

Circulating Fluid Temperature Controller

Thermo-chiller

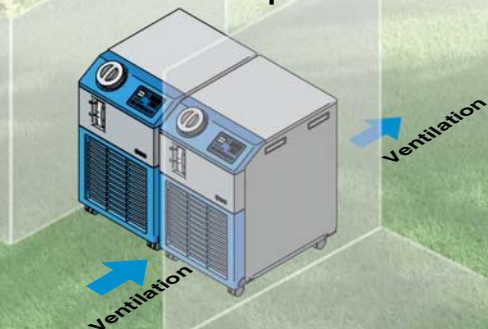
Compact Type

New



Space Saving

Installation close to a wall is possible on both sides.



NEW Variations added

- Water-cooled refrigeration
- Cooling capacity: **1300 W, 2400 W** (60 Hz)
- All models: CE marking and UL compliant
- Single-phase 100 VAC (50/60 Hz)
115 VAC (60 Hz)

Fits neatly
under a
laboratory
work bench.

Light-
weight

40 kg



- Cooling capacity (60 Hz):
**1300 W/1900 W/
2400 W**
- Temperature stability: $\pm 0.1^{\circ}\text{C}$
- Temperature range setting:
5 to 40°C

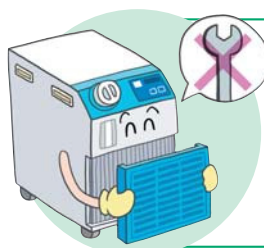
**Power supply available
all over the world**

- Single-phase 200 to 230 VAC (50/60 Hz)
- Single-phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)



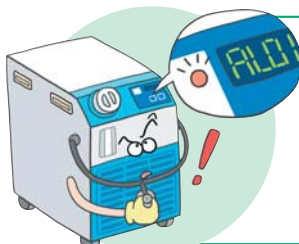
Convenient functions

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



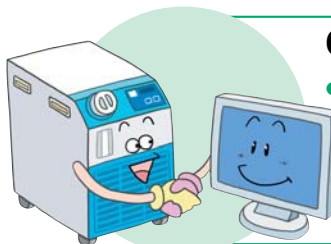
Easy maintenance

- Tool-less maintenance of filter



Self diagnosis function and check display

- 31 types of alarm codes



Communication function

- Equipped with serial communication (RS232C, RS485) and contact I/Os (2 inputs and 3 outputs) as standard.

Series HRS

Environmental compliance

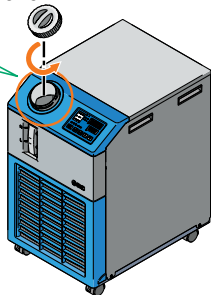
RoHS directive R407C as refrigerant



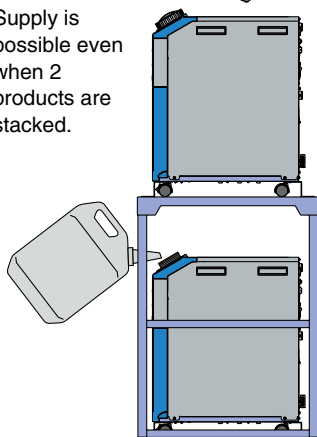
CAT.ES40-55B

Shaped for easy supply of circulating fluid

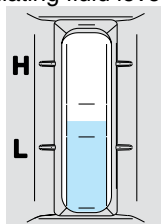
The angled supply port facilitates the supply of circulating fluid.



Supply is possible even when 2 products are stacked.

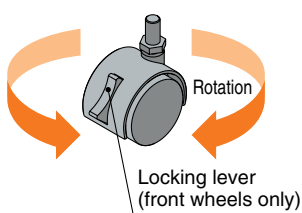


Easy check of the circulating fluid level



With unfixed caster

Useful for transportation onto a floor or moving to change arrangement.



Display panel

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



Large digital display

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

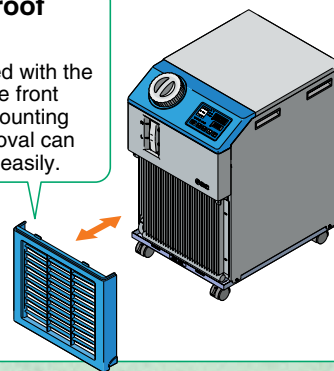
Simple operation

- Step ① Press the **RUN/STOP** keys.
 → Step ② Adjust the temperature setting with the **↓** **↑** keys.
 → Step ③ Press the **RUN/STOP** key to stop.
 Easy operation by these steps

Tool-less maintenance of filter

Dustproof filter

Integrated with the grill of the front panel. Mounting and removal can be done easily.



Adoption of the magnet pump

No fluid leakage because the seal-less pump is used

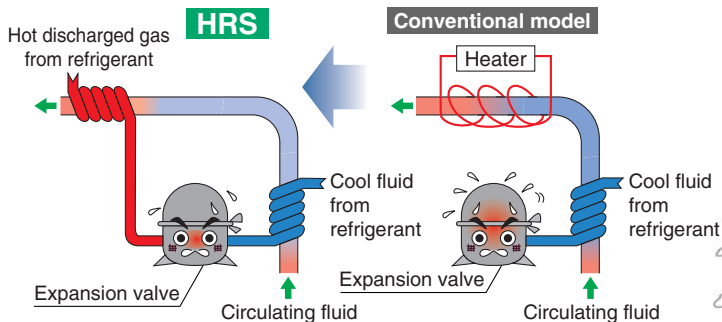
Optional accessories

Anti-quake bracket

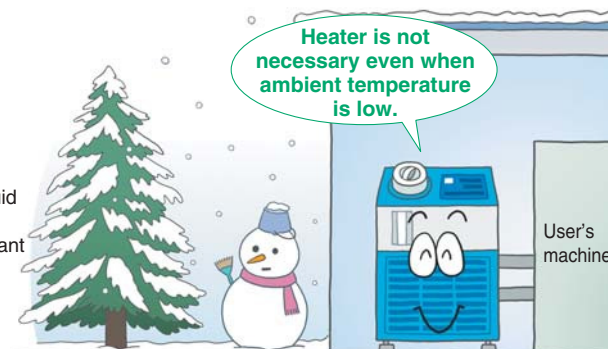
Used to fix to a floor or base.

With Heating Function

Heating method using discharged heat makes a heater unnecessary.



* This is just an example diagram.
 Refer to "Construction and Principles" on features 5 for piping.



Convenient Functions

Unit conversion function

The unit can be changed between °C and °F and MPa and PSI.

Orange lamp lights up.



Timer operation function

Timer for ON and OFF can be set in units of 0.5 h up to 99.5 h.

Ex.) Can set to stop on Saturday and Sunday and restart on Monday morning.

Ex. SE.02 "ON timer"



Timer
The time remaining can be checked.

Low tank level detecting function

The reduction of the fluid level in the tank is notified by alarm code.



Red lamp lights up.

Power failure auto-restart function

Automatic restart from stop-page due to power failure, etc. is possible without pressing the RUN/STOP key and remote operation.

Key-lock function

Can be set in advance to protect the set values from being changed by pressing keys by mistake.

Function to output a signal for completion of preparation

Notifies by communication when the temperature reaches the pre-set temperature range.

Anti-freezing operation function

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

Self Diagnosis and Check Display for Easy Maintenance

Display of 31 types of alarm codes

Operation is monitored all the time by the integrated sensor.

Should any error occur, the self diagnosis result is displayed by the applicable alarm code from 31 types.

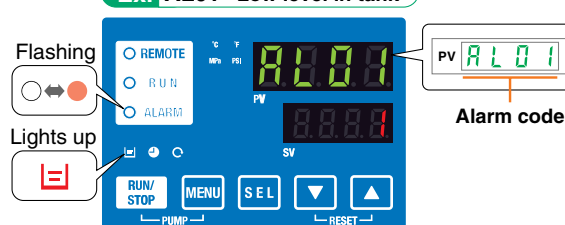
This makes it easier to identify the cause of the alarm.

Can be used before requesting service.

Changeable alarm set values

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

Ex. AL01 "Low level in tank"

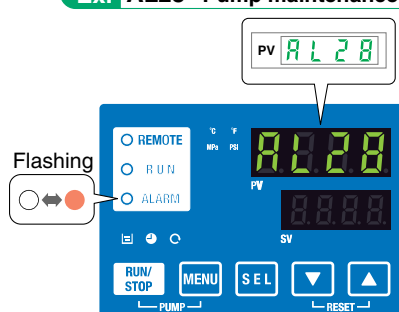


Alarm codes notify of checking times.

Notifies when to check the pump and fan motor. Helpful for facility maintenance.

