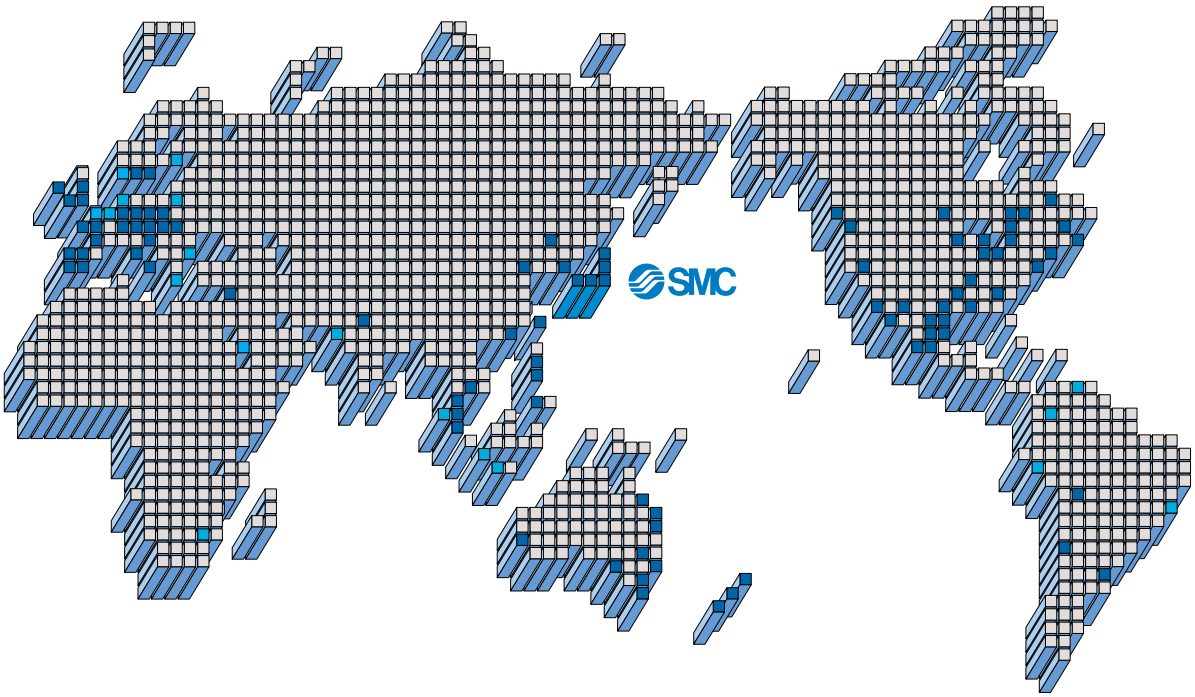
2. Perform an inspection of the circulating fluid every 3 months.

1. In case of fluorinated fluids:
   Discharge the circulating liquid and avoid any dirty objects, or water moisture, or foreign objects entering the system.
2. In case of ethylene glycol aqueous solution:
   Density must be 60%.
3. In case of clean water, DI water:
   Replacement is recommended.

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

Regarding the water quality standards for facility water, refer to "Temperature Control Equipment Precautions".

SMC'S GLOBAL MANUFACTURING, DISTRIBUTION AND SERVICE NETWORK



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