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

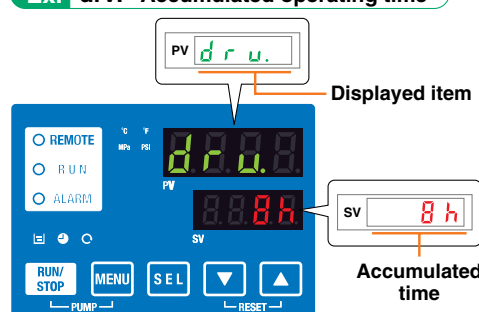
Ex. AL28 "Pump maintenance"



Check display

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

Ex. drv. "Accumulated operating time"



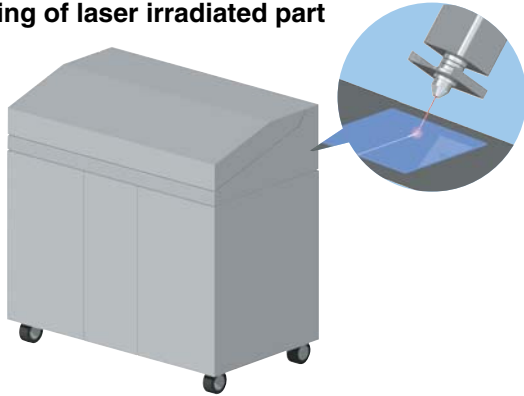
Displayed item
Circulating fluid discharge temperature
Circulating fluid return temperature
Compressor gas temperature
Circulating fluid discharge port pressure
Compressor gas discharge pressure
Compressor gas return pressure
Accumulated operating time
Accumulated operating time of pump
Accumulated operating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

* These are displayed only for air-cooled refrigeration.

Application Examples

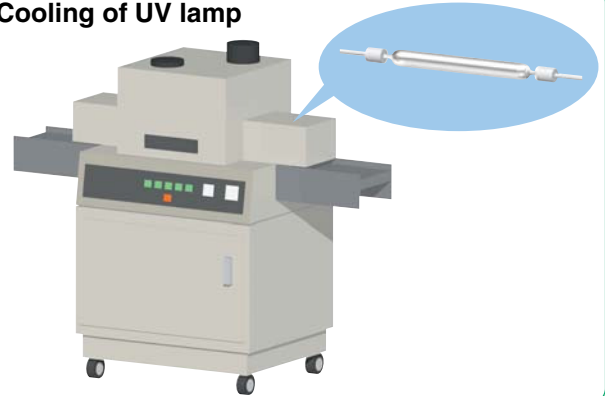
Laser machining

- Cooling of laser irradiated part



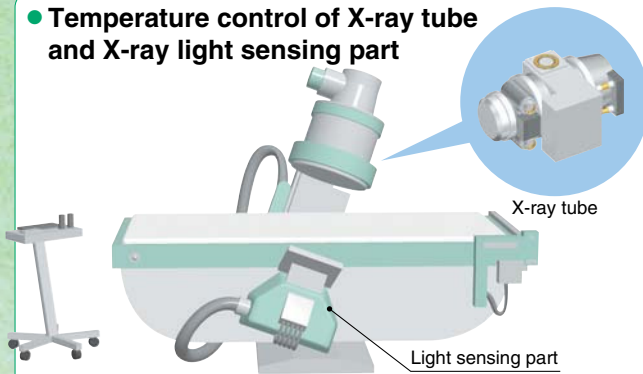
UV curing device (printing, painting, bonding and sealing)

- Cooling of UV lamp



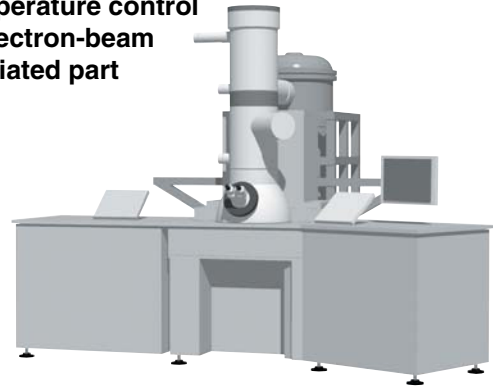
X-ray (digital) instrument

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



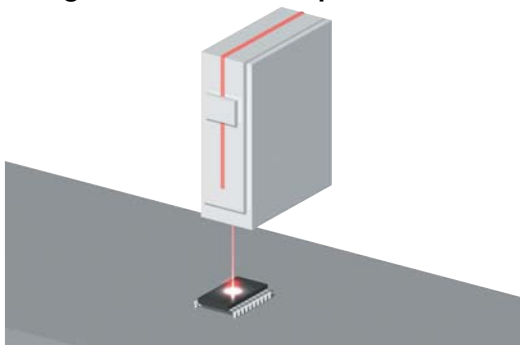
Electronic microscope

- Temperature control of electron-beam irradiated part



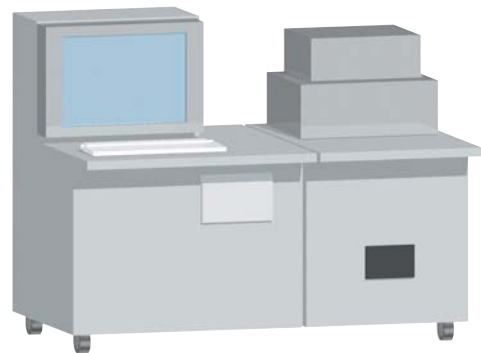
Laser marker

- Cooling of laser irradiated part



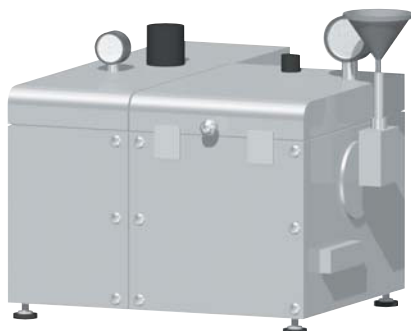
Ultra sonic wave inspection machine

- Temperature control of ultra sonic wave laser part



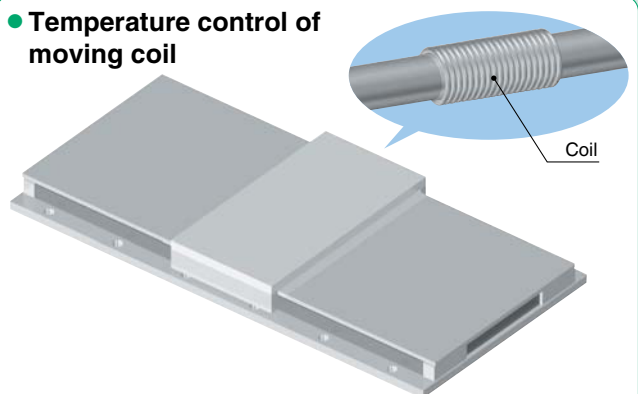
Atomizing device (food and cosmetics)

- Temperature control of sample and device



Linear motor

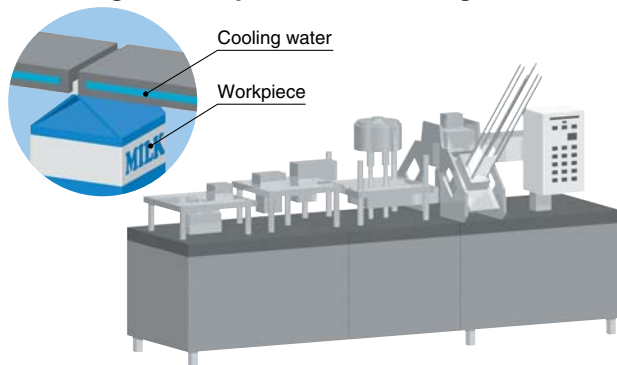
- Temperature control of moving coil



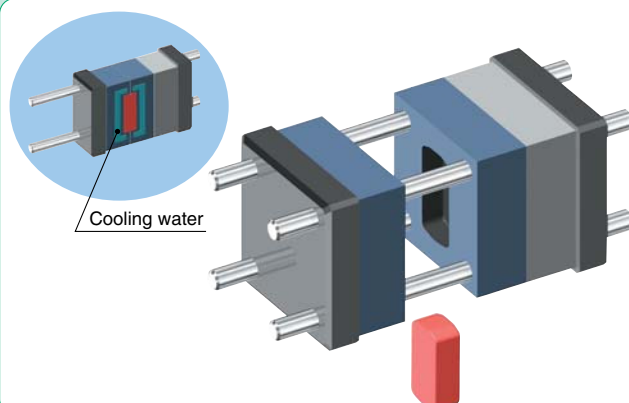
Application Examples

Packaging line (sealing of film and paper package)

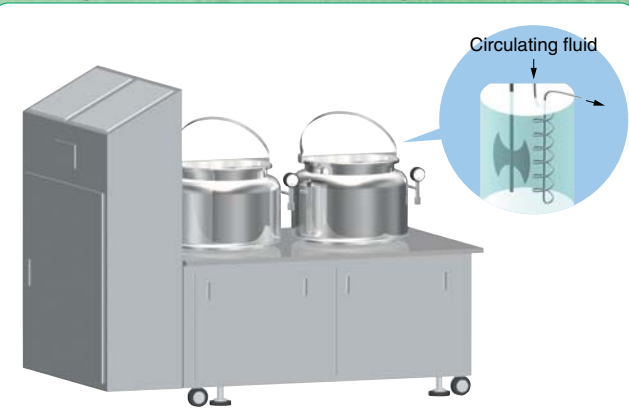
- Cooling of work pieces for bonding



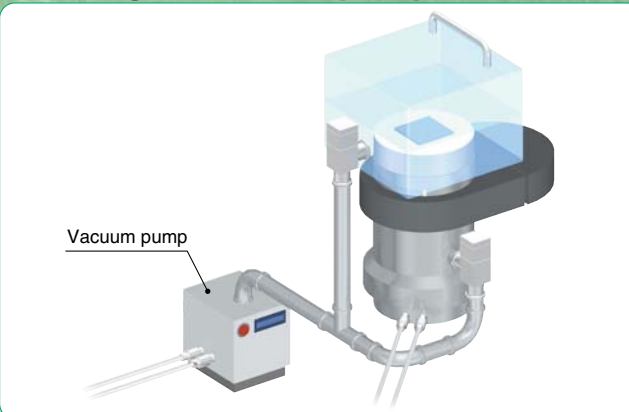
Cooling of die



Temperature control of paint material

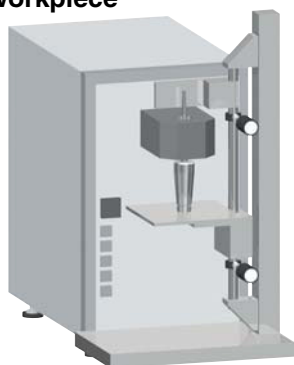


Cooling of vacuum pump



Shrink fitting machine

- Cooling of workpiece



Gas cylinder cabinet

- Temperature control inside cabinet



Concentrating equipment

- Temperature control of concentration fluid



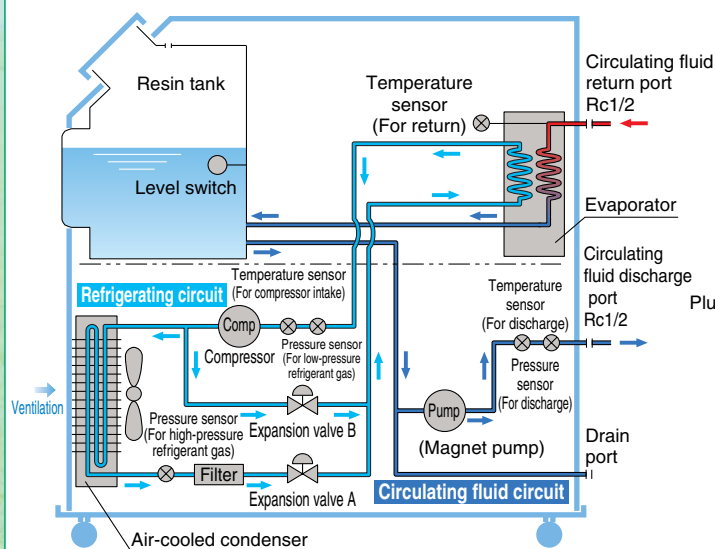
Reagent cooling equipment

- Temperature control of reagent

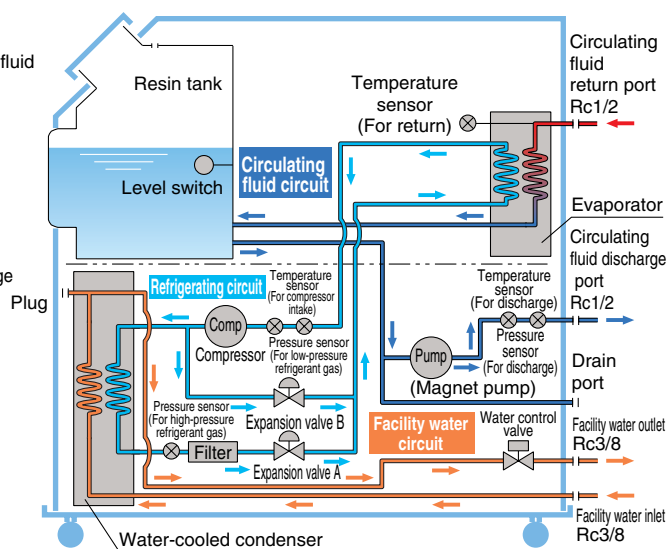


Construction and Principles

Air-cooled HRS□-A-□



Water-cooled HRS□-W-□



Circulating fluid circuit

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

Refrigerating circuit

High-temperature, high-pressure refrigerant gas compressed by the compressor is made to release heat by the condenser, and turns to liquid. As the liquefied high-pressure refrigerant passes through the expansion valve A, it expands and cools down; as it passes through the evaporator, heat is extracted from the circulating fluid and it evaporates.

The evaporated refrigerant is once again sucked in and compressed by the compressor, and the above cycle is repeated. The expansion valve B is open to heat the circulating fluid.

Facility water circuit

(For water-cooled refrigeration)
HRS□-W-□

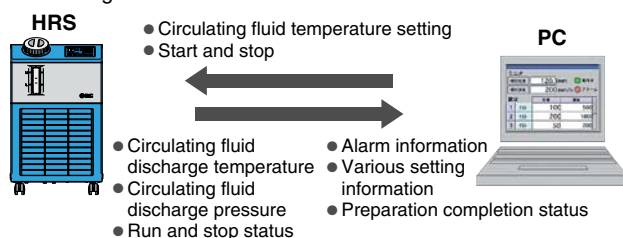
The water control valve opens and closes to keep the refrigerant gas pressure consistent. The facility water flow rate is controlled by the water control valve.

Communication Function

The serial communication (RS232C/RS485) and contact I/Os (2 inputs and 3 outputs) are equipped as standard. Communication with the user's machine and system construction are possible, depending on the application. A 24 VDC output can be also provided, and is available for a flow switch (SMC's PF2W, etc.).

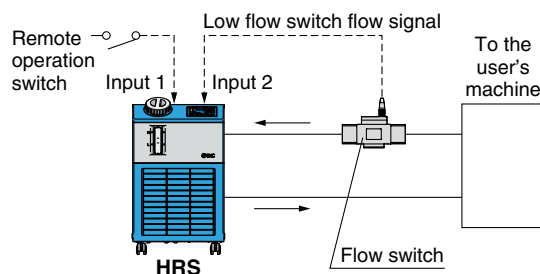
Ex. 1 Remote signal I/O through serial communication

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



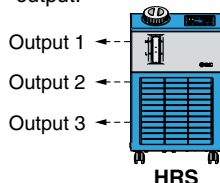
Ex. 2 Remote operation signal input

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



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

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



Output setting example

- Output 1: Temperature rise
- Output 2: Pressure rise
- Output 3: Operation status (start and stop)

CONTENTS

Series HRS

● Basic Model

How to Order / Specifications

Single-phase 100/115 VAC P.1

Single-phase 200 to 230 VAC P.2

Cooling Capacity / Pump Capacity /
Required Facility Water Flow Rate P.3

Dimensions P.4

Operation Display Panel P.5

Alarm P.5

Communication Function P.6

● Optional Accessories

① Anti-quake Bracket P.7

② Piping Conversion Fitting
(Air-cooled refrigeration) P.7

③ Piping Conversion Fitting
(Water-cooled refrigeration) P.7

④ Concentration Meter P.7

● Calculation of Cooling Capacity

Calculation of Required Cooling
Capacity P.8, 9

Precautions for Calculation of
Cooling Capacity P.9

Circulating Fluid Typical Physical
Property Values P.9

Warranty P.10

Specific Product Precautions P.11,12

Safety Instructions Back cover

Thermo-chiller **Compact Type**

Series *HRS*



How to Order

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

Cooling capacity

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

Cooling method

A	Air-cooled refrigeration
W	Water-cooled refrigeration

Power supply

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

Pipe thread type

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

Specifications

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

Note 1) For water-cooled refrigeration

Note 2) It should have no condensation.

Note 3) If clear water is to be used, use water that conforms to Clear Water Quality Standard of the Japan Refrigeration and Air Conditioning Industrial Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).

Note 4) ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Circulating fluid flow rate: Circulating fluid rated flow, ④ Circulating fluid: Clear water, ⑤ Facility water temperature: 25°C

Note 5) Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temperature is lower than 10°C.

Note 6) Outlet temperature when the circulating fluid flow is rated flow, and the circulating fluid discharge port and return port are directly connected.

Installation environment and the power supply are within specification range and stable.

Note 7) The capacity at the product outlet when the circulating fluid temperature is 20°C.

Note 8) Required flow for cooling capacity or maintaining the temperature stability.

The specification of the cooling capacity and the temperature stability may not be satisfied if the flow rate is lower than the rated flow.

Note 9) To be prepared by the user. Use an earth leakage breaker with sensitivity of 15 mA or 30 mA.

Note 10) Front: 1 m, height: 1 m, stable with no load, Other conditions → Note 4)

Note 11) Weight in the dry state without circulating fluids.

Note 12) This is the flow necessary when a load for the cooling capacity is applied at a circulating fluid temperature of 20°C, and rated circulating fluid flow rate and facility water temperatures of 25°C.

How to Order

Single-phase 200 to 230 VAC **HRS 018 - A - 20**

Cooling capacity

012	Cooling capacity: 1100/1300 W (50/60 Hz)
018	Cooling capacity: 1700/1900 W (50/60 Hz)
024	Cooling capacity: 2100/2400 W (50/60 Hz)

Cooling method

A	Air-cooled refrigeration
W	Water-cooled refrigeration

Power supply

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

Pipe thread type

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

Specifications

Model		HRS012-A□-20	HRS012-W□-20	HRS018-A□-20	HRS018-W□-20	HRS024-A□-20	HRS024-W□-20
Cooling method		Air-cooled refrigeration	Water-cooled refrigeration	Air-cooled refrigeration	Water-cooled refrigeration	Air-cooled refrigeration	Water-cooled refrigeration
Refrigerant		R407C (HFC)					
Control method		PID control					
Ambient temperature/humidity <small>Note 2)</small>		Temperature: 5 to 40°C, Humidity: 30 to 70%					
Circulating fluid system	Circulating fluid <small>Note 3)</small>	Clear water, 15% ethylene glycol aqueous solution <small>Note 5)</small>					
	Temperature range setting (°C) <small>Note 2)</small>	5 to 40					
	Cooling capacity (50/60 Hz) (W) <small>Note 4)</small>	1100/1300		1700/1900		2100/2400	
	Temperature stability (°C) <small>Note 6)</small>	±0.1					
	Pump capacity (50/60 Hz) (MPa) <small>Note 7)</small>	0.13/0.18 (at 7 ℓ/min)					
	Rated flow (50/60 Hz) (ℓ/min) <small>Note 8)</small>	7/7					
	Tank capacity (ℓ)	Approx. 5					
	Port size	Rc1/2					
Wetted parts material		Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic Carbon, PP, PE, POM, FKM, EPDM, PVC					
Facility water system <small>Note 1)</small>	Temperature range (°C)	—	5 to 40	—	5 to 40	—	5 to 40
	Pressure range (MPa)	—	0.3 to 0.5	—	0.3 to 0.5	—	0.3 to 0.5
	Required flow rate <small>Note 12)</small> (50/60 Hz) (ℓ/min)	—	8	—	12	—	14
	Inlet-outlet pressure differential of facility water (MPa)	—	0.3 or more	—	0.3 or more	—	0.3 or more
	Port size	Rc3/8					
	Wetted parts material	Stainless steel, Copper (Heat exchanger brazing), Bronze, Synthetic rubber					
Electrical system	Power supply	Single-phase 200 to 230 VAC (50/60 Hz) Allowable voltage range ±10%					
	Circuit protector (A)	10					
	Applicable earth leakage breaker capacity (A) <small>Note 9)</small>	10					
	Rated operating current (50/60 Hz) (A)	4.6/5.1		4.7/5.2		5.1/5.9	
	Rated power consumption (50/60 Hz) (kVA) <small>Note 4)</small>	0.9/1.0		0.9/1.0		1.0/1.2	
Noise level (50/60 Hz) (dB) <small>Note 10)</small>		60/61					
Accessories		Fitting (for drain outlet) 1 pc., Input/output signal connector 1 pc., Power supply connector 1 pc., Operation manual (for installation/operation) 1, Quick manual (with a clear case) 1, Alarm code list sticker 1, Ferritic core (for communication) 1 pc.					
Weight (kg) <small>Note 11)</small>		43					

Note 1) For water-cooled refrigeration

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Note 3) If clear water is to be used, use water that conforms to Clear Water Quality Standard of the Japan Refrigeration and Air Conditioning Industrial Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).

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Note 8) Required flow for cooling capacity or maintaining the temperature stability.

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Note 9) To be prepared by the user. Use an earth leakage breaker with sensitivity of 30 mA.

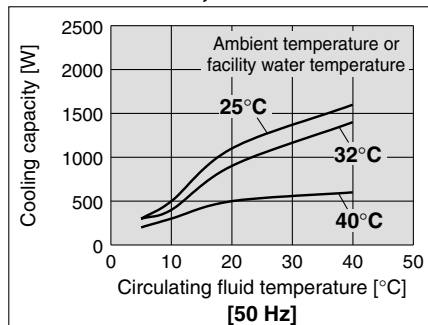
Note 10) Front: 1 m, height: 1 m, stable with no load, Other conditions → Note 4)

Note 11) Weight in the dry state without circulating fluids.

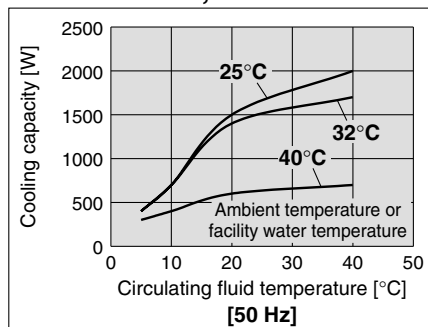
Note 12) This is the flow necessary when a load for the cooling capacity is applied at a circulating fluid temperature of 20°C, and rated circulating fluid flow rate and facility water temperatures of 25°C.

Cooling Capacity

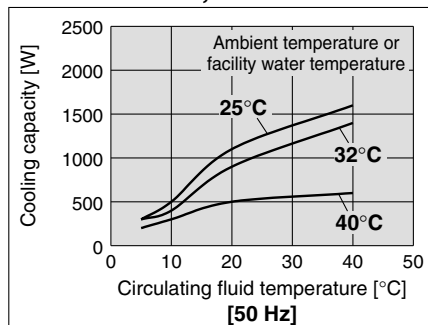
HRS012-A-10, HRS012-W-10



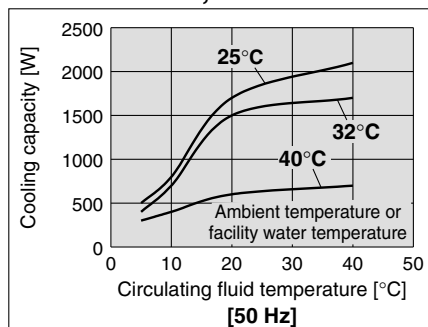
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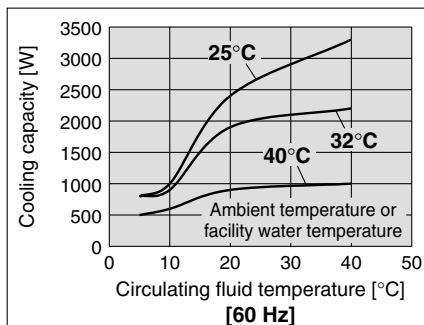
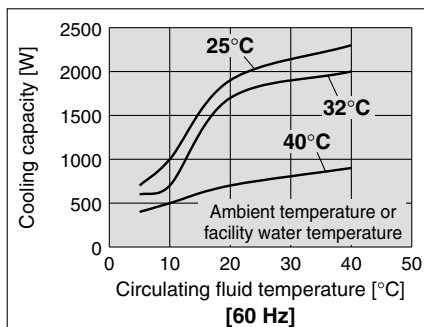
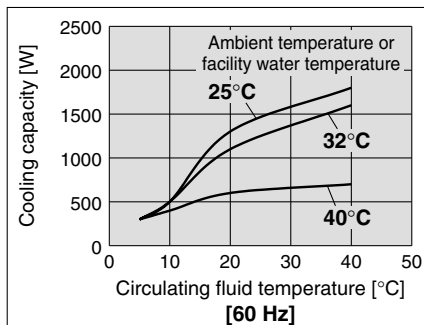
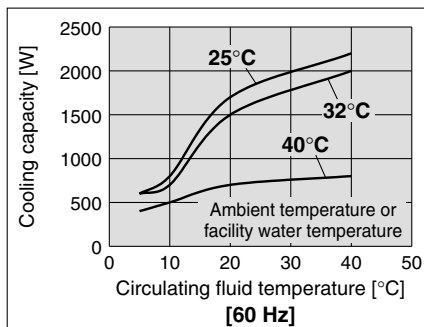
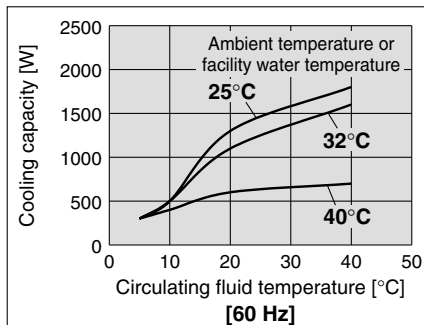
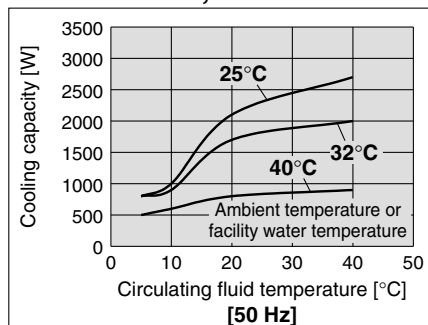
HRS012-A-20, HRS012-W-20



HRS018-A-20, HRS018-W-20

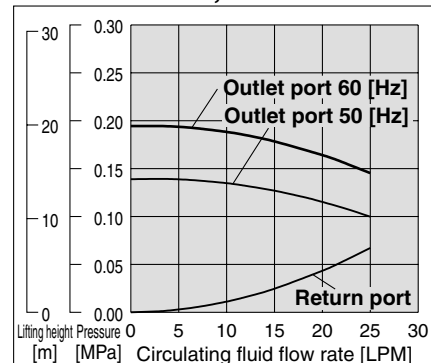


HRS024-A-20, HRS024-W-20

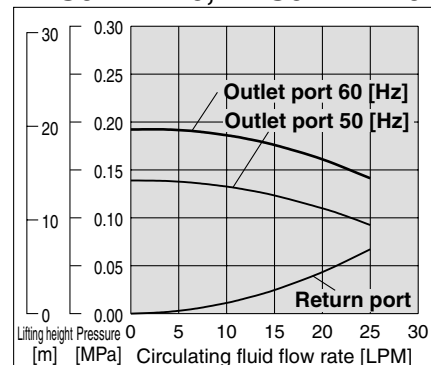


Pump Capacity

HRS012-A-10, HRS018-A-10 HRS012-W-10, HRS018-W-10

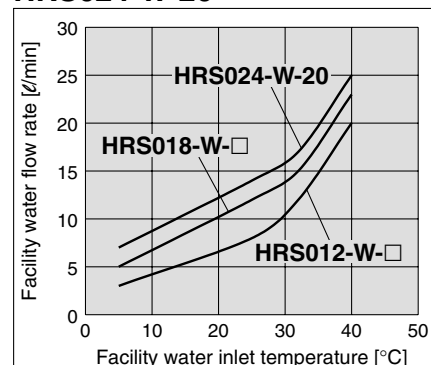


HRS012-A-20, HRS018-A-20 HRS012-W-20, HRS018-W-20 HRS024-A-20, HRS024-W-20



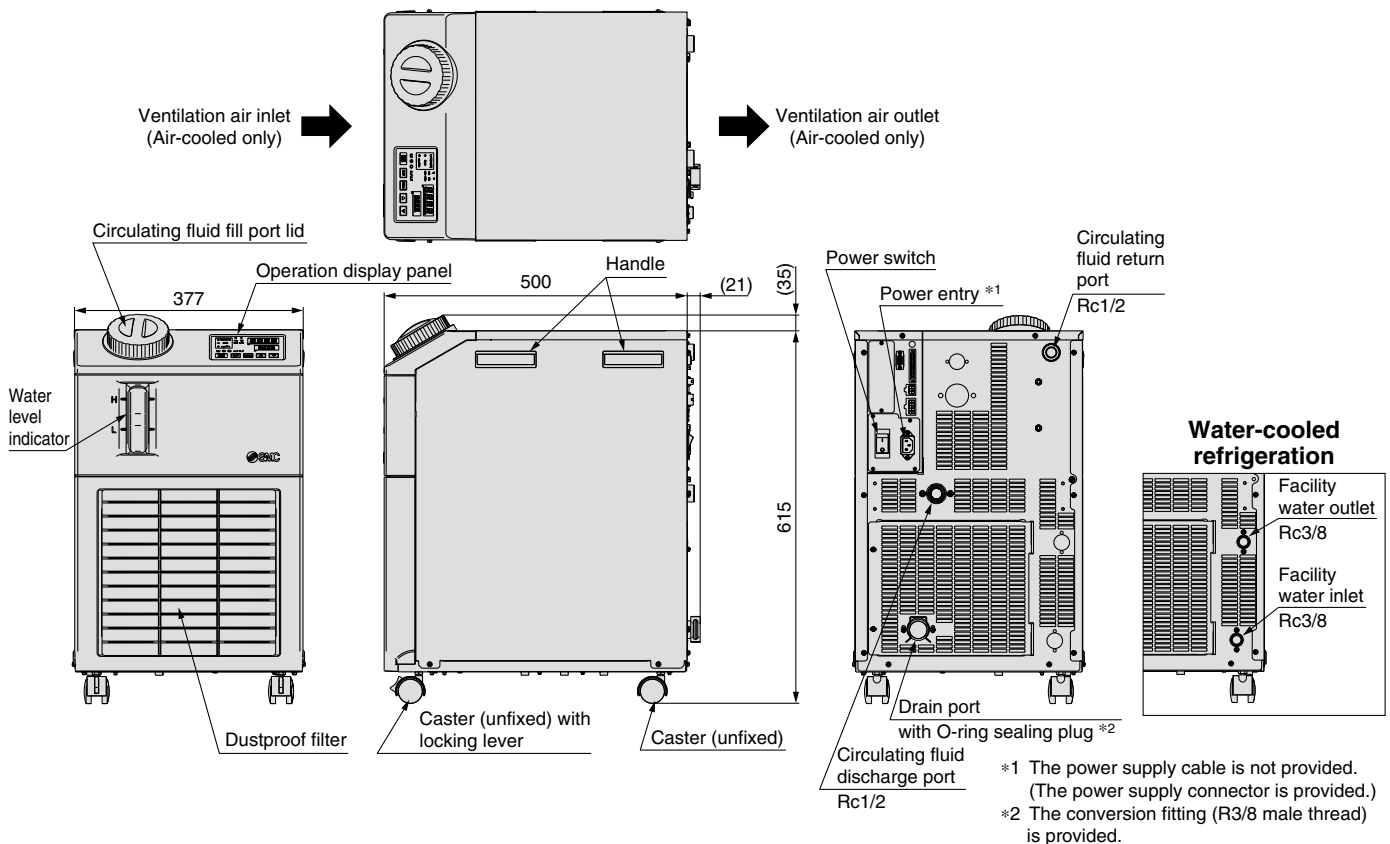
Required Facility Water Flow Rate

HRS012-W-□ HRS018-W-□ HRS024-W-20



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

Dimensions



Mounting/Installation

⚠ Warning

1. Do not use the product outdoors.
2. Do not place heavy objects on top of this product, or step on it.

The external panel can be deformed and danger can result.

⚠ Caution

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

2. Secure with bolts, anchor bolts, etc.

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

Tightening Torque for Fasteners

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

Piping

⚠ Caution

1. Regarding the circulating fluid pipings, consider carefully the suitability for shutoff pressure, temperature and circulating fluid.

If the operating performance is not sufficient, the pipings may burst during operation.

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

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

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

Piping

⚠ Caution

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

5. This product series consists of circulating fluid temperature controllers with built-in tanks.

Do not install equipment on your system side such as pumps that forcibly return the circulating fluid to the unit. Also, if you attach an external tank that is open to the air, it may become impossible to circulate the circulating fluid. Proceed with caution.

Electrical Wiring

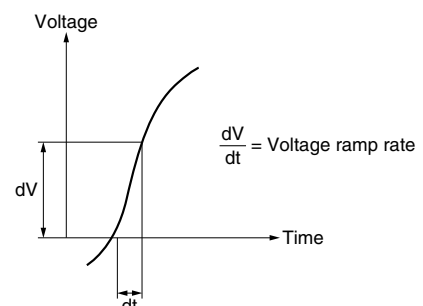
⚠ Warning

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

⚠ Caution

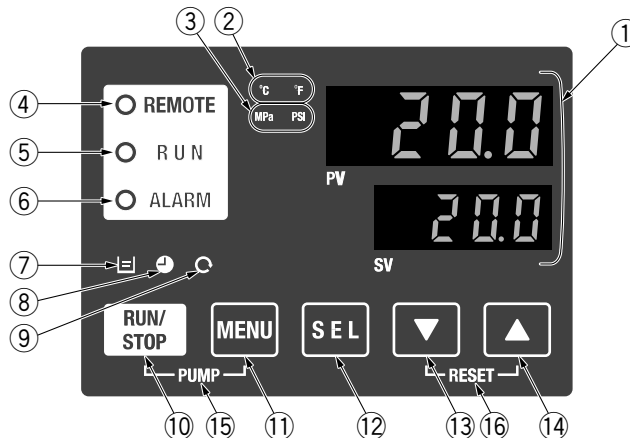
1. Communication cables should be prepared by user.
2. Ensure a stable power supply with no voltage surges and distortion.

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



Operation Display Panel

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



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

Alarm

The product has 31 types of alarms as standard, and displays each of them by its alarm code on the PV screen with the [ALARM] lamp ([LOW LEVEL] lamp) lit up on the operation display panel. The alarm can be read out through communication.

Alarm code	Alarm message	Operation status
AL01	Low level in tank	Stop* ¹
AL02	High circulating fluid discharge temperature	Stop
AL03	Circulating fluid discharge temperature rise	Continue* ¹
AL04	Circulating fluid discharge temperature drop	Continue* ¹
AL05	High circulating fluid return temperature (60°C)	Stop
AL06	High circulating fluid discharge pressure	Stop
AL07	Abnormal pump operation	Stop
AL08	Circulating fluid discharge pressure rise	Continue* ¹
AL09	Circulating fluid discharge pressure drop	Continue* ¹
AL10	High compressor intake temperature	Stop
AL11	Low compressor intake temperature	Stop
AL12	Low super heat temperature	Stop
AL13	High compressor discharge pressure	Stop
AL15	Refrigerating circuit pressure (high pressure side) drop	Stop
AL16	Refrigerating circuit pressure (low pressure side) rise	Stop
AL17	Refrigerating circuit pressure (low pressure side) drop	Stop

Alarm code	Alarm message	Operation status
AL18	Compressor overload	Stop
AL19* ²	Communication error* ²	Continue* ¹
AL20	Memory error	Stop
AL21	DC line fuse cut	Stop
AL22	Circulating fluid discharge temperature sensor failure	Stop
AL23	Circulating fluid return temperature sensor failure	Stop
AL24	Compressor intake temperature sensor failure	Stop
AL25	Circulating fluid discharge pressure sensor failure	Stop
AL26	Compressor discharge pressure sensor failure	Stop
AL27	Compressor intake pressure sensor failure	Stop
AL28	Pump maintenance	Continue
AL29	Fan motor maintenance* ³	Continue
AL30	Compressor maintenance	Continue
AL31* ²	Contact 1 input signal detection	Stop* ¹
AL32* ²	Contact 2 inputs signal detection	Stop* ¹

*¹ "Stop" or "Continue" are default settings. The user can change them to "Continue" and "Stop". For details, read the Operation Manual.

*² "AL19, AL31 and AL32, Communication error" is disabled in the default setting. If this function is necessary, it should be set by the user referring to the Operation Manual.

*³ For water-cooled models, the alarm is not activated.

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

Communication Function

Contact I/O

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

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

Serial Communication

The serial communication (RS-485/RS-232C) enables the following items to be written and read out. For details, refer to the Operation Manual for communication.

Writing

Run/Stop
Circulating fluid temperature setting (SV)

Readout

Circulating fluid present temperature (PV)
Circulating fluid discharge pressure (SV)
Status information
Alarm occurrence information

Item		Specifications
Connector type		D-sub 9-pin, Female connector
Protocol		Modicon Modbus compliant/Simple communication protocol
Standard		EIA standard RS-485
Circuit diagram	To the product	
	User's machine side	

* The terminal resistance of RS-485 (120 Ω) can be switched by the operation display panel. For details, refer to the Operation Manual. Do not connect other than in the way shown above, as it can result in failure.

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

Series HRS

Optional Accessories

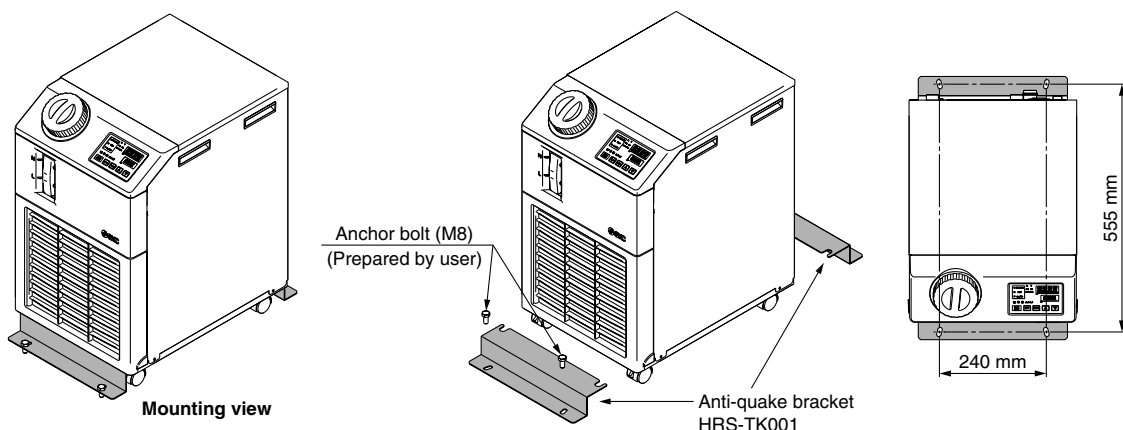
Optional Accessories

① Anti-quake Bracket

Bracket for earthquakes

Prepare the anchor bolts (M8) which are suited to the floor material by user. (Anti-quake bracket thickness: 1.6 mm)

Part No. HRS-TK001 (For single unit)



② Piping Conversion Fitting (for Air-cooled Refrigeration) (Conversion fitting for circulating fluid + drain fitting)

HRS012-A□-□, HRS018-A□-□, HRS024-A□-□

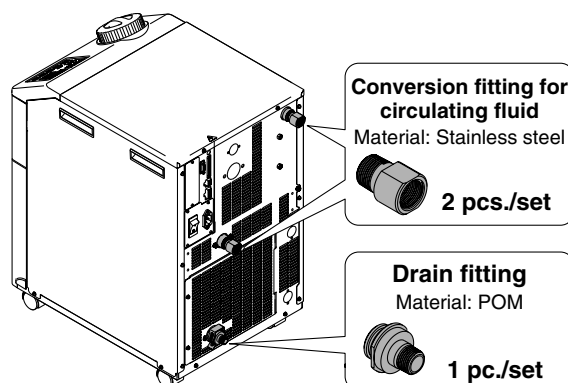
This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2.

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

Part No. HRS-EP001	G thread conversion fitting set
Part No. HRS-EP002	NPT thread conversion fitting set

Protruded part when the conversion fitting for circulating fluid is mounted

Approx. 45 mm



③ Piping Conversion Fitting (for Water-cooled Refrigeration) (Conversion fitting for circulating fluid + conversion fitting for facility water + drain fitting)

HRS012-W□-□, HRS018-W□-□, HRS024-W□-□

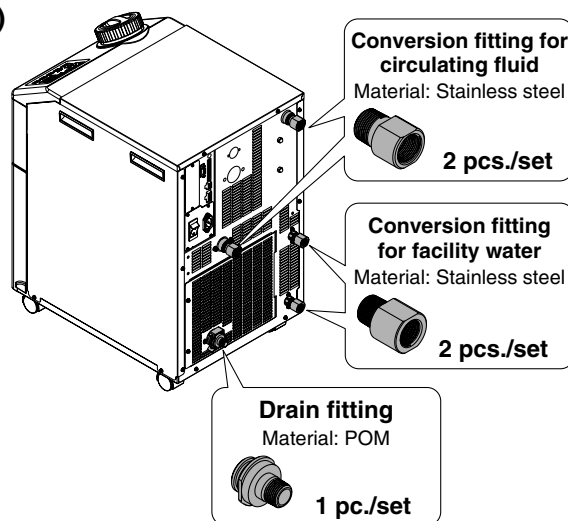
This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2 and for facility water from Rc3/8 to G3/8 or NPT3/8.

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

Part No. HRS-EP003	G thread conversion fitting set
Part No. HRS-EP004	NPT thread conversion fitting set

Protrusion when the conversion fitting for facility water is mounted

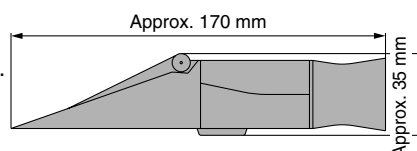
Approx. 37 mm



④ Concentration Meter

Can be used to control the concentration of ethylene glycol aqueous solution regularly.

Part No. HRZ-BR002



Calculation of Cooling Capacity

Calculation of Required Cooling Capacity

Example 1: When the heat generation amount in the user'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 user's machine.*

Q: Heat generation amount

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

Power consumption **P**: 1000 [W]

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

Cooling capacity = Considering a safety factor of 20%,

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

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

Power supply output **VI**: 1.0 [kVA]

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

In this example, using a power factor of 0.85:

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

Cooling capacity = Considering a safety factor of 20%,

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

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

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

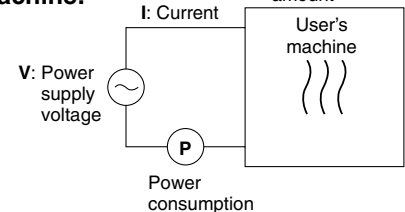
$$Q = P = \frac{W}{\text{Efficiency}}$$

In this example, use an efficiency of 0.7:

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

Cooling capacity = Considering a safety factor of 20%,

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



* The above examples calculate the heat generation amount based on the power consumption. The actual heat generation amount may differ due to the structure of user's machine. Please be sure to check it carefully.

Example 2: When the heat generation amount in the user's machine is not known.

Obtaining the temperature difference between inlet and outlet by circulating the circulating fluid inside the user's machine.

Amount of heat generated by machine Q	: Unknown [W] ([J/s])
Circulating fluid	: Clear water*
Circulating fluid flow rate (mass) qm	: ($= \rho \times q_v \div 60$) [kg/s]
Circulating fluid density p	: 1 [kg/dm ³]
Circulating fluid flow rate (volume) qv	: 10 [dm ³ /min]
Circulating fluid specific heat capacity C	: 4.2×10^3 [J/(kg·K)]
Circulating fluid outlet temperature T1	: 293 [K] (20 [°C])
Circulating fluid return temperature T2	: 295 [K] (22 [°C])
Circulating fluid temperature difference ΔT	: 2.0 [K] ($= T_2 - T_1$)
Conversion factor: minutes to seconds (SI units)	: 60 [s/min]

* Refer to page 9 for the typical physical property value of clear water or other circulating fluids.

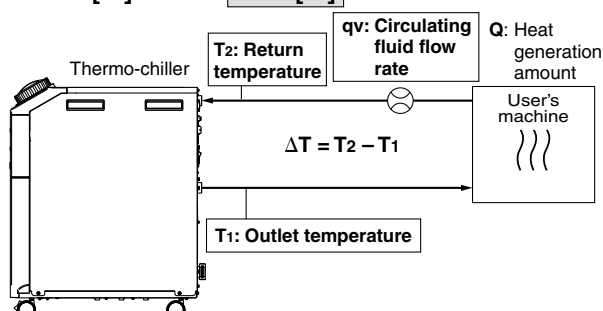
$$Q = q_m \times C \times (T_2 - T_1)$$

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

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

Cooling capacity = Considering a safety factor of 20%,

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



Example of the conventional measurement units (Reference)

Amount of heat generated by machine Q	: Unknown [cal/h] → [W]
Circulating fluid	: Clear water*
Circulating fluid flow rate (weight) qm	: ($= \rho \times q_v \times 60$) [kgf/h]
Circulating fluid weight: volume ratio γ	: 1 [kgf/l]
Circulating fluid flow rate (volume) qv	: 10 [l/min]
Circulating fluid specific heat capacity C	: 1.0×10^3 [cal/(kgf·°C)]
Circulating fluid outlet temperature T1	: 20 [°C]
Circulating fluid return temperature T2	: 22 [°C]
Circulating fluid temperature difference ΔT	: 2.0 [°C] ($= T_2 - T_1$)
Conversion factor: hours to minutes	: 60 [min/h]
Conversion factor: kcal/h to kW	: 860 [(cal/h)/W]

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

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

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

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

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

Cooling capacity = Considering a safety factor of 20%,

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

Calculation of Cooling Capacity

Calculation of Required Cooling Capacity

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

Heat dissipated by cooled substance (per unit time) Q : Unknown [W] ([J/s])
 Cooled substance : Water
 Cooled substance mass m : ($= \rho \times V$) [kg]
 Cooled substance density ρ : 1 [kg/dm³]
 Total volume of the object being cooled down V : 20 [dm³]
 Specific heat capacity of cooled substance C : 4.2 x 10³ [J/(kg·K)]
 Temperature of cooled substance when cooling begins T_0 : 305 [K] (32 [°C])
 Cooled substance temperature after t hour T_t : 293 [K] (20 [°C])
 Cooling temperature difference ΔT : 12 [K] ($= T_0 - T_t$)
 Cooling time Δt : 900 [s] ($= 15$ [min])

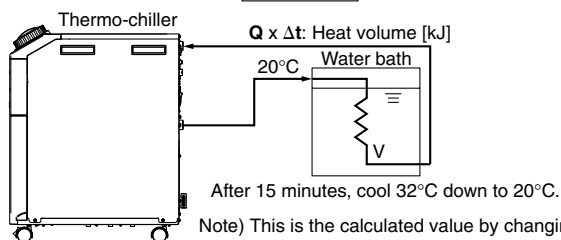
* Refer to the following for the typical physical property values by circulating fluid.

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

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

Cooling capacity = Considering a safety factor of 20%,

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



Example of the conventional measurement units (Reference)

Heat dissipated by cooled substance (per unit time) Q : Unknown [cal/h] → [W]
 Cooled substance : Water
 Cooled substance weight m : ($= \rho \times V$) [kgf]
 Cooled substance weight (volume ratio) γ : 1 [kgf/d]
 Total volume of the substance being cooled down V : 20 [d]
 Specific heat capacity of cooled substance C : 1.0 x 10³ [cal/(kgf·°C)]
 Temperature of cooled substance when cooling begins T_0 : 32 [°C]
 Cooled substance temperature after t hour T_t : 20 [°C]
 Cooling temperature difference ΔT : 12 [°C] ($= T_0 - T_t$)
 Cooling time Δt : 15 [min]
 Conversion factor: hours to minutes : 60 [min/h]
 Conversion factor: kcal/h to kW : 860 [(cal/h)/W]

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

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

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

Cooling capacity = Considering a safety factor of 20%,

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

Precautions for Calculation of Cooling Capacity

1. Heating capacity

When the circulating fluid temperature is set above room temperature, it needs to be heated by the product. The heating capacity depends on the circulating fluid temperature. Consider the radiation rate and heat capacity of the user's machine and confirm that the necessary heating capacity is secured beforehand.

2. Pump capacity

<Circulating fluid flow rate>

Circulating fluid flow rate varies depending on the circulating fluid discharge pressure. Consider the installation height difference between our chiller and a user's machine, and the piping resistance such as circulating fluid pipings, or piping size, or piping curves in the machine. Confirm beforehand if the required flow is achieved using the pump capacity curves.

<Circulating fluid discharge pressure>

Circulating fluid discharge pressure has the possibility to increase up to the maximum pressure in the pump capacity curves. Confirm beforehand if the circulating fluid pipings or circulating fluid circuit of the user'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 ρ : 1 [kg/dm³] (or, using conventional unit system, weight: volume ratio γ = 1 [kgf/d])
 Specific heat capacity C : 4.19 x 10³ [J/(kg·K)] (or, using conventional unit system of units, 1 x 10³ [cal/(kgf·°C)])

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

Water

Physical property value Temperature	Density ρ [kg/dm ³]	Specific heat C [J/(kg·K)]	Conventional unit system	
			Weight: volume ratio γ [kgf/d]	Specific heat C [cal/(kgf·°C)]
5°C	1.00	4.2 x 10 ³	1.00	1 x 10 ³
10°C	1.00	4.19 x 10 ³	1.00	1 x 10 ³
15°C	1.00	4.19 x 10 ³	1.00	1 x 10 ³
20°C	1.00	4.18 x 10 ³	1.00	1 x 10 ³
25°C	1.00	4.18 x 10 ³	1.00	1 x 10 ³
30°C	1.00	4.18 x 10 ³	1.00	1 x 10 ³
35°C	0.99	4.18 x 10 ³	0.99	1 x 10 ³
40°C	0.99	4.18 x 10 ³	0.99	1 x 10 ³

15% Ethylene Glycol Aqueous Solution

Physical property value Temperature	Density ρ [kg/dm ³]	Specific heat C [J/(kg·K)]	Conventional unit system	
			Weight: volume ratio γ [kgf/d]	Specific heat C [cal/(kgf·°C)]
5°C	1.02	3.91 x 10 ³	1.02	0.93 x 10 ³
10°C	1.02	3.91 x 10 ³	1.02	0.93 x 10 ³
15°C	1.02	3.91 x 10 ³	1.02	0.93 x 10 ³
20°C	1.01	3.91 x 10 ³	1.01	0.93 x 10 ³
25°C	1.01	3.91 x 10 ³	1.01	0.93 x 10 ³
30°C	1.01	3.91 x 10 ³	1.01	0.94 x 10 ³
35°C	1.01	3.91 x 10 ³	1.01	0.94 x 10 ³
40°C	1.01	3.92 x 10 ³	1.01	0.94 x 10 ³

* Note) The above values are for reference. Contact the circulating fluid supplier for details.

Series HRS 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

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

3. Items out of warranty

The following cases are not subject to warranty.

- ① Nonconformance caused by implementing no check-up (daily check-up, regular check-up) specified by SMC.
- ② Nonconformance caused by the usage other than stipulated in the operation 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, etc.)
- 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 operation manual.
- ⑨ Nonconformance caused by no observation to the following 5, "Items to be observed by user."

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 user

In order to use this product safely, the correct usage and check-up by user are necessary.

Please be sure to observe the following things. Please note that we may decline the repair request upon warranty in case that the following things are not observed.

- (1) Use the unit in accordance to the proper handling as mentioned in the operation manual.
- (2) Conduct inspection and maintenance (daily check-up, regular check-up) as mentioned in the operation manual.
- (3) Record the inspection and maintenance results as mentioned in the operation manual.

6. How to ask a repair upon warranty

When a warranty repair is requested, please contact the nearest sales distributor.

With this, we will repair the unit upon warranty.

We promise a repair for free on the basis of the above mentioned periods or terms. Therefore, nonconformance occurred after the warranty period will be charged in principle.



Series HRS

Specific Product Precautions 1

Be sure to read this before handling.

Refer to back cover for the Safety Instructions, "Handling Precautions for SMC Products" (M-E03-3) and the Operation Manual for Temperature Control Equipment Precautions. Please download the Operation Manual via our website. <http://www.smcworld.com/>

Design

⚠ Warning

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

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

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

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

Selection

⚠ Warning

1. Model selection

For selecting a model of thermo-chiller, it is required to know the heat generation amount of a user's machine. Obtain the heat generation amount, referring to "Calculation of Cooling Capacity" in this catalog before selecting a model.

Handling

⚠ Warning

1. Thoroughly read the Operation Manual.

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

Operating Environment/Storage Environment

⚠ Warning

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

- 1) Environment like written in "Temperature Control Equipment Precautions".
- 2) Locations where spatter will adhere to when welding.
- 3) Locations where it is likely that the leakage of flammable gas may occur.
- 4) Locations having a large quantity of dust.
- 5) A location in which water freezes.
If such a location is unavoidable, contact SMC.

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

These models are for indoor use only.
Do not install outdoors where rain or snow may fall on them.

Operating Environment/Storage Environment

⚠ Warning

3. Conduct ventilation and cooling to discharge heat.

(Air-cooled refrigeration)

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

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

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

4. The product is not designed for clean room usage. It generates particles internally.

Circulating Fluid

⚠ Caution

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

2. When using clear water as a circulating fluid, use water that conforms to the appropriate water quality standards.

Use water that conforms to the standards shown in the below table (including water used for dilution of ethylene glycol aqueous solution).

Clear Water (as Circulating Fluid) Quality Standard

The Japan Refrigeration and Air Conditioning Industry Association

JRA GL-02-1994 "Cooling water system - Circulation type - Make-up water"

	Item	Unit	Standard value
Standard item	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
	Sulfuric acid ion (SO ₄ ²⁻)	[mg/L]	50 or less
	Acid consumption amount (at pH4.8)	[mg/L]	50 or less
	Total hardness	[mg/L]	70 or less
	Calcium hardness (CaCO ₃)	[mg/L]	50 or less
Reference item	Ionic state silica (SiO ₂)	[mg/L]	30 or less
	Iron (Fe)	[mg/L]	0.3 or less
	Copper (Cu)	[mg/L]	0.1 or less
	Sulfide ion (S ₂ ⁻)	[mg/L]	Should not be detected.
	Ammonium ion (NH ₄ ⁺)	[mg/L]	0.1 or less
	Residual chlorine (Cl)	[mg/L]	0.3 or less
	Free carbon (CO ₂)	[mg/L]	4.0 or less

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

3. Use ethylene glycol aqueous solution which does not contain additives such as antiseptics.

4. When using ethylene glycol aqueous solution, maintain a maximum concentration of 15%.

Overly high concentrations can cause a pump overload. Low concentrations, however, can lead to freezing when circulating fluid temperature is 10°C or lower and cause the thermo-chiller to break down.

5. A magnet pump is used as a circulating pump for circulating fluid.

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



Series HRS

Specific Product Precautions 2

Be sure to read this before handling.

Refer to back cover for the Safety Instructions, "Handling Precautions for SMC Products" (M-E03-3) and the Operation Manual for Temperature Control Equipment Precautions.

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

Facility Water Supply

Warning

(Water-cooled refrigeration)

1. Supply pressure should be 0.5 MPa or less.

When the supply pressure is high, it will cause water leakage.

2. Be sure to prepare your utilities so that the pressure of the Thermo-chiller facility water outlet is at 0 MPa (atmospheric pressure) or more.

If the facility water outlet pressure becomes negative, the internal facility water piping may collapse, and proper flow control of facility water will be impossible.

Operation

Warning

1. Confirmation before operation

1) The fluid level of a tank should be within the specified range of "HIGH" and "LOW".

When exceeding the specified level, the circulating fluid will overflow.

2) Remove the air.

Conduct a trial operation, looking at the fluid level.

Since the fluid level will go down when the air is removed from a user's piping system, supply water once again when the fluid level is reduced. When there is no reduction in the fluid level, the job of removing the air is completed.

2. Confirmation during operation

- Confirm the circulating fluid temperature.

The operating temperature range of the circulating fluid is between 5 and 40°C.

When the amount of heat generated from a user's machine is greater than the product's capability, the circulating fluid temperature may exceed this range. Use caution regarding this matter.

3. Emergency stop method

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

Operation Restart Time

Caution

1. Wait five minutes or more before restarting operation after it has been stopped. If the operation is restarted within five minutes, the protection circuit may activate and the operation may not start properly.

Protection Circuit

Caution

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

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

Maintenance

Caution

<Periodical inspection every one month>

1. Cleaning the ventilation hole

If the fin portion of the air-condenser becomes clogged with dust or debris, a decline in cooling performance can result.

In order to avoid deforming or damaging the fin, clean it with a long-haired brush or air gun.

<Periodical inspection every three months>

1. Inspect the circulating fluid.

1) When using clear water

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

- Tank cleaning

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

2) When using ethylene glycol aqueous solution

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

Dilute or add as needed to adjust the concentration.

<Periodical inspection during the winter season>

1. Make water-removal arrangements beforehand.




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

2. Consult a professional.

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

Safety Instructions

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

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

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

Warning

- The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.**
Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.
- Only personnel with appropriate training should operate machinery and equipment.**
The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.
- Do not service or attempt to remove product and machinery/equipment until safety is confirmed.**
 - The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
 - When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
 - Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.
- Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.**
 - Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
 - Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
 - An application which could have negative effects on people, property, or animals requiring special safety analysis.
 - Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Caution

- The product is provided for use in manufacturing industries.**
The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/ Compliance Requirements

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

Read and accept them before using the product.

Limited warranty and Disclaimer

- The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.*2)
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
- For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
- Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

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

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

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

Record of changes

- Edition B** * Addition of water-cooled refrigeration
* Addition of cooling capacity 1100 W (50 Hz)/1300 W (60 Hz),
2100 W (50 Hz)/2400 W (60 Hz)
* Addition of single phase 100 VAC (50/60 Hz), 115 VAC (60 Hz)
* All models: CE marking and UL compliant

NY

Safety Instructions

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

